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NATIONAL DAM INSPECTION PROGRAM. FRANCES SLOCUM DAM (NDS-ID-PA---ETC(U)
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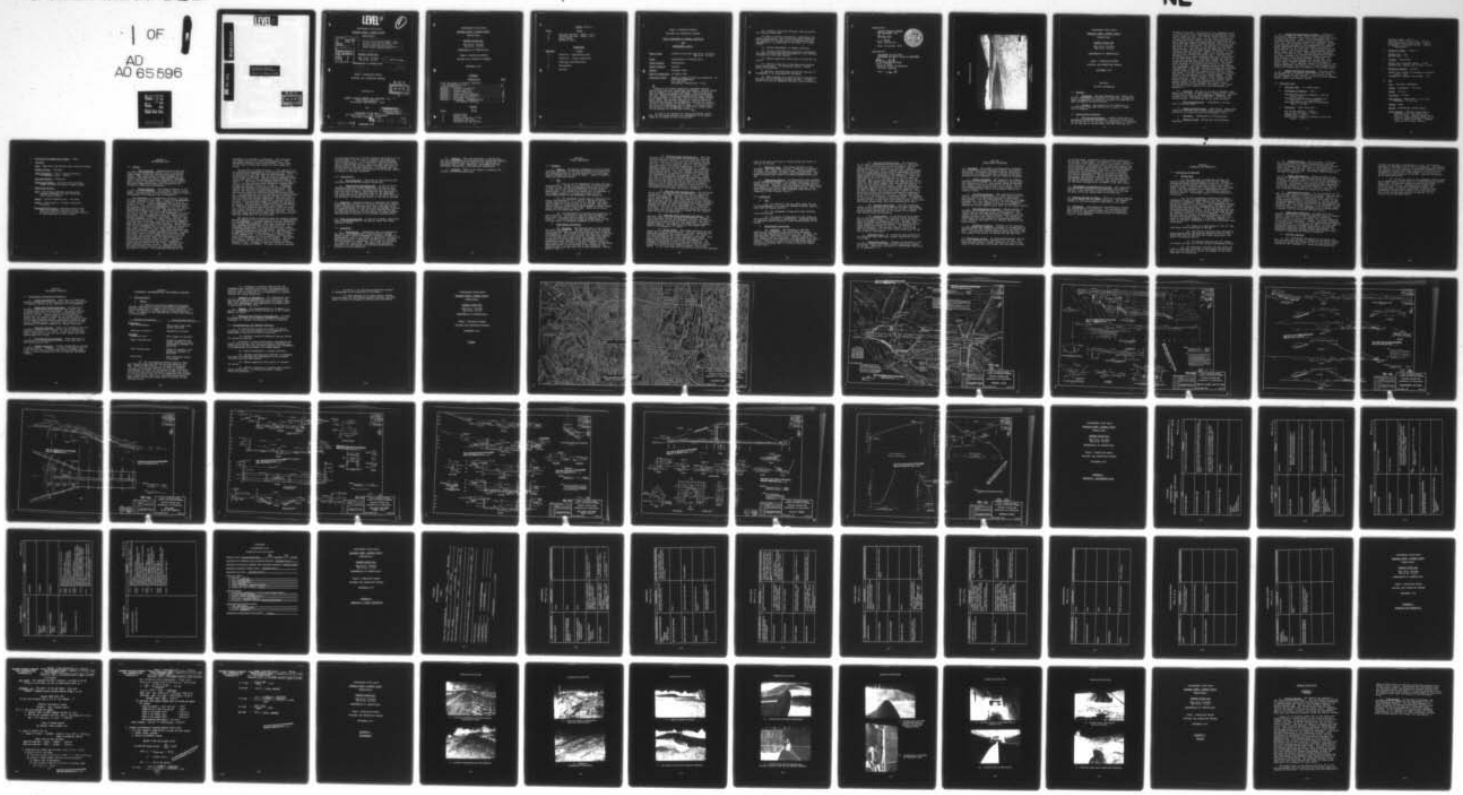

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LEVEL II

SUSQUEHANNA RIVER BASIN

ABRAHAMS CREEK, LUZERNE COUNTY

PENNSYLVANIA

(6) National Dam Inspection Program. Frances Slocum Dam (NDS-ID-PA-00574, DER-ID-40-218), Susquehanna River Basin, Abrahams Creek, Luzerne County, Pennsylvania. Phase I Inspection Report.

FRANCES SLOCUM DAM

NDS ID No. PA-00574
DER ID No. 40-218

(15) DACW31-78-C-0046

COMMONWEALTH OF PENNSYLVANIA

(11) Sep 78

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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

Prepared by

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

For

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

SEPTEMBER 1978

SUSQUEHANNA RIVER BASIN

ABRAHAMS CREEK, LUZERNE COUNTY

PENNSYLVANIA

FRANCES SLOCUM DAM

NDS ID No. PA-00574
DER ID No. 40-218

COMMONWEALTH OF PENNSYLVANIA

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SEPTEMBER 1978

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C	Hydrology and Hydraulics.
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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Frances Slocum Dam (NDS ID No. PA-00574; DER ID No. 40-218)
Owner:	Commonwealth of Pennsylvania
State Located:	Pennsylvania
County Located:	Luzerne
Stream:	Abrahams Creek
Date of Inspection:	16 August 1978
Inspection Team:	Gannett Fleming Corddry and Carpenter, Inc. Consulting Engineers P.O. Box 1963 Harrisburg, Pennsylvania 17105

Based on the visual inspection, available records, calculations and past operational performance, Frances Slocum Dam is judged to be in good condition. The spillway will pass the Probable Maximum Flood (PMF) without overtopping the dam. Based on criteria established for these studies by the Department of the Army, Office of the Chief of Engineers (OCE), the spillway capacity is rated as adequate. The existing spillway can accommodate a flood with a peak inflow of 146 percent of the PMF flow. If the low areas of the top of the embankment were brought up to design grade, the spillway could accommodate a flood with a peak inflow of 154 percent of the PMF peak inflow.

In view of the concern for safety of Frances Slocum Dam, the following measures are recommended to be undertaken by the Owner as soon as practical:

(1) Develop a detailed emergency warning system for Frances Slocum Dam.

In order to correct operational, maintenance and repair deficiencies, and to more accurately determine the condition of the dam, the following measures are recommended to be undertaken by the Owner in a timely manner:

(1) Restore embankment to design elevation.

(2) Perform investigations required to determine the cause of unsatisfactory performance of the spillway training walls and make repairs.

(3) Remove vegetation from joints of concrete toe gutter.

(4) Monitor condition of spillway slab concrete where cracks exist. If conditions worsen, repairs should be undertaken.

In addition, the following operational measure is recommended to be undertaken by the Owner:

(1) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency warning system procedures.

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.

A. C. HOOKE
Head, Dam Section

Date: 26 October, 1978

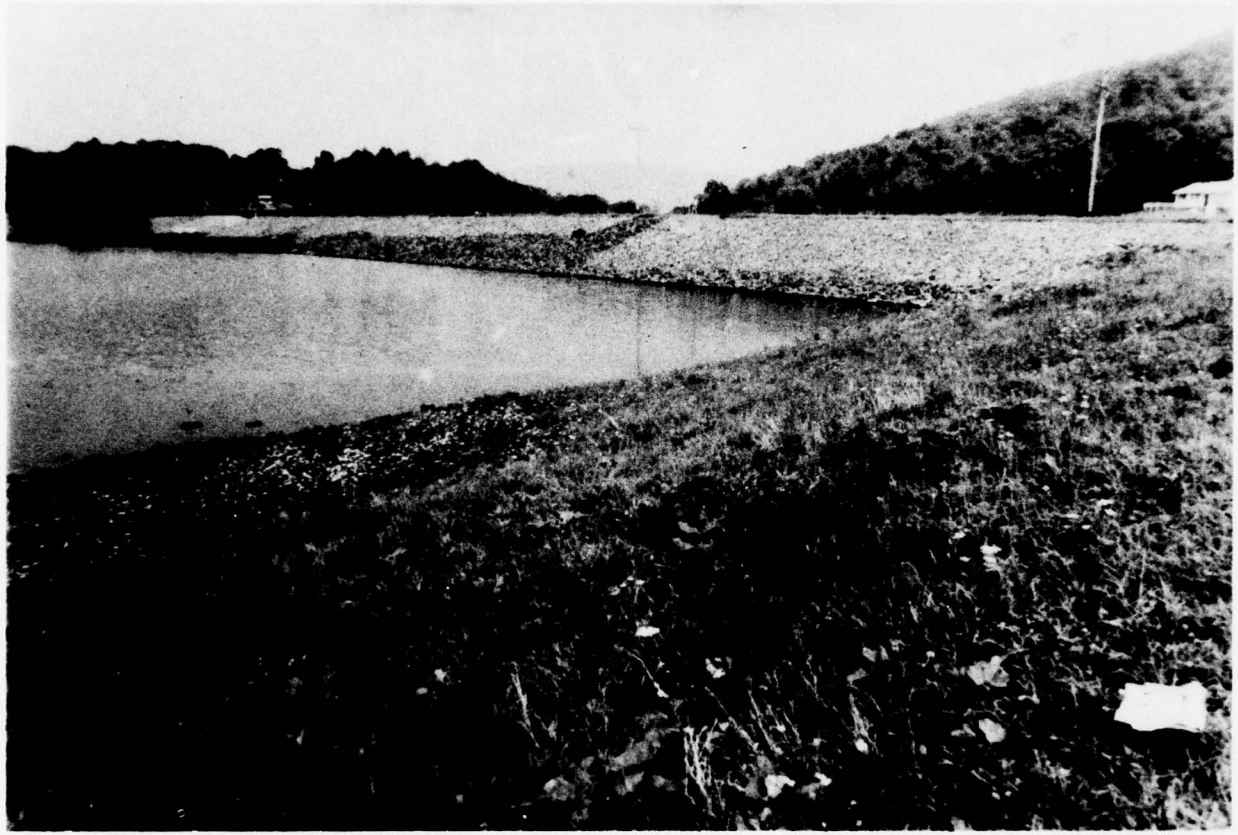
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

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

Date: 11 Dec 78

FRANCES SLOCUM DAM



Embankment.
View from Upstream.

SUSQUEHANNA RIVER BASIN

ABRAHAMS CREEK, LUZERNE COUNTY

PENNSYLVANIA

FRANCES SLOCUM DAM

NDS ID No. PA-00574
DER ID No. 40-218

COMMONWEALTH OF PENNSYLVANIA

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SEPTEMBER 1978

SECTION 1

PROJECT INFORMATION

1.1 General.

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

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

1.2 Description of Project.

a. Dam and Appurtenances. Frances Slocum Dam is a homogeneous earthfill dam 800 feet long and 51 feet high. The centerline of the spillway is perpendicular to the axis of the dam and is located about 190 feet from the left

abutment of the dam. The portion of the embankment that is to the right of the spillway has an earthfilled cutoff trench along its axis. The cutoff trench extends to rock over a reach 200 feet long. In that reach the rock has a single line grout curtain that was grouted using the split spacing, stage grouting method to a depth of 40 feet. Along this same reach, a gravel blanket drain and a rock toe drain were constructed. The portion of the embankment that is to the left of the spillway does not have a cutoff trench. The spillway has an ogee weir that is curved in plan and the crest length is 100 feet. At the centerline of the spillway, there is an opening through the weir that controls the normal pool. The spillway discharges into a steep concrete chute with a flip bucket at its downstream end. Discharges through the opening in the weir outlet into a low-flow channel that was constructed along the centerline of the chute. The outlet works consists of an intake structure at the upstream toe of the dam, a 30-inch diameter concrete pipe through the embankment, and a gate structure located just upstream from the axis of the dam. The 30-inch diameter outlet conduit enters a manhole located in the fill for a highway slope. A 42-inch diameter concrete pipe provides the outfall from the manhole to the stream channel. A gate valve is on the 30-inch diameter outlet conduit in the gate structure. There is also a 4-inch diameter bypass conduit around the 30-inch diameter gate valve. The bypass conduit is also equipped with a gate valve. Various features of the project are shown on the Plates at the end of this Report and on the Photographs in Appendix D.

b. Location. The dam is located on Abrahams Creek about 6 miles north of Wilkes-Barre, Pennsylvania. Frances Slocum Dam is shown on USGS Quadrangle, Kingston, Pennsylvania, with coordinates N41°19'55" - W75°53'10" in Luzerne County. The location map is shown on Plate 1.

c. Size Classification. Intermediate (51 feet high, 5,340 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Frances Slocum Dam (Paragraph 5.1e.).

e. Ownership. Commonwealth of Pennsylvania.

f. Purpose of Dam. Recreation and floodwater detention.

g. Design and Construction History. Interest in the project began in 1960, when a study showed that a reservoir on Abrahams Creek would reduce peak flood flows in downstream areas. Later, it was determined that a reservoir would also have significant recreation potential, and a multi-purpose project was proposed. Frances Slocum Dam was designed by the Commonwealth of Pennsylvania, Department of Forests and Waters, Division of Flood Control, in 1961 and 1962. The Contractor for the dam, Irvin T. Miller and Company, Burgettstown, Pennsylvania, began work in 1964. The project was completed in 1965. In 1976, the Pennsylvania Department of Transportation (PennDOT) was involved in highway construction adjacent to the right abutment of the dam. To prevent erosion of the highway fill during use of the outlet works, PennDOT extended the 30-inch diameter outlet conduit into a manhole located in the fill for the highway embankment and installed a 42-inch diameter concrete pipe leading from the manhole to the stream channel.

h. Normal Operational Procedure. The pool level in the reservoir is normally maintained at the invert of the opening in the spillway weir. Gate valves on the 30-inch diameter outlet conduit and on the 4-inch diameter bypass conduit are normally closed.

1.3 Pertinent Data.

a. Drainage Area. 6.1 square miles.

b. Discharge at Damsite. (cfs.)

Maximum known flood at damsite - 190 cfs (June, 1972).
Emergency drawdown line at maximum pool elevation - 135 (approximate).
Spillway capacity with pool at Elevation 1086.6 - 13,260.

c. Elevation. (Feet above msl.)

Top of dam (design) - 1087.0.
Top of dam (low spot) - 1086.6.
Maximum pool - 1086.6.
Normal pool (invert of opening in spillway crest) - 1070.0.

Spillway crest - 1077.0.
Upstream invert outlet works - 1037.5.
Downstream invert outlet works - 1034.8.
Streambed at centerline of dam - 1036.0 (approximate).

d. Reservoir Length. (Miles.)

Normal pool - 2.2.
Maximum pool - 3.0.

e. Storage. (Acre-feet.)

Normal pool (spillway crest) - 1,550.
Maximum pool (design top of dam) - 5,340.

f. Reservoir Surface. (Acres.)

Normal pool (invert of opening in spillway crest) - 164.
Maximum pool (design top of dam) - 275.

g. Dam.

Type - Earthfill embankment.

Length - Embankment - 800 feet.

Height - 51 feet.

Top Width - 20 feet.

Side Slopes - Downstream - 1V on 2.5H.
Upstream - 1V on 3.0H.

Zoning - None.

Cutoff - Earthfilled cutoff trench.

Grout Curtain - 200-foot long reach at maximum section has single line grout curtain. Grouted using split spacing, stage grouting method in two zones to depth of 40 feet. Primary holes are on 10-foot centers.

h. Diversion and Regulating Tunnels. None.

i. Spillway.

Type - Ogee weir with 28-foot wide low-flow opening.

Length of Weir - 100 feet.

Crest Elevation - 1077.0; invert elevation of opening in weir - 1070.0.

Upstream Channel - Reservoir.

Downstream Channel - Concrete chute and flip bucket followed by natural stream channel.

j. Regulating Outlets.

Type - One 30-inch diameter concrete pipe through embankment and one 4-inch diameter bypass conduit.

Length - 30-inch diameter pipe - 275 feet.

Access - Downstream toe of dam or from gate structure.

Regulating Facilities - One gate valve on each pipe just upstream from axis of dam. Operating stands are in gate structure located at upstream edge of crest of dam.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. Engineering data that was available for review was limited to a set of project plans stamped "Prefinal" and the permit application report. The project plans include a summary of the hydraulic data and the logs of subsurface investigations. The project plans were prepared by the Department of Forests and Waters, Division of Flood Control. The permit application report was prepared by the Division of Dams and Encroachments.

b. Design Features. The primary features of the project are the embankment, the spillway, and the outlet works. A general plan of the features is shown on Plate 2. Photographs of the features are in Appendix D.

The embankment is a homogeneous earthfill structure 800 feet long and 50 feet high. A plan of the embankment is shown on Plate 2, and a profile along its axis is shown on Plate 3. Typical embankment sections are shown on Plate 4. The top of the embankment is 20 feet wide. The upstream slope of the embankment is 1V on 3H, and the downstream slope is 1V on 2.5H. The upstream slope is protected by riprap from below normal pool level to the top of the dam. The top of the embankment is covered with grass, and the downstream slope is covered with a mixture of grass, crownvetch, and weeds. About 660 feet of the embankment are to the right of the spillway, and 140 feet are to the left. A cutoff trench was excavated along the axis of the dam under the part of the embankment that is to the right of the spillway. Within the section of the embankment that is to the right of the spillway, there is a 200-foot long reach where the cutoff trench was excavated to rock. This reach coincides with the location of the maximum embankment section. A single line grout curtain 40 feet deep was constructed along this reach, and a gravel blanket drain and a rock toe drain were constructed under the downstream part of the embankment section (Plates 3 and 4). The grout curtain was constructed using the split spacing, stage grouting method with two zones. Primary holes were located at 10-foot centers. Some portions of the gravel blanket drain are on overburden and some portions are on rock. The remaining portions of the

embankment are founded on overburden. The overburden is a dense glacial till with low permeability. The embankment materials were obtained from a borrow area on the right hillside and consist of silty sands and silts.

