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NATIONAL DAM INSPECTION PROGRAM. HADLEY DAM (PA-489, NDI NUMBER--ETC(U)

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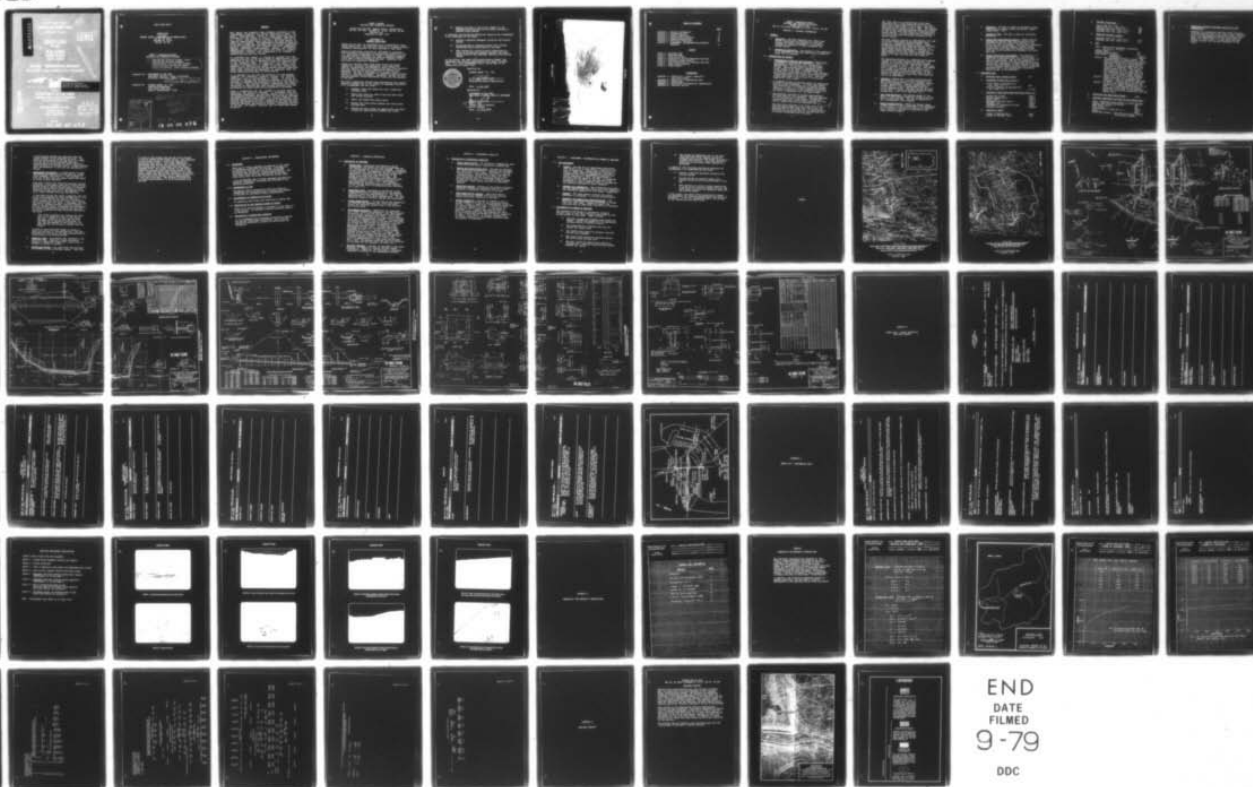
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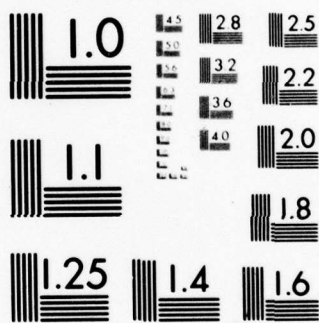
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OHIO RIVER BASIN

BRIDGES, PA., BERKELEY COUNTY

PENNSYLVANIA

HADLEY DAM

(PA 480)

NSN No. PA 88845

Project No. 43-52

NSN No. PA 480

LEVEL ^H

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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DEPARTMENT OF THE ARMY

Baltimore District, Corps of Engineers

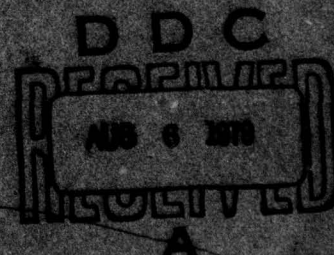
Baltimore, Maryland 21203

prepared by
MICHAEL BAKER, JR., INC.

Consulting Engineers

4801 Dutch Ridge Road

Beaver, Pennsylvania 15009



July 1979

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OHIO RIVER BASIN

HADLEY DAM
(PA 489)
MERCER COUNTY, COMMONWEALTH OF PENNSYLVANIA
NDI No. PA 00245
PennDER No. 43-52
SCS No. PA 489

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

6 National Dam Inspection Program. Hadley
Dam (PA-489, NDI Number PA-00245,
PennDER Number 43-52, SCS Number PA-489),
Ohio River Basin, Morrison Run, Mercer
County, Pennsylvania. Phase I Inspection Report,

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

10 Chuan Yuan / Chen

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PREFACE

This report was 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.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Hadley Dam (PA 489), Mercer County, Pennsylvania
NDI No. PA 00245, PennDER No. 43-52, SCS No. PA 489
Morrison Run
Inspected 27 April 1979

ASSESSMENT OF
GENERAL CONDITIONS

Hadley Dam (PA 489) is classified as an "Intermediate" size-"High" hazard dam. The structure consists of a zoned earthfill embankment approximately 750 feet long and 51 feet high.

Hydraulic/hydrologic evaluations, performed in accordance with procedures established by the Baltimore District of the U.S. Army Corps of Engineers for Phase I Inspection Reports, revealed that the spillways will pass the Probable Maximum Flood (PMF) without overtopping the dam. Therefore, the spillways are considered "adequate."

Taking into account those items noted during the visual inspection, available correspondence, prior inspection reports, calculations and information obtained from interviewing local Mercer County Soil Conservation Service (SCS) personnel, the dam is considered to be in good overall condition. The dam is situated in a somewhat remote location and has no operating equipment. Therefore, the dam has only received sporadic visits from Mercer County and SCS personnel in the past.

The visual inspection revealed some deficiencies that require remedial treatment but do not signify an emergency situation. It is recommended that the owner:

- 1) Regrade, treat and reseed the ruts, eroded and sloughed areas.
- 2) Remove the trash and debris from atop and around the intake structure.
- 3) Refill and reseed the rodent holes.
- 4) Replace the joint sealer between the outlet pipe and head wall.
- 5) Regrade the area around the impact basin and place a granular cushion/filter beneath the riprap.

- 6) Regrade the area in the outlet channel of the emergency spillway and provide proper drainage to prevent future piping.

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.

In the future, the owner should periodically inspect the embankment and concrete appurtenances and repair as necessary. It is also recommended that a log be kept of the inspections and repair work.

Submitted by:

MICHAEL BAKER, JR., INC.



C. Y. Chen
C. Y. Chen, Ph.D., P.E.
Engineering Manager-Geotechnical

Date: 9 July 1979

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

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

Date: 21 July 1979

HADLEY DAM



Overall View

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Appendix B - Check List - Engineering Data
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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
HADLEY DAM (PA 489)
NDI No. PA 00245, PennDER No. 43-52, SCS No. PA 489

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 - Hadley Dam, a floodwater retarding dam designed by the U.S. Department of Agriculture, Soil Conservation Service (SCS), is also known by its SCS number PA 489. The zoned earthfill embankment has a crest length of 750 feet, a maximum height of 51 feet, and a top width of 18 feet. The upstream side slope is 3H:1V (Horizontal to Vertical) with a 10-foot wide berm at El. 1108.0 feet. The downstream side slope is 2H:1V with a 10-foot wide berm at El. 1117.0 feet.

→ A foundation drain is provided under the downstream portion of the embankment. A 4-foot wide trench was excavated in the foundation to depths varying from 3 to 10 feet. A 12-inch diameter perforated drainpipe is provided in the foundation drain with its outlet discharging into the impact basin.

→ The principal spillway is located approximately 630 feet from the left abutment. The main features of the spillway are a pond drain, a reinforced concrete riser and a pipe conduit through the fill with an impact basin at the discharge end.

The pond drain consists of 52 linear feet of 24-inch corrugated metal pipe that drains into the upstream face of the riser unit. A cover plate is installed on the inside face of the upstream wall to prevent discharges from this pipe.

The riser unit is a concrete drop inlet type structure with a crest elevation of 1108.0 feet and a total crest width of 13.33 feet. The floor elevation of the riser is 1097.0 feet. Two concrete end walls and a concrete splitter beam are located on top of the riser and function as modified anti-vortex devices. A steel trash rack is fastened to the top of the riser to prevent blockage of the outlet conduit.

The pipe conduit consists of approximately 260 feet of 30-inch reinforced concrete pressure pipe placed on a reinforced concrete cradle. Eight reinforced concrete anti-seep collars are provided at intervals of 25 feet along the conduit. An impact basin energy dissipator is provided at the down gradient end of the conduit. Beyond the impact basin is a 20-foot long rock-lined channel which is 12 feet wide and has side slopes of 2H:1V.

The emergency spillway is a vegetated earth channel located in the right abutment of the dam. The channel is a 180-foot wide trapezoidal channel with side slopes of 3H:1V. The 30-foot wide level control section is at El. 1141.0 feet. The channel has a slope of 2 percent at the entrance and a 2.3 percent slope in the exit portion. An earth dike is provided along the inside slope of the channel to keep the flow away from the downstream toe of the embankment.

- b. Location - Hadley Dam is located on Morrison Run approximately 0.6 mile from its confluence with the Little Shenango River, Perry Township, Mercer County, Pennsylvania. Hadley, Pennsylvania is located about 2.0 miles downstream along the Little Shenango River. The dam site can be found on the USGS 7.5 minute quadrangle Greenville East, Pennsylvania, N 41° 25.5' and W 80° 15.1'.
- c. Size Classification - The maximum height of the dam is 51 feet and the reservoir volume to the dam crest is 840 acre-feet. The dam is therefore in the "Intermediate" size category.
- d. Hazard Classification - There are several homes located within 0.5 mile downstream of the embankment. In the event of a dam failure many lives could be lost; therefore, the dam is classified in the "High" hazard category.

- e. Ownership - The dam is owned by the Mercer County Commissioners, Mercer County Courthouse, Mercer, Pennsylvania 16137.
- f. Purpose of Dam - The dam is used for floodwater detention.
- g. Design and Construction History - Hadley Dam was designed by the SCS under the authority of the Watershed Protection and Flood Prevention Act, Public Law 566, as amended. The dam was constructed by the Foster Grading Company, Jackson Center, Pennsylvania from June 1967 through July 1968, with the winter shutdown from December 1967 until May 1968.
- h. Normal Operational Procedures - The reservoir is typically at the riser crest El. 1108.00 feet. There has reportedly been no major flood since the dam was constructed. The dam is inspected on a yearly basis according to procedures for SCS dams. Operational information is very limited as the dam is in a somewhat remote location, has no operating equipment and is only sporadically visited by Mercer County or SCS personnel.

1.3 PERTINENT DATA

- a. Drainage Area (square miles) - 4.6
- b. Discharge at Dam Site (c.f.s.) -
 Outlet Works at Maximum Pool
 (El. 1148.7 ft.) - 128
 Spillway Capacity at Maximum Pool
 (El. 1148.7 ft.) - 11,133
- c. Elevation (feet above Mean Sea Level [M.S.L.]) -
 Design Top of Dam - 1148.7
 Maximum Design Pool - 1145.9
 Riser Crest - 1108.0
 Emergency Spillway Crest - 1141.0
 Sediment Pool - 1108.0
 Streambed at Centerline of Dam - 1098+
 Maximum Tailwater - Unknown
- d. Reservoir (feet) -
 Length of Maximum Pool - 3200
 Length of Sediment Pool - 1200

e. Storage (acre-feet) -

Top of Dam (El. 1148.7 ft.) -	820
Maximum Pool (El. 1145.9 ft.) -	695
Spillway Crest (El. 1141.0 ft.) -	568
Sediment Pool (El. 1108.0 ft.) -	25

f. Reservoir Surface (acres) -

Spillway Crest (El. 1141.0 ft.) -	29.5
Sediment Pool (El. 1108.0 ft.) -	4.8

g. Dam -

Type - Zoned earth embankment containing
112,124 c.y. of fill

Length (feet) -	750
Maximum Height (feet) -	51
Side Slopes - Upstream -	2.91H:1V
Downstream -	1.94H:1V

Zoning - The embankment contains 4 zones. The upstream slope is constructed of well to poorly graded gravels with gravel-sand mixtures, little or no fines (GM-GP). The cutoff trench and impervious zone consists of inorganic clays of low to medium plasticity (CL). The center zone consists of silty sands (SM) and the downstream zone is constructed of well to poorly graded sands, gravelly sands with little or no fines (SM-SP).

Cutoff - Compacted earth with a maximum base width of 20 feet in foundation and lower abutments. Constructed of CL material.

Drains - A 4-foot wide trench excavated in the foundation to depths varying from 3 to 10 feet. A 12-inch diameter perforated drainpipe is provided in the foundation drain with its outlet discharging into the impact basin.

h. Diversion and Regulating Tunnel - None

i. Spillway (Emergency Spillway in SCS Terminology) -

Type - Vegetated earth channel in right abutment	
Length (feet along centerline) -	800
Base Width (feet) -	180
Side Slopes -	3H:1V
Crest Elevation (feet M.S.L.) -	1141.0
Gates -	None
Downstream Channel - Spillway exits into 15-foot wide natural channel	

i. Regulating Outlets (Principal Spillway in SCS Terminology) -

Consists of a reinforced concrete riser structure, with the overflow weir at El. 1108.0 feet, connected to the 30-inch diameter reinforced concrete outlet pipe. The downstream end of the outlet pipe has invert El. 1092.0 feet. A cover plate has been bolted in place over the pond drainpipe in the riser.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Hadley Dam was designed by the SCS. Design data included in this report were obtained from:

- 1) SCS Drawings No. PA-489-P, "Little Shenango River Watershed, Floodwater Retarding Dam PA-489, Mercer County, Pennsylvania," 17 Sheets, designed 1966, "as built" 1968. (Copies of Sheets 3, 4, 6, 7 and 12 are included in this report as Plates 3-7; prints of other sheets are available in Pennsylvania Department of Environmental Resources' ±PennDER1 and SCS's files.)
- 2) Dam Permit Application Report prepared by the Pennsylvania Department of Forests and Waters (predecessor of PennDER) on 10 May 1966.
- 3) "Design Report, Site PA 489, Little Shenango Watershed, Pennsylvania," by the SCS.

2.2 CONSTRUCTION

Chronological information concerning the construction of Hadley Dam was not available; however, some information such as start and stop dates were obtained from PennDER's files and the Mercer County Conservation District office. During the construction of the dam, the SCS provided full-time inspection. A representative of the Pennsylvania Department of Forests and Waters (now PennDER) made periodic visits to the dam during construction. Memoranda and black and white photographs of these visits are also available in PennDER's files.

2.3 OPERATION

Hadley Dam is normally at the sediment pool level throughout the year. The Mercer County Conservation District personnel are responsible for scheduling maintenance and inspections for the Mercer County Commissioners.

2.4 EVALUATION

- a. Availability - The information reviewed consisted of PennDER's file on the dam along with information from the Mercer County Conservation District office.
- b. Adequacy - The information available is 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 visual inspection of Hadley Dam was made on 27 April 1979. No unusual weather conditions were experienced and the lake was at El. 1108.7 feet; therefore, 0.7 feet of water was flowing over the riser crest. The dam and its appurtenances were found to be in good overall condition at the time of inspection. Noteworthy deficiencies observed are described briefly in the following paragraphs. The visual inspection check list and field sketch are given in Appendix A.
- b. Dam - There were several superficial deficiencies noted during the visual inspection of the embankment. The majority of these problems were erosion ditches and ruts. The erosion ditches were formed by surface runoff; the ruts were caused by vehicular traffic on the crest and the downstream face (see field sketch for location). Rodent holes were also found at two locations on the upstream face. Sloughing was noted on the downstream face between the crest and the 10-foot wide bench. This sloughing did not appear to be recent and therefore probably occurred soon after construction and before the ground cover had grown enough to prevent movement.

Along the downstream toe of the embankment there were several wet areas noted. According to the rain gaging station at Pymatuning State Park, the local area had received 1.09+ inches of rain from 8:00 AM 26 April 1979 through 8:00 AM 27 April 1979 (the date of our inspection). Due to the rain prior to the inspection, it is assumed that the wet areas were a result of runoff rather than seepage through the dam. In an attempt to verify the assumption, a site visit was performed on 5 June 1979; however, our efforts were thwarted by a heavy rain on this date also.

A minor seepage area was located below the downstream toe just to the left of the impact basin. The flow from the area was very small (estimated at less than 5 g.p.d.) and no evidence of piping was observed in the area. Although the seepage is considered minor at the present time, the area should be checked during future inspections.

A large piping problem was observed along the outlet channel of the emergency spillway. The materials have piped out at the mouth of a small rill at the end of the emergency spillway. Although this piping does not affect the structural integrity of the dam itself, it does indicate that the materials in the area are susceptible to piping.

- c. Appurtenant Structures - A large amount of trash and debris was found around and atop the intake riser assembly (see Photo 1). The concrete in both the intake riser and impact basin were noted as being in good condition.

Some minor erosion has occurred along the outside perimeter of the impact basin and a sink hole has formed directly behind the head wall of the basin. This hole may be due to fines washing out from behind the outlet pipe due to the absence of the joint sealer between the pipe and head wall.

It was noted during the visual inspection that the outlet pipe extended out from the head wall 2 to 3 inches at the top and was flush at the bottom. After checking the "as built" plans, which showed the pipe and head wall flush, a telephone call was made to Mr. Richard Crowley, District Conservationist, Mercer County, concerning the discrepancy. Mr. Crowley discussed the problem with the construction inspector and the following explanation was given:

"The normal procedure for forming the head wall is to plumb the forms to the top of the pipe. However, on this dam (PA 489), the pipe has an unusually high grade, so the form was plumbed to the bottom of the pipe and the top allowed to extend from the forms."

If this is true (and there seems no reason to doubt the validity of the explanation), the pipe and head wall are now in the same configuration as constructed and no problem exists.

