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NATIONAL DAM INSPECTION PROGRAM. WILD CREEK DAM, CARBON COUNTY,--ETC(U)
JUN 78 J H FREDERICK, W S GARDNER DACW31-78-C-0048

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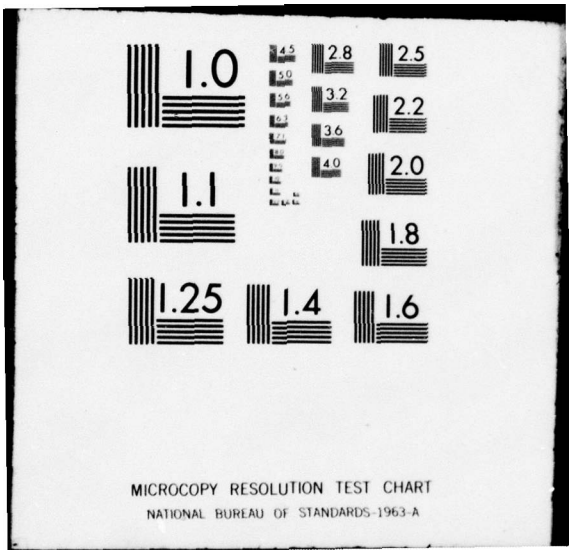
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John H. /Frederick, Jr.
William S. /Gardner

National Dam Inspection Program. Wild Creek Dam, Carbon County, Pennsylvania (National I.D. Number PA-ØØ6Ø9), Delaware River Basin, Wild Creek, Carbon County, Pennsylvania

Phase I Inspection Report,

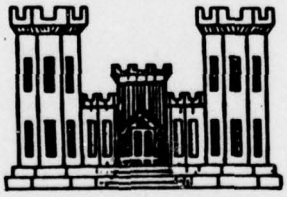
LEVEL II

(1)

DELAWARE RIVER BASIN

WILD CREEK DAM
CARBON COUNTY, PENNSYLVANIA
NATIONAL I.D. NO. PA 00609

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared by:

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Plymouth Meeting, Pennsylvania 19462

Submitted to:

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

Contract DACW31-78-C-0048

June 1978

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Wild Creek Dam and Reservoir

County Located: Carbon County
State Located: Pennsylvania
Stream: Wild Creek
Coordinates: Latitude 40° 53.8' Longitude 75° 33.8'
Date of Inspection: 11 May 1978

(cont fr p. 1) This dam was

Wild Creek Dam has been designed to pass the probable maximum flood. However, it is the second in a series of two dams on Wild Creek above Beltzville Reservoir. A sudden breach of the upper, Penn Forest, dam would probably result in overtopping failure of Wild Creek Dam. The Corps of Engineers' Beltzville Dam, immediately downstream from Wild Creek, is reportedly designed to withstand this event. Since Wild Creek Dam has been designed to pass the PMF, the spillway is considered to be "Adequate".

Wild Creek Dam appears to be in excellent condition. It is well maintained and attended to on a daily basis by a staff of operational personnel. No visible signs of uncontrolled leakage, sloughing, or significant displacement were discovered other than along the spillway retaining walls where some cracking was observed. It was noted that this zoned embankment dam was designed without protective filters between the impervious core and coarser outer shell. However, no indications of internal erosion have manifested themselves in over 40 years of service.

In summary, our examination disclosed no conditions that are judged to impinge on the overall integrity or safety of this dam. Therefore, no recommendations for further study or remedial action are made other than the installation of a warning system in case a critical condition develops. It is recommended that seepage from the roofs of the emergency drain and water supply tunnels be periodically monitored. If flow increases appreciably, or turbidity develops, the cracks should be sealed.

John H. Frederick, Jr., P.E. — Date 6/19/78
Maryland Registration 7301

B

W S Gardner — 6/19/78
William S. Gardner, P.E. — Date
Penna. Registration 004302E

APPROVED BY:

11 Jul 78

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

Date

OVERVIEW
WILD CREEK DAM, CARBON COUNTY, PENNSYLVANIA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
WILD CREEK DAM
NATIONAL ID #PA 00609

SECTION 1
PROJECT INFORMATION

1.1 General.

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

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

1.2 Description of Project.

a. Dam and Appurtenances. Wild Creek Dam is a zoned rolled earth and coarse fill embankment with riprap facing on the upstream side. The downstream side is a rolled coarse rock shell. It is approximately 1076 feet long and 135 feet high. The dam was designed with a central core of impervious fill materials extending down to the rock surface. The dam contains a concrete core wall and a grout curtain. A reinforced concrete chute spillway for overflow discharge is located on the right abutment and described in greater detail on Table 1. There is a reinforced concrete discharge tunnel approximately 14 feet wide by 14 feet high beneath the dam which was used during construction for stream diversion. Subsequently, the channel was blocked and a 36-inch cast iron pipe was installed which can be used for emergency drawdown. The valve is located at the toe of the dam.

Water supply discharge pipes are controlled by valves and sluice gates at the intake structure located at the left abutment of the dam. The water is transferred by two 38-inch cast iron pipes housed in a six foot radius semi-circular reinforced concrete tunnel.

b. Location. The dam is located on Wild Creek approximately 1900 feet north of Lakeside Drive and 3500 feet from the intersection of Lakeside Drive and Route 209 in Carbon County, Pennsylvania. The dam site and reservoir are shown on USGS Quadrangle, Pohopoco, Pennsylvania, at coordinates N 40° 53.8', W 75° 33.8'. A Regional Location Plan of Wild Creek Dam and Reservoir is enclosed as Plate 1, in Appendix E.

c. Size Classification. Large (height is 135 feet and reservoir is 12583 acre-feet). The height is the controlling factor for the classification.

d. Hazard Classification. High hazard classification because of the potential for significant property loss downstream.

e. Ownership. Bethlehem Municipal Water Authority.

f. Purpose of Dam. Water supply for Bethlehem.

g. Design and Construction History. Wild Creek Dam was designed by the Bethlehem City Engineer at the request of the City Council of Bethlehem. Design work began in early 1937 but was delayed until confirmation for securing Federal aid was received. Final design drawings were issued in March 1939 by the Bethlehem Municipal Water Authority.

A series of model studies were performed at Lehigh University under the Direction of Dr. A.T. Ippen; Assistant Professor of Civil Engineering, to confirm and re-design the spillway. From these studies came the present spillway and chute design.

Records infer that the dam was constructed by the C.W. Good Company and his "assorted" subcontractors. No other data was available.

It is not known exactly when the dam was completed but, based on State records, it is believed that the embankment was completed in 1941.

h. Normal Operating Procedures. A minimum flow of 1.7 cfs is required to be discharged into Wild Creek in accordance with the provisions of the construction permit. Reportedly, this minimum flow is regulated at the Chemical Building. The main water supply line from the Intake Tower supplies water to the Chemical Building for treatment. Thereafter, water is transported via a 23-mile pipeline to the City of Bethlehem. Excess reservoir water is discharged over the emergency spillway into Wild Creek.

1.3 Pertinent Data

a.	Drainage Area (sq. miles)	22
b.	Discharge at Dam Site (cfs)	
	Max. Known Flood (8/2/69)	472 (est.)
	Design Max. Flood	no data in records
	1-36" Diameter Pipe	no rating curve
	2-38" Water Supply Pipe	no rating curve
	Spillway at Top of Dam	17,500
c.	Elevations (feet)	
	Top of Dam	835
	Top of Spillway	820
	Normal Pool	820
	Max. Design Pool	unknown
	Intake Sluice Gates (2-38")	720
	Gate Valves at Valve Chamber (2-38")	712
	Drain Pipe (36")	unknown
d.	Reservoir	
	Length at Normal Pool	1.7 miles
	Fetch at Normal Pool	1.0 mile
	Maximum Reservoir Depth	135 feet
e.	Storage (acre-feet)	
	Normal Pool	12,583
	Top of Dam	17,143
f.	Reservoir Surface (acres)	
	Normal Pool	304
g.	Dam Data	
	Type	Rolled earth with impervious core with 10 ft. high concrete core wall. Slopes are riprapped.
	Length	1,076 feet
	Crest Width	30 feet
	Maximum Height of Dam	135 feet
	Slide Slopes	
	Upstream- Above El. 820	2H:1V
	Above El. 790	2½H:1V
	Above El. 760	3H:1V
	Below El. 760	3½H:1V

Downstream-Above El. 805	2H:1V
Below El. 805	2½H:1V
Below El. 765	3H:1V
Cut-Off	Concrete Core Wall
Grout Curtain	Yes, single line; 3 ft. on-center.

h. Diversion and Regulating Tunnel

Type Water Supply	2-38" C.I. Pipes
Drain	1-36" C.I. Pipe
Closure	Gate valves on all limited tunnel access to water supply and drain pipes from manhole and addit, respectively.
Regulating Facilities	Water Supply regulated at Intake Tower. Dam regulated at Addit entrance.

i. Spillway

Type	Concrete Ogee Crest
Length	85 feet
Crest Elevation	820 feet
Downstream Channel	The channel gradient is approximately 2%, side slopes are covered with trees and brush, channel meanders through tree and brush covered flood plain.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of engineering data on Wild Creek Dam is presented in the checklist, attached as Appendix A. Engineering design data available for Wild Creek Dam was contained primarily in a 36-sheet set of design drawings dated March 1, 1939. A set of these drawings is in the Owner's possession and at the Commonwealth of Pennsylvania, Department of Environmental Resources main office in Harrisburg, Pennsylvania.

Other documents available and reviewed included:

1. 24 - 3-1/2 x 6 inch construction photographs.

2. Office of the District Engineer, U.S. Army Engineer District, Philadelphia, Corps of Engineers, "Beltzville Dam and Reservoir Design Memorandum No. 1", Hydrology and Hydraulics, December 1963; includes hydrographs for Wild Creek Dam.

3. Report Upon the Application of the City of Bethlehem, Construction Application Permit dated August 10, 1938.

4. Lehigh Alumni Bulletin,Lehigh University, Wild Creek Spillway, by Dr. A.T. Ippen, November 1939.

5. Miscellaneous memoranda, letters and visual inspection reports.

6. Results of in-place density tests, dated August and September, 1940.

7. A series of flow release records from Mr. Ario Wear, Director of Parks and Public Property, to Mr. C.K. Weigle, mid to late 1940's.

In this data, there was reference to, but no documentation of, physical and strength properties of embankment materials, engineering analysis of embankment stability, design criteria, construction specifications, and construction of the dam. The results of in-place density tests were difficult to analyze because compaction standards were not listed from which comparisons could be made.

b. Design Features. The principal design features of Wild Creek Dam are illustrated on the Plan, Profile and Cross-Section of the embankment that are enclosed in Appendix E as Plates 2 through 6. These plates are reproduced from the drawings issued by the Bethlehem Municipal Water Authority. The drawings show the embankment having a maximum height of 135 feet from the streambed elevation of approximately 700 to a design crest elevation of 835. The dam contained a central vertical impervious core that is shown extending down to the top of rock.

Underseepage is controlled by a 10 foot concrete core wall embedded three feet into rock. Below this, design drawings show a single line grout curtain with holes spaced three feet on-center.

The central clay core is encased in a rolled coarse fill without a transition filter or drainage system. The upstream slope is protected with an additional three feet of approximately 12-inch rock over a six inch sand and gravel bedding. The upstream varies in inclination from 2H:1V from the crest to elevation 820 to 2½H:1V from elevation 820 to 790 to 3H:1V from elevation 790 to elevation 760 and 3½H:1V below elevation 760. Downstream the slope varies from 2H:1V between elevation 835 and 805 to 2½H:1V from elevation 805 to 765 and 3H:1V below elevation 765. Reportedly, there is a downstream toe drain as shown on Plate 3.

A reinforced concrete spillway with a crest elevation of 820 is located in the right abutment of the dam. The hydraulic parameters of the spillway are discussed in Section 5 below. The design drawings identify the spillway walls to be basically of a cantilevered design with walls of uniform thickness. The stilling basin discharges into the original course of Wild Creek. Plate 2 shows the original spillway design which was changed, after a series of model studies were performed, to the configuration shown on Plate 4.

2.2 Construction.

a. Construction documentation is limited to a series of miscellaneous letters, notes and memoranda. Even the date of completion is left to speculation and is assumed to be early in 1941 or, possibly, late 1940. Construction photographs indicate that the dam and appurtenant structures were most likely constructed in general accordance with the design drawings.

2.3 Operation Data.

The construction permit indicates that the discharge system must maintain a minimum stream flow of 1.7 cfs. Water supply discharge records together with reservoir levels are maintained at the Chemical Building downstream. The flow to Bethlehem is controlled at the Chemical Building. Records documenting the use of the emergency drain facility were not available but are reportedly on file at the Chemical Building.

