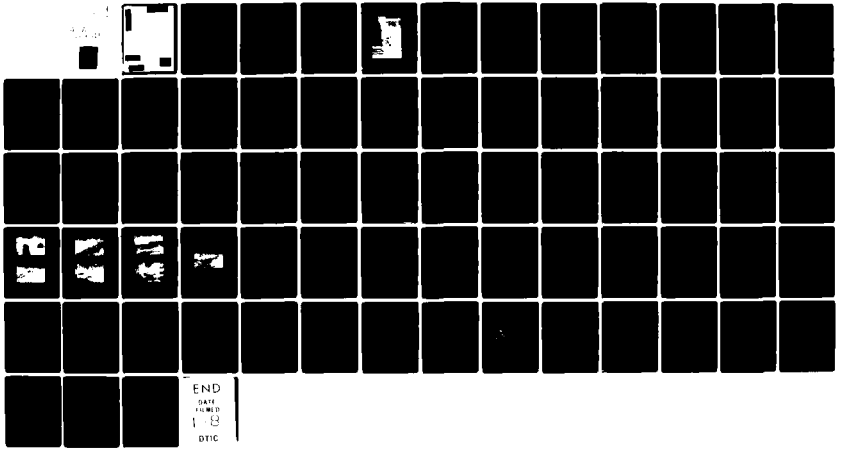
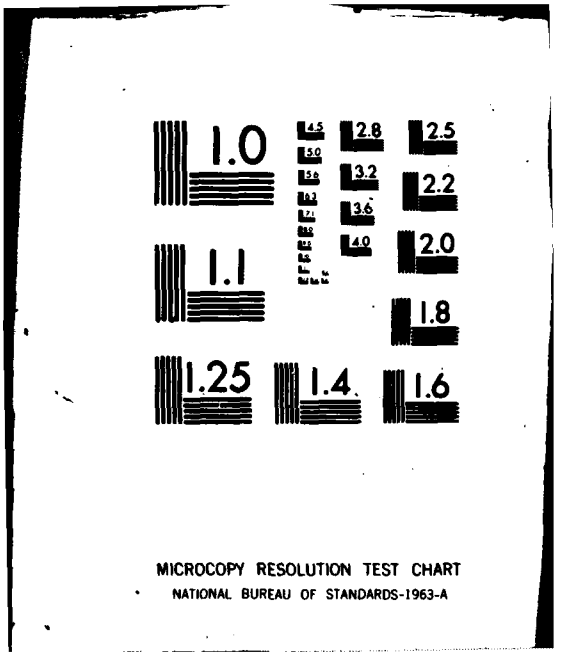
AD-A091 455 BERGER ASSOCIATES INC HARRISBURG PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. BELMONT DAM (NDI-ID NUMBER PA---ETC(U)
AUG 80 H JONGSMA DACW31-80-C-0019
UNCLASSIFIED NL



END
DATE FILMED
1-81
DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD A091455

DTIC FILE COPY

"Original contains color plates: All DTIC reproductions will be in black and white"

DTIC
ELECTE
DEC 4 1980
A

This document has been approved for public release and sale; its distribution is unlimited.

PREFACE

This report has been prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

"Original contains color plates: All DTIC reproductions will be in black and white"

NOV 1 2 1980

A

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

Form 50

BRIEF ASSESSMENT OF GENERAL CONDITIONS
AND RECOMMENDATIONS

Name of Dam:	BELMONT DAM
State & State No.:	PENNSYLVANIA, 35-33
County:	LACKAWANNA
Stream:	TRIBUTARY TO LACKAWANNA RIVER
Date of Inspection:	May 6, 1980

A

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in poor condition. The dam is considered to be unsafe, non-emergency.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is small and the hazard classification is high. These classifications indicate that the Spillway Design Flood (SDF) should be in the range of one-half the Probable Maximum Flood (PMF) to the full PMF. The recommended SDF for this dam is the full PMF. The spillway capacity is inadequate to pass the SDF peak inflow without overtopping the dam. The project is capable of passing 95 percent of the PMF and is considered to be inadequate, but not seriously inadequate.

The following recommendations are presented for immediate action by the owner:

1. That a detailed engineering investigation be made by a professional engineer, experienced in the design and construction of dams, to evaluate the seepage condition and the stability of the dam. Recommendations made by this engineer should be implemented immediately.

2. That an in depth hydrologic and hydraulic study be made by a professional engineer, experienced in the design and construction of dams, to evaluate the possibility of developing a formal and adequate spillway at the upstream breached embankment of the dam and closing the existing spillway.

3. That all brush, trees and cuttings be removed from the downstream embankment slope and that a professional engineer, experienced in the design and construction of dams, be consulted for the removal of tree stumps and roots.

4. That all waste material be removed from the downstream slope and that this slope be provided with an adequate slope protection.

5. That the spillway and discharge channel be repaired if its continued use is contemplated. The chainlink fence shall be removed from the spillway.

6. That a method be developed for positive closure of the upstream end of the outlet pipe in case of an emergency.

7. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged precipitation.

8. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

SUBMITTED BY:

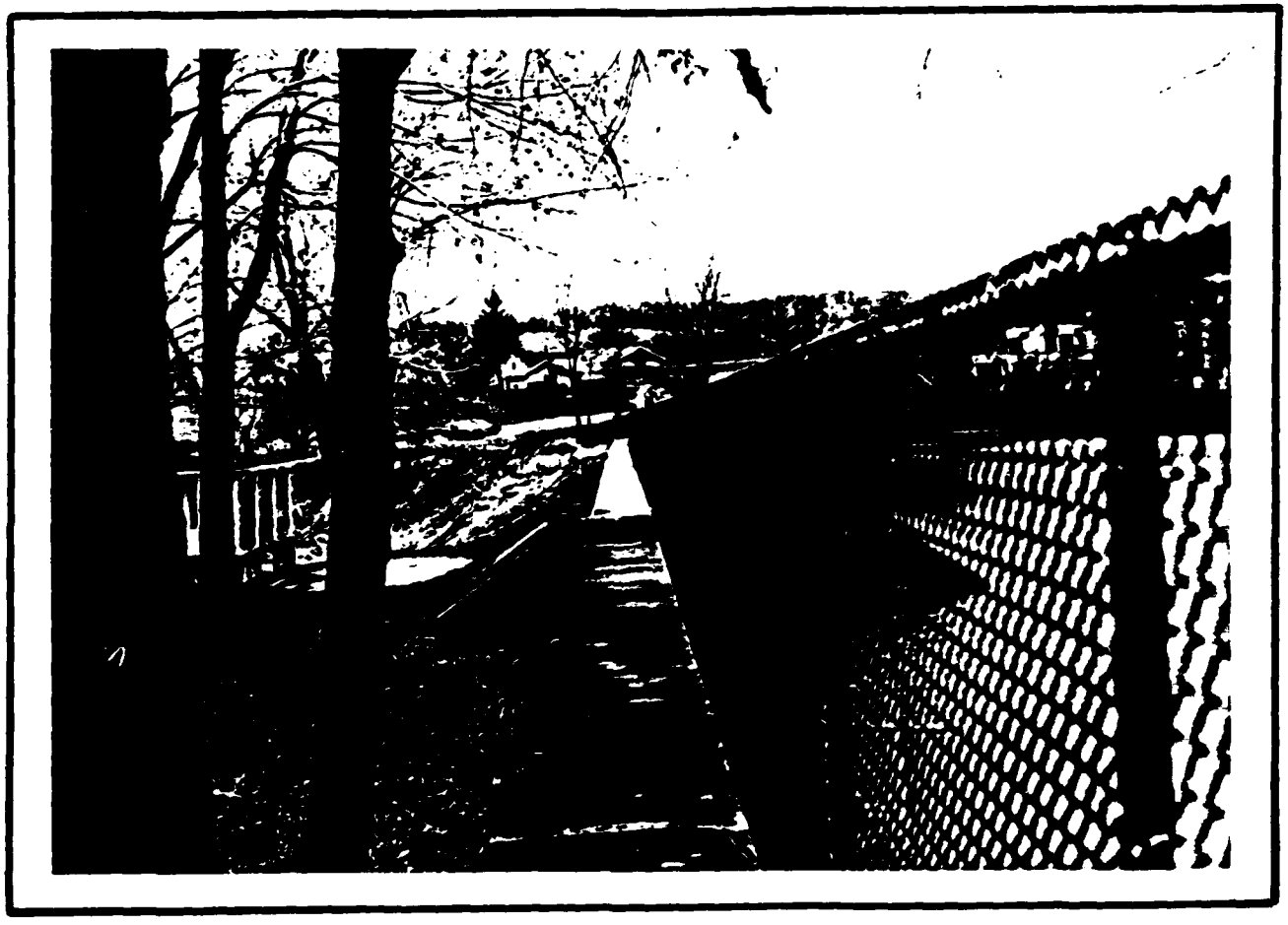
BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: August 1, 1980

APPROVED BY:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

DATE 30 August 1980



OVERVIEW

BELMONT DAM

Photograph No. 1

TABLE OF CONTENTS

		Page
SECTION 1 - PROJECT INFORMATION		
1.1	GENERAL	1
1.2	DESCRIPTION OF PROJECT	1
1.3	PERTINENT DATA	3
SECTION 2 - ENGINEERING DATA		
2.1	DESIGN	6
2.2	CONSTRUCTION	6
2.3	OPERATION	6
2.4	EVALUATION	6
SECTION 3 - VISUAL INSPECTION		
3.1	FINDINGS	8
3.2	EVALUATION	10
SECTION 4 - OPERATIONAL PROCEDURES		
4.1	PROCEDURES	11
4.2	MAINTENANCE OF DAM	11
4.3	MAINTENANCE OF OPERATING FACILITIES	11
4.4	WARNING SYSTEM	11
4.5	EVALUATION	11
SECTION 5 - HYDROLOGY/HYDRAULICS		
5.1	EVALUATION OF FEATURES	12
SECTION 6 - STRUCTURAL STABILITY		
6.1	EVALUATION OF STRUCTURAL STABILITY	14
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS		
7.1	DAM ASSESSMENT	16
7.2	RECOMMENDATIONS	16

APPENDIX A - CHECK LIST OF VISUAL INSPECTION REPORT
APPENDIX B - CHECK LIST OF ENGINEERING DATA
APPENDIX C - PHOTOGRAPHS
APPENDIX D - HYDROLOGY AND HYDRAULIC CALCULATIONS
APPENDIX E - PLATES
APPENDIX F - GEOLOGIC REPORT

(11) Aug 80 (12) 69

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM.

BELMONT DAM

NDI-ID PA-00252,
DER-ID 35-33,
Lackawanna County, Pennsylvania.

SECTION 1 - PROJECT INFORMATION

(15) DACW31-80-C-0019

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 inspections of dams throughout the United States.

B. Purpose

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

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

Note: The design drawing (Plate III, Appendix E) indicates a normal pool elevation of 503, which was raised by four feet in 1907 (Plate IV, Appendix E). The U.S.G.S. Quadrangle sheet indicates a reservoir elevation of 1248.0. This U.S.G.S. elevation is used in this report as top of spillway elevation.

Belmont Dam is an earthfill structure with a masonry core wall. The core wall was raised in elevation by four feet. The length of the concrete wall is about 605 feet and the top of the crest is about 33 feet above the downstream toe . A 23.5 foot wide spillway is located near the left abutment. An intake structure is located at the upstream toe. This structure consists of a wet well which discharges through a 16-inch diameter pipe under the embankment. The flow through the pipe is controlled by a valve located in a valve house near the downstream toe. This valve is normally in the open position and the actual flow is controlled downstream with other valves on a ten inch diameter line. To increase the storage capacity, the core wall was raised by four feet in 1907. This addition would have caused overtopping at the upstream end

411005

of the reservoir; therefore, a 150 foot long, five foot high, earthfill embankment was constructed at the upstream end closing off the natural draw. In the 1960's flow over the spillway caused flooding downstream from the dam. To relieve this condition, the upstream embankment was breached. The low point of this breach is below the spillway elevation and all normal inflow is now discharged through this breach.

B.	Location:	Fell Township, Lackawanna County U.S.G.S. Quadrangle - Waymart, Pa. Latitude 41°-35.4', Longitude 75°-28.9' Appendix E, Plates I & II
C.	Size Classification:	Small: Height - 33 feet Storage - 107 acre-feet
D.	Hazard Classification:	High (Refer to Section 3.1.E.)
E.	Ownership:	Mr. Joseph Cianflone, Facilities Engineer Gentex Corporation Carbondale, PA 18407
F.	Purpose:	Industrial water supply. Sometimes for recreation by school located on the west shore of the reservoir.

G. Design and Construction History

The dam was designed by Messrs. William H. Marple and E.M. Holcombe for the Belmont Water Company. The contractor, Martin Cawley, completed construction of the dam in 1902 or 1903 under the daily supervision of Mr. Holcombe. To increase the storage capacity, the masonry core wall was increased in height by 4'-9" in 1907, increasing the actual crest elevation by 2'-9" (Plate IV, Appendix E). It is assumed that at that time a low area at the upstream (north) end of the reservoir was closed off with a 150 foot long, five foot high, earthfill embankment. Any flow over the spillway caused problems in Simpson, Pennsylvania, located immediately downstream from the dam. The Township Supervisors requested Pennsylvania Department of Environmental Resources (PennDER) on October 1, 1968, to breach the upstream dam. There are no records of approval of actual breach. At present, all normal inflow is discharged through this breach.

H. Normal Operating Procedures

Operating procedures do not exist. Water flows from the wet well through a 16-inch diameter pipe under the embankment to a valve house at the downstream toe. This valve is always open. Beyond this valve, the water flows through a 10-inch diameter pipe to the factory where flow is regulated. Normal excess in flow is discharged through

the breach at the north end of the reservoir. Present owners do not recall water flowing over the spillway in the main dam. Use of water exceeds inflow in the summer and pool level drops considerably.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

From files:	.1
Computed for this report:	.18
Use:	.18

B. Discharge at Dam Site (cubic feet per second)
See Appendix D for hydraulic calculations

Maximum known flood estimated from records for the U.S.G.S. gaging station which is located on nearby South Branch Tunkhannock Creek	68
Outlet works (water supply) low-pool outlet at pool Elev. 1230	17
Outlet works (water supply) at pool level Elev. 1248.0 (spillway crest)	33
Spillway capacity at pool Elev. 1250.1 (top of dam)	236
Discharge capacity breach at the north end at pool Elev. 1250.1	326

C. Elevation (feet above mean sea level)

Top of dam (low point)	1250.1
Spillway crest (main dam)	1248.0
Breach at north end	1246.7
Upstream portal invert	1223.25
Streambed at downstream toe of dam (estimate)	1217.±

D. Reservoir (miles)

Length of normal pool	.2
Length of maximum pool	.2

E. Storage (acre-feet)

Spillway crest (Elev. 1248.0)	92
Top of dam (Elev. 1250.1)	107

F. Reservoir Surface (acres)

Top of dam (Elev. 1250.1)	7.6
Spillway crest (Elev. 1248)	6.7

G. Dam

Refer to Plate III in Appendix E for section.

