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NATIONAL DAM INSPECTION PROGRAM. TAR RUN DAM (NDS PA-00692/DER --ETC(U)
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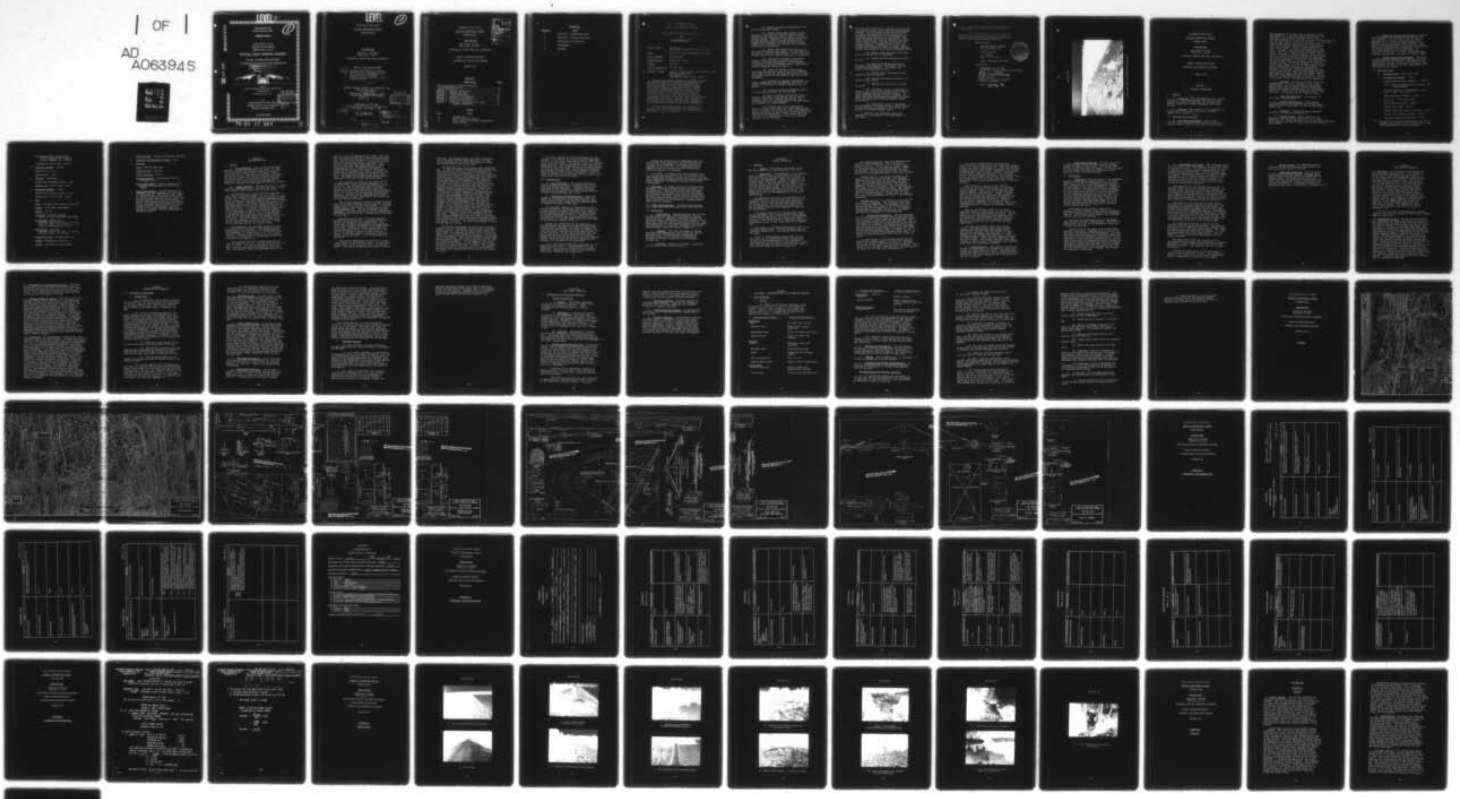

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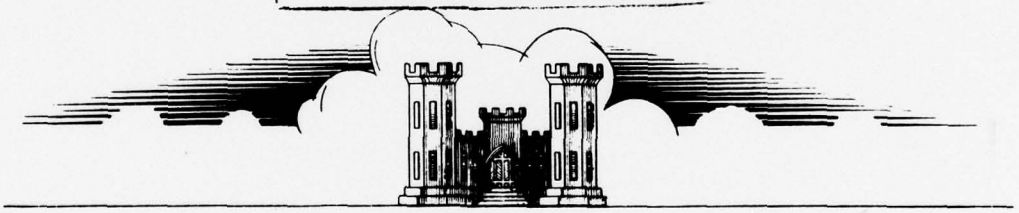
DELAWARE RIVER BASIN
TAR RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

TAR RUN DAM
NDS ID NO. PA-00692
DER ID NO. 54-124

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

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

AUGUST 1978

LEVEL II

(1)

DELAWARE RIVER BASIN

TAR RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

TAR RUN DAM

NDS ID No. PA-00692
DER ID No. 54-124

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

(6)

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM.
Tar Run Dam (NDS PA-00692 / DER 54-124),
Delaware River Basin, Tar Run,
Schuylkill County, Pennsylvania. Phase I
Inspection Report.

Prepared By

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Contract No. DACW31-78-C-0046

(15) For

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

(12) 83p.

(11) AUGUST 1978

DELAWARE RIVER BASIN

TAR RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

TAR RUN DAM

NDS ID No. PA-00692
DER ID No. 54-124

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

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PASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Tar Run Dam NDS ID No. PA-00692/DER ID No. 54-124
Owner:	Schuylkill County Municipal Authority
State Located:	Pennsylvania
County Located:	Schuylkill County
Stream:	Tar Run
Date of Inspection:	19 July 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, Tar Run Dam is judged to be in fair condition. The existing 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 existing spillway capacity is rated as adequate. The existing spillway can accommodate a flood of 1,530 cfs. This is 105 percent of the PMF peak inflow. However, high spillway discharges would overtop the spillway training wall, thus creating an erosion hazard to the embankment.

In view of the concern for the safety of Tar Run Dam, the following measures are recommended, in approximate order of priority, to be undertaken by the Owner as soon as practical:

(1) Remove the debris and growth in the spillway discharge channel.

(2) Perform additional studies to more accurately ascertain the required height of wall adjacent to the spillway apron as well as the required hydraulic capacity of the channel downstream of the spillway. The nature and extent of the remedial work necessary to make the channel downstream of the spillway weir hydraulically adequate should then be determined.

(3) Remove the asphalt from the top of the control structure and inspect the structure for evidence of concrete deterioration. Ensure that the 20-inch valve in the control structure is operational.

(4) Undertake a program to monitor at frequent intervals the apparent sliding of the riprap on the downstream slope of the embankment. If evidence of further movement occurs, appropriate remedial measures should be taken.

(5) Raise the riprap to top of dam elevation. The two low areas on the top of embankment should be filled, and measures should be taken to prevent erosion of the material from the top of embankment.

(6) Institute a program of detailed annual inspections for Tar Run Dam, and utilize the results to ascertain if remedial measures are required.

(7) Develop a detailed emergency operation and warning system for Tar Run Dam.

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

(1) Install ten or more observation wells, or other instrumentation, downstream of the axis of the dam. Two wells, or other instrumentation, should be located in the vicinity of the wet area at the toe of the embankment. Four others should be located in the seepage areas. Two in one seepage area and two in the other.

The other four should be at appropriate locations to determine general water level in downstream embankment. Data collected from observation wells or other instrumentation should be utilized in evaluating the stability of the embankment and assessing piping potential in the future. Continue to observe wet area and seepage areas downstream from the dam. Periodically measure and record quantity of seepage from all areas. If seepage increases or turbidity is noted, appropriate action should be taken to control apparent seepage and turbidity with properly designed drains.

(2) Remove brush and trees from downstream slope and toe of embankment.

(3) Repair spalling concrete on spillway weir.

(4) Monitor shrinkage cracking of concrete at spillway weir and surface cracking at outlet works headwall. If changes are noted, take appropriate action.

(5) Replace valve operating bar and maintain in good condition.

(6) Repair deteriorated mortar in approach channel walls.

(7) Replace missing stones in spillway apron.

(8) Undertake a study to determine if flows in the outlet works channel are the source of the seepage observed near the channel. If these flows are not the source of seepage, the study should be continued to determine the source and to determine what remedial measures might be necessary.

(9) Undertake a study to determine the suitability of the access road during periods of high spillway discharge as well as the suitability of alternate access routes.

In addition, the following operational measures are recommended to be undertaken by the Owner:

(1) During periods of unusually heavy rains, provide round-the-clock surveillance of Tar Run Dam.

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

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.

A.C. HOOKE
Head, Dam Section

Date: September 20, 1978

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

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

Date: 23 Sep 78

TAR RUN DAM

Downstream Slope of Embankment from Spillway.

DELAWARE RIVER BASIN

TAR RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

TAR RUN DAM

NDS ID No. PA-00692
DER ID No. 54-124

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

ABSTRACT

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. ABSTRACT

a. Dam and Appurtenances. Tar Run Dam consists of an embankment with concrete core wall, a concrete gravity ogee spillway and an outlet works.

The embankment is 75 feet high at maximum section and extends for 1,620 feet across the valley. The embankment has a design top width of 20.0 feet. Both the upstream and downstream slopes are covered with rip-rap and vary from 1V on 2H to 1V on 2.5H. A 11-foot wide berm extends along a portion of the downstream slope. The concrete ogee spillway is located near the right abutment. It has a crest length of 40 feet. The crest is 5 feet below design top of dam and it is about 3 feet above the downstream masonry apron. The outlet works facilities consist of an intake structure, a 20-inch diameter cast-iron pipe (CIP), a control structure located just upstream of the core wall and a valve house at the downstream toe of the embankment. The control structure houses a 20-inch valve that was provided as an upstream closure facility. A 12-inch diameter CIP taps into the 20-inch diameter CIP at the valve house. Both pipes extend under the berm and terminate at a headwall. The outlet channel downstream from the headwall extends for about 200 feet before joining the original stream. The spillway channel enters about 200 feet downstream from this point. Various features of the dam are shown on plates at the end of the report and on the photographs in Appendix D.

b. Location. The dam is located on Tar Run approximately 2.8 miles northwest of St. Clair, Pennsylvania, and 4.5 miles north of Pottsville, Pennsylvania. Tar Run Dam is shown on USGS Quadrangle, Shenandoah, Pennsylvania, with coordinates N40°45'20" - W76°13'15" in Schuylkill County, Pennsylvania. The location map is shown on Plate 1.

c. Size Classification. Intermediate (75 feet high, 605 acre-feet).

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

e. Ownership. Schuylkill County Municipal Authority, Pottsville, Pennsylvania.

f. Purpose of Dam. Water supply for the communities of St. Clair, Pottsville, Port Carbon, Shanetown, East Mines, Wadesville, East Norwegian, Norwegian, North Manheim, New Castle, Palo Alto, and Mt. Carbon, Pennsylvania.

g. Design and Construction History. Information concerning the designer of Tar Run Dam was not available. It is believed that the dam was designed by N.J. Beisel, General Manager and Engineer for the Pottsville Water Company. The dam was constructed between 1932 and 1933 by the Vang Construction Company, Pittsburgh, Pennsylvania. Mr. Beisel supervised the construction. No known modifications have occurred since the original construction. In 1961, the present Owner acquired the dam from the Pottsville Water Company.

h. Normal Operational Procedure. The pool is maintained at spillway crest with excess inflow discharging over the spillway. Releases from the outlet works, as well as spillway discharges, flow downstream to Tar Run Intake Dam, where water enters the distribution system.

1.3 Pertinent Data.

a. Drainage Area. 0.86 square mile.

b. Discharge at Damsite. (cfs.)

Maximum known flood at damsite - 1,380 (1)

Outlet works at maximum pool elevation - 90 (approximate).

Spillway capacity at maximum pool elevation - 1,530 (low area).

Design spillway capacity - 1,650.

c. Elevation. (Feet above msl.)

Top of dam (low area) - 1529.6.

Design top of dam - 1530.0.

Maximum pool (top of dam low area) - 1529.6.

Normal pool (spillway crest) - 1525.0.

Upstream invert outlet works - 1475.0.

(1) Estimated for Tropical Storm Agnes, June 1972, assuming the pool was 0.5 foot below top of dam and including outlet works discharges.

Downstream invert outlet works -
12-inch diameter CIP - 1469.5.
20-inch diameter CIP - 1469.6.

Streambed at toe of dam - 1455.0.

d. Reservoir Length. (Miles.)

Normal pool - 0.22.

Maximum pool - 0.24.

e. Storage. (Acre-feet.)

Normal pool (spillway crest) - 480.

Maximum pool (top of dam) - 605.

f. Reservoir Surface. (Acres.)

Normal pool (spillway crest) - 25.5.

Maximum pool (top of dam) - 28.8.

g. Dam.

Type - Earthfill with concrete core wall.

Length - 1,620 feet (embankment).

Height - 75 feet.

Top Width - 20 feet (design).
Varies 12 feet to 14 feet (existing).

Side Slopes - Downstream
from El. 1530 to El. 1500 - 1V on 2H.
below El. 1500 - 1V on 2.5H.
11-foot wide berm at El. 1472.5.

Side Slopes - Upstream
from El. 1530 to El. 1500 - 1V on 2H.
below El. 1500 - 1V on 2.5H.

Impervious core - Concrete core wall.

Zoning - Homogeneous earthfill.

Cutoff - Core wall in rock trench.

Grout curtain - Single line beneath core wall.

h. Diversion and Regulating Tunnel. None.

i. Spillway.

Type - Concrete ogee weir.

Length of weir - 40 feet.

Crest elevation - 1525.0.

Upstream channel - Approximately flat at Elevation 1522.0.

Downstream channel - Masonry apron on 5.5-percent slope leading to rock-lined channel.

j. Regulating Outlets. 20-inch diameter CIP extending through embankment to valve house at downstream toe. One 20-inch gate valve in control structure upstream of core wall. Two 20-inch gate valves in valve house. One 12-inch diameter CIP taps off 20-inch diameter line between the 20-inch gate valves. One 12-inch gate valve provided on 12-inch diameter line in valve house. Both the 20-inch and 12-inch diameter lines discharge at a headwall 30 feet downstream of the valve house.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. Very little engineering data for the dam was available for review. In 1932, the Pennsylvania Water Supply Commission prepared a report on the structure prior to issuing a permit for construction. This report resulted in the recommendation to modify the control structure upstream of the core wall. In accordance with this recommendation, the control structure was modified. No numerical analyses of design were available for review.

b. Design Features. The dam consists of a zoned-earthfill embankment with a concrete core wall, a concrete gravity ogee spillway and an outlet works.

The embankment is 75 feet high and 1,620 feet long (Plate 3 and Photographs B, C, D, E, and J). The design top elevation is 1530.0 and the design top width is 20.0 feet. Both the upstream and downstream slopes are 1V on 2H above Elevation 1500.0 and 1V on 2.5H below Elevation 1500.0. The design riprap thickness on the upstream and downstream slopes varies from 2 feet at Elevation 1530.0, to 3 feet at Elevation 1500.0, to 4 feet at the toes. A rockfill zone at the downstream toe extends along an approximate 500-foot length of the embankment (Plate 3). An 11-foot wide berm at Elevation 1472.5 extends along the downstream slope of the embankment across the deepest section of the valley. This berm connects to an access road at the left abutment. Access to the outlet works and the spillway channel is via this berm. Access to the spillway weir is via the top of dam.

The embankment fill upstream of the core wall is selected clay and gravel. The embankment fill downstream of the core wall is a coarser material. The embankment is founded on a 4- to 17-foot thick layer of overburden that consists of sand, gravel and clay. A description of the geology at the site is presented in Appendix E.

