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NATIONAL DAM INSPECTION PROGRAM. BEAR GAP NUMBER 2 (NDS PA-816)--ETC(U)
JUL 78 DACW31-78-C-0044
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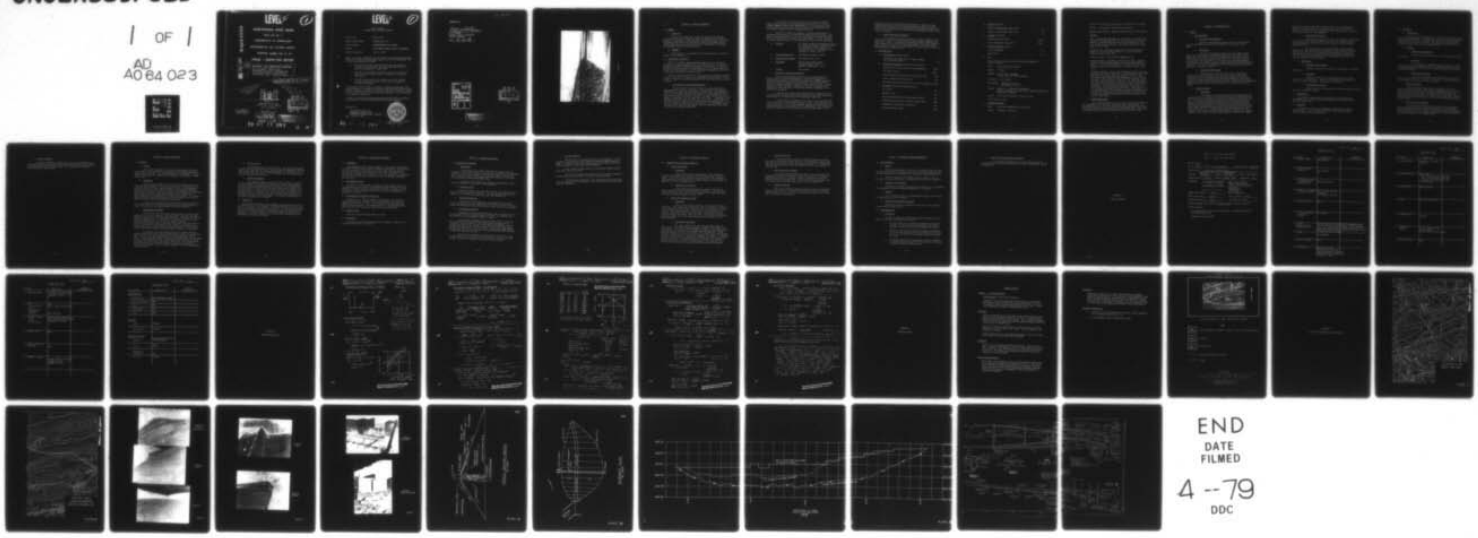

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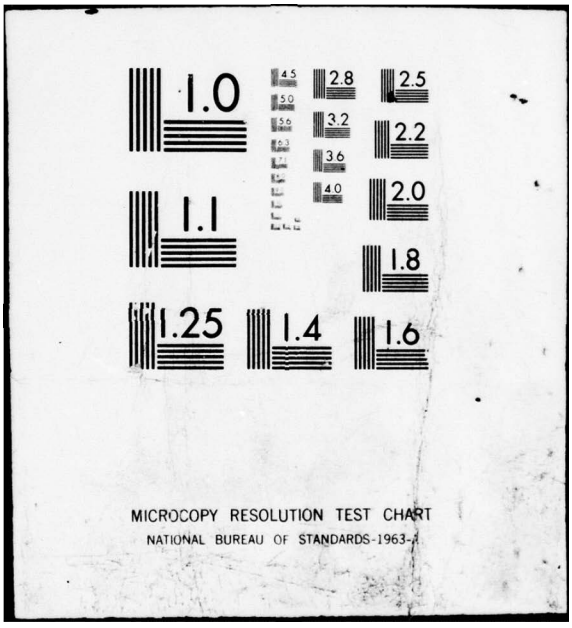
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LEVEL II

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SUSQUEHANNA RIVER BASIN

BEAR GAP NO. 2

COMMONWEALTH OF PENNSYLVANIA

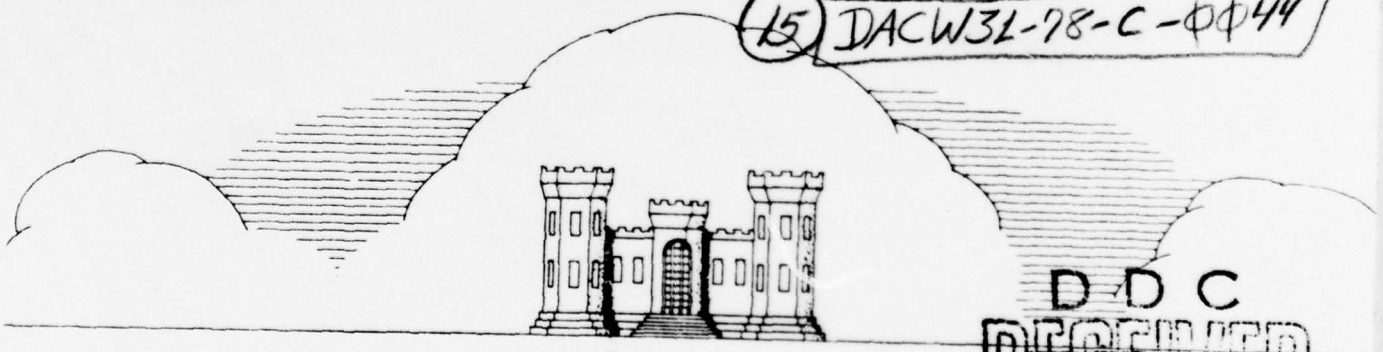
NORTHUMBERLAND AND COLUMBIA COUNTIES

INVENTORY NUMBER NDS PA. 816

PHASE I INSPECTION REPORT

(6) NATIONAL DAM INSPECTION PROGRAM.
Bear Gap Number 2 (NDS PA-816),
Susquehanna River Basin, Northumberland
and Columbia Counties, Commonwealth of
Pennsylvania. Phase I Inspection Report.

(15) DACW31-78-C-0044



Prepared For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland

by
BERGER ASSOCIATES, INC.
CONSULTING ENGINEERS
HARRISBURG, PA.

(11) JUL 78

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LEVEL II

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	BEAR GAP NO.2
State & State Number:	PENNSYLVANIA, 49-4
County Located:	NORTHUMBERLAND AND COLUMBIA
Stream:	SOUTH BRANCH ROARING CREEK, SUSQUEHANNA
Date of Inspection:	June 13, 1978

Based on a visual inspection, past performance and available engineering data, the dam and its appurtenances appear to be in fair condition. The following recommendation is made:

1. The owner shall make a detailed hydrologic and hydraulic analysis for this dam and improve the spillway capacity to meet the requirements of that study.

2. The owner shall develop a method to close off the upstream ends of the two 30-inch pipes for emergency and periodic inspection.

3. The owner shall monitor the seepage in the left abutment and take appropriate action if the quantity increases or turbidity is detected.

In accordance with the Corps of Engineers' evaluation guidelines, the spillway capacity is inadequate to pass the PMF (Probable Maximum Flood) without overtopping the dam. The spillway capacity is capable of passing only 31 percent of the PMF peak inflow and, therefore, it is considered to be seriously inadequate.

A formal surveillance and downstream warning system shall be developed by the owner to be used during periods of high precipitation.

Submitted By:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA
Contract No. DACW31-78-C-0044
Date: July 31, 1978

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
HENDRIK JONGSMA
ENGINEER
No. 5557E

79 01 17 091

Bear Gap #2

APPROVED BY:

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

DATE: 31 Jul 78

OVERVIEW

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 insepctions of dams throughout the United States. The Phase I Inspection and Report are limited to a review of available data, a visual inspection of the dam site and basic calculations to determine the hydraulic adequacy of the spillway.

B. Purpose

The purpose is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

NOTE: The original design drawings indicate the top of dam at elevation 923, and the spillway weir at elevation 918.0. An as-built drawing shows elevation 838.0 as the depth of excavation for the cutoff trench and records indicate a total height of 83 feet, which makes top of dam at elevation 921.0. The spillway depth was measured as 8.0 feet, which means a spillway elevation of 913.0

The owner has drawings in the file indicating the spillway elevation at 930, 932 or 932.67. The U.S.G.S. quadrangle indicates 933.0. This report is based on a spillway elevation of 933 and a top of dam elevation at 941.0.

A. Description of Dam and Appurtenances

The Bear Gap No.2 Reservoir Dam is an earth and rockfill embankment with a concrete core wall. A cutoff trench was excavated into rock which forms the foundation of the core wall. See Appendix D, Plate VI for a typical section. The length of the embankment is 570 feet and the hydraulic height is 66 feet. An ogee spillway, 100 feet in length, is located at the left abutment of the dam. The approach to the spillway is directly from the lake. The outlet from the spillway is a 620 foot long chute made up of a concrete slab and training walls. The end of the chute is supported on piers where the flow discharges into a stilling basin excavated into natural rock and containing large blocks of concrete for energy dissipation.

The regulating facilities consists of two 30-inch diameter pipes with an open end at the upstream end and regulated by valves in a valve chamber located at the downstream toe. An 8-inch bypass valve and pipe permits the diversion of water from the valve house to an 8-inch diameter aeration pipe on the downstream side.

Plates III through IX, Appendix D, contain reproductions of photographs and details of the dam and the appurtenant structures. This dam is located approximately 4.4 miles downstream of Bear Gap No.6 Dam, (NDS No. PA-817) which is owned by the same company. A small intake dam is located approximately 0.5 mile downstream of the dam under discussion.

B. Location: Mt. Carmel Township, Northumberland County and Cleveland Township, Columbia County U.S. Quadrangle, Mount Carmel, Pa. Latitude 40°-49.4', Longitude 76°-29.7' (Appendix D, Plates I and II)

C. Size Classification: Intermediate (Height 66 feet)

D. Hazard Classification: High (see Section 3.1.E)

E. Ownership: Roaring Creek Water Company
204 East Sunbury Street
Shamokin, Pennsylvania 17872

F. Purpose: Water Supply

G. Design and Construction History

The dam and appurtenant structures were designed by Wm. H. Dechant and Son, Peading, Pennsylvania. Construction approval by Pennsylvania Department of Environmental Resources (PennDER) was given in April, 1915, and construction was started in the spring of 1916. Work on the dam was stopped in 1920 and started again in 1922. Gannett, Seelye and Fleming became the engineer in 1923 and construction was completed in that same year. The records indicate a redesign, but no details were available.

Temporary thirty-inch high flashboards were installed in 1924 to increase the storage capacity during the period that the upstream dam (Bear Gap No.6) was drawn down for the raising of that dam.

