AD-A058 878 HARRIS ECI ASSOCIATES WOODBRIDGE NJ F/G 13/2
NATIONAL DAM SAFETY PROGRAM. LAKE LEFFERTS DAM (NJ00089). RARIT--ETC(U)
JUL 78 R GERSHOWITZ DACW61-78-C-0100
UNCLASSIFIED NL

1 OF 2
ADA
058878

RARITAN RIVER BASIN

MATAWAN CREEK, MONMOUTH COUNTY

NEW JERSEY

LAKE LEFFERTS DAM

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NJ 00089

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

JULY 1978

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NJ00089
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle): Phase I Inspection Report
National Dam Safety Program
Lake Lefferts Dam
Monmouth County, N.J.

5. TYPE OF REPORT & PERIOD COVERED: (9) FINAL report
6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s): Robert Gekshowitz, P.E.

8. CONTRACT OR GRANT NUMBER(s): (15) DACW61-78-C-0100

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Harris-ECI Associates
453 Amboy Ave.
Woodbridge, N.J. 07095

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
U.S. Army Engineer District, Philadelphia
Custom House, 2d & Chestnut Streets
Philadelphia, Pennsylvania 19106

12. REPORT DATE: (11) July, 1978
13. NUMBER OF PAGES: 100

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): (10) Robert Gershowitz

15. SECURITY CLASS. (of this report): Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

(12) 111 p.

DDC
SEP 19 1978
E

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

(6) National Dam Safety Program. Lake Lefferts Dam (NJ00089). Raritan River Basin, Matawan Creek, Monmouth County, New Jersey. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

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

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Dams--New Jersey
National Dam Safety Program Phase I
Dam Safety
Dam Inspection, Lake Lefferts 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.

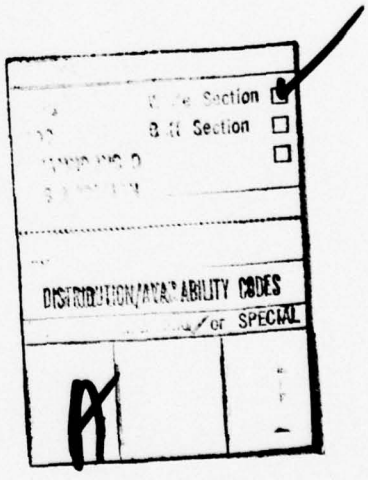
DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

410 824

NOTICE

THIS DOCUMENT HAS BEEN REPRODUCED FROM THE BEST COPY FURNISHED US BY THE SPONSORING AGENCY. ALTHOUGH IT IS RECOGNIZED THAT CERTAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RELEASED IN THE INTEREST OF MAKING AVAILABLE AS MUCH INFORMATION AS POSSIBLE.



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

IN REPLY REFER TO
NAPEN-D

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

31 AUG 1978

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Lake Lefferts Dam in Monmouth 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 Lefferts Dam is judged to be in fair overall condition. However, the dam's spillway is considered seriously inadequate since 4 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. The spillway's adequacy should be determined by the owner, employing a qualified, professional consultant, using more sophisticated methods and procedures within six months from the date of approval of this report. Also, a study to investigate augmenting the spillway capacity should be immediately undertaken and completed within nine months from the date of approval of this report. Any remedial measures necessitated as a result of these studies should be initiated in calendar year 1979. 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. Engineering and subsurface investigations and studies to determine the structural stability of the deflected left downstream embankment retaining wall and the lateral stability of the spillway and bridge section should be completed within nine months from the date of approval of the report. Any remedial action necessitated as a result of these investigations and studies should be initiated in calendar year 1979.

c. The downstream area at the left embankment should be regraded for proper drainage away from the foot of the retaining wall within 6 months from the date of approval of this report.

d. The inoperable 24-inch diameter low level outlet should be restored to full operational use within three months from the date of approval of this report.

e. The dam's hazard potential category should be changed from "high" to "significant."

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 J. Howard of the Third 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.