The concrete core wall extends to within 2.0 feet of design top of dam. The top width of the core wall is 1 foot. For the top 48 feet of the core wall, both the upstream and downstream faces have 48V on 1H batters. Below the battered section, the

core wall has a uniform width of 3 feet. The core wall is reinforced with No. 2 bars of unknown spacing. The wall was constructed in 30-foot long monoliths and in 10-foot lifts. A 4-inch key painted with tar was provided between monoliths. The bottom of the core wall was placed in a trench excavated in rock. The width of the trench varies between 2 and 3 feet and the depth also varies up to a maximum of 12 feet. A single line grout curtain extends along the bottom of the core wall. The depth and spacing of the grout holes vary. The grouting was done after the section of core wall in the rock trench had been placed.

The spillway is located at the right end of the embankment (Plate 2 and Photographs E, F, G, H, and I). The centerline of the spillway is 125 feet to the left of the right end of the dam. The weir is a concrete ogee section with a crest length of 40 feet. The crest is at Elevation 1525.0, and it is 3 feet above the approach and discharge channels. The weir has an upstream cutoff wall which extends to rock. Each end of the cutoff wall is tied into the core wall.

The spillway approach channel is level at Elevation 1522.0 and is benched into the natural hillside slopes with a 1V on 2H cut on the right. A vertical masonry wall on each side of the spillway retains the embankment fill. This wall extends along the embankment template and acts both as an approach wall upstream of the crest and a training wall downstream of the crest.

Downstream of the weir a 40-foot wide dry masonry apron extends on a 5.5-percent grade for 30 feet to the end of the training wall. The apron then continues downstream at the same grade for 37 feet to where it narrows to a bottom width of 10 feet. Along this 37-foot reach, there is masonry paving on the 1V on 1H side slopes. The top of the paving is about 1.4 feet above the apron. A concrete cutoff is located at the downstream end of the apron. It is 5 feet deep by 2 feet wide.

The channel downstream of the apron is about 2 feet below top of original ground. It is 10-foot bottom width, 1V on 1H slopes, and a 4.6-percent grade. The channel extends on this grade for about

180 feet. The channel tapers out onto a relatively flat area about 90 feet vertically above Tar Run. It was intended that spillway discharges cut their own channel beyond the run-out area.

The main features of the outlet works facilities are: a concrete intake structure with bar screen near the upstream toe of slope; a 20-inch diameter CIP extending through the embankment; a reinforced concrete control structure upstream of the core wall; and a masonry valve house at the downstream toe. The intake structure is located about 30 feet upstream of the upstream toe of embankment. The invert at the intake structure is 1475.0. The intake structure has 4-foot deep concrete cutoff key and is just upstream of a rockfill dam that was used for diversion purposes during construction. The 20-inch diameter CIP is encased in concrete that has a 44-inch square outside dimension. Seepage collars, 12 inches by 12 inches, project above the top and sides of the encasement on 20-foot centers. The control structure permits the pipe to be valved before it passes downstream through the core wall (Plates 3 and 4 and Photograph C). The control structure is located 800 feet from the right end of dam. It is circular in section, having an inside diameter of 5.0 feet and walls that are 1.5 feet thick. It rises from Elevation 1471.9 to top of dam for a total height of 58 feet. The downstream side of the control structure is integral with the core wall. A manhole cover is provided on the top and a ladder extends down into the control structure. A 20-inch gate valve for controlling discharge through the 20-inch diameter CIP is located at the bottom of the control structure. The valve stem extends to within 2.25 feet of the top.

The masonry valve house is located at the downstream toe of the embankment (Plates 3 and 4 and Photographs J and K). Two 20-inch gate valves within the valve house are connected in series on the 20-inch diameter CIP. A 12-inch diameter CIP with a 12-inch gate valve is connected to the 20-inch diameter line between the 20-inch valves. Both the 12-inch and 20-inch lines extend parallel from the valve house for about 30 feet to a concrete headwall. At the headwall, the invert elevation of the 12-inch line is 1469.5 and the invert elevation of the 20-inch line is 1469.6. The headwall is also the point of discharge for a 6-inch diameter CIP drain which extends from the bottom of the control structure.

An outlet channel is located downstream of the headwall. It consists of a masonry-paved trapezoidal section, 58 feet long, which has an 8-foot width and 1V on 1.5H side slopes. The channel is on a 1.4-percent grade and has a 4-foot deep masonry cutoff wall at the downstream end. The downstream end of the paved channel is about at Elevation 1469. Beyond the paved section, the channel continues down to the original streambed, which is about 34 feet lower in elevation. This last reach of channel was cut through natural ground by discharge flow from the outlet works.

2.2 Construction.

a. Data Available. The Pennsylvania Water Supply Commission was quite concerned with the construction methods utilized. Frequent inspections were made by the Commission. Inspection reports, construction photographs, grouting records, and construction specifications are on file.

b. Construction Considerations. After each length of the core wall trench was excavated, the trench was inspected by an engineer from the Pennsylvania Water Supply Commission and approval given to proceed with work in that area.

It was noted, during the inspections by Commission personnel, that springs existed on each side of the original streambed and that 4-inch diameter porous drains had been extended from these springs to a point downstream of the toe. Apparently it had been anticipated that such conditions would be encountered, as a typical drain section was included in the contract drawings (Plate 2).

During the inspections by the Commission, it was discovered that some of the grouting was being accomplished by pumping 3 to 5 bags of cement into the hole and then letting the grout hole remain until some later date, when more grouting would be done on the same hole. It was also discovered that the holes had been drilled and grouted in succession, instead of drilling and grouting by the split-spacing method. Both of these practices of grouting were ordered to be modified by the Commission.

It was also noted during the inspections by the Commission, that some of the embankment fill was being placed in too wet a condition to be properly compacted. Modifications to the construction procedure were ordered by the Commission.

During the inspections the Commission also discovered that drain pipes were constructed from the upstream toe of embankment to springs immediately upstream of the core wall. The Commission put an immediate stop to this practice and ordered such drains as existed to be grouted.

In summary, it appears that some practices utilized during construction were not in accordance with good engineering practice, either then or now, and that close inspection by engineers from the Pennsylvania Water Supply Commission was needed to assure satisfactory construction.

2.3 Operation. No formal records of operation were reviewed. Based on information from the Owner, all structures as presently constructed have performed satisfactorily. The Owner did note that the spillway required some repairs after Tropical Storm Agnes in June 1972. The Owner stated that the outlet works was fully opened during this storm and that the pool level neared the top of embankment, although measurements were not obtained.

2.4 Other Investigations. No known investigations other than those previously described were reviewed.

2.5 Evaluation.

a. Availability. Engineering data was provided by the Division of Dams and Encroachments, Bureau of Water Quality Management, Department of Environmental Resources, Commonwealth of Pennsylvania, and by the Owner, Schuylkill County Municipal Authority. The Owner made available the general manager and caretakers for information. A caretaker assisted in operating demonstrations during the visual inspection.

b. Adequacy. The type and amount of design data and other engineering data is 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 Tar Run Dam is good, with the exceptions noted below.

b. Embankment. The embankment is in generally good condition. A survey performed for this inspection revealed that there were two low areas on the top of the embankment. These low areas are located on each side of the spillway, adjacent to the spillway walls. The low area to the right of the spillway extends for 55 feet, and its lowest point is 0.4 foot below design grade. The low area to the left of the spillway extends for 75 feet, and its lowest point is 0.4 foot below design grade. The remainder of the top of embankment is at or above design grade.

The embankment fill that was observable at top of embankment is a gravelly sand with very little cohesion. Some of this material had eroded onto the riprap on the upstream and downstream slopes of the embankment. An erosion gully from top of dam extending downstream was observed 30 feet left of the spillway.

The riprap protection on the upstream slope of the embankment has a top elevation which varies between Elevations 1527.1 and 1528.5, as determined by a survey performed for this inspection (Photograph A). The top of riprap on the downstream slope is generally about 1 foot lower than top of embankment.

The riprap on the downstream slope is very loose with many uneven areas. It slid underfoot when an inspector walked on it. The uneven areas appear to be slides.

There is brush growing sporadically about 2 feet high, on the downstream slope. Within about 20 feet of the downstream toe of the embankment the vegetation on the slope is much heavier. Mature trees are also growing along the toe in may areas. The upstream slope is clear of vegetation.

Two seepage and a wet area were observed near the toe of the embankment. Their location is shown on Plate 3. The wet area is 50 feet right of the valve house in an undrained pocket. There was evidence of flow previously having occurred in the area. The soil was fairly soft, as the inspector's boots penetrated about 1-inch into the soil.

Seepage Area No. 1 is about 400 feet to the right of the left end of the dam. The seepage emanates from a wet area at the toe of the embankment. The seepage area measured about 80 feet along the toe by 45 feet in width. The area is generally covered with water. The soil beneath is very soft. A clear seepage of about 2 gpm, apparently originating at two localized areas, flows from the wet area along the toe to the right for 300 feet. It passes through a culvert that is under the berm of the embankment and flows to the original streambed.

Seepage Area No. 2 is slightly to the right of the original streambed. One localized clear seep of 0.5 gpm was observed. This seepage joins with general seepage of 0.5 gpm in this area and with the seepage from Seepage Area No. 1. The combined seepage then passes down the original streambed. The original streambed is quite overgrown.

c. Appurtenant Structures. The spillway weir has a crest length of 40 feet, and it was apparently constructed as a single monolith (Photographs E and F). Four shrinkage cracks extend through the weir. The upstream side of the weir, near the crest, has spalled to a depth of 2 inches. The downstream side of the weir has spalled to a greater extent, one area being spalled along a 12-foot length to a depth of 4 inches. In the spillway approach walls, the mortar is completely deteriorated below spillway crest level. The mortar is also deteriorated where the weir joins the walls.

A small amount of grass is growing in the dry masonry apron downstream of the weir (Photograph H). One 3-foot square of masonry is missing. The downstream end of the apron is eroded and undermined. Downstream of the spillway training walls, the walls along the apron are 1.4-feet high (Photograph G).

The channel downstream of the apron has trees close to both banks with some dead trees lying across the channel (Photograph H). Where the man-made channel runs out, the spillway discharges have eroded a channel about 10-feet deep. Reaches of this channel have boulders strewn along the bottom. The banks in this reach are nearly vertical. Near the confluence of this channel and Tar Run, the channel drops on an approximate 1V on 3H slope and then extends downstream. The channel along this reach is not well defined.

The concrete at the top of the control structure is severely deteriorated. It crumbled at the slightest touch. The reinforcing was completely exposed. Apparently an attempt had been made to protect this concrete. Asphalt covered most of the top of this structure (Photograph C). The asphalt covered the edges of the manhole cover and the cover could not be removed. Operation of the 20-inch diameter valve in the control structure was, therefore, not observed. Apparently, the 20-inch valve is used as an upstream closure facility.

The 12-inch diameter valve in the valve house was partially open during the day of the inspection. Its operation was not observed. The operation of the downstream 20-inch diameter valve was observed. Two men opened the valve about 5 percent in 10 minutes with no apparent problems. The metal operating bar is very rusty and bent under load.

The concrete headwall had a few surface cracks. The banks of the outlet works channel downstream of the headwall and masonry apron are not well defined. The root system of trees adjacent to the channel were exposed. A large seepage area was observed 20-feet right of the outlet works channel, about 100 feet downstream from the valve house. The seepage area had clear water flowing at about 40 gpm. The seepage area appeared lower than the outlet works channel.

d. Reservoir Area. The reservoir slopes are wooded and quite flat. No evidence of creep, rock slides, or landslides was visible. The Schuylkill County Municipal Authority owns and posts the entire watershed. The Owner indicated that sedimentation was not a problem.

e. Downstream Conditions. Tar Run, below the confluence with the Tar Run Dam spillway channel, extends through a wooded valley. The access road to the dam extends along the stream. It was estimated that the access road might be impassable during periods of high spillway discharge.

3.2 Evaluation.

a. Embankment. The low areas on the embankment reduce the spillway discharge capacity. The fill observed at the top of embankment is readily erodable. Evidence of erosion was observed. Riprap not extending to the top of embankment is therefore of some concern. The existing top width measures 12 to 14 feet, as determined by a survey performed for this inspection and not 20 feet as designed. If the riprap was extended up to top of dam, as is shown on the construction drawings (Plate 3), the top width would increase by 4.5 feet. Since the existing upstream and downstream edges of top of dam are rounded, apparently be erosion, it is believed that erosion of the material is the cause of the reduced top width.

The bulges on the riprap on the downstream slope were thought to be surface sliding of the loose riprap, with no sliding of the embankment beneath. The sliding could, however, be an indication of more serious problems.

Brush on the downstream slope of the embankment and near the toe is undesirable. The Owner reported that the brush on the downstream slope was cleared two years ago.

The wet area to the right of the valve house had been reported as a seepage area in some of the periodic inspections by the Commonwealth. The seepage areas observed during this inspection were also reported during the periodic inspections by the Commonwealth. As was noted in Paragraph 2.2b., drains were placed under the embankment during construction. Some of the seepage observed may be from the drains, although no drains were observed. The substandard construction methods noted in Paragraph 2.2b. may also be contributing to the seepage. The seepage has apparently stabilized.

b. Appurtenant Structures. The shrinkage cracks in the spillway weir were probably caused by the excessive monolith length. The spalling is probably caused by exposure to flowing water or honeycombing of the concrete during construction. Neither of these conditions are sufficiently serious to present an immediate hazard. The deterioration of the mortar in the approach walls was probably caused by exposure to fluctuating pool levels and freezing-thawing cycles. The deteriorated mortar may prevent the wall from acting as a watertight structure.

The vegetation in the masonry apron is sufficiently small to be of no concern at present. The missing masonry may allow high spillway discharges to unravel the remaining masonry. The low spillway walls immediately beyond the toe of embankment are of come concern, as flow over the wall on the left would flow down the embankment, creating an erosion hazard. This condition is evaluated further in Section 5.

The debris in the excavated spillway channel downstream of the apron would raise tailwater. Not extending the excavated channel to the stream and letting the spillway discharge make its own channel is not always good engineering practice. The erosion resulting from this condition is undesirable; however, the eroded area is about 200 feet from the dam, and it is not considered to be a hazard to the dam. Continued erosion of the area will probably progress in the downstream direction or away from the dam.

The conditions observed at the top of the control structure are of some concern. The asphalt does not allow the manhole cover to be removed, thereby making the 20-inch valve inaccessible. The reason for the concrete deterioration is unknown. It could have been caused by a poor concrete mix. There is concern for the condition of the concrete in the entire structure.

The Owner stated that the 12-inch valve in the valve house was usually operated daily to regulate streamflows. The 20-inch valve in the valve house was fully operable. The operating bar was, at best, unreliable.

Cracking at the headwall is not sufficiently severe to be of concern at present. The seepage observed to the right of the outlet works channel was probably coming from the water in the channel.

c. Reservoir Area. No conditions were observed in or near the reservoir which might present significant hazard to the dam.

d. Downstream Conditions. Lack of access during periods of high spillway discharge would prevent observation of potential problems during those periods. The Owner did not report any access problems during Tropical Storm Agnes. He stated that during this storm, the dam was under constant observation. Additional discussion of downstream conditions is presented in Paragraph 5.1e.

SECTION 4
OPERATIONAL PROCEDURE

4.1 Procedure. The reservoir is maintained at spillway crest Elevation 1525.0 with excess reservoir inflow discharging over the spillway. At the valve house, the downstream valve on the 20-inch diameter line is normally closed and the upstream valve is normally open. The valve on the 12-inch diameter line is normally operated in the throttled position to vary discharge as required by demand and pool elevation at Tar Run Intake Dam located 0.6 mile downstream of Tar Run Dam. Water taken from Tar Run Intake Dam enters a 12-inch diameter pressure main where it flows by gravity. The main connects to pipes carrying flows from other dams in the Owner's system. It extends to a treatment plant located near the small community of Dark Water, about 1.7 miles downstream from Tar Run Intake Dam. From there water flows into the distribution system. The communities served are in the Pottsville area and are listed in Paragraph 1.2f.

The Owner stated that the emergency 20-inch diameter line was fully opened during Tropical Storm Agnes in June, 1972.

