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NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM, BEATTIES MILL DAM (NJ00821), PASSA--ETC(U)
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PASSAIC RIVER BASIN,
PASSAIC RIVER, PASSAIC COUNTY,
NEW JERSEY.

BEATTIES MILL DAM
(NJ 00821)

PHASE I INSPECTION REPORT.
NATIONAL DAM SAFETY PROGRAM



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DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO.: DAEN/NAP-53842/NJ00821-81/08

AUGUST 1981

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		



IN REPLY REFER TO

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

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Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase 1 Inspection Report for Beatties Mill Dam in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Beatties Mill Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 30 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood.) However, more detailed hydraulic and hydrologic studies are not recommended due to the limited site condition and the intended purpose of the dam. To ensure the adequacy of the structure, the following actions as a minimum, are recommended:

a. Within one year from the date of approval of this report the owner should engage a qualified professional consultant to perform the following:

(1) Design and oversee repair procedures for the replacement of the large masonry blocks which have been dislodged from the north side of the training wall which is at the left center of the dam.

(2) Evaluate the potential for undermining of the foundation support at the downstream end of the masonry spillway training wall at the left center of the dam caused by the loss of several large bedrock blocks, and design and oversee corrective measures as needed.

(3) Investigate measures to assure the stability of the dam under severe overtopping conditions.

NAPEN-N

Honorable Brendan T. Byrne

b. Within one year from the date of approval of this report the owner should repair the eroded construction joints.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

d. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Minish of the Eleventh District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,



ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

Incl
As stated

Copies furnished:

Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'pawa, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

BEATTIES MILL DAM (NJ00824)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 23 April 1981 by Anderson-Nichols and Co. Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Beatties Mill Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 30 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood.) However, more detailed hydraulic and hydrologic studies are not recommended due to the limited site condition and the intended purpose of the dam. To ensure the adequacy of the structure, the following actions as a minimum, are recommended:

a. Within one year from the date of approval of this report the owner should engage a qualified professional consultant to perform the following:

(1) Design and oversee repair procedures for the replacement of the large masonry blocks which have been dislodged from the north side of the training wall which is at the left center of the dam.

(2) Evaluate the potential for undermining of the foundation support at the downstream end of the masonry spillway training wall at the left center of the dam caused by the loss of several large bedrock blocks, and design and oversee corrective measures as needed.

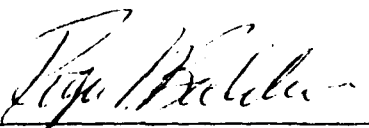
(3) Investigate measures to assure the stability of the dam under severe overtopping conditions.

b. Within one year from the date of approval of this report the owner should repair the eroded construction joints.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

d. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED:



ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE:

4. Aug 81

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Beatties Mill
Identification No.:	Fed ID No. NJ00821
State Located:	New Jersey
County Located:	Passaic
Stream:	Passaic River
River Basin:	Passaic
Date of Inspection	April 23, 1981

ASSESSMENT OF GENERAL CONDITIONS

Beatties Mill Dam is a 19-foot high concrete run-of-the-river dam with 267 feet of its 287 foot crest serving as a spillway. A 3-foot wide, 1-foot deep notch in the spillway crest carries low flows. The dam is 85 years old and underwent major reconstruction in 1945-1946. It is of intermediate size and in fair condition, and serves to create a pool allowing diversion of 75 mgd from the Passaic River to the Passaic Valley Water Commission's water treatment plant for treatment and municipal use.

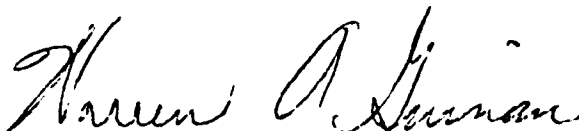
Several stones are missing from the upstream end of a stone masonry training wall at the left center of the dam. This has caused vertical and horizontal displacement of other stones in the training wall, and could lead to seepage and undermining of the spillway. In addition, some erosion and undermining of the rock foundation at the downstream end of the training wall has occurred.

The spillway would pass 29% of the Spillway Design Flood, which is one-half of the PMF. Failure of the dam would cause interruption of raw water supply (75 mgd) to the Passaic Valley Water Commission's water treatment plant. This interruption of a public utility would entail economic losses but would cause little, if any, threat of loss of life. Therefore the hazard classification of Beatties Mill Dam is significant.

It is recommended that the owner retain the services of a professional engineer, qualified in the design and construction of dams, to accomplish the following tasks in the near future: Design and oversee repairs to the training wall at the left center of the dam, evaluate the potential for undermining of the foundation at the downstream end of the training wall and design and oversee corrective measures as needed, and investigate measures to assure the stability of the dam under severe overtopping conditions.

It is further recommended that the owner accomplish the following in the near future as part of operating and maintenance procedures: repair construction joints on the dam and develop a written operation and maintenance schedule to ensure the safety of the dam.

ANDERSON-NICHOLS & COMPANY, INC.

A handwritten signature in cursive script, appearing to read "Warren A. Guinan".

Warren A. Guinan, P.E.
Project Manager
New Jersey No. 16848



April 23, 1981

OVERVIEW PHOTO
BEATTIES MILL DAM

PREFACE

This report is 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. 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 continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. The test 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.

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM
BEATTIES MILL DAM
FED ID NO. #NJ00821

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Authority to perform the Phase I Safety Inspection of Beatties Mill Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 12 December 1980 under Basic Contract No. FPM-39 and Contract No. A01093 dated 10 October, 1979. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the U.S. Army Engineers District, Philadelphia. The inspection discussed herein was performed by Anderson-Nichols & Company, Inc.

b. Purpose: The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to the safety of Beatties Mill Dam and appurtenances. Conclusions are based upon available data and visual inspection. The results of this study are used to determine any need for emergency measures and to conclude if additional studies, investigations, and analyses are necessary and warranted.

1.2 Project Description

a. Description of Dam and Appurtenances. Beatties Mill Dam is a concrete run-of-the-river dam with a structural and hydraulic height of 19.3 feet. Most of the dam's crest is a 267 foot long broad-crested overflow spillway in three sections - an arched 152-foot center section (concave upstream), a 55-foot right wingwall tying into a factory building which serves as the right abutment, and a 60-foot left wingwall tying into the left abutment. There is a 3-foot wide, 1-foot deep notch in the right wingwall for low flows. The dam's crest width is about 5 feet, the upstream face is 2H:1V (4 feet) and then nearly vertical, and the downstream face slopes 1H:1-1/2V.

The pond created by Beatties Mill Dam serves to create a diversion pool for a canal leading to a water treatment plant. This canal is controlled from a gate house about 300 feet upstream of the left abutment.

b. Location. The dam is located in Little Falls, New Jersey, on the Passaic River. It is at 40°53.1' north latitude and 74°14.1' west longitude on the Paterson Quadrangle. To reach Beatties Mill Dam, take exit 53 from U.S. Interstate Highway 80 to Riverview Drive South. After about 0.7 miles, turn right on Union Avenue. The gate leading to Beatties Dam is 0.2 miles south on Union Avenue on the right.

c. Size Classification. Beatties Mill Dam is classified as being intermediate in size on the basis of storage at the dam crest of 4,870 acre-feet, which is less than 50,000 acre-feet but more than 1,000 acre-feet, in accordance with criteria given in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. The failure of Beatties Mill Dam would cause a threat of loss to few, if any, lives. However, the hazard classification is considered to be significant because failure of the dam would interrupt inflow to the Passaic Valley Water Commission's water treatment plant, which is an important public utility.

e. Ownership. The dam is owned by the Passaic Valley Water Commission. Information may be obtained by writing the Commission at P.O. Box 230, Clifton, New Jersey, or by calling (201)772-3900.

f. Purpose. Beatties Mill Dam creates a pond from which an average of 75 mgd of Passaic River water is diverted to Passaic Valley Water Commission water treatment plant for treatment and use as water supply.

g. Design and Construction History. The cornerstone of the gatehouse controlling diversions to the water treatment plant indicates that Beatties Mill Dam was originally constructed in 1896. The dam was damaged by flooding in 1945, and major reconstruction designed by Bogert-Childs Engineering Associates was carried out in 1945-1946.

h. Normal Operational Procedure. Water for the Passaic Valley Water Commission is diverted to treatment as needed by canal. The average rate of diversion is 75 mgd. No other operational procedures were disclosed for this dam.

i. Site Geology. No boring information was available at the time the dam was inspected. Information derived from the Geologic Map of New Jersey (Kummel and Johnson, 1912) and the Glacial Drift Map of New Jersey (Salisbury, Kummel, Peet and Whitson, 1902) indicates that soils within the immediate site area consist of stratified drift which may include sand and gravel in plains, deltas, eskers, kames, and terraces.

Bedrock of igneous origin was observed in massive outcrops along the entire foundation during the inspection of this dam. The previously mentioned map (Kummel and Johnson) indicates that bedrock in this area consists of shale and sandstone with igneous intrusives of Triassic age.

1.3 Pertinent Data

a. Drainage Area

762 square miles

b. Discharge at Damsite (cfs)

Maximum flood at damsite - For USGS Gage 013895000, Passaic River at Little Falls, N.J., the maximum discharge from 1897 to the present is 28,000 cfs on October 10, 1903. The gage is 0.6 miles downstream of the dam, and has a drainage area of 762 square miles.

Total ungated spillway capacity at maximum pool elevation (at top of dam) - 12,701 cfs

c. Elevation (ft. above NGVD)

Top of dam - 164.1

Test flood (1/2 PMF) - 171.6

Recreation pool (at time of inspection) - about 157.2

Spillway crest - 156.8

Streambed at centerline of spillway - low point 144.8

Maximum tailwater - (F.I.S. 500 year flood) - 156

d. Reservoir (length in feet)

Length of maximum pool - (at 164.1' NGVD) - 117,000 (estimated)

Spillway crest - 76,000 (estimated)

e. Storage (acre-feet)

Spillway crest - 1,435

Test Flood (1/2 PMF) - 9,218

Top of dam - 4,870

f. Reservoir Surface (acres)

Top of dam - 536

Spillway crest - 350

g. Dam

Type - concrete gravity

Length - 287 feet

Height - 19.3 feet (hydraulic)

- 19.3 feet (structural)

Top width - about 5 feet

Side slopes - upstream 2H:1V for four feet then nearly vertical; downstream 1H:1-1/2V

Zoning - Not applicable

Impervious core - Not applicable

Cutoff - unknown

Grout curtain - unknown

h. Spillway

Type - Concrete overflow

Length of weir - 267 feet

Crest elevation - 157.8' NGVD - 3 foot notch at 156.8' NGVD

Low level outlet - None

U/S Channel - Passaic River

D/S Channel - Passaic River

i. Regulating Outlets

Type - Diversion canal controlled by gate located in gate house; seven 10' x 12' liftgates. Trash racks located at edge of reservoir outside gate house.

Width - Canal about 75 feet wide

Access - From left (north) bank through gate house to gates. Trash racks accessible from walkway upstream of gate house. Debris collected are passed downstream through trash flume and connecting 30-inch pipe.

SECTION 2 ENGINEERING DATA

2.1 Design

No hydraulic or hydrologic engineering data were disclosed. The plans for the 1945-1946 reconstruction were obtained.

2.2 Construction

Extensive correspondence exists between the Passaic Valley Water Commission and the New Jersey Department of Conservation concerning the 1945-1946 reconstruction of the dam. This correspondence is reproduced in Appendix 1.

2.3 Operation

No written operational data were found.

2.4 Evaluation

a. Availability. A search of the New Jersey Department of Environmental Protection files revealed the information discussed above.

b. Adequacy. The data obtained combined with the visual inspection are deemed adequate to complete this Phase 1 Inspection Report

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. Dam. Some erosion and undermining of the large rock outcrop downstream of the left abutment of the dam has occurred. Several large masonry blocks are missing at the junction of the spillway and the masonry block training wall which is perpendicular to the spillway at the left center of the dam. The existence of former root systems was observed behind several of the adjacent blocks which had remained in place. Several of the top cap stones on the training wall had been displaced up to 3 inches vertically downward adjacent to the intersection with the spillway. Horizontal separations up to 5 inches wide were measured between blocks located in the spillway and the adjacent center masonry block training wall. Some undermining of the large stones was observed near the downstream end of the masonry training wall. The toe of the concrete spillway is undermined 2-4 inches along its entire length. The downstream face of the dam is eroded, exposing the coarse aggregate, with deeper erosion at the construction joints and apparent cold joints.

b. Appurtenant Structures. The trash racks, walkway, and gate house all appeared to be in good condition. The trash flume and connecting pipe were free of debris. Some debris had collected on the trash racks. The diversion canal was essentially free of debris; however, brush and small trees line the canal banks.

c. Reservoir Area. The watershed above the lake is gently sloping and urbanized with numerous mill buildings and homes. Slopes on the shore appear to be stable. Some sedimentation was observed in the reservoir.

d. Downstream Channel. Bedrock channel with some displacement of large blocks of massive rock outcrop has occurred along the right and left sides of the channel downstream of the dam. Trees are growing along the top of the rock outcrops along the left side of the channel downstream of the dam.

SECTION 4 OPERATIONAL PROCEDURES

4.1 Procedures

No written operating procedures were revealed. Acceptable procedures are followed for operation of the diversion to the water treatment plant.

4.2 Maintenance of Dam

No formal maintenance procedures for the dam were found.

4.3 Maintenance of Operating Facilities

No formal maintenance procedures for the operating facilities were discovered. However, maintenance is adequate for continual use.

4.4 -Warning System

No description of any warning system was found.

4.5 Evaluation of Operational Adequacy

The remedial measures described in Section 7.2 should be implemented as described to improve operation and maintenance for the dam.

SECTION 5 HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. Design Data. Because no original hydrologic design data were revealed, an evaluation of such data could not be performed.

b. Experience Data. The water surface elevation caused by the flood of record for the dam, in October 1903, is shown on a stone in the diversion structure controlling the canal to the water treatment plant. The peak elevation was about 169 feet above NGVD, 11 feet above the present spillway crest. The peak flow from the October 1903 flood at the USGS gage 0.6 miles downstream of the dam was 28,000 cfs. Since the dam was rebuilt in 1945, the stage-discharge relationship in the 1903 flood cannot be compared to the stage discharge curve developed in this report. In 1945, the dam was damaged by high waters. No record of the peak stage in the reservoir from this flood could be found.

c. Visual Inspection. At the time of the inspection, all flow was through the 3-foot wide notch in the main spillway, allowing a clear view of the spillway crest and downstream face.

d. Beatties Mill Dam Overtopping Potential. The hydraulic/hydrologic evaluation for this dam is based on a selected Spillway Design Flood (SDF) equal to one-half the Probable Maximum Flood (PMF) in accordance with the range of test floods given in the evaluation guidelines for dams classified as significant hazard and intermediate size. The PMF was obtained from Passaic River Basin - New Jersey and New York - Survey Report for Water Resources by the New York District of the Corps of Engineers. The half-PMF inflow to the pond is 44,000 cfs, with a peak outflow of 43,785 cfs causing a stage of 171.6 feet above NGVD. (Hydrologic/hydraulic computations are attached as Appendix 4.)

