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NATIONAL DAM SAFETY PROGRAM. LAKE VREELAND (NJ00229), PASSAIC R--ETC(U)
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PASSAIC RIVER BASIN

RAMAPO RIVER, BERGEN COUNTY

NEW JERSEY

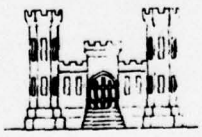
LEVEL II

LAKE VREELAND

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NJ 00229



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

JULY 1978

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Lake Vreeland
Bergen County, New Jersey

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Gilbert Associates, Inc.
P.O. Box 1489
Reading, Pa. 19603

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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)

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National Dam Safety Program
Dam inspection report Phase I.
Lake Vreeland Dam, N.J.

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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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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

IN REPLY REFER TO
NAPEN-D

31 JUL 1978

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

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Lake Vreeland Dam in Bergen 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 on the first three pages of the report.

Based on visual inspection, available records, calculations and past operational performance, Lake Vreeland Dam is judged to be in poor condition. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Studies should be undertaken and completed by the owner to increase the spillway capacity within six months from the date of approval of this report. Improved spillway construction should begin within one year from the date of approval of this report. Due to the potential for overtopping of the dam, detailed emergency operation, warning and evacuation plans should be developed and placed in operation within two months from the date of approval of this report. Until the spillway is enlarged, Boy Scout activities in the flood plain downstream of the dam should be avoided during periods of heavy rainfall and high-stream flows.

b. The use of flashboards to raise the lake's level should be immediately discontinued until all remedial work on the dam has been completed.

c. Piezometers should be installed for measuring and monitoring porewater pressure or water level in the embankment within three months from the date of approval of this report. Any remedial actions required as a result of the piezpmeter study should be initiated within calendar year 1979.

d. Engineering investigations and studies should be made of the condition of the tilted concrete corewall as well as determination of the properties of the embankment as is pertains to the structure's stability. These investigations and studies should be completed within six months from the date of approval of this report. Any remedial measures found necessary as a result of these investigations and studies should be initiated within calendar year 1979.

e. Tree and brush growth on the downstream slope of the dam should be removed, the slopes returned to their original design configuration and stabilized with suitable vegetative growth within one year from the date of approval of this report.

f. Sinkholes in dam's downstream crest should be filled with an imperious, stable material within two months from the date of approval of this report.

g. The owners should establish effective Operations and Maintenance procedures by issuing an O. & M. manual within four months of the date of approval of this report.

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

Harry V. Dutchyshyn

1 Incl
As stated

HARRY V. DUTCHYSHYN
Colonel, Corps of Engineers
District Engineer

Cy furn:
Mr. Dirk C. Hofman, P.E.
Department of Environmental Protection

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Lake Vreeland
State:	New Jersey
County:	Bergen
USGS Quadrangle Sheet:	Ramsey, N.J.
Coordinates:	N 41° 03' 48" W 74° 14' 18"
Stream:	Off the Ramapo River
Date of Inspection:	30 May 1978

The dam as inspected is in poor condition, as defined in Appendix H. The spillway is seriously inadequate. It is estimated that the spillway capacity is 24 percent of the outflow peak of the probable maximum flood (PMF) and 85 percent of the 100-year flood. The items listed below require action which should commence immediately:

1. The use of flashboards should be discontinued until the dam has been further studied and rehabilitated as needed. Flashboards should be removed immediately.

2. Piezometers should be installed and monitored.

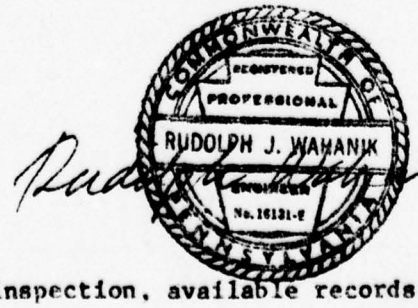
3. A study should be made of the tilted (and possibly cracked) concrete corewall.

4. A foundation investigation should be conducted to determine the engineering properties on the embankment materials, and to determine the stability of the dam.

5. The spillway capacity should be determined by the owner using precise and sophisticated methods.

6. The dam should be modifiedin accordance with studies as described above.

7. Boy Scouts activities in the area located downstream of the dam should be avoided during periods of heavy rainfall and high stream flows.



Based on visual inspection, available records, calculations and post

operational performance, Lake Vreeland Dam is judged to be in poor condition. The dam's spillway is considered seriously inadequate as 25 percent of the Probable Maximum Flood (PMF) would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Studies should be undertaken and completed by the owner to increase the spillway capacity within six months from the date of approval of this report. Improved spillway construction should begin within one year from the date of approval of this report. Due to the potential for overtopping of the dam, detailed emergency operation, warning and evacuation plans should be developed and placed in operation within two months from the date of approval of this report. Until the spillway is enlarged, Boy Scout activities in the flood plain downstream of the dam should be avoided during periods of heavy rainfall and high-stream flows.

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e. Tree and brush growth on the downstream slope of the dam should be removed, the slopes returned to their original design configuration and stabilized with suitable vegetative growth within one year from the date of approval of this report.

f. Sinkholes in dam's downstream crest should be filled with an imperious, stable material within two months from the date of approval of this report.

g. The owners should establish effective Operations and Maintenance procedures by issuing an O. & M. manual within four months of the date of approval of this report.

APPROVED: Harry V. Dutchyshyn

HARRY V. DUTCHYSHYN
Colonel, Corps of Engineers
DDistrict Engineer

DATE: 31 July 1978

May 1978

OVERVIEW - LAKE VREELAND DAM

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

TABLE OF CONTENTS

1.0 PROJECT INFORMATION

1.1 GENERAL

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the U.S. Corps of Engineers to initiate a national program of safety inspections of non-Federal dams throughout the United States. Gilbert Associates, Inc. has entered into contract No. DACW61-78-C-0114 with the Philadelphia Office of the U.S. Corps of Engineers to inspect this dam, Gilbert Work Order 06-7249-000.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for the Safety Inspection of Dams (Reference 1) and contract requirements between Gilbert Associates, Inc. and the U.S. Army Corps of Engineers. The objectives are to expeditiously identify whether the dam poses an immediate threat to human life and property and to recommend future studies and/or any obvious remedial actions that may be incurred by this inspection.

1.2 PROJECT DESCRIPTION

1.2.1 Description of Dam and Appurtenance: The Lake Vreeland Dam is as 18-foot high, 190-foot long earthfill dam which according to the drawings supplied to us by the New Jersey Department of Environmental Protection (DEP) has a concrete corewall extending downward to bedrock or 2 feet into stiff clay. The upstream embankment was made with puddled earth having a primary slope of 1-1/2 horizontal:1 vertical. The downstream embankment was formed chiefly with rock fill having a primary slope of 1 horizontal:1 vertical. The top of the corewall lies at elevation 638 feet (about MSL) and the crest of masonry overflow spillway located at the left side of the dam lies at elevation 635 feet (MSL). A 27-inch reinforced concrete pipe with a rising stem slide gate mounted on the intake end passes through the dam.

1.2.2 Location: The dam is located on Fox Brook, about 1 mile upstream from the junction of Fox Brook and the Ramapo River. The dam site is about 2 miles north of the Borough of Oakland, N.J. The terrain around the dam site is hilly and the area is generally covered with dense forest. Glacial drift is distributed over the surface and consists of many boulders in the low area. The rocks exposed on both abutments are Precambrian biotite gneiss.

1.2.3 Size Classification: The dam is classified as a small structure because of its impoundment (approximately 60 acre-feet), according to Section 2.1.1 of Reference 1.

1.2.4 Hazard Classification: The dam is located 1 mile west of the Ramapo River on Fox Brook, and 2 miles upstream from the Borough of Oakland, N.J. in a sparsely populated area. The dam is classified as a significant high hazard potential based on the requirements of Section 2.1.2 of Reference 1.

1.2.5 Ownership: The lake and dam are part of Camp Glen Gray, which is owned by the Boy Scouts of America (BSA), Essex Council, 36 Park Place, Newark, N.J. 07102.

1.2.6 Purpose of the Dam: The Lake Vreeland Dam was constructed for Camp Glen Gray of the Boy Scouts of America to create a lake for recreational purposes. There is one 27-inch diameter gated outlet pipe to drain the lake. The water level is controlled by an ungated overflow weir at the left abutment.

1.2.7 Design and Construction History: The dam was designed by the Walter Kidde Co., Inc. of 140 Cedar Street, New York, New York. Construction was started in July 1917 by the Ambursen Construction Company. The dam was built to a temporary height of elevation 631 feet, and completed to its final height of elevation 639 feet in October 1927. The lake was dredged in 1976. The New Jersey Department of Environmental Protection (DEP) in Trenton, New Jersey, has microfilmed plans and specifications, inspection reports, and construction photographs pertaining to this project.

1.2.8 Normal Operational Procedures: Originally the lake level could be raised from elevation 635 feet (spillway crest) to elevation 638 feet by using three flashboards. At the time of inspection one flashboard was in use. In view of the general deteriorated condition of the dam, this board was removed at the inspector's request. The 27-inch diameter gated outlet drain can be opened to drain the lake, and to aid the spillway in discharging additional flows. The rising stem slide gate on the 27-inch outlet drain was refurbished in 1976, and can only be reached by and operated from a boat.

1.3 PERTINENT DATA

1.3.1 Drainage Area: 0.815 square mile (522 acres)

1.3.2 Discharge at Damsite: Not Available

1.3.3 Elevation: (Feet above MSL): Water level elevation 636 feet corresponds to contour elevation 636 feet in USGS Quandrangle Sheet. (630 feet on Atlas Sheet #23 of the State of New Jersey - (Note on Drawing 51704 dated June 15, 1917.))
Top Dam: 639 feet
Max. Pool - Spillway Design Flood (SDF) Surcharge: 642.3 feet
Stream Bed at Centerline of Dam: Approximately 621 feet

1.3.4 Reservoir: Length of maximum pool - 850 feet

1.3.5 Storage (Acre Feet):
Top of Dam: 60 Acre-feet
SDF Surcharge: 89.1 feet
At Weir Crest Level: 36.5 Acre-feet

1.3.6 Reservoir Surface (Acres):
Top of Dam: 7.5 acres
SDF Surcharge: 10.0 acres
Spillway Crest: 4.4 acres

1.3.7 Dam Type: Zoned earthfill with concrete corewall.
Length - Design 154.0 feet
Measured 190.0 feet

Height - Design 19 feet
Measured 18 feet

Top Width - Design 4.5 feet
Measured 8.5 feet

Side Slopes - Upstream Design 2 horizontal:1 vertical
Measured Vertical and approximately 2 horizontal: 1 vertical

Downstream Design 1.5 horizontal:1 vertical
Measured 1.5 horizontal:1 vertical to 1 horizontal:1 vertical

Zoning - Concrete corewall and upstream tamped clay material from elevation 619 feet to elevation 639 feet. Downstream slope predominantly rockfill with a cushion of small loose stone against the corewall.

Impervious Core - Concrete corewall and upstream impervious material extend from the original surface to elevation 639 feet for the soil and elevation 638 feet for the concrete.

Cutoff - Concrete corewall was extended 2.0 feet into bedrock or blue clay, *according to drawings supplied by DEP.*

Grout curtain - None

1.3.8 Diversion and Regulating Tunnel: None

1.3.9 Spillway: Crest Elevation 635 feet
Width = Design 21.33 feet
Measured 20.0 feet
Freeboard - 4 feet to bottom of footbridge.

1.3.10 Regulatory Outlet: 27-inch reinforced concrete pipe (RCP) with slide gate.

2.0 ENGINEERING DATA

2.1 DESIGN

A plan, cross-section, and profile of the dam are shown on the drawings on file at the Department of Environmental Protection (DEP) in Trenton, New Jersey. Some proposed design features were described in an investigation report or permit application, which is available at the above agency. A design report of the dam is not available.

2.2 CONSTRUCTION

Memoranda on the construction inspections of the dam were available from DEP.

2.3 OPERATION

During the preliminary site visit on May 11, 1978 one 15-inch flashboard was in place in the 20.0-foot wide spillway. In view of the potential for dam overtopping during floods, the BSA Camp Management was requested not to use any flashboards until further analysis has been completed. At the time of the dam inspection, May 30, 1978, no flashboards were in use. On June 27, 1978 a 26-inch high flashboard panel, which raised the water 24-inches, was being used to increase the depth of water at the boat landing/swimming area.

The original walkway from the top of the dam to the slide gate operator also supported a diving tower. According to Mr. Steve O'Brian of BSA, the swimming area and boat landing were moved to the South Shore about 20 years ago, and the walkway with diving tower was removed. Presently the slide gate operator can only be reached by and operated from a boat.

2.4 EVALUATION

2.4.1 Availability: The design and construction data are sketchy and incomplete. There are no design calculations, subsurface, or material investigation data.

2.4.2 Adequacy: There was no as-built drawing on file for the dam. The corewall foundation information was inadequate.

2.4.3 Validity: The design drawings were not consistent with the observed side slopes, crest width, length of dam, and riprap layout.

3.0 VISUAL INSPECTION

3.1 FINDINGS

3.1.1 Dam: Some sink holes as large as 9 inches in diameter were observed along the top of the dam. These sink holes were present chiefly along the downstream side of the concrete corewall and the upstream edge of the crest. A section of the exposed corewall on the south side was tilted about 10 degrees toward the downstream. The ground surface at the crest and the top of the corewall were not uniform, which may indicate the results of differential settlements. The downstream embankment varied considerably in slope, material composition and gradation, and method of construction. The material exposed along the donwstream slopes is composed chiefly of silty sand, gravel, and boulders. The junction of the embankment and abutment did not show any seepage at the time of inspection. Seepage was not observed along the embankment slopes and toes. There is a small wet ditch located along the toe of the right valley wall at the distance of about 20 feet downstream from the toe of the embankment. A group of intermittent springs with estimated flow of 15-20 gpm at the time of inspection has developed 220 feet downstream from the toe of the embankment at the center of the access roadway. Small amounts of leakage reported (see letter Page E-4, Appendix E) coming out of downstream toe along the concrete culvert pipe at the time of initial reservoir filling, was not discovered at this time of inspection. At a subsquent site visit by the inspection team on June 27, 1978, neither springs nor wet spots were visible.