Type: Earthfill with masonry core. Dam raised four feet above earthfill with concrete parapet wall on top of core wall.

Length: 605 feet.

Height: 33 feet above toe of dam.

Top Width: Concrete wall - 4.0 feet.
Earthfill - varies.

Side Slopes:	Design	Surveyed
Upstream	3H to 1V	Unknown
Downstream	2.5H to 1V	Varies

Zoning: Masonry core wall.

Cutoff: Core wall placed on concrete footing in trench. Trench is about 7 feet deep (Plate III, Appendix E).

Grouting: None.

H. Outlet Facilities

Type: Stoplog structure (water supply intake).

Location: Upstream toe near left abutment.

Outlet Conduit: 16" pipe through embankment.

Closure: Stoplogs on upstream end; 16" valve in valve house at downstream toe.

I. Spillway

South

Type: Broad crested weir.

Length: 23.5 feet.

Crest elevation: 1248.

Location: In main dam 138 feet from left abutment.

North

Type: U-shaped swale through embankment, created by man made breach of the dam.

Top Width: 61 feet.

Crest Elevation: 1246.7.

Location: Through earth embankment at north end of lake.

J. Emergency Outlet

None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The engineering design data for Belmont Dam are limited. The dam was constructed prior to the requirement for a permit. The available material consists of two drawings. One drawing (Plate III) is dated August 25, 1903. The dam was reportedly constructed in 1902 and this drawing could be an "as built" section and profile. The second drawing (Plate IV, Appendix E) indicates the methods for increasing the height of the dam.

A report, "Evaluation of the Belmont Reservoir," was prepared by Northeastern Engineering Company, Clarks Summit. This report, dated February, 1978, evaluated the storage capacity of the reservoir and made some recommendations for the improvement of the embankment.

2.2 CONSTRUCTION

The construction data is limited to a statement of the owners in 1915 that the core wall was founded on stone and hardpan.

2.3 OPERATION

Formal records of operation have not been maintained by the owners. Ownership has been transferred several times. Inspection reports by PennDER indicate that seepage and a soggy condition at the toe has been a problem since at least 1917 until 1957. Only one report since 1957, in 1965, is available; and this report did not report the seepage.

2.4 EVALUATION

A. Availability

The only available construction drawings are contained in the files of PennDER. These files contain also inspection reports and letters discussing the condition of the dam.

B. Adequacy

The construction drawings, combined with previous inspection reports and the recent in depth inspection, are considered to be sufficiently adequate to make a reasonable assessment of the dam.

C. Operating Records

Operating records, including maximum pool levels, have not been maintained by the owner. Inspection reports by PennDER indicate that seepage has been a problem since at least 1917. A weir to measure

the seepage amount was installed near the right abutment and weekly weir readings are in the file for the period of April, 1918, to August, 1919. Discharges up to 12,300 gallons/day are recorded in July, 1918. The pool was lowered in the fall of 1918 and the contractor excavated a trench at the right upstream side of the core wall. A four foot vein of quicksand, 40 feet from the right end of the dam, was discovered under the foundation. A concrete slab was poured under and against the upstream side of the core wall. Weir readings from January to July, 1919, indicate a seepage flow of about 3,200 gallons/day.

D. Post Construction Changes

Besides the corrections discussed in the previous paragraph, a letter in the PennDER files indicates that the upstream face of the core wall was grouted to a depth of six feet below the flowline in 1935.

In 1965, and again in 1968, the Fell Township Supervisors requested the assistance of PennDER in reducing the discharge over the spillway. In 1968 it was requested to open the upstream end of the reservoir permitting the normal discharge to flow in a northerly direction through a natural swale in an uninhabited area.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of Belmont Dam is poor. The downstream slope is irregular. Waste material, containing large pieces of concrete, have been dumped in several areas. Heavy brush and trees were cut from the slope in February, 1980, and the cuttings have not been removed. Close observation of the slope, the downstream toe, and the area immediately downstream of the toe was impossible. Seepage was noticed on the slope and downstream toe, and the fill and natural ground appeared to be saturated and soft. The concrete breast of the dam appeared to be in good condition. The spillway, however, is in a deteriorated condition.

Mr. J. Cianflone and Mr. Frank Kuna of Gentex Corporation accompanied the inspectors during the inspection.

The visual inspection check list is in Appendix A of this report. Sketches of a general plan, profile and typical cross sections as surveyed during the inspection are presented in Appendix A as Plates A-I, A-II and A-III.

Photographs taken of the facilities on the day of the inspection are reproduced in Appendix C.

B. Embankment

The upstream earthfill embankment is below the normal reservoir water surface elevation. A high chainlink fence on top of the concrete wall (Photographs No. 1 and No. 2) prevented close observation of the upstream side. Riprap appeared to be present on the upstream slope. The crest of the dam is a four foot wide concrete wall. The top of the wall is in good condition, straight and level over its 605 foot length. The downstream side of the wall showed many repair patches. The wall is, however, in good condition.

The top of the embankment at the downstream side of the wall varies several feet in height over its length, and also varies considerably in width. The downstream slope is in fair condition over about a 200 foot length from the left abutment. A house is located to the right of the spillway (Photograph No. 2). The basement of this house is below normal reservoir elevation and it was reported that the basement is wet.

Heavy brush and trees up to 18-inch in diameter had been permitted to grow on the slope. This growth was cut in February, 1980. Cuttings were left on the slope and all tree stumps are still in the

embankment slope (Photographs No. 4 & No. 5). Waste material has been dumped on the downstream slope near the center and near the right abutment (Photographs No. 3 & No. 4). The lower half of the slope is saturated, as is the area beyond the toe and around the valve house. The soil was soft and at some locations the weight of a person would cause the foot to sink six inches into the ground.

C. Appurtenant Structures

A wet well was constructed at the upstream toe. The water level in the wet well could be controlled with stoplogs. A screen house on the structure has been removed and a concrete slab has been placed over the opening. This structure is accessible only by boat and was not inspected. The pool level drops considerably in the summer, and it is assumed that, at present, no stoplogs are in the structure. Water flows from the wet well through a 16-inch diameter pipe to a valve house at the downstream toe. Flow can be controlled here with a valve. This valve is, however, normally left open and water consumption is controlled further downstream at the plant with other valves on a 10-inch diameter supply line.

The dam has a concrete masonry spillway near the left abutment. The walls of the spillway are in a deteriorated condition (Photograph No. 6) and the discharge channel immediately below the weir is in such a condition that it is expected that heavy damage would occur if a large discharge would occur (Photograph No. 7). Water was seeping through the rock surface of the channel. The chainlink fence across the spillway reduces the efficiency of the opening.

The owner's representative stated that this spillway has not been used for many years. An inspection of the breach at the upstream end of the reservoir showed that water flows out of the reservoir at this point (Photograph No. 8). It appeared that the channel and immediate area had been recently cleared and opened. The inflow to the reservoir is about 50 feet to the east of this outflow point.

D. Reservoir Area

The reservoir has wooded slopes on the left side. The right side is flat where a school with parking lot and playground is located immediately adjacent to the reservoir.

E. Downstream Channel

The present outflow is through the low area at the north end of the reservoir. When the reservoir level rises sufficiently to flow over the constructed spillway, both ends of the reservoir have a downstream area. Only the area below the main dam is considered as a downstream area affected by the dam. From the spillway, a dry, rock lined

channel leads to a 24-inch diameter pipe under a secondary road. From this point the channel is ill defined. Any flow would have to cross over another highway and then enter the flat, heavily populated area of Simpson, Pennsylvania. Through this area the channel is only a small swale which passes between several homes. A potential hazard to loss of life exists downstream from the dam if the dam fails. The hazard category for Belmont Dam is considered to be "High."

3.2 EVALUATION

The overall visual evaluation of Belmont Dam is poor. All cuttings should be removed from the downstream slope and in the area immediately downstream of the toe. The seepage and soggy condition of this area requires immediate attention. If the hydraulic analysis (Section 5) indicates that the spillway in the dam is required, this structure should be rehabilitated and the downstream channel should be improved. All waste material on the downstream slope should be removed.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The operational procedures at Belmont Dam are very limited. The outlet pipe has no control at the upstream end, and the valve in the valve house is generally left in open position. The reservoir water is treated with chemicals in the reservoir and used for industrial purposes. The pool level drops during a dry period.

4.2 MAINTENANCE OF DAM

It is apparent that little maintenance has been provided. The recent cutting of brush and trees indicates that a heavy growth was present on the downstream slope. There have been no recent efforts to control seepage through the embankment.

4.3 MAINTENANCE OF OPERATING FACILITIES

The intake tower was not inspected. The valve house was in fair condition on the outside. The inside shows little maintenance of the valves. The spillway is in a deteriorated condition.

4.4 WARNING SYSTEM

A formal surveillance and downstream warning system does not exist at the present time.

4.5 EVALUATION

The operational procedures for Belmont Dam should include the removal of all brush and trees from the embankment and in an area 20 feet beyond the toe of the dam. This work should be repeated on a regular basis. Valves should be maintained and operated on an annual basis.

A formal surveillance plan and downstream warning system should be developed for implementation during periods of high or prolonged precipitation.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analyses available from PennDER for Belmont Dam does not exist. No frequency curve, unit hydrograph, nor flood routings were submitted by the designer to PennDER.

An inspection report by Northeastern Engineering Company was provided by the owner. This report contained a spillway rating curve, stage-storage curve, design flood hydrograph of one-half PMF, and routing of the design hydrograph. The computations contained in Appendix D were made as a check.

B. Experience Data

Records of the water levels in the Reservoir are not maintained. Calculations based on the records of the U.S.G.S. gaging station for the South Branch of Tunkhannock Creek at nearby Moundale, Pennsylvania, indicate that the greatest flood occurred in October, 1976, and produced an inflow to the reservoir of about 68 cfs. The project passed that flood without any reported damage.

C. Visual Observations

The spillway appears able to operate satisfactorily; however, the channel downstream is not capable of handling the discharge from the dam. This channel is a shallow, rock lined swale which narrows considerably farther downstream.

It was noted that the stoplog structure is not used for controlling flow. This structure is accessible only by boat. Since the reservoir is used for industrial water supply, the valve at the downstream toe is normally left open. There is no drawdown facility.

D. Overtopping Potential

Belmont Dam has a total storage capacity of 107 acre-feet and an overall height of 33 feet, both referenced to the top of the dam. These dimensions indicate a size classification of "Small." The hazard classification is "High" (see Section 3.1.E.).

The Spillway Design Flood (SDF) for a dam having the above classifications is in the range of one-half the Probable Maximum Flood (PMF) to the full PMF. Due to the presence of the town of Simpson immediately downstream of the dam, the recommended SDF for the Belmont

Dam is the full PMF. For this dam, the PMF peak inflow is 649 cfs (see Appendix D for HEC-1 inflow computations).

Comparison of the estimated PMF peak inflow of 649 cfs with the estimated spillway discharge capacity of 562 cfs (spillway and swale) indicates that a potential for overtopping of the Belmont Dam exists.

An estimate of the storage effect of the reservoir and routing of the computed hydrograph through the reservoir shows that this dam does not have the necessary storage available to pass the SDF without overtopping. The spillway-reservoir system can pass a flood event equal to 95% of a PMF.

E. Spillway Adequacy

The small size and high hazard categories, in accordance with the Corps of Engineers criteria and guidelines, indicates that the SDF for this dam should be in the range of one-half the PMF to the full PMF. The recommended SDF is the full PMF.

Calculations show that the spillway discharge capacity and reservoir storage capacity combine to handle 95% of the PMF (Refer to Appendix D).

Since the spillway discharge and reservoir storage capacity cannot pass the full PMF without overtopping, but can pass more than one-half the PMF without overtopping, the spillway is considered to be inadequate but not seriously inadequate.

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 Observations

1. Embankment

The visual inspection of Belmont Dam indicates that this dam has a serious seepage problem. The saturated condition of several areas on the slope and beyond the toe is cause of concern. The estimated flow in one area was 3 gallons/minute. The presence of large tree stumps, with its root system is a concern in an embankment with seepage problems. The concrete parapet wall on top of the dam appears to be in good condition.

2. Appurtenant Structures

The spillway and downstream channel do not appear to be in adequate condition to accomodate a heavy discharge. The outlet pipe has no means of a positive closure at the upstream end.

B. Design and Construction Data

The design drawings indicate a typical section (Plate III, Appendix E) adequate for this height of dam. The core wall on the centerline was placed on hardpan and consists of rubble masonry. The seepage problem indicates that the embankment material is not adequately impervious and that the rubble masonry wall does not prevent seepage. Construction details of the spillway are not available.

C. Operating Records

Operating records for this dam have not been maintained by the owner. Reference is made to Section 2.4.C. for discussion of inspection reports.

D. Post Construction Changes

These changes include the installation of an approximate four foot wide by 4'-9" high concrete wall to raise the reservoir level. This addition appears to be stable. Inspection reports, however, indicate that considerable leakage through the horizontal joint occurred. The placing of grout in 1935 appears to have sealed this joint.

E. Seismic Stability

This dam is located in Seismic Zone 1 and it is considered that if the static stability is sufficient, the dam may be assumed to withstand minor earthquake-induced dynamic forces. Since the static stability is questionable, the seismic stability cannot be assessed at this time.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection and the review of the available design and construction data indicate that Belmont Dam is in poor condition. The seepage and soggy condition of the downstream toe are reasons for concern. Maintenance procedures need improvement and the spillway and spillway discharge channel should be rehabilitated. The dam in its present condition is considered unsafe, non-energency.

The hydrologic and hydraulic computations indicate that the combination of reservoir storage capacity and the discharge capacity of spillway and swale are adequate to pass 95 percent of the PMF. The spillway is not capable of passing the full PMF and is considered to be inadequate, but not seriously inadequate.

