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NATIONAL DAM SAFETY PROGRAM. MEMPHIS RESERVOIR DAM (MO 10163) M--ETC(U)

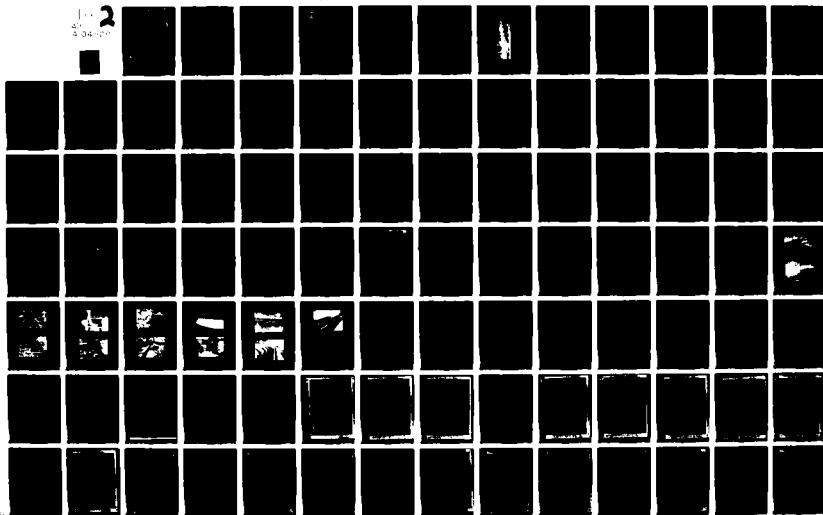
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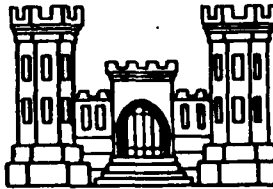
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MEMPHIS RESERVOIR DAM
SCOTLAND COUNTY, MISSOURI
MO 10163

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**PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM**

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.		

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DEPARTMENT OF THE ARMY
 ST. LOUIS DISTRICT, CORPS OF ENGINEERS
 210 NORTH 12TH STREET
 ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Memphis Reservoir Dam (Mo. 10163),
 Phase I Inspection Report

This report presents the results of field inspection and evaluation of Memphis Reservoir Dam (Mo. 10372). It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED 1 MAR 1975
 Chief, Engineering Division (Date)

APPROVED BY: SIGNED 1 MAR 1979
 Colonel, CE, District Engineer (Date)

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Memphis Reservoir Dam, Missouri Inv. No. 10163
State Located: Missouri
County Located: Scotland
Stream: Unnamed Tributary of the North Fabius River
Date of Inspection: October 4, 1978

Memphis Reservoir Dam No. Mo.10163 was inspected using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Three houses, the Scotland County Fairgrounds, several farm buildings, and a State Highway crossing would be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Memphis Reservoir Dam is in the small size classification since it is less than 40 feet high and impounds less than 1,000 acre-feet of water.

Our inspection and evaluation indicates that the spillway of Memphis Reservoir Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Memphis Reservoir Dam is a small size dam with a high hazard potential required by the guidelines to pass the Probable Maximum Flood without overtopping. Since there is a significant development downstream of the dam, the Probable Maximum flood is the appropriate spillway design flood. It was determined that the spillway will pass 25 percent of the Probable Maximum Flood without overtopping the dam. Also, our evaluation indicates that the spillway will pass the 100-year flood; that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Other deficiencies noted by the inspection team were a need for an periodic inspection by a qualified professional engineer; the lack of a maintenance schedule; small trees and brush on the upstream embankment slope; vegetation in the approach channel of the spillway; and eroded and spalled concrete on the spillway structure. The lack of stability and seepage analysis on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.



MEMPHIS RESERVOIR DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Memphis Reservoir Dam, I.D. No. 10163

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

MEMPHIS RESERVOIR DAM, Missouri Inv. No. 10163

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for the Memphis Reservoir Dam was carried out under Contract DACW 43-78-C-0160 to the Department of the Army, St. Louis District, Corps of Engineers, by the engineering firms of Consoer, Townsend & Associates Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of the Memphis Reservoir Dam was made on September 28, and October 4, 1978. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

It should be noted that reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to north abutment or side, and right to the south abutment or side.

d. Evaluation Criteria

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D. These guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The dam embankment is a homogeneous earthfill structure. The crest of the embankment has a width of 20 feet and a length of approximately 854 feet. The crest has a minimum elevation of 720.2 feet above MSL, and the maximum height of the embankment is 28.2 feet above the minimum streambed elevation along the centerline of the dam.

The upstream slope of the embankment section is constructed with a 1V to 2H slope, and the downstream embankment slope is 1V to 1-3/4H. A thin layer of rock riprap is provided on the upstream slope from the crest to approximately elevation 715.0. The riprap is composed of angular blocks of limestone up to 2 feet in diameter with the majority of the blocks 6 inches to 1 foot in diameter. The crest and downstream embankment slopes are protected with a vegetative cover.

Bedrock at the site and within the vicinity is composed of Pennsylvanian age limestone and minor amounts of sandstones and shales. No bedrock crops out over the site, but the rolling hills are mantled with a residual clay, a weathered product of the bedrock. The site is adjacent to the floodplain of the North Fabius River, thus, alluvial deposits of unknown thickness are expected in the relatively broad valley at this site.

The abutments and spillways for the dam are founded in the residual clays. The embankment across the valley has been placed upon alluvial sediments.

Available design drawings do not indicate the type of foundation treatment undertaken prior to fill placement.

There are three spillways for the Memphis Reservoir. The service spillway, which is the oldest among the three spillways, is located on the right abutment of the embankment. This spillway consists of an uncontrolled concrete weir section, a spillway chute, a stilling basin with baffle blocks, and an exit channel. Spillway No. 2, which was also part of the original construction, is connected to the right entrance wall of the service spillway crest structure. This spillway was rebuilt in 1958, due to severe concrete cracking and failure of the original spillway crest. The present spillway crest is a new concrete wall containing seven weir openings. The spillway chute and exit channel remain the same as the original construction.

The emergency spillway is located at approximately 300 feet south of the dam embankment at the southeast corner of the reservoir. The emergency spillway is a grass lined open channel which runs easterly for about 150 feet, then turns north into the natural channel.

Structural dimensions of these spillway are given in Section 1.3, Appendix D, and in the plates in this report.

Up to the time of this report, design data with an adequate description of the submerged and underground features of the outlet works and pumping plant was not available. The description herein, therefore, is derived wholly from the visual inspection observations.

An intake tower approximately 4 feet square and constructed of concrete is situated in the reservoir about 40 feet upstream of the dam crest. Access to the tower is provided by two parallel steel I-beams, spanning from the dam crest to the tower, to which a walkway of wood planks is bolted.

A pump vault lies at the downstream toe of the dam opposite the intake tower. The vault contains two horizontally mounted centrifugal pumps with 4-inch discharge pipes connected in parallel to a 6-inch discharge line. The pump suction connections connect to a 6-inch pipe which, presumably, passes under the dam embankment to connect to the intake tower.

The water surface elevation was about 1 inch below the service spillway crest at the time of inspection.

The reservoir rim is generally gentle sloping, with a city park area at the left shore and trees, grass and brush at the right shore.

b. Location

The Memphis Reservoir Dam is located on an unnamed tributary of the North Fabius River, Scotland County, Missouri. The reservoir is also located just downstream from the Memphis Lake and Park Dam, which was built in 1974. The nearest downstream community is Memphis, Missouri, which is roughly 2 miles from the dam. The dam and reservoir are shown on the Memphis Quadrangle Sheet (7.5 minute series) in Section 14, Township 65 North, Range 12 West.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam height category as being "Small" since its storage is less than 1,000 acre-feet. The dam is also classified as "Small" in dam size category because its height is less than 40 feet. The overall size classification is, accordingly, "Small" in size.

d. Hazard Classification

The dam has been classified as having "High" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with the classification. The estimated damage zone extends two miles downstream of the dam. Within the damage zone are two to three houses, the Scotland County Fairgrounds, several farm buildings, and a State highway crossing. The floodplain is farmed.

e. Ownership

Memphis Reservoir Dam is owned by the City of Memphis, Missouri.

f. Purpose of Dam

The main purpose of the dam is to impound water for use as water supply for the City of Memphis, Missouri.

g. Design and Construction History

Memphis Reservoir Dam was constructed in 1931. In 1958, the new concrete spillway wall with the series of weir openings was constructed. This reconstruction was designed by Frank Beard, P.E., of Kahoka, Missouri. Raising of the dam was planned and designed in 1958, but the work was never done.

h. Normal Operational Procedures

The dam is used to impound water for recreational use and water supply. The water level is controlled by rainfall, runoff, evaporation, and discharges from the Memphis Lake and Park Dam (10217), which is located approximately one-half mile upstream. It is believed that the reservoir is kept as full as possible at all times.

1.3 Pertinent Data

Memphis Reservoir Dam

- a. Drainage Area (acres): 947 (Excluding drainage area of Memphis Lake & Park Dam)

b. Discharge at Damsite

Estimated experienced maximum flood (cfs):	700
Estimated ungated spillway capacity at maximum pool elevation (cfs):	3,751

c. Elevation (Feet above MSL)

Top of dam:	720.2
Spillway crest:	
Spillway No. 1	716.2
Spillway No. 2	717.1
Emergency Spillway	717.7
Minimum streambed elevation at centerline of dam:	701.0
Maximum tailwater:	Unknown

d. Reservoir

Length of maximum pool (feet):	5,600
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e. Storage (Acre-Feet)

Top of dam:	235
-------------	-----

f. Reservoir Surface (Acres)

Top of dam:	54
Spillway crest:	41

g. Dam

Type:	Earth embankment
Length:	854 feet
Height (maximum):	28.2 feet
Top width:	20 feet
Side slopes:	
Downstream	1V to 1-3/4H
Upstream	1V to 2H
Zoning:	None

Impervious core:	None
Cutoff:	Not known
Grout curtain:	None

h. Diversion and Regulating Tunnel None

i. Spillway

Type:	Uncontrolled
Length of weir (feet):	
Spillway No. 1	58
Spillway No. 2	57.19 feet
Emergency Spillway	75
Crest Elevation (feet above MSL):	
Spillway No. 1	716.2
Spillway No. 2	717.1
Emergency Spillway	717.7

j. Regulating Outlets

Type:	6-inch cast iron pipe
Length:	80 feet
Closure:	Gate valve at pump vault
Maximum Capacity:	Unknown

Memphis Lake and Park Dam

a. Drainage Area: 1,950 acres

b. Discharge at Damsite: All discharge at the dam-site is through two uncontrolled spillways with an 18-inch cast iron gate in the service spillway shaft, a low level outlet conduit, and a water supply system

Estimated experienced maximum flood: 0 cfs
Estimated ungated spillway capacity
at maximum pool elevation: 7,565 cfs

c. Elevation: (Feet above MSL)

Top of dam:	780.0
Spillway crest: (Service spillway)	770.0
(Emergency spillway)	774.0
Minimum streambed elevation at centerline of dam:	710.0
Maximum tailwater:	Unknown

d. Reservoir

Length of maximum pool:	8,600 feet ±
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e. Storage: (Acre-Feet)

Top of dam (from 1974 inventory):	7,030
Spillway crest: (Service spillway)	5,164
(Emergency spillway)	4,109

f. Reservoir Surface: (Acres)

Top of dam (interpolated value):	342
Spillway crest:	248

g. Dam

Type:	Zoned earth embankment
Length:	1,635 feet
Height (maximum):	70 feet
Top width:	10 feet
Side slopes:	
(Downstream)	1V to 2-1/2H for top 20 feet 1V to 4H for next 16 feet 1V to 10H for next 4 feet 1V to 2-1/2H to ground surface
(Upstream)	Same

Zoning: Three - core, shells and stabilization berms

Impervious core: 5-foot top width with 1V to 1H upstream slope and 3/4V to 1H downstream slope

Cutoff: Core trench with 10-foot bottom width and 1V to 1H side slopes

Grout curtain: None

h. Diversion Tunnel None

i. Spillway

Type:	(Service spillway)	Uncontrolled
	(Emergency spillway)	Uncontrolled
Length of weir:	(Service spillway)	25 feet
	(Emergency spillway)	250 feet
Crest elevation:	(Service spillway)	770 feet
	(Emergency spillway)	774 feet

j. Regulating Outlets

Type: 18-inch sluice gate discharging into service spillway conduit

Length: 350 feet

Closure: 18-inch sluice gate

Maximum capacity: 30 cfs

Type: 12-inch diameter ductile iron low level outlet pipe

Length: 420 feet

Closure: Mud valve at upstream end and gate valve at downstream end

Maximum capacity: + 25 cfs

Type: 12-inch diameter ductile iron water supply outlet

Length: Unknown

Closure:

Gate valve at upstream end

Maximum capacity:

Unknown

SECTION 2: ENGINEERING DATA

2.1 Design

The available design drawings are very incomplete. No drawings of the original construction were found, and the only drawings located were of proposed reconstruction in 1958, most of which was not constructed. These drawings partially show the existing structures at that time.

2.2 Construction

The dam was originally constructed in 1931. In 1958, a new spillway wall for spillway No. 2 was constructed upstream of the existing wall which ran in a north-south direction.

2.3 Operation

No operation records for Memphis Reservoir Dam are available.

2.4 Evaluation

a. Availability

The only engineering data available are drawings made in 1958 showing proposed reconstruction, most of which was not constructed. These drawings partially show the existing dam at that time. No design computations, construction data, or operation data is available.

In addition, no pertinent data was available for review of hydrology spillway capacity, flood routing through the reservoir, outlet capacity, slope stability, seepage analysis, or foundation conditions.

b. Adequacy

The engineering data available is inadequate to aid in evaluating the hydraulic and hydrologic capabilities and stability of the dam for Phase I investigations.

The lack of engineering data did not allow for a definitive review and evaluation. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection, past performance history, and sound engineering judgment.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

No valid engineering data is available.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of Memphis Reservoir Dam was made on September 28, and October 4, 1978. The following persons were present during the inspection:

<u>Name</u>	<u>Affiliation</u>	<u>Disciplines</u>
Yin Au-Yeung	Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
David Bramwell	Engineering Consultants, Inc.	Geology
Jon Diebel	Engineering Consultants, Inc.	Soils
John Ismert	Engineering Consultants, Inc.	Mechanical
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil & Structural

Specific observations are discussed below.

b. Dam

The crest of the dam is adequately protected by vegetative cover. The crest makes a nearly 90 degree bend to the west at the left side of the dam.

The upstream embankment slope is protected with a 1 to 2 foot thick layer of dumped riprap. The riprap is composed of angular blocks of limestone up to 2 feet thick, with most of the blocks having a size between 6 inches and 1 foot. The riprap extends from a point several feet from the

top of the crest on below elevation 716.2 for an unknown depth. Some large brush and small trees are beginning to grow on the upstream slope of the embankment, but not to an extensive degree at this time. Sloughing and erosion was not prevalent on the slope at this time.

The downstream embankment slope is protected by a vegetative cover. The vegetation had been recently cleared prior to the inspection. Some stumps of trees which had been previously cut were observed. No signs of past or present instability were seen on the embankment or in the foundation at any location. Also, no seepage was observed on the downstream embankment slope or downstream of the toe of the dam.

c. Appurtenant Structures

(1) Spillway

Mostly due to the old age of the structure, the service spillway shows signs of deterioration. Some leakage is occurring through the vertical concrete weir. In addition, vertical and horizontal cracking, and concrete spalling and erosion was observed throughout the concrete channel. Dense grasses are growing in the spillway approach areas.

Spillway No. 2, which is relatively new, is in adequate condition. Only minor cracks in the weir structure were observed.

The emergency spillway is well-defined and adequately protected by thick grass.

All three spillways merge into the natural channel approximately 70 feet downstream of the embankment toe.

(2) Outlet Works

Inspection was made of the unsubmerged portion of the intake tower. The concrete which could be observed was old, but in satisfactory condition. The top of the tower is covered by a steel sheet cover which could not be removed. A heavy wire screen mounted to a crude wooden frame was suspended over the face of one side of the tower; presumably this is a trash screen over the intake opening.

The cover of the pump vault was removed and the vault was entered for inspection. The appearance of the pumping and piping equipment was satisfactory, except there was several inches of standing water over the vault floor, and the electrical control boxes were open and the exposed wiring was in disarray. It was obvious from the condition of the wiring that the pumps were not operational.

d. Reservoir Area

No wave wash, excessive erosion, or slope slides were observed along the shore of the reservoir. At present, no development has occurred along the shoreline. In general, the reservoir rim is stable. Most of the inflow into the reservoir is controlled by releases from the Memphis Lake and Park Dam, which is located about one-half mile upstream from Memphis Reservoir.

e. Downstream Channel

Spillway discharge from all the spillways merge into the natural channel at approximately 70 feet downstream of the embankment toe. The downstream channel is an unlined trapezoidal channel which was sparsely covered with fallen tree trunks and debris at the time of inspection. However, this minor obstruction in the channel does not seem to pose serious restrictions to the spillway capacity. Signs of moderate erosion and sloughing on the right bank of the channel were observed.

3.2 Evaluation

The visual inspection did not exhibit any items which are sufficiently significant to indicate a need for immediate remedial action.

The following deficiencies were observed which could affect the safety of the dam, or which will require maintenance within a reasonable period of time.

1. The trees and brush beginning to grow on the upstream embankment slope.
2. The vegetation growing in the approach channel for the service spillway and the slotted spillway.
3. The deteriorated concrete and leakage observed in the concrete channel of the service spillway.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Normal procedure is to allow the reservoir to stay close to full at all times. Should the water level drop below acceptable levels, water is released from the Memphis Lake and Park Dam (MO 10217), and allowed to flow along the natural streambed to the reservoir downstream. Basically, the water level is controlled by rainfall, runoff, evaporation, and water consumption of the city of Memphis, Missouri.

4.2 Maintenance of Dam

Maintenance is performed at the damsite by workers employed by the city of Memphis, Missouri. At the time of inspection, it was apparent that all trees and brush had been recently cleared from the downstream embankment slope. Small trees are growing on the upstream slope, and should also be removed. Observation of the small pump vault located at the downstream toe, opposite the intake tower, showed the pumps to be inoperable. The inspection team was not aware of any available maintenance or water level records.