3.1.2 Appurtenant Structures: Concrete surfaces of the spillway wall show some aggregate but do not appear to be detracting from the overall stability of the structure. The wooden bridge and handrail over the spillway were in good condition. The right spillway abutment is of concrete and in good condition (see Appendix H). The left spillway abutment is of fieldstone and needs some touching up with mortar.

3.1.3 Reservoir Area: Considerable fine sediments composed chiefly of silty clay to clayey silt were laid in and around the upper reservoir area. Vegetation cover in some areas near the shore is very poor. No serious problems were observed in the reservoir area.

3.1.4 Downstream Channel: The channel has a steep gradient. The effect of erosion and scouring along the rock-exposed channel bottom is minimal, except at the channel bottom - wall interface. The downstream channel appeared to be in a stable condition with no serious sideslope erosion problems.

3.2 EVALUATION

The visual inspection revealed discrepancies between the approved drawings and the structure as it exists. In May 1956 the dam was inspected by the State of New Jersey, and at that time the structure conformed closely to the design drawings. At present the crest is 4.0 feet wider than designed; the upstream slope starts 3.0 feet below the crest instead of at the top of the dam (as shown in Figure 4).

The riprap is stacked vertically and the corewall is exposed over 50 percent of its length. The tilt of a portion of the corewall as evidenced at the crest cast doubts with respect to the integrity of the concrete corewall. The foundation of the concrete corewall may have experienced excessive differential settlement if the wall is founded partially on blue clay and bedrock.

The development of some sink holes at the crest indicated that settlements had taken place probably due to washing out of fine embankment material during the past overtopping of the dam. The undesirable sedimentation around the upper reservoir area may eventually affect the capacity of the reservoir and the safety of dam and its appurtenant structure.

The stretch of stream bed of Fox Brook between the dam and the junction with the Ramapo River approximately 6000 feet away traverses a rough, wooded ravine and crosses one road and one pond. The BSA Camp Office and the BSA Camp Ranger's residence are located approximately 300 feet downstream of the dam. Further downstream and in the vicinity of Fox Brook there are three dwellings.

3.3 ATTENDEES

Boy Scouts of America, Essex Council
R. Lee - Camp Supervisor
C. Ball - Ranger in Charge

Gilbert Associates, Inc.

Rudolph J. Wahanik
Fine T. Hsu
Rudi P. Visser

4.0 OPERATIONAL PROCEDURES

4.1 PROCEDURES

No documented plan for the operation of the Vreeland Dam is available. The water level of the lake is determined by the spillway on the left abutment. Flashboards have been used to raise the water level up to elevation 638 feet (top of corewall). According to Mr. Steve O'Brien of BSA, this was done to increase the available water depth for recreational purposes. There is no operational procedure at this dam. A 6-inch steel pipe siphon with shutoff valve located in the top of the dam at elevation 635.50 feet is used for fire protection of the camp.

4.2 MAINTENANCE OF DAM

Since the construction of the dam, it has been overtopped at least three times (Page E-5 of Appendix E). This inspection has revealed considerable sink holes (See photographs in Appendix C) on the dam top that are in between the rocks which now form the top of dam. An attempt was made by the owners of the dam to fill these voids between the inspection visits.

According to Mr. R. Lee of BSA, the lake was drained in September 1976, and up to 18,000 cubic yards of accumulated sediment were removed. At that time the slide gate was refurbished. It was September 1977 before the lake was up to elevation 635 feet again.

4.3 DESCRIPTION OF OPERATING FACILITIES - Not Applicable

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

As far as is known, no warning system has been used since the dam was constructed. With the ranger's residence below the dam, there may be adequate time to contact the downstream residents.

4.5 EVALUATION

The maintenance procedures for this dam are virtually non-existent. The spillway channel on the downstream side shows evidence of considerable erosion where the water has eroded the grouted stone at the bottom - wall interface. Tree and brush growth on the downstream slope of the dam should be removed, and the slopes restored to conform to the original design.

5.0 HYDRAULIC/HYDROLOGIC DESIGN

The hydrologic analysis presented in this report pertains to present hydrologic conditions and do not consider future changes produced by uncertain conditions such as urbanization, forest fires, or other modifications within the watershed. Details of the methods used and of the corresponding calculations are attached in Appendix D.

5.1 EVALUATION OF FEATURES

In 1956 it was evident to the State of New Jersey (see inspection report dated May 1956 and letter dated May 17, 1956, Appendix E) that the spillway was inadequate to pass floods larger than the 100-year flood. There is no evidence to prove that the embankment was raised as suggested in some of the earlier inspections reports (Appendix E) to reduce the frequency of overtopping.

5.2 SPILLWAY CAPACITY

The capacity of the spillway was determined by the Corps of Engineers screening criteria, and the owner should determine the actual capacity by using more precise and sophisticated methods (Reference 5). The spillway rating curve used is shown in Figure D-3 of Appendix D and the spillway capacity at different reservoir elevation is:

Reservoir Water Level Ft	Spillway Discharge cfs
635	0
636	65
637	195
638	359
639	553
640	1260
641	2420
642	3894
643	5610

Notes:

1. All discharges above elevation 639.00 feet are overtopping the dam.
2. The capacity of the spillway with flashboards will depend on the height of flashboards used.

5.3 SPILLWAY PERFORMANCE

The maximum spillway capacity of the dam was estimated at about 553 cubic feet per second (cfs) with 4 feet of head over the crest of the spillway. This indicates that the earthfill embankments would be overtopped if subject to a flow larger than 550 cfs which is approximately 12 percent of the recommended Corps of Engineers spillway design flood (PMF or 4590 cfs) and 85% of the 100-year flood of 650 cfs (See Appendix D for details). If overtopping does result, dam failure due to erosion of the earth embankment would be quite possible. Due to its location, failure of the Vreeland Dam could result in a minor economic loss and some loss of life downstream of the dam depending on the time of collapse. If the dam failure occurs during time of BSA activities, additional loss of life could occur in the immediate vicinity of the dam. Therefore, BSA activities in the immediate downstream area of the dam should be avoided during periods of heavy rainfall and high stream flows.

5.4 RESERVOIR PERFORMANCE

Information concerning flow records or major floods at the dam site are not available. The drainage area at the dam site is 522 acres (0.815 square miles).

To estimate the maximum reservoir elevation, the spillway dam hydrograph equivalent to 100 percent and to 50 percent of the PMF was routed through the reservoir using the HEC-1 computer program (Reference 1). Since the reservoir has only 4 feet of freeboard and 36.5 acre-feet of storage at the normal pool elevation, it was assumed that the reservoir would be full at the time of occurrence of the flood, or at elevation 635.00 feet.

From this study the following was estimated:

PMF %	Inflow Peaks cfs	Outflow Peaks cfs	Maximum Pool ft elevation	Ft of Dam Overtopping
100	4590	2290	642.3	3.3
50	2290	2220	640.8	1.8
14		650	639.2	0.2
12		550	639.00	0

5.5 RESERVOIR DRAWDOWN

There are no volume curves for the reservoir in existence and the USGS quadrangle (Reference 3) does not provide enough information to calculate them. To calculate the time required to drawdown 36.5 acre-feet from the Vreeland Lake from elevation 635 feet down to elevation 620 feet, it was assumed that the reservoir volume varies with the depth and that the 27-inch diameter concrete pipe had a Mannings n = 0.018. The drawdown times (see Appendix D for details) are:

Water Level ft	Reservoir Storage Acre-ft	Total Drawdown Time in Hours
635	36.5	0
632	29.2	1.44
629	21.9	3.04
626	14.6	4.85
623	7.3	6.99
620	0	9.75

6.0 DAM STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

6.1.1 Visual Observations: The presence of sink holes at the top of dam, partial tilting of the concrete corewall, relatively steep downstream slopes, and poorly graded downstream embankment material indicate that the stability of the embankment should be further investigated.

6.1.2 Design and Construction Data: The relatively steep side slopes as constructed are different from those in the original design. The concrete corewall might be founded partially on bedrock and partially in stiff clay as indicated on the drawing. The steep side slopes of the dam and non-uniform foundation material have raised the problem of dam instability under unfavorable load conditions.

6.1.3 Operating Records: Not Applicable

6.1.4 Post-Construction Changes: Since the inspection by the State of New Jersey on May 10, 1955 (See Figures 3 and 4), the dam cross section has changed greatly from the original design. These post-construction changes might have been necessary to repair the damage caused by the overtoppings of the dam.

The stability of the structure needs to be reviewed on the basis of such changes when additional subsurface information is available and the condition of the concrete corewall is better understood.

6.1.5 Seismic Stability: Although this dam is located within Zone 1 on the Algermissen Seismic Risk Map of the United States (1969 edition), there are questions with respect to the static stability of the dam, as set forth in paragraph 6.1.1, and, therefore, in accordance with paragraph 3.6.4 of Reference 2, no assumptions can be made as to the seismic stability of the dam.

7.0 ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

This assessment and recommendations/remedial measures are made in accordance with the Conditions contained in Appendix H.

7.1 DAM ASSESSMENT

7.1.1 Safety: On the basis of Gilbert Associates, Inc. visual field inspection and available historic data, the dam appears to have some critical signs of distress, such as a deviation from the horizontal and vertical alignments, sink holes developing in the dam crest, the rough and uneven dam crest, and tilted corewall. The embankment has been overtopped at least three times since its construction 60 years ago, due to inadequate spillway capacity. It is not known if the overtopping occurred while the flashboards used during the summertime were in place at the spillway.

Additional items of concern are:

a. The corewall was designed to be 1.0 foot below the dam crest; some 50 percent of the corewall was visible at the time of the inspection due to overtopping of the dam and/or settling of the embankment material.

b. The tilted (and possibly cracked) corewall was designed to be founded within the blue clay or sound rock. It is conceivable that differential settlement has taken place.

c. The sink holes in the crest appear to be of relatively recent origin (no vegetation growing in same).

d. The upper 3.0 feet of the 2 horizontal:1 vertical upstream slope was reshaped into a wall of vertically stacked riprap.

e. The downstream slope 1.5 horizontal:1 vertical has been reshaped to include a bench of fine-grained material, with the upper right section of riprap stacked to form a 1 horizontal:1 vertical slope.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The following measures require immediate action:

a. The instruction of piezometers for measuring and monitoring porewater pressure or water level within the embankment.

b. Classification and determination of the engineering properties of the embankment and foundation materials through subsurface investigations and laboratory testing, and the performance of stability analyses for the dam.

c. The determination of the concrete spillway size required to pass the PMF and prevent future overtopping of the dam.

d. Modification of the dam as indicated by items a. through c. above.

e. BSA activities avoided downstream of the dam during periods of heavy rainfall and high stream flows.