From available photographs in the file it can be deducted that repairs were made to the spillway channel in 1946. During the tropical storm Agnes (June, 1972) extensive damage occurred to the spillway. The erosion started at a point about 150 feet downstream of the ogee section and slabs, walls and the stilling basin were all washed away. A new

spillway chute and stilling basin was designed by Gannett, Fleming, Corddry and Carpenter and the reconstruction was completed in 1975. Some additional guniting in the stilling basin has been performed this year and the reservoir pool was drawn down approximately 13 feet at the time of inspection.

H. Normal Operating Procedures

The reservoir was constructed and is used for domestic water supply and is owned by the Roaring Creek Water Company, Shamokin, Pa., since 1946. Water is released at the downstream valve house through an 8-inch aeration pipe into the downstream channel. The actual water supply intake is located at a small intake dam (Bear Gap No.1) about 0.5 mile downstream of Bear Gap No.2.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

(calculated for this report - original figure was 12.8 square miles)	13.4

B. Discharge at Dam Site (cubic feet per second)

Maximum known flood at dam site (see Appendix B)	2,000
Warm water outlet	None
Outlet tunnels low pool outlet at pool Elev. 888	120
Outlet tunnels at pool Elev. 933	320
Spillway capacity at pool Elev. 941 (top of earthfill)	7,800

C. Elevation (feet above mean sea level)

Top of dam	941
Spillway crest	933
Upstream portal invert of outlet tunnels (Est.)	885
Downstream portal invert of outlet tunnels (Est.)	880
Streambed at centerline of dam (Est.)	875
Maximum tailwater (Est.)	890

D. Reservoir (miles)

Length of maximum pool (Elev. 941)	1.3
Length of normal pool (Elev. 933)	1.0

E. Storage (acre-feet)

Normal pool (Elev. 933)	1,440
Top of embankment (Elev. 941)	1,990

F. Reservoir Surface (acres)

Top of embankment	77
Normal pool	61

G. Dam

For a schematic plan and typical section see Appendix D, Plates VI and VII.

Type: Rolled earth and rockfill.

Length: 570 feet.

Height: 66 feet above streambed.
83 feet above core wall foundation.

Top Width: 12 to 16 feet.

Side Slopes: Upstream 3.0H to 1V
Downstream 1.5H to 1V

Zoning: Upstream - rolled earth embankment.
Center - Concrete core wall with an upstream puddle core.
Downstream - Rockfill.

Cutoff: 8 feet wide core wall in trench to rock.

Grout Curtain: None.

H. Regulating Tunnels

Type: Two 30-inch diameter cast iron pipes.

Length: Estimated - 400 feet.

Closure: Gate valves in gate house at downstream toe of dam.

Access: Gate house at toe of dam is at grade.

Regulating Facilities: Manually operated valves as noted above.

I. Spillway

Type - Uncontrolled standard ogee crest about 3 feet above the channel on the upstream side. It is on a skew of 32°, so the left end is further down the chute than the right end. The left end has a drop of about 7 feet and the drop on the right side is about 3 feet.

Length of weir - 100 feet, along crest. The side walls are sloped so the length between walls at the top of the weir opening is about 102.7 feet.

Crest elevation - 933 from USGS topographic map.

Upstream channel - Spillway is at left end of dam. Approach channel is wide open and appears to have an upward slope of about 5%. The surface is gravel. It is about 130 feet long, 120 feet wide, and 3 feet deep near the weir at normal pool stage.

Downstream channel - All but the top 150 feet of the chute was washed out by the June 1972 flood. Reconstruction of the spillway chute and stilling basin was completed in 1975. Some additional repair work was under progress at the time of this inspection. The new chute is about 600 feet long and carries the water well past the toe of the dam. The last 150 feet of the chute rests on columns and the end is about 40 feet above the ground. The free fall discharge ends in a 50-foot by 40-foot bucket. From the bucket, a mountain stream flows 0.5 mile through thick woods to Reservoir No.1. Reservoir No.1 is a very small pond from which water is pumped for domestic use. For the next 4 miles or so, below Reservoir No.1, there are perhaps 5 low-lying farm homes which could be flooded if Bear Gap No.2 Dam failed.

J. Regulating Outlets

Twin, 30-inch diameter cast iron pipes, which pass through the dam embankment, do not have any controls at their upstream end. At their downstream end, there is a ground-level masonry gate house which contains two 30-inch gate valves and an 8-inch bypass valve. All valves are manually operated and they discharge directly into the stream.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

A. Data Available

1. Hydrology and Hydraulics

Hydrologic and hydraulic design criteria or design data were not available in the files of PennDER or at the office of the owner.

2. Embankment

The files of PennDER contained only one drawing, dated March, 1919, indicating the work completed by the end of 1918. This drawing has been traced on Plate VIII, Appendix D, and shows the depth of the cutoff trench excavated for the core wall from Station 1+80 to Station 6+00. The owner has, in his office, a set of design drawings and referred us to Gannett, Fleming, Corddry and Carpenter his consultant. Plate VI, VII and VIII are sketches of the dam section and general plan obtained in the owner's office.

3. Appurtenant Structures

Design criteria and design data for the appurtenant structures were not available in the files of PennDER. The design drawings for the new spillway chute and energy dissipator are in the files of the owner and PennDER and some design drawings on the original design were also available at the owner's office. Observed field conditions indicate, however, that construction was not in accordance with these plans.

B. Design Features

1. Embankment

The available construction drawings and photographs show a concrete core wall located in the center of the dam. This wall is 8 feet wide at the bottom and steps down to a narrower section towards the top. A trench was excavated to rock for this wall and the wall was poured in sections with keyed vertical joints. Horizontal pours were roughened by placing stones in the concrete before the concrete set up. To increase the impermeability a puddle core was placed at the upstream side of the core wall. A handlaid dry stone wall was placed at the downstream side of the core wall (see Appendix D, Plate VI for typical section). The original design drawings indicate a rolled earth embank-

ment on the upstream side with a slope of 3H to 1V. The downstream section of the dam is shown as a rockfill with a slope of 1.5H to 1V. During the field inspection a degree indicator showed slopes of about 2H to 1V for both sides of the embankment.

2. Appurtenant Structures

The intake is under water at the upstream side and consists of two 30-inch steel pipes encased in concrete. No records of cutoff walls were found. The control valves are located in a valve house at the downstream toe.

The ogee weir is in the left abutment and photographs indicate that the core wall was continued under the spillway. The weir and the first 100 feet of the spillway were constructed of concrete. The spillway chute was originally either exposed rock or handlaid rip rap. At present all slabs and walls of the spillway chute are either concrete or gunite over stone walls.

C. Design Data

1. Hydrology and Hydraulics

PennDER's files did not contain any hydrologic or hydraulic design data.

2. Embankment

PennDER's files did not include design data or design criteria for the embankment. There was no indication of borings, test pits or a geological report. Grouting is not indicated.

3. Appurtenant Structures

Design criteria or design data for the appurtenant structures were not available for review.

2.2 CONSTRUCTION

The available construction data consisted of some construction photographs and a record drawing indicating progress on the core wall until the end of 1919.

2.3 OPERATION

The purpose of the dam and appurtenant structures is to supply domestic water. Formal records of operation indicating discharge over the spillway are not maintained.

2.4 EVALUATION

A. Availability

The only available design data in PennDER's files consisted of construction photographs. The owner has a set of blue prints with some design details. However, it appears that changes to the design were made after construction was started. Drawings and specifications for the new spillway chute are in the PennDER files.

B. Adequacy

1. Hydrology and Hydraulics

Design criteria and data were not available in the files of PennDER.

2. Embankment

The description of embankment construction and a review of the typical section indicates that the embankment design was based on acceptable engineering principles to prevent seepage and to provide a stable embankment.

3. Appurtenant Structures

There were no detailed design drawings of the spillway crest and chute available for review in the files. Design drawings of the reconstruction are in the files of PennDER.

C. Operating Records

Formal operating records were not available for review. Tropical storm Agnes (June, 1972) caused an approximate pool level of 3 to 3.5 feet above the spillway weir and a considerable length of the spillway chute was washed away. On August 10, 1972, the owner was instructed to draw the lake down to 10 feet below normal pool elevation. This order was rescinded on May 11, 1976, after a new spillway channel was constructed.

D. Post Construction Changes

No reported modifications have been made to the embankment. After the washout in 1972, new construction on the spillway channel occurred during the next few years. Construction of these improvements were completed in May, 1975. Design drawings and construction specifications are available in the PennDER files.

E. Seismic Stability

The dam is located in Seismic Zone 1 and it is considered that the static stability with normal safety factors is sufficient to withstand minor earthquake induced dynamic forces. No calculations or studies have been made to confirm this.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of the dam and appurtenant structures is excellent. The reservoir and embankment give a pleasant appearance and are well maintained. The visual checklist is in Appendix A. Photographs taken during the inspection are reproduced in Appendix D, Plates III, IV and V.

B. Embankment

The horizontal alignment of the dam has a slight curve at the north end (right abutment). The top of the dam and the slopes were in excellent condition. Trees were growing very close to the embankment, but they were all rooted in natural ground. The overhanging branches makes close inspection of the toe of fill near the abutments more difficult. Some seepage was noted at the left abutment, and the surface was a little soggy, but no transportation of fines were detected. Mr. Sacona, representing the owner, stated that the flow was constant, but did not know if a higher pool level influences the quantity.

At the time of inspection some additional repairs were made at the stilling basin and the pool level had been lowered approximately 13 feet. The rip rap on the upstream slope was in good condition.

C. Appurtenant Structures

The intake for the two 30-inch blowoff pipes was located under water and could not be observed. The valve house is located just downstream of the toe and is in reasonably good shape. Valves on the blowoff pipes are operated on an at least twice a year basis according to the owner's representative. At the time of inspection one of the pipes was partially open to maintain a pool level below the spillway weir. An 8-inch pipe with separate valve controls is attached to the blowoff pipes and is normally used to control releases. The 8-inch pipe is elevated outside the valve house and used for aeration of the water.

The spillway weir and training walls were in good condition. Tropical storm Agnes (June, 1972) had caused heavy erosion of the spillway chute starting at a point approximately 100 feet downstream from the weir. A total reconstruction of the chute and stilling basin was completed in 1975. Some additional repairs consisting of guniting and the placing of gabions were under way at the time of inspection. The stilling basin had been pumped dry and the effectiveness of the energy dissipation could not be observed. Plates IV and V, Appendix D, contains photographs of the spillway.

D. Reservoir Area

The reservoir area is very well kept. The lake is surrounded by woods and the lake banks did not show any erosion problems. The Bear Gap No.6 Dam (NDS #817) is located approximately 4.4 miles upstream. If Bear Gap No.6 Dam would fail, it can be assumed that the surge of water would overtop Bear Gap No.2 Dam.

E. Downstream Channel

The downstream channel below the stilling basin is a typical natural stream with trees close to the banks. A small intake dam for the water intake and pumping station are located 0.5 mile downstream. Farther downstream several homes and farm buildings are located within the flood plain. If Bear Gap No.2 would fail, after overtopping, it is considered that the additional loss of life would be more than a few persons and that the economic loss would be appreciably increased with the conditions just before overtopping. The hazard classification for this dam is considered to be "High".