- d. Reservoir Area - No problems were observed in the reservoir area. Reservoir slopes are gently sloping to moderately steep with a good cover of grasses or stands of forests.
- e. Downstream Channel - No significant obstructions are located in the downstream channel. The first

0.5 mile of the stream from the dam flows through a heavily wooded narrow stream valley. The remainder of the stream valley is wider and consists of relatively open areas. The slopes immediately downstream from the dam are relatively steep. As the stream nears its confluence with the Little Shenango River, the slopes flatten out and remain moderately sloping along the entire length of the river. There are three homes located in low lying areas between the dam and the confluence of Morrison Run and the Little Shenango River (approximately 1 mile below the dam). The Borough of Greenville is located approximately 10 miles downstream from the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal emergency procedures in the event of impending catastrophe for the dam. According to provisions by the SCS, the dam should be checked following each occurrence of heavy precipitation. The pond drain outlet pipe has been sealed by bolting a cover plate over its outlet within the intake riser.

It is recommended that a formal emergency procedure be prepared, prominently displayed and furnished to all operating personnel.

4.2 MAINTENANCE OF DAM

The Mercer County Conservation District office is responsible for the scheduling of routine maintenance of the dam for the Mercer County Commissioners.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities were installed at Hadley Dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system or procedure in the event of a dam failure. An emergency warning procedure should be developed.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

It is recommended that personnel periodically examine the dam and appurtenant structures, and a routine preventive maintenance schedule be established and documented.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

- a. Design Data - Hydrologic and Hydraulic design calculations for Hadley Dam were obtained from the SCS "Design Report" on file with PennDER. According to SCS criteria, the emergency spillway and freeboard hydrographs were developed and routed through the reservoir to establish the elevations of the design high water and crest of the dam. The emergency spillway hydrograph was developed using a 6-hour rainfall of 9.3 inches resulting in a peak discharge of 5948 c.f.s. The freeboard hydrograph was developed using a 6-hour rainfall of 18.7 inches with a corresponding peak discharge of 11,443 c.f.s.
- b. Experience Data - According to the Mercer County Conservation District Representative, the maximum reservoir stage was approximately El. 1126 feet or approximately 18 feet above sediment pool. No other reservoir stage or rainfall records are maintained.
- c. Visual Observations - At the time of the inspection, no condition was observed that could seriously affect the discharge capabilities of the spillway and outlet works.
- d. Overtopping Potential - Hadley Dam is classified as a "High" hazard-"Intermediate" size dam requiring evaluation for a spillway design flood (SDF) equal to the Probable Maximum Flood (PMF). The outlet works and spillway consist of a typical SCS concrete riser and a vegetated earth channel. The hydrologic and hydraulic capabilities of the dam were evaluated by routing the PMF through the reservoir with the aid of the U.S. Army Corps of Engineers' Flood Hydrograph Package, HEC-1. The PMF hydrograph developed as a part of this analysis had a peak discharge of 5777 c.f.s. using a 6-hour Probable Maximum Precipitation (PMP) of 21.9 inches. The results of this routing indicate that the reservoir and spillways are capable of passing the PMF with a maximum reservoir level of El. 1146.1 feet, which is approximately 2.6 feet below the minimum top of dam. The maximum discharge from the reservoir, as indicated by this analysis, is 5760 c.f.s.
- e. Spillway Adequacy - The dam, as outlined in the above analysis, is capable of passing the PMF without overtopping. Therefore, the spillway is 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 Hadley Dam.
- b. Design and Construction Data - The dam was designed and constructed according to standard SCS procedures for structures of this type. According to the SCS "Design Report," the upstream slope of the dam has a minimum safety factor of 1.32 under full draw-down conditions and the downstream slope has a minimum safety factor of 1.52 under steady seepage conditions. These safety factors are considered adequate.
- c. Operating Records - Nothing in the readily available operating information indicates cause for concern relative to structural stability of the dam.
- d. Post-Construction Changes - There have been no post-construction changes which would adversely affect structural 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 an area of very low seismic activity. As indicated in paragraph 6.1.b., Hadley Dam could be shown to meet the static stability requirements set forth by the "Recommended Guidelines for Safety Inspection of Dams." As a result, no further consideration of seismic stability is considered necessary under the present circumstances.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

- a. Safety - The dam and its appurtenant structures were found to be in good overall condition at the time of inspection. Hadley Dam is evaluated as being a "High" hazard-"Intermediate" size dam in accordance with the "Recommended Guidelines for Safety Inspection of Dams" and should have a spillway capacity equal to the PMF. As presented in Section 5, the spillway and reservoir were determined to have a capacity equal to the PMF and are therefore assessed as being "adequate."
- b. Adequacy of Information - The information available and the observations made during the field inspection are considered adequate for this Phase I Inspection.
- c. Urgency - The owner should initiate the action discussed in paragraph 7.2 as soon as practicable.
- d. Necessity for Additional Data/Evaluation - The hydraulic/ hydrologic analysis performed in connection with this Phase I Inspection Report has indicated that no additional evaluation is necessary.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection and review of information revealed certain items of work which should be performed as soon as practicable by the owner. These include:

- 1) The ruts, eroded and sloughed areas should be graded, treated and seeded with an appropriate seeding mixture to prevent erosion.
- 2) The trash should be removed from atop and around the intake riser.
- 3) The rodent holes should be properly refilled and the area reseeded.
- 4) The joint sealer should be replaced between the outlet pipe and head wall.
- 5) The area around the impact basin should be regraded and a granular cushion/filter placed beneath the riprap.

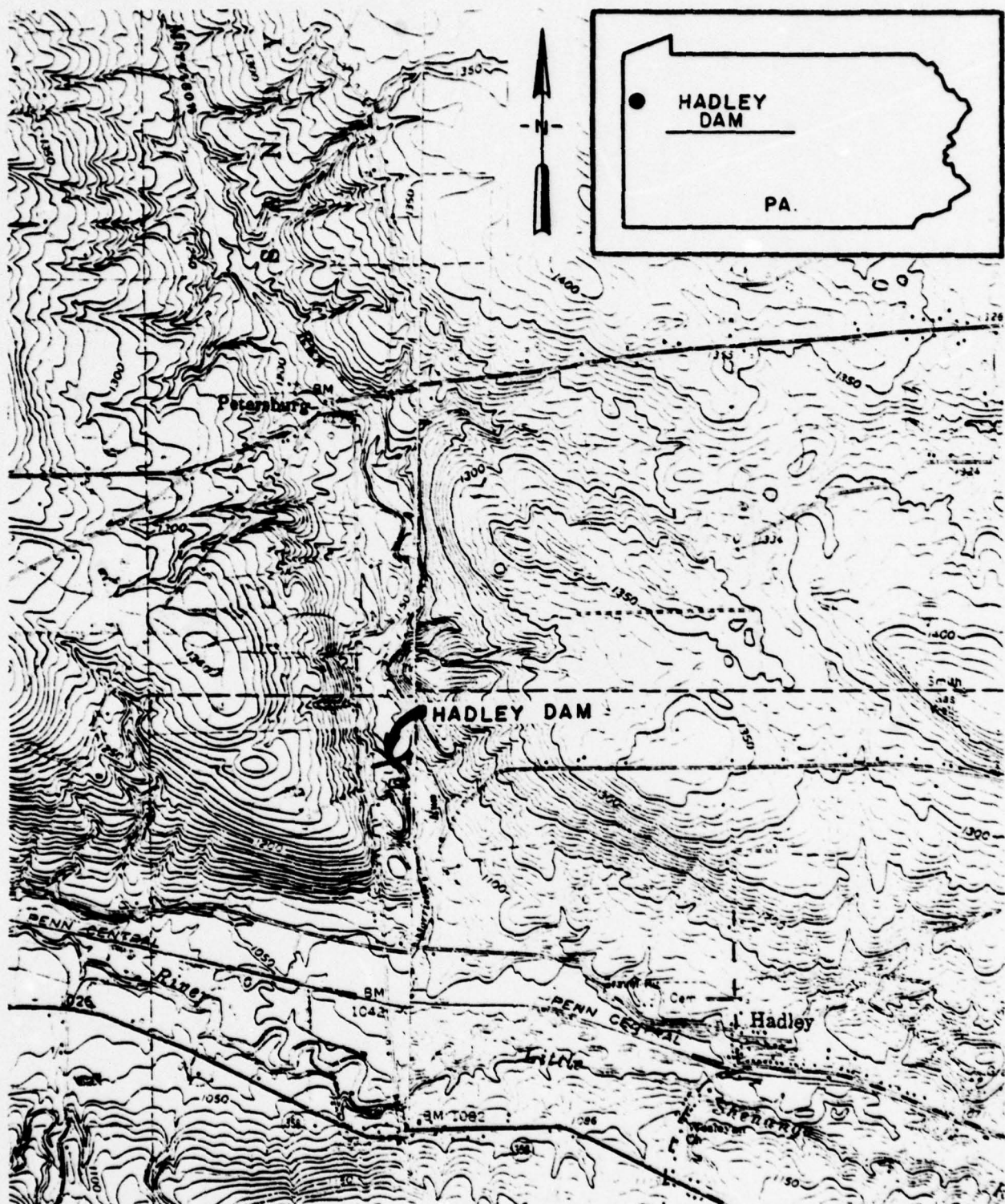
- 6) The marshy and depressed area in the emergency spillway outlet channel should be regraded and provided with proper drainage to prevent future piping. This area should be monitored in the future after repairs are performed.

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.

In the future, the owner should periodically inspect the embankment and concrete appurtenances and repair as necessary. It is also recommended that a log be kept of the inspections and repair work.

PLATES



SCALE 1:24000

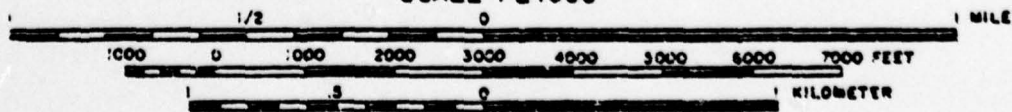


PLATE I LOCATION PLAN
HADLEY DAM

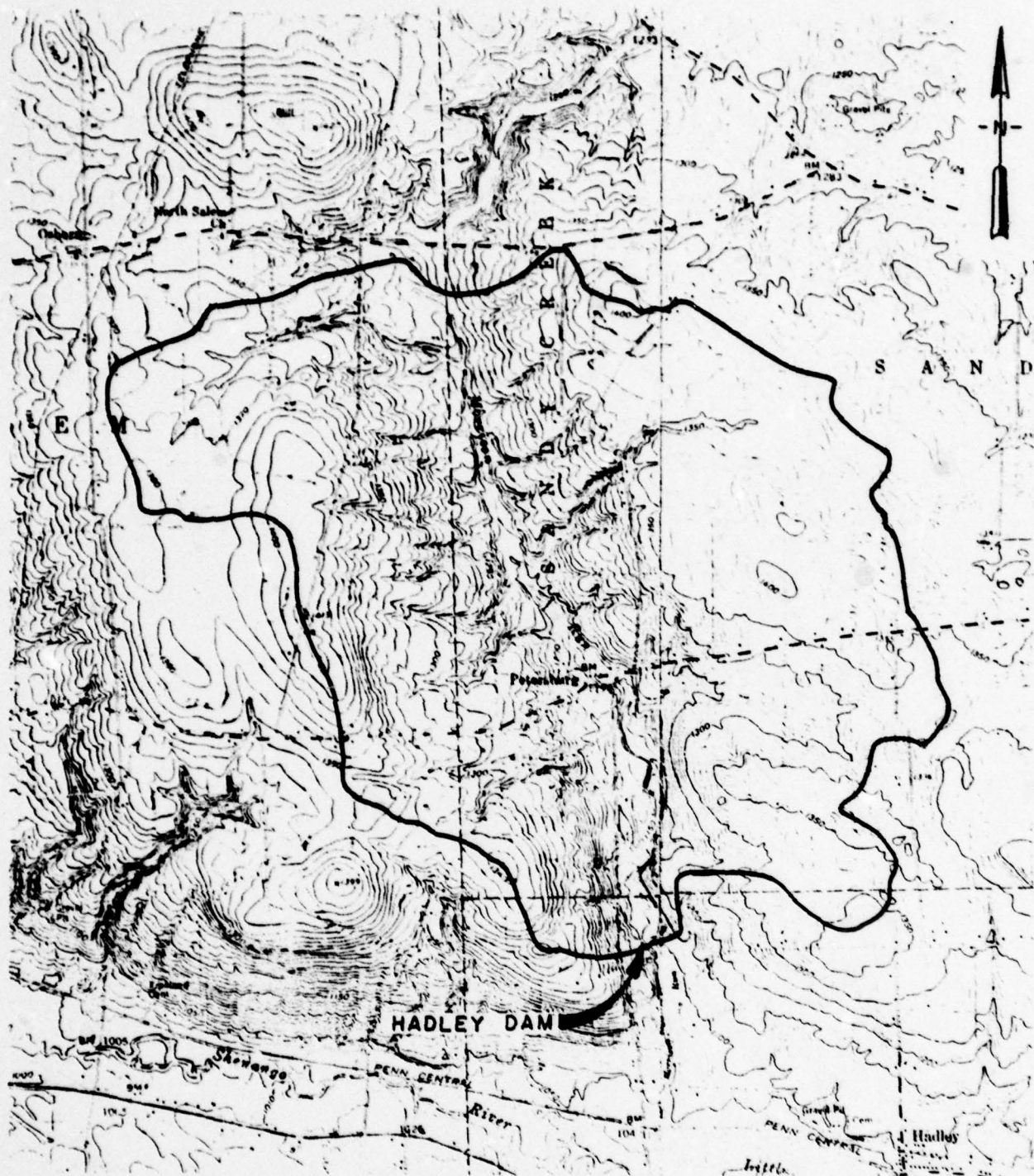
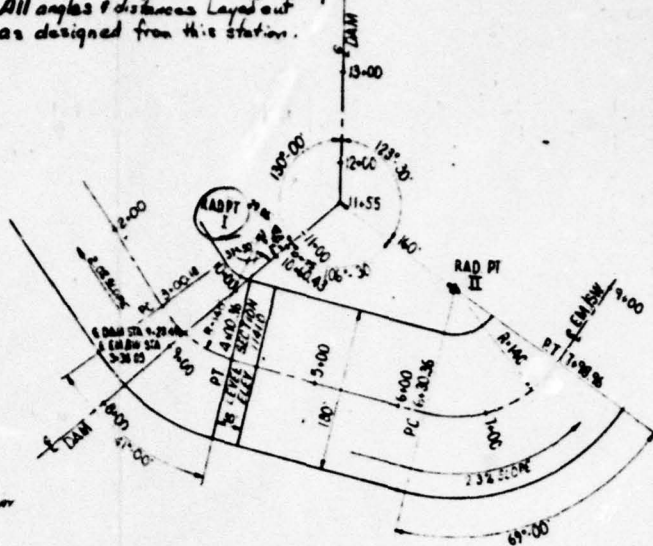
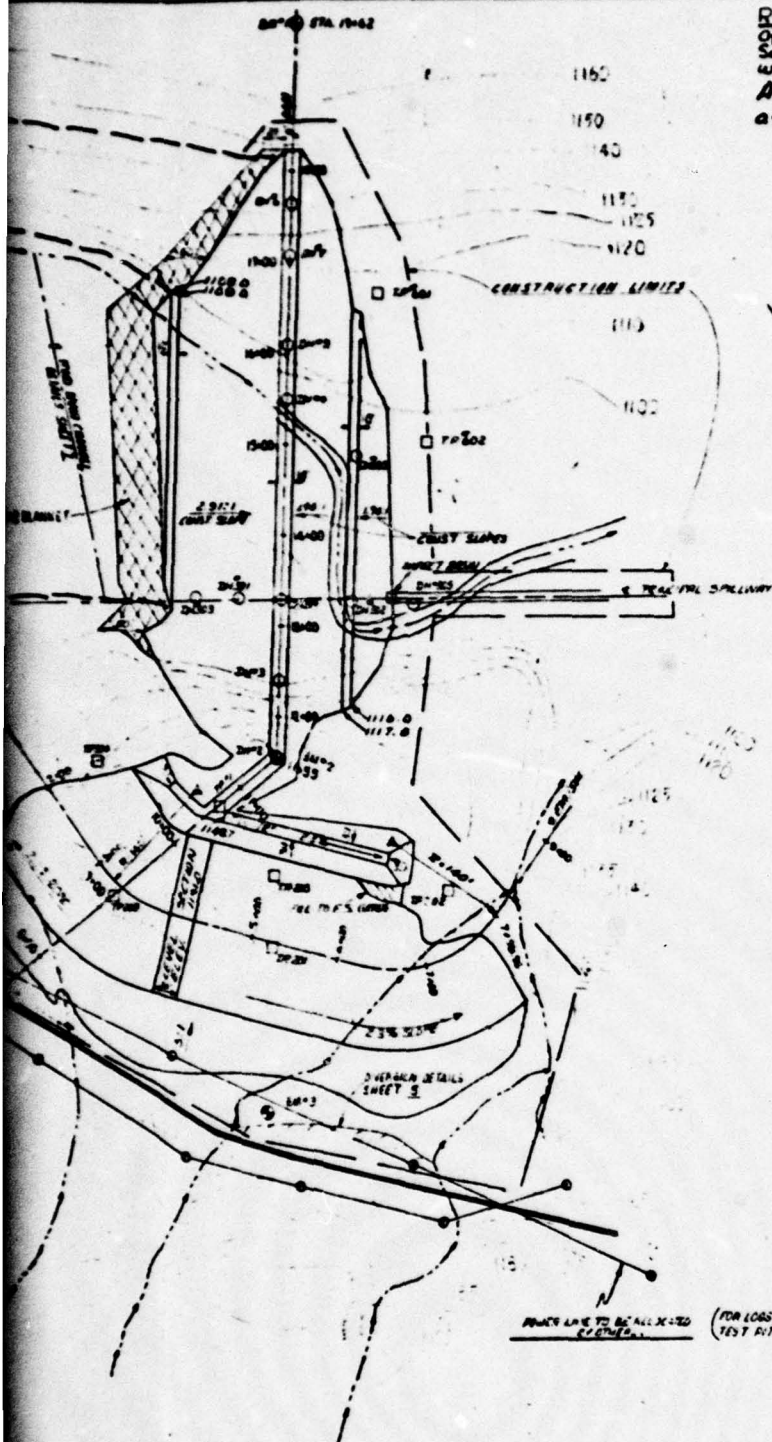


PLATE 2 WATERSHED MAP
HADLEY DAM

RAD PT I -
Offset from E Sta 10+75
So that top of Em. Sp. cut
would not infringe on road Right of Way.
All angles & distances Layed out
as designed from this station.



