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NATIONAL DAM INSPECTION PROGRAM. UPPER TUMBLING RUN DAM (ID NUM--ETC(U)
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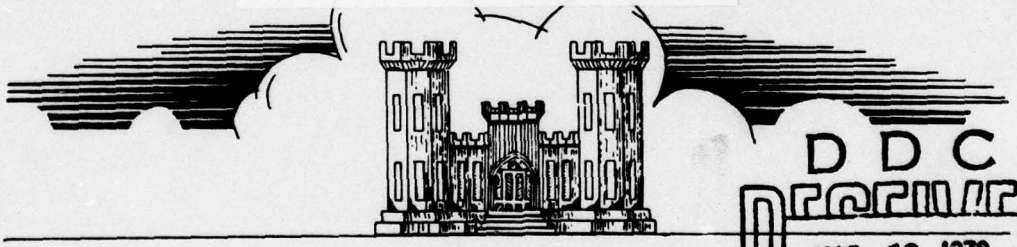
SCHUYLKILL RIVER BASIN
TUMBLING RUN, SCHUYLKILL COUNTY
PENNSYLVANIA
ID NO. PA.00689

UPPER TUMBLING RUN DAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Contract No. DACW31-78-C-0048



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

AUGUST 1978

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE.

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LEVEL II

(1)

SCHUYLKILL RIVER BASIN

(6) UPPER TUMBLING RUN DAM
SCHUYLKILL COUNTY, PENNSYLVANIA
NATIONAL I.D. NO. PA 00689

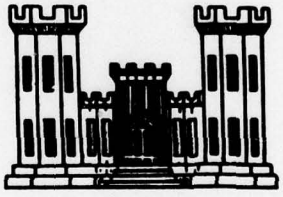
National Dam Inspection Program. Upper Tumbling Run Dam (ID Number PA-00689), Schuylkill River Basin, Tumbling Run Creek, Schuylkill County, Pennsylvania. Phase I Inspection Report.

(11) Aug 78

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

(15) DACW31-78-C-0048

(12) 77 p.



394 157

Prepared by:

WOODWARD-CLYDE CONSULTANTS
5120 Butler Pike
Plymouth Meeting, Pennsylvania 19462

Submitted to:

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

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE.

August 1978

394 157

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Upper Tumbling Run Dam
County Located: Schuylkill County
State Located: Pennsylvania
Stream: Tumbling Run Creek
Coordinates: Latitude 40° 45' Longitude 76° 10'
Date of Inspection: 4 August 1978

Upper Tumbling Run Dam is owned by the Schuylkill Haven Borough and is used as a water supply structure for the town of Schuylkill Haven and surrounding areas. Limited records indicate that the dam was constructed in 1835 and that post-construction investigations were performed in 1913, 1914, 1920 and 1967. The facility is judged to be in fair condition, although the embankment slopes are considered to be steep. Furthermore, the condition of the outlet works is unknown. Hydrologic and hydraulic calculations indicate that the overtopping of the dam will occur at 30 percent of the probable maximum flood (PMF). Therefore, the spillway is considered to be "Seriously Inadequate".

The dam is classified as an "Intermediate" size structure by virtue of its 55-foot height. It is also classified as a "High" hazard dam consistent with the potential at failure for extensive property damage, including the failure of Lower Tumbling Run Dam, and loss of life at the water treatment plant and further downstream at Mount Carbon, Pennsylvania.

A review of the records indicates that there is insufficient engineering and construction data to adequately evaluate the stability of the dam and condition of the outlet works. Specifically, there was no substantial data delineating the types of material and configuration of the embankment. Foundation details were also unknown.

The following recommended remedial work is considered critical and should be performed immediately.

1. The spillway system should be reconstructed to meet current hydrologic/hydraulic criteria.

2. Prepare "As-Built" drawings in conjunction with a geotechnical investigation and stability analyses performed under the direction of a registered professional engineer. Piezometers should be installed to delineate the phreatic surface through the embankment.

3. The outlet works should be inspected and assessed.

The following items are considered important and should be performed as soon as practical.

1. The underbrush along both abutments should be cleared to facilitate a thorough visual inspection of the seepage sources.

2. Seepage measuring devices should be installed to monitor seepage rates and changes in turbidity.

3. Formal operations and maintenance and warning procedures should be developed, implemented and incorporated into the water treatment facilities operation. The warning procedure should include a method of warning downstream residents that high flows are to be expected. Evacuation procedures should also be developed.

4. The Owner should also develop an inspection checklist as an amendment to the maintenance procedure to insure that all critical items are inspected and maintained on a periodic basis.

John H. Frederick, Jr. P.E.
Maryland Registration 7301
Woodward-Clyde Consultants

9/22/78
Date

William S. Gardner, P.E.
Pennsylvania Registraion 4302E
Woodward-Clyde Consultants

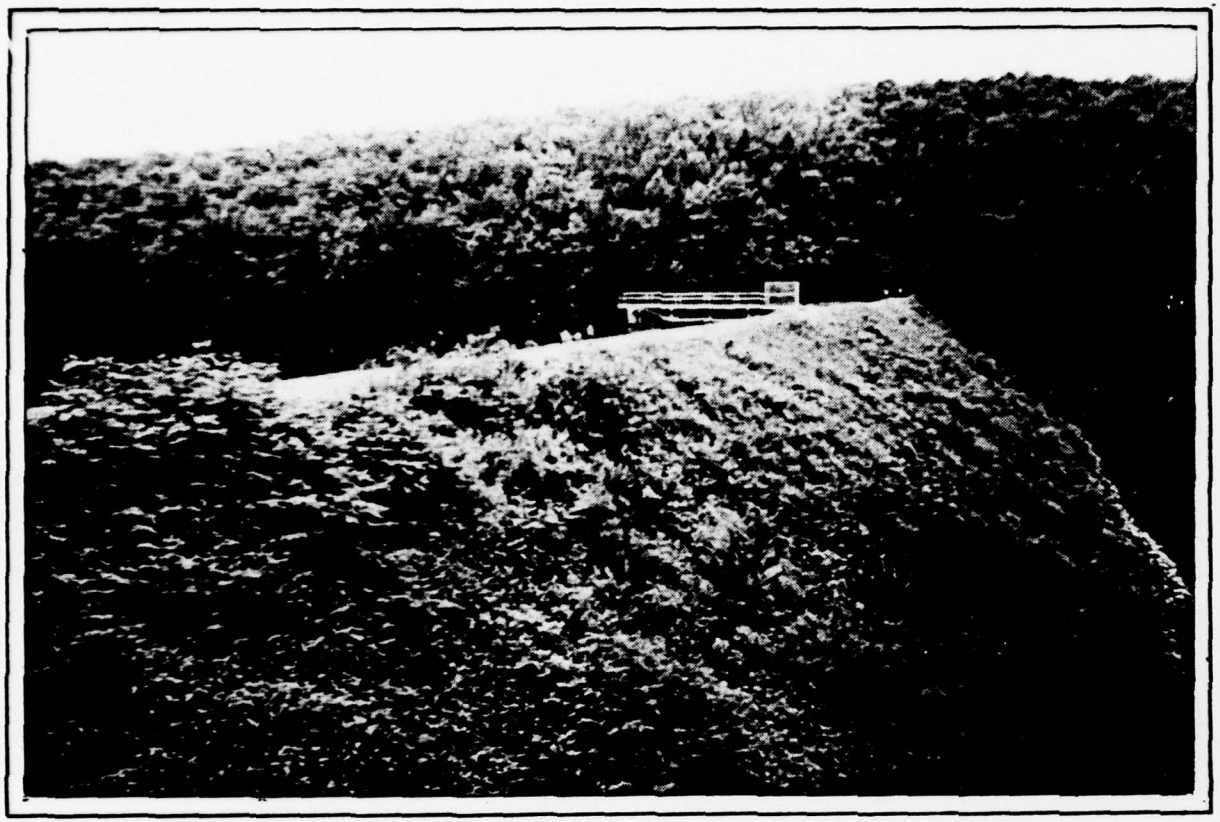
9/22/78
Date

APPROVED BY:

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

28 Sep 78
Date

Under the recently revised spillway evaluation guidelines, this dam is considered unsafe, non-emergency.



OVERVIEW
UPPER TUMBLING RUN DAM, SCHUYLKILL COUNTY, PENNSYLVANIA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
UPPER TUMBLING RUN DAM
NATIONAL ID # PA 00689
DER ID #54-42

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.

ABSTRACT

1.2 Description of Project.

a. Dam and Appurtenances. Upper Tumbling Run Dam is a 55-foot high earth dam across Tumbling Run Creek. The 570-foot long dam impounds a 35.6 acre reservoir. Very limited data exists regarding physical features of the dam. However, local borrow material was used in the construction. The downstream slope is steep (approximately 1.6H:1V) and completely covered with riprap. The upstream slope is also steep (1.3H:1V; crest to waterline) and riprapped from the crest to slightly below normal pool elevation.

Two 10-inch I.D. cast iron pipes extend through the dam. These pipes are located at the base of the dam. Valves have been installed at the pipe intake, with controls extending to the surface. An access bridge extends from the crest to the control valves. These valves are normally closed and have been used in the past to drain the reservoir, supplement the lower reservoir, and increase discharge when significant spillway flows occur. Excess water is discharged over the 52-foot wide spillway, excavated into rock at the left abutment.

The intake structure is a vertical masonry block wall constructed within the upstream slope, as shown in Photograph No. 15. The discharge structure is also stone masonry with the walls extending approximately 6 feet above the pipes. No changes or modifications to the outlet works have been reported. See Photograph No. 16.

b. Location. The dam is located across Tumbling Run Creek in North Manheim Township, Schuylkill County, Pennsylvania. The dam is located approximately 2,600 feet upstream of Lower Tumbling Run Dam. The dam site and

reservoir are shown on USGS Quadrangle entitled, "Pottsville, Pennsylvania", at coordinates N 40° 45' W 76° 10'. A Regional Location Plan is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as "Intermediate" by virtue of its 55-foot height.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the potential for extensive property damage and loss of life at the water treatment plant and further downstream at Mount Carbon, Pennsylvania.

e. Ownership. The dam is owned by the Schuylkill Haven Borough located at 39 Dock Street, Schuylkill Haven, Pennsylvania.

f. Purpose of Dam. The dam was initially constructed to supply water to the canals of the Schuylkill Navigation Company, but has been used since 1908 for water supply in conjunction with Lower Tumbling Run Dam.

g. Design and Construction History. The dam is reported to have been constructed in 1835 and 1836. The plans were prepared and construction was performed under the direction of Mr. Edwin H. Gill. Original records could not be found and it is judged that they no longer exist. Post-construction investigations were made in 1913, 1914, and 1920, by the Water Supply Commission of Pennsylvania. These investigations established some physical features of the dam. Another investigation was performed in 1967 by Gilbert Associates, Inc., Harrisburg, Pennsylvania. There are no records of failure or serious problems with this structure.

h. Normal Operating Procedures. Reservoir flows are normally discharged by the spillway weir. Valves of the two 10-inch I.D. cast iron pipes are closed in the upstream side of the dam and are not normally opened. The valves are opened if significant flows are occurring in the spillway or if the Lower Tumbling Run Reservoir level drops appreciably. The valves are also opened periodically, as directed by the Borough Manager or water treatment plant foreman.

1.3 Pertinent Data.

A summary of pertinent data for Upper Tumbling Run Dam is presented as follows:

1.	Drainage Area (sq. miles)	5.5
2.	Discharge at Dam Site (cfs max.)	
	Spillway	2,200
	Outlet Works	14

3.	Elevations (feet above MSL)[1]	
	Top of Dam	697.5
	Spillway	
	Crest	691.3
	Notch (Normal Pool)	689.9
4.	Reservoir (miles)	
	Length at Normal Pool	0.6
	Fetch at Normal Pool	0.3
5.	Storage (acre-feet)	
	Normal Pool	760
	Top of Dam	980
6.	Reservoir Surface (acres)	
	Normal Pool	35.6
7.	Dam Data	
	Type	Rolled earth with riprap covering the upper portion of the upstream slope and complete downstream slope.
	Length	570 feet
	Maximum Height	55 feet
	Top Width	12 feet
	Side Slopes (Approximate)	
	Upstream	
	Riprapped Slope	1.3H:1V, measured
	Below water level at time of inspection	Unknown
	Downstream	1.6H:1V, measured.
8.	Spillway	
	Type	Broad-crested concrete notched weir and rock.
	Length	52 feet
	Elevation[1]	
	Crest	691.3
	Notch	689.9

[1] Estimated from USGS Mapping and available drawings.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Availability. A summary of engineering data is presented on the checklist attached as Appendix A. Principal documents containing pertinent data used for this report are as follows.

1. "Report Upon the Investigation of the Philadelphia & Reading Coal & Iron Company Dams On Tumbling Run, Schuylkill County, Pennsylvania", by the Water Supply Commission of Pennsylvania, dated December 22, 1913, and supplementary reports of 1914.