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,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

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

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

Based on visual inspection, available records, calculations and past operational performance, Lake Lefferts Dam is judged to be in fair overall condition. However, the dam's spillway is considered seriously inadequate since 4 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. The spillway's adequacy should be determined by the owner, employing a qualified, professional consultant, using more sophisticated methods and procedures within six months from the date of approval of this report. Also, a study to investigate augmenting the spillway capacity should be immediately undertaken and completed within nine months from the date of approval of this report. Any remedial measures necessitated as a result of these studies should be initiated in calendar year 1979. 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. Engineering and subsurface investigations and studies to determine the structural stability of the deflected left downstream embankment retaining wall and the lateral stability of the spillway and bridge section should be completed within nine months from the date of approval of the report. Any remedial action necessitated as a result of these investigations and studies should be initiated in calendar year 1979.

c. The downstream area at the left embankment should be regraded for proper drainage away from the foot of the retaining wall within 6 months from the date of approval of this report.

d. The inoperable 24-inch diameter low level outlet should be restored to full operational use within three months from the date of approval of this report.

e. The dam's hazard potential category should be changed from "high" to "significant."

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 21 Aug 78

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Lake Lefferts Dam, I.D. NJ 00089
State Located:	New Jersey
County Located:	Monmouth
Stream:	Matawan Creek
Date of Inspection:	May 8 and 10, 1978

Assessment of General Condition of Dam with Respect to Safety and Recommended Action with Degree of Urgency

Lake Lefferts Dam has a seriously inadequate spillway capacity, which can pass 3.3 percent (estimated) of the Probable Maximum Flood (PMF). This determination was made according to Corps of Engineers screening method procedures and should be checked by the owner using more accurate methods and procedures. Overtopping of the dam could lead to embankment failure, even though the present dam has withstood many overtoppings in the past 23 years without serious damage. A study to investigate the alternatives for augmenting the spillway capacity and formulate a plan of action should be completed within 9 months.

- The embankment's left downstream retaining wall has deflected, indicating conditions in variance with design assumptions. Engineering data is needed to assess the stability of this embankment section, and needed data should be acquired within 6 months, and a stability assessment should be completed within 9 months.

- The lateral stability of the spillway and bridge section is questionable and needed engineering data should be acquired within 6 months and a stability assessment completed in 9 months.

- The inoperable 24-inch diameter low level outlet should be restored to full operational use within 3 months.

- The poorly draining area downstream of the left embankment should be regraded within 6 months.

- A communication channel should be established between the owner and Matawan Borough Police to formulate a plan to bar access to Aberdeen Road and Ravine Drive at times of impending dam overtoppings.

- The hazard potential category should be changed from "High" to "Significant".

Robert Gershowitz, P.E.

Robert Gershowitz, P.E.

May 1978

L A K E L E F F E R T S D A M

CONCRETE SPILLWAY AND LEFT UPSTREAM SECTION
OF RAVINE DRIVE ROADWAY EMBANKMENT

TABLE OF CONTENTS

ASSESSMENT OF GENERAL CONDITION OF DAM WITH RESPECT TO SAFETY AND RECOMMENDED ACTION WITH DEGREE OF URGENCY

TABLE OF CONTENTS
(Continued)

PLATES

APPENDICES

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

LAKE LEFFERTS DAM, N.J. ID 00089

SECTION 1

1. PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August 1972 authorizes the Secretary of the Army, through the Corps of Engineers to initiate a program of safety. Inspections for Lake Lefferts Dam were carried out under Contract DACW61-78-C-0100 to the Department of the Army, Philadelphia District, Corps of Engineers by the engineering firm of Harris-ECI Associates of Woodbridge, New Jersey.

b. Purpose of Inspection

The purpose of the inspection and evaluation is to identify conditions which threaten the public safety and thus permit the correction of the conditions in a timely manner by the owners. The National Inventory of Dams will be updated by the data acquired during the inspection.

1.2 Description of Project

a. General Description of Dam and Appurtenances

Lake Lefferts Dam consists of a combined semi-circular concrete spillway structure abutting on a concrete bridge which spans across the channel of Matawan Creek. The spillway and bridge structure is adjoined by an earth roadway embankment on both sides. The thrust of the semi-circular

weir section is taken by the massive concrete abutment sections of the bridge. Both the spillway and the bridge abutments are founded on timber piles. The head water cutoff was originally achieved by 4-inch thick timber sheet piles driven under the upstream face of the semi-circular weir wall and continued under the bridge abutment wingwalls and the upstream face of the adjoining embankments. The cutoff under the spillway was improved in 1930 as described in Section 2.2. The bridge deck is composed of concrete encased steel beams.

Mounted on the upstream face of the semi-circular spillway section are the low level outlet pipes; one 30 inches in diameter, the other 24 inches. These low level outlets are operated by gate operating stands resting on the spillway crest with extension cranks accessible for operation from the upstream sidewalk of the bridge. The dam crest is paved as a roadway, accommodating two black topped lanes with a sidewalk on the upstream side and a shoulder on the downstream side. The road is named Ravine Drive.

