

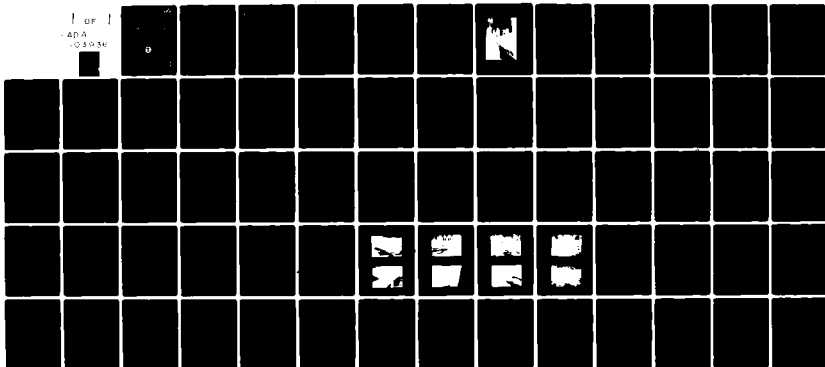
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NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13  
NATIONAL DAM SAFETY PROGRAM. PENWELL MILL DAM (NJ 00781). DELAN--ETC(U)  
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DELAWARE RIVER BASIN  
MUSCONETONG RIVER,  
HUNTERDON COUNTY  
NEW JERSEY

# PENWELL MILL DAM

## NJ 00781

### PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM



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DEPARTMENT OF THE ARMY

Philadelphia District  
Corps of Engineers  
Philadelphia, Pennsylvania

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MAY 1981

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DEPARTMENT OF THE ARMY  
 PHILADELPHIA DISTRICT, CORPS OF ENGINEERS  
 CUSTOM HOUSE - 20 & CHESTNUT STREETS  
 PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO  
 NAPEN-N

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

11-1-68

Dear Mr. O'Dowd:

We are forwarding, for your information, under separate cover the available copies of the Final Report for Penwell Mill Dam, NJ00781. Since the dam does not meet the size criteria for inclusion in the National Inventory of Dams, a Corps of Engineers Assessment has not been prepared. The report does, however, provide a valid indication of the condition of the dam.

Sincerely,

1 Incl (14 cys)  
 As stated fwd sep

D. J. SHERIDAN  
 Chief, Planning/Engineering Division

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DELAWARE RIVER BASIN  
MUSCONETCONG RIVER, HUNTERDON COUNTY  
NEW JERSEY

PENWELL MILL DAM

NJ00781

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Penwell Mill Dam (NJ 00781). Delaware River  
Basin, Musconetong River. Hunterdon County,  
New Jersey. Phase I Inspection Report.

*15-200-1-1-981*

DEPARTMENT OF THE ARMY  
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS  
PHILADELPHIA, PENNSYLVANIA 19106

MAY 1981

*1/10/81* *1/15/81* *4/12/81*

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name: Penwell Mill Dam, I.D. NJ 00781  
State Located: New Jersey  
County Located: Hunterdon County  
Stream: Musconetcong River  
River Basin: Delaware River Basin  
Date of Inspection: January 12 and February 3, 1981

Assessment of General Conditions

Penwell Mill Dam is a concrete dam spanning the Musconetcong River. It is comprised of two overflow spillways separated by a small island. To the left of the dam are three timber stop plank sluice ways. The sluice way furthest to the left controls the flow to the mill. The overall condition of the dam is good. There are no major signs of distress. The downstream channel is well defined and in good condition. The hazard potential is recommended to be downgraded to "low".

Penwell Mill Dam is considered inadequate in view of its lack of spillway capacity to pass the SDF (100-year storm) without overtopping the dam. The spillway is capable of passing a flood equal to 7.6 percent of the SDF (100-year storm) and is assessed as "inadequate".

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory. The following actions are recommended along with a timetable for their completion. All recommended actions should be conducted under the supervision of an Engineer who is experienced in the design, construction and inspection of dams.

1. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.
2. Repair all spalled and deteriorated concrete on the abutments and wingwalls of the sluice ways within twelve months.
3. Replace all broken timber stop planks at the sluice ways within twelve months.

4. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

Furthermore, while of a less urgent nature, the following additional actions are recommended and should be carried out within twelve months.

1. The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.
2. Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam to form a coherent as-built set.



John P. Talerico, P.E.  
HARRIS-ECI ASSOCIATES



Photo taken February 3, 1981

P E N W E L L   M I L L   D A M

View of dam looking towards the right from the low-level outlet.

## 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 the 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 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 reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide 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 PROGRAM

PENWELL MILL DAM, I.Q. NJ 00781

S E C T I O N 1

1. PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers, and was carried out by the engineering firm of Harris-ECI Associates, Woodbridge, New Jersey.

b. Purpose of Inspection

The visual inspection of Penwell Mill Dam was made on January 12 and February 3, 1981. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

Penwell Mill Dam is a concrete dam about 239 feet in length. There is a 90 foot concrete spillway at the dam's right side and an 85 foot spillway, 1-inch higher than the right spillway, at the dam's left side. The two spillways are separated by an island approximately 64 feet wide in the river channel. To the immediate left of the left spillway is a 6 foot wide sluice way consisting of two concrete walls and timber stop planks. The stop planks are slotted into the bottom of the sluice way, and held in place by a vertical and a horizontal I beam. Adjacent to this sluice way is a 70 foot island.

On the island's left side is a second 6 foot sluice way consisting of two concrete walls and timber stop planks, which are held in place in the same manner as the other sluice way. Adjacent to this sluice way is an 8 foot section of the river bank that connects to a 12 foot wide outlet which supplies water to Penwell Mill by way of a raceway. The flow to the mill is controlled by timber stop planks. The planks are held in place by slots in the concrete wingwalls at the ends and a vertical steel I beam in the center. The concrete walls are 2.5 feet thick by 7 feet on the left and 5.5 feet on the right. The distance from the top of the walls to the spillway crest varies from 2 to 2.5 feet.

The flow from the sluice way adjacent to the left spillway discharges into the downstream channel at the bottom of the spillway. The flow from the other sluice way discharges into a narrow channel that meets the main channel (Musconetcong River) approximately 70 feet downstream from the spillway.

The Musconetcong River continues passing under the Penwell Road bridge through an 6.5 foot x 76 foot opening, approximately 400 feet downstream from the spillway.

A generalized description of the soil conditions is contained in Report No. 6, Hunterdon County, Engineering Soil Survey of New Jersey, by Rutgers University. The report dated 1952 describes the river area soil as recent alluvium. Recent alluvium can be described as materials with a wide range of grain sizes which often have been sorted into rough intermingled layers by successive stages of water action. The underlying formation is limestone of varying thickness with a depth to bedrock of greater than 10 feet. The NJ Department of Environmental Protection Geologic Overlay Sheet 24 describes the underlying rock as Undifferentiated Cambro-Ordovician.

b. Location

Penwell Mill Dam is located on the Musconetcong River in the Township of Lebanon, Hunterdon County, New Jersey. It is accessible from Route 57 at Penwell by way of Penwell Road.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "small", since its storage volume of 4 acre-feet is less than 1,000 acre-feet. The dam is also classified as "small" because its height of 6 feet is less than 40 feet. The overall size classification of Penwell Mill Dam is "small".

d. Hazard Classification

A hazard classification of "low" has been assigned to the dam. This is based on the fact that a hypothetical failure would not result in damage

to the one house 600 feet downstream on the left and four houses 2,000 feet downstream on the right and no loss of life can be expected in the event of dam failure.

e. Ownership

Penwell Mill Dam is owned by:

Isabella Thomas  
R.D.I, Box 46  
Port Murray, NJ 07865

Attention: Ralph B. Thomas  
(201)689-0353

f. Purpose

Penwell Mill Dam is presently used to supply water power to Penwell Mill.

g. Design and Construction History

Penwell Mill Dam was constructed as a timber crib-rock fill dam with timber overflow spillways, in 1861. An inspection in June of 1943, showed that a new plank crest and some concrete work at the left end had been done. In 1972 the left spillway was concreted and the right spillway was concreted in 1976.

h. Normal Operating Procedures

The discharge from the dam is unregulated and is allowed to naturally balance the inflow from the river.

