

GREAT SALT PLAINS LAKE

SALT FORK OF ARKANSAS RIVER, OKLAHOMA

WATER CONTROL MANUAL

OCTOBER 1999

**GREAT SALT PLAINS LAKE
SALT FORK OF ARKANSAS RIVER,
OKLAHOMA**

**WATER CONTROL MANUAL
APPENDIX A
TO
WATER CONTROL MASTER MANUAL
ARKANSAS RIVER BASIN**

OCTOBER 1999

**DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
OKLAHOMA**

NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be used in loose-leaf 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. All elevations referred to in this manual, unless noted otherwise, are in feet, NGVD (National Geodetic Vertical Datum).

EMERGENCY REGULATION ASSISTANCE PROCEDURES

In the event that unusual conditions arise during duty hours and at various hours during weekends and holidays, contact can be made by telephone to the Water Control Section, Tulsa District Office (918/669-7097). If the above office cannot be contacted, assistance can be achieved by contacting, in the order listed, one of persons shown below. Section VII of this Manual contains detailed instructions for emergency regulations. All project personnel associated with regulation of the project must be thoroughly familiar with the procedure outlined in this section.

EMERGENCY
PERSONNEL ROSTER

<u>TITLE AND NAME</u>	<u>RESIDENCE TELEPHONE</u>
(b) (6)	(b) (6)
Backup Coordinator (b) (6)	
Backup Coordinator (b) (6)	
Chief, Reservoir Control Section (b) (6)	
Chief, Hydrology-Hydraulics Branch (b) (6)	

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PERTINENT DATA
GREAT SALT PLAINS LAKE

LOCATION: On the Salt Fork of Arkansas River at river mile 103.3, approximately 12 miles east of Cherokee, Oklahoma in Alfalfa County, Oklahoma.

DRAINAGE AREA: 3,200 square miles above the dam.

DAM:
 Type: Random impervious earthfill embankment.
 Length: 6,010 feet (including spillway).
 Crest Elevation: 1,168.5 feet, NGVD.
 Max. Height: 68 feet above streambed.
 Crest Width: 25 feet.

DIKES: None.

SPILLWAY:
 Location: Right abutment.
 Type: Cascade, uncontrolled.
 Crest Elevation: 1,138.5 feet, NGVD (upper weir).
 1,125.0 feet, NGVD (center weir).
 1,110.0 feet, NGVD (lower weir).
 Width: 310 feet.
 Control: None.
 Hoists: None.

OUTLET WORKS:
 Type and Size: Four ungated 10' x 12' sluices.
 Invert Elevation: 1,125.0 feet, NGVD (upper weir).
 Location: Through each of the three weirs.
 Control: None on the upper weir. Removable stop logs on the Middle and lower weirs.

LOW FLOW CONTROL PIPES:
 Location: Middle weir.
 Type: 2 36-inch diameter pipes.
 Entrance Elev: 1,110.0 feet, NGVD.

WATER SUPPLY OUTLET: None.

POWER FEATURES: None.

<u>LAND ACQUISITION:</u>	<u>Guide Contour</u>	<u>Area(Acres)</u>
Fee Simple	Blocked to 1,138.5	31,935
Easement	None	

Lake Capacity

Feature	Elevation (ft., NGVD)	Area (Acres) ⁽¹⁾	Accumulative (Acre-Feet) ⁽¹⁾	Equivalent Runoff (Inches) ⁽²⁾	Incremental (Acre-feet)	Outlet Works Capacity (c.f.s.)
Top of Dam	1,168.5					
Maximum Pool	1,156.2	46,230	884,800	5.20	643,300	115,400
Spillway Crest	1,138.5	25,660	241,500	1.42		13,600
Top of Flood Control Pool	1,138.5	25,660	241,500	1.42		13,600
Top of Conservation Pool	1,125.0	7,780	26,110	0.15	26,110	360
Top of Inactive Pool	1,110.0				--	0
Flood Control Storage	1,125.0-1138.5	--	215,390	1.27	--	--
Conservation Storage	1,110.0-1125.0	--	26,110	.15	--	--
Streambed at Dam	1,100.5	--	--	--	--	--

⁽¹⁾ Based on 1978 sedimentation survey.

⁽²⁾ From a 3,200 square-mile drainage area above the dam site. One inch of runoff = 170,700 acre-feet.

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APPENDIX A, PART I
TO
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I - INTRODUCTION

1-01. Authorization. This Manual is submitted in accordance with ER 1110-2-240 and prepared in accordance with EM 1110-2-3600, ER 1110-2-8156, and ER 1110-2-241.

1-02. Purpose and Scope. The purpose of this Manual is to document the plan of water control; to present detailed information to higher authority; and to give guidance to personnel who will become concerned with, or responsible for, regulation of the lake during the life of the project. This manual also updates the Great Salt Plains Lake Reservoir Regulation Manual, Appendix A to the Arkansas River Basin Regulation master manual and supersedes regulations contained in the Reservoir Regulation Manual for Great Salt Plains Lake dated November 1966.

1-03. Related Manuals and Reports. This Manual is Appendix A, to the Arkansas River Basin Water Control Master Manual. Other manuals important to the regulation of Great Salt Plains Lake are:

Appendix M - Keystone	(November 1989)
Appendix T - Kaw	(February 1995)
Appendix DCP-8 - Drought Contingency Plan for Mid-Arkansas Projects	(June 1991)

Locations of existing and authorized projects in the Tulsa District are shown on Plate 1-1.

Reports important to the regulation of Great Salt Plains Lake are:
Operation and Maintenance Manual
Contingency Plan for Emergencies (June 1992)

1-04. Project Owner. Great Salt Plains Lake is owned by the U.S. Government.

1-05. Operating Agency. The Corps of Engineers is the operating agency for Great Salt Plains Lake. The Canton Resident Office, Operations Division, Tulsa District, has the responsibility for project operations. The project will be under 24 hours surveillance when the lake level is above elevation 1,132.0, and daily surveillance when the lake level is between elevations 1130.0 and 1132.0. When the project is under surveillance, operation personnel will closely monitor the project and the downstream river reaches.

The project is furnished a list of the Water Control Section personnel to contact when necessary. The Canton Resident Office will furnish the Water Control Section a list of project personnel, giving their office and home telephone numbers and addresses.

1-06. Regulating Agencies. The Corps of Engineers is the regulatory agency for Great Salt Plains Lake. This responsibility is with the Water Control Section, Hydrology-Hydraulics Branch, Tulsa District. Presently, there are no other agencies involved in the functional responsibilities of Great Salt Plains Lake.

II - DESCRIPTION OF PROJECT

2-01. Location. Great Salt Plains Lake is located at mile 103.3 on the Salt Fork of the Arkansas River, about 12 miles east of Cherokee in Alfalfa County, Oklahoma. Project location is shown on Plate 2-1.

2-02. Purpose. The Great Salt Plains Reservoir is one unit of the comprehensive plan for flood control, generation of hydro-electric power, navigation, and allied water uses on the Arkansas River and tributaries in Kansas, Arkansas, and Oklahoma.

2-03. Physical Components.

a. Embankment. The embankment is a rolled random and impervious earthfill structure with crest at elevation 1168.5 and a maximum height of 68 feet above the streambed. The embankment section has a crest length of 5,700 feet, exclusive of the spillway. The width of the embankment at crest is 25 feet. The upstream slopes of the embankment are protected by riprap and gravel. The downstream slopes are seeded to grass. A general plan and a typical section of the embankment are shown on Plate 2-2.

b. Spillway. The spillway is an uncontrolled cascade-type consisting of three concrete gravity structures. The three weirs are about 325 feet apart and are 310 feet wide. Each weir has a stilling basin with baffles. The weirs are of such height that the fall between maximum pool elevation and tailwater elevation is in three equal stages. The upper weir, with a crest at elevation 1138.5, passes flows when the lake reaches the top of flood control pool, while the center weir maintains the top of the conservation pool. A section through the spillway is shown on Plate 2-2.

c. Outlet Works. The outlet works consist of four 10' x 12' uncontrolled sluices through each of the three weirs. The sluices through the middle and lower weirs are closed with removable stop logs. Two gated 36-inch pipes through the middle weir are used to regulate low flows.

d. Water Supply. None.

e. Sedimentation and Degradation Ranges. Thirty-one (31) sediment ranges are located in and above the reservoir area, with their ends marked with permanent monuments. The locations of the sediment ranges are shown on Plate 2-3. Numerous degradation ranges are established below Great Salt Plains Dam to provide information on the downstream channel condition. All ranges are located on the Salt Fork Arkansas River. The original sediment survey was completed in 1941. Resurveys were conducted in 1949, 1961, 1971, and 1978.

2-04. Related Control Facilities. None.

2-05. Real Estate Acquisition. The fee taking line for Great Salt Plains was a blocked perimeter based on elevation 1138.5, the spillway crest, or the elevation of the envelope curve of backwater effects on a full pool, whichever

was higher. The government purchased 31,935 acres of land in 91 separate tracts. The taking line for Great Salt Plains Lake are shown on Plate 2-1.

2-06. Public Facilities. Recreation facilities constructed by the Government are basic facilities which consist of roads, parking areas, trails, boat ramps, picnic developments, and water and sanitary facilities. Concession facilities operated by private interests supply food and refreshments, bait, fishing and hunting supplies, and other miscellaneous items for public convenience.

The U.S. Fish and Wildlife Service manages 31,065 acres of land and water within the project area as a National Wildlife refuge. The Oklahoma Department of Tourism and Recreation has been granted a lease to 840 acres of land for public park purposes. The Corps of Engineers has retained the remaining 30 acres of the project area, which contains the dam, buildings, controls and facilities necessary for the maintenance and operation of the project. The Oklahoma Department of Tourism and Recreation maintains four public-use areas, including recreational facilities in these areas constructed by the Corps of Engineers. The name, location of the public-use areas, and the wildlife refuge area are shown on plate 2-1.

III - HISTORY OF PROJECT

3-01. Authorization. Great Salt Plains Dam and Reservoir was authorized by the Flood Control Act approved June 22, 1936 (Public Law 738, 74th Congress).

3-02. Planning and Design.

a. House Document No. 308. A comprehensive report of possible plans of development of the Arkansas River and tributaries for flood control and other uses was published in 1936 as House Document No. 308, 74th Congress, 1st Session. The report considered several reservoirs for flood control and other purposes in the Salt Fork Basin, one of which was the Great Salt Plains site.

b. Definite Project Report. - Department Circular Letter, R. And H. No. 45 dated June 26, 1936, directed that a Definite Project Report be submitted for each flood control item authorized by the Flood Control Act of 1936. The Definite Project Report was transmitted to the Chief of Engineers, by letter dated June 10, 1937, and was approved by the 14th Indorsement dated August 3, 1938.

c. Analysis of Design. - An Analysis of Design for Great Salt Plains Dam was submitted in May 1939.

d. Executive Order No. 9337. - Executive Order Number 9337 dated April 24, 1943, designated the Great Salt Plains Reservoir Area as a National Wildlife Refuge. Approximately 31,065 acres of the project area are controlled and administered by the Fish and Wildlife Service of the U.S. Department of Interior.

3-03. Construction. A resumé of construction activities for Great Salt Plains Lake is presented in Table 3-1.

TABLE 3-1
RESUMÉ OF CONSTRUCTION ACTIVITIES

Activity	Date
Construction began	September 1938
Date of diversion	September 1940
Final storage began	May 1941
Conservation pool filled	November 1941

3-04. Related Projects. Great Salt Plains Lake is a multi-purpose project for flood control and conservation, including recreation and fish and wildlife. Great Salt Plains, Kaw and Keystone Lakes are integral units in a three-unit system. This system is a part of the multi-purpose plan for flood control, generation of hydroelectric power, navigation, and allied water uses on the Arkansas River and tributaries in Kansas, Arkansas, and Oklahoma.

3-05. Modification to Regulation. The flood control and conservation regulations as contained in this Manual supersede those contained in the Reservoir Regulation Manual for Great Salt Plains Reservoir, dated November 1966.

As such, no major modifications to the regulation plan were made and therefore the regulations remain essentially unchanged.

3-06. Principle Regulation Problems. Flood control operation of Great Salt Plains Lake is automatic, with the four ungated conduits designed to discharge 13,600 cfs when the lake level is at elevation 1138.5 (top of flood control pool).

IV - WATERSHED CHARACTERISTICS

4-01. General Characteristics.

a. Salt Fork of the Arkansas River. - The Salt Fork of the Arkansas River, a tributary of the Arkansas River, flows in a southeasterly direction across northern Oklahoma and joins the Arkansas River approximately 52 miles downstream of the Kansas-Oklahoma State line. The watershed is about 150 miles long and has an average width of approximately 45 miles. The drainage area of the basin is 6,764 square miles. The Salt Fork of the Arkansas River is a typical prairie stream, having a shallow sand filled channel, low banks and a moderately wide valley. A peculiar characteristic of the watershed is that the main stem follows closely along the southern rim while its principal tributary, the Chikaskia River, runs closely along the northern rim, joining the main stem about 26 miles from its mouth. The fall of the Salt Fork of the Arkansas River varies from about 10 feet per mile near the source to about 1 foot per mile near the mouth. A stream profile of the river is shown on Plate 4-1.

b. Medicine Lodge River. - This river is a major tributary of the Salt Fork of the Arkansas River above Great Salt Plains Dam. Medicine Lodge River enters the Salt Fork of the Arkansas River at river mile 118.5 and has a drainage area of 1,296 square miles. The channel is sand choked, and from 300 to 400 feet in width and its banks are four to five feet high. The channel gradient in Oklahoma is such as to produce high velocities causing considerable bank caving and loss of arable land by sanding. The fall of the river varies from about 50 feet per mile near the source to 6 feet per mile near the mouth.

c. Chikaskia River. - The river flows in a southeasterly direction to its confluence with the Salt Fork of the Arkansas River at river mile 26.0 and has a drainage area of 2,009 square miles. In the lower portion of the basin the river has natural levees and spreads over large areas at flood stage. The Chikaskia River is 145 miles long. The fall of the river varies from about 7 feet per mile near the source to about 3 feet per mile near the mouth.

4-02. Topography. Topography of the Great Salt Fork of the Arkansas River watershed varies from rolling prairies in the upper reach to flat terrain in the lower reach.

4-03. Geology & Soils. Great Salt Plains lake is located in the interior Lowland physiographic province. The bedrock strata are sedimentary rocks, mostly sandstone of Pennsylvania age. The Tertiary alluvial deposits consist of terrace deposits, dune sand, and loess.

4-04. Sedimentation and Degradation Ranges. A relatively large amount of sedimentation occurs at Great Salt Plains Lake because of the large amount of agriculture in the drainage basin and the absence of any upstream reservoirs.

The measurement of sediment deposited in the lake is accomplished by periodic soundings along established range lines. The cross-sections of these ranges have been determined and their ends marked by permanent monuments with known vertical and horizontal positions. Sediment resurveys will be made by Division and

District personnel. The original sediment survey for Great Salt Plains Lake was completed in May 1941. The most recent sediment survey was completed in 1978. The 1978 survey indicated a sedimentation rate of 728 acre-feet/year. Sedimentation ranges for Great Salt Plains Lake are shown on Plate 2-3.

4-05. Climate. The climate of the Salt Fork Arkansas River watershed is characterized by moderate winters and comparatively long summers with relatively high temperatures. Summer rains generally occur as thunderstorms with very intense rainfall of short duration and limited areal coverage. The winter rains are generally of low intensity, but cover a large area and are of considerably longer duration. The Gulf of Mexico is the source of much of the precipitation which falls on the basin.

Climatic characteristics for the basin are described in the following subsections:

- a. Temperature. -
- | | |
|----------------------------------------------|----------------|
| Mean annual | 58.1 degrees F |
| Maximum recorded (July 1936, Alva, OK) | 120 degrees F |
| Minimum recorded (Feb. 1951, Greensburg, KS) | -18 degrees F |
- b. Rainfall. - Basin Average Totals Based on Period of Record (1923 - 1995) (1)
- | | |
|----------------------------------------------------------------------|--------------|
| Average annual | 24.98 inches |
| Maximum annual (1949) | 35.46 inches |
| Minimum annual (1956) | 12.68 inches |
| Percent occurring during growing season
(April through September) | 72.1 percent |
- c. Snowfall. -
- | | |
|-------------|-------------|
| Mean Annual | 14.3 inches |
|-------------|-------------|

(1) The average monthly and annual rainfall and runoff data are shown in Table 4-1.

TABLE 4-1
AVERAGE MONTHLY AND ANNUAL RAINFALL AND RUNOFF DATA
GREAT SALT PLAINS DAM

Month	Average ⁽¹⁾ rainfall (inches)	Percent average annual rainfall	Average runoff ^{(1) (2)}		Percent of average annual runoff
			(acre-feet)	(inches)	
January	0.68	2.7	10,660	.06	3.4
February	0.89	3.6	14,660	.09	4.7
March	1.60	6.4	25,650	.15	8.2
April	2.26	9.1	34,260	.20	11.0
May	3.73	14.9	60,900	.36	19.6
June	3.75	15.0	50,070	.29	16.1
July	2.60	10.4	25,150	.15	8.1
August	3.02	12.1	23,110	.14	7.4
September	2.40	9.6	18,450	.11	5.9
October	1.86	7.4	22,740	.13	7.3
November	1.24	5.0	15,710	.09	5.0
December	0.96	3.8	10,320	.06	3.3
Total	24.99	100.0	311,680	1.83	100.0

- (1) Drainage area above Great Salt Plains Dam is 3,200 square miles
(2) Period of record, January 1923 through September 1995.

d. Evaporation. The estimated monthly pan evaporation at Great Salt Plains Lake is shown in Table 4-2.

e. Wind. The prevailing wind is from a southerly direction, with the greatest wind movements occurring in the spring months. A study of available wind velocity data indicated that for 1-minute and 1-hour durations, the highest wind velocities that can be expected are 70 and 50 miles per hour, respectively.

4-06. Storms & Floods. Most of the flood-producing storms over the watershed above Great Salt Plains Dam have been from 3 to 5 days duration and have occurred in the spring and the fall months. The winter months produce little precipitation. Maximum rainfall occurs in May and June, with a noticeable decrease in the average rainfall in July and August and an increase again in September. The maximum storm over the watershed above Great Salt Plains Dam during the 73 year Period of Record was 7.68 inches from 12 to 19 May 1935. Storms with an average precipitation of 3 inches or more over the area above Great Salt Plains Lake are shown in Table 4-3 on pages T4-3 through T4-5. Over the Period of Record, about 68 percent of the rainfall occurred during the months April through September. The averages were computed from published precipitation records of rainfall recorded for the basin. These records do not necessarily record the center of intense storms. Antecedent precipitation, season of the year, and many other factors influence storm runoff so that floods have frequently followed periods of relatively small amounts of recorded rainfall. Conversely, some storms of greater amounts of recorded rainfall have caused only minor flooding. Major floods at the Alva, Kiowa, Tonkawa and Ralston gages are shown in Tables 4-4a through 4-4d located on pages T4-6 through T4-10.

4-07. Runoff Characteristics. The river has a moderately low base flow. The river basin is a rolling plains region and the soils vary from heavy clays to sand dunes. Throughout a major portion of the watershed these soils have a relatively high infiltration rate, resulting in a substantial modification of stream flows. The runoff from Medicine Lodge River, principal tributary of the Salt Fork of Arkansas River above the dam, contributes a large part to flows into Great Salt Plains Reservoir. Stream gages pertinent to Great Salt Plains Lake are Alva, Kiowa, Tonkawa, and Ralston. Pertinent data for stream gaging stations used for regulation of Great Salt Plains Lake is shown on Table 4-5. Estimated monthly and annual flows past Great Salt Plains Dam are shown in Table 4-6 on pages T4-11 and T4-12. The inflow volume frequency by months is shown in Table 4-7. The flow duration curve is shown on Plate 4-2.

Peak inflows taken from monthly inflow computation records at the damsite for the period 1922 through 1996 were used to compute the maximum annual peak inflow probability. The inflow probability was derived in accordance with Bulletin 17B, "Guidelines for Determining Flood Flow Frequency," dated September 1981, with SWD requirements as stated in DF dated 22 August 1979. The peak inflow probability curve is shown on Plate 4-3.

TABLE 4-5
PERTINENT DATA FOR STREAM GAGING STATIONS

Station	River	Miles above mouth	Period of record	Gage zero	Flood stage (feet)
Alva, OK	Salt Fork Arkansas	141.0	Feb. 1938 to Aug. 1954	1297.04	6.0
			Oct. 1979 to present	1292.04	10.0
Kiowa, KS	Medicine Lodge	22.2	Feb. 1938 to Sep. 1950	1289.99 ⁽¹⁾	10.0
			Oct. 1954 to Sep. 1955	1286.99	10.0
			Jun. 1959 to present	1286.99	10.0
Tonkawa, OK	Salt Fork Arkansas	33.8	(2) Jan. 1936 to present	930.22	17.0
Ralston, OK	Arkansas	594.0	(2)(3) Jun. 1922 to present	776.70	16.0

⁽¹⁾Kiowa, KS gage datum 1289.99 till October 1944.

⁽²⁾Flows at Tonkawa and Ralston are modified by Great Salt Plains Reservoir since May 1941.

⁽³⁾Flows at Ralston are modified by Kaw Lake since April 1976.

TABLE 4-7
INFLOW VOLUME FREQUENCY
 (January 1922 - December 1995)

Month	MONTHLY INFLOW VOLUME IN ACRE-FEET				
	Frequency of Occurrence in Years				
	2	5	10	20	50
January	8,260	15,700	21,700	28,200	37,700
February	8,870	19,200	30,200	45,000	103,000
March	13,700	34,500	57,500	88,800	148,000
April	19,900	50,100	80,800	120,00	186,000
May	30,500	86,900	149,000	233,000	384,000
June	31,300	75,900	118,000	167,000	244,000
July	13,200	36,300	61,100	93,800	152,000
August	9,460	30,800	55,200	87,900	146,000
September	10,000	29,800	48,900	71,300	105,000
October	7,110	26,400	55,100	104,000	222,000
November	8,630	23,800	38,800	57,000	85,800
December	8,520	15,400	20,500	25,600	32,500

4-08. Water Quality. Water quality surveys have not been conducted for Great Salt Plains Lake.

4-09. Channel and Floodway Characteristics. The channel capacity for the Salt Fork Arkansas River below Great Salt Plains Dam is 10,000 cfs. Crest travel times are provided in Plate 4-4.

4-10. Upstream Structures. Great Salt Plains Lake is the farthest upstream structure on the Salt Fork Arkansas River. Kaw Lake is on the Arkansas River above the Salt Fork confluence with the Arkansas.

4-11. Downstream Structures. The next structure on the Arkansas River below Great Salt Plains Lake is Keystone Lake. Kaw and Keystone are operated as a

system with Great Salt Plains Lake in the multi-purpose plan for flood control, hydropower, navigation, and allied water uses on the Arkansas River and its tributaries.

4-12. Economic Data.

a. Population. Table 4-8 displays the actual 1980 and 1990 population of counties and major cities (Oklahoma) in the Salt Fork River basin, Oklahoma and Kansas. Also displayed are estimates of population for future years, 2000, 2010, and 2020. A general decline of about 9 percent occurred in Oklahoma counties from 1980 to 1990, largely due to the decline in the oil and related industries. Oklahoma counties with relatively larger cities, Garfield (Enid), and Kay (Ponca City) show increases in population projected over future years. Other counties show a continuing decline over future years. Kansas counties show a general decline of 8 to 10 percent from 1980 to 1990, except for Sumner county south of the city of Wichita Kansas (a 4 percent increase), then a slight increase over future decades.

b. Agriculture. General farming, mainly wheat, and livestock production are found throughout the basin. Farming practices usually consist of raising one or two cash crops, together with the raising of feed crops, livestock and poultry. Wheat and corn are the principal cash crops in the basin with alfalfa and grain sorghum being the principal feed crops. The average acreage devoted to crops and the value of crops in the Salt Fork of the Arkansas river floodplain is shown in Table 4-9.

c. Industry. The watershed of the Salt Fork of Arkansas River above Great Salt Plains Dam is used mainly for agricultural purposes and has little industry. There has been relatively little change in the industrial structure over the past several decades except for the decline of the oil and oil related industry. In Kansas, only Sumner county had a growth in manufacturing employees, about 22 percent from 1982 to 1987. In Oklahoma, all counties in the basin had a decrease in manufacturing employees from 1982-87. Most of the industrial establishments are for processing farm products, which include grain elevators, creameries, and flour and feed mills. Other industries are agricultural implement works and machine shops. Some oil and gas production occurs scattered throughout the basin. Oil refineries are located in Kay county and Garfield county.

d. Flood Damages. The estimated average annual damages, average annual damages prevented, and average annual residual damages on the Salt Fork of Arkansas River below Great Salt Plains Dam to the Arkansas River are shown in Table 4-10.

Table 4-8

**POPULATION OF COUNTIES AND CITIES
IN THE SALT FORK OF ARKANSAS RIVER BASIN
OKLAHOMA AND KANSAS**

County and City	1980	1990	2000	2010	2020
OKLAHOMA					
Woods County	10,923	9,103	9,005	8,780	8,390
Alva	6,416	5,495	5,510	5,390	5,185
Alfalfa County	7,077	6,416	6,290	6,240	6,085
Cherokee	2,105	1,787	1,690	1,660	1,595
Grant County	6,518	5,689	5,865	6,170	6,495
Garfield County	62,820	56,735	60,735	63,845	65,165
Enid	50,363	45,309	48,405	50,860	51,865
Kay County	49,852	48,056	51,145	53,900	55,445
Blackwell	8,400	7,538	7,710	8,045	8,130
Ponca City	26,238	26,359	28,650	30,340	31,485
Noble County	11,573	11,045	11,665	12,230	12,395
Perry	5,796	4,978	4,950	5,115	5,045
TOTAL OKLAHOMA	148,763	137,044	144,705	151,165	153,975
KANSAS					
Commanche County	2,554	2,313	2,412	2,442	2,515
Barber County	6,548	5,874	6,616	6,946	7,413
Harper County	7,778	7,124	7,328	7,419	7,673
Sumner County	24,928	25,841	25,979	26,873	27,988
TOTAL KANSAS	41,808	41,152	42,335	43,680	45,589
TOTAL COUNTIES	190,571	178,196	187,040	194,845	199,564

Source: "Population Projections for Oklahoma, 1990-2020", Oklahoma Department of Commerce, April 1993. 1993 County and city Extra, Annual Metro, City and County Data Book, 1992. Kansas Statistical Abstract, 1990-1991. Population Projects of Kansas Counties, University of Kansas.

TABLE 4-9
ANNUAL VALUE OF CROPS
 (1996 Current Normalized Prices)

CROP	Great Salt Plains To the Chikaskia River		Chikaskia River To the Mouth		Total	
	Acres	Value (\$)	Acres	Value (\$)	Acres	Value (\$)
Wheat	17,070	\$1,633,258	7,980	\$ 763,526	25,050	\$2,396,784
Corn	790	\$ 161,160	270	\$ 55,080	1,060	\$ 216,240
Grain Sorghum	790	\$ 150,100	670	\$ 127,300	1,460	\$ 277,400
Alfalfa	1,190	\$ 422,807	670	\$ 238,051	1,860	\$ 660,858
Pasture	17,470	\$2,482,836	1,060	\$ 150,647	18,530	\$2,633,484
Wood Pasture	2,390	\$ 84,917	2,650	\$ 94,155	5,040	\$ 179,071
TOTAL	39,700	\$4,935,078	13,300	\$1,428,759	53,000	\$6,363,837

TABLE 4-10
AVERAGE ANNUAL FLOOD DAMAGES
 (July 1997)

Item	Average Annual Damages	Average Annual Damages Prevented	Average Annual Residual Damages
Crops	\$1,399,920	754,042	\$ 645,877
Structures	\$1,502,914	\$ 712,786	\$ 790,128
TOTALS	\$2,902,833	\$1,466,828	\$1,436,005

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. Hydrometeorological Stations.

a. Facilities. The Water Control Section, Hydrology-Hydraulics Branch, Tulsa District Office; the National Weather Service (NWS); and the U.S. Geological Survey (USGS) cooperate to collect data and maintain a reliable communication network. All pertinent reporting observation stations for the Salt Fork Arkansas River basin are shown on Plate 5-1.

Streamflow gages at Alva, OK and Kiowa, KS (Medicine Lodge River) are useful for predicting inflow. Precipitation stations important to Great Salt Plains Lake are:

a. Data Collection Platforms (DCP) - Pratt, Kiowa, and Harper, KS and Alva and Great Salt Plains Dam, OK.

b. Mesonet - Alva, Cherokee, Freedom, and May Ranch, OK.

c. National Weather Service Observers - Cherokee, Freedom, Alva, and Helena, OK and Attica, Coldwater, Greensburg, Kiowa, Medicine Lodge, and Sun City, KS.

Stream flow gages downstream of Great Salt Plains Lake are Tonkawa on the Salt Fork Arkansas River and Ralston on the Arkansas River.

A remote indicator pool gage with a 24-hour continuous recorder is used to monitor pool elevation. A staff gage located on the upstream side of the dam is periodically checked to verify the recorder gage.

b. Reporting. The reporting procedure for precipitation and stream gaging stations is on a cooperative basis with the NWS. The reporting criteria for the pertinent precipitation and stream gaging stations are shown in Table 5-1. Hydrometeorological data collected at Great Salt Plains Lake will be submitted to the Water Control Section, Hydrology-Hydraulics Branch, Tulsa District Office (telephone (918) 669-7097 or VHF-FM radio, call signal WUI-3). Detailed instructions on reporting criteria are presented in Section 2 of Exhibit C, Standing Instructions to Project Manager.

TABLE 5-1
REPORTING CRITERIA FOR PERTINENT STATIONS

Station	Report to	Times of report
Rainfall stations		
Airport stations	National Weather Service	6-hour rainfall as of 6 a.m., 12 noon, 6 p.m., and 12 midnight.
Corps of Engineers dams	Data Collection Platform	As needed.
All other stations	National Weather Service	Initial report at 7:00 a.m. Report at 1:00 p.m. When 0.50 inches of precipitation has occurred since 7:00 a.m. Report at 7:00 p.m. when 0.50 inches of precipitation has occurred since 1:00 p.m.
Stream gage stations		
Medicine Lodge River		
Kiowa, Kansas	Data Collection Platform	As needed.
Salt Fork Arkansas River		
Alva, OK	Data Collection Platform	As needed.
Tonkowa, OK	Data Collection Platform	As needed.
Arkansas River		
Ralston, OK	Data Collection Platform	As needed.
Radar Stations	National Weather Service	Hourly.

c. Maintenance. Maintenance and repair of the weather stations instrumentation are responsibilities of the NWS. Maintenance and repair of stream gages are responsibilities of the administering agency. Both the Corps

of Engineers and the USGS have stream gaging equipment in the Salt Fork Arkansas River Basin. The Hydrology/Hydraulics Section, Hydrology-Hydraulic Branch, Tulsa District, is charged with the responsibility for the equipment owned by the Corps of Engineers.

d. Automation. Presently, only a few stream gages in the Tulsa District are manually called by telephone. The remainder are Data Collection Platform's (DCP's) which record data hourly and transmit the data every four hours. The data is transmitted via satellite to a downlink and computer facility owned and operated by the National Oceanic and Atmospheric Administration (NOAA) near Washington, D.C. The data is transferred to the Tulsa District water control computer using domestic satellite (DOMSAT). When received, the river stage is converted to flow and lake elevation is converted to storage. All the data is then stored in a data base in the Corps' water control computer for access when needed. DCP's also report rain data in the same way. In addition to DCP data, observer rainfall data is collected and stored in the computer for use in forecasting. Observers phone the NWS offices in this region and the NWS then encodes the data into a Standard Hydrologic Exchange Format (SHEF). This data is then transferred to the water control computer using telephone modems and a dedicated phone line to the Tulsa River Forecast Center. Once the data is received, it is decoded and handled in a manner similar to the DCP data. Informative display of all this data is possible through the use of several versatile computer programs developed for use on the water control computer.

