CADDO LAKE
WATER CONTROL PLAN

NEW ORLEANS DISTRICT

SEPTEMBER 1982

PERTINENT DATA

CADDO LAKE DAM

DRAINAGE AREA	sq mi	2,700
CONSERVATION POOL		
Elevation	ft m.s.l.	168.5
Area	acre	26,800
Storage	acre-ft	128,600
MAIN DAM		
Dam Spillway (concrete)		
Low portion		
Length	ft	860
Elevation	ft	168.5
High portion		
Length	ft	920 and 620
Elevation	ft	170.5
End section		
Length	ft	50 each end
Elevation	ft	176
Total length of concrete spillway	ft	2,500
Embankment portion (earth)		
Length	ft	1,200
Elevation	ft	176
Total length of main dam	ft	3,700
Stilling pond		
Minimum water surface elevation	ft	160.5
Top of containing dike		
Elevation	ft	170.5
Length	ft	2,590±
Ogee weir		
Width of weir crest	ft	100
Elevation of weir crest	ft	160.5

PLATE INDEX

Plate	Title
1	General map and drainage areas
2	Location map
3	Monthly reservoir operation
4	Profile of dam
5	Rating curves
6	Storage and area curves
7	Stage frequency curve
8	Average monthly runoff
9	Caddo Lake 1958 flood hydrograph
10	Caddo Lake 1973 flood hydrograph

EXHIBIT INDEX

Exhibit	Title
a.	Aerial photo of Caddo Lake Dam
b.	Aerial photo of Caddo Lake Dam
c.	Aerial photo of Caddo Lake Dam
d.	Standing instructions to the Project Manager

September 1982

CADDO LAKE WATER CONTROL PLAN

1. Introduction. This manual is submitted in accordance with DIVR 1110-2-3600 titled Engineering and Design, Water Control Management, Preparation of Water Control Plans and Manual.

Caddo Lake is a feature of the Federal Navigation Project, "Cypress Bayou and the Waterway Between Jefferson, Texas, and Shreveport, Louisiana". Caddo Lake Dam is located in Caddo Parish about 19 miles northwest of Shreveport in northwestern Louisiana. The dam is located near the mouth of Cypress Bayou, where it joins with Black Bayou to form Twelve Mile Bayou, and approximately 23 miles above the confluence of Twelve Mile Bayou and Red River (see plate 1). Caddo Lake Dam was authorizd in 1910 and completed in 1914 to prevent the loss of Caddo Lake, then threatened by erosion in the outlet channel after removal of the rafts in Red River and Twelve Mile Bayou, and to insure that navigable depths would continue to be available for waterway traffic between Mooringsport, Louisiana, and Jefferson, Texas.

Caddo Lake Replacement Dam was authorized by the Flood Control Act of 27 October 1965 to preserve the socio-economic base that had developed over the years as a result of Caddo Lake. Benefits associated with the replacement dam were mainly non-Federal, however construction of the replacement dam was approved subject to local interest accepting ownership and operation and maintenance responsibilities. The project is not subject to Part 208, Title 33, of the code of Federal Regulations, by virtue of Section 7 of the 1944 Flood Control Act. The replacement dam was completed in 1971 and was under the jurisdiction of the Caddo Levee District for about 5 years. In October 1976 Public Law 94-587 shifted operation and maintenance responsibilities to the Federal government. Since the Government acquired no rights to the lands under or around Caddo Lake, the replacement dam was designed not to increase lake elevations above the experienced conditions. However, in order to meet possible future water supply demands in the area, the spillway structure was designed to accommodate future crest elevation increases for enlarging the lake storage capacity.

2. Hydrometeorology. Rainfall distribution is fairly uniform throughout Caddo Lake's watershed varying from 47 inches at the damsite to 43 inches near the upper limit of the basin. Snowfall occurs about once every two years averaging approximately 2.5 inches per year. Normal annual precipitation is about 46 inches with monthly normals varying from 2.7 inches in August and September to 5.1 inches in May. The predominant flood season is in April - May.

Stage data is received from five gaging stations located in the immediate area of the lake, see plate 2. These gaging stations are automatic recording type stations whose charts are pulled weekly and mailed into the district for processing and handling. Basin rainfall data is obtained from the National Weather Service for various rainfall stations throughout the basin, see plate 2. Rainfall is obtained either by direct telephone communications or via NOAA Weather Wire. Inflows and outflows are determined utilizing a storage curve and spillway rating curve. Monthly operational charts depicting rainfall, inflow, discharge and stage data as shown on plate 3 are prepared and forwarded to LMVED-WR.

Caddo Dam passes flows from a drainage area of approximately 2700 square miles of the Cypress Bayou drainage basin. The runoff from about 850 square miles is controlled by Ferrells Bridge Dam which is located about 50 miles upstream from Caddo Dam. High flows are generally experienced during the period from March through May, while low flows normally occur from August through November. Average monthly runoff in cfs for the period 1958 through 1981 is shown in Plate 8.

Eight major floods have occurred at Caddo Dam since 1930. The greatest flood on record occurred during April - June 1958. The flood was produced by the storm of 25 April - 4 May, centered at Daingerfield, Texas. During the period a maximum of 20.7 inches of rainfall was recorded at Daingerfield with over 10 inches falling in a 48-hour period from 26 - 28 April. The watershed above Caddo Dam experienced an average rainfall of 15.7 inches. With Ferrells Bridge Dam in operation, the stage at Caddo Lake went to 182.6 ft on 5 May, which is the maximum stage of record at Caddo Lake Dam, producing a peak discharge of 36,000 cfs. The peak inflows to the reservoir was 71,500 cfs with a total runoff of 9.9 inches from 24 April to 15 June. During moderate to large floods Caddo Lake's uncontrolled outlet becomes completely submerged and reverts to an open river condition. Consequently, the backwater effect of the dam on upstream stages during these floods are minimal. Because there is no flood control storage and the dam becomes completely submerged during large floods, a hypothetical design flood has not been routed through the project. (See plates 9 and 10 for typical flood hydrographs)

The New Orleans District does not make stage forecast for Caddo Lake. The National Weather Service makes stage forecast for the Mooringsport gage during flood periods. These forecast are distributed via NOAA Weather Wire circuit. The Mooringsport gage is located several miles above the damsite.

