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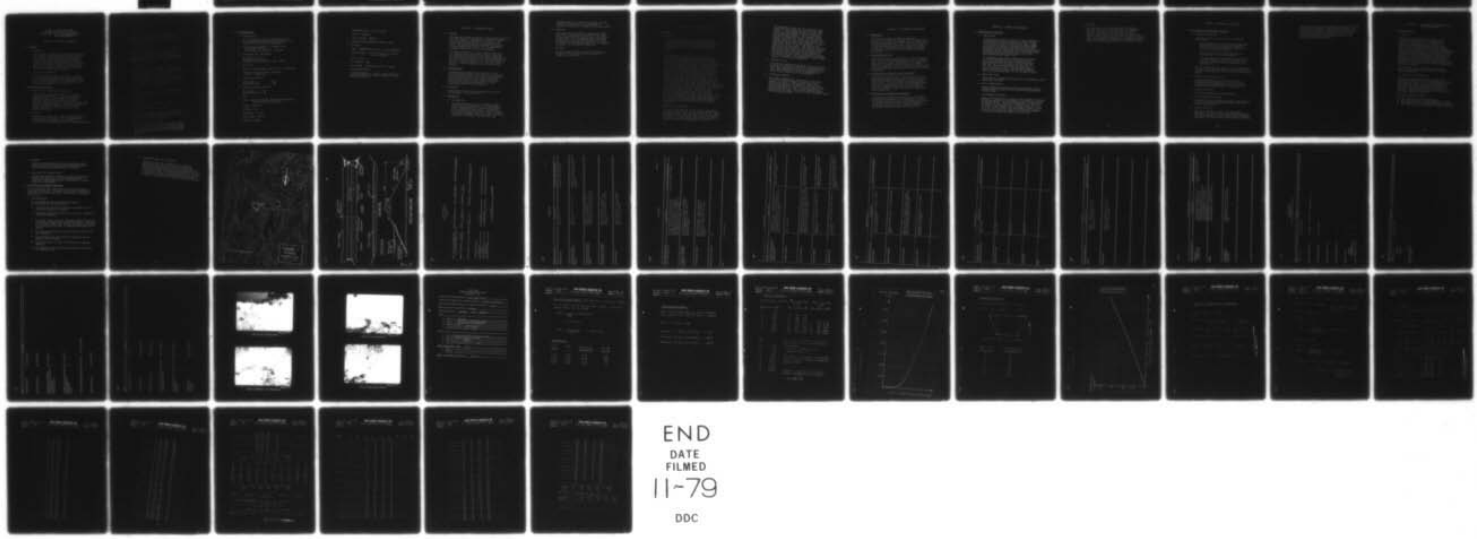

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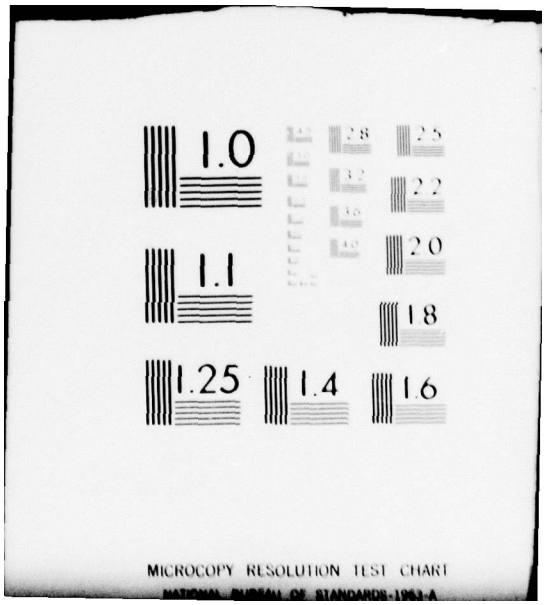
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HIGHLAND LAKE TRIBUTARY, SUSSEX COUNTY
NEW JERSEY

LEVEL II

NJ NO NAME DAM
NO 27
NJ 00511

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

No Name Dam Number 27 (NJ-00511). Sussex County, Highland Lake Tributary, Sussex County, New Jersey. Phase 1 Inspection Report.

(9) Final rept., (10) F. Keith /Jolls

(15) DACW61-79-C-0011

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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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)

Seepage
Riprap
Dams
Embankments
No Name Dam, No 27
National Dam Inspection Act Report

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 - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-D

20 SEP 1979

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

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for New Jersey No Name Dam No. 27 in Sussex 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, New Jersey No Name Dam No. 27, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillway is considered inadequate since 74 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood.) To insure 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. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. 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. Within six months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability. This should include test borings to determine material properties relative to stability and seepage and installation of piezometers to facilitate seepage studies. Any remedial measures found necessary should be initiated within calendar year 1980.

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

(1) The dam crest should be regraded and brought up to a uniform elevation and seeded.

(2) The debris should be removed from the site, especially within the spillway.

(3) The eroded areas along the embankment shoreline should be further protected with large size riprap. Additionally, if the lower saddle near the left abutment is to remain as an auxiliary spillway, it should be protected with riprap.

(4) All trees and secondary growth should be removed from the backslopes.

(5) The blow-off gate valve should be repaired and the manhole cover replaced.

(6) Provisions should be made to increase the drawdown capacity.

(7) The seepage at the left abutment should be monitored on a regular basis.

(8) The owners should develop a checklist for periodic maintenance inspections so a record of conditions and repairs can be maintained.

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 James A. Courter of the Thirteenth 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-D
Honorable Brendan T. Byrne

An important aspect of the Dam Safety 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:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

John O'Dowd, Acting Chief
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Division of Water Resources
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NEW JERSEY NO NAME DAM NO. 27 (NJ00511)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 16 May 1979 by Louis Berger & 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.

New Jersey No Name Dam No. 27, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillway is considered inadequate since 74 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood.) To insure 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. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. 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. Within six months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability. This should include test borings to determine material properties relative to stability and seepage and installation of piezometers to facilitate seepage studies. Any remedial measures found necessary should be initiated within calendar year 1980.

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

(1) The dam crest should be regraded and brought up to a uniform elevation and seeded.

(2) The debris should be removed from the site, especially within the spillway.

(3) The eroded areas along the embankment shoreline should be further protected with large size riprap. Additionally, if the lower saddle near the left abutment is to remain as an auxiliary spillway, it should be protected with riprap.

(4) All trees and secondary growth should be removed from the backslopes.

(5) The blow-off gate valve should be repaired and the manhole cover replaced.

(6) Provisions should be made to increase the drawdown capacity.

(7) The seepage at the left abutment should be monitored on a regular basis.

(8) The owners should develop a checklist for periodic maintenance inspections so a record of conditions and repairs can be maintained.

APPROVED: [signature] LTC
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 17 September 1979

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam N.J. No Name No. 27 (a.k.a. Upper Highland Lake) Fed ID# NJ 00511

State Located New Jersey
County Located Sussex
Coordinates Lat. 4110.7 - Long. 7428.2
Stream Unnamed Tributary to Highland Lake
Date of Inspection 16 May 1979

ASSESSMENT OF GENERAL CONDITIONS

No Name Dam No. 27 is in a fair overall condition but the spillway can accommodate only 73% of the ½ PMF design flood. Since it is situated within a heavily developed recreational community and has a high hazard classification, it is recommended that further studies be conducted in the near future to assess the structural stability and seepage conditions. Recommended remedial actions to be undertaken in the near future as part of the owners' maintenance program include repair and seeding of the eroded areas of all slopes, the placement of riprap along the shoreline, replacement of missing parts of the gate valve and drain, clearing of the spillway channel of debris, augmenting the drawdown capacity and development of a community warning system.