2.4 Evaluation.

a. Availability. All engineering data reproduced in this report and studied for this investigation were provided by the Pennsylvania Department of Environmental Resources.

b. Adequacy. Due to the limited amount of detailed engineering data available, the final assessments of this investigation were based primarily on the visual inspection, verbal reports of the dam operation, design drawings, miscellaneous reports, and the hydraulic analyses performed as part of this investigation which included hydrologic/hydraulic data from Beltzville Dam design studies.

c. Validity. Design drawings show the proposed borrow source and quarry location for the embankment. Records infer their use but do not directly confirm the location of borrow sources. In-place density tests were documented for a two-month period, Section 2.1, Reference 6, but do not present the standard curves from which a comparison can be made. Based on the visual inspection, construction photographs, and design drawings, it is concluded that the dam and appurtenances were most likely constructed as designed. It is noted that the chute spillway was re-designed, as shown on Plate 4, after a series of model studies were performed at Lehigh University (Section 2.1, Reference 4).

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 indicate that the dam and its appurtenances were properly constructed and are very well maintained.

b. Dam. During the visual survey, there were no indications or evidence observed of distortions in alignment or grade that would be indicative of movement of the embankment or foundation. A careful inspection of the dam disclosed no evidence of seepage emergence on the downstream slope except for drainage from the drainage blanket. Although this drainage blanket could not be located on the design drawings, notes on a State Inspection Report states that a drainage blanket discharges dam seepage into the stream channel location, shown on Photograph No. 8.

c. Appurtenant Structures. At the time of the inspection, not more than one inch of water was flowing over the spillway. The spillway flow was observed to be smooth and uniform over the crest and down the spillway channel. As shown on Photos 3 and 4, vertical cracks were observed midway between construction joints and two compression cracks were observed at construction joints (Photos 6 and 7). All other portions of the spillway are in excellent condition.

Some minor seepage was observed in the drain tunnel ceiling and side walls, principally at the construction joints. Additional seepage was observed at the concrete plug. At this plug approximately 8 to 12 inches of calcium carbonate deposits were observed on the tunnel floor. The exposed portion of the cast iron drain pipe was in excellent condition. Flow rates could not be determined but all seepage was clear. Some leaching was observed in the form of calcium carbonate deposits and stalactites. (See Photo No. 9).

The water supply tunnel was also inspected and the supply pipes were observed to be in excellent condition. Seepage was observed from many construction joints and stalacties of calcium carbonate were forming throughout the tunnel. In general, the tunnel was in good condition. The Control Tower and valves were also found to be in excellent condition.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of siltation, slope instability, or other features that would significantly affect the flood storage capacity of the reservoir.

e. Downstream Channel. Downstream of the stilling basin, Wild Creek flows in a rock streambed with no evidence of major erosion. The stream flows through a fairly wide brush covered flood plain which narrows considerably as it passes under Lakeside Drive. This flood plain presents no major obstructions to large volumes of water flow with the exception of the constriction on Lakeside Drive. Potential damage centers downstream include the bridge at Lakeside Drive, the Chemical Control Building and private properties along Wild Creek. Considering the potential for extreme property damage and possible loss of life during high flows, the structure is classified as High Hazard.

3.2 Evaluation.

The survey of the dam disclosed no evidence of apparent past or present movement to indicate instability of the dam embankment. The cracks observed along the spillway retaining wall can probably be attributed to excessive spacing between joints or lack of sufficient reinforcing steel and the compression distress attributed to slight movement of the wall. The seepage observed within the discharge conduits does not appear to represent an immediate hazard to the integrity of the dam.

SECTION 4
OPERATION PROCEDURES

4.1 Procedures.

The maximum reservoir level is regulated by discharge over the spillway with a design crest elevation of 820. Water for public consumption use is drawn off through the two 38-inch pipes with the flow regulated at the Chemical Building. Shut-off valves for these pipes are located both in the Control Tower and in the Chemical Building. The reservoir emergency drain line which exits into the streambed downstream of the dam has a valve just inside the entrance chamber. Operation records for all control devices are maintained at the Chemical Building.

4.2 Maintenance of the Dam.

The dam is reportedly maintained by the Owner's personnel who periodically check the structure and repair as necessary.

4.3 Maintenance of Operating Facilities.

The valve control mechanisms and the intake tower are clean; painted and lubricated as needed to insure proper operation and indicate periodic maintenance. All valves in the intake tower were exercised and appeared to operate properly. Valves in the Chemical Building were not inspected. The emergency reservoir drain valve was not exercised but appeared to be in good condition.

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 Chemical Building at all times and available to inspect the dam during critical conditions.

4.5 Evaluation.

It is believed that the current operating procedures are a reasonably realistic means of operating the control facilities of Wild Creek Dam. A formal warning procedure to be implemented during periods of extreme rainfall should be formulated so that residents downstream could be amply warned of possible high volumes of flow in Wild Creek and the bridge downstream (constricting conditions) monitored.

SECTION 5
HYDROLOGY/HYDRAULIC

5.1 Evaluation of Features.

a. Design/Evaluation Data. Original design data was limited to statements in the Application Report, dated August 29, 1938; a 1942 memo to the file; an April 4, 1939 telegram to Mr. Charles Ryder from Mr. Thaddeus Merriman; and an undated, unsigned computational check in the files. More comprehensive hydrologic data is contained in the Beltzville Dam and Reservoir Investigation, Design Memorandum No. 1, Hydrology and Hydraulics, prepared by the Corps of Engineers.

(1) The watershed above Wild Creek Dam, as disclosed by the State files, OCE report, and current USGS maps, is approximately 22 square miles, including the drainage area of the upstream dam, Penn Forest. The area between the two dams is 5.9 square miles, irregularly shaped, about 3.5 miles wide by 2.4 miles long. The area is 90 percent wooded and sparsely populated. Approximately 50 percent is owned by the Bethlehem Municipal Water Authority and part of the land is Pennsylvania State game lands. The watershed characteristics are not expected to change. Elevations range from 1202 at the extreme upper end to 820 at the reservoir. No swimming, fishing or boating is allowed in the reservoir; hunting is allowed outside the animal fence which surrounds the reservoir. Wild Creek Dam is located 2000 feet above the high water line of Beltzville Dam.

(2) According to the April 4, 1939 telegram, the spillway was designed to pass the PMF, but no value was mentioned. The spillway model tests results presented in the Alumni Bulletin state that the spillway is capable of passing a maximum of 17,500 cfs, but does not mention the required head. The theoretical discharge (head equal to 15 feet) was greater than 19,000 cfs according to the calculations in the State files.

(3) An evaluation of Wild Creek Dam, along with its upstream Dam, Penn Forest, was performed by the Corps of Engineers during the investigation of Beltzville Dam and Reservoir. The PMF peak inflow was determined to be 16,800 cfs and the routed peak outflow is 15,300 cfs.

(4) Under established criteria of Federal (OCE) Guidelines, the recommended spillway design flood for the size (Large) and hazard potential (High) classification of this dam is the probable maximum flood.

b. Experience Data. Rainfall records are kept at the Chemical Building located about 2000 feet downstream of the dam and sent periodically to the Weather Service. Daily reservoir water surface elevations are also maintained. The record flow over the spillway occurred on August 2, 1969 when the depth of flow over the spillway was 1.35 feet (estimated 472 cfs) resulting from 4.6 inches of rainfall in 24 hours recorded at the Chemical House.

c. Visual Observations. On the date of the inspection, no conditions were observed that would indicate that the capacity of the appurtenant structures would be significantly reduced during a flood occurrence. Detailed observations are located in Appendix B.

d. Overtopping Potential. The studies performed by the Corps indicated that Wild Creek Dam spillway is capable of passing the PMF without overtopping. The estimated freeboard is greater than one foot (see Appendix C, Sheet 4). The same study indicated that the upstream Penn Forest Dam is also capable of passing the PMF without overtopping. In the event that Penn Forest Dam should fail during the PMF, Wild Creek Dam would also fail as a result of the large inflow.

e. Spillway Adequacy.

(1) As Wild Creek Dam Spillway is capable of passing the PMF without overtopping, the spillway capacity is adequate. The tailwater during passing of the PMF is estimated to be 80 feet or more below the spillway crest.

(2) Located between Wild Creek Dam and Beltzville Reservoir (a distance of about 2000 feet) are two homes and the Chemical Building for Bethlehem Municipal Water Authority. If Both Penn Forest and Wild Creek Dams were to fail during the PMF, Beltzville Dam would contain the inflow of water with about 1.5 feet of freeboard (Corps of Engineers' Report).

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The visual observations did not indicate any existing embankment stability problems. The visual inspection of the spillway walls revealed several vertical cracks between construction joints and two compression spalls that do not appear to be detrimental to the stability of the walls.

Seepage was observed primarily between construction joints of the drain tunnel and water supply tunnel. Potential conditions of instability were not observed in either tunnel.

b. Design and Construction Data. Since there is no evidence that any formal stability or seepage analyses were ever made for this dam, the evaluation of the structural stability can be based only on a review of the design drawings. The visual inspection and past performance indicates that the dam is presently stable. Although there are no direct records, inferences in the documentation indicate that the borrow source and quarry sites noted in the design documents were used during construction. Photographs of construction tend to confirm that proper placement and zoning were performed.

c. Operating Records. Verbal reports of the performance of the dam gave no indication of any hazard associated with the operation of the dam.

d. Post-Construction Changes. There were no reports nor is there any evidence that modifications or alterations were made to the dam.

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 loading. However, since there are no formal static stability analyses, the theoretical seismic stability of this dam cannot be assessed.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection and the long-term performance of Wild Creek Dam indicates that the dam embankment and foundation has and is performing satisfactorily. The concrete cracks at the spillway wall are believed to represent a defect in the structure, but not necessarily an immediate hazard to the safety of the dam. Similarly, while the conditions, primarily seepage, within the discharge tunnels are indicative of structural discontinuities, these features do not appear to represent a serious hazard to the integrity of the dam.

The hydraulic and hydrologic analyses were performed using data developed for Beltzville Dam, a downstream watershed, by the Corps of Engineers. Using this data and the proper scaling effects, this analyses indicates that the dam would pass the PMF event. Thus, the spillway is considered "Adequate".

b. Adequacy of Information. The information available is such that the assessment of the safety of the dam embankment must be based primarily on the visual inspection, hydraulic analysis and existing documentation available.

c. Urgency. Recommendations presented below should be implemented as soon as practicable.

d. Necessity of Additional Studies. Although the data did not include summaries of the stability analysis of the embankment, the visual inspection of the embankment does not indicate that additional studies are needed.

7.2 Recommendations

a. Facilities. It is recommended that seepage flow from the tunnel cracks/joints be monitored on a periodic basis (yearly). Should the flow increase appreciably or become turbid, the cracks should be sealed.

b. Operation and Maintenance Procedures. A formal warning procedure during periods of high precipitation and runoff should be developed and implemented. The Owner should also develop an operation procedure to follow in the event of an emergency.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Wild Creek Reservoir*

ID # *PA 00609*

ITEM	REMARKS
AS-BUILT DRAWINGS	*Pennsylvania files contained only design drawings. Very little difference was observed between design drawings and field observations.*
REGIONAL VICINITY MAP	*See Plate 1 of report.*
CONSTRUCTION HISTORY	*Very little construction data was available.*
TYPICAL SECTIONS OF DAM	*This data was included in the Pennsylvania files and a typical embankment section is enclosed in the report.*
OUTLETS - PLAN	*Data was available in the Pennsylvania files.*
DETAILS	
CONSTRAINTS	*There were none found in the files and none observed downstream.*
DISCHARGE RATINGS	*This data was not readily available.*
RAINFALL/RESERVOIR RECORDS	*Discharge records and rainfall data are maintained in the Chemical Plant downstream.*

ITEM	REMARKS
DESIGN REPORTS	*No reports in the files.*
GEOLOGY REPORTS	*Site geologic conditions documented in letter dated November 22, 1938 addressed to Bethlehem Municipal Water Authority from Benjamin L. Miller, Geologist of Lehigh University. Also current publications available from Pennsylvania State Geological Survey.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*There were no reports in the files. However, there is a letter from Mr. Robert Fox, dated August 29, 1939, which states that Lehigh University performed model studies and redesigned the spillway and stilling pool to handle 17,000 cfs. A copy of Lehigh's report by Dr. A.T. Ippen, dated November, 1939, is in the file.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*No reports in the file.*
POST-CONSTRUCTION SURVEYS OF DAM	*None in the file.*
BORROW SOURCES	*These were noted on drawings but there was no documentation found confirming their use.*

ITEM	REMARKS
MONITORING SYSTEMS	*None*
MODIFICATIONS	*None*
HIGH POOL RECORDS	*The maximum recorded water surface elevation of the reservoir was 821.35 in 1969 as a result of a 4.62inch rainfall.*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None known.*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None reported in Pennsylvania files.*
MAINTENANCE OPERATION RECORDS	*No formal written documents.*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*Plan views, sections and miscellaneous details were in Pennsylvania files and available for review*
OPERATING EQUIPMENT PLANS & DETAILS	*Blueprints of the valves and other water outlet controlling devices were available for review. Selected drawings are enclosed in the report.*

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Wild Creek Reservoir* County *Carbon* State *Pennsylvania* National ID # *PA 00609*

Type of Dam *Earth and Rock* Hazard Category *I*

Date(s) Inspection *11 May 1978* Weather *Clear and Warm* Temperature *65-70°F*

Pool Elevation at Time of Inspection *820* M.S.L. Tailwater at Time of Inspection *680* M.S.L.