4.2 Maintenance of Dam. The dam is visited daily by a caretaker, who checks the security of the site. Pool elevations are taken weekly and delivered to the Owner's central office, where the data is filed and used to determine the storage remaining. The caretaker is responsible for observing the general condition of the dam and appurtenant structures and reporting any changes or deficiencies to the Owner's General Manager. Brush is usually cut every two years. Penn East Corporation, an engineering consultant to the Owner, makes an inspection of the Schuylkill County Municipal Authority system each year. Reports are sent to the Owner and are kept on file. The Owner apparently does not require a detailed inspection of the physical condition of the dam, as the annual reports place emphasis on the Authority's operations. Informal inspections are made by the caretakers during their daily visits to the damsite. These visits are mostly to obtain data for operating conditions and to check for trespassers. The Owner also employs a private security firm to apprehend trespassers.

4.3 Maintenance of Operating Facilities. The Owner stated that the 12-inch valve in the valve house is lubricated and fully operated once every year. There is no regular maintenance program for the 20-inch valves, two of which are in the valve house and one of which is in the control structure.

4.4 Warning Systems in Effect. The Owner gave the inspection team a verbal description of the emergency warning and operation system that is applicable for all Schuylkill County Municipal Authority Dams. The Owner said that, during periods of heavy rainfall, available personnel are dispatched to the dams to observe conditions round-the-clock. All company vehicles are equipped with radios, and the personnel can communicate with a central facility. Evaluation of risk is made by the General Manager. He is also responsible for notification of emergency conditions to the Schuylkill-Pottsville Office of Civil Defense, which in turn would notify local authorities. The Office of Civil Defense does not have a detailed emergency warning plan for the Owner's dams, but is does have a detailed emergency warning plan for severe weather conditions and similar events. Detailed emergency operational procedures have not been formally established for Tar Run Dam but are as directed by the Owner's General Manager.

4.5 Evaluation. The maintenance of the 12-inch valve located in the valve house is good. Although the 20-inch valves located in the valve house were fully operational, the lack of a regular maintenance program is undesirable. Lack of a regular maintenance program for the 20-inch valve located in the control structure is undesirable. The valve might not be functional if needed during emergency conditions. The growth of brush on the downstream slope of the embankment indicates that a more frequent brush cutting schedule would be warranted. The procedures used by the Owner to inspect the dam need improvement. During the annual inspection, there is insufficient emphasis placed on the physical condition of the dam. Also, insufficient emphasis is placed on the physical condition of the dam during the daily visits by the caretakers. The emergency operational procedures are too informal and not in sufficient detail. The emergency warning system is good, but the assessment of conditions that would require activation of the emergency warning system could be improved. The chain of command is too informal, not in sufficient detail, and apparently not well defined in the General Manager's absence.

SECTION 5
HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data.

(1) No hydrologic and hydraulic analysis for the original Tar Run Dam design was available for review. The spillway capacity was established by the Pennsylvania Water Supply Commission for their report on the application to construct the dam.

(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 Tar Run Dam is the 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) In the report on the application by the Owner to construct Tar Run Dam, the Pennsylvania Water Supply Commission indicated that the spillway capacity was 1,730 cfs. The lowest elevation of the low spots near the spillway is 1529.6. With the reservoir at this level, the head on the spillway is 4.6 feet and the spillway capacity, as computed for this study, is 1,530 cfs (Appendix C).

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

b. Experience Data. For this study, a PMF peak derived from generalized data supplied by the Baltimore District, Corps of Engineers for this area of the Delaware River Basin was adapted to Tar Run watershed. The peak inflow obtained by the Baltimore District, Corps of Engineers from the generalized data was 1,700 cfs per square mile. The PMF peak flow was estimated to be 1,460 cfs at Tar Run Reservoir. The maximum known flood at the damsite was estimated at 1,380 cfs. Based on information from the Owner, this discharge was estimated assuming that the pool was 0.5 foot below top of dam and that the outlet works valve was fully open.

c. Visual Observations. On the date of the inspection, no conditions were observed that might decrease the spillway capacity. As was noted in Section 3, the channel downstream of the spillway apron had some debris across the channel. This channel has a design bottom width of 10 feet with 1V on 1H side slopes and a design bed slope of 4.6 percent. The channel is about 2 feet below the original ground level. It is apparent that this channel could not pass the larger spillway discharges, even if it were cleared of debris. At present, the backwater effects from this channel would cause water to overtop the low wall along the left side of the lower spillway apron. As was noted in Section 3, this was considered a hazard to the dam. Should the low wall by the apron be raised, the channel downstream of the apron might cause a backwater effect on the spillway weir.

d. Overtopping Potential. For an occurence of the Tar Run PMF, the peak inflow of 1,460 cfs into Tar Run Reservoir is less than the spillway capacity of 1,530 cfs. There is no potential for overtopping.

e. Downstream Conditions. Tar Run Dam is 2.8 miles northwest of St. Clair, Pennsylvania, as shown on Plate 1. Flows from Tar Run Dam proceed downstream about 0.6 mile to a small dam (Photograph L). Although part of the Owner's system,

the dam is not in use at present. The water then flows 0.2 mile to Tar Run Intake Dam (Photograph M). Both these dams are sufficiently small that their failure would not add a significant amount of water to the stream. However, they would provide no significant mitigating effects to flood flows originating upstream. Tar Run then flows 0.2 mile to its confluence with Mill Creek, after passing under Pennsylvania Route 61. Mill Creek then flows 1.3 miles to its confluence with Wolf Creek. Mill Creek then proceeds downstream 1.3 miles to St. Clair. Mill Creek in the above reach generally parallels Pennsylvania Route 61 and crosses under railroad tracks a number of times. The road and railroad crossings for both Tar Run and Mill Creek are either bridges or culverts under low embankments, neither of which would provide significant mitigating effects to flood flows.

Mill Creek flows for 0.8 mile through the center of St. Clair, which has homes directly adjacent to the low river banks. The creek then flows 1.4 miles along the edge of a railroad yard, and then flows for 0.6 mile through Port Carbon, Pennsylvania, to its confluence with the Schuylkill River. Port Carbon has homes directly adjacent to the low river banks. Downstream conditions indicate that a high hazard classification is warranted for Tar Run Dam.

f. Spillway Adequacy.

(1) The spillway is capable of passing the PMF peak inflow of 1,460 cfs without overtopping Tar Run Dam.

(2) The maximum tailwater is estimated to be Elevation 1460.3 at the PMF discharge of 1,460 cfs. At maximum pool elevation, there is a difference of about 70 feet between headwater and tailwater. Overtopping of the embankment would cause erosion failure. If Tar Run Dam should fail the hazard to loss of life downstream from the dam will be significantly increased from that which would exist just prior to overtopping.

(3) Based on established OCE criteria as outlined in Paragraph 5.1a.(2), the spillway capacity of Tar Run Dam with the embankment at the existing elevation, is rated as adequate. Neglecting the effects of surcharge storage, the

spillway discharge capacity of 1,530 cfs can accommodate a flood with a peak inflow that is 105 percent of the PMF peak inflow. However, there is an erosion hazard to the embankment because of the low spillway training walls, as noted in Paragraph 5.1c.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of the dam resulted in a number of observations relevant to structural stability. These observations are listed herein for various features.

(2) Embankment. Seepage was observed at the toe of the embankment; and survey data, acquired for this inspection, revealed differences between the existing embankment template and the design template. Evidence of sliding of the riprap on the downstream slope was also observed. A detailed description and evaluation of these conditions are in Paragraphs 3.1b. and 3.2a., respectively.

(3) Spillway. Deterioration of mortar in joints was observed in the spillway approach wall. Shrinkage cracks and spalling were noted in the concrete spillway weir. A detailed description and evaluation of these conditions are in Paragraphs 3.1c. and 3.2b., respectively.

b. Design and Construction Data. No record of design data or stability analysis was available for review. In the report upon the application of the Pottsville Water Company to obtain a construction permit for Tar Run Dam, the Pennsylvania Water Supply Commission considered the design of the dam to be in accordance with good engineering practice, except as was noted in Paragraph 2.1a. No mention was made of the spillway weir stability in the report. Based on data available for review, there is no record of numerical analyses for either the spillway or the embankment.

Analysis of the embankment stability is beyond the scope of this study. Also, sufficient data would have to be acquired before the analysis could be performed.

The existing spillway weir crest elevation is approximately 3 feet above the invert elevation of the downstream spillway channel. Stability

analysis are not usually performed on structures this small. From a review of the cross section of this structure (Plate 2), it is judged that is should be stable under the anticipated loading conditions.

c. Operating Records. No formal records of operation were reviewed. There was no information available for review that indicated any evidence of previous stability problems.

d. Postconstruction Changes. As noted herein, there have been no postconstruction changes made to Tar Run Dam.

e. Seismic Stability. Tar Run 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. However, since there are no formal static stability analyses, and since there is the potential of earthquake forces moving or cracking the concrete core wall, the theoretical seismic stability of Tar Run Dam cannot be assessed.

SECTION 7
ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on the visual inspection, available records, calculations and past operational performance, Tar Run Dam is judged to be in fair condition. However, some maintenance and repair deficiencies were noted. A summary of features and observed deficiencies are listed below:

Feature and Location	Observed Deficiencies
Embankment:	
Top	Low areas and erosion.
Upstream slope	Riprap below design elevation.
Downstream slope	Slides in riprap and brush.
Downstream toe	Brush and trees; and seepage.
Spillway:	
Weir	Shrinkage cracks and spalling.
Approach walls	Deteriorated mortar.
Apron	Vegetation and missing stones.
Left training wall	Wall too low.
Channel below apron	Debris, channel undersized.
Outlet Works:	
Control structure	Access blocked and deteriorated concrete.
Valve house	Deteriorated operating bar.

Feature and Location	Observed Deficiencies
Outlet Works: (Cont'd.)	
Headwall	Surface cracks.
Outlet channel	Poorly defined water-course; possible cause of seepage.
Downstream Channel:	
Access road	Poor access during high spillway discharges.

(2) The overtopping potential analysis shows that Tar Run Dam, with the embankment at the existing elevation, will not be overtopped by the PMF. Based on OCE criteria, as outlined in Paragraph 5.1a(2), the existing spillway capacity is rated as adequate. The existing spillway can accomodate a flood with a peak inflow of 105 percent of the PMF. However, there is an erosion hazard to the embankment, as higher spillway discharges would overtop the spillway training walls.

(3) Stability computations were not performed for this study. It was judged that the spillway weir would be stable under the anticipated loading 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 a part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented as noted therein.

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

Recommendations and Remedial Measures.

a. In view of the concern for the safety of Tar Run Dam, the following measures are recommended, in approximate order of priority, to be undertaken by the Owner as soon as practical:

(1) Remove the debris and growth in the spillway discharge channel.

(2) Perform additional studies to more accurately ascertain the required height of wall adjacent to the spillway apron as well as the required hydraulic capacity of the channel downstream of the spillway. The nature and extent of the remedial work, necessary to make the channel downstream of the weir hydraulically adequate, should then be determined.

(3) Remove the asphalt from the top of the control structure and inspect the structure for evidence of concrete deterioration. Ensure that the 20-inch valve in the control structure is operational.

(4) Undertake a program to monitor at frequent intervals the apparent sliding of the riprap on the downstream slope of the embankment. If further movement occurs, appropriate remedial measures should be taken.

(5) Raise the riprap to top of dam elevation. The two low areas on the top of embankment should be filled, and measures should be taken to prevent erosion of the material from the top of embankment.

(6) Institute a program of detailed annual inspections for Tar Run Dam, and utilize the results to ascertain if remedial measures are required.

(7) Develop a detailed emergency operation and warning system for Tar Run Dam.

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

(1) Install ten or more observation wells, or other instrumentation, downstream of the axis of the dam. Two wells, or other instrumentation, should be located in the vicinity of the wet area at the toe of the embankment. Four others should be located in the seepage areas. Two in the one seepage area and two in the other. The other four should be at appropriate locations to determine

general water level in downstream embankment. Data collected from observation wells or other instrumentation should be utilized in evaluating the stability of the embankment and assessing piping potential in the future. Continue to observe wet area and seepage areas downstream from the dam. Periodically measure and record quantity of seepage from all areas. If seepage increases or turbidity is noted, appropriate action should be taken to control seepage and turbidity with properly designed drains.

(2) Remove brush and trees from downstream slope and toe of embankment.

(3) Repair spalling concrete on spillway weir.

(4) Monitor shrinkage cracking of concrete at spillway weir and surface cracking at outlet works headwall. If changes are noted, take appropriate action.

(5) Replace valve operating bar and maintain in good condition.

(6) Repair deteriorated mortar in approach channel walls.

(7) Replace missing stones in spillway apron.

(8) Undertake a study to determine if flows in the outlet works channel are the source of the seepage observed near the channel. If these flows are not the source of seepage, the study should be continued to determine the source and to determine what remedial measures might be necessary.

(9) Undertake a study to determine the suitability of the access road during periods of high spillway discharge as well as the suitability of alternate access routes.

c. In addition, the following operational measures are recommended to be undertaken by the Owner.

(1) Provide round-the-clock surveillance of Tar Run Dam during periods of unusually heavy rains.

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

DELAWARE RIVER BASIN

TAR RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

TAR RUN DAM

NDS ID No. PA-00692
DER ID No. 54-124

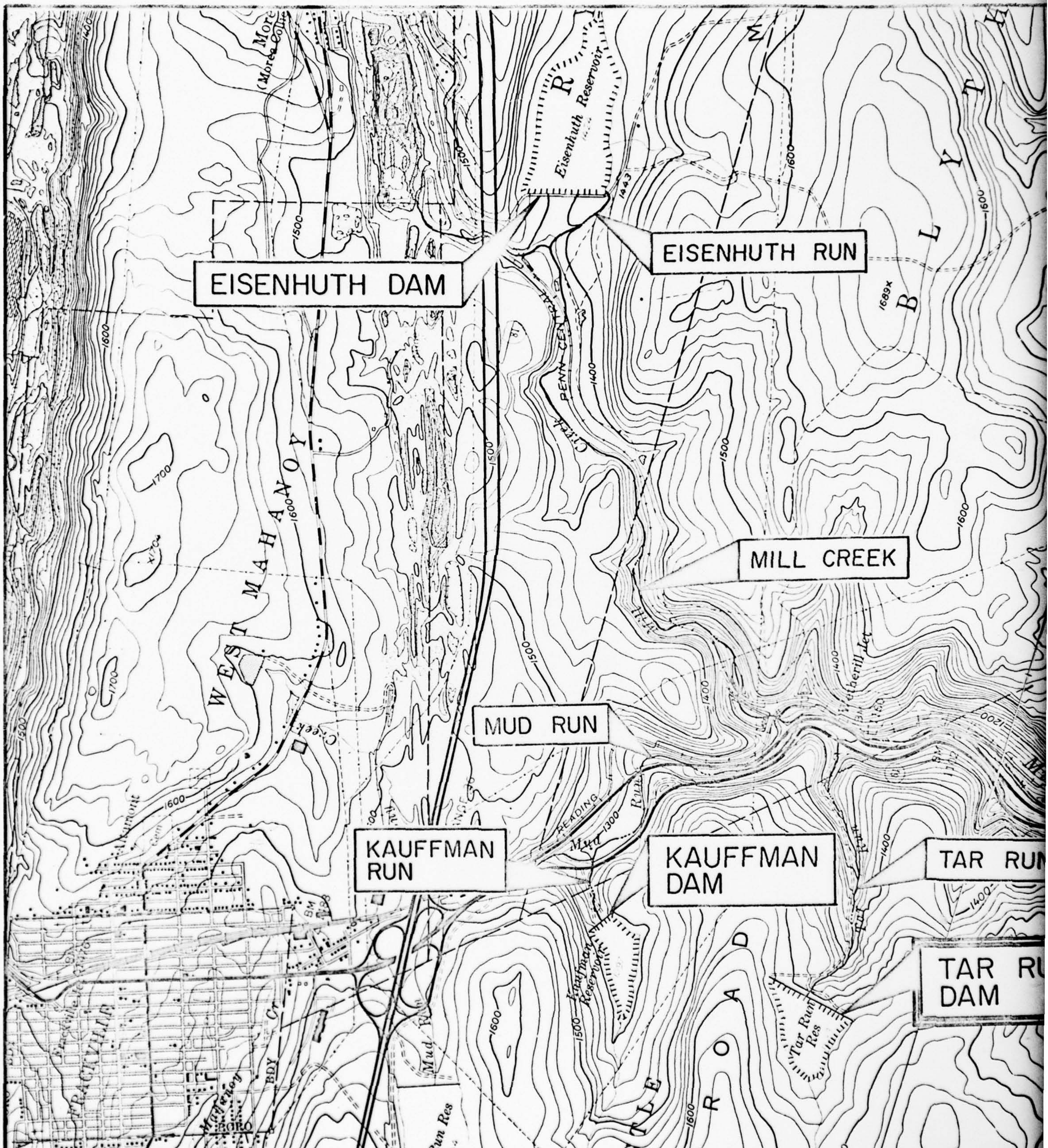
SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