2. "Report Upon the Tumbling Run Supply of the Silver Creek Water Company", by the Water Supply Commission of Pennsylvania, dated November 12, 1920.

3. "Investigation of Tumbling Run Dams, W.O. 6338-00", by Gilbert Associates, Inc., dated March 1, 1967.

4. Letter to Water and Power Resources Board, Department of Forests and Waters, from the Silver Creek Water Company, by Mr. H. W. Weber, April 9, 1935.

5. Miscellaneous letters, correspondence, memos, drawings and inspection reports located in the Department of Environmental Resources main office in Harrisburg, Pennsylvania.

The data consisted of post-construction reports investigating and reporting few pertinent engineering details. Documents regarding the design could not be found and are no longer believed to exist.

b. Design Features. The principal features have been obtained from post-construction reports and topographic plans included in the State files. A plan view of the physical features are presented in Appendix E, as Plate 2. Two photographs taken during a post-construction investigation are also included in Appendix D as Photographs 15 and 16, showing the intake tower and discharge outlet system.

There is conflicting information regarding the inclination of the upstream and downstream slopes. A summary of the reported slope inclinations is presented in the following Table 1.

TABLE I
SUMMARY OF REPORTED SLOPES

Upstream Slope	
Crest to bottom of riprap	
Water Supply Commission, 1913	0.5H:1V
Silver Creek Water Company, 1935	1H:1V
Gilbert Associates, Inc., 1967	1.3H:1V*
Below riprap	
Water Supply Commission, 1913	2.5H:1V**
Silver Creek Water Company, 1935	1-11/16H:1V
Downstream	
Water Supply Commission, 1913	1.5H:1V
Silver Creek Water Company, 1935	1-3/8H:1V
Gilbert Associates, Inc., 1967	1.6H:1V

* Measurement assumed applicable only to the riprapped portion above the water line.
** Berms 2.5 feet wide reported at 16 and 24 feet below dam crest.

Field measurements with an Abney Level made in connection with this report indicate a downstream slope of 1.6H:1V and an upstream slope above the water level of 1.3H:1V (slope of grouted riprap).

The crest was measured during the visual inspection and found to be 570 feet long and 12 feet wide. The spillway is 52 feet wide with a notched concrete broad crested weir. The weir notch is approximately 6 feet wide and 1.4 feet deep. See Photograph 4.

2.2 Construction.

Data concerning construction history is very limited and is presented in Section 1.2.

2.3 Operation Data.

Operational records and other related data have not been recorded.

2.4 Evaluation.

a. Availability. All information presented herein was extracted from records located in the Department of Environmental Resources files in Harrisburg, Pennsylvania or from conversations with the Owner's representative. Design and construction data could not be located.

b. Adequacy. The available data included in the State files and presented in this report are not adequate to evaluate the engineering aspects of the dam.

c. Validity. There are several discrepancies in the post-construction reports which require verification. A significant amount of pertinent data is nonexistent and must be determined to evaluate this dam.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B and are summarized and evaluated as follows. In general, the appearance of the facility indicates that the dam is currently in fair condition.

b. Dam. No indications or evidence of movement of the dam was observed with the exception of crest settlement which has resulted in a slightly irregular surface. There were no surface cracks, sloughing, or misalignment observed. The downstream slope has a few minor irregularities assessed to be attributed to riprap readjustment, and not embankment movements. The upstream riprap was grouted and is in good condition. Seepage was noted along the left abutment near the toe of the dam, as shown on Sheet 5a, Appendix B. This flow was reported over a period of years and was assessed to be flowing through the bedding planes of the bedrock. Water was also noted flowing at the base of the dam at the right abutment. The flow along the right abutment could not be traced because of the dense vegetation along the slope.

c. Appurtenant Structures.

1. Spillway. The spillway was excavated into the rock at the left abutment, and measured to be 52 feet wide at the weir section. The right side of the spillway channel has a mortared stone wall which extends downstream to the point at which the channel is directed into the Lower Tumbling Run Dam reservoir. The left side of the channel has been excavated into rock. Erosion was noted near the change in direction of the channel. The spillway bottom is a very irregular rock surface with some rock spalling noted. Woody vegetation was observed growing in the spillway. See Photographs 4 and 5.

2. Outlet Works. The outlet works were submerged and could not be inspected. The valves for the two 10-inch I.D. pipes were exercised. However, a slight swirling of the reservoir water surface above and immediately downstream of the outlet structure was observed before and after exercising the valves, indicating leakage. The access bridge supports at the crest were cracked, but were not indicative of an unstable condition.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of significant siltation, slope instability, or other features that would significantly affect the storage capacity of the reservoir. It was reported that dredging was performed near the headwaters of the reservoir several years ago. There is a wooden bridge located at the headwaters of the reservoir which could work loose during severe storms; float downstream and; possibly, block the spillway.

e. Downstream Channel. There is no downstream channel, as flows from the spillway are discharged directly into Lower Tumbling Run Reservoir.

3.2 Evaluation.

In summary, the visual survey of the dam disclosed no evidence of existing instability of the dam. However, the steepness of the downstream slope and seepage at the left and right abutments, along with the age and leakage of the outlet works, are considered items of concern. Therefore, additional investigation and evaluation is recommended as described in Section 7.

SECTION 4
OPERATION PROCEDURES

4.1 Procedures.

Normal operating procedures do not require a dam tender, although personnel work daily in the water treatment facility immediately downstream of Lower Tumbling Run Dam who check the dams and facilities on a regular basis (weekly). Discharge from the dam is normally controlled by the spillway.

4.2 Maintenance of the Dam.

The dam is maintained by the Schuylkill Haven Borough and is periodically checked by the State Department of Environmental Resources. No maintenance manual currently exists and maintenance is generally limited to non-structural work such as clearing of vegetation. Grouting of the upstream riprap was performed in the early 1960's.

4.3 Maintenance of Operating Facilities.

Maintenance of the operating facilities is performed by the Schuylkill Haven Borough. However, maintenance consists primarily of exercising the valves and lubricating the valve control shaft at the access bridge.

4.4 Warning Systems in Effect.

There are no formal warning systems or procedures established to be followed during periods of exceedingly heavy rainfall. Personnel are at the water treatment facility daily and are available if a potentially hazardous condition develops. The Borough Manager stated that representatives from the town watch and camp, if necessary, at the dam during periods of heavy rainfall. In the event of an emergency, the local Civil Defense Authority would be notified.

4.5 Evaluation.

No written operating procedures exist at this time, but should be developed and integrated with the procedures of the treatment facility. Maintenance procedures should be developed and incorporated into the operating procedures of the treatment facility and include a checklist of items to be observed during inspection of the dam and outlet works.

Since a formal warning procedure does not exist, a formal procedure should be developed and implemented during periods of extreme rainfall. This

procedure should consist of a detailed method for notifying personnel working in the treatment plant and residents downstream.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design/Evaluation Data. No original design data was available. Two inspection reports, one by C. E. Ryder of The Water Supply Commission of Pennsylvania, dated 22 December 1913, and one by H. T. Newton of Gilbert Associates, Inc., dated 1 March 1967, were in the State files. Data reviewed were obtained from these reports, and from several drawings, many untitled and undated, supplemented with field observations. Lower Tumbling Run Dam is also the subject of inspection under the National Dam Inspection Program and the results of the hydrologic/hydraulic analyses are incorporated in this Section.

The watershed is small, approximately 5.5 square miles, and roughly rectangular, lying between parallel ridges 0.9 to 1.0 miles apart. The watershed slopes are steep, rocky and densely wooded. The upper end of the watershed is about 6 miles above the dam, at an elevation near 1,100 feet, compared to a normal reservoir pool of 690 feet. The ridge elevations range from 1,200 to 1,400 feet. Most of the watershed is owned by the Schuylkill Haven Borough and the runoff characteristics are not expected to change in the near future.

The spillway is a rectangular channel cut through the left rock abutment. The crest is 52 feet wide at elevation 691.3. A small portion of the crest is paved with concrete, and contains a notch 1.4 feet deep and about 6 feet wide. For the present analysis, this notch was neglected. Below the crest, the rough rock channel slopes downward 6 to 8 percent along the side hill and narrows, but not enough to impede flow over the crest. The spillway is capable of discharging 2,200 cfs with the water level at the top of the dam (see Appendix C).

The 1913 report includes a flood routing study, using 6 inches of rainfall in 24 hours with 100 percent runoff ("...in excess of the largest recorded rainfall for this district..."), resulting in an inflow of 1,050 cfs, constant over the 24 hours. It was found that after 14 hours, the outflow was also 1,050 cfs, with the water level approximately 3.6 feet above the spillway crest. According to current criteria, 6 inches of rain is about 20 percent of the maximum probable precipitation.

In accordance with the criteria established by the Federal (OCE) Guidelines, the recommended spillway design flood for this "Intermediate" size dam with a "High" hazard potential is the probable maximum flood (PMF).

b. Experience Data. According to the Owner's representatives, the storm of record is Tropical Storm Agnes, June 1972, which produced over 13 inches of rain on June 22 and June 23, at Zerbey Airport, 15 miles west of the dam. This rainfall produced a maximum water level in Upper Tumbling Run Reservoir of 1.5 feet below the crest of the dam, an estimated discharge of 1450 cfs.

During Tropical Storm Agnes, water reportedly overflowed the right bank of the spillway channel approximately 200 feet downstream of the crest, just before the channel gradient increases and discharges into Lower Tumbling Run Reservoir.

c. Visual Observations. On the date of inspection, no conditions were observed to indicate reduction of spillway capacity during maximum discharge. It appeared, however, that flows at maximum spillway discharge could damage and erode the lower part of the right side of the discharge channel, possibly causing some erosion near the toe of the dam below. Observations regarding the downstream conditions and reservoir are located in Appendix B.

d. Overtopping Potential. The PMF peak inflow is estimated to be 8,028 cfs, using data from the West Branch of the Schuylkill River, as instructed by the Baltimore District, Corps of Engineers. Flood routing by the approximate method (Sheets 6 and 7, Appendix C) indicates that the available spillway capacity and flood storage are inadequate to pass more than 30 percent of the PMF without overtopping.

e. Spillway Adequacy. The spillway system is judged "Seriously Inadequate" as all of the following conditions exist (Engineering Technical Letter No. 1110-2-234, 10 May 1978):

> "1. There is high hazard to loss of life from large flows downstream of the dam.
>
> "2. 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.
>
> "3. The dam and spillway are not capable of passing one-half of the probable maximum flood without overtopping failure."

Item 1 is covered in the following subsection and item 3 is covered above. Overtopping of Upper Tumbling Run Dam would result in its failure, which would inevitably lead to the failure of Lower Tumbling Run Dam, 1/2 mile downstream. Therefore, the spillway is "Seriously Inadequate".

f. Downstream Conditions. About 1,200 feet below Lower Tumbling Run Dam, the valley is blocked by an abandoned multi-track railroad earth embankment, and a multi-lane highway at a lower level on the downstream side. Tumbling Run, below the dams, passes under the combined railroad and highway embankment through a culvert. The culvert is approximately 10 by 18 feet at its smallest section. The embankment is estimated to be 35 to 40 feet above the invert of the culvert on the upstream side. The creek joins the Schuylkill River in the town of Mount Carbon, Pennsylvania just below the tunnel outlet.

The capacity of the culvert, with 25 feet of water backed up behind the embankment, is about 5,800 cfs (Sheet 8, Appendix C). Storage behind the embankment appears to be about a quarter of the capacity of either dam. Consequently, while the culvert would most likely pass a PMF outflow through larger spillways, it would clearly massively overtop in a failure, which is likely with any inflow over 30 percent of PMF.

There are three buildings between Lower Tumbling Run Dam and the embankment that are possibly subject to damage in the event of large flows from the dam. The buildings would be destroyed, with possible loss of life, in the event of dam failure. In the event of dam failure and embankment failure, there are several industrial buildings and houses along the Schuylkill River which would be damaged or destroyed, justifying the "High" hazard classification.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The visual observations did not indicate any existing embankment stability problems, although the downstream slope and observed portion of the upstream slope are very steep. As discussed in Appendix B, seepage was observed at the left and right abutments, and leakage of the outlet pipes was apparent. Seepage from the abutments was clear and has been reported for a considerable number of years. Therefore, the seepage is judged not to be associated with piping.

The spillway is in fair condition with stable side channels. The rock surface is very irregular and some spalling was observed. Woody vegetation noted within the spillway should be removed.

