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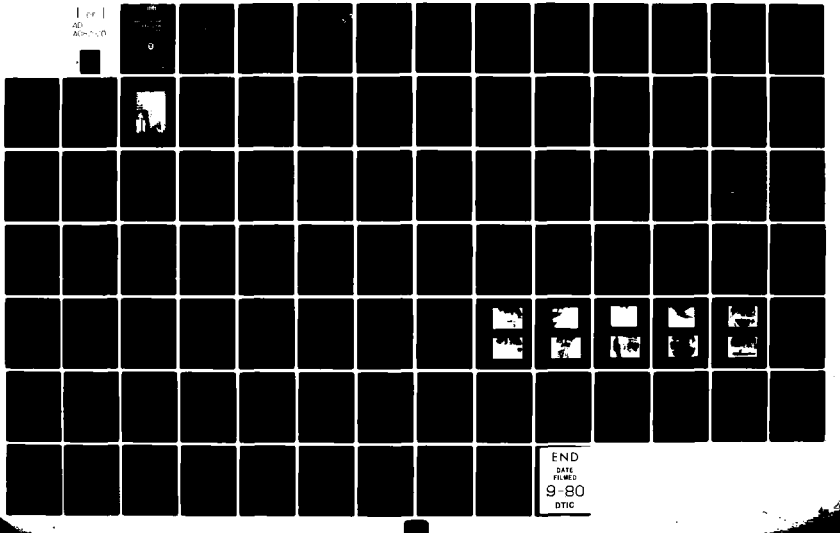

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WALLKILL RIVER BASIN
LONG HOUSE CREEK,
PASSAIC COUNTY
NEW JERSEY

UPPER GREENWOOD LAKE DAM
NJ 00186

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DACW61-79-C-0011

DTIC ELECTE AUG 13 1980 S C

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DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

MARCH 1980

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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER: NJ00186	2. GOVT ACCESSION NO.: AD-A087 920
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7. AUTHOR(s): JOHN TALERICO	8. CONTRACT OR GRANT NUMBER(s): DACW61-79-C-0011
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Frederic R. Harris, Inc. 453 Amboy Ave. Woodbridge, N.J. 07095	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: NJ Department of Environmental Protection Division of Water Resources P.O. Box CN029 Trenton, NJ 08625	12. REPORT DATE: March, 1980 13. NUMBER OF PAGES: 80
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16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
Embankments
Visual Inspection
Structural Analysis
National Dam Safety Program
Upper Greenwood Lake Dam, New Jersey
Spillways

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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

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

IN REPLY REFER TO
NAPEN-N

05 AUG 1980

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

Dear Governor Byrne:

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

Based on visual inspection, available records, calculations and past operational performance, Upper Greenwood Lake Dam, a high hazard potential structure, is judged to be in good overall condition. However, the spillway is considered seriously inadequate because a flow equivalent to 39 percent of the Probable Maximum Flood (PMF) would cause the dam to be overtopped. The seriously inadequate spillway is assessed as an UNSAFE, non-emergency condition, until more detailed studies prove otherwise or corrective measures are completed. The classification of UNSAFE applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with an UNSAFE classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard of loss of life downstream from the dam. To ensure adequacy of the structure, the following actions, as a minimum, are recommended.

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. The ability of the dam to withstand overtopping should also be studied. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. The two steel I-beams that span the spillway and their pier supports should be removed. These I-beams, during high flow, could entrap and collect debris causing a reduced spillway capacity. A reduced capacity could increase the frequency of overtopping.

c. The following remedial actions should be completed within twelve months from the date of approval of this report:

(1) Repair all cracked and spalled concrete.

(2) All brush and trees should be removed from the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection.

(3) Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

(4) Remove debris from the downstream channel.

(5) Consider providing additional low-level outlet facilities to decrease draw down time.

(6) The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

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

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

NAPEN-N
Honorable Brendan T. Byrne

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

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

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

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

UPPER GREENWOOD LAKE DAM (NJ00186)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 14 November and 4 December 1979 by Harris - ECI Associates, Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Upper Greenwood Lake Dam, a high hazard potential structure, is judged to be in good overall condition. However, the spillway is considered seriously inadequate because a flow equivalent to 39 percent of the Probable Maximum Flood (PMF) would cause the dam to be overtopped. The seriously inadequate spillway is assessed as an UNSAFE, non-emergency condition, until more detailed studies prove otherwise or corrective measures are completed. The classification of UNSAFE applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with an UNSAFE classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard of loss of life downstream from the dam. To ensure adequacy of the structure, the following actions, as a minimum, are recommended.

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. The ability of the dam to withstand overtopping should also be studied. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. The two steel I-beams that span the spillway and their pier supports should be removed. These I-beams, during high flow, could entrap and collect debris causing a reduced spillway capacity. A reduced capacity could increase the frequency of overtopping.

c. The following remedial actions should be completed within twelve months from the date of approval of this report:

(1) Repair all cracked and spalled concrete.

(2) All brush and trees should be removed from the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection.

(3) Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

(4) Remove debris from the downstream channel.

(5) Consider providing additional low-level outlet facilities to decrease draw down time.

(6) The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

APPROVED: _____
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 28 July 1980

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

IN REPLY REFER TO
NAPEN-N

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

6 JUN [illegible]

Dear Governor Byrne:

This is in reference to our ongoing National Program for Inspection of Non-Federal Dams within the State of New Jersey. Upper Greenwood Lake Dam (Federal I.D. No. NJ00186), a high hazard potential structure has recently been inspected. The dam is owned by the Upper Greenwood Lake Property Owners Association, and is located on a branch of West Brook in West Milford Township.

Using Corps of Engineers screening criteria, it has been determined that the dam's spillway is seriously inadequate because a flow equivalent to 39 percent of the Probable Maximum Flood would cause the dam to be overtopped. The seriously inadequate spillway is assessed as an UNSAFE, non-emergency condition, until more detailed studies prove otherwise, or corrective measures are completed. The classification of UNSAFE applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with an UNSAFE classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard potential to loss of life downstream from the dam. As a result of this UNSAFE determination, it is recommended that the dam's owner take the following measures within 30 days of the date of this letter:

a. Engage the services of a qualified professional consultant to more accurately determine the spillway adequacy by using more detailed and sophisticated hydrologic and hydraulic analyses, and to recommend any remedial measures required to prevent overtopping of the dam.

b. In the interim, a detailed emergency operation plan and downstream warning system should be promptly developed. Also, around the clock surveillance should be provided during periods of unusually heavy precipitation.

A final report on this Phase I Inspection will be forwarded to you within two months.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

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

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

UNSAFE DAM
NATIONAL PROGRAM OF INSPECTION OF DAMS

a. NAME: Upper Greenwood Lake Dam

b. ID NO.: NJ00136

c. LOCATION State: New Jersey, County: Passaic.
River or Stream: Long House Creek.
Nearest D/S City or Town: West Milford.

d. HEIGHT: 19.0 feet

e. MAXIMUM IMPOUNDMENT CAPACITY: 5,681 ac. ft.

f. TYPE: Earthfill.

g. OWNER: Upper Greenwood Lake P.O.A., Inc.

h. DATE GOVERNOR NOTIFIED OF UNSAFE CONDITIONS: 6 June 1980

i. CONDITION OF DAM RESULTING IN UNSAFE ASSESSMENT: Preliminary report calculations indicate 39% of the PMF would overtop the dam.

l. URGENCY CATEGORY: High Hazard, UNSAFE, Non-Emergency.

m. EMERGENCY ACTIONS TAKEN:
Gov. notified of this condition by District Engineer's letter of 6 June 1980.

j. DESCRIPTION OF DANGER INVOLVED: High Hazard potential, overtopping and failure of the dam would significantly increase hazard potential to loss of life and property downstream of dam.

n. REMEDIAL ACTIONS TAKEN:
N.J.D.E.P. will notify dam's owner upon receipt of our letter.

k. RECOMMENDATIONS GIVEN TO GOVERNOR:
Within 30 days of the date of the District Engineer's letter the owner should do the following:
a. Engage the services of a qualified professional consultant to more accurately determine the spillway adequacy by using more detailed and sophisticated hydrologic and hydraulic analyses, and to recommend any remedial measures required to prevent overtopping of the dam.
b. In the interim, a detailed emergency operation plan and downstream warning system should be developed. Also, around-the-clock surveillance should be provided during periods of unusually heavy precipitation.

o. REMARKS: Final report, to be issued within six weeks, will have WHITE cover.

T.B. HEVERIN, Coordinator
Dam Inspection Program
U.S.A.E.D., Philadelphia

WALLKILL RIVER BASIN

LONG HOUSE CREEK, PASSAIC COUNTY

NEW JERSEY

UPPER GREENWOOD LAKE DAM

NJ00186

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT, CORPS OF ENGINEERS

PHILADELPHIA, PENNSYLVANIA 19106

MARCH 1980

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Upper Greenwood Lake Dam, I.D. NJ 00186
State Located:	New Jersey
County Located:	Passaic County
Stream:	Long House Creek
River Basin:	Wallkill River
Date of Inspection:	November 14 and December 4, 1979

Assessment of General Condition

Upper Greenwood Lake Dam is an earthfill dam containing a concrete ogee spillway at the right side of the dam. The overall condition of the dam is good. There is no major sign of distress or instability in the embankment although there is vertical cracking in spillway abutment walls. The low-level sluice gate is in operable condition. The hazard potential is rated as "high".

The adequacy of Upper Greenwood Lake Dam is considered questionable in view of its lack of spillway capacity to pass the SDF (PMF) without overtopping the dam. The spillway is capable of passing a flood equal to 38 percent of the PMF, and is assessed as "seriously inadequate".

At present, the engineering data available is not sufficient to make a definite statement on the stability of the dam. The following actions therefore, 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. Carry out a more precise hydrologic and hydraulic analysis of the dam within twelve months, to determine the need and type of mitigating measures necessary. Based on the results of these studies, remedial measures should be instituted. This should include the installation of a tailwater gage.

2. The two steel I-beams that span the spillway and their pier supports should be removed. These I-beams, during high flow, could entrap and collect debris causing a reduced spillway capacity. A reduced capacity could increase the frequency of overtopping.

3. Repair all cracked and spalled concrete within twelve months.

4. All brush and trees should be removed from the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within 12 months.

5. Investigate embankment for animal burrows and fill in any burrow holes with impervious material.

6. Remove debris from downstream channel within twelve months.

7. 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 action is recommended and should be carried out within a reasonable period of time.

1. Consider providing additional low-level outlet facilities to decrease draw down time.

2. 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.

John P. Talerico

John P. Talerico, P.E.
Harris ECI - Associates

Photo taken on December 3, 1979

U P P E R G R E E N W O O D L A K E D A M

View toward left edge of dam. Cover for low-level outlet gate on crest of embankment, downstream side, is visible at upper center of photo.

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 theChief 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

UPPER GREENWOOD LAKE DAM, I.D. NJ00186

SECTION 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 Upper Greenwood Lake Dam was made on November 14, 1979. 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

Upper Greenwood Lake Dam is an earthfill dam approximately 360 feet long and 19.0 feet high with a concrete core wall, and steel sheet piling cut-off. There is a 50-foot wide concrete ogee spillway at the right end of the embankment with concrete abutments. The crest of the spillway is 3.33 feet below the top of the dam embankment.

At one time, a wooden foot bridge spanned the spillway but all that remains are two I-beams supported by two piers.

The embankment has a top width of 11 feet with upstream slope of 2.5H:1V and downstream of 2H:1V. Rip-rap protection has been placed on the upstream side of the embankment.

The low-level outlet consists of a 42-inch concrete pipe through the embankment approximately 100 feet left of the spillway. The flow through the pipe is controlled by a manually operated sluice gate located in the center of the embankment. The inlet end of the pipe is located at the upstream toe of the slope and has a trash rack according to the plans. The outlet discharges into the stone lined spillway channel.

The downstream spillway channel runs parallel to the embankment 60 feet from the top of the dike and discharges into the Long House Creek Channel just before it crosses under Upper Greenwood Road through an 18-foot opening.

Six shallow test pits were taken at the dam site. See Plate 4. The test pits show deposits of clay, sand and gravel, and occasional layers of fine sand and clay. Also some of the deeper pits show boulders and those at the old stream bed show vegetation and clay.

A generalized description of the soil conditions is contained in Report No. 3, Passaic County, Engineering Soil Survey of New Jersey, by Rutgers University. The report dated 1951, describes the lake area soils as shallow unconsolidated deposits over sandstone and shale bedrock, possible ground moraine over gneiss (not mapped), stratified drift deposited by the Wisconsin glacier and recent alluvium. The test pits show no shallow rock so the first deposit is not present. Ground moraine is unstratified, heterogenous material including clay, silt and sand sizes, with varying amount of gravel, cobbles and boulders. And stratified drift is assorted, relatively homogeneous material, predominantly of sand sizes, with various amounts of silt and gravel. The clay, sand, gravel, mixed together, and the boulder deposits are obvious ground moraine while the sand or sand and clay deposits are stratified drift. The recent alluvium is the stream bed deposit. Geologic Overlay Sheet 22, describes the underlying rock, which appears deep, as Pyroxene Gneiss. This appears to verify the ground moraine.

b. Location

Upper Greenwood Lake Dam is located on Long House Creek in the Township of West Milford, Passaic County, New Jersey. It is accessible by way of Lake Shore Drive.

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 Engineers, the dam is classified in the dam size category as being "Intermediate", since its storage volume of 5,681 acre-feet is more than 1,000 acre-feet, but less than 50,000 acre-feet. The dam is also classified as "small" because its height of 19.0 feet is less than 40 feet. The overall size classification is governed by the larger of these two determinations, and accordingly, Upper Greenwood Lake Dam is classified as "intermediate" in size.

d. Hazard Classification

A hazard potential classification of "high" has been assigned to the dam on the basis that a hypothetical failure would result in excessive damage to the road immediately downstream of the dam. Because the road is heavily traveled and there are two inhabitable buildings within the flood path, the possibility exists of the loss of more than a few lives in the event of dam failure.

e. Ownership

Upper Greenwood Lake Dam is owned by:

Upper Greenwood Lake
Property Owners Association, Inc.
P.O. Box 457
Hewitt, NJ 07421

Attention: Mr. George Bizub
(201) 853-7852

f. Purpose

Upper Greenwood Lake Dam is presently used for recreational purposes only.

g. Design and Construction History

Upper Greenwood Lake Dam was constructed in 1932. Plans showing the original design are available, but no design criteria computations or inspection reports of the construction could be found. In 1947, the existing spillway was raised 8-inches in order to raise the lake surface for esthetics. This was accomplished by grouting dowels into the existing spillway and placing an 8-inch layer of concrete across the top and downstream face of the spillway.

No other modifications have taken place since 1947.

h. Normal Operating Procedures

The discharge from the lake is unregulated and is allowed to naturally balance the inflow into the lake. The low-level outlet is used to lower the lake level to allow property owners to make repairs to their docks and waterfront property.

