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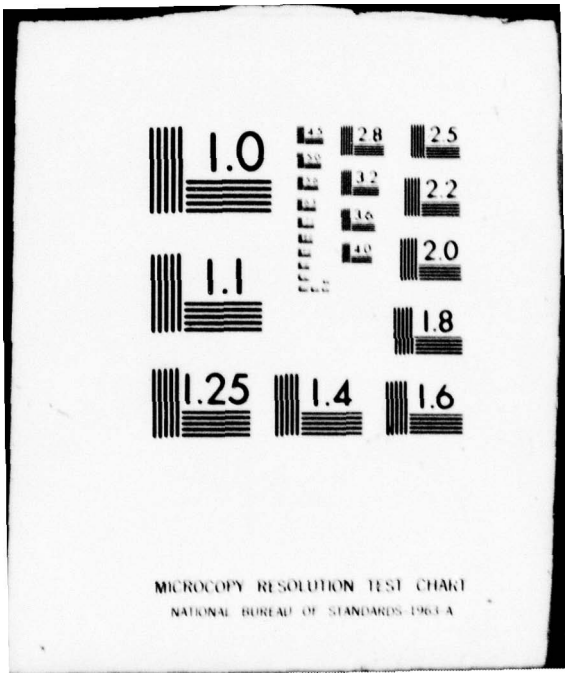
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OHIO RIVER BASIN

PA 474
(PA NO NAME No. 35)
MERCER COUNTY, COMMONWEALTH OF PENNSYLVANIA
NDI No. PA 00249
PennDER No. 43-50
SCS No. PA 474

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

(6) National Dam Inspection Program. (PA-474 (PA No Name Number 35), NDI Number PA-00249, PennDER Number 43-50, SCS Number PA-474), Ohio River Basin, Saw Mill Run, Mercer County, Pennsylvania. Phase I Inspection Report.

Prepared for: DEPARTMENT OF THE ARMY
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(11) Jul 79 (12) 82 p.

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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.

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

PA 474 (PA No Name No. 35), Mercer County, Pennsylvania
NDI No. PA 00249, PennDER No. 43-50, SCS No. PA 474
Saw Mill Run
Inspected 9 May 1979

ASSESSMENT OF GENERAL CONDITIONS

PA 474 (also known as PA No Name No. 35) is a zoned earth floodwater retarding dam designed by the U.S. Department of Agriculture, Soil Conservation Service (SCS). The dam consists of a main embankment, a vegetated earth emergency spillway, an intake riser and outlet conduit (principal spillway) and a saddle dike. The dam is a "High" hazard-"Small" size dam and is owned and operated by the Mercer County Commissioners. The main embankment has a crest length of 1640 feet and a maximum height of 30 feet.

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 Probable Maximum Flood (PMF) without overtopping the dam. The spillway is therefore considered "adequate."

The dam was found to be in good overall condition at the time of inspection on 9 May 1979. However, the owner should perform the following several minor items of remedial work as soon as practicable:

1) Periodically inspect the seepage area to the left of the outlet structure to identify a change in quantity of seepage or the exiting of muddy water from this area and, if necessary, study the situation in detail and take appropriate remedial measures.

2) Remove the sedimentation and vegetation above the inlet and outlet of the spring drain in the dike and clean the pipe out, if necessary. The downstream channel may need to be reshaped to provide sufficient drainage away from the toe of the dike.

3) Remove the stockpiled brush from the emergency spillway channel.

4) Fill the animal burrows in the embankment and establish a rodent control program.

5) Replace the joint filler between the outlet conduit and the impact basin head wall.

6) Periodically inspect and maintain the filter drain outlets.

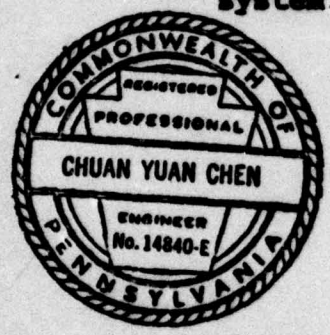
7) Clear the debris from the trash rack of the riser and periodically inspect and maintain the trash rack in the future.

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.



Submitted by:

MICHAEL BAKER, JR., INC.

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Engineering Manager-Geotechnical

Date: 6 July 1979

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 21 July 1979

Overall View of Dam from Left Abutment

Overall View of Dike from Knoll located between Dam and Dike

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
PA 474 (PA NO NAME No. 35)
NDI No. PA 00249, PennDER No. 43-50, SCS No. PA 474

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 - PA 474 (also referred to as PA No Name No. 35) was designed by the U.S. Department of Agriculture, Soil Conservation Service (SCS) for floodwater detention. The dam consists of a zoned earth embankment, a vegetated earth emergency spillway channel, a riser intake with a 36-inch diameter outlet conduit, and a saddle dike located to the right of the main embankment.

The crest length of the main embankment is 1640 feet. The maximum height of the dam at the original streambed is 30 feet. The dam crest is at El. 1264.3 feet and the top width is 14 feet. The inclination of the upstream face is 2.5H:1V (Horizontal to Vertical) with a 10-foot wide berm at El. 1242 feet. The downstream slope is 2.5H:1V. A filter trench was installed in the downstream prism of the embankment from original Station 4+92 to 9+77. A portion of the filter trench is provided with 6-inch diameter filter drainpipe. The two outlets of the filter drainpipes exit into the impact basin approximately 1 foot downstream of the baffle wall. To the right of the main embankment is a small knoll which separates the saddle dike from the main embankment. This knoll consists primarily of sandy silt (ML) soils and is approximately 540-feet long between the two embankments. The crest length of the dike is

CONT'

CONT →

670 feet and the maximum height is 9 feet. The crest width of the homogeneous embankment (dike) is 14 feet. The inclination of both the upstream and downstream slopes of the dike is 2.5H:1V.

← ABSTRACT

The outlet works (principal spillway in SCS terminology) consists of a two-stage reinforced concrete riser connected to a 36-inch diameter reinforced concrete pipe. The riser unit consists of a low flow orifice 2 feet by 1.33 feet with a crest El. 1241.8 (sediment pool). Two 9-foot long overflow weirs (one on each side of the riser) with a crest El. 1249.2 feet form the second stage of the riser. The weirs have a 1.5-foot vertical clearance below the soffit of the concrete slab on the top of the riser. The riser unit has a 24-inch diameter pond drainpipe extending 26 feet upstream to a vertical section of 30-inch pipe. This pond drain served as diversion during construction. The end of the pipe (where it exits into the riser) is presently bolted shut with a 1/4-inch steel plate. The outlet conduit for the riser is 144.3-feet long and rests on a concrete cradle. Five reinforced concrete anti-seep collars are spaced on approximately 20-foot centers along the first 100 feet of the conduit. The conduit exits into a reinforced concrete impact basin.

A 450-foot long vegetated earth emergency spillway channel is located at the left abutment of the dam. The control section for the channel is at El. 1257.0 feet and is 100-feet wide at the base. The side slopes are 4H:1V on the left and 2H:1V on the right. A wrap around dike, approximately 160-feet long, was built tb protect the toe of the main embankment from scour during flood flows. The toe of the dike is protected with riprap from the control section to the downstream end of the dike.

b. Location - PA 474 (PA No Name No. 35) is located on Saw Mill Run about 1.0 mile southwest of the Borough of Sandy Lake and 0.5 mile east of the Borough of Stoneboro. Portions of the dam are located in both the Borough of Stoneboro and Sandy Lake Township in Mercer County, Pennsylvania. Located approximately 600 feet downstream from the dam is U.S. Route 62, which runs in a northeast-southwest direction. Access to the dam is via a township road (located to the southwest of the dam) from U.S. Route 62. A dirt path from the township road then provides the nearest access to the dam and reservoir. The coordinates of the dam are Latitude N 41°-20.1' and Longitude W 80°-05.7'.

c. Size Classification - The maximum height of the dam is 30 feet and the reservoir volume to the top of dam (El. 1264.3 feet) is 814 acre-feet. The dam is therefore in the "Small" size category.

d. Hazard Classification - This dam is in the "High" hazard category because it is likely that more than a few lives would be lost and economic losses would be excessive in the event of a failure of this dam under flood pool conditions.

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 - The 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 Kane Brothers Company, 975 Bears Den Road, Youngstown, Ohio from April 1965 to September 1966 (with an appropriate winter shutdown period).

h. Normal Operational Procedures - The principal and emergency spillways are uncontrolled. The pool is normally at the level of the low inlet of the riser structure, El. 1241.8 feet. No major flood has occurred since construction of the dam in 1965-66 and the pool level has not reached the crest elevation (El. 1257.0 feet) of the emergency spillway. The dam does not have any operating equipment and is only occasionally visited by Mercer County or SCS personnel. Mercer County and SCS personnel inspect the dam each year according to procedures for annual inspection of SCS dams of this type. Copies of annual inspection reports are available in the Mercer County Conservation District office and in the Pennsylvania Department of Environmental Resources' (PennDER) file for this dam. Routine maintenance is performed by Mercer County personnel when it is necessary.

1.3 PERTINENT DATA

a. Drainage Area (square miles) -	1.56
b. Discharge at Dam Site (c.f.s.) -	
Maximum Flood -	Unknown
Total Spillway Capacity (At Pool El. 1264.3 ft.) -	6892
c. Elevation (feet above Mean Sea Level [M.S.L.]) -	
Design Top of Dam -	1264.3
Minimum Top of Dam -	1264.5
Sediment Pool -	1241.8
Maximum Pool (Design) -	1261.1
Maximum Pool (Phase I Analysis*) -	1261.2
Emergency Spillway Crest -	1257.0
Streambed at Centerline of Dam -	1234
Maximum Tailwater -	Unknown
d. Reservoir (feet) -	
Length of Maximum Pool -	2900
Length of Flood Control Pool -	1400
Length of Sediment Pool -	800
e. Storage (acre-feet) -	
Sediment Pool (El. 1241.8 ft.) -	14
Flood Control Pool (El. 1257.0 ft.) -	366
Top of Dam (El. 1264.3 ft.) -	814
f. Reservoir Surface (acres) -	
Sediment Pool (El. 1241.8 ft.) -	2.5
Flood Control Pool (El. 1257.0 ft.) -	46
Top of Dam (El. 1264.3 ft.) -	79
g. Dam -	
Type -	Zoned earthfill
Length (feet) -	1640
Height (feet) -	30
Top Width (feet) -	14
Side Slopes - Upstream - (with 10-foot wide berm at El. 1242 ft.)	2.5H:1V
Downstream -	2.5H:1V

* See Appendix D.

Zoning - Three zones and two different types of materials were used to zone the main embankment. A typical section of the dam is shown on Plate 3. Also, the type of material used for each zone is given on Plate 3.

Cutoff - A 12-foot base width cutoff trench was installed below the main embankment varying from 2 to 6 feet below original ground level. The "as built" depths of the cutoff trench are shown on Plate 5.

Drains - A filter trench was provided in the main embankment from original Station 4+92 to 9+77. The fine aggregate (ASTM fine concrete aggregate) was installed an average depth of 3 feet below the stripping line. From Station 5+88 to 8+97 the filter trench was provided with a 6-inch diameter filter drainpipe surrounded by a coarse filter. The two outlets for the drainpipe exit into the impact basin just downstream of the baffle wall. (See Plate 6.)

h. Saddle Dike -

Type -	Homogeneous earthfill
Length (feet) -	670
Height (feet) -	9
Top Width (feet) -	14
Side Slopes - Upstream -	2.5H:1V
Downstream -	2.5H:1V

i. Diversion and Regulating Tunnel - None

j. Spillway (Emergency Spillway in SCS Terminology) -

Type -	Vegetated earth channel located at left abutment of main dam
Length (feet) -	450
Base Width (feet) -	100
Side Slopes - Left -	4H:1V
Right -	2H:1V
Crest Elevation (feet M.S.L.) -	1257.0
Gates -	None
Downstream Channel -	Flows would pass through a well vegetated area (grass) for approximately 200 feet, then through a wooded area, and into the original stream channel.

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

Type - Two-stage inlet riser and 36-inch reinforced concrete outlet pipe

First Stage Orifice -	
Crest Elevation (feet M.S.L.) -	1241.8
Width (feet) -	2.0
Height (feet) -	1.33 (1'-4")
Second Stage Overflow Weir -	
Crest Elevation (feet M.S.L.) -	1249.2
Length (feet)* -	9.0
Vertical Clearance (feet) -	1.5

Outlet Pipe - A 36-inch I.D. reinforced concrete pipe supported on a concrete cradle. The concrete cradle was installed on the bottom of the outlet conduit excavation (in situ soils). Five reinforced concrete anti-seep collars were provided on approximately 20-foot centers. The pipe was installed in 16-foot long sections for a total length of 144.3 feet (including the wall section at the intake riser).

Riser Floor Invert Elevation (feet M.S.L.) -	1230.0
Outlet Conduit Exit Invert Elevation (feet M.S.L.) -	1228.56
Impact Basin	
Length (feet) -	15.75
Base Width (feet) -	11.8 (11'-10")
Invert Elevation (feet M.S.L.) -	1226.56
Tailwater Sill Elevation (feet M.S.L.) -	1228.56

Downstream Channel - A 20-foot rock riprap-lined section, then an approximately 190-foot long earth lined section before exiting into the original channel.

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* 9-foot length on each of two sides of the riser.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Floodwater Retarding Dam PA 474 (PA No Name No. 35) was designed by the SCS according to its standard practice for structures of this type, circa 1964. Design data reviewed included:

1) SCS Drawings No. PA-474-P, "Sandy Creek Watershed Project, Floodwater Retarding Dam PA-474, Crawford and Mercer Counties, Pennsylvania." Design drawings are available in PennDER's files. "As built" drawings are available in the SCS Harrisburg office and the Mercer County Conservation District office.

2) "Sandy Creek Watershed Work Plan," report prepared by the Mercer County Commissioners, et. al., March 1962. (A copy is available in the Mercer County Conservation District office in Mercer.)

3) Dam Permit Application Report prepared by the Pennsylvania Department of Forests and Waters (predecessor of PennDER) on 11 May 1965.

4) Design information including laboratory soil data, slope stability calculation summaries, hydrologic and hydraulic design calculations, and structural design calculations are available in the SCS Harrisburg office files.

5) Various post-construction inspection reports by the SCS and the Mercer County Conservation District personnel. (Copies are available in PennDER's files.)

2.2 CONSTRUCTION

Readily available information on the construction of this dam was reviewed in connection with this Phase I Investigation. This information consisted of PennDER File No. 43-50 for this dam.

Many design and construction modifications recorded were incorporated into the "as built" drawings. Most of these drawings have been included in this report; however, all additional drawings are available in the files of the SCS Harrisburg office or the Mercer County Conservation District office.

2.3 OPERATION

The "Sandy Creek Watershed Work Plan" and a subsequent agreement between the Mercer County Commissioners and the SCS, dated 9 June 1965, detail the provisions for operation and maintenance of this structure. This agreement is available in the files of the Mercer County Conservation District office.

2.4 EVALUATION

a. Availability - The PennDER File No. 43-50, the Mercer County Conservation District office file, and the file contained in SCS Harrisburg office are readily available for review.

b. Adequacy - The information available is adequate for a Phase I Inspection of this dam.

c. Validity - Observations and measurements performed during the visual inspection did not indicate any deviations from the "as built" drawings for this dam.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General - The inspection was performed on 9 May 1979. No unusual weather conditions were experienced and the lake was at sediment pool. A subsequent site visit was performed on 5 June 1979. The dam and 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 and field sketch are given in Appendix A.

b. Dam - Clear seepage was observed exiting at an estimated rate of 0.5 g.p.m. to the left of the outlet structure. The two filter drain outlets which exit into the impact basin were flowing with clear water. The left outlet was flowing at an estimated rate of 5 g.p.m. The right drain outlet was clogged with material. After removal of the material the drain outlet flowed partially full then tapered to a trickle. This drain was stained orange. This orange staining could possibly be from two sources: 1) iron staining; 2) algae growth.

Several rodent/animal burrows were observed in the embankment. The locations of these holes are shown on the field sketch.

c. Dike - A 6-inch diameter corrugated metal pipe which passes through the dike was designed to carry flow from a natural groundwater spring located just upstream from the dike. Both the inlet and the outlet of this drain are covered with sedimentation and vegetation.

d. Appurtenant Structures - Overall, the concrete of the riser intake, outlet conduit and impact basin was observed to be in good condition. However, the joint filler between the outlet conduit and the head wall of the outlet structure was deteriorated and missing in some spots. The trash rack of the low level inlet was partially clogged with debris at the time of inspection. Several small trees (1 to 2 inch diameter) were cut from and stockpiled in the discharge channel of the emergency

spillway. Also, at the end of the discharge channel of the emergency spillway, a fence crosses the channel.

e. Reservoir Area - The sediment pool reservoir is small (approximately 14 acre-feet) and has shallow water areas conducive to the growth of cattails. The Mercer County Conservation District uses the reservoir for protection of wildlife and has installed a number of floating duck nests in the reservoir. No unusual sedimentation in the reservoir was observed. The reservoir area for the flood control pool is protected.

f. Downstream Channel - The original stream channel of Saw Mill Run forms the outlet discharge channel. Approximately 600 feet downstream from the dam is U.S. Route 62. Two mobile homes are located approximately 400 feet downstream of the dam and may be affected by flood discharges from the dam. Additionally, approximately 20 homes are located in low lying areas below the dam which could be affected by large discharges from the reservoir. These homes are located in the Borough of Stoneboro. The center of Stoneboro is approximately 3000 feet downstream of the dam. Saw Mill Run passes through Stoneboro and outlets into the downstream channel from Sandy Lake. This channel then flows into Sandy Creek.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures are summarized in paragraph 1.2.h.

There are no formal emergency procedures in the event of impending catastrophe for the dam. The condition of the dam is checked by Mercer County personnel some time subsequent to each occurrence of heavy precipitation. The emergency spillway and riser intake are uncontrolled and the pond drainpipe has a steel plate bolted on its inlet to the riser structure. The reservoir under normal conditions remains at approximate El. 1241.8 feet and has 15.2 feet of additional storage to the crest of the emergency spillway.

It is recommended that formal emergency procedures and evacuation plans be prepared and prominently displayed, and furnished to all personnel.

4.2 MAINTENANCE OF DAM AND APPURTENANCES

Maintenance of the dam and appurtenant structure is the responsibility of Mercer County. Maintenance is performed by Mercer County personnel when necessary. The dam and appurtenant structures are formally inspected annually by personnel from the Mercer County Conservation District office and the SCS. During these inspections, the condition of the dam is reviewed and recommendations for repairs, when necessary, are made. There is no operating equipment for this dam.

