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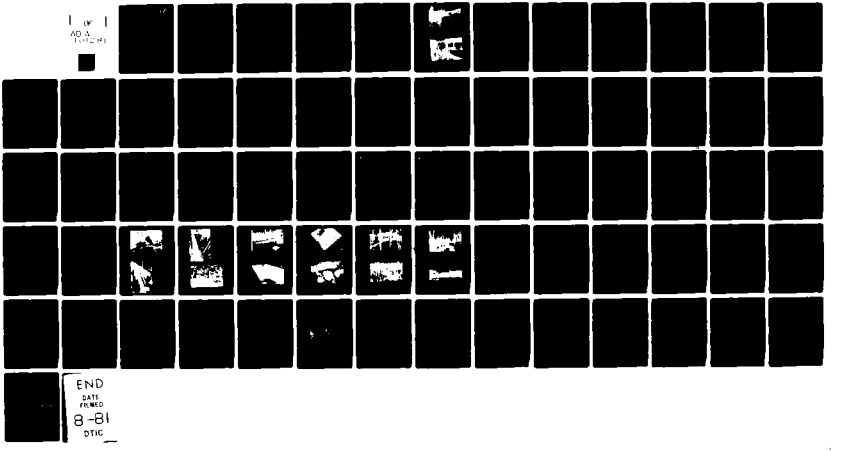

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DELAWARE RIVER BASIN
INDIAN CREEK
PENNSYLVANIA

NDI ID PA 00786

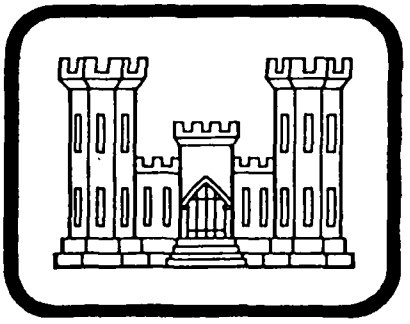
PA DER 39-4

HOSENSACK NO.4 DAM

OWNED BY

HOMEQUITY COMPANY, INC.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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PREPARED FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS

BALTIMORE, MARYLAND
21203

BY

O'BRIEN & GERE

PHILADELPHIA, PENNSYLVANIA
19103

APRIL 1981

National Dam Inspection Program. Hosensack Number 4 Dam (NDI ID PA 00786, PA DER 39-4), Delaware River Basin, Indian Creek, Pennsylvania. Phase I Inspection Report.

DELAWARE RIVER BASIN

HOSENSACK NO. 4 DAM
PENNSYLVANIA

NDI ID PA 00786

OWNED BY
HOMEQUITY CO., INC.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared for:

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

Prepared by:

O'BRIEN & GERE ENGINEERS, INC.
1617 JF Kennedy Boulevard - Suite 1760
Philadelphia, Pennsylvania 19103

Contract DACW31-81-C-0016

APRIL 1981

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 investigations, 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.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Hosensack No. 4 Dam
State Located:	Pennsylvania
County Located:	Lehigh
Stream:	Indian Creek
Coordinates:	Latitude $40^{o}27.4'$, Longitude $75^{o}31.2'$
Date of Inspection:	December 19, 1980

ASSESSMENT

Hosensack No. 4 Dam is a masonry structure with an upstream earth embankment about 310 feet long and a maximum height of 32 feet.

The dam was originally constructed in 1885. After a major failure in 1935, the dam was reconstructed. The dam is owned by Homequity Co., Inc., Wilton, Connecticut. The impoundment is owned by Mr. and Mrs. Francis G. Lunney, Quakertown, Pennsylvania, and is presently used for private recreation. Originally the impoundment provided water for power generation for a mill which was located about 150 feet downstream of the right abutment. The mill has since been converted into a private home.

The maximum storage capacity at Elevation 487 of 45 acre-feet and the maximum height of 32 feet place the dam in the "Small" size category. A railroad embankment and three inhabited houses are located within 1,200 feet downstream of the dam. Because of the potential for appreciable property damage and the possible loss of a few lives in the event of a dam failure, the dam is classified as having a "Significant" hazard potential.

A review of the results of the hydrologic and hydraulic analyses indicates that the spillway is able to pass the Spillway Design Flood (SDF) without the dam being overtopped; therefore, the spillway is considered "Adequate".

Based on visual observation and a review of the information obtained from the Pennsylvania Department of Environmental Resources, Hosensack No. 4 Dam appears to be in poor condition.

Recommendations and Remedial Measures

The following recommendations and remedial measures should be initiated immediately. The Owner should retain the services of a licensed professional engineer experienced in the design and construction of dams to assist in complying with these recommendations and remedial measures.

a. Facilities.

1. A comprehensive investigation and testing program should be initiated to assess the condition of the embankment and foundation.

2. Cracks in the spillway retaining walls should be repaired.

3. Trees in the embankment should be removed. Depressions or voids in the embankment resulting from such removal should be backfilled and compacted with suitable material. A plan for removing trees growing in masonry sections of the dam should be developed and implemented.

b. Operation and Maintenance

1. The Owner should develop and implement a formal maintenance and inspection program.

2. The functioning of the reservoir drain should be checked periodically.

3. A downstream warning system should be developed by the Owner. During periods of heavy rainfall, the dam should be monitored and appropriate agencies should be alerted in the event of an impending failure.

O'BRIEN & GERE ENGINEERS, INC.

Date: 29 April 81

Peter C. Johnson, P.E.
Senior Vice President
Pennsylvania Registration No. PE-02246-E

Approved by: Date: 22 MAY 81

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

UPSTREAM OVERVIEW FROM THE LEFT ABUTMENT.

DOWNSTREAM OVERVIEW FROM THE LEFT ABUTMENT.

TABLE OF CONTENTS

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
HOSENSACK NO.4 DAM
NDI ID # PA 00786

SECTION 1

PROJECT INFORMATION

1.1 General

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

b. Purpose. The purpose of this inspection is to determine if Hosensack No. 4 Dam constitutes a hazard to human life or property.

1.2 Description of Project (This description is based on information obtained from the Pennsylvania Department of Environmental Resources (DER), Division of Dam Safety, Harrisburg, Pennsylvania, and from the field inspection).

a. Dam and Appurtenances. Hosensack No. 4 Dam is a masonry structure with an upstream embankment. The dam has a maximum height of about 32 feet and a length of 310 feet. The crest of the earth embankment is about 30 feet wide and slopes toward the reservoir at approximately 5H:1V. The upstream slope of the embankment is about 0.5H:1V. The masonry portion of the dam is about 2 feet wide at the top and 20 feet wide at the base. Both the upstream and downstream faces of the masonry wall are battered at approximately 0.3H:1V. A 175-foot long overflow spillway is located about 100 feet from the right abutment near the center of the structure and is capped with concrete in the masonry portion. The non-overflow portion of the dam is retained at each end of the spillway by cemented rubble masonry walls which vary in height from 10 feet at the downstream end to 3 feet at the upstream end.

A 24-inch diameter reinforced concrete drain pipe is located in the non-overflow portion of the dam about 3.5 feet left of the spillway section. The pipe is encased in concrete for its full length. Two concrete collars which extend about 6 inches beyond the pipe encasement are located along the pipe where the pipe passes through the embankment. The drain pipe intake is located at the upstream toe of the embankment. Discharge through the pipe is controlled with stop planks in a drainage tower approximately 15 feet downstream from the intake. The drainage tower extends to the crest of the masonry dam. The tower, which is 4-feet by 4 feet inside, is constructed of cemented rubble masonry. The stop planks can be positioned from the top of the tower by means of a lifting rod. The tower opening is covered with a steel plate. The reservoir drain pipe outlets at the downstream face of the masonry section of the dam.

A 30-inch diameter steel pipe penstock is located about 32 feet from the right abutment of the dam. Discharge to the penstock is controlled at the intake which is located at the upstream edge of the crest of the embankment. No information

relative to the type of control is available. The penstock extends through the dam and terminates about 150 feet downstream of the dam. At one time the penstock supplied water to a mill at this location. The mill has since been converted into a private home. Discharge to the penstock has been completely blocked off at the intake.

The area for about 10 feet downstream of the spillway is protected with boulders covered with concrete.

b. Location. Hosensack No. 4 Dam is located on Indian Creek about 4 miles north of East Greenville, in Lower Milford Township in Lehigh County, Pennsylvania. The dam site is shown on USGS Quadrangle sheet entitled "East Greenville, PA". at coordinates N 40°27.4', W 75°31.2'. A regional vicinity map for Hosensack No. 4 Dam is included as Figure 1, Appendix E.

c. Size Classification. The maximum height of the dam is about 32 feet and the reservoir storage at the crest of the dam is approximately 45 acre-feet. The dam is therefore classified as a "Small" size structure (height less than 40 feet and storage less than 1,000 acre-feet).

d. Hazard Classification. A railroad embankment and three inhabited dwellings are located within 1,200 feet downstream of the dam. The dam is therefore classified as a "Significant" hazard structure due to the potential for possible loss of life and appreciable property damage.

e. Ownership. The dam is owned by Homequity Co., Inc., Wilton, Connecticut. Correspondence should be addressed to: Homequity Co., Inc., 249 Danbury Rd, Wilton, Connecticut, Attn: Mrs. C. Blanks (Phone 203-762-2281).

f. Purpose of Dam. The dam is currently used for private recreational purposes. It was originally built to provide water power for a mill and the impoundment was also used for ice harvesting.

g. Design and Construction History. No design or construction information relative to the construction of the dam is available. A review of the Pennsylvania DER files shows that the dam was initially built in 1885. Originally the dam was owned by the John Hancock Ice Company. The impoundment was used to provide water power for a mill and it was also used for ice harvesting. The original 25-foot high, 225-foot long dam was constructed as a dry stone masonry wall with an earthfill on the upstream side. The entire crest of the dam was available for discharge. The embankment crest was protected with several layers of timber. A review of the earliest available inspection report of the dam (dated March 17, 1915) revealed that a considerable amount of leakage was observed at the toe of the dam. The cause of this leakage was attributed to the fact that undesirable material was not removed from the foundation prior to construction. Reference is also made to a partial failure of the dam due to ice pressures in 1904. The failed section of the dam was subsequently repaired with timber cribbing. Later inspection reports state that a second partial failure of the dam occurred in 1921. The dam was repaired in that same year. Minor repairs were made to the dam between 1921 and 1935 which consisted of restoring the embankment on the right side to design elevation and repairing the masonry.

A major failure of the dam occurred in July 1935 as a result of intense rainfall. The failure occurred through the timber cribbing, causing a breach sixty feet wide near the left abutment for the full height of the structure. Damage was limited to erosion of the Reading Railroad embankment about 200 feet downstream of the dam.

The dam was rebuilt in 1936 by the Works Progress Administration (WPA). Plans were submitted with the Permit Application in April 1936. Copies of the plans are included as Sheets 2 and 3 of Appendix E. As reconstructed, the dam height was increased by about 7 feet and the spillway length was decreased to 175 feet. As a result of a state review of the plans, it was recommended that the dam crest be reduced from 7 feet to 4 feet above the spillway. This recommendation apparently was not complied with because the spillway freeboard is 7 feet.

Progress reports of the reconstruction were periodically made by the State. Modifications were requested regarding the size of masonry stone used and in the methods used for placing the embankment material. Placement of the embankment was halted in December 1936 because of the frozen condition of the in place material.

The reconstruction was completed in the spring of 1937. After the initial filling, the impoundment was dewatered because leakage was observed. Depressions found in the embankment material placed upstream of the spillway were blamed on poor compaction of the material. A trench was excavated in the embankment along the masonry section to a point where the material appeared to be well compacted. The trench was filled with compacted gravel and clay. Following this corrective measure the dam was placed in service.

A review of inspection reports subsequent to the reconstruction reveals that deficiencies such as embankment settlement, seepage at the downstream toe and reservoir drain and cracks and stone displacement in the masonry wall were noted. No record of repairs made since 1937 are available.

h. Normal Operating Procedures. No restraints to discharge over the spillway exist. The reservoir drain is normally closed. No requirements for minimum daily releases are known of.

1.3 Pertinent Data.

a. Drainage Area. (Square Miles) 3.9

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Maximum Spillway Capacity, Elev. 487	10,370

c. Elevations - (Feet above MSL estimated from USGS).

Top of Dam (Maximum Pool)	487
Spillway Crest (Normal Pool)	480
Streambed at Dam	455
Drain pipe invert at outlet	455

d. Reservoir Length (Feet).

Normal Pool, Elev. 480	600
Maximum Pool, Elev. 487	700

e. Reservoir Storage (Acre Feet).

Normal Pool, Elev. 480	21
Maximum Pool, Elev. 487	45

f. Reservoir Surface (Acres).

Normal Pool, Elev. 480	2.8
Maximum Pool, Elev. 487	4.3

g. Dam Data.

