November 4, 2021

Closure Completion Notification

Big Sandy Plant

Fly Ash Pond

On October 7, 2021, the Big Sandy Plant Fly Ash Pond was transitioned to closure status in accordance with 40 CFR 257.102. The CCR unit was closed in place and has initiated the written Post Closure Plan. This notice of completion of closure is being placed in the operating record in accordance with 40 CFR 257.102(h).

Effective with the Closure Completion Notification, the following operating record documents, as applicable, are no longer required going forward:

- Hazard Potential Classification
- Emergency Action Plan
- Face to Face Meeting Documentation for EAP
- History of Construction and Revisions for Surface Impoundments
- Structural Stability Assessments
- Safety Factor Assessments
- Fugitive Dust Plan
- Inflow Design Flood System Control Plan

CLOSURE CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the Big Sandy Plant Fly Ash Pond (FAP) has been closed in accordance with the closure plan specified by paragraph 257.102(b) and the requirements of section 257.102.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

STATE OF KENTUCKY
DAVID ANTHONY MILLER
33232
LICENSED PROFESSIONAL ENGINEER

33232	KENTUCKY	11.04.21
License Number	Licensing State	Date

8. ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

AECOM

KENTUCKY POWER BIG SANDY POWER PLANT

LAWRENCE COUNTY, KENTUCKY

FLY ASH POND PHASE I CLOSURE CONSTRUCTION

I, Thomas A. Kovacic, P.E., being a Registered Professional Engineer in accordance with the Kentucky's Professional Engineer's Registration do hereby certify to the best of my knowledge, information and belief, that the information contained in the accompanying AEP Big Sandy Plant Fly Ash Pond Closure Construction Quality Assurance Certification Report dated November 27, 2018 is true and correct and has been prepared in accordance with the accepted practice of engineering.

PE ____Thomas A. Kovacic____ DATE ___October 4, 2021_________

ADDRESS AECOM Technical Services, Inc.
1300 East 9th Street, Suite 500
Cleveland, OH 44114

TELEPHONE (216)-622-2300

8. ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

AECOM

KENTUCKY POWER BIG SANDY POWER PLANT

LAWRENCE COUNTY, KENTUCKY

FLY ASH POND PHASE II AND PHASE III 2018 CLOSURE CONSTRUCTION

I, Thomas A. Kovacic, P.E., being a Registered Professional Engineer in accordance with the Kentucky Professional Engineer's Registration do hereby certify to the best of my knowledge, information and belief, that the information contained in the accompanying AEP Big Sandy Plant Fly Ash Pond Phase II and Phase III 2018 Closure Construction Quality Assurance Certification Report dated January, 2020, is true and correct and has been prepared in accordance with the accepted practice of engineering.

SIGNATURE ________Thomas . Kovacic____________ DATE ____October 5, 2021 _____

ADDRESS AECOM Technical Services, Inc.
1300 East 9th Street, Suite 500
Cleveland, OH 44114

TELEPHONE (216)-622-2300

STATE OF KENTUCKY ★ THOMAS A. KOVACIC 20958 LICENSED PROFESSIONAL ENGINEER ★

October 5, 2021

9. ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

AECOM

KENTUCKY POWER BIG SANDY POWER PLANT

LAWRENCE COUNTY, KENTUCKY

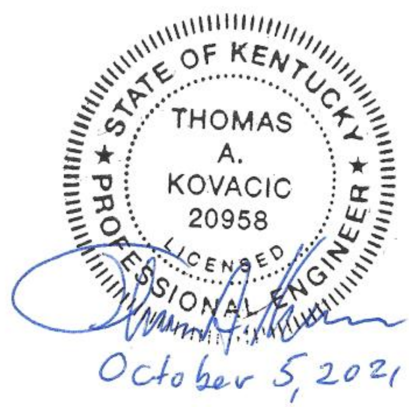
FLY ASH POND PHASE III AND PHASE IVA 2019 CLOSURE CONSTRUCTION

I, Thomas A. Kovacic, P.E., being a Registered Professional Engineer in accordance with the Kentucky Professional Engineer's Registration do hereby certify to the best of my knowledge, information and belief, that the information contained in the accompanying report is true and correct and has been prepared in accordance with the accepted practice of engineering.

SIGNATURE Thomas A. Kovacic DATE October 5, 2021

ADDRESS AECOM Technical Services, Inc.
1300 East 9th Street, Suite 500
Cleveland, OH 44114

TELEPHONE (216)-622-2300



9. ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

AECOM

KENTUCKY POWER BIG SANDY POWER PLANT

LAWRENCE COUNTY, KENTUCKY

FLY ASH POND PHASE IV 2020 and 2021 AND FINAL CLOSURE CONSTRUCTION

I, Thomas A. Kovacic, P.E., being a Registered Professional Engineer in accordance with the Kentucky Professional Engineer's Registration do hereby certify to the best of my knowledge, information and belief, that the information contained in the accompanying AEP Big Sandy Plant Fly Ash Pond Phase IV 2020-2021 and Final Closure CQA Certification Report is true and correct and has been prepared in accordance with the accepted practice of engineering.

SIGNATURE	Thomas A. Kovacic	DATE October 7, 2021
ADDRESS	AECOM Technical Services, Inc. 1300 East 9th Street, Suite 500 Cleveland, OH 44114	
TELEPHONE	(216)-622-2300	

STATE OF KENTUCKY
THOMAS
A.
KOVACIC
20958
LICENSED
PROFESSIONAL ENGINEER

October 7, 2021

INFLOW DESIGN FLOOD CONTROL PLAN

CFR 257.82

Fly Ash Pond

Big Sandy Plant
Louisa, Kentucky

October, 2016

Prepared for: Kentucky Power – Big Sandy Plant

Louisa, Kentucky

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

GERS – 16-029

INFLOW DESIGN FLOOD CONTROL PLAN
CFR 257.82
BIG SANDY PLANT
FLY ASH POND

PREPARED BY ______________________ DATE 8-19-16
Brian G. Palmer, P.E.

REVIEWED BY ______________________ DATE 8/19/2016
Brett Dreger, P.E.

APPROVED BY ______________________ DATE 8/22/2016
Gary F. Zych, P.E.
Manager – AEP Geotechnical Engineering

Gary F. Zych
STATE OF KENTUCKY
GARY F. ZYCH
29188
LICENSED
PROFESSIONAL ENGINEER
8/22/2016

I certify to the best of my knowledge, information, and belief that the information contained in this closure plan meets the requirements of 40 CFR § 257.82

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1.0 OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.82 for the hydrologic and hydraulic evaluation of CCR surface impoundments.

2.0 DESCRIPTION OF THE CCR UNIT

It is owned and operated by Kentucky Power. The facility operates two surface impoundments for storing CCRs called the Fly Ash Pond and the Bottom Ash Pond. This report deals with the hydrologic and hydraulic evaluation for the Fly Ash Pond.

The Fly Ash Pond is a valley impoundment with a main dam and a saddle dam. The Big Sandy Fly Ash Pond received sluiced fly ash and waste water from the plant via the bottom ash pond. Bottom Ash excavated from the Big Sandy Bottom Ash Pond is also placed within the Fly Ash Pond.

The Big Sandy Power Plant has ceased burning coal and has been refueled for natural gas. The Fly Ash Pond currently receives waste water from the plant for discharge through the permitted outfall.

3.0 INFLOW DESIGN FLOOD 257.82(a)(3)

The facility is classified as a High Hazard Potential Dam. The Inflow Design Flood is the Probable Maximum Flood (PMF).

4.0 FLOOD CONTROL PLAN 257.82(c)

All storm water runoff from the watershed drains into the reservoir created by the Fly Ash Pond Dam. The design to safely pass the inflow design flood without overtopping the crest of the dam is based on the normal pool being at maximum normal operating pool and utilizing the principal spillway and emergency spillway to handle the PMF without overtopping the crest of the dam.

The analysis in Attachment A includes related excerpts from the 1993 design report and the associated report Appendix E that provides the description of the spillway system, flood storage capacity, inflow peak discharge and volume, peak discharge from the facility and maximum pool elevation.

The calculations show that the facility has the capacity to manage the inflow design flood.`

ATTACHMENT A

Attachment A-1

Excerpts from 1993 Design Report

Hydrology and Hydraulics

KENTUCKY POWER
BIG SANDY PLANT
FLY ASH RETENTION DAM
FINAL RAISING
DESIGN REPORT

PROJECT OVERVIEW

Kentucky Power Company (KPCo) has been slurrying fly ash produced at Big Sandy Electric Generating Plant into Horseford Creek fly ash pond since 1970. The estimated life of the fly ash pond, with the present dam crest at Elevation 675, is until the year 2000. It is anticipated that Unit 1 and 2 will be retired by January 1, 2024 and January 1, 2030, respectively. Therefore, it is necessary to increase the ash storage life of the pond until at least the year 2030.

Kentucky Power Company proposes to increase the available ash storage volume by raising the dam height to a crest elevation of 711 feet. The increased height will provide an ash storage capacity of approximately 12.9×10^6 cubic yards. The plan and sections for the proposed raising of the main dam and the construction of the saddle dam are presented in the accompanying set of design drawings. A complete listing of drawings is included in the drawing's cover sheet. The AEPSC Civil Engineering Division Technical Specifications for material and construction are attached under separate cover. The geotechnical aspects of the key components of the project are discussed below. This information is presented, in support of KPCo's application for an amendment to permit No. 3685 issued on September 20, 1988.

Main Dam

The extension of the core zone for the raising will be constructed from clays of low to medium plasticity obtained from the proposed borrow area. The downstream shell will be constructed using bottom ash. The faces of the dam will be lined with riprap to minimize erosion. The raising of the dam will be constructed at a maximum rate of 15 feet per year. Furthermore, a maximum of 5 feet of material may be placed in a given construction period. A minimum of 3 months should elapse between consecutive construction periods.

Cohesive soil will be placed to a final configuration of 2-3/4H:1V. Compaction will be accomplished at moisture contents ranging from -1% to +2% of the optimum moisture content. The soil shall be compacted in uniform, thin lifts to a unit dry weight equal to at least 95% of the maximum unit dry weight as determined in the laboratory by means of the Standard Proctor Compaction test. Bottom ash from Big Sandy Plant will continue to be used in the chimney drain and downstream shell to its final configuration of 1-3/4H:1V. This material will be compacted in uniform, thin lifts to at least 70% relative density determined by ASTM D 4253-83 and ASTM D4254-83. No moisture control will be required when compacting bottom ash. Results of the engineering and stability analyses indicated that the dam will perform within factors of safety commonly accepted for facilities of this type.

At locations where new construction meets the abutments or existing permanent features of the site, the new materials will be benched into the existing grade to allow placement in horizontal lifts and compaction control. Any feature of the site which may infringe into areas of proposed construction will be relocated as indicated on the drawings.

BIG SANDY PLANT
HORSEFORD CREEK FLY ASH DAM

HYDROLOGY

General

The watershed of the Horseford Creek Dam is depicted on Fig. 6.1. The major drainage feature, Horseford Creek, drains into Blaine Creek which flows into the Big Sandy River at river mile 19.6.

Presently, the crest of the existing dam is at el. 678±. Discharge is regulated by the intake tower of the principal spillway which is connected to a 30-inch diameter reinforced concrete pipe. The concrete pipe terminates into a riprap-lined channel. The intake tower consists of twin shafts with side openings for decanting effluent. Concrete stoplogs are placed in the side openings as necessary to maintain settling action of the fly ash and act as an over-flow weir to establish operating levels. During most operating conditions, discharge through the principal spillway will be controlled by weir flow over both stoplogs. The current emergency spillway consists of a 50-foot wide open channel excavated in rock on the left abutment of the saddle dam.

The proposed raising of the main dam will necessitate filling in the existing emergency spillway, raising of the saddle dam, and constructing a new emergency spillway.

The following sections present the hydrologic considerations and analyses performed during the design phase of this project.

Basin Characteristics

Fig. 6.1 depicts the limits of the watershed boundary for the fly ash dam. A review of available topographic maps and aerial photographs was made to determine essential basin characteristics. Such characteristics include the drainage boundaries, areas, slopes, soil types, land use and time of concentration. The time of concentration is defined as the elapsed time for runoff to travel from the hydraulically most distant part of the watershed to some reference point downstream.

Present land use within the watershed is limited to the fly ash pond proper and the adjacent wooded hillslopes. Raising of the dam will only alter the total acreage for both land uses.

A detailed soil survey for Lawrence County has not been published. Previous reports on the Phase 1 and 2 designs classified the soils such that they fall under the hydrologic soil group C as defined by the Soil Conservation Service

(SCS) of the U.S. Department of Agriculture. The table below lists the basin characteristics used for this project.

Drainage Area	675 acres
Average Land Slope	28%
Hydrologic Soil Group	C
SCS Curve Number (weighted)	73
Time of Concentration	0.25 hour

Based on Drawing No. 12-30030, the fly ash pond will have the following surface areas and storage capacities above elevation 650 feet.

Elevation	Area (ac)	Storage (ac-ft)
650	87	0
660	103	945
680	145	3406
700	169	6540
710	184	8302

Fig. 6.2 illustrates the stage-area-volume relationship for the fly ash pond.

Assumptions and Design Requirements

No rainfall-runoff data were available for the site. Therefore, runoff hydrographs were generated using the SCS method as described in the National Engineering Handbook, Section 4 - Hydrology. Since the raised pool levels will inundate a significant portion of the watershed, the hydrograph analysis for the emergency spillway was divided in two subwatersheds - the pond area and the remaining drainage area. The hydrograph for the pond area was developed by converting the precipitation hyetograph into an inflow hydrograph since there is 100 percent instantaneous runoff. The inflow hydrograph for the remaining area was determined by the referenced method. These two hydrographs were combined to define the design flood hydrographs. The general design requirements for the principal and emergency spillways have been established by the Kentucky Department for Environmental Protection, Division of Water.

Principal Spillway

According to Division of Water, Engineering Memorandum No. 5, design of the principal (service) spillway for Class C dams must be such that the average frequency of use of the emergency spillway cut in rock is predicted to be less than once in fifty years. To meet this criteria, the 10-day principal spillway hydrograph (PSH) must be developed based on the procedures in the SCS National Engineering Handbook. The principal spillway shall also have the capacity to release 80% of the maximum flood waters retained in the reservoir within ten days.

It was assumed that a 50-year rainfall event would produce the 50-year flood. Antecedent soil moisture condition II was assumed for the hydrograph development. Precipitation values were obtained from the Division of Water, Engineering Memorandum No. 2 (rev. 1979). For the project site located in Lawrence County, the rainfall values are 5.1 and 8.9 inches for the 50-year, 1 day and 10 day storms, respectively.

Emergency Spillway

The emergency spillway shall pass the design emergency spillway hydrograph (ESH) and freeboard hydrograph (FH) without overtopping the dam. For Class C dams, the minimum hydrologic criteria are:

ESH design rainfall, P = P100 + 0.26 (PMP-P100)
FH design rainfall, P = PMP

For this project, the design rainfalls have a duration of 6 hours. The PMP, probable maximum precipitation, is defined as the greatest depth of precipitation for a given duration that is meteorologically possible for a given basin at a particular time of year. The probable maximum flood (PMF) is the result of the PMP. For the project site, the rainfall values are 4.3 and 28.1 inches for the 100-year P100 and PMP storms, respectively. Antecedent moisture condition II was assumed for both storms.

Hydrologic Analysis

Most rainfall - runoff computations and all reservoir flood routings were conducted using the U.S. Army Corps of Engineers HEC-1 computer program. Basin characteristics, stage-storage, and discharge rating curves are input data supplied by the user.

Principal Spillway

Daily discharges from the reservoir will continue to be regulated by the existing principal spillway structure with no modifications. The principal spillway hydrograph (PSH) was manually calculated following the procedures in the SCS Handbook. Ash sluice waters (estimated to be 10 cfs) were added to the PSH to develop a total inflow hydrograph. Flood routings were conducted to establish a maximum operating pool level and the invert elevation of the emergency spillway.

Emergency Spillway

Flood routings of the freeboard hydrograph were conducted to determine the size of the emergency spillway necessary to pass the probable maximum flood without overtopping the dam. The initial water surface in the reservoir was assumed to be at the maximum operating level at the beginning of the storm. Flood routings were conducted for two situations (a) the principal spillway discharging and (b) neglecting those discharges.

Based on the principal spillway hydrograph flood routings, the 10-day drawdown level was at the maximum operating level. Therefore, the freeboard hydrograph was the controlling flood to set the emergency spillway dimensions and minimum top of dam.

In addition to the 6-hour PMF, a 24-hour PMF was developed and routed through the facility. This was done to verify the pond's capacity to handle a larger volume storm over a longer duration. The 24-hour PMP has a value of 35.5 inches.

Results

Principal Spillway

The development of the 50-year principal spillway hydrograph (PSH) indicates a peak inflow of 357 cfs which includes 10 cfs of ash sluice waters and 5 cfs of minimum quick return flow. The runoff volume over the 10 day duration is 610 acre-feet.

A maximum operating pool level has been set at elevation 705. This corresponds to a maximum stop-log elevation of 704. Final flood routings of the PSH started at an initial pool level equivalent to the maximum operating level. The reservoir rises to a maximum elevation of 706.0 feet. The peak outflow through the principal spillway is 54 cfs. Fig. 6.3 is a plot of the inflow and outflow principal spillway hydrographs. The receding flood pool is drained within eight days and six hours after the peak pool level is attained. Therefore, the requirements of Section E-I of Engineering Memorandum No. 5 are satisfied.

Emergency Spillway

The development of the 6-hour PMF hydrograph indicates a peak inflow of 10,610 cfs and a runoff volume of 1159 acre-feet.

The invert of the emergency spillway has been set at elevation 706.25 which is above the 50-year PSH flood elevation. The reservoir will rise to elevation 709.4 feet during passage of the PMF. This is based on an initial pool level of 705 feet and a 100 foot wide emergency spillway section. The flood routing was based on the principal spillway being plugged, a conservative condition. The peak outflow from the facility is 1672 cfs. Fig. 6.4 is a plot of the inflow and outflow emergency spillway hydrographs.

The 24-hour PMF generates 1564 acre-feet of runoff and has a peak inflow of 15,687 cfs. The pond will rise to elevation 710.5 feet and the peak outflow is 2433 cfs.

Summary and Conclusions

The 50-year, 10-day principal spillway hydrograph and the 6-hour probable maximum flood hydrograph were generated for the proposed raising of the Horseford Creek Dam. The SCS procedures for hydrologic design were followed with the use of the U.S. Army Corps of Engineers computer programs HEC-1 and HEC-2. Table No. 6.1 gives a summary of the study.

The existing principal system will be used without any modifications. It has the capacity to safely discharge the design flood without engaging the emergency spillway. The total spillway system (principal and emergency) has enough capacity to pass the probable maximum flood without overtopping the crest of the dam. There is sufficient freeboard for wind and wave height calculated to be 1.39 feet.

TABLE NO. 6.1
SUMMARY OF HYDROLOGIC/HYDRAULIC DATA

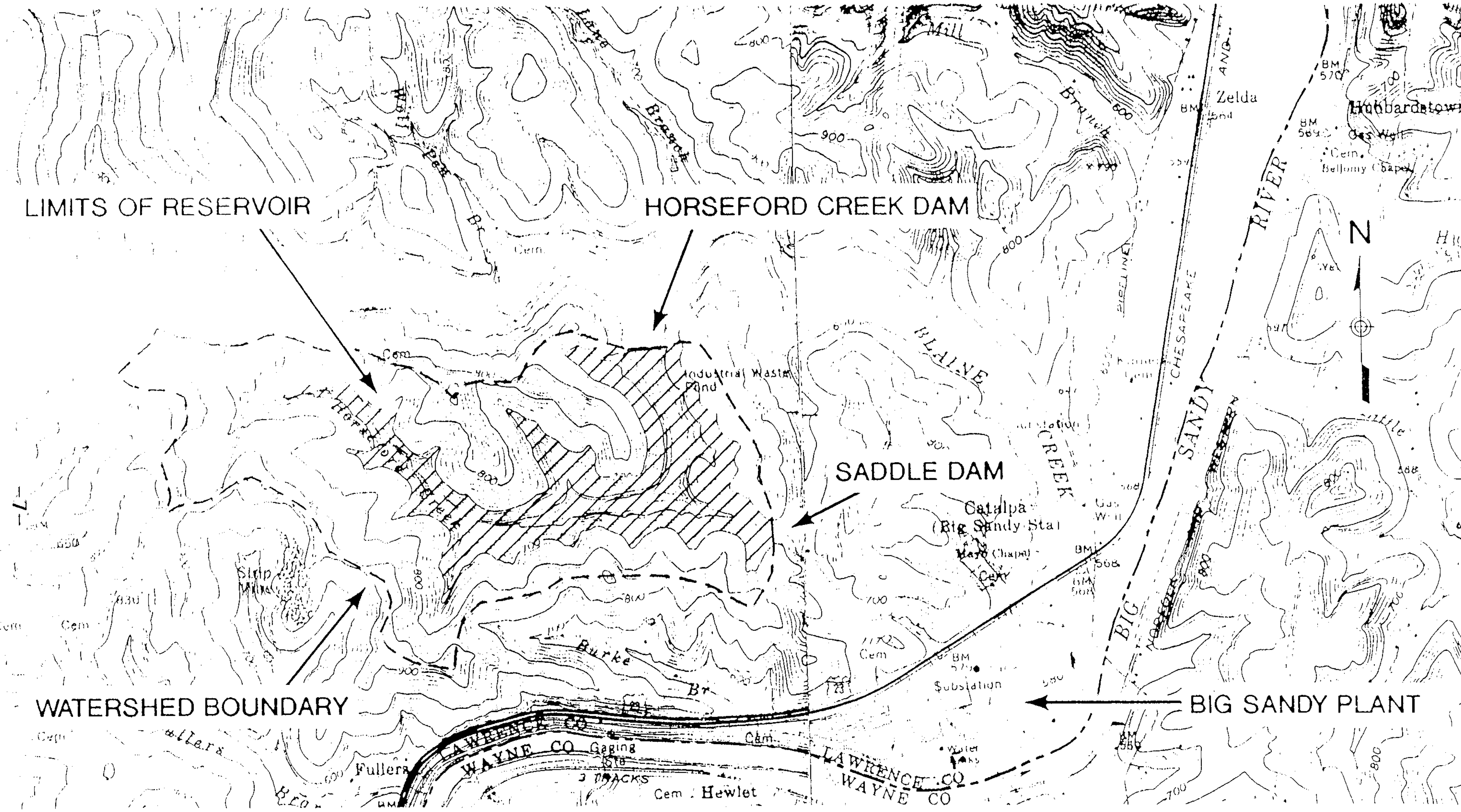
DRAINAGE AREA	0.9 SQ. MI.
DESIGN INFLOW FLOODS	
50-YR, 10-DAY PEAK	357 cfs
6-YR PMF PEAK	10,610 cfs
24 HR PMF	15,687 cfs
PEAK DISCHARGE	
50-YR, 10-DAY	54 cfs
6-HR PMF	1,672 cfs
24 HR PMF	2,433
MAXIMUM POOL ELEVATION	
50-YR, 10-DAY	706.0 FT
6-HR PMF	709.4 FT
24 HR PMF	710.5
DAM CREST ELEVATION	711.0 FT
MAXIMUM OPERATING POOL ELEVATION	705.0 FT

PRINCIPAL SPILLWAY:

CONCRETE RISER TOWER AND CONDUIT
SHAFT OPENING 2 @ 3.0' X 4.0'
30" DIAMETER REINFORCED CONCRETE PIPE

EMERGENCY SPILLWAY:

EXCAVATED CHANNEL IN ROCK	
CREST ELEVATION	706.25 FT
BOTTOM WIDTH	100 FT
SIDE SLOPES	1H:6V



EFERENCE: USGS QUADRANGLE MAPS
FALLSBURG, KY.-W.VA.
PRICHARD, W.VA.-KY.