4.3 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

At the present time, there is no warning system or evacuation plan in the event of a dam failure. An emergency warning procedure should be developed.

4.4 EVALUATION OF OPERATIONAL ADEQUACY

The present operational and maintenance procedures are considered adequate.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data - Hydrologic and hydraulic design calculations for PA 474 were obtained from the SCS "Design Report" on file at PennDER. According to SCS criteria, circa 1964, 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 dam, respectively. The emergency spillway hydrograph was developed using a 6-hour rainfall of 9.6 inches resulting in a peak discharge of 4929 c.f.s. The freeboard hydrograph was developed using a 6-hour rainfall of 19.1 inches with a corresponding peak discharge of 9500 c.f.s.

b. Experience Data - No reservoir stage or rainfall records are maintained at the dam site. According to the Mercer County Conservation District Representative the emergency spillway has never been activated.

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 - PA 474 is classified as a "High" hazard-"Small" size dam requiring evaluation for a spillway design flood (SDF) in the range of 1/2 Probable Maximum Flood (1/2 PMF) to the Probable Maximum Flood (PMF). Since the reservoir has a maximum storage capability nearly equal to that of an "Intermediate" size dam, the PMF was chosen as the SDF.

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 part of this analysis had a peak discharge of 2710 c.f.s. using a 6-hour Probable Maximum Precipitation (PMP) of 21.8 inches. The results of this routing indicate that the reservoir is capable of passing the PMF with a maximum reservoir level of El. 1261.2 feet, which is 3.3 feet below the minimum crest of the dam. The maximum discharge from the reservoir, as indicated by this analysis, is 2473 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 adequate according to the recommended criteria.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - The seepage area noted to the left of the outlet structure during the visual inspection should be periodically examined in the future to verify that the quantity of seepage is not increasing and transportation of fine material is not occurring. Should the extent of the seepage area or turbidity of the seepage increase with time, the condition should be studied in detail and appropriate remedial measures taken.

b. Design and Construction Data - Calculations of embankment slope and foundation stability were not available for review. However, a summary report from the SCS Soil Mechanics Laboratory at Lincoln, Nebraska dated 8 December 1964 presented the results of the laboratory soil testing program and slope stability analysis performed. Shear strength properties obtained and used in the slope stability analysis were reported as follows:

Foundation Materials -	
Soil Type -	Sandy Silt (ML)
Type of Test Performed -	Consolidated Undrained Triaxial Shear Test
Angle of Internal Friction (ϕ) -	26.5°
Cohesion (c) -	200 p.s.f.
Sample Type -	Undisturbed Sample
Embankment Materials -	
Soil Type -	Silty Clay (CL-ML)
Type of Test Performed -	Consolidated Undrained Triaxial Shear Test
Angle of Internal Friction (ϕ) -	26°
Cohesion (c) -	725 p.s.f.
Sample Type -	Remolded and compacted at 95% Standard Proctor

The results of three stability analyses (using the Swedish Circle Method) was presented, however, their analysis used a 3H:1V upstream slope and 2H:1V downstream slope. The SCS results indicated the slopes to be stable under their assumed geometry and the report concluded that the slopes would also be stable under 2.5H:1V slopes upstream and downstream. It should be pointed out that the foundation drain recommended by the SCS to prevent piping and relieve uplift at the toe was installed. Also, the selective placement (zoning) of the embankment was installed as recommended.

Based upon the above information, coupled with the visual inspection, it is concluded that no further stability assessments are deemed necessary.

c. Operating Records - No operating records are maintained. The operation procedures do not indicate any cause for concern relative to the structural stability of the dam.

d. Post-Construction Changes - The post-construction changes to the dam do not adversely affect the structural stability.

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. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if they have adequate stability under static loading conditions. As indicated in paragraph 6.1.b., this dam could be shown to meet the stability requirements of the "Recommended Guidelines for Safety Inspection of Dams." Therefore, further consideration of the seismic stability is not warranted for this Phase I Inspection Report.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety - The dam was in good overall condition at the time of inspection. The seepage observed during the visual inspection does not constitute a hazard to the safety of the structure according to the conditions present at the time of the inspection. PA 474 is a "High" hazard-"Small" size dam and should have a hydraulic capability sufficient to pass the PMF. As presented in Section 5, the spillways and reservoir were determined adequate to pass the PMF without overtopping the dam.

b. Adequacy of Information - The information available combined with the visual observations and measurements made during the field 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, unless future inspections of the seepage area indicate changing conditions.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection revealed a few items of remedial work which should be performed as soon as practicable by the owner. These include:

1) Periodically inspect the seepage area to the left of the outlet structure to identify a change in quantity of seepage or the exiting of muddy water from this area and, if necessary, study the situation in detail and take appropriate remedial measures.

2) Remove the sedimentation and vegetation above the inlet and outlet of the spring drain in the dike and clean the pipe out, if necessary. The downstream channel may need to be reshaped to provide sufficient drainage away from the toe of the dike.

3) Remove the stockpiled brush from the emergency spillway channel.

4) Fill the animal burrows in the embankment and establish a rodent control program.

5) Replace the joint filler between the outlet conduit and the impact basin head wall.

6) Periodically inspect and maintain the filter drain outlets.

7) Clear the debris from the trash rack of the riser and periodically inspect and maintain the trash rack in the future.

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.

PLATES

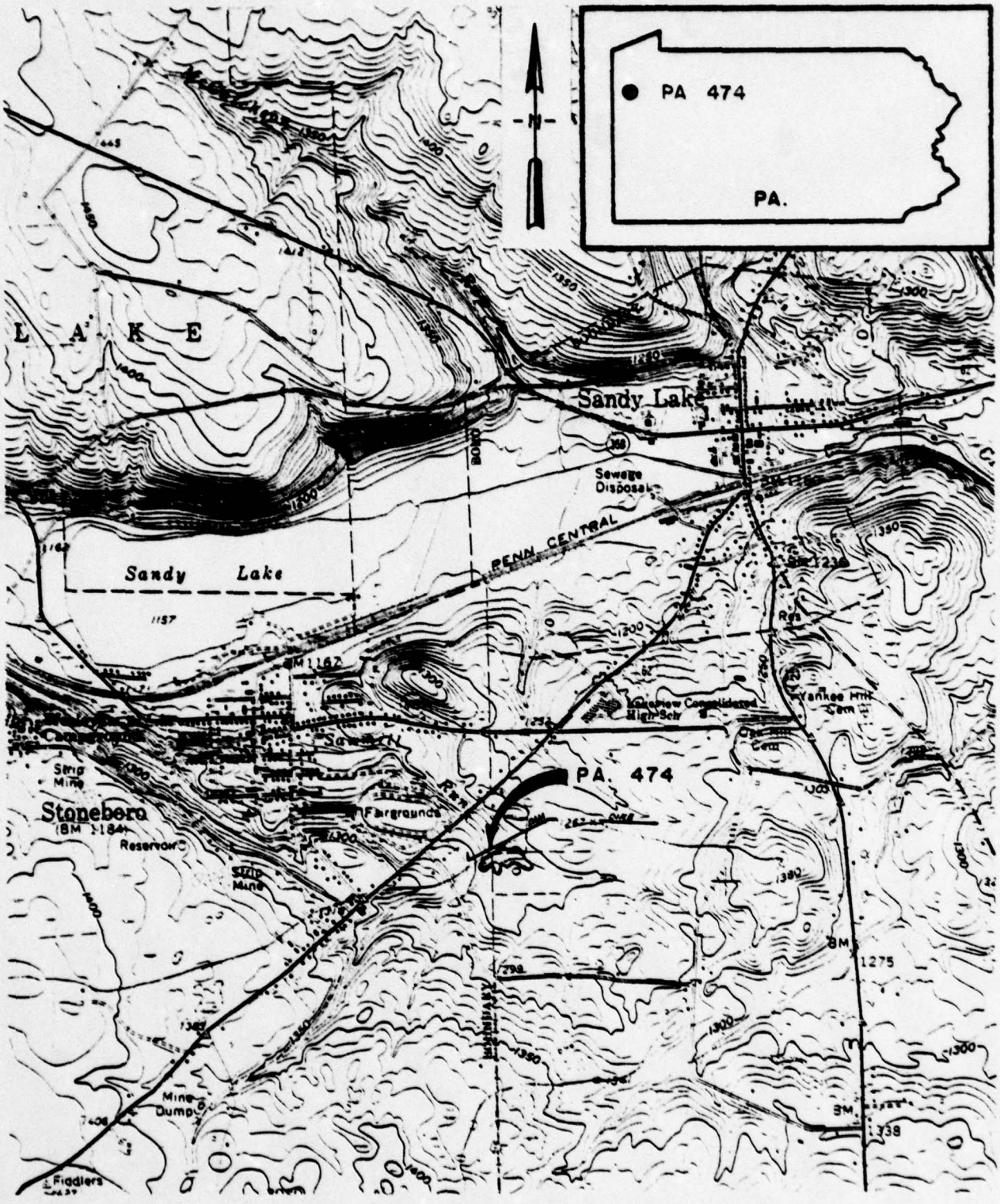
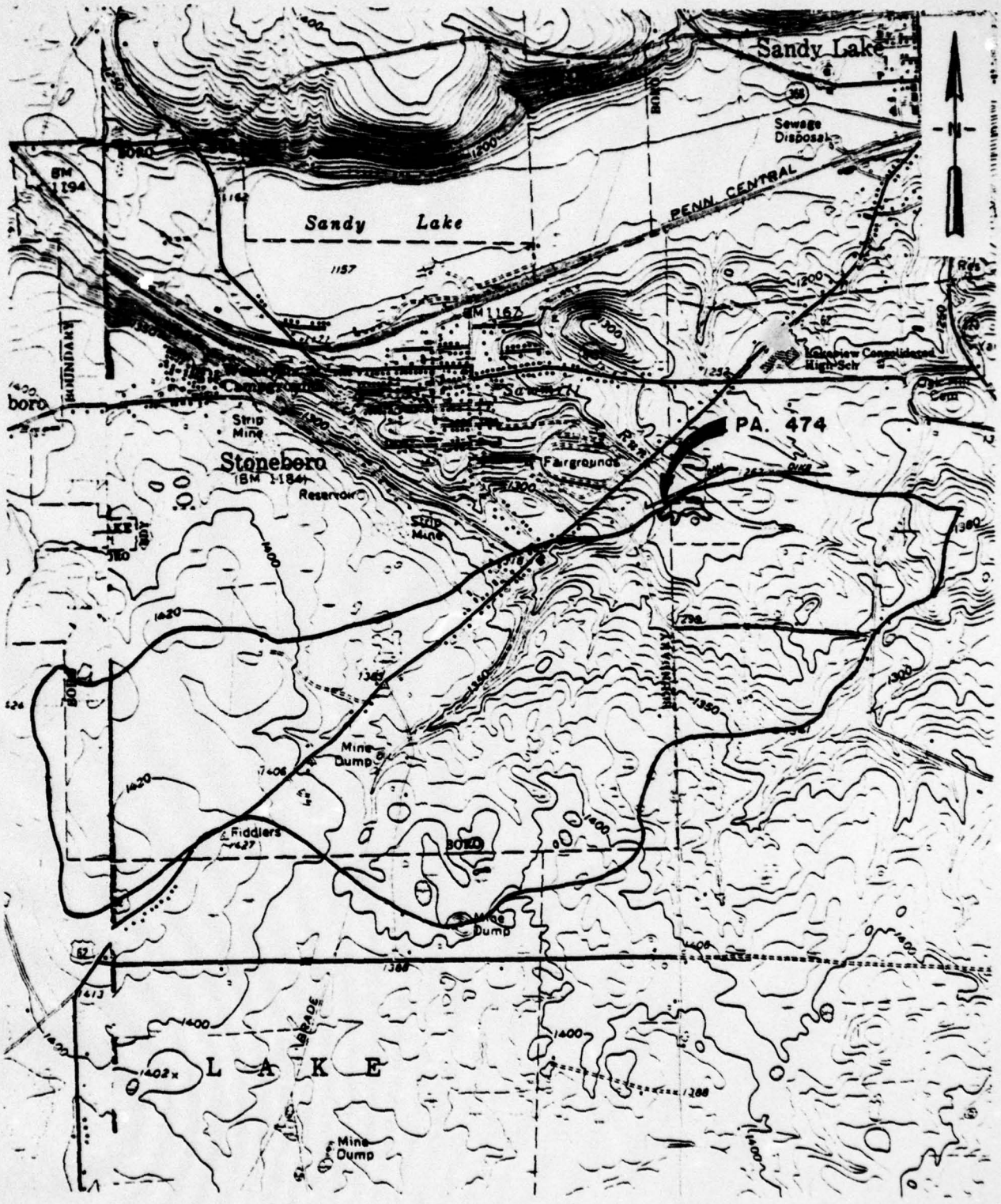


PLATE 1 LOCATION PLAN

PA 474



SCALE 1:24000

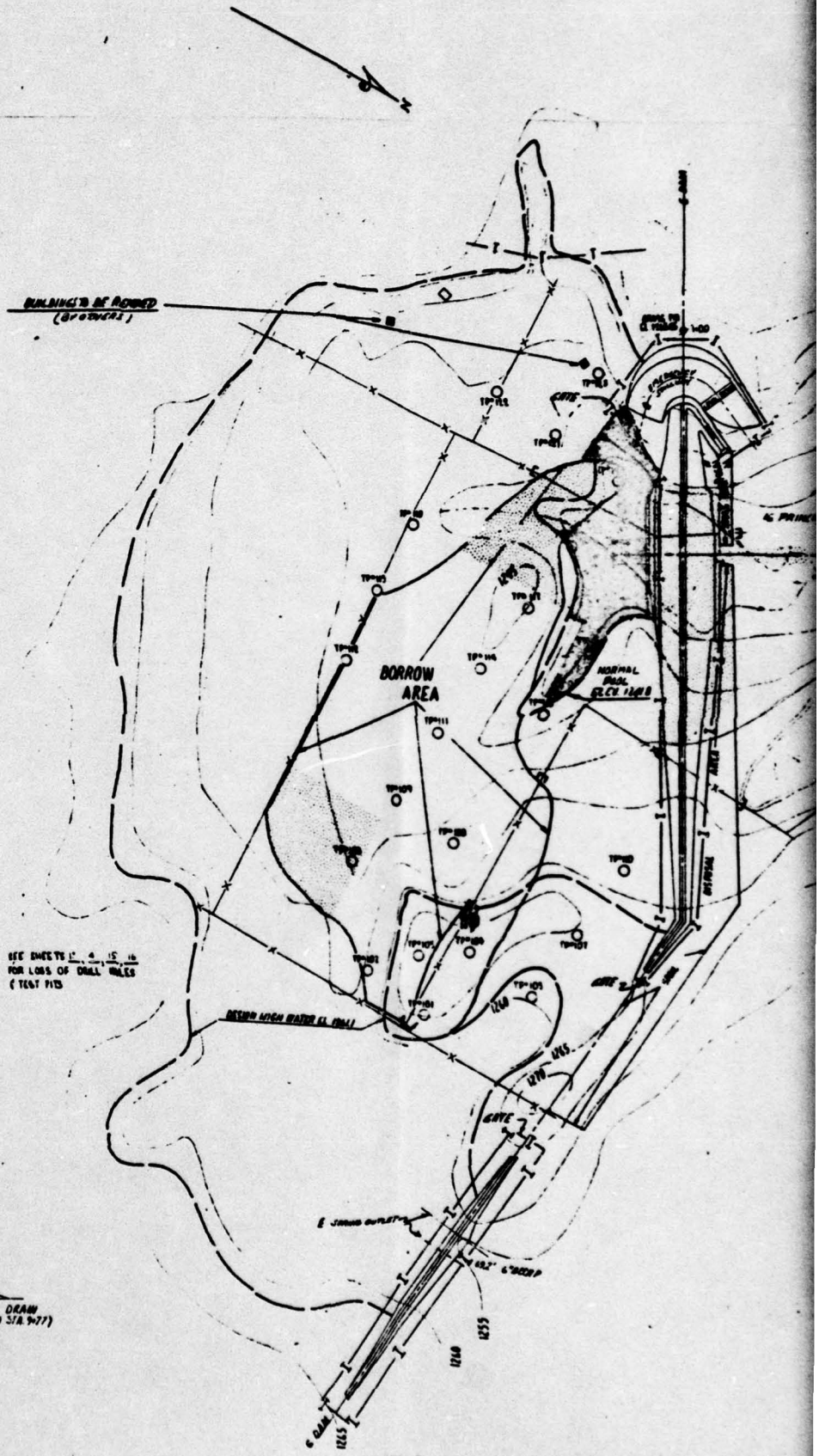
1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

.5 0 1 KILOMETER

PLATE 2 WATERSHED MAP

PA 474



NOTE: A MINIMUM OF 30 AC FT TO BE EXCAVATED IN BORROW AREA BETWEEN ELEV. 1268 & 1252.0

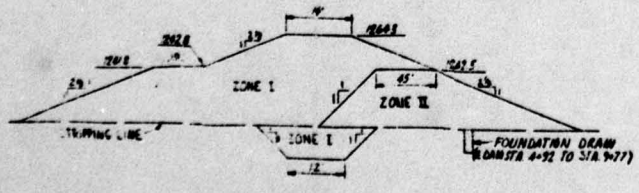
EARTH FILL

ZONE I MATERIAL AS REPRESENTED BY TP-104 DEPTH 1 TO 9 FEET [illegible] IN FIELD AS ML, [illegible] IN LAB AS ML-CL AND MATERIAL AS REPRESENTED BY TP-102, DEPTH 0.5 TO 6.0 FEET, [illegible] IN FIELD AS CL AND ML.

ZONE II MATERIAL AS REPRESENTED BY TP-103 DEPTH 2.5 TO 3.5 FEET [illegible] IN FIELD AS SM, [illegible] IN LAB AS SM AND MATERIAL AS REPRESENTED BY TP-105, DEPTH 2 TO 7 FEET, [illegible] IN FIELD AS SM, [illegible] IN LAB AS SM.