1.3 Pertinent Data

a. Drainage Area 105.9 sq. miles

b. Discharge at Dam Site

Ungated spillway capacity at elevation of top of dam: 498 cfs (410.5 NGVD)

Total spillway capacity at maximum pool elevation (SDF): 6,590 cfs (413.31 NGVD)

c. Elevation (Feet above NGVD)

Top of dam: 410.5  
Maximum pool design surcharge (SDF): 413.31  
Recreation pool: 409.67  
Spillway crest: 409.67  
Streambed at centerline of dam: 404.5 (Estimated)  
Maximum tailwater: 406 (Estimated)

d. Reservoir

Length of maximum pool: 350 ft. (Estimated)  
Length of recreation pool: 500 ft. (Estimated)

e. Storage (acre-feet)

Spillway Crest: 3  
Top of dam: 4  
Maximum pool (SDF): 18

f. Reservoir Surface (acres)

Top of dam: 2 (Estimated)  
Maximum pool (SDF): 10 (Estimated)  
Recreation pool: 1.67  
Spillway crest: 1.67 (409.67 NGVD)

g. Dam

Type:	Concrete
Length:	353 ft. (Effective)
Height:	6 ft.
Top width:	Varies
Side slopes - Upstream:	Unknown
- Downstream:	
Zoning:	Unknown
Impervious core:	None
Cutoff:	None
Grout curtain:	None

h. Diversion and Regulating Tunnel

N/A

i. Spillway

Type:	Overflow weir
Length of weir:	Right-90 ft., Left-85 ft.
Crest elevation:	409.67 NGVD
Gates:	None
U/S Channel:	Musconetcong River
D/S Channel:	Musconetcong River

j. Regulating Outlets

Low level outlet:	2 - 6 ft. x 7 ft. deep sluice ways, 12 ft x 5 ft. deep raceway.
Controls:	Timber stop planks
Emergency gate:	None
Outlet:	405 NGVD (Estimated)

## SECTION 2

### 2. ENGINEERING DATA

#### 2.1 Design

There are no drawings or design computations for Penwell Mill Dam available. No data from soil borings, soil tests or other geotechnical data is available. The only information relating to the dam is a copy of an inspection report done by the State Water Policy Commission on file at the Trenton offices of the NJ Department of Environmental Protection (NJ-DEP).

#### 2.2 Construction

Data is not available concerning the as-built construction of the dam. No data exists on the construction methods, borrow sources, or other data pertinent to the construction of the dam.

#### 2.3 Operation

Formal operation records are not kept for the dam. The overflow from the dam is unregulated and the river is allowed to operate naturally.

#### 2.4 Evaluation

##### a. Availability

The availability of engineering data is very poor. The stated information concerning the dam is available from the NJ-DEP.

##### b. Adequacy

The engineering data available together with that obtained in the field, was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform a stability analysis, but preliminary evaluation could be made based on visual observations.

##### c. Validity

Information contained in a previous inspection report and checked by limited field measurement appears to be valid.

## SECTION 3

### 3. VISUAL INSPECTION

#### 3.1 Findings

##### a. General

The visual inspection of Penwell Mill Dam revealed the dam and spillways to be in good condition, but in need of minor repairs. The river level was above the crest of the spillways at the time of the inspection.

##### b. Dam

The right and left sections of the concrete overflow dam appear sound. No spalling or cracks were noticed along the top or downstream face of the dam. No misalignment of the dam in the horizontal or vertical planes was evident. All visible construction joints appeared in good condition.

##### c. Appurtenant Structures

###### 1. Spillways

The entire length of the right and left sections of the dam are the spillways.

###### 2. Outlet Works

Two 6 foot sluice ways serve as low-level outlets. One adjacent to the left spillway and the other 70 feet to the left of the first. Timber stop planks, slotted into the concrete and held in place by a vertical and horizontal I-beam, are used to control the flow through the sluice ways. At both locations the stop planks were broken, allowing water to flow between the planks.

There is minor spalling on the downstream face of the left abutment for the sluice way at the left spillway. The lower portion of the downstream face of both abutments for the left sluice way are heavily spalled and deteriorated exposing the rock fill. The concrete at the water level of both walls has completely deteriorated resulting in undermining of the abutments.

There is also a 12-foot outlet, which supplies water to the mill by way of a raceway, located 8 feet to the left of the second sluice way. Timber stop planks slotted into the concrete and held in place by a vertical I-beam, are used to control the flow. At this location some of the planks were broken allowing water to flow under the flash board instead of over it. The concrete on the downstream face of both wingwalls is heavily spalled.

Minor seepage was observed at the base of the left abutment of the sluice way adjacent to the left spillway.

d. Reservoir Area

Slopes on both sides of the reservoir are steep to flat and partially wooded. There is no indication of slope instability.

e. Downstream Channel

The downstream channel is in good condition. There is a small island immediately downstream in the river channel near the left spillway. The slopes of the river are relatively flat, shallow and wooded.

Approximately 400 feet from the spillway, Penwell Road bridge crosses the channel. There is one house about 600 feet downstream on the river's left bank and another four houses approximately 2,000 feet downstream of the dam on the right bank. All five buildings are above the flood plain.

## SECTION 4

### 4. OPERATIONAL PROCEDURES

#### 4.1 Procedures

Penwell Mill Dam is used to impound water which is used as a power source for Penwell Mill. The level of the impounded water is maintained through the unregulated flow over the spillways.

#### 4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam. The owner of Penwell Mill is responsible for the maintenance of the dam.

#### 4.3 Maintenance of Operating Facilities

The low-level outlets consists of two sluice ways and a raceway to the mill. All three outlets consists of two concrete walls and a series of timber stop planks slotted into the concrete and held in place by steel I-beams. The water level can be lowered by the removal of the stop planks. At the time of inspection there were broken stop planks at all three locations, allowing water to flow through.

#### 4.4 Evaluation

The present operational and maintenance procedures are fair with the dam and spillway being maintained in a serviceable condition.

## SECTION 5

### 5. HYDRAULIC/HYDROLOGIC

#### 5.1 Evaluation of Features

##### a. Design

The drainage area above Penwell Mill Dam is approximately 105.9 square miles. A drainage map of the watershed of the dam site is presented on Plate 1, Appendix D.

The topography within the basin is generally moderate to steeply sloped. Elevations range from approximately 1200 feet above NGVD at the north end of the watershed to about 410 feet at the dam site. Land use patterns within the watershed are mostly undeveloped and wooded with some residential development around the upstream lake areas.

The evaluation of the hydraulic and hydrologic features of the dam was based on criteria set forth in the Corps guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The SDF for the dam is the 100-year storm.

The 100-year Flood was calculated from 100-year precipitation using National Weather Service Hydro - 35 and Technical Paper No. 40. Snyder's coefficients  $C_t = 3.7$  and  $C_p = 0.557$  were used to develop a synthetic unit hydrograph.

Initial and constant infiltration loss rates were applied to the 100-year rainfall to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the 100-year Flood hydrograph utilizing program HEC-1-DB.

The SDF peak outflow calculated for the dam is 6,590 cfs. This value is derived from the 100-year flood, and results in overtopping of the dam, assuming that the lake was originally at the spillway crest elevation.

The stage-outflow relation for the spillway was determined from the geometry of the spillway and dam, utilizing HEC-1-Dam Safety Version program.

The reservoir stage-storage capacity relationship was computed directly by the conic method, utilizing the HEC-1-DB program. The reservoir surface areas at various elevations were measured by planimeter from a U.S.G.S. Quadrangle topographic map. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based on the assumption that the dam remains intact during routing. The spillway rating curve is presented in the Hydrologic Computation, Appendix D.

Drawdown calculations indicate that to empty the lake to an elevation of 406 NGVD through the three stop plank outlets would take 4.5 minutes, assuming a 2 cfs/square mile inflow. This is not considered to be an excessive drawdown period.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site.

c. Visual Observation

The downstream channel, of the Musconetcong River, is fairly wide with relatively flat, shallow and wooded slopes. The river passes under Penwell Road 400 feet downstream of the dam. There is one house 600 feet downstream of the dam on the left and four houses 2000 feet downstream on the right.

The side slopes of the reservoir are steep to flat and do not exhibit any signs of instability. The drainage area is wooded and moderately to steeply sloped.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 2.81 feet. Computations indicate that the dam can pass approximately 7.6 percent of the 100-year storm without overtopping the dam crest. Since the 100-year storm is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the spillway capacity of the dam is assessed as "inadequate".