B. Adequacy of Information

The design and construction information contained in the files of PennDER, combined with the visual inspection, are considered to be adequate for making a reasonable assessment of this dam.

C. Urgency

The recommendations presented below should be implemented immediately.

D. Necessity for Additional Studies

The results of this inspection indicate the need for studies of the seepage condition to evaluate the embankment stability. The lack of a discharge channel below the spillway, and the populated area, raised the consideration of closing the main spillway and constructing an adequate spillway at the upstream end of the reservoir. An in depth evaluation of this problem is recommended.

7.2 RECOMMENDATIONS

1. That a detailed engineering investigation be made by a professional engineer, experienced in the design and construction of dams, to evaluate the seepage condition and the stability of the dam. Recommendations made by this engineer should be implemented immediately.

2. That an in depth hydrologic and hydraulic study be made by a professional engineer, expierenced in the design and construction of dams, to evaluate the possibility of developing a formal and adequate spillway at the upstream breached embankment of the dam and closing the existing spillway.

3. That all brush, trees and cuttings be removed from the downstream embankment slope and that a professional engineer, experienced in the design and construction of dams, be consulted for the removal of tree stumps and roots.

4. That all waste material be removed from the downstream slope and that this slope be provided with an adequate slope protection.

5. That the spillway and discharge channel be repaired if its continued use is contemplated. The chainlink fence on the spillway shall be removed.

6. That a method be developed for positive closure of the upstream end of the outlet pipe in case of an emergency.

7. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged precipitation.

8. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

APPENDIX A

CHECKLIST OF VISUAL INSPECTION REPORT

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 35-33 NDI NO. PA-00 252

NAME OF DAM BELMONT DAM HAZARD CATEGORY High

TYPE OF DAM Earthfill with masonry core wall

LOCATION Fell TOWNSHIP Lackawanna COUNTY, PENNSYLVANIA

INSPECTION DATE 5/6/80 WEATHER Cloudy TEMPERATURE 80's

INSPECTORS: R. Houseal (Recorder) OWNER'S REPRESENTATIVE(s):

H. Jongsma Frank Kana

R. Shireman Joseph Cianflone

A. Bartlett

NORMAL POOL ELEVATION: 1248.0 AT TIME OF INSPECTION:

Spillway -0.6

BREAST ELEVATION: 1250.1 POOL ELEVATION: 1247.4

SPILLWAY ELEVATION: 1248.0 TAILWATER ELEVATION:

MAXIMUM RECORDED POOL ELEVATION: Unknown

GENERAL COMMENTS:

The general appearance of this dam is poor. Seepage is observed on the slope of and downstream from the toe of the embankment. Considerable brush is presently laying at random over the downstream slope including trees up to 18" in diameter. (Cutting took place in February, 1980). Numerous stumps remain on the slope.

It appears that the downstream slope has been used as a waste area for soil, concrete and rocks over the years.

On June 3, 1980, a follow-up inspection was made. In attendance were: Messrs. Ed Hecker & J. Snyder (C.O.E.), John Chernesky (PennDER), R.V. Houseal (Berger Assoc.), and Cianflone & Fryer (Ganflex).

NDI NO. PA-00 252

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	The crest of the dam is a concrete wall in good condition. Fence on top. The upstream is submerged to the vertical wall. Downstream is irregular and not uniform.
B. UNUSUAL MOVEMENT BEYOND TOE	No movement beyond toe noticed. Thin woods still occupy this area.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	The downstream slope is uneven and irregular. Tree stumps and cuttings are strewn over the slope. Concrete slabs and earthfill have been dumped at random over this slope.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	Horizontal - Tangent - good. Vertical - Top of concrete - refer to profile Plate A-III.
E. RIPRAP FAILURES	Upstream slope submerged completely. Could not observe condition.
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Abutments appear sound.
G. SEEPAGE	Considerable seepage on and downstream from the toe of the embankment also in area below spillway (see Plate A-I).
H. DRAINS	None.
J. GAGES & RECORDER	None.
K. COVER (GROWTH)	Trees & brush recently cut from downstream slope. Concrete and other waste.

NDI NO. PA-00 252

VISUAL INSPECTION
OUTLET WORKS

	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	Masonry or concrete wet well in reservoir about 50 feet from wall.
B. OUTLET STRUCTURE	Valve House - three valves - one large 16-inch with wheel, two smaller - one with and one without handle. Not operated today.
C. OUTLET CHANNEL	Flat marshy area downstream from house, but not used for outlet. Outlet is a through pipe to the owner's plant.
D. GATES	Downstream gate in valve house on through pipe - pipe is open.
E. EMERGENCY GATE	See D. above.
F. OPERATION & CONTROL	No records.
G. BRIDGE (ACCESS)	Accessible only by boat.

NDI NO. PA-00 252

VISUAL INSPECTION
SPILLWAY

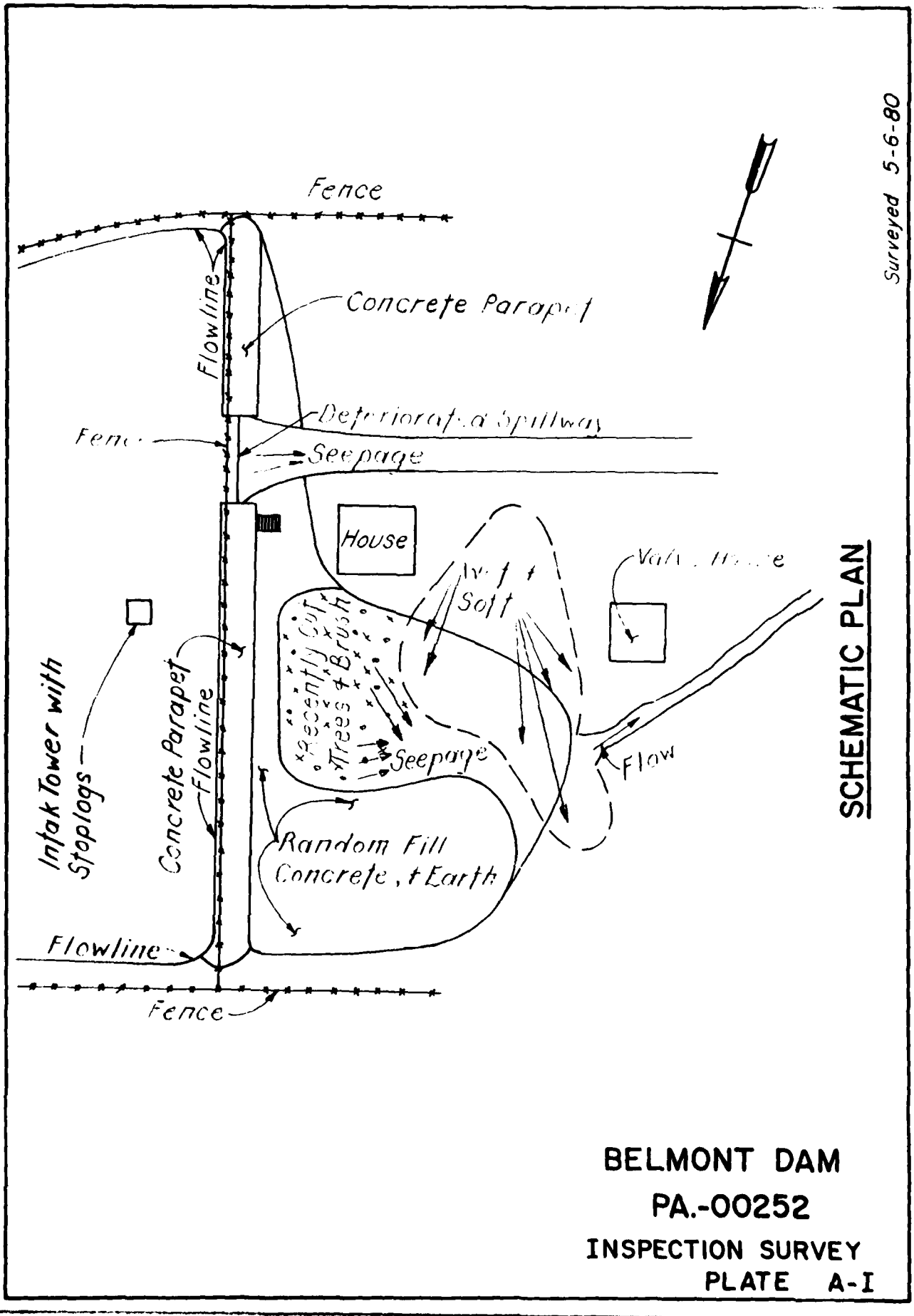
	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	Approach to spillway is directly from the reservoir.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Concrete broad crested weir in good condition. Seepage in channel below weir. No flow over weir.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	Natural rock and large stone in channel. Channel is narrow and leads to highway drainage ditch between several homes.
D. BRIDGE & PIERS	None.
E. GATES & OPERATION EQUIPMENT	None.
F. CONTROL & HISTORY	Representative did not recall ever having seen water flow over the spillway. Water surface drops seasonally.

Note: At upstream end of reservoir a channel has been excavated, permitting water to flow out of reservoir in a northerly direction. This channel is about 1.3 feet below crest of spillway in dam.

NDI NO. PA-00 252

VISUAL INSPECTION

	OBSERVATIONS AND REMARKS
INSTRUMENTATION Monumentation	None.
Observation Wells	None.
Weirs	None.
Piezometers	None.
Staff Gauge	None.
Other	None.
RESERVOIR Slopes	School located on right bank. Mostly wooded on left side.
Sedimentation	No records.
Watershed Description	Wooded.
DOWNSTREAM CHANNEL Condition	Stone lined steep channel. Passes under highway with small pipe. Only a small swale at other side of highway. Does not appear to be adequate. Natural channel at north end of reservoir.
Slopes	Downstream of dam - flat. North end steep.
Approximate Population	None at north end (present channel). Several hundred below dam.
No. Homes	Town of Simpson.

