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OHIO RIVER BASIN
TRAVERSE RUN, BEAVER COUNTY
PENNSYLVANIA

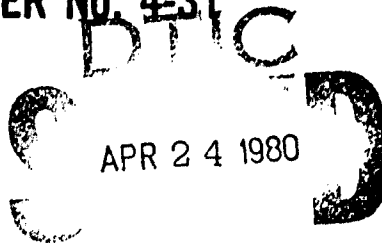


GROUP CAMP DAM

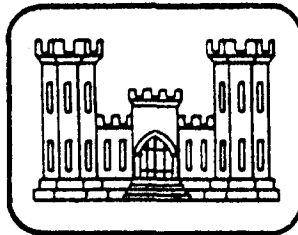
NDI No. PA 00259

PennDER No. 4-31

LEVEL II



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



prepared for

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

prepared by

MICHAEL BAKER, JR., INC.

Consulting Engineers
4301 Dutch Ridge Road
Beaver, Pennsylvania 15009

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February 1980

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(6) National Dam Inspection Program
Group Camp Dam

OHIO RIVER BASIN

Traverse Run,

~~GROUP CAMP DAM~~
BEAVER COUNTY, COMMONWEALTH OF PENNSYLVANIA.
NDI ~~NO.~~ PA-00259
PENNER ~~NO.~~ 4-31

Number

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PREFACE

This report is prepared under guidance contained in the "Recommended Guidelines for Safety Inspection of Dams," for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

Form 50 or less

A

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Group Camp Dam, Beaver County, Pennsylvania
NDI No. PA 00259, PennDER No. 4-31
Traverse Creek
Inspected 19 November 1979

ASSESSMENT OF
GENERAL CONDITIONS

Group Camp Dam is owned and operated by the Pennsylvania Department of Environmental Resources (PennDER) and is classified as a "Significant" hazard - "Small" size dam.

Hydraulic/hydrologic evaluations, performed in accordance with procedures established by the Baltimore District, Corps of Engineers, for Phase I Inspection Reports, revealed that the spillway will pass the 100-year flood without overtopping the dam. (Note: A spillway design flood [SDF] in the range of the 100-year flood to the 1/2 Probable Maximum Flood [1/2 PMF] is required for Group Camp Dam. The 100-year flood was chosen because the dam is on the low side of the "Small" size category.) The spillway is therefore considered "adequate."

The dam was found to be in good overall condition at the time of inspection. Several minor items of remedial work should be performed by the owner as soon as practicable. These include:

- 1) Repair the areas of minor spalled concrete on the weir, the left training wall, and the chute slab.
- 2) Fill the rodent/animal burrows in the embankment.
- 3) Repair the erosion around the outlet head wall.
- 4) Repair the area at the end of the left spillway training wall. Extending all storm sewers and drainage pipe to discharge in the stilling basin may decrease the frequency of repair to this area.

In addition, the following operational measures are recommended to be undertaken by the owner:

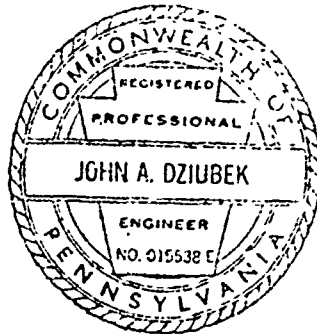
- 1) Develop a detailed emergency operation and warning system.

GROUP CAMP DAM

- 2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.
- 3) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.

Submitted by:

MICHAEL BAKER, JR., INC.



John A. Dziubek
John A. Dziubek, P.E.
Engineering Manager-Geotechnical

Date: 20 February 1980

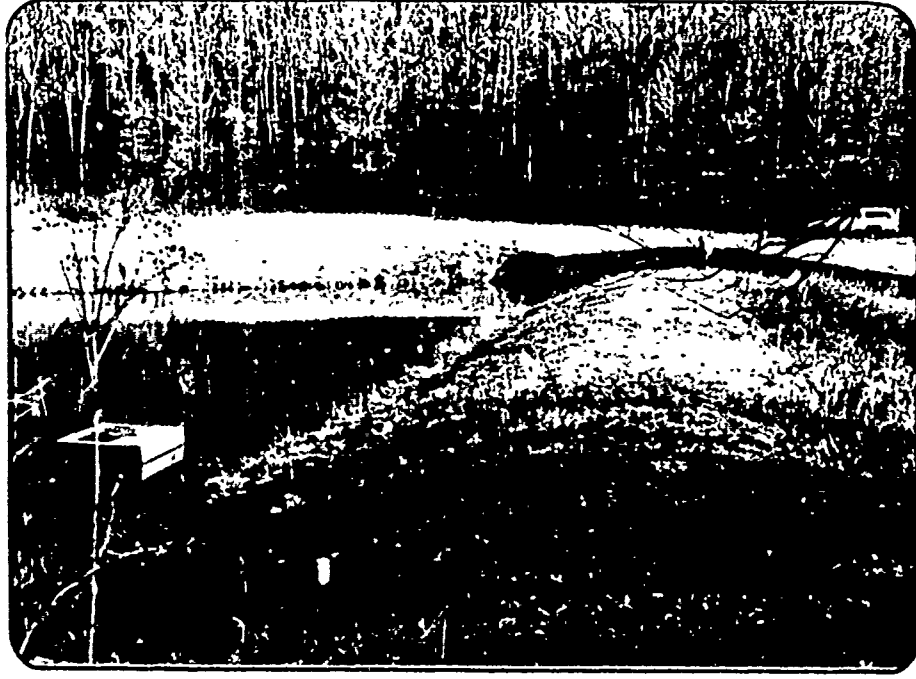
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 19 March 1980

GROUP CAMP DAM



View of Upstream Side of Dam from the Right Abutment



View of Downstream Side of Dam from the Right Abutment

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
GROUP CAMP DAM
NDI No. PA 00259, PennDER No. 4-31

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

- a. Authority - The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.
- b. Purpose of Inspection - The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

- a. Description of Dam and Appurtenances - Group Camp Dam is located 1.1 miles upstream from Pennsylvania Route 18 on Traverse Creek in Raccoon State Park. The dam is an earthfill embankment (with central clay core) approximately 20 feet high (maximum) and 220 feet long. The downstream slope is 2H:1V (Horizontal to Vertical) and the upstream slope is 3H:1V.

The spillway, curved in plan view, is located at the left abutment of the dam and consists of a concrete paved approach, small (in height) ogee weir, and discharge chute channel. The crest length is 65.5 feet and the chute is 67 feet long from the crest to the stilling basin. The chute channel narrows from 65.5 feet at the crest to approximately 45 feet at the entrance into the stilling basin. The chute channel is on a 11.5H:1V slope. The stilling basin is masonry stone paved and the side walls are masonry stone.

The outlet works for the dam consist of a control tower 8 feet out from shore which houses a 16 inch gate valve approximately 12.7 feet below the surface of the water. The outlet conduit is a 36 inch corrugated metal pipe which is encased in 6 inches of reinforced concrete with four anti-seep collars.

- b. Location - Group Camp Dam is located across Traverse Creek in Hanover Township, Beaver County, Pennsylvania.

The coordinates of the dam are N 40° 30.7' and W 80° 26.5'.

- c. Size Classification - The maximum height of the dam is 20 feet and the reservoir volume at the crest of the dam is 135 acre-feet. The dam is therefore in the "Small" size category.
- d. Hazard Classification - At the present time, there are no residential structures located in the downstream area that would be affected by excessive discharges from the reservoir. However, there are several small bridges, secondary roads, maintenance buildings, and the park ranger office which could suffer economic damage by excessive discharge. Therefore, this dam is considered in the "Significant" hazard category.
- e. Ownership - The dam and lake are owned by the Commonwealth of Pennsylvania, Pennsylvania Department of Environmental Resources (PennDER). Mr. Frank Sayut, Park Superintendent, PennDER, R.D. No. 1, Hookstown, Pennsylvania 15050 is responsible for maintenance and operation of the dam.
- f. Purpose of Dam - The dam and reservoir is used for fish and wildlife development and recreation.
- g. Design and Construction History - The dam was designed and constructed by the Department of Interior, National Park Service. Construction of the dam was started in March 1938 and completed in November 1938.
- h. Normal Operational Procedures - The reservoir is maintained at the normal pool level (Elevation 950 feet). There has reportedly been no major flood since the dam was constructed. Mr. Sayut's (the Park Superintendent) recollection of the deepest flow over the crest was approximately 6 inches. The dam is visited at least once a week by the park rangers; however, during the warmer months a more frequent schedule is instituted. The drawdown facilities are operated annually to insure proper operation.

1.3 PERTINENT DATA

- a. Drainage area (square miles) - 6.85
- b. Discharge at Dam Site (c.f.s.) -
 - Maximum Flood - Unknown
 - Spillway Capacity (at Pool El. 957.0 ft.) - 3750

c. Elevation (feet above Mean Sea Level [M.S.L.]) -

Top of Dam -	957.0
Spillway Crest -	950.0
Streambed at Centerline of Dam -	937.0
Maximum Tailwater -	Unknown

d. Reservoir (feet) -

Length of Maximum Pool -	2750
Length of Normal Pool -	1800

e. Storage (acre-feet) -

Top of Dam (El. 957.0 ft.) -	135
Normal Pool (El. 950.0 ft.) -	25

f. Reservoir Surface (acres) -

Top of Dam (El. 957.0 ft.) -	25.4
Normal Pool (El. 950.0 ft.) -	8.0

g. Dam -

Type -	Earthfill
Length (feet) -	220
Height (feet) -	20
Top Width (feet) -	8
Side Slopes - Upstream -	3H:1V
Downstream -	2H:1V

Zoning - A central clay core with a top width of 3 feet at El. 957.00 ft. and a width of 18 feet at the groundline.

Cut-off - A cut-off trench was excavated 8 feet wide and 4 to 5 feet deep. Steel sheet piling was then driven from groundline to bedrock along the centerline of the dam in the cut-off trench. The cut-off trench was then backfilled with the clay core material.

Drains - Along the spillway training walls and under the chute slab, exiting into the stilling basin. A rockfill toe (as shown on the design plans) for the embankment was not observed.

h. Diversion and Regulating Tunnel - None

i. Spillway -

Type - Concrete ogee weir with chute channel

Length of Crest Perpendicular to

Flow (feet) - 65.5

Crest Elevation (feet M.S.L.) - 950.00

Upstream Channel - Concrete

apron

approach

Stilling Pool -

Riprap-lined

Downstream Channel -

Natural

- j. Regulating Outlet - Consists of a 36 inch corrugated metal pipe encased in 6 inches of reinforced concrete with three 5 foot x 5 foot x 1 foot anti-seep collars and one 13 foot x 13 foot x 1 foot anti-seep collar located in the clay core connected to the steel sheet piling. A 16 inch gate valve is connected to the 36 inch corrugated metal pipe in a concrete control structure approximately 8 feet out from the shoreline on the upstream face. The water enters the control tower at its base through a trash rack and enters the riser. The flow is then controlled by the 16 inch gate valve at the entrance to the outlet conduit. The riser chamber can be dewatered by the insertion of stop logs at the entrance into the chamber.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

There were no design data available for review concerning the Group Camp Dam. The only information available was from PennDER's File No. 4-31. The file included:

- 1) The original permit application to the Commonwealth of Pennsylvania, Water and Power Resources Board from the National Park Service dated 18 January 1938.
- 2) Inspection and progress reports made during the construction of the dam.
- 3) Application to drawdown the lake to remove docks, dated 25 August 1956.
- 4) Post-construction reports from 1938 through 1976. The latest inspection report contained in the files was dated November 1976.
- 5) Application to drawdown the lake so that repairs could be made to the spillway, outlet control structure, and for the removal of 7000 cubic yards of sediment.
- 6) Various photographs from the construction period and post-construction inspections.

The original design drawings are reproduced and presented as Plates 3 through 8.

2.2 CONSTRUCTION

The Group Camp Dam was constructed by the National Park Service. Construction on the dam was started on 3 January 1938, and was completed in November 1938.

2.3 OPERATION

The lake level is maintained at normal pool throughout the year. The 16 inch gate valve is exercised once a year to insure its operation. The dam is visited at least once a week by a park ranger, and more frequently in times of warmer weather. An inspection of the dam is made twice a year by the Park Superintendent and the Maintenance Foreman. There are detailed records of

these semiannual inspections available in the PennDER file. However, there is no operation and maintenance manual.

The lake was drained in September 1970 so that repairs could be made to the outlet control structure, concrete spillway and training walls, and for the removal of 7000 cubic yards of sediment.

2.4 EVALUATION

- a. Availability - The drawings available from the PennDER's files were not listed as "as built." However, from review of the periodic construction reports, the drawings appear to be accurate.
- b. Adequacy - The information available is generally adequate for a Phase I Inspection.
- c. Validity - There is no indication at the present time to doubt the validity of the available engineering data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

- a. General - The dam and its appurtenant structures were found to be in good overall condition at the time of the inspection. Noteworthy deficiencies observed are described briefly in the following paragraphs. The complete visual inspection check list, field sketch, top of dam profile, and typical cross-section are given in Appendix A.
- b. Dam - The following is a list of obvious deficiencies noted during the visual inspection of the embankment.
 1. Minor erosion on the left upstream side of the embankment at the spillway training wall and the normal pool level.
 2. Several old rodent holes were discovered at Station 1+50, approximately 10 to 12 feet below the crest of the dam on the downstream slope. (Note: The station used during the visual inspection is shown on the field sketch.)
- c. Appurtenant Structures - The following is a list of obvious deficiencies noted during the visual inspection of the appurtenant structures:
 1. Minor spalling of the concrete weir on the weir's right end.
 2. Concrete spalling on left training wall at water level in the approach channel.
 3. Some concrete spalling on the right side of the floor of the concrete discharge chute.
 4. Some vegetation growing up through the expansion and construction joints along the concrete discharge chute.
 5. The intake structure was in good overall condition. However, the riser chamber water level was at normal pool level and access to the 16 inch gate could not be gained for inspection.

6. The condition of the conduit at the outlet works showed some corrosion of the 36 inch corrugated metal pipe. There was also erosion around the head wall and some debris and sediment in the discharge channel.

- d. Reservoir Area - The reservoir slopes are moderately sloping and heavily wooded. Sedimentation is, according to the Park Superintendent, a continual problem in the reservoir.
- e. Downstream Channel - The downstream channel is a naturally occurring channel with a dense growth of trees and low brush. Approximately 1200 feet downstream from the dam there is a small secondary road and another 4200 feet below the secondary road there is the park office, maintenance shops, and U.S. Route 18. Approximately 12,000 feet below the dam is Raccoon Creek Reservoir.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal written instructions for operating the reservoir or evacuating the downstream area in case of an impending catastrophe.

It is recommended that formal emergency procedures be adopted, prominently displayed, and furnished to all operating personnel.

4.2 MAINTENANCE OF DAM

PennDER is responsible for maintenance of the dam. Generally, the maintenance procedures instituted by their personnel are considered adequate.

4.3 MAINTENANCE OF OPERATING FACILITIES

The 16 inch gate valve for the emergency outlet works is operated twice a year by park personnel and maintenance is performed as needed.

4.4 DESCRIPTION OF ANY WARNING SYSTEM

At the present time, there is no warning system or evacuation plan in operation. It is recommended that a formal emergency procedure be prepared, prominently displayed, and furnished to all operating personnel.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

- a. Design Data - PennDER files were reviewed for hydrologic and hydraulic design data. The files contained no detailed computations. One letter referring to the hydraulic design of the spillway was located. This letter stated that the spillway was designed to pass a peak discharge of 700 cubic feet per second per square mile. According to the letter, dated 17 February 1938, this was considered ample. No information available indicated how the design discharge was computed.
- b. Experience Data - There was no information available on the maximum reservoir level or discharge.
- c. Visual Observations - No conditions were observed at the time of the inspection that would indicate the dam and appurtenant structures could not operate satisfactorily in the event of a flood.
- d. Overtopping Potential - Group Camp Dam is classified as a "Significant" hazard - "Small" size dam requiring evaluation for a spillway design flood (SDF) in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF). Since the dam is on the low end of the small size category, the 100-year flood was chosen as the SDF. Using regression equations developed by the Pittsburgh District of the Corps of Engineers, the peak inflow to the impoundment for the 100-year storm was calculated to be 2191 c.f.s. The spillway is capable of passing a flow of 3750 c.f.s. with no overtopping of the dam. Because the spillway capacity is greater than the maximum inflow to the impoundment, the dam is capable of passing the SDF without overtopping.
- e. Spillway Adequacy - The dam, as outlined in the above analysis, is capable of passing the 100-year flood without overtopping. The spillway is therefore considered adequate according to the recommended criteria.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

- a. Visual Observations - No structural inadequacies were noted during the visual inspection of the dam.
- b. Design and Construction Data - Calculations of embankment slope and foundation stability were not available for review. It should be pointed out that the foundation of the dam is the famed "Pittsburgh Red Beds," a clay shale which weathers rapidly when exposed and subjected to water. It is estimated that the designers and constructors of the dam were apparently aware of the properties (or potential problems) associated with this formation because of the addition of the sheet pile cut-off in this low head dam. Because of the low height of the dam, its total width and moderate slopes (5H:1V total), and because no signs of distress or seepage was observed; it is inferred that the dam could be shown to meet the stability criteria required. No further stability analysis is deemed necessary for this Phase I Inspection Report.
- c. Operating Records - Nothing in the operational information indicates concern relative to the structural stability of the dam. The reservoir has been drawdown previously and no instability of the upstream slope was reported.
- d. Post-Construction Changes - The post-construction modifications reported in Section 2 do not adversely affect the stability of the dam.
- e. Seismic Stability - The dam is located in Zone 1 on the "Seismic Zone Map of the Contiguous United States," Figure 1, page D-30, "Recommended Guidelines for Safety Inspection of Dams." This is a zone of minor seismic activity, and, therefore, further consideration of the seismic stability is not warranted.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

- a. Safety - Group Camp Dam was found to be in good overall condition at the time of inspection. Group Camp Dam is a "Significant" hazard - "Small" size dam requiring a spillway capacity in the range of 100-year flood to 1/2 PMF. The 100-year flood was chosen as the SDF because the dam is on the low side of the "Small" size category. As presented in Section 5, the spillway and reservoir are adequate to pass the 100-year flood without overtopping the dam. Therefore, the spillway is considered "adequate."
- b. Adequacy of Information - The information available and the observations made during the visual inspection are considered sufficient for this Phase I Inspection Report.
- c. Urgency - The owner should initiate the action discussed in paragraph 7.2 as soon as practicable.
- d. Necessity for Additional Data/Evaluation - No further investigation is necessary.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection revealed certain items of remedial work which should be performed by the owner. These include:

- 1) Repair the areas of minor spalled concrete on the weir, the left training wall, and the chute slab.
- 2) Fill the rodent/animal burrows in the embankment.
- 3) Repair the erosion around the outlet head wall.
- 4) Repair the area at the end of the left spillway training wall. Extending all storm sewers and drainage pipe to discharge into the stilling basin may decrease the frequency of repair to this area.