Water could rise 7.3 feet above the crest of the low flow notch in the spillway, to 164.1 feet above NGVD, before overtopping the left abutment of the dam. Under this head the spillway capacity is 12,701 cfs, 29% of the selected SDF. Flood routing calculations indicate that Beatties Mill Dam would be overtopped for 91 hours to a maximum elevation of 171.6 feet NGVD, 7.5 feet above the crest of the left abutment, under half-PMF conditions.

e. Draw-down Capacity. Water could be diverted from Beatties Mill Dam at times of low flow through the canal leading to the water treatment plant. The time required to draw the reservoir down would depend on inflow and on the capacity of the canal.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

The displacement of large masonry blocks at the junction of the spillway and center masonry block training wall may lead to seepage and undermining of the spillway. The dislodgment of several large blocks of bedrock at the downstream end of the masonry block training wall may cause stability problems to the training wall if allowed to continue.

6.2 Design and Construction Data.

No design or construction data pertinent to the structural stability of the dam are available.

6.3 Operating Records.

No operating records pertinent to the structural stability of the dam are available.

6.4 Post-Construction Changes.

Plans and sections from the 1945-1946 reconstruction of the dam are available; however no computational data pertinent to the structural stability of the dam are available.

6.5 Seismic Stability

This dam is in Seismic Zone 1. According to the Recommended Guidelines, dams located in Seismic Zone 1 "may be assumed to present no hazard from earthquake, provided static stability conditions are satisfactory and conventional safety margins exist". None of the visual observations made during the inspection are indicative of unstable conditions. However, because no data are available concerning the engineering properties of the foundation materials for this dam, it is not possible to make an engineering evaluation of the stability of the structure or the factor of safety under static conditions.

SECTION 7
ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Beatties Mill Dam is 85 years old and is in fair condition.

b. Adequacy of Information. The information available is such that the assessment of the dam must be based primarily on the results of the visual inspection.

c. Urgency. The recommendations made in 7.2.a and 7.2.b should be implemented by the owner as prescribed.

d. Necessity for Additional Data/Evaluation. The information available from the visual inspection is adequate to identify the potential problems which are listed in 7.2.a. These problems require the attention of a professional engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problems. If left unattended, the problems could lead to failure of the dam.

7.2 Recommendation/Remedial Measures

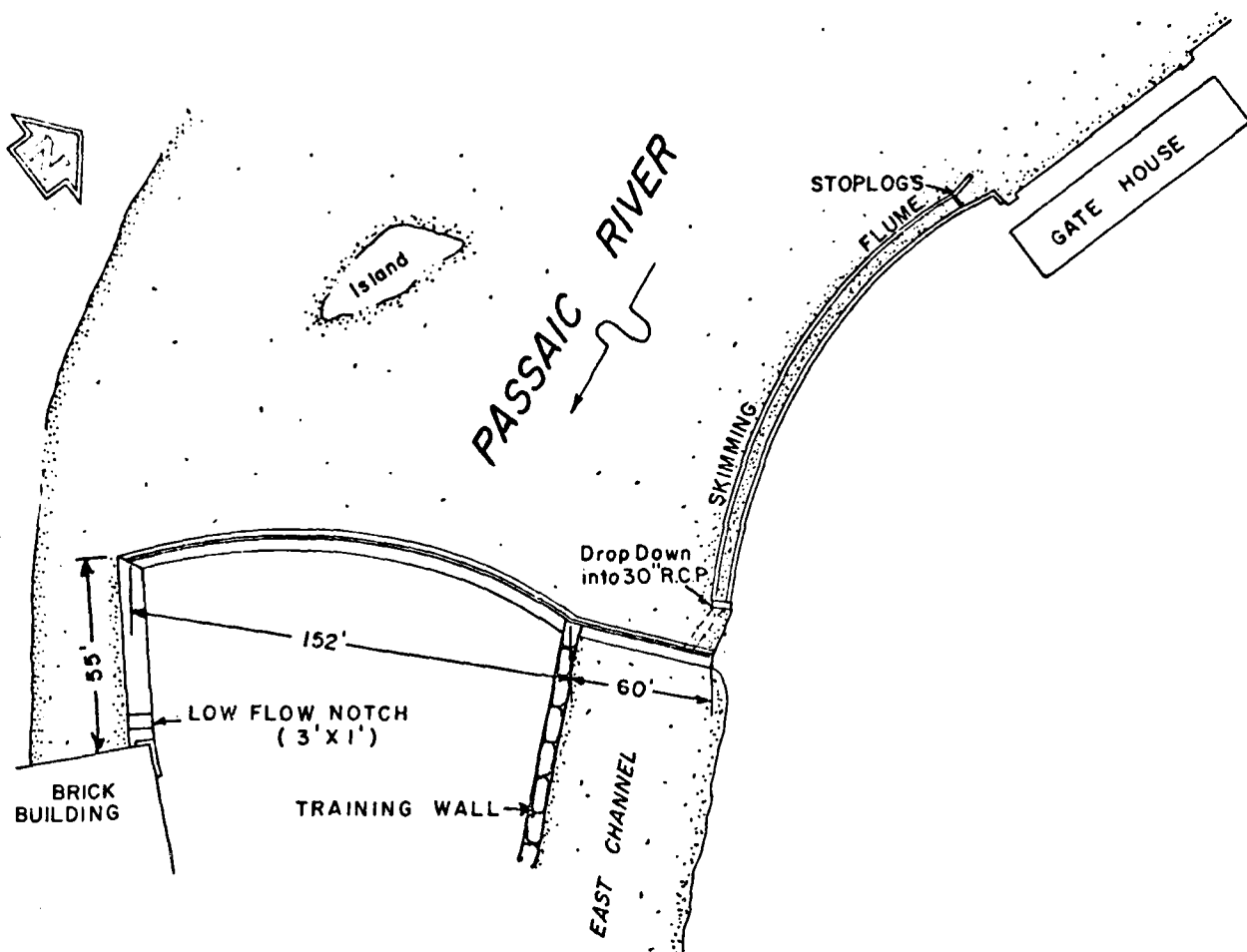
a. Recommendations. The owner should retain a professional engineer qualified in the design and construction of dams to accomplish the following in the near future:

- (1) Design and oversee repair procedures for the replacement of the large masonry blocks which have been dislodged from the north side of the training wall which is at the left center of the dam.
- (2) Evaluate the potential for undermining of the foundation support at the downstream end of the masonry spillway training wall at the left center of the dam caused by the loss of several large bedrock blocks, and design and oversee corrective measures as needed.
- (3) Investigate measures to assure the stability of the dam under severe overtopping conditions.

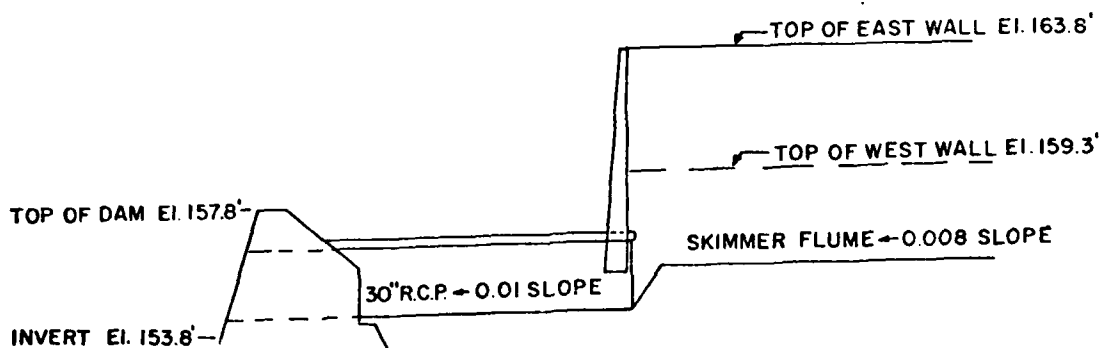
b. Alternatives. None recommended.

c. Operating and Maintenance Procedures. The owner should accomplish the following in the near future:

- (1) Repair the eroded construction joints.
- (2) Develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.



PLAN



ELEVATION

Anderson-Nichols & Co., Inc.		U.S. ARMY ENGINEER DIST PHILADELPHIA	
BOSTON		CORPS OF ENGINEERS	
MASSACHUSETTS		PHILADELPHIA, PA	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
BEATTIE'S MILL DAM			
PASSAIC RIVER		NEW JERSEY	
		SCALE NOT TO SCALE	
		DATE: JUNE 1981	



SCALE IN MILES



MAP BASED ON STATE OF NEW JERSEY
OFFICIAL MAP & GUIDE.

Anderson-Nichols & Co., Inc.		U.S. ARMY ENGINEER DIST. PHILADELPHIA	
BOSTON		CORPS OF ENGINEERS	
MASSACHUSETTS		PHILADELPHIA, PA.	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
BEATTIES MILL DAM			
LOCATION MAP			
PASSAIC RIVER		NEW JERSEY	
		SCALE: 1" = 4 Miles Approx.	
		DATE: JUNE 1981	

APPENDIX 1
ENGINEERING AND EXPERIENCE DATA
BEATTIES MILL DAM

Borough of West Paterson

Department of Administration

ALFRED A. REDA
Municipal Clerk
Administrator



RECEIVED
AUG 23 10 25 AM '72

DEPT. OF ENVIRONMENTAL PROTECTION
DIV. OF WATER RESOURCES
August 21, 1972

PASSAIC COUNTY, N. J.

833 MURKIN AVENUE
WEST PATERSON, N. J. 07659
(201) 276 0900

414

Mr. Aziz
State Department of Environmental Protection,
Division of Water Resources
Trenton, NJ

RE: Beattie Dam Little Falls
Township Passaic County NJ

Dear Mr. Aziz:

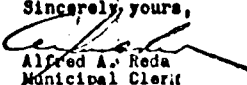
With respect to the above noted matter please be advised that on August 15, 1972 Mr. Wendell Inhofer, General Superintendent of the Passaic Valley Water Commission, made a visual inspection of the Beattie Dam and was accompanied by Mr. Robert P. Schilling, Municipal Engineer, for the Borough of West Paterson.

For your information I am enclosing herewith a copy of Mr. Schilling's report dated August 15th wherein it is indicated the aforementioned found no evidence of cracks or other structural defects etc.

Please note that at the time of this inspection Mayor Alfred H. Baumann of West Paterson was away on vacation and has just returned. Upon his direction I am forwarding this report to you.

Should you desire any additional information on this matter, please do not hesitate to call my office. Thanking you for your cooperation, I wish to remain,

Sincerely yours,


Alfred A. Reda
Municipal Clerk
Administrator

AAR:gd
Enc.

CC: Mayor Alfred H. Baumann

Robert P. Schilling
Municipal Engineer



7/14
3AA

PASSAIC VALLEY WATER COMMISSION

1000 MAIN AVENUE
CLIFTON, NEW JERSEY
P. O. BOX 823

RECEIVED
AUG 14 1972

WENDALL R. INHOFFER
General Superintendent
and Chief Engineer

August 14, 1972

DEPT. OF ENVIRONMENTAL
DIV. OF WATER RESOURCES

Mr. Dirk C. Hofman, P.E.
Chief - Bureau of Water Control
State of New Jersey
Department of Environmental Protection
Division of Water Resources
Trenton, New Jersey 08625

Dear Mr. Hofman:

Re: Hestties Dam, Application No. 404

This is to inform you that on Saturday, August 12, 1972, the writer personally inspected Hestties Dam after all overflow had been diverted to the Commission's intake canal.

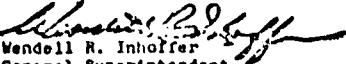
You are hereby advised that cracks and leaks reported in the Herald News on June 26, 1972, were not apparent during this inspection.

A number of photographs were taken and will be forwarded to your office in the near future.

Very truly yours,

PASSAIC VALLEY WATER COMMISSION

WRI:grt


Wendell R. Inhoff
General Superintendent
and Chief Engineer

Re: Battle E-2
Little Falls Township,
Passaic County, N.J.

This is to advise that on this date I met with Mr. Wendell Inghoffer, General Superintendent and Chief Engineer, Pacific Valley Water Commission, in connection with an earlier report received regarding possible structural defects in the Battle Dam, in Little Falls, N.J.

Respectfully submitted,

Robert P. Schilling
Municipal Engineer

RPS/cc

Morris County Mosquito Extermination Commission

2 Franklin Place

COMMISSIONERS
A. THOMAS STOUT, President
WILLIAM V. FRANK, Vice President
REV. JUDITH E. WALSH, Secretary
SPENCER E. MATH, Jr., Secretary
DR. JOHN E. MURPHY
GEORGE E. LAURACH

JAMES T. HART, Jr.
Superintendent
Telephone Morristown 4-1222

MORRIS PLAIN, N. J.
October 22, 1946.

N. J. State Water Policy Commission
28 West State Street
Trenton, New Jersey.

Attention, Mr. Howard T. Critchlow

Gentlemen:

I am writing to inquire whether the State Water Policy Commission has checked the work completed at Beatties Dam, Little Falls, by the Passaic Valley Water Commission with respect to the following:

1. Elevation of the re-capped spillway.
2. Length of present spillway including wall on the mill side.

I have been informed by my associates in Little Falls that great secrecy surrounded the work, with watchmen, etc. All were forbidden to discuss the work; however, information is abroad that the spillway was raised a few inches in the re-capping process and the portion of the dam paralleling the mill side was cut off so that it can be no longer considered a spillway area. This may be rumor as most reports are; however, we must be prepared to answer.

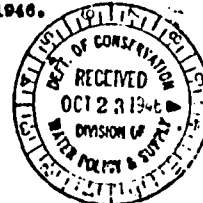
Our position is one opposing even a fraction of an inch rise in the elevation of the spillway and the curtailment of any spillway area. If your Department has checked the work by running levels from the B.W. established by the Riparian Stream and Waterway Survey to the points on the spillway as shown on the plan of that survey and found no increase we will be more than pleased. If this was not done in the course of approving the final work we will take the steps necessary to make the survey in order to answer the rumors.

