

AD-A063 926

D'APPOLONIA CONSULTING ENGINEERS PITTSBURGH PA
NATIONAL DAM INSPECTION PROGRAM. BEAVERDAM RUN
JUN 78

F/G 13/2
DAM (PA 805), OH--ETC(U)
DACW31-78-C-0049

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LEVEL II

OHIO RIVER BASIN
BEAVERDAM RUN, CAMBRIA COUNTY

PENNSYLVANIA

BEAVERDAM RUN DAM

FD-NO. PA. 805

①
NW

⑥

PHASE I INSPECTION REPORT

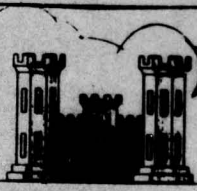
NATIONAL DAM INSPECTION PROGRAM.

Beaverdam Run Dam (PA 805), Ohio River
Basin, Beaverdam Run, Cambria County,
Pennsylvania. Phase I Inspection Report.

DISTRIBUTION STATEMENT A

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PREPARED FOR
DACW31-78-C-0049

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND 21203

①② 69p.

BY

D'APPOLONIA CONSULTING ENGINEERS
10 DUFF ROAD
PITTSBURGH, PA. 15235

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LEVEL II

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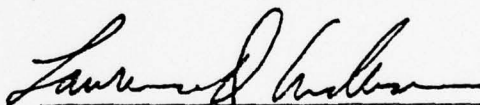
PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

NAME OF DAM: Beaverdam Run Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Cambria
STREAM: Beaverdam Run, tributary of South Fork of Little Conemaugh River
DATE OF INSPECTION: May 15 and 30, 1978

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 Beaverdam Run Dam is assessed to be good.

However, the nonfunctional drainpipe sluice gate should be immediately repaired. Other conditions that require attention are: (1) evaluation of the adequacy of riprap on the embankment adjacent to the emergency spillway, (2) appropriate action to stop erosion in the primary spillway discharge channel, (3) monitoring of seeps at the toe of the dam, and (4) elimination of the potential overflow from the emergency spillway channel towards the toe of the dam.

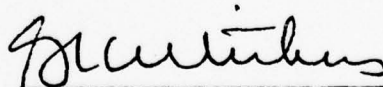
The spillway has the capacity to pass the probable maximum flood without overtopping. Therefore, the spillway is adequate.



Lawrence D. Andersen, P.E.
Vice President



APPROVED BY:



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

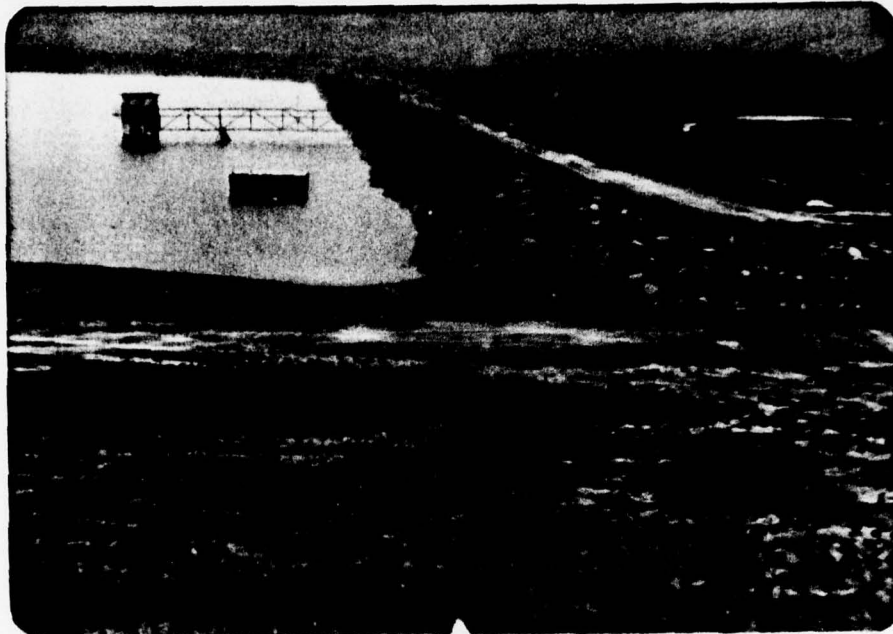
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Contract No. DACW31-78-C-0049

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BEAVERDAM RUN DAM
NDS I.D. NO. 805
MAY 15, 1978



Upstream Face



Downstream Face

PHASE I
NATIONAL DAM INSPECTION PROGRAM
BEAVERDAM RUN DAM
NDS I.D. NO. 805

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 dam consists of an earth embankment approximately 1400 feet long, with a maximum height of 55 feet from the downstream toe (Plates 1 and 2).

The primary spillway is located right of center and the emergency spillway is located on the right abutment (looking downstream). Flow through the primary spillway is controlled by sharp crested weirs at Elevation 2367 (USGS Datum) on a concrete drop structure (Plate 3). The drop structure discharges into a 66-inch concrete pipe which passes through the embankment and discharges into a plunge pool.

The crest of the 100-foot-wide emergency spillway is at Elevation 2370, which is 7 feet below the dam crest (Elevation 2377). The emergency spillway discharges into an earth channel.

The outlet works for the dam consist of one 24-inch cast-iron supply line and a 36-inch steel drainpipe located to the right of the center of the embankment. Discharge through the pipes is controlled by valves located in the intake tower (Plate 3).

The reservoir impounds 7700 acre-feet of water. The 36-inch drainpipe constitutes the emergency drawdown facility for the dam.

b. Location. Beaverdam Run Dam is located (Plate 4) on Beaverdam Run, two miles east of Beaverdale in Summerhill

Township, Cambria County, Pennsylvania. The impounded reservoir serves as a domestic water supply source. Downstream from the dam, Beaverdam Run flows through a narrow and steep valley for a distance of about 2-1/2 miles to its confluence with the South Fork of Little Conemaugh River at Beaverdale. The stream flows under a street in Beaverdale, about 500 feet upstream from its mouth. There are approximately 20 houses and 2 commercial buildings in the area of the town which is considered to be the main impact area of a flood. It is estimated that a failure of the dam could also cause significant loss of life and property damage along the course of the South Fork of Little Conemaugh River.

c. Size Classification. Intermediate (based on 55-foot height).

d. Hazard Classification. High.

e. Ownership. Highland Sewer and Water Authority.

f. Purpose of Dam. Water supply.

g. Design and Construction History. The dam was designed by the Neilan Engineers, Inc., of Somerset, Pennsylvania, in 1970. The dam was constructed by Windy Hill Construction Company, with completion in December 1975.

h. Normal Operating Procedure. The reservoir is normally maintained at Elevation 2367, the level of the uncontrolled primary spillway, leaving 10 feet of freeboard to the top of the dam at Elevation 2377. The emergency spillway crest is at Elevation 2370. The supply water is taken through the 24-inch-diameter supply line controlled from the intake tower.

1.3 Pertinent Data

a. Drainage Area - 6.5 square miles

b. Discharge at Dam Site (cfs)

Maximum known flood at dam site - None reported

Warm water outlet at pool elevation - N/A

Diversion tunnel low pool outlet at pool elevation - N/A

Diversion tunnel outlet at pool elevation - N/A

Gated spillway capacity at pool elevation - N/A

Gated spillway capacity at maximum pool elevation - N/A

Ungated spillway at maximum pool elevation - 5700 (as exists)

Total spillway capacity at maximum pool elevation - 5700
(as exists)

c. Elevation (USGS Datum) (feet)

Top of dam - 2377
Maximum pool-design surcharge - N/A
Full flood control pool - 2370
Recreation pool - N/A
Spillway crest - 2367
Upstream portal invert diversion tunnel - 2323
Downstream portal invert diversion tunnel - 2321.5
Streambed at center line of dam - 2319
Maximum tailwater - Unknown

d. Reservoir (feet)

Length of maximum pool - 4500
Length of recreation pool - N/A
Length of flood control pool - 5000

e. Storage (acre-feet)

Recreation pool (normal) - 7700
Flood control pool - 1350
Design surcharge - 3150
Top of dam - 12,200

f. Reservoir Surface (acres)

Top of dam - 530
Maximum pool - N/A
Flood control pool - 410
Recreation pool - N/A
Spillway crest - 360

g. Dam

Type - Earth
Length - 1400 feet
Height - 55 feet
Top width - 20 feet
Side slopes - 2H:1V, 2.5H:1V, downstream; 2.5H:1V, upstream
Zoning - Yes
Impervious core - Yes
Grout curtain - Yes

h. Diversion and Regulating Tunnel

Type - 36-inch steel pipe
Length - 290 feet
Closure - Sluice gate
Access - Controls at intake tower
Regulating facilities - N/A

i. Spillway

Primary

Emergency

Type -	Sharp-crested weir	Broad-crested weir
Length -	33 feet	100 feet
Crest elevation -	2367 feet	2370 feet
Gates -	None	None
Upstream channel -	Lake	Lake
Downstream channel -	66-inch RCP dis- charging to trap- ezoidal channel with 12-foot bottom width	Trapezoidal chanel 100 feet wide

SECTION 2 ENGINEERING DATA

2.1 Design

a. Data Available

(1) Hydrology and Hydraulics. The emergency and primary spillway rating curves, design inflow hydrographs, and outflow hydrographs are included in the design drawings (Plate 5).

(2) Embankment. The embankment was designed based on a report (Soil and Foundation Report, Proposed Dam Across Beaverdam Run, Summerhill Township, Cambria County, Pennsylvania, March 1967) prepared by Larsen Engineers of Harrisburg, Pennsylvania, for Neilan Engineers, Inc., Consulting Engineers, of Somerset, Pennsylvania. This report includes results of geologic reconnaissance of the site, subsurface exploration, laboratory testing programs, and recommendations for a 70-foot-high embankment design based on stability analyses.

(3) Appurtenant Structures. Structural design analyses were not available.

b. Design Features

(1) Embankment

(a) As designed, the dam is a zoned embankment consisting of a clay core and outer shell sections, a downstream filter blanket, and an upstream clay blanket which terminates in a cutoff trench located 500 feet upstream from the axis of the dam. Design included a grout curtain at the upstream end of the clay blanket. Plate 2 shows the typical dam section. Buttresses (clay blankets) were constructed on both abutments upstream of the dam to control seepage through the abutments.

(b) The embankment was designed to have two to one (horizontal to vertical) slopes on the downstream face from the crest to Elevation 2365 and 2.5 to 1 slopes below this elevation. Upstream slopes were designed to be 2.5 to 1 above Elevation 2362 and 3 to 1 below this elevation.

- (c) The subsurface investigation conducted by Larsen Engineers during 19669 consisted of 88 auger borings, 10 core borings, and 20 rotary borings ranging in depth up to 109 feet. This investigation covered an area of 1000 feet along the valley by 1000 to 1500 feet on both sides of the valley and a 100-acre borrow area immediately upstream from the embankment location. The subsurface investigation considered four dam locations within this area. Plate 6 illustrates the subsurface profile at the dam site. It consists of clayey gravel, clayey sand, and silts underlain by bedrock on the right abutment. The profile indicates that the Lower Kittanning coal seam below the right abutment had been partially deep mined.
- (d) Soil testing for the embankment materials consisted of classification, compaction, shear strength, and permeability tests.

c. Appurtenant Structures. The appurtenances of the dam consist of a primary spillway, low level drainpipe, and a supply line controlled from an intake tower. The 66-inch-diameter primary spillway discharge pipe is supported by a reinforced concrete cradle. The 24-inch supply line and 36-inch drainpipe are encased in concrete. Flow through these pipes is controlled by manually operated controls located in the intake tower which is accessed by a steel pedestrian bridge (Plate 7).

d. Design Data

(1) Hydrology and Hydraulics. A design drawing indicates that the spillway design was based on SCS criteria. The freeboard inflow hydrograph had a peak of 15,746 cubic feet per second (cfs) and the emergency spillway hydrograph had a peak of 5430 cfs (Plate 5). The maximum discharge capacity of the emergency spillway is shown to be approximately 6800 cfs with no freeboard, and the total spillway discharge capacity is shown to be 7100 cfs. (As noted in Section 1.3, the spillway as it now exists has lower capacity than as designed.)