1.3 Pertinent Data

a. Drainage Area — 6.2 sq.mi.

b. Discharge at Dam Site

Ungated spillway capacity at elevation of top of dam:	1,139 cfs (1,104.0 NGVD)
Total spillway capacity at maximum pool elevation (SDF):	7,028 cfs (1,106.65 NGVD)

c. Elevation (Feet above NGVD)

Top of dam:	1,104.0
Maximum pool design surcharge (SDF):	1,106.65
Recreation pool:	1,101±
Spillway crest:	1,100.7
Streambed at centerline of dam:	1,085.0 (estimated)
Maximum tailwater:	1,090.5 (estimated)

d. Reservoir

Length of maximum pool:	8,000± ft. (estimated)
Length of recreation pool:	7,600± ft. (estimated)

e. Storage (acre-feet)

Spillway Crest:	2,106
Top of dam:	3,994
Maximum pool (SDF):	5,681

f. Reservoir Surface (acres)

Top of dam:	720 (estimated)
Maximum pool (SDF):	852 (estimated)
Spillway Crest:	556 (1,100.7 NGVD)

g. Dam

Type:	Earth fill with concrete ogee spillway
Length:	410 ft. (effective)
Height:	19.0 ft.
Top width:	11.0 ft.
Side slopes - Upstream:	2.5H:1V
- Downstream:	2.0H:1V
Zoning:	Unknown
Impervious core:	15 ft. sheet piling 350 ft. concrete core
Cutoff:	Sheet piling
Grout curtain:	None

h. Diversion and Regulating Tunnel

N/A

i. Spillway

Type:	Ungated ogee overflow
Length of weir:	50 ft.
Crest elevation:	1,100.7 NGVD
Gates:	None
U.S. Channel:	Upper Greenwood Lake
D/S Channel:	After the spillway, a 30-ft wide channel (210-ft long) discharges into Long House Creek

j. Regulating Outlets

Low level outlet:	42-inch RCP
Controls:	Manually operated outlet gate
Emergency gate:	None
Outlet:	1086.5 NGVD

SECTION 2

2. ENGINEERING DATA

2.1 Design

Drawings for the original construction in 1932 and spillway modification in 1947 are available at the Trenton offices of the N.J. Department of Environmental Protection(NJ-DEP). One drawing, from the 1932 set, shows foundation test pits along the dam base. No further embankment data from soil borings, soil tests, design computations, or other geotechnical data are available to assess the stability properly. Data concerning the hydraulic capacity of the spillway is also unavailable.

2.2 Construction

Data is not available concerning the as-built construction of the dam. No data exists of 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 and reservoir. The lake is allowed to operate naturally without regulation.

2.4 Evaluation

a. Availability

The availability of engineering data is poor. The stated drawings and some correspondence concerning the spillway modification are available from the NJ-DEP.

b. Adequacy

The engineering data available, together with that obtained in the field, were 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

The dam and spillway appear to correspond to the drawings, but the provision for a foot bridge over the spillway is not shown.

SECTION 3

3 VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Upper Greenwood Lake Dam revealed the dam and spillway to be in serviceable condition but that some repairs followed by a regular program of inspection and maintenance are required. LThe Lake level was above the spillway's crest at the time of inspection.

b. Dam

The earth embankment appears to be sound. No surface cracking on the embankment or at the toe was noted. Sloughing or erosion of embankment and abutment slopes was not visible. No misalignment of the embankment in the horizontal or vertical plane was observed. No riprap failures were noted. Numerous birch trees, 2-inches to one foot in diameter, and shrubs, are growing on the downstream side of the embankment. No seepage or sloughing was found in any portion of the downstream face of the embankment. No evidence of burrowing by animals was observed; however at the time of the inspection the embankment was covered with leaves, therefore the possibility does exist that there may be burrow holes in the embankment.

c. Appurtenant Structures

1. Spillway

The concrete spillway appears in good condition. Horizontal and vertical alignment of the spillway crest appeared good. Vertical cracks were visible on both abutment walls. The concrete sidewalk, adjacent to the right abutment, has cracks and holes along its base. Wood planks, cobblestones, and other debris were noted on top of the spillway and in its discharge channel. Two cracks were noted in the concrete of the discharge channel apron.

2. Bridge and Piers

Two steel I-beams, approximately 3 feet apart and supported by two piers, span the spillway. The I-beams once had supported the bridge's deck which had apparently consisted of the wood planks mentioned above as debris.

3. Outlet Works

The surface of the stilling basin of the low level outlet was under water. The low level outlet structure, at the stilling basin, has a concrete headwall. The drain at the headwall was also under water. The visible portion of the concrete headwall is in good condition. The low level outlet gate, in good condition, operated satisfactorily.

d. Reservoir Area

The reservoir side slopes are moderate to steep. There is no indication of slope instability. Boat landings, houses and trees are on the right bank. There is a private beach on the left bank adjacent to the embankment.

e. Downstream Channel

The downstream channel is in good condition. Cobblestones and boulders are on the bottom of the channel. There were wood planks, fallen trees, and other debris in the channel. A roadway bridge crosses over the channel approximately 200 feet from the spillway. The channel's slopes are moderate. Two houses are on the right side of the channel, located approximately 250 feet from the spillway or about 50 feet beyond the roadway bridge.

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

Upper Greenwood Lake Dam is used to impound water for recreational activities. The level of the lake is maintained through the unregulated flow over the spillway. The lake is not lowered on a regular basis, but is occasionally lowered to allow property owners to make repairs to their properties.

4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam and appurtenant structures. The Upper Greenwood Lake Property Owners Association is responsible for the maintenance of the dam.

4.3 Maintenance of Operating Facilities

The low-level outlet operating facilities consist of one manually operated 42-inch sluice gate. At the time of inspection, operation of the valve was satisfactorily demonstrated.

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 Upper Greenwood Lake Dam is approximately 6.2 square miles. A drainage map of the watershed of the dam site is presented on Plate 1, Appendix D.

The topography within the basin mildly sloped. Elevations range from approximately 1,400 feet above NGVD at the east end of the watershed to about 1,100 feet at the dam site. Land use patterns within the watershed are mostly woodland with concentrated residential development about the lake area.

The evaluation of the hydraulic and hydrologic features of the dam and lake was based on criteria set forth in the Corps Guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The Spillway Design Flood for the dam is equal to the PMF.

The probable maximum flood (PMF) was calculated from the probable maximum precipitation using Hydrometeorological Report No. 33 with standard reduction factors. Due to the small drainage area, the SCS triangular hydrograph transformed to a curvilinear hydrograph was adopted for developing the unit hydrograph, with the aid of the HEC1-DB Flood Hydrograph Computer Program.

Initial and infiltration loss rates, were applied to the Probable Maximum Precipitation to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the PMF and various ratios of PMF utilizing program HEC-1DB.

The SDF peak outflow calculated for the dam is 7028 cfs. This value is derived from the PMF, 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 HEC1-DB program.

The reservoir stage-storage capacity relationship was computed directly by the conic method, utilizing the HEC1-DB program. The conic method assumes that the reservoir capacity resembles a series of vertically stacked cones. 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.

A breach analysis indicates that the stage of the stream where it crosses Upper Greenwood Road is 3.7 feet higher, due to dam failure from overtopping at 50% PMF than it would be without failure at 50% PMF. This is likely to jeopardize the well traveled road and two houses downstream of the road significantly more than without failure. The discharge facility is thus rated "seriously inadequate".

Drawdown calculations indicate that to empty the lake to an elevation of 1088.45 NGVD through the one low-level sluice would take 13 days, assuming a 2 cfs/square mile inflow. This is considered to be an excessive drawdown period, and provision of additional outlets should be considered.

b. Experience Data

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

c. Visual Observation

The downstream channel is well defined. Riprap is on its bottom and at some places along the sides. The channel's slopes are moderate. A roadway bridge crosses over the channel approximately 200 feet from the spillway. There are two houses on the right bank, located approximately 50 feet beyond the roadway bridge or approximately 250 feet downstream of the spillway.

The slopes of the reservoir are moderate to steep and do not exhibit signs of instability. The drainage area is wooded, moderately flat sloped and developed for residential use around the lake.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 2.98 feet. Computations indicate that the dam can pass approximately 33 percent of the PMF without overtopping the dam crest. Since the PMF 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 "seriously inadequate".

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no major signs of distress in the embankment of the Upper Greenwood Lake Dam. Birch tress growing on the embankments downstream slope could pose a threat to stability. Burrow holes were not observed. However, it is possible that some could exist and be obscured by leaf cover. The spillway is in good condition but shows vertical cracking at its abutment walls. The piers and I-beams, that once supported a wooden walkway, are in good condition.

b. Design and Construction Data

No design computations relating to stability were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction are available for use in the stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam. The dam and spillway have served satisfactorily since the modification in the late 1940's.

d. Post-Construction Changes

The existing spillway was raised in 1947 as described in Section 1.2g.

e. Static Stability

A static stability analysis was not performed for Upper Greenwood Lake 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. Since static stability factors have not been confirmed, it cannot be stated that seismic stability is 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.

The safety of Upper Greenwood Lake is in question because the dam does not have adequate spillway capacity to pass the SDF which is the PMF without overtopping. Overtopping of the dam carries with it the danger of possible progressive failure of the dam. The dam's present spillway capacity is about 33 percent of the PMF.

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 at the visual inspection, the preliminary assessment of 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 dam's stability. A preliminary assessment of the dam could be made by visual observation only.

c. Urgency

Carry out a more precise hydrologic and hydraulic analysis of the dam within twelve months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages. The ability of the dam to withstand overtopping should also be studied.

The existing dam plans and drawings should be annotated and updated to form a coherent as-built set within twelve months.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway capacity are as follows:

1. Increase the embankment height, thus permitting a higher discharge to pass over the spillway and reducing the possibility of overtopping.
2. Lower the spillway crest elevation.
3. Increase the effective spillway crest length.
4. A combination of any of the above alternatives.

b. Recommendations

1. The two steel I-beams that span the spillway and their pier supports should be removed. These I-beams, during high flow, could entrap and collect debris causing a reduced spillway capacity. A reduced capacity could increase the frequency of overtopping.
2. Repair all cracked and spalled concrete with epoxy cement within twelve months.
3. All brush and trees should be removed from the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within 12 months.
4. Investigate embankment for animal burrows and fill in any burrow holes with impervious material.
5. Remove debris from downstream channel 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. Consider providing additional low-level outlet facilities, to decrease the drawdown time.

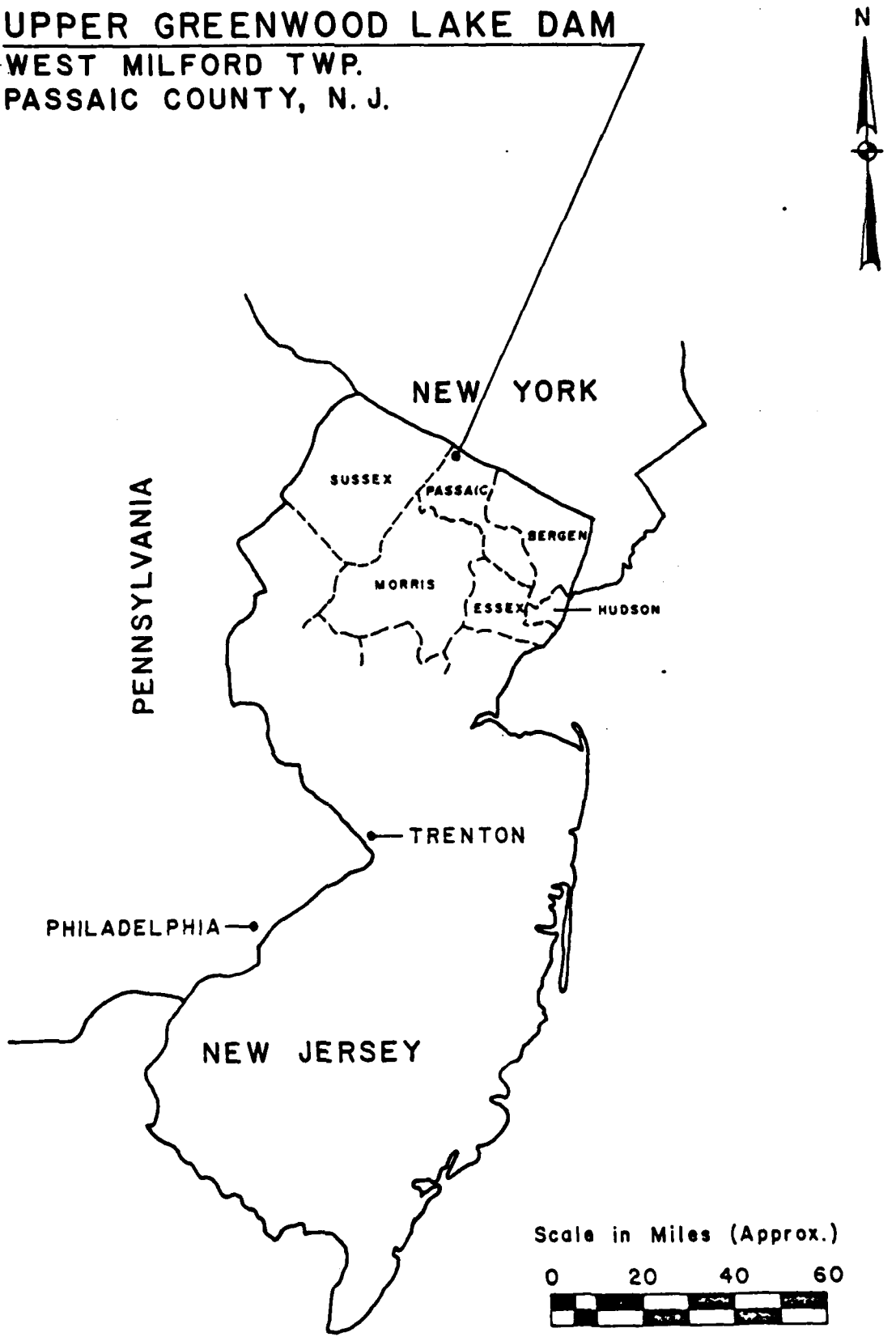
c. O & M Procedures

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.

PLATES

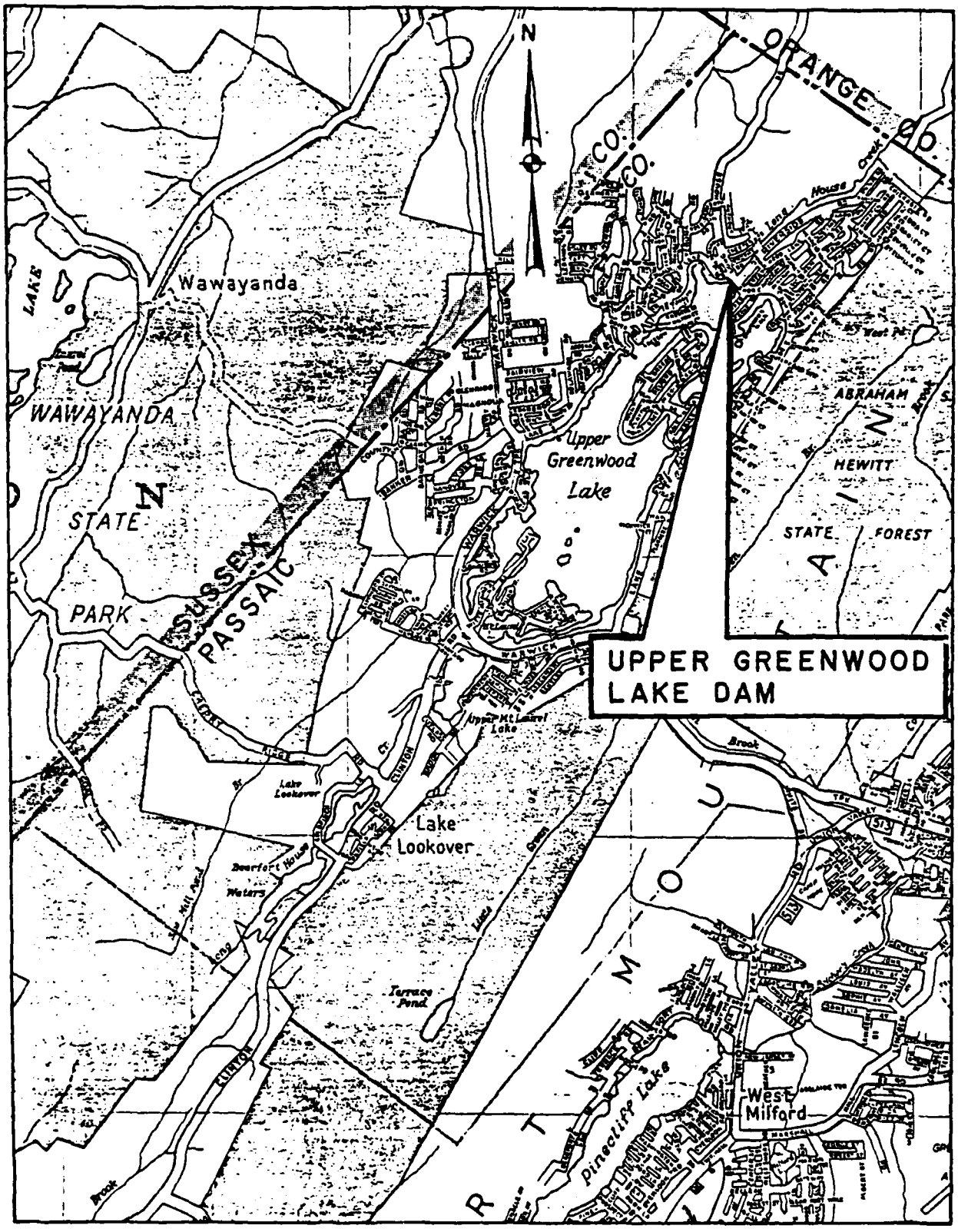
UPPER GREENWOOD LAKE DAM

WEST MILFORD TWP.
PASSAIC COUNTY, N. J.



