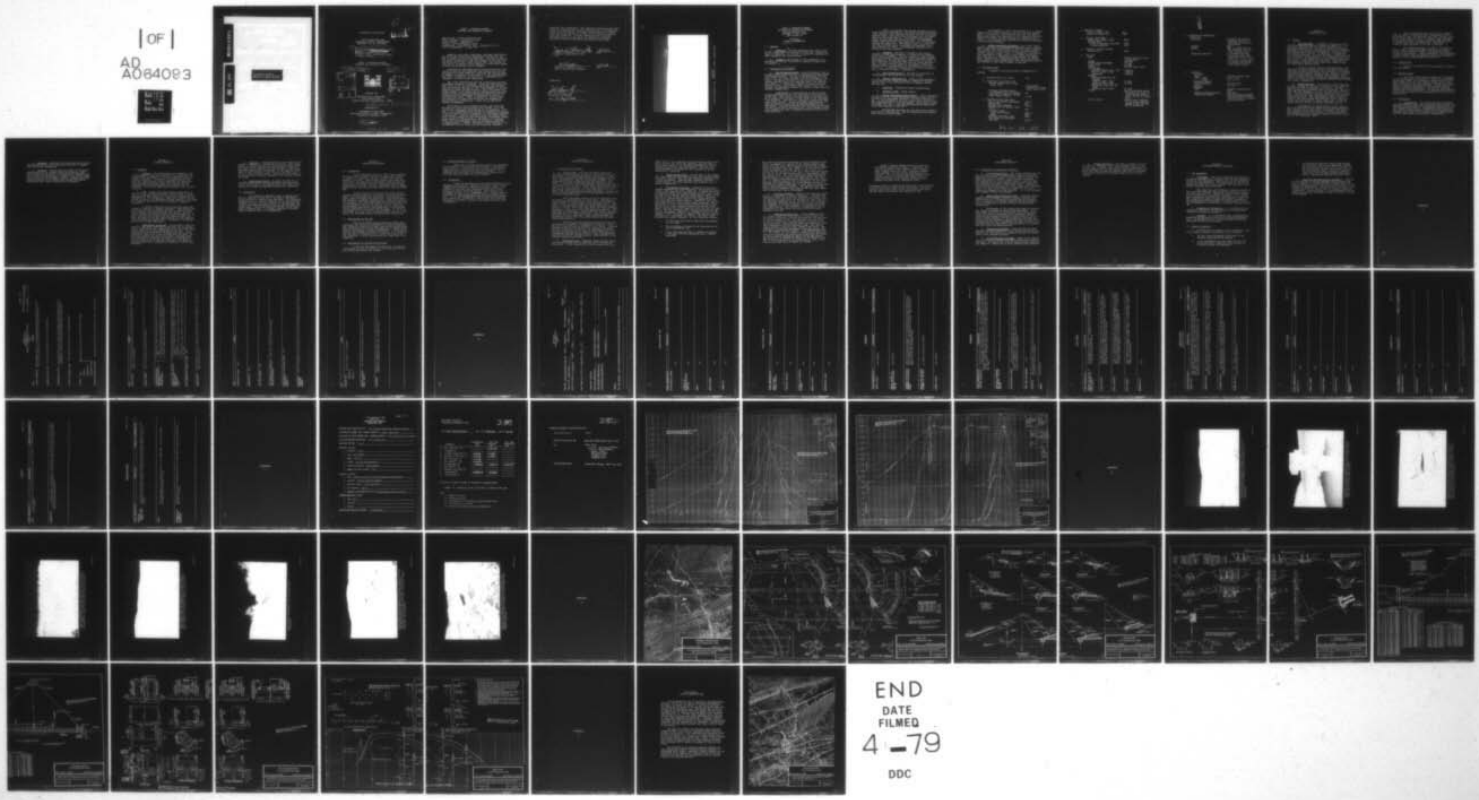
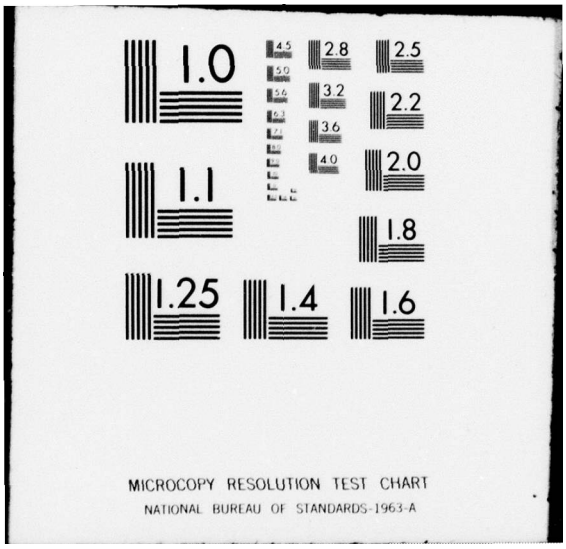
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LEVEL II

SCHUYLKILL RIVER BASIN

LITTLE SCHUYLKILL DAM
SCHUYLKILL COUNTY, PENNSYLVANIA
NATIONAL I.D. NO. PA-00655

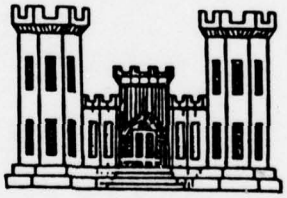
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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

(10) John H. /Frederick, Jr.
William S. /Gardner

(12) 76p.

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Prepared by:

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(15) DACW31-78-C-0048

Submitted to:

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

(11) June 1978

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Little Schuylkill Dam
County Located: Schuylkill County
State Located: Pennsylvania
Stream: Little Schuylkill Creek
Coordinates: Latitude 40° 50.2' Longitude 76° 0.3'
Date of Inspection: 23 May 1978

Based on the visual inspection, available records and the short past operational performance of this dam, the dam is judged to be in good condition. The dam is owned by the County of Schuylkill and was designed by the Soil Conservation Service as a flood control dam. The purpose of this dam is to control Little Schuylkill Creek which passes through the downstream town of Tamaqua.

Evaluation of watershed data provided by the Soil Conservation Service and hydrologic data associated with the upstream Still Creek Reservoir indicates that the spillway is capable of passing a flood similar to the probable maximum flood. Therefore, the spillway is considered to be "Adequate" for this "High" hazard dam.

The visual observations did not indicate any existing embankment instability problems. There was some minor erosion noted on the up- and downstream slopes and one small seep was observed adjacent to the right abutment of the dam immediately above the impact basin. Both the erosion and seepage appear to be stable but the seepage should be monitored and the relationship between the reservoir head and seepage quantity established to determine if there is a variation with time. Visual inspection of the principal and emergency spillways did not reveal any evidence of deterioration or instability. There are no additional studies recommended.

Since there is no dam tender on-site, and since the dam does not store water except during floods, it is believed that continuous surveillance is not necessary. However, it is recommended that the dam be inspected during and after each severe storm to determine if a hazardous condition is developing. Since the structure does not impound water, there is the possibility that desiccation (shrinkage) cracks could develop in the structure. Therefore, it is recommended that the embankment slope be thoroughly inspected at least annually. Should shrinkage cracks develop, it is recommended that the crack area be scarified, regraded,

compacted and revegetated. The inspection program should also check for vandalism and overall deterioration of the dam and appurtenant structures. The Owner should develop a maintenance inspection checklist to help insure that all critical items are inspected. A formal warning system should be developed for use in the event an emergency is noticed during the time the dam stores and passes large flows.

John H. Frederick, Jr., P.E.
Maryland Registration 3701

8/2/78
Date

W S Gardner

William S. Gardner, P.E.
Penna. Registration 004302E

8/2/78
Date

APPROVED BY:

John H Kenworthy III

JOHN H. KENWORTHY
LTC, Corps of Engineers
Acting District Engineer

DATE: 23 August 1978



OVERVIEW
LITTLE SCHUYLKILL DAM, SCHUYLKILL COUNTY, PENNSYLVANIA

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LITTLE SCHUYLKILL DAM
NATIONAL ID #PA 00655
DER ID #54-174

SECTION 1
PROJECT INFORMATION

ABSTRACT

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

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

ABSTRACT

1.2 Description of Project.

a. Dam and Appurtenances. Little Schuylkill Dam is a zoned rolled earth dam with a downstream drainage trench and drainage blanket. The dam is approximately 700 feet long and 87 feet high, measured from the streambed to the crest. The dam was designed to use available borrow materials derived within the reservoir area. The interior zone (Zone 1) is reportedly composed of sandy clays and gravelly clays. The exterior zone (Zones 2 and 3) materials are reportedly composed of gravelly clays and silty gravels, respectively.

Underseepage is controlled by a cutoff trench located approximately 80 feet upstream of the centerline of the dam. This trench is 40 feet wide at the base with 2H:1V slopes from the base of the trench to the stripping line elevation. The dam also contains a triple-line staggered grout curtain. Holes are spaced longitudinally 10 feet on-center and five feet up and downstream of the centerline. The upstream section has a riprap facing from the toe of the dam to elevation 1071, with a gravel filter layer between the Zone 2 embankment materials and the riprap protection.

Water is released from the dam through the principal spillway comprised of a two-stage reinforced concrete riser located at the upstream toe and a 48-inch reinforced concrete pipe. The outlet pipe discharges into an impact basin at the downstream toe. The stream flow normally passes through the lower intake orfice. If impoundment levels reach elevation 1048, additional flow is discharged through the upper weir. Thereafter, water is stored behind the structure until it reaches the emergency spillway elevation of 1103.0. The emergency spillway is located in the right abutment.

b. Location. The dam is located on the Little Schuylkill Creek approximately 3.2 miles north-northwest of the town of Tamaqua. The dam, reservoir, and drainage basin are located in Schuylkill, Carbon and Berks Counties, Pennsylvania. The dam was built concurrently with Neifert Creek Dam, located 800 feet west of Little Schuylkill Dam. The dam site and reservoir are shown on USGS Quadrangle Delano, Pennsylvania, at coordinates N 40° 50.2', W 76° 0.3'. A Regional Location Plan of Little Schuylkill Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as "Intermediate" by virtue of its 87 foot height.

d. Hazard Classification. "High" hazard because of the potential for extensive property damage and possible loss of life to the downstream town of Tamaqua, should the dam fail.

e. Ownership. Schuylkill County Commissioners.

f. Purpose of Dam. Flood control.

g. Design and Construction History. Little Schuylkill Dam was built as a flood retarding structure under the provisions of the Watershed Protection and Flood Prevention Act. It was designed by the Soil Conservation Service (SCS) and constructed by S.J. Groves Company. Construction began on October 10, 1967. Final design drawings and specifications were prepared by the SCS.

The Resident Engineer for the SCS during construction was Mr. John Mickley. The SCS inspectors were Messrs. Byron Roth and Eugene LaBar.

By September 5, 1968, the Contractor, S.J. Groves Company had finished topping out the 87 foot high embankment. At that date it was reported that the only work remaining was some rock excavation in the emergency spillway. Based on available records discussed in subsequent sections, it is concluded that the dam was built in accordance with the design drawings.

h. Normal Operating Procedures. As a "dry" flood control structure not designed for permanent water impoundment, normal flow passes directly into the lower intake of the concrete riser (see Plate 2) and is discharged downstream. During a storm, water is released at a controlled rate through the intake riser at two intake elevations. All other water is temporarily stored behind the embankment. During rare, exceptionally high flows, the system was designed to pass excess water over the emergency spillway located in the right abutment of the dam.

1.3 Pertinent Data.

A summary of pertinent data is summarized as follows:

a. Drainage Area (sq. miles)	15.6
b. Discharge at Dam Site (cfs)	
Maximum Known Flood at Dam (June, 1972)	2 feet below emergency spillway. Crest (Elev. 1101)
Principal Spillway (Water at Emergency Spillway Crest)	320
Combined Discharge at Maximum Pool (Elev. 1116.6)	37,500
c. Elevation (feet above MSL)	
Top of Dam (after settlement)	1116.6
Normal Pool	Dry
Maximum Pool Possible	1116.6
Maximum Pool of Record (June, 1972)	1101
Principal Riser	
Lower (Pond Drain)	1028.0
Upper	1048
Emergency Spillway Crest	1103
Exit Invert of Principal Spillway	1024.9

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d.	**Reservoir (miles)**	
	Length at Elev. 1103	1.7
	Length at Normal Pool	None
e.	**Storage (acre-feet)**	
	Normal Pool (Elev. 1028)	None
	Maximum Pool	
	Crest of Emergency Spillway	3698
	At PMF Elevation	6000
f.	**Reservoir Surface (acres)**	
	Normal Pool	None
g.	**Dam Data**	
	Type	Rolled earth with downstream drain
	Length	700 feet
	Height above streambed	87 feet
	Crest width	25 feet
	Volume	452,580 cubic yards
	Side Slopes	
	Upstream Crest to El. 1072	2.89H:1V
	From El. 1072 to toe	3.85H:1V
	Downstream	2.41H:1V
	Benches	
	Upstream slope has two benches	
	Width at Elev. 1072	25 feet
	Width at Elev. 1049	12 feet
	Downstream slope has one bench	
	Width at Elev. 1060	12 feet
	Cutoff	Two 40 foot wide cutoff trenches from 10+50 to 17+60 located approximately 80 U/S of centerline
	Grout Curtain	Triple line, staggered 10' on-center spacing. Spaced 5 feet U/S and D/S of centerline

h. Diversion and Regulating Facilities

Diversion	Streambed was used for diversion while the principal spillway was constructed.
Closure	None
Access	Only to intake and outlet structure of principal intake riser.
Regulating Facility	a) Intake riser pond drain inlet weir continuously drains reservoir: 3.5' x 4.0' inlet b) Excess flow passes into upper inlet with a 4.0' x 12.0' inlet

i. Spillway

Principal	
Type	Concrete intake riser
Size - Upper	4.0' x 12.0'
- Lower	4.0' x 3.5'
Discharge Conduit	
Size (Diameter)	48 inch (RCP)
Length	610 feet
Emergency	
Type	Channel excavated into rock
Width at Control Section	200 feet
Downstream Channel	Both Spillways discharge into the natural stream channel which has a gravel and rock bottom.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of engineering data on Little Schuylkill Dam is attached as Appendix A. Engineering data available for Little Schuylkill Dam was contained primarily in a 23-page set of half-size drawings provided by the United States Department of Agriculture, Soil Conservation Service. In addition, a 20-page set of full-size drawings, and flood routings, prepared by the U.S. Department of Agriculture, Soil Conservation Service, were on file at the Department of Environmental Resources main office in Harrisburg, Pennsylvania. Department of Environmental Resources (DER) files also contain a set of construction specifications.

The SCS archives located in Mechanicsburg, Pennsylvania, contain complete files on the design and construction of the dam including the following: Soil Mechanics and Geology reports, design folder, drawings, and construction documentation including daily records, field testing results for both concrete and embankment construction. All other pertinent documents available and reviewed are listed in Appendix A.

b. Design Features. The principal design features of Little Schuylkill Dam are illustrated on the plans and profiles enclosed in Appendix E as Plates 2 through 7. These plates were reproduced from SCS drawings. The drawings show the embankment to have a maximum height of 87 feet. The dam contains a central impervious core of sandy clays and gravelly clays with exterior zones of gravelly clayey sandy silts. The downstream section contains an interior drainage blanket and drainage trench. The upstream section contains a riprap layer over a filter material from the toe of the dam to elevation 1071.0.

Underseepage is controlled by a grout curtain and a 40-foot wide cutoff trench located approximately 80 feet upstream of the centerline of the dam. The tripleline stagger spaced grout curtain is constructed along the centerline of the emergency spillway and along a portion of the embankment zone.

The as-constructed upstream slope is 2.98H:1V from the crest to elevation 1072. From elevation 1072 to elevation 1071, the upstream slope has a 25-foot wide berm. Below elevation 1071, a 3.85H:1V slope continues to elevation 1049.0. Between elevations 1049 and 1048, a 12-foot wide berm was constructed. Thereafter, a 3.85H:1V slope continues to the toe of the dam.

The downstream slope is 2.41H:1V to elevation 1061.0 with a 12-foot wide berm sloping to elevation 1060.0. Below elevation 1060.0, the slope is 2.41H:1V to the toe of the dam. Design features of the reinforced concrete intake riser and emergency spillway are shown on Plates 5 and 6 and discussed in Section 1.2.

2.2 Construction.

Details of construction are presented in Section 1.2, paragraph g.

2.3 Operation Data.

As a "dry" flood control structure, the design of Little Schuylkill Dam allows all water to be released. During high flows, this release is controlled by the intake system built into the concrete riser and the emergency spillway on the right abutment. There are no staff gages or recording equipment nor are records of water surface elevations maintained. The dam is accessible during high flow periods and it is reported that reservoir water surface elevations are monitored by the local Civil Defense Unit.