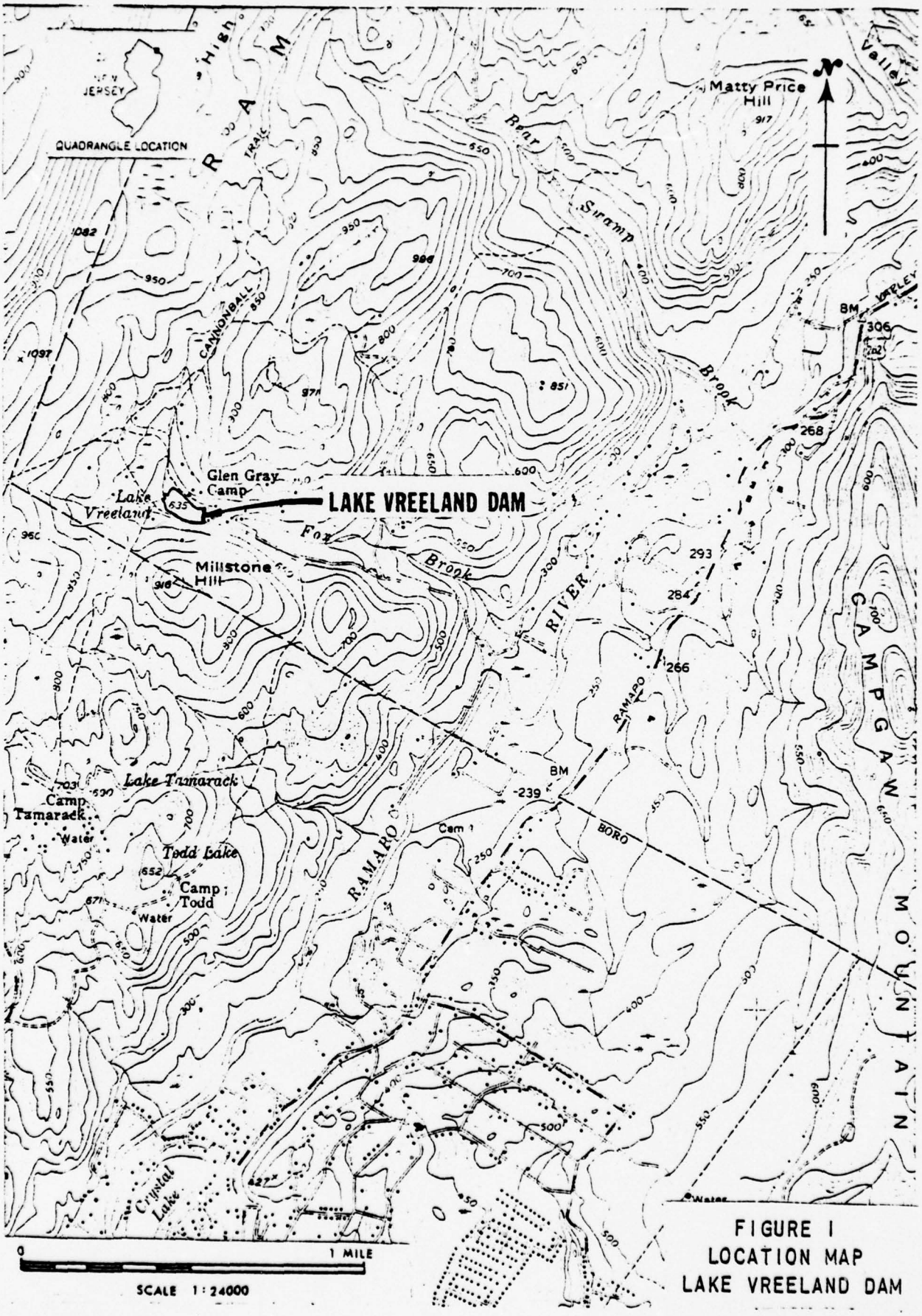


FIGURE 1
LOCATION MAP
LAKE VREELAND DAM

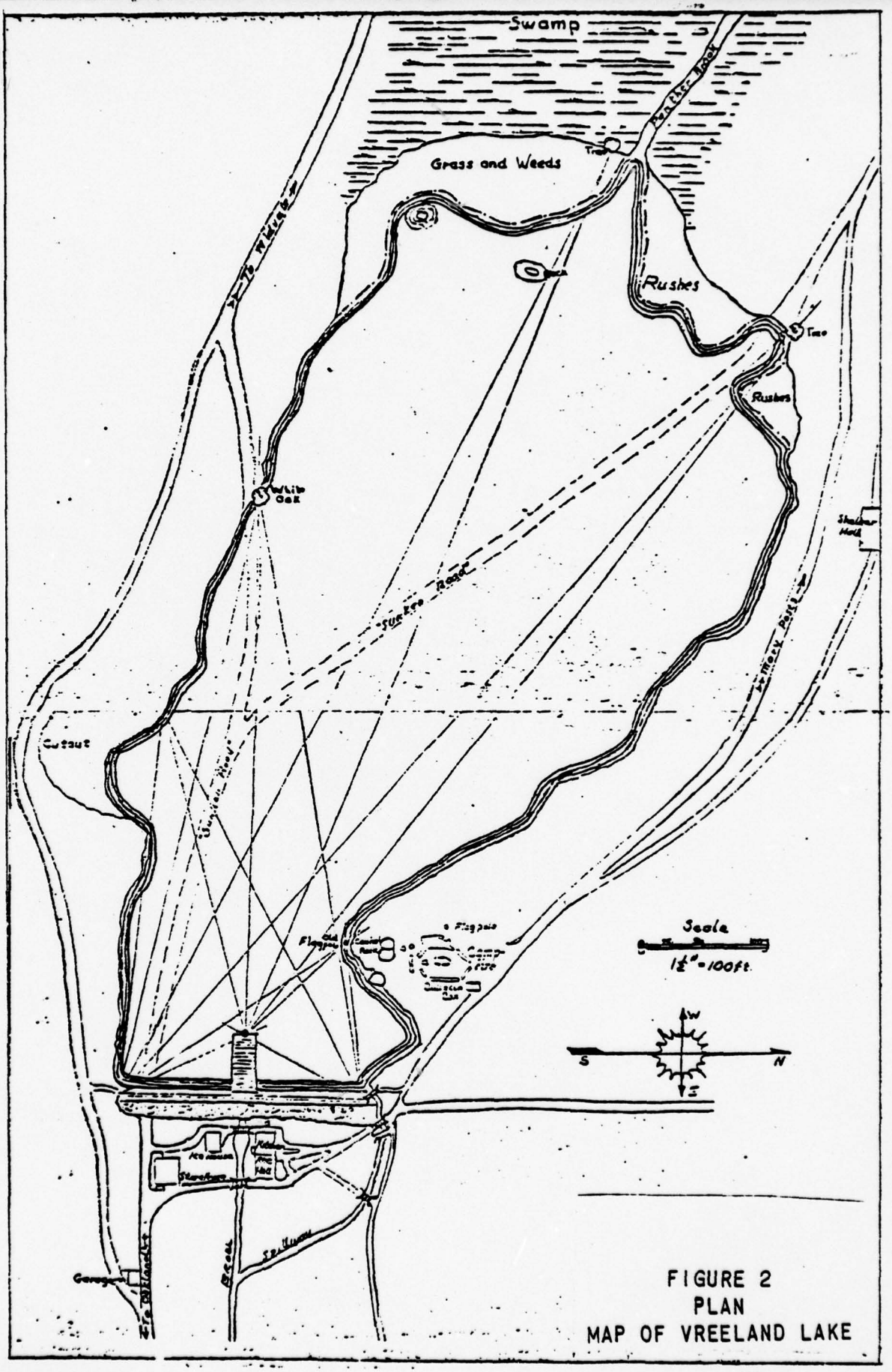
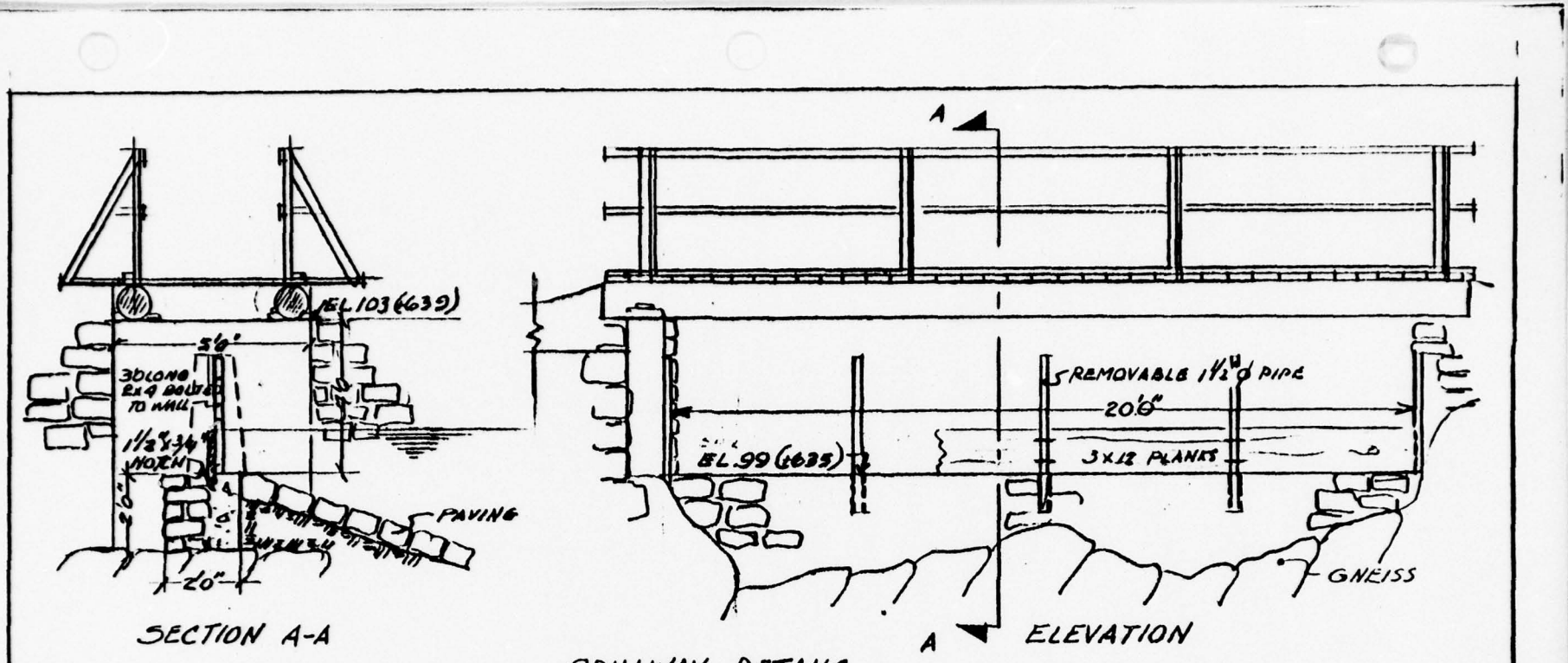
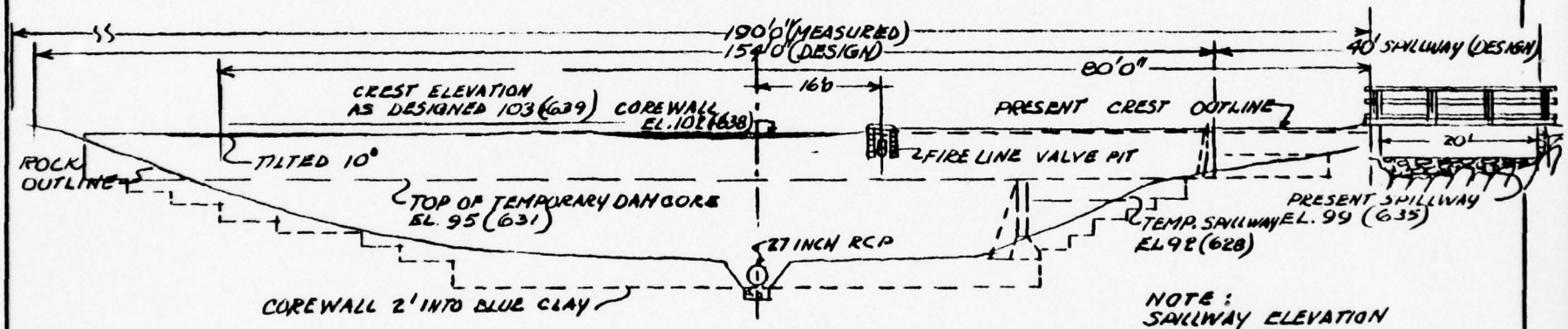


FIGURE 2
PLAN
MAP OF VREELAND LAKE



SPILLWAY DETAILS
SCALE 1 INCH = 2 FEET
SOURCE: DWG 52141



COREWALL OUTLINE
SCALE 1 INCH = 20 FEET
SOURCE: DWG 51704

NOTE:
SPILLWAY ELEVATION
99 FEET EQUALS
M.S.L. + 635 FEET.

FIGURE 3
LAKE VREELAND DAM

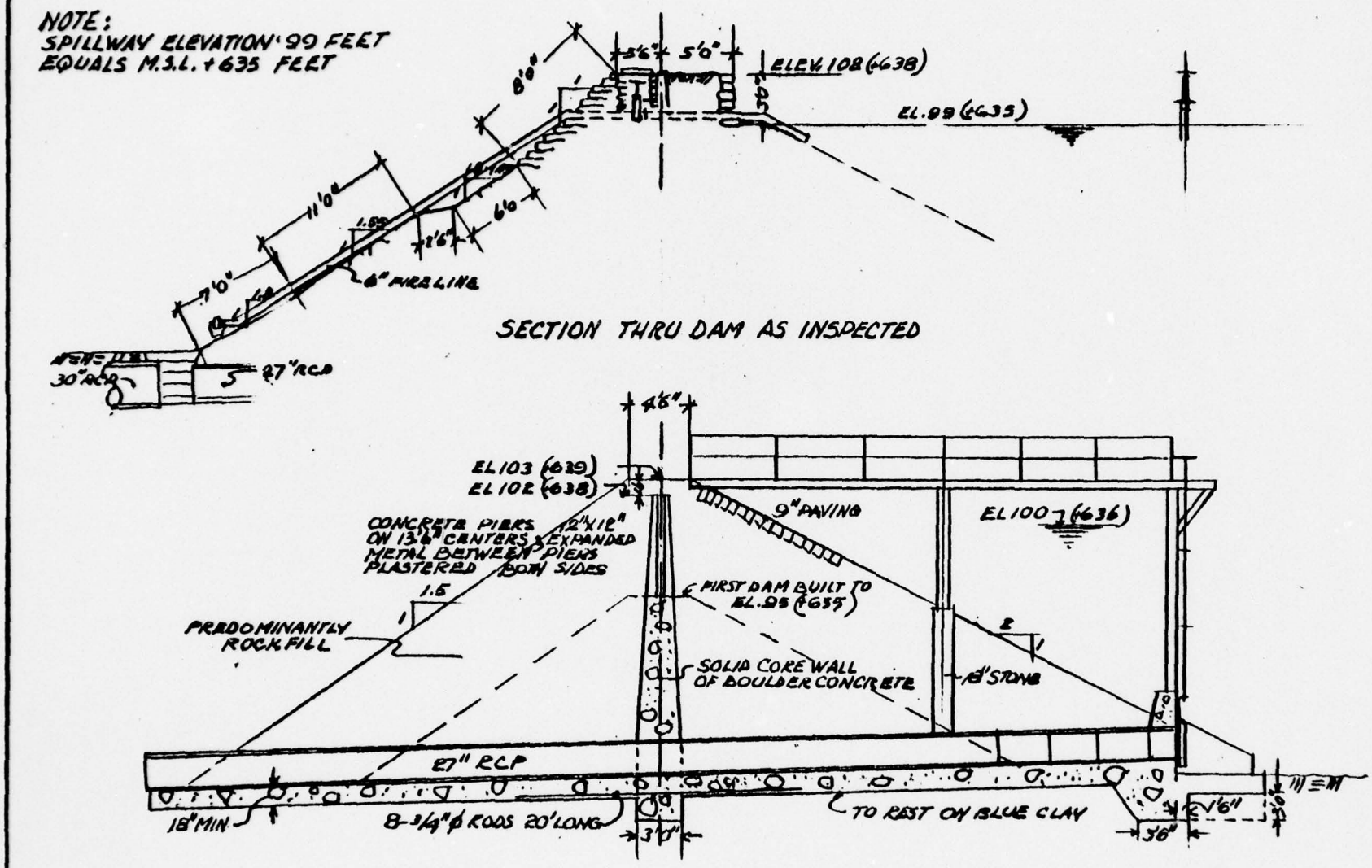


FIGURE 4
LAKE VREELAND DAM

APPENDIX A

VISUAL CHECKLIST

Check List
Visual Inspection
Phase 1

Name Dam: Lake Vreeland County: Bergen State: New Jersey Coordinators: Philadelphia District Corps of Engineers

Date(s) Inspection: May 30, 1978 Weather: sunny Temperature: 76°F

Pool Elevation at Time of Inspection: 629 feet MSL Tailwater at Time of Inspection: Not Applicable

Inspection Personnel:	Others:
Fine T. Hsu	Boy Scouts of America - Essex Council
Rudi P. Visser	R. Lee - Camp Supervisor
Rudolph J. Wahanik	C. Ball - Ranger in Charge