5-02. Water Quality Stations. No water quality stations currently exist at Great Salt Plains Lake.

5-03. Sedimentation Stations.

a. Facilities. The thirty-one (31) sedimentation ranges above Great Salt Plains Lake are used for sedimentation measurements. These ranges are surveyed periodically for the purpose of computing sediment deposition, and new lake area and capacity data. The last sedimentation survey was completed in 1978.

b. Reporting. As necessary.

c. Maintenance. Sedimentation and degradation ranges will be maintained by the Corps of Engineers.

5-04. Recording Hydrologic Data. Hydrologic information is recorded as it is received by the Water Control Section as described in the following subsections.

a. Elevation, Flows, and Storage. The raw data is stored by station and by time as it is received by the water control computer. Several computer programs convert the raw data into stage/pool elevation data and the corresponding flow/storage values as determined from rating curves. This processed data is then stored in two data bases. As the data bases fill, they

are occasionally archived on tape for permanent storage. Stream flow measurements made by the USGS are called in and entered into a computer program for storage.

b. Precipitation. Precipitation data from the DCP stations and the project are combined with NWS observer precipitation data and stored in the data base with the stage/discharge data. This data can then be accessed by computer programs for plotting distribution, determining basin rainfall, and forecasting runoff (see Chapter VI).

c. Water Quality Data. No water quality data exists for Great Salt Plains Lake.

d. Radar and Satellite Reports. Current computer-enhanced satellite images, weather charts, and national radar summaries are automatically received into the water control computer from a private vendor. Also, a computer-enhanced image of the real-time radar scope image depicting cloud coverage and relative intensity is available from the National Weather Service and is routinely received from Oklahoma City. NWS locations in and near the Tulsa District with this capacity, in addition to Oklahoma City, are Kansas City and Monett, Missouri; Garden City and Wichita, Kansas; and Amarillo, Texas. Hard copies of any of this data are available by use of plotters located in the Water Control Section.

5-05. Communication Network. Wire facilities at Canton Lake are local and long distance telephone service. Radio communication is by VHF-FM fixed station (call signal WUI-301) capable of reaching local mobile stations, the Tulsa District, and other stations on the north loop of the District via repeater relay. Maintenance of the telephone lines is the responsibility of the company leasing the lines to the Government. To alert the public of impending gate changes, a warning horn is located at the project.

5-06. Communication with Project.

a. Regulating Office. Instructions for the storage and release of water from Great Salt Plains Lake will be communicated by the Water Control Section to the responsible project operative personnel at Canton Lake. This communication will normally be made by long distance telephone, but on occasion could be made by VHF-FM radio. The project reporting instructions, described in paragraph 5-07 and Exhibit C of this Manual, will be communicated directly to the Water Control Section. Should communication between the project and the District Office be disrupted, the Project Manager will, on his own initiative, direct regulation of the lake in accordance with the emergency rules of regulations as required in Section VII and Exhibit C of this Manual. The Organization Chart for Flood Control Regulation of Great Salt Plains Lake is shown on Plate 5-2.

b. Between Project Office and Others. Communication between project personnel and other Federal, State, and local agencies will be sufficient to effect the coordination described in Section IX of this Manual.

5-07. Project Reporting Instructions. Daily lake data from Great Salt Plains Lake is obtained from computer database in the Water Control Section, Hydrology-Hydraulics Branch, Tulsa District Office (telephone 918-669-7097 or VHF-FM radio, call signal WUI-3). The Water Control Section office is manned from 7:00 a.m. to 4:30 p.m. daily and occasionally on weekends and holidays. Data for nonworking days is also available from the computer database. The daily report is in the form shown on Plate 5-3. Should unusual conditions arise during nonworking hours, one of the persons listed on page i should be contacted. The following data should be included in the daily report.

a. As of 8 a.m. Pool elevations at 8 a.m., number and amount low flow valve openings; precipitation and evaporation in inches for the preceding 24 hours (7 a.m. to 7 a.m.); and wind velocity and direction (at 8 a.m.).

b. Each Low Flow Valve Operation. Canton project personnel report date and time of each valve operation, number of valve open and amount of valve opening before and after gate operation, lake elevation. Confirmation of valve changes shall be made immediately after completion of the change. Complaints about pool elevations or releases, operating machinery failure, and out-of-service times for maintenance shall be reported to the Water Control Section as they occur.

c. During Flood Periods. When Canton personnel have the project under surveillance, additional reports may be required by the Water Control Section.

d. Rainfall Reports. Rainfall reports are obtained via Data Collection Platform.

5-08. Warnings. Impacts from low-flow valve changes are minimal, however it is the responsibility of the Canton Lake Manager and project personnel authorized to make low-flow valve changes to maintain a list in current status of residents and/or property which might be endangered or inconvenienced by large and/or prolonged discharges. If damaging discharges are expected to occur, notification will be made by telephone, or oral warning by Corps employees. Notification will be made in accordance with the Tulsa District supplements to ER 500-1-1. This would include media such as radio, television, telephone, citizens band radio, use of law enforcement and civil defense agencies and their communication system, National Guard and reserve units, supplemented by oral warning by Corps employees. Studies have been made to determine the possible downstream flood conditions which could exist in the event of a maximum spillway discharge or failure of the dam at maximum pool. Approximate water surface profiles and flooded area maps giving the results of these studies are kept in the Great Salt Plains Lake Operation and Maintenance Manual, Volume II, Contingency Plan for Emergencies. In every case, when a valve change is made a horn is blown to give warning to people immediately downstream of Great Salt Plains Dam.

5-09. Frequency of Valve Changes. During flood periods, low flow valve operation will be minimal. Frequency of low flow valve changes during low flow operation will generally be less than once a day.

VI - HYDROLOGIC FORECASTS

6-01. General. Hydrologic forecasts are necessary in predicting stream flow above Great Salt Plains Lake and corresponding outflow to be used in forecasts for Tonkawa and Ralston stream gages and Keystone Lake.

a. Role of Corps of Engineers. Hydrologic forecasts are made by the Forecasting Section, Tulsa District, for use in the regulation of lakes for flood control and other authorized purposes and for the benefit of Corps of Engineers' constructed projects and flood-mitigating activities. As distinguished from the NWS which furnishes weather and flood forecasts to the public, the District furnishes current information on lake levels, weather, stream flow, or any other available information on observed conditions, along with technical advice. The Water Control Section (lake information recording), telephone number (918) 669-7521, is listed in the Tulsa, Oklahoma telephone directory to provide the public a means of receiving current lake information such as pool levels and discharges. General news releases are made by the Public Affairs Office which is kept fully informed of the hydrologic situation as appropriate. Further discussion of the role of the Corps of Engineers in hydrologic forecasts is presented in Section V of the Water Control Master Manual for the Arkansas River Basin.

b. Role of Other Agencies. The National Weather Service (NWS) in Norman, Oklahoma, is the official agency making flood forecast information available to the public. This information is obtained by the Corps of Engineers by way of computer modem. The NWS issues routine scheduled reports containing the following forecasts:

- (1) Weather forecasts (daily, severe weather, and 5-day extended).
- (2) National weather summaries and additional details for the five south-central states (four times daily).
- (3) Quantitative precipitation forecasts (four times daily - one (1) 24-hour quantitative precipitation forecast and three (3) 6-hour quantitative precipitation forecasts).
- (4) 3-day river stage forecasts, when available.
- (5) Rainfall required to produce bankfull stages (weekly).
- (6) Urgent priority messages such as severe weather warnings, watches, forecasts, and statements and instructions from Civil Defense during emergency conditions are transmitted immediately, regardless of scheduled traffic. Unscheduled traffic, including the following, is sent any time the circuit is idle.

- (a) Damage reports.
- (b) Road information and winter weather conditions.
- (c) River and flood warning bulletins, forecasts and statements.
- (d) 30-day forecast.

(7) Percent chance of precipitation (twice daily).

6-02. Flood Condition Forecasts.

a. Requirements. Flood condition forecasts are necessary whenever substantial rainfall has occurred on the basin above Great Salt Plains Lake. The flood forecasting reaches used for Great Salt Plains Lake are shown on Plate 6-1.

b. Methods. The Forecasting-Section makes individual lake inflow forecasts and forecasts of flow for the uncontrolled areas below the dams. These forecasts are made using computer program 723-X6-L2010 (HEC-1).

- (1) Forecasting River Stages. The official forecasts of the NWS are used in predicting river stages. Forecasts are also made by the Forecasting-Section by applying the peak flows determined by the procedures described below to stage discharge curves. Forecasts for the stream gages listed in Table 4-5 and upstream gages are pertinent to the regulation of Great Salt Plains Lake.
- (2) Forecasting Flows. The following sub-paragraphs describe the methods used to forecast flows into Great Salt Plains Lake.
 - (a) Runoff Estimate. Precipitation data is received from the NWS and the DCP's by the water control computer. The average precipitation over the project basin is computed by a computer program called RAIN. The RAIN program takes the DCP data and plots isohyetal maps of 24-hour rainfall. It then computes the basin average total rainfall using a triangular mesh analysis. The program is able to break the rainfall down into sub-basin totals for input into the HEC-1 forecasting model, from which reservoir inflow volume estimates are made and pool elevations are predicted.
 - (b) Computer Model. The HEC-1 inflow model has been developed for Great Salt Plains Lake. A sample of the input for the HEC-1 inflow model is shown in Exhibit B.
 - (c) Inflow Computations. Computation of the forecasted inflow and pool elevations is accomplished by using the HEC-1 computer model. Input requirements are runoffs, or rainfall, and loss rate; initial base flow, if any; starting pool elevation; and controlled releases. The model is run interactively on the Water Control Data

System Computer located in the Hydrology-Hydraulics Branch of the Tulsa District office and on the water control computer in the Southwest Division office in Dallas. The model is also available on a magnetic tape which can be loaded on any other computer. These are used as backups if the primary computer is down. DSS files are backed up on magnetic disk periodically. A sample of the summary output is shown in Exhibit B. The predicted inflow hydrograph is verified and adjusted as necessary by comparing it to the actual developing hydrograph. The developing hydrograph is computed from known pool elevations and controlled releases. A sample inflow computation is shown on Plate 6-2.

- (d) Flood Control Releases. Estimated hydrographs at control points downstream from the dam are made by procedures described in Section V of the Arkansas River Basin Water Control Master Manual and paragraph 6-02 of this Manual. These hydrographs are adjusted to conform with the latest hydrologic information available. Outflows from Great Salt Plains Lake are routed and combined with the adjusted hydrographs for determinations of hydrographs at the desired downstream control points.

6-03. Conservation Purpose Forecasts.

a. Requirements. Conservation forecasts may be required to predict pool levels during fish spawning season, special recreation events, and water quality.

b. Methods. Forecasts for conservation purposes during non-flood periods would rely largely on statistical interpretation of historical data. The flow duration curve, Plate 4-2, and the peak inflow probability curve (natural river conditions), Plate 4-3, would be considered in conjunction with NWS forecasts in making conservation forecasts during non-flood periods.

6.04. Long-range Forecasts.

a. Requirements. The regulatory decision involved in evacuating stored floodwater, sustaining yield during low flow periods, and maintaining constant, or slowly changing pool levels for conservation purposes is dependent on accurate estimates of the water volume that will pass through the reservoir.

b. Methods. Reliable methods for long-range runoff forecasts are not presently available. The NWS publishes an "Average Monthly Weather Outlook" semi-monthly which may be used as an estimate of the trend of the weather but should not be given too much weight for one forecast, especially for a specific point. The NWS forecasts described in paragraph 6-01b are more useful in a shorter range.

VII - WATER CONTROL PLAN

7-01. General Objectives. The primary purpose of Great Salt Plains Lake is flood control. Great Salt Plains Lake, along with Kaw Lake and Keystone Reservoir, are integral parts of the reservoir system used to control flooding in the Arkansas River Basin above Tulsa. This reservoir system is a part of the multi-purpose plan for flood control, generation of hydro-electric power, navigation, and allied water uses on the Arkansas River and tributaries in Kansas, Arkansas, and Oklahoma. Flood releases from Great Salt Plains Lake are automatic, through four ungated sluices.

7-02. Constraints. The four ungated sluices are designed to discharge 13,600 cfs when the reservoir is at elevation 1138.5 (top of flood control pool).

7-03. Overall Plan For Water Control.

a. General. Great Salt Plains Lake is a unit in a multi-purpose system for the benefit of water resources in the Arkansas River Basin. Development of these resources is discussed in the Arkansas River Basin Water Control Master Manual, while the specific purposes of each of the various projects are detailed in the appropriate appendix.

b. System Regulation. Flood releases are automatic (see para 7-01).

7-04. Standing Instructions to Project Manager. During flood periods, the lake will be regulated in accordance with the normal regulations for flood control operations as directed in sub-paragraph 7-05a and Exhibit C of this Manual. Instructions for any low-flow valve changes will be issued by the Water Control Section. In the event communication with the Tulsa District Office is disrupted, the lake regulation will become the responsibility of the Canton Lake Manager and will be regulated in accordance with sub-paragraph 7-05b and Exhibit C of this Manual. In addition, the Canton Lake Manager will immediately make every effort to re-establish communications with the Tulsa District Office. The Canton Lake Manager will make observations of pool level data when the project is under surveillance and report those observations as directed in paragraph 5-07 and repeated in Exhibit C. Should an emergency situation occur in which communication is not lost, such as a drowning accident, a broken buoy line, or power outage, the Water Control Section will be notified immediately.

7-05. Flood Control.

a. Normal Regulation for Flood Control Operations. Flood Control operation of Great Salt Plains Reservoir is automatic, with the four ungated sluices being designed to discharge 13,600 cfs when the reservoir level is at elevation 1138.5 (top of the flood control pool). The dam constitutes a relatively high degree of protection for the Salt Fork of Arkansas River flood plain from the dam downstream to its confluence with the Arkansas River, and provides notable benefits from that point to the upper limits of Keystone Reservoir. The only controlled operation of the outlet works is the operation of the two 36-inch low-flow valves which will be directed by the District Office.

b. Emergency Flood Control Regulations. Should communication with the Tulsa District Office be disrupted, the Canton Lake Manager will make every effort to re-establish communication with the Tulsa District Office and, if necessary, send information to the Tulsa District Office by any means available. Any releases being made through the low-flow valves at the time emergency conditions arise will be discontinued until communications with the District Office are re-established.

7-06. Recreation. Recreation is not included as any authorized project purpose, therefore, no storage or releases are specifically provided for recreational purposes.

7-07. Water Quality. No storage or releases are specifically provided for water quality control. However, emergency water quality releases will be made to respond to distressed fish conditions as discussed in the next paragraph.

7-08. Fish and Wildlife. In April 1943, Executive Order No. 9337 designated the reservoir area as a National Wildlife Refuge. Low-flow releases are occasionally made on an "as-needed" basis to relieve oxygen deficiency of fish trapped in stilling basins. Management of the fish and wildlife resources will be under the direction of the United States Fish and Wildlife Service.

7-09. Water Supply. No storage or releases are provided for water supply.

7-10. Water Rights.

a. General. Water rights for the Salt Fork Arkansas River are issued by the Oklahoma Water Resources Board.

b. Regulation Procedure for Water Rights. Releases from inflow to satisfy downstream water rights will be made at the request of the Oklahoma Water Resources Board. The Board will inform the Water Control Section as to the amount and time distribution of the required release.

7-11. Hydro-electric Power. Operation of Great Salt Plains Lake does not include hydro-electric power generation.

7-12. Navigation. Operation of Great Salt Plains Lake is automatic.

7-13. Sediment. There are no regulation procedures for sediment.

7-14. Drought Contingency Plans. A drought contingency plan for the Mid-Arkansas River basin was approved in June 1991. This plan identifies water uses and needs within the basin and out lines steps which can be taken to alleviate the problems encountered during a drought.

7-15. Flood Emergency Action Plans. A flood emergency action plan is outlined in the Operation and Maintenance Manual, Volume II, for Great Salt Lake. The purpose of the manual is to specify procedures to protect the public from possible property damage or loss of life as a result of large

uncontrolled releases of water due to failure, or severe damage to the dam appurtenant works.

7-16. Deviation from Normal Regulation. Low-flow valve operation will be very infrequent and deviations even more infrequent, however, the procedure is included. The District Commander is occasionally requested to deviate from normal regulation of the lakes. Prior approval is obtained from the Southwestern Division Office for the subsequent action, except as noted in sub-paragraph 7-16a below. Deviation requests usually fall into the following categories:

a. Emergencies. Some emergencies that can be expected are: drowning and other accidents, failure of operating facilities, and flushing of pollution where water quality is not a project purpose. Necessary action under emergency conditions is taken immediately unless such action would create equal or worse conditions. The Southwestern Division Office is informed as soon as practicable. A written confirmation showing the deviation and conditions will be furnished to CESWD-ETE-P (Form SWD 898).

b. Unplanned Minor Deviations. These are unplanned instances that create a temporary need for minor deviations from the normal regulation of the lake, although they are not considered emergencies. Construction accounts for the major portion of these incidents and includes utility stream crossings, bridgework, and major construction contracts. Changes in releases are sometimes necessary for maintenance and inspection. Requests for changing release rates are generally from 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 lakes, and possible alternative measures. In the interest of maintaining good public relations, the requests are complied with providing there are no adverse effects on the overall operation of the project for maximum benefits to the authorized purposes. Approval for these minor deviations will normally be obtained from the Southwestern Division Office by telephone. A written confirmation showing the deviation and conditions will be furnished to CESWD-ETE-P (Form SWD 898).

c. Planned Deviations. Other instances include anticipated or planned deviations. Each condition would be analyzed on its merits. Sufficient data on flood potential, lake and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes will be presented by letter, telephone, or facsimile to the Southwestern Division Office along with Tulsa District recommendations for review or approval.

7-17. Rate of Release Changes. The capacity of both low-flow valves full open is far less than one-sixth of channel capacity. The increase and decrease in releases from the lake shall be accomplished in a manner, which minimizes damage to the reservoir area and downstream channel. Every reasonable precaution will be made to eliminate, if possible, bank sloughing, undercutting, excessive erosion, and danger to human and animal lives. Situations will arise which will not allow an orderly increase and/or decrease in

releases. Example of these situations are large flood releases as described in paragraph 7-05, and drownings which occur downstream of the dam.

7-18. Operational Curves. The upper weir and sluice rating curves are shown on Plate 7-1. The low-flow rating curve partial and full openings for one valve operation is shown on Plate 7-2. The tailwater rating curve is shown in Plate 7-3. The evaporation curves are shown on Plate 7-4. Elevation versus area capacity data are compiled in Table 7-1 on pages T7-1 through T7-5.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. General. Hydrographs of the spillway design flood, the standard project flood (one-half of spillway design flood), and the flood of May 1951 are presented in this manual. These examples were selected to show the reservoir effects on a variety of flood conditions.

8-02. Flood Control.

a. Probable Maximum Flood. The probable maximum flood is not considered to be a valid design flood for this project.

b. Spillway Design Flood. Plate 8-1 shows the operational hydrographs of the spillway design flood with a peak inflow of 365,000 c.f.s. and a volume of 1,252,000 acre-feet routed through the reservoir, on an empty flood control pool (elevation 1125.0 m.s.l.) and on a pool elevation of 1136.0 s.m.l. Elevation 1136.0 m.s.l. was used in the "Analysis of Design, Great Salt Plains Dam," dated May 1939, for routing the spillway design flood through the reservoir. This elevation was the maximum pool obtained as determined by a study of reservoir operations, using computed flows for a period of 31 years.

c. Standard Project Flood (one-half spillway design flood). Plate 8-2 shows the operational hydrographs of the standard project flood (one-half the spillway design flood) having a peak inflow of 182,500 c.f.s. and a volume of 626,000 acre-feet routed through the reservoir on an empty flood control pool (elevation 1125.0 m.s.l.) and on a pool elevation of 1136.0 m.s.l.

d. Flood of May 1951. The flood of May 1951 was caused by a storm over Salt Fork of Arkansas River Basin during the period May 14-22. The average rainfall above and below the dam was 7.18 inches and 5.23 inches, respectively. The operational hydrograph for the flood is shown on Plate 8-3.

8-03. Recreation. Recreation is not included as an authorized project purpose, therefore, no storage or releases are specifically provided for recreational purposes. The Oklahoma Department of Tourism operates and maintains the recreational areas.

8-04. Water Quality. No storage or releases are specifically provided for water quality control. Low-flow releases are made to respond to distressed fish conditions as discussed in the next paragraph.

8-05. Fish and Wildlife. In April 1943, Executive Order No. 9337 designated the reservoir area as a national wildlife refuge. Low flow releases are occasionally made on an as-needed basis to relieve oxygen deficiency of fish downstream of the dam. Management of the fish and wildlife resources are under the direction of the United States Fish and Wildlife Service.

8-06. Water Supply. No storage or releases are provided for water supply.

8-07. Hydro-electric Power. Operation of Great Salt Plains Lake does not include hydro-electric generation.

8-08. Navigation. Operation of Great Salt Plains in automatic.

8-09. Drought Contingency Plans. The Drought Contingency Plan has carefully

addressed the problems encountered during a drought. It provides a base for implementing actions necessary for conservation and has been structured according to the severity of the drought. This will enable the Water Control Section to more effectively coordinate with the public and district elements during such emergencies.

8-10. Flood Emergency Action Plans. Preparation of these reports has focused attention upon the need for effective coordination during floods. Coordination strategy has been established between the Water Control Section and other district elements which deal with the media and local government. This has proven to yield positive results during the more recent flood events.

8-11. Frequencies.

a. Peak Inflow Probability. Peak inflows taken from monthly inflow computation records at the damsite for the period 1922 through 1993 were used to compute the maximum annual peak inflow probability. The inflow probability was derived in accordance with Bulletin 17B, "Guidelines for Determining Flood Flow Frequency," dated September 1981, with SWD requirements as stated in DF dated 22 August 1979. The peak inflow probability curve is shown on Plate 4-3.

b. Pool Elevation Duration and Probability. Pool level hydrographs for a period of record, from January 1944 through December 1997 have been analyzed for exceedance probabilities. Pool elevation probabilities are shown on Plate 8-4. The pool elevation duration curve is shown on Plate 8-5.

c. Key Control Points. Principal control point for Great Salt Plains Lake is the Tonkawa Gage. Forecasts of hydrographs at these points are made by procedures described in paragraph 6-02 of this Manual. Generally, outflows less than 12,000 cfs do not cause out-of-bank flooding.

8-12. Other Studies.

a. Improvements in Forecasting. Studies are in progress to improve the forecasting techniques presented in Section VI of this Manual. Computer programs have been developed to forecast inflows into the lake, the resulting pool elevations and the effects of outflows at the downstream gages. Use of these programs has greatly shortened the reaction time in preparing regulation schedules.

b. Channel and Floodway Improvement. There are currently no channelization projects in progress between Great Salt Plains Lake and Keystone Reservoir. Ground and aerial reconnaissance are made as required to determine if revised channel capacities are warranted.

IX - WATER CONTROL MANAGEMENT

9-01. Responsibilities and Organizations.

a. Corps of Engineers. Great Salt Plains Lake is owned by the U.S. Government. The Tulsa District of the Corps of Engineers is the operating agency for Great Salt Plains Lake. Project reporting instructions are presented in Section V, and project operating instructions are presented in Section VII of this Manual.

- (1) Responsibilities and Duties During Normal Operations. The Water Control Section, Hydrology-Hydraulics Branch, Tulsa District Office, is charged with the following responsibilities and duties under general supervision of the Engineering and Construction Division.
 - (a) Regulation of lakes and dissemination of data.
 - (b) Investigations and refinement of regulation procedures.
 1. Analysis of past floods.
 2. Reconnaissance to determine channel capacities.
 3. Improvement of forecasting techniques.
 4. Plan and coordinate the hydrometeorologic reporting network with the National Weather Service and the U.S. Geological Survey.
 - (c) Train personnel in flood control duties.
 1. Periodic visits to projects by personnel of the section to familiarize themselves with regulation facilities, become acquainted with the operating personnel, and provide the background for improving facilities and methods.
 2. Instruct personnel of the Hydrology-Hydraulics Branch in flood control procedures to supplement the Water Control Section during flood emergencies, when necessary.
 - (d) Prepare reports on lake regulations.
 1. Recurring reports.
 2. Water control manuals.
 3. Postflood reports.
- (2) Responsibilities and Duties During Flood Emergencies. During flood emergencies, the Water Control Section is responsible for the following:
 - (a) Evaluation of current hydrologic, hydraulic, and meteorologic data.
 - (b) Presentation of storm and flood analysis to the District Engineer and other interested District personnel.

- (c) When necessary, furnish personnel to assist project operating personnel in flood regulations.
- (d) Regulation of lakes in accordance with flood control regulation schedules.
- (e) Furnish information to higher authority.
 - 1. Initial reports to the Southwestern Division and Office of the Chief of Engineers by telephone.
 - 2. Situation reports by facsimile.
- (f) Furnish information to the Public Information Center.

The duties of the project operating personnel under flood conditions are set forth in Section VII of this Manual. The details of the overall procedures of the Tulsa District under emergency conditions are set forth in Tulsa District Supplement A, Natural Disaster Activities, to ER 500-1-1.

- (3) Assignment of Personnel. During nonflood periods, instructions for the routine regulation of the lake are accomplished by personnel of the Water Control Section. However, during flood periods, assistance of other personnel may be required to maintain effective regulation of the lake. The area and magnitude of the flood will determine the number of people engaged in each particular activity.
- (4) Provision for 24-hour Alert. The National Weather Service and project personnel are provided with a list of names, addresses, and telephone numbers of key personnel of the Engineering and Construction Division with instructions to provide warning if unusual conditions occur. Responsible personnel are on duty at the Tulsa District Office 24 hours a day whenever basin and/or project conditions warrant and during flood emergencies. Responsible personnel will be on duty or on call at the project at all times.
- (5) Role of Project Manager. The Project Manager will regulate the lake according to instructions issued by personnel of the Water Control Section. The instructions follow the "Normal Regulations for Flood Control," included in Section VII and paragraph II-2 of Exhibit C. If the Project Manager loses communication with the District Office, he will immediately make every effort to re-establish communication with the District Office while initiating emergency regulations for flood control, which is also included in Section VII and paragraph II-3 of Exhibit C of this Manual.

b. Other Federal Agencies. The National Weather Service and the U.S. Geological Survey cooperate together with the Water Control Section, Hydrology-Hydraulics Branch, Tulsa District Office, to accumulate rainfall and streamflow data. The Environmental Protection Agency, together with the State of Oklahoma, establishes the standards for water quality releases.

c. State and County Agencies. Management of the fish and wildlife resources of Great Salt Plains Lake is the responsibility of the United States Fish and Wildlife Service.

d. Private Organizations. Presently, there are no private organizations which have regulatory responsibilities at Great Salt Plains Lake.

9-02. Interagency Coordination. Cooperative arrangements with other Federal agencies, state agencies, and local interests are discussed in Section X of the Water Control Master Manual, Arkansas River Basin, Tulsa and Little Rock Districts, dated July 1980. Excerpts of interest to the regulation of Great Salt Plains Lake are presented below.

a. Local Press and Corps Bulletins. The Corps of Engineers and the NWS cooperate in forecasting river stages and streamflows. The Corps will provide the local press with NWS river stage and flood forecasts, which may be supplemented with observed river stages, observed and forecasted lake conditions and other information on observed conditions, and technical advice to enable local interests to obtain optimum flood protection and to perform rescue and relief functions.

b. National Weather Service. The Tulsa District Office and the Tulsa River Forecast Center, NWS, exchange hydrometeorologic data and reports in order to prevent duplication of effort in obtaining and disseminating data. The NWS is the responsible agency for issuing public forecasts of stream stages. This exchange of data is discussed in greater detail in Section VI of this Manual.

c. U.S. Geological Survey. The Corps of Engineers and the U.S. Geological Survey (USGS) cooperate in a program for the construction, maintenance, and operation of stream gaging stations throughout the Tulsa District. During floods, the Corps of Engineers and the USGS coordinate field activities to maximize the number of stream discharge measurements.

d. Power Marketing Agency. Operation of Great Salt Plains Lake does not include hydro-electric power generation.

e. Other Federal, State, or Local Agencies. The Tulsa District Office exchanges information with state government officials, the Oklahoma Department of Transportation, Oklahoma Highway Patrol, and others during flood emergencies. The Tulsa District also coordinates with state agencies concerning fish and wildlife throughout normal operation.

9-03. Interagency Agreements. None.

9-04. Commissions, River Authority, Compacts and Committees. Arkansas River Basin compacts have been established between the states of Arkansas and Oklahoma, and Kansas and Oklahoma. The major purposes of these compacts are:

a. To promote interstate comity between Arkansas and Oklahoma, and Kansas and Oklahoma.

b. To provide for an equitable apportionment of the waters of the Arkansas River between Arkansas and Oklahoma, and Kansas and Oklahoma, and to promote the orderly development thereof.

c. To provide an agency for administering the water apportionment agreed to in the compacts.

d. To encourage the maintenance of an active pollution abatement program in each of the three states and to seek the further reduction of both natural and manmade pollution in the waters of the Arkansas River Basin.

e. To facilitate the cooperation of the water administration agencies of Arkansas and Oklahoma, and Kansas and Oklahoma in the total development and management of the water resources of the Arkansas River Basin.

9-05. Non-Federal Hydropower. Operation of Great Salt Plains Lake does not include hydro-electric power generation.

9-06. Reports.

a. Daily Reports. The daily report is prepared in accordance with TDR 1130-2-12 by the Water Control Section daily, except Saturday, Sunday, and holidays to cover a period of 24 hours. The report provides data for use by personnel whose work requires knowledge pertaining to: the regulation of reservoirs, field investigations, stream gaging, construction of flood control projects affected by releases from reservoirs, answering public inquiries, and preparing public releases. The report includes a summary of hydrologic conditions as of 8 a.m. of that date, weather forecast, including the extended outlook for the next four days, any quantitative precipitation forecasts or general rainfall data, and lake data for the previous and present days. The report is completed by the Hydrology-Hydraulics Branch daily under normal conditions and dispatched from the water control computer in Tulsa to the water control computer in the Southwestern Division Office.

b. Monthly Lake Reports. The Water Control Section, in accordance with paragraph 6-04 of EM 1110-2-3600 and paragraph 12(d) of ER 1110-2-240, prepares the monthly lake regulation tabulation. These reports are a record of lake regulation for all flood control, navigation, or multiple-purpose storage lakes that are under supervision of, or of direct interest to, the District Office. Supplemental information on the regulation of the lakes, such as explanation of deviations from approved schedules, is added as a note on the tabulation or as an attachment. These tabulations are promptly prepared each month and transmitted from the water control computer in Tulsa to the water control computer in the Southwestern Division Office.

c. Flood Situation Reports. The Water Control Section submits daily situation reports during floods in accordance with ER 500-1-1 and OM 500-1-6. The report contains various types of information relative to the floods. Pertinent data specifically required for reservoirs are as follows: name of reservoir, reservoir stage, predicted maximum stage and anticipated date, rates of inflow and outflow in cfs, percent of flood control storage used to date and at predicted maximum stage, and any special information particularly pertinent to the flood situation.

d. Post Flood Reports. This report is prepared in accordance with ER 500-1-1 and OM 500-1-6, as soon as practicable after a flood causing major damage. The report describes flood emergency operation by the Corps of Engineers and others. Included in summary form are: available hydrologic information, damage estimate, and other engineering data considered to be essential for flood control and flood plain studies or in the review of possible claims against the United States. The report is prepared by the District Office Planning Division personnel, using information compiled and prepared by the Water Control Section. The report should be completed within approximately 3 months of the time of flooding, including statement of final cost.

e. Annual Report. This report is prepared by the Water Control Section. The report contains a summation of the general conditions of the river basins and the individual projects in the District for the preceding fiscal year. The report also presents the activities and accomplishments of the Water Control Section for the past year. The report is forwarded to the Southwestern Division Arkansas River Control Center for inclusion in the Division's annual report.

f. Summary of Reports. Table 9-1 is a summary of the reports required in the regulation of lakes in the Tulsa District.