The embankment is retained on the upstream side by a creosoted timber bulkhead wall and on the downstream left abutment side by a timber pile supported, timber sheeted retaining wall. The downstream right abutment embankment has a conventional sloping face for most of its short length, but the transition to the concrete wingwall of the spillway bridge is made by a short, timber pile supported, timber sheeted retaining wall.

The downstream channel of Matawan Creek is tidal and meanders within low banks in a wide downstream tidal plain. The immediate channel banks downstream of the bridge are armored with grouted riprap for a distance of approximately 90 feet and the channel floor is similarly protected for approximately 40 feet.

Lake Lefferts is relatively shallow and extends for 7,300 feet upstream of the dam axis. The reservoir rim is moderately steep and covered by vegetation.

b. Location

Lake Lefferts Dam is located on Matawan Creek at the Borough of Matawan, Monmouth County. The nearest downstream community is Matawan itself. Matawan Creek forms a small independent basin discharging directly into the Raritan Bay part of the Atlantic Ocean.

c. Size Classification

Lake Lefferts Dam is classified as being "Intermediate" on the basis of its reservoir storage volume, which is more than 1,000-acre feet, but less than 50,000-acre feet. It is classified as "Small" on the basis of its total height, which is less than 40 feet. The overall size classification is the larger of these two determinations, and accordingly the dam is classified as "Intermediate" in size.

d. Hazard Classification

In the National Inventory of Dams, Lake Lefferts Dam has been classified as having "High Hazard Potential"on the basis that failure of the dam would cause excessive property damage to residences downstream, and could potentially cause more than a few deaths. Visual inspection of the downstream tidal flat shows that breach of the dam would cause little damage to residences which are located on high ground but could be hazardous to people utilizing the low lying Aberdeen Road. Accordingly, it is proposed to change the Hazard Classification Potential to "Significant".

e. Ownership

According to Monmouth County officials, Lake Lefferts Dam was built by Jacob Lefferts and title should be in the hands of his successors. An inspection report in the New Jersey Department of Environmental Protection files, dated September 27, 1955, states: "The County also owns and is responsible for the spillway structure, which fact was confirmed by a later conference in Freehold with Mr. Preston, County Road Supervisor". At present, the County operates the low level outlet gates. Accordingly, ownership of the dam is attributed to Monmouth County.

f. Purpose of Dam

The purpose of the dam is to impound water for recreational purposes. The normal uses are small boating, fishing and swimming.

g. Design and Construction Spillway

The spillway and bridge structure and embankment were originally designed in 1927 by the Monmouth County Engineer, according to drawings supplied by the County and built in the same year by Robert S. Findley. The work was completed in 1928. Plans exist for raising the spillway crest and roadway by two feet but apparently this scheme was never carried out. Later, the spillway crest was repeatedly modified to gain extra spillway discharge capacity at the freeboard available. It is currently approximately 0.6 of a foot below its originally constructed level.

The Borough of Matawan took over the operating control of the dam in 1929, but control of the operation has currently reverted to Monmouth County. The dam has a record of being overtopped several times and was partially washed out in 1944 and 1955. According to data in the New Jersey Department of Environmental Protection (NJ-DEP) files, the current bulkheaded and retained embankment fill dates from a reconstruction after the 1955 washout.

In 1970, the riprapped downstream channel section was added to protect the spillway and bridge section from being undermined.

h. Normal Procedures

The dam is very carefully controlled by the Monmouth County operators, since it has a very low spillway capacity at the available freeboard. The low level outlets are frequently opened in anticipation of and during periods of rainfall. According to the County Engineers, overtoppings can usually be avoided by timely openings of the low level outlets.

1.3 Pertinent Data

a. Drainage Areas

At dam site, the drainage area is 6.1 square miles.

b. Discharge at Dam Site

Maximum known flood at damsite:	Estimated at 1,420 cfs on August 19, 1955. No firm records available after 1955.
Warm water outlet at pool elevation:	None
Diversion tunnel low pool outlet at pool elevation:	NA
Diversion tunnel outlet at pool elevation:	NA
Gated spillway capacity at pool elevation:	208
Gated spillway capacity at maximum pool elevation:	NA
Ungated spillway capacity at maximum pool elevation:	355 cfs
Total spillway capacity at maximum pool elevation:	619 cfs

c. Elevation (ft. above MSL)