The support at the dam crest for the access bridge was noted to be cracked, but judged to be currently stable. A detailed study is in order to determine the future service life of the existing outlet works, and to determine if and when replacement is warranted.

b. Design and Construction Data. No design or construction data is known to exist. All data concerning physical features of the dam have been determined by post-construction investigations, and judged to be inadequate for a detailed evaluation of the dam.

c. Operating Procedures. No operating procedures currently exist.

d. Post-Construction Changes. The only post-construction change reported was the pneumatic mortaring (grouting) of the upstream riprap in the early 1960's.

e. Seismic Stability. This dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. Since the static factor of safety for this dam is unknown, a seismic stability evaluation could not be made. Considering the steepness of the existing slopes, it is judged that both static and seismic factors of safety should be determined.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. The visual inspection indicates the dam is in fair condition. There is no engineering or construction data other than information obtained from post-construction investigations. The downstream slope is steep and would not meet current standards of practice. The outlet works are 152 years old and may be near the end of useful service life. The spillway capacity is judged to be "Seriously Inadequate" using the Corps of Engineers criteria. Localized seepage has been occurring for a significant period of time, and although it has not caused any problems, the flow should be monitored for changes in flow rates and turbidity.

Lower Tumbling Run Dam was also inspected under the National Dam Inspection Program. Results of that investigation indicate that failure of Upper Tumbling Run Dam will cause failure of Lower Tumbling Run Dam.

b. Adequacy of Information. Insufficient engineering and construction data was found to adequately evaluate the stability of the dam and service life of the outlet works. Specifically, there is no substantial data delineating the types of materials and configuration of the embankment. Foundation preparation details are also unknown. Details of the outlet works were available only from photographs.

c. Urgency. It is concluded that the recommendations considered to be critical in Section 7.2 be implemented immediately. All other items should be implemented as soon as practical.

7.2 Remedial Measures.

a. Facilities. The following recommended remedial work is considered critical and should be performed immediately.

1. The spillway system should be reconstructed to meet current hydrologic/hydraulic criteria.

2. Prepare "As-Built" drawings in conjunction with a geotechnical investigation and stability analyses of the slopes. This should include the installation of piezometers to locate the phreatic surface through the embankment.

3. The outlet works should be inspected and repaired, if necessary.

The following items are considered important and should be performed as soon as practical.

1. The underbrush along both abutments should be cleared to facilitate a thorough visual inspection of the seepage sources.

2. Seepage measuring devices should be installed to monitor seepage rates and possible changes in turbidity.

b. Operation and Maintenance Procedures. Formal operations, maintenance, and warning procedures should be developed and incorporated into the water treatment facility's operation. The warning procedure should include a method of warning downstream residents that high flows are to be expected. Evacuation procedures should also be developed.

The Owner should also develop an inspection checklist as an amendment to the maintenance procedure to insure that all critical items are inspected and maintained on a periodic basis.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Upper Tumbling Run Dam*

ID # *PA 00689*

ITEM	REMARKS
AS-BUILT DRAWINGS	*None*
REGIONAL VICINITY MAP	*Unmarked plans of Upper and Lower Tumbling Run Reservoirs.*
CONSTRUCTION HISTORY	*Post-construction investigations included limited construction history which is presented in the text of this report.*
TYPICAL SECTIONS OF DAM	*None*
OUTLETS - PLAN	
DETAILS	*None*
CONSTRAINTS	
DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	*None*

ITEM	REMARKS
DESIGN REPORTS	*None*
GEOLOGY REPORTS	*None*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*None*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*None*
POST-CONSTRUCTION SURVEYS OF DAM	*None*
BORROW SOURCES	*None*

ITEM	REMARKS
MONITORING SYSTEMS	*None*
MODIFICATIONS	*None*
HIGH POOL RECORDS	*None*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*The following post-construction studies are known to have been made and included in the DER files:* *1. "Report Upon the Investigation of the Philadelphia & Reading Coal & Iron Company Dams on Tumbling Run, Schuylkill County, Pennsylvania", by the Water Supply Commission of Pennsylvania, dated December 22, 1913, and supplementary reports of 1914. ----(Continued on Sheet 4 of 4).*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None*
MAINTENANCE OPERATION RECORDS	*None*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*None*
OPERATING EQUIPMENT PLANS & DETAILS	*None*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS--*CONTINUED* *FROM SHEET 3 of 4*	2. *"Report Upon the Tumbling Run Supply of the Silver Creek Water Company", by the Water Commission of Pennsylvania, dated November 12, 1920.* 3. *Letter to Water and Power Resources Board, Department of Forest and Waters, Harrisburg, Pennsylvania from the Silver Creek Water Company by Mr. H.W. Weber, dated April 9, 1935.* 4. *"Investigation of Tumbling Run Dams, W.O. 6338-00", by Gilbert Associates, Inc., Reading, Pennsylvania.*

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Upper Tumbling Run Dam* County *Schuylkill* State *Pennsylvania* National ID # *PA 00689*

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

Date(s) Inspection *4 Aug. 1978* Weather *Cloudy, Rain* Temperature *70's*

Pool Elevation at Time of Inspection *690.0* M.S.L. Tailwater at Time of Inspection *644.3* M.S.L.

Inspection Personnel:

Brady Bisson (Geotechnical) *John Boschuk, Jr. (Geotechnical/Civil)* *John H. Fredrick, Jr. (Geotechnical)* *(1 Aug. 1978)*

Vince McKeever (Hydrologist) *Ralph H. Cross (Hydrologist)*

John Boschuk, Jr. Recorder

Remarks:

Mr. Dick Nagle, Chief Operator and Mr. Kenny Frehafer, Borough Manager, were on site and provided information during the inspection.

CONCRETE/MASONRY DAMS

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

CONCRETE/MASONRY DAMS

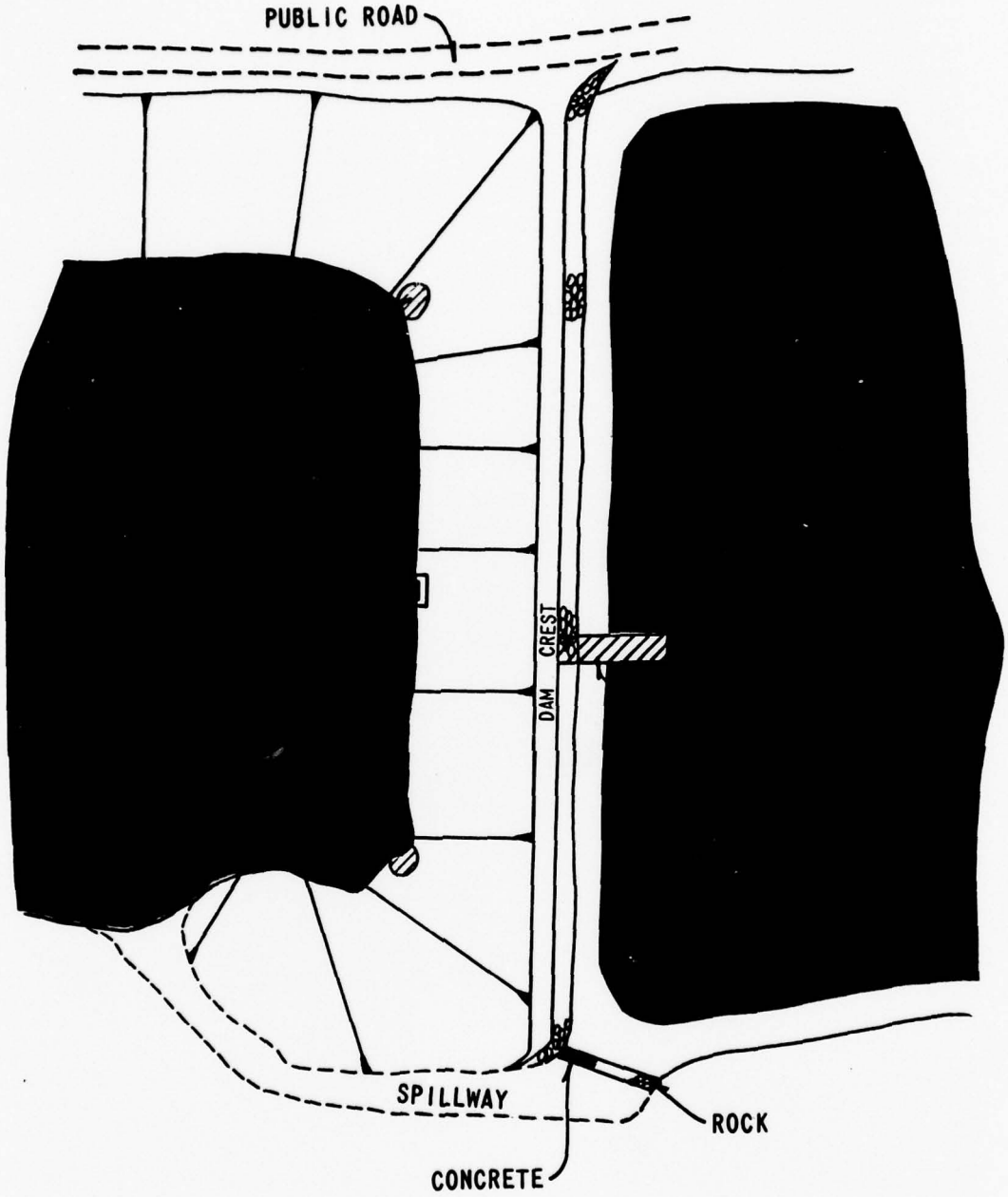
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*N/A*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*N/A*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed but slight slope bulging was observed on the lower third of the donwstream slope. This appears to be riprpap adjustment which occurred many years ago and not embankment movements.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*See above for details.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*The alignment is good with no unusual movements. Slightly irregular crest surface due to settlement.*	
RIPRAP FAILURES	*None observed. Upstream riprap facisng was sprayed with gunite and observed to be in good condition. Since the water level was above the base of the riprap level the condition of the slope below the riprap could not be observed.*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*All junctions were in good condition.*	
ANY NOTICEABLE SEEPAGE	*Yes. Seepage was observed along the left downstream abutment and it was clear. Seepage was also noted at the toe of the right abutment but it could not be traced due to debris and dense vegetation. The Owner's representative stated that beavers deposited this debris.*	
STAFF GAGE AND RECORDER	*None*	
DRAINS	*None observed. There were no plans available to indicate that the dam contains any drains nor was there evidence observed during the inspection to indicate that drains exist.*	



SEEPAGE LOCATION PLAN
UPPER TUMBLING RUN DAM

SHEET 5a OF 11

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*All outlet systems except for the valve stems are in the embankment and could not be inspected.*	
ACCESS BRIDGE SUPPORT	*The portions of the concrete bridge supports above the water surface were observed to contain a number of cracks. The cracks should be repaired. See Photograph No. 11.*	
INTAKE STRUCTURE	*The valves were exercised and they turned but the inspection team could not confirm that they worked. The valves appear to be leaking as indicated by a slight swirling of the water surface near the outlet structure before and after the valves were exercised. See Photograph 15 showing the intake structure in 1914. Since that date the wood bridge was replaced with a steel bridge.*	
OUTLET STRUCTURE	*The structure is under water being below Lower Tumbling Run reservoir level. Water disturbance immediately above the outlet system showed signs that water was being discharged as described above.*	
OUTLET CHANNEL	*None*	
EMERGENCY GATE	*None observed.*	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*The concrete weir is in poor condition but intack and should function well during normal rainfall. Parts of the channel are overgrown with woody vegetation which should be removed. The concrete is spalled and deteriorated. It should be reconstructed.*	
APPROACH CHANNEL	*Natural channel is cut through natural rock and is in good condition.*	
DISCHARGE CHANNEL	*Water over the weir section discharges into the natural rock channel. The channel is rough, contains woody vegetation, and is narrow.*	
BRIDGE AND PIERS	*None*	

GATED SPILLWAY

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

INSTRUMENTATION

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

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*Side slopes are moderate to steep, well vegetated and stable.*	
SEDIMENTATION	*The Owners representative stated that reservoir sedimentation was minimal and that some sediment was removed from the upper reaches, headwaters, several years ago. The length of time this reservoir has been in service is an indication that some sedimentation has occurred.*	
OTHER	*There is a bridge at the headwaters which could be washed out, float downstream and block the spillway. This wooden bridge should be anchored.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*None. The spillway discharges directly into Lower Tumbling Run Reservoir.*	
SLOPES	*N/A*	
APPROXIMATE NO. OF HOMES AND POPULATION	*Direct discharge into Lower Tumbling Run Reservoir.*	

APPENDIX

C

UPPER TUMBLING RUN DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *Steep, rocky, 100 percent wooded.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *689.9 feet (760 Acre-Feet).*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *697.5 (1045 Acre-Feet).*

ELEVATION MAXIMUM DESIGN POOL: *697.5 feet.*

ELEVATION TOP DAM: *697.5 feet.*

SPILLWAY

a. Elevation *691.3 feet (~7 feet wide notch at 689.9 feet)*

b. Type *Rectangular channel cut through rock.*

c. Width *52 feet.*

d. Length *150 feet to drop down hill.*

e. Location Spillover *Left (South) abutment.*

f. Number and Type of Gates *None.*

OUTLET WORKS:

a. Type *Two 10-inch pipes through base of dam.*

b. Location *Approximately under center of dam.*

c. Entrance inverts *Approximately 638 feet.*

d. Exit inverts *Approximately 638 feet.*

e. Emergency draindown facilities -----

HYDROMETEOROLOGICAL GAGES:

a. Type *Recording rain gage station.*

b. Location *Joe Zerbey Airport, 15 miles from dam.*

c. Records *Sent to National Weather Service.*

MAXIMUM NON-DAMAGING DISCHARGE: *2200 cfs. (capacity of Lower Tumbling Run Spillway)*

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

Date: 23 Aug 78
By: R.H. Cross
Sheet: 2 of 10

DAM Upper Tumbling Run Nat. ID No. PA 00689 DER No. 54-42

	ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1.	Min. Crest Elev., ft.	697.5		
2.	Freeboard, ft.			0
3.	Spillway(1) Crest Elev, ft.	691.0		691.3
3a.	Secondary(2) Crest Elev, ft.	—		
4.	Max. Pool Elev., ft.			697.5
5.	Max. Outflow(3), cfs	2200		
6.	Drainage Area, mi^2			5.5
7.	Max. Inflow(4), cfs			8028
8.	Reservoir Surf. Area, Acre	35.55		33.4
9.	Flood Storage(5), ~~ft^3~~ Ac-Ft			220
10.	Inflow Volume, ~~ft^3~~			6732 Ac-ft

Reference all figures by number or calculation on attached sheets:

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

NOTES:

(1) Main emergency spillway.

