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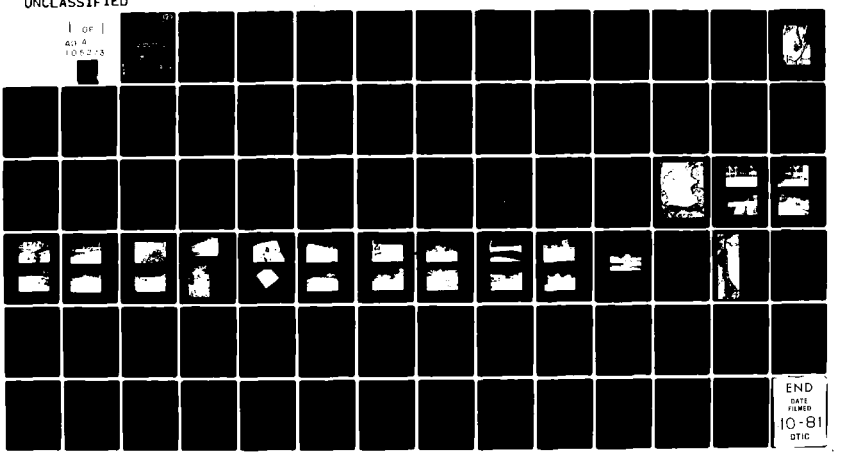

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AD A105273

LAKEVIEW PARK DAM

ST. FRANCOIS COUNTY, MISSOURI

MO 30288

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
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St. Louis District

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FOR: STATE OF MISSOURI

OCTOBER, 1980

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4. TITLE *(and Subtitle)* Phase I Dam Inspection Report National Dam Safety Program Lakeview Park Dam (MO 30288) St. Francois County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Hoskins-Western-Sonderegger, Inc.	8. CONTRACT OR GRANT NUMBER(s) DACW43-80-C-0071
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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National Dam Safety Program. Lakeview Park Dam (MO 30288) Mississippi-Kaskaskia - St. Louis Basin, St. Francois County, Missouri. Phase I Inspection Report.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dam Safety, Lake, Dam Inspection, Private Dams

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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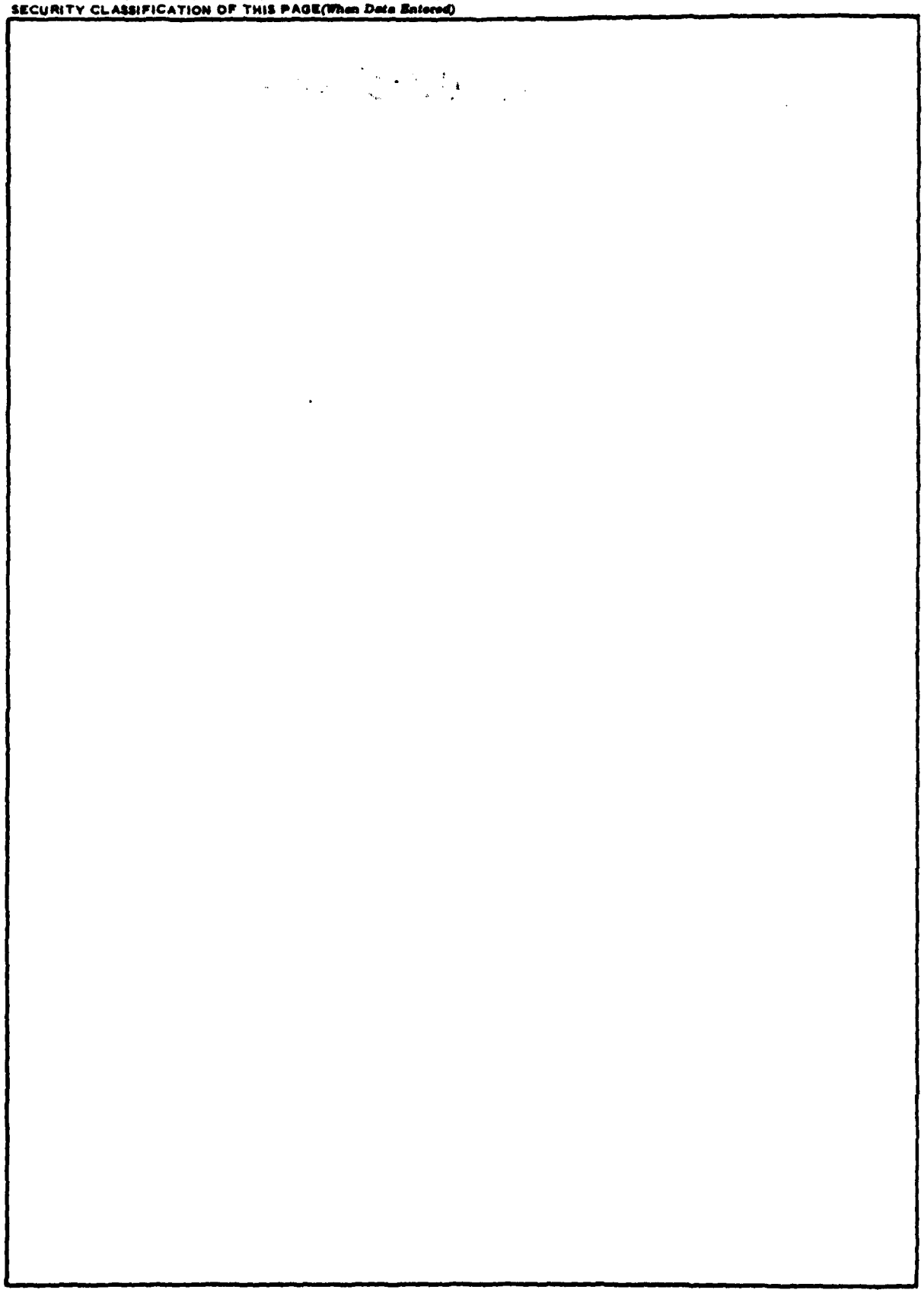

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LAKEVIEW PARK DAM
ST. FRANCOIS COUNTY, MISSOURI
MISSOURI INVENTORY NO. MO 30288

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY
HOSKINS-WESTERN-SONDEREGGER, INC.
CONSULTING ENGINEERS
LINCOLN, NEBRASKA

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

OCTOBER, 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Lakeview Park Dam - MO 30288

This report presents the results of field inspection and evaluation of the Lakeview Park Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division

2 JUL 1981
Date

APPROVED BY: SIGNED
Colonel, CE, Commanding

7 JUL 1981
Date

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM
ASSESSMENT SUMMARY

Name of Dam	Lakeview Park Dam
State Located	Missouri
County Located	St. Francois County
Stream	Turkey Creek
Date of Inspection	October 29, 1980

Lakeview Park Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general conditions of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers.

Lakeview Park Dam has a height of twenty-seven (27) feet and a storage capacity at the minimum top elevation of the dam of one hundred forty (140) acre-feet. In accordance with the guidelines, a small size dam has a height greater than or equal to twenty-five (25) feet but less than forty (40) feet and a storage capacity greater than or equal to fifty (50) acre-feet but less than one thousand (1,000) acre-feet. The size classification is determined by either the storage capacity or height, whichever gives the larger size category. Lakeview Park Dam is classified as a small size dam.

In accordance with the guidelines and based on visual observation, the dam is classified as having a high hazard potential. Failure would threaten life and property. The estimated damage zone extends approximately four (4) miles downstream of the dam. Within the damage zone are a natural gas pipeline and pressure regulating station, 14 or more dwellings, numerous industrial buildings, a railroad, 2 city streets and Highway K.

Our inspection and evaluation indicates that the spillways meet the criteria set forth in the recommended guidelines for a small dam having a high hazard potential. Considering the small volume of water impounded and the broad downstream floodplain, one-half of the Probable Maximum Flood is the appropriate spillway design flood. The spillways will pass the 100-year flood (1% probability flood - a flood having a one percent chance of being exceeded in any one year) without overtopping the dam. The spillways will pass 55% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

Lakeview Park Dam is in good condition. Deficiencies noted include the growth of small trees and brush on the downstream slope, erosion of the downstream slope, the lack of good vegetative cover on the downstream slope and the need to clean and reshape the approach channel to the spillways.

Design data were not available for this 100-year old dam. Based on visual observation, an interview with Mr. Gayle Blackwell, City Manager of Bonne Terre and on analysis made during and subsequent to the inspection, the following recommendations are made:

a. Alternatives.

(1) The spillways will pass 55% of the probable maximum flood. No alternative is required for enlargement of the spillways.

(2) In view of the number of dwellings and industrial buildings in the downstream damage zone, it is recommended that the owner develop a reliable flood warning and evacuation plan.

b. Operation and Maintenance Procedures.

(1) Seepage and stability analyses comparable to the requirements of the recommended guidelines were not available. However, in light of the performance history and abnormally large cross section of this dam, such analyses are not considered essential to this evaluation of safety.

(2) Cleaning and reshaping the approach channel of the spillways would improve the hydraulic efficiency of the structure.

(3) Clearing trees and brush, reshaping and revegetating the downstream slope would improve the erosional resistance of the slope and facilitate more meaningful inspections with respect to seeps and deformations.

(4) If fill dirt is being borrowed from the embankment, the practice should be halted.

(5) A program of regular inspections should be initiated and the reports made a portion of this project file.

Rey S. Decker
E-3703

Gordon Jamison

Gordon Jamison

Garold Ulmer

Garold Ulmer
E-19246

H. P. Hoskins

Harold P. Hoskins, Chairman of the Board
Hoskins-Western-Sonderegger, Inc.
E-8696

PHOTO NO. 1 - OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKEVIEW PARK DAM - MO 30288
ST. FRANCOIS COUNTY, MISSOURI

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Lakeview Park Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. 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 to "Report of the Chief of Engineers on the National Program of Inspection of Dams," dated May, 1975, and published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) Embankment. This dam is composed of massive quantities of mill tailings from zinc-lead mining operations. The length from the left abutment (north) to the right end (south) is approximately 880 feet. (Station 0+50± to Station 9+30± as shown on Plate C-1, Appendix C.) The left 350 feet of the dam (Station 0+50± to Station 4+00) has been classified for purposes of this report as an emergency spillway. The profile elevation of 865.1 at Station 4+00 is used in this report as the minimum top of dam elevation. The height of the dam based on this elevation is 27 feet ± and the maximum storage is 140 acre-feet ±.

(2) Principal Spillway. The principal spillway is uncontrolled and consists of approximately 250 feet of vegetated earth approach channel constructed through the left (north) abutment

leading to a 15-inch diameter corrugated metal pipe culvert which crosses under the paved road that traverses the length of the dam. The low point on the emergency spillway is located almost directly above the culvert. The upstream end of the culvert is protected by a mortared stone headwall.

(3) Emergency Spillway. The emergency spillway is uncontrolled and consists of the paved road that traverses the dam between Stations 0+50± and 4+00±. The low point in the profile of the emergency spillway is at the approximate location of the 15-inch pipe that serves as the principal spillway. The length of approach to the paved road, from normal pool elevation of the lake, varies from 40 feet ± at Station 4+00 to a maximum of 250 feet ± at Station 1+00. The paved surface of the road is approximately 22 feet in width and serves as the control section for the spillway. Flows through the spillway, after crossing the paved road, will be on a broad road shoulder which breaks to a 1V on 3.4H maximum slope at Station 4+00± to intersect the original ground line. Flows crossing the spillway will flow away from the toe of the dam and should not endanger the dam at the point of maximum section.

(4) Low-Level Outlet. The low-level outlet is a 10-inch cast iron pipe that runs from the reservoir through the dam to a manually operated gate valve that is housed in a concrete block valve pit located approximately 260 feet downstream from the centerline of the paved road that traverses the dam. The 10-inch pipe surfaces approximately 20 feet downstream from the valve pit. Photos 14 and 15 show the valve and valve pit. Photo No. 13 shows the outlet end of the drawdown pipe.

(5) Pertinent physical data are given in paragraph 1.3.

b. Location. The dam is located in the northwest part of St. Francois County as shown on Plate A-2. The dam and lake are near the south corporate limits of the City of Bonne Terre and are in the extreme southwest corner of Survey #467 as shown on Plates A-1 and A-2.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Lakeview Park Dam has a height of 27 feet and a storage capacity of 140 acre-feet. This dam is classified as a small size dam. A small size dam has a height greater than or equal to 25 feet but less than 40 feet and a storage capacity greater than or equal to 50 acre-feet but less than 1,000 acre-feet. The size classification is determined by either the storage or height, whichever gives the larger size category.

d. Hazard Classification. Guidelines for determining hazard classification of dams and impoundments are presented in the guidelines as referenced in paragraph 1.1c above.

Aerial photographs of the downstream damage zone of this dam were taken in October, 1980. These photographs were used as reference in the field observations of the damage zone which were made during the inspection. Based on the field observations and on the referenced guidelines, this dam is in the High Hazard Potential Classification. The estimated damage zone extends approximately 4 miles downstream of the dam. Within the damage zone are a natural gas pipeline and pressure regulating station, 14 or more dwellings, numerous industrial buildings, a railroad, 2 city streets and Highway K.

e. Ownership. The dam is owned by the City of Bonne Terre, Missouri 63628 - Attention: Mr. Gayle Blackwell, City Manager.

f. Purpose of Dam. This dam impounds water that is used for recreation purposes.

g. Design and Construction History. Design data were not available for this dam nor is much known about the construction history. Mr. Gayle Blackwell, City Manager of Bonne Terre, was very helpful in furnishing the following information:

(1) The dam was constructed approximately 100 years ago.

(2) The purpose of the dam, at the time of construction, was to impound water which was pumped from mines. The water was used for water supply by the City of Bonne Terre and by a lead-zinc mill.

(3) Delivery of water to the two users was through two 10-inch cast iron pipelines which were valve controlled. One of these lines has been permanently plugged, and the other is now used as a low-level outlet. Depth of the low-level outlet below normal pool elevation is approximately 20 feet.

(4) Materials of construction were mill tailings.

(5) The lake was drained to the level of the low-level outlet in 1976 in order to remove silt that had settled in the lake.

(6) The material removed from the lake bottom was used in two locations. Three to four feet of material was placed on the south side of the dam to bring a low area up to road or crest of dam grade. (This area is the area shown on Plate C-1 between Stations 1+00 and 4+00 and is bounded by the shoreline of the lake and the spillway channel.) The second location where material was placed was on the north side of the dam (Station 1+00± to Station 5+50±). Placement in this location resulted in widening the crest as well as the base of the dam.

(7) The depth of water remaining in the deepest part of the lake after drawdown for silt removal was approximately 30 feet. The

maximum depth of water in the lake based on normal pool elevation is approximately 50 feet as determined by soundings made by City personnel. (Based on these comments and a study of the topography of the area, it would seem probable that at least portions of the lake occupy an area where open pit mining was done and that the dam was constructed downstream from the open pit. The maximum depth as reported is considerably greater than can be accounted for by contour analysis. An unknown volume of water lying below the level of the original channel would not be released in case of total failure of the dam.)

h. Normal Operating Procedure. Mr. Blackwell stated in the interview that a standing order has been issued to City personnel to open the valve on the 10-inch low-level outlet line when the principal spillway nears capacity flow. He also stated that a submersible pump had been installed in a flooded mine lying to the west of the reservoir. This pump is operated from May until October on a round-the-clock basis in order to maintain the level and quality of the water in the lake. The rate of pumping was quoted as 108,000 gallons per day. In addition, the pool level is controlled by rainfall, infiltration, evaporation and the capacity of the uncontrolled spillways.

1.3 PERTINENT DATA

a. Drainage Area. 85.5 acres (0.134 square miles).

b. Discharge at Damsite.

(1) All discharges at the damsite are through the following:

(a) A principal spillway consisting of approximately 250 feet of vegetated earth approach channel leading to a 15-inch diameter corrugated metal pipe culvert that crosses under the paved road that traverses the length of the dam.

(b) An emergency spillway consisting of a crest formed by the low profile of the paved road from Station 0+50± to Station 4+00± on the dam profile (numbered left to right looking downstream). The approach channel to the emergency spillway crest is triangular in shape with the base being the right bank of the principal spillway approach channel.

(2) Estimated maximum flood at damsite -- Unknown. Mr. Blackwell stated that long-time residents claim that water has come close to flowing across the road on a few occasions.

(3) The principal spillway capacity varies from 0 c.f.s. at elevation 860.0 feet to 11 c.f.s. at the crest of the emergency spillway (elevation 863.7 feet) to 13 c.f.s. at the minimum top of dam (elevation 865.1 feet, field measurement).

(4) The emergency spillway capacity varies from 0 c.f.s. at its crest (elevation 863.7 feet) to 730 c.f.s. at the minimum top of dam (elevation 865.1 feet).

(5) Total spillway capacity at the minimum top of dam is 743 c.f.s. ±.

c. Elevations (feet above M.S.L.).

(1) Observed pool - 860.0±

(2) Normal pool - 860.0±

(3) Spillway crests

Principal - 860.0±

Emergency - 863.7±

(4) Maximum experienced pool - 863.0± (estimated on basis of claims made by long-time residents).

(5) Top of dam (minimum) - 865.1

(6) Stream bed at centerline of dam - 838± (based on Mr. Blackwell's statement in regard to depth of drawdown pipe).

(7) Maximum tailwater - Unknown

d. Reservoir. Length (feet) of pool.

(1) At principal spillway crest - 1100±

(2) At emergency spillway crest - 1200±

(3) At top of dam (minimum) - 1300±

e. Storage (acre-feet).