Inspection Personnel:

Mary Beck (Hydrologist)
John Boschuk (Geotech/Civil)
John H. Frederick (Geotechnical) (performed site inspection 5/9/78)
Vincent McKeever (Hydrologist)
Richard Mabry (Geotechnical)
Raymond Lambert (Geologist)

John Boschuk, Jr. Recorder

Remarks:

Other personnel on-site included: *John Anspack* - *Owner-Representative*
Larry Enstrom - *Caretaker*
Roger Gordon - *Representative for Optical Techniques, Inc.*
Joseph Ellam - *Representative of DER On-site for 2 hours only*

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 were observed*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None were observed*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*None were observed, but some minor slughing associated with degradation of rock at the right abutment of the dam near the right wall of the intake channel entrance.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*No significant movement was observed.*	
RIPRAP FAILURES	*None observed.*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*There were no discontinuities or distorsions observed at these contact zones except as noted on Sheet 4, third item.*	
ANY NOTICEABLE SEEPAGE	*There was not seepage observed through the abutments of the dam. However, seepage was observed beyond the toe approximately 30 feet downstream of the diversion conduit entrance house on the right side. This same seepage was noted during an April 23, 1941 inspection by Mr. Scott H. Bair. The Resident Engineer, Mr. J.S. Richards explained that the seepage was a french drain.*	
STAFF GAGE AND RECORDER	*Water levels are taken daily with a calibrated rope at the intake tower. Data is maintained at the treatment plant.*	
DRAINS	*The french draines noted above appears to be operating properly and the water was flowing clearly. A 90° weir is located just downstream of this drain. The weir reading at the time of inspection was 0.469 feet.*	

OUTLET WORKS

(Primary Water Supply System)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*The conduit tunnel was inspected from the manhole upstream to the bulkhead (approximately 1000 feet). The pipes appeared to be in good condition with no leakage observed. There was some leakage from joints and cracks in the tunnel especially at the upper end, approximately 30 feet from the bulkhead. The water does not appear to be under pressure and maximum flow from any single seep is approximately 1/2 gpm. Most flows are less then 1/4 gpm. These joints should be reinspected within the next 5 years and sealed if flow increases.*	
INTAKE STRUCTURE	*The intake tower appeared to be in good to excellent condition. All valves were exercised and appeared to operate properly. It is reported by the Owner that plans have been made to recondition the intake system in the near future. Intake screens are cleaned once a month on the average.*	
OUTLET STRUCTURE	*The outlet structure consists of two pipes which feed water under ground via a tunnel from the intake tower to the chemical treatment plant. This tunnel was inspected and the pipes were observed to be in good condition. There is one crack 4 ft. upstream on east wall from first valve. There is a 20-inch long crack in same area with a flow of $\leq$ 1 gpm out of lower 1/3. The sixth pipe joint from the bulkhead wall leaks around the entire joint; steel is exposed to west. First pipe joint from bulkhead also leaks at a rate of < 1 gpm.*	
OUTLET CHANNEL	*None*	
EMERGENCY GATE	*(Blow-Off Valve and Pipe): The blow-off pipe (diversion pipe) is housed in a tunnel and the pipe discharges downstream of the dam. This tunnel was inspected and the pipe was observed to be in good condition. Some minor seepage was observed in the tunnel roof near the bulkhead wall and at a few locations along the tunnel. Flow was usually less than 1/2 gpm. A reinspection should be performed within the next 5 years. If flow increases significantly, the cracks should be sealed.*	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*The concrete weir is 85 feet long, water flows uniformly over crest and down the chute, indicating no settlement has taken place.*	
APPROACH CHANNEL	*The approach channel is 10 feet deep (at weir) and is approximately 80 feet long with wing walls extending 15 feet above weir crest elevation*	
DISCHARGE CHANNEL	*The concrete chute discharges into a stilling basin. The stilling basin end wall is approximately 10 feet above the natural stream bed.*	
BRIDGE AND PIERS	*An abandoned stone arch road bridge is located approximately 300 feet downstream from stilling basin. The bridge will not obstruct flow from the spillway.*	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*N/A*	
APPROACH CHANNEL	*N/A*	
DISCHARGE CHANNEL	*N/A*	
BRIDGE AND PIERS	*N/A*	
GATES AND OPERATION EQUIPMENT	*N/A*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*One weir is located downstream of the outlet pipe inspection entrance just downstream of the toe.*	
PIEZOMETERS	*None*	
OTHER	*USGS stream gaging station is located on Wild Creek above Wild Creek Dam and below Penn Forest Dam. Weather Service Rain Gaging Station (Kresgeville 3W) located at the Chemical Building downstream from Wild Creek Dam.*	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

SLOPES *Reservoir slopes are stable and range from moderate to steep with conifers growing up to the water's edge.*

SEDIMENTATION *No visible sedimentation at upper ends of reservoir, therefore, no reduction in flood water storage expected.*

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*The channel downstream of the stilling basin meanders through the flood plain which is brush covered. There is an abandoned road bridge, approximately 300 feet downstream of stilling basin. Channel passes under highway bridge approximately 800 feet downstream of stilling basin.*	
SLOPES	*The channel gradient is approximately two percent and the channel slopes are covered with trees and brush.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*The chemical building and facilities and one other home are located between Wild Creek Dam and Beltzville Dam and Reservoir, which would be subject to damage if the dam failed.*	

APPENDIX

C

WILD CREEK DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *mostly wooded, upstream dam controls about 72% of watershed*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *820 (4,100 mgal)*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *835 top of dam*

ELEVATION MAXIMUM DESIGN POOL: *830*

ELEVATION TOP DAM: *835*

SPILLWAY:

a. Elevation *820*

b. Type *ogee weir with concrete chute spillway*

c. Width *N/A*

d. Length *85'*

e. Location Spillover *right abutment*

f. Number and Type of Gates *none*

OUTLET WORKS: *(Water Supply)*

a. Type *two 38-inch diameter*

b. Location *left abutment*

c. Entrance inverts *720*

d. Exit inverts *to Chemical Building*

e. Emergency draindown facilities *36-inch CTP located in 14-ft. diversion tunnel*

HYDROMETEOROLOGICAL GAGES:

a. Type *Standard Rain Gage*

b. Location *Chemical Building*

c. Records *At Chemical Building and sent to Weather Service*

MAXIMUM NON-DAMAGING DISCHARGE: *not determined*

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

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

DAM Wild Creek Nat. ID No. PA 609 DER No. 13-83

	ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1.	Min. Crest Elev., ft.	835 ft.		
2.	Freeboard, ft.	5 ft.		
3.	Spillway(1) Crest Elev, ft.	820 ft.		
3a.	Secondary(2) Crest Elev, ft.	—		
4.	Max. Pool Elev., ft.	830 ft		
5.	Max. Outflow(3), cfs	15,000 cfs	15,300 cfs	
6.	Drainage Area, mi^2	22 $mile^2$	22.1 $mile^2$	
7.	Max. Inflow(4), cfs		16,800 cfs	
8.	Reservoir Surf. Area	238 Ac		304 Ac.
9.	Flood Storage(5)			
10.	Inflow Volume			

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.

Date: 5/8/78
By: MFB
Sheet: 3 of 5

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Item (from page	Source
2A, 5A, 6A, 8A, 4A	Application Report, dated Aug. 29, 1938
	Construction Drawings, Contract No. 5
1A	Dwg. 7, March 1, 1939
3A	Dwg 12-A, Aug. 26, 1939
8C, 6C	USGS Maps Pohopoco Mountain (1970)
5B, 6B, 7B	C of E Design Memo No. 1 Beltzville Dam and Reservoir Hydrology and Hydraulics

BY _____ DATE _____ SUBJECT _____ SHEET 4 OF 5

CHKD BY _____ DATE _____ Hydrology & Hydraulics JOB No _____

Wild Creek Dam

Spillway Discharge

$Q = C L H^{3/2}$

L = crest length = 85 ft.

hydraulic model studies indicate a maximum discharge of 17,500 cfs

assume H = 15' (maximum value)

$17{,}500 = 85 \cdot C \cdot 15^{3/2}$

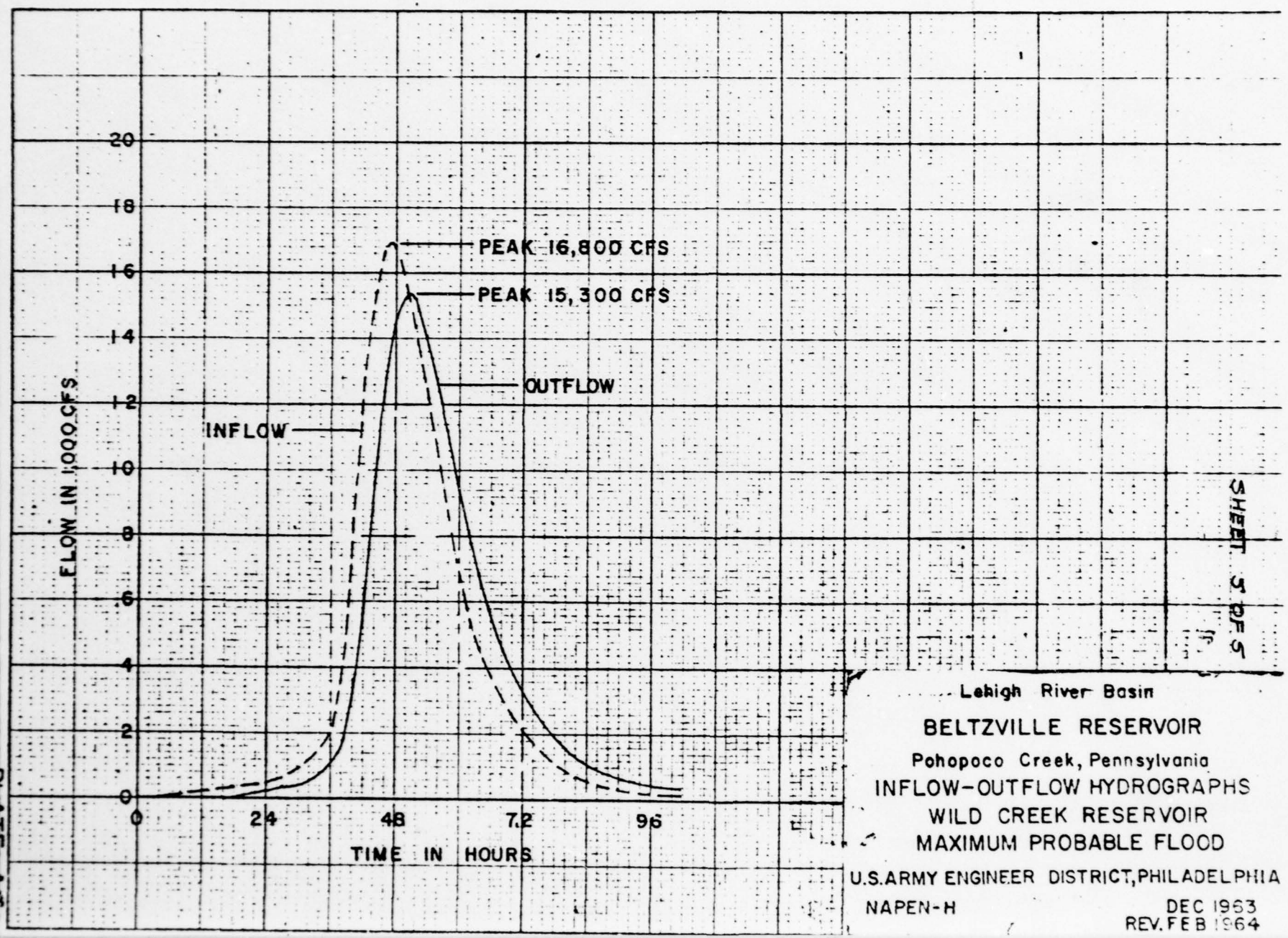
C = 3.54 assume this value constant

Freeboard associated with routed PMF (see sheet 5)

$15{,}300 \text{ cfs} = 85 \cdot 3.54 \cdot H^{3/2}$

H = 13.7 ft.