4.3 Maintenance of Operating Facilities

The only operating facility at the damsite is the small water supply pump vault located at the downstream toe opposite the 3-foot square concrete intake tower. The small vault contains two horizontally mounted centrifugal pumps with 4-inch discharge pipes

connected in parallel to a 6-inch discharge line. The appearance of the pumping and piping equipment in the vault was satisfactory, except there was several inches of standing water over the vault floor and the electrical control boxes were open, with the exposed wiring in disarray. It was obvious from the condition of the wiring that the pumps were not operational, due to a lack of maintenance.

4.4 Description of Any Existing Warning System

The inspection team is not aware of any existing warning system in effect.

4.5 Evaluation

The maintenance and operation at the damsite is fair. The clearing of the upstream slope should be done within a reasonable period of time, and the access to the pump vault should be made secure and kept locked for public safety. Other items requiring maintenance are discussed in Section 3.2.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

No hydrologic design data is available.

The watershed area of Memphis Reservoir is roughly 2,899 acres, which includes the New Memphis Lake and its watershed area of + 1,950 acres. This area is approximately 5 percent covered with brush and forest. Land gradients average about 4 percent. The Memphis Reservoir is located just downstream of the New Memphis Lake, on an unnamed tributary of the North Fabius River. The Memphis Lake and Park Dam is located approximately one-half mile upstream from the Memphis Reservoir.

Elevations within the watershed range from approximately 700 feet above MSL at the damsite to over 815 feet above MSL in the upper portion of the watershed.

A drainage map showing the watershed area is included in Appendix B.

Evaluation of the hydraulic and hydrologic features of Memphis Reservoir Dam was based on criteria set forth the the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the

U.S. Weather Bureau Publication, Hydrometeoroglogical Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on criteria given in EM 1110-2-1411 (Standard Project Storm). The SCS triangular hydrograph, transformed to a curvilinear hydrograph, was adopted for developing the unit hydrograph for drainage area between the upstream dam and the Memphis Reservoir. The derived unit hydrograph is presented in Appendix B.

Initial and infiltration loss rates were applied to the PMP to obtain rainfall excesses. The rainfall excesses were then applied to the unit hydrograph to obtain the PMF hydrograph, utilizing the Corps of Engineers' computer program HEC-1, (Dam Safety Version), which was prepared specifically for dam safety analysis. The computed peak discharge of the PMF and one-half of the PMF for drainage area between the upstream dam and Memphis Reservoir are 10,971 cfs and 5,486 cfs, respectively.

Both the PMF and one-half of the PMF inflow hydrographs for drainage area between the upstream dam and the Memphis Reservoir were added to the routed PMF, and one-half of the PMF from the upstream reservoir. The combined hydrographs were routed through the Memphis Reservoir by the Modified Puls Method, also utilizing the HEC-1 (Dam Safety Version) computer program. The peak outflow discharges for the PMF and one-half of the PMF at the Memphis Reservoir Dam are 15,358 cfs and 4,515 cfs, respectively. Both the PMF and one-half of the PMF, when routed through the reservoir, resulted in overtopping of the dam.

The stage-outflow relation for the spillways were prepared from field notes and sketches. The reservoir stage-capacity data were based on the U.S.G.S. quadrangle topographic maps in combination with data given in the National Dam Safety Inventory Table. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway overtop rating curve assumed that the dam remains intact during routing. In the routing computations, the discharge through the outlet facilities was excluded due to its insignificant magnitude as compared to the total spillway discharge and the PMF. The spillway rating curves and the reservoir capacity curve are also presented in Appendix B.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to interviews with local residents, the maximum reservoir level was never higher than the crest of the embankment.

c. Visual Observations

The service spillway structure is deteriorating. Vertical cracks, moderate erosion and spalling on the concrete were apparent. The right bank of the exit channel shows signs of a moderate degree of erosion and sloughing. There is grass growing in front of the spillway entrance of both the service spillway and the No. 2 spillway.

The emergency spillway is in adequate condition.

All the spillways and the exit channels are located at the furthest right abutment and are away from the downstream toe of the dam. Releases from the spillways will not endanger the integrity of the dam.

d. Overtopping Potential

As indicated in Section 5.1-a., both the Probable Maximum Flood and one-half of the Probable Maximum Flood, when routed through the reservoir, resulted in overtopping of the dam. The PMF and one-half of the PMF overtopped the dam crest by 3.93 feet and 1.23 feet, respectively. The total duration of embankment overflow is 9.0 hours during the PMF, and 3.83 hours during one-half of the PMF. The spillway of the Memphis Reservoir Dam is capable of passing a flood equal to approximately 25 percent of the PMF just before overtopping the dam. The 25 percent PMF has a frequency occurrence of less than the 1 percent chance flood. Since the PMF is the minimum Spillway Design Flood (SDF) for Memphis Reservoir Dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps, the spillway capacity of the dam is considered "Inadequate".

The effect from rupture of the dam could extend approximately 2 miles downstream of the dam. There are two to three farmhouses, the Scotland County Fairgrounds, several farm buildings and one State Highway crossing within this 2 miles of floodplain area. The floodplain is extensively farmed.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlement or distress observed on the embankment or foundation during the visual inspection. The upstream slope, crest, and downstream slope are well protected by either riprap or vegetation. Seepage was not observed on the downstream slope or beyond the toe of the embankment. The small trees and brush beginning to grow on the upstream embankment slope should be cleared.

The concrete spillway structures, although old and deteriorating, are in satisfactory structural condition. Some grouting to stop the leakage should be performed, and patching of badly spalled areas should be done as it becomes necessary.

The downstream channel may require remedial work following discharges through the spillway during flood conditions, but no immediate remedial work is required at this time.

No problems were observed with the water supply outlet which would jeopardize the safety of the dam.

b. Design and Construction Data

No design or construction data relating to the structural stability of the dam or appurtenant structures were found.

c. Operating Records

No operating records are available relating to the stability of the dam or appurtenant structures. Water levels have not been recorded, however, the dam was within 1 inch of being full on the day of inspection, and is assumed to be close to full at all times. The only operation facility at the dam is the water supply outlet pipe.

d. Post Construction Changes

No post construction changes exist which will affect the structural stability of the dam. At spillway No. 2, the new spillway wall replaced an old wall which had failed.

e. Seismic Stability

In general, projects located in Seismic Zones 0, 1 and 2 can be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist. Memphis Reservoir Dam is located in Seismic Zone 1. A detailed seismic analysis is not felt to be necessary for this embankment.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that an unsafe condition could be detected.

a. Safety

The spillway capacity at Memphis Reservoir Dam was found to be inadequate. The spillway is capable of passing a flood equal to 25 percent of the PMF.

The general physical condition of the dam and appurtenant structures is fair. The leakage through the service spillway crest should be stopped, and patchwork to the deteriorating concrete should be done as it becomes necessary.

The vegetation should be cleared from the approach channels to the spillway.

The trees starting to grow on the upstream embankment slope should be cut before they become a hazard to the embankment. The downstream embankment slope should be maintained in its present condition.

b. Adequacy of Information

Information concerning operation and maintenance of the dam and appurtenant structures is somewhat lacking. It is recommended that the following programs be initiated to help alleviate this problem:

1. Periodic inspection of the dam by an engineer experienced in design and construction of earth dams.
2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.
3. The dam should be surveyed and an as-built set of plans and drawings should be completed.
4. Perform seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams".

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished in the near future.

Increasing the spillway capacity is of a more urgent nature than the other recommended actions.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, and if the remedial measures recommended in Paragraph 7.2 are undertaken as soon as possible, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

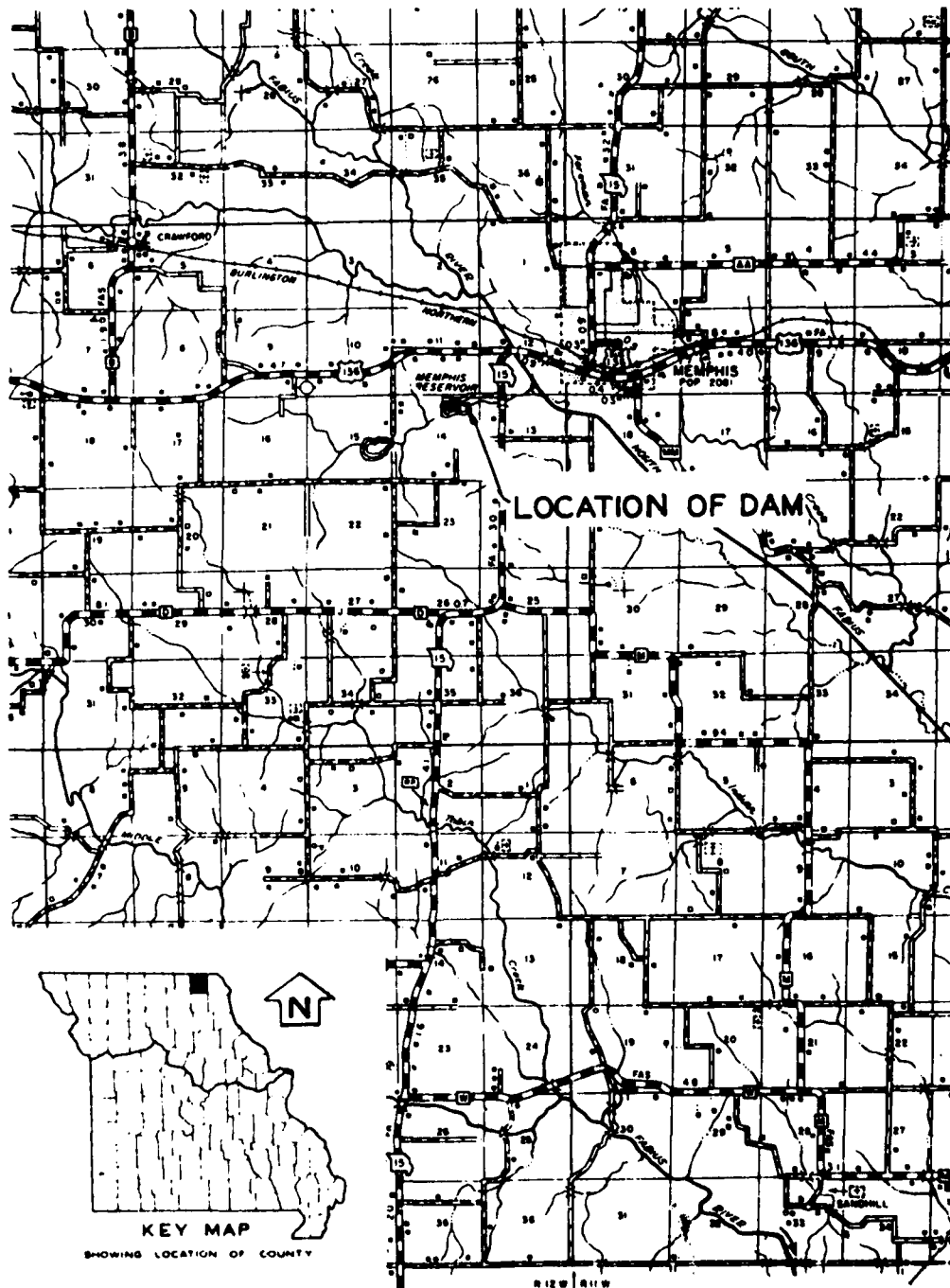
a. The spillway size and/or height of the dam should be increased to pass the Probable Maximum Flood.

b. O & M Maintenance Procedures

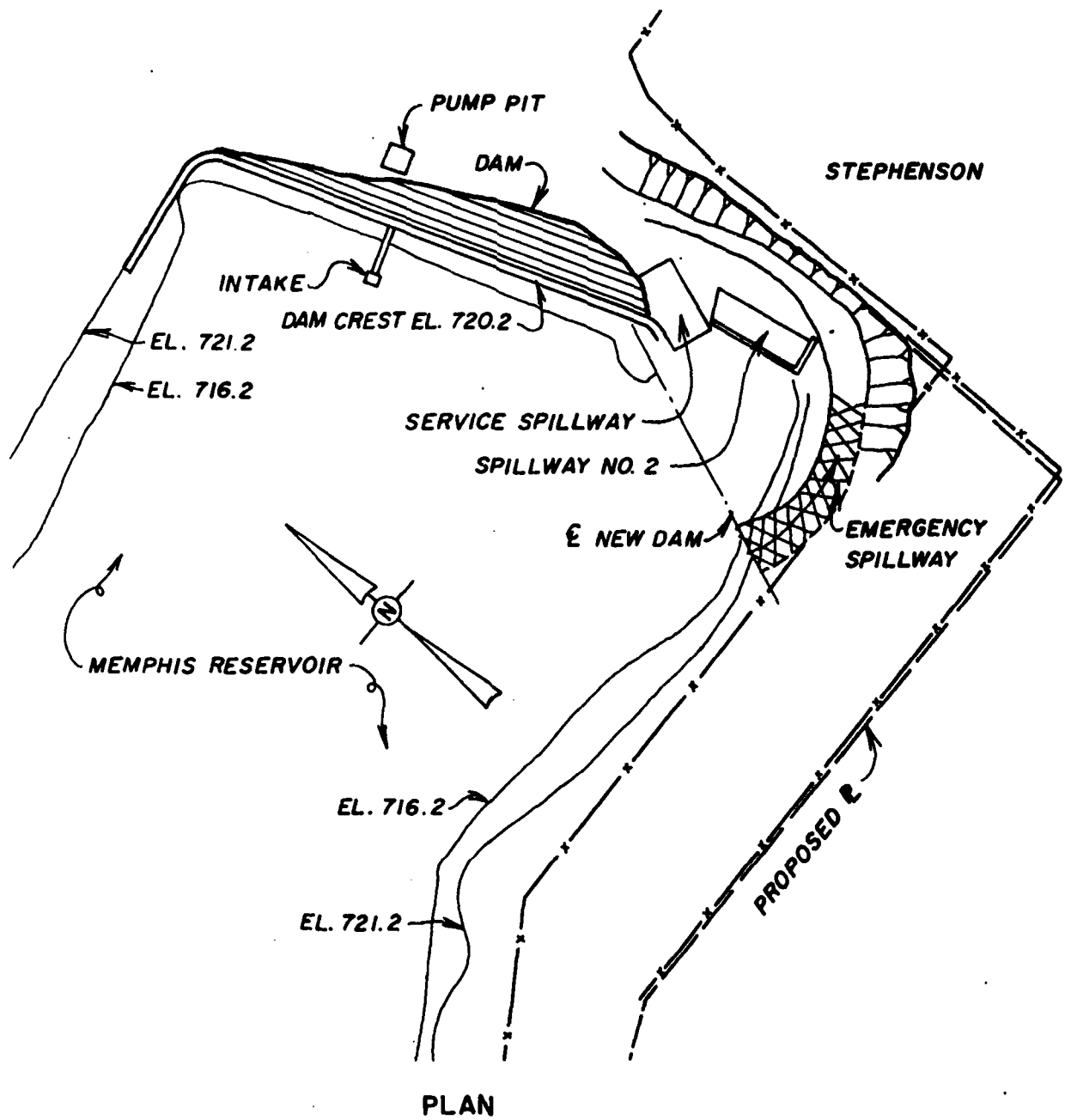
1. Periodic inspection of the dam by an engineer experienced in design and construction of earth dams.
2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. The dam should be surveyed and an as-built set of plans and drawings should be completed.
4. Cut the small trees and brush on the upstream embankment slope.
5. Clear the vegetation from the approach channels of the spillways.
6. Patch the eroded and spalled concrete on the spillway structure as it becomes necessary.
7. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams.