3. Project Management. Caddo Lake Dam is completely uncontrolled. Water levels within Caddo Lake depend primarily on rainfall - runoff above the damsite. During large floods Caddo Dam becomes completely submerged and Twelve Mile Bayou governs discharge from Caddo Lake. The role of the project manager is to periodically visit the structure when lake levels exceed 168.5 feet NGVD. His principal duties consists of inspecting the dam and appurtenant structurs to determine if there exists any adverse conditions which may endanger the structure and to report such conditions to the district office for action. Also, during storm seasons, the manager shall keep himself informed on inclement weather conditions affecting the project.

4. Water Control Plan. The replacement of Caddo Dam has provided improvements for the benefit of navigation as well as various recreational projects. The Caddo Levee District is presently the owner of Caddo Lake Dam consisting of those areas necessary for the embankment, spillway and outlet channel. All other lands associated with Caddo Lake are either privately or state owned lands.

Caddo Lake Dam is a combination earth embankment and concrete spillway having about the same overall length as the original dam, but with the spillway section located at the left side of the dam. A stilling pool is formed downstream from the spillway by a 100-foot long ogee weir flanked by earth embankments. A stilling basin downstream from the ogee weir provides the desired energy dissipation during periods of low flow. An outlet channel connects the ogee weir to Twelve Mile Bayou. Photographic illustriations are shown on Exhibits a, b, and c.

The various features of Caddo Dam are described below: (see plate 4)

a. Earth Embankment. The earth embankment extends from the south bank about 1200 feet where it meets the concrete spillway. The embankment has a 1 on 3 side slope on the upstream face and a 1 on 4 side slope on the downstream face. Erosion protection consists of riprap for the upstream face and sod on the downstream face. The crest width is 30 feet at elevation 176 feet NGVD. During large floods the entire embankment becomes submerged with several feet of water.

b. Concrete Spillway. The spillway is a bi-level broad-crested weir. The lower portion is 860 feet long at elevation 168.5 feet NGVD. The lower weir is flanked by 920 feet of weir on the south side and 620 feet of weir on the north side both at elevation 170.5 NGVD. Low flows up to about 8,000 cfs from Caddo Lake are discharged over the concrete spillway. The foundation of the concrete structure was designed for raising to an elevation of up to 172.5 feet should it become desirable to raise stages in Caddo Lake for navigation or water supply storage at some future date.

c. Stilling Pond. The stilling pond is located just downstream of the concrete spillway. A low earth embankment at elevation 170.5 with 1:3 upstream slope, a 30 foot crest width, and 1:10 downstream slope contains the pond. A system of ditches downstream from the low portion of the spillway collects and directs flow over to a concrete ogee-type weir. The ogee weir was constructed such that a sufficient water level is retained in the pond to provide the necessary stilling of water flowing over the dam.

d. Ogee Weir. The uncontrolled ogee weir and stilling basin immediately downstream form the outlet works for the stilling pond. The weir is 100 feet wide with a crest elevation of 160.5 feet between concrete training walls that extend to elevation 173.5 feet. The weir is tied in to high ground on the north and the earth section of the main dam by an earth dike to elevation 170.5 feet. The weir discharges into a concrete stilling basin and thence into a reinforced concrete apron. The stilling basin, 30.67 feet long, has one row of baffle blocks and an end sill to dissipate the energy in Caddo Lake discharges through the formation of a hydraulic jump. The outlet channel starts at the edge of the concrete apron. A 75-foot long riprap blanket is located downstream from the stilling basin to protect the weir and training walls from discharge scouring and undermining tendencies.

e. Outlet Channel. A trapezoidal channel with a 20-foot bottom width and 1:3 side slope connects the ogee weir stilling basin with Black Bayou. Considerate erosion has occurred along the outlet channel such that design dimensions are no longer present. A tailwater rating curve is shown on plate 5.

f. Water Levels. High flows are generally experienced during the period from March through May and low flows occur from August through November. The maximum flood of record occurred in April - May 1958. The elevation of Caddo Lake reached 182.6 and the peak discharge was 36,000 cfs. The minimum elevation observed in Caddo Lake was 166.0 in 1934. This is 2.5 feet lower than the weir crest. A stage frequency curve is shown on plate 7.

Navigation: Caddo Lake Dam is a feature of the navigation project, "Cypress Bayou and Waterway from Jefferson, Texas, to Shreveport, Louisiana", Its purpose was to prevent loss of navigable depths in Caddo Lake threatened by erosion of Twelve Mile Bayou and Red River as a result of the removal of rafts. Anticipated navigation benefits never fully materialized and authorized studies for the replacement dam recognized that sufficient Federal interest no longer existed to support the project. Existing commercial navigation on Caddo Lake is that associated with development and production from oil wells in the lake. However, since most of the oil from the wells is moved by pipelines, commercial traffic on the lake consists predominately of that associated with servicing the wells during production and drilling to deeper producing sands.