SCALE:
0 2000 4000 FEET

Big Sandy Plant
Horseford Creek Fly Ash Dam
Watershed Map

FIGURE 6.1

Big Sandy Plant
Horseford Creek Fly Ash Dam
Stage-Area-Volume Curves

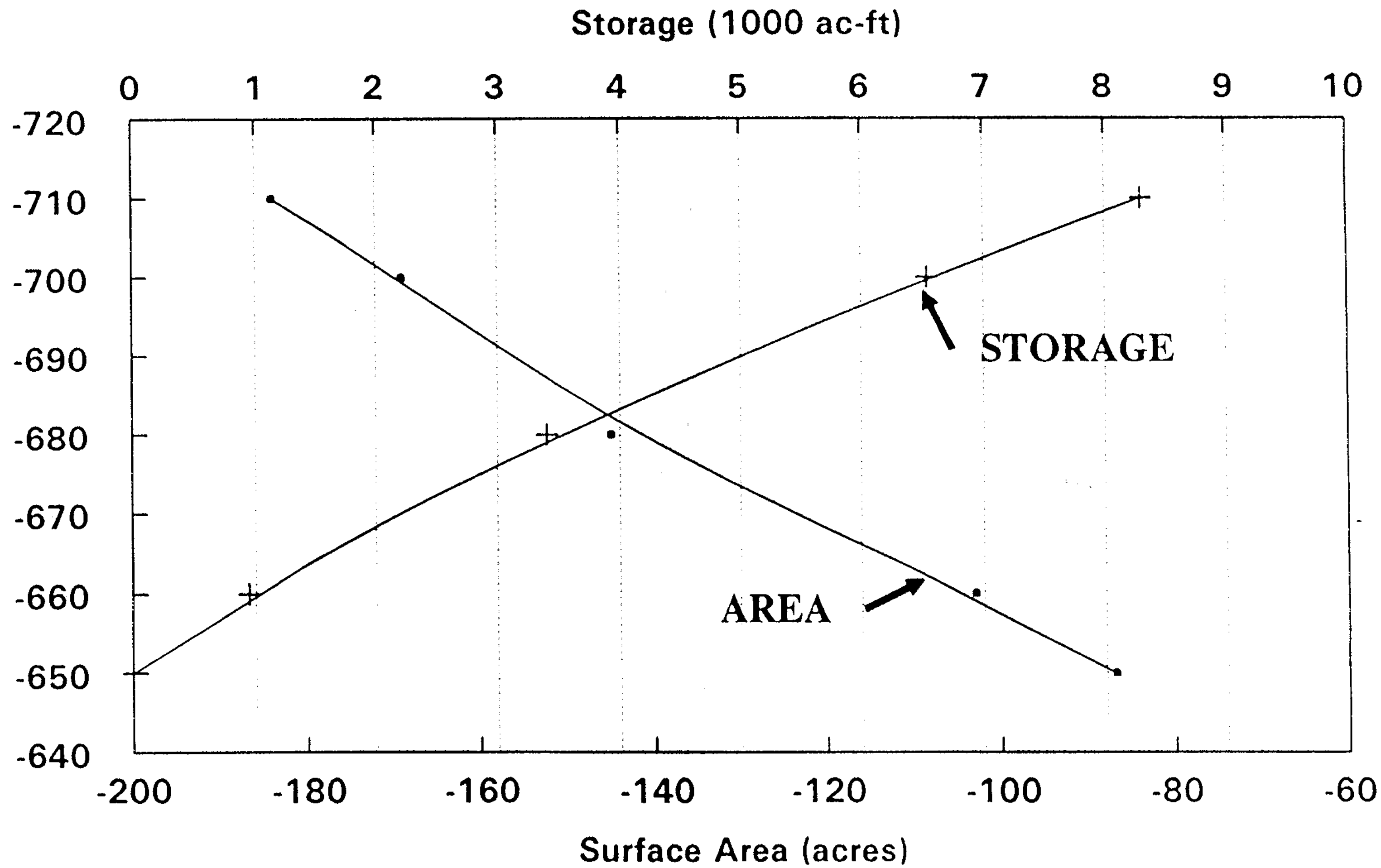


FIGURE 6.2

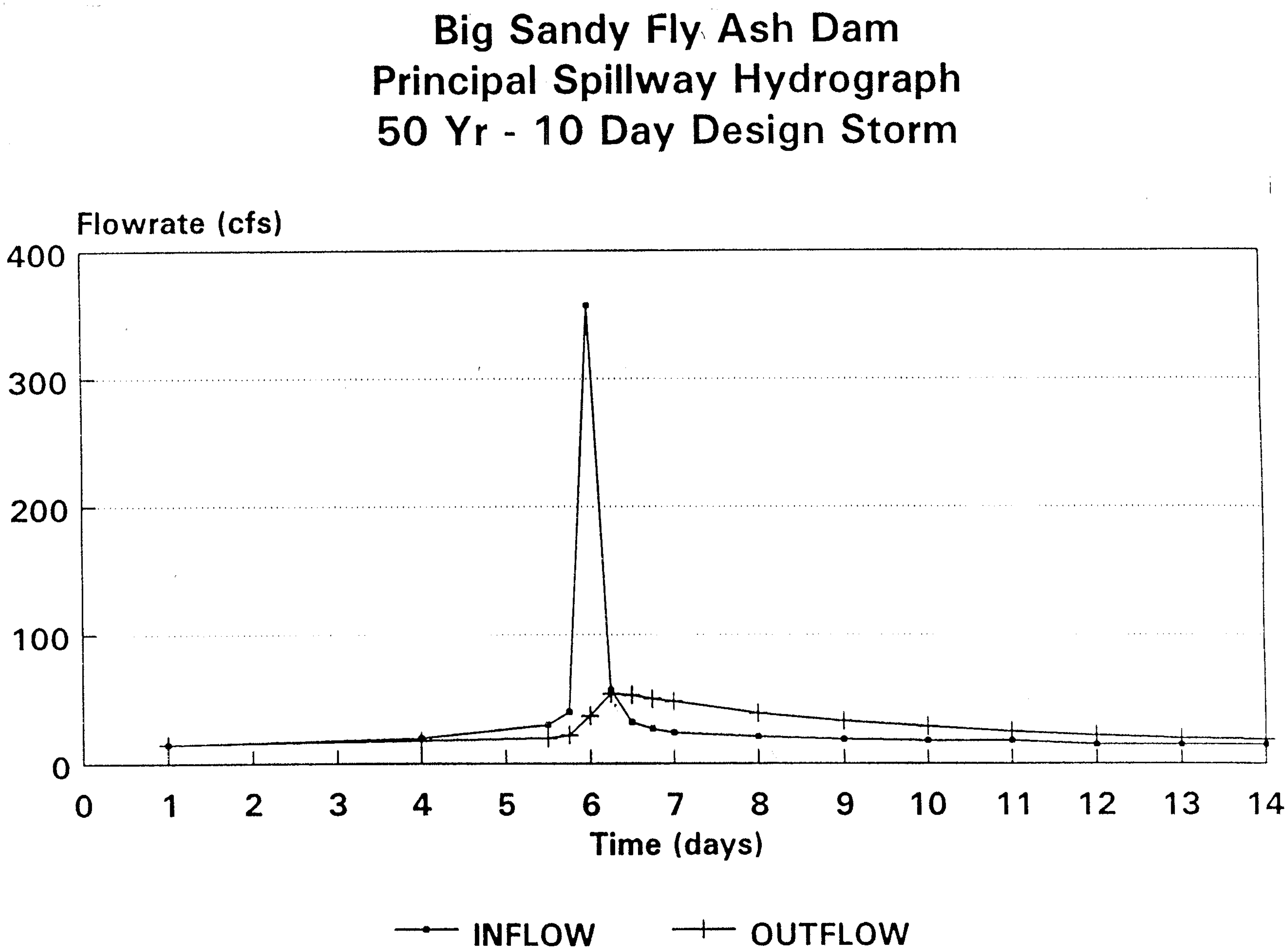

Big Sandy Fly Ash Dam
Principal Spillway Hydrograph
50 Yr - 10 Day Design Storm
Flowrate (cfs)
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time (days)
INFLOW
OUTFLOW

FIGURE 6.3

Big Sandy Fly Ash Dam
Emergency Spillway
6 Hr PMF Design Flood

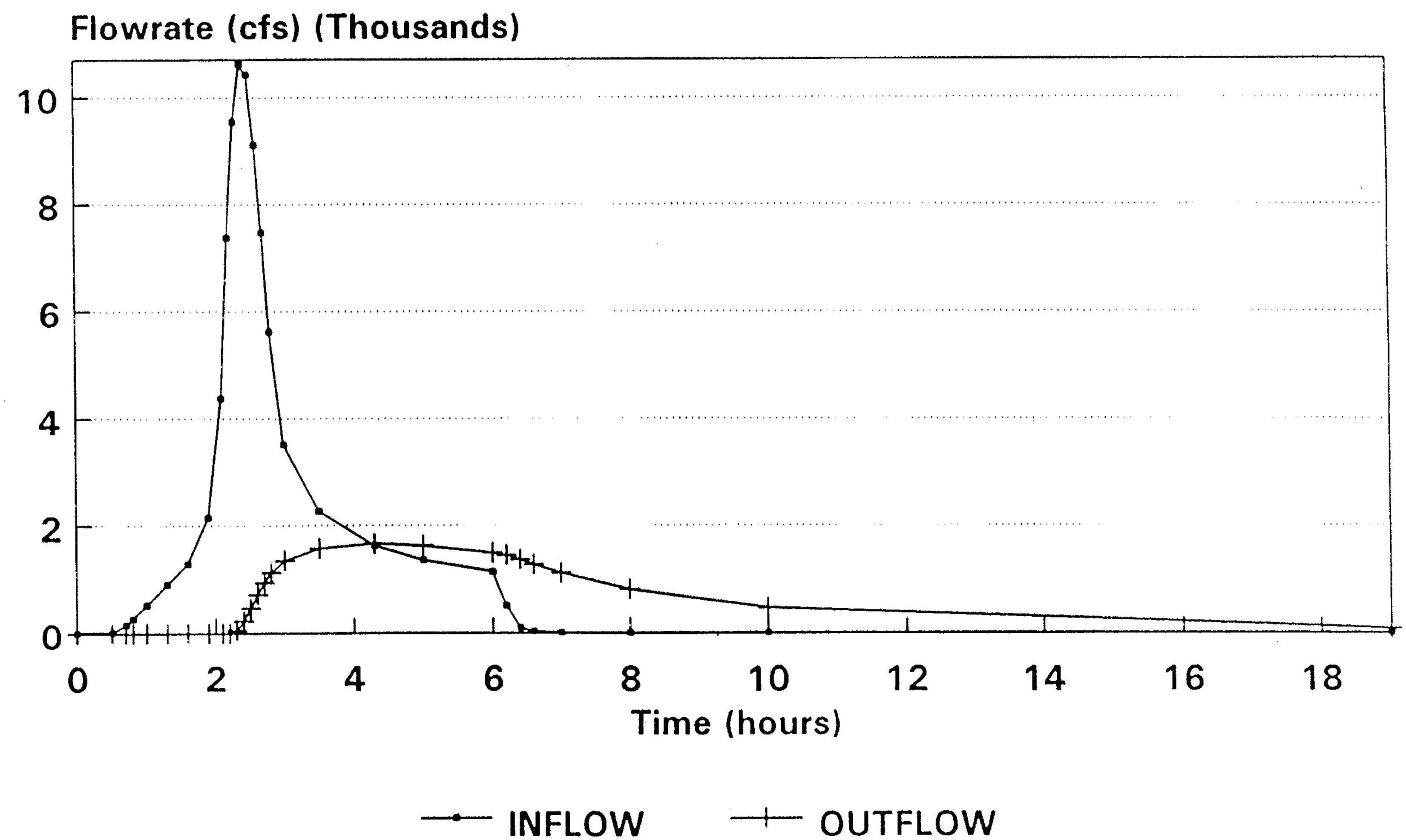


FIGURE 6.4

KENTUCKY POWER COMPANY
BIG SANDY PLANT
FLY ASH RETENTION DAM
STAGE 3 RAISING
ENGINEERING REPORT

Prepared by
American Electric Power Service Corporation
Civil Engineering Department
Geotechnical Section

March 1993

PROJECT OVERVIEW

Kentucky Power Company (KPCo) has been slurrying fly ash produced at Big Sandy Electric Generating Plant into Horseford Creek fly ash pond since 1970. The estimated life of the fly ash pond, with the present dam crest at Elevation 675, is until the year 2000. It is anticipated that Unit 1 and 2 will be retired by January 1, 2024 and January 1, 2030, respectively. Therefore, it is necessary to increase the ash storage life of the pond until at least the year 2030.

Kentucky Power Company proposes to increase the available ash storage volume by raising the dam height to a crest elevation of 711 feet. The increased height will provide an ash storage capacity of approximately 12.9 x 10^6 cubic yards. The plan and sections for the proposed raising of the main dam and the construction of the saddle dam are presented in the accompanying set of design drawings. A complete listing of drawings is included in the drawing's cover sheet. The AEPSC Civil Engineering Division Technical Specifications for material and construction are attached under separate cover. The geotechnical aspects of the key components of the project are discussed below. This information is presented, in support of KPCo's application for an amendment to permit No. 3685 issued on September 20, 1988.

Main Dam

The extension of the core zone for the raising will be constructed from clays of low to medium plasticity obtained from the proposed borrow area. The downstream shell will be constructed using bottom ash. The faces of the dam will be lined with riprap to minimize erosion. The raising of the dam will be constructed at a maximum rate of 15 feet per year. Furthermore, a maximum of 5 feet of material may be placed in a given construction period. A minimum of 3 months should elapse between consecutive construction periods.

Cohesive soil will be placed to a final configuration of 2-3/4H:1V. Compaction will be accomplished at moisture contents ranging from -1% to +2% of the optimum moisture content. The soil shall be compacted in uniform, thin lifts to a unit dry weight equal to at least 95% of the maximum unit dry weight as determined in the laboratory by means of the Standard Proctor Compaction test. Bottom ash from Big Sandy Plant will continue to be used in the chimney drain and downstream shell to its final configuration of 1-3/4H:1V. This material will be compacted in uniform, thin lifts to at least 70% relative density determined by ASTM D 4253-83 and ASTM D4254-83. No moisture control will be required when compacting bottom ash. Results of the engineering and stability analyses indicated that the dam will perform within factors of safety commonly accepted for facilities of this type.

At locations where new construction meets the abutments or existing permanent features of the site, the new materials will be benched into the existing grade to allow placement in horizontal lifts and compaction control. Any feature of the site which may infringe into areas of proposed construction will be relocated as indicated on the drawings.

Saddle Dam

The impervious zone of the saddle dam will be constructed from clays of low to medium plasticity obtained from the proposed area. The downstream shell will be constructed using bottom ash. The faces of the dam will be lined with riprap. Construction of the saddle dam will require the filling of the existing emergency spillway which consists of a rock channel.

Cohesive soil will be placed to a final configuration of 2 3/4H:IV on the upstream slope. Compaction will be achieved at a moisture content ranging from -1% to +2% of the optimum moisture content. The soil shall be compacted in uniform thin lifts at a unit dry weight equal to at least 95% of the maximum unit dry weight as determined in the laboratory by means of the Standard Proctor Compaction tests. Bottom ash from Big Sandy Plant will be used in the chimney drain and downstream shell to its final configuration of 1-3/4H:1V. This material will be compacted in uniform thin lifts to at least 70% relative density as determined by ASTM D 4253-83 and ASTM D 4254-83. No moisture control will be required when compacting bottom ash. Results of the engineering and stability analyses indicate that the saddle dam will perform within factors of safety commonly accepted.

The existing emergency spillway will be filled with a fly ash/bottom ash stabilized mix, which is elastically compatible with the surrounding rock. This material will be placed to support the clay core on the area of the existing channel. The remaining of the channel will be filled with bottom ash as the downstream shell is constructed.

At locations where new construction meet the abutments, the new materials will be benched into the existing grade to allow placement in horizontal lifts and compaction control. Any feature of the site which may infringe into areas of proposed construction will be relocated as indicated on the drawings.

Emergency Spillway

The proposed emergency spillway will be constructed on the left abutment of the proposed saddle dam a few feet south of the existing emergency spillway. The spillway will consist of a rock cut channel approximately 100 foot wide and having a bottom graded at 2% slope. The walls of the rock cut will be graded at a slope equal to 1H:6V.

Rock excavated from the construction of the emergency spillway may be used as riprap provided it meets or exceeds commonly accepted criteria.

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6.0 HYDROLOGY

6.1 General

The watershed of the Horseford Creek Dam is depicted on Fig. 6.1. The major drainage feature, Horseford Creek, drains into Blaine Creek which flows into the Big Sandy River at river mile 19.6.

Presently, the crest of the existing dam is at el. 678±. Discharge is regulated by the intake tower of the principal spillway which is connected to a 30-inch diameter reinforced concrete pipe. The concrete pipe terminates into a riprap-lined channel. The intake tower consists of twin shafts with side openings for decanting effluent. Concrete stoplogs are placed in the side openings as necessary to maintain settling action of the fly ash and act as an overflow weir to establish operating levels. During most operating conditions, discharge through the principal spillway will be controlled by weir flow over both stoplogs. The current emergency spillway consists of a 50-foot wide open channel excavated in rock on the left abutment of the saddle dam.

The proposed raising of the main dam will necessitate filling in the existing emergency spillway, raising of the saddle dam, and constructing a new emergency spillway.

The following sections present the hydrologic considerations and analyses performed during the design phase of this project.

6.2 Basin Characteristics

Fig. 6.1 depicts the limits of the watershed boundary for the fly ash dam. A review of available topographic maps and aerial photographs was made to determine essential basin characteristics. Such characteristics include the drainage boundaries, areas, slopes, soil types, land use and time of concentration. The time of concentration is defined as the elapsed time for runoff to travel from the hydraulically most distant part of the watershed to some reference point downstream.

Present land use within the watershed is limited to the fly ash pond proper and the adjacent wooded hillslopes. Raising of the dam will only alter the total acreage for both land uses.

A detailed soil survey for Lawrence County has not been published. Previous reports on the Phase 1 and 2 designs classified the soils such that they fall under the hydrologic soil group C as defined by the Soil Conservation Service

(SCS) of the U.S. Department of Agriculture. The table below lists the basin characteristics used for this project.

Drainage Area	675 acres
Average Land Slope	28%
Hydrologic Soil Group	C
SCS Curve Number (weighted)	73
Time of Concentration	0.25 hour

Based on Drawing No. 12-30030, the fly ash pond will have the following surface areas and storage capacities above elevation 650 feet.

Elevation	Area (ac)	Storage (ac-ft)
650	87	0
660	103	945
680	145	3406
700	169	6540
710	184	8302

Fig. 6.2 illustrates the stage-area-volume relationship for the fly ash pond.

6.3 Assumptions and Design Requirements

No rainfall-runoff data were available for the site. Therefore, runoff hydrographs were generated using the SCS method as described in the National Engineering Handbook, Section 4 - Hydrology. Since the raised pool levels will inundate a significant portion of the watershed, the hydrograph analysis for the emergency spillway was divided in two subwatersheds - the pond area and the remaining drainage area. The hydrograph for the pond area was developed by converting the precipitation hyetograph into an inflow hydrograph since there is 100 percent instantaneous runoff. The inflow hydrograph for the remaining area was determined by the referenced method. These two hydrographs were combined to define the design flood hydrographs. The general design requirements for the principal and emergency spillways have been established by the Kentucky Department for Environmental Protection, Division of Water.

6.3.1 Principal Spillway

According to Division of Water, Engineering Memorandum No. 5, design of the principal (service) spillway for Class C dams must be such that the average frequency of use of the emergency spillway cut in rock is predicted to be less than once in fifty years. To meet this criteria, the 10-day principal spillway hydrograph (PSH) must be developed based on the procedures in the SCS National Engineering Handbook. The principal spillway shall also have the capacity to release 80% of the maximum flood waters retained in the reservoir within ten days.

It was assumed that a 50-year rainfall event would produce the 50-year flood. Antecedent soil moisture condition II was assumed for the hydrograph development. Precipitation values were obtained from the Division of Water, Engineering Memorandum No. 2 (rev. 1979). For the project site located in Lawrence County, the rainfall values are 5.1 and 8.9 inches for the 50-year, 1 day and 10 day storms, respectively.