LAYOUT OF EMERGENCY SPILLWAY 2

EMERGENCY SPILLWAY CURVE DATA

CURVE I (ENTRANCE)

STATION	DEFLECTION Δ	CHORD
PC 3+10.12	0°-00'	
3+20.22	4°-06'	20.02'
3+40.25	8°-12'	20.02'
3+60.24	12°-18'	20.02'
3+80.33	16°-24'	20.02'
PT 4+00.36	20°-30'	20.02'

CURVE II (EXIT)

STATION	DEFLECTION Δ	CHORD
PC 6+30.36	0°-00'	
6+47.22	3°-21'	16.85'
6+64.08	6°-54'	16.85'
6+80.94	10°-21'	16.85'
6+97.80	13°-48'	16.85'
7+14.66	17°-15'	16.85'
7+31.52	20°-42'	16.85'
7+48.38	24°-09'	16.85'
7+65.24	27°-36'	16.85'
7+82.10	31°-03'	16.85'
PT 7+98.96	34°-30'	16.85'

I = 41°-00'
R = 140'
T = 52.34'
L = 100.18'
C = 16.06'
M = 8.87'
E = 9.47'
PC = 3+10.12
PT = 4+00.36

I = 69°-00'
R = 140'
T = 76.22'
L = 166.60'
C = 158.94'
M = 24.62'
E = 24.85'
PC = 6+30.36
PT = 7+98.96

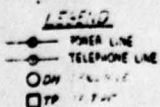
AS BUILT PLANS 2

PLATE 3

LITTLE SHENANGO RIVER WATERSHED
FLOODWATER RETARDING DAM PA-489
MERCER COUNTY, PENNSYLVANIA
PLAN OF DAMSITE

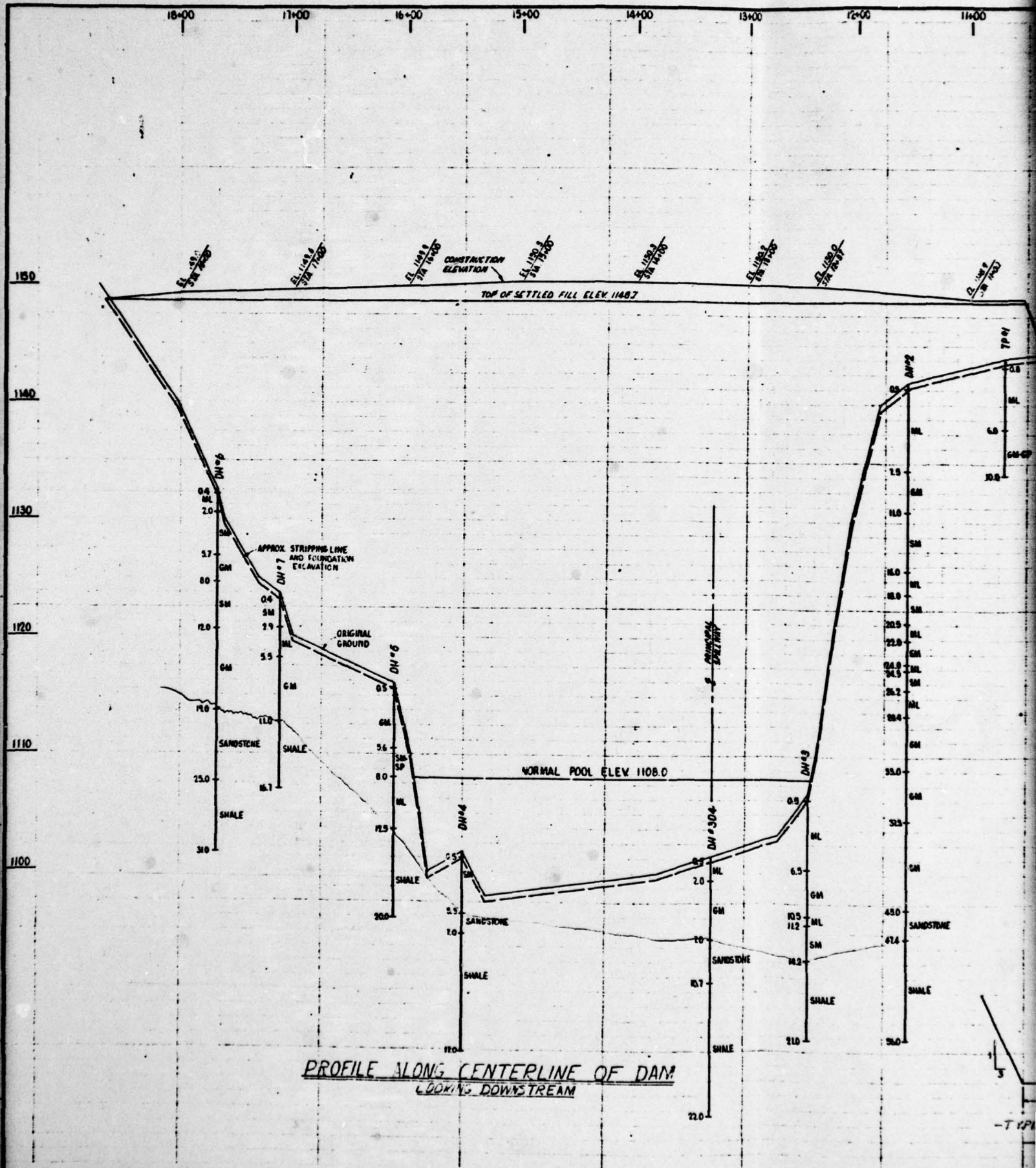
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

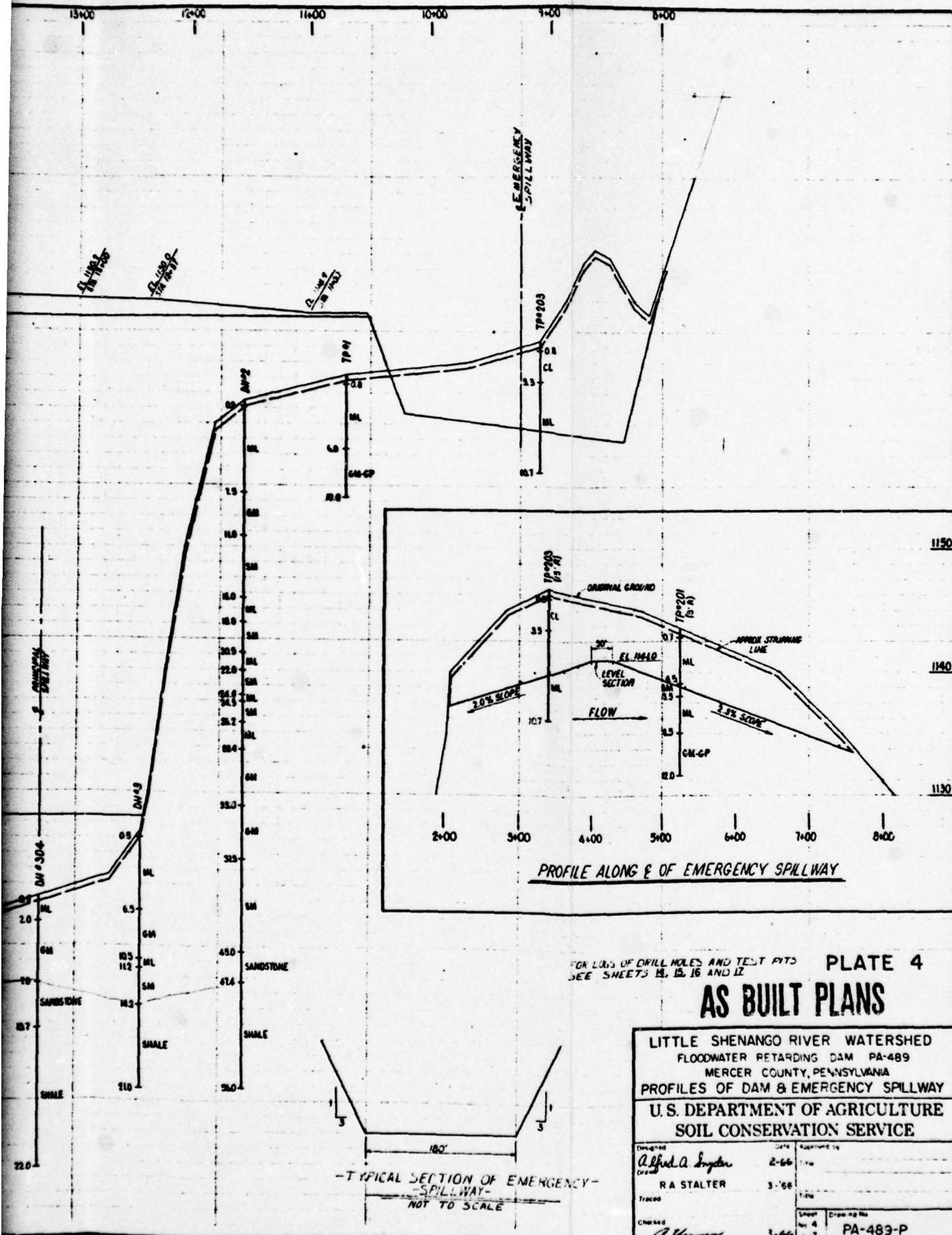
Designed by *Arthur J. Ingber* 2-66
R. A. STALTER 3-66
James H. Hill 3-66
PA-489-P



TYPICAL SECTION OF EMERGENCY SPILLWAY
AND DIKE
LOOKING DOWNSTREAM
(5'-10" SCALE)

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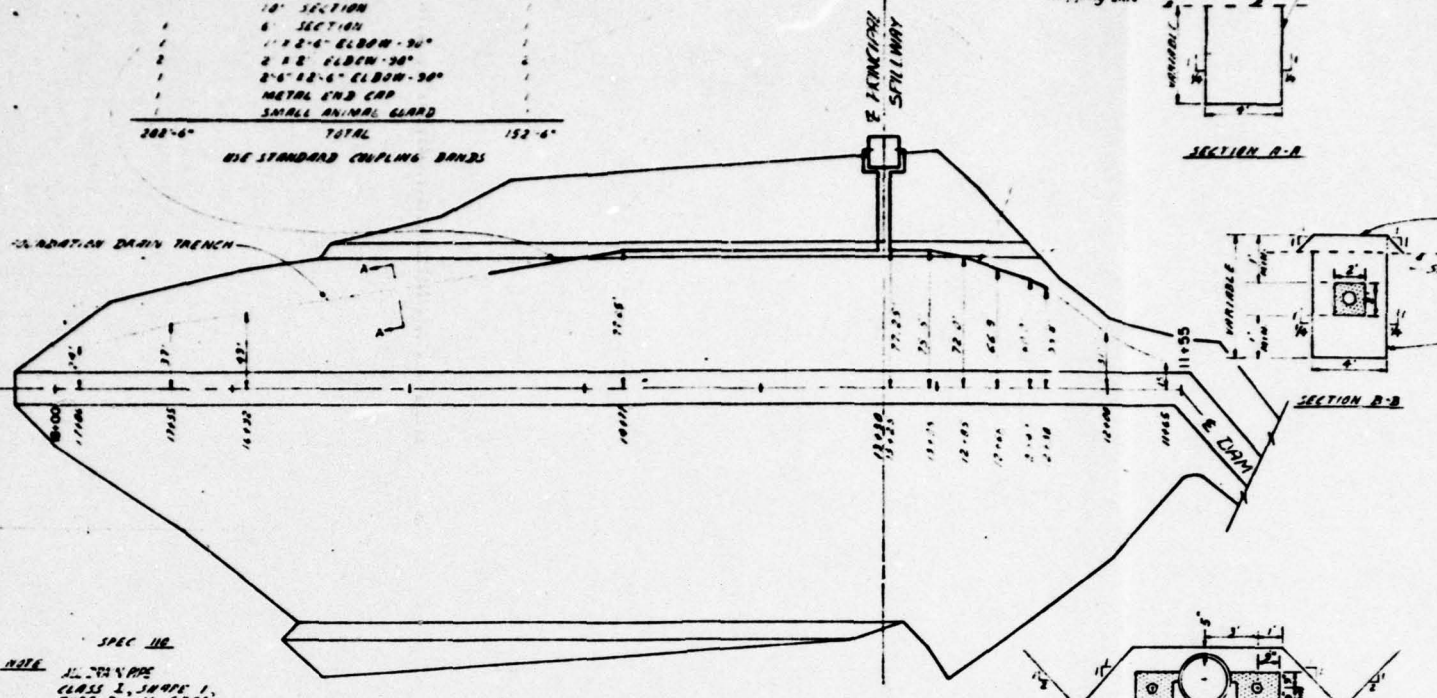




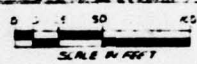
THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DOC

12" 2" 4" DRAIN PIPE (CORROSION RESISTANT)		
QUANTITY	ITEM	QUANTITY
SECTION NO./LN		RIGHT OF RR, 3M
13	20' SECTION	6
1	10' SECTION	1
1	6' SECTION	1
1	1" 2" 4" ELBOW - 90°	1
2	2" 4" ELBOW - 90°	2
1	2" 4" 12" 4" ELBOW - 90°	1
1	METAL END CAP	1
1	SMALL ANIMAL GUARD	1
202'-6"	TOTAL	152'-6"