With best regards to you and your assistants, I remain,

Yours Truly,

Robert L. Vannote
Robert L. Vannote, Exec. Sec'y
Municipal Committee for Mosquito
Control in the Passaic Valley

RLV:ia



Report on Dam Inspection

HEATLEY'S DAM

PASADENA RIVER, PASADENA COUNTY

APPLICATION NO. 104

DAM NO. 26-30

On August 25, 1946 inspection was made in company with Richard E. Sengman, Superintendent, Pasadena Valley Water Commission, of the spillway abut which has been completed recently under license approved November 1, 1945 for the sub-foot dam. Inspection disclosed that the work on the spillway has been completed in accordance with the approved drawings and is an excellent job. Inspections were taken from three angles. It is recommended that the approved letter accepting the repairs to the spillway be sent to Mr. Sengman.

At the time of inspection, the contractor was removing the earth dike which had been constructed upstream of the spillway to permit repairs and was using that material to build a dike along the left bank to permit construction of the skimming flume.

This dike is being removed to below the original stream bed level where rock permits.

Ernest E. J.
August 25, 1946

George R. Shanklin
George R. Shanklin
Acting Chief Engineer

[illegible]

¹ LAW OFFICES

2012年12月24日



Several - 1000, 1000 to 2000

regarding the modification of the contract for the
Bottle manufactured by the defendant, I am, Sir,
Jersey. My client, the defendant, is a resident
in Lincoln Park, New Jersey, and is a resident of
result of the alteration of the contract of the
mentioned Com, his property is rendered
rendered worthless. Therefore, would you be
kind enough to communicate with the defendant
this matter.

Sincerely yours

010:0100

APR 11 1964

George A. Robinson

Trenton, N. J.
July 25, 1946



Report on Site Inspection

REPORT OF THE DISTRICT COURT

APRIL 20, 1946

DEN NO. 86-50

On May 17, 1946 inspection was made of the work in progress on the dam to this dam on the Little River in Little Falls, Parole County. The inspection disclosed that the new spillway work had been completed to the water of the crest section in the middle of the dam. At the time of the inspection all work had been interrupted by high flows. The board observed on the new section was approximately 2 inches.

Trenton, N. J.
May 27, 1946

George R. Shanklin
George R. Shanklin
Asst. Chief Engineer



Mr. William P. Brown, General Superintendent

Little Falls,
Minnesota, U.S.A.

Dear Mr. Brown:

Received in your letter of May 13, 1964, enclosing a set of drawings for the repair of your dock structure at Little Falls, Minnesota. This is in advice of the fact that the drawings, entitled "Little Falls Dock Repair", dated May 13, 1964, have been received and a final bill of the design originally approved by me on May 13, 1964, is being prepared for your files, approx. 15 days from now.

Sheet No. 1, entitled "General Plan" is not included for the reason that there are no changes shown on that drawing.

Sheet No. 2, entitled "Proposed Flashboard Details" cannot be accepted for the reason that the permit was issued subject to special condition 11, "It is hereby understood that approval herein does not permit the placing of flashboards on the crest of the structure".

Yours very truly,


H. F. Critchlow
Chief Engineer

cc: 11

Superior Portland Cement Co.

May 9, 1916

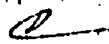
Mr. Richard E. Boyce, General Superintendent
Baltimore & Annapolis Canal
Baltimore, Maryland
Baltimore, Maryland

Patent Station 104

Dear Mr. Boyce:

In reply to your letter of May 3, 1916 suggesting that the top of the wing wall at the lower end of Battle's dam on the tunnel line at Little Falls, be raised 8 inches higher than the crest elevation 197.0 of the main dam, we can advise you that this office has no objection to this change in the design, provided however it is made. If this change is adopted, please file in duplicate revised drawings showing same.

Yours very truly,


H. T. Critchlow
Chief Engineer

ENCLOSURE



RECEIVED
MAY 10 1946

Plant Engineer, Grand Coulee Dam

Grand Coulee Dam, Washington

Laurel, Idaho

On April 24, 1946, in company with O. W. Bartwell, District Engineer, Bureau of Reclamation, I visited the Grand Coulee Dam, Washington, and the site of the proposed new spillway. The work in progress on the spillway is being done in little falls, bed, etc.

The spillway structure is the one spillway crest has been built on the left side of the crest channel. The spillway crest is being built and it appears to be a concrete structure. The spillway crest has been placed on the left side of the crest for this section. Mr. Bartwell and I discussed the work on the spillway and the work to be completed before July 1.

Following the inspection, Mr. Bartwell and I discussed the location of a spillway station to be located at this point for the purpose of determining the spillway crest for the foundation and the location of the spillway crest about 100 feet above the spillway station is to be located the records of the spillway to be located at the spillway station to be located in the gorge below the point of discharge of the turbines and other plant water.

Tranton, N. J.
May 6, 1946

George R. Shanklin
George R. Shanklin
Asst. Chief Engineer

PASSAIC VALLEY WATER COMMISSION

137 ELLISON STREET

PATENSON, I
NEW JERSEY

May 3, 1946

JOHN T. CRITCHLOW, President
DAVID M. CRITCHLOW, Vice President
JOHN A. CRITCHLOW, Secretary
JOHN A. CRITCHLOW, Treasurer
JOHN A. CRITCHLOW, Auditor
JOHN A. CRITCHLOW, Chairman of the Board



Department of Conservation
Division of Water Policy and Supply
28 West State Street
Trenton, N.J.

Attention: H.T. Critchlow, Chief Engineer

Re: Repair "Beattie's Dam"

Gentlemen:

It has just been suggested that the top of the wing-wall on the Beattie's mill side of the above captioned structure, be held at an elevation 8 inches higher than the crest of the main dam. This would materially improve the operating appearance when a small amount of water is flowing over the dam, and would confine the flow to the main section.

The plans, as approved, call for holding the same crest level throughout, namely, elevation 167.80.

Would you approve of the change suggested above?

Very truly yours,
PASSAIC VALLEY WATER COMMISSION

Richard K. Bonyun
Richard K. Bonyun
General Superintendent

RKB:G

Report on the Little Falls Dam

REPORT OF THE

LITTLE FALLS, PASSAIC RIVER

APPLICATION NO. 401

RAM NO. 26-30

On October 10, 1945, an action was made and conference was held with Richard E. Bogert, General Superintendent Passaic Valley Water Canalization and Mr. Bogert and the members of the Little Falls Engineering Association, Consulting Engineers, to discuss the repair and construction of a skimming flume at Little Falls, New Jersey, on the Passaic River at Little Falls.

The inspection disclosed that the crest of the main dam had been severely damaged by the July 1944 flood, wherein two courses of the stone masonry had been washed off the top of the dam for a distance of 12 feet near the right wing wall and for a distance of 6 feet near the left end of the main spillway. The left wing wall was in good condition with a concrete apron. However, of this wing wall is somewhat obstructed at the left end by an outcrop of ledge rock on the downstream face. The right wing wall, opposite the Brattle Manufacturing Company plant, is in very poor condition and leaks badly.

The preliminary drawings filed October 1 were discussed with Messrs. Bongun and Bogert, who were advised (1) that no approval to start construction could be granted before the next Council meeting on November 1; (2) that approval of the repairs and the skimming flume would be recommended without the provisions for flashboards; (3) that the outlet of the skimming flume be modified to reduce its obstruction of the left wing wall. Mr. Bogert agreed to eliminate the two concrete sills shown on the spillway for future flashboards, but requested that the pipe sockets and eye-bolts shown on the final drawings for use with flashboards at some future date be approved, since the cost of installing these items at the future date would be large as compared with the cost of installing them at this time. In order to avoid a serious obstruction to the left wing wall and heavy rock excavation below this wing wall, it was decided to end the skimming flume 20 feet above the dam and discharge through a concrete pipe, the top of which would be located below the crest of the dam. In support of the flashboard provisions Mr. Bogert was requested to file a letter with his application substantiating the need of the flashboards.

Trenton, New Jersey
October 25, 1945

George F. Shanklin
George F. Shanklin
Asst. Chief Engineer

Dam Application No. 1091

(26-90)

State of New Jersey
State Water Policy Commission

REPORT ON DAM APPLICATION

To the State Water Policy Commission,
State of New Jersey.

Gentlemen:

The application of Passaic Valley Water Commission, 137 Wilson St., Paterson, N.J.,

filed October 22, 1935 for approval of plans and for a permit to repair a dam
construct a skimming flume above this dam
known as Beattie's Dam and to make in Little Falls on Passaic River

tributary to Newark Bay in Passaic County, New Jersey,
has been examined by George B. Shanklin Chief
Assistant Division Engineer.

PRINCIPAL FEATURES

Location 26.1.6.6.6	Site inspected Oct. 10, '45 - G.B.S.
Purpose of dam Potable public water supply	Length of dam 160 feet
Drainage area 772.9 sq. mi.	Elevation of top line 157.8 Applicant's datum
Area of Lake natural channel	Capacity of lake 157.5 M.G. Goodell
Type of dam Stone masonry dam capped with concrete top width 2.25 feet	
Upstream slope 2-1/2 to 1 of batter	Downstream slope 1 to 1-1/2
Foundation material Trap rock ledge	Max. height 82 feet
Type of spillway Freefall overflow, masonry dam	Length of spillway 285 feet
Max. head on spillway 11.12 feet See other side.	
Spillway capacity 31,075 sec. ft. at 11.12 feet	sec. ft. per sq. mi. See other side.
Estimated maximum flood flow 42,000 sec. ft. at 11.12 feet	sec. ft. per sq. mi. Oct. 10, 1903
Outlets other than spillway Intake canal and gate house for Passaic Valley Water Comm. plant on left bank upstream of dam and intake works for Beattie's Mfg. plant on right bank at dam.	
Drawings filed	

It has been found that the site for the dam is suitable and the plans adequate to ensure the construction of a structure which will not be a menace to life or property. It is therefore recommended that the plans be approved and that a permit be issued, subject, however, to the following terms and conditions:—

1. That this permit does not give any property rights, either in real estate or material, nor any exclusive privileges; neither does it authorize any injury to private property nor invasion of private rights, nor any infringement of Federal, State or local laws or regulations, nor does it waive the obtaining of Federal assent, when necessary.

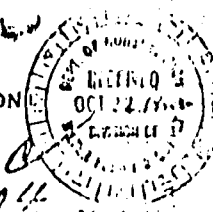
PASSAIC VALLEY WATER COMMISSION

157 ELLISON STREET

PATERBORO, N.J.

NEW JERSEY

DAM APPLICATION No. 404



N. J. Dept. of Conservation
Division of Water Policy & Supply
20 West State Street
Trenton 8, New Jersey

Attention: W. T. Critchley,
Chief Engineer.

Re: Dam #26, 30 Passaic County

Gentlemen:

We are enclosing herewith application forms for permission to repair this Commission's Dam, known as "Beattie's Dam", across the Passaic River at Little Falls. Also enclosed is a complete set of plans and specifications for the project.

Following our conference on the site with Mr. Shanklin on October 10th, we have revised the design of the outlet end of the skimming flume in accordance with your suggestions to eliminate any obstruction at the crest of the dam. The proposed elevation of the new crest is the same as that of the existing crest of the arched section. This elevation of crest will be held throughout the entire spillway and will effect a betterment in discharge capacity, since the crests of the existing wing walls on either side of the arched section are now and have been some three to four inches higher than the crest of the arched section.

You will note on the drawings that we are requesting approval for the installation of pipe sockets in the new dam crest for the future installation of flashboards, if and when applied for and approved by your Board.

We submit the following arguments to justify our request:

- (1) The pipe sockets would be flush with the top of the dam, filled and sealed with material of a

removable nature, and would offer no resistance to free discharge.

- (2) Flashboards would not be installed unless formal approval were granted by your Board. This policy would be confirmed by the Commission by formal resolution, if you request such action.
- (3) The design of the flashboard supports, if and when applied for and approval granted, would consist of stainless steel pins with a calibrated cut-away section at crest level, and designed and tested to fail at a predetermined elevation of water level above the permanent crest of the dam. The flashboards would then fall to the downstream face of the dam and be held there by chains fastened to the eye bolts set in the face of the dam. Such a design for flashboards would cause no hardship to upstream property owners during times of low flow conditions and would fail and create no obstruction to the free discharge over the dam during times of high water.

We are anticipating, at this time, the need for flashboards on this dam at some time in the future for the following reasons:

- (1) The Little Falls Purification Plant on this Commission's Passaic River source of potable water supply is designed on gravity flow of water from the river through intake canal, screen house, coagulation basins, influent piping and on to the filters. It is estimated that the present maximum gradient

PASSAIC VALLEY WATER COMMISSION

- with water level at the river of 157.8 (crest level of the dam) will not permit production of potable water from this source 'a excess of 50 m.g.d. The future installation of flashboards to permit the carrying of 1 ft. higher elevation of water at the river intake, during times of low flow, would materially increase the potable water yield from this source of supply.
- (2) The future installation of the flashboards would provide certain other advantages such as increased hydro-electric generation, which might be vital in our ability to pump water during failure of our auxiliary source of power,

As stated in our letter of September 28th, the Commission considers the repair of the dam urgent, and time to be of the essence, For this reason we have explained at length our present and future plans in anticipation of your deliberation on the application. The work has been advertised and bids will be received by the Commission on October 24th, and we respectfully request your approval of the project by that date or shortly after, in order that the contract may be awarded without delay.

Very truly yours,
PACIFIC VALLEY WATER COMMISSION
Richard E. Bonyun
Richard E. Bonyun
General Superintendent

REB:VM

PACIFIC VALLEY WATER COMMISSION

PASSAIC VALLEY WATER COMMISSION

137 ELLISON STREET

PATERSON, 1
NEW JERSEY

September 20, 1948



H.T. Grishlow, Chief Engineer
New Jersey Department of Conservation
Division of Water Supply and Supply
70 West State Street
Trenton 6, New Jersey

Pat. Dam No. 17-10 Passaic County

Gentlemen:

In response to your letter of September 11th, regarding repairs to our Paterson Dam, at Little Falls, we hereby make formal application for approval to proceed with this construction.

Enclosed herewith is a copy of a preliminary report of Bogert-Childs Engineering Associates, together with preliminary drawings of the work to be undertaken. It is proposed to do the following work:

- (1) Reconstruct the crest and down stream slope of the curved section of the dam and the straight section on gate house side, with poured concrete of typical cross-section as shown on scheme 1. of the drawings.
- (2) To reinforce the existing side wall on the Peattie Manufacturing side with poured concrete typical section L-R as shown on the drawings.
- (3) To hold the elevation of the new concrete crest of the main dam and side wall, at the same elevation as the crest of the present dam.
- (4) To construct a "skimming flume" from the floating boom at the gate house to and through the dam as shown on the drawings.
- (5) To provide in the new crest of the dam and side wall, slots for the future installation of flash boards if and when approved by your department.