Type	Masonry with upstream earth embankment
Length	310 feet
Height	32 feet
Top width	30 feet
Side Slopes upstream	0.5H:1V
downstream	0.3H:1V dry stone masonry wall
Zoning	Refer to Section B-B, Sheet 3, Appendix E
Impervious Core	Embankment consists of 2 zones of earth material with high clay contents. Refer to Section B-B, Sheet 3, Appendix E
Foundation Treatment	No information available

h. Diversion System.

A 30-inch diameter steel penstock to the former mill located downstream of dam with control at the intake has been out of service for many years. The type of control is unknown.

i. Spillway.

Type	Ungated overflow
Length	175 feet
Width	2 feet
Energy Dissipator	Grouted riprap apron downstream of dam
Downstream Channel	Natural Stream

j. Outlet Works.

A 24-inch diameter reinforced concrete pipe functions as the outlet works. Control is by means of stop planks in a drainage tower.

SECTION 2

ENGINEERING DATA

2.1 Design

a. Data Available. Engineering data for Hosensack No. 4 Dam is limited to a plan entitled "Plan of Proposed Reconstruction of Stahl's Dam". Reconstruction of the dam was performed by the Works Progress Administration in 1936. The plan is reproduced in Appendix E as Sheets 2 and 3.

Other information provided by Pennsylvania DER and used in preparing this report include a general correspondence file initiated in 1915 and a photograph series initiated in 1915.

b. Design Features. The principal design features for the dam are shown on the drawings reproduced in Appendix E as Sheets 2 and 3. The features have been discussed in Section 1.2a.

2.2 Construction

According to the Pennsylvania DER correspondence file, the dam was originally built in 1885. Following many minor failures through the years, a major failure occurred in 1935. The dam was rebuilt in 1936 by the Works Progress Administration. No evidence exists to suggest that the construction was not performed in conformance with the plans. However, a recommendation made by the state to reduce the freeboard from 7 feet to 4 feet was not complied with.

2.3 Operational Data

The penstock is no longer used to divert water from the impoundment to the mill, which has been converted to a private dwelling. It appears that the control at the inlet to the penstock is in the closed position.

No records exist of reservoir drain operation. It appears that the stop planks are in place, thus preventing any discharge through the reservoir drain pipe.

2.4 Evaluation

a. Availability. All engineering data reproduced in this report and studied for this investigation were provided by the Pennsylvania DER and supplemented by conversations with the Owner's representative.

b. Adequacy. The information made available by the Pennsylvania DER, conversations with the Owner's representative and observations made during the field investigation provided adequate data for a Phase I evaluation.

c. Validity. There appears to be no reason to question the validity of the limited data available.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The observations and comments of the field inspection team are presented in Appendix A. At the time of the inspection, the water surface was approximately one foot below the spillway crest. The overall appearance of the dam is poor.

b. Dam. (Left and right hand designations are referenced looking downstream.)

The upstream slope of the embankment to the right of the spillway is submerged and was not visible at the time of the inspection. No upstream embankment protection was evident; however, no erosion was noted. The upstream slope of the embankment to the left of the spillway is protected by a low masonry wall which extends to the left abutment. The wall appears to be in fair condition and no settlement was noted in the fill behind the wall.

The crest of the embankment to the right of the spillway is uniform; however, localized depressions were noted at two locations; one immediately upstream of the embankment/spillway junction and the second at the upstream end of the masonry training wall.

The crest of the embankment to the left of the spillway is non-uniform. The embankment material has either settled or the embankment was not initially built to grade. Several large trees are located on the embankment crest. The largest has a diameter of about 18 inches and is in excess of 40 feet in height.

The embankments on both sides of the spillway appear to be lower in grade than shown on the plan. The stone masonry retaining wall extends about 2 feet above the embankment crest. A survey of the top of the stone masonry wall was made during the inspection, which shows the top of the wall to be about 7 feet above the spillway crest.

The embankments on both sides of the spillway are retained at the spillway by cemented rubble masonry walls. The horizontal and vertical alignment of the walls appear to be fair. A crack is located in both walls about 15 feet upstream of the spillway crest extending for the full visible depth of the wall. The cracks are sloped at about 30 degrees from vertical in the downstream direction.

The approach to the spillway was submerged at the time of inspection. The horizontal alignment of the crest appears to be fair with debris accumulated at many locations along the crest. At least three trees, rooted in the downstream face of the masonry spillway, extend above the spillway crest.

A concrete cap has been constructed on the spillway crest of the masonry portion of the dam. An 8 foot long portion of this cap located about 50 feet from the left end of the spillway has been displaced. The masonry portion of the dam is

about 2 feet wide at the top and extends above the embankment by about two feet. A survey of the crest of the wall was made during the inspection. The profile is shown on Sheet 11B, Appendix A. The vertical alignment varies by approximately one foot for the length of the embankment sections of the dam. The horizontal alignment of the wall appears to be satisfactory.

Extensive seepage was noted at the toe of the stone masonry for a distance of about 100 feet from the midpoint of the spillway to the left abutment. Seepage was also evident coming through the masonry about 4 feet below the spillway crest. The quantity of seepage (50 gpm) is considered excessive in both cases although the discharge was clear. Vegetation is growing from the downstream face of the masonry.

A void in the wall is located at the toe of the spillway section about 40 feet from the left end of the spillway. The dimensions of the displaced stone masonry are approximately 4 feet by 4 feet in area and 2 feet deep.

At approximately the midpoint of the spillway section near the toe, the sound of water flowing through the stone masonry was detected. The discharge does not flow through the surface of the masonry in this region.

c. Appurtenant Structures. The apparent control for the penstock is submerged and appears to be closed. The condition of the intake and the control could not be assessed during the inspection. The penstock shows no signs of leakage.

The 24-inch diameter reinforced concrete reservoir drain pipe is located on the left side of the dam. The intake is submerged and was not visible at the time of inspection. Discharge through the drain is controlled by positioning stop planks about 15 feet downstream of the intake. Access to the control section in the pipe is by means of a tower about 30 feet high. The visible portion of the drainage tower appears to be in a fair condition. The cover plate for the top of the drainage tower is missing. It appears that a steel cable on the upstream side of the drainage tower is used to position the stop planks.

The reinforced concrete pipe terminates at the downstream face of the masonry portion of the dam. No discharge was noted coming from the pipe; however, seepage estimated at 20gpm was detected along the perimeter of the pipe.

d. Reservoir. The ground adjacent to the reservoir is steeply sloped and wooded. No slope failures were in evidence adjacent to the shoreline. More than half of the impoundment appears to be filled with sediment.

e. Downstream Channel. The area immediately downstream of the masonry toe of the spillway is surfaced with riprap for about 10 feet. The riprap slopes toward the center of the spillway and then to the downstream channel. Grout is evident in many of the joints of this riprapped surface. The downstream channel is relatively flat and littered with boulders. The overbanks are flat and heavily wooded. About 200 feet downstream of the dam, the discharge in the channel is directed through a a culvert approximately 16 feet high and 30 feet wide under a railroad embankment.

3.2 Evaluation

Based on visual observations, the dam and appurtenances are in poor condition.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

According to the Owner's representative, no operational procedures exist for the site. High flows discharge over the ungated overflow spillway section. The control devices for the 24-inch diameter reservoir drain pipe and the 30-inch diameter penstock are apparently closed and are no longer used.

4.2 Maintenance of the Dam

According to the Owner's representative, no maintenance program exists for the dam. It appears that no maintenance has been performed on the dam in recent years.

4.3 Maintenance of Operating Facilities

According to the Owner's representative, no maintenance program for operating facilities exist. No records exist for operation of either the reservoir drain or penstock.

4.4 Warning System in Effect

According to the Owner's representative, no warning system or procedures have been established for monitoring the structure during periods of heavy rainfall or in the event of impending dam failure.

4.5 Evaluation

Periodic inspection of the dam and operating equipment should be made by a qualified engineer. A maintenance program should be developed and implemented. Records of maintenance performed should be maintained by the Owner.

A formal warning system should be developed.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features

a. Design Data. According to the Owner's representative, no information relative to the hydrologic and/or hydraulic design of the dam is available.

The watershed has a maximum width of about 1.5 miles and a maximum length of about 4.0 miles. Elevations range from approximately Elev. 1,000 to normal pool Elevation 480. The drainage area is about 3.9 square miles and is essentially undeveloped and forested.

b. Experience Data. According to the Owner's representative, no rainfall records or spillway discharge records are maintained. No evidence that the embankment has ever been overtopped was apparent during the inspection.

c. Visual Observations. Debris has collected on the spillway crest and trees are growing from the downstream face of the masonry approximately 2 feet below the crest. The debris and trees would restrict discharge over the spillway.

d. Overtopping Potential. Hosensack No. 4 Dam is classified as a "Small" size, "Significant" hazard dam. Accordingly, the Spillway Design Flood (SDF) ranges from the 100 year flood to fifty percent of the PMF. Because of the three inhabited dwellings located within 1,200 feet downstream of the dam, fifty percent of the PMF was selected as the appropriate SDF. The SDF hydrograph was routed through the reservoir with the starting water surface at the spillway crest, El. 480. The peak inflow and outflow rates for the SDF are about 4070 cfs. The maximum stage in the reservoir for this event is El. 483.75, 3.25 feet below the top of the dam.

e. Spillway Adequacy. The spillway capacity is classified as "Adequate" since it is capable of passing the SDF.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The overall structural appearance of the dam at the time of inspection was poor. Depressions in the embankment crest and cracking in the masonry training walls could indicate settlement and/or loss of embankment material. If the extensive seepage at the toe of the dam and below the spillway crest is left uncorrected, structural damage could eventually result.

The masonry portion of the dam is in poor condition. Large trees and other vegetation are growing from joints in the masonry. A portion of the masonry located near the spillway toe has been displaced. However, the vertical and horizontal alignment of the wall appears to be satisfactory.

Judging from visual observations, the dam does not appear to be structurally stable for all potential loadings.

b. Design and Construction Data. Design and construction data relative to the dam is unavailable. A review of correspondence indicates that the dam was originally constructed as an earth embankment with a dry stone masonry downstream section. A major failure occurred in 1935 with a full depth of dam breach occurring. The dam was rebuilt in 1936 to its present configuration.

c. Operating Records. According to the Owners representative, no operating records are maintained.

d. Post-Construction Changes. No post-construction changes subsequent to the reconstruction in 1936 are known of.

e. Seismic Stability. Hosensack No. 4 Dam is located in Seismic Zone 1 as shown on the Seismic Zone Map of Contiguous States. A dam located in Seismic Zone 1 is considered to be structurally adequate for Zone 1 earthquake loading if it is structurally adequate for static loadings. Since the dam does not appear to be structurally stable for potential static loadings, it is doubtful if it would be stable for seismic loadings.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Evaluation. Based on visual observations, the dam and appurtenances are in poor condition.

Depressions in the embankment and cracking in the training walls indicate embankment movement or settlement.

Seepage (50 gpm) was observed at the toe of the spillway for most of its length and through the masonry of the spillway about 4 feet below the crest. Seepage (20 gpm) was also observed discharging from around the reservoir drain pipe. Although the seepage was clear, the quantity of seepage was excessive.

A section of the masonry near the spillway toe has been displaced resulting in a void in the dam. A portion of the concrete spillway crest has also been displaced.

Based on the flood routing performed for this report, the spillway is capable of passing the PMF. However, due to a lack of maintenance, the debris has collected on the spillway and a number of trees are growing from the masonry downstream of the spillway. In the event of high discharges, it does not appear that the spillway could discharge as designed. It is possible that severe damage could occur to the spillway during overtopping.

The stop planks for the reservoir drain and the gate for the penstock were not operated during the inspection. However, it does not appear that the stop planks and the gate have been operated recently and their status is questionable. Accessability to the stop planks and the gate may be difficult during high reservoir stages.

b. Adequacy. The information made available by DER, conversations with the Owner's representative and observations made during the field investigation provided adequate data for a Phase I evaluation.

c. Urgency. The remedial measures recommended in Section 7.2 should be effected immediately.

d. Necessity for further investigation. Further investigation should be implemented as discussed in Section 7.2a.

7.2 Recommendations and Remedial Measures

The following recommendations and remedial measures should be initiated immediately. The Owner should retain the services of a licensed professional engineer experienced in the design and construction of dams to assist in complying with these recommendations and remedial measures.

a. Facilities.

1. A comprehensive investigation and testing program should be initiated to assess the condition of the embankment and foundation.