TABLE 9-1
SUMMARY OF REPORTS

Name of Report	When Required	Form Number	Regulation Requiring Reporting
Daily Report (RCS SWTED-H-3)	Daily, except Saturday, Sunday, and holidays	SWT Form 813	OM 1130-2-12
Monthly Lake Report	Monthly	----	ER 1110-2-240, EM 1110-2-3600
Flood Situation Report	During floods	----	ER 500-1-1, OM 500-1-6
Post Flood Report	Following a flood causing major damage	----	ER 500-1-1, OM 500-1-6
Annual Report	Annually	----	ER 1110-2-240

TABLES

**TABLE 4-2
ESTIMATED MONTHLY PAN EVAPORATION**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1947	2.15	2.29	4.4	6.65	8.68	10.94	12.36	13.9	12.72	8.4	2.72	2.01	87.22	7.27
1948	2.25	2.27	3.82	9.59	10.84	10.59	11.61	10.07	9.96	6.94	2.98	2.36	83.3	6.94
1949	2.29	2.37	4.63	5.89	8.6	10.24	11.9	10.66	8.15	6.39	4.56	1.81	77.49	6.46
1950	2.06	3.85	7.66	8.09	9.15	13.14	9.03	8.25	6.54	5.99	6.44	1.96	79.4	6.62
1951	2.4	3.08	4.79	6.2	7.46	8.03	10.03	10.29	6.96	5.29	3.06	2.05	69.66	5.8
1952	1.14	2.81	4.02	5.4	8.3	14.52	13.29	10.92	9.34	6.53	3.96	2.4	82.63	6.89
1953	2.02	3.51	5.69	6.8	9.89	15	9.83	10.55	10.2	5.84	2.7	2.42	84.35	7.03
1954	2.68	4.49	5.76	7.94	6.39	13.18	16.08	14.21	11.76	5.76	4.39	3.03	95.67	7.97
1955	2.06	2.27	5.94	9.73	9.96	9.48	13.24	11.12	8.97	6.41	4.27	2.97	86.44	7.2
1956	2.41	2.42	6.95	8.76	11.44	13.45	13.62	15.43	13.23	8.32	3.92	2.26	102.21	8.52
1957	1.84	2.57	3.99	5.38	6.86	7.98	12.14	11.44	5.99	3.09	2.26	2.6	66.14	5.51
1958	1.58	2.15	1.86	5.38	7.92	9.47	10.41	9.15	7.26	5.27	3.58	1.47	65.5	5.46
1959	1.38	2.14	5.91	6.64	8.61	7.84	8.13	11.44	9.16	4.46	3.1	2	70.81	5.9
1960	0.96	1.72	3.65	8.01	8.82	9.99	9.16	10.24	8.01	4.4	3.57	1.49	70.02	5.83
1961	1.95	2.23	5.11	7.48	8.77	9.25	11.03	9.29	7.18	6.24	1.94	1.78	72.25	6.02
1962	1.95	3.13	4.91	6.85	11.29	9.36	10.96	11.5	6.24	4.48	2.65	1.68	75.04	6.25
1963	2.06	2.84	6.47	8.17	8.02	9.44	11.91	11.75	6.56	7.24	2.93	1.14	78.57	6.55
1964	2.84	3.03	6.42	11.65	11.56	13.99	16.64	13.72	9.87	7.16	3.5	1.7	104.1	8.67
1965	2.11	2.55	4.35	8.61	10.54	11.43	16.09	13.11	9.51	6.54	3.66	2.42	90.94	7.58
1966	2.16	2.26	7.5	8.52	11.37	14.79	15.21	10.51	6.99	8.19	5.33	2.37	95.22	7.93
1967	2.16	2.82	8.06	10.1	10.42	11.2	9.58	10.78	7.42	8.22	2.9	2.09	85.87	7.16
1968	1.48	2.63	6.84	8.26	8.14	11.39	13.49	14.03	9.26	7.42	2.89	2.24	88.11	7.34
1969	1.77	3.39	4.09	7	8.26	11.5	14.71	11.8	7.75	5.46	3.96	2.21	81.94	6.83
1970	1.67	3.65	3.03	8.14	12.17	12.21	15.71	14	9.01	4.95	4.01	2.36	91.11	7.59
1971	2	2.19	5.45	9.26	12.8	13.14	14.76	10.66	10.83	6.69	3.63	1.86	93.29	7.77
1972	2.05	2.83	8.73	9.36	9.55	13.64	12.71	12.5	7.62	6.26	1.97	1.66	88.9	7.41
1973	2.18	2.32	5.25	5.32	10.2	14.12	14.34	12.72	7.02	6.73	2.83	1.96	85.01	7.06
1974	3.44	2.68	4.47	9.9	9.81	12.3	16.39	10.13	5.27	4.26	2.73	1.77	85.07	7.09
1975	2.23	2.22	4.43	6.07	6.66	9.25	11.17	11.74	8.39	8.64	3.34	1.93	76.26	6.36
1976	2.42	3.62	8.34	7.09	7.09	12.32	13.04	14.46	8.22	5.36	2.96	2.16	87.06	7.26
1977	1.95	3.17	5.16	7.14	8.1	11.56	14.15	10.36	7.35	5.68	2.49	1.85	79	6.56
1978	2.06	2.62	5.35	7.76	7.95	9.04	14.67	14.55	8.84	7.42	3.06	2.29	85.83	7.15
1979	2.09	2.51	4.39	5.75	8.52	9.92	10.52	10.82	8.37	8.76	3.16	2.47	77.3	6.44

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1960	2.19	2.07	4.29	6.37	6.96	10.33	12.84	14.4	10.39	7.01	3.44	2.31	82.6	6.88
1961	1.86	2.96	5.22	8.52	7.91	10.44	11.46	10.06	8.04	4.51	2.9	2.38	76.28	6.36
1962	1.56	2.07	5.32	6.9	7.13	7.2	10.54	10.26	8.76	6.76	3.19	2.14	71.83	5.99
1963	2.18	1.67	4.82	6.15	8.03	8.06	13.19	12.92	9.32	4.39	2.21	0.32	73.26	6.1
1964	0.97	3.9	3.36	5.42	7.18	10.99	13.67	10.75	9.21	4.92	3.89	0.98	75.22	6.27
1965	1.24	1.18	4.16	6.5	8.09	9.48	11.62	9.96	8	3.88	2.13	0.31	66.55	5.55
1966	0.31	0.52	5.67	7.31	8.16	8.79	13.36	8.34	6.29	3.37	1.98	2.04	66.14	5.51
1967	2.35	2.05	3.9	7.03	6.65	8.52	10.18	9.94	5.95	5.5	3.31	1.41	66.79	5.5658333
1968	1.24	2.05	3.97	5.5	7.99	9.91	9.63	11.47	7.55	4.39	3.44	2.63	66.77	5.8141667
1969	2.15	0.85	3.13	7.45	7.36	7.32	9.12	7.67	6.07	5.83	3.97	2.14	63.16	5.2633333
1990	2.86	2.36	3.34	5.27	6.19	12.24	12.59	10.36	7.62	6.18	3.27	2.2	74.52	6.21
1991	1.48	2.46	3.44	6.29	7.05	9.82	12.73	10.63	6.43	6.82	3	1.85	71.82	5.985
1992	1.55	0.61	3.78	5.36	6.99	5.92	10.76	7.74	7.27	5.4	2.2	1.4	58.96	4.915
1993	1.55	1.7	3.17	5.12	5.86	7.89	11.35	9.65	6.42	4.8	2.91	1.93	62.17	5.1808333
1994	1.35	2.54	5.67	6.54	6.49	10.2	9.77	10.2	6.48	4.68	2.12	1.79	68.03	5.6691667
1995	1.39	2.28	3.09	5.04	4.78	7.43	10.36	8.64	5.25	5.87	3.21	1.97	59.29	4.9408333
1996	1.55	2.1	3.67	6.32	9.6	8.31	9.36	6.46	4.35	5.51	1.84	0.36	61.25	5.1041667
TOTAL	95.85	124.12	247.86	362.02	426.86	526.59	614.76	555.99	403.43	296.25	180.34	96.75	3609.42	325.76833
MEAN	1.917	2.4824	4.9572	7.2404	8.5372	10.5318	12.2652	11.1118	8.0666	5.965	3.2068	1.935	76.1684	6.5153667

TABLE 4-3

MAJOR STORMSJANUARY 1923 THROUGH DECEMBER 1996GREAT SALT PLAINS LAKE

Inclusive Date	Average Rainfall (inches)
28 May-3 Jun 1923	5.25
14-19 Sep 1923	3.38
30 Sep-3 Oct 1923	3.58
10-13 Oct 1923	3.80
7-13 June 1925	3.05
1-3 Oct 1926	3.14
1-3 Aug 1927	4.08
16-19 Nov 1928	3.20
16-17 Aug 1932	3.86
12-19 May 1935	7.68
7-10 Sep 1937	3.04
18-23 May 1938	4.03
19-26 Oct 1941	5.15
14-16 Apr 1945	1.88*
24-28 Sep 1945	4.12
7-16 Apr 1947	4.04
24-29 Jun 1948	3.76
12-14 Aug 1948	3.24
14-19 May 1949	3.91
4-5 Jun 1949	1.49*
3-5 Sep 1949	2.48
27 Jul-1 Aug 1950	3.71
14-22 May 1951	7.18
20-25 Jun 1951	3.78
28 Jun-1 Jul 1951	2.49
5-9 Sep 1951	3.00
8-12 Jul 1953	3.01
18-20 May 1955	3.45
14-19 Jun 1955	3.07
8-13 Jun 1957	2.07
26 Jun -1 July 1957	3.76

TABLE 4-3 (continued)

MAJOR STORMSJANUARY 1923 THROUGH DECEMBER 1996

GREAT SALT PLAINS LAKE

Inclusive Date	Average Rainfall (inches)
14-15 Sep 1957	3.37
22-25 Sep 1959	3.58
30 Sep - 5 Oct 1959	3.41
24-26 Aug 1960	1.79*
3-8 May 1961	2.28
19-20 Aug 1961	3.07
22-24 Jun 1963	2.40
23-26 Aug 1969	4.65
16-18 Apr 1970	2.45
27-28 May 1970	5.70
23-31 Mar 1973	4.15
22-29 Sep 1973	6.05
10 Oct 1973	3.60
9 May 1979	1.98*
30-31 Oct 1979	3.06
16-20 Jun 1980	3.55
8-10 May 1981	3.08
12-20 May 1982	3.72
9-13 Jul 1982	3.56
8-11 Oct 1985	3.74
29 Sep- 4 Oct 1986	2.08*
23-24 Mar 1987	1.56*
22-29 May 1987	3.02
12-19 May 1989	3.70
7-15 Jun 1989	3.93
11-15 Aug 1989	3.75
25-29 Jun 1992	3.10
4-9 Aug 1992	4.19
1-3 May 1993	2.46*
7-12 May 1993	2.54*
15-18 May 1993	1.25*

*Not a major storm, but listed because flooding occurred

TABLE 4-3(continued)

MAJOR STORMS

JANUARY 1923 THROUGH DECEMBER 1996

GREAT SALT PLAINS LAKE

Inclusive Date	Average Rainfall (inches)
12-16 Jul 1993	3.15
3-6 Aug 1993	4.22
23-27 May 1995	2.71*
8-11 Jun 1995	2.58*
1-6 Aug 1995	3.51
22-27 Jul 1996	4.71
1-3 Aug 1996	2.46*
14-21 Sep 1996	3.92
14-17 Nov 1996	3.33
4-11 Apr 1997	3.93
20-24 Sep 1997	3.43
31 Oct - 3 Nov 1998	5.21

TABLE 4-4a
 FLOODS FOR PERIOD OF RECORD
 Alva Gage
 (Salt Fork Arkansas River)
 Flood Stage 10.0 Feet

Date	Stage (feet)	Discharge (cfs)
08-May 1922	10.3	not available
27-Apr 1938	7.51	17,000
19-May 1938	7.95	19,900
23-May 1938	8.42	22,300
31-May 1938	7.00	14,500
16-Aug 1938	8.90	25,300
13-Sep 1938	5.95	10,000
27-Jun 1939	6.10	9,900
30-Aug 1940	5.98	9,500
24-Sep 1940	6.00	9,500
01-Sep 1941	6.43	8,150
23-Oct 1941	9.08	27,000
19-Apr 1942	6.40	8,110
24-Apr 1942	6.70	8,760
03-Oct 1942	7.00	14,000
10-Apr 1944	6.80	13,000
22-Apr 1944	7.60	13,500
26-Jun 1945	7.20	8,900
10-Jul 1945	6.57	8,240
28-Sep 1945	8.65	16,200
18-Jun 1946	6.60	8,330
10-Apr 1947	6.72	8,660
13-Apr 1947	6.64	8,330
04-Jun 1947	6.70	8,660
21-Jun 1947	7.10	10,100
28-Jun 1948	8.26	12,500
14-Aug 1948	8.20	15,200
16-May 1949	9.43	26,200
19-May 1949	7.27	12,300
04-Jun 1949	6.70	9,700
08-Jun 1949	7.00	11,000
13-Jun 1949	7.87	16,000
04-Sep 1949	7.12	11,500
11-Sep 1949	7.77	15,400
28-Jul 1950	7.65	10,700
17-May 1951	7.84	17,500
22-May 1951	6.62	11,000
21-Jun 1951	6.52	10,600
24-Jun 1951	6.88	12,500
30-Jun 1951	8.52	21,700
12-Jul 1953	8.50	not available
24-May 1954	8.35	not available
30-Oct 1979	15.04	9,230
10-Oct 1985	15.24	12,800
24-Mar 1987	14.91	11,000

TABLE 4-4b

Floods For Period of Record

Kiowa, KS Gage
 (Medicine Lodge River)
 Flood Stage 10.0 Feet

Date	Year	Stage/feet	Discharge (cfs)
02/14	1922	11.90	not available
05/08	1922	16.00	not available
05/23	1923	12.20	not available
06/08	1923	11.90	not available
05/05	1938	11.05	13000.00
10/22	1941	11.75	16000.00
09/24	1945	9.70	9510.00
09/28	1945	9.82	9600.00
05/17	1949	9.90	11100.00
06/05	1949	9.64	8360.00
09/05	1949	10.19	13100.00
06/-	1957	15.50	not available
10/17	1968	11.16	6730.00
03/31	1973	11.14	6920.00
10/12	1973	12.10	12000.00
10/31	1979	11.30	7100.00
07/10	1982	10.33	4900.00
10/11	1985	10.02	5460.00
03/24	1987	10.22	6480.00

TABLE 4-4c
Floods for Period of Record
Tonkawa Gage
(Salt Fork Arkansas River)
Flood Stage 17.0 Feet

Date	Stage (feet)	Discharge (cfs)
06-10-1923	26.80	not available
08-17-1932	19.40	not available
06-06-1935	23.00	not available
09-09-1937	16.76	14500
05-20-1938	22.82	40800
05-24-1938	21.94	34500
06-01-1938	17.41	16300
04-26-1942	17.70	15500
06-22-1942	16.69	13400
05-20-1943	17.86	16500
04-23-1944	19.26	22500
12-05-1944	18.05	16800
04-16-1945	20.06	23500
09-30-1945	17.35	14300
04-14-1947	18.53	16600
05-16-1947	18.35	16000
05-10-1948	16.58	12700
08-15-1948	17.22	13300
02-13-1949	17.09	13300
03-31-1949	16.60	12600
05-21-1949	19.33	19600
05-29-1949	16.85	13000
05-19-1951	17.36	14300
05-22-1951	18.71	17200
06-26-1951	17.43	13800
07-02-1951	20.14	22600
07-04-1951	19.35	19200
07-15-1951	21.59	31200
10-03-1955	17.51	12100
05-17-1957	20.62	19600
05-25-1957	19.70	18500
06-25-1957	21.14	21200
07-03-1957	19.17	17200
10-05-1959	23.48	28400
05-09-1961	17.90	15200
05-22-1961	16.98	13000

TABLE 4-4c
Floods for Period of Record
Tonkawa Gage
(Salt Fork Arkansas River)
Flood Stage 17.0 Feet

09-13-1961	21.17	22600
11-02-1961	22.10	24300
10-26-1964	17.39	12200
11-18-1964	21.69	21400
04-21-1970	20.30	20700
03-11-1973	22.03	22800
04-02-1973	20.21	17500
04-25-1973	18.41	14800
10-11-1973	28.98	97300
03-11-1974	21.06	23200
09-02-1974	17.58	15600
11-05-1974	23.06	31300
06-09-1975	19.51	19700
06-11-1975	18.17	16800
11-21-1979	19.89	16700
05-18-1982	19.55	15600
03-27-1983	17.64	13400
03-24-1984	19.25	16700
04-09-1984	17.18	12200
11-15-1985	20.05	18000
10-03-1986	27.61	74700
03-01-1987	19.72	16200
03-18-1987	17.54	12800
03-24-1987	19.49	15800
05-28-1987	25.12	47000
07-05-1987	18.49	14700
09-29-1987	21.43	24300
03-04-1988	19.58	16600
04-02-1988	19.46	16400
06-12-1989	17.10	12600
08-06-1992	20.58	20100
05-03-1993	21.65	25500
05-10-1993	24.40	45500
05-19-1993	19.29	16000
11-21-1994	18.84	15300
08-06-1995	19.49	16400
08-11-1995	21.81	26400
08-04-1995	26.28	40900

TABLE 4-4d
Floods For Period of Record
Ralston Gage
(Arkansas River)
(Flood Stage 16.0 Feet)

Date	Stage (Feet)	Discharge (Cfs)
06-11-1923	23.00	200000
10-06-1926	18.90	not available
05-21-1935	16.00	not available
05-22-1938	16.44	75600
06-24-1942	18.54	94000
05-20-1943	18.12	97200
04-25-1944	22.62	179000
04-19-1945	19.55	124000
09-30-1945	18.51	108000
10-02-1945	19.48	110000
04-16-1947	18.50	114000
08-04-1950	17.60	92800
05-20-1951	19.23	106000
05-24-1951	17.70	95500
06-27-1951	17.42	91100
07-03-1951	21.45	135000
07-16-1951	20.28	120000
05-20-1957	21.41	120000
06-13-1957	17.46	77900
07-01-1957	19.88	112000
10-05-1959	21.62	158000
05-08-1961	21.22	165000
09-14-1961	18.50	114000
11-04-1961	17.83	103000
11-18-1964	22.60	171000
06-27-1969	16.42	77000
04-20-1970	18.33	101000
03-12-1973	19.41	121000
04-03-1973	16.92	95000
10-13-1973	22.98	211000
03-11-1974	17.72	106000
11-05-1974	18.62	111000
09-30-1986	17.87	103000
10-04-1986	22.20	174000
05-12-1993	18.76	139000

TABLE 4-6
ESTIMATED MONTHLY AND ANNUAL FLOWS IN ACRE-FEET
GREAT SALT PLAINS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1923	6000	6000	8800	13800	79800	121000	13100	4200	71600	202800	11800	12000	550900
1924	6100	7200	20600	44800	21000	8100	86000	12600	42400	10400	4900	7000	271100
1925	3900	3200	2400	8200	6200	45400	36800	4500	29800	2000	23600	3400	169300
1926	5100	5600	5300	8600	7100	20400	8600	6600	16900	90800	4800	4500	184300
1927	6700	8200	8200	12400	13400	27000	10700	164000	4200	4100	3300	5600	267800
1928	6700	13000	12800	29600	47400	27800	27000	6400	3200	7300	65600	16100	262900
1929	30400	23200	18700	23400	42000	48000	24800	10000	10000	7600	24200	11000	273300
1930	15000	13700	8400	8900	84800	32400	5100	8600	3600	6500	8000	6400	201400
1931	6100	5600	17500	28000	34600	26000	5800	6200	8200	3700	19000	8800	169500
1932	7900	6000	5800	5600	8900	64000	71600	157000	8000	2900	2500	6000	346200
1933	2300	1700	1800	7400	1400	600	1400	46000	1700	2100	1200	1800	69400
1934	4400	4000	4000	8100	5900	31000	2300	2200	12400	2800	3600	4100	84800
1935	6600	6500	6000	4400	319000	11000	2500	12600	3300	3500	12700	5200	393500
1936	4900	3100	3400	1100	15600	47200	1500	120	8900	24600	1800	3500	115720
1937	4300	2900	7900	2200	32800	29000	8100	2000	68400	3100	1500	3000	165200
1938	2000	6500	7000	33600	250800	74700	15400	37800	10600	860	18700	4300	462060
1939	8200	5200	13100	30000	9700	8700	2600	4100	0	290	60	310	82260
1940	120	3300	1500	5900	14300	18300	2800	7500	7700	760	7100	2500	71780
1941	5000	8000	7800	28800	50800	2600	37100	8900	11800	177600	36400	17000	391800
1942	9800	10400	13400	112100	22300	31300	18400	19500	6800	51700	9100	13800	318600
1943	9100	9300	6600	9300	25900	5900	480	10	2300	6300	1400	6400	82990
1944	6600	5300	13800	121800	63700	5900	8700	15000	8100	22100	7500	26200	304700
1945	14900	13200	29700	98600	38600	39100	29500	5800	67200	31200	6700	7400	381500
1946	11700	13900	11900	18200	25600	5800	170	100	10	3800	23300	18000	132480
1947	12000	6100	37900	126000	113700	30200	8900	7000	20	3000	460	10400	355680
1948	3000	33700	64700	13500	5800	69100	41300	131600	8100	3600	32500	14100	421000
1949	38900	150600	47700	34500	305000	217000	51200	16600	133400	29600	15400	15700	1055600
1950	15000	17000	14300	9700	12900	11100	61900	119900	12100	5400	5200	7400	291900
1951	8300	12800	12600	16300	199700	269500	186700	16100	53300	22700	21800	15000	834800
1952	17400	14400	27200	78900	69300	10800	0	5300	0	0	3300	5600	232200
1953	6200	5100	11500	5000	5600	2300	23500	1400	1000	3700	850	4900	71050
1954	2600	4600	4100	5400	29800	3400	0	600	0	600	0	0	51100
1955	130	3100	1400	1600	35000	86200	9900	5800	8900	17700	1100	2500	173330
1956	2800	3500	3200	2400	2000	5300	17700	2000	260	420	800	1400	41780
1957	560	1300	6600	55000	277200	252700	86400	2800	27500	18900	14500	8600	752060
1958	10500	8000	28000	23400	21300	70800	46600	5900	7400	2800	4900	4800	234400
1959	5500	7000	19300	16500	40700	7400	4700	5700	50300	100900	11800	13200	283000
1960	16900	52200	50400	19300	33600	35400	34100	54900	11200	24600	10800	15600	359000
1961	11000	14100	27400	24100	68200	37200	13100	68100	22100	16100	30200	19500	351100
1962	22300	16500	12500	14000	6300	57800	17000	9100	19300	5900	6900	6200	193800
1963	4800	7100	8700	8600	4200	89000	17800	3800	23700	1800	2200	1100	172800
1964	4700	4200	3300	7400	9200	5700	4200	19300	1700	2300	56000	13700	131700
1965	5000	7900	6800	12100	16400	87300	11100	8300	33400	12400	3600	9400	213700
1966	5200	15200	7400	9300	3000	0	9200	11000	2900	1600	500	2900	68200

TABLE 4-8 (CONTINUED)
ESTIMATED MONTHLY AND ANNUAL FLOWS IN ACRE-FEET
GREAT SALT PLAINS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1967	3300	4500	3800	13100	4400	25800	25200	3300	11600	5600	4100	6400	111100
1968	5200	6000	9600	16500	30300	30600	5800	28900	11700	34200	7200	6300	192300
1969	6300	11800	22700	98300	56900	45400	5900	25500	65700	10700	7000	8400	364600
1970	6600	6200	12600	81000	14700	36300	4000	6000	8700	6100	4000	6000	192200
1971	6700	10800	17200	8900	5600	27400	9700	3700	7700	13500	22500	13300	147000
1972	8200	9600	8700	13500	11300	14900	30200	8300	9400	7000	8100	8000	137200
1973	23000	30300	268200	242000	70800	13600	16700	4100	52000	175100	25600	32600	954000
1974	25100	17000	61300	61500	25700	11900	6200	47500	23500	12900	59600	23700	375900
1975	27100	33000	40700	25600	97400	118500	18400	8600	2100	2100	13600	11900	399000
1976	9300	8700	11900	42900	65600	11400	10600	2800	5800	3100	2600	3200	177900
1977	3500	9300	8500	13500	63700	23500	7900	29300	38800	7800	13000	8300	227100
1978	8800	19600	20800	18400	63200	66500	6000	4300	4000	700	3900	3500	219700
1979	4700	7700	69600	15900	83000	22600	34600	8600	3300	14500	73300	13200	351000
1980	17100	15600	25600	61600	46500	77500	5900	4000	550	710	20	7000	262080
1981	4900	2500	9700	4700	50700	22800	8900	10400	39800	17600	92100	11500	275600
1982	9100	22300	25800	10200	148900	146300	119200	7100	2000	3100	5700	7200	506900
1983	7000	14200	43800	76100	46400	109200	18300	2300	12700	11100	9600	6500	357200
1984	7600	9700	67400	94800	30500	23500	2200	1000	180	3500	8000	23400	271780
1985	13700	18200	20400	21000	67200	42700	19000	9100	38100	140100	39800	21800	451100
1986	13700	11600	12500	12100	23400	90500	10900	28300	28100	136000	49300	24200	440600
1987	30600	77900	173500	54000	143700	62800	65200	21300	52600	24700	15600	29200	751100
1988	36700	20400	84100	133500	33100	21200	16400	1700	3700	6400	7800	9300	374300
1989	12140	11180	25690	30080	57940	105720	35610	80130	57970	18570	14550	13470	463050
1990	28760	31290	54330	34870	29400	20080	5950	4200	5780	7970	13190	9320	245140
1991	12690	9180	8110	30700	16440	21100	5220	6520	6710	2730	18660	14260	152320
1992	8370	3610	11740	17310	10700	91610	47170	64770	3170	4110	41850	32230	336640
1993	37880	57620	70310	57570	444200	67140	145290	93820	14720	7930	11900	11700	1020080
1994	11900	12840	15900	24900	41460	33480	11090	5590	5360	16314	37310	11018	227162
1995	12050	8281	36298	38460	181986	191408	72864	135671	33124	73588	0	8430	792160
MEAN	10659	14662	25646	34260	60896	50066	25153	23202	18802	23432	15499	10296	312574
MAXIMUM	38900	150600	268200	242000	444200	269500	186700	164000	133400	202800	92100	32600	1055600
MINIMUM	120	1300	1400	1100	1400	0	0	10	0	0	0	0	41780

T4-12

TABLE 7-1

ELEVATION VERSUS AREA AND CAPACITY DATA

GREAT SALT PLAINS LAKE, OK
 28 JULY 1998 - BASED ON 1978 RESURVEY
 AREA (1000'S OF AC)

ELEV	0	1	2	3	4	5	6	7	8	9
1110	.000	.000	.000	.000	.000	.000	.000	.000	.000	.195
1120	1.252	3.210	4.444	6.011	7.109	7.780	9.003	10.006	11.207	12.554
1130	13.788	14.807	15.976	16.983	18.092	19.526	21.495	23.043	24.765	26.557
1140	28.169	29.547	30.835	31.915	32.898	33.822	34.701	35.776	37.020	38.242
1150	39.216	40.028	41.058	42.635	43.962	44.882	46.118	46.665	47.522	48.458
1160	48.690	.000	.000	.000	.000	.000	.000	.000	.000	.000

CAPACITY 1000'S OF ACRE-FEET

ELEV	0	1	2	3	4	5	6	7	8	9
1110	.000	.000	.000	.000	.000	.000	.000	.000	.000	.098
1120	.821	3.052	6.879	12.107	18.667	26.111	34.503	44.007	54.614	66.494
1130	79.665	93.963	109.354	125.834	143.371	162.180	182.691	204.960	228.864	254.525
1140	281.888	310.746	340.937	372.312	404.718	438.078	472.340	507.578	543.976	581.607
1150	620.336	659.958	700.501	742.348	785.646	830.068	875.568	921.960	969.053	1017.043
1160	1065.617	.000	.000	.000	.000	.000	.000	.000	.000	.000

TABLE 7-1 (Continued)

ELEVATION VERSUS AREA AND CAPACITY DATA

GREAT SALT PLAINS LAKE, OK
 28 JULY 1998 - BASED ON 1978 RESURVEY
 CAPACITY [1000'S OF ACRE-FEET]
 AREA [1000'S OF ACRES]

POOL ELEV	[FT. NGVD]										
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
1110.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
1111.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
1112.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
1113.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
1114.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
1115.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
1116.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
1117.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
1118.0	.000	.001	.004	.009	.016	.024	.035	.048	.063	.079	
1119.0	.098	.122	.158	.204	.260	.327	.405	.493	.592	.701	
	.195	.301	.407	.512	.618	.724	.829	.935	1.041	1.146	

TABLE 7-1 (Continued)

ELEVATION VERSUS AREA AND CAPACITY DATA

GREAT SALT PLAINS LAKE, OK
 28 JULY 1998 - BASED ON 1978 RESURVEY
 CAPACITY [1000'S OF ACRE-FEET]
 AREA [1000'S OF ACRES]

