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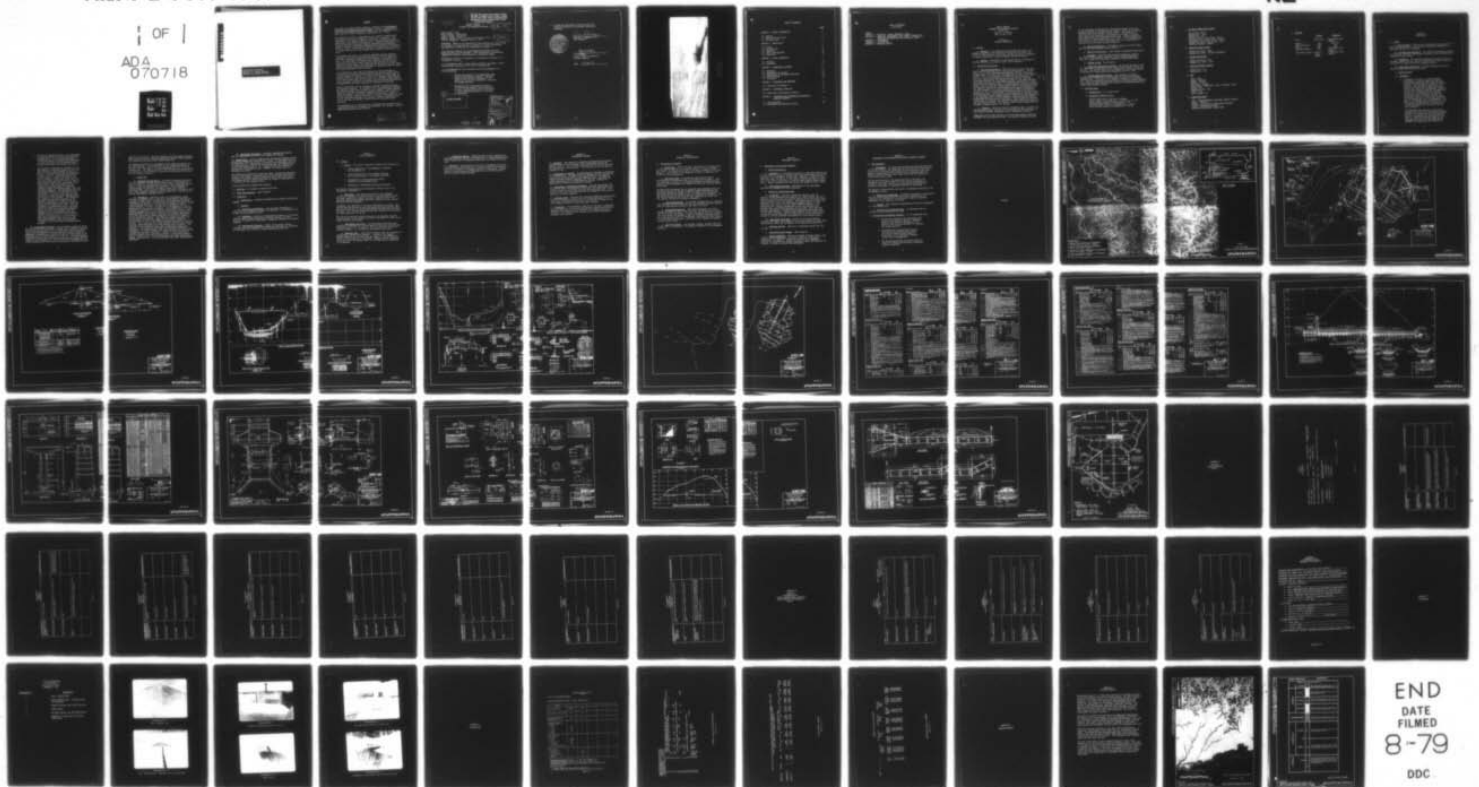
D'APPOLONIA CONSULTING ENGINEERS INC PITTSBURGH PA
NATIONAL DAM INSPECTION PROGRAM. PA-647 DAM (NDI ID NUMBER PA-8--ETC(U)
MAR 79

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DACW31-79-C-0014

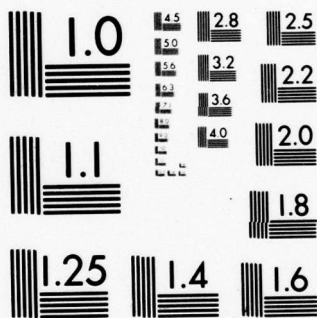
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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Department of the Army, 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 visual observations and review of available data. Detailed investigation and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

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 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 the dam depends on numerous and constantly changing internal and external factors which are 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.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

6 National Dam Inspection Program, PA-647 Dam (NDI ID Number PA-821, DER ID Number 63-76), Ohio River Basin, Robinson Fork, Washington County, Pennsylvania, Phase I Inspection Report.

[CONT'D FROM P. 1]

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

11 Mar '79

NAME OF DAM: PA-647
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Washington
STREAM: Robinson Fork, a tributary of Wheeling Creek
DATE OF INSPECTION: December 8 and 21, 1978

12 80 p.

ASSESSMENT: Based on the evaluation of the conditions as they existed on the dates of inspection and as revealed by visual observations, the condition of PA-647 dam is considered to be good.

A wet area was observed on the downstream slope below the berm elevation near the left abutment. This area should be periodically observed and remedial work performed if conditions change.

The spillway capacity is classified to be adequate according to the recommended criteria.

It is recommended that a formal warning system be developed to alert the downstream residents in the event of emergencies.

It is recommended that the following action be implemented on a continuing basis:

1. The wet area located on the downstream slope should be periodically observed. Necessary remedial work should be performed if the extent of the wet area increases or sloughing and seepage develops.
2. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert downstream residents in the event of emergencies.

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3. The dam and appurtenant structures should be inspected regularly and necessary maintenance performed.



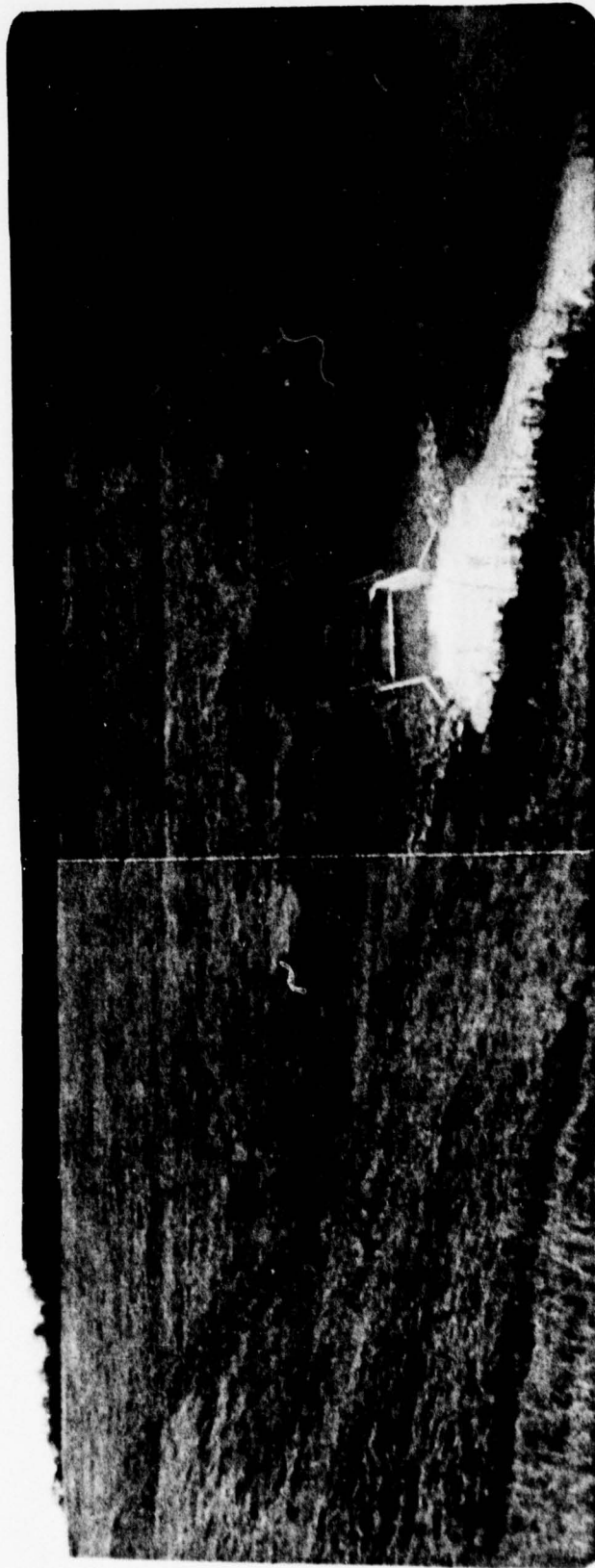
Lawrence D. Andersen

Lawrence D. Andersen, P.E.
Vice President

G. K. Withers

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

DATE: 22 Apr 79



PA-647 DAM
NDI I.D. NO. PA-821
DECEMBER 8, 1978

TABLE OF CONTENTS

	<u>PAGE</u>
SECTION 1 - PROJECT INFORMATION	1
1.1 General	1
1.2 Description of Project	1
1.3 Pertinent Data	2
SECTION 2 - DESIGN DATA	5
2.1 Design	5
2.2 Construction	8
2.3 Operation	8
2.4 Other Investigations	8
2.5 Evaluation	8
SECTION 3 - VISUAL INSPECTION	9
3.1 Findings	9
3.2 Evaluation	10
SECTION 4 - OPERATIONAL FEATURES	11
4.1 Procedure	11
4.2 Maintenance of the Dam	11
4.3 Maintenance of Operating Facilities	11
4.4 Warning System	11
4.5 Evaluation	11
SECTION 5 - HYDRAULICS AND HYDROLOGY	12
5.1 Evaluation of Features	12
SECTION 6 - STRUCTURAL STABILITY	13
6.1 Evaluation of Structural Stability	13
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS/PROPOSED REMEDIAL MEASURES	14
7.1 Dam Assessment	14
7.2 Recommendations/Remedial Measures	14

TABLE OF CONTENTS
(Continued)

PLATES

- APPENDIX A - CHECKLIST, VISUAL INSPECTION, PHASE I
- APPENDIX B - CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION,
OPERATION AND HYDROLOGIC AND HYDRAULIC, PHASE I
- APPENDIX C - PHOTOGRAPHS
- APPENDIX D - CALCULATIONS
- APPENDIX E - REGIONAL GEOLOGY

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
PA-647 DAM
NDI I.D. NO. PA-821
DER I.D. NO. 63-76

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. The PA-647 dam is one of the seven flood control structures in the Wheeling Creek watershed. The dam consists of an earth embankment approximately 500 feet long with a maximum height of 95 feet from the downstream toe and a crest width of 15 feet. The flood discharge facilities for the dam consist of a drop inlet type primary spillway located near the left abutment (looking downstream) and an emergency spillway on the right abutment. The primary spillway is a drop inlet structure consisting of a single stage reinforced concrete riser, a 48-inch-diameter reinforced concrete conduit, and a reinforced concrete impact basin at the downstream end. The emergency spillway is a trapezoidal earth channel excavated into the right abutment. An 18-inch reinforced concrete wall extending 10 feet into the rock constitutes the overflow control section of the emergency spillway. The reservoir drain facilities for the dam consist of a reinforced concrete intake structure located near the upstream toe of the embankment and a 30-inch-diameter reinforced concrete conduit discharging into the drop inlet structure. Flow through the reservoir outlet pipe is controlled by a manually operated sluice gate located in the drop inlet structure. The reservoir outlet system constitutes the emergency drawdown facility for the dam.

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P. 11] →

b. Location. The dam is located on Robinson Fork, a tributary of Wheeling Creek, about one mile east of Majorsville, West Virginia, in West Findley Township, Washington County, Pennsylvania (Plate 1).

Downstream from the dam, Robinson Fork flows approximately 2000 feet southwest and joins Wheeling Creek. An industrial warehouse located

at the confluence of Robinson Fork and Wheeling Creek is the only structure located in the Robinson Fork valley. Below the confluence, Wheeling Creek flows through a narrow valley. The community of Alley Grove, which consists of approximately 20 homes, is located approximately one mile downstream from the dam. A major natural gas pump station is also located within this reach. It is estimated that the failure of the dam would cause large loss of life and property damage in Alley Grove and further downstream.

c. Size Classification. Intermediate (based on 95-foot height and 6500 acre-feet maximum storage capacity).

d. Hazard Classification. High (based on downstream conditions).

e. Ownership. Wheeling Creek Watershed Commission (address: Mr. James D. Ealy, Manager, Wheeling Creek Watershed Commission, Room 513, County Office Building, Waynesburg, Pennsylvania 15370).

f. Purpose of Dam. Flood control.

g. Design and Construction History. The dam was designed by the U.S. Department of Agriculture, Soil Conservation Service, during 1972 and 1973. The dam was constructed by Monroeville Construction Company of Monroeville, Pennsylvania, with completion on July 7, 1977.

h. Normal Operating Procedure. The reservoir is normally maintained at Elevation 876, the elevation of uncontrolled primary spillway crest. The crest of the emergency spillway is at Elevation 920. Inflow occurring when the lake level is above the primary spillway crest level but below the emergency spillway is discharged through the uncontrolled primary spillway.

1.3 Pertinent Data

a. Drainage Area - 22.4 square miles

b. Discharge at Dam Site (cfs)

Maximum known flood at dam site - Unknown

Outlet conduit at maximum pool - 419 (pool at El. 920)

Gated spillway capacity at maximum pool - N/A

Ungated spillway capacity at maximum pool - 50,400

Total spillway capacity at maximum pool - 50,400

c. Elevation (USGS Datum) (feet)

Top of dam - 937.6
Maximum pool - 937.6
Normal pool - 876
Upstream invert outlet works - 845.75
Downstream invert outlet works - 842.68
Streambed at center line of dam - 842+
Maximum tailwater - Unknown

d. Reservoir Length (feet)

Normal pool level - 5200
Maximum pool level - 10,000 (estimated)

e. Storage (acre-feet)

Normal pool level - 279
Maximum pool level - 6500

f. Reservoir Surface (acres)

Normal pool - 33
Maximum pool - 180

g. Dam

Type - Earth
Length - 500 feet
Height - 95 feet
Top width - 15 feet
Side slopes - Downstream: 3H:1V; Upstream: 3H:1V
Zoning - Yes
Impervious core - Yes
Cutoff - Yes
Grout curtain - No

h. Regulating Outlet

Type - 30-inch-diameter reinforced concrete conduit
Length - 50+ feet
Closure - Sluice gate at drop inlet structure
Access - Drop inlet structure
Regulating facilities - Sluice gate

i. Spillway

	<u>Primary</u>	<u>Emergency</u>
Type -	Drop inlet	Trapezoidal earth channel
Length -	N/A	200 feet
Crest elevation -	876	920
Gates -	None	None
Upstream channel -	Lake	Trapezoidal earth channel
Downstream channel -	48-inch outlet conduit	Trapezoidal earth channel

SECTION 2
DESIGN DATA

2.1 Design

a. Data Available. The available information was provided by the Soil Conservation Service (SCS) and the Pennsylvania Department of Environmental Resources (PennDER).

(1) Hydrology and Hydraulics. The available information consists of principal, freeboard, and emergency spillway inflow hydrographs and associated flood routings.

(2) Embankment. The available information consists of design drawings, geology and soil reports, laboratory soil test results, and the results of slope stability and seepage analyses.

(3) Appurtenant Structures. Available information includes design drawings and design calculations.

b. Design Features

(1) Embankment

a. As designed, the dam is a zoned embankment consisting of a central impervious core and upstream and downstream shell sections (Plates 2 and 3). The core section extends to top of foundation rock through a cutoff trench excavated at the center of the embankment (Plate 4). The internal drainage system for the embankment consists of a 3-foot-thick filter blanket located under the downstream toe (Plate 5). The blanket starts at a point 200 feet downstream from the axis of the dam and terminates near the downstream toe of the embankment. The width of the blanket varies from 50 to 75 feet. The blanket also extends up the abutments to a level approximately 60 feet below the dam crest elevation.

The embankment materials were classified as residual silty clays with liquid limits ranging from 36 to 44 percent and plasticity indices from 12 to 18 percent for the impervious core (Zone I), compacted weathered shale for the upstream shell (Zone II), and sandstone and limestone for downstream shell (Zone III).

- b. The dam was designed to have 3 to 1 (horizontal to vertical slopes on both the downstream and upstream faces. On the downstream slope, a 10-foot-wide bench is located at Elevation 895. A 14-foot-wide bench on the upstream slope is located at Elevation 876 (normal pool level).
- c. The subsurface investigation conducted for the dam consists of numerous borings and test pits. The locations of these borings are shown in Plate 6. Selected boring logs are illustrated in plates 7 and 8. The typical subsurface profile (Plate 4) consists of three to five feet of medium to stiff sandy clayey silts on the valley sides and about 12 feet of loose to dense sand and gravel and clayey sands at the valley floor. The rock beneath the site includes alternating layers of limestone, calcareous shale, carbonaceous shale, coal, and calcareous sandstone. The Waynesburg coal seam was encountered 80 to 90 feet below the dam crest level. The rocks at the dam site were described as having horizontal bedding planes with distinct joint patterns. The weathering was assessed to be more pronounced on the abutments, extending to a depth of 20 feet, while the weathering in the valley bottom was estimated to be less than 20 feet. Both the weathered and unweathered rock in the valley bottom was found to be relatively permeable. Results of field tests indicate that the permeability of the foundation rock ranged between 19 feet per day (7×10^{-3} cm/sec) to more than 50 feet per day (2×10^{-3} cm/sec). These high permeabilities occurred in the Uniontown Limestone, which was encountered at about 30 to 35 feet below the average ground surface.

(2) Appurtenant Structures. The appurtenant structures of the dam include drop inlets, primary spillway, and an emergency spillway. The primary spillway consists of a single-stage reinforced concrete riser, a 48-inch-diameter reinforced concrete conduit through the embankment, terminating at a reinforced concrete impact basin at the downstream toe of the dam (Plates 9, 10 and 11). A 30-inch-diameter reinforced concrete pipe which receives flow from an intake structure located at the upstream toe of the dam and which discharges into the primary spillway drop inlet structure constitutes the reservoir drain

facilities for the dam. Both the reservoir drain and primary spillway pipes are supported on continuous reinforced concrete cradle equipped with reinforced concrete cutoff collars (Plate 12).

The emergency spillway is a trapezoidal earth channel excavated into the right abutment. The bottom width of the trapezoidal channel is 200 feet with side slopes 3:1 on the embankment side and 2:1 on the abutment side. The control section of the spillway is at Elevation 920 and consists of an 18-inch-thick concrete wall extending 10 feet into the rock (Plates 13 and 14).

c. Design Data

(1) Hydrology and Hydraulics. Available information indicates that the emergency spillway was designed to pass a hydrograph with a peak of 52,680 cfs, corresponding to 24.38 inches of precipitation in 6 hours, without overtopping the embankment. This hydrograph was routed through the reservoir starting at normal pool elevation (Elevation 876), which produced a maximum pool level at Elevation 937.6 with a peak emergency spillway outflow of 50,936 cfs. The top of the dam was established at Elevation 937.6.

(2) Embankment. Laboratory tests for the embankment design consisted of classification, compaction, consolidation, permeability, and shear strength tests. Consolidation tests performed on samples compacted to 100 percent of Standard Proctor maximum dry density showed a consolidation potential of 2.3 percent of embankment height, a total settlement of 2 feet. The dam crest was cambered by 2 feet to compensate for the expected settlement. The permeability of the core material was estimated to be 0.008 foot per day (10^{-6} cm/sec). Shear strength parameters of the core material were obtained from consolidated-undrained triaxial shear tests with pore pressure measurements. Tests were conducted on samples compacted to 100 percent Standard Proctor maximum dry density. The effective strength parameters for six potential core materials ranged from an effective internal friction angle of 23.5 to 31 degrees and effective cohesion of 250 to 700 psf. It is reported that a slope stability analysis was conducted utilizing modified Swedish circle and sliding block procedures. The stability of the downstream slope under steady-state seepage and stability of the upstream slope under rapid drawdown conditions were considered. For steady seepage, pool level was taken at Elevation 920, the emergency spillway crest level. Results of the sliding block stability analyses were available for review. The minimum computed factor of safety was 2.1 for the downstream slope under steady-state seepage conditions and 1.4 for the upstream slope under rapid drawdown conditions.

(3) Appurtenant Structures. Available information indicates that the appurtenant structures were standard SCS designs.

2.2 Construction. As-built drawings and construction progress reports prepared by PennDER were available for review. To the extent that can be determined, the construction of the dam was in conformance with the SCS specifications. The dam was constructed under the supervision of an SCS field representative. It is reported that the earthwork was monitored by field density tests. However, the results were not available for review.

One significant construction change was noted. During the excavation of the cutoff trench, a limestone layer was encountered with solution channels. To prevent seepage through this layer, the cutoff trench was widened and Zone I was carried down on a slope 0.5 horizontal to 1 vertical past the limestone layer.

No post-construction changes were reported.

2.3 Operation. No records of operation are kept.

2.4 Other Investigations. None reported.

2.5 Evaluation

a. Availability. Available information was obtained from SCS and PennDER.

b. Adequacy

(1) Hydrology and Hydraulics. The available information is considered to be adequate to assess the conformity of the design to the current spillway design criteria.

(2) Embankment. Review of the geotechnical aspects of the design indicates that the design generally followed currently accepted practice for subsurface investigation, laboratory testing, and stability analyses.