(1) Observed pool - 82±

(2) Normal pool - 82±

(3) Spillway crests

Principal - 82±

Emergency - 120±

(4) Maximum experienced pool - 115±

(5) Top of dam (minimum) - 140±

f. Reservoir Surface (acres).

(1) Observed pool - 9.2±

(2) Normal pool - 9.2±

(3) Spillway crests

Principal - 9.2±

Emergency - 11.8±

(4) Maximum experienced pool - 11.3±

(5) Top of dam (minimum) - 13.0±

g. Dam.

(1) Type - Earth fill

(2) Length - 880 feet

(3) Height - 27 feet ±

(4) Top width - Variable (50' minimum to 180' maximum)

(5) Side slopes

(a) Downstream - Variable - 1V on 2.5 to 3H

(b) Upstream - Variable - 1V on 2.5 to 3H

(6) Zoning - Unknown

(7) Impervious core - Unknown

(8) Cutoff - Unknown

(9) Grout curtain - Unknown

(10) Wave protection - Limestone riprap

(11) Drains - Unknown

h. Diversion Channel and Regulating Tunnel. None.

i. Spillways.

(1) Principal

(a) Type - The principal spillway is an uncontrolled 15-inch corrugated metal pipe culvert which crosses under the

road crossing the dam. A vegetated earth channel approximately 250 feet in length leads from the lake to the culvert.

(b) Crest (invert) elevation - Channel - 860.0
- 15" CMP - 858.8

Outlet - 15" CMP - 856.2

(c) Length - Channel - 250 feet ±
- 15" CMP - 68 feet ±

(2) Emergency

(a) Type - The emergency spillway is a portion of the dam extending from Station 0+50± on the left (north) to Station 4+00± (south). The original crest width of the dam in this area is not known; however, material removed from the lake during desilting operations in 1976 were deposited on the upstream side of the dam to raise the area to the elevation of the road crossing the dam. The area was graded to drain from the road to the lake. The effect of this work was to widen the crest of the dam. Significant amounts of material removed from the lake were also deposited on the downstream side of the asphalt surfaced road which further increased the crest and base width of the dam.

(b) Control Section - The control section is a 22-foot width asphalt surfaced road extending from Station 0+50± to Station 4+00±.

(c) Crest Elevation - 863.7±

(d) Upstream Channel - The vegetated earth channel that serves the principal spillway also serves the emergency spillway. Discharges exceeding the capacity of this channel will flow across the wide crest of the dam to the asphalt surfaced road which acts as the control section. The earth channel slopes upward from the lake for the first 100 feet ± to a high point, then breaks downward to flow to the principal spillway pipe. There are a few trees on either side of the channel which will not be detrimental to spillway discharges. The overland approach to the control section is across well vegetated earth and a widened road section which is well graveled. The overland approach is the area that was filled in 1976. Other than a few trees along the shore of the lake, there are no obstructions that would affect flows.

(e) Downstream Channel - The original downstream channel from the dam is covered with an overburden of mill tailings

as shown in Photo No. 1 - Overview. The depth of the overburden at the downstream toe of the dam is not known. The downstream channel from the principal and emergency spillways is through the wooded area shown in the lower right quadrant of Photo No. 1. The channel begins at the road at the right center of the photo and follows a curved course through the wooded area exiting from the photo at the lower right corner. The channel is overgrown with trees and brush, but did not show signs of significant erosion.

j. Regulating Outlets. There is a 10-inch draw-down pipe through the base of the dam. The inlet is about 20 feet below the normal pool elevation.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Design data were not available for this dam.

2.2 CONSTRUCTION

No construction data were available for this dam. Mr. Blackwell, City Manager, reported that the dam had been constructed approximately 100 years ago to impound water pumped from a mine. He also reported that material taken from the lake bottom in 1976 during desilting operations was deposited upstream and downstream from the road crossing the dam in the area now classified as the emergency spillway.

2.3 OPERATION

The spillways are uncontrolled. Mr. Blackwell stated that the lake elevation is kept rather constant during the summer months by pumping water from an adjacent mine tunnel. He also stated that the 10-inch draw-down pipe is put into operation whenever the principal spillway approaches capacity flow.

2.4 EVALUATION

a. Availability. No data were available.

b. Adequacy. The field surveys, visual observations and the verbal report of Mr. Blackwell presented herein are considered adequate to support the conclusions of this report. 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. However, due to the long history of this dam (100 years ±), its lack of signs of stress indicating instability, its abnormally large cross section, its resistance to earthquake damage (6 modified Mercalli intensity IV earthquakes since construction) and its lack of any seepage emerging to the surface would indicate that the dam is structurally stable and that the requirement for seepage and stability analyses should be waived.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the Lakeview Park Dam was made on October 29, 1980. Engineers from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska, making the inspection were:

Rey S. Decker - Geotechnical
Garold G. Ulmer - Hydraulics and Hydrology
Gordon Jamison - Hydraulics and Hydrology

The owner was represented during the inspection by Mr. Gayle Blackwell, City Manager, who was also interviewed prior to the inspection.

b. Dam.

(1) Geology and Soils (abutment and embankment). The embankment is situated in the hilly northern region of the St. Francois mountains on the eastern border of the Ozark Physiographic Province. The predominate soil association is the Hagerstown-Tilsit silty clay-silty clay loam. The predominate structural features are the Schultz fault, 2 miles to the southwest; and the Carbanne fault, 1.5 miles to the northwest.

The embankment is composed of a mixture of clayey silt (MH), silty clay (CH) and sand-gravel mill tailings (SP-GP). The embankment apparently lies atop an old mill tailings pile composed of crushed limestone (SP-SM) material. The valley soils are composed of silts and clayey silts (ML-MH) with a sand and gravel fraction. The tailings pile and alluvial soils fill in a deep valley cut into the bedrock. The Bonne Terre formation, Cambrian Age, lies at an undetermined depth. Drainage under the embankment is controlled by the underlying alluvium and mill tailings.

The embankment occurs in Seismic Zone 2 which is indicative of moderate probability of seismic activity. Earthquakes, within a 50-mile radius, having modified Mercalli intensities equal to or greater than IV, occurred in 1907, 1929, 1946, 1967, 1973 and 1976.

Solution cavitation with consequent catastrophic collapse is unlikely at this impoundment.

(2) Upstream Slope. The upstream slope is well protected by limestone and chert riprap varying in size from about 3 to 18 inches. There was no indication of significant erosion along the water line. There were no indications of crack, slumps or rodent activity. There are a number of 6 to 8-inch diameter

trees growing on the upstream slope. The slope of the upstream face is variable, which is probably due to the age of the dam and the rehabilitation it has undergone through the years. Photos 4 and 10 show the upstream face.

(3) Crest. The profile of the crest is uniform in grade, reflecting the use of the dam as a paved road. The high point in the profile is on the right (south) side and is dictated by the elevation of the railroad crossing on the east. The low point is on the left (north) side at the principal spillway location. Plate C-1 shows the plan and profile of the dam. The asphaltic concrete road traversing the length of the dam is 22 feet ± in width and is in good condition with no visible signs of distress. The crest width is unusually wide and varies from 50 to 180 feet ±. In addition to the paved road, an overhead power line and a natural gas pipeline also traverse the length of the dam. A gas pressure regulating station is located at the widest point of the crest (Station 7+00±). There was no evidence of cracking or unequal settlement in the crest nor was there any rodent activity. The materials on either side of the paved road consist of ML and MH-CH with chert and limestone gravel. Views of the crest are shown in Photos 3, 4, 11 and 18.

(4) Downstream Slope. The roughly triangular shaped fill extending from Station 5+50± to Station 9+30± as shown on Plate C-1, Plate B-1 and Photo No. 1 - Overview is located in the deeper portion of the original valley. The slopes of the downstream section through this length of the dam are variable. The maximum measured was 1V:1.4H at Station 8+75 as compared to 1V:2.4H at Station 6+32. The surface of the downstream slope in this area is very irregular, and it is not known whether the material was placed as part of the embankment or makes up a part of an old tailings dump. It would appear, however, that the irregularities were due to methods of construction. There were no signs indicating slumping or sliding of the slope. It is not known whether the configuration of the slope shown in Photo No. 12 is due to original construction or to subsequent borrowing of fill material from the slope.

Considerable erosion was evident in portions of the downstream slope in this area of the dam. Mr. Blackwell stated that City personnel monitor the downstream slope for erosion and occasionally will send in heavy equipment to dress the slopes. Vegetative growth on the downstream slope in this area consists of weeds, a sparse growth of crown vetch, brush and small saplings.

The only evidence of possible seepage was a growth of phreatophytes which were observed downstream from Station 5+65± as shown in Photo No. 9. No free water was observed.

Materials in the downstream slope were field classified as SM-SP mill tailings mixed with ML-MH soils and cherty limestone gravel and cobbles probably from mine waste. Materials at the base of the slope generally consist of SM-SP mill tailings as shown in Photos 16 and 17. Photos 8, 9, 19, 20 and 21 show other views of the downstream slope.

The length of dam extending from Station 0+50 to Station 5+50± spanned the upper level of the valley in which the dam was built. The downstream slope of the length between Station 1+00± and Station 5+50± was modified by addition of significant quantities of materials taken from the lake bottom during desilting operations in 1976. The maximum measured slope was 1V to 3.4H for a distance of 15 feet ± as shown on the cross section taken at Station 4+00±. The vegetation on the downstream slope along this length of the dam consists of an undercover of crown vetch and a heavy cover of weeds. The weed growth is shown in the foreground of Photo No. 8. No evidence of abnormal deformations or excessive erosion was noticed in this area of the dam. The heavy weed growth on the downstream slope made visual observations very difficult.

(5) Miscellaneous. The effective crest of the dam is extremely wide and the road surface appears to be in good condition.

The apparent use of noncohesive silty and sandy mill tailings for the foundation and parts of the embankment might ordinarily cause concern about structural stability in a Seismic Zone 2 area. However, this dam has such an abnormally large cross sectional area and base width-height ratio that it is highly improbable that a Zone 2 earthquake would cause serious damage to this dam.

c. Appurtenant Structures.

(1) Principal Spillway. The approach channel to the highway culvert is becoming channelized and blocked with leaves, tall grass, and other debris. The headwall to the culvert is made of stone and mortar and appears to be in good condition. The downstream end of the 15-inch culvert was exposed and appears to be in fair condition. Photos 5 and 6 show the approach channel and Photo No. 7 shows the entrance to the culvert.

(2) Emergency Spillway. The upstream approach to the emergency spillway (Station 0+50± to Station 4+00±) is across well vegetated, gently sloping terrain to a graveled roadside parking area that leads to the asphalt-surfaced road that traverses the length of the dam. The approach channel to the principal spillway is cut through the left side of this area and serves as a channel to the emergency spillway as well. Photos 4, 5

and 6 show portions of the approach. Station 4+00 is located approximately midway between the two trees in the center of Photo No. 4 where the shoreline of the lake begins turning away from the road. The graveled section of the widened road is in very good condition with no signs of distress. The asphalt surfaced road is in good condition.

(3) Low-Level Outlet. The low-level outlet appeared to be open, and the valve was accessible. According to Mr. Blackwell, the valve is opened at least once every summer. Photos 13, 14 and 15 show views of the valve, valve pit and outlet end of the pipe.

d. Reservoir Area. There was no significant erosion along the shoreline of the reservoir. Mr. Blackwell stated that the water level had been lowered in 1976 and the sediments which had accumulated for almost a century had been removed.

e. Downstream Channel. There is no significant erosion in the channel immediately downstream from the principal spillway. The channel for about 1000 feet downstream of the spillway is overgrown with trees and shrubs. Spillway discharges do not encroach upon the dam.

3.2 EVALUATION

This dam appears to be in good condition even though the downstream slope looks more like a waste pile than a dam. It has been in place for about 100 years without any serious seepage or stability problems. No information is available on the kind of materials used for the embankment except that it appears to be largely noncohesive silty and/or sandy (ML-SP) mill tailings and gravelly clayey silt (ML-MH) mine waste. However, the abnormally wide crest and base width to height ratio would indicate adequate safety against shear failures even with moderate (Zone 2) seismic forces. The potential for liquifaction and volume change in the mill tailings foundation materials due to moderate earthquake forces is not known. However, liquifaction is not considered to be a serious problem for this dam since it appears that seepage under the dam is well below the ground surface, and the dam has been subjected to at least six earthquakes of modified Mercalli intensity IV or higher without apparent distress.

"Old timers" report that the dam has never been overtopped. The hydraulic/hydrologic analyses conducted for this report indicate that the deep valley section of the dam will not be overtopped by 50% of the probable maximum flood. Discharges through the emergency spillway for a prolonged period of time could be expected to cause erosive damage to the slope downstream from the paved road due to the nature of the materials forming the embankment. In the unlikely event of erosion continuing upstream to the lake, the water released from the reservoir would be approximately 80 acre-feet as compared to 140 acre-feet if the dam were breached at the location of the old channel.

The breach would not occur suddenly due to the amount of earth fill upstream from the paved road and the depth of water in the valley downstream from the dam would be much less than would be expected from a breach occurring in the deep valley section of the dam.

Trees and brush growing on the dam will probably never endanger the integrity of the structure since it has such a wide crest and cross section. Grubbing and dressing up and maintaining the downstream slope would, however, make future inspections and monitoring of seepage and/or deformations following seismic activities much easier and more meaningful.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The pool level is largely controlled by rainfall, infiltration, evaporation, and the capacity of the uncontrolled spillways. In the summer months, the pool level is maintained by pumping into the lake from a flooded mine tunnel adjacent to the lake. The pool level can be lowered by use of the 10-inch low-level outlet pipe.

4.2 MAINTENANCE OF DAM

Maintenance work on the dam is done by the City. There is no regular scheduled maintenance program. Mr. Blackwell reported that they watch the downstream slope and when erosion becomes significant, "they go in from time to time and straighten it up."

Clearing the trees and brush and dressing up the downstream section to form a fairly uniform surface on the slope followed by establishment of grass and legume cover would facilitate future maintenance and inspections.

4.3 MAINTENANCE OF OPERATING FACILITIES

The valve and pipe of the low-level outlet system are maintained in operating condition by the City.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in effect for this dam.

4.5 EVALUATION

Considering the age of the dam, maintenance of the structure appears to be reasonably good. Clearing, evening the surface and vegetating the downstream slope would reduce the erosion potential and future maintenance requirements.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were available for this dam.

b. Experience Data. The drainage area, reservoir surface area, and elevation-storage data were developed from the USGS Bonne Terre, Missouri 7½ minute topographic quadrangle map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on data collected in the field at the time of the field inspection. Hydraulic/hydrologic computations are included as Appendix D of this report.

c. Visual Observations.

(1) The approach channel to the culvert under the highway should be cleaned, reshaped, and a gradual negative slope maintained between the entrance to the channel and the inlet to the culvert.

(2) The length of dam from Station 0+50± to Station 4+00± has been classified as an emergency spillway due to the configuration of the profile of the dam and to the extraordinary width of the crest of the dam. The spillway is uncontrolled and consists of the 22-foot wide asphalt paved road which serves as the control section. The approach distance from normal pool to the upstream edge of the paved road (measured normal to the road) varies uniformly from 40 feet ± at Station 4+00 to 160 feet ± at Station 2+00. The 250-foot length vegetated earth channel that leads to the principal spillway also leads to the low point of the emergency spillway. Flows exceeding the capacity of the earth channel will rise on the approach area to the road until the road is overtopped. Plate C-1 shows the plan and profile of the dam.

d. Overtopping Potential. The spillways will pass 50% of the Probable Maximum Flood (PMF) and the 1% probability flood without overtopping the dam. The spillway capacity is 55% of the PMF. The results of the routings through the dam are tabulated in regards to the following conditions:

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	*Maximum Depth Over Dam Feet	Duration Over Top Hours
1%	395	9	862.5	-	-
1/2 PMF	810	640	865.0	-	-
PMF	1620	1440	865.5	0.4	0.5
0.55 PMF	890	743	865.1	-	-

*Minimum top of dam elevation - 865.1 feet

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and a small size. Therefore, the 1/2 PMF to PMF is the test for the adequacy of the dam and its spillway.