(2) Secondary ungated spillway.

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

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

(5) Between lowest ungated spillway and maximum pool.

BY RH Cross DATE 22 Aug 78 SUBJECT Upper Tumbling Run Dam - Hydrology & Hydraulics SHEET 3 OF 10

CHKD. BY ____ DATE ____ JOB No ____

Sources - Sheet 2.

3A, 1A, 8A	Letter Report, H.T. Newton of Gilbert Assoc., Inc, 1 Mar 1967
3C	Value in 3A - 6.2 ft measured between spillway & dam crests
2C, 4C	Assumed no freeboard
5A	Report by C.E. Ryder, Water Supply Comm. of Pa., 22 Dec 1913
7C, 9C, 10C	See Sheet 6

Note - Item 3 - See Sheet 5 re 1.4 ft notch in spillway crest.

6C, 8C	USGS Map Pottsville (1968)

Classification (Ref. Recommended Guidelines for Safety Inspection of Dams)

1. Hazard Classification is HIGH
2. Size Classification is INTERMEDIATE based on height of about 50 ft.
3. Spillway design flood should be PMF based on the above classification -

Hydrologic/Hydraulic Analysis

1. Design data was unavailable. Two post-construction inspection reports, by the Water Supply Commission of Pa. dated 22 Dec. 1913, and by Gilbert Associates, Inc., dated 1 Mar. 1967, contain limited hydrologic/hydraulic information. Several drawings on file, many untitled and undated, also contain data on elevations and dimensions, generally conflicting.

1913 Report:
Reservoir surface area = 30 Acres
Reservoir capacity 224,400,000 gal.
Spillway width = 61 ft
Watershed Area = 6.5 mi^2
Spillway capacity = 2200 cfs

1967 Report:
Reservoir surface area = 35.55 Acres
Reservoir capacity = 247,700,000 gal.
Spillway width = 56 ft
Spillway capacity = 2100 cfs
Spillway crest elevation = 691.0 ft
Dam Crest Elev. 697.5 ft

2. Evaluation of data:

Surface area of 35.55 acres is consistent with drawings.
Spillway width field checked as 52 ft
Capacity of 247,700,000 gal. consistent with a drawing.

Terms "spillway elevation" & "normal pool elevation" are not equivalent. There is a notch in the spillway crest 1.4 ft deep by about 6 to 7 ft wide. "Normal pool" will be at the bottom of this notch, while head for max discharge calculations is measured from the rest of the crest of the spillway.

Take dam crest elev. as 697.5 ft
Dam crest field checked, 6.2 ft above main spillway crest, thus spillway is at elev 697.5 - 6.2 = 691.3, and "normal pool" is 691.3 - 1.4 = 689.9 ft, close to values near 690.0 reported on several drawings.

Discharge of 2200 cfs appears reasonable;
Check: Assume critical flow over wier 52 ft wide with 6.2 ft head

$d_c = 2/3 \times 6.2 = 4.13$ ft
$A = b d_c = 4.13 \times 52 = 214.9$ ft^2
$V_c = (2 g H_c)^{1/2} = (2 \times 32.2 \times 1/3 \times 6.02)^{1/2} = 11.5$ ft/sec

So $Q = V_c A = \underline{2479}$ cfs

Try also $Q = C L H^{3/2}$ Use $C = 2.8$
$= 2.8 \cdot 52 \cdot 6.2^{3/2} = \underline{2248}$ cfs

$\Rightarrow$ <u>USE 2200 cfs</u>

$= Q_{o\ max}$

3. PMF Inflow:

PMF for Upper Tumbling Run, as instructed by the Baltimore district, Corps of Engineers, is obtained by comparison with West Branch Schuylkill River PMF, 9200 cfs for 4.8 mi^2

$$PMF = 7200\left(\frac{5.5}{4.8}\right)^{0.8} = \underline{8028}\ cfs = Q_{I\ max}$$

4 Volume of PMF

From U.S.W.B. TP-40,
PMP, 6-hr, 10 mi^2 (or less) is 25.5 in.
Assume runoff = 90% = 22.95 in

$$\text{Then } V_I = \frac{22.95}{12} \times 5.5\ mi^2 \times 640 = \underline{6732}\ Ac\text{-}ft$$

5. Flood storage available:

$$V_S = 35.55\ Ac \times (697.5 - 691.3)$$
$$= \underline{220.4}\ Ac\text{-}ft$$

6 Flood Routing (Procedure: Sheets 9 & 10)

6a: PMF: $Q_O/Q_I = \frac{2200}{8028} = 0.274 = p$

Stor. Req. $V_R = (1-p)\,V_I$

$= (1-.274) \cdot 6732$

$= 4887 >> 220\ Ac\text{-}ft$ fails.

6b 50% PMF: $\frac{Q_o}{Q_I} = \frac{2200}{.5 \times 8028} = 0.548$

$V_R = (1 - .548) \times (0.5 \times 6732)$

$= 1521 \gg 220$ Ac-ft. Fails.

6c 30% PMF: $\frac{Q_o}{Q_I} = \frac{2200}{.3 \times 8028} = 0.913$

$V_R = (1 - .913)(.3 \times 6732)$

$= 176 \approx 200$ Ac-Ft OK

∴ DAM WILL ACCEPT AT MOST 30% OF P.M.F. WITHOUT OVERTOPPING, WITH NO FREEBOARD.

7. Consequences of Failure:

Half a mile downstream is Lower Tumbling Run dam. The Lower T.R. reservoir extends to the toe of Upper T.R. Dam.

Failure of Upper T.R. Dam from overtopping will inevitably lead to the failure of Lower T.R. Dam.

Approximately 1200 ft downstream from Lower T.R. Dam is an abandoned multiple-track railroad embankment, with a crest elevation estimated to be 35-40 ft above the stream bed at the culvert under the embankment and adjacent highway.

From examining the U.S.G.S. Topographic map "Pottsville, Pa. (1944, rev. 1968). It appears that the embankment would retain & store less than a quarter

of the capacity of either Upper or lower Tumbling Run Dams.

Discharge through the culvert under the RR. embankment, measured as approximately 10' x 18' at the smallest section, assuming 25 ft head:

$$\text{Disch } Q = C_c A \sqrt{2gH}$$

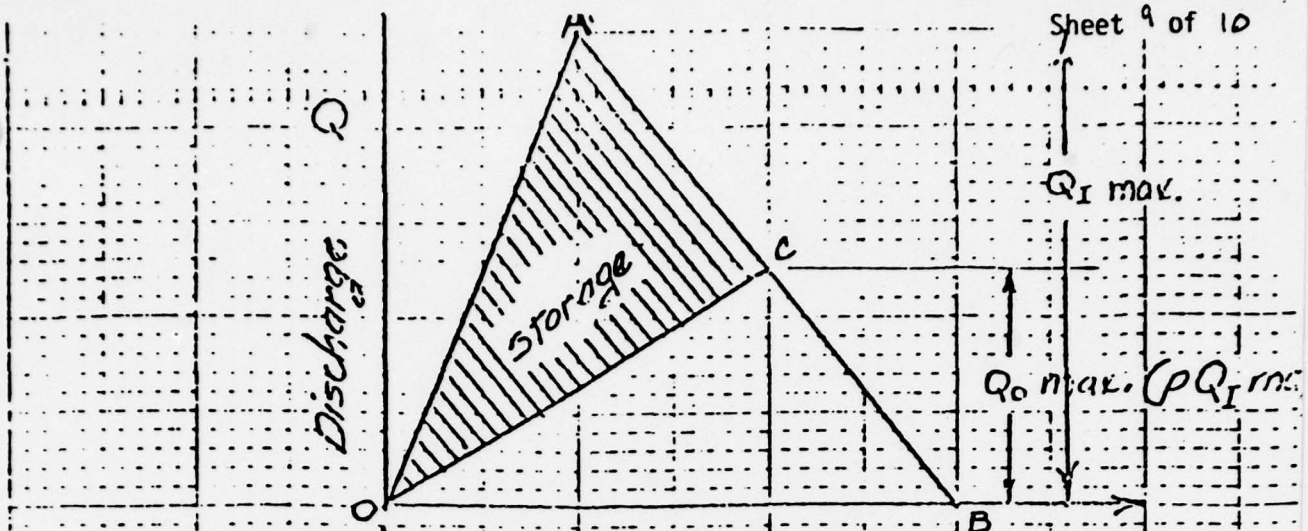
$A = 10 \times 18 = 180 \text{ ft}^2$

C_c Estimated to be 0.8

$H = 25$ ft assuming no tailwater.

$$Q = 0.8 \times 180 \times \sqrt{2 \times 32.2 \times 25} = \underline{5778 \text{ cfs}}$$

Failure of Upper T.R. Dam would result in failure of lower T.R. Dam, and massive overtopping and possible destruction of the RR embankment, and those parts of the town of Mount Carbon, Pa., along the Schuylkill River near the confluence of Tumbling Run.



PURPOSE: Establish relationship between maximum spillway discharge and storage required to pass flood hydrograph without exceeding maximum pool level.

$$\frac{\Delta AOC}{\Delta AOB} = \frac{\Delta AOB - \Delta COB}{\Delta AOB} = 1 - \frac{\Delta COB}{\Delta AOB}$$

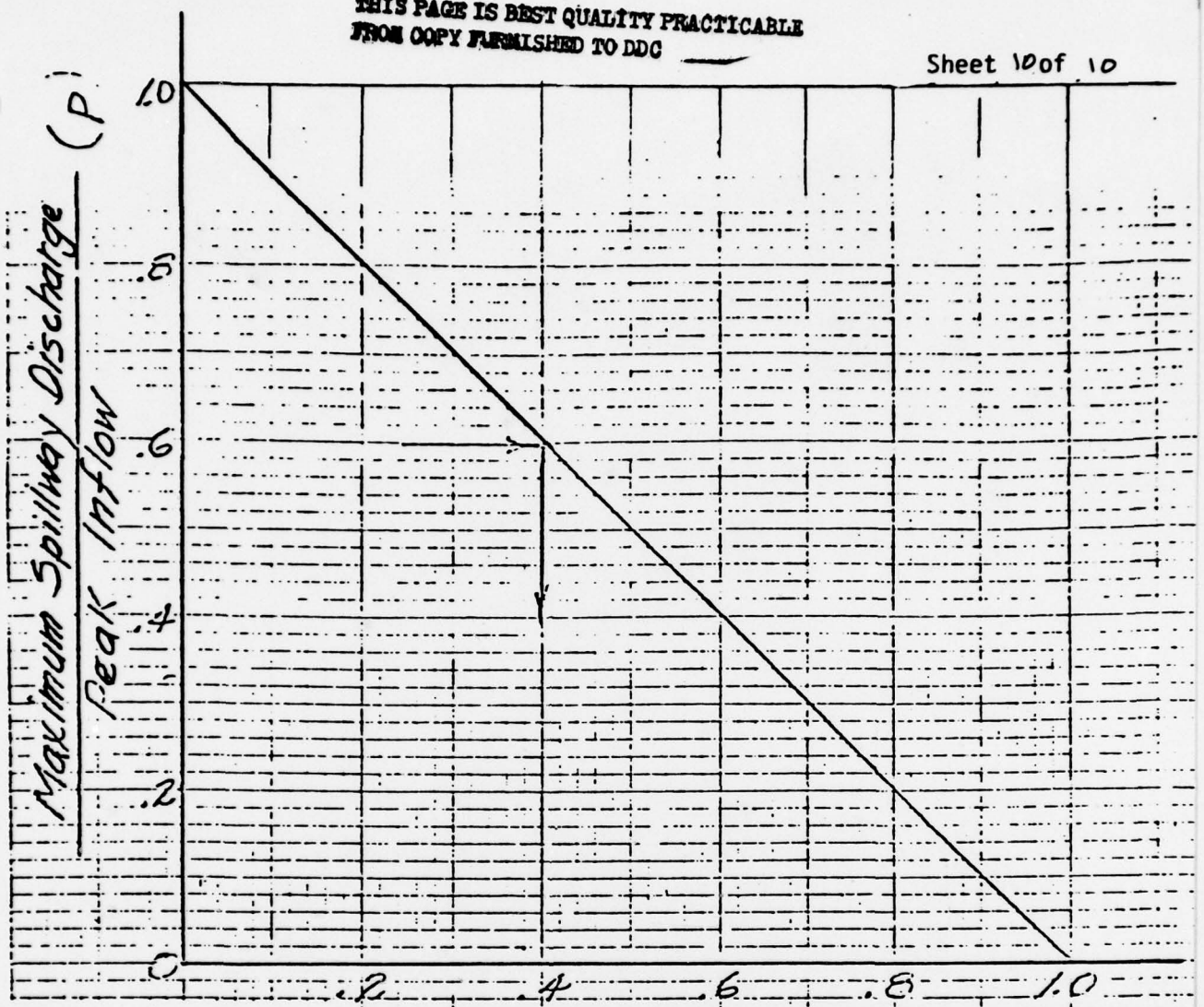
$$\frac{\Delta AOC}{\Delta AOB} = 1 - \frac{T \rho Q_I \text{ max}/2}{T\ Q_I \text{ max}/2} = 1 - \rho$$