KEY MAP

PLATE 1

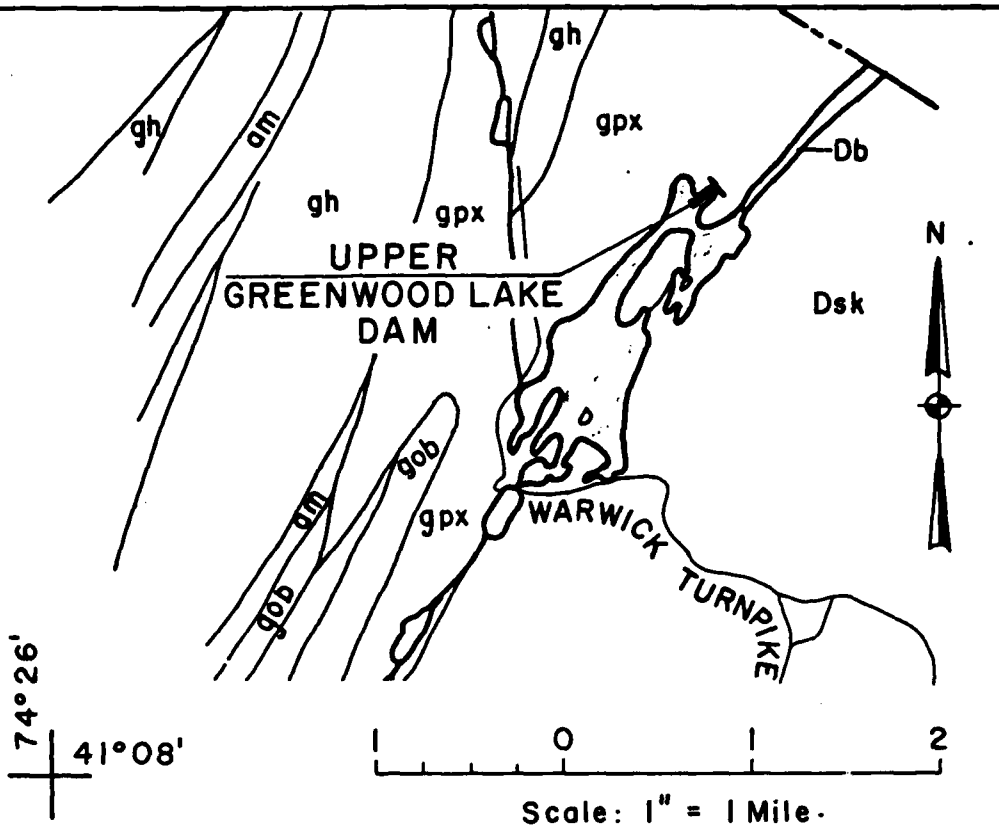


Scale in Feet (Approx.)

2,000 0 2,000 4,000 6,000 8,000 10,000

VICINITY MAP

PLATE IA



LEGEND

PRE~CAMBRIAN

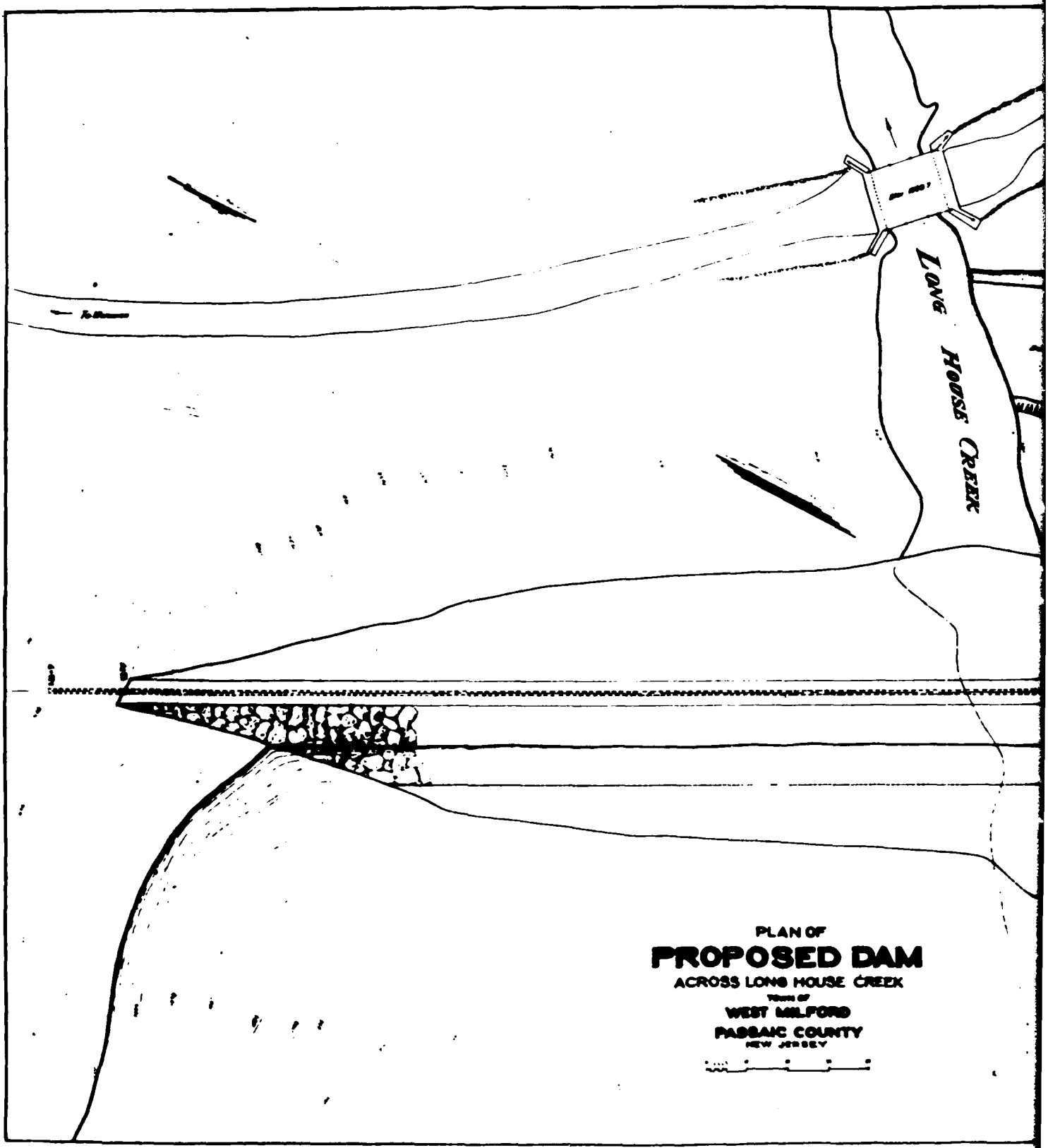
am	Amphibolite
gh	Mostly Hornblende Granite and Gneiss
gob	Quartz~Oligoclase~Biotite Gneiss
gpx	Pyroxene Gneiss

DEVONIAN

Db	Bellvale Sandstone
Dsk	Skunnemunk Conglomerate

GEOLOGIC MAP
UPPER GREENWOOD LAKE DAM

PLATE 2


LONG HOUSE CREEK
PLAN OF
PROPOSED DAM
ACROSS LONG HOUSE CREEK
WEST MILFORD
PASSAIC COUNTY

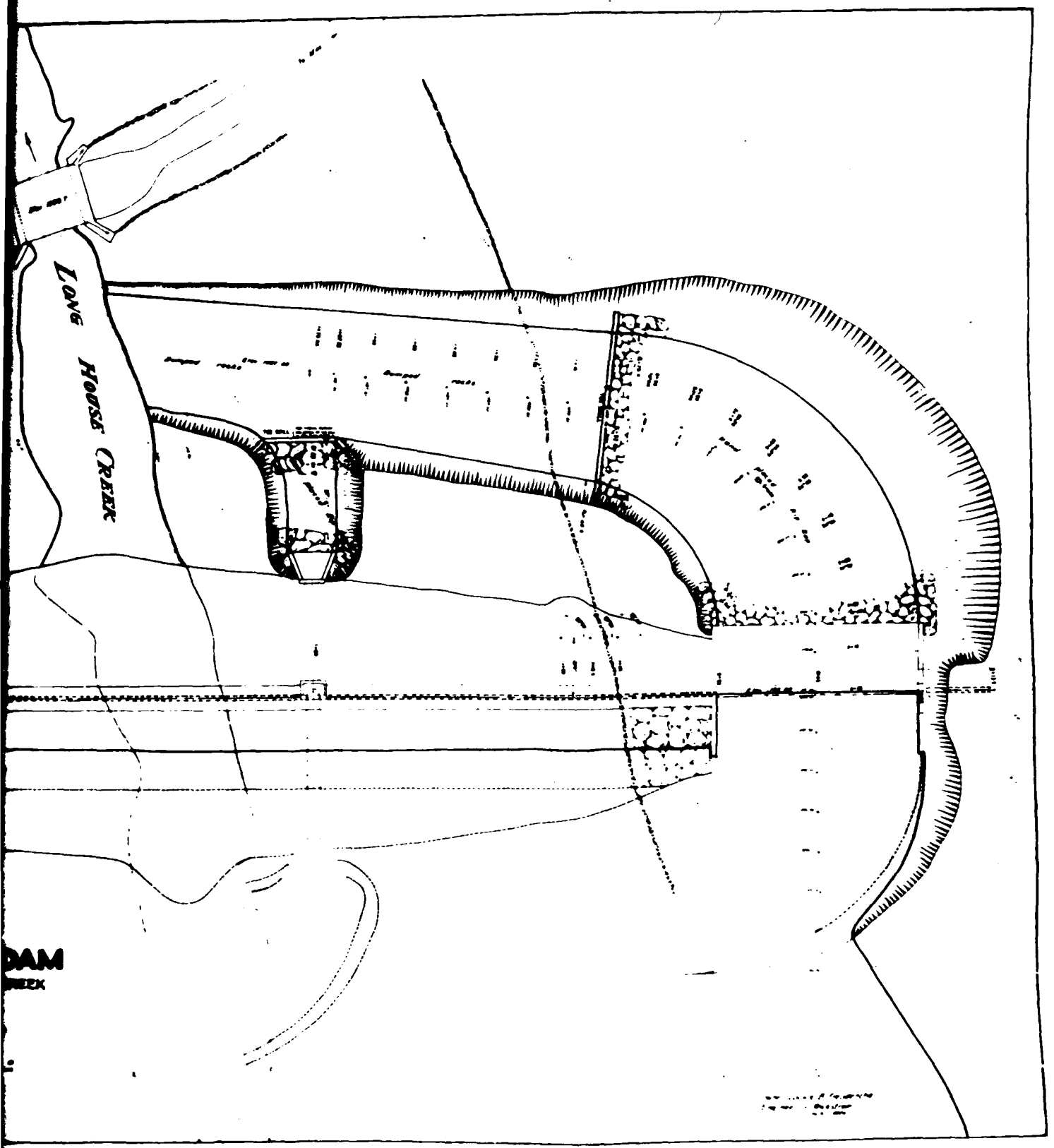
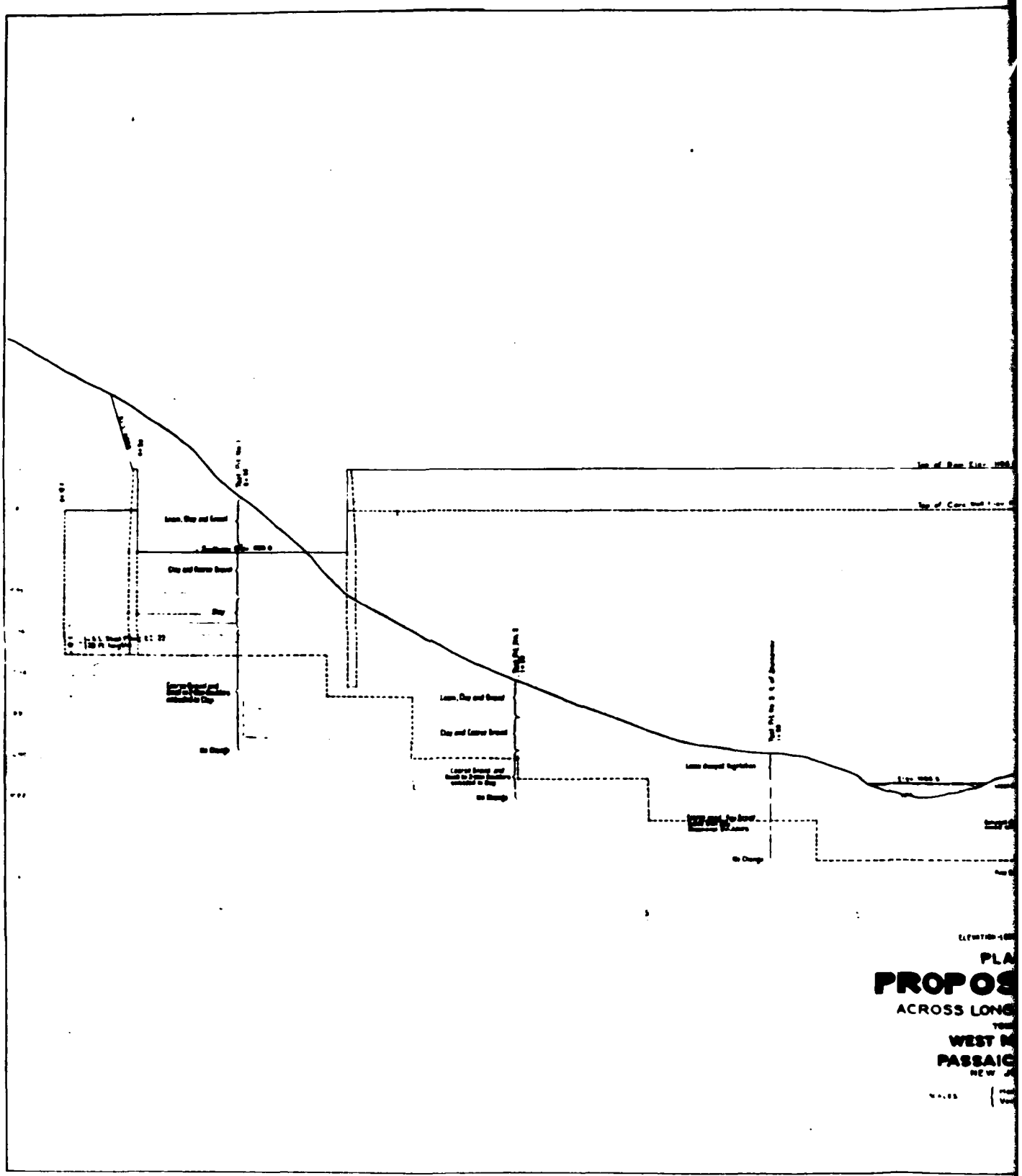
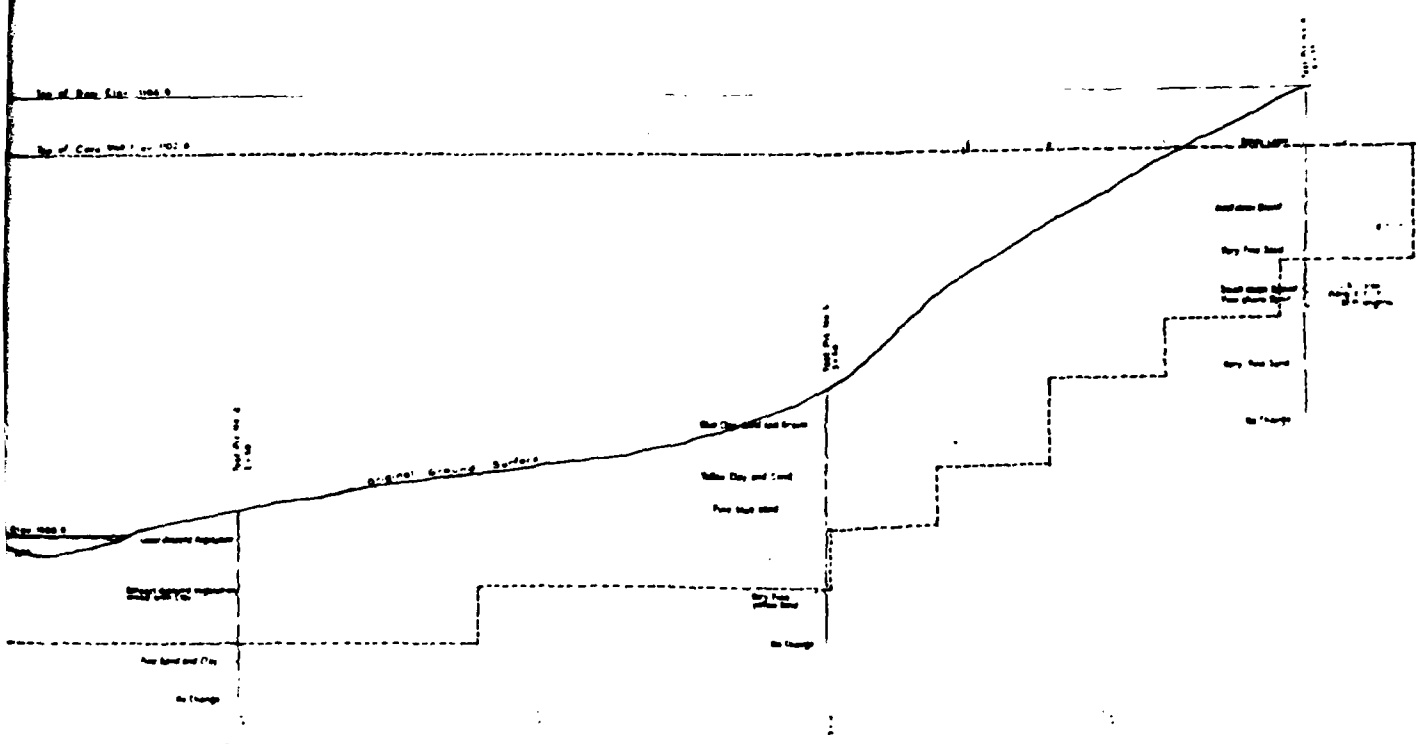