The estimated damage zone is described in paragraph 1.2d in this report.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation. The dam is apparently structurally stable. It has been in place for about 100 years, and has been subjected, according to reports, to maximum loading conditions including several Mercalli IV or stronger earthquakes. There is no evidence of detrimental seepage, slides, or abnormal deformations.

b. Design and Construction Data. No design or construction data were available. 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. However, due to the long history of this dam (100 years ±), its lack of signs of stress indicating instability, its abnormally large cross section, its resistance to earthquake damage (6 modified Mercalli intensity IV earthquakes since construction) and its lack of any seepage emerging to the surface would indicate that the dam is structurally stable and that the requirement for seepage and stability analyses should be waived.

c. Operating Records. The operating facilities for this dam are a 10-inch diameter gate valve controlled low-level outlet and a submersible pump which is installed in a flooded mine lying to the west of the reservoir. Mr. Blackwell stated that there has been a standing order issued to City personnel to open the valve on the low-level outlet line when the spillway nears capacity flow. He also stated that the pump was operated from May to October on a round-the-clock basis to maintain the level and quality of the water in the reservoir.

d. Post-Construction Changes. The inspection team is not aware of any post-construction changes on the dam. Sediment accumulations in the reservoir were removed in 1976, and the sediment removed was placed on the upstream and downstream sides of the paved road crossing the dam in the length classified as emergency spillway.

e. Seismic Stability. This dam is located in Seismic Zone 2. An earthquake of the magnitude predicted in this area might cause some damage to this dam, but it is not likely that it would cause failure.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Based on visual observation this dam appears to be structurally stable and in good condition. The spillways of the dam will pass 55% of the probable maximum flood without overtopping the deep valley portion of the dam. The dam is characterized by its wide crest widths and large cross sections. Trees growing on the upstream slope and the crest of the dam should not endanger the integrity of the dam because of the bulk of material in the dam. The trees and brush growing on the downstream slope should be removed in order to facilitate repair of eroded areas. The erosional scars should be repaired, the slope evened and a vegetative cover established that will improve the erosional resistance of the slope. The approach channel to the spillways should be cleaned of debris and reshaped in order to improve the hydraulic efficiency of the dam. 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. However, due to the long history of this dam (100 years ±), its lack of signs of stress indicating instability, its abnormally large cross section, its resistance to earthquake damage (6 modified Mercalli intensity IV earthquakes since construction) and its lack of any seepage emerging to the surface would indicate that the dam is structurally stable and that the requirement for seepage and stability analyses should be waived.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based on long performance history, the interview with Mr. Blackwell, and visual observations. It is recommended that the requirement of the "Recommended Guidelines for Safety Inspection of Dams" in regard to seepage and stability analyses be waived for the reasons stated in paragraphs 2.4.b, 6.1.b and 7.1.a above.

c. Urgency. There does not appear to be an immediate urgency to accomplish the remedial measures recommended in paragraph 7.

d. Necessity for Further Investigations. Further investigations are not considered necessary.

e. Seismic Stability. This dam is located in Seismic Zone 2. An earthquake of this magnitude might cause some damage to this dam, but would not be expected to cause failure in light of the long performance history on this dam, as discussed in paragraphs 3.2 and 6.1.b.

7.2 REMEDIAL MEASURES

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a registered professional engineer experienced in the design and construction of earth dams.

a. Alternatives.

(1) The spillways will pass 55% of the probable maximum flood. No alternative is required for enlargement of the spillways.

(2) In view of the number of dwellings and industrial buildings in the downstream damage zone, it is recommended that the owner develop a reliable flood warning and evacuation plan.

b. Operation and Maintenance Procedures.

(1) Seepage and stability analyses comparable to the requirements of the recommended guidelines were not available. However, in light of the performance history and abnormally large cross section of this dam, such analyses are not considered essential to this evaluation of safety.

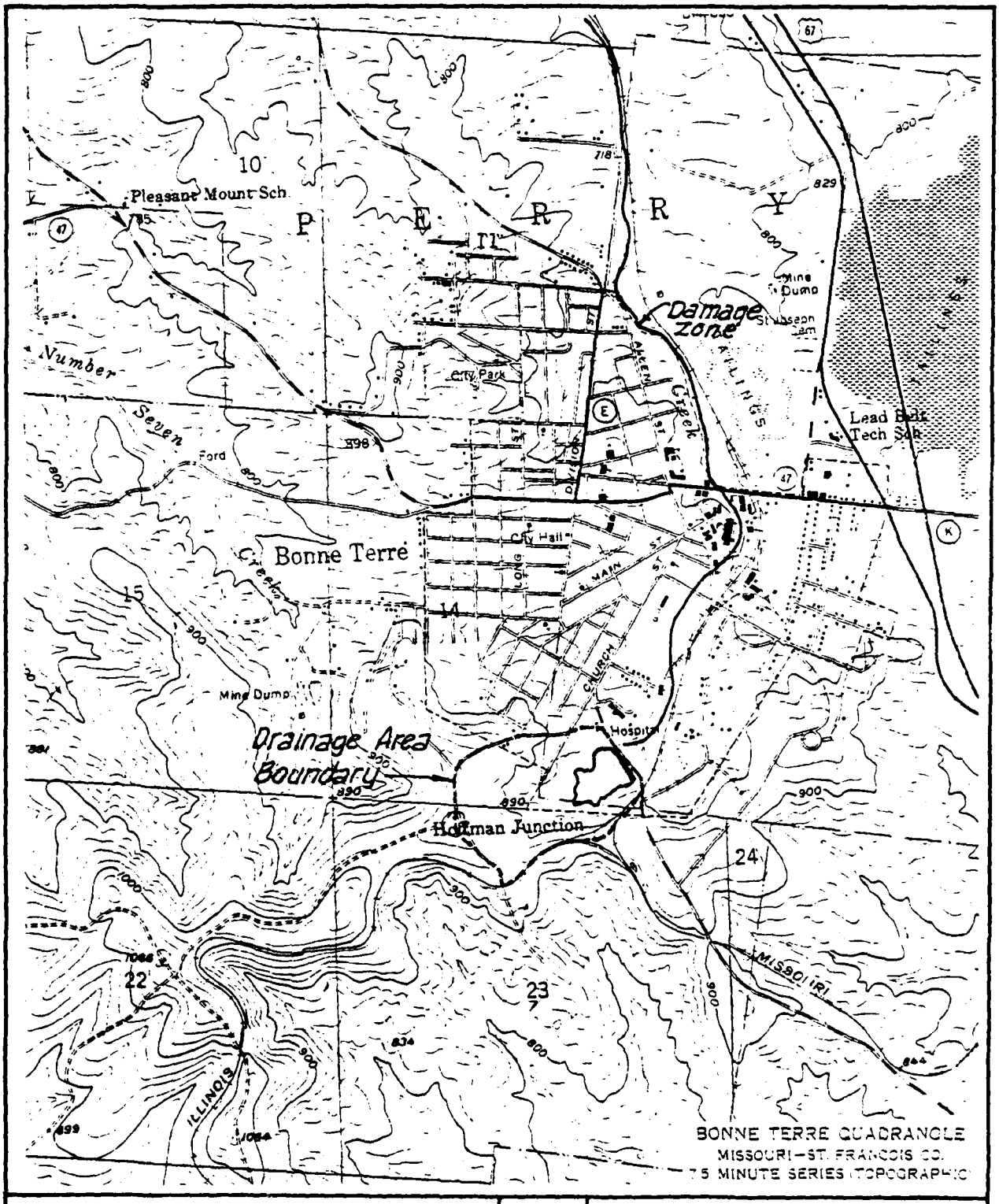
(2) Cleaning and reshaping the approach channel of the spillways would improve the hydraulic efficiency of the structure.

(3) Clearing the small trees and brush, reshaping and revegetating the downstream slope would improve the erosional resistance of the slope and facilitate more meaningful inspections with respect to seeps and deformations.

(4) If fill dirt is being borrowed from the embankment, the practice should be halted.

(5) A program of regular inspections should be initiated and the reports made a portion of this project file.

APPENDIX A
MAPS



Scale in feet

2000 1000 0 2000 4000

Contour Interval – 20'