The spillway is shown on Plate 5. The centerline of the spillway is perpendicular to the axis of the dam and it is located about 190 feet from the left abutment. The spillway has an ogee weir that is curved in plan and the crest length is 100 feet. The weir has an opening through it with the invert of the opening at Elevation 1070.0 (Plate 5). The crest of the spillway weir is at Elevation 1077.0. A steep concrete chute section is located downstream from the weir (Plates 5, 6, and 7). Discharges through the opening in the weir outlet into a low-flow channel that follows the centerline of the chute. The slab of the chute has a gravel drain beneath it. Drain outlets are located at intervals along the low-flow channel. The upstream part of the chute has an 8 percent slope and converges from 100 feet wide at the weir to 60 feet wide at a distance 80 feet downstream. The lower part of the chute has a 40 percent slope and a constant width of 60 feet. A concrete flip bucket is located at the end of the chute. The spillway is separated from the embankment by concrete training walls on each side (Plates 5, 6, and 7). The wall monoliths upstream from the weir are cantilever walls founded on earth. The wall monoliths at the weir consist of stems cantilevered from the weir. The wall sections along the chute are cantilever walls with a wide base that forms part of the chute slab.

The outlet works is situated along the original streambed and consists of an intake structure at the upstream toe of the embankment, a 30-inch diameter concrete outlet conduit through the embankment, and a gate structure located just upstream from the axis of the dam (Plate 8). As originally constructed, an outlet structure was located at the downstream toe of the embankment. However, as part of highway construction adjacent to the right abutment, PennDOT extended the outlet conduit to a manhole located in the highway fill. A 42-inch diameter concrete pipe leads from the manhole to the stream channel. The intake structure is concrete and it has a trashrack. The 30-inch diameter outlet conduit is on a concrete cradle founded on rock. Seepage collars are located at 15-foot intervals along the conduit. The gate structure shelters

an operating stand for a 30-inch diameter gate valve on the outlet conduit. An air vent is located just downstream from the gate valve. A 4-inch diameter conduit bypasses the 30-inch diameter valve. There is a gate valve on the bypass conduit, and the operating stand for that valve is also located in the gate structure. A bulkhead that can be used to close off the upstream end of the outlet conduit is stored in the gate structure.

2.2 Construction.

a. Data Available. There was no construction data available for review for Frances Slocum Dam.

b. Construction Considerations. As far as can be determined from the visual inspection, the dam was constructed essentially in accordance with the set of drawings that were reviewed. One exception that was noted is the protection on the upstream slope of the embankment. The plans show slope protection only to the crest level of the spillway, but riprap was placed to the top of the dam.

2.3 Operation. Detailed records of operation for Frances Slocum Dam are available in the form of inspection reports. Formal inspections have been made twice each year by the Park Superintendent and once each year by PennDER, Division of Completed Projects. The only major problem that has occurred during the life of the project has been cracking and spalling of concrete of the spillway training walls.

2.4 Other Investigations. As far as is known, there have been no investigations of the project other than those described herein.

2.5 Evaluation.

a. Availability. Engineering data was provided by the Owner, the Commonwealth of Pennsylvania, PennDER, Bureau of Water Quality Management, Division of Dams and Encroachments, and by the Bureau of Operations, Division of Completed Projects. Additional information is available from the Bureau of Engineering, but it was not available for review for this study. The Owner made available personnel for information and operating demonstrations during the visual inspection.

b. Adequacy. The type and amount of design data and other engineering data available for review are limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The general appearance of this project indicated that most of the project features have been properly maintained and are in good condition, but that some project features are in need of repair. Specific observations are described herein.

b. Dam.

(1) The top of the embankment had some vertical irregularities. Design top of dam level is Elevation 1087.0. A survey of the top of the embankment revealed low areas at each side of the spillway that were 0.4 foot below design grade. The survey also showed that the shoulder of the roadway adjacent to the dam was about 0.2 foot below design grade of the embankment (Photograph A).

(2) The embankment slopes were in excellent condition (Photographs A, B, C, and D). Riprap on the upstream slope was intact to the top of the dam, and there were no weeds or brush growing in the riprap. The downstream slope is covered with a mixed growth of grass, crownvetch, and weeds about 2 feet high. There was no brush growing on the downstream slope.

(3) The embankment toe gutters were generally in good condition. The gutter along the right abutment is rock-lined, and there were no signs of erosion (Photograph C). A concrete gutter along the downstream toe had a slight amount of vegetation growing in the joints.

c. Appurtenant Structures.

(1) Spillway. The approach area to the spillway was clear (Photograph E). The bar screen over the opening in the spillway weir was well-maintained and free of debris (Photograph F). Some cracks in the concrete were visible on the downstream side of the spillway weir where the opening in the spillway weir transitions to a channel along the centerline of the spillway chute (Photographs G and L). Attempted surface repairs by the Park personnel using an epoxy cement have not been successful. Except for the aforementioned cracks in the vicinity of the opening in the spillway weir, the ogee weir was in good condition (Photographs G and J).

(2) Spillway Right Training Wall. The right training wall of the spillway has several deficiencies. The most upstream monolith, or first monolith, has one vertical crack at its upstream end that extends through the wall. The third monolith, which is the monolith just upstream of the concrete ogee weir, has 7 fine diagonal cracks on its face (Photograph J). Similarly, the fourth monolith has 3 fine diagonal cracks and one fine vertical crack. The joint between the third and fourth monoliths is spalled to a depth of 4 inches and the waterstop is exposed (Photographs J and K). About one inch of differential movement was measured between the tops of the third and fourth monoliths. The inside face of the third monolith has an inward inclination of about 77V on 1H, while the inside face on the fourth monolith has an inward inclination of about 96V on 1H. Downstream from the fourth monolith, the monoliths along the chute and flip bucket are in good condition.

(3) Spillway Left Training Wall. The condition of the left training wall of the spillway is similar in character to the right training wall but not nearly as severe (Photograph H). The first and second monoliths are in good condition. The third monolith has 2 fine diagonal cracks, and the fourth monolith is in good condition. The joint between the third and fourth monoliths is badly cracked and ready to spall (Photograph H). Differential movement at the tops of the monoliths at the joint was 0.25 inch. The rest of the monoliths along the chute and flip bucket are in good condition except for one surface spall on one of the monoliths.

(4) Spillway Chute Slab and Flip Bucket. The spillway chute slab had no major deficiencies. Several fine transverse cracks were apparent, but most of them did not go all the way across the slab monoliths. One slab monolith has settled slightly, but there were no apparent adverse effects. The chute slab and flip bucket are shown on Photographs G, M, and N.

(5) Outlet Works. The intake structure was submerged and could not be inspected. The gate structure and operating equipment were in good condition. All metalwork was painted and the valve stems were lubricated. Both the 30-inch diameter and 4-inch diameter gate valves opened easily during the inspection (Photograph O). An aluminum bulkhead was stored in the gate structure. The bulkhead is designed to be installed by a diver on the upstream end of the 30-inch diameter conduit if the need arises. It was noted that the louvered air vent on the upstream

side of the gate structure is located below the level of the top of the dam.

d. Reservoir Area. The slopes adjacent to the reservoir vary from steep to mild. There was no evidence of creep, rock slides, or land slides. The watershed is a mixture of woodland, farmland, and developed areas. The Owner indicated that there is no known sedimentation problem.

e. Downstream Channel. No obstructions were apparent in the downstream channel. The channel area below the flip bucket is rock, and there were no signs of extreme erosion (Photograph N). Numerous low-lying houses are situated along the stream in the valley downstream from the dam. About 2.5 miles downstream from the dam, Abrahams Creek enters the community of West Wyoming (Plate 1).

3.2 Evaluation.

a. Dam.

(1) The effect of the low areas along the top of the embankment is to make the maximum spillway capacity less than the design capacity.

(2) The embankment slopes have been satisfactorily maintained.

(3) The growth of vegetation in the joints of the concrete toe gutter is undesirable. Continued growth of vegetation would eventually cause deterioration of the gutter.

b. Appurtenant Structures.

(1) Spillway. The cracking of the concrete at the spillway has not caused any conditions that present significant hazard to the dam. However, the concrete might deteriorate in the future to the extent that repairs would be warranted. Surface repairs of the type attempted by Park personnel have generally been unsuccessful. Successful repair of the cracks would require substantial chipping away of concrete along the length of each crack.

(2) Spillway Training Walls. The condition of the right training wall of the spillway is unsatisfactory. The ends of the waterstop are exposed, and the effectiveness of the waterstop is doubtful. During periods of high pool levels, seepage could develop through the joint that might cause piping of embankment materials. Loss of embankment materials could cause a condition that might result in overtopping of the embankment. While the condition of the left training wall is not as severe as the right wall, it is considered to be part of the same problem. The similarities between the deficiencies of the right and left walls suggest that the problems arose as a result of the design of the walls. Review of previous inspection reports clearly indicates that the deficiencies had become apparent by 1973, and possibly began as early as 1969, at which time the project was 4 years old. The inspection reports also indicate substantial worsening of the condition between 1973 and 1975. Without additional study, it is not possible to determine whether the problem is still active or whether it has stabilized. It should be recognized that a great flood would impose loads on the walls that would exceed those have been experienced to date.

(3) Spillway Chute Slab. The fine transverse cracks on the spillway chute slab and the minor settlement of one slab do not present hazard to the dam. However, the concrete might deteriorate in the future to the extent that repairs would be warranted.

(4) Outlet Works. No deficiencies were apparent in the outlet works. The location of the louvered vent at the gate structure is such that the gate structure would be flooded at maximum pool level. However, this would primarily cause a maintenance problem and would not cause significant hazard to the dam. In addition, as shown in Section 5, the spillway capacity is so large that the probability of the water level being near to the top of dam is very remote.

c. Reservoir Area. No conditions were observed in the reservoir area that might present significant hazard to the dam.

d. Downstream Channel. Nothing was observed in the downstream channel that would present significant hazard to the dam. Additional discussion of downstream conditions is in Paragraph 5.1.e.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedure. The project is operated in accordance with the Operation and Maintenance Manual for Frances Slocum Dam. The manual provides detailed operating instructions for normal conditions, periods of low flow, periods of flood emergency, and for reservoir drawdown.

a. Normal Procedure. The reservoir is normally maintained at the invert of the opening in the spillway weir (Elevation 1070.0), with excess inflow going down the channel along the centerline of the chute. The 30-inch diameter gate valve on the outlet conduit and the 4-inch diameter gate valve on the bypass conduit are normally closed.

b. Low Flow Procedure. When evaporation exceeds inflow, the Park Superintendent is under instructions to call the Office of the Chief Engineer in Harrisburg, Pennsylvania. The Chief Engineer will instruct the Superintendent as to the amount, if any, of flow augmentation required. Any flow augmentation would be provided by opening the 4-inch diameter gate valve on the bypass conduit.

c. Flood Emergency Procedure. During periods of flooding, the 30-inch valve and 4-inch valve are kept closed, and the spillway passes all floodwaters. Continuous patrols are conducted during floods to check for seepage, erosion, and floating debris. The Manual provides names and phone numbers of engineering personnel to be called in the event of any unusual conditions that might develop.

d. Drawdown Procedure. Drawdown of the reservoir for maintenance and inspection purposes is accomplished by opening the 30-inch diameter gate valve on the outlet conduit. The Operation and Maintenance Manual specifies that the drawdown rate should not exceed one inch per hour.

4.2 Maintenance of Dam. The Park Superintendent and his staff are responsible for maintenance of the dam. The Superintendent makes a formal inspection of all the features of the dam every six months, and the report is sent

to the Secretary, Department of Environmental Resources, Harrisburg, Pennsylvania. In addition, a formal inspection of the dam is also made each year by the Division of Completed Projects. The Operation and Maintenance Manual contains detailed instructions for inspection and maintenance of the dam and appurtenant structures. The three formal inspections of the dam each year, as well as informal inspections made more frequently, are used to evaluate the need for maintenance. The inspection performed for this study, and follow-up reports on file for previously recommended maintenance, indicate that the maintenance of the dam is satisfactory, but that some repair work for the spillway training walls is needed in the near future.

4.3 Maintenance of Operating Facilities. The inspection and maintenance program for the operating facilities is similar to the previously described program for the dam. The gate valves are opened fully twice each year.

4.4 Warning Systems in Effect. There is no formal warning system in effect for the downstream areas. The Superintendent or the Park Foreman is available at all times.

4.5 Evaluation. The inspection and maintenance program for the project are satisfactory. The operating procedures used for the various conditions are satisfactory. The lack of an emergency warning system for downstream areas is unsatisfactory.

SECTION 5
HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data.

(1) No hydrologic or hydraulic analyses for Frances Slocum Dam were available for review. However, the project plans included hydraulic data for the dam consisting of the following: spillway rating curve, area-capacity curves, outlet works rating curve, and a drawdown curve. The data appeared to be satisfactory and was accepted for use in this study. The hydraulic data are shown on Plate 9. The design capacity of the spillway is 14,160 cfs.

(2) In the recommended guidelines for safety inspection of dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended spillway design flood for the size (intermediate) and hazard potential (high) classification of Frances Slocum Dam is the Probable Maximum Flood (PMF). If the dam and spillway are not capable of passing the PMF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

(3) The hydrologic analysis for this study was based on existing conditions of the Frances Slocum watershed, and the effects of future development of the watershed were not considered.

b. Experience Data. For this study, a PMF peak for the watershed of Frances Slocum Dam was derived from generalized data supplied by the Baltimore District, Corps of Engineers for this area of the Susquehanna River Basin. The PMF peak flow was estimated to be 13,420 cfs at Frances Slocum Dam. Hydrologic computations are included in Appendix C.

c. Visual Observations. Three low areas on the top of the embankment were revealed during the visual inspection. The lowest level of the top of the embankment is at Elevation 1086.6, which is 0.4 foot lower than design elevation. Accordingly, the maximum spillway capacity is 13,260 cfs instead of the design capacity of 14,160 cfs. The existing spillway capacity, 13,260 cfs, was used in this study for the purpose of rating the spillway.

d. Overtopping Potential. For an occurrence of the PMF, the peak inflow of 13,420 cfs is greater than the existing spillway capacity of Frances Slocum Dam. However, a check of the surcharge storage effect shows that the surcharge storage available is sufficient to contain the PMF inflow hydrograph without overtopping the dam (Appendix C). Therefore, Frances Slocum Dam will not be overtopped by the estimated PMF. The design capacity of the spillway, which would be available if the embankment were at design grade, is greater than the estimated PMF peak inflow.

e. Downstream Conditions. As shown on Plate 1, Frances Slocum Dam is located on Abrahams Creek in Luzerne County. From the dam to the community of Carverton, which is about 1.1 miles downstream, the stream valley has only a few low-lying houses. However, the reach beginning at Carverton and extending 1.4 miles downstream has numerous low-lying houses. At a distance of about 2.5 miles downstream from the dam, Abrahams Creek enters the densely populated communities of West Wyoming and Wyoming. The downstream conditions indicate that a high hazard classification is warranted for Frances Slocum Dam.

f. Spillway Adequacy.

(1) Considering the effects of surcharge storage, the existing spillway of Frances Slocum Dam is capable of passing the PMF peak inflow of 13,420 cfs without overtopping the dam (Appendix C). Based on established OCE

criteria as outlined in Paragraph 5.1 a.(2), the spillway capacity of Lackawanna Dam is rated as adequate. Considering the effects of 3,700 acre-feet of available surcharge storage, the existing spillway discharge capacity of 13,260 cfs can accommodate a flood with a peak inflow of 19,610 cfs for a storm of the same duration as the PMF. This is 146 percent of the PMF peak inflow.

(2) If the low areas on the embankment were brought up to design grade, which would be a relatively minor maintenance task, the spillway capacity would be the design capacity of 14,160 cfs. Considering the effects of 3,790 acre-feet of available surcharge storage, the spillway design discharge capacity of 14,160 cfs would accommodate a flood with a peak inflow of 20,665 cfs for a storm of the same duration as the PMF, or 154 percent of the PMF peak inflow.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. There were no conditions observed during the visual inspection that were considered to adversely reflect on the stability of the embankment.

b. Design and Construction Data. No records of stability computations were available for review; and no construction data were available. The plans show the upstream slope to be 1V on 3H and the downstream slope to be 1V on 2.5H. Surveys made for this inspection showed that the as-built slopes do not deviate significantly from the design slopes. The design slopes are within the range normally used for homogeneous earthfill dams with a drainage system. Therefore, the stability of the embankment is probably adequate for design conditions.

c. Operating Records. There is no evidence that any stability problems have occurred for the dam during its operational history of 13 years. As far as can be determined, conditions at the site have been stable since the construction of the dam.

d. Post-Construction Changes. There have been no significant structural modifications of the dam since it was constructed in 1965.

e. Seismic Stability. Frances Slocum 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 loading.

SECTION 7
ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on the visual inspection available records, calculations and part operational performance, Frances Slocum Dam is judged to be in good condition. However, deficiencies of varying degree of importance were noted. A summary of the features and observed deficiencies is listed below:

Feature and Location	Observed Deficiencies
Embankment:	
Top of embankment	Three areas lower than design elevation.
Concrete toe gutter	Vegetation at joints.
Spillway:	
Opening in weir	Fine cracks in concrete.
Right training wall	Cracks in concrete and severe spalling at joint; differential movement of monoliths.
Left training wall	Cracks in concrete; differential movement of monoliths.
Chute slab	Fine transverse cracks in concrete.

(2) The overtopping potential analysis shows that Frances Slocum Dam will not be overtopped by the PMF. Based on OCE criteria, as outlined in Paragraph 5.1a.(2), the spillway capacity is rated as adequate. Considering the effects of surcharge storage, the existing spillway can pass 146 percent of the PMF peak inflow. If the low areas on the top of the embankment were brought up to design grade, which is a relatively minor maintenance task, the spillway would pass 154 percent of the PMF peak inflow.

(3) Although no stability analyses for the embankment were available for review, the combination of exterior lines, design features, and performance history indicate that the stability of the embankment is probably adequate for design conditions.

b. Adequacy of Information. The information available is such that an assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented as soon as practical or in a timely manner, as noted.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations will be required.

7.2 Recommendations and Remedial Measures.

a. In view of the concern for safety of Frances Slocum Dam, the following measures are recommended to be undertaken by the Owner as soon as practical:

(1) Develop a detailed emergency warning system for Frances Slocum Dam.

b. In order to correct operational, maintenance and repair deficiencies, and to more accurately determine the condition of the dam, the following measures are recommended to be undertaken by the Owner in a timely manner.

(1) Restore embankment to design elevation.

(2) Perform investigations required to determine the cause of unsatisfactory performance of the spillway training walls and make repairs.