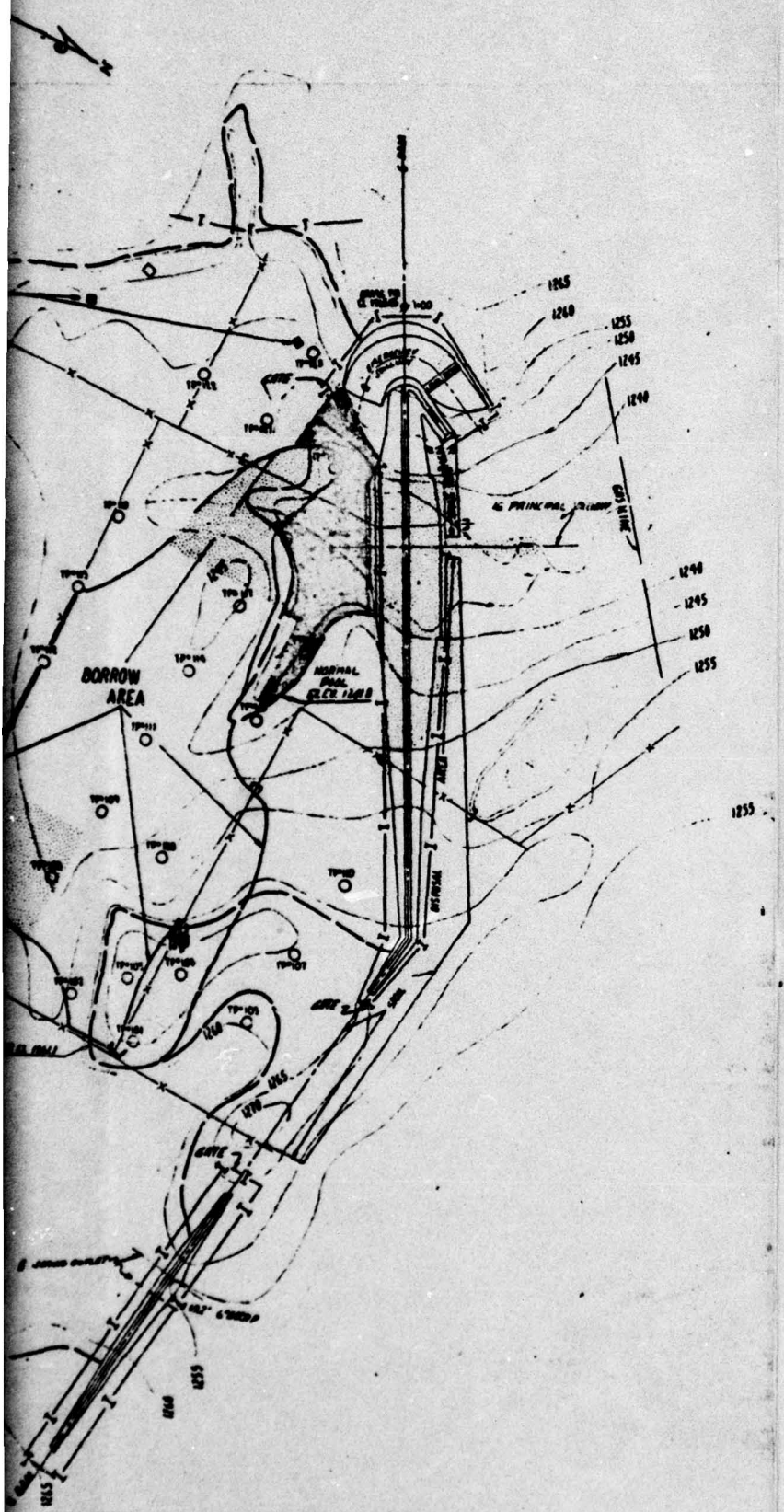
COMPACTION SHALL BE CLASS 'A'. THE FILL MATERIAL SHALL BE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DENSITY OBTAINED IN COMPACTION TESTS OF THE FILL MATERIALS PERFORMED BY METHOD 'A' ASTM D698

MAXIMUM LAYER THICKNESS 9" (BEFORE COMPACTION).
MAXIMUM SIZE OF ROCK FRAGMENTS IS 6"



TYPICAL SECTION OF DAM
NOT TO SCALE

SEE SHEETS 1, 4, 15, 16 FOR LOGS OF DRILL HOLES & TEST PITS



[redacted] AREA

AREA TO BE CLEARED [illegible] 64 ACRES

NOTE: AREAS TO BE SEEDED INCLUDE DAM, DIKE, EMERGENCY SPILLWAY, BORROW AREA AND DISTURBED AREAS IN VICINITY OF DAM.

SOIL DISPOSAL AREA LIMITS TO BE STAKED IN FIELD.

THIS PAGE IS BEST QUALITY PRACTICABLE
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—X— EXISTING FENCE
[—X—] SECTION TO BE REMOVED
—I— FENCE TO BE INSTALLED
FOR FENCE DETAILS SEE SHEET 11

2..14.

PLATE 3

AS BUILT PLANS

SCALE 0 50 100 200 400 FEET

SANDY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-474
MERCER COUNTY, PENNSYLVANIA
PLAN OF STORAGE AREA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed James A. Riddlington 2-65	Date	Approved by	
Drawn R A STALTER	FEB 65	Title	
Traced		Title	
Checked Cyrille Thomas 2-65		Sheet No. 2 of 6 sheets	Drawing No. PA-474-P

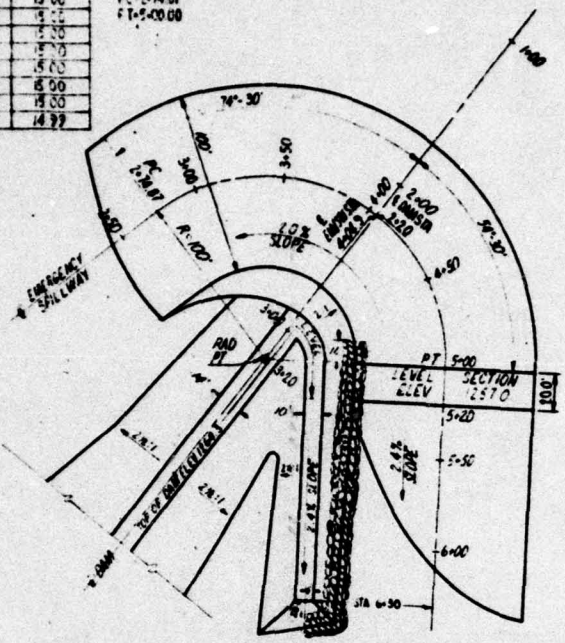
2

FORM SCS 513 (APRIL 1963)

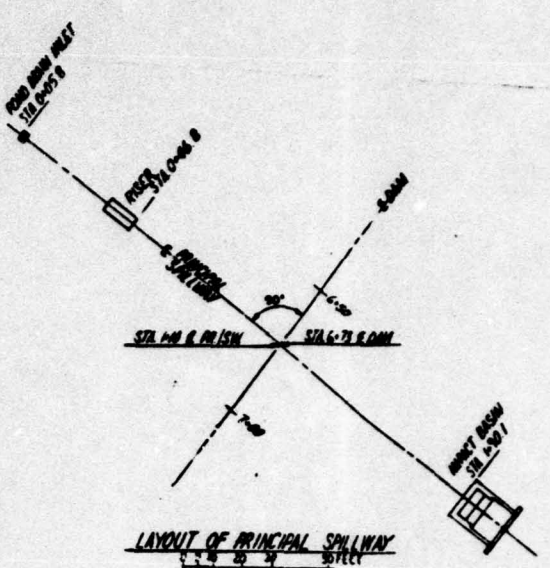
EMERGENCY SPILLWAY & CURVE DATA

STATION	DEFLECTION	CHORD
PC 2+36.87	0°-00	———
2+51 88	4°-18	15 00
2+66 89	8°-36	15 00
2+81 90	12°-54	15 00
2+96 91	17°-12	15 00
3+11 92	21°-30	15 00
3+26 93	25°-48	15 00
3+39 96	30°-06	15 00
3+54 95	34°-24	15 00
3+69 96	38°-42	15 00
3+84 97	43°-00	15 00
3+99 98	47°-18	15 00
4+13 99	51°-36	15 00
4+28 00	55°-54	15 00
4+43 01	60°-12	15 00
PT 4+57 20	64°-30	14 99

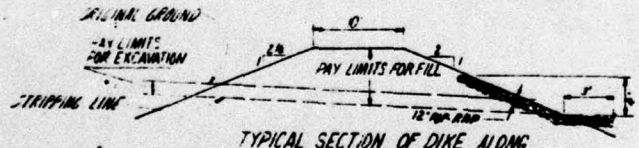
L = 129'-60
R = 100'
T = 70 65
L = 125 13
Chd = 120 52
M = 96.95
E = 132 28
PC = 2+36 87
PT = 5+00 00