(2) Embankment. The embankment design was based on the geology and the soils report prepared by Larsen Engineers. The report includes logs for borings and test pits and selected classification tests for borrow materials, but no reference to soil strength tests was found. The stability analysis considered short-term stability, steady-state seepage, and rapid drawdown conditions, based on assumed soil strength values listed in the report, and obtained safety factors that ranged from the low of 2.02 for steady-state seepage conditions to the high of 3.23 for short-term stability.

(3) Appurtenant Structures. There are no design calculations available for the appurtenant structures.

2.2 Construction. Construction drawings prepared by Neilan Engineers were available for review. To the extent that can be determined, the construction of the dam was apparently conducted in accordance with the specifications as prepared by Neilan Engineers, Inc. No reference was found to indicate any unusual problems were encountered during construction of the dam.

2.3 Operation. There are no formal operating records available for the dam. As designed, the dam serves as a water supply reservoir. The supply water from the reservoir discharges through a 24-inch pipe, controlled by valves located in the intake tower and joins the transmission system.

The 36-inch "blow-off" pipe is also controlled from the intake tower. It discharges into the stream through a channel near the center of the dam.

2.4 Other Investigations. The dam was completed in 1975 and inspected by the state in 1977. The 1977 inspection report is available in the state files.

2.5 Evaluation

a. Availability. Available engineering data were provided by PennDER.

b. Adequacy

(1) Hydrology and Hydraulics. The reported results of the hydrology and hydraulic analyses indicate that the design followed currently accepted practices for such analyses. Area-capacity curves, spillway rating curves, inflow and outflow hydrographs are included in the design drawings (Plate 5).

(2) Embankment. Review of the geotechnical aspects of the design indicates that although the design generally followed currently accepted practice for subsurface investigations, the stability analyses were apparently based on assumed soil strength values rather than actual strength values obtained from laboratory test results. The assumed soil strength values are questionable. No seepage analyses were found in the design report.

(3) Appurtenant Structures. Review of the design drawings indicates that as designed there are no significant design deficiencies that should affect the overall performance of the appurtenant structures.

c. Operating Records. No formal operating records are available for the dam. Water company personnel reported that in a recent operation of the outlet pipe sluice gate the gate's riser stem buckled and the gate is presently not functional.

d. Post-Construction Changes. There have been no reported modifications to the original dam design.

e. Seismic Stability. The dam is located in Seismic Zone 1 and 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 assumed to present no hazard from earthquakes.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of Beaverdam Run Dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.
2. Visual examination of the spillway and its components, the downstream end of the outlet pipe, and other appurtenant features.
3. Observation of factors affecting the runoff potential of the drainage basin.
4. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 8 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.

1. Only one seepage area was observed. This was located to the left of the primary spillway along the toe. The total flow was estimated to be approximately 2 to 3 gallons per minute (gpm). The effect of this seepage on the overall performance of the dam is considered to be inconsequential at the present time, but it should continue to be monitored to assure that it is not increasing. The reservoir has probably not been filled long enough for steady-state seepage through the dam to have developed.
2. Approximately four isolated wet and swampy areas were found below the toe on the valley floor (Plate 8). No significant flow appeared to be discharging from these areas.
3. The grass cover on the downstream face of the dam was considered to be poor, requiring reseeding.

c. Appurtenant Structures. The spillway structures, spillway crests, channels, and plunge pools were examined for deterioration or other signs of distress and obstructions that would limit flow.

In general, the structures were found to be in good condition, with the exception of major erosion observed in the primary spillway discharge channel (Photograph 7) downstream from the plunge pool. This condition is not considered to be a safety hazard at its present extent. However, it should continue to be monitored to assure that it will not affect the performance of the plunge pool. The riprap at the emergency spillway entrance channel is inadequate to protect the embankment from erosion during high flows. Approximately 100 feet downstream from the crest, the left side of the emergency spillway channel is too low to contain major flows through the spillway. At flow depths of two to three feet over the spillway crest, it appears that the channel would overflow downslope toward the toe of the embankment.

d. Reservoir Area. The watershed is predominantly covered with woodlands and infiltration capacity is estimated to be good. A minor portion of the drainage basin has been strip mined and reclaimed (Plate 4).

The shorelines are not considered to be susceptible to massive landslides which would affect the storage volume of the reservoir or cause overtopping of the dam by displaced water.

e. Downstream Channel. Beaverdam Run downstream from the dam flows through a narrow and steep valley. There is one bridge over the stream and a second bridge immediately downstream from its mouth on the South Fork of Little Conemaugh River. These bridges are shown in the photographs in Appendix C. Sketches of these bridges are included in Appendix A. Further description of the downstream channel is included in Section 1.2.

3.2 Evaluation. In general, the condition of the dam is considered to be good. A review of the 1977 inspection report revealed that the general appearance of the dam was assessed to be good. Slight seepage at the toe and some scouring action in the spillway discharge channel was reported.

In this current inspection, the condition of the seepage and channel scour was found to be similar to that described in the previous inspection report.

Although the present condition of the wet areas does not appear to be affecting the stability of the downstream slope, observation of this condition in future inspections will be required to assure continued stability of the embankment.

Reseeding of the downstream face appears necessary to prevent erosion.

Evaluation of the adequacy of the riprap on the emergency spillway entrance channel is recommended.

SECTION 4 OPERATIONAL FEATURES

4.1 Procedure. Review of the design drawings and field observations indicate that there are no formal procedures for operating the dam. The only operational feature of the dam which may affect the safety of the dam is the drainpipe gate, in case it is required to lower the reservoir.

The clearing of debris from the primary spillway inlet structure as required and continued inspection of the facilities by the dam tender are the principal maintenance operations which would affect safety.

4.2 Maintenance of the Dam. While the general maintenance conditions of the embankment appear satisfactory, reseeding will be required to prevent future erosion problems.

4.3 Maintenance of Operating Facilities. As reported by Highland Sewer and Water Authority personnel, the riser stem of the drainpipe sluice gate was buckled and therefore the gate cannot presently be operated.

4.4 Warning System. No formal flood warning system exists for the Beaverdam Run Dam. The dam tender resides in Johnstown, approximately 15 miles west of the dam, and makes daily trips to the dam. No communication facilities are available at the site.

4.5 Evaluation. The dam is satisfactorily maintained and it is considered to be accessible under all weather conditions for inspection and emergency action purposes.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Beaverdam Run Dam has a watershed area of 7.5 square miles and impounds a reservoir with a surface area of 360 acres. The dam has both a primary and an emergency spillway. As it presently exists, the emergency spillway has a discharge capacity of 7100 cfs with no freeboard.

b. Experience Data. As previously stated, Beaverdam Run 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 the PMF.

The adequacy of the spillway was analyzed based on the simplified procedure developed by the Baltimore District, Corps of Engineers (Appendix D). Based on this analysis procedure, it was determined that the PMF inflow hydrograph will have a peak flow of 12,000 cfs and a total volume of approximately 9000 acre-feet. A further analysis according to the procedure indicates that the spillway is capable of passing the PMF without overtopping.

c. Visual Observations. The emergency spillway channel does not appear to be adequate to pass flood flows. Large flows would overflow the spillway channel and flow towards the embankment toe.

d. Overtopping Potential. As stated above, the dam can pass the recommended flood flows without overtopping.

e. Spillway Adequacy. The spillway can pass the recommended design flood, therefore it is adequate.

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 short-term stability of the dam and no unsatisfactory conditions were reported in the past.

(2) Appurtenant Structures. Structural performance of the appurtenant structures are considered to be satisfactory.

b. Design and Construction Data

(1) Embankment. The foundation investigation report prepared by Larsen Engineers in 1967 states that the stability of the embankment was analyzed for short-term, rapid drawdown, and steady-state seepage conditions and reports minimum factors of safety of 2.02 for steady-state seepage. However, the analyses were apparently based on assumed strength values and the strengths noted in the report do not appear reasonable.

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

c. Operating Records. The structural stability of the dam is not considered to be affected by the operational features of the dam.

d. Post-Construction Changes. There have been no reported modifications to the original design that would affect the structural stability of the structure.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety. The visual observations and review of available information indicate that the Beaverdam Run Dam is in good condition. However, the drainpipe gate was found to be nonfunctional and requires immediate repairs. It appears that the dam was constructed with reasonable care and the design generally followed the currently accepted engineering practices.

The capacity of the spillway was found to be "adequate."

b. Adequacy of Information. The available information in conjunction with 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. Of the five recommendations listed above, the repair of the outlet pipe sluice gate should be implemented immediately while the others should be considered as soon as practicable or on a continued basis.

d. Necessity for Further Investigation. The condition of the dam is not considered to require further investigation at this time.

7.2 Recommendations/Remedial Measures

1. The owner should be advised to make appropriate repairs to the outlet pipe gate immediately.
2. The adequacy of riprap at the entrance channel of the emergency spillway should be evaluated to determine if it provides sufficient protection against erosion of the embankment during high flows.
3. Necessary corrective measures should be taken to prevent overflow from the emergency spillway discharge channel from flowing towards the toe of the dam.
4. The seepage at the toe of the dam should be monitored and recorded.
5. Attention should be given to the scour problem in the primary spillway discharge channel to prevent this condition from becoming a threat to the integrity of the dam.

6. The dam and appurtenant structures should be inspected regularly and any unusual conditions should be reported to the appropriate authorities.
7. To prevent future erosion problems, the embankment should be reseeded.