N

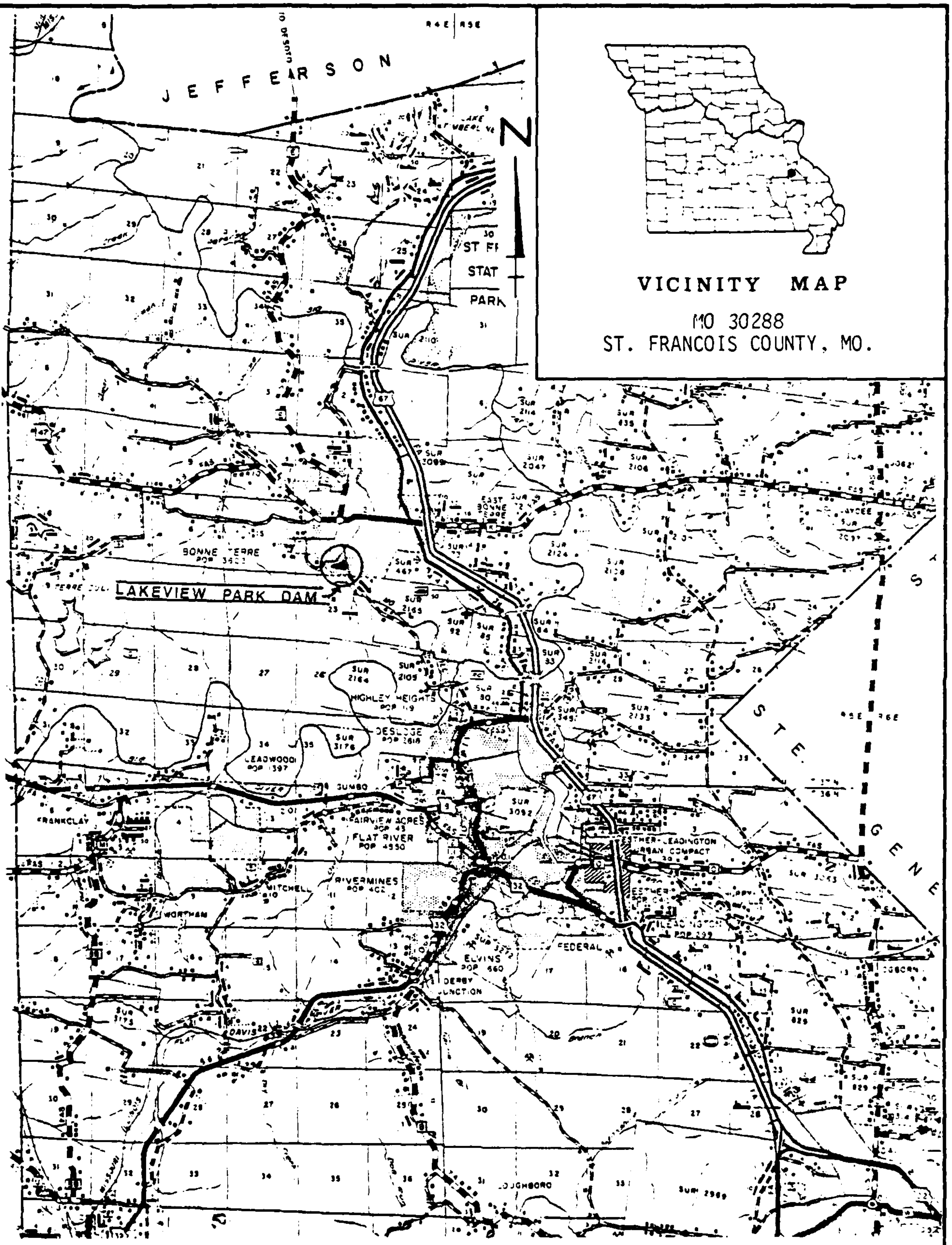
VICINITY TOPOGRAPHY

LAKEVIEW PARK DAM

ST. FRANCOIS COUNTY, MISSOURI

MO 30288

PLATE A-1

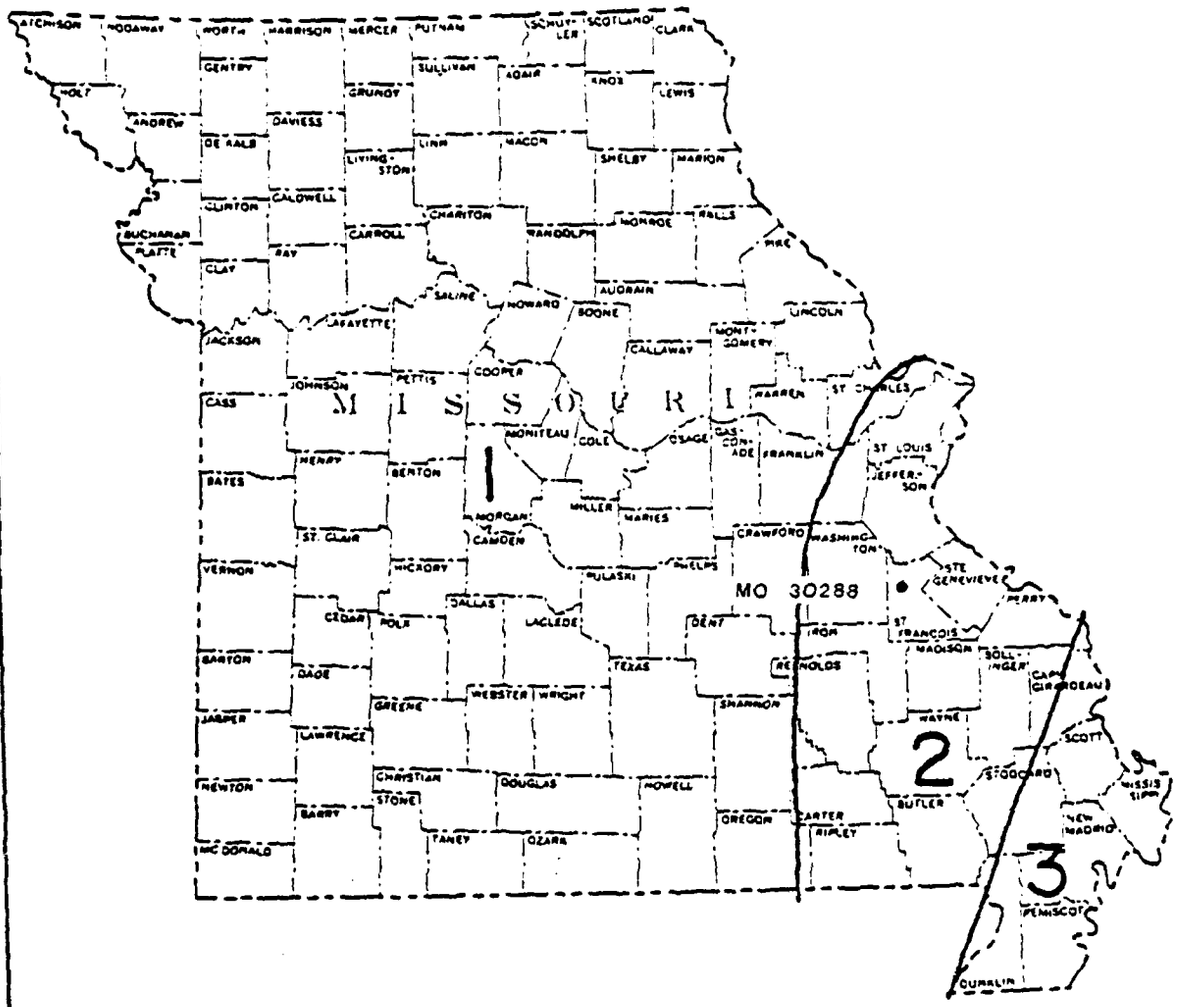


Scale in miles

0 1 2 3 4 5

LOCATION MAP

PLATE A-2



MISSOURI
SEISMIC ZONE MAP

PLATE A-3

APPENDIX B
PHOTOGRAPHS

LAKEVIEW PARK DAM
ST. FRANCOIS COUNTY, MISSOURI
MO. 30288

PHOTO INDEX

PLATE B-1

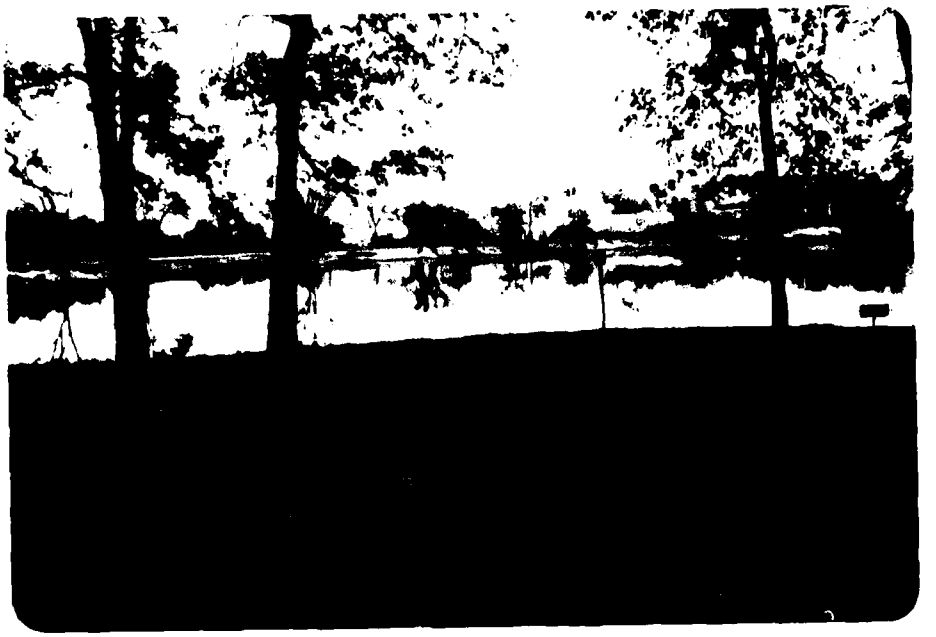


PHOTO NO. 2 - OVERVIEW FROM LEFT UPSTREAM BANK

PHOTO NO. 3 - CREST OF DAM FROM LEFT END

PHOTO NO. 4 - UPSTREAM FACE FROM LEFT END

PHOTO NO. 5 - LOOKING DOWNSTREAM INTO ENTRANCE OF PRINCIPAL SPILLWAY CHANNEL

PHOTO NO. 6 - LOOKING DOWNSTREAM IN SPILLWAY CHANNEL FROM FOOTBRIDGE

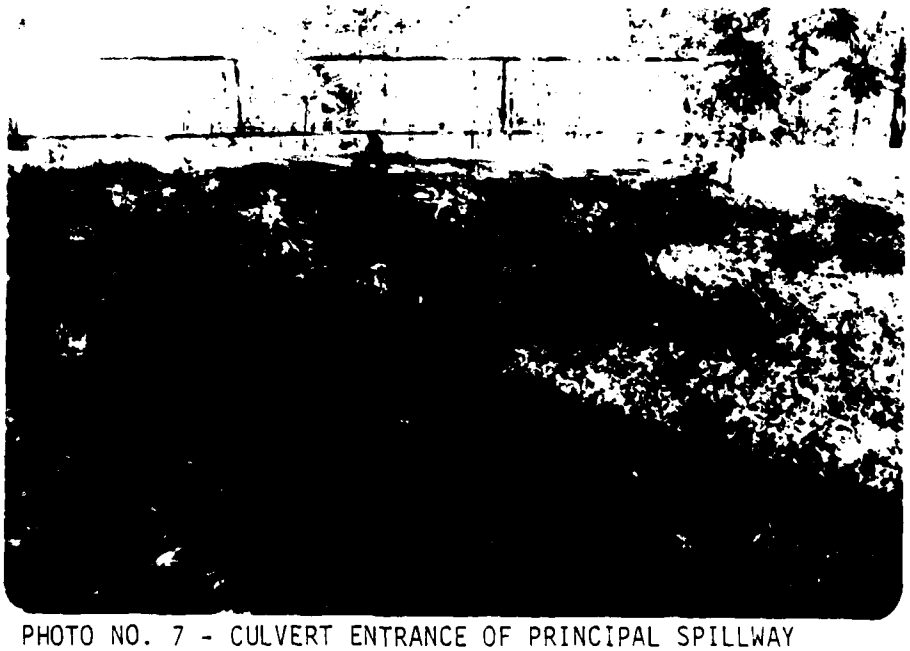


PHOTO NO. 7 - CULVERT ENTRANCE OF PRINCIPAL SPILLWAY

PHOTO NO. 8 - DOWNSTREAM SLOPE FROM LEFT END

PHOTO NO. 9 - SEEP AREA ON SLOPE DOWNSTREAM FROM STATION 5+65

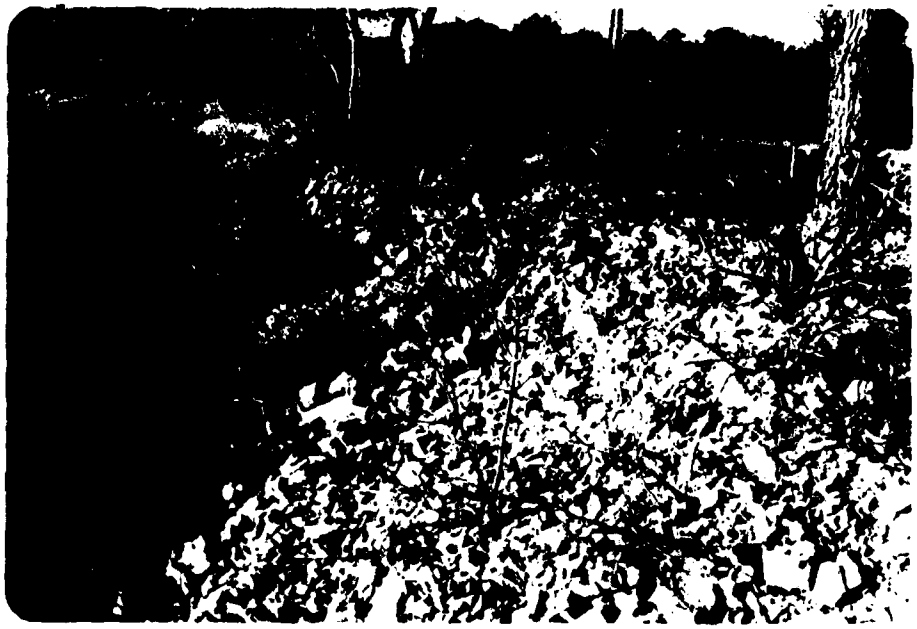


PHOTO NO. 10 - CLOSEUP OF RIPRAP ON UPSTREAM SLOPE

PHOTO NO. 11 - VIEW SHOWING WIDENING OF THE CREST STARTING AT ABOUT STATION 5+00

PHOTO NO. 12 - DOWNSTREAM SLOPE OF THE WIDENED SECTION OF THE DAM

PHOTO NO. 13 - OUTLET OF
10-INCH DRAWDOWN PIPE

PHOTO NO. 14 - VIEW OF GATE VALVE FOR 10-INCH DRAWDOWN PIPE

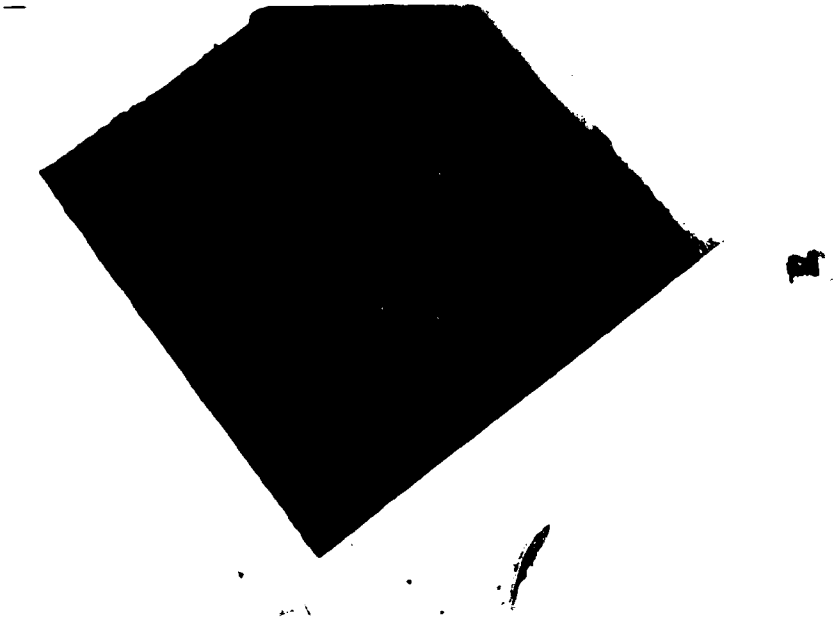


PHOTO NO. 15 - VIEW OF GATE VALVE FOR 10-INCH DRAWDOWN PIPE

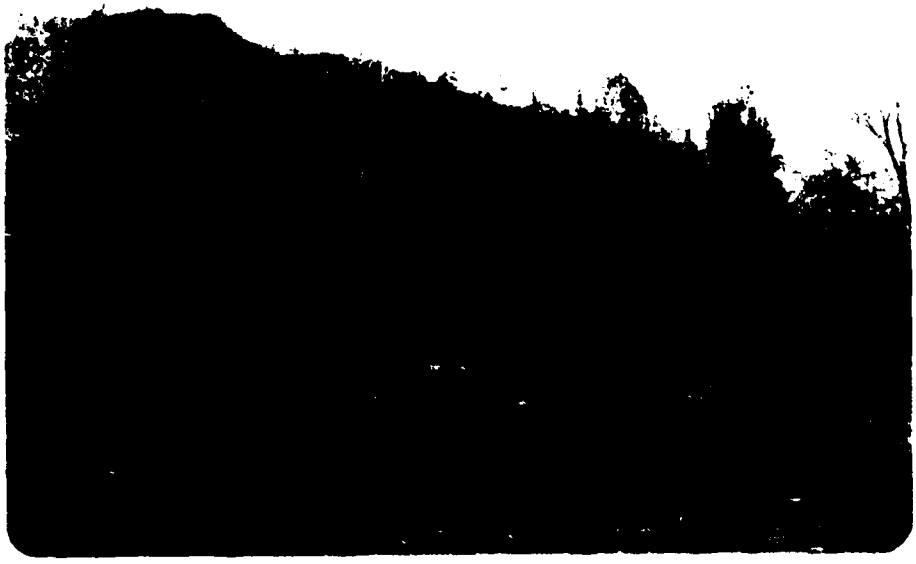


PHOTO NO. 16 - DOWNSTREAM SLOPE ON THE RIGHT SIDE OF THE WIDENED AREA OF THE CREST

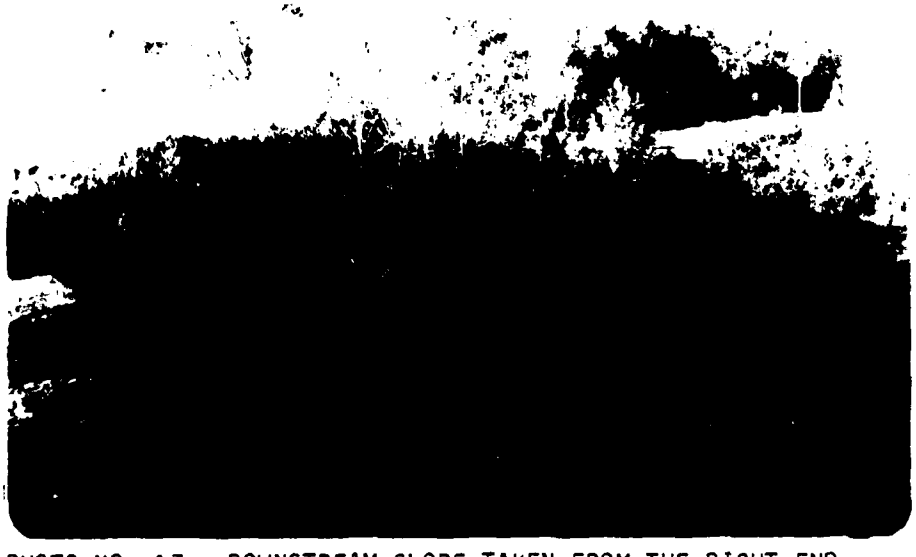


PHOTO NO. 17 - DOWNSTREAM SLOPE TAKEN FROM THE RIGHT END

PHOTO NO. 18 - CREST OF DAM TAKEN FROM THE RIGHT END

PHOTO NO. 19 - LOOKING DOWN THE VALLEY FROM THE RIGHT ABUTMENT

PHOTO NO. 20 - LOOKING DOWNSLOPE BELOW ABOUT STATION 6+50. CONCRETE VALVE HOUSE FOR DRAWDOWN PIPE CAN BE SEEN IN BACKGROUND

PHOTO NO. 21 - LOOKING DOWNSLOPE FROM NEAR PUMP HOUSE

PHOTO NO. 22 - LOOKING UPSTREAM OVER LAKE FROM ABOUT STATION 4+50

PHOTO NO. 23 - TRUCK TERMINAL IN HAZARD AREA ABOUT 1000 FEET BELOW DAM

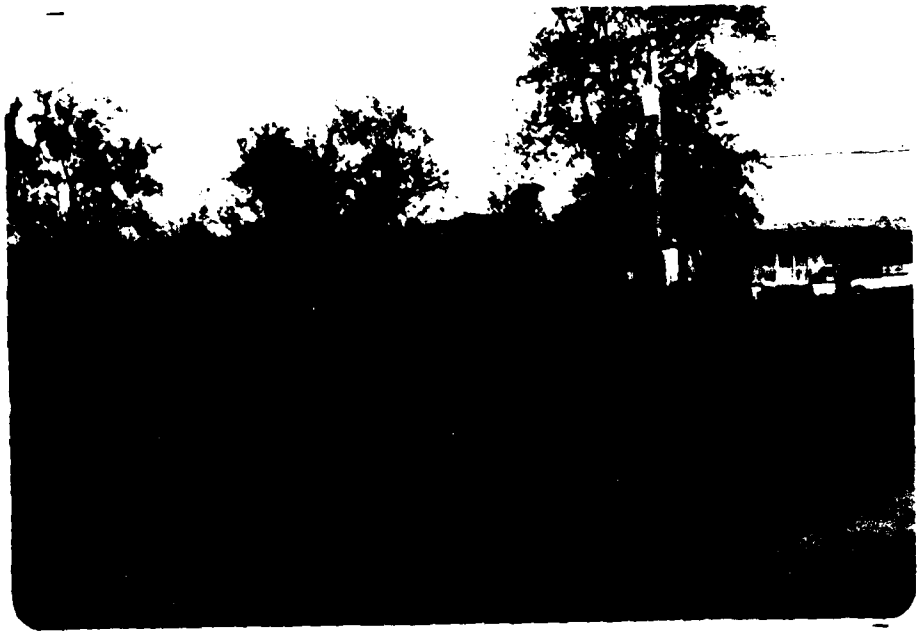
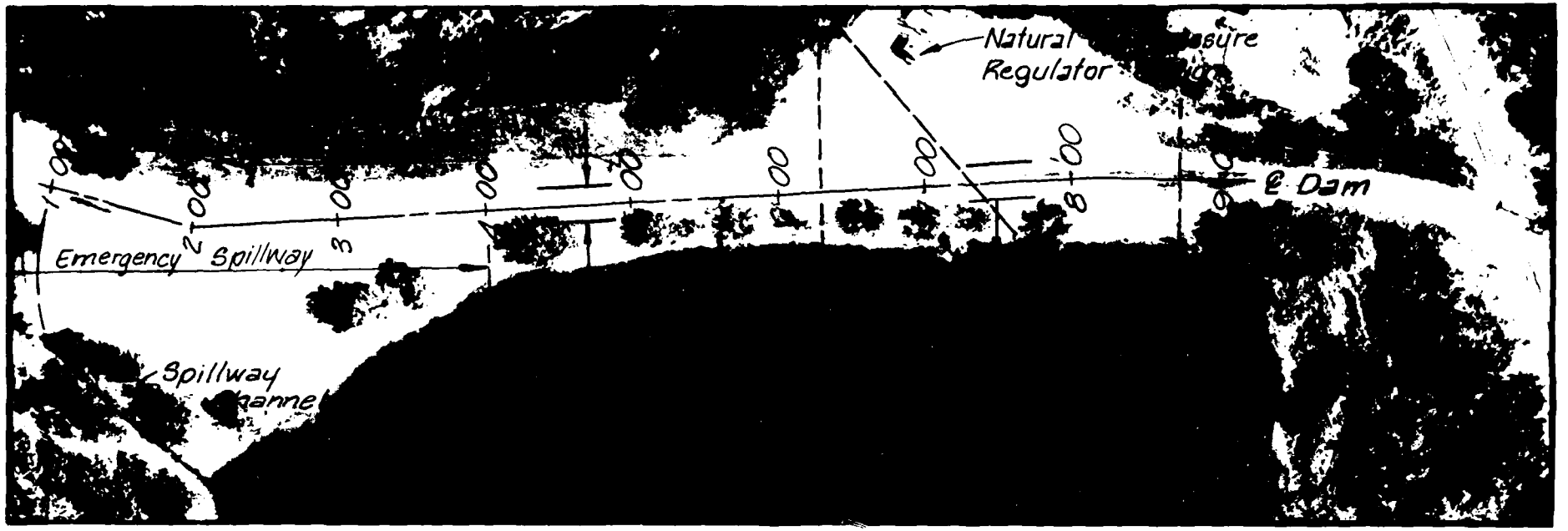


PHOTO NO. 24 - HOUSE AND TRUCK TERMINAL IN HAZARD AREA ABOUT 1000 FEET BELOW DAM

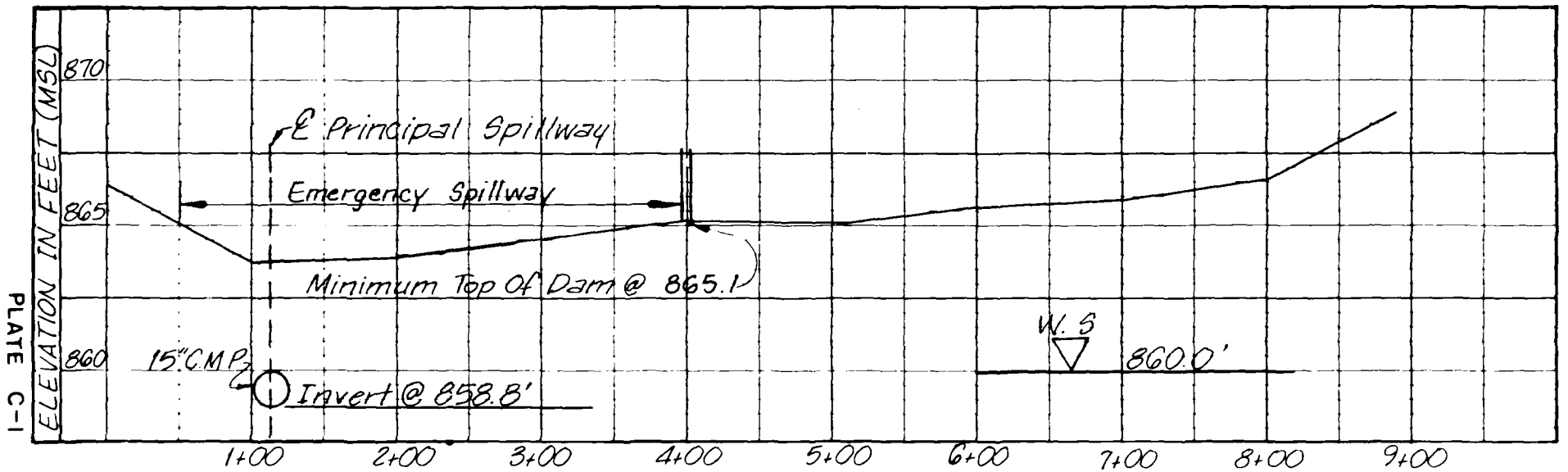
PHOTO NO. 25 - HOUSES IN HAZARD AREA ABOUT 2000 FEET BELOW DAM