## SECTION 6

### 6. STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability

##### a. Visual Observations

At the time of inspection Penwell Mill Dam did not exhibit any visible signs of major distress. There was no evidence of tilting, misalignment or movement on the foundation. Minor seepage was observed near the base of the downstream face of the left abutment of the sluice way adjacent to the left spillway. There was some spalling and patchwork on the downstream abutment faces at all three outlets. In addition, at the left sluice way, the concrete has deteriorated at the water level on both walls causing undermining of the walls. Numerous trees are growing on the islands between the spillways and between the sluice ways.

##### b. Design and Construction Data

No design computations were uncovered during the report preparation phase. No construction data, plans or geotechnical data are available for carrying out a conventional stability analysis on the dam.

##### c. Operating Records

No operating records are available relating to the stability of the dam.

##### d. Post-Construction Changes

In 1972 the left spillway was concreted and in 1976 the right spillway was concreted.

##### e. Static Stability

A static stability analysis was not performed for Penwell Mill Dam because the lack of data on which to base assumptions of material properties within embankment zones might produce misleading results, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist, and based on the findings of the visual inspection, the preliminary assessment of the static and seismic stabilities is that they are satisfactory.

## SECTION 7

### 7. ASSESSMENT/REMEDIAL MEASURES

#### 7.1 Dam Assessment

##### a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

Penwell Mill Dam is inadequate because the dam does not have the spillway capacity to pass the SDF, 100-year storm, without overtopping. The present spillway capacity of the dam is approximately 7.6 percent of the 100-year storm.

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment material engineering properties, but based on the findings of the visual inspection, preliminary assessment of the static stability is that it is satisfactory.

##### b. Adequacy of Information

The information uncovered was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even an approximate computation of the stability of the dam. A preliminary assessment of the dam could be made by visual observation only.

##### c. Urgency

The remedial measures and recommended actions along with a timetable for their completion are detailed below. All recommended action should be conducted under the supervision of an engineer who is experienced in the design, construction and inspection of dams.

#### 7.2 Remedial Measures

##### a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway capacity are not required as the hazard potential of the dam is rated as "low".

b. Recommendations

1. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.
2. Repair all spalled and deteriorated concrete on the abutments and winwalls of the sluice ways within twelve months.
3. Replace all broken timber stop planks at the sluice ways within twelve months.

The following additional actions are recommended:

1. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.
2. Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam to form a coherent as-built set.

c. O & M Procedures

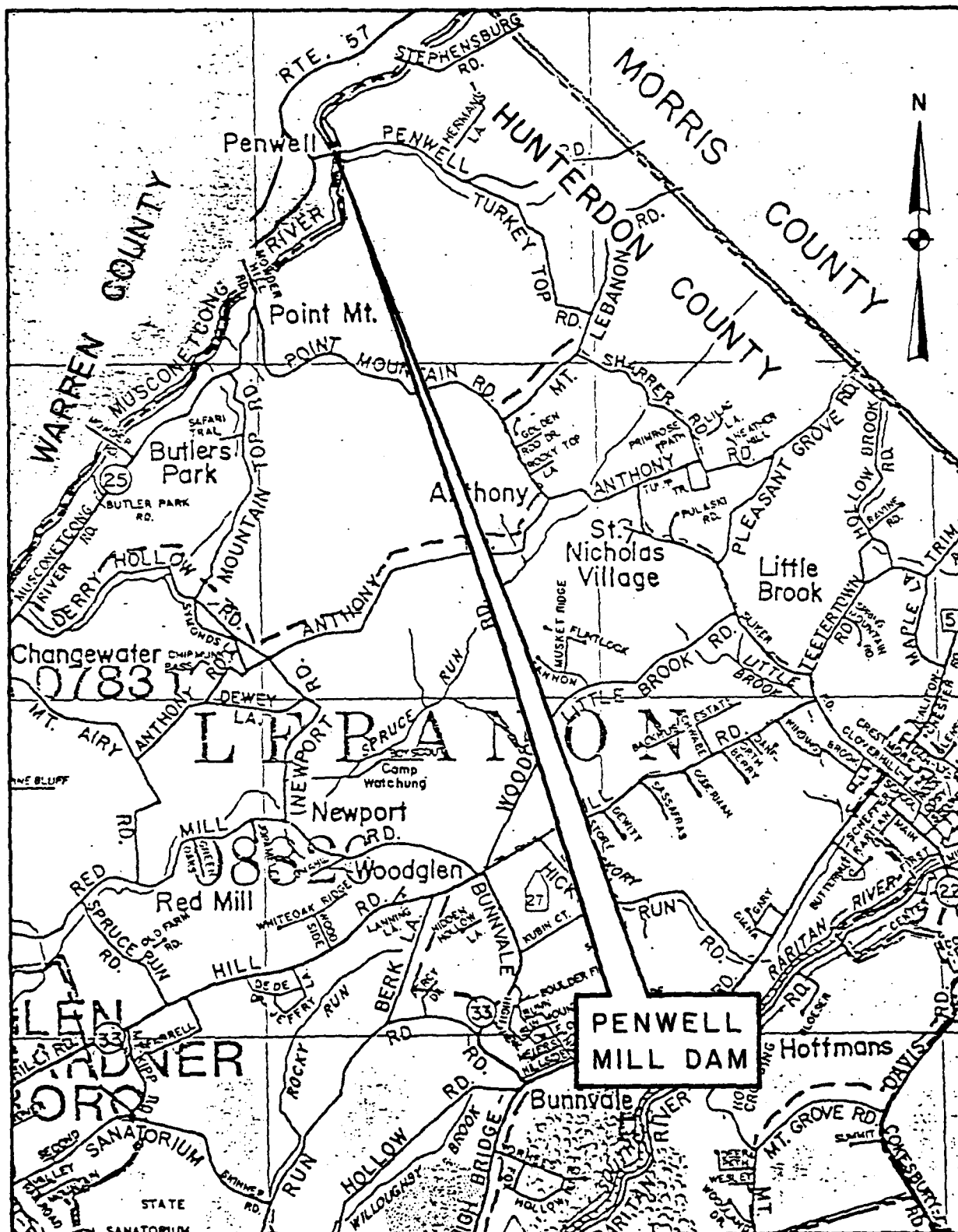
The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

P L A T E S

PENWELL MILL DAM  
LEBANON TOWNSHIP  
HUNTERDON CO., N. J.