In addition, the following operational measures are recommended to be undertaken by the owner:

- 1) Develop a detailed emergency operation and warning system.
- 2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.
- 3) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.

APPENDIX A

VISUAL INSPECTION CHECK LIST, FIELD SKETCH,
TOP OF DAM PROFILE, AND TYPICAL CROSS-SECTION

Check List
Visual Inspection
Phase 1

Name of Dam Group Camp Dam County Beaver State PA Coordinates Lat. N 40°30.7'

NDI PA # 00259
PENNDER # 4-31

Long. W 80°26.5'

Date of Inspection 19 November 1979 Weather Clear, sunny Temperature 45°-50° F.

Pool Elevation at Time of Inspection 950.2 ft. M.S.L. Tailwater at Time of Inspection 941.0 ft. M.S.L.

Inspection Personnel:

Michael Baker, Jr., Inc.:

James G. Ulinski
Jeffrey A. Quay
Jeff Maze

Owner's Representatives:

Mr. Frank Sayut,
Park Superintendent
(interviewed at park office)

Field Review (6 February 1980)

John A. Dziubek
James G. Ulinski

James G. Ulinski Recorder

4 4
4 4

A-2

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

LEAKAGE

**STRUCTURE TO
ABUTMENT/EMBANKMENT
JUNCTIONS**

DRAINS

WATER PASSAGES

FOUNDATION

A-3

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES		
STRUCTURAL CRACKING		
VERTICAL AND HORIZONTAL ALIGNMENT		
MONOLITH JOINTS		
CONSTRUCTION JOINTS		

AX

EMBANKMENT

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

SURFACE CRACKS

None observed

**UNUSUAL MOVEMENT OR
CRACKING AT OR BEYOND
THE TOE**

None observed

**SLOUGHING OR EROSION OF
EMBANKMENT AND ABUTMENT
SLOPES**

Some erosion has occurred on the upstream slope adjacent to the spillway training wall just above the normal pool level. Some erosion has occurred at the left end of the spillway training wall.

The erosion on the upstream slope is only minor and does not present a problem. The erosion at the left end of the spillway training wall should be repaired.

**VERTICAL AND HORIZONTAL
ALIGNMENT OF THE CREST**

The horizontal and vertical alignment of the crest was in good condition.

RIPRAP FAILURES

The hand placed riprap on the upstream face is acceptable. The riprap extends to approximately 2.5 ft. above the normal pool level.

EMBANKMENT

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

RODENT HOLES

Several rodent holes were observed in the embankment. (See Field Sketch for approximate location).

The rodent holes should be filled.

JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM

No distress was observed.

ANY NOTICEABLE SEEPAGE

None

STAFF GAGE AND RECORDER

None

DRAINS

No drains for the embankment were observed. The drains for the spillway slab are 5 ft. apart and exit at the downstream end of the spillway chute slab going into the stilling basin. Because of flow through the spillway it could not be determined if they are functioning.

OUTLET WORKS

Name of Dam: GROUP CAMP DAM
 NDI # PA 00259

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The outlet conduit is a 36 in. diameter C.M.P. encased in concrete. The condition of the conduit at the outlet is slightly to moderately corroded.	
INTAKE STRUCTURE	The intake structure was in good overall condition, although only the riser above the water level could be examined. The water level in the upstream chamber was at the same water level as the reservoir.	
OUTLET STRUCTURE	The head wall is in good condition. A minor amount of erosion has occurred on each side of the head wall.	
OUTLET CHANNEL	The outlet channel has a minor amount of siltation from the right hillside. No obstructions in the channel were observed.	
EMERGENCY GATE	The 16 in. gate valve is opened annually in April of each year.	

UNGATED SPILLWAY

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
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CONCRETE WEIR

The concrete weir was in good overall condition except for minor spalling at the right end.

The spalled concrete should be repaired.

APPROACH CHANNEL

The approach channel was submerged and no problems were observed. The left wall of the approach channel at the upstream end is spalled at the normal pool level.

The spalled concrete should be repaired.

DISCHARGE CHANNEL

The discharge channel (chute) was in good overall condition except for spalling, primarily on the right side (see Field Sketch). It was observed that at some previous time repairs were performed at the end of the right spillway training wall.

BRIDGE AND PIERS

Not Applicable

A-8

GATED SPILLWAY - Not Applicable

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE SILL		
APPROACH CHANNEL		
DISCHARGE CHANNEL		
BRIDGE AND PIERS		
GATES AND OPERATION EQUIPMENT		

A-9

INSTRUMENTATION - None

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

<u>VISUAL EXAMINATION</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
---------------------------	---------------------	-----------------------------------

MONUMENTATION/SURVEYS

OBSERVATION WELLS

WEIRS

PIEZOMETERS

OTHER

RESERVOIR

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

SLOPES

The slopes of the reservoir are moderate and forested. No problems were observed.

SEDIMENTATION

Siltation of the upper end of the reservoir has occurred. The Park Superintendent stated that sedimentation in this reservoir is a continual problem and noted that the reservoir was partially dredged in 1971.

DOWNSTREAM CHANNEL

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

CONDITION
(OBSTRUCTIONS,
DEBRIS, ETC.)

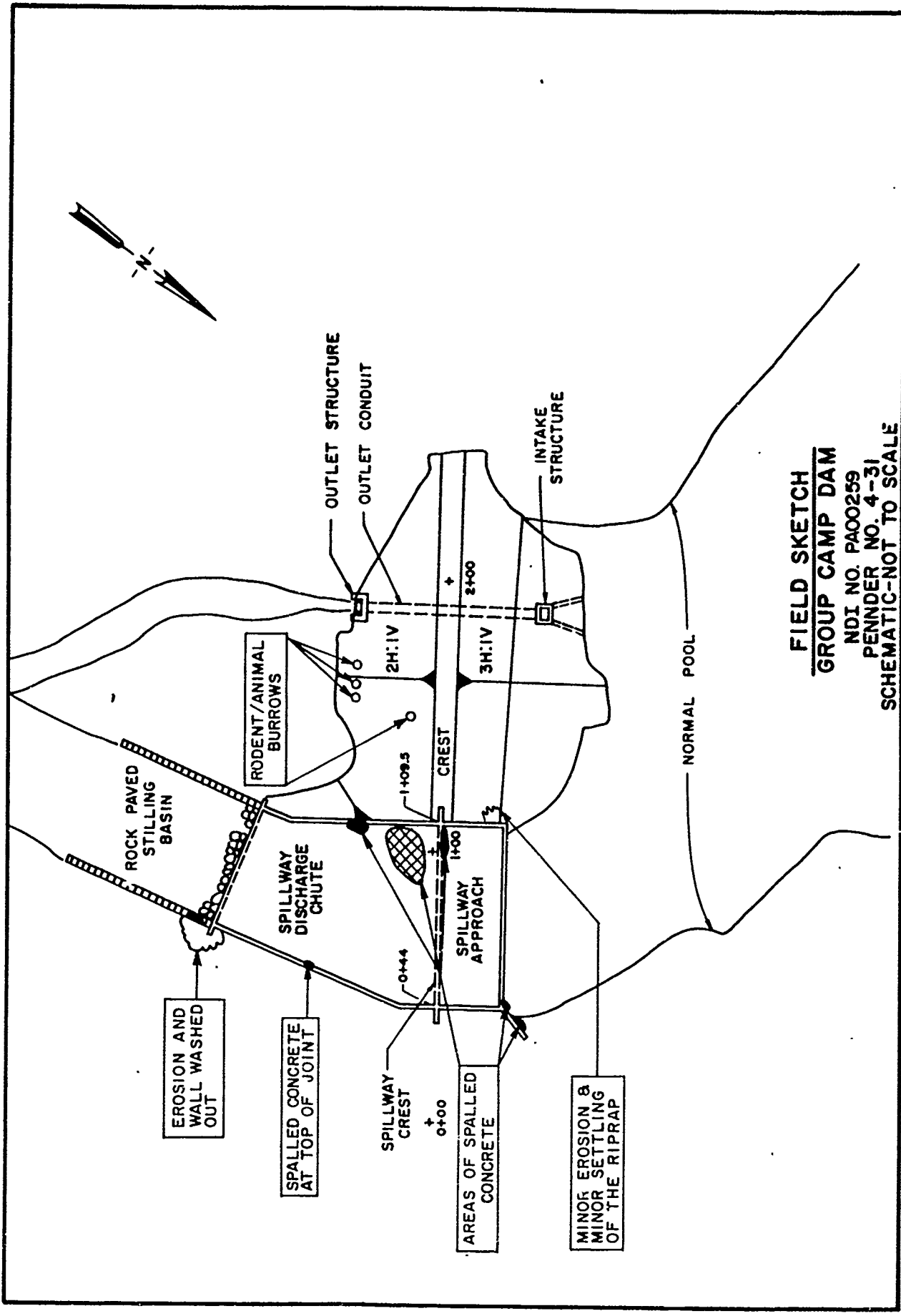
Some trees are lying in the channel downstream from the dam but will not prevent the passage of flows. Approximately 1200 ft. downstream from the dam is a park road and culvert. This culvert and road would probably be overtopped during heavy flows.

SLOPES

The slope of Traverse Creek is mild and the creek is partially forested. The adjacent slopes are moderate and forested.

APPROXIMATE NO.
OF HOMES AND
POPULATION

The first park road downstream from the dam may incur some economic damage from heavy flows. Located approximately 5500 ft. downstream from the dam is U.S. Route 18 constructed on an embankment with an arch culvert. Located on the flat plain upstream of this culvert is the State Park Headquarters and maintenance facilities. It is doubtful that loss of life would occur but some economic loss would result from a dam failure. Located 2.25 mi. downstream from Group Camp Dam is Raccoon Creek State Park Dam (or Main Lake Dam), NDI # PA 00262, PENNDER # 4-34. This dam was inspected in the 1979 fiscal year inspection program.



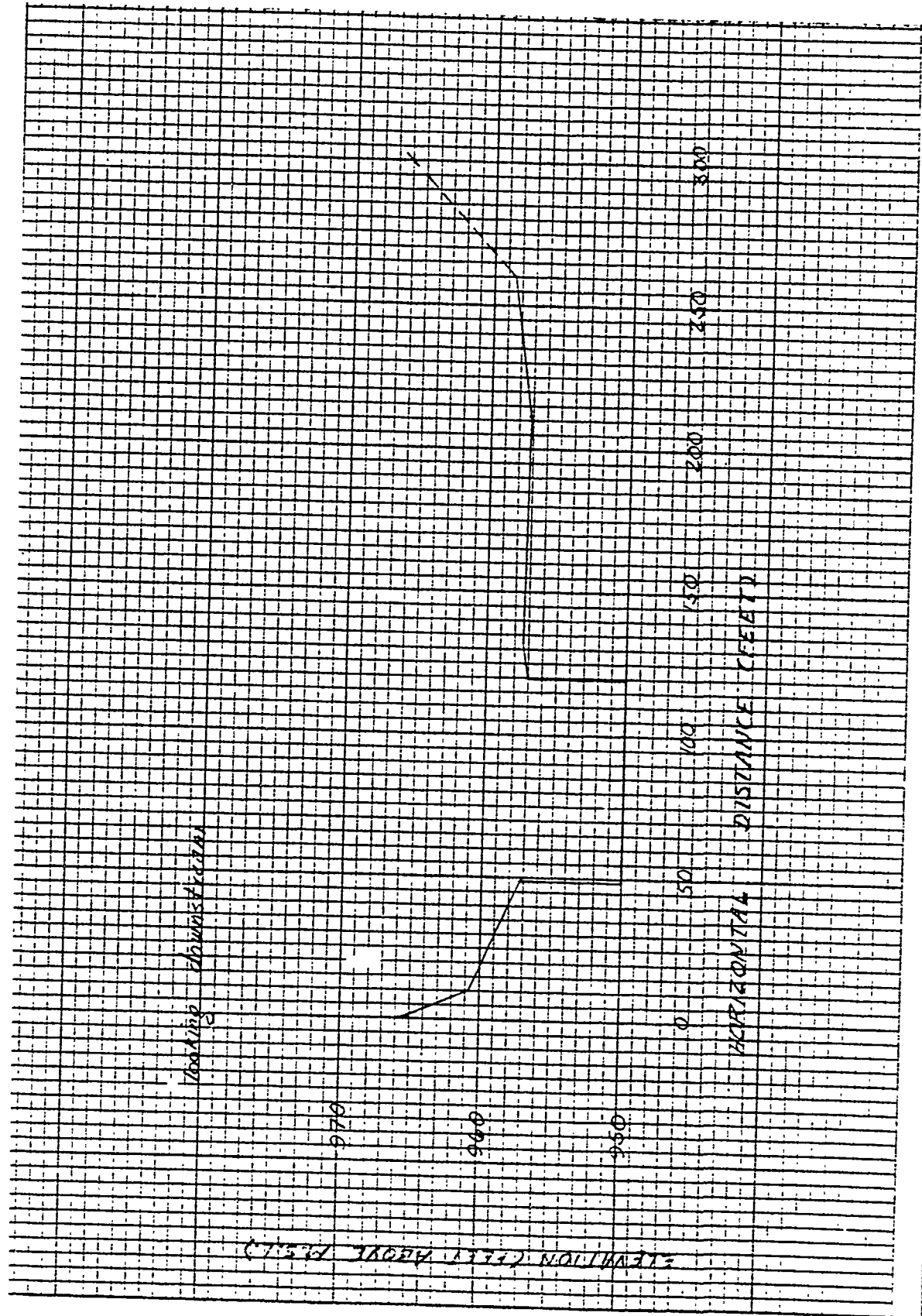
FIELD SKETCH
GROUP CAMP DAM

NDI NO. PA00259
 PENNER NO. 4-31
 SCHEMATIC-NOT TO SCALE

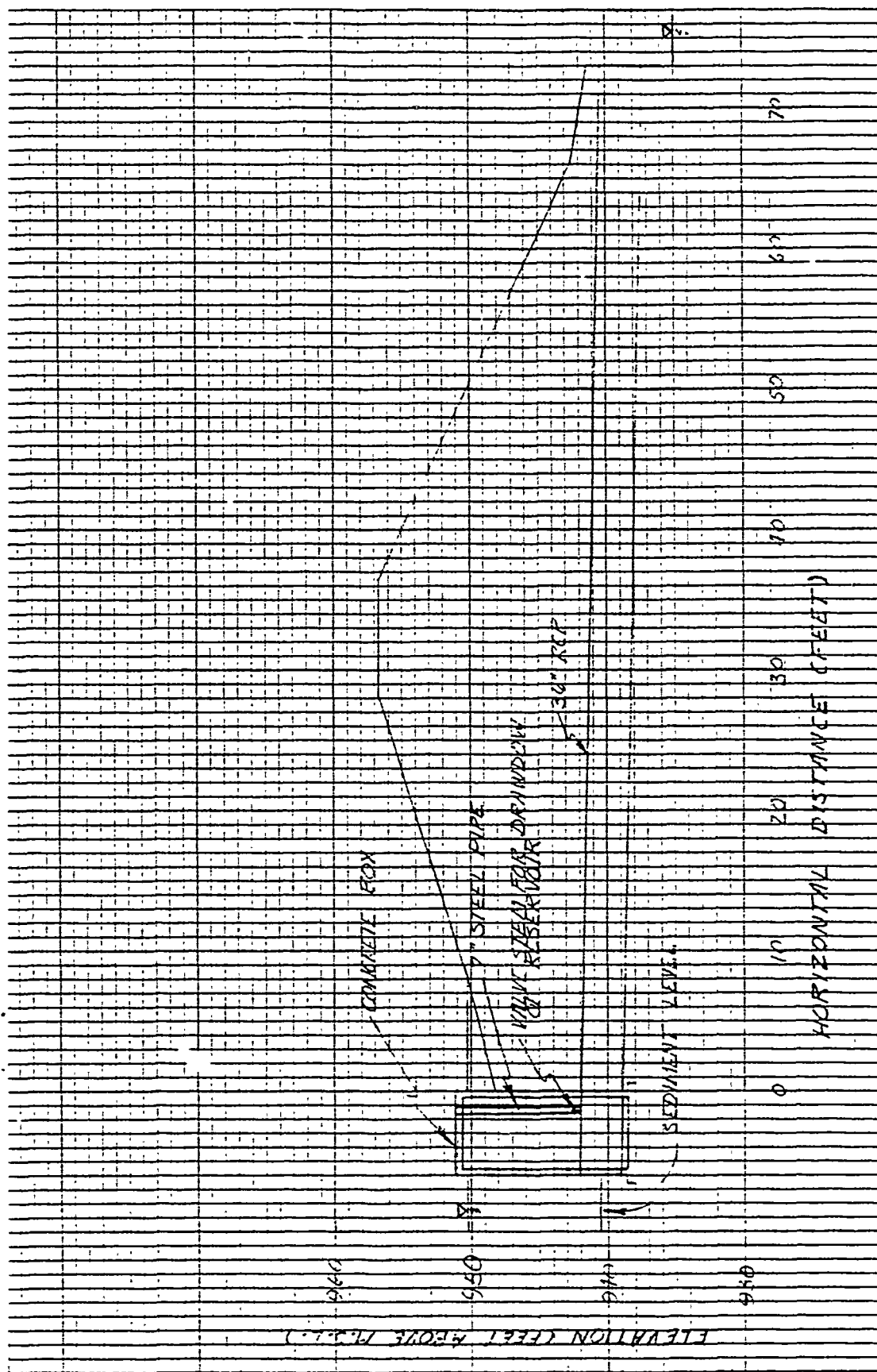
GROUP CAMP DAM

A-13

TOP OF DAM PROFILE



TYPICAL CROSS-SECTION



APPENDIX B

ENGINEERING DATA CHECK LIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

ITEM	REMARKS
------	---------

PLAN OF DAM

See Plate 4 of this report.