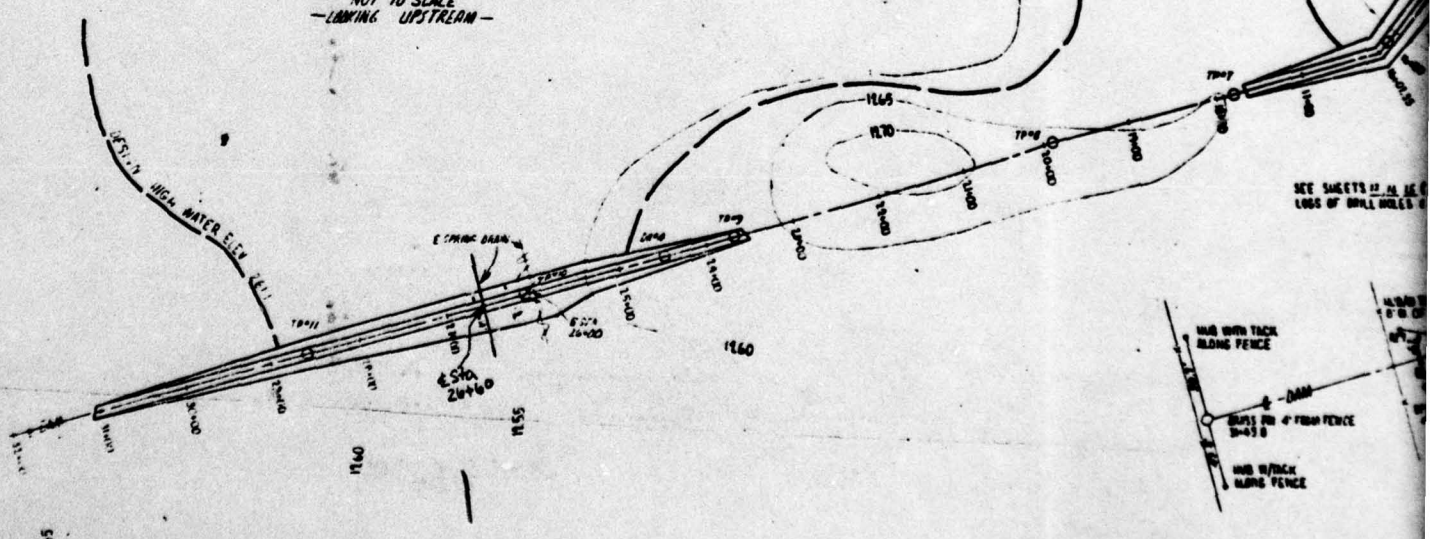
LAYOUT OF EMERGENCY SPILLWAY & DIKE

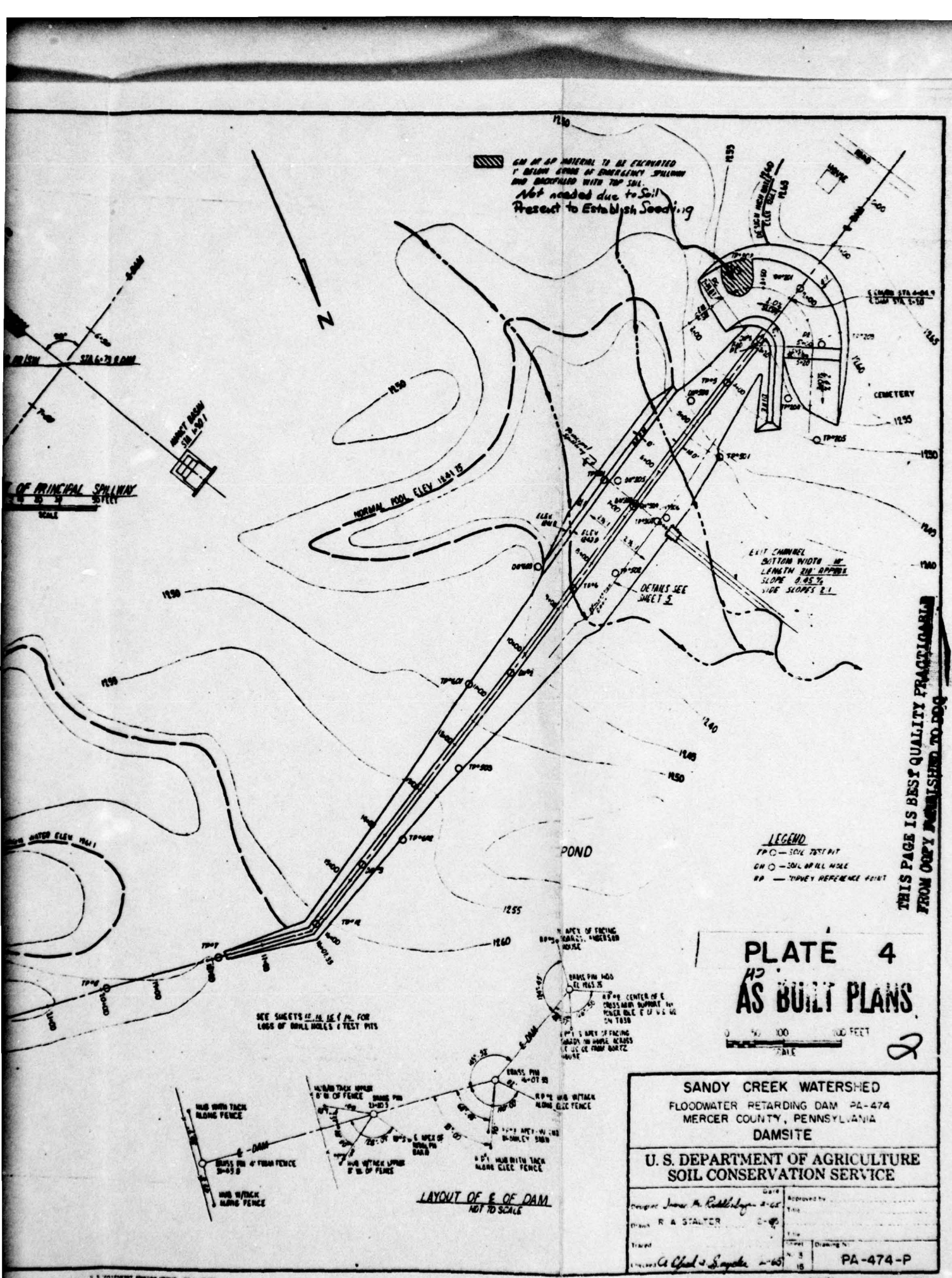


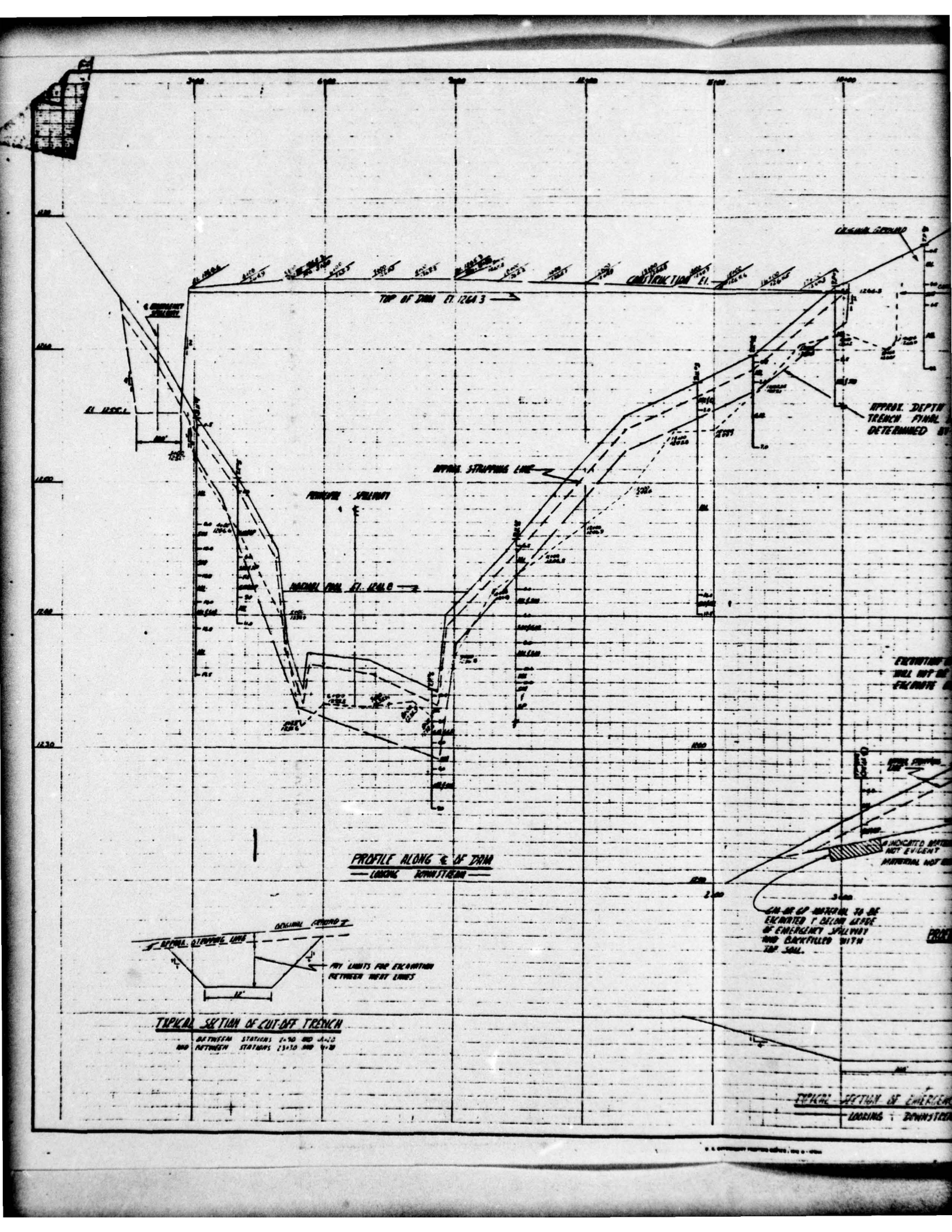
LAYOUT OF PRINCIPAL SPILLWAY

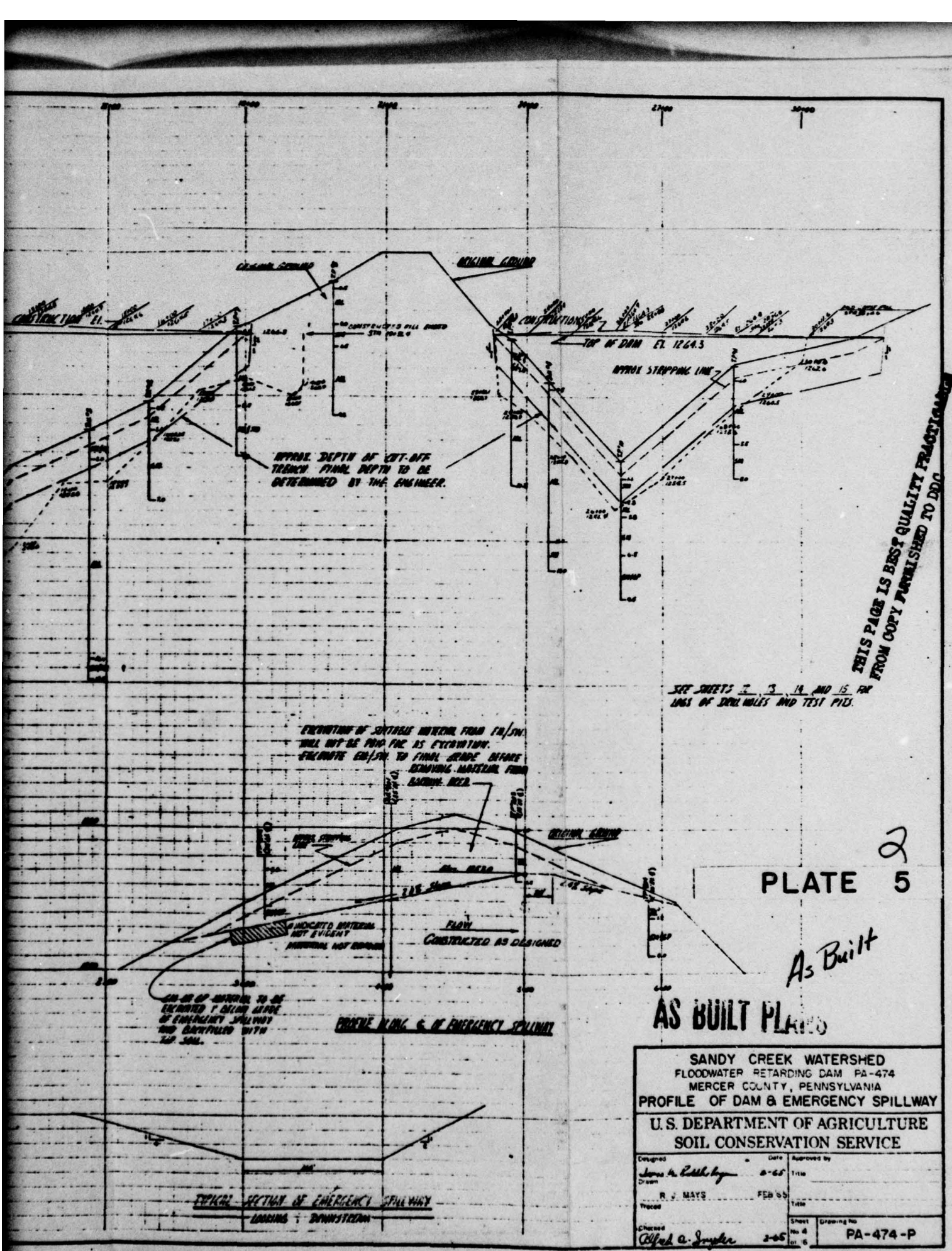


TYPICAL SECTION OF DIKE ALONG EMERGENCY SPILLWAY
NOT TO SCALE
—LOOKING UPSTREAM—




GM OR BP MATERIAL TO BE EXCAVATED 1' BELOW GRADE OF EMERGENCY SPILLWAY AND BACKFILLED WITH TOP SOIL.
Not needed due to Soil Present to Establish Seeding
N
NORMAL POOL ELEV 1461.35
EXIT CHANNEL
BOTTOM WIDTH 40'
LENGTH 210' APPROX
SLOPE 0.45%
SIDE SLOPES 2:1
DETAILS SEE SHEET 5
CEMETERY
POND
LEGEND
FP ○ — SOIL TEST PIT
GM ○ — SOIL OR ILL HOLE
BP — SURVEY REFERENCE POINT
SEE SHEETS 11 & 12 FOR LOGS OF DRILL HOLES & TEST PITS
LAYOUT OF ℄ OF DAM
NOT TO SCALE
THIS PAGE IS BEST QUALITY PRACTICABLE FROM COPY FURNISHED TO DDC
PLATE 4
AS BUILT PLANS
SANDY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-474
MERCER COUNTY, PENNSYLVANIA
DAMSITE
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PA-474-P


TOP OF DAM EL. 1264.3
EMERGENCY SPILLWAY
EL. 1250.0
PERMANENT SPILLWAY
APPROX. STRIPPING LINE
ORIGINAL GROUND
CONSTRUCTION EL.
APPROX. DEPTH
TRENCH FINAL
DETERMINED BY
EXCAVATION
WILL NOT BE
EARTH FILL
INDICATED MATERIAL
NOT EVIDENT
MATERIAL NOT
PROFILE ALONG ℄ OF DAM
LOOKING DOWNSTREAM
CAP OF EARTH MATERIAL TO BE
EXCAVATED TO GRADE
OF EMERGENCY SPILLWAY
AND BACKFILLED WITH
TOP SOIL.
ORIGINAL GROUND
APPROX. STRIPPING LINE
PAY LIMITS FOR EXCAVATION
BETWEEN THESE LINES
12'
TYPICAL SECTION OF CUT-OFF TRENCH
BETWEEN STATIONS
AND BETWEEN STATIONS
TYPICAL SECTION OF EMERGEN
LOOKING DOWNSTREA



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2

PLATE 5

As Built

AS BUILT PLANS

SANDY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-474
MERCER COUNTY, PENNSYLVANIA
PROFILE OF DAM & EMERGENCY SPILLWAY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by
James A. Ritchey	8-65	Title
Drawn R. J. MAYS	FEB 65	Title
Traced		
Checked Alfred A. Snyder	2-65	Sheet No. 4 of 15 — Drawing No. PA-474-P

6" DIA FILTER DRAIN PIPE

5	20' SECTIONS
1	6' SECTION (PERFORATED)
1	5'-6" SECTION
1	6'-10" SECTION
1	90° ELBOW (1X1)
2	90° ELBOWS (1X2)
1	90° ELBOW (1X2½)
1	METAL END CAP
1	SMALL ANIMAL GUARD (SEE SHEET 10)

129'-10" TOTAL (USE STANDARD COUPLING BANDS)

6" DIA FILTER DRAIN PIPE

12	20' SECTIONS (PERFORATED)
1	17' SECTION (PERFORATED)
1	7' SECTION (PERFORATED)
1	5'-6" SECTION
1	6'-10" SECTION
1	22½-30° ELBOW (1X1)
1	90° ELBOW (1X1)
2	90° ELBOWS (1X2)
1	90° ELBOW (1X2½)
1	METAL END CAP
1	SMALL ANIMAL GUARD (SEE SHEET 10)

249'-10" TOTAL (USE STANDARD COUPLING BANDS)

MATERIAL SPEC. 1118
CONSTRUCTION SPEC. 12

NOTE:
ALL FILTER DRAIN PIPE TO BE HARD OR STEEL
SHAPE I, CLASS II, COATING TYPE A, ... CAN

FOUNDATION DRAIN TRENCH INSTALLED AS DESIGNED

MODIFICATION 46.0' DA

ASTM ...
ASTM ...

PLAN VIEW OF FOUNDATION DRAIN

TOE OF DAM

DISPOSAL AREA FOR ROCK HAULED FROM ...
SEE SHEET 6

ISOMETRIC OF FOUNDATION DRAIN OUTLET

SECTION D-D

SECTION ...
SAME AS ... WITH DRAIN ...

PROFILE OF FOUNDATION DRAIN
(LOOKING DOWNSTREAM)

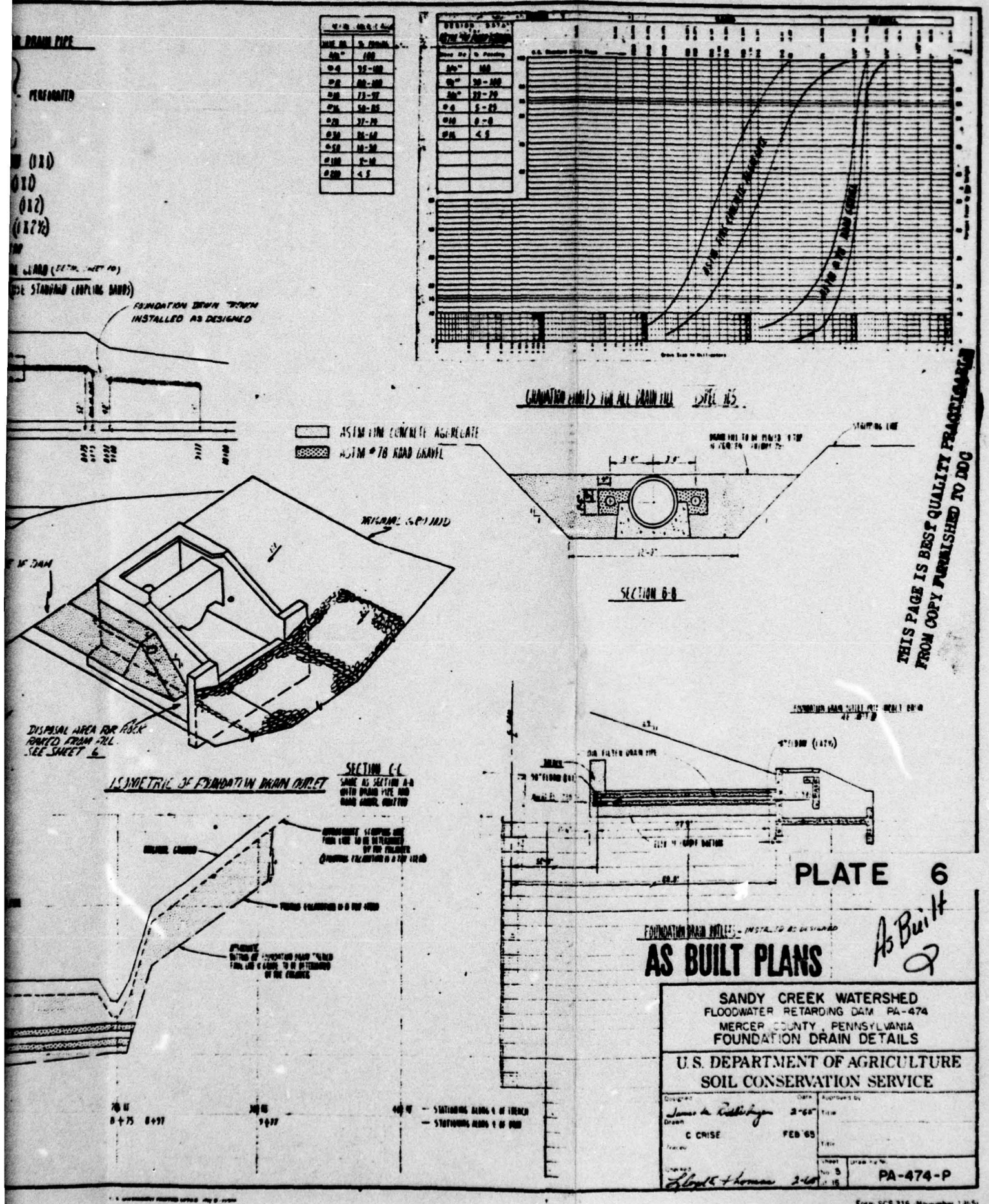

PLATE 6

As Built

AS BUILT PLANS

SANDY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-474
MERCER COUNTY, PENNSYLVANIA
FOUNDATION DRAIN DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed James A. Rutherford 2-65
Drawn C CRISE FEB '65
Traced
Checked Lloyd E. Thomas 2-65
Approved by
Title
Title
Sheet No. 5 of 15 sheets
Drawing No. PA-474-P

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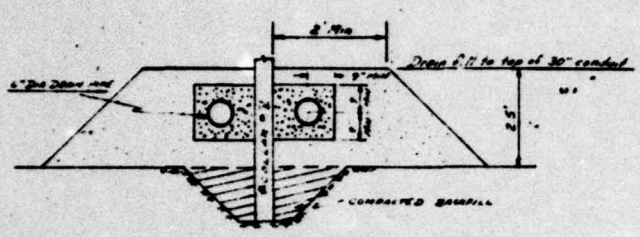
6" Dia. Filter Drain Pipe (Perforated)

2	15'-6" Sections
4	1'=2" Elbows
1	1'=1'=1' Tee
1	Metal End Cap

Use Standard Coupling Bands

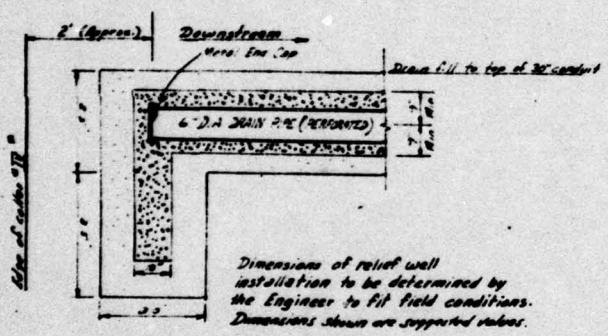
Material Spec. 110
Construction Spec. 12

A.S.T.M. Fine concrete aggregate
A.S.T.M. #78 Road Gravel
} Approx volume of d



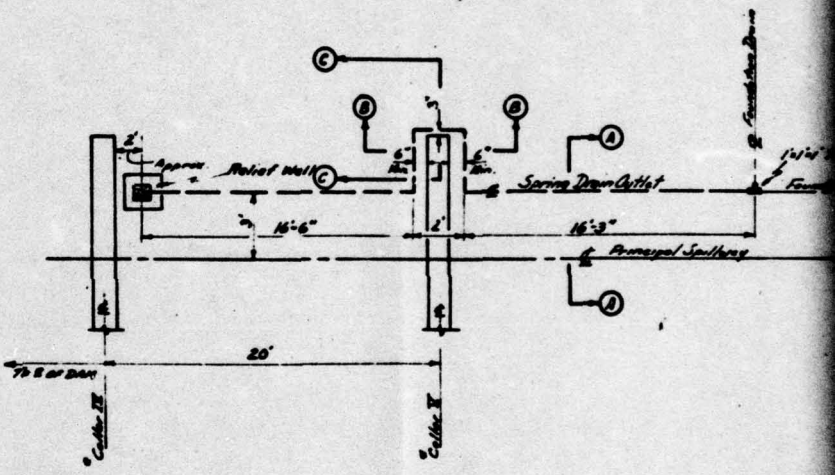
SECTION B-B

Note:
For gradation limits for all drain fill and additional filter drain pipe installation data see sheet #5 of const'r. plans.



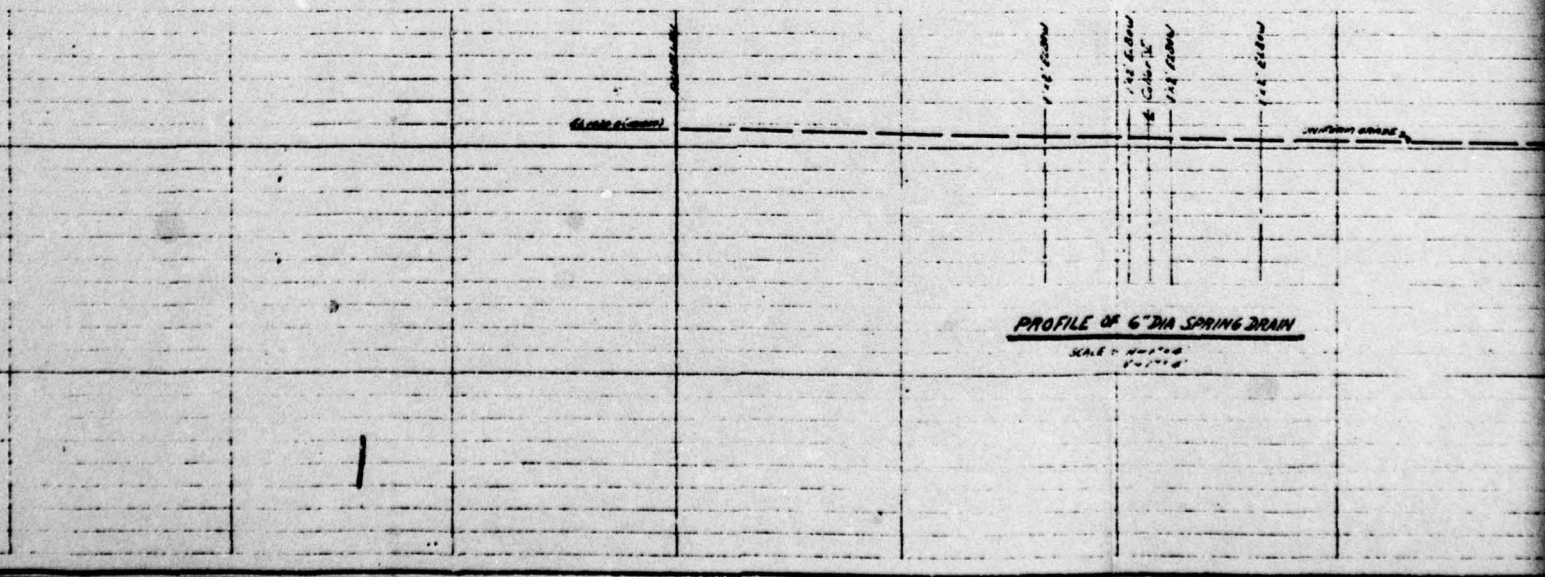
Dimensions of relief well installation to be determined by the Engineer to fit field conditions. Dimensions shown are suggested values.