(3) Appurtenant Structures. Review of the design drawings indicates that the appurtenant structures were designed and constructed in conformance with currently accepted engineering practices.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of PA-647 dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.
2. Visual examination of the emergency spillway and visible portions of the primary spillway.
3. Observation of factors affecting runoff potential of the drainage basin.
4. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 15 and in the photographs in Appendix C.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

In general, the condition of the dam is considered to be good. Only one wet area was observed on the downstream slope near the left abutment below the berm. No perceivable seepage was associated with this wet area. Also, several erosion ditches were observed on the upstream and downstream faces of the dam.

The top of the dam was surveyed relative to the emergency spillway crest elevation and was found to be within two-tenths of a foot of the design elevation with camber.

c. Appurtenant Structures. The appurtenant structures were examined for deterioration or other signs of distress or obstructions that would limit flow. In general, the structures were found to be in good condition. No deficiencies were noted at this time.

d. Reservoir Area. A map review indicates that the watershed is predominantly covered with woodlands. A review of the regional geology (Appendix E) indicates that the slopes of the reservoir are likely to be susceptible to landslides. However, massive landslides which may affect the storage volume of the reservoir are considered to be unlikely.

e. Downstream Channel. Downstream from the dam, Robinson Run flows approximately 2000 feet southwest where it joins Wheeling Creek. Further description of downstream conditions is included in Section 1.2b.

3.2 Evaluation. The condition of the dam is considered to be good. A wet spot on the downstream face of the dam should be periodically observed to document if a seepage condition is developing. Erosion ditches on the upstream and downstream faces of the dam should be filled to prevent further erosion.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. The reservoir is normally maintained at the primary spillway crest level with excess inflow discharging through the primary spillway. The reservoir outlet pipe can be used to draw down the permanent pool when required. The reservoir outlet pipe gate is normally closed.

4.2 Maintenance of the Dam. The maintenance of the dam is considered to be satisfactory. The downstream and upstream faces of the dam are covered with grass and appear to be annually mowed. The Wheeling Creek Watershed Commission reported that there is no full-time dam tender responsible for the maintenance of the dam. The dam is maintained by Commission personnel as required.

4.3 Maintenance of Operating Facilities. The only operational feature of the dam is the reservoir outlet pipe sluice gate operated by a hoist located on the primary spillway drop inlet structure. Since the top of the drop inlet structure was not accessible, this facility could not be closely examined.

4.4 Warning System. Wheeling Creek Watershed Commission reported that a remote flood stage warning system is located approximately six to seven miles downstream from the dam which initiates an alarm in the civil defence facilities in Wheeling, West Virginia.

4.5 Evaluation. The maintenance condition of the dam is considered to be satisfactory. The dam and appurtenances should be periodically inspected with emphasis on the wet area on the downstream slope to document if the conditions are changing and necessary maintenance performed when required.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. PA-647 dam has a watershed of 22.4 square miles and impounds a reservoir with a surface area of 33 acres at normal pool level. The emergency spillway of the dam is located on the right abutment. The capacity of the emergency spillway is reported to be 50,936 cfs with no freeboard.

b. Experience Data. As previously stated, PA-647 dam is classified as an intermediate dam in the high hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass full probable maximum flood (PMF).

The PMF inflow hydrograph for the reservoir was determined using the Dam Safety Version of the HEC-1 computer program, developed by the Hydrologic Engineering Center of the U.S. Army, Corps of Engineers. The data used for the computer input are presented in Appendix D. The PMF inflow hydrograph was found to have a peak flow of 25,331 cfs. The computer outputs are included in Appendix D.

c. Visual Observations. On the date of inspection, no conditions were observed that would indicate that the emergency spillway capacity would be significantly reduced in the event of a flood.

d. Overtopping Potential. PMF inflow hydrograph was routed through the reservoir and it was found that the dam can pass 100 percent PMF without overtopping. To obtain an upper bound on the maximum pool level during the passage of PMF, the spillway discharge rating was conservatively based on a rectangular cross section, with the base of the rectangle taken equal to the base of the trapezoidal emergency spillway cross section.

e. Spillway Adequacy. The spillway capacity (greater than 100 percent PMF) is classified to be adequate according to the recommended criteria.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, the field observations did not reveal any signs of distress that would significantly affect the stability of the embankment at this time. However, it should be understood that since the dam is a flood control facility and was at normal pool at the time of inspection, it was not under maximum loading conditions. Maximum loading occurs only during the passage of major floods.

(2) Appurtenant Structures. Performance of the appurtenant structures is considered to be satisfactory.

b. Design and Construction Data

(1) Embankment. Available information indicates that the stability of the embankment was analyzed for steady seepage and rapid drawdown conditions using the modified Swedish circle and sliding block slope stability analysis procedures. The minimum factor of safety was reported to be 2.1 for the steady-state seepage stability of the downstream slope and 1.4 for the rapid drawdown condition of the upstream slope. Strength parameters for the core material were obtained from consolidated-undrained triaxial shear tests with pore pressure measurements. Assumed strength parameter values were used for the shell materials. Construction progress reports indicate that the dam was constructed under the supervision of an SCS field representative, and the earthwork was monitored by field density tests.

(2) Appurtenant Structures. Review of the design drawings indicates that there are no apparent structural deficiencies that would significantly affect the performance of the appurtenant structures.

c. Operating Records. There are no operating records kept for the dam.

d. Post-Construction Changes. None reported.

e. Seismic Stability. The dam is located in Seismic Zone 1, and based on visual observations, the static stability of the dam is considered to be adequate. Therefore, based on the recommended criteria for evaluation of seismic stability of dams, the structure is presumed to present no hazard from earthquakes.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that PA-647 dam is in good condition. No conditions were observed that would significantly affect the overall performance of the structure at this time. However, as previously noted, the dam was not inspected under its maximum loading condition, which would occur when the reservoir is filled during major storms.

The wet area observed at the downstream face of the dam is not considered to be serious relative to the overall performance of the dam at this time. However, this area should be periodically observed to determine if a seepage condition is developing.

The capacity of the spillway was found to be adequate according to the recommended criteria.

b. Adequacy of Information. Available information in conjunction with the visual observations and the previous experience of the inspectors are considered to be sufficient to make a reasonable assessment of the condition of the dam.

c. Urgency. The following recommendations should be implemented on a continuing basis.

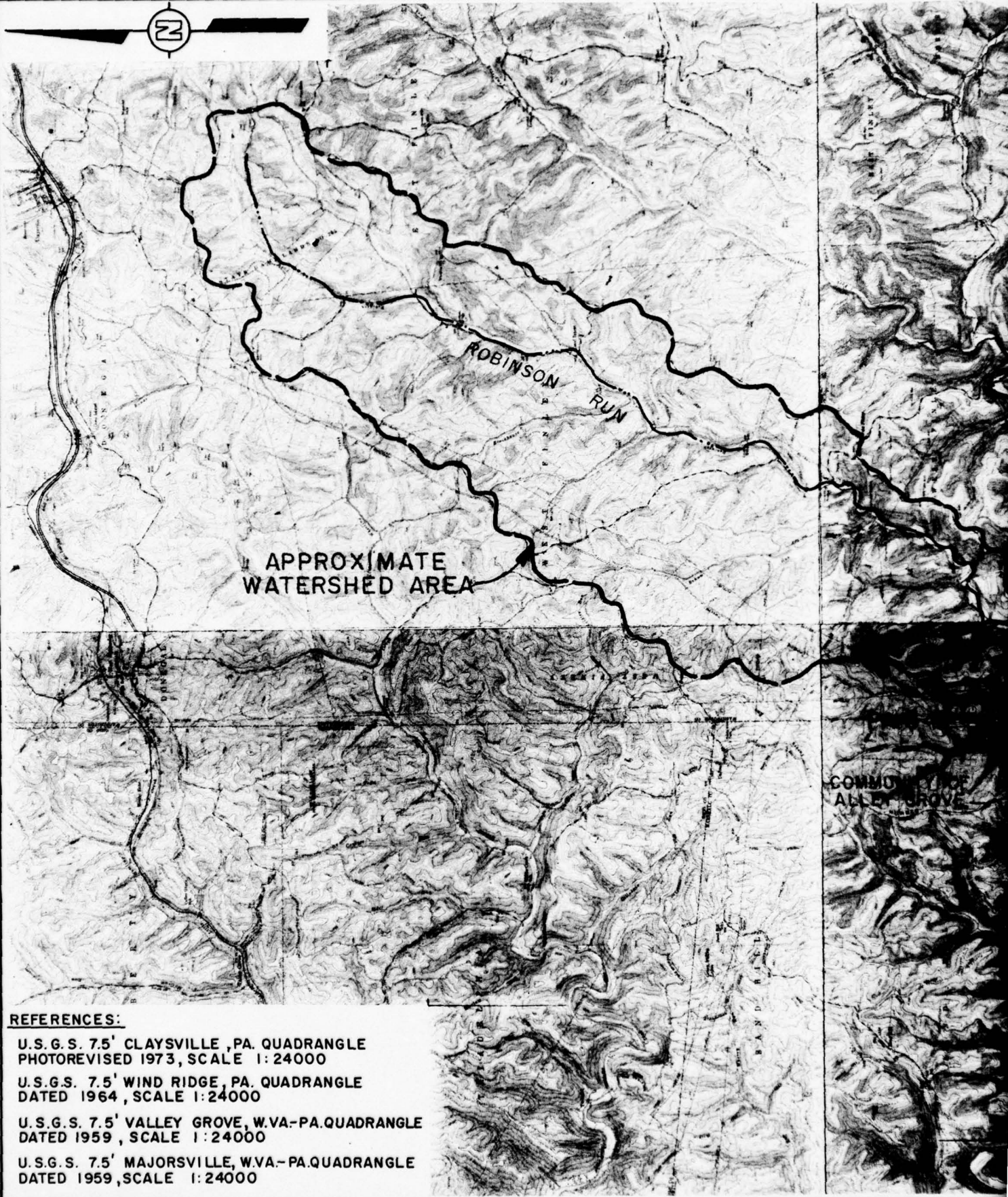
d. Necessity for Additional Data. No additional data is considered to be required at this time.

7.2 Recommendations/Remedial Measures. It is recommended that:

1. The wet area located on the downstream slope should be periodically observed. Necessary remedial work should be performed if the extent of the wet area increases or sloughing and seepage develops.
2. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert downstream residents in the event of emergencies.
3. The dam and appurtenant structures should be inspected regularly and necessary maintenance should be performed.

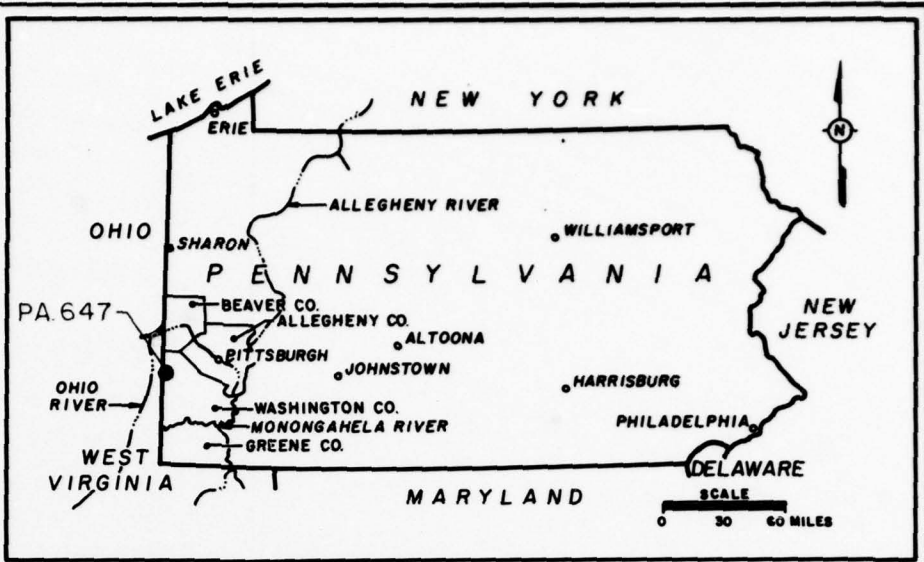
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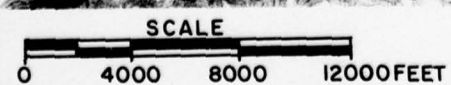
REFERENCES:

- U.S.G.S. 7.5' CLAYSVILLE, PA. QUADRANGLE
PHOTOREVISED 1973, SCALE 1:24000
- U.S.G.S. 7.5' WIND RIDGE, PA. QUADRANGLE
DATED 1964, SCALE 1:24000
- U.S.G.S. 7.5' VALLEY GROVE, W.VA.-PA. QUADRANGLE
DATED 1959, SCALE 1:24000
- U.S.G.S. 7.5' MAJORSVILLE, W.VA.-PA. QUADRANGLE
DATED 1959, SCALE 1:24000



KEY PLAN

PLATE I
 PA. 647 DAM
 VICINITY, FLOOD PLAIN & WATERSHED MAP



D'APPOLONIA

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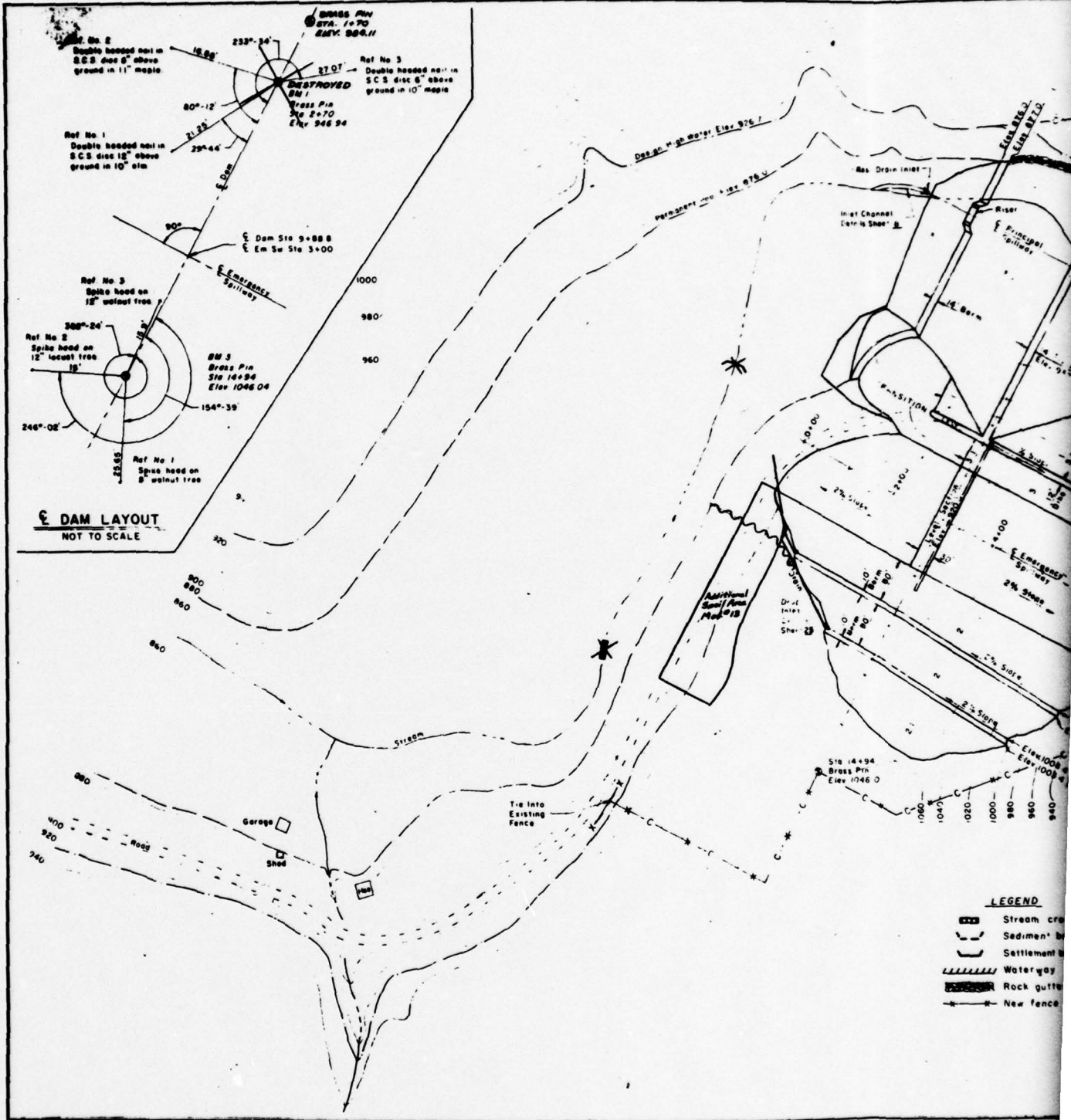
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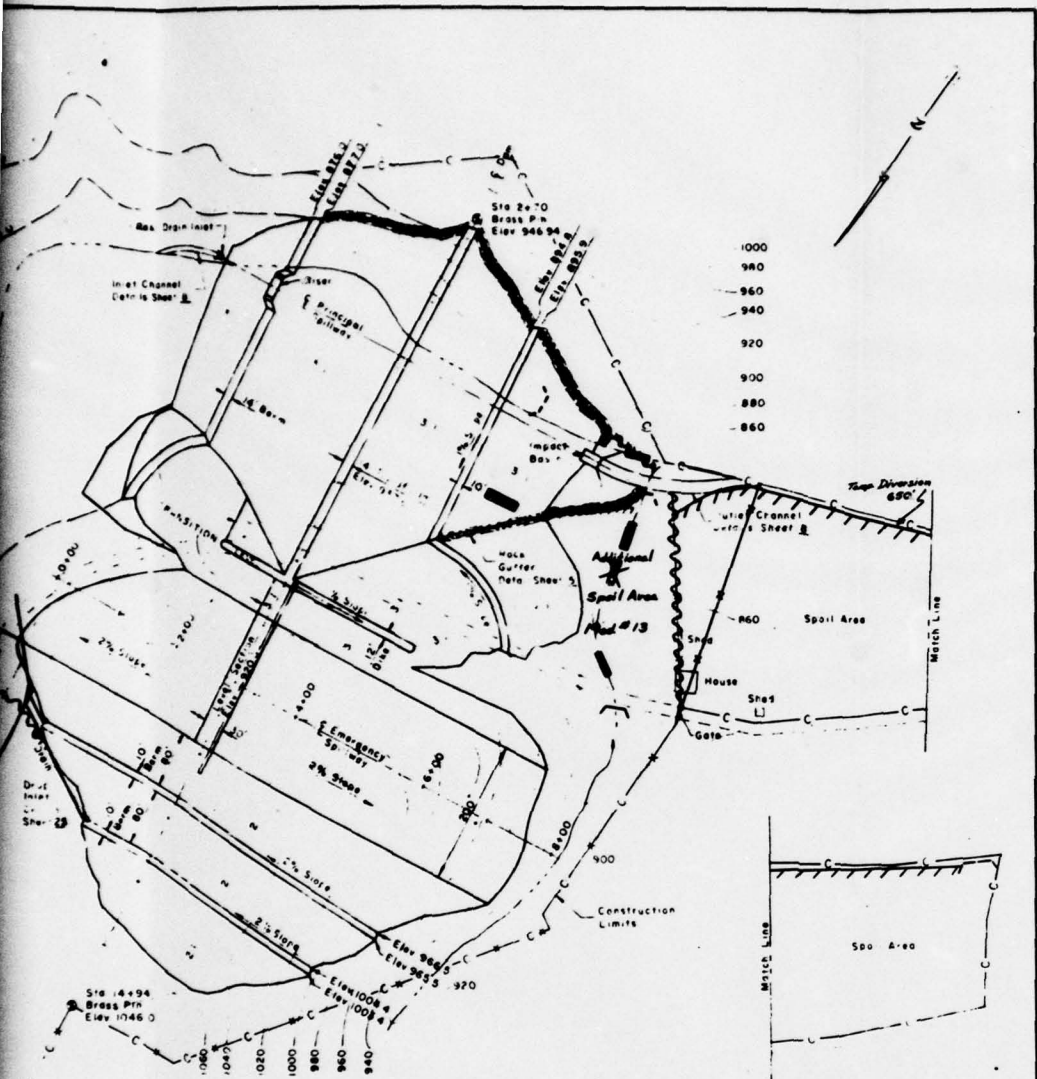
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LEGEND

- Stream cross
- Sediment bar
- Settlement bar
- Waterway
- Rock gutter
- New fence

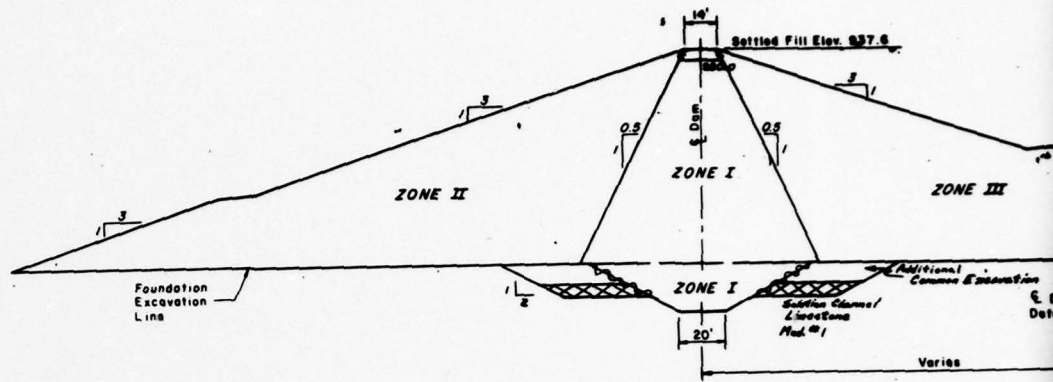


AS BUILT PLANS

- LEGEND**
- Stream crossing
 - Sediment basin (Rock fill)
 - Settlement basin (Earth fill)
 - Waterway
 - Rock gutter
 - New fence