PHOTO NO. 26 - HOUSES IN HAZARD AREA ABOUT 2000 FEET BELOW DAM

APPENDIX C
PROJECT PLATES

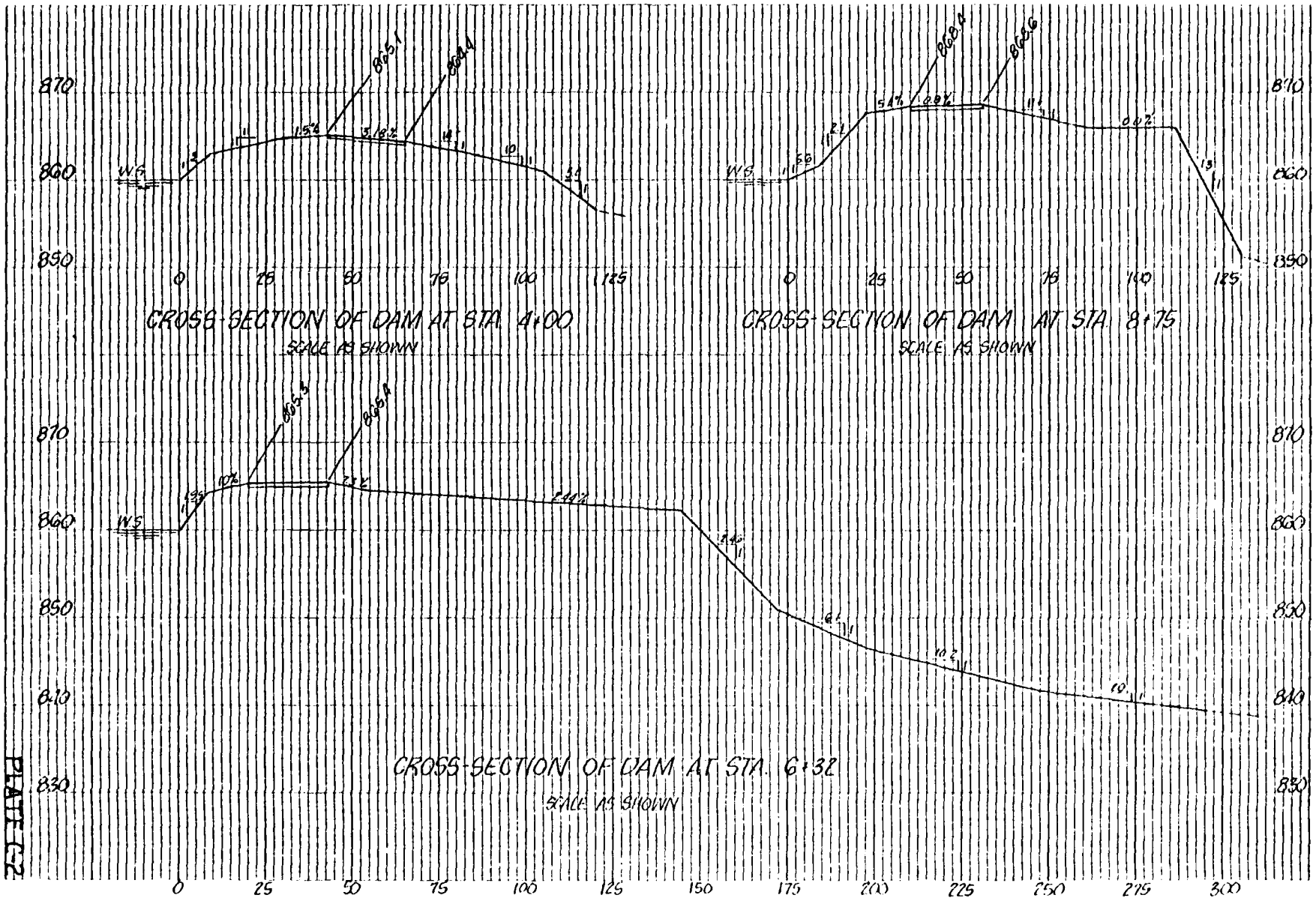


PLAN OF DAM
Scale: 1" = 100'



CENTERLINE PROFILE OF DAM
Scale As Shown

PLATE C-1


CROSS-SECTION OF DAM AT STA. 4+00
SCALE AS SHOWN
CROSS-SECTION OF DAM AT STA. 8+75
SCALE AS SHOWN
CROSS-SECTION OF DAM AT STA. 6+32
SCALE AS SHOWN
PLATE G-2

APPENDIX D
HYDRAULIC AND HYDROLOGIC DATA

HYDROLOGIC COMPUTATIONS

1. The SCS dimensionless unit hydrograph and the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Corps of Engineers, Davis, California, were used to develop the inflow hydrographs (see this section).

   a. Twenty-four hour, one percent probabilistic rainfall for the dam location was taken from the data for the rainfall station at Sullivan, Missouri, as supplied by the St. Louis District, Corps of Engineers per their letter dated 4 March 1980. The twenty-four hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis policy and guidance for hydraulics and hydrology.

   b. Drainage area = 0.134 square miles (85.5 acres).

   c. Time of concentration of runoff = 11 minutes (computed from the "Kirpich" formula and the California Highways and Public Works Culverts Practice formula).

   d. The antecedent storm conditions for the probable maximum precipitation were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The antecedent storm conditions for the one percent probabilistic precipitation were an average of the conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (SCS AMC II). The initial pool elevation was assumed at the control elevation of the principal spillway approach channel.

   e. The total twenty-four hour storm duration losses for the one percent probabilistic storm were 2.54 inches. The total losses for the PMF storm were 1.30 inches. These data are based on SCS runoff curve No. 78 and No. 90 for antecedent moisture conditions SCS AMC II and AMC III, respectively. The watershed is composed primarily of SCS soil groups C & D (Peridge-Cantwell-Gasconade soils). Land use is about 80% wooded, 10% grass, and 10% water.

   f. Average soil loss rates = 0.05 inch per hour approximately (for PMF storm, AMC III).

2. The combined discharge rating consisted of three components: the flow through the principal spillway, the flow through the emergency spillway and the flow going over the top of the dam.

   a. The principal spillway rating was developed by using a combination of channel flow for extremely low flow (about 7 c.f.s.) and culvert flow as determined by formulas and charts from FHA-BPR HEC No. 5.

b. The emergency spillway rating curve was developed using the Corps of Engineers, Water Surface Profile HEC-2 computer program. The critical depth method was used assuming critical depth at the downstream crest.

c. The flows over the dam were determined by using the dam overtopping analyses (irregular top of dam) within the HEC-1 (Dam Safety Version) program. Due to the extremely wide crest, the dam overtopping flows were computed by three methods: USGS-TWRI, HEC-1 Dam, and Water Surface Profile HEC-2. Floods were routed using both the maximum and minimum discharge ratings, HEC-1 Dam and HEC-2, and results were found to compare within 0.1 foot for the PMF, so the HEC-1 Dam version was used.

3. Floods were routed through the reservoir using the HEC-1 (Dam Safety Version) program to determine the capabilities of the spillway and dam embankment crest. The input, output and plotted hydrographs are attached to this section.

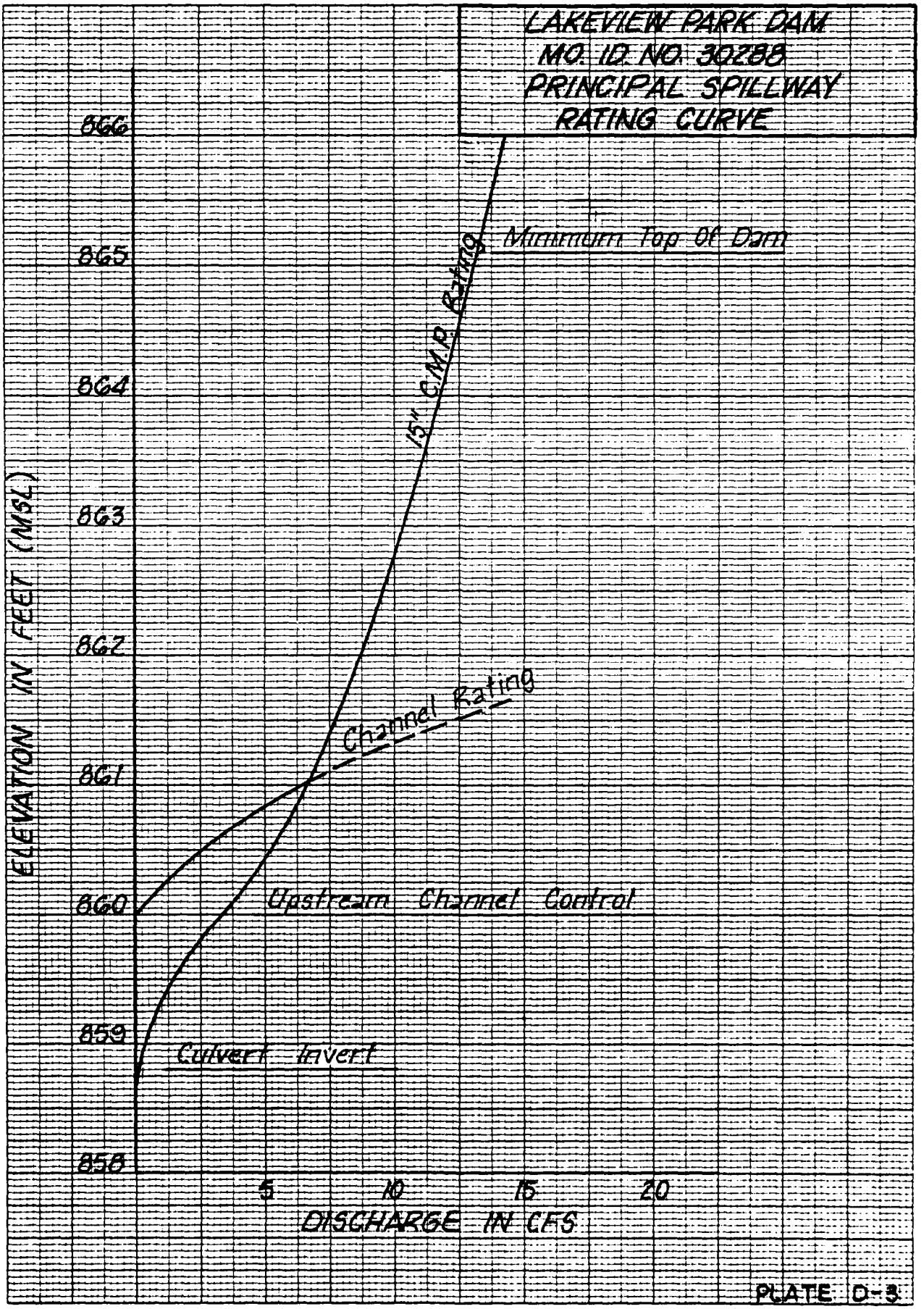
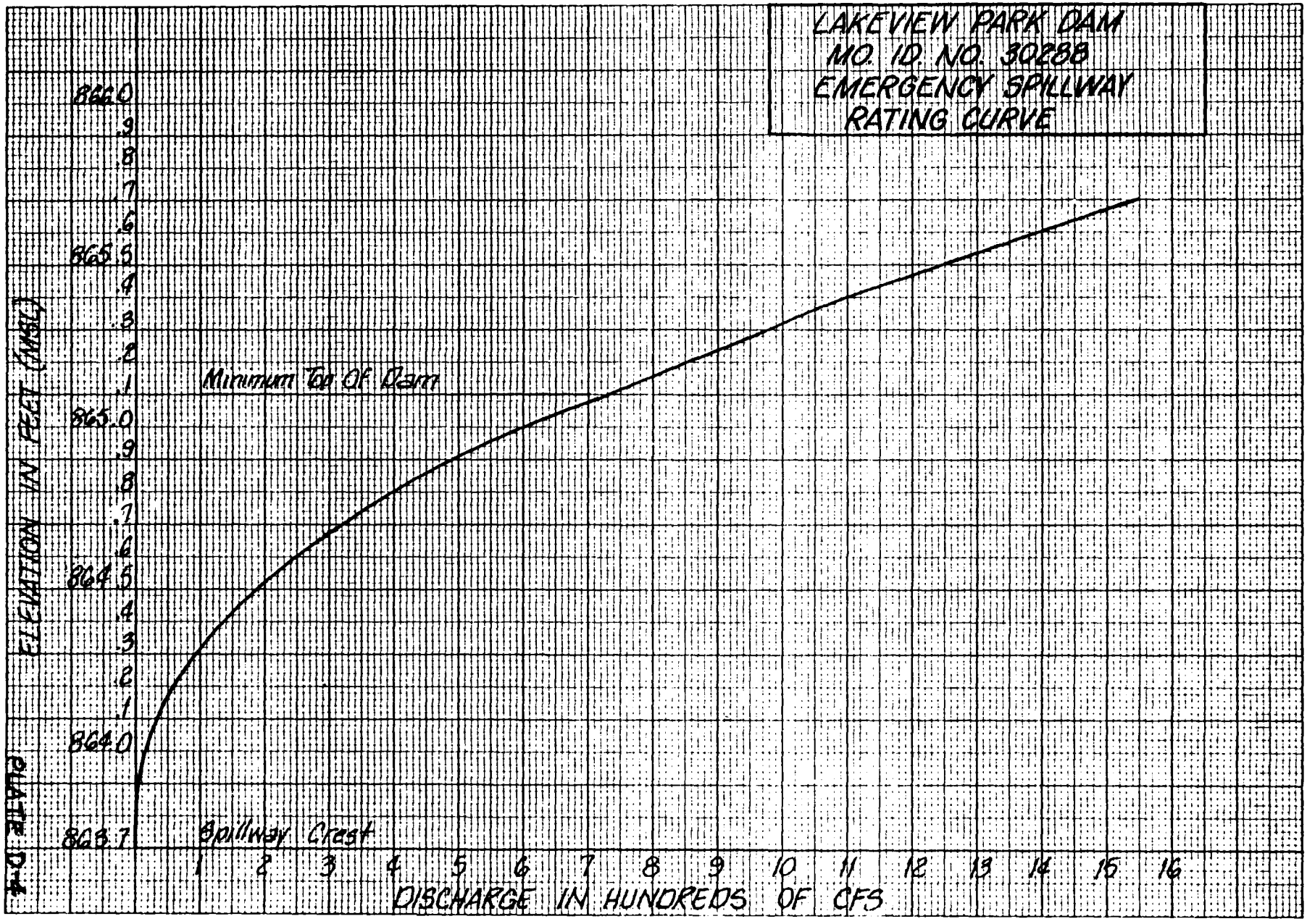