3.2 EVALUATION

The observed condition of the embankment and appurtenant structures is considered good. The embankment is constructed with a concrete core wall but no records of a toe drain were found. Some seepage was apparent but not considered detrimental to the safety of the dam at the time of inspection. The pumping station is located immediately downstream and personnel of the water company visit the site daily, although not all appurtenant structures are checked.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

This impoundment dam for water supply is one of several dams owned by the Roaring Creek Water Company, Shamokin, Pennsylvania. Approximately 0.5 mile downstream of this dam, at a small intake dam, the water is pumped into the distribution pipeline. The water is aerated at Dam No.2 through releases in an 8-inch pipe. The main purpose is to maintain the lake at the normal pool elevation of 933. No specific procedures are in effect.

4.2 MAINTENANCE OF DAM

The area of the facilities is checked on a daily basis and very well maintained. The grass on the downstream slope appears to be mowed regularly. Wooded areas are encroaching on the dam. Although no trees are growing on the embankment, the toe of the dam on the abutments is difficult to inspect.

4.3 MAINTENANCE OF OPERATING FACILITIES

According to Mr. Sacona, company representative, the valves are operated quite often. Although there is no schedule, the valves are operated at least twice a year. The condition of the valve house was good and easy accessible. The pumping station is located immediately downstream and this station has around the clock supervision.

4.4 WARNING SYSTEM

There is no formal warning system in effect.

4.5 EVALUATION

The general operational procedures are acceptable, except that no formal warning system is in effect.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

A. Design Data

No hydrologic and hydraulic analysis for Bear Gap No.2 was available. There were no plans or construction drawings for the original work nor for the recent repairs to the spillway chute. For the most part, information used in this report was either measured in the field or was obtained from USGS topographic maps.

A spillway rating curve and a reservoir area-capacity curve have been computed for this report (see Appendix B).

B. Experience Data

The owner reported that the 1972 flood was the greatest flood that had been experienced at Dam No.2. He recalled that flood caused a head of 3 to 3.5 feet on the spillway crest (see Appendix B).

C. Visual Obersvations

On the date of the inspection, no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event, until the dam is overtopped.

D. Overtopping Potential

Comparison of the estimated PMF peak inflow of 24,800 cfs with the estimated ultimate spillway capacity of 7,800 cfs, indicated that the potential for overtopping of Dam No.2 exists.

Calculations in Appendix B show that Bear Gap No.2, Bear Gap No.6, and Lake Kline Dam do not have the storage available that is necessary to pass the PMF or the 1/2 PMF without overtopping. The two upstream dams (Lake Kline and Bear Gap No.6) would each be overtopped and fail if subjected to a PMF or 1/2 PMF. Such failure would release an additional 125 acre-feet of water from Lake Kline and 3,985 acre-feet of water from Bear Gap No.6 Dam.

Bear Gap No.2 Dam would be overtopped by 1/2 PMF even if the two upstream dams did not exist so their only effect would be to cause a slight increase in downstream flow in the event of failure.

E. Spillway Adequacy

Dam No.2 has a Size Classification of "Intermediate" (1,238 acre-feet of storage and 66 feet high) and a Hazard Classification of "High". A domestic water supply pumping station and about 5 low-lying homes are within the first four miles downstream.

These classifications indicate a Recommended Spillway Design Flood (SDF) equal to the PMF.

The spillway capacity is considered to be seriously inadequate as the project will pass only 31 percent of PMF peak inflow.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observation

1. Embankment

There were no visual indications of undue embankment stresses or sloughage. The surface of the embankment was in excellent shape. Except for a small amount of seepage near the left abutment. This seepage was piped underneath a roadway leading to the spillway and appeared to be of a permanent nature.

2. Appurtenant Structures

Visual observations indicate no present stability or stress problems in any of the appurtenant structures. A new spillway chute and stilling basin was recently constructed to replace the spillway which was heavily damaged in June, 1972.

B. Design and Construction Data

1. Embankment

There were no design criteria or design data available for review. The typical section shown on Plate VI, Appendix D, indicates a well engineered section with a concrete core wall extending to rock surface. Photographs indicate a deep trench to solid rock and that vertical keyed construction joints were used. Successive horizontal pours were keyed with rocks. The core wall is 8 feet wide at the bottom and has a puddle core on the upstream side and rock piled up on the downstream side.

2. Appurtenant Structures

The actual intake of the two 30-inch blowoff pipes is under water. From records and photographs it appears that these pipes were placed in a trench, concrete encased and puddled. Photographs also indicate that the core wall was extended under the spillway. Design data and criteria were not in the files. The spillway weir and training walls are constructed from concrete and appear to be stable. Considerable cracking has occurred, but these do not endanger the stability or integrity of the walls. The spillway walls are at present all concrete or gunited stone walls. Some of the walls appear to be relatively low. The new stilling basin is at present partially protected by gabions.

C. Operating Records

No formal operating records of spillway discharges are kept. The only reported major problem occurred in 1972 during the Agnes storm when most of the spillway chute and basin were washed out. Photographs and some letters indicate that some damage occurred to the spillway in 1924 and 1938.

D. Post Construction Changes

The only reported modifications made to the original dam and appurtenant structures consisted of the reconstruction of a length of approximately 600 feet of spillway channel, starting about 100 feet downstream from the spillway weir. This reconstruction included a free fall section and a stilling basin shown on Plate V, Appendix D.

E. Seismic Stability

This dam is located in Seismic Zone No.1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. However, no calculations, studies, etc., were made to confirm this conclusion.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection, the review of available design data and the operational history indicates that the dam is in good condition and has been constructed in accordance with acceptable engineering practice.

The main concern is the spillway capacity which is only 31 percent of PMF peak inflow and is considered to be seriously inadequate.

B. Adequacy of Information

Although the available information was limited, it is considered to be adequate to make a reasonable assessment of the project.

C. Urgency

It is considered that the recommendations made in this section be implemented as soon as possible.

D. Necessity for Additional Studies

Additional studies are required as outlined in the recommendations listed in this section.

7.2 RECOMMENDATIONS

A. Facilities

In order to assure a continued satisfactory operation of this dam, the following recommendations are made:

1. The owner shall make a detailed hydrologic and hydraulic analysis for these facilities and improve the spillway capacity to meet the requirements found in that study.

2. The owner shall develop a plan for blocking the upstream end of the two 30-inch pipes for periodic inspection and for use in the event of an emergency caused by a rupture of a pipe.

3. The owner shall monitor the seepage on the left abutment. If seepage quantity increases or if turbidity is detected, appropriate measures shall be taken.

B. Operation and Maintenance Procedures

It is considered important that a formal surveillance and downstream warning system be developed to be used during periods of high precipitation.

APPENDIX A

VISUAL INSPECTION

CHECK LIST - DAM INSPECTION PROGRAM

PHASE I - VISUAL INSPECTION REPORT

NAD NO. 816

PA. ID # 49-4 NAME OF DAM Bear Gap No.2 HAZARD CATEGORY Significant

TYPE OF DAM: Rockfill with Concrete Core

LOCATION: Mount Carmel and Cleveland TOWNSHIP Northumberland & Columbia COUNTY, PENNSYLVANIA

INSPECTION DATE 6/13/78 WEATHER Cloudy - Cool TEMPERATURE 50's

INSPECTORS: H. Jongsma - R. Houseal
A. Bartlett - R. Steacy

For Bear Gap Water Co
Field: Harry Sacona
Office: Douglas McWilliams
For D.E.R
Stuart Gansell
Bill Kosmer

NORMAL POOL ELEVATION: 933± AT TIME OF INSPECTION:

BREAST ELEVATION: 941.0± POOL ELEVATION: 919.7±

SPILLWAY ELEVATION: 933. ± TAILWATER ELEVATION:

MAXIMUM RECORDED POOL ELEVATION: None of Record - 1972 Max. recalled

GENERAL COMMENTS:

Pool drawn down at time of this inspection to accommodate guniting in the Stilling Basin.

Appearance of dam is good.

DAM NO. NAD 816

VISUAL INSPECTION

EMBANKMENT	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. SURFACE CRACKS	None evident.	
B. UNUSUAL MOVEMENT BEYOND TOE	None evident	
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	No slope distress.	
D. VERTICAL & HORIZONTAL ALIGNMENT OF CREST	Dam is curved at right abutment. No settlement observed.	
E. RIPRAP FAILURES	None	
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	No distress	
G. SEEPAGE Measured at least 1 gallon per min.	Seepage observed on downstream of embankment about 2/3 way down slope at the jointure of the embankment with the original ground. Seepage begins with soft soggy area then concentrates into a thin stream. Water is clear and flow is steady.	
H. DRAINS	None observed	
J. GAGES & RECORDER	None	
K. COVER(GROWTH)	Upstream - Rip Rap Fern growth in the stone above normal pool elevation. Downstream slope - grass & fern Top of dam - stone	

DAM NO. NAD 816

VISUAL INSPECTION

OUTLET WORKS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. INTAKE STRUCTURE	Under water - unable to observe.	
B. OUTLET STRUCTURE	Valve house - Two - 30" pipes with valves plus one 12" aeration pipe. One 30" pipe and 12" discharging at time of inspection	
C. OUTLET CHANNEL	Natural Stream	
D. GATES	Two - 30" Gate Valves	
E. EMERGENCY GATE	As above	
F. OPERATION & CONTROL	Use 30" valves to lower pool elevation. Use 12" valve to aerate water	
G. BRIDGE (ACCESS)	None	

DAM NO. NAD 816

VISUAL INSPECTION

SPILLWAY	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. APPROACH CHANNEL	From lake over earth then concrete slab to the ogee spillway - clear.	
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Ogee Fair - normal deterioration Fair condition	
C. DISCHARGE CHANNEL Lining Cracks Stilling Basin	Concrete slabs and walls. Lower end of concrete channel supported on columns.	
D. BRIDGE & PIERS	None	
E. GATES & OPERATION EQUIPMENT	None	
F. CONTROL & HISTORY	Serious washout of spillway channel - 1972 Repairs were made.	