(3) Remove vegetation from joints of concrete toe gutter.

(4) Monitor condition of spillway slab concrete where cracks exist. If conditions worsen, repairs should be undertaken.

c. In addition, the following operational measure is recommended to be undertaken by the Owner:

(1) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency warning system procedures.

SUSQUEHANNA RIVER BASIN

ABRAHAMS CREEK, LUZERNE COUNTY

PENNSYLVANIA

FRANCES SLOCUM DAM

NDS ID No. PA-00574
DER ID No. 40-218

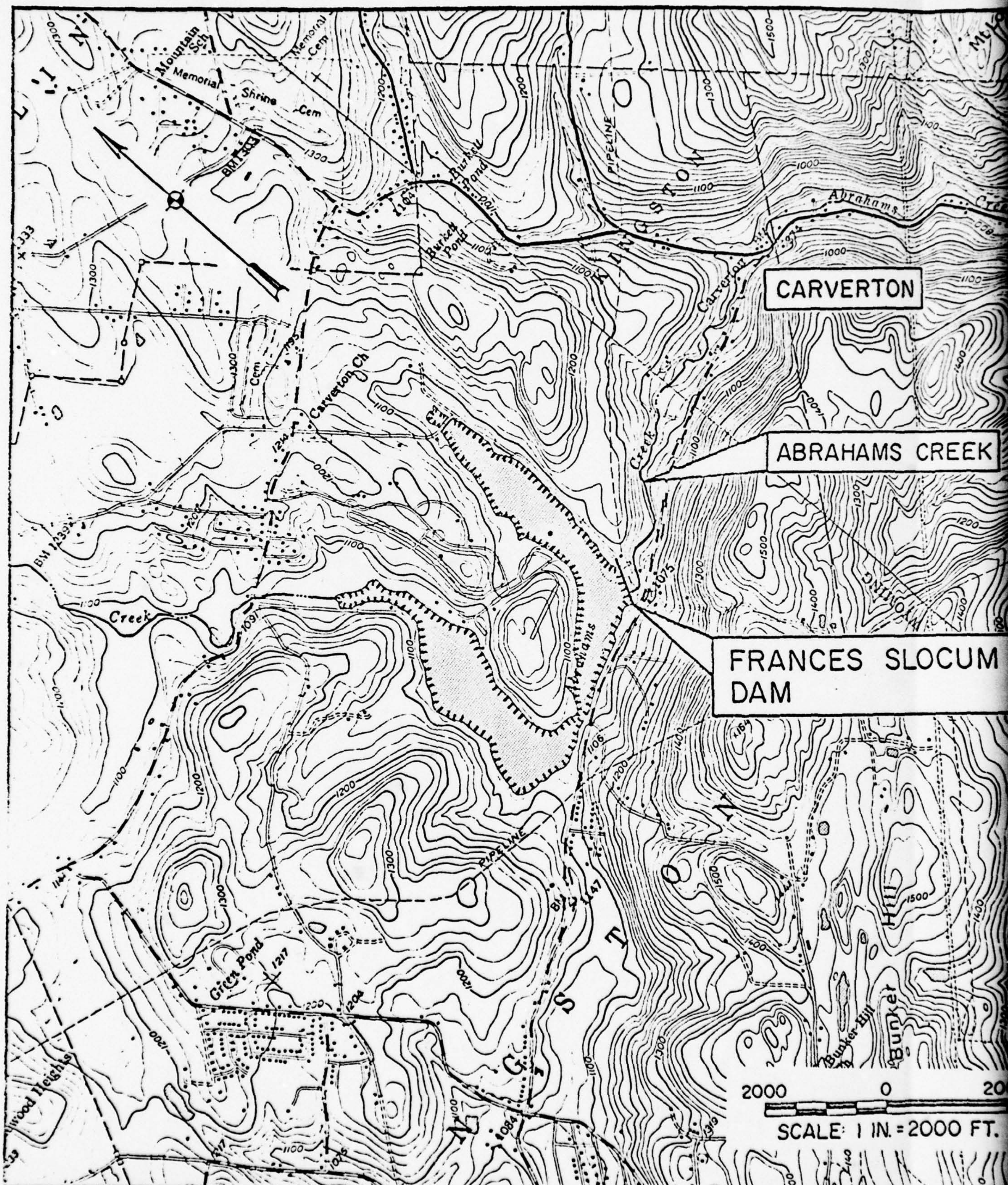
COMMONWEALTH OF PENNSYLVANIA

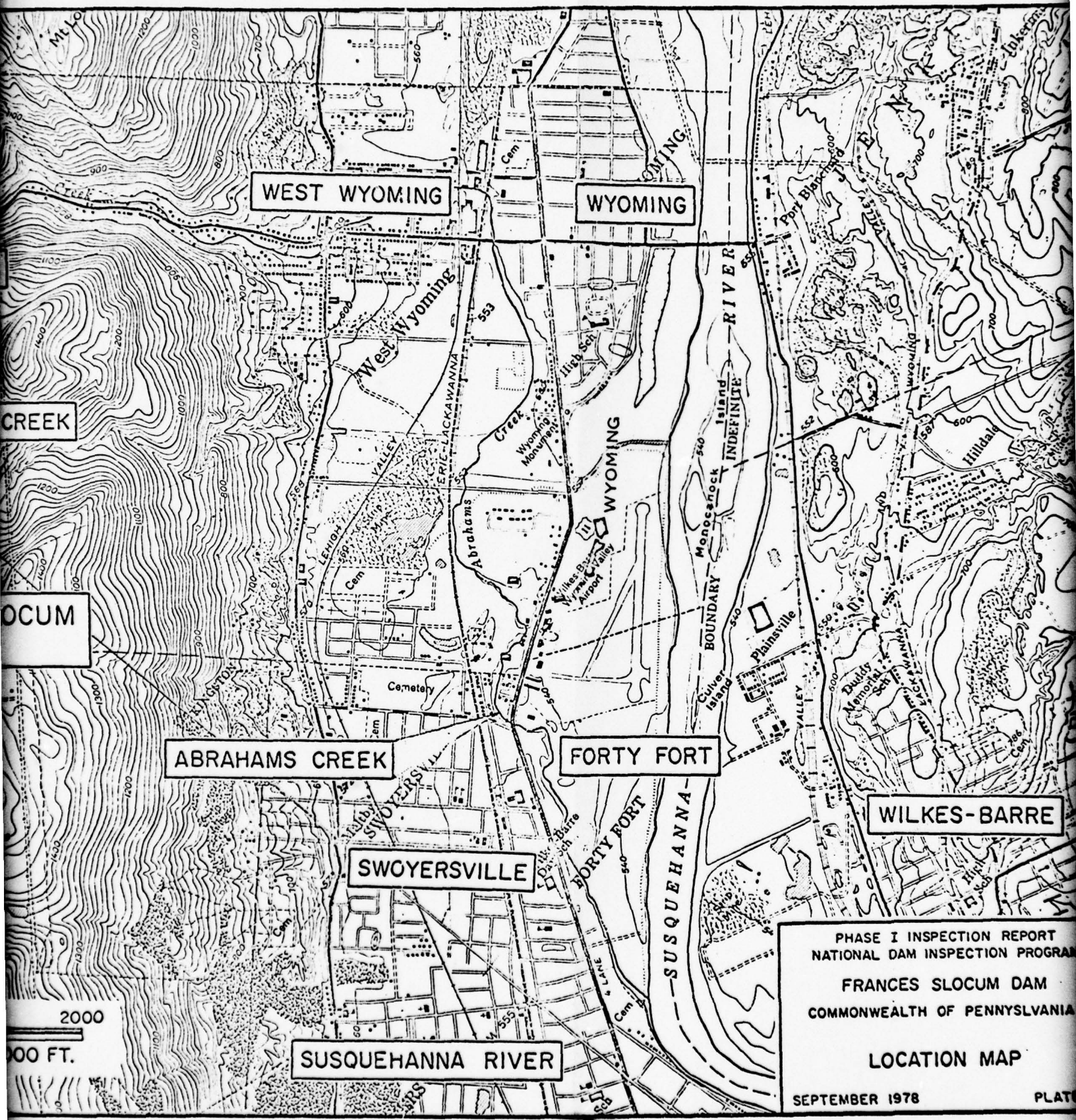
PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SEPTEMBER 1978

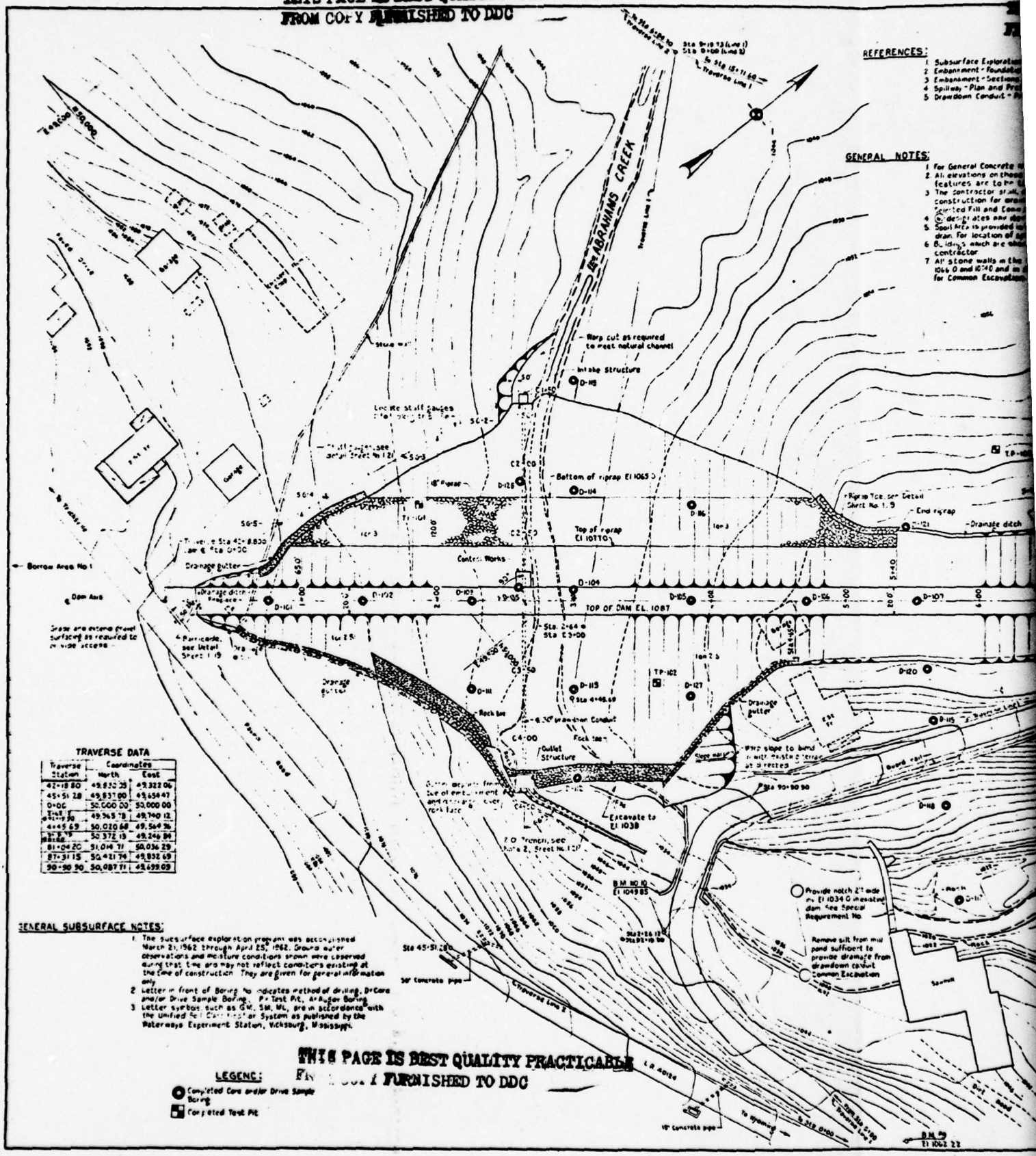
PLATES


CARVERTON
ABRAHAMS CREEK
FRANCES SLOCUM DAM
Memorial Shrine Cem
Carverton Ch
Burkett Pond
Abrahams Creek
PIPELINE
Green Pond
Bunker Hill
2000 0 20
SCALE: 1 IN. = 2000 FT.


WEST WYOMING
WYOMING
ABRAHAMS CREEK
FORTY FORT
SWOYERSVILLE
WILKES-BARRE
SUSQUEHANNA RIVER
CREEK
OCUM
2000
00 FT.
West Wyoming
Abrahams Creek
Wyoming
Forty Fort
Susquehanna River
Wilkes-Barre
Plainsville
Hillsdale
Cemetery
Wyoming Monument
Wilkes-Barre Wyoming Valley Airport
Culver Island
Island
INDEFINITE
BOUNDARY
Monocanock
Duddy Memorial Sch
High Sch
Cem
LEHIGH VALLEY
ERIE-LACKAWANNA
LACKAWANNA VALLEY
SUSQUEHANNA RIVER
Creek
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
FRANCES SLOCUM DAM
COMMONWEALTH OF PENNSYLVANIA
LOCATION MAP
SEPTEMBER 1978
PLATE

REPORT
N PROGRAM
DAM
NSYLVANIA
AP
PLATE 1

d 3

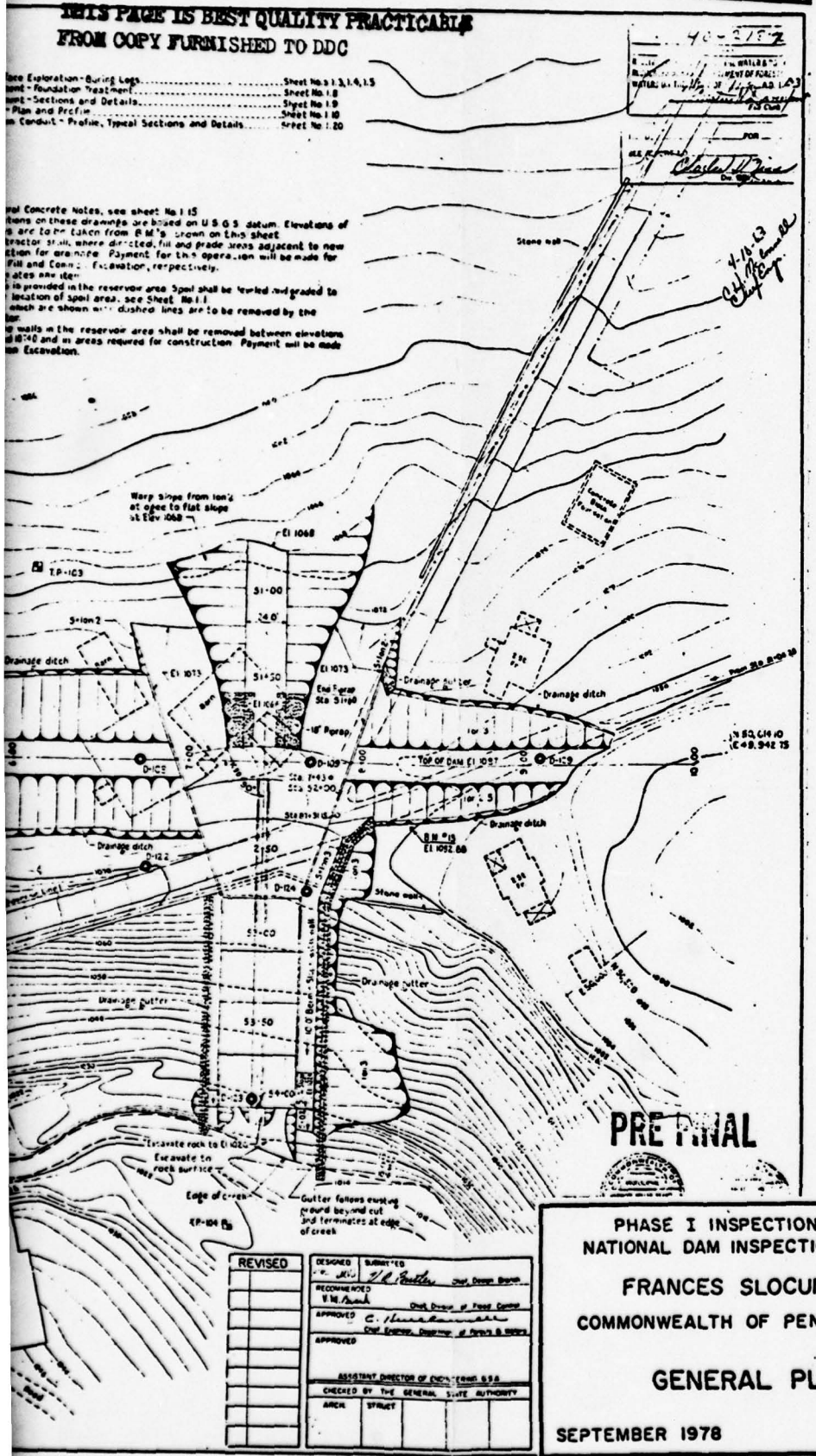


TRAVERSE DATA

Traverse Station	Coordinates North	Coordinates East
42+18.80	49,830.25	49,322.06
45+51.28	49,831.00	49,654.47
0+00	50,000.00	50,000.00
Traverse Sta 3+19.30	49,965.78	49,740.12
4+45.69	50,020.68	49,569.36
Traverse Sta 5+81.19	50,372.13	49,246.84
81+04.20	51,014.71	50,036.29
87+31.15	50,421.74	49,832.69
90+90.90	50,087.71	49,699.09

GENERAL SUBSURFACE NOTES:

1. The subsurface exploration program was accomplished March 21, 1962 through April 25, 1962. Ground water observations and moisture conditions shown were observed during that time and may not reflect conditions existing at the time of construction. They are given for general information only.
2. Letter in front of Boring No. indicates method of drilling, D=Core and/or Drive Sample Boring, P=Test Pit, A=Auger Boring.
3. Letter symbols such as GW, SM, ML, are in accordance with the Unified Soil Classification System as published by the Waterways Experiment Station, Vicksburg, Mississippi.