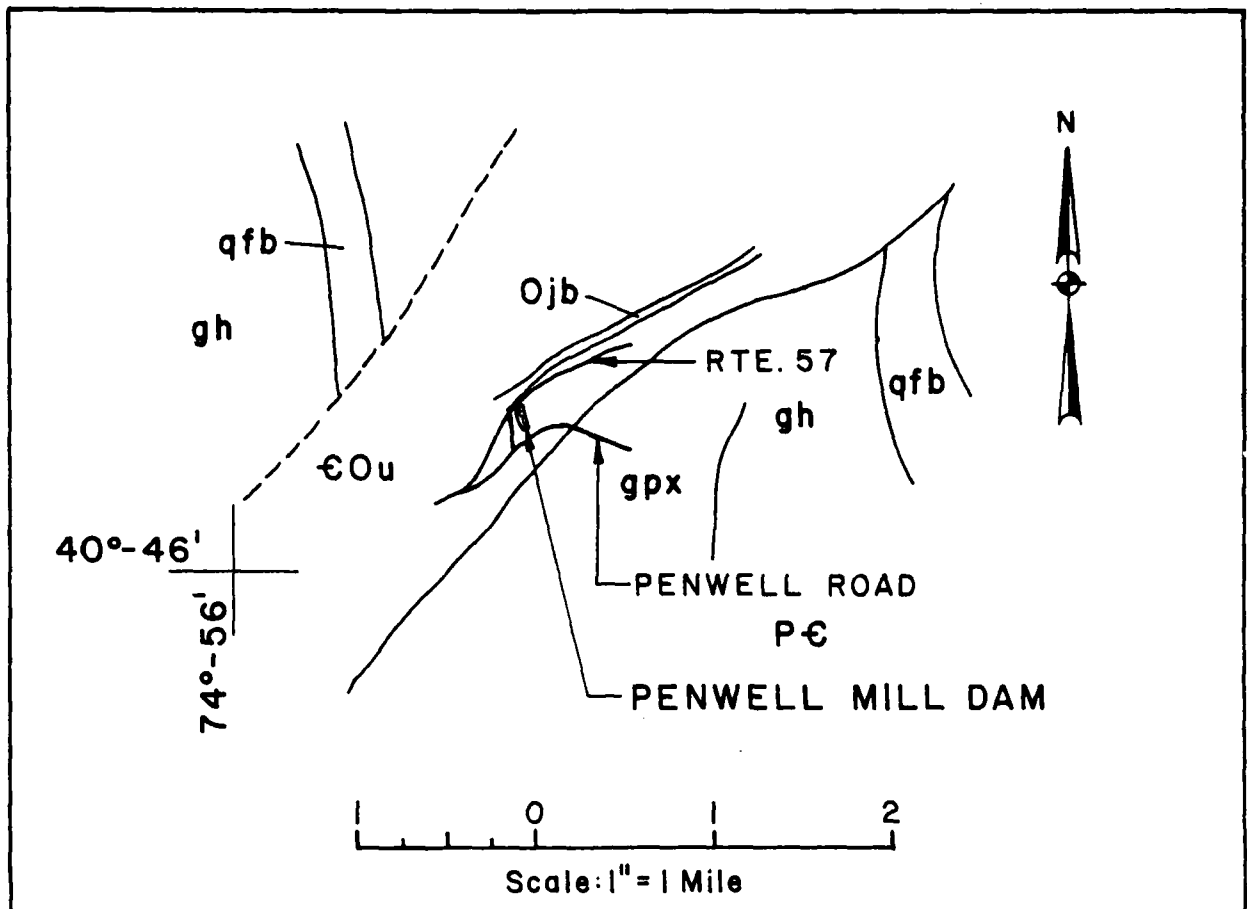


KEY MAP



Scale in Miles (Approx.)

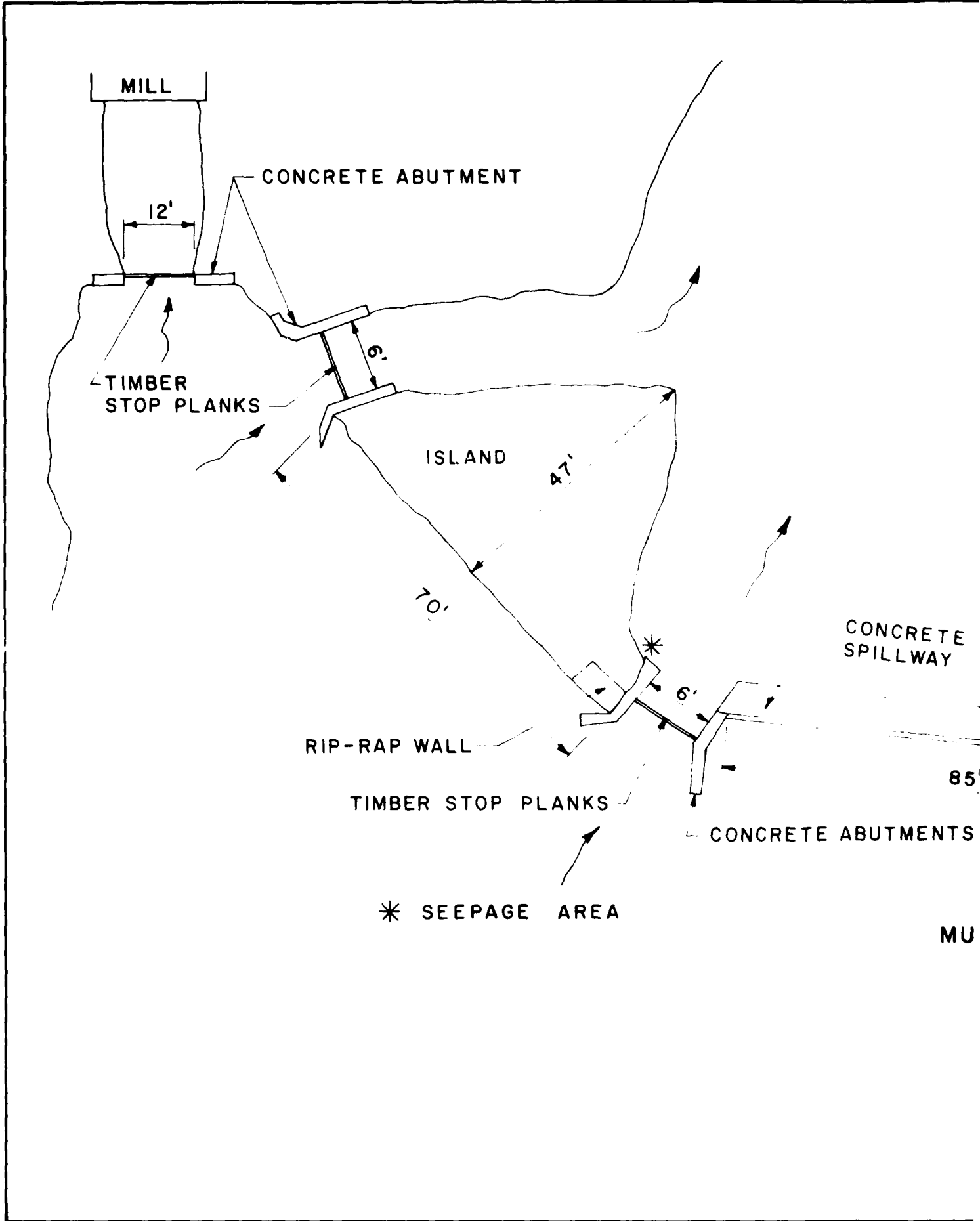




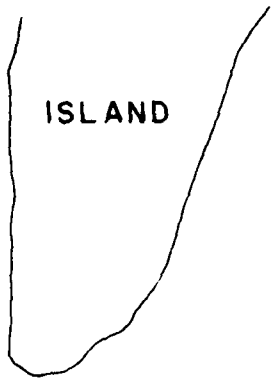
**LEGEND**

- ORDOVICIAN**  
 Ojb Jacksonburg Formation
- CAMBRO-ORDOVICIAN**  
 €Ou Undifferentiated Cambro-Ordovician
- PRE-CAMBRIAN**  
 P€ Undifferentiated Pre-Cambrian
- gh Hornblende Granite  
 gpx Pyroxene Gneiss  
 qfb Quartz-Feldspar-Biotite Gneiss
- FAULT**  
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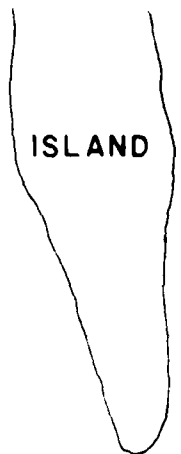
**GEOLOGIC MAP  
 PENWELL MILL DAM**



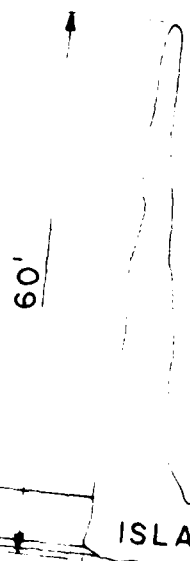
MU



ISLAND



ISLAND



60'

ISLAND

CONCRETE OVERFLOW  
SPILLWAY

STONE WALL

CONCRE

85'

ABUTMENTS

64'

MUSCONETCONG RIVER

PLAN

SCALE: 1" = 20'

ISLAND

N

GUIDE  
RAIL

CONCRETE OVERFLOW SPILLWAY

E WALL

90'

ROADWAY

PENWELL MILL DAM  
LEBANON TWP., HUNTERDON COUNTY, N.J.