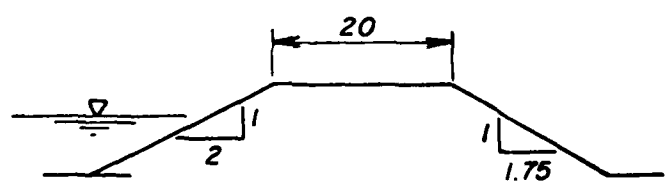
PLATES



LOCATION MAP
 MEMPHIS RESERVOIR DAM
 SCOTLAND COUNTY, MISSOURI

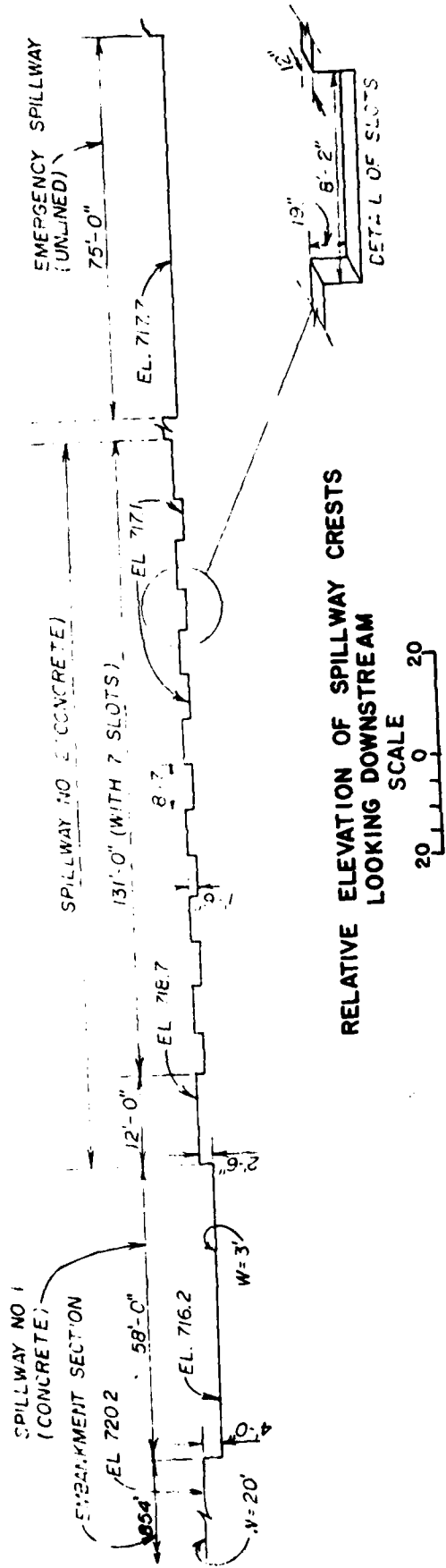


PLAN



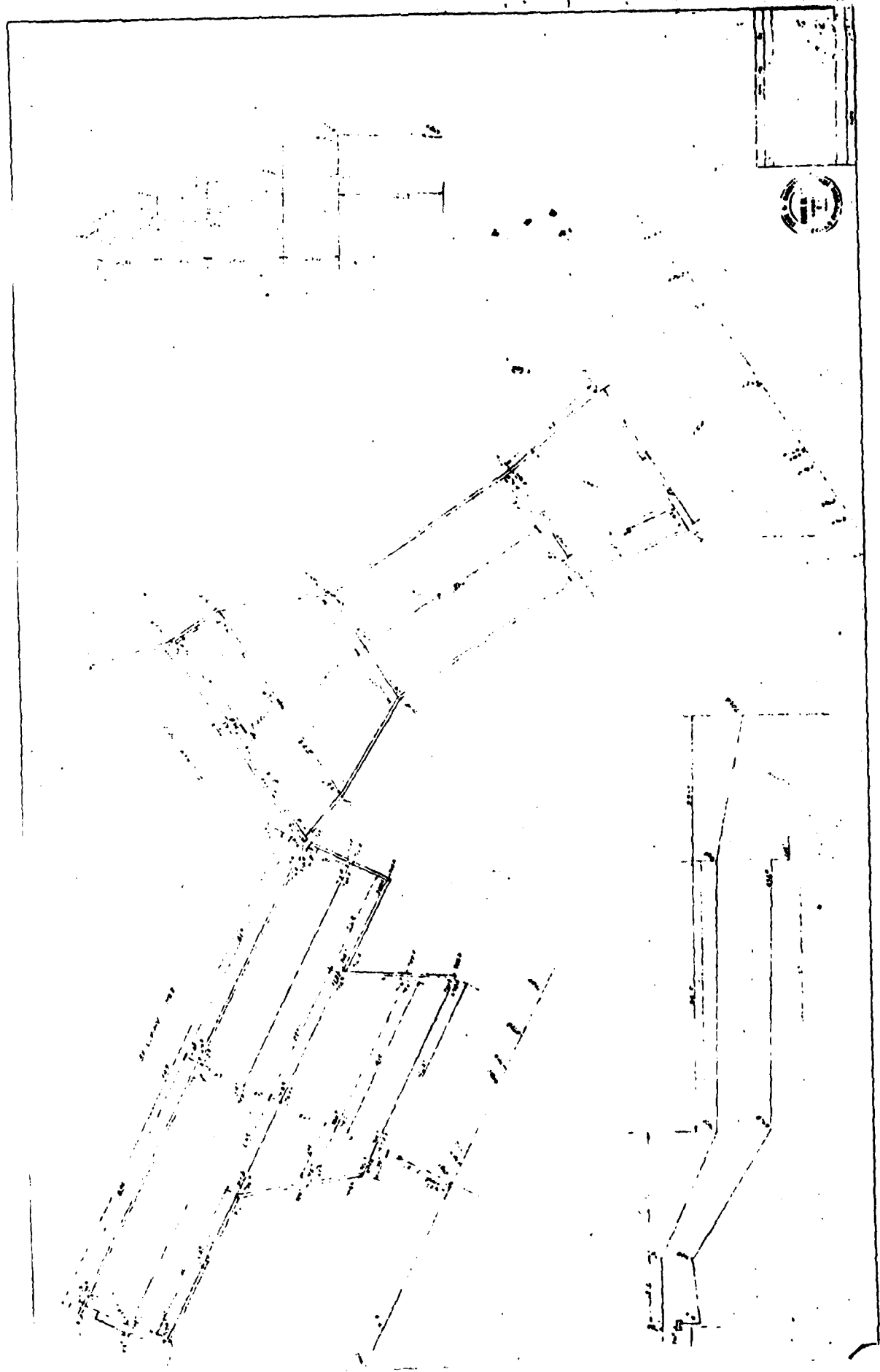
TYPICAL SECTION

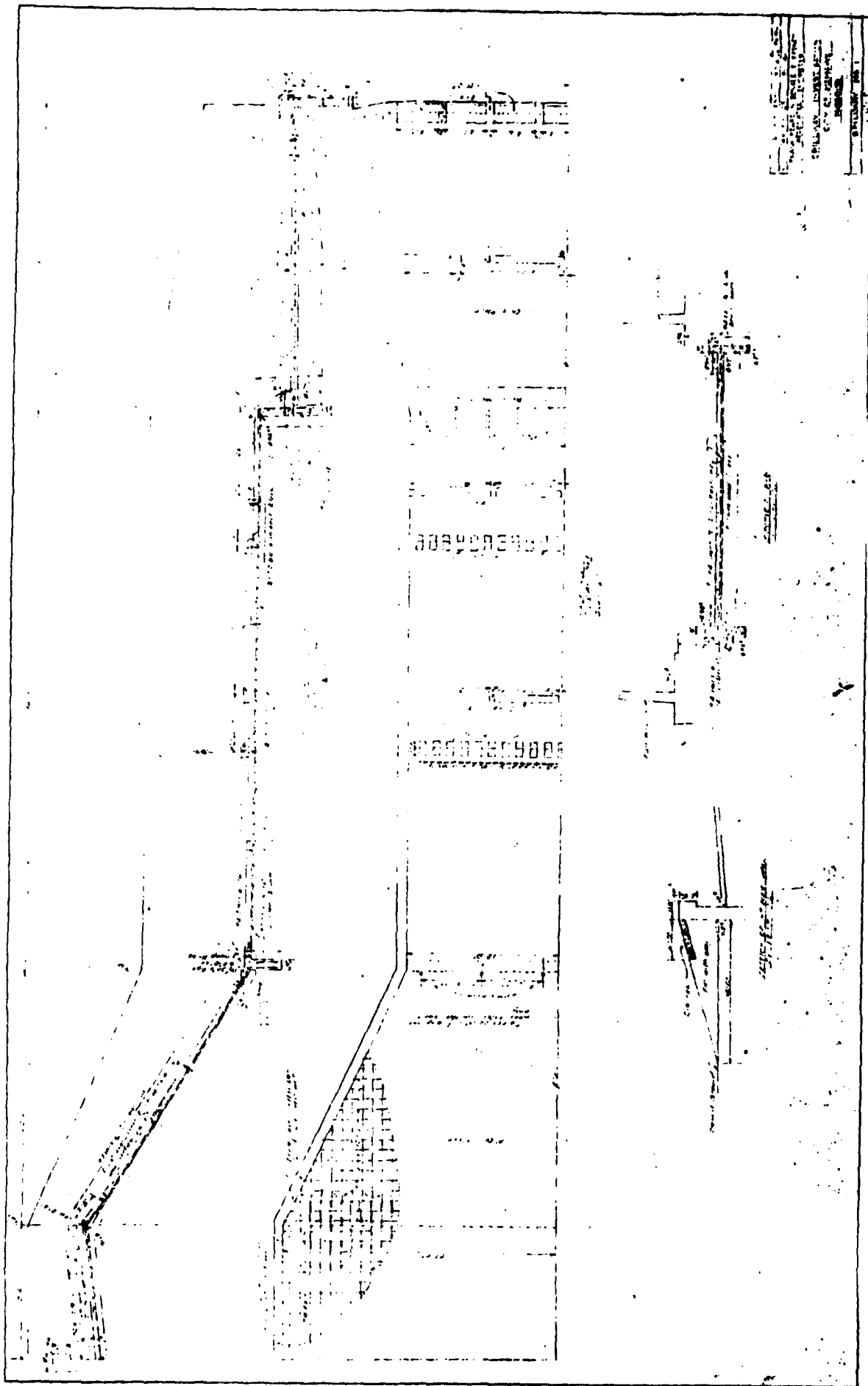
**MEMPHIS RESERVOIR DAM
PLAN AND SECTION**

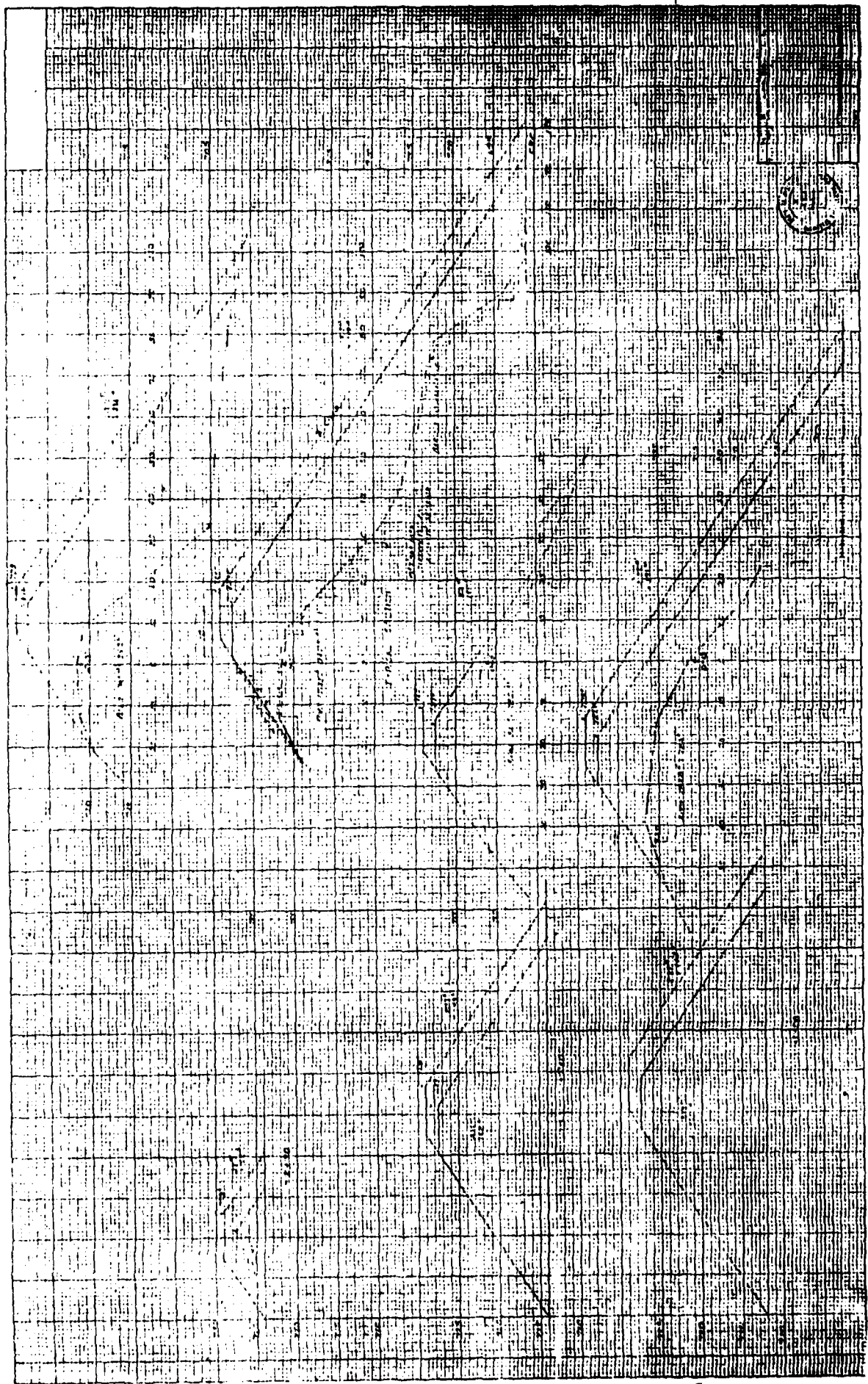


RELATIVE ELEVATION OF SPILLWAY CRESTS
 LOOKING DOWNSTREAM
 SCALE

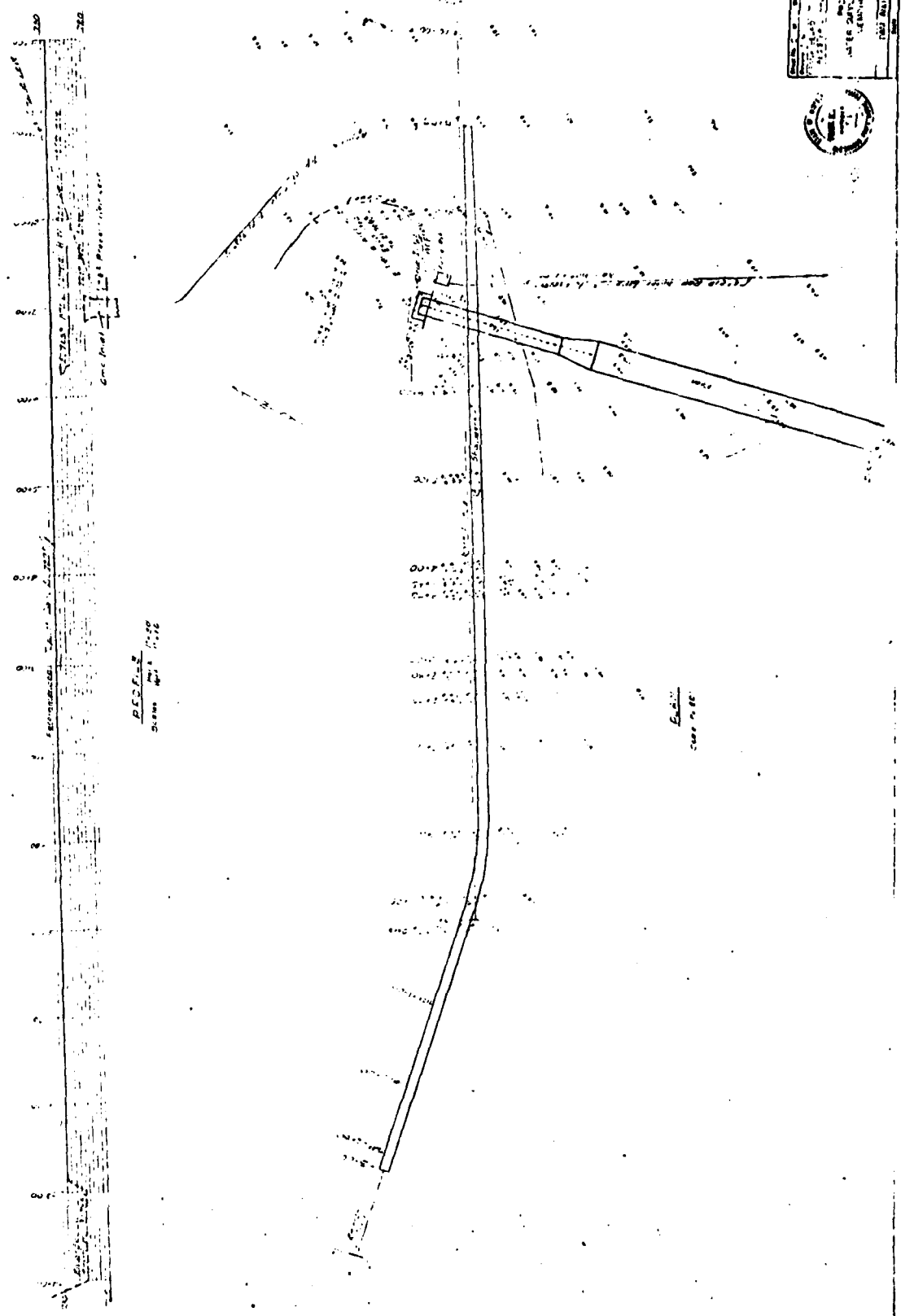
MEMPHIS LAKE DAM







U.S. GEOLOGICAL SURVEY
 WATER RESOURCES DIVISION
 MISSISSIPPI RIVER COMMISSION
 MEMPHIS, TENNESSEE
 1952

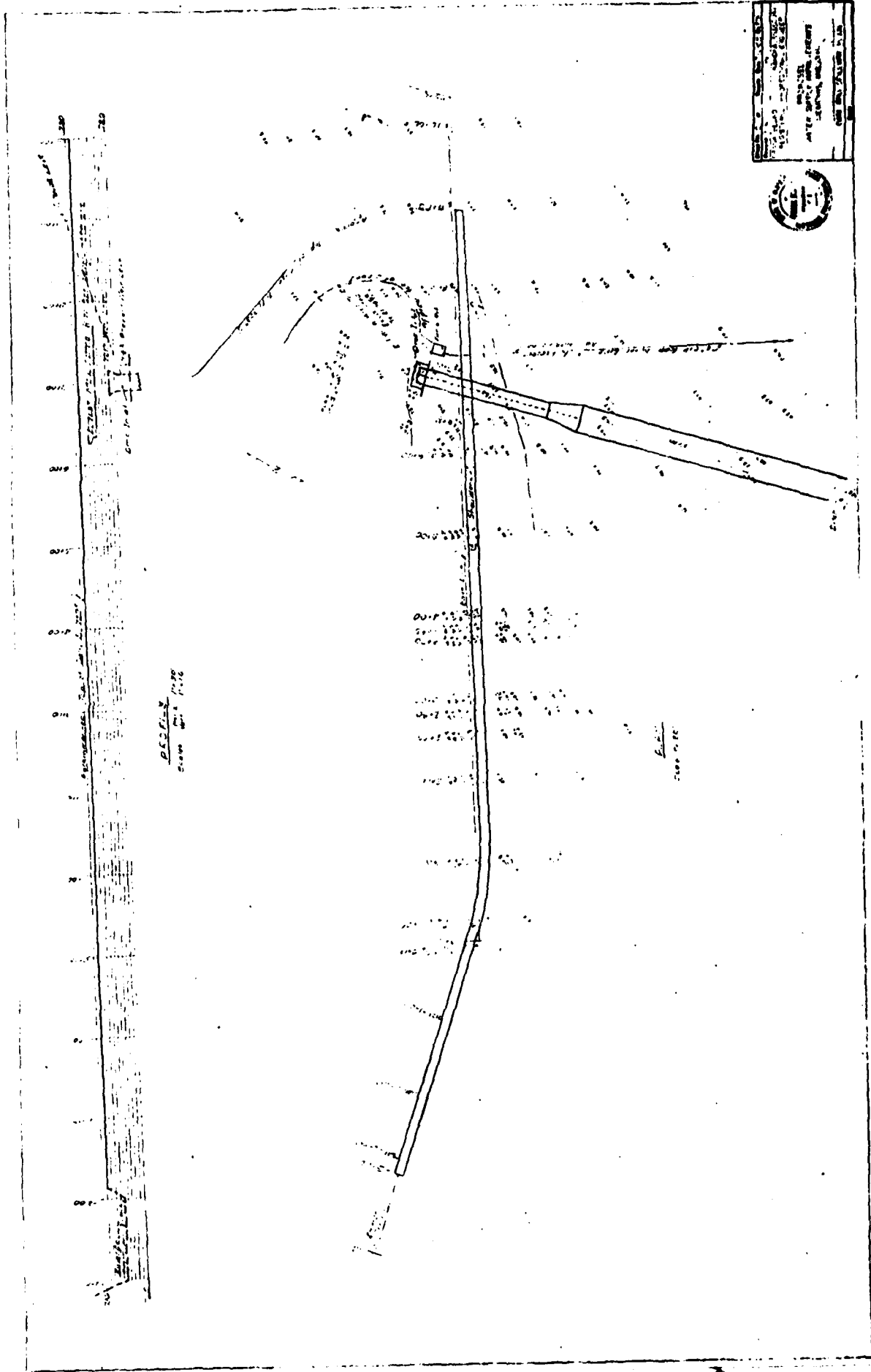


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Profile
 Station 100+00 to 200+00