POOL ELEV	[FT. NGVD]	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
1120.0		.821	.956	1.111	1.285	1.479	1.692	1.925	2.177	2.449	2.741
		1.252	1.448	1.644	1.840	2.035	2.231	2.427	2.623	2.819	3.014
1121.0		3.052	3.379	3.719	4.071	4.435	4.811	5.200	5.601	6.015	6.441
		3.210	3.333	3.457	3.580	3.704	3.827	3.951	4.074	4.197	4.321
1122.0		6.879	7.331	7.799	8.283	8.782	9.297	9.828	10.374	10.936	11.513
		4.444	4.601	4.758	4.914	5.071	5.228	5.384	5.541	5.698	5.854
1123.0		12.107	12.713	13.331	13.959	14.599	15.249	15.911	16.583	17.267	17.961
		6.011	6.121	6.231	6.340	6.450	6.560	6.670	6.780	6.890	6.999
1124.0		18.667	19.381	20.102	20.829	21.564	22.305	23.053	23.807	24.569	25.336
		7.109	7.176	7.243	7.310	7.378	7.445	7.512	7.579	7.646	7.713
1125.0		26.111	26.895	27.692	28.500	29.321	30.154	30.999	31.857	32.726	33.608
		7.780	7.902	8.025	8.147	8.269	8.392	8.514	8.636	8.759	8.881
1126.0		34.503	35.408	36.323	37.249	38.184	39.129	40.085	41.050	42.026	43.012
		9.003	9.103	9.204	9.304	9.404	9.505	9.605	9.705	9.806	9.906
1127.0		44.007	45.014	46.032	47.063	48.106	49.160	50.227	51.306	52.396	53.499
		10.006	10.126	10.246	10.366	10.486	10.607	10.727	10.847	10.967	11.087
1128.0		54.614	55.741	56.882	58.036	59.204	60.385	61.580	62.789	64.010	65.245
		11.207	11.342	11.476	11.611	11.746	11.881	12.015	12.150	12.285	12.419
1129.0		66.494	67.756	69.030	70.316	71.614	72.925	74.249	75.584	76.932	78.292
		12.554	12.677	12.801	12.924	13.048	13.171	13.295	13.418	13.541	13.665

TABLE 7-1 (Continued)

ELEVATION VERSUS AREA AND CAPACITY DATA

GREAT SALT PLAINS LAKE, OK
 28 JULY 1998 - BASED ON 1978 RESURVEY
 CAPACITY [1000'S OF ACRE-FEET]
 AREA [1000'S OF ACRES]

POOL ELEV [FT. NGVD]	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
1130.0	79.665	81.049	82.443	83.847	85.262	86.686	88.121	89.566	91.022	92.487
	13.788	13.890	13.992	14.094	14.196	14.298	14.399	14.501	14.603	14.705
1131.0	93.963	95.449	96.947	98.457	99.979	101.512	103.057	104.614	106.182	107.762
	14.807	14.924	15.041	15.158	15.275	15.392	15.509	15.625	15.742	15.859
1132.0	109.354	110.957	112.569	114.192	115.825	117.468	119.121	120.784	122.457	124.140
	15.976	16.077	16.177	16.278	16.379	16.480	16.580	16.681	16.782	16.882
1133.0	125.834	127.537	129.252	130.978	132.716	134.464	136.223	137.993	139.775	141.567
	16.983	17.094	17.205	17.316	17.427	17.538	17.649	17.759	17.870	17.981
1134.0	143.371	145.187	147.018	148.863	150.723	152.596	154.484	156.387	158.304	160.235
	18.092	18.236	18.379	18.522	18.666	18.809	18.952	19.096	19.239	19.383
1135.0	162.180	164.143	166.125	168.127	170.148	172.189	174.250	176.331	178.431	180.551
	19.526	19.723	19.920	20.117	20.314	20.511	20.708	20.904	21.101	21.298
1136.0	182.691	184.848	187.021	189.209	191.412	193.632	195.866	198.116	200.382	202.663
	21.495	21.650	21.805	21.959	22.114	22.269	22.424	22.579	22.733	22.888
1137.0	204.960	207.273	209.603	211.950	214.315	216.696	219.095	221.512	223.945	226.396
	23.043	23.215	23.388	23.560	23.732	23.904	24.076	24.249	24.421	24.593
1138.0	228.864	231.349	233.852	236.374	238.913	241.470	244.045	246.638	249.249	251.878
	24.765	24.944	25.124	25.303	25.482	25.661	25.840	26.020	26.199	26.378
1139.0	254.525	257.188	259.868	262.564	265.276	268.005	270.749	273.509	276.286	279.079
	26.557	26.718	26.879	27.041	27.202	27.363	27.524	27.685	27.847	28.008

TABLE 7-1 (Continued)

ELEVATION VERSUS AREA AND CAPACITY DATA

GREAT SALT PLAINS LAKE, OK
 28 JULY 1998 - BASED ON 1978 RESURVEY
 CAPACITY [1000'S OF ACRE-FEET]
 AREA [1000'S OF ACRES]

POOL ELEV [FT. NGVD]	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
1140.0	281.888	284.711	287.549	290.400	293.265	296.144	299.037	301.944	304.864	307.798
	28.169	28.307	28.445	28.583	28.720	28.858	28.996	29.134	29.271	29.409
1141.0	310.746	313.707	316.681	319.668	322.667	325.680	328.706	331.744	334.795	337.860
	29.547	29.676	29.805	29.934	30.062	30.191	30.320	30.449	30.577	30.706
1142.0	340.937	344.026	347.125	350.236	353.357	356.489	359.632	362.786	365.950	369.126
	30.835	30.943	31.051	31.159	31.267	31.375	31.483	31.591	31.699	31.807
1143.0	372.312	375.508	378.714	381.930	385.156	388.392	391.638	394.893	398.158	401.433
	31.915	32.013	32.112	32.210	32.308	32.407	32.505	32.603	32.701	32.800
1144.0	404.718	408.013	411.316	414.629	417.951	421.283	424.623	427.973	431.332	434.701
	32.898	32.991	33.083	33.175	33.268	33.360	33.452	33.545	33.637	33.730
1145.0	438.078	441.465	444.860	448.264	451.677	455.099	458.530	461.969	465.417	468.874
	33.822	33.910	33.998	34.086	34.174	34.262	34.349	34.437	34.525	34.613
1146.0	472.340	475.815	479.301	482.798	486.306	489.824	493.354	496.894	500.444	504.006
	34.701	34.809	34.916	35.024	35.131	35.239	35.346	35.454	35.561	35.669
1147.0	507.578	511.162	514.758	518.367	521.988	525.622	529.268	532.926	536.597	540.280
	35.776	35.901	36.025	36.149	36.274	36.398	36.522	36.647	36.771	36.896
1148.0	543.976	547.684	551.405	555.137	558.882	562.639	566.408	570.189	573.983	577.789
	37.020	37.142	37.264	37.387	37.509	37.631	37.753	37.875	37.998	38.120
1149.0	581.607	585.436	589.275	593.124	596.982	600.850	604.728	608.615	612.512	616.419
	38.242	38.340	38.437	38.534	38.632	38.729	38.826	38.924	39.021	39.119

EXHIBITS

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

GREAT SALT PLAINS LAKE

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA
GREAT SALT PLAINS LAKE

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	Damsite	A-2

I. - GENERAL INFORMATION

<u>ITEM</u>	<u>DESCRIPTION</u>
Other names for project	Formerly referred to as Great Salt Plains Reservoir.
Location	Alfalfa County, Oklahoma, Salt Fork of the Arkansas River (river mile 103.3).
Type of project	Dam and lake.
Objectives of regulations	Multi-purpose - Flood control, conservation including recreation, and fish and wildlife.
Project owner	U.S. Government.
Operating agency	U.S. Corps of Engineers. The working hours of operation for weekdays are 7:00 a.m. to 4:30 p.m.; working hours for weekends, holidays and nights vary, normal working hours are the same as weekdays and flood emergency conditions are 24 hours.
Regulating agency	U.S. Army Corps of Engineers.
Water supply contracts	None.
Water rights	Administered by the Oklahoma Water Resources Board.
Project cost	\$4,626,270.
Closure date	May 1941.

II. - LAKE INFORMATION

TABLE A-1

ELEVATION, AREAS, AND STORAGES FOR GREAT SALT PLAINS

Feature	Elevation (feet, NGVD)	Area (acres)	Storage	
			(acre- feet)	(inches) ⁽¹⁾
Top of dam	1168.5	-	-	-
Maximum pool	1156.2	46,230	884,800	5.20
Spillway crest	1138.5	25,660	241,500	1.42
Top of flood control pool	1138.5	-	-	-
Top of conservation pool	1125.0	7,780	26,110	0.15
Top of inactive pool	1110.0	-	-	-
Flood control storage	1125-1138.5	-	215,390	1.27
Conservation storage	1110-1125	-	26,110	0.15
Streambed at Dam	1100.5	-	-	-

⁽¹⁾ From a total drainage area of 3200 square miles.

TABLE A-2

MAJOR FLOODS PAST GREAT SALT PLAINS LAKE DAMSITE

Date	Peak Inflow (cfs)	Volume (acre-feet)	Runoff (inches)
May 1 - 14, 1993	22,750 ⁽¹⁾	319,700	1.87
Jun 21 - Jul 3, 1951	38,600	300,000	1.76
Oct 30 - Nov 5, 1998	36,700 ⁽¹⁾	234,000	1.38
Jun 22 - Jul 5, 1957	22,000	233,000	1.37
May 26 - Jun 15, 1995	17,500 ⁽¹⁾	231,000	1.35
May 10 - 21, 1957	45,000	211,000	1.24
May 14 - 24, 1949	35,000	210,000	1.23
Jul 26 - Aug 11, 1996	16,550 ⁽¹⁾	197,000	1.15
May 15 - 20, 1951	46,000	193,000	1.13
Oct 22 - Nov 12, 1941	48,200	179,000	1.05

⁽¹⁾ Peak Daily Inflow

II. - LAKE INFORMATION, cont'd

<u>ITEM</u>	<u>DESCRIPTION</u>
Real estate taking line for fee title	The fee taking line for Great Salt Plains Lake is a blocked perimeter to elevation 1138.5, the crest of the emergency spillway.
Real estate taking line for easement	None
Range of clearing	Not reported. The portion of the lake open all year for boating and fishing shown on Plate 31.
Pool elevation corresponding to discharge capability of maximum non-damaging flow rate downstream	Non-damaging channel capacity below Great Salt Plains Dam is estimated at 10,000 cfs. This flowrate would be discharged at elevation 1133.5.
Reservoir length at top of conservation pool	6 miles.
Reservoir length at top of flood pool	10 miles.
Safety aspects possibly requiring warning	Not known.
Emergency drawdown	The minimum time to empty from top of conservation pool (elevation 1,125) to top of minimum pool (elevation 1,110) is approximately 2.3 days. The outlet works consist of four 10'x12' uncontrolled sluices through each of the three weirs. The sluices through the middle and lower weirs are closed with removable stop logs.

III. - HYDROLOGY

<u>ITEM</u>	<u>DESCRIPTION</u>
Drainage area	3200 square miles.
Probable maximum flood	Not applicable.
Spillway design flood	
Maximum water surface elevation	1156.2 feet, NGVD.
Peak inflow (into full pool)	365,000 cfs.
Total storm runoff (into full pool)	7.32 Inches.
Volume (into full pool)	1,252,000 acre-feet.
Maximum outflow	101,800 cfs.
Flood duration	7 days.
Standard project flood	
Maximum water surface elevation	1147.6 feet, NGVD.
Peak inflow (into full pool)	182,500 cfs.
Total storm runoff	3.67 inches.
Volume (into full pool)	626,000 acre-feet.
Maximum outflow	47,800 cfs.
Flood duration	7 days.
Climate	Semi-arid.
One-inch runoff	170,700 acre-feet.
Storm types	Primarily thunderstorms.
Flood seasons	Primary flood period March through June with a secondary flood period of September through November; however, floods have occurred in every month of the year.
Low flow season	August, December through February; however, low flow can occur at any time of the year.

III. - HYDROLOGY cont'd

<u>ITEM</u>	<u>DESCRIPTION</u>
Minimum daily flow	0 acre-feet on several occasions.
Minimum monthly flow	0 acre-feet on several occasions.
Minimum annual flow and date	41,780 acre-feet in 1956.
Average annual flow	312,570 acre-feet.
Maximum annual flow and date	1,055,600 acre-feet in 1949.
Maximum monthly flow and date	444,200 acre-feet in May, 1993.
Name and location of key streamflow stations	Kiowa, Kansas, Medicine Lodge River (river mile 22.2). Alva, Oklahoma, Salt Fork of the Arkansas River (river mile 141.0). Tonkawa, Oklahoma Salt Fork of the Arkansas River (river mile 33.8). Ralston, Oklahoma, Arkansas River (river mile 594.0).
Type of hydrometeorologic data recorded at damsite	Pool elevations, rainfall.
Number of precipitation stations used in hydrologic forecasting of Great Salt Plains Lake	Seventeen (17).
Number of sediment ranges	Thirty-one (31).

IV. - EMBANKMENT

Location	Salt Fork of the Arkansas River, river mile 103.3.
Purpose	Flood control, water quality control, recreation, and water supply.
Type	Earthfill.
Type of fill	Random and impervious.
Slope protection	Riprap upstream, seeded to grass downstream.
Height	68 feet above streambed.
Length	5,700 feet (excluding spillway).
Top elevation	1168.5 feet, NGVD.
Design flood	Spillway Design Flood developed in original project design.
Freeboard	12.3 feet
Used for roadway	Not used.
Elevation of streambed	1100.5 feet, NGVD.

V. - SPILLWAY

Location	Right saddle.
Type	Uncontrolled, cascade.
Crest elevation	1138.5 feet, NGVD.
Net overflow length	310 feet.
Discharge capacity (Maximum pool elevation)	101,800 c.f.s.
Type of energy dissipator	Stilling basin baffles.
Type of emergency closure	None.
Spillway activation	Uncontrolled.

VI. - OUTLET FACILITIES

<u>ITEM</u>	<u>DESCRIPTION</u>
Location	Through each spillway weir.
Number and size and gates	Two 36 inch low flow gates. No gates on the four 10'x12' sluices through the upper weir.
Type of service gates	Removable stop logs on the middle and lower weir. Motorized gates on the two low flow pipes.
Conduit diameter	Four 10'x12' sluices through each weir. Two 36 inch pipes through the middle weir.
Entrance invert elevation	1110.0 feet, NGVD.
Exit invert elevation	1082.0 feet, NGVD at lower weir.
Discharge at pertinent elevations	Spillway: Discharge at Max. Pool, elevation 1156.2, 101,800 cfs; Outlet works: Discharge at Max. Pool, elevation 1156.2, 101,800 cfs; Discharge at Top of Flood Control Pool, elev. 1138.5, 13,600 cfs; Discharge at Top of Conservation Pool, elev.1125.0, 0 cfs; (Unless stop logs removed.) Low flow discharge at top of conservation pool, elev.1,125, 47 cfs.
Minimum pool elevation inoperative	1105.0 feet, NGVD.
Minimum time required to open or close service gates	Sluices through upper weir are uncontrolled.
Type of emergency closure	No provision to close sluices through upper weir.
Type of energy dissipator	Stilling basin with baffle blocks.

VII. - WATER SUPPLY - None

VIII. - CONTROL POINT

<u>ITEM</u>	<u>DESCRIPTION</u>
Gage	Tonkawa, Oklahoma.
Location	River mile 33.8 (Salt Fork Arkansas River). On the left bank near end of US highway 77 bridge over the Salt Fork of the Arkansas River in Tonkawa. 7.8 miles upstream from the Chikaskia River.
Purpose of gage	Provide stage and precipitation data and serve as a forecast and benefit point.
Channel and flood plain description	The channel is well defined in the vicinity of the gage. The flood plain is wide.
Drainage area	4,528 sq. mi.
Target flow rate	Flood stage is 17.0 ft, about 12,000 cfs.
Time of crest travel	40 hours.
Monitoring provisions	Data Collection Platform.
Zero of gage	930.22 feet, NGVD.
Channel usage	Water quality and fishing.

VIII. - CONTROL POINTS cont'd

<u>ITEM</u>	<u>DESCRIPTION</u>
Gage	Ralston, Oklahoma.
Location	River mile 594.0. On the right upstream abutement of State Hiway 18 bridge at Ralston, 2.0 miles downstream from Salt Creek and 2.0 miles upstream from Grayhorse Creek.
Purpose of gage	Provide stage and precipitation data and serve as a control point for flood releases from Kaw Lake. Serve as a forecast and benefit point for Great Salt Plains Lake.
Channel and flood plain description	The channel is well defined in the vicinity of the gage. The flood plain is wide.
Drainage area	54,465 sq. mi.
Target flow rate	80,000 cfs.
Time of crest travel	70 hours.
Monitoring provisions	Data Collection Platform.
Zero of gage	776.7 feet, NGVD.
Channel usage	Water supply and fishing.

EXHIBIT B

GREAT SALT PLAINS LAKE

HEC-1F MODEL

ID GREAT SALT PLAINS LAKE
ID FORECAST RUNOFF MODEL HEC-1
ID
ID 1 INCH RUNOFF IN 2 HOURS
ID

DAYLOR MAR 98

*FREE

IT 120 01JUL98 0000 120
IO 5
VS KIOW ALVA GSINF GSREL GSAL GSAL
VV 2.11 2.11 2.11 2.11 7.11 2.11

* *****

KK SUNCT UPPER MEDICINE LODGE RIVER AT SUN CITY

BA 388

BF 0 -0.10 1.03

* L LOSS RATES FOR MEDICINE LODGE RIVER ABOVE KIOWA GAGE

LU 0.0 0.00

PB 0

ZR=PI B=SUNCT C=PRECIP-INC F=ADJUST

US 12.0 0.60

* *****

KK RSUN ROUTE MEDICINE LODGE RIVER FROM SUN CITY TO MEDICINE LODGE (29 MI)

RM 5 10 0.20

* *****

KK MEDLG MEDICINE LODGE RIVER LOCAL AT MEDICINE LODGE

BA 395

BF 0 -0.10 1.03

PB 0

ZR=PI B=MEDLG C=PRECIP-INC F=ADJUST

US 14.0 0.65

* *****

KK MLOGD MEDICINE LODGE RIVER TOTAL AT MEDICINE LODGE

HC 2

* *****

KK RLOGD ROUTE MEDICINE LODGE RIVER FROM MEDICINE LODGE TO KIOWA GAGE (28 MI)

RM 6 12 0.25

* *****

KK KIOWL MEDICINE LODGE RIVER LOCAL FROM MEDICINE LODGE TO KIOWA GAGE

BA 119

* B BASE FLOW FOR MEDICINE LODGE RIVER AT KIOWA GAGE

BF 0 -0.10 1.03

PB 0

ZR=PI B=KIOWL C=PRECIP-INC F=ADJUST

US 11.0 0.70

* *****

KK KIOW MEDICINE LODGE RIVER AT KIOWA GAGE

* :PLOT-MACRO: KIOW

HC 2

ZW B=KIOW C=FLOW-LOC CUM F=CALC

* *****

KK RKIOW ROUTE MEDICINE LODGE RIVER FROM KIOWA TO SALT FORK CONFL (22.2 MI)

RM 3 6 0.40

* *****

KK AETNA UPPER SALT FORK ARK RIVER AT AETNA

BA 586

* B BASE FLOW FOR SALT FORK RIVER AB ALVA GAGE

BF 0 -0.10 1.03

* L LOSS RATES FOR SALT FORK AB ALVA GAGE

```

LU 0.0 0.00
PB 0
ZR=PI B=AETNA C=PRECIP-INC F=ADJUST
US 14.0 0.75
* *****
KK RAETN ROUTE UPPER SALT FORK FROM AETNA TO ALVA (45 MI)
RM 6 16 0.30
* *****
KK ALVAL SALT FORK NEAR ALVA LOCAL
BA 423
BF 0 -0.10 1.03
PB 0
ZR=PI B=ALVAL C=PRECIP-INC F=ADJUST
US 16.0 0.75
* *****
KK ALVA SALT FORK RIVER AT ALVA GAGE
* :PLOT-MACRO: ALVA
HC 2
ZW B=ALVA C=FLOW-LOC CUM F=CALC
* *****
KK RALVA ROUTE SALT FORK FROM ALVA TO MEDICINE LODGE CONFL (23 MI)
RM 4 8 0.35
* *****
KK DRIFT UPPER DRIFTWOOD CREEK
BA 218
BF 0 -0.10 1.03
* L LOSS RATES FOR REMAINING AREAS BELOW KIW AND ALVA GAGES
LU 0.0 0.00
PB 0
ZR=PI B=DRIFT C=PRECIP-INC F=ADJUST
US 10.0 0.73
* *****
KK RDRIF ROUTE UPPER DRIFTWOOD CK TO CONFL MEDICINE LODGE & SALT FORK (18 MI)
RM 3 6 0.30
* *****
KK BURLI LOWER MEDICINE LODGE, SALT FORK, AND DRIFTWOOD
BA 285
BF 0 -0.05 1.02
PB 0
ZR=PI B=BURLI C=PRECIP-INC F=ADJUST
US 8.0 0.70
* *****
KK CONFL TOTAL FLOW FROM MEDICINE LODGE, SALT FORK, AND DRIFTWOOD
* :PLOT-MACRO: CONFL
HC 4
ZW B=CONFL C=FLOW-LOC CUM F=CALC
* *****
KK RCONFL ROUTE MEDICINE LODGE, SALT FORK, AND DRIFTWOOD TO GREAT SALT PLAINS
KM 11 MI FROM CONFL TO CONSV POOL
RM 5 10 0.20
* *****
KK SANDY UPPER SANDY AND LITTLE SANDY CREEKS
BA 426
BF 0 -0.10 1.03
PB 0
ZR=PI B=SANDY C=PRECIP-INC F=ADJUST
US 11.6 0.74

```

* *****
 KK RSAND ROUTE UPPER SANDY AND LITTLE SANDY CKS TO GREAT SALT PLAINS (8 MI)
 RM 2 4 0.30
 * *****

KK GSLOC GREAT SALT PLAINS RES LOCAL
 BA 347.3
 BF 0 -0.05 1.02
 PB 0
 ZR=PI B=GSLOC C=PRECIP-INC F=ADJUST
 US 8.2 0.60
 * *****

KK GSPSA GREAT SALT PLAINS RES SURFACE AREA
 KM UI AND BA VARIES WITH DIFFERENT STARTING ELEV'S
 KM ALSO ADJUST "BA" IN "KK GSLOC"
 BA 12.16
 BF 0 -0.01 1.02
 LU 0 0
 PB 0
 ZR=PI B=GSPSA C=PRECIP-INC F=ADJUST
 UI 3922
 * *****

KK GSINF INFLOW INTO GREAT SALT PLAINS RES
 HC 4
 ZW B=GSAL C=FLOW-RES IN F=CALC
 * *****

KK GSREL DOUBLE 36 INCH LOW FLOW BYPASS PIPES
 BA 1
 ZR=-QI B=GSAL C=FLOW-RES OUT F=EST
 * *****

KK GSNET NET INFLOW INTO GREAT SALT PLAINS RES
 HC 2
 * *****

KK GSAL GREAT SALT PLAINS RES POOL ROUTING
 * :PLOT-MACRO: GSAL

* E STARTING POOL ELEV FOR GREAT SALT PLAINS

RS	1	ELEV	1125.00									
SV	6879	26111	30307	34503	44007	54614	66494	79665	93963	109354		
SV125834	162180	204960	243424	281888	404718	543976	700501	884846	1065617			
SE	1122	1125	1125.5	1126	1127	1128	1129	1130	1131	1132		
SE	1133	1135	1137	1138.5	1140	1144	1148	1152	1156.2	1160		
SQ	0	0	330	960	2360	3730	5100	6230	7500	8500		
SQ	9400	11000	12700	13500	16000	28600	47000	71000	101000	133000		

 ZW B=GSAL C=ELEV F=CALC
 * *****

KK GSPQO GREAT SALT PLAINS OUTFLOW FOR DSS
 RS 1 FLOW -1
 SV 0 1
 SQ 0 20000
 ZW B=GSAL C=FLOW-RES OUT F=CALC
 * *****

ZZ

. FORECAST BASEFILE:GSAL

. FORECAST PERIOD:120

. DATAFILE:HEC1 *****HEC1 FILE FOR DCP DATA*****

ID GREAT SALT PLAINS LAKE
ID FORECAST RUNOFF MODEL HEC-1

DAYLOR MAR 98

ID ROUTING REACH LENGTHS ARE APPROXIMATE

ID

*FREE

IT 120 120

IO 5

KK SUNCT UPPER MEDICINE LODGE RIVER AT SUN CITY

BA 388

BF 0 -0.10 1.03

* L LOSS RATES FOR MEDICINE LODGE RIVER ABOVE KIOWA GAGE

LU 0.0 0.00

PB 0

ZR=PI B=SUNCT C=PRECIP-INC F=ADJUST

US 12.0 0.60

KK RSUN ROUTE MECIDINE LODGE RIVER FROM SUN CITY TO MEDICINE LODGE (29 MI)

RM 5 10 0.20

KK MEDLG MEDICINE LODGE RIVER LOCAL AT MEDICINE LODGE

BA 395

BF 0 -0.10 1.03

PB 0

ZR=PI B=MEDLG C=PRECIP-INC F=ADJUST

US 14.0 0.65

KK MLOGD MECIDINE LODGE RIVER TOTAL AT MEDICINE LODGE

HC 2

KK RLOGD ROUTE MEDICINE LODGE RIVER FROM MEDICINE LODGE TO KIOW GAGE (28 MI)

RM 6 12 0.25

KK KIOWL MEDICINE LODGE RIVER LOCAL FROM MEDICINE LODGE TO KIOWA GAGE

BA 119

* B BASE FLOW FOR MEDICINE LODGE RIVER AT KIOW GAGE

BF 0 -0.10 1.03

PB 0

ZR=PI B=KIOWL C=PRECIP-INC F=ADJUST

US 11.0 0.70

KK KIOW MEDICINE LODGE RIVER AT KIOW GAGE

* :PLOT-MACRO: KIOW

HC 2

ZW B=KIOW C=FLOW-LOC CUM F=CALC

KK RKIOW ROUTE MEDICINE LODGE RIVER FROM KIOWA TO SALT FORK CONFL (22.2 MI)

RM 3 6 0.40

KK AETNA UPPER SALT FORK ARK RIVER AT AETNA

BA 586

* B BASE FLOW FOR SALT FORK RIVER AB ALVA GAGE

BF 0 -0.10 1.03

* L LOSS RATES FOR SALT FORK AB ALVA GAGE

LU 0.0 0.00

PB 0

ZR=PI B=AETNA C=PRECIP-INC F=ADJUST

US 14.0 0.75

* *****

KK RAETN ROUTE UPPER SALT FORK FROM AETNA TO ALVA (45 MI)

RM 6 16 0.30

* *****

KK ALVAL SALT FORK NEAR ALVA LOCAL

BA 423

BF 0 -0.10 1.03

PB 0

ZR=PI B=ALVAL C=PRECIP-INC F=ADJUST

US 16.0 0.75

* *****

KK ALVA SALT FORK RIVER AT ALVA GAGE

* :PLOT-MACRO: ALVA

HC 2

ZW B=ALVA C=FLOW-LOC CUM F=CALC

* *****

KK RALVA ROUTE SALT FORK FROM ALVA TO MEDICINE LODGE CONFL (23 MI)

RM 4 8 0.35

* *****

KK DRIFT UPPER DRIFTWOOD CREEK

BA 218

BF 0 -0.10 1.03

* L LOSS RATES FOR REMAINING AREAS BELOW KIW AND ALVA GAGES

LU 0.0 0.00

PB 0

ZR=PI B=DRIFT C=PRECIP-INC F=ADJUST

US 10.0 0.73

* *****

KK RDRIF ROUTE UPPER DRIFTWOOD CK TO CONFL MEDICINE LODGE & SALT FORK (18 MI)

RM 3 6 0.30

* *****

KK BURLI LOWER MEDICINE LODGE, SALT FORK, AND DRIFTWOOD

BA 285

BF 0 -0.05 1.02

PB 0

ZR=PI B=BURLI C=PRECIP-INC F=ADJUST

US 8.0 0.70

* *****

KK CONFL TOTAL FLOW FROM MEDICINE LODGE, SALT FORK, AND DRIFTWOOD

* :PLOT-MACRO: CONFL

HC 4

ZW B=CONFL C=FLOW-LOC CUM F=CALC

* *****

KK RCONFL ROUTE MEDICINE LODGE, SALT FORK, AND DRIFTWOOD TO GREAT SALT PLAINS

KM 11 MI FROM CONFL TO CONSV POOL

RM 5 10 0.20

* *****

KK SANDY UPPER SANDY AND LITTLE SANDY CREEKS

BA 426

BF 0 -0.10 1.03

PB 0

ZR=PI B=SANDY C=PRECIP-INC F=ADJUST

US 11.6 0.74

* *****
KK RSAND ROUTE UPPER SANDY AND LITTLE SANDY CKS TO GREAT SALT PLAINS (8 MI)
RM 2 4 0.30

* *****
KK GSLOC GREAT SALT PLAINS RES LOCAL
BA 347.3
BF 0 -0.05 1.02
PB 0
ZR=PI B=GSLOC C=PRECIP-INC F=ADJUST
US 8.2 0.60

* *****
KK GSPSA GREAT SALT PLAINS RES SURFACE AREA
KM UI AND BA VARIES WITH DIFFERENT STARTING ELEV'S
KM ALSO ADJUST "BA" IN "KK GSLOC"
BA 12.16
BF 0 -0.01 1.02
LU 0 0
PB 0
ZR=PI B=GSPSA C=PRECIP-INC F=ADJUST
UI 3922

* *****
KK GSINF INFLOW INTO GREAT SALT PLAINS RES
HC 4
ZW B=GSAL C=FLOW-RES IN F=CALC

* *****
KK GSREL DOUBLE 36 INCH LOW FLOW BYPASS PIPES
BA 1
ZR=-QI B=GSAL C=FLOW-RES OUT F=EST

* *****
KK GSNET NET INFLOW INTO GREAT SALT PLAINS RES
HC 2

* *****
KK GSAL GREAT SALT PLAINS RES POOL ROUTING

* :PLOT-MACRO: GSAL

* E STARTING POOL ELEV FOR GREAT SALT PLAINS

RS	1	ELEV	1125.00											
SV	6879	26111	30307	34503	44007	54614	66494	79665	93963	109354				
SV125834	162180	204960	243424	281888	404718	543976	700501	884846	1065617					
SE	1122	1125	1125.5	1126	1127	1128	1129	1130	1131	1132				
SE	1133	1135	1137	1138.5	1140	1144	1148	1152	1156.2	1160				
SQ	0	0	330	960	2360	3730	5100	6230	7500	8500				
SQ	9400	11000	12700	13500	16000	28600	47000	71000	101000	133000				

ZW B=GSAL C=ELEV F=CALC

* *****
KK GSPQO GREAT SALT PLAINS OUTFLOW FOR DSS

RS 1 FLOW -1

SV 0 1

SQ 0 200000

ZW B=GSAL C=FLOW-RES OUT F=CALC

* *****
ZZ

.DATAFILE:EXT1 *****EXTRACT FILE FOR DCP DATA *****

200 2 0

//ALVA/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM

//AVSO2/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM

//BFSO2/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM

```

//BLAC/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//CANT/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//CORB/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//CRSO2/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//FDSO2/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//FSUP/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//GSAL/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//HARP/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//KIOW/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//LAHO/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//LHSO2/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//LARN/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//MACK/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//MFSO2/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//MURD/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//MYSO2/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//NYEC/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//PRAT/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//SEIL/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//TONK/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//WAYN/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//WOO2/PRECIP/99JAN1999/1HOUR/OBS/ C=PRECIP-CUM
//ALVA/FLOW-LOC CUM/99JAN1999/1HOUR/OBS/
//KIOW/FLOW-LOC CUM/99JAN1999/1HOUR/OBS/
//TONK/FLOW-LOC CUM/99JAN1999/1HOUR/OBS/
//GSAL/FLOW-RES IN/99JAN1999/1HOUR/OBS/
//GSAL/FLOW-RES OUT/99JAN1999/1HOUR/OBS/
//GSAL/ELEV/99JAN1999/1HOUR/OBS/