$$\Delta AOC = (1-\rho)\ \Delta AOB \quad \text{where } 0 \le \rho \le 1.0$$

ρ	ΔAOC
1.00	0
0.75	0.25 ΔAOB
0.50	0.50 ΔAOB
0.25	0.75 ΔAOB
0	1.00 ΔAOB

REFERENCE

PRELIMINARY ENGINEER TECHNICAL LETTER NO. 1110-2- 25 January 1978

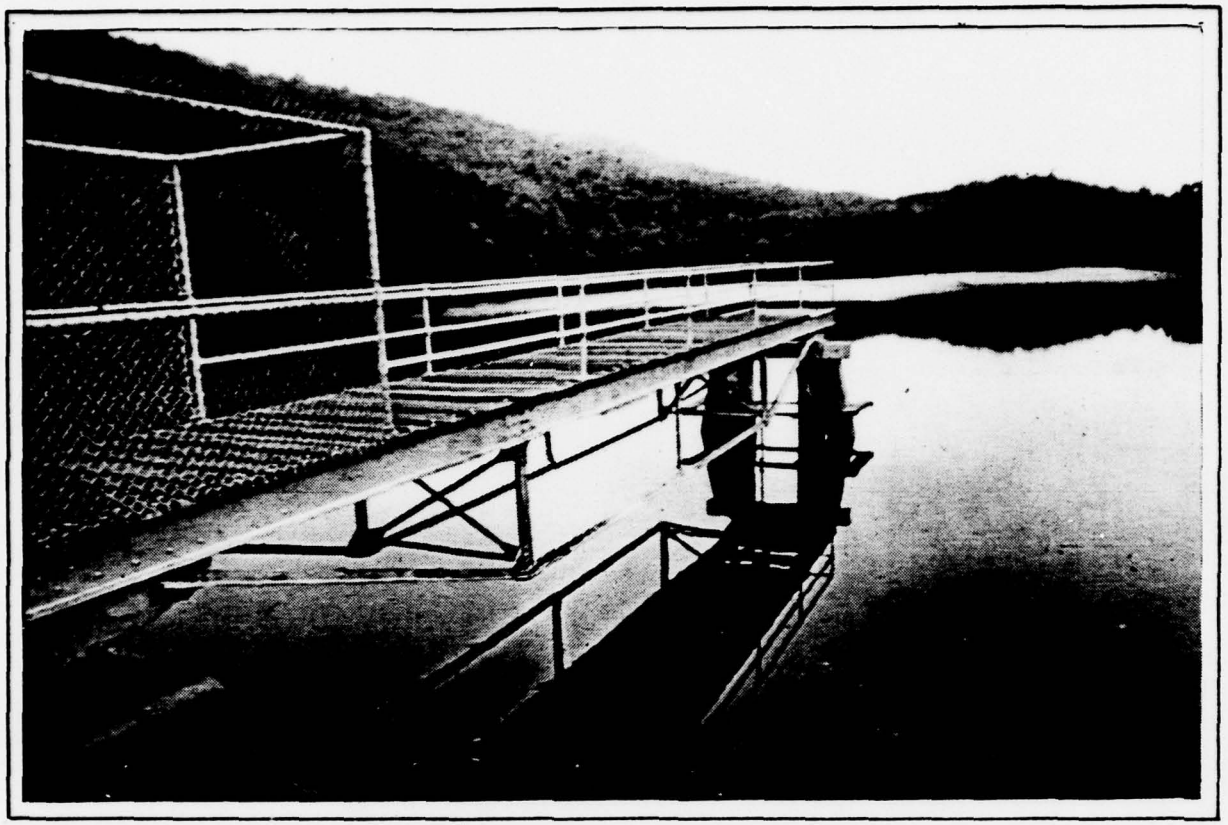


Steps to obtain required reservoir to pass inflo... hydrograph without overtopping dam.

1. Obtain maximum spillway discharge
2. Develop inflow hydrograph
3. Compute relationship of maximum spillway capacity to peak inflow
4. Read relationship of required reservoir storag... to volume of inflow hydrograph from curve

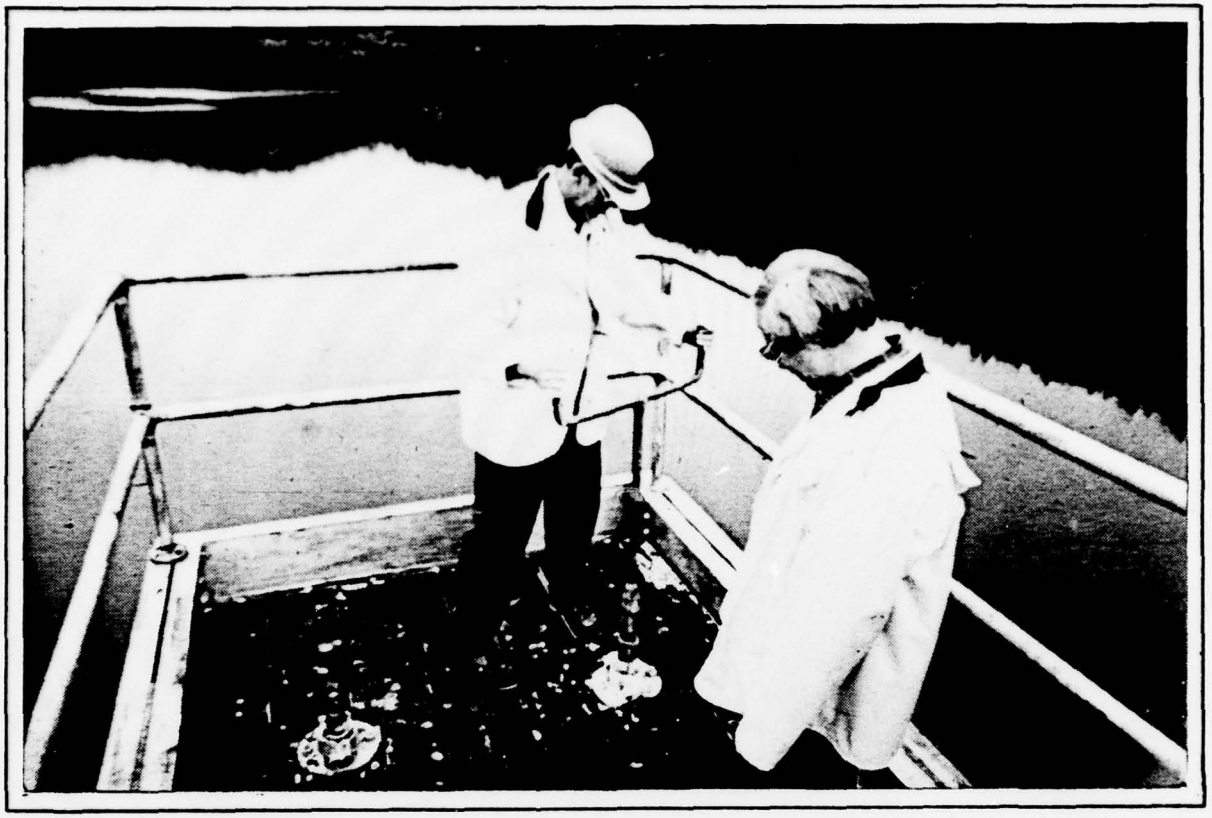
APPENDIX

D



INTAKE TOWER AND BRIDGE.

PHOTOGRAPH NO. 1

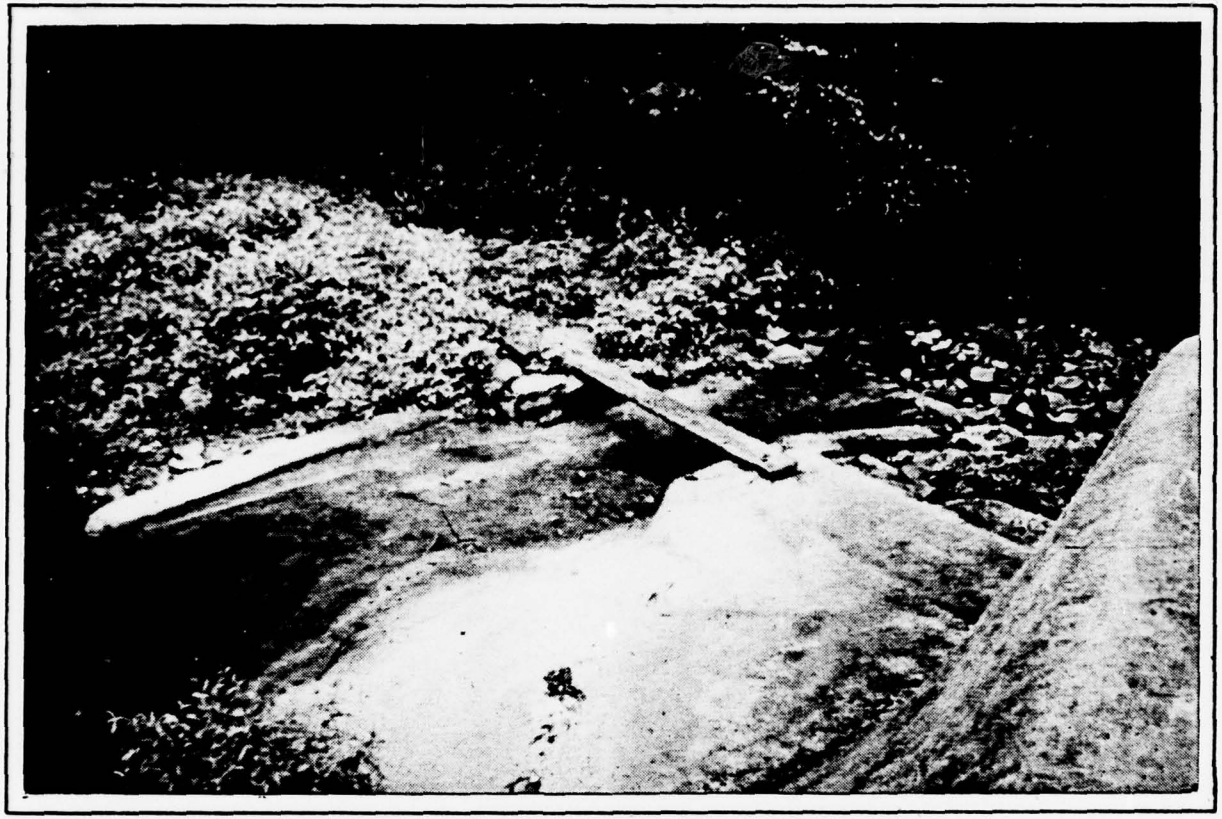


INTAKE TOWER CONTROL VALVES.

PHOTOGRAPH NO. 2

APPROACH CHANNEL TO SPILLWAY.