F. Keith Jolls, P.E.
Project Manager

OVERVIEW OF N.J. NO NAME NO. 27 DAM

MAY, 1979

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PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the establisned 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.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: N.J. NO NAME DAM NO. 27
FED. I.D. #NJ00511

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Corps of Engineers, Philadelphia to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the N.J. "No Name" Dam No. 27 and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The dam at N.J. No Name Site No. 27 (a.k.a. Upper Highland Lake) is a 400 foot long earth embankment with a riprap lined trapezoidal spillway at the right abutment. A 6 inch diameter, low-level drain is located 165 feet from the left abutment and has a gate valve housed in a reinforced concrete manhole 36 feet from the center line of the crest (at the toe of the downstream slope).

b. Location

The dam is situated on a small unnamed, mountain tributary above the west side of Highland Lake and is 300 feet southwest of the junction of Pocassett and Algonquian Roads in Vernon Township,

Sussex County, New Jersey. [illegible]

c. Size Classification

The dam has a maximum height of [illegible] feet and a maximum storage capacity of [illegible] acre-feet. Accordingly, this dam is in the small size category as defined by the criteria in the Recommended Guidelines for Safety Inspection of Dams (storage less than 1,000 acre-feet and height less than 40 feet).

d. Hazard Classification

The dam is located immediately upstream of an extensive residential development in the community of Highland Lakes. The downstream channel [illegible] in size as it descends the mountain slope and meanders between homes and the residential street system. A failure could cause extensive damage to private homes and commercial property and result in a significant loss of life. Accordingly, it is recommended that this dam be classified as high hazard.

e. Ownership

This dam is owned by the Highland Lakes Country Club and Community Association Inc., Highland Lakes, New Jersey.

f. Purpose of Dam

The dam was constructed for the purpose of creating a recreational lake.

g. Design and Construction History

The dam was designed by Newel C. Harrison of Tri-County Engineers, Butler, N.J. and constructed in 1958-1959 by Dollar & VanBlackon, General Contractors of Vernon, N.J.

h. Normal Operating Procedures

There are no formal operating procedures which are applicable to this dam. However, a full-time maintenance staff is employed by the Lake Association for the purpose of groundskeeping and repair.

1.3 PERTINENT DATA

a. Drainage Area

N.J. No Name No. 27 has a drainage area of 0.12 square miles which consists primarily of woodland and residential development.

b. Total spillway capacity at maximum pool elevation - 370 cfs
at low point on dam crest - 128 cfs

c. Elevations (ft. above MSL)

Top of dam - 1310
Spillway crest - 1307
Streambed at centerline of dam - 1297.5

d. Reservoir

Length of maximum pool (top of dam) - 1,450 feet

Length of recreation pool (spillway crest) - 1,400 feet

e. Storage (acre-feet)

Top of dam	- 238
Recreation pool	- 180

f. Reservoir Surface (acres)

Top of dam	- 39
Recreation pool	- 18

g. Dam

Type - Earth with riprap lined spillway and low level blow-off drain pipe.

Length - 400 feet

Height - 12.5

Top Width - 14 feet

Side Slopes - 2H:1V

Zoning - 2 zones

Impervious Core - Clay corewall

Cutoff - Unknown

Grout curtain - Unknown

h. Diversion and Regulating Tunnel - None

i. Spillway

Type - Trapezoidal channel at right abutment.

Channel width - 10 feet at base, 22 feet at crest elevation.

Gates - None

U/S Channel - None

D/S Channel - Riprap-lined exit to swamp.

j. Regulating Outlets

6 inch diameter, C.I. blow off pipe with gate valve in reinforced concrete manhole (invert elevation 1297.5).

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

An extensive search of various agencies and discussions with the owner's representatives failed to produce any design details, reports, or drawings. All dimensions depicted herein were measured in the field. Hearsay information indicates the dam has a clay corewall, but details of the foundation, embankment and blow-off pipe are unknown.

The dam is located in a region underlain by the Pre-Cambrian age Byram gneiss, a dense, hard and characteristically banded metamorphic granitoid. The reservoir occupies a small, rock-bound depression caused by glacial scouring. The thin overburden in this area consists primarily of silt and organic material. The dam appears to be founded on the bedrock.

2.2 CONSTRUCTION

No construction details were available to the inspection team with the exception of the probable date the dam was built. The contractor could not be located nor were as-built plans available. There are no records of the construction plans having been filed with the NJDEP or of any inspections made by State engineers.

2.3 OPERATION

No data pertaining to the operation at this dam was obtained. (See Section 4).

2.4 EVALUATION

a. Availability

Although the hydraulic and hydrologic conditions could be determined from field measurements and observations, several significant design conditions could not be evaluated due to a lack of engineering data. These included slope and embankment stability, depth to bedrock, foundation conditions, the existence and

configuration of a cutoff or corewall, and the relative permeability of the embankment. Therefore, sufficient information was unavailable.

b. Adequacy

The information available is considered inadequate for a meaningful assessment of the dam's overall safety within the purview of PL 92-367. Accordingly, it is recommended that additional studies and field tests be performed in order to gather the information required for a complete evaluation of the overall condition.

c. Validity

As no design data was available, the validity thereof is not germane to the assessment summarized in Section 7.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of N.J. No Name No 27 was conducted on May 16, 1979. Although extensive remedial measures appear necessary, most were viewed as of a secondary nature and the dam is considered to be in a generally fair overall condition.

b. Dam

The embankment is 400 feet long and lies between two naturally higher bedrock abutments on either side of what was originally a swamp. The crest is covered with grass and light brush while the downstream slope is overgrown with saplings and trees as large as 9 inches in diameter. The crest has a well-worn footpath along its center and a uneven, undulating surface which varies from 1.5 to 3 feet above normal pool. The lowest portion is a saddle located at the left abutment where a layer of large stone riprap has been placed. The front face exhibits signs of erosion and minor sloughing and the riprap along the upstream slope appears to have settled in several areas with smaller stone and gravel dumped into the depressions in an attempt to stabilize the erosion. The crest is depressed slightly at the right abutment where the spillway channel is located. Erosion is particularly severe at the junction of the spillway and embankment despite the presence of large stone on the slopes. Heavy seepage was noted emanating from along the downstream slope toe of the right half of the embankment and at the junction of the embankment and left abutment. Considerable ponding was evident at the latter location.

c. Appurtenant Structures

Discharge from the lake is provided by the trapezoidal shaped spillway at the right abutment. The riprapped slopes extend up both sides of the channel and about 10 feet into the lake across the invert. The invert is quite uneven and the flow through the channel was low and sluggish at the time of

the inspection. Some of the riprap has been displaced and erosion was noted on both sidewalls. A considerable amount of debris and trash have been dumped in both the upstream and downstream channels. The channel curves around the downstream toe of the dam and discharges into the wet, swampy region below the blowoff outfall, which is located about 30 feet downstream of the gate valve manhole. It is completely buried in silt with only the top edge of the pipe visible. The manhole cover and gate wheel are missing as is a section of pipe between the gate valve and the outfall line. The exposed pipe and valve in the manhole are rusted but the valve appears operable if greased and reconditioned. The reinforced concrete walls appear in satisfactory condition.

d. Reservoir Area

The dam was constructed primarily for recreational purposes and numerous homes and a bathing beach have been constructed around the periphery of the lake. There appears to be heavy sedimentation along certain portions of the shoreline.

e. Downstream Channel

The channel immediately downstream of the spillway first meanders through a relatively flat swampy area which is surrounded by homes. About 300 feet downstream, the gradient increases as the stream flows down the side of Wawayanda Mountain toward Highland Lake. The natural channel narrows considerably and passes through a small diameter culvert under Algonquian Road.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal operating procedures presently in existence although the Lake Association employs a permanent maintenance crew in addition to seasonal part-time help. This staff is responsible for groundskeeping, preventive maintenance, lake operations, and repairs to the community property but present operations are restricted by funding limitations.