REGIONAL VICINITY MAP

A USGS 7.5 minute topographic quadrangle, Hookstown, Pennsylvania, was used to prepare the vicinity map which is enclosed in this report as the Location Plan (Plate 1).

CONSTRUCTION HISTORY

The dam was designed and constructed by the Department of Interior, National Park Service. Construction of the dam was started in March 1938, and completed in November 1938.

TYPICAL SECTIONS OF DAM

See Plate 8 of this report.

HYDROLOGIC/HYDRAULIC DATA

Limited information available in PenNDER File No. 4-31.

OUTLETS - PLAN
and
DETAILS

See Plate 7 of this report.

- CONSTRAINTS

None

- DISCHARGE RATINGS

No information available

RAINFALL/RESERVOIR RECORDS

No records are kept.

4 4

B-2

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

<u>ITEM</u>	<u>REMARKS</u>
DESIGN REPORTS	None available
GEOLOGY REPORTS	A copy of the report entitled "Geological Report on Proposed Dam Sites at Raccoon Creek Recreational Demonstration Project, Burgettstown, Pennsylvania," prepared by Donald C. Hazlett, Assistant Geologist, and dated 28 October 1937, was obtained from the Raccoon Creek State Park office files.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	A Geological Profile is presented on Plate 3 of this report. Additional information concerning borings and test pits is available in the above mentioned geologic report.
POST-CONSTRUCTION SURVEYS OF DAM	None performed
BORROW SOURCES	No information available

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

B-3

ITEM REMARKS

MONITORING SYSTEMS

None

MODIFICATIONS

Modifications to the riser unit of the outlet works have been performed. In addition, the reservoir area was partially dredged. Maintenance consisting of repairing spalled concrete and damaged masonry has also been performed.

HIGH POOL RECORDS

None recorded. According to the recollection of Mr. Frank Sayut, the maximum depth of flow in recent years was 6 in.

POST-CONSTRUCTION ENGINEERING
STUDIES AND REPORTS

Maintenance and formal inspections of the dam were performed on the following dates: 1) 20 September 1938, 2) 24 July 1940, 3) 2 November 1961, 4) 17 November 1967, 5) 30 September 1968, 6) 20 October 1969, 7) 15 May 1970, 8) December 1970 (Note: The specific date of inspection was not included on the maintenance inspection form), 9) 14 July 1971, 10) May 1972, 11) November 1972, 12) May 1973, 13) November 1973, 14) 7 May 1974, 15) 24 September 1975, 16) November 1975, 17) May 1976, 18) 25 August 1976, 19) November 1976.

Note: Later inspections were probably performed on a biannual basis; however, they were not included in the microfiche file reviewed because the time of preparation of the file was probably in early 1977.

Copies of these inspection reports are available in the Pennder file for this dam.

PRIOR ACCIDENTS OR FAILURE OF DAM
DESCRIPTION
REPORTS

None

Name of Dam: GROUP CAMP DAM
NDI # PA 00259

B-4

ITEM

REMARKS

MAINTENANCE
OPERATION
RECORDS

Are available in the Pennder file as annual inspection reports. Additional information concerning minor repairs is available at the Park Office.

SPELLWAY PLAN,

SECTIONS,
and
DETAILS

See Plates 5 and 6 of this report.

OPERATING EQUIPMENT
PLANS & DETAILS

See Plate 7 of this report.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 6.85 sq.mi. (primarily farmland and forests)

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 950.0 ft.
(25 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 957.0 ft.
(135 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 957.0 ft. (minimum elevation)

CREST: Spillway

- a. Elevation 950.0 ft.
- b. Type Concrete ogee
- c. Width of Crest Parallel to Flow 67 ft. from crest of weir to
- d. Length of Crest Perpendicular to Flow 65.5 ft. downstream
- e. Location Spillover At left abutment of dam end of dis-
- f. Number and Type of Gates None charge channel

OUTLET WORKS: Facilities for dewatering reservoir

- a. Type 36 in. diameter concrete conduit
- b. Location Approximately 60 ft. from right abutment
- c. Entrance inverts El. 939.0 ft.
- d. Exit inverts El. 937.3 ft.
- e. Emergency draindown facilities: Valve located inside 6 ft.x
6 ft. concrete platform

HYDROMETEOROLOGICAL GAGES: None installed

- a. Type _____
- b. Location _____
- c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE 3850 c.f.s.

APPENDIX C

PHOTOGRAPH LOCATION PLAN AND PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View

Top Photo - View of Upstream Side of Dam from
(OV-T) the Right Abutment

Bottom Photo - View of Downstream Side of Dam from
(OV-B) the Right Abutment

Photo Location Plan

Photo 1 - View of Spillway Crest and Right Training Wall

Photo 2 - View of Spillway Approach

Photo 3 - View of Spillway from Downstream

Photo 4 - View of Downstream Channel

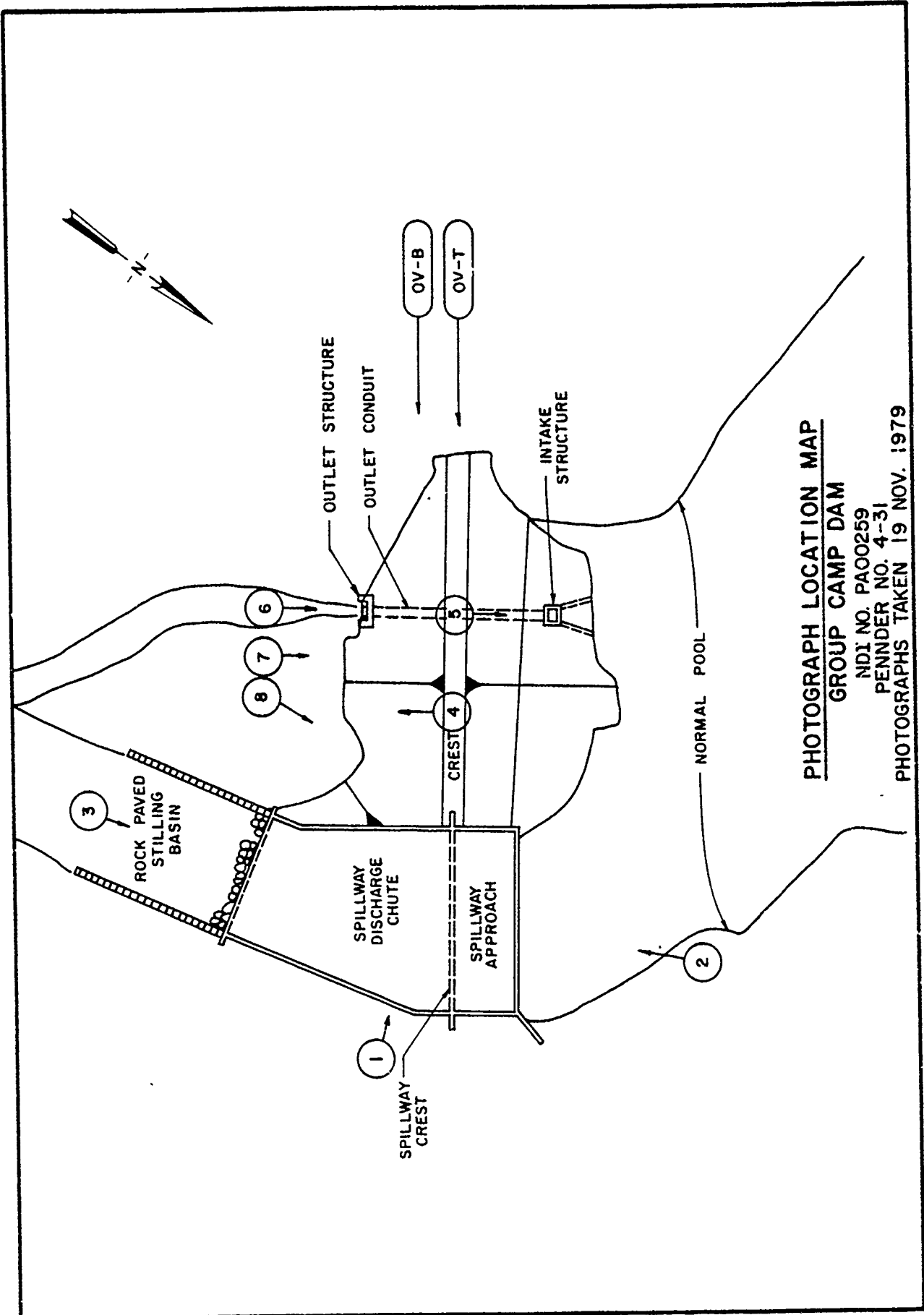
Photo 5 - View of Intake Riser

Photo 6 - View of Outlet Conduit and Outlet Head Wall

Photo 7 - View of Right Half of the Downstream Slope

Photo 8 - View of Left Half of the Downstream Slope

Note: Photographs were taken on 19 November 1979.



PHOTOGRAPH LOCATION MAP
 GROUP CAMP DAM
 NDI NO. PA00259
 PENNDER NO. 4-31
 PHOTOGRAPHS TAKEN 19 NOV. 1979

GROUP CAMP DAM



PHOTO 1. View of Spillway Crest and Right Training Wall



PHOTO 2. View of Spillway Approach

GROUP CAMP DAM



PHOTO 3. View of Spillway from Downstream



PHOTO 4. View of Downstream Channel

GROUP CAMP DAM



PHOTO 5. View of Intake Riser

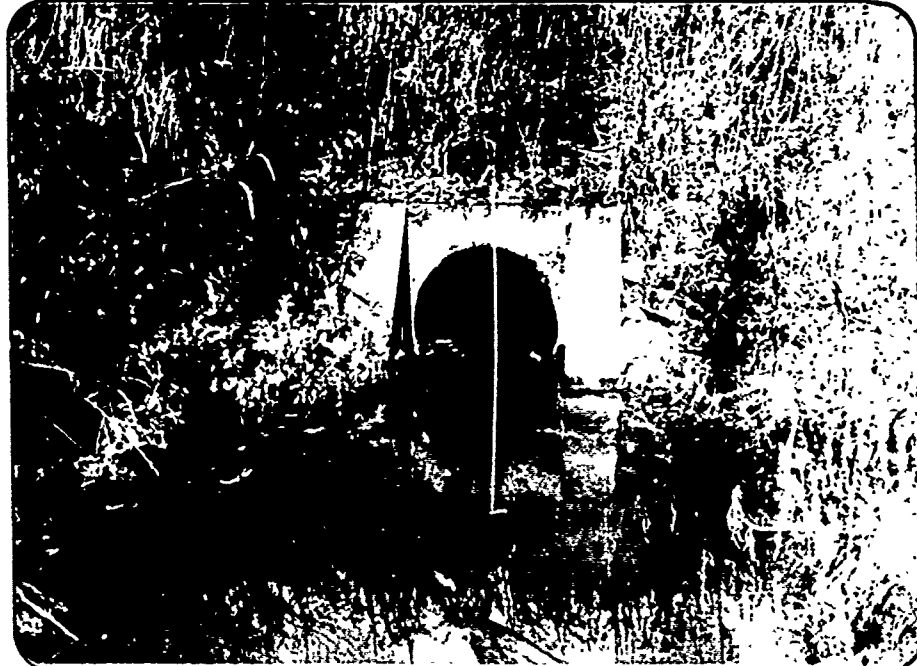


PHOTO 6. View of Outlet Conduit and Outlet Head Wall

GROUP CAMP DAM

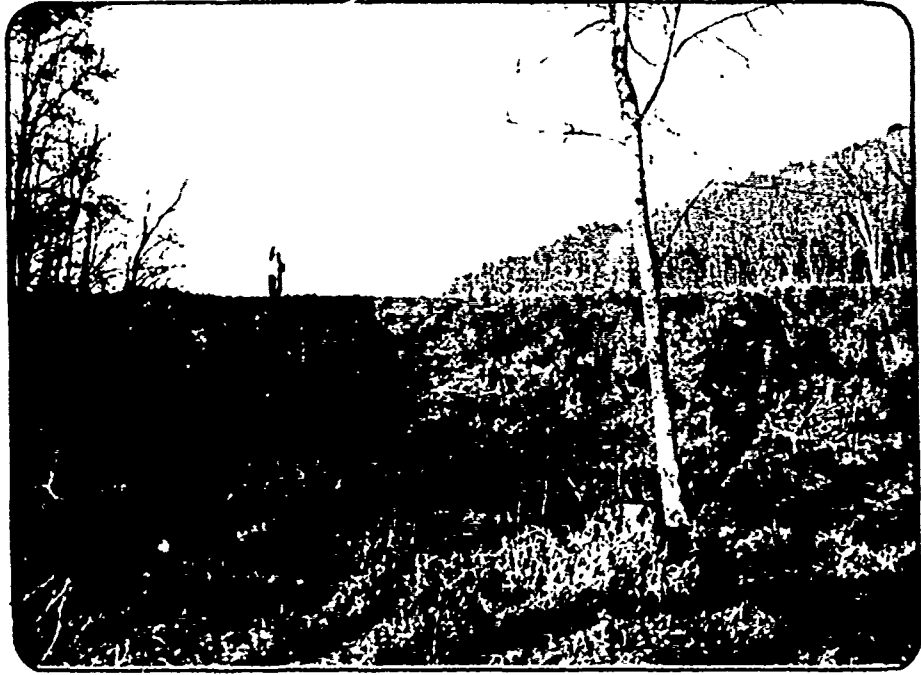


PHOTO 7. View of Right Half of the Downstream Slope



PHOTO 8. View of Left Half of the Downstream Slope

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject GROUP CAMP DAM S.O. No. _____

APPENDIX D - HYDROLOGIC AND Sheet No. _____ of _____

HYDRAULIC COMPUTATIONS Drawing No. _____

Computed by _____ Checked by _____ Date _____

TABLE OF CONTENTS

<u>SUBJECT</u>	<u>PAGE</u>
PREFACE	6
HYDROLOGIC AND HYDRAULIC ANALYSIS	
DATA BASE	1
DRAINAGE AREA MAP	2
100-YEAR FLOOD FLOW CALCULATION	3
RATING CURVES	4
TOP OF DAM PROFILE	7
TYPICAL CROSS-SECTION	8

PREFACE

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The hydrologic determinations presented in this Phase I Inspection Report are based on the use of a Snyder's unit hydrograph developed by the U.S. Army Corps of Engineers. Due to the limited number of gaging stations available in this hydrologic region and the wide variations of watershed slopes, the Snyder's coefficients may yield results of limited accuracy for this watershed. As directed however, a further refinement of these coefficients is beyond the scope of this Phase I Investigation.

In addition, the conclusions presented pertain to present conditions, and the effect of future development on the hydrology has not been considered.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: GROUP CAMP DAM

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.0 INCHES/24 HOURS⁽¹⁾

STATION	1	2	3	4	5
Station Description	GROUP CAMP DAM				
Drainage Area (square miles)	6.85				
Cumulative Drainage Area (square miles)	6.85				
Adjustment of PMP for Drainage Area (%) ⁽²⁾	ZONE 7				
6 Hours	102				
12 Hours	120				
24 Hours	130				
48 Hours	140				
72 Hours	-				
Snyder Hydrograph Parameters					
Zone ⁽³⁾	28				
C_p/C_t ⁽⁴⁾	.57/1.7				
L (miles) ⁽⁵⁾	4.74				
L_{ca} (miles) ⁽⁵⁾	2.24				
$t_p = C_t (L \cdot L_{ca})^{0.3}$ (hours)	3.45				
Spillway Data					
Crest Length (ft)	65.5				
Freeboard (ft)	7.0				
Discharge Coefficient	3.09				
Exponent	1.5				

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).