Elev.
 feet above sea level

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D. C. 20250

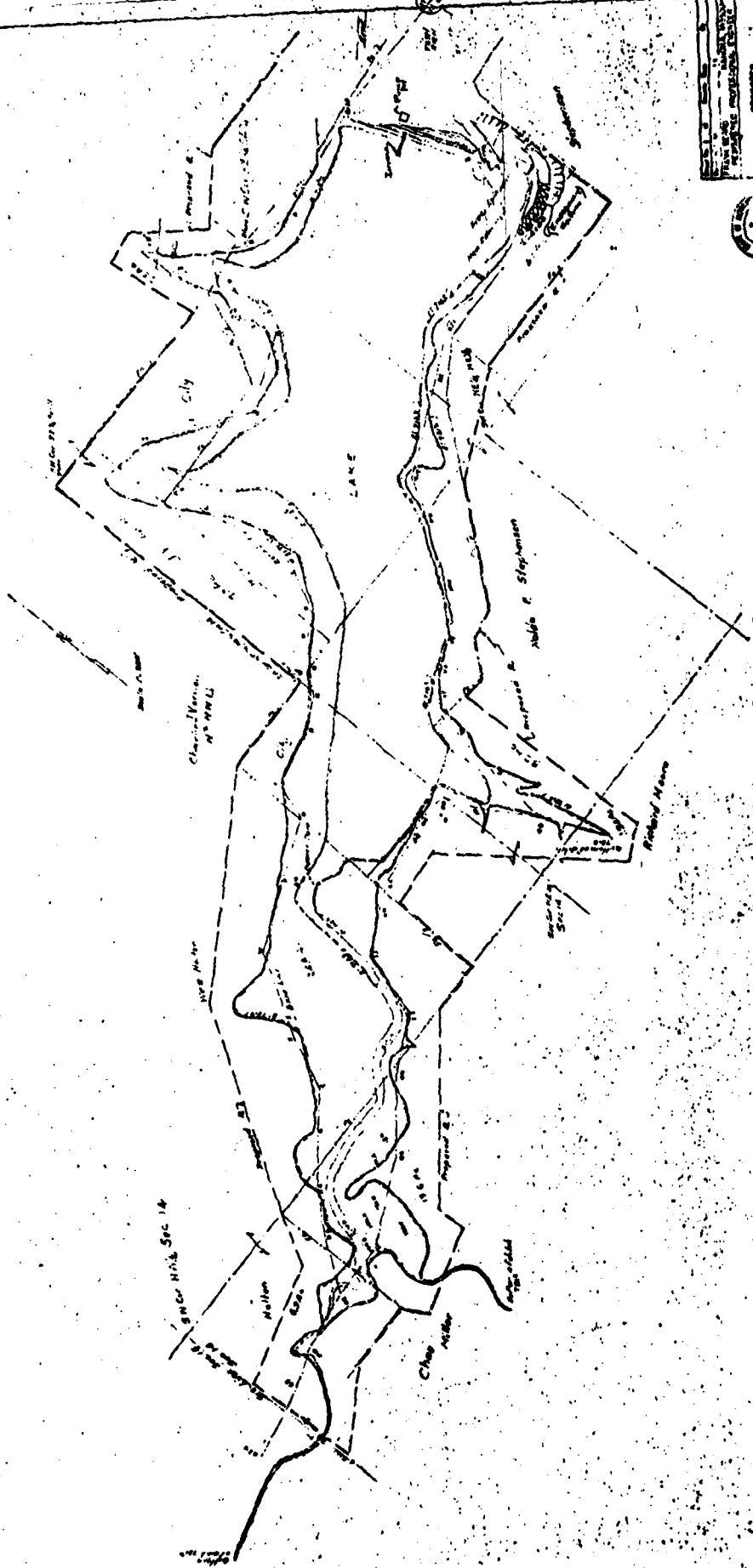


SECTION 10,
T. 10 N., R. 10 W.

E. 1/2

SECTION 10,
T. 10 N., R. 10 W.

PLANNED
WITH SURVEY INSTRUMENTS
BY
ALBERT E. BARNETT



Sec 14

Hulton

Chas. Miller

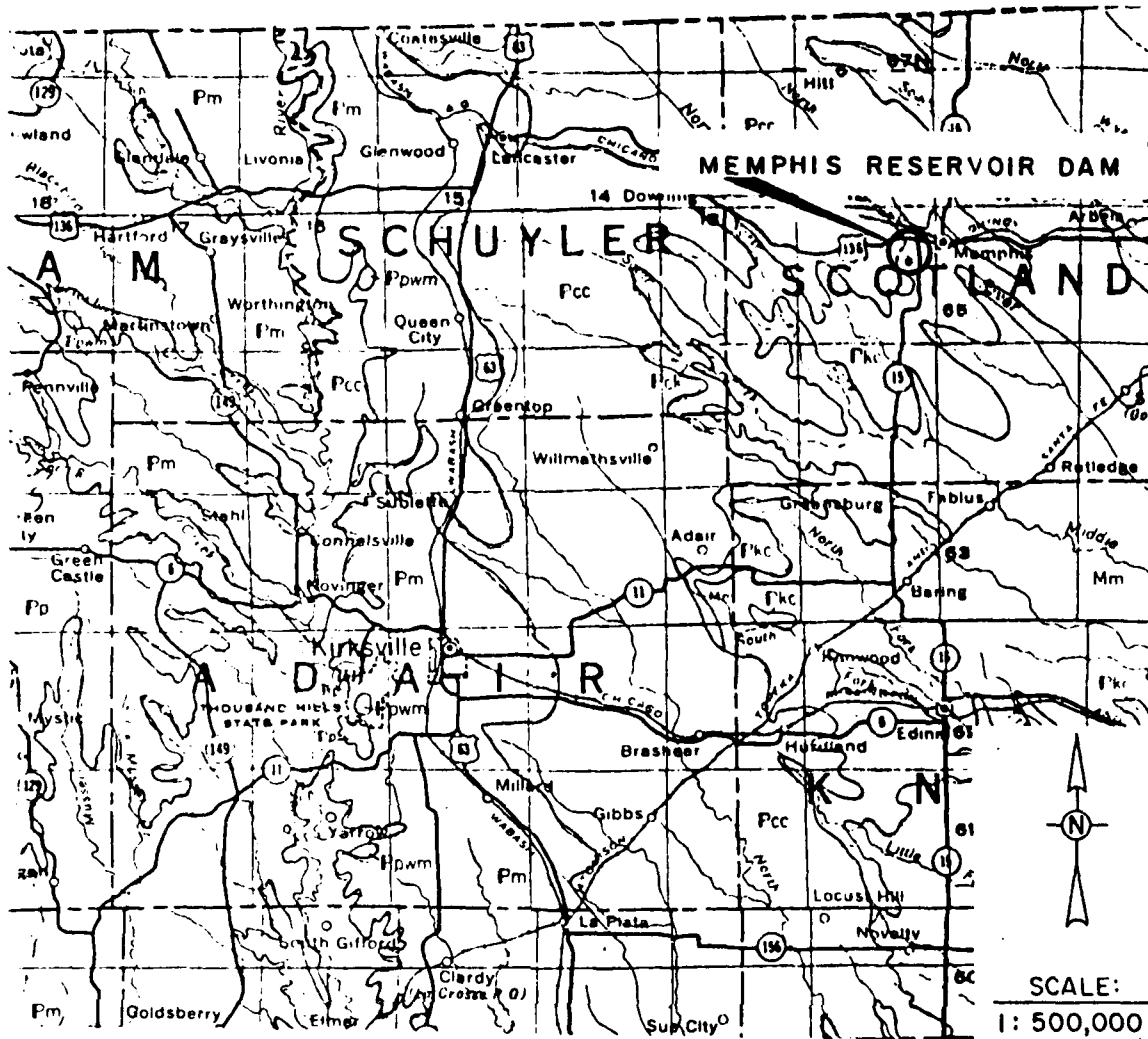
Class. Fence

City

LAKE

James & Stephen

Robt. Mann



Explanation

Pennsylvanian System

- P_{kc} - Kansas City group: cyclic deposits with numerous limestones.
- P_{pwm} - Pleasanton group: sandstone channel member.
- P_m - Marmaton group: cyclic deposits with limestones.
- P_{cc} - Cherokee group: cyclic deposits, predominately shale, sandstone and coal beds.

Mississippian System

- M_m - sandy, oolitic, fossiliferous, lithographic, or cherty limestones.
- M_o - cherty, crinoidal limestone, with some shale.
- M_k - intercalated limestones and shales.

Reference: Geologic Map of Missouri, 1961, Division of Geological Survey and Water Resources, State of Missouri.

General Geologic Map

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

MEMPHIS RESERVOIR DAM

- Photo 1 - View along crest of dam taken from near left abutment.
- Photo 2 - Picture of upstream slope of embankment taken from left side of dam.
- Photo 3 - Picture of crest and downstream embankment slope taken from near center of dam looking toward left abutment.
- Photo 4 - Picture of downstream embankment slope taken from near center of dam looking toward left abutment.
- Photo 5 - Picture of intake structure for water supply piping.
- Photo 6 - Picture of pump house vault for water supply.
- Photo 7 - Picture of downstream channel of spillway taken from near center of dam toward right side of dam.
- Photo 8 - Picture of concrete overflow crest of service spillway taken at left side of spillway.
- Photo 9 - Picture of concrete overflow of service spillway taken from downstream of spillway.
- Photo 10 - Picture of downstream discharge channel with energy dissipators below service spillway.
- Photo 11 - Picture of emergency spillway approach channel and crest.
- Photo 12 - Picture of crest of emergency spillway and failed downstream wall taken from right abutment of spillway.
- Photo 13 - Picture of drop downstream of emergency spillway.

Memphis Reservoir Dam



Photo 1 - View along crest of dam taken from near left abutment.



Photo 2 - Picture of upstream slope of embankment taken from left side of dam.

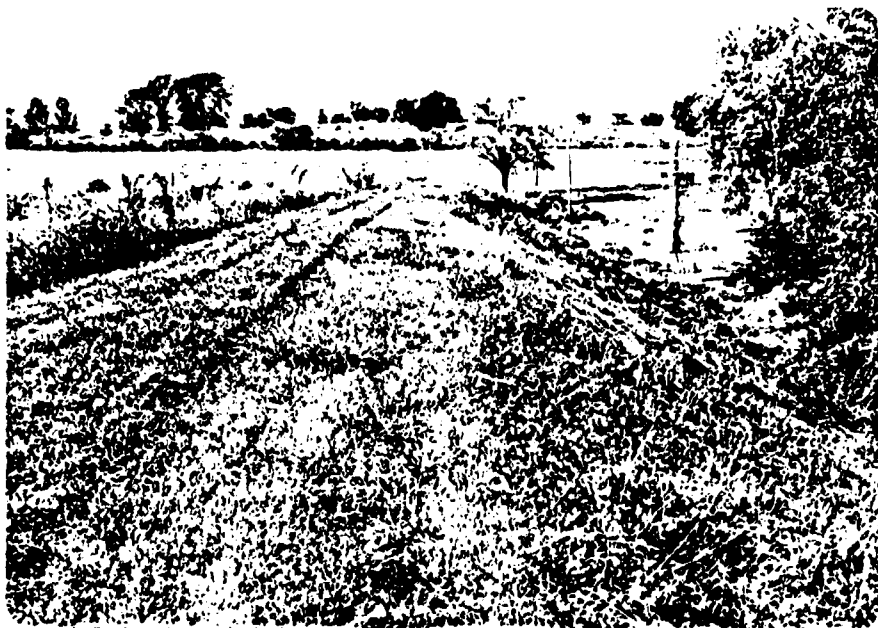


Photo 3 - Picture of crest and downstream embankment slope taken from near center of dam looking toward left abutment.



Photo 4 - Picture of downstream embankment slope taken from near center of dam looking toward left abutment.

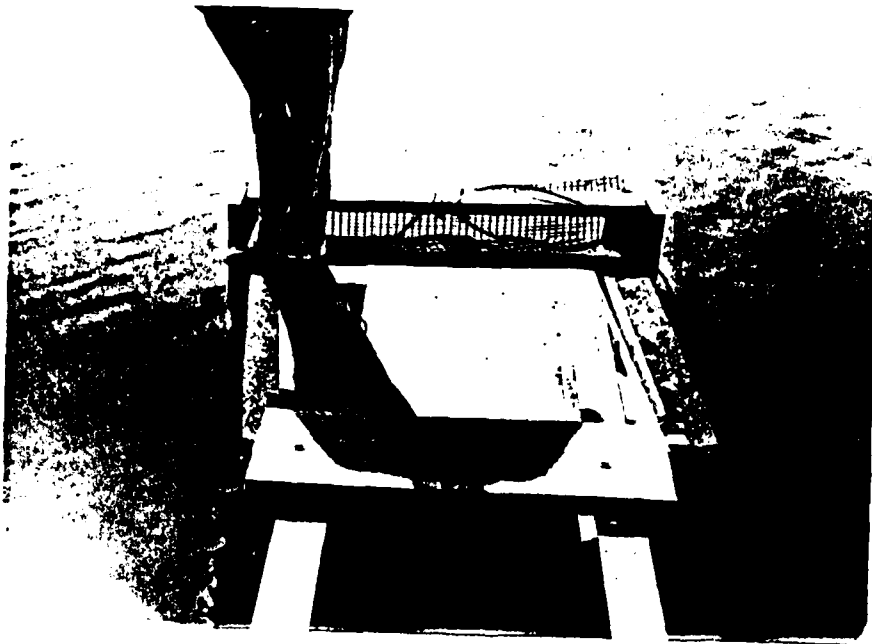


Photo 5 - Picture of intake structure for water supply piping.

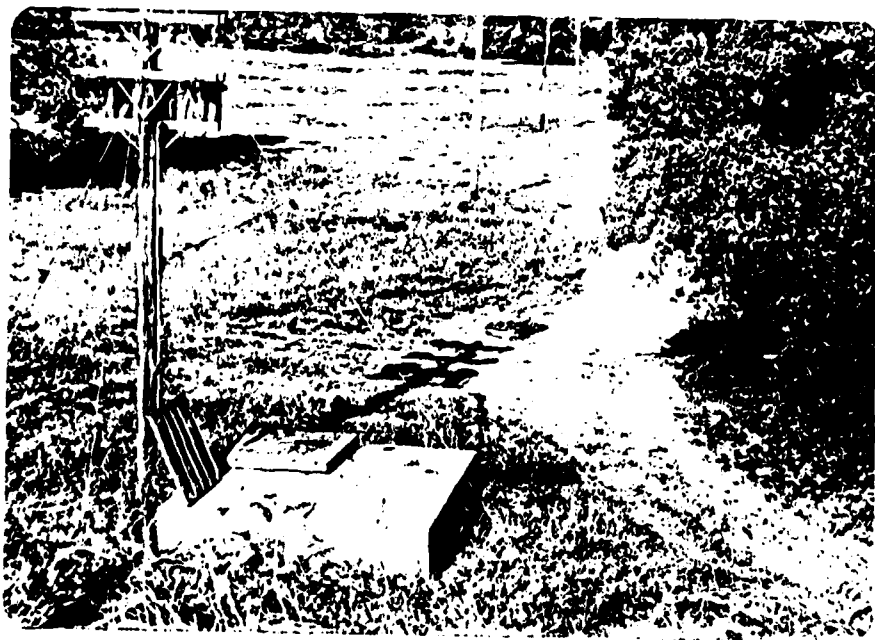


Photo 6 - Picture of pump house vault for water supply.



Photo 7 - Picture of downstream channel of spillway taken from near center of dam toward right side of dam.

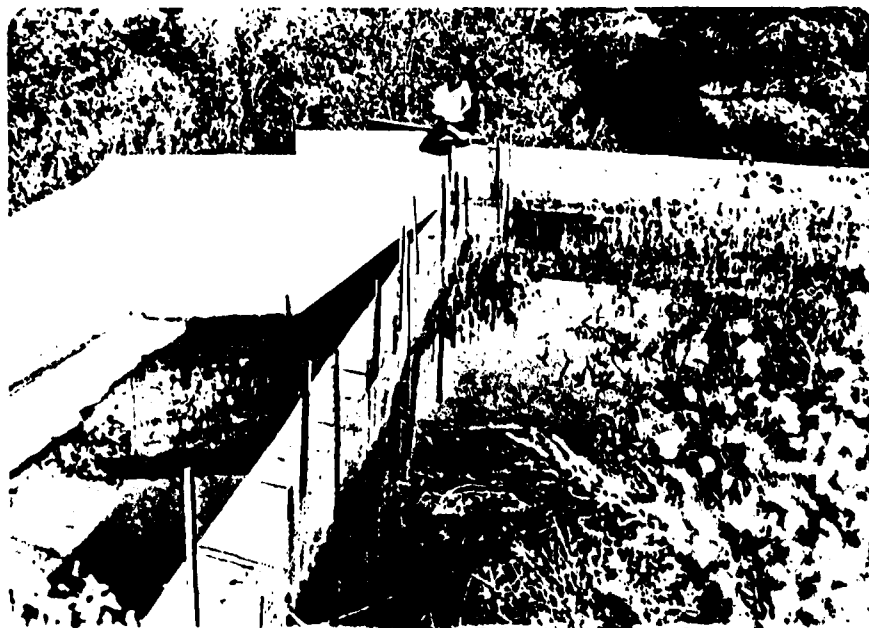


Photo 8 - Picture of concrete overflow crest of service spillway taken at left side of spillway.