2.4 Evaluation.

a. Availability. All engineering data evaluated and reproduced for this report was provided by either the Pennsylvania Department of Environmental Resources or the Soil Conservation Service. Supplemental data including the complete design analysis and as-built documentation, together with construction records are available through the SCS State Office in Harrisburg, Pennsylvania.

b. Adequacy. Although the design data which exists and computed by the Soil Conservation Service is comprehensive and well-documented.

c. Validity. Design drawings showed the proposed borrow source to be located within the reservoir area. Discussions with the Owner's representative confirmed the use of these borrow materials. Based on the visual inspection and the ten photographs available, together with the design drawings, it is judged that the dam and appurtenances were most likely constructed as designed.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B, and are summarized and evaluated as follows. In general, the appearance of the facility, based on the visual inspection and comparison with the design drawings, shows that the dam and its appurtenances were constructed in accordance with the drawings. The dam and appurtenances appear to be in good condition.

b. Dam. During the visual survey, there were no indications or evidence observed of distortions in alignment or grade that would be indicative of movement of the embankment or the foundations. Some minor erosion was observed on the up- and downstream slopes, however, the slopes are vegetated with crown vetch and presently appear to be stable.

A careful inspection of the upstream slope disclosed no evidence of seepage emergence. Some seepage was observed within the reservoir area and is typical of natural seepage patterns throughout the region. No downstream seepage was observed along the left abutment of the dam. Only one very slight seep was observed along the right abutment of the dam, approximately 50 feet upstream from the discharge impact basin. In general, the dam appears to be in good condition.

c. Appurtenant Structures. At the time of this inspection, the water level was at the base of the control riser. Some debris has accumulated around the riser allowing the water to back-up approximately one foot. It is understood from the Owner's representative that a local contractor cleans this riser at least once per year. Debris was noted on the top of the riser, indicating that flood waters had inundated the riser to an elevation of at least 1050 prior to the last clean-up. All appurtenant structures were inspected and observed to be in good condition.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of significant siltation, slope instability, or other features that would significantly effect the flood storage capacity of the reservoir. One minor surficial slope slide was observed on the reservoir slope near the left abutment of the dam. At the base of this slide, a small seep was noted. Typical for this area, it is believed that sidehill seepage at this location caused the slide.

e. Downstream Channel. As shown on Photo No. 6, the downstream channel is predominantly rock and gravel lined. Both sides of the channel below the impact basin are heavily wooded and densely covered with vegetation.

3.2 Evaluation.

No evidence of apparent, past or present movement to indicate instability of the dam or embankment during periods of retention was detected. The inspection revealed that the overall condition of the dam and appurtenances is good. The only feature of note detected was a small seep emerging near the base of the dam above the impact basin. This seep should be watched during subsequent investigations. If seepage increases or becomes turbid, remedial action is recommended.

SECTION 4
OPERATION PROCEDURES

4.1 Procedures.

Little Schuylkill Dam is a "dry" flood retention structure which controls the rate of storm water runoff by means of a two-stage vertical concrete riser and an emergency spillway. Under normal stream flow conditions, all water is discharged into the lower intake of the concrete riser and passed through a 48-inch reinforced pipe located below the dam. The pipe discharges into an impact basin and the flow subsequently enters the natural streambed.

During high flow conditions, the water passes through the lower intake at a controlled rate while excess water is stored behind the embankment. When the water level rises and reaches the upper weir at elevation 1048, the discharge increases significantly. Water is stored in the reservoir until the impoundment level reaches the crest of the emergency spillway at elevation 1103. Flow over the emergency spillway is discharged into the downstream channel immediately below the impact basin. All systems are ungated and do not require an attendant. It is to be noted that the riser crest (elevation 1048) was set at the top of the estimated 50-year sedimentation accumulation.

4.2 Maintenance of the Dam.

The dam is owned by the Schuylkill County Commissioners who contract maintenance to a local contractor. The contractor cleans the intake riser yearly and performs other maintenance of the dam and reservoir as deemed necessary by the Schuylkill County Commissioners. There are no official maintenance procedures available. It is reported that the dam is inspected prior to each maintenance and the contractor is given instructions as to the work to be completed.

4.3 Maintenance of Operating Facilities.

Since the operating facilities are all ungated, maintenance consists of inspecting the structures for debris collection around the intakes.

4.4 Warning Systems in Effect.

There are no formal warning systems or procedures established to be followed during periods of exceedingly heavy rainfall. During high flows, access to the dam for inspection can be gained from the left abutment. It is reported that the local Civil Defense Unit monitors the structure during periods of heavy rainfall.

4.5 Evaluation.

Since the dam does not store water permanently, the embankment could not be inspected to evaluate how it would respond under reservoir loading conditions. There is no evidence to indicate that hazardous conditions develop during this short retention period. Since there is no attendent on-site, it is recommended that a formal warning procedure be implemented during periods of extreme rainfall. It is also recommended that a maintenance procedure and checklist be formulated to assure that all items are periodically checked, including the downstream seep noted in Section 3.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. Original available design data was limited to statements located in the State Files, particularly in the Application Report, dated June 2, 1966, and flood routings performed by the Soil Conservation Service. Subsequently, the SCS files were reviewed. The watershed contains an upstream dam and reservoir, Still Creek. The latest USGS maps indicate a drainage area of 6.9 square miles for Still Creek versus the 8.7 square miles used in SCS flood routing. Still Creek watershed is long and narrow, approximately 3.8 miles long and 1.4 to 2.4 miles wide, the long direction being east-west. Still Creek Dam is located approximately 2.3 miles upstream and east of Little Schuylkill Dam.

The north-south portion of Little Schuylkill Dam watershed is approximately 3.7 miles long. The shape of the watershed is funnel-shaped, with the east-west portion about 9 miles (including Still Creek drainage basin). The width of the watershed 4,000 feet above the dam is approximately 2.1 miles. The elevations range from 1950 on Spring Mountain to 1130 feet at the upstream toe of the dam. The watershed is mountainous, about 90 percent wooded, sparsely populated and with some new housing. It is not expected that the area will experience rapid growth although the possibility exists that strip mining may alter the watershed characteristics.

Original spillway capacity calculations rate the spillway to be capable of discharging a total of 13,700 cfs at design high water (elevation 1111.3 feet). Combined spillway capacity with the reservoir level at the top of the dam is rated as 37,550 cfs. In accordance with the criteria established by the Federal (OCE) Guidelines, the recommended spillway design flood for this "Intermediate" size dam and "High" hazard potential classification is the probable maximum flood (PMF).

b. Experience Data. Reservoir water surface elevations during floods are not measured and no records are maintained. It was reported by a local resident that the

water level in the reservoir during Hurricane Agnes (June 1972) was two feet below the emergency spillway crest, which would result in an estimated discharge of 350 cfs through the principal spillway system. The June 1972 storm produced 5.28 inches of rain recorded at the upstream Still Creek Dam.

c. Visual Observations. On the date of the inspection, no conditions were observed that would indicate that the outlet capacity would be significantly reduced during a flood occurrence. Observations regarding the downstream channel, spillway condition and reservoir are located in Appendix B.

d. Overtopping Potential. Analysis of the overtopping potential of Little Schuylkill Dam required evaluation of the upstream Still Creek Dam. A design storm and a freeboard storm, which approximates the PMF, were routed through Still Creek by the Soil Conservation Service (SCS). The Still Creek storms were developed using a drainage area of 8.7 square miles, which is not supported by current USGS maps (6.9 square miles). Therefore, the calculated peak inflow of the routed storms is greater than it should be as is the routed peak outflow from Still Creek. The SCS Still Creek routings indicate the design storm passes through Still Creek reservoir with two feet of freeboard. The SCS freeboard (PMF) routing indicates the dam will be overtopped. However, no statement as to the overtopping of Still Creek Dam is made in any reports, correspondence, etc., available for review. The Still Creek spillway was judged "Adequate" for the following reasons:

1. The drainage area used in PMF storm development is too large;

2. SCS procedures are known to be conservative for small watersheds; and

3. Still Creek Dam Spillway is capable of passing a PMF peak inflow as estimated from a similar watershed.

The inflow hydrographs developed for Little Schuylkill Dam (shown in Appendix C) consist of the routed outflow from Still Creek Dam (peak PMF discharge of 22,200 cfs, conservatively assuming time lag), added to the intervening area inflow hydrograph (peak PMF inflow of 16,700 cfs) for a total peak PMF inflow of 38,200 cfs. This storm was routed and the top of the dam was set equal to the maximum reservoir water level. The intervening area hydrograph was developed based on an area of 6.88 square miles, less than the 7.79 square miles determined from USGS maps and, therefore, is slightly smaller than it should be. As the total drainage area contributing to Little Schuylkill Dam (as disclosed by current USGS maps) is less than the total area used in the hydrologic analysis. The expected peak PMF inflow would be somewhat less than 38,200 cfs, and, therefore, the dam will not be overtopped.

e. Spillway Adequacy. Based on the available information, the spillway is judged "Adequate". The two-stage discharge system (principal and emergency spillways) and the upstream reservoir are not suitable for the flood routing technique suggested by the January 25, 1978, Preliminary Engineer Technical Letter No. 1110-2 and, therefore, the judgement of spillway adequacy is qualitative rather than quantitative. The tailwater is estimated to be approximately 50 feet below the crest of the dam during passing of the PMF.

f. Downstream Conditions. Little Schuylkill Dam is a flood control structure built in conjunction with the Neifert Creek Dam, located approximately 800 feet west of Little Schuylkill Dam. The drainage area controlled by Neifert Creek Dam is approximately 3.1 square miles. Little Schuylkill joins Neifert Creek approximately 1,000 feet downstream of Little Schuylkill Dam. The channel passes through a 400-foot wide, wooded flood plain. Approximately 3,000 feet downstream of the dam is the Central New Jersey Railroad tressel. (See Photographs 5 and 6). The tressel is not likely to significantly obstruct large flow although the possibility exists that the tressel piers would be damaged by debris if the dam failed. The potential for downstream damage was estimated by the SCS in the watershed work plan dated April, 1958. A section of this work plan is quoted as follows:

"Severe flooding damage occurs periodically at Tamaqua (population 12,000), at Reynolds, location of the Atlas Powder Company, and on several other reaches along the river. Flooding damages start between a 5- and 10-year frequency of occurrence. The high stream gradient produces velocities capable of causing great damage even at bank-full stages to the Reading Railroad's main branch along the Little Schuylkill River".

Consistent with the "High" hazard potential classification of this structure, significantly more damage, including loss of life, would occur if the structure failed during the PMF than if it did not fail during the PMF.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The visual observations did not indicate any existing embankment stability problems. There are some minor erosion gullies noted on the up- and downstream slopes, however, these have been overgrown with vegetation and are currently stable. The only seepage observed was a small seepage zone located along the right abutment upstream of the impact basin. Evidence of vegetation around the seep and of the seep itself indicates that it is most likely sidehill seepage and not associated with seepage from the reservoir. It is not believed that remedial action is necessary.

b. Design and Construction Data. Available design documentation included a series of design drawings prepared by the Soil Conservation Service for this project and a complete set of design computations are on file at the Soil Conservation Service office in Mechanicsburg, Pennsylvania.

Photographs of the construction tend to confirm that proper placement and zoning were performed. It is also noted that the Soil Conservation Service had representatives on-site throughout the construction period. Since the photographs confirmed the existence of the interior design features and the inspection confirmed the exterior design features, coupled with the fact that Soil Conservation Services' representatives were on-site, it is believed that the construction was performed in accordance with the plans and specifications.

c. Operating Procedures. Since the dam has been designed to only temporarily retain water and control the rate of flow downstream by an unmanned regulatory system, there are no records available.

d. Post-Construction Changes. There are no reports nor is there any evidence that modifications were made to this dam. The design and as-built drawings were available and compared. There were no major modifications observed.

e. Seismic Stability. This dam is located in Seismic Zone 1. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. Since the static stability analysis could not be reviewed, the seismic stability of the dam could also not be evaluated.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Assessment. The visual inspection and review of the design documentation indicates that the dam embankment, foundation and appurtenant structures of Little Schuylkill Dam are in good condition. The involvement of the SCS in design and construction also suggests that the dam is adequately designed and constructed.

The hydrologic and hydraulic routings included in the available design documents indicated that this structure will pass the PMF. Therefore, the discharge systems of the structure are considered "Adequate". It is noted that although the structure has been designed to pass the PMF, significant property damage potential is likely to the downstream town of Tamaqua if a catastrophic failure of the embankment occurred while retaining a portion of the PMF.

b. Adequacy of Information. It is judged that the information available for the purpose of the prescribed inspection program was adequate.

c. Urgency. It is considered that recommendations suggested be implemented during the routine maintenance work. Recommendations for written procedures should be performed as soon as practicable.

7.2 Remedial Measures.

a. Considering the results of this inspection, specific remedial measures recommended are as follows:

1. The log currently wedged at the base of the entrance tower should be removed.

2. It is recommended that the Owner monitor the downstream seep, especially after periods of retention behind the embankment.

3. A relationship should be established between the reservoir head and the quanities of seepage existing on the right side of the dam. If the relationship between the seepage quanities and the reservoir pool is found to increase with time or the seepage becomes excessive or turbid, appropriate measures should be taken.

b. Operation and Maintenance Procedures. Because of the location of the dam upstream from the populated area of Tamaqua, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. The Owner should develop a maintenance checklist to insure that all critical items are inspected on a periodic basis. It is recommended that the trash racks be kept thoroughly cleaned to prevent clogging of the system.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Little Schuylkill Dam*

ID # *PA 00655*

ITEM	REMARKS
AS-BUILT DRAWINGS	*None available. SCS 1/2 size design drawings were available, 23 sheets. SCS full size drawings were also available, 15 sheets, # PA-422A-P.*
REGIONAL VICINITY MAP	*This data was included in the SCS design drawings.*
CONSTRUCTION HISTORY	*None in DER files, but several miscellaneous letters inferred the state of progress. Two sets of field books, "Job Diary" and "Constructions Records" are on file in SCS archives, Mechanicsburg, Pennsylvania.*
TYPICAL SECTIONS OF DAM	*This data was included in the SCS design drawings.*
OUTLETS - PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	*This data was provided with the SCS design drawings.*
RAINFALL/RESERVOIR RECORDS	*None available other than data upstream at Still Creek Reservoir.*

ITEM	REMARKS
DESIGN REPORTS	*A copy of the prepared specifications is contained in the DER files. Design reports located in SCS archives.*
GEOLOGY REPORTS	*None in DER files, located in SCS archives.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*(1) Preliminary storm routing data provided on 4 SCS sheets dated 1963 and 1964.* *(2) Design computations were referenced in a letter dated June 6, 1966 to Mr. Lunetta from Mr. Right (SCS) but data was not in DER files.* *(3) Complete design computations located in SCS archives.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*(1) Dam profiles and borings are presented on SCS design drawing PA-422-P, sheet 4 of 20 dated May, 1966, entitled " Profiles of Dam and Emergency Spillway".* *(2) Logs of drill holes presented on Drawing PA-422-P, sheets 14 through 18 of 18.* *(3) Soil compaction data presented on Drawing PA-422-P, sheet 20 of 20 dated May, 1966.*
POST-CONSTRUCTION SURVEYS OF DAM	*None.*
BORROW SOURCES	*Data provided on SCS design drawing PA-422-P, sheet 2 of 20 dated May, 1966, entitled "Plan of Storage Area".*

ITEM	REMARKS
MONITORING SYSTEMS	*None.*
MODIFICATIONS	*None.*
HIGH POOL RECORDS	*None.*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None. Only a few from inspection reports.*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None.*
MAINTENANCE OPERATION RECORDS	*None. The structure is used solely as a flood control structure and does not retain water.*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*Data provided on SCS drawings.*
OPERATING EQUIPMENT PLANS & DETAILS	*None other than open spillway and intake structure.*
PHOTOGRAPHS	*The DER files contained several (8 to 12) black and white photos of construction and post construction Pennsylvania State (DER) inspection records.*

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Little Schuylkill River Dam* County *Schuylkill* State *Pennsylvania* National ID # *PA 00655*

Type of Dam *Rolled Earth* Hazard Category *I (High)*

Date(s) Inspection *23 May 1978* Weather *Mild* Temperature *65°F*

Pool Elevation at Time of Inspection *1028* M.S.L. Tailwater at Time of Inspection *1025.4* M.S.L.