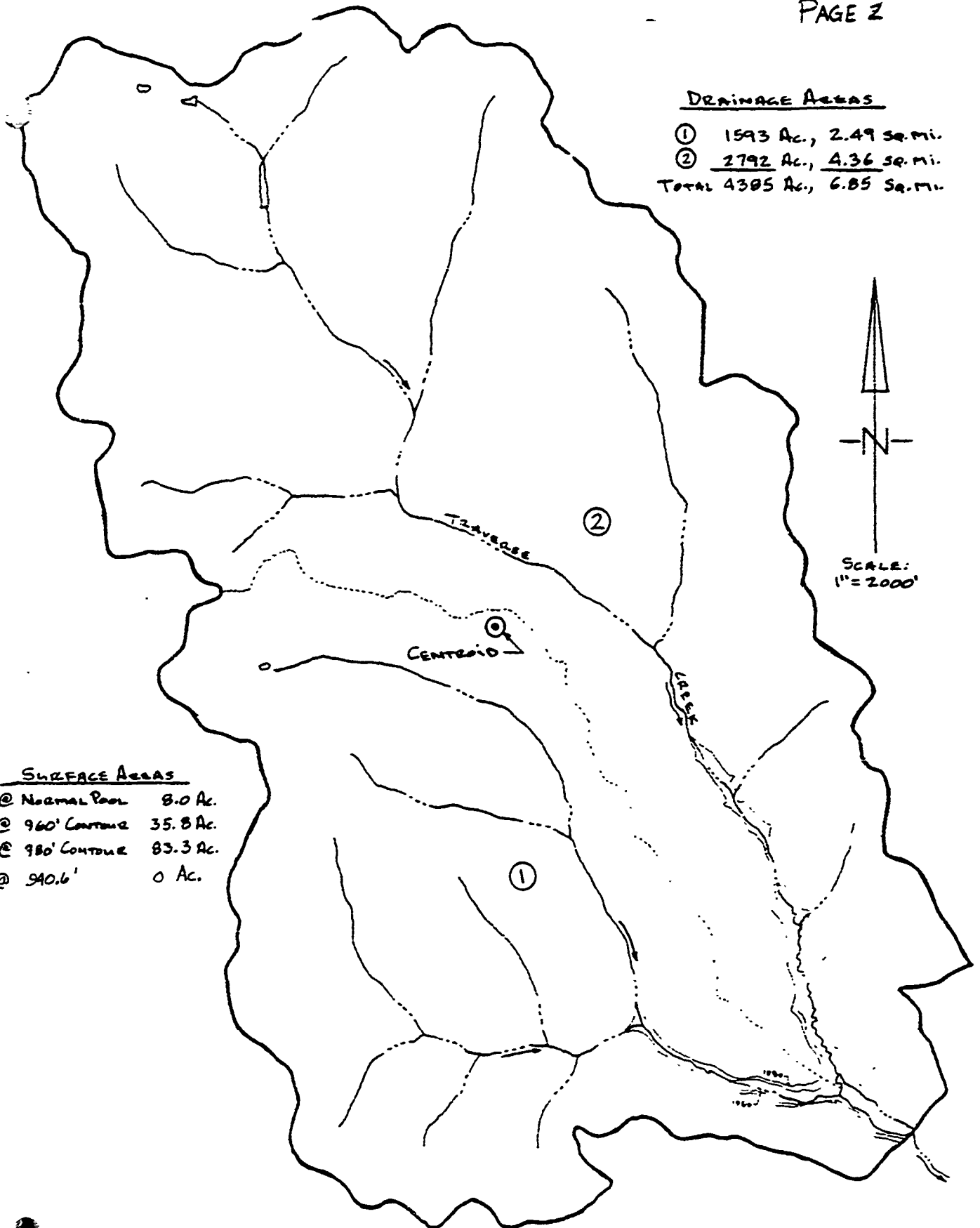
(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.

L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

DRAINAGE AREAS

- ① 1593 Ac., 2.49 sq. mi.
- ② 2792 Ac., 4.36 sq. mi.
- TOTAL 4385 Ac., 6.85 sq. mi.



SURFACE AREAS

- @ Normal Pool 8.0 Ac.
- @ 960' Contour 35.8 Ac.
- @ 980' Contour 85.3 Ac.
- @ 940.6' 0 Ac.

DRAINAGE AREA MAP

GROUP CAMP DAM

HOOKSTOWN, PA. QUAD.

MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject GROUP CAMP DAM S.O. No. _____
100 YEAR FLOOD FROM Sheet No. 3 of 8
OHIO RIVER BASIN REGRESSION EQUATION Drawing No. _____
Computed by WDL Checked by _____ Date 3/21/80

CALCULATION OF 100-YR FLOW: (FROM ANALYSIS PERFORMED BY THE
PITTSBURGH DISTRICT, COE)

$$Q_{100} = 120.38 (D.A. \times S)^{1/2} \quad 0.744099$$

D.A. = DRAINAGE AREA = 6.85 MI²

S = CHANNEL SLOPE IN THE LOWER
P.T. OF THE WATERSHED.

S = 52 FT/MILE

$$Q_{100} = 120.38 ([6.85] [52])^{1/2} \quad 0.744099$$

$$Q_{100} = 2191.9 \text{ CFS}$$

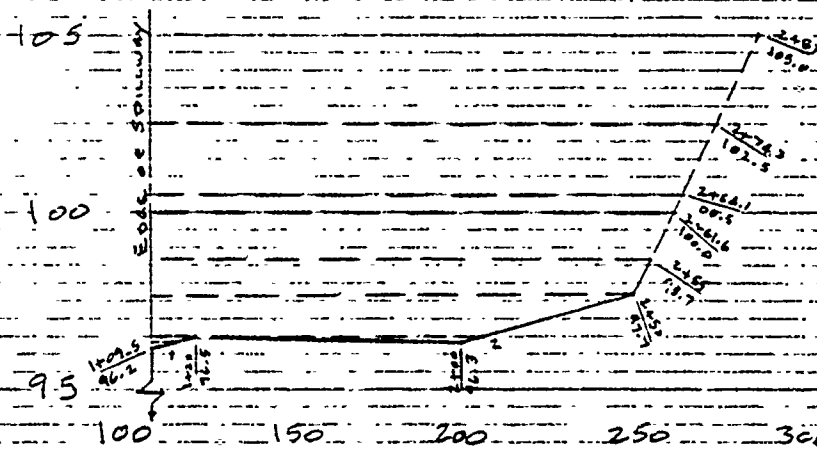
THE SPILLWAY CAPACITY AT THE TOP OF THE DAM (ELEV. 957.0 FT)
IS 3750 CFS (SEE RATING CURVE ON SHEET 6 OF THIS APPENDIX).

SINCE THE SPILLWAY CAPACITY IS GREATER THAN THE MAXIMUM
INFLOW TO THE IMPOUNDMENT, THE SPILLWAY IS ADEQUATE TO
SAFELY PASS THE 100-YR FLOOD WITHOUT OVERTOPPING.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject Grand Camp Dam S.O. No. 13517-00-ARA-02
(Raccoon St. Park) Sheet No. 4 of 8
Rating Curve (Excl. spillway) Drawing No. _____
Computed by J. Sanyal Checked by _____ Date 12-10-79



End Sta
1. 1+13.7
2. 2+07.1

MEAN HYDRAULIC DEPTH = $D = \frac{AREA}{FREE SURFACE TOP WIDTH}$

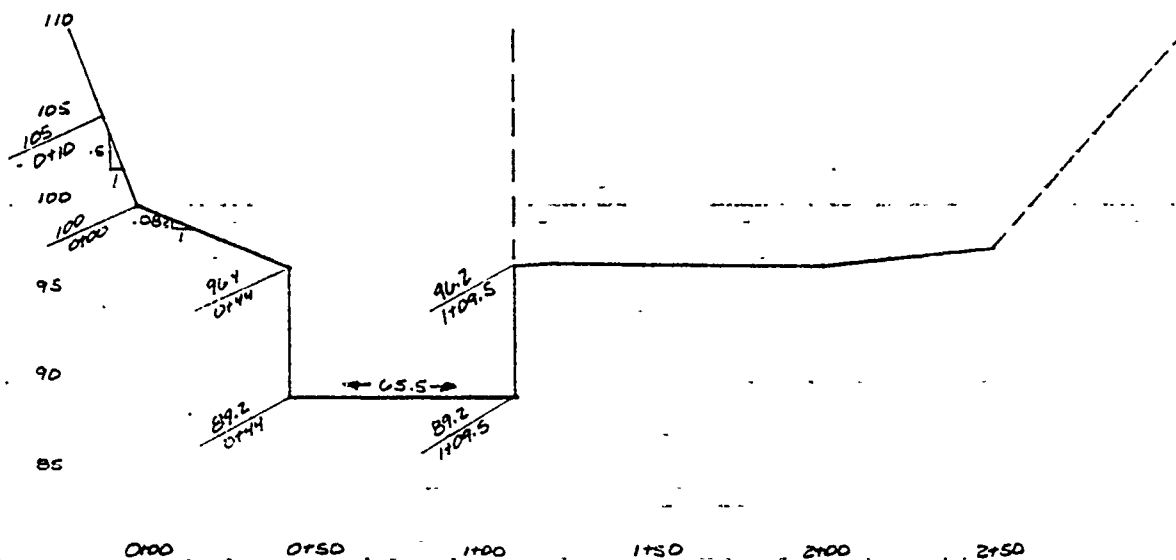
RATING CURVE BASED ON CRITICAL DEPTH

(From Chow, OPEN CHANNEL HYDRAULICS, P. 43)

VELOCITY = $\sqrt{32.2 \text{ FT/SEC}^2 \times D}$

$Q = AV$

WSEL	Area (sq ft)	Top width (ft)	Velocity (fps)	Q (cfs)	$\frac{V^2}{2g}$	Elev. Elev.
96.2	0	0	0	0	0	0
96.3	0.21	4.2	1.27	0.27	0.03	96.33
96.5	9.68	97.6	3.19	30.91	0.16	96.66
97.7	152.54	142.5	5.91	901.91	0.54	98.24
98.7	295.54	145.5	3.09	2390.13	1.02	99.72
100.0	488.98	152.1	10.17	4975.08	1.61	101.61
100.5	565.66	154.6	10.85	6139.83	1.83	102.33
102.5	885.06	164.8	13.15	11638.81	2.69	105.19



RATING CURVE BASED ON CRITICAL DEPTH:

$$D = \frac{\text{MEAN HYDRAULIC DEPTH}}{\text{FREE SURFACE TOP WIDTH}} = \frac{\text{AREA}}{\text{TOP WIDTH}}, \text{ VELOCITY} = \sqrt{32.2 \text{ FT/SEC}^2 (D)}, Q = VA$$

WSEL	AREA SQ FT	TOP WIDTH FT	VELOCITY FPS	Q CFS	V ² EG	EG ELEV
89.2	00	65.5	0.0	0.0	0.0	89.20
90.0	52.4	65.5	5.08	265.95	.40	90.40
91.0	117.9	65.5	7.61	897.59	.90	91.90
92.0	183.40	65.5	9.50	1741.73	1.40	93.40
93.0	248.90	65.5	11.06	2753.24	1.90	94.90
94.0	314.40	65.5	12.43	3908.69	2.40	96.40
96.0	379.90	65.5	13.67	5191.72	2.96	97.90
96.0	445.40	65.5	14.80	6570.72	3.40	99.40
96.2	458.50	65.5	15.01	6883.61	3.56	99.70
96.3	465.05	65.5	15.12	7031.64	3.55	99.85
96.4	471.60	65.5	15.23	7180.72	3.60	100.00
96.5	478.21	66.72	15.19	7264.87	3.58	100.80
97.7	567.05	81.35	14.98	8495.38	3.48	101.18
98.7	654.51	93.55	15.01	9823.79	3.50	102.20
100.0	786.42	109.40	15.21	11961.45	3.59	103.59
100.5	842.65	115.50	15.33	12,915.40	3.65	104.14
102.5	1098.04	139.89	15.90	17,456.69	3.92	106.42

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject Group Camp Dam
Combined Rating Curve

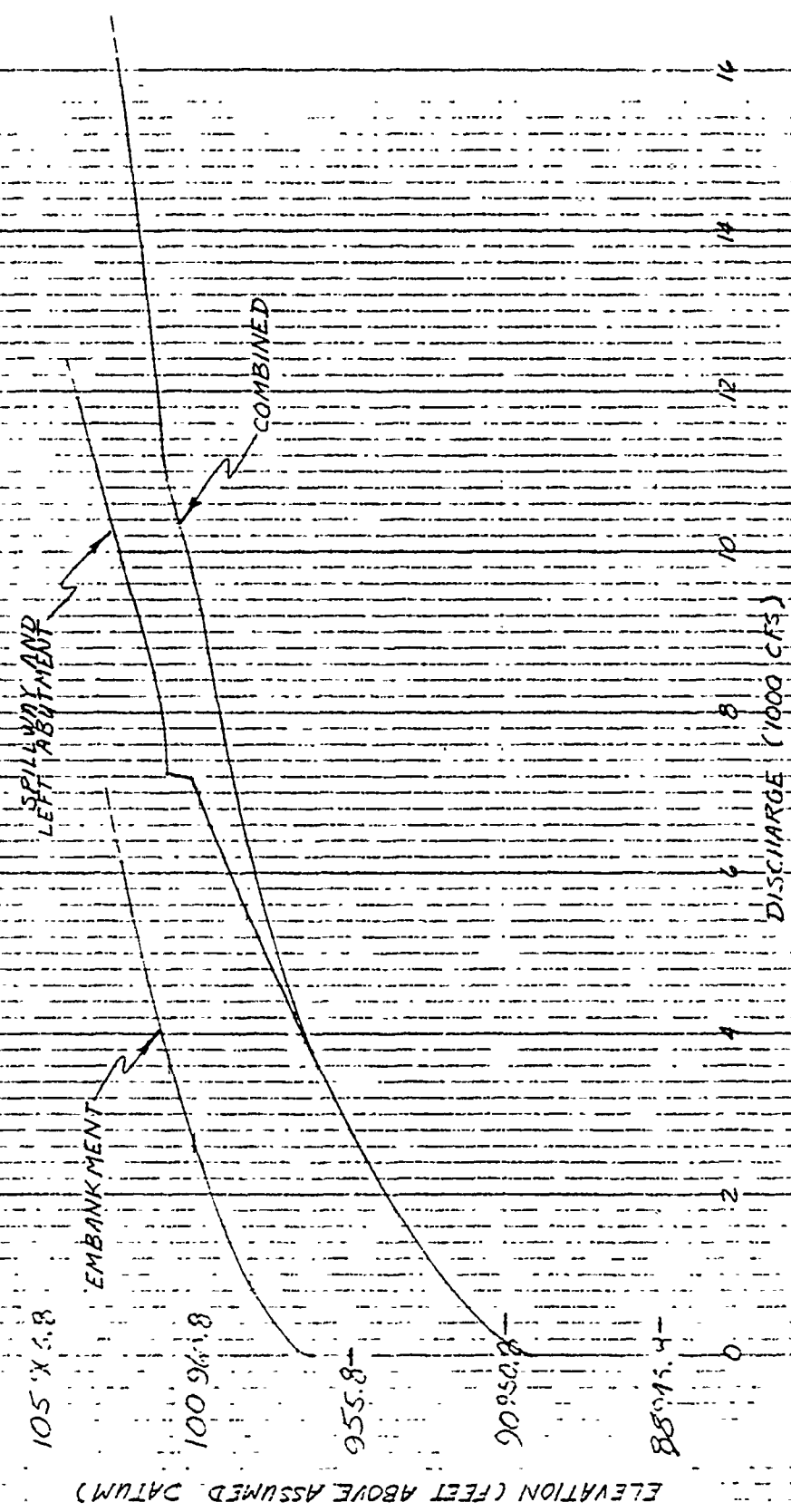
S.O. No. 135A700-ARA-01

Sheet No. 6 of 8

Drawing No. _____

Computed by JAG Checked by _____

Date 12-19-79



ELEVATION (FEET ABOVE ASSUMED DATUM)

DISCHARGE (1000 CFS)

K&E 10 X 10 TO THE INCH #7 X 10 INCHES
HEUPFLL & ESSER CO. MADE IN USA

46 0703

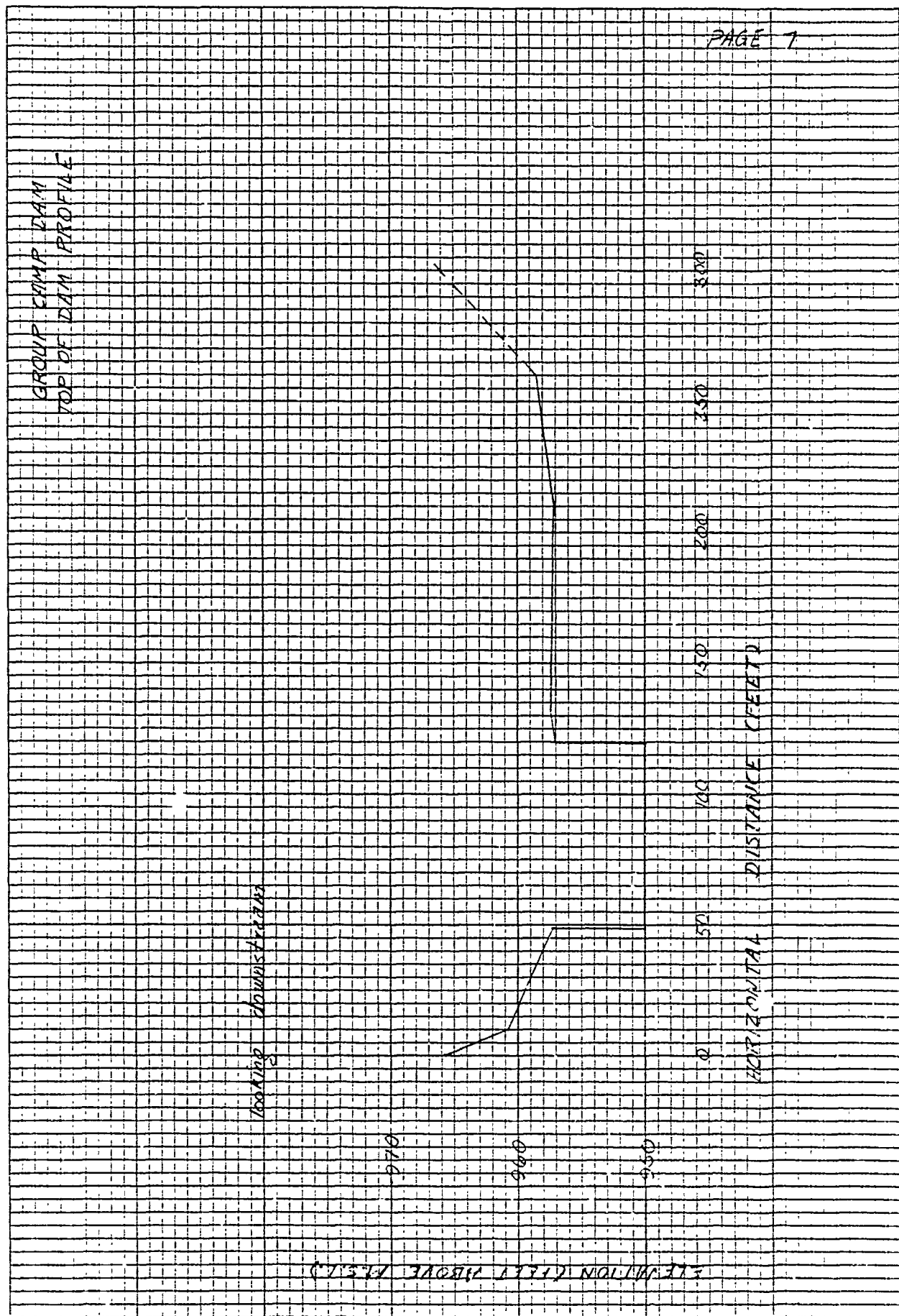
PAGE 1

GROUP CAMP DAM
TOP OF DAM PROFILE

Looking
Northwest

ELEVATION (FEET ABOVE M.S.L.)