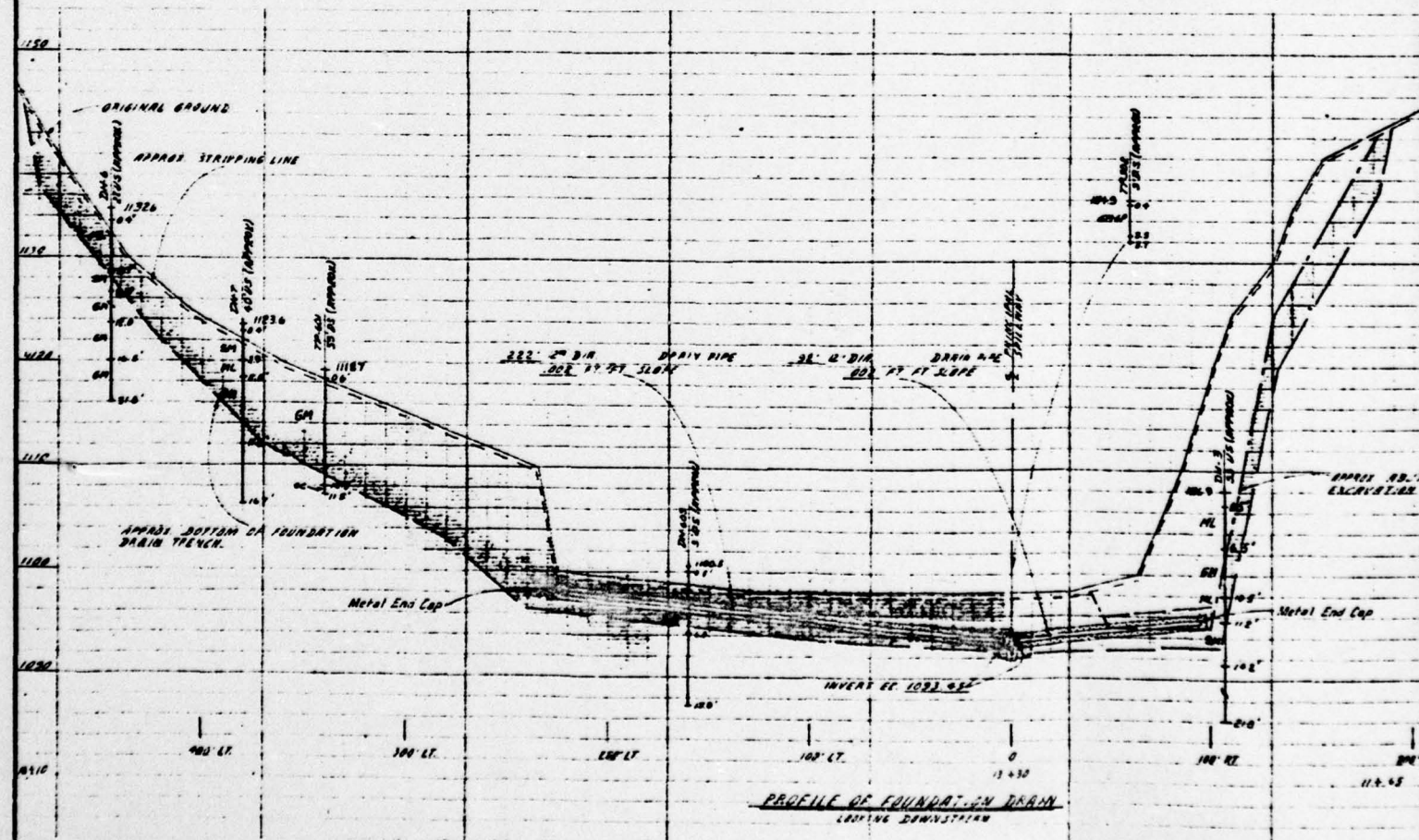
USE STANDARD COUPLING BANDS



PLAN VIEW OF FOUNDATION DRAIN

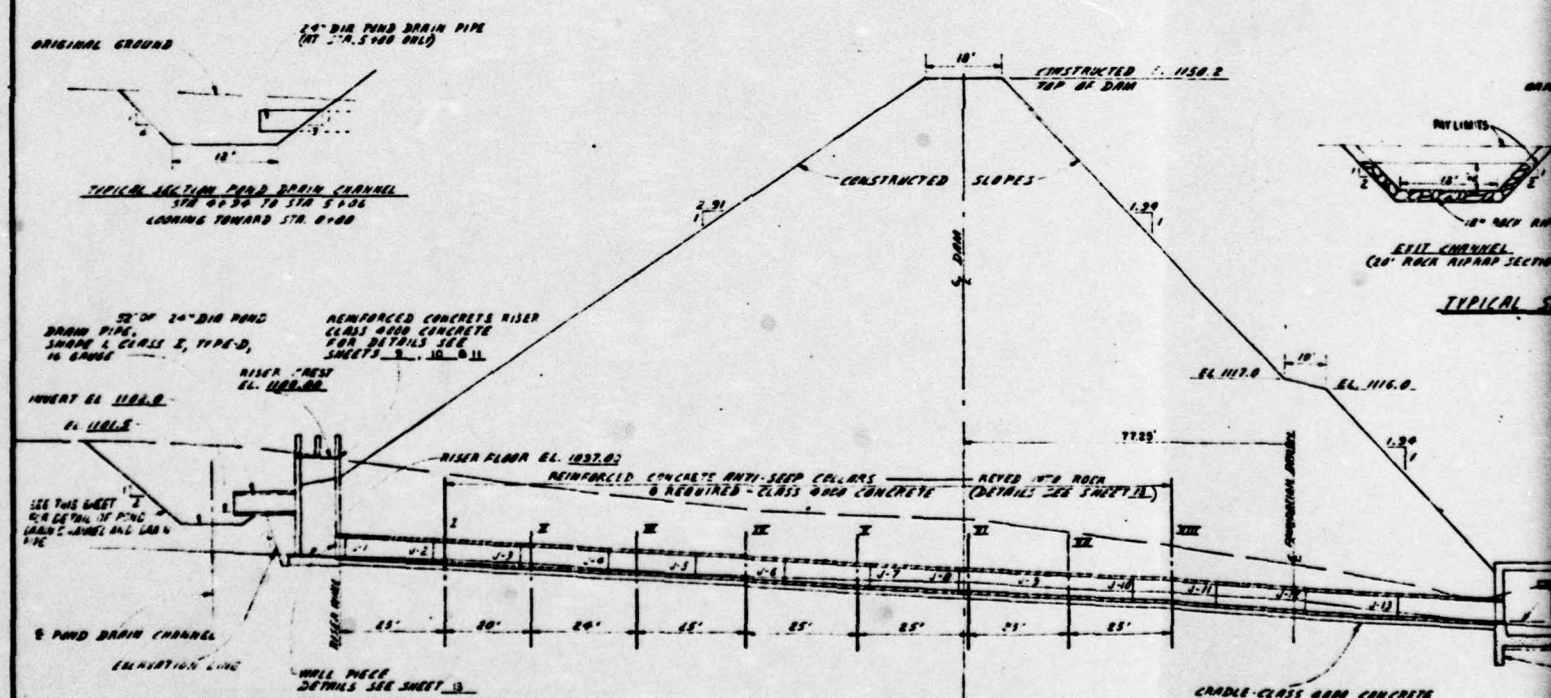
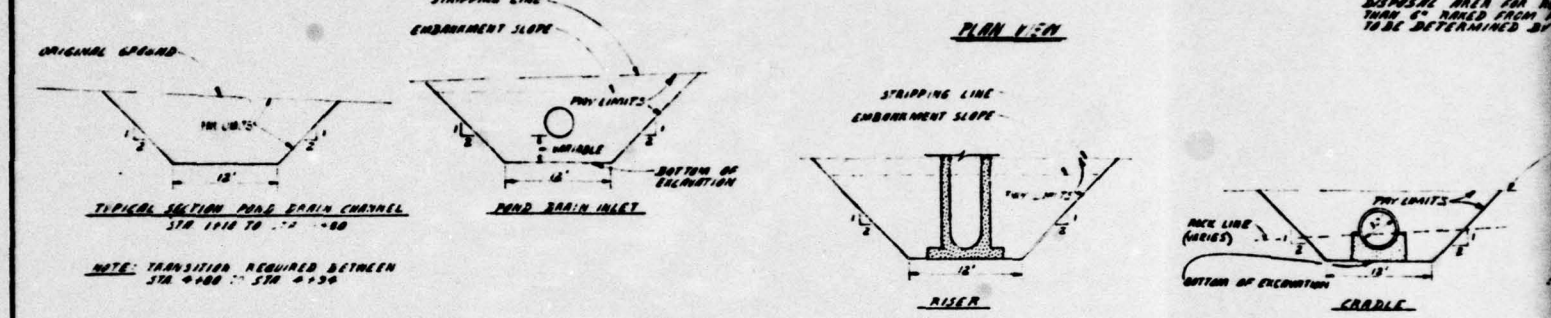
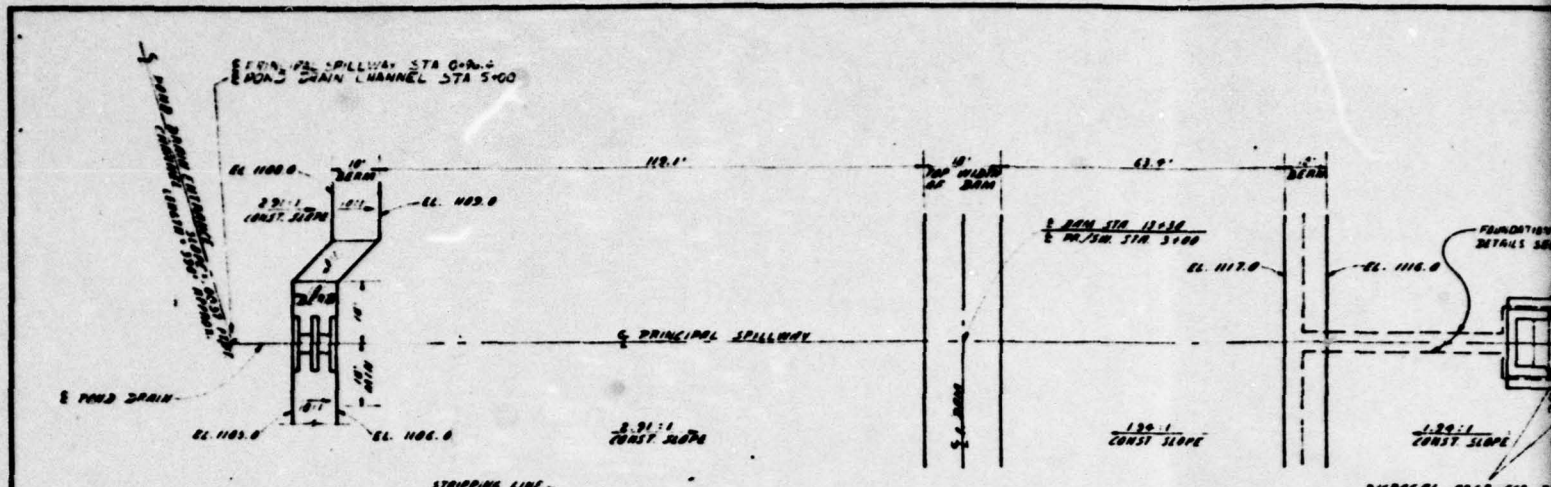


NOTE: ALUMINUM PIPE CLASS I, SHAPE 1, TYPE D, 16-GAGE



PROFILE OF FOUNDATION DRAIN

Designation	Quantity
Save	2
5"	2
1 1/2"	2
1"	2
3/4"	2
1/2"	2
3/8"	2
1/4"	2
0"	2



PRINCIPAL SPILLWAY PIPE JOINT DATA - 30" S.D.

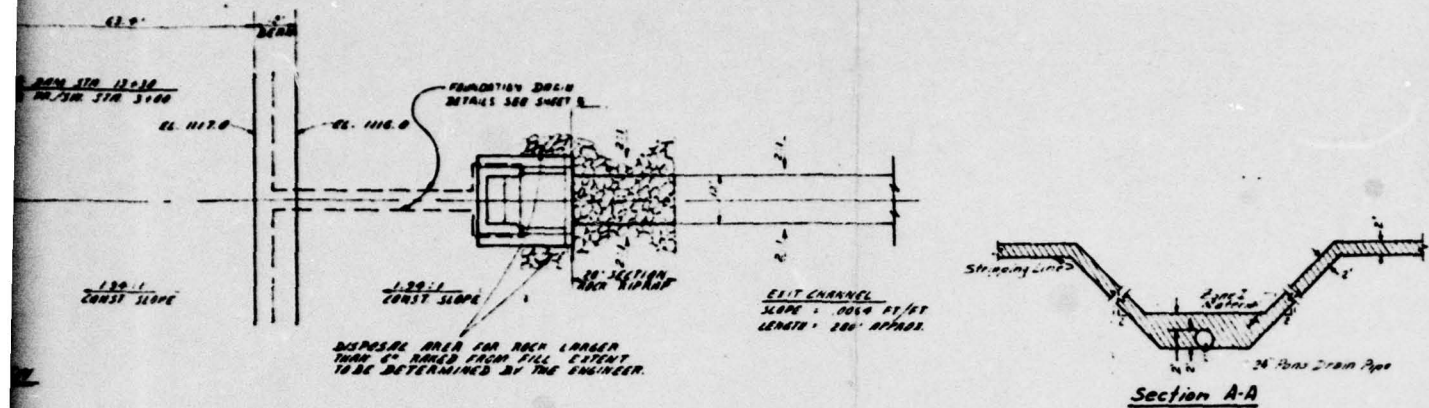
FOR 6 SECTIONS OF PIPE	FOR 20 SECTIONS OF PIPE
JOINT	JOINT
1-1	1-1
2-2	2-2
3-3	3-3
4-4	4-4
5-5	5-5
6-6	6-6
7-7	7-7
8-8	8-8
9-9	9-9
10-10	10-10
11-11	11-11
12-12	12-12
13-13	13-13
14-14	14-14
15-15	15-15
16-16	16-16
17-17	17-17
18-18	18-18
19-19	19-19
20-20	20-20
21-21	21-21
22-22	22-22
23-23	23-23
24-24	24-24
25-25	25-25
26-26	26-26
27-27	27-27
28-28	28-28
29-29	29-29
30-30	30-30

PRINCIPAL SPILLWAY ANTI-SEEP COLLAR DATA

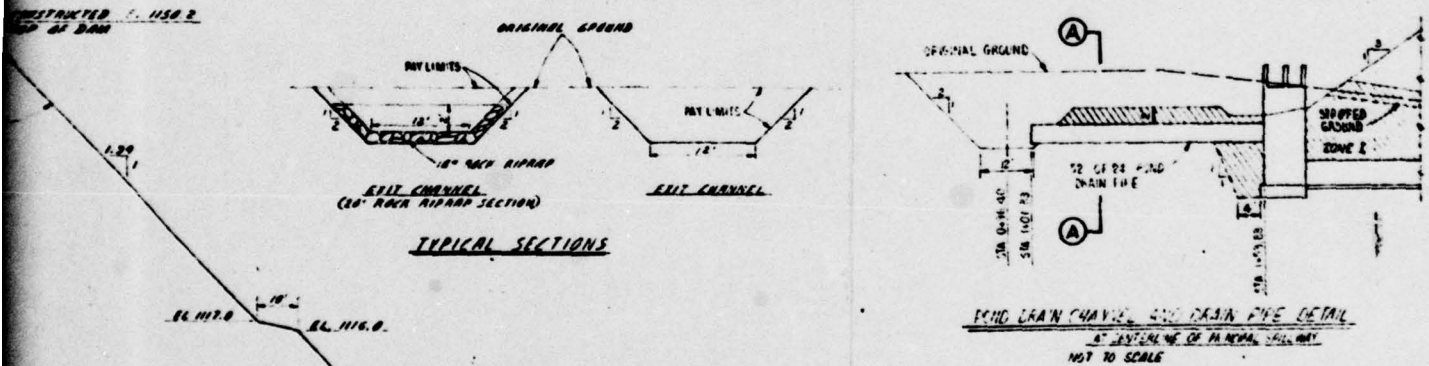
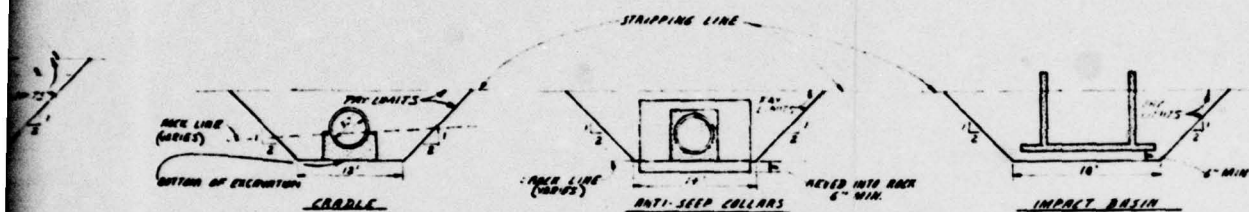
FOR 16 SECTIONS OF PIPE	FOR 20 SECTIONS OF PIPE
COLLARA	COLLARA
1-1	1-1
2-2	2-2
3-3	3-3
4-4	4-4
5-5	5-5
6-6	6-6
7-7	7-7
8-8	8-8
9-9	9-9
10-10	10-10
11-11	11-11
12-12	12-12
13-13	13-13
14-14	14-14
15-15	15-15
16-16	16-16
17-17	17-17
18-18	18-18
19-19	19-19
20-20	20-20
21-21	21-21
22-22	22-22
23-23	23-23
24-24	24-24
25-25	25-25
26-26	26-26
27-27	27-27
28-28	28-28
29-29	29-29
30-30	30-30

30" INSIDE DIA. 16 - 16" SECTIONS 1 - 9 SECTION 1 - WALL PIECE FOR PRESSURE HEAD LOAD = 5,000 LBS MIN. 2 EDGE REIN. 0.01" CRACK 0.001" CRACK TOTAL LENGTH = 1.00' NOTE: IMPACT 30 DIA.

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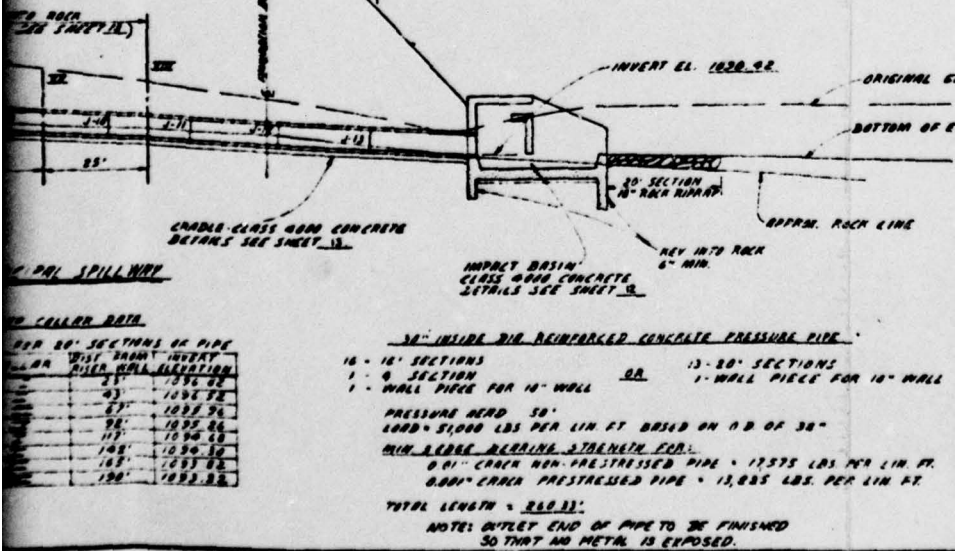


Section A-A



NOTES: PLAN AND PROFILE FOR PRINCIPAL SPILLWAY SHOWN ARE BASED ON DATA FOR 20' SECTIONS OF CONDUIT. ALL ROCK RIPRAP IS TO BE IN THIS SPILLWAY EQUIPMENT PLANT.

AS BUILT PLANS NOT TO SCALE PLATE 6

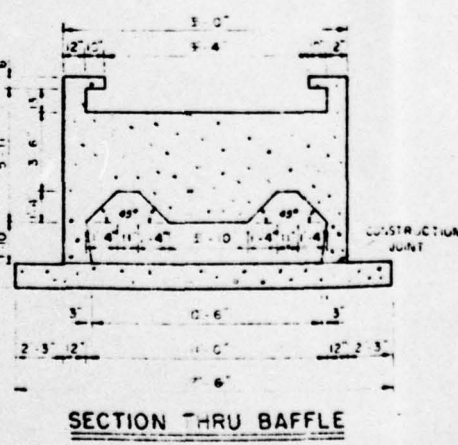
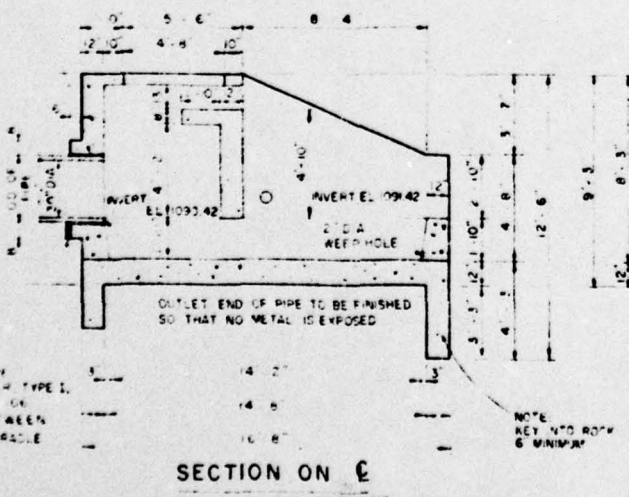
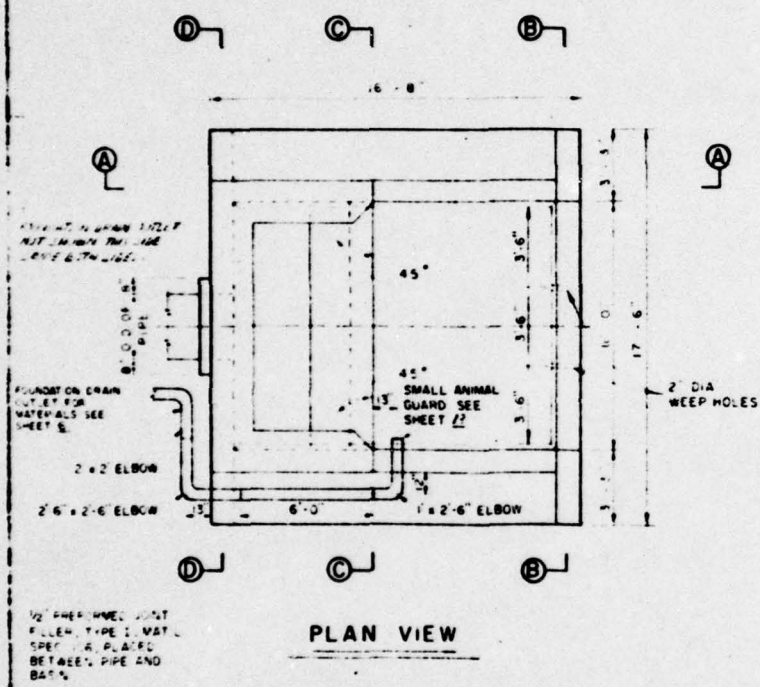
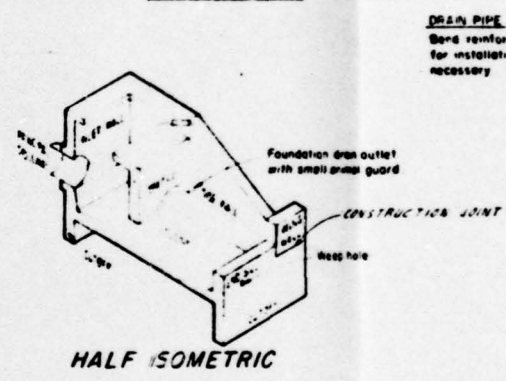
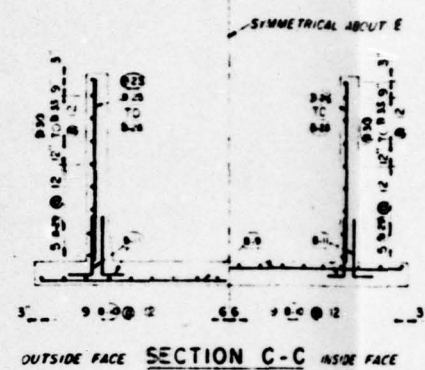
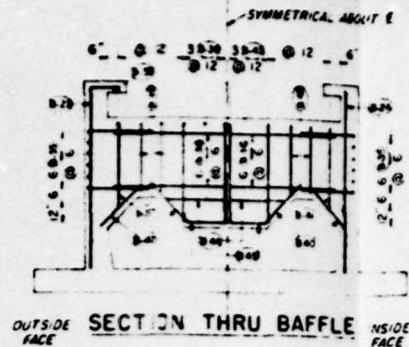
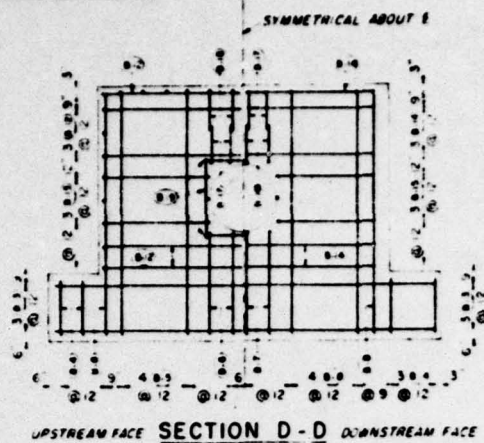