PLATE D-3

LAKEVIEW PARK DAM
MO. ID. NO. 30288
EMERGENCY SPILLWAY
RATING CURVE



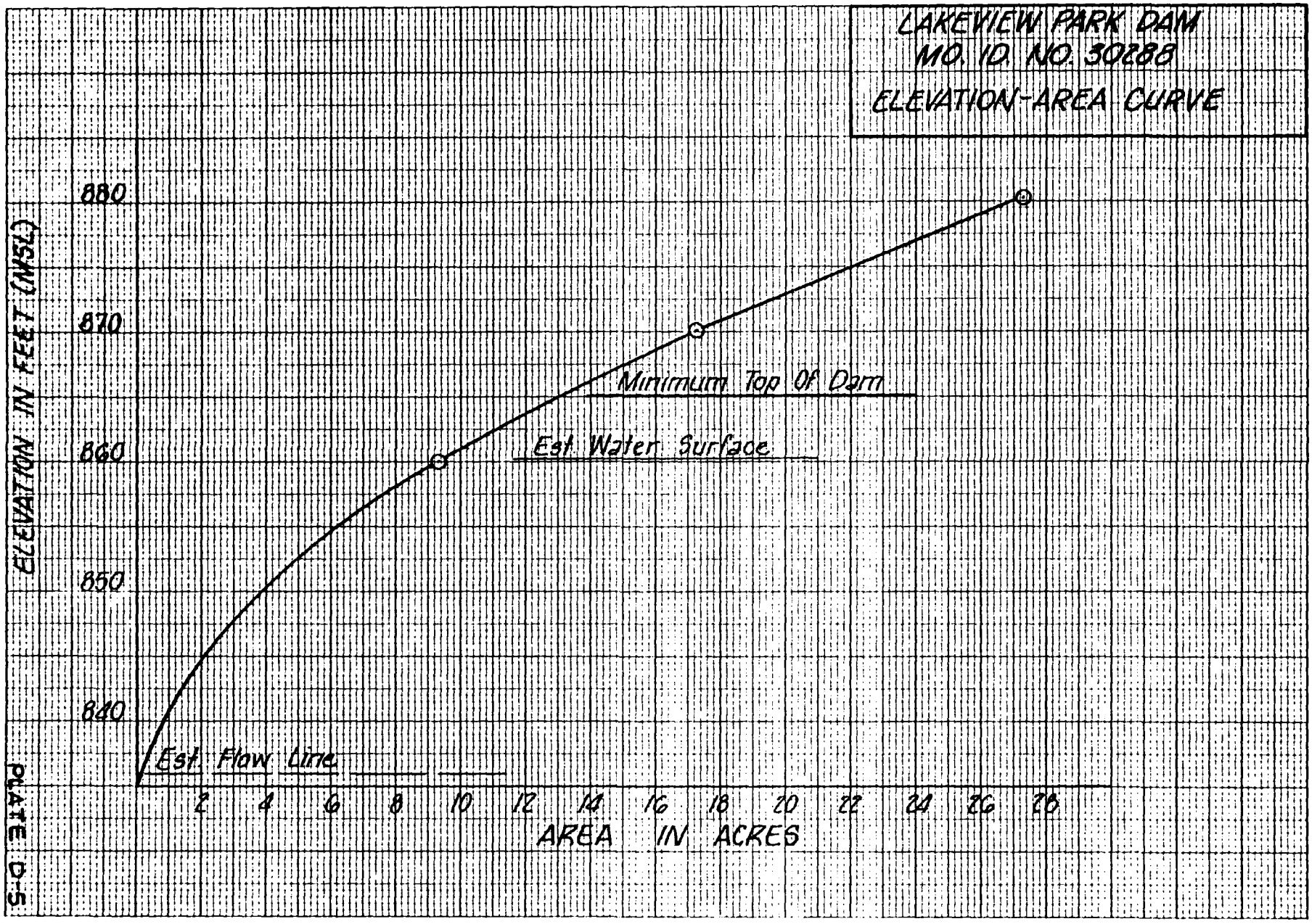
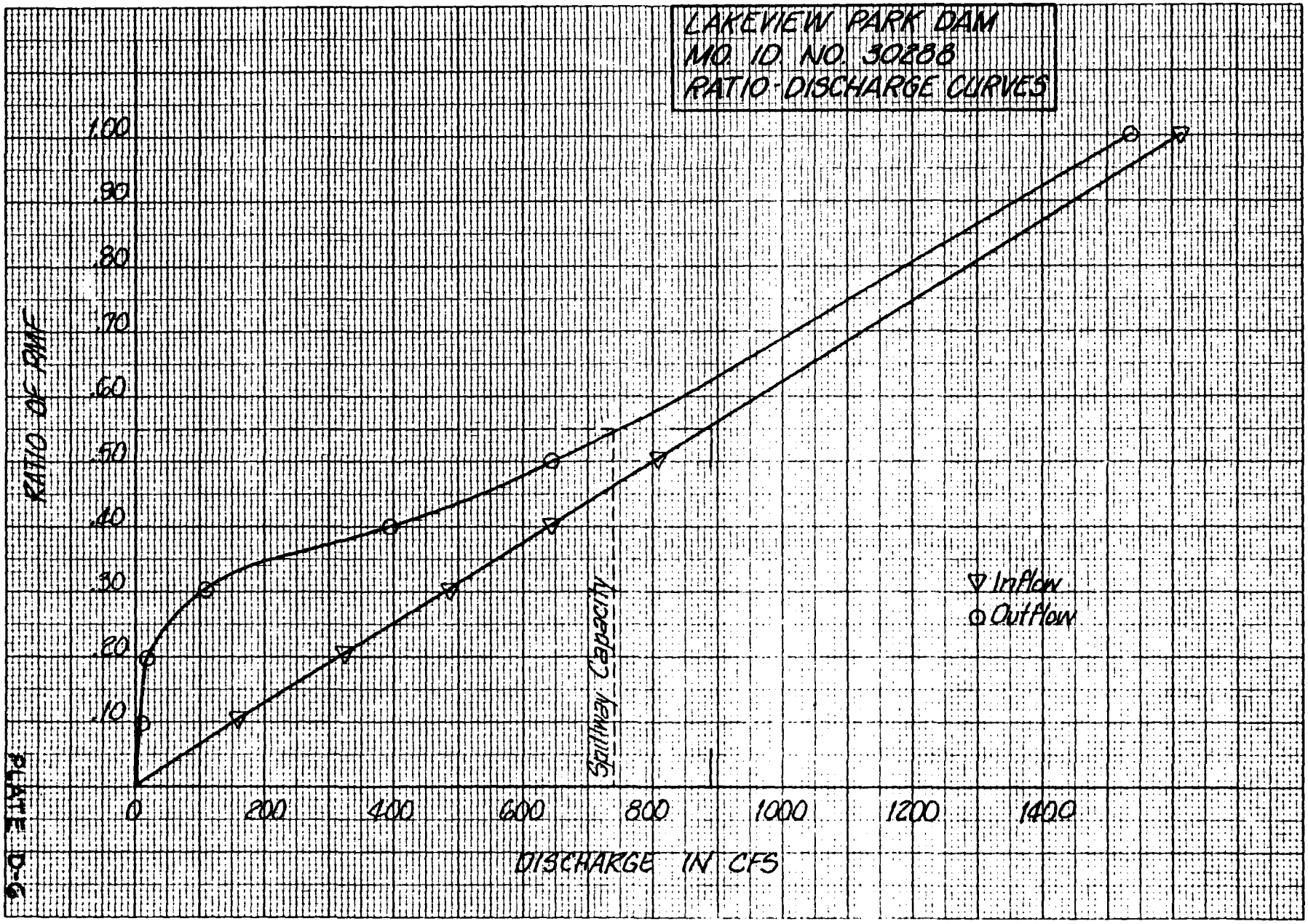


PLATE D-5



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A1                          LAKEVIEW PARK DAM/MO ID NO 30288
A2       SAFETY ANALYSIS OF DAM OVERTOPPING USING ASSIGNED FLOOD FREQUENCIES
A3              H & H ANALYSIS BY ROUTING PMF RATIOS THRU THE RESERVOIR
B 0002880000000000000005                                  000000000000000000000003
B1000005
J 00000100000000800000001
J1000.0500000.1000000.1500000.2000000.3000000.4000000.50000001.0
K 000000000000001                         000000000000000000000001
K1       CALCULATION OF INFLOW HYDRO TO LAKEVIEW PARK RES.
M 000001000000020000.134          0000.134000001,000000000000000000000001
P 000000000026.1000001020000012100000130
T                                                              -1.0    -90.0
W2       00000.17
X 000000     -.0100000001
K 000001000000002                         000000020000000000000001
K1       ROUTED FLOWS THRU LAKEVIEW PARK DAM
Y                              0000000100000001
Y1000001                                                  -860.0       -1
Y40860.0000860.2000860.4000860.6000860.8000861.0000861.7000862.8000863.7000864.0
Y40864.2000864.5000864.7000864.9000865.1000865.5000865.7
Y5000000000001,0000002,0000003,4000004,8000006,5000008,0000010,0000011,500000027
Y5000067000001920000033300000513000007430000126400001564
$A0000000000003,0000006,3000009,2000012,9000017,1000022,0000027,3
$E0838.0000847,5000855,0000860,0000865,0000870,0000875,0000880,0
$$0860.0
$D0865,1000003,0000001,500000400
$L000000000001000000016500000200000000300
$V0865,1000865,1000865,5000865,7000865,9
K 000099
A
A
A
A
A
```

PLATE D-7

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE# 81/04/09.
     TIME# 16.47.57.
```

LAKEVIEW PARK DAM/MO ID NO 30288
SAFETY ANALYSIS OF DAM OVERTOPPING USING ASSIGNED FLOOD FREQUENCIES
H & H ANALYSIS BY ROUTING PMF RATIOS THRU THE RESERVOIR

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	USTAN
288	0	5	0	0	0	0	0	3	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 8 LRTIO= 1

RTIOS= .05 .10 .15 .20 .30 .40 .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDRO TO LAKEVIEW PARK RES.

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000001	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.13	0.00	.13	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	26.10	102.00	121.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-90.00	0.00	0.00

CURVE NO = -90.00 WETNESS = -1.00 EFFECT CN = 90.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .17

RECESSION DATA
STRTQ= 0.00 QRCSN= -.01 RTIOR= 1.00

UNIT HYDROGRAPH 12 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .17 VOL= 1.00

93. 281. 289. 181. 91. 49. 26. 13. 7. 4.
2. 1.

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.05	145	.22	.22	.01	83.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.10	146	.22	.22	.01	125.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.15	147	.22	.22	.01	169.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.20	148	.22	.22	.00	196.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.25	149	.22	.22	.00	210.
1.01	.30	6	.01	0.00	.01	0.	1.01	12.30	150	.22	.22	.00	217.
1.01	.35	7	.01	0.00	.01	0.	1.01	12.35	151	.22	.22	.00	221.
1.01	.40	8	.01	0.00	.01	0.	1.01	12.40	152	.22	.22	.00	223.
1.01	.45	9	.01	0.00	.01	0.	1.01	12.45	153	.22	.22	.00	225.
1.01	.50	10	.01	0.00	.01	0.	1.01	12.50	154	.22	.22	.00	226.
1.01	.55	11	.01	0.00	.01	0.	1.01	12.55	155	.22	.22	.00	226.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.00	156	.22	.22	.00	226.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.05	157	.27	.26	.00	231.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.10	158	.27	.26	.00	243.
1.01	1.15	15	.01	0.00	.01	0.	1.01	13.15	159	.27	.26	.00	256.
1.01	1.20	16	.01	0.00	.01	0.	1.01	13.20	160	.27	.26	.00	264.
1.01	1.25	17	.01	0.00	.01	0.	1.01	13.25	161	.27	.26	.00	268.
1.01	1.30	18	.01	.00	.01	0.	1.01	13.30	162	.27	.26	.00	271.
1.01	1.35	19	.01	.00	.01	0.	1.01	13.35	163	.27	.26	.00	272.
1.01	1.40	20	.01	.00	.01	0.	1.01	13.40	164	.27	.26	.00	273.
1.01	1.45	21	.01	.00	.01	0.	1.01	13.45	165	.27	.26	.00	273.

PLATE D-8

PLATE D-9

1.01	9.10	110	.07	.06	.00	67.	1.01	21.10	255	.02	.02	.00	20.
1.01	9.15	111	.07	.06	.00	67.	1.01	21.15	255	.02	.02	.00	20.
1.01	9.20	112	.07	.06	.00	67.	1.01	21.20	256	.02	.02	.00	20.
1.01	9.25	113	.07	.06	.00	67.	1.01	21.25	257	.02	.02	.00	20.
1.01	9.30	114	.07	.07	.00	67.	1.01	21.30	258	.02	.02	.00	20.
1.01	9.35	115	.07	.07	.00	67.	1.01	21.35	259	.02	.02	.00	20.
1.01	9.40	116	.07	.07	.00	67.	1.01	21.40	260	.02	.02	.00	20.
1.01	9.45	117	.07	.07	.00	67.	1.01	21.45	261	.02	.02	.00	20.
1.01	9.50	118	.07	.07	.00	68.	1.01	21.50	262	.02	.02	.00	20.
1.01	9.55	119	.07	.07	.00	68.	1.01	21.55	263	.02	.02	.00	20.
1.01	10.00	120	.07	.07	.00	68.	1.01	22.00	264	.02	.02	.00	20.
1.01	10.05	121	.07	.07	.00	68.	1.01	22.05	265	.02	.02	.00	20.
1.01	10.10	122	.07	.07	.00	68.	1.01	22.10	266	.02	.02	.00	20.
1.01	10.15	123	.07	.07	.00	68.	1.01	22.15	267	.02	.02	.00	20.
1.01	10.20	124	.07	.07	.00	68.	1.01	22.20	268	.02	.02	.00	20.
1.01	10.25	125	.07	.07	.00	68.	1.01	22.25	269	.02	.02	.00	20.
1.01	10.30	126	.07	.07	.00	68.	1.01	22.30	270	.02	.02	.00	20.
1.01	10.35	127	.07	.07	.00	68.	1.01	22.35	271	.02	.02	.00	20.
1.01	10.40	128	.07	.07	.00	69.	1.01	22.40	272	.02	.02	.00	20.
1.01	10.45	129	.07	.07	.00	69.	1.01	22.45	273	.02	.02	.00	20.
1.01	10.50	130	.07	.07	.00	69.	1.01	22.50	274	.02	.02	.00	20.
1.01	10.55	131	.07	.07	.00	69.	1.01	22.55	275	.02	.02	.00	20.
1.01	11.00	132	.07	.07	.00	69.	1.01	23.00	276	.02	.02	.00	20.
1.01	11.05	133	.07	.07	.00	69.	1.01	23.05	277	.02	.02	.00	20.
1.01	11.10	134	.07	.07	.00	69.	1.01	23.10	278	.02	.02	.00	20.
1.01	11.15	135	.07	.07	.00	69.	1.01	23.15	279	.02	.02	.00	20.
1.01	11.20	136	.07	.07	.00	69.	1.01	23.20	280	.02	.02	.00	20.
1.01	11.25	137	.07	.07	.00	69.	1.01	23.25	281	.02	.02	.00	20.
1.01	11.30	138	.07	.07	.00	69.	1.01	23.30	282	.02	.02	.00	20.
1.01	11.35	139	.07	.07	.00	69.	1.01	23.35	283	.02	.02	.00	20.
1.01	11.40	140	.07	.07	.00	69.	1.01	23.40	284	.02	.02	.00	20.
1.01	11.45	141	.07	.07	.00	69.	1.01	23.45	285	.02	.02	.00	20.
1.01	11.50	142	.07	.07	.00	69.	1.01	23.50	286	.02	.02	.00	20.
1.01	11.55	143	.07	.07	.00	69.	1.01	23.55	287	.02	.02	.00	20.
1.01	12.00	144	.07	.07	.00	69.	1.02	0.00	288	.02	.02	.00	20.
									SUM	33.93	32.63	1.50	33782.
										(862.)	(829.)	(38.)	(956.60)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1619.	378.	117.	117.	33780.
CMS	46.	11.	3.	3.	957.
INCHES		26.24	32.58	32.58	32.58
MM		666.39	827.47	827.47	827.47
AC-FT		187.	233.	233.	233.
THOUS CU M		231.	287.	287.	287.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	81.	19.	6.	6.	1689.
CMS	2.	1.	0.	0.	48.
INCHES		1.31	1.63	1.63	1.63
MM		33.32	41.37	41.37	41.37
AC-FT		9.	12.	12.	12.
THOUS CU M		12.	14.	14.	14.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	162.	38.	12.	12.	3379.
CMS	5.	1.	0.	0.	96.
INCHES		2.62	3.26	3.26	3.26
MM		66.64	82.75	82.75	82.75
AC-FT		19.	23.	23.	23.
THOUS CU M		23.	29.	29.	29.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	243.	57.	18.	18.	5068.
CMS	7.	2.	0.	0.	144.
INCHES		3.94	4.89	4.89	4.89
MM		99.96	124.12	124.12	124.12
AC-FT		28.	35.	35.	35.
THOUS CU M		35.	43.	43.	43.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 4

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME

CFS	324.	76.	33.	23.	6794.
CMS	9.	2.	1.	1.	191.
INCHES		5.25	6.52	6.52	6.52
MM		133.28	165.49	165.49	165.49
AC-FT		37.	47.	47.	47.
THOUS CU M		46.	57.	57.	57.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	486.	113.	35.	35.	10136.
CMS	14.	3.	1.	1.	287.
INCHES		7.87	9.77	9.77	9.77
MM		199.92	248.24	248.24	248.24
AC-FT		56.	70.	70.	70.
THOUS CU M		69.	86.	86.	86.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	647.	151.	47.	47.	13515.
CMS	18.	4.	1.	1.	383.
INCHES		10.49	13.03	13.03	13.03
MM		266.56	330.99	330.99	330.99
AC-FT		75.	93.	93.	93.
THOUS CU M		92.	115.	115.	115.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	809.	189.	59.	59.	16894.
CMS	23.	5.	2.	2.	478.
INCHES		13.12	16.29	16.29	16.29
MM		333.19	413.73	413.73	413.73
AC-FT		94.	116.	116.	116.
THOUS CU M		116.	144.	144.	144.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1619.	378.	117.	117.	33788.
CMS	46.	11.	3.	3.	957.
INCHES		26.24	32.58	32.58	32.58
MM		666.39	827.47	827.47	827.47
AC-FT		187.	233.	233.	233.
THOUS CU M		231.	287.	287.	287.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTED FLOWS THRU LAKEVIEW PARK DAM

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000002	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-860.	-1

STAGE	860.00	860.20	860.40	860.60	860.80	861.00	861.20	862.80	863.70	864.00
	864.20	864.50	864.70	864.90	865.10	865.50	865.70			
FLOW	0.00	1.00	2.00	3.40	4.80	6.50	8.00	10.00	11.50	27.00
	67.00	192.00	333.00	513.00	743.00	1269.00	1564.00			
SURFACE AREA=	0.	3.	6.	9.	13.	17.	22.	27.		
CAPACITY=	0.	10.	44.	82.	137.	212.	309.	432.		
ELEVATION=	850.	848.	855.	860.	865.	870.	875.	880.		

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
860.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		DAM DATA		
	TOPEL	COQD	EXPD	DAMWID
	865.1	3.0	1.5	400.

CREST LENGTH	0.	100.	165.	200.	300.
AT OR BELOW ELEVATION	865.1	865.1	865.5	865.7	865.9

STATION 000002, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	3.	3.	3.	3.	3.	3.	3.	4.	4.
4.	5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	5.		

STORAGE

82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
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82.	82.	82.	82.	82.	82.	82.	82.	82.	83.
83.	83.	83.	83.	83.	83.	83.	83.	83.	83.
83.	83.	83.	83.	83.	83.	83.	83.	83.	83.
83.	83.	83.	83.	83.	83.	83.	83.	83.	83.
83.	83.	83.	83.	83.	83.	83.	83.	83.	83.
83.	83.	83.	83.	83.	83.	83.	83.	83.	83.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	85.
85.	85.	85.	85.	85.	85.	85.	85.	85.	85.
86.	86.	86.	86.	86.	86.	86.	86.	86.	86.
87.	87.	87.	87.	87.	87.	87.	88.	88.	89.
89.	89.	90.	90.	90.	90.	90.	90.	90.	90.
90.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	89.	89.	89.	89.	89.	89.		