Inspection Personnel:

Mary Beck (Hydrologist) *Vincent McKeever (Hydrologist)*

John Boschuk (Geotech/Civil) *Raymond Lambert (Geologist)*

John Frederick (Geotechnical)

John Boschuk, Jr. Recorder

Remarks:

Mr. Hugo Subrime - Owner's representative was on-site and provided assistance, as necessary.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	*N/A*	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	*N/A*	
DRAINS	*N/A*	
WATER PASSAGES	*N/A*	
FOUNDATION	*N/A*	

CONCRETE/MASONRY DAMS

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

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*Some minor erosion was observed on the downstream slopes and abutments as a result of motor bike traffic. On the upstream slope, grass covered gullies up to 12 inches deep and 15 inches wide were observed. These D/S gullies appear to be old and relatively stable.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*No unusual movement was observed.*	
RIPRAP FAILURES	*None observed.*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ABUTMENT OBSERVATION	*A small hillside slope failure was noted in the left abutment on the upstream side of the embankment. The slope failure was in natural material, not on the embankment. A seep emerges from the toe of the slope slough and is probably responsible for the failure. The slough measures about 15 to 20 feet in diameter with a 10 to 12 foot depth.*	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*No significant erosion or other deterioration features were observed.*	
ANY NOTICEABLE SEEPAGE	*Only one significant seepage zone was noted at the junction of the dam and the right abutment on the downstream side. Moss is growing in the area and is shown on Photo 8, Appendix D. Other noted seepage was in the reservoir area eminating from several zones near the stream channel.*	
STAFF GAGE AND RECORDER	*None*	
VEGETATION	*Some woody vegetation, including trees, are starting to grow on the slopes. These should be removed as soon as practicable.*	
DRAINS	*None observed.*	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT —	*The only portion of the outlet structure that was visible was the pipe outfall in the baffle wall structure. It appeared to be in good condition. The rest of the pipe is buried in the dam.* —	
INTAKE STRUCTURE	*Two stage reinforced concrete riser, each stage protected by a trash rack. Lower stage had 3 ft. diameter, 8 to 10 ft. long log and other debris wedged against trash rack and upper trash rack had debris on top. There was no spalling or significant deterioration observed.*	
OUTLET STRUCTURE	*A four ft. reinforced concrete pipe, 609 ft. long, discharging into an impact basin. At time of the inspection, the pipe was flowing greater than one-half full and the system appeared to be performing satisfactorily. The baffle wall and outfall structure appeared to be in good condition.*	
OUTLET CHANNEL	*Outlet channel is riprapped for approximately 50 ft. downstream of the impact basin. No erosion in either riprapped channel or natural channel further downstream was observed.*	
EMERGENCY GATE	*None.*	

UNGATED SPILLWAY

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*None. The spillway is approximately 200 feet wide and is cut into the rock through the right abutment. The bedrock which makes up the emergency spillway base and portion of the right (west) abutment is the shaley member of the Pocono Formation. This rock slakes and may result in localized rock falls in the spillway area. Also the sandstone is blocky and can fall into the spillway area from near-vertical rock cuts.*	
APPROACH CHANNEL	*About 100 feet long with approximately two percent reverse grade. Rock talus forming at base of right wall at several locations, not expected to reduce flow significantly during large flows. Few trees up to 4 to 5 years old at entrance to channel. Should be removed.*	
DISCHARGE CHANNEL	*The channel section is cut through the right abutment and is approximately 200 feet long with a 2½+ percent grade. Thereafter the channel drops abruptly at an approximately 60 percent slope and drains into the natural creek channel.*	
BRIDGE AND PIERS	*None. However, there is a railroad tressel approximately 1700 feet downstream. A photo can be found in Appendix D.*	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*None*	—
APPROACH CHANNEL	*None*	
DISCHARGE CHANNEL	*None*	
BRIDGE AND PIERS	*None*	
GATES AND OPERATION EQUIPMENT	*None*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER	*None. A rain gage can be located upstream at Still Creek Reservoir (National I.D. No. PA 00700, State DER ID 54-111).*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*Little Schuylkill is a dry dam, the reservoir side slopes are moderate to steep, stable, well vegetated.*	
SEDIMENTATION	*A minimal amount of sedimentation was observed in the reservoir which would not reduce the design flood water storage capacity. There is some debris noted along the reservoir which marks the flood high water line.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*The only major obstruction noted downstream is the steel railroad tressel about 1700 feet downstream of the outfall structure. The flood plain as shown on Photo 6 is heavily wooded.*	
SLOPES	*Side slopes appear to be stable and wooded to the channel bank. The valley gradient is approximately one percent or less.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*Approximately 4.5 miles downstream there are a large number of houses and businesses in the town of Tamaqua.*	

APPENDIX

C

LITTLE SCHYULKILL DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *90 % wooded, mountainous, sparsly populated*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *none- a "dry" dam*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *1116.6 (5940 Ac-Ft top of dam)*

ELEVATION MAXIMUM DESIGN POOL: *1113.3 (4940 Ac-Ft)*

ELEVATION TOP DAM: *1116.6*

EMERGENCY SPILLWAY:

a. Elevation *1103.0*

b. Type *rock channel*

c. Width *200 feet*

d. Length *300 feet along centerline*

e. Location Spillover *right abutment*

f. Number and Type of Gates *none*

PRINCIPAL SPILLWAY:

a. Type *concrete riser, 48" concrete conduit and impact basin*

b. Location *150 feet from left abutment*

c. Entrance inverts *1028.0 and 1048.0*

d. Exit inverts *1024.9*

e. Emergency draindown facilities *through ungated orfice at 1028.0*

HYDROMETEOROLOGICAL GAGES:

a. Type *none*

b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: *not determined*

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

Date: 6/25/78
By: MFB
Sheet: 2 of 5

DAM Little Schuylkill Dam Nat. ID No. PA00635 DER No. 54-174

	ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1.	Min. Crest Elev., ft.		1116.6 ft.	
2.	Freeboard, ft.			
3.	Spillway[1] Crest Elev, ft.	1048 ft.	1048 ft	
3a.	Secondary[2] Crest Elev, ft.	1103 ft	1103 ft	
4.	Max. Pool Elev., ft.	1111.3 ft		
5.	Max. Outflow[3], cfs	37,500 cfs		
6.	Drainage Area, mi^2	15.58 mile^2	15.58 mile^2	14.69 mile^2
7.	Max. Inflow[4], cfs			
8.	Reservoir Surf. Area, ft^2			
9.	Flood Storage[5]	3698 Ac-Ft	3698 Ac-Ft	
10.	Inflow Volume, ft^3			

Reference all figures by number or calculation on attached sheets:

Example: 3A - Drawing No. xxx by J. Doe, Engr., in State File No. yyyy.

NOTES:

(1) Principal spillway

(2) Emergency spillway

(3) At maximum pool, with freeboard, ungated spillways only.

(4) For columns B, C, use PMF.

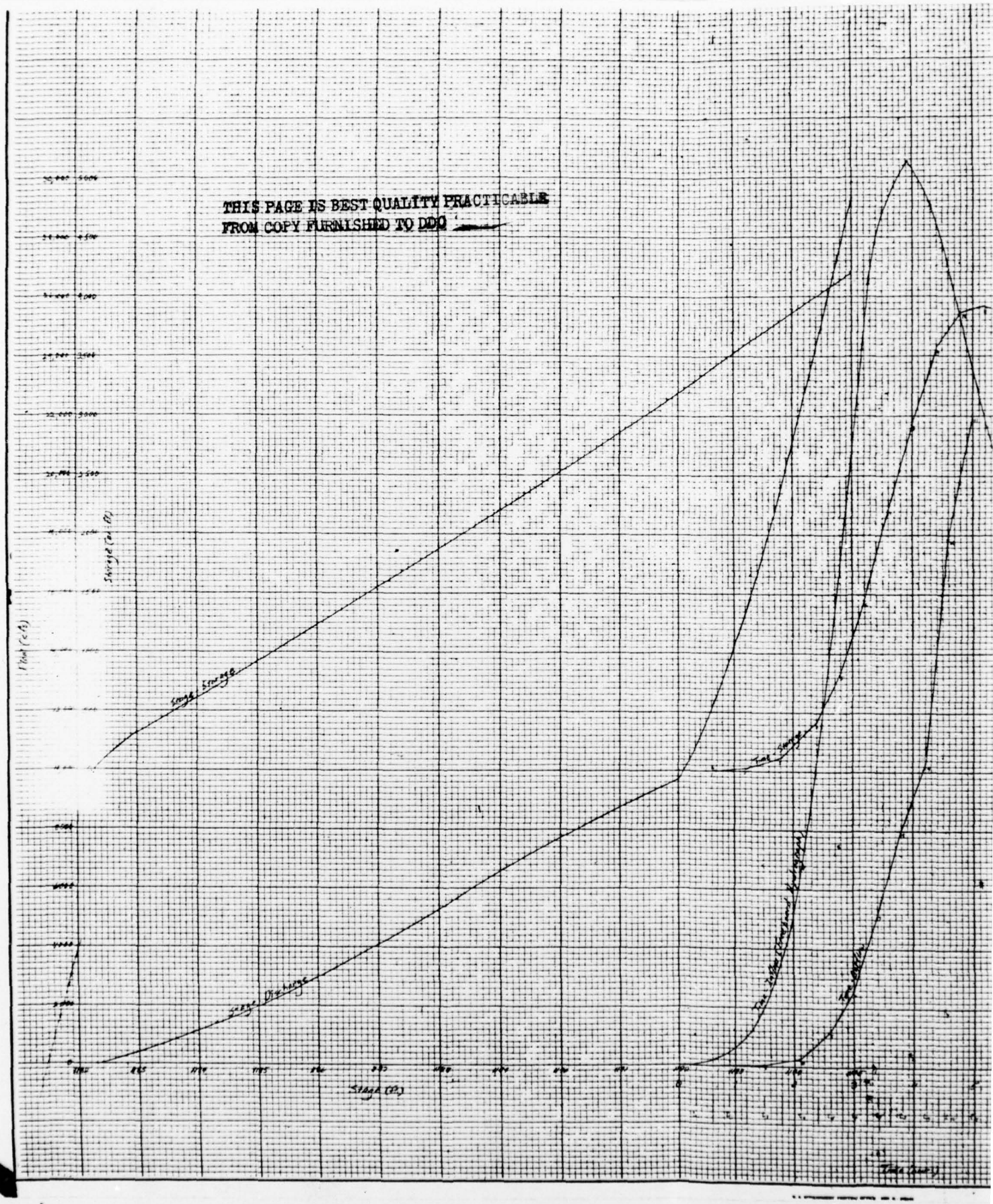
(5) Between lowest ungated spillway and maximum pool.

Date: 6/25/78
By: MFB
Sheet: 3 of 5

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Item (from sheet 2)	Source
3A, 3aA, 4A, 5A, 6A, 9A	Application Report dated June 2, 1966
6C	USGS Maps 6.9 mile^2 Still Creek Reservoir 7.79 mile Intervening Area Delano (1969) Conyngham (1969) Tamaqua (1976) Hazelton (1969)
1B, 3B, 3aB, 6B, 9B	Construction Drawings dated June 1966

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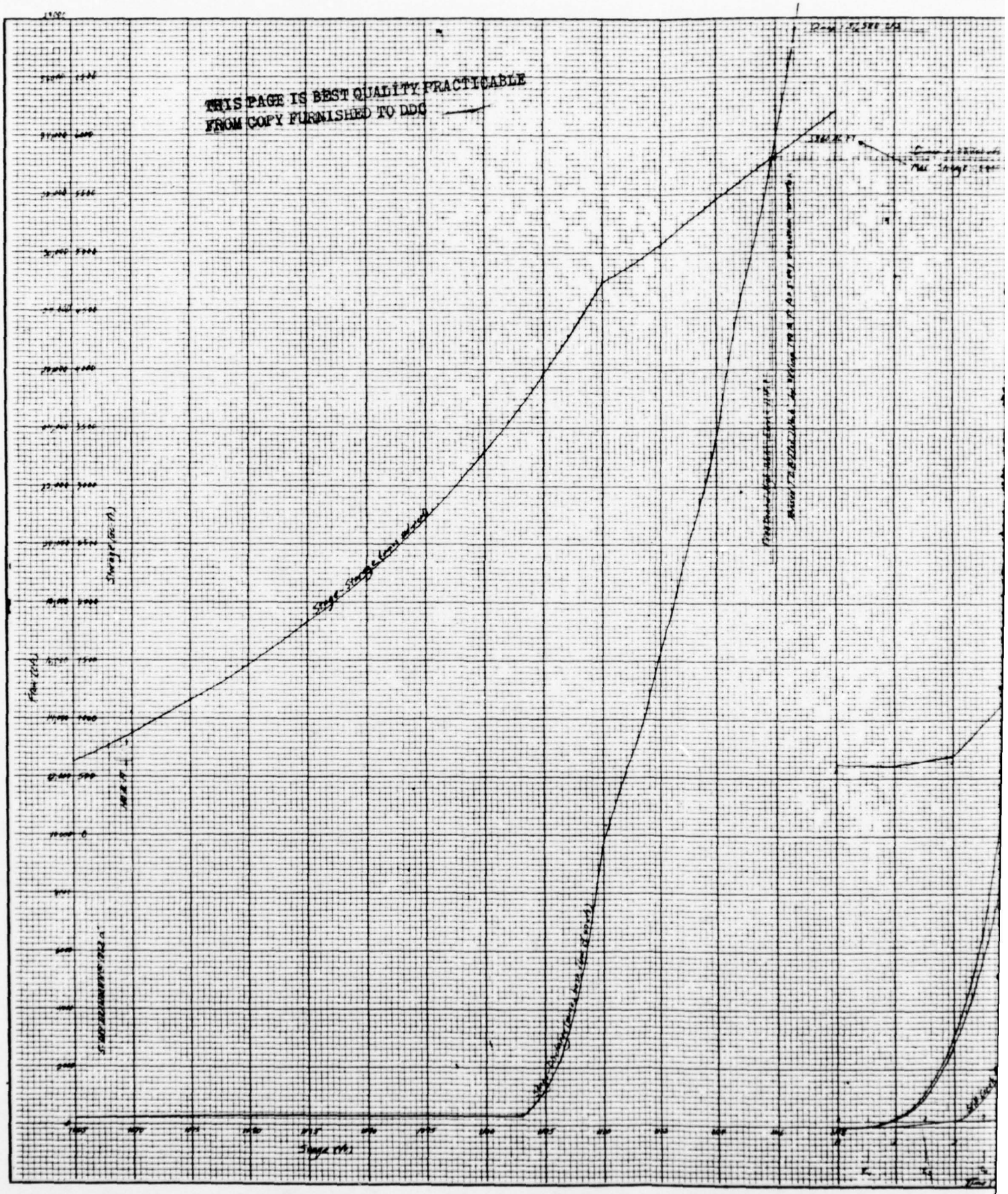
Sheet 4 of 5
PA DER File 54-174

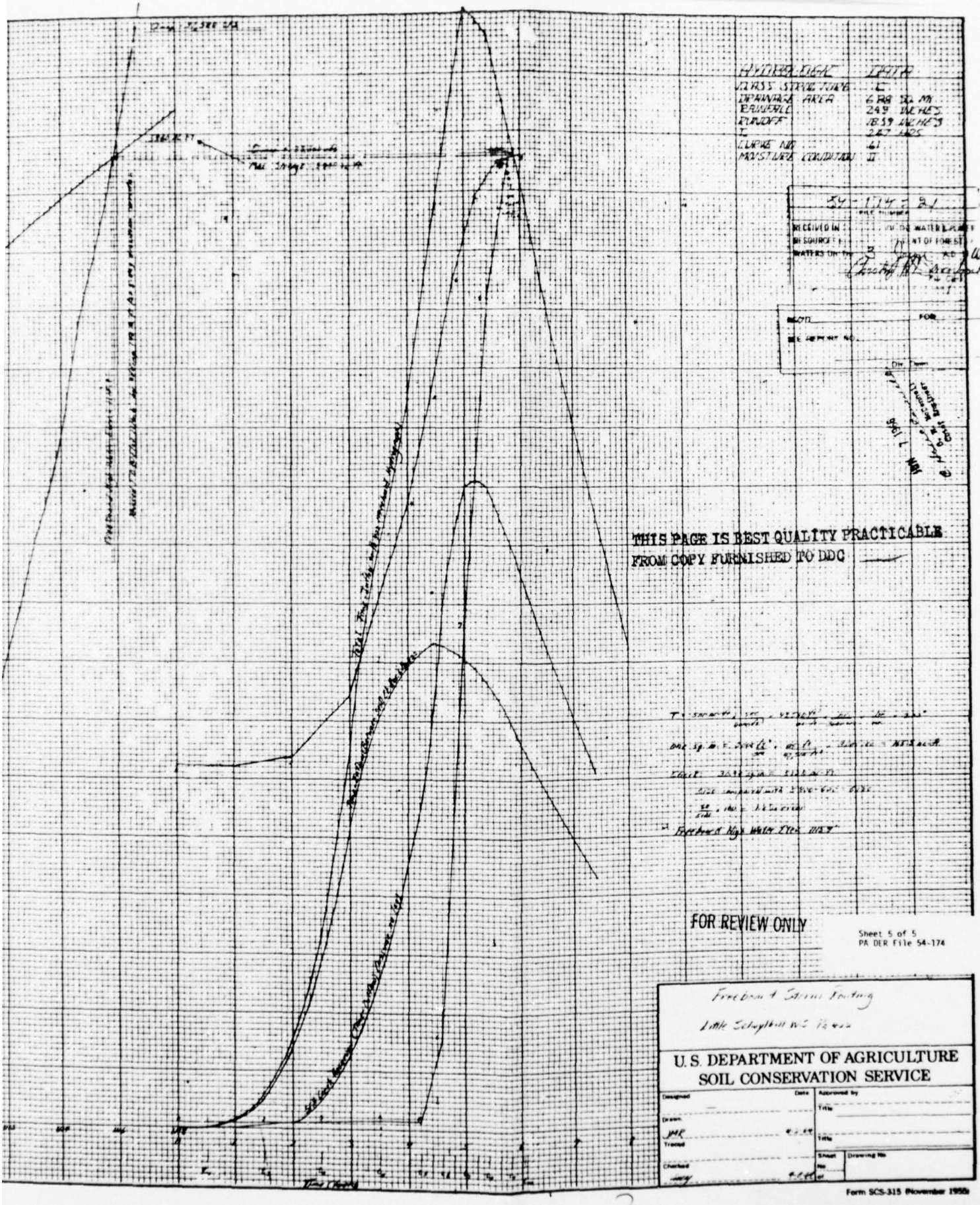
Freeboard Storm Routing
Little Schuylkill W.S.
Still Creek Reservoir

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by	Title
Drawn			
JMF Traced			Title
Checked JMF	12/9/93	Sheet No. of	Drawing No.