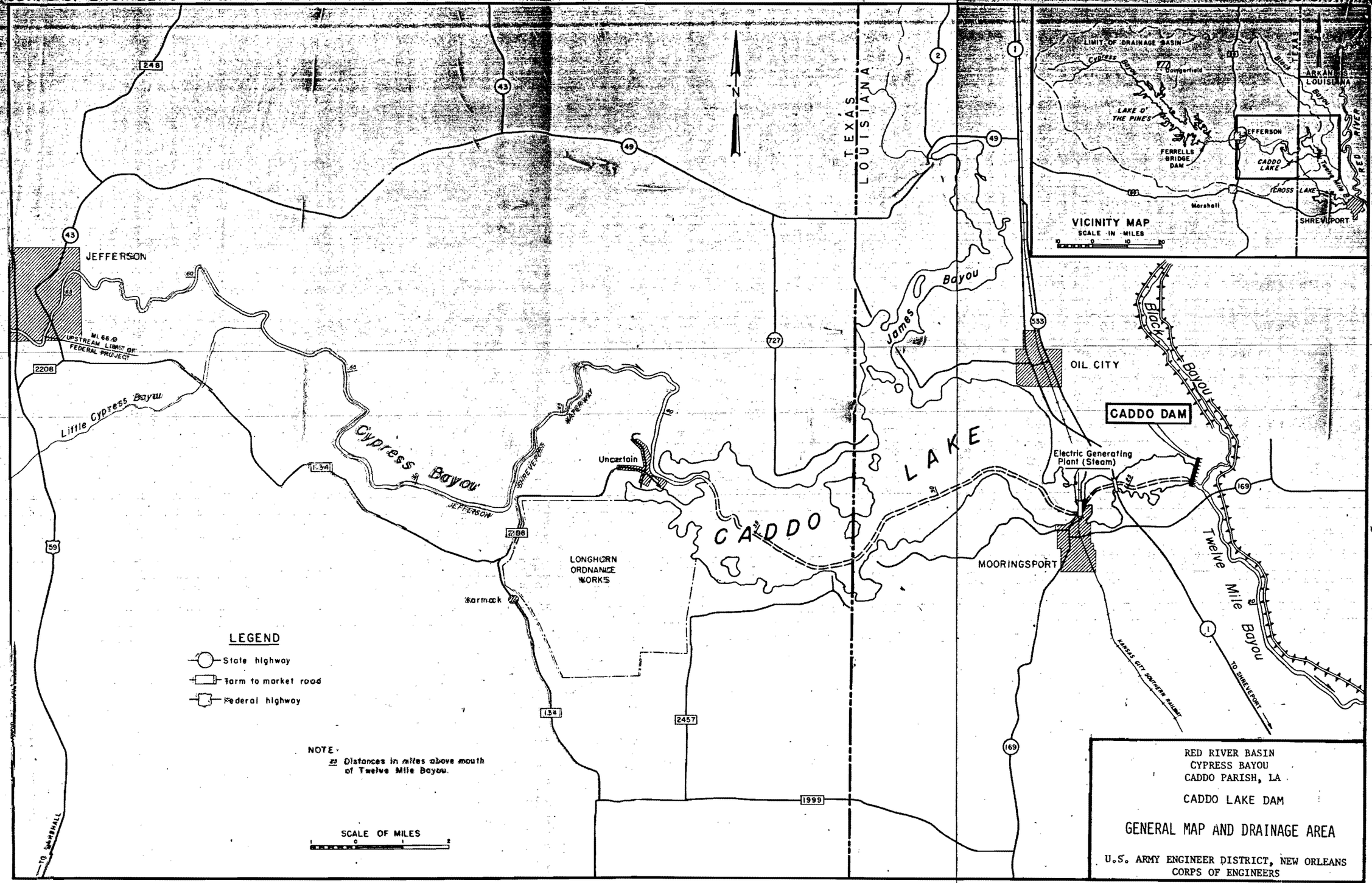
Water Supply: Due to the detention time provided by water storage capacity, good water has been available in Caddo Lake for many years. Therefore, nearby towns and cities turned to Caddo Lake as a source of municipal water supply as their water requirements expanded. Industries requiring large quantities of water for both consumptive and non-consumptive use also have located near the lake. The known principal users of water from Caddo Lake are as follows: (1) Marshall, Texas, (2) Mooringsport, Louisiana, (3) Waterworks District No. 1, Oil City, Louisiana, (4) Longhorn Ordinance Works, Karnack, Texas, (5) Southwestern Electric Power Company, (6) Universal Polychem Corporation and (7) Gulf Oil Company. Water supply was not a project purpose and no specific storage has been allocated for water supply. Regulation of this project is not required for this feature.

Water Quality: In Louisiana, there are three water quality stations (19550, 19600, 19650) within Caddo Lake and one station (19750) downstream of Caddo Lake Dam on Twelve Mile Bayou. There is one station (19525) upstream of the dam in Texas. Location of these stations are shown on Plate 2. Measurements taken include four parameters: (1) temperature, (2) PH, (3) dissolved oxygen, and (4) conductance. Water quality sampling also includes surface sampling for analysis of physical parameters such as turbidity, total dissolved solids and total suspended solids, as well as biological and chemical parameters. Data collected with the exception of dissolved oxygen and PH, are within acceptable limits of the Louisiana Stream Control Commission (LSCC) criteria. Water quality data is entered into NOD's HEIS data system and EPA's STORET

system. This provides easy access to Caddo Lake water quality data. Releases from Caddo Lake are of good quality. The water quality downstream meets all LSCC criteria except for PH. The PH readings occasionally exceed the state's criteria. Since the spillway and outlet structure are uncontrolled, there is no means to regulate the quality of the releases. However, since the quality of the releases is good, no regulation is necessary.

Recreation: Caddo Lake has long been a favorite recreational area for many residents of Shreveport, Bossier City, Marshall, Jefferson, Longview, Texarkana and other nearby areas. The lake affords an excellent opportunity for recreational boating and fishing, hunting and commercial fishing. A large number of permanent and summer-type homes, private and commercial camps, boathouses, and boat launching facilities are located on or near the shoreline of the lake. Public access is available at the dam and via Louisiana State Highway No. 1 right-of-way. Although significant recreational benefits are derived from Caddo Lake, recreation was not a project purpose and regulation of the project is not required for this feature.