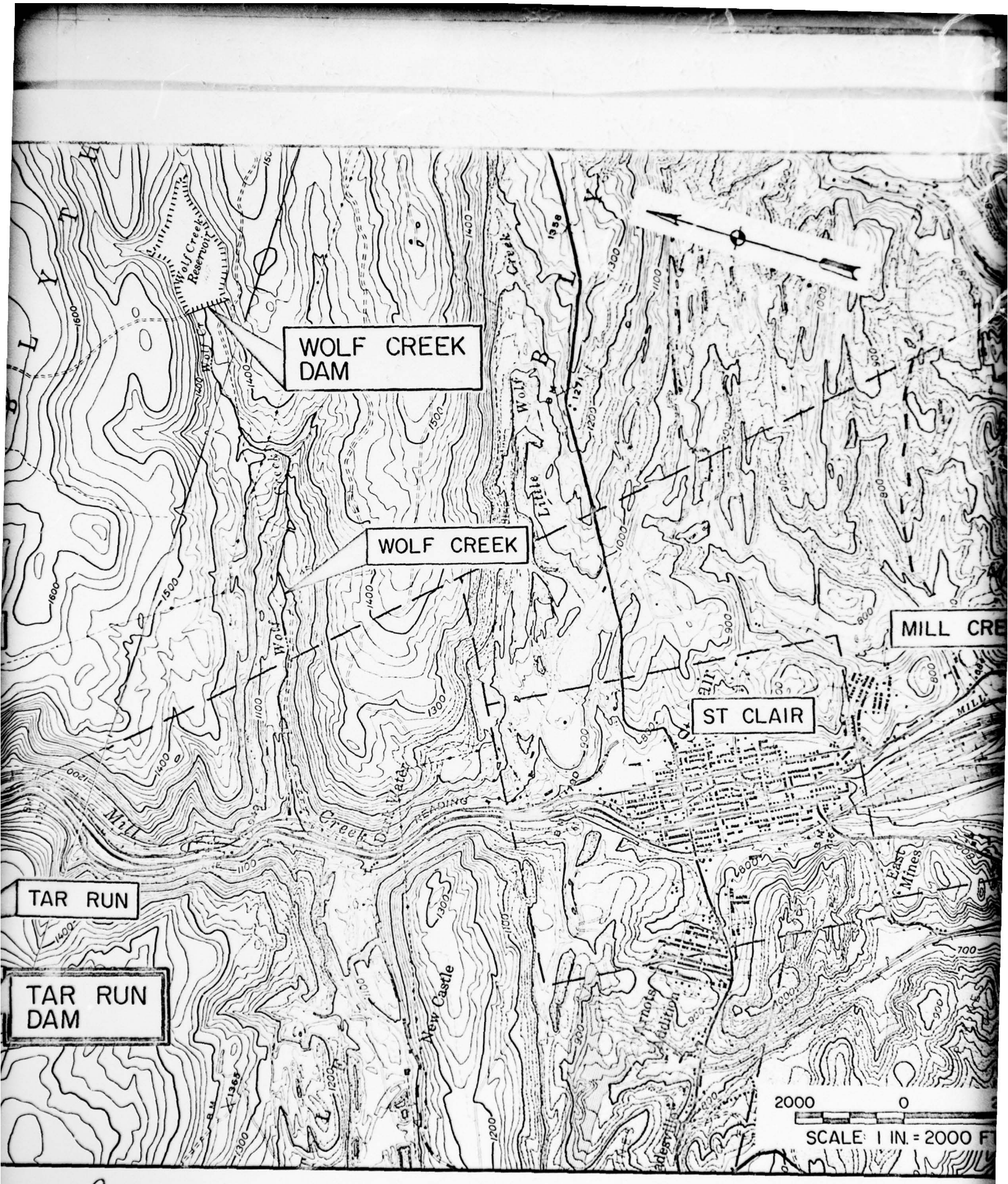
PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

PLATES


EISENHUTH DAM
EISENHUTH RUN
Eisenhuth Reservoir
MILL CREEK
MUD RUN
KAUFFMAN RUN
KAUFFMAN DAM
TAR RUN
TAR RU
DAM
WEST MAHANOY
Kauffman Reservoir
Tar Run Res
BROAD
FRACKVILLE
PENN CENTRAL
READING


WOLF CREEK DAM
WOLF CREEK
ST CLAIR
TAR RUN
TAR RUN DAM
Wolf Creek Reservoir
Little Wolf Creek
Mill Creek
New Castle
East Mines
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2000
0

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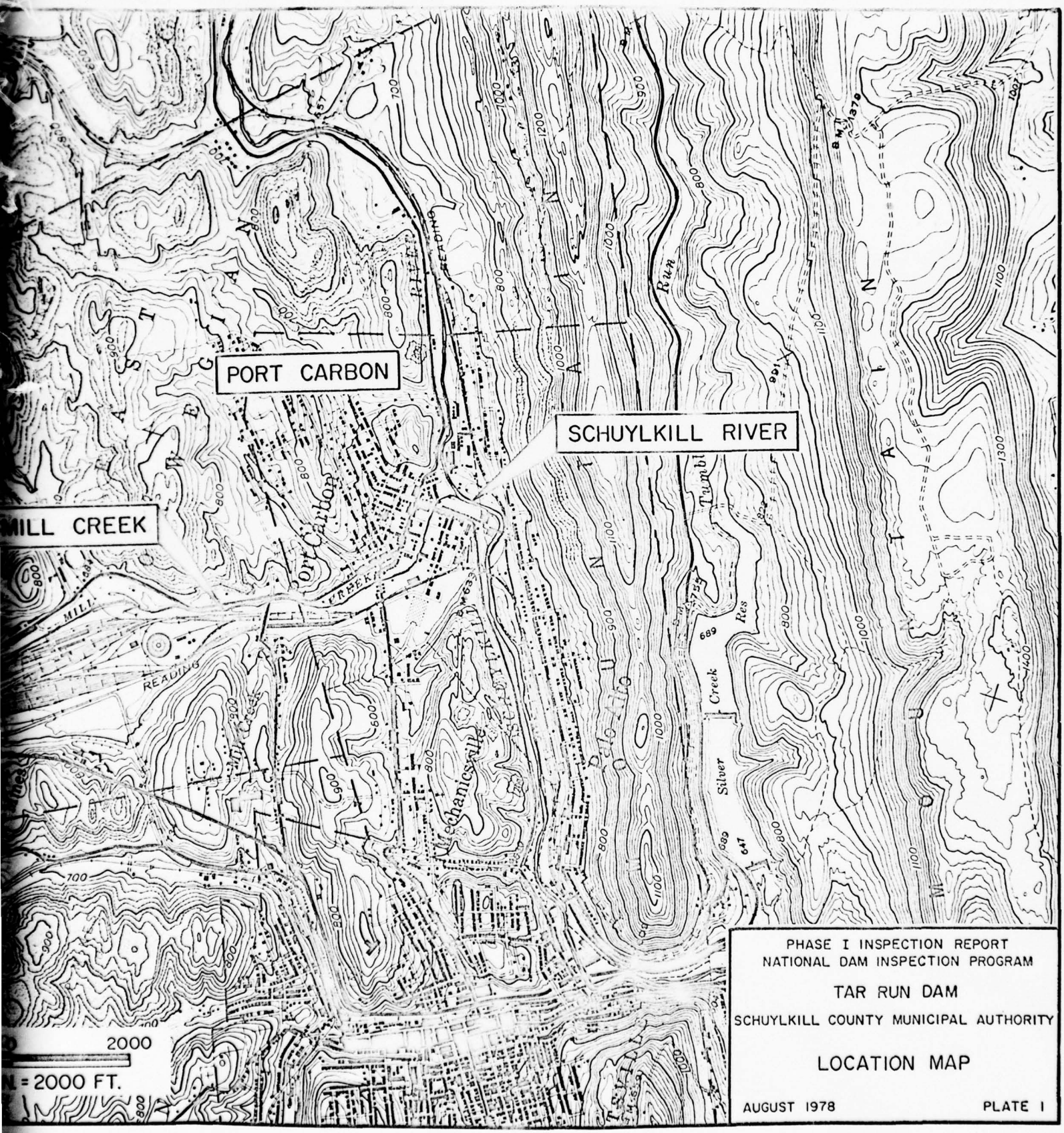


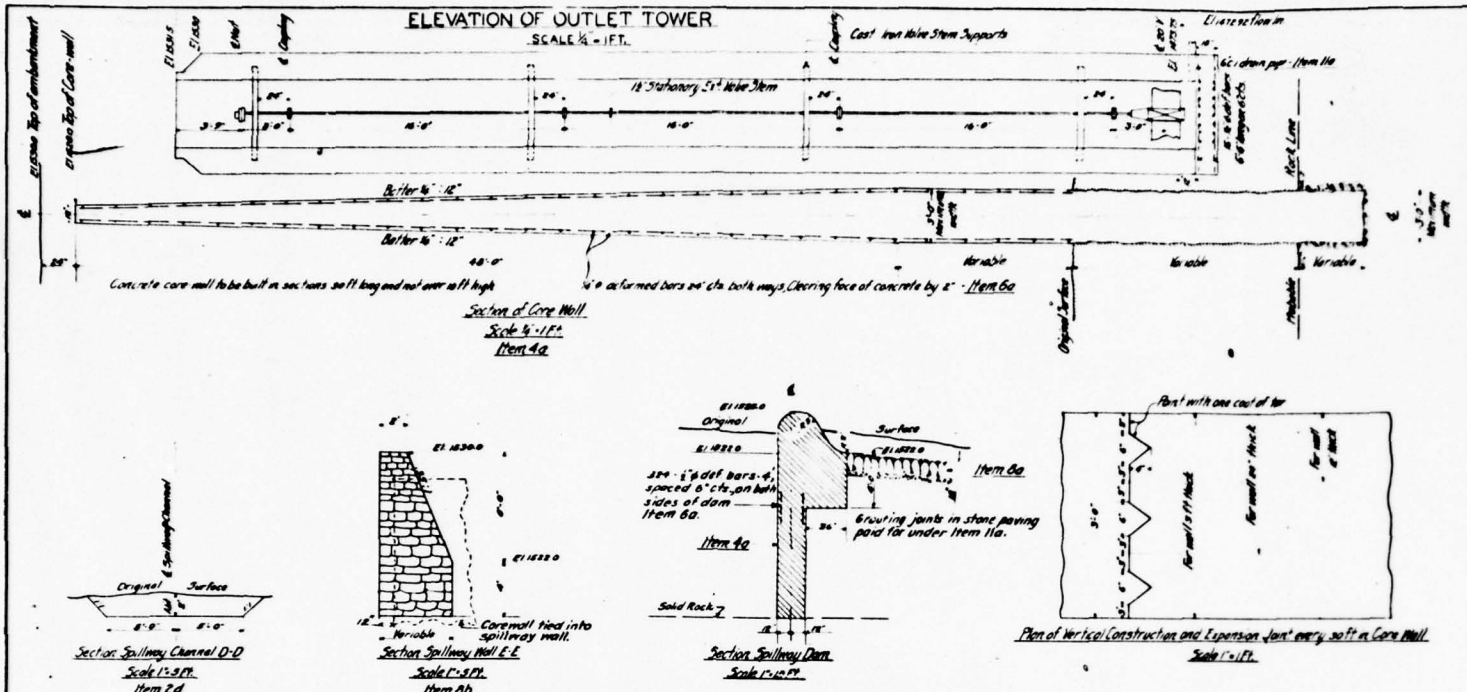
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

TAR RUN DAM

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

LOCATION MAP

AUGUST 1978 PLATE 1



Core wall extends to within 12" of face of spillway wall.

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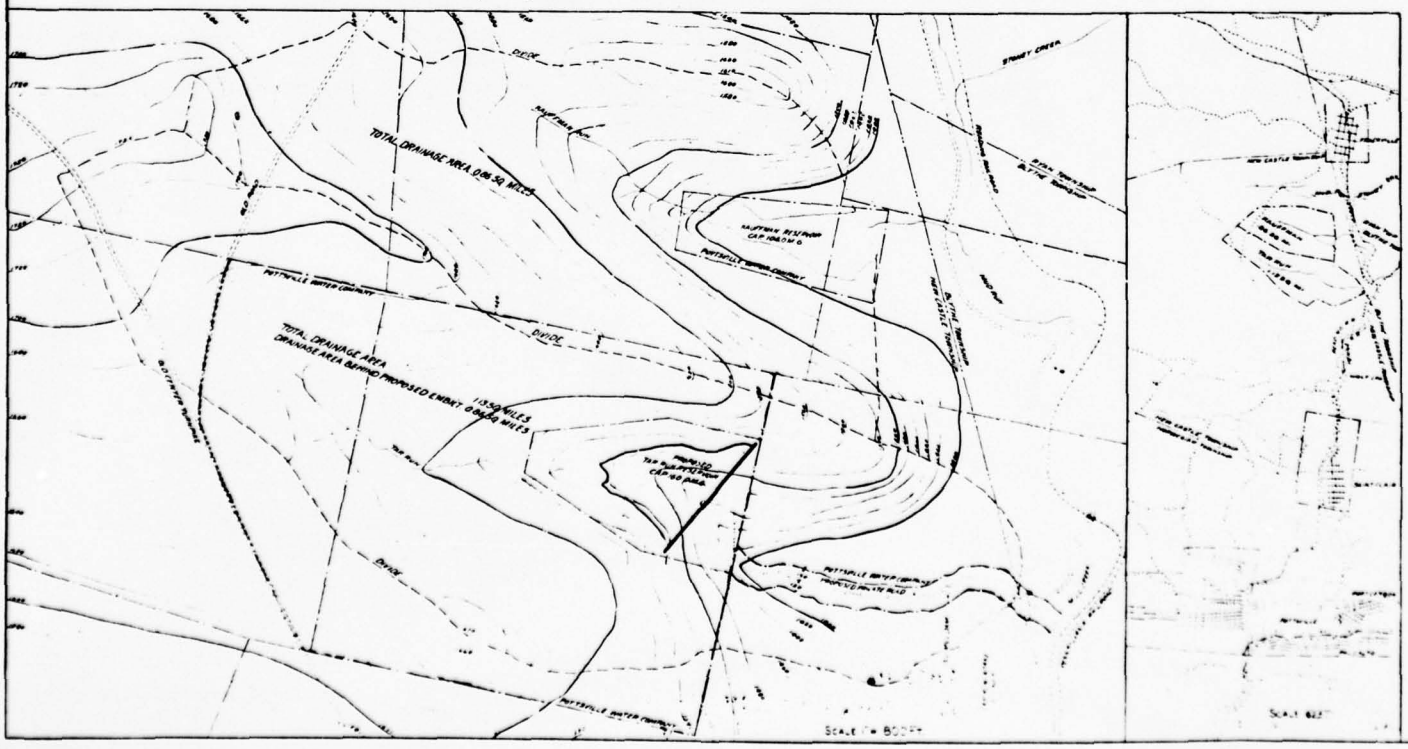
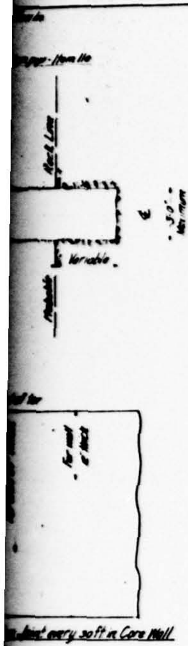
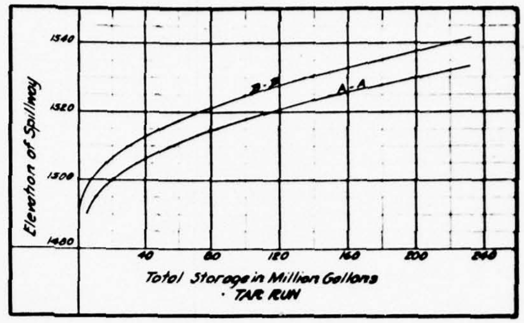