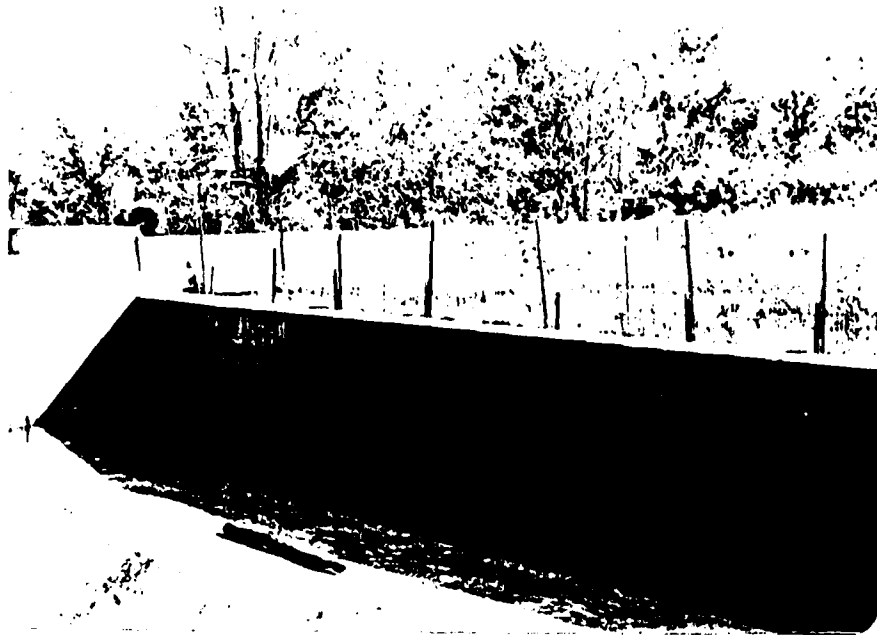


Photo 9 - Picture of concrete overflow of service spillway taken from downstream of spillway.

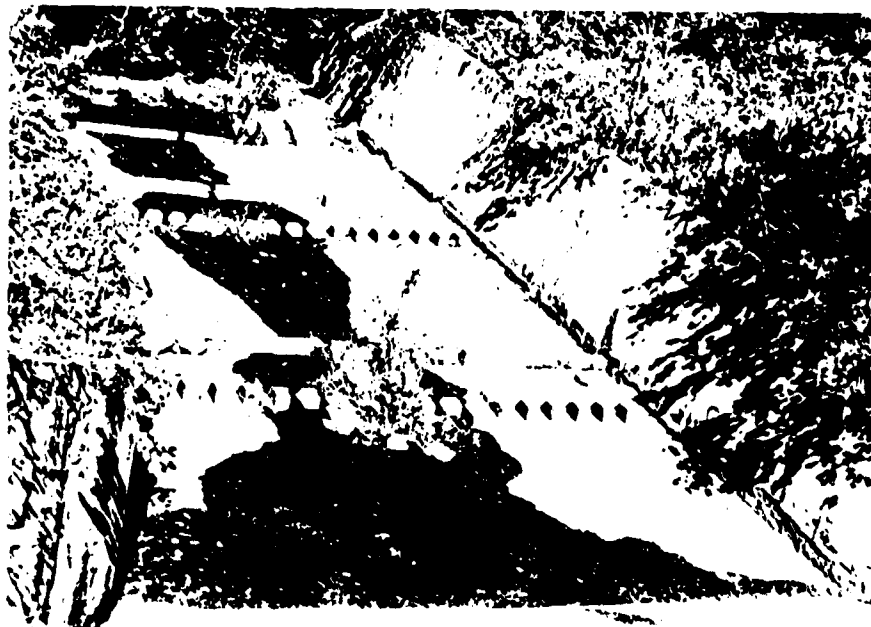


Photo 10 - Picture of downstream discharge channel with energy dissipators below service spillway.



Photo 11 - Picture of emergency spillway approach channel and crest.

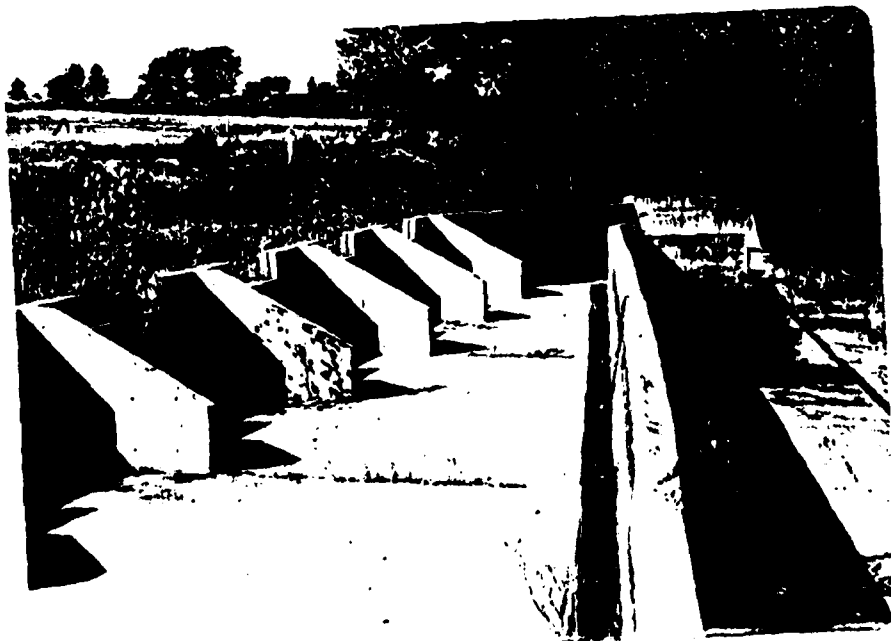
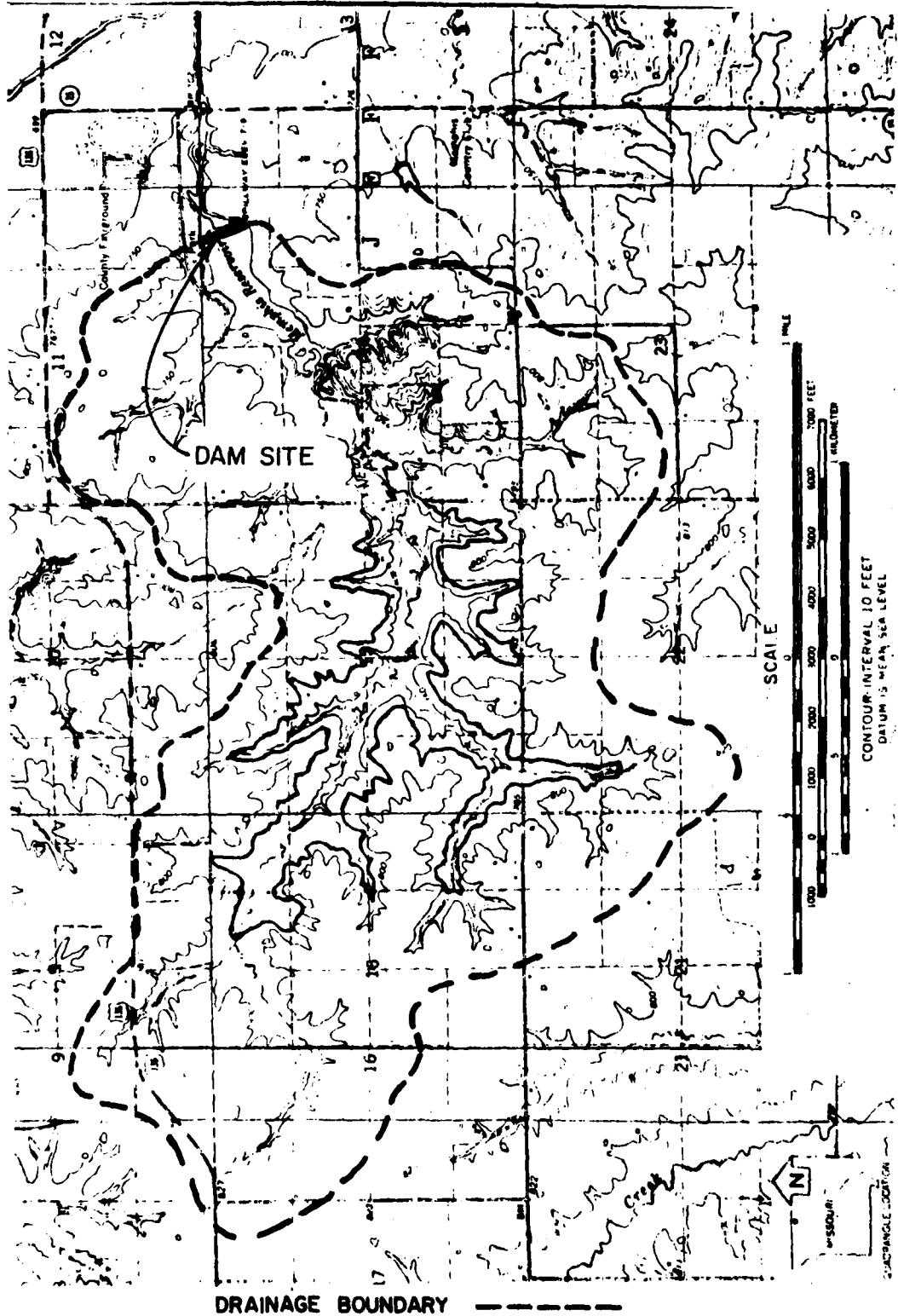


Photo 12 - Picture of crest of emergency spillway and failed downstream wall taken from right abutment of spillway.



Photo 13 - Picture of emergency spillway downstream of concrete weir.

APPENDIX B
HYDROLOGIC COMPUTATIONS



**MEMPHIS RESERVOIR DAM
DRAINAGE AREA**

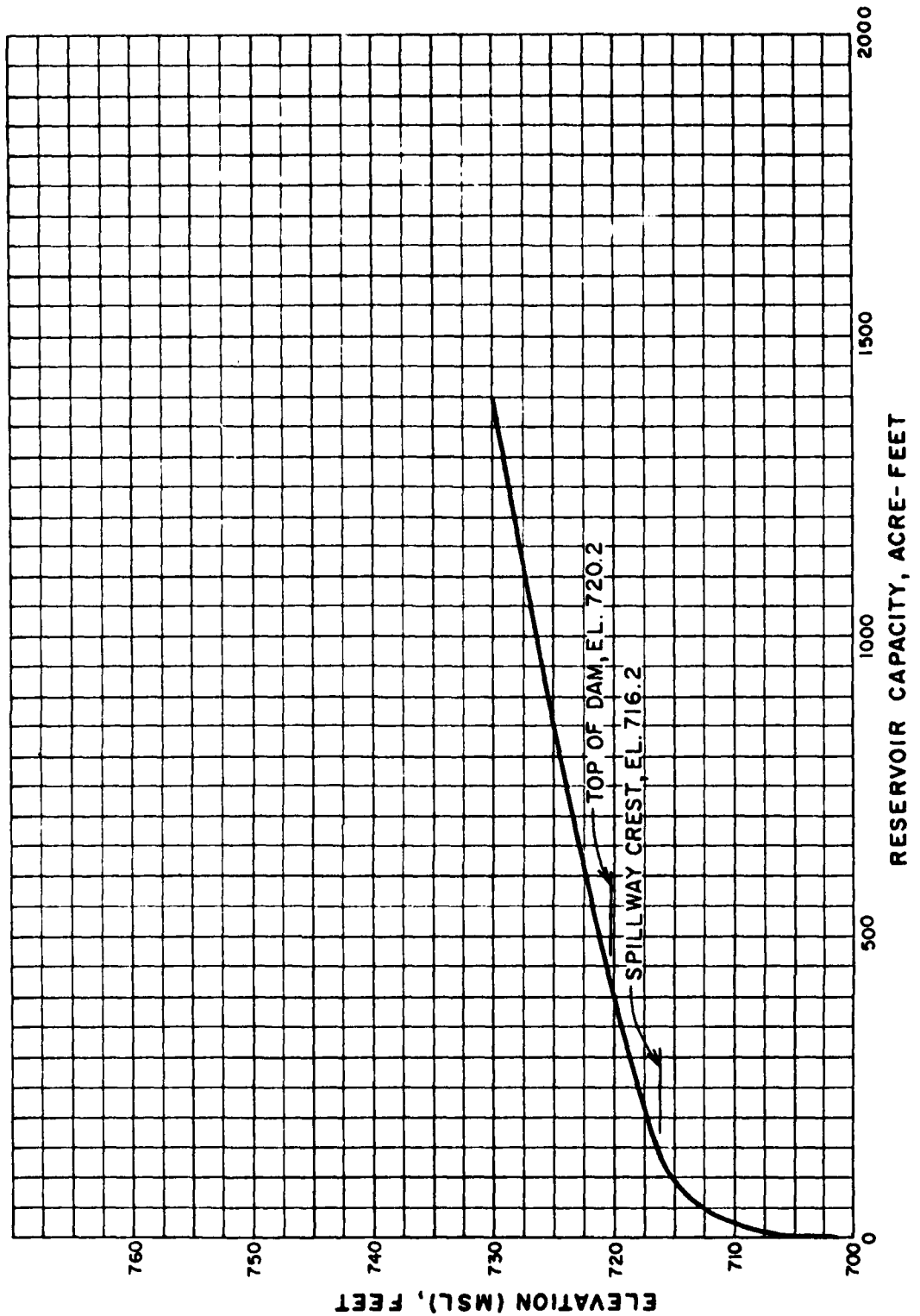
MISSOURI DAM SAFETY INSPECTION
 MEMPHIS RESERVOIR DAM (OLD.)
 RESERVOIR AREA CAPACITY DATA

SHEET NO. 1 OF
 JOB NO. 1223-001-1
 BY MLB DATE 4-10-78

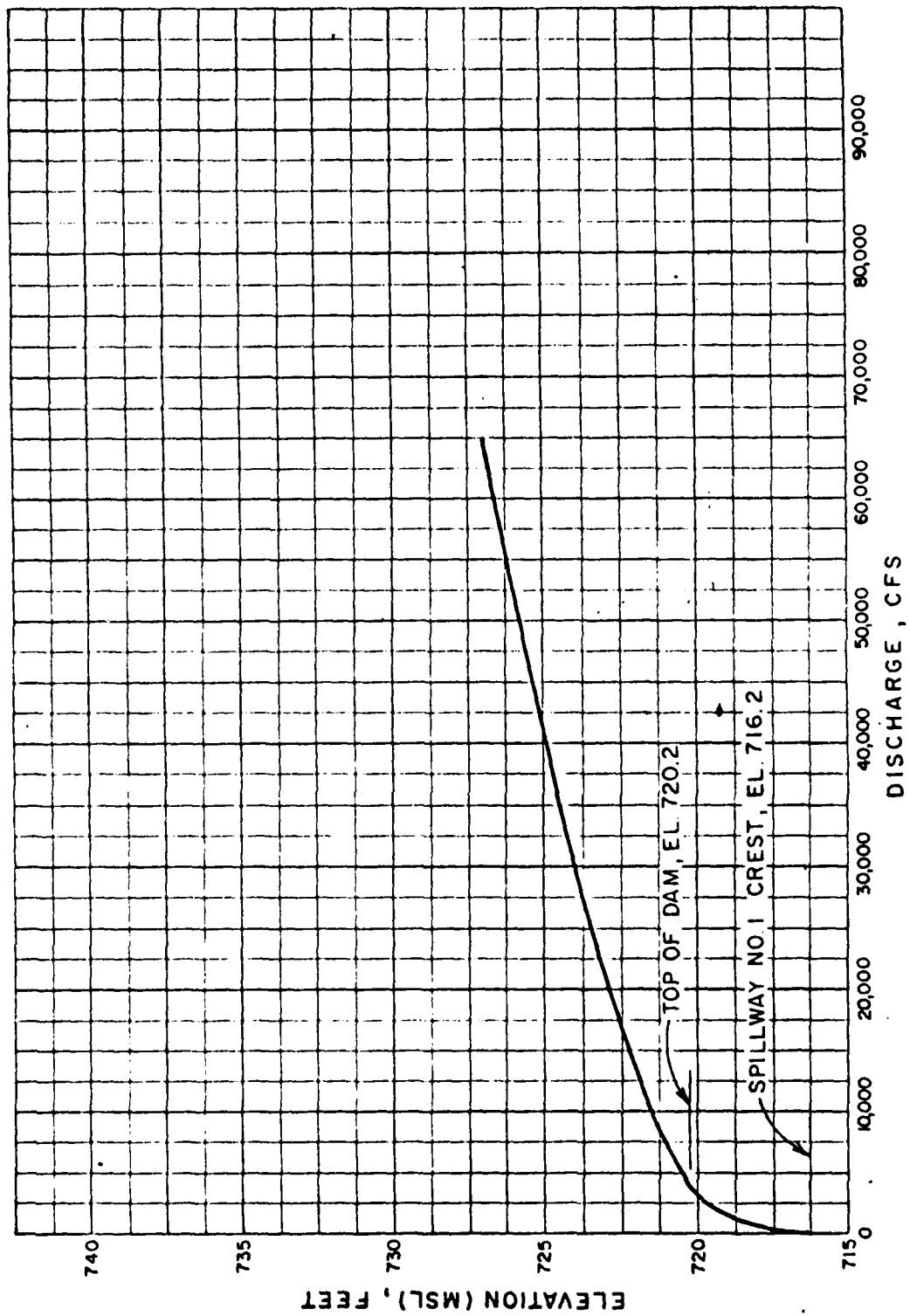
MEMPHIS RESERVOIR DAM (OLD)
RESERVOIR AREA CAPACITY DATA.