CORPS OF ENGINEERS U.S. ARMY



RED RIVER BASIN
CYPRESS BAYOU
CADDO PARISH, LA.

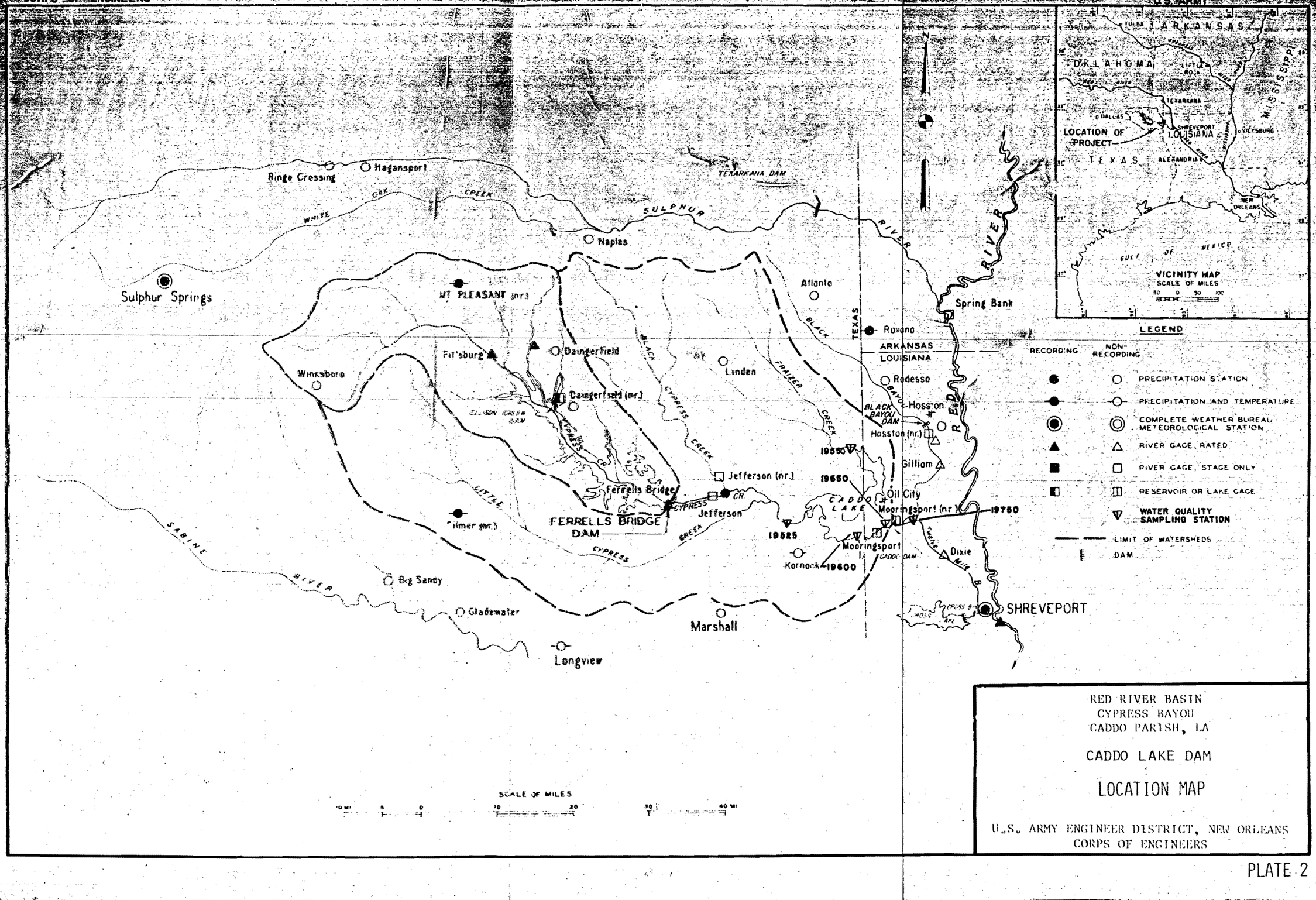
CADDO LAKE DAM

GENERAL MAP AND DRAINAGE AREA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

PLATE 1

CORPS OF ENGINEERS — U.S. ARMY



LEGEND

RECORDING	NON-RECORDING	
●	○	PRECIPITATION STATION
●—	○—	PRECIPITATION AND TEMPERATURE
◉	◎	COMPLETE WEATHER BUREAU METEOROLOGICAL STATION
▲	△	RIVER GAGE, RATED
■	□	RIVER GAGE, STAGE ONLY
◧	◫	RESERVOIR OR LAKE GAGE
	▽	WATER QUALITY SAMPLING STATION
	——	LIMIT OF WATERSHEDS
	⊧	DAM