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HYDROLOGIC DATA
WATERSHED AREA 6.88 SQ. MI.
RAINFALL 2.49 INCHES
RUNOFF .839 INCHES
CURVE NO. 61
MOISTURE CONDITION II
FOR
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Sheet 5 of 5
PA DER File 54-174
Freeburn Storm Routing
Little Schuylkill W.S. 12
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Drawn
Traced
Checked
Approved by
Title
Sheet No.
Drawing No.
Form SCS-315 (November 1958)

APPENDIX

D



VIEW FROM RIGHT ABUTMENT. UPSTREAM SECTION IS ON LEFT SIDE OF PHOTO AND EMERGENCY SPILLWAY CHANNEL IS IN FOREGROUND.

PHOTO NO. 1



PRINCIPAL SPILLWAY ENTRANCE WITH TWO INTAKE LEVELS.
NOTE TRASH ACCUMULATION AT ENTRANCE OF LOWER INTAKE.
TRASH ALSO LIES ON UPPER INTAKE.

PHOTO NO. 2



PRINCIPAL SPILLWAY OUTFALL STRUCTURE AND STILLING BASIN. THE PIPE DISCHARGES WATER AGAINST A BAFFLE WALL (SHOWN) AND THE WATER PASSES UNDER AND THROUGH NOTCHES ON EACH SIDE OF THE WALL.

PHOTO NO. 3



VIEW OF EMERGENCY SPILLWAY AND RIGHT WALL OF SPILL-
WAY CHANNEL. THE ROCK FACE CONSISTS OF SOUTH DIPPING
SANDSTONE AND SHALE OF THE MAUCH CHUNK FORMATION.

PHOTO NO. 4



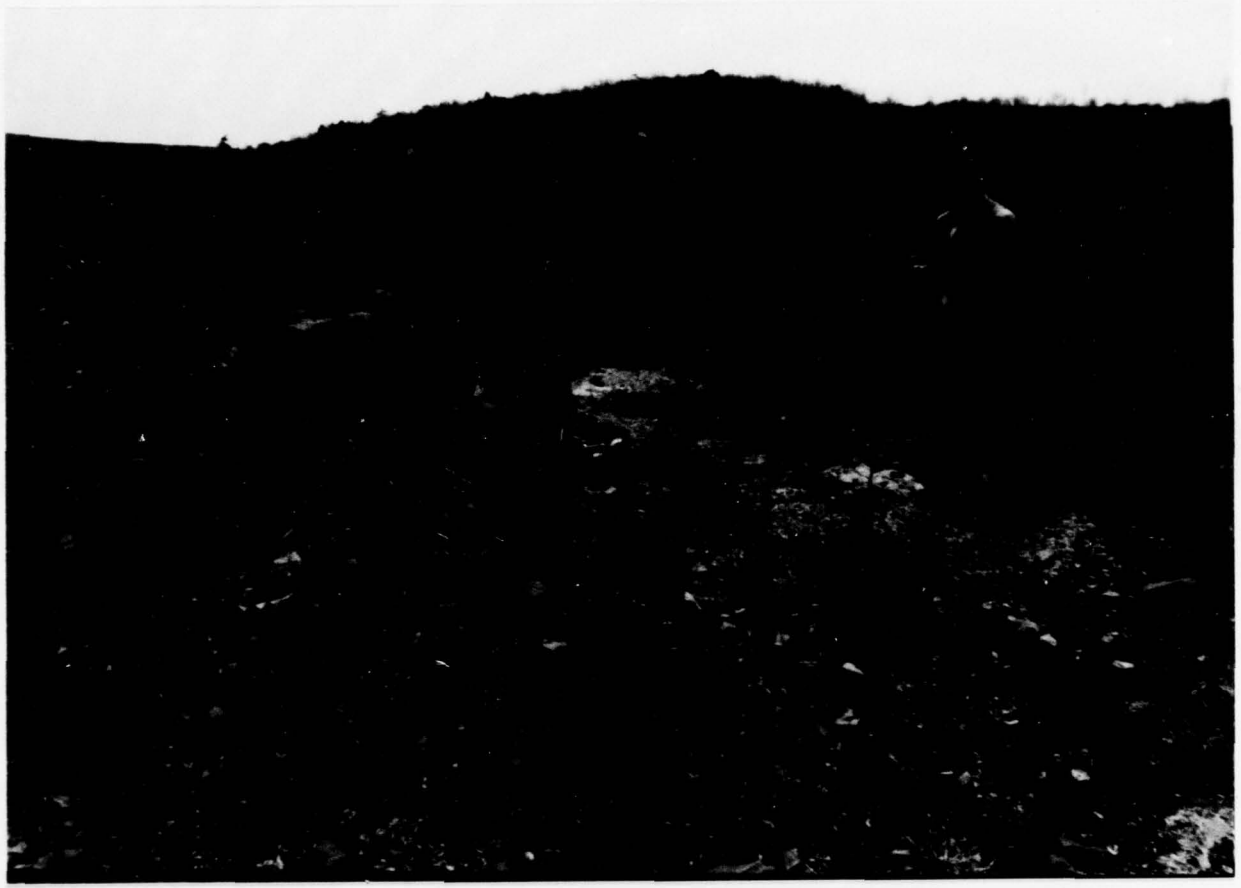
VIEW LOOKING DOWN THE EMERGENCY SPILLWAY CHANNEL WHICH ENTERS INTO THE STREAM BELOW. THE SOIL MANTLE WHICH SUPPORTS THE GROWTH OF GRASS IS VERY THIN.

PHOTO NO. 5



VIEW LOOKING DOWNSTREAM. NOTE RAILROAD BRIDGE DOWNSTREAM.

PHOTO NO. 6



VIEW LOOKING ACROSS EMERGENCY SPILLWAY TORWARD THE DAM. UPSTREAM SECTION OF DAM IS ON LEFT. NOTE TRIPLE LINE GROUT CURTAIN PIPES INDICATED BY GEOLOGIC HAMMER, FLASHLIGHT AND INSPECTOR.

PHOTO NO. 7

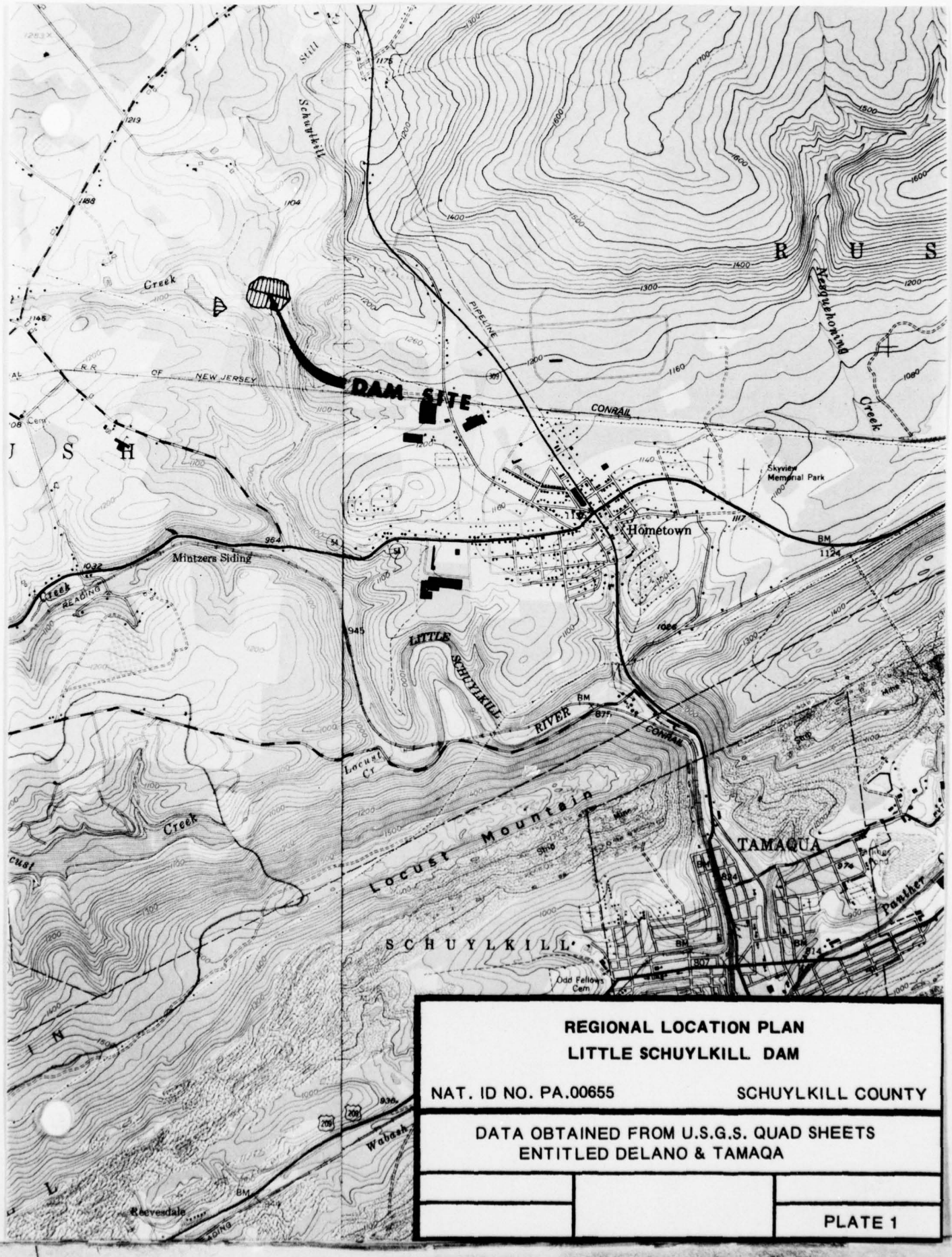


VIEW OF ONLY SEEPAGE NOTED ON THE DOWNSTREAM SLOPE. EMERGENCE CAN BE SEEN IN CENTER OF PHOTO WHERE MOSS GROWTH DEVELOPED.

PHOTO NO. 8

APPENDIX

E



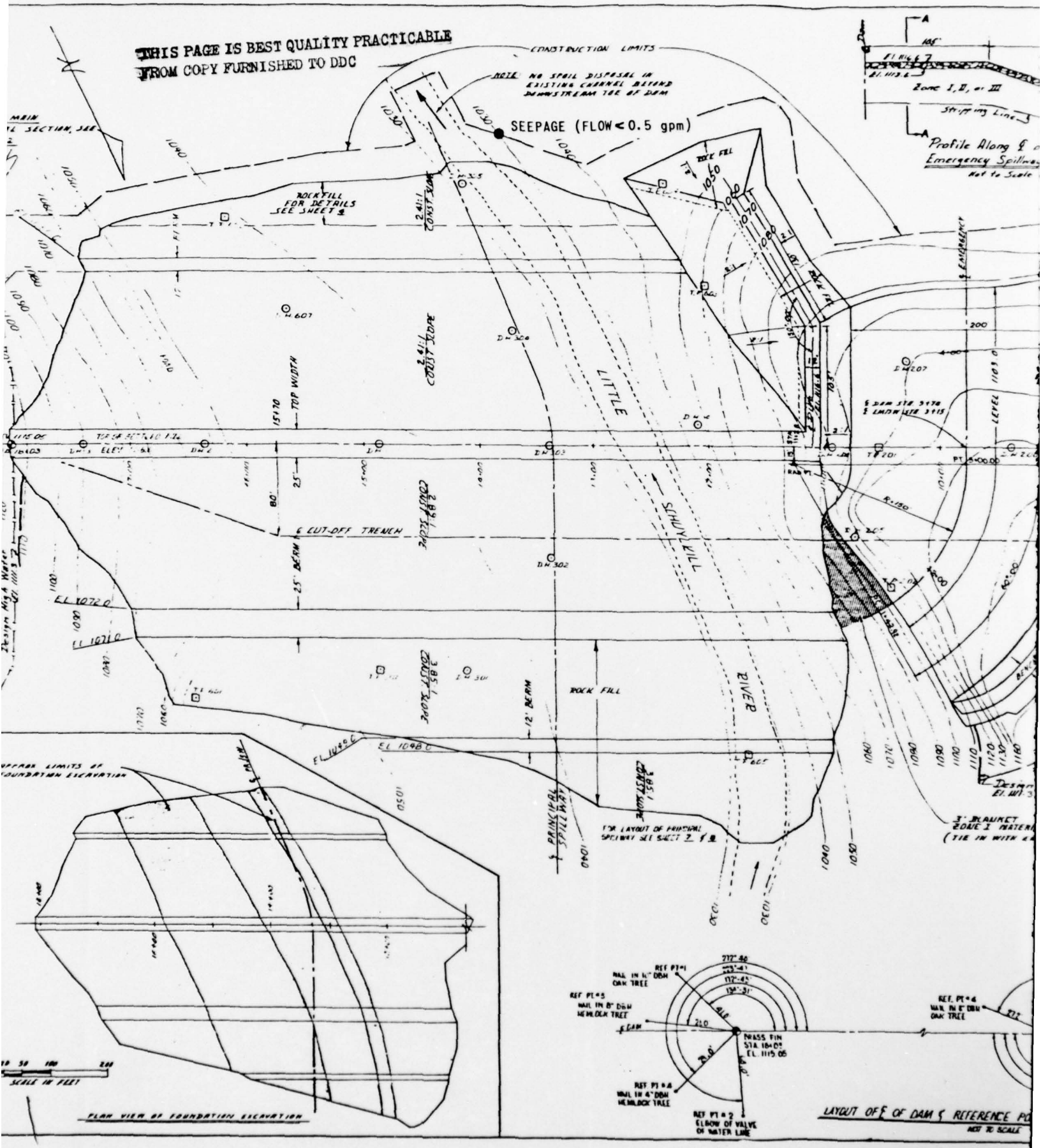
REGIONAL LOCATION PLAN
LITTLE SCHUYLKILL DAM

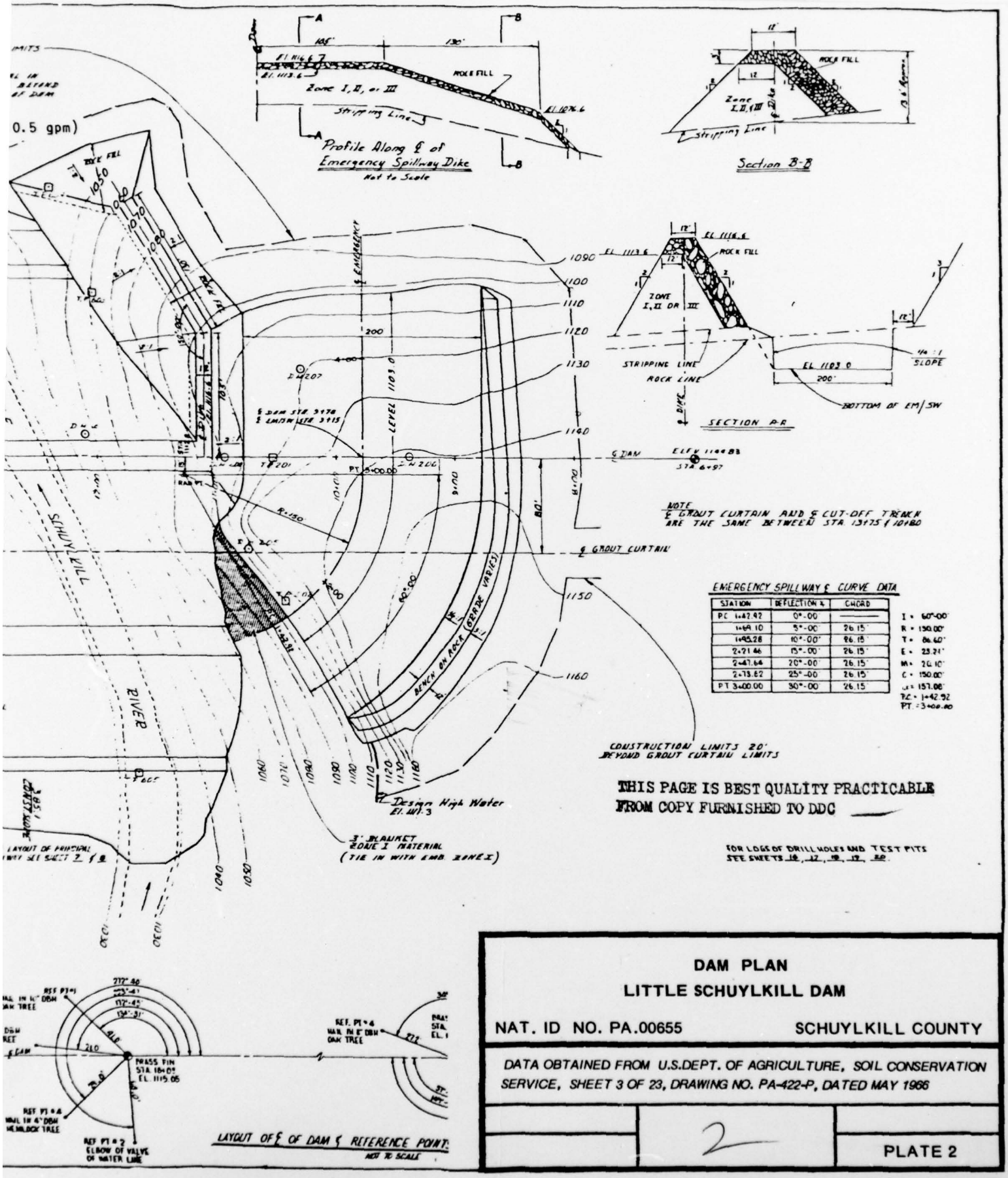
NAT. ID NO. PA.00655 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S.G.S. QUAD SHEETS
ENTITLED DELANO & TAMAQA