LITTLE SHENANGO RIVER WATERSHED
FLOODWATER RETARDING DAM PA-489
MERCER COUNTY, PENNSYLVANIA
PLAN-PROFILES OF PRINCIPAL SPILLWAY

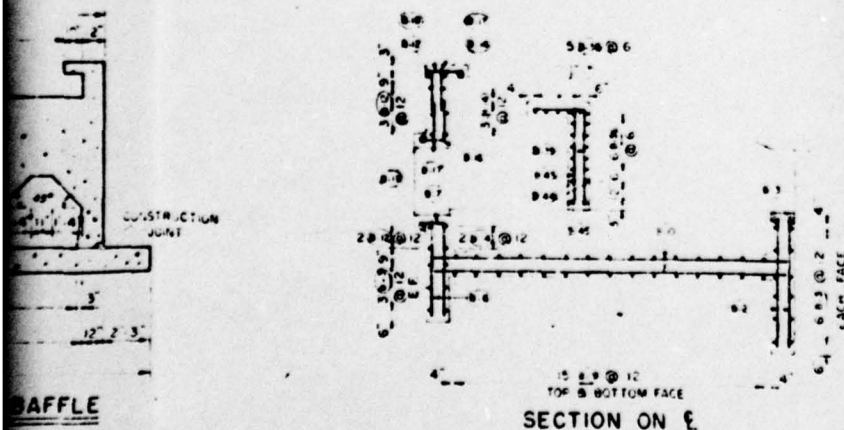
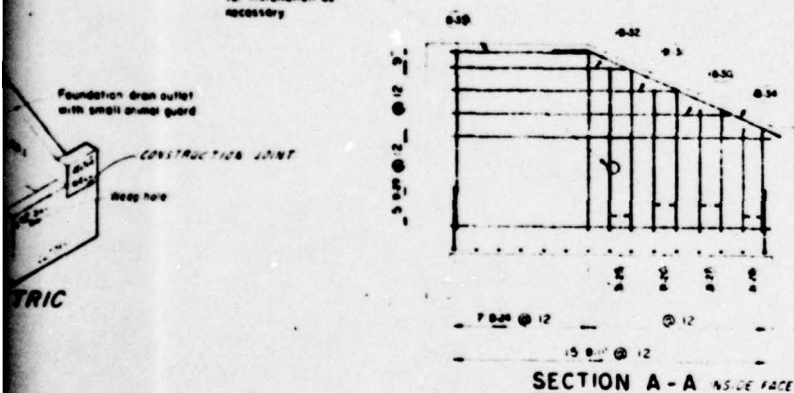
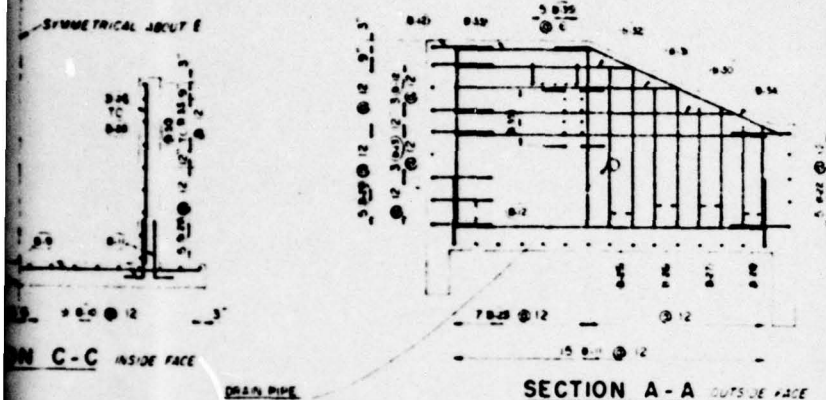
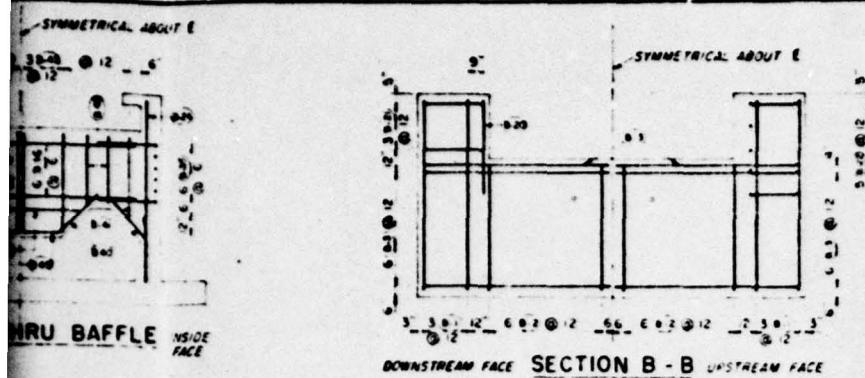
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by <i>Alfred A. Snyder</i>	Date <i>2-66</i>	Approved by
Drawn by <i>C. CRIDE</i>	MAK-66	Title
Traced	Sheet <i>7</i>	Drawing No.
Checked by <i>R. Yarnes</i>	3-66	PA-489-P

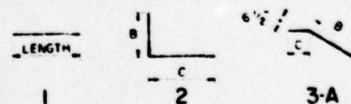
U.S. ARMY (APRIL 1963)



GENERAL NOTES
SEE SHEET 13



STEEL SCHEDULE									
MARK	LOCATION	QUN	SIZE	LENGTH	TYPE	B	C	TOTAL FT	
B-1	CUTOFF	12	5	8-6	1			102 00	
2		24	5	5-7	1			134 00	
3		20	5	17-0	1			340 00	
4		10	5	2-6	1			25 00	
B-5		8	5	12-3	2	10-9	1-6	98 00	
6		4	5	4-3	1			17 00	
7		3	5	5-3	2	4-3	1-0	15 75	
8		12	5	10-9	1			129 00	
9	FLOOR	30	5	17-0	1			510 00	
B-10		36	5	16-0	1			576 00	
B-11		60	5	3-9	2	2-9	1-0	225 00	
12	INLET WALL	12	5	9-5	2	7-1	2-4	113 00	
13		6	5	6-2	2	4-6	3-8	37 00	
14		7	5	11-6	1			80 50	
B-15		6	5	5-3	2	4-3	1-0	31 50	
16		3	5	2-9	2	1-9	1-0	8 25	
17		7	5	2-11	1			20 43	
18		4	5	3-0	2	1-3	1-9	12 00	
19		4	5	3-9	1			15 00	
B-20	WING WALLS	2	5	4-3	1			8 50	
21		6	5	2-9	1			16 50	
22		10	5	4-0	2	2-3	1-9	40 00	
23	SIDE WALLS	14	5	9-6	2	8-0	1-6	133 00	
24		14	5	8-0	1			112 00	
B-25		8	5	7-1	1			56 67	
26		8	5	6-3	1			50 00	
27		8	5	5-6	1			44 00	
28		8	5	4-6	1			36 00	
29		20	5	16-0	1			320 00	
B-30		4	5	12-6	1			50 00	
31		4	5	10-3	1			41 00	
32		4	5	7-9	1			31 00	
33		4	5	6-0	1			24 00	
34		4	5	11-1	3A	9-6	1-7	44 33	
B-35	BAFFLE	34	5	3-9	2	2-9	1-0	127 50	
36		17	5	10-6	1			178 50	
37		2	5	6-4	2	4-0	2-4	12 67	
38		4	5	5-4	2	3-0	2-4	21 33	
39		5	5	6-7	2	4-3	2-4	32 92	
B-40		8	5	2-0	1			20 00	
41		2	5	4-0	1			8 00	
42		4	5	3-0	1			12 00	
43		5	5	4-3	1			21 25	
44		2	5	5-6	1			11 00	
P-45		2	5	3-6	1			7 00	



BAR TYPES

QUANTITIES

REINFORCING STEEL
NO. 5 BARS 394640 LBS
41194 LBS

CONCRETE
CLASS 4000 309 CU YDS

PLATE 7

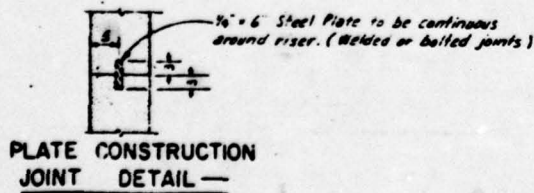
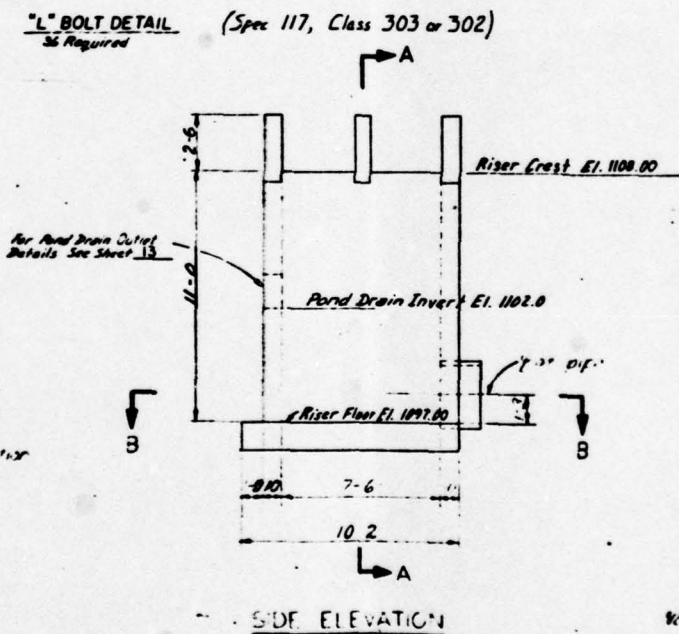
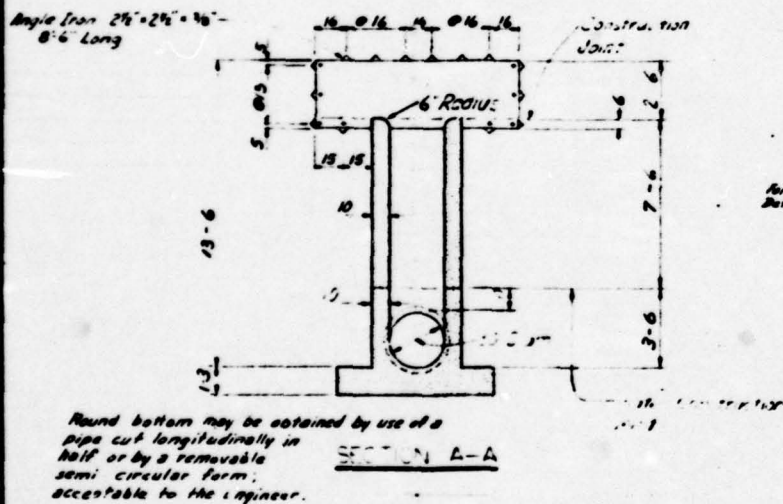
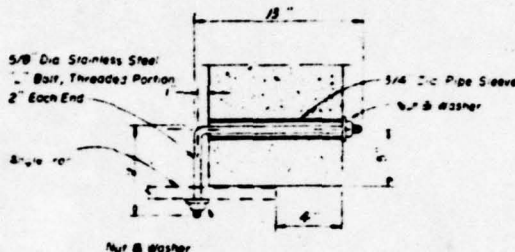
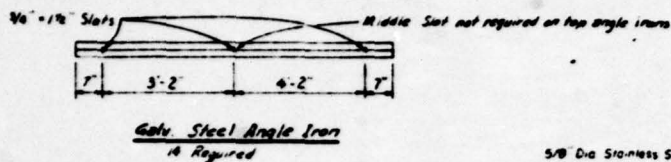
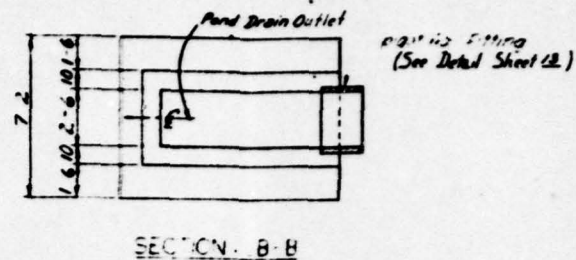
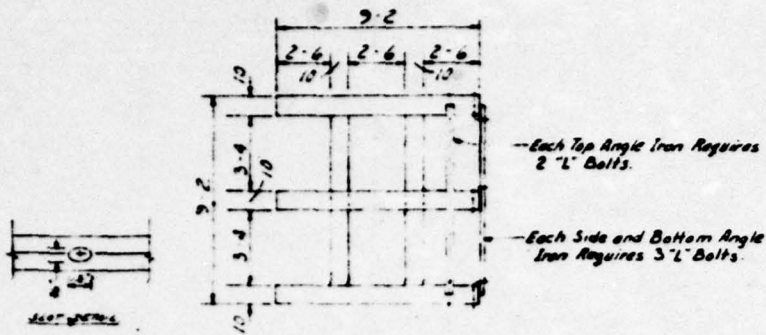
LITTLE SHENANGO RIVER WATERSHED
FLOODWATER RETARDING DAM PA-489
MERCER COUNTY, PENNSYLVANIA
IMPACT BASIN DETAILS

AS BUILT PLANS

GENERAL NOTES
SEE SHEET 13

PA-489-P

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Steel:

45 Bars	1597.9'	Lin. Ft.	1666	Lbs.
40 Bars	413.5'	Lin. Ft.	627	Lbs.
8' Bars	306.0'	Lin. Ft.	6.6	Lbs.
		Total	2913	Lbs.

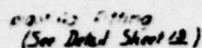
Concrete

Class 4000 — 13.9 Cu. Yds.

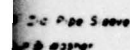
STANDARD COVERED RISER (MODIFIED)	
DESIGN CONSTANTS	
$f'_c = 4000$ psi	$f'_c = 1600$ psi
$n = 8$	$f_s = 20,000$ psi
STANDARD DWG. NO.	ES-3030-2015E
DATE 7-65	SHEET 1 OF 3

Note: See

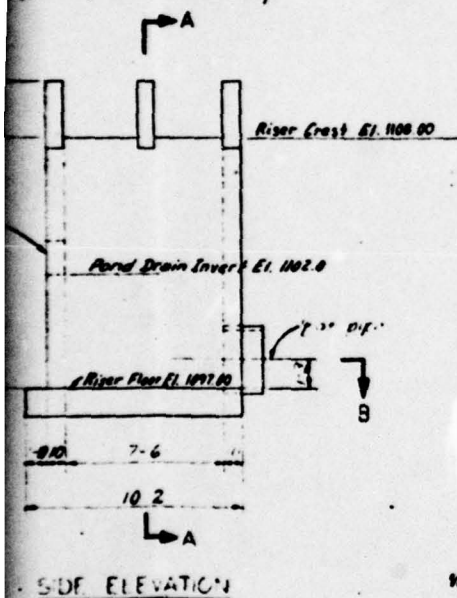
Notes:
1. For
2. Radius
3. The



SECTION. B-B



Spec 117, Class 303 or 302)



(Riser Only)

89	---	---	---	---	1669	LDS.
89	---	---	---	---	621	LDS.
89	---	---	---	---	656	LDS
89	---	---	---	---	4913	DS.

STEEL SCHEDULE

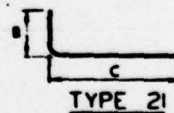
[illegible]

Note.
See Sheet 13 For General Notes.

Notes

- Bar dimensions are out to out of bar.
- Radius of bar equals 3 bar diameters for sizes equal to or less than #7.
- The 2" and 3" dimensions from face of concrete to steel are clear distances.

B-2P TYPES



0 2 4
Scale in Feet

AS BUILT PLANS

PLATE 8

**LITTLE SHENANGO RIVER WATERSHED
FLOODWATER RETARDING DAM PA-489
MERCER COUNTY, PENNSYLVANIA
STRUCTURAL DETAILS (RISER)**

**U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE**

Date		Approved by	
2-66			
To		From	
Title		Serial	
		no 9	
		of 17	
PA-489-P		PA-489-P	

FORM SCS-313, APRIL 1963

DO NOT DESTROY THIS COPY

APPENDIX A

**CHECK LIST - VISUAL INSPECTION
AND FIELD SKETCH**

Check List
Visual Inspection
Phase 1

A-1

Name of Dam HADLEY DAM County Mercer State PA Coordinates Lat. N 41° 25.5'
(PA 489)
NDI # PA 00245
PennDER # 43-52
SCS # PA 489 Long. W 80° 15.1'

Date of Inspection 27 April 1979 Weather Overcast, Windy Temperature 50°F.

Pool Elevation at Time of Inspection 1108.7 ft.* M.S.L. Tailwater at Time of Inspection 1091.5 ft.* M.S.L.
*All elevations are referenced to the principal spillway crest (El. 1108.0 ft.)