RED RIVER BASIN
CYPRESS BAYOU
CADDO PARISH, LA

CADDO LAKE DAM

LOCATION MAP

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

PLATE 2

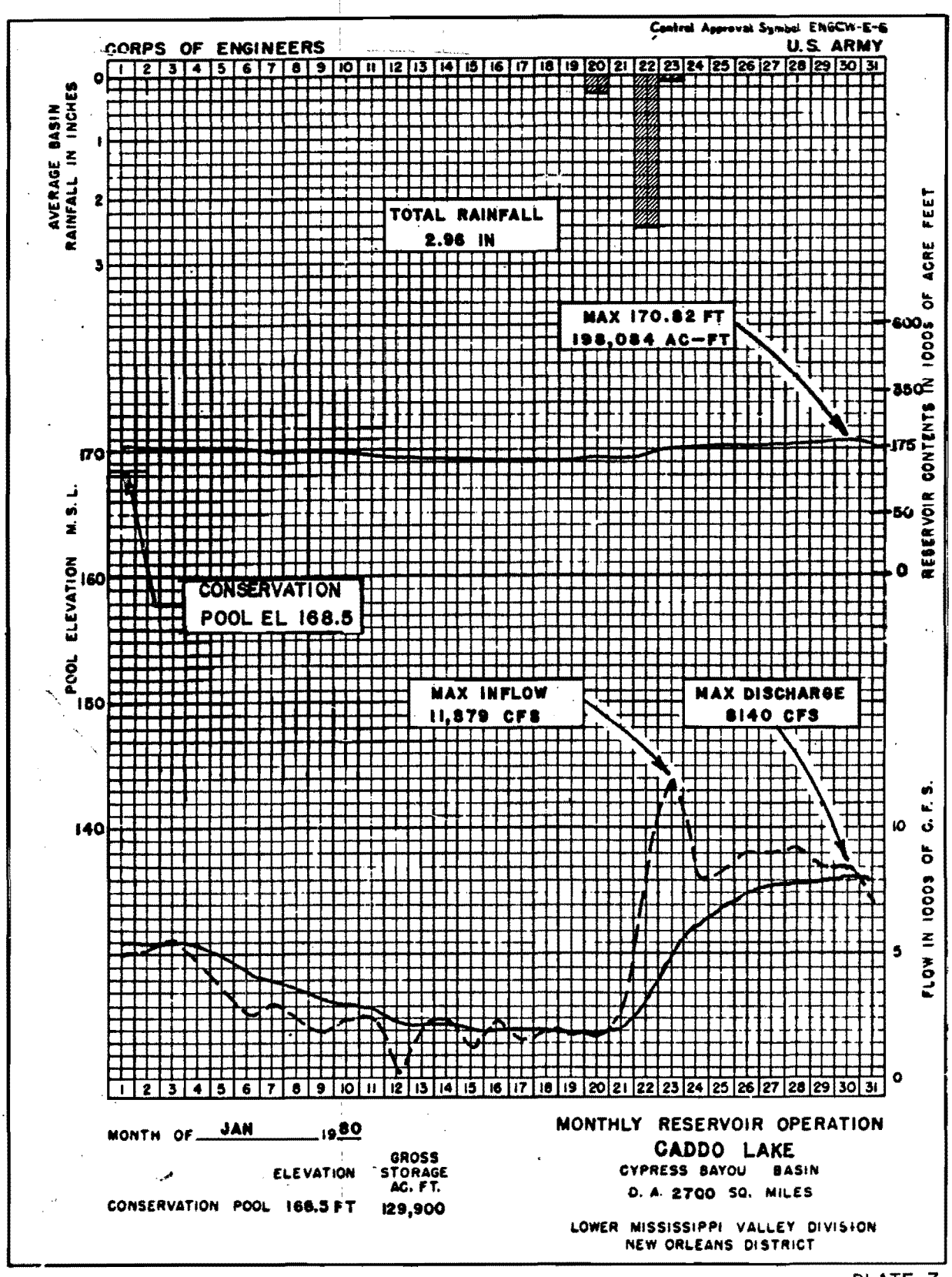
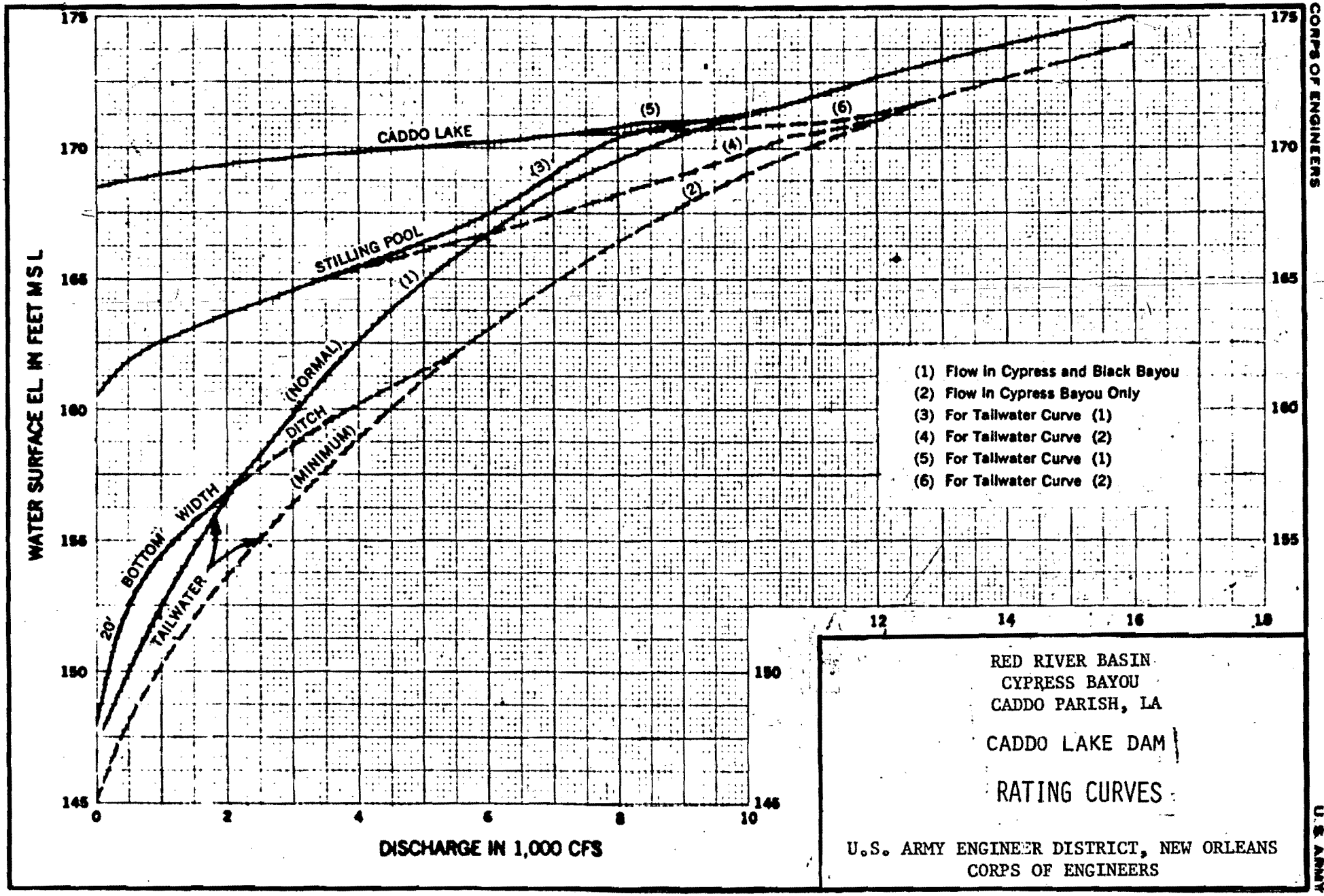