15 - 13.7 = 1.3 ft freeboard



SHEET 5 OF 5

Lehigh River Basin

BELTZVILLE RESERVOIR

Pohopoco Creek, Pennsylvania

INFLOW-OUTFLOW HYDROGRAPHS

WILD CREEK RESERVOIR

MAXIMUM PROBABLE FLOOD

U.S. ARMY ENGINEER DISTRICT, PHILADELPHIA

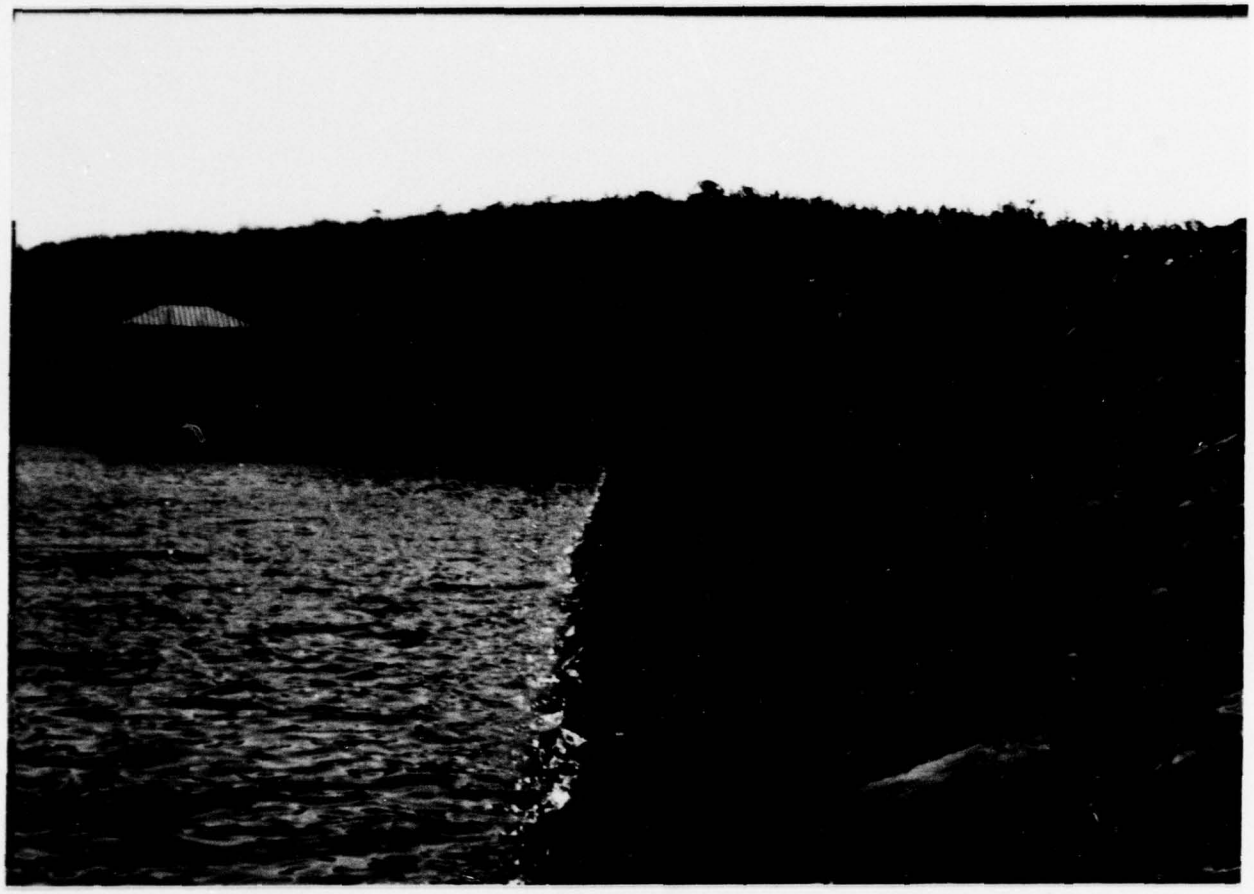
NAPEN-H

DEC 1963

REV. FEB 1964

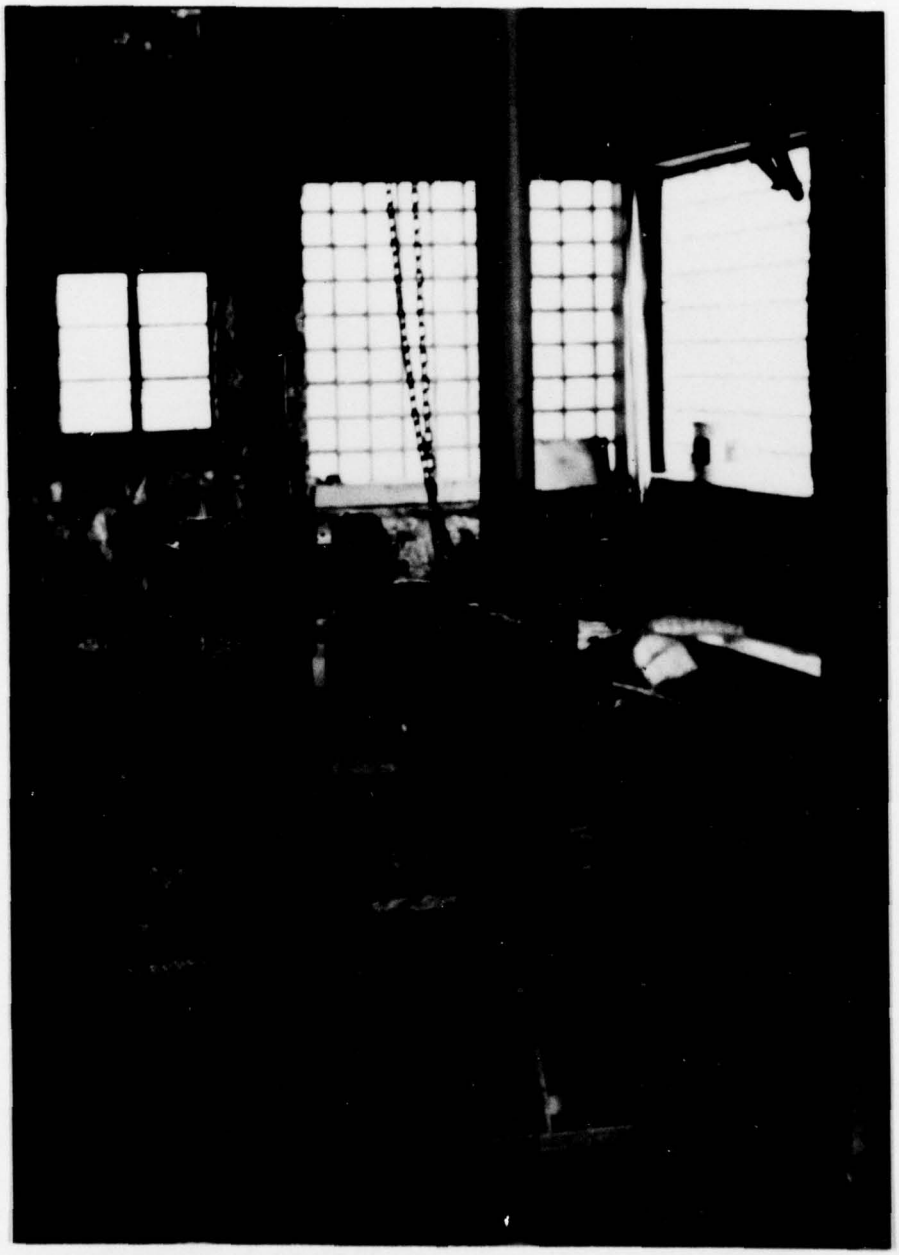
APPENDIX

D



VIEW LOOKING FROM UPSTREAM SLOPE TOWARDS LEFT ABUTMENT
AT INTAKE TOWER.

PHOTO NO. 1



VIEW INSIDE TOWER LOOKING AT WATER SUPPLY CONTROL VALVES. EACH VALVE WAS EXERCISED BY THE PLANT OPERATOR.

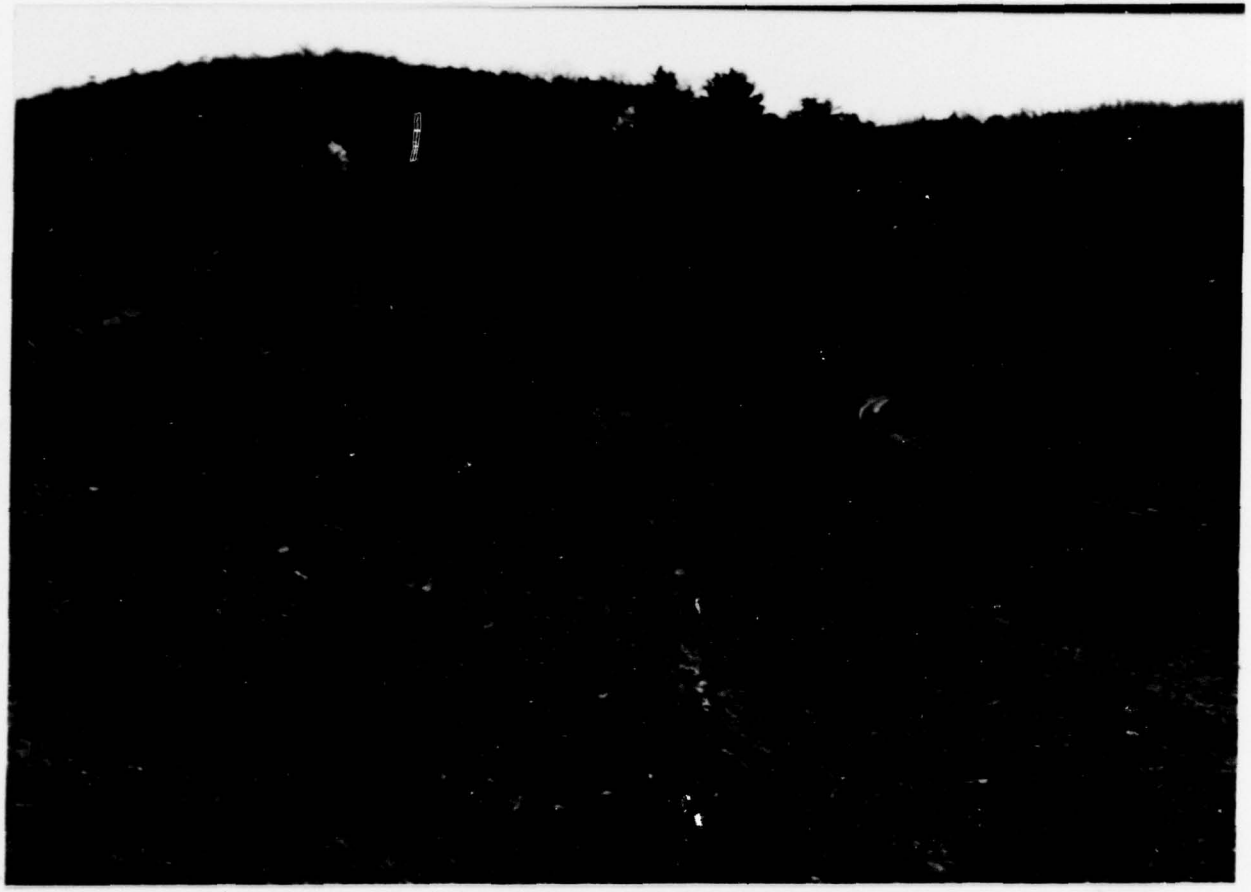
PHOTO NO. 2

VIEW OF EMERGENCY SPILLWAY CREST. RIGHT RETAINING WALL IS IN THE BACKGROUND.

PHOTO NO. 3

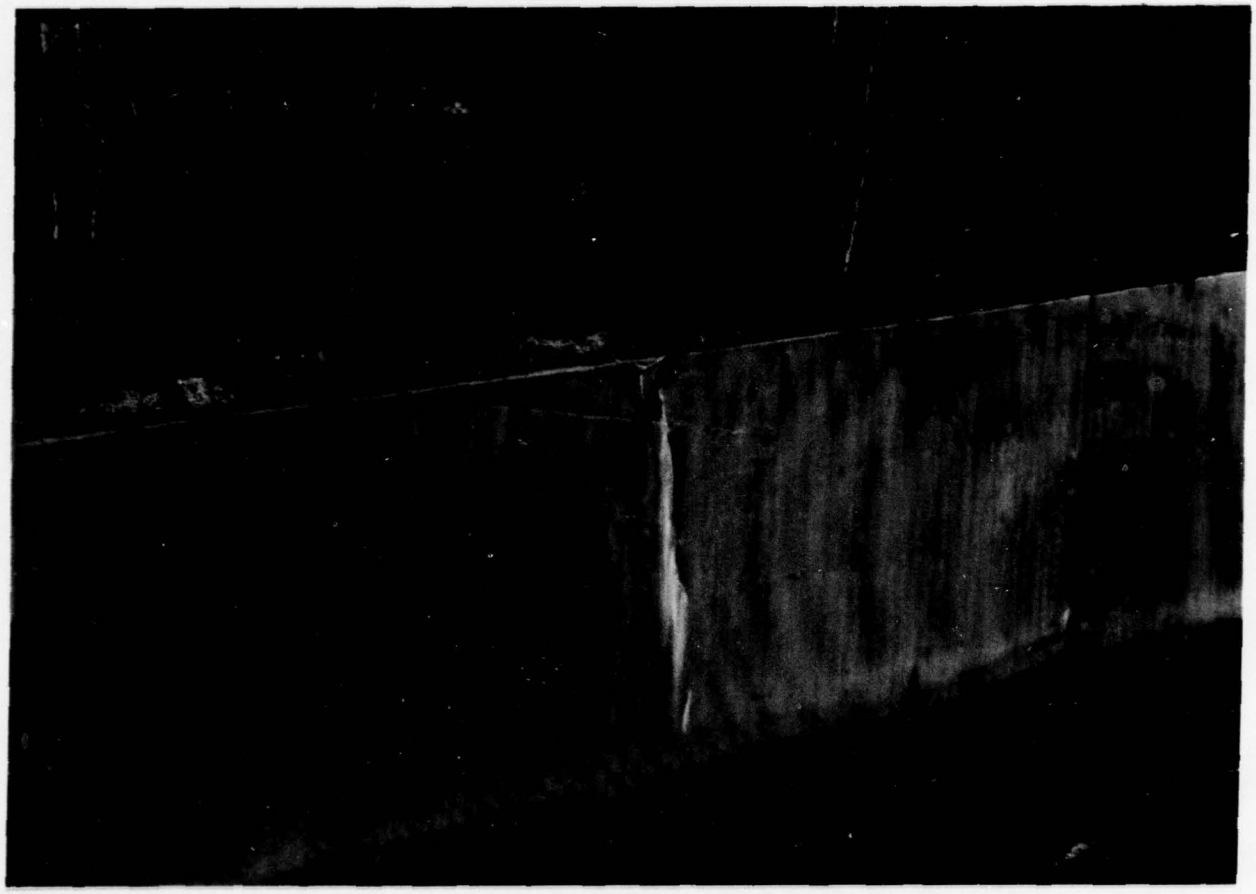
VIEW LOOKING DOWN EMERGENCY SPILLWAY. THE DAM IS LOCATED LEFT OF SPILLWAY OUTSIDE OF CAMERA VIEW.