RELIEF WELL DETAIL



* Collar no.'s refer to those shown on the const'r. plans; sheet #6

PLAN VIEW
Not to Scale



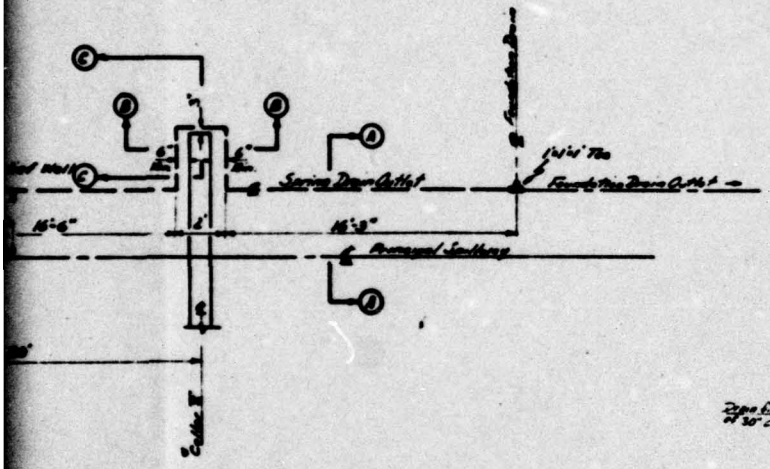
PROFILE OF 6" DIA SPRING DRAIN

Drain Pipe (Perforated)
Sections
Elbows
Tee
End Cap
Standard Coupling Bands

Material Spec. 440.
Construction Spec. 12.

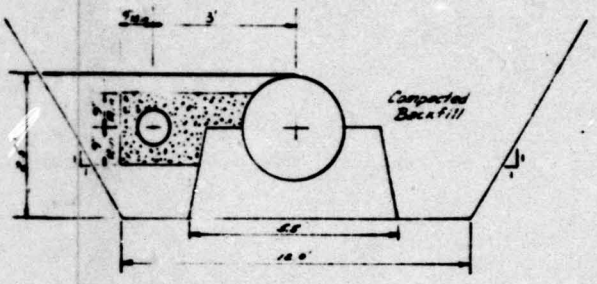
A.S.T.M. Fine concrete aggregate
A.S.T.M. #78 Road Gravel
} Approx volume of drain fill required = 38 Cu Yds

tion limits for all drain fill and additional
pe installation data see sheet #5 of const'n plans.

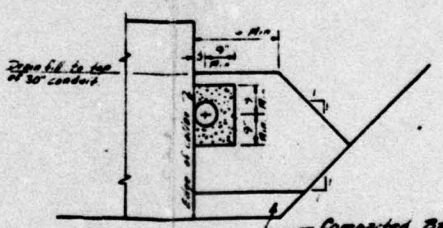


those shown
sheet #6

PLAN VIEW
Not to Scale



SECTION A-A



SECTION C-C

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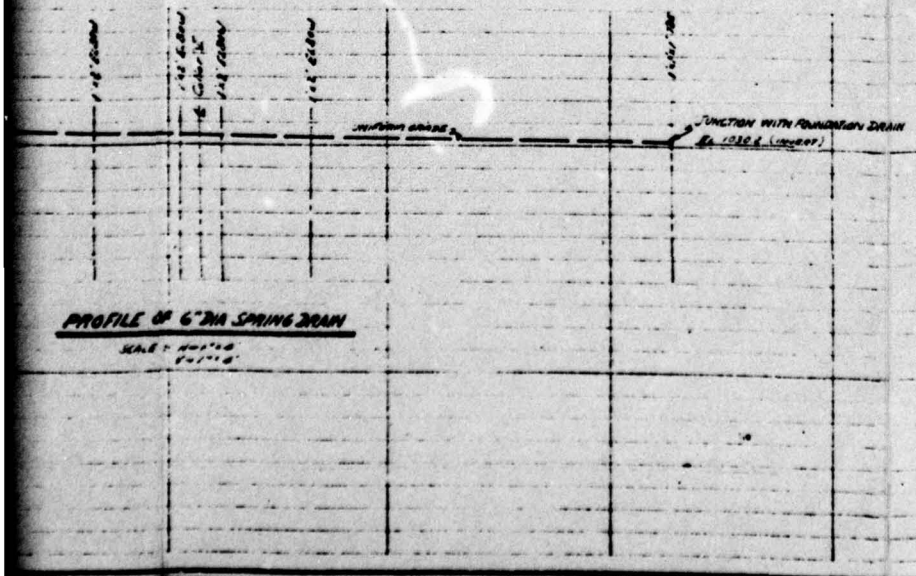
AS BUILT PLANS



PROFILE OF 6" DIA SPRING DRAIN

PLATE 7

As Bu

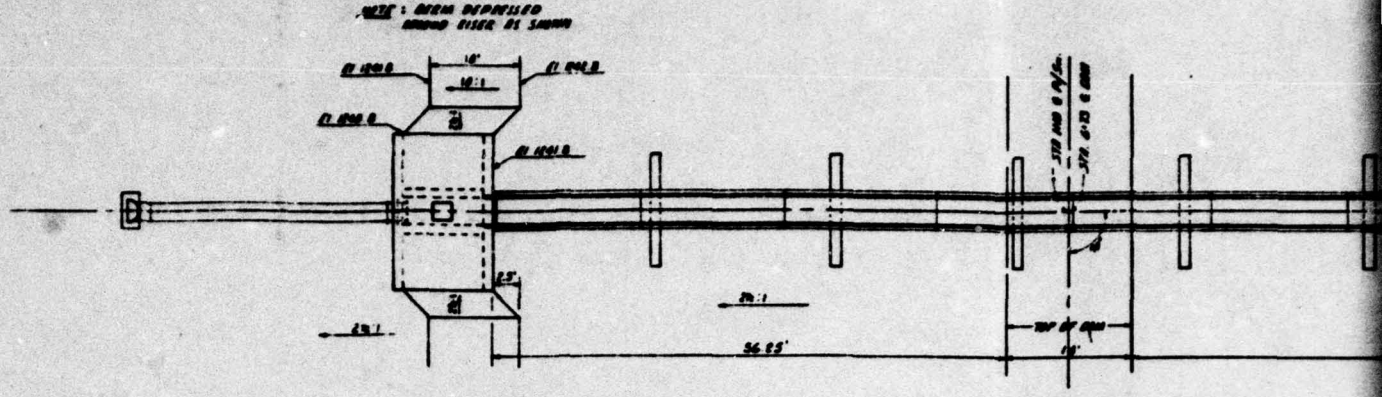
MODIFICATION

2

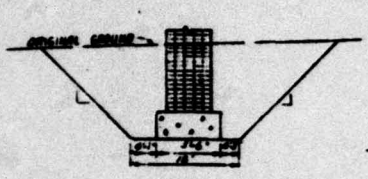
SANDY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-474
MERCER COUNTY, PENNSYLVANIA
SPRING DRAIN DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

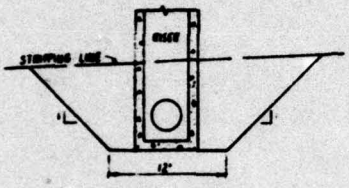
Designed — Date
Drawn RJM GFB — 12 MAY 66
Traced
Checked
Approved by
Title Craig M. Light, St. Cons. Engineer
Sheet No. 7A of 10 sheets
Drawing No. PA-474-P



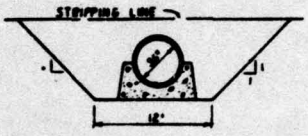
PLAN VIEW OF PRINCIPAL SPILLWAY



POND DRAIN INLET

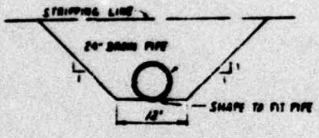


RISER



CRADLE

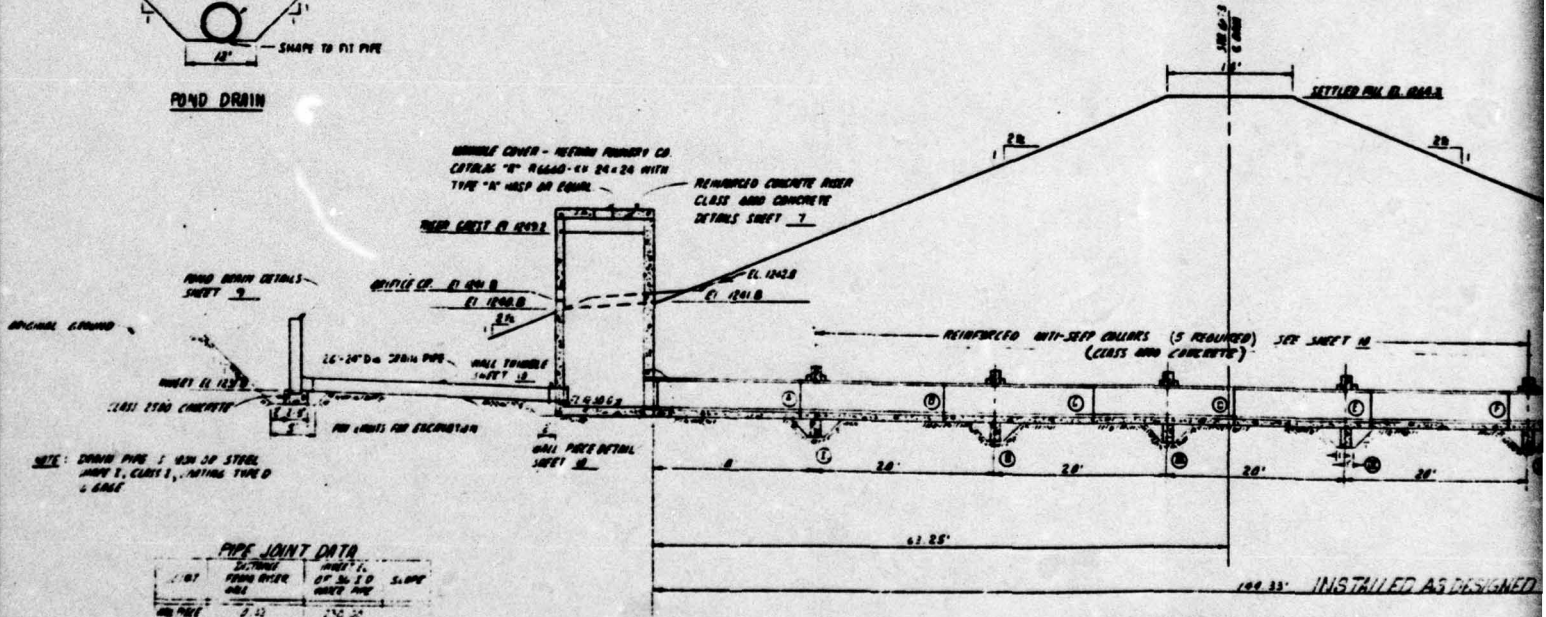
ANTI-SEEP COLLAR



POND DRAIN

TYPICAL SECTIONS - INSTALLED AS DESIGNED

PAY LIMITS FOR EXCAVATION BETWEEN NEAT LINES



PROFILE OF PRINCIPAL SPILLWAY

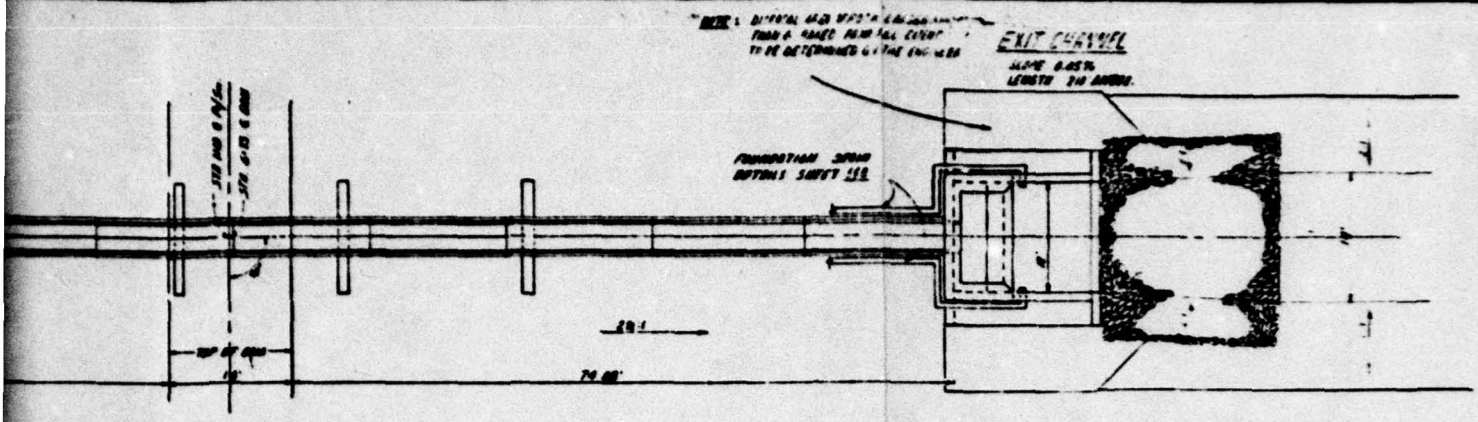
PIPE JOINT DATA

JOINT	DISTANCE FROM RISER AXIS	INVERT EL. OF 36" I.D. CORR. PIPE	SLOPE
RISER	0.00	1230.26	
A	16.33	1229.98	
B	32.33	1229.80	
C	48.33	1229.76	
D	64.33	1229.68	
E	80.33	1229.52	2%
F	96.33	1229.28	
G	112.33	1229.36	1.5%
H	128.33	1228.90	
OUTLET	144.33	1228.66	

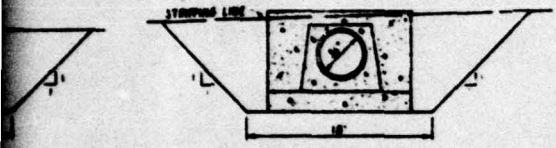
DIMENSIONS OF PIPE ARE BASED ON SCHEDULE SIZE AND DO NOT INCLUDE CREEP

ANTI-SEEP COLLAR DATA

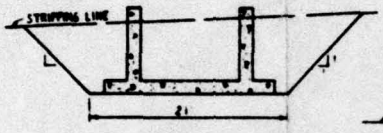
COLLAR	DISTANCE FROM RISER AXIS	INVERT EL. OF 36" I.D. CORR. PIPE
1	18	1229.91
2	38	1229.81
3	58	1229.71
4	78	1229.61
5	98	1229.51



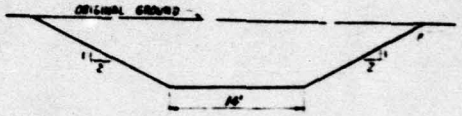
PLAN VIEW OF PRINCIPAL SPILLWAY



ANTI-SEEP COLLAR



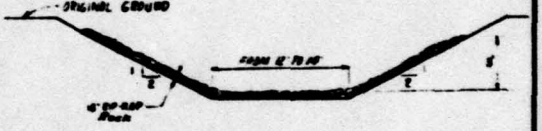
IMPACT BASIN



EXIT CHANNEL

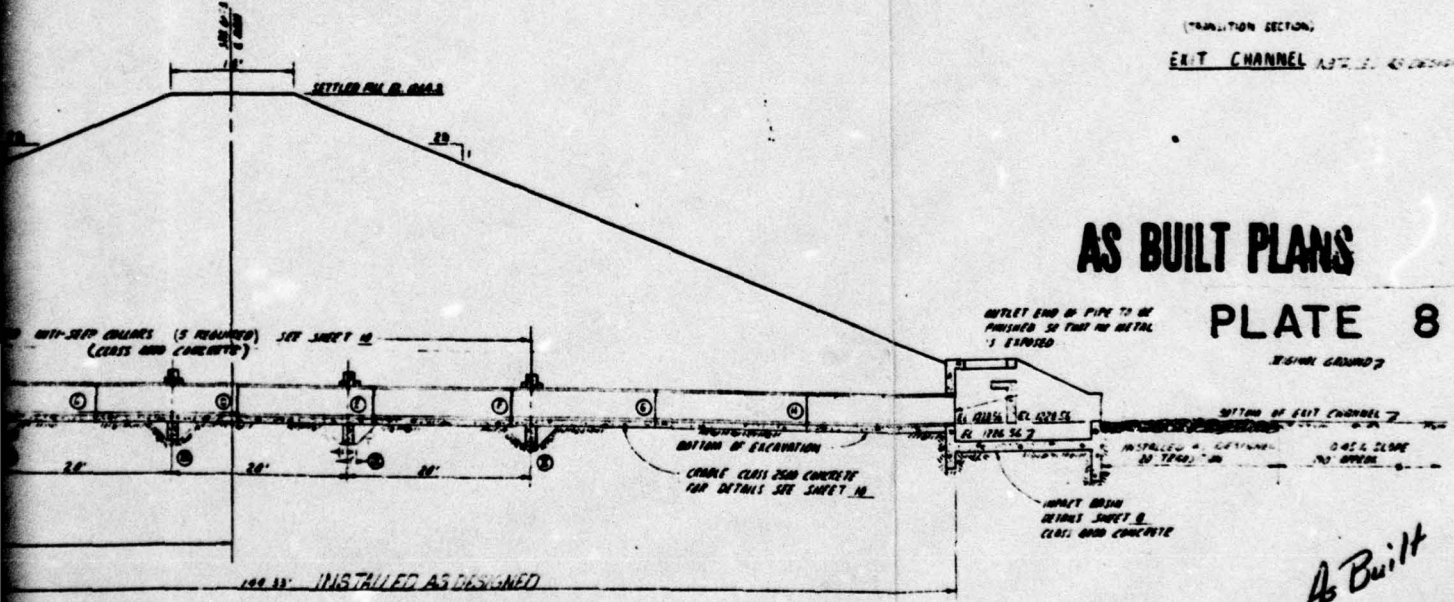
TYPICAL SECTIONS AS BUILT AS DESIGNED

PAY LIMITS FOR EXCAVATION BETWEEN NEAT LINES



(TRANSITION SECTION)

EXIT CHANNEL AS BUILT AS DESIGNED



PROFILE OF PRINCIPAL SPILLWAY

NOT TO SCALE

PRESSURE HEAD 16'
LOAD = 27,000 LBS PER LIN. FT. BASED ON O.D OF 42"
AND 3 EDGE BEARING STRENGTH FOR:
8.00" CRACK NON-PRESTRESSED PIPE = 8450 LBS PER LIN FT
8.00" CRACK PRESTRESSED PIPE = 6,350 LBS PER LIN FT

42" I.D REINFORCED CONCRETE WATER PIPE
9 - 16' SECTIONS
1 - WALL PIECE FOR 12" WALL
PIPE 33' TOTAL

AS BUILT PLANS

PLATE 8

SANDY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-474
MERCER COUNTY, PENNSYLVANIA
PLAN-PROFILE OF PRINCIPAL SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed Dwight F. Thomas 2-65
Drawn R. J. MAYS FEB 65
Traced
Checked Alfred A. Smyth 2-65
Approved by
Title
Date
Sheet No. 8 of 16 sheets
Drawing No. PA-474-P

SCS 333B (APRIL 196

As Built

2

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FROM COPY FURNISHED TO DDC

APPENDIX A

CHECK LIST - VISUAL INSPECTION AND FIELD SKETCH

Check List
Visual Inspection
Phase 1

Name of Dam PA 474 County Mercer State PA Coordinates Lat. N 41° 20.1'

Long. W 80° 05.7'

NDI # PA 00249
PennDER # 43-50
SCS # PA 474

Date of Inspection 9 May 1979 Weather Sunny Temperature 90°F.