6.3.2 Emergency Spillway

The emergency spillway shall pass the design emergency spillway hydrograph (ESH) and freeboard hydrograph (FH) without overtopping the dam. For Class C dams, the minimum hydrologic criteria are:

ESH design rainfall, P = P100 + 0.26 (PMP-P100)
FH design rainfall, P = PMP

For this project, the design rainfalls have a duration of 6 hours. The PMP, probable maximum precipitation, is defined as the greatest depth of precipitation for a given duration that is meteorologically possible for a given basin at a particular time of year. The probable maximum flood (PMF) is the result of the PMP. For the project site, the rainfall values are 4.3 and 28.1 inches for the 100-year P100 and PMP storms, respectively. Antecedent moisture condition II was assumed for both storms.

6.4 Hydrologic Analysis

Most rainfall - runoff computations and all reservoir flood routings were conducted using the U.S. Army Corps of Engineers HEC-1 computer program. Basin characteristics, stage-storage, and discharge rating curves are input data supplied by the user.

6.4.1 Principal Spillway

Daily discharges from the reservoir will continue to be regulated by the existing principal spillway structure with no modifications. The principal spillway hydrograph (PSH) was manually calculated following the procedures in the SCS Handbook. Ash sluice waters (estimated to be 10 cfs) were added to the PSH to develop a total inflow hydrograph. Flood routings were conducted to establish a maximum operating pool level and the invert elevation of the emergency spillway.

6.4.2 Emergency Spillway

Flood routings of the freeboard hydrograph were conducted to determine the size of the emergency spillway necessary to pass the probable maximum flood without overtopping the dam. The initial water surface in the reservoir was assumed to be at the maximum operating level at the beginning of the storm. Flood routings were conducted for two situations (a) the principal spillway discharging and (b) neglecting those discharges.

Based on the principal spillway hydrograph flood routings, the 10-day drawdown level was at the maximum operating level. Therefore, the freeboard hydrograph was the controlling flood to set the emergency spillway dimensions and minimum top of dam.

In addition to the 6-hour PMF, a 24-hour PMF was developed and routed through the facility. This was done to verify the pond's capacity to handle a larger volume storm over a longer duration. The 24-hour PMP has a value of 35.5 inches.

6.5 Results

6.5.1 Principal Spillway

The development of the 50-year principal spillway hydrograph (PSH) indicates a peak inflow of 357 cfs which includes 10 cfs of ash sluice waters and 5 cfs of minimum quick return flow. The runoff volume over the 10 day duration is 610 acre-feet.

A maximum operating pool level has been set at elevation 705. This corresponds to a maximum stop-log elevation of 704. Final flood routings of the PSH started at an initial pool level equivalent to the maximum operating level. The reservoir rises to a maximum elevation of 706.0 feet. The peak outflow through the principal spillway is 54 cfs. Fig. 6.3 is a plot of the inflow and outflow principal spillway hydrographs. The receding flood pool is drained within eight days and six hours after the peak pool level is attained. Therefore, the requirements of Section E-I of Engineering Memorandum No. 5 are satisfied.

6.5.2 Emergency Spillway

The development of the 6-hour PMF hydrograph indicates a peak inflow of 10,610 cfs and a runoff volume of 1159 acre-feet.

The invert of the emergency spillway has been set at elevation 706.25 which is above the 50-year PSH flood elevation. The reservoir will rise to elevation 709.4 feet during passage of the PMF. This is based on an initial pool level of 705 feet and a 100 foot wide emergency spillway section. The flood routing was based on the principal spillway being plugged, a conservative condition. The peak outflow from the facility is 1672 cfs. Fig. 6.4 is a plot of the inflow and outflow emergency spillway hydrographs.

The 24-hour PMF generates 1564 acre-feet of runoff and has a peak inflow of 15,687 cfs. The pond will rise to elevation 710.5 feet and the peak outflow is 2433 cfs.

6.6 Summary and Conclusions

The 50-year, 10-day principal spillway hydrograph and the 6-hour probable maximum flood hydrograph were generated for the proposed raising of the Horseford Creek Dam. The SCS procedures for hydrologic design were followed with the use of the U.S. Army Corps of Engineers computer programs HEC-1 and HEC-2. Table No. 6.1 gives a summary of the study.

The existing principal system will be used without any modifications. It has the capacity to safely discharge the design flood without engaging the emergency spillway. The total spillway system (principal and emergency) has enough capacity to pass the probable maximum flood without overtopping the crest of the dam. There is sufficient freeboard for wind and wave height calculated to be 1.39 feet.

TABLE NO. 6.1
SUMMARY OF HYDROLOGIC/HYDRAULIC DATA

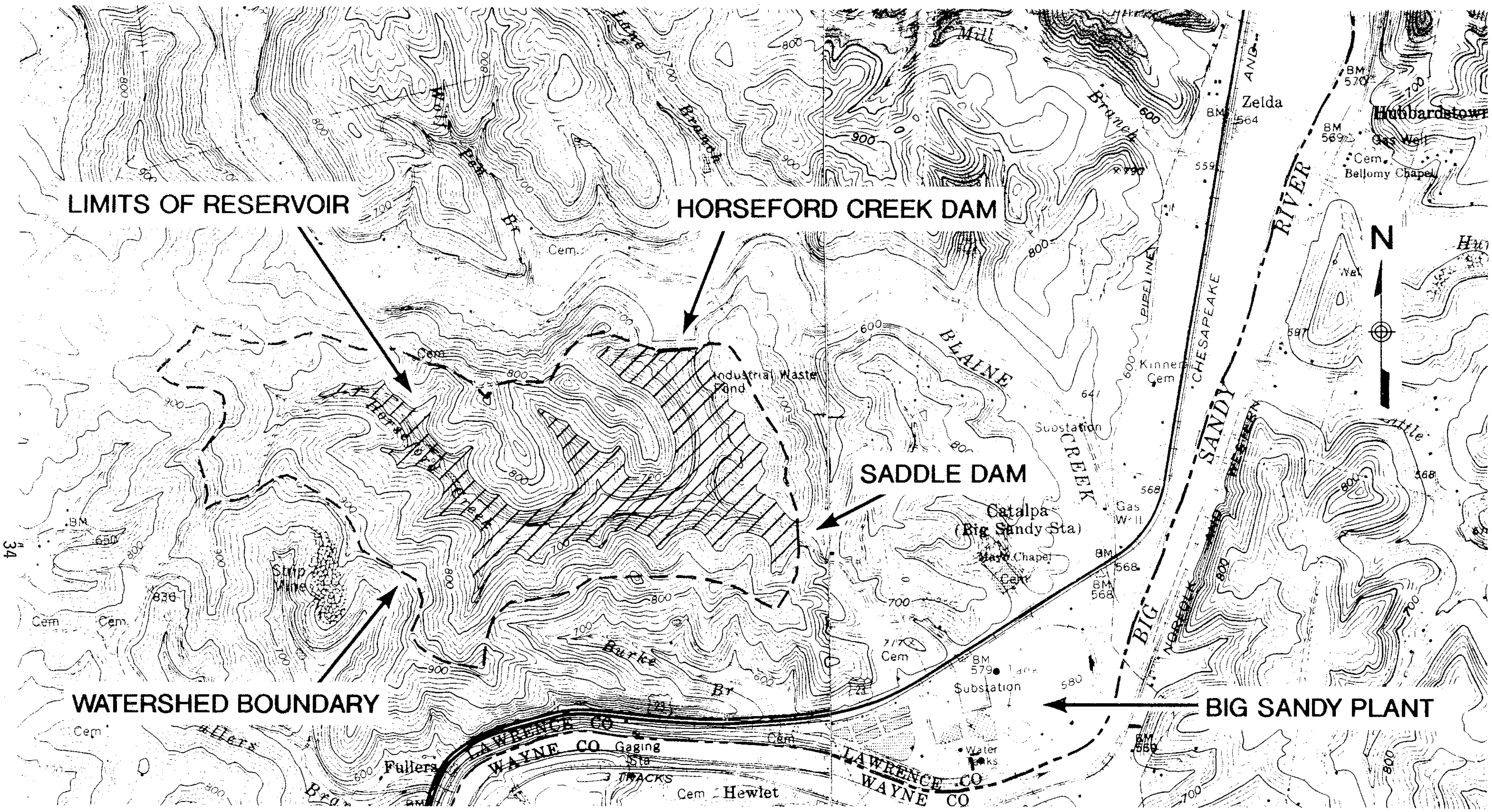
DRAINAGE AREA	0.9 SQ. MI.
DESIGN INFLOW FLOODS	
50-YR, 10-DAY PEAK	357 cfs
6-YR PMF PEAK	10,610 cfs
24 HR PMF	15,687 cfs
PEAK DISCHARGE	
50-YR, 10-DAY	54 cfs
6-HR PMF	1,672 cfs
24 HR PMF	2,433
MAXIMUM POOL ELEVATION	
50-YR, 10-DAY	706.0 FT
6-HR PMF	709.4 FT
24 HR PMF	710.5
DAM CREST ELEVATION	711.0 FT
MAXIMUM OPERATING POOL ELEVATION	705.0 FT

PRINCIPAL SPILLWAY:

CONCRETE RISER TOWER AND CONDUIT
SHAFT OPENING 2 @ 3.0' X 4.0'
30" DIAMETER REINFORCED CONCRETE PIPE

EMERGENCY SPILLWAY:

EXCAVATED CHANNEL IN ROCK	
CREST ELEVATION	706.25 FT
BOTTOM WIDTH	100 FT
SIDE SLOPES	1H:6V



REFERENCE: USGS QUADRANGLE MAPS
FALLSBURG, KY.-W.VA.
PRICHARD, W.VA.-KY.

SCALE:

0 2000 4000 FEET

Big Sandy Plant Horseford Creek Fly Ash Dam Watershed Map

FIGURE 6.1

Big Sandy Plant
Horseford Creek Fly Ash Dam
Stage-Area-Volume Curves

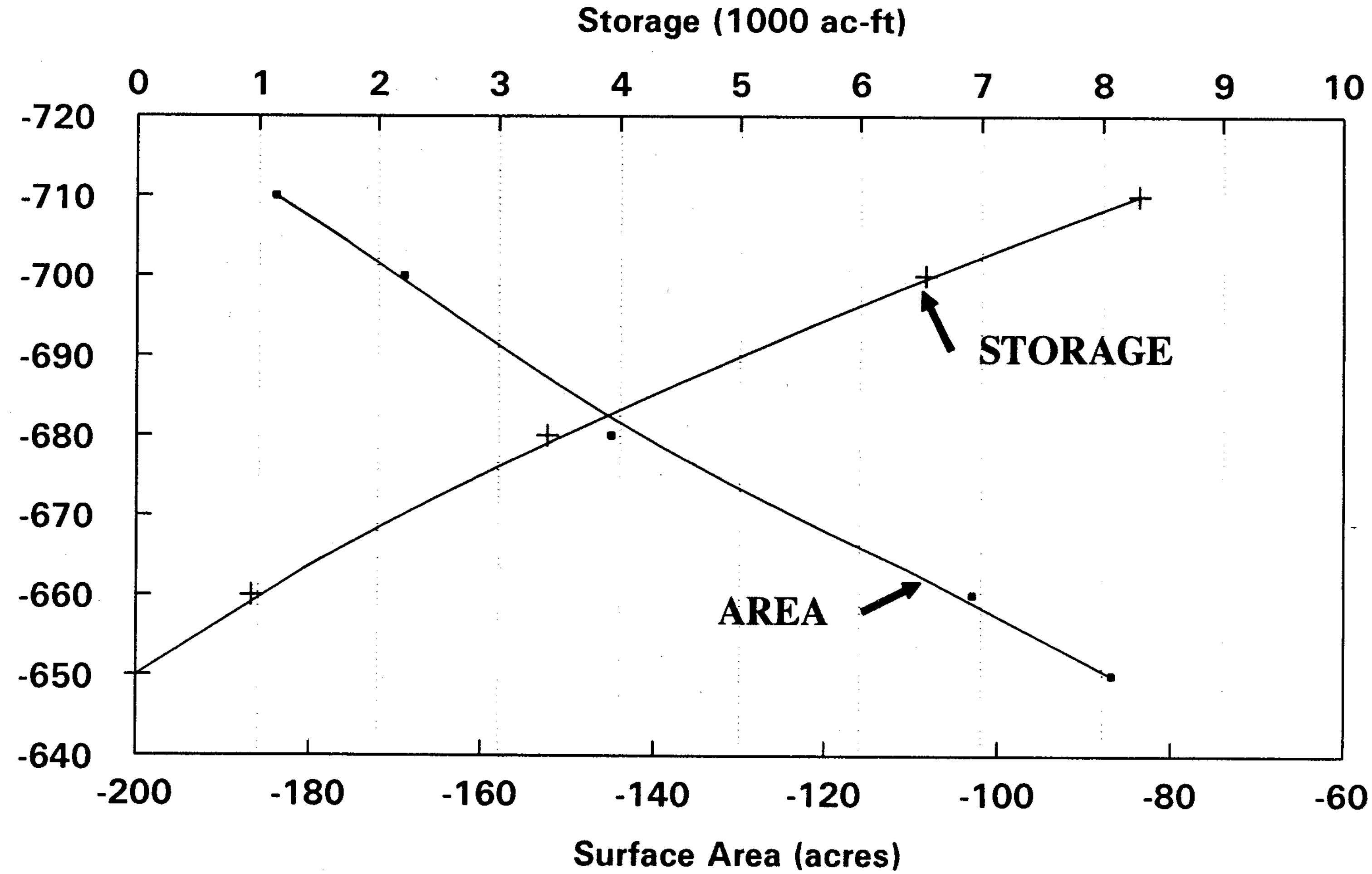


FIGURE 6.2

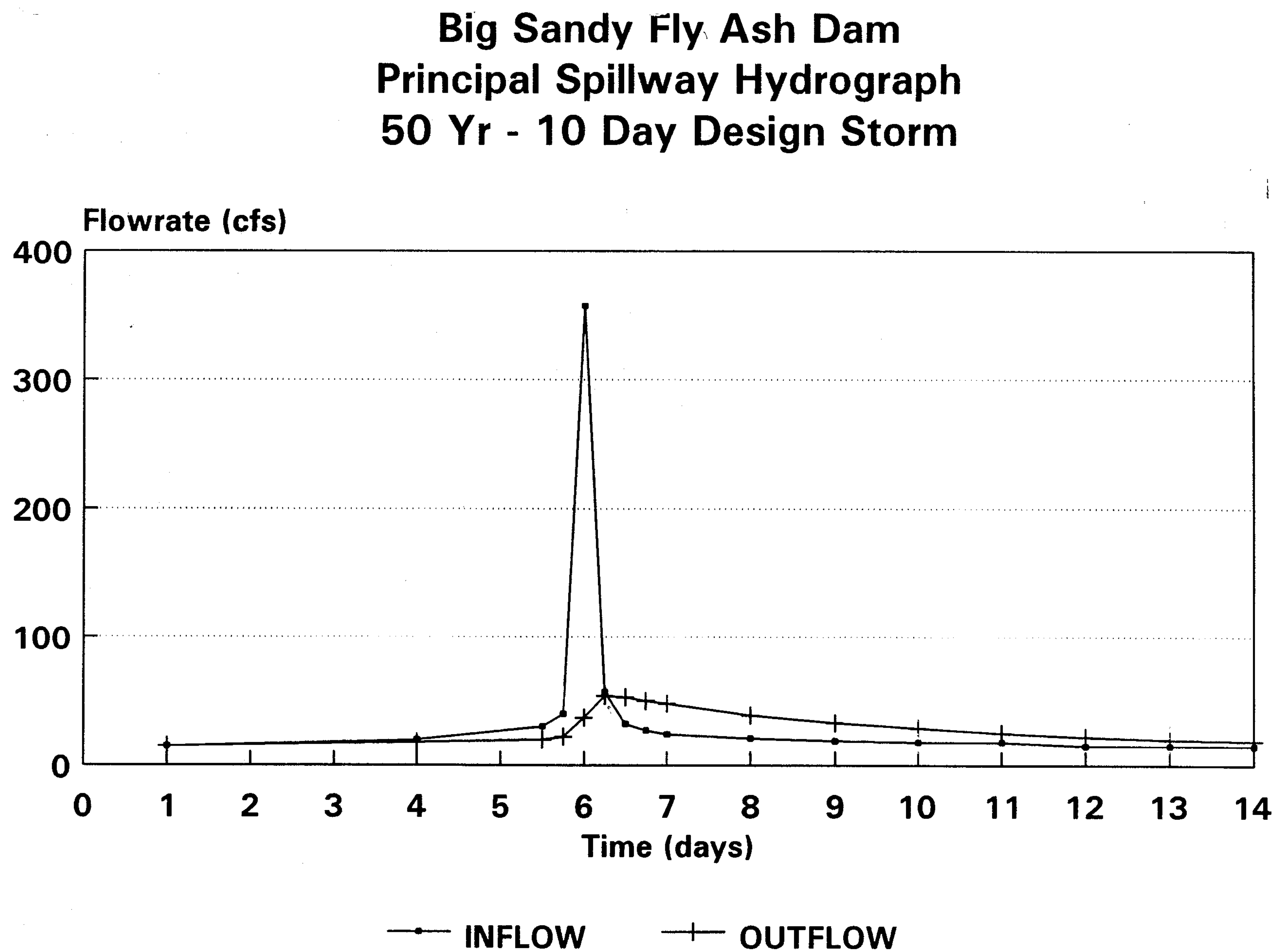

Big Sandy Fly Ash Dam
Principal Spillway Hydrograph
50 Yr - 10 Day Design Storm
Flowrate (cfs)
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time (days)
INFLOW
OUTFLOW

FIGURE 6.3

Big Sandy Fly Ash Dam
Emergency Spillway
6 Hr PMF Design Flood

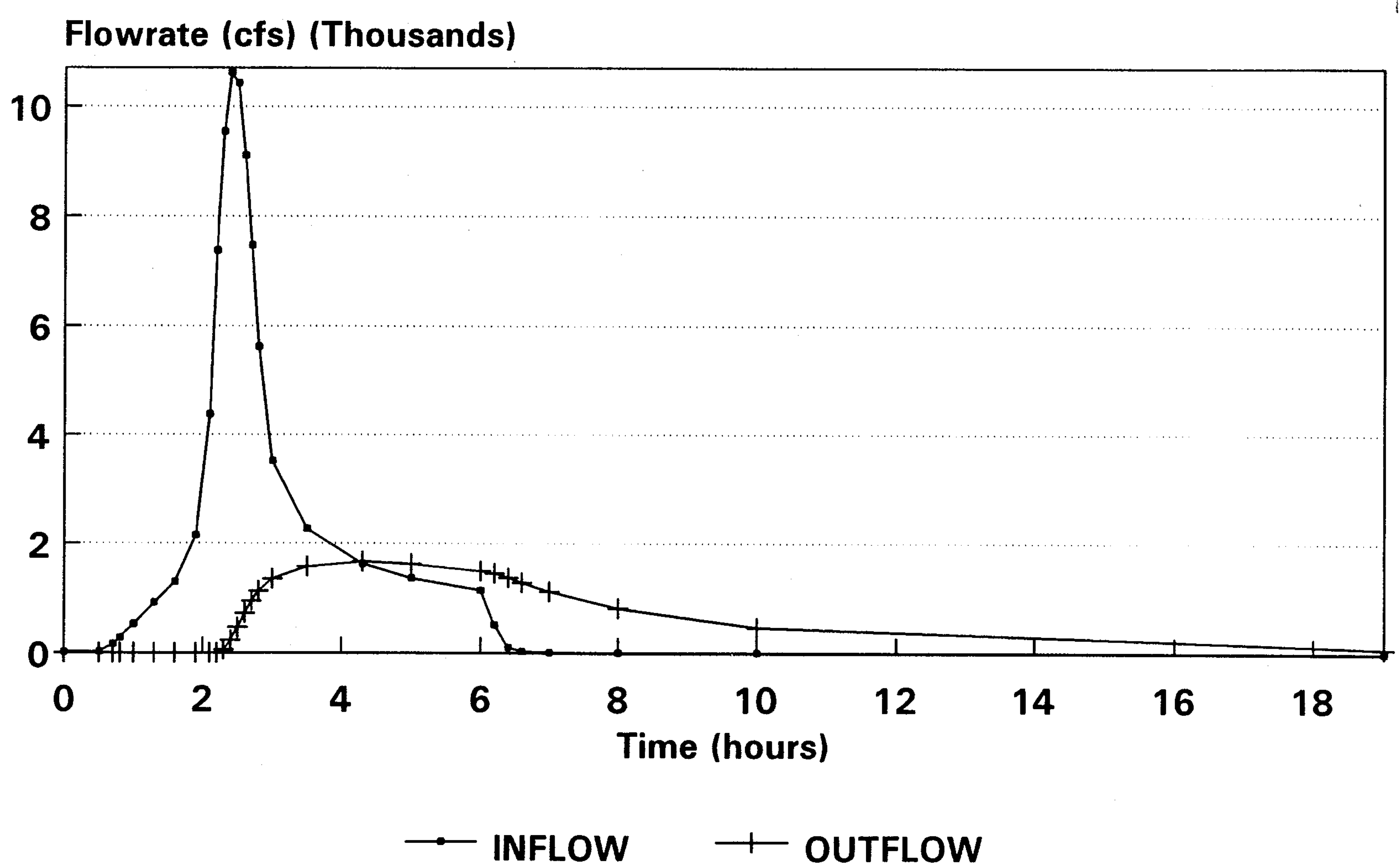


FIGURE 6.4

Attachment A-2

1993 Report Appendix E

Hydrologic Figures and Computations

APPENDIX E: Hydrologic Figures and Computations

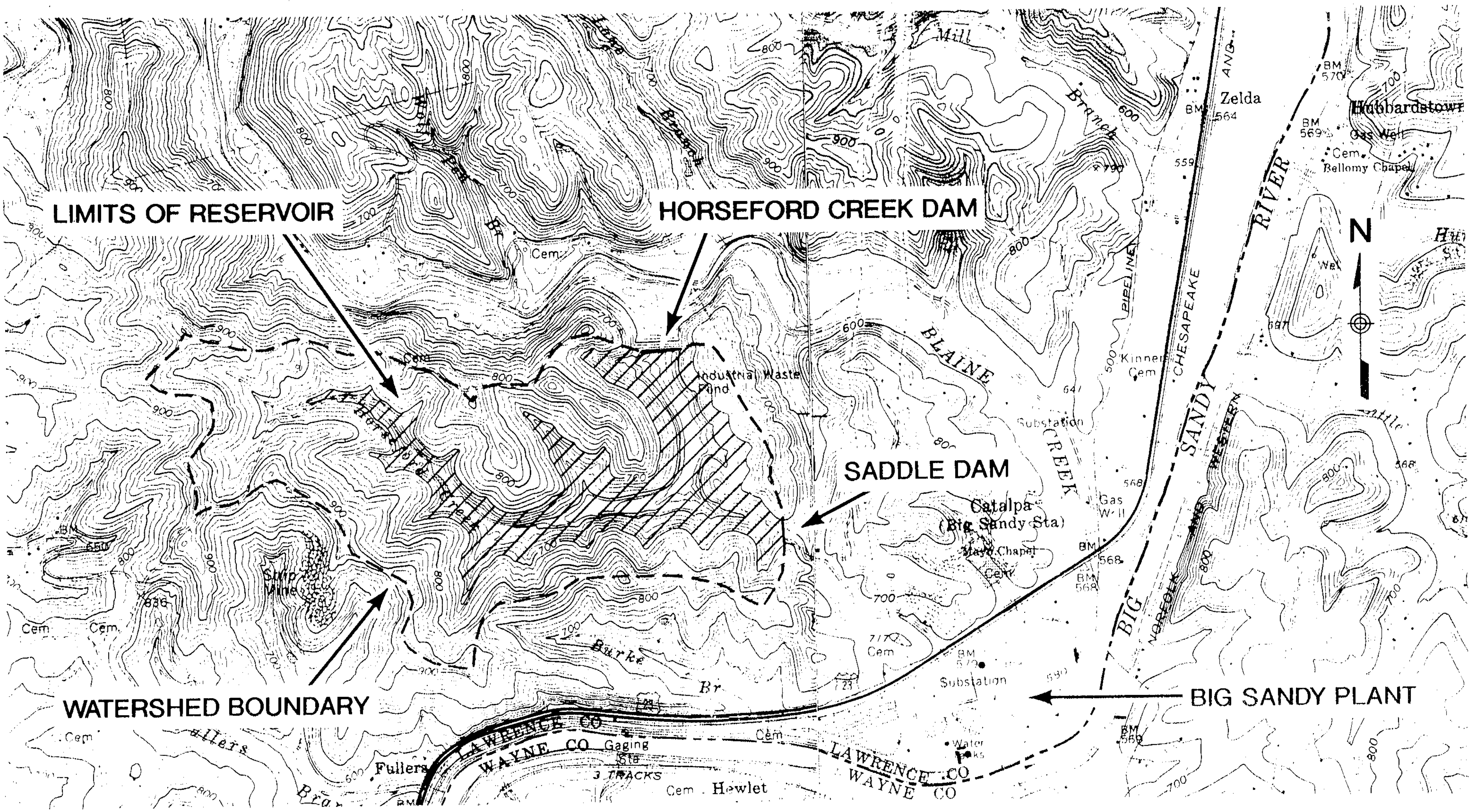
Kentucky Power Company
Big Sandy Fly Ash Dam
Stage 3 Raising
Engineering Report