Central Approval Symbol ENGCW-E-6
CORPS OF ENGINEERS
U.S. ARMY
AVERAGE BASIN RAINFALL IN INCHES
POOL ELEVATION M.S.L.
RESERVOIR CONTENTS IN 1000s OF ACRE FEET
FLOW IN 1000s OF C.F.S.
TOTAL RAINFALL 2.96 IN
MAX 170.82 FT 198,084 AC-FT
CONSERVATION POOL EL 168.5
MAX INFLOW 11,879 CFS
MAX DISCHARGE 8140 CFS
MONTH OF JAN 1980
ELEVATION
GROSS STORAGE AC. FT.
CONSERVATION POOL 168.5 FT 129,900
MONTHLY RESERVOIR OPERATION
CADDO LAKE
CYPRESS BAYOU BASIN
D. A. 2700 SQ. MILES
LOWER MISSISSIPPI VALLEY DIVISION
NEW ORLEANS DISTRICT

PLATE 3



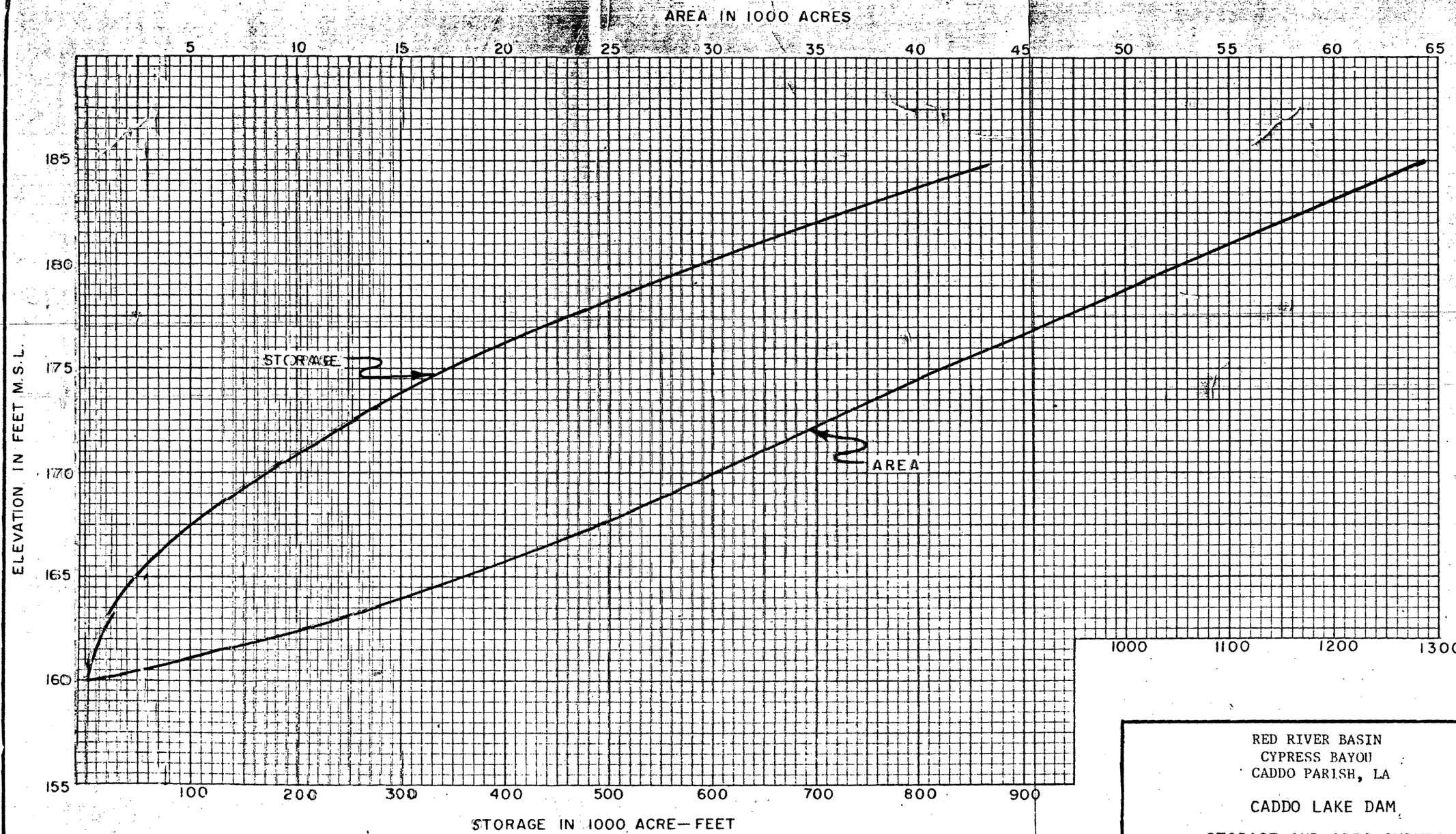
RED RIVER BASIN
CYPRESS BAYOU
CADDO PARISH, LA