2. Cracks in the spillway retaining walls should be repaired.

3. Trees in the embankment should be removed. Depressions or voids in the embankment resulting from such removal should be backfilled and compacted with suitable material. A plan for removing trees growing in masonry sections of the dam should be developed and implemented.

b. Operation and Maintenance

1. The Owner should develop and implement a formal maintenance and inspection program.

2. The functioning of the reservoir drain should be checked periodically.

3. A downstream warning system should be developed by the Owner. During periods of heavy rainfall, the dam should be monitored and appropriate agencies should be alerted in the event of an impending failure.

APPENDIX A

CHECKLIST
VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam Hosensack Number 4 County Lehigh State Pennsylvania National ID # PA00786

Type of Dam Earth Embankment Hazard Category Significant

Date(s) Inspection 12/19/80 Weather Partly Cloudy Temperature 30°

Pool Elevation at Time of Inspection ±479 M.S.L. Tailwater at Time of Inspection ±458 M.S.L.

Inspection Personnel:

Leonard R. Beck
Richard A. Beck
Lee DeHeer
Jon Rauschkolb
Richard E. Horvath

Richard E. Horvath Recorder

Remarks:

The inspection team was accompanied by Mr. Ronald H. Eichenberg, Broker/Manager, John W. Monaghon, Realtors.

Sheet 1 of 11

DRY STONE MASONRY WALL
(DOWNSTREAM FACE OF DAM)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Seepage was noted at the toe of the wall. The limits of seepage extend from about the midpoint of the spillway to the left abutment toe, a distance of about 90 feet. Seepage was also noted at an elevation 3 to 4 feet below the spillway crest for most of the length of the spillway.	The quantity of seepage is appreciable (50gpm), however the water is clear.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	The abutment/embankment junctions appear to be satisfactory with no seepage noted.	
DRAINS	The dry stone masonry wall is free draining.	
WATER PASSAGES	Seepage was noted along perimeter of the reservoir drain pipe and as discussed under "any noticeable seepage".	The seepage around the reservoir drain pipe is an additional 20gpm. See remark under "any noticeable seepage".
FOUNDATION	Not observed.	

DRY STONE MASONRY WALL
(DOWNSTREAM FACE OF DAM)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	The masonry wall was constructed as a dry rubble wall.	
STRUCTURAL CRACKING	Cracks were noted in cemented masonry training walls on either side of the spillway. The cracks extend from the crest to the water line on slopes approximating 30^{0} from vertical in the downstream direction.	Repair the cracks in the cemented masonry training walls.
VERTICAL AND HORIZONTAL ALIGNMENT	Horizontal and vertical alignment appear to be satisfactory. A portion of the concrete cap on the spillway crest about 8 feet long is missing.	Replace the portion of missing concrete cap.
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	Some of the stones in the wall have been displaced. The most prominent location is about the midpoint of the spillway just above the toe. The limits of displaced stone is about 4 feet by 4 feet in area and 2 feet deep.	Replace the missing stones.

Sheet 3 of 11

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Not observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Sloughing or erosion of the exposed areas of the embankment is not apparent.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The embankment is retained by a dry stone masonry wall. The top of the embankment has settled in some areas.	Investigate the cause of the settlement and make the necessary repairs of the embankment.
RIPRAP FAILURES	N/A	

Sheet 4 of 11

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No settlement was noted at the junctions of the embankment and abutment. Depressions were noted in the embankment at the right side of the spillway, in back of the stone masonry training wall.	Investigate the cause of the depressions and make the necessary repair of the embankment.
ANY NOTICEABLE SEEPAGE	Refer to Sheet 2 of 11 under "any noticable seepage".	
STAFF GAGE AND RECORDER	None on the site.	
DRAINS	The stone masonry retaining wall is free draining.	

Sheet 5 of 11

RESERVOIR DRAIN
(24 inch diameter)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed.	
INTAKE STRUCTURE	Submerged at the bottom of the reservoir; therefore, it could not be observed.	
OUTLET STRUCTURE	The pipe is flush with downstream face of the dry stone masonry wall. Seepage was noted around the perimeter of the pipe.	Refer to remarks under "water passages" on sheet 2 of 11.
OUTLET CHANNEL	Discharge from the drain is directed to a riprap apron constructed for the length of the spillway and extending downstream for about 5 feet. The apron is sloped to drain to the center of the dam and discharge to the natural channel downstream.	
EMERGENCY GATE	The drain control is located at the upstream face of the embankment. The discharge is controlled by the positioning of stop planks. Access to the drain pipe is via a vertical tower extending from the crest to the base of the embankment.	

Sheet 6 of 11

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	A portion of the concrete cap approximately 8 feet long has been displaced.	Replace the portion of the concrete cap which has been displaced.
APPROACH CHANNEL	The approach channel is the floor of the reservoir which was inaccessible during the inspection.	
DISCHARGE CHANNEL	A riprap apron is constructed at the toe of the spillway and extends downstream for about 5 feet. The apron is sloped to the center of the spillway at which point flow enters the natural downstream channel.	
BRIDGE AND PIERS	N/A	

Sheet 7 of 11

GATED SPILLWAY

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

Sheet 8 of 11

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None in place.	
OBSERVATION WELLS	None in place.	
WEIRS	None in place.	
PIEZOMETERS	None in place.	
OTHER	None in place.	

Sheet 9 of 11

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes to the reservoir are steep. No evidence of earth slides into the reservoir are apparent.	
SEDIMENTATION	No measurement of sedimentation was made. However based on conversations with local residents and visual observations, the impoundment appears to be heavily silted.	

Sheet 10 of 11

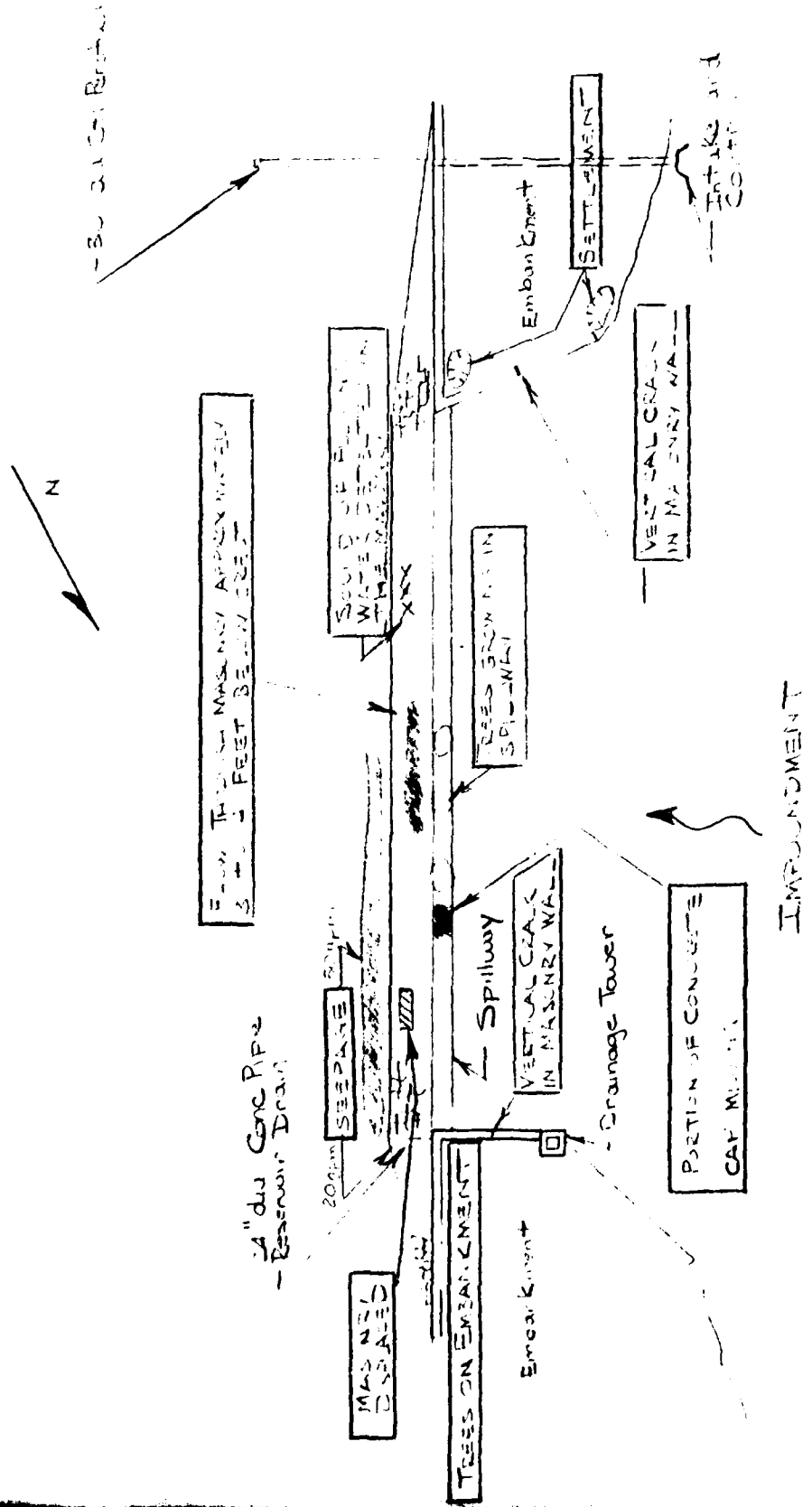
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The channel is littered with stone. Approximately 150 feet downstream of the dam, the channel is directed through a large arch culvert in a railroad embankment.	
SLOPES	The downstream channel is on a gradient of approximately one percent. The channel banks are about 3 feet high on slopes of about 2H:1V	
APPROXIMATE NO. OF HOMES AND POPULATION	One inhabited house is located about 100 feet downstream of the dam. Three inhabited houses are located approximately 1,200 feet downstream of the dam.	

Sheet 11 of 11

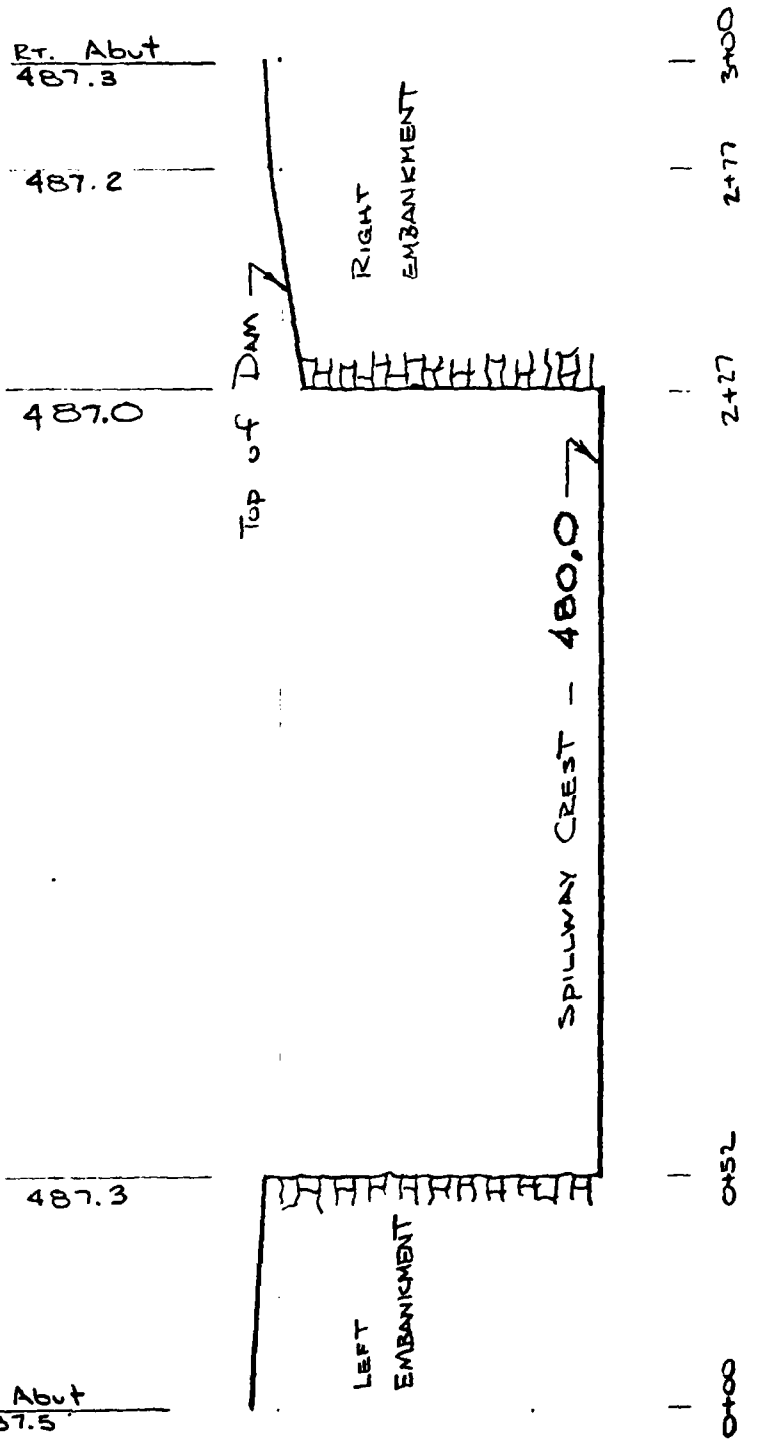
O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO.
[illegible] Dam No. 4 Dam	11A	PEH	1/9/81	[illegible]



O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
HOSENSACK NO. 4 DAM	11B	REH	1/9/81	1841-014



SURVEY OF VERTICAL ALIGNMENT

APPENDIX B

CHECKLIST
ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Hosensack No. 4

ID # PA00786

ITEM	REMARKS
AS-BUILT DRAWINGS	No "as built" drawings are available.
REGIONAL VICINITY MAP	Refer to Appendix E
CONSTRUCTION HISTORY	Construction history is limited to a correspondence file initiated by the state in 1915.
TYPICAL SECTIONS OF DAM	Typical sections are shown on proposed construction drawings for reconstruction of the dam. Refer to Appendix E.
OUTLETS - PLAN	Refer to Appendix E for drawing
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	Not available
RAINFALL/RESERVOIR RECORDS	Not available

Sheet 1 of 4

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS	No data available.
HYDROLOGY & HYDRAULICS	Limited to data provided with the application for reconstruction.
DAM STABILITY	No data available.
SEEPAGE STUDIES	No data avialable.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	No data available.
POST-CONSTRUCTION SURVEYS OF DAM	No data available.
BORROW SOURCES	No data available.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	See Section 1.2.g of this report.
HIGH POOL RECORDS	No data available.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	See section 1.2.g of this report
MAINTENANCE OPERATION RECORDS	None available.