4.2 MAINTENANCE OF DAM

While the primary responsibility of the maintanence staff centers around groundskeeping, their duties also extend to repair work within their capability. However, it appears that the dam is presently receiving less than adequate attention (as indicated by the accumulation of trash and thick growth on the embankment).

4.3 DESCRIPTION OF WARNING SYSTEM IN EFFECT

No formal warning system is presently in effect. Observant residents living near the dam could note conditions during heavy storms and notify local authorities. It was observed that the downstream homes are situated very close to the channel and only an automated warning system could provide sufficient advance notice in case of a hazardous storm condition.

4.4 EVALUATION OF OPERATIONAL ADEQUACY

The present operational procedures and community safeguards are deemed to be inadequate in view of the position of the dam and the downstream hazards. An overall community warning system should be developed along with a more intensive program of inspection and maintenance (see Section 7).

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

In accordance with the criteria in the Recommended Guidelines for Safety Inspection of Dams, it has been determined that the No Name #27 dam is small in size but is placed in the high hazard category. Accordingly the spillway design flood (SDF) was determined by the inspection team to be one-half the probable maximum flood (PMF). The inflow hydrograph was calculated using precipitation data from Hydrometeorological Report #33.

In accordance with Corps of Engineers directives, the inflow hydrograph and flood routing were performed utilizing the HEC-1 computer program. Peak inflow to the reservoir for the ½ PMF was 309 cfs. When routed through the reservoir, this reduced to 176 cfs. The spillway capacity before overtopping occurs is 128 cfs and therefore can only accommodate 73% of the design flood.

b. Experience Data

There was no information available to the inspection team concerning this dam.

c. Visual Observations

Visual inspection indicates that the hydraulic review substantially conforms to the drainage characteristics of this basin.

d. Overtopping Potential

Based on the hydraulic evaluation there appears to be only minimal potential for overtopping of the central portion of the dam crest. However, the spillway is constricted by debris and there is little freeboard (1.5 feet) in the area of the "saddle" near the left abutment. Thus, it is not inconceivable that overtopping could occur at that location from wave action or by further blockage of the main spillway by debris or winter ice.

e. Drawdown

At the present time it is possible to dewater the lake via a 6-inch blowoff pipe (to elevation 1297.5). However, using this pipe, it would take at least 8 weeks to draw the lake down without any inflow to the reservoir. Consequently, this is considered inadequate for emergency situations and a study should be conducted to determine a more feasible method of augmenting the drawdown capacity.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

The major items of concern to the inspection team were:

- The unevenness of the dam crest and possible susceptibility to breaching and washout should the spillway be blocked (especially by ice in the spring months).

- The seepage in the vicinity of the left abutment and the blow-off manhole.

- The accumulation of trash which could create a rodent-infestation problem with burrows and their attendant piping weaknesses in the embankment.

However, based entirely upon the visual inspection, the dam is evaluated as being in fair structural condition with only the minor defocoemcoes previously noted.

b. Design and Construction Data

Summarizing Section 2, no design plans or calculations were available. It is felt that insufficient information was obtained to fully assess the structural aspects. (See Section 7).

c. Operating Records

No formal records have been maintained.

d. Post Construction Changes

There have been no apparent hydraulic modifications or major structural improvements since the dam's initial installation.

e. Seismic Stability

The dam is located in Zone 1 and experience indicates that dams of this size and configuration will have adequate stability under dynamic loading conditions if stable under static loading conditions.

The dam has stood for approximately 20 years and field observations revealed no significant indications of structural instability. However, the complete lack of design and construction data precludes a definitive assessment of the dam's structural condition and warrants additional investigation in view of the hazard conditions downstream.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/ REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

Subject to the inherent limitations of the visual inspection procedures stipulated by the Corps of Engineers, N.J. "No Name" Dam No. 27 appears to be in a fair overall condition for normally expected flood conditions. The dam embankment is built of unknown construction material and some seepage was observed. Overtopping of the dam crest could erode the backslopes and possibly breach the dam near the left abutment. No serious detrimental conditions were observed to render a structurally inadequate assessment but the long-term stability remains questionable until the remedial measures set forth hereinafter are completed and further geotechnical review is analyzed.

The inspection team was primarily concerned with the downstream hazards should a collapse occur at this dam.

b. Adequacy of Information

Except for visual observations, little information was available as no engineering data exists regarding the composition of the embankment. No recent surveys or inspections have been made and performance data is believed to be nonexistent. The availability of information is therefore deemed to be inadequate to fully assess the dam's long-term stability.

The data required includes:

1) The composition of the embankment;
2) The zoning (if any) of the embankment material;
3) The existence of any impermeable core or cutoff;
4) The condition of the foundation and dam interface.

c. Urgency

Further investigation should be undertaken in the near future as a collapse of this dam could inflict serious damage upon the downstream community.

d. Necessity for Further Study

Because the structural stability cannot reasonably be established with any reliance, the obtaining of additional information and the undertaking of further studies is recommended.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

It is recommended that additional engineering studies be initiated in the near future due to the lack of definitive information with which to assess the structural stability of the dam.

a. Recommendations

It is recommended that the following repairs be undertaken in the near future.

1) The dam crest should be regraded and brought up to a uniform elevation and seeded.

2) The debris should be removed from the site, especially within the spillway.

3) The eroded areas along the embankment shoreline should be further protected with large size riprap. Additiona if the lower saddle near the left abutment is to remain as an auxiliary spillway, it should be protected with riprap.

4) All trees and secondary growth should be removed from the backslopes.

5) The blow-off gate valve should be repaired and the manhole cover replaced.

6) Provisions should be made to increase the drawdown capacity.

7) The seepage at the left abutment should be monitored on a regular basis.

b. O&M Maintenance and Procedures

Inasmuch as the dam is owned by the community the local police and Civil Defense authorities should develop definitive plans for monitoring the dam during periods of heavy flows and procedures for alerting the homes immediately downstream in the event of potential floods. The owners should also develop a checklist for periodic maintenance inspections so a record of conditions and repairs can be maintained.