```

.DATAFILE:PRCP *****PRECIP INPUT FILE *****
ID GREAT SALT PLAINS LAKE FORCAST MODEL NOV84 BRIAN MCCORMICK

*FREE

IT 120 99JAN99 9999 99

**PRECIPITATION GAGES

ZR F-OBS

PG	STATION	364845	983850	0	2HOUR	INDEX
PG	ALVA	364845	983850	0	2HOUR	INDEX
PG	AVSO2	365924	990036	0	2HOUR	INDEX
PG	BFSO2	365000	993800	0	2HOUR	INDEX
PG	BLAC	364831	971639	0	2HOUR	INDEX
PG	CANT	360503	983605	0	2HOUR	INDEX
PG	CORB	370743	973603	0	2HOUR	INDEX
PG	CRSO2	364500	982136	0	2HOUR	INDEX
PG	FDSO2	364400	990800	0	2HOUR	INDEX
PG	FSUP	363314	993415	0	2HOUR	INDEX
PG	GSAL	364440	980807	0	2HOUR	INDEX
PG	HARP	371630	980230	0	2HOUR	INDEX
PG	KIOW	370059	982900	0	2HOUR	INDEX
PG	LAHO	362400	980600	0	2HOUR	INDEX
PA	LHSO2	362248	980636	0	2HOUR	INDEX
PG	LARN	381200	992050	0	2HOUR	INDEX
PG	MACK	375219	985230	0	2HOUR	INDEX
PG	MFSO2	364700	974500	0	2HOUR	INDEX
PG	MURD	373400	975059	0	2HOUR	INDEX
PG	MYSO2	365924	990036	0	2HOUR	INDEX
PG	NYEC	370201	1001154	0	2HOUR	INDEX
PG	PRAT	373816	984313	0	2HOUR	INDEX
PG	SEIL	361106	985515	0	2HOUR	INDEX
PG	TONK	364029	971842	0	2HOUR	INDEX

PG WAYN 363102 985244 0 2HOUR INDEX
PG WOO2 362617 991639 0 2HOUR INDEX

** SUBBASINS

BN SUNCT

ZW F=ADJUST

BP 1 373006 990216

BN MEDLG

BP 1 372210 984307

BN KIOWL

BP 1 370958 983215

BN AETNA

BP 1 371153 990806

BN ALVAL

BP 1 365944 984949

BN DRIFT

BP 1 370133 983732

BN BURLI

BP 1 365512 982507

BN SANDY

BP 1 370840 981633

BN GSLOC

BP 1 364340 981723

BN GSPSA

BP 1 364406 981125

ZZ

.DATAFILE:MAC1 *****DSSUTL MACRO NO. 1 (MAC1)*****

BOOTSTRAP

!RUN ONE

MACRO ONE

ENDMACRO

.DATAFILE:MAC2 *****DSPLAY MACRO NO. 1 (MAC2)*****

BOOTSTRAP

!RUN TWO

MACRO TWO

TI T-5D T+7D

DEV 4107

DG STYLE=DOTTED

SW LBN RBN

ENDMACRO

MACRO KIW

US, MEDICINE LODGE RIVER AT KIOWA GAGE

PA //KIOW/FLOW-LOC CUM/99JAN1999/2HOUR/OBS/

PA //KIOW/FLOW-LOC CUM/99JAN1999/2HOUR/CALC/

PL

ENDMACRO

MACRO ALVA

US, SALT FORK ARKANSAS RIVER AT ALVA GAGE

PA //ALVA/FLOW-LOC CUM/99JAN1999/2HOUR/OBS/

PA //ALVA/FLOW-LOC CUM/99JAN1999/2HOUR/CALC/

PL

ENDMACRO

MACRO CONFL

US, CONFL OF MEDICINE LODGE AND SALT FORK RIVERS, AND DRIFWOOD CK

PA //GSAL/FLOW-RES IN/99JAN1999/2HOUR/OBS/

PA //CONFL/FLOW-LOC CUM/99JAN1999/2HOUR/CALC/

PA //KIOW/FLOW-LOC CUM/99JAN1999/2HOUR/OBS/

PA //ALVA/FLOW-LOC CUM/99JAN1999/2HOUR/OBS/

PL
 ENDMACRO
 MACRO GSAL
 SW LBN RBN
 US, TCP=1125, TFP=1138.5 (EQ RUNOFF=1.41") TD=1168.5, %FULL= QUALITY=
 PA //GSAL/FLOW-RES OUT/99JAN1999/2HOUR/EST/
 PA //GSAL/FLOW-RES OUT/99JAN1999/2HOUR/OBS/
 PA //GSAL/FLOW-RES OUT/99JAN1999/2HOUR/CALC/
 PA //GSAL/FLOW-RES IN/99JAN1999/2HOUR/OBS/
 PA //GSAL/FLOW-RES IN/99JAN1999/2HOUR/CALC/
 PA //GSAL/ELEV/99JAN1999/2HOUR/OBS/
 PA //GSAL/ELEV/99JAN1999/2HOUR/CALC/
 PL
 ENDMACRO
 MACRO TONK
 US, SALT FORK ARK RIVER AT TONKAWA
 PA //TONK/FLOW-LOC CUM/99JAN1999/2HOUR/OBS/
 PA //GSAL/FLOW-RES OUT/99JAN1999/2HOUR/OBS/
 PA //GSAL/FLOW-RES OUT/99JAN1999/2HOUR/CALC/
 PL
 ENDMACRO
 MACRO DCPPCP
 NO ON
 PA //LARN/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //MACK/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //PRAT/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //MURD/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PL
 !PAUSE
 PA //HARP/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //CORB/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PL
 !PAUSE
 PA //MFSO2/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //BLAC/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //TONK/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PL
 !PAUSE
 PA //LAHO/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //LHSO2/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PL
 !PAUSE
 PA //CANT/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //SEIL/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //WAYN/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //WOO2/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PL
 !PAUSE
 PA //GSAL/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //KIOW/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //MYSO2/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PL
 !PAUSE
 PA //ALVA/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //AVSO2/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PA //CRSO2/PRECIP-CUM/99JAN1999/2HOUR/OBS/
 PL

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! PAUSE
PA //FSUP/PRECIP-CUM/99JAN1999/2HOUR/OBS/
PA //NYEC/PRECIP-CUM/99JAN1999/2HOUR/OBS/
PA //BFSO2/PRECIP-CUM/99JAN1999/2HOUR/OBS/
PA //FDSO2/PRECIP-CUM/99JAN1999/2HOUR/OBS/
PL
NO OFF
ENDMACRO
MACRO SUBPCP
PA //SUNCT/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //MEDLG/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //KIOWL/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PL
! PAUSE
PA //AETNA/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //ALVAL/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PL
! PAUSE
PA //DRIFT/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //BURLI/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PL
! PAUSE
PA //SANDY/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //GSLOC/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //GSPSA/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PL
ENDMACRO
.DATAFILE:MAC3 *****DSSUTL MACRO NO. 2 (MAC3)*****
BOOTSTRAP
!RUN THREE
MACRO THREE
CA.NS O=CBEDAF
FI
ENDMACRO
.DATAFILE:HYET *****6CAST*NUHYET INPUT FILE (HYET)*****
C THIS FILE IS USED TO INPUT TOTAL BASIN PRECIP
C FOR A SPECIFIED TIME PERIOD(S).
C THE FORMAT IS A PA CARD FOLLOWED BY DA CARD(S)
C
C NOTE: EVERY PA CARD GROUP MUST CONTAIN ITS OWN
C       DATE CARDS FOR THE PRECIP TO BE ADJUSTED
C
C
PA //SUNCT/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
DA 99JAN99 9999 99JAN99 9999 -1
PA //MEDLG/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //KIOWL/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //AETNA/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //ALVAL/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //DRIFT/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //BURLI/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //SANDY/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //GSLOC/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
PA //GSPSA/PRECIP-INC/99JAN1999/2HOUR/ADJUST/
.DATAFILE:RELE *****RESERVOIR RELEASE INPUT FILE*****
C THIS FILE IS USED TO INPUT RESERVOIR RELEASES
C FOR CONTROLLED CONDUIT ONLY FOR THE SPECIFIED TIME PERIOD(S)

```

C THE FORMAT IS A PA CARD GROUP FOLLOWED BY DA CARD(S)

C

C NOTE: EVERY PA CARD GROUP MUST CONTAIN ITS OWN

C DATE CARDS FOR THE OUTFLOWS TO BE ADJUSTED

C

C ADD LOW FLOW CONDUIT ONLY: MAX 360 CFS AT TOP CONS POOL ELEV 1125.0

C UNCONTROLLED SLUICES AND SPILLWAY ARE IN HEC-1 POOL ROUTING

C

PA //GSAL/FLOW-RES OUT/99JAN1999/2HOUR/EST/

DA 99JAN99 9999 99JAN99 9999 -1

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* NOVEMBER 1989 *
* REVISED 07 NOV 89 *
*
* RUN DATE 06/08/1998 TIME 10:12:36 *
*
*****

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*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* THE HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*
*****

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X X XXXXXXXX XXXXX X
X X X X X XX
X X X X X
XXXXXXXX XXXX X XXXXX X
X X X X XXXX X
X X X X X X X
X X XXXXXXXX XXXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1
PAGE 1

HEC-1 INPUT

LINE
ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

1 ID GREAT SALT PLAINS LAKE DAYLOR MAR 98
2 ID FORECAST RUNOFF MODEL HEC-1
3 ID
4 ID 1 INCH RUNOFF IN 2 HOURS
5 ID

*** FREE ***

6 IT 120 01JUL98 0000 120
7 IO 5
8 VS KIWOW ALVA GSINF GSREL GSAL GSAL
9 VV 2.11 2.11 2.11 2.11 7.11 2.11
* *****

10 KK SUNCT UPPER MEDICINE LODGE RIVER AT SUN CITY
11 BA 388
12 BF 0 -0.10 1.03
* L LOSS RATES FOR MEDICINE LODGE RIVER ABOVE KIOWA GAGE
13 LU 0.0 0.00
14 PB 0
15 ZR =PI B=SUNCT C=PRECIP-INC F=ADJUST
16 US 12.0 0.60
* *****

17 KK RSUN ROUTE MEDICINE LODGE RIVER FROM SUN CITY TO MEDICINE LODGE (29 MI)
18 RM 5 10 0.20
* *****

19 KK MEDLG MEDICINE LODGE RIVER LOCAL AT MEDICINE LODGE
20 BA 395
21 BF 0 -0.10 1.03
22 PB 0
23 ZR =PI B=MEDLG C=PRECIP-INC F=ADJUST
24 US 14.0 0.65
* *****

25 KK MLODG MEDICINE LODGE RIVER TOTAL AT MEDICINE LODGE
26 HC 2
* *****

27 KK RLODG ROUTE MEDICINE LODGE RIVER FROM MEDICINE LODGE TO KIWOW GAGE (28 MI)
28 RM 6 12 0.25
* *****

29 KK KIWOW MEDICINE LODGE RIVER LOCAL FROM MEDICINE LODGE TO KIWOW GAGE
30 BA 119
* B BASE FLOW FOR MEDICINE LODGE RIVER AT KIWOW GAGE
31 BF 0 -0.10 1.03
32 PB 0
33 ZR =PI B=KIOWOW C=PRECIP-INC F=ADJUST

34

US 11.0 0.70

* *****

1
PAGE 2

HEC-1 INPUT

LINE

ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

35      KK      KIW MEDICINE LODGE RIVER AT KIW GAGE
      * :PLOT-MACRO: KIW
36      HC      2
37      ZW      B=KIOW C=FLOW-LOC CUM F=CALC
      * *****

38      KK      RKIOW ROUTE MEDICINE LODGE RIVER FROM KIOWA TO SALT FORK CONFL (22.2 MI)
39      RM      3      6      0.40
      * *****

40      KK      AETNA UPPER SALT FORK ARK RIVER AT AETNA
41      BA      586
      * B      BASE FLOW FOR SALT FORK RIVER AB ALVA GAGE
42      BF      0      -0.10      1.03
      * L      LOSS RATES FOR SALT FORK AB ALVA GAGE
43      LU      0.0      0.00
44      PB      0
45      ZR =PI      B=AETNA C=PRECIP-INC F=ADJUST
46      US      14.0      0.75
      * *****

47      KK      RAETN ROUTE UPPER SALT FORK FROM AETNA TO ALVA (45 MI)
48      RM      6      16      0.30
      * *****

49      KK      ALVAL SALT FORK NEAR ALVA LOCAL
50      BA      423
51      BF      0      -0.10      1.03
52      PB      0
53      ZR =PI      B=ALVAL C=PRECIP-INC F=ADJUST
54      US      16.0      0.75
      * *****

55      KK      ALVA SALT FORK RIVER AT ALVA GAGE
      * :PLOT-MACRO: ALVA
56      HC      2
57      ZW      B=ALVA C=FLOW-LOC CUM F=CALC
      * *****

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58      KK  RALVA ROUTE SALT FORK FROM ALVA TO MEDICINE LODGE CONFL (23 MI)
59      RM      4      8      0.35
* *****
60      KK  DRIFT UPPER DRIFTWOOD CREEK
61      BA      218
62      BF      0      -0.10      1.03
* L      LOSS RATES FOR REMAINING AREAS BELOW KIOW AND ALVA GAGES
63      LU      0.0      0.00
64      PB      0
65      ZR =PI      B=DRIFT C=PRECIP-INC F=ADJUST
66      US      10.0      0.73
* *****

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HEC-1 INPUT

1
PAGE 3

LINE
ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

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67      KK  RDRIF ROUTE UPPER DRIFTWOOD CK TO CONFL MEDICINE LODGE & SALT FORK ( 18 MI)
68      RM      3      6      0.30
* *****
69      KK  BURLI LOWER MEDICINE LODGE, SALT FORK, AND DRIFTWOOD
70      BA      285
71      BF      0      -0.05      1.02
72      PB      0
73      ZR =PI      B=BURLI C=PRECIP-INC F=ADJUST
74      US      8.0      0.70
* *****
75      KK  CONFL TOTAL FLOW FROM MEDICINE LODGE, SALT FORK, AND DRIFTWOOD
* :PLOT-MACRO: CONFL
76      HC      4
77      ZW      B=CONFL C=FLOW-LOC CUM F=CALC
* *****
78      KK  RCONFL ROUTE MEDICINE LODGE, SALT FORK, AND DRIFTWOOD TO GREAT SALT PL AINS
79      KM      11 MI FROM CONFL TO CONSV POOL
80      RM      5      10      0.20
* *****
81      KK  SANDY UPPER SANDY AND LITTLE SANDY CREEKS
82      BA      426
83      BF      0      -0.10      1.03
84      PB      0
85      ZR =PI      B=SANDY C=PRECIP-INC F=ADJUST

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86      US      11.6      0.74
      * *****

87      KK      RSAND ROUTE UPPER SANDY AND LITTLE SANDY CKS TO GREAT SALT PLAINS (8 MI)
88      RM          2          4          0.30
      * *****

89      KK      GSLOC GREAT SALT PLAINS RES LOCAL
90      BA      347.3
91      BF          0      -0.05      1.02
92      PB          0
93      ZR      =PI          B=GSLOC C=PRECIP-INC F=ADJUST
94      US          8.2          0.60
      * *****

95      KK      GSPSA GREAT SALT PLAINS RES SURFACE AREA
96      KM          UI AND BA VARIES WITH DIFFERENT STARTING ELEV'S
97      KM          ALSO ADJUST "BA" IN "KK GSLOC"
98      BA      12.16
99      BF          0      -0.01      1.02
100     LU          0          0
101     PB          0
102     ZR      =PI          B=GSPSA C=PRECIP-INC F=ADJUST
103     UI          3922
      * *****

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HEC-1 INPUT

1
PAGE 4

LINE
ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

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104     KK      GSINF INFLOW INTO GREAT SALT PLAINS RES
105     HC          4
106     ZW          B=GSAL C=FLOW-RES IN F=CALC
      * *****

107     KK      GSREL DOUBLE 36 INCH LOW FLOW BYPASS PIPES
108     BA          1
109     ZR      =-QI          B=GSAL C=FLOW-RES OUT F=EST
      * *****

110     KK      GSNET NET INFLOW INTO GREAT SALT PLAINS RES
111     HC          2
      * *****

112     KK      GSAL GREAT SALT PLAINS RES POOL ROUTING
      * :PLOT-MACRO: GSAL

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109354
1065617
1132
1160
8500
133000

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* E      STARTING POOL ELEV FOR GREAT SALT PLAINS
RS      1      ELEV 1125.00
SV      6879   26111  30307  34503  44007  54614  66494  79665  93963
115     SV 125834 162180 204960 243424 281888 404718 543976 700501 884846
116     SE 1122   1125  1125.5  1126   1127   1128   1129   1130   1131
117     SE 1133   1135  1137   1138.5 1140   1144   1148   1152  1156.2
118     SQ      0     0    330    960   2360   3730   5100   6230   7500
119     SQ  9400  11000  12700  13500  16000  28600  47000  71000  101000
120     ZW      B=GSAL C=ELEV F=CALC
* *****
121     KK  GSPQO GREAT SALT PLAINS OUTFLOW FOR DSS
122     RS      1      FLOW    -1
123     SV      0      1
124     SQ      0  200000
125     ZW      B=GSAL C=FLOW-RES OUT F=CALC
* *****
126     ZZ

```

1*****

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

MAXIMUM STAGE +	TIME OF OPERATION MAX STAGE	STATION	PEAK	TIME OF	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN
			FLOW	PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
+	HYDROGRAPH AT	SUNCT	12697.	12.00	12167.	8330.	3633.	388.00
+	ROUTED TO	RSUN	11021.	24.00	10737.	7982.	3608.	388.00
+	HYDROGRAPH AT	MEDLG	11930.	14.00	11513.	8238.	3661.	395.00
+	2 COMBINED AT	MLODG	19012.	20.00	18720.	15167.	7225.	783.00

+	ROUTED TO	RLODG	17997.	32.00	17629.	14637.	7179.	783.00
+	HYDROGRAPH AT	KIOWL	4880.	12.00	4528.	2849.	1172.	119.00
+	2 COMBINED AT	KIOW	18486.	32.00	18215.	15368.	8197.	902.00
+	ROUTED TO	RKIOW	18317.	38.00	18036.	15281.	8188.	902.00
+	HYDROGRAPH AT	AETNA	20478.	14.00	19720.	13445.	5635.	586.00
+	ROUTED TO	RAETN	17508.	30.00	16939.	12699.	5595.	586.00
+	HYDROGRAPH AT	ALVAL	12928.	16.00	12541.	9151.	3974.	423.00
+	2 COMBINED AT	ALVA	22070.	28.00	21641.	18431.	9432.	1009.00
+	ROUTED TO	RALVA	21578.	36.00	21164.	18222.	9409.	1009.00
+	HYDROGRAPH AT	DRIFT	10189.	10.00	9643.	5494.	2217.	218.00
+	ROUTED TO	RDRIF	9366.	16.00	8921.	5403.	2209.	218.00
+	HYDROGRAPH AT	BURLI	15854.	10.00	14572.	7385.	2826.	285.00
+	4 COMBINED AT	CONFL	41367.	36.00	40797.	35535.	22267.	2414.00
+	ROUTED TO	RCONFL	39682.	46.00	39136.	34989.	22123.	2414.00
+	HYDROGRAPH AT	SANDY	17468.	12.00	16465.	10283.	4210.	426.00
+	ROUTED TO	RSAND	16691.	16.00	15782.	10147.	4203.	426.00

+	HYDROGRAPH AT	GSLOC	16347.	10.00	14908.	8547.	3330.	347.30
+	HYDROGRAPH AT	GSPSA	3922.	2.00	1327.	355.	130.	12.16
+	4 COMBINED AT	GSINF	41628.	46.00	41038.	37230.	29061.	3199.46
+	HYDROGRAPH AT	GSREL	0.	2.00	0.	0.	0.	1.00
+	2 COMBINED AT	GSNET	41628.	46.00	41038.	37230.	29061.	3200.46
+	ROUTED TO	GSAL	10780.	70.00	10775.	10720.	10373.	3200.46
+	1134.72		70.00					
+	ROUTED TO	GSPQO	10780.	70.00	10775.	10720.	10373.	3200.46

TABLE 1 STATION

KIOW FLOW ALVA FLOW GSINF FLOW GSREL FLOW GSAL STAGE GSAL FLOW

PER DAY MON HRMN

1	1	JUL	0000	.00	.00	.00	.00	1125.00	.00
2	1	JUL	0200	352.02	596.14	5655.55	.00	1125.06	36.52
3	1	JUL	0400	1269.42	2174.07	6578.81	.00	1125.17	115.06
4	1	JUL	0600	2470.02	4281.11	13658.91	.00	1125.37	244.26
5	1	JUL	0800	3724.06	6589.70	21165.37	.00	1125.70	588.10
6	1	JUL	1000	4786.79	8973.03	27044.52	.00	1126.14	1160.75
7	1	JUL	1200	5599.42	11152.20	31032.25	.00	1126.62	1831.36
8	1	JUL	1400	6239.89	12945.08	34420.36	.00	1127.14	2548.39
9	1	JUL	1600	6944.38	14569.75	37475.96	.00	1127.65	3253.91
10	1	JUL	1800	8150.18	16204.68	39019.53	.00	1128.17	3965.17
11	1	JUL	2000	9924.94	17565.87	38677.84	.00	1128.65	4623.81
12	1	JUL	2200	12026.29	18735.54	37326.99	.00	1129.10	5214.88
13	2	JUL	0000	14180.60	20093.75	35953.36	.00	1129.49	5657.38
14	2	JUL	0200	16102.45	21368.73	34784.27	.00	1129.86	6075.75
15	2	JUL	0400	17541.41	22070.40	33789.25	.00	1130.20	6481.50
16	2	JUL	0600	18347.40	21852.09	33008.92	.00	1130.51	6873.82
17	2	JUL	0800	18486.35	20629.81	32627.07	.00	1130.80	7251.94
18	2	JUL	1000	18078.76	18615.33	32886.98	.00	1131.09	7590.64
19	2	JUL	1200	17110.29	16172.55	34025.31	.00	1131.37	7866.93
20	2	JUL	1400	15723.90	13646.80	35785.16	.00	1131.66	8155.76

21	2	JUL	1600	14094.07	11276.77	37795.42	.00	1131.96	8461.63
22	2	JUL	1800	12388.35	9186.51	39683.28	.00	1132.27	8739.80
23	2	JUL	2000	10735.78	7569.02	41071.26	.00	1132.58	9024.10
24	2	JUL	2200	9216.00	6232.33	41628.49	.00	1132.91	9314.59
25	3	JUL	0000	7865.67	5151.19	41146.13	.00	1133.20	9563.61
26	3	JUL	0200	6692.67	4310.89	39586.11	.00	1133.48	9786.93
27	3	JUL	0400	5691.08	3686.39	37080.63	.00	1133.74	9993.89
28	3	JUL	0600	4852.28	3235.36	33886.73	.00	1133.97	10178.68
29	3	JUL	0800	4166.89	2909.08	30316.26	.00	1134.17	10337.62
30	3	JUL	1000	3618.71	2664.98	26667.02	.00	1134.34	10469.24
31	3	JUL	1200	3184.51	2472.05	23173.68	.00	1134.47	10574.01
32	3	JUL	1400	2841.61	2310.43	19986.91	.00	1134.57	10653.80
33	3	JUL	1600	2570.68	2168.47	17181.21	.00	1134.64	10711.29
34	3	JUL	1800	2354.84	2039.72	14777.40	.00	1134.69	10749.49
35	3	JUL	2000	2179.27	1920.74	12763.39	.00	1134.71	10771.39
36	3	JUL	2200	2031.88	1809.66	11107.17	.00	1134.72	10779.83
37	4	JUL	0000	1903.71	1705.44	9764.64	.00	1134.72	10777.33
38	4	JUL	0200	1788.82	1607.40	8685.55	.00	1134.71	10766.08
39	4	JUL	0400	1683.54	1515.07	7819.20	.00	1134.68	10747.85
40	4	JUL	0600	1585.77	1428.07	7119.07	.00	1134.66	10724.08
41	4	JUL	0800	1494.26	1346.09	6545.55	.00	1134.62	10695.87
42	4	JUL	1000	1408.29	1268.81	6066.74	.00	1134.58	10664.04
43	4	JUL	1200	1327.37	1195.98	5658.01	.00	1134.54	10629.23
44	4	JUL	1400	1251.15	1127.32	5300.95	.00	1134.49	10591.90
45	4	JUL	1600	1179.32	1062.61	4982.27	.00	1134.44	10552.38
46	4	JUL	1800	1111.62	1001.61	4692.67	.00	1134.39	10510.95
47	4	JUL	2000	1047.80	944.11	4425.88	.00	1134.33	10467.80
48	4	JUL	2200	987.65	889.92	4177.69	.00	1134.28	10423.10
49	5	JUL	0000	930.96	838.83	3945.37	.00	1134.22	10376.98
50	5	JUL	0200	877.52	790.68	3727.04	.00	1134.16	10329.56

TABLE 1
(CONT.)

STATION

KIOW
FLOW

ALVA
FLOW

GSINF
FLOW

GSREL
FLOW

GSAL
STAGE

GSAL
FLOW

PER DAY MON HRMN

51	5	JUL	0400	827.15	745.29	3521.40	.00	1134.10	10280.95
52	5	JUL	0600	779.66	702.51	3327.47	.00	1134.04	10231.24
53	5	JUL	0800	734.91	662.18	3144.46	.00	1133.98	10180.52
54	5	JUL	1000	692.72	624.17	2971.70	.00	1133.91	10128.88
55	5	JUL	1200	652.96	588.34	2808.57	.00	1133.85	10076.41
56	5	JUL	1400	615.47	554.57	2654.53	.00	1133.78	10023.16
57	5	JUL	1600	580.14	522.73	2509.05	.00	1133.71	9969.21
58	5	JUL	1800	546.84	492.73	2371.66	.00	1133.64	9914.62
59	5	JUL	2000	515.45	464.44	2241.90	.00	1133.57	9859.47
60	5	JUL	2200	485.86	437.78	2119.34	.00	1133.50	9803.80
61	6	JUL	0000	457.97	412.65	2003.57	.00	1133.43	9747.67
62	6	JUL	0200	431.68	388.96	1894.22	.00	1133.36	9691.13

63	6 JUL	0400	406.90	366.63	1790.93	.00	1133.29	9634.22
64	6 JUL	0600	383.54	345.59	1693.36	.00	1133.22	9577.01
65	6 JUL	0800	361.53	325.75	1601.19	.00	1133.15	9519.52
66	6 JUL	1000	340.77	307.05	1514.11	.00	1133.08	9461.79
67	6 JUL	1200	321.21	289.42	1431.84	.00	1133.00	9403.88
68	6 JUL	1400	302.77	272.81	1354.11	.00	1132.93	9332.82
69	6 JUL	1600	285.39	257.15	1280.68	.00	1132.85	9260.79
70	6 JUL	1800	269.01	242.39	1211.29	.00	1132.77	9188.77
71	6 JUL	2000	253.57	228.47	1145.72	.00	1132.69	9116.79
72	6 JUL	2200	239.01	215.36	1083.77	.00	1132.61	9044.88
73	7 JUL	0000	225.29	203.00	1025.22	.00	1132.53	8973.08
74	7 JUL	0200	212.36	191.34	969.89	.00	1132.45	8901.41
75	7 JUL	0400	200.17	180.36	917.60	.00	1132.37	8829.90
76	7 JUL	0600	188.68	170.01	868.18	.00	1132.29	8758.57
77	7 JUL	0800	177.85	160.25	821.47	.00	1132.21	8687.46
78	7 JUL	1000	167.64	151.05	777.32	.00	1132.13	8616.58
79	7 JUL	1200	158.01	142.38	735.59	.00	1132.05	8545.94
80	7 JUL	1400	148.94	134.20	696.14	.00	1131.97	8470.97
81	7 JUL	1600	140.39	126.50	658.85	.00	1131.89	8387.72
82	7 JUL	1800	132.33	119.24	623.60	.00	1131.80	8304.98
83	7 JUL	2000	124.74	112.39	590.27	.00	1131.72	8222.75
84	7 JUL	2200	117.58	105.94	558.75	.00	1131.64	8141.05
85	8 JUL	0000	110.83	99.86	528.96	.00	1131.56	8059.89
86	8 JUL	0200	104.47	94.13	500.78	.00	1131.48	7979.30
87	8 JUL	0400	98.47	88.73	474.14	.00	1131.40	7899.27
88	8 JUL	0600	92.82	83.63	448.95	.00	1131.32	7819.82
89	8 JUL	0800	87.49	78.83	425.12	.00	1131.24	7740.96
90	8 JUL	1000	82.47	74.31	402.59	.00	1131.16	7662.69
91	8 JUL	1200	77.73	70.04	381.27	.00	1131.09	7585.02
92	8 JUL	1400	73.27	66.02	361.11	.00	1131.01	7507.97
93	8 JUL	1600	69.06	62.23	342.04	.00	1130.93	7406.57
94	8 JUL	1800	65.10	58.66	324.00	.00	1130.85	7303.47
95	8 JUL	2000	61.36	55.29	306.94	.00	1130.77	7201.63
96	8 JUL	2200	57.84	52.12	290.79	.00	1130.69	7101.02
97	9 JUL	0000	54.52	49.13	275.52	.00	1130.61	7001.65
98	9 JUL	0200	51.39	46.31	261.06	.00	1130.53	6903.52
99	9 JUL	0400	48.44	43.65	247.39	.00	1130.45	6806.61
100	9 JUL	0600	45.66	41.14	234.44	.00	1130.38	6710.91

TABLE 1
(CONT.)

PER DAY	MON	HRMN	KIOW FLOW	ALVA FLOW	GSINF FLOW	GSREL FLOW	GSAL STAGE	GSAL FLOW
101	9 JUL	0800	43.04	38.78	222.19	.00	1130.30	6616.43
102	9 JUL	1000	40.57	36.55	210.60	.00	1130.23	6523.16
103	9 JUL	1200	38.24	34.46	199.63	.00	1130.16	6431.07
104	9 JUL	1400	36.04	32.48	189.24	.00	1130.09	6340.18

105	9	JUL	1600	33.98	30.61	179.41	.00	1130.02	6250.46
106	9	JUL	1800	32.02	28.86	170.10	.00	1129.94	6164.21
107	9	JUL	2000	30.19	27.20	161.29	.00	1129.87	6079.75
108	9	JUL	2200	28.45	25.64	152.95	.00	1129.79	5996.35
109	10	JUL	0000	26.82	24.17	145.05	.00	1129.72	5914.01
110	10	JUL	0200	25.28	22.78	137.57	.00	1129.65	5832.73
111	10	JUL	0400	23.83	21.47	130.49	.00	1129.58	5752.48
112	10	JUL	0600	22.46	20.24	123.78	.00	1129.51	5673.27
113	10	JUL	0800	21.17	19.08	117.43	.00	1129.44	5595.09
114	10	JUL	1000	19.96	17.98	111.41	.00	1129.37	5517.91
115	10	JUL	1200	18.81	16.95	105.71	.00	1129.30	5441.74
116	10	JUL	1400	17.73	15.98	100.31	.00	1129.24	5366.57
117	10	JUL	1600	16.71	15.06	95.19	.00	1129.17	5292.38
118	10	JUL	1800	15.75	14.20	90.34	.00	1129.11	5219.16
119	10	JUL	2000	14.85	13.38	85.75	.00	1129.04	5146.91
120	10	JUL	2200	14.00	12.61	81.40	.00	1128.98	5067.30
			MAX	18486.35	22070.40	41628.49	.00	1134.72	10779.83
			MIN	.00	.00	.00	.00	1125.00	.00
			AVE	2702.50	3055.65	9826.76	.00	1131.63	7825.85

*** NORMAL END OF HEC-1 ***

EXHIBIT C

**STANDING INSTRUCTIONS TO PROJECT
MANAGER
GREAT SALT PLAINS LAKE**

EXHIBIT C

**STANDING INSTRUCTIONS TO PROJECT MANAGER
GREAT SALT PLAINS LAKE**

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<u>II - REGULATION PROCEDURES</u>		
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EXHIBIT C

STANDING INSTRUCTIONS TO PROJECT MANAGER
GREAT SALT PLAINS LAKE

I - GENERAL

1. Operation. The lake will be regulated in accordance with the normal regulations for flood control as directed in Section VII of this Manual or Paragraph II-2 of this Exhibit. Instructions for any low-flow valve changes will be issued by the Water Control Section. In the event communications with the Tulsa District Office are disrupted, the lake will be regulated in accordance with the schedule of emergency regulations for flood control (see Section VII of this Manual or paragraph II-3 of this Exhibit). In addition, the Canton Lake Manager will immediately make every effort to re-establish communications with the Tulsa District Office.