Sheet 3 of 4

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Refer to Appendix E for drawing.
OPERATING EQUIPMENT PLANS & DETAILS	Refer to Appendix E for drawing.
MISCELLANEOUS	

Sheet 4 of 4

APPENDIX C

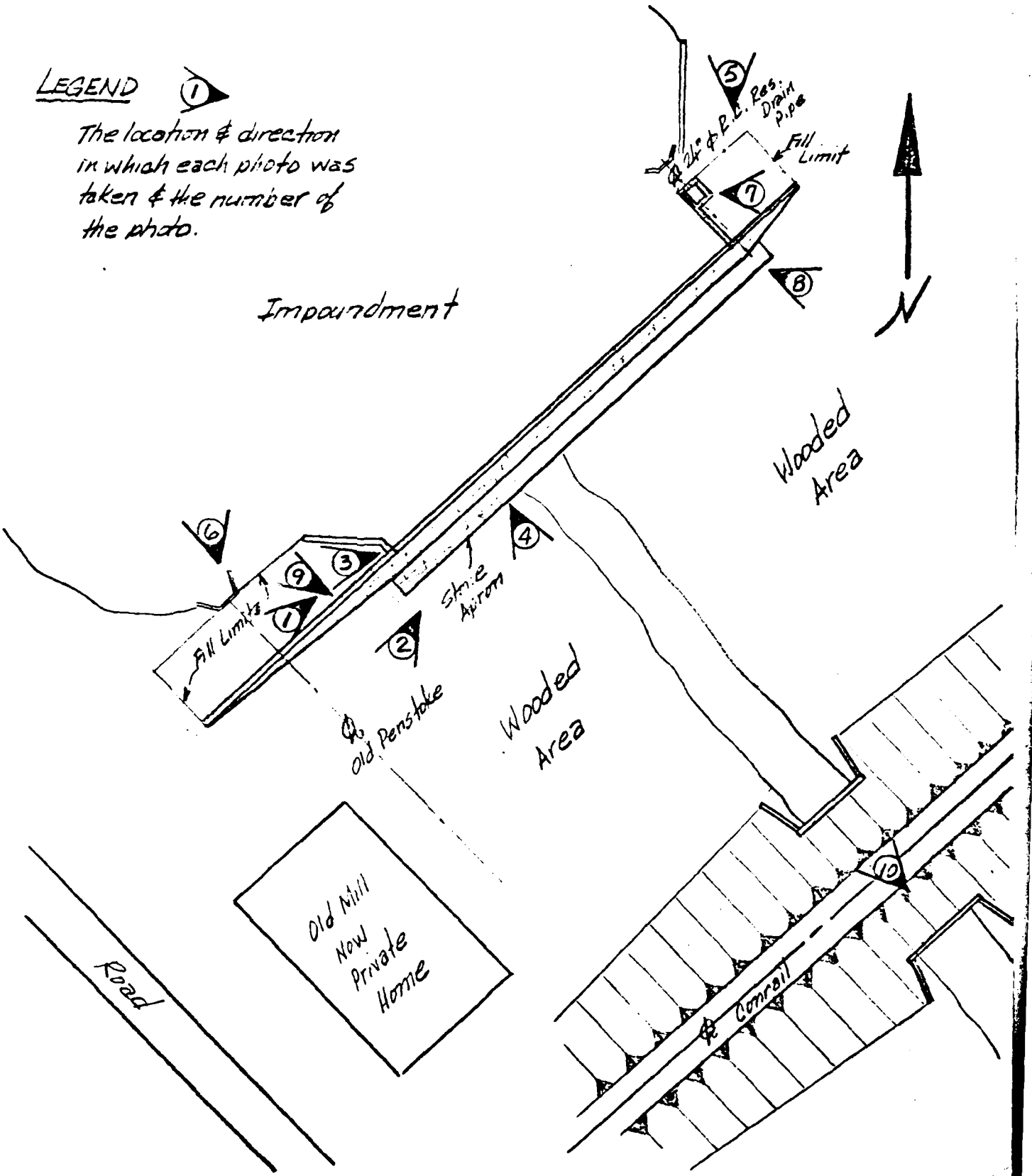
PHOTOGRAPHS

APPENDIX C

SELECTED PHOTOGRAPHS OF THE PROJECT

O'BRIEN & GERE
ENGINEERS INC

	SHEET	BY	DATE	JOB NO
Hosensack #4	A			1841-014



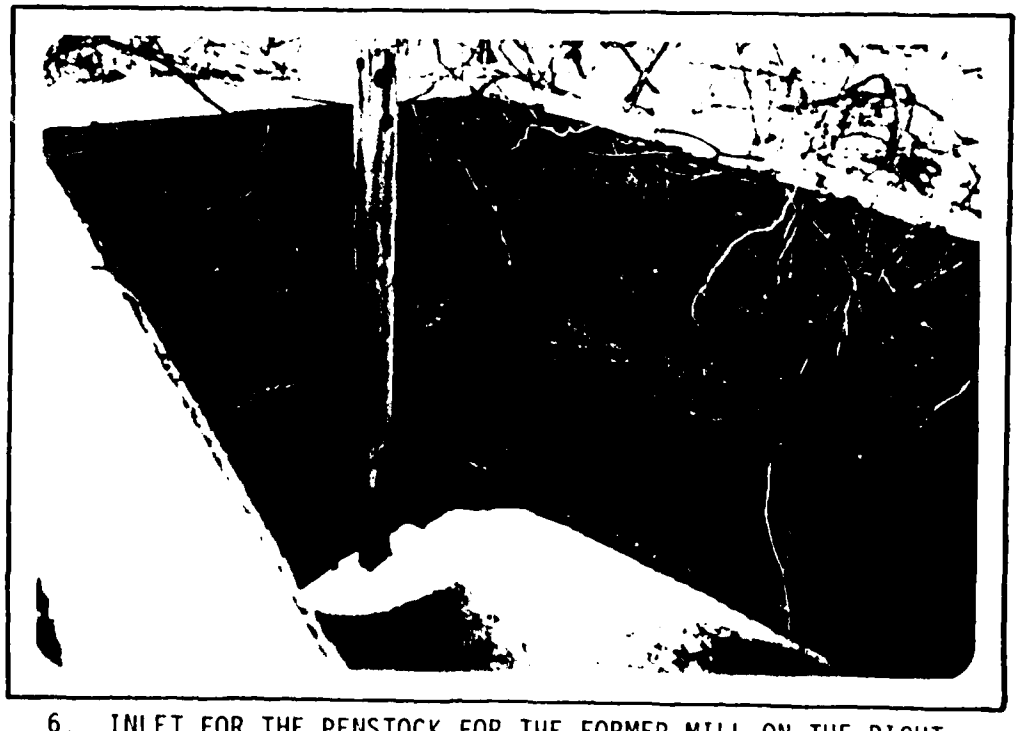
1. VIEW ALONG THE TOP OF THE DAM FROM THE RIGHT ABUTMENT. (12/19/80)

2. DOWNSTREAM FACE OF THE DAM WITH A TREE GROWING ON THE DAM AND SEEPAGE ISSUING FROM BETWEEN THE MASONRY MEMBERS. (12/19/80)

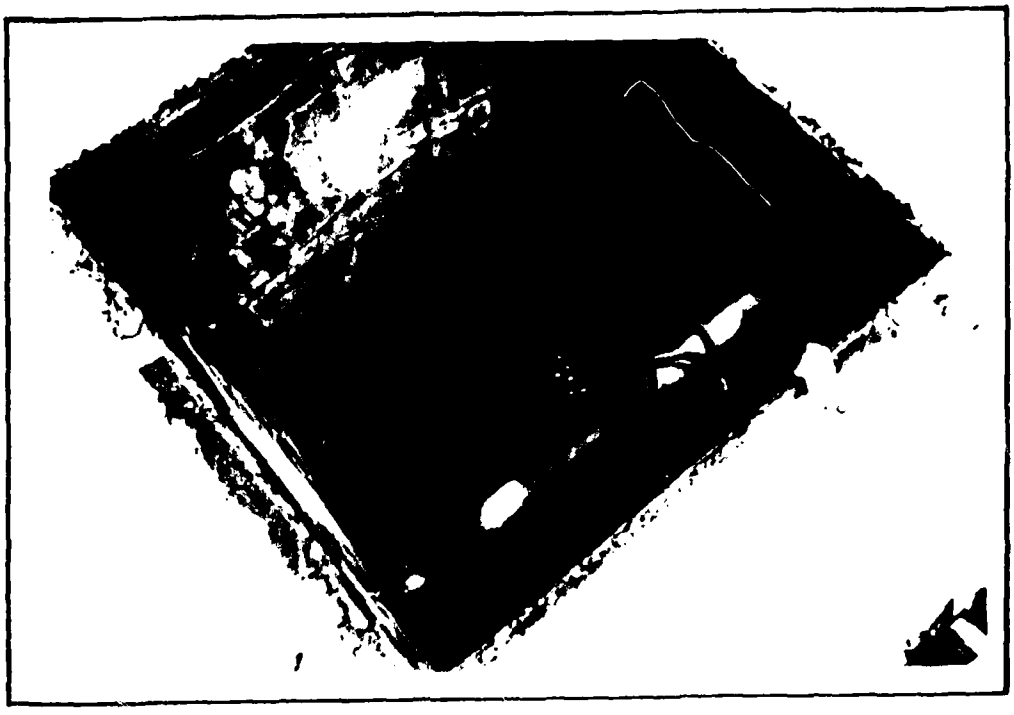
3. VIEW FROM THE CREST OF THE SPILLWAY SHOWING DISCHARGE FROM SEEPAGE AT THE DOWNSTREAM TOE OF THE DAM. (12/19/80)

4. CLOSE-UP OF THE SEEPAGE DISCHARGE AT THE DOWNSTREAM TOE OF THE DAM. (12/19/80)

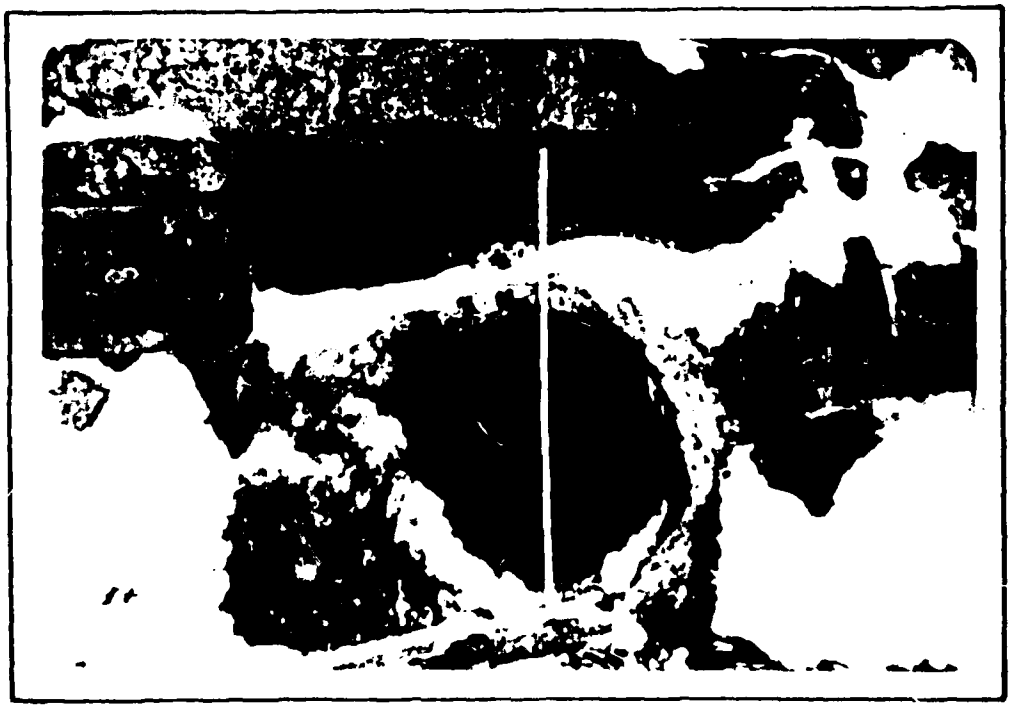
5. HEADWALL AND SIDEWALL LEFT OF THE SPILLWAY SHOWING TREES GROWING NEXT TO THE WALLS. (12/19/80