Top dam:	Approx. Elev. 16.4 at the low point
Maximum pool-design surcharge:	Elev. 16.4
Full flood control pool:	NA
Normal pool:	Elev. 14.4
Spillway crest (gated):	NA
Upstream portal invert diversion tunnel:	NA
Downstream portal invert diversion tunnel:	NA
Streambed at centerline of dam:	Elev. 0.4 estimated
Maximum tailwater:	Tidal; Mean High Water Elev. 3.04. Tailwater at high stream discharge could be controlled by culvert under N.Y. and Long Branch R.R. embankment downstream of dam.

d. Reservoir

Length of maximum pool:	7300 feet
Length of normal pool:	6200 feet
Length of flood control pool:	NA

e. Storage (acre-feet)

Normal pool:	1,450 AF
Flood control pool:	NA
Design surcharge:	1,800 AF
Top of dam:	1,800 AF

f. Reservoir Surface (acres)

Top dam:	97 Acres
Maximum pool:	97 Acres
Flood-control pool:	NA
Recreation pool:	75 Acres
Spillway crest:	75 Acres

g. Dam

Type:	Earth embankment, timber bulkheaded & retained with central semi-circular concrete spillway.
Length:	Approx. 430 feet
Height:	16 feet
Top width:	Varies, approx. 44 feet is typical
Side slopes:	Vertical, timber sheeted and retained for most of length. Right abutment has a short length with a downstream slope of approximately 2H on 1V.
Zoning:	
Impervious core:	Unknown
Cutoff:	Timber sheeting
Grout curtain:	None

h. Diversion and Regulating Tunnel

Type:	NA
Length:	NA
Closure:	NA
Access:	NA
Regulating facilities:	NA

i. Spillway

Type:	Semi-circular concrete arch
Length of weir:	38 feet
Crest elevation:	14.4 MSL
Gates:	None
U/S channel:	None
D/S channel:	Bridge opening 24-foot wide with vertical abutments, followed by riprapped channel section 80-foot long.

j. Regulating Outlets

Type:	One 30-inch diameter and one 24-inch diameter through concrete spillway arch.
Length:	Short tube
Closure:	Gate valve mounted on upstream side
Access:	None, valves are underwater. Stems extend up to sidewalk

SECTION 2

2. ENGINEERING DATA

2.1 Design

Drawings available from Monmouth County and the files of the New Jersey Department of Environmental Protection (NJ-DEP) do not adequately define the dam as it stands today. The various drawings date back to the original construction and are clarified and annotated as follows: (see Plates, Appendix B)

- Drawings 2 and 3

The drawings show details of the semi-circular spillway and spillway bridge structure. The County Datum used is 10 feet below the NGVD datum based on Mean Sea Level. These drawings show a single 24-inch diameter outlet, but a second 30-inch diameter outlet has been added since, on the right side of spillway semi-circle. The original crest has been repeatedly altered.

- Drawing 4

This drawing shows a proposed raising of the spillway crest and roadway by 2 feet. The County believes this work was done, but if it was, the current grades of the roadway and crest do not reflect this alteration. The County elevation datum was used in this drawing.

- Drawing 5

This drawing shows the road retaining wall as rebuilt after the 1944 washout but before the 1955 reconstruction after hurricane Diane. The retaining wall system on the downstream face on the left abutment is different in details from what is currently observable in the site. The right downstream retaining wall corresponds to the current condition.

No plans for the reconstructed timber retaining wall on the left downstream face or the timber bulkhead on the upstream side have been uncovered.

- Drawings 6 and 7

These drawings are topographic surveys taken in 1968 and 1970 in connection with the proposed construction of the riprapped reach of downstream stream channel completed in 1971. The embankment grades and spillway crest elevation are keyed to the NGVD (MSL) datum.

Extensive data in the NJ-DEP files relates to the inadequacy of the dam's spillway to pass flood discharges of intermediate frequency. One of the continuing problems mentioned is that the roadway fill has settled significantly in the past thus reducing the available freeboard and concurrently reducing the quantity of water the spillway can pass without overtopping the road. The bulkhead sheeting on the upstream face and the downstream timber retaining wall were apparently attempts to control roadway settlements, and to contain the roadway in order to cope with the overtopping problem. As mentioned before, the spillway crest has been repeatedly modified and currently it is approximately 0.6 of a foot below its original level.

No design computations have been uncovered concerning the stability of the spillway structure, the roadway embankment or the structural design of the downstream embankment timber retaining wall.

A check list for engineering data is included in Appendix A.

2.2 Construction

The available data on construction uncovered for this report came from data in the NJ-DEP files and relates to the original construction and some early leakage problems.