2. Data Reporting Instructions. Daily lake data is obtained from computer database in the Water Control Section, Hydrology-Hydraulics Branch, Tulsa District Office (telephone 918-669-7097 or VHF-FM radio, call signal WUI-3). The Water Control Section office is manned from 7:00 a.m. to 4:30 p.m. daily and occasionally on weekends and holidays. Data for nonworking days is also available from the computer database. The daily report is in the form shown on Plate 5-3. Should unusual conditions arise during nonworking hours, one of the persons listed on page i should be contacted. The following data should be included in the daily report:

a. As of 8 a.m. Pool elevations at 8 a.m., and 12 noon, 4 p.m., and 12 midnight of the previous day; number of low-flow valves open; amount of valve opening; precipitation in inches for the preceding 24 hours (7 a.m. to 7 a.m.).

b. Each Low-Flow Valve Operation. Canton Lake personnel report the date and time of valve operation, number of valves open and amount of valve opening before and after operation, lake elevation. Confirmation of valve changes shall be made immediately after completion of the change. Complaints about pool elevations or releases, operating machinery failure, and out-of-service times for maintenance shall be reported to the Water Control Section as they occur.

c. During Flood Periods. When Canton Lake personnel have the project under surveillance, additional reports may be required by the Water Control Section.

d. Rainfall Reports. Rainfall reports will not be available.

3. Reporting Unusual Events. Events or conditions not normally encountered in the routine operation of the dam and lake which might endanger the dam or necessitate temporary or permanent revision of the operating procedures such as settlement, movement, or cracking of the earth embankment or abutments; unusual* change in seepage rates, or development of new seepage areas; mechanical

malfunction or failure; structural settlement, movement, cracking, or vibration; landslides, rockslides, or indications of an impending movement; or an occurrence indicating any degree of jeopardy to the safety of the dam, or to the safety of the public shall be reported promptly to the Water Control Section, Hydrology-Hydraulics Branch.

4. Warnings. Impact from low-flow valve changes are minimal, however, it is the responsibility of the Canton Lake Manager and project personnel authorized to make low-flow valve changes to maintain a list in current status of residents and/or property which might be endangered or inconvenienced by large and/or prolonged discharges. If damaging discharges are expected to occur, notification will be made by telephone, or oral warning by Corps employees. Notification will be made in accordance with the Tulsa District supplements to ER 500-1-1. This would include media such as radio, television, telephone, citizens band radio, use of law enforcement and civil defense agencies and their communication system, National Guard and reserve units, supplemented by oral warning by Corps employees. Studies have been made to determine the possible downstream flood conditions which could exist in the event of a maximum spillway discharge or failure of the dam at maximum pool. Approximate water surface profiles and flooded area maps giving the results of these studies are kept in the Great Salt Plains Lake Operation and Maintenance Manual, Volume II, Contingency Plan for Emergencies. In every case, when a valve change is made a horn is blown to give warning to people immediately downstream of Great Salt Plains Dam.

5. Frequency of Gate Changes. During flood periods, low-flow valve operation will be minimal. Frequency of valve changes during low-flow operation will generally be less than once a day.

II - REGULATION PROCEDURES

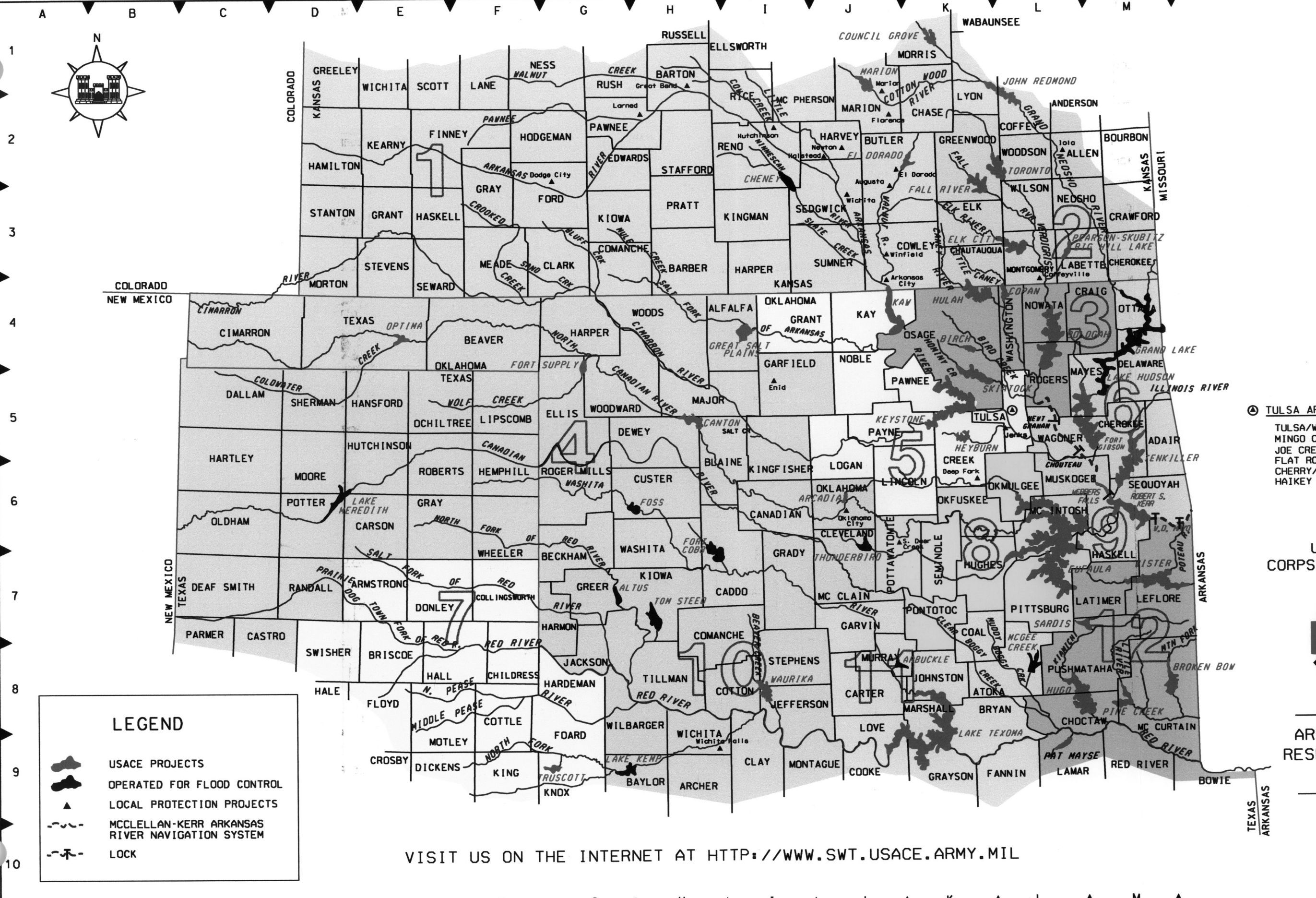
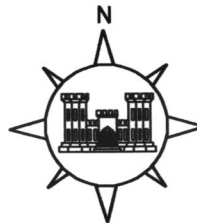
1. Regulating River Stages and Discharges. The four ungated sluices are designed to discharge 13,600 cfs when the reservoir is at elevation 1138.5 (top of flood control pool).

2. Normal Regulation of Flood Control Operation. Flood control operation of Great Salt Plains Reservoir is automatic. The only controlled operation of the outlet works, is the operation of the two 36-inch low-flow valves which shall be directed by the District office.

3. Emergency Regulations of Flood Control. Should communication with the Tulsa District Office be disrupted, the Canton Lake Manager will make every effort to re-establish communication with the Tulsa District Office and, if necessary, send information to the Tulsa District office by any means available. Any releases being made through the low-flow valves at the time emergency conditions arise will be discontinued until communications with the District office are re-established.

4. During Emergency Events. The Canton Lake Manager may temporarily deviate from the current release rates in the event an immediate short-term departure is

deemed necessary for emergency reasons to protect the safety of dam, or to avoid serious hazards to life. Such actions shall be immediately reported by the fastest means of communication available. Actions shall be confirmed in writing the same day to the Water Control Section and shall include justification for the action. Continuation of the deviation will require the express approval of the Water Control Section.



AREAS OF RESPONSIBILITY	
1	MARION
2	FALL RIVER
3	OOLOGAH
4	CANTON
5	KEYSTONE
6	FORT GIBSON
7	CHLORIDE CONTROL
8	EUFAULA
9	ROBERT S. KERR
10	WAURIKA
11	TEXOMA
12	HUGO
SEE REVERSE FOR MANAGERS AND COUNTIES	

- ④ TULSA AREA LEVEES
- TULSA/WEST TULSA
 - MINGO CREEK
 - JOE CREEK
 - FLAT ROCK/VALLEY VIEW CRKS
 - CHERRY/RED FORK CREEKS
 - HAIKEY CREEK

U.S. ARMY
CORPS OF ENGINEERS



AREA MANAGER
RESPONSIBILITY
LIMITS

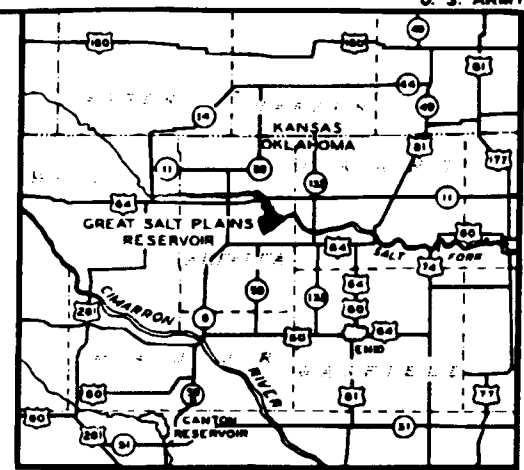
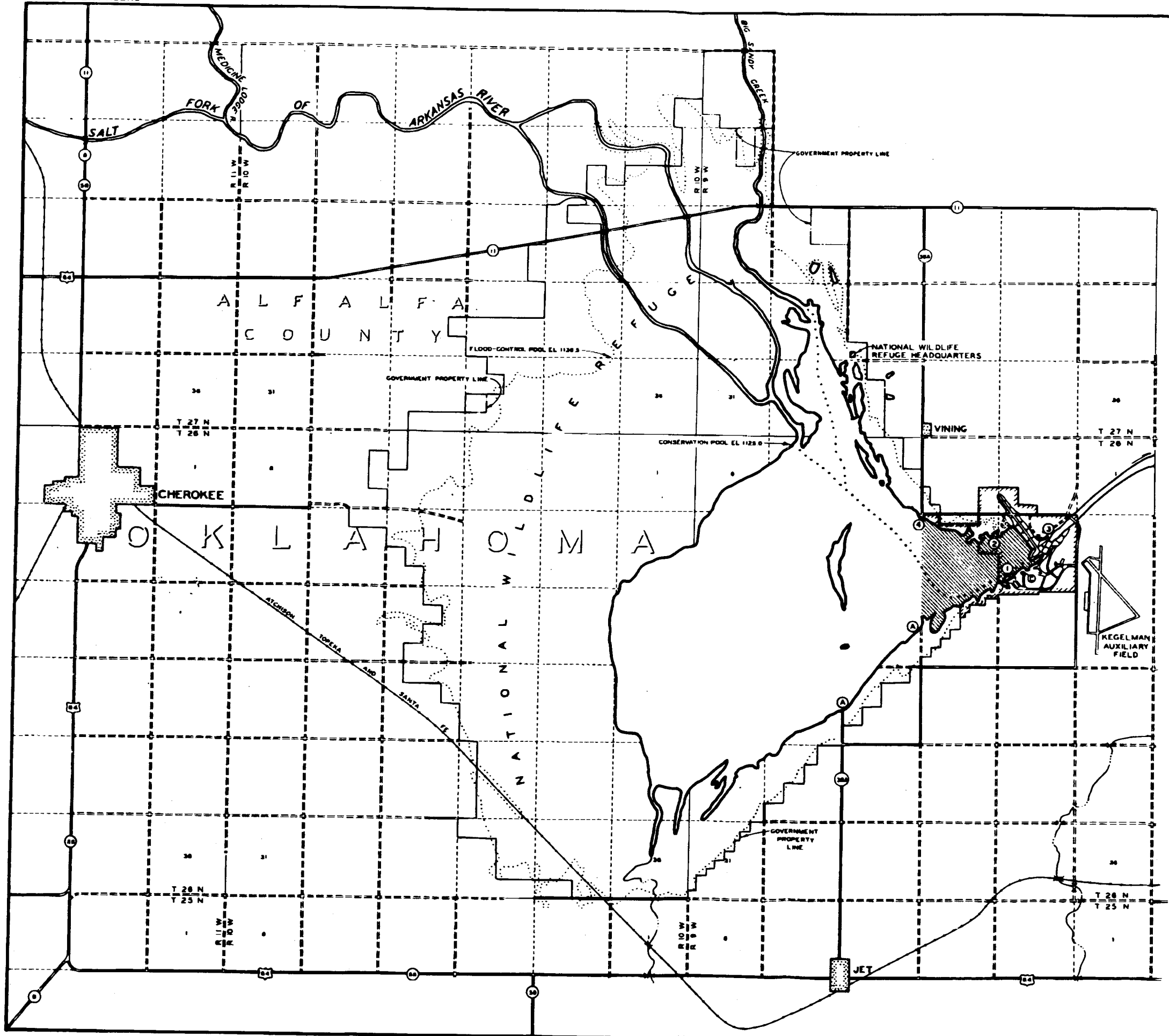
MAY 1998

1-1

LEGEND

- USACE PROJECTS
- OPERATED FOR FLOOD CONTROL
- LOCAL PROTECTION PROJECTS
- MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM
- LOCK

VISIT US ON THE INTERNET AT [HTTP://WWW.SWT.USACE.ARMY.MIL](http://www.swt.usace.army.mil)



VICINITY MAP
SCALE OF MILES
0 10 20 30

- PUBLIC-USE AREAS**
- | NO. | NAME |
|-----|-----------------------------------|
| 1 | SOUTH RECREATION AREA |
| 2 | SANDY BEACH |
| 3 | SALT RIVER ROAD NORTH & NORTHWIDE |
| 4 | COTTONWOOD POINT |
- NOTE
⊙ CONCESSION FACILITIES AVAILABLE

- LEGEND**
- RESERVOIR DATA**
- 1188.3 TOP OF DAM
 - 1128.0 CONSERVATION POOL EL.
 - 1128.3 FLOOD-CONTROL POOL EL.
- RESERVOIR AREA**
- 6,890 ACRES AT CONSERVATION POOL
 - 28,340 ACRES AT FLOOD-CONTROL POOL
 - 41 MILES OF SHORE LINE (AT EL. 1123.0)
- SYMBOLS**
- PAVED ROADS
 - GRAVELED ROADS
 - DIRT ROADS
 - GREAT SALT PLAINS STATE PARK
 - NATIONAL WILDLIFE REFUGE ADMINISTERED BY DEPT. OF INTERIOR, FISH AND WILDLIFE SERVICE
 - ACCESS POINT
 - PROJECT OFFICE
 - OPEN FOR BOATING AND FISHING ALL YEAR

ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA

GREAT SALT PLAINS LAKE
LOCATION MAP, VICINITY MAP, AND
GENERAL DEVELOPMENT PLAN

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
DRAWN BY: G.L.G.
CHECKED BY: J.W.C.

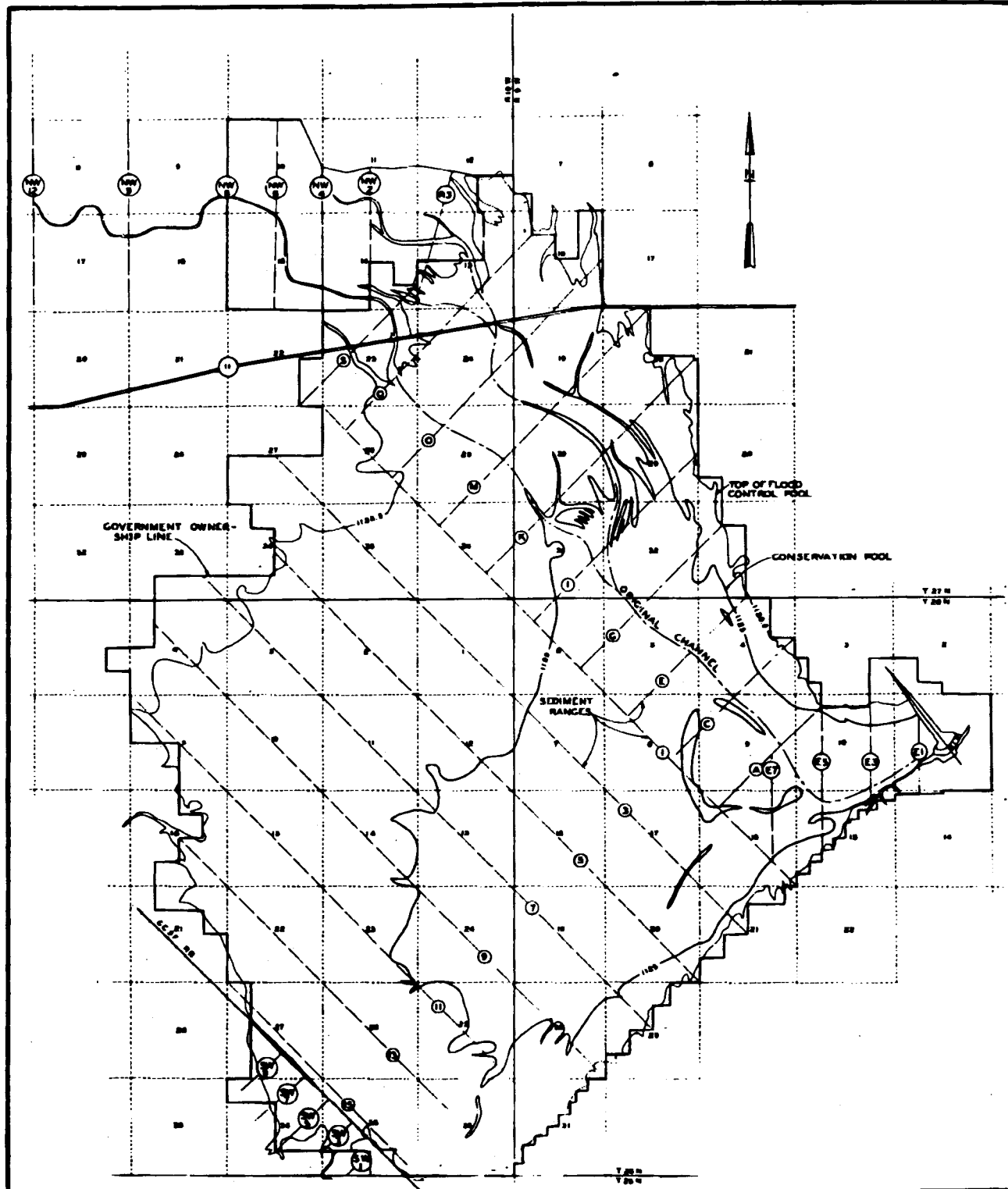
(b) (7)(F)



ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE

GENERAL PLAN
AND SECTIONS

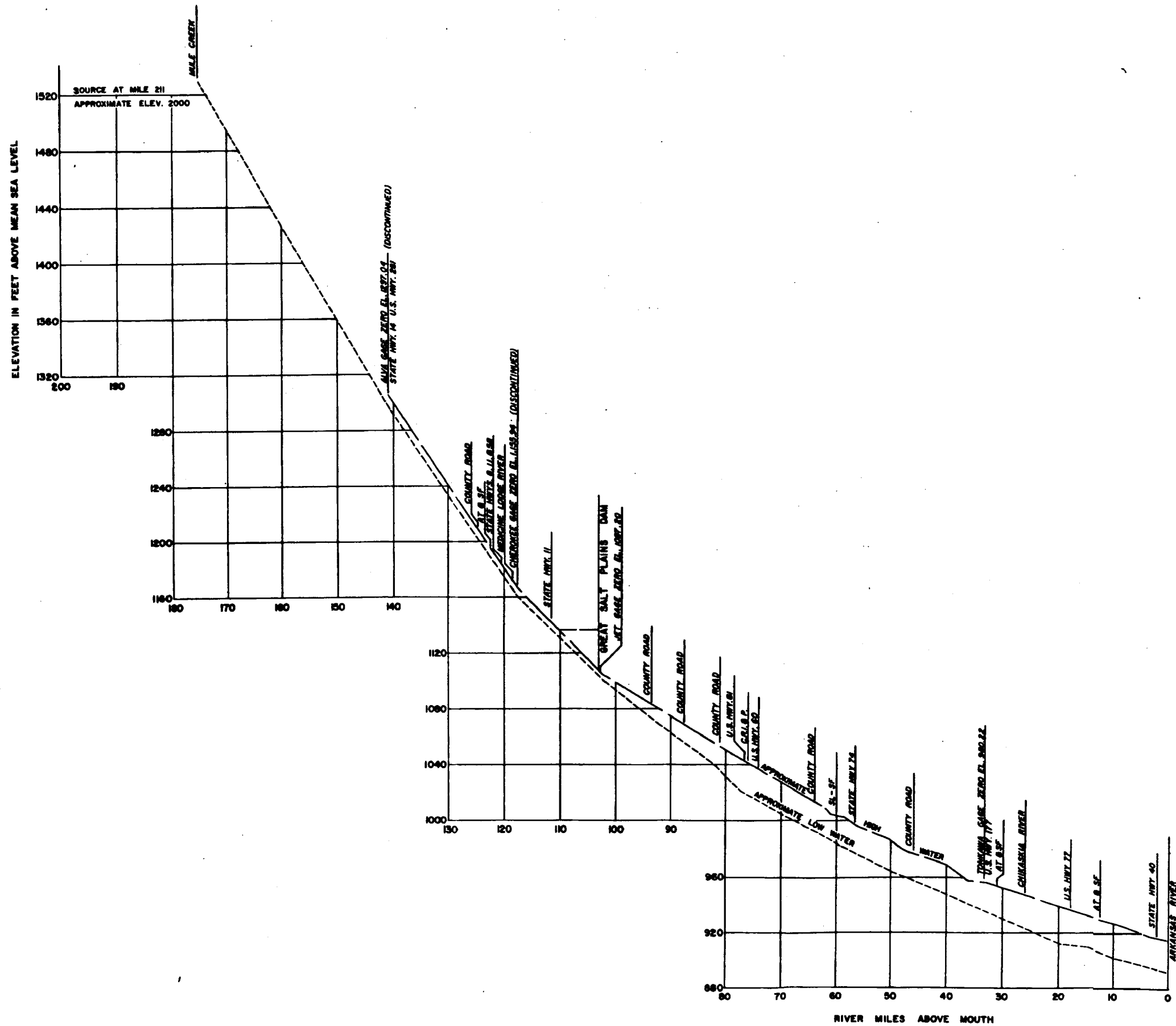
DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
DRAWN BY: G.L.G.
CHECKED BY: J.W.C.



ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE

SEDIMENTATION RANGES

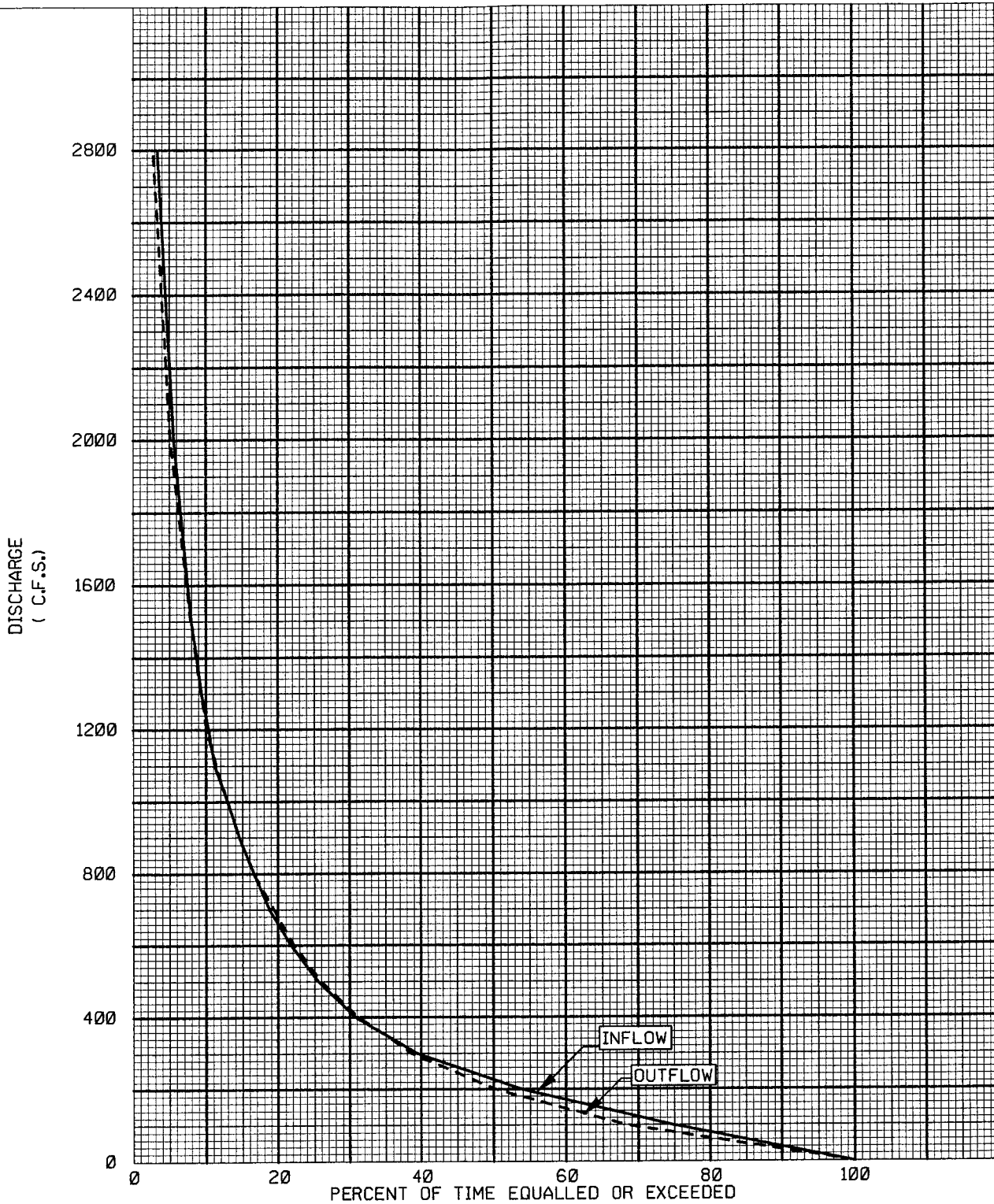
DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
DRAWN BY: G.L.G.
CHECKED BY: J.W.C.



NOTES:
 1. NO GENERAL BANK LINE DATA AVAILABLE.
 2. NO HIGH WATER DATA AVAILABLE ABOVE R.M. 141.
 3. LOW WATER ESTIMATED FROM R.M. 141-170.5

ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
 GREAT SALT PLAINS LAKE
 SALT FORK OF ARKANSAS RIVER
 PROFILE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
 DRAWN BY : G.L.G.
 CHECKED BY : J.W.C.



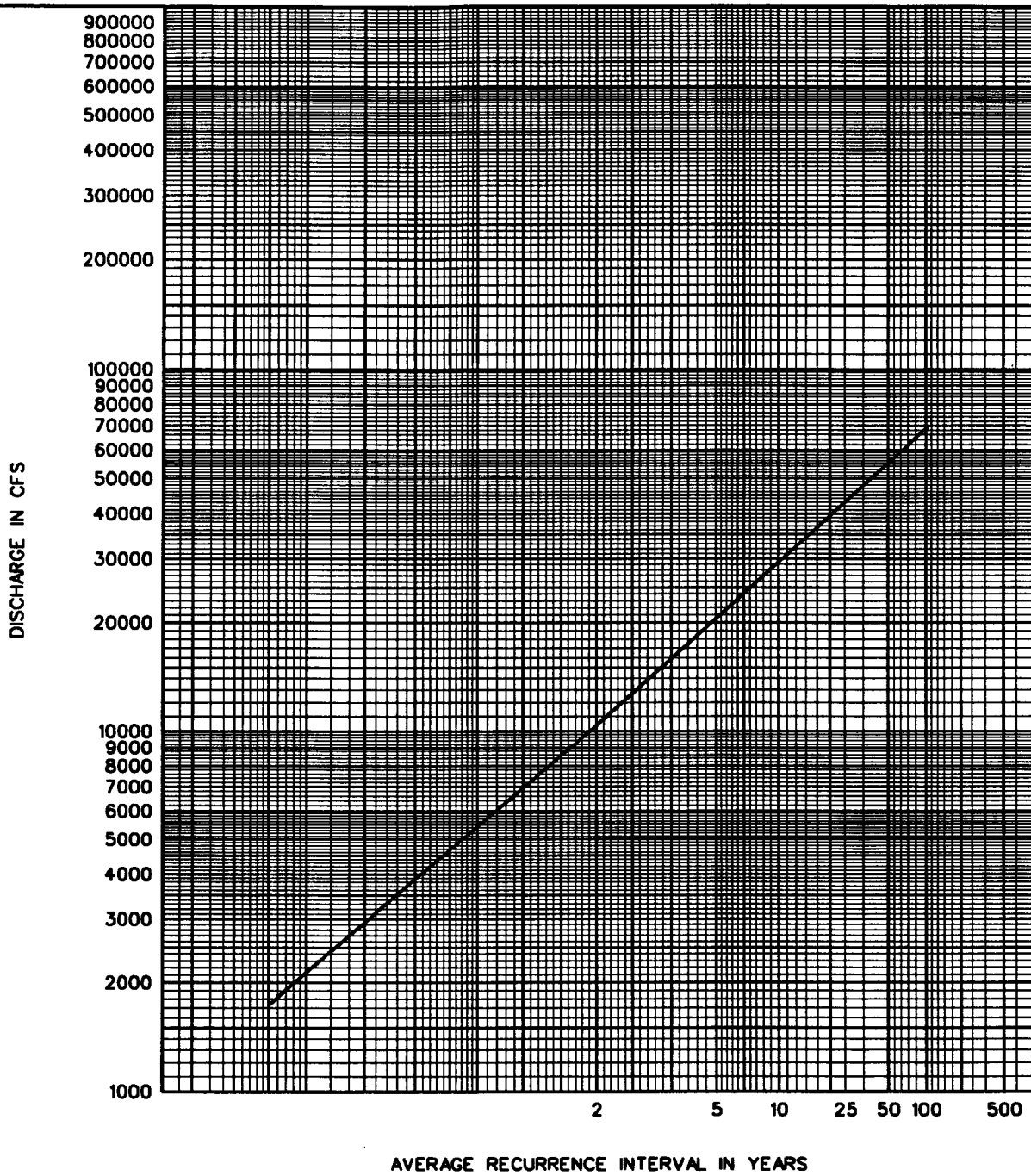
NOTE:

1. INFLOW CURVE
APPROACHES ZERO AT 22,000 C.F.S.
2. OUTFLOW CURVE
APPROACHES ZERO AT 10,000 C.F.S.
3. BASED ON PERIOD OF RECORD
JAN. 1978 THRU DEC. 1994

ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE

FLOW DURATION CURVE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
DRAWN BY: G.L.G.
CHECKED BY: J.W.C.