Rudi P. Visser - Recorder

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE OR LEAKAGE	Top of core wall visible over 50 percent of dam crest. No leakage	
STRUCTURE TO ABUTMENT/EMBANKMENT FUNCTIONS	Not Applicable	
DRAINS	Not Applicable	
WATER PASSAGES	Not Applicable	
FOUNDATION	Not Applicable	
SURFACE CRACKS CONCRETE SURFACES	Not Applicable	
STRUCTURAL CRACKING	Not Applicable	
VERTICAL AND HORIZONTAL ALIGNMENT	Not Applicable	
MONOLITH JOINTS	Not Applicable	
CONSTRUCTION JOINTS	Not Applicable	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No cracks visible; localized sinkholes up to nine inches in diameter on the dry side of the concrete corewall along the dam top, along the wet side of the dam, and along the edge of the top. An attempt was made by the Boy Scout Camp Ranger to fill some of the holes with sand.	Recommend filling the holes with sand-cement mix
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None visible.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	No visible erosion of abutments. Downstream slope was originally constructed as 1.5 horizontal:1 vertical; now consists of a 1 horizontal:1 vertical slope becoming 1 horizontal:1.75 vertical, a horizontal bench, and a 1 horizontal:1.75 vertical slope to the toe. This downstream slope shows definite signs of overtopping and severe erosion.	The horizontal berm probably formed by pushing up of fill from the toe to repair erosion damage.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DOWNSTREAM SLOPE OF DAM OF DAM	The downstream slope is very irregular in appearance - shows sign of erosion. The following slope distances and angles were measured: from top of dam 8 feet down at 30°-35°, approximately horizontal 2.5-foot wide bench, then 11 feet at 33°, with a final 7 feet at 30° to the parking lot grade. The upper 8 feet, over an approximate distance of 150 feet shows riprap stacked at a 45°-50°. The lower part of the slope consists of loose fine grained soil and rock fragments which appears to have been pushed up by a bulldozer. Large boulders are partly and fully exposed in the lower left slope. Some 10 to 15-foot tall trees of 3 to 4 inches in diameter and shrubs are growing on the slope. A 6-inch steel fireline with hydrant connection traverses the slope to parking lot.	Trees and shrubs should be cut. The whole slope needs regrading with granular material which will not erode when dam is overtopped.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Horiz. Alignment: Crest shows some deviation from centerline. Vert. Alignment: Core wall visible over 50± percent of dam top. Part of the corewall near the right abutment is tilted 10° towards the downstream side.	At time of completion of dam (in 1927) corewall was 1.0 foot below dam top

EMBANKMENT

Sheet 3

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RIPRAP FAILURES	Three feet of riprap visible, stacked vertically resting on gently sloping shelf of soil (±3.5 feet wide) on wet side.	The upstream slope was constructed to 2 horizontal: 1 vertical and the entire slope was protected with paving 9 inches thick.
CORE WALL	Visible in two locations, about 25-foot sections. The section nearest the right abutment shows a 10°± angle with the vertical, and the top of the wall section is not level, but slopes towards the downstream side.	Possibility exists that the core wall has cracked, and that water is seeping through said crack with resultant piping etc.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No distress or seepage noted	
ANY NOTICEABLE SEEPAGE	1 Minor seepage located at the foot of the slope about 70 feet downhill from the tow of the slope. 2 A series of springs flowing at estimated 15-20 gpm is visible in the middle of the parking area, and 220 feet below the toe of the dam.	The Boy Scout Camp Ranger did not remember if this spring was flowing during deepening of lake in 1976. Lake was drained at the time.
STAFF GAGE AND RECORDER	NONE	
DRAINS	NONE	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	27-inch RCP from slide gate in lake to downstream toe, where pipe increases in size to a 30-inch RCP to brook. No junction box has been built for this connection, some logs and planking sufficed. 27-inch RCP flowing at about 25 gpm.	Installed in fall 1976 - good condition.
INTAKE STRUCTURE	NONE	
OUTLET STRUCTURE	27-inch slide gate, 36 feet from dam in lake could not be inspected, activated from the upstream side. The 27-inch RCP drain and headwall support the gate mechanism.	Slide gate installed in August 1976 supported by 4 inch - I beam and cross member - original design indicates platform to slide gate. Slide gate refurbished or replaced in 1976. This platform should be replaced.
OUTLET CHANNEL	Water was flowing along the steep rock bottom of the outlet channel.	
EMERGENCY GATE	NONE	

UNGATED SPILLWAY

VISUAL EXAXIMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The weir measured 20.8 feet wide, is in good condition with a 4-foot opening from top of weir to bottom of wooden bridge with a concrete wall on the right side and a combination stone and concrete structure on bedrock on the left side.	
APPROACH CHANNEL	NONE	
DISCHARGE CHANNEL	The discharge channel has a steep gradient over a distance of approximately 100 feet. The channel invert consists of gneiss bedrock; nominal scouring and down cutting was observed. The walls are constructed of fieldstone and mortar. Some erosion was noticeable at the wall - invert interface.	Erosion at wall-channel invert areas should be repaired.
BRIDGE AND PIERS	Wooden walkway bridge, 3-1/2 feet wide - on concrete wing founded on bedrock.	Good condition

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not Applicable	
APPROACH CHANNEL	Not Applicable	
DISCHARGE CHANNEL	Not Applicable	
BRIDGE AND PIERS	Not Applicable	
GATES AND OPERATION EQUIPMENT	Not Applicable	

INSTRUMENTATION

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

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The landform around the reservoir is gentle to slightly hilly. Most of the slopes were covered with glacial till composed chiefly of an unsorted mixture of clay, silt, sand, gravel, and boulders. Some slopes are formed of massive outcrops.	Vreeland Lake is fed by Panther Creek and two unnamed streams.
SEDIMENTATION	Around the upper reservoir area considerable fine sediments including silty clay to clayey silt were deposited in the reservoir, and deposited along the banks after the dredging operation. Vegetation in this area is very sparse.	The lake was drained in fall 1976; 18,000 cubic yards of sediment removed. Water level back to normal pool in September 1977. A swampy area is located immediately upstream of the lake.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Occasional debris such as dead trees.	Channel over 100 feet ± only, becomes Fox Brook to Ramapo River.
SLOPES	About 45° to 90°	
APPROXIMATE NO. OF HOMES AND POPULATION	Three homes Approximately 10 people	

APPENDIX B

ENGINEERING DATA CHECKLISTS

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Design by Walter Kidde & Co. Inc. July 1917.
REGIONAL VICINITY MAP	7-1/2 minute USGS - Ramsey N.J. & N.Y. 1955
CONSTRUCTION HISTORY	Construction started in 1917, completed to 15-foot level (el. 631.00) Core wall raised to 18-foot level in 1922 Dam and fill completed in 1927
TYPICAL SECTIONS OF DAM	15-foot high boulder concrete corewall, tapering from 3.0 feet to 2.0 feet. Becoming a mesh reinforced panel between piers to present height Upstream slope constructed of soil. Downstream slope constructed of rockfill primarily.
HYDROLOGIC/HYDRAULIC DATA	
OUTLETS - PLAN	27-inch RCP pipe with slide gate.
- DETAILS	Not Available
- CONSTRAINTS	Not Available
- DISCHARGE RATINGS	Not Available
RAINFALL/RESERVOIR RECORDS	Not Available

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
DESIGN REPORTS	None - some construction photographs & design drawings, specifications available at New Jersey Department of Environmental Protection, Division of Flood Plain Management, Trenton, N.J.
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS	Not Available
HYDROLOGY & HYDRAULICS	Not Available
DAM STABILITY	Not Available
SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS	Not Available
BORING RECORDS	Not Available
LABORATORY	Not Available
FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	5/17/56 Letter from Normal O. Wittwer - Supervising Engineer - State of N.J. "Embankment has settled, corewall not visible" Dam overtopped 3 times" 8/24/67 Letter from John N. Brooks, Hydraulic Engineer, State of N.J. mention of seepage 30 feet from downstream toe.
BORROW SOURCES	Not Available - Probably from clearing of lake area.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
SPILLWAY PLAN	Present spillway does not conform to 1917 construction drawing
SECTIONS	(See Figures 3 and 4)
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Not Available Not Available
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	None
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Letter dated 5/17/56 by Norman Wittwer - Describes inadequacy of spillway, not large enough to pass flood of 8/19/55 without overtopping. Recommended raising crest of dam 1 foot or not more than 5.0 feet above spillway crest.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.815 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 635.00 feet (36.5 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Not Applicable

ELEVATION MAXIMUM DESIGN POOL: Not Available

CREST: Masonry/Concrete

a. Elevation: 635
b. Type: Vertical concrete drop spillway
c. Width: 2.0 feet
d. Length: 20.5 feet
e. Location Spillover: Level
f. Number and Type of Gates: None

OUTLET WORKS: Emergency Drawdown Facilities

a. Type: 27-inch diameter concrete pipe 73 feet long with upstream gate control
b. Location: Underneath the dam
c. Entrance inverts: 620
d. Exit inverts: 617
e. Emergency draindown facilities: Yes, see description above

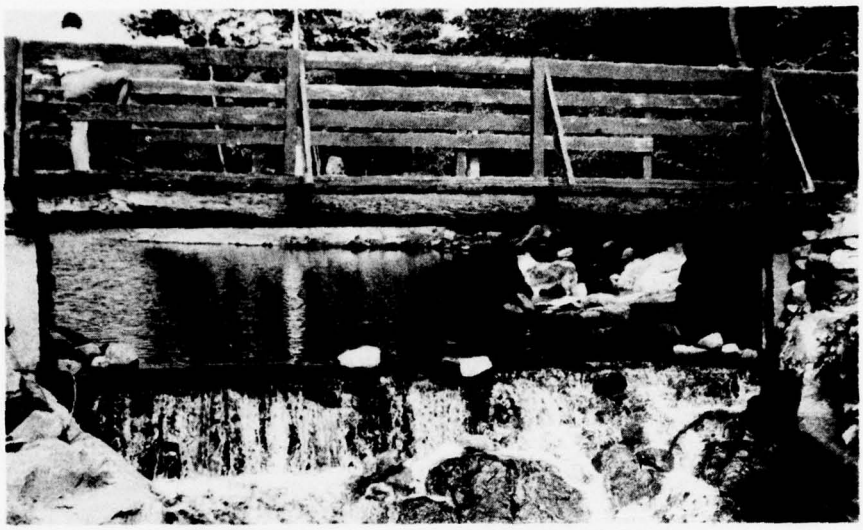
HYDROMETEOROLOGICAL GAGES: Not Applicable

a. Type:
b. Location:
c. Records:

MAXIMUM NON-DAMAGING DISCHARGE: 550 cfs

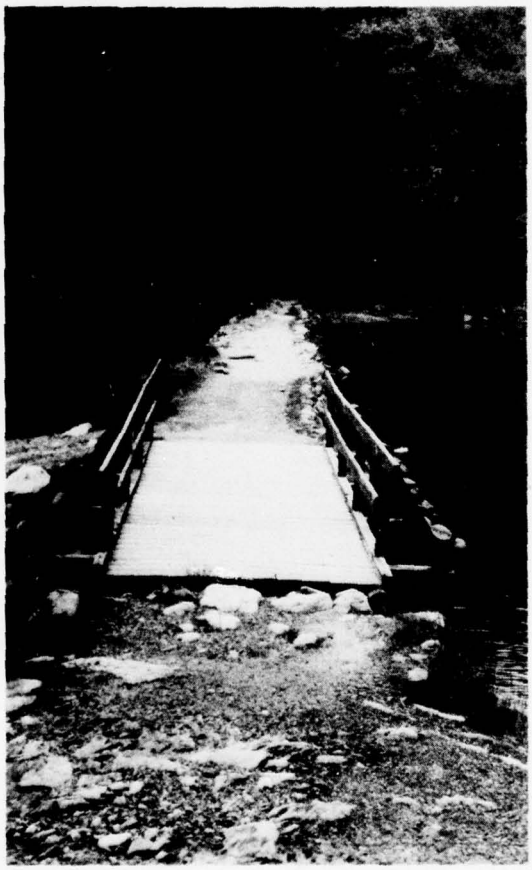
APPENDIX C

PHOTOGRAPHS



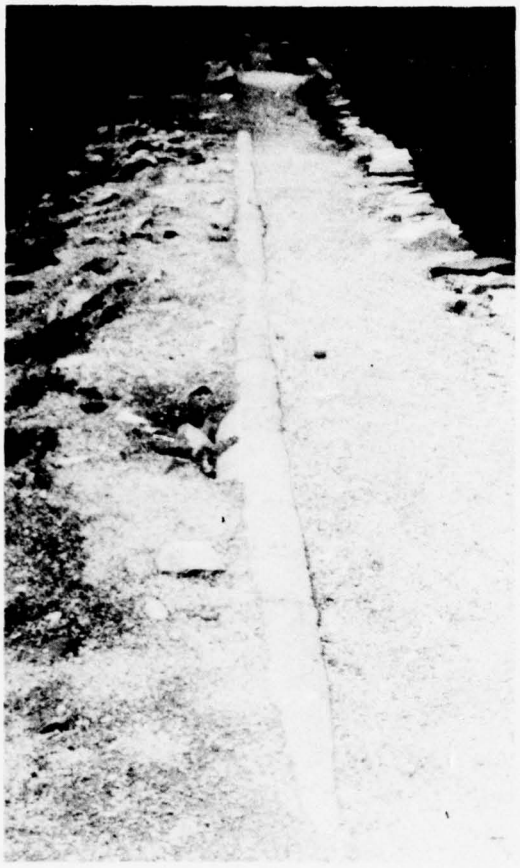
May 1978

SPILLWAY



May 1978

DAM CREST AND BRIDGE OVER SPILLWAY



May 1978
EXPOSED CONCRETE CORE

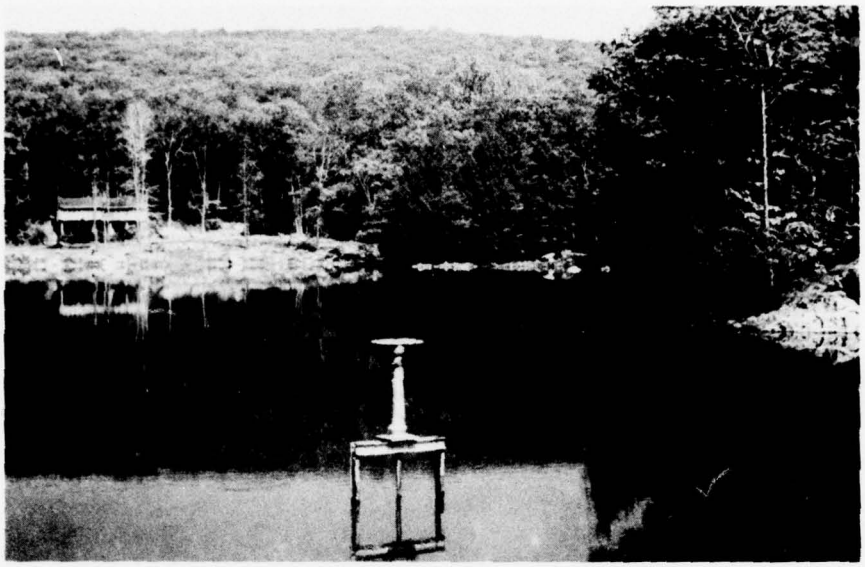
VIEW OF UPSTREAM RIPRAP
AND VERTICAL DAM FACE
May 1978