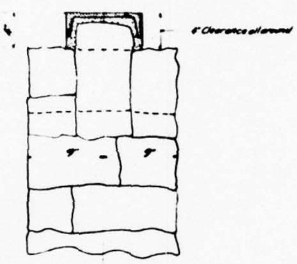


LIST OF REINFORCING BARS IN CORE WALL

SECTION	NUMBER OF BARS OF VARIOUS LENGTHS ALL ¼ ϕ DEF.												
	1-9	3-9	5-0	5-9	7-0	7-9	9-0	9-9	11-0	11-9	13-0	13-9	29-6
1	32												4
2		32											6
3				32									8
4						32							10
5						32							10
6								32					12
7										32			14
8										32			14
9												32	16
10					32			32					18
11					32			32					18
12							32	32					20
13								32	32				22
14								32			32		24
15			32					32	32				26
16					32			32	32				28
17							32	32	32				30
18			32					32	64				36
19							32	32	64				40
20								32	64		32		44
21					32			32	96				48
22							32	32	96				50
23								32	128				52
24								32	96		32		54
25							32	32	128				60
26							32	32	128				60
27			32					32	128				56
28								32	128				52
29							32	32	96				50
30					32			32	96				48
31			32					32	96				46
32								32	96				42
33							32	32	64				40
34					32			32	64				38
35			32					32	64				36
36								32	32		32		34
37								32	64				32
38							32	32	32				30
39					32			32	32				28
40			32					32	32				26
41								32			32		24
42								32	32				22
43					32			32					18
44			32					32					16
45										32			14
46								32					12
47								32					12
48						32							10
49				32									8
50				32									8
51		32											6
52	32												4
TOTAL	64	64	224	96	256	96	288	1216	2048	96	160	32	1436

All straight bars. Lap vertical bars 18"





Typical Section of Gate House Wall

Alternate headers and stretchers at 9" channel iron door frame so alternate stones project towards web between flanges. Fill all spaces between door frame and wall with cement mortar.

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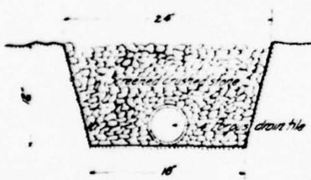
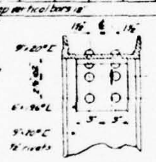
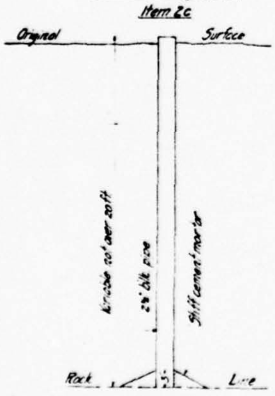


Section of Drainage Ditch
Item 2c

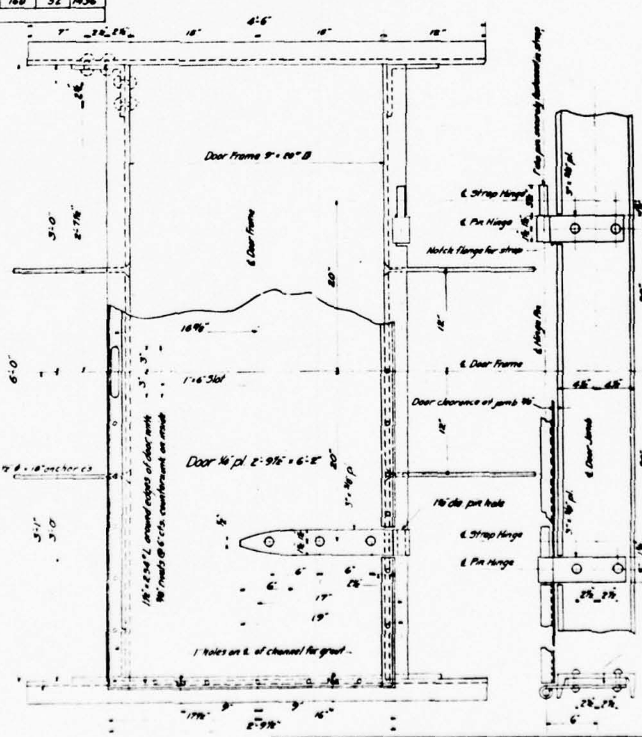


Make All Four Corners Alike



Elevation of Grout Pipe Connection - Item 5b

After cleaning rock surface at bottom of core wall trench set grout pipe where directed by Engineer, brace it rigidly in vertical position and then place the cement mortar around the foot of the pipe. After mortar sets proceed with placing concrete in trench using extreme care not to displace grout pipe. When core wall trench is filled with concrete to surface of ground proceed with diamond drill borings inside grout pipe to depths determined by the Engineer.



Plan of Gate House Door
Scale 1½" = 1 Ft
Item 6b

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POTTSVILLE WATER COMPANY
POTTSVILLE, PENNA.

TAR RUN RESERVOIR

GENERAL PLAN AND DETAILS

SCALE AS NOTED DATE FEB.15, 1932. APPROVED [signature] GEN. MGR. & ENGR.
DRAWN _____ REVISED FEB. 22/1932
CHECKED _____ REVISED _____

FILE NO. 1020

PHASE I INSPECTI
NATIONAL DAM INSPEC

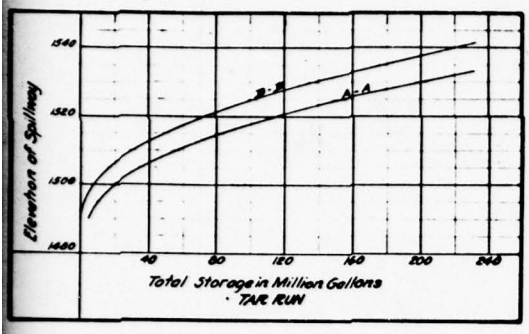
TAR RUN

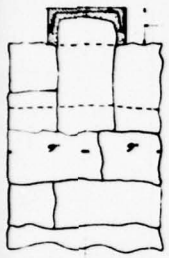
SCHUYLKILL COUNTY MUN

GENERAL
AND DETA

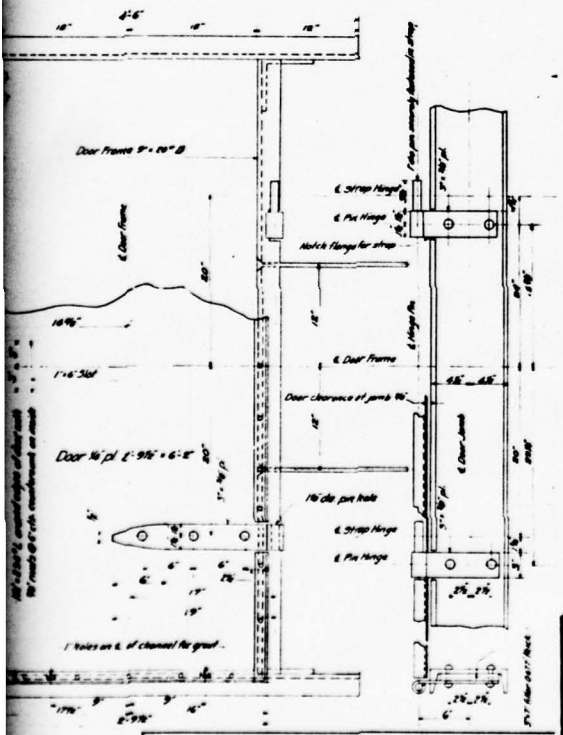
AUGUST 1978

2





Typical Section of Gate House Wall



POTTSVILLE WATER COMPANY
POTTSVILLE, PENNA.

TAR RUN RESERVOIR

GENERAL PLAN AND DETAILS

SCALE AS NOTED DATE FEB. 15, 1922 APPROVED _____ GEN. SUPT. & ENGR. _____
DRAWN _____ REVISED FEB. 22, 1922
CHECKED _____ REVISED _____

FILE NO. 1020

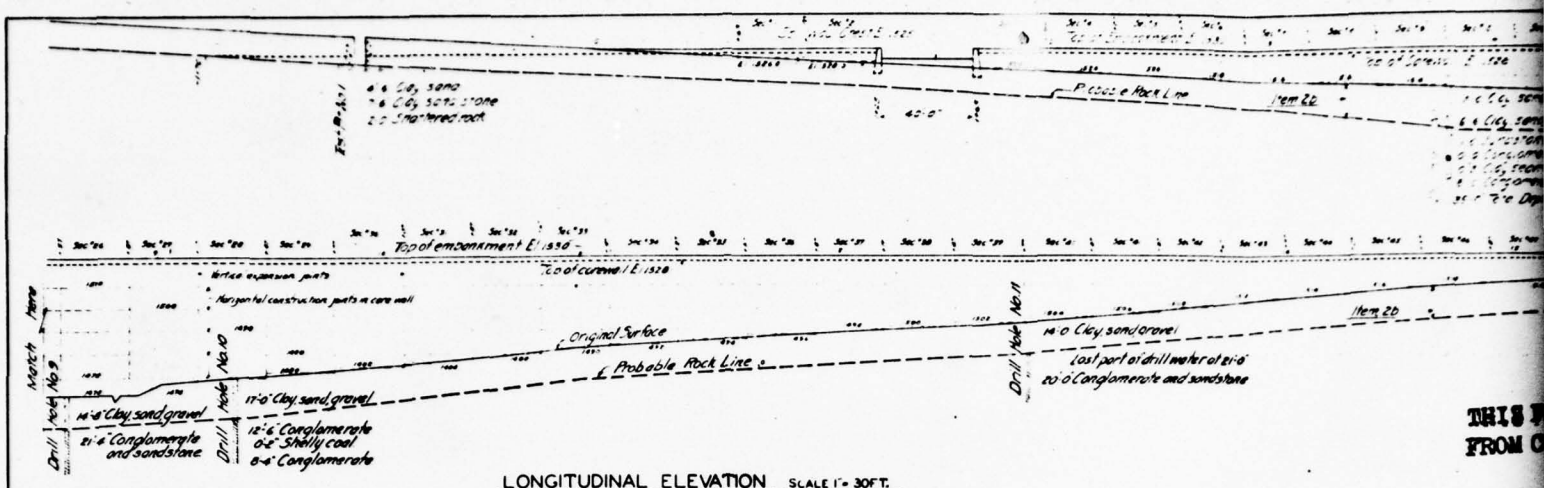
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

TAR RUN DAM

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

GENERAL PLAN
AND DETAILS

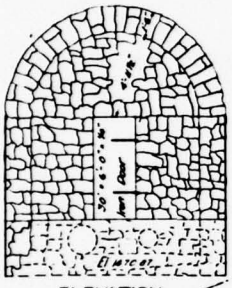
AUGUST 1978 PLATE 2



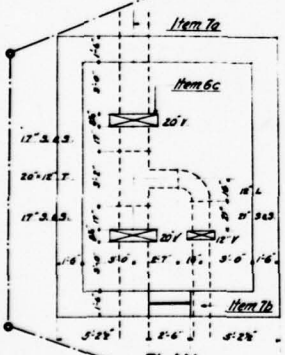
LONGITUDINAL ELEVATION SCALE 1"= 30FT.

WIDTH OF CORE WALL TRENCH

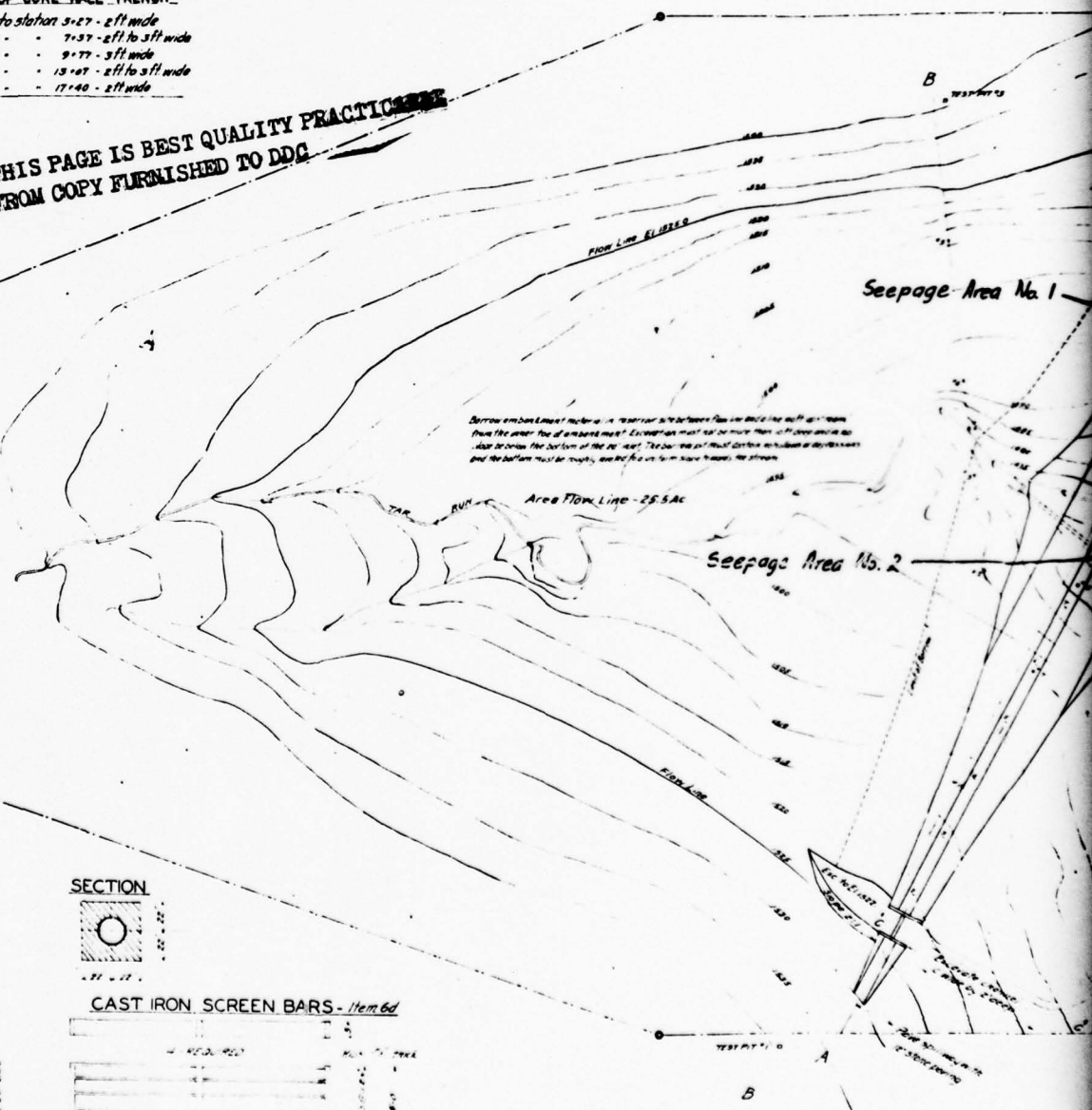
Station -1+70 to station 3+27 - 2ft wide
" 3+27 " " 7+37 - 2ft to 3ft wide
" 7+37 " " 9+77 - 3ft wide
" 9+77 " " 13+07 - 2ft to 3ft wide
" 13+07 " " 17+40 - 2ft wide



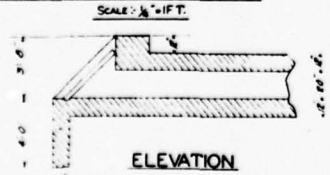
ELEVATION
Item 6b



PLAN
GATE HOUSE SCALE 1/4"=1FT.