PHOTOGRAPH NO. 3

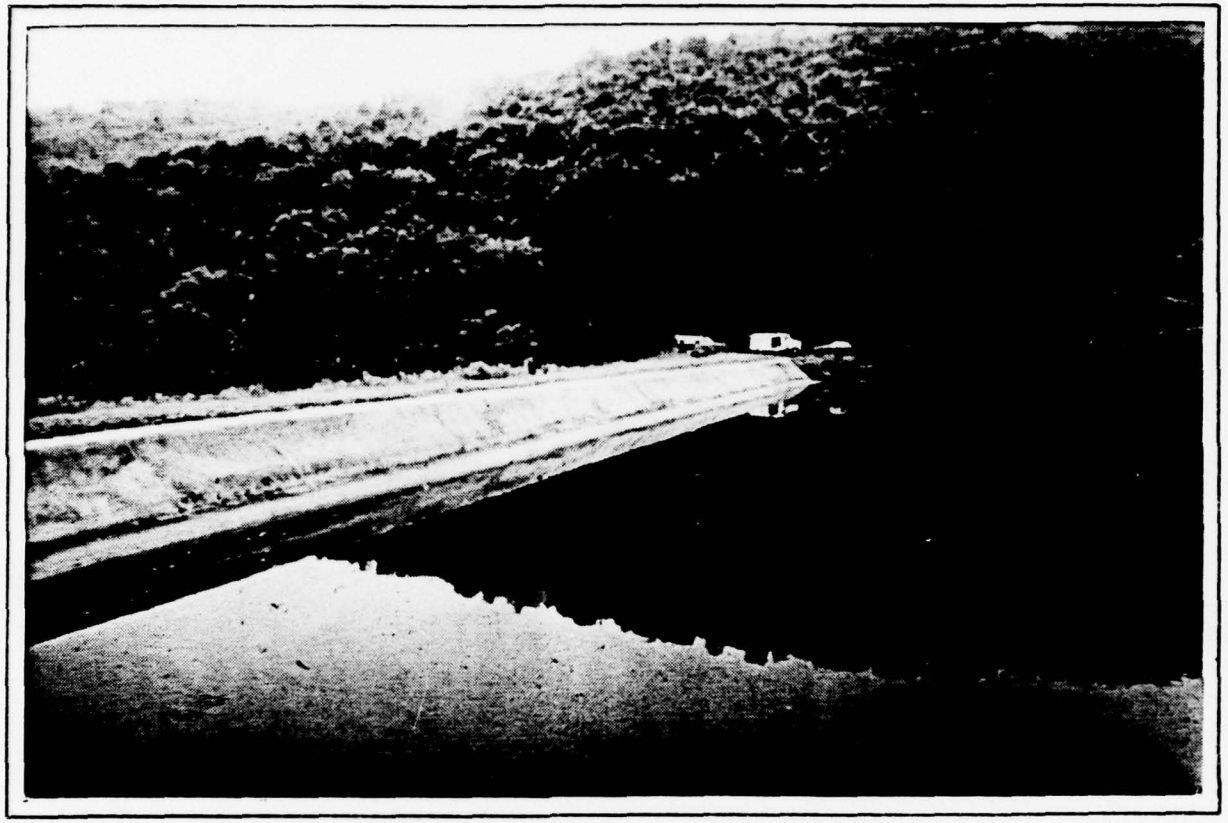


VIEW OF EMERGENCY SPILLWAY.

PHOTOGRAPH NO. 4

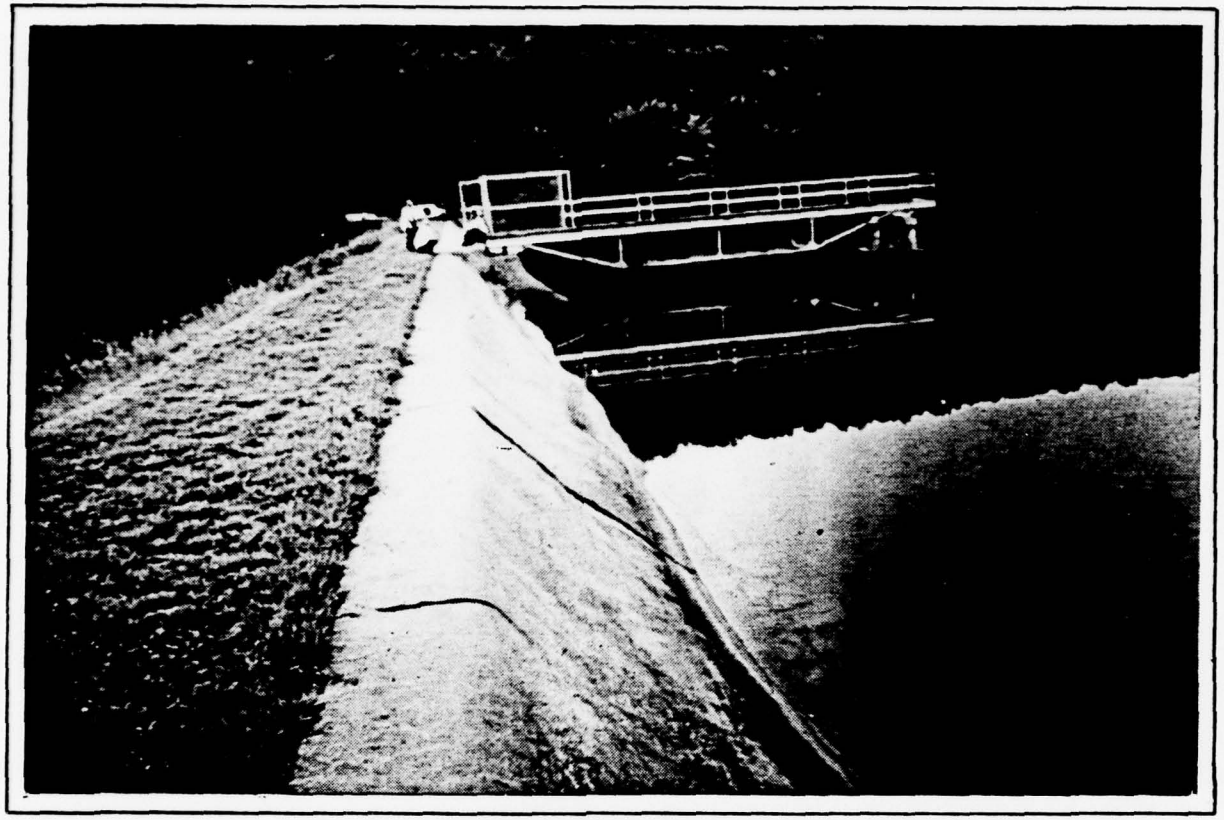
VIEW OF EMERGENCY SPILLWAY
DISCHARGE CHANNEL.

PHOTOGRAPH NO. 5



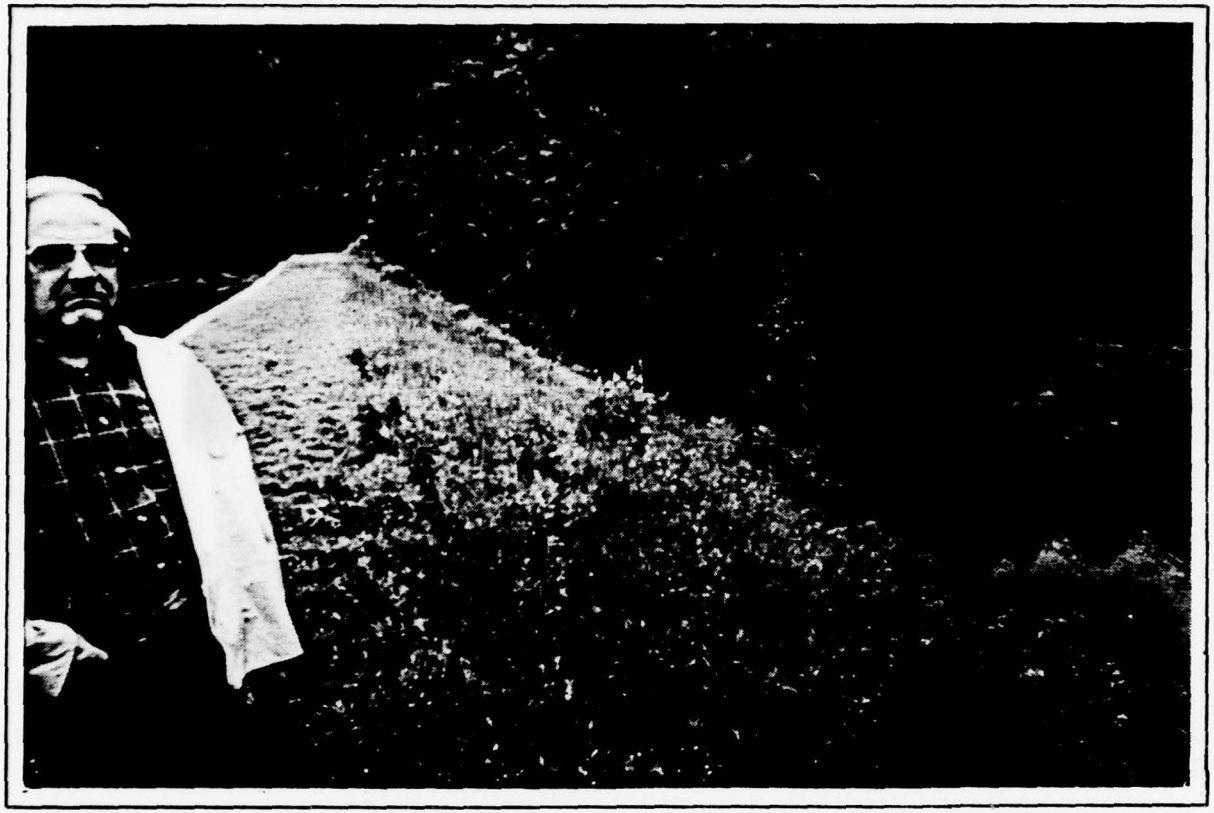
OVERVIEW OF UPSTREAM SLOPE.
RIPRAP WAS COVERED WITH
GUNITE GROUT.

PHOTOGRAPH NO. 6



OVERVIEW OF GROUTED RIPRAP LOOKING TOWARD RIGHT ABUTMENT. SURFACE UNDULATES BECAUSE OF ROCK SURFACE.

PHOTOGRAPH NO. 7



OVERVIEW OF DOWNSTREAM SLOPE.

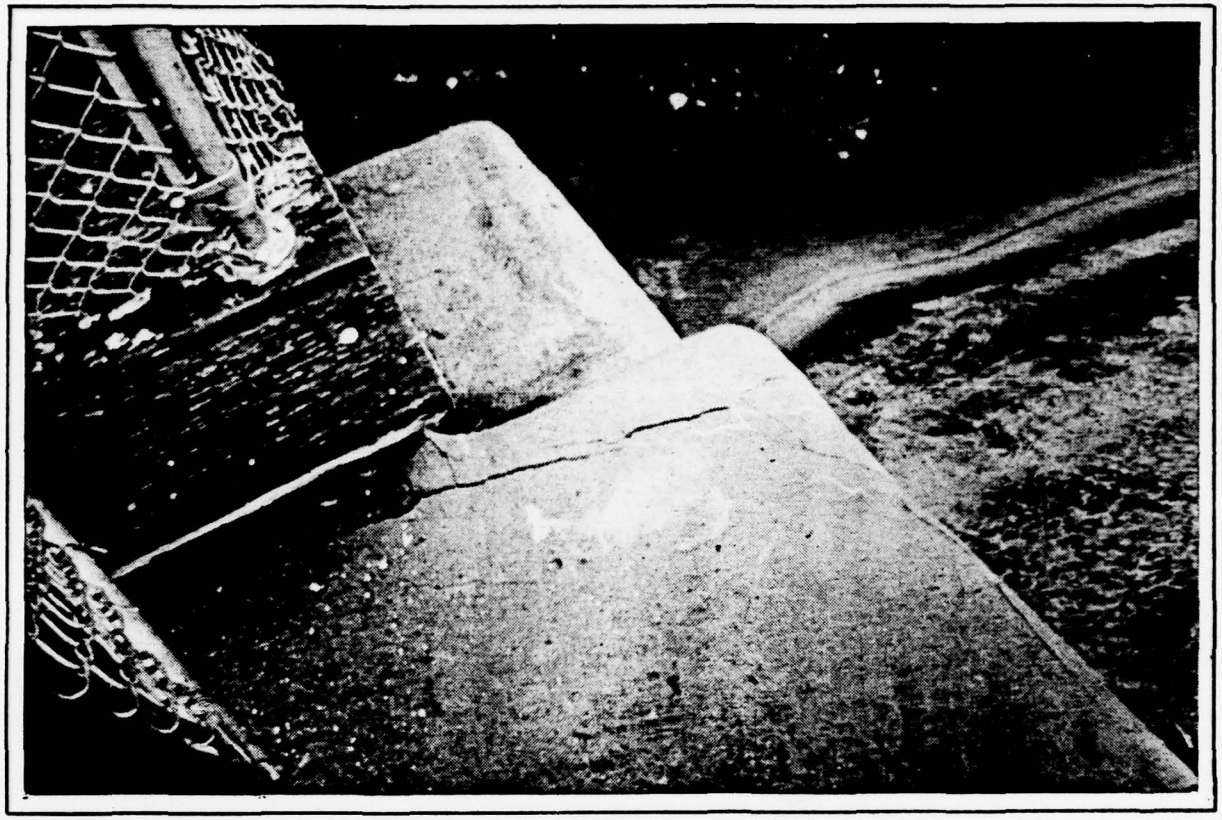
PHOTOGRAPH NO. 8

OVERVIEW OF RIPRAP AT DOWNSTREAM TOE. THE WATER IS THE UPPER END OF LOWER TUMBLING RUN RESERVOIR.