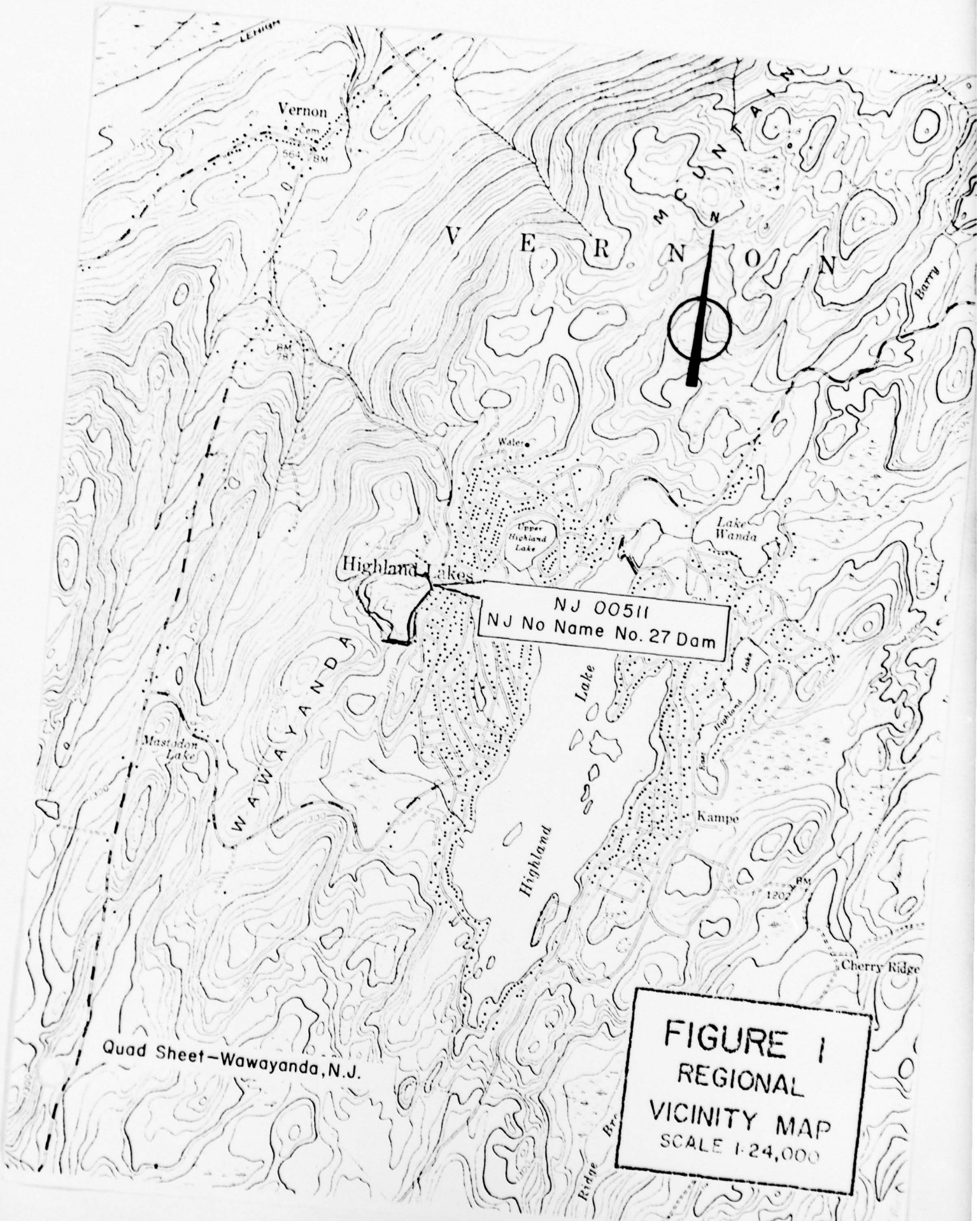
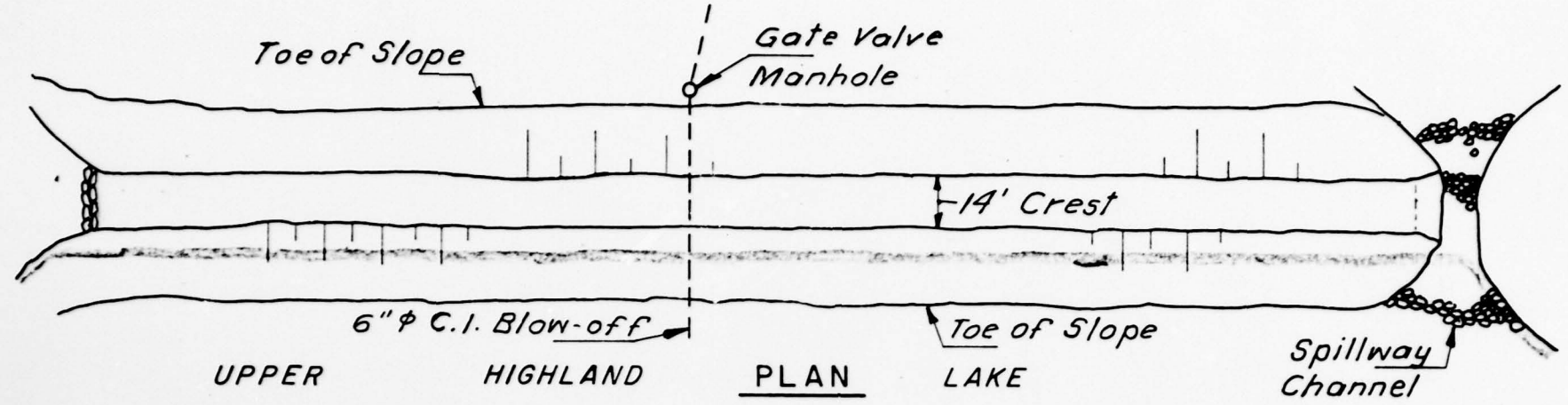
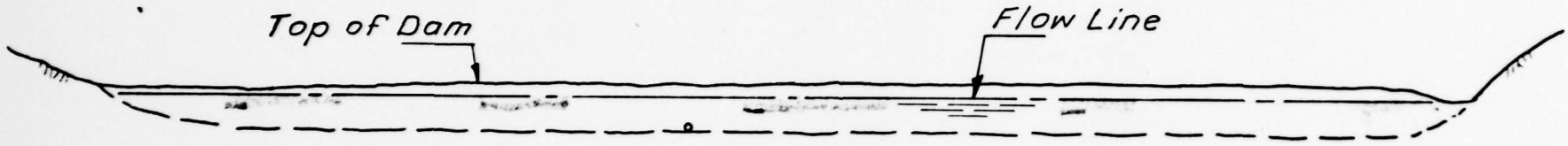


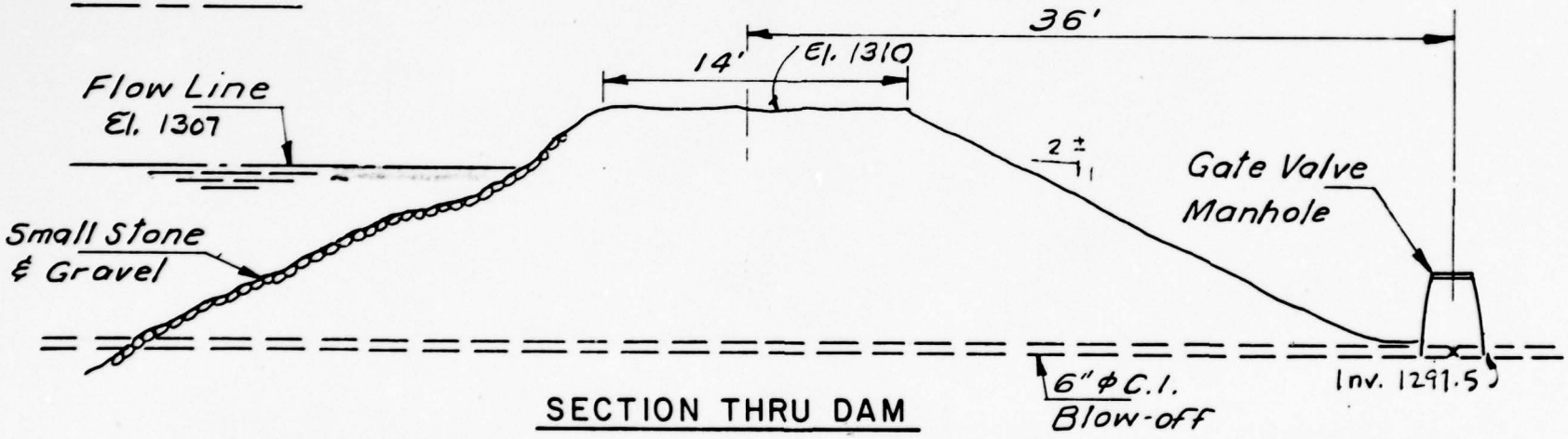
FIGURE 1
REGIONAL
VICINITY MAP
SCALE 1:24,000





ELEVATION

Not to Scale



SECTION THRU DAM

Fig 2 of 5

Check List
Visual Inspection
Phase 1

Name Dam N.J. No Name #27 (a/k/a Upper Highland Lake) County Sussex State New Jersey Coordinators N.J.D.E.P.