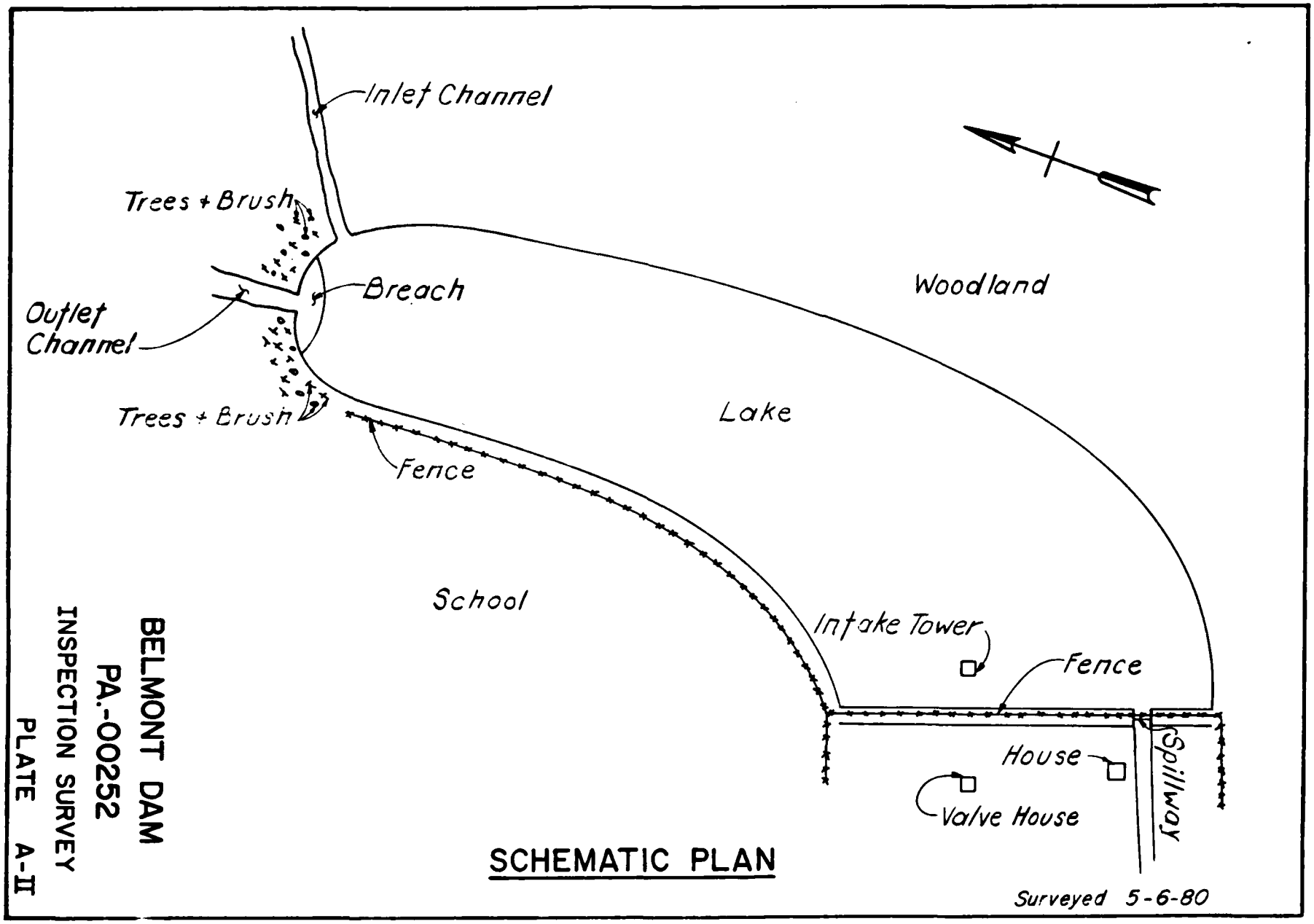


BELMONT DAM

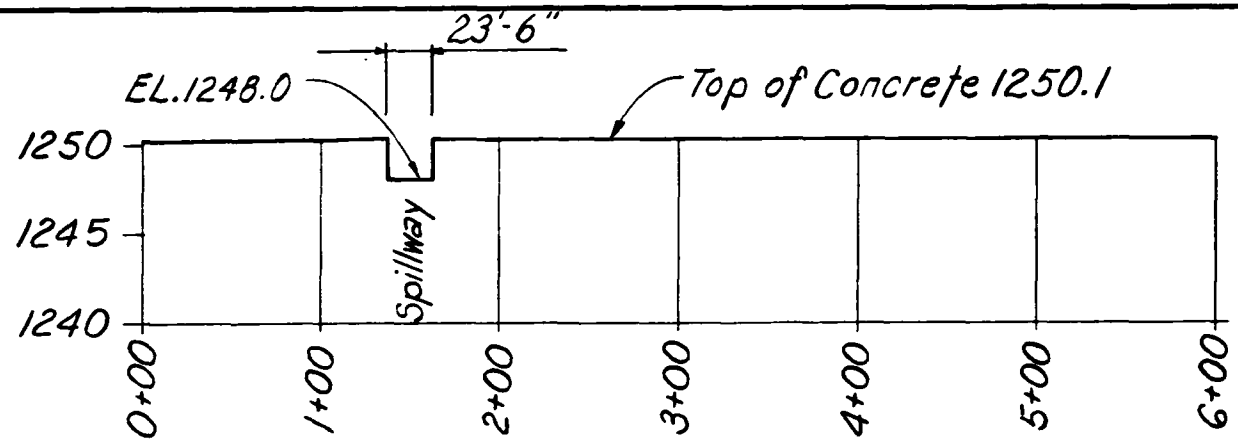
PA.-00252

INSPECTION SURVEY

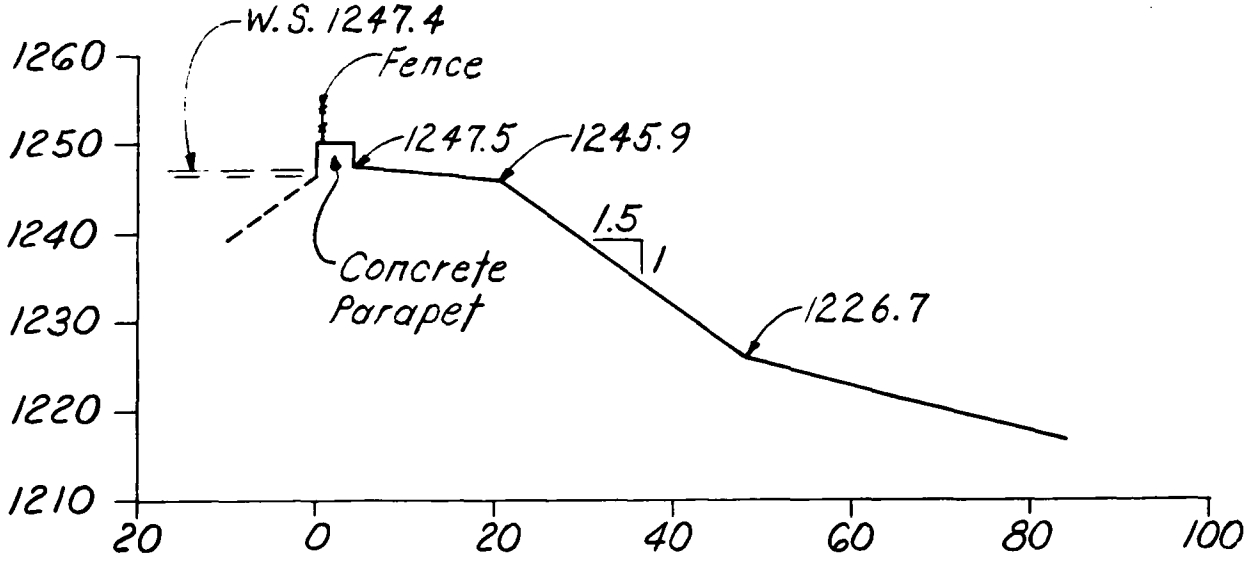
PLATE A-I



BELMONT DAM
PA.-00252
INSPECTION SURVEY
PLATE A-II



PROFILE - TOP MASONRY CORE WALL



EMBANKMENT SECTION STA. 3+00

Surveyed 5-6-80

BELMONT DAM

PA-00252

INSPECTION SURVEY

PLATE A-III

APPENDIX B

CHECKLIST OF ENGINEERING DATA

CHECK LIST
ENGINEERING DATA

PA DER # 35-33 NDI NO. PA-00 252

NAME OF DAM BELMONT DAM

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle - Waymart, Pa. See Plate II, Appendix E
CONSTRUCTION HISTORY	Constructed in 1902. Raised in 1907. Dam at north end of reservoir breached in sixties.
GENERAL PLAN OF DAM	Not available. See sketch Plate A-I, Appendix A.
TYPICAL SECTIONS OF DAM	Plates III and IV, Appendix E.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	 Plate III, Appendix E. None. None. None.

NDI NO. PA-00 252

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	None.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Not available.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	Not available.
POST CONSTRUCTION SURVEYS OF DAM	Unknown.
BORROW SOURCES	Unknown.

NDI NO. PA-00 252

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Dam raised in 1907.
HIGH POOL RECORDS	No records.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	"Evaluation of Belmont Reservoir" prepared by Northeastern Engineering Co., dated February, 1978.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	None.
MAINTENANCE & OPERATION RECORDS	No records.
SPILLWAY PLAN, SECTIONS AND DETAILS	No details.

NDI NO. PA-00 252

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	16-inch valve at downstream toe. Plate III, Appendix E.
CONSTRUCTION RECORDS	No records.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	None, except PennDER inspection reports.
MISCELLANEOUS	

NDI NO. PA-00 252

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Woodland

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev. 1248 Acre-Feet 92

TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev. 1250.1 Acre-Feet 107

MAXIMUM DESIGN POOL: Elev. 1250.1

TOP DAM: Elev. 1250.1

SPILLWAY:	SPILLWAY	SWALE
a. Elevation	1248	1246.7
b. Type	broad crested weir	natural channel
c. Width	23.5	60' top width
d. Length	---	---
e. Location Spillover	near left abutment	near northeast end of lake
f. Number and Type of Gates	none	none

OUTLET WORKS:

a. Type water supply line

b. Location stoplog structure at upstream toe

c. Entrance inverts 1223.25

d. Exit inverts ---

e. Emergency drawdown facilities none

HYDROMETEOROLOGICAL GAGES:

a. Type none

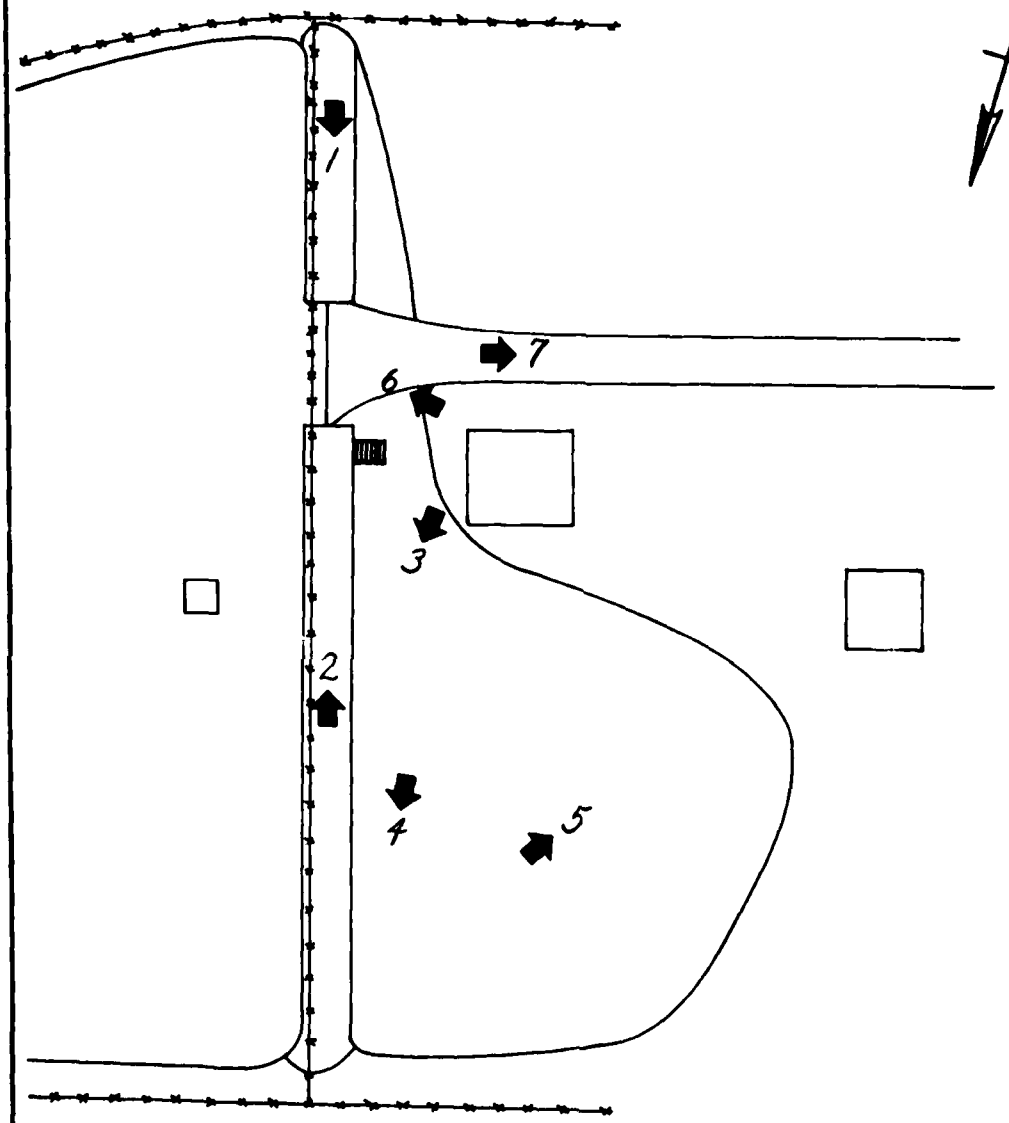
b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 562 cfs

APPENDIX C

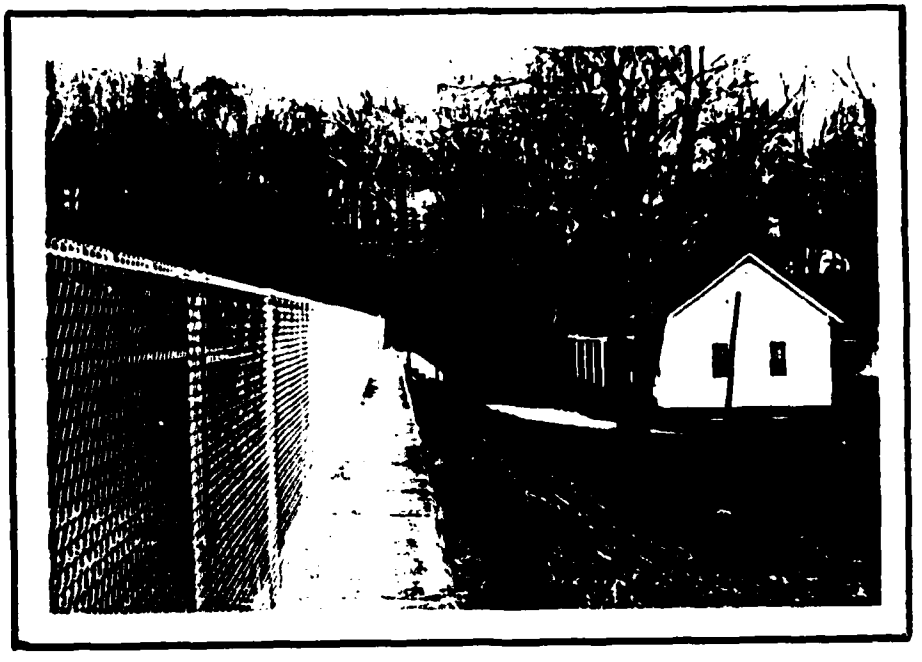
PHOTOGRAPHS



Surveyed 5-6-80

No. 8 Taken at Upstream End of Reservoir.

BELMONT DAM
PA.-00252
KEY MAP OF PHOTOGRAPHS
PLATE C-I

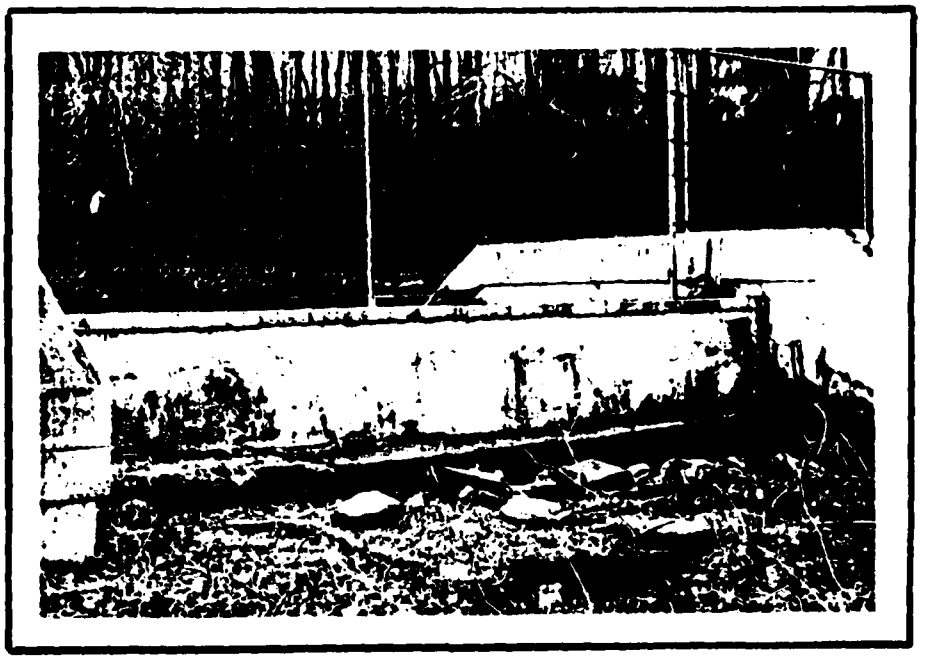


TOP OF DAM LOOKING TO LEFT ABUTMENT - NO. 2

DOWNSTREAM SLOPE NEAR CENTER - NO. 3

DUMPED FILL ON DOWNSTREAM SLOPE - NO. 4

CUTTINGS ON SLOPE & VALVE HOUSE - NO. 5



DOWNSTREAM SIDE OF SPILLWAY - NO. 6

DOWNSTREAM CHANNEL FOR SPILLWAY - NO. 7

UPSTREAM END OF RESERVOIR - NO. 8
NOTE CUT MADE IN DRAINAGE DIVIDE

PA-00252
Plate C-V

APPENDIX D

HYDROLOGY AND HYDRAULIC CALCULATIONS

SUMMARY DESCRIPTION
OF
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam, and (2) the capability to estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