APPENDIX E: Hydrologic Figures and Computations

1. Design Data

2. Computer Printouts

APPENDIX 1



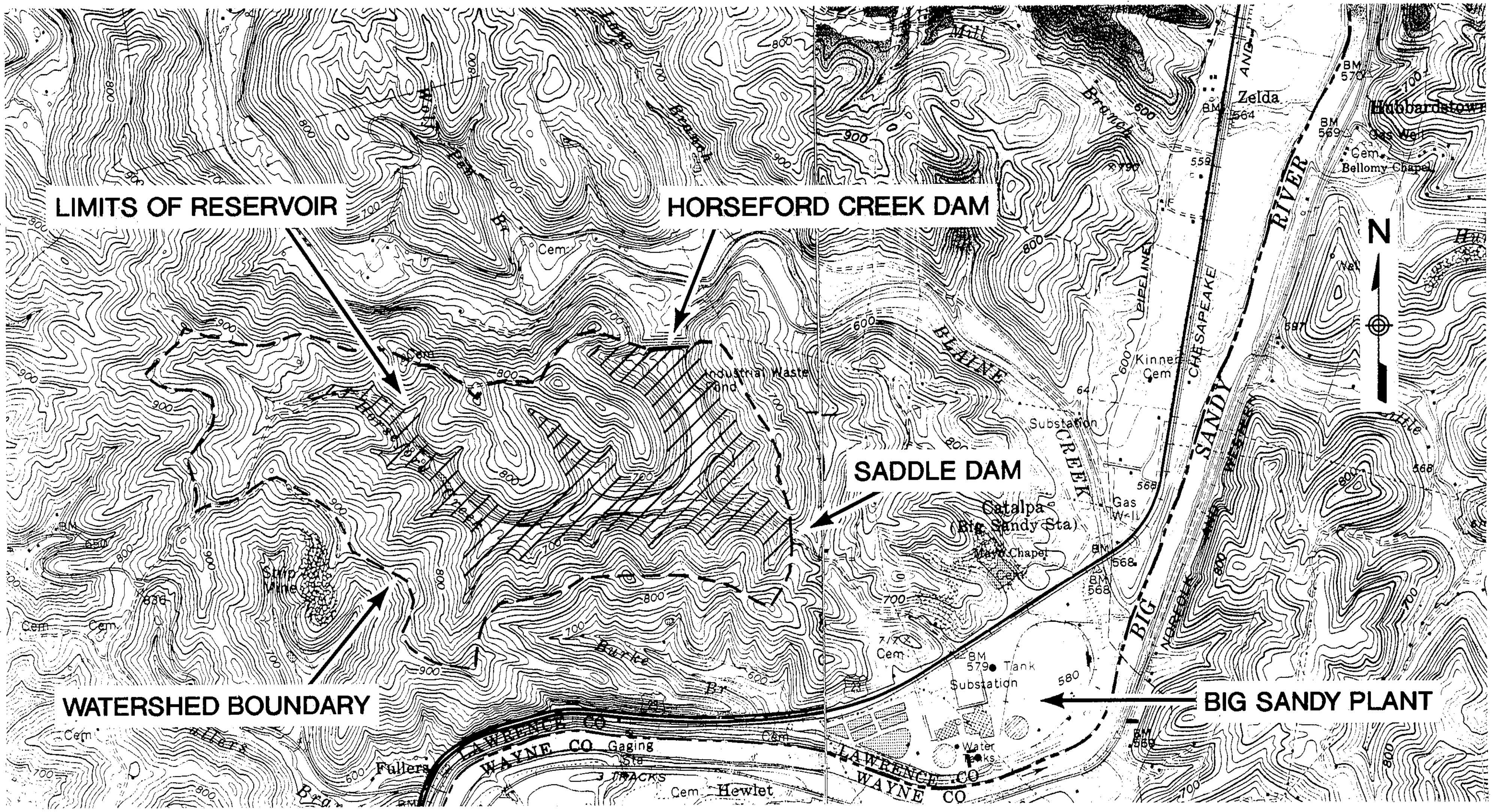
REFERENCE: USGS QUADRANGLE MAPS
FALLSBURG, KY.-W.VA.
PRICHARD, W.VA.-KY.

SCALE:

0 2000 4000 FEET

Big Sandy Plant
Horseford Creek Fly Ash Dam
Watershed Map

FIGURE 6.1



REFERENCE: USGS QUADRANGLE MAPS
FALLSBURG, KY.-W.VA.
PRICHARD, W.VA.-KY.

SCALE:

0 2000 4000 FEET

Big Sandy Plant
Horseford Creek Fly Ash Dam
Watershed Map

FIGURE 6.1

Big Sandy Plant
Horseford Creek Fly Ash Dam
Stage-Area-Volume Curves

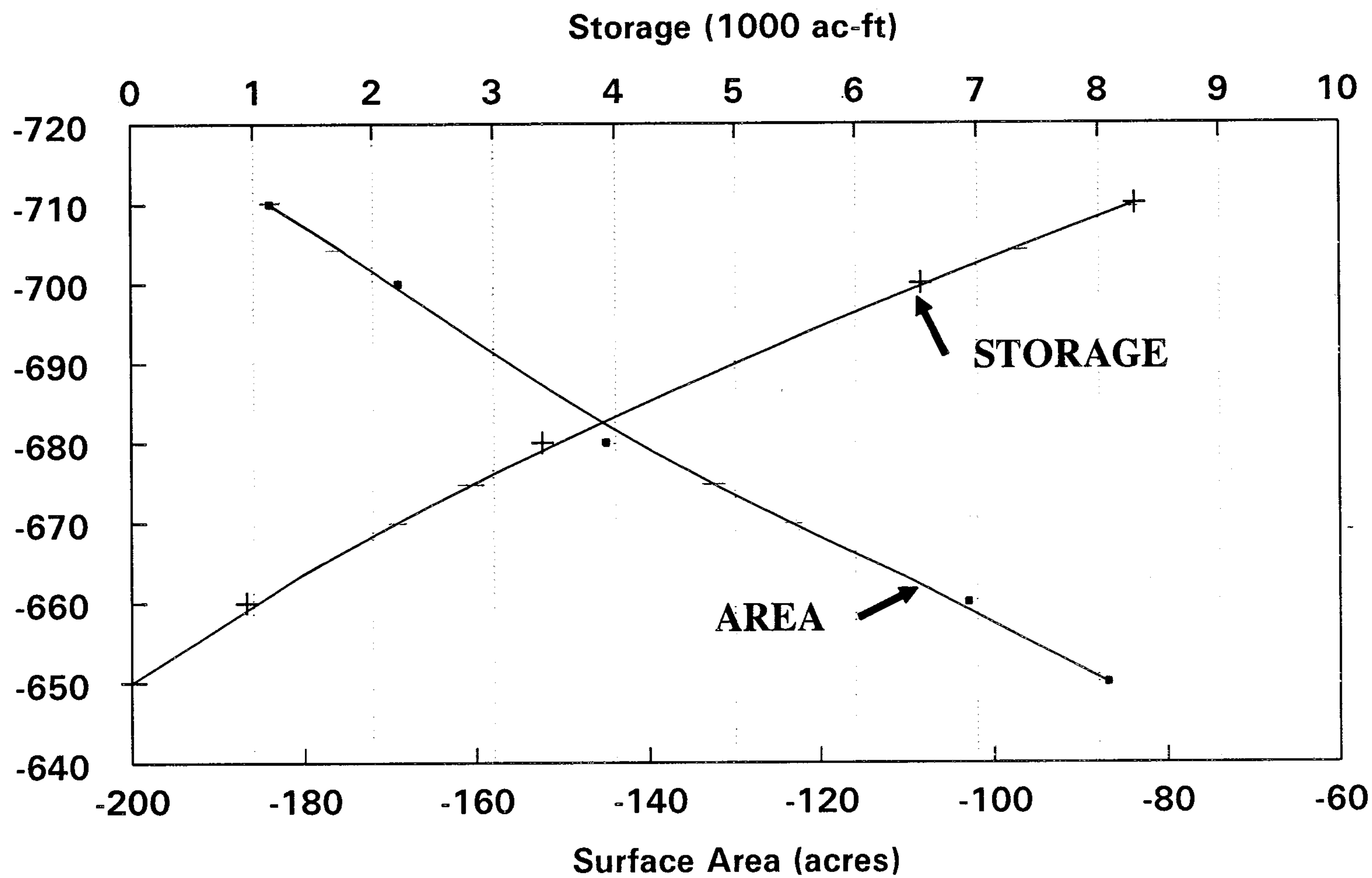


FIGURE 6.2

Big Sandy Fly Ash Dam
Principal Spillway Hydrograph
50 Yr - 10 Day Design Storm

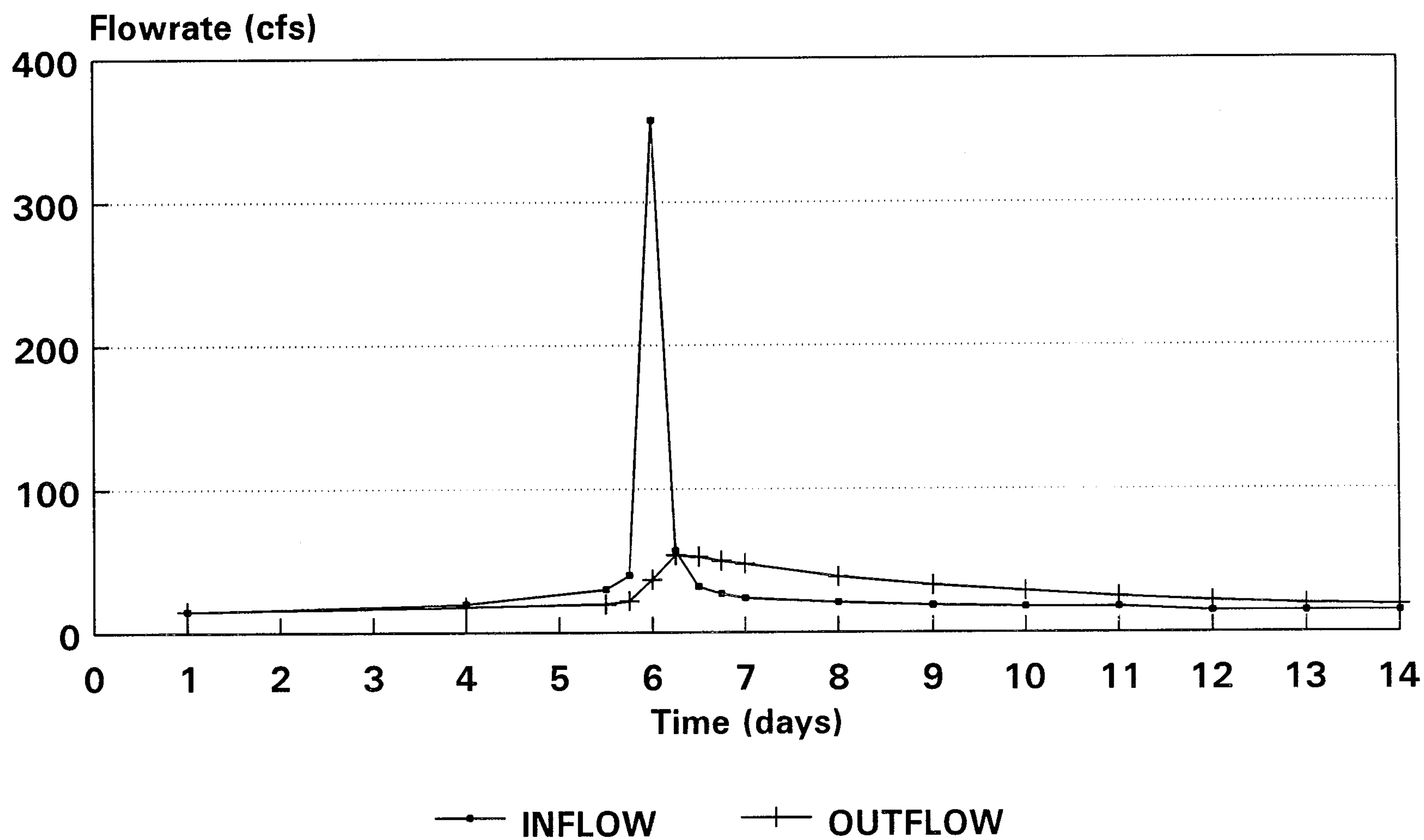


FIGURE 6.3

Big Sandy Fly Ash Dam
Emergency Spillway
6 Hr PMF Design Flood

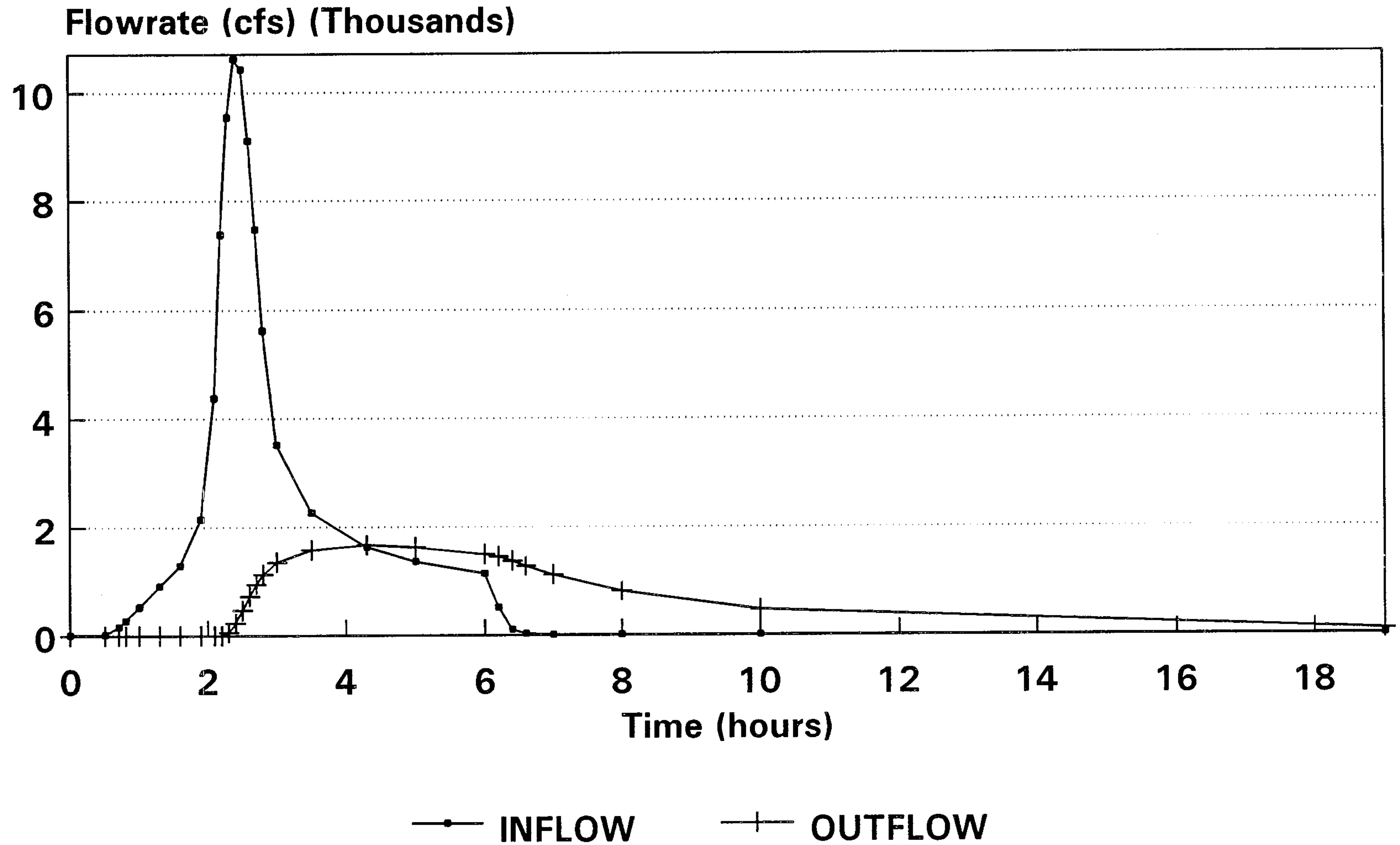


FIGURE 6.4

AEPBSP-000802

7223(9-83)
FORM GE-8 (C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ____ OF ____
DATE 2/14/90 BY AFZ CK. ____
COMPANY KPCo G.O. ____
PLANT BIG SANDY

SUBJECT HYDROLOGY - PHASE III DAM RAISING

DESIGN CRITERIA: AS PER DESIGN CRITERIA FOR DAMS & ASSOCIATED STRUCTURES, ENGINEERING MEMORANDUM No. 5, KENTUCKY NATURAL RESOURCES, DEPART. OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER

FOR CLASS C - HIGH HAZARD

PRINCIPAL SPILLWAY : $P = P_{50}$ (IF CUT IN ROCK)
EMERGENCY SPILLWAY : $P = P_{100} + 0.26(PMP - P_{100})$
FREEBOARD : $P = PMP$

6-HR STORM DURATION

DESIGN BASIS: (6-HOUR STORM)

P_{100} = 4.3 in
P_{PMP} = 28.1 in (REF: HMR No. 51)
PREVIOUS PMP VALUE OF 26.9 AS QUOTED IN THE PHASE I INSPECTION REPORT
P_{50} = 3.9 in

24-HOUR DISTRIBUTION
P_{10} = 4.0
P_{50} = 5.1
P_{100} = 5.6   100-YR, 10-DAY = 9.9 INCHES
PMP = 35.5

ALL RAINFALL VALUES TAKEN FROM "RAINFALL FREQUENCY VALUES FOR KENTUCKY", ENG. MEMO #2, REV. JUNE 1, 1979.

AEPBSP-000803

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COLUMBUS, OHIO

SHEET 1 OF
DATE 2/13/90 BY AFZ CK.
COMPANY KPCo G.O.
PLANT BIG SANDY

SUBJECT HYDROLOGY - PHASE III DAM RAISING

PHASE III PROJECT WILL RAISE THE EXISTING DAM FROM A CREST ELEVATION OF 675 FT TO ELEVATION 700-705 FT.

WATERSHED CHARACTERISTICS (FOR PROPOSED RAISING)

DRAINAGE AREA = 576 AC
= 0.9 SQ.MI

HYDRAULIC LENGTH = 2500 FT (EXCLUDING RESERVOIR)
RESERVOIR LENGTH = 7700 FT
WATERSHED ELEV
MAX. = 960 FT
MIN. = 700 FT (EST. TOP OF DAM)

LAND USE:			CN
RESERVOIR	157 AC	@ ELEV 700 FT.	100
WOODLANDS	419 AC	(0.655 SQ.MI)	73
OPEN AREAS			
GRASSED			71
BARE			

HYDROLOGIC SOIL GROUP: C (AS PER PREVIOUS REPORTS)

SUBJECT HYDROLOGY - PHASE III DAM RAISING

TIME OF CONCENTRATION

a) FROM NOMOGRAPH IN USBR, 'DESIGN OF SMALL DAMS
pg 71 (CALIFORNIA HIGHWAYS & PUBLIC WORKS)

t_c = 0.15 HRS

b) CURVE NUMBER METHOD

$$\text{lag } L = l^{0.8}(S+1)^{0.7} / [1900 (Y)^{1/2}]$$

l = hydraulic length (ft)
S = 1000/CN - 10
Y = AVERAGE land slope, ≐ 28%

$$L = \frac{(2500)^{0.8}(3.7+1)^{0.7}}{1900(28)^{1/2}}$$

L = 0.15 hr = 0.6 t_c

∴ t_c = L/0.6 = 0.26 hr

c) UPLAND METHOD
ASSUME THAT 500 FT OF HYDRAULIC LENGTH IS OVERLAND FLOW AND THE REMAINING DISTANCE IN ILL-DEFINED CHANNELS AND GULLIES.