PLATE 1

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DAM PLAN

LITTLE SCHUYLKILL DAM

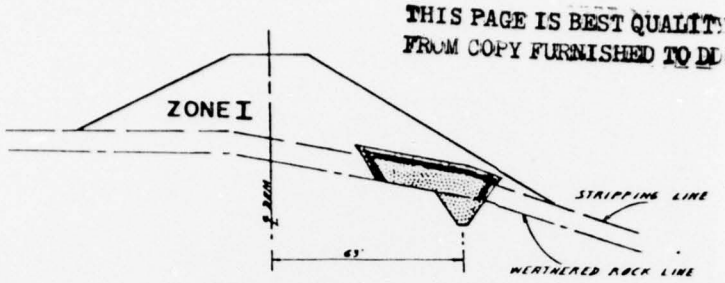
NAT. ID NO. PA.00655 **SCHUYLKILL COUNTY**

DATA OBTAINED FROM U.S.DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, SHEET 3 OF 23, DRAWING NO. PA-422-P, DATED MAY 1966

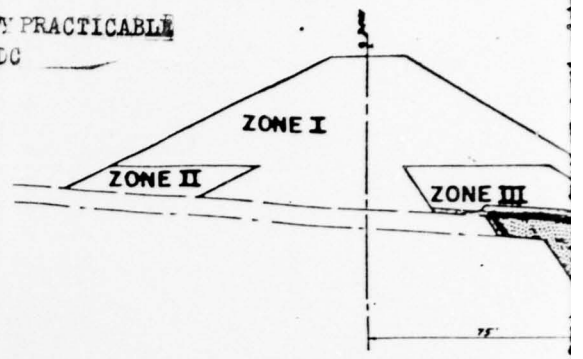
2

PLATE 2

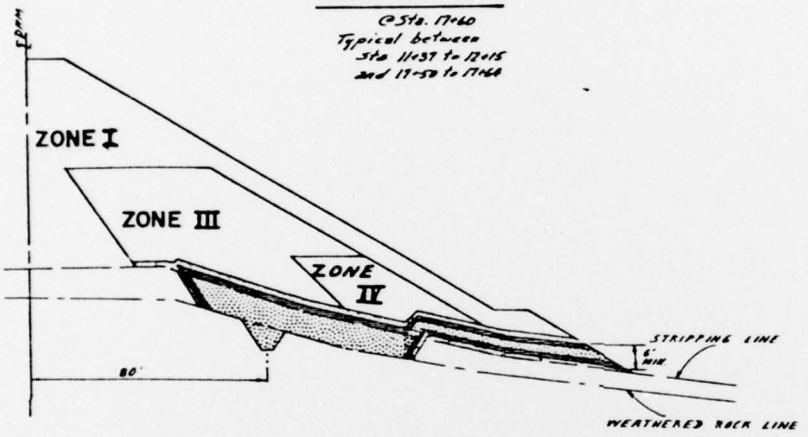
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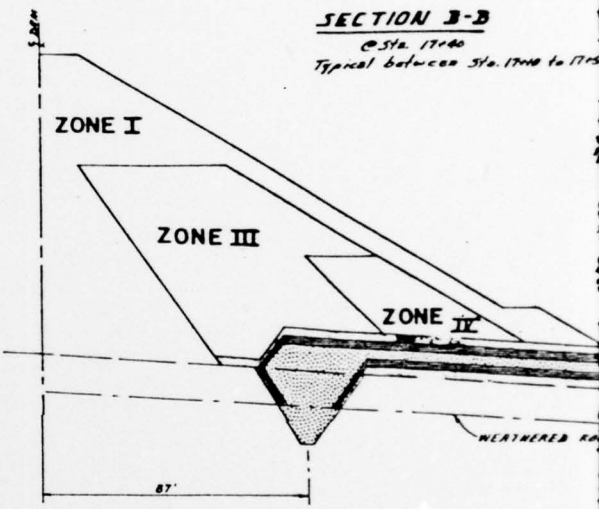
SECTION A-A
@ Sta. 17+60
Typical between
Sta 11+37 to 12+15
and 19+50 to 17+68



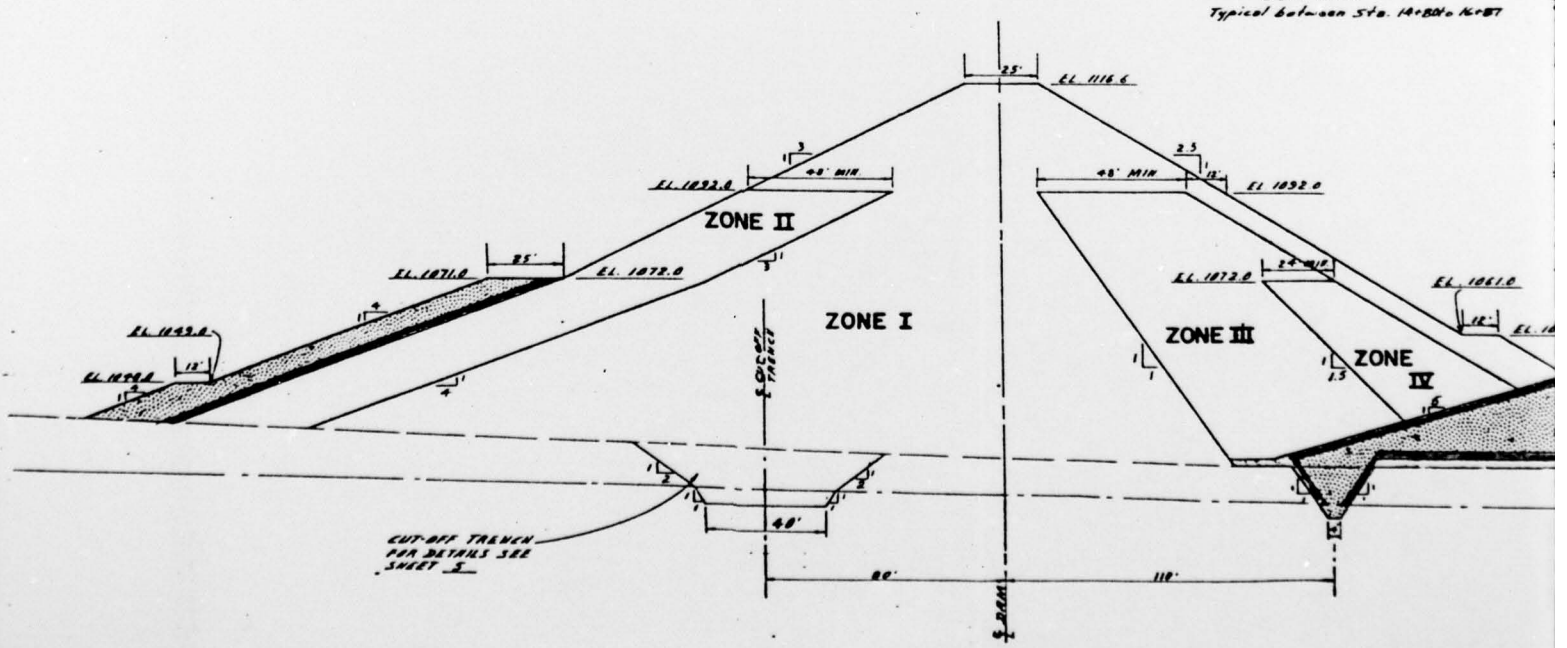
SECTION B-B
@ Sta. 17+40
Typical between Sta. 17+10 to 17+5



SECTION C-C
@ Sta 17+00
Typical between
Sta. 12+15 to 12+82
and 16+87 to 17+10

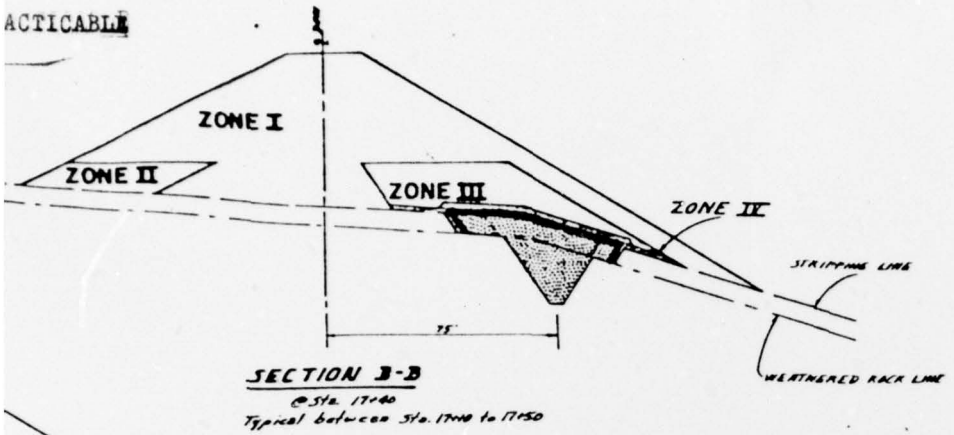


SECTION D-D
@ Sta 16+20
Typical between Sta. 14+80 & 16+87



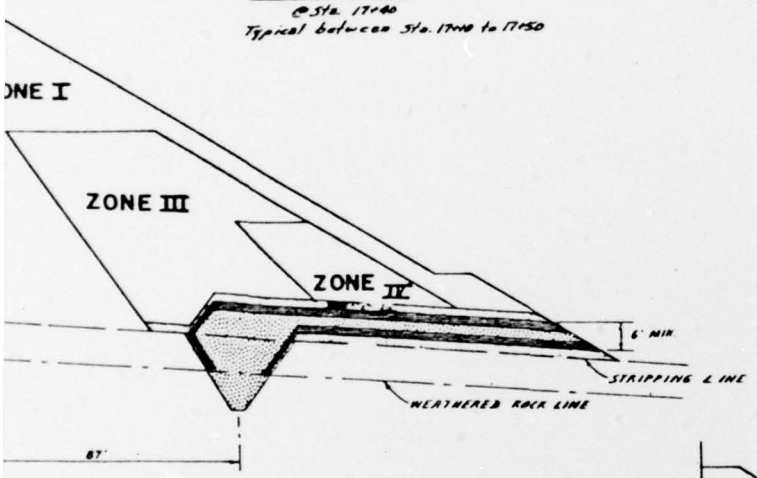
SECTION E-E
@ Sta 13+25
Typical between Sta. 13+11 to 14+00

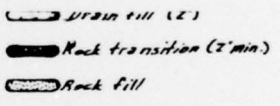
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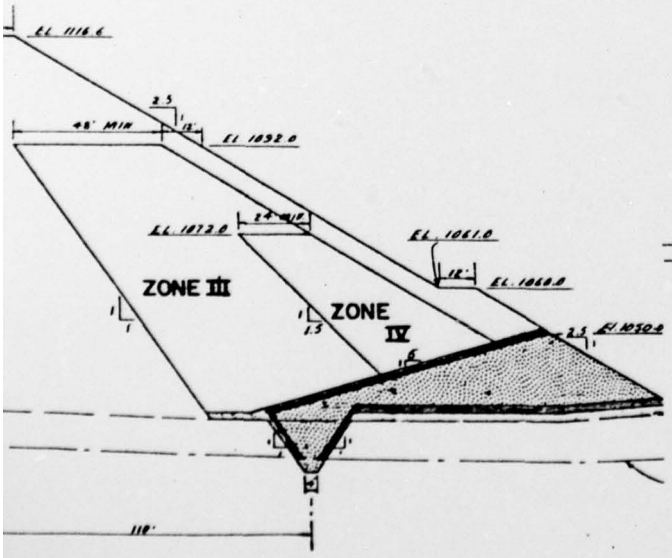
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@ Sta. 17+40
Typical between Sta. 17+10 to 17+50

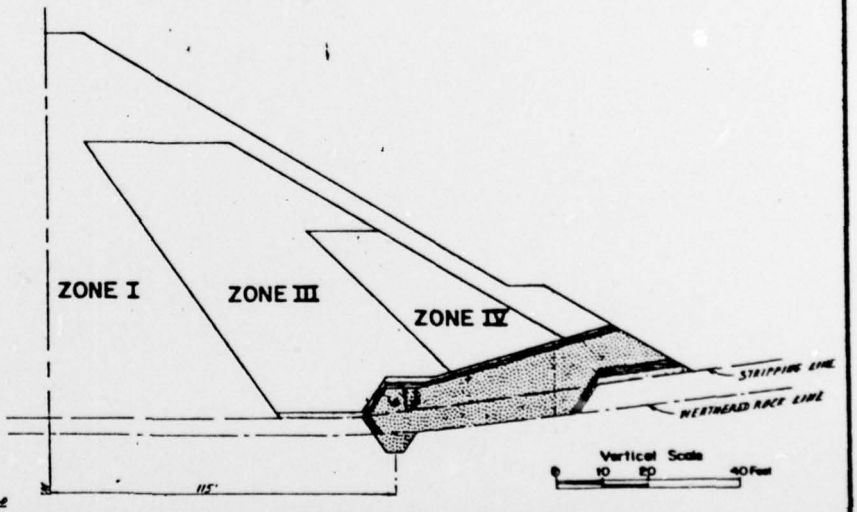
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SECTION D-D
@ Sta 16+20
Typical between Sta. 14+80 to 16+87





E-E
1985
between Sta. 13+11 to 14+00

DAM SECTIONS
LITTLE SCHUYLKILL DAM

NAT. ID NO. PA.00655 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, SHEET 4 OF 23, DRAWING NO. PA-422-P, DATED MAY 1966

PLATE 3

PRINCIPAL SPILLWAY CURVE DATA

I = 22°30'
R = 255.04'
T = 50.55'
E = 4.92'
M = 9.83'
C = 98.78'
Lc = 99.61'

STATION	DEFLECTION	CHORD
PC 5+40.64	0°-00'	—
6+60.30	8°-19'	19.86
5+80.16	4°-28'	19.86
6+00.02	6°-42'	19.86
6+19.88	8°-56'	19.86
PT 6+39.83	11°-10'	19.95

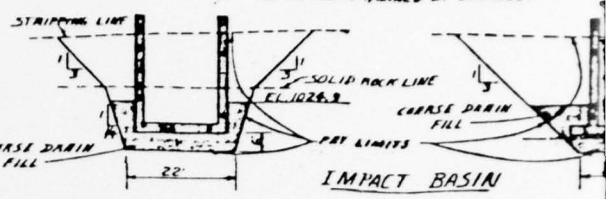
20' LENGTHS

STATION	DEFLECTION	CHORD
PC 6+53.01	0°-00	—
5+68.87	2°-19'	15.86
5+84.73	4°-28'	15.86
6+00.59	6°-42'	15.86
6+16.45	8°-56'	15.86
PT 6+32.40	11°-10'	15.95

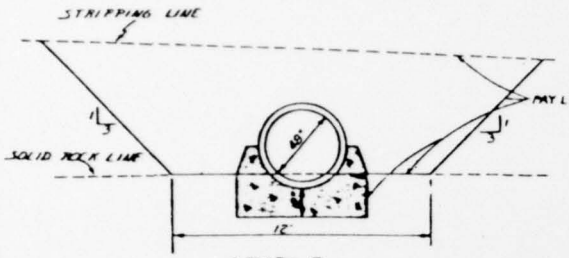
16' LENGTHS

I = 22°30'
R = 203.72'
T = 40.21'
E = 3.93'
M = 7.86'
C = 78.91'
Lc = 79.61'