PHOTO NO. 4



VIEW OF DOWNSTREAM EMBANKMENT SLOPE LOOKING AT THE LEFT ABUTMENT.

PHOTO NO. 5

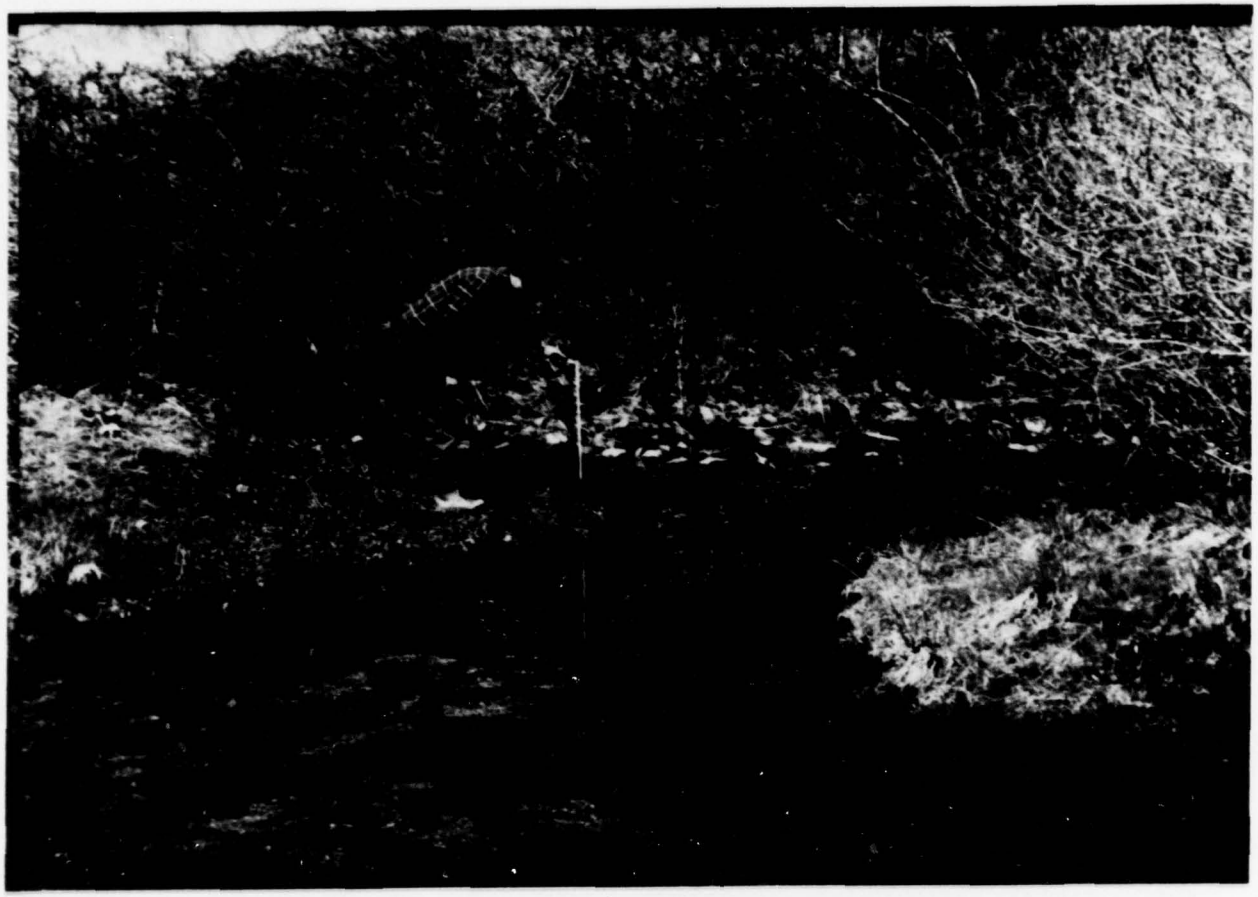


VIEW OF RIGHT RETAINING WALL OF EMERGENCY SPILLWAY. NOTE VERTICAL CRACK APPROXIMATELY MID-WAY BETWEEN CONSTRUCTION JOINTS. SEVERAL CRACKS OF THIS TYPE WERE OBSERVED AT SEVERAL SECTIONS OF THE WALL ON BOTH SIDES OF THE SPILLWAY.

PHOTO NO. 6

LEFT RETAINING WALL OF EMERGENCY SPILLWAY LOOKING DOWN AT COMPRESSION FAILURE AT CONSTRUCTION JOINT. SPILLWAY CHANNEL IS LOCATED AT TOP OF PHOTO. TWO JOINTS OF THIS NATURE WERE OBSERVED.

PHOTO NO. 7

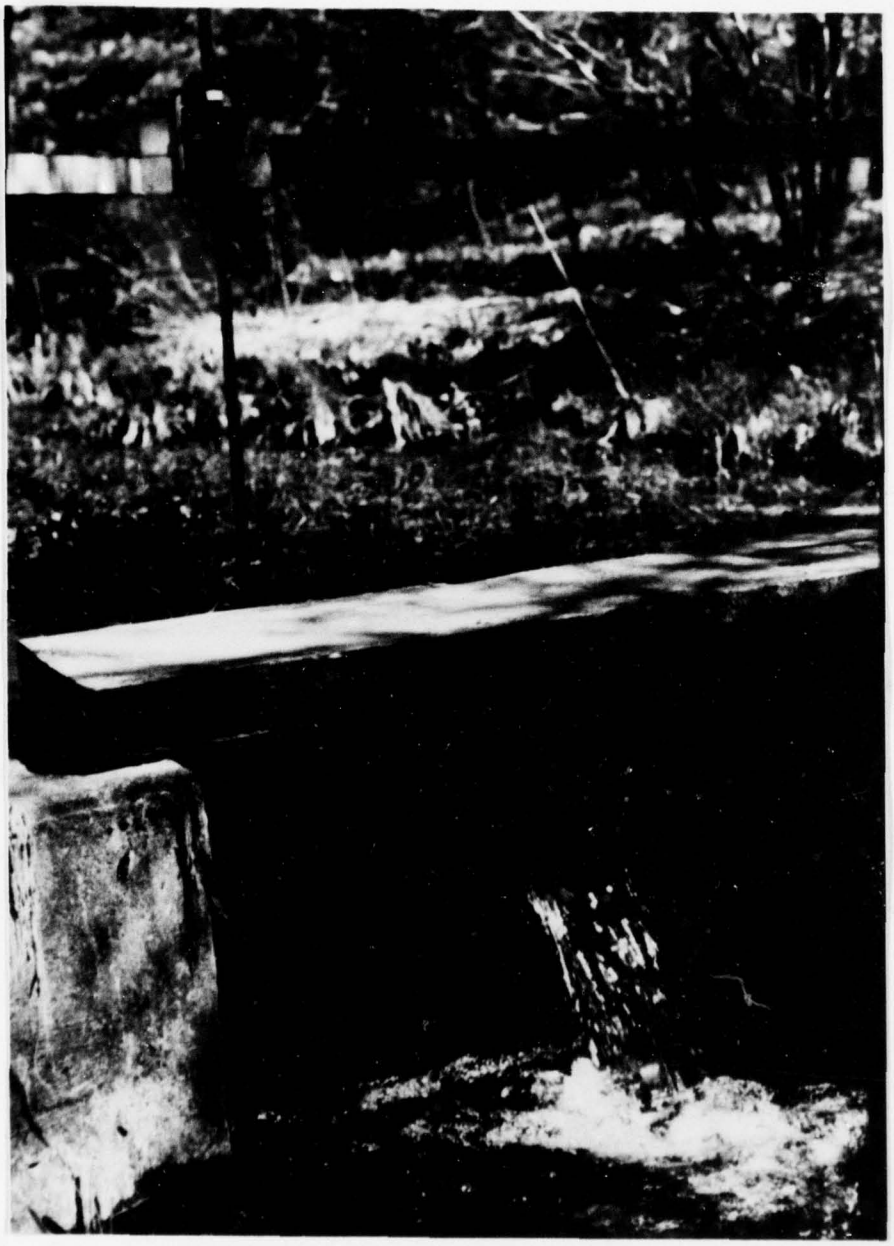


VIEW LOOKING UPSTREAM AT EXIT OF FRENCH DRAIN LOCATED DOWNSTREAM OF DISCHARGE PIPE ON RIGHT SIDE OF CHANNEL.

PHOTO NO. 8

VIEW INSIDE DIVERSION TUNNEL LOOKING UPSTREAM. CALCITE DEPOSITS OF 8 TO 12 INCHES THICK WERE OBSERVED RESULTING FROM SEEPAGE THROUGH JOINTS.

PHOTO NO. 9

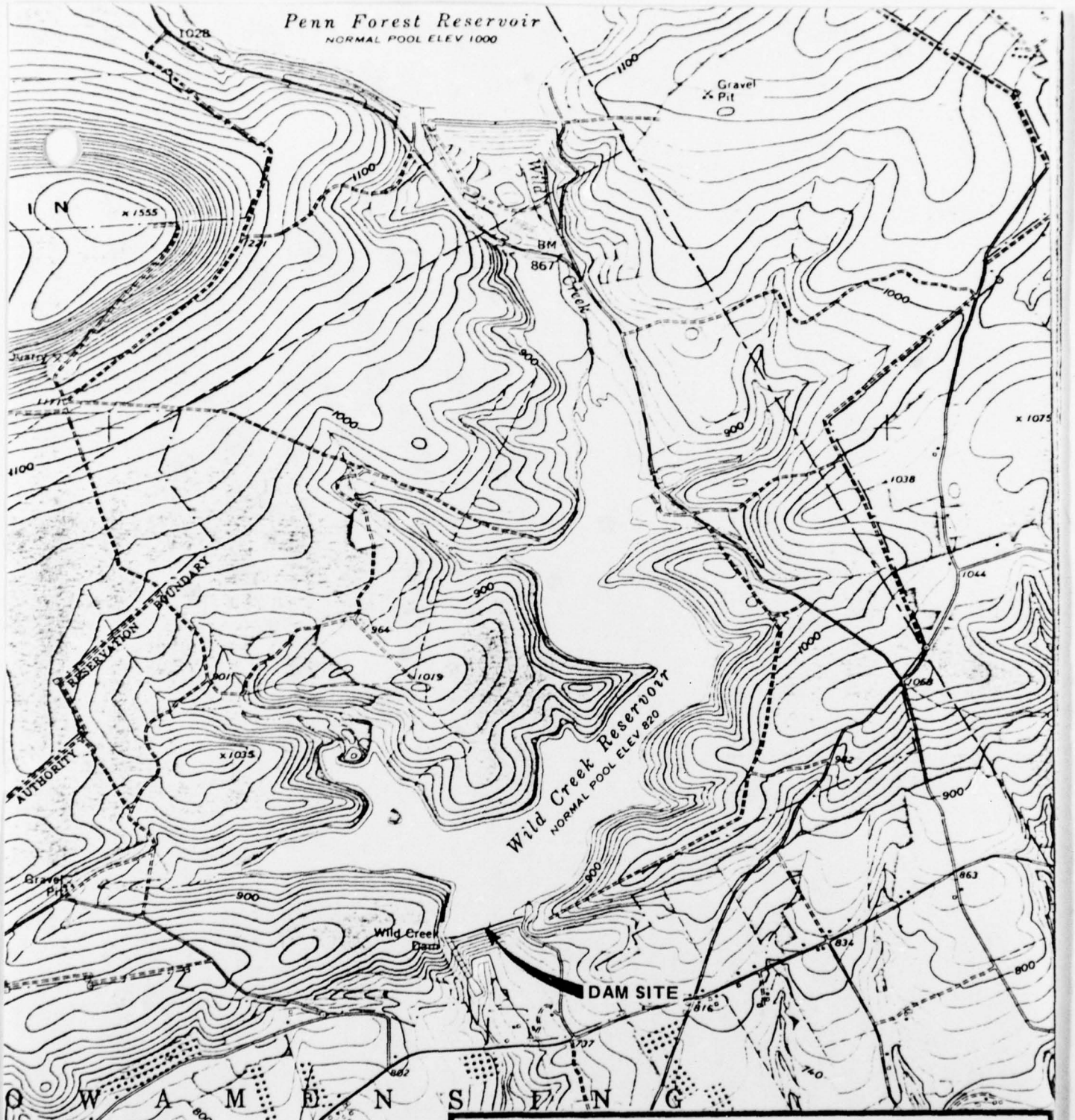


VIEW OF "V" NOTCH WEIR LOCATED DOWNSTREAM
OF DIVERSION TUNNEL OUTLET STRUCTURE.