Rock Exploration - Boring Logs ..... Sheet No.s 1.3, 1.4, 1.5
Treatment - Foundation Treatment ..... Sheet No. 1.8
Treatment - Sections and Details ..... Sheet No. 1.9
Conduit - Plan and Profile ..... Sheet No. 1.10
Conduit - Profile, Typical Sections and Details ..... Sheet No. 1.20

Typical Concrete Notes, see sheet No. 1.15
Elevations on these drawings are based on U.S.G.S. datum. Elevations of areas are taken from B.M.'s shown on this sheet
Tractor strip, where directed, fill and grade areas adjacent to new construction for drainage. Payment for this operation will be made for Fill and Common Excavation, respectively.
Gates and stem
is provided in the reservoir area. Spoil shall be leveled and graded to location of spoil areas, see Sheet No. 1.1
which are shown with dashed lines are to be removed by the
Walls in the reservoir area shall be removed between elevations of 1040 and in areas required for construction. Payment will be made Excavation.

REVISED	DESIGNED	SUBMITTED
	RECOMMENDED	Chief, Design Branch
	APPROVED	Chief, Division of Flood Control
	APPROVED	Chief Engineer, Department of Forests & Waters
	ASSISTANT DIRECTOR OF CIVIL WORKS, U.S.A.	
	CHECKED BY THE GENERAL STATE AUTHORITY	
	ARCH.	STRUCT.

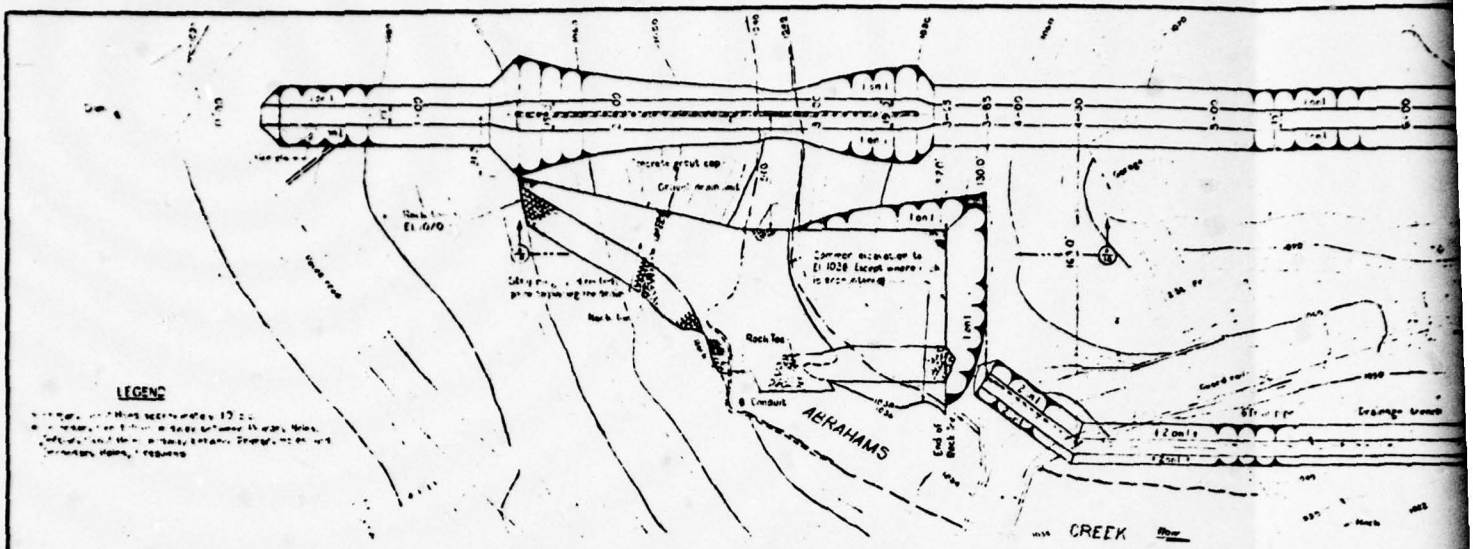
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

FRANCES SLOCUM DAM

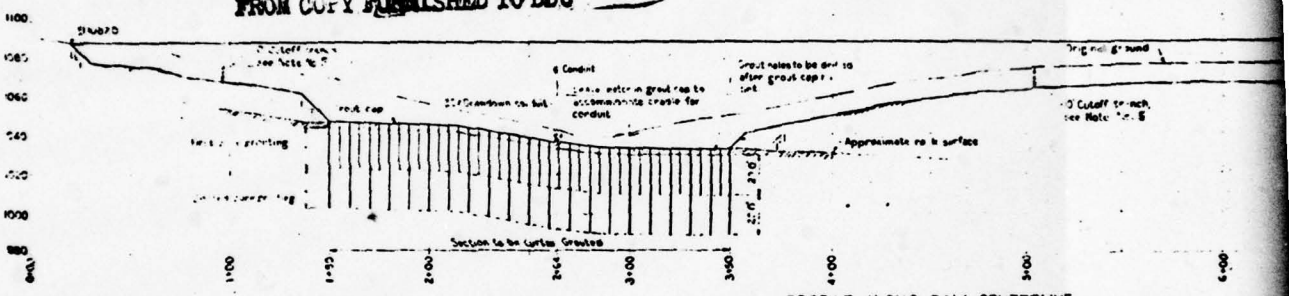
COMMONWEALTH OF PENNYSLVANIA

GENERAL PLAN

SEPTEMBER 1978 PLATE 2

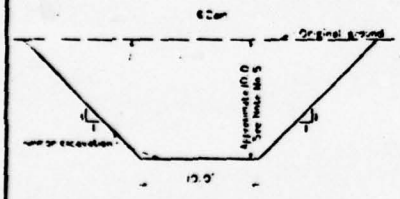


FOUNDATION TREATMENT PLAN



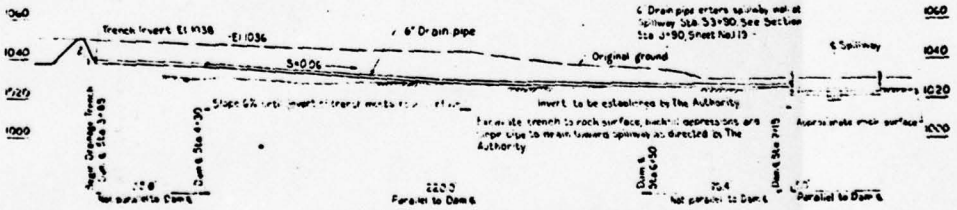
PROFILE ALONG DAM CENTERLINE

Scale: 1 in = 30 ft (Approx)



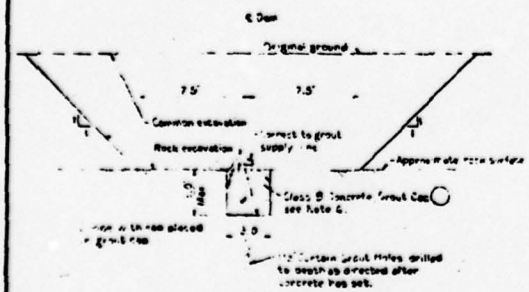
TYPICAL SECTION THRU CUTOFF TRENCH

Scale: 1 in = 5 ft



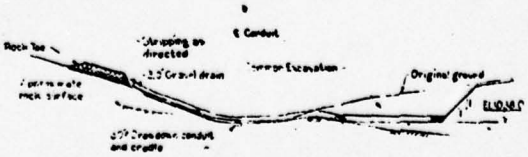
DRAINAGE TRENCH CENTERLINE PROFILE

Scale: 1 in = 30 ft (Approx)



TYPICAL SECTION THRU GROUT CURTAIN

Scale: 1 in = 5 ft



SECTION (A) (18)

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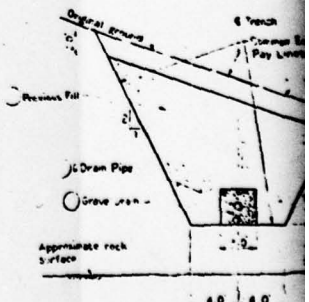

TYPICAL DRAINAGE TRENCH

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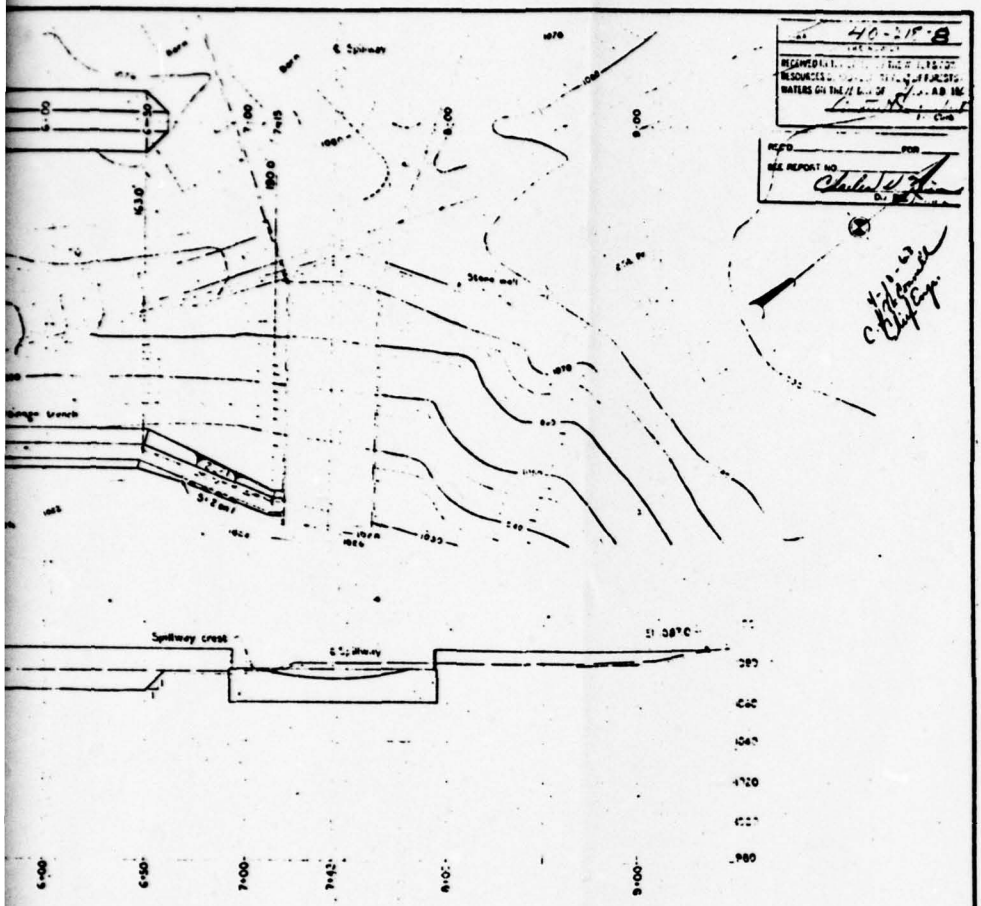


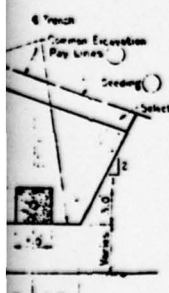
REFERENCES:

1. Subsurface Exploration - Boring Logs	Sheets No. 1.3, 1.4 & 1.5
2. Embankment - Plan	Sheet No. 1.7
3. Embankment Cross Sections and Details	Sheet No. 1.9
4. Spillway - Plan and Profile	Sheet No. 1.10
5. Diversion Conduit - Profile Typical Sections and Details	Sheets No. 1.20

NOTES:

1. The spacing and depth of holes for curtain grouting are shown on this sheet for purposes of illustration. The actual spacing and depth of holes will be determined by The Authority as work progresses.
2. Grouting shall always proceed from more advanced to less advanced.
3. Drilling and grouting shall be done by stage methods in accordance with the specifications, and as directed by The Authority.
4. The portion of the drainage trench indicated on [illegible] shall be backfilled to the invert established by The Authority prior to placing pervious fill and drainage.
5. Actual depth of cutoff trench which may be greater than or less than 10 feet, will vary according to field conditions and shall be established by The Authority.
6. The actual depth of grout cap shall be dependent upon the quality of rock and shall be determined by The Authority.

PRE FINAL



E TRENCH SECTION

REVISED	DESIGNED	SUBMITTED
	DRAWN	E. E. Foster, Chief, Design Branch
	TRACED	RECOMMENDED U.M. Franck, Chief, Design of Dams Section
	CHECKED	APPROVED C. Hess Thomas, Chief Engineer, Department of Forests & Waters
		APPROVED ASSISTANT DIRECTOR OF ENGINEERING G.S.A.
		CHECKED BY THE GENERAL STATE AUTHORITY: ARCH, STRUCT

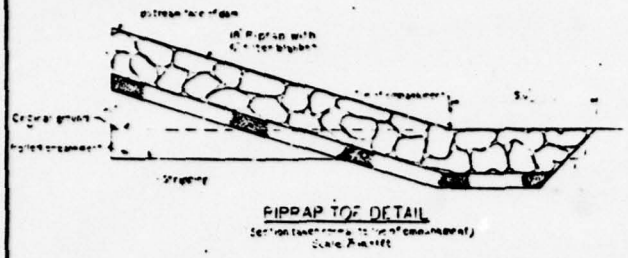
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