PLATES

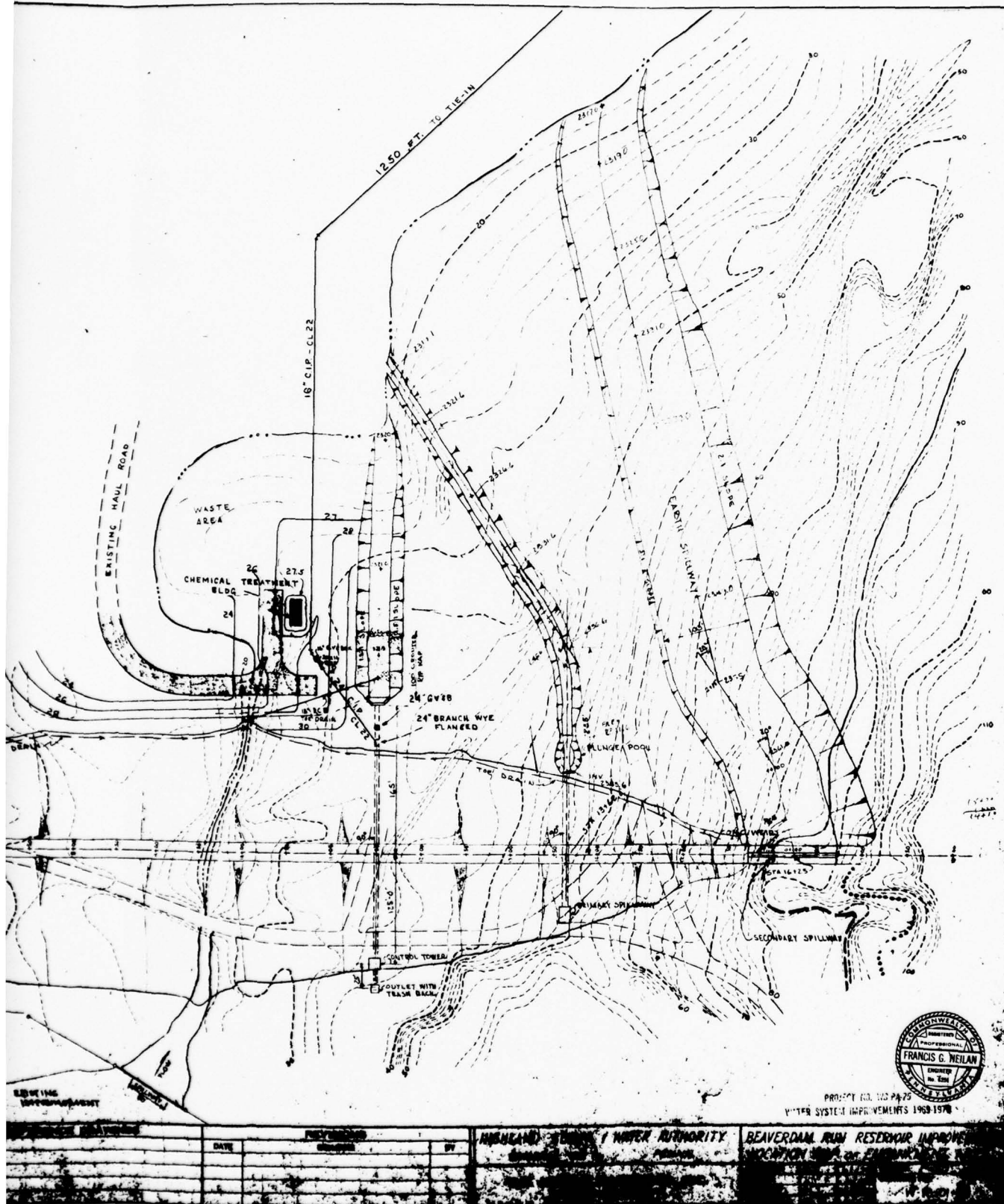
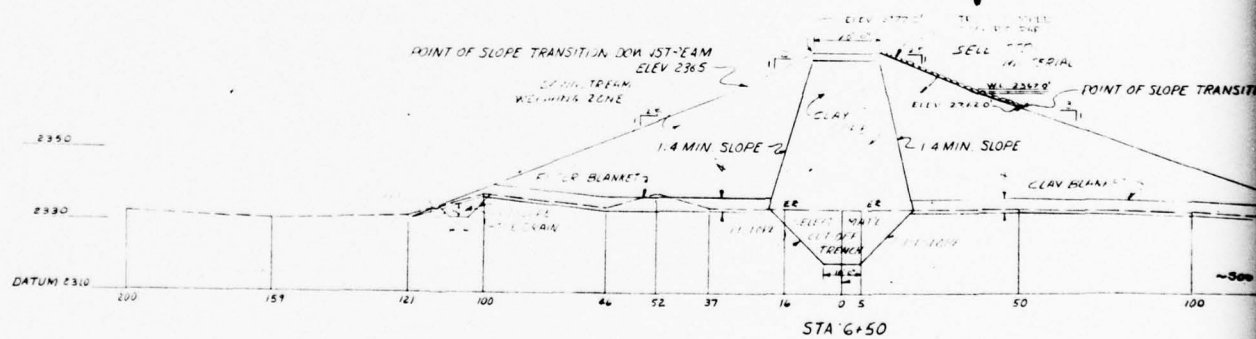
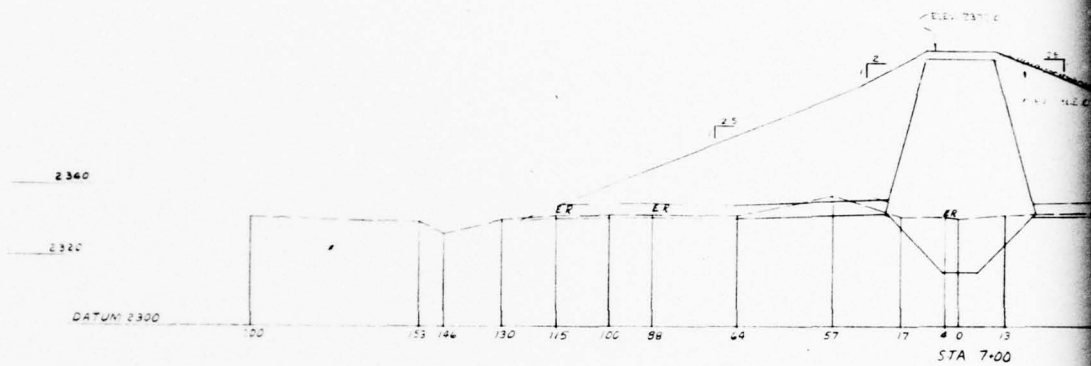
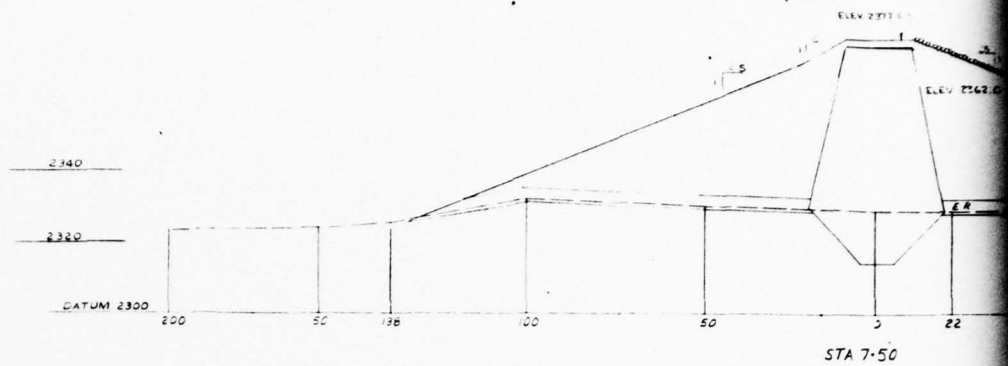


PLATE I

D'APPOLONIA

8

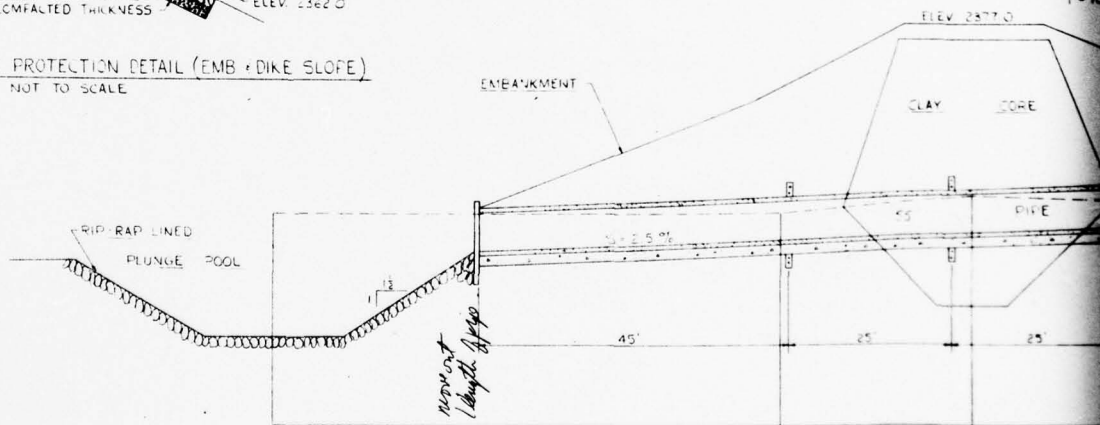
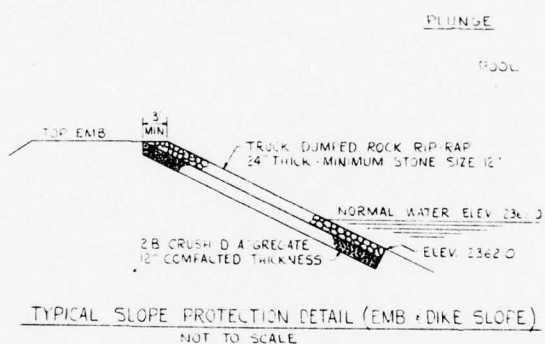
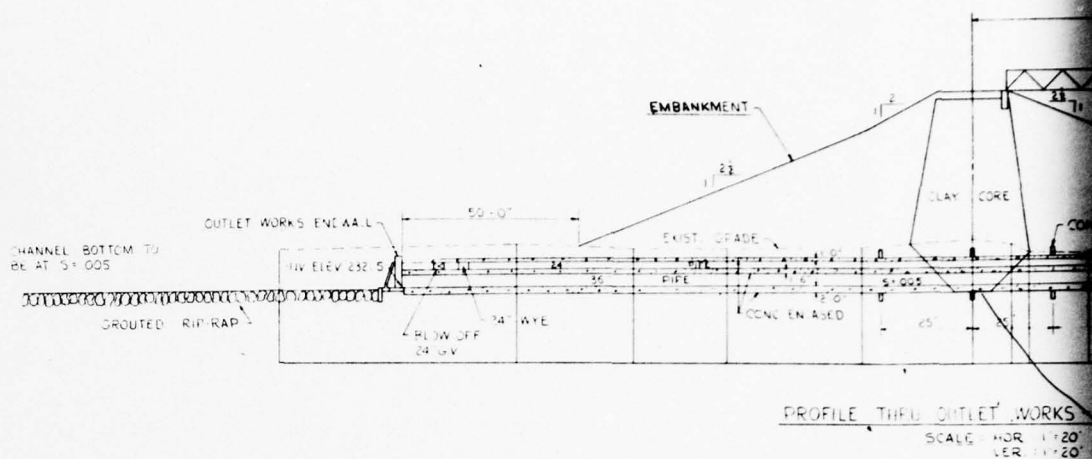
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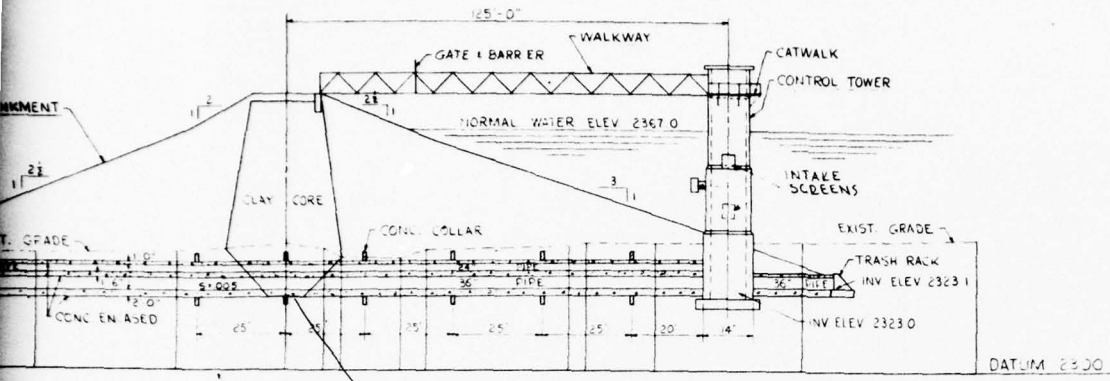
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 APPROVED BY: JHP
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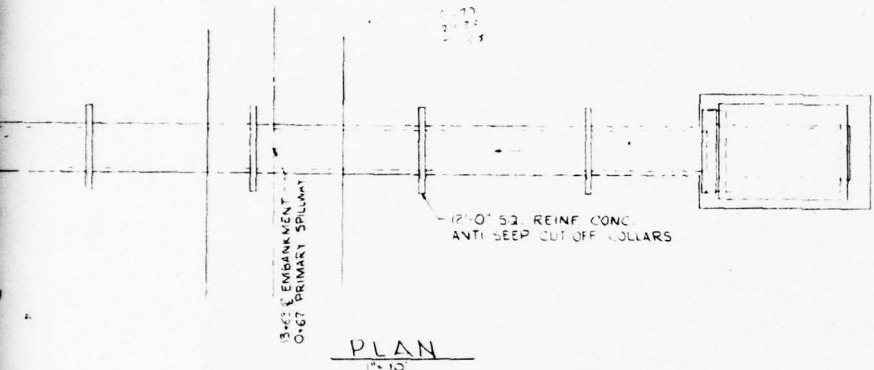