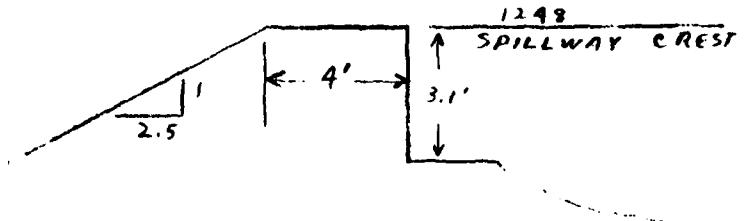
The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

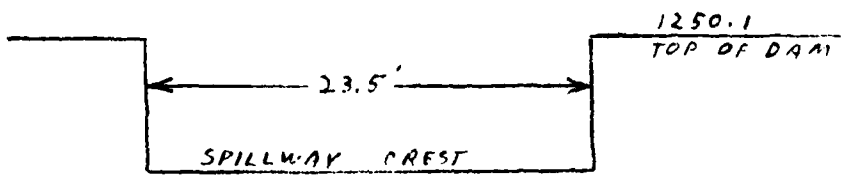
For detailed information regarding this program refer to the Users Manual for the Flood Hydrograph Package (HEC-1) Dam Safety Version prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

BY RLS DATE 6/6/80 **BERGER ASSOCIATES** SHEET NO. 1 OF
CHKD. BY DATE PROJECT D91
SUBJECT BELMONT DAM

SPILLWAY RATING



BROADCRESTED WEIR
C = 3.3 (KINGS HDBK)



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

$H = 1250.1 - 1248 = 2.1'$

$Q = 3.3 \times 23.5 \times (2.1)^{1.5}$

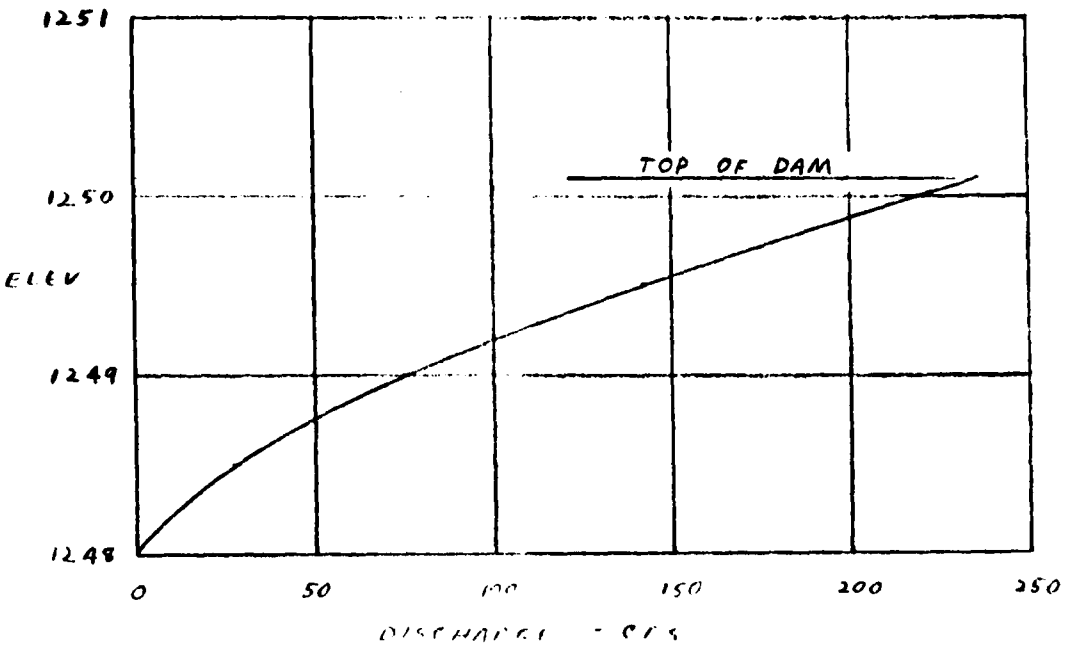
$= 236$ CFS

BY RLS DATE 6/9/80 **BERGER ASSOCIATES** SHEET NO. 2 OF

CHKD. BY DATE PROJECT D965

SUBJECT BELMONT DAM

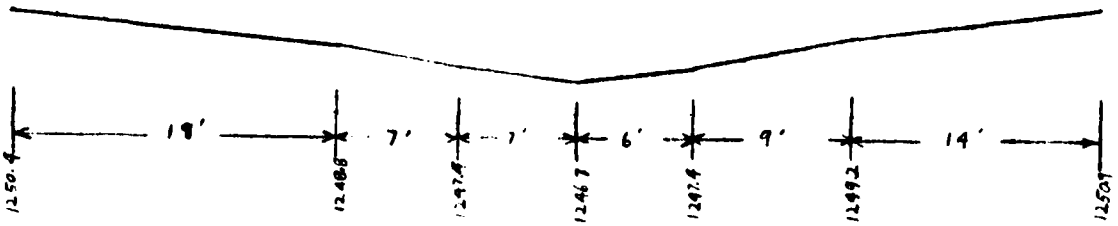
SPILLWAY RATING CURVE



BY RLS DATE 6/5/80 **BERGER ASSOCIATES** SHEET NO. 3 OF
CHKD. BY DATE PROJECT D9
SUBJECT BELMONT DAM

DISCHARGE THRU SWALE

NATURAL CHANNEL



C = 2.7

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

AT ELEV 1247.4

2.7 x 13 x (.75)$^{1.5}$ = 7 CFS

AT ELEV 1248.0

2.7 x 13 x (.91)$^{1.5}$ = 33

2.7 x 3 x (.2)$^{1.5}$ = 1

2.7 x 3 x (.2)$^{1.5}$ = 1 Σ = 35 CFS

AT ELEV 1248.6

2.7 x 13 x (1.11)$^{1.5}$ = 67

2.7 x 6 x (.6)$^{1.5}$ = 8

2.7 x 6 x (.6)$^{1.5}$ = 5 Σ = 83 CFS

AT ELEV 1249.2

2.7 x 13 x (2.14)$^{1.5}$ = 111

2.7 x 7 x (1.1)$^{1.5}$ = 22

2.7 x 5 x (.2)$^{1.5}$ = 1

2.7 x 9 x (.9)$^{1.5}$ = 21 Σ = 156 CFS

AT ELEV 1250.1

2.7 x 13 x (3.03)$^{1.5}$ = 187

2.7 x 7 x (2)$^{1.5}$ = 53

2.7 x 15 x (.66)$^{1.5}$ = 21

2.7 x 9 x (1.8)$^{1.5}$ = 59

2.7 x 7 x (.14)$^{1.5}$ = 6 Σ = 326 CFS

BY RLS DATE 7/29/80 **BERGER ASSOCIATES** SHEET NO. 4 OF
CHKD. BY DATE PROJECT D96
SUBJECT BELMONT DAM

DISCHARGE SUMMARY

ELEV.	SPILLWAY (CFS)	SWALE (CFS)	EMBANKMENT (CFS)	TOTAL (CFS)
1246.7	0	0	0	0
1247.4	0	7	0	7
1248	0	35	0	35
1248.6	36	83	0	119
1249.2	102	156	0	258
1250.1	236	326	0	562
1250.5	307	433	398	1138
1251	403	581	1342	2326

BY RLS DATE 6/24/80 **BERGER ASSOCIATES** SHEET NO. 5 OF
CHKD. BY DATE PROJECT 096
SUBJECT BELMONT DAM

DISCHARGE THRU OUTLET WORKS

ONLY OUTLET PIPE IS A 16" DIA PIPE THRU THE EMBANKMENT CONNECTING TO AN INDUSTRIAL WATER SUPPLY DISTRIBUTION SYSTEM DOWNSTREAM. NO DRAW DOWN FACILITY EXISTS.

16" DIA. PIPE $C = 0.6$

$Q = CA\sqrt{2gH}$

AT NORMAL POOL ELEV. 1249

$H = 1249 - 1223.6 = 24.9'$

$Q = 0.6 \times \pi \times \frac{(1.33)^2}{4} \times (2 \times 32.2 \times 24.9)^{0.5}$

$= 33$ CFS

AT LOW POOL ELEV 1230

$H = 1230 - 1223.1 = 6.4'$

$Q = 0.6 \times \pi \times \frac{(1.33)^2}{4} \times (2 \times 32.2 \times 6.4)^{0.5}$

$= 17$ CFS

BY RLS DATE 6/2/80 **BERGER ASSOCIATES** SHEET NO. 6 OF
CHKD. BY DATE PROJECT D41
SUBJECT BELMONT DAM

MAXIMUM KNOWN FLOOD AT DAMSITE

THERE ARE NO RECORDS OF POOL LEVELS FOR THIS DAM. BASED ON THE RECORDS OF THE GAGE STATION FOR SOUTH BRANCH TUNKHANNOCK CREEK AT NEARBY MONTDALE, PA. (D.A. = 12.6 SQ. MI.) THE MAXIMUM DISCHARGE AT THE GAGE OCCURRED IN OCTOBER 1976 WHEN A DISCHARGE OF 2050 CFS WAS OBSERVED. THE MAXIMUM INFLOW TO BELMONT DAM IS ESTIMATED TO BE:

$$Q = \left(\frac{.18}{12.6}\right)^{0.3} \cdot 2050$$

$$= 68 \text{ CFS}$$

DESIGN FLOOD

SIZE CLASSIFICATION

MAXIMUM STORAGE = 107 ACRE-FEET
MAXIMUM HEIGHT 31 FEET
SIZE CLASSIFICATION IS "SMALL"

HAZARD CLASSIFICATION

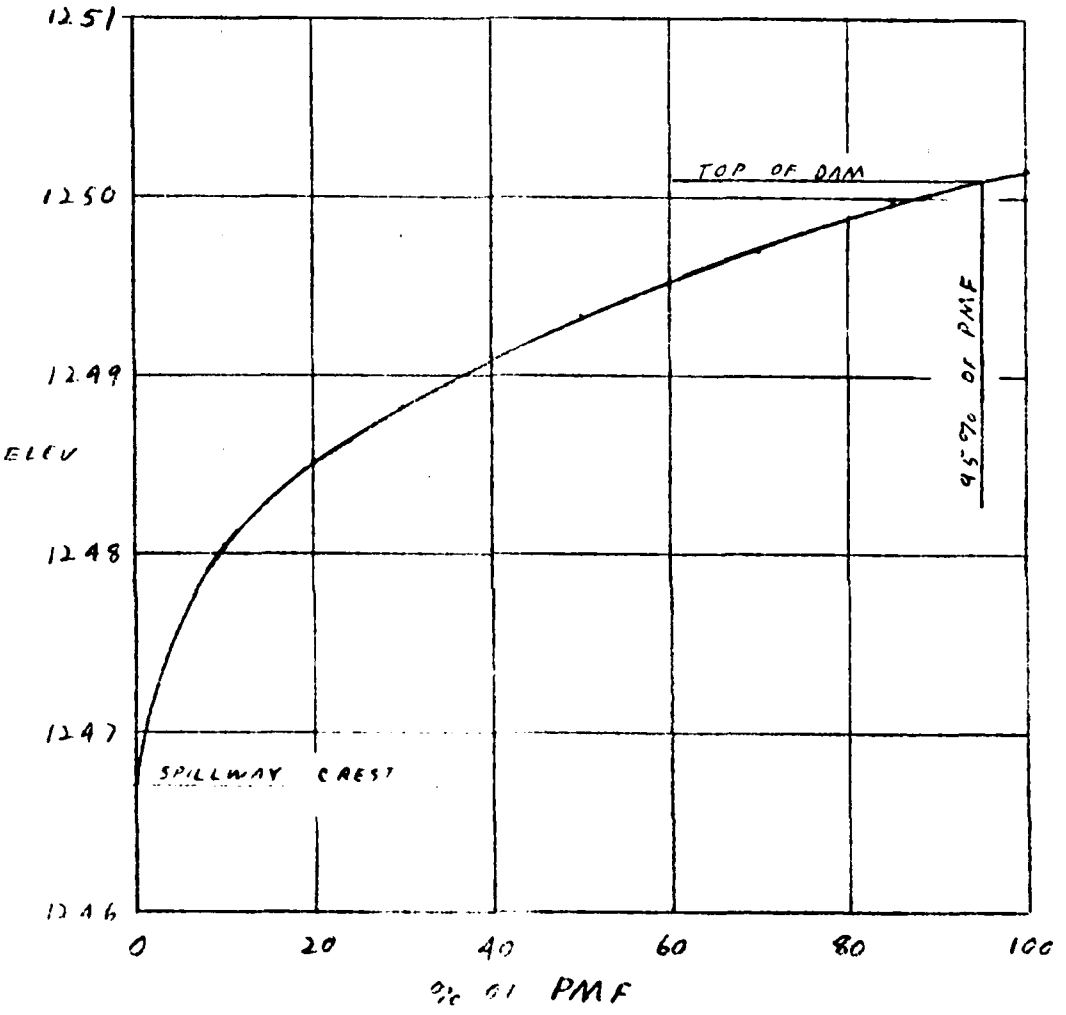
VILLAGE OF SIMPSON IS LOCATED DOWNSTREAM OF THE DAM.
USE "HIGH"

RECOMMENDED SPILLWAY DESIGN FLOOD

THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SDF EQUAL TO ONE HALF PMF TO THE PROBABLE MAXIMUM FLOOD.