OVERLAND VELOCITY = 1.0 FPS @ 17%
GULLIES / CHANNELS = 6 FPS @ 10%

$t_c = t_o + t_{CH}$
= 500/1.0 + 2300/6 = 883 sec
t_c = 0.24 HR

USE	t_c = 0.25 HR
	L = 0.15 HR

A

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FORM GE-8 (C)

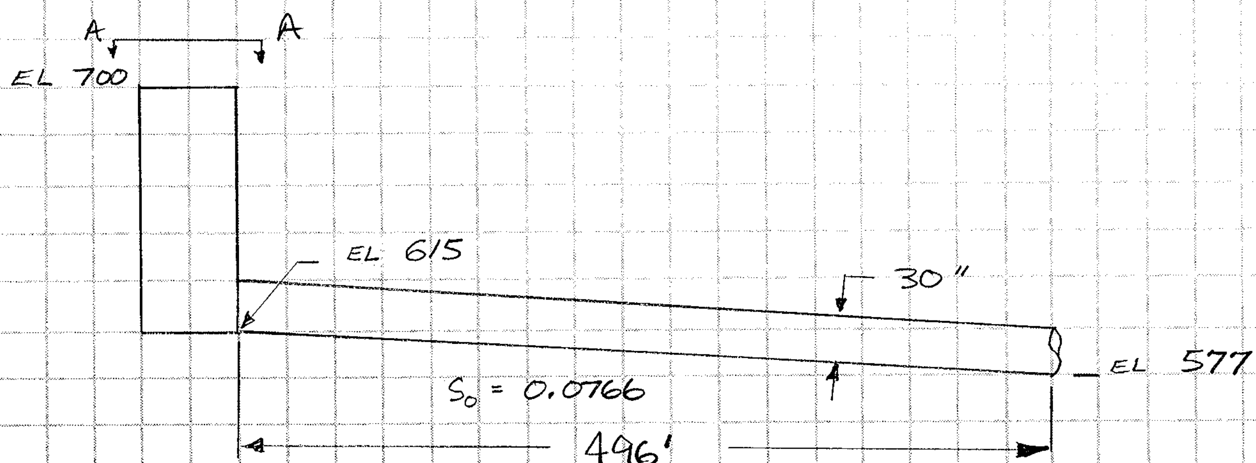
ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ______ OF ______
DATE 2/13/90 BY MFZ CK. ______
COMPANY KPCo G.O. ______
PLANT BIG SANDY

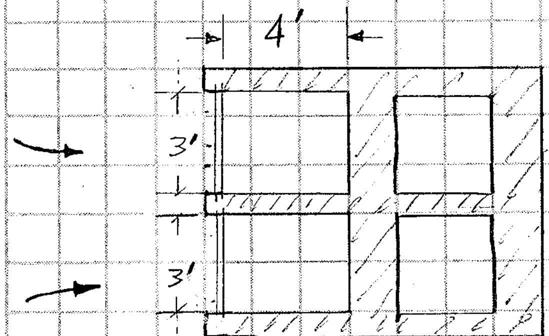
SUBJECT HYDROLOGY - PHASE III DAM RAISING

PRINCIPAL SPILLWAY - HYDRAULICS

DROP INET STRUCTURE - CONCRETE TOWER WITH TWO STOP-LOGGED OPENINGS TO DECANT FLOW INTO A 30" DIAMETER REINFORCED CONCRETE PIPE.



(as per HARZA dwg 984 C 104)



SECTION A-A

FLOW THROUGH THE PRINCIPAL SPILLWAY IS CONTROLLED BY
a) WEIR FLOW OVER STOP LOGS
b) ORIFICE FLOW DOWN THE TOWER WHEN WEIR SUBMERGED
c) PRESSURE FLOW THRU 30" PIPE.
d) INLET CONTROL AT 30"Ø ENTRANCE

AEPBSP-000806

B

7223(9-83)
FORM GE-8 (C)

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1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ____ OF ____
DATE 2/13/90 BY MFZ CK. ____
COMPANY KPCo G.O. ____
PLANT BIG SANDY

SUBJECT HYDROLOGY - PHASE III DAM RAISING

a) WEIR FLOW: $Q = CLH^{3/2}$ where $L = 6.0$ FT, $C = 3.1$

HEAD (FT)	Q (CFS)
0.0	0.0
0.5	6.6
1.0	18.6
1.5	34.2
2.0	52.6
2.5	73.5
3.0	96.6
4.0	148.8
5.0	208.0
6.0	273.0

b.) ORIFICE FLOW: $Q = C_d A \sqrt{2gH}$

THE MINIMUM THROAT AREA OF THE TOWER IS $2 \times (3' \times 4') = 24$ SF

$C_d = 0.62$

HEAD (FT)	Q (CFS)
0.0	0
1.0	119
2.0	169
3.0	207
4.0	239
4.5	253
5.0	267
6.0	293

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FORM GE-8 (C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ______ OF ______
DATE 2/13/90 BY MFZ CK. ______
COMPANY KPCo G.O. ______
PLANT BIG SANDY

SUBJECT HYDROLOGY - PHASE III DAM RAISING

c.) PRESSURE FLOW : $HW - TW = \frac{V^2}{2g}\left(+ K_i + K_f + K_o \right) + \frac{V_2^2}{2g}$

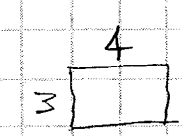
where $K_i = 0.5$ (SQUARE INLET)
$K_o = 1.0$ (STANDARD OUTLET)
$K_f = f\,L/D$ $\quad f = (185\ n^2)/D^{1/3}$

V_2 = NEGLIBLE DOWNSTREAM VELOCITY

FOR 30"ϕ PIPE : $n = 0.013$ ⟹ $f = 0.023$
$L = 496 + 15 = 511$ FT

SHAFT LOSSES : $n = 0.013$ PLACE IN TERMS OF 30"ϕ PIPE

$$L_e = \frac{f_s}{f_p} L_s \left(\frac{D_p}{D_s}\right)^5$$



$\overline{D_s}$ = EQUIVALENT DIAMETER $D_s = 4R$
$P = 2(2(3) + 2(4)) = 28$
$A = 2(3)(4) = 24$
$R = A/P = 24/28 = 0.86$
$\overline{D_s} = 4(0.86)$
$\overline{D_s} = 3.43$ FT

$$f = 185(0.013)^2/(3.43)^{1/3} = 0.021$$

$$L_e = \frac{0.021}{0.023}(73)\left(\frac{2.5}{3.43}\right)^5 = 14 \text{ FT}$$

∴ TOTAL $L = 511 + 14 = 525$ FT

⟹ $K_f = 0.023\left(\frac{525}{2.5}\right)$
$= 4.83$

SUBSTITUTING IN THE PRESSURE FLOW EQ
$HW - TW = \frac{V^2}{2g}\left(+ 0.5 + 1.0 + 4.83\right)$
$HW - TW = 6.33\,V^2/2g$

D

7223(9-83)
FORM GE-8 (C)

ENGINEERING DEPT.

AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ______ OF ______
DATE 2/14/90 BY MFZ CK. ______
COMPANY KPCo G.O. ______
PLANT BIG SANDY

SUBJECT HYDROLOGY - PHASE III DAM RAISING

ASSUME TAILWATER TO BE AT THE CROWN OF THE OUTLET. SOLVING FOR PIPE VELOCITY, v YIELDS

$$v = \left[(HW - 579.5)\,2g/6.33\right]^{1/2} \qquad A_{30} = 4.909\ FT^2$$

HW (FT)	v (FPS)	Q (CFS)
675	31.2	153
680	32.0	157
685	32.8	161
690	33.5	164
695	34.3	168
700	35.0	172
705	35.7	175
710	36.4	179

d) INLET CONTROL $\qquad Q_{FULL} = 113$ CFS

USE $K_e = 0.5$ (HEADWALL)

HW/D	HW	Q (CFS)
1.5	618.75	35
2.0	620.0	45
3.0	622.5	60
4.0	625.0	70
5.0	627.5	80
7.0	632.5	98
9.0	637.5	113

E

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FORM GE-8 (C)

ENGINEERING DEPT.

AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ______ OF ______
DATE 2/14/90 BY AFZ CK. ______
COMPANY KPCo G.O. ______
PLANT BIG SANDY

SUBJECT HYDROLOGY - PHASE III DAM RAISING

COMMENTS ON PRINCIPAL SPILLWAY RATING:

- SINCE THE TOWER AREA IS MUCH LARGER THAN THE PIPE, IT IS APPARENT THAT ORIFICE FLOW AT THE THROAT WILL NOT BE A CONTROLLING FACTOR.
- FOR THE PHASE III RAISING, DISCHARGE WILL BE CONTROLLED BY WEIR FLOW UP TO 148 CFS AND THEN PRESSURE FLOW THRU OUTLET PIPE.

FINAL PRINCIPAL SPILLWAY RATING

HEAD	Q (CFS)	MGD
0	0.0	0
0.5	6.6	4.25
1.0	18.6	12.0
1.5	34.2	22.1
2.0	52.6	33.9
2.5	73.5	47.4
3.0	96.6	62.3
4.0	148.8	96.0

PLUS PRESSURE FLOW - MAX FLOW IS 179 CFS

7222(R3-84)IAP50
FORM GE-8 (C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ______ OF ______
DATE 3/20/91 BY MFZ CK. ______
COMPANY KPCo G.O. ______
PLANT BIG SANDY

SUBJECT F. A. D. RAISING TO ELEV. 710

CALCULATE WIND TIDE AND WAVE HEIGHT.
ASSUME WINDS ARE FROM THE SOUTH AT 50 mph
(SOUTHERLY WINDS SELECTED SINCE DAM HAS AN E-W AXIS).
AVG POND DEPTH = 10 FT (5 FT NORMAL + 5 FT FLOOD)

METHOD REFERENCED IN: WATER RESOURCES ENGINEERING
LINSLEY & FRANZINI, 1964

θ	$\cos\theta$	E-W x	$x\cos\theta$
42	.743	600	446
36	.809	680	550
30	.866	1270	1100
24	.914	2150	1965
18	.951	2430	2310
12	.978	3110	3041
6	.995	2920	2905
0	1.0	3030	3030
6	.995	2670	2657
12	.978	2780	2719
18	.951	1150	1094
24	.914	1000	914
30	.866	910	788
36	.809	880	712
42	.743	860	639
	Σ 13.512		Σ 24,870 FT

EFFECTIVE FETCH, $F = \Sigma x\cos\theta / \Sigma\cos\theta$
$= 24870 / 13.152$
$= 1891$ FT
$= 0.36$ MILE

7222(R3-84)IAP50
FORM GE-8 (C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ______ OF ______
DATE 8/20/91 BY MFZ CK. ______
COMPANY KPCo G.O. ______
PLANT BIG SANDY

SUBJECT F.A.D. RAISING TO ELEV 710

WIND TIDE, $Z_s = N^2 F / 1400 d$

$= (50)^2(.36)/(1400(10))$

$Z_s = 0.06$ FT

WAVE HEIGHT $Z_w = 0.034 N^{1.06} F^{0.47}$

$= 0.034(50)^{1.06}(.36)^{0.47}$

$Z_w = 1.33$ FT

AEPBSP-000812

7222(R3-84)IAP50
FORM GE-8 (C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ____ OF ____
DATE 8/6/91 BY HFZ CK. ____
COMPANY KPCo G.O. ____
PLANT BIG SANDY

SUBJECT F.A.D. RAISING TO ELEV 710 - PSH
PRINCIPAL SPILLWAY HYDROGRAPH

THE KENTUCKY DNR REQUIREMENTS FOR HYDROLOGY REFERENCE THE SCS METHOD. FOR THE PRINCIPAL SPILLWAY HYDROGRAPH, FOLLOW THE SCS METHOD AND PERFORM MANUAL CALCULATIONS. FOR THE EMERGENCY SPILLWAY HYDROGRAPH, THE HYDROGRAPHS WILL BE GENERATED BY THE CORPS OF ENGINEERS COMPUTER MODEL HEC-1 USING THE SCS DIMENSIONLESS UNIT GRAPH.

FOR THE PRINCIPAL SPILLWAY HYDROGRAPH (PSH), THE TOTAL WATERSHED WILL BE TREATED AS ONE BASIN. (FOR OTHER HYDROGRAPHS, THE WATERSHED WILL BE DIVIDED INTO 2 SUBBASINS — (1) RESERVOIR AND (2) SURROUNDING HILLSIDES.) THE FOLLOWING PARAMETERS WILL BE USED TO DEVELOP THE PSH.

DRAINAGE AREA = 576 AC (0.9 SQ.MI)
WEIGHTED CURVE No., CN = 80 (BASED ON HYDRO. GP C)
LAG TIME = 0.15 HR

DESIGN STORM FREQUENCY = 100 YR FOR CLASS C SOIL EMER. SP/WY.
RAIN VALUES FOR DESIGN FREQ:
24 HR = 5.6 IN
10 DAY = 9.9 IN

FROM NEH HANDBOOK, TABLE 21.2, THE 100 YR - 10 DAY CN = 65 BASED ON CN = 80

ESTIMATE CLIMATIC INDEX: $C_i = \frac{100P}{(T)^2}$ $P \approx 40$ IN, $T = 60°$ (HIGH)

$C_i = 1.1$ IF $T = 55$ ($P = 42$) $C_i = 1.4$

FOR $C_i > 1$ QUICK RETURN FLOW SHOULD BE DETERMINED AND ADDED TO PSH.

AEPBSP-000813

7222(R3-84)IAP50
FORM GE-8 (C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ______ OF ______
DATE 8/6/91 BY MFZ CK. ______
COMPANY KPCo G.O. ______
PLANT BIG SANDY

SUBJECT F.A.D. RAISING TO ELEV. 710 PSH
PRINCIPAL SPILLWAY HYDROGRAPH

FROM ENGINEERING MEMORANDUM No. 2, KDNR, THE QUICK RETURN FLOW FOR LAWRENCE COUNTY IS 5.0 CSM
QRF = 5.0 CSM (0.9 SM) = 4.5 CFS

DETERMINE RUNOFF, RO, FOR 1 DAY & 10 DAY RAINFALL
1 DAY P = 5.6, CN = 80 ⇒ RO = 3.4 IN
10 DAY P = 9.9, CN = 65 ⇒ RO = 5.5 IN

COMPUTE $RO_1/RO_{10} = 3.4/5.5 = 0.62$

COMPUTE $AQ_{10} = 0.9\ mi^2 (5.5\ in) = 4.95\ mi^2\text{-}in$

TO DEVELOP THE PSH USE THE VALUE SHOWN IN TABLE 21.10 (NEH 4) FOR $t_c = 1.5$ hr
$Q_1/Q_{10} = .6$ ⇒ SERIAL NO. 5

THE MINIMUM QUICK RETURN FLOW WILL BE ADDED TO PSH AS PART OF BASE INFLOW HYDROGRAPH

FOR EMERGENCY SPILLWAYS CUT IN ROCK, THE DESIGN FREQUENCY IS 50-YR

50-YR, 24-HR = 5.1 IN RO = 3.0 IN
50-YR, 10 DAY = 8.9 IN RO = 4.65 IN

$RO_1/RO_{10} = 0.64$

$AQ_{10} = 0.9(4.65) = 4.2\ mi^2\text{-}in$

USE PSH ORDINATES FOR $t_c = 1.5$ HR
$Q_1/Q_{10} = 0.6$

7222(R3-84)IAP50
FORM GE-8 (C)

ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET ______ OF ______
DATE 8/6/91 BY HFZ CK. ______
COMPANY KPCo G.O. ______
PLANT BIG SANDY

SUBJECT F.A.D. RAISING TO ELEV. 710
PRINCIPAL SPILLWAY HYDROGRAPH

TIME (DAYS)	ORD (CFS/AQ_{10})	100-YR Q (CFS)	50-YR Q (CFS)
0	0	0	0
.1	.528	2.6	2.2
.5	.671	3.3	2.8
1.0	.754	3.7	3.2
2.0	.922	4.6	3.9
3.0	1.225	6.1	5.1
3.5	1.482	7.3	6.2
4.0	2.014	10.0	8.4
4.2	2.808	14	11.8
4.4	3.374	17	14
4.6	4.154	21	17
4.7	4.960	25	21
4.8	6.567	33	28
4.9	10.131	50	43
5.0	81.384	403	342
5.1	31.367	155	132
5.2	12.872	64	54
5.3	7.150	35	30
5.4	5.069	25	21
5.5	4.112	20	17
5.6	2.998	15	13
5.8	2.554	13	11
6.0	2.028	10	9
6.5	1.678	8.3	7
7.0	1.342	6.6	6
8.0	.924	4.6	4
9.0	.727	3.6	3
10.0	.587	2.9	2.5
10.1	.022	0.1	0.1
10.3	0	0	0

BIG SANDY PLANT
EXPANDED PSH
@ Δt = 0.25 day

TIME (DAY)	100-YR Q FLOW (CFS)	50-YR Q FLOW (CFS)
0.0	0	0
0.25	2.9	2.5
.5	3.3	2.8
.75	3.5	3.0
1.0	3.7	3.2
1.25	3.9	3.4
1.50	4.1	3.55
1.75	4.4	3.7
2.00	4.6	3.9
2.25	5.0	4.2
2.50	5.4	4.5
2.75	5.7	4.8
3.0	6.1	5.1
3.25	6.6	5.6
3.5	7.3	6.2
3.75	8.7	7.3
4.0	10.0	8.4
4.25	15	9.0
4.5	19	15
4.75	29	25
5.0	403	342
5.25	50	42
5.5	20	17
5.75	14	12
6.0	10	9
6.25	9	8
6.5	8.3	7
6.75	7.4	6
7.0	6.6	6
7.25	6.1	5.5
7.50	5.6	5
7.75	5.1	4.5
8.0	4.6	4
8.25	4.3	3.75
8.5	4.1	3.5
8.75	3.8	3.25
9.0	3.6	3
9.25	3.5	2.9
9.5	3.3	2.8
9.75	3.1	2.6
10.0	2.9	2.5
10.25	0.1	0.1
10.50	0	0

APPENDIX 2

```
*****************************************         *****************************************
*                                       *         *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *         *    U.S. ARMY CORPS OF ENGINEERS       *
*            FEBRUARY 1981              *         *  THE HYDROLOGIC ENGINEERING CENTER    *
*          REVISED 30 OCT 81            *         *           609 SECOND STREET           *
*                                       *         *       DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/20/91    TIME 14.34.06  *         *  (916) 440-3285 OR (FTS) 448-3285     *
*                                       *         *                                       *
*****************************************         *****************************************
```

INPUT: BSPSH50

BIG SANDY FLY ASH DAM

50-YR PRINCIPAL SPILLWAY HYDRO

```
X     X  XXXXXXX   XXXXX         X
X     X  X        X     X       XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX
```

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. SEE SEPTEMBER 1981 INPUT DESCRIPTION FOR NEW DEFINITIONS.