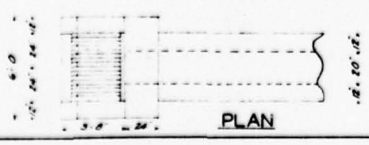


INLET TO 20" OUTLET PIPE
SCALE 1/2"=1FT.



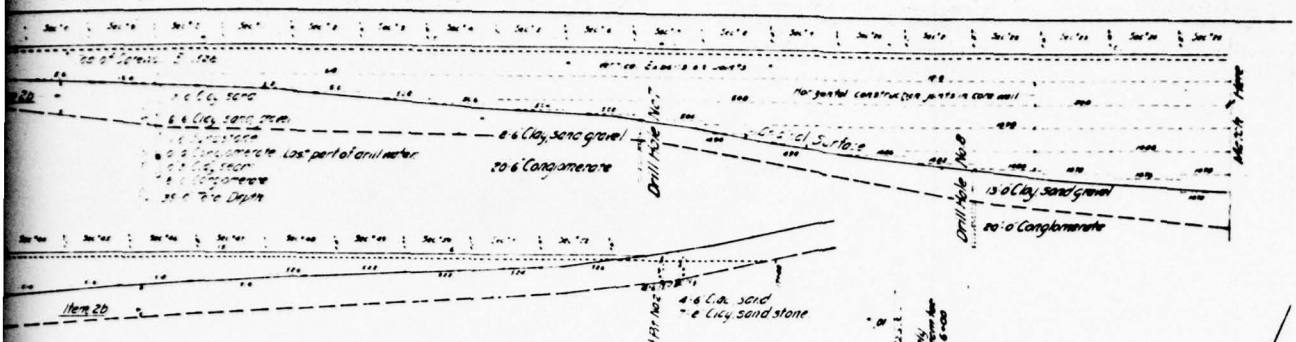
ELEVATION

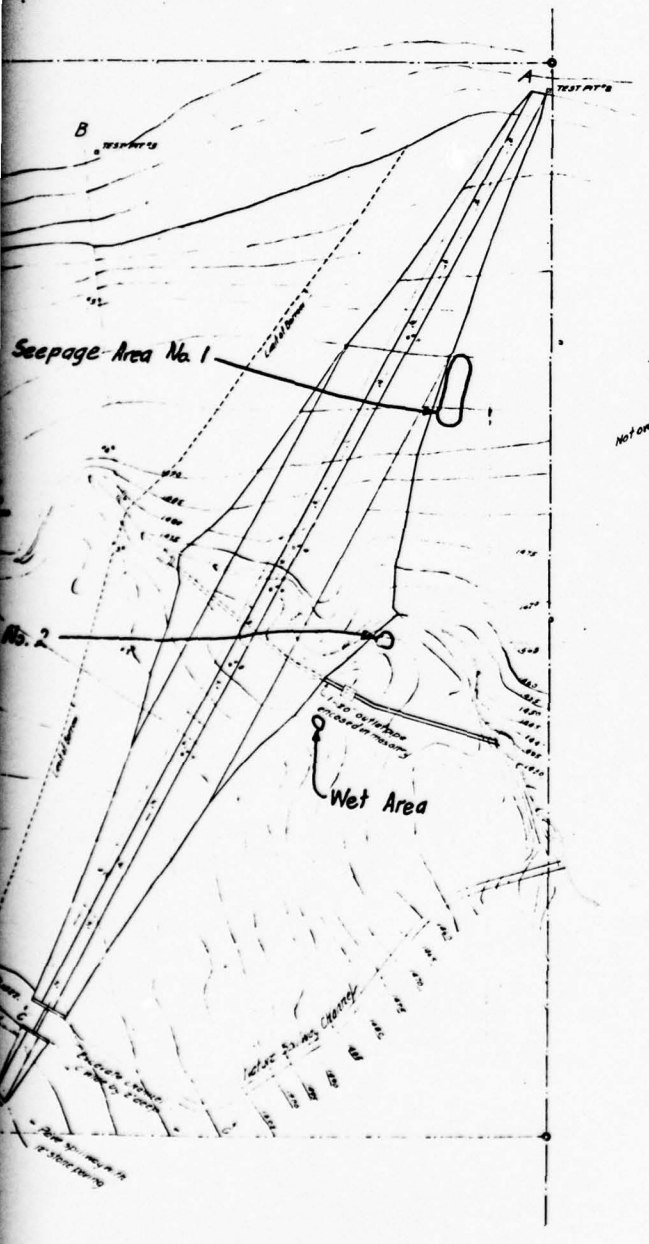
SECTION

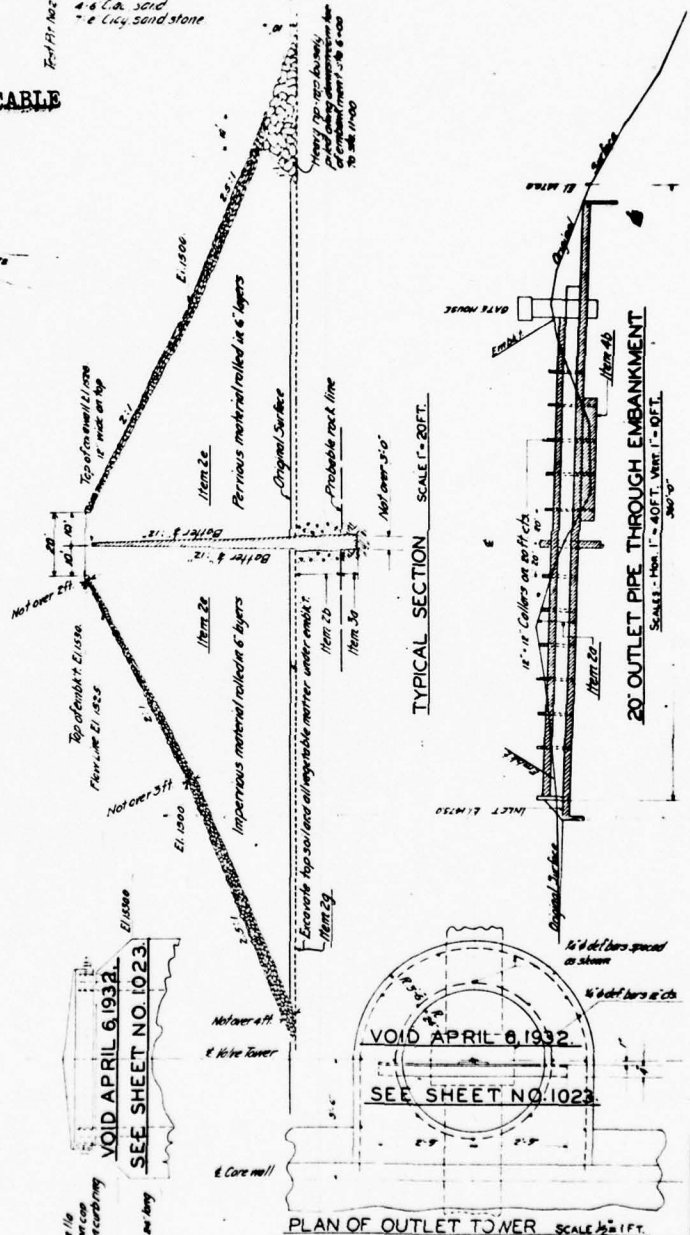


PLAN

CAST IRON SCREEN BARS - Item 6d







POTTSVILLE WATER COMPANY
POTTSVILLE, PENNA.

TAR RUN RESERVOIR

EMBANKMENT SECTION AND DETAILS

SCALE AS NOTED DATE FEB. 5 1932 APPROVED R. H. Sweet GEN. SUPT. & ENGR.
DRAWN _____ REVISED Feb. 22, 1932.
CHECKED _____ REVISED _____
FILE NO. 1021

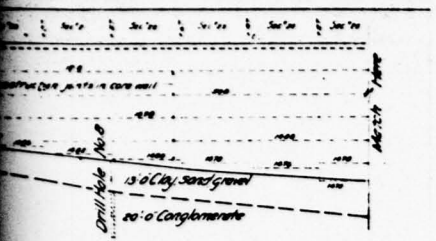
PHASE I INSPECTION
NATIONAL DAM INSPECTIO

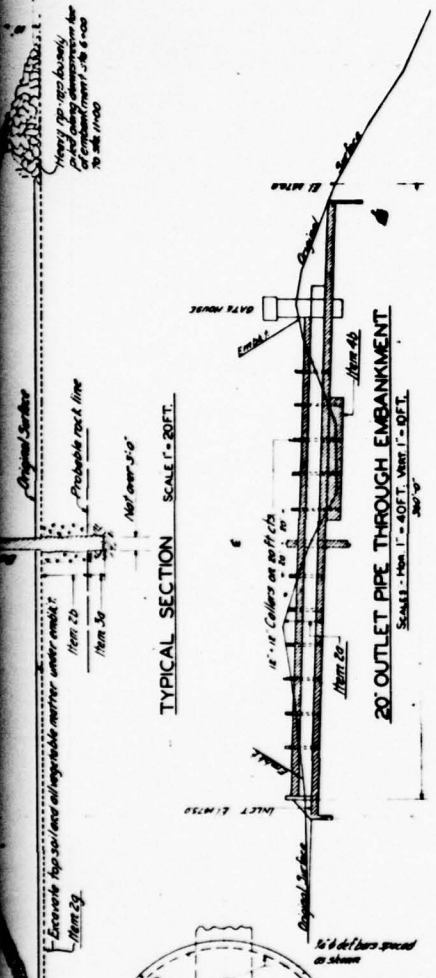
TAR RUN DA

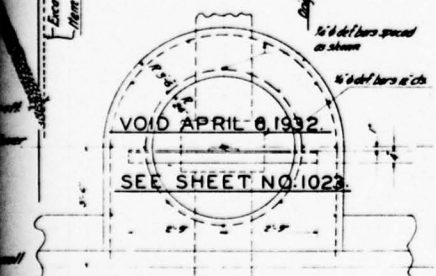
SCHUYLKILL COUNTY MUNICI

PLAN, PROFI
SECTIONS AND D

AUGUST 1978







PLAN OF OUTLET TOWER SCALE ½" = 1 FT.

POTTSVILLE WATER COMPANY
POTTSVILLE, PENNA.

TAR RUN RESERVOIR

EMBANKMENT SECTION AND DETAILS

SCALE AS NOTED DATE FEB. 5, 1932 APPROVED
DRAWN ____ REVISED FEB. 22, 1932.
CHECKED ____ REVISED ____
FILE NO. 1021

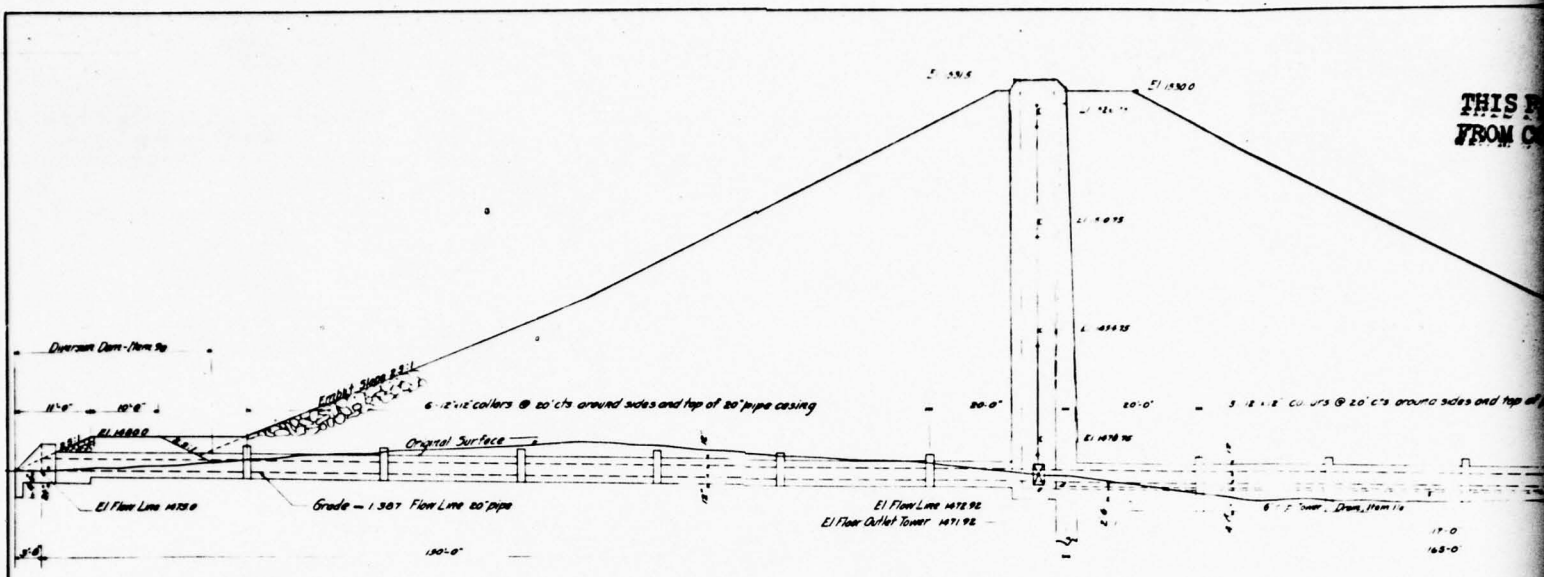
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

TAR RUN DAM

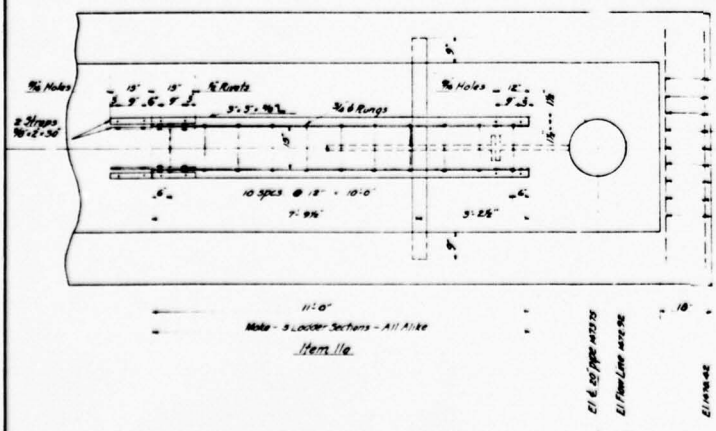
SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

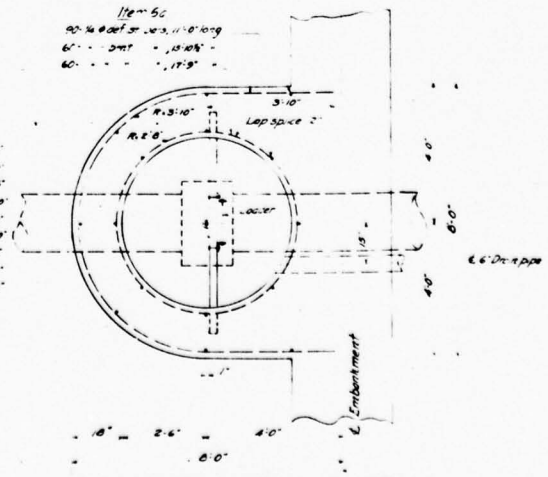
PLAN, PROFILES,
SECTIONS AND DETAILS

AUGUST 1978 PLATE 3

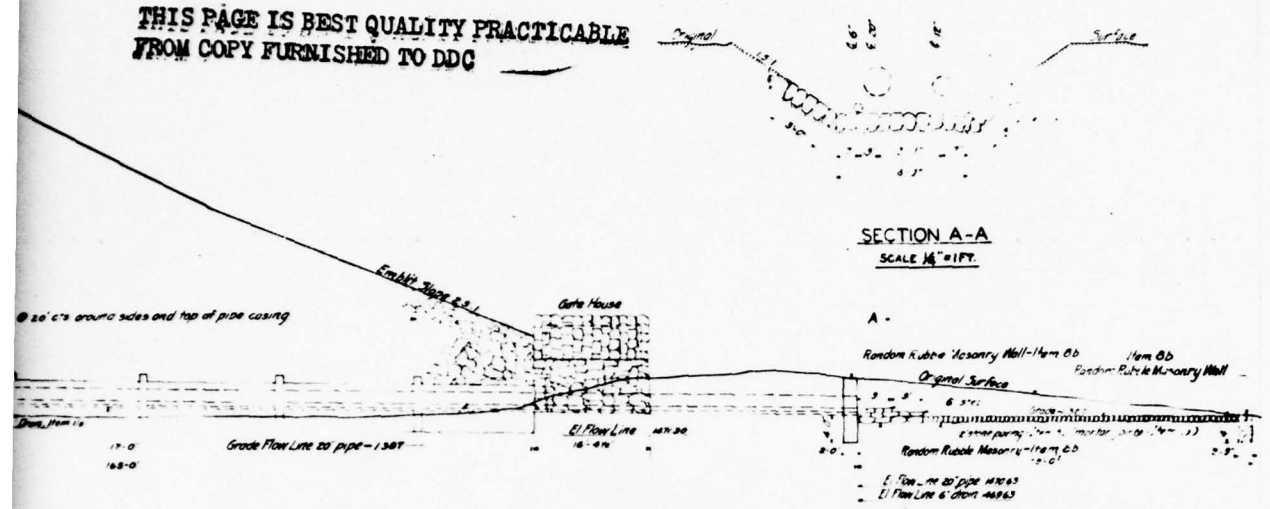


PROFILE 20" OUTLET PIPE
SCALE 1" = 10 FT.