SKETCH OF PLAN  
PREPARED FROM FIELD NOTES TAKEN  
DURING INSPECTION ON JAN 12, 1981

BY  
HARRIS-ECI ASSOCIATES  
WOODBIDGE, N J

SCALE AS SHOWN  
DATE FEB 1981  
SHEET 1 OF 1

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION  
MAINTENANCE DATA

CHECK LIST  
VISUAL INSPECTION  
PHASE 1

Name Dam Penwell Mill Dam County Hunterdon State New Jersey Coordinators NJ-DEP

Date(s) Inspection January 12, 1981 Weather Clear Temperature -10° F  
February 3, 1981 Cloudy 20° F

Pool Elevation at Time of Inspection 409.7 NGVD Tailwater at Time of Inspection 406 NGVD

Inspection Personnel:

January 12, 1981  
February 3, 1981  
William Birch  
Thomas Moroney  
Joseph Sirianni (Recorder)  
Thomas Moroney

OWNER/REPRESENTATIVE:

Harold Thomas  
R.D.I. Box 46  
Port Murray, NJ 07865  
(Did not attend)

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE None observed	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS Minor seepage observed at base of downstream face of left abutment of sluice way adjacent to left spillway.	Monitor for clearness and quantity.
DRAINS None.	
WATER PASSAGES None.	
FOUNDATIONS Unknown.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	None observed. Water flowing over spillway.	
STRUCTURAL CRACKING	None observed.	
VERTICAL & HORIZONTAL ALIGNMENT	Horizontal and vertical alignments appeared good for both spillways.	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	Good.	

EMBANKMENT

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS AND RECOMMENDATIONS

EARTH EMBANKMENT

Island between spillways with some trees, also island between outlets 1 and 2 with some trees growing on it.

JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM

Good.

ANY NOTICEABLE SEEPAGE

None.

STAFF GAGE AND RECORDER

None.

DRAINS

None.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	None visible stilling basins were under water.	
INTAKE STRUCTURE	3 stop plank structures. First two are sluice ways used as low-level outlets, the third structure leads to a raceway leading to the mill. Upper planks are broken on both low-level outlets and there is leakage between the planks at all three outlets.	Replace the broken timber stop planks.
OUTLET STRUCTURE	All outlets have slotted concrete abutments that hold the stop planks. There is spalling on the downstream faces of the concrete walls at all three outlets. At the left low-level outlet the concrete on both abutments has deteriorated at the water level causing the walls to be undermined.	Repair spalled concrete and the deteriorated walls.
OUTLET FACILITIES	Junctions of all outlets to embankments are good.	
EMERGENCY GATE	None.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
<p>CONCRETE WEIR</p> <p>Concrete overflow weir in two sections:                      Right - approximately 90 feet long and 5 feet high.                      Left - approximately 85 feet long and 5.5 feet high</p> <p>Both are in good condition.</p>		
<p>APPROACH CHANNEL</p> <p>Musconetcong River</p>		
<p>DISCHARGE CHANNEL</p> <p>Musconetcong River</p>		
<p>BRIDGE AND PIERS</p> <p>None.</p>		

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/SURVEYS None.		
OBSERVATION WELLS None.		
WEIRS None.		
PIEZOMETERS None.		
OTHER None.		

RESERVOIR

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS AND RECOMMENDATIONS

SLOPES

Slopes are steep to flat on both sides and partially wooded. Route 57 is along the right bank.

SEDIMENTATION

None visible.

DOWNSTREAM CHANNEL

<u>VISUAL EXAMINATION OF</u>	<u>REMARKS AND RECOMMENDATIONS</u>
<p><u>OBSERVATIONS</u></p> <p>CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)</p> <p>No debris, small island in river channel by left spillway.</p>	
<p>SLOPES</p> <p>Slopes are flat, shallow and wooded.</p>	
<p>APPROXIMATE NUMBER OF HOMES AND POPULATION</p> <p>Penwell Road bridge with utility conduit is 400 feet downstream. There is one house on left bank 600 feet downstream and four houses on the right approximately 2,000 feet downstream.</p>	

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	None available.
REGIONAL VICINITY MAP	Available-Hunterdon County Map and U.S.G.S. Quadrangle Sheet for Washington, N.J.
CONSTRUCTION HISTORY	No formal history exists, but can be deduced from available microfilm at NJ Department of Environmental Protection (NJ-DEP), 1474 Prospect Street, P.O. Box CN-029, Trenton, NJ 08625
TYPICAL SECTIONS OF DAM	None available.
HYDROLOGIC/HYDRAULIC DATA	None available.
OUTLETS - PLAN	None available.
- DETAILS	None available.
- CONSTRAINTS	None available.
- DISCHARGE RATINGS	None available.
RAINFALL / RESERVOIR RECORDS	None available.

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
(continued)

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	Available U.S.G.S. Geologic Overlay Sheet for Hunterdon County and Engineering Soil Survey of New Jersey, Report No. 6, Hunterdon County by Rutgers University (New Brunswick, N.J.)
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Unknown.
SPILLWAY PLAN - SECTIONS - DETAILS	None available.

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None.
MODIFICATIONS	Left spillway concreted in 1972. Right spillway concreted in 1976.
HIGH POOL RECORDS	Not kept.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Available on microfilm at NJ Department of Environmental Protection (NJ-DEP), 1474 Prospect Street, P.O. Box CN-029, Trenton, NJ 08625
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None known to exist.
MAINTENANCE OPERATION RECORDS	None known to exist.

APPENDIX B

PHOTOGRAPHS

(Photographs Taken February 3, 1981)

PENWELL MILL DAM



Photo 1 - View of left spillway and upstream river.



Photo 2 - View of right spillway looking towards island that separates the spillways.

PENWELL MILL DAM



Photo 3 - View left spillway and low-level outlet from downstream.

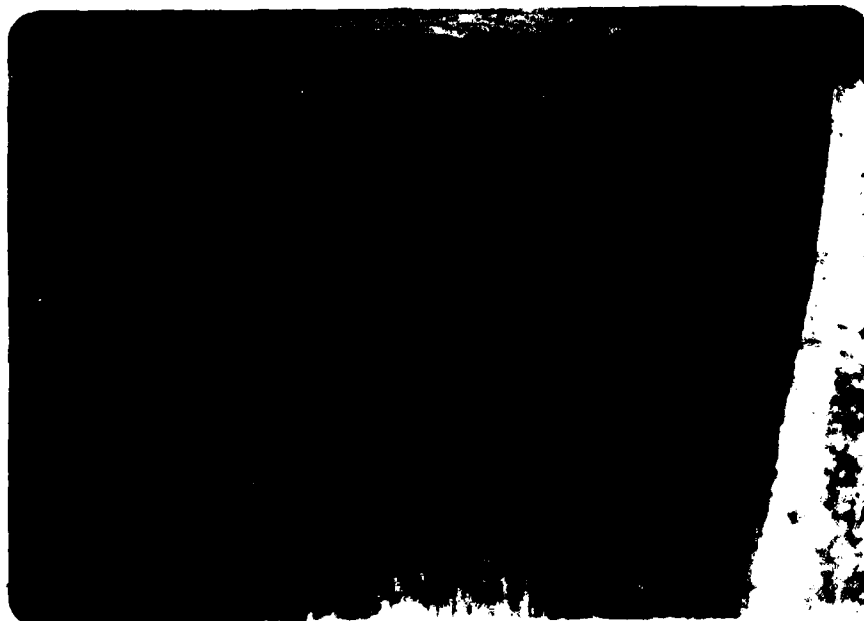


Photo 4 - View of broken timber stop planks of low-level outlet at the left spillway.

PENWELL MILL DAM

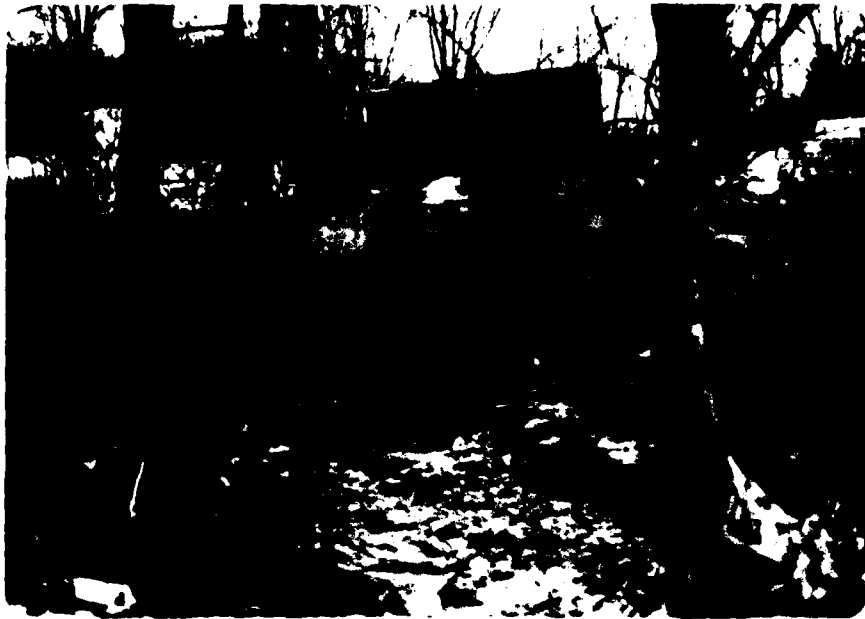


Photo 5 - Downstream view of left low-level outlet. Note deterioration and undermining of bottom of concrete walls.