BY RLS DATE 6/9/80 **BERGER ASSOCIATES** SHEET NO. 7 OF
CHKD. BY DATE PROJECT D91
SUBJECT BELMONT DAM

SPILLWAY CAPACITY CURVE



HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: BELMONT RIVER BASIN: SUSQUEHANNA

PROBABLE MAXIMUM PRECIPITATION (PMP) = 21.3 INCHES/24 HOURS[1]

(FOR FOOTNOTES SEE NEXT PAGE)

STATION		1	2	3	4
STATION DESCRIPTION		BELMONT LAKE	BELMONT DAM		
DRAINAGE AREA (SQUARE MILES)		.18			
CUMULATIVE DRAINAGE AREA (SQUARE MILE)		.18	.18		
ADJUSTMENT OF PMP FOR DRAINAGE AREA (%)[2]	6 HOURS	111			
	12 HOURS	123			
	24 HOURS	133			
	48 HOURS	142			
	72 HOURS	---			
	Zone 1				
SNYDER HYDROGRAPH PARAMETERS	ZONE[3]	11			
	C_p / C_t[4]	.62/1.5			
	L (MILES)[5]	.72			
	L_{ca} (MILES)[5]	.23			
	$T_p = C_t (L \cdot L_{ca})^{0.3}$ (hours)				
SPILLWAY DATA	CREST LENGTH (FT.)		23.5	SWALE	
	FREEBOARD (FT.)		2.1	3.4	
	DISCHARGE COEFFICIENT		3.3	2.7	
	EXPONENT		1.5	1.5	
	ELEVATION		1248	1246.7	
AREA[6] (ACRES)	NORMAL POOL (1248)	6.7			
	ELEV. 1260	11.6			
	ELEV.				
STORAGE (ACRE-FEET)	NORMAL POOL[7]	92			
	ELEV. 1206.8 [8]	0			
	ELEV. [8]				
	ELEV [8]				

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: BELMONT RIVER BASIN: SUSQUEHANNA

PROBABLE MAXIMUM PRECIPITATION (PMP) = 21.3 INCHES/24 HOURS[1]

(FOR FOOTNOTES SEE NEXT PAGE)

STATION		1	2	3	4
STATION DESCRIPTION		BELMONT LAKE	BELMONT DAM		
DRAINAGE AREA (SQUARE MILES)		.18			
CUMULATIVE DRAINAGE AREA (SQUARE MILE)		.18	.18		
ADJUSTMENT OF PMP FOR DRAINAGE AREA (%)[2]	6 HOURS	111			
	12 HOURS	123			
	24 HOURS	133			
	48 HOURS	142			
	72 HOURS	---			
	Zone 1				
SNYDER HYDROGRAPH PARAMETERS	ZONE[3]	11			
	C_p / C_t[4]	.62/1.5			
	L (MILES)[5]	.72			
	L_{ca} (MILES)[5]	.23			
	$T_p = C_t (L \cdot L_{ca})^{0.3}$ (hours)				
SPILLWAY DATA	CREST LENGTH (FT.)		23.5	SWALE	
	FREEBOARD (FT.)		2.1	3.4	
	DISCHARGE COEFFICIENT		3.3	2.7	
	EXPONENT		1.5	1.5	
	ELEVATION		1248	1246.7	
AREA[6] (ACRES)	NORMAL POOL (1248)	6.7			
	ELEV. 1260	11.6			
	ELEV.				
STORAGE (ACRE-FEET)	NORMAL POOL[7]	92			
	ELEV. 1206.8 [8]	0			
	ELEV. [8]				
	ELEV [8]				

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).

(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.
L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

(6) Planimetered area encompased by contour upstream of dam.

(7) PennDER files.

(8) Computed by conic method.

JULY 1978
LAST MODIFICATION 26 FEB 79

```
**********
  1          A1      BELMONT DAM   ****   UNNAMED TRIBUTARY TO LACKAWANNA RIVER
  2          A2     FELL TWP., LACKAWANNA COUNTY, PA.
  3          A3     NDI # PA-00252     PA DER # 35-33
  4          R   300     0     15      0      0      0      0      0     -4      0
  5          B1    5
  6          J     1     9      1
  7          J1    1   .85    .7     .6     .5     .4     .3     .2     .1
  8          K           1                                  1
  9          K1            INFLOW  HYDROGRAPH
 10          M     1     1    .18
 11          P          21.3   111    123    133    142
 12          T                                         1    .05
 13          W    .87   .62
 14          X   -1.5   .05     2
 15          K     1     2                              1
 16          K1            RESERVOIR  ROUTING
 17          Y                       1
 18          Y1    1                                        92     -1
 19          Y41246.7 1247.4   1248 1248.6 1249.2 1250.1 1250.5   1251
 20          Y5    0     7     35    119    258    562   1138   2326
 21          $A    0   6.7   11.6
 22          $E1206.8  1248   1260
 23          $$1246.7
 24          $D1250.1
 25          K    99
1                        PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                              RUNOFF HYDROGRAPH AT          1
                              ROUTE HYDROGRAPH TO           2
                              END OF NETWORK


1**********
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION     JULY 1978
   LAST MODIFICATION  26 FEB 79
 **********

 RUN  DATE# 80/06/09.
      TIME# 06.23.19.
```

BELMONT DAM **** UNNAMED TRIBUTARY TO LACKAWANNA RIVER
FELL TWP., LACKAWANNA COUNTY, PA.
NDI # PA-00252 PA DER # 35-33

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS= 1.00 .85 .70 .60 .50 .40 .30 .20 .10

[illegible] **** [illegible] TRIBUTARY TO LACKAWANNA RIVER 2/-1
FELL TWP., LACKAWANNA COUNTY, PA.
NDI # PA-00252 PA DER # 35-33

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1
RTIOS= 1.00 .85 .70 .60 .50 .40 .30 .20 .10

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.18	0.00	.18	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.30	111.00	123.00	133.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= .87 CP= .62 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= .05 RTIOR= 2.00

UNIT HYDROGRAPH 20 END-OF-PERIOD ORDINATES, LAG= .87 HOURS, CP= .62 VOL= 1.00

11.	39.	68.	80.	70.	51.	38.	28.	21.	15.
11.	8.	6.	5.	3.	3.	2.	1.	1.	1.

0 END-OF-PERIOD FLOW

MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP

SUM 24.20 21.81 2.39 1000[illegible]
(615.)(554.)(61.)(285.4

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSAK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	92.	-1

STAGE	1246.70	1247.40	1248.00	1248.60	1249.20	1250.10	1250.50	1251.00
FLOW	0.00	7.00	35.00	119.00	258.00	562.00	1138.00	2326.00
SURFACE AREA=	0.	7.	12.					
CAPACITY=	0.	92.	200.					
ELEVATION=	1207.	1248.	1260.					

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
1246.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1250.1	0.0	0.0	0.

PEAK OUTFLOW IS 635. AT TIME 40.75 HOURS

PEAK OUTFLOW IS 518. AT TIME 40.75 HOURS

PEAK OUTFLOW IS 427. AT TIME 40.75 HOURS

PEAK OUTFLOW IS 365. AT TIME 40.75 HOURS

PEAK OUTFLOW IS 300. AT TIME 40.75 HOURS

PEAK OUTFLOW IS 234. AT TIME 40.75 HOURS

PEAK OUTFLOW IS 173. AT TIME 40.75 HOURS

PEAK OUTFLOW IS 108. AT TIME 41.00 HOURS

PEAK OUTFLOW IS 43. AT TIME 41.50 HOURS

CHK OUTFLOW IS 45. AT TIME 41.50 HOURS

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

				RATIOS APPLIED TO FLOWS								
OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				1.00	.85	.70	.60	.50	.40	.30	.20	.10
HYDROGRAPH AT	1	.18	1	649.	552.	455.	390.	325.	260.	195.	130.	65.
	(	.47)	(	18.39)(	15.63)(	12.87)(	11.03)(	9.19)(	7.36)(	5.52)(	3.68)(	1.84)
ROUTED TO	2	.18	1	635.	518.	427.	365.	300.	234.	173.	108.	43.
	(	.47)	(	17.97)(	14.67)(	12.08)(	10.32)(	8.51)(	6.62)(	4.88)(	3.05)(	1.21)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1247.99	1246.70	1250.10
STORAGE	92.	84.	107.
OUTFLOW	35.	0.	562.

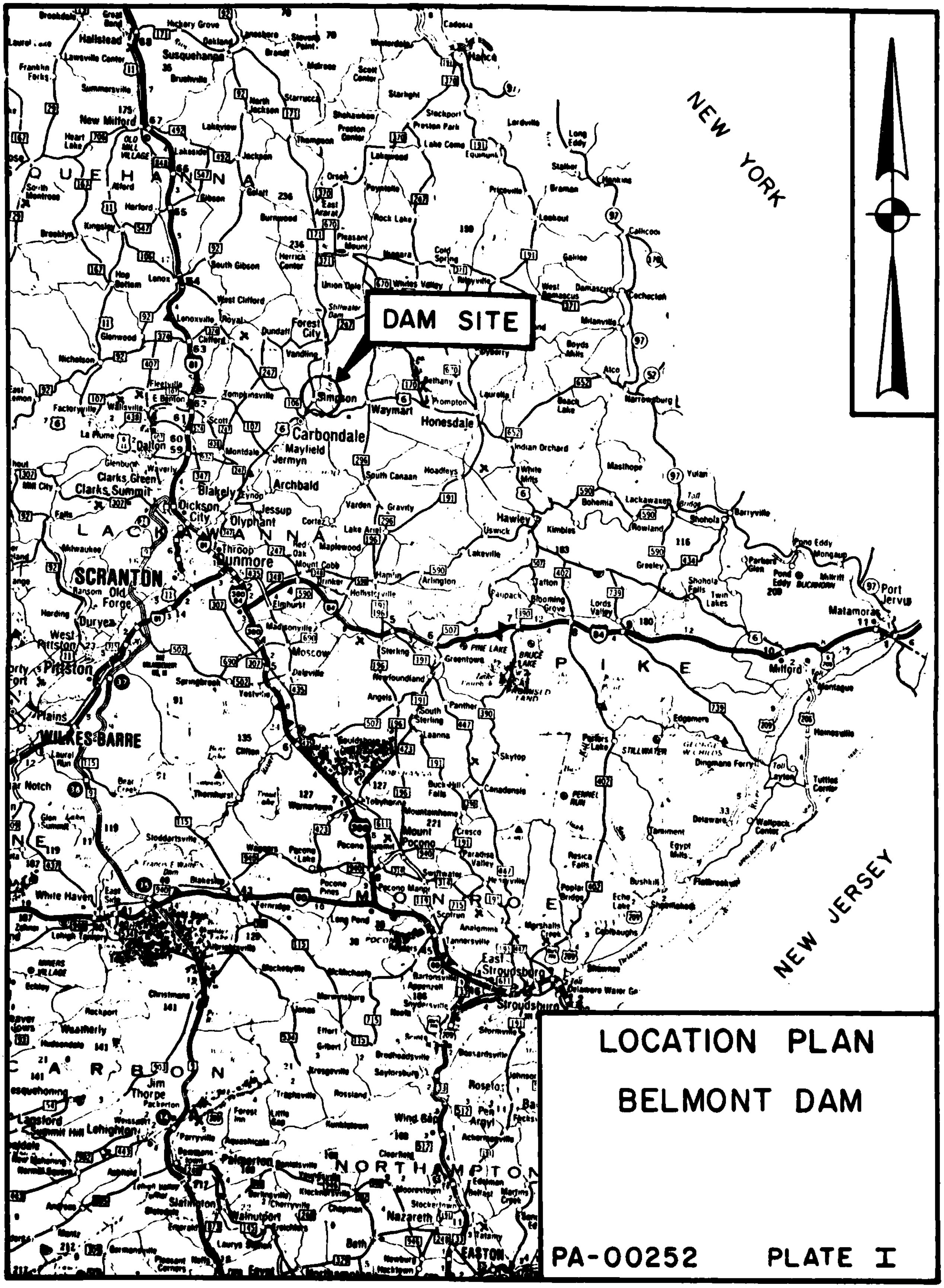
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1250.15	.05	107.	635.	.50	40.75	0.00
.85	1249.97	0.00	106.	518.	0.00	40.75	0.00
.70	1249.70	0.00	104.	427.	0.00	40.75	0.00
.60	1249.52	0.00	103.	365.	0.00	40.75	0.00
.50	1249.33	0.00	101.	300.	0.00	40.75	0.00
.40	1249.10	0.00	100.	234.	0.00	40.75	0.00
.30	1248.83	0.00	98.	173.	0.00	40.75	0.00
.20	1248.52	0.00	96.	108.	0.00	41.00	0.00
.10	1248.05	0.00	92.	43.	0.00	41.50	0.00

EOI ENCOUNTERED.