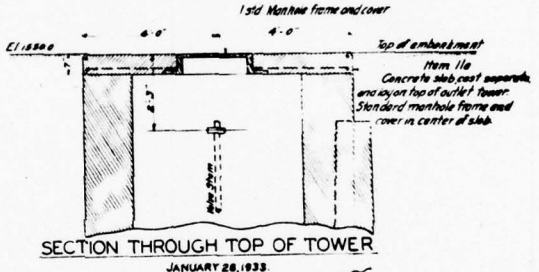




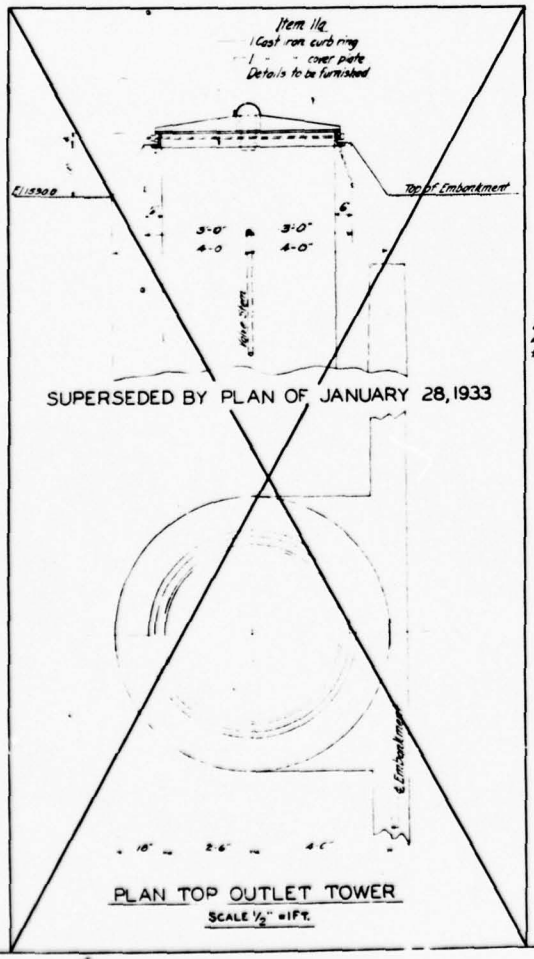
PLAN BOTTOM OUTLET TOWER
SCALE 1/8" = 1 FT.

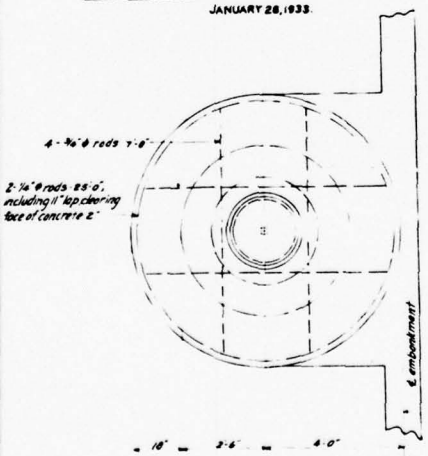


SECTION A-A
SCALE 1/4" = 1 FT.



SECTION THROUGH TOP OF TOWER
JANUARY 28, 1933.





PLAN TOP OUTLET TOWER
SCALE 1/2" = 1 FT.
JANUARY 28, 1933.

POTTSVILLE WATER COMPANY
POTTSVILLE, PENNA.

TAR RUN RESERVOIR

OUTLET PIPE AND OUTLET TOWER

SCALE ... APPROVED ... GEN. MGR. & ENGR. ...
DRAWN ... RE-SED. ...
CHECKED ... RE-SED. ...
FILE NO 1023

PHASE I INSPECTION
NATIONAL DAM INSPECTIO

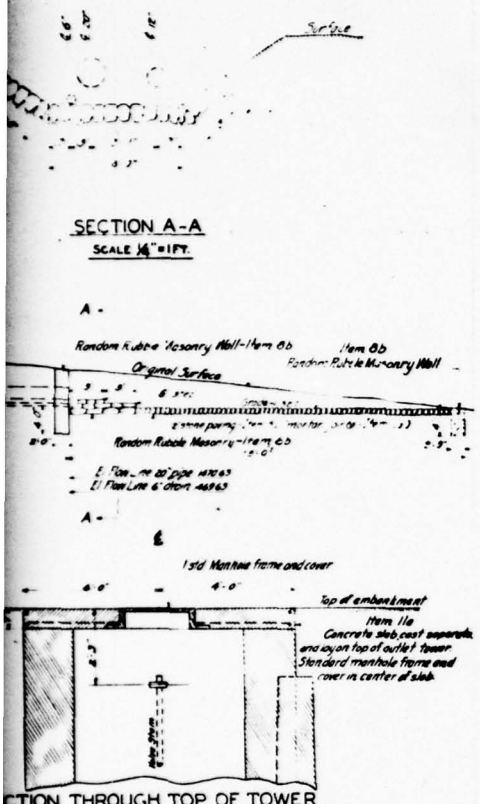
TAR RUN DA

SCHUYLKILL COUNTY MUNICIP

OUTLET WOR

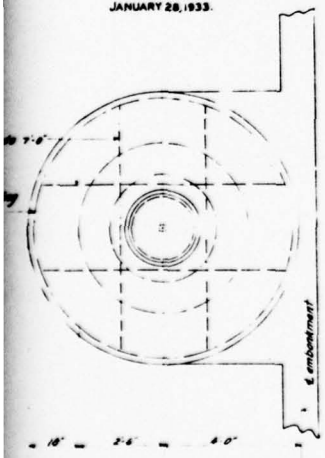
AUGUST 1978

2



SECTION A-A
SCALE ¼"=1FT.

CTION THROUGH TOP OF TOWER
JANUARY 28, 1933.



PLAN TOP OUTLET TOWER
SCALE ½"=1FT.
JANUARY 28, 1933.

POTTSVILLE WATER COMPANY
POTTSVILLE, PENNA.

TAR RUN RESERVOIR

OUTLET PIPE AND OUTLET TOWER

DATE APRIL 6 1932 APPROVED CHIEF ENGR.
DRAWN REVISED
CHECKED REVISED
FILE NO 1023

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

TAR RUN DAM

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

OUTLET WORKS

AUGUST 1978 PLATE 4

3

DELAWARE RIVER BASIN

TAR RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

TAR RUN DAM

NDS ID No. PA-00692
DER ID No. 54-124

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Tar Run

NDS ID NO.: PA-00692 DER ID NO.: 54-124

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	None available. Some notations on construction plans indicating changes. Grouting records available.
REGIONAL VICINITY MAP	Project is shown on Shenandoah, Pennsylvania, Quandrangle N4045-W7607.5/7.5, 1955. Photo revised 1969.
CONSTRUCTION HISTORY	Built 1932 - 1933. Construction progress reports are available.
TYPICAL SECTIONS OF DAM	Available.
OUTLETS: Plan Details Constraints Discharge Ratings	Plans only are available.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None available.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	Core borings along axis are shown on drawings. Memoranda.
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	None available.
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	None available.
POSTCONSTRUCTION SURVEYS OF DAM	None available.

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	Within reservoir between upstream toe and a line 100 feet upstream of upstream toe.
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	None.
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	None.

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	Weekly pool records are available.
SPILLWAY: Plan Sections Details	Plans and sections are available.
OPERATING EQUIPMENT: Plans Details	Plans are available.
PREVIOUS INSPECTIONS Dates Deficiencies (Continued on Page A-5)	1933: Small flow from pipe 100 feet below toe. 1934: Small flow from toe 50 feet right of valve house. Seepage in old channel toe. Wet area on bench 1/2-way up left embankment, which drains into stream along toe. 1935: Settlement around gate chamber, flow of water from the right. Hill at the right of valve house. Also flow 200 feet to the left of left end to the road. Erosion in spillway channel. 1938: Small stream flow from the intersection of right hillside and embankment about 50 feet right of valve house. 1941: Some of the riprap near the spillway has been removed. Concrete cover on top of valve chamber is broken and disintegrated. 1945: Top of embankment is 8 inches lower than the top of abutments for a distance 50 feet to the right of the spillway. Riprap on the upstream face

ITEM	REMARKS
PREVIOUS INSPECTIONS (Continued from page A-4)	adjacent to the spillway has been repaired. Seepage 50 feet to the right of the valve house. Swampy condition at the lower toe at center. 1962: No deficiencies. 1971: Seepage left of valve house. 1972: (Post Tropical Storm Agnes inspection by the Bureau of Reclamation, Corps of Engineers, and PennDER) crest needs to be graded and shaped.

CHECKLIST

ENGINEERING DATA

HYDROLOGY AND HYDRAULICS

NAME OF DAM: Tar Run NDS ID NO.: PA-00692 DER ID NO.: 54-124

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1529.6

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1529.6

ELEVATION MAXIMUM DESIGN POOL: 1529.6 - Existing (1530.0 - Design)

ELEVATION TOP DAM: 1529.6

SPILLWAY CREST:
- a. Elevation 1525.0
- b. Type Ogee.
- c. Width Not Applicagle.
- d. Length 40.0 Feet.
- e. Location Spillover Right Abutment.
- f. Number and Type of Gates None.

OUTLET WORKS:
- a. Type 20-inch diameter CIP, 12-inch diameter CIP taps off 20-inch line.
- b. Location Approximate Center of Embankment.
- c. Entrance Inverts 1475.0 - 20-inch diameter.
- d. Exit Inverts 1469.6 - 20-inch diameter, 1469.5 - 12-inch diameter
- e. Emergency Draindown Facilities None Except Above.

HYDROMETEOROLOGICAL GAGES:
- a. Type None.
- b. Location None.
- c. Records None.

MAXIMUM NONDAMAGING DISCHARGE: 1,530 CFS

DELAWARE RIVER BASIN

TAR RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

TAR RUN DAM

NDS ID No. PA-00692
DER ID No. 54-124

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Tar Run County: Schuylkill State: Pennsylvania

NDS ID No.: PA-00692 DER ID No.: 54-124

Type of Dam: Zoned earthfill with concrete core wall. Hazard Category: High

Date(s) Inspection: 19 July 1978 Weather: Clear Temperature: 70°F

General Soil Condition: Moist - except top of dam, which was dry.

Pool Elevation at Time of Inspection: 1519.8 msl/Tailwater at Time of Inspection: 1469± msl

Inspection Personnel:

J. Crouse (GFCC)

D. Ebersole (GFCC)

E. Hecker (NAB)

A. Whitman (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	Small erosion gully 30 feet left of spillway on downstream slope. Top of embankment is washing into the riprap both upstream and downstream.	Top of embankment appears to be a gravelly sand with virtually no cohesion.
CREST ALIGNMENT: Vertical Horizontal	Horizontal - straight. Vertical - surveyed - low areas adjacent to spillway walls. (0.4 feet below design elevation)	Embankment is overbuilt along most of its length.
RIPRAP FAILURES	Riprap on downstream slope has bulges. It is very loose.	Bulges are probably sliding along earthen surface beneath. No earth movement noted. Riprap on upstream slope has top elevation of 1527.1 to 1528.5.

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	None.	
ANY NOTICEABLE SEEPAGE	See page B-9.	
STAFF GAGE AND RECORDER	None.	
DRAINS	6-inch diameter CIP extending from control structure upstream of core wall to outlet works headwall.	No deficiencies.
VEGETATION	Upstream slope - negligible Downstream slope - sporadic brush about 2 feet high except for 20 feet upstream of toe, where brush is much thicker.	Trees at toe along most of embankment.

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES AT HEADWALL	Minor surface cracking on headwall.	
INTAKE STRUCTURE	Submerged.	
OUTLET STRUCTURE	Control structure upstream of core wall. Concrete at top almost totally disintegrated. Top is covered with asphalt, which covers edges of manhole cover.	Manhole cover could not be removed.
OUTLET CHANNEL	Steep over bedrock in poorly defined channel.	100 feet downstream of toe, 20 feet right of stream - wet area with 40 gpm clear seepage. Seepage probably from stream, which is higher.
EMERGENCY GATE	Opened 20-inch gate valve about 5 percent in 10 minutes with no apparent problems.	12-inch valve was in use during inspection - to augment stream flow. Operating bar was very rusty.

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR AND APPROACH CHANNEL	Formed as single monolith. Shrinkage cracks 1.1, 21.3, 25.5, and 33.6 feet from right end. Spalling 1 to 2 inches deep on upstream side and along crest. Spalling on earth with scattered stones. Mortar is almost completely missing in the approach walls below crest elevation and where the weir joins the walls.	The spalling on the downstream side was 3 to 4 inches deep including one area 12 feet long. Owner stated that spillway had been repaired after Tropical Storm Agnes.
DISCHARGE CHANNEL	Mortared stone apron. Grass in joints. One 3-foot square area of stone is missing.	Beyond toe of embankment spillway channel wall is only 1.4 feet high. Water flowing over wall would flow by toe of embankment.
BRIDGE AND PIERS	None.	
CHANNEL BELOW APRON	Downstream end of apron is eroded and undermined. Below apron channel is narrow and rocky with trees on banks. Some dead trees across (Continued at right)	channel. Channel does not appear capable of passing large discharges without overtopping. At 90° bend to left, severe erosion in sandy soil.

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	

RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Mild - no observed evidence of movement in sandy soil.	
SEDIMENTATION	No apparent problems	Owner says survey performed over reservoir indicated no significant sedimentary fill.
WATERSHED DESCRIPTION	Totally wooded and totally owned by Owner.	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	Channel below outlet works is ill-defined. Channel is steep over bedrock.	Access may be impossible during periods of high discharge.
SLOPES	Side slopes 1V on 1H to a 200-foot± wide floodplain in valley.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	None observable from dam.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE (Continued from page B-3)	50 feet right of valve house - wet area in undrained pocket with 1-inch boot penetration. Evidence of previous flow. (Clear area with flattened leaves.)	
(Continued)	400 feet from left end of dam - wet area 80' long by 45' wide from the toe. Downstream - area soft and covered with water Seepage about 2 gpm clear flows along toe, through a 15" ± square culvert under berm to old stream bed.	
(Continued)	Near old stream bed. On left a localized seep of 0.5 gpm clear and general seepage of 0.5 gpm joins with seepage from wet area nearer left abutment.	