PHOTOGRAPH NO. 9

VIEW SHOWING THE STEEPNESS OF
THE DOWNSTREAM SLOPE.

PHOTOGRAPH NO. 10



CRACKED ABUTMENT OF SUPPORT FOR
BRIDGE FROM EMBANKMENT TO THE
CONTROL TOWER.

PHOTOGRAPH NO. 11

SEEP FROM LEFT ABUTMENT INTO
LOWER TUMBLING RUN RESERVOIR.

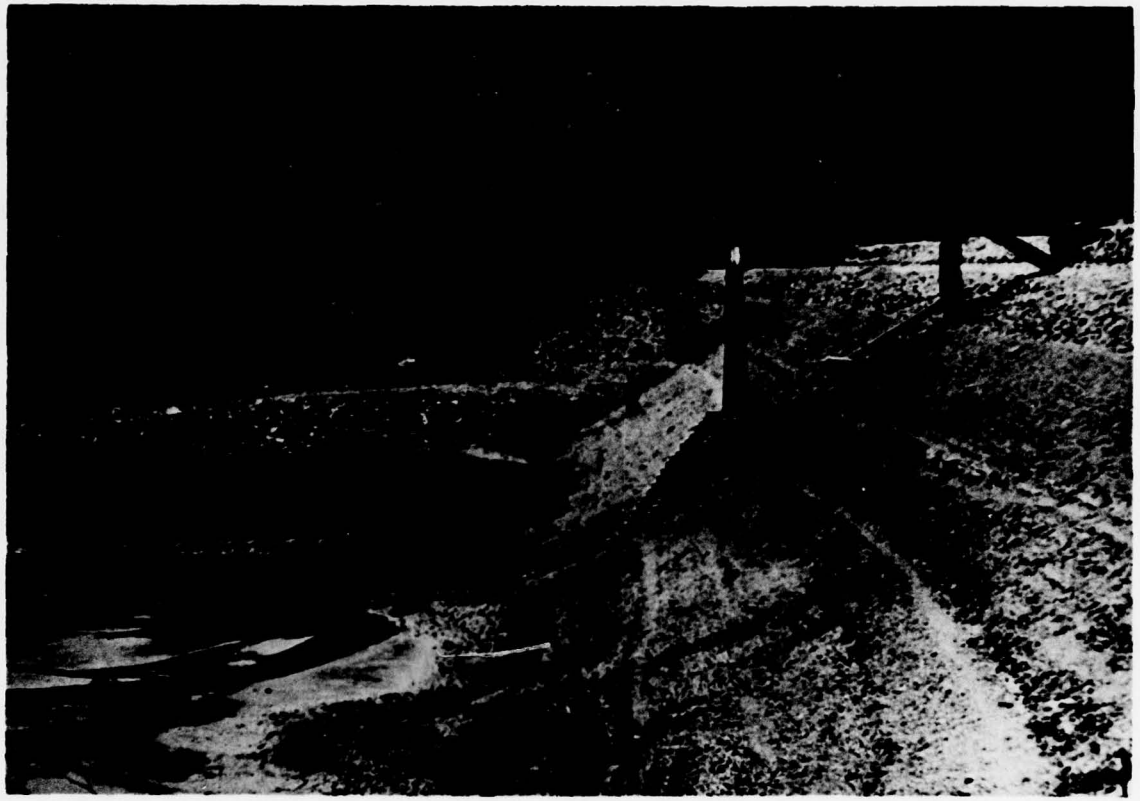
PHOTOGRAPH NO. 12

CLOSE-UP OF SEEPAGE FROM LEFT ABUTMENT. SEE PHOTOGRAPH NO. 12 FOR OVERVIEW.

PHOTOGRAPH NO. 13

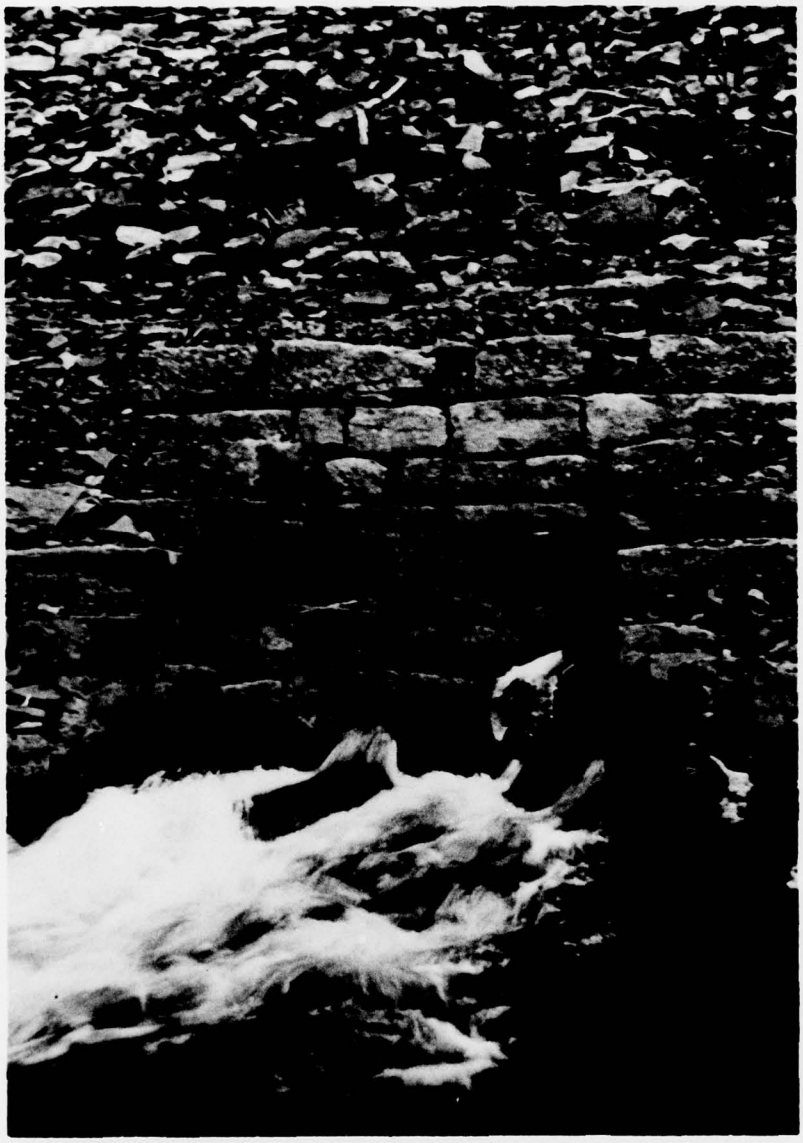
SEEPAGE FROM RIGHT ABUTMENT WITH
FLOW DISCHARGING INTO LOWER
TUMBLING RUN RESERVOIR.