WHEELING CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-647
 WASHINGTON COUNTY, PENNSYLVANIA
 PLAN OF STRUCTURAL WORKS
 ENGINEERED BY J. M. D'APPOLONIA
 CIVIL ENGINEER
 PA 647-P

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 1-3-79 APPROVED BY JHP 3/1/79 3.1.79



TYPICAL SECTION OF DAM

0 10 20 30 40 FEET
SCALE

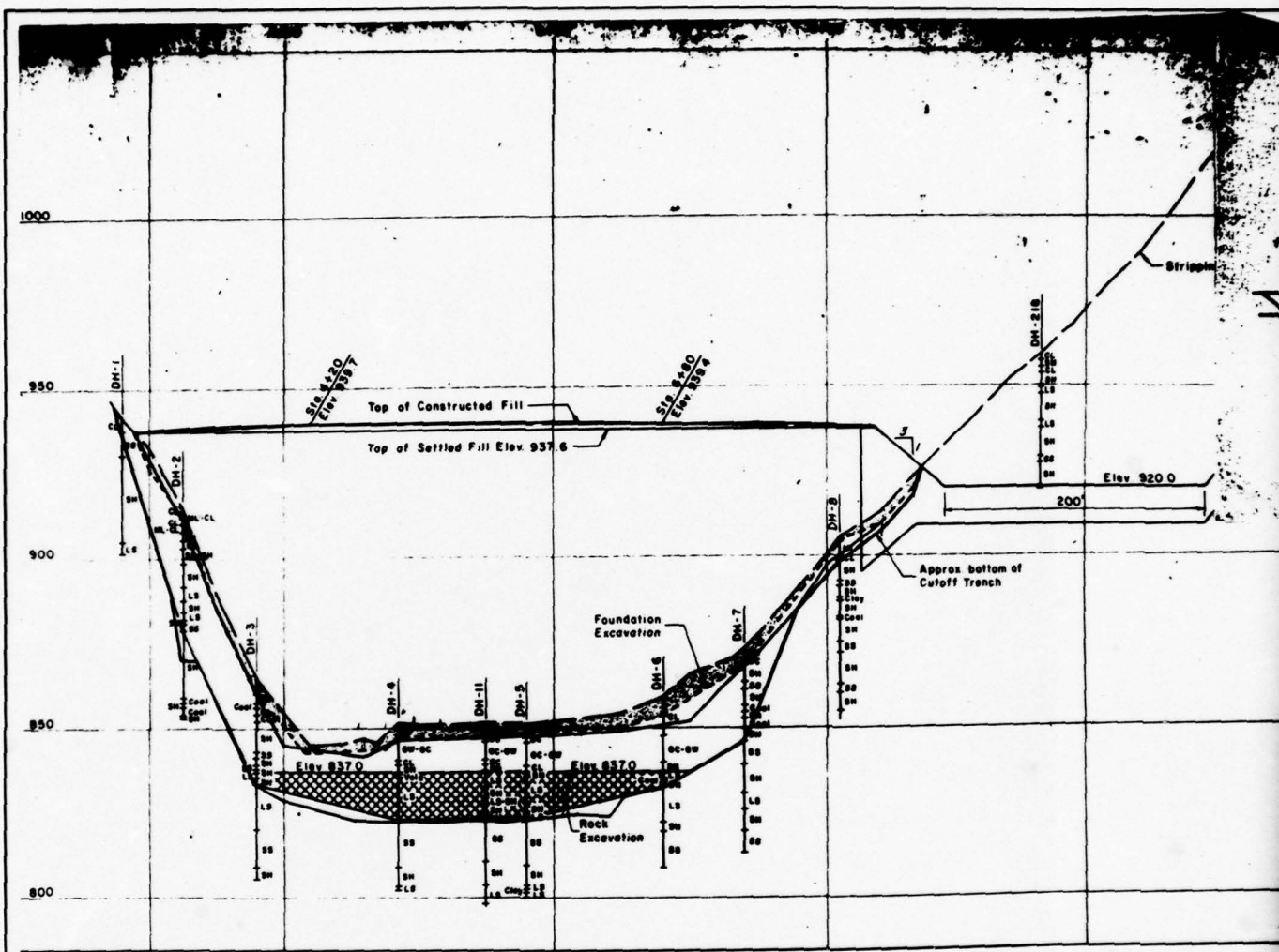
SELECTIVE PLACEMENT	MATERIAL	MAX. ROCK SIZE	MAX. LIFT	REQ'D. WATER CONTENT	COMPACTION	
					CLASS	DEFINITION
1a	Material as represented by TP-202, depth 1.0' to 4.0', and TP-210, depth 5.0' to 8.0', classified as CL and ML, respectively. Weathered shales (hardness 2 or less) (SC, SC, GM, SM) excavated from Em. Sw.	6"	9"	Optimum - 1% to +3%	A	100% Max. density by ASTM D-698, Method "A".
1a	Shale excavated from Emergency Spillway	12"	18"	As designated by the Engineer	C	Compact with min. six passes of 450 p.s.i. tamping roller per lift.
1a	Sandstone and Limestone excavated from Emergency Spillway	12"	18"	As designated by the Engineer	C	Compact with min. six passes of 450 p.s.i. tamping roller per lift.

- 1. Maximum permissible lift thickness before compaction.
- 2. Water content of fill matrix at time of compaction. Variation from water content shown may be approved by the Engineer.
- 3. For typical compaction curves, see sheets 30 and 31.
- 4. Selective placement of material within zones will be required.

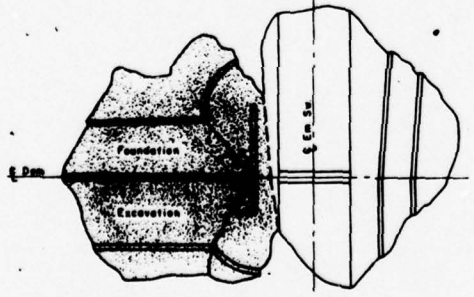
CONSTRUCTION

- 1. Constructed Sh...
- 2. 93' - 1 Upstr...
- 2. 93' - 1 Down...
- 2. For construction see sheet 3...

DRAWN BY ACS CHECKED BY JHP 3/1/77 DRAWING NUMBER 78-367-B40
 1-3-79 APPROVED BY JHP 3.1.77

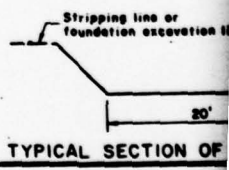


PROFILE ALONG CENTERLINE OF DAM



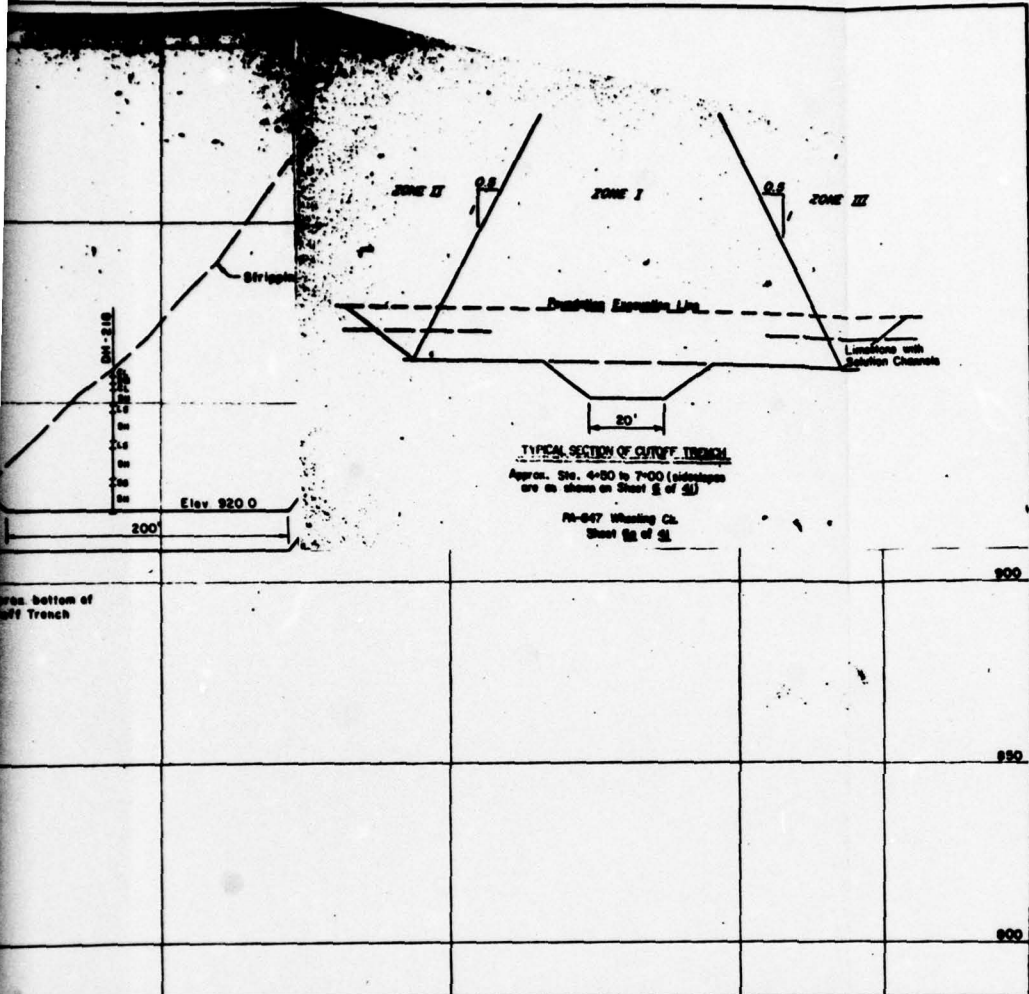
PLAN VIEW OF FOUNDATION EXCAVATION

SCALE 0 25 50 FEET



TYPICAL SECTION OF FOUNDATION EXCAVATION

ITEM NO.	DESCRIPTION	QUANTITY
1	Foundation	1.0
2	Excavation	1.0
3	Transition	1.0
4	Excavation	1.0
5	Transition	1.0

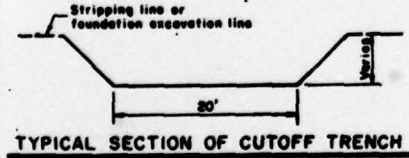


TYPICAL SECTION OF CUTOFF TRENCH
 Approx. Sta. 4+80 to 7+00 (slopes are as shown on Sheet 2 of 21)
 PA-647 Wheeling Co.
 Sheet 21 of 21

CENTERLINE OF DAM

CONSTRUCTION NOTES

1. For logs of test holes see sheets 22 thru 23.
2. E Dam = E Cutoff trench.



SLOPES	STATION
2:1	4+75 to 4+80
transition	4+80 to 4+75
4:1	4+75 to 4+80
transition	4+80 to 4+75
2:1	4+75 to 4+70

AS BUILT PLANS

WHEELING CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-647
 WASHINGTON COUNTY, PENNSYLVANIA
 PROFILE ALONG E DAM

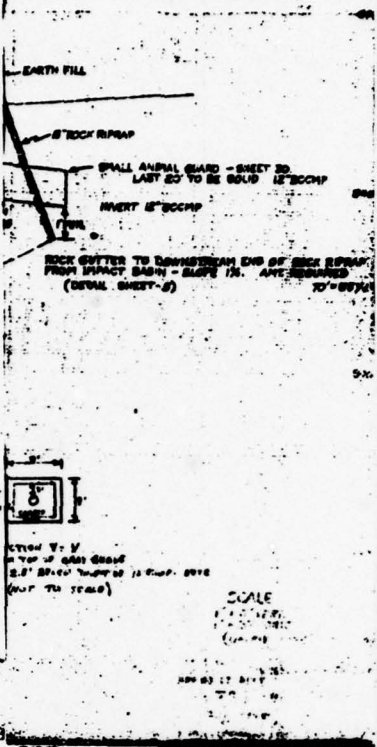
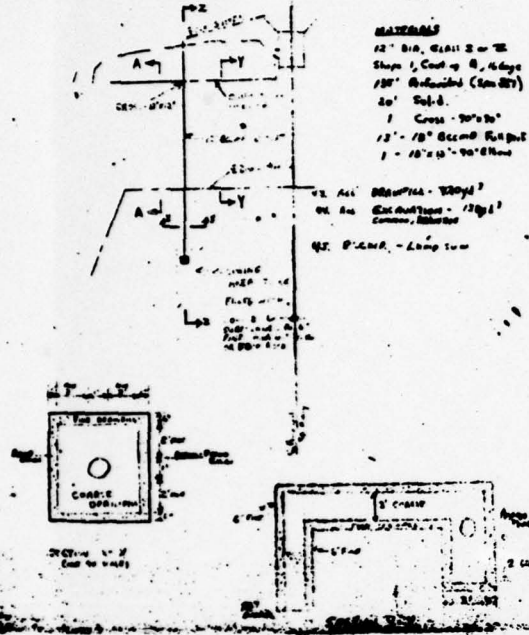
U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

DATE: 8-78
 DRAWN BY: R. A. STALTER
 CHECKED BY: [Signature]
 PROJECT: PA-647-P

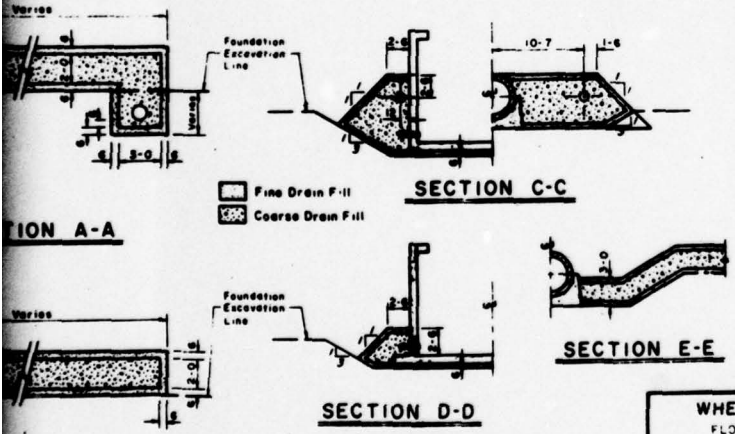
PLATE 4

D'APPOLONIA

WASHINGTON STATE
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 PROJECT: Floodwater Retarding Dam
 DRAWING NO: PA-647-P
 SHEET NO: 41
 SCALE: 1" = 10'



PROFILE ALONG CENTERLINE OF DRAIN OUTLET TRENCH



DRAIN FILL GRADATION LIMITS

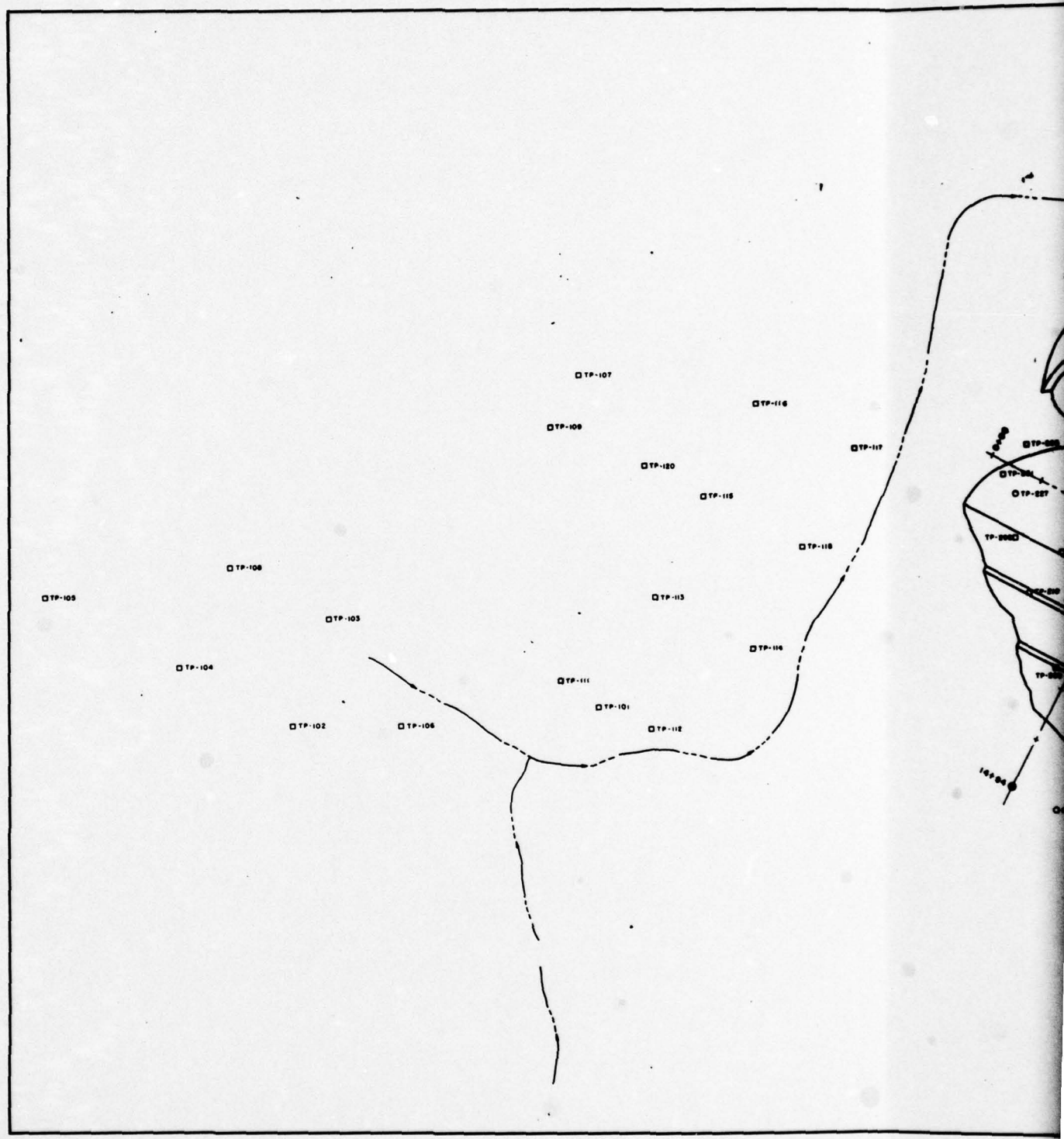
SEIVE NO.	% PASSING (Based on Dry Weight)
1"	100
No. 4	90-100
No. 8	70-92
No. 16	50-80
No. 30	30-65
No. 60	10-30
No. 100	1-8
No. 200	<3

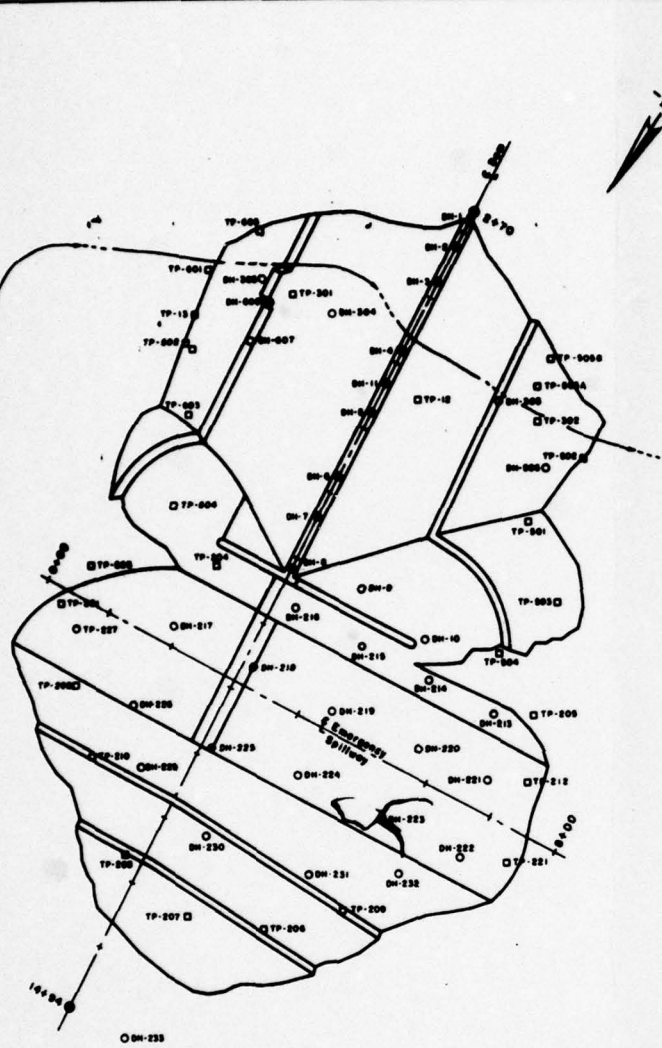
SEIVE NO.	% PASSING (Based on Dry Weight)
1"	100
No. 4	90-100
No. 8	70-92
No. 16	50-80
No. 30	30-65
No. 60	10-30
No. 100	1-8
No. 200	<3

- PIPE QUANTITIES**
- 304' - 12" Dia. Pipe
 - 2 - 1' x 1' - 90° Elbows
 - 2 - 1' x 2' - 6" - 90° Elbow
 - 1 - 1' x 1' - 60° Elbow
 - 2 Metal End Caps
 - 2 Small Animal Guards (Sheet 39)
 - 517' Total

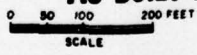
AS BUILT PLANS
 WHEELING CREEK WATERSHED
 FLOODWATER RETARDING DAM 1A-647
 WASHINGTON COUNTY, PENNSYLVANIA
 FOUNDATION DRAINAGE
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 S. Steiner
 PA-647-P