Date(s) Inspection 5/16/79 Weather Clear Temperature 65°

Pool Elevation at Time of Inspection 1307 M.S.L. Tailwater at Time of Inspection 1298 M.S.L.

Inspection Personnel:

T. Chapter
K. Jolls
M. Carter
D. Mulligan
K. Greenfield

T. Chapter Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None visible	Surface very irregular.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Very wet below right embankment toe.	Swampy area below dam appears to be natural state (not seepage).
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion at embankment face in front of spillway. Erosion path to outlet manhole; light erosion along entire face.	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Some undulation - crest is lower at left abutment - well worn foot path along centerline of crest.	
RIPRAP FAILURES	Riprap appears to have settled along the face. Covered with small stone & gravel.	

EMBANKMENT

ISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
'REES SHRUBBERY ETC.	Entire backslope of the right half of the dam is overgrown to crest elevation with trees up to 9" in diameter; some debris and garbage (mattresses, cans, etc.) dumped at the right end of the embankment.	Potential rodent problem.
UNCTION OF EMBANKMENT ND ABUTMENT, SPILLWAY ND DAM	Left abutment is heavily riprapped and the embankment crest is lower. Right embankment eroded down to spillway channel.	
NY NOTICEABLE SEEPAGE	Spillway channel wraps around the base of the toe. Heavy seepage below toe at the right side of embankment extends to the outlet manhole.	
TAFF GAGE AND RECORDER	None	
RAINS	None visible	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Blow-off is a 6" steel pipe(very rusty). The pipe outlet is located about 30 feet from the valve manhole and is completely buried in mud and silt with only the top edge visible.	Pipe should be cleaned and the the outlet cleared.
INTAKE STRUCTURE	Not visible.	
OUTLET STRUCTURE	Reinforced concrete manhole valve chamber; invert of pipe 48" below M.H. sill; section of pipe between valve and outlet missing; M.H. cover is missing.	Pipe section and M.H. cover should be replaced
OUTLET CHANNEL	Swamp fed by seepage and flows from spillway.	Seepage should be monitored on regular basis.
EMERGENCY GATE	No wheel on gate valve; heavy rust on all metal.	Gate wheel should be replaced and all metal cleaned and primed.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None - Riprap channel, bottom & sides at right abutment.	
APPROACH CHANNEL	Riprap extends about 10' from ℄ towards lake.	
DISCHARGE CHANNEL	Same as above - channel curves around back of the toe contributing to wetness and swamp conditions in this area.	
BRIDGE AND PIERS	Plywood foot bridge spans the narrow channel of spillway.	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None noted	
OBSERVATION WELLS	None noted	
WEIRS	None noted	
PIEZOMETERS	None noted	
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Wooded - Relatively steep to gentle - Homes along entire perimeter of lake.	
SEDIMENTATION	Heavy sedimentation along upstream slope of dam. Riprap buried in many places.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Area immediately below dam is a swamp which is emptied by a very narrow channel flowing between homes in heavily developed resort community. Several homes immediately below dam on edge of swamp.	Recommend high hazard class.
SLOPES	Flat for several hundred feet, then steepens to about 4% gradient.	
APPROXIMATE NO. OF HOMES AND POPULATION	Numerous homes (30-40) along both sides of very narrow channel.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not available
REGIONAL VICINITY MAP	Available - USGS Quad - Wawayanda, N.J.
CONSTRUCTION HISTORY	Not available
TYPICAL SECTIONS OF DAM	" "
HYDROLOGIC/HYDRAULIC DATA	" "
OUTLETS - PLAN	" "
- DETAILS	" "
-CONSTRAINTS	" "
-DISCHARGE RATINGS	" "
RAINFALL/RESERVOIR RECORDS	" "

ITEM	REMARKS
SPILLWAY PLAN	Not available
SECTIONS	" "
DETAILS	" "
OPERATING EQUIPMENT	" "
PLANS & DETAILS	" "

ITEM	REMARKS
DESIGN REPORTS	Not available
GEOLOGY REPORTS	Not available
DESIGN COMPUTATIONS	Not available
HYDROLOGY & HYDRAULICS	" "
DAM STABILITY	" "
SEEPAGE STUDIES	" "
MATERIALS INVESTIGATIONS	Not available
BORING RECORDS	" "
LABORATORY	" "
FIELD	" "
POST-CONSTRUCTION SURVEYS OF DAM	Not available
BORROW SOURCES.	Not available

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Not available
HIGH POOL RECORDS	Not available
POST CONSTRUCTION ENGINEERING	Not available
STUDIES AND REPORTS	" "
PRIOR ACCIDENTS OR FAILURE OF DAM	Not available
DESCRIPTION	" "
REPORTS	" "
MAINTENANCE	Not available
OPERATION	" "
RECORDS	" "

May, 1979

View of Crest Looking North

May, 1979

View of Seepage - Left Embankment

May, 1979

View of Principal Spillway

May, 1979

View of Downstream Channel

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.12 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1307 MSL (180 acrefeet)

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

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1310 MSL (238 acrefeet)

CREST:

a. Elevation 1307 MSL
b. Type Riprap lined trapezoidal channel
c. Width 10' at base, 22' at dam crest
d. Length N/A
e. Location Spillover Right abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 6" diameter blow-off pipe and gate valve
b. Location 165 feet from left abutment
c. Entrance inverts Unknown
d. Exit inverts 1297.5
e. Emergency draindown facilities Same

HYDROMETEOROLOGICAL GAGES: None
a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 128 cfs

BY D.J.M. DATE 8-79
CHKD. BY ____ DATE ____
SUBJECT ____

LOUIS BERGER & ASSOCIATES INC.

N.J. NO NAME # 27 DAM

SHEET NO. A1 OF
PROJECT C234

Time of concentration: (drainage area = 0.12 square miles)

due to small size of drainage area assume a time of concentration of 10 minutes

$$\therefore t_p = \frac{0.17}{2} + 0.17 \times 0.6$$

$$= 0.18 \text{ hours}$$

$$Q_p = \frac{484 \times 0.12}{0.18} = 322.7 \text{ cfs}$$

UNITGRAPH:

Time (hours)	T/Tp	Dimensionless Ordinate (DO)	Q (cfs) = Qp × DO
0.17	0.94	0.99	319
0.33	1.83	0.40	129
0.50	2.78	0.10	32
0.67	3.72	0.02	6

BY D.J.M. DATE 8-79
CHKD. BY ____ DATE ____
SUBJECT ____

LOUIS BERGER & ASSOCIATES INC.