PLATE 3


Loam, Clay and Gravel
Clay and Coarse Gravel
Clay
Loam, Clay and Gravel
Clay and Coarse Gravel
Loam deposit highbottom
PL
PROPOS
ACROSS LONG
WEST
PASSAIC



PLAN OF

ROPOSED DAM

ACROSS LONG HOUSE CREEK

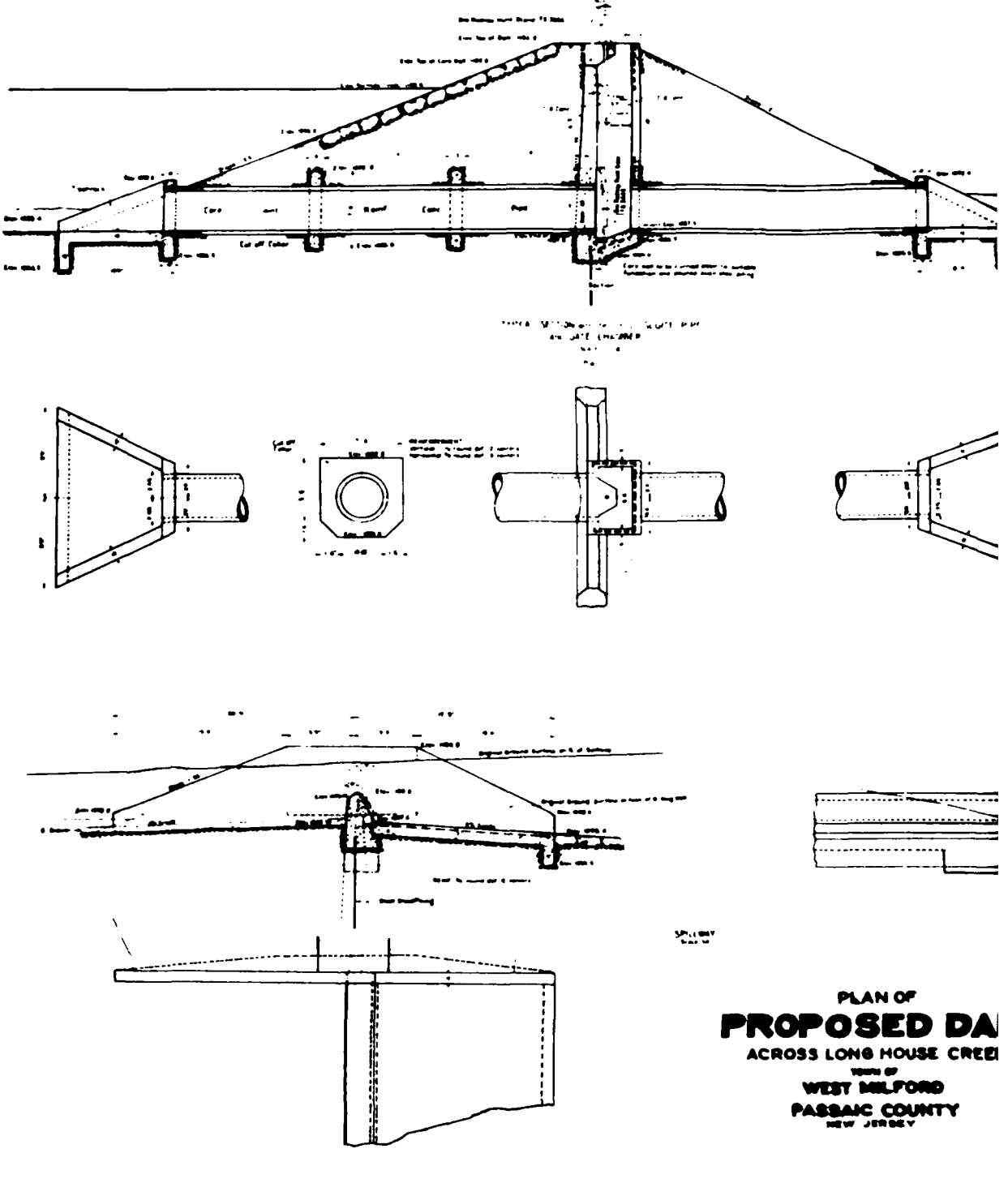
TOWNSHIP OF

WEST MILFORD

PASSAIC COUNTY

NEW JERSEY

PLATE 4



PLAN OF

PROPOSED DA

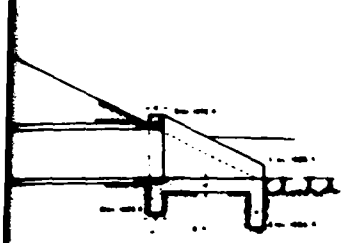
ACROSS LONG HOUSE CREE

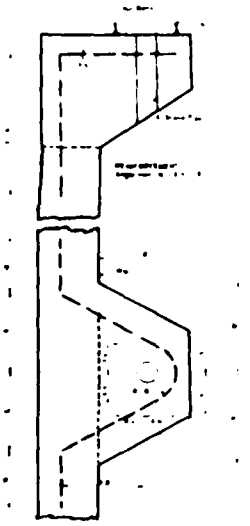
TOWN OF

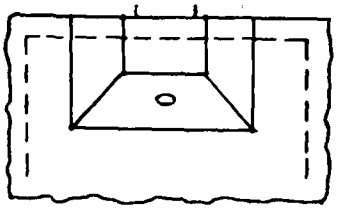
WEST MILFORD

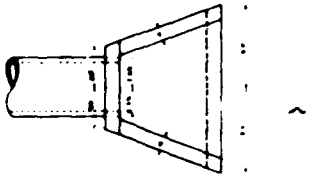
PASSAIC COUNTY

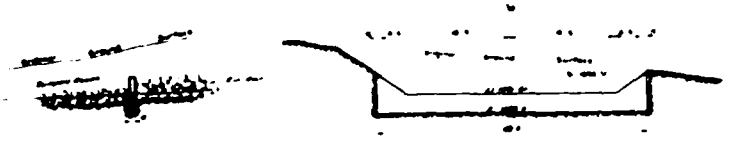
NEW JERSEY

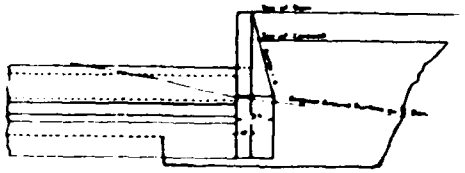


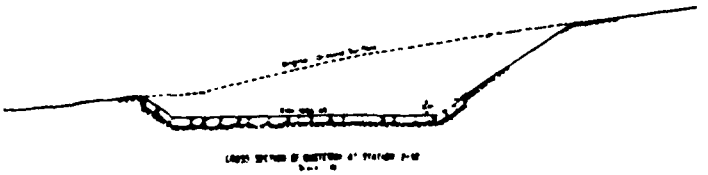












PLAN OF

POSED DAM

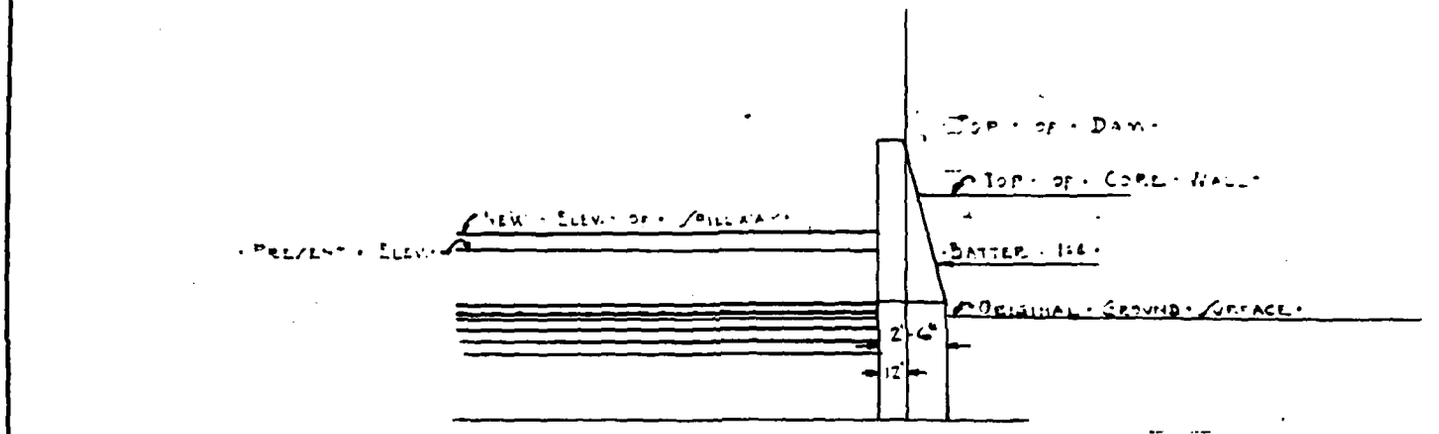
S LONG HOUSE CREEK

WEST MILFORD

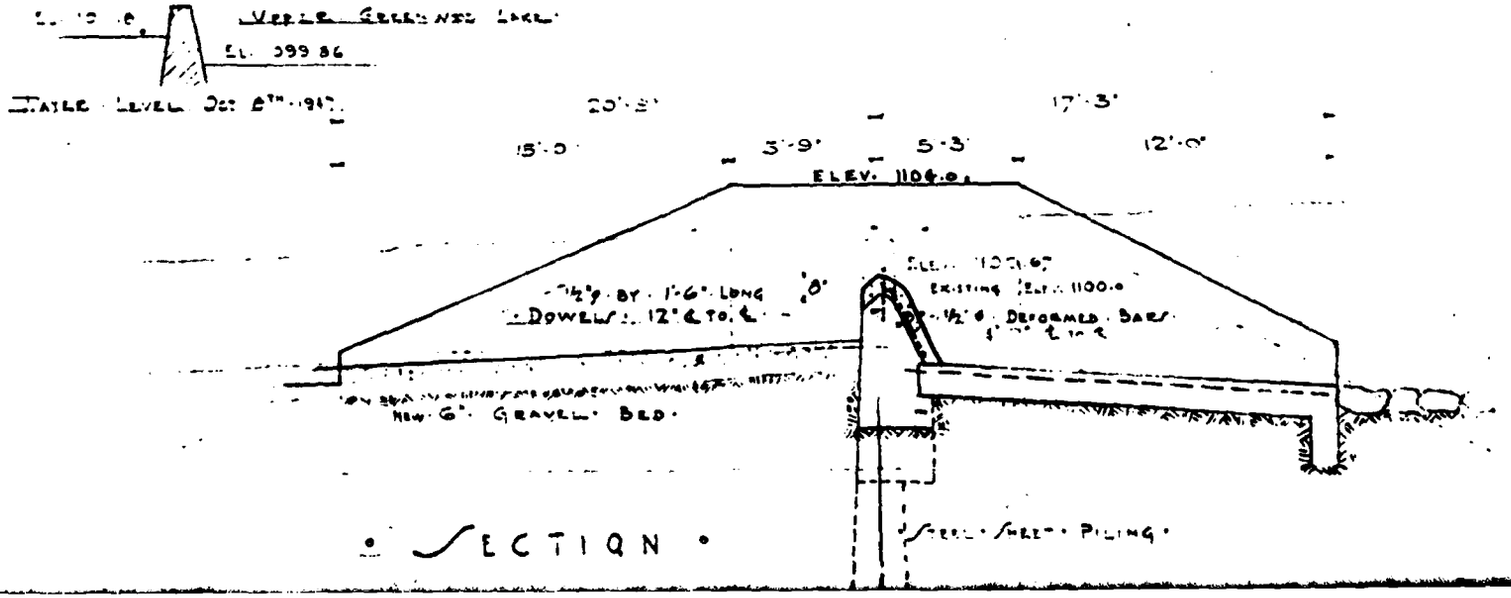
PASSAIC COUNTY

2

PLATE 5



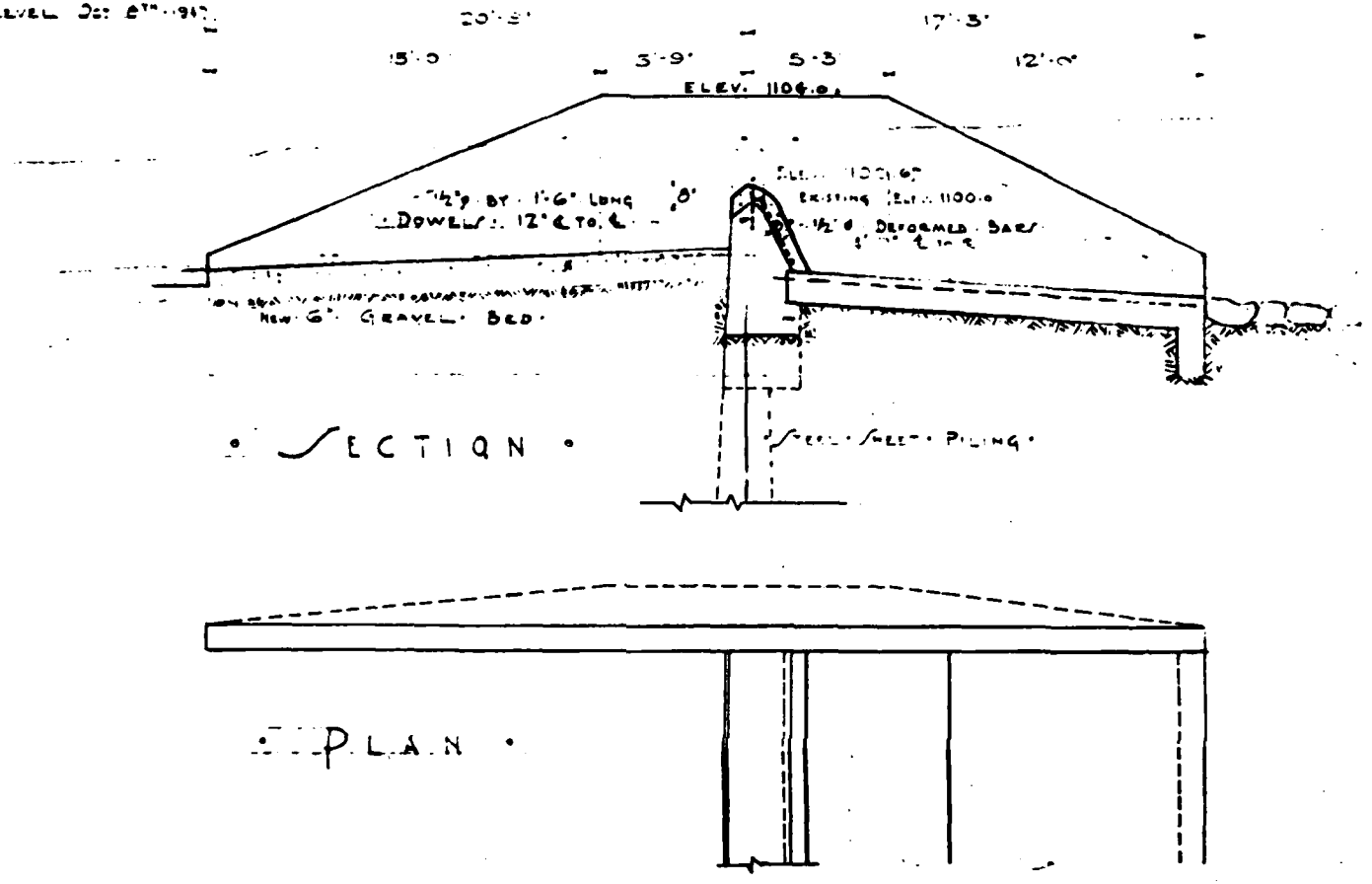
ELEVATION



SECTION

EL. 999.86

STATE LEVEL Oct 8TH 1947



SECTION

PLAN

PROPOSED
SPILLWAY ALTERATION
OF
DAM ACROSS LONG HOUSE CREEK
TOWNSHIP OF WEST MILFORD
PASSAIC COUNTY
NEW JERSEY

SCALE 1" = 4'-0"

DATE: SEPTEMBER 16TH 1947
ENGINEER: A MEIER
LICENSE: NO. 10866

PLATE 6

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam UPPER GREENWOOD LAKE DAM County Passaic State New Jersey Coordinators NJ-DEP

Date(s) Inspection November 14, 1979
December 4, 1979
Weather Cloudy Temperature 35°F.

Pool Elevation at Time of Inspection 1100.4 NGVD Tailwater at Time of Inspection 1095.5 NGVD

Inspection Personnel:

November 14, 1979:

Chuck Chin
Eugene Koo
Thomas Lakovich (Recorder)

December 4, 1979:

Chuck Chin
James McCormick

OWNER/REPRESENTATIVE:
December 4, 1979

George Bizub
Upper Greenwood Lake
Property Owners Association, Inc.
Hewitt, NJ 07412

CONCRETE / MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE N/A		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS N/A		
DRAINS N/A		
WATER PASSAGES N/A		
FOUNDATIONS N/A		

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS--CONCRETE SURFACES N/A		
STRUCTURAL CRACKING N/A		
VERTICAL & HORIZONTAL ALIGNMENT N/A		
MONOLITH JOINTS N/A		
CONSTRUCTION JOINTS N/A		

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS	None noticed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No visible movement or cracking at or beyond toe was noticed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	No sloughing or erosion was visible	
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST	Good	
RIPRAP FAILURES	None	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
Numerous birch trees, 2 in. to 1 ft. in diameter, and shrubs growing on downstream side of earth embankment		Remove trees and shrubs
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No differential settlement was noted.	
ANY NOTICEABLE SEEPAGE	None noticed	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	Could not see surface of stilling basin of low level outlet.Under Water.	
INTAKE STRUCTURE	Low level drain under water in lake. Not visible.	
OUTLET STRUCTURE	Low level drain has concrete headwall. Drain underwater--not visible. Visible portion of concrete headwall in good condition. Low level outlet gate, in good condition, operated satisfactorily.	
OUTLET FACILITIES	None	
EMERGENCY GATE	None	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	The concrete spillway appears in good condition. Wood planks, cobblestones and other debris were noted on top of spillway. Vertical cracks were visible on both abutments. Concrete sidewalk, adjacent to right abutment, has cracks and holes along its base.	Remove wood planks, cobble stones & other debris from spillway. Determine extent of cracks & repair. Remove and replace sidewalk.
APPROACH CHANNEL	Reservoir	
DISCHARGE CHANNEL	Two cracks in concrete apron of stilling basin on right side. Cracks are located approximately 3 ft. & 7 ft. from right abutment. Wood planks and other debris were in the stilling basin.	Repair concrete cracks. Remove wood planks and other debris.
BRIDGE AND PIERS	Two steel I-beams supported by two piers, span the spillway. The beams once had supported the bridge's deck which consisted of the wood planks mentioned above as debris.	Remove "I" beams and piers to prevent entrapment of debris thus reducing the spillway capacity.

GATED SPILLWAY

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

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	Moderate to steep side slopes. No indication of slope instability	
SEDIMENTATION	None noticed	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Good condition. Wood planks, fallen trees and other debris in channel. Roadway bridge (Upper Greenwood Rd.) crosses over channel approximately 200 ft. from the spillway.	Remove wood planks, fallen trees & other debris