DRAWN BY	ACS	CHECKED BY	3/1/79	DRAWING	78-367-B42
	1-3-79	APPROVED BY	JHP	NUMBER	3.1.79





AS BUILT PLANS



WHEELING CREEK WATERSHED FLOODWATER RETARDING DAM PA-647 WASHINGTON COUNTY, PENNSYLVANIA LOCATION OF TEST HOLES			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed by	Date	Approved by	
Drawn by R A STALTER	12-72		
Checked by C. Stalter	12-72	Scale	Drawing No
		No. 31	PA-647-P
		of 41	

PLATE 6

D'APPOLONIA

22-5 (Continued)

SAMPLES

Unif. Soil Class	Type	From To	%	SAMPLES	
				From To	%
SC	Bit	7	18.5	80	
		7	18.5	15.5	100
		8	15.5	25.5	100
		9	25.5	35.5	100
		10	35.5	45.0	75
		11	45.0	46.0	100
		12	46.0	50.0	100

Hole Depth	From To	Description of Materials	Unif. Soil Class	Type	From To	%	SAMPLES	
							From To	%
		Fraction is found of sub-angular to sub-rounded sandstone & shale, wet, med. density, brn.	Dia	13	100	22.4	31.1	100
12.2	14.0	Clay, sandy & gravelly, a concretion of CL						
14.0	15.3	Med. gry shale, coarse fraction forms 30 - 40% of sample, hard, moist, gry. shaly clay shale, gry, breaks up in conular into small pieces which may be dated with fingers, clay seams & small hair size vertical fractures. Uniontown Formation, Monongahela Group.						
15.3	20.0	Gry fine - grained limestone (siltite), hardness 4. Med. hard, bedding joints to 1' - 2' - 3' - 4' - 5' - 6' - 7' - 8' - 9' - 10' - 11' - 12' - 13' - 14' - 15' - 16' - 17' - 18' - 19' - 20' - 21' - 22' - 23' - 24' - 25' - 26' - 27' - 28' - 29' - 30' - 31' - 32' - 33' - 34' - 35' - 36' - 37' - 38' - 39' - 40' - 41' - 42' - 43' - 44' - 45' - 46' - 47' - 48' - 49' - 50' - 51' - 52' - 53' - 54' - 55' - 56' - 57' - 58' - 59' - 60' - 61' - 62' - 63' - 64' - 65' - 66' - 67' - 68' - 69' - 70' - 71' - 72' - 73' - 74' - 75' - 76' - 77' - 78' - 79' - 80' - 81' - 82' - 83' - 84' - 85' - 86' - 87' - 88' - 89' - 90' - 91' - 92' - 93' - 94' - 95' - 96' - 97' - 98' - 99' - 100'						
20.4	23.0	Silty limestone, med. gry, hardness 3, med. bedded, fractured & jointed, some fracturing, clay seams from 22.0 - 22.4, few thin, vertical water eroded seams.						
23.0	26.4	Med. gry, clay shale, med. bedded up to 1.0' between bedding joints, med. & clay filled seams, vuggy, hardness 4.						
26.4	27.5	Med. gry, fine grained, silty limestone, fractured. Some water eroded joints & seams, hardness 4.						
27.5	41.4	Med. gry sandstone, fine grained, thin to thick bedded, occasionally limy, micaceous, more than 50% of bedding joints are more than 12". hardness 4.						
41.4	45.3	Med. gry shale, coarse broken into med. bedded pieces to 44.0' & then is very broken, hardness 2.						
45.3	47.6	Dark gry shale with clay seams, med. bedded core pieces to very broken along clay seams, hardness 2, Uniontown Coal, Uniontown Formation, Monongahela Group.						
47.6	48.7	Silty limestone, med. gry with clay seams, med. bedded, med. broken. Pittsburgh Formation, Monongahela Group.						
48.7	49.7	Gry shaly clay, some shale parting, hardness 1.						
49.7	50.0	Gry limestone with shale partings, hardness 3, med. bedded, some eroded bedding joints with clay seams. Pittsburgh Formation, Monongahela Group.						
50.0		Bottom of hole. WL (7/9/70) 7.1', 1000 hrs. WL (7/10/70) 6.0', 1335 hrs. WL (7/13/70) 9.0'.						

Unif. Soil Class Type From To %
 Legend by: A. Dwyer 7/13/70
 Drilling Equipment: CMC Truck Mounted, Rig #1

Hole Depth	From To	Description of Materials	Unif. Soil Class	Type	From To	%	STANDARD PENETRATION		SAMPLES	
							Blows per 6"	Used No.	Type	From To
0.0	0.5	Topsoil, shale chips, roots	2-5-6	Spt	1	Jer	0.0	1.5	85	
0.5	1.5	Clay, silty & sandy with CL a few shale gravels, 30% fine to coarse sand, moist, stiff, yellow brn. (colluvial)	6-7-10	"	2	"	1.5	3.0	100	
1.5	5.5	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	6-8-11	"	3	"	3.0	4.5	100	
5.5	11.0	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	10-8-13	"	4	"	4.5	6.0	87	
11.0	14.2	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	10-11-14	"	5	"	6.0	7.5	85	
14.2	17.2	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	14-5-5	"	6	"	7.5	9.0	15	
17.2	20.5	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	2-5-6	"	7	"	9.0	10.5	100	
20.5	22.3	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	5-13-16	"	8	"	10.5	12.0	85	
22.3	24.0	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	10-8-11	"	9	"	12.0	14.0	85	
24.0	24.8	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	13-5-12	"	10	"	14.0	15.5	40	
24.8	26.7	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	2-4-10	"	11	"	15.5	17.0	33	
26.7	36.7	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	7-9-9	"	12	"	17.0	18.5	40	
36.7	39.5	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	21-5-0	"	13	"	18.5	19.5	0	
39.5	40.0	Clay, silty with 20% fine CL to coarse sand, coal & shale fragments below 4.1', very stiff, moist, dark to med. brn. Drilling water doesn't leak from hole. (Colluvial)	14	"	14	"	20.5	21.0	0	
40.0		Bottom of hole. WL (7/11/70) 13.1', WL (7/12/70) 12.4'.			15	"	21.0	21.0	100	
40.0		Bottom of hole. WL (7/11/70) 13.1', WL (7/12/70) 12.4'.			18	"	43.2	40.0	100	

AS BUILT PLANS

WHEELING CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-647
 WASHINGTON COUNTY, PENNSYLVANIA
 LOGS OF TEST HOLES
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

Date: 7/98
 PA-647-P

Unif. Soil Class	Type	From To	%	STANDARD PENETRATION		SAMPLES	
				Blows per 6"	Used No.	Type	From To
SC	Bit	7	18.5	80			
		7	18.5	15.5	100		
		8	15.5	25.5	100		
		9	25.5	35.5	100		
		10	35.5	45.0	75		
		11	45.0	46.0	100		
		12	46.0	50.0	100		

Note: All soil and rock classifications were determined by visual examination.

Unif. Soil Class	Type	From To	%	STANDARD PENETRATION		SAMPLES	
				Blows per 6"	Used No.	Type	From To
3-3-5	Spt	1	Jer	0.0	1.5	85	
4-4-4	"	2	"	1.5	3.0	20	
1-8-8	"	3	"	3.0	4.5	87	
6-8-9	"	4	"	4.5	6.0	87	
4-8-7	"	5	"	6.0	7.5	80	
8-10-12	"	6	"	7.5	9.0	40	
11-12-12	"	7	"	9.0	10.5	50	
12-12-12	"	8	"	10.5	12.0	50	
28-34-34	"	9	"	12.0	13.5	55	
28-34-34	"	10	"	13.5	14.4	80	
28-34-34	"	11	"	14.4	15.4	100	
28-34-34	"	12	"	15.4	22.4	40	

DM-7, ELEV. 874.99, 7+40, Centerline
 Logged by: Y. A. Dumper & J. Van, A. L. Miller
 Drilling Equipment: CMC Truck Mounted Rig #2

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION		SAMPLES		
			Smb.	Blows per 6"	Type	From To	%
0.0 0.5	Topsoil, roots, cobbles, shales, some organic material.	3-4-7	Sgt	1	Jan	0.0 1.5	80
0.5 3.5	Gravel, sandy & silty, 20% fine, loose, moist, brn.	3-9-18	-	3	Jan	1.5 3.0	0
3.5 5.0	Gravel, clayey & sandy - coarse fraction breaks into a "CL soil" with finger pressure. The strata is a aggregate of non-durable we. shale.	23-08-95	Coating Drilling	4	-	4.5 6.0	87
5.0 10.0	Wee., gry, clay shale, soft, hardness 1, breaks into pieces along bedding joints with secondary fracturing & jointing, bedding joints with secondary fracturing & jointing, bedding joints 1/2 - 2.0', Lower Member, Waynesburg Formation, Dunkard Group.	10-10-12	Dia	5	N00	7.5 8.5	60
10.0 12.2	Sandstone shaly, fine grained, porous streaks, hardness 2 - 2 1/2, with thin shale partings, gry with tan streaks, thin to med. bedded pieces of core.	4-9-2	-	5	-	6.0 7.5	100
12.2 17.1	Gry shale with tan streaks, wee., soft, hardness 1 - 2, clay layers 1/2 - 1 1/2' & 15.8 - 15.9'.	8-19-36	-	8	-	28.0 36.0	100
17.1 18.7	Coal, soft, black with impurities, vertical fractures. Waynesburg coal, upper bench.	9-30-70	-	7	-	4.0 10.0	40
18.7 19.7	Dark gry shale, very soft to soft, hardness 1 - 2, thin bedded.	-	-	9	-	14.0 21.0	100
19.7 21.5	Dark gry to black carbonaceous shale, slightly silty.	-	-	10	-	21.5 28.0	100
21.5 23.9	Coal, black, very soft, hardness 1, with vertical fractures & impurities - Lower Member, Waynesburg Formation, Dunkard Group.	-	-	11	-	28.0 36.0	100
23.9 27.1	Black carbonaceous shale - to dark gry, very soft to soft, hardness 1 - 2, Lower Member, Waynesburg Formation, Dunkard Group.	-	-	12	-	36.0 46.0	100
27.1 32.4	Gry silty & sandy shale, soft to med. soft, hardness 2 - 3, med. bedded pieces of core formation, Monacahele Group.	-	-	13	-	47.6 57.0	100
32.4 42.8	Coarse fine grained sandstone, med. soft, hardness 3, slightly calcareous, shaly zones with bituminous or shale partings, micaceous & pyritic dense.	-	-	14	-	57.0 66.0	100
42.8 47.5	Gry clayey shale, soft, hardness 2, vertical fractures & broken at 41.8. Limestone with interbedded shale, limestone is finely crystalline & dense, gry to gray tan, med. soft, hardness 3, shale - soft, hardness 2, med. bedded joints show signs of water erosion.	-	-	15	-	66.0 80.0	100
47.5 53.7	Gry calcareous shale, fossiliferous, joints, limestone concretions, hardness 3 - 4, dense.	-	-	16	-	76.0 86.0	91
53.7 60.0	Fine grained sandstone, gry, med. bedded, slightly wee. joints, some shale streaks, Uniontown Formation, Monacahele Group.	-	-	17	-	86.0 94.5	100
60.0	Bottom of hole. WL (7/22/70) 13.1'. WL (2/14/70) 11.0'						

DM-8, ELEV. 902.2, 8+00, 100' D.S.
 Logged by: Y. A. Dumper 7/20/70
 Drilling Equipment: CMC Truck Mounted Rig #1

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION		SAMPLES		
			Smb.	Blows per 6"	Type	From To	%
0.0 0.4	Clay, sandy & silty with a few gravel, dry, med.	MC-CL 1-8-13	Sgt	1	Jan	0.0 1.5	55
0.4 2.0	Med. sandstone, very broken, med. soft, hardness 3, brn. breaks into pieces in 8 spots, Lower Member, Waynesburg Formation, Dunkard Group.	6-9-28	-	2	N00	1.5 3.0	0
2.0 4.7	Gry calcareous sandstone with tan stained zones, especially on joints & seams, med. wee., med. hard (hardness 4).	36-40-25	-	4	-	4.5 6.0	70
4.7 10.0	Olive colored clay shale with iron stained joints & clay seams, very brown, thin bedded core pieces, soft (hardness 2), very wee. & partly decomposed.	0.5/62	Dia	5	N00	6.5 11.0	86
10.0 14.0	Yellow tan to gry sandy shale, fractured & very broken, few clay seams, med. soft (hardness 3), vertical fractures & joints in core, joints open 1/16", the seams become very permeable & drilling water is not all returned to the surface. Partly wee. & decomposed.	-	-	7	-	11.0 17.0	100
14.0 16.0	Gry clay shale to yellow tan, partly wee., partly to very broken, contains clay filled seams up to 1" thick, thin bedded core pieces, soft to med. soft (hardness 2).	-	-	8	-	17.0 22.0	100
16.0 17.5	Gry limestone with iron stained calcite seams, fractured & broken & the seams have been repaired with the calcite, med. wee., some clay seams, thin to med. bedded, med. soft (hardness 3).	-	-	9	-	22.0 30.5	100
17.5 21.8	Gry silty shale with clay seams, med. to slightly wee., very broken & fractured, breaks down into a shaly clay (CL) in barrel, soft (hardness 2).	-	-	10	-	30.5 40.0	100
21.8 27.6	Gry clay shale, very slightly wee., slightly broken, med. soft to soft (hardness 2 - 3).	-	-	11	-	40.0 47.6	100
27.6 30.9	Gry calcareous sandstone, med. bedded, med. soft to med. hard (hardness 3 - 4), silty with some shale partings, med. grained sandstone, fresh.	-	-	12	-	47.6 57.0	100
30.9 40.0	Gry clay shale, wee., some breakage at bedding joints but generally unbroken with a few thin clay seams, med. bedded, few sandy & clay seams, Lower member, Waynesburg Formation, Dunkard Group.	-	-	13	-	57.0 66.0	100
40.0	Bottom of hole. WL (7/22/70) 11.0'. WL (7/22/70) 20.8'.						

DM-8 Continued

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION		SAMPLES		
			Smb.	Blows per 6"	Type	From To	%
47.2 45.8	Lower member, Waynesburg Formation, Dunkard Group.						
45.8 70.2	Gry, calcareous sandstone, med - thickbedded, calcareous cement, fresh, unbroken, moderately hard (hardness 4), Uniontown Formation, Monacahele Group.						
70.2 74.0	Dark gry shale, med. soft (hardness 3), med. bedded pieces of core up to 1.0', joints fit together well. Shaly clay seams from 72.5 & become calcareous below 70.0'. Fresh although there are clay seams from 74.0 - 76.2 & 76.0 - 75.3.						
74.0 74.4	Gry limestone, med. bedded, shaly seams and bedding joints, fresh, med. hard (hardness 4).						
74.4 81.0	Gry to black shale & shaly clay, med. broken, thin bedded core pieces, med. soft (hardness 2), fresh.						
81.0 82.0	Med. to dark gry silty limestone, med. bedded, slightly broken, med. hard (hardness 3/4), fresh.						
82.0 84.0	Gry limestone conglomerate, small limestone gravel in a silty limestone matrix, dark gry, med. hard (hardness 4), med. bedded, med. broken, some black & gry shale clasts.						
84.0 86.8	Med. gry silty limestone, med. broken, med. bedded, some shaly partings, few shaly clay joint fillings, fresh, med. soft, (hardness 3).						
86.8 91.7	Gry shale, slightly broken in upper jointed clay films, some limestone concretions, stick bedded to med. bedded, med. soft, (hardness 3).						
91.7 94.5	Gry sandstone, shaly in part, fine to med. grained, massive, 1 piece of core 4" long, some clay seams, med. hard (hardness 4), fresh, Uniontown Formation, Monacahele Group.						
94.5	Bottom of hole. WL (7/22/70) 10.2'. 0915 hours, stable.						

DM-9, ELEV. 902.2, 8+00, 100' D.S.
 Logged by: Y. A. Dumper 7/20/70
 Drilling Equipment: CMC Truck Mounted Rig #1

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION		SAMPLES		
			Smb.	Blows per 6"	Type	From To	%
0.0 0.4	Clay, sandy & silty with a few gravel, dry, med.	MC-CL 1-8-13	Sgt	1	Jan	0.0 1.5	55
0.4 2.0	Med. sandstone, very broken, med. soft, hardness 3, brn. breaks into pieces in 8 spots, Lower Member, Waynesburg Formation, Dunkard Group.	6-9-28	-	2	N00	1.5 3.0	0
2.0 4.7	Gry calcareous sandstone with tan stained zones, especially on joints & seams, med. wee., med. hard (hardness 4).	36-40-25	-	4	-	4.5 6.0	70
4.7 10.0	Olive colored clay shale with iron stained joints & clay seams, very brown, thin bedded core pieces, soft (hardness 2), very wee. & partly decomposed.	0.5/62	Dia	5	N00	6.5 11.0	86
10.0 14.0	Yellow tan to gry sandy shale, fractured & very broken, few clay seams, med. soft (hardness 3), vertical fractures & joints in core, joints open 1/16", the seams become very permeable & drilling water is not all returned to the surface. Partly wee. & decomposed.	-	-	7	-	11.0 17.0	100
14.0 16.0	Gry clay shale to yellow tan, partly wee., partly to very broken, contains clay filled seams up to 1" thick, thin bedded core pieces, soft to med. soft (hardness 2).	-	-	8	-	17.0 22.0	100
16.0 17.5	Gry limestone with iron stained calcite seams, fractured & broken & the seams have been repaired with the calcite, med. wee., some clay seams, thin to med. bedded, med. soft (hardness 3).	-	-	9	-	22.0 30.5	100
17.5 21.8	Gry silty shale with clay seams, med. to slightly wee., very broken & fractured, breaks down into a shaly clay (CL) in barrel, soft (hardness 2).	-	-	10	-	30.5 40.0	100
21.8 27.6	Gry clay shale, very slightly wee., slightly broken, med. soft to soft (hardness 2 - 3).	-	-	11	-	40.0 47.6	100
27.6 30.9	Gry calcareous sandstone, med. bedded, med. soft to med. hard (hardness 3 - 4), silty with some shale partings, med. grained sandstone, fresh.	-	-	12	-	47.6 57.0	100
30.9 40.0	Gry clay shale, wee., some breakage at bedding joints but generally unbroken with a few thin clay seams, med. bedded, few sandy & clay seams, Lower member, Waynesburg Formation, Dunkard Group.	-	-	13	-	57.0 66.0	100
40.0	Bottom of hole. WL (7/20/70) 11.0'. WL (7/22/70) 20.8'.						

DM-10, ELEV. 906.8, 8+10, 209.5' D.S.
 Logged by: A. L. Miller & Y. A. Dumper 8/4/70
 Drilling Equipment: Joy Truck Mounted

Hole Depth From To	Description of Materials	Unif. Soil Class	STANDARD PENETRATION		SAMPLES		
			Smb.	Blows per 6"	Type	From To	%
0.0 0.5	Topsoil	2-6-4	Sgt	1	Jan	0.0 1.5	66
0.5 3.0	Clay, silty & sandy, 10% coarse sand & gravel, moist, stiff, brn.	3-5-5	-	2	-	1.5 3.0	54
3.0 6.0	Clay, silty & sandy, 20 - 30% shale sand, moist, very stiff, brn to gry, shale spherulite, becomes hard with depth.	6-9-28	-	3	-	3.0 4.5	100
6.0 0.7	Wee. brn shale, very broken, soft - med. soft, (hardness 2 - 3), clay seams, Lower Member, Waynesburg Formation, Dunkard Group.	36-40-25	-	4	-	4.5 6.0	70
0.7 12.2	Gry shaly sandstone, wee. brn. clay seams in clayey sandstone sections, med. soft when wee. to med. hard when fresh (hardness 3 - 4), silty, med. broken.	0.5/62	Dia	5	N00	6.5 11.0	86
12.2 14.7	Wee., brn. clay shale, iron stained seams with clay filling & vertical joints & fractures, very broken, soft, (hardness 2).	-	-	7	-	11.0 17.0	100
14.7 25.5	Gry clay shale with limestone concretions, slightly wee. to med. wee. on some seams, med. broken, med. bedded pieces of core & some clay seams, med. soft (hardness 3).	-	-	8	-	17.0 22.0	100
25.5 27.5	Limestone & interbedded shale with clay seams, gry, limestone is med. bedded & wee., & med. hard (hardness 4), shale is broken, wee. on seams & is med. soft (hardness 3).	-	-	9	-	22.0 30.5	100
27.5 34.3	Gry clay shale with clay seams, eroded on joints, med. broken to slightly broken below 31.0, thin to med. bedded pieces of core, med. soft (hardness 3).	-	-	10	-	30.5 40.0	100
34.3 38.0	Gry, silty & shaly sandstone, med. bedded, med. wee., slightly broken, iron stained seams & joints few of which are clay filled, med. hard (hardness 4).	-	-	11	-	40.0 47.6	100
38.0 40.0	Gry, clay shale with broken clay filled seams, fresh, med. bedded pieces of core, med. soft (hardness 3), Lower member, Waynesburg Formation, Dunkard Group.	-	-	12	-	47.6 57.0	100
40.0	Bottom of hole. WL (8/5/70) 14.2'. WL (8/4/70) 11.3'.						