HORIZONTAL DISTANCE (FEET)



GROUP CAMP DAM
TYPICAL CROSS SECTION

ELEVATION FEET ABOVE M.S.L.

960
950
940
930

CONCRETE BOX

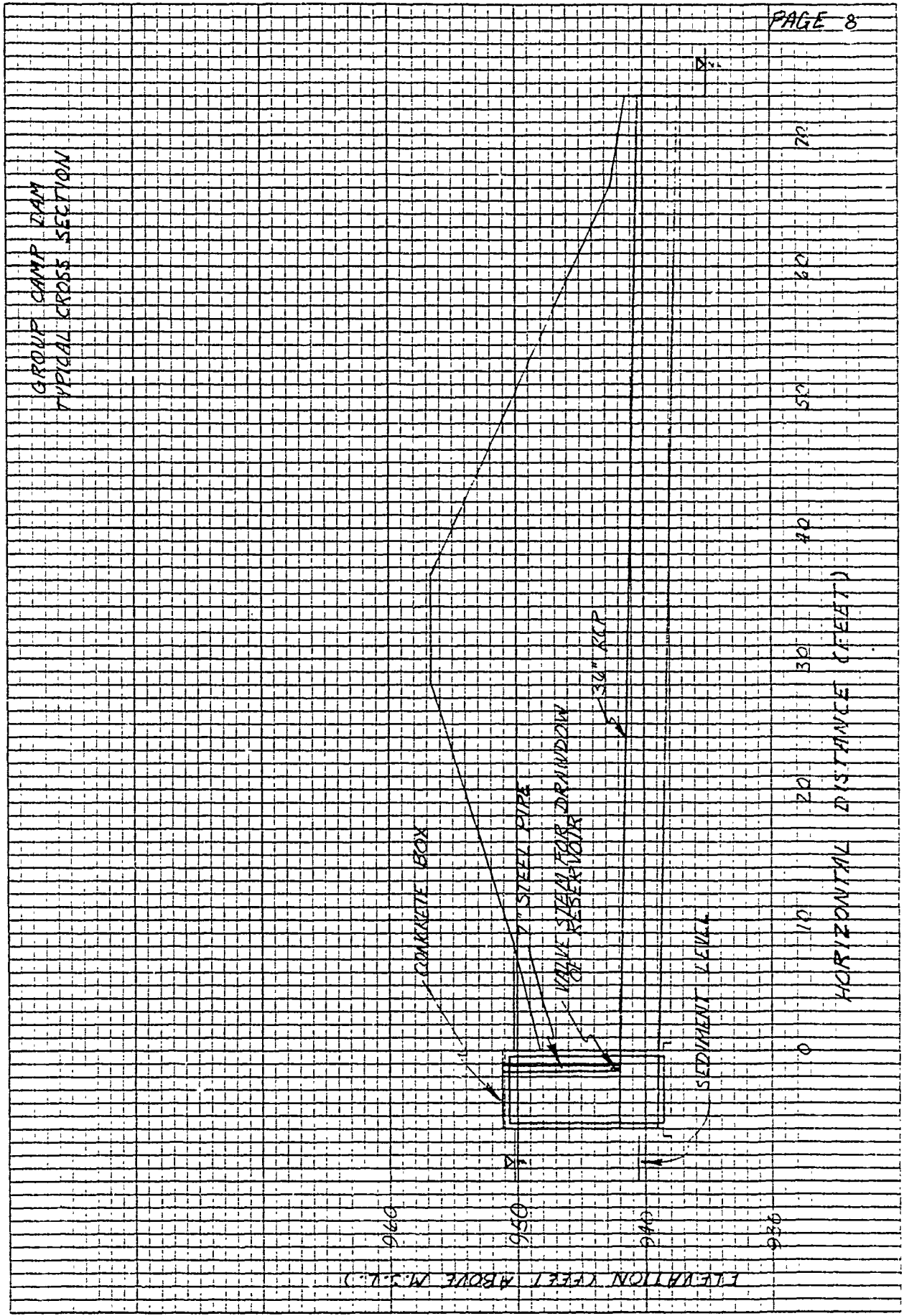
7" STEEL PIPE

WAVE RESISTANT DRUMMOND
OR RESERVOIR

30" RCP

SEDIMENT LEVEL

0 10 20 30 40 50 60 70
HORIZONTAL DISTANCE (FEET)



MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject Group Camp Dam
Combined Rating Curve

S.O. No. 135A700-ARA-01

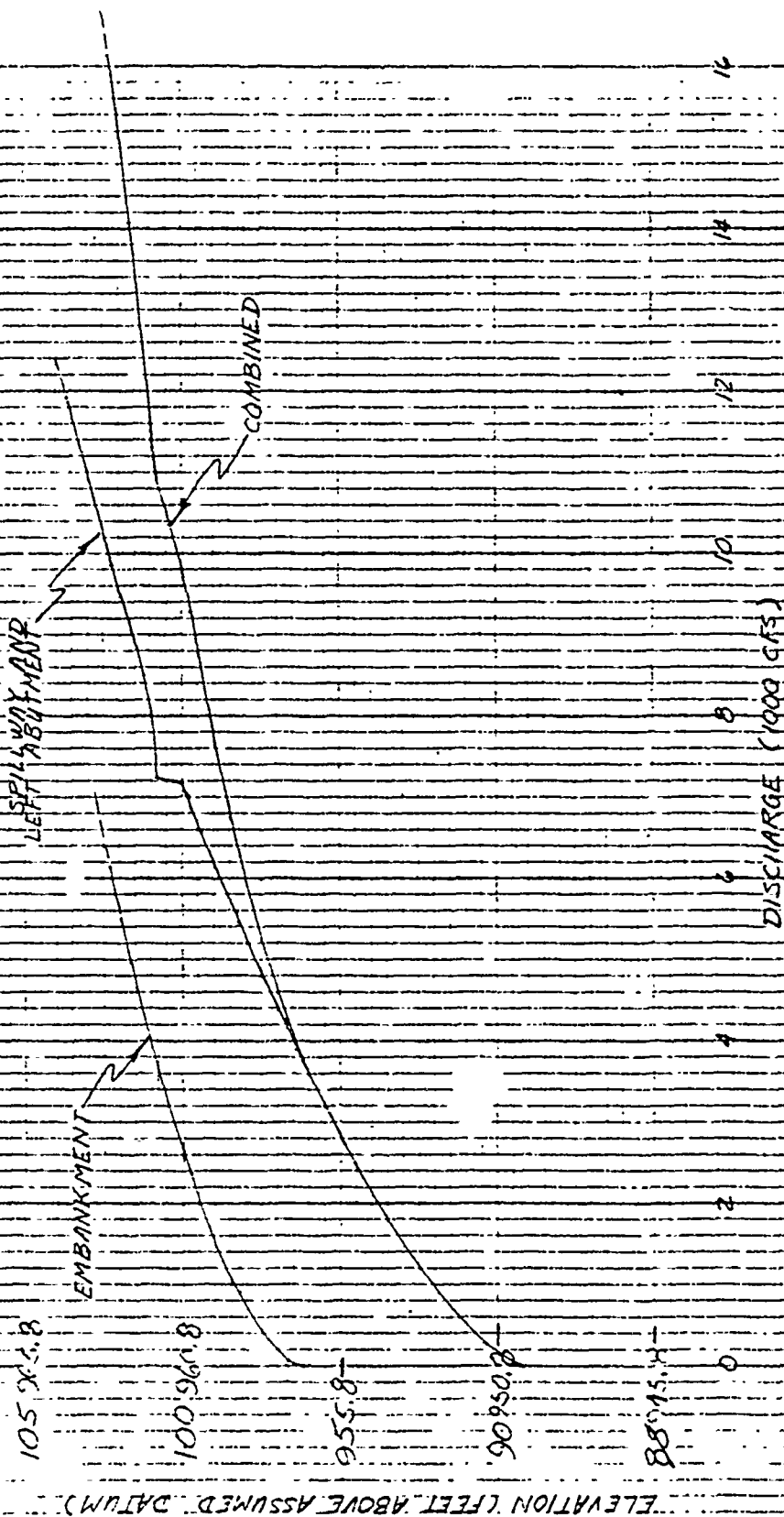
Sheet No. 9 of 16

Drawing No. _____

Computed by JAG

Checked by _____

Date 12-19-79



ELEVATION (FEET ABOVE ASSUMED DATUM)

DISCHARGE (1000 CFS)

LEFT ABUTMENT

EMBANKMENT

COMBINED

105.2

100.0

95.8

98.5

85.5

46 0703

K&E 10 X 10 TO THE INCH 7 X 10 INCHES
HEUPHEL & ESSER CO. MADE IN USA



GROUP CAMP DAM
TOP OF DAM PROFILE

PAGE 10

Looking Towards East

970

960

950

0

100

150

200

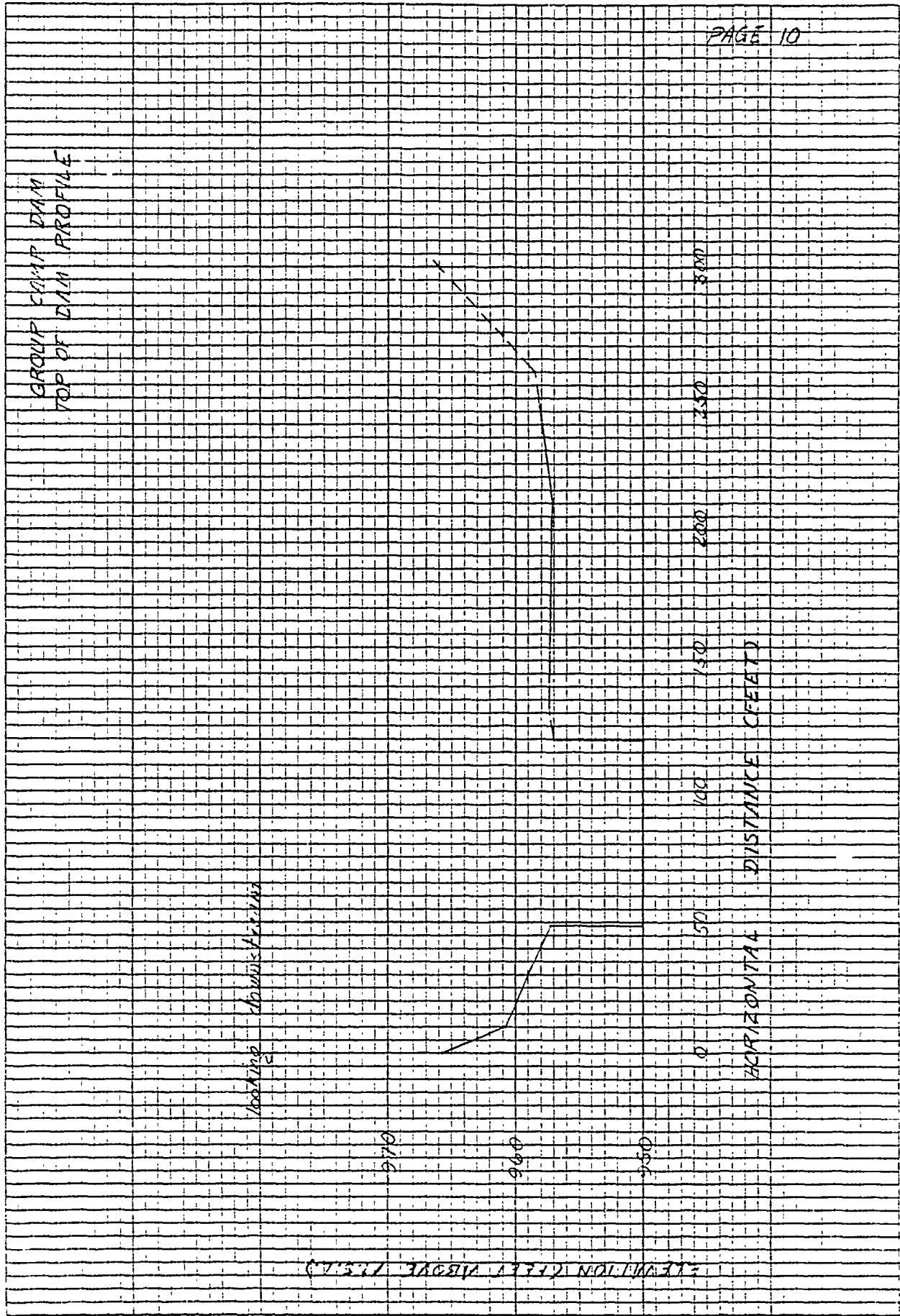
250

300

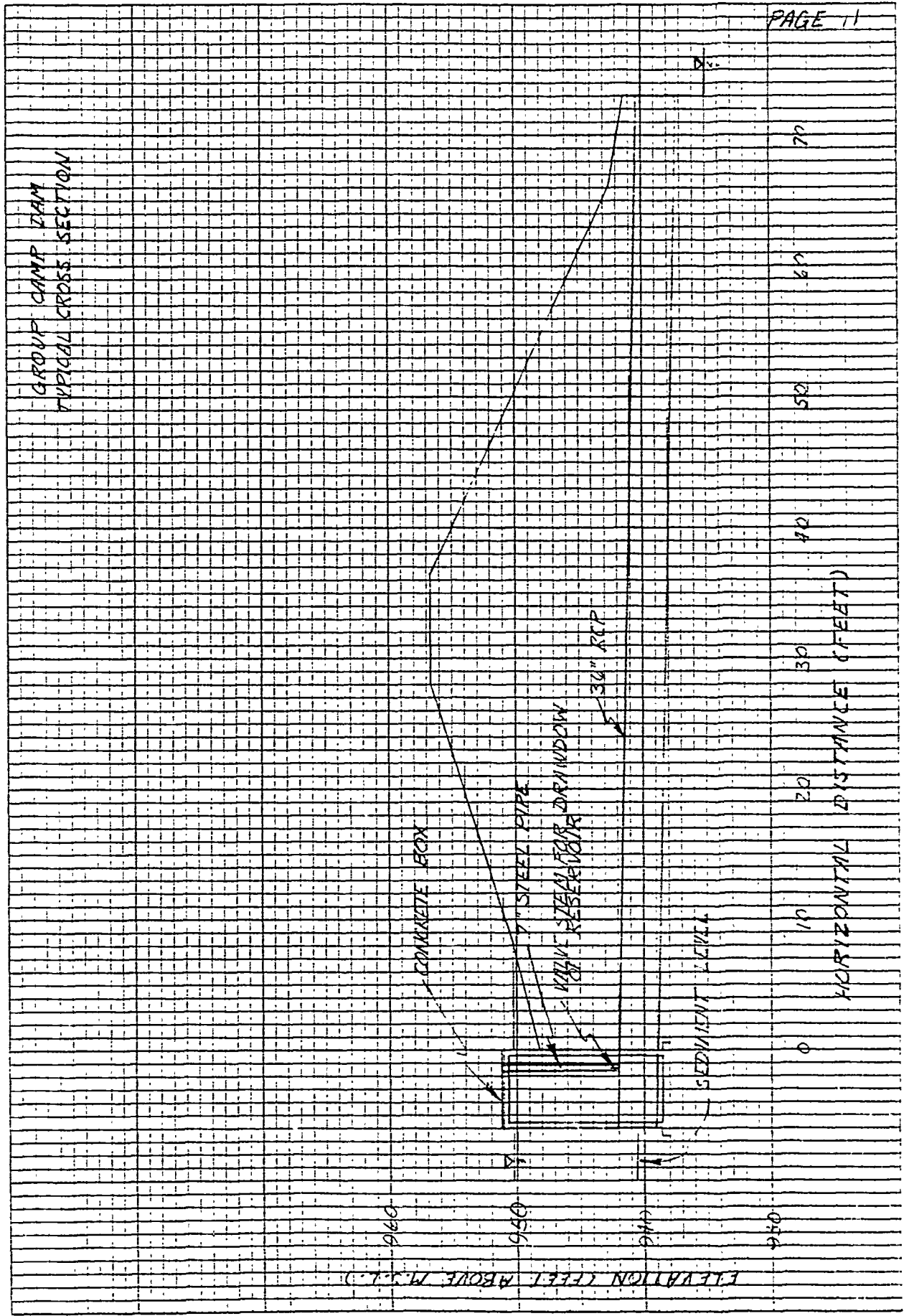
HORIZONTAL

DISTANCE FEET

ELEVATION FEET ABOVE M.S.L.