DAM NO. NAD 816

VISUAL INSPECTION

MISCELLANEOUS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
INSTRUMENTATION		
Monumentation	None observed or noted.	
Observation Wells	None	
Weirs	None	
Piezometers	None	
Other	None	
RESERVOIR		
Slopes	Forested	
Sedimentation	No record	
DOWNSTREAM CHANNEL		
Condition	Natural stream below the Stilling Basin.	
Slopes	Wooded	
Approximate Population	15	
No. Homes	5 homes	

APPENDIX B

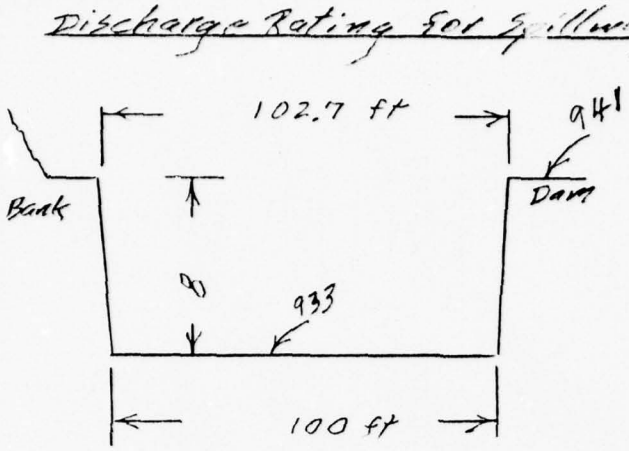
HYDROLOGY/HYDRAULICS

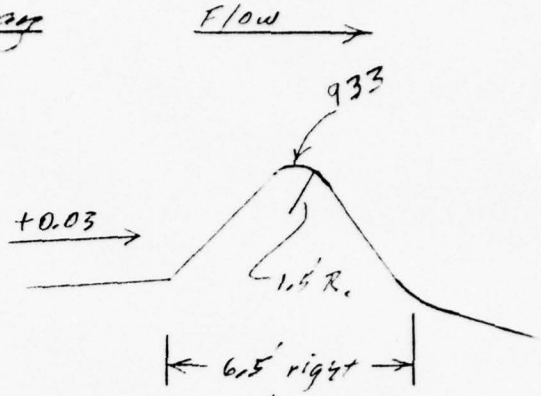
PROJECT Dam Investigation SHEET NO. 1 OF

SUBJECT Bear Gap No. 2 Dam - Roaring Creek, ID No. 816

COMPUTED BY RES DATE 6-23-78 CHECKED BY JJP 7-5-78

Discharge Rating for Spillway





$\cos 32^\circ = 0.85$

Use "C" = 3.8 for H = 5.0
and 4.0 for H = 8.0
Ref. Brater + King
6th Ed. p. 5-28.
C = 3.42 for H = 2

Top of dam (941)

$Q = 0.85 \times CL(H)^{3/2}$

↑ cos. of skew angle

$= 0.85 \times 4.0 \times 101.35 \times (8)^{3/2}$

$= 7{,}800$ cfs

Q at elev. 938

$Q = 0.85 \times CL(H)^{3/2}$

$= 0.85 \times 3.8 \times 100.84 \times (5)^{3/2}$

$= 3640$ cfs

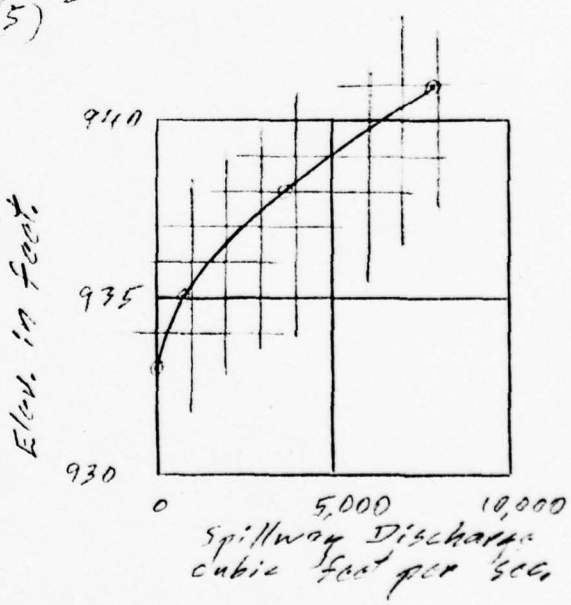
Q at elev. 935

Assume flow is perpendicular to weir

$Q = CLH^{3/2}$

$= 3.42 \times 100.34 \times (2)^{3/2}$

$= 970$ cfs



PROJECT _____ SHEET NO. ____ OF ____

SUBJECT Bear Gap No. 2 Dam - Roaring Creek - ID No. 816

COMPUTED BY RES DATE 6-27-78 CHECKED BY JJP 7-5-78

Maximum known flood at damsite

Owner reports flood of June 22, 1972 caused a head of 3 to 3.5 feet on spillway crest.

933 +3 = 936 ft = 1,600 cfs from graph
933 +3.5 = 936.5 ft = 2,000 cfs from graph

Nearby USGS gaging station records

Sta	Drainage Area	Date	Peak Discharge
Wapwallopen	43.8 sq. mi	6-22-72	5,410
Ringtown	1.77	6-22-72	487

$\left(\frac{13.4}{43.8}\right)^{.8} \times 5410 = 2,100$ $\left(\frac{13.4}{1.77}\right)^{.8} \times 487 = 2,500$

Use 2,000 cfs

Outlet tunnel at pool elev. 888

2 30" dia. C.I. pipes, with 30" gate valves at downstream end. No intake tower.

$V = \frac{1.486}{n} \times (r)^{2/3} \times (s)^{1/2}$ Est. length of tunnels = 400 ft.

$= \frac{1.486}{0.016} \times (1.25)^{2/3} \times (0.0169)^{1/2}$ $n = 0.016$

$r = 1.25$

$= 92.9 \times 1.16 \times 0.13$ $s = \frac{888 - 881.25}{400} = 0.0169$

$= 14.01$ ft/sec.

$Q = VA = 14.01 \times \pi R^2$

$= 14.01 \times \pi \times (1.25)^2$

$= 68.8 \times 2$ pipes $= 138$ cfs

To allow for entrance and pipe line losses

Use 120 cfs.

Outlet tunnel at pool elev. 933

$\frac{1}{2}$ 30" outlet pipe $= 885 + 1.25 = 886.25$

$h = 933 - 886.25 = 46.75$

$Q = C\,a\sqrt{2gh} = 0.6 \times \pi \times (1.25)^2 \times (64.3 \times 46.75)^{1/2}$

$= 2.95 \times 54.8 = 162$ cfs

2 pipes $= 324$ cfs

Use 320 cfs.

PROJECT _____ SHEET NO. _____ OF _____

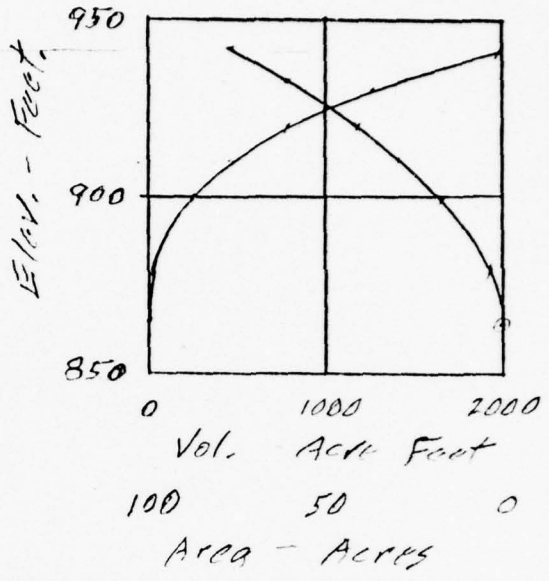
SUBJECT Bear Gap No. 2 Dam Roaring Creek - I.D. No. 216

COMPUTED BY RES DATE 6-27-78 CHECKED BY JJP-7-5-78

Area - Capacity

Elev	Acres	Ac-Ft	Total Ac-Ft.
865	0	30.	0.
880	4	65.	30.
890	9	130.	95.
900	17	220.	225.
910	27	340.	445.
920	41	480.	785.
930	55	173.	1265.
933	60.6	550.	1438.
941	77		1988.

Calculations based on data taken from USGS Topo sheet



PMF Susquehanna River Basin - Region 2

Drainage Area = 13.4 Sq. Mi.

PMF = 1,850 cfs/sq. mi.

= 24,800 cfs

	Drainage Area (Sq. mi)	PMF Discharge (CFS)
Lake Kline	4.77	10,900.
Intervening Area	4.03	9,500.
Dam No. 6	8.8	
Intervening Area	4.6	10,500.
Dam No 2	13.4	

$\left(\frac{4.77}{13.4}\right)^{.9} \times 24,800 = 10,900.$ $\left(\frac{4.03}{13.4}\right)^{.8} \times 24,800 = 9,500.$

$\left(\frac{4.6}{13.4}\right)^{.8} \times 24,800 = 10,500.$

Lake Kline spillway capacity est. 2,000 cfs
contents to weir crest 125 acre feet.
Lake Kline will fail and release at least
10,900 cfs and an additional
125 acre feet of water.

Dam No 6 inflow 10,900 + 9,500 = 20,400 cfs.

Say 25 = 25 × 53.33 × 8.8 = 11,730

+ Lake Kline 125.

11,900 ac ft.

Dam No. 6 contents weir crest to top = 5599 - 3985.

= 1614 ac. ft.

Dam No. 6 will be overtopped.

PROJECT Lake Storage SHEET NO. 4 OF

SUBJECT Bear Gap No. 2 Dam - Br. Roaring Cr - ID No. 816

COMPUTED BY RES DATE 6-30-78 CHECKED BY JJR 7-5-78

PMF (cont.)

Dam No. 2 inflow = at least 24,800 cfs

Say 26" = 26 x 53.33 x 13.4 = 18,580 ac. ft

+ Kline = 125

+ No. 6 = 3,985

22,700 ac. ft.

Overtopping Potential

Dam No. 2 $\frac{\text{Max spillway Q}}{\text{Peak Inflow (PMF)}} = \frac{7,800}{24,800} = 0.31$

$\frac{\text{Req Resv. Storage}}{\text{Vol. of Inflow}} = 0.69$. From short cut routing method furnished by Balt. Dist. C of E.

Req Resv. Storage = 0.69 x 22,700 = 15,700 ac. ft.

Available storage = 1,988 - 1,438 = 550 ac ft.

Dam No. 2 will be overtopped.

½ PMF Dam No. 2 ½ PMF = $\frac{24,800}{2}$ = 12,400 cfs

Lake Kline inflow = $\frac{10,900}{2}$ = 5,400 cfs.

= 12" = 12 x 53.33 x 4.77 = 3050 ac. ft.

$\frac{\text{Max Spillway Q}}{\text{Peak inflow}} = \frac{2,000}{5,400} = 0.37$.

$\frac{\text{Req. Resv. Stor.}}{\text{Vol of Inflow}} = 0.63$

Req. Resv. Stor. = 0.63 x 3050 = 1920 ac. ft.

Avail Stor = 125 ac. ft.

Lake Kline will overtop.

Dam No. 6 inflow = at least 5,400

+ Intervening = 4,750

10,150 cfs

= 12" = 12 x 53.33 x 8.8 = 5630 ac ft.

+ Kline = 125

5,760 ac. ft

$\frac{\text{Max Spillway Q}}{\text{Peak Inflow}} = \frac{6120}{10,150} = 0.60$

$\frac{\text{Req. Resv. Stor.}}{\text{Vol. of inflow}} = 0.40$

SUBJECT Bear Gap No. 2 Dam - Fr. Roaring Cr. - I.D. No. 616 SHEET NO.