PHOTO NO. 10

APPENDIX

E

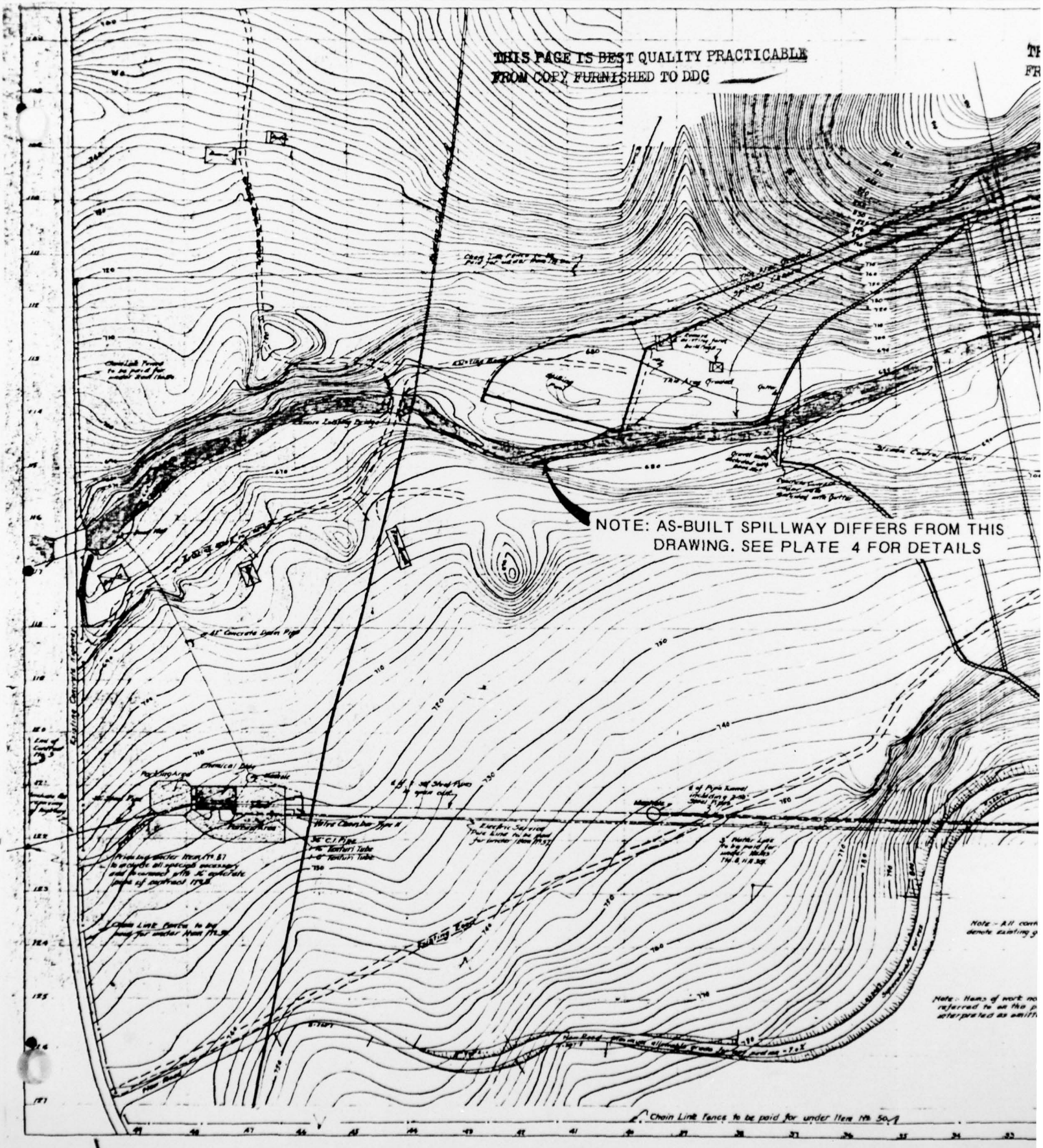


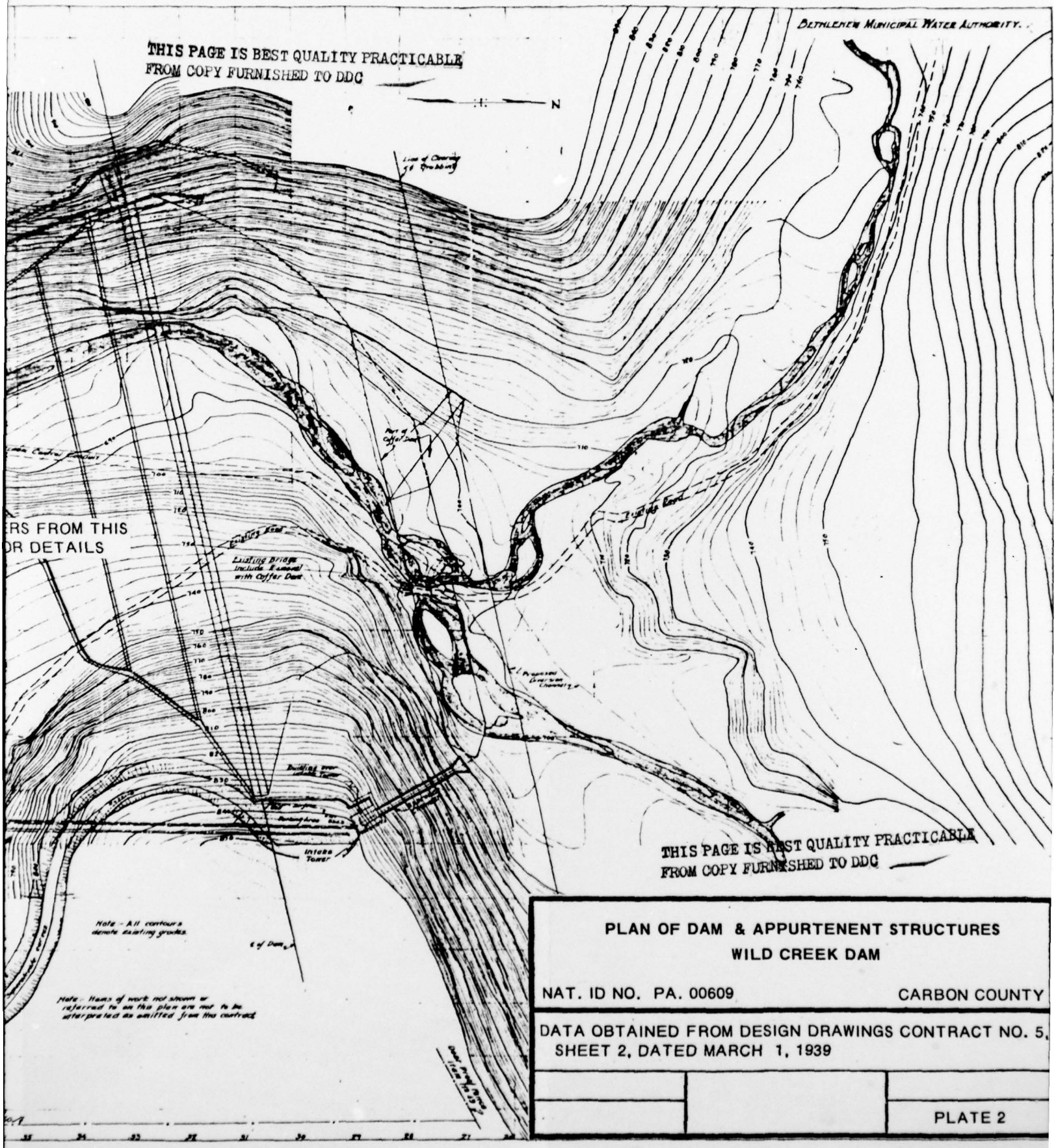
REGIONAL LOCATION PLAN
WILD CREEK RESERVIOR

NAT. ID NO. PA.00609 CARBON COUNTY

DATA OBTAINED FROM U.S.G.S. QUAD SHEET
POHOPOCO MOUNTAIN

PLATE 1



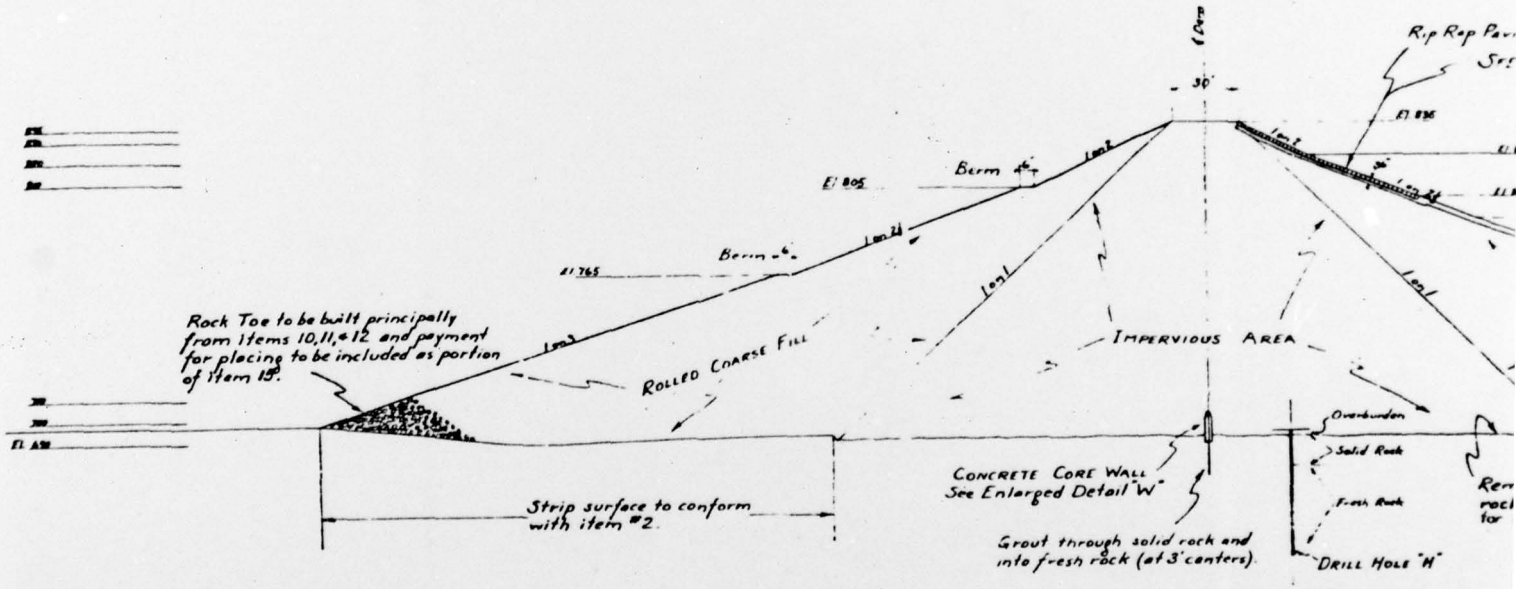


PLAN OF DAM & APPURTENENT STRUCTURES
WILD CREEK DAM

NAT. ID NO. PA. 00609 CARBON COUNTY

DATA OBTAINED FROM DESIGN DRAWINGS CONTRACT NO. 5, SHEET 2, DATED MARCH 1, 1939

PLATE 2



SECTION "A-A"
See Sheet #6 Contract #5
Scale 1" = 50'