TP-11, CLAY, 851.0, 5-35, 50' D.S.
 Located by: T. A. Dwyer
 Drilling Equipment: CME Truck Mounted Air #3

Hole Depth From To	Description of Materials	Soil Class		STANDARD PENETRATION		SAMPLE		
		Symb.	No.	Blows per Ft.	Bit Used	No.	Type	From To Ft.
0.0 4.0	Silt, fine sandy & clayey, trace of med & coarse sand, 20 - 30% fine sand, moist, med. brn, med to stiff, black shale chips, root hairs, silt (alluvium).	ML-CL	2-3-4	7-9-7	Sgt	1 Jar	0.0 1.5	80
						2 "	1.5 3.0	67
						3 "	3.0 4.5	85
						4 "	4.5 6.0	73
						5 "	6.0 7.5	15
						6 "	7.5 9.0	67
4.0 5.5	Sand, silty & clayey, moist, loose to med., yellow brn, 30% med. plastic fines, 20% coarse sand, rest is fine to med. sand (alluvium).	SC	3-5-6	7-11-11		7 "	9.0 10.5	67
						8 "	10.5 12.0	85
						9 "	12.0 13.5	100
5.5 11.0	Sand & gravel, silty & clayey, 10 - 20% med. plastic fines, moist to wet, loose, brn. Estimated gradation from spoon sample is 5% gravel, 30 - 40% fine - coarse sand. Coarse fraction is both sandstone & shale fragments ("creek gravel" - alluvium).	CC-M		10-35-50/0.2	Dia	10 100#	13.2 15.0	95
						11 "	15.0 20.0	90
						12 "	20.0 25.0	95
						13 "	25.0 30.0	100
						14 "	30.0 35.0	100
						15 "	35.0 40.0	100
						16 "	40.0 45.0	99
						17 "	47.5 53.0	75
						18 "	53.0 55.0	100
						19 "	55.0 60.0	100
						20 "	60.0 65.0	99
						21 "	65.0 70.0	90
11.0 12.5	Wet, gray, 37% med. plastic fines, sand is fine - coarse, multi-colored shale fragments.	SC				22 "	70.0 75.0	82
12.5 14.5	Med. gray shale, soft med. broken, med. bedded thin bedded pieces of core, Intontown Formation, Monongahela Group.							
14.5 19.7	Gr. fine grained limestone with a few clay seams that are med. bedded, broken to slightly broken, seams open 1/16" - 1/8" clay seam from 17.5 - 18.0'.							
19.7 22.3	Gray limestone conglomerate - pieces of white clay limestone in a gray clay shale matrix, med. broken, medium bedded core pieces, clay deposits on joints, med. soft (hardness 3).							
22.3 24.5	Gray, limy clay shale with clay filled joints & seams, slightly weat., med. bedded core pieces that are med. broken, med. soft (hardness 3).							
24.5 25.0	Gray fine-grained limestone with interbedded shale, med. weat., med. bedded pieces of core that are med. broken, shale is med. soft (hardness 3), limestone is med. hard (hardness 4).							
25.0 27.1	Gray limy shale with limestone concretions, med. bedded pieces of core, clay seams, fresh, med. soft (hardness 3).							
27.1 41.1	Gray, limy, shaly sandstone, clay & shale filled joints, med. to thick bedded pieces, iron stained seams, bedding joints up to 1.5' apart, voids at 30.0 - 35.0 & 35.0 - 35.5, fast circulation at 36.7, blocks of mica & pyrite, med. hard (hardness 4).							
41.1 48.0	Gray clay shale with limestone concretions, few clay filled joints, few sandy zones to 41.1' thick, no concretions below 43.0' med. soft (hardness 3), med. bedded core pieces, Intontown Formation, Monongahela Formation.							
48.0 53.0	Gray silty limestone with shaly clay seams up to 1.5' thick, med. bedded, med. hard (hardness 4), med. broken, clay seams are very soft (hardness 1), fresh, Pittsburgh formation, Monongahela Group.							
53.0 54.5	Gray clay shale, med. soft (3), med. bedded pieces of core that are med. broken and very slightly weat.							
54.5 59.0	Gray silty limestone, with few clay seams, med. to thick bedded, med. hard (hardness 4).							
59.0 61.0	Gray clay shale, med. soft (hardness 3), med. bedded core pieces, slightly broken, fresh, some clay films on bedding joints.							
61.0 69.9	Gray, silty, fine grained limestone with some interbedded limy clay shale, med. bedded, slightly broken with diagonal joints, med. hard (hardness 4).							
69.9 75.0	Gray clay shale, slightly limy with clay filled bedding joints, med. bedded pieces of core, fresh, med. soft (hardness 3), Pittsburgh Formation, Monongahela Group.							
75.0	Bottom of hole. ML (87/70) 7.5'							

TP-12, CLAY, 851.0, 5-35, 50' D.S. 8/26/70

Hole Depth From To	Description of Materials	Class	From To No. Type Ft. Ft.
0.0 3.3	Silt, clayey, 30% fine - coarse sand, moist, stiff, brn.	ML-CL	extra large 1 Jar 0.0 6.0
3.3 5.5	Sand & gravel, silty & clayey, 10 - 20% med. plastic fines, few cobbles, med. moist to wet, brn.	GM-SC	Sample for in place density
5.5	Bottom of hole. (132.45 p.c.f.)		

TP-13, CLAY, 852.5, 5-75, 200' D.S. 8/26/70

Hole Depth From To	Description of Materials	Class	From To No. Type Ft. Ft.
0.0 2.0	Silt, fine sandy, 10 - 20% (fine sand, moist, medium density, brn, alluvium.	ML	1 Jar 0.0 6.0
2.0 4.4	Sandy, silty & clayey 20 - 40% low plastic fines, moist, SH med. brn, becomes clouder with depth with some interbedded limy clay shale, med. bedded.		Sample for in place density determination
4.4 6.5	Sand & gravel, silty 10 - 20% low plastic fines, brn, bedding gray at 6.0 loose to med. density, becomes wet at 5.5'. (131.03 p.c.f.)	GM-SC	

AS BUILT PLANS

WHEELING CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-647
 WASHINGTON COUNTY, PENNSYLVANIA

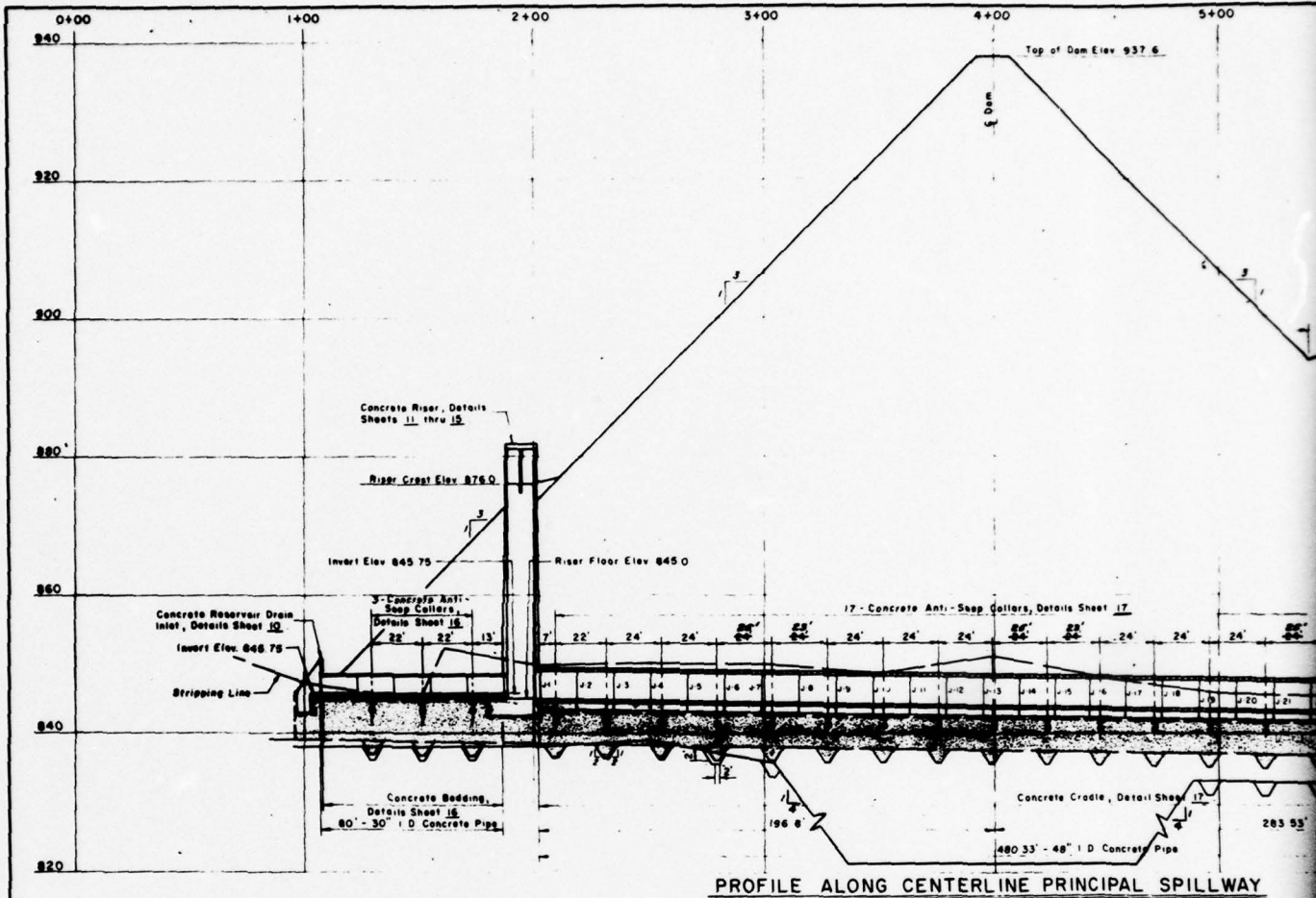
LOGS OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

33/41 PA-647-P

Note: All soil and rock classifications were determined by visual examination.

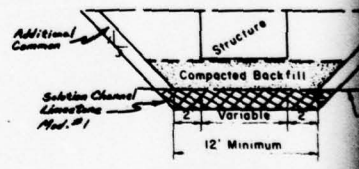
DRAWN BY ACS CHECKED BY BE 3/1/79 DRAWING NUMBER 78-367-B 45
 APPROVED BY JHP 3.1.79



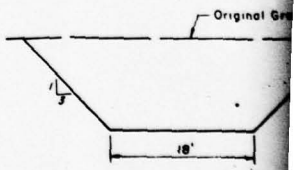
PROFILE ALONG CENTERLINE PRINCIPAL SPILLWAY

CONSTRUCTION NOTES

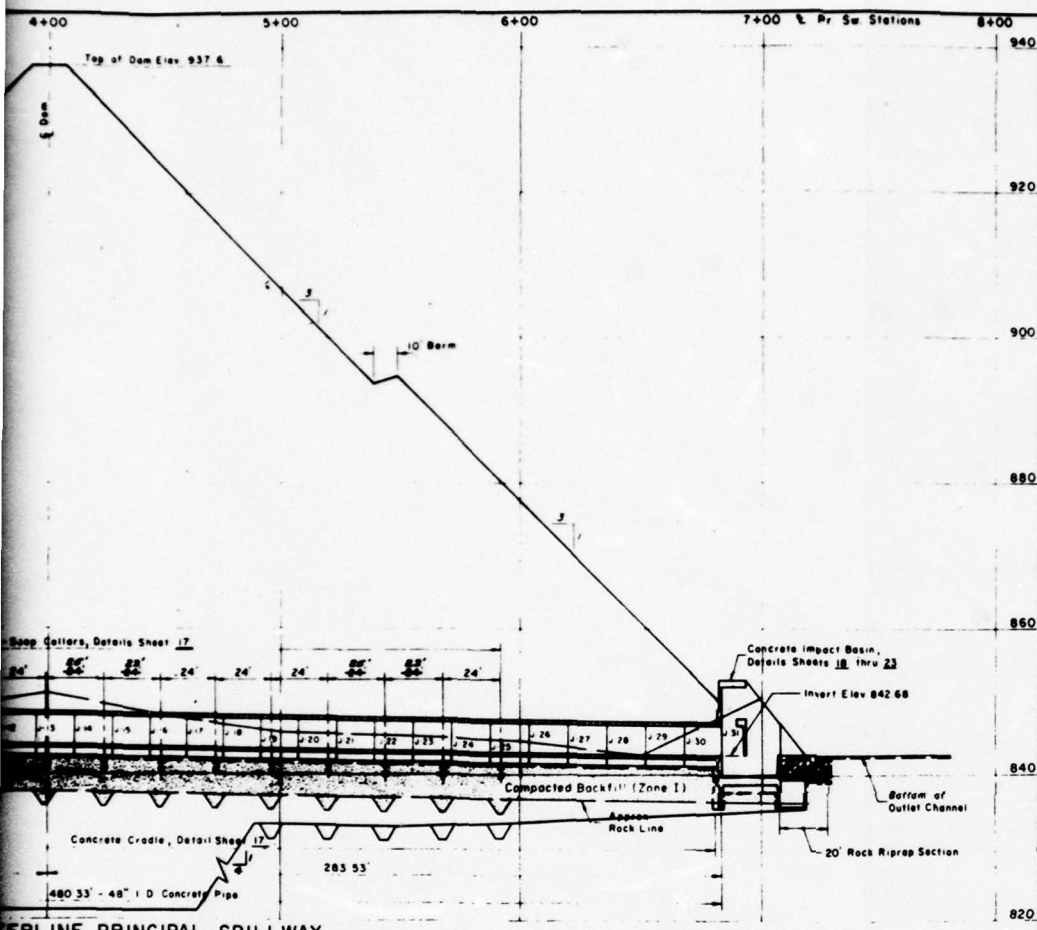
1. Riprap bedding shall meet fine drain fill gradation limits. See sheet I.
2. Inlet end of 30" pipe (bell end) and outlet end of 48" pipe (spigot end) to be finished so that no metal is exposed.
3. Pipe layout data will be furnished by the Engineer.
4. Layout shown is for 16' conduit sections. If 20' sections are used, some dimensions and quantities will change.
5. For cutoff trench excavation see sht. 6.



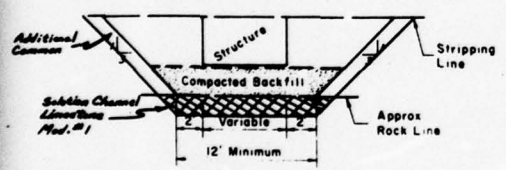
PRINCIPAL SPILLWAY
From Sta 0+95 to Sta 7+18 (Approx)



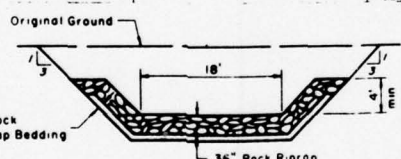
OUTLET CHANNEL
(Line and grade to be determined by the Engineer.)



PRINCIPAL SPILLWAY



PRINCIPAL SPILLWAY
From Sta 0+95 to Sta 7+18 (Approx)



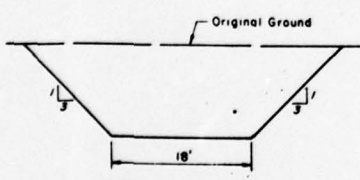
OUTLET CHANNEL
20' Rock Riprap Section

AS BUILT PLANS

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
PRINCIPAL SPILLWAY EXCAVATION
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

C. Stalter 10-72
H. A. STALTER 11-72

9 PA-647-P

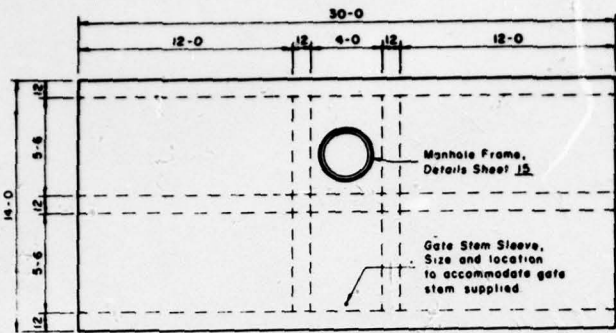


OUTLET CHANNEL
(Line and grade to be determined by the Engineer)

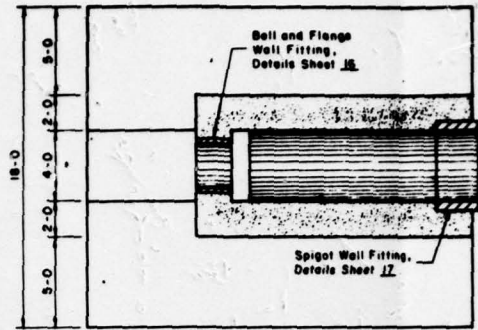
DRAWING 78-367-B46
 NUMBER 3.1.79

ACCS CHECKED BY BE
 1-3-79 APPROVED BY JHP

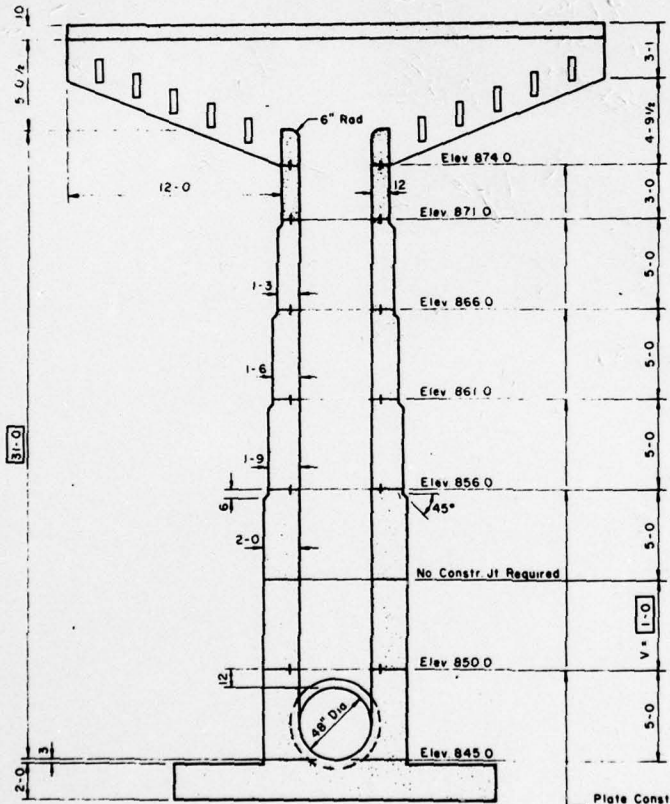
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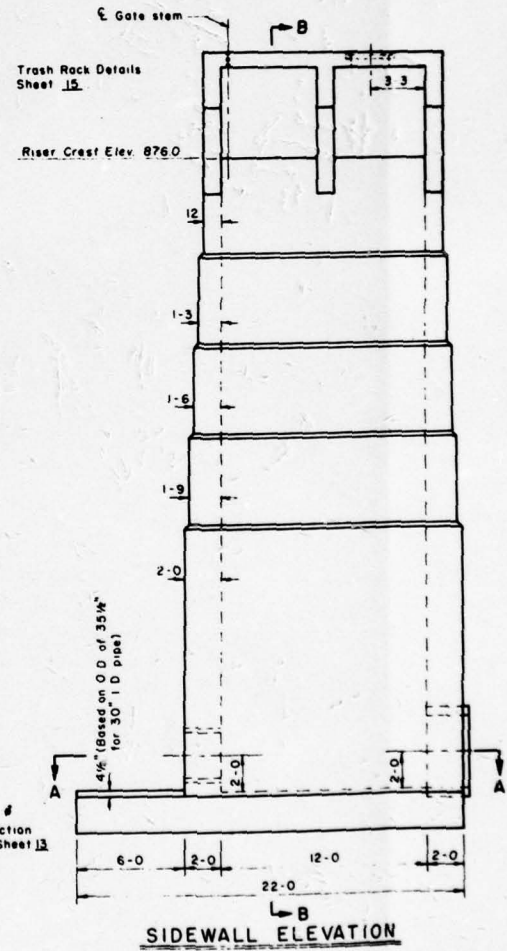
PLAN - TOP



SECTION A-A



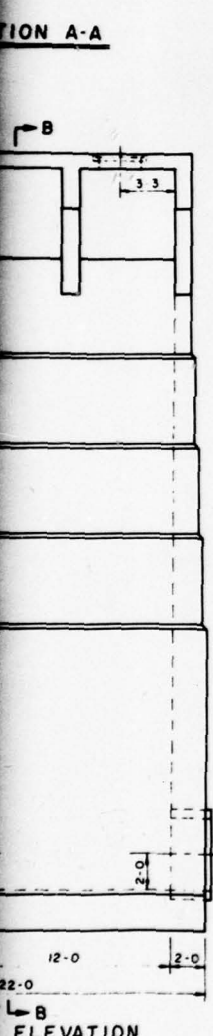
SECTION B-B



SIDEWALL ELEVATION

MARK	SIZE
R1	6
R2	6
R3	6
R4	6
R5	6
R6	6
R7	6
R8	6
R9	6
R10	6
R11	6
R12	6
R13	6
R14	6
R15	6
R16	6
R17	6
R18	6
R19	6
R20	6
R21	6
R22	6
R23	6
R24	6
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R26	6
R27	6
R28	6
R29	6
R30	6
R31	6
R32	6
R33	6

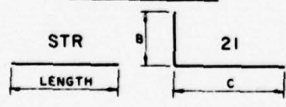
STEEL
 QUAN
 No 5 Bar
 No 6 Bar
 No 7 Bar
 No 8 Bar
 CONCR
 Class 40