6. INLET FOR THE PENSTOCK FOR THE FORMER MILL ON THE RIGHT ABUTMENT OF THE DAM. (12/19/80)



7. GATE CHAMBER FOR RESERVOIR DRAIN NEAR THE LEFT ABUTMENT OF THE DAM. (12/19/80)



8. OUTLET OF THE 24-INCH DIAMETER RESERVOIR DRAIN NEAR THE LEFT ABUTMENT OF THE DAM. (12/19/80)

9. 200-FOOT CHANNEL REACH BETWEEN THE DAM AND THE RAILROAD EMBANKMENT SHOWING THE MILL (NOW PRIVATE HOME) AND PENSTOCK TO THE RIGHT. (12/19/80)

10. CHANNEL REACH BETWEEN THE RAILROAD AND THE HIGHWAY ABOUT 200 to 350 FEET DOWNSTREAM OF THE DAM. (12/19/80)

11. TYPICAL DOWNSTREAM CHANNEL REACH. (12/19/80)

12. POTENTIAL DAMAGE AREA ABOUT 0.25 MILES DOWNSTREAM OF THE DAM. (12/19/80)

APPENDIX D

HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

HOSENSACK NO. 4 DAM
HYDROLOGIC & HYDRAULIC
ENGINEERING DATA

TABLE OF CONTENTS

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Rural, farmland, wooded areas and few small communities

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 480.0 (21 A.F.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: N/A

ELEVATION TOP DAM (STORAGE CAPACITY): 487.0 (45 A.F.)

SPILLWAY

a. Elevation 480.0

b. Type Drop Spillway

c. Width 2 feet

d. Length 175 feet

e. Location Spillover Approximately Centered on Dam

f. Number and Type of Gates None

OUTLET WORKS:

a. Type 24-inch diameter R.C. Pipe

b. Location Near Left Abutment

c. Entrance inverts ≈ Elev. 459

d. Exit inverts ≈ Elev. 458.5

e. Emergency draindown facilities Stop logs accessible by drainage tower (on line with reservoir drain) near left abutment

HYDROMETEOROLOGICAL GAGES:

a. Type None within watershed

b. Location N/A

c. Records N/A

MAXIMUM NON-DAMAGING DISCHARGE: Not Known

NOTE: ELEVATIONS ESTIMATED FROM USGS QUAD. MAP.
ELEVATIONS ARE IN FEET, MEAN SEA LEVEL

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed 1/

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out.

1/ "High" hazard structures only

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
HOSENSACK LAKE DAM	3	REH	1/7/81	1841-014
			3/11/81	

HYDROLOGY

- DRAINAGE AREA (PLANIMETERED FROM USGS QUAD SHEET) = 3.9 Sq Miles

- DESIGN FLOOD

  Size Classification - Small

  Hazard Classification - High

  SDF → ½ PMF — PMF

  USE ½ PMF

- PMP Determination (HR #33)

HOSENSACK LAKE DAM is located in Zone Number 6 (for rainfall distribution)

PMP ≈ 23" (200 Sq. miles - 24 hours)

Time (Hrs)	Percent	Rainfall (Inches)
6	112	25.8
12	124	28.5
24	132	30.4
48	142	32.7

- SNYDER COEFFICIENTS (PROVIDED BY Balt Dist. COE)

  Zone 7

  C_t = PLATE C = 1.35

  C_p = 0.65

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
HODENSACK LAKE DAM	4	ZEK	1/7/81	1841-014
		VCR	3/11/81	

HYDROLOGY (CONT)

L = 5.3 miles

L_{CA} = 3.5 miles

From Plate C

$t_p = 1.35 (L L_{CA})^{0.3}$

= 3.24 Hrs

Hydraulics

Spillway Discharge

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

C = 3.2 (2' wide concrete weir crest)
L = 175'
H = Hydraulic hd. on spwy., assume velocity head is negligible

Embankment Overtopping

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

C = 3.0 (2' wide stone wall weir crest)
L = 125'
H = Hydraulic hd on dam crest, assume velocity head is negligible

Stage - Area (Planimetered from Quad. Sheet)

El. 480 = 2.8 Ac.
El. 500 = 7.3 Ac.

```
1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  01 APR 80
 **********************************
        1            A1                  NATIONAL DAM INSPECTION PROGRAM
        2            A2                                HOSENSACK
        3            A3                             PMF HYDROGRAPH
        4            B     300      0     15      0      0      0      0      0     -4      0
        5            B1      5
        6            J       1      9      1
        7            J1     .2     .3     .4     .5     .6     .7     .8     .9    1.0
        8            K       0  INFLOW                                   1
        9            K1                              RUNOFF TO HOSENSACK
       10            M       1      1    3.9                                          1
       11            P       0     23    112    124    132    142
       12            T                                                 1.0    .05
       13            W    3.24    .65
       14            X    -1.5   -.05      2
       15            K       1    DAM                                    1
       16            K1                           ROUTING THROUGH HOSENSACK
       17            Y                             1      1
       18            Y1      1                                        -480
       19            $A      0    2.8    7.3
       20            $E    458    480    500
       21            $$    480    175    3.2    1.5
       22            $D    482      3    1.5    125
       23            K      99
 1                           PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                   RUNOFF HYDROGRAPH AT        INFLOW
                                   ROUTE HYDROGRAPH TO           DAM
                                   END OF NETWORK

                                        NATIONAL DAM INSPECTION PROGRAM
                                                  HOSENSACK
                                               PMF HYDROGRAPH

                                              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=    .20    .30    .40    .50    .60    .70    .80    .90   1.00
```

56 5

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SUB-AREA RUNOFF COMPUTATION

RUNOFF TO HOSENSACK

	ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
INFLOW		0	0	0	0	0	1	0	0

HYDROGRAPH DATA

	IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
	1	1	3.90	0.00	3.90	0.00	0.000	0	1	0

PRECIP DATA

	SPFE	PMS	R6	R12	R24	R48	R72	R96
	0.00	23.00	112.00	124.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

	LROPT	STRTL	UNITL	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= 3.24 CP= .65 NTA= 0

RECESSION DATA

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

UNIT HYDROGRAPH 67 END-OF-PERIOD ORDINATES, LAG= 3.25 HOURS, CP= .66 VOL= 1.00

11.	42.	85.	135.	190.	248.	308.	368.	421.	463.
493.	513.	520.	515.	491.	452.	413.	378.	345.	316.
288.	264.	241.	220.	201.	184.	168.	154.	141.	129.
117.	107.	98.	90.	82.	75.	69.	63.	57.	52.
48.	44.	40.	37.	33.	31.	28.	26.	23.	21.
19.	18.	16.	15.	14.	12.	11.	10.	10.	9.
8.	7.	7.	6.	6.	5.	5.			

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.13	23.74	2.39	240115.
										(664.)	(603.)	(61.)	(6799.30)

S7 6

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

HYDROGRAPH ROUTING

ROUTING THROUGH ROSENSACK

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	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	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	480.	0

SURFACE AREA=	0.	3.	7.
CAPACITY=	0.	21.	118.
ELEVATION=	455.	480.	500.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
480.0	125.0	3.2	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
480.0	3.0	1.5	125.

PEAK OUTFLOW IS 1625. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 2439. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 3252. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 4065. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 4879. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 5692. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 6505. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 7318. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 8131. AT TIME 42.75 HOURS

Sh 7

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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)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .20	RATIO 2 .30	RATIO 3 .40	RATIO 4 .50	RATIO 5 .60	RATIO 6 .70	RATIO 7 .80	RATIO 8 .90	RATIO 9 1.00
HYDROGRAPH AT	INFLOW	3.90	1	1627.	2440.	3253.	4067.	4880.	5693.	6506.	7320.	8133.
		(10.10)		(46.06)(	69.09)(	92.12)(	115.15)(	138.18)(	161.21)(	184.24)(	207.27)(	230.30)
ROUTED TO	DAM	3.90	1	1625.	2439.	3252.	4065.	4879.	5692.	6505.	7318.	8131.
		(10.10)		(46.02)(	69.07)(	92.09)(	115.12)(	138.15)(	161.17)(	184.20)(	207.22)(	230.25)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	480.00	480.00	487.00
STORAGE	21.	21.	45.
OUTFLOW	0.	0.	10371.

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
.20	482.63	0.00	27.	1625.	0.00	42.75	0.00
.30	482.67	0.00	29.	2439.	0.00	42.75	0.00
.40	483.23	0.00	31.	3252.	0.00	42.75	0.00
.50	483.75	0.00	32.	4065.	0.00	42.75	0.00
.60	484.23	0.00	34.	4879.	0.00	42.75	0.00
.70	484.69	0.00	36.	5692.	0.00	42.75	0.00
.80	485.13	0.00	37.	6505.	0.00	42.75	0.00
.90	485.55	0.00	39.	7319.	0.00	42.75	0.00
1.00	485.95	0.00	40.	8131.	0.00	42.75	0.00