CADDO LAKE DAM

RATING CURVES

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

PLATE 5



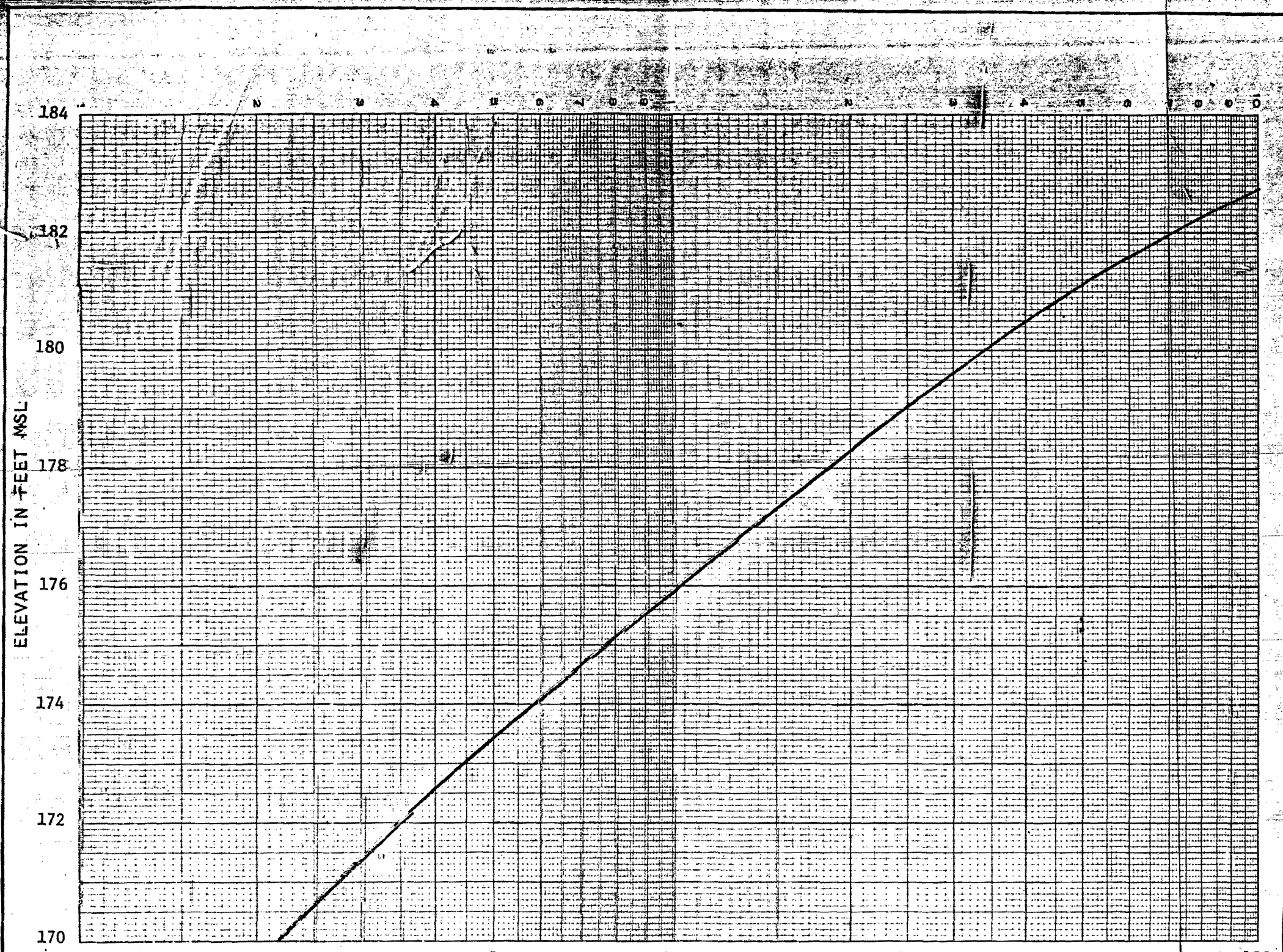
RED RIVER BASIN
CYPRESS BAYOU
CADDO PARISH, LA

CADDO LAKE DAM

STORAGE AND AREA CURVES

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

PLATE 6



RED RIVER BASIN
CYPRESS BAYOU
CADDO PARISH, LA

CADDO LAKE DAM

STAGE FREQUENCY CURVE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

PLATE 7

Caddo Lake

Average Monthly Runoff
(1958 - 1981)

Month	Runoff (cfs)
January	2,980
February	3,380
March	3,798
April	4,105
May	3,669
June	1,976
July	765
August	290
September	520
October	475
November	1,093
December	2,404

INFLOW AND OUTFLOW IN 1000 C.F.S.

POOL ELEVATION IN FEET N.G.V.D.