RISER STEEL SCHEDULE

MARK	SIZE	QUANTITY	LENGTH	TYPE	B	C	TOTAL LENGTH	MARK	SIZE	QUANTITY	LENGTH	TYPE	B	C	TOTAL LENGTH
B1	6	6	17-8	STR			108-0	R34	6	24	6-7	STR			188-0
B2	7	25	17-8	STR			437-8	R35	6	8	6-7	STR			52-8
B3	6	18	13-9	STR			257-0	R36	6	28	4-6	STR			128-0
B4	6	36	10-8	STR			378-0	R37	6	12	4-6	STR			54-0
B5	7	24	13-8	STR	4-11	8-9	264-8	R38	6	32	13-0	STR			416-0
B6	6	18	21-8	STR			387-0	R39	6	16	5-0	STR			80-0
B7	6	13	17-4	STR			227-8	R40	5	36	11-10	STR	3-11	7-11	422-0
B8	6	3	17-6	STR			52-8	R41	6	28	4-0	STR			112-0
B9	6	12	17-8	STR			210-0	R42	6	12	4-0	STR			48-0
B10	6	8	9-8	STR	1-0	6-8	77-4	R43	5	28	11-4	STR	3-8	7-8	317-3
B11	6	6	9-8	STR	1-0	6-8	58-0	R44	6	12	4-0	STR			48-0
B12	6	24	9-8	STR	1-0	6-8	232-0								
B13	6	4	9-8	STR	1-0	6-8	38-8	T1	5	12	13-6	STR			162-0
B14	7	14	13-0	STR			182-0	T2	6	12	12-9	STR			183-0
B15	6	6	5-0	STR			30-0	T3	5	6	7-0	STR			42-0
B16	7	24	14-0	STR	5-0	9-0	336-0	T4	5	12	9-0	STR			108-0
B17	7	2	11-3	STR	2-3	9-0	22-6	T5	5	6	13-0	STR			78-0
B18	7	4	10-11	STR	1-11	9-0	43-8	T6	5	6	17-0	STR			102-0
B19	7	4	10-7	STR	1-7	9-0	42-4	T7	5	6	21-3	STR			127-6
B20	7	4	10-4	STR	1-4	9-0	41-4	T8	5	6	25-6	STR			153-0
B21	7	4	10-3	STR	1-3	9-0	41-0	T9	5	24	29-6	STR			708-0
B22	7	2	11-6	STR	2-6	9-0	23-0	T10	5	4	13-6	STR			54-0
B23	6	2	2-10	STR			5-8	T11	5	4	13-0	STR			52-0
B24	3	2	2-4	STR			4-8	T12	5	4	14-0	STR			56-0
B25	6	2	2-0	STR			4-8	T13	6	8	4-5	STR	1-9	2-8	35-4
B26	6	2	2-0	STR			4-8	T14	6	8	4-10	STR	1-9	3-1	38-8
B27	6	8	3-9	STR			30-0	T15	6	8	5-3	STR	1-9	3-6	42-0
R1	6	24	7-11	STR			190-0	T16	6	8	5-8	STR	1-9	3-11	45-4
R2	6	8	7-11	STR			63-4	T17	6	8	6-1	STR	1-9	4-4	48-8
R3	6	32	5-6	STR			176-0	T18	6	8	6-6	STR	1-9	4-9	52-0
R4	6	16	5-6	STR			88-0	T19	6	8	6-11	STR	1-9	5-2	55-4
R5	7	4	13-0	STR			52-0	T20	6	8	7-4	STR	1-9	5-7	58-8
R6	6	2	3-0	STR			10-0	T21	6	8	7-9	STR	1-9	6-0	62-0
R7	6	8	13-8	STR	4-10	8-10	109-4	T22	6	8	8-2	STR	1-9	6-5	65-4
R8	5	20	13-0	STR			260-0	T23	6	8	8-7	STR	1-9	6-10	68-8
R9	6	10	5-0	STR			50-0	T24	6	16	9-0	STR	1-9	7-3	144-0
R10	6	36	13-8	STR	4-10	8-10	482-0	T25	6	12	9-4	STR	1-9	7-7	112-0
R11	6	28	4-4	STR			121-4	T26	6	2	8-9	STR	1-6	7-3	17-6
R12	6	16	4-4	STR			69-4	T27	6	2	8-6	STR	1-3	7-3	17-0
R13	5	4	12-10	STR	4-5	8-5	51-4	T28	6	12	9-1	STR	1-9	7-4	109-0
R14	6	24	6-11	STR			166-0	T29	6	4	8-8	STR	1-9	6-11	34-8
R15	6	8	6-11	STR			55-4	T30	6	4	8-3	STR	1-9	6-6	33-0
R16	6	30	4-8	STR			135-0	T31	6	4	7-10	STR	1-9	6-1	31-4
R17	6	14	4-8	STR			63-0	T32	6	4	7-5	STR	1-9	5-8	29-8
R18	5	20	13-0	STR			260-0	T33	6	4	7-0	STR	1-9	5-3	28-0
R19	6	10	5-0	STR			50-0	T34	6	4	6-7	STR	1-9	4-10	26-4
R20	5	36	12-10	STR	4-5	8-5	432-0	T35	6	4	6-2	STR	1-8	4-5	24-8
R21	6	30	4-4	STR			120-0	T36	6	4	5-9	STR	1-9	4-0	23-0
R22	6	14	4-4	STR			60-8	T37	6	4	5-4	STR	1-9	3-7	21-4
R23	5	4	12-4	STR	4-2	8-2	49-4	T38	6	4	4-11	STR	1-9	3-2	19-8
R24	6	24	6-11	STR			166-0	T39	6	4	4-6	STR	1-9	2-9	18-0
R25	6	8	6-11	STR			55-4	T40	6	4	4-1	STR	1-9	2-4	16-4
R26	6	30	4-8	STR			135-0	T41	6	60	1-4	STR			80-0
R27	6	14	4-8	STR			63-0	T42	5	44	13-6	STR			594-0
R28	5	20	13-0	STR			260-0	T43	5	4	8-3	STR			33-0
R29	6	10	5-0	STR			50-0	T44	5	2	7-9	STR			19-8
R30	5	36	12-4	STR	4-2	8-2	444-0	T45	5	4	2-9	STR			11-0
R31	6	26	4-4	STR			112-8	T46	5	2	2-3	STR			4-8
R32	6	14	4-4	STR			60-8								
R33	5	4	11-10	STR	3-11	7-11	47-4								

BAR TYPES



QUANTITIES (Riser Only)

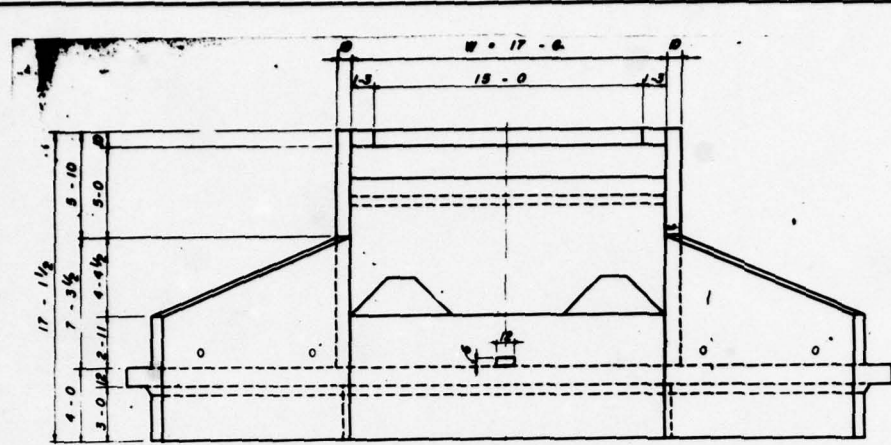
STEEL
 No 5 Bars 5293.8 Ft = 5505.5 Lbs
 No 6 Bars 6410.8 Ft = 3616.3 Lbs
 No 7 Bars 2808.0 Ft = 5119.8 Lbs
 No 8 Bars 649.5 Ft = 1710.1 Lbs
 8406.2 Lbs
 27,082 lbs.
CONCRETE Mod. # 216 lbs.
 Class 4000 129.3 Cu Yds Reinforced

Note: For Construction Notes, see sheet 13



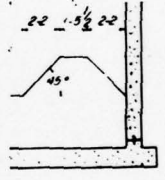
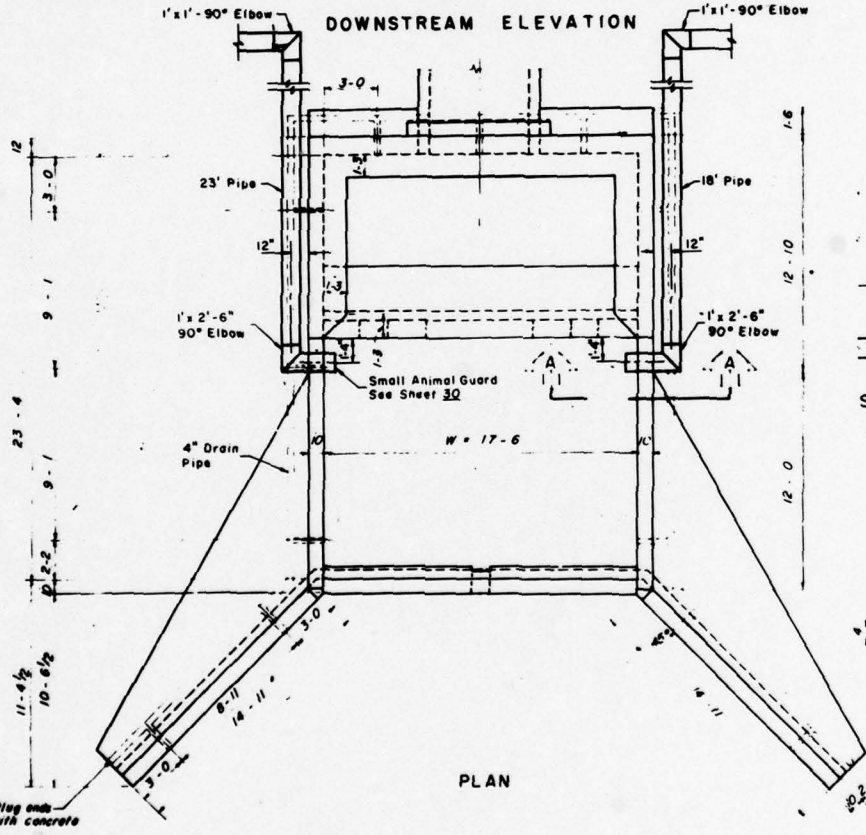
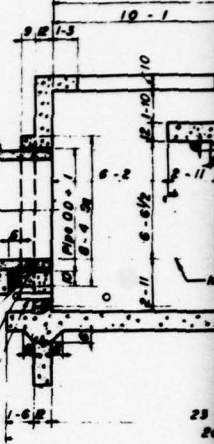
WHEELING CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-647
 WASHINGTON COUNTY, PENNSYLVANIA
RISER
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 E. Stahler 10-72
 R. A. STALETEN 11-72
 PA-647-P

DRAWING NUMBER 78-361-B47
 DATE 3/1/79
 CHECKED BY BE
 APPROVED BY JAP
 DRAWN BY 1-3-79

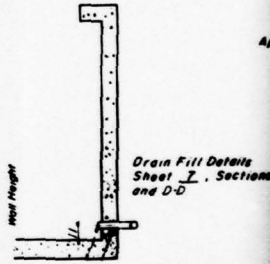


Note: Last section of conduit to be laid horizontal

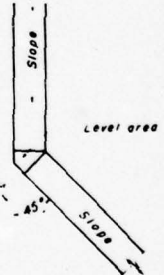
Pipe 10 48"
 Concrete grade
 Compressible material (Styrofoam)
 1/2" preformed joint filler, Type I (Spec 538)
 Drain & Filter see section below



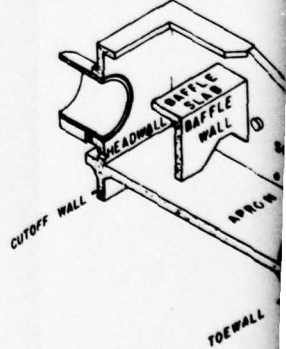
SECTION A NOT TO SCALE



SECTION THROUGH DRAIN & FILTER NOT TO SCALE



PLAN - JUNCTION SIDEWALL AND WINGWALL NOT TO SCALE

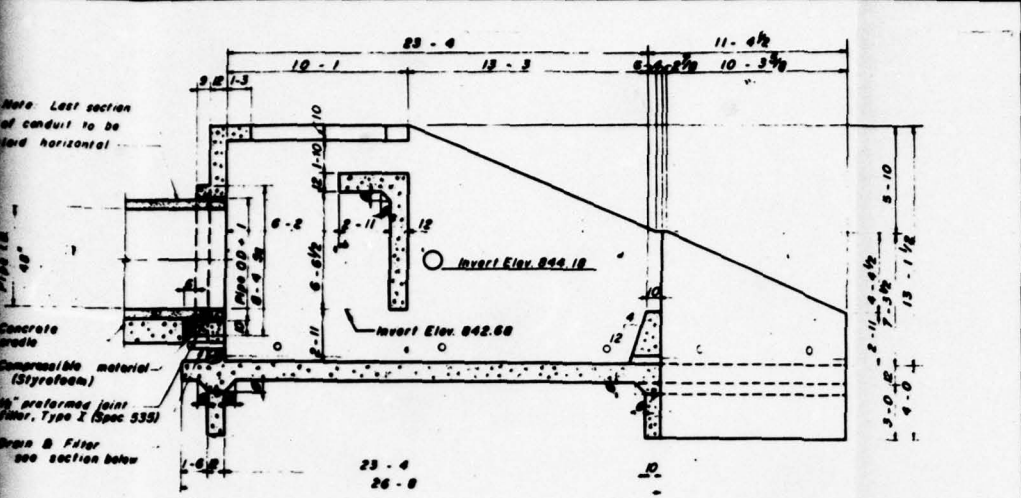


ISOMETRIC VIEW

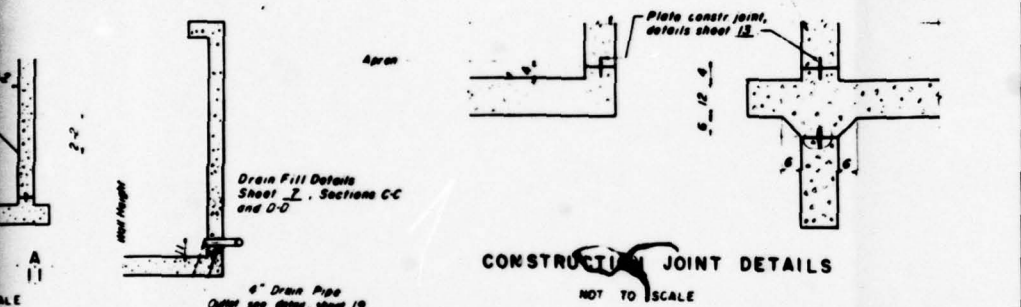
STANDARD IMPACT BASIN	
DESIGN CONSTANTS	$f_c = 4000 \text{ psi}$ $f_s = 1600 \text{ psi}$ $n = 8$ $f_a = 20,000 \text{ psi}$
STANDARD DRAWING NO. ES-4175	
DATE 1-7	SHEET 1 OF 5

CARL RÖHDE
 Consulting Engineer
 654 Ridgeway Rd Lake Oswego Ore

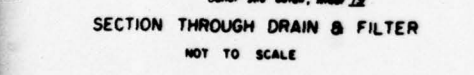
1 0 5 10
 SCALE IN FEET
 EXCEPT AS NOTED



SECTION ON CENTERLINE



CONSTRUCTION JOINT DETAILS

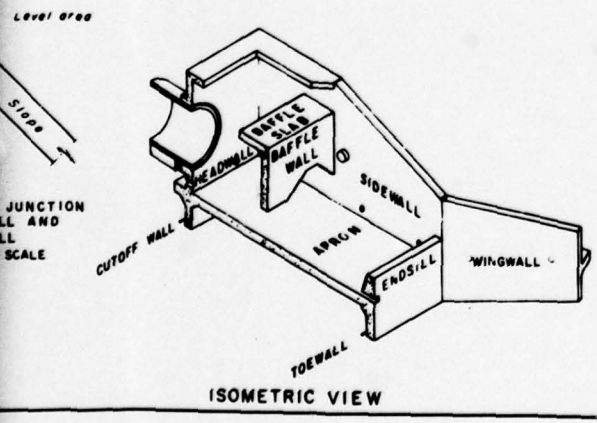


SECTION THROUGH DRAIN & FILTER

AS BUILT PLAN

QUANTITIES

Formwork (Contact area)	3080	Sq Ft
Reinforced Concrete	77	Cu Yds
Reinforcing Steel	14,100	Lbs
Drainage		
4" Perforated drain pipe	126	Lm Ft
Annual screen detail, sheet 12	13	00
Drain pipe tee for std. dist. too branch	13	00
Drain pipe 30" ell	2	00
Drain pipe 45" ell	2	00
4" asbestos cement, perforated, underdrain pipe shall be used (Spec 343, ASTM C-508)		
Joints 1/4" x 6" Carbon steel plate Structural grade 995		Lbs



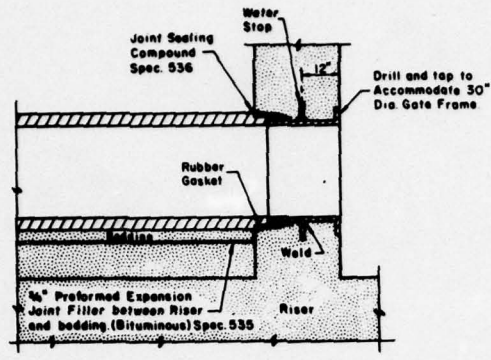
ISOMETRIC VIEW

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
IMPACT BASIN

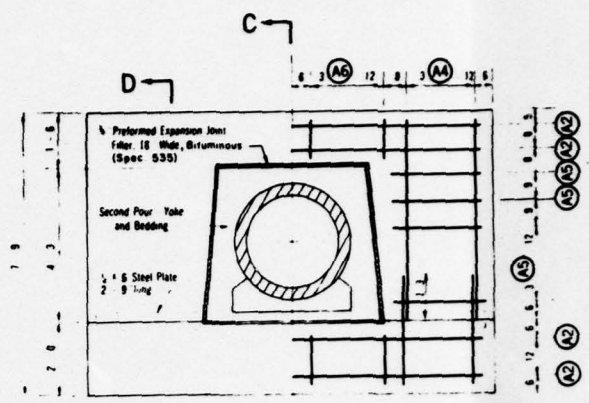
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by	Date	Approved by	
Drawn			
Checked			
Scale	11-72	Sheet No.	PA-647-P

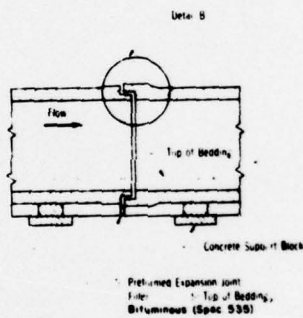
DRAWN BY: ACS
 CHECKED BY: JBE
 APPROVED BY: JAP
 DRAWING NUMBER: 78-367-B 48
 DATE: 3/1/79



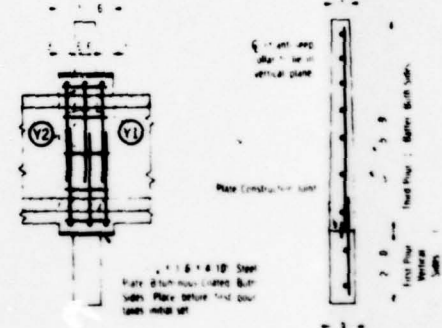
BELL & FLANGE WALL FITTING



DETAIL OF ANTI-SEEP COLLAR

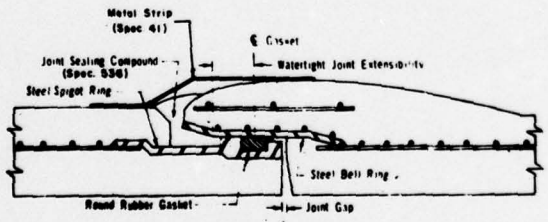


DETAIL OF PIPE JOINT



SECTION C-C

SECTION D-D



DETAIL B

JOINT REQUIREMENTS			
Length of Pipe Section	Minimum Joint Length	Minimum Joint Limiting Angle	
feet	inches	degrees	
≤ 30	1-1/8	0.02269	1°-10'

For pipe length other than shown, joint requirements will be determined by the Engineer.

Where pipes of different lengths are connected, adjoining pipes shall meet the requirements of the longer pipe.

Prior to delivery of pipe, the pipe joint detail proposed for use shall be submitted to the Engineer for approval.

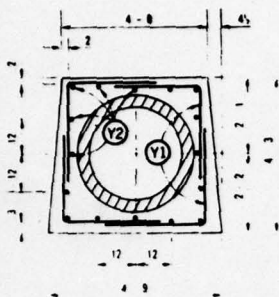
Inside Diameter of Pipe	Internal Load		Minimum Allowable Length
	Hydrostatic Pressure	Surge Pressure	
inches	feet	feet	feet
30	82.6	6.348	

The outside diameter of pipe assumed where the pipe furnished has an outside diameter in design, the three-edge bearing strength multiplied by the ratio of the pipe furnished to the outside diameter.

STANDARD CONDUIT DETAILS
 REINFORCED CONCRETE PRESSURE PIPE
 STANDARD SPEC. 401.101
 SYSTEMS DIV. NO. ES-8030-BE
 DATE: 2/70

Joint length equals watertight joint extensibility plus joint gap.

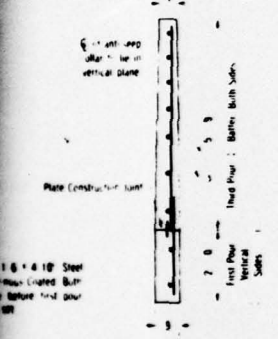
The pipe shall be drawn together so that the maximum joint gap does not exceed 1/8 inch for pipe laid on a straight line. For combined pipe or pipe laid on a curved line, the joint gap at the closest point shall not exceed 1/4 inch.