GROUP CAMP DAM
TYPICAL CROSS SECTION



 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 OAH SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79
 HBJ UPDATE 04 JUN 79

RUN DATE 01/04/80
 TIME 09:25

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
 HYDROLOGIC AND HYDRAULIC ANALYSIS OF GROUP CAMP DAM
 100-YEAR FLOOD

 JOB SPECIFICATION
 NQ NHR NHIN IDAY IHR INCN METRC IPLY IPRT NSPAN
 400 0 30 0 0 0 0 0 0 0 0 0
 JOPER NMI LROPT TRACE
 5 0 0 0

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 1 NRATIO= 1 LRTIO= 1

RATIO= 1.00

SUB-AREA RUNOFF COMPUTATION

HYDROGRAPH DEVELOPMENT
 IRTAQ ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUOTO
 1 0 0 0 0 0 0 1 0 0 0

IHYDG IUNG TAREA SNAP TRSDA TRSPE RATIO ISNOW ISAME LOCAL
 0 1 6.85 0.0 0.0 6.85 0.0 0.0 0 0 1 0

LOSS DATA
 LROPE STRKR DLTRK RTIOL GRAIN STRKS RTIOK STRYL CNSIL ALSMX RTIMP
 0 0.0 0.0 1.00 0.0 0.0 0.0 1.00 2.60 0.36 0.0 0.0

UNIT HYDROGRAPH DATA
 TP= 3.45 CP=0.57 NTA= 0

RECESSION DATA
 STARTQ= -1.50 QRCSN= -0.05 RTIOR= 2.00

UNIT HYDROGRAPH 44 END-OF-PERIOD ORDINATES, LAG= 3.48 HOURS, CP= 0.57 VOL= 1.00
 37. 136. 272. 427. 574. 681. 736. 723. 653. 572.
 501. 438. 384. 336. 294. 258. 226. 198. 173. 151.
 133. 116. 102. 89. 78. 68. 60. 52. 46. 40.
 35. 31. 27. 24. 21. 18. 16. 14. 12. 11.
 9. 8. 7. 6.

NO.DA HR.MN PERIOD RAIN EXCS LOSS NO.DA HR.MN PERIOD FLOW NO.DA HR.MN PERIOD RAIN EXCS LOSS LUMP Q

SUM 5.00 1.38 3.42 12064.
 (127.11 35.11 92.11 350.04)

HYDROGRAPH ROUTINE														
FLOOD ROUTING THROUGH GROUP CAMP DAM														
ISTAQ	ICOMP	ITAPE	IECON	JPLT	JPRJ	INAME	ISTAGE	IAUTO						
2	1	0	0	0	0	1	0	0	ROUTING DATA					
QLOSS	AVG	IRIS	ISAME	IOPT	IPHP	LSTR								
0.0	0.0	1	1	0	0	0								
NSTPS	MSTDL	LAG	AMSKK	O.C	TSK	STORA	ISPRAT							
1	0	0	0.0	0.0	0.0	-950.	-1							
STAGE	950.00	951.20	952.70	954.20	955.70	957.20	959.05	960.80						
	961.60	962.40	963.10											
FLOW	0.0	266.00	898.00	1741.00	2753.00	3909.00	4260.00	4920.00	9800.00					
SURFACE AREA	0.	8.	36.	83.										
CAPACITY	0.	25.	227.	1386.										
ELEVATION	941.	950.	960.											
CREL		SPHID	COON	EXPR	ELEVL	COOL	CAREA	EXPL						
950.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0						
DAM DATA														
TOPEL		COQU	EXPD	DAMWID										
957.0		2.6	1.5	0.										
PEAK OUTFLOW IS 998. AT TIME 20.00 HOURS														

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

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN RATIO	1
				1.00
HYDROGRAPH AT	1	6.85 (17.74)	1	1009. (28.58)
ROUTED TO	2	6.85 (17.74)	1	998. (28.25)

SUMMARY OF DAM SAFETY ANALYSIS

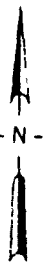
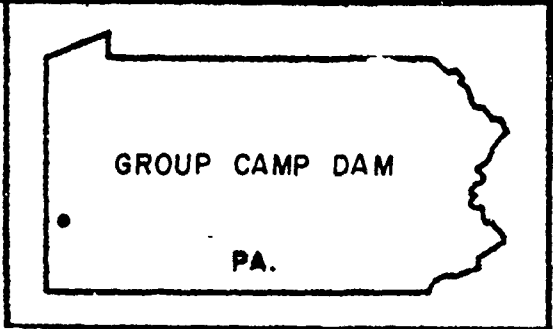
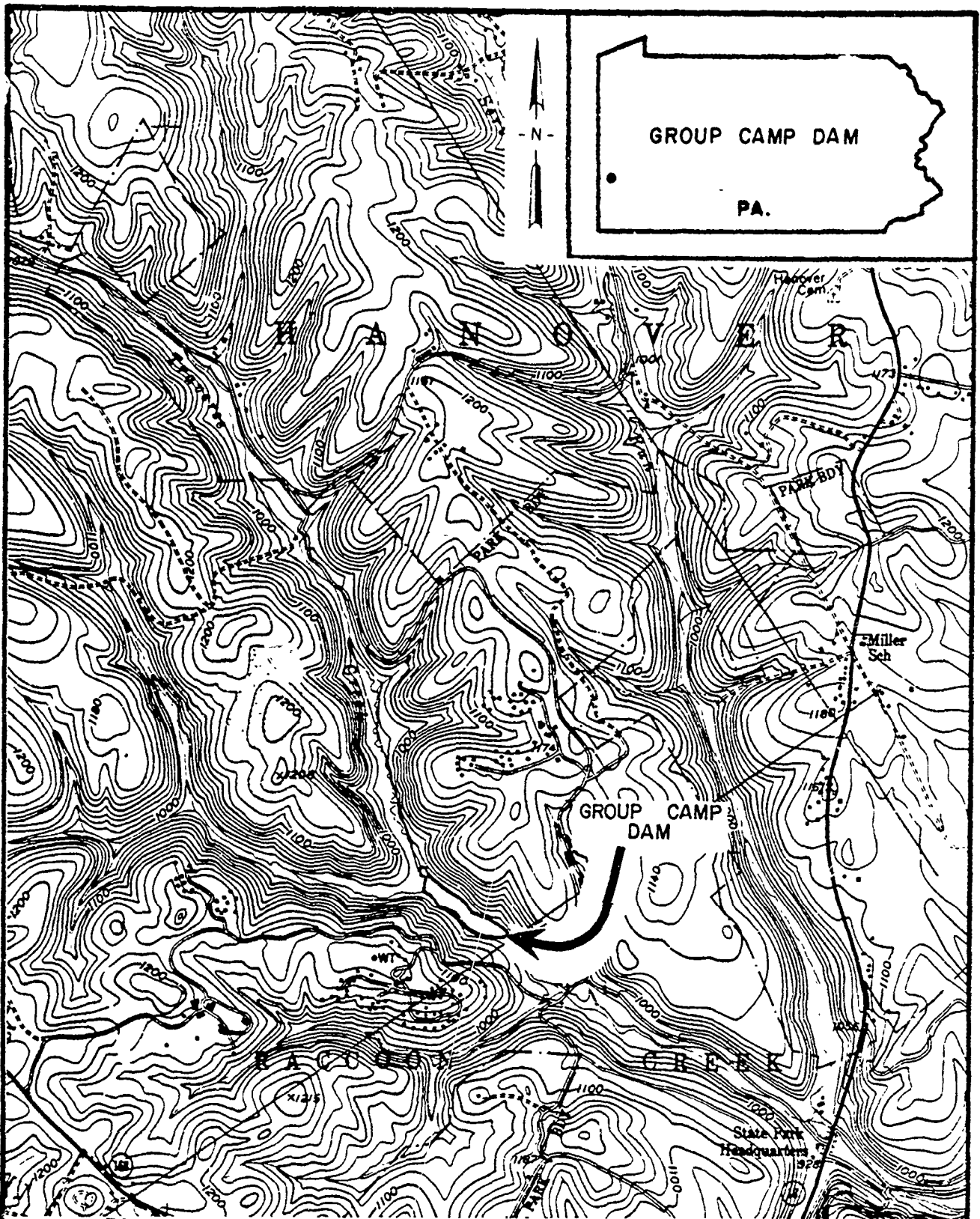
PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	RATIO OF 100-YEAR FLOOD W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
	950.00 25. 0.	950.00	950.00	957.00 136. 3755.	1.00	0.0	56.	998.	0.0	20.00	0.0

APPENDIX E

PLATES

CONTENTS

- Plate 1 - Location Map
- Plate 2 - Watershed Map
- Plate 3 - Plan of Reservoir and Profile of Dam
- Plate 4 - Plan of Dam
- Plate 5 - Plan, Profile, and Section of Spillway
- Plate 6 - Sections Through Spillway Channel
- Plate 7 - Plan, Section, and Details of Outlet Works
- Plate 8 - Sections Through the Embankment
- Plate 9 - Construction Progress Reports Delineating
(in Profile) the Limits of Sheet Piling and
Spillway Cut-Off Wall



SCALE 1:24000

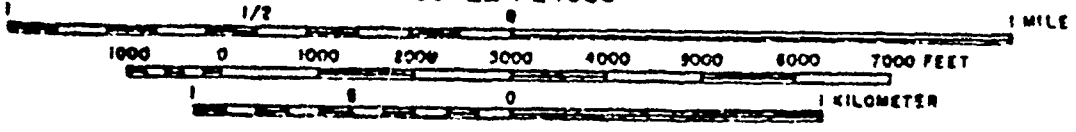
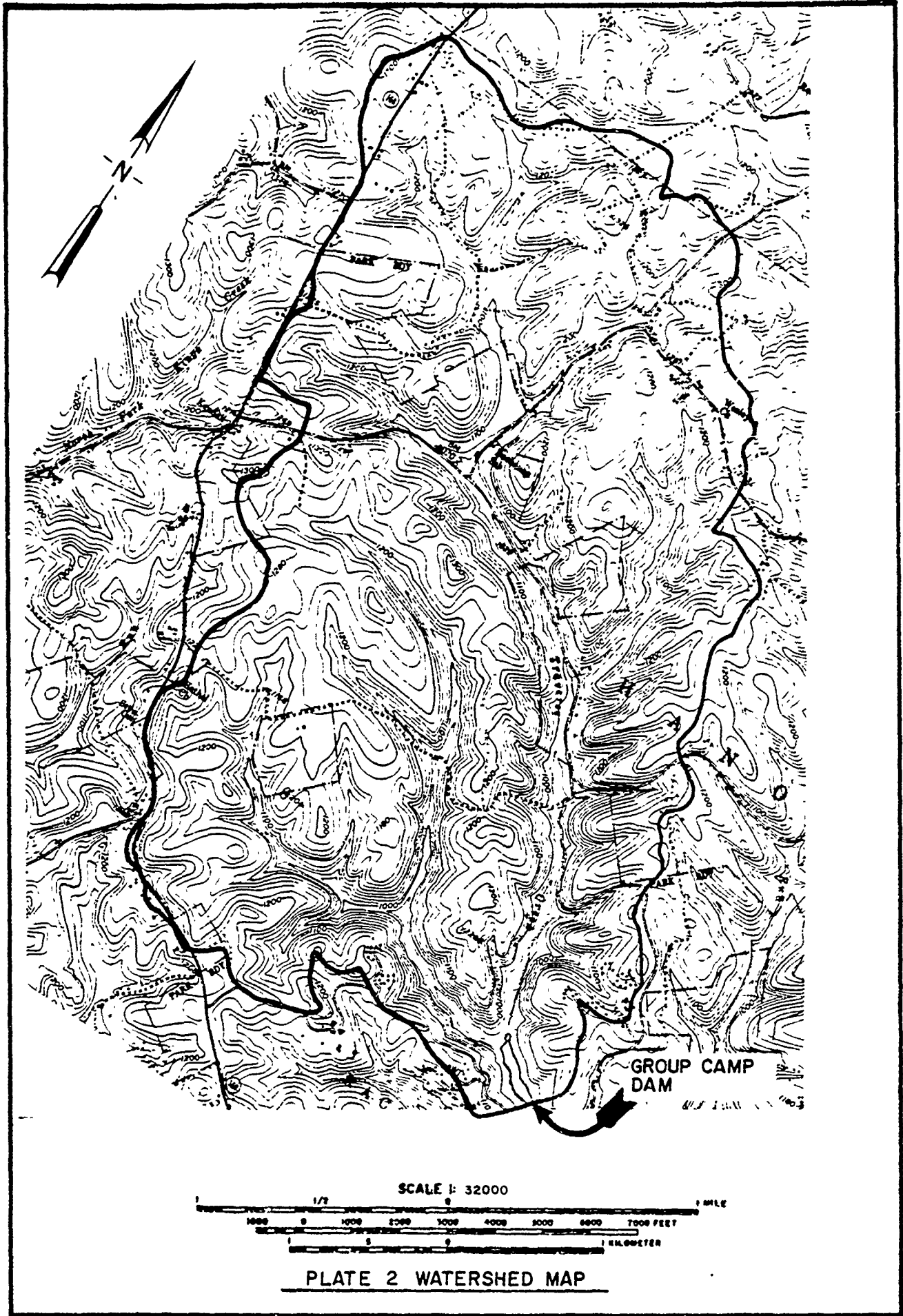


PLATE I - LOCATION MAP

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GROUP CAMP
DAM

SCALE 1: 32000

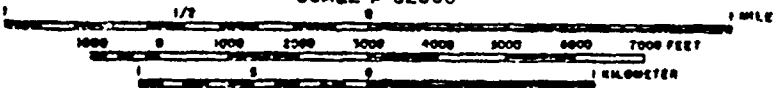
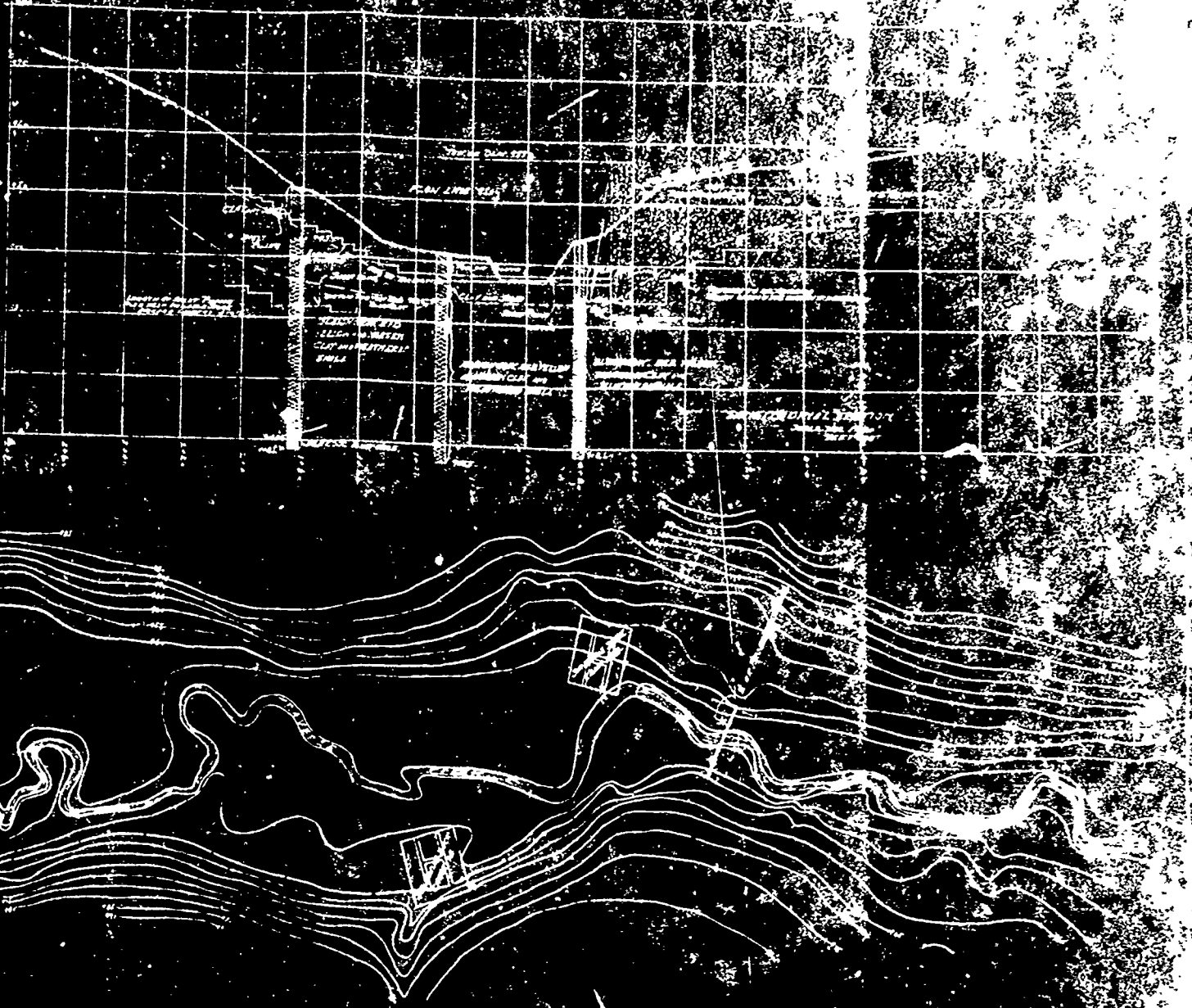