Pool Elevation at Time of Inspection 1242.5 ft.* M.S.L. Tailwater at Time of Inspection 1229.0 ft.* M.S.L.

*All elevations are referenced to the crest of the riser orifice (El. 1241.8 ft.)

Inspection Personnel:

Michael Baker, Jr., Inc.:

Rodney E. Holderbaum
James G. Ulinski

Site Visit (5 June 1979)

Dr. C. Y. Chen
James G. Ulinski

James G. Ulinski Recorder

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: PA 474
NDI # PA 00249

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS		
DRAINS		
WATER PASSAGES		
FOUNDATION		

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: PA 474

NDI # PA 00249

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

EMBANKMENT

A-4

Name of Dam: PA 474
NDI # PA 00249

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No problems observed	
RIPRAP FAILURES	None	

EMBANKMENT

Name of Dam: PA 474

NDI # PA 00249

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RODENT/ANIMAL BURROWS	Several rodent/animal burrows were observed in the embankment. The approximate location of these holes are shown on the field sketch.	The holes should be repaired.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems observed	
ANY NOTICEABLE SEEPAGE	Minor seepage was observed to the left of the outlet structure (impact basin) wall. Clear flow of approximately 0.5 g.p.m. at the time of inspection.	This area should be observed periodically in the future to identify any changes in characteristics.
STAFF GAGE AND RECORDER	None installed	
DRAINS	Two 6-in. corrugated metal drainpipes enter the impact basin (one on each side). The left drain was flowing with clear water, approximately 1.5 in. deep in the invert (approximately 15 g.p.m.). The right drain was clogged. After unclogging, the drain flowed full for approximately five minutes and eventually tapered off to a slow trickle.	These drains shall be inspected periodically for turbidity, volume of flow and blockage.

OUTLET WORKS

Name of Dam: PA 474
NDI # PA 00249

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The outlet conduit, at its exit, was in good condition. The remainder of the conduit was unobservable.	
INTAKE STRUCTURE	Very good condition. The interior and exterior surfaces show no sign of deterioration. Some debris has accumulated around the trash rack.	Debris should be removed periodically.
OUTLET STRUCTURE	Joint filler between the outlet conduit and concrete outlet structure has deteriorated. No other deterioration was observed.	Joint filler should be replaced and inspected periodically.
OUTLET CHANNEL	The outlet channel is in fairly good condition. A small road crossing is located several hundred ft. downstream from the dam.	The road crossing could become clogged with debris but would not significantly affect discharges from the reservoir.
EMERGENCY GATE	The 24-in. diameter pond drain outlet has a steel plate bolted in front of it.	
SPRING DRAIN IN DIKE	A 6-in. C.M.P. provides drainage for a groundwater spring located upstream of the dike. This drain has an inlet on the upstream side of the dike and outlets downstream of the dike. Both the inlet and outlet were covered with sedimentation and vegetation.	The inlet and outlet should be uncovered and the drain and pipe made functional according to design intent.

Name of Dam: PA 474
NDI # PA 00249

UNGATED SPILLWAY
(EMERGENCY SPILLWAY IN SCS TERMINOLOGY)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	No concrete weir was installed. The spillway is a well vegetated side channel spillway.	
APPROACH CHANNEL	The approach channel is well vegetated and free of debris.	
DISCHARGE CHANNEL	Several small trees (1-2 in. diameter) were cut from and stockpiled in the discharge channel. A fence is located at the end of the emergency spillway discharge channel.	All brush and debris should be removed from the channel.
BRIDGE AND PIERS	Not Applicable	

GATED SPILLWAY- Not Applicable

A-8

Name of Dam: PA 474

NDI # PA 00249

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

INSTRUMENTATION - None

Name of Dam: PA 474

NDI # PA 00249

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS		
OBSERVATION WELLS		
WEIRS		
PIEZOMETERS		
OTHER		

RESERVOIR

Name of Dam: PA 474

NDI # PA 00249

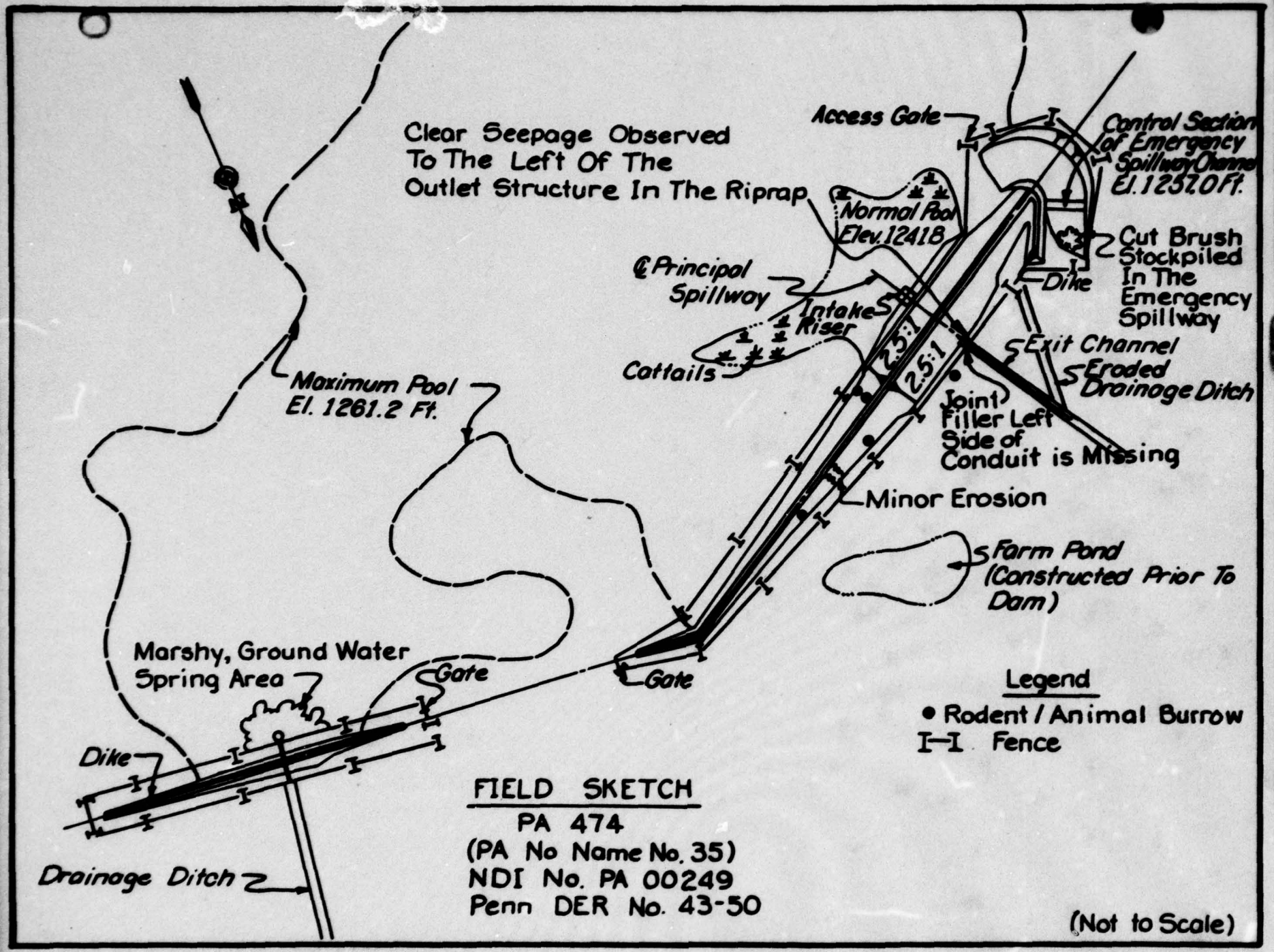
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The areas adjacent to the reservoir are generally mildly sloping farmland. The slopes are stable from a soil mechanics point of view.	
SEDIMENTATION	Considering the age of the structure and the watershed characteristics, sedimentation should not be significant at this time.	The reservoir was designed by the SCS with allowance for 50 years of sediment accumulation.

DOWNSTREAM CHANNEL

Name of Dam: PA 474

NDI # PA 00249

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No major obstructions are located in the downstream channel. Several small bridges span the stream which could become blocked with debris during a large flood.	
SLOPES	The slopes adjacent to the downstream channel are mild to flat and are stable from a soil mechanics point of view. The downstream channel slope is mild, averaging 2.5% below the dam.	
APPROXIMATE NO. OF HOMES AND POPULATION	Saw Mill Run flows into the Borough of Stoneboro approximately 3000 ft. downstream from the dam. Approximately 20 homes are located in low lying areas and could be affected by large discharges from the reservoir.	


Clear Seepage Observed To The Left Of The Outlet Structure In The Riprap
Access Gate
Control Section of Emergency Spillway Channel El. 1257.0 Ft.
Normal Pool Elev. 1241.8
Cut Brush Stockpiled In The Emergency Spillway
℄ Principal Spillway
Intake Riser
Dike
Cattails
Maximum Pool El. 1261.2 Ft.
2.5:1
2.5:1
Exit Channel Eroded Drainage Ditch
Joint Filler Left Side of Conduit is Missing
Minor Erosion
Farm Pond (Constructed Prior To Dam)
Marshy, Ground Water Spring Area
Gate
Gate
Dike
Drainage Ditch
Legend
• Rodent / Animal Burrow
I—I Fence
FIELD SKETCH
PA 474
(PA No Name No. 35)
NDI No. PA 00249
Penn DER No. 43-50
(Not to Scale)

APPENDIX B

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: PA 474
NDI # PA 00249

ITEM	REMARKS
PLAN OF DAM	Reference Drawings: "Sandy Creek Watershed, Floodwater Retarding Dam PA-474, Mercer County, Pennsylvania," U.S. Department of Agriculture, Soil Conservation Service (SCS), October 1964 (16 sheets of "as built" drawings available in SCS Harrisburg office and Mercer County Conservation District office; prints of the design drawings are available in PennDER's files). Plan of Dam - Reference Drawings Sheets 2 and 3 included in this report as Plates 3 and 4.
REGIONAL VICINITY MAP	A portion of a USGS 7.5 minute topographic quadrangle, Sandy Lake, 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 by the SCS and constructed by Kane Brothers Co. of Youngstown, Ohio. The construction occurred from April 1965 to September 1966 with an appropriate winter shutdown period. Inspection was provided by the SCS during the construction.
TYPICAL SECTIONS OF DAM	See Plates 3 and 5 (Reference Drawings Sheets 2 and 4).
HYDROLOGIC/HYDRAULIC DATA	Some hydrologic/hydraulic data are included in the "Sandy Creek Watershed Work Plan" report prepared by the Mercer County Commissioners, et. al., March 1962. Other information is included in the Dam Permit Application Report (11 May 1965) available in PennDER's files. Additional hydrologic/hydraulic data are available in the files of the SCS Harrisburg office.
OUTLETS - PLAN	Reference Drawings - Sheets 3, 5, and 6. (Included in this report as Plated 3, 7, and 5, respectively.
- DETAILS	Reference Drawings - Sheets 5, 6, 7, 8, 9, and 10.
- CONSTRAINTS	None
- DISCHARGE RATINGS	are available in the SCS design files.
RAINFALL/RESERVOIR RECORDS	None available

ITEM	REMARKS
DESIGN REPORTS	No complete design report is readily available, but design report components are available in the files of the SCS Harrisburg office. Additional design information is included in the "Sandy Creek Watershed Work Plan" and in the PennDER Dam Permit Application Report.
GEOLOGY REPORTS	No geology report is readily available. Some geologic information is included in the "Sandy Creek Watershed Work Plan," the files of the SCS Harrisburg office, and various Pennsylvania Geological Survey publications.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Design computations are available in the files of the SCS Harrisburg office.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	See Reference Drawings Sheets 2, 3, 4, 13, 14, 15, and 16. Additional information is available in the SCS Harrisburg office files.
POST-CONSTRUCTION SURVEYS OF DAM	The post-construction survey was used to prepare the "as built" drawings, most of which are presented as plates of this report.
BORROW SOURCES	Reference Drawing Sheet 2 (Plate 3 of this report) shows the extent of the borrow area. Additionally, if suitable material was encountered in the emergency spillway excavation, this material was used before the borrow area was opened up.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Modifications (design changes) during construction were incorporated into the "as built" drawings. No additional modifications have been performed.
HIGH POOL RECORDS	No records are kept.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	The dam is inspected annually by personnel from the SCS and the Mercer County Conservation District. In 1969 a detailed inspection of the riser unit was performed.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	Maintenance and operation are reviewed as a part of the annual inspections and recommendations for corrective action are given, if necessary.

Name of Dam: PA 474
NDI # PA 00249

ITEM	REMARKS
SPILLWAY PLAN, SECTIONS, and DETAILS	See Plates 3, 4, and 5.
OPERATING EQUIPMENT PLANS & DETAILS	None

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.56 sq. mi. (primarily farmland and woods)

ELEVATION TOP SEDIMENT POOL (STORAGE CAPACITY): 1241.8 ft. (14 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1257.0 ft. (366 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: 1261.1 ft.

ELEVATION TOP DAM: 1264.3 ft.

CREST: (SCS Terminology - Emergency Spillway)

a. Elevation 1257.0 ft. (control section)
b. Type Vegetated earth channel
c. Width 100 ft.
d. Length Approximately 450 ft.
e. Location Spillover At left end of dam
f. Number and Type of Gates None

OUTLET WORKS: (SCS Terminology - Principal Spillway)

a. Type Concrete riser
b. Location At edge normal pool approximately 400 ft. from left abutment.
c. Entrance inverts El. 1241.8 ft. (orifice)
El. 1249.2 ft. (high stage intake)
d. Exit inverts El. 1228.6 ft.
e. Emergency draindown facilities 24-in drainpipe (bolted shut at present time)

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

APPENDIX C

PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall Views of Dam
Upper Photo - Overall View of Dam from Left Abutment

Lower Photo - Overall View of Dike from Knoll Located Between Dam and Dike

Photo 1 - Upstream Slope of Dam, Intake Riser and Reservoir

Photo 2 - Close-up View of Intake Riser (Principal Spillway)

Photo 3 - Downstream Slope of Dam, Outlet Structure and Outlet Channel

Photo 4 - Close-up View of Outlet Structure (Note flow exiting toe drain outlet in right-center of photo.)

Photo 5 - View of Upstream Portion of Emergency Spillway from Edge of Reservoir

Photo 6 - View of Downstream Portion of Emergency Spillway Channel

Photo 7 - View of Crest of Dam from Original Station 16+07 (corner) Looking Towards Left Abutment of Dam

Photo 8 - View of Right Wing of Dam from Original Station 16+07 (corner)
(Knoll located between dam and dike begins at approximate location of fence gate shown in photo.)

Photo 9 - View of Outlet Channel from Head Wall of Outlet Structure (Note two mobile homes located in right-center of photo.)

Photo 10 - View of Roadway Culvert Downstream of Dam

Note: Photographs were taken on 9 May 1979.

PHOTO 1. Upstream Slope of Dam, Intake Riser and Reservoir

PHOTO 2. Close-up View of Intake Riser (Principal Spillway)

PHOTO 3. Downstream Slope of Dam, Outlet Structure and Outlet Channel

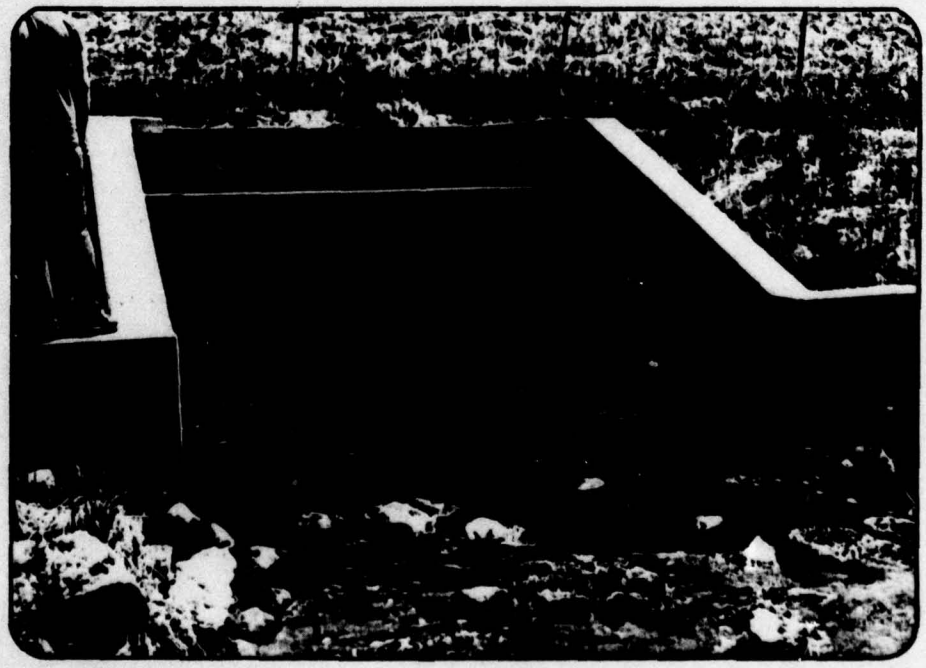


PHOTO 4. CLose-up View of Outlet Structure
(Note flow exiting toe drain outlet in right-center of photo.)