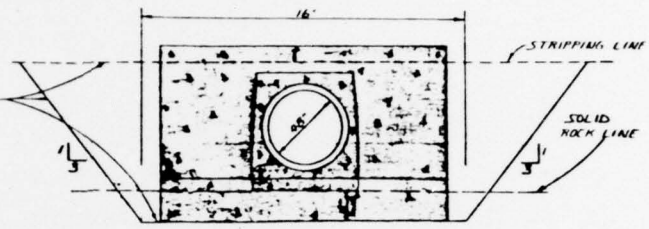
NOTE:
APPROPRIATE EXCAVATION CROSS-SECT
TO BE DETERMINED BY ENGINEER



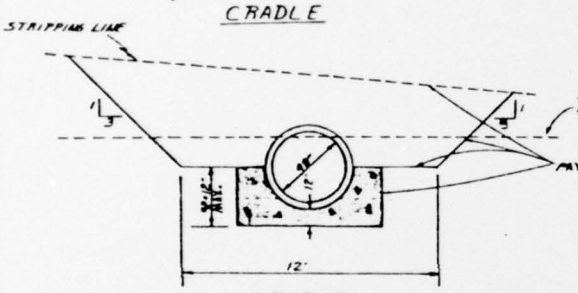
IMPACT BASIN



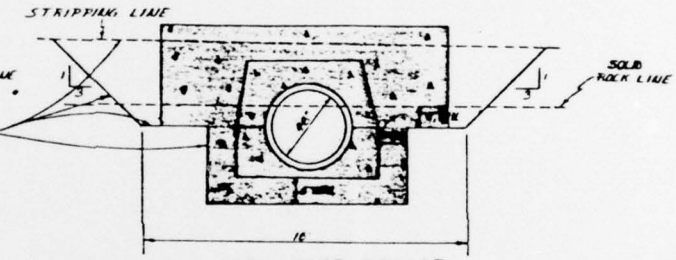
CRADLE



ANTI-SEEP COLLAR

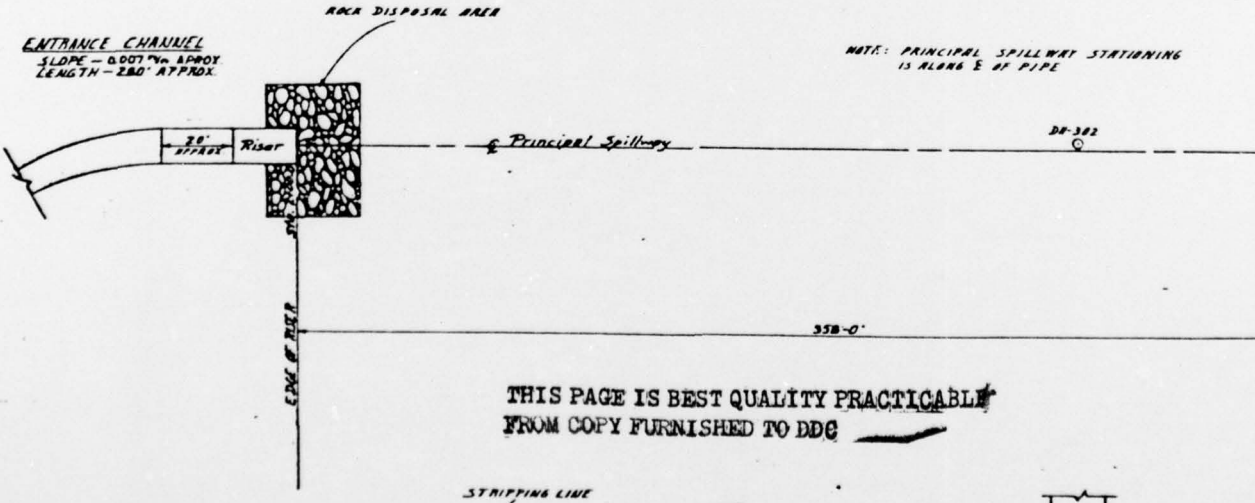


CRADLE

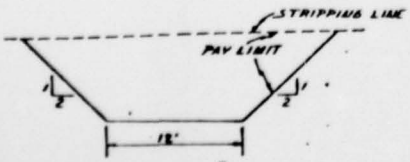


ANTI-SEEP COLLAR

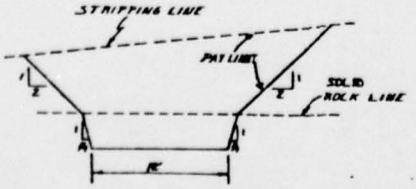
-TYPICAL SECTIONS-



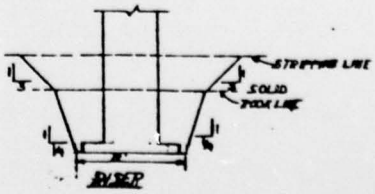
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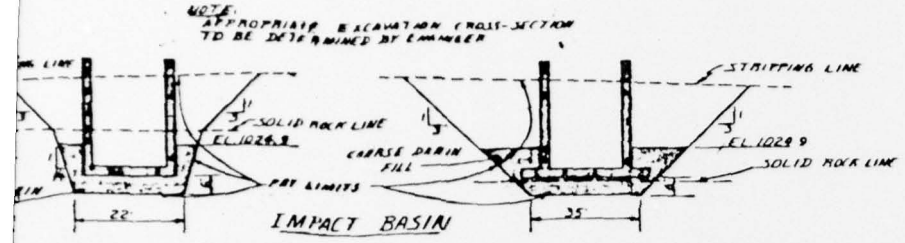
ENTRANCE CHANNEL

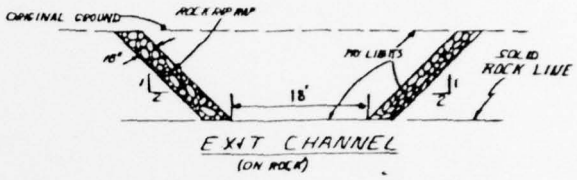


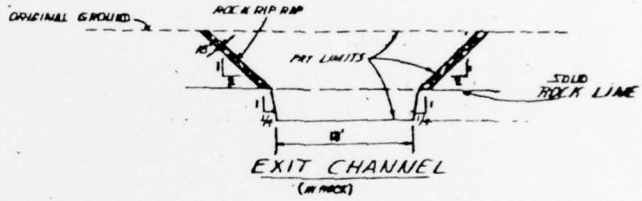
ENTRANCE CHANNEL
(IN ROCK)

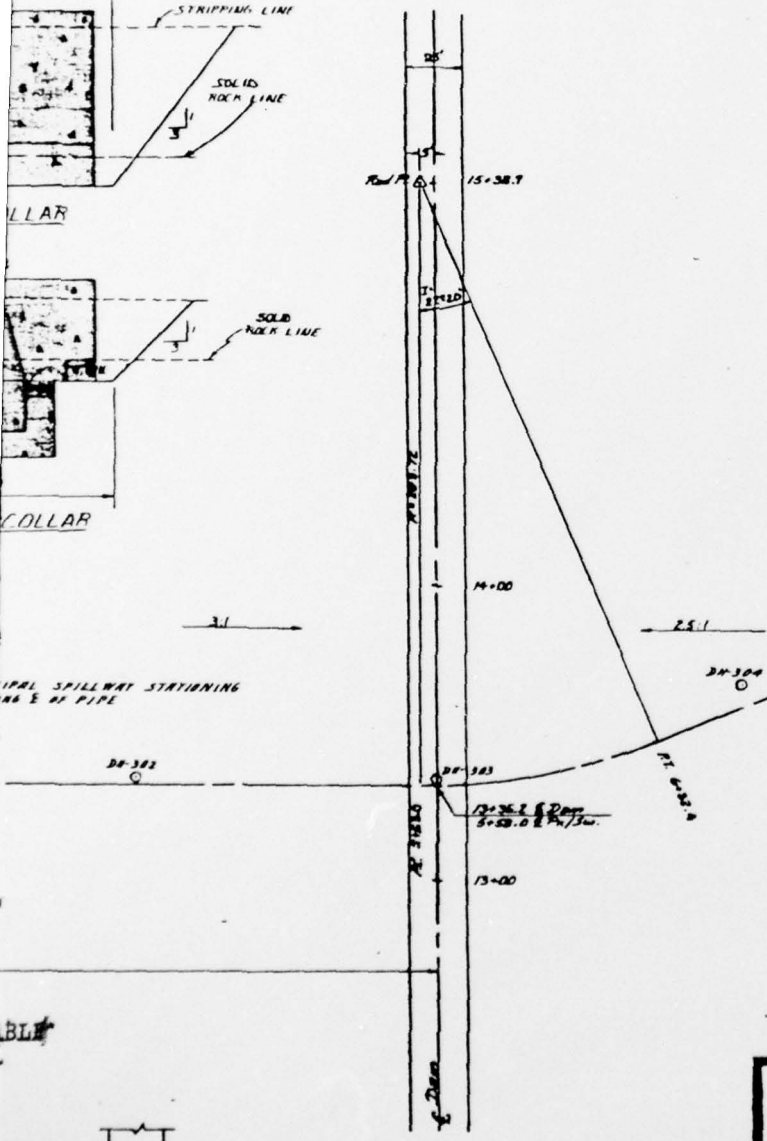


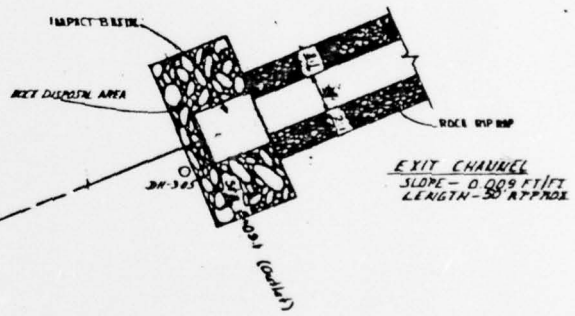
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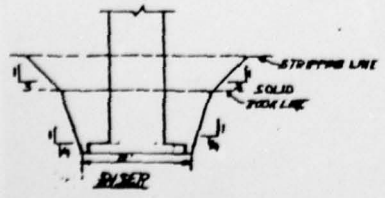












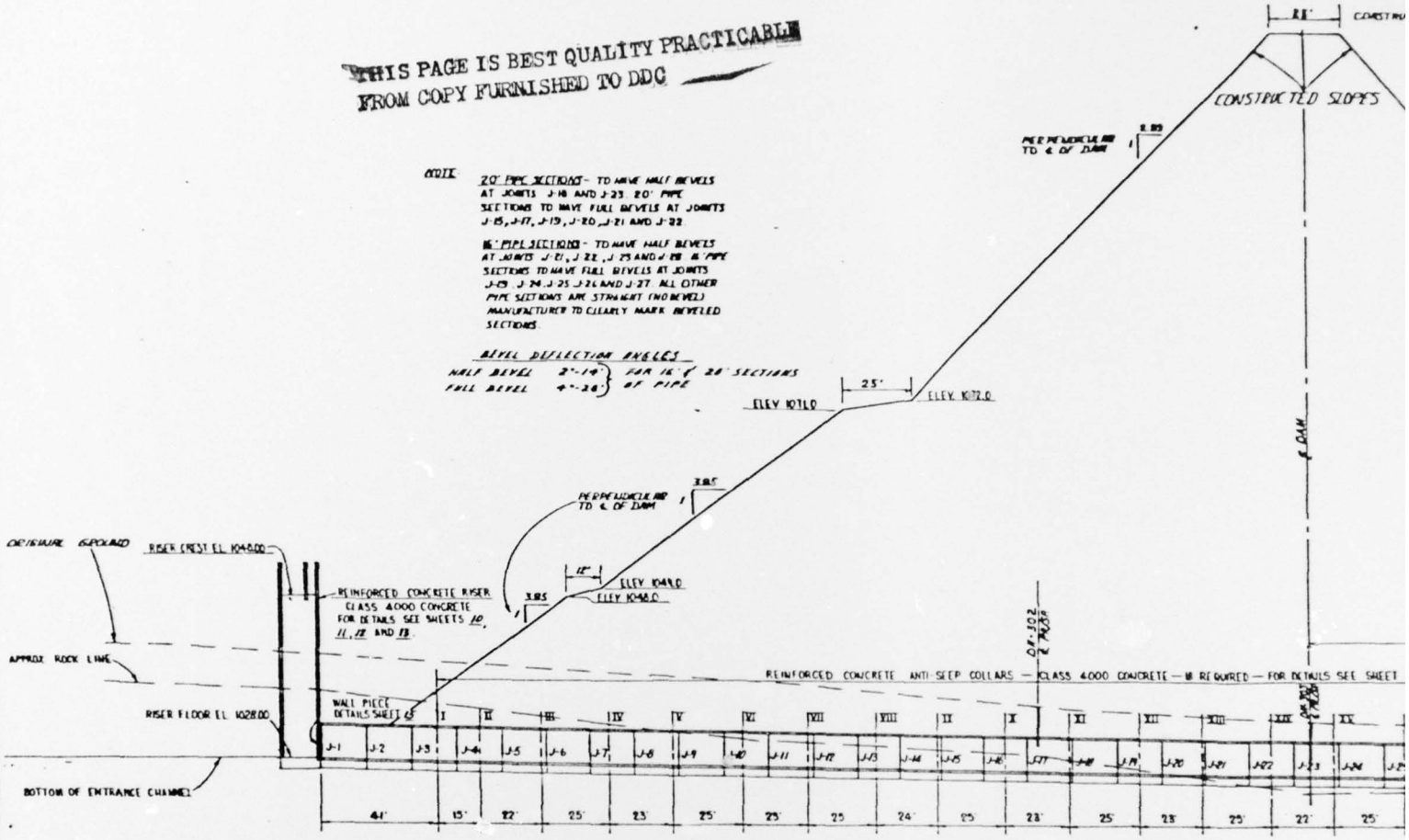
SPILLWAY PLAN
LITTLE SCHUYLKILL DAM

NAT. ID NO. PA.00655 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S.DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, SHEET 7 OF 23, DRAWING NO. PA-422-P, DATED MAY 1966

2		PLATE 4

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PROFILE OF PRINCIPAL SPILLWAY
NOT TO SCALE

48" I.D. PRINCIPAL SPILLWAY PIPE JOINT DATA

FOR 16' SECTIONS OF PIPE

STRENGTH CLASS	JOINT	DISTANCE FROM RISER WALL	INVERT ELEVATION
I	J-1	0.3'	1028.00
	J-2	16.4'	1028.00
	J-3	32.5'	1028.00
	J-4	48.5'	1028.00
	J-5	64.6'	1028.00
	J-6	80.6'	1028.00
	J-7	96.7'	1028.00
	J-8	112.8'	1028.00
	J-9	128.8'	1028.00
	J-10	144.9'	1028.00
	J-11	160.9'	1028.00
	J-12	177.0'	1028.00
II	J-13	193.1'	1028.00
	J-14	209.1'	1028.00
	J-15	225.2'	1028.00
	J-16	241.2'	1028.00
	J-17	257.8'	1028.00
	J-18	273.4'	1028.00
III	J-19	289.2'	1028.00
	J-20	305.2'	1026.75
	J-21	321.1'	1025.50
	J-22	337.1'	1024.40
	J-23	353.0'	1024.90
	J-24	368.9'	1024.90
	J-25	384.7'	1024.90
	J-26	400.6'	1024.90
	J-27	416.5'	1024.90
II	J-28	432.4'	1024.90
	J-29	448.5'	1024.90
	J-30	464.5'	1024.90
	J-31	480.6'	1024.90
I	J-32	496.6'	1024.90
	J-33	512.7'	1024.90
	J-34	528.8'	1024.90
	J-35	544.8'	1024.90
	J-36	560.9'	1024.90
	J-37	576.9'	1024.90
	J-38	593.0'	1024.90
	OUTLET	609.1'	1024.90

FOR 20' SECTIONS OF PIPE

JOINT	DISTANCE FROM RISER WALL	INVERT ELEVATION	STRENGTH CLASS
J-1	0.3'	1028.00	I
J-2	20.4'	1028.00	
J-3	40.4'	1028.00	
J-4	60.5'	1028.00	
J-5	80.5'	1028.00	
J-6	100.5'	1028.00	
J-7	120.6'	1028.00	
J-8	140.6'	1028.00	
J-9	160.7'	1028.00	
J-10	180.7'	1028.00	
J-11	200.7'	1028.00	
J-12	220.8'	1028.00	II
J-13	240.8'	1028.00	
J-14	260.9'	1028.00	
J-15	280.9'	1028.00	
J-16	300.9'	1028.45	III
J-17	321.5'	1027.90	
J-18	340.9'	1027.90	
J-19	360.3'	1027.90	
J-20	380.2'	1027.90	
J-21	400.0'	1027.90	
J-22	419.9'	1027.90	
J-23	439.8'	1027.90	II
J-24	459.9'	1027.90	
J-25	479.9'	1027.90	
J-26	500.0'	1027.90	
J-27	520.0'	1027.90	
J-28	540.0'	1027.90	I
J-29	560.1'	1027.90	
J-30	580.1'	1027.90	
J-31	600.2'	1027.90	
OUTLET	610.8'	1027.90	