N.J. No. NAME # 27 DAM

SHEET NO. A2 OF
PROJECT C234

PRECIPITATION DATA:

from Hydrometeorological Report # 33 for 200 square miles and 24 hours (in inches)

PMP = 22.5 inches

Maximum 6 hour percentage = 113%

Maximum 12 hour percentage = 123%

Maximum 24 hour percentage = 132%

BY D.J.M. DATE 8-79
CHKD. BY ____ DATE ____
SUBJECT ____

LOUIS BERGER & ASSOCIATES INC.
N.J. I.D. NAME #27 DAM

SHEET NO. A3 OF
PROJECT C234

Spillway discharge:

flow through channel		*flow over dam L = 30'			flow over dam L = 370'		
H	Q	H	C	Q	H	C	Q
0	0						
1	67						
2	200	0.5	2.8	30			
3	368	1.5	2.8	154			
4	561	2.5	2.8	332	1	2.8	1,120
5	772	3.5	2.8	550	2	2.8	3,168
6	996	4.5	2.8	802	3	2.8	5,820
7	1230	5.5	2.8	1083	4	2.8	8,960
8	1471	6.5	2.8	1392	5	2.8	12,522

ΣQ

H	Q
0	0
1	67
2	230
3	522
4	2,013
5	4,490
6	7,618
7	11,273
8	15,385

Flow through channel computed using Mannings formula with the following assumptions

$n = 0.04$ slope = 0.015
average width = 16'

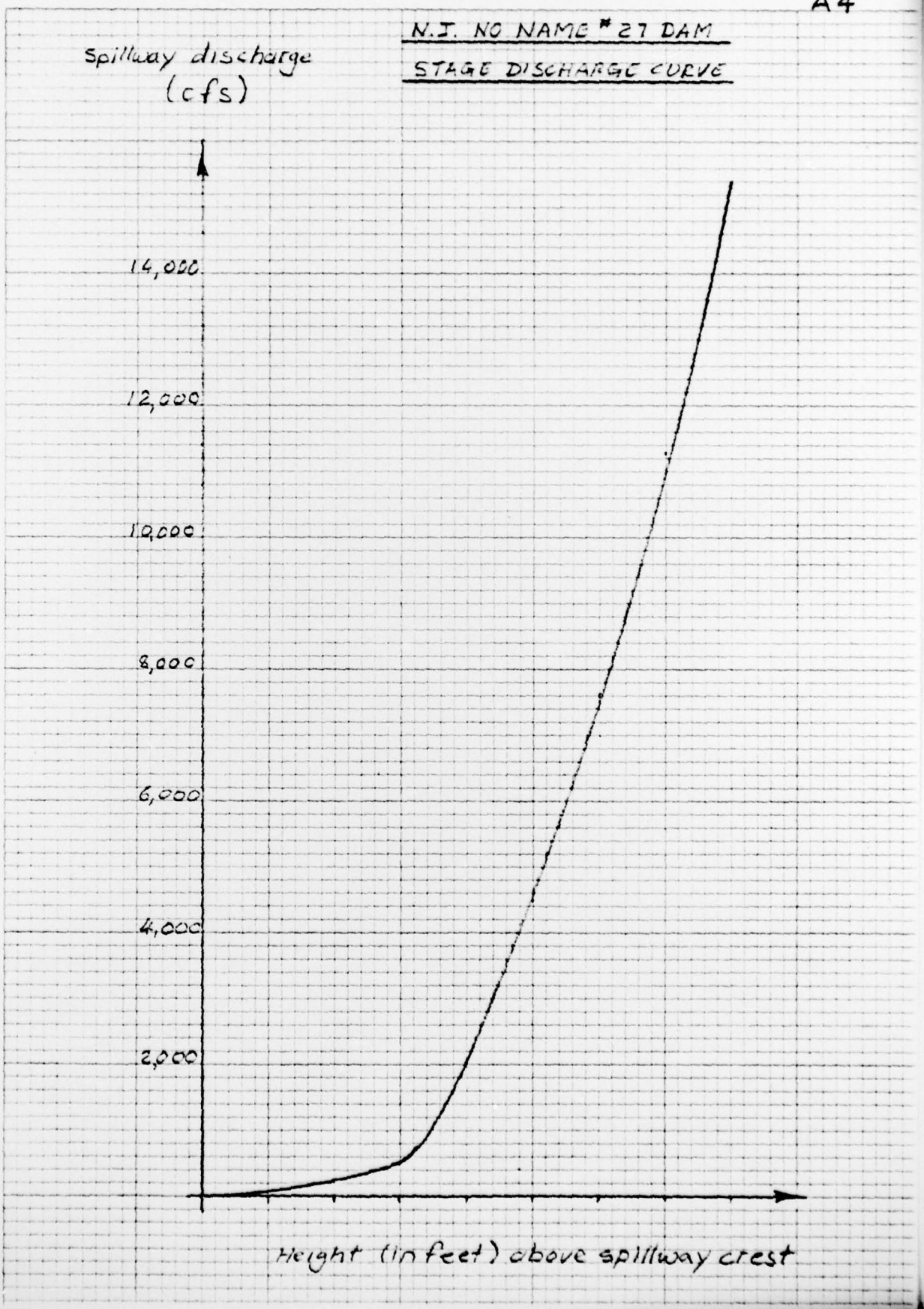
*low point is 1.5' above crest elevation and is assumed to have an effective width of 30'

Spillway capacity @ 1.5' just before lowpoint is overtopped

= 128 cfs

N.J. NO NAME # 27 DAM

STAGE DISCHARGE CURVE



BY D.J.M. DATE 6-79
CHKD. BY ..... DATE .....
SUBJECT .....

LOUIS BERGER & ASSOCIATES INC.

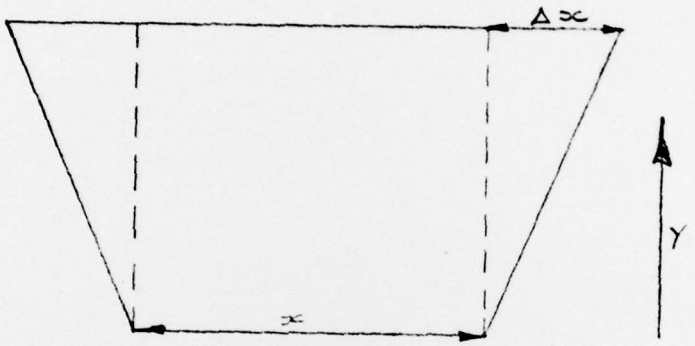
N.J. No NAME = 27 DAM

SHEET NO. A7 OF
PROJECT 2234

Surcharge storage :