PLATE 2 WATERSHED MAP



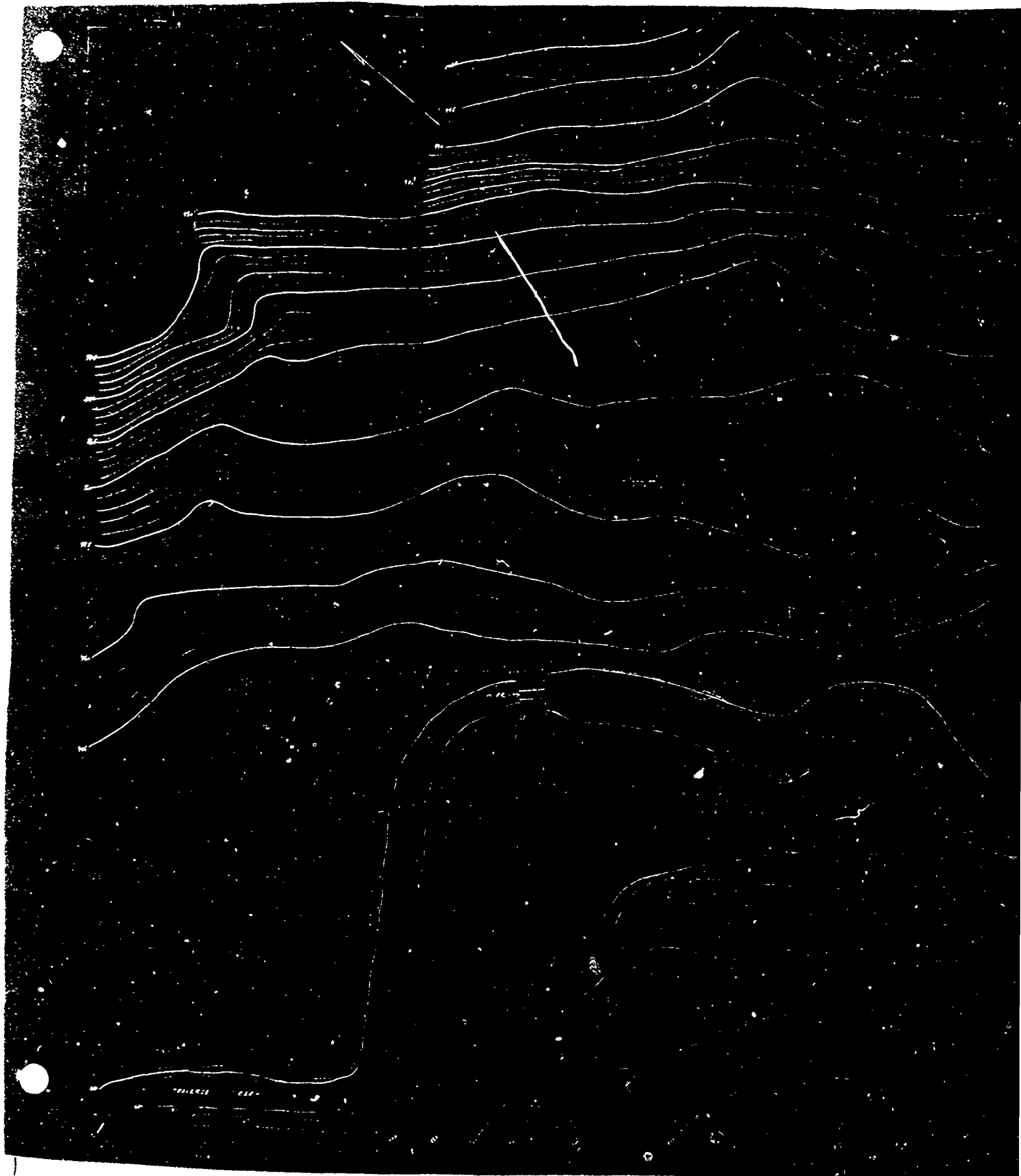


PLAN

SCALE: 1" = 100'
 1. 100' 200' 300' 400' 500'
 2. 100' 200' 300' 400' 500'
 3. 100' 200' 300' 400' 500'

UNITED STATES
 DEPARTMENT OF THE ARMY
 National City, Kansas
 Connected with
 ARMY STATION
 DEPARTMENT OF THE ARMY

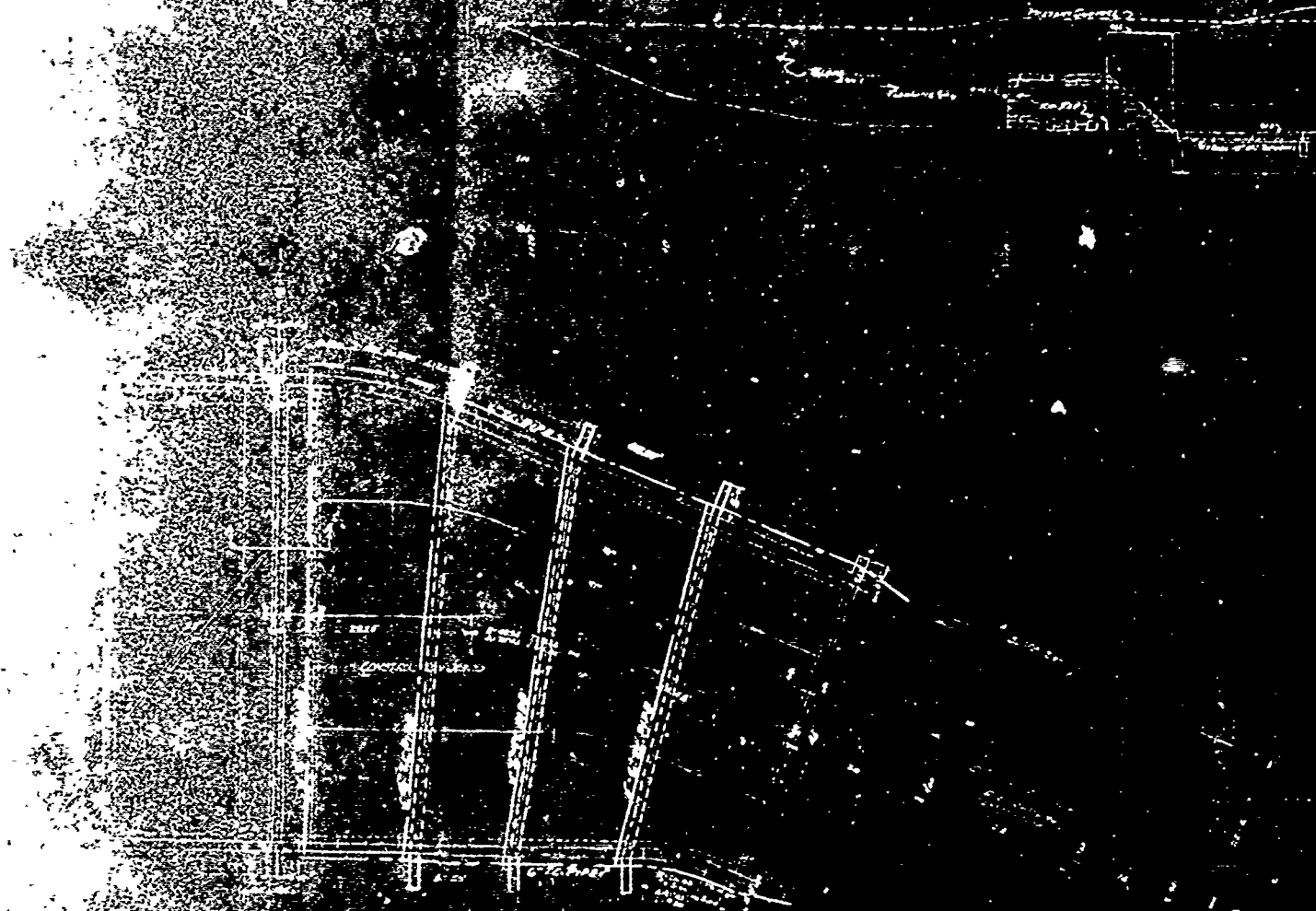
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DATE	1/1/50
BY	CH. 1000
REASON	
APPROVED	
DATE	



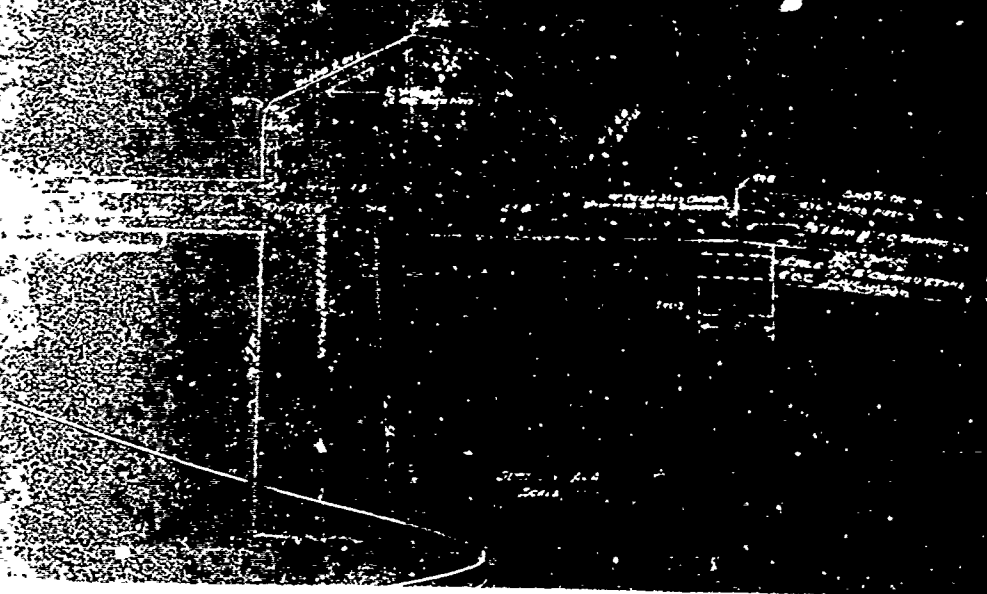
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THIS PAGE IS NOT COMPLETELY REPRODUCIBLE
FROM COPY FOLIO 13 TO 1300 PLATE 4



PLAN OF CHURCH PLANNING
SCALE 1/4"





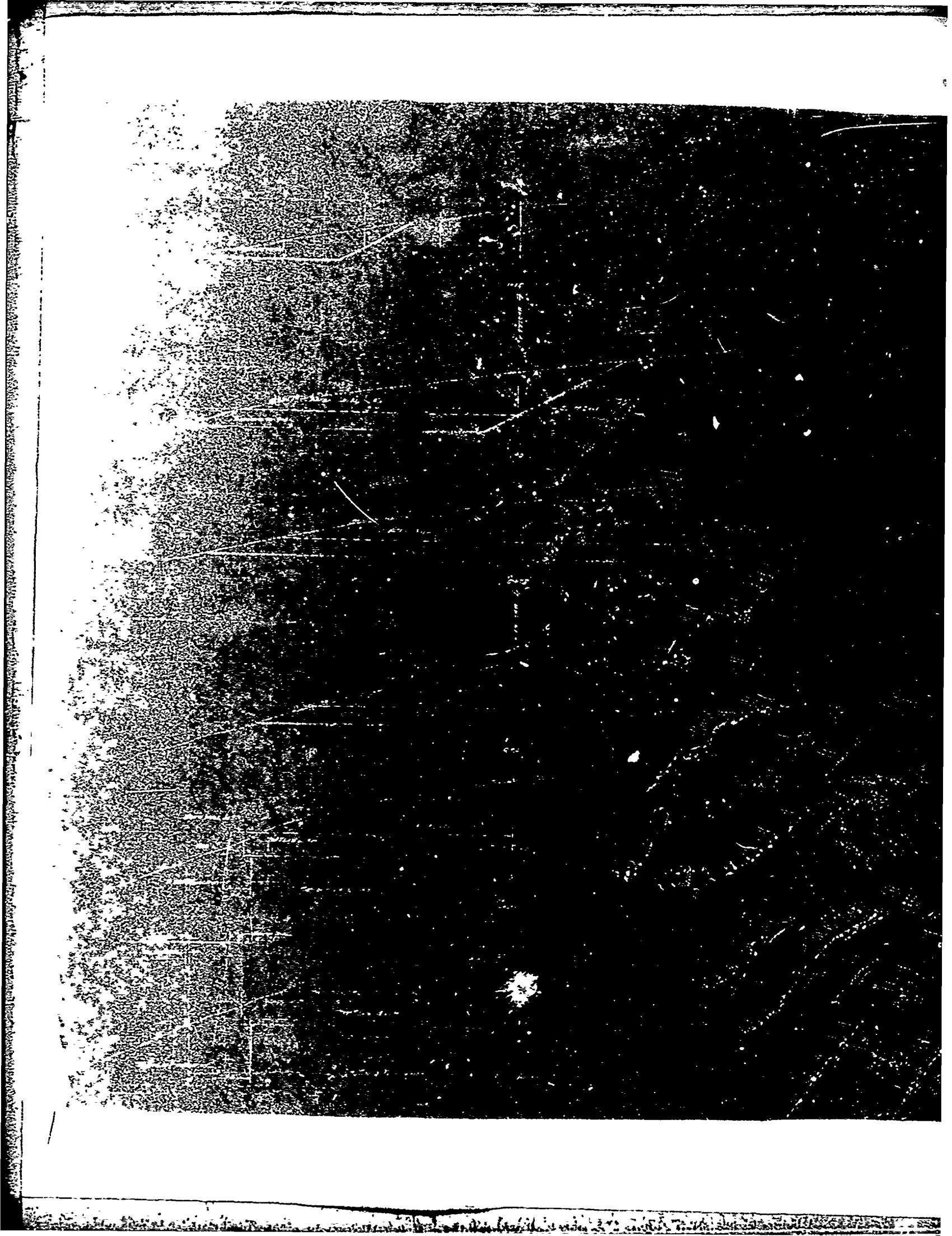
UNITED STATES
 DEPARTMENT OF THE INTERIOR
 NATIONAL PARK SERVICE
 Bismarck Creek Arch

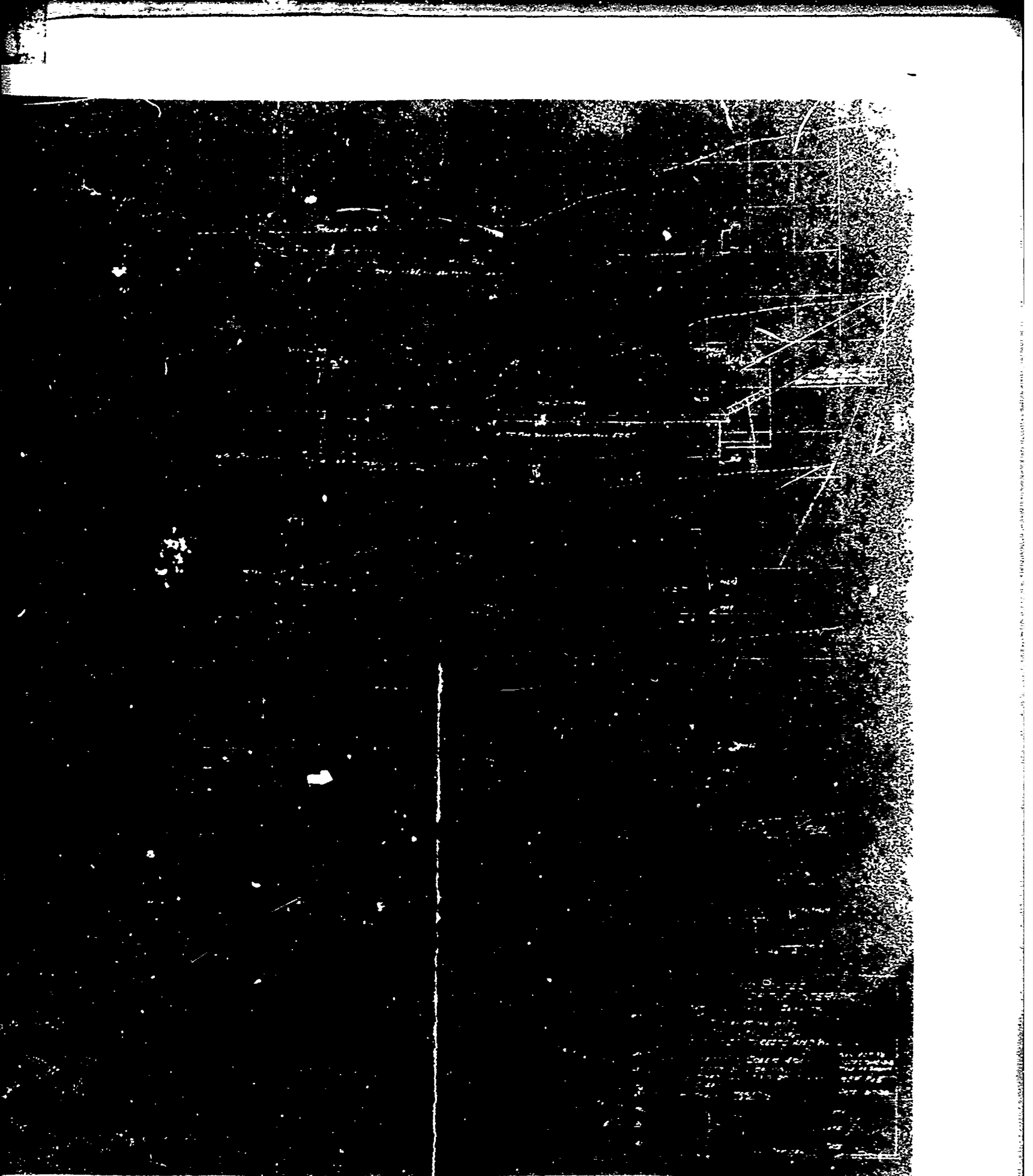
UNITED STATES DEPARTMENT OF THE INTERIOR
 NATIONAL PARK SERVICE
 Bismarck Creek Arch