*Not approved
for flash boards*

This application does not include a request for any change in elevation of the crest of the existing dam, or for the installation of flash boards previously mentioned in our letter of September 6th, but is merely a request for approval to proceed with the permanent

New Jersey Department of Conservation -D- September 28, 1940

rebuilding of the existing structure, the maintenance of which is vital to the operation of this Commission's Passaic River water supply.

Since the flood of July 22nd, recent high water over the dam has caused more damage to the structure and for this reason it is imperative that work on the repairs be placed under way as soon as possible.

Will you therefore kindly give this matter your prompt consideration so that there may be no undue delay in proceeding with the project.

Very truly yours,
PASSAIC VALLEY WATER COMMISSION

Richard E. Bonyun
Richard E. Bonyun
General Superintendent

REB:G

PASSAIC VALLEY WATER COMMISSION

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 100-100000-100000

PATHEFRONTS
NEW YORK

September 6, 1954

H. T. Critchlow, Chief Engineer
N. J. Dept. of Conservation
Division of Water Policy & Supply
28 West State Street
Trenton 8, New Jersey

Dear Mr. Critchlow

During the recent flood of July 22nd and 23rd, material damage was done to this Commission's dam across the Lewis River at Little Falls. The dam is known as "Beattie's dam". Several of the coping stones forming the crest of the stone masonry dam were washed away.

We are starting with the preparations of plans and specifications for the work of making a permanent repair to the structure. To be included in this project is a new sluiceway from the floating boom at our River intake, to end through the dam to facilitate removal of debris which collects at the intake. Also contemplated is the installation of collapsible floodboards on the top of the dam which would permit the carrying of approximately 1 ft. higher elevation of water in the pond above the dam during dry flow conditions, but which would collapse at time of high water and not interfere with the free discharge over the dam.

It is my understanding that such work is subject to the approval of your department and for this reason I am advising you of the project. We have engaged the services of Bixart-Childs Engineering Associates in the preparation of design, plans and specifications.

Please advise if I am correct in assuming that your approval is necessary, and if so please inform us of the procedure to follow.

Very, truly yours,
PASSAIC VALLEY WATER COMMISSION

(over)

Richard E. Bonyun
General Superintendent

APPENDIX 2

CHECK LIST

VISUAL INSPECTION

BEATTIES MILL DAM

Check List
Visual Inspection
Phase 1

Name Dam Beatties Mill Dam County Passaic State NJ (00821) Coordinators NJDEP
 Date(s) Inspection 2/17/81 4/23/81 Weather Clear Rain Temperature 52° 55°
 Pool Elevation at Time of Inspection 157.2' NGVD Tailwater at Time of Inspection 152' NGVD

Inspection Personnel:

<u>W. Guinan</u>	<u>C. Plaud</u>	<u>D. Deane</u>
<u>S. Gilman</u>	<u>J. Stone</u>	<u>K. Stuart</u>
<u>R. Murdock</u>	<u> </u>	<u> </u>

R. Murdock/K. Stuart/S. Gilman Recorder

Mr. L. O'Brien - Owner's Representative

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE OR LEAKAGE	None observed	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Considerable loss of stone support at junction of spillway and buttress and underneath downstream end of buttress.	Repair training wall and down- stream support.
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	Entire structure is founded on bedrock.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Surface of dam is eroded exposing the coarse aggregate	
STRUCTURAL CRACKING	Evidence of horizontal cracks or cold construction joints in d/s right end face.	Repair joint
VERTICAL AND HORIZONTAL ALIGNMENT	No indication of horizontal or vertical movement	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	Vertical joints are eroded to 1-inch deep. No leakage noted. Bottom of weir is undermined at base approximately 2-4 inches all along toe of concrete dam.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Canal diversion for Passaic Valley Water Commission.	Canal - good condition
INTAKE STRUCTURE	Building over intake channel Diversion to canal controlled from gate house. Channel in good condition.	Channel with cut stone walls
OUTLET STRUCTURE	N/A	
OUTLET CHANNEL	Canal to water treatment plant	
EMERGENCY GATE	N/A	

UNGATED SPILLWAY

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

CONCRETE WEIR

Good shape

APPROACH CHANNEL

Passaic River

DISCHARGE CHANNEL

Passaic River - open channel, bedrock channel bottom.

Beattie Mill building adjacent to right bank d/s

BRIDGE AND PIERS
OVER SPILLWAY

N/A

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

SLOPES

Gradually to moderately sloped. Mill buildings on right side of reservoir; wooded.

SEDIMENTATION

Some sedimentation observed in the reservoir.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Rocky, well-defined channel	
SLOPES	Stable, steep slopes	
APPROXIMATE NO. OF HOMES AND POPULATION	None threatened	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Plans from 1945-1946 reconstruction on file at NJDEP, Post Office Box CN-029, Trenton, N.J. 08625
REGIONAL VICINITY MAP	Prepared for this report
CONSTRUCTION HISTORY	No information available on the original construction in 1896 (est.). General information is available, however, in the NJDEP files on the 1945-1946 reconstruction. Copies of this information are included in Appendix 1 of this report.
TYPICAL SECTIONS OF DAM	Dam sections pertinent to the 1945-1946 reconstruction are on file at NJDEP; see "PLAN OF DAM" above.
HYDROLOGIC/HYDRAULIC DATA	84 years of discharge record at U.S.G.S. gage, 0.6 miles downstream of dam. 28,000 cfs in October 1903 is flood of record. No other information disclosed.
OUTLETS - PLAN	Not available
- DETAILS	Not available
- CONSTRAINTS	Not available
- DISCHARGE RATINGS	Not available
RAINFALL/RESERVOIR RECORDS	Not available. Peak stage from 1903 storm 11.1 feet above spillway crest.

ITEM	REMARKS
DESIGN REPORTS	Letters regarding 1945-1946 reconstruction available at NJDEP. See "PLAN OF DAM" on page 2-8.
GEOLOGY REPORTS	Not available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Not available
2-9	
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not available
POST-CONSTRUCTION SURVEYS OF DAM	Not available
BORROW SOURCES	Not applicable

ITEMS	REMARKS
SPILLWAY PLAN	
SECTIONS	On file at NJDEP. See "PLAN OF DAM" on page 2-8 of this report.
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Not available

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Plans for 1945-1946 reconstruction at NJDEP. See "PLAN OF DAM" on page 2-8 of this report.
HIGH POOL RECORDS	October 1903, 11.1 feet over crest of dam. (1945 reconstruction changed stage-discharge relationship.)
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Damaged by high flows in 1945 (see Engineering Data, Appendix 1)
MAINTENANCE OPERATION RECORDS	Not available

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 762 square miles, wetlands,
urban areas, wooded areas

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 156.8 feet NGVD
(1,435 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY) _____
Not applicable

ELEVATION MAXIMUM TEST FLOOD POOL: 171.6 feet NGVD

ELEVATION TOP DAM: 164.1 feet NGVD (4,870 acre-feet)

SPILLWAY CREST: free overflow concrete spillway

- a. Elevation 157.8 feet NGVD (3 foot notch at 156.8)
- b. Type broad-crested
- c. Width 5 feet
- d. Length 267 feet
- e. Location Spillover entire top of dam
- f. Number and Type of Gates None

OUTLET WORKS: gated canal

- a. Type lift gates
- b. Location 300 feet upstream of left abutment
- c. Entrance Invert unknown
- d. Exit Invert unknown

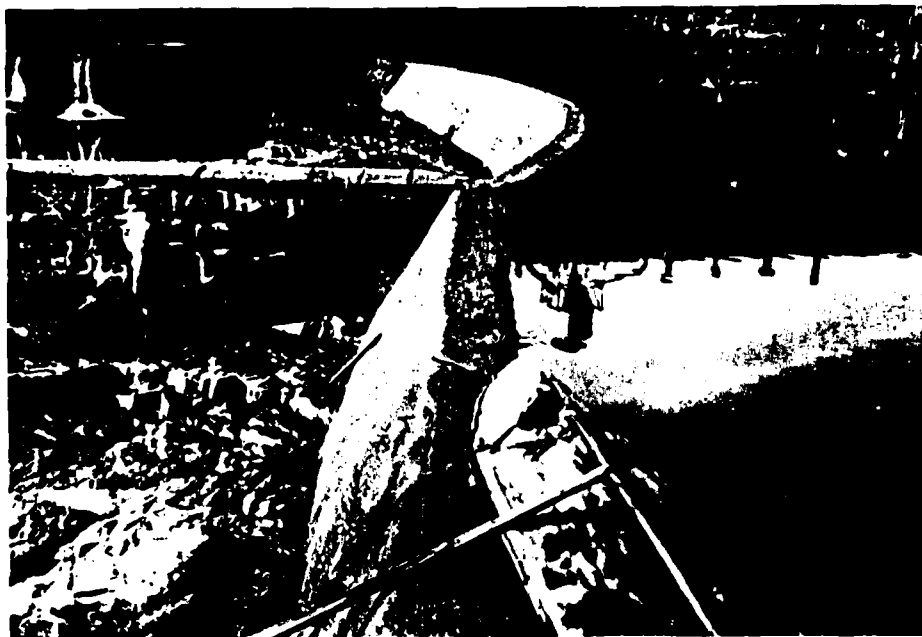
HYDROMETEOROLOGICAL GAGES: None

MAXIMUM NON-DAMAGING DISCHARGE: 12,701 cfs

APPENDIX 3

PHOTOGRAPHS

BEATTIES MILL DAM



April 23, 1981

View along axis of dam from left (north) abutment



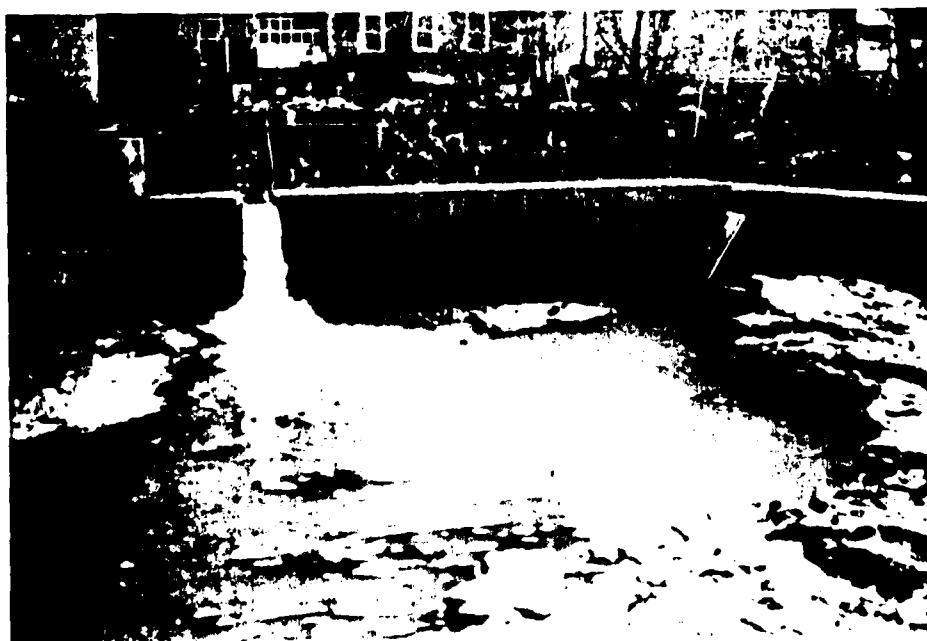
April 23, 1981

View of dam and pool area from downstream left bank



April 23, 1981

View of left wingwall and abutment



April 23, 1981

View of right wingwall and abutment. Note low level flow notch.



February 17, 1981

Small overflow spillway in right side, straight section of dam. Note large log in notch.



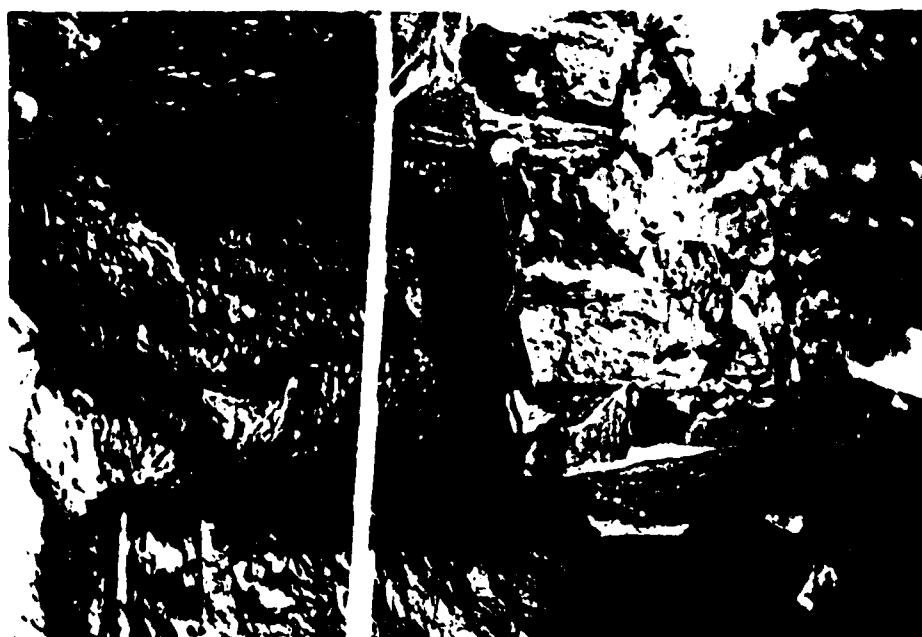
April 23, 1981

Erosion of training wall adjacent to spillway.



April 23, 1981

Root system visible behind missing stones. Stone block at crest (top of photo) is displaced three inches downward.



April 23, 1981

View of five-inch separation between masonry blocks near the base of the intersection between the training wall and the spillway.



April 23, 1981

Upstream side of intake building for canal to water treatment plant. Note high water mark from 1903 flood to the right of and below the right window.



April 23, 1981

View of canal to water treatment plant from intake building.