May 1978

VIEW OF LEFT ABUTMENT
NOTICE PEDESTAL FOR BOTTOM RELEASE GATE

May 1978

UPSTREAM VIEW OF DAM



May 1978

VIEW OF RESERVOIR
NOTE: THERE IS NO BRIDGE TO CONTROL GATE

SINKHOLE ON DAM CREST

May 1978

APPENDIX D

HYDRAULIC COMPUTATIONS

Gilbert Associates, Inc. Reading, Pennsylvania	SUBJECT: C.O.E. / LAKE VREELAND	FILING CODE:	PAGE: i OF i+14 PAGES
ANALYSIS/CALCULATION	PROJECT NAME: NJ DAM INSPECTIONS	W.O. NUMBER: 7249	
DEPARTMENT NUMBER: 0674	DEPARTMENT NAME:		

COVER PAGE AND DESIGN VERIFICATION RECORD

REVISION NUMBER	3	2	1	0
ORIGINATOR (INITIALS AND SURNAME)				R.A. PUTT - 1-8 R.J. WAHANIK - 9-14
DATE COMPLETED				PUTT - 7.25.78 WAHANIK 7.24.78
THIS ANALYSIS/CALCULATION CONTAINS ASSUMPTIONS REQUIRING LATER CONFIRMATION (YES OR NO)				NO
VERIFIER (INITIALS AND SURNAME)				D.O. VEIL
DATE VERIFIED				7.26.78
THE DESIGN ANALYSIS/CALCULATION HAS BEEN REVIEWED BY ME AGAINST THE APPLICABLE DESIGN REVIEW QUESTIONS (REFERENCE ANSI N45.2.11). ANY FINDINGS UNCOVERED DURING MY REVIEW HAVE BEEN DIRECTED TO THE ORIGINATOR AND RESOLVED. (VERIFIER'S SIGNATURE)				David O. Veil
THE DESIGN REVIEW OF THE ANALYSIS/CALCULATION INCLUDED EVALUATION AGAINST THE FOLLOWING QUESTIONS:	REMARKS:	REMARKS:	REMARKS:	REMARKS:
WERE INPUTS, INCLUDING CODES, STANDARDS, AND REGULATORY REQUIREMENTS, CORRECTLY SELECTED AND APPLIED?				YES
ARE ASSUMPTIONS ADEQUATELY DESCRIBED AND REASONABLE?				NO
ARE ASSUMPTIONS REQUIRING REVERIFICATION ADEQUATELY IDENTIFIED?				YES
HAVE APPLICABLE CONSTRUCTION AND OPERATING EXPERIENCES BEEN CONSIDERED?				YES
WAS AN APPROPRIATE ANALYSIS/CALCULATION METHOD USED?				YES
IS THE OUTPUT REASONABLE COMPARED TO INPUTS?				YES

FILING CODE

GAI 445 3-77

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
READING, PA.

CLIENT: COE
PROJECT: NJ DAM INSPECTIONS
FILING CODE:
W.O. 7249 PAGE 1 OF 14
SYSTEM: LAKE VREELAND
ORIGINATOR: R. A. PITT
DATE: 5-23-78
CALCULATION FOR: HYDROLOGY
REVIEWER: [illegible]
DATE: 7/25/78

RESULTS

A) DRAINAGE AREA

AREA = 5.68 PLANIMETER UNITS
= 522 ACRES
= 0.815 SQUARE MILES

B) TIME OF CONCENTRATION

AVERAGE STREAM SLOPE = 315 FT/6000 FT
= 5.25 %
AVERAGE VELOCITY = 4 FPS
TIME = 6000/240 = 25 MINUTES

WOODLAND OVERLAND SLOPE = 130 FT/1800 FT
= 7.2 %
AVERAGE VELOCITY = 2 FPS
TIME = 1800/120 = 15 MINUTES

TIME OF CONCENTRATION = 25 + 15 = 40 MIN

USE 1 HOUR FOR TIME OF CONCENTRATION AS A MINIMUM PRACTICAL LIMIT.

FILING CODE

GAI 350 REV. 10-72

GILBERT ASSOCIATES, INC. ENGINEERS AND CONSULTANTS READING, PA.	CLIENT COE	FILING CODE
	PROJECT NJ DAM INSPECTIONS	W.O. 7249 PAGE 2 of 14
SYSTEM LAKE VREELAND		ORIGINATOR R.A. PUTT DATE 5-23-76
CALCULATION FOR UNIT HYDROGRAPH		REVIEWER DM Moore DATE 7/25/78
		RESULTS SCS Unit Hydrograph Method

c) $T_c = 1 \text{ HR} = 60 \text{ MIN}$

ΔD = UNIT RAINFALL DURATION
$= 0.133\ T_c = 8 \text{ MIN}$

$T_p = \frac{\Delta D}{2} + 0.6\ T_c = 40 \text{ MIN}$

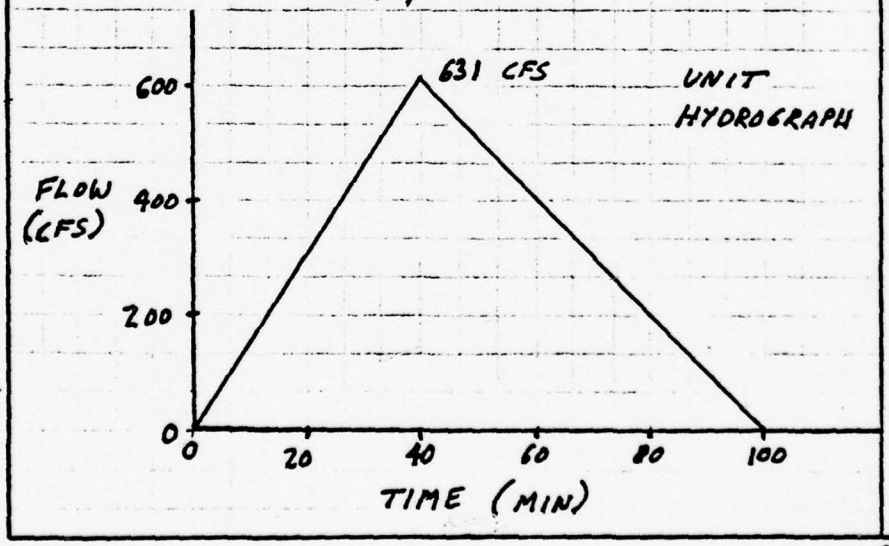
$T_b = 2.67\ T_p = 107 \text{ MIN}$

LET $T_b = 100 \text{ MIN}$

$T_r = T_b - T_p = 100 - 40 = 60 \text{ MIN}$

$K = \frac{2}{1 + \frac{60}{40}} = 0.80$

$q_p = \frac{(645)(0.800)(0.815)(1.0)}{40/60} = 631 \text{ CFS}$



FILING CODE

GAI 350 REV. 10-72

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
READING, PA.

CLIENT: COE
PROJECT: NJ DAM INSPECTIONS
FILING CODE:
W.O. 7249 PAGE 3 of 14
SYSTEM: LAKE VREELAND
ORIGINATOR: RA PUTT 9m DATE 7/25/78
CALCULATION FOR: UNIT HYDROGRAPH
REVIEWER: 9mm DATE 7/25/78
RESULTS

HEC 1 UNIT HYDROGRAPH ORDINATES
FOR 10 MINUTE TIME INTERVAL

TIME (MIN)	FLOW (CFS)
10	158
20	316
30	473
40	631
50	526
60	421
70	316
80	210
90	105
100	0

D) LOSS RATES

ALL SOILS IN DRAWAGE BASIN ARE ROCKAWAY - ROLK OUTCROP SERIES. WITH GOOD PERMEABILITY IN VIPER AND LOWER LAYERS AND A POORLY PERMEABLE FRAGIPAN BETWEEN THE TWO. PERMEABILITY THROUGH THE FRAGIPAN IS LESS THAN 2.0 INCHES/HR. THE FOLLOWING VALUES SHOULD ACCURATELY REPRESENT THE LOSSES.

INITIAL RAINFALL LOSS = 1.0 INCH

UNIFORM RAINFALL LOSS = 0.15 IN/HR

FILING CODE

GAI 350 REV. 10-72

GILBERT ASSOCIATES, INC. ENGINEERS AND CONSULTANTS READING, PA.	CLIENT COE	FILING CODE
	PROJECT NJ DAM INSPECTIONS	W.O. 7249 PAGE 4 OF 14
SYSTEM LAKE VREELAND		ORIGINATOR R A PUTT DATE 5-24-78
CALCULATION FOR HYDROLOGY		REVIEWER [signature] DATE 7/25/78
		RESULTS

E) LAKE AREA

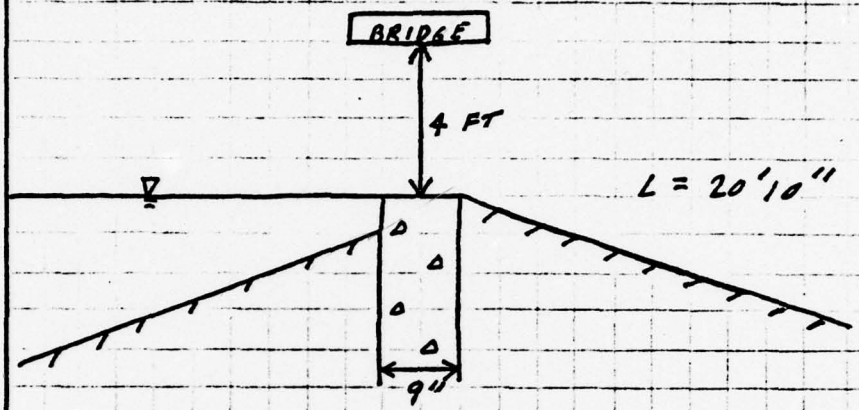
THE POOL AREA OF LAKE VREELAND IS LESS THAN 0.01 SQUARE MILE, AND AT ABOUT 1% OF THE TOTAL DRAINAGE AREA IS INSIGNIFICANT.

FILING CODE

GAI 350 REV. 10-72

GILBERT ASSOCIATES, INC. ENGINEERS AND CONSULTANTS READING, PA.	CLIENT COE	FILING CODE
	PROJECT NJ DAM INSPECTIONS	W.O. 7249 PAGE 5 OF 14
SYSTEM LAKE VREELAND		ORIGINATOR RA POTT DATE 7/25/78
CALCULATION FOR VOLUME - OUTFLOW RELATION		REVIEWER DATE 7/25/78
		RESULTS

SKETCH - END VIEW -



SPILLWAY WILL ACT AS A BROAD-CRESTED WEIR.

$$Q = CLH^{3/2}$$

USING COEFFICIENTS GIVEN BY KING HANDBOOK OF HYDRAULICS -

H (FT)	C	Q (CFS)
0.0	-	0
0.2	2.75	5
0.6	2.89	28
1.0	3.14	65
1.5	3.27	125
2.0	3.31	195
2.5	3.32	273
3.0	3.32	359
3.5	3.32	453
4.0	3.32	553

FILING CODE

GAI 350 REV. 10-72

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
READING, PA.

CLIENT: COE
PROJECT: N J DAM INSPECTIONS
FILING CODE:
W.O. 7249 | PAGE 6 of 14
SYSTEM: LAKE VREELAND
ORIGINATOR: RA Putt 7/25/78
CALCULATION FOR: VOLUME - OUTFLOW
REVIEWER: [illegible] 7/25/78
RESULTS

SURFACE AREA VARIES FROM 4.42 ACRES AT ELEVATION 635 TO 8.26 ACRES AT ELEVATION 640, ASSUME A LINEAR RELATION

POOL ELEVATION (FT ABOVE MSL)	SURFACE AREA (ACRES)	STORAGE VOLUME (AC-FT)	OUTFLOW (CFS)
635.0	4.42	0.0	0
635.2	4.57	0.9	5
635.6	4.88	2.8	28
636.0	5.19	4.8	65
636.5	5.57	7.5	125
637.0	5.96	10.4	195
637.5	6.34	13.5	273
638.0	6.72	16.7	359
638.5	7.11	20.2	453
639.0	7.49	23.8	553

FILING CODE

GAI 350 REV. 10-72

GILBERT ASSOCIATES, INC. ENGINEERS AND CONSULTANTS READING, PA.	DEPARTMENT NAME COE	DEPT. NO.	FILING CODE
	PROJECT NAME NJ DAMS	W.O. NUMBER 7249	PAGE 7/14

SUBJECT: LAKE VREELAND – HYDRAULICS

ORIGINATOR: R A PUTT
DATE: 6-19-78
VERIFIER: [signature]
DATE: 7/25/78

VOLUME – OUTFLOW RELATION

POOL ELEVATION (FT ABOVE MSL)	SURFACE AREA (ACRES)	STORAGE VOLUME (AC-FT)	TOTAL OUTFLOW (CFS)
635.0	4.42	0.0	0.0
636.0	5.19	4.8	65.
637.0	5.96	10.4	195.
638.0	6.72	16.7	359.
639.0	7.49	23.8	553.
640.0	8.26	31.7	1260.
641.0	9.03	40.4	2420.
642.0	9.80	49.8	3894.
643.0	10.56	59.9	5610.

FILING CODE

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
READING, PA.