ELEV. FT.	RESERVOIR SURFACE AREA (ACRES)	INCREMENTAL VOLUME (AC-FT)	TOTAL VOLUME (AC-FT)	REMARKS
701	0.6	—	0	ASSUMED STREAM BED AT CENTER OF DAM
706	4.8	9.0	9.0	DATA FROM CONSTRUCTION PLANS
711	21.2	64.9	73.9	DATA FROM CONSTRUCTION PLANS
716	40.0	152.9	226.8	DATA FROM CONSTRUCTION PLANS
716.2	40.6 *	8	235.0*	SPILLWAY CREST EL.
720	51.9	173.5	410.5	DATA FROM CONSTRUCTION PLANS
720.2	59.8*	10.6	421.0*	TOP OF DAM.
730	145.4	976.0	1397.0	AREA FROM U.S.G.S. MAP
740	259.1	2022.5	3419.5	AREA FROM U.S.G.S. MAP.

* INTERPOLATED DATA.



MEMPHIS RESERVOIR DAM
RESERVOIR CAPACITY CURVE



MEMPHIS RESERVOIR DAM
 SPILLWAY & OVERTOP RATING
 CURVE

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI
 MEMPHIS RESERVOIR DAM
 UNIT HYDROGRAPH PARAMETERS

SHEET NO. 1 OF
 JOB NO. 1223-001-1
 BY KLB DATE 11-7-78

1. DRAINAGE AREA, $A = 947 \text{ AC} = \underline{1.48 \text{ SQ. MI}}$

2. LENGTH OF STREAM, $L = 1.44 \text{ MI}$

3. DIFFERENCE IN ELEV., $\Delta H = 815 - 719 = 96 \text{ FT.}$

4. TIME OF CONCENTRATION, T_c

$$T_c = \left(\frac{11.9 \times L^3}{\Delta H} \right)^{0.385}$$

$$T_c = \left(\frac{11.9 \times 1.44^3}{96} \right)^{0.385}$$

$$T_c = \underline{0.68}$$

5. LAG TIME, $L_t = 0.6 \times T_c$

$$L_t = 0.6 \times 0.68 = 0.41$$

6. RAINFALL UNIT DURATION, D

$$D \leq \frac{L_t}{4} = \frac{0.41}{4} = 0.10$$

$$\text{USE } D = 5 \text{ min} = 0.083 \text{ HR}$$

TO MATCH UPSTREAM CALCULATIONS

7. TIME TO PEAK, T_p

$$T_p = \frac{D}{2} + 0.6 \times T_c$$

$$T_p = \frac{0.083}{2} + 0.6 \times 0.68$$

$$T_p = \underline{0.45 \text{ HR.}}$$

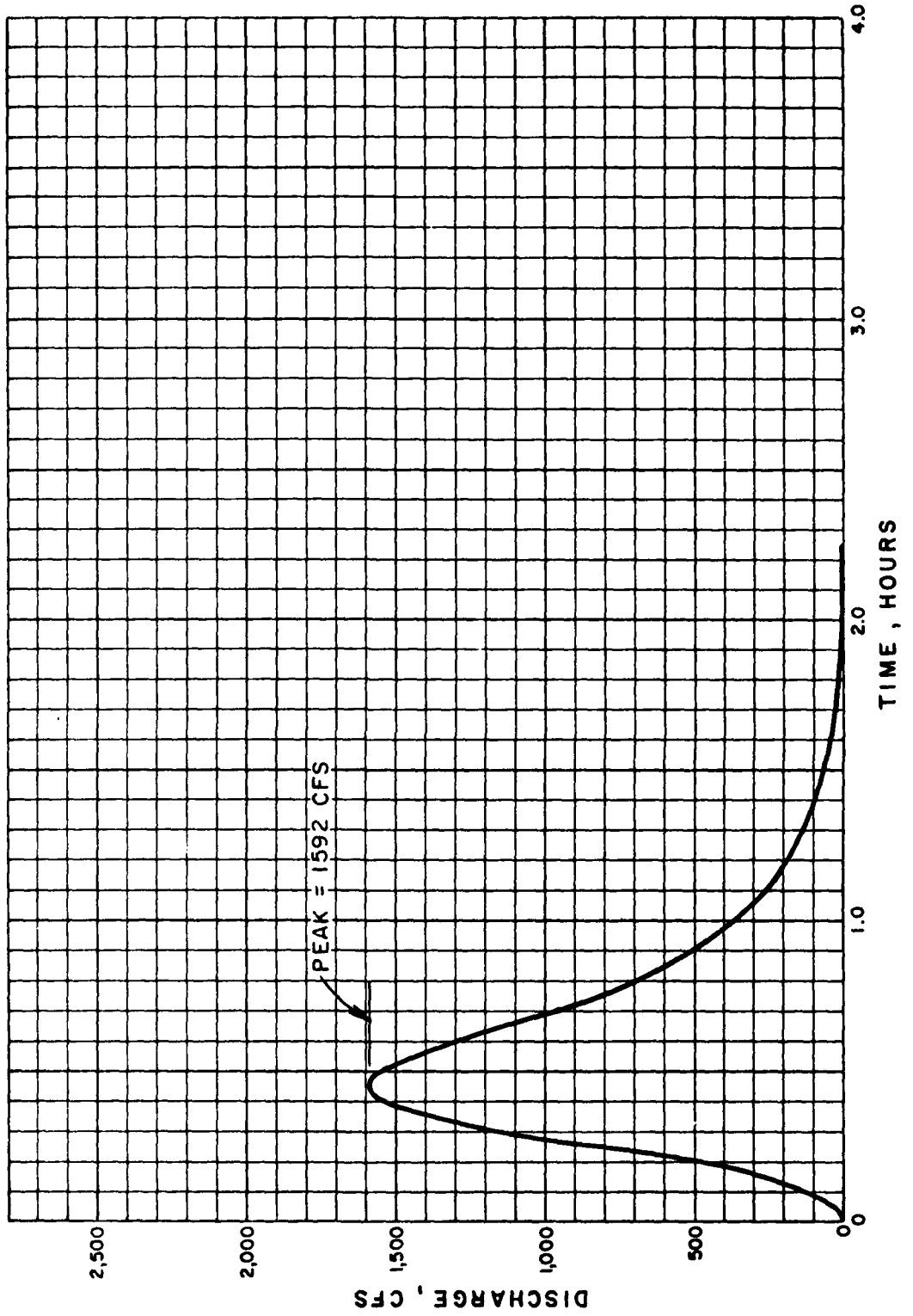
8. $q_p = \frac{484 \times A}{T_p} = \frac{484 \times 1.48}{0.45} = \underline{1592 \text{ CFS.}}$

DAM SAFETY INSPECTION - MISSOURI
 MEMPHIS RESERVOIR
 UNIT HYDROGRAPH DERIVATION

SHEET NO. 2 OF
 JOB NO. 1223-001-1
 BY KLB DATE 11-7-78

7) CURVILINEAR UNIT HYDROGRAPH

TIME, T/T _P	DISCHARGE RATIO q/q _P	UNIT HYDROGRAPH	
		TIME, T (HRS)	DISCHARGE q (CFS)
0.000	0.000	0.000	0.000
0.1	0.015	0.05	23.88
0.2	0.075	0.09	119.40
0.3	0.16	0.14	254.72
0.4	0.28	0.18	445.76
0.5	0.45	0.23	716.90
0.6	0.60	0.27	955.20
0.7	0.77	0.32	1225.84
0.8	0.89	0.36	1416.88
0.9	0.97	0.41	1549.24
1.0	1.00	0.45	1592.00
1.1	0.98	0.50	1560.16
1.2	0.92	0.54	1464.64
1.3	0.84	0.59	1337.28
1.4	0.75	0.63	1194.00
1.5	0.66	0.68	1050.72
1.6	0.56	0.72	891.52
1.8	0.42	0.81	668.64
2.0	0.32	0.90	509.44
2.2	0.24	0.99	382.08
2.4	0.18	1.08	286.56
2.6	0.13	1.17	206.96
2.8	0.098	1.26	156.02
3.0	0.075	1.35	119.40
3.5	0.036	1.58	57.31
4.0	0.018	1.80	28.66
4.5	0.009	2.03	14.33
5.0	0.004	2.25	6.37



MEMPHIS RESERVOIR DAM
5 MINUTE UNIT HYDROGRAPH

DAM SAFETY INSPECTION/MISSOURI

SHEET NO. 1 OF

MEMPHIS RESERVOIR DAM

JOB NO. 1223-001

- PROBABLE MAXIMUM STORM (PMS)

BY MAS DATE

DETERMINATION OF PMS

1. Determine drainage area of the basin

$$D.A. = 947 \text{ acres} = 1.48 \text{ Sq. mi.}$$

2. Determine PMP Index rainfall:

Location of centroid of basin:

$$\text{Long. } 92.21^{\circ}; \text{ Lat. } 40.44^{\circ}$$

$$\rightarrow \text{PMP for } 200 \text{ Sq. mi. \& 24 hrs duration} \\ = 23.8'' \text{ (from Fig 1, HMR NO 33)}$$

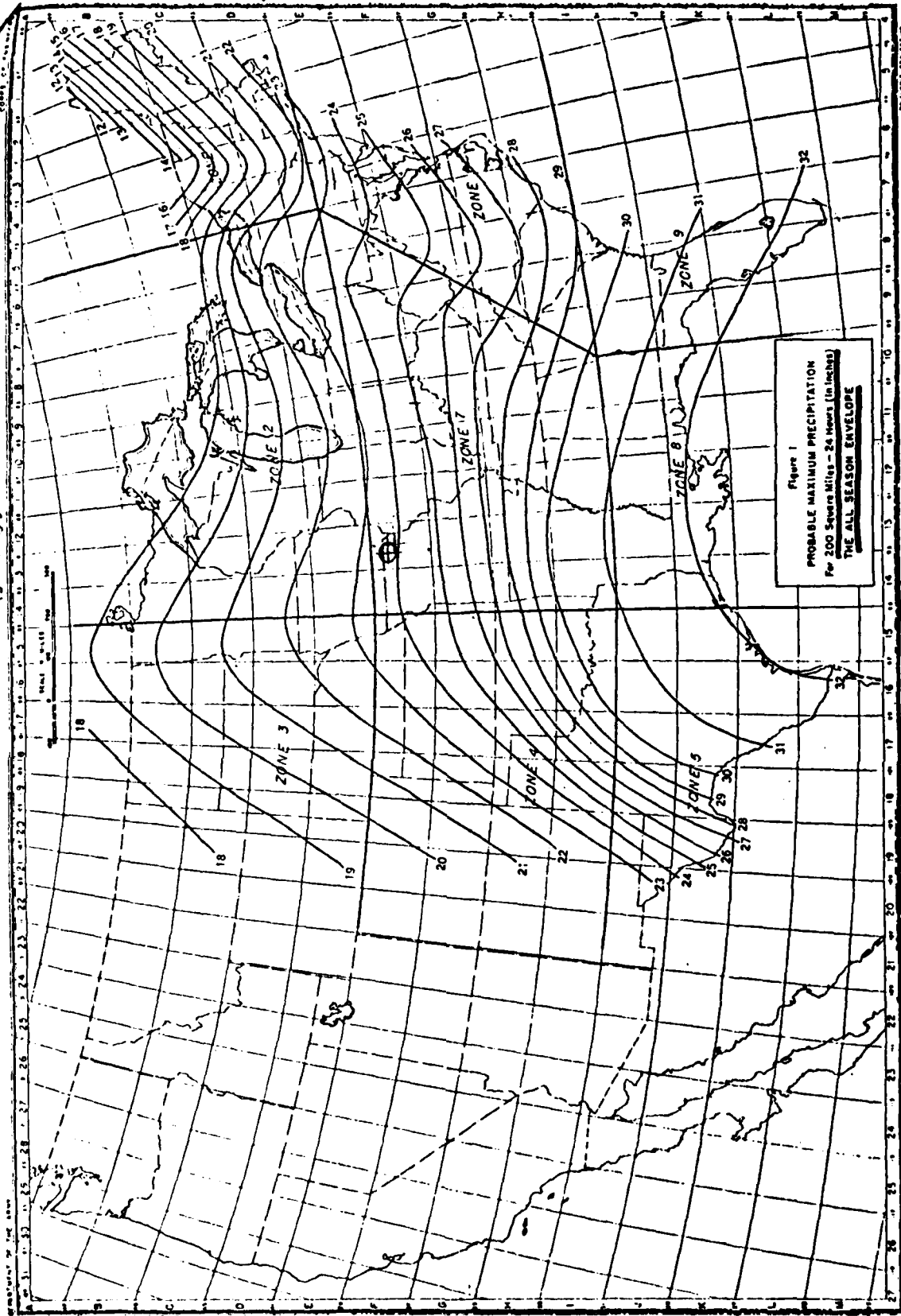
3. Determine basin rainfall in terms of percentage of PMP Index rainfall for various durations:

$$\text{Location: Long. } 92.21^{\circ}; \text{ Lat. } 40.44^{\circ}$$

⇒ Zone 7

Duration (Hrs.)	Percent of Index rainfall (%)	Total rainfall (Inches)	Rainfall increments (Inches)	Duration of incre- ment (Hrs.)
6	100	23.8	23.8	6
12	120	28.6	4.8	6
24	130	30.9	2.3	12

92 91 89



23.8"

MEMPHIS RESERVOIR DAM
DETERMINATION OF PMP

DAM SAFETY INSPECTION - MISSOURI

SHEET NO. 1 OF 1

MEMPHIS RESERVOIR (OLD)

JOB NO. 1223-001-1

100 YEAR FLOOD BY REGRESSION EQUATION BY KLR DATE 11-20-78

MEMPHIS RESERVOIR

100 YEAR FLOOD BY REGRESSION EQUATION

REGRESSION EQUATION FOR 100 YEAR FLOOD FOR MISSOURI:

$$Q_{100} = 85.1 A^{0.934} A^{-0.02} S^{0.576}$$

WHERE:

A = DRAINAGE AREA IN SQ. MI.

S = MAIN CHANNEL SLOPE FE/MI.

(AVG. SLOPE BETWEEN 0.1 L AND 0.05 L, BEING LENGTH OF MAIN CHANNEL)

FOR MEMPHIS RESERVOIR:

A = 1.48 SQ. MI.

$$S = \frac{795 - 727}{0.75 \times 1.44} = 62.96 \text{ FE/MI.}$$

$$Q_{100} = 85.1 (1.48)^{0.934} (1.48)^{-0.02} (62.96)^{0.576}$$

= 1330 CFS

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DAN SAFETY INJECTION - MISSOURI
 MEMPHIS RESERVOIR (NEW AND OLD)
 PMP AND 10 PERCENT WVD DESIGNATION AND ROUTING

INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SEE UNIT HYDROGRAPH NEW
 25.00 100 120 130 0.05 0.07

UI 0.0 1006 3500 4342 3020 2000 2100 1050 1020
 UI 700 300 200 170 130 100 70 50 30
 UI 10 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

K1 ROUTE HYDROGRAPH THROUGH NEW MEMPHIS RESERVOIR 1
 V0370.00 771.00 772.00 773.00 774.00 775.00 776.00 777.00 778.00 779.00 780.00
 V0760.11 60. 247. 485. 850. 1317. 2910. 7565. 14036. 20029.
 V506707. 80.0 301.1 940.8 2170.0 4100.0 5100.0 7030.0 10000.0
 SE 725. 750. 780. 760. 770. 770. 770. 760. 760. 760.

K1 INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SEE UNIT HYDROGRAPH OLD
 25.00 100 120 130 0.05 0.07

UI 0.0 170 470 1050 1420 1592 1492 1360 930
 UI 750 500 300 200 100 112 60 60 60
 UI 42 30 20 17 14 11 6 5 2
 UI 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

K1 COMBINE UPSTREAM ROUTED HYDROGRAPH WITH DOWNSTREAM HYDROGRAPH BEFORE ROUTING
 K1 ROUTE COMBINED HYDROGRAPH THROUGH OLD MEMPHIS RESERVOIR AND DAM
 V1 710.2 710.7 717.1 717.4 718.2 718.7 719.5 720.2 721.0 723.0
 V4 725.0 727.0 730.0 730.0 730.0 730.0 730.0 730.0 730.0 730.0
 V5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
 V6 21000 41250 60000 103500

51 9.0 73.9 226.0 238.0 410.5 421.0 1597.0 3419.5
52 700 711 716 740.2 780.0 780.2 738 740
53 90 90 90 90 90 90 90 90
54 701 701 701 701 701 701 701 701
55 710.8 710.8 710.8 710.8 710.8 710.8 710.8 710.8
56 720.2 720.2 720.2 720.2 720.2 720.2 720.2 720.2
57

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 03
ROUTE HYDROGRAPH TO 3
RUNOFF HYDROGRAPH AT 18
COMBINE 2 HYDROGRAPHS AT 18
ROUTE HYDROGRAPH TO 18
END OF NETWORK

INFLOW PMF AND ONE-HALF PMF HYDROGRAPH COMPUTATION
FOR NEW MEMPHIS RESERVOIR

 FLOOD HYDROGRAPH PACKAGE (CHECK-1)
 DAM SAFETY VERSION JULY 1978
 LABY MODIFICATION 21 AUG 78

RUN DATE= 78/11/29
 TIME= 12.19.50

DAM SAFETY INSPECTION - MISSOURI
 KEMMIS RESERVOIR (NEW AND OLD)
 PMP AND 50 PERCENT PMP DETERMINATION AND ROUTING

NO MHR NMIN TOAY IHR IMIN METRC IPLT IPRT NSTAN
 300 0 5 0 0 0 0 0 0 0 0 0
 JOPEL NMT LROPT TRACE
 5 0 0 0

MULTI-PLAN ANALYSES TO BE PERFORMED
 MPLANS 1 NRATIO 2 LRATIO 1

RTIOB 1.00 .59

***** SUB-AREA RUNOFF COMPUTATION *****

INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT RES UNIT
 IRTAB ICOMP IECOM IYAPE JPLT JPRT INAME ISTATE IAUTO
 3 0 0 0 0 0 1 0 0

INVOO IUNG TAREA SNAP TROBA TROPC RATIO ISHOW ISAME LOCAL
 1 0 3.05 0.00 120.00 150.00 0.00 0.00 0 0 0

PRECIP DATA
 RPE R6 R12 R24 R48 R72 R96
 0.00 23.00 100.00 120.00 150.00 0.00 0.00 0.00

LOSS DATA
 LROPT STARR OLTRK RTIOL ERAIN STRAB RTIOK STRIL CNSTL ALBHK RTIMP
 0 0.00 0.00 1.00 0.00 0.00 1.00 .85 .07 0.00 0.00

0. 1800. 1920. 2100. 1450. 1020.
 100. 500. 800. 170. 300. 30.
 0. 0. 0. 0. 0.