SLOPES	Moderate	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Two houses are located approximately 250 ft. from the spillway.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available on microfilm at NJ Department of Enviironmental Protection (NJ-DEP), 1474 Prospect Street, P.O. Box CN-029, Trenton, NJ)8625
REGIONAL VICINITY MAP	Available-Passaic County Map & U.S.G.S. Quadrangle Sheet for Greenwood Lake, N.Y.-N.J.
CONSTRUCTION HISTORY	No formal history exists, but it can be deduced from available plans and drawings
TYPICAL SECTIONS OF DAM	Available on microfilm at NJ-DEP
HYDROLOGIC/HYDRAULIC DATA	No Hydrologic data. Hydraulic data available on microfilm at NJ-DEP
OUTLETS - PLAN	Available on microfilm (NJ-DEP)
- DETAILS	Available on microfilm (NJ-DEP)
- CONSTRAINTS	None
- DISCHARGE RATINGS	Not available
RAINFALL / RESERVOIR RECORDS	Not 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 Passaic County and Engineering Soil Survey of New Jersey. Report No. 3--Passaic County, by Rutgers University (New Brunswick, N.J.).
DESIGN COMPUTATIONS *HYDROLOGY & HYDRAULICS* DAM STABILITY SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS	None available
BORING RECORDS	Test pit data, dated 1932, available on microfilm at NJ-DEP
LABORATORY	None available
FIELD	None available
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Unknown
SPILLWAY PLAN - SECTIONS - DETAILS	Available on microfilm at NJ-DEP

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

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available
MONITORING SYSTEMS	None available
MODIFICATIONS	Existing spillway altered in 1947. Available on microfilm at NJ-DEP
HIGH POOL RECORDS	Not kept
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Existing condition report, June 22, 1969, available on microfilm at NJ-DEP
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None known to exist
MAINTENANCE OPERATION RECORDS	None known to exist

APPENDIX B

PHOTOGRAPHS

(Taken on November 14, 1979)

Photo 1 - View of spillway from downstream. Note remains of bridge's wood deck at left. Dam and low level outlet is out of view on right.

Photo 2 - Detail showing cracks and holes in concrete sidewalk. View is from downstream.

Photo 3 - View of dam from right abutment. Note vertical cracks in abutment and the birch trees growing on dam's downstream side. The cover for the low level gate is top center.

Photo 4 - View from left abutment. Note vertical cracks in abutment.

Photo 5 - Detail showing vertical cracks in left abutment.

Photo 6 - Detail showing cracks in spillway's apron.

Photo 7 - View of reservoir area from spillway's right abutment.

Photo 8 - View of reservoir area from spillway's left abutment. Private beach is at upper left.

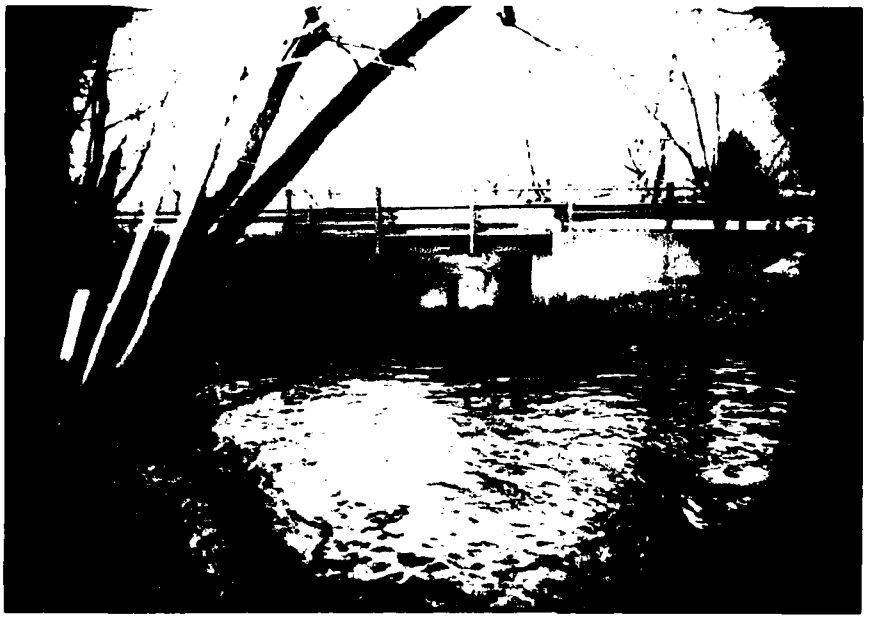


Photo 9 - View of roadway bridge (Upper Greenwood Road) crossing over channel approximately 200 feet downstream from the spillway.

Photo 10 - View of two houses approximately 50 feet downstream of roadway bridge mentioned above or about 250 feet downstream from the spillway.

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: UPPER GREENWOOD LAKE DAM

Drainage Area Characteristics: 6.2 sq.mi., generally flat, forest & residential

Elevation Top Normal Pool (Storage Capacity): 1,100.7 NGVD (2,106 Acre-feet)

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

Elevation Maximum Design Pool: 1,106.65 NGVD (5,681 Ac-Ft-SDF pool)

Elevation Top Dam: 1,104.0 NGVD (3,994 acre-feet)

SPILLWAY CREST:

a. Elevation 1,100.7 NGVD

b. Type Ungated ogee overflow

c. Width 2 ft.

d. Length 50 ft.

e. Location Spillover Full length

f. No. and Type of Gates None

OUTLET WORKS:

a. Type One 42-inch diameter low level outlet

b. Location 100 ft. left of spillway

c. Entrance Inverts 1,088.4 NGVD

d. Exit Inverts 1,086.5 NGVD

e. Emergency Draindown Facilities 42-inch with manual operated low level outlet gate

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

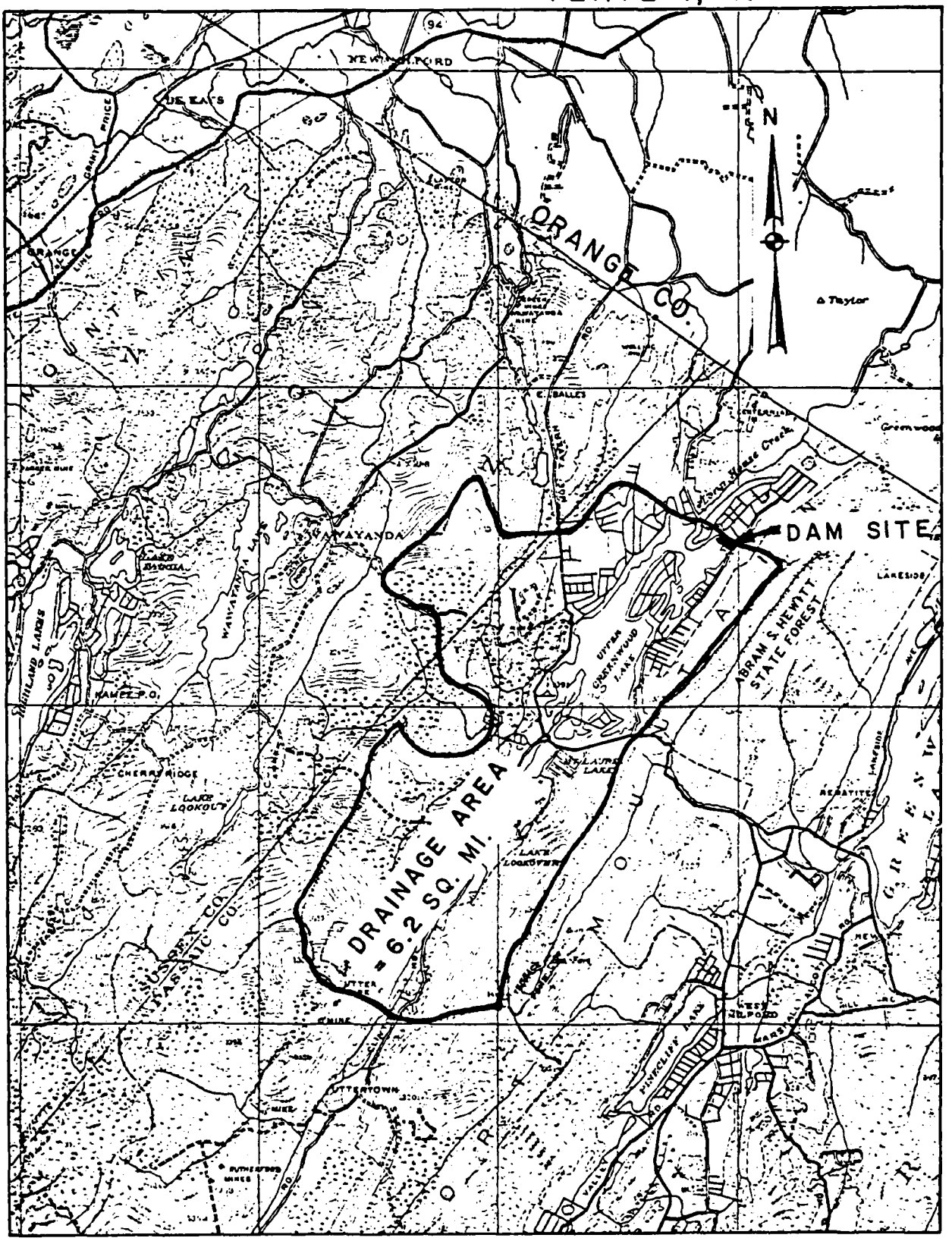
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: 1,139 cfs at el. 1,104 NGVD

APPENDIX D

HYDROLOGIC COMPUTATIONS

PLATE 1, APPENDIX D



Scale 1" = 1 Mile

UPPER GREENWOOD LAKE DAM
DRAINAGE BASIN

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT NJ Dam Safety Prog Group XVII
Upper Greenwood Lake
COMPUTED BY EK CHECKED BY CLC

SHEET NO. 1 OF 10
JOB NO. 10-A83-01
DATE 12/10/79

SIZE CLASSIFICATION

Surface Area of Main Impoundment	521 Acre ±
Average Depth of Lake	10 Ft ±
Structural Height of Dam	19.0 Ft
Size Classification	Intermediate

Hazard Potential Classification

Two Houses and Heavily Traveling County Rd. Just D/S of Dam

Hazard Potential Classification	High
Recommended SDF	PMF

HYDROLOGIC ANALYSIS

The HEC-1 DB will be used to route the flood using SCS Traingular Unit Hydrolograph with Curvilinear Transformation

D.A. = 6.2 sq mi

Precipitation

From Fig 15, At boundary Zone 1 & Zone 6 (Ref. Design of Small Dam)

Probable Max. Precipitation = 25 inches for 6 hrs

Duration and 10 Sq. mi° area.