DEPARTMENT NAME	DEPT. NO.	FILING CODE
COE	0674	
PROJECT NAME	W.O. NUMBER	PAGE
N.J DAM INSPECTIONS	7249	8/14

SUBJECT: LAKE VREELAND - HYDRAULICS

ORIGINATOR: RAPutt... DATE 7/25/78
VERIFIER: [signature] DATE 7/25/78

DAM OVERFLOW

FLOW OVERTOPPING DAM IS LIKE FLOW OVER 10-FT DEEP BROAD-CRESTED WEIR.
COEFFICIENT = CONSTANT = 2.64

LENGTH = 220 FT

HEAD ABOVE SPILLWAY (FT)	DAM OVERFLOW (CFS)
0.0	0
4.0	0
5.0	580
6.0	1640
7.0	3020
8.0	4650

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GAI 350 REV. 3-77

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CLIENT COE

PROJECT N.J. Dam Inspections

FILING CODE

W.O. 7249 PAGE 9 OF 14

SYSTEM Lake Vreeland

ORIGINATOR Wahanik

DATE July 24/78

CALCULATION FOR Spillway Design Flood Surcharge

REVIEWER David O. Veal

DATE 7-26-78

RESULTS

to obtain the SDF storage and areas the data of pages 8 and 13 were represented graphically and the required data read out. See graph page 10

the data used in the graph is:

Water level. ft	Reservoir Area Acres	Reservoir Capacity Acre-ft.
620		0
623		7.3
626		14.6
629		21.9
632		29.2
635	4.42	36.5
636	5.19	41.3
637	5.96	46.9
638	6.72	53.2
639	7.49	60.3
640	8.26	68.2
641	9.03	76.9
642	9.80	86.3
643	10.56	96.4

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GAI 350 REV. 10-72

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
READING, PA.

CLIENT COE

PROJECT N.J. Dam Inspections

SYSTEM Lake Vreeland

CALCULATION FOR Spillway Design Flood Surcharge

FILING CODE

W.O. 7249 PAGE 10 OF 14

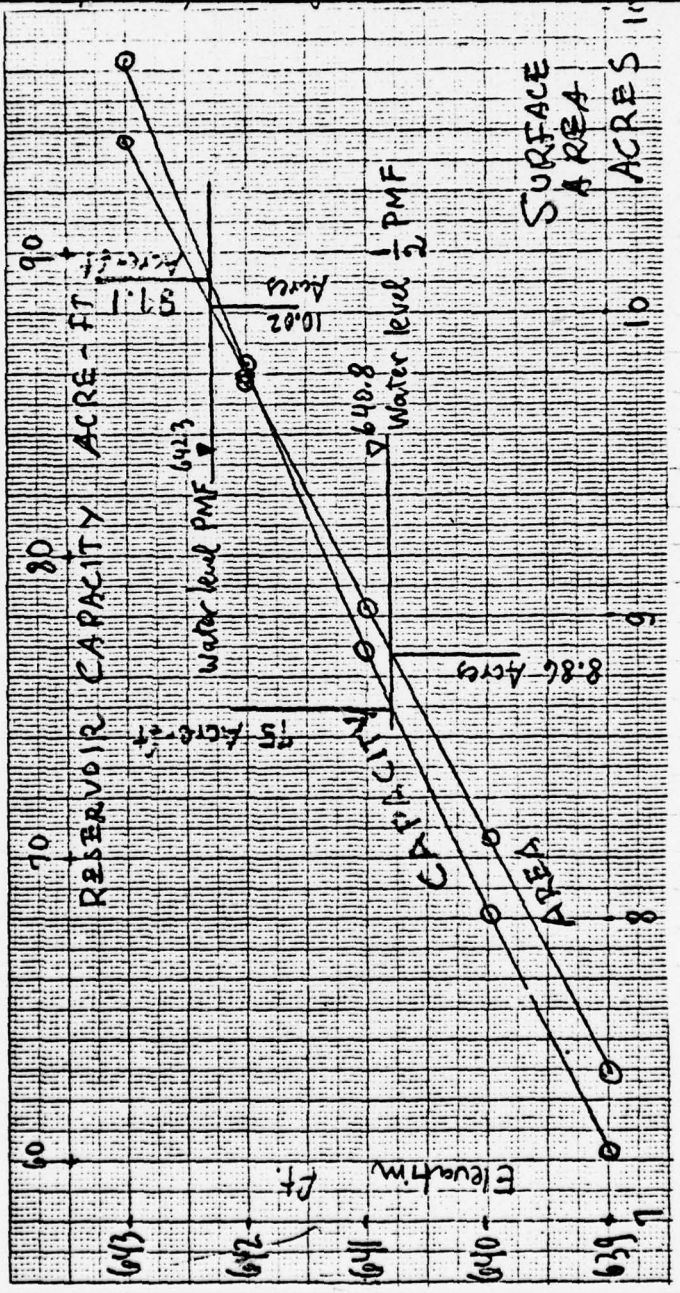
ORIGINATOR WAHANIK

DATE July 24/78

REVIEWER David O'Neil

DATE 7-26-78

RESULTS



FILING CODE

GAI 350 REV. 10-72

GILBERT ASSOCIATES, INC. ENGINEERS AND CONSULTANTS READING, PA.	CLIENT C.O.E.	FILING CODE
	PROJECT N.J. Dam Inspection	W.O. 7249 PAGE 11 OF 14
SYSTEM VREELAND DAM		ORIGINATOR WAHANIK
CALCULATION FOR 100 Year flood		DATE July 24/78
		REVIEWER David O. Veal
		DATE 7-26-78
		RESULTS

References used:

1- U.S. Weather Bureau
Rainfall - Frequency Atlas of the United States
Weather Bureau Technical Paper No. 40.

2- Soil conservation Service
Engineering Field Manual
Chapter 2 - Estimating Runoff
U.S.D.A. 1969

3- Soil conservation Service
Engineering Field Manual
Chapter 3 - Hydraulics
U.S.D.A. 1969

4- HEC-1, CoE

100 YEAR FLOOD

the SCS (Ref 2) will be used to calculate the 100 year flood because D.A is less than 2000 Acres

D.A. = 522 Acres

100 year / 24 hour rainfall = 7.2". (Ref 1)

CN = 65 (Ref 2)

Step slope ⇒ Type II Storm Distribution

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	PROJECT N.J. Dam Inspection	W.O. 7249 PAGE 12 OF 14
SYSTEM VREELAND DAM		ORIGINATOR Wehanik
CALCULATION FOR 100 Year Flood and drawdown		DATE July 24/78
		REVIEWER David O. Hall
		DATE 7.26.78

RESULTS

Ramsey Quad Sheet ⇒ Type B

Q_{100} = 650 cfs

RESERVOIR DRAWDOWN

There are no capacity curves for the reservoir in existance and the corresponding USGS Quadrangle does not provide enough information to calculate them. To calculate the time required to drawdown the water volume stored below the crest of the spillway (EL. 635.00), the dredging drawing supplied by Fells Contracting Co. of Verona, New Jersey will be used. The work was performed in 1976 and the drawing shown in appendix D indicates an average depth of 8.27 ft for the lake, and therefore the water stored in the lake below elevation 635 ft is 8.27 ft x 4.42 Acres equal to 36.55 Acre-ft.

The 36.55 Acre-ft are stored between elevation 635.00 and Elevation 620.00' and for purposes of the drawdown calculations it will be assumed that the Lake Volume varies proportionally to the depth in ft. (see table in page 13)

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PROJECT N.S. Dam Inspection

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W.O. 7249 PAGE 13 OF 14

SYSTEM VREELAND DAM

ORIGINATOR WAHANIK

DATE July 27/78

CALCULATION FOR Reservoir Drawdown times

REVIEWER Raul Veil

DATE 7.26.78

RESULTS

the 27 inch pipe used to lower the water level in Vreeland Lake is 73 ft long and based on the visual inspection Manning's $n = 0.018$ has been assigned to it.
Using the equations and values of reference 3 this pipe with a center line elevation of 617.00 at its point of discharge will be able to convey

$$Q_{cfs} = 15.084\sqrt{H_{ft}}$$

being H = water level − (617.00) in ft.

the reservoir volumes are shown below; the calculations of drawdown times are shown on page 14

water level	water depth	Reservoir Storage Ac-ft	Storage ft³	Differential Storage ft³
635	15	36.5	1592118	
				318423.6
632	12	29.2	1273694	
				318423.6
629	9	21.9	955271	
				318423.6
626	6	14.6	636847	
				318423.6
623	3	7.3	318424	
				318423.6
620	0	0	0	

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GAI 350 REV. 10-72

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PROJECT N.J. Dam Inspection

FILING CODE

W.O. 7249 PAGE 14 OF 14

SYSTEM VREELAND DAM

ORIGINATOR WAHANIK

DATE July 24/78

CALCULATION FOR Drawdown Times

REVIEWER David Veal

DATE 7-26-78

RESULTS

Storage water level ft	Center of gravity of layer of water	Available Head above Elevation 617.00 ft.	pipe outflow in cfs $15.08\sqrt{H}$	partial time in sec. required to empty 318423.6 ft³ of water of each layer	partial time in Hours	Cumulative total drawdown time in HOURS
635						0
	633.5	16.50	61.27	5197	1.44	1.44
632						
	630.5	13.50	55.42	5746	1.60	3.04
629						
	627.5	10.50	48.88	6514	1.81	4.85
626						
	624.5	7.50	41.31	7708	2.14	6.99
623						
	621.5	4.50	32.00	9951	2.76	9.75
620						

Note: a minimum inflow of 2 ft³/sec/sq.mi. will result in a total inflow of 163 cfs to the 0.815 sq. mi drainage Area. Consideration of this flow into the calculations will not change the drawdown Time in hours.