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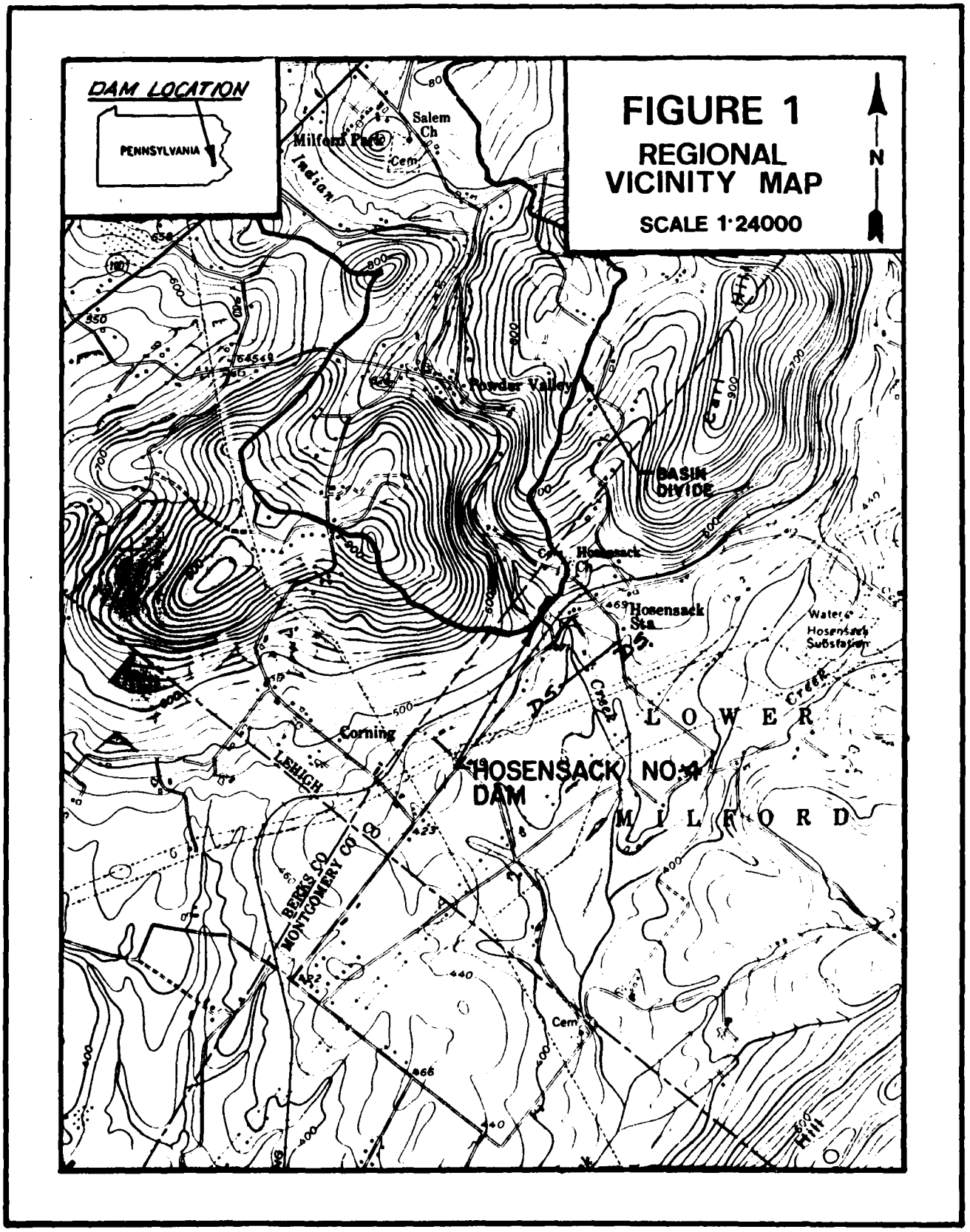
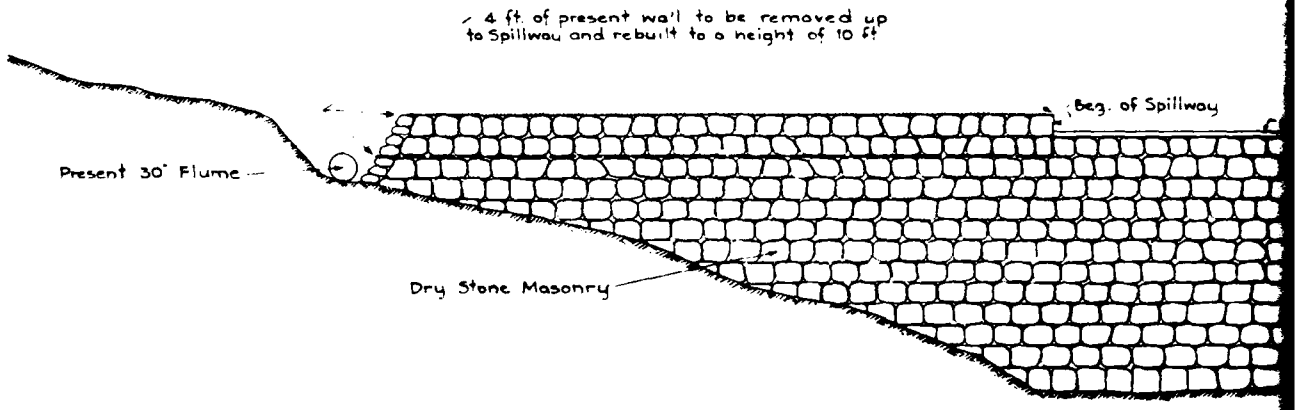
APPENDIX E

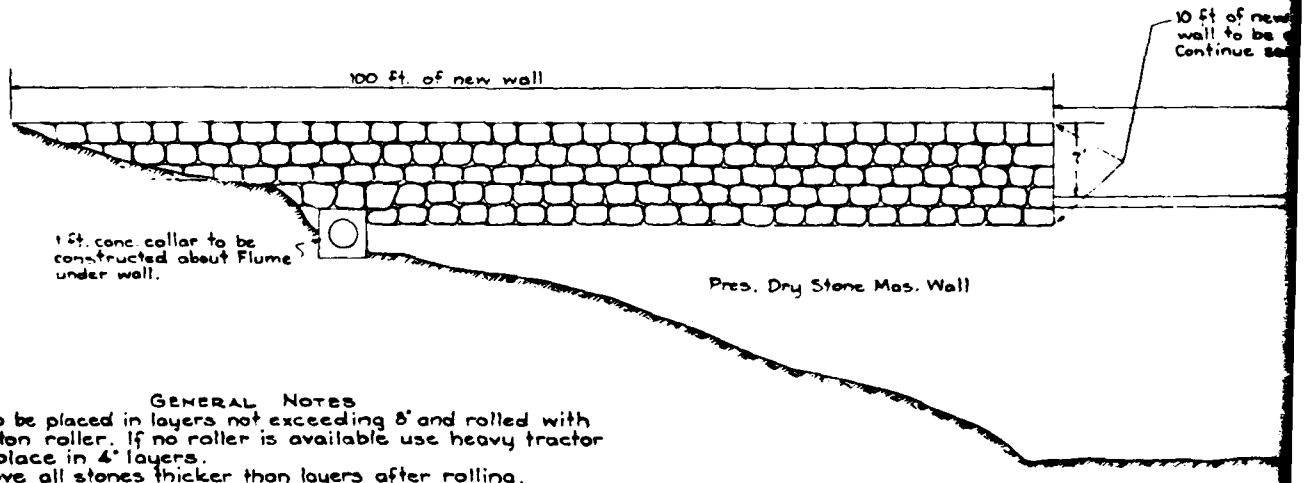
REGIONAL VICINITY MAP
&
DRAWINGS


DAM LOCATION
PENNSYLVANIA
FIGURE 1
REGIONAL
VICINITY MAP
SCALE 1:24000
N
Salem
Ch
Cem
Milford Park
Indian
Powder Valley
DIVIDE
Hosensack
Ch
Hosensack
Sta
Water
Hosensack
Substation
Corning
LEHIGH
HOSENSACK NO. 4
DAM
L O W E R
M I L F O R D
BERKS CO
MONTGOMERY CO
Cem
Hill

RECO

POWDER V



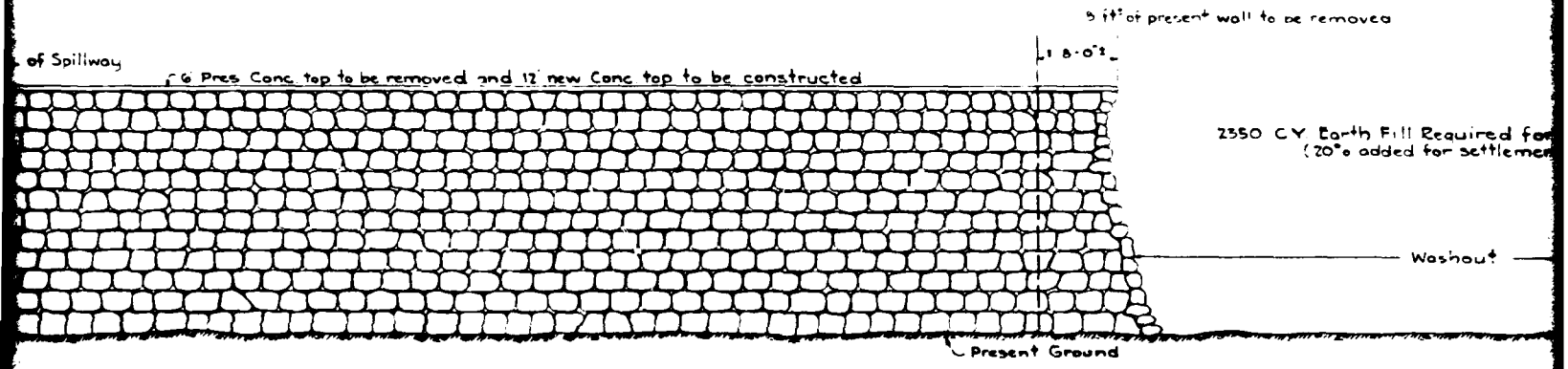


GENERAL NOTES

Fill to be placed in layers not exceeding 8" and rolled with a 10 ton roller. If no roller is available use heavy tractor and place in 4" layers.
Remove all stones thicker than layers after rolling.
Cut-off trench not to be back filled until approval has been given by the Water and Power Resources Board.

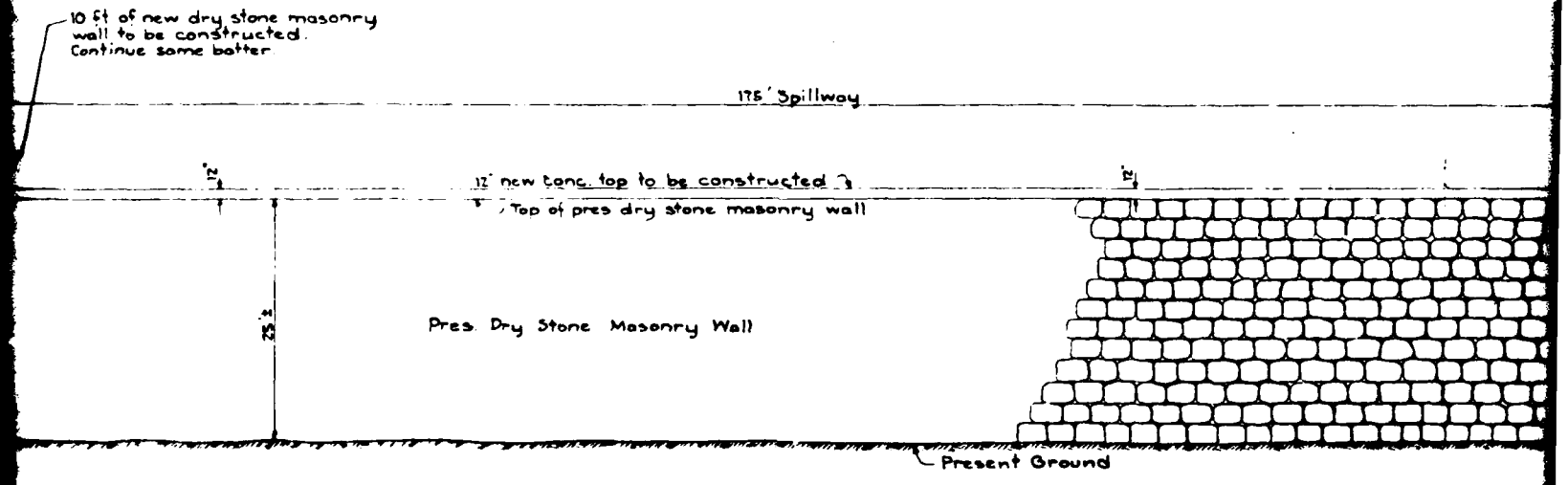
PLAN OF PROPOSED
RECONSTRUCTION OF STAHL'S DAM

LOCATED ON INDIAN CREEK
A TRIBUTARY TO HOSENSACK CREEK
OWDER VALLEY - UPPER MILFORD & LOWER MILFORD TWPS.
LEHIGH COUNTY



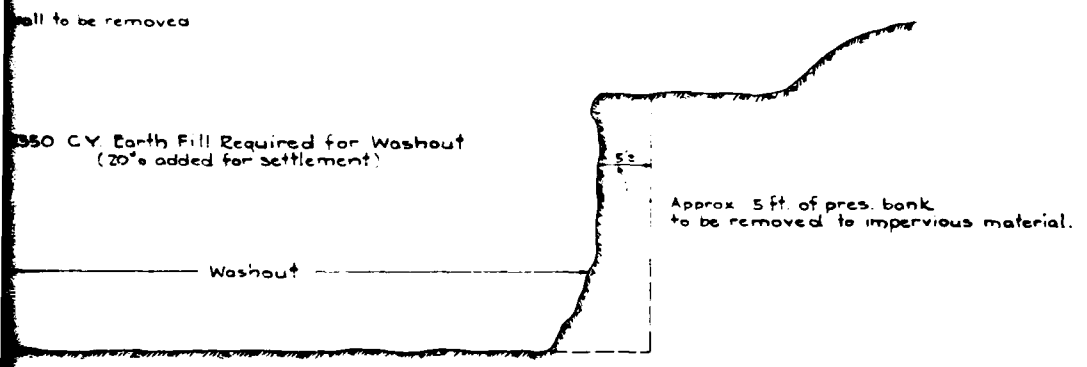
DOWNSTREAM ELEVATION A-A
(Present Condition)

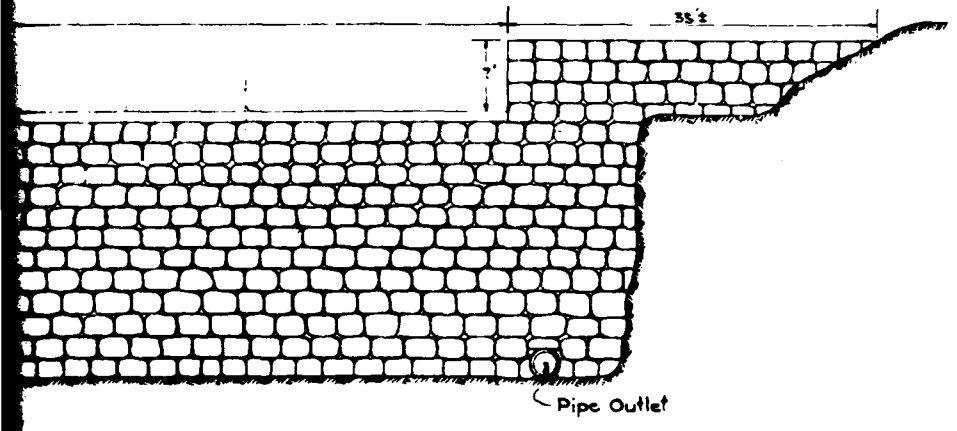
Scale
1" ≈ 17' (For this reduced drawing)