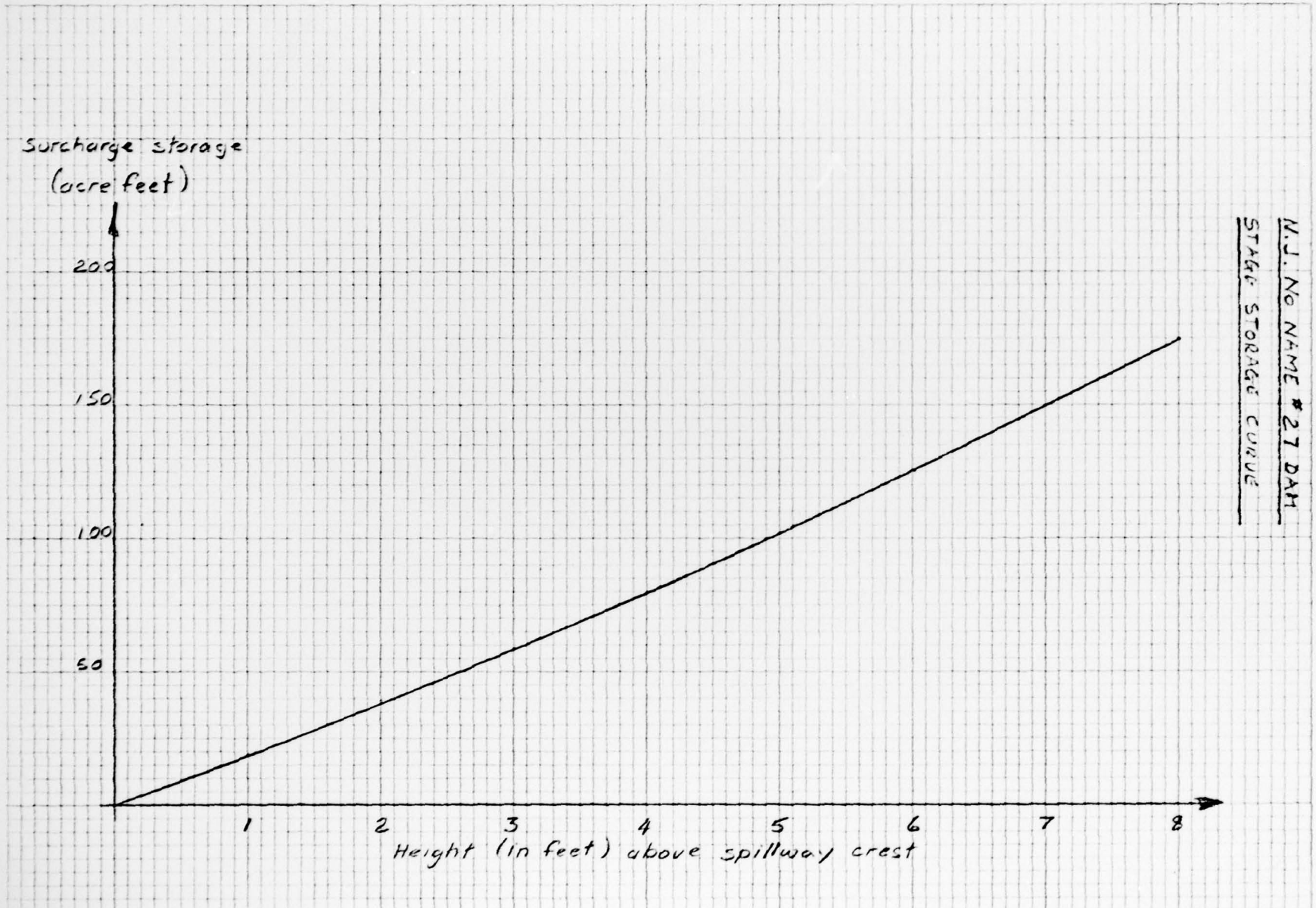
Area of lake @ normal pool = 18 acres

Area of 1320' contour 30 acres



Increment in volume $\Delta V = (x + \Delta x)Y$

Height in feet above crest	Surcharge storage (acre feet)
0	
1	18
2	38
3	58
4	79
5	102
6	125
7	149
8	174



N.J. NO NAME #27 DAM

STAGE STORAGE CURVE

A-3

BY D. J. M. DATE 6-79
CHKD. BY ____ DATE ____
SUBJECT ____

LOUIS BERGER & ASSOCIATES INC.
N. J. No Name # 27 DAM

SHEET NO. A1 OF
PROJECT C 234

GENERAL SUMMARY OF APPENDIX:

length of dam = 400'
Average length of spillway = 16'

Maximum spillway capacity @ top of dam = 370 cfs
@ lowpoint = 128 cfs

Surcharge storage @ top of dam = 58 acre feet
storage @ normal pool = 180 acre feet

∴ Total storage @ top of dam = 238 acre feet

lake area @ normal pool = 15 acres
lake area @ top of dam = 39 acres

Drainage area = 0.12 Square miles

BY D.J.M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A10 OF
CHKD. BY ____ DATE ____ N.J. NO. NAME = 27 DH1 PROJECT C234
SUBJECT Approximate drawdown calculations

Storage @ normal pool = 180 acre feet = 7840800 feet^3

available head = 9.5 feet

assume drawdown in two stages with no inflow and no tailwater

dewater through 6" pipe

1) head = 7.13'

$Q \simeq 2.3$ cfs

$$\text{time} = \frac{7840800}{2 \times 2.3 \times 3600} \simeq 473.5 \text{ hours}$$

ii) head = 2.38'

$Q = 1.34$ cfs

$$\text{time} = \frac{7840800}{2 \times 1.34 \times 3600} \simeq 815 \text{ hours}$$

Σ time $= (473.5 + 815)/24 \simeq 54$ days

$\simeq 7\ 3/4$ weeks Say 8 weeks

BY D J H DATE 8-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO A 11 OF

CHKD. BY _____ DATE _____ N J NO NAME # 27 DAM PROJECT C 234

SUBJECT _____

N.J. NO NAME 27 DAM
HY
AUGUST 1979

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	10	0	0	0	0	0	0	0

JOPER NWT
0

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	0.12	0.0	0.12	0.00	0.500	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	22.50	117.00	123.00	130.00	0.0	0.0	0.0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.50	0.10	0.0	0.0

GIVEN UNIT GRAPH. NUPGG= 4

319. 129. 32. 6.

UNIT GRAPH TOTALS 486. CFS OR 1.05 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.0 QRCSN= 0.0 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.02	0.00	0.
2	0.02	0.00	0.
3	0.02	0.00	0.
4	0.02	0.00	0.
5	0.02	0.00	0.
6	0.02	0.00	0.
7	0.02	0.00	0.
8	0.02	0.00	0.
9	0.02	0.00	0.
10	0.02	0.00	0.
11	0.02	0.00	0.
12	0.02	0.00	0.
13	0.02	0.00	0.
14	0.02	0.00	0.

LOUIS BERGER & ASSOCIATES INC.

N. J. NO NAME # 27 DAM

15	0.02	0.00	0.
16	0.02	0.00	0.
17	0.02	0.00	0.
18	0.02	0.00	0.
19	0.02	0.00	0.
20	0.02	0.00	0.
21	0.02	0.00	0.
22	0.02	0.00	0.
23	0.02	0.00	0.
24	0.02	0.00	0.
25	0.02	0.00	0.
26	0.02	0.00	0.
27	0.02	0.00	0.
28	0.02	0.00	0.
29	0.02	0.00	0.
30	0.02	0.00	1.
31	0.02	0.00	1.
32	0.02	0.00	1.
33	0.02	0.00	1.
34	0.02	0.00	1.
35	0.02	0.00	1.
36	0.02	0.00	1.
37	0.05	0.03	11.
38	0.05	0.03	15.
39	0.05	0.03	16.
40	0.05	0.03	16.
41	0.05	0.03	16.
42	0.05	0.03	16.
43	0.05	0.03	16.
44	0.05	0.03	16.
45	0.05	0.03	16.
46	0.05	0.03	16.
47	0.05	0.03	16.
48	0.05	0.03	16.
49	0.05	0.03	16.
50	0.05	0.03	16.
51	0.05	0.03	16.
52	0.05	0.03	16.
53	0.05	0.03	16.
54	0.05	0.03	16.
55	0.05	0.03	16.
56	0.05	0.03	16.
57	0.05	0.03	16.
58	0.05	0.03	16.
59	0.05	0.03	16.
60	0.05	0.03	16.
61	0.05	0.03	16.
62	0.05	0.03	16.
63	0.05	0.03	16.
64	0.05	0.03	16.
65	0.05	0.03	16.
66	0.05	0.03	16.
67	0.05	0.03	16.
68	0.05	0.03	16.
69	0.05	0.03	16.
70	0.05	0.03	16.
71	0.05	0.03	16.
72	0.05	0.03	16.
73	0.54	0.32	108.
74	0.54	0.32	146.
75	0.54	0.32	155.

BY D J M DATE 5-79

CHKD. BY _____ DATE _____

SUBJECT N.J 150 NAME # 27 DAM

LOUIS BERGER & ASSOCIATES INC.