FILING CODE

GAI 350 REV. 10-72

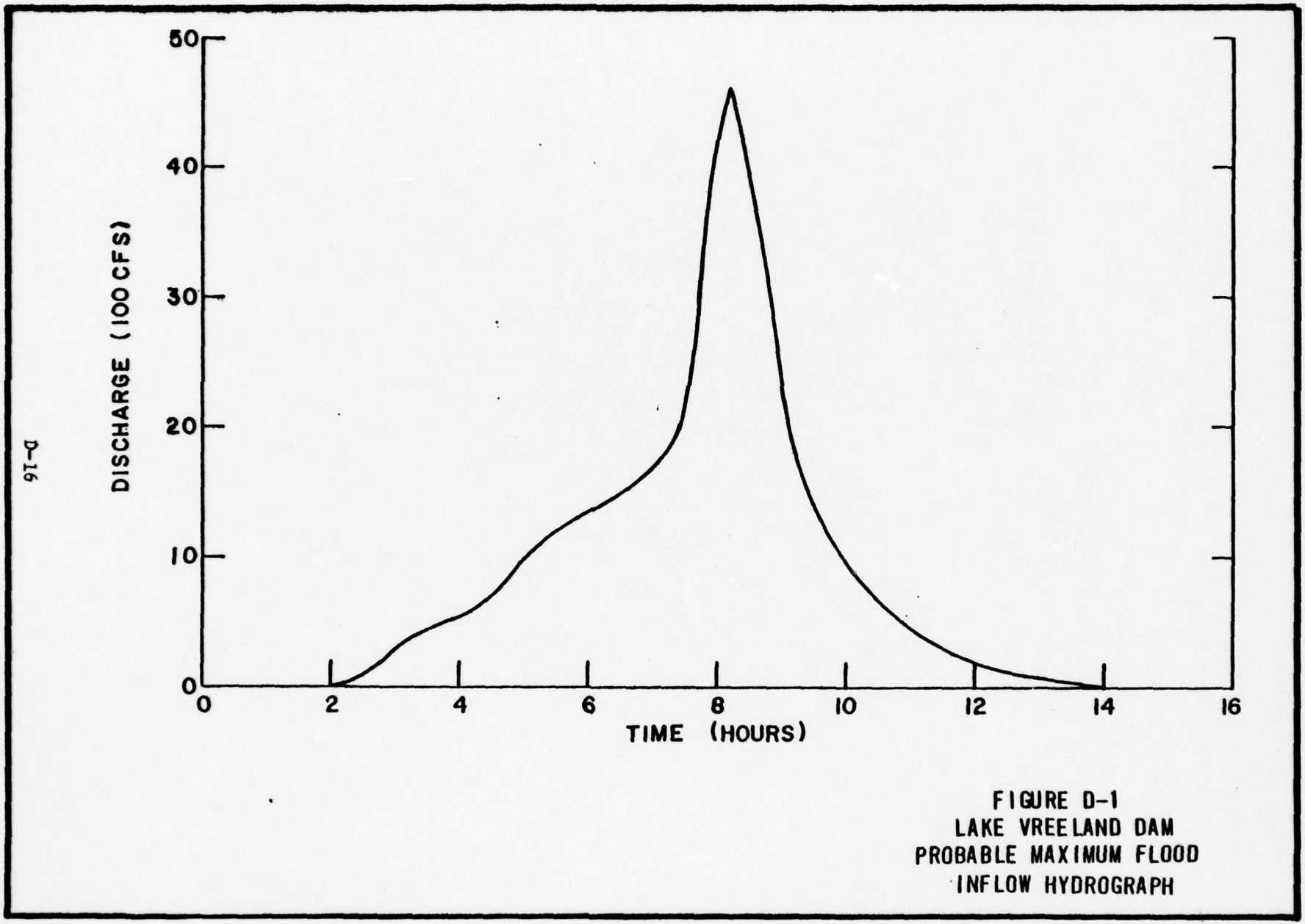


FIGURE D-1
LAKE VREELAND DAM
PROBABLE MAXIMUM FLOOD
INFLOW HYDROGRAPH

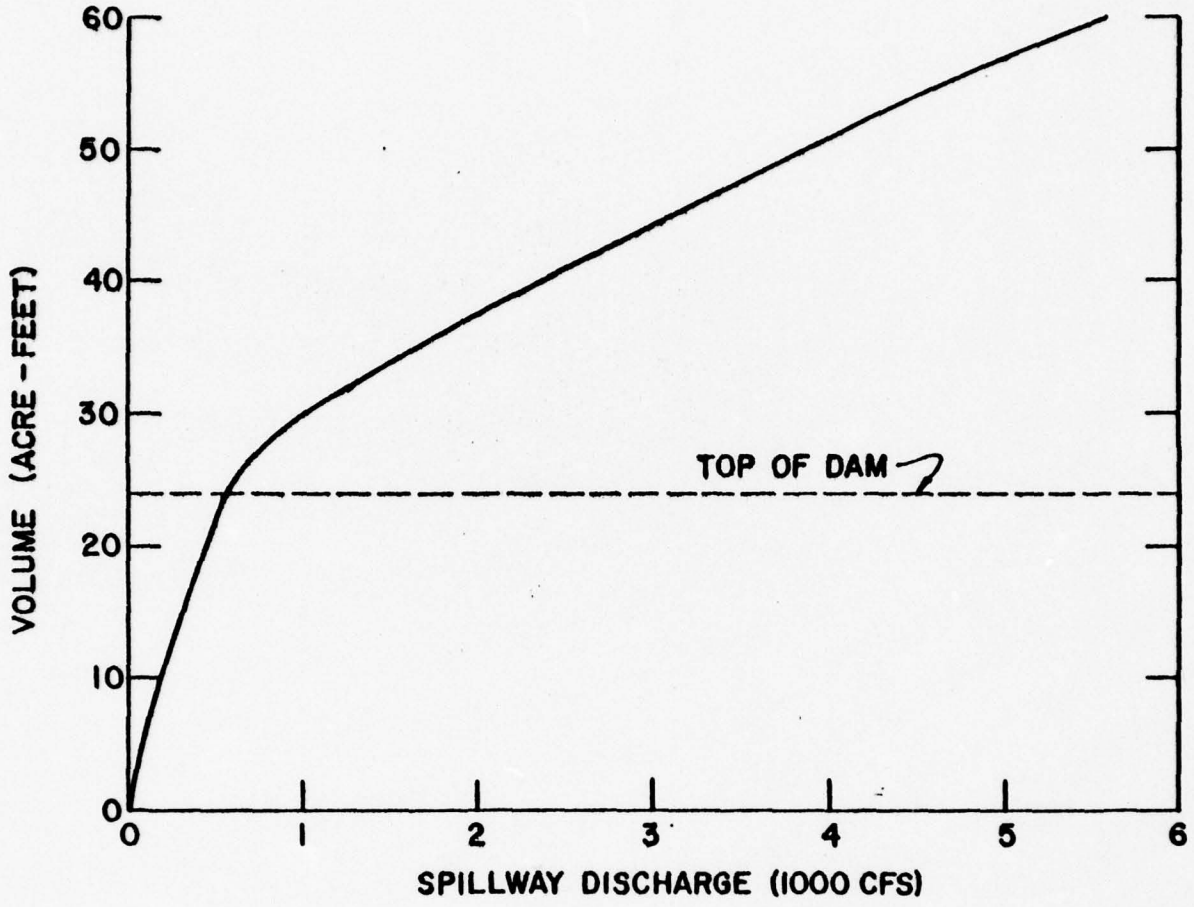


FIGURE D-2
LAKE VREELAND DAM
RESERVOIR VOLUME
SPILLWAY DISCHARGE RELATIONSHIP

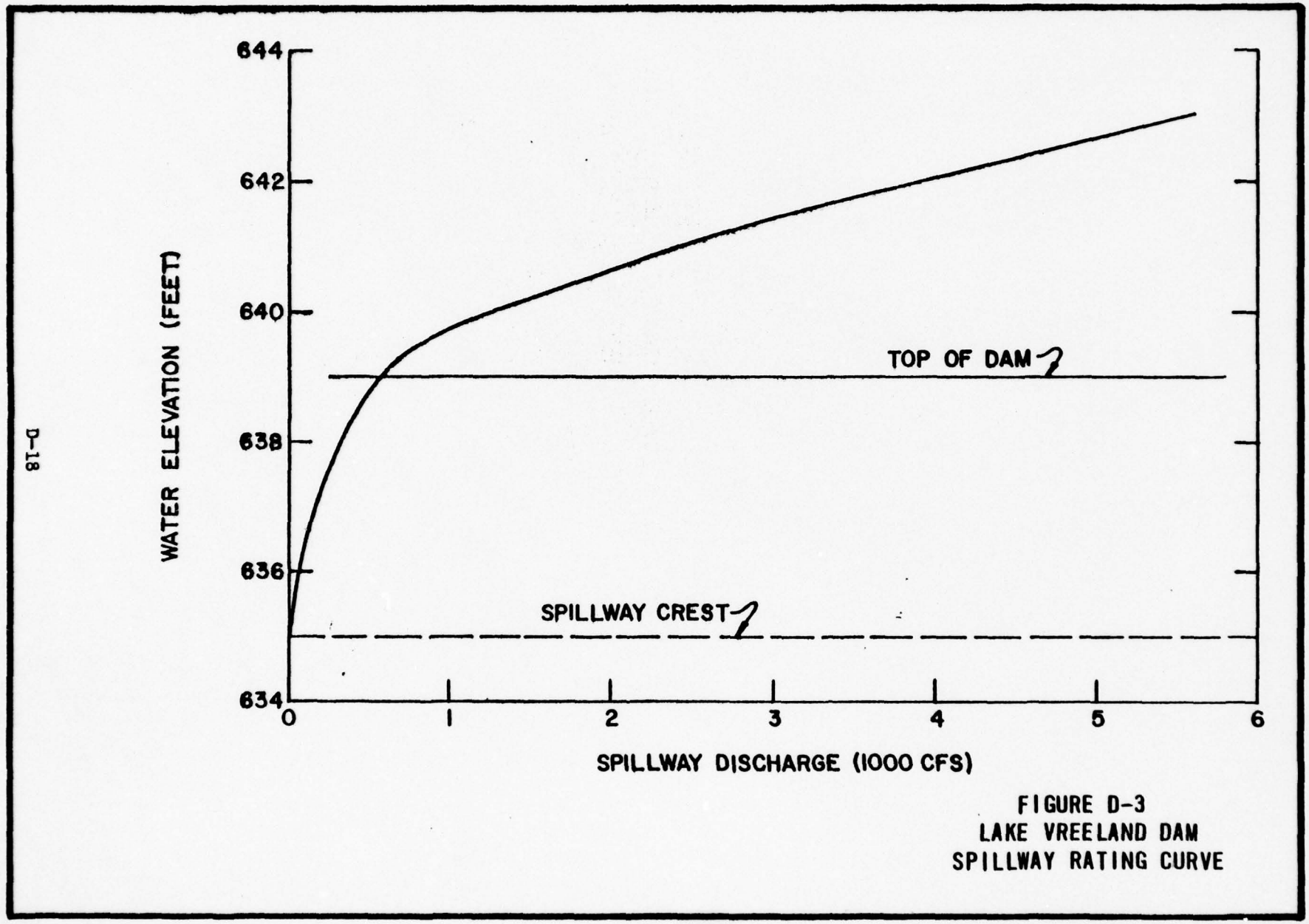


FIGURE D-3
LAKE VREELAND DAM
SPILLWAY RATING CURVE

APPENDIX E

PREVIOUS INSPECTION REPORTS

MEMORANDUM ON THE INSPECTION OF THE MONTCLAIR BOY SCOUT DAM NEAR OAKLAND, NEW JERSEY.

Dam 2-A

The writer made an inspection of the Montclair Boy Scout Dam on the afternoon of [redacted] for the purpose of inspecting the stage of completion of the structure, the elevation of the water surface and the leakage through the structure. He was accompanied by Mr. [illegible] Miller, Engineer and Mr. F. [illegible] Gray, Scout Commissioner, who were both desirous of having an examination made particularly in relation to the question of seepage through the dam.

The cut-off wall had been completed to full height, while the [illegible] fill had been completed up to an average height of [illegible] below the top of the cut-off wall. The down-stream fill was completed to approximately the same height as the up-stream fill. The spillway had not been completed but at the spillway site (north end) a low opening was left to provide for overflow and prevent any overtopping of the fill due to possible high rates of run-off. The structure will probably remain in this condition until more funds are available for its completion.

[illegible] conditions found during inspection were satisfactory. [illegible]

[illegible] seepage was [illegible] found [illegible] developed near the southeast [illegible] approximately [illegible] down-stream [illegible]

from the bottom of the dam, by taking a series of observations on the temperature of the water at various places, the results seemed to eliminate the possibility that the water issuing from the spring came from the lake from a point near the bottom. This conclusion is based upon the fact that the temperature of the water in the spring (60° F) was practically the same as the temperature of the water in the bottom of the lake taken at the up-stream end of the sluice pipe returning to the dam. This temperature registered 61° F and the depth of the water was about 15 ft. The temperature of the water taken from a well driven through the clay [illegible] the lake bottom and into an underlying [illegible] was [illegible] located near the cook house [illegible] that from the spring. However, the difference in temperature between the two points would seem to indicate that they do not come from the same source. Temperature of the water passing through the sluice pipe in the dam was 60° F. which agreed with the temperature of the water in the bottom of the lake and the water issuing from the spring. The temperature of the [illegible] at the surface was 69° F. The surface of the [illegible] water was [illegible] below the top of the cut-off wall

[illegible] June 19, the crest of the lake being [illegible]

[illegible] has been lowered by opening the valve at the head
of the release pipe in order to allow the undesirable water and silt
on the bottom to escape.

Four views were taken at the time of this inspection to
show the condition of the structure and the same will be found filed
with the application papers.

JK23

[illegible] BOY SCOUT [illegible] DAM

Application No. 17

[illegible] 23-31.6.3.[illegible]

[redacted] in company with Mr. H. [illegible] Critchlow inspection was made of this dam.

Flash boards about 15 inches high were found in place on the spillway. A small amount of leakage was observed coming out of downstream toe along the concrete culvert pipe which forms the blow-off. This leakage is not serious. General condition of the dam is good. Water [illegible] top of flash boards.

John R. Brooks

John R. Brooks
Hydraulic Engineer.

[illegible]
October [illegible] 192[illegible]

Report on Dam Inspection

L. Vreeland
Montclair Boy Scouts Assoc.
Branch of Ramapo River
Application No. 17

An inspection was made of the subject dam on May 10, 1956 in company with Judson G. Leonard, Scout Executive. The purpose of the inspection was to advise him as to necessary repairs, and to the feasibility of raising the dam by approximately 2.0 ft.

The dam as constructed conforms closely to the drawings approved in 1917 under Application 17. The embankment may have settled a few inches, although the top of the concrete core wall is not visible. According to Mr. Snyder, the ranger on continuous duty, the dam has been overtopped three times since it was constructed, the last time in August 1955. The only damage last summer was the dislodging of a few stones at the top of the stone embankment facing, and the washing away of a few inches of earth from the top. The writer advised Mr. Leonard to have the embankment brought up to grade, and preferably one foot higher than the existing top.

The spillway is 20.5 ft. long, is fitted with 1.0' of flashboards as shown on the approved drawing, and has 2.6 ft freeboard above the top of flashboards.

The writer advised against increasing the height of the dam, as the slight increase in pond area would not warrant the cost.

Norman C. Whitaker
Supervising Engineer

May 17, 1956

Mr. Judson G. Leonard
60 So. Fullerton Avenue
Montclair, New Jersey

Re: Dam Application No. 17

Dear Mr. Leonard:

This will confirm the verbal opinions given to you at our inspection of May 10th of the Lake Vreeland dam across a branch of the Ramapo River in Mahwah Township.

It is obvious from past experience that the spillway as constructed is not adequate to discharge large floods such as that of August 19, 1955 without over topping the earth embankment. The damage to the embankment during the last flood was not serious, and can be easily repaired, but it is recommended that the top of the embankment be raised at least one foot above the level as it existed before the flood, or not less than 5.0 ft. above the masonry portion of the spillway crest. While such raising may not entirely eliminate overtopping of the dam embankment, it will have the effect of reducing its frequency.

As to raising the normal water level by two or more feet, the writer's observation of the mountainous character of the basin in which the lake is located would indicate that the slight increase in lake area which would be gained would not justify the cost of doing this work. If it should be decided to raise the lake level, application and drawings should be submitted to this Division for approval before construction is started.

Enclosed for your information is a copy of our booklet entitled "Dam Booklet".

Very truly yours,

Norman C. Wittmer
Supervising Engineer

NCW/af
encl.

FELLS CONTRACTING CO.

EXCAVATING – GRADING – HAULING

P.O. BOX 35 • VERONA, NEW JERSEY • 239-0576

August 30 1976

Essex Co nt Council
Boy Scouts of America
60 South Fulerton Ave
Montclair New Jersey 07042

Re: Lake cleanout

Gentlemen;

We are pleased to submit the following quotation on removal of silt and other work on the lake as per your specifications.

1- Replace the present pipe that runs across the parking lot to the brook behind the shower house with new 30" reinforced concrete pipe with a 6" stone cushion around the pipe. The material that is removed for pipe placement will be dumped behind the maintenance yard area.

2- Open the main valve in the lake and drain the entire lake. Remove and repair or replace the valve that is now in the lake. The valve that is put back into the lake will have 4" I beam supports to the top of the lake and a cross piece of steel to support the bonnet so that it can be opened and closed effectively in the future.

3- Remove and dump the material that must come out of the lake in either or both of the pre-agreed dump areas which are the area around Mary Post Field and down the road by the old dump area. There will be a 50' approximately buffer zone between the road and the dump area. The dump area will be machine graded upon completion of job with a bull-dozer and leveldd as best as possible.

4- Clean out an area at the mouth of the lake on the south brook to act as a silt basin. Some of the rock that is removed from the area will be placed along the banks of the present road to form a rock wall.

5- Clean out the mouth of the north brook and build a silt basin area in the mouth of the brook.

6- Increase the size of the lake approimately 15' on the west end of the lake.

7- Any trees that are in the way in the dump area shall be cut down and left in the area to help control the movement of the material removed from the lake.

8- The general specifications of the depth shall be followed as much as possible however there will be no removal of solid rock if any is found.

FELLS CONTRACTING CO.

EXCAVATING – GRADING – HAULING

P.O. BOX 35 • VERONA, NEW JERSEY • 239-0576

The price that we are submitting is based on the removal of 25,000 yards of material. This will be determined by the number of truck loads of material that are hauled out of the lake area. It is to be agreed between both parties as to the size of the trucks and the count of the trucks shall determine the yardage removed.

The charge per yard for any material over the 25,000 yards shall be at the rate of $1.25 per yard and the yardage shall be determined in the same fashion as the original 25 000 yards. If there is less that 25,000 yards removed the price as submitted for the total job shall remain.

Terms of Payment: TOTAL PRICE $54,950.00

$20 000.00 at award of contract
$20,000.00 at the start of the trucks moving the material out.
$ Final payment upon completion of all soil removal.
It is agreed that $5,000.00 shall be held back from the final payment if the valve is not in place at the time of completion of soil removal. It is possible that the valve will not be ready when the excavating and removal work is completed and that it will have to be put in after all other work is completed.

General Information:

It is our opinion that the material which is to be removed will be able to be worked with approimately 3weeks afterthe draining of the lake is completed. However. If the material is too wet to work with the job will be held until the winter time when the material will be harder or dried. It is our hope that we will not have to wait until winter time to move this material but if it is necessary we want you to know that the lake may not be filled during the winter tire.