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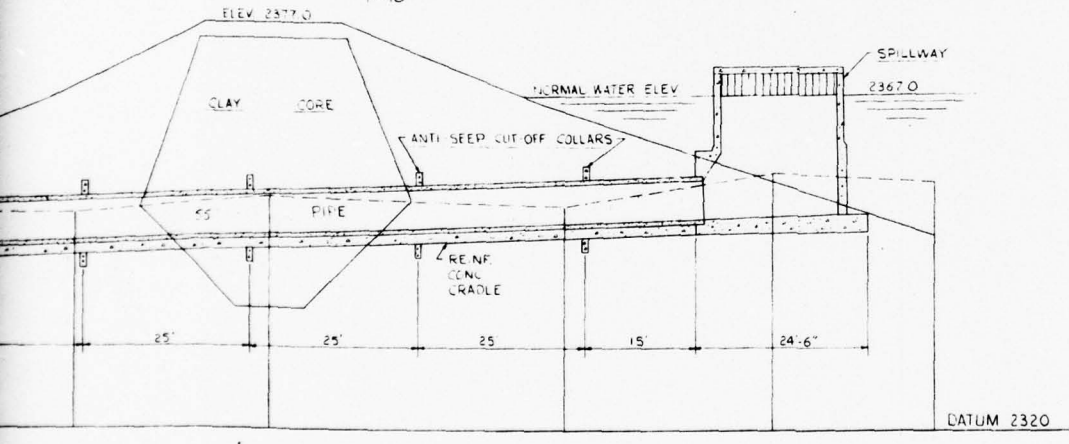


PROFILE THRU OUTLET WORKS STA 11+50
 SCALE: HOR 1"=20'
 VER 1"=20'

Handwritten note: New dam and spillway with 5 ft 1" 1"



PLAN
 1"=10'



SECTION THRU PRIMARY SPILLWAY
 SCALE: HOR 1"=10'
 VER 1"=10'

Handwritten note: include data as to what are conditions under the embankment.



REFERENCE DRAWINGS		REVISIONS		HIGHLAND SEWER & WATER AUTHORITY		BEAVERDAM RUN RESERVOIR IMPROVEMENTS	
DATE	REMARKS	BY		CAMBRIA CO. PENNA.		PRIMARY SPILLWAY-OUTLET WORKS	
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						DRAWN	ELY JUL 13 1904
						CHECKED	ELY JUL 13 1904
						APPROVED	FOR JUL 13 1904

PLATE 3

D'APOLONIA

2

APPROXIMATE WATERSHED AREA (6.5 SQ. MI.)

SUSQUEHANNA RIVER

BEAVERDAM RUN DAM

BRIDGE #2 STATE ROUTE 160

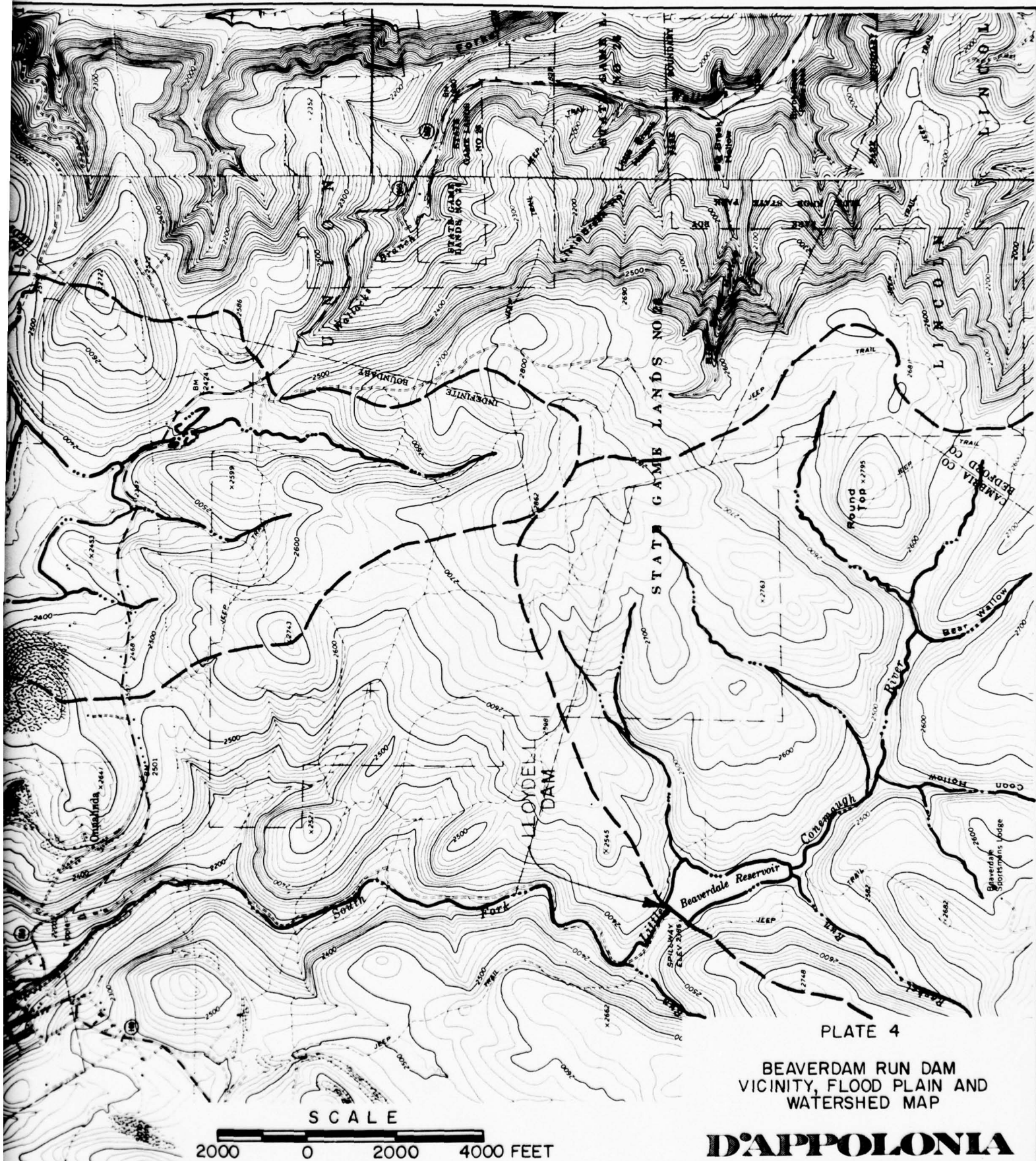
APPROXIMATELY 20 HOUSES

REFERENCES:

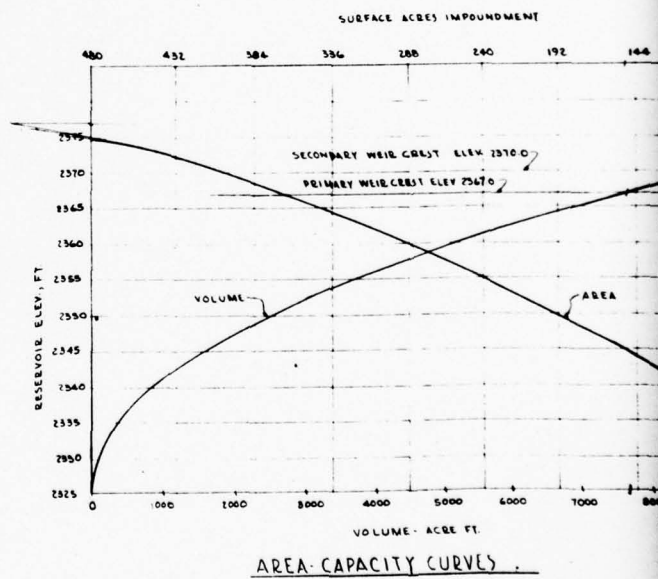
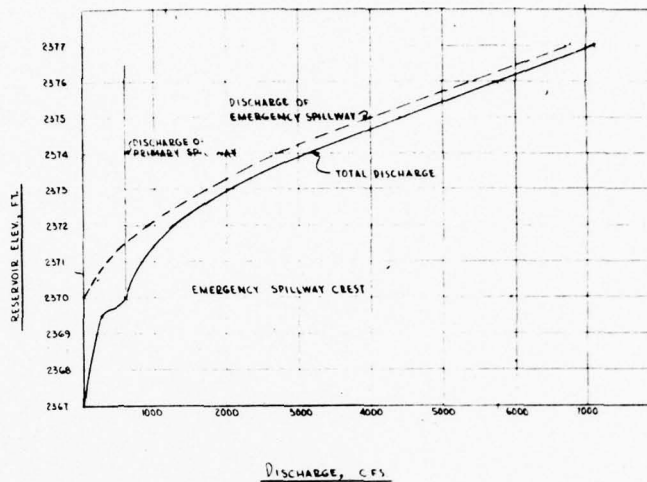
U.S.G.S. 7.5' BLUE KNOB, PA. QUADRANGLE 1963, SCALE - 1:2000

U.S.G.S. 7.5' BEAVERDALE, PA. QUADRANGLE PHOTOREVIS

U.S.G.S. 7.5' BEAVERDALE, PA. QUADRANGLE
PHOTOREVIS

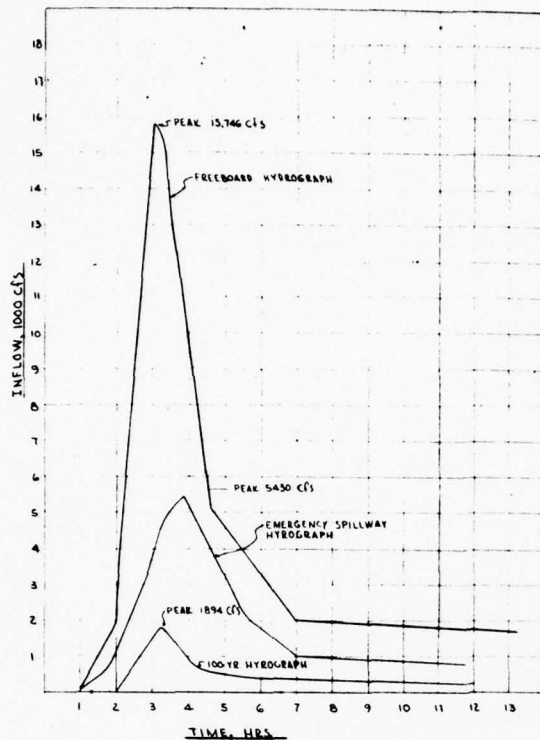


DRAWN BY	RGN	CHECKED BY	6-2-78	DRAWING NUMBER	78-114-B42
	5-25-78	APPROVED BY	6/2/78		

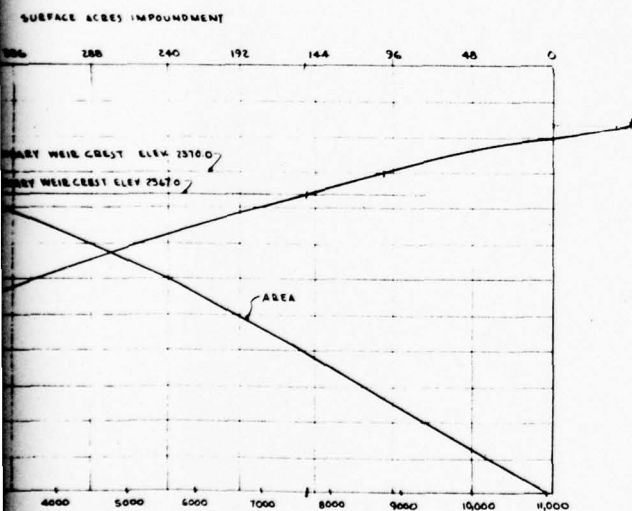


360 Ac
1,700 ac ft

[illegible]