Photo 6 - Downstream view of outlet and raceway leading to mill.

PENWELL MILL DAM



Photo 7 - View of downstream channel looking upstream towards dam.



Photo 8 - View downstream at Penwell Road bridge looking downstream.

APPENDIX C

SUMMARY OF ENGINEERING DATA

2

CHECK LIST  
HYDROLOGIC AND HYDRAULIC DATA  
ENGINEERING DATA

Name of Dam: PENWELL MILL DAM

Drainage Area Characteristics: 105.9 sq. mi.

Elevation Top Normal Pool (Storage Capacity): 409.67 NGVD (3 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: 413.31 NGVD (SDF pool: 18 acre-feet)

Elevation Top Dam: 410.5 NGVD (4 acre-feet)

SPILLWAY CREST:

a. Elevation 409.67 NGVD - Both spillways

b. Type 2 concrete overflow spillways.

c. Width 1 ft.

d. Length Left - 85 ft. Right - 90 ft.

e. Location Spillover Entire length, both spillways

f. No. and Type of Gates None

OUTLET WORKS:

a. Type 3 - stop plank sluice ways

b. Location One located adjacent to left spillway, another 70 ft. left of 1st one & the third one 8 ft. left of the second.

c. Entrance Inverts 405 NGVD (Estimated)

d. Exit Inverts 405 NGVD (Estimated)

e. Emergency Draindown Facilities Timber stop planks

HYDROMETEOROLOGICAL GAGES:

a. Type None

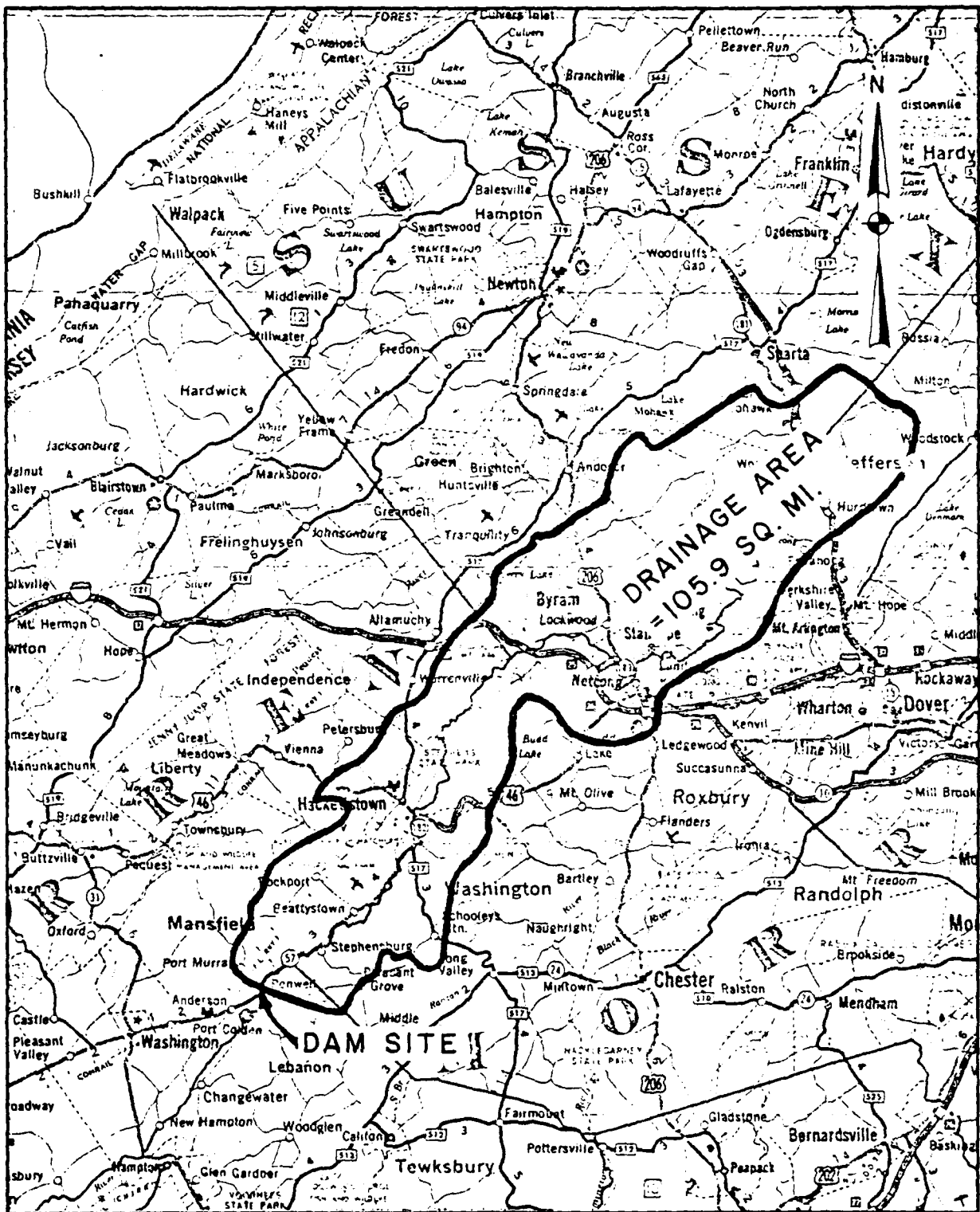
b. Location None

c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: 498 cfs at elevation 410.5 NGVD

APPENDIX D

HYDROLOGIC COMPUTATIONS



Scale: 1" = 4 Miles

PENWELL MILL DAM  
DRAINAGE BASIN

### Area of the Lake at normal pool level

(No information available from any source, U.S.G.S. Quad does not show any lake. From field observation it is estimated that the lake is 150 Ft long.)

$$\begin{aligned} \text{Area} &= 353 \text{ Ft (Length of Stillway Island)} \times 205 \text{ Ft} \\ &= 1.67 \text{ Ac} \end{aligned}$$

Height of the Dam = 6 Ft (Max)

Small Dam ; Low Hazard

S.D.F. = 100 year flood

### Hydrologic analysis

$$D.A. = 105.9 \text{ sq miles}$$

Inflow hydrograph at reservoir was determined using HEC 1 DB program. Inflow routed through the reservoir.

### Reservoir Stage Area Relations

Elevation	Area in Ac
405	0
409.67	1.67 Ac
420	27.55 Ac

Reservoir storage stage relationship was determined by HEC 1 DB program from the area stage relationship.

① Precipitation Frequency Values (inches) of 100 yr. For

60 min.	3.05	} Ref NWS - Hygro - 35 Ref NWS - TP No. 40
2 hr.	3.88	
3 hr.	4.35	
4 hr.	4.73	
5 hr.	4.98	
6 hr.	5.20	

C

100 year Rainfall distribution (1 hr duration)

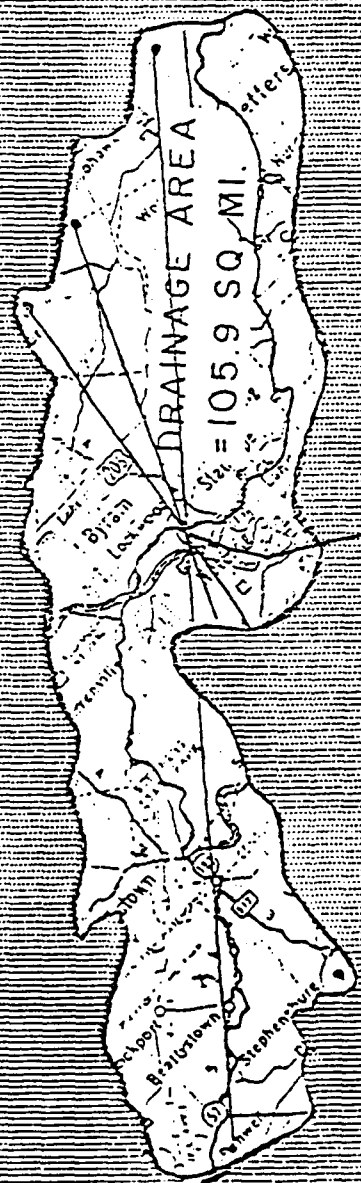
Time (hr)	Total depth (inch)	4d wch.
1	3.05	3.05
2	3.88	.83
3	4.35	.47
4	4.73	.38
5	4.98	.25
6	5.20	.22