It is understood that no camp equipment or materials are to be used on this job. We would appreciate it if the Headquarters Lodge can' be used by us during this operation.

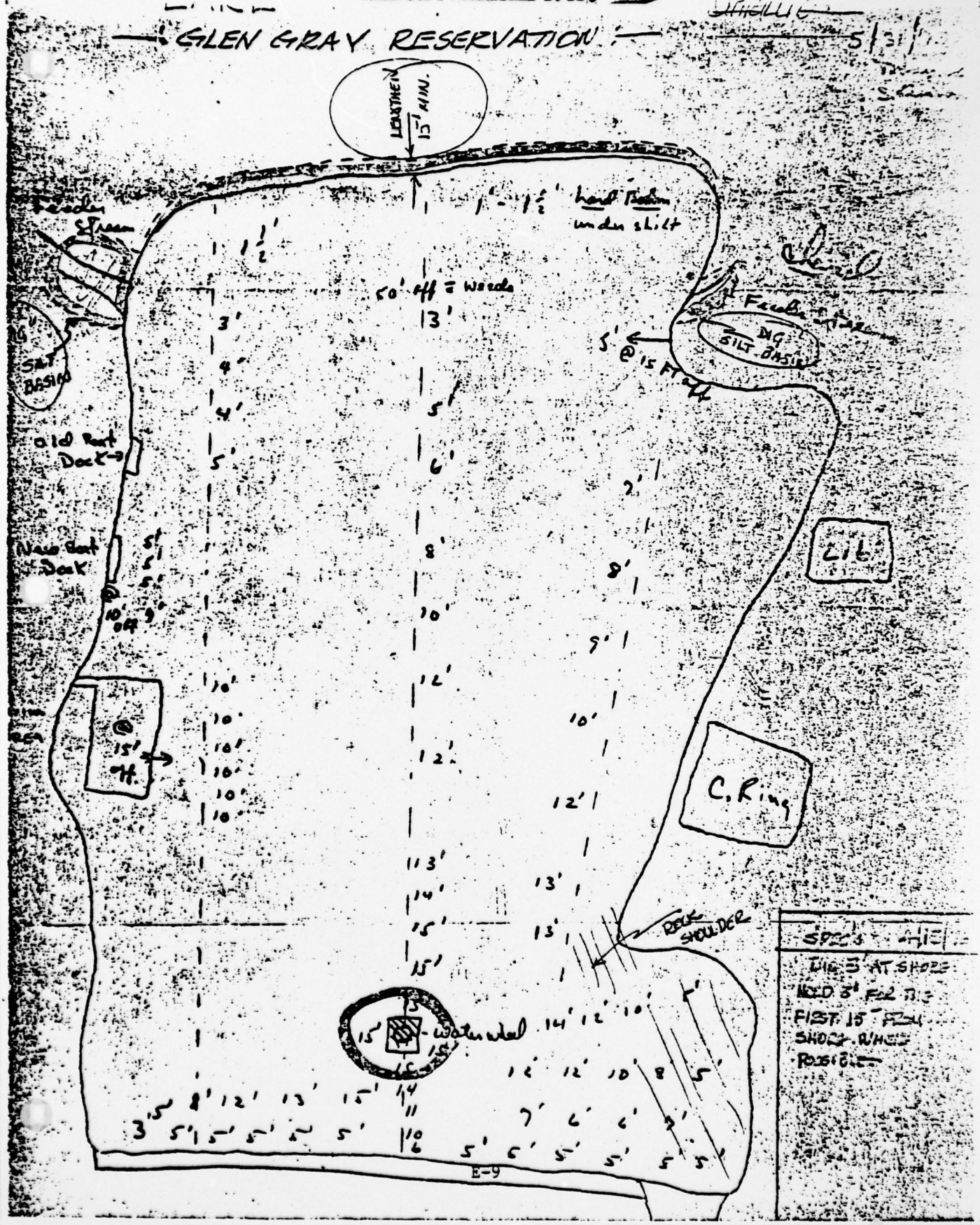
It is also understood that any payments on this job shall be received by our Company within 10 days of submitting of the bill.As you can imagine the cost of machinery to do a job such as this is extremely high and these bills must be paid immediately upon completion of their work.

Thank you in advance for your prompt consideration of the above proposal and if you have any questions please feel free to contact our company at anytime and we will be happy to meet with you and discuss this job.

Very truly yours.

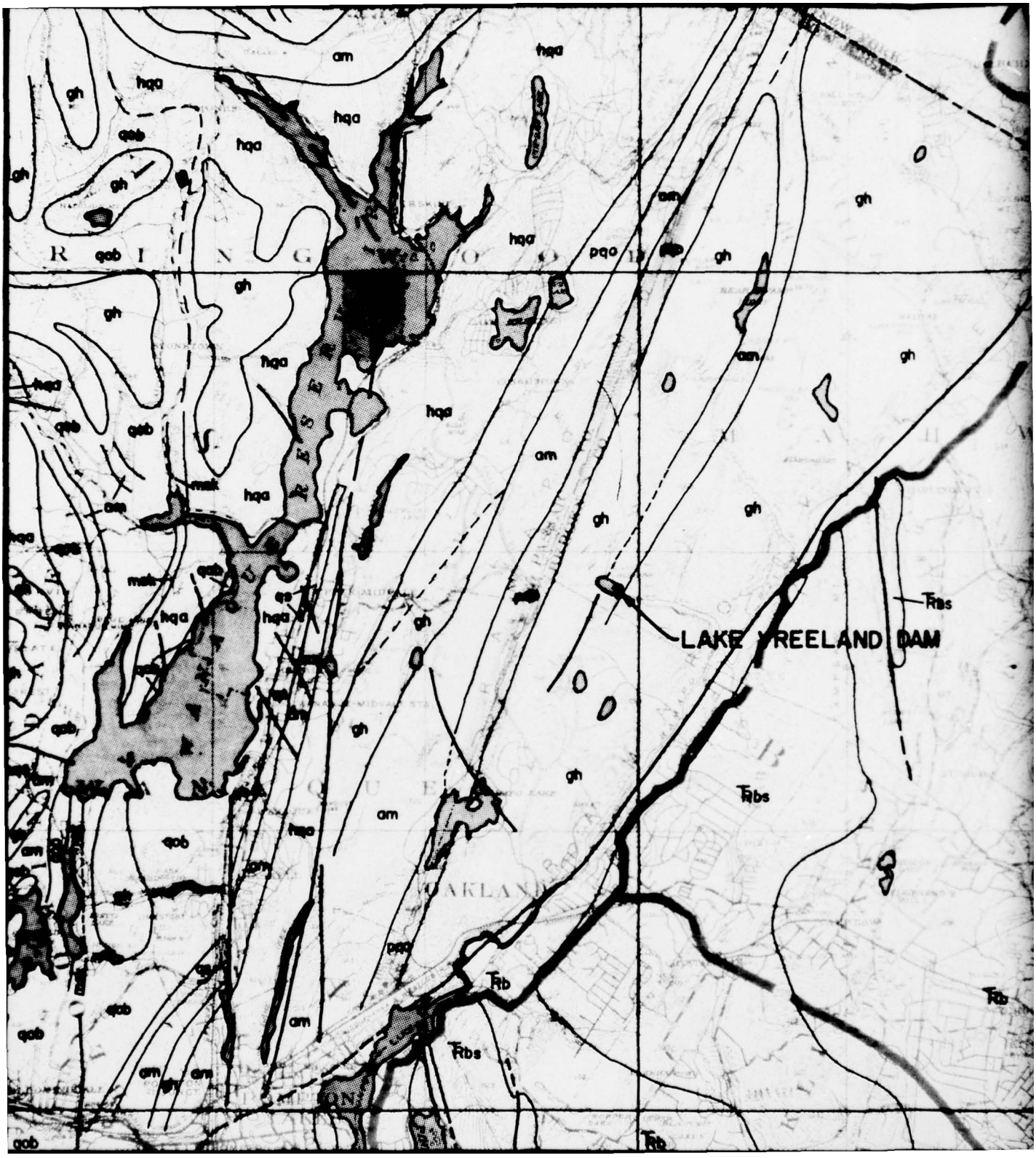
Stephen A. Fenton

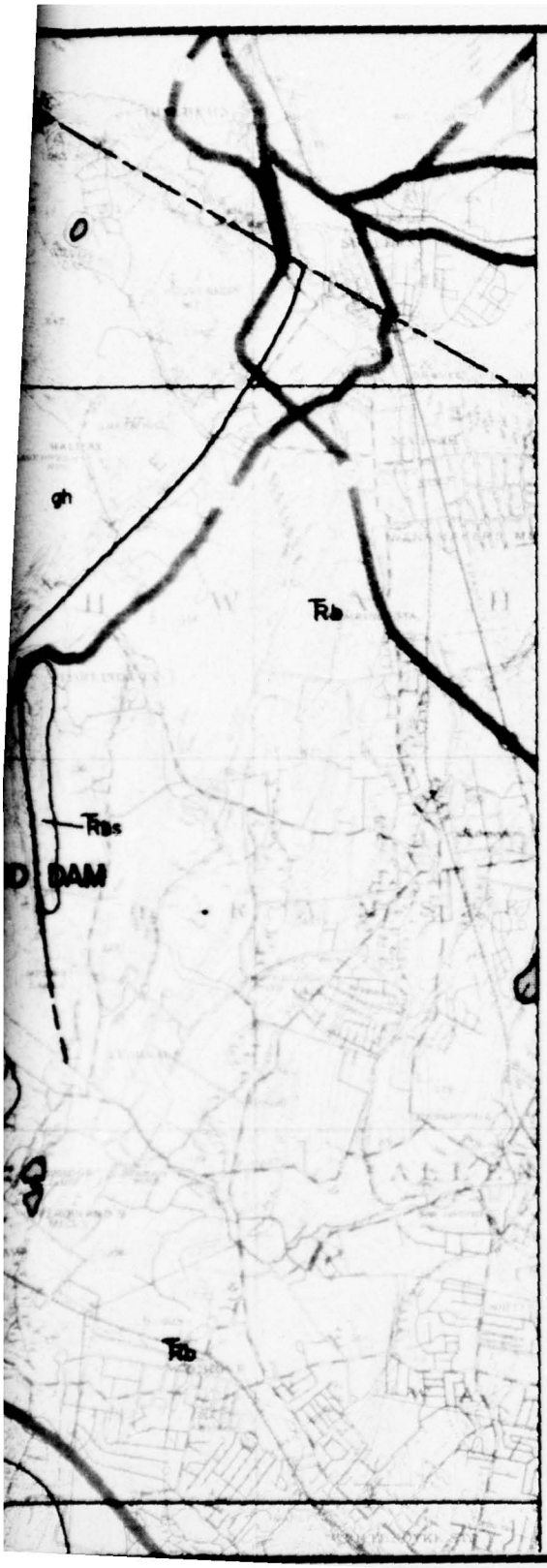
Stephen A. Fenton
President



APPENDIX F

REGIONAL GEOLOGIC MAP


LAKE WREELAND DAM
Trbs
Trb
qab
hqa
am
gh
pqo



LEGEND

TRIASSIC

Trb	BRUNSWICK FORMATION
Trbs	BASALT FLOWS

PRECAMBRIAN

gh	MOSTLY HORNBLENDE GRANITE AND GRANITE GNEISS
am	AMPHIBOLITE
pqo	PYROXENE GNEISS; MAINLY QUARTZ-OLIGOCLASE - CLINOPYROXENE GNEISS
hqa	PYROXENE GNEISS; MAINLY QUARTZ-ANDESINE GNEISS WITH BOTH ORTHO-AND CLINOPYROXENE
qo	QUARTZ-OLIGOCLASE-GNEISS
qob	QUARTZ-OLIGOCLASE-BIOTITE GNEISS
qs	SILLIMANITE GNEISS
msk	MARBLE AND SKARN

——— CONTACT LINE

——— FAULT LINE

NOTES:

1. THE PRECAMBRIAN MAP UNITS REPRESENT GENERALIZED GROUPINGS OF ROCK TYPES BASED MAINLY ON MINERAL COMPOSITION. THERE IS MUCH LOCAL VARIATION IN THE MINERAL COMPOSITION.
2. THE CONTACT LINES AND FAULT LINE SHOWN ON THE DRAWING ARE DASHED WHERE INFERRED.

SOURCE:

NEW JERSEY GEOLOGICAL SURVEY TOPOGRAPHIC SERIES AND GEOLOGIC OVERLAY SHEETS 23.

1 0 1 2

SCALE IN MILES

APPENDIX F
REGIONAL GEOLOGIC MAP
SHOWING DAM LOCATION

APPENDIX G

REFERENCES

REFERENCES:

1. HEC-1 "Flood Hydrograph Package" January 1973, the Hydrologic Engineering Center.

2. Recommended Guidelines for Safety Inspection of Dam, Appendix D.

3. USGS Quadrangle sheets for Ramsey, N. J. and N. Y.

4. Engineering Field Manual, Soil Conservation Service, U.S.D.A., 1969.

5. Additional Hydrology and Hydraulics Guidance for Distribution to Contractor Involved in the Dam Safety Program. U.S. Corps of Engineers Disposition Form dated July 10, 1978.

APPENDIX H

CONDITIONS

APPENDIX H

CONDITIONS

This report is based on a visual inspection of the dam, a review of available engineering data, and a hydrologic analysis performed during Phase I investigation as set forth in the Recommended Guidelines for Safety Inspection of Dams, as modified by the contract between the U.S. Corps of Engineers and Gilbert Associates, Inc., Contract No. DACW61-78-C-0114.

The foregoing review, inspection, and analysis are by their nature limited in scope. It is possible that hazardous conditions exist and that conditions exist which with time might develop into safety hazards and that these conditions are not detectable by means of the aforesaid review, inspection, and analysis. Accordingly Gilbert Associates, Inc. cannot and does not warrant or represent that conditions which are hazardous do not exist, or that conditions do not exist which with time might develop into safety hazards.

As required by the Corps of Engineers, the terms "good", "fair", "poor", "condition" have been used in this report to characterize the information obtained from the aforesaid review, inspection, and analysis. The definitions of these terms as used are:

"good condition" - minor studies or remedial measures are required.

"fair condition" - sizeable studies or remedial measures are required due to deficiencies which could be hazardous depending on conditions. Immediate attention is required.

"poor condition" - major studies or remedial measures are required due to deficiencies which could be hazardous depending on conditions. Immediate studies or corrective action is required.