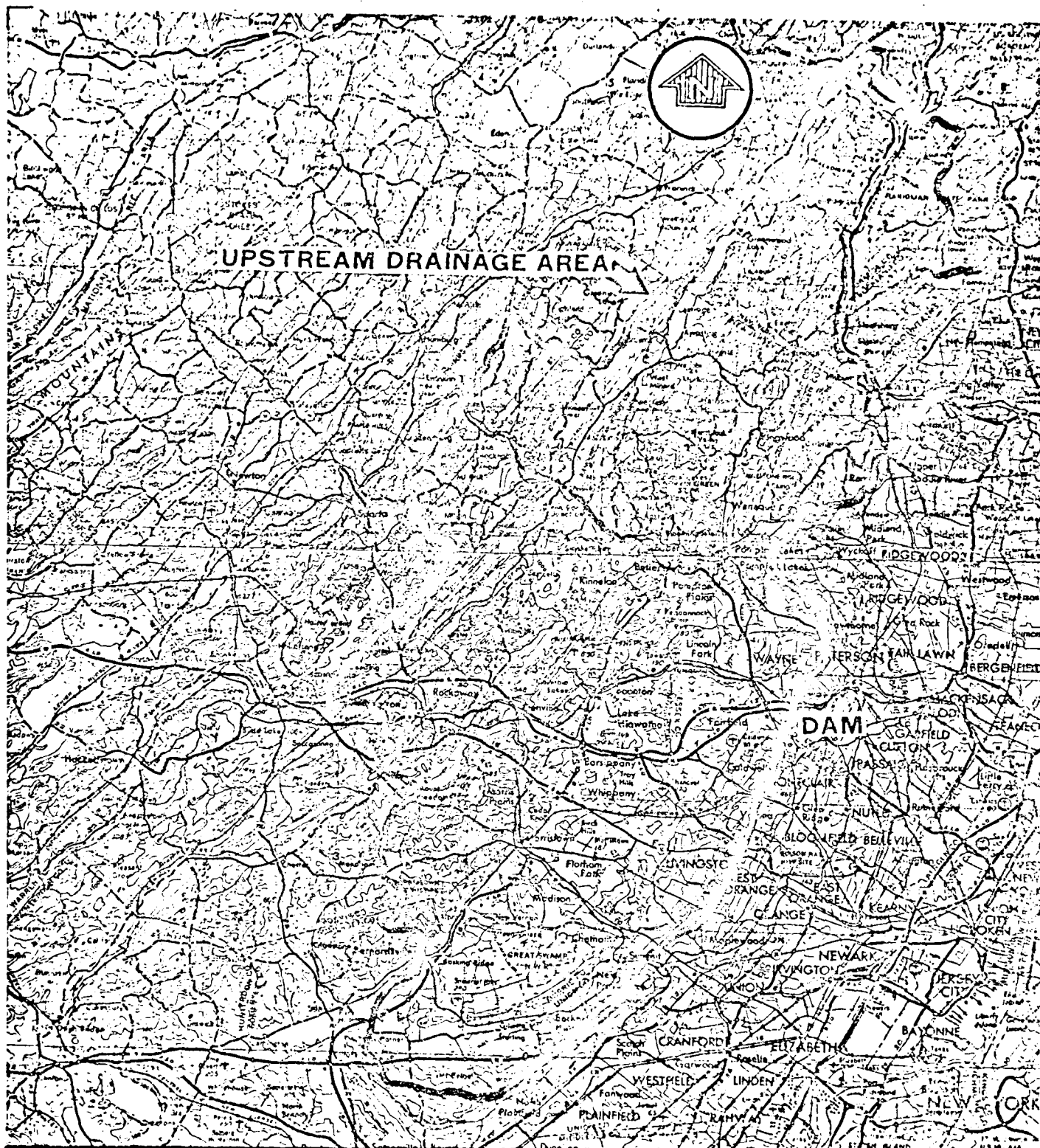
April 23, 1981

View of loss of rock support below downstream end
of training wall.

APPENDIX 4

HYDROLOGIC COMPUTATIONS

BEATTIES MILL DAM



NATIONAL PROGRAM OF INSPECTION OF
NON-FED. DAMS
BETTIES MILL DAM

REGIONAL VICINITY MAP

JUNE 1981

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

Anderson-Nichols & Company, Inc.

BOSTON, MA

SCALE IN MILES



MAP BASED ON U.S.G.S. 1:250,000 SERIES SHEET
NK 18-8 SCRANTON, PA., N.Y., N.J. 1962, REVISED
1976, AND NK 18-11 NEWARK, N.J., PA., N.Y. 1944,
REVISED 1969.

ols & Company, Inc.

Subject Beatties Mill

Sheet No. 1 of 8
 Date 2/16/60
 Computed PP
 Checked PP

JOB NO. _____
 SQUARES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
 1/4 IN. SCALE

PMF

The PMF is from Passaic River Basin Survey Report for 1945
Resources Volume 2, Appendix A, Figure A-64. (Report by New York
 District, Corps of Engineers).

Time (hours)

PMF flow at Beatties Dam

13	0	2,300
14	6	2,300
15	12	2,300
16	18	2,300
17	24	2,300
18	30	2,300
19	36	3,000
20	42	7,700
21	48	21,000
22	54	40,000
23	60	60,000
24	66	73,500
25	72	83,500
26	78	88,000
27	84	87,000
28	90	83,500
29	96	77,500
30	102	69,000
31	108	62,000
32	114	54,500
33	120	47,500
34	126	40,500*
35	132	34,000*
36	138	28,000*
37	144	22,000*
38	150	16,000*
39	156	11,000*
	162	6,000*

* Estimates of recession values

JOB NO.

SQUARES
1/4 IN. SCALE

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

Stage 1/2 Discharge

The hydraulic profile for Bentley's Mill Dam is shown on p. 3.

Spillway

$$Q = \text{Low flow notch + crest} = 3(3)(E-156.8)^{3/2} + 3(264)(E-157.8)^{3/2}$$

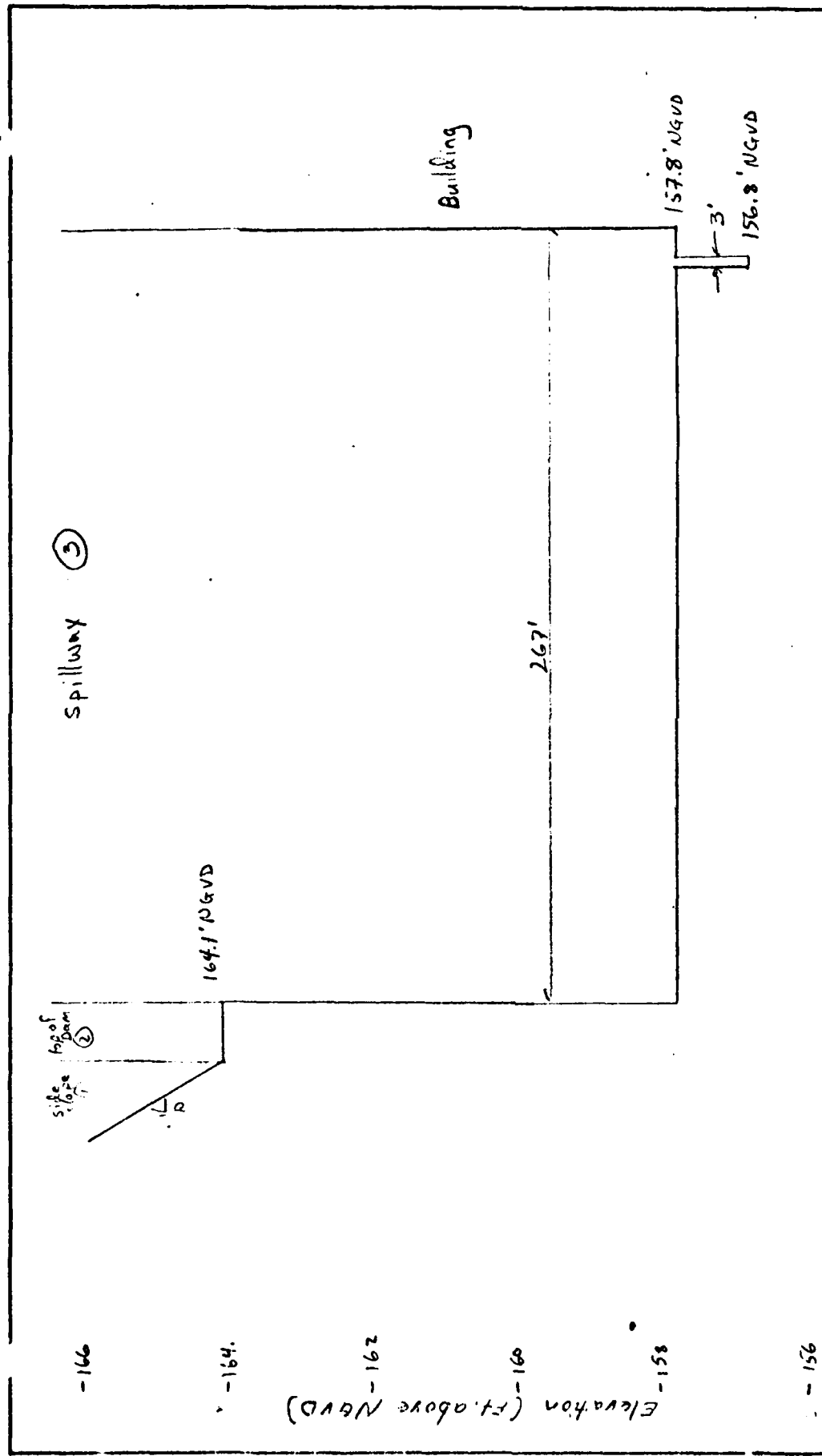
Top of Dam

$$Q = 3.0(20)(E-164.1)^{3/2}$$

Side Slope

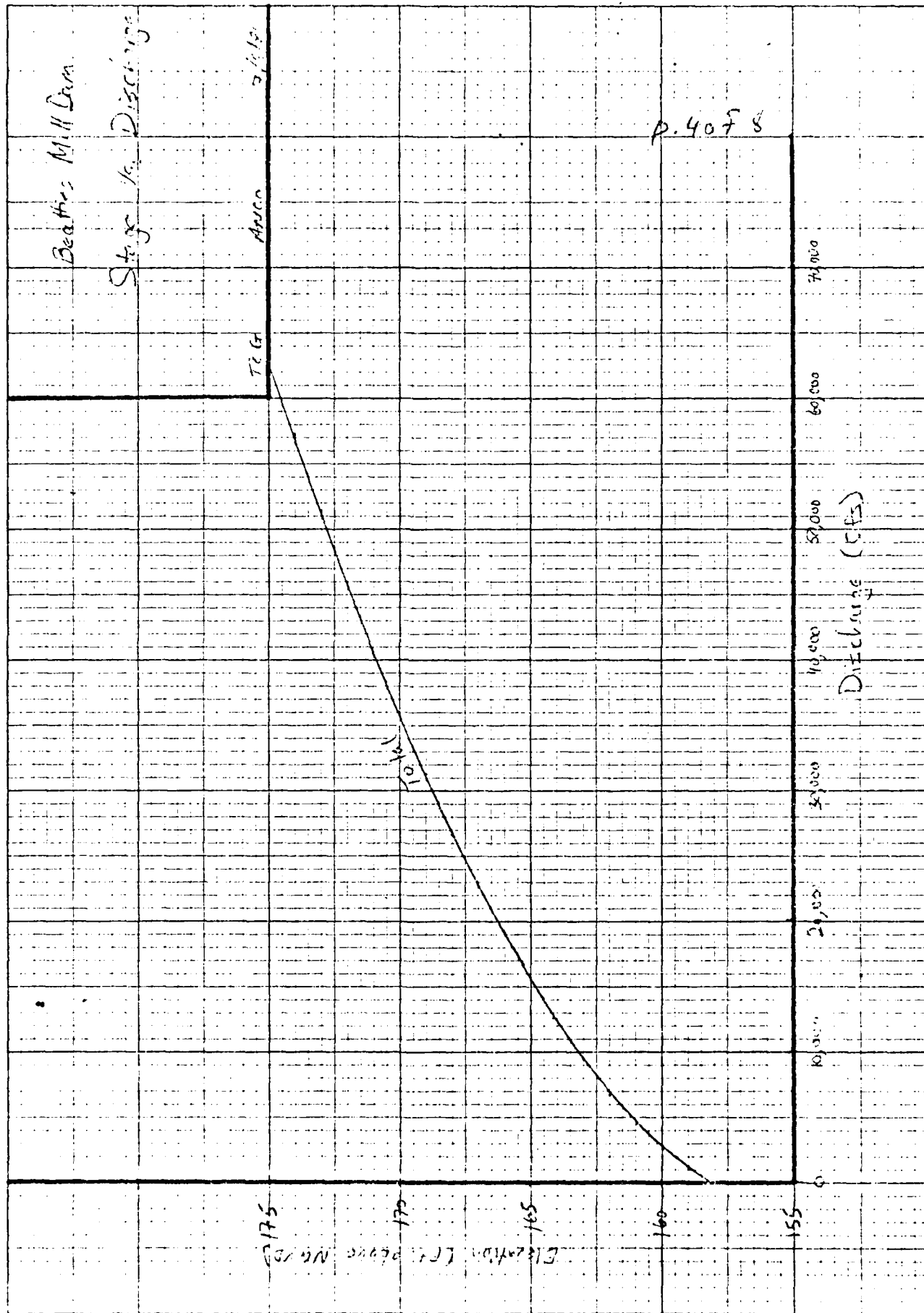
$$Q = CL H_{0.25}^{3/2} = 2.6(10)(E-164.1)(0.5(E-164.1))^{3/2}$$

Elevation (Ft. above NAD)	Q_{spillway} (cfs)	$Q_{\text{top of Dam}}$ (cfs)	$Q_{\text{side Slope}}$ (cfs)	Q_{Total} (cfs)
148.6	0	0	0	0
156.8	0	0	0	0
157.8	9.0	0	0	9
158	83	0	0	83
159	1,070	0	0	1,070
160	2,636	0	0	2,636
161	4,611	0	0	4,611
162	6,924	0	0	6,924
163	9,530	0	0	9,530
164.1 ✓	12,701	0	0	12,701
165	15,512	51	7	15,570
166	18,248	157	46	19,051
167	22,394	296	132	22,822
168	26,138	462	276	26,876
169 ✓	30,070	651	489	31,210
171	38,464	1,087	1,150	40,701
173	47,521	1,593	2,172	51,286
174	52,283	1,868	2,835	56,986
175	57,185	2,159	3,406	62,750



ANDERSON - NICHOLS

VERNON	BOSTON	CONCORD
Beathies Mill Dam		
Hydraulic Profile		
DATE 7/6/81	SCALE 1" = 50' H 1" = 20' V	JOB NO.
		SHEET NO. 23 of 8



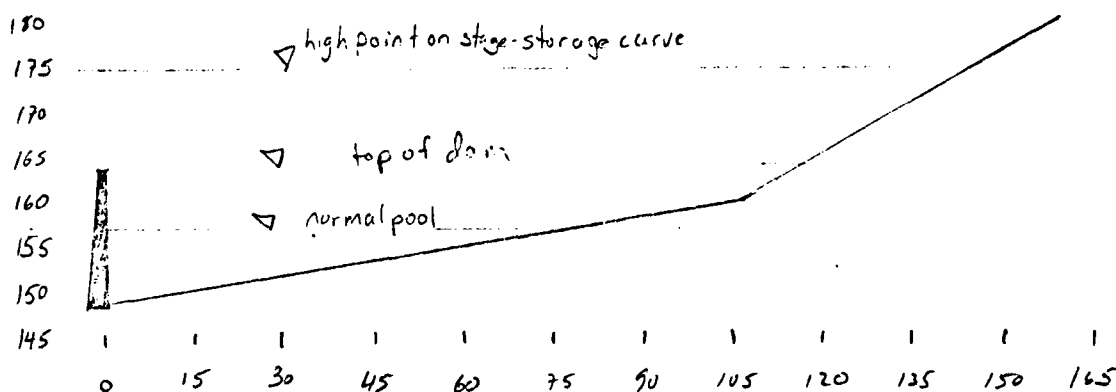
JOB NO.