INFLOW HYDROGRAPH



CAPACITY CURVES



REFERENCE DRAWINGS		REVISIONS		BY	DATE	REMARKS	HYDROGRAPH CURVES

HIGHLAND SEWER & WATER AUTHORITY
CAMBRIA CO. PENNA

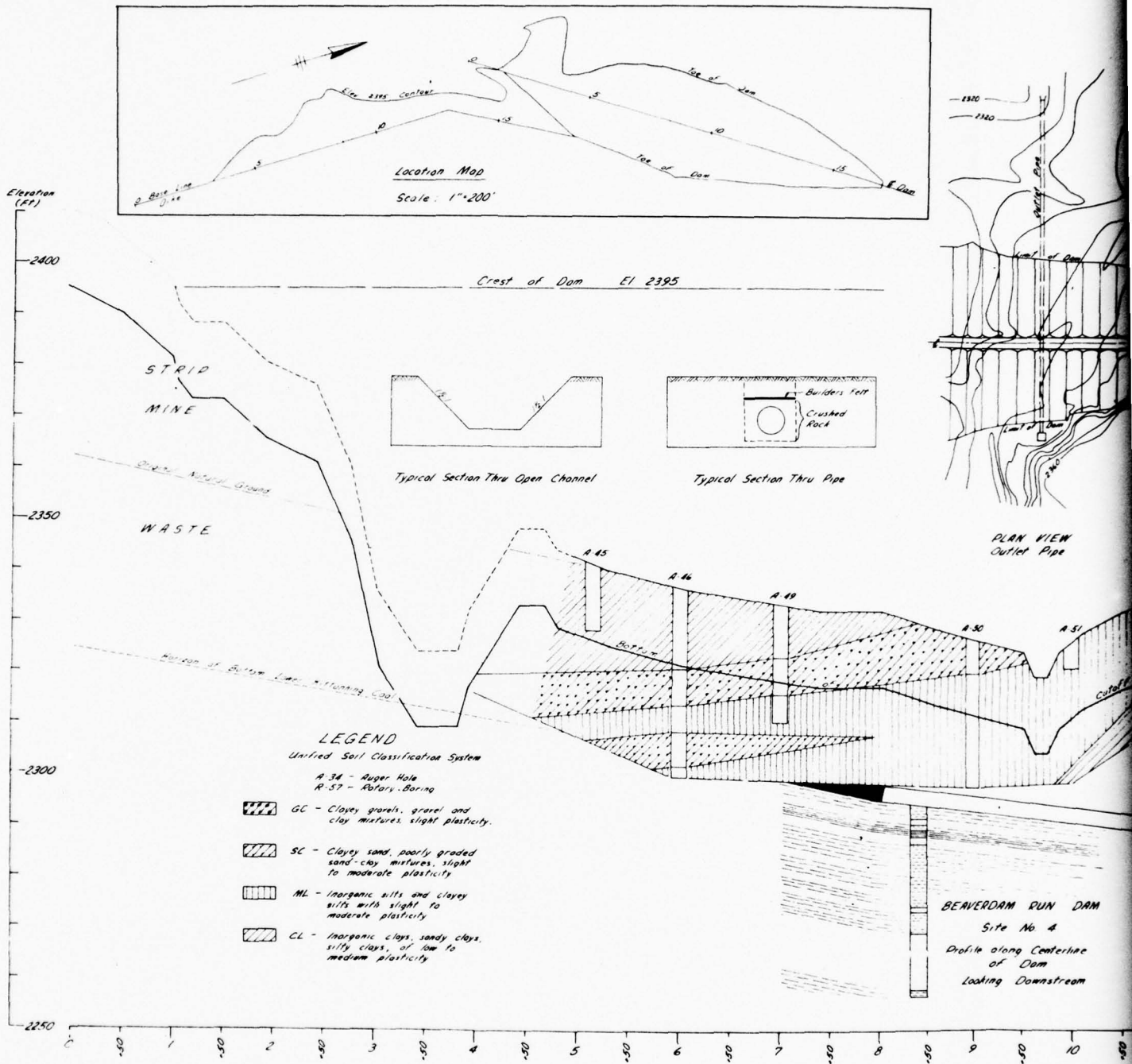
THE NEILAN ENGINEERS, INC.
BERKSHIRE, PENNSYLVANIA

DESIGNED BY	DATE	BY	DATE
CHECKED BY	DATE	BY	DATE
APPROVED BY	DATE	BY	DATE

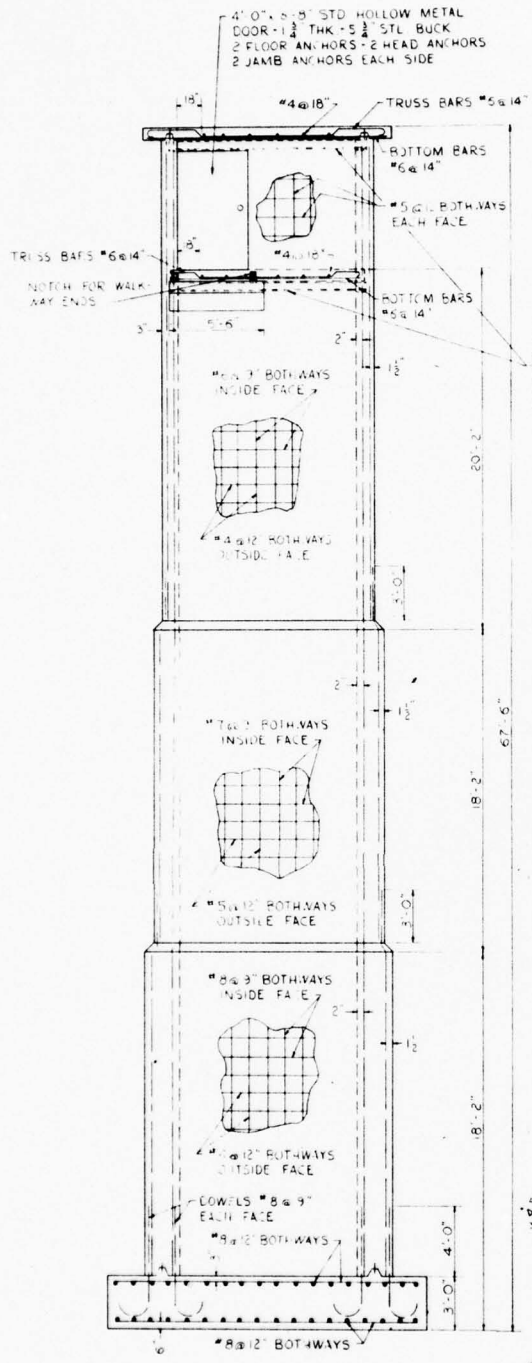
PLATE 5

D'APPOLONIA

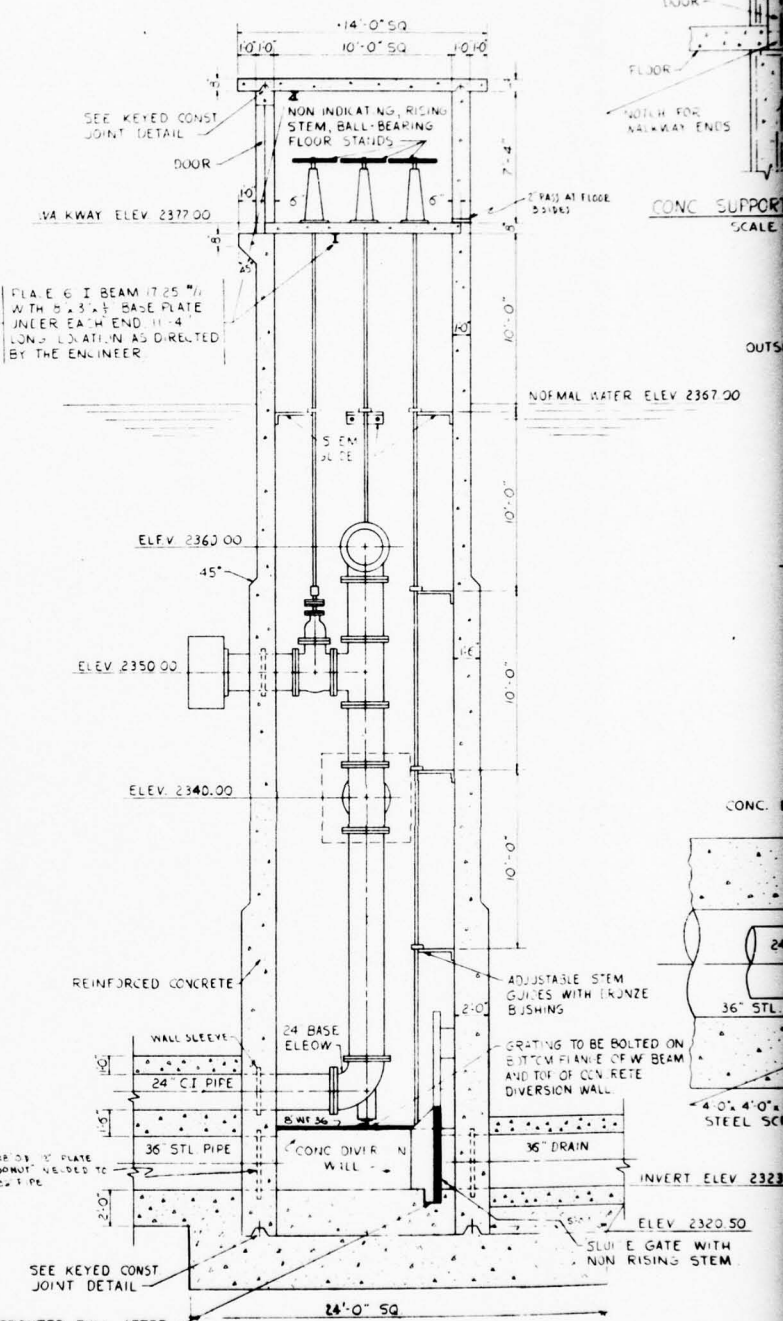
DRAWN BY
 5-25-78
 RGN
 CHECKED BY
 6-2-78
 JHP
 6-2-78
 DRAWING NUMBER
 78-114-B40