COMPUTED BY RES DATE 6-30-78 CHECKED BY JJP 7-5-78

Ya PMF (cont.)

Req. Reser. Storage = 0.40 × 5760 = 2304 ac. ft.

Available Storage = 5599 - 3985 = 1,614 ac. ft.

No. 6 Dam will be overtopped.

Dam No. 2 inflow = at least 10,800 cfs

+ Intervening = $\frac{10,500}{2}$ = 5,200

16,000

= 12" = 12 × 53.33 × 13.4 = 8,580 ac. ft.

+ Kline = 125

+ No. 6 = 3985

12,690 ac. ft.

$\frac{\text{Max Spillway Q}}{\text{Peak Inflow}} = \frac{7,800}{16,000} = 0.49$

$\frac{\text{Req. Reser. Stor.}}{\text{Vol. of inflow}} = 0.51$

Req. Reser. Stor. = 0.51 × 12,690 = 6,470 ac. ft

Avail. Stor = 1,988 - 1438 = 550 ac. ft.

No. 2 Dam will be overtopped by ½ PMF.

Additional information from engineering firm that designed spillway repairs

The June 1972 flood destroyed most of the spillway chute. The firm of Gannett Fleming Corddry & Carpenter, Inc. designed a new spillway chute, which has since been built. Mr. Pickering, of the above firm, recalls from memories that they computed a peak flow figure of 2,900 cfs for the June 1972 flood, and that the new chute was designed for a peak flow of 7,000 cfs.

Calculations made for this investigation indicate a peak flow of 2,000 cfs for the 1972 flood and a maximum capacity of 7,800 cfs for the spillway weir.

APPENDIX C

GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Name: Mauch Chunk Formation.

Lithology: Grayish red and reddish brown sandstone interbedded with similarly colored siltstone, mudstone and shale. Some thin interbeds of green to grayish green mudstones are common. Cement in the sandstones consists of hematite and silica.

Structure

The dam is located on the north limb of the complex syncline which forms the Western Middle Anthracite Coal Field. The beds strike N80°E and dip about 45°S, on the average. Local folds are possibly present, but are not mapped as there are almost no bedrock exposures in the valley of Roaring Creek.

There are a number of faults known to offset the crest of Little Mountain on the north side of the valley. None are mapped in the vicinity of the dam.

Fracture traces have the following orientations: N10°-14°W, N18°W, N45°W, N60°W, E-W, N16°-20°E, N56°E and N68°E.

Overburden

There is no core boring information in the file. There are, however, a number of photographs in the file taken during the construction of the core wall. The trench for the core wall was dug into fresh rock. The overburden was probably originally quite thick, especially on the north side.

Aquifer Characteristics

While some of the sandstone units in the Mauch Chunk Formation may have some primary porosity and permeability, most, or all, ground water movement is along bedding planes and fractures. Since the grains and cement of the rock are essentially insoluble minerals, there is little chance of enlargement of fracture openings by ground water movement.

Discussion

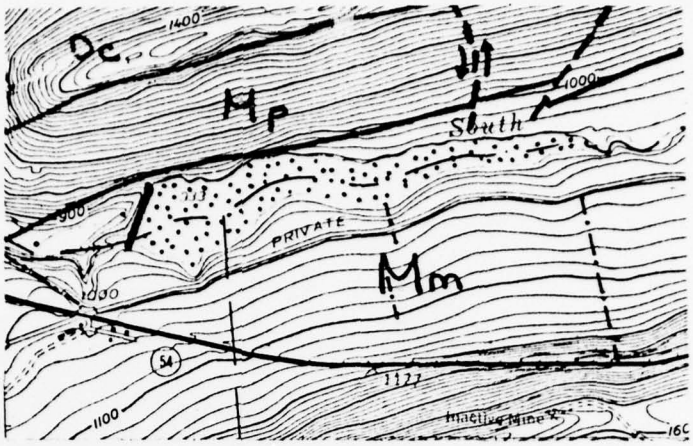
Ground water movemet in the Mauch Chunk Formation is probably principally along bedding. Since this dam is built nearly at right angles to bedding there is the possibility of substantial ground water movement through the bedrock, under the core wall. However, since the rock is essentially insoluble, and is well cemented there is little chance of enlarging the openings in the fresh bedrock.

Sources of Information

1. Arndt, H. H., 1971 "Geologic Map of the Mt. Carmel Quadrangle" U.S. Geological Survey Map G.Q. 99.

2. Air Photographs, scale 1:24,000, dated 1969.

GEOLOGIC MAP
South Branch Roaring Creek Dam #2



(Geology from U.S. Geol. Surv. map GQ-919)

KEY

Mm	Mauch Chunk Fm- middle & lower member undifferentiated
Mp	Pocono Fm
Dc	Catskill Fm
-·-·-·-	air photo fracture trace
————	fault

SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

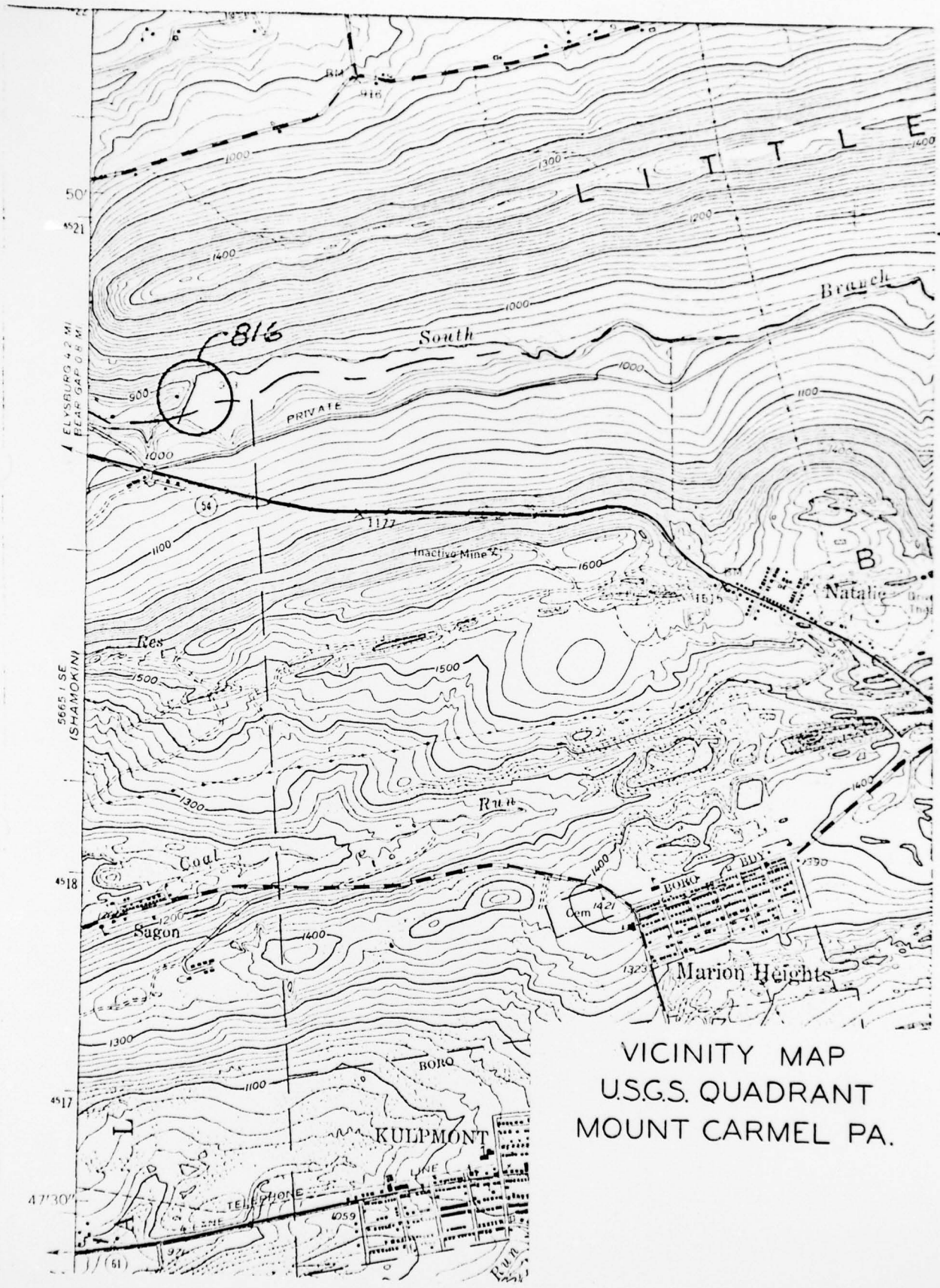
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

APPENDIX D

LOCATION, PHOTOGRAPHS & DESIGN DRAWINGS

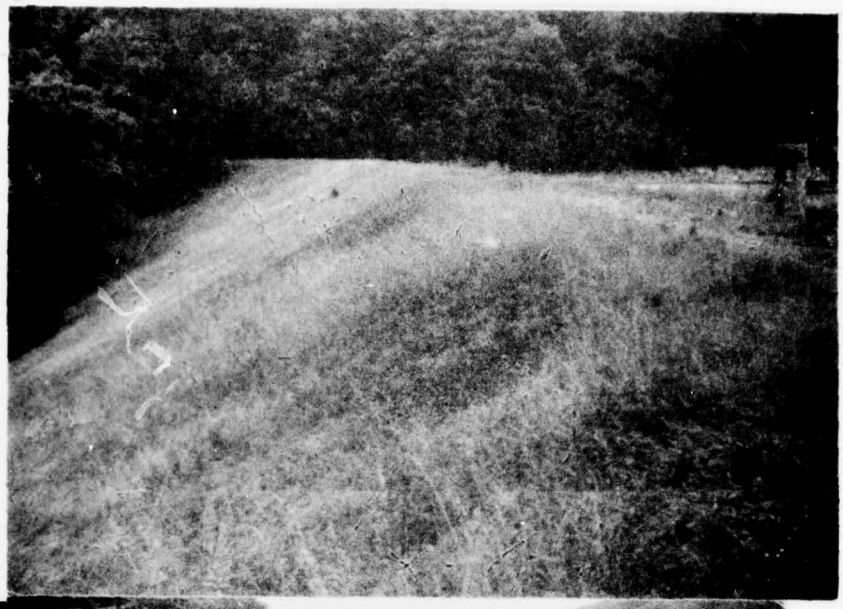
LOCATION PLAN
BEAR GAP No 2

PLATE I



VICINITY MAP
U.S.G.S. QUADRANT
MOUNT CARMEL PA.