DELAWARE RIVER BASIN

TAR RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

TAR RUN DAM

NDS ID No. PA-00692
DER ID No. 54-124

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

APPENDIX C

HYDROLOGY AND HYDRAULICS

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT TAR RUN DAM (54-124) FILE NO. 7613.20
HYDROLOGY AND HYDRAULICS ANALYSIS SHEET NO. 1 OF 2 SHEETS
FOR USCE - BALTIMORE DISTRICT
COMPUTED BY JMC DATE 7/26/78 CHECKED BY [illegible] DATE 8/9/78

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 = 60 FEET AND CAPACITY = 480 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, MIKE KANOWITZ, RECOMMENDS 1,700 CSM FOR THE PMF PEAK FLOW FOR THE TAR RUN DAM WATERSHED

PMF PEAK = 1,700 CFS/SQ.MI. × 0.86 SQ. MI. = 1,462 – SAY 1,460 CFS

EFFECT OF UPSTREAM RESERVOIRS

NO UPSTREAM RESERVOIRS EXIST

B. ABILITY OF SPILLWAY TO PASS PMF

1. CAPACITY OF SPILLWAY – DESIGN TOP OF DAM ELEV. = 1530.0'
ACTUAL MIN. TOP OF DAM ELEV. = 1529.6'
SPILLWAY CREST ELEV. = 1525.0'
DESIGN HEAD ON SPILLWAY = 5.0'.
AVAILABLE HEAD ON SPILLWAY = 4.6'.

FROM "REPORT UPON THE APPLICATION OF THE POTTSVILLE WATER COMPANY," BY THE WATER SUPPLY COMMISSION OF PENNSYLVANIA, MARCH 3, 1932, THE SPILLWAY CAPACITY AT THE DESIGN HEAD OF 5.0 FEET IS 1,730 CFS. CALCULATING "C" FROM THE GENERAL WEIR EQUATION, ← design

$Q = CLH^{3/2}$
$C = Q/LH^{3/2}$
$C = 1,730/(40)(5.0)^{3/2}$
$C = 3.87$ (← OGEE-SHAPED CREST)

AT A HEAD OF 4.6 FEET, THE ACTUAL EXISTING SPILLWAY CAPACITY IS: $Q = (3.87) \times 40 \times (4.6)^{3/2}$
$= 1,611$ C-1

SP 11860A

Q = 1,527 - SAY 1,530 CFS ←

[illegible]

2. THE PMF PEAK FLOW IS LESS THAN OR EQUAL TO THE SPILLWAY CAPACITY
   a. NO SPILLWAY ROUTING FOR THE PMF IS NECESSARY
   b. THE DAM CAN BE ASSUMED TO BE ABLE TO PASS THE PMF WITHOUT OVERTOPPING

∴ THE SPILLWAY CAPACITY IS ADEQUATE

PERCENT OF PMF THAT SPILLWAY CAN PASS
(WITHIN EFFECT OF SURCHARGE STORAGE)

$$\%\text{ OF PMF} = \frac{Q_{SPILLWAY}}{Q_{PMF}} \times 100\%$$

$$= \frac{1,530}{1,460} \times 100\%$$

$$\%\text{ OF PMF} = 105\%$$

DELAWARE RIVER BASIN

TAR RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

TAR RUN DAM

NDS ID No. PA-00692
DER ID No. 54-124

SCHUYLKILL COUNTY MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

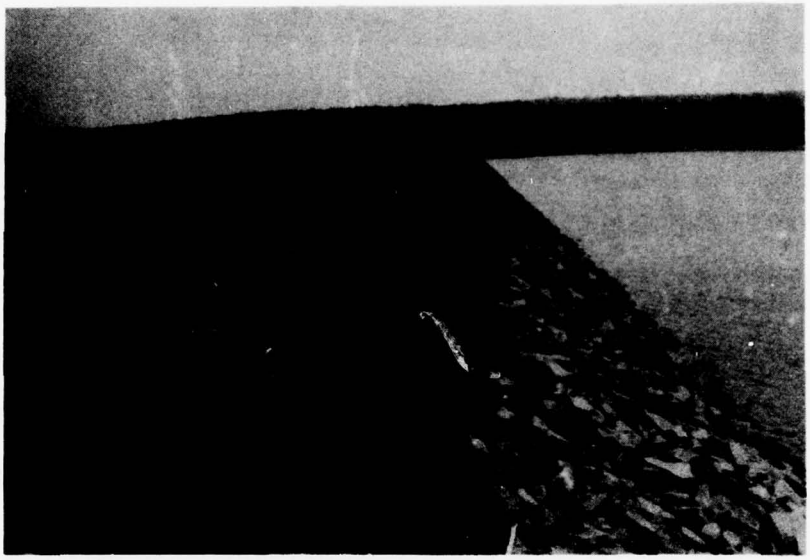
NATIONAL DAM INSPECTION PROGRAM

AUGUST 1978

APPENDIX D

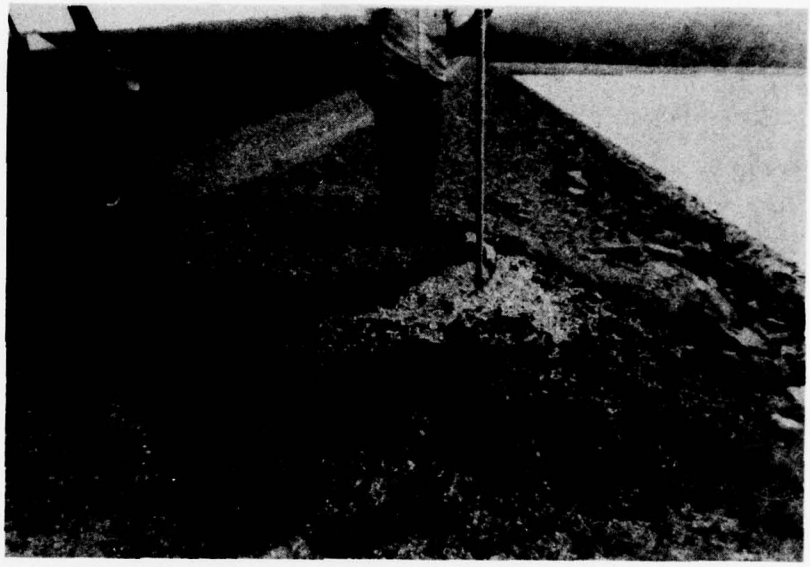
PHOTOGRAPHS

TAR RUN DAM

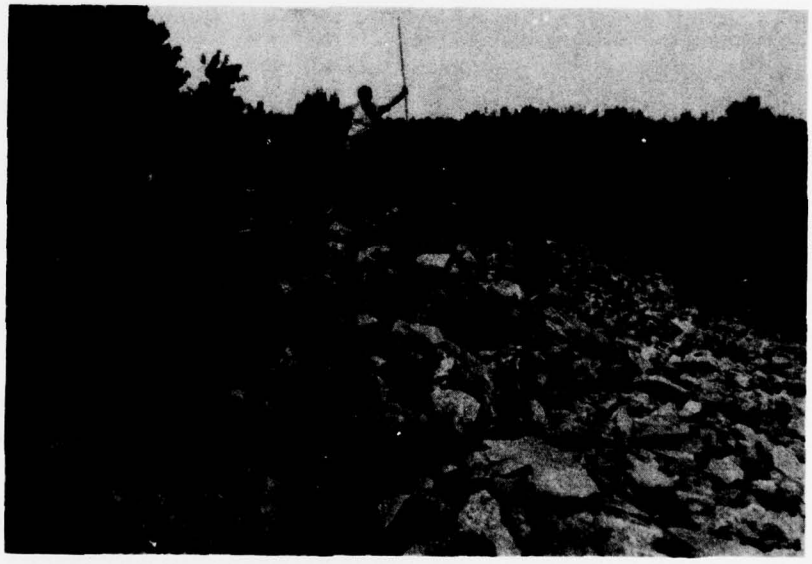


A. Riprap on Upstream Slope of Embankment.

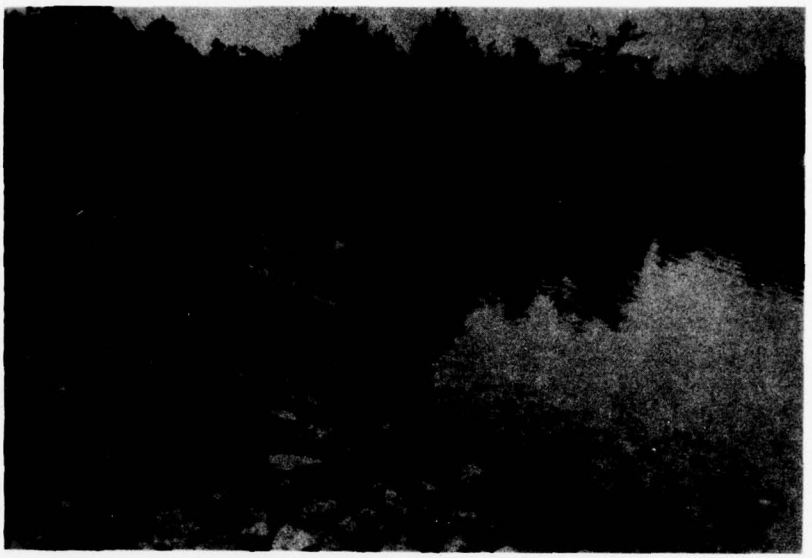
B. Left Abutment.



C. Top of Control Structure
Upstream of Core Wall.



D. Riprap on Downstream Slope of Embankment.



E. Spillway Approach Channel —
Looking Towards Right Abutment.

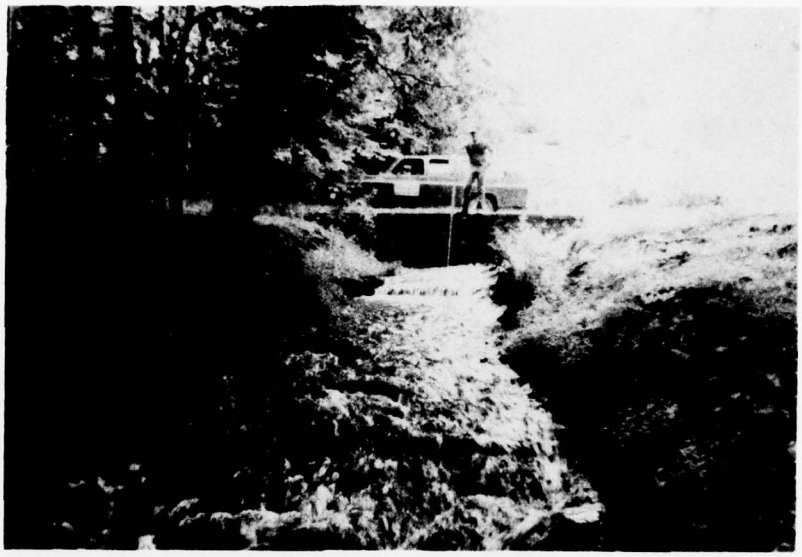
F. Concrete Spillway Weir and Masonry Apron.

G. Spillway Outlet Channel Training Wall and Masonry Apron.

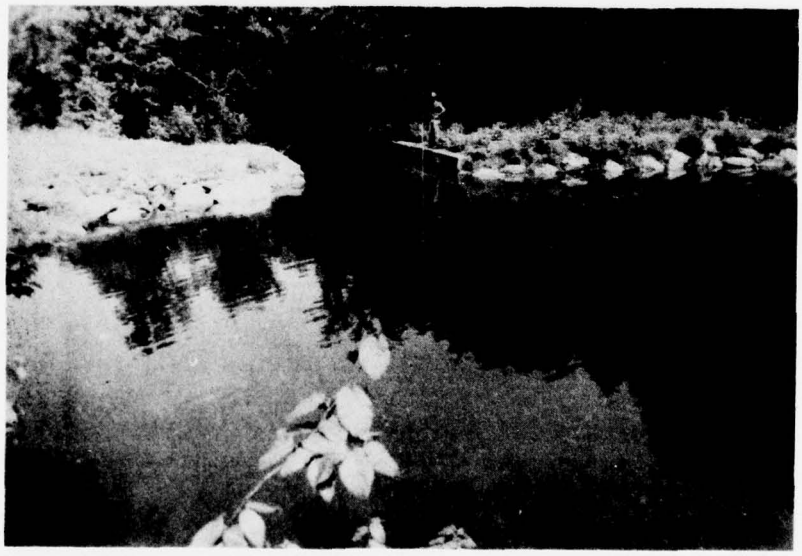
H. Spillway Outlet Channel — Looking Downstream.

I. Spillway Outlet Channel —
Looking Downstream at 90° Bend to Left.

J. Valve House and Outlet Works Headwall
from Top of Embankment.



K. Outlet Works Headwall and Channel.



L. Small Dam Between Tar Run Dam and Tar Run Intake Dam.

TAR RUN DAM

N. Tar Run Intake Dam, Downstream of Tar Run Dam.

DELAWARE RIVER BASIN

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APPENDIX E

GEOLOGY

TAR RUN DAM

APPENDIX E

GEOLOGY

1. General Geology. The dam and reservoir are located in Schuylkill County. The County lies entirely south of the Wisconsin and Illinoian drift borders. The Jerseyan drift border is believed to traverse the middle of the county, but very few definite deposits of drift have been located. The rock formations exposed in Schuylkill County range from the post-Pottsville formations, of Pennsylvania age, down to the Tuscarora Sandstone, of Silurian age. The youngest formations, the post-Pottsville, crop out in the large Southern anthracite field and part of the Western Middle field. The oldest formation, the Tuscarora, crops out along Kittatinny (Blue) Mountain which forms the southern boundary of the County.

The geologic structure of Schuylkill County is complex. The strata have been sharply folded along northeast axes, and the truncated hard and soft beds now form an intricate system of long narrow ridges and valleys. The carboniferous rocks suffer the most intense folding and are overturned in many places. The most important structure feature economically is the large synclinorium of the Southern anthracite field which occupies the center of the County. This basin consists of a number of smaller connected basins, which become successively deeper and have steeper sides as they progress towards the South. In the southern part of the County, the Silurian and Devonian rocks have been folded for some distance on both sides of the Schuylkill River. An anticline passes eastward from Cressona, exposing the Cayuga group and part of the Clinton formation. A syncline extending West from Landingville exposes the Catskill group. The Lehighton anticline of Carbon County extends into Schuylkill County as far as Reynolds. The ridge north of Port Clinton is an anticlinal ridge exposing the Clinton formation, and a syncline crosses the Schuylkill River just north of Port Clinton exposing the Cayuga Group.

The geology produces a complex runoff pattern in Schuylkill County whereby there is drainage in five different directions. The northwestern part is drained by Mahantango Creek, and smaller streams, all of which drain into the Susquehanna River north of Harrisburg. The southwestern part is drained by Swatara Creek, which drains into the Susquehanna River south of Harrisburg. The northernmost part is drained by Catawissa Creek, which drains into the North Branch of the Susquehanna River upstream of Danville. The eastern portion of the County is drained by tributaries of the Lehigh River, which in turn drains into the Delaware River near Easton. The central and greater part of the County is drained by tributaries of the Schuylkill River, which, in turn, drains into the Delaware River near Philadelphia.

2. Site Geology. The damsite is underlain by gray conglomerate and gray sandstone strata of the Pottsville formation in the highly faulted and folded Southern anthracite field in the center of the county. The area is drained by the Schuylkill River. The axis of a syncline called Reservoir Syncline, follows the approximate original streambed through the damsite and reservoir. The axis of the Eisenhuth Anticline is located about one-half mile to the left of the Reservoir Syncline; while the axis of the Powder Hill Anticline is located about one-half mile to the right of the Reservoir Syncline. A major fault, called Reservoir Fault, is located about midway between the axes of the Reservoir Syncline and the Eisenhuth Anticline and was encountered during construction immediately beyond the left end of the embankment.

The upper portion of the bedrock was highly fractured and shattered. It was necessary to excavate from 5 to 15 feet into the bedrock in order to find a firm rock foundation for the cutoff trench. The cutoff trench was filled with concrete and served as a foundation for the concrete core wall that extended to within 2 feet of the top of dam. The concrete filling in the cutoff trench also served as a grout cap from which to pressure grout the underlying rock foundation. Grout holes, on from 3.5 to 12 foot spacing, were drilled and grouted, with pressure, of from 10 to 30 p.s.i., to a depth of 20 feet below the bottom of the cutoff

trench. The fault, which was found in the hillside beyond the left end of the cutoff trench and core wall construction, was found to be gouge-filled and relatively water tight, so it was not disturbed.