Inspection Personnel:

Michael Baker, Jr., Inc.:

James G. Ullinski
Rodney E. Holderbaum
David Johns

Owner's Representative
Mercer County Conservation District:

James Mondok (part-time)

Site Visit 5 June 1979

Dr. C. Y. Chen
James G. Ullinski

David Johns Recorder

CONCRETE/MASONRY DAMS - Not Applicable

A-2

Name of Dam: HADLEY DAM (PA 489)

DOI # PA 00245

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

LEAKAGE

STRUCTURE TO
ABUTMENT/EMBANKMENT
JUNCTIONS

DRAINS

WATER PASSAGES

FOUNDATION

CONCRETE/MASONRY DAMS - Not Applicable

A-3

Name of Dam: HADLEY DAM (PA 489)

NDI # PA 00245

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

SURFACE CRACKS
CONCRETE SURFACES

STRUCTURAL CRACKING

VERTICAL AND HORIZONTAL
ALIGNMENT

MONOLITH JOINTS

CONSTRUCTION JOINTS

EMBANKMENT

A-4

Name of Dam: HADLEY DAM (PA 489)

NDI # PA 00245

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	1. Minor sloughing has occurred at several small areas on the downstream face. 2. Rutting has occurred along crest due to vehicular traffic. 3. At approximately 19 ft. from the left abutment, two erosion gullies have also formed due to vehicular traffic. The ruts are 1-ft. deep by 2.5 ft. wide. 4. Erosion has occurred on both sides of the outlet structure and a hole has formed directly behind the head wall.	1. The sloughed areas should be regraded and seeded. 2. The ruts should be regraded, treated and seeded with an appropriate mixture to prevent erosion. 3. The erosion gullies should be regraded, treated and seeded with an appropriate mixture to prevent erosion. 4. The area around the outlet structure should be brought up to grade and a granular cushion/filter placed under the riprap.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The vertical and horizontal alignment shown on the "as built" drawings was checked by field survey and both are congruent.	
RIPRAP FAILURES	None	

EMBANKMENT

Name of Dam: HADLEY DAM (PA 489)
NDI # PA 00245

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems were observed.	
ANY NOTICEABLE SEEPAGE	A minor amount of seepage was noted to the left of the outlet channel.	This area should be checked during future inspections.
STAFF GAGE AND RECORDER	None installed	
DRAINS	Two 12-in. diameter toe drainpipes, with small animal guards, discharge from the outlet structure on either side of the outlet pipe. Toe drains of granular material and rockfill were also observed along portions of downstream slope junctions with both abutments.	The drainpipes appeared to be in operating order.

OUTLET WORKS
(PRINCIPAL SPILLWAY IN
SCS TERMINOLOGY)

A-6

Name of Dam: HADLEY DAM (PA 489)
NDI # PA 00245

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Most of the outlet conduit was inaccessible. The conduit at its exit, however, appeared to be in good condition.	
INTAKE STRUCTURE	A large amount of debris has collected on top of the structure. No other problems were observed.	Debris should be removed from the structure periodically.
OUTLET STRUCTURE	The joint sealer between the outlet conduit and concrete outlet structure has deteriorated. Some minor deterioration of the concrete surfaces was also observed.	The joint sealer should be replaced. The minor deterioration of the concrete is not considered abnormal for the age of the structure.
OUTLET CHANNEL	No problems were observed.	
EMERGENCY GATE	The 24-in. diameter pond drain was bolted shut with a 1/4-in. steel plate.	

Name of Dam: HAULEY DAM (PA 489) UNGATED SPILLWAY
 NDI # PA 00245 (EMERGENCY SPILLWAY IN
 SCS TERMINOLOGY)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CONTROL SECTION	The control section is well vegetated and free of debris and obstructions.	
APPROACH CHANNEL	The approach channel is well vegetated and free of debris and erosion.	
DISCHARGE CHANNEL	Some settlement has occurred in the channel possibly due to transport of soil particles by groundwater movement..	The settled areas should be filled and reseeded.
BRIDGE AND PIERS	Not Applicable	

GATED SPILLWAY - Not Applicable

Name of Dam: HADLEY DAM (PA 489)
NOI # PA 00245

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

CONCRETE SILL

APPROACH CHANNEL

DISCHARGE CHANNEL

BRIDGE AND PIERS

GATES AND OPERATION
EQUIPMENT

INSTRUMENTATION - None Installed

A-9

Name of Dam: HADLEY DAM (PA 489)
DOI # PA 00245

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
---------------------------	---------------------	-----------------------------------

MONUMENTATION/SURVEYS

OBSERVATION WELLS

WEIRS

PIEZOMETERS

OTHER

RESERVOIR

A-10

Name of Dam: HADLEY DAM (PA 489)

NDI # PA 00245

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

SLOPES

The reservoir slopes are generally relatively steep and consist of primarily forest and farmlands.

SEDIMENTATION

Considering the age of the structure, sedimentation should be relatively insignificant.

The reservoir was designed by the SCS with allowance for 50 yrs. of sediment accumulation.

DOWNSIDE CHANNEL

A-11

Name of Dam: WADLEY DAM (PA 489)
 NDI # PA 00245

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)

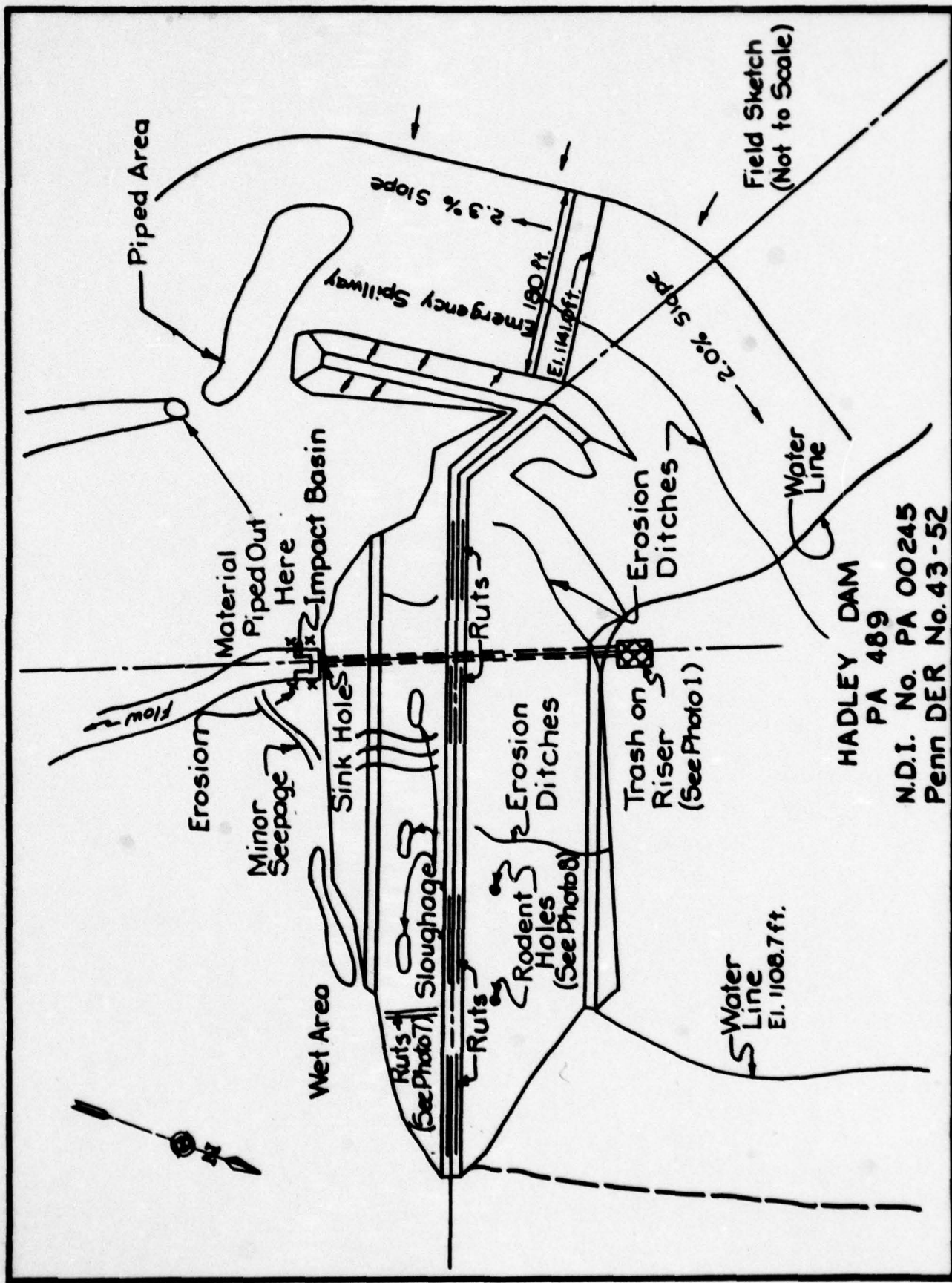
No significant obstructions are located in the downstream channel. The first half mi. of the stream downstream from the dam flows through a heavily wooded narrow stream valley. The remainder of the stream valley is wider and consists of relatively open areas.

SLOPES

The slopes immediately downstream from the dam are relatively steep. As the stream nears the confluence with the Little Shenango River, the slopes flatten out and remain moderately sloping along the entire length of the river.

APPROXIMATE NO. OF HOMES AND POPULATION

Two or three homes are located in low lying areas between the dam and the confluence with the Little Shenango River, a distance of approximately 1 mi. The Borough of Greenville is located approximately 10 mi. downstream from the dam.



HADLEY DAM
PA 489
N.D.I. No. PA 00245
Penn DER No. 43-52

APPENDIX B

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: HADLEY DAM (PA 489)
 NDI # PA 00245

ITEM	REMARKS
PLAN OF DAM	See Plate 3, Plan of Dam Site.
REGIONAL VICINITY MAP	See Plate 1, a portion of the USGS Greenville East, Pennsylvania 7.5 minute quadrangle series map showing dam location with state location inset.
CONSTRUCTION HISTORY	The dam was designed by the Department of Agriculture, Soil Conservation Service (SCS) and constructed by the Foster Grading Co. of Jackson Center, Pennsylvania from June 1967 through July 1968.
TYPICAL SECTIONS OF DAM	See Plate 4, Profiles of Dam and Emergency Spillway.
HYDROLOGIC/HYDRAULIC DATA	SCS "Design Report Site PA-489, Little Shenango Watershed" available in PennDER's files.
OUTLETS - PLAN	See Plate 6, Plan-Profile of Principal Spillway.
- DETAILS	See Plate 7, Impact Basin Details.
- CONSTRAINTS	No information is readily available.
- DISCHARGE RATINGS	PennDER's Dam Permit Application Report indicates a maximum outflow of 115 c.f.s. Additional information is available in the SCS "Design Report".
RAINFALL/RESERVOIR RECORDS	None available

Name of Dam: HADLEY DAM (PA 489)
NDI # PA 00245

B-2

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

DESIGN REPORTS	The SCS "Design Report, PA 489, Little Shanango Watershed," is available in PennDER's files.
----------------	--

GEOLOGY REPORTS See Appendix E.

DESIGN COMPUTATIONS Design computations are included in the SCS "Design Report."
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

MATERIALS INVESTIGATIONS Logs of drill holes and test pits are shown on Sheets 14 to 17 of the "as built" plans,
BORING RECORDS available in PennDER's files.
LABORATORY
FIELD

POST-CONSTRUCTION SURVEYS OF DAM Annual inspections have been made from 1970-1977 by representatives of the
Mercer County Commissioners and the SCS. Copies of the inspection reports
are available in PennDER's files.

BORROW SOURCES Glacial soil deposits in the spillway and the reservoir areas: Plan - Reference Drawings - Sheet 2.
Boring and Test Pit Logs - Reference Drawings - Sheets 14-17 - Little Shenango River Watershed,
Floodwater Retarding Dam PA-489 Mercer County, Pennsylvania - "as built" plans. These plans are
available from PennDER's files.

Name of Dam: HADLEY DAM (PA 489)

NDI # PA 00245

B-3

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

MONITORING SYSTEMS	None
--------------------	------

MODIFICATIONS	None
---------------	------

HIGH POOL RECORDS	No information available
-------------------	--------------------------

POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Annual inspection reports are available in PennDER's files.
---	---

PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
---	------

MAINTENANCE OPERATION RECORDS	No records are readily available.
-------------------------------	-----------------------------------

Name of Dam: HADLEY DAM (PA 489)
NDI # PA 00245

B-4

ITEM

REMARKS

SPILLWAY PLAN.

SECTIONS,
and

DETAILS See Plate 6, Plan - Profile of Principal Spillway.

OPERATING EQUIPMENT None installed
PLANS & DETAILS

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

B-5

DRAINAGE AREA CHARACTERISTICS: 4.6 sq.mi. (primarily farmland)
ELEVATION TOP SEDIMENT POOL (STORAGE CAPACITY): 1108.0 ft. (25 ac.-ft.)
ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1141.0 ft. (568 ac.-ft.)
ELEVATION MAXIMUM DESIGN POOL: 1146.0 ft.
ELEVATION TOP DAM: 1148.5 ft.
CREST: (SCS Terminology - Emergency Spillway)

- a. Elevation El. 1141.0 ft. (control section)
- b. Type Vegetated earth channel, curved in plan
- c. Width 180 ft.
- d. Length 600 ft.
- e. Location Spillover Right abutment
- f. Number and Type of Gates None

OUTLET WORKS: (SCS Terminology - Principal Spillway)

- a. Type Reinforced concrete riser and 30-in. diameter reinforced concrete outlet pipe
- b. Location Approximately 630 ft. from left abutment
- c. Entrance inverts El. 1108.0 ft.
- d. Exit inverts El. 1090.42 ft.
- e. Emergency draindown facilities Pump water into low-level inlet. (Steel plate bolted on end of pond drainpipe, entrance invert El. 1102.0 ft.)

HYDROMETEOROLOGICAL GAGES: None

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

MAXIMUM NON-DAMAGING DISCHARGE Unknown

APPENDIX C

PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam from Left Abutment

Photo 1 - Intake Riser Assembly Covered with Debris

Photo 2 - Outlet Structure

Photo 3 - View of Reservoir Area Taken from Upstream Face of Dam

Photo 4 - View of Exit Channel Taken from Outlet Works

Photo 5 - Emergency Spillway Looking Toward Exit Channel
(Embankment Is to the Left.)

Photo 6 - Emergency Spillway Looking Toward Reservoir
(Embankment Is to the Right.)

Photo 7 - Ruts on Downstream Face of Dam
(Ruts Are Due to Four-Wheel Drive Vehicle;
See Field Sketch for Location.)

Photo 8 - Groundhog Burrow on Upstream Face of Dam
(See Field Sketch for Location.)

Note: Photographs were taken on 27 April 1979.