FRANCES SLOCUM DAM

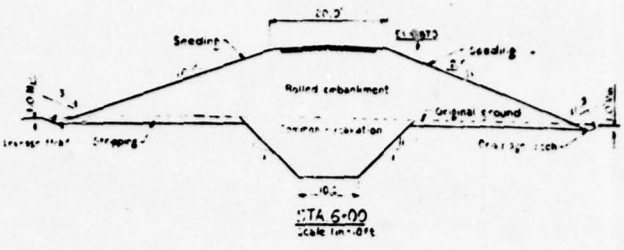
COMMONWEALTH OF PENNYSLVANIA

PROFILE ALONG AXIS OF DAM

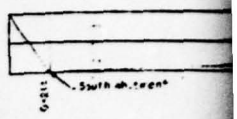
SEPTEMBER 1978 PLATE 3

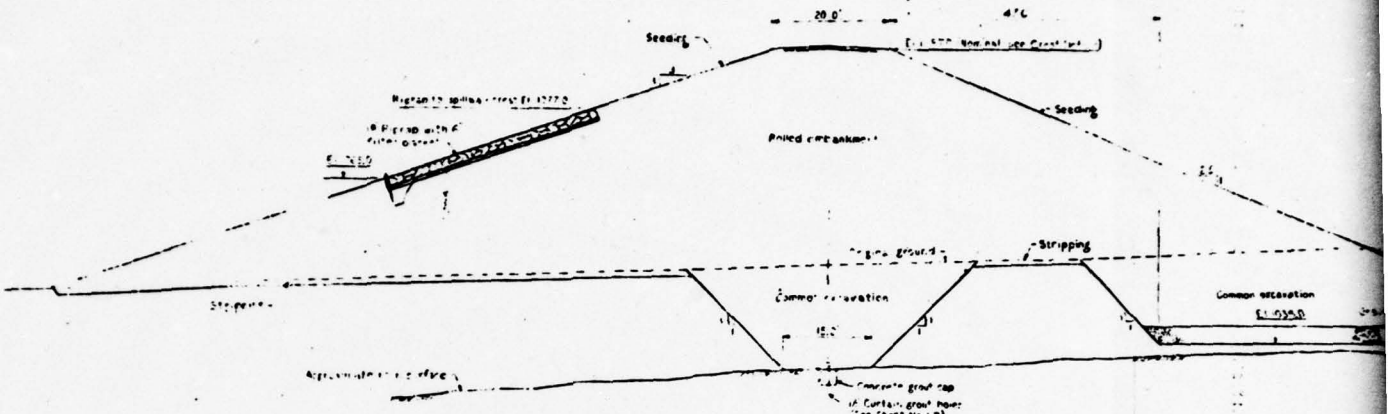


RIPRAP TOE DETAIL

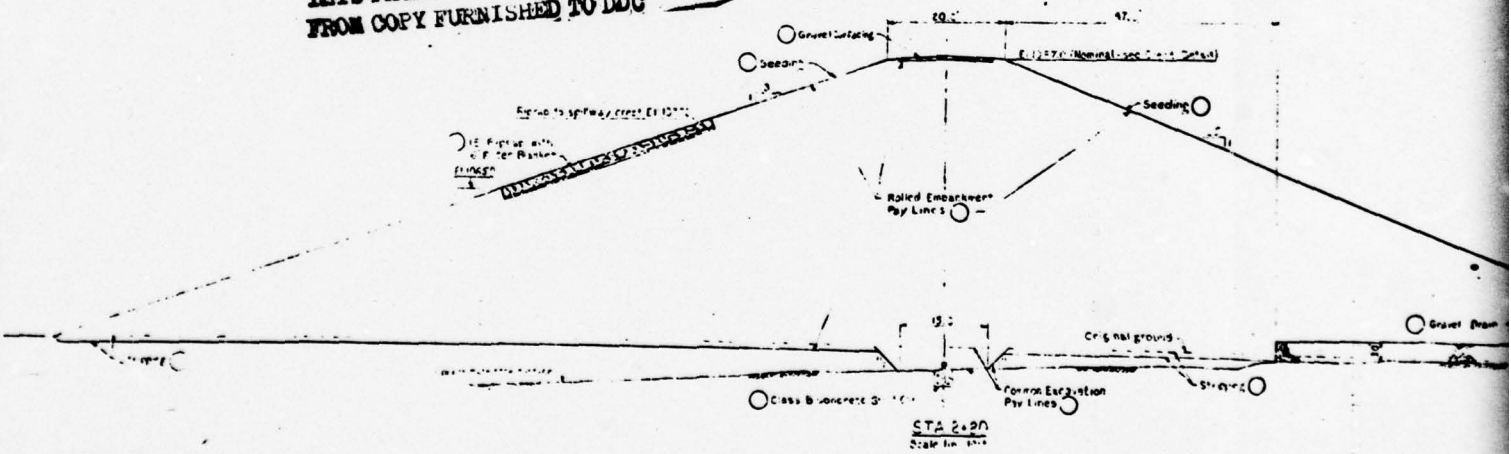


STA 6+00

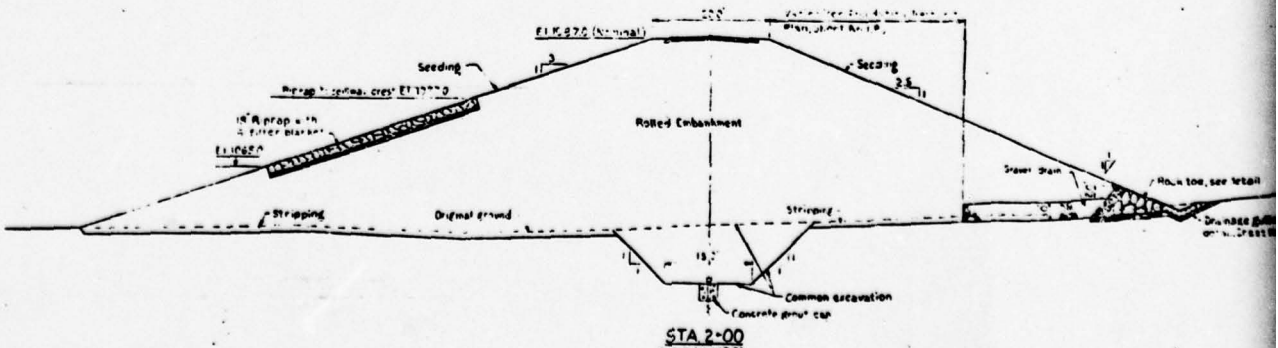




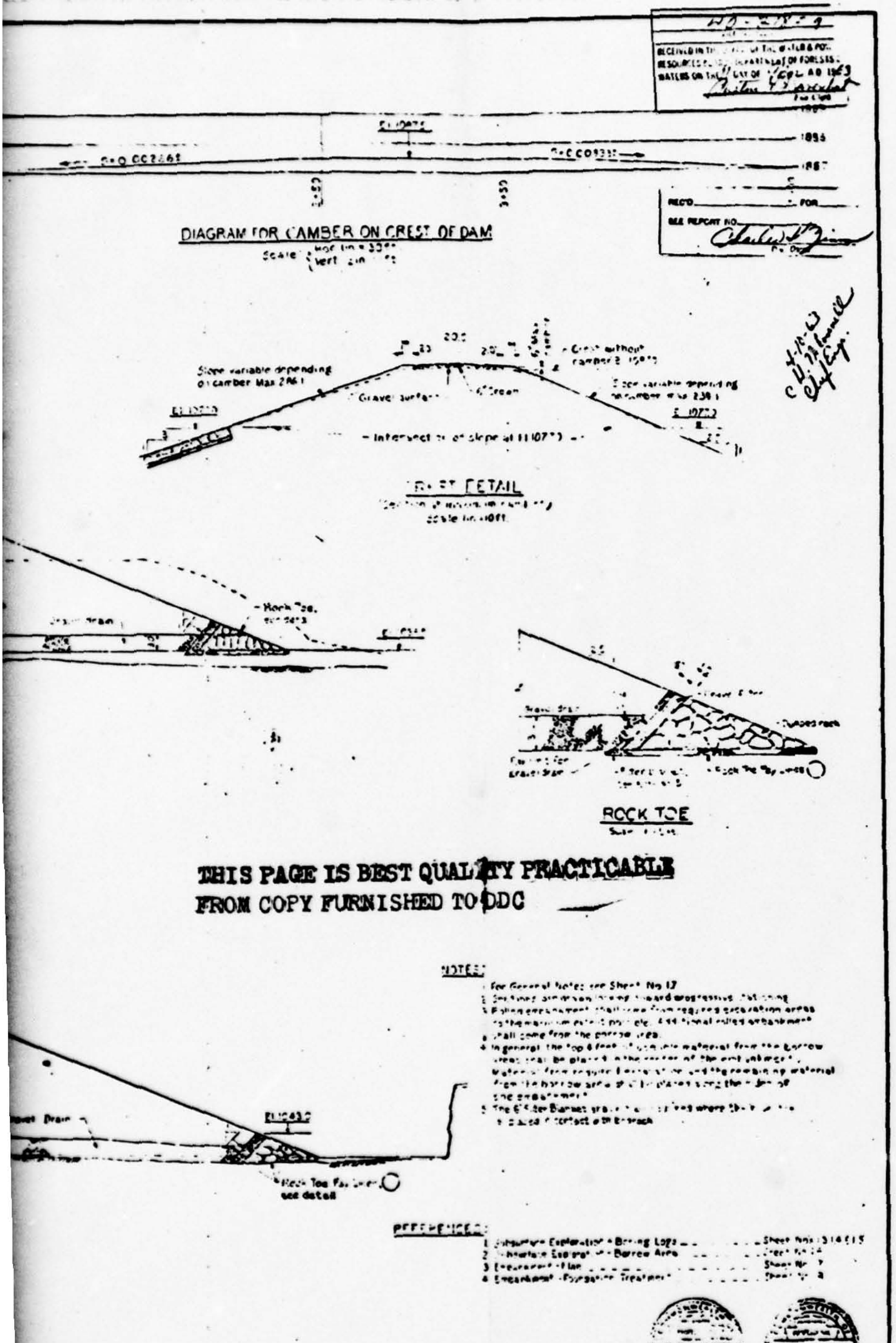
STA 3+49



STA 2+30



STA 2+00



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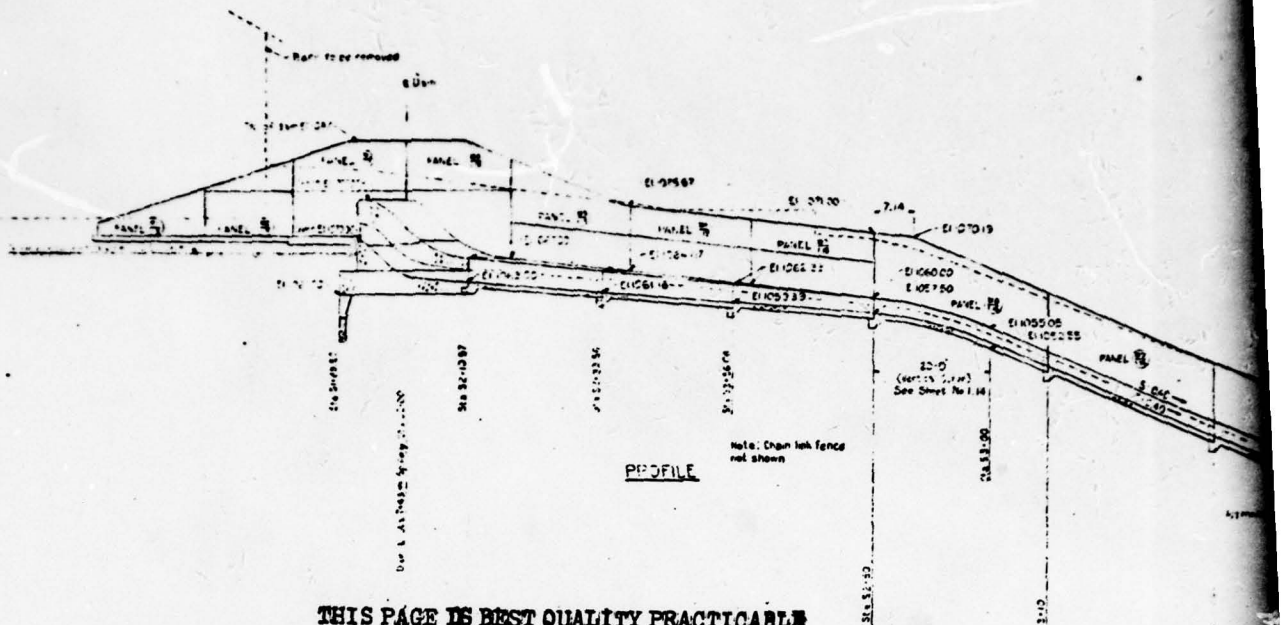
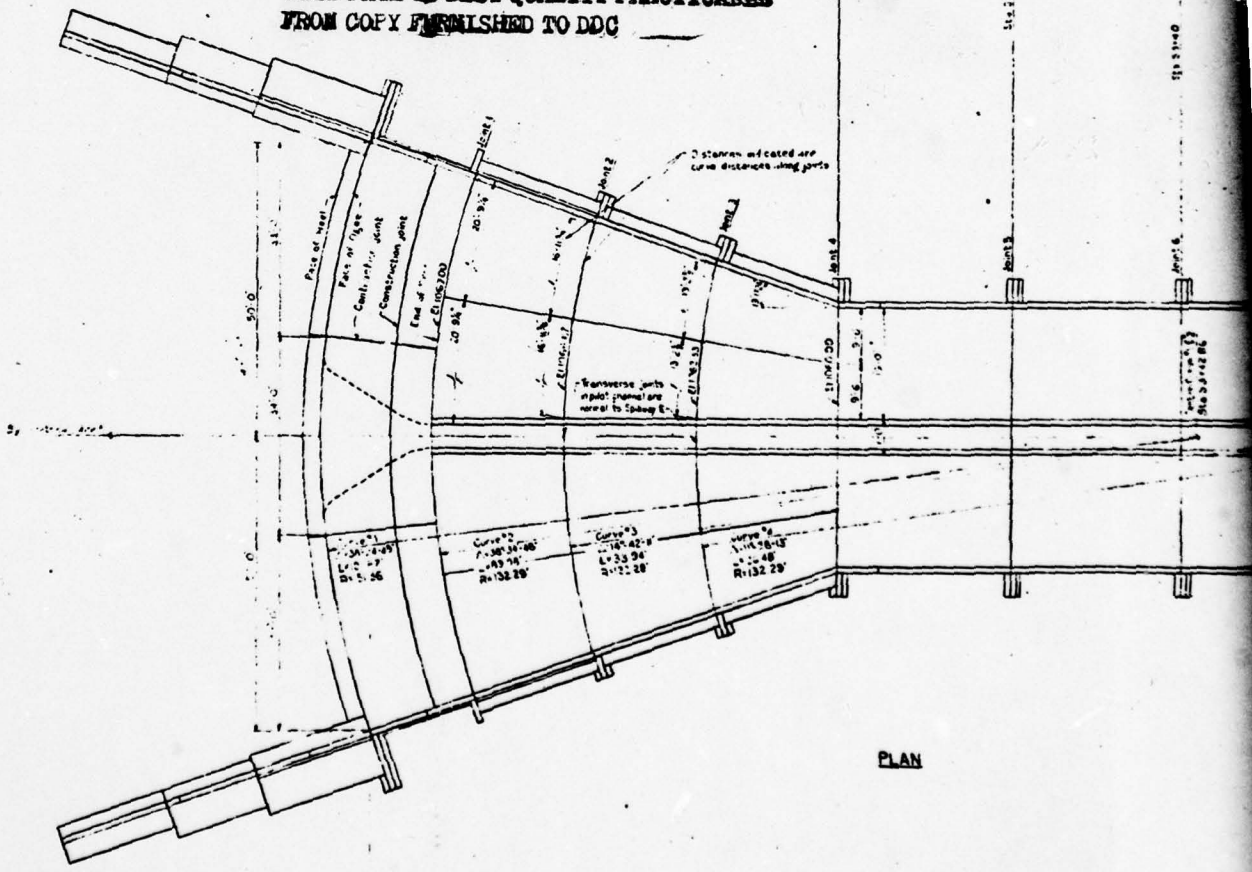
NATIONAL DAM INSPECTION PROGRAM

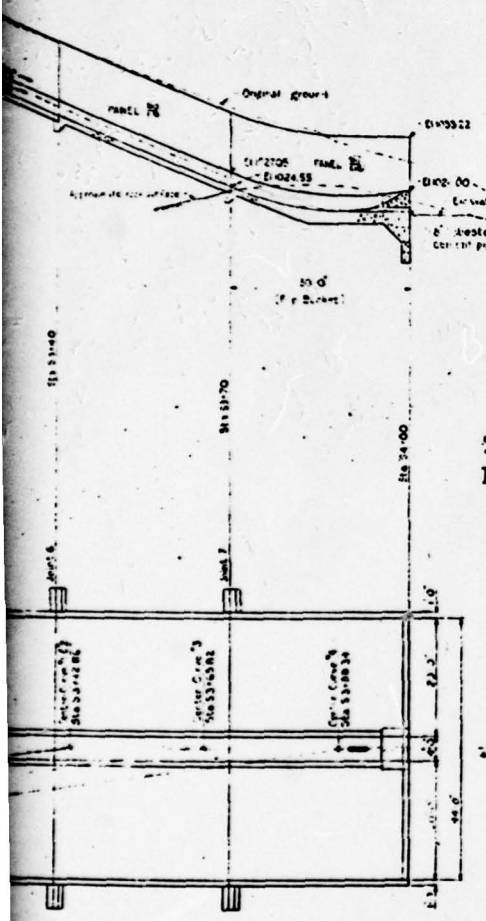
FRANCES SLOCUM DAM
COMMONWEALTH OF PENNSYLVANIA

EMBANKMENT SECTIONS

SEPTEMBER 1978 PLATE 4







REFERENCES:

1. Subsurface Exploration - Boring Logs — Sheet No 1.5
2. Embankment - Plan — Sheet No 1.7
3. Spillway Inlet and Transition Details — Sheet No 1.13
4. Spillway Outlet Details — Sheet No 1.14
5. Spillway Cross Sections — Sheet No 1.15 & 1.16

NOTE:

1. For General Notes see Sheet No 1.7
2. Invert elevations in the transition area shall be constant along the arc

PRE FINAL

REVISED

DESIGNED — SUBMITTED: H.R. Butler, Chief, Design Branch
RECOMMENDED: V.W. Bond, Chief, Division of Flood Control
APPROVED: C. Hunt Cornell, Chief Engineer, Department of Forests & Waters
APPROVED: ASSISTANT DIRECTOR OF ENGINEERING S.S.A.
CHECKED BY THE GENERAL STATE AUTHORITY
ARCH | STRUCT

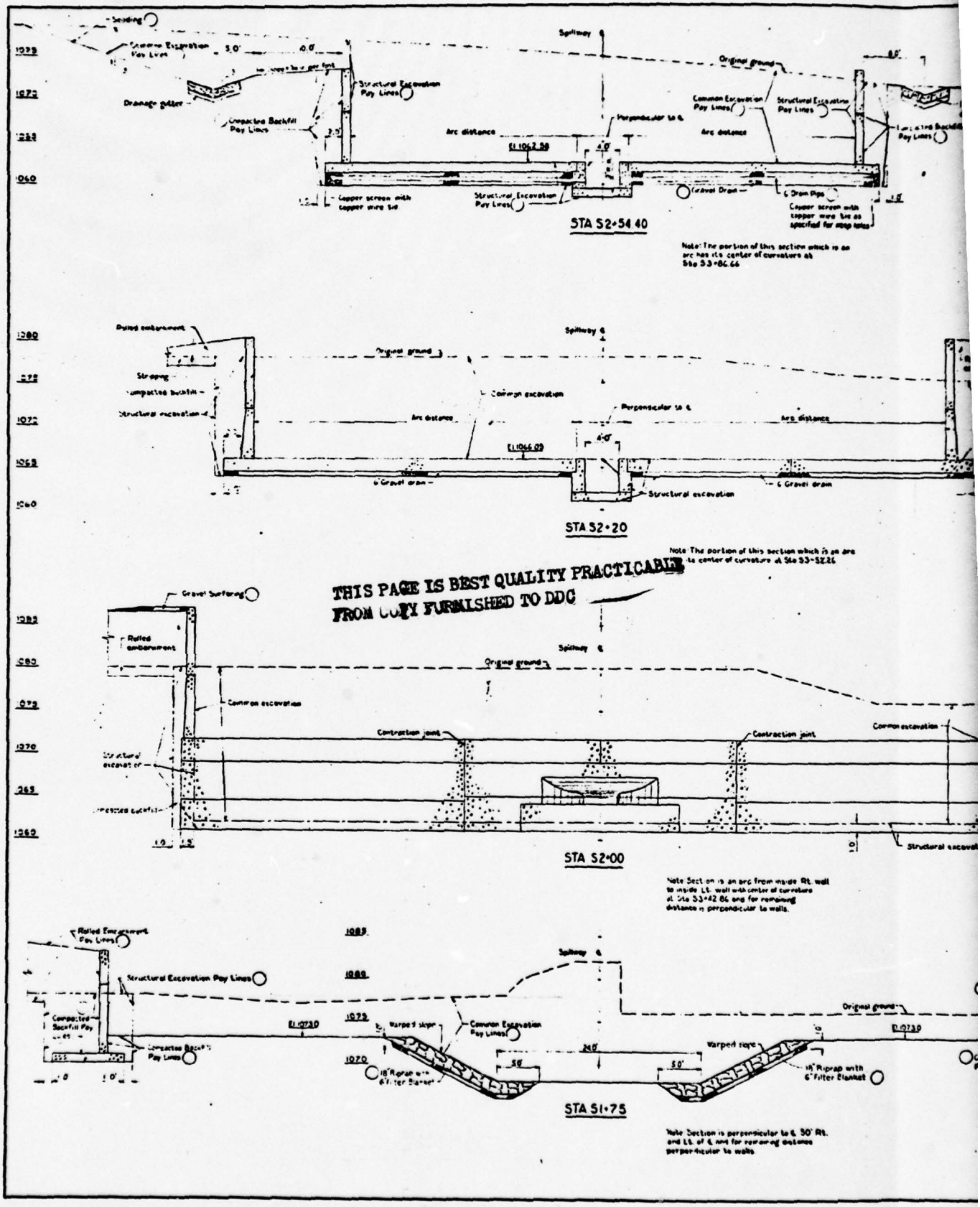
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

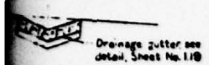
FRANCES SLOCUM DAM

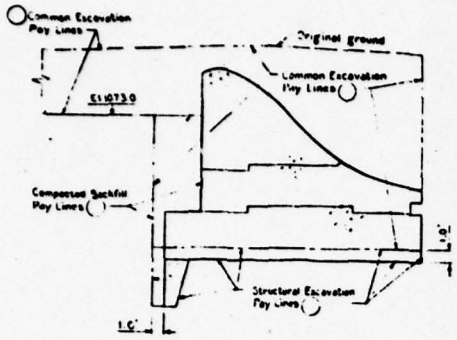
COMMONWEALTH OF PENNYSLVANIA

SPILLWAY
PLAN AND PROFILE

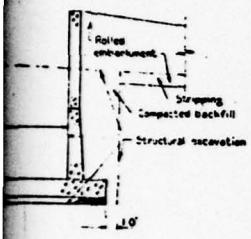
SEPTEMBER 1978 — PLATE 5

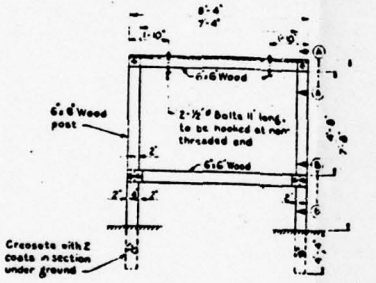




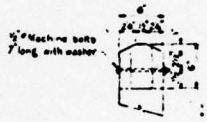


OGEE PAYMENT SECTION

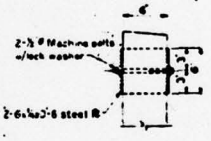




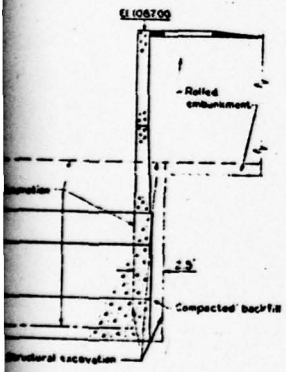
FRAME FOR PROJECT SIGN
Scale: ½"=1'



VIEW A-A
Scale: 1"=1'

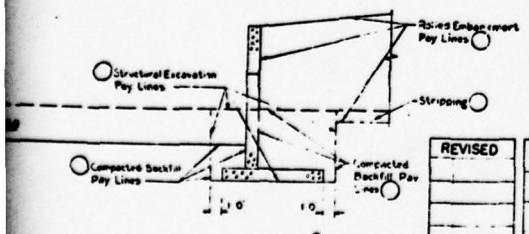


VIEW B-B
Scale: 1"=1'



REFERENCES:
1. Embankment - Plan ..... Sheet No 1.7
2. Spillway - Plan and Profile ..... Sheet No 1.13
3. Spillway - Structural Details ..... Sheet Nos 1.15, 1.16 & 1.17

NOTES:
1. All sections are drawn looking downstream.