PLATE II

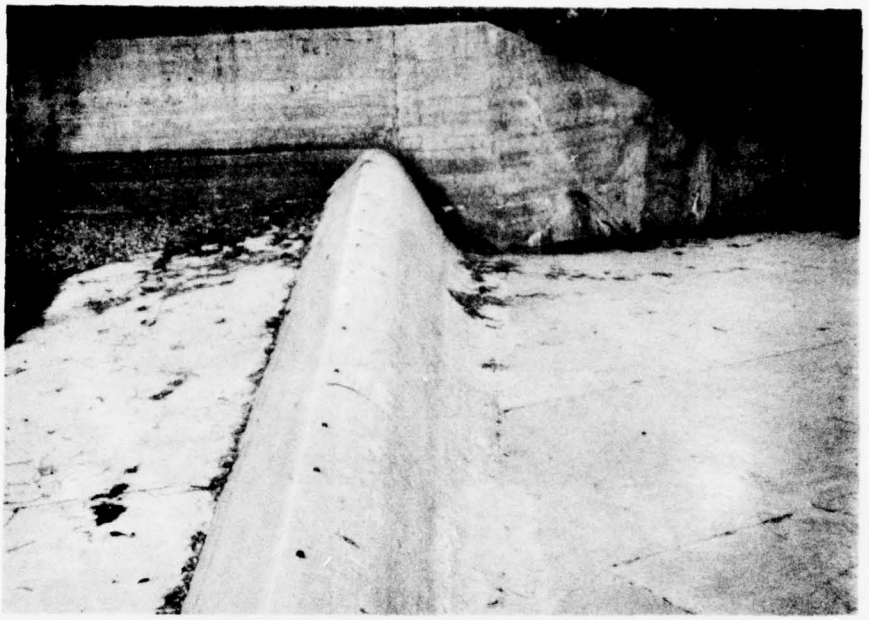


Downstream
Slope
Looking North

Downstream
Slope

Reservoir

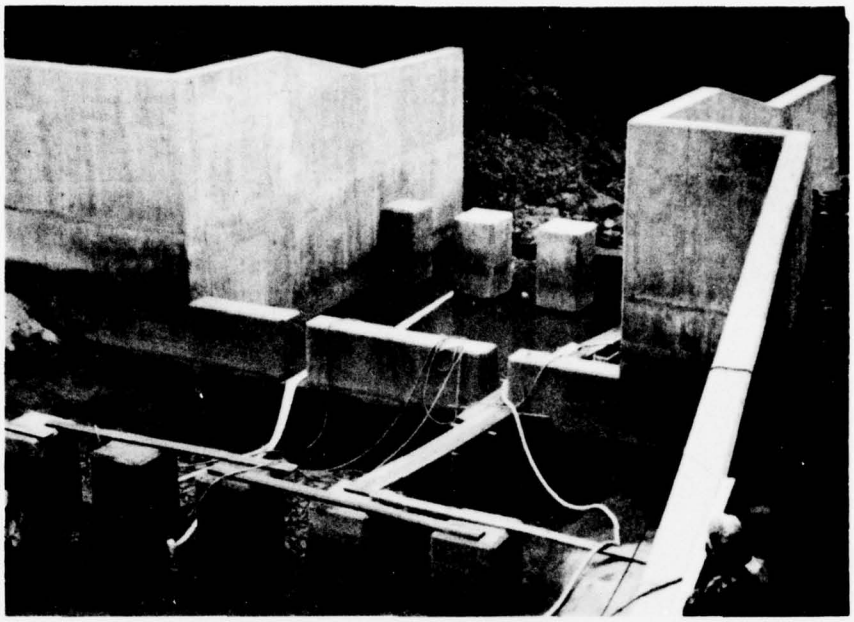
PLATE III



Spillway
Weir

Spillway
Channel

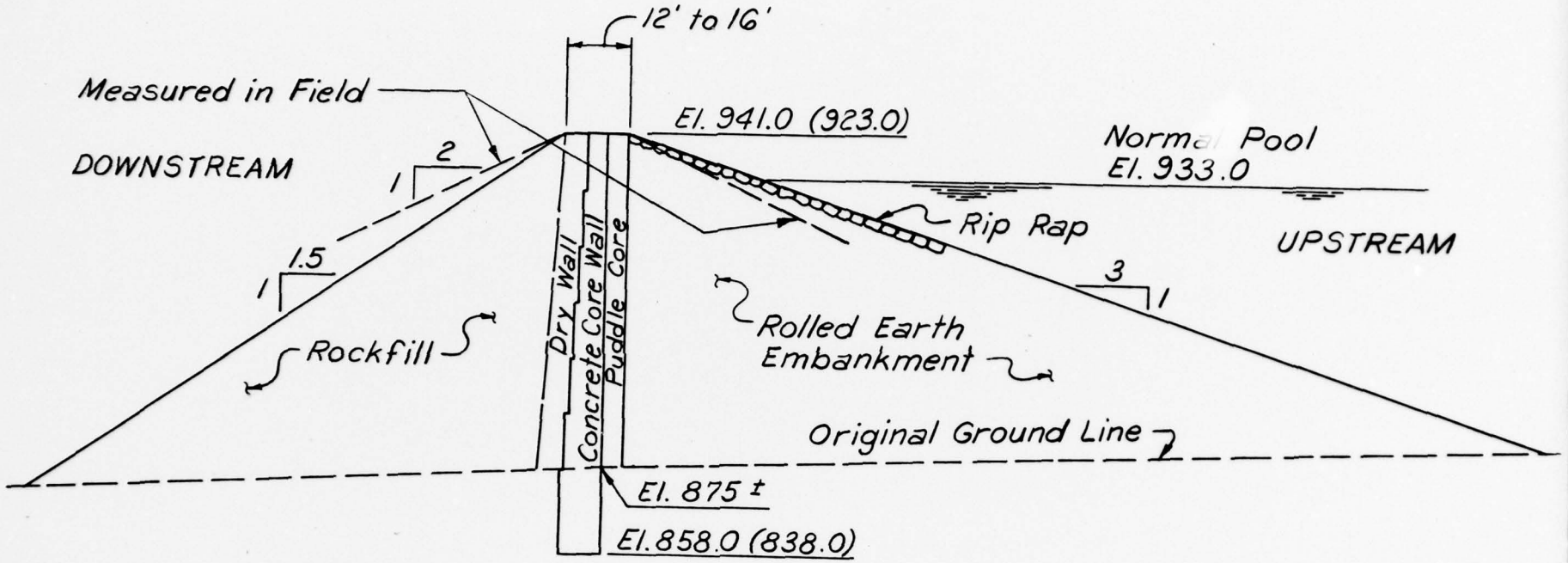
PLATE IV



Energy
Dissipator

Spillway
Looking Upstream