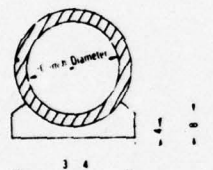
DETAIL OF ANTI-SEEP COLLAR YOKE

STEEL SCHEDULE						
Anti-seep Collar and Yoke, S. Segment						
Mark	Size	Quantity per Collar	Length	Type	Total Quantity	Total Length
A1	4	6	2'-0"	1	18	36'-0"
A2	4	4	10'-10"	1	12	130'-0"
A3	4	6	1'-6"	1	18	27'-0"
A4	4	6	5'-6"	1	18	99'-0"
A5	4	10	2'-0"	1	30	92'-0"
A6	4	6	1'-0"	1	18	18'-0"
Y1	4	12	9'-2"	21	28	188'-0"
Y2	4	16	1'-2"	1	48	66'-0"

SEEP COLLAR



SECTION D-D

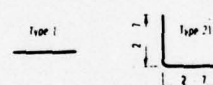


DETAIL OF BEDDING

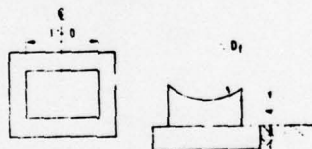
QUANTITIES

Concrete	Cu. Yds.
Anti-seep Collar including Yoke	
Each	2.339
Total	7.188
Bedding	
** Per Linear Foot of Bedding	0.0747
Total	0.58
Steel	
Pounds	438.87
Anti-seep Collar including Yoke	

Quantities are based on an outside diameter of pipe of 36 inches.
 * This quantity is given by $2.339 = 0.0001030 (D_1 + 30) (D_2) 38$, cu yds.
 ** This quantity is given by $0.0734 = 0.0005 (D_1) 38$, cu yds.
 D₁ outside diameter of pipe furnished inches



BAR TYPES



SUGGESTED SUPPORT BLOCKS

Sufficient blocks shall be provided to support the pipe to the required final grade. The Contractor shall determine the number and size of blocks required.

STRENGTH REQUIREMENTS

Inside Diameter of Pipe	Internal Load		External Load	
	Hydrostatic Pressure	Height of Water	Minimum 3 Edge Bearing Strength in Pounds per Lineal Foot of Pipe	Applicable Standard Specification
30 inches	92.6	92.6	6,348	AWA C-101 AWA C-102

The outside diameter of pipe assumed in design is 36.0 inches. Where the pipe furnished has an outside diameter greater than assumed in design, the three-edge bearing strength of the pipe furnished must not be less than the specified three-edge bearing strength multiplied by the ratio of the outside diameter of the pipe furnished to the outside diameter assumed in design.

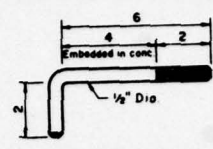
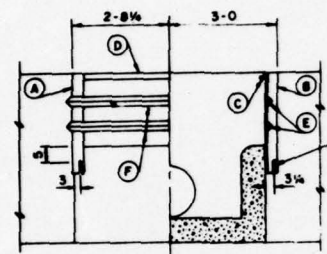
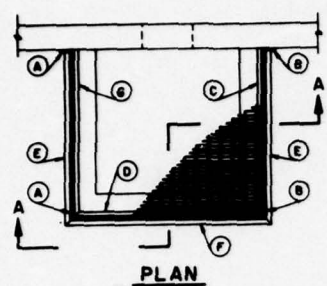
AS BUILT PLANS

WHEELING CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-647
 WASHINGTON COUNTY, PENNSYLVANIA
 CONDUIT

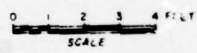
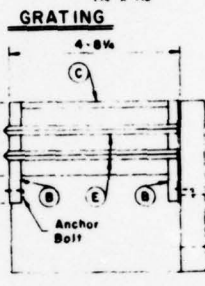
U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

Approved: _____ Date: _____
 Checked: _____ Date: _____
 Drawing No: 10-01
 PA-647-P

DRAWING 78-367-B 49
 NUMBER 3.1.73
 CHECKED BY BE
 APPROVED BY JHP
 3/1/79
 1-3-79
 DRAWN BY



ANCHOR BOLT
 SUPPLY WITH HEX NUTS AND
 LOCK WASHERS ASTM A-276

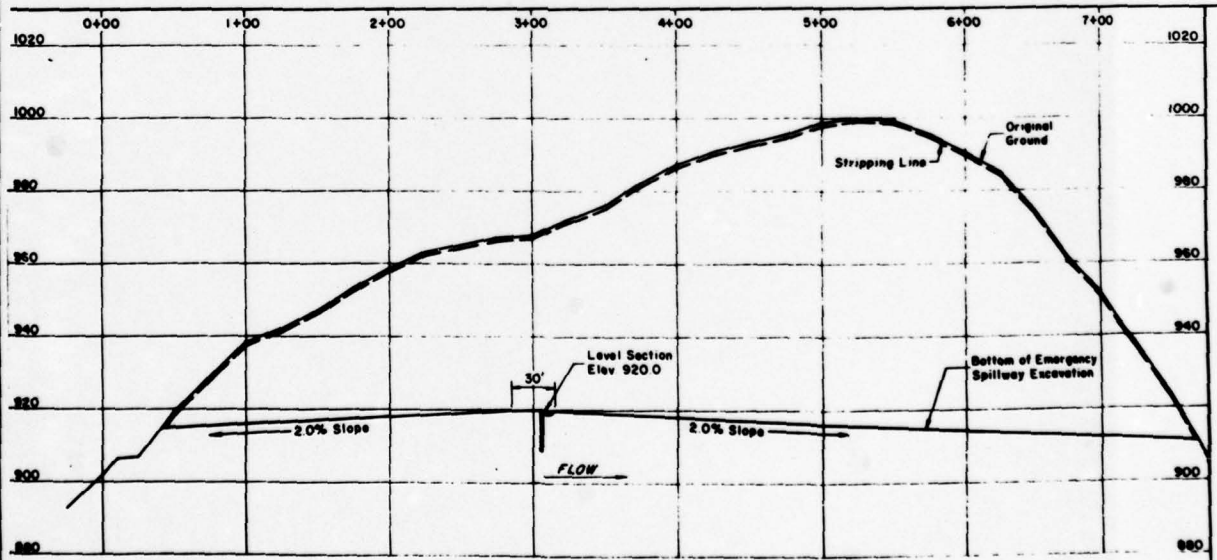


EMERGENCY SPILLWAY DROP INLET TRASH RACK
 (2 REQUIRED)

BILL OF MATERIALS			
ITEM	SIZE	LENGTH	QUANTITY
Angle (A)	4 x 4 x 1/2	2'-9"	2
" (B)	"	2'-9"	2
" (C)	2 x 2 x 1/2	4'-8"	1
" (D)	"	5'-4"	1
" (E)	"	4'-9 1/2"	4
" (F)	"	5'-7 1/2"	2
" (G)	"	4'-8"	1
Grating	5-3 1/2 x 4-7 1/2	-	1
Anchor Bolt	1/2 Dia	2 x 6	4

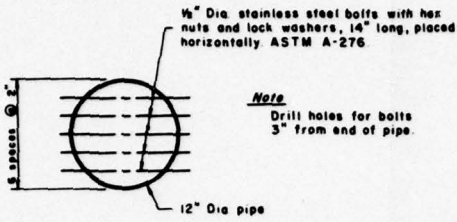
CONSTRUCTION DETAILS

- Angles and grating in trash rack shall conform to Spec 581 for aluminum alloy
- Anchor bolts, nuts and washers shall be stainless steel and conform to ASTM A-276
- Grating fasteners to be sized and spaced according to manufacturers recommendations. Grating to be removable
- Aluminum surfaces placed in contact with concrete, shall be given a heavy coat of an alkali-resistant, bituminous paint before installation (Military Spec MIL-P-6883A)
- All points of contact between angles to be welded



PROFILE ALONG CENTERLINE EMERGENCY SPILLWAY

MATERIALS		
SIZE	LENGTH	QUANTITY
1/2" Dia	2'-9"	2
1/2" Dia	2'-9"	2
1/2" Dia	4'-6"	1
1/2" Dia	5'-4"	1
1/2" Dia	4'-9 1/2"	6
1/2" Dia	5'-7 1/2"	2
1/2" Dia	4'-8"	1
1/2" Dia	4'-7 1/2"	1
1/2" Dia	2' x 6'	4



SMALL ANIMAL GUARD
(2 REQUIRED)

CONSTRUCTION DETAILS

Grating in trash rack shall be 5/8" x 3/4" aluminum alloy.

Nuts, washers and bolts shall be galvanized and conform to ASTM A-276.

Washers to be sized and spaced in accordance with manufacturer's recommendations.

Washers to be removable.

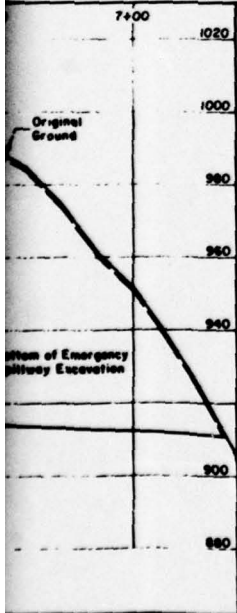
Surfaces placed in contact with each other shall be given a heavy coat of an oil-soluble, bituminous paint before assembly (Military Spec MIL-P-6883A).

Washers to be spaced in accordance with manufacturer's recommendations.

Washers to be removable.

Washers to be spaced in accordance with manufacturer's recommendations.

Washers to be removable.



AS BUILT PLANS

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
MISCELLANEOUS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

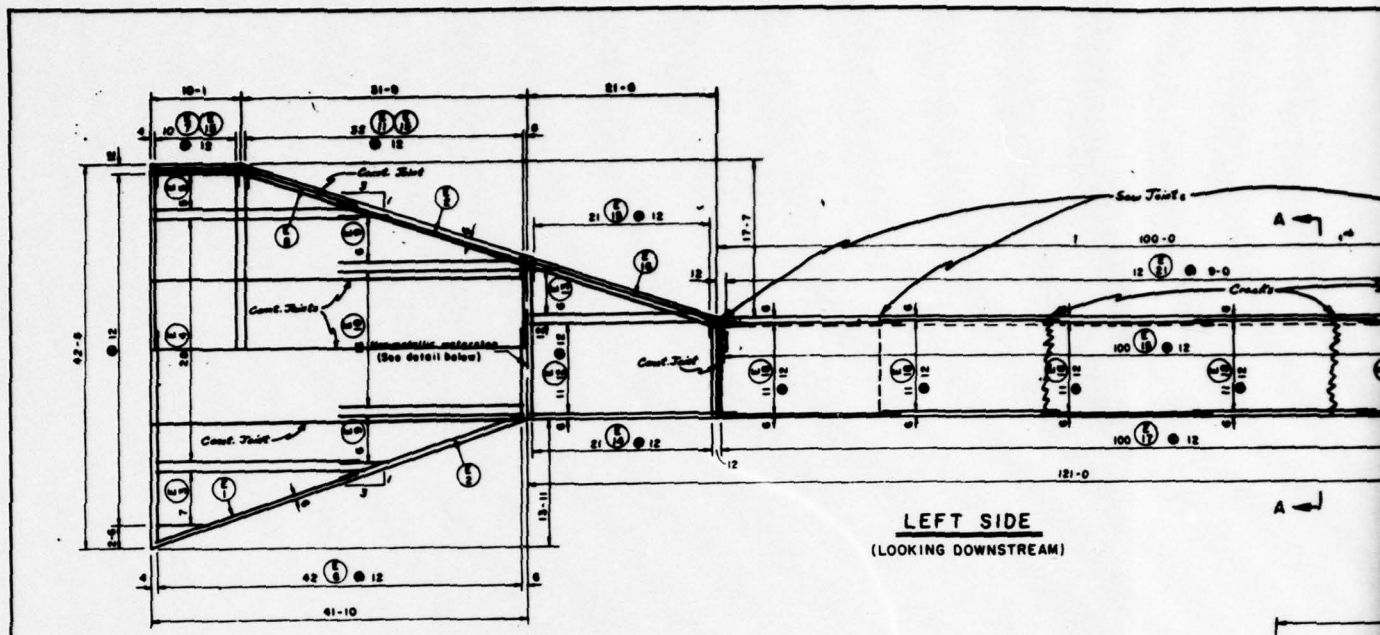
Drawn by *C. Stalter* Date *11-72* Approved by *[Signature]*
Checked by *R A STALTER* Date *12-72* Date *12-72*

30' PA-647-P
41

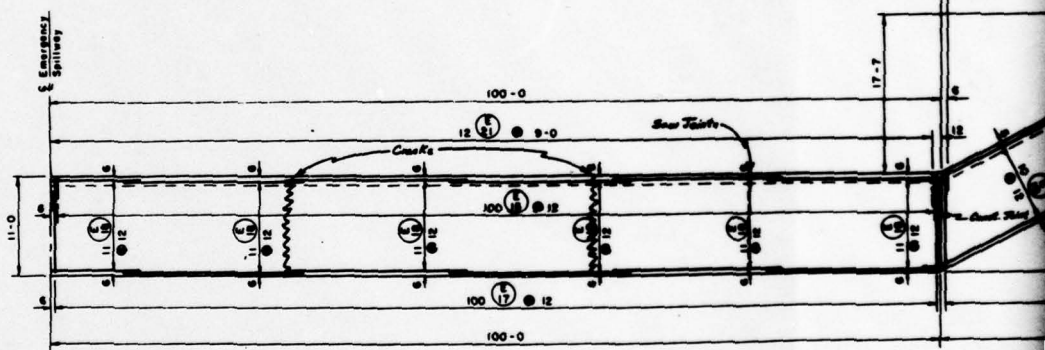
PLATE 13

D'APPOLONIA

DRAWN BY **ACS** CHECKED BY **RE** 3/1/79 DRAWING NUMBER 78-3-1-B50
 1-3-79 APPROVED BY **JHP** 3.1.79



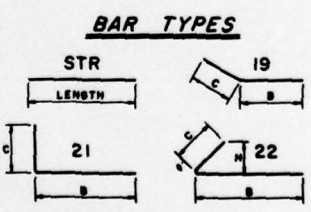
LEFT SIDE
(LOOKING DOWNSTREAM)



RIGHT SIDE
(LOOKING DOWNSTREAM)

STEEL SCHEDULE									
MARK	SIZE	QUANTITY	LENGTH	TYPE	B	C	H	D.L.	TOTAL LENGTH
1	10	1	23-9	STR					23-9
2	10	6	21-6	STR					129-6
3	10	7	6-0 to 24-0	STR				3-0	105-0
4	10	18	12-6	STR					226-8
5	10	8	17-0 to 24-0	STR				3-0	150-0
6	10	42	25-6 to 9-10	STR				0-4	700-0
7	10	10	10-0	STR					200-0
8	10	10	23-3	STR					233-0
9	10	12	5-6 to 20-8	STR (2 sets of 6)	9-6	13-9	0-8	3-0	156-0
10	10	8	20-6	STR					164-8
11	10	8	8-6 to 20-0	STR				0-4	171-0
12	10	11	22-9	STR					251-9
13	10	6	3-3 to 18-3	STR				3-0	144-0
14	10	11	10-4 to 17-0	STR				0-4	177-0
15	10	10	1-4	STR					100-0
16	10	10	24-0	STR	21	3-9	1-9		180-0
17	10	10	10-4	STR	15	22-0	2-0	0-8	180-0
18	10	10	10-0	STR					100-0
19	10	15	24-6	STR	19	22-6	2-0	0-10	231-0
20	10	15	21-0	STR					210-0
21	10	10	14-9	STR	22	12-9	2-0	1-5	135-0

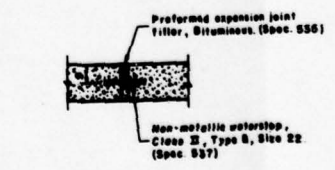
W & L Denotes the change in length between adjacent bars in a set



QUANTITIES (This Sheet Only)

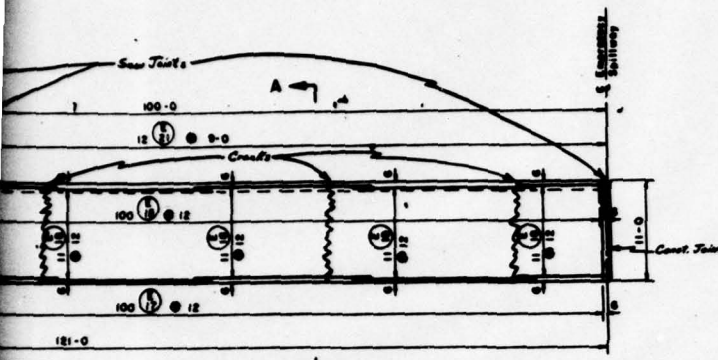
STEEL
 No. 6 Bars 11,780 Ft. = 17,648 Lbs.
 No. 11 Bars 339 Ft. = 1,801 Lbs.
 19,480 Lbs.

CONCRETE
 Class 4000 272.2 Cu Yds. Reinforced

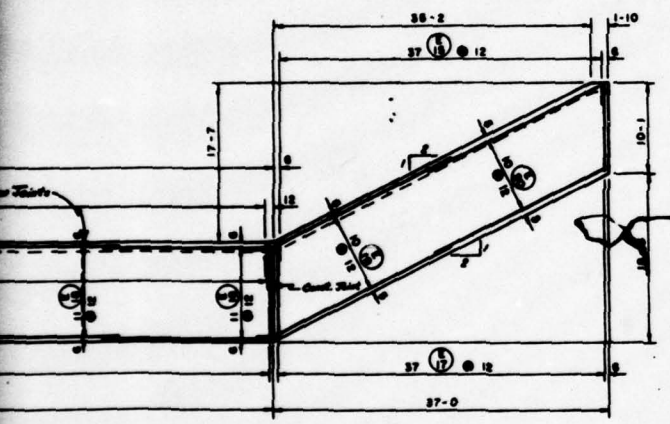


NON-METALLIC WATERSTOP

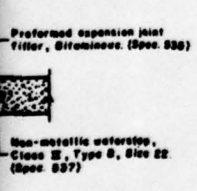




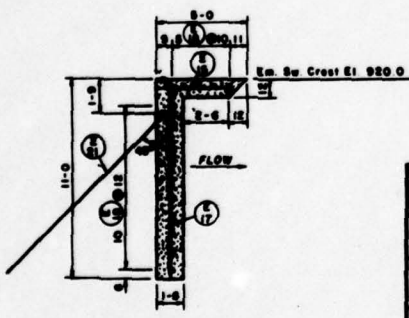
DE
(STREAM)



DE
(STREAM)



ALLIC WATERSTOP



SECTION A-A
0 1 2 3 4 5 6 7 8 FEET
SCALE

For Construction Notes, see sheet 13.

0 1 2 3 4 5 6 7 8 9 10 12 14 16 FEET
SCALE

AS BUILT PLANS

WHEELING CREEK WATERSHED
FLOODWATER RETARDING DAM PA-647
WASHINGTON COUNTY, PENNSYLVANIA
EMERGENCY SPILLWAY CUTOFF WALL

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by <i>E. Stalter</i>	Date 9-73	Approved by Title
Drawn by <i>R. A. Stalter</i>	Date 5-73	Checked by Title
Field Notes <i>David P. ...</i>	Date 9-20-01	Project No. PA-647-P

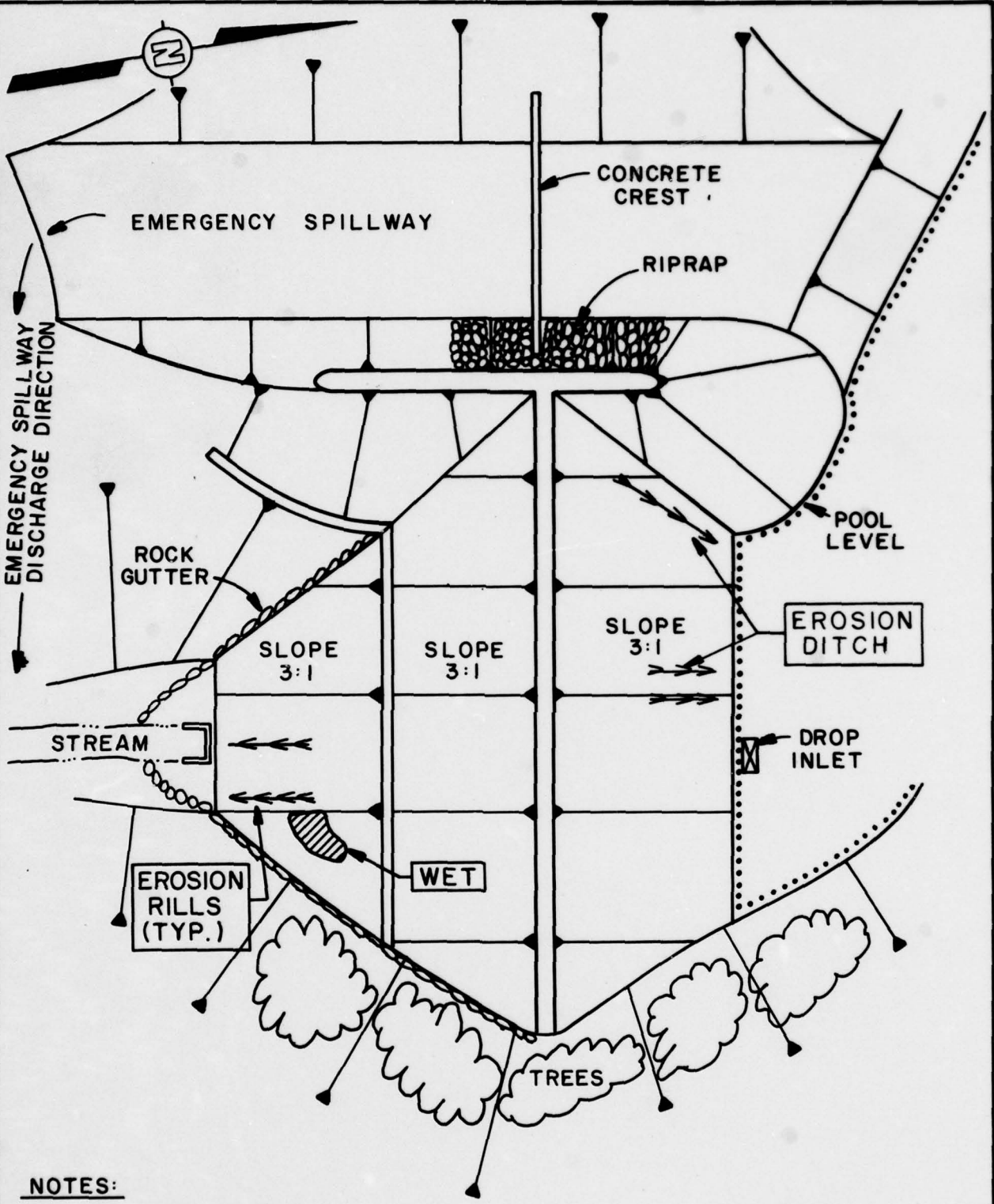
43

PLATE 14

D'APPOLONIA

2

DRAWN BY RDB
 CHECKED BY BE
 APPROVED BY JAP
 DATE 3/1/79
 DRAWING NUMBER 78-67-A7
 DATE 3.1.79
 EMERGENCY SPILLWAY DISCHARGE DIRECTION



NOTES:

1. EMERGENCY SPILLWAY FREEBOARD: 17.6 FEET
2. POOL LEVEL DATE OF INSPECTION: 43.5 FEET BELOW EMERGENCY SPILLWAY CREST.

NOT TO SCALE

PLATE 15
 PA. 647 DAM
 GENERAL PLAN
 FIELD INSPECTION NOTES
 FIELD INSPECTION DATE: DEC. 8, 1978

D'APPOLONIA

APPENDIX A
CHECKLIST
VISUAL INSPECTION
PHASE I

APPENDIX A
CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM PA-647 ID# NDI I.D. NO. PA-821
DER I.D. NO. 63-76

COUNTY Washington STATE Pennsylvania

HAZARD CATEGORY High

TYPE OF DAM Earth

DATE(S) INSPECTION December 8, 1978 WEATHER Rainy TEMPERATURE 50s

POOL ELEVATION AT TIME OF INSPECTION 876.8 M.S.L. TAILWATER AT TIME OF INSPECTION 844.9 M.S.L.