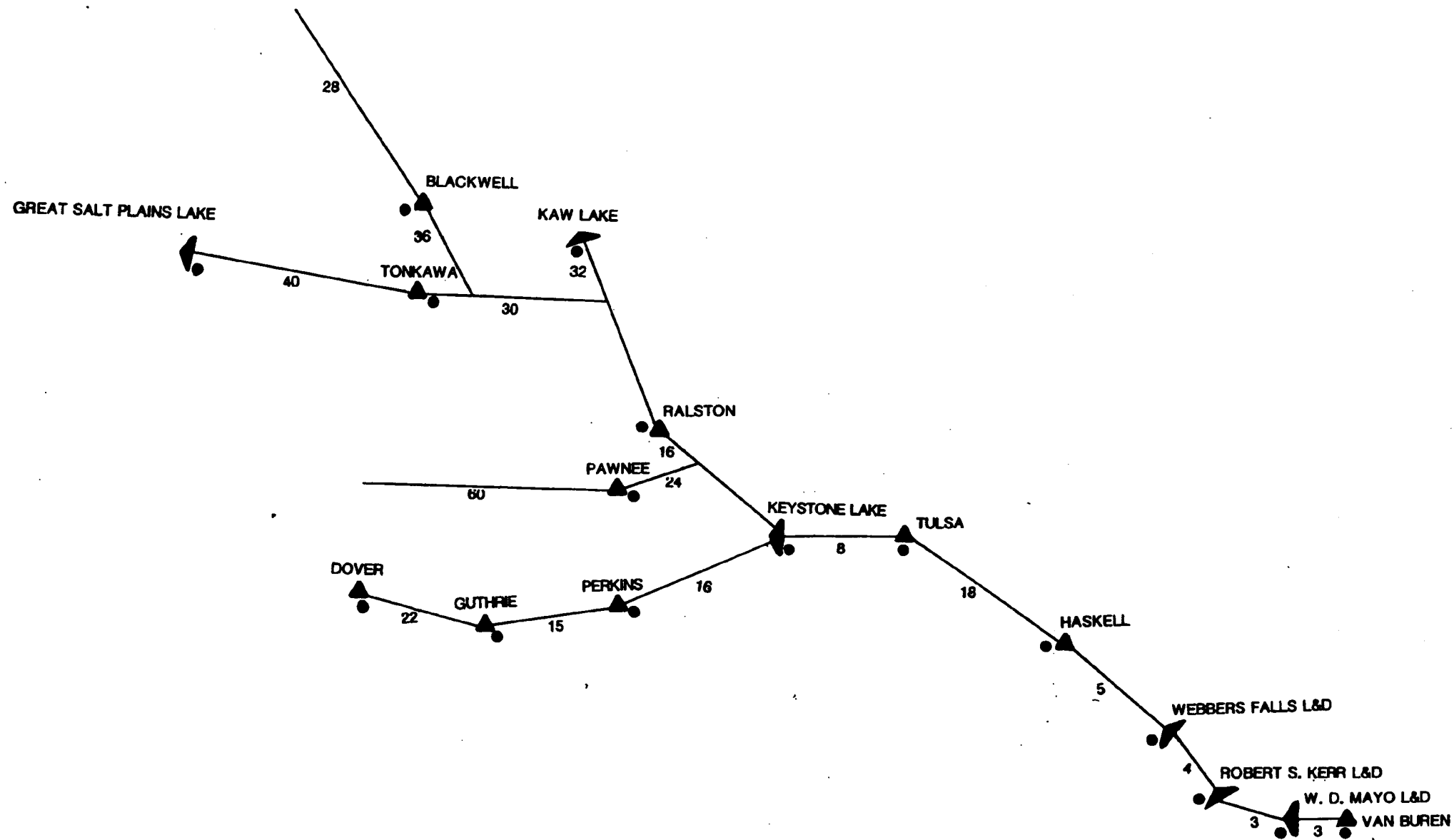
— COMPUTED PEAK INFLOW PROBABILITY

NOTE:

1. BASED ON PERIOD OF RECORD 1944 TO 1999.
2. ADOPTED SKEW COEFFICIENT OF +.10 WAS USED.

ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE
PEAK INFLOW
PROBABILITY CURVE

DEPT. OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1999
 DRAWN: G.L.G.
 CHECKED: J.W.C.



▲ LAKES
● CONTROL POINTS

NOTE:

1. TIME OF TRAVEL IN HOURS FOR LARGE RISES IS SHOWN:
● 24 ●
2. TIME SHOWN ABOVE UPSTREAM STATION IS AVERAGE TIME TO CREST AFTER BEGINNING OF RUNOFF.

NOTE: USE AS A GUIDE ONLY, ACTUAL TRAVEL TIMES VARY ACCORDING TO MAGNITUDE OF FLOW

ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE

TIME OF CREST TRAVEL

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
DRAWN BY: G.L.G.
CHECKED BY: J.W.C.

TONKAWA GAGE (FEET)

27
25
23
21
19
17

STRUCTURE LOSSES

ACRES FLOODED

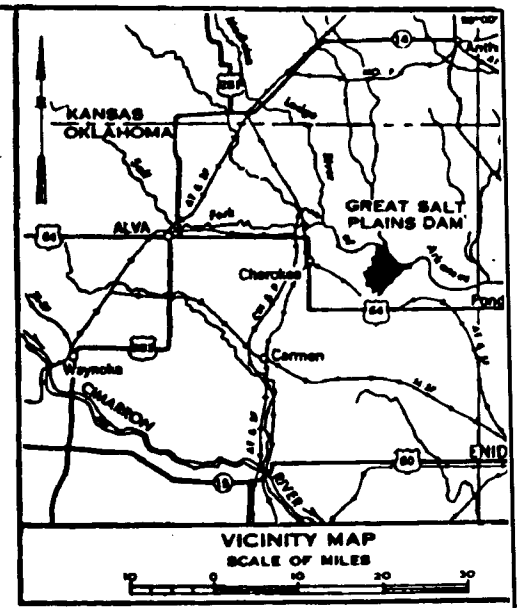
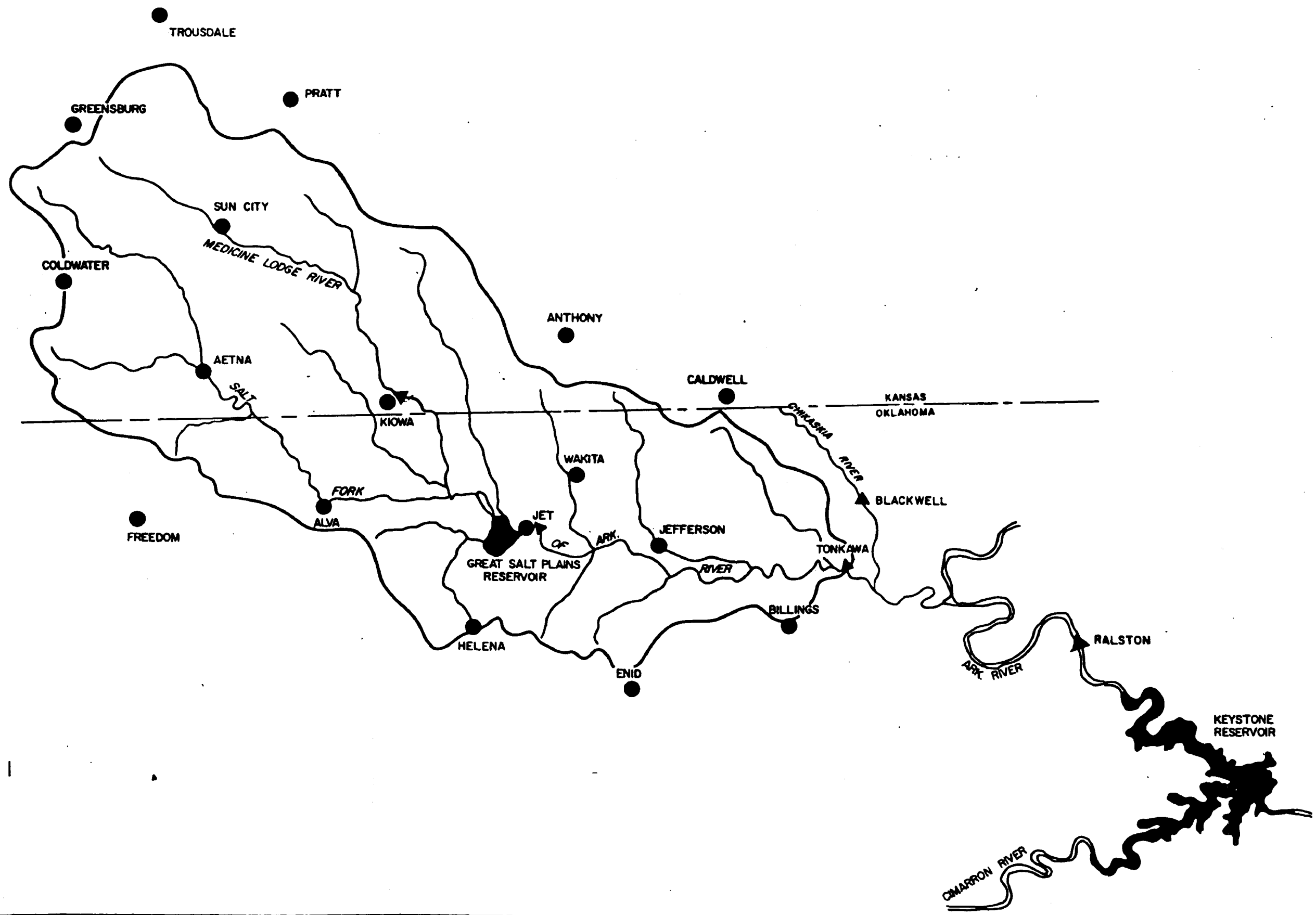
1997 PRICES




\$10,000	\$12,000	\$14,000	\$16,000
50,000	60,000	70,000	80,000

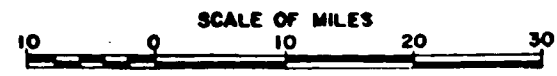
STR. LOSSES (\$1,000)	0	\$2,000	\$4,000	\$6,000	\$8,000
ACRES FLOODED	0	10,000	20,000	30,000	40,000

ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE
**STRUCTURAL LOSS
AND AREA CURVES**
GREAT SALT PLAINS DAM
TO THE MOUTH

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
DRAWN BY: G.L.G.
CHECKED BY: J.M.C.



- LEGEND**
-  RESERVOIR IN OPERATION
 -  PRECIPITATION STATION
 -  STREAM GAGING STATION

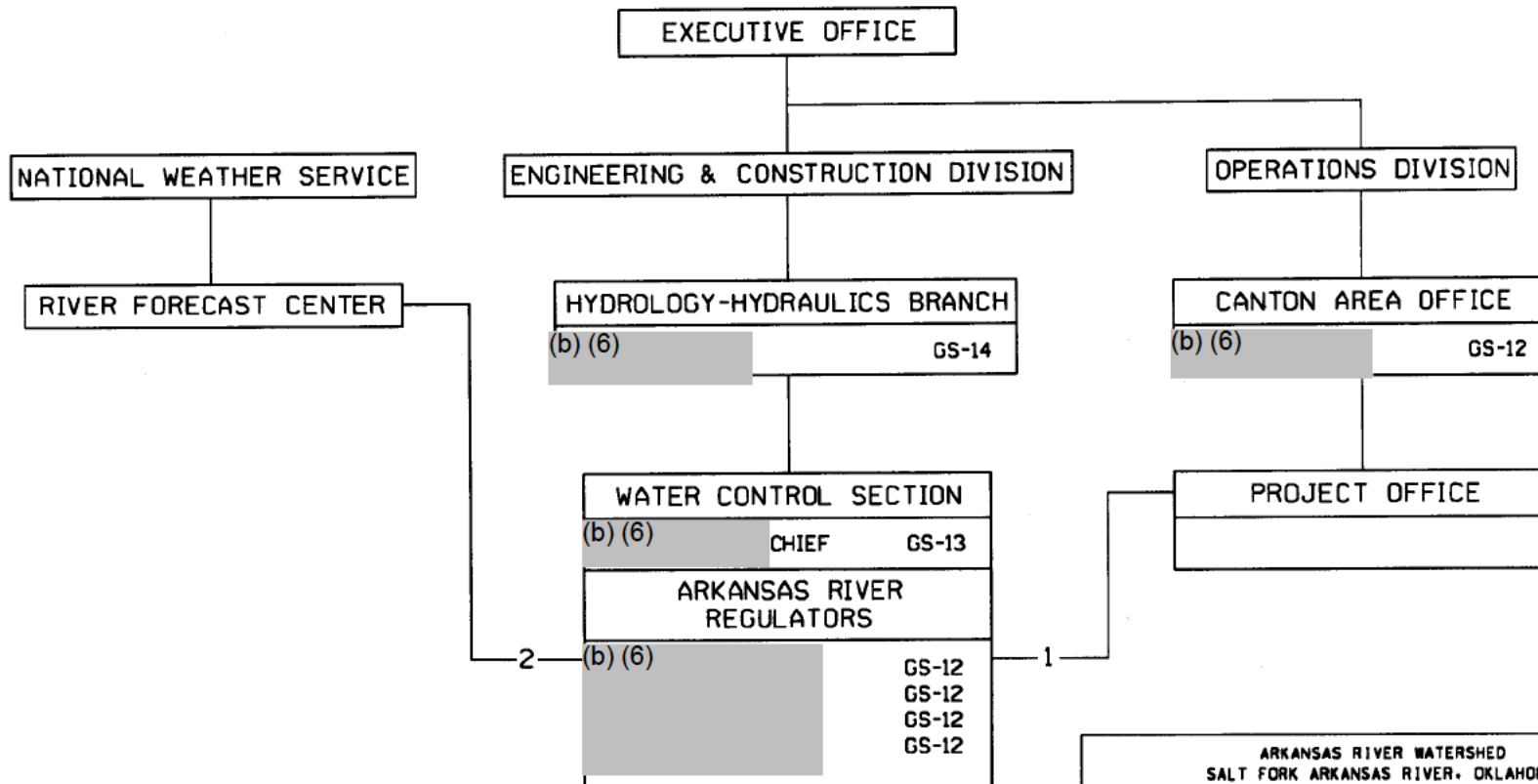


ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
 GREAT SALT PLAINS LAKE

REPORTING RAINFALL AND STREAM GAGING STATIONS
 LOCATION MAP

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1950
 DRAWN BY: G.L.G.
 CHECKED BY: J.W.C.

ORGANIZATION OF FLOOD CONTROL REGULATION
 GREAT SALT PLAINS LAKE
 TULSA DISTRICT
 (Oct 1998)



ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
 GREAT SALT PLAINS LAKE

**ORGANIZATIONAL CHART
 OF FLOOD CONTROL REGULATION**

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
 DRAWN BY: G.L.D.
 CHECKED BY: J.W.C.

1. DIRECT COMMUNICATIONS ARE MAINTAINED BETWEEN THE LAKES AND THE WATER CONTROL SECTION FOR TRANSMISSION OF LAKE DATA AND INSTRUCTIONS.
2. PRECIPITATION AND STREAM GAGE DATA ARE FURNISHED BY THE NATIONAL WEATHER SERVICE, RIVER FORECAST CENTER.

LAKE DATA
GSAL

26 JUNE 1991

LINE NUMBER	ITEM	TIME									
1	POOL ELEVATION	12M	1124.70								
2	POOL ELEVATION	4PM	1124.67								
3	POOL ELEVATION	12M	1124.62								
4	POOL ELEVATION	8AM	1124.58								
5	TAILWATER ELEVATION	8AM									
6	24 HR AVE. POWER DISCHARGE	12M									
7	24 HR AVE. TOTAL DISCHARGE	12M									
8	NET POWER GENERATION	12M									
9	GEN*1 HRS IN USE	12M									
	GEN*2 HRS IN USE	12M									
	GEN*3 HRS IN USE	12M									
	GEN*4 HRS IN USE	12M									
10	INSTANTANEOUS POWER DISCHARGE	8AM									
11	INSTANTANEOUS TOTAL DISCHARGE	8AM									
12	LAKE CONDITIONS	8AM	∅								
13	WEATHER COND.	8AM	∅								
		1PM									
		7PM									
		1AM									
14	TOTAL PRECEDING 6 HOUR PRECIPITATION ENDING AT	7AM									
		7AM	0.0								
15	TOTAL 24 HOUR PRECIPITATION	7AM	0.0								
16	COMMENTS ON PRECIP. DIST.										
17	EVAPORATION 24 HOURS	8AM	0.35								
18	WIND DIRECTION	8AM	S								
19	WIND VELOCITY	8AM	B-1								
20	WATER SUPPLY										
21	GATE SETTINGS NO. TYPE, OPENING	8AM	LF 100%								
22	GATE CHANGES DATE TIME		4APR98 1400								
23	POOL ELEVATION		1124.69								
24	FROM: GATE SETTING		LF 30%								
25	TO: GATE SETTING		LF 100%								
26	GATE CHANGES DATE TIME										
27	POOL ELEVATION										
28	FROM: GATE SETTING										
29	TO: GATE SETTING										
30	RIVER STAGE LOW FLOW WEIR										

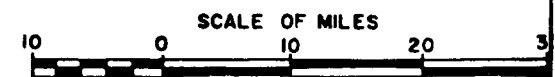
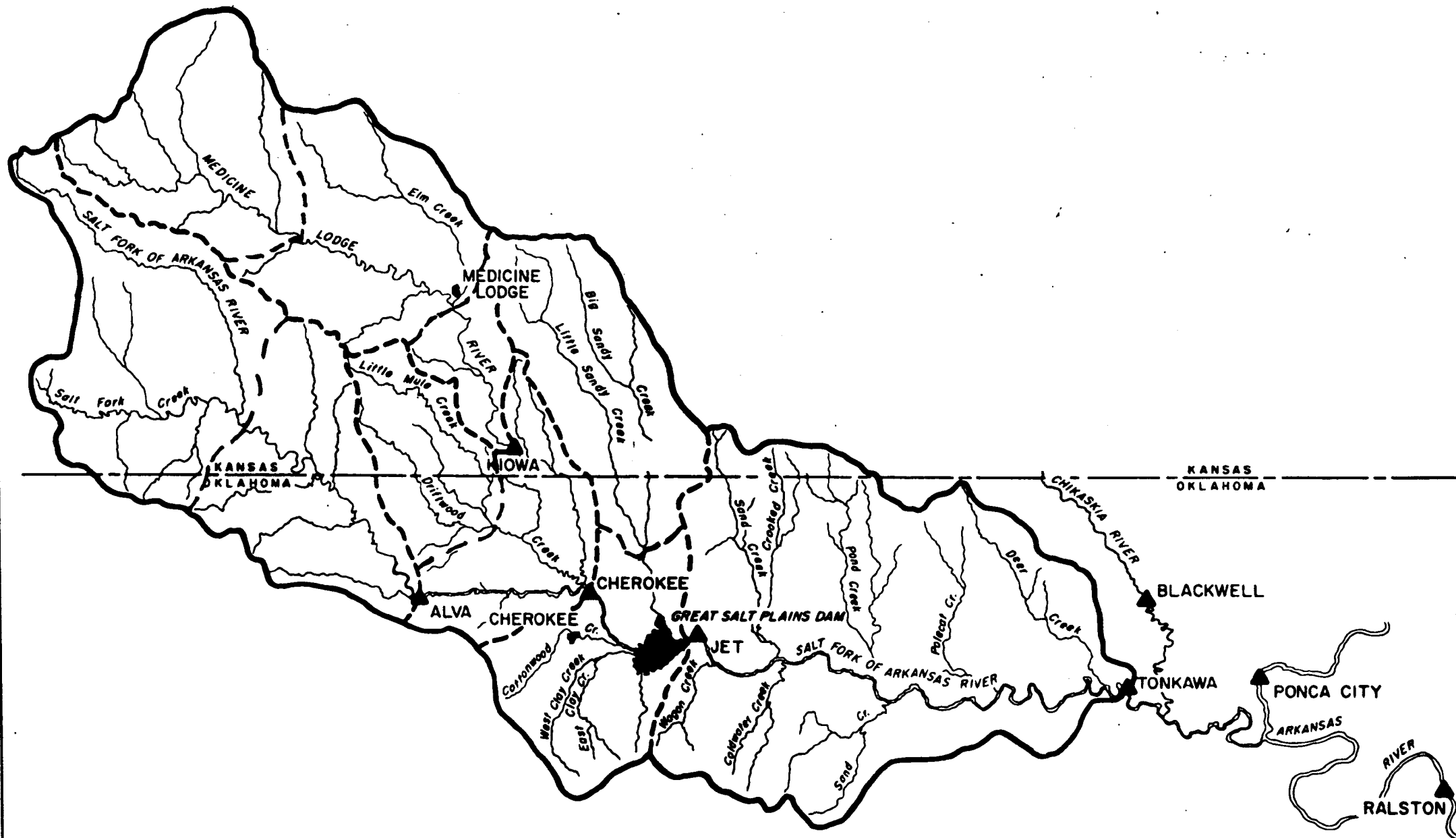
ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE

LAKE DATA

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 1998
DRAWN: G.L.G.
CHECKED: J.W.C.

LEGEND

 **GREAT SALT PLAINS RESERVOIR**



ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE

FORECAST REACHES

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
DRAWN BY: G.L.G.
CHECKED BY: J.W.C.

GREAT SALT PLAINS LAKE
Project Name
DISCHARGE AND INFLOW COMPUTATION

Page _____ of _____

Computed By: _____

Date: June XX

Checked By: _____

Date: _____

Book No. _____

Date	Time	Pool Elevation	TOTAL STORAGE (1000' S A.F.)	INCREMENTAL STORAGE		Gates Operating		Discharge in c.f.s.						(7) Inflow		
				(1) (2) (1000's A.F.)	(3) c.f.s.	No. & Type	Opening	Instantaneous			Average					
								(4) Flood Control	Power	Total	(5) Flood Control	Power	(6) Evap.		Total	
10	0800	1125	37.45			1LF	80			82	82					
	1200	1125.01	37.54	0.08	4+270			2	82	84	83		25	88	4/358	
	1800	1125.02	37.82	0.08	4+240			5	82	87	86		25	91	4/331	
	2400	1125.04	37.80	0.18	8+270			10	82	72	89		25	94	8/284	
11	0800	1125.08	38.15	0.7	24+380			20	82	82	70		25	85	24/445	
	1200	1125.25	38.88	1.51	4+4830	1LF	80	110	82	172	127				4/4857	
	1200	1125.25				1LF	0	110	0	110						
	1800	1125.3	40.1	0.44	4+1320			150	0	150	130				4/1450	
	2400	1125.4	41.01	0.91	8+1385			240		240	185				8/1580	
12	0800	1125.85	43.32	5.17	24+2585			500		500	285		80	325	24/2910	

- (1) Reservoir capacity table.
 (2) Subtract storage at beginning of period from storage at end of periods. If pool is rising, change in storage is (+), if falling negative (-).
 (3) Change in storage (2.1) x 12 = change in storage in c.f.s. No. of hours in period.
 (4) From discharge rating curves.
 (5) Average discharge rating curves.
 (6) Pan evaporation applied to evaporation curves.
 (7) Inflow = change in storage (c.f.s.) + average discharge + evaporation.

NOTE: During flood periods evaporation is usually neglected in preliminary inflow calculations. Number of hours for the inflow period is indicated by M

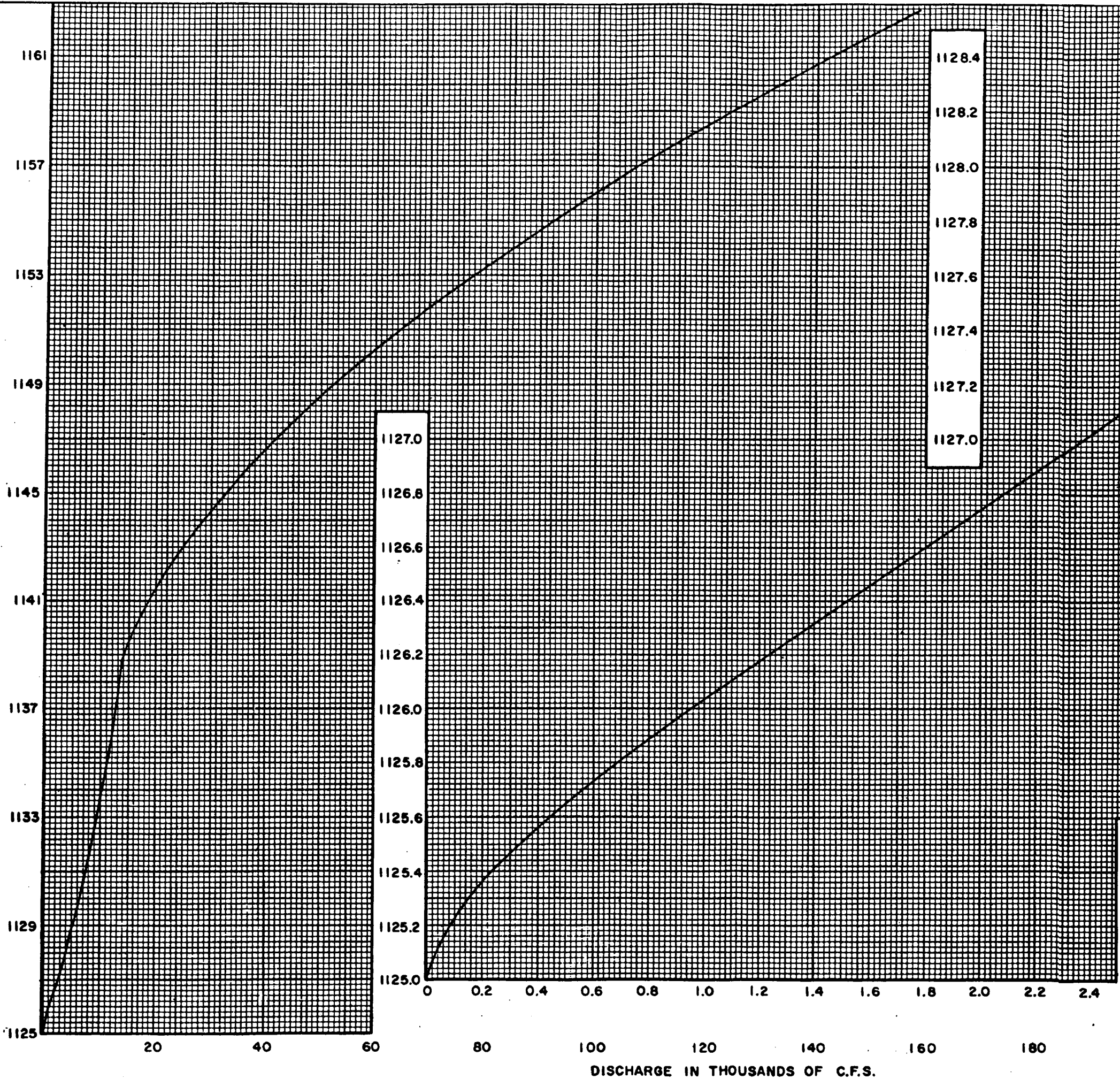
ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER
 GREAT SALT PLAINS LAKE
**SAMPLE DISCHARGE
 AND INFLOW
 COMPUTATION**

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS ENGINEERS 1998
 DRAWN BY: G.L.G.
 CHECKED BY: J.W.C.

6-2

SWD Form 188A
 25 Nov. 82
 8/86 electronic format by SWT

POOL ELEVATION IN FEET (M.S.L.)



2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0

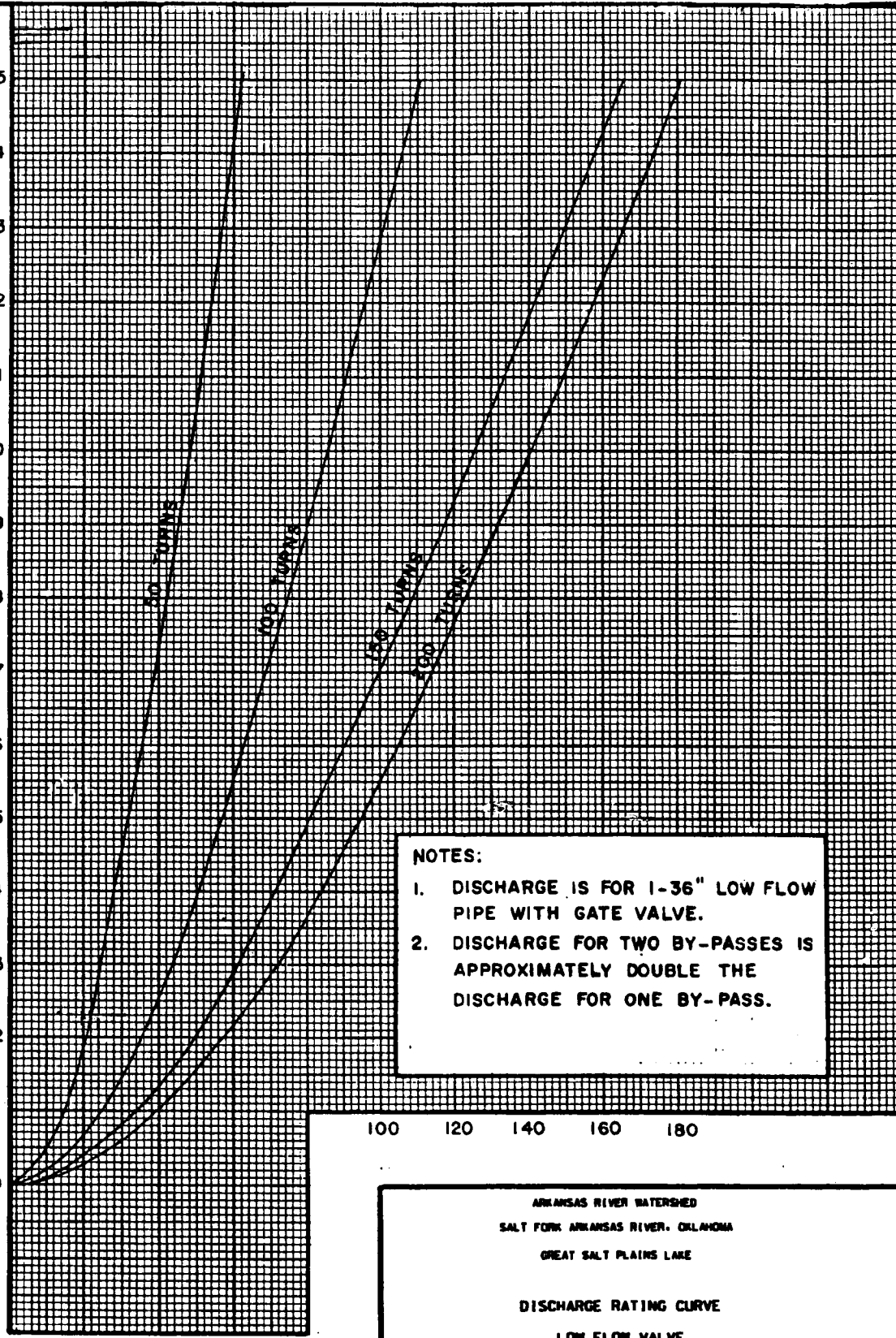
ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE

DISCHARGE RATING CURVE
UPPER WEIR AND SLUICES

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
DRAWN BY: G.L.G.
CHECKED BY: J.W.C.