PRE FINA

REVISED

DESIGNED	SUBMITTED	
C.E.C.	V.R. Bostic	Chief, Design Branch
RECOMMENDED	V.W. Bard	Chief, Division of Flood Control
APPROVED	C. Rhett Lamond	Chief Engineer, Department of Forests & Waters
APPROVED		ASSISTANT DIRECTOR OF ENGINEERING GSA
CHECKED BY THE GENERAL STATE AUTHORITY		
ARCH	STRUCT	

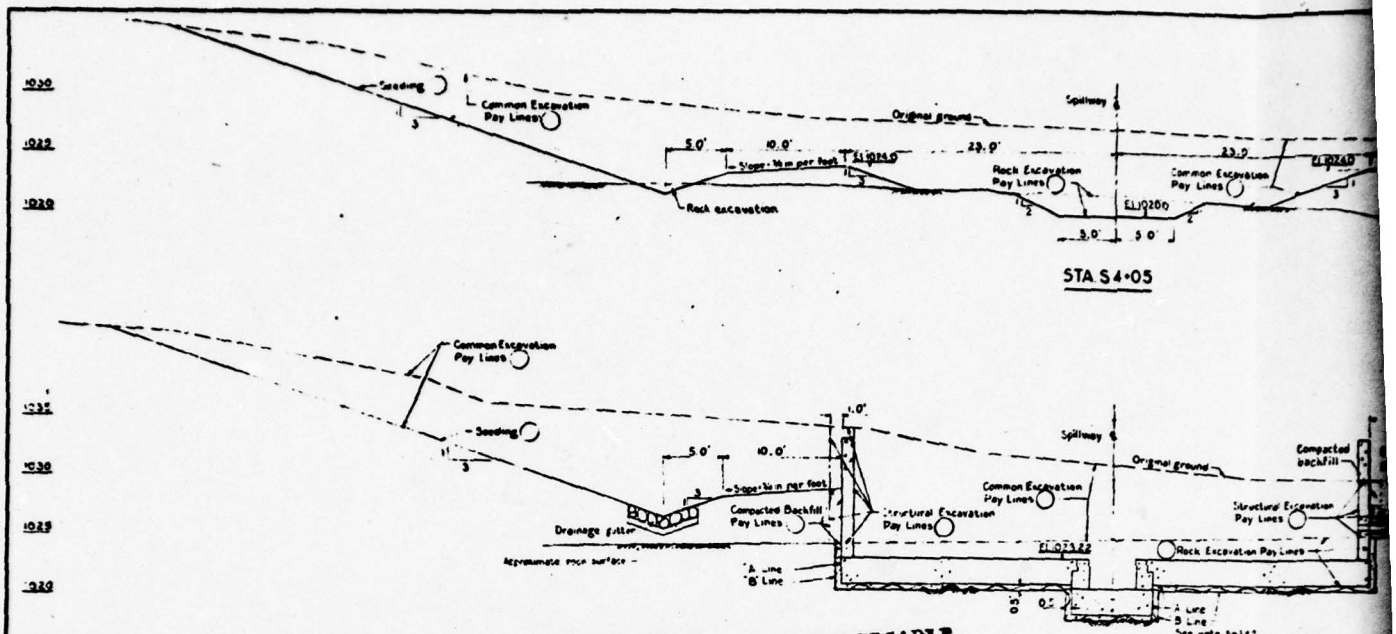
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

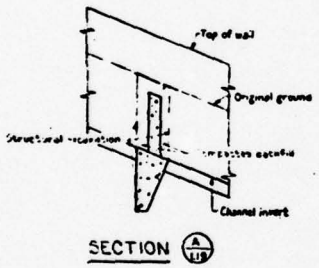
FRANCES SLOCUM DAM

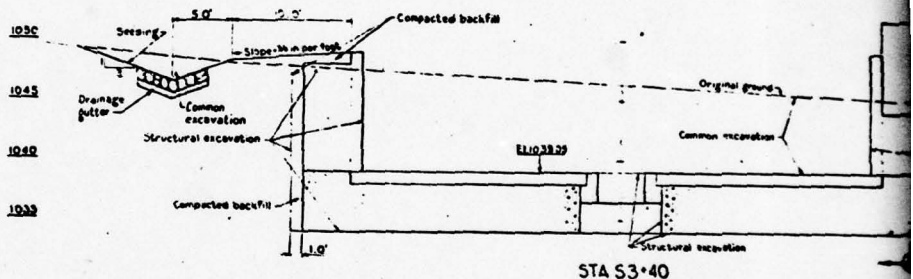
COMMONWEALTH OF PENNYSLVANIA

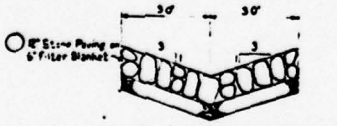
SPILLWAY SECTIONS
SHEET 1 OF 2

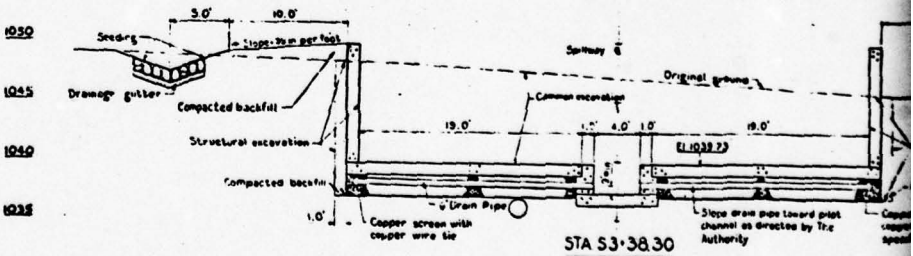
SEPTEMBER 1978 PLATE 6

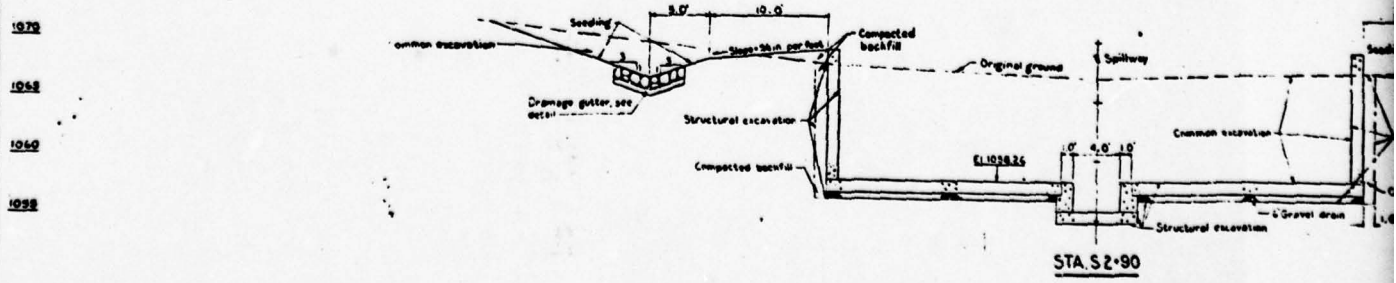


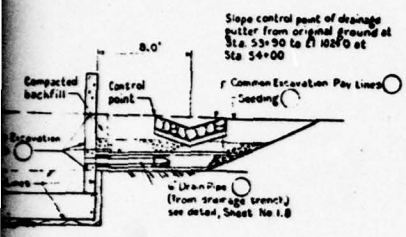


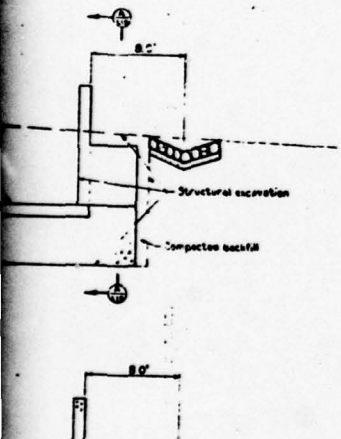


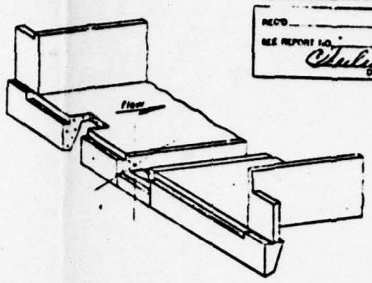






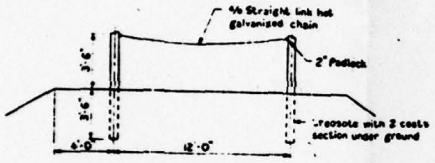






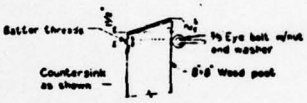
ISOMETRIC VIEW SHOWING TYPICAL SPILLWAY JOINT

Not to scale



CROSS SECTION

Scale: Horiz. 1/4"



EYE BOLT DETAIL

No Scale

BARRICADE

REFERENCES:

1. Embankment - Plan ..... Sheet No 1.7
2. Spillway - Plan and Profile ..... Sheet No 1.13
3. Spillway - Structural Details ..... Sheet No 1.15 & 1.17

NOTES:

1. The 'A' lines shown on the section at Sta 53+90 are lines within which no unexcavated rock will be permitted.
2. Payment for excavation or concrete will not be made beyond the 'B' line unless specifically directed by The Authority. Maximum payment will be made to the actual excavated line or the 'B' line, whichever is less, if in the opinion of The Authority, due care was exercised.
3. All sections are drawn looking downstream.

PRE FINA

REVISED

DESIGNED	SUBMITTED
	H.E. Butler, Chief, Design Branch
RECOMMENDED	
V.N. Bouch, Chief, Design of Flood Control	
APPROVED	C. Shumaker
Chief Engineer, Department of Forests & Waters	
APPROVED	
ASSISTANT DIRECTOR OF ENGINEERING GSA	
CHECKED BY THE GENERAL STATE AUTHORITY	
ARCH.	STRUCT.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