UNIT GRAPH TOTALS 25922. CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA
 RTIOB 1.00

MO,DA HR,MN PERIOD DAIN ERSS LOSS COMP 0 MO,DA HR,MN PERIOD RAIN ERSS LOSS COMP 0

1.01	10.09	121	.07	.01	1.01	22.38	271	.01	1.01	331
1.01	10.10	122	.07	.01	1.01	22.40	272	.01	1.01	332
1.01	10.15	123	.07	.01	1.01	22.45	273	.01	1.01	333
1.01	10.20	124	.07	.01	1.01	22.50	274	.01	1.01	334
1.01	10.25	125	.07	.01	1.01	22.55	275	.01	1.01	335
1.01	10.30	126	.07	.01	1.01	23.00	276	.01	1.01	336
1.01	10.35	127	.07	.01	1.01	23.05	277	.01	1.01	337
1.01	10.40	128	.07	.01	1.01	23.10	278	.01	1.01	338
1.01	10.45	129	.07	.01	1.01	23.15	279	.01	1.01	339
1.01	10.50	130	.07	.01	1.01	23.20	280	.01	1.01	340
1.01	10.55	131	.07	.01	1.01	23.25	281	.01	1.01	341
1.01	11.00	132	.07	.01	1.01	23.30	282	.01	1.01	342
1.01	11.05	133	.07	.01	1.01	23.35	283	.01	1.01	343
1.01	11.10	134	.07	.01	1.01	23.40	284	.01	1.01	344
1.01	11.15	135	.07	.01	1.01	23.45	285	.01	1.01	345
1.01	11.20	136	.07	.01	1.01	23.50	286	.01	1.01	346
1.01	11.25	137	.07	.01	1.01	23.55	287	.01	1.01	347
1.01	11.30	138	.07	.01	1.02	0.00	288	.01	1.01	348
1.01	11.35	139	.07	.01	1.02	.05	289	.01	1.01	349
1.01	11.40	140	.07	.01	1.02	.10	290	.01	1.01	350
1.01	11.45	141	.07	.01	1.02	.15	291	.01	1.01	351
1.01	11.50	142	.07	.01	1.02	.20	292	.01	1.01	352
1.01	11.55	143	.07	.01	1.02	.25	293	.01	1.01	353
1.01	12.00	144	.07	.01	1.02	.30	294	.01	1.01	354
1.01	12.05	145	.20	.19	1.02	.35	295	.01	1.01	355
1.01	12.10	146	.20	.19	1.02	.40	296	.01	1.01	356
1.01	12.15	147	.20	.19	1.02	.45	297	.01	1.01	357
1.01	12.20	148	.20	.19	1.02	.50	298	.01	1.01	358
1.01	12.25	149	.20	.19	1.02	.55	299	.01	1.01	359
1.01	12.30	150	.20	.19	1.02	1.00	300	.01	1.01	360

SUM 30.94 26.79 2.15 688871.
(786.)(731.)(59.)(19506.08)

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
26290.	7652.	2392.	2246.	68882.
740.	217.	66.	65.	19506.
	23.34	29.16	29.16	
	592.93	741.16	741.16	
	3765.	4744.	4744.	
	4681.	5852.	5852.	

HYDROGRAPH AT STA 3 FOR PLAN 1, RTIO 1

1.01	10.09	121	.07	.01	1.01	22.38	271	.01	1.01	331
1.01	10.10	122	.07	.01	1.01	22.40	272	.01	1.01	332
1.01	10.15	123	.07	.01	1.01	22.45	273	.01	1.01	333
1.01	10.20	124	.07	.01	1.01	22.50	274	.01	1.01	334
1.01	10.25	125	.07	.01	1.01	22.55	275	.01	1.01	335
1.01	10.30	126	.07	.01	1.01	23.00	276	.01	1.01	336
1.01	10.35	127	.07	.01	1.01	23.05	277	.01	1.01	337
1.01	10.40	128	.07	.01	1.01	23.10	278	.01	1.01	338
1.01	10.45	129	.07	.01	1.01	23.15	279	.01	1.01	339
1.01	10.50	130	.07	.01	1.01	23.20	280	.01	1.01	340
1.01	10.55	131	.07	.01	1.01	23.25	281	.01	1.01	341
1.01	11.00	132	.07	.01	1.01	23.30	282	.01	1.01	342
1.01	11.05	133	.07	.01	1.01	23.35	283	.01	1.01	343
1.01	11.10	134	.07	.01	1.01	23.40	284	.01	1.01	344
1.01	11.15	135	.07	.01	1.01	23.45	285	.01	1.01	345
1.01	11.20	136	.07	.01	1.01	23.50	286	.01	1.01	346
1.01	11.25	137	.07	.01	1.01	23.55	287	.01	1.01	347
1.01	11.30	138	.07	.01	1.02	0.00	288	.01	1.01	348
1.01	11.35	139	.07	.01	1.02	.05	289	.01	1.01	349
1.01	11.40	140	.07	.01	1.02	.10	290	.01	1.01	350
1.01	11.45	141	.07	.01	1.02	.15	291	.01	1.01	351
1.01	11.50	142	.07	.01	1.02	.20	292	.01	1.01	352
1.01	11.55	143	.07	.01	1.02	.25	293	.01	1.01	353
1.01	12.00	144	.07	.01	1.02	.30	294	.01	1.01	354
1.01	12.05	145	.20	.19	1.02	.35	295	.01	1.01	355
1.01	12.10	146	.20	.19	1.02	.40	296	.01	1.01	356
1.01	12.15	147	.20	.19	1.02	.45	297	.01	1.01	357
1.01	12.20	148	.20	.19	1.02	.50	298	.01	1.01	358
1.01	12.25	149	.20	.19	1.02	.55	299	.01	1.01	359
1.01	12.30	150	.20	.19	1.02	1.00	300	.01	1.01	360

1.01	10.09	121	.07	.01	1.01	22.38	271	.01	1.01	331
1.01	10.10	122	.07	.01	1.01	22.40	272	.01	1.01	332
1.01	10.15	123	.07	.01	1.01	22.45	273	.01	1.01	333
1.01	10.20	124	.07	.01	1.01	22.50	274	.01	1.01	334
1.01	10.25	125	.07	.01	1.01	22.55	275	.01	1.01	335
1.01	10.30	126	.07	.01	1.01	23.00	276	.01	1.01	336
1.01	10.35	127	.07	.01	1.01	23.05	277	.01	1.01	337
1.01	10.40	128	.07	.01	1.01	23.10	278	.01	1.01	338
1.01	10.45	129	.07	.01	1.01	23.15	279	.01	1.01	339
1.01	10.50	130	.07	.01	1.01	23.20	280	.01	1.01	340
1.01	10.55	131	.07	.01	1.01	23.25	281	.01	1.01	341
1.01	11.00	132	.07	.01	1.01	23.30	282	.01	1.01	342
1.01	11.05	133	.07	.01	1.01	23.35	283	.01	1.01	343
1.01	11.10	134	.07	.01	1.01	23.40	284	.01	1.01	344
1.01	11.15	135	.07	.01	1.01	23.45	285	.01	1.01	345
1.01	11.20	136	.07	.01	1.01	23.50	286	.01	1.01	346
1.01	11.25	137	.07	.01	1.01	23.55	287	.01	1.01	347
1.01	11.30	138	.07	.01	1.02	0.00	288	.01	1.01	348
1.01	11.35	139	.07	.01	1.02	.05	289	.01	1.01	349
1.01	11.40	140	.07	.01	1.02	.10	290	.01	1.01	350
1.01	11.45	141	.07	.01	1.02	.15	291	.01	1.01	351
1.01	11.50	142	.07	.01	1.02	.20	292	.01	1.01	352
1.01	11.55	143	.07	.01	1.02	.25	293	.01	1.01	353
1.01	12.00	144	.07	.01	1.02	.30	294	.01	1.01	354
1.01	12.05	145	.20	.19	1.02	.35	295	.01	1.01	355
1.01	12.10	146	.20	.19	1.02	.40	296	.01	1.01	356
1.01	12.15	147	.20	.19	1.02	.45	297	.01	1.01	357
1.01	12.20	148	.20	.19	1.02	.50	298	.01	1.01	358
1.01	12.25	149	.20	.19	1.02	.55	299	.01	1.01	359
1.01	12.30	150	.20	.19	1.02	1.00	300	.01	1.01	360

PMF HYDROGRAPH ROUTING
NEW MEMPHIS RESERVOIR

ONE-HALF PMF HYDROGRAPH

NEW MEMPHIS RESERVOIR

770.9	771.2	771.5	771.8	772.1	772.4	772.7	773.0	773.3	773.6	773.9	774.2	774.5	774.8	775.1	775.4	775.7	776.0	776.3	776.6	776.9	777.2	777.5	777.8	778.1	778.4	778.7	779.0	779.3	779.6	779.9	780.2	780.5	780.8	781.1	781.4	781.7	782.0	782.3	782.6	782.9	783.2	783.5	783.8	784.1	784.4	784.7	785.0	785.3	785.6	785.9	786.2	786.5	786.8	787.1	787.4	787.7	788.0	788.3	788.6	788.9	789.2	789.5	789.8	790.1	790.4	790.7	791.0	791.3	791.6	791.9	792.2	792.5	792.8	793.1	793.4	793.7	794.0	794.3	794.6	794.9	795.2	795.5	795.8	796.1	796.4	796.7	797.0	797.3	797.6	797.9	798.2	798.5	798.8	799.1	799.4	799.7	800.0	800.3	800.6	800.9	801.2	801.5	801.8	802.1	802.4	802.7	803.0	803.3	803.6	803.9	804.2	804.5	804.8	805.1	805.4	805.7	806.0	806.3	806.6	806.9	807.2	807.5	807.8	808.1	808.4	808.7	809.0	809.3	809.6	809.9	810.2	810.5	810.8	811.1	811.4	811.7	812.0	812.3	812.6	812.9	813.2	813.5	813.8	814.1	814.4	814.7	815.0	815.3	815.6	815.9	816.2	816.5	816.8	817.1	817.4	817.7	818.0	818.3	818.6	818.9	819.2	819.5	819.8	820.1	820.4	820.7	821.0	821.3	821.6	821.9	822.2	822.5	822.8	823.1	823.4	823.7	824.0	824.3	824.6	824.9	825.2	825.5	825.8	826.1	826.4	826.7	827.0	827.3	827.6	827.9	828.2	828.5	828.8	829.1	829.4	829.7	830.0	830.3	830.6	830.9	831.2	831.5	831.8	832.1	832.4	832.7	833.0	833.3	833.6	833.9	834.2	834.5	834.8	835.1	835.4	835.7	836.0	836.3	836.6	836.9	837.2	837.5	837.8	838.1	838.4	838.7	839.0	839.3	839.6	839.9	840.2	840.5	840.8	841.1	841.4	841.7	842.0	842.3	842.6	842.9	843.2	843.5	843.8	844.1	844.4	844.7	845.0	845.3	845.6	845.9	846.2	846.5	846.8	847.1	847.4	847.7	848.0	848.3	848.6	848.9	849.2	849.5	849.8	850.1	850.4	850.7	851.0	851.3	851.6	851.9	852.2	852.5	852.8	853.1	853.4	853.7	854.0	854.3	854.6	854.9	855.2	855.5	855.8	856.1	856.4	856.7	857.0	857.3	857.6	857.9	858.2	858.5	858.8	859.1	859.4	859.7	860.0	860.3	860.6	860.9	861.2	861.5	861.8	862.1	862.4	862.7	863.0	863.3	863.6	863.9	864.2	864.5	864.8	865.1	865.4	865.7	866.0	866.3	866.6	866.9	867.2	867.5	867.8	868.1	868.4	868.7	869.0	869.3	869.6	869.9	870.2	870.5	870.8	871.1	871.4	871.7	872.0	872.3	872.6	872.9	873.2	873.5	873.8	874.1	874.4	874.7	875.0	875.3	875.6	875.9	876.2	876.5	876.8	877.1	877.4	877.7	878.0	878.3	878.6	878.9	879.2	879.5	879.8	880.1	880.4	880.7	881.0	881.3	881.6	881.9	882.2	882.5	882.8	883.1	883.4	883.7	884.0	884.3	884.6	884.9	885.2	885.5	885.8	886.1	886.4	886.7	887.0	887.3	887.6	887.9	888.2	888.5	888.8	889.1	889.4	889.7	890.0	890.3	890.6	890.9	891.2	891.5	891.8	892.1	892.4	892.7	893.0	893.3	893.6	893.9	894.2	894.5	894.8	895.1	895.4	895.7	896.0	896.3	896.6	896.9	897.2	897.5	897.8	898.1	898.4	898.7	899.0	899.3	899.6	899.9	900.2	900.5	900.8	901.1	901.4	901.7	902.0	902.3	902.6	902.9	903.2	903.5	903.8	904.1	904.4	904.7	905.0	905.3	905.6	905.9	906.2	906.5	906.8	907.1	907.4	907.7	908.0	908.3	908.6	908.9	909.2	909.5	909.8	910.1	910.4	910.7	911.0	911.3	911.6	911.9	912.2	912.5	912.8	913.1	913.4	913.7	914.0	914.3	914.6	914.9	915.2	915.5	915.8	916.1	916.4	916.7	917.0	917.3	917.6	917.9	918.2	918.5	918.8	919.1	919.4	919.7	920.0	920.3	920.6	920.9	921.2	921.5	921.8	922.1	922.4	922.7	923.0	923.3	923.6	923.9	924.2	924.5	924.8	925.1	925.4	925.7	926.0	926.3	926.6	926.9	927.2	927.5	927.8	928.1	928.4	928.7	929.0	929.3	929.6	929.9	930.2	930.5	930.8	931.1	931.4	931.7	932.0	932.3	932.6	932.9	933.2	933.5	933.8	934.1	934.4	934.7	935.0	935.3	935.6	935.9	936.2	936.5	936.8	937.1	937.4	937.7	938.0	938.3	938.6	938.9	939.2	939.5	939.8	940.1	940.4	940.7	941.0	941.3	941.6	941.9	942.2	942.5	942.8	943.1	943.4	943.7	944.0	944.3	944.6	944.9	945.2	945.5	945.8	946.1	946.4	946.7	947.0	947.3	947.6	947.9	948.2	948.5	948.8	949.1	949.4	949.7	950.0	950.3	950.6	950.9	951.2	951.5	951.8	952.1	952.4	952.7	953.0	953.3	953.6	953.9	954.2	954.5	954.8	955.1	955.4	955.7	956.0	956.3	956.6	956.9	957.2	957.5	957.8	958.1	958.4	958.7	959.0	959.3	959.6	959.9	960.2	960.5	960.8	961.1	961.4	961.7	962.0	962.3	962.6	962.9	963.2	963.5	963.8	964.1	964.4	964.7	965.0	965.3	965.6	965.9	966.2	966.5	966.8	967.1	967.4	967.7	968.0	968.3	968.6	968.9	969.2	969.5	969.8	970.1	970.4	970.7	971.0	971.3	971.6	971.9	972.2	972.5	972.8	973.1	973.4	973.7	974.0	974.3	974.6	974.9	975.2	975.5	975.8	976.1	976.4	976.7	977.0	977.3	977.6	977.9	978.2	978.5	978.8	979.1	979.4	979.7	980.0	980.3	980.6	980.9	981.2	981.5	981.8	982.1	982.4	982.7	983.0	983.3	983.6	983.9	984.2	984.5	984.8	985.1	985.4	985.7	986.0	986.3	986.6	986.9	987.2	987.5	987.8	988.1	988.4	988.7	989.0	989.3	989.6	989.9	990.2	990.5	990.8	991.1	991.4	991.7	992.0	992.3	992.6	992.9	993.2	993.5	993.8	994.1	994.4	994.7	995.0	995.3	995.6	995.9	996.2	996.5	996.8	997.1	997.4	997.7	998.0	998.3	998.6	998.9	999.2	999.5	999.8	1000.1	1000.4	1000.7	1001.0	1001.3	1001.6	1001.9	1002.2	1002.5	1002.8	1003.1	1003.4	1003.7	1004.0	1004.3	1004.6	1004.9	1005.2	1005.5	1005.8	1006.1	1006.4	1006.7	1007.0	1007.3	1007.6	1007.9	1008.2	1008.5	1008.8	1009.1	1009.4	1009.7	1010.0	1010.3	1010.6	1010.9	1011.2	1011.5	1011.8	1012.1	1012.4	1012.7	1013.0	1013.3	1013.6	1013.9	1014.2	1014.5	1014.8	1015.1	1015.4	1015.7	1016.0	1016.3	1016.6	1016.9	1017.2	1017.5	1017.8	1018.1	1018.4	1018.7	1019.0	1019.3	1019.6	1019.9	1020.2	1020.5	1020.8	1021.1	1021.4	1021.7	1022.0	1022.3	1022.6	1022.9	1023.2	1023.5	1023.8	1024.1	1024.4	1024.7	1025.0	1025.3	1025.6	1025.9	1026.2	1026.5	1026.8	1027.1	1027.4	1027.7	1028.0	1028.3	1028.6	1028.9	1029.2	1029.5	1029.8	1030.1	1030.4	1030.7	1031.0	1031.3	1031.6	1031.9	1032.2	1032.5	1032.8	1033.1	1033.4	1033.7	1034.0	1034.3	1034.6	1034.9	1035.2	1035.5	1035.8	1036.1	1036.4	1036.7	1037.0	1037.3	1037.6	1037.9	1038.2	1038.5	1038.8	1039.1	1039.4	1039.7	1040.0	1040.3	1040.6	1040.9	1041.2	1041.5	1041.8	1042.1	1042.4	1042.7	1043.0	1043.3	1043.6	1043.9	1044.2	1044.5	1044.8	1045.1	1045.4	1045.7	1046.0	1046.3	1046.6	1046.9	1047.2	1047.5	1047.8	1048.1	1048.4	1048.7	1049.0	1049.3	1049.6	1049.9	1050.2	1050.5	1050.8	1051.1	1051.4	1051.7	1052.0	1052.3	1052.6	1052.9	1053.2	1053.5	1053.8	1054.1	1054.4	1054.7	1055.0	1055.3	1055.6	1055.9	1056.2	1056.5	1056.8	1057.1	1057.4	1057.7	1058.0	1058.3	1058.6	1058.9	1059.2	1059.5	1059.8	1060.1	1060.4	1060.7	1061.0	1061.3	1061.6	1061.9	1062.2	1062.5	1062.8	1063.1	1063.4	1063.7	1064.0	1064.3	1064.6	1064.9	1065.2	1065.5	1065.8	1066.1	1066.4	1066.7	1067.0	1067.3	1067.6	1067.9	1068.2	1068.5	1068.8	1069.1	1069.4	1069.7	1070.0	1070.3	1070.6	1070.9	1071.2	1071.5	1071.8	1072.1	1072.4	1072.7	1073.0	1073.3	1073.6	1073.9	1074.2	1074.5	1074.8	1075.1	1075.4	1075.7	1076.0	1076.3	1076.6	1076.9	1077.2	1077.5	1077.8	1078.1	1078.4	1078.7	1079.0	1079.3	1079.6	1079.9	1080.2	1080.5	1080.8	1081.1	1081.4	1081.7	1082.0	1082.3	1082.6	1082.9	1083.2	1083.5	1083.8	1084.1	1084.4	1084.7	1085.0	1085.3	1085.6	1085.9	1086.2	1086.5	1086.8	1087.1	1087.4	1087.7	1088.0	1088.3	1088.6	1088.9	1089.2	1089.5	1089.8	1090.1	1090.4	1090.7	1091.0	1091.3	1091.6	1091.9	1092.2	1092.5	1092.8	1093.1	1093.4	1093.7	1094.0	1094.3	1094.6	1094.9	1095.2	1095.5	1095.8	1096.1	1096.4	1096.7	1097.0	1097.3	1097.6	1097.9	1098.2
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INFLOW PMF AND ONE-HALF PMF