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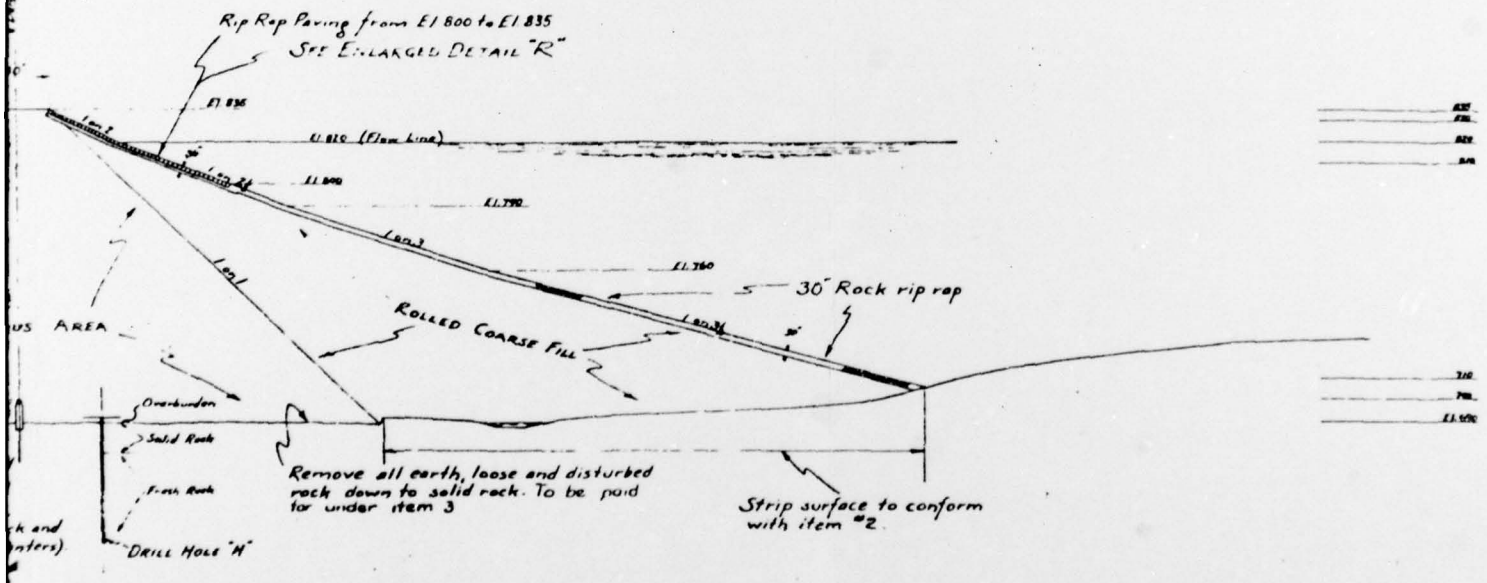

N "A-A"
"6 Contract "5
1"=30'

TYPICAL DESIGN EMBANKMENT WILD CREEK DAM	
NAT. ID NO. PA. 00609	CARBON COUNTY
DATA OBTAINED FROM DESIGN DRAWINGS CONTRACT NO. 5, SHEET 7, DATED MARCH 1, 1939	
	PLATE 3

2

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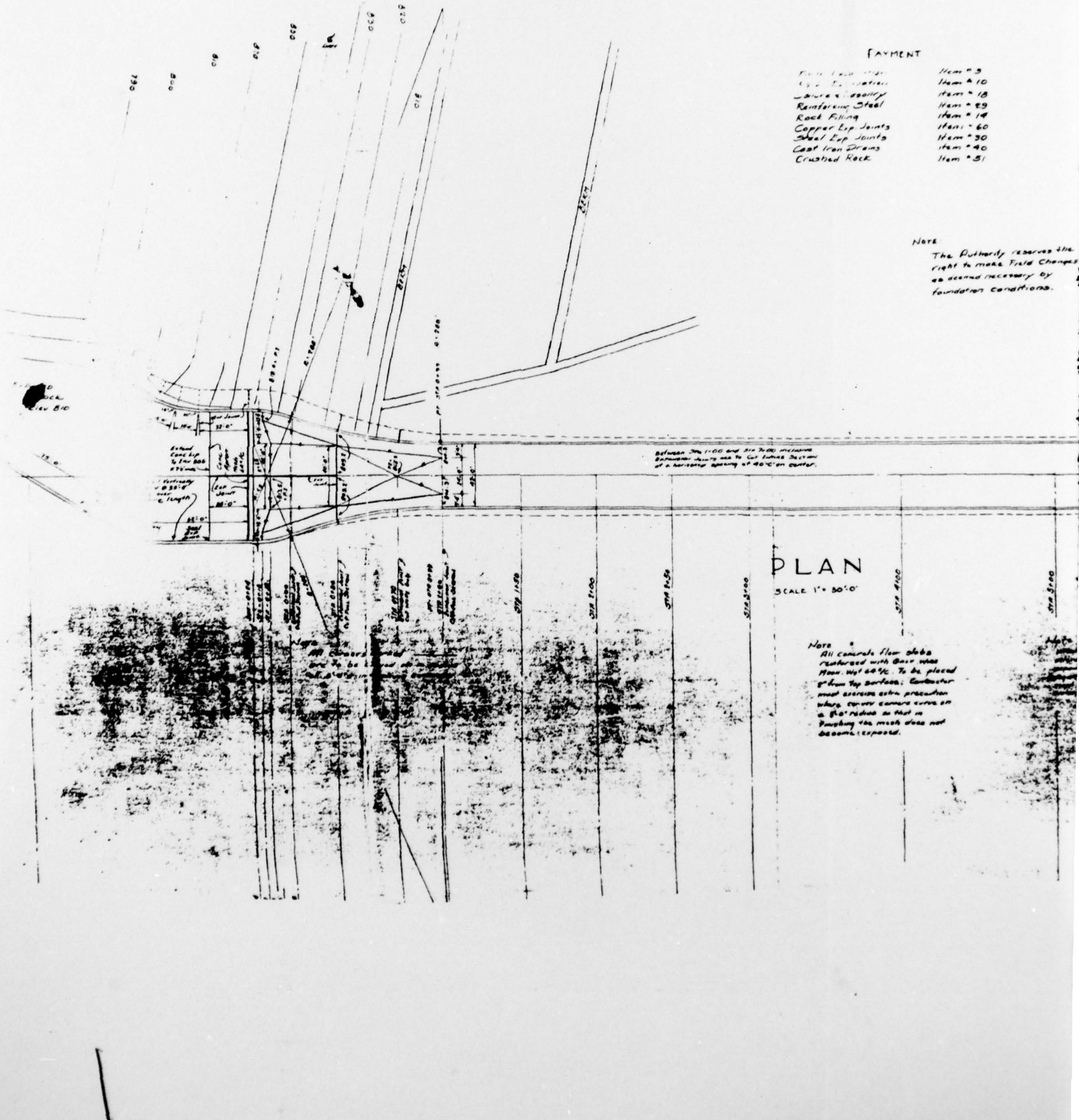

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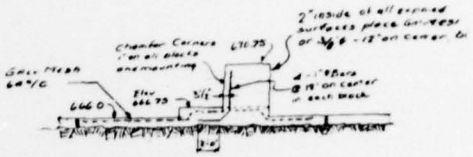
BETHLEHEM MUNICIPAL WA...

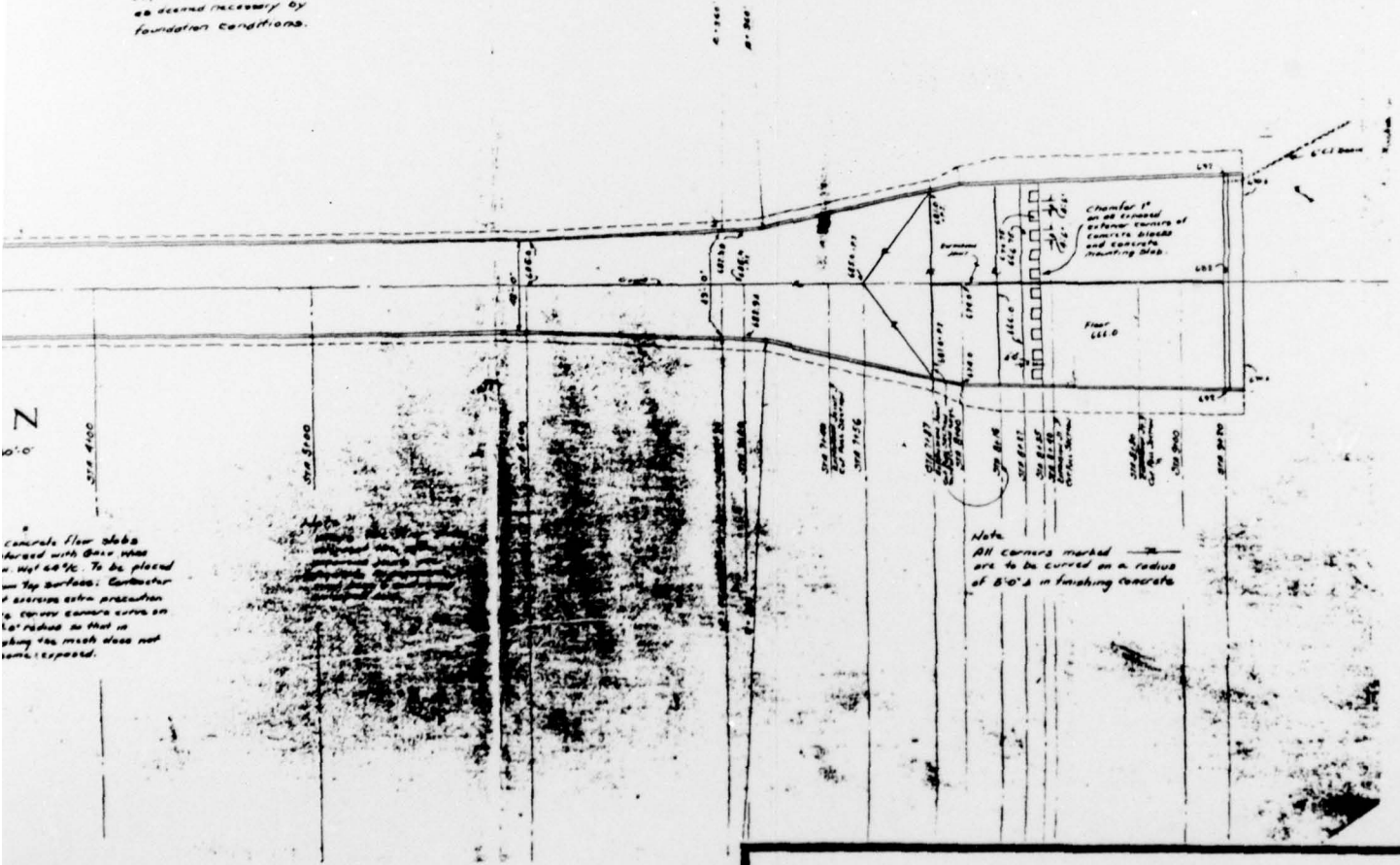
PAYMENT

[illegible]	Item # 3
[illegible]	Item # 10
[illegible]	Item # 18
Steel	Item # 29
[illegible]	Item # 14
Joints	Item # 60
Joints	Item # 30
Drains	Item # 40
Rock	Item # 31

Note
The Authority reserves the right to make field changes as deemed necessary by foundation conditions.



SECTION OF BLOCKS
SCALE 1" = 1'0"