STAGE

860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.1	860.1	860.1	860.1	860.1	860.1
860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1
860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1

OVN

STATION 000002, PLAN 1, RATIO 7

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	2.	2.	2.	2.	2.
2.	2.	2.	3.	3.	3.	3.	3.	3.	3.
4.	4.	4.	4.	4.	4.	4.	5.	5.	5.
5.	5.	5.	6.	6.	6.	6.	6.	6.	6.
7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.	8.	8.	8.	8.	8.	8.
8.	8.	8.	9.	9.	9.	9.	9.	9.	9.
9.	10.	10.	10.	10.	10.	10.	10.	11.	11.
11.	11.	11.	11.	11.	14.	18.	23.	27.	43.
56.	68.	87.	106.	129.	162.	238.	393.	564.	642.
610.	527.	450.	379.	320.	279.	246.	222.	204.	191.
185.	180.	176.	173.	171.	167.	162.	157.	152.	147.
143.	140.	137.	135.	133.	132.	130.	124.	112.	98.
83.	70.	63.	58.	55.	48.	44.	41.	38.	35.
32.	30.	28.	27.	26.	26.	25.	25.	24.	24.
24.	23.	23.	23.	22.	22.	22.	21.	21.	21.
20.	20.	20.	19.	19.	19.	19.	18.	18.	18.
18.	17.	17.	17.	17.	17.	16.	16.	16.	16.
16.	16.	15.	15.	15.	15.	15.	15.	15.	14.
14.	14.	14.	14.	14.	14.	14.	14.		

STORAGE

82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
83.	83.	83.	83.	83.	83.	83.	83.	83.	83.
83.	83.	83.	83.	83.	83.	83.	83.	83.	83.
83.	83.	83.	83.	83.	83.	83.	84.	84.	84.
84.	84.	84.	85.	85.	85.	85.	85.	86.	86.
86.	86.	86.	87.	87.	87.	87.	87.	88.	88.
88.	88.	88.	89.	89.	89.	89.	89.	90.	90.
90.	90.	90.	91.	91.	91.	91.	91.	91.	92.
92.	92.	92.	92.	93.	93.	93.	93.	93.	94.
94.	94.	94.	94.	95.	95.	95.	95.	95.	95.
96.	96.	96.	96.	96.	97.	97.	98.	98.	99.
100.	100.	101.	102.	103.	103.	104.	105.	106.	106.
107.	108.	109.	110.	111.	112.	113.	113.	114.	115.
116.	117.	118.	119.	120.	122.	123.	124.	125.	126.
126.	127.	128.	128.	129.	130.	132.	134.	136.	137.
137.	136.	135.	134.	133.	132.	132.	131.	131.	131.
131.	[illegible]	130.	130.	130.	130.	130.	130.	130.	129.
129.	[illegible]	129.	129.	129.	129.	129.	129.	128.	128.
128.	[illegible]	127.	126.	126.	126.	126.	125.	125.	125.
125.	125.	125.	125.	124.	124.	124.	124.	124.	124.
124.	124.	124.	124.	124.	123.	123.	123.	123.	123.
123.	123.	123.	123.	123.	123.	123.	123.	123.	123.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.	122.	122.
122.	122.	122.	122.	122.	122.	122.	122.		

STAGE

860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.1	860.1	860.1	860.1	860.1
860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1
860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.2	860.2	860.2
860.2	860.2	860.3	860.3	860.3	860.3	860.3	860.4	860.4	860.4
860.4	860.4	860.5	860.5	860.5	860.5	860.5	860.6	860.6	860.6
860.6	860.6	860.7	860.7	860.7	860.7	860.7	860.8	860.8	860.8
860.8	860.8	860.9	860.9	860.9	860.9	860.9	861.0	861.0	861.0
861.0	861.0	861.1	861.1	861.1	861.1	861.1	861.2	861.2	861.2
861.2	861.2	861.2	861.3	861.3	861.3	861.3	861.3	861.4	861.4
861.4	861.4	861.4	861.4	861.5	861.5	861.5	861.6	861.7	861.7
861.8	861.9	861.9	862.0	862.1	862.1	862.2	862.3	862.3	862.4

862.5	862.6	862.7	862.7	862.8	863.0	863.0	863.0	863.1	863.2
863.3	863.4	863.5	863.6	863.7	863.7	863.8	863.9	864.0	864.1
864.1	864.2	864.2	864.3	864.3	864.4	864.6	864.8	864.9	865.0
865.0	864.9	864.8	864.8	864.7	864.6	864.6	864.5	864.5	864.5
864.5	864.5	864.5	864.5	864.4	864.4	864.4	864.4	864.4	864.4
864.4	864.4	864.4	864.4	864.4	864.4	864.4	864.3	864.3	864.3
864.2	864.2	864.2	864.2	864.1	864.1	864.1	864.1	864.1	864.0
864.0	864.0	864.0	864.0	864.0	864.0	864.0	864.0	864.0	863.9
863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9
863.9	863.9	863.9	863.9	863.8	863.8	863.8	863.8	863.8	863.8
863.8	863.8	863.8	863.8	863.8	863.8	863.8	863.8	863.8	863.8
863.8	863.8	863.8	863.8	863.8	863.8	863.8	863.8	863.8	863.8
863.8	863.8	863.8	863.7	863.7	863.7	863.7	863.7		

PEAK OUTFLOW IS 642. AT TIME 15.83 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	642.	138.	39.	39.	11209.
CMS	18.	4.	1.	1.	317.
INCHES		9.57	10.00	10.00	10.00
MM		242.98	274.39	274.39	274.39
AC-FT		68.	77.	77.	77.
THOUS CU M		84.	95.	95.	95.

OVF

STATION000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

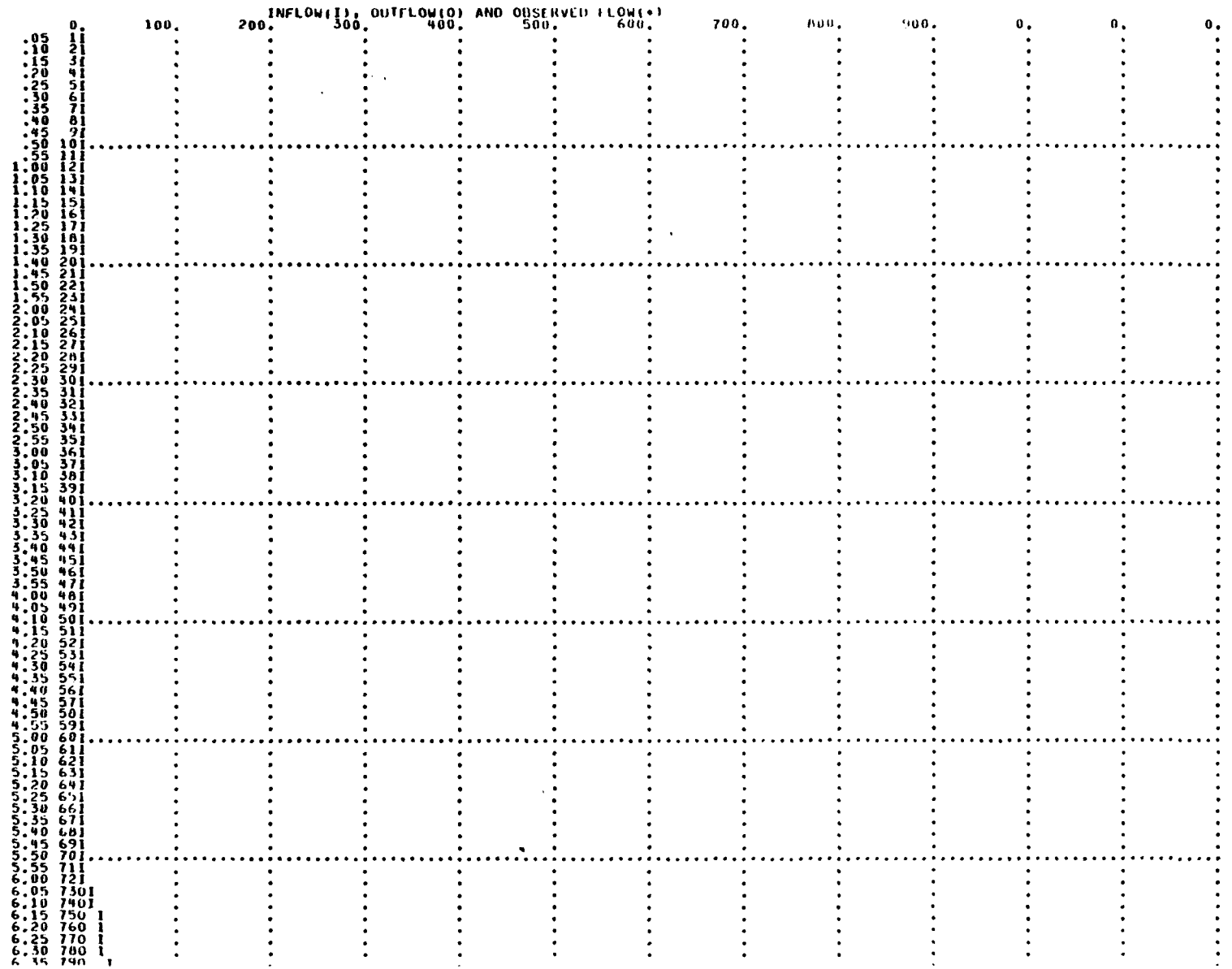

PLATE D-15

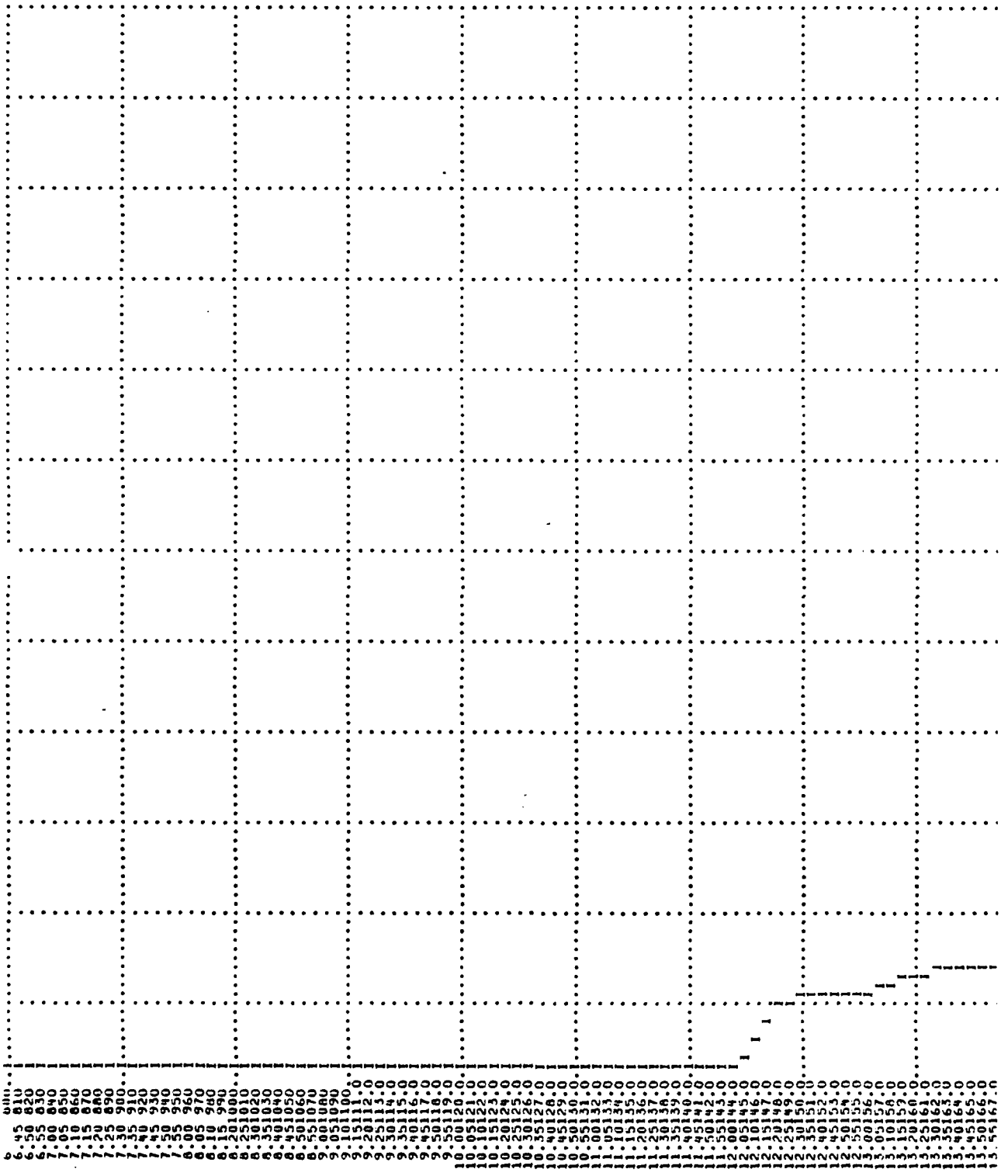

PLATE D-16

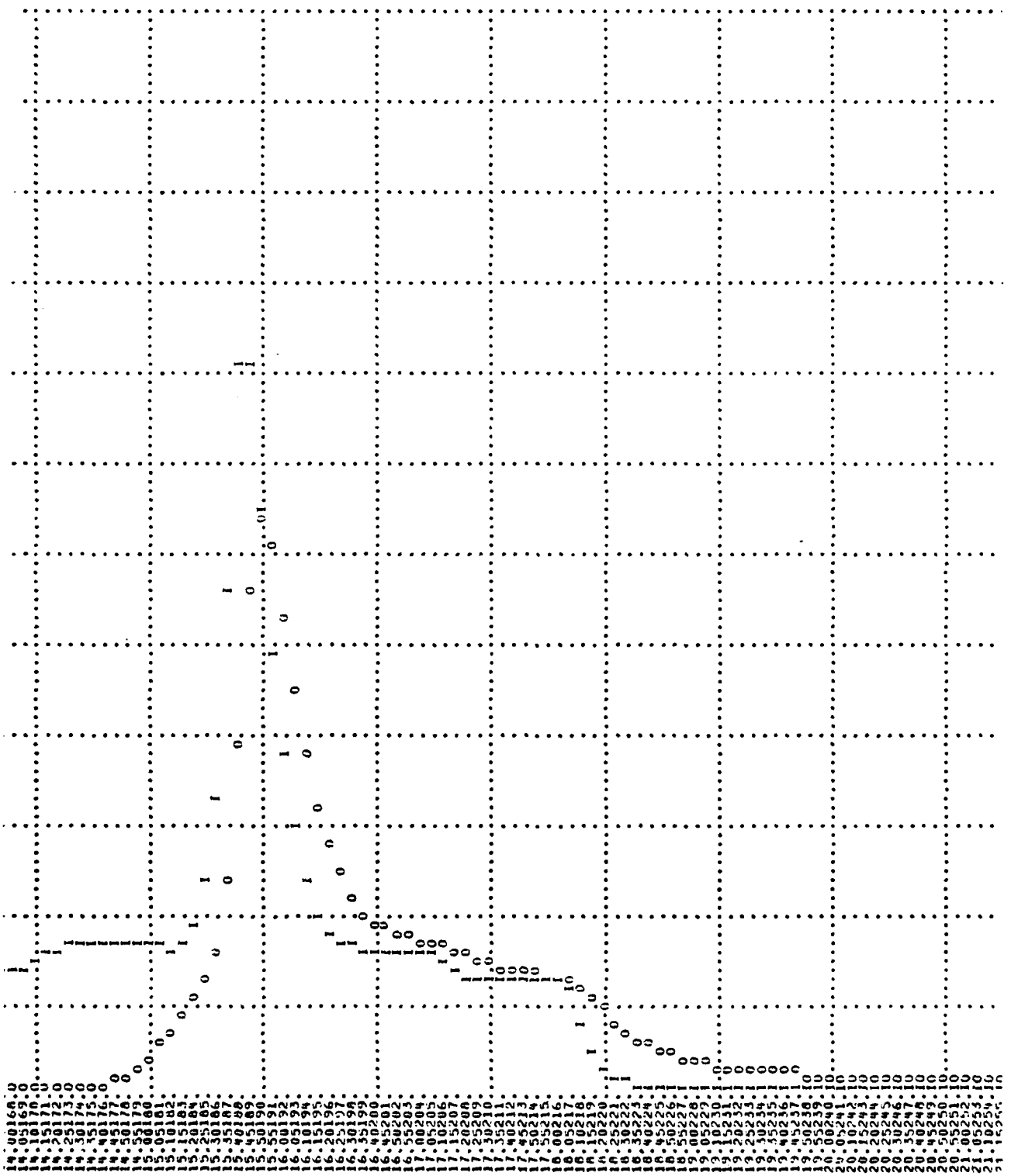

PLATE D-17

PLATE D-18

•OVN•

STATION 000002, PLAN 1, RATIO 8

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	2.	1.	1.	1.	1.	1.	2.	2.	2.
2.	2.	3.	3.	3.	4.	4.	4.	4.	5.
5.	5.	6.	6.	6.	7.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
9.	9.	9.	9.	9.	10.	10.	10.	10.	10.
10.	10.	10.	10.	10.	10.	10.	11.	11.	11.
11.	11.	14.	20.	26.	40.	64.	97.	129.	156.
179.	201.	223.	239.	250.	257.	262.	266.	269.	276.
286.	298.	309.	318.	325.	330.	334.	338.	340.	341.
340.	333.	330.	341.	376.	453.	651.	1039.	1384.	1435.
1252.	1026.	827.	680.	568.	488.	436.	398.	372.	354.
342.	334.	330.	327.	325.	319.	309.	297.	286.	277.
270.	265.	262.	259.	257.	256.	251.	235.	205.	174.
149.	126.	106.	89.	76.	66.	61.	57.	53.	50.
47.	44.	41.	39.	37.	35.	34.	32.	31.	30.
29.	28.	27.	27.	27.	26.	26.	26.	26.	26.
26.	26.	25.	25.	25.	25.	25.	25.	25.	24.
24.	24.	24.	24.	24.	24.	24.	24.	24.	24.
23.	23.	23.	23.	23.	23.	23.	23.	23.	23.
23.	22.	22.	22.	22.	22.	22.	22.		