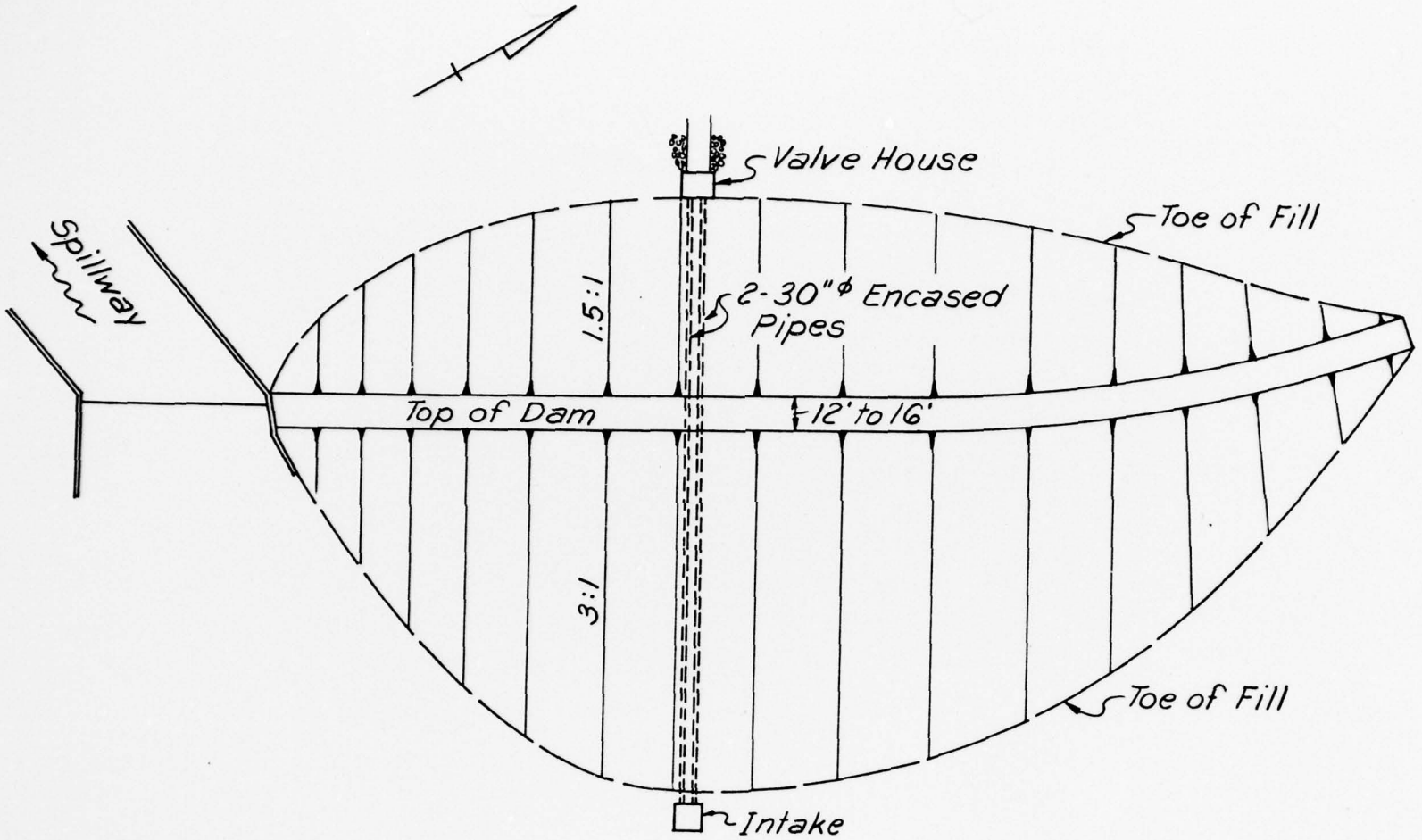
PLATE V



TYPICAL SECTION – SKETCH

No Scale

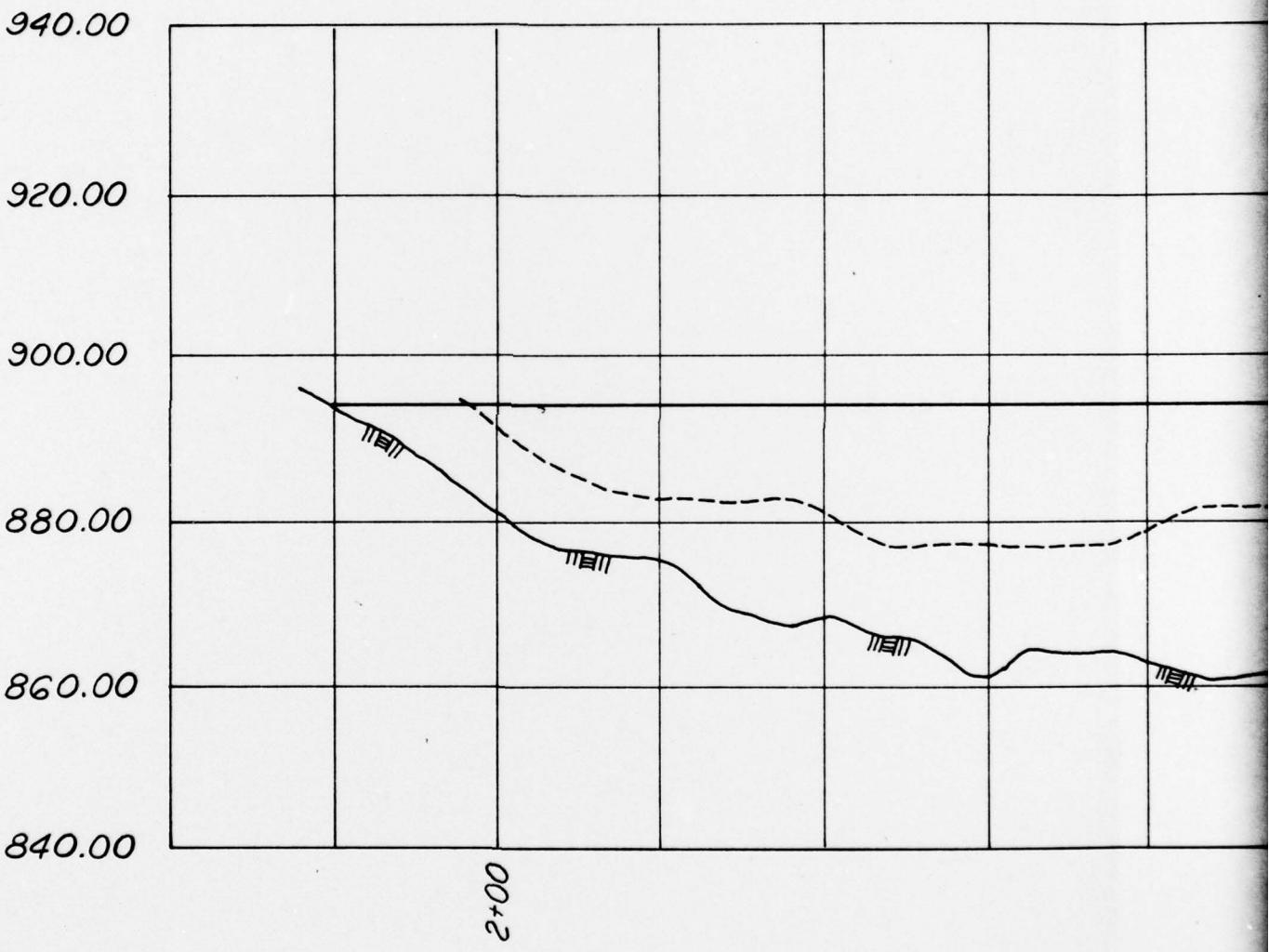
PLATE VII

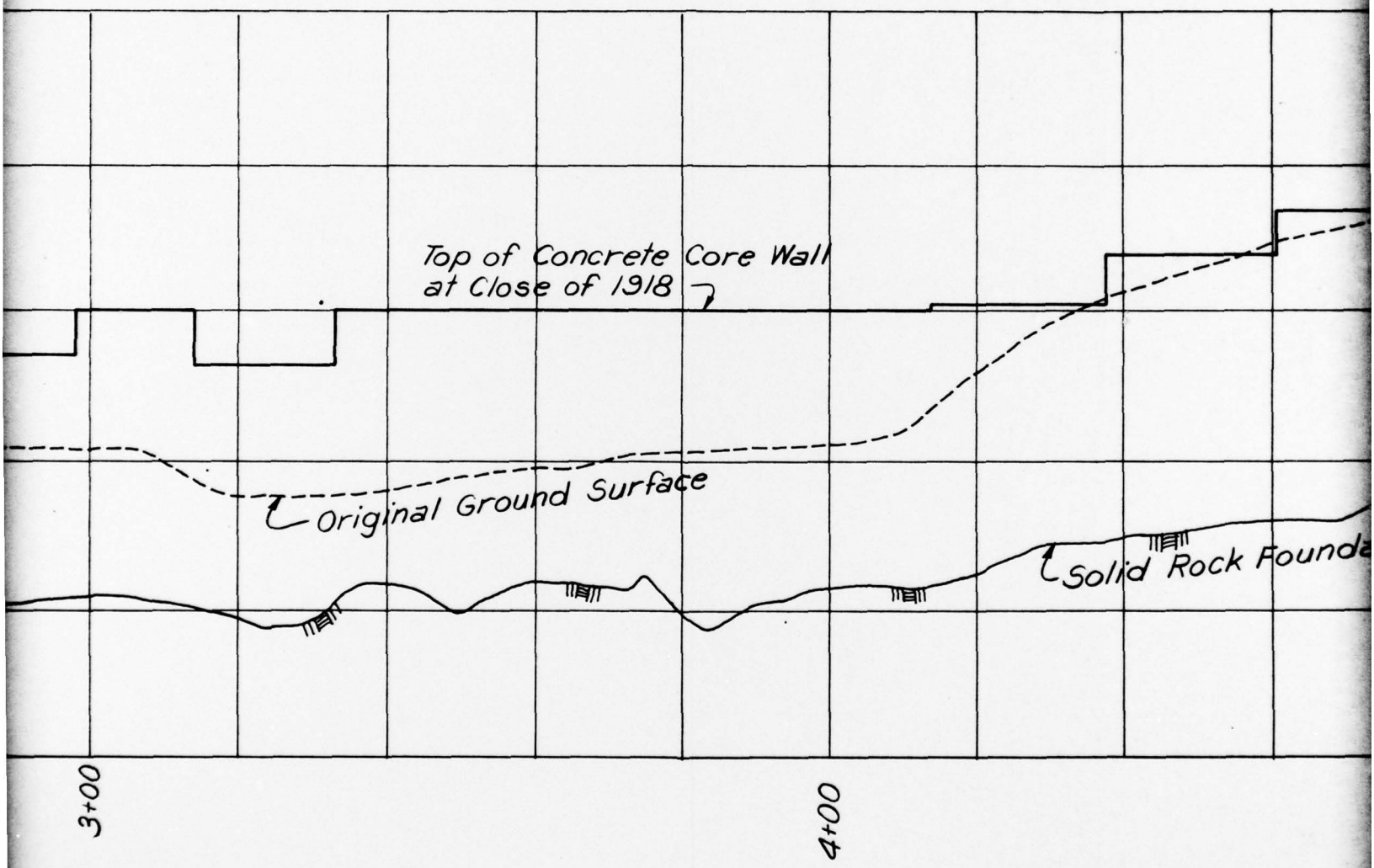


SCHEMATIC PLAN

No Scale

PLATE VII


940.00
920.00
900.00
880.00
860.00
840.00
2+00



SECTION ℄ DAM
(1918)