HADLEY DAM



PHOTO 1. Intake Riser Assembly Covered with Debris

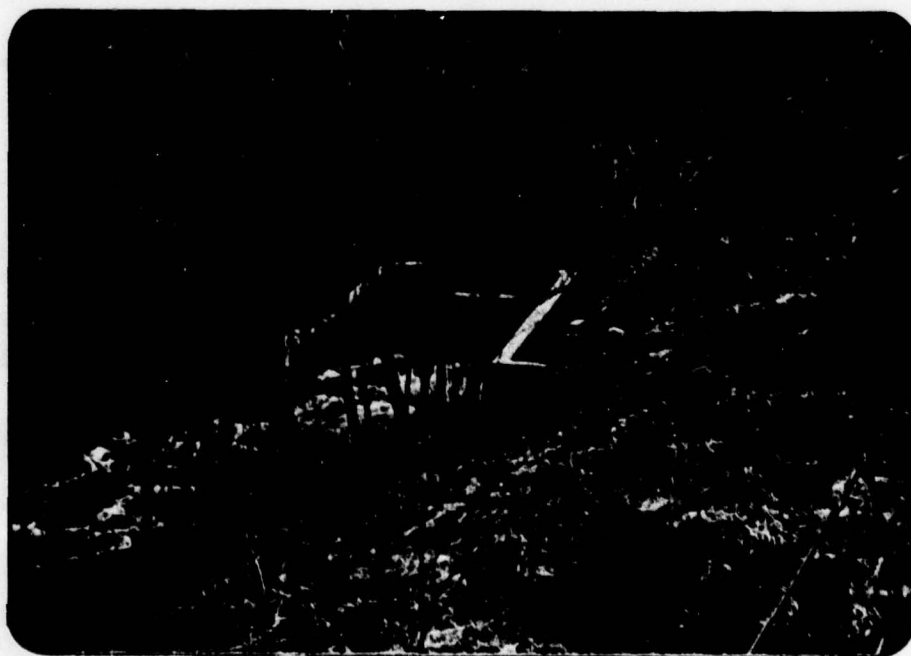


PHOTO 2. Outlet Structure

HADLEY DAM

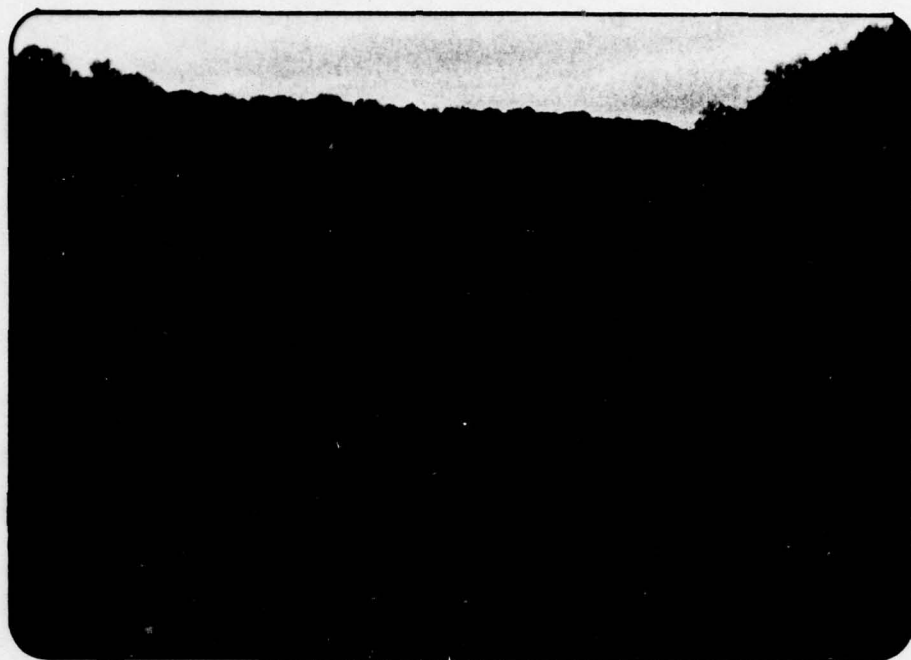


PHOTO 3. View of Reservoir Area Taken from Upstream Face of Dam

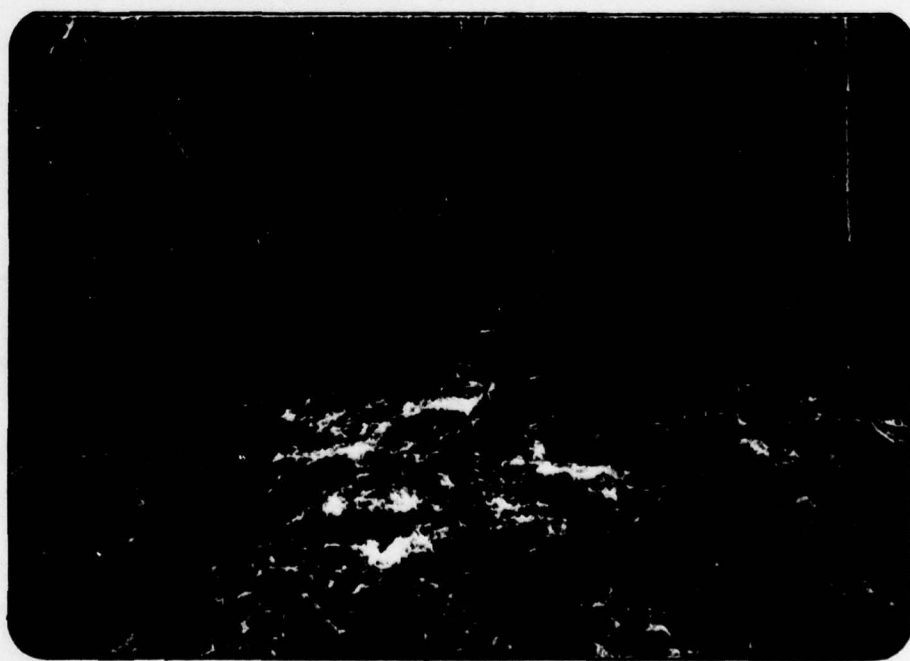
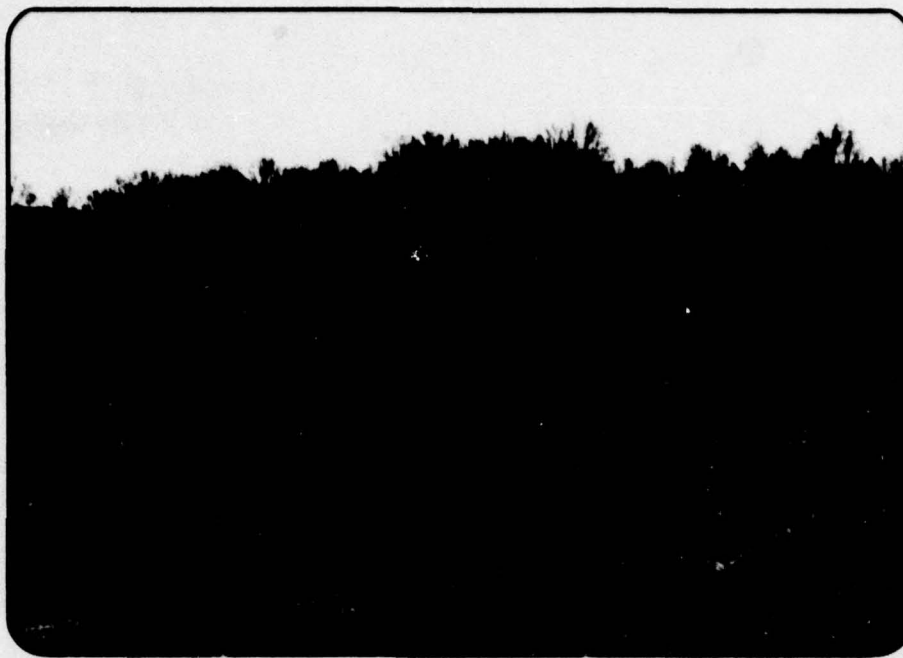
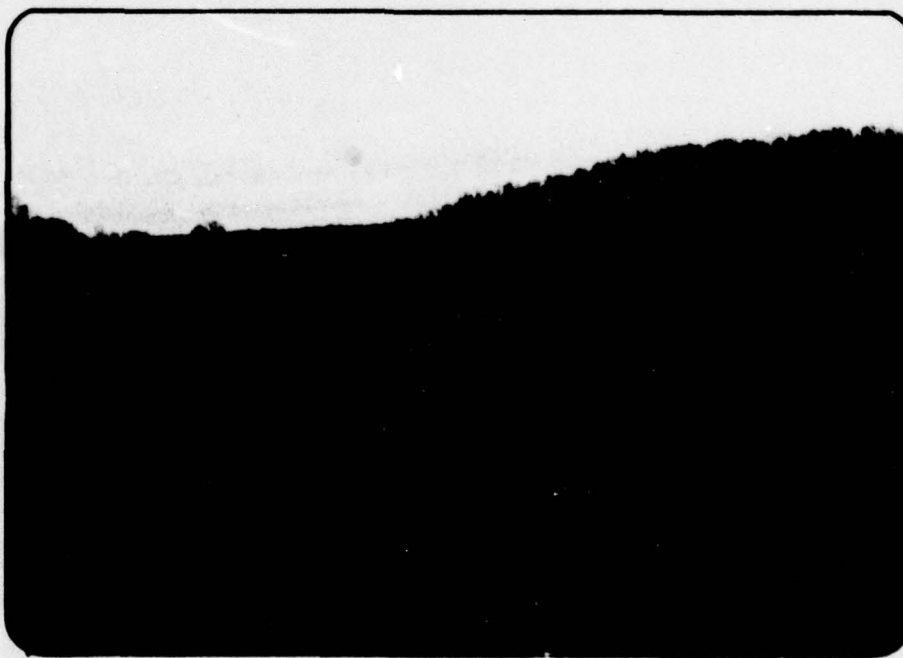


PHOTO 4. View of Exit Channel Taken from Outlet Works

HADLEY DAM



**PHOTO 5. Emergency Spillway Looking toward Exit Channel
(Embankment is to the left.)**



**PHOTO 6. Emergency Spillway Looking toward Reservoir
(Embankment is to the right.)**

HADLEY DAM

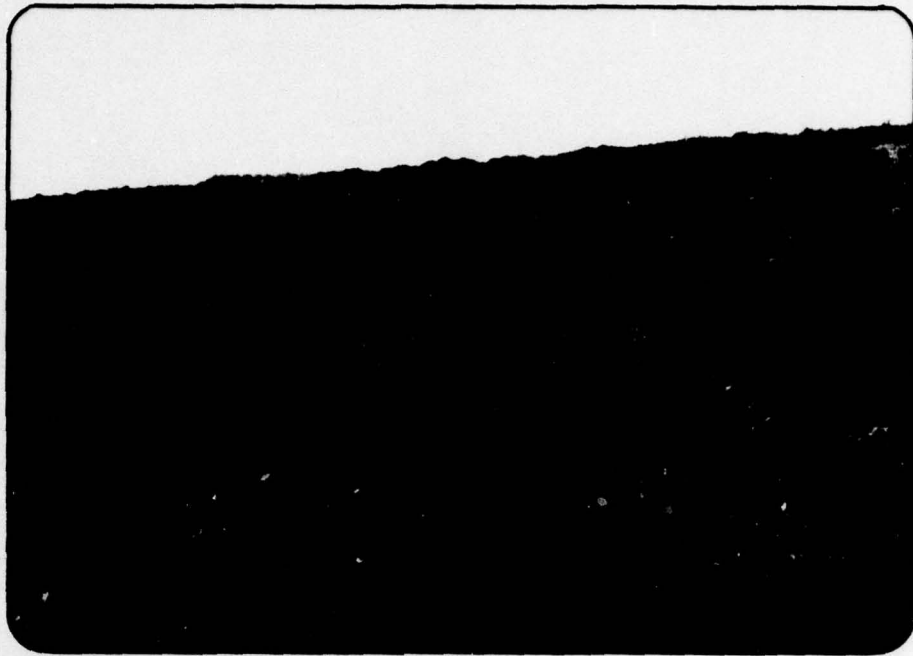
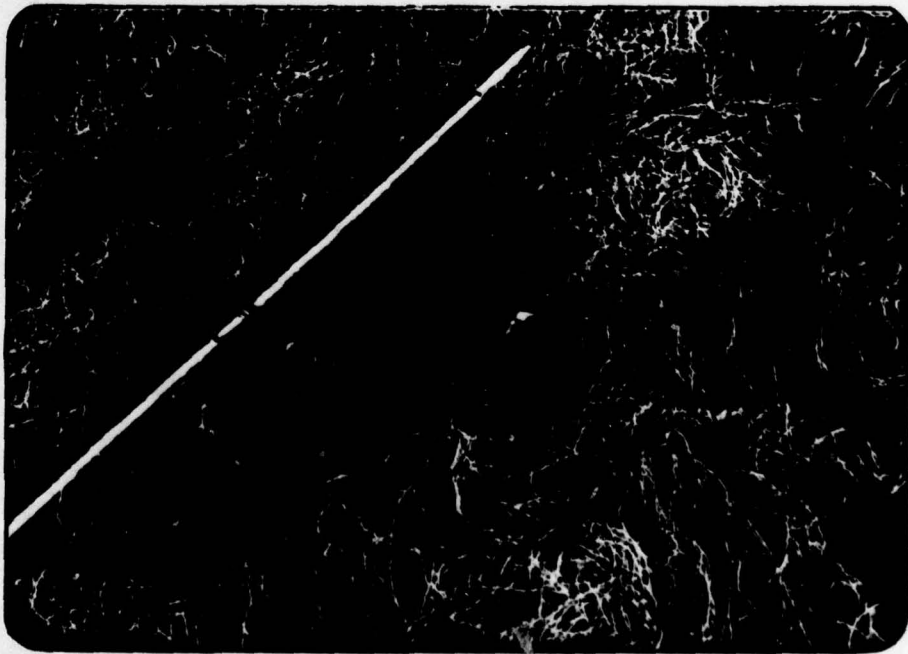


PHOTO 7. Ruts on Downstream Face of Dam (Ruts due to four-wheel drive vehicle; see field sketch for location.)



**PHOTO 8. Groundhog Burrow on Upstream Face of Dam
(See field sketch for location.)**

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject HADLEY DAM (PA. No. 489) S.O. No. _____

Sheet No. _____ of _____

Drawing No. _____

Computed by _____ Checked by _____ Date _____

TABLE OF CONTENTS

<u>SUBJECT</u>	<u>PAGE</u>
PREFACE	i
RAINFALL AND HYDROLOGIC DATA	1
WATERSHED PLAN	2
STAGE VS. STORAGE, AREA	3
STAGE VS. DISCHARGE	4
TOP OF DAM PROFILE	5
MAP OF DOWNSTREAM AREA	6
COMPUTER ANALYSIS (HEC-1)	7

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 variation 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.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject HADLEY DAM (PA. NO. 489) S.O. No. _____
RAINFALL AND HYDROLOGIC DATA Sheet No. 1 of 11
Drawing No. _____
Computed by J.A.S. Checked by REN Date 3-19-79

RAINFALL DATA DRAINAGE IS LOCATED IN ZONE 2

AS DA. IS LESS THAN 10 mi^2 USE
 10 mi^2 % P 24-200

$$P_{24 \text{ HR.} - 200 \text{ MI}} = 23.4 \text{ in.}$$

$$P(6 \text{ HR.}) = 117\%$$

$$P(12 \text{ HR.}) = 127\%$$

$$P(24 \text{ HR.}) = 141\%$$

$$P(48 \text{ HR.}) = 151\%$$

HYDROLOGIC DATA DRAINAGE AREA IS LOCATED IN ZONE 21,

$CR = 0.40$, CE PLATE 0
 $t_p = 2.7 (L \times L_{eq})^{.68}$

$$t_R = 20 \text{ MIN.}$$

$$L = 3.71 \text{ MI.}$$

$$L_{eq} = 1.57 \text{ MI.}$$

$$t_p = 2.7 (L \times L_{eq})^{.68}$$

$$t_p = 2.7 (3.71 \times 1.57)^{.68}$$

$$t_p = 4.60 \text{ HRS.}$$

$$t_r = t_p / 5.5$$

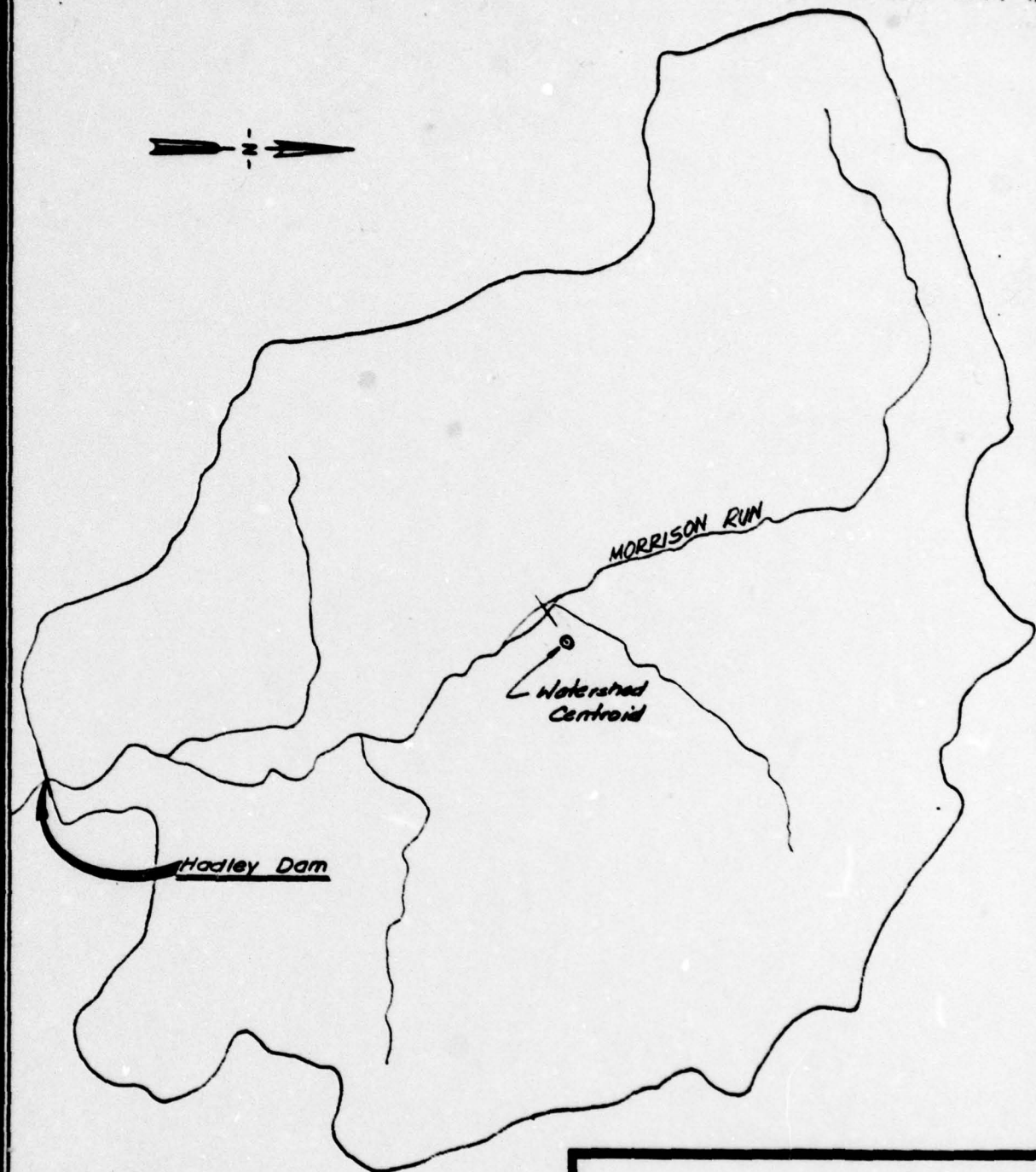
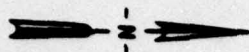
$$t_r = 4.60 / 5.5$$

$$t_r = 0.84 \text{ HR.}$$

$$t_{PR} = t_p + 0.25 (t_R - t_r)$$

$$t_{PR} = 4.60 + 0.25 \left(\frac{20}{60} - 0.84 \right)$$

$$t_{PR} = 4.47 \text{ HRS.}$$



QUADS :
 GREENVILLE EAST & HADLEY
 DRAINAGE AREA : 4.58 SQ. MI.
 L = 3.8 MI. Leg = 1.6 MI.
 0 2000 4000
 SCALE IN FEET

DATE: 5-16-79

HADLEY DAM
 WATERSHED MAP

MICHAEL BAKER JR. INC.
 Consulting Engineers & Surveyors

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject HADLEY DAM (PA. NO. 489)

S.O. No. _____

STAGE VS. STORAGE, AREA

Sheet No. 3 of 11

Drawing No. _____

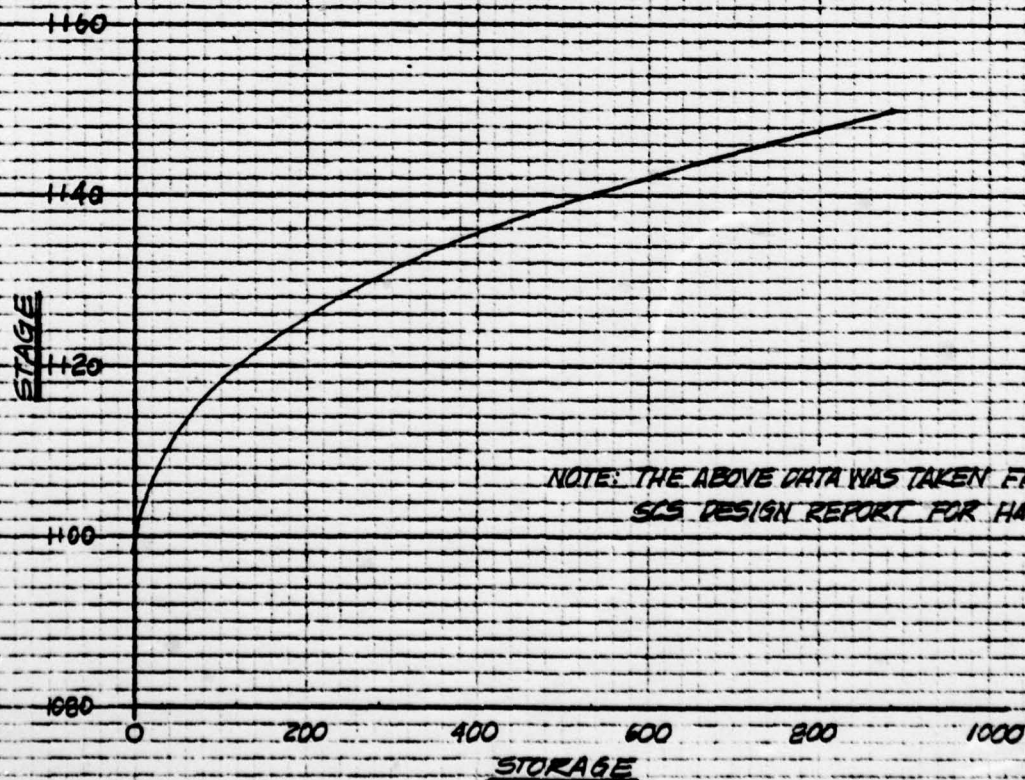
Computed by J.G.S.