SQUARES
1/4 IN. SCALE

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Stage Vs Storage

The Passaic River upstream of Beatties Mill Dam is very flat. From U.S.G.S. maps, the 160' contour line is 106,000 feet upstream of the dam, and the 180' contour is 158,000 feet upstream. The lowpoint in the reservoir pool is shown to be 148.6' MGD on the plans, with the low point on the low flow weir at 156.8'. Top of dam is 164.1'



Stationing, 1000 ft U/S of dam.

at normal pool (156.8)

Surface area = length x avg. width

$$\text{Length} = \frac{156.8 - 148.6}{160 - 148.6} (106,000) = 76,246 \text{ ft.}$$

$$\text{avg. width} = 700 \text{ ft}$$

$$\text{area} = (76,246)(700) \text{ ft}^2 = 350.1 \text{ acres}$$

$$\text{Storage} = \text{Area (Avg Depth)} = 350.1 \left(\frac{156.8 - 148.6 + 0}{2} \right) = 1435 \text{ Ac.}$$

JOB NO.

SQUARES
1/4 IN. SCALE

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

1

2

3

4

5

6

7

8

9

10

11

12

13

14

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39

at top of damSurface area = length $\times$ Avg. width

$$\text{Length} = 106,000 + \frac{4.1}{20}(52,000) \\ = 116,660 \text{ ft}$$

$$\text{Avg. width} = 200 \text{ ft}$$

$$\text{area} = 116,660(200) \left(\frac{1}{43,560} \right) = 536 \text{ ac.}$$

Storage = Surface area to 160 (Avg. Depth) + S.A. to 164.1 (Avg. Depth)

$$= \frac{106,000(200)}{43,560} \left(\frac{(164.1-148.6)+(164.1-160)}{2} \right) + \frac{116,660(200)}{43,560} \left(\frac{(164.1-160)+0}{2} \right)$$

$$= (486.7)(9.8) + 48.9(2.05) = 4,870 \text{ ac. ft.}$$

at 175' NGVD

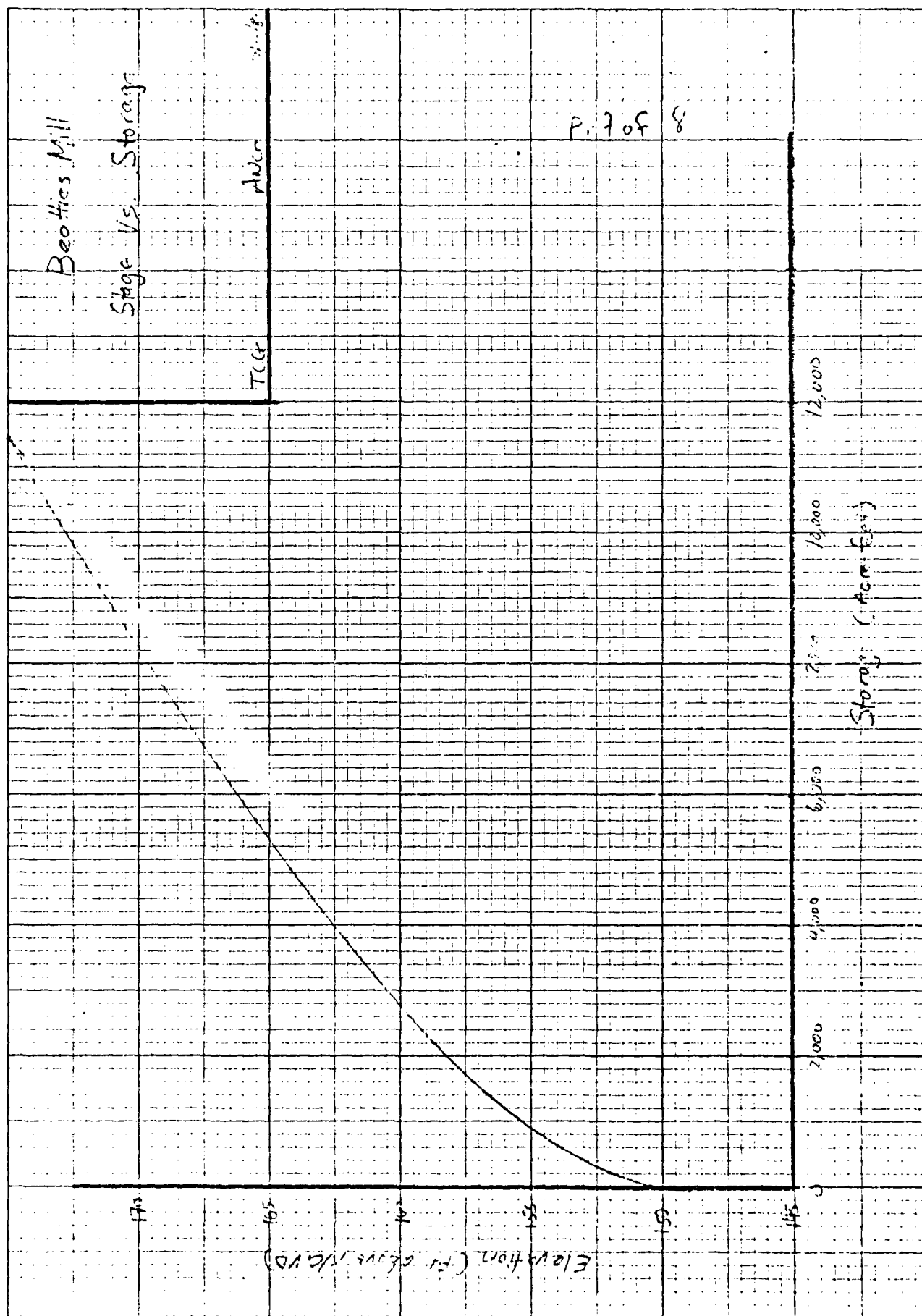
$$\text{Storage} = \frac{106,000(200)}{43,560} \left(\frac{(175-148.6)+(175-160)}{2} \right) \\ + \frac{52,000 \left(\frac{15}{20} \right) 200}{43,560} \left(\frac{(175-160)+0}{2} \right)$$

$$= 486.7(20.7) + 179.1(7.5) = 11,418 \text{ ac. ft.}$$

Stage vs. Storage is plotted on page
to HEC-1.

The following points are in:

<u>E (NGVD)</u>	<u>Stor (Ac.-ft.)</u>
148.6	0
156.8	1,435
157.8	1,820
160	2,790
162	3,740
164.1	4,870
167	6,410
169	7,600
171	8,830
172	10,160

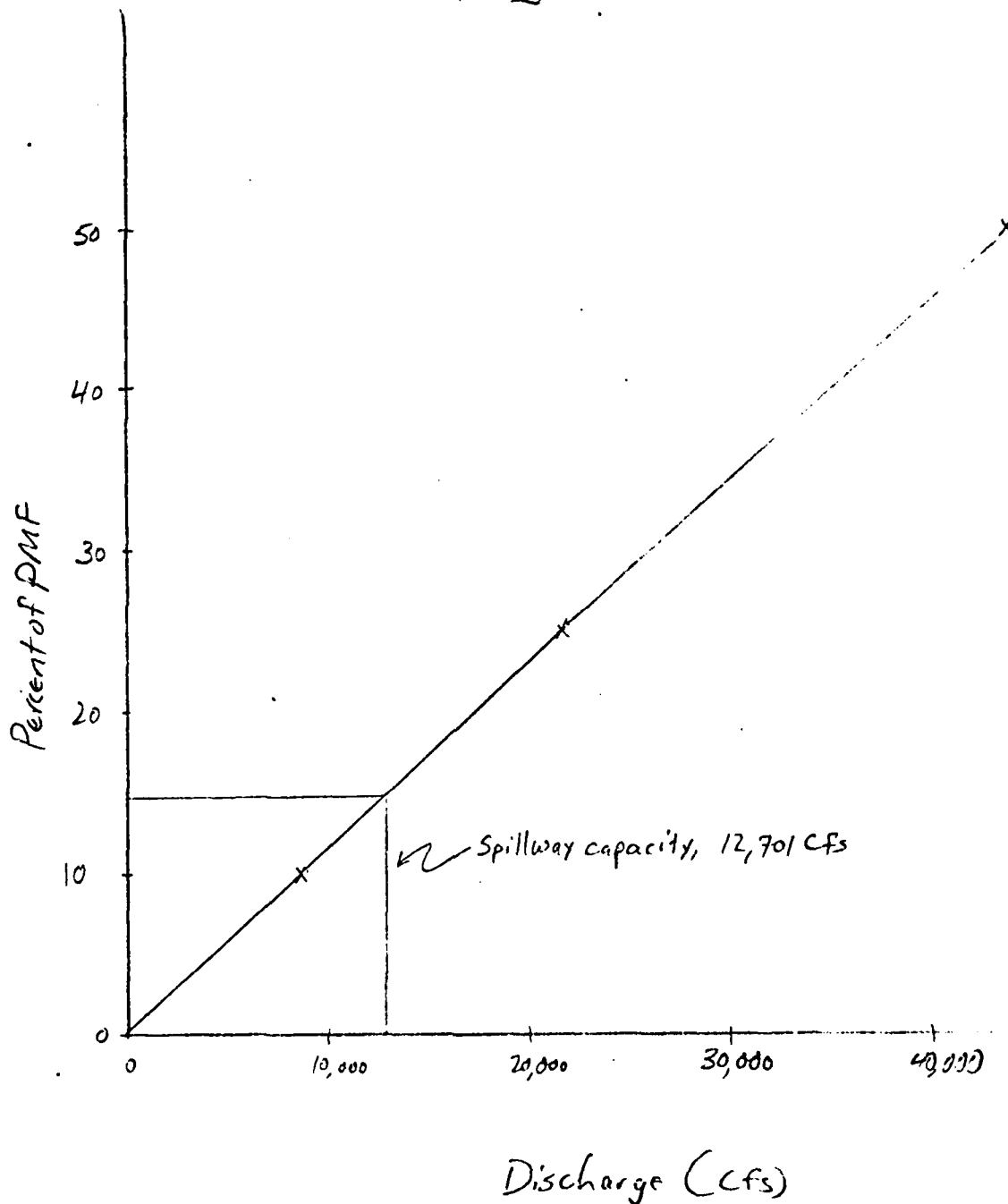


JOB NO.

SQUARES
1/4 IN. SCALE

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

Overtopping Analysis



APPENDIX 5

HEC 1 OUTPUT

BEATTIES MILL DAM

HEC-1 INPUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
1	IC	BEATTIES MILL DAM	OVERTOPPING ANALYSIS								
2	ID	NEW JERSEY DAM NO. 821 - PASSAIC COUNTY -	LITTLE FALLS								
3	II	0.1, 0.25, 0.5 MULTIPLES OF THE PMF									
4	II	0.1	0.25	0.5							
5	II	0.25	0.5								
6	II	0.5									
7	KA	BEATTIES MILL POND INFLOW HYDROGRAPH									
8	KM	INFLOW FROM PASSAIC RIVER BASIN SURVEY REPORT FOR WATER RESOURCES									
9	II	360									
10	CI	2300:	2300:	2300:	2300:	2300:	2300:	2300:	2300:	2300:	2300:
11	CI	60000:	73500:	83500:	88000:	83500:	77500:	69000:	62000:	54500:	40000:
12	CI	47500:	40500:	34000:	28000:	22000:	16000:	11000:	6000:	2300:	2300:
13	KZ	A2 ROUTE INFLOW HYDROGRAPH THROUGH BEATTIES MILL POND									
14	KZ	0	1435:	1435:	2790:	3740:	4870:	6410:	7600:	8830:	10160:
15	SV	148.0	1435.8	1627.8	2790.0	3740.0	4870.1	6410.7	7600.0	8830.0	10160.0
16	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
17	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
18	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
19	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
20	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
21	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
22	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
23	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
24	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
25	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
26	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
27	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
28	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
29	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
30	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
31	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
32	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
33	SV	148.0	156.8	157.8	263.8	624.2	1701.1	2282.2	3170.1	4071.0	5188.0
34	SV	148.0	1								

CUMULATIVE AREA = 0.0 SQ MI

HYDROGRAPH AT STATION A1 FOR PLAN 1, RATIO = 0.10

PEAK FLOW (CFS) 8400.
TIME (HR) 78.00
(INCHES) 8759.
(AC-FT) 4383.
CUMULATIVE AREA = 0.0 SQ MI
MAXIMUM AVERAGE FLOW
24-HR 8503.
72-HR 6885.
199.00-HR 3138.
0.000
51614.

*** **

HYDROGRAPH AT STATION A1 FOR PLAN 1, RATIO = 0.25

PEAK FLOW (CFS) 22000.
TIME (HR) 78.00
(INCHES) 21897.
(AC-FT) 10859.
CUMULATIVE AREA = 0.0 SQ MI
MAXIMUM AVERAGE FLOW
24-HR 21257.
72-HR 17213.
199.00-HR 7845.
0.000
129029.

*** **

HYDROGRAPH AT STATION A1 FOR PLAN 1, RATIO = 0.50

PEAK FLOW (CFS) 44000.
TIME (HR) 78.00
(INCHES) 4375.
(AC-FT) 2171.
CUMULATIVE AREA = 0.0 SQ MI
MAXIMUM AVERAGE FLOW
24-HR 42514.
72-HR 34226.
199.00-HR 15691.
0.000
258062.