FRANCES SLOCUM DAM

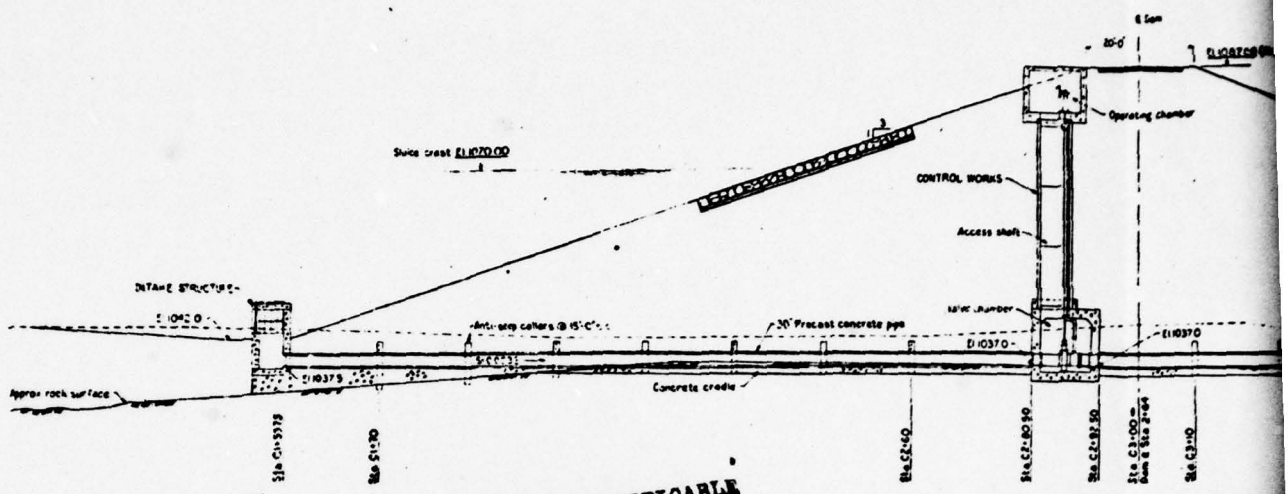
COMMONWEALTH OF PENNYSLVANIA

SPILLWAY SECTIONS
SHEET 2 OF 2

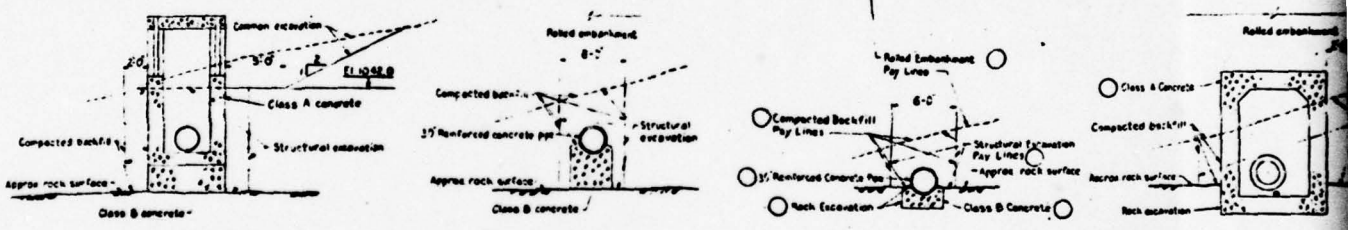
SEPTEMBER 1978 PLATE 7

1

2

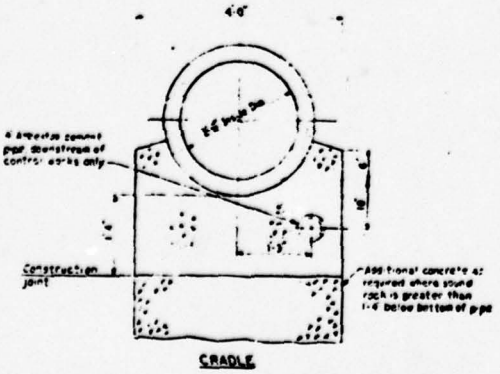


PROFILE

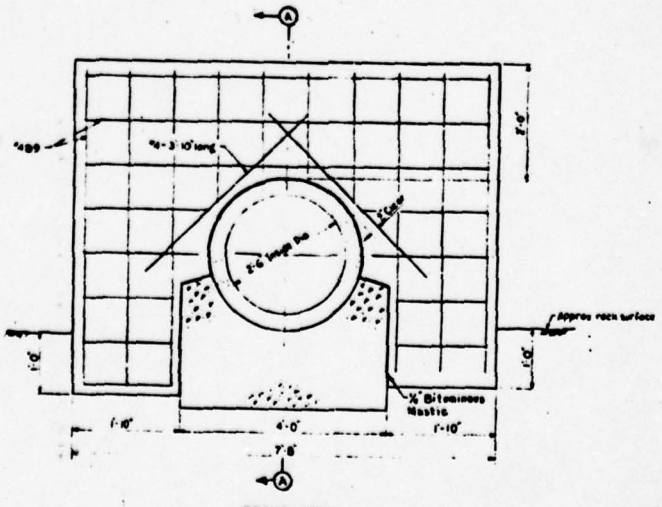


STA C 1+50 STA C 1+75 STA C2+10 STA C2+90

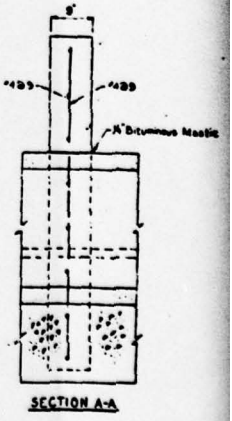
TYPICAL SECTIONS



CRADLE



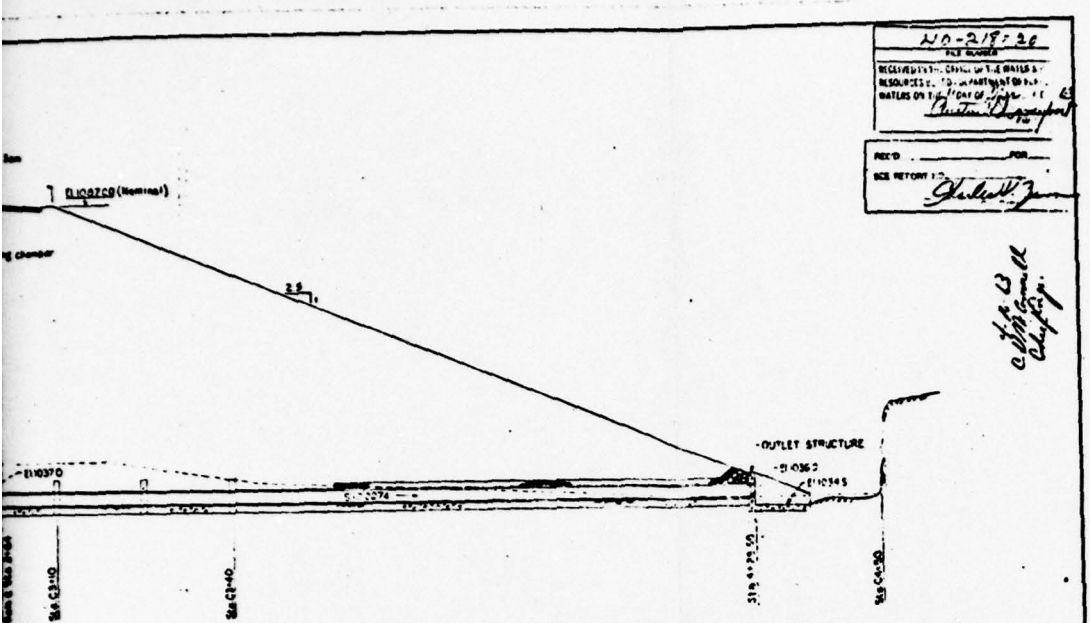
FRONT VIEW

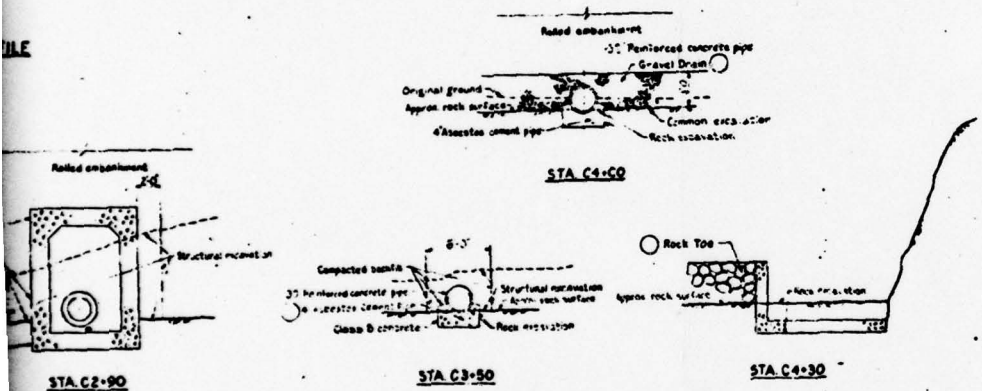


SECTION A-A

CONDUIT DETAILS

ANTI-SEEP COLLAR





STA C4+00

STA C2+90

STA C3+50

STA C4+30

REFERENCES:

1 Subsurface Exploration - Borings Logs II ..... Sheet No 1.4
2 Embankment - Plan ..... Sheet No 1.7
3 Drawdown Conduit - Inlet and Outlet Structure ..... Sheet No 1.21
4 Drawdown Conduit - Control Works Details ..... Sheet No 1.22

NOTES:

1 For Concrete Notes, see Sheet No. 1.18
2 All sections are taken looking upstream.
3 Joints shall be placed in the concrete cradle to coincide with joints in the precast conduit. The joint shall consist of a bituminous painted surface.
4 Heavy equipment shall not pass over the conduit until compacted backfill has been placed to a minimum depth of two feet above the pipe

REVISED

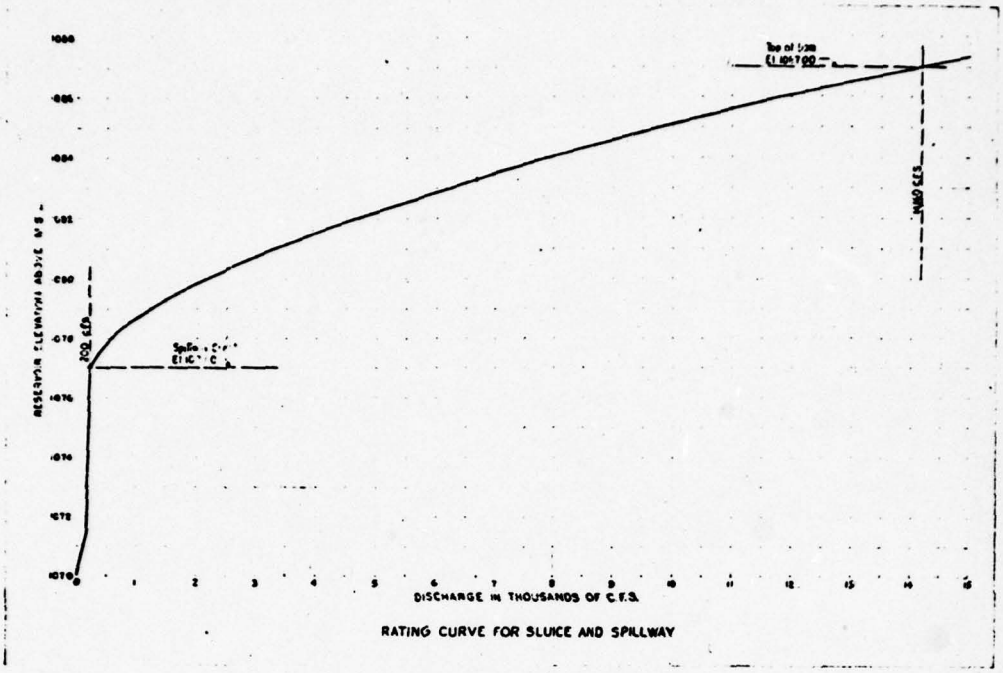
DESIGNED	SUBMITTED
RVJ	V.L. Bartlett, Chief, Design Branch
RECOMMENDED	
V.W. Bauer, Chief, Design of Flood Control	
APPROVED	C. Hamilton Humphreys, Chief Engineer, Department of Forests & Waters
APPROVED	
ASSISTANT DIRECTOR OF ENGINEERING SSA	
CHECKED BY THE GENERAL STATE AUTHORITY	
ARCH	STRUCT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

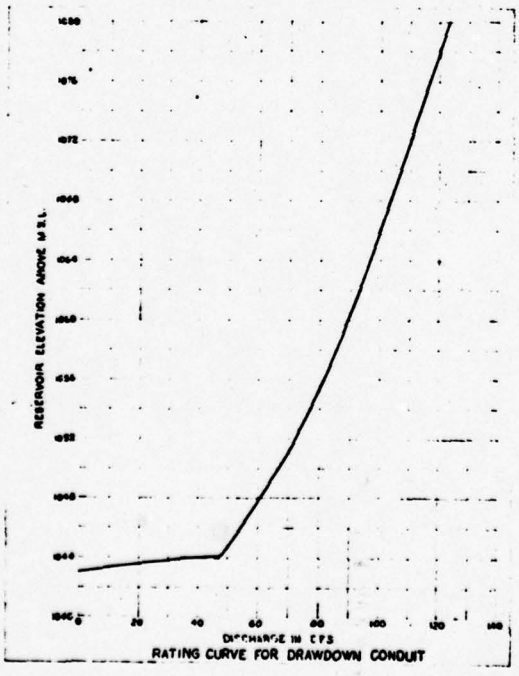
FRANCES SLOCUM DAM
COMMONWEALTH OF PENNYSLVANIA

OUTLET WORKS

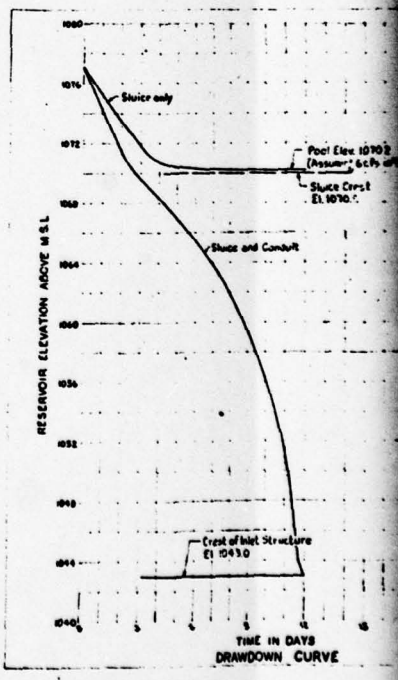
SEPTEMBER 1978 PLATE 8



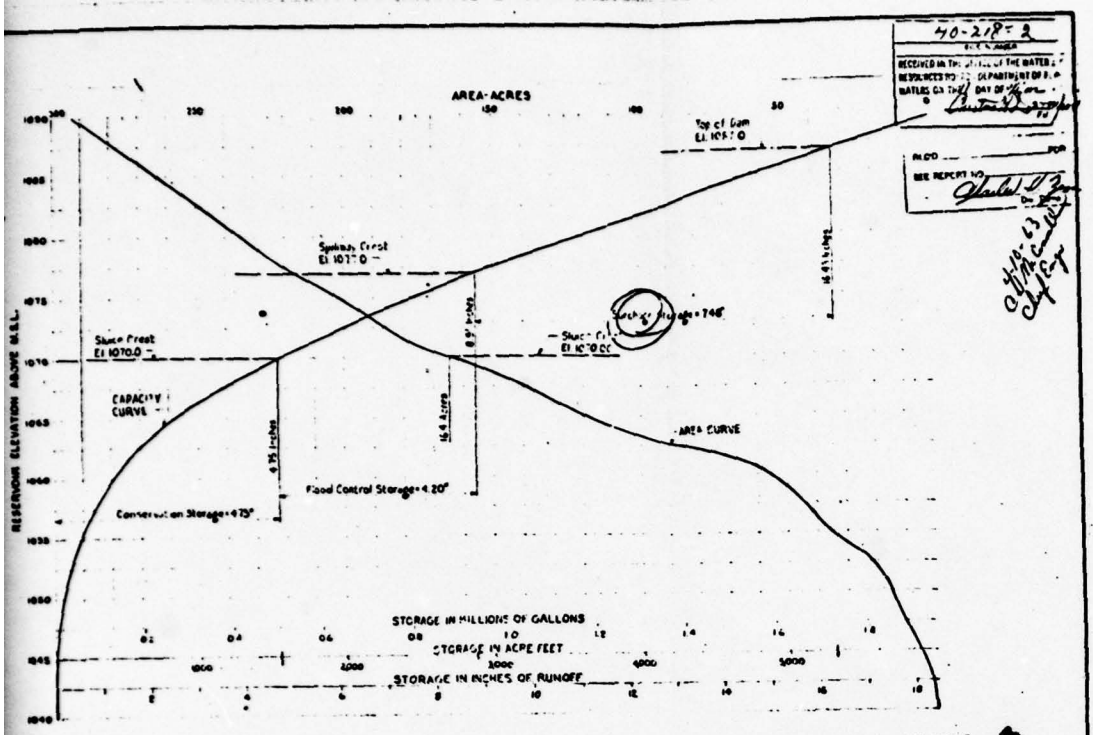
RATING CURVE FOR SLUICE AND SPILLWAY



RATING CURVE FOR DRAWDOWN CONDUIT



DRAWDOWN CURVE



40-218-2

RECEIVED IN THE OFFICE OF THE WATER ...
REFERRED TO ... DEPARTMENT OF ...
HARRISBURG THIS ... DAY OF ...

FOR

SEE REPORT NO.

NOTES:
1. The Drainage area of Sarasens Creek at the Dam site is 6.1 square miles
2. The flow which would be equaled or exceed 50% of the time is estimated to be 6 c.f.s.

PRE FINAL

REVISED

DESIGNED ... SUBMITTED ... Chief, Design Branch
RECOMMENDED ... Chief, Design of Flood Control
APPROVED ... Chief Engineer (Department of Forests & Waters)
APPROVED
ASSISTANT DIRECTOR OF ENGINEERING SSS
CHECKED BY THE GENERAL STATE AUTHORITY
ARCH | STRUCT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

FRANCES SLOCUM DAM

COMMONWEALTH OF PENNYSLVANIA

HYDRAULIC DATA

SEPTEMBER 1978 PLATE 9

2

SUSQUEHANNA RIVER BASIN

ABRAHAMS CREEK, LUZERNE COUNTY

PENNSYLVANIA

FRANCES SLOCUM DAM

NDS ID No. PA-00574
DER ID No. 40-218

COMMONWEALTH OF PENNSYLVANIA

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SEPTEMBER 1978

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Frances Slocum Dam

NDS ID NO.: PA-00574 DER ID NO.: 40-218

ITEM	REMARKS
AS-BUILT DRAWINGS	Complete set of drawings stamped "Prefinal".
REGIONAL VICINITY MAP	Project is shown on USGS Quandrangle sheet Kingston, Pennsylvania, N4115-W7552.5/7.5, 1946, Photo revised 1969.
CONSTRUCTION HISTORY	Constructed 1964-1965 by Commonwealth of Pennsylvania, Department of Forests and Waters, Division of Flood Control. Outlet works modified 1976.
TYPICAL SECTIONS OF DAM	Available.
OUTLETS: Plan Details Constraints Discharge Ratings	Available.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	Available.
DESIGN REPORTS	1963: Permit Application Report preapred by Department of Forests and Waters, Division of Dams and Encroachments.
GEOLOGY REPORTS	General and site geology in Permit Application Report.
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	Summary of hydraulic data included on drawings.
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	Boring records included on drawings. No laboratory results.
POSTCONSTRUCTION SURVEYS OF DAM	None.

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	Right hillside above dam.
MONITORING SYSTEMS	Five staff gages.
MODIFICATIONS	1976: To accommodate adiacent highway construction, outlet conduit was extended to a manhole in highway embankment. Additional pipe leads from manhole to stream channel.
HIGH POOL RECORDS	June 1972: Water at Elevation 1074.5 (2.5 feet below spillway crest).
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	None.

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	Available.
SPILLWAY: Plan Sections Details	Available.
OPERATING EQUIPMENT: Plans Details	Available.
PREVIOUS INSPECTIONS Dates Deficiencies (Continued on Sheet A-5)	5/67: Cave-in of rock ledge at conduit outlet (Park Supt.) 11/67: No deficiencies (Park Supt.) 5/68: Erosion of toe gutter at right abutment (Division of completed projects (DCP)). 6/68: Trash accumulation; gutter was repaired (Part Supt.) 11/68: No deficiencies (Park Supt.) 6/69: Marmots in embankment exterminated; minor cracks in spillway repaired with epoxy cement; rocks and mud in outlet structure (Part Supt.) 12/70: Minor cracks in spillway repaired; spillway discharge channel cleaned; valves opened (Park Supt.) 9/71: Rocks and debris in spillway area; vegetation in joints of spillway; brush in riprap; spalled concrete at bottom of ogee (DCP).

ITEM	REMARKS
PREVIOUS INSPECTIONS (Continued from Sheet A-4)	6/72: Repaired toe gutter on right side; repaired cracks in spillway; removed debris from trashrack (Part Supt.) 12/72: No deficiencies (Part Supt.) 4/73: Erosion downstream from flip bucket; cracks in right spillway wall; miscellaneous maintenance items (DCP) 5/73: Maintenance recommended in 4/73 inspection performed (Part Supt.) 12/73: No deficiencies (Part Supt.) 7/74: No seepage; spalls on sipllway right wall; vegetation in spillway joints (DCP). 7/75: Large vertical cracks in spillway sidewalls; vegetation in spillway joints; brush on downstream slope (DCP). 11/75: No deficiencies (Part Supt.) 5/76: No deficiencies (Part Supt.) 6/76: Spalling at vertical joints of spillway walls; brush at downstream toe and on upstream slope (DCP). 12/76: No deficiencies (Part Supt.)

CHECKLIST

ENGINEERING DATA

HYDROLOGY AND HYDRAULICS

NAME OF DAM: Frances Slocum Dam NDS ID NO.: PA-00574 DER ID NO.: 40-218

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): Elevation 1070.0.

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Elevation 1086.6.

ELEVATION MAXIMUM DESIGN POOL: Elevation 1087.0.

ELEVATION TOP DAM: Elevation 1086.6.

SPILLWAY CREST:
- a. Elevation 1077.0.
- b. Type Concrete ogee.
- c. Width Not applicable.
- d. Length 100 feet.
- e. Location Spillover Near left abutment.
- f. Number and Type of Gates None.

OUTLET WORKS:
- a. Type 30-inch diameter R.C.P. and 4-inch diameter bypass.
- b. Location Center of valley.
- c. Entrance Inverts Elevation 1037.5.
- d. Exit Inverts Elevation 1034.8.
- e. Emergency Draindown Facilities Same as outlet works.

HYDROMETEOROLOGICAL GAGES:
- a. Type Staff gages.
- b. Location Right abutment.
- c. Records Available.

MAXIMUM NONDAMAGING DISCHARGE: Unknown.

SUSQUEHANNA RIVER BASIN

ABRAHAMS CREEK, LUZERNE COUNTY

PENNSYLVANIA

FRANCES SLOCUM DAM

NDS ID No. PA-00574
DER ID No. 40-218

COMMONWEALTH OF PENNSYLVANIA

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SEPTEMBER 1978

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Frances Slocum Dam County: Luzerne State: Pennsylvania

NDS ID No.: PA-00574 DER ID No.: 40-218

Type of Dam: Earthfill Hazard Category: High

Date(s) Inspection: 15-16 August 1978 Weather: Clear Temperature: 95°

Pool Elevation at Time of Inspection: 1070.0 msl/Tailwater at Time of Inspection: 1035.9 msl

Inspection Personnel:

D. Wilson (GFCC)	F. Rosencrans (Park Foreman)	
J. Crouse (GFCC)	R. Rahn (PennDER)	
D. Ebersole (GFCC)		

D. Wilson (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	None.	
CREST ALIGNMENT: Vertical Horizontal	Horizontal: no irregularities. Vertical: low areas at each side spillway (El. 1086.6) and at roadway at right abutment (El. 1086.8).	Design top of dam level is Elevation 1087.0.
RIPRAP FAILURES	1. Upstream slope: riprap in excellent condition; intact to top of dam. 2. Downstream slope: mixed cover of grass, crownvetch, weeds; no brush.	1. Average size 6"-12"; sound sandstone; no weeds. 2. Cover about 24" high cut twice each year.