PHOTO 5. View of Upstream Portion of Emergency Spillway, from Edge of Reservoir

PHOTO 6. Downstream Portion of Emergency Spillway Channel

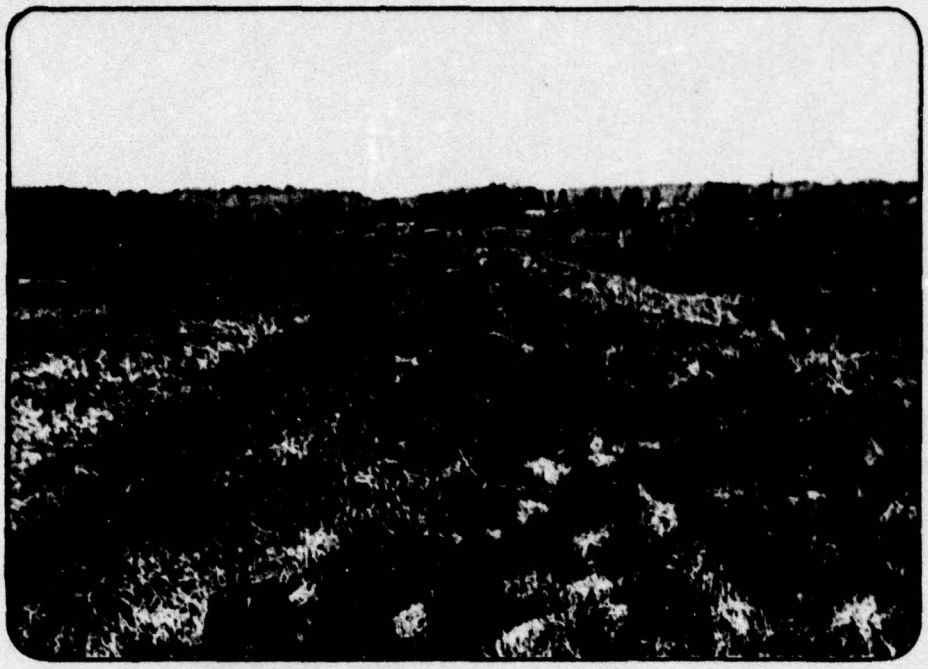


PHOTO 7. View of Crest of Dam from Original Station 16 + 07 (corner) Looking Towards Left Abutment of Dam

PHOTO 8. View of Right Wing of Dam from Original Station 16 + 07 (corner) (Knoll located between dam and dike begins at approximate location of the fence gate shown in photo.)

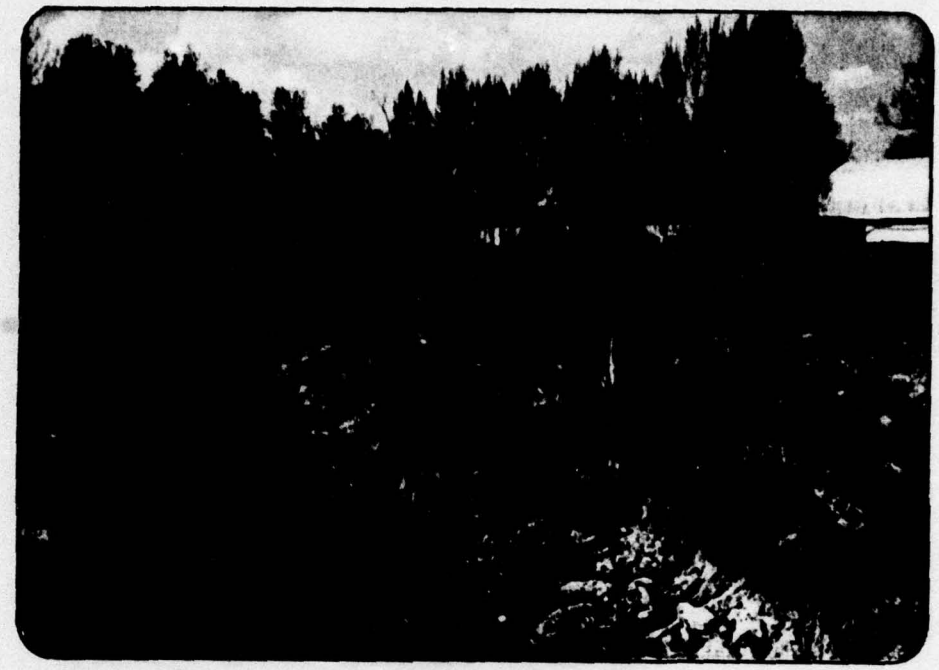


PHOTO 9. View of Outlet Channel from Head Wall of Outlet Structure (Note two mobile homes located in the right-center of the photo.)

PHOTO 10. Roadway Culvert Downstream of Dam

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject PA-474 Dam (Pa no name #35) S.O. No. _____ Sheet No. _____ of _____ Drawing No. _____

Computed by _____ Checked by _____ Date _____

TABLE OF CONTENTS

	Page
PREFACE	i
RAINFALL & HYDROGRAPH DATA	1
WATERSHED MAP	2
STAGE vs DISCHARGE CURVE	3
STAGE vs STORAGE CURVE	4
TOP OF DAM PROFILE	5
MAP OF DOWNSTREAM DAMAGE AREA	6
COMPUTER ANALYSIS	7-11

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 PA-474 Dam S.O. No.
RAINFALL & HYDROGRAPH DATA Sheet No. 1 of 11
Drawing No.
Computed by g.a.s. Checked by REH Date 2-16-79

RAINFALL

FROM HMR 33, DRAINAGE AREA IS LOCATED IN ZONE 2

PMP 24 hr - 200 mi. = 23.3 inches

$P_{6hr} = 117\%$
$P_{12hr} = 127\%$
$P_{24hr} = 141\%$
$P_{48hr} = 151\%$

} Rainfall ratios for D.A. = 1.56 mi.²

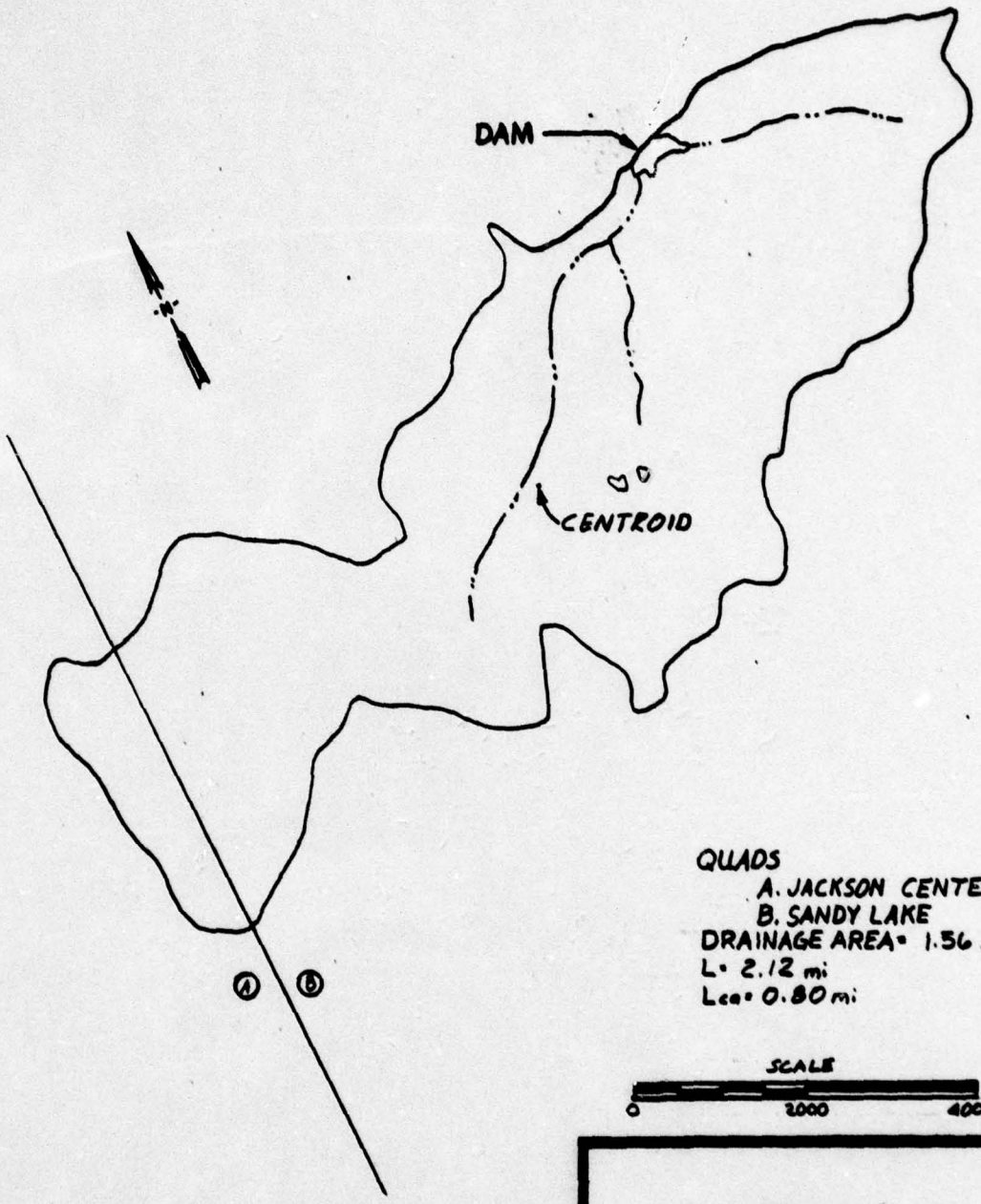
HYDROGRAPH

DAM IS LOCATED IN ZONE 23, $C_t \rightarrow$ plate L $C_p = 0.55$
$L = 2.12$ mi
$L_{ca} = 0.80$ mi
$t_R = .33$ hrs

$$t_p = 3.3(L\,L_{ca})^{0.3}$$
$$= 3.3(2.12 \times 0.8)^{0.3}$$
$$= 3.87 \text{ hrs}$$

$$t_r = t_p / 5.5$$
$$= 3.87/5.5$$
$$= 0.70 \text{ hr.}$$

$$t_{pR} = t_p + 0.25(t_R - t_r)$$
$$= 3.87 + 0.25(0.33 - 0.70)$$
$$= 3.78 \text{ hrs}$$



QUADS
A. JACKSON CENTER
B. SANDY LAKE
DRAINAGE AREA = 1.56 sq. mi.
L = 2.12 mi
Lca = 0.80 mi

SCALE
0 2000 4000

PA-474
WATERSHED MAP

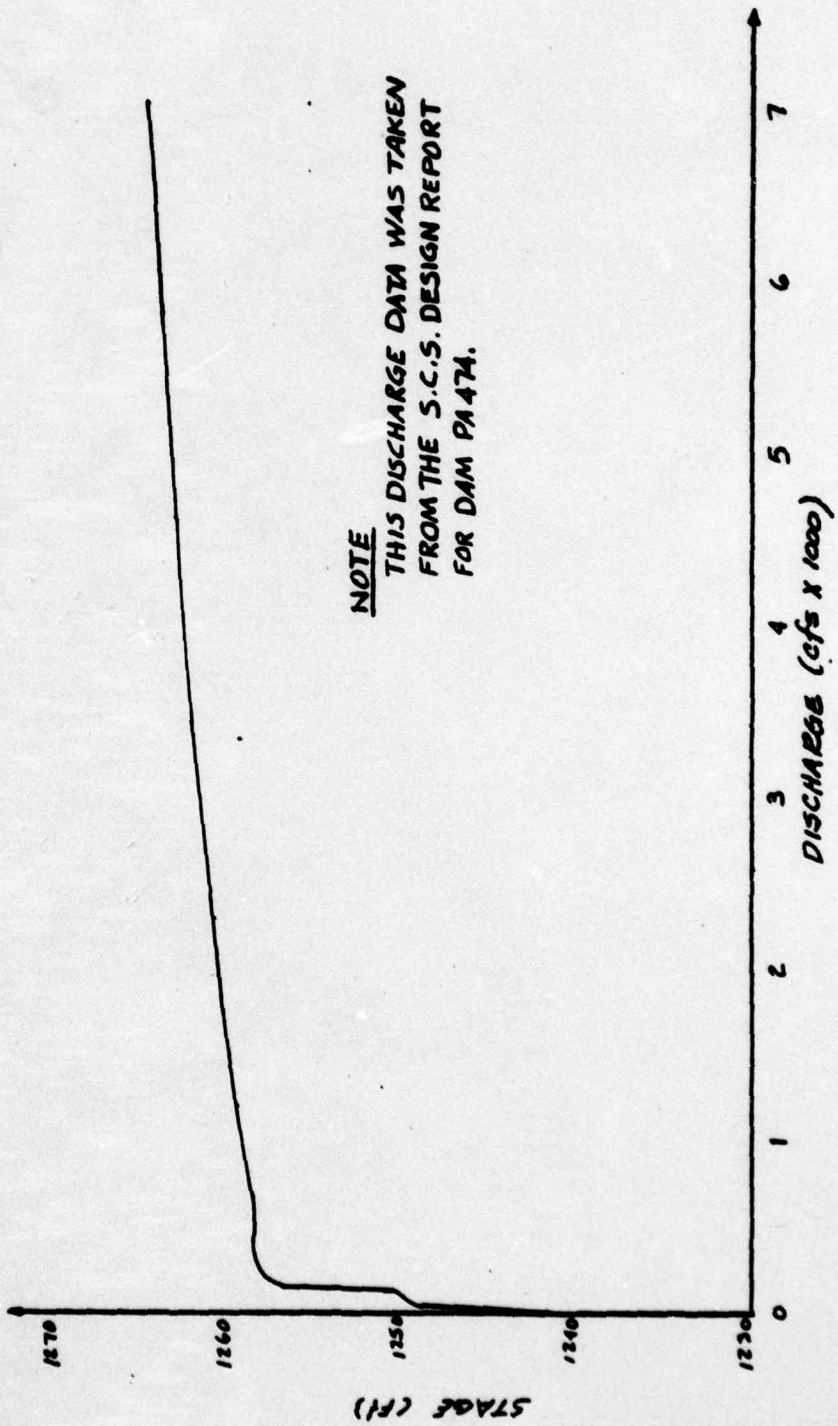
MICHAEL BAKER JR. INC.
Consulting Engineers & Surveyors

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject PA-474 Dam — S.O. No.
Sheet No. 3 of 11
STAGE VS DISCHARGE — Drawing No.
Computed by G.A.S. Checked by PEH Date 2-21-79

STAGE	DISCHARGE
1241.8	0
1243	11
1245	24
1247	32
1249.2	39
1251.2	131
1253.2	138
1255.2	145
1257	151
1258.73	669
1259.62	1202
1260.34	1746
1260.98	2302
1262.09	3440
1263.10	4613
1264	5816
1264.8	7045



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Subject PA-474 Dam — S.O. No.

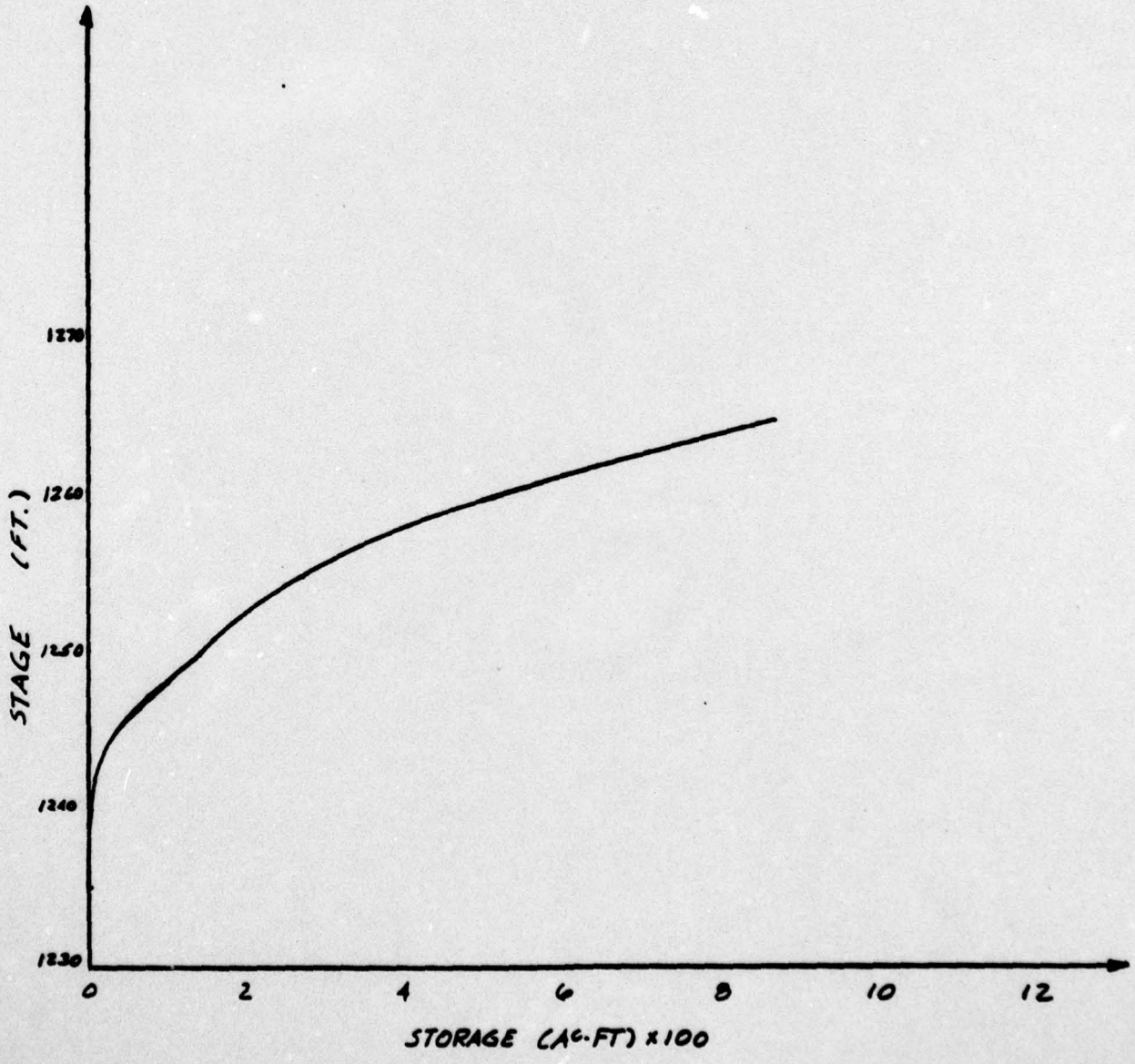
Sheet No. 4 of 11

STAGE VS STORAGE — Drawing No.

Computed by q.a.s. — Checked by REH — Date 2-21-79

STAGE	STORAGE
1235	0
1240	3.75
1243	31.25
1250	119.25
1255	266.75
1260	309.75
1265	863.25

NOTE
THIS STORAGE DATA WAS TAKEN FROM THE S.C.S. DESIGN REPORT FOR DAM PA 474.