PLAN OF EMERGENCY SPILLWAY
WILD CREEK DAM

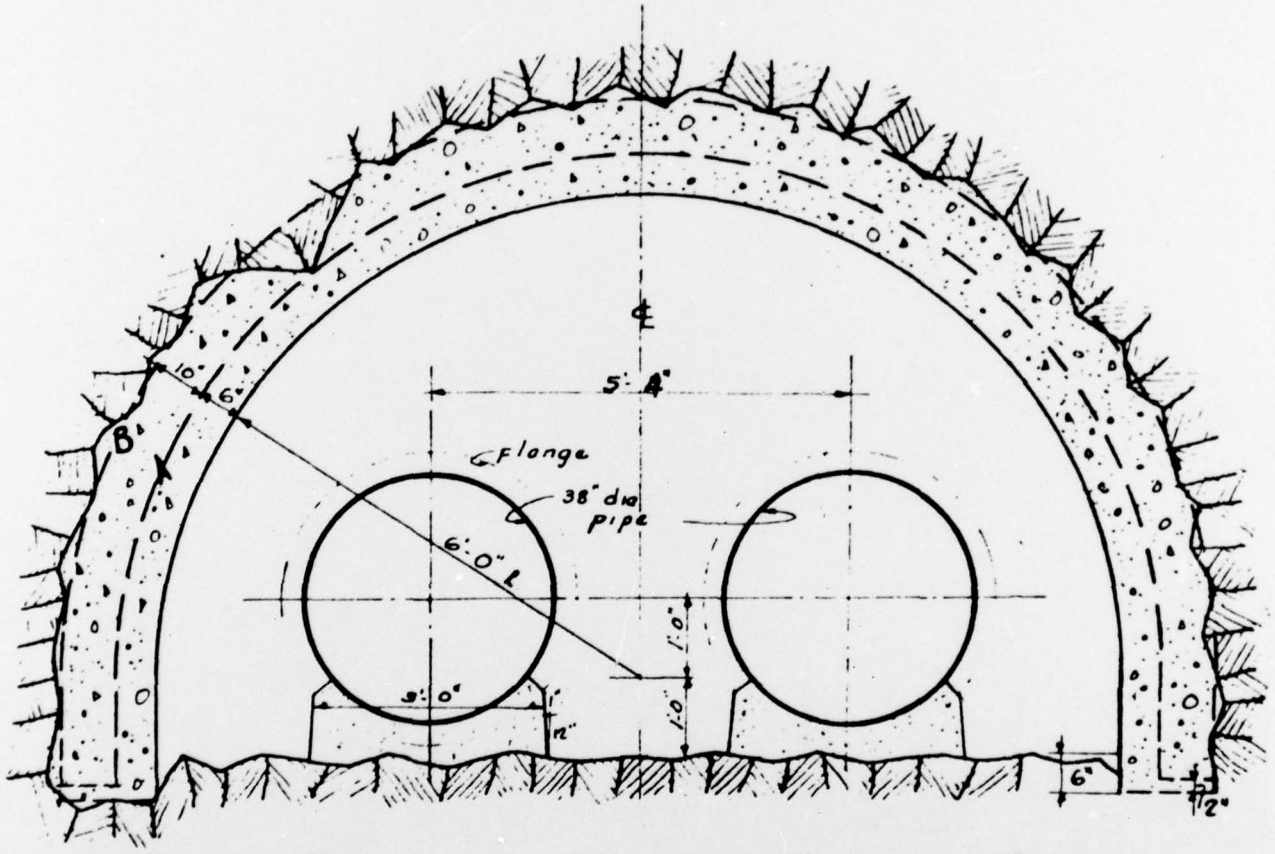
NAT. ID NO. PA.00609 CARBON COUNTY

THE SPILLWAY WAS REDESIGNED AS SHOWN FROM MODEL STUDIES PERFORMED AT LEHIGH UNVERSITY

2

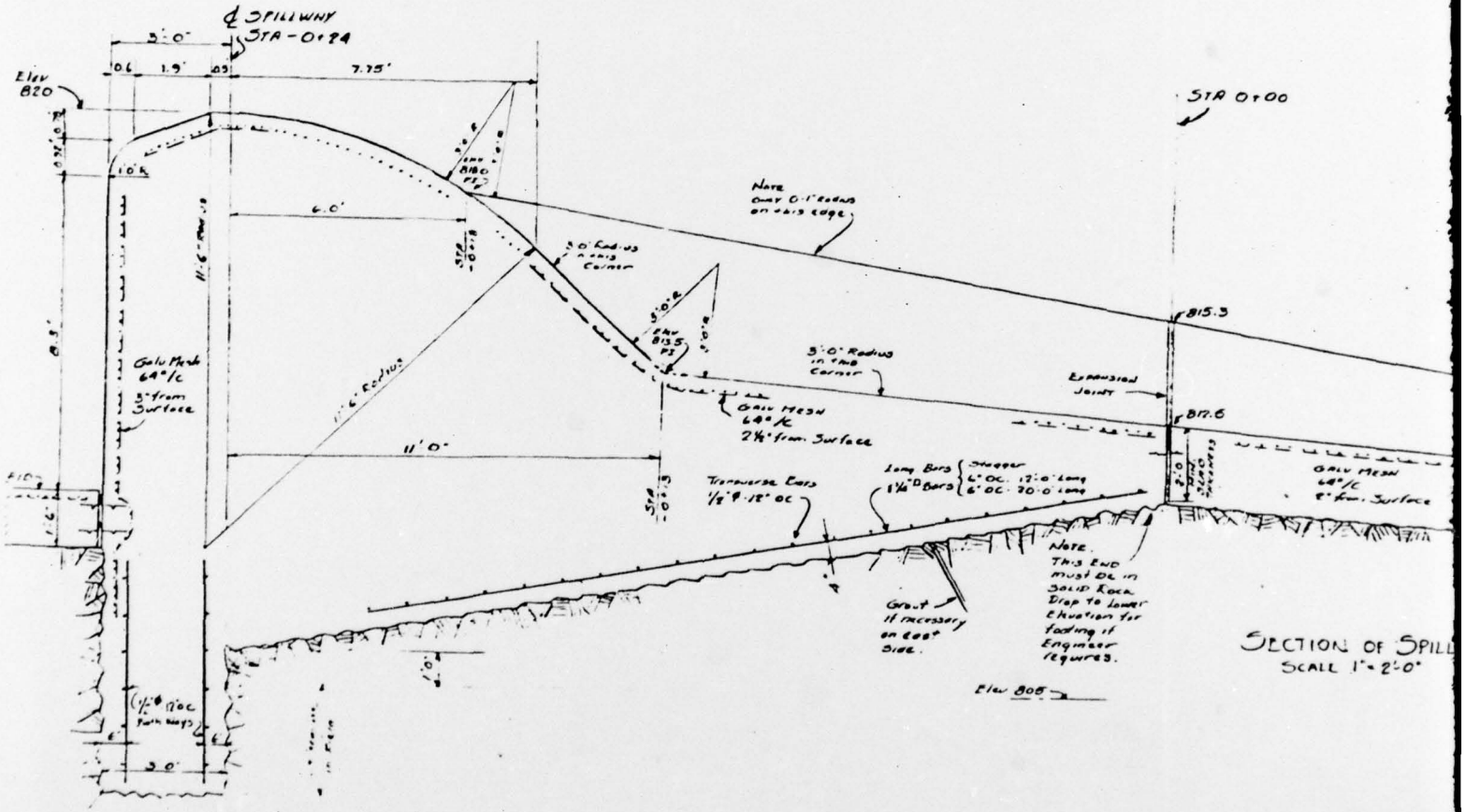
PLATE 4

BETHLEHEM MUNICIPAL WATER AUTHORITY



· SECTION · AA · OF CONCRETE TUNNEL ·

SECTION OF TUNNEL CONNECTING INTAKE TOWER TO CHEMICAL BUILDING WILD CREEK DAM
NAT. ID NO. PA. 00609 — CARBON COUNTY
DATA OBTAINED FROM DESIGN DRAWINGS CONTRACT NO. 5 SHEET 21, DATED MARCH 1, 1939
PLATE 5



SECTION OF SPILL
SCALE 1" = 2'-0"

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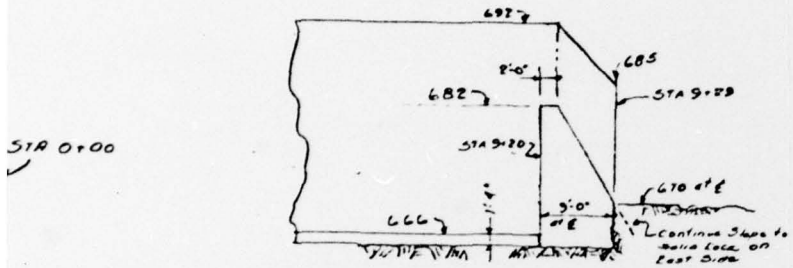
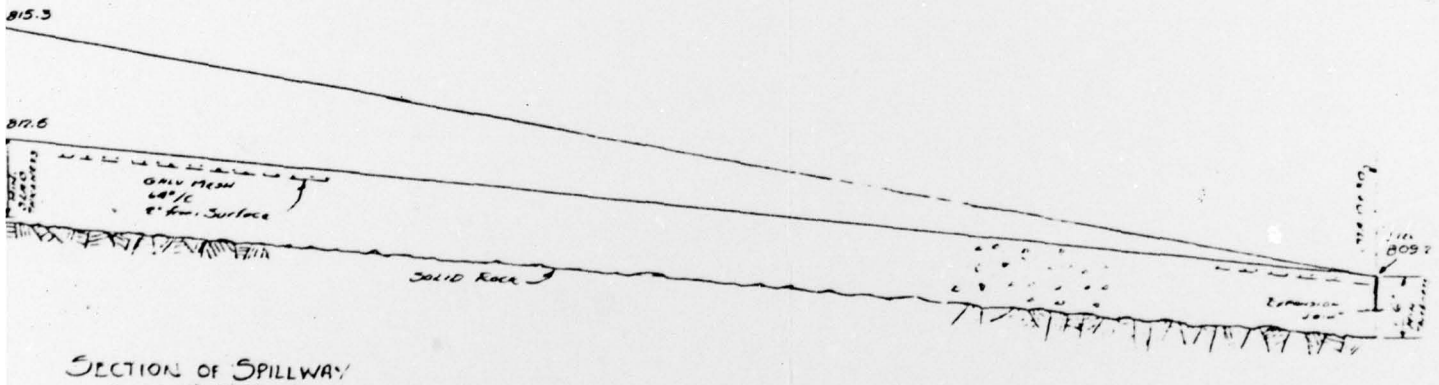


SECTION OF BAFFLE WALL
SCALE 1"=10'-0"



SECTION OF SPILLWAY
SCALE 1"=2'-0"

TYPICAL SPILLWAY SECTION WILD CREEK DAM	
NAT. ID NO. PA. 00609	CARBON COUNTY
DATA OBTAINED FROM DESIGN DRAWINGS CONTRACT NO. 5 SHEET 12-A , DATED AUG. 26, 1939	
2	PLATE 6

APPENDIX

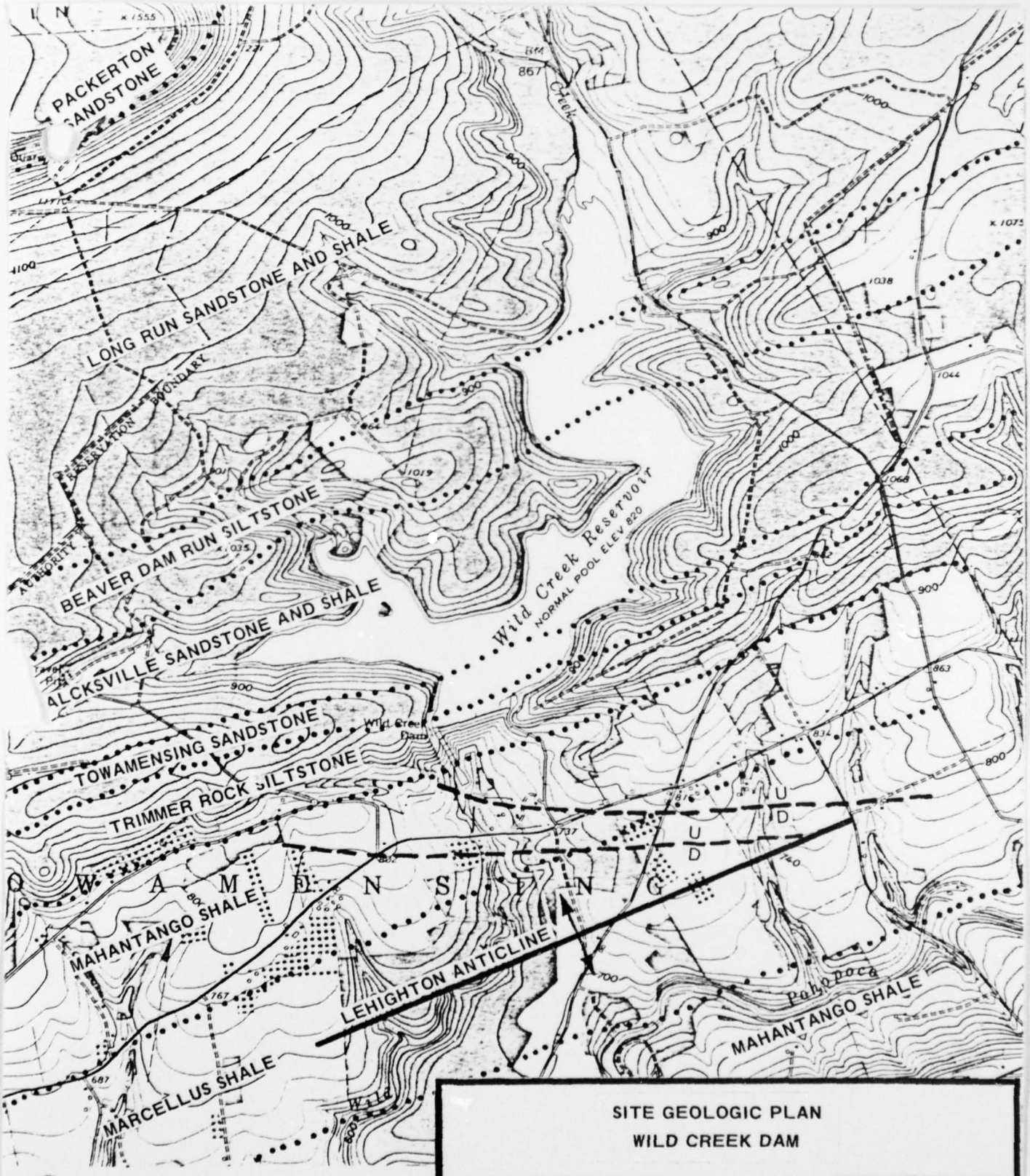
F

SITE GEOLOGY
WILD CREEK DAM

Wild Creek Dam is located in the Appalachian Mountain section of the Valley and Ridge Physiographic Province. As shown in Plate F-1, the dam is located on the north limb of the Lehighton anticline where rock types consist of sandstone, siltstone and shale of Devonian age. The dam is founded in the Trimmers Rock Formation which is made up of a thin-bedded sequence of interbedded shale, sandstone and siltstone. Rock bedding striking to the northeast with high angle northerly dips and high angle joints with northerly strikes and low angle joints with southerly dips characterize the abutment areas. The Trimmers Rock Formation is characterized by moderate infiltration capacities along parting plaines and low to moderate slope stability.

This region of Pennsylvania was glaciated during Pleistocene time and the dam lies near the southern border of glacial drift. No glacial deposits are found in the immediate abutment areas and are generally absent from the reservoir shoreline for a distance of approximately 1500 feet inland.

Geologic conditions such as low groundwater infiltration rates, upstream (northerly) dip of bedrock, lack of cavities and high strength are favorable for a dam locality.



SITE GEOLOGIC PLAN
WILD CREEK DAM

NAT. ID NO. PA.00609 CARBON COUNTY

DATA OBTAINED FROM PENNA. STATE GEOLOGIC SURVEY ATLAS 195 ab, 1975

PLATE F-1