DRAWN BY: RGN
 CHECKED BY: JHP
 APPROVED BY: JHP
 5-25-78
 6-2-78
 6-2-78
 78-114-B41
 DRAWING NUMBER

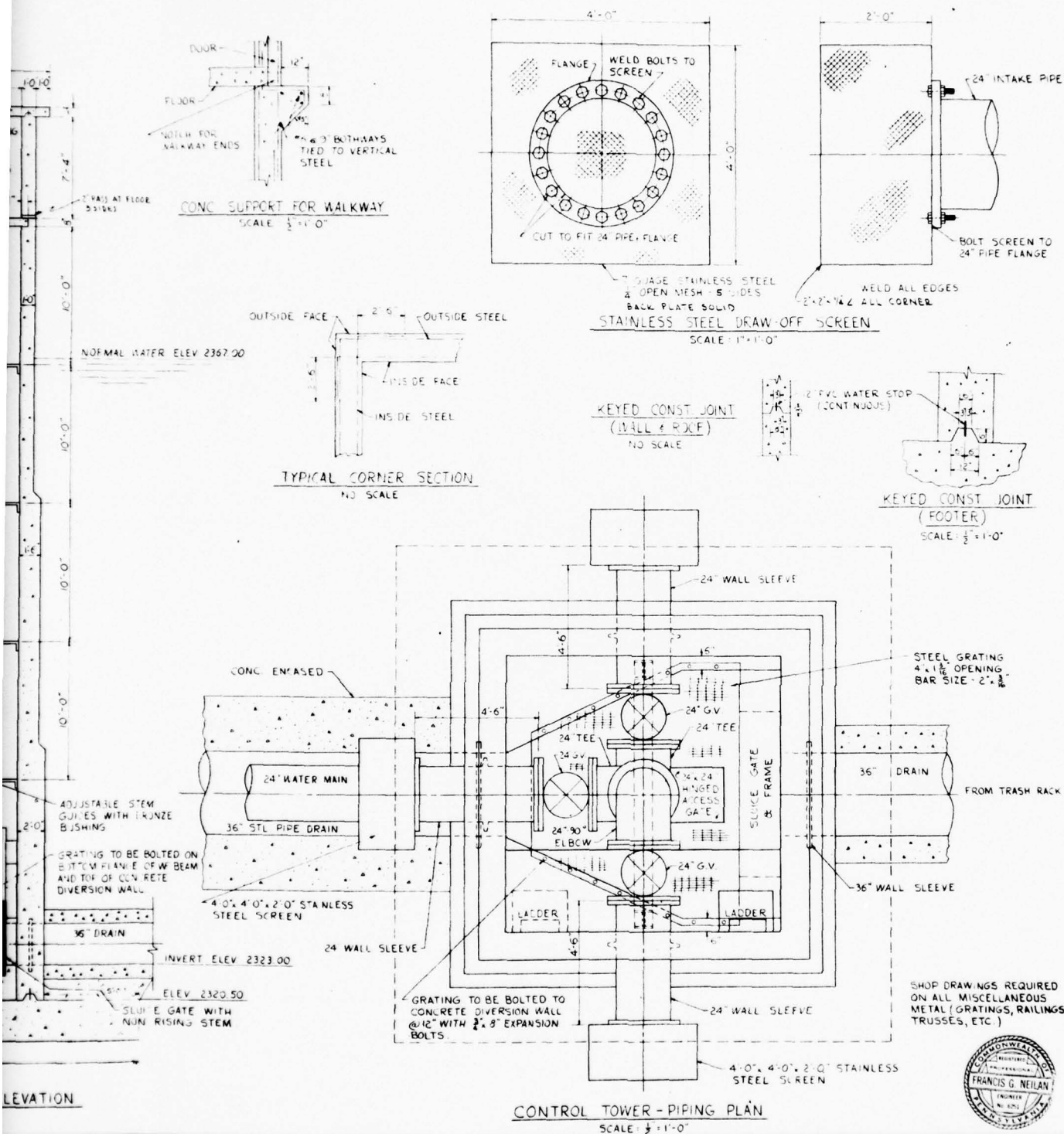


CONTROL TOWER REINFORCING DETAILS
 SCALE: 1/4" = 1'-0"

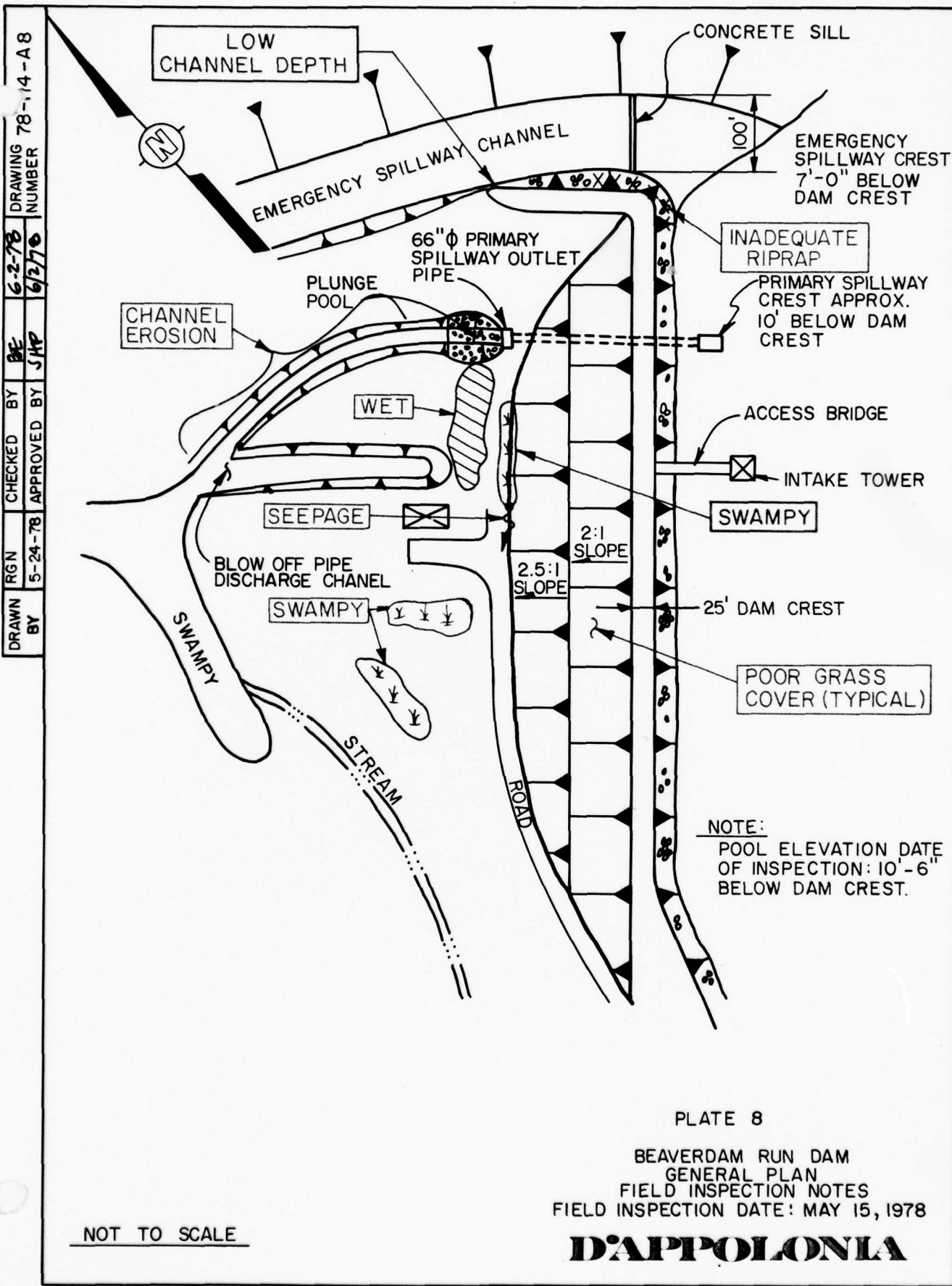


CONTROL TOWER-PIPING ELEVATION
 SCALE: 1/4" = 1'-0"

FIELD NOTES:	REFERENCE DRAWINGS	DATE



REFERENCE DRAWINGS		REVISIONS			HIGHLAND SEWER & WATER AUTHORITY CAMBRIA CO. PENNA.		BEAVERDAM RUN RESERVOIR IMPROVEMENTS CONTROL TOWER-OUTLET WORKS			
	DATE	REMARKS	BY		THE NEILAN ENGINEERS, INC. SOMERSET, PENNSYLVANIA		DESIGNED	RLT	DATE TO	SCALE: AS NOTED
							DRAWN	T.K.	DATE TO	DRAWING NO.
							CHECKED	RLT	DATE TO	
							APPROVED	RLT	DATE TO	W-18-01-05



DRAWN BY	RGH	CHECKED BY	6-2-78	DRAWING NUMBER	78-14-A8
BY	5-24-78	APPROVED BY	6/2/78		

PLATE 8

BEAVERDAM RUN DAM
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE: MAY 15, 1978

NOT TO SCALE

D'APOLONIA

APPENDIX A
CHECKLIST, VISUAL INSPECTION
PHASE I

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM BEAVERDAM RUN DAM COUNTY CAMBERIA STATE PA. ID# NDS: 805 DER: 11-105

TYPE OF DAM EARTH FILL HAZARD CATEGORY HIGH.

DATE(S) INSPECTION MAY 15, 1978 WEATHER RAINY TEMPERATURE 50 °

POOL ELEVATION AT TIME OF INSPECTION ~2366.5' M.S.L. TAILWATER AT TIME OF INSPECTION _____ M.S.L.

INSPECTION PERSONNEL:

<u>BILGIN EREL</u>	<u>REVIEW INSPECTION BY:</u>	<u>ELIO D'APPOLONIA</u>
<u>WAH-TAK CHAN</u>	<u>(MAY 30, 1978)</u>	<u>LAWRENCE ANDERSEN</u>
_____	_____	<u>JAMES DOULLOT.</u>

BILGIN EREL RECORDER

VISUAL INSPECTION
PHASE I
EMBANKMENT

NAME OF DAM BEAVER DAM RUN AM
ID# NDS: 805, DER: 11-105

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE FOUND.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE FOUND.	
SLOUCHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	GRASS COVER ON DOWNSTREAM SLOPE IS POOR. MINOR EROSION RILLS.	RESEEDING IS RECOMMENDED.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	NO PERCEIVABLE MISALIGNMENT.	
RIPRAP FAILURES	NONE	

VISUAL INSPECTION
PHASE I
EMBANKMENT

NAME OF DAM BEAVERDAM EMBANKMENT
ID# NDS: 805, DER 11-105

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	NO VISUAL SIGNS OF DISTRESS. NO SEEPAGE.	
ANY NOTICEABLE SEEPAGE	MINOR SEEPAGE & WET AREAS IN THE VICINITY OF THE TOE. SEE PLATE B.	
STAFF GAGE AND RECORDER	NONE	
DRAINS	THE FILTER BLANKET BELOW THE DOWN-STREAM SLOPE OF THE DAM, DRAINS INTO A PIPE ALONG THE TOE OF THE DAM. DISCHARGE END OF THIS PIPE WAS NOT LOCATED IN THE FIELD.	

VISUAL INSPECTION
PHASE I
CONCRETE/MASONRY DAMS

NAME OF DAM BEAVERDAM RD. DAM
ID# NDS: 805, DER 11-105

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	(EARTH FILL DAM) N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

VISUAL INSPECTION
PHASE I
CONCRETE/MASONRY DAMS

NAME OF DAM BEAVER DAM RD DAM
ID# NDS: 805, DER: 11-105

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	(EARTH FILL DAM) N/A.	
STRUCTURAL CRACKING	N/A.	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A.	
MONOLITH JOINTS	N/A.	
CONSTRUCTION JOINTS STAFF GAGE OF RECORDER:	N/A.	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

NAME OF DAM BEAVERDAM RUI DAM
ID# NDS: 805 DER 11-105

VISUAL EXAMINATION OF CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	ONE MINOR CRACK IN 66" ϕ PRIMARY SPILLWAY DISCHARGE CONDUIT ~20 FT UPSTREAM FROM DOWNSTREAM END.	CRACKS IN THIER PRESENT EXTENT ARE CONSIDERED TO BE INCONSEQUENTIAL.
INTAKE STRUCTURE	SOME MINOR CRACK ON PRIMARY SPILLWAY INLET STRUCTURE	
OUTLET STRUCTURE		
OUTLET CHANNEL	OUTLET PIPE CHANNEL : GOOD CONDITION PRIMARY SPILLWAY CHANNEL : SIGNIFICANT EROSION.	
EMERGENCY GATE	OUTLET PIPE SLUICE GATE NOT FUNCTIONAL (GATE STEM BUCKLED)	REPAIRS REQUIRED.