Duration (hrs)	% of PMF		
	Zone 1	Zone 6	AVE. VALUE
6	99	100	99.5
12	111	109	110
24	119	117	118
48	127	126	126.5

Value are reduced by 20% to account for Misalignment of Basin & Storm Isohystals.

INFILTRATION DATA.

Drainage are consits of Most of Mmg, Sc and Some of $\frac{\text{Gmx 24-R}}{\text{Mmg}}$

Hydrologic Soil Group — D

USE INTIAL INFITration — 0.5 inch

USE CONSTANT INFITration — 0.05 inch/hr

TIME OF CONCENTRATION

1) ESTIMATING T_C from velocity Estimate & Watercourse Length

	slope	vel	
Overland Flow	$\frac{225}{21200} = 0.9\%$	1.5 fps	Wood Lands (upper watershed)
1st Reach	$\frac{75}{20800} = .36\%$	1 fps	Natural channel

$$t_c = \left(\frac{21200}{1.5} + 20800\right)/3600 = 10.3 \text{ hr}$$

2) From Nomograph "Design of Small Dam"

$\Delta H = 225 + 75 = 300$

$L = 45000$ Ft

$t_c = 3.1$ hrs

3) USING F.A.A. Formula for Surface Flow (Airport Drainage)

$$T_c = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{S}} = \frac{1.8(1.1-.3)\sqrt{45000}}{\sqrt[3]{0.667}\ 60} = 5.83 \text{ hrs}$$

$D = 45000$
$C = 0.30$ (Residential and Woodland)
$S = \frac{300}{45000} = 0.667\%$

USE $T_C = 6.41$

$\underline{Lag} = 0.6\ T_C = 0.6 \times 6.41 = 3.85$ hr.

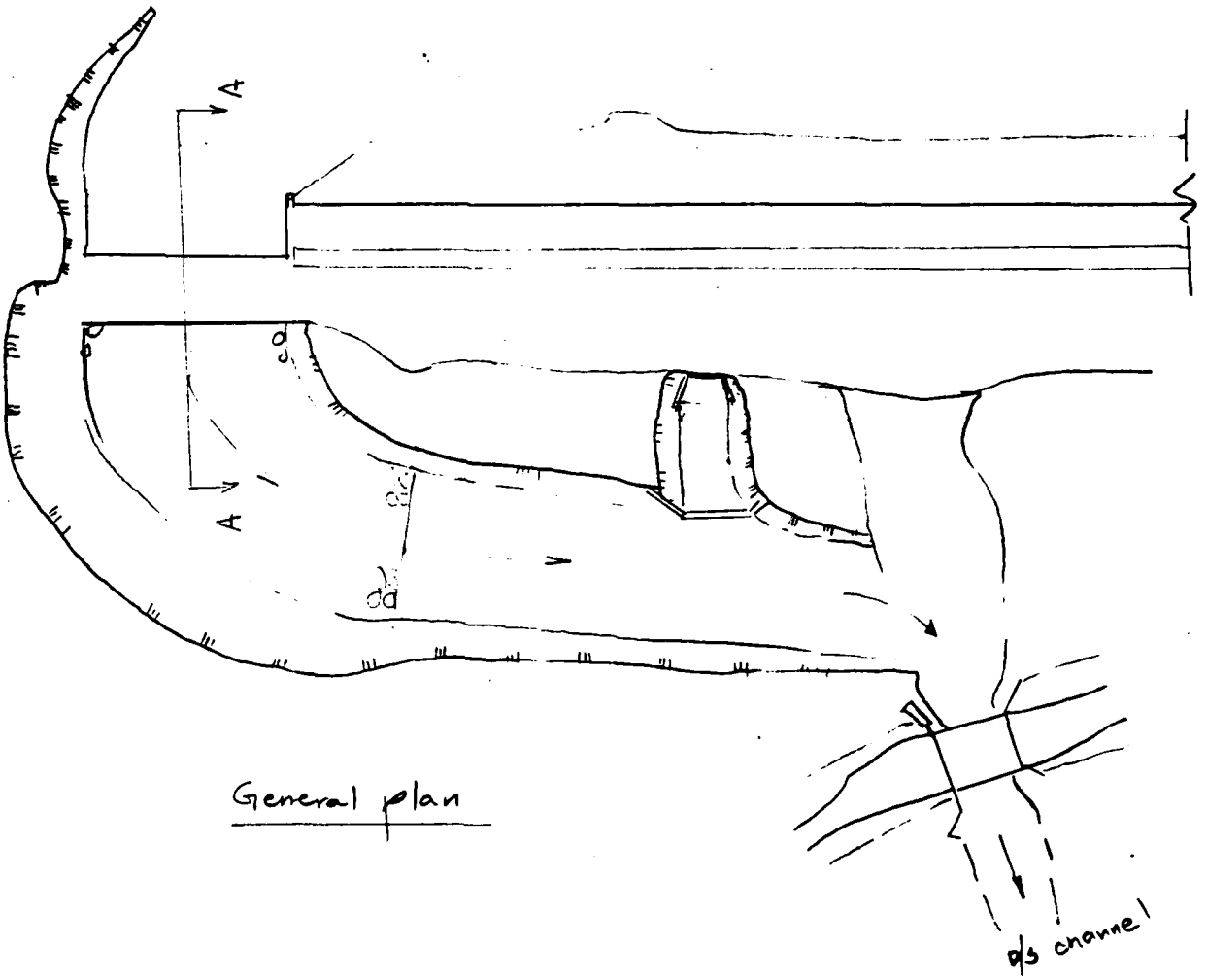
ELEVATION – AREA – CAPACITY RELATIONSHIP

INFormation obtained from USGS

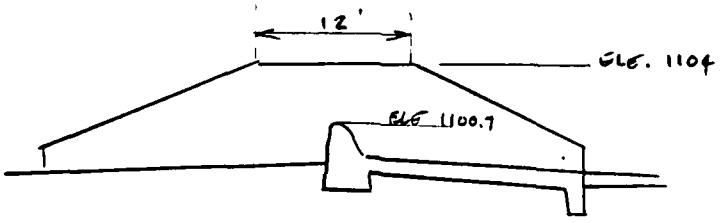
ELE	1090*	1160	1120
Surface Area (AC)	0	521	1019

* Bottom of LAKE AT Spillway

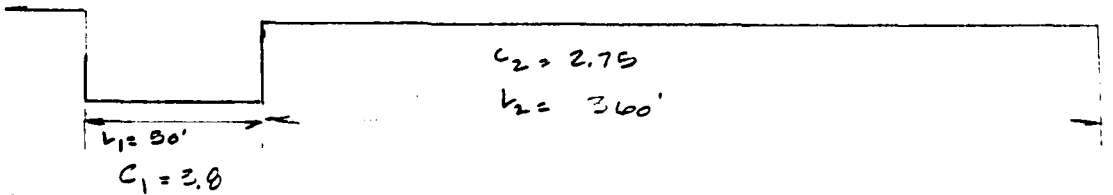
HEC-1-DB program will develop Storage capacity from surface area & elevations.



General plan



SECTION A-A

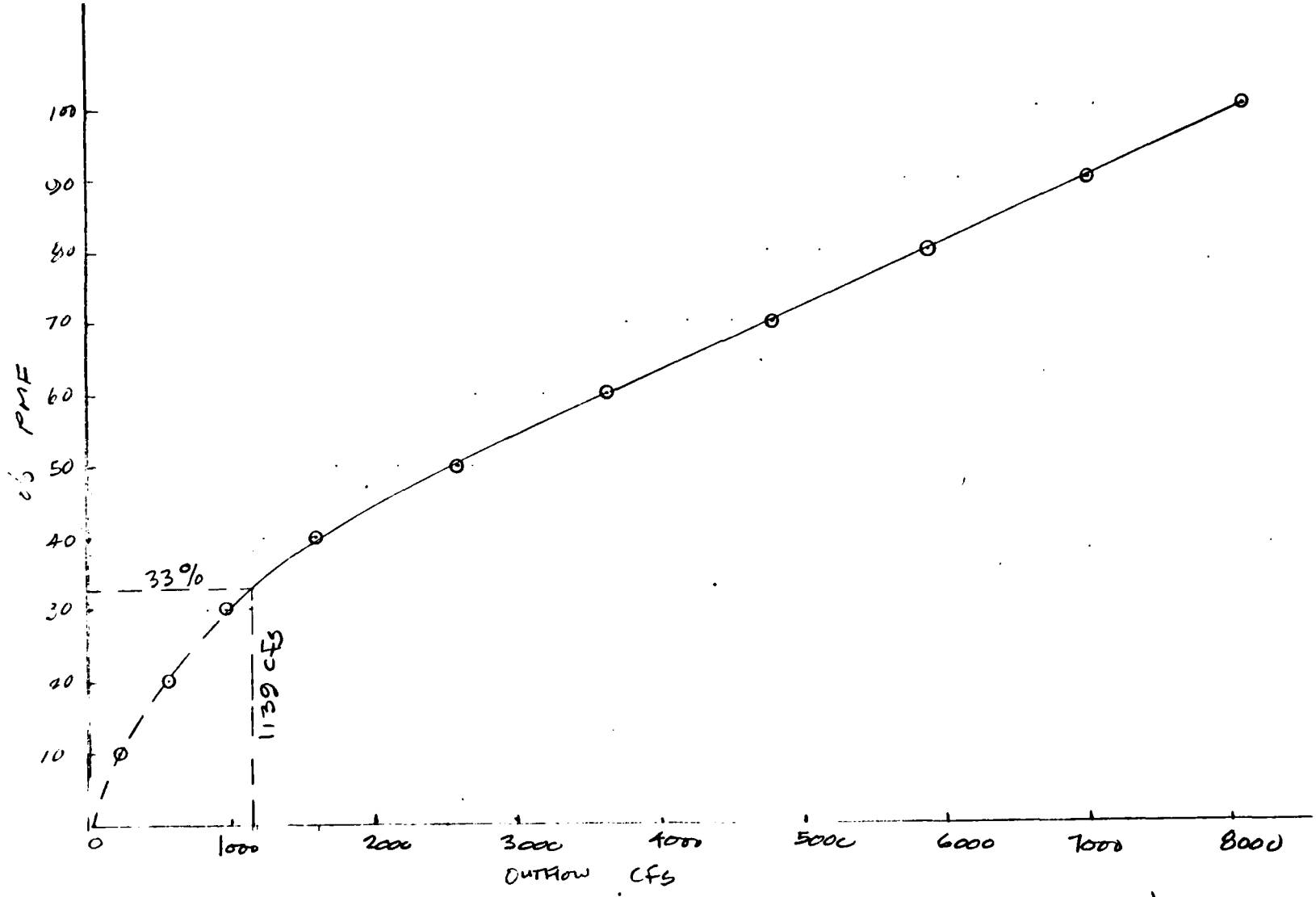


(Ref "Design of Small Dam" & "Hydraulics of Bridge waterway")

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT NJ DAM SAFETY PROG. GROUP XVII SHEET NO. 6 OF 10
Upper Greenwood Lake JOB NO. 10-AB3-01
COMPUTED BY B.K. CHECKED BY C.L.C. DATE 12/11/79

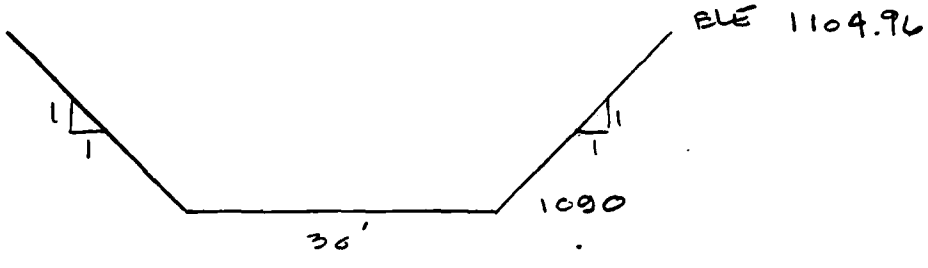
OVERTOPPING POTENTIAL



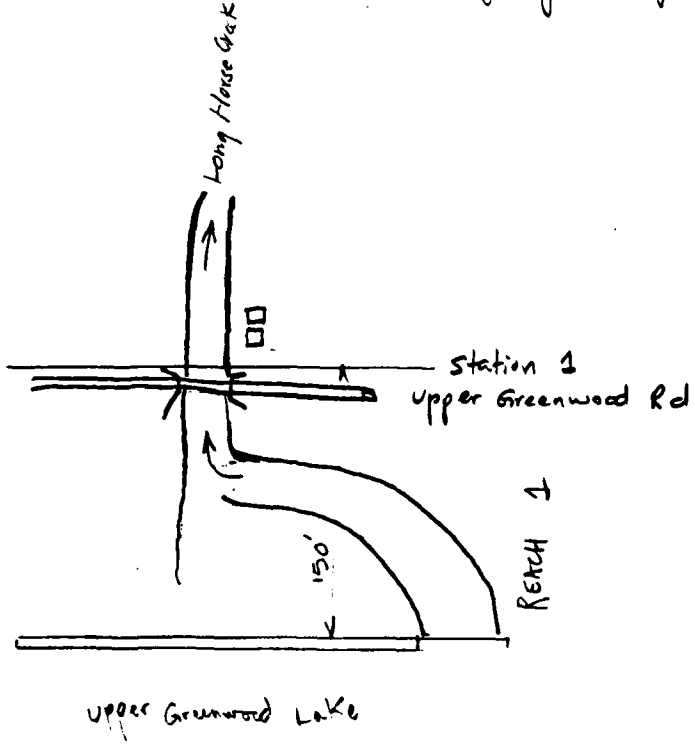
Overtopping of Dam Occurs at Ele. 1104 with Q = 1139 cfs (~ 33% PMF)

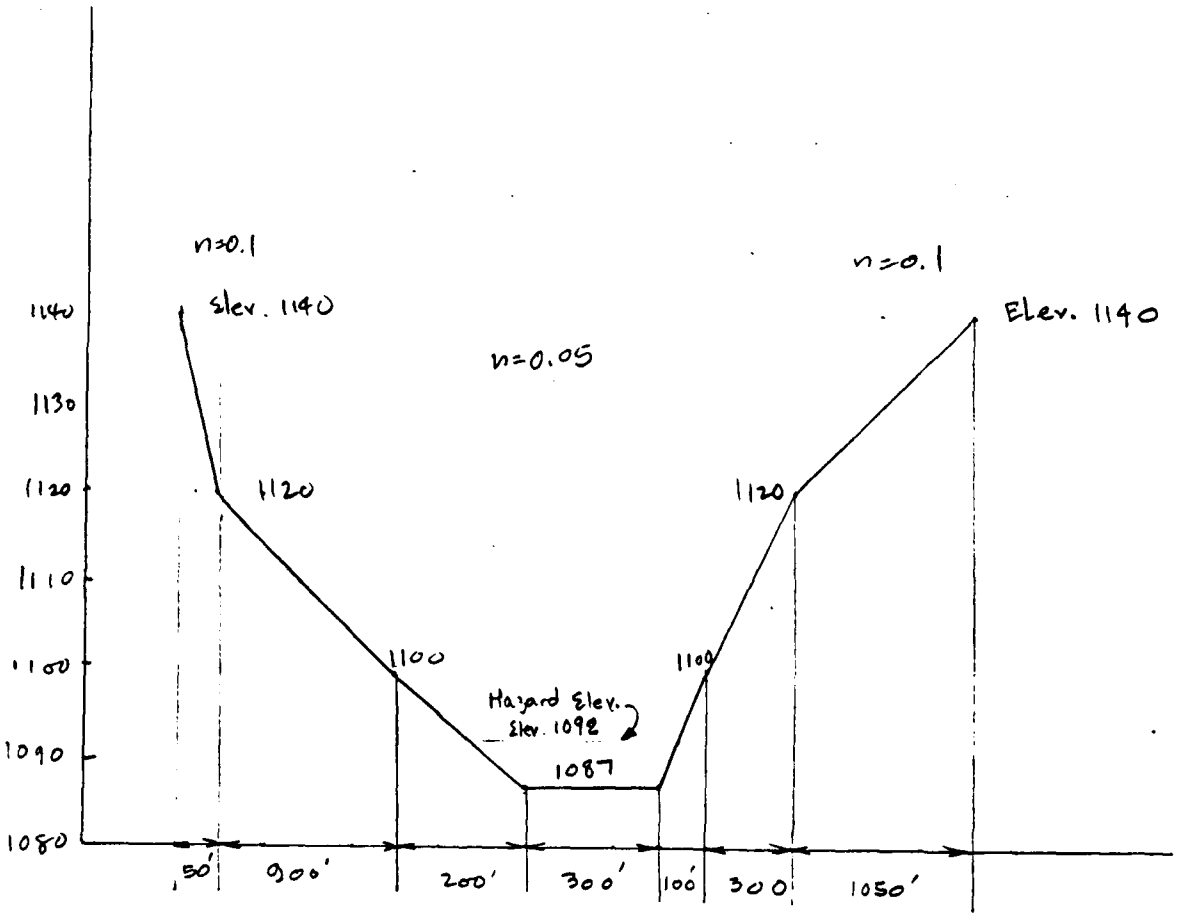
Breach Analysis

The Breach begins to develop when Reservoir Stage reaches Ele. 1104.96 at 50% PMF with failure time 0.5 hr.