*** **

* A2 *

13 KK ROUTE INFLOW HYDROGRAPH THROUGH BEATTIES MILL POND

HYDROGRAPH ROUTING DATA

14 PS	STORAGE ROUTING HETPS RSTVC X	1 STICK TYPE OF INITIAL CONDITION 1435.00 0.0	NUMBER OF SURGEACHES INITIAL CONDITION 1435.00 0.0	WORKING R AND D COEFFICIENT	15 SV	STORAGE	0.0	1435.0	1820.0	2790.0	3740.0	4870.0	6410.0	7600.0	8830.0	10160.0
16 SE	ELEVATION	148.60	156.80	157.80	160.00	162.00	164.10	167.00	169.00	171.00	173.00	175.00	177.00	179.00	181.00	183.00
17 SC	DISCHARGE	0.	0.	9.	2636.	6924.	12701.	22822.	31210.	40701.	51286.	61871.	72456.	83041.	93626.	104211.
18 SE	ELEVATION	148.60	156.80	157.80	160.00	162.00	164.10	167.00	169.00	171.00	173.00	175.00	177.00	179.00	181.00	183.00
19 SS	SPILLWAY CREL SPWID COOD EXPW	156.80 267.00 3.00 1.50	SPILLWAY CREST ELEVATION SPILLWAY WIDTH WEIR COEFFICIENT EXPONENT OF HEAD	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50	156.80 267.00 3.00 1.50
20 ST	TOP OF DAM TOP OF DAM COOD EXPD	164.10 287.00 0.0 1.50	ELEVATION AT TOP OF DAM DAM WIDTH WEIR COEFFICIENT EXPONENT OF HEAD	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50	164.10 287.00 0.0 1.50

STORAGE	0.0	1435.00	1820.00	2790.00	3740.00	4870.00	6410.00	7600.00	8830.00	10160.00
OUTFLOW	0.0	0.0	9.00	2636.00	6924.00	12701.00	22822.00	31210.00	40701.00	51286.00

HYDROGRAPH AT STATION A2
FOR PLAN 1, RATIO = 0.10

PEAK OUTFLOW IS 8730. AT TIME 82.00 HOURS

PEAK FLOW (CFS) 8730.	TIME (HR) 82.00	6-HR 8716 0.000 4322.	24-HR 8471 0.000 16801.	MAXIMUM AVERAGE FLOW 72-HR 6859 0.000 40816.	199.00-HR 3110 0.000 51146.
PEAK STORAGE (AC-FT) 4(93).	TIME (HR) 82.00	6-HR 4091.	24-HR 4042.	MAXIMUM AVERAGE STORAGE 72-HR 3710.	199.00-HR 2705.
PEAK STAGE (FEET) 162.66	TIME (HR) 82.00	6-HR 162.65	24-HR 162.56	MAXIMUM AVERAGE STAGE 72-HR 161.90	199.00-HR 159.73

CUMULATIVE AREA = 0.0 SQ MI

HYDROGRAPH AT STATION A2
FOR PLAN 1, RATIO = 0.25

PEAK OUTFLOW IS 21669. AT TIME 81.00 HOURS

PEAK FLOW
 (CFS)
 1169.
 TIME
 (HR)
 81.00

(CFS)
 (INCHES)
 (AC-FT)

6-HR
 21834.
 0.000
 10827.

MAXIMUM AVERAGE FLOW
 24-HR
 21208.
 0.000
 42065.

199.00-HR
 7809.
 0.000
 128436.

PEAK STORAGE
 (AC-FT)
 6765.
 TIME
 (HR)
 81.00

6-HR
 6260.

MAXIMUM AVERAGE STORAGE
 24-HR
 6164.
 5540.

199.00-HR
 3635.

PEAK STAGE
 (FEET)
 166.73
 TIME
 (HR)
 91.00

6-HR
 166.72

MAXIMUM AVERAGE STAGE
 24-HR
 166.54
 165.36

199.00-HR
 161.56

CUMULATIVE AREA = 0.0 SQ MI

HYDROGRAPH AT STATION A2
 FOR PLAN 1, RATIO = 0.50

PEAK OUTFLOW IS 43785. AT TIME 81.00 HOURS

PEAK FLOW
 (CFS)
 43785.
 TIME
 (HR)
 81.00

(CFS)
 (INCHES)
 (AC-FT)

6-HR
 43700.
 0.000
 21669.

MAXIMUM AVERAGE FLOW
 24-HR
 42444.
 0.000
 84187.

199.00-HR
 15642.
 0.000
 257257.

PEAK STORAGE
 (AC-FT)
 9214.
 TIME
 (HR)
 81.00

6-HR
 9267.

MAXIMUM AVERAGE STORAGE
 24-HR
 9049.
 7982.

199.00-HR
 4876.

PEAK STAGE
 (FEET)
 171.56
 TIME
 (HR)
 81.00

6-HR
 171.56

MAXIMUM AVERAGE STAGE
 24-HR
 171.32
 169.59

199.00-HR
 163.82

CUMULATIVE AREA = 0.0 SQ MI

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS		
				RATIO 1	RATIO 2	RATIO 3
				0.10	0.25	0.50
HYDROGRAPH AT	A1	0.0	1	FLOW	22000	42000
				TIME	78.00	78.00
ROUTED TO	A2	0.0	1	FLOW	21862	43785
				TIME	81.00	81.00
** PEAK STAGES IN FEET **						
	1			162.68	166.73	171.58
				82.00	81.00	81.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION A2

PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 156.80 1435. 0.	SPILLWAY CREST 156.80 1435. 0.	TOP OF DAM 164.10 4870. 12701.	DURATION OVER TOP HOURS	MAXIMUM OUTFLOW CFS	MAXIMUM STORAGE AC-FT	MAXIMUM DEPTH OVER DAM	RATIO OF PIF	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
					0.0	8730.	4093.	0.0	0.10	82.00	0.0
					60.00	21829.	6265.	2.83	0.25	81.00	0.0
					91.00	43765.	9218.	7.48	0.50	81.00	0.0

*** NORMAL END OF JOB ***

HEC-1 INPUT

LINE	1	2	3	4	5	6	7	8	9	10
	ID	1	2	3	4	5	6	7	8	9.....10
1	ID	BEATTIES MILL DAM OVERTOPPING ANALYSIS								
2	ID	NEW JERSEY DAM NO. 821 - PASSAIC COUNTY - LITTLE FALLS								
3	ID	0.5 MULTIPLE OF THE PMF 200								
4	ID	60								
5	ID	2								
6	JR	FLOW 0.5								
7	KK	A1 BEATTIES MILL POND INFLOW HYDROGRAPH								
8	KN	INFLOW FROM PASSAIC RIVER BASIN SURVEY REPORT FOR WATER RESOURCES								
9	IN	360								
10	CI	2300	2300	2300	2300	2300	2300	3000	7700	21000
11	CI	600	73500	83500	87000	83500	77500	69000	62000	40000
12	CI	4750	40500	34000	28000	22000	16000	11000	6000	2300
13	KK	A2 ROUTE INFLOW HYDROGRAPH THROUGH BEATTIES MILL POND								
14	SV	STUR								
15	SV	148.6	1435	1820	2790	3740	4870	6410	7600	8830
16	SV	0	156.8	157.8	160	162	164.1	167	169	171
17	SV	148.6	156.8	157.8	2636	6924	12701	22822	31210	40701
18	SV	156.8	156.8	157.8	160	162	164.1	167	169	171
19	SV	164.1	267.0	3.0	1.5	1.5	1.5	1.5	1.5	1.5
20	SV									
21	SV									
22	SV									

 * U.S. ARMY CORPS OF ENGINEERS *
 * THE HYDROLOGIC ENGINEERING CENTER *
 * 609 SECOND STREET *
 * DAVIS, CALIFORNIA 95616 *
 * (916) 440-3285 OR (FTS) 448-3285 *

 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * FEBRUARY 1981 *
 *
 * RUN DATE 07/07/81 TIME 13.07.24 *

BEATTIES MILL DAM OVERTOPPING ANALYSIS TOM GOOCH ANCO
 NEW JERSEY DAM NO. 821 - PASSAIC COUNTY - LITTLE FALLS
 0.5 MULTIPLE OF THE PMF

5 IO OUTPUT CONTROL VARIABLES PRINT CONTROL
 IPLOT 1 PLOT CONTROL
 QSCAL 0 HYDROGRAPH PLOT SCALE
 DMSG YES PRINT DIAGNOSTIC MESSAGES

IT HYDROGRAPH TIME DATA 60 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0000 STARTING DATE
 ITIME 200 NUMBER OF HYDROGRAPH ORIGINATES
 NDATE 9 0700 ENDING DATE
 NTIME COMPUTATION INTERVAL 1.00 HOURS
 TOTAL TIME BASE 199.00 HOURS

ENGLISH UNITS
 DRAINAGE AREA SQUARE MILES
 PRECIPITATION DEPTH INCHES
 LENGTH, ELEVATION FEET
 FLOW CUBIC FEET PER SECOND
 STORAGE VOLUME ACRES
 SURFACE AREA ACRES
 TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION 1 NUMBER OF PLANS
 HPLAN
 JR MULTI-RATIO OPTION
 RATIOS OF RUNOFF
 0.50

7 KK *****
 * A1 *

BEATTIES MILL POND INFLOW HYDROGRAPH

INFLOW FROM PASSAIC RIVER BASIN SURVEY REPORT FOR WATER RESOURCES

9 IN TIME DATA FOR INPUT TIME SERIES
 JXMIN 360 TIME INTERVAL IN MINUTES
 JXDATE 1 0 STARTING DATE
 JXTIME 0 STARTING TIME

0 BA SUBBASIN RUNOFF DATA
 SUBBASIN CHARACTERISTICS
 AREA 0.0 SUBBASIN AREA

DA	MCN	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1	000	000	1	000	7	000	000	1	1833	7	000	000	1	1833	7	000	000	1	1833
2	000	000	2	000	8	000	000	2	1617	8	000	000	2	1617	8	000	000	2	1617
3	000	000	3	000	9	000	000	3	1330	9	000	000	3	1330	9	000	000	3	1330
4	000	000	4	000	10	000	000	4	0900	10	000	000	4	0900	10	000	000	4	0900
5	000	000	5	000	11	000	000	5	0667	11	000	000	5	0667	11	000	000	5	0667
6	000	000	6	000	12	000	000	6	0400	12	000	000	6	0400	12	000	000	6	0400
7	000	000	7	000	13	000	000	7	0133	13	000	000	7	0133	13	000	000	7	0133
8	000	000	8	000	14	000	000	8	0000	14	000	000	8	0000	14	000	000	8	0000
9	000	000	9	000	15	000	000	9	0000	15	000	000	9	0000	15	000	000	9	0000
10	000	000	10	000	16	000	000	10	0000	16	000	000	10	0000	16	000	000	10	0000
11	000	000	11	000	17	000	000	11	0000	17	000	000	11	0000	17	000	000	11	0000
12	000	000	12	000	18	000	000	12	0000	18	000	000	12	0000	18	000	000	12	0000
13	000	000	13	000	19	000	000	13	0000	19	000	000	13	0000	19	000	000	13	0000
14	000	000	14	000	20	000	000	14	0000	20	000	000	14	0000	20	000	000	14	0000
15	000	000	15	000	21	000	000	15	0000	21	000	000	15	0000	21	000	000	15	0000
16	000	000	16	000	22	000	000	16	0000	22	000	000	16	0000	22	000	000	16	0000
17	000	000	17	000	23	000	000	17	0000	23	000	000	17	0000	23	000	000	17	0000
18	000	000	18	000	24	000	000	18	0000	24	000	000	18	0000	24	000	000	18	0000
19	000	000	19	000	25	000	000	19	0000	25	000	000	19	0000	25	000	000	19	0000
20	000	000	20	000	26	000	000	20	0000	26	000	000	20	0000	26	000	000	20	0000
21	000	000	21	000	27	000	000	21	0000	27	000	000	21	0000	27	000	000	21	0000
22	000	000	22	000	28	000	000	22	0000	28	000	000	22	0000	28	000	000	22	0000
23	000	000	23	000	29	000	000	23	0000	29	000	000	23	0000	29	000	000	23	0000
24	000	000	24	000	30	000	000	24	0000	30	000	000	24	0000	30	000	000	24	0000
25	000	000	25	000	31	000	000	25	0000	31	000	000	25	0000	31	000	000	25	0000

PEAK FLOW
(CFS)
86000.

TIME
(HR)
78.00

MAXIMUM AVERAGE FLOW
24-HR
85027.
6-HR
87500.
16-HR
85027.
0.000
0.000
0.000
409707.
516137.