RESULTS

(MAX. OPER) INITIAL POOL 705

MAX. WSEL 706.04 FT

AEPBSP-000818

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

   1         ID                  BIG SANDY FLY ASH DAM
   2         ID                  FINAL RAISING -- HYDROLOGY
   3         ID                  DESIGN FLOOD --  50
   4         ID                  SCS PRINCIPAL SPILLWAY HYDROGRAPH
   5         IT     360       0       0     100
   6         IO       1

   7         KK    BASE          BASE INFLOW TO RESERVOIR
   8         KM                  ASH SLUICE WATER AND QUICK RETURN FLOW (10 + 5)
   9         IN    7200
  10         QI      15      15      15

  11         KK    RAIN          10 DAY PRINCIPAL SPILLWAY HYDROGRAPH
  12         IN     360
  13         QI       0     2.5     2.8     3.0     3.2     3.4    3.55     3.7     3.9     4.2
  14         QI     4.5     4.8     5.1     5.6     6.2     7.3     8.4     9.0      15      25
  15         QI     342      42      17      12       9       8       7       6       6     5.5
  16         QI       5     4.5       4    3.75     3.5    3.25       3     2.9     2.8     2.6
  17         QI     2.5     0.1       0

  18         KK      IN          COMBINE FLOOD AND BASE FLOWS
  19         KO       1
  20         HC       2

  21         KK     DAM          ROUTE THRU DAM
  22         KM                  PRIN. SP/W CREST AT 1 FT BELOW INITIAL WSEL
  23         KO       1
  24         RS       1    ELEV     705
  25         SA     103     145     169     184
  26         SE     660     680     700     710
  27         SQ       0     6.6      18      34      52      96     149     182
  28         SE     704   704.4     705   705.5     706     707     708     710
  29         SS     710      50     3.0     1.5
  30         ST     710      50     3.0     1.5
  31         ZZ
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AEPBSP-000819

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****************************************                                      ****************************************
*                                      *                                      *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *   U.S. ARMY CORPS OF ENGINEERS       *
*            FEBRUARY 1981             *                                      * THE HYDROLOGIC ENGINEERING CENTER     *
*          REVISED 30 OCT 81           *                                      *        609 SECOND STREET             *
*                                      *                                      *     DAVIS, CALIFORNIA 95616          *
*  RUN DATE  08/20/91    TIME 14.34.06 *                                      * (916) 440-3285 OR (FTS) 448-3285     *
*                                      *                                      *                                      *
****************************************                                      ****************************************


                                            BIG SANDY FLY ASH DAM
                                            FINAL RAISING -- HYDROLOGY
                                            DESIGN FLOOD --  50
                                            SCS PRINCIPAL SPILLWAY HYDROGRAPH

   6 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           1  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN         360  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         100  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     25    0  ENDING DATE
                      NDTIME        1800  ENDING TIME

                    COMPUTATION INTERVAL    6.00 HOURS
                         TOTAL TIME BASE  594.00 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT


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

               **************
               *            *
   7 KK        *    BASE    *          BASE INFLOW TO RESERVOIR
               *            *
               **************
                                            ASH SLUICE WATER AND QUICK RETURN FLOW (10 + 5)

   9 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN        7200  TIME INTERVAL IN MINUTES
                      JXDATE      1    0  STARTING DATE
                      JXTIME           0  STARTING TIME
```

AEPBSP-000820

SUBBASIN RUNOFF DATA

0 BA SUBBASIN CHARACTERISTICS

TAREA 0.0 SUBBASIN AREA

***

****

HYDROGRAPH AT STATION BASE

****

DA MON	HRMN	ORD	FLOW	*	DA MON	HRMN	ORD	FLOW	*	DA MON	HRMN	ORD	FLOW	*	DA MON	HRMN	ORD	FLOW
1	0000	1	15.	*	7	0600	26	15.	*	13	1200	51	15.	*	19	1800	76	15.
1	0600	2	15.	*	7	1200	27	15.	*	13	1800	52	15.	*	20	0000	77	15.
1	1200	3	15.	*	7	1800	28	15.	*	14	0000	53	15.	*	20	0600	78	15.
1	1800	4	15.	*	8	0000	29	15.	*	14	0600	54	15.	*	20	1200	79	15.
2	0000	5	15.	*	8	0600	30	15.	*	14	1200	55	15.	*	20	1800	80	15.
2	0600	6	15.	*	8	1200	31	15.	*	14	1800	56	15.	*	21	0000	81	15.
2	1200	7	15.	*	8	1800	32	15.	*	15	0000	57	15.	*	21	0600	82	15.
2	1800	8	15.	*	9	0000	33	15.	*	15	0600	58	15.	*	21	1200	83	15.
3	0000	9	15.	*	9	0600	34	15.	*	15	1200	59	15.	*	21	1800	84	15.
3	0600	10	15.	*	9	1200	35	15.	*	15	1800	60	15.	*	22	0000	85	15.
3	1200	11	15.	*	9	1800	36	15.	*	16	0000	61	15.	*	22	0600	86	15.
3	1800	12	15.	*	10	0000	37	15.	*	16	0600	62	15.	*	22	1200	87	15.
4	0000	13	15.	*	10	0600	38	15.	*	16	1200	63	15.	*	22	1800	88	15.
4	0600	14	15.	*	10	1200	39	15.	*	16	1800	64	15.	*	23	0000	89	15.
4	1200	15	15.	*	10	1800	40	15.	*	17	0000	65	15.	*	23	0600	90	15.
4	1800	16	15.	*	11	0000	41	15.	*	17	0600	66	15.	*	23	1200	91	15.
5	0000	17	15.	*	11	0600	42	15.	*	17	1200	67	15.	*	23	1800	92	15.
5	0600	18	15.	*	11	1200	43	15.	*	17	1800	68	15.	*	24	0000	93	15.
5	1200	19	15.	*	11	1800	44	15.	*	18	0000	69	15.	*	24	0600	94	15.
5	1800	20	15.	*	12	0000	45	15.	*	18	0600	70	15.	*	24	1200	95	15.
6	0000	21	15.	*	12	0600	46	15.	*	18	1200	71	15.	*	24	1800	96	15.
6	0600	22	15.	*	12	1200	47	15.	*	18	1800	72	15.	*	25	0000	97	15.
6	1200	23	15.	*	12	1800	48	15.	*	19	0000	73	15.	*	25	0600	98	15.
6	1800	24	15.	*	13	0000	49	15.	*	19	0600	74	15.	*	25	1200	99	15.
7	0000	25	15.	*	13	0600	50	15.	*	19	1200	75	15.	*	25	1800	100	15.

****

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	594.00-HR
15.	6.00	(CFS)	15.	15.	15.	15.
		(INCHES)	0.000	0.000	0.000	0.000
		(AC-FT)	7.	30.	89.	736.

CUMULATIVE AREA = 0.0 SQ MI

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*   *

AEPBSP-000821

```
11 KK     *      RAIN  *            10 DAY PRINCIPAL SPILLWAY HYDROGRAPH
          *            *
          **************

12 IN           TIME DATA FOR INPUT TIME SERIES
                      JXMIN         360  TIME INTERVAL IN MINUTES
                      JXDATE      1   0  STARTING DATE
                      JXTIME          0  STARTING TIME

                SUBBASIN RUNOFF DATA

 0 BA           SUBBASIN CHARACTERISTICS
                      TAREA         0.0  SUBBASIN AREA

                                        ***
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HYDROGRAPH AT STATION RAIN

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	7		0600	26	8.	13		1200	51	0.	19		1800	76	0.
1		0600	2	3.	7		1200	27	7.	13		1800	52	0.	20		0000	77	0.
1		1200	3	3.	7		1800	28	6.	14		0000	53	0.	20		0600	78	0.
1		1800	4	3.	8		0000	29	6.	14		0600	54	0.	20		1200	79	0.
2		0000	5	3.	8		0600	30	6.	14		1200	55	0.	20		1800	80	0.
2		0600	6	3.	8		1200	31	5.	14		1800	56	0.	21		0000	81	0.
2		1200	7	4.	8		1800	32	5.	15		0000	57	0.	21		0600	82	0.
2		1800	8	4.	9		0000	33	4.	15		0600	58	0.	21		1200	83	0.
3		0000	9	4.	9		0600	34	4.	15		1200	59	0.	21		1800	84	0.
3		0600	10	4.	9		1200	35	4.	15		1800	60	0.	22		0000	85	0.
3		1200	11	5.	9		1800	36	3.	16		0000	61	0.	22		0600	86	0.
3		1800	12	5.	10		0000	37	3.	16		0600	62	0.	22		1200	87	0.
4		0000	13	5.	10		0600	38	3.	16		1200	63	0.	22		1800	88	0.
4		0600	14	6.	10		1200	39	3.	16		1800	64	0.	23		0000	89	0.
4		1200	15	6.	10		1800	40	3.	17		0000	65	0.	23		0600	90	0.
4		1800	16	7.	11		0000	41	3.	17		0600	66	0.	23		1200	91	0.
5		0000	17	8.	11		0600	42	0.	17		1200	67	0.	23		1800	92	0.
5		0600	18	9.	11		1200	43	0.	17		1800	68	0.	24		0000	93	0.
5		1200	19	15.	11		1800	44	0.	18		0000	69	0.	24		0600	94	0.
5		1800	20	25.	12		0000	45	0.	18		0600	70	0.	24		1200	95	0.
6		0000	21	342.	12		0600	46	0.	18		1200	71	0.	24		1800	96	0.
6		0600	22	42.	12		1200	47	0.	18		1800	72	0.	25		0000	97	0.
6		1200	23	17.	12		1800	48	0.	19		0000	73	0.	25		0600	98	0.
6		1800	24	12.	13		0000	49	0.	19		0600	74	0.	25		1200	99	0.
7		0000	25	9.	13		0600	50	0.	19		1200	75	0.	25		1800	100	0.

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	594.00-HR
342.	120.00	(CFS)	192.	106.	42.	6.
		(INCHES)	0.000	0.000	0.000	0.000
		(AC-FT)	95.	211.	249.	307.

CUMULATIVE AREA = 0.0 SQ MI

AEPBSP-000822

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              **************
              *            *
18 KK         *     IN     *        COMBINE FLOOD AND BASE FLOWS
              *            *
              **************

19 KO           OUTPUT CONTROL VARIABLES
                      IPRNT          1   PRINT CONTROL
                      IPLOT          0   PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

20 HC           HYDROGRAPH COMBINATION
                      ICOMP          2   NUMBER OF HYDROGRAPHS TO COMBINE
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HYDROGRAPH AT STATION IN
SUM OF 2 HYDROGRAPHS

****

DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW
1		0000	1	15.	*	7		0600	26	23.	*	13		1200	51	15.	*	19		1800	76	15.
1		0600	2	18.	*	7		1200	27	22.	*	13		1800	52	15.	*	20		0000	77	15.
1		1200	3	18.	*	7		1800	28	21.	*	14		0000	53	15.	*	20		0600	78	15.
1		1800	4	18.	*	8		0000	29	21.	*	14		0600	54	15.	*	20		1200	79	15.
2		0000	5	18.	*	8		0600	30	21.	*	14		1200	55	15.	*	20		1800	80	15.
2		0600	6	18.	*	8		1200	31	20.	*	14		1800	56	15.	*	21		0000	81	15.
2		1200	7	19.	*	8		1800	32	20.	*	15		0000	57	15.	*	21		0600	82	15.
2		1800	8	19.	*	9		0000	33	19.	*	15		0600	58	15.	*	21		1200	83	15.
3		0000	9	19.	*	9		0600	34	19.	*	15		1200	59	15.	*	21		1800	84	15.
3		0600	10	19.	*	9		1200	35	19.	*	15		1800	60	15.	*	22		0000	85	15.
3		1200	11	20.	*	9		1800	36	18.	*	16		0000	61	15.	*	22		0600	86	15.
3		1800	12	20.	*	10		0000	37	18.	*	16		0600	62	15.	*	22		1200	87	15.
4		0000	13	20.	*	10		0600	38	18.	*	16		1200	63	15.	*	22		1800	88	15.
4		0600	14	21.	*	10		1200	39	18.	*	16		1800	64	15.	*	23		0000	89	15.
4		1200	15	21.	*	10		1800	40	18.	*	17		0000	65	15.	*	23		0600	90	15.
4		1800	16	22.	*	11		0000	41	18.	*	17		0600	66	15.	*	23		1200	91	15.
5		0000	17	23.	*	11		0600	42	15.	*	17		1200	67	15.	*	23		1800	92	15.
5		0600	18	24.	*	11		1200	43	15.	*	17		1800	68	15.	*	24		0000	93	15.
5		1200	19	30.	*	11		1800	44	15.	*	18		0000	69	15.	*	24		0600	94	15.
5		1800	20	40.	*	12		0000	45	15.	*	18		0600	70	15.	*	24		1200	95	15.
6		0000	21	357.	*	12		0600	46	15.	*	18		1200	71	15.	*	24		1800	96	15.
6		0600	22	57.	*	12		1200	47	15.	*	18		1800	72	15.	*	25		0000	97	15.
6		1200	23	32.	*	12		1800	48	15.	*	19		0000	73	15.	*	25		0600	98	15.
6		1800	24	27.	*	13		0000	49	15.	*	19		0600	74	15.	*	25		1200	99	15.
7		0000	25	24.	*	13		0600	50	15.	*	19		1200	75	15.	*	25		1800	100	15.

****

PEAK FLOW   TIME   MAXIMUM AVERAGE FLOW

AEPBSP-000823

```
 (CFS)     (HR)                     6-HR        24-HR       72-HR    594.00-HR
  357.    120.00        (CFS)       207.        121.         57.         21.
                      (INCHES)     0.000       0.000       0.000       0.000
                       (AC-FT)      103.        240.        338.       1043.

                        CUMULATIVE AREA =     0.0  SQ MI

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

           **************
           *            *
 21 KK     *     DAM    *          ROUTE THRU DAM
           *            *
           **************
                                    PRIN. SP/W CREST AT 1 FT BELOW INITIAL WSEL

 23 KO           OUTPUT CONTROL VARIABLES
                       IPRNT          1  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

                 HYDROGRAPH ROUTING DATA

 24 RS           STORAGE ROUTING
                       NSTPS          1  NUMBER OF SUBREACHES
                        ITYP       ELEV  TYPE OF INITIAL CONDITION
                      RSVRIC     705.00  INITIAL CONDITION
                           X        0.0  WORKING R AND D COEFFICIENT

 25 SA                  AREA      103.0      145.0      169.0      184.0

 26 SE           ELEVATION       660.00     680.00     700.00     710.00

 27 SQ           DISCHARGE           0.         7.        18.        34.        52.        96.       149.       182.

 28 SE           ELEVATION       704.00     704.40     705.00     705.50     706.00     707.00     708.00     710.00

 29 SS           SPILLWAY
                        CREL     710.00  SPILLWAY CREST ELEVATION
                       SPWID      50.00  SPILLWAY WIDTH
                        COQW       3.00  WEIR COEFFICIENT
                        EXPW       1.50  EXPONENT OF HEAD

 30 ST           TOP OF DAM
                       TOPEL     710.00  ELEVATION AT TOP OF DAM
                      DAMWID      50.00  DAM WIDTH
                        COQD       3.00  WEIR COEFFICIENT
                        EXPD       1.50  EXPONENT OF HEAD

                                                        ***

                                          COMPUTED STORAGE-ELEVATION DATA

           STORAGE        0.0    2468.06    5604.99    7369.46
         ELEVATION     660.00     680.00     700.00     710.00
```

AEPBSP-000824

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.0	2468.06	5604.99	6292.80	6362.87	6468.47	6556.87	6645.64	6824.32	7004.52
OUTFLOW	0.0	0.0	0.0	0.0	6.60	18.00	34.00	52.00	96.00	149.00
ELEVATION	660.00	680.00	700.00	704.00	704.40	705.00	705.50	706.00	707.00	708.00

STORAGE	7369.46
OUTFLOW	182.00
ELEVATION	710.00

****

HYDROGRAPH AT STATION DAM

****

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	18.	6468.5	705.0	9		1200	35	31.	6538.8	705.4	18		0000	69	16.	6454.4	704.9
1		0600	2	18.	6467.6	705.0	9		1800	36	30.	6532.9	705.4	18		0600	70	16.	6453.7	704.9
1		1200	3	18.	6467.5	705.0	10		0000	37	29.	6527.4	705.3	18		1200	71	16.	6453.1	704.9
1		1800	4	18.	6467.5	705.0	10		0600	38	28.	6522.3	705.3	18		1800	72	16.	6452.5	704.9
2		0000	5	18.	6467.6	705.0	10		1200	39	27.	6517.6	705.3	19		0000	73	16.	6451.9	704.9
2		0600	6	18.	6467.7	705.0	10		1800	40	26.	6513.3	705.3	19		0600	74	16.	6451.3	704.9
2		1200	7	18.	6468.0	705.0	11		0000	41	25.	6509.2	705.2	19		1200	75	16.	6450.8	704.9
2		1800	8	18.	6468.3	705.0	11		0600	42	25.	6504.9	705.2	19		1800	76	16.	6450.3	704.9
3		0000	9	18.	6468.7	705.0	11		1200	43	24.	6500.4	705.2	20		0000	77	16.	6449.9	704.9
3		0600	10	18.	6469.2	705.0	11		1800	44	23.	6496.2	705.2	20		0600	78	16.	6449.4	704.9
3		1200	11	18.	6469.7	705.0	12		0000	45	22.	6492.5	705.1	20		1200	79	16.	6449.0	704.9
3		1800	12	18.	6470.4	705.0	12		0600	46	22.	6489.0	705.1	20		1800	80	16.	6448.6	704.9
4		0000	13	18.	6471.1	705.0	12		1200	47	21.	6485.9	705.1	21		0000	81	16.	6448.2	704.9
4		0600	14	19.	6472.0	705.0	12		1800	48	21.	6483.0	705.1	21		0600	82	16.	6447.9	704.9
4		1200	15	19.	6473.0	705.0	13		0000	49	20.	6480.4	705.1	21		1200	83	16.	6447.6	704.9
4		1800	16	19.	6474.4	705.0	13		0600	50	20.	6478.0	705.1	21		1800	84	16.	6447.2	704.9
5		0000	17	19.	6476.1	705.0	13		1200	51	19.	6475.8	705.0	22		0000	85	16.	6446.9	704.9
5		0600	18	20.	6478.2	705.1	13		1800	52	19.	6473.7	705.0	22		0600	86	16.	6446.6	704.9
5		1200	19	20.	6481.6	705.1	14		0000	53	19.	6471.9	705.0	22		1200	87	16.	6446.3	704.9
5		1800	20	22.	6488.5	705.1	14		0600	54	18.	6470.2	705.0	22		1800	88	16.	6446.1	704.9
6		0000	21	37.	6572.3	705.6	14		1200	55	18.	6468.6	705.0	23		0000	89	16.	6445.8	704.9
6		0600	22	54.	6652.3	706.0	14		1800	56	18.	6467.2	705.0	23		0600	90	16.	6445.6	704.9
6		1200	23	53.	6648.0	706.0	15		0000	57	18.	6465.9	705.0	23		1200	91	16.	6445.4	704.9
6		1800	24	50.	6637.2	706.0	15		0600	58	18.	6464.6	705.0	23		1800	92	15.	6445.1	704.9
7		0000	25	48.	6625.6	705.9	15		1200	59	17.	6463.4	705.0	24		0000	93	15.	6444.9	704.9
7		0600	26	46.	6614.2	705.8	15		1800	60	17.	6462.3	705.0	24		0600	94	15.	6444.8	704.9
7		1200	27	43.	6603.3	705.8	16		0000	61	17.	6461.2	705.0	24		1200	95	15.	6444.6	704.9
7		1800	28	41.	6593.1	705.7	16		0600	62	17.	6460.2	705.0	24		1800	96	15.	6444.4	704.9
8		0000	29	39.	6583.5	705.7	16		1200	63	17.	6459.2	704.9	25		0000	97	15.	6444.2	704.9
8		0600	30	38.	6574.7	705.6	16		1800	64	17.	6458.3	704.9	25		0600	98	15.	6444.1	704.9
8		1200	31	36.	6566.5	705.6	17		0000	65	17.	6457.4	704.9	25		1200	99	15.	6443.9	704.9
8		1800	32	34.	6558.9	705.5	17		0600	66	17.	6456.6	704.9	25		1800	100	15.	6443.8	704.9
9		0000	33	33.	6551.7	705.5	17		1200	67	17.	6455.9	704.9							
9		0600	34	32.	6545.0	705.4	17		1800	68	17.	6455.1	704.9							

****

PEAK OUTFLOW IS 54. AT TIME 126.00 HOURS

PEAK FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	594.00-HR

AEPBSP-000825

54.	126.00	(CFS)	53.	50.	43.	22.
		(INCHES)	0.000	0.000	0.000	0.000
		(AC-FT)	26.	99.	257.	1068.

PEAK STORAGE	TIME			MAXIMUM AVERAGE STORAGE		
(AC-FT)	(HR)		6-HR	24-HR	72-HR	594.00-HR
6652.	126.00		6650.	6636.	6602.	6485.

PEAK STAGE	TIME			MAXIMUM AVERAGE STAGE		
(FEET)	(HR)		6-HR	24-HR	72-HR	594.00-HR
706.04	126.00		706.03	705.95	705.74	705.09

CUMULATIVE AREA = 0.0 SQ MI

AEPBSP-000826

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	BASE	15.	6.00	15.	15.	15.	0.0		
HYDROGRAPH AT	RAIN	342.	120.00	192.	106.	42.	0.0		
2 COMBINED AT	IN	357.	120.00	207.	121.	57.	0.0		
ROUTED TO	DAM	54.	126.00	53.	50.	43.	0.0	706.04	126.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	705.00	710.00	710.00
STORAGE	6468.	7369.	7369.
OUTFLOW	18.	182.	182.

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
1.00	706.04	0.0	6652.	54.	0.0	126.00	0.0

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

```
JJJJJJJJJJ    00000000    2222222222    9999999999      11      8888888888              AAAAAAAAAA
JJJJJJJJJJ   0000000000  222222222222  999999999999     111     888888888888            AAAAAAAAAAAA
        JJ   00    0000  22        22  99        99    1111     88        88            AA        AA
        JJ   00   00 00            22  99        99      11     88        88            AA        AA
        JJ   00  00  00            22  99        99      11      88      88             AA        AA
        JJ   00 00   00           22   999999999999      11       88888888              AAAAAAAAAAAA
        JJ   00 00   00          22    999999999999      11       88888888              AAAAAAAAAAAA
        JJ   00 00   00        22                99      11      88      88             AA        AA
JJ      JJ   0000    00      22                  99      11     88        88            AA        AA
JJ      JJ   000     00    22          99        99      11     88        88            AA        AA
JJJJJJJJ     0000000000  222222222222  999999999999  1111111111 888888888888            AA        AA
 JJJJJJ       00000000   222222222222   9999999999   1111111111  8888888888             AA        AA
```

```
 ************************************
  ***  EEEEEEEE  NN    NN  DDDDDDD    ***
 ****  EE        NNN   NN  DD     DD  ****
*****  EE        NNNN  NN  DD     DD  *****
****** EEEEEEE   NN NN NN  DD     DD  ******
*****  EE        NN  NNNN  DD     DD  *****
 ****  EE        NN   NNN  DD     DD  ****
  ***  EEEEEEEE  NN    NN  DDDDDDD    ***
 ************************************
```

DELIVER CODE - AEP 15GZ
JOB NAME - HYD
JOB NUMBER - 02918
PROGRAMMER - ZYCH,G.F.
ROOM NUMBER - 15GZ
SYSOUT CLASS - A
PRINT TIME - 2.42.49 PM EST
PRINT DATE - 20 AUG 91
PRINT DEVICE - COLUMBUS.COCB.PRT3

```
 ************************************
  ***  EEEEEEEE  NN    NN  DDDDDDD    ***
 ****  EE        NNN   NN  DD     DD  ****
*****  EE        NNNN  NN  DD     DD  *****
****** EEEEEEE   NN NN NN  DD     DD  ******
*****  EE        NN  NNNN  DD     DD  *****
 ****  EE        NN   NNN  DD     DD  ****
  ***  EEEEEEEE  NN    NN  DDDDDDD    ***
 ************************************
```

```
*****************************************                                    *****************************************
*                                       *                                    *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                    *   U.S. ARMY CORPS OF ENGINEERS        *
*            FEBRUARY 1981              *                                    *  THE HYDROLOGIC ENGINEERING CENTER    *
*          REVISED 30 OCT 81            *                                    *         609 SECOND STREET             *
*                                       *                                    *      DAVIS, CALIFORNIA 95616          *
*  RUN DATE  02/18/93    TIME 13.43.03  *                                    *  (916) 440-3285 OR (FTS) 448-3285     *
*                                       *                                    *                                       *
*****************************************                                    *****************************************
```

INPUT FILE: BSANDY

BIG SANDY FLY ASH DAM

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X         XXXXX X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

FREEBOARD HYDROGRAPH

6-HR STORM

PRINCIPAL SPILLWAY ASSUMED PLUGGED

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. SEE SEPTEMBER 1981 INPUT
DESCRIPTION FOR NEW DEFINITIONS.