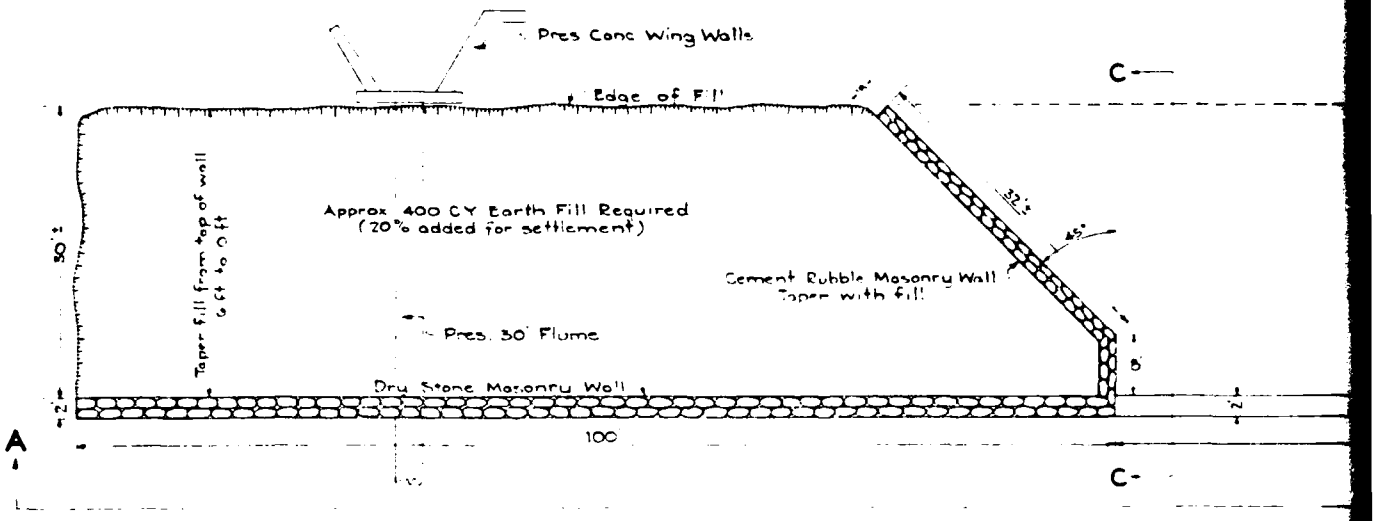
DOWNSTREAM ELEVATION A-A
(Completed)

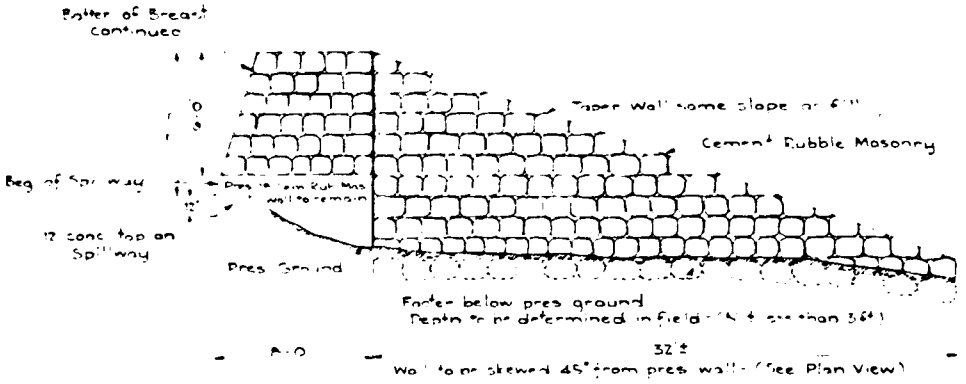
Scale
1" = 17' (For this reduced drawing)


all to be removed
350 C.Y. Earth Fill Required for Washout
(20% added for settlement)
5'±
Approx. 5 ft. of pres. bank
to be removed to impervious material.
Washout

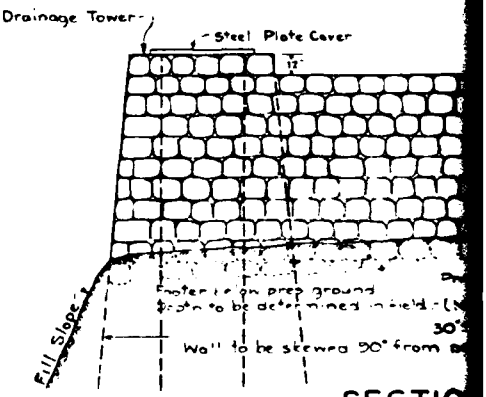

35'±
7'
Pipe Outlet

Sheet 2

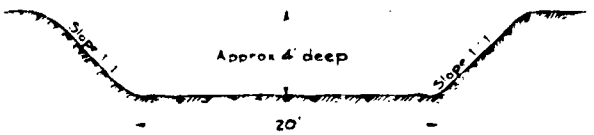




SECTION C-C

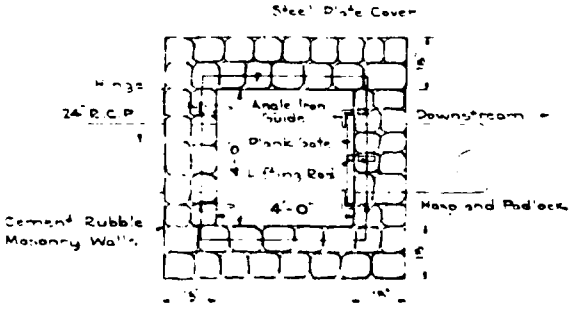


SECTIO



CHANNEL SECTION

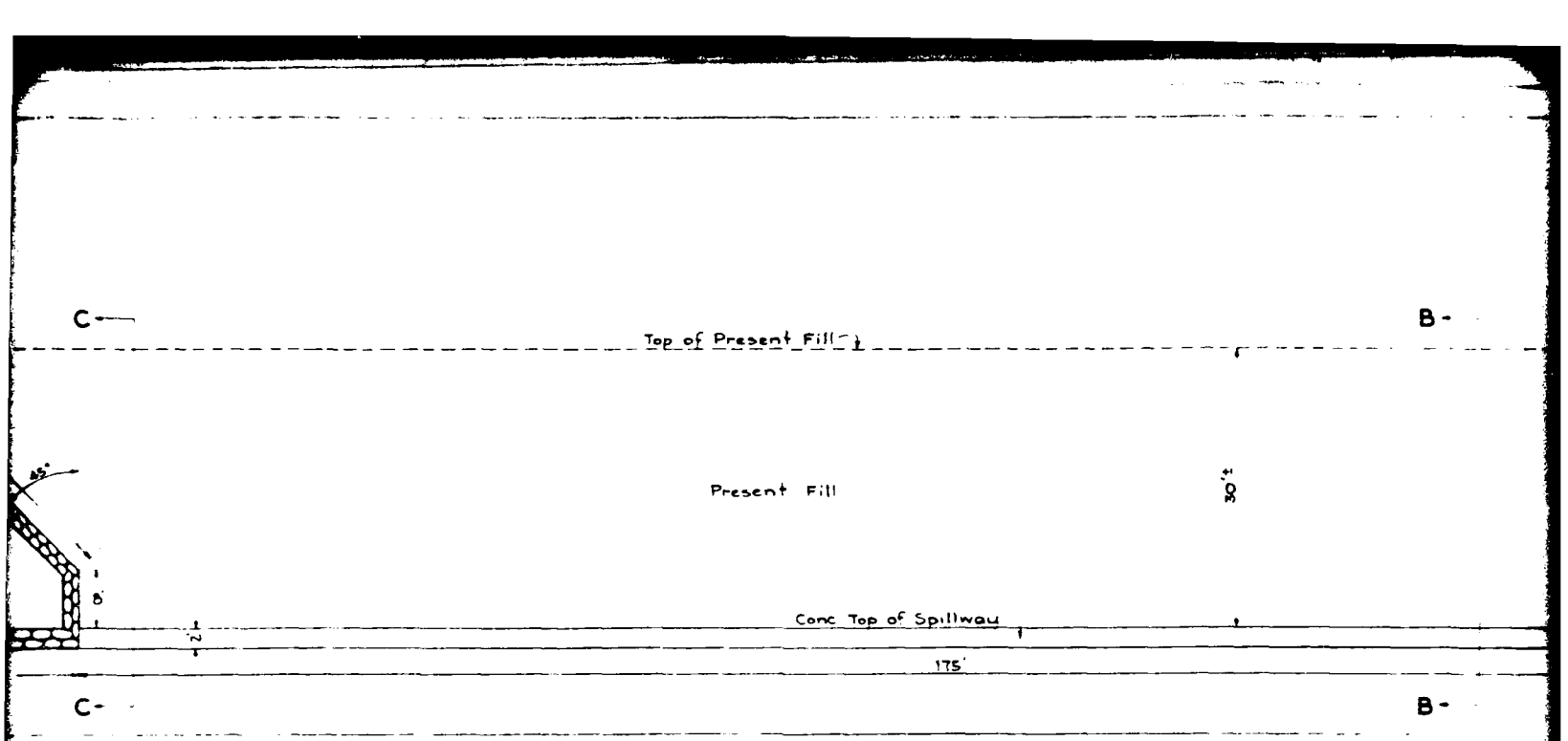
Approx 1070 Cu Yds Excav for cleaning channel of flood debris, consisting of large and small stones, etc., a distance of 300'±.



TOP VIEW OF DRAINAGE TOWER

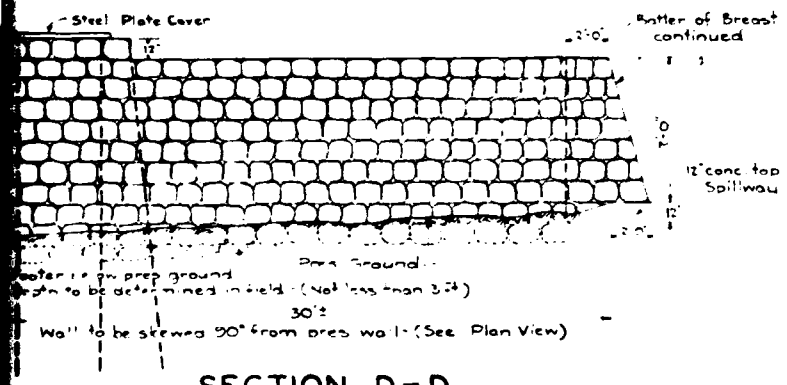
24 R.C.P.