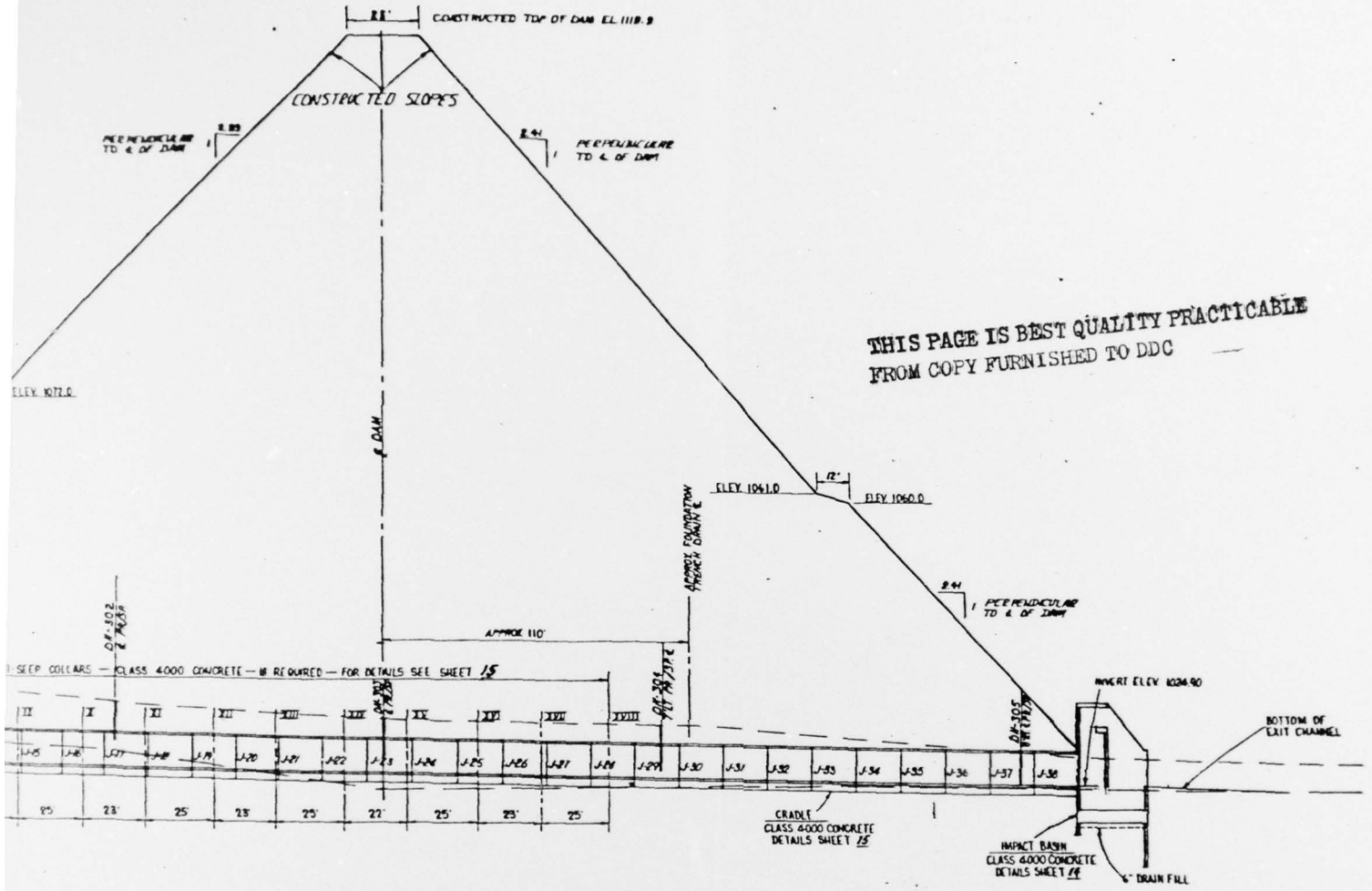
PRINCIPAL SPILLWAY ANTI-SEEP COLLAR DATA

FOR 16' SECTIONS OF PIPE

COLLAR	DISTANCE FROM RISER WALL	INVERT ELEVATION
I	41.0'	1028.00
II	96.0'	1028.00
III	98.0'	1028.00
IV	103.0'	1028.00
V	126.0'	1028.00
VI	151.0'	1028.00
VII	174.0'	1028.00
VIII	199.0'	1028.00
IX	223.0'	1028.00
X	246.0'	1028.00
XI	271.0'	1028.00
XII	296.0'	1027.47
XIII	319.0'	1025.61
XIV	344.0'	1024.90
XV	366.0'	1024.90
XVI	391.0'	1024.90
XVII	414.0'	1024.90
XVIII	439.0'	1024.90

FOR 20' SECTIONS OF PIPE

COLLAR	DISTANCE FROM RISER WALL	INVERT ELEVATION
I	43.0'	1028.00
II	68.0'	1028.00
III	93.0'	1028.00
IV	118.0'	1028.00
V	145.0'	1028.00
VI	168.0'	1028.00
VII	193.0'	1028.00
VIII	218.0'	1028.00
IX	243.0'	1028.00
X	268.0'	1028.00
XI	293.0'	1027.05
XII	318.0'	1025.09
XIII	348.0'	1024.90
XIV	368.0'	1024.90
XV	393.0'	1024.90
XVI	417.0'	1024.90
XVII	442.0'	1024.90



PROFILE OF PRINCIPAL SPILLWAY

NOT TO SCALE

NOTE: PROFILE OF PRINCIPAL SPILLWAY SHOWN IS BASED ON DATA FOR 16 SECTIONS OF CONDUIT

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SPILLWAY ANTI-SEEP COLLAR DATA

FOR 20' SECTIONS OF PIPE

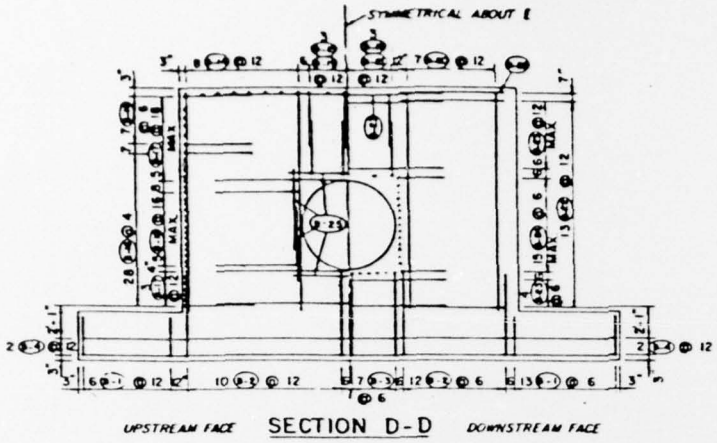
COLLAR	DISTANCE FROM RISER WALL	INVERT ELEVATION
I	45.0'	1028.00
II	68.0'	1028.00
III	93.0'	1028.00
IV	116.0'	1028.00
V	145.0'	1028.00
VI	168.0'	1028.00
VII	193.0'	1028.00
VIII	218.0'	1028.00
IX	243.0'	1028.00
X	268.0'	1028.00
XI	293.0'	1027.05
XII	318.0'	1025.09
XIII	348.0'	1024.90
XIV	368.0'	1024.90
XV	393.0'	1024.90
XVI	417.0'	1024.90
XVII	442.0'	1024.90

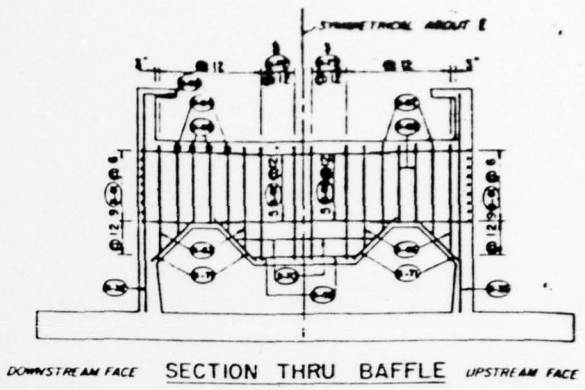
SPILLWAY SECTION
LITTLE SCHUYLKILL DAM

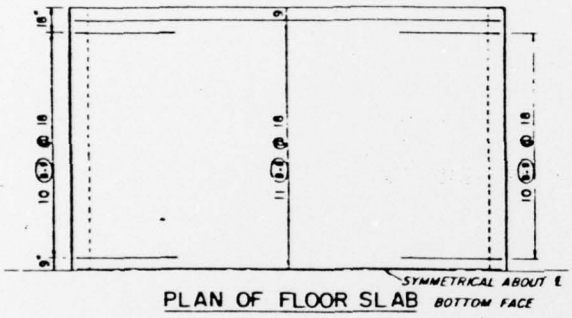
NAT. ID NO. PA 00655 SCHUYLKILL COUNTY

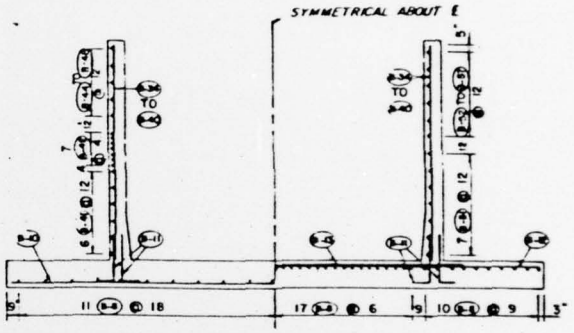
DATA OBTAINED FROM U.S.DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, SHEET 8 OF 23, DRAWING NO. PA.422-P, DATED MAY 1966

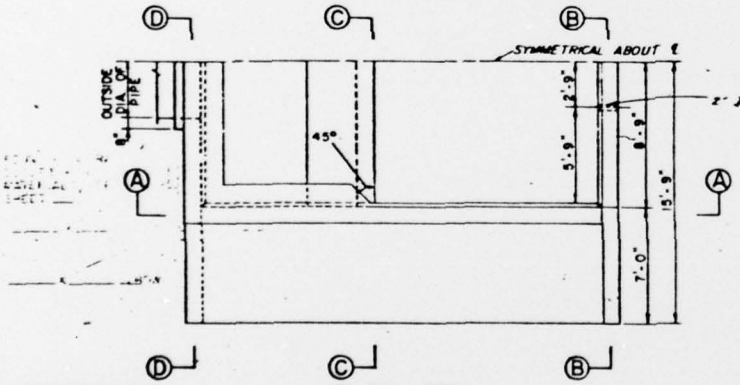
PLATE 5

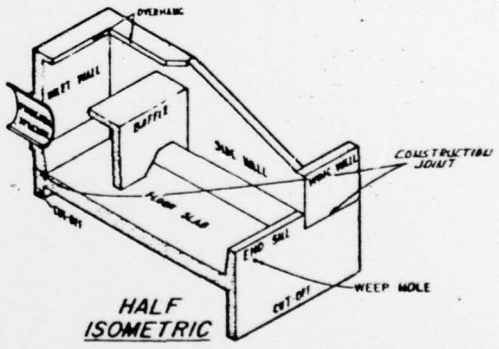


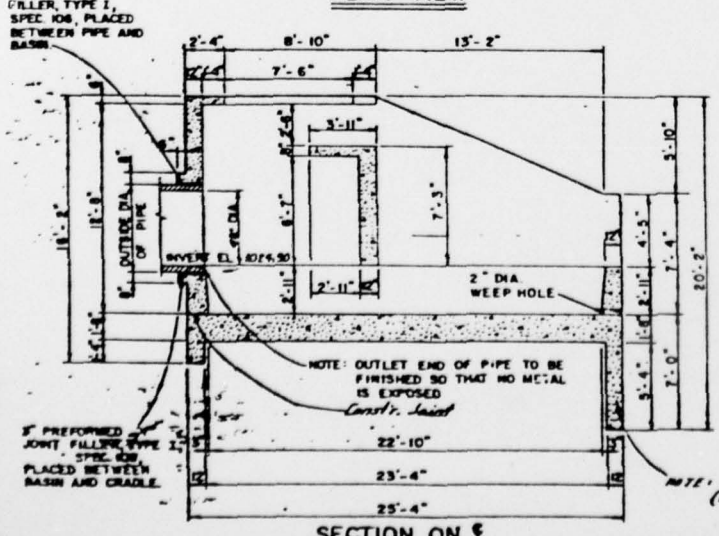


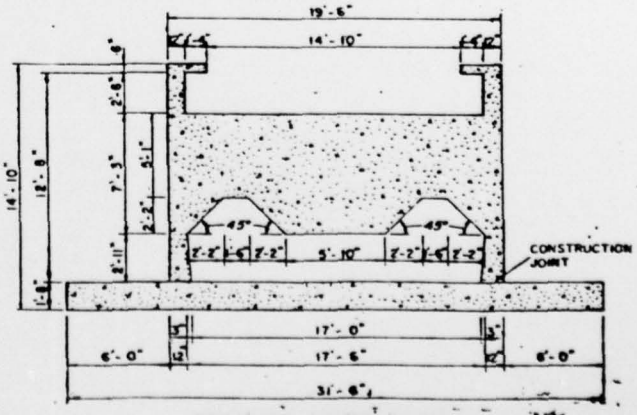




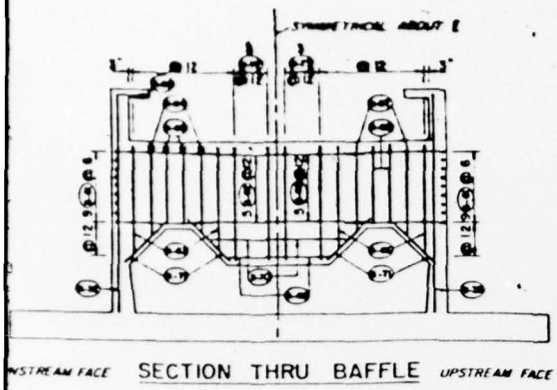


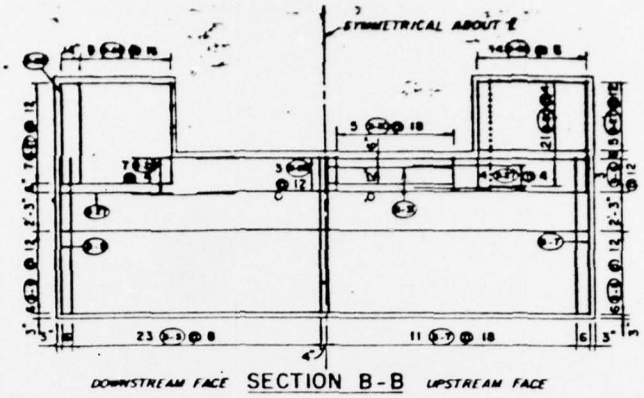


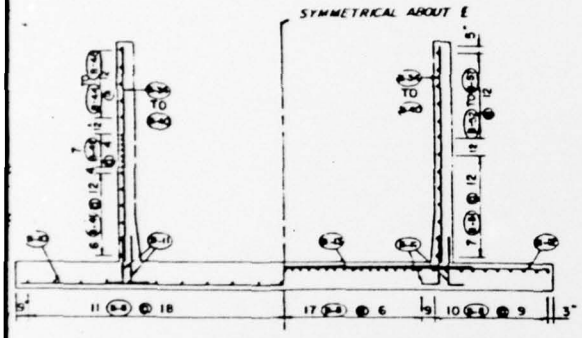




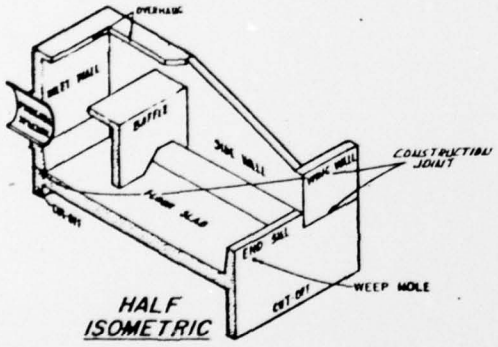
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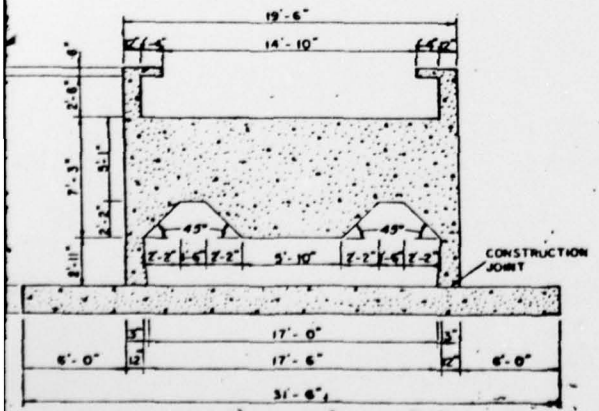




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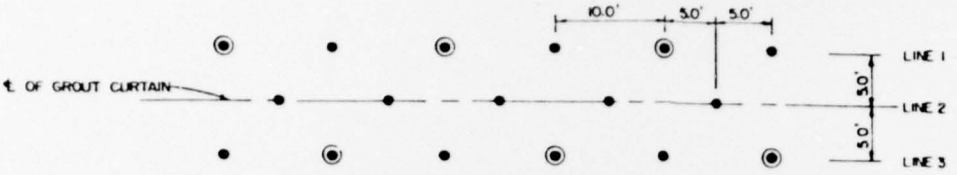
SECTION THRU BAFFLE

STILLING BASIN DETAILS LITTLE SCHUYLKILL DAM	
NAT. ID. NO. PA. 00655	SCHUYLKILL COUNTY
DATA OBTAINED FROM U.S.DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, SHEET 14 OF 23, DRAWING NO. PA-422-P, DATED MAY 1. 6	
	PLATE 6

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NOTE: FOR PROFILE ALONG ℄ OF GROUT CURTAIN SEE SHEET 5

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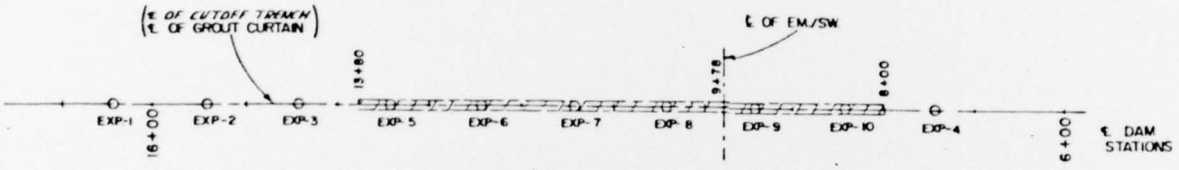


GROUT HOLE DRILLING PATTERN

NOT TO SCALE

LEGEND

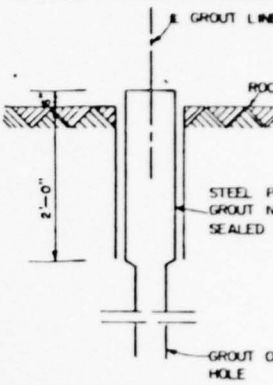
- PRIMARY HOLE
- SECONDARY HOLE
- EXP — EXPLORATORY DRILL HOLE