FINAL RESULTS

AEPBSP-000830

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

ID                BIG SANDY FLY ASH DAM
ID                FINAL RAISING -- HYDROLOGY
ID                DESIGN FLOOD -- 6 HR PMF
ID                COMPUTER GENERATED HYDROGRAPH SCS
IT        6       0       0     200
IO        1
IN       12
PG       10      28
PC      0.0    .013    .027    .042    .059    .078    .099    .122    .147    .180
PC     .230    .380    .530    .625    .670    .705   .7360   .7640   .7900   .8140
PC    .8360   .8560   .8750   .8931   .9103   .9267   .9423   .9573   .9719   .9861
PC      1.0

KK       IN           DEVELOP RUNOFF HYDROGRAPH TO FLY ASH DAM
BA     0.90
LS        0      73
PR       10
PW        1
PT       10
UD      .15

KK     BASE           BASE INFLOW TO RESERVOIR  (ASH SLUICE WATER)
IN      360
QI       15      15      15

KK       IN           COMBINE FLOOD AND BASE FLOWS
KO        1
HC        2

KK      DAM           ROUTE THRU DAM
KM                    PRIN. SP/W CREST AT 1 FT BELOW INITIAL WSEL
KM                    ASSUME PRINCIPAL SPILLWAY PLUGGED
KO        1
RS        1    ELEV     705
SA      133     157     172
SE      680     700     710
SS   706.25     100     3.0     1.5
ZZ
```

AEPBSP-000831

```
****************************************                                                  ****************************************
*                                      *                                                  *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
*             FEBRUARY 1981            *                                                  *  THE HYDROLOGIC ENGINEERING CENTER   *
*           REVISED 30 OCT 81          *                                                  *          609 SECOND STREET           *
*                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
*  RUN DATE  02/18/93    TIME 13.43.03 *                                                  *  (916) 440-3285 OR (FTS) 448-3285    *
*                                      *                                                  *                                      *
****************************************                                                  ****************************************



                                             BIG SANDY FLY ASH DAM
                                             FINAL RAISING -- HYDROLOGY
                                             DESIGN FLOOD -- 6 HR PMF
                                             COMPUTER GENERATED HYDROGRAPH SCS

   6 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          1  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

   7 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         12  TIME INTERVAL IN MINUTES
                      JXDATE      1   0  STARTING DATE
                      JXTIME          0  STARTING TIME

     IT          HYDROGRAPH TIME DATA
                        NMIN          6  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1   0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        200  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      1   0  ENDING DATE
                      NDTIME       1954  ENDING TIME

                   COMPUTATION INTERVAL    0.10 HOURS
                        TOTAL TIME BASE   19.90 HOURS

           ENGLISH UNITS
                DRAINAGE AREA          SQUARE MILES
                PRECIPITATION DEPTH    INCHES
                LENGTH, ELEVATION      FEET
                FLOW                   CUBIC FEET PER SECOND
                STORAGE VOLUME         ACRE-FEET
                SURFACE AREA           ACRES
                TEMPERATURE            DEGREES FAHRENHEIT


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


             **************
             *            *
  13 KK      *     IN     *               DEVELOP RUNOFF HYDROGRAPH TO FLY ASH DAM
             *            *
             **************
```

AEPBSP-000832

```
SUBBASIN RUNOFF DATA

14 BA          SUBBASIN CHARACTERISTICS
                     TAREA        0.90  SUBBASIN AREA

               PRECIPITATION DATA

18 PT            TOTAL STORM STATIONS        10
 0 PW                         WEIGHTS      1.00

16 PR              RECORDING STATIONS        10
17 PW                         WEIGHTS      1.00

15 LS          SCS LOSS RATE
                     STRTL        0.74  INITIAL ABSTRACTION
                    CRVNBR       73.00  CURVE NUMBER
                     RTIMP        0.0   PERCENT IMPERVIOUS AREA

19 UD          SCS DIMENSIONLESS UNITGRAPH
                      TLAG        0.15  LAG

                                        ***

          PRECIPITATION STATION DATA

                   STATION    TOTAL    AVG. ANNUAL    WEIGHT
                        10    28.00        0.0          1.00

               TEMPORAL DISTRIBUTIONS

               STATION       10,  WEIGHT =   1.00
                    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                    0.01    0.01    0.01    0.01    0.01    0.01    0.02    0.02    0.02    0.03
                    0.07    0.08    0.07    0.08    0.05    0.05    0.02    0.02    0.02    0.02
                    0.02    0.02    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01

WARNING *** TIME INTERVAL IS GREATER THAN LAG/2

                                                     UNIT HYDROGRAPH
                                                 10 END-OF-PERIOD ORDINATES
          1029.    2189.    1489.     613.     278.     120.      55.      24.      11.       0.