INSPECTION PERSONNEL:
Bilgin Erel REVIEW INSPECTION PERSONNEL:
(December 21, 1978)

Wah-Tak Chan L. D. Andersen
Bilgin Erel J. H. Poellot
Bilgin Erel

Bilgin Erel RECORDER

VISUAL INSPECTION
 PHASE I
 EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUCHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Several erosion gullies on the upstream face near the right abutment 6 to 8 inches deep. Smaller erosion gullies on the downstream face below berm level.	The erosion gullies should be filled and vegetated.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Crest elevation is within two-tenths of a foot of the design elevation relative to the emergency spillway crest level.	
RIPRAP FAILURES	No riprap on the dam. Riprap on the embankment side of the emergency spillway channel; satisfactory.	

VISUAL INSPECTION
 PHASE I
 EMBANKMENT
 OBSERVATIONS

VISUAL EXAMINATION OF	EMBANKMENT OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No signs of distress.	
ANY NOTICEABLE SEEPAGE	One wet area on the downstream slope below berm level near the left abutment.	The wet area should be closely observed to document if a seepage condition is developing.
STAFF GAGE AND RECORDER	None.	
DRAINS	Drainage blanket pipes drain into the side of the outlet structure. There is no flow in the drainpipes.	

VISUAL INSPECTION
 PHASE I
 OUTLET WORKS

VISUAL EXAMINATION OF CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	The visible portions of the outlet works are in good condition.	
INTAKE STRUCTURE	In good condition.	
OUTLET STRUCTURE	In good condition.	
OUTLET CHANNEL	No significant obstructions.	
EMERGENCY GATE	Reservoir drainpipe gate hoist is located in the drop inlet structure. Not accessible for inspection.	The operational condition of the reservoir drainpipe gate should be periodically evaluated.

VISUAL INSPECTION
 PHASE I
 UNGATED SPILLWAY (EMERGENCY SPILLWAY)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete cutoff wall across the spillway channel. In good condition.	
APPROACH CHANNEL	Trapezoidal earth channel. In good condition.	
DISCHARGE CHANNEL	Trapezoidal earth channel. In good condition.	
BRIDGE AND PIERS	None.	

VISUAL INSPECTION
 PHASE I
 GATED SPILLWAY

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

VISUAL INSPECTION
 PHASE I
 INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None found.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	Two drainpipes discharging into the outlet structure. No flow in the drainpipes.	

VISUAL INSPECTION
 PHASE I
 RESERVOIR
 OBSERVATIONS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Steep to moderate.	
SEDIMENTATION	Unknown.	
UPSTREAM RESERVOIRS	No major impoundments.	

VISUAL INSPECTION
 PHASE I
 DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No apparent obstructions immediately downstream from the dam.	
SLOPES	No apparent instability (immediately downstream from the dam).	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Community of Alley Grove is located approximately one mile downstream from the dam. There are approximately 20 homes in Alley Grove and one major natural gas pump station near Alley Grove. Population: approximately 100.	

APPENDIX B
CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
AND HYDROLOGIC AND HYDRAULIC
PHASE I

APPENDIX B
 CHECKLIST
 ENGINEERING DATA
 DESIGN, CONSTRUCTION, OPERATION
 PHASE I

NAME OF DAM PA-647
 ID#NDI I.D. NO. PA-821
 DER I.D. NO. 63-76

ITEM	REMARKS
AS-BUILT DRAWINGS	The drawings are available in state and Soil Conservation Service files.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	The dam was designed by the U.S. Department of Agriculture, Soil Conservation Service. It was constructed by Monroeville Construction Company of Monroeville, Pennsylvania, with completion in July 1977.
TYPICAL SECTIONS OF DAM	See Plate 3.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	See Plates 9, 10, 11 and 12.

**CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I**

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	Not available.
DESIGN REPORTS	Soil Conservation Service internal memo dated August 3, 1971.
GEOLOGY REPORTS	Detailed Geologic Investigation of Dam Sites, SCS Form 376, dated September 1970.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Hydrology, hydraulics, geotechnical and structural calculations are available in SCS files.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Included in design and geology reports (see Plate 4 for typical subsurface profile). See Plates 7 and 8 for selected boring logs.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None reported.
BORROW SOURCES	Described in engineer's report.
MONITORING SYSTEMS	None.
MODIFICATIONS	None reported.
HIGH POOL RECORDS	Not recorded.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None reported.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported.
MAINTENANCE OPERATION RECORDS	Not available.
SPILLWAY PLAN SECTIONS DETAILS	Primary spillway: See Plates 9, 10, 11 and 12. Emergency spillway: See Plates 13 and 14.
OPERATING EQUIPMENT PLANS AND DETAILS	Available in SCS files.

**CHECKLIST
ENGINEERING DATA
HYDROLOGIC AND HYDRAULIC**

DRAINAGE AREA CHARACTERISTICS: 22.4 square miles (wooded)
ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 876 (279 acre-feet)
ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: 920 (3713 acre-feet)
ELEVATION; MAXIMUM DESIGN POOL: 937.6 (high point); 937.5 (low point)
ELEVATION; TOP DAM: 939.6
SPILLWAY: (Emergency Spillway)

- a. Elevation 920
- b. Type Trapezoidal open channel (critical depth overflow section)
- c. Width 200 feet (base width perpendicular to flow direction)
- d. Length 400+ feet (from crest to end of trapezoidal section)
- e. Location Spillover Adjacent to emergency spillway
- f. Number and Type of Gates None

OUTLET WORKS:

- a. Type 30- and 48-inch reinforced concrete conduit
- b. Location Near left abutment
- c. Entrance Inverts El. 845.75
- d. Exit Inverts El. 842.68
- e. Emergency Draindown Facilities 30-inch pipe

HYDROMETEOROLOGICAL GAGES:

- a. Type None
- b. Location None
- c. Records None

MAXIMUM NONDAMAGING DISCHARGE: Emergency spillway discharge capacity (50,000+ cfs)

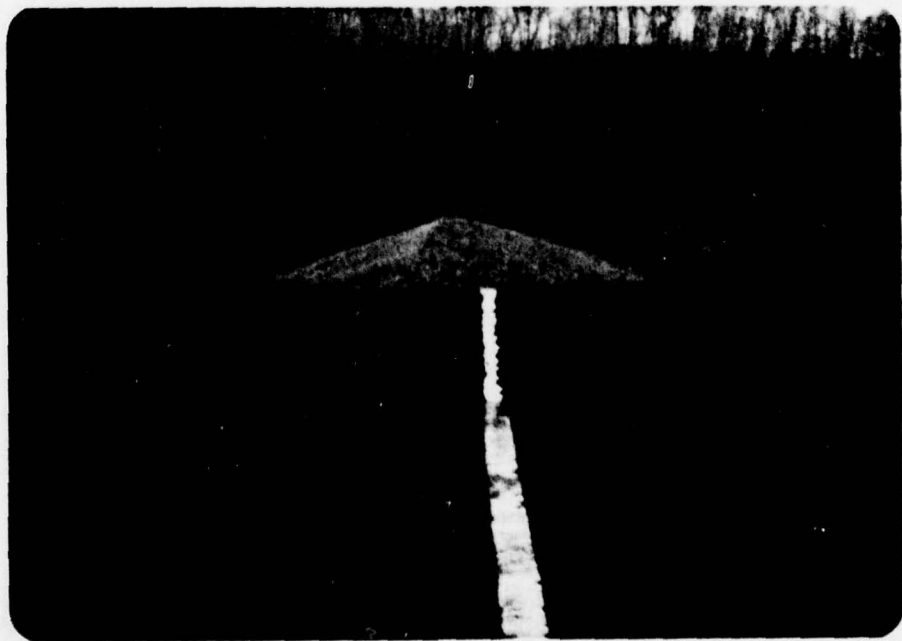
APPENDIX C
PHOTOGRAPHS

LIST OF PHOTOGRAPHS
PA-647 DAM
NDI I.D. NO. PA-821
DECEMBER 8, 1978

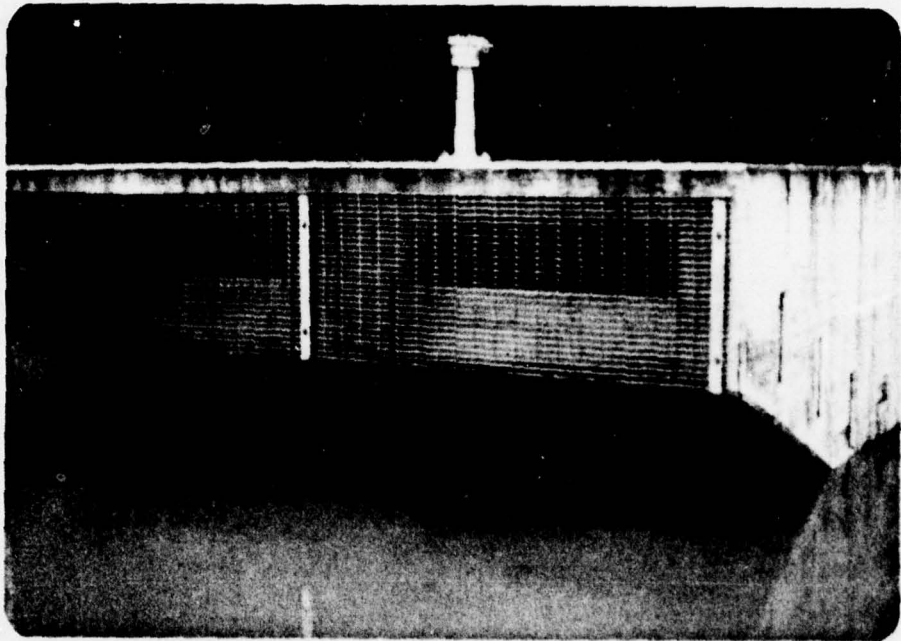
<u>PHOTOGRAPH NO.</u>	<u>DESCRIPTION</u>
1	Crest (looking west).
2	Crest (looking east). Spillway crest in foreground.
3	Primary spillway, drop inlet structure.
4	Impact basin.
5	Gas pump station (one mile downstream).
6	Community of Alley Grove (two miles downstream).



Photograph No. 1
Crest (looking west).



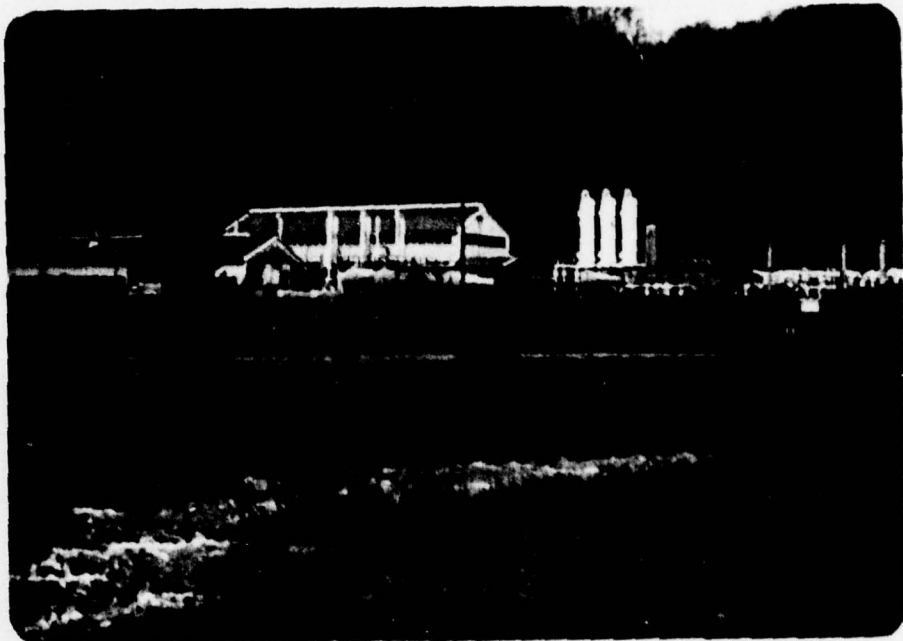
Photograph No. 2
Crest (looking east). Spillway crest in foreground.



Photograph No. 3
Primary spillway, drop inlet structure.



Photograph No. 4
Impact basin.



Photograph No. 5
Gas pump station (one mile downstream).



Photograph No. 6
Community of Alley Grove (two miles downstream).

APPENDIX D
CALCULATIONS

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: PA-647 (NDI I.D. PA-821)

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.3 INCHES/24 HOURS⁽¹⁾

STATION	1	2	3	4	5
Station Description	Reservoir	Dam			
Drainage Area (square miles)	22.4	0			
Cumulative Drainage Area (square miles)	22.4	22.4			
Adjustment of PMP for Drainage Area (%) ⁽²⁾					
6 Hours	95	-			
12 Hours	114	-			
24 Hours	124	-			
48 Hours	134	-			
72 Hours	-	-			
Snyder Hydrograph Parameters					
Zone ⁽³⁾	28B	-			
C_p/C_t ⁽⁴⁾	0.57/1.7	-			
L (miles) ⁽⁵⁾	12.1	-			
L_{ca} (miles) ⁽⁵⁾	6.4	-			
$t_p = C_t(L_{ca})^{0.3}$ (hours)	6.3	-			
Spillway Data					
Crest Length (ft)	-	200			
Freeboard (ft)	-	17.6			
Discharge Coefficient	-	3.1			
Exponent	-	1.5			

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

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

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

(4) Snyder's Coefficients.

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

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

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.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
LAST MODIFICATION 11 JAN 79
.....
1  A1 SNYDER UNIT HYDROGRAPH, FLOOD ROUTING DAM OVERTOPPING ANALYSIS
2  A2 PA-647 DAM, WASHINGTON COUNTY, NDI-ID-PA821 PROJECT NO. 78-367-07
3  A3 FOR 30%, 60%, 50%, 60%, 70%, 80%, 90%, AND 100% PMF
4  B 300 0 10 0 0 0 0 0 0 0 -4 0
5  B1 5
6  J 1 8
7  J1 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00
8  K 0 1
9  K1 CALCULATION OF INFLOW HYDROGRAPH TO PA-647 DAM, NDI-ID PA821 1
10  1 22.4 22.4
11  P 1 24.3 95 114 126 134 1.0 .05 0.009
12  T
13  W 6.3 0.57
14  X -1.0 -0.05 2.0
15  K 1 2
16  K1 ROUTING FLOW THROUGH PA-647 DAM, NDI-ID-PA821 1
17  Y 1
18  Y1 1
19  $S 279.0 1089.0 3575.0 4990.0 7690.0 279.0
20  $E 876.0 894.0 920.0 930.0 946.0
21  $$ 920.0 200.0 3.1 1.5
22  $D 937.6 5.1 1.5 500.0
23  K

```

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS							
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8
				.30	.40	.50	.60	.70	.80	.90	1.00
HYDROGRAPH AT	1	22.40 (58.02)	1	7599. (215.19)	10155. (286.92)	12666. (358.65)	15199. (430.38)	17732. (502.12)	20265. (573.85)	22798. (645.58)	25331. (717.31)
ROUTED TO	2	22.40 (58.02)	1	6273. (177.63)	9458. (267.82)	12284. (347.84)	14916. (422.37)	17479. (494.95)	19984. (565.90)	22459. (635.97)	24971. (707.11)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

ELEVATION STORAGE
 OUTFLOW
 INITIAL VALUE
 874.00
 279.
 0.
 SPILLWAY CHEST
 920.00
 3575.
 0.
 TOP OF DAM
 937.60
 6272.
 45778.

RATIO OF PMF	MAXIMUM RESERVOIR U.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
.30	924.68	0.00	4237.	6273.	0.00	47.83	0.00
.40	926.15	0.00	4445.	9458.	0.00	46.83	0.00
.50	927.32	0.00	4611.	12294.	0.00	46.33	0.00
.60	928.33	0.00	4754.	14916.	0.00	46.17	0.00
.70	929.26	0.00	4886.	17479.	0.00	46.00	0.00
.80	930.13	0.00	5012.	19984.	0.00	46.00	0.00
.90	930.95	0.00	5150.	22459.	0.00	46.00	0.00
1.00	931.75	0.00	5285.	24971.	0.00	46.00	0.00

OVERTOPPING ANALYSIS SUMMARY

PAGE D4 of 4

APPENDIX E
REGIONAL GEOLOGY

APPENDIX E
REGIONAL GEOLOGY

Pennsylvania Dam 647 is located near the axis of the Finney Syncline, a structure composed of a series of small basins. The dam is located south of one of these basins, with the strata dipping gently north-northeast. The strata are composed of the Washington and Greene formations, both members of the Dunkard Group (Permian Age), and consist of interbedded shale, limestone, sandstone, and coal. The bedding strikes approximately N40W and dips 5 degrees to the east. There are two major joint systems with strikes of N45W and N45E. Other trends include N75E, N15W, and north-south. All of the discontinuities are nearly vertical.

The strata are typical of those found in southwestern Pennsylvania. The shale is gray to green-gray, soft, and frequently calcareous. The limestone is a gray crystalline argillaceous limestone. The sandstone is a gray shaly rock which may be calcareous. There are also numerous coal seams or their equivalent composed of black shale. These strata are interbedded with the shale, the predominant rock type.

There are numerous coal seams in the area, with the Pittsburgh, Waynesburg, and Washington coal seams the most economically mineable seams. The Waynesburg and Washington seams are located near the surface, and there are some "country bank" mines in the Waynesburg seam north of the dam and reservoir. The Pittsburgh seam is approximately 300 feet below the dam.

The soil in the area is mostly residual and may be thick, with weathered rock occurring up to depths of 20 feet or more. The strata in the area are easily weathered and the weathered material is subject to movement on slopes. In the area, 30 to 40 percent of the land is covered by slide deposits, and there are several old slides in the slopes above the dam and reservoir, as indicated on the U.S. Geological Survey Map of Landslides for Washington County, Pennsylvania, dated 1978.

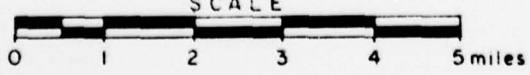
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 78-1-A18



DUTCH FORK AND PA 647 DAMS
 GEOLOGY MAP

REFERENCE
 GREATER PITTSBURGH REGION GEOLOGIC MAP
 COMPILED BY W. R. WAGNER, J. L. CRAFT, L. HEYMAN
 AND J. A. HARPER, DATED 1975, SCALE 1:125,000

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 NUMBER: 209

GROUP FORMATION

DESCRIPTION

	Alluvium	Qt	Sand, gravel, clay.
	Terrace deposits		Sand, clay, gravel on terraces above present rivers; includes Carmichaels Formation.
DUNKARD	Greene		Cyclic sequences of sandstone, shale, red beds, thin limestones and coals.
	Washington	Pw	Cyclic sequences of sandstone, shale, limestone, and coal; contains Washington coal bed at base.
	Waynesburg		Cyclic sequences of sandstone, shale, limestone and coal; contains Waynesburg coal bed at base.
	MONONGAHELA	Pm	Cyclic sequences of shale, limestone, sandstone and coal; contains Pittsburgh coal bed at base.
P: CONEMAUGH	Casselman	Pcc	Cyclic sequence of sandstone, shale, red beds and thin limestone and coal.
	Ames		
	Glenshaw	Pcg	Cyclic sequences of sandstone, shale, red beds and thin limestone and coal; several fossiliferous limestone; Ames limestone bed at top.
ALLEGHENY	Vanport		Cyclic sequences of shale, sandstone, limestone, and coal; contains Brookville coal at base and Upper Freeport coal at top; within group are the commercial Vanport limestone and Kittanning and Clarion coals.
		Pa	

GEOLOGY MAP LEGEND

REFERENCE:

GREATER PITTSBURGH REGION GEOLOGIC MAP
 COMPILED BY W.R. WAGNER, J.L. CRAFT, L. HEYMAN
 AND J.A. HARPER, DATED 1975, SCALE 1:125000

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