N>

APPENDIX E

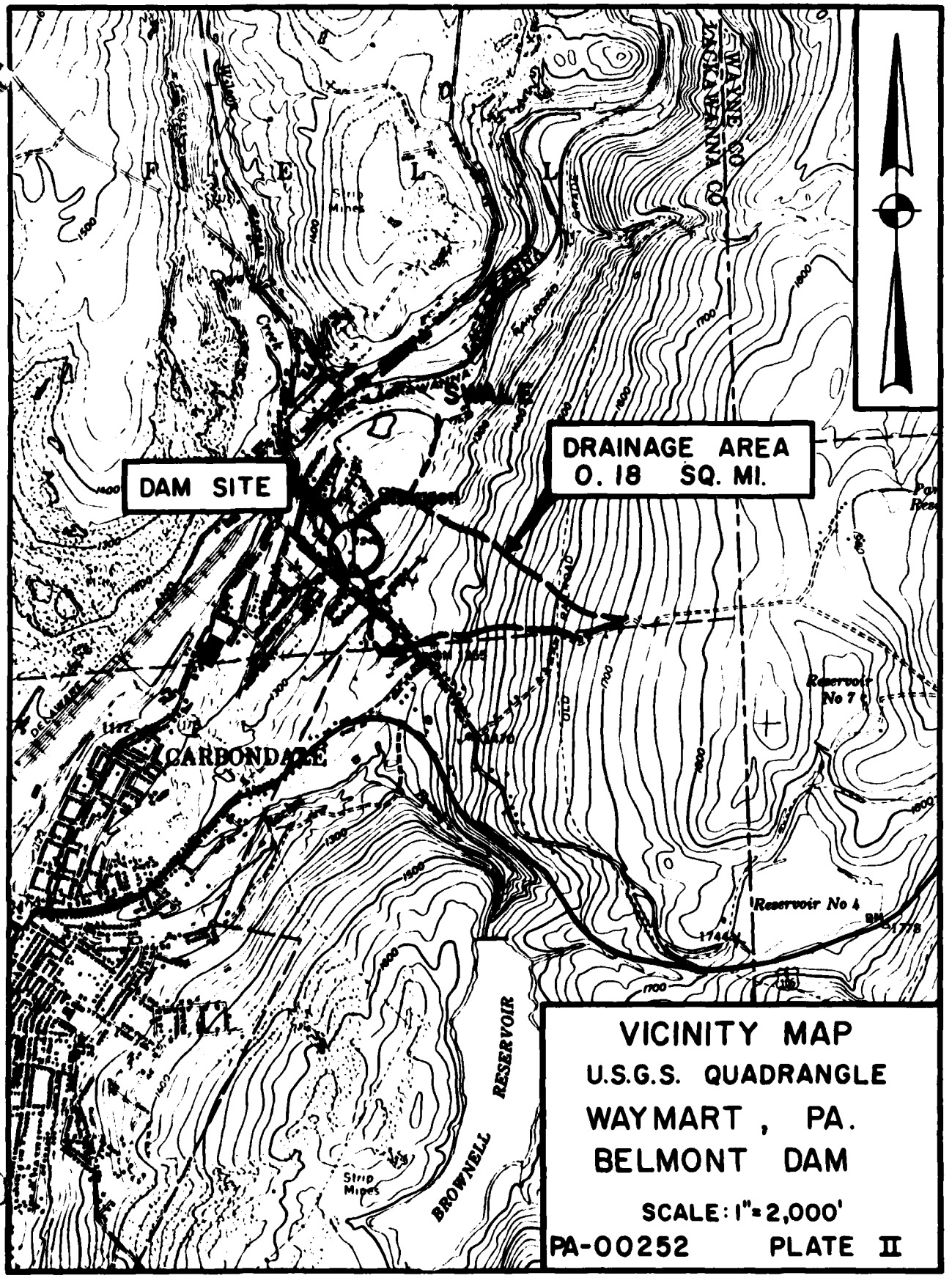
PLATES



LOCATION PLAN

BELMONT DAM

PA-00252 PLATE I



VICINITY MAP

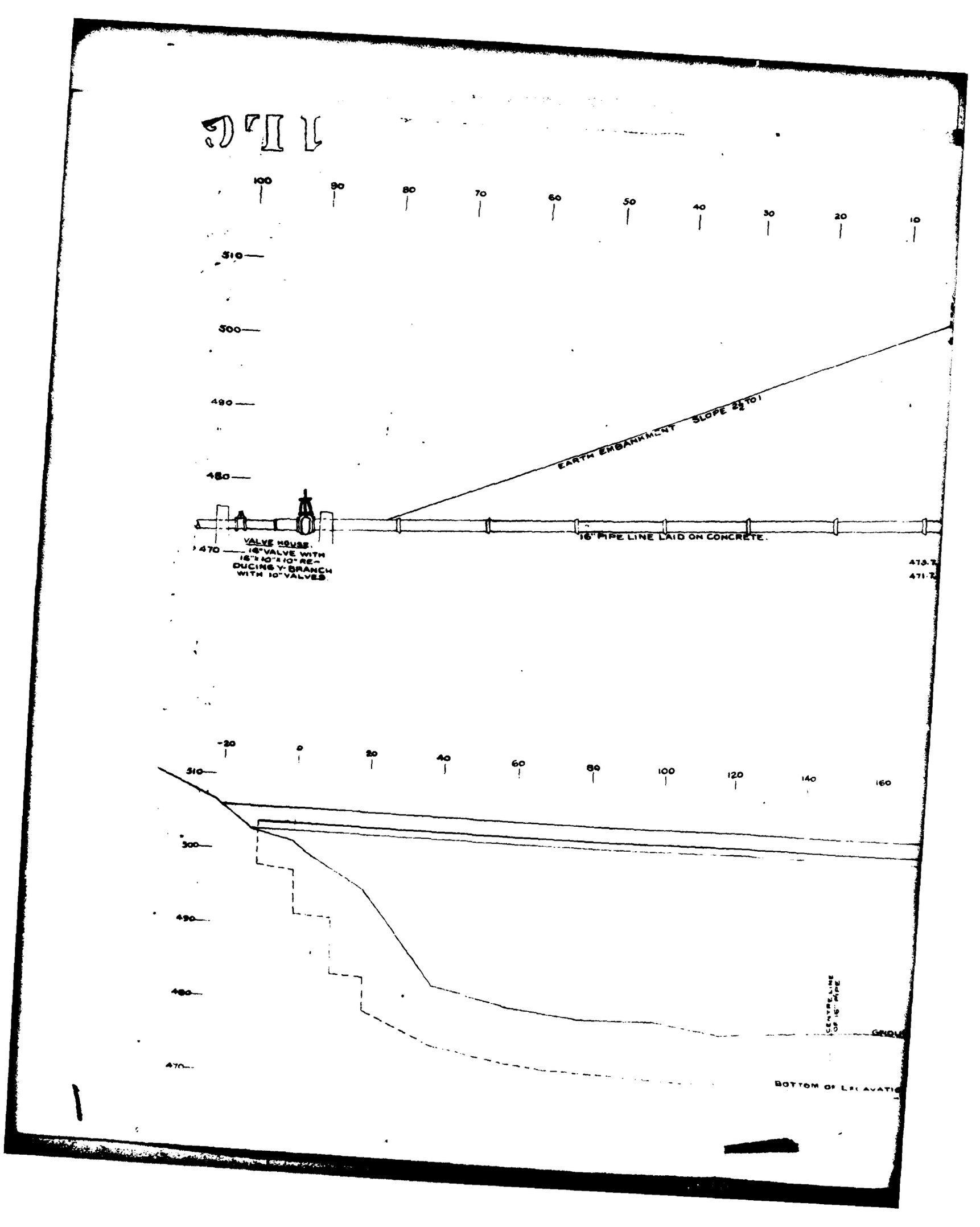
U.S.G.S. QUADRANGLE

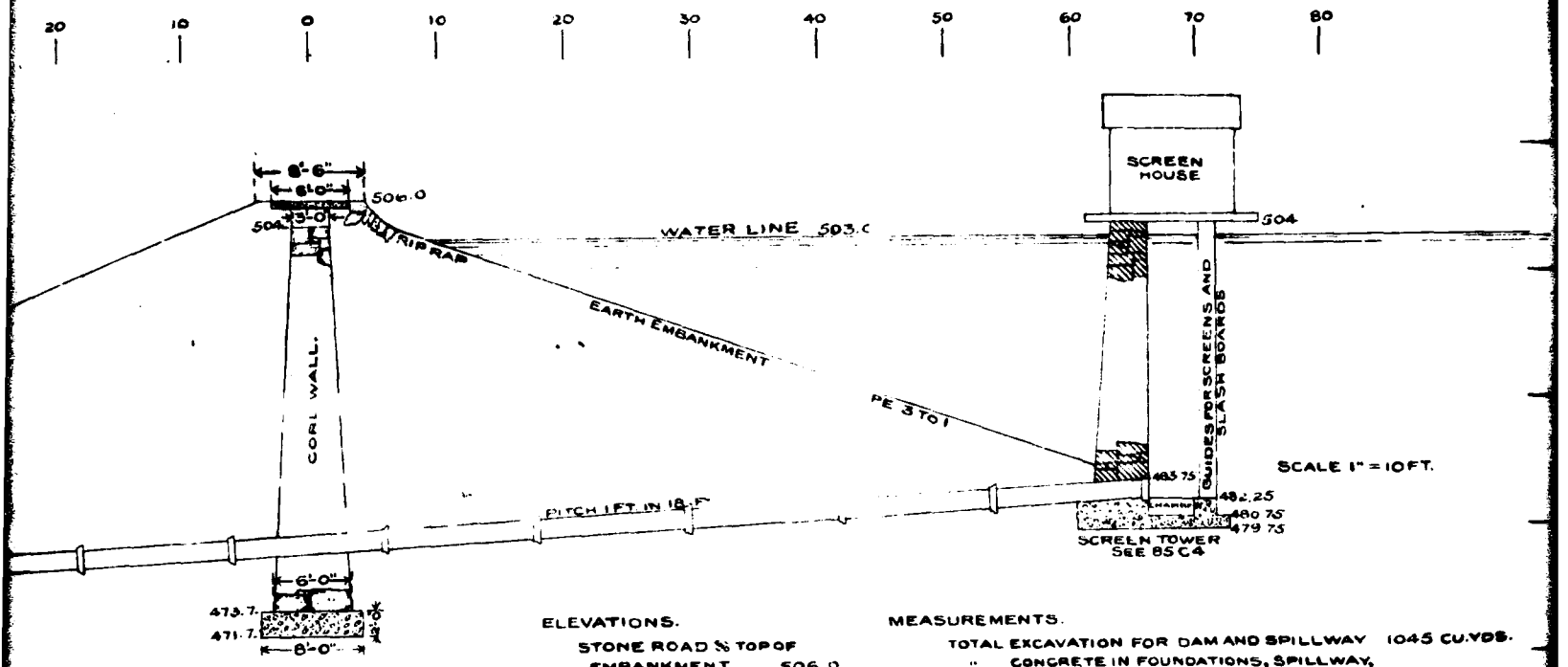
WAYMART, PA.

BELMONT DAM

SCALE: 1" = 2,000'

PA-00252 PLATE II


100
90
80
70
60
50
40
30
20
10
510
500
490
480
470
EARTH EMBANKMENT SLOPE 2½ TO 1
16" PIPE LINE LAID ON CONCRETE.
VALVE HOUSE.
16" VALVE WITH
16"x10"x10" RE-
DUCING Y-BRANCH
WITH 10" VALVES.
473·2
471·2
-20
0
20
40
60
80
100
120
140
160
510
500
490
480
470
CENTRE LINE
OF 16" PIPE
GROU
BOTTOM OF EXCAVATI

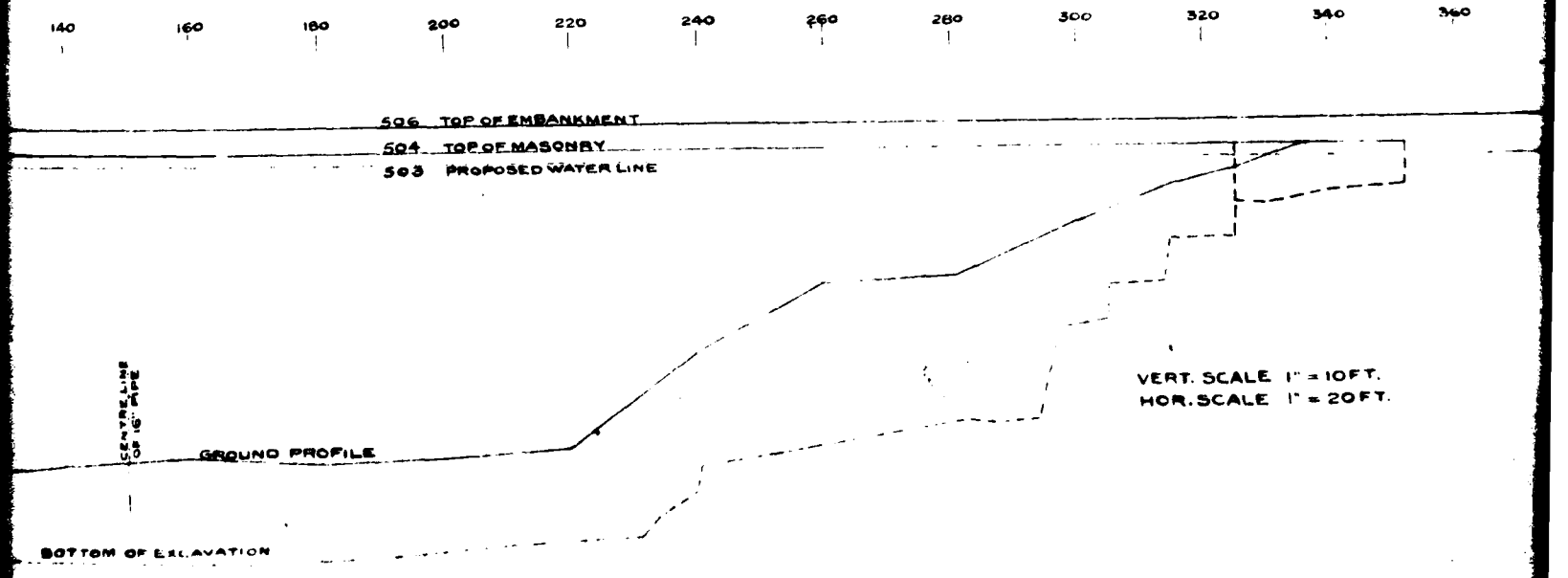


ELEVATIONS.

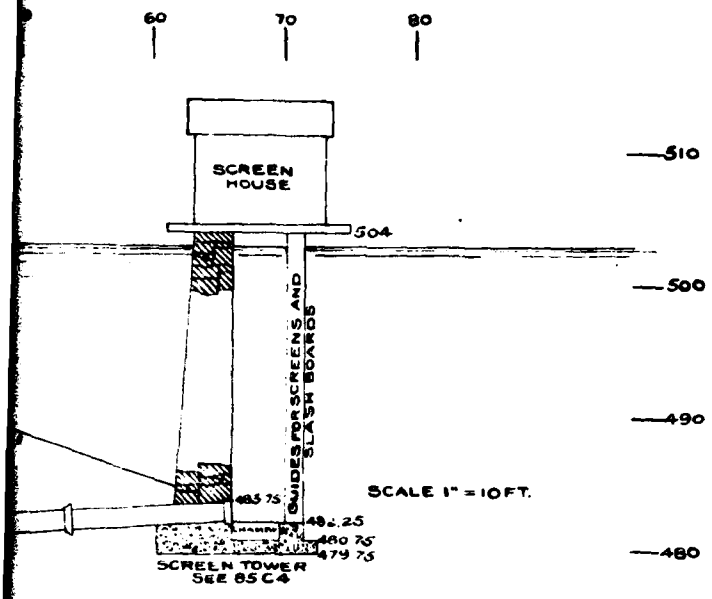
STONE ROAD & TOP OF EMBANKMENT	506.0
TOP OF MASONRY	504.0
WATER LEVEL GAUGE 20'-10"	503.1

MEASUREMENTS.