POOL ELEVATION IN FEET - M.S.L.

1125
1124
1123
1122
1121
1120
1119
1118
1117
1116
1115
1114
1113
1112
1111
1110



0 20 40 60 80
DISCHARGE IN C.F.S.

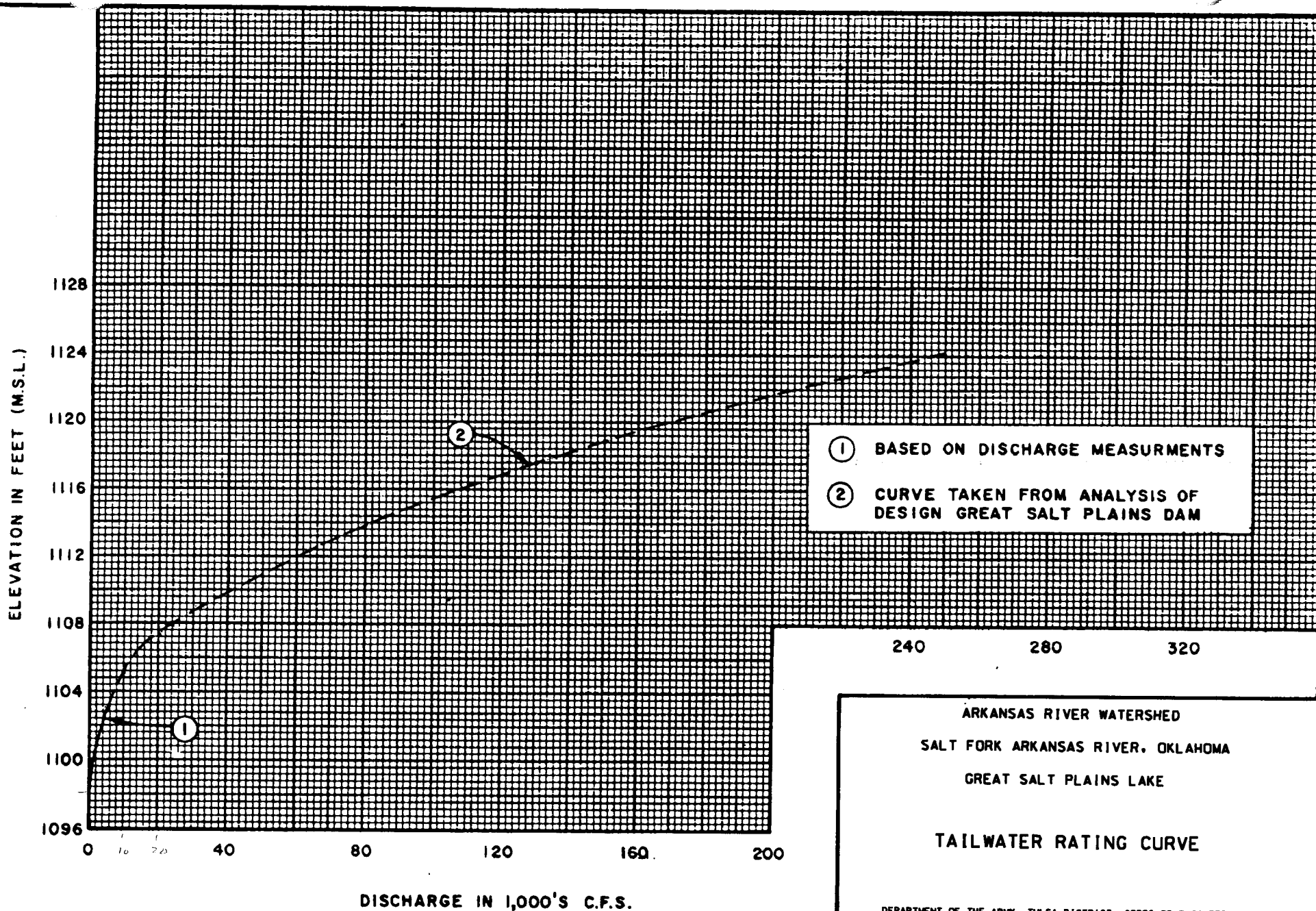
NOTES:
1. DISCHARGE IS FOR 1-36" LOW FLOW PIPE WITH GATE VALVE.
2. DISCHARGE FOR TWO BY-PASSES IS APPROXIMATELY DOUBLE THE DISCHARGE FOR ONE BY-PASS.

100 120 140 160 180

ARKANSAS RIVER WATERSHED
SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE

DISCHARGE RATING CURVE
LOW FLOW VALVE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
DRAWN BY: G.L.G.
CHECKED BY: J.W.C. 7-2



① BASED ON DISCHARGE MEASUREMENTS
 ② CURVE TAKEN FROM ANALYSIS OF DESIGN GREAT SALT PLAINS DAM

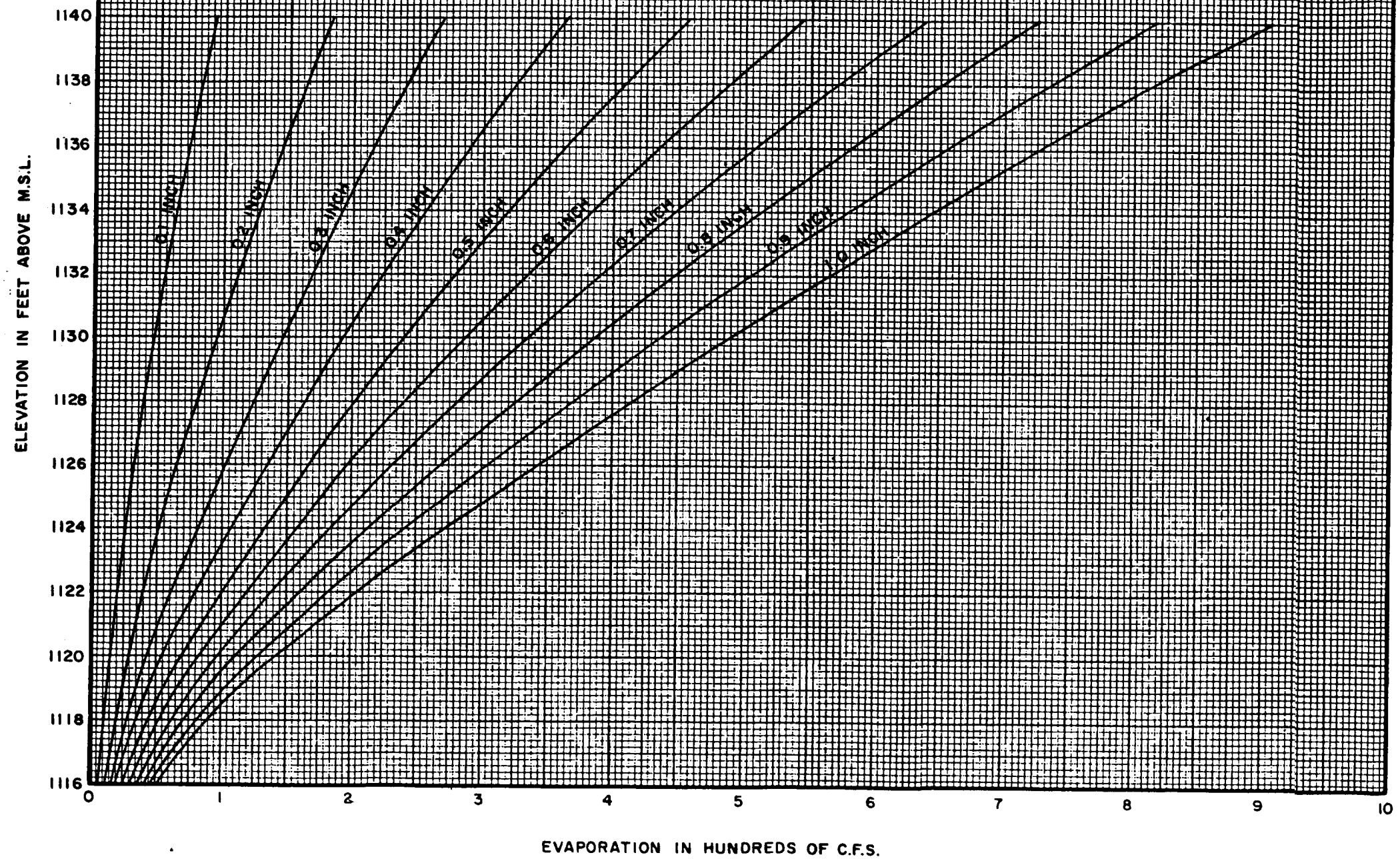
240 280 320

ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
 GREAT SALT PLAINS LAKE

TAILWATER RATING CURVE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
 DRAWN BY: G.L.G.
 CHECKED BY: J.W.C.

7-3



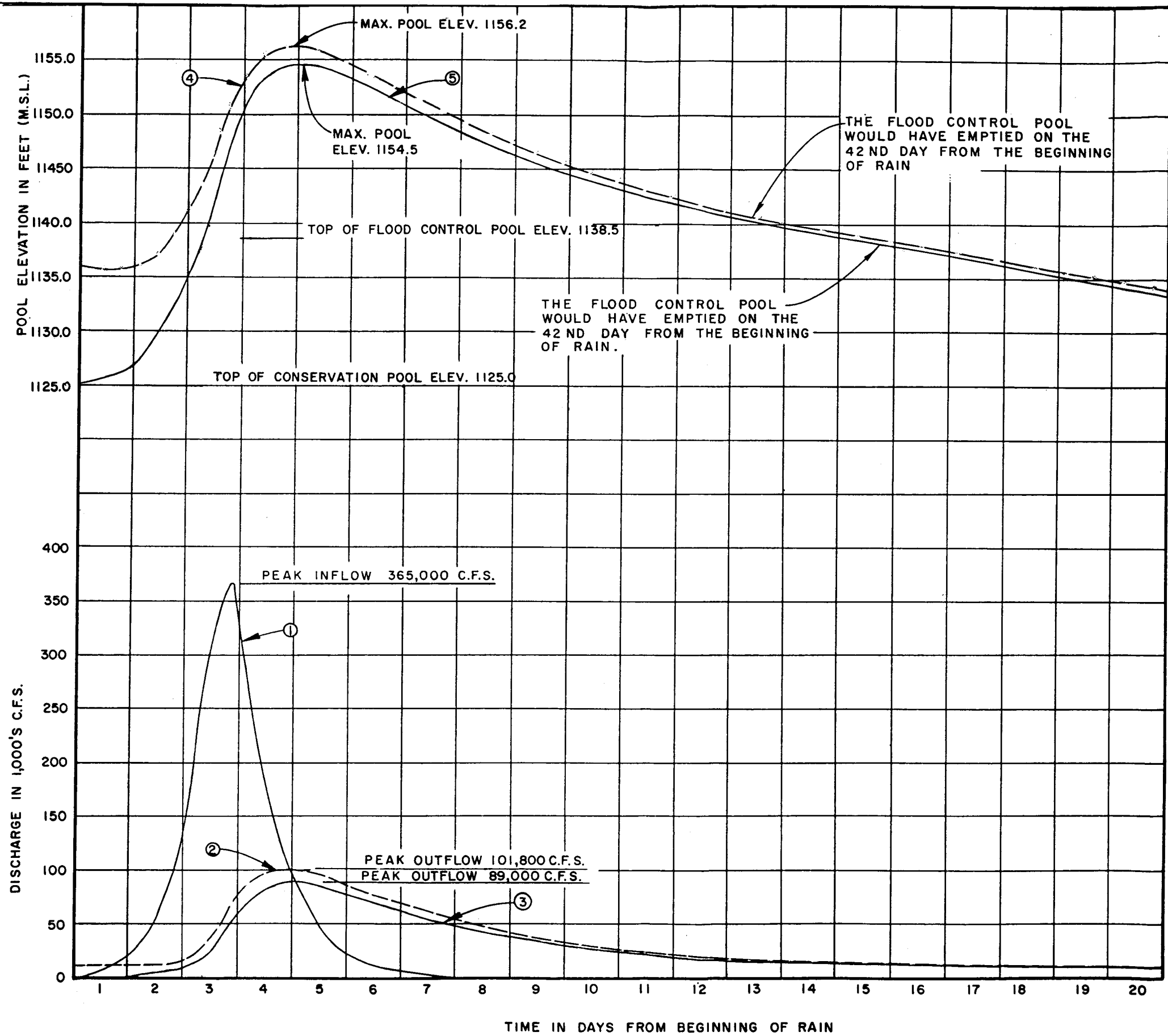
NOTE:
 CURVES COMPUTED FOR 70% OF
 TANK EVAPORATION. NOTATION AT
 LEFT OF EACH CURVE DENOTES
 ACTUAL TANK EVAPORATION. FOR
 INTERMEDIATE RATES, INTERPOLATE
 BETWEEN APPROXIMATE LIMITS.

ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
 GREAT SALT PLAINS LAKE

EVAPORATION CURVES

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
 DRAWN BY: G.L.G.
 CHECKED BY: J.W.C.

7-4



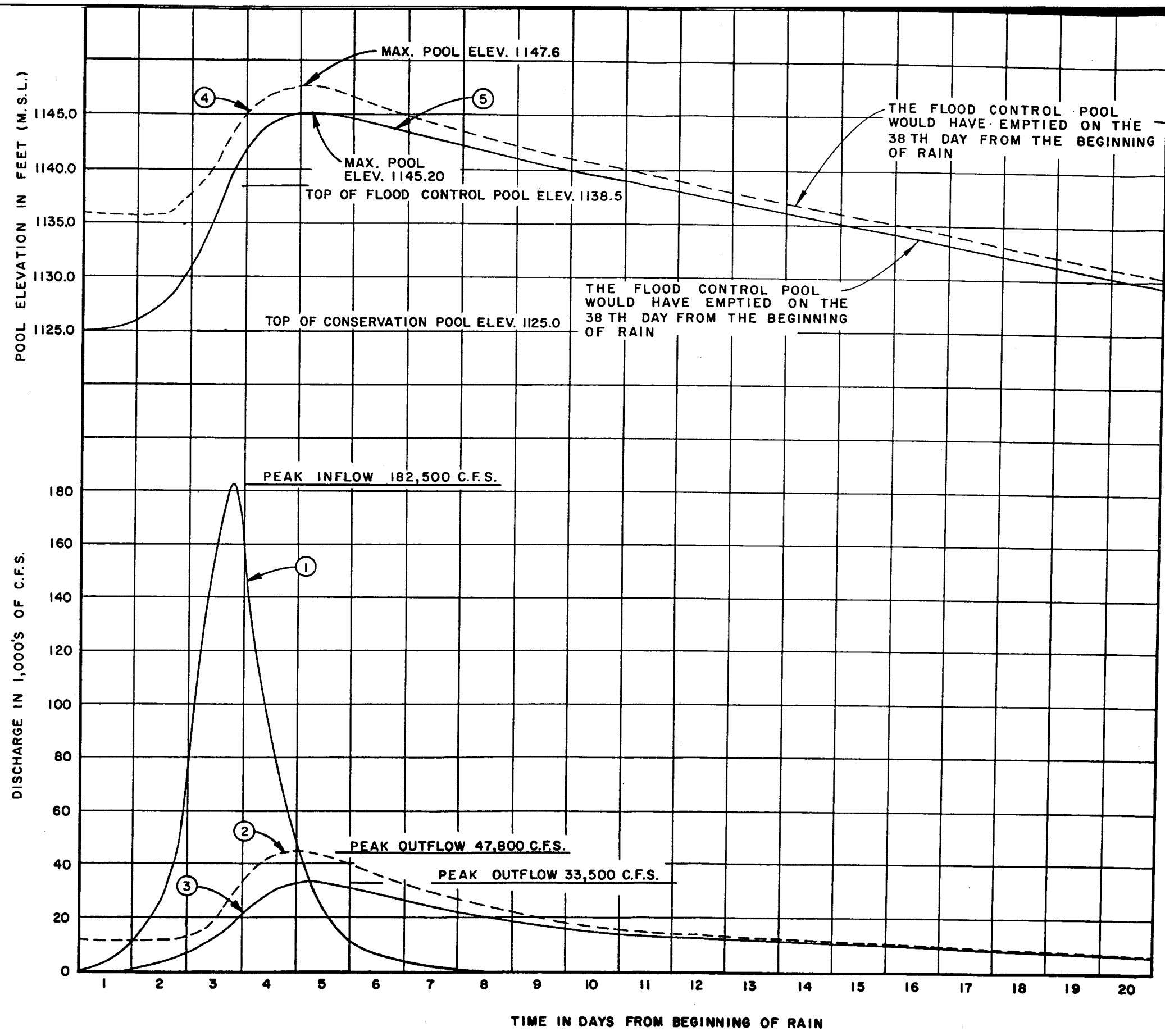
NOTE:

- ① INFLOW HYDROGRAPH
- ② OUTFLOW FLOOD ON POOL ELEV. 1136.0 N.G.V.D. (SEE PARA. 8-02b)
- ③ OUTFLOW - FLOOD ON EMPTY POOL
- ④ POOL STAGE - FLOOD ON POOL ELEV. 1136.0 N.G.V.D.
- ⑤ POOL STAGE - FLOOD ON EMPTY POOL

ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
 GREAT SALT PLAINS LAKE

 OPERATIONAL HYDROGRAPHS
 SPILLWAY DESIGN FLOOD

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
 DRAWN BY: G.L.G.
 CHECKED BY: J.W.C.



NOTE:

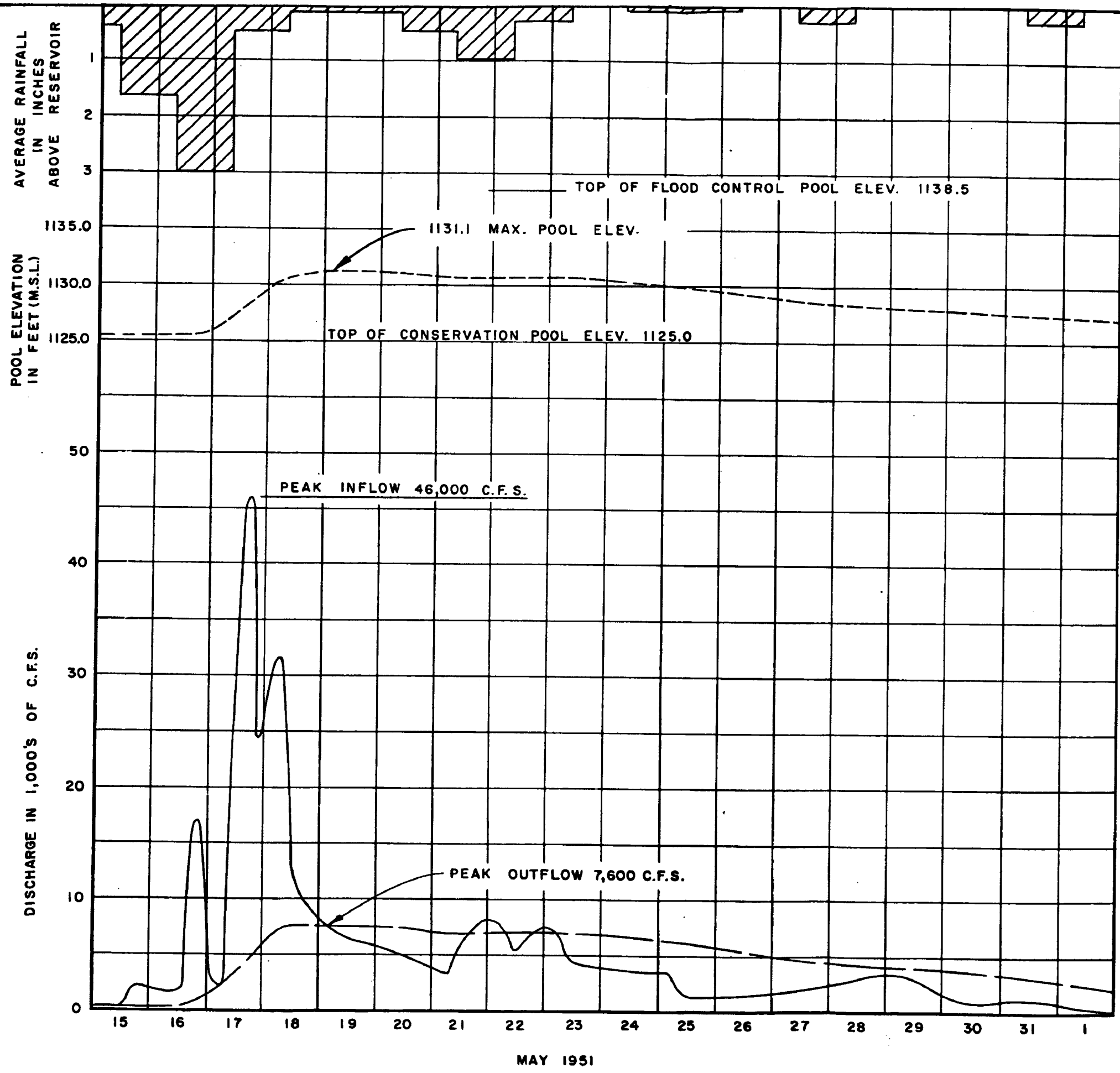
- ① INFLOW HYDROGRAPH
- ② OUTFLOW FLOOD ON POOL
ELEV. 1136.0 N.G.V.D. (SEE PARA. 8-02b)
- ③ OUTFLOW - FLOOD ON EMPTY POOL
- ④ POOL STAGE - FLOOD ON POOL
ELEV. 1136.0 N.G.V.D.
- ⑤ POOL STAGE - FLOOD ON EMPTY POOL

ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
 GREAT SALT PLAINS LAKE

OPERATIONAL HYDROGRAPHS
 STANDARD PROJECT FLOOD
 (1/2 SPILLWAY DESIGN FLOOD)

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
 DRAWN BY: G.L.G.
 CHECKED BY: J.W.C.

8-2



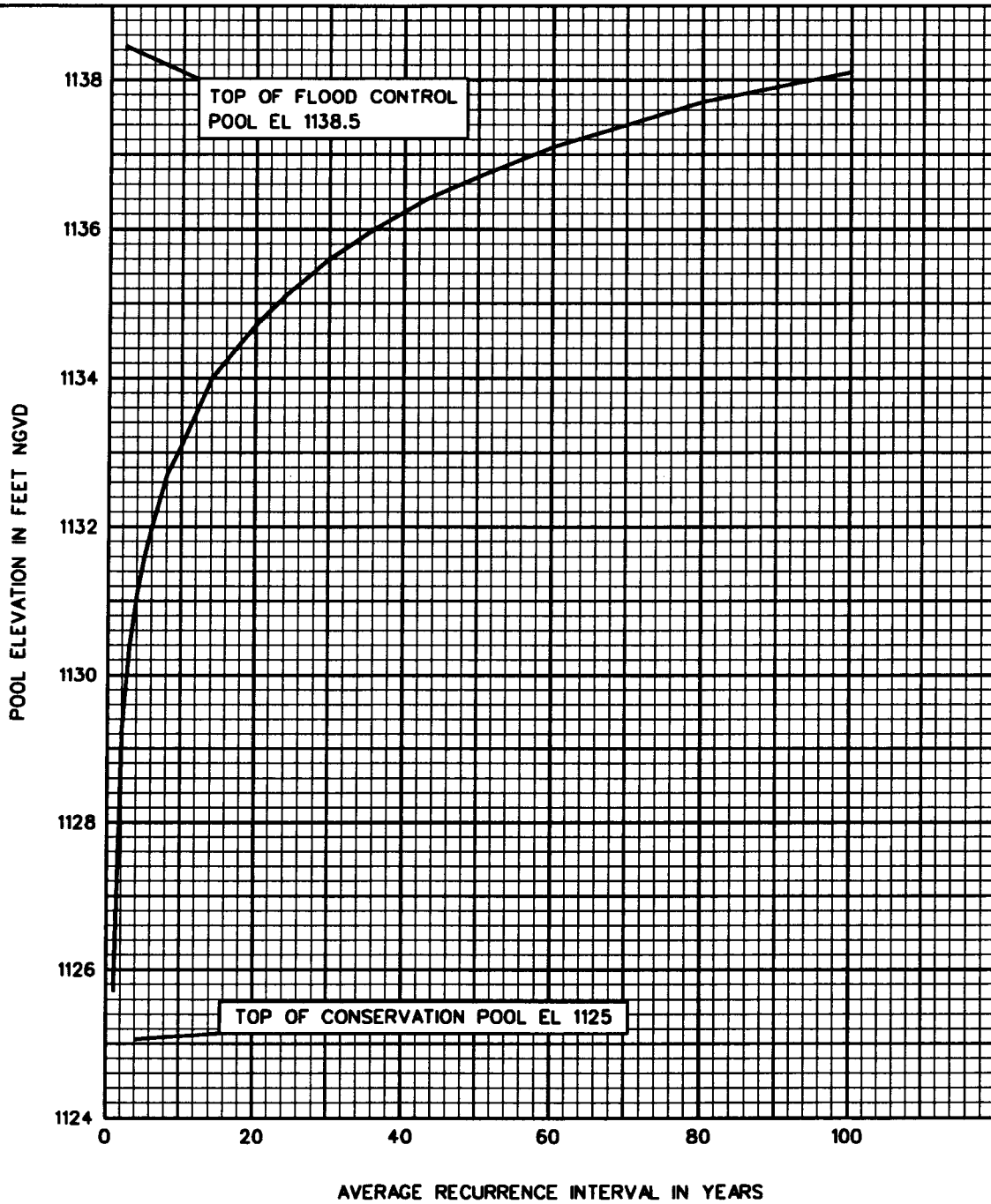
LEGEND

- INFLOW HYDROGRAPH
- OUTFLOW
- - - POOL STAGE

ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
 GREAT SALT PLAINS LAKE

OPERATIONAL HYDROGRAPHS
 FLOOD OF MAY 1951

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
 DRAWN BY: G.L.G.
 CHECKED BY: J.W.C.



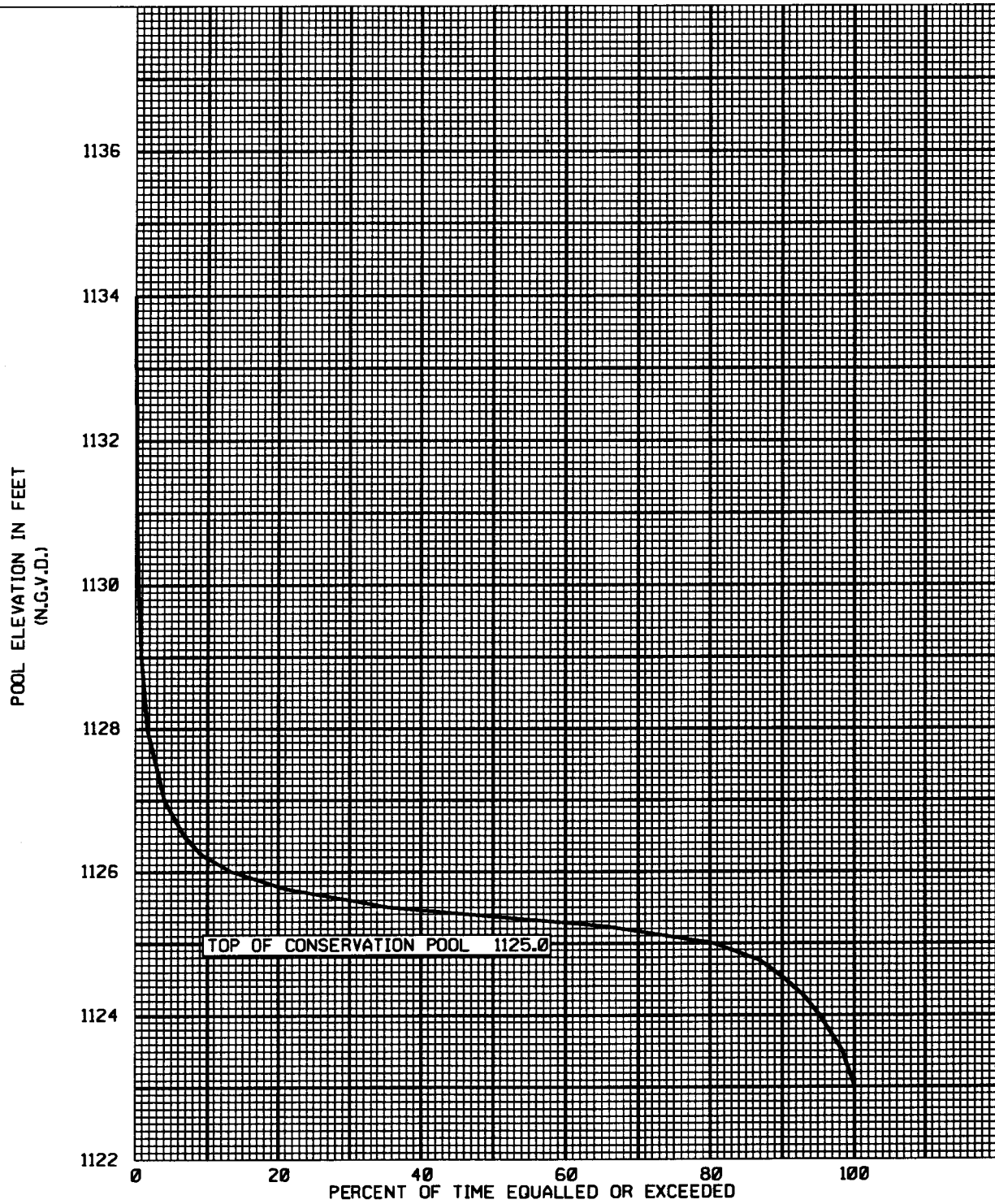
NOTE:

CURVE IS BASED UPON PERIOD OF RECORD OCTOBER 1943 THRU NOVEMBER 1998 AND BASED ON 1978 SEDIMENT SURVEY.

ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
GREAT SALT PLAINS LAKE

**POOL ELEVATION
 PROBABILITY CURVE**

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 1998
 DRAWN: G.L.G.
 CHECKED: J.W.C.



NOTE: BASED ON PERIOD OF RECORD
 JAN. 1978 THRU DEC. 1994

ARKANSAS RIVER WATERSHED
 SALT FORK ARKANSAS RIVER, OKLAHOMA
 GREAT SALT PLAINS LAKE

**POOL ELEVATION
 DURATION CURVE**

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 1998
 DRAWN BY: G.L.G.
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