Checked by REH

Date 3-19-79

* FROM DESIGN DATA (SCS DESIGN REPORT)

STAGE (FE)	STORAGE (AC. FT.)	AREA (AC.)
1095	0	0
1110	31	6.0
1120	119	11.6
1130	284	21.3
1140	533	28.6
1150	885	42.0



MICHAEL BAKER, JR., INC.
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Subject HADLEY DAM (PA. NO. 489)

STAGE VS. DISCHARGE

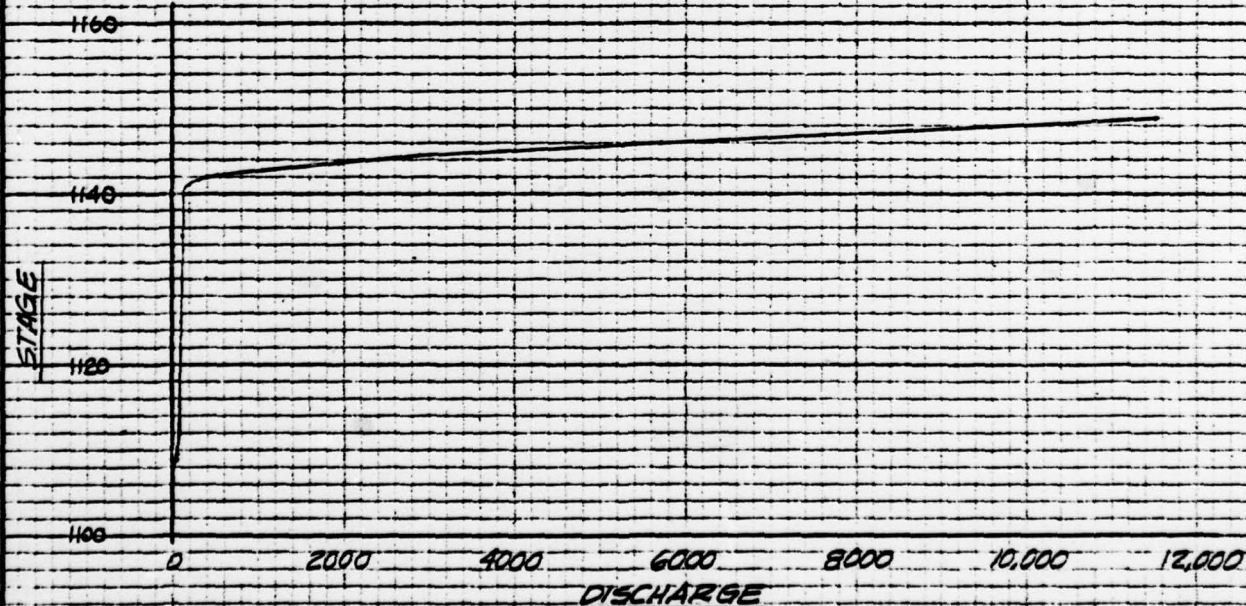
S.O. No. _____

Sheet No. 4 of 11

Drawing No. _____

Computed by G.O.S. Checked by REH Date 3-19-79

STAGE (ft)	DISCHARGE (cfs)	STAGE (ft)	DISCHARGE (cfs)
1108.0	0	1135.0	11
1108.5	15	1141.0	119
1108.6	20	1142.8	1030
1109.0	43	1143.7	1951
1109.5	68	1144.4	2880
1112.0	74	1145.0	3816
1113.0	79	1146.1	5108
1120.0	88	1147.1	7622
1125.0	96	1148.0	9557
1130.0	104	1148.8	11,504

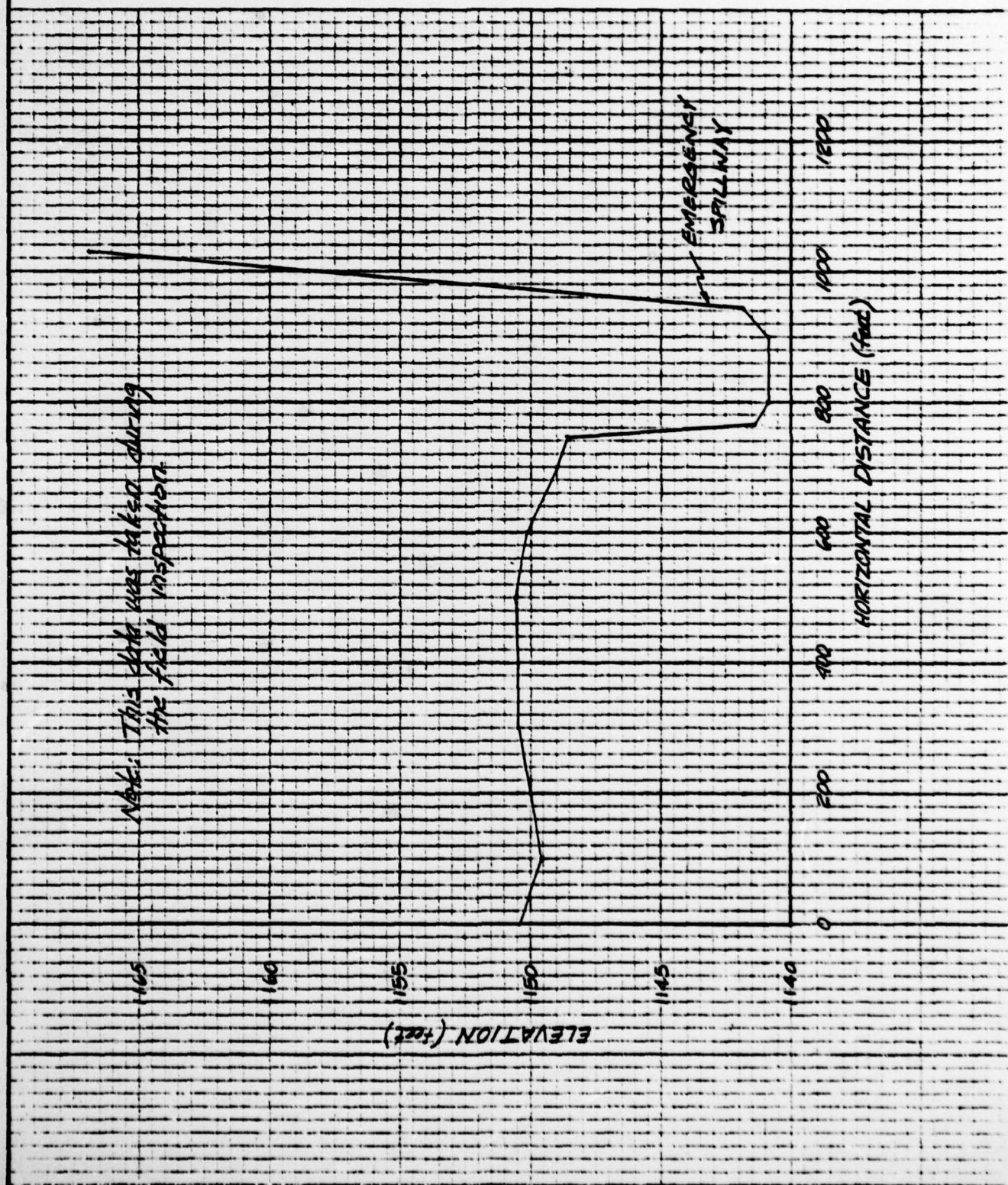


NOTE: THE ABOVE DATA WAS TAKEN FROM THE SCS DESIGN
REPORT FOR HADLEY DAM.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

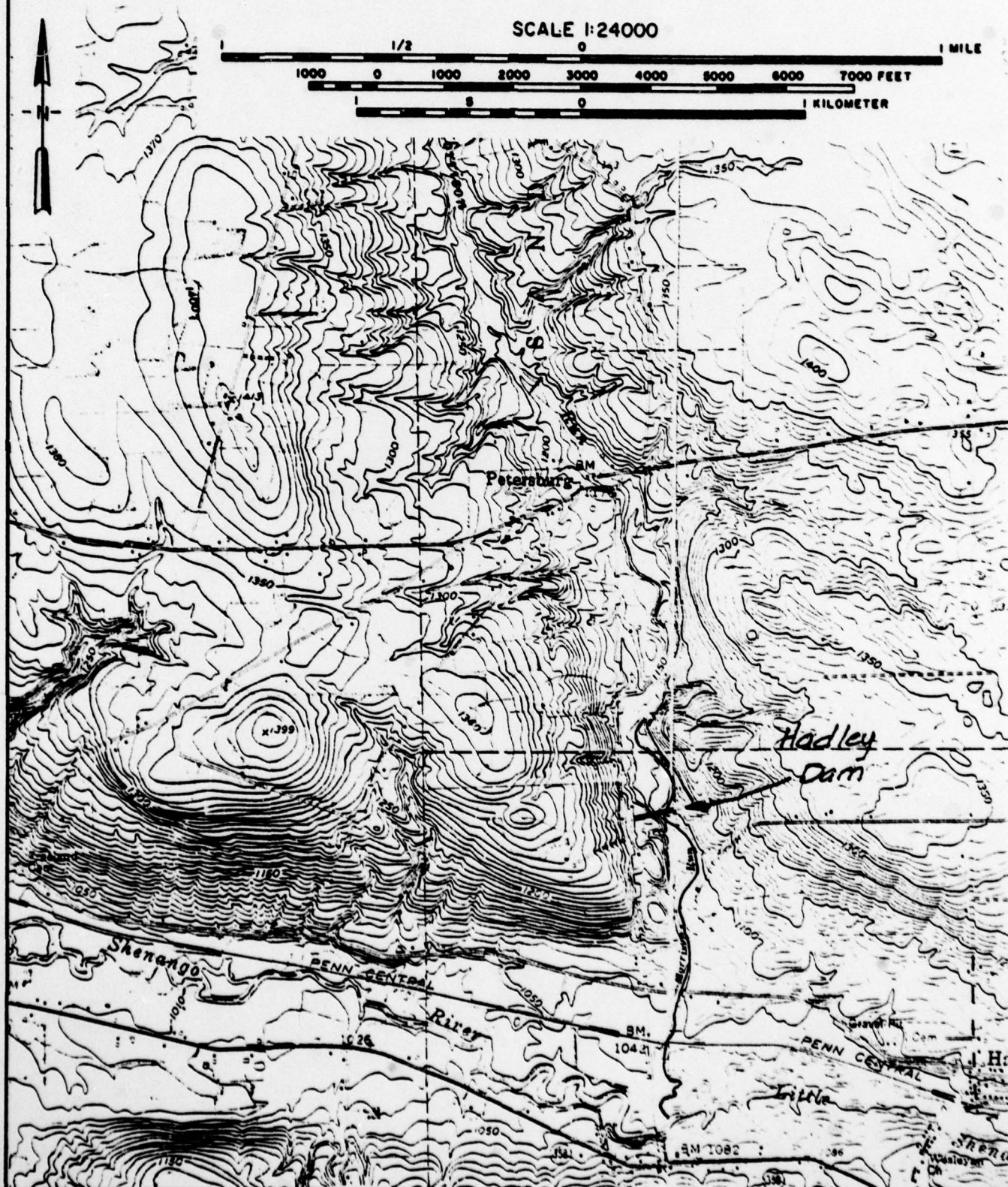
Box 280
Beaver, Pa. 15009

Subject HADLEY DAM S.O. No. _____
TOP OF DAM PROFILE Sheet No. 5 of 11
Drawing No. _____
Computed by SCB Checked by _____ Date 5-15-79



Box 280
Beaver, Pa. 15009

Subject Hadley Dam S.O. No. _____
Map of Downstream Area Sheet No. 6 of 11
 _____ Drawing No. _____
 Computed by SCB Checked by REH Date 6-15-79



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

RUN DATE 06/18/79
 TIME 09.14

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
 HYDROLOGIC AND HYDRAULIC ANALYSIS OF PA 489 MRJ 11
 PROBABLE MAXIMUM FLOOD PMF/UNIT GRAPH BY SNYDER'S METHOD

JOB SPECIFICATION									
NO	MHR	NMIN	IDAY	JHR	IMIN	METRC	IPLT	IPRT	ASTAN
300	0	20	0	0	0	0	0	-4	0
		JOPER		NWT	LKOPT	TPACE			
		5		0	0	0			

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

RTIOS= 1.00

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

SNYDER'S UNIT HYDROGRAPH FOR MAOLEY DAM

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

HYDROGRAPH DATA

TRSDA	TRSPC	RATIO	ISNOW	ISAME	LCCAL
0.0	0.0	0.0	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	23.40	117.00	127.00	141.00	151.00	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.800

LOSS DATA

LPOPT	STRKR	DLTKR	RTICL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.0	0.0	1.00	0.0	0.0	1.00	1.00	0.05	0.0	0.0

UNIT HYDROGRAPH DATA

TP= 4.47 CP=0.40 NTA= 0

RECESSION DATA

STRTO= -1.50 QRCSN= -0.05 RTIOR= 2.00

UNIT HYDROGRAPH END-OF-PERIOD COORDINATES, LAG= 4.49 HOURS, CP= 0.40 VUL= 0.50									
5.	18.	37.	60.	87.	115.	145.	176.	204.	227.
246.	260.	271.	269.	264.	254.	244.	234.	225.	216.
208.	200.	192.	184.	177.	170.	164.	157.	151.	145.
139.	134.	129.	124.	119.	114.	110.	105.	101.	97.

Q3.	90.	86.	83.	80.	77.	74.	71.	68.	65.
43.	60.	58.	56.	55.	51.	49.	47.	46.	44.
42.	40.	39.	37.	36.	34.	33.	32.	31.	29.
28.	27.	26.	25.	24.	23.	22.	21.	20.	20.
19.	18.	17.	17.	16.	15.	15.	14.	14.	13.
13.	12.	12.	11.	11.	10.	10.	10.	9.	9.

Q3.	90.	86.	83.	80.	77.	74.	71.	68.	65.
43.	60.	58.	56.	55.	51.	49.	47.	46.	44.
42.	40.	39.	37.	36.	34.	33.	32.	31.	29.
28.	27.	26.	25.	24.	23.	22.	21.	20.	20.
19.	18.	17.	17.	16.	15.	15.	14.	14.	13.
13.	12.	12.	11.	11.	10.	10.	10.	9.	9.

HYDROGRAPH ROUTING

THIS IS A ROUTING FOR FALEY DAM

ISTAU ICOMP IRECU ITAPE JPLT JPKT INAME ISTATE IATC
DAM C 0 0 0 0 0 1 0

ROUTING DATA
QLOSS CLOSS AVG IRES ISAME IOPT IPHP LSTR
0.0 0.0 0.0 1 1 0 0 0

NSTPS MSTDL LAG AMSAK X TSK STORA ISPRAT
1 0 0 0.0 0.0 0.0 -1100. -1

STAGE	1108.00	1108.50	1108.60	1109.00	1109.50	1112.00	1115.00	1120.00	1125.00	1130.00
	1135.00	1141.00	1142.80	1143.70	1144.40	1145.00	1146.10	1147.10	1148.00	1148.00
FLOW	0.0	15.00	20.00	43.00	68.00	74.00	79.00	88.00	96.00	104.00
	111.00	119.00	1030.00	1951.00	2080.00	3816.00	5708.00	7622.00	9557.00	11504.00

CAPACITY= 0. 31. 119. 284. 533. 885.

ELEVATION= 1098. 1110. 1120. 1130. 1140. 1150.

CPFL SPWID COMW FYPH ELEV COUL CAREA EXPL
1108.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

DAM DATA
TOPEL COMD EXPD DAMSID
1148.7 2.6 1.5 750.

PEAK OUTFLOW IS 5401. AT TIME 44.33 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	4.58	1	5418.
	(	11.86)	(	153.43)(
ROUTED TO	DAM	4.58	1	5418.
	(	11.86)	(	152.94)(

SUMMARY OF DAM SAFETY ANALYSIS

[illegible]

2

APPENDIX E

REGIONAL GEOLOGY

HADLEY DAM (PA 489)
NDI No. PA 00245, PennDER No. 43-52, SCS No. PA 489

REGIONAL GEOLOGY

Bedrock units along Morrison Run, the location of Hadley Dam, are relatively flat-lying members of the Cuyahoga group, Mississippian system. The Sharpsville sandstone, generally fine-grained sandstone and dark gray shale and siltstone is the predominant member in the reservoir and dam area. Geologic references show numerous fracture traces in the area surrounding the reservoir. The geologic report made for design of the dam indicates variable bedrock permeability rates with "vertical fractures" in one of the borings.

This section of the Appalachian Plateaus physiographic province has been glaciated, resulting in deposits of glacial till of variable thickness; on the floor of the valley the sands and silts were only about 5 to 7 feet thick whereas on the sides of the valley the glacial deposits of sand, silt and gravel are up to 45 feet thick. In addition to these glacial soils, there were some recent alluvium and colluvium at the dam site.

The geologic map and legend on the following page show the relationship of the dam to regional geology.



LEGEND



SHENANGO FORMATION

The upper member (Msu) is composed of soft medium- to dark-gray shale with interbeds of siltstone and lenses of fine-grained sandstone. Unimportant as an aquifer. The lower member (Msl) is composed of medium- to fine-grained light-gray sandstone and medium- to dark-gray shale and siltstone. Yields moderate to large quantities of water that is locally high in iron content at shallow depths.



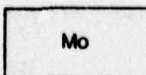
MEADVILLE SHALE

Medium- to dark-gray shale, siltstone, and lenses of fine-grained sandstone and occasional thin beds of limestone. Generally yields sufficient water for domestic and stock use.



SHARPSVILLE SANDSTONE

Very fine grained, light-gray sandstone and medium- to dark-gray shale and siltstone. Yields small to large quantities of water. Largest yields are obtained in the Shenango 15' quadrangle; locally contains saline water.



ORANGEVILLE SHALE

Dark-gray shale, occasionally containing some thin siltstone beds. Unimportant as an aquifer.

MISSISSIPPIAN

Cuyahoga Group