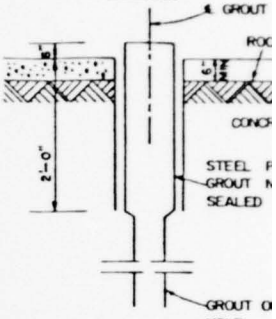
PLAN VIEW SHOWING GROUT CURTAIN LOCATION

FOR LAYOUT OF GROUT CURTAIN, SEE SHEET 3

0 50 100 200 FT



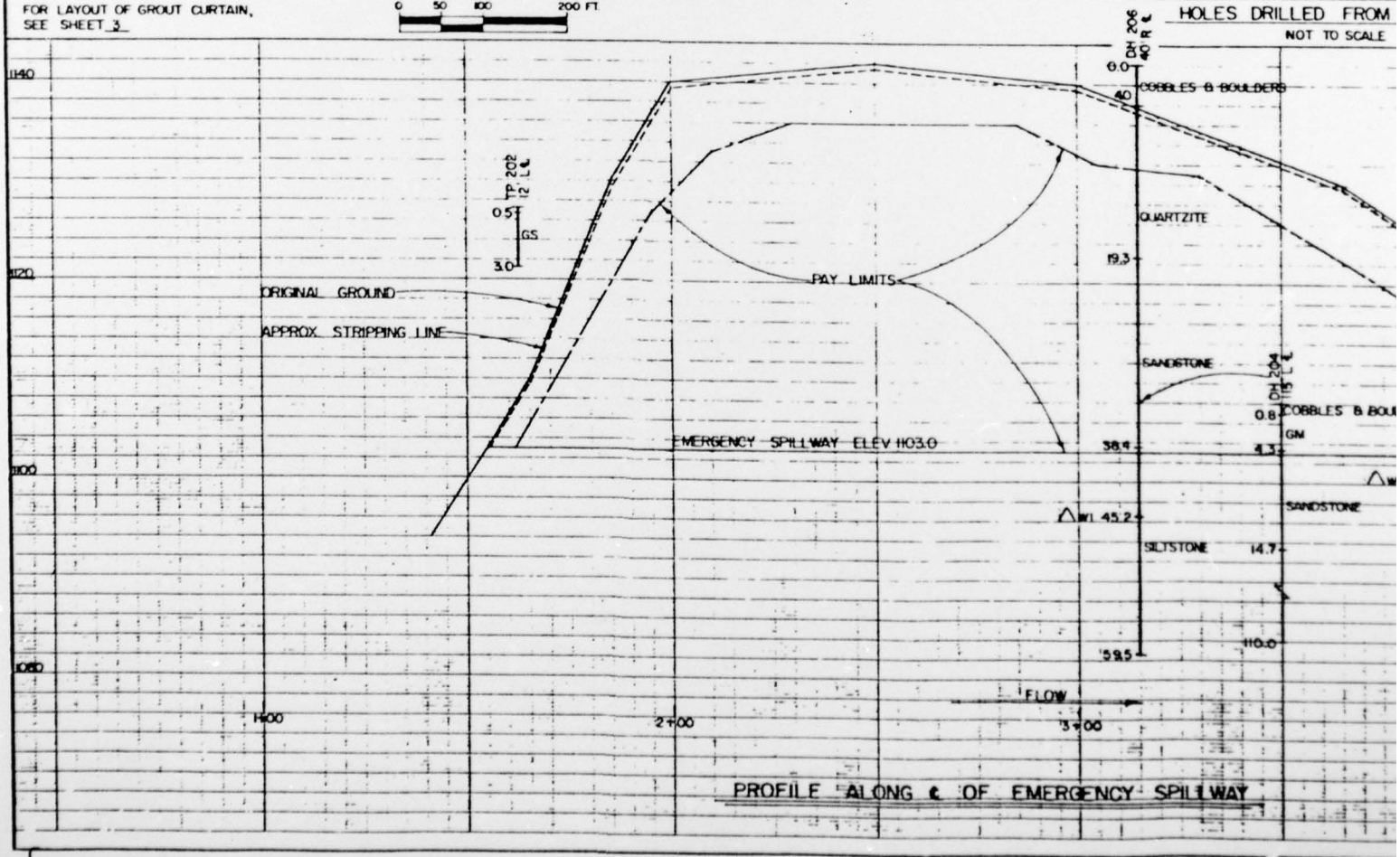
TYPE I



TYPE II

TYPICAL NIPPLE SETTING FOR HOLES DRILLED FROM

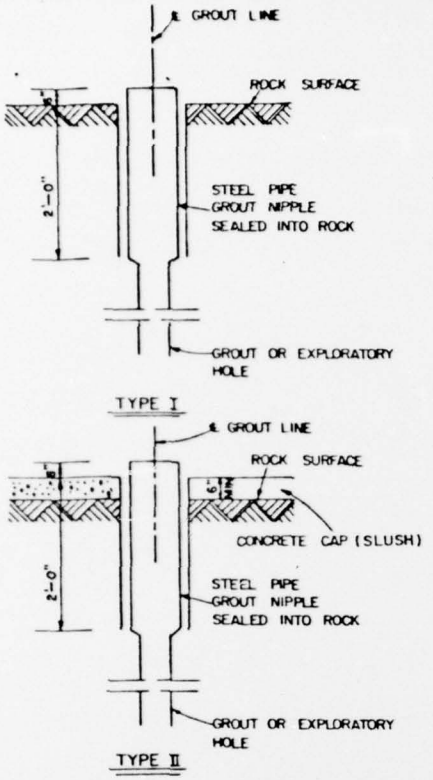
NOT TO SCALE



PROFILE ALONG ℄ OF EMERGENCY SPILLWAY

TY PRACTICABLE
DDC

LINE 1
LINE 2
LINE 3



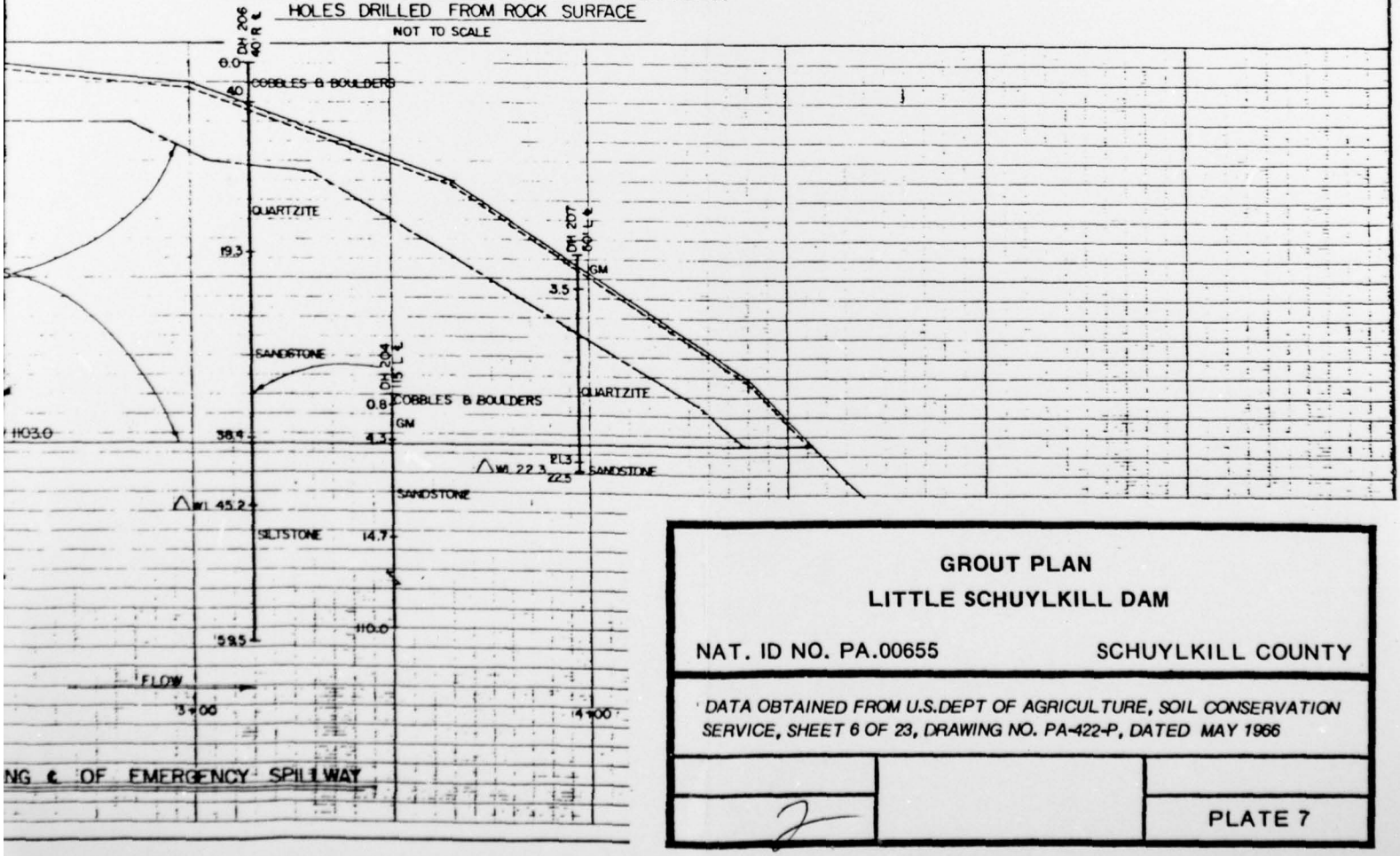
6+00
℄ DAM STATIONS

TYPICAL NIPPLE SETTING FOR GROUT OR EXPLORATORY HOLES DRILLED FROM ROCK SURFACE
NOT TO SCALE

CONSTRUCTION DETAILS

1. DRILLING GROUT HOLES WILL BE DONE BY THE SPLIT SPACING METHOD ALL DRILLING & GROUTING SHALL BE ACCOMPLISHED ON LINES 1 & 3 BEFORE ANY DRILLING & GROUTING IS DONE ON LINE 2. THE NEED FOR GROUTING LINE 2 WILL BE DETERMINED BY THE ENGINEER BASED ON RESULTS OF PRESSURE TESTS & GROUT TAKE IN EXPLORATORY HOLES NO. 3,4,5,6,7 & 8 OR AT OTHER LOCATIONS DESIGNATED BY THE ENGINEER & DRILLED AFTER COMPLETION OF THE GROUTING ON LINES 1 & 3.
2. IN GENERAL, STAGE GROUTING WILL BE USED TO ESTABLISH THE GROUT CURTAIN.
3. SETTINGS TYPE I OR II FOR GROUT NIPPLES SHALL BE USED AS DETERMINED BY ROCK CONDITIONS ENCOUNTERED & AS DIRECTED BY THE ENGINEER.
4. EXPLORATORY HOLES 1-4 SHALL BE DRILLED EARLY IN THE GROUTING WORK TO HELP ESTABLISH THE NEED FOR EXTENSION OF THE GROUT CURTAIN.
5. CEMENT SHALL BE TYPE II
6. PRIMARY & SECONDARY HOLES WILL GENERALLY BE DRILLED TO THE FULL DEPTH OF A GIVEN STAGE WITH THE DEPTH OF A STAGE NOT TO EXCEED 40 FEET. GROUTING WILL REQUIRE AT LEAST ONE STAGE IN THE VALLEY BOTTOM AND TWO STAGES IN THE RIGHT ABUTMENT.
7. GROUTING SHALL PROCEED TOWARD THE LEFT ABUTMENT UNTIL TIGHT ROCK IS ENCOUNTERED. ON THE RIGHT ABUTMENT, GROUTING SHALL PROCEED AS DIRECTED BY THE ENGINEER

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GROUT PLAN
LITTLE SCHUYLKILL DAM

NAT. ID NO. PA.00655 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S.DEPT OF AGRICULTURE, SOIL CONSERVATION SERVICE, SHEET 6 OF 23, DRAWING NO. PA-422-P, DATED MAY 1966

2		PLATE 7

APPENDIX

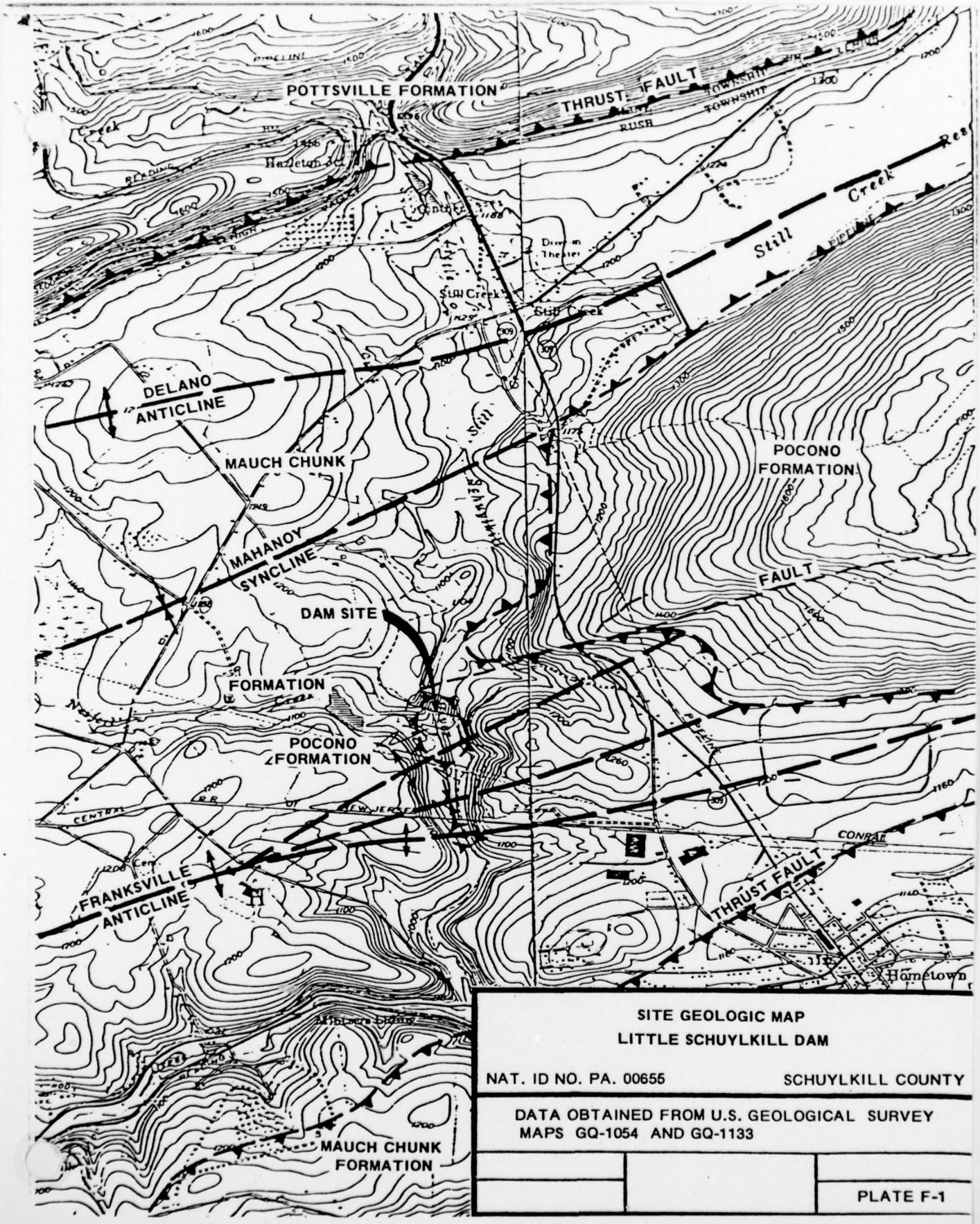
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SITE GEOLOGY
LITTLE SCHUYLKILL DAM

Little Schuylkill Dam is located in the Appalachian Mountain Section of the Valley and Ridge Physiographic Province. As shown in Plate F-1, the dam is located in the sandstone and shale of the Pocono and Mauch Chuck formations of Mississippian age. The entire dam structure is founded in the Pocono Formation except for the right abutment which is underlain by the Mauch Chunk Formation (see Photo No. 4). In the right abutment area, bedrock strikes west-northwest and dips approximately 20 degrees to the south (downstream direction). Jointing strikes northwest and dips 70 degrees to the southwest (downstream direction (and 65 degrees to the northeast. Another major joint set strikes east-northeast with near-vertical dips to the north.

The dam lies between two regional east-northeast trending folds in an area of localized thrust faulting. Several faults occur in the immediate dam foundation area as shown on Plate F-1. One is a low angle thrust fault with an elliptical fault trace due to erosion which formed the present Little Schuylkill River valley. The other fault which terminates near the right abutment strikes east-northeast with a sense of movement of down-to-the-south.

The combination of southerly dipping bedding and joint planes and faulted terrain would be conducive to downstream water seeps. Problems of water seepage are not considered to be significant since this dam is a flood control structure and is not expected to be at maximum capacity for extended periods.



SITE GEOLOGIC MAP
LITTLE SCHUYLKILL DAM

NAT. ID NO. PA. 00655 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S. GEOLOGICAL SURVEY MAPS GQ-1054 AND GQ-1133

PLATE F-1