OLD MEMPHIS RESERVOIR

(Local Flows)

MO,DA	HR,MIN	PERIOD	RAIN	EXCS	LOSS	COMP 0	HO,DA	HR,MIN	PERIOD	RAIN	EXCS	LOSS	COMP 0
1.01	1.05	1	.01	0.00	.01	0	1.01	12.35	151	.20	.19	.01	1921.
1.01	1.10	2	.01	0.00	.01	0	1.01	12.40	152	.20	.19	.01	1916.
1.01	1.15	3	.01	0.00	.01	0	1.01	12.45	153	.20	.19	.01	1898.
1.01	1.20	4	.01	0.00	.01	0	1.01	12.50	154	.20	.19	.01	1828.
1.01	1.25	5	.01	0.00	.01	0	1.01	12.55	155	.20	.19	.01	1920.
1.01	1.30	6	.01	0.00	.01	0	1.01	13.00	156	.20	.19	.01	1994.
1.01	1.35	7	.01	0.00	.01	0	1.01	13.05	157	.24	.23	.01	2031.
1.01	1.40	8	.01	0.00	.01	0	1.01	13.10	158	.24	.23	.01	2099.
1.01	1.45	9	.01	0.00	.01	0	1.01	13.15	159	.24	.23	.01	2133.
1.01	1.50	10	.01	0.00	.01	0	1.01	13.20	160	.24	.23	.01	2177.
1.01	1.55	11	.01	0.00	.01	0	1.01	13.25	161	.24	.23	.01	2237.
1.01	1.00	12	.01	0.00	.01	0	1.01	13.30	162	.24	.23	.01	2308.
1.01	1.05	13	.01	0.00	.01	0	1.01	13.35	163	.24	.23	.01	2382.
1.01	1.10	14	.01	0.00	.01	0	1.01	13.40	164	.24	.23	.01	2444.
1.01	1.15	15	.01	0.00	.01	0	1.01	13.45	165	.24	.23	.01	2508.
1.01	1.20	16	.01	0.00	.01	0	1.01	13.50	166	.24	.23	.01	2551.
1.01	1.25	17	.01	0.00	.01	0	1.01	13.55	167	.24	.23	.01	2624.
1.01	1.30	18	.01	0.00	.01	0	1.01	14.00	168	.24	.23	.01	2688.
1.01	1.35	19	.01	0.00	.01	0	1.01	14.05	169	.30	.29	.01	2828.
1.01	1.40	20	.01	0.00	.01	0	1.01	14.10	170	.30	.29	.01	2885.
1.01	1.45	21	.01	0.00	.01	0	1.01	14.15	171	.30	.29	.01	2664.
1.01	1.50	22	.01	0.00	.01	0	1.01	14.20	172	.30	.29	.01	2701.
1.01	1.55	23	.01	0.00	.01	0	1.01	14.25	173	.30	.29	.01	2770.
1.01	2.00	24	.01	0.00	.01	0	1.01	14.30	174	.30	.29	.01	2899.
1.01	2.05	25	.01	0.00	.01	0	1.01	14.35	175	.30	.29	.01	2977.
1.01	2.10	26	.01	0.00	.01	0	1.01	14.40	176	.30	.29	.01	3048.
1.01	2.15	27	.01	0.00	.01	0	1.01	14.45	177	.30	.29	.01	3130.
1.01	2.20	28	.01	0.00	.01	0	1.01	14.50	178	.30	.29	.01	3188.
1.01	2.25	29	.01	0.00	.01	0	1.01	14.55	179	.30	.29	.01	3233.
1.01	2.30	30	.01	0.00	.01	0	1.01	15.00	180	.30	.29	.01	3267.
1.01	2.35	31	.01	0.00	.01	0	1.01	15.05	181	.18	.18	.01	3293.
1.01	2.40	32	.01	0.00	.01	0	1.01	15.10	182	.16	.16	.01	3314.
1.01	2.45	33	.01	0.00	.01	0	1.01	15.15	183	.16	.16	.01	3309.
1.01	2.50	34	.01	0.00	.01	0	1.01	15.20	184	.54	.54	.01	3297.
1.01	2.55	35	.01	0.00	.01	0	1.01	15.25	185	.63	.63	.01	3270.
1.01	3.00	36	.01	0.00	.01	0	1.01	15.30	186	1.54	1.53	.01	3338.
1.01	3.05	37	.01	0.00	.01	0	1.01	15.35	187	2.93	2.93	.01	3523.
1.01	3.10	38	.01	0.00	.01	0	1.01	15.40	188	.94	.94	.01	4082.
1.01	3.15	39	.01	0.00	.01	0	1.01	15.45	189	.63	.63	.01	5074.
1.01	3.20	40	.01	0.00	.01	0	1.01	15.50	190	.54	.54	.01	6783.
1.01	3.25	41	.01	0.00	.01	0	1.01	15.55	191	.36	.36	.01	8029.
1.01	3.30	42	.01	0.00	.01	0	1.01	16.00	192	.36	.36	.01	10327.
1.01	3.35	43	.01	0.00	.01	0	1.01	16.05	193	.28	.27	.01	10971.
1.01	3.40	44	.01	0.00	.01	0	1.01	16.10	194	.28	.27	.01	10747.
1.01	3.45	45	.01	0.00	.01	0	1.01	16.15	195	.28	.27	.01	10016.
1.01	3.50	46	.01	0.00	.01	0	1.01	16.20	196	.28	.27	.01	8695.
1.01	3.55	47	.01	0.00	.01	0	1.01	16.25	197	.28	.27	.01	7866.
1.01	4.00	48	.01	0.00	.01	0	1.01	16.30	198	.28	.27	.01	6413.
1.01	4.05	49	.01	0.00	.01	0	1.01	16.35	199	.28	.27	.01	5882.
1.01	4.10	50	.01	0.00	.01	0	1.01	16.40	200	.28	.27	.01	5224.
1.01	4.15	51	.01	0.00	.01	0	1.01	16.45	201	.28	.27	.01	4636.
1.01	4.20	52	.01	0.00	.01	0	1.01	16.50	202	.28	.27	.01	4111.
1.01	4.25	53	.01	0.00	.01	0	1.01	16.55	203	.28	.27	.01	3677.
1.01	4.30	54	.01	0.00	.01	0	1.01	17.00	204	.28	.27	.01	3223.
1.01	4.35	55	.01	0.00	.01	0	1.01	17.05	205	.22	.21	.01	3059.
1.01	4.40	56	.01	0.00	.01	0	1.01	17.10	206	.22	.21	.01	2922.
1.01	4.45	57	.01	0.00	.01	0	1.01	17.15	207	.22	.21	.01	2818.
1.01	4.50	58	.01	0.00	.01	0	1.01	17.20	208	.22	.21	.01	2727.

1.01	4.55	59	.01	0.00	.01	0.	1.01	17.25	209	.22	.21	.01	3216.
1.01	5.00	60	.01	0.00	.01	0.	1.01	17.30	210	.22	.21	.01	3090.
1.01	5.05	61	.01	0.00	.01	0.	1.01	17.35	211	.22	.21	.01	2964.
1.01	5.10	62	.01	0.00	.01	0.	1.01	17.40	212	.22	.21	.01	2838.
1.01	5.15	63	.01	0.00	.01	0.	1.01	17.45	213	.22	.21	.01	2712.
1.01	5.20	64	.01	0.00	.01	0.	1.01	17.50	214	.22	.21	.01	2586.
1.01	5.25	65	.01	0.00	.01	0.	1.01	17.55	215	.22	.21	.01	2460.
1.01	5.30	66	.01	0.00	.01	0.	1.01	18.00	216	.22	.21	.01	2334.
1.01	5.35	67	.01	0.00	.01	0.	1.01	18.05	217	.22	.21	.01	2208.
1.01	5.40	68	.01	0.00	.01	4.	1.01	18.10	218	.22	.21	.01	2082.
1.01	5.45	69	.01	0.00	.01	10.	1.01	18.15	219	.22	.21	.01	1956.
1.01	5.50	70	.01	0.00	.01	20.	1.01	18.20	220	.22	.21	.01	1830.
1.01	5.55	71	.01	0.00	.01	31.	1.01	18.25	221	.22	.21	.01	1704.
1.01	6.00	72	.01	0.00	.01	43.	1.01	18.30	222	.22	.21	.01	1578.
1.01	6.05	73	.01	0.00	.01	53.	1.01	18.35	223	.22	.21	.01	1452.
1.01	6.10	74	.01	0.00	.01	62.	1.01	18.40	224	.22	.21	.01	1326.
1.01	6.15	75	.01	0.00	.01	77.	1.01	18.45	225	.22	.21	.01	1200.
1.01	6.20	76	.01	0.00	.01	106.	1.01	18.50	226	.22	.21	.01	1074.
1.01	6.25	77	.01	0.00	.01	165.	1.01	18.55	227	.22	.21	.01	948.
1.01	6.30	78	.01	0.00	.01	243.	1.01	19.00	228	.22	.21	.01	822.
1.01	6.35	79	.01	0.00	.01	329.	1.01	19.05	229	.22	.21	.01	696.
1.01	6.40	80	.01	0.00	.01	409.	1.01	19.10	230	.22	.21	.01	570.
1.01	6.45	81	.01	0.00	.01	482.	1.01	19.15	231	.22	.21	.01	444.
1.01	6.50	82	.01	0.00	.01	533.	1.01	19.20	232	.22	.21	.01	318.
1.01	6.55	83	.01	0.00	.01	573.	1.01	19.25	233	.22	.21	.01	192.
1.01	7.00	84	.01	0.00	.01	603.	1.01	19.30	234	.22	.21	.01	62.
1.01	7.05	85	.01	0.00	.01	626.	1.01	19.35	235	.22	.21	.01	276.
1.01	7.10	86	.01	0.00	.01	645.	1.01	19.40	236	.22	.21	.01	150.
1.01	7.15	87	.01	0.00	.01	656.	1.01	19.45	237	.22	.21	.01	24.
1.01	7.20	88	.01	0.00	.01	666.	1.01	19.50	238	.22	.21	.01	174.
1.01	7.25	89	.01	0.00	.01	674.	1.01	19.55	239	.22	.21	.01	148.
1.01	7.30	90	.01	0.00	.01	680.	1.01	20.00	240	.22	.21	.01	122.
1.01	7.35	91	.01	0.00	.01	684.	1.01	20.05	241	.22	.21	.01	96.
1.01	7.40	92	.01	0.00	.01	688.	1.01	20.10	242	.22	.21	.01	70.
1.01	7.45	93	.01	0.00	.01	690.	1.01	20.15	243	.22	.21	.01	44.
1.01	7.50	94	.01	0.00	.01	692.	1.01	20.20	244	.22	.21	.01	18.
1.01	7.55	95	.01	0.00	.01	693.	1.01	20.25	245	.22	.21	.01	2.
1.01	8.00	96	.01	0.00	.01	694.	1.01	20.30	246	.22	.21	.01	276.
1.01	8.05	97	.01	0.00	.01	695.	1.01	20.35	247	.22	.21	.01	150.
1.01	8.10	98	.01	0.00	.01	696.	1.01	20.40	248	.22	.21	.01	24.
1.01	8.15	99	.01	0.00	.01	696.	1.01	20.45	249	.22	.21	.01	174.
1.01	8.20	100	.01	0.00	.01	697.	1.01	20.50	250	.22	.21	.01	148.
1.01	8.25	101	.01	0.00	.01	697.	1.01	20.55	251	.22	.21	.01	122.
1.01	8.30	102	.01	0.00	.01	697.	1.01	21.00	252	.22	.21	.01	96.
1.01	8.35	103	.01	0.00	.01	697.	1.01	21.05	253	.22	.21	.01	70.
1.01	8.40	104	.01	0.00	.01	697.	1.01	21.10	254	.22	.21	.01	44.
1.01	8.45	105	.01	0.00	.01	697.	1.01	21.15	255	.22	.21	.01	18.
1.01	8.50	106	.01	0.00	.01	697.	1.01	21.20	256	.22	.21	.01	2.
1.01	8.55	107	.01	0.00	.01	697.	1.01	21.25	257	.22	.21	.01	276.
1.01	9.00	108	.01	0.00	.01	697.	1.01	21.30	258	.22	.21	.01	150.
1.01	9.05	109	.01	0.00	.01	697.	1.01	21.35	259	.22	.21	.01	24.
1.01	9.10	110	.01	0.00	.01	697.	1.01	21.40	260	.22	.21	.01	174.
1.01	9.15	111	.01	0.00	.01	697.	1.01	21.45	261	.22	.21	.01	148.
1.01	9.20	112	.01	0.00	.01	697.	1.01	21.50	262	.22	.21	.01	122.
1.01	9.25	113	.01	0.00	.01	697.	1.01	21.55	263	.22	.21	.01	96.
1.01	9.30	114	.01	0.00	.01	697.	1.01	22.00	264	.22	.21	.01	70.
1.01	9.35	115	.01	0.00	.01	697.	1.01	22.05	265	.22	.21	.01	44.
1.01	9.40	116	.01	0.00	.01	697.	1.01	22.10	266	.22	.21	.01	18.
1.01	9.45	117	.01	0.00	.01	697.	1.01	22.15	267	.22	.21	.01	2.
1.01	9.50	118	.01	0.00	.01	697.	1.01	22.20	268	.22	.21	.01	276.

COMBINED UPSTREAM ROUTED HYDROGRAPHS
WITH DOWNSTREAM LOCAL HYDROGRAPHS

AD-A104 828

PRC CONSOER TOWNSEND INC ST LOUIS MO
NATIONAL DAM SAFETY PROGRAM. MEMPHIS RESERVOIR DAM (MO 10163) M--ETC(U)
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SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

AND
DAM SAFETY ANALYSIS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN RATIO	1	RATIO	2
				1.00		.50
HYDROGRAPH AT	3	3.05 (7.90)	1	24290, (744,041)	13145, (372,221)	
ROUTED TO	3	3.05 (7.90)	1	7445, (210,031)	2176, (61,621)	
HYDROGRAPH AT	14	1.48 (3.83)	1	10071, (310,671)	5084, (155,341)	
2 COMBINED	18	4.53 (11.73)	1	17150, (485,681)	8571, (196,081)	
ROUTED TO	18	4.53 (11.73)	1	15356, (434,691)	4515, (127,081)	

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

ELEVATION
STORAGE
OUTPUT

INITIAL VALUE
770.00
4109.
0.

SPILLWAY CREST
770.00
4109.
0.

TOP OF DAM
770.00
7030.
8999.

RATIO
OF
BMF
1.00
.50

MAXIMUM
RESERVOIR
W.S. ELEV
779.79
776.28

MAXIMUM
STORAGE
AC-FT
6963.
5873.

MAXIMUM
OUTFLOW
CFS
7405.
2176.

DURATION
OVER TOP
HOURS
0.00
0.00

TIME OF
MAX OUTFLOW
HOURS
16.83
18.25

TIME OF
FAILURE
HOURS
0.00
0.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

ELEVATION STORAGE OUTFLOW
 716.20 235. 0.
 716.20 235. 0.
 720.20 421. 2381.

INITIAL VALUE SPILLWAY CREST TOP OF DAM
 716.20 716.20 720.20
 235. 235. 421.
 0. 0. 2381.

RATIO OF PHF	MAXIMUM RESERVOIR STORAGE W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	724.13	3.93	512.	13359.	9.00	16.33	0.00
.90	721.83	1.23	544.	8515.	3.03	16.58	0.00

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