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	Low areas at spillway and right abutment (see Sheet B-2).	Low area at roadway at right abutment would cause flow along road then down highway slope to toe of dam.
ANY NOTICEABLE SEEPAGE	None.	
STAFF GAGE AND RECORDER	Staff gages at right abutment.	Good condition.
DRAINS	No observed flow from toe drains.	
TOE GUTTERS	Generally good condition but some weeds at joints.	

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Could only inspect downstream end.	30-inch conduit enters manhole and makes nearly 90-degree bend. Outlet from manhole is 42-inch RCP. At 1/2 gate opening; water in manhole was 1-foot above top pipe.
INTAKE STRUCTURE	1. Intake structure submerged. 2. Gate structure: excellent condition. All metalwork painted and stems lubricated.	1. Could not inspect. 2. Louvered vent in gate structure is below top of dam. Would flood structure before water at maximum pool level.
OUTLET STRUCTURE	Manhole: good condition.	
OUTLET CHANNEL	Natural stream channel. Stone arch bridge crosses channel.	Bridge is not a hydraulic constraint.
EMERGENCY GATE	1. 30-inch gate valve: opened easily to 1/2 full opening. 2. 4-inch gate valve: opened easily. 3. Emergency bulkhead stored in gate structure.	Both valves have indicators. Normally opened twice each year.

UNGATED SPILLWAY

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good condition except some cracking at center on downstream side where low flow channel begins.	
APPROACH CHANNEL	Clear; no operating constraints.	Average approach depth is about 4 feet.
DISCHARGE CHANNEL	No abnormalities.	
BRIDGE AND PIERS	None.	
RIGHT TRAINING WALL (Continued on Sheet B-6)	1. First monolith (at upstream end): one crack through wall at upstream end. 2. Second monolith: good. 3. Third monolith: 7 fine diagonal cracks.	3. Batter on channel side is about 77V on 1H.

UNGATED SPILLWAY

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RIGHT TRAINING WALL (Continued from Sheet B-5)	4. Joint between third and fourth monolith: 1 inch differnetial movement at top; joint badly spalled; waterstop exposed. 5. Fourth monolity: 3 fine diagonal cracks and 1 fine vertical crack. 6. Remaining downstream monoliths are in good condition.	4. Depth of spalling 4 inches; third monolith apparently moved; 5. Batter on channel side is 96V on 1H.
LEFT TRAINING WALL	Joint between third and fourth monoliths similar to right wall but not as severe. About 0.25-inch differnetial movement. Two fine diagonal cracks on third monolith. No diagonal cracks on fourth monolith.	One local surface spall on one downstream monolith.
CHUTE SLAB	Occasional fine transverse cracks; do not go all the way across slab; one slab monolith has slight settlement.	Epoxy patching technique for transverse cracks unsuccessful.

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	Staff gages at right abutment.	Good condition.

RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Slopes vary from mild to steep. No evidence of instability.	
SEDIMENTATION	None reported by Park Foreman.	
WATERSHED DESCRIPTION	Mixture of woodland, farmland, and developed areas.	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	No obstructions.	
SLOPES	No evidence of erosion or instability.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Numerous low-lying houses in valley; community of West Wyoming along stream.	

SUSQUEHANNA RIVER BASIN

ABRAHAMS CREEK, LUZERNE COUNTY

PENNSYLVANIA

FRANCES SLOCUM DAM

NDS ID No. PA-00574
DER ID No. 40-218

COMMONWEALTH OF PENNSYLVANIA

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SEPTEMBER 1978

APPENDIX C

HYDROLOGY AND HYDRAULICS

CLASSIFICATION

HIGH HAZARD, SINCE DOWNSTREAM POPULATION IS SUBSTANTIAL, AND FAILURE OF THE DAM COULD RESULT IN MORE THAN A FEW LIVES LOST AND EXCESSIVE ECONOMIC LOSS

INTERMEDIATE SIZE, SINCE HEIGHT = 48 FEET AND CAPACITY = 5,340 AC-FT
REFERENCE: "RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS," p. D-8.

SPILLWAY DESIGN FLOOD (SDF)

THE SDF SHOULD BE THE PMF (FROM p. D-12 OF "REC. GUIDELINES...")

HYDROLOGY AND HYDRAULICS ANALYSIS

REFERENCE: PHASE I PROCEDURE PACKAGE

II. A. 2. PMF INFLOW HYDROGRAPH NOT AVAILABLE
a. BALTIMORE CONTACT RECOMMENDS OBTAINING PMF PEAK FROM CURVE
b. FROM CURVE FOR SUSQUEHANNA RIVER BASIN, REGION 2, AND DRAINAGE AREA = 6.1 SQ. MI.,
PMF = 2,200 CFS/SQ. MI. × 6.1 SQ. MI. = 13,420 CFS.

EFFECT OF UPSTREAM RESERVOIRS

NO SIGNIFICANT UPSTREAM RESERVOIRS EXIST

B. ABILITY OF SPILLWAY TO PASS PMF
1. CAPACITY OF SPILLWAY - REFERENCE: PROJECT NO. G.S.A. 180-5, SHEET NO. 1.2, FRANCES SLOCUM DAM PLANS, DER FILES

RATING CURVE FOR SLUICE AND SPILLWAY

DESIGN TOP OF DAM ELEV. = 1087.0 ; DISCHARGE = 14,160 CFS
ACTUAL TOP OF DAM ELEV. = 1086.6 ; DISCHARGE = 13,260 CFS.

3. THE PMF PEAK FLOW IS GREATER THAN THE SPILLWAY CAPACITY (13,420 > 13,260)
b. ROUTING OF THE PMF IS NOT AVAILABLE
(1.) THE SPILLWAY WILL PASS (13,260/13,420) = 0.988 = p = 98.8% OF THE PMF PEAK
(2.) INCLOSURE 3 METHOD TO ESTIMATE THE STORAGE EFFECT OF THE RESERVOIR
(a) TRIANGULAR SHAPE FOR PMF HYDROGRAPH
(b) ASSUME 24 INCHES OF RUNOFF AS PER INSTRUCTIONS FROM BALTIMORE CONTACT
VOL = ½ b h ; b = 2 VOL/h

VOL = 24" RUNOFF x 6.1 SQ. MI. x 640 ACRES/SQ. MI. = 93,696 AC-IN

93,696 AC-IN x 1 FT/12 IN x 43,560 FT²-HR/3,600 AC-SEC = 94,477 CFS-HRS

$b = \frac{2\,VOL}{h} = \frac{(2)\ 94,477\ CFS\text{-}HRS}{13,420\ CFS} = 14.1\ HRS$

$1 - p = 1 - 0.988 = 0.012 = \Delta AOC/\Delta AOB$

$\Delta AOB = \frac{1}{2}bh = VOL = 93,696\ AC\text{-}IN \times (1\ FT/12\ IN) = 7,808\ AC\text{-}FT$

SUBSTITUTING, $\Delta AOC = (1-p)\,\Delta AOB = 0.012\,(7,808) = 94\ AC\text{-}FT$

REQUIRED STORAGE = ΔAOC = 94 AC-FT

(c) INCREMENTAL STORAGE AVAILABLE BETWEEN NORMAL POOL ELEVATION AND MAXIMUM POOL ELEVATION

NORMAL POOL ELEVATION ≈ SLUICE CREST ELEV.	= 1070.0'
MAXIMUM POOL ELEV. = ACTUAL TOP OF DAM ELEV.	= 1086.6'
STORAGE AT POOL ELEVATION 1070.0'	= 1,550 AC-FT
STORAGE AT POOL ELEVATION 1086.6'	= 5,250 AC-FT
STORAGE AT POOL ELEVATION 1087.0'	= 5,340 AC-FT

ACTUAL INCREMENTAL STORAGE AVAILABLE = 3,700 AC-FT

STORAGE REQUIRED = 94 AC-FT << STORAGE AVAILABLE = 3,700 AC-FT

C. PROCEDURES FOR DETERMINATION OF ADEQUATE/INADEQUATE SPILLWAY CAPACITY

1. THE STORAGE NECESSARY TO CONTAIN THE PMF IS LESS THAN THE STORAGE AVAILABLE
   a. SPILLWAY CAPACITY IS ADEQUATE
   b. POTENTIAL FOR OVERTOPPING IS MINIMAL

PERCENT OF PMF THAT SPILLWAY CAN PASS

$\%\ \text{OF PMF THAT SPILLWAY CAN PASS} = \frac{Q_T}{Q_{PMF}} \times 100\%$

WHERE $Q_T = Q_{\text{SPILLWAY CAPACITY}} + 2S/\Delta t$,

S = SURCHARGE STORAGE,

AND T = TIME OF PMF HYDROGRAPH

$\%\ \text{OF PMF} = \frac{13,260 + \left(\frac{2 \times 3,700\ AC\text{-}FT}{14.1\ HRS} \times \frac{43,560\ FT^2\text{-}HRS}{3,600\ AC\text{-}SECS}\right)}{13,920} \times 100\%$

$$\% \text{ OF PMF} = \frac{13{,}250 + 6350}{13{,}420} \times 100\%$$

$$\% \text{ OF PMF} = 146\% \text{ (ACTUAL CONDITIONS)}$$

$$\% \text{ OF PMF} = \frac{14{,}160 + \left(\frac{2 \times 3{,}750 \text{ AC-FT}}{14.1 \text{ HRS}} \times \frac{43{,}560 \text{ FT}^2\text{-HRS}}{3{,}600 \text{ AC-SECS}}\right)}{13{,}420} \times 100\%$$

$$\% \text{ OF PMF} = \frac{14{,}160 + 6505}{13{,}420} \times 100\%$$

$$\% \text{ OF PMF} = 154\% \text{ (DESIGN CONDITIONS)}$$

SUSQUEHANNA RIVER BASIN

ABRAHAMS CREEK, LUZERNE COUNTY

PENNSYLVANIA

FRANCES SLOCUM DAM

NDS ID No. PA-00574
DER ID No. 40-218

COMMONWEALTH OF PENNSYLVANIA

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SEPTEMBER 1978

APPENDIX D

PHOTOGRAPHS

A. Junction of Embankment and Right Abutment. Staff Gages at Right.

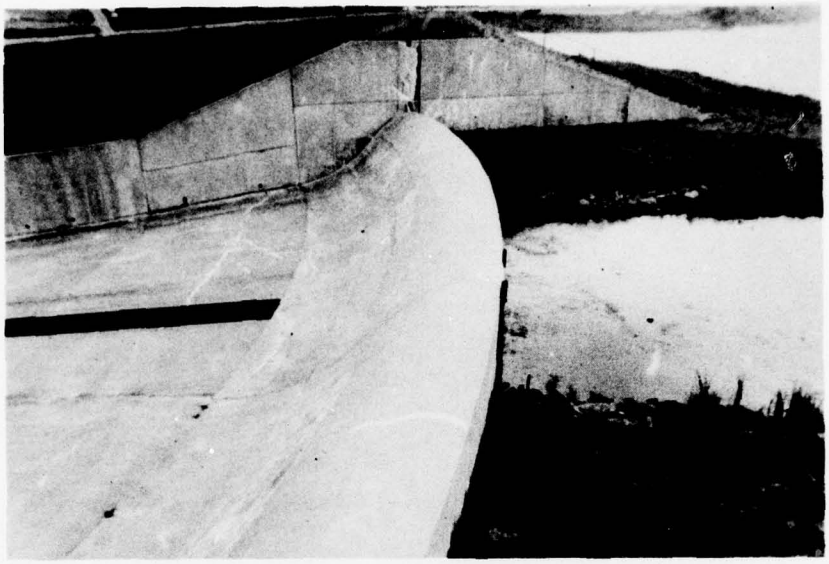
B. Junction of Embankment and Left Abutment.

C. Downstream Slope of Embankment.
View from Right Abutment.

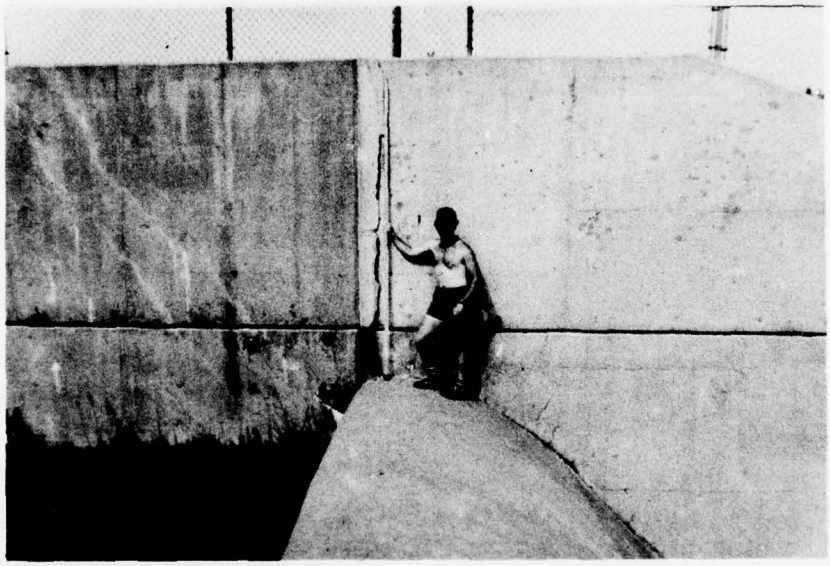
D. Spillway.
Embankment in Background.

E. Spillway Approach Channel.

F. Bar Screen Over Low-Flow Opening in Spillway.



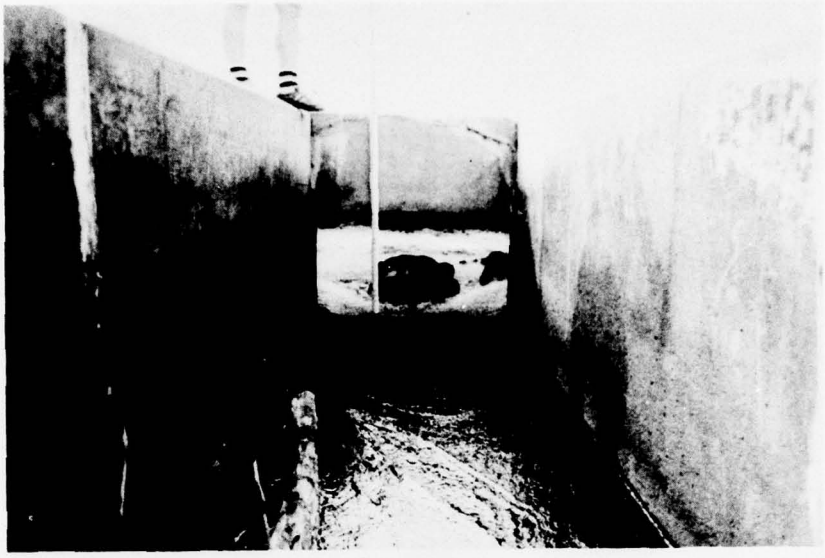
G. Concrete Ogee and Right Training Wall.



H. Concrete Ogee and Left Training Wall
Showing Cracking at Joint and on Upstream Monolith.

J. Concrete Ogee and Right Training Wall Showing Monolith Cracking and Spalling at Joint.

K. Detailed View of Cracking and Spalling at Joint.



L. Low-Flow Outlet at Downstream Side of Spillway Weir.

M. Concrete Chute and Flip Bucket.

N. Concrete Chute, Flip Bucket, and Paved Gutters.

O. Flow from Outlet Works during Valve Operation.

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APPENDIX E

GEOLOGY

FRANCES SLOCUM DAM

APPENDIX E
GEOLOGY

1. General Geology. The damsite and reservoir are located in Luzerne County. The rock formations exposed in Luzerne County range from the post-Pottsville formations, of Pennsylvanian Age, down to the Onondaga formation, of Middle Devonian Age. The Wisconsin terminal moraine crosses the southern part of the County, and the greater part of the County is covered by glacial drift. Extensive deposits of glacial outwash occur along the Susquehanna River and less extensive deposits along the smaller streams.

Nearly all of Luzerne County lies in the Valley and Ridge Province in which nearly all the rocks have been strongly folded. In going from north to south across the County, five major folds are encountered, all of which trend northeast. The first of these is a shallow syncline on the crest of North Mountain, forming the Mehoopany coal basin. The second is the Milton Anticline, which exposes the Portage group in the northwestern part of the County and gradually flattens out toward the northeast. The third and most pronounced is the Lackawanna Syncline, which originates in Lackawanna County to the north, and has preserved the post-Pottsville formations throughout the Wyoming Valley. The maximum depth of this syncline is reached in the vicinity of Wilkes-Barre and Plymouth. The double rim of this syncline is formed by the resistant Pottsville formations and Pocono sandstone, separated by the less resistant Mauch Chunk shale. The fourth fold is the Berwick (Montour) Anticline, which exposes a few feet of the Onondaga formation in the vicinity of Beach Haven. This fold reaches its maximum development farther west and only the eastern portion reaches Luzerne County. The fifth major fold comprises a series of anticlines and synclines forming the Eastern Middle Anthracite Field in the vicinity of Hazleton. The synclinal basins in this region are relatively shallow and there are large areas from which all coalbeds have been eroded.

The general dips of the region vary from 0° to 40°, and the maximum dips are found on the rims and within the synclinal coal basins. The relatively soft post-Pottsville

beds in their cores are severely folded and contorted with numerous minor faults. The northern and easternmost parts of the County border the Appalachian Plateau Province and are characterized by horizontal, or nearly horizontal strata. The Catskill continental group of rocks underlies those parts of Luzerne County that are outside of the five major folds.

2. Site Geology. In the area of interest, the Susquehanna River represents the approximate axis of the Lackawanna Syncline. The dam and reservoir are sited in nearly horizontally stratified sandstone and shale formations of the Catskill continental group northwest of the Susquehanna River and the Lackawanna Syncline. At the damsite, the badly broken and decomposed bedrock is overlaid by a deep overburden of dense grayish-brown glacial till (sand, silt and gravel).