Rainfall design arrangement

.25, .83, 3.05, .47, .38, .22

# SNYDERS DING PARAMETERS

33.30 miles  
 16.8 miles  
 29 (0.67)  
 23.9 miles



DAM SITE

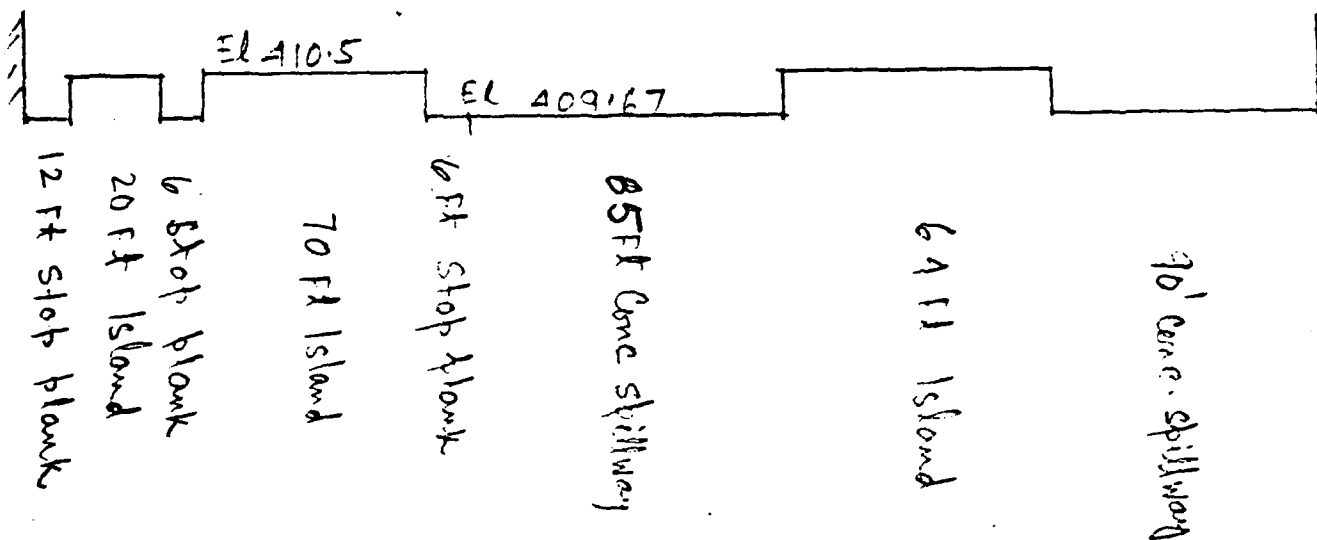
SCALE 1/4 MILES

Inflow Hydrograph was determined from the Unit Hydrograph and PMP. Snyder's unit Hydrograph parameters are reflected as

$$C_t = 3.70 \text{ and } C_p = 0.577$$

$$t_p = 4(L L_c)^{0.3} = 3.7(30 \times 16.8)^{0.3} = 23.9 \text{ hrs}$$

Schematic Layout of Dam



Effective length of Spillway =  $L_s = 199 \text{ Ft}$   $C = 3.31$

Effective length of Dam =  $L_D = 154 \text{ Ft}$   $C = 2.5$   
(Very Broad)

$$Q = C_s L_s H_s^{3/2} + C_D L_D H_D^{3/2}$$

$$= 3.31 \times 199 H_s^{3/2} + 2.5 \times 154 H_D^{3/2}$$

$$= 659 H_s^{1.5} + 385 H_D^{1.5}$$

Note: Stop planks are approximately 2' higher than the spillway. But at the time of inspection, it is found that leakage through the planks. Stop planks are considered at spillway level for the calculation of rating curve.

PRC Harris, Inc.  
CONSULTING ENGINEERS

SUBJECT N. J. Dam Inspection  
Penwell Mill Dam  
COMPUTED BY S. B. CHECKED BY \_\_\_\_\_

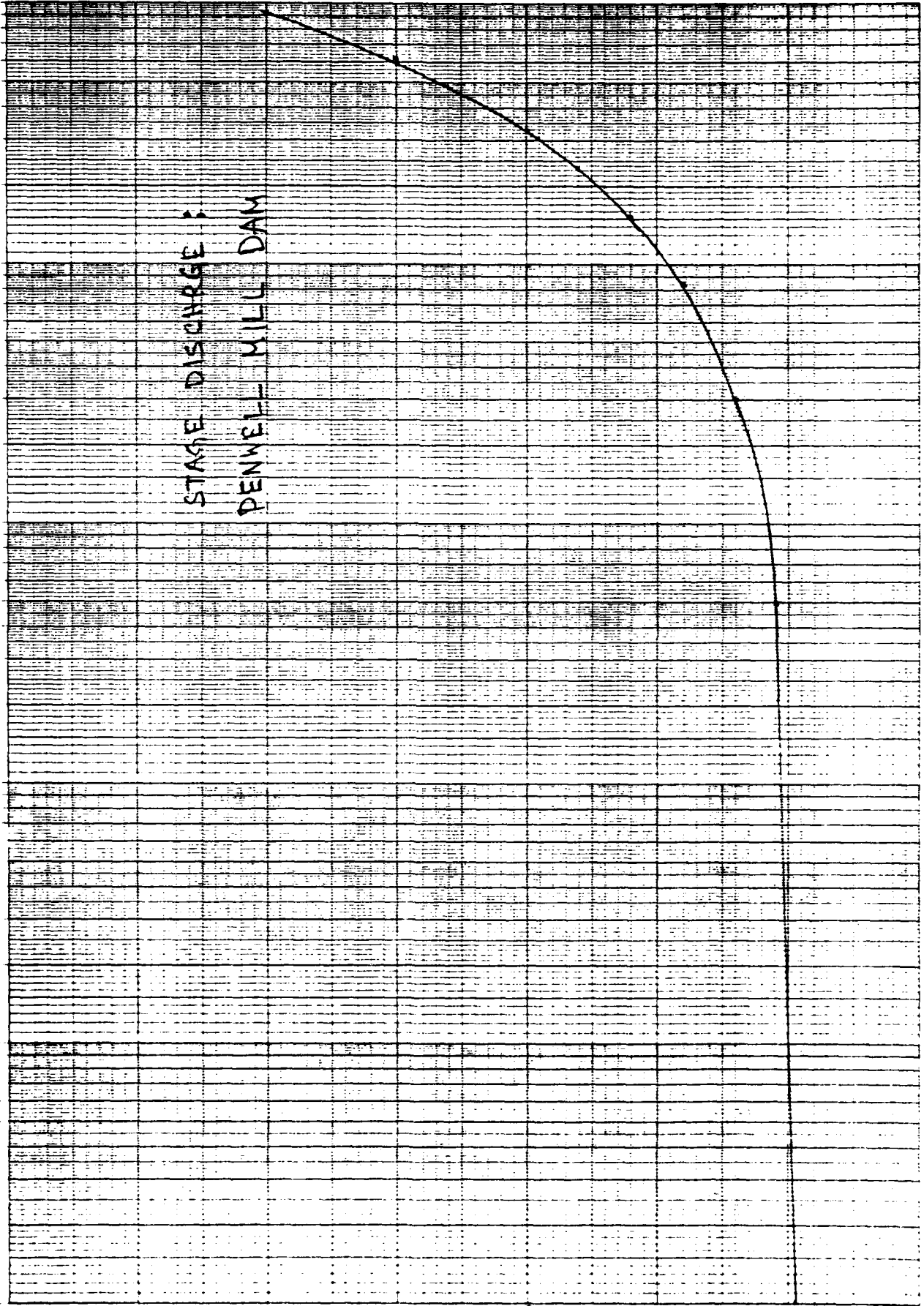
SHEET NO. 6 OF \_\_\_\_\_  
JOB NO. 10-1176-01  
DATE March, 1981

W.S. El	H <sub>S</sub>	Q <sub>S</sub> = 659 H <sub>S</sub> <sup>1.5</sup>	H <sub>D</sub>	Q <sub>D</sub> = 385 H <sub>D</sub> <sup>1.5</sup>	Q = Q <sub>S</sub> + Q <sub>D</sub>
409.67	0	0			0
410.5	.83	498	0	0	498
412	2.33	2344	1.5	707	3051
414	4.33	5937	3.5	2,521	8,458
416	6.33	10,495	5.5	4,966	15,461
418	8.33	15,843	7.5	7,908	23,751
420	10.33	21,879	9.5	11,273	33,152
425	15.33	39,555	14.5	21,257	60,812
430	20.33	60,468	19.5	33,152	93,620

46 6210

KE SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO. MADE IN U.S.A.