At the time of construction of the spillway and bridge structure, the material at the footing level was fine sand overlain by 2 feet of black swamp muck. The fine sand layer extended down to a depth of 13 feet, under which a 14-foot layer of hard clay was found. Coarse sand of undetermined thickness underlays the clay. To support the spillway and bridge structure, timber bearing piles, 50-foot long were driven to refusal using a No. 9 Terry Steam hammer. Penetration was between 46 and 48 feet below footing elevation. A double row of 4-inch T&G timber sheet piling, 12 to 16-foot long, was driven around the spillway perimeter and the adjacent bridge abutment. A single row of 4-inch T&G timber sheet piling was continued on the upstream face of the right embankment for 70 feet beyond the bridge and on the left upstream face for 340 feet beyond the bridge. The single row sheeting at the embankment had a length of 14 feet. In 1930, a leak developed causing a boil downstream of the bridge. A single row of steel sheet piling was driven around the perimeter of spillway and 12 inches upstream of it, continuing for 3 feet along each bridge abutment. The space between the new sheet piling and the existing concrete was filled with concrete. In 1931, a similar series of boils developed and was stopped by placement of 5 to 6 truck loads of clay in the area of the left upstream bridge abutment wingwall and extended 15 to 20 feet to the left of the wingwall. The leakage was thought to be caused by displacement of the embankment sheet piling by settlement of the embankment fill.

2.3 Operation

No data pertaining to the past operation of the dam were uncovered. The dam is currently operated by Monmouth County and the lake level is closely controlled by opening of the 30-inch diameter low level outlet in anticipation of and during rainstorms with any significant accumulations of precipitation, in order to prevent roadway overtopping incidents.

Since the discontinuance of the U.S.G.S. gage at Lake Lefferts, lake elevation records have not been kept.

2.4 Evaluation

a. Availability

The availability of engineering data is not considered fully adequate to assess the safety of the structure for the Phase I Inspection. Missing data pertains to the engineering properties of the embankment, its zoning if any, phreatic levels in the embankment and the subsoil parameters. Acquisition of this embankment foundation data is deemed especially important in view of the apparent continued settlement of the embankment under its own load and the hydraulic loadings imposed by the reservoir water.

Data relating to tailwater levels at one half to full PMF are needed to assess the stability of the spillway. The downstream railroad embankment culverts could impose a constraint on tailwater levels and should be included in the investigations.

No single set of drawings is available depicting current conditions along the embankment and the bulkhead and retaining walls. Typical cross sections are needed at various critical places along the axis. The owner should assemble such a set and fill in needed information as required by additional surveying.

A check list of Engineering Construction and Maintenance Data is included in Appendix A.

b. Adequacy

The engineering data assembled is not considered fully adequate for the Phase I inspection. Data required for full assessment of safety is listed in the paragraph above. This data is also required to properly assess the available alternatives for correction of deficiencies uncovered.

c. Validity

The validity of the data assembled for the spillway and bridge is considered adequate based on analysis of survey data taken in 1968 and 1970 and confirmed visually during the field inspection. The data assembled for the embankment is not considered valid at all, since it represents construction that has been destroyed by the flood of 1955. The owner should assemble a valid set of drawings reflecting current conditions.

SECTION 3

3. Visual Inspection

3.1 Findings

a. General

Lake Lefferts Dam is in fair overall condition physically, but has a seriously inadequate spillway capacity because of an extremely low freeboard aggravated by the apparent continued settlement of the embankment.

b. Dam

- Spillway

The top of the spillway crest is eroded, with some steel reinforcing bars exposed. The crest is not fully level, and variations of up to 1.5 inches are detectable. Minor horizontal and vertical cracking was visible on the downstream face. There is some local spalling of concrete adjacent to the right low level outlet.

- Spillway Bridge

The condition of the abutments are good, there is no significant cracking, and the concrete surfaces are in acceptable condition. There is some local surface spalling visible on the downstream face. The upstream left parapet wall is leaning into the pool. The bridge superstructure is in acceptable condition.

- Embankment

There is no evidence of leakage or seepage at this time. The upstream timber bulkhead sheeting is in good condition, for the portion visible above the lake level.

The downstream face on the right abutment has adequately flat slopes and the timber retaining wall connection between embankment and the concrete bridge wingwall was in good condition. The vegetation on the left downstream bank area is properly maintained and controlled

The downstream face of the left abutment is supported for its full height by a timber retaining wall. The face sheeting is supported by a system of vertical and battered timber piles. Where no batter piles are used, the vertical piles are tied back into the abutment. A section of the retaining wall has moved forward approximately 12 inches over a length of approximately 75 feet, starting at a point about 125 feet to the right of the spillway bridge. At this point, the vertical piles lean downstream, and the batter piles have probably punched down. The embankment has, in the past, settled and the settlement process is apparently slowly continuing, based on rough freeboard measurements made on the visual inspection as compared to 1968.