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PLATE 5

2





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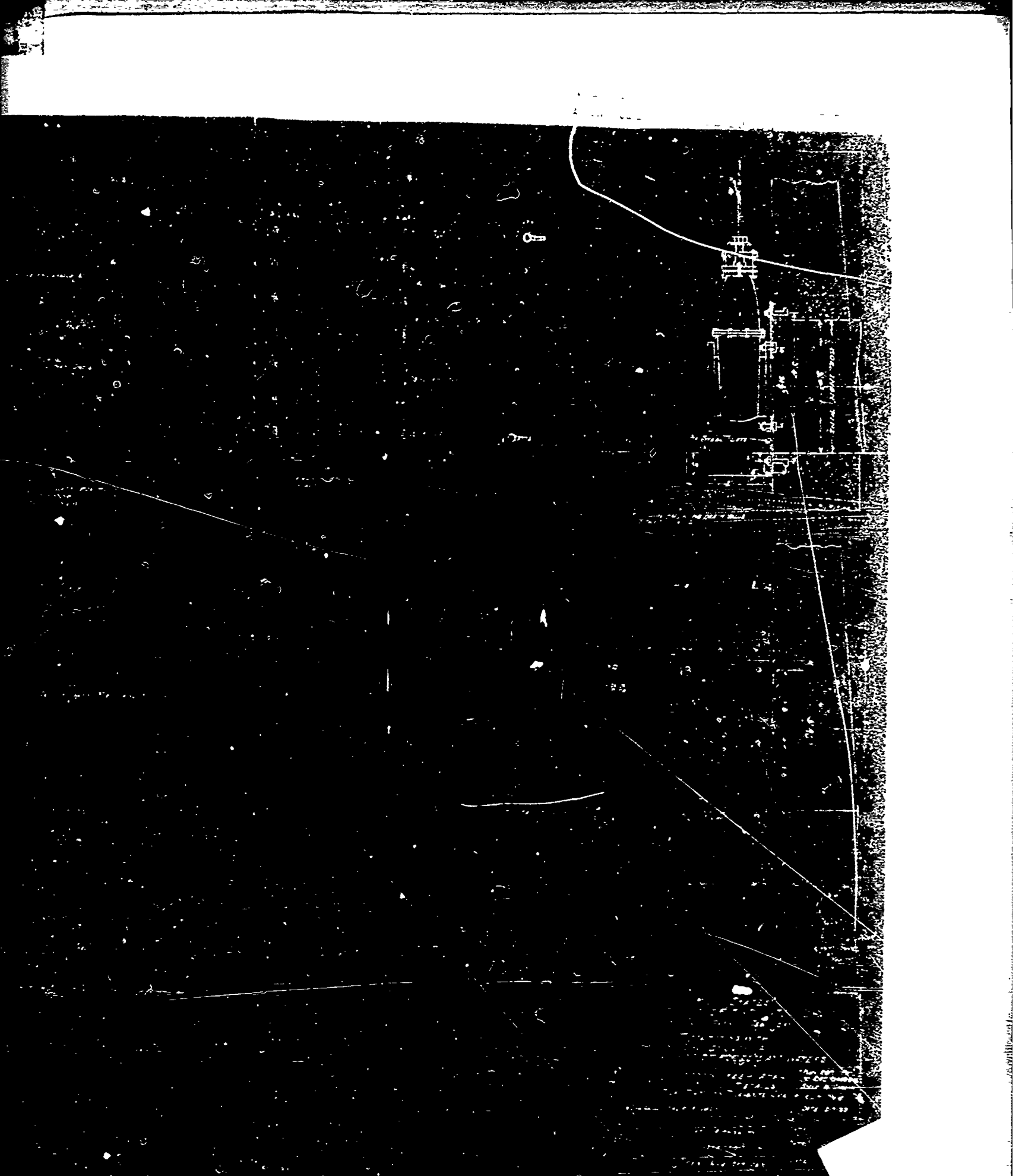


PLATE 7



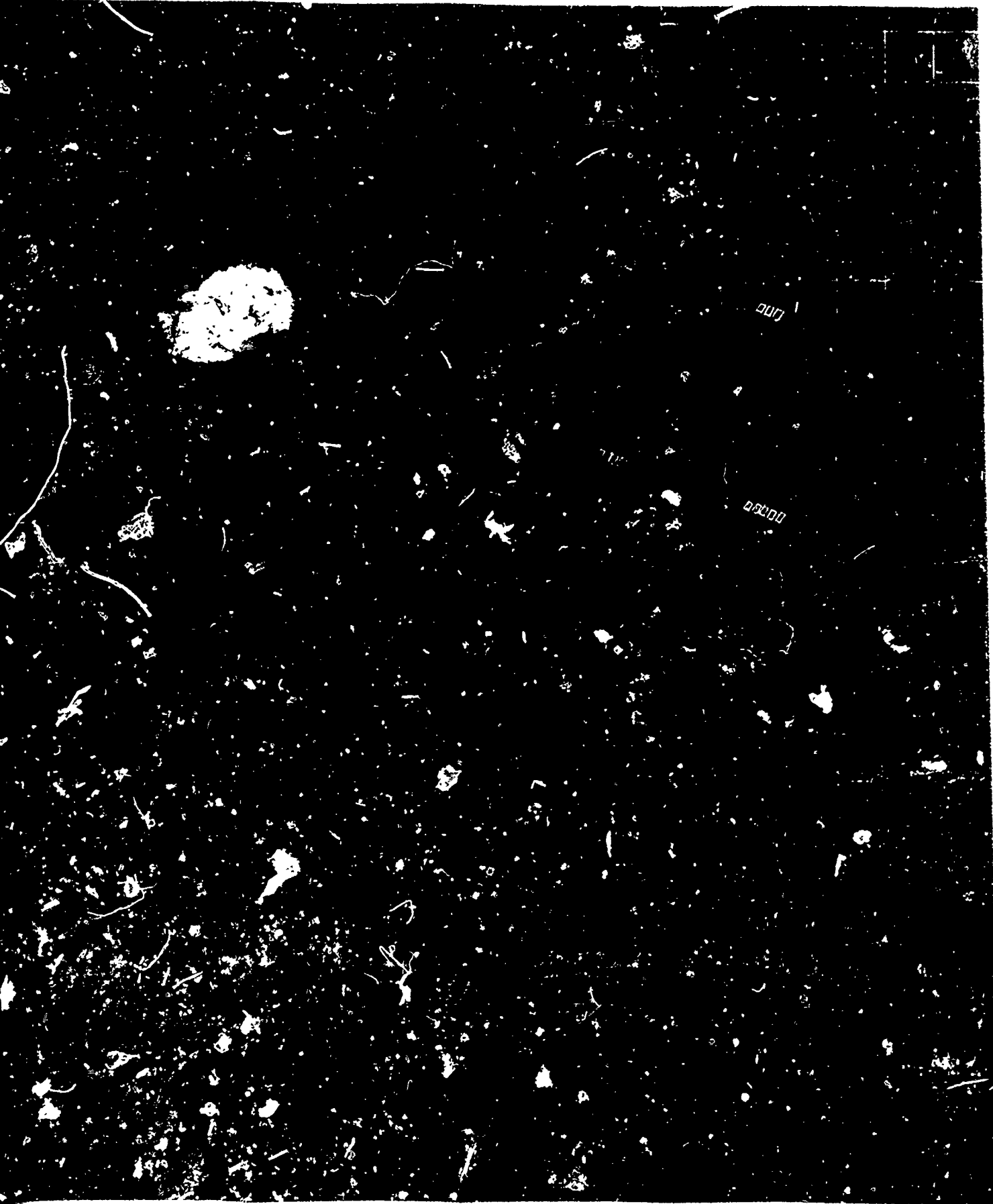
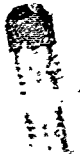


PLATE 8



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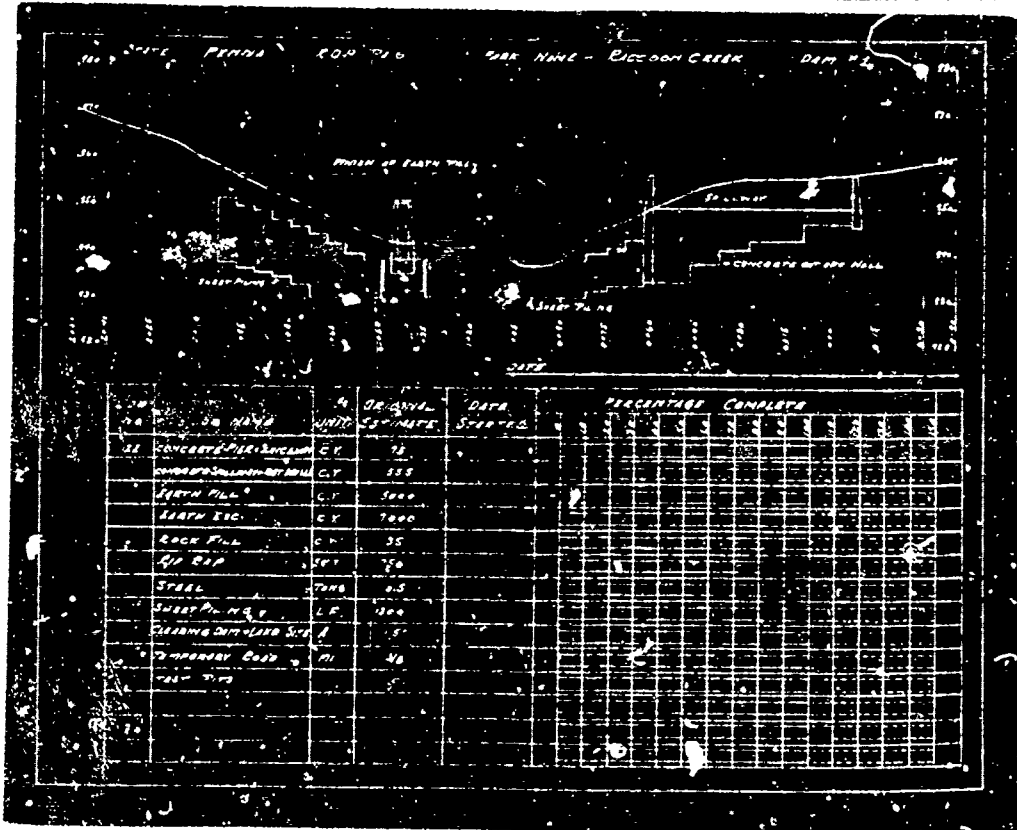
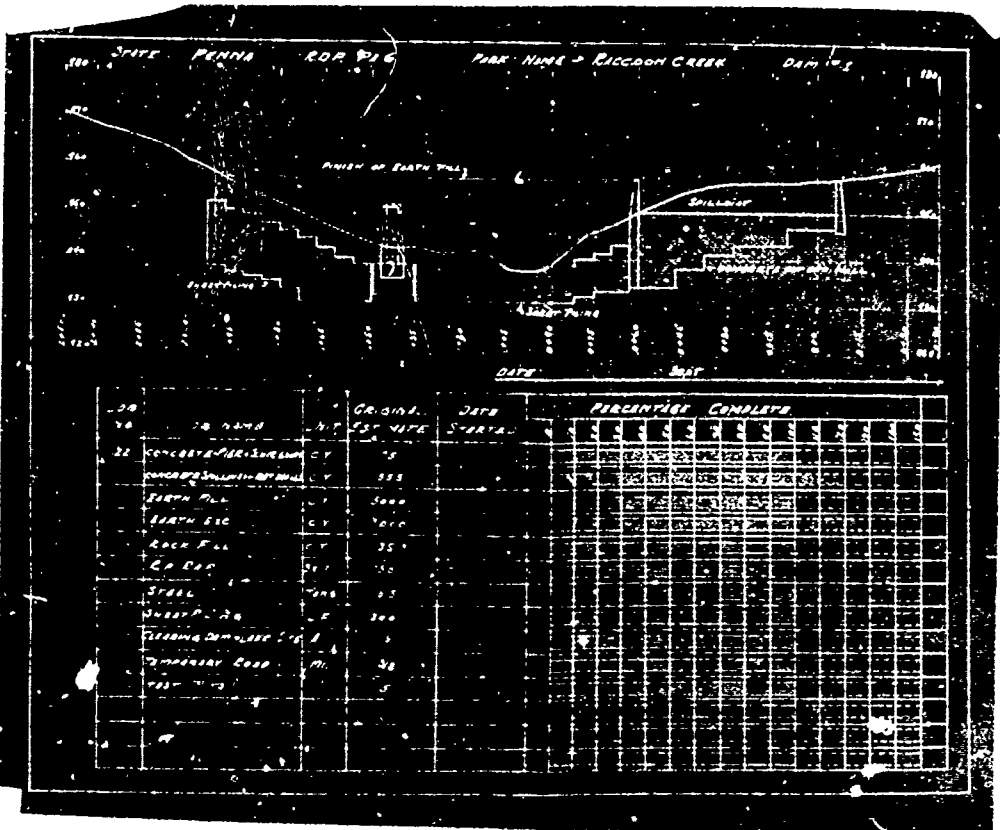


PLATE 9

APPENDIX I

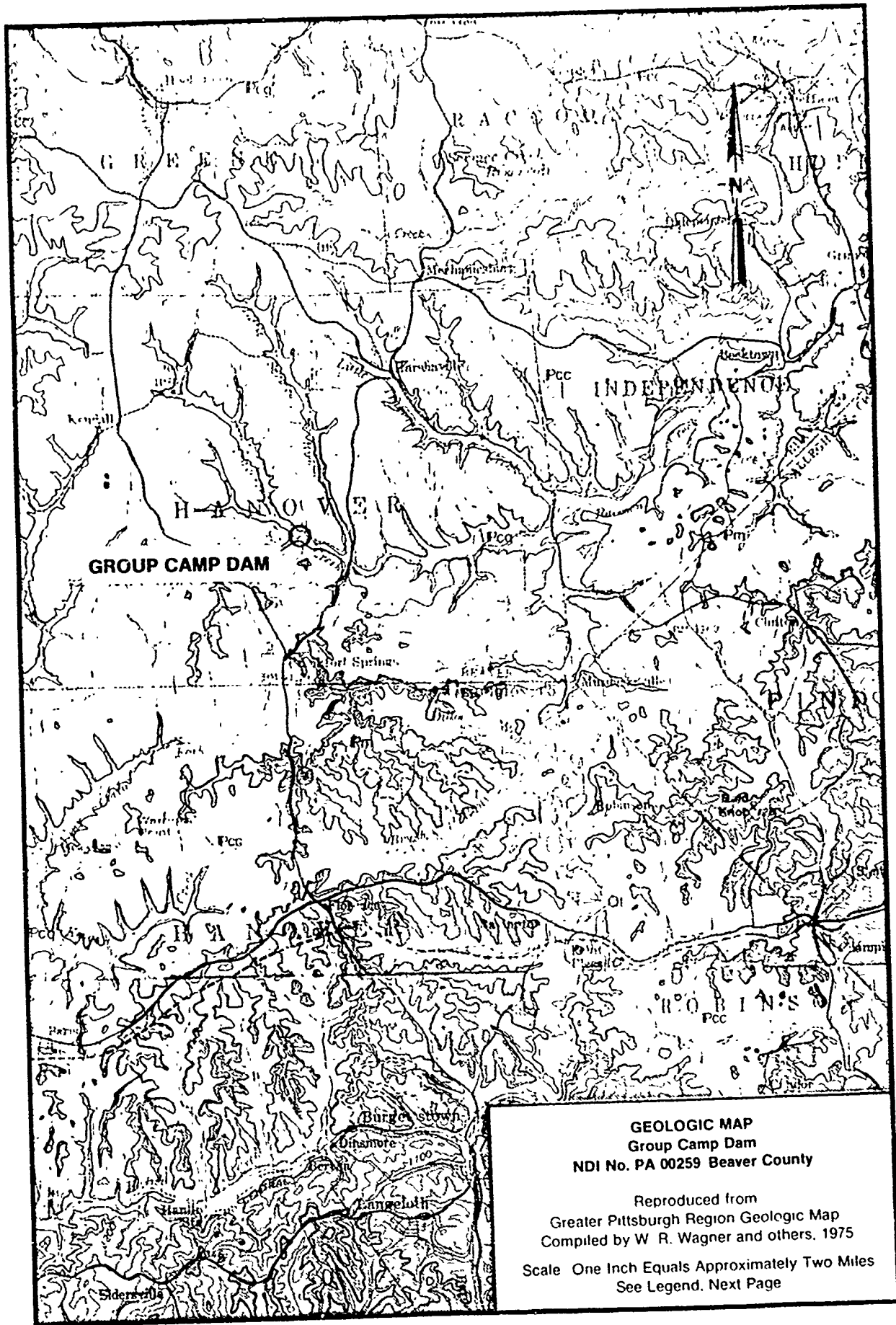
REGIONAL GEOLOGY

GROUP CAMP DAM
NDI No. PA 00259, PennDER No. 4-31

REGIONAL GEOLOGY

The dam and reservoir are located in an unglaciated area of the Appalachian Plateaus Physiographic Province. Bedrock units below the dam are part of the Glenshaw Formation, Conemaugh Group, Pennsylvanian System. This formation consists of cyclic sequences of sandstone, shale, red beds, and thin limestone and coal. The Ames Limestone, which is the marker bed between the Glenshaw Formation and the overlying Casselman Formation, outcrops on the valley walls above the dam. Lying below the Ames Limestone is a unit known as the "Pittsburgh Red Beds" which consists of greenish-gray, red, and variegated clay shales. The dam is founded on these shales. These shales have been known to cause landslide problems in the Pittsburgh Region; however, the strata are only slightly dipping (60 to 80 feet per mile to the southeast) at the dam site and have not yet caused any problems.

The Upper Freeport Coal is located approximately 240 feet (Elevation 700 feet) below the dam and has not been mined in the area. The Pittsburgh Coal is located well above the dam site and is exposed along the hilltops south of Traverse Creek.



GEOLOGY MAP LEGEND

GROUP FORMATION

DESCRIPTION

	Alluvium	Oi	Sand, gravel, clay.
	Terrace deposits		Sand, clay, gravel on terraces above present rivers; includes Carmichaels Formation.
DUNKARD	Greene		Cyclic sequences of sandstone, shale, red beds, thin limestones and coals.
	Washington	Pw	Cyclic sequences of sandstone, shale, limestone, and coal; contains Washington coal bed at base.
	Waynesburg		Cyclic sequences of sandstone, shale, limestone and coal; contains Waynesburg coal bed at base.
MONONGAHELA		Pm	Cyclic sequences of shale, limestone, sandstone and coal; contains Pittsburgh coal bed at base.
CONEMAUGH	Casselman	Pcc	Cyclic sequence of sandstone, shale, red beds and thin limestone and coal.
	Ames		
	Glenshaw	Pcg	Cyclic sequences of sandstone, shale, red beds and thin limestone and coal; several fossiliferous limestone; Ames limestone bed at top.
ALLEGHENY	Vanport	Pa	Cyclic sequences of shale, sandstone, limestone, and coal; contains Brookville coal at base and Upper Freeport coal at top; within group are the commercial Vanport limestone and Kittanning and Clarion coals.
		Pa	
POTTSVILLE		Pp	Sandstone and shale; contains some conglomerate and locally mineable coal.
Mauch Chunk		Mmc	Red and green shale with some sandstone; contains Wymys Gap and Lovahanna limestones.
Pocono		Po	Sandstone and shale with Burgoon sandstone at top.