VISUAL INSPECTION
PHASE 1

NAME OF DAM BEAVERDAM RUN DAM

UNGATED SPILLWAY (EMERGENCY)

ID# NDS: 805, DEC 11-125

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	GOOD CONDITION.	
APPROACH CHANNEL	IN GENERAL GOOD CONDITION. R/RAP ON LEFT SIDE OF ENTRANCE CHANNEL APPEARS TO BE NOT ADEQUATE FOR HIGH FLOW.	ADEQUACY OF R/RAP ON LEFT SIDE OF ENTRANCE CHANNEL SHOULD BE RE-EVALUATED.
DISCHARGE CHANNEL	NOT DEEP ENOUGH TO CONTAIN FULL FLOW, AT A POINT ~ 100 FT FROM CONTROL SECTION.	FLOW LEAVING THE CHANNEL IS LIKELY TO FLOW TOWARD THE TOE OF THE DAM.
BRIDGE AND PIERS	NO BRIDGE.	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

NAME OF DAM BEAVERDAM RUN DAM
ID# NDS: 805, DER: 11-105

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	NO GATED SPILLWAY 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

NAME OF DAM BEAVER DAM RUN DAM
ID# NDS: 805, DEC: 11-105

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE FOUND	
OBSERVATION WELLS	NONE FOUND	
WEIRS	NONE FOUND	
PIEZOMETERS	NONE FOUND	
OTHER	NONE FOUND	

VISUAL INSPECTION

PHASE I

RESERVOIR

NAME OF DAM BEAVER DAM RUN DAM

ID# NDS : 805 , DER : 11-105

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	GENTLE, NO INDICATION OF HIGH SHORELINE EROSION.	
SEDIMENTATION	DAM IS ONLY 2 YEARS OLD. SEDIMENTATION IS NOT LIKELY TO BE A PROBLEM.	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

NAME OF DAM BEAVERDAM RUN DAM
ID# NDS: 805 DER: 11-105

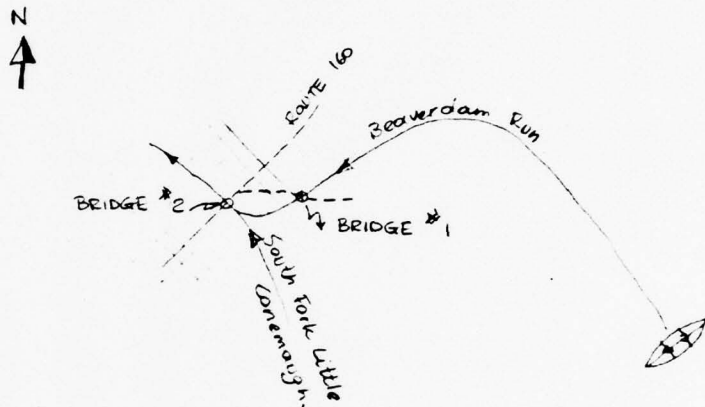
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	NATURAL STREAM.	SKETCHES OF BRIDGES OVER THE STREAM IS INCLUDED IN APPENDIX A.
SLOPES		
APPROXIMATE NUMBER OF HOMES AND POPULATION	20 HOMES & 2 COMMERCIAL BUILDINGS IN THE MAIN IMPACT AREA OF A FLOOD. POPULATION ~ 150	FURTHER DAMAGE & LIFE LOSS IS ALSO LIKELY, BELOW BEAVERDALE.

D'APOLONIA

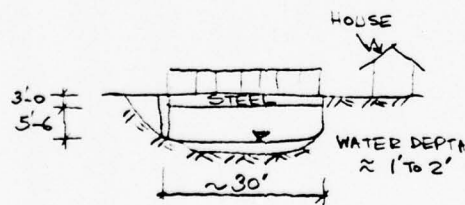
CONSULTING ENGINEERS, INC.

By BE Date 5-15-78 Subject BEAVERDAM RUN DAM NOS: 805 Sheet No. 1 of 1
 Chkd. By WTC Date 5/15/78 FIELD SKETCH. Proj. No. 78-114-1

STREAM CROSS SECTION @ BRIDGE LOCATIONS (IMMEDIATE DAMAGE REACH)

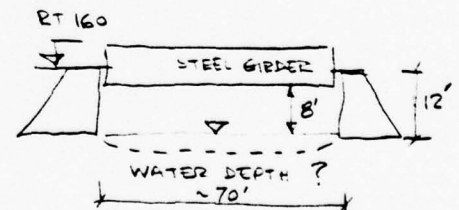


BRIDGE #1



BRIDGE ON TOWN STREET

BRIDGE #2



BRIDGE ON RT-160

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

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM BEAVERDAM RUN DAM
ID# NDS: 805, DER: 11-105

ITEM	REMARKS
AS-BUILT DRAWINGS	DESIGN DRAWING ARE INCLUDED IN DER FILES.
REGIONAL VICINITY MAP	SEE PLATE 4
CONSTRUCTION HISTORY	COMPLETED IN DECEMBER 1975. FURTHER INFORMATION AVAILABLE IN DER FILES.
TYPICAL SECTIONS OF DAM	SEE PLATE 2
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATING	} SEE PLATE - 7 NOT AVAILABLE

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM BEAVERDAM RUN DAM
ID# NDS:805, DER:11-105

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NOT AVAILABLE
DESIGN REPORTS	"SOILS AND FOUNDATION REPORT, PROPOSED DAM ACROSS BEAVER DAM RUN" PREPARED BY LARSEN ENGINEER OF HARRISBURG PA, FOR NEILAN ENGINEER OF SOMERSET PA.
GEOLOGY REPORTS	INCLUDED IN ENGINEERING REPORT.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	HYDROLOGY AND HYDRAULIC CALC NOT AVAILABLE STABILITY ANALYSIS RESULTS INCLUDED IN ENGINEERS REPORT.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	INCLUDED IN ENGINEERS REPORT.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM BEAVERDAM RUN DAM
ID# NDS: 805, DER: 11-105

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	NONE AVAILABLE.
BORROW SOURCES	INDICATED IN ENGINEERS REPORT
MONITORING SYSTEMS	NONE FOUND.
MODIFICATIONS	NONE REPORTED.
HIGH POOL RECORDS	NONE AVAILABLE.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM BEAVERDAM RUN DAM
ID# NDS: 805, DER: 11-105

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE FOUND
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	NONE REPORTED
MAINTENANCE OPERATION RECORDS	NONE AVAILABLE.
SPILLWAY PLAN SECTIONS DETAILS	PLAN SEE PLATE - 1, DETAILS ARE INCLUDED IN DESIGN DRAWING AVAILABLE IN DER FILES.
OPERATING EQUIPMENT PLANS AND DETAILS	SEE PLATE - 7.

NAME OF DAM BEAVERDAM RUN DAM

ID# NDS: 805 DER: 11-105

CHECKLIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: _____

ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 7700 ACRE- FEET @ EL 2367.0'

ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: 8800 AC-FT @ EL 2370.0'

ELEVATION; MAXIMUM DESIGN POOL: 2370.0'

ELEVATION; TOP DAM: 2377.0' (USGS DATUM - AS DESIGNED)

CREST:

- a. Elevation 2377' (USGS DATUM - AS DESIGNED)
- b. Type EARTH.
- c. Width 20 FT.
- d. Length 1400 FT.
- e. Location Spillover NO VISIBLE LOW SPOT ON CREST.
- f. Number and Type of Gates NONE

OUTLET WORKS:

- a. Type 36" ϕ STEEL PIPE. (OUT-LET PIPE)
- b. Location THROUGH THE EMBANKMENT - RIGHT OFF CENTER.
- c. Entrance Inverts 2323.1 FT.
- d. Exit Inverts 2321.5 FT.
- e. Emergency Draindown Facilities 36" ϕ OUT-LET PIPE.

HYDROMETEOROLOGICAL GAGES:

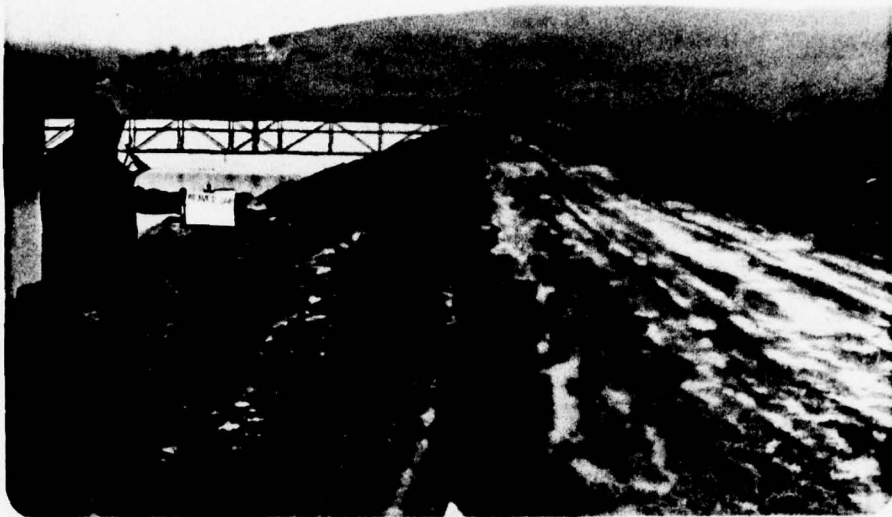
- a. Type NONE
- b. Location N/A
- c. Records N/A.

MAXIMUM NONDAMAGING DISCHARGE: \approx 7000 cfs. (FIRST SIGNIFICANT DAMAGE AT BEAVERDALE)

APPENDIX C
PHOTOGRAPHS

LIST OF PHOTOGRAPHS
BEAVERDAM RUN DAM
NDS I.D. NO. 805
MAY 15, 1978

<u>PHOTOGRAPH NO.</u>	<u>DESCRIPTION</u>
1	Crest.
2	Emergency spillway crest and approach channel.
3	Primary spillway discharge pipe.
4	Primary spillway, plunge pool, and discharge channel.
5	Blow-off pipe outlet.
6	Blow-off pipe plunge pool and discharge channel.
7	Erosion in discharge channel.
8	Bridge No. 1.
9	Confluence of Beaverdam Run and South Fork of Little Conemaugh River.
10	Bridge No. 2.



Photograph No. 1
Crest.



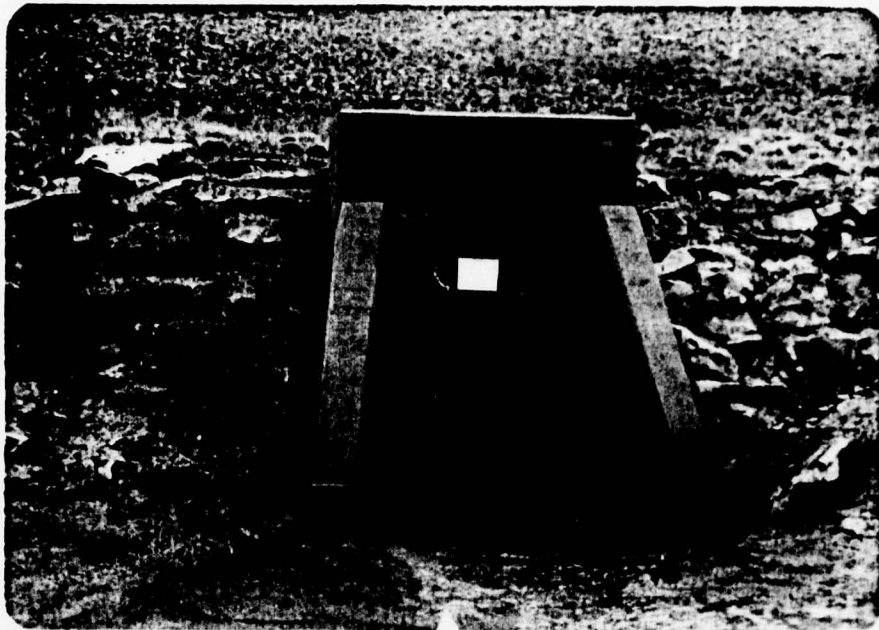
Photograph No. 2
Emergency spillway crest and approach channel.



Photograph No. 3
Primary spillway discharge pipe.



Photograph No. 4
Primary spillway, plunge pool, and discharge channel.



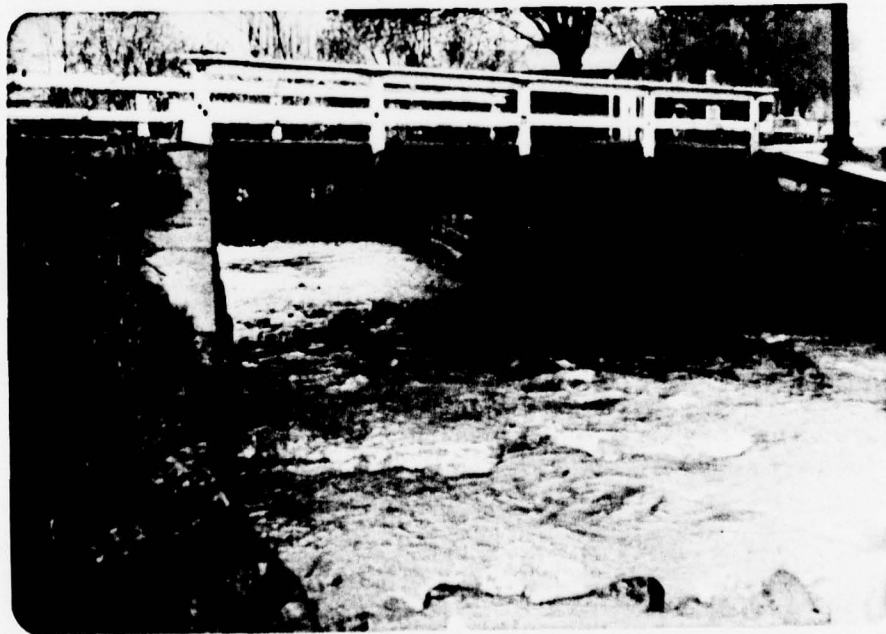
Photograph No. 5
Blow-off pipe outlet.