- Survey Plats

The condition of the downstream timber retaining wall was structurally sound. The area downstream of the wall is poorly graded, hummocky, and retains tidal and surface runoff water. Vegetation growth is poorly controlled.

- Low Level Spillway

The spillway structure contains two sluice gates, located on the upstream face of spillway wall; a 30-inch diameter gate on the right side of the semi-circle and a 24-inch diameter gate on the left side. Both outlets exit on the downstream side of the spillway wall at an approximate centerline elevation of 4.3.

Both gates are of the pressure seating type, equipped with manually operated, 90-degree bevel reduction gear drives, manufactured by Coffin Valve Company. These gate operators are connected by means of a standard

universal joint (Hooke's type) to an extension shaft. The extension shafts allow the sluice gates to be operated from the surface of the roadway which bridges the spillway. The universal joint on the 24-inch valve is worn and is quite loose. In addition, the support guide for the extension shaft has broken loose from the concrete spillway. In its present condition, this gate cannot be operated with any reliability. These items should be replaced. The other operator and extension shaft for the 30-inch diameter valve is in good condition.

Both sluice gates stems were obscured by the foundation of the operating stand. Generally, the stems tend to corrode in this area since they are at the water surface and oxygen is plentiful. Inspection would require removal of the operating stand or observation from below by boat, at a time when the reservoir level is 3 to 4 feet below the spillway crest.

There was some leakage (approximately 20 gpm) from each sluice gate, however, the flow should have no detrimental effects.

There is a fire department suction line leading from the lake to the roadway bridge.

c. Appurtenant Structure

There are no appurtenant structures associated with this dam.

d. Reservoir Area

The reservoir rims are moderately steep to a height of 15 to 20 feet above the lake surface and are covered by trees. There was no evidence of rim slope slumping or sloughing. The upper end of the reservoir has silt accumulations at the inlet of Matawan Brook. The silt accumulations at the dam has been lessened by the continued and frequent use of the low level outlet.

e. Downstream Channel

The downstream channel has low banks and meanders in a 700-foot wide tidal flat. The immediate downstream section of the creek channel has been protected by grouted riprap along its banks and bottom for a distance of approximately 80 feet. The downstream creek levels are affected by tidal fluctuations and a high downstream railroad embankment, pierced by 3 ten-foot diameter culvert openings, could control tailwater levels at the downstream side of the dam at PMF levels. The downstream tidal flat banks rise moderately steeply from the plain, and residences and businesses have been built on higher ground. There are several hundred people living on this high ground area, adjacent to the tidal flat between the dam axis and the embankment formerly belonging to the New York and Long Branch Railroad, and many more downstream of the embankment. A low lying road, named Aberdeen Road crosses the tidal flat just upstream of the railroad embankment and could be affected by PMF water levels.

3.2 Evaluation

1. Spillway and Bridge

   Considered in acceptable physical condition, but the low capacity of the spillway at the available freeboard is a safety concern.

2. Low Level Outlets

   The apparent inoperability of the 24-inch diameter outlet is considered unacceptable for dam safety in view of the very limited spillway capacity.

3. Embankment

   Settlement of the embankment has reduced freeboard and has led to overtopping. Signs of retaining wall movements are a safety concern.

4. Left Downstream Area

This area is poorly graded for drainage and could be a contributing cause of embankment settlement and retaining wall movement.

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

Lake Lefferts Dam is operated by Monmouth County. The lake level is closely controlled, to avoid overtopping and subsequent damage to the roadway embankment. The low level outlet gate is opened in anticipation of, and during periods of significant rainfall, utilizing the storage of the lake below the spillway crest to absorb rainfall peaks.

4.2 Maintenance of the Dam

The dam embankment, bridge and spillway are maintained as part of Monmouth County's road network by Monmouth County on an as-needed basis. Extensive work was performed in rebuilding the downstream timber retaining wall after the 1955 flood damage, and more recently in 1970, to riprap the downstream channel in order to stop undercutting of the bridge. The emphasis is placed on avoiding damage to the roadway embankment and bridge and in maintaining traffic.

4.3 Maintenance of Operating Facilities

Maintenance of the low level outlets is on an as-needed basis by Monmouth County.