STAGE DISCHARGE  
PENWELL MILL DAM

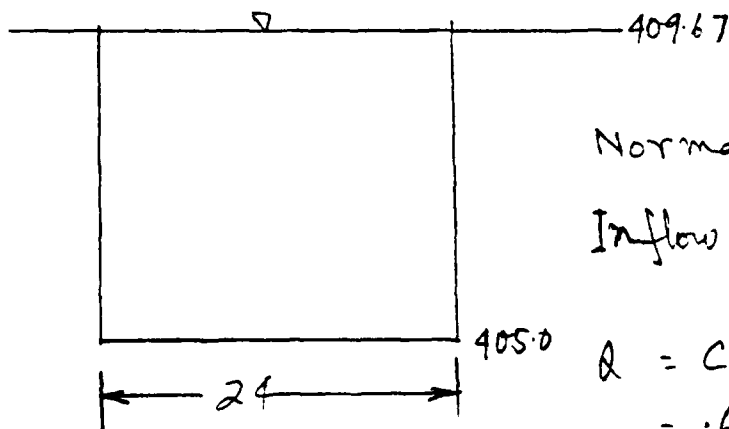


100,000  
10,000  
1,000  
100 cfs

430  
425  
420  
415  
410  
405

## Drawdown Computation

There are three stop planks, each 6 ft wide and each, 12' wide  
Total 24' wide.



Normal elevation to start = 409.67

$$\text{Inflow} = \frac{2 \text{ cfs}}{\text{mi}^2} \times 105.9 \approx 212 \text{ cfs}$$

$$Q = CA \sqrt{2gh} \quad C = 0.62$$

$$= .62 \sqrt{2g} A \sqrt{h} \approx 5 A \sqrt{h}$$

Assume tailwater elevation = 405.0

$$\text{Area } A_2 = \left(\frac{h_2}{h_1}\right)^2 A_1 = \left(\frac{h_2}{4.67}\right)^2 \times 1.67 = .0766 h_2^2$$

( $A_1 = 1.67AC$      $h_1 = 4.67 \text{ FT}$ )

$$\text{Drawdown time} = \frac{\text{Vol in AF} \times 43560}{Q \times 3600} = \frac{12.1 \text{ Vol}}{Q} \text{ Hrs.}$$

$$= 726 \frac{\text{Vol}}{Q} \text{ Min}$$

$$\text{Drawdown time with inflow} = \frac{212 \times t}{Q} \text{ Hrs.}$$

Area of orifice variable with depth  
= 24' x h.

Res Elev	Area	Avg. Area	Vol	Avg Res Depth ft	Area of Orifice A = 24 ft <sup>2</sup>	Q & CFS	Drawdown Time = t Vol x 72.6 Q	Min	Cum Time	Drawdown with inflow 2.12 ft Q	Min	Cum Time
409.67	1.67	1.45	.97	4.34	104	1084	.65	.13	.65	.13	.78	
409	1.23	.96	.96	3.5	84	786	.89	.24	1.54	.24	1.91	
408	.69	.50	.50	2.5	60	475	.76	.34	2.30	.34	3.01	
407	.31	.20	.20	1.5	36	221	.66	.64	2.96	.64	4.31	
406	.08	.04	.04	.5	12	43*	.66	3.35	3.64	3.35	8.34	
405	0											

\* Inflow exceeding outflow. For Practical purpose drawdown upto an elevation of 406 is considered  
Time of Drawdown without inflow = 2.96 min ≈ 3 min  
Time of Drawdown with inflow = 4.31 min ≈ 4.5 min

FLOOD HYDROGRAPH PACKAGE (HEC-1)									
DAM SAFETY VERSION JULY 1978									
LAST MODIFICATION 26 JUN 79									
*****									
1	A	N.J. DAM INSPECTION							
2	A2	PENWELL HILL DAM							
3	A3	100 YEAR FLOOD (SOP)							
4	K	100	0	0	0	0	0	0	0
5	M	1	0	0	0	0	0	0	0
6	J	1	1						
7	J1	1							
8	K	0	RES						
9	K1	0	LOCAL INITIAL						
10	M	0	105.9						
11	U	0	105.9						
12	U1	0.35	1.05	1.47	1.38	1.32			
13	V	1					1	.1	.02
14	W	23.9	0.77						
15	X	1	1.05						
16	F	1	дам						
17	A3	ROUTING THROUGH DAM							
18	V								
19	V1								
20	Y	4409.67	410.5	414	416	418	420	425	430
21	Y1	0	478	3051	15451	33751	51152	69812	89500
22	W	0	1.01						
23	V	405	409.57						

0140577  
20 41075  
A

THIS FILE WAS GENERATED BY THE FLOOD MODELING PROGRAM  
RANOFF HYDROLOGICAL AT  
FBIHQ, WASHINGTON, DC  
100 11 10 1981

\*\*\*\*\*  
FLOOD HYDROGRAPH PACKAGE (FILE 1)  
NOV 1979  
LAST MODIFICATION 25 11 79  
\*\*\*\*\*

RUN DATE: WED, JUN 03 1981  
TIME: 11:33:17

N.J. DAM INSPECTION  
PEMELL MILL DAM  
100 YEAR FLOOD (SOF)

NO	NOX	UNIT	IFAT	IFIN	IFEN	IFEC	IFLT	IFRT	IFSTAN
100	1	0	0	0	0	0	0	0	0

UNIT FLOW AVAILABLE TO BE FURNISHED  
APPROXIMATELY 1.000E+1

RTIOS= 1.00

\*\*\*\*\*  
SUB AREA NUMBER COMPUTATION  
\*\*\*\*\*

LOCAL INFLO	ESTIM	UNDE	IFLO	IFAF	IFUL	IFAT	IFSTAD	LAUTO
0	0	0	0	0	0	0	0	0

HYDROGRAPH DATA

TIME	AREA	SWAP	INSSA	IFSSC	RATIO	ISADM	ISAME	LOCAL
0	1	105.70	0.00	0.00	0.00	0	0	0

NO	STORIN	UNIT	DAY
0	0.00	0.00	0.00

TRUFF	STRAR	DELTA	RTIOE	STAGE	RATIO	STAGE	ENSTE	ALSWA	RTIME
0	0.00	0.00	1.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT AREA FROM VETA

UNIT VALUE DATA

AREA	STAGE	RTIOE	STAGE	RTIOE
0	0.00	0.00	0.00	0.00

\*\*\*\*\*  
\*\*\*\*\*





STOP FLOW AND STORAGE CURVES OF PERIODS SUMMARY FOR MULTIPLE DAMS WITH COORDINATE OPERATIONS  
FLOODS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)  
AREA IN SQUARE FEET (SQARE METERS)

OPERATION	STATION	AREA	FLAT RATIO	1
HEBBIKUM PI	RES	105,90	1	6590
		( 274,28)		( 186,60)

SUMMARY OF DAM SAFETY ANALYSIS

INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	TIME OF FLOW	TYPE OF FAILURE
409.67	409.67	410.50	3.1	MODERATE
0.	0.	0.	4.93	MODERATE

INITIAL VALUE	MAXIMUM STORAGE	MAXIMUM DEPTH OVER DAM	MAXIMUM FLOW	MAXIMUM TIME OF FLOW	TYPE OF FAILURE
409.67	186.60	65.90	3.1	3.1	MODERATE
0.	186.60	65.90	0.	4.93	MODERATE

**END  
DATE**