Assume bridge d/s of dam fails instantly upon impact of flood wave.

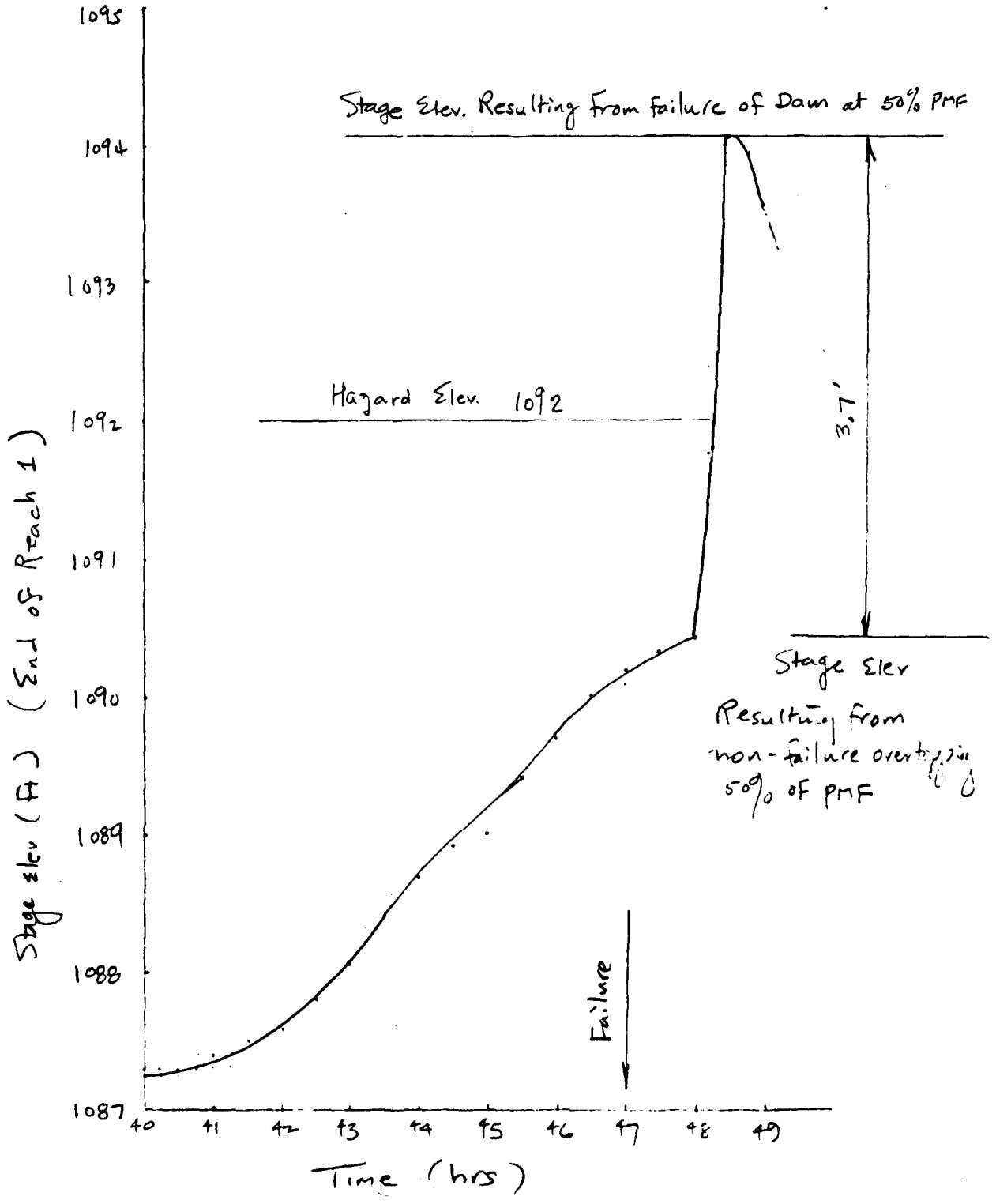




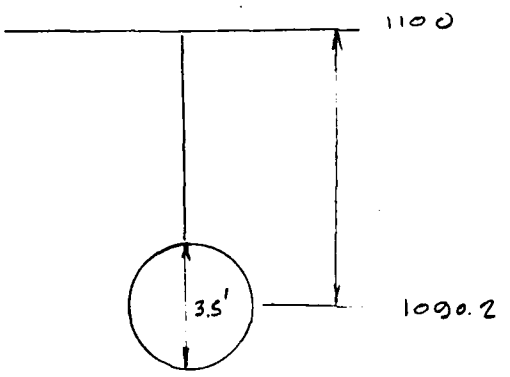
Cross Section

END OF REACH 1 (Station 1)

$S = 0.0012$


Stage Elev. Resulting from failure of Dam at 50% PMF
Hazard Elev. 1092
3.7'
Stage Elev Resulting from non-failure overtopping 50% of PMF
Failure
Stage elev (ft) (End of Reach 1)
1095
1094
1093
1092
1091
1090
1089
1088
1087
40
41
42
43
44
45
46
47
48
49
Time (hrs)

Drawdown Time Computation



Normal elevation to start @ 1100

D.A = 6.2 Sq Mi

Inflow @ 2 CFS/Sq.Mi = 12.4 cfs

$Q = CA\sqrt{2gh}$ $C = 0.63$

$= 48.64\sqrt{h}$

Res Elv	Area acre	Ave Area	Volume Ac-Ft	Ave Res El	h	Q. Ave. outlet discharge cfs $48.64\sqrt{h}$	t_1 hrs time to plan $\frac{\text{Vol} \times 2U}{1.98Q}$	Cul time hrs	t_2 time to drain $\frac{2 \times 12.4 \times t_1}{Q}$	Cul time (hr)
1100	521									
		427.2	854.4	1099		144.3	71.8	71.8	6.2	78.0
1098	333.4									
		260.5	521	1097		126.8	99.8	121.6	4.9	132.7
1096	187.6									
		135.5	271	1095		106.6	30.8	152.9	3.6	167.1
1094	83.4									
		52.1	104.2	1093		81.4	15.5	167.9	2.9	185
1092	20.8									
		12.5	22.5	1091.1		46.1	5.9	173.8	1.6	192.5
1090.2	3.3									
1088.7	0									

A) Time of complete drawdown with no inflow = 173.8 hr ≅ 7 days

B) Time of complete drawdown with inflow = 192.5 hr ≅ 8 days

$A_1 \cong \frac{A_2}{(\frac{h}{H}+1)^2}$ $h + H_f = 10$ $A_2 = 521$ acre

```
A1                N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII  10A8301
A2                N J 00186 UPPER GREENWOOD LAKE, BERGEN COUNTY, NJ
A3                MULT RATIO ROUTING,PRC-HARRIS INC., WOODBRIDGE, N J
B     150         0       15                                  0       0       4
B1      5
J       1         9       1
J1    1.0        .9       .8      .7      .6      .5      .4      .3      .1
K       0    LAKE                        0       0       1
K1                INFLOW HYDROGRAPH THROUHG UPPER GREENWOOD LAKE
M       1         2       6 2             6.2     0.8                             1
P                25      99 5     110     118    126.5
T                                                       0.5    0.05
W2              3.85
X      -1        -.05       2
K       1       DAM                     0       0       1
K1                ROUTING DISCHARGE THROUGH DAM
Y                                       1       1
Y1      1                                               -1100.7       0
$A      0       521     1019
$E   1090      1100     1120
$$1100.7         50      3.8     1.5
$D   1104      2.75      1.5     360
K      99
A
A
A
A
A
8
```

Passaic County, NJ

N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII 10A8301
N J 00186 UPPER GREENWOOD LAKE, ~~BERGEN COUNTY, NJ~~ Passaic County, NJ
MULT RATIO ROUTING,PRC-HARRIS INC., WOODBRIDGE, N J

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	15	0	0	0	0	0	4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1
RTIOS= 1.00 .90 .80 .70 .60 .50 .40 .30 .10

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

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH THROUHG UPPER GREENWOOD LAKE

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	6.20	0.00	6.20	.80	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.00	99.50	110.00	118.00	126.50	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	.50	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 3.85

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 79 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= 3.85 VOL= 1.00

14.	36.	69.	110.	156.	213.	282.	358.	448.	532.
608.	663.	708.	737.	749.	753.	748.	731.	703.	670.
636.	597.	552.	504.	447.	395.	348.	314.	283.	255.
230.	207.	190	173.	156.	141.	127.	113.	103.	93.
84.	76.	69.	62.	55.	50.	45.	40.	37.	33.
30.	27.	25.	22.	20.	18.	16.	15.	13.	12.
11.	10.	9.	8.	7.	7.	6.	6.	5.	5.
4.	4.	3.	3.	2.	2.	1.	1.	0.	

0 PMF

END-OF-PERIOD FLOW												
MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.15	1	.00	0.00	.00	6.	1.02	.15	97	.03	.01	.01	162.
1.01	.30	2	.00	0.00	.00	5.	1.02	.30	98	.03	.01	.01	147.
1.01	.45	3	.00	0.00	.00	5.	1.02	.45	99	.03	.01	.01	133.
1.01	1.00	4	.00	0.00	.00	5.	1.02	1.00	100	.03	.01	.01	122.
1.01	1.15	5	.00	0.00	.00	4.	1.02	1.15	101	.03	.01	.01	113.
1.01	1.30	6	.00	0.00	.00	4.	1.02	1.30	102	.03	.01	.01	106.
1.01	1.45	7	.00	0.00	.00	4.	1.02	1.45	103	.03	.01	.01	100.
1.01	2.00	8	.00	0.00	.00	4.	1.02	2.00	104	.03	.01	.01	97.
1.01	2.15	9	.00	0.00	.00	3.	1.02	2.15	105	.03	.01	.01	95.
1.01	2.30	10	.00	0.00	.00	3.	1.02	2.30	106	.03	.01	.01	96.
1.01	2.45	11	.00	0.00	.00	3.	1.02	2.45	107	.03	.01	.01	98.
1.01	3.00	12	.00	0.00	.00	3.	1.02	3.00	108	.03	.01	.01	102.
1.01	3.15	13	.00	0.00	.00	3.	1.02	3.15	109	.03	.01	.01	107.
1.01	3.30	14	.00	0.00	.00	2.	1.02	3.30	110	.03	.01	.01	112.
1.01	3.45	15	.00	0.00	.00	2.	1.02	3.45	111	.03	.01	.01	119.
1.01	4.00	16	.00	0.00	.00	2.	1.02	4.00	112	.03	.01	.01	126.
1.01	4.15	17	.00	0.00	.00	2.	1.02	4.15	113	.03	.01	.01	133.
1.01	4.30	18	.00	0.00	.00	2.	1.02	4.30	114	.03	.01	.01	141.
1.01	4.45	19	.00	0.00	.00	2.	1.02	4.45	115	.03	.01	.01	148.
1.01	5.00	20	.00	0.00	.00	2.	1.02	5.00	116	.03	.01	.01	155.
1.01	5.15	21	.00	0.00	.00	1.	1.02	5.15	117	.03	.01	.01	161.
1.01	5.30	22	.00	0.00	.00	1.	1.02	5.30	118	.03	.01	.01	168.
1.01	5.45	23	.00	0.00	.00	1.	1.02	5.45	119	.03	.01	.01	174.
1.01	6.00	24	.00	0.00	.00	1.	1.02	6.00	120	.03	.01	.01	179.
1.01	6.15	25	.01	0.00	.01	1.	1.02	6.15	121	.09	.07	.01	185.
1.01	6.30	26	.01	0.00	.01	1.	1.02	6.30	122	.09	.07	.01	192.
1.01	6.45	27	.01	0.00	.01	1.	1.02	6.45	123	.09	.07	.01	200.
1.01	7.00	28	.01	0.00	.01	1.	1.02	7.00	124	.09	.07	.01	210.
1.01	7.15	29	.01	0.00	.01	1.	1.02	7.15	125	.09	.07	.01	222.
1.01	7.30	30	.01	0.00	.01	1.	1.02	7.30	126	.09	.07	.01	238.
1.01	7.45	31	.01	0.00	.01	1.	1.02	7.45	127	.09	.07	.01	258.
1.01	8.00	32	.01	0.00	.01	1.	1.02	8.00	128	.09	.07	.01	282.
1.01	8.15	33	.01	0.00	.01	1.	1.02	8.15	129	.09	.07	.01	311.
1.01	8.30	34	.01	0.00	.01	1.	1.02	8.30	130	.09	.07	.01	345.
1.01	8.45	35	.01	0.00	.01	1.	1.02	8.45	131	.09	.07	.01	384.
1.01	9.00	36	.01	0.00	.01	1.	1.02	9.00	132	.09	.07	.01	425.
1.01	9.15	37	.01	0.00	.01	0.	1.02	9.15	133	.09	.07	.01	470.
1.01	9.30	38	.01	0.00	.01	0.	1.02	9.30	134	.09	.07	.01	516.
1.01	9.45	39	.01	0.00	.01	0.	1.02	9.45	135	.09	.07	.01	562.
1.01	10.00	40	.01	0.00	.01	0.	1.02	10.00	136	.09	.07	.01	609.
1.01	10.15	41	.01	0.00	.01	0.	1.02	10.15	137	.09	.07	.01	655.
1.01	10.30	42	.01	0.00	.01	0.	1.02	10.30	138	.09	.07	.01	700.
1.01	10.45	43	.01	0.00	.01	0.	1.02	10.45	139	.09	.07	.01	744.
1.01	11.00	44	.01	0.00	.01	0.	1.02	11.00	140	.09	.07	.01	785.
1.01	11.15	45	.01	0.00	.01	0.	1.02	11.15	141	.09	.07	.01	824.
1.01	11.30	46	.01	.00	.01	0.	1.02	11.30	142	.09	.07	.01	861.