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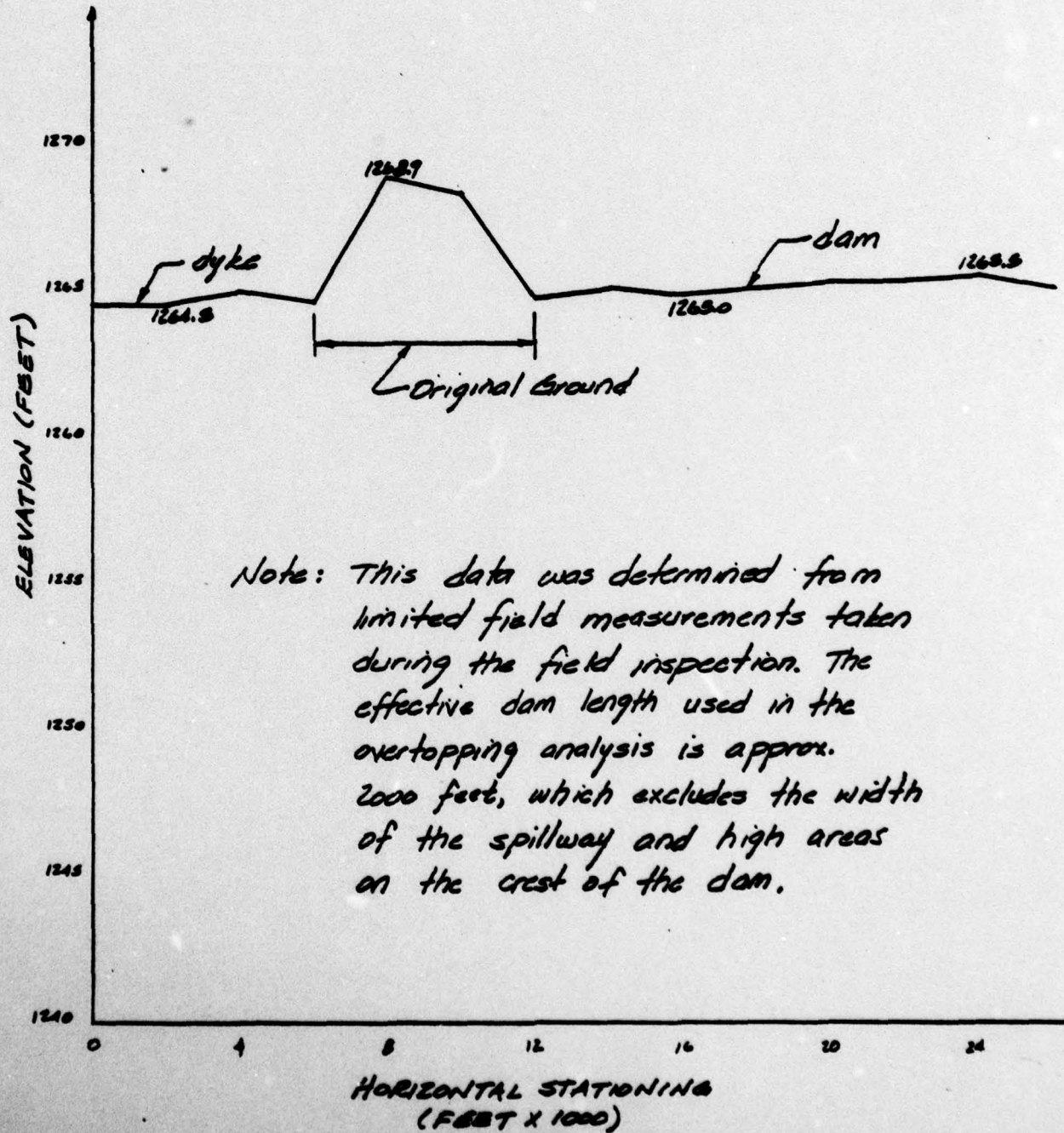
Subject PA-474 Dam S.O. No.

Sheet No. 5 of 11

TOP OF DAM PROFILE Drawing No.

Computed by G.A.S. Checked by REH Date 6-4-79

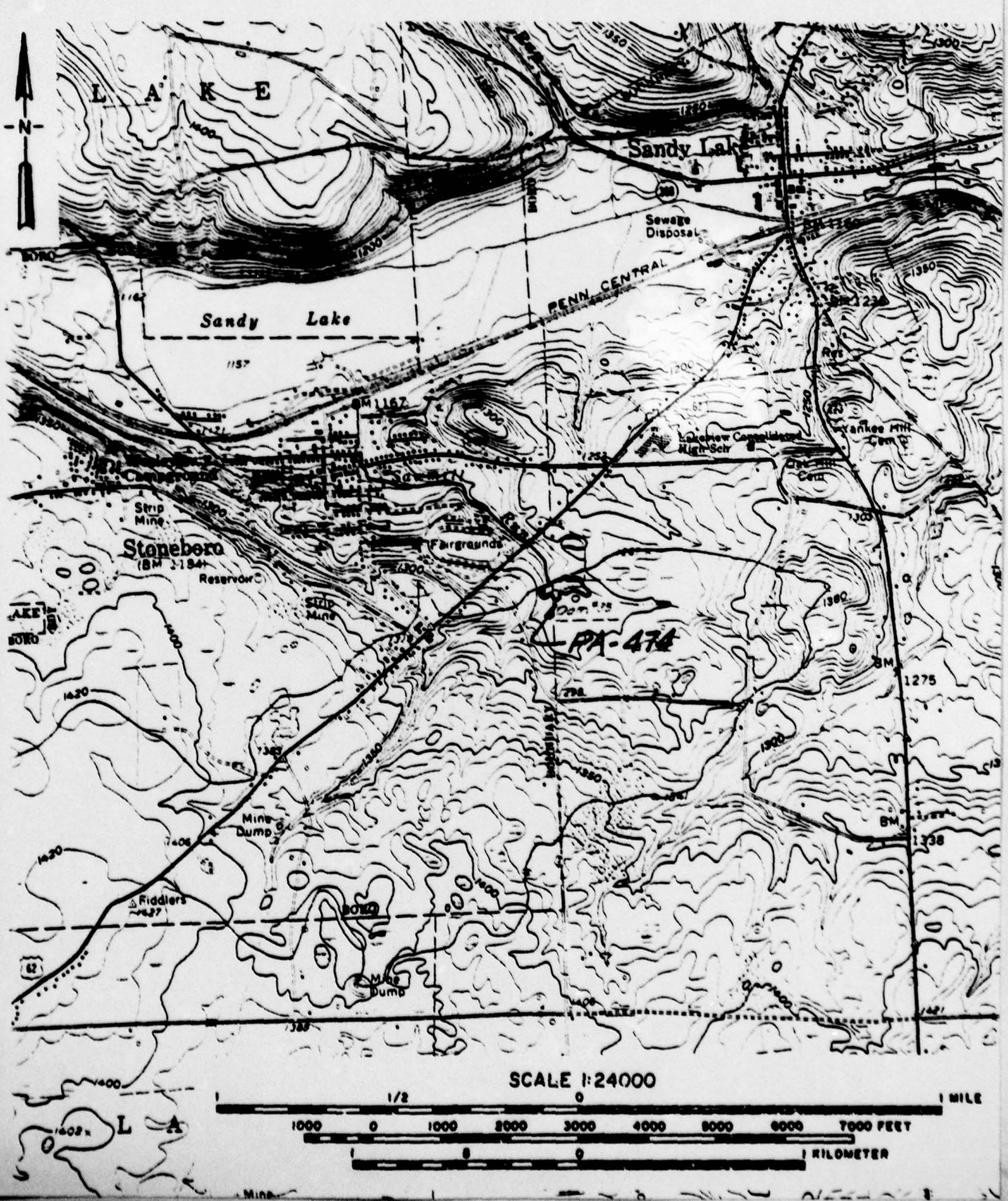


Note: This data was determined from limited field measurements taken during the field inspection. The effective dam length used in the overtopping analysis is approx. 2000 feet, which excludes the width of the spillway and high areas on the crest of the dam.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject PA-474 Dam
Map of Downstream Area
S.O. No.
Sheet No. 6 of 11
Drawing No.
Computed by Checked by Date



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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
  MBJ UPDATE         04 JUN 79
**********
    1                A1       NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
    2                A2       HYDROLOGIC AND HYDRAULIC ANALYSIS OF PA 474 MBJ  12
    3                A3       PROBABLE MAXIMUM FLOOD PMF/UNIT GRAPH BY SNYDERS METHOD
    4                B    200       0       20        0        0        0        0        0       -4        0
    5                B1     5
    6                J      1       1
    7                J1   1.0
    8                K      0       1                                          1
    9                K1             SNYDER UNIT HYDROGRAPH
   10                M      1       1     1.56                                                     1
   11                P             23.3     117      127      141      151
   12                T                                                        1.0     0.05
   13                L    3.78     .55
   14                X    -1.5   -0.05      2.0
   15                K      1      DAM
   16                K1             THIS IS A ROUTING AT DAM PA. 474
   17                V                                        1        1
   18                Y1     1                                                -1241.8      -1
   19                Y41241.8    1243     1245     1247   1249.2   1251.2   1253.2   1255.2    1257 1258.73
   20                Y41259.6 1260.34  1260.98  1262.09  1263.10     1264   1264.8
   21                Y5     0       11       24       32       39      131      138      145      151      669
   22                Y5  1202     1746     2302     3440     4613     5816     7065
   23                $S     0     3.75    31.25   116.25   266.75   509.75   863.25
   24                $E  1235     1240     1245     1250     1255     1260     1265
   25                $$1241.8
   26                $D1264.3     2.65      1.5     2000*
   27                K     99
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* See note - page 5

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
  NBJ UPDATE         04 JUN 79
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RUN  DATE 06/15/79
     TIME    12.56
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NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
HYDROLOGIC AND HYDRAULIC ANALYSIS OF PA 474 NBJ 12
PROBABLE MAXIMUM FLOOD PMF/UNIT GRAPH BY SNYDERS METHOD

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
200	0	20	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0	0		

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

RTIOS= 1.00

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

SUB-AREA RUNOFF COMPUTATION

SNYDER UNIT HYDROGRAPH

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.56	0.0	1.56	0.0	0.0	0	1	0

PRECIP DATA

SPFF	PMS	R6	R12	R24	R48	R72	R96
0.0	23.30	117.00	127.00	141.00	151.00	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	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= 3.78 CP=0.55 NTA= 0

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

UNIT HYDROGRAPH 77 END-OF-PERIOD ORDINATES, LAG= 3.81 HOURS, CP= 0.55 VOL= 1.00

4.	13.	27.	44.	62.	81.	101.	118.	132.	142.
148.	150.	145.	135.	125.	116.	108.	100.	93.	86.
80.	74.	68.	63.	59.	54.	51.	47.	43.	40.

Sheet 8 of 11

31.	32.	32.	30.	28.	26.	24.	22.	20.	19.
17.	16.	15.	14.	13.	12.	11.	10.	10.	9.
8.	8.	7.	7.	6.	6.	5.	5.	4.	4.
4.	4.	3.	3.	3.	3.	2.	2.	2.	2.
2.	2.	2.	1.	1.	1.	1.			

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	28.15	25.71	2.44	77432.
										(715.)(	653.)(	62.)(	2192.63)

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

HYDROGRAPH ROUTING

THIS IS A ROUTING AT DAM PA. 474

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

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.0	0.0	0.0	-1242.	-1

STAGE	1241.80	1243.00	1245.00	1247.00	1249.20	1251.20	1253.20	1255.20	1257.00	1258.73
	1259.60	1260.34	1260.98	1262.09	1263.10	1264.00	1264.80			
FLOW	0.0	11.00	24.00	32.00	39.00	131.00	138.00	145.00	151.00	669.00
	1202.00	1746.00	2302.00	3440.00	4613.00	5816.00	7045.00			

CAPACITY=	0.	4.	31.	119.	267.	510.	863.
ELEVATION=	1235.	1240.	1245.	1250.	1255.	1260.	1265.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1241.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1264.3	2.6	1.5	2000.

PEAK OUTFLOW IS 2473. AT TIME 44.33 HOURS

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

OPERATION	STATION	AREA	PLAN	RATIO 1 1.00
HYDROGRAPH AT	1	1.56	1	2710.
		(4.04)		(76.73)(
ROUTED TO	DAM	1.56	1	2473.
		(4.04)		(70.03)(

RATIOS APPLIED TO FLOWS

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1241.80	1241.80	1264.30
STORAGE	14.	14.	814.
OUTFLOW	0.	0.	6277.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1261.15	0.0	591.	2473.	0.0	44.33	0.0

APPENDIX E

REGIONAL GEOLOGY

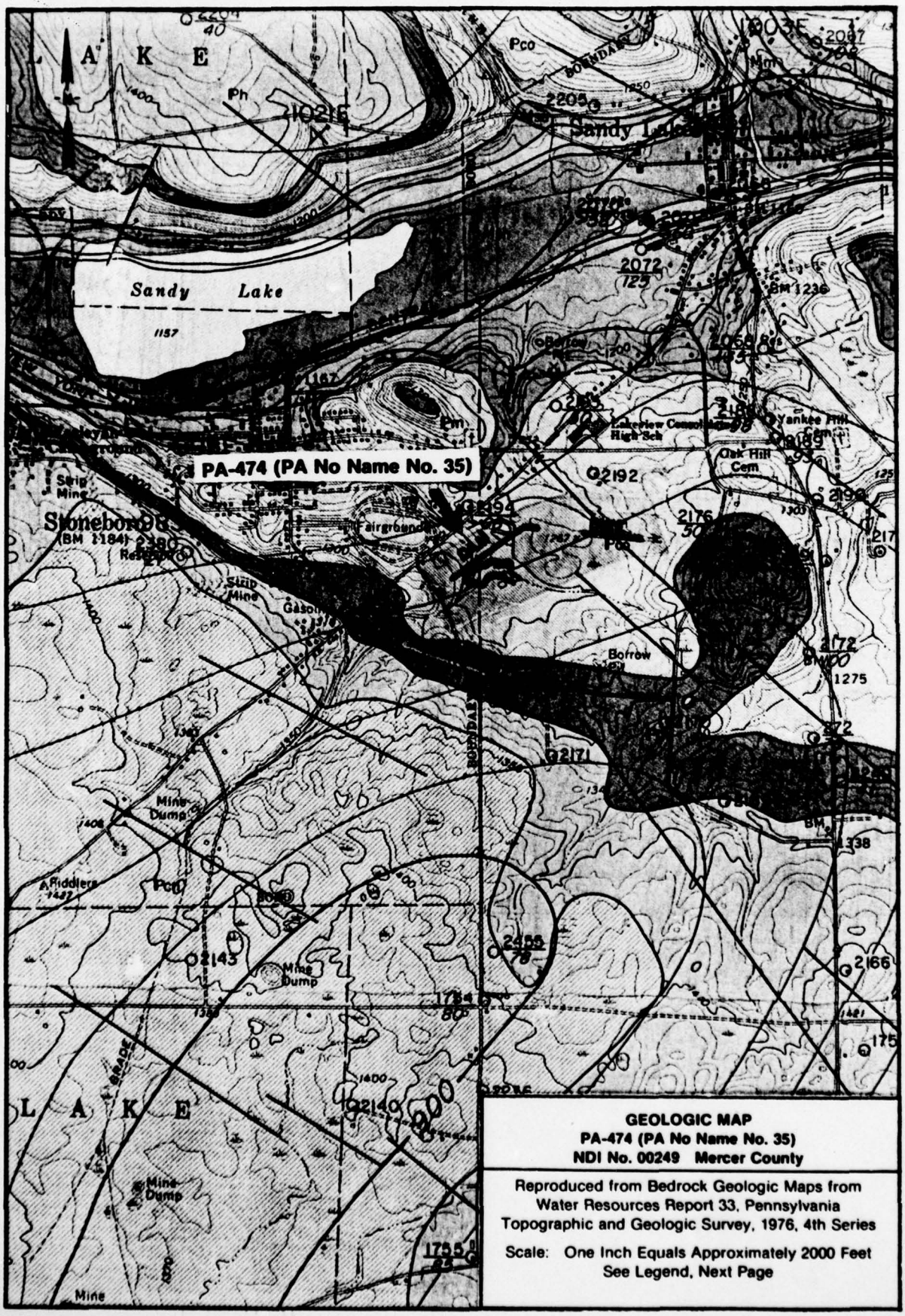
PA 474 (PA NO NAME No. 35) DAM
NDI No. PA 00249, PennDER No. 43-50, SCS No. PA 474

REGIONAL GEOLOGY

PA 474 Dam has been constructed across the shallow valley of Saw Mill Run, which is in the Glaciated Section of the Appalachian Plateaus Physiographic Province.

Foundation soils beneath the dam vary in thickness from 14 to 18 feet according to design test borings. Beneath a thin 4 to 5-foot thick mantle of recent alluvium is a layer of glacial till about 10 to 18 feet thick. The glacial material, as described on the boring logs, is largely ML, SM silts and sands with some GM-GP gravel. The water table was high throughout the site.

According to the geologic map on the following page, bedrock units beneath the soil cover are members of the Connoquenessing formation, Pottsville group, Pennsylvania system. The bedrock dips to the southeast (generally upstream) at a rate of approximately 100 feet per mile. The boring logs describe the bedrock as sandstone with some thin shale interbeds.



GEOLOGIC MAP
PA-474 (PA No Name No. 35)
NDI No. 00249 Mercer County

Reproduced from Bedrock Geologic Maps from Water Resources Report 33, Pennsylvania Topographic and Geologic Survey, 1976, 4th Series

Scale: One Inch Equals Approximately 2000 Feet

See Legend, Next Page

LEGEND

PENNSYLVANIAN

Pottsville Group

MERCER FORMATION

Mostly dark-gray shale, but contains thin beds of coal and limestone and lenses of sandstone. Generally unimportant as an aquifer, but locally yields may be sufficient for domestic and stock use.

Pco

CONNOQUENESSING FORMATION

Medium- to fine-grained gray sandstone containing lenses of dark-gray shale and discontinuous beds of Quakertown coal. Yields moderate quantities of water that is locally high in iron content.

Pp

POTTSVILLE UNDIFFERENTIATED

Sandstones, possibly containing some relatively thick beds of shale; correlation with Connoquenessing, Mercer, and Homewood Formations uncertain. Unimportant as an aquifer.

MISSISSIPPIAN

Msu

Msl

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.