SHEET NO A12 OF

PROJECT C334

76	0.34	0.32	
77	0.34	0.32	157.
78	0.34	0.32	157.
79	0.41	0.39	157.
80	0.41	0.39	178.
81	0.41	0.39	187.
82	0.41	0.39	189.
83	0.41	0.39	190.
84	0.41	0.39	190.
85	0.51	0.49	190.
86	0.51	0.49	222.
87	0.51	0.49	235.
88	0.51	0.49	238.
89	0.51	0.49	239.
90	0.51	0.49	239.
91	1.29	1.27	239.
92	1.29	1.27	488.
93	1.29	1.27	588.
94	1.29	1.27	613.
95	1.29	1.27	618.
96	1.29	1.27	618.
97	0.47	0.46	618.
98	0.47	0.46	358.
99	0.47	0.46	253.
100	0.47	0.46	227.
101	0.47	0.46	223.
102	0.47	0.46	223.
103	0.37	0.36	223.
104	0.37	0.36	190.
105	0.37	0.36	177.
106	0.37	0.36	174.
107	0.37	0.36	173.
108	0.37	0.36	173.
109	0.03	0.01	173.
110	0.03	0.01	53.
111	0.03	0.01	18.
112	0.03	0.01	7.
113	0.03	0.01	5.
114	0.03	0.01	5.
115	0.03	0.01	5.
116	0.03	0.01	5.
117	0.03	0.01	5.
118	0.03	0.01	5.
119	0.03	0.01	5.
120	0.03	0.01	5.
121	0.03	0.01	5.
122	0.03	0.01	5.
123	0.03	0.01	5.
124	0.03	0.01	5.
125	0.03	0.01	5.
126	0.03	0.01	5.
127	0.03	0.01	5.
128	0.03	0.01	5.
129	0.03	0.01	5.
130	0.03	0.01	5.
131	0.03	0.01	5.
132	0.03	0.01	5.
133	0.03	0.01	5.
134	0.03	0.01	5.
135	0.03	0.01	5.
136	0.03	0.01	5.

137	0.03	0.01	5.	
138	0.03	0.01	5.	
139	0.03	0.01	5.	
140	0.03	0.01	5.	
141	0.03	0.01	5.	
142	0.03	0.01	5.	
143	0.03	0.01	5.	
144	0.03	0.01	5.	
145	0.0	0.0	2.	
146	0.0	0.0	0.	
147	0.0	0.0	0.	
148	0.0	0.0	0.	
149	0.0	0.0	0.	
150	0.0	0.0	0.	
SUM	23.94	21.18	10358.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	618.	265.	72.	69.	10363.
INCHES		20.51	22.31	22.31	22.31
AC-FT		131.	143.	143.	143.

RUNOFF MULTIPLIED BY 0.50

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	5.	7.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	54.	73.	77.	78.	78.	78.	89.	94.
95.	95.	95.	95.	111.	118.	119.	120.	120.	120.
244.	294.	307.	309.	309.	309.	179.	127.	114.	111.
111.	111.	95.	88.	87.	87.	87.	87.	31.	9.
4.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	1.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	309.	132.	36.	35.	5181.
INCHES		10.26	11.16	11.16	11.16
AC-FT		66.	71.	71.	71.

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

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	0	0	1

ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

STORAGE= 0.	18.	38.	58.	79.	102.	125.	149.	174.

BY D. J. M. DATE 8-79
CHKD. BY ____ DATE ____
SUBJECT ____

LOUIS BERGER & ASSOCIATES INC.
N. J. NO NAME # 27 DAM

SHEET NO. A15 OF
PROJECT C 234

OUTFLOW= 0. 67. 230. 522. 2013. 4490. 7618. 11273. 15385

TIME	EOP STOR	AVG IN	EOP OUT
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0.	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0.	0.	0.
19	0.	0.	0.
20	0.	0.	0.
21	0.	0.	0.
22	0.	0.	0.
23	0.	0.	0.
24	0.	0.	0.
25	0.	0.	0.
26	0.	0.	0.
27	0.	0.	0.
28	0.	0.	0.
29	0.	0.	0.
30	0.	0.	0.
31	0.	0.	0.
32	0.	0.	0.
33	0.	0.	0.
34	0.	0.	0.
35	0.	0.	0.
36	0.	0.	0.
37	0.	3.	0.
38	0.	6.	1.
39	0.	8.	1.
40	0.	8.	1.
41	0.	8.	2.
42	1.	8.	2.
43	1.	8.	2.
44	1.	8.	3.
45	1.	8.	3.
46	1.	8.	3.
47	1.	8.	3.
48	1.	8.	4.
49	1.	8.	4.
50	1.	8.	4.
51	1.	8.	4.
52	1.	8.	4.
53	1.	8.	5.
54	1.	8.	5.
55	1.	8.	5.
56	1.	8.	5.
57	1.	8.	5.
58	1.	8.	5.

BY D. J. M. DATE 8-79
CHKD. BY _____ DATE _____
SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.
N. J. NO NAME # 27 DAM

SHEET NO. A16 OF
PROJECT C234

59	1.	8.	6.
60	2.	8.	6.
61	2.	8.	6.
62	2.	8.	6.
63	2.	8.	6.
64	2.	8.	6.
65	2.	8.	6.
66	2.	8.	6.
67	2.	9.	6.
68	2.	8.	6.
69	2.	8.	7.
70	2.	8.	7.
71	2.	8.	7.
72	2.	8.	7.
73	2.	31.	8.
74	3.	64.	11.
75	4.	75.	14.
76	5.	78.	17.
77	5.	78.	20.
78	6.	78.	23.
79	7.	84.	26.
80	8.	91.	29.
81	9.	94.	33.
82	10.	95.	36.
83	10.	95.	39.
84	11.	95.	42.
85	12.	103.	45.
86	13.	114.	48.
87	14.	118.	52.
88	15.	119.	55.
89	16.	120.	58.
90	16.	120.	61.
91	18.	182.	68.
92	21.	269.	89.
93	23.	300.	111.
94	26.	308.	132.
95	28.	309.	151.
96	30.	309.	168.
97	31.	244.	176.
98	31.	153.	174.
99	30.	120.	168.
100	30.	112.	162.
101	29.	111.	157.
102	28.	111.	152.
103	28.	105.	147.
104	27.	92.	141.
105	26.	88.	135.
106	26.	87.	130.
107	25.	87.	125.
108	25.	87.	121.
109	24.	59.	115.
110	23.	20.	105.
111	21.	6.	94.
112	20.	3.	84.
113	19.	3.	76.
114	18.	3.	68.
115	17.	3.	64.
116	16.	3.	61.
117	16.	3.	58.
118	15.	3.	55.
119	14.	3.	53.

BY D J M DATE 8-79
CHKD. BY ____ DATE ____
SUBJECT ____

LOUIS BERGER & ASSOCIATES INC.
N.J. NO NAME # 27 DAM

SHEET NO. A17 OF
PROJECT C234

120	13.	3.	50.	
121	13.	3.	48.	
122	12.	3.	46.	
123	12.	3.	43.	
124	11.	3.	41.	
125	11.	3.	39.	
126	10.	3.	38.	
127	10.	3.	36.	
128	9.	3.	34.	
129	9.	3.	33.	
130	8.	3.	31.	
131	8.	3.	30.	
132	8.	3.	28.	
133	7.	3.	27.	
134	7.	3.	26.	
135	7.	3.	25.	
136	6.	3.	24.	
137	6.	3.	22.	
138	6.	3.	21.	
139	6.	3.	21.	
140	5.	3.	20.	
141	5.	3.	19.	
142	5.	3.	18.	
143	5.	3.	17.	
144	4.	3.	16.	
145	4.	2.	16.	
146	4.	1.	15.	
147	4.	0.	14.	
148	4.	0.	14.	
149	3.	0.	13.	
150	3.	0.	12.	
SUM			4950.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	176.	103.	34.	33.	4950.
INCHES		7.59	10.66	10.66	10.66
AC-FT		51.	68.	68.	68.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	309.	132.	36.	35.	0.12
ROUTED TO	1	176.	103.	34.	33.	0.12