STORAGE

82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
82.	82.	82.	82.	82.	82.	82.	82.	82.	82.
83.	83.	83.	83.	83.	83.	83.	83.	83.	83.
83.	83.	83.	83.	83.	83.	83.	83.	83.	83.
83.	83.	83.	83.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	85.	85.	86.
86.	86.	87.	87.	88.	88.	88.	89.	89.	89.
90.	90.	91.	91.	91.	92.	92.	93.	93.	93.
94.	94.	95.	95.	95.	96.	96.	97.	97.	97.
98.	98.	99.	99.	99.	100.	100.	101.	101.	101.
102.	102.	103.	103.	103.	104.	104.	105.	105.	106.
106.	106.	107.	107.	108.	108.	108.	109.	109.	110.
110.	110.	111.	111.	112.	112.	113.	114.	116.	117.
119.	120.	122.	123.	124.	126.	127.	128.	129.	130.
130.	131.	131.	132.	132.	132.	132.	132.	132.	132.
132.	133.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	134.	135.	137.	141.	144.	144.
143.	141.	139.	138.	136.	135.	135.	134.	134.	134.
133.	133.	133.	133.	133.	133.	134.	133.	132.	132.
132.	132.	132.	132.	132.	132.	132.	132.	131.	130.
130.	129.	128.	128.	127.	127.	127.	126.	126.	126.
126.	126.	125.	125.	125.	125.	125.	125.	125.	125.
125.	125.	125.	125.	125.	125.	125.	124.	124.	124.
124.	124.	124.	124.	124.	124.	124.	124.	124.	124.
124.	124.	124.	124.	124.	124.	124.	124.	124.	124.
124.	124.	124.	124.	124.	124.	124.	124.	124.	124.
124.	124.	124.	124.	124.	124.	124.	123.		

STAGE

860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0	860.0
860.0	860.0	860.0	860.1	860.1	860.1	860.1	860.1	860.1	860.1
860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1	860.1
860.1	860.1	860.1	860.1	860.1	860.2	860.2	860.2	860.2	860.2
860.2	860.2	860.2	860.2	860.2	860.3	860.3	860.3	860.5	860.4
860.4	860.5	860.5	860.5	860.6	860.6	860.7	860.7	860.7	860.8
860.8	860.9	860.9	860.9	861.0	861.0	861.0	861.1	861.1	861.2
861.2	861.2	861.3	861.3	861.4	861.4	861.4	861.5	861.5	861.6
861.6	861.6	861.7	861.7	861.8	861.8	861.8	861.9	861.9	862.0
862.0	862.0	862.1	862.1	862.1	862.2	862.2	862.3	862.5	862.3
862.4	862.4	862.4	862.5	862.5	862.5	862.6	862.6	862.7	862.7
862.7	862.8	862.8	862.9	862.9	863.0	863.0	863.1	863.3	863.4
863.5	863.6	863.7	863.9	864.0	864.1	864.2	864.3	864.4	864.4

864.5	864.5	864.5	864.6	864.6	864.7	864.7	864.7	864.7	864.7
864.6	864.7	864.7	864.7	864.7	864.8	865.0	865.5	865.5	865.5
864.7	864.7	864.7	864.7	864.7	864.9	864.8	864.8	864.7	864.7
865.4	865.3	865.2	865.0	864.9	864.9	864.7	864.6	864.6	864.6
864.7	864.7	864.7	864.7	864.7	864.7	864.7	864.6	864.6	864.6
864.6	864.6	864.6	864.6	864.6	864.6	864.6	864.6	864.5	864.5
864.4	864.3	864.3	864.3	864.2	864.2	864.2	864.1	864.1	864.1
864.1	864.1	864.1	864.1	864.1	864.0	864.0	864.0	864.0	864.0
864.0	864.0	864.0	864.0	864.0	864.0	864.0	864.0	864.0	864.0
864.0	864.0	864.0	864.0	864.0	864.0	864.0	864.0	864.0	864.0
863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9
863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9
863.9	863.9	863.9	863.9	863.9	863.9	863.9	863.9		

PEAK OUTFLOW IS 1435. AT TIME 15.83 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1435.	354.	97.	97.	2793.
CMS	41.	10.	3.	3.	79.
INCHES		24.56	26.80	26.80	26.80
MM		623.72	680.65	680.65	680.65
AC-FT		175.	191.	191.	191.
THOUS CU M		216.	236.	236.	236.

DVF

STATION000002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

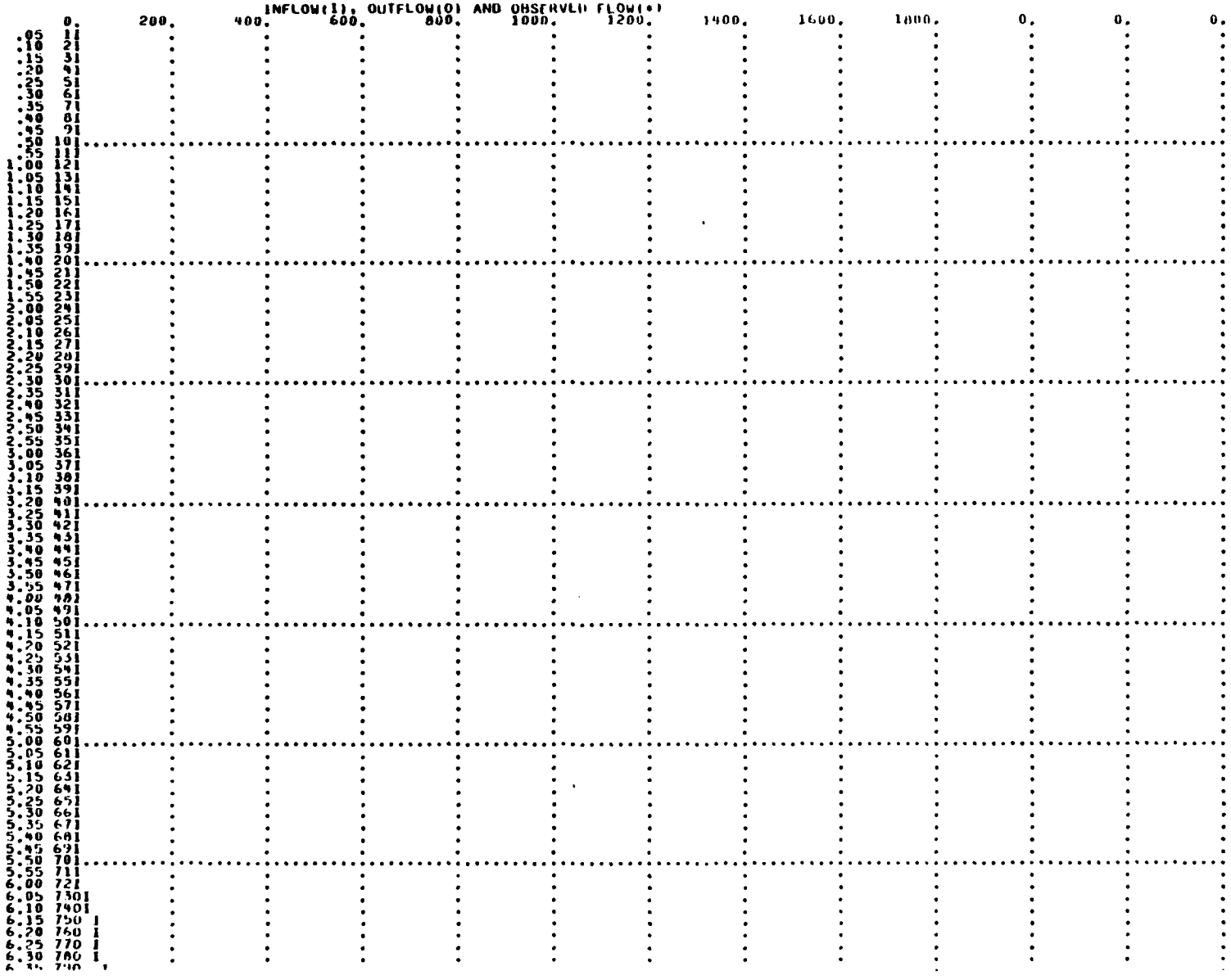

PLATE D-21

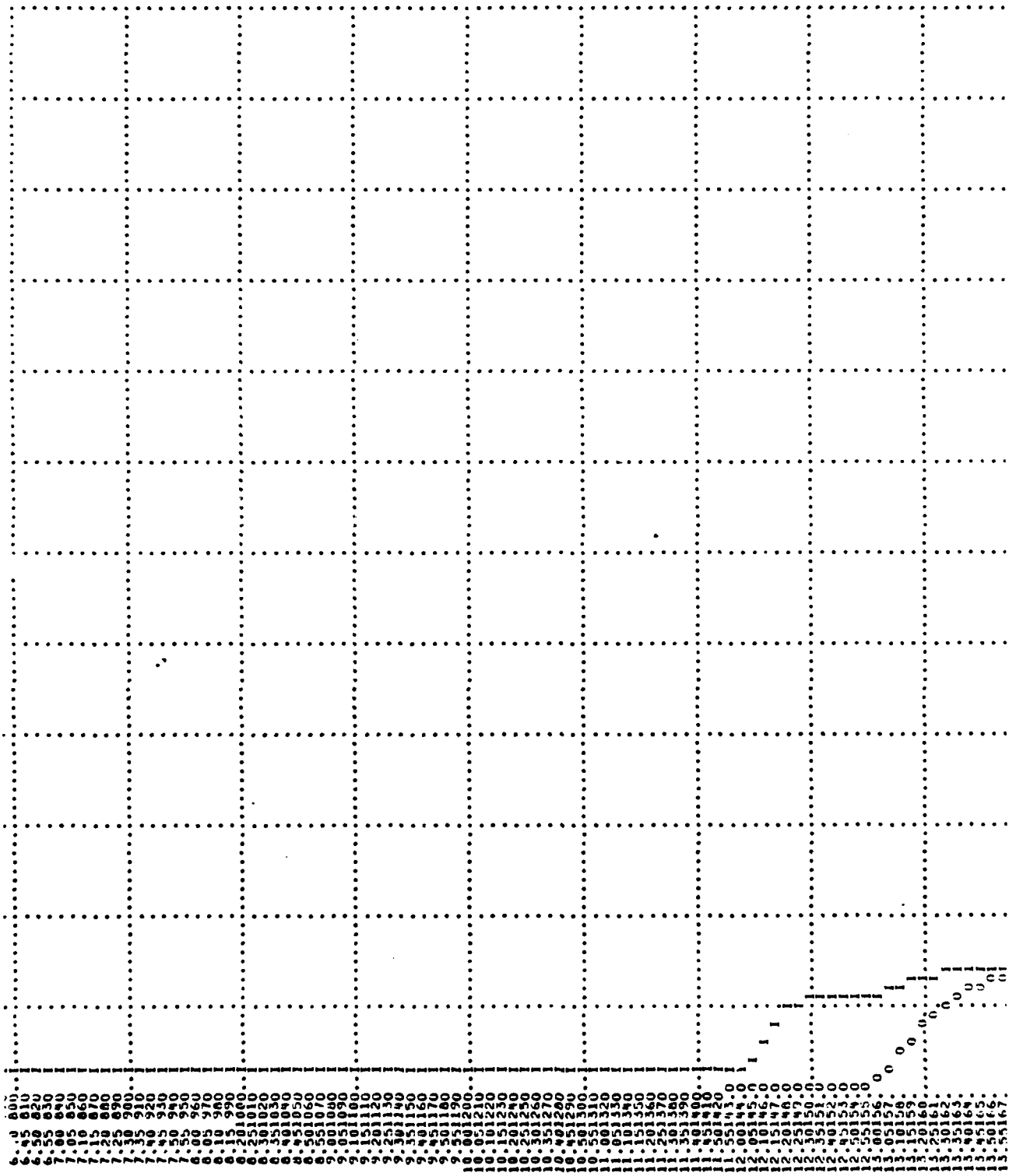

PLATE D-22

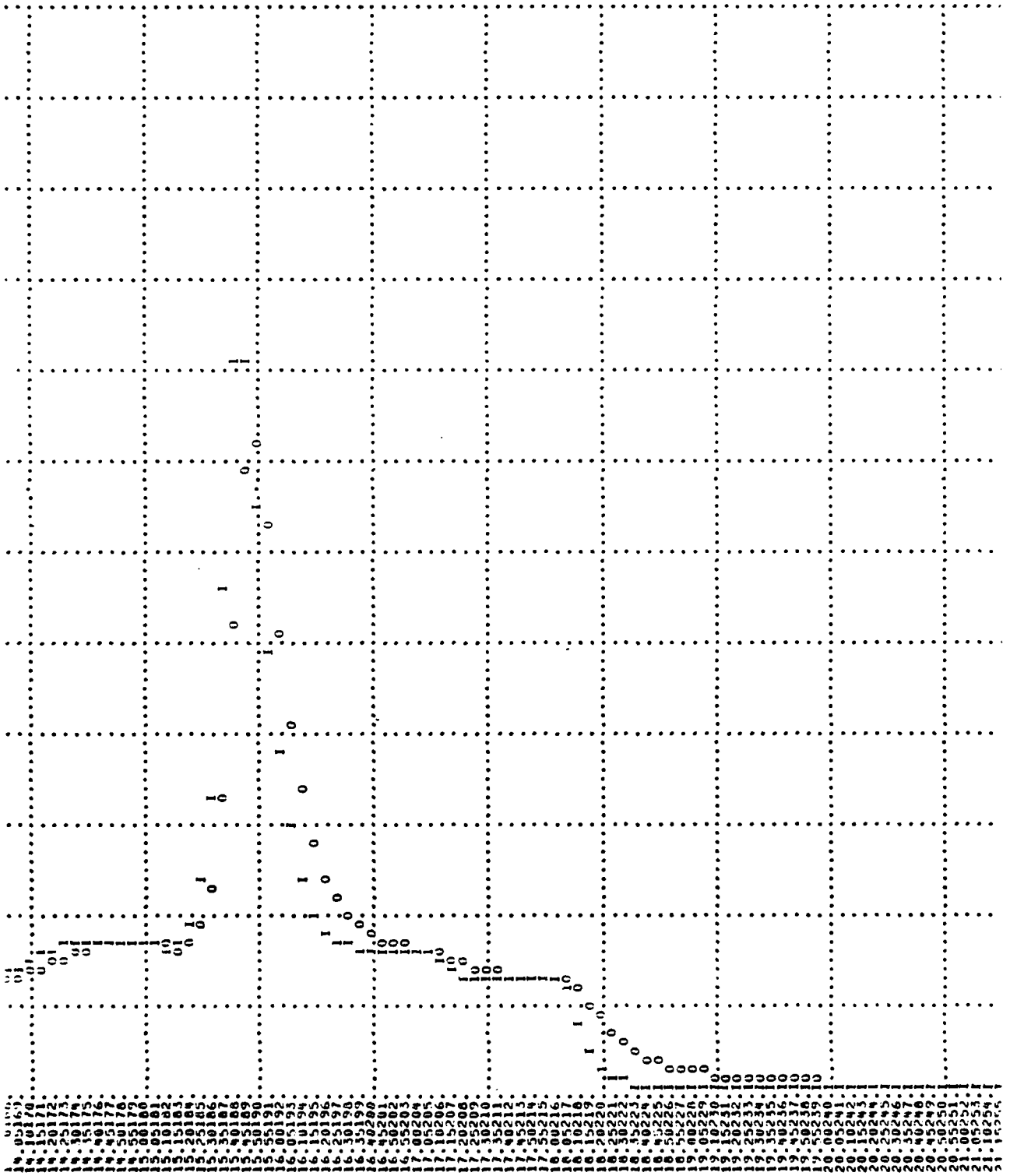

PLATE D-23

PLATE D-24

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)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .05	RATIO 2 .10	RATIO 3 .15	RATIO 4 .20	RATIO 5 .30	RATIO 6 .40	RATIO 7 .50	RATIO 8 1.00
HYDROGRAPH AT	000001	.13	1	81.	162.	243.	324.	486.	647.	809.	1619.
	(	.35)	(	2.29)(	4.58)(	6.88)(	9.17)(	13.75)(	18.33)(	22.92)(	45.84)
ROUTED TO	000002	.13	1	6.	8.	10.	15.	107.	394.	642.	1435.
	(	.35)	(	.16)(	.24)(	.29)(	.37)(	3.00)(	11.17)(	18.19)(	40.63)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	860.00	860.00	865.10
STORAGE	82.	82.	130.
OUTFLOW	0.	0.	795.

RATIO OF PMF	MAXIMUM RESERVOIR 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
.05	860.97	0.00	91.	6.	0.00	18.25	0.00
.10	861.92	0.00	101.	8.	0.00	18.25	0.00
.15	862.85	0.00	111.	10.	0.00	18.33	0.00
.20	863.73	0.00	121.	13.	0.00	18.33	0.00
.30	864.30	0.00	128.	109.	0.00	16.33	0.00
.40	864.77	0.00	134.	394.	0.00	15.92	0.00
.50	865.01	0.00	137.	642.	0.00	15.83	0.00
1.00	865.54	.44	144.	1435.	.50	15.83	0.00

PLATE D-26