AVERAGE DAILY RAINFALL IN INCHES

INFLOW

OUTFLOW

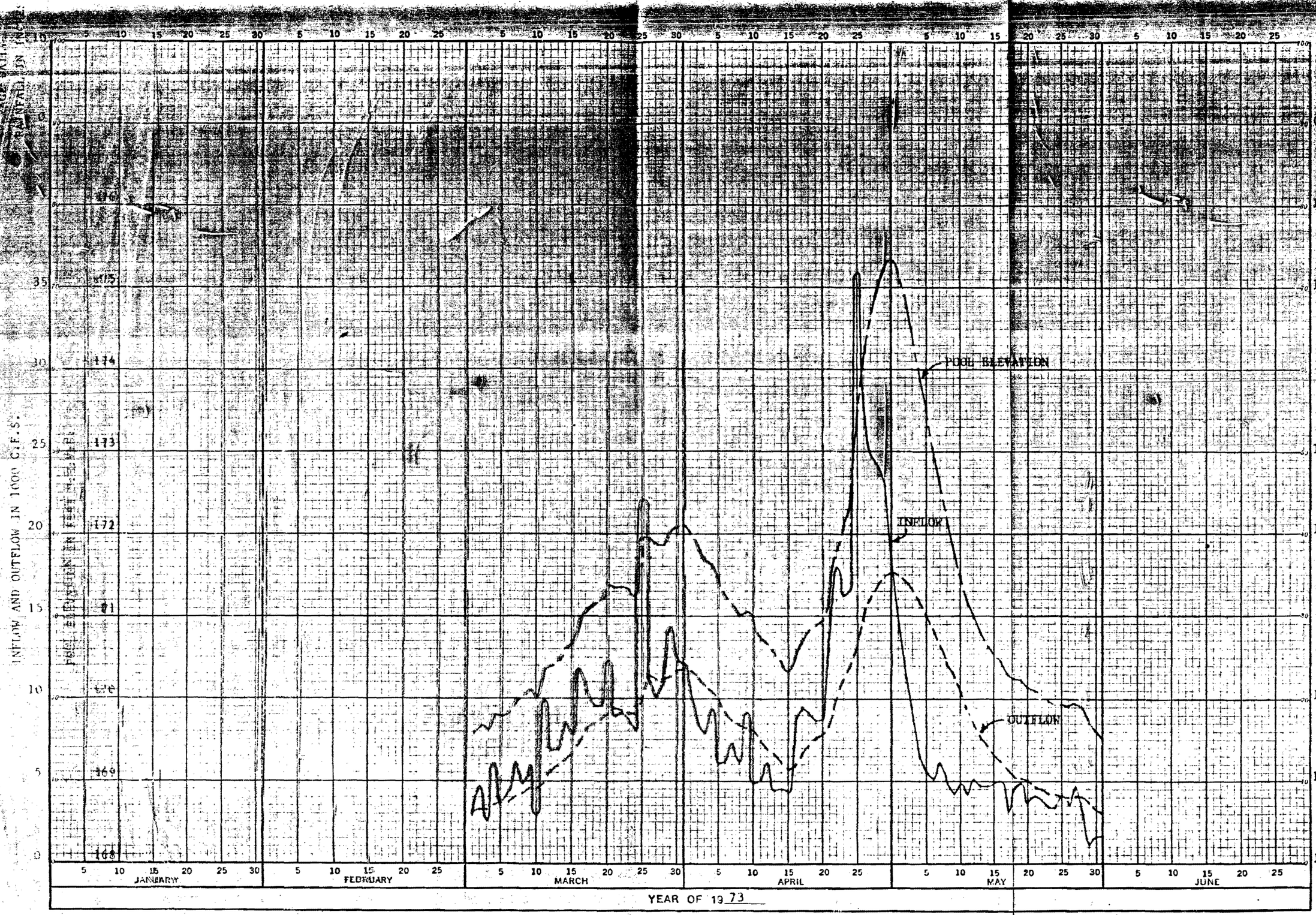
POOL ELEVATION

JANUARY | FEBRUARY | MARCH | APRIL | MAY | JUNE

YEAR OF 1958

CADDO LAKE 1958 FLOOD HYDROGRAPH

PLATE 9



CADDO LAKE 1973 FLOOD HYDROGRAPH

PLATE 10

Standing Instructions to the Project Manager

1. General Information and Responsibilities.

a. General Information. Caddo Lake Dam is located in Caddo Parish about 19 miles northwest of Shreveport in northwestern Louisiana (see plate 1). The replacement dam was completed in 1971 and the Caddo Levee District had operation and maintenance responsibilities for about 5 years. In October 1976 Public Law 94-587 shifted operation and maintenance responsibilities to the Federal government. The main water control objective of this project was to prevent the loss of navigable depths in Caddo Lake threatened by erosion of Twelve Mile Bayou and Red River as a result of the removal of rafts. Caddo Lake is also a source of water supply for several nearby cities and industries which have located near the lake. However, water supply was not a project purpose and regulation of this project is not required for this feature. The dam consists of an earth embankment, a concrete bi-level spillway, a stilling pond, an uncontrolled ogee weir and an outlet channel, and is a completely uncontrolled structure. Therefore, there are no constraints on it's physical operation and it is not a local protection project.

b. Role of the Project Manager. The project manager of Caddo Lake needs no day to day instructions from the District Office since the dam is a completely uncontrolled structure.

2. Data Collection and Reporting. Stage data is received from five gaging stations located in the immediate area of the lake, see plate 2. These gaging stations are automatic recording type stations whose charts are pulled weekly and mailed into the district for processing and handling. Basin rainfall data is obtained from the National Weather Service for various rainfall stations throughout the basin, see plate 2. Rainfall is obtained either by direct telephone communications or via NOAA Weather Wire.

In Louisiana, there are three water quality stations (19550, 19600, 19650) within Caddo Lake and one station (19750) downstream of Caddo Lake Dam on Twelve Mile Bayou. There is one station (19525) upstream of the dam in Texas. The location of these stations are shown on plate 2. Measurements taken include four parameters: (1) temperature, (2) PH, (3) dissolved oxygen, and (4)s conductance. Water quality sampling also includes surface sampling for analysis of physical parameters such as turbidity, total dissolved solids and total suspended solids, as well as biological and chemical parameters. Water quality data is entered into NOD's HEIS data system and EPA's STORET system. This provides easy access to Caddo Lake water quality data.

3. Water Control Action and Reporting. Caddo Lake Dam is completely uncontrolled. Water levels within Caddo Lake depend primarily on rainfall - runoff above the damsite. During large floods Caddo Dam becomes completely submerged and Twelve Mile Bayou governs discharge from Caddo Lake. The role of the project manager is to periodically visit the structure when lake levels exceed 168.5 feet NGVD. His principal duties consists of inspecting the dam and appurtenant structures to determine if there exists any adverse conditions which may endanger the structure and to report such conditions to the district office for action.

EXHIBIT "d"