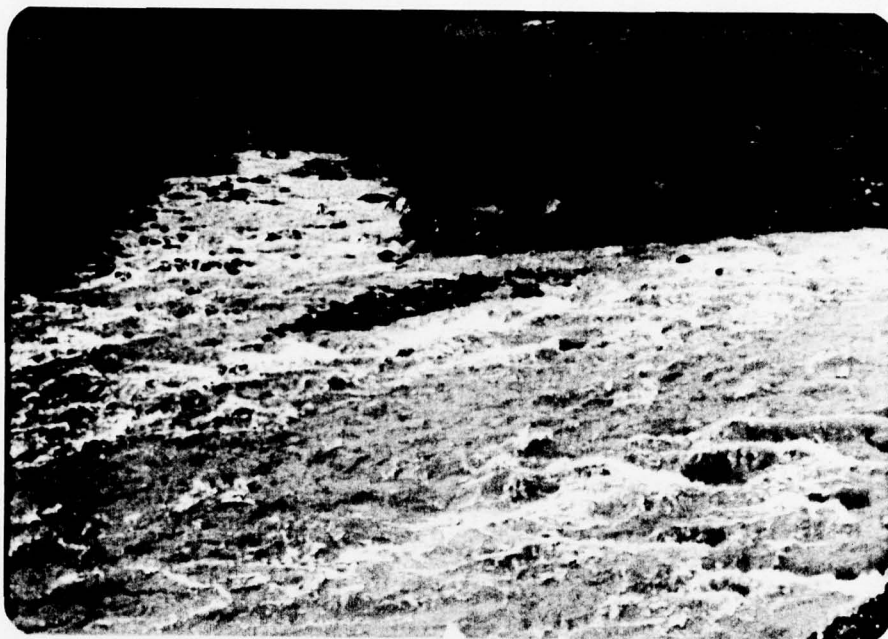
Photograph No. 6
Blow-off pipe plunge pool and discharge channel.



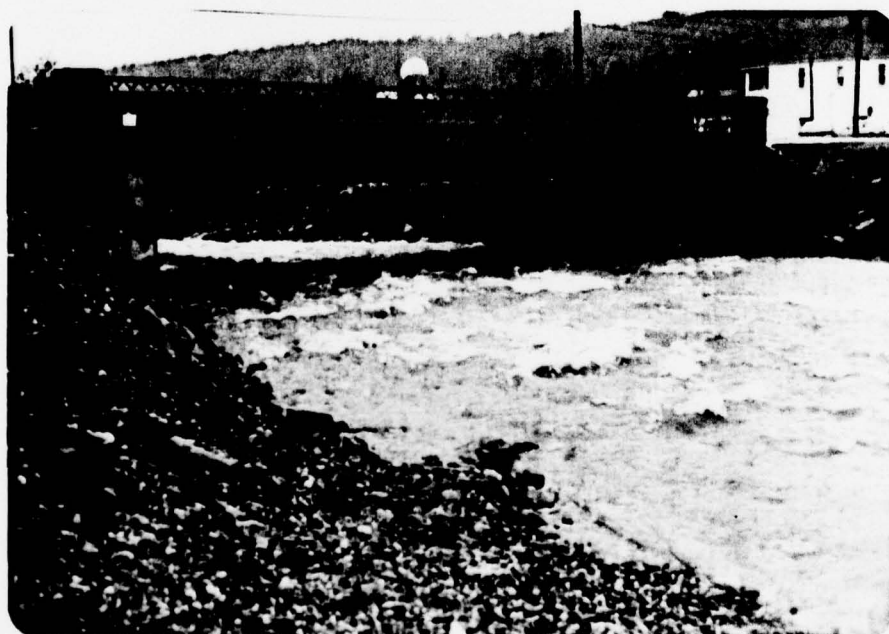
Photograph No. 7
Erosion in discharge channel.



Photograph No. 8
Bridge No. 1.



Photograph No. 9
Confluence of Beaverdam Run and South Fork
of Little Conemaugh River.



Photograph No. 10
Bridge No. 2.

APPENDIX D
CALCULATIONS

D'AMPOLONA

CONSULTING ENGINEERS, INC.

By EE Date 6-20-78 Subject BEAVERDAM RUN DAM Sheet No. 1 of 3
 Chkd. By WTC Date 6-20-78 HYDROLOGY & HYDRAULICS Proj. No. 78-114-11

DAM : BEAVERDAM RUN *
 WATERSHED AREA : 6.5 SQ. MILES. (INDEPENDENT MEASUREMENT)
 INFLOW HYDROGRAPH : USE OHIO BASIN GRAPHS

FROM GRAPHS PROVIDED BY BALTIMORE DISTRICT :

TOTAL TIME $T = 42$ HRS
 PEAK PMF/SQ. MILE $Q_p = 1650$ cfs/SQ. MILE.

PEAK PMF FLOW $Q = q_p A = 1650 \times 10.66 = 10,725$ cfs.

VOL OF INFLOW $= \frac{1}{2} T \times 3600 \times Q \frac{1}{43560}$
 $= 18,614$ ACRES- FEET.

RUNOFF IN INCHES $= \frac{18,614}{6.5 \times 640} \cdot 12 = 53.7$ " 7 26"

PER DISTRICT RECOMMENDATION USE 26" RUNOFF.

VOL. INFLOW FOR 26" RUNOFF $Q_{26} = 18,614 \times \frac{26}{53.7} = 9,012$ AC. FT

TIME FOR 26" RUN OFF $T_{26} = \frac{2 \times 9,012 \times 43,560}{3600 \times 10,725} = 20.3$ HRS

SPILLWAY CAPACITIES :

- 1) EMERGENCY SPILLWAY: FREE BOARD = 7 FT
 (DAM CREST EL 2377, SPILLWAY CREST: EL 2370)

$Q = CLH^{1.5}$ $C = 2.7$ (BROAD CRESTED WEIR)

$Q = 2.7 \times 100 \times 7^{1.5} = 5000$ CFS

* PREVIOUS REPORT : DRAINAGE AREA 7.5 SQ. MILES

DAPIPOLONA

CONSULTING ENGINEERS, INC

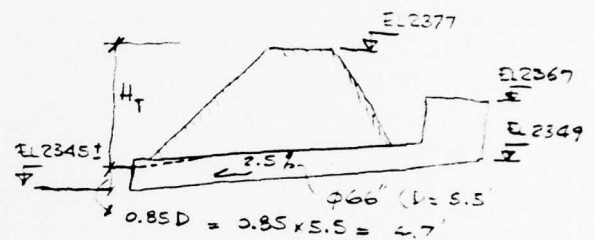
By GE Date 6-20-78 Subject BEAVERDAM RUN DAM Sheet No. 2 of 3
 Chkd. By WTC Date 6-20-78 HYDROLOGY & HYDRAULICS Proj No. 78-114-11

2) PRIMARY SPILLWAY : FREEBOARD = 10'

$$H_T = (2377 - 2345) - 4.7$$

$$= 27.3 \text{ FT}$$

$$\text{SAY } H_T = 27'$$



REFERENCE

DESIGN OF SMALL DAM P. 567 FIG. 2-10

$$H_T = 27' \quad D = 66" \quad K_e = 0.5 \quad L = 135' \quad n = 0.012 \rightarrow Q \approx 700 \text{ CFS}$$

COMBINED DISCHARGE CAPACITY OF SPILLWAYS:-

$$Q_T = 5000 + 700 = 5700$$

APPROXIMATE ROUTING ACCORDING TO COE PROCEDURE

AVAILABLE SURCHARGE STORAGE: 4500 AC-FT
 (BETWEEN EL 2367 & EL 2377) FROM DESIGNERS DATA.

REQUIRED STORAGE CAP. TO PASS 26" RUN OFF

$$V_R = \left(1 - \frac{\text{MAX SPILLWAY CAP.}}{Q_{\text{MAX. IN}}} \right) (V_O \text{ OF INFLOW})$$

$$= \left(1 - \frac{5700}{10,725} \right) 9,012 = 4223 \text{ AC-FT} < 4500 \text{ AC-FT}$$

∴ SPILLWAY CAN PASS 26" RUNOFF W/O OVERTOPPING.

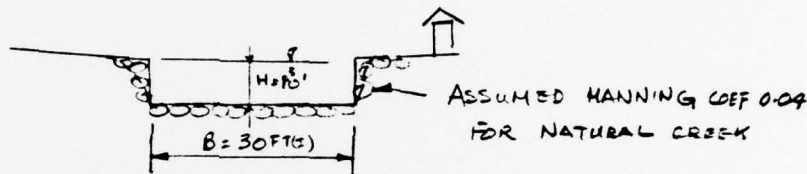
DAPIPOLONA

CONSULTING ENGINEERS, INC.

By WTC Date 5-15-78 Subject BEAVERDAM RUN DAM Sheet No. 3 of 3
 Chkd. By EA Date 6-1-78 HYDROLOGY & HYDRAULICS Proj. No. 78-14-11

ESTIMATED DOWNSTREAM WATER DEPTH NEAR FIRST BRIDGE

$$\text{CHANNEL SLOPE} = \frac{40}{1000} = 0.04$$



$$A = 30 H \quad P = 30 + 2H$$

$$R = \frac{A}{P}$$

$$V = \frac{1.486}{n} R^{2/3} S^{1/2} = \frac{1.486}{0.04} R^{2/3} 0.04^{1/2} = 7.43 R^{2/3}$$

$$Q = VA$$

H, FT	A, FT ²	P, FT	R, FT	V, fps	Q, cfs
0.5	15	31	0.48	4.6	68.7
1.0	30	32	0.9	7.1	213.5
1.5	45	33	1.4	9.1	411.2
2.0	60	34	1.8	10.9	651.0
3	90	36	2.5	13.7	1231.8
4	120	38	3.2	16.0	1919.1
5	150	40	3.8	17.9	2690.1
6	180	42	4.3	19.6	3528.7
7	210	44	4.8	21.1	4423.0
8	240	46	5.2	22.4	5364.2
9	270	48	5.6	23.5	6345.0
10	300	50	6.0	24.5	7360.0

SPILLWAY
CAPACITY
Q = 5700 cfs OK

STORM WATER WILL RETAIN WITHIN THIS SECTION OF STREAM BED

UNDAMAGED DISCHARGE IS THUS EQUAL TO SPILLWAY CAPACITY = 5700 cfs

APPENDIX E
REGIONAL GEOLOGY

APPENDIX E REGIONAL GEOLOGY

Cambria County lies within the Allegheny Mountains section of the Appalachian Plateau Province. Terrain of this area is characterized by a series of mountain ridges running more or less parallel in a general northeast to southwest direction, forming a rolling plateau in which the dam is located. Dips of bedrock in the area are very gentle in Cambria County except along Laurel Hill and Allegheny Mountain which lie in the western and eastern parts of the county, respectively. Rocks near the site belong to the Conemaugh and Allegheny Formations of the Pennsylvanian System. The reservoir covers approximately 80 acres; 10 acres have been completely undermined and 24 acres have been partially undermined. Thickness of the strata between the Lower Kittanning Coal, which was deep mined, and the ground surface varies from 645 to 750 feet.