TOTAL EXCAVATION FOR DAM AND SPILLWAY	1045	CU. YDS.
" CONCRETE IN FOUNDATIONS, SPILLWAY, AND UNDER 16" PIPE	277	" "
" RUBBLE MASONRY (CORE WALL)	1320	" "
" ASHLAR MASONRY (SCREEN TOWER)	75	" "
" EARTH EMBANKMENT	14420	" "
" RIP RAP (EMBANKMENT AND SPILLWAY)	815	" "

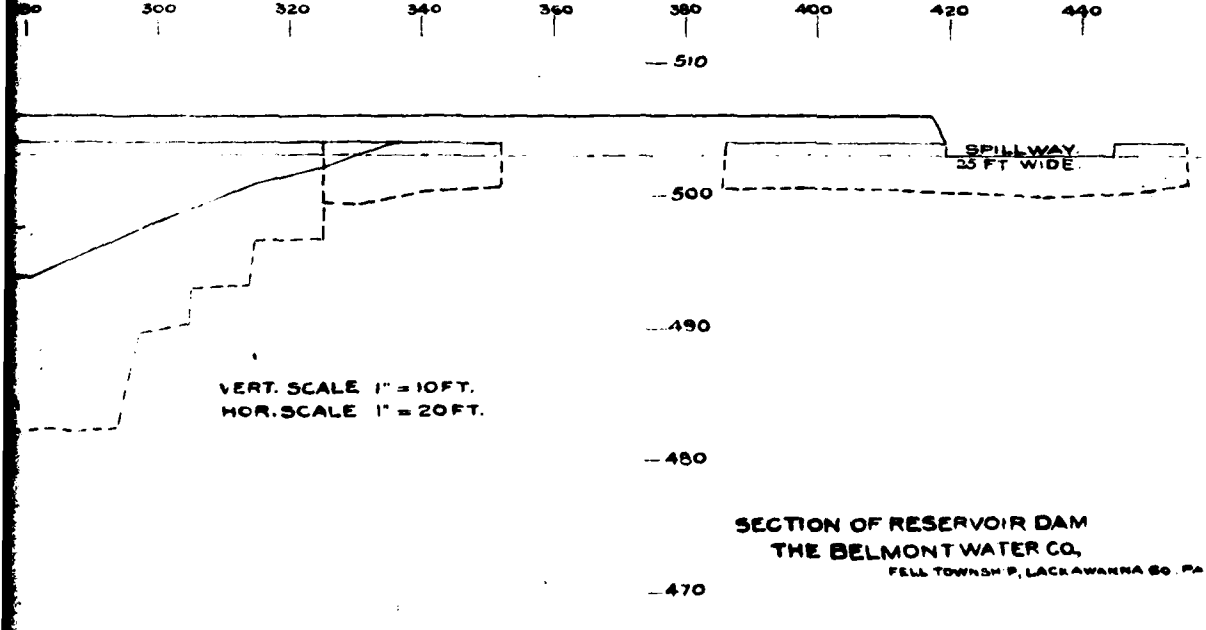


12



UREMENTS.

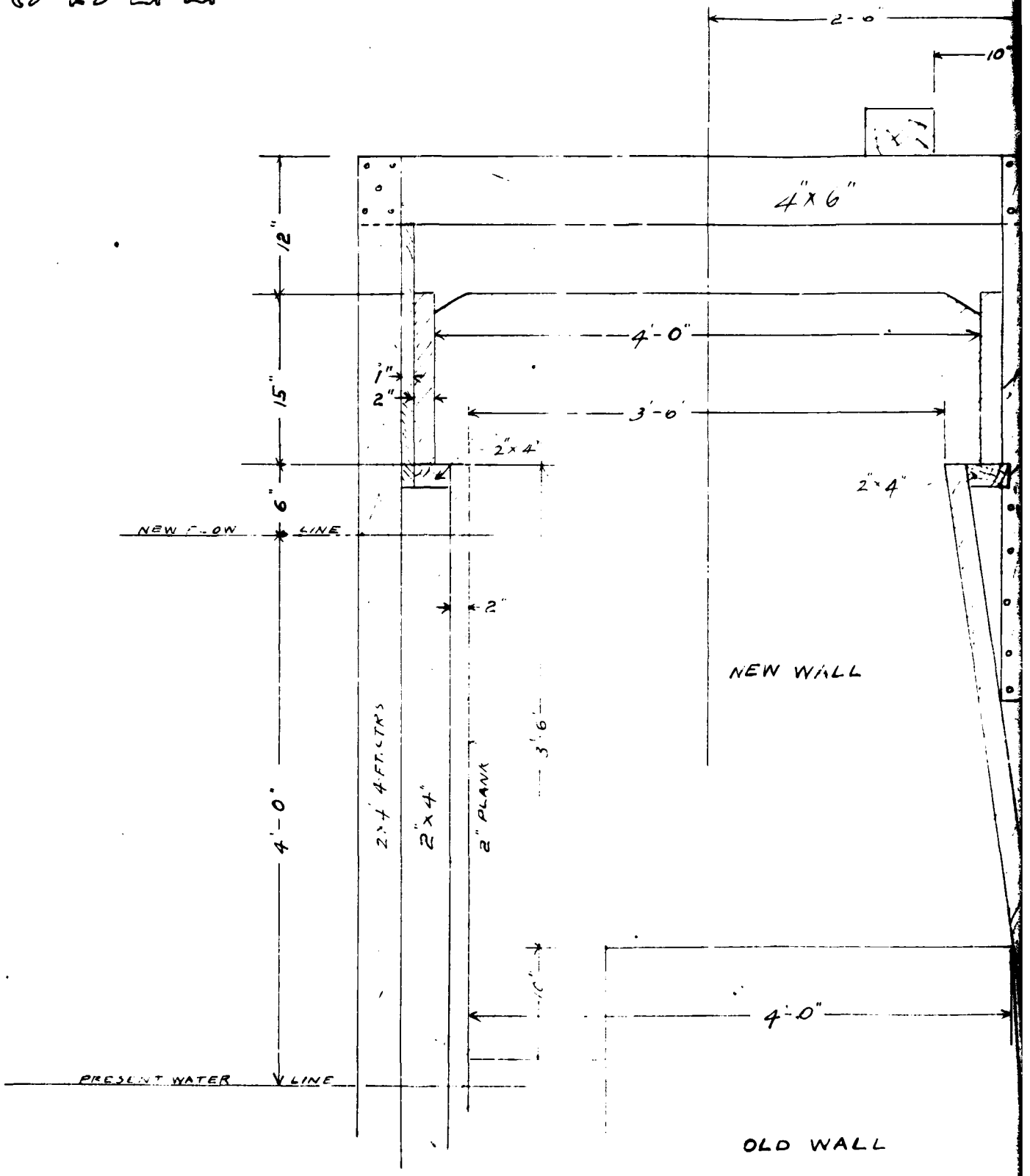
TOTAL EXCAVATION FOR DAM AND SPILLWAY	1045	CU.YDS.
" CONCRETE IN FOUNDATIONS, SPILLWAY, AND UNDER 16" PIPE	277	" "
" RUBBLE MASONRY (CORE WALL)	1320	" "
" ASHLAR MASONRY (SCREEN TOWER)	75	" "
" EARTH EMBANKMENT	14420	" "
" RIP RAP (EMBANKMENT AND SPILLWAY)	815	" "

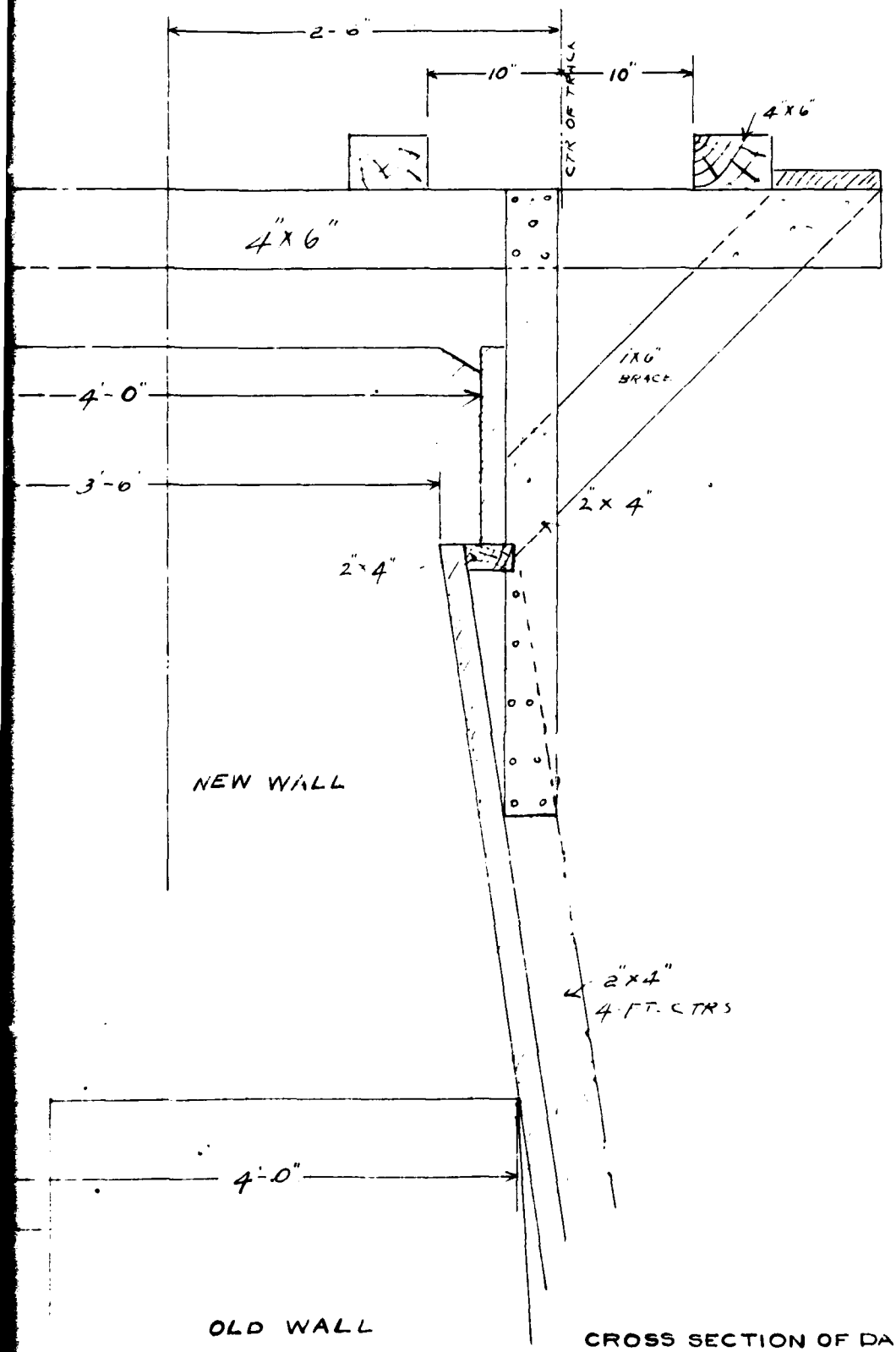


SECTION OF RESERVOIR DAM
THE BELMONT WATER CO.
FELL TOWNSHIP, LACKAWANNA CO. PA

DATE · AUG. 25TH 1903.
DRAWN BY E.M.H.

PA-00252
PLATE III


2'-0"
10"
4"x 6"
12"
15"
6"
4'-0"
4'-0"
3'-0"
1"
2"
2"x 4"
2"x 4"
NEW WALL
NEW LOW LINE
2"
2"x 4" FT. CLTS
2"x 4"
2" PLANK
3'6"
4'-0"
PRESENT WATER LINE
OLD WALL



CROSS SECTION OF DAM
SHOWING FORM AND DUMPING TRACK
BELMONT WATER CO.
THE CARBONDALE MACHINE CO
CARBONDALE, PA

DATE DEC 18-06
SCALE 1"=1'
DRAWN BY C.H.H.
TRACED BY
CHECKED BY
SUBMITTED TO

PA-00252
PLATE IV

APPENDIX F

GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Name: Pottsville Formation.

Lithology: Quartz pebble conglomerate, interbedded with fine to coarse grained sandstone with some beds of black shale and coal. No mineable coals are present in the Pottsville Formation in this area.

Structure

The dam is located near the axis of the Lackawanna Syncline. Minor folding and faulting are present in the area, but have not been mapped in detail. The area has been too built up and disturbed by nearby strip mining to determine air photo fracture traces.

Overburden

The area is within the limits of Pleistocene glaciation and variable thicknesses of glacial till and outwash sands and gravels are present. No boring or test pit information is present.

Aquifer Characteristics

The Pottsville Formation is composed of rocks that are essentially impermeable. Ground water movement is along bedding planes and on fractures such as joints and faults. The most permeable aquifers in the region are the sands and gravels of the outwash deposits.

Discussion

Almost no details are available concerning the foundation of this dam. A note in the file indicates that excavation was to be eight feet below the existing surface. This may mean that the concrete core wall is founded on bedrock, because the glacial material seems to be thin in this area. However, many old dams of this type were founded on glacial till.

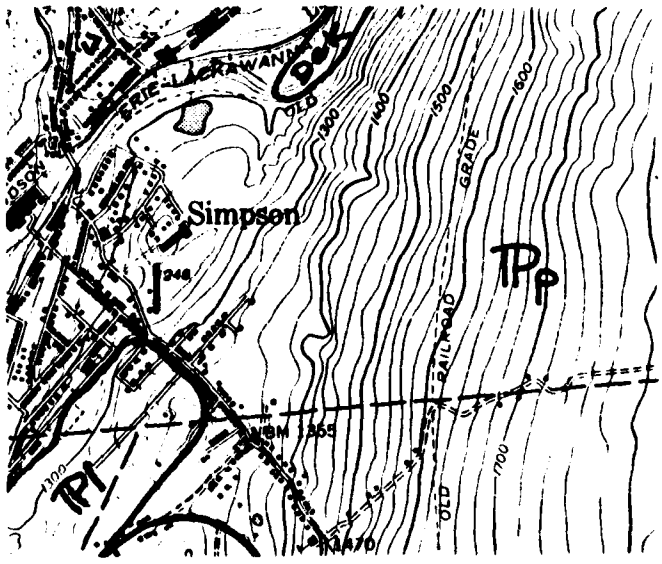
Sources of Information

1. J.R. Hollowell and H.E. Koester (1975) "Ground Water Resources of Lackawanna County, Pa." Pa. Geologic Survey Water Resources Report 41.

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

3. Plans and notes in file.

GEOLOGIC MAP - Belmont Dam



TPl	Llewellyn Fm.
TPp	Pottsville Fm.
Dck	Catskill Fm.- undifferentiated

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