4.4 Description of any Warning System in Effect

There is no warning system in effect.

4.5 Evaluation

Operational procedures are relatively simple in line with the simple facilities. The owner should institute a procedures manual for regulation of the lake level and log all gate openings and closings, and all maintenance and inspection visits. An annual inspection visit is recommended, utilizing a form similar to the federal visual inspection forms appended in this report, Appendix A.

A staff gage should be added to the upstream bridge abutment and water levels should be recorded at routine visits and during severe rainstorms and overtoppings.

SECTION 5

5. HYDRAULIC / HYDROLOGY

5.1 Evaluation of Features

a. Design Data

The evaluation of the hydraulic and hydrologic features of the Lake Lefferts Dam was based on criteria set forth in the Corps of Engineers Guidelines, Section 4.3 and additional guidance provided by the Philadelphia District, Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using Hydrometeorological Report No. 33 with standard reduction factors. The S.C.S. method of triangular Unit Hydrograph was used to derive Unit Hydrograph.

Initial infiltration loss rates were applied using S.C.S. procedures to the Probable Maximum Storm Rainfall in order to obtain rainfall excesses. The rainfall excess was then applied to the unit hydrograph to obtain the PMF hydrograph, utilizing computer program HEC-1. The computed peak discharges for the PMF and one half of the PMF are 26,868 cfs and 13,434 cfs respectively.

These inflow hydrographs were routed through the reservoir by the Modified Puls Method utilizing computer program HEC-1. The peak outflow discharges for the PMF and one half of PMF are 24,516 cfs and 12,258 cfs respectively. Both the PMF and one half of the PMF result in overtopping of the dam. The assumption was made that the dam would remain intact during routing.

The spillway rating curve and the reservoir capacity curves are presented in Plates 2 and 3 of Appendix D respectively.

The spillway has a capacity of 355 cfs at top of dam level representing 1.45 percent of the unrouted PMF. When routed through the reservoir, the dam can handle an inflow of approximately 3.3 percent of the PMF without overtopping.

b. Experience Data

The dam has been overtopped on numerous occasions. The worst flood of record during the period 1932-1955 when the U.S.G.S. gage was operational occurred on August 13, 1955, when the stage was recorded at 18.23 MSL (overtopping estimated at 1.3 to 1.8 feet) with the discharge given at 1,420 cfs. The dam embankment was seriously eroded and the U.S.G.S. gage was discontinued after that event. Since rebuilding the dam in 1955, the dam has been overtopped on several occasions up to about 18 inches, but has survived without a major failure. No significant downstream damages were recorded.

c. Visual Observations

Although silting has been observed on the upstream end of the lake, it has not progressed far enough to significantly affect the validity of the hydrologic computations made. The 24-inch diameter low level outlet is currently not considered operable, and should be restored to use immediately to enhance the control of overtopping.

d. Overtopping Potential

As indicated in Section 5.1.a., both the PMF and the one half of the PMF, when routed through the reservoir, result in overtopping the dam. The PMF and one half PMF overtopped the dam by 5.0 feet and 3.5 feet, respectively. The PMF is the SDF for this dam according to the Recommended Guidelines for Inspection of Dams by the Corps of Engineers, and the spillway capacity of the Lake Lefferts Dam is considered seriously inadequate.

e. Reservoir Drawdown

The reservoir drawdown below the spillway crest elevation 14.4 MSL is accomplished by permitting discharge through the 30-inch and 24-inch diameter outlet pipes with centerlines elevations at Elev. 3.65. Assuming drawdown to the centerline of the pipe, elevation 3.65 results in a maximum head differential of 10.75 feet. Assuming a constant inflow of 12.2 cfs (2 cfs/square mile), the drawdown can be accomplished in 2 days and 18 hours. Assuming no inflow into the reservoir, the drawdown time is reduced to 2 days and 9 hours.

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The structural stability of the embankment is in question, since part of the timber pile retaining wall on the downstream left embankment has moved forward by 12 inches deflecting the vertical piles and punching down the batter piles at the supported face. Apparently, there are significantly different soil loadings in the retained fill and/or significantly lower vertical and lateral pile loading capacities than were assumed in making the design. The poorly drained and graded area at the wall face may contribute to these differences.

b. Design and Construction Data

No computations have been made available for checking the stability of the embankment and the spillway and bridge structure. Insufficient engineering data on embankment and foundation materials is available to make an independent assessment. No accurate drawings are available depicting the details of the downstream retaining wall.