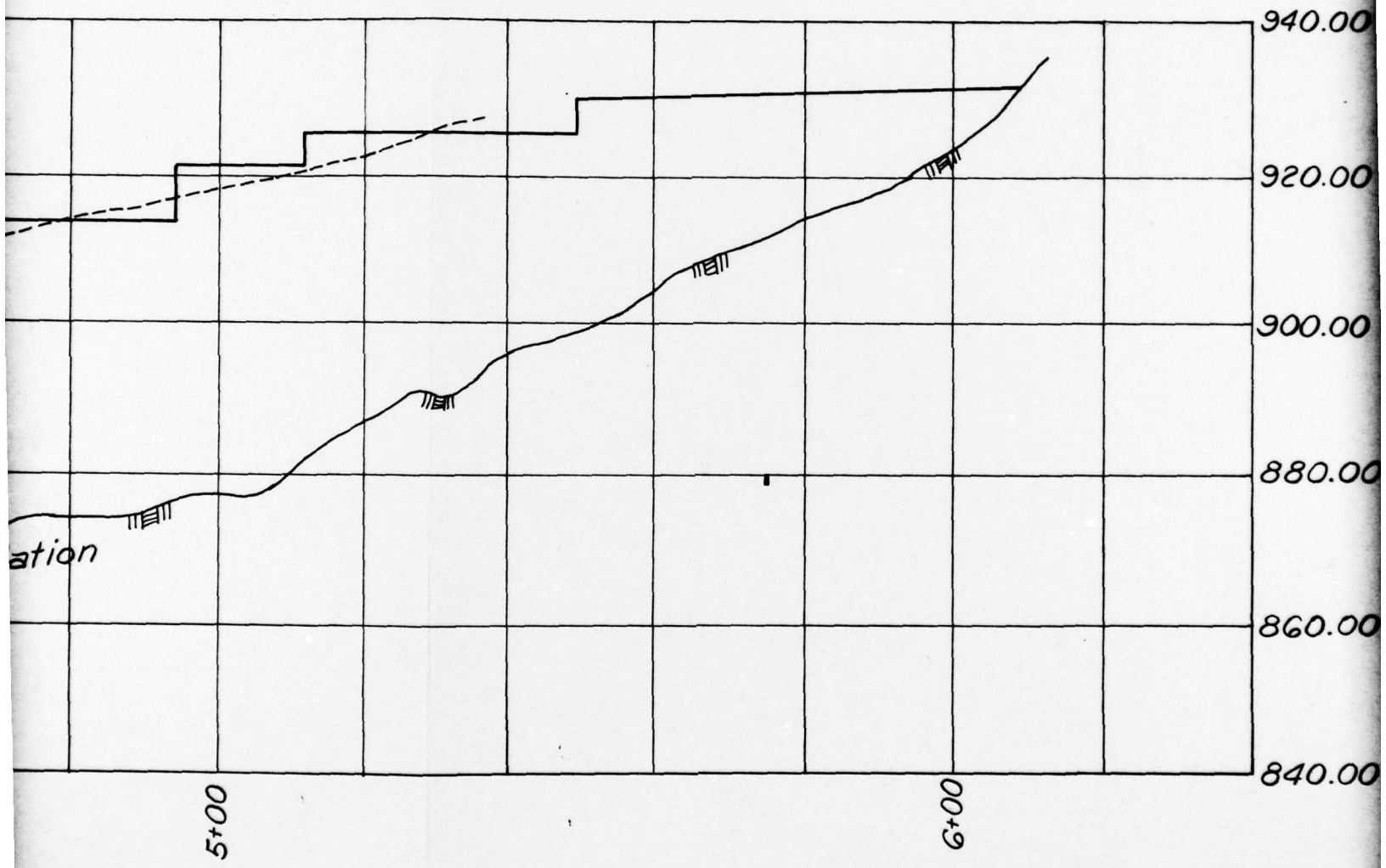


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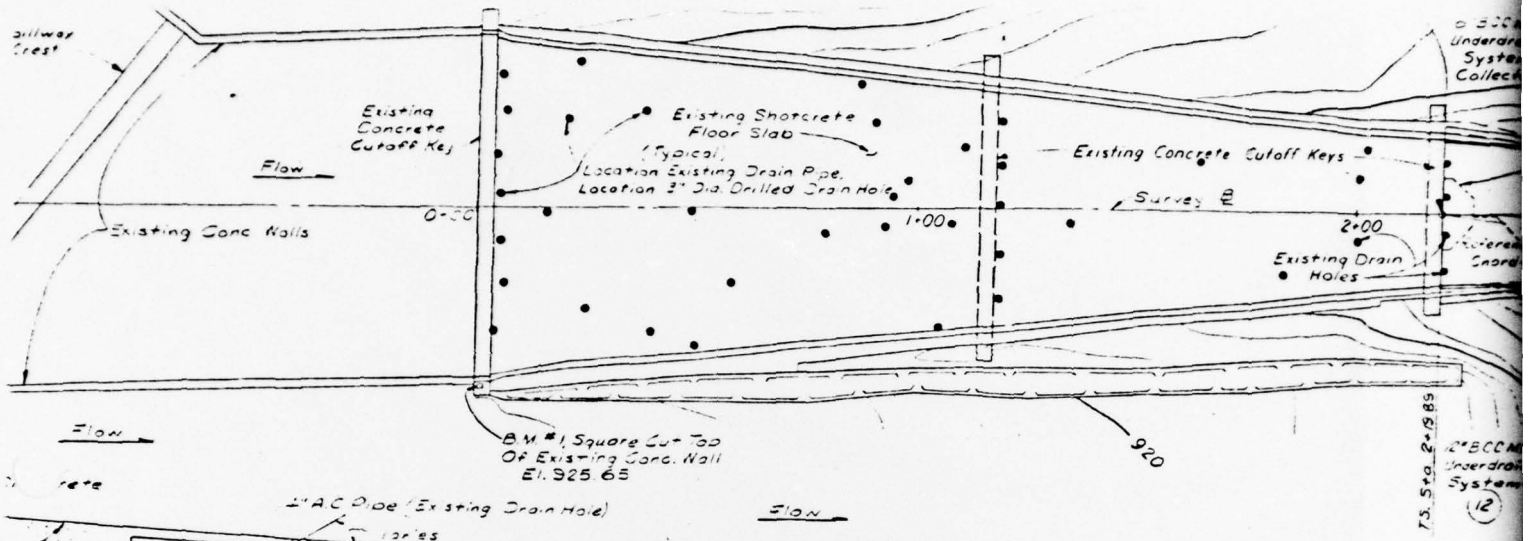
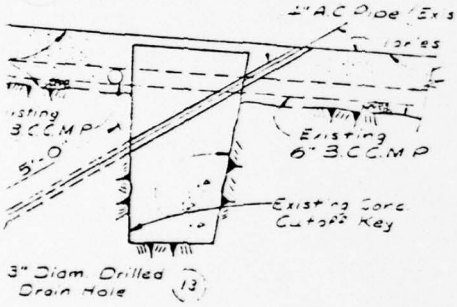
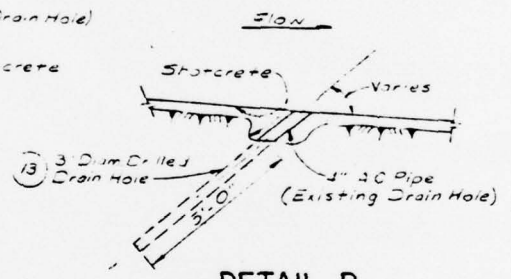
PLATE V

2,

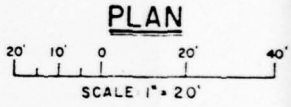




DETAIL A
NO SCALE

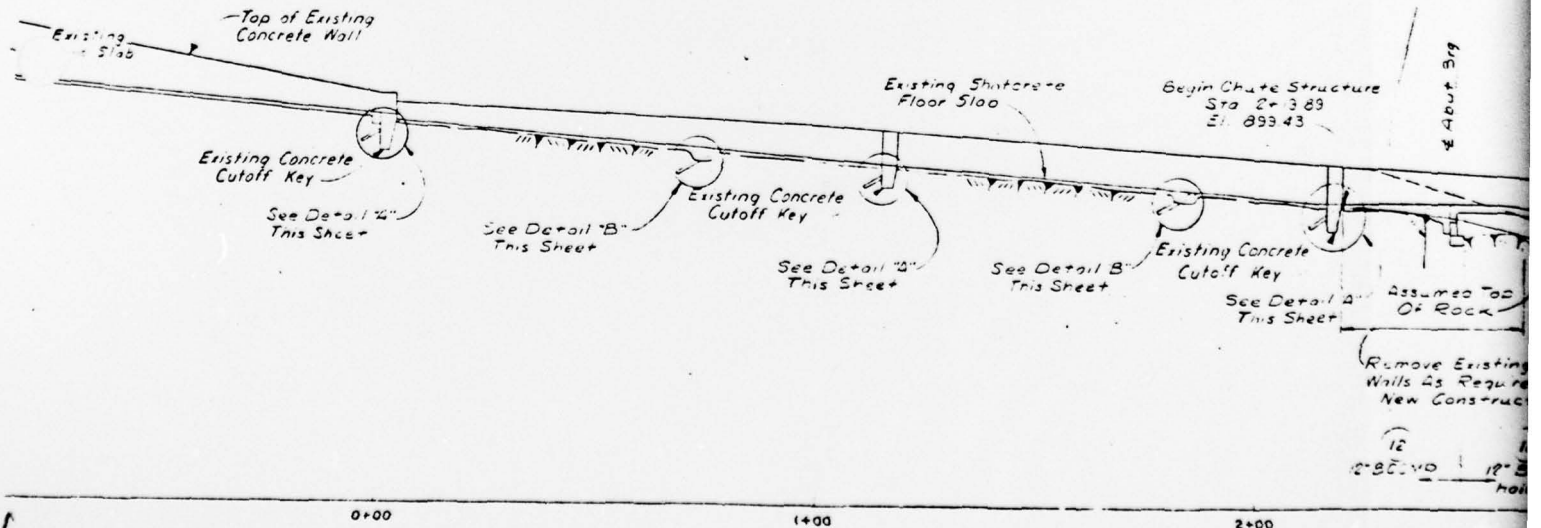


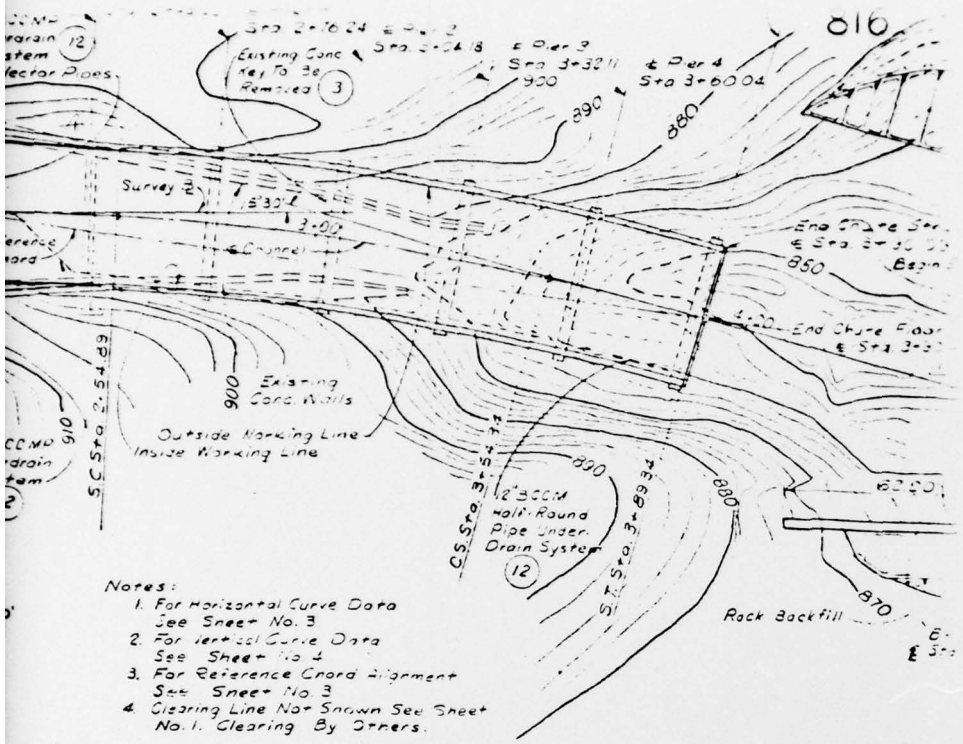
DETAIL B
NO SCALE



PLAN

#10 Hooked Anchor Bars Grouted
Holes Approx 10:0 Deep. Loc
Slope Of Anchor Bars To Be S
It Is Estimated That 10 Anch
Will Be Required From ℄ Sta
℄ Sta 2+48





routes in 3" Dia
Location And
Be Set in Field
Anchor Bars
Sta 2+20 To

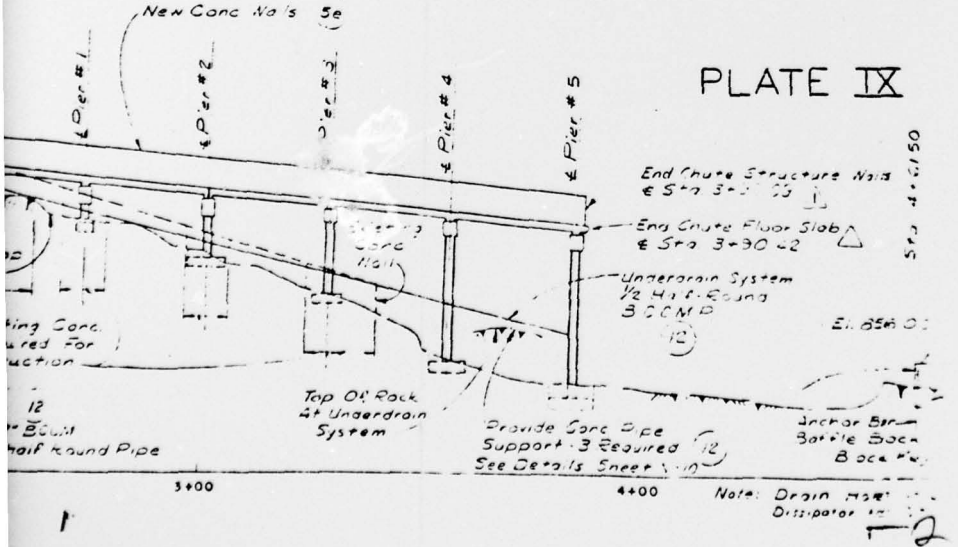


PLATE IX