PHOTOGRAPH NO. 14



EXPOSED UPSTREAM SLOPE PHOTOGRAPHED BY SILVER CREEK WATER COMPANY, JULY 13, 1914

PHOTOGRAPH NO. 15

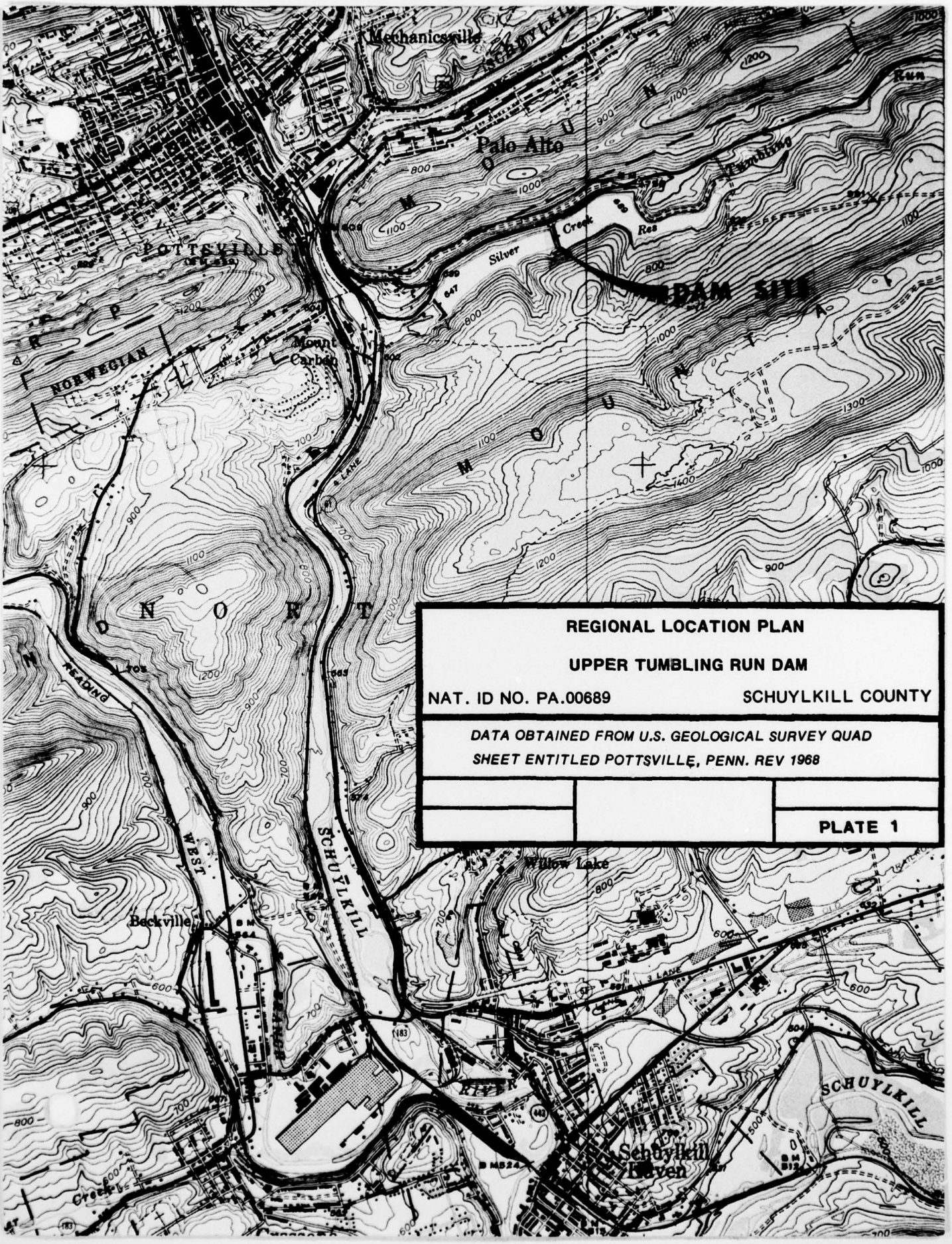


EXPOSED OUTLET STRUCTURE
PHOTOGRAPHED BY SILVER
CREEK WATER COMPANY, MARCH
25, 1914

PHOTOGRAPH NO. 16

APPENDIX

E



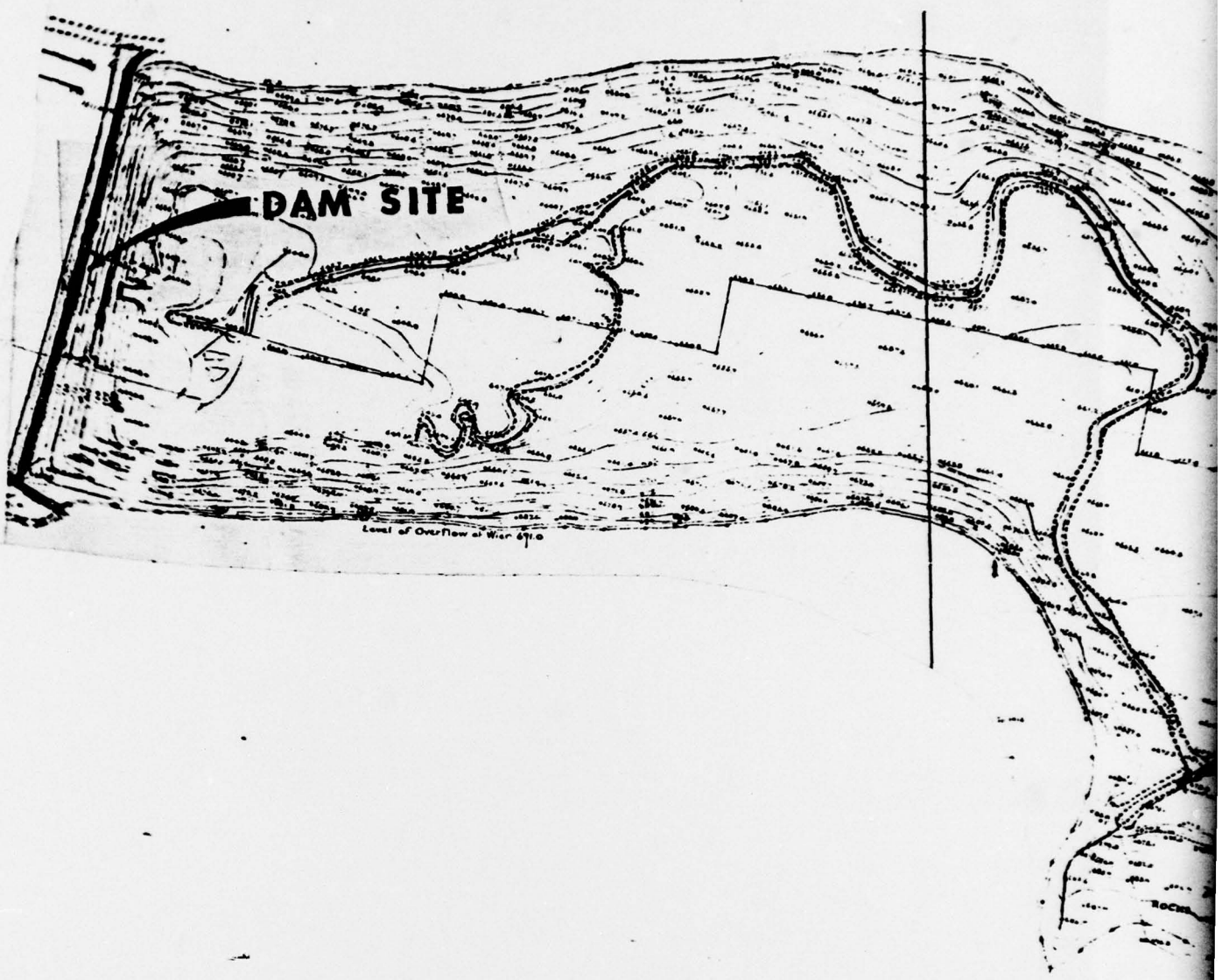
REGIONAL LOCATION PLAN

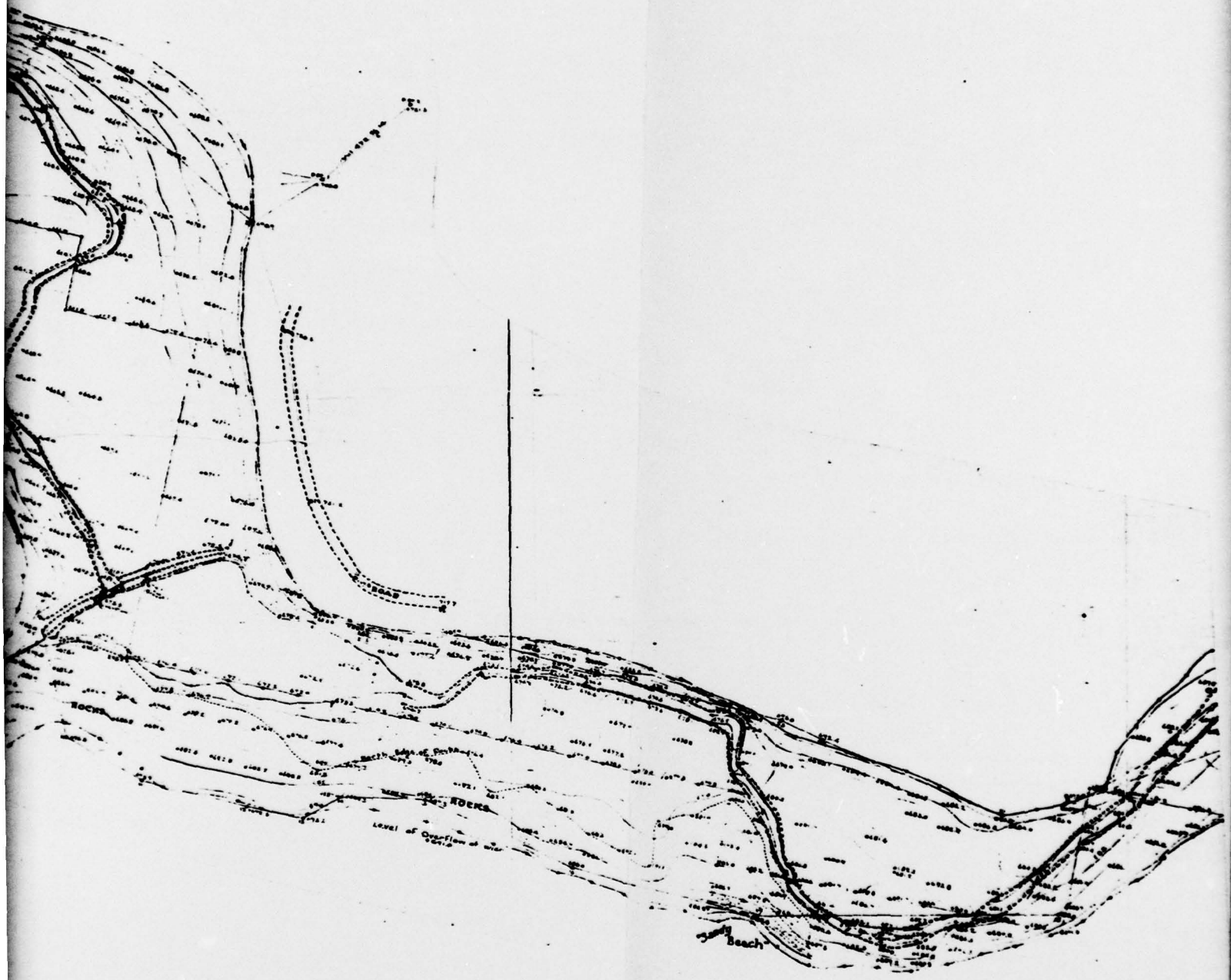
UPPER TUMBLING RUN DAM

NAT. ID NO. PA.00689 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S. GEOLOGICAL SURVEY QUAD SHEET ENTITLED POTTSVILLE, PENN. REV 1968

PLATE 1


DAM SITE
Level of Overflow at Weir 691.0



PLAN OF DAM & RESERVIOR

UPPER TUMBLING RUN DAM

NAT. ID NO. PA.00689 SCHUYLKILL COUNTY

DATA OBTAINED FROM DEPARTMENT OF ENVIROMENTAL RESOURCES, HARRISBURG, PA.

PLATE 2

UPPER TUMBLING RUN DAM
NATIONAL ID NO. 00689

DEPARTMENT OF ENVIRONMENTAL RESOURCES FILES AND THE OWNER FILES CONTAINED NO DRAWINGS PERTINENT TO:

1. *TYPICAL EMBANKMENTS SECTIONS AND DETAILS*
2. *TYPICAL SECTIONS THROUGH THE WATER SUPPLY SYSTEMS*
3. *TYPICAL SECTIONS THROUGH THE SPILLWAY*

PLATE 3

APPENDIX

F

SITE GEOLOGY
UPPER TUMBLING RUN DAM

Upper Tumbling Run Dam is located in the Appalachian Mountain Section of the Valley and Ridge Physiographic Province. The bedrock at the dam site is reported to consist of the red and brown sandstones, siltstones, and shales of the Mauch Chunk Formation (see Plate F-1). To the north, the Mauch Chunk Formation is bounded by the sandstones, shales and coal of the Pennsylvanian Pottsville and Llewellyn Formations, and to the south the Mauch Chunk Formation is bounded by the sandstones, siltstones, and shales of the Mississippian, Pocono and the Devonian Catskill Formation (Wood, 1973). Bedding is overturned, striking to the east-northeast and dipping steeply to the south-southwest (Wood, 1973). Two dominant sets of open, variably spaced joints have been observed: one set oriented along the strike of bedding, dipping gently to the northwest, and a second set striking north-northwest, and dipping steeply to the west (Wood, 1973; Sevon, 1975). No faults have been mapped beneath the dam, although two faults, one on either side of the reservoir, have been reported striking parallel to the reservoir.

Pleistocene age deposits are very limited in the dam site area, and are reported to mainly consist of periglacial talus deposits that cover much of the Tumbling Run stream valley (Wood, 1973).

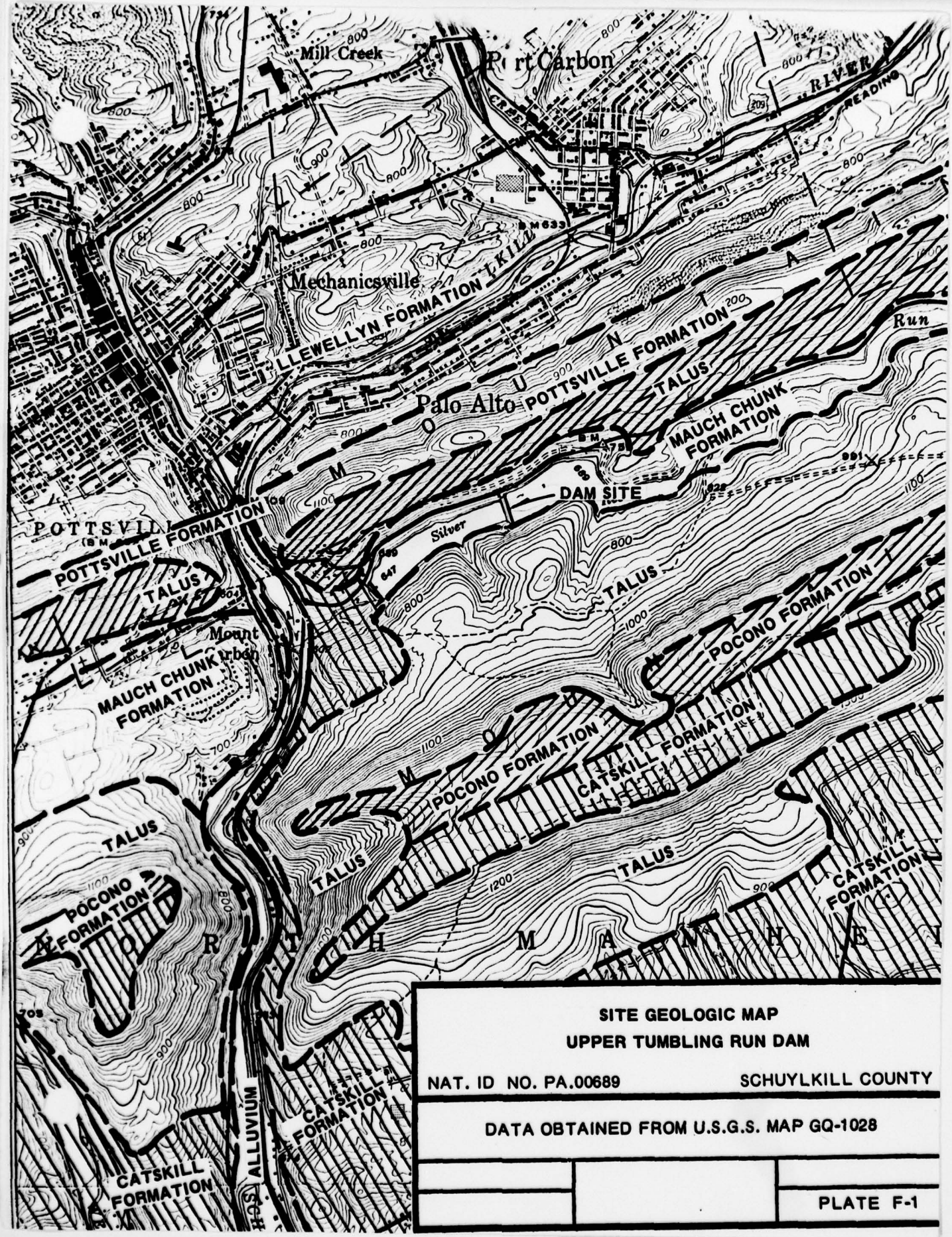
Downstream seepage should not be a major problem unless the major east-northeast joint set is well developed, and is a zone of groundwater transport, beneath the dam due to the dam being constructed perpendicular to these features.

References:

1. *Sevon, W.D., 1975, Geology and Mineral Resources of the Christmans and Pohopoco Mountain Quadrangle Carbon and Monroe Counties, Pennsylvania: Pa. Geol. Survey Atlas 195 ab, Plate 1, 1:24,000.*

2. *Willard, Bradford, 1939, Guide to the Geology of the Upper Schuylkill Valley: Pa. Geol. Survey, 4th Series, Bull. 1939, 24 p.*

3. *Wood, G.H., 1973, Geologic Map of the Pottsville Quadrangle, Schuylkill County, Pennsylvania: USGS Geologic Map GQ1028, 1:24,000.*



SITE GEOLOGIC MAP

UPPER TUMBLING RUN DAM

NAT. ID NO. PA.00689 SCHUYLKILL COUNTY

DATA OBTAINED FROM U.S.G.S. MAP GQ-1028

PLATE F-1