CROSS SECT

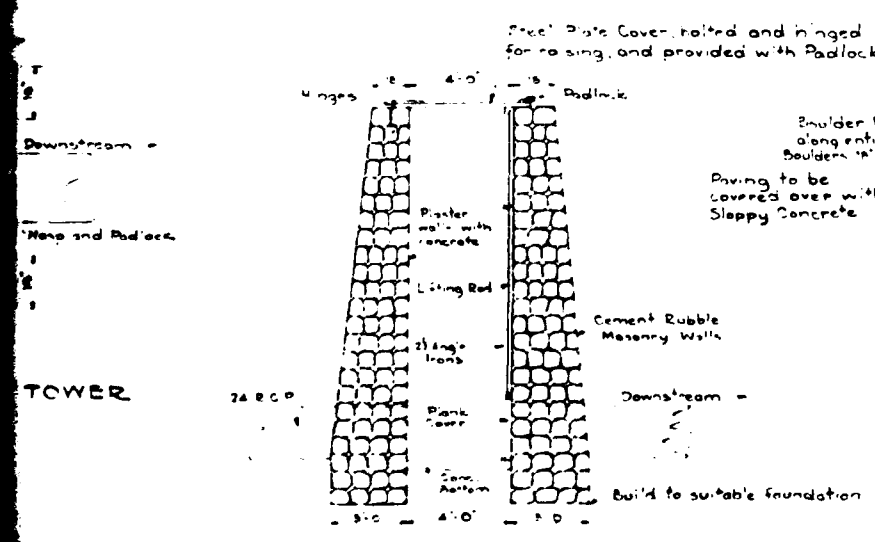


PLAN VIEW

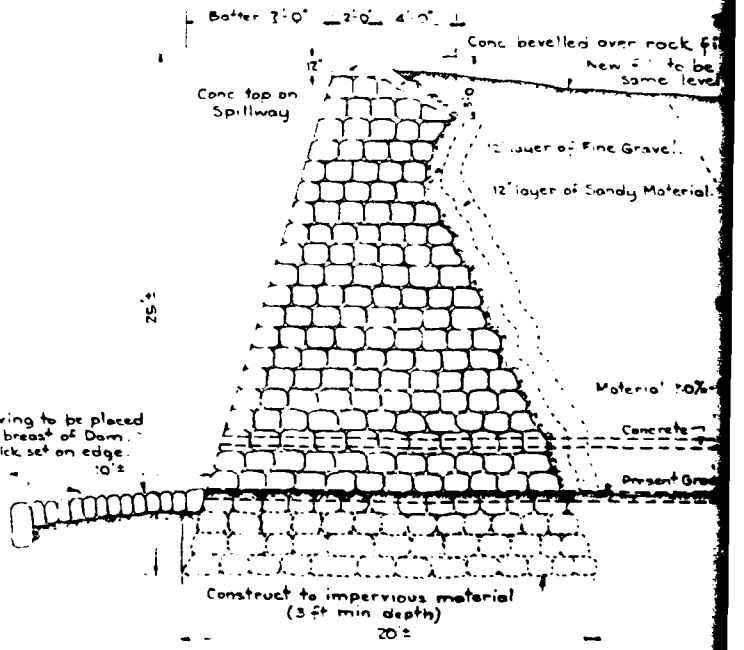
Scale
1" ≈ 17' (For this reduced drawing)



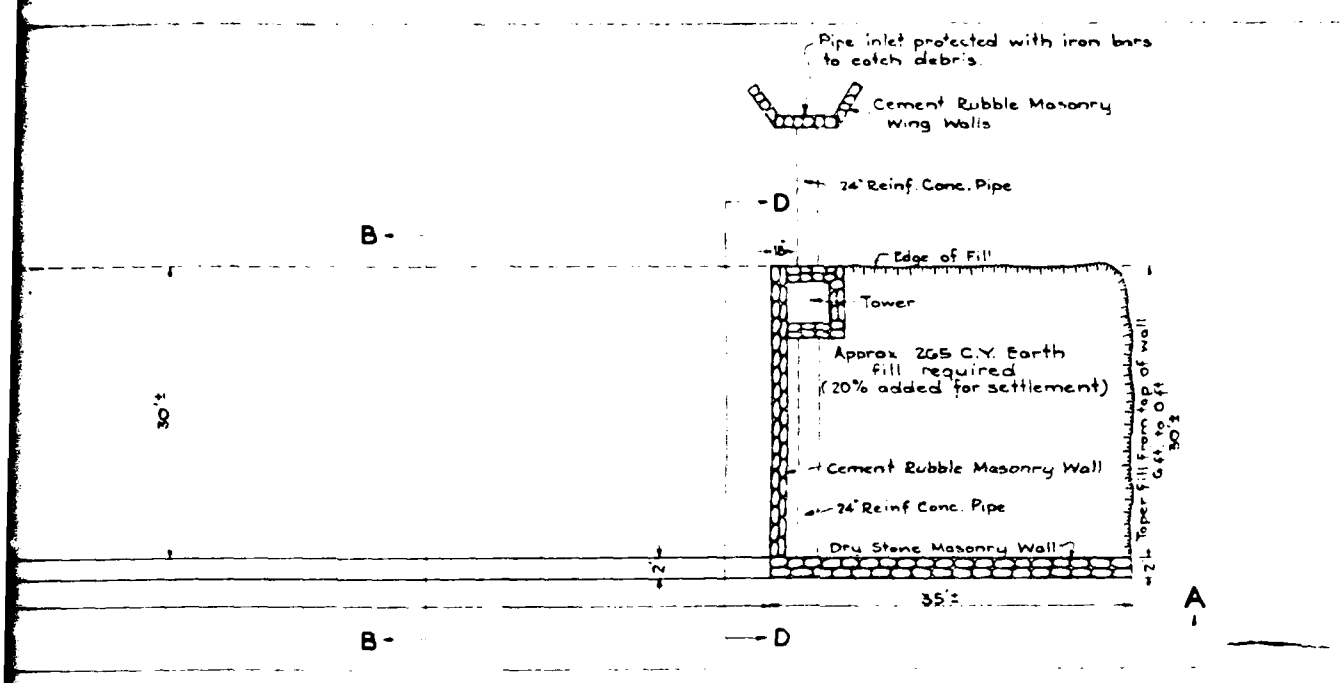
SECTION D-D

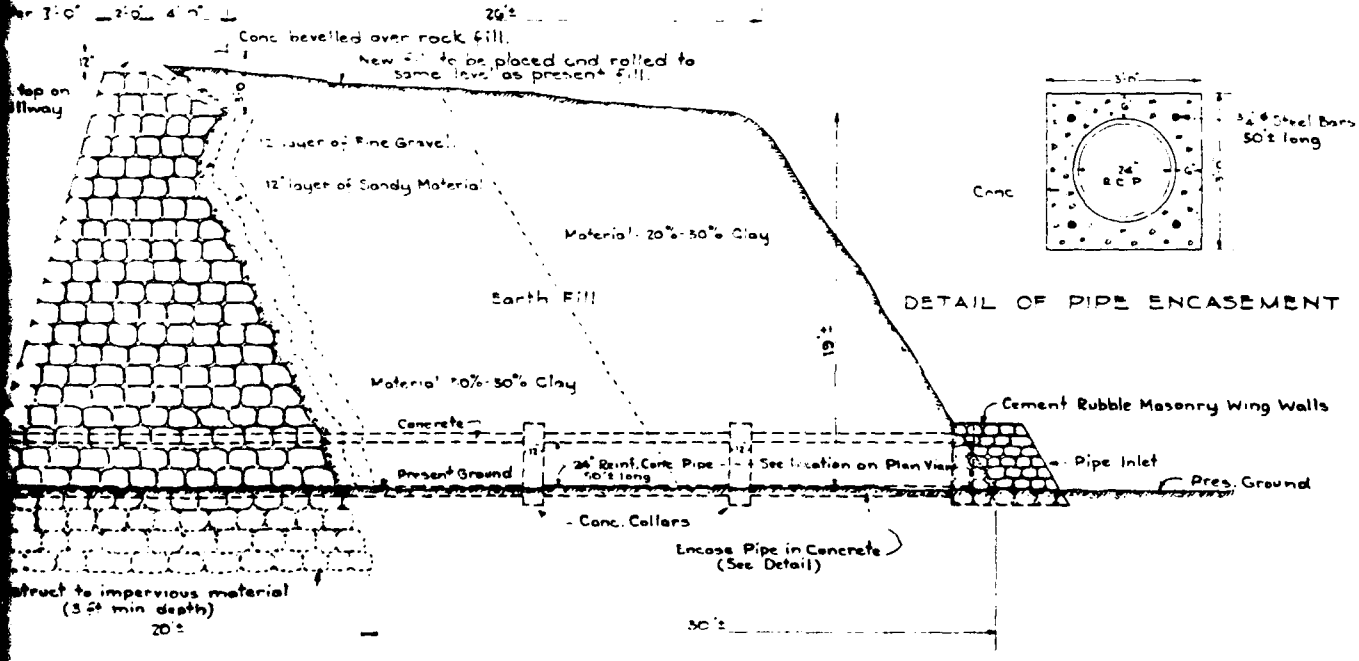


CROSS SECTION VIEW OF DRAINAGE TOWER
(See Plan View for location)



SECTIO
SHOWING CONSTRUC
PLACEMENT OF FI





SECTION B-B

SHOWING CONSTRUCTION OF DAM BREAST
PLACEMENT OF FILL AND PIPE DETAIL

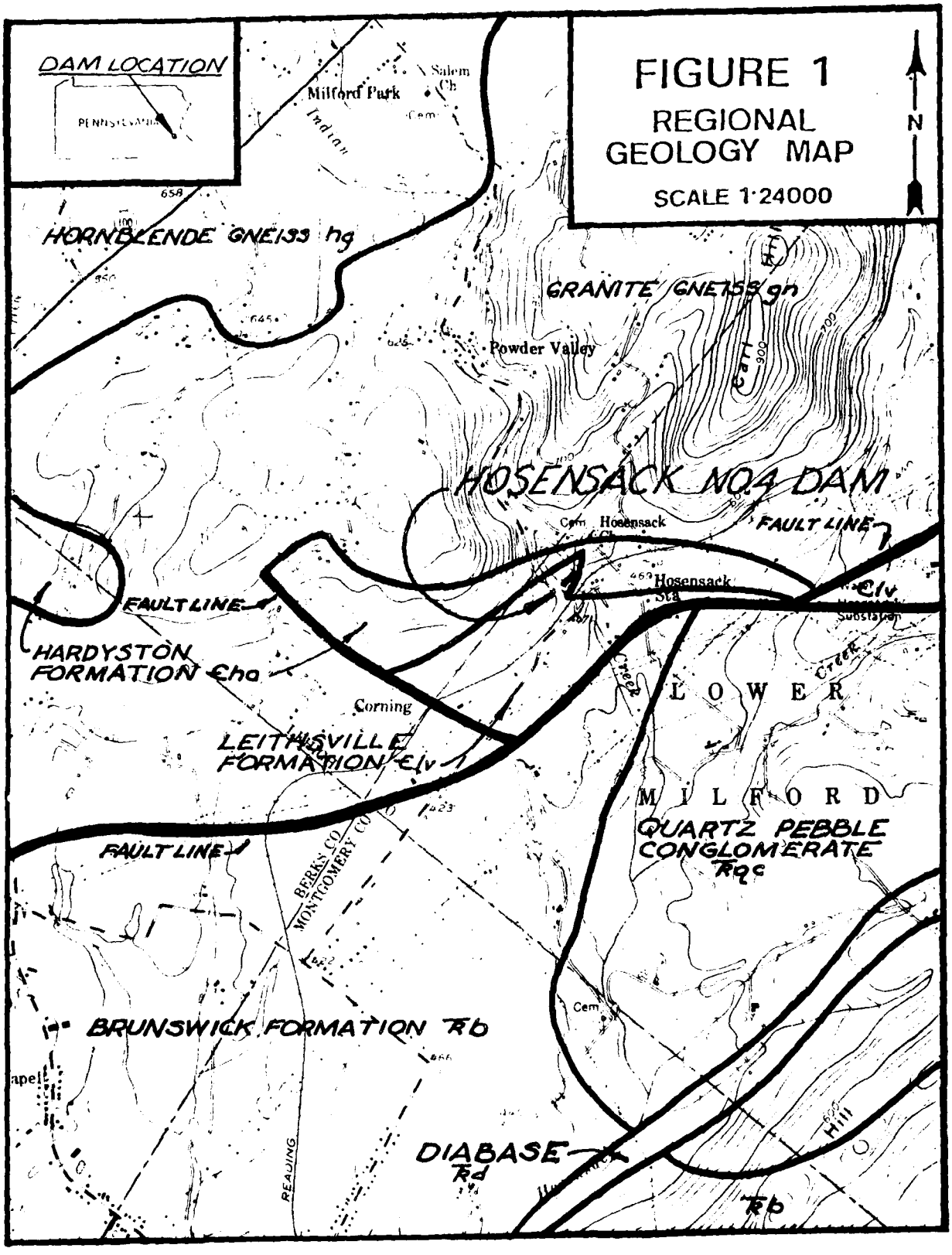
APPENDIX F

GEOLOGY

SITE GEOLOGY

HOSENSACK NO. 4 DAM

Hosensack No. 4 Dam is located in the New England Upland Section Physiograph Province. As shown in Figure 1, bedrock of the dam site is composed of massive dolomite with thin shaly interbeds of the Leithsville Formation and quartzite with conglomerate at the base of the Hardston Formation. Both of these formations are of the Cambrian age's Great Valley group. An apparently inactive fault is located about 1,200 feet downstream of the dam.


DAM LOCATION
PENNSYLVANIA
FIGURE 1
REGIONAL
GEOLOGY MAP
SCALE 1:24000
N
Milford Park
Salem Ch
Cem
Indian
HORNBLENDE GNEISS hg
GRANITE GNEISS gn
Powder Valley
HOSENSACK NO.4 DAM
Cem
Hosensack
Ch
FAULT LINE
Hosensack
Sta
Clv
Substation
FAULT LINE
HARDYSTON
FORMATION €ho
Corning
LEITHSVILLE
FORMATION €lv
L O W E R
M I L F O R D
QUARTZ PEBBLE
CONGLOMERATE
Rqc
FAULT LINE
BERKS CO.
MONTGOMERY CO.
BRUNSWICK FORMATION Rb
Cem
DIABASE
Rd
READING
Hill
Rb