CUMULATIVE AREA = 0.0 SQ MI

HYDROGRAPH AT STATION = 0.50
PLAN 1,

DA	MON	HRMN	GRD	FLOW (CFS)	FLOW (AC-FT)	DA	MON	HRMN	GRD	FLOW (CFS)	FLOW (AC-FT)	DA	MON	HRMN	GRD	FLOW (CFS)	FLOW (AC-FT)
1	1	000	1	1150.	1150.	5	5	000	101	35917.	35917.	7	7	000	151	8000.	8000.
1	1	000	2	1150.	1150.	5	5	000	102	35208.	35208.	7	7	000	152	7583.	7583.
1	1	000	3	1150.	1150.	5	5	000	103	34500.	34500.	7	7	000	153	7167.	7167.
1	1	000	4	1150.	1150.	5	5	000	104	33917.	33917.	7	7	000	154	6533.	6533.
1	1	000	5	1150.	1150.	5	5	000	105	33333.	33333.	7	7	000	155	6217.	6217.
1	1	000	6	1150.	1150.	5	5	000	106	32750.	32750.	7	7	000	156	5504.	5504.
1	1	000	7	1150.	1150.	5	5	000	107	32167.	32167.	7	7	000	157	5047.	5047.
1	1	000	8	1150.	1150.	5	5	000	108	31583.	31583.	7	7	000	158	4650.	4650.
1	1	000	9	1150.	1150.	5	5	000	109	31000.	31000.	7	7	000	159	4333.	4333.
1	1	000	0	1150.	1150.	5	5	000	110	30375.	30375.	7	7	000	160	4000.	4000.
1	1	000	1	1150.	1150.	5	5	000	111	29750.	29750.	7	7	000	161	3653.	3653.
1	1	000	2	1150.	1150.	5	5	000	112	29125.	29125.	7	7	000	162	3333.	3333.
1	1	000	3	1150.	1150.	5	5	000	113	28500.	28500.	7	7	000	163	3000.	3000.
1	1	000	4	1150.	1150.	5	5	000	114	27875.	27875.	7	7	000	164	2667.	2667.
1	1	000	5	1150.	1150.	5	5	000	115	27250.	27250.	7	7	000	165	2333.	2333.
1	1	000	6	1150.	1150.	5	5	000	116	26625.	26625.	7	7	000	166	2000.	2000.
1	1	000	7	1150.	1150.	5	5	000	117	26000.	26000.	7	7	000	167	1667.	1667.
1	1	000	8	1150.	1150.	5	5	000	118	25375.	25375.	7	7	000	168	1333.	1333.
1	1	000	9	1150.	1150.	5	5	000	119	24750.	24750.	7	7	000	169	1000.	1000.
1	1	000	0	1150.	1150.	5	5	000	120	24125.	24125.	7	7	000	170	667.	667.
1	1	000	1	1150.	1150.	5	5	000	121	23500.	23500.	7	7	000	171	333.	333.
1	1	000	2	1150.	1150.	5	5	000	122	22875.	22875.	7	7	000	172	000.	000.
1	1	000	3	1150.	1150.	5	5	000	123	22250.	22250.	7	7	000	173	000.	000.
1	1	000	4	1150.	1150.	5	5	000	124	21625.	21625.	7	7	000	174	000.	000.
1	1	000	5	1150.	1150.	5	5	000	125	21000.	21000.	7	7	000	175	000.	000.
1	1	000	6	1150.	1150.	5	5	000	126	20375.	20375.	7	7	000	176	000.	000.
1	1	000	7	1150.	1150.	5	5	000	127	19750.	19750.	7	7	000	177	000.	000.
1	1	000	8	1150.	1150.	5	5	000	128	19125.	19125.	7	7	000	178	000.	000.
1	1	000	9	1150.	1150.	5	5	000	129	18500.	18500.	7	7	000	179	000.	000.
1	1	000	0	1150.	1150.	5	5	000	130	17875.	17875.	7	7	000	180	000.	000.
1	1	000	1	1150.	1150.	5	5	000	131	17250.	17250.	7	7	000	181	000.	000.
1	1	000	2	1150.	1150.	5	5	000	132	16625.	16625.	7	7	000	182	000.	000.
1	1	000	3	1150.	1150.	5	5	000	133	16000.	16000.	7	7	000	183	000.	000.
1	1	000	4	1150.	1150.	5	5	000	134	15375.	15375.	7	7	000	184	000.	000.
1	1	000	5	1150.	1150.	5	5	000	135	14750.	14750.	7	7	000	185	000.	000.
1	1	000	6	1150.	1150.	5	5	000	136	14125.	14125.	7	7	000	186	000.	000.
1	1	000	7	1150.	1150.	5	5	000	137	13500.	13500.	7	7	000	187	000.	000.
1	1	000	8	1150.	1150.	5	5	000	138	12875.	12875.	7	7	000	188	000.	000.
1	1	000	9	1150.	1150.	5	5	000	139	12250.	12250.	7	7	000	189	000.	000.
1	1	000	0	1150.	1150.	5	5	000	140	11625.	11625.	7	7	000	190	000.	000.
1	1	000	1	1150.	1150.	5	5	000	141	11000.	11000.	7	7	000	191	000.	000.
1	1	000	2	1150.	1150.	5	5	000	142	10375.	10375.	7	7	000	192	000.	000.
1	1	000	3	1150.	1150.	5	5	000	143	9750.	9750.	7	7	000	193	000.	000.
1	1	000	4	1150.	1150.	5	5	000	144	9125.	9125.	7	7	000	194	000.	000.
1	1	000	5	1150.	1150.	5	5	000	145	8500.	8500.	7	7	000	195	000.	000.
1	1	000	6	1150.	1150.	5	5	000	146	7875.	7875.	7	7	000	196	000.	000.
1	1	000	7	1150.	1150.	5	5	000	147	7250.	7250.	7	7	000	197	000.	000.
1	1	000	8	1150.	1150.	5	5	000	148	6625.	6625.	7	7	000	198	000.	000.
1	1	000	9	1150.	1150.	5	5	000	149	6000.	6000.	7	7	000	199	000.	000.
1	1	000	0	1150.	1150.	5	5	000	150	5375.	5375.	7	7	000	200	000.	000.

HYDROGRAPH AT STATION A2 PLAN 1, RATIO = 0.50

PEN	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	HRMN	ORD	OUTFLOW	STORAGE	STA
000	000	1	0.0	0.0	170.2	0	000	135	16946.	515	170.2	0	000	135	16946.	515	165
000	000	2	2.0	8347.6	170.4	6	000	136	16435.	515	170.4	6	000	136	16435.	515	165
000	000	3	4.0	8476.0	170.6	6	000	137	15929.	515	170.6	6	000	137	15929.	515	165
000	000	4	6.0	8695.1	170.8	6	000	138	15425.	515	170.8	6	000	138	15425.	515	165
000	000	5	8.0	8959.1	171.0	6	000	139	14923.	515	171.0	6	000	139	14923.	515	165
000	000	6	10.0	9272.4	171.2	6	000	140	14421.	515	171.2	6	000	140	14421.	515	165
000	000	7	12.0	9640.4	171.4	6	000	141	13921.	515	171.4	6	000	141	13921.	515	165
000	000	8	14.0	10069.7	171.6	6	000	142	13421.	515	171.6	6	000	142	13421.	515	165
000	000	9	16.0	10752.6	171.8	6	000	143	12921.	515	171.8	6	000	143	12921.	515	165
000	000	10	18.0	11504.5	172.0	6	000	144	12421.	515	172.0	6	000	144	12421.	515	165
000	000	11	20.0	12331.5	172.2	6	000	145	11921.	515	172.2	6	000	145	11921.	515	165
000	000	12	22.0	13240.6	172.4	6	000	146	11421.	515	172.4	6	000	146	11421.	515	165
000	000	13	24.0	14238.7	172.6	6	000	147	10921.	515	172.6	6	000	147	10921.	515	165
000	000	14	26.0	15322.8	172.8	6	000	148	10421.	515	172.8	6	000	148	10421.	515	165
000	000	15	28.0	16499.9	173.0	6	000	149	9921.	515	173.0	6	000	149	9921.	515	165
000	000	16	30.0	17776.0	173.2	6	000	150	9421.	515	173.2	6	000	150	9421.	515	165
000	000	17	32.0	19157.1	173.4	6	000	151	8921.	515	173.4	6	000	151	8921.	515	165
000	000	18	34.0	20639.2	173.6	6	000	152	8421.	515	173.6	6	000	152	8421.	515	165
000	000	19	36.0	22218.3	173.8	6	000	153	7921.	515	173.8	6	000	153	7921.	515	165
000	000	20	38.0	23899.4	174.0	6	000	154	7421.	515	174.0	6	000	154	7421.	515	165
000	000	21	40.0	25677.5	174.2	6	000	155	6921.	515	174.2	6	000	155	6921.	515	165
000	000	22	42.0	27557.6	174.4	6	000	156	6421.	515	174.4	6	000	156	6421.	515	165
000	000	23	44.0	29534.7	174.6	6	000	157	5921.	515	174.6	6	000	157	5921.	515	165
000	000	24	46.0	31613.8	174.8	6	000	158	5421.	515	174.8	6	000	158	5421.	515	165
000	000	25	48.0	33799.9	175.0	6	000	159	4921.	515	175.0	6	000	159	4921.	515	165
000	000	26	50.0	36088.0	175.2	6	000	160	4421.	515	175.2	6	000	160	4421.	515	165
000	000	27	52.0	38482.1	175.4	6	000	161	3921.	515	175.4	6	000	161	3921.	515	165
000	000	28	54.0	40986.2	175.6	6	000	162	3421.	515	175.6	6	000	162	3421.	515	165
000	000	29	56.0	43604.3	175.8	6	000	163	2921.	515	175.8	6	000	163	2921.	515	165
000	000	30	58.0	46340.4	176.0	6	000	164	2421.	515	176.0	6	000	164	2421.	515	165
000	000	31	60.0	49198.5	176.2	6	000	165	1921.	515	176.2	6	000	165	1921.	515	165
000	000	32	62.0	52182.6	176.4	6	000	166	1421.	515	176.4	6	000	166	1421.	515	165
000	000	33	64.0	55296.7	176.6	6	000	167	921.	515	176.6	6	000	167	921.	515	165
000	000	34	66.0	58544.8	176.8	6	000	168	421.	515	176.8	6	000	168	421.	515	165
000	000	35	68.0	61930.9	177.0	6	000	169	46.	515	177.0	6	000	169	46.	515	165
000	000	36	70.0	65459.0	177.2	6	000	170	0.	515	177.2	6	000	170	0.	515	165
000	000	37	72.0	69133.1	177.4	6	000	171	0.	515	177.4	6	000	171	0.	515	165
000	000	38	74.0	72957.2	177.6	6	000	172	0.	515	177.6	6	000	172	0.	515	165
000	000	39	76.0	76935.3	177.8	6	000	173	0.	515	177.8	6	000	173	0.	515	165
000	000	40	78.0	81071.4	178.0	6	000	174	0.	515	178.0	6	000	174	0.	515	165
000	000	41	80.0	85369.5	178.2	6	000	175	0.	515	178.2	6	000	175	0.	515	165
000	000	42	82.0	89833.6	178.4	6	000	176	0.	515	178.4	6	000	176	0.	515	165
000	000	43	84.0	94467.7	178.6	6	000	177	0.	515	178.6	6	000	177	0.	515	165
000	000	44	86.0	99285.8	178.8	6	000	178	0.	515	178.8	6	000	178	0.	515	165
000	000	45	88.0	104292.9	179.0	6	000	179	0.	515	179.0	6	000	179	0.	515	165
000	000	46	90.0	109504.0	179.2	6	000	180	0.	515	179.2	6	000	180	0.	515	165
000	000	47	92.0	114935.1	179.4	6	000	181	0.	515	179.4	6	000	181	0.	515	165
000	000	48	94.0	120591.2	179.6	6	000	182	0.	515	179.6	6	000	182	0.	515	165
000	000	49	96.0	126477.3	179.8	6	000	183	0.	515	179.8	6	000	183	0.	515	165
000	000	50	98.0	132608.4	180.0	6	000	184	0.	515	180.0	6	000	184	0.	515	165
000	000	51	100.0	138990.5	180.2	6	000	185	0.	515	180.2	6	000	185	0.	515	165
000	000	52	102.0	145628.6	180.4	6	000	186	0.	515	180.4	6	000	186	0.	515	165
000	000	53	104.0	152528.7	180.6	6	000	187	0.	515	180.6	6	000	187	0.	515	165
000	000	54	106.0	159696.8	180.8	6	000	188	0.	515	180.8	6	000	188	0.	515	165
000	000	55	108.0	167138.9	181.0	6	000	189	0.	515	181.0	6	000	189	0.	515	165
000	000	56	110.0	174861.0	181.2	6	000	190	0.	515	181.2	6	000	190	0.	515	165
000	000	57	112.0	182879.1	181.4	6	000	191	0.	515	181.4	6	000	191	0.	515	165
000	000	58	114.0	191207.2	181.6	6	000	192	0.	515	181.6	6	000	192	0.	515	165
000	000	59	116.0	199860.3	181.8	6	000	193	0.	515	181.8	6	000	193	0.	515	165
000	000	60	118.0	208844.4	182.0	6	000	194	0.	515	182.0	6	000	194	0.	515	165
000	000	61	120.0	218174.5	182.2	6	000	195	0.	515	182.2	6	000	195	0.	515	165
000	000	62	122.0	227866.6	182.4	6	000	196	0.	515	182.4	6	000	196	0.	515	165
000	000	63	124.0	237925.7	182.6	6	000	197	0.	515	182.6	6	000	197	0.	515	165
000	000	64	126.0	248357.8	182.8	6	000	198	0.	515	182.8	6	000	198	0.	515	165
000	000	65	128.0	259177.9	183.0	6	000	199	0.	515	183.0	6	000	199	0.	515	165
000	000	66	130.0	270392.0	183.2	6	000	200	0.	515	183.2	6	000	200	0.	515	165
000	000	67	132.0	281915.1	183.4	6	000	201	0.	515	183.4	6	000	201	0.	515	165
000	000	68	134.0	293752.2	183.6	6	000	202	0.	515	183.6	6	000	202	0.	515	165
000	000	69	136.0	305908.3	183.8	6	000	203	0.	515	183.8	6	000	203	0.	515	165
000	000	70	138.0	318389.4	184.0	6	000	204	0.	515	184.0	6	000	204	0.	515	165
000	000	71	140.0	331200.5	184.2	6	000	205	0.	515	184.2	6	000	205	0.	515	165
000	000	72	142.0	344347.6	184.4	6	000	206	0.	515	184.4	6	000	206	0.	515	165
000	000	73	144.0	357835.7	184.6	6	000	207	0.	515	184.6	6	000	207	0.	515	165
000	000	74	146.0	371669.8	184.8	6	000	208	0.	515	184.8	6	000	208	0.	515	165
000	000	75	148.0	385854.9	185.0	6	000	209	0.	515	185.0	6	000	209	0.	515	165
000	000	76	150.0	399995.0	185.2	6	000	210	0.	515	185.2	6	000	210	0.	515	165
000	000	77	152.0	414595.1	185.4	6	000	211	0.	515	185.4	6	000	211	0.	515	165
000	000	78	154.0	429660.2	185.6	6	000	212	0.	515	185.6	6	000	212	0.	515	165
000	000	79	156.0	445194.3	185.8	6	000	213	0.	515	185.8	6	000	213	0.	515	165
000	000	80	158.0	461202.4	186.0	6	000	214	0.	515	186.0	6	000				

EAK OUTFLOW IS 43785. AT TIME 81.00 HOURS

PEAK FLOW (CFS) 43785.	TIME (HR) 81.00	(INCHES) (CFS) (AC-FT)	6-HR 43700. 0.000 21669.	MAXIMUM AVERAGE FLOW 24-HR 42444. 0.000 84187.	72-HR 34374. 0.000 204538.	199.00-HR 15642. 0.000 257257.
EAK STORAGE (AC-FT) 5218.	TIME (HR) 81.00		6-HR 9207.	MAXIMUM AVERAGE STORAGE 24-HR 9049.	72-HR 7982.	199.00-HR 4876.
PEAK STAGE (FEET) 171.56	TIME (HR) 81.00		6-HR 171.56	MAXIMUM AVERAGE STAGE 24-HR 171.32	72-HR 169.59	199.00-HR 163.82

CUMULATIVE AREA = 0.0 SQ MI

PEAK FLOW AND STAGE (INC-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

RATIOS APPLIED TO FLOWS

OPERATION STATION AREA PLAN PLAN RATIO.1
 0.50

HYDROGRAPH AT A1 0.0 1 FLOW
 44000.
 78.00

ROUTED TO A2 0.0 1 FLOW
 43785.
 81.00

** PEAK STAGES IN FEET **
 1 STAGE
 171.58
 81.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION A2

PLAN 1

ELEVATION STORAGE OUTFLOW	INITIAL VALUE 156.80 1435. 0.	SPILLWAY CREST 156.80 1435. 0.	TOP OF DAM 164.10 4870. 12701.		
RATIO OF PHF	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS
0.50	171.58	7.48	9218.	43785.	91.00
					81.00
					0.0

*** NORMAL END OF JOB ***

APPENDIX 6

REFERENCES

BEATTIES MILL DAM

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