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

                                           HYDROGRAPH AT STATION       IN

*************************************************************************************************
                                                       *
   DA MON HRMN  ORD    RAIN   LOSS  EXCESS    COMP Q   *    DA MON HRMN  ORD    RAIN   LOSS  EXCESS    COMP Q
                                                       *
    1     0000    1    0.0    0.0    0.0          0.   *     1     1000  101    0.0    0.0    0.0          0.
    1     0006    2    0.18   0.18   0.00         0.   *     1     1006  102    0.0    0.0    0.0          0.
    1     0012    3    0.18   0.18   0.00         0.   *     1     1012  103    0.0    0.0    0.0          0.
    1     0018    4    0.20   0.20   0.00         0.   *     1     1018  104    0.0    0.0    0.0          0.
    1     0024    5    0.20   0.20   0.00         0.   *     1     1024  105    0.0    0.0    0.0          0.
    1     0030    6    0.21   0.20   0.01        14.   *     1     1030  106    0.0    0.0    0.0          0.
    1     0036    7    0.21   0.18   0.03        62.   *     1     1036  107    0.0    0.0    0.0          0.
    1     0042    8    0.24   0.18   0.06       151.   *     1     1042  108    0.0    0.0    0.0          0.
```

AEPBSP-000833

1	0048	9	0.24	0.16	0.08	263.	*	1	1048	109	0.0	0.0	0.0	0.
1	0054	10	0.27	0.16	0.10	385.	*	1	1054	110	0.0	0.0	0.0	0.
1	0100	11	0.27	0.15	0.12	513.	*	1	1100	111	0.0	0.0	0.0	0.
1	0106	12	0.29	0.14	0.15	642.	*	1	1106	112	0.0	0.0	0.0	0.
1	0112	13	0.29	0.13	0.16	773.	*	1	1112	113	0.0	0.0	0.0	0.
1	0118	14	0.32	0.13	0.20	902.	*	1	1118	114	0.0	0.0	0.0	0.
1	0124	15	0.32	0.11	0.21	1030.	*	1	1124	115	0.0	0.0	0.0	0.
1	0130	16	0.35	0.11	0.24	1156.	*	1	1130	116	0.0	0.0	0.0	0.
1	0136	17	0.35	0.10	0.25	1281.	*	1	1136	117	0.0	0.0	0.0	0.
1	0142	18	0.46	0.12	0.34	1468.	*	1	1142	118	0.0	0.0	0.0	0.
1	0148	19	0.46	0.10	0.36	1732.	*	1	1148	119	0.0	0.0	0.0	0.
1	0154	20	0.70	0.14	0.56	2132.	*	1	1154	120	0.0	0.0	0.0	0.
1	0200	21	0.70	0.12	0.58	2689.	*	1	1200	121	0.0	0.0	0.0	0.
1	0206	22	2.10	0.27	1.83	4365.	*	1	1206	122	0.0	0.0	0.0	0.
1	0212	23	2.10	0.18	1.92	7362.	*	1	1212	123	0.0	0.0	0.0	0.
1	0218	24	2.10	0.13	1.97	9532.	*	1	1218	124	0.0	0.0	0.0	0.
1	0224	25	2.10	0.10	2.00	10595.	*	1	1224	125	0.0	0.0	0.0	0.
1	0230	26	1.33	0.05	1.28	10410.	*	1	1230	126	0.0	0.0	0.0	0.
1	0236	27	1.33	0.05	1.28	9096.	*	1	1236	127	0.0	0.0	0.0	0.
1	0242	28	0.63	0.02	0.61	7460.	*	1	1242	128	0.0	0.0	0.0	0.
1	0248	29	0.63	0.02	0.61	5605.	*	1	1248	129	0.0	0.0	0.0	0.
1	0254	30	0.49	0.01	0.48	4292.	*	1	1254	130	0.0	0.0	0.0	0.
1	0300	31	0.49	0.01	0.48	3505.	*	1	1300	131	0.0	0.0	0.0	0.
1	0306	32	0.43	0.01	0.42	3026.	*	1	1306	132	0.0	0.0	0.0	0.
1	0312	33	0.43	0.01	0.42	2728.	*	1	1312	133	0.0	0.0	0.0	0.
1	0318	34	0.39	0.01	0.38	2525.	*	1	1318	134	0.0	0.0	0.0	0.
1	0324	35	0.39	0.01	0.38	2372.	*	1	1324	135	0.0	0.0	0.0	0.
1	0330	36	0.36	0.01	0.36	2255.	*	1	1330	136	0.0	0.0	0.0	0.
1	0336	37	0.36	0.01	0.36	2162.	*	1	1336	137	0.0	0.0	0.0	0.
1	0342	38	0.34	0.01	0.33	2079.	*	1	1342	138	0.0	0.0	0.0	0.
1	0348	39	0.34	0.01	0.33	1997.	*	1	1348	139	0.0	0.0	0.0	0.
1	0354	40	0.31	0.01	0.30	1919.	*	1	1354	140	0.0	0.0	0.0	0.
1	0400	41	0.31	0.01	0.30	1839.	*	1	1400	141	0.0	0.0	0.0	0.
1	0406	42	0.28	0.01	0.27	1761.	*	1	1406	142	0.0	0.0	0.0	0.
1	0412	43	0.28	0.01	0.27	1681.	*	1	1412	143	0.0	0.0	0.0	0.
1	0418	44	0.27	0.00	0.26	1618.	*	1	1418	144	0.0	0.0	0.0	0.
1	0424	45	0.27	0.00	0.26	1567.	*	1	1424	145	0.0	0.0	0.0	0.
1	0430	46	0.25	0.00	0.25	1525.	*	1	1430	146	0.0	0.0	0.0	0.
1	0436	47	0.25	0.00	0.25	1486.	*	1	1436	147	0.0	0.0	0.0	0.
1	0442	48	0.24	0.00	0.24	1450.	*	1	1442	148	0.0	0.0	0.0	0.
1	0448	49	0.24	0.00	0.24	1414.	*	1	1448	149	0.0	0.0	0.0	0.
1	0454	50	0.23	0.00	0.23	1380.	*	1	1454	150	0.0	0.0	0.0	0.
1	0500	51	0.23	0.00	0.23	1347.	*	1	1500	151	0.0	0.0	0.0	0.
1	0506	52	0.22	0.00	0.21	1315.	*	1	1506	152	0.0	0.0	0.0	0.
1	0512	53	0.22	0.00	0.21	1283.	*	1	1512	153	0.0	0.0	0.0	0.
1	0518	54	0.21	0.00	0.21	1254.	*	1	1518	154	0.0	0.0	0.0	0.
1	0524	55	0.21	0.00	0.21	1228.	*	1	1524	155	0.0	0.0	0.0	0.
1	0530	56	0.20	0.00	0.20	1207.	*	1	1530	156	0.0	0.0	0.0	0.
1	0536	57	0.20	0.00	0.20	1188.	*	1	1536	157	0.0	0.0	0.0	0.
1	0542	58	0.20	0.00	0.20	1171.	*	1	1542	158	0.0	0.0	0.0	0.
1	0548	59	0.20	0.00	0.20	1155.	*	1	1548	159	0.0	0.0	0.0	0.
1	0554	60	0.19	0.00	0.19	1141.	*	1	1554	160	0.0	0.0	0.0	0.
1	0600	61	0.19	0.00	0.19	1128.	*	1	1600	161	0.0	0.0	0.0	0.
1	0606	62	0.0	0.0	0.0	922.	*	1	1606	162	0.0	0.0	0.0	0.
1	0612	63	0.0	0.0	0.0	499.	*	1	1612	163	0.0	0.0	0.0	0.
1	0618	64	0.0	0.0	0.0	212.	*	1	1618	164	0.0	0.0	0.0	0.
1	0624	65	0.0	0.0	0.0	94.	*	1	1624	165	0.0	0.0	0.0	0.
1	0630	66	0.0	0.0	0.0	40.	*	1	1630	166	0.0	0.0	0.0	0.
1	0636	67	0.0	0.0	0.0	17.	*	1	1636	167	0.0	0.0	0.0	0.
1	0642	68	0.0	0.0	0.0	7.	*	1	1642	168	0.0	0.0	0.0	0.

1	0648	69	0.0	0.0	0.0	2.	*	1	1648	169	0.0	0.0	0.0	0.
1	0654	70	0.0	0.0	0.0	0.	*	1	1654	170	0.0	0.0	0.0	0.
1	0700	71	0.0	0.0	0.0	0.	*	1	1700	171	0.0	0.0	0.0	0.
1	0706	72	0.0	0.0	0.0	0.	*	1	1706	172	0.0	0.0	0.0	0.
1	0712	73	0.0	0.0	0.0	0.	*	1	1712	173	0.0	0.0	0.0	0.
1	0718	74	0.0	0.0	0.0	0.	*	1	1718	174	0.0	0.0	0.0	0.
1	0724	75	0.0	0.0	0.0	0.	*	1	1724	175	0.0	0.0	0.0	0.
1	0730	76	0.0	0.0	0.0	0.	*	1	1730	176	0.0	0.0	0.0	0.
1	0736	77	0.0	0.0	0.0	0.	*	1	1736	177	0.0	0.0	0.0	0.
1	0742	78	0.0	0.0	0.0	0.	*	1	1742	178	0.0	0.0	0.0	0.
1	0748	79	0.0	0.0	0.0	0.	*	1	1748	179	0.0	0.0	0.0	0.
1	0754	80	0.0	0.0	0.0	0.	*	1	1754	180	0.0	0.0	0.0	0.
1	0800	81	0.0	0.0	0.0	0.	*	1	1800	181	0.0	0.0	0.0	0.
1	0806	82	0.0	0.0	0.0	0.	*	1	1806	182	0.0	0.0	0.0	0.
1	0812	83	0.0	0.0	0.0	0.	*	1	1812	183	0.0	0.0	0.0	0.
1	0818	84	0.0	0.0	0.0	0.	*	1	1818	184	0.0	0.0	0.0	0.
1	0824	85	0.0	0.0	0.0	0.	*	1	1824	185	0.0	0.0	0.0	0.
1	0830	86	0.0	0.0	0.0	0.	*	1	1830	186	0.0	0.0	0.0	0.
1	0836	87	0.0	0.0	0.0	0.	*	1	1836	187	0.0	0.0	0.0	0.
1	0842	88	0.0	0.0	0.0	0.	*	1	1842	188	0.0	0.0	0.0	0.
1	0848	89	0.0	0.0	0.0	0.	*	1	1848	189	0.0	0.0	0.0	0.
1	0854	90	0.0	0.0	0.0	0.	*	1	1854	190	0.0	0.0	0.0	0.
1	0900	91	0.0	0.0	0.0	0.	*	1	1900	191	0.0	0.0	0.0	0.
1	0906	92	0.0	0.0	0.0	0.	*	1	1906	192	0.0	0.0	0.0	0.
1	0912	93	0.0	0.0	0.0	0.	*	1	1912	193	0.0	0.0	0.0	0.
1	0918	94	0.0	0.0	0.0	0.	*	1	1918	194	0.0	0.0	0.0	0.
1	0924	95	0.0	0.0	0.0	0.	*	1	1924	195	0.0	0.0	0.0	0.
1	0930	96	0.0	0.0	0.0	0.	*	1	1930	196	0.0	0.0	0.0	0.
1	0936	97	0.0	0.0	0.0	0.	*	1	1936	197	0.0	0.0	0.0	0.
1	0942	98	0.0	0.0	0.0	0.	*	1	1942	198	0.0	0.0	0.0	0.
1	0948	99	0.0	0.0	0.0	0.	*	1	1948	199	0.0	0.0	0.0	0.
1	0954	100	0.0	0.0	0.0	0.	*	1	1954	200	0.0	0.0	0.0	0.

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TOTAL RAINFALL = 28.00, TOTAL LOSS = 4.00, TOTAL EXCESS = 24.00

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	19.90-HR
10595.	2.40	(CFS)	2323.	701.	701.	701.
		(INCHES)	23.994	24.003	24.003	24.003
		(AC-FT)	1152.	1152.	1152.	1152.

CUMULATIVE AREA = 0.90 SQ MI

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               **************
               *            *
20 KK          *    BASE    *            BASE INFLOW TO RESERVOIR  (ASH SLUICE WATER)
               *            *
               **************

21 IN          TIME DATA FOR INPUT TIME SERIES
                  JXMIN          360  TIME INTERVAL IN MINUTES
                  JXDATE      1    0  STARTING DATE
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JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

14 BA SUBBASIN CHARACTERISTICS
TAREA 0.90 SUBBASIN AREA

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HYDROGRAPH AT STATION BASE

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DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW
1		0000	1	15.	*	1		0500	51	15.	*	1		1000	101	15.	*	1		1500	151	15.
1		0006	2	15.	*	1		0506	52	15.	*	1		1006	102	15.	*	1		1506	152	15.
1		0012	3	15.	*	1		0512	53	15.	*	1		1012	103	15.	*	1		1512	153	15.
1		0018	4	15.	*	1		0518	54	15.	*	1		1018	104	15.	*	1		1518	154	15.
1		0024	5	15.	*	1		0524	55	15.	*	1		1024	105	15.	*	1		1524	155	15.
1		0030	6	15.	*	1		0530	56	15.	*	1		1030	106	15.	*	1		1530	156	15.
1		0036	7	15.	*	1		0536	57	15.	*	1		1036	107	15.	*	1		1536	157	15.
1		0042	8	15.	*	1		0542	58	15.	*	1		1042	108	15.	*	1		1542	158	15.
1		0048	9	15.	*	1		0548	59	15.	*	1		1048	109	15.	*	1		1548	159	15.
1		0054	10	15.	*	1		0554	60	15.	*	1		1054	110	15.	*	1		1554	160	15.
1		0100	11	15.	*	1		0600	61	15.	*	1		1100	111	15.	*	1		1600	161	15.
1		0106	12	15.	*	1		0606	62	15.	*	1		1106	112	15.	*	1		1606	162	15.
1		0112	13	15.	*	1		0612	63	15.	*	1		1112	113	15.	*	1		1612	163	15.
1		0118	14	15.	*	1		0618	64	15.	*	1		1118	114	15.	*	1		1618	164	15.
1		0124	15	15.	*	1		0624	65	15.	*	1		1124	115	15.	*	1		1624	165	15.
1		0130	16	15.	*	1		0630	66	15.	*	1		1130	116	15.	*	1		1630	166	15.
1		0136	17	15.	*	1		0636	67	15.	*	1		1136	117	15.	*	1		1636	167	15.
1		0142	18	15.	*	1		0642	68	15.	*	1		1142	118	15.	*	1		1642	168	15.
1		0148	19	15.	*	1		0648	69	15.	*	1		1148	119	15.	*	1		1648	169	15.
1		0154	20	15.	*	1		0654	70	15.	*	1		1154	120	15.	*	1		1654	170	15.
1		0200	21	15.	*	1		0700	71	15.	*	1		1200	121	15.	*	1		1700	171	15.
1		0206	22	15.	*	1		0706	72	15.	*	1		1206	122	15.	*	1		1706	172	15.
1		0212	23	15.	*	1		0712	73	15.	*	1		1212	123	15.	*	1		1712	173	15.
1		0218	24	15.	*	1		0718	74	15.	*	1		1218	124	15.	*	1		1718	174	15.
1		0224	25	15.	*	1		0724	75	15.	*	1		1224	125	15.	*	1		1724	175	15.
1		0230	26	15.	*	1		0730	76	15.	*	1		1230	126	15.	*	1		1730	176	15.
1		0236	27	15.	*	1		0736	77	15.	*	1		1236	127	15.	*	1		1736	177	15.
1		0242	28	15.	*	1		0742	78	15.	*	1		1242	128	15.	*	1		1742	178	15.
1		0248	29	15.	*	1		0748	79	15.	*	1		1248	129	15.	*	1		1748	179	15.
1		0254	30	15.	*	1		0754	80	15.	*	1		1254	130	15.	*	1		1754	180	15.
1		0300	31	15.	*	1		0800	81	15.	*	1		1300	131	15.	*	1		1800	181	15.
1		0306	32	15.	*	1		0806	82	15.	*	1		1306	132	15.	*	1		1806	182	15.
1		0312	33	15.	*	1		0812	83	15.	*	1		1312	133	15.	*	1		1812	183	15.
1		0318	34	15.	*	1		0818	84	15.	*	1		1318	134	15.	*	1		1818	184	15.
1		0324	35	15.	*	1		0824	85	15.	*	1		1324	135	15.	*	1		1824	185	15.
1		0330	36	15.	*	1		0830	86	15.	*	1		1330	136	15.	*	1		1830	186	15.
1		0336	37	15.	*	1		0836	87	15.	*	1		1336	137	15.	*	1		1836	187	15.
1		0342	38	15.	*	1		0842	88	15.	*	1		1342	138	15.	*	1		1842	188	15.
1		0348	39	15.	*	1		0848	89	15.	*	1		1348	139	15.	*	1		1848	189	15.
1		0354	40	15.	*	1		0854	90	15.	*	1		1354	140	15.	*	1		1854	190	15.
1		0400	41	15.	*	1		0900	91	15.	*	1		1400	141	15.	*	1		1900	191	15.
1		0406	42	15.	*	1		0906	92	15.	*	1		1406	142	15.	*	1		1906	192	15.
1		0412	43	15.	*	1		0912	93	15.	*	1		1412	143	15.	*	1		1912	193	15.

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  1   0418   44      15.   *   1   0918   94      15.   *   1   1418  144      15.   *   1   1918  194      15.
  1   0424   45      15.   *   1   0924   95      15.   *   1   1424  145      15.   *   1   1924  195      15.
  1   0430   46      15.   *   1   0930   96      15.   *   1   1430  146      15.   *   1   1930  196      15.
  1   0436   47      15.   *   1   0936   97      15.   *   1   1436  147      15.   *   1   1936  197      15.
  1   0442   48      15.   *   1   0942   98      15.   *   1   1442  148      15.   *   1   1942  198      15.
  1   0448   49      15.   *   1   0948   99      15.   *   1   1448  149      15.   *   1   1948  199      15.
  1   0454   50      15.   *   1   0954  100      15.   *   1   1454  150      15.   *   1   1954  200      15.
                           *                            *                            *
*************************************************************************************************************

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
   (CFS)       (HR)                 6-HR       24-HR       72-HR     19.90-HR
     15.       0.10       (CFS)      15.         15.         15.         15.
                        (INCHES)    0.155       0.514       0.514       0.514
                         (AC-FT)      7.         25.         25.         25.

                        CUMULATIVE AREA =     0.90 SQ MI


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

              **************
              *            *
  23 KK       *     IN     *             COMBINE FLOOD AND BASE FLOWS
              *            *
              **************

  24 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           1  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

  25 HC          HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                         ***

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

                                            HYDROGRAPH AT STATION       IN
                                                SUM OF  2 HYDROGRAPHS

*************************************************************************************************************
                               *                            *                            *
 DA MON HRMN  ORD      FLOW    *  DA MON HRMN  ORD     FLOW    *  DA MON HRMN  ORD     FLOW    *  DA MON HRMN  ORD     FLOW
                               *                            *                            *
  1   0000    1      15.   *   1   0500   51    1362.   *   1   1000  101      15.   *   1   1500  151      15.
  1   0006    2      15.   *   1   0506   52    1330.   *   1   1006  102      15.   *   1   1506  152      15.
  1   0012    3      15.   *   1   0512   53    1298.   *   1   1012  103      15.   *   1   1512  153      15.
  1   0018    4      15.   *   1   0518   54    1269.   *   1   1018  104      15.   *   1   1518  154      15.
  1   0024    5      15.   *   1   0524   55    1243.   *   1   1024  105      15.   *   1   1524  155      15.
  1   0030    6      29.   *   1   0530   56    1222.   *   1   1030  106      15.   *   1   1530  156      15.
  1   0036    7      77.   *   1   0536   57    1203.   *   1   1036  107      15.   *   1   1536  157      15.
  1   0042    8     166.   *   1   0542   58    1186.   *   1   1042  108      15.   *   1   1542  158      15.
  1   0048    9     278.   *   1   0548   59    1170.   *   1   1048  109      15.   *   1   1548  159      15.
  1   0054   10     400.   *   1   0554   60    1156.   *   1   1054  110      15.   *   1   1554  160      15.
  1   0100   11     528.   *   1   0600   61    1143.   *   1   1100  111      15.   *   1   1600  161      15.
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1	0106	12	657.	1	0606	62	937.	1	1106	112	15.	1	1606	162	15.
1	0112	13	788.	1	0612	63	514.	1	1112	113	15.	1	1612	163	15.
1	0118	14	917.	1	0618	64	227.	1	1118	114	15.	1	1618	164	15.
1	0124	15	1045.	1	0624	65	109.	1	1124	115	15.	1	1624	165	15.
1	0130	16	1171.	1	0630	66	55.	1	1130	116	15.	1	1630	166	15.
1	0136	17	1296.	1	0636	67	32.	1	1136	117	15.	1	1636	167	15.
1	0142	18	1483.	1	0642	68	22.	1	1142	118	15.	1	1642	168	15.
1	0148	19	1747.	1	0648	69	17.	1	1148	119	15.	1	1648	169	15.
1	0154	20	2147.	1	0654	70	15.	1	1154	120	15.	1	1654	170	15.
1	0200	21	2704.	1	0700	71	15.	1	1200	121	15.	1	1700	171	15.
1	0206	22	4380.	1	0706	72	15.	1	1206	122	15.	1	1706	172	15.
1	0212	23	7377.	1	0712	73	15.	1	1212	123	15.	1	1712	173	15.
1	0218	24	9547.	1	0718	74	15.	1	1218	124	15.	1	1718	174	15.
1	0224	25	10610.	1	0724	75	15.	1	1224	125	15.	1	1724	175	15.
1	0230	26	10425.	1	0730	76	15.	1	1230	126	15.	1	1730	176	15.
1	0236	27	9111.	1	0736	77	15.	1	1236	127	15.	1	1736	177	15.
1	0242	28	7475.	1	0742	78	15.	1	1242	128	15.	1	1742	178	15.
1	0248	29	5620.	1	0748	79	15.	1	1248	129	15.	1	1748	179	15.
1	0254	30	4307.	1	0754	80	15.	1	1254	130	15.	1	1754	180	15.
1	0300	31	3520.	1	0800	81	15.	1	1300	131	15.	1	1800	181	15.
1	0306	32	3041.	1	0806	82	15.	1	1306	132	15.	1	1806	182	15.
1	0312	33	2743.	1	0812	83	15.	1	1312	133	15.	1	1812	183	15.
1	0318	34	2540.	1	0818	84	15.	1	1318	134	15.	1	1818	184	15.
1	0324	35	2387.	1	0824	85	15.	1	1324	135	15.	1	1824	185	15.
1	0330	36	2270.	1	0830	86	15.	1	1330	136	15.	1	1830	186	15.
1	0336	37	2177.	1	0836	87	15.	1	1336	137	15.	1	1836	187	15.
1	0342	38	2094.	1	0842	88	15.	1	1342	138	15.	1	1842	188	15.
1	0348	39	2012.	1	0848	89	15.	1	1348	139	15.	1	1848	189	15.
1	0354	40	1934.	1	0854	90	15.	1	1354	140	15.	1	1854	190	15.
1	0400	41	1854.	1	0900	91	15.	1	1400	141	15.	1	1900	191	15.
1	0406	42	1776.	1	0906	92	15.	1	1406	142	15.	1	1906	192	15.
1	0412	43	1696.	1	0912	93	15.	1	1412	143	15.	1	1912	193	15.
1	0418	44	1633.	1	0918	94	15.	1	1418	144	15.	1	1918	194	15.
1	0424	45	1582.	1	0924	95	15.	1	1424	145	15.	1	1924	195	15.
1	0430	46	1540.	1	0930	96	15.	1	1430	146	15.	1	1930	196	15.
1	0436	47	1501.	1	0936	97	15.	1	1436	147	15.	1	1936	197	15.
1	0442	48	1465.	1	0942	98	15.	1	1442	148	15.	1	1942	198	15.
1	0448	49	1429.	1	0948	99	15.	1	1448	149	15.	1	1948	199	15.
1	0454	50	1395.	1	0954	100	15.	1	1454	150	15.	1	1954	200	15.

****

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	19.90-HR
10610.	2.40	(CFS)	2338.	716.	716.	716.
		(INCHES)	12.074	12.258	12.258	12.258
		(AC-FT)	1159.	1177.	1177.	1177.

CUMULATIVE AREA = 1.80 SQ MI

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              **************
              *            *
   26 KK      *     DAM    *         ROUTE THRU DAM
              *            *
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AEPBSP-000838

****

PRIN. SP/W CREST AT 1 FT BELOW INITIAL WSEL
ASSUME PRINCIPAL SPILLWAY PLUGGED

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29 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          1  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

             HYDROGRAPH ROUTING DATA

30 RS          STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       ELEV  TYPE OF INITIAL CONDITION
                    RSVRIC     705.00  INITIAL CONDITION
                         X        0.0  WORKING R AND D COEFFICIENT

31 SA                 AREA      133.0      157.0      172.0

32 SE            ELEVATION     680.00     700.00     710.00

33 SS          SPILLWAY
                      CREL     706.25  SPILLWAY CREST ELEVATION
                     SPWID     100.00  SPILLWAY WIDTH
                      COQW       3.00  WEIR COEFFICIENT
                      EXPW       1.50  EXPONENT OF HEAD
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COMPUTED STORAGE-ELEVATION DATA

STORAGE	0.0	2896.68	4541.11
ELEVATION	680.00	700.00	710.00

COMPUTED OUTFLOW-ELEVATION DATA

OUTFLOW	0.0	0.0	0.37	2.97	10.06	23.88	46.68	80.64	128.05	191.25
ELEVATION	680.00	706.25	706.26	706.30	706.35	706.44	706.54	706.67	706.82	706.99
OUTFLOW	272.21	373.46	497.16	645.40	820.56	1024.88	1260.62	1530.01	1835.11	2178.34
ELEVATION	707.19	707.41	707.65	707.92	708.21	708.52	708.85	709.21	709.59	710.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.0	2896.68	3906.84	3908.75	3914.51	3924.14	3937.64	3955.01	3976.23	4001.35
OUTFLOW	0.0	0.0	0.0	0.37	2.97	10.06	23.88	46.68	80.64	128.05
ELEVATION	680.00	700.00	706.25	706.26	706.30	706.35	706.44	706.54	706.67	706.82
STORAGE	4030.43	4063.36	4100.29	4141.20	4186.07	4234.97	4287.94	4345.00	4406.20	4471.53
OUTFLOW	191.25	272.21	373.46	497.16	645.40	820.56	1024.88	1260.62	1530.01	1835.11
ELEVATION	706.99	707.19	707.41	707.65	707.92	708.21	708.52	708.85	709.21	709.59
STORAGE	4541.07									
OUTFLOW	2178.34									
ELEVATION	710.00									

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HYDROGRAPH AT STATION DAM

AEPBSP-000839

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	3700.1	705.0	*	1		0642	68	1238.	4339.5	708.8	*	1		1324	135	226.	4044.7	707.1
1		0006	2	0.	3700.3	705.0	*	1		0648	69	1197.	4329.6	708.8	*	1		1330	136	222.	4042.9	707.1
1		0012	3	0.	3700.4	705.0	*	1		0654	70	1157.	4320.0	708.7	*	1		1336	137	218.	4041.2	707.1
1		0018	4	0.	3700.5	705.0	*	1		0700	71	1119.	4310.7	708.7	*	1		1342	138	214.	4039.6	707.0
1		0024	5	0.	3700.6	705.0	*	1		0706	72	1082.	4301.8	708.6	*	1		1348	139	210.	4037.9	707.0
1		0030	6	0.	3700.8	705.0	*	1		0712	73	1046.	4293.1	708.5	*	1		1354	140	206.	4036.4	707.0
1		0036	7	0.	3701.3	705.0	*	1		0718	74	1012.	4284.7	708.5	*	1		1400	141	202.	4034.8	707.0
1		0042	8	0.	3702.3	705.0	*	1		0724	75	981.	4276.6	708.5	*	1		1406	142	198.	4033.3	707.0
1		0048	9	0.	3704.1	705.0	*	1		0730	76	951.	4268.7	708.4	*	1		1412	143	195.	4031.8	707.0
1		0054	10	0.	3706.9	705.0	*	1		0736	77	921.	4261.1	708.4	*	1		1418	144	191.	4030.3	707.0
1		0100	11	0.	3710.7	705.0	*	1		0742	78	893.	4253.7	708.3	*	1		1424	145	188.	4028.9	707.0
1		0106	12	0.	3715.6	705.1	*	1		0748	79	865.	4246.6	708.3	*	1		1430	146	185.	4027.4	707.0
1		0112	13	0.	3721.6	705.1	*	1		0754	80	839.	4239.7	708.2	*	1		1436	147	182.	4026.0	707.0
1		0118	14	0.	3728.6	705.1	*	1		0800	81	813.	4233.0	708.2	*	1		1442	148	179.	4024.7	707.0
1		0124	15	0.	3736.7	705.2	*	1		0806	82	790.	4226.5	708.2	*	1		1448	149	176.	4023.3	706.9
1		0130	16	0.	3745.9	705.3	*	1		0812	83	768.	4220.2	708.1	*	1		1454	150	173.	4022.0	706.9
1		0136	17	0.	3756.1	705.3	*	1		0818	84	746.	4214.0	708.1	*	1		1500	151	170.	4020.7	706.9
1		0142	18	0.	3767.6	705.4	*	1		0824	85	724.	4208.1	708.0	*	1		1506	152	167.	4019.5	706.9
1		0148	19	0.	3780.9	705.5	*	1		0830	86	704.	4202.3	708.0	*	1		1512	153	165.	4018.2	706.9
1		0154	20	0.	3797.0	705.6	*	1		0836	87	683.	4196.7	708.0	*	1		1518	154	162.	4017.0	706.9
1		0200	21	0.	3817.1	705.7	*	1		0842	88	664.	4191.3	707.9	*	1		1524	155	159.	4015.8	706.9
1		0206	22	0.	3846.3	705.9	*	1		0848	89	645.	4186.0	707.9	*	1		1530	156	157.	4014.6	706.9
1		0212	23	0.	3894.9	706.2	*	1		0854	90	628.	4180.8	707.9	*	1		1536	157	154.	4013.4	706.9
1		0218	24	62.	3964.6	706.6	*	1		0900	91	612.	4175.8	707.9	*	1		1542	158	152.	4012.3	706.9
1		0224	25	231.	4046.7	707.1	*	1		0906	92	596.	4171.0	707.8	*	1		1548	159	149.	4011.2	706.9
1		0230	26	465.	4130.7	707.6	*	1		0912	93	580.	4166.2	707.8	*	1		1554	160	147.	4010.1	706.9
1		0236	27	719.	4206.6	708.0	*	1		0918	94	565.	4161.6	707.8	*	1		1600	161	145.	4009.0	706.9
1		0242	28	949.	4268.2	708.4	*	1		0924	95	550.	4157.1	707.7	*	1		1606	162	142.	4007.9	706.9
1		0248	29	1131.	4313.7	708.7	*	1		0930	96	535.	4152.8	707.7	*	1		1612	163	140.	4006.9	706.8
1		0254	30	1260.	4344.9	708.9	*	1		0936	97	521.	4148.5	707.7	*	1		1618	164	138.	4005.9	706.8
1		0300	31	1355.	4366.4	709.0	*	1		0942	98	508.	4144.4	707.7	*	1		1624	165	136.	4004.8	706.8
1		0306	32	1424.	4382.0	709.1	*	1		0948	99	495.	4140.4	707.6	*	1		1630	166	134.	4003.9	706.8
1		0312	33	1476.	4393.9	709.1	*	1		0954	100	483.	4136.5	707.6	*	1		1636	167	131.	4002.9	706.8
1		0318	34	1518.	4403.4	709.2	*	1		1000	101	471.	4132.7	707.6	*	1		1642	168	129.	4001.9	706.8
1		0324	35	1553.	4411.1	709.2	*	1		1006	102	460.	4128.9	707.6	*	1		1648	169	127.	4001.0	706.8
1		0330	36	1582.	4417.4	709.3	*	1		1012	103	449.	4125.3	707.6	*	1		1654	170	126.	4000.1	706.8
1		0336	37	1606.	4422.6	709.3	*	1		1018	104	438.	4121.8	707.5	*	1		1700	171	124.	3999.2	706.8
1		0342	38	1626.	4426.9	709.3	*	1		1024	105	428.	4118.3	707.5	*	1		1706	172	122.	3998.3	706.8
1		0348	39	1643.	4430.3	709.4	*	1		1030	106	418.	4114.9	707.5	*	1		1712	173	121.	3997.4	706.8
1		0354	40	1655.	4433.0	709.4	*	1		1036	107	408.	4111.6	707.5	*	1		1718	174	119.	3996.5	706.8
1		0400	41	1664.	4434.9	709.4	*	1		1042	108	398.	4108.4	707.5	*	1		1724	175	117.	3995.7	706.8
1		0406	42	1670.	4436.1	709.4	*	1		1048	109	389.	4105.3	707.4	*	1		1730	176	116.	3994.8	706.8
1		0412	43	1672.	4436.7	709.4	*	1		1054	110	379.	4102.3	707.4	*	1		1736	177	114.	3994.0	706.8
1		0418	44	1672.	4436.6	709.4	*	1		1100	111	371.	4099.3	707.4	*	1		1742	178	113.	3993.2	706.8
1		0424	45	1670.	4436.1	709.4	*	1		1106	112	363.	4096.4	707.4	*	1		1748	179	111.	3992.4	706.8
1		0430	46	1666.	4435.2	709.4	*	1		1112	113	355.	4093.5	707.4	*	1		1754	180	110.	3991.6	706.8
1		0436	47	1660.	4434.0	709.4	*	1		1118	114	347.	4090.8	707.4	*	1		1800	181	108.	3990.8	706.8
1		0442	48	1653.	4432.6	709.4	*	1		1124	115	340.	4088.0	707.3	*	1		1806	182	107.	3990.1	706.7
1		0448	49	1646.	4430.9	709.4	*	1		1130	116	333.	4085.4	707.3	*	1		1812	183	105.	3989.3	706.7
1		0454	50	1637.	4429.0	709.3	*	1		1136	117	325.	4082.8	707.3	*	1		1818	184	104.	3988.6	706.7
1		0500	51	1627.	4426.9	709.3	*	1		1142	118	319.	4080.3	707.3	*	1		1824	185	103.	3987.8	706.7
1		0506	52	1616.	4424.7	709.3	*	1		1148	119	312.	4077.8	707.3	*	1		1830	186	101.	3987.1	706.7
1		0512	53	1605.	4422.2	709.3	*	1		1154	120	305.	4075.3	707.3	*	1		1836	187	100.	3986.4	706.7
1		0518	54	1593.	4419.6	709.3	*	1		1200	121	299.	4073.0	707.2	*	1		1842	188	99.	3985.7	706.7
1		0524	55	1580.	4416.9	709.3	*	1		1206	122	292.	4070.7	707.2	*	1		1848	189	97.	3985.0	706.7

AEPBSP-000840

1	0530	56	1567.	4414.1	709.3	*	1	1212	123	286.	4068.4	707.2	*	1	1854	190	96.	3984.4	706.7
1	0536	57	1553.	4411.2	709.2	*	1	1218	124	280.	4066.2	707.2	*	1	1900	191	95.	3983.7	706.7
1	0542	58	1540.	4408.3	709.2	*	1	1224	125	274.	4064.0	707.2	*	1	1906	192	93.	3983.0	706.7
1	0548	59	1526.	4405.3	709.2	*	1	1230	126	269.	4061.9	707.2	*	1	1912	193	92.	3982.4	706.7
1	0554	60	1513.	4402.4	709.2	*	1	1236	127	264.	4059.8	707.2	*	1	1918	194	91.	3981.8	706.7
1	0600	61	1500.	4399.4	709.2	*	1	1242	128	259.	4057.8	707.2	*	1	1924	195	90.	3981.1	706.7
1	0606	62	1484.	4395.7	709.2	*	1	1248	129	254.	4055.8	707.1	*	1	1930	196	89.	3980.5	706.7
1	0612	63	1457.	4389.6	709.1	*	1	1254	130	249.	4053.8	707.1	*	1	1936	197	88.	3979.9	706.7
1	0618	64	1418.	4380.7	709.1	*	1	1300	131	244.	4051.9	707.1	*	1	1942	198	86.	3979.3	706.7
1	0624	65	1373.	4370.6	709.0	*	1	1306	132	239.	4050.1	707.1	*	1	1948	199	85.	3978.7	706.7
1	0630	66	1327.	4360.1	708.9	*	1	1312	133	235.	4048.2	707.1	*	1	1954	200	84.	3978.2	706.7
1	0636	67	1281.	4349.7	708.9	*	1	1318	134	231.	4046.4	707.1	*						
						*							*						

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
(CFS)	(HR)		6-HR	24-HR	72-HR	19.90-HR
1672.	4.20	(CFS)	1325.	546.	546.	546.
		(INCHES)	6.844	9.362	9.362	9.362
		(AC-FT)	657.	899.	899.	899.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
(AC-FT)	(HR)	6-HR	24-HR	72-HR	19.90-HR
4437.	4.20	4356.	4107.	4107.	4107.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
(FEET)	(HR)	6-HR	24-HR	72-HR	19.90-HR
709.39	4.20	708.92	707.42	707.42	707.42

CUMULATIVE AREA = 1.80 SQ MI

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	IN	10595.	2.40	2323.	701.	701.	0.90		
HYDROGRAPH AT	BASE	15.	0.10	15.	15.	15.	0.90		
2 COMBINED AT	IN	10610.	2.40	2338.	716.	716.	1.80		
ROUTED TO	DAM	1672.	4.20	1325.	546.	546.	1.80	709.39	4.20

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

```
JJJJJJJJJJ    00000000     2222222222     00000000     9999999999   555555555555          AAAAAAAAAA
JJJJJJJJJJ   0000000000   222222222222   0000000000   999999999999  555555555555         AAAAAAAAAAAA
    JJ       00      0000  22          22  00      0000  99        99  55                    AA        AA
    JJ       00     00 00              22  00     00 00  99        99  55                    AA        AA
    JJ       00    00  00              22  00    00  00  99        99  55                    AA        AA
    JJ       00   00   00             22   00   00   00  999999999999  555555555             AAAAAAAAAAAA
    JJ       00  00    00           22     00  00    00  999999999999  5555555555            AAAAAAAAAAAA
    JJ       00 00     00         22       00 00     00            99          55            AA        AA
JJ  JJ       0000      00       22         0000      00            99           55           AA        AA
JJ  JJ       000       00     22           000       00  99        99           55           AA        AA
JJJJJJJ      0000000000   222222222222   0000000000   999999999999  555555555555          AA        AA
 JJJJJ        00000000    222222222222    00000000     9999999999   55555555555           AA        AA
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  ************************************
 ***  EEEEEEEE  NN    NN  DDDDDDD   ***
****  EE        NNN   NN  DD     DD ****
***** EE        NNNN  NN  DD     DD *****
******EEEEEEE   NN NN NN  DD     DD ******
***** EE        NN  NNNN  DD     DD *****
****  EE        NN   NNN  DD     DD ****
 ***  EEEEEEEE  NN    NN  DDDDDDD   ***
  ************************************
```

DELIVER CODE - AEP 15GZ
JOB NAME - HYD
JOB NUMBER - 02095
PROGRAMMER - ZYCH,G.F.
ROOM NUMBER - 15GZ
SYSOUT CLASS - A
PRINT TIME - 1.47.31 PM EST
PRINT DATE - 18 FEB 93
PRINT DEVICE - COLUMBUS.COCB.PRT3


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  ************************************
 ***  EEEEEEEE  NN    NN  DDDDDDD   ***
****  EE        NNN   NN  DD     DD ****
***** EE        NNNN  NN  DD     DD *****
******EEEEEEE   NN NN NN  DD     DD ******
***** EE        NN  NNNN  DD     DD *****
****  EE        NN   NNN  DD     DD ****
 ***  EEEEEEEE  NN    NN  DDDDDDD   ***
  ************************************
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