1 01	11 45	47	01	0.00	.01	0.	1.02	11.45	143	.09	.07	.01	895.
1 01	12 00	48	01	0.00	.01	0.	1.02	12.00	144	.09	.07	.01	926.
1 01	12 15	49	04	0.00	04	0.	1.02	12.15	145	.50	.49	.01	960.
1 01	12 30	50	04	0.00	.04	0.	1.02	12.30	146	.50	.49	.01	999.
1 01	12 45	51	04	0.00	.04	0	1.02	12.45	147	.50	.49	.01	1049.
1 01	13 00	52	04	0 00	04	0.	1.02	13.00	148	.50	.49	.01	1114.
1 01	13 15	53	04	0.00	.04	0.	1.02	13.15	149	.60	.58	.01	1196.
1 01	13 30	54	04	0.00	.04	0	1.02	13.30	150	.60	.58	.01	1303.
1 01	13 45	55	04	0.00	.04	0.	0.00	0.00	151	.60	.58	.01	1440.
1 01	14 00	56	04	.01	.03	0.	0.00	0 00	152	.60	.58	.01	1611.
1 01	14 15	57	05	.04	.01	1.	0.00	0.00	153	.75	.73	.01	1824.
1 01	14 30	58	05	04	.01	3.	0.00	0.00	154	.75	.73	.01	2080.
1 01	14 45	59	05	.04	.01	6.	0.00	0.00	155	.75	.73	.01	2377.
1 01	15 00	60	05	04	01	11.	0 00	0.00	156	.75	.73	.01	2710.
1 01	15 15	61	05	04	.01	18	0.00	0 00	157	.76	.74	.01	3076.
1 01	15 30	62	.11	10	.01	28	0.00	0.00	158	1.51	1.50	.01	3481.
1 01	15 45	63	.31	.29	01	45.	0.00	0.00	159	4.23	4.22	.01	3964.
1.01	16 00	64	08	.06	.01	69.	0.00	0.00	160	1.06	1.05	.01	4504.
1.01	16.15	65	05	.04	.01	99.	0.00	0.00	161	.70	.68	.01	5107.
1 01	16 30	66	05	04	01	135	0 00	0 00	162	.70	68	01	5752.
1 01	16.45	67	05	.04	.01	176.	0.00	0.00	163	.70	.68	01	6423
1.01	17 00	68	05	.04	.01	223.	0.00	0.00	164	.70	.68	.01	7136.
1.01	17 15	69	.04	.03	.01	274.	0.00	0.00	165	.55	.53	.01	7888.
1.01	17.30	70	.04	.03	.01	329.	0.00	0.00	166	.55	.53	.01	8661.
1.01	17.45	71	.04	.03	.01	388.	0.00	0.00	167	.55	.53	.01	9450.
1 01	18.00	72	.04	.03	01	443	0 00	0 00	168	.55	.53	.01	10182.
1 01	18.15	73	.00	0.00	.00	494.	0.00	0.00	169	.04	.03	.01	10822.
1 01	18.30	74	00	0.00	.00	537.	0.00	0.00	170	.04	.03	.01	11330.
1 01	18.45	75	.00	0.00	.00	573.	0.00	0.00	171	.04	.03	.01	11724.
1 01	19 00	76	.00	0.00	.00	600	0.00	0.00	172	.04	.03	.01	11985.
1 01	19 15	77	.00	0 00	.00	618	0.00	0.00	173	.04	.03	.01	12115.
1 01	19 0	78	.00	0.00	00	629	0 00	0 00	174	.04	.03	.01	12138.
1.01	19.45	79	.00	0.00	.00	633	0.00	0.00	175	.04	.03	.01	12051.
1 01	20.00	80	.00	0.00	.00	628	0 00	0 00	176	.04	.03	.01	11843.
1.01	20.15	81	.00	0.00	.00	614.	0.00	0.00	177	.04	.03	.01	11516.
1.01	20.30	82	.00	0.00	.00	594.	0.00	0.00	178	.04	.03	.01	11106.
1 01	20 45	83	.00	0.00	.00	570.	0 00	0.00	179	.04	.03	.01	10630.
1 01	21 00	84	.00	0.00	.00	541.	0.00	0 00	180	.04	.03	.01	10096.
1 01	21 15	85	.00	0.00	.00	508	0.00	0.00	181	.04	.03	.01	9501.
1 01	21.30	86	00	0.00	.00	472.	0.00	0.00	182	.04	03	.01	8867.
1 01	21.45	87	.00	0.00	.00	434.	0.00	0.00	183	.04	.03	.01	8189.
1 01	22.00	88	.00	0.00	.00	396.	0.00	0.00	184	.04	.03	.01	7532.
1.01	22.15	89	.00	0.00	.00	360.	0.00	0.00	185	.04	.03	.01	6904.
1.01	22.30	90	.00	0.00	.00	328.	0 00	0.00	186	.04	.03	.01	6336.
1.01	22.45	91	.00	0.00	.00	298.	0.00	0.00	187	.04	.03	.01	5800.
1.01	23.00	92	00	0.00	.00	270.	0.00	0.00	188	.04	.03	.01	5298.
1 01	23 15	93	00	0 00	.00	244.	0.00	0.00	189	04	.03	.01	4833.
1 01	23 30	94	.00	0.00	.00	220.	0 00	0.00	190	.04	.03	.01	4404.
1.01	23 45	95	.00	0 00	.00	199.	0.00	0.00	191	.04	.03	.01	4021.
1 02	0 00	96	00	0 00	.00	180.	0.00	0.00	192	.04	.03	.01	3666.
									SUM	25.30	23.33	1.97	335152.
										(643.)	(593.)	(50.)	(9490.45)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12138.	9755.	3335.	1736.	333314.
CMS	344.	276.	94.	49.	9438.
INCHES		14.64	20.01	20.84	20.84
MM		371.77	508.34	529.27	529.27
		4822.	4414.	6887.	6887.

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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 1.00	RATIO 2 .90	RATIO 3 .80	RATIO 4 .70	RATIO 5 .60	RATIO 6 .50	RATIO 7 .40	RATIO 8 .30	RATIO 9 .10
HYDROGRAPH AT	LAKE	6.20	1	12138.	10924.	9710.	8496.	7283.	6069.	4855.	3641.	1214.
		(16.06)	(	343.71)(	309.34)(	274.96)(	240.59)(	206.22)(	171.85)(	137.48)(	103.11)(	34.37)
ROUTED TO	DAM	6.20	1	8092.	6981.	5874.	4771.	3674.	2605.	1599.	954.	219.
		(16.06)	(	229.14)(	197.69)(	166.34)(	135.09)(	104.05)(	73.77)(	45.27)(	27.02)(	6.19)

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1100.70	1100.70	1104.00
STORAGE	2106.	2106.	3991.
OUTFLOW	0.	0.	1139.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1106.98	2.98	5904.	8092.	6.50	45.75	0.00
.90	1106.63	2.63	5671.	6981.	6.25	46.00	0.00
.80	1106.27	2.27	5426.	5874.	5.75	46.00	0.00
.70	1105.87	1.87	5168.	4771.	5.50	46.25	0.00
.60	1105.44	1.44	4890.	3674.	5.00	46.50	0.00
.50	1104.96	.96	4586.	2605.	4.25	47.00	0.00
.40	1104.40	.40	4234.	1599.	3.00	47.75	0.00
.30	1103.63	0.00	3770.	954.	0.00	48.00	0.00
.10	1101.80	0.00	2708.	219.	0.00	48.00	0.00

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
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A1                N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII  10A8301
A2                N J 00186 UPPER GREENWOOD LAKE, BERGEN COUNTY, NJ
A3                MULT RATIO ROUTING,PRC-HARRIS INC., WOODBRIDGE, N J
B     150         0       15                                    0       0       1
B1      5
J       2         1       1
J1     .5
K       0    LAKE                                  0       0       1
K1                INFLOW HYDROGRAPH THROUHG UPPER GREENWOOD LAKE
M       1       2     6.2                   6.2     0.8                             1
P               25    99.5      110       118    126.5
T
W2              3.85                                                0.5     0.05
X      -1     -.05       2
K       1     DAM                                   0       0       1
K1                ROUTING DISCHARGE THROUGH DAM
Y                                       1       1
Y1      1                                                   -1100.7       0
$A      0     521     1019
$E   1090    1100     1120
$$1100.7      50      3.8      1.5
$D   1104    2.75      1.5      360
$B     30       1     1090      0.5   1100.7 1104.96
$B     30       1     1090      0.5   1100.7    2000
K       1  REACH                                                    1
K1          CHANNEL ROUTING
Y                                       1       1
Y1      1
Y6      1      .05       .1     1087    1120     150  0.0013
Y7   1150    1140     1200     1120    2100    1100    2300    1087    2600    1087
Y7   2700    1100     3000     1720    4050    1140
K      99
A
A
A
A
A
1
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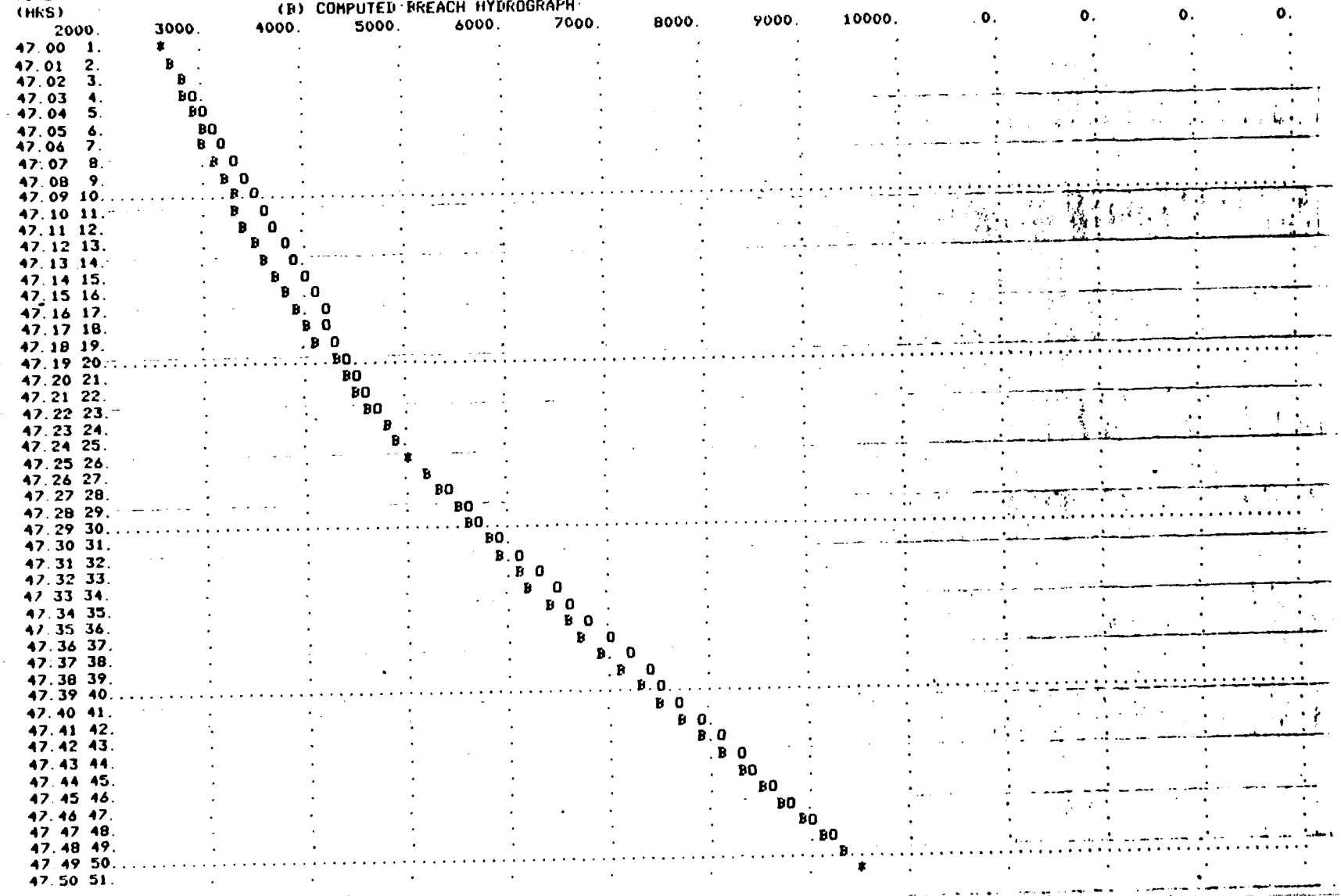
Passaic County, N.J.

STATION DAM

(O) INTERPOLATED BREACH HYDROGRAPH
(B) COMPUTED BREACH HYDROGRAPH
(*) POINTS AT NORMAL TIME INTERVAL



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HYDROGRAPH ROUTING

CHANNEL ROUTING

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

ALL PLANS HAVE SAME 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	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0500	.1000	1087.0	1120.0	150.	.00130

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
1150.00 1140.00 1200.00 1120.00 2100.00 1100.00 2300.00 1087.00 2600.00 1087.00
2700.00 1100.00 3000.00 1720.00 4050.00 1140.00

STORAGE	0.00	1.91	4.07	6.46	9.09	11.97	15.08	18.43	22.06	26.12
	30.66	35.68	41.16	47.12	53.55	60.46	67.83	75.68	84.00	92.79
OUTFLOW	0.00	828.45	2701.30	5462.48	9085.93	13578.00	18958.75	25255.09	33166.24	42761.38
	53484.03	65373.60	78465.04	92791.48	108385.14	125277.74	143500.62	163084.84	184061.21	206460.32
STAGE	1087.00	1088.74	1090.47	1092.21	1093.95	1095.68	1097.42	1099.16	1100.89	1102.63
	1104.37	1106.11	1107.84	1109.58	1111.32	1113.05	1114.79	1116.53	1118.26	1120.00
FLOW	0.00	828.45	2701.30	5462.48	9085.93	13578.00	18958.75	25255.09	33166.24	42761.38
	53484.03	65373.60	78465.04	92791.48	108385.14	125277.74	143500.62	163084.84	184061.21	206460.32

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	RATIO 1 .50
HYDROGRAPH AT	LAKE	6.20 (16.06)	1	6069. (171.85)(
			2	6069. (171.85)(
ROUTED TO	DAM	6.20 (16.06)	1	9511. (269.31)(
			2	2605. (73.77)(
ROUTED TO	REACH	6.20 (16.06)	1	9375. (265.46)(
			2	2605. (73.77)(

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SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1100.70	1100.70	1104.00
STORAGE	2106.	2106.	3991.
OUTFLOW	0.	0.	1139.

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
.50	1104.96	.96	4586.	9511.	4.25	47.50	47.00

PLAN 2

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1100.70	1100.70	1104.00
STORAGE	2106.	2106.	3991.
OUTFLOW	0.	0.	1139.

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
.50	1104.96	.96	4586.	2605.	4.25	47.00	0.00

PLAN 1 STATION REACH

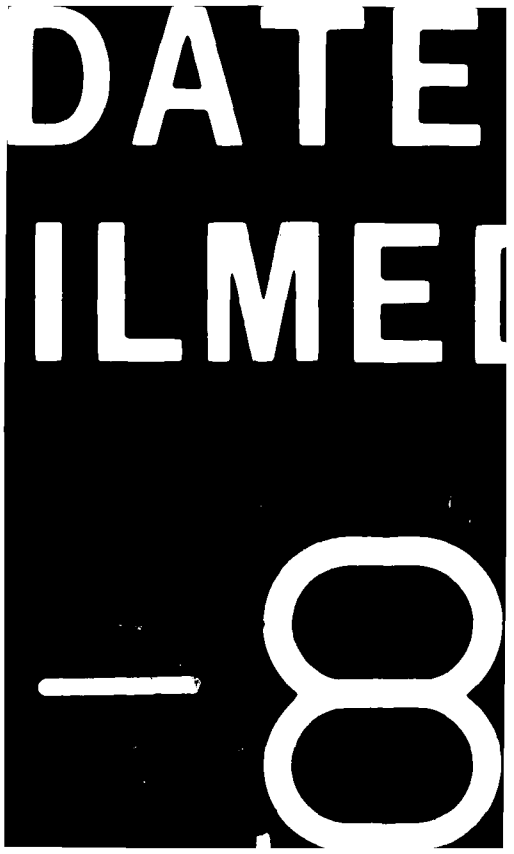
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9375.	1094.1	47.50

PLAN 2 STATION REACH

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2605.	1090.4	47.00

1**********

FLOOD HYDROGRAPH PACKAGE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