A preliminary assessment of the pile foundation under the spillway and bridge shows that it would have difficulty meeting safe lateral pile load criteria under normal operating conditions. The owner should check and verify the stability of the spillway and bridge structure and the downstream retaining wall on the basis of appropriate soil parameters and saturation levels.

c. Operating Records

The spillway structure has been in service since 1928 and performed well from the time the last repair was made to the sheet pile cutoff system in 1931. The present embankment bulkhead and retaining walls date from 1955, the last time the dam was seriously washed out during an overtopping. The present configuration has been overtopped on several occasions since 1955, without causing significant damage, according to the County Engineer. The County has made a determined operating effort to prevent dam overtoppings by using the low level outlet discharges to lower the lake level in anticipation of severe storm events.

d. Post Construction Changes

The spillway has been modified on several occasions to gain more freeboard which is considered beneficial. Apparently, a second 30-inch diameter low level outlet has been installed to augment the spillway capacity, also considered beneficial to the stability of the dam. The latest embankment design on the left abutment has shown that it has more resistance to overtoppings, even though some deflections can be observed.

e. Seismic Stability

In general, projects located in Seismic Zone 0, 1 and 2 may be assumed to present no hazard from earthquake, provided that static stability conditions are satisfactory and conventional safety margins exist.

SECTION 7

7. ASSESSMENT / REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

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

The dam's hazard potential has been changed from "High" to "Significant" for reasons described in Section 1.2.d.

- Lake Lefferts Dam has a seriously inadequate spillway capacity amounting to only 3.3 percent of the routed PMF. Required spillway capacity was determined by Corps of Engineers screening methods and the Owner should determine the required spillway capacity using more sophisticated and accurate methods and procedure.

- The spillway length is inadequate and the freeboard available before overtopping is only 2 feet. Overtoppings in the high frequency range of rainfalls is averted only by an alert operating force, which lowers the lake in anticipation of large inflows.

- Overtopping of this dam entails a significant risk to the downstream area. Past operating experience show that similar dams have been washed out in the storms of 1944 and 1955. Although the present embankment retaining wall de-

sign has stood up despite overtopping since 1955, its continued ability to do so can by no means be assured since only flows in the range of 5 percent of the PMF have been experienced at the dam site.

- The left downstream retaining wall has deflected forward by 12 inches over a 75-foot section indicating a significant variance in actual condition from what was assumed in the design and should be further investigated to pinpoint causes and formulate remedies.

- The 24-inch diamater low level outlet is inoperable and is a negative factor in assessing the dam's safety.

b. Adequacy of Information

Information is inadequate to assess the safety of the dam. To assess the safety of the left downstream timber retaining wall, the information needed is:

1. A complete as-built section through the embankment.

2. Engineering parameters of the soils in the embankment, in the subgrade and along the depth of pile embedment.

3. Information on the phreatic line in the embankment.

4. Comparison of the above data with similar information at a cross section showing no distress.

5. Establishment of a tailwater rating curve at PMF levels.

To assess the safety of the spillway structure, the following data is needed:

1. Engineering parameter of the soils in which the piles are embedded.

2. Data on phreatic levels in area beneath the bridge footings.

3. A tailwater rating curve.

c. Urgency

- A plan to augment the spillway capacity of the dam should be formulated and approved within 9 months.

- Engineering data relating to stability should be acquired within 6 months, together with the tailwater rating curve.

- Investigations into the stability of the downstream retaining wall should be completed in 9 months and be coordinated with spillway capacity augmentation studies.

- The 24-inch diameter low level outlet should be repaired within 3 months.

- The downstream area at the left embankment should be regraded for proper drainage away from the foot of the retaining wall within 6 months.

d. Necessity for Future Investigations

Based on the information presented in Section 7.1 - a. and b., the need for further investigations is definitely indicated.

7.2 Remedial Measures

a. Alternatives

1. An additional spillway, possibly gated or of syphon type, in the general vicinity of the present one.

2. Raising the embankment height to provide additional freeboard for the spillway weir.

3. Lowering the existing spillway weir and the addition of flash boards to preserve the current lake level.

4. Armoring and hardening the present embankment to assure embankment integrity during overtoppings in the PMF range.

5. Lowering the lake level to take advantage of additional active storage capacity during severe rainstorms.

6. A combination of any of the above methods.

b. O & M Procedures

- The owner should establish an operating procedure for the regulation of the lake level during severe rainstorms.

- An annual inspection visit should be initiated to assess the dam's safety using a visual check list similar to the one used in this report.

- All visits to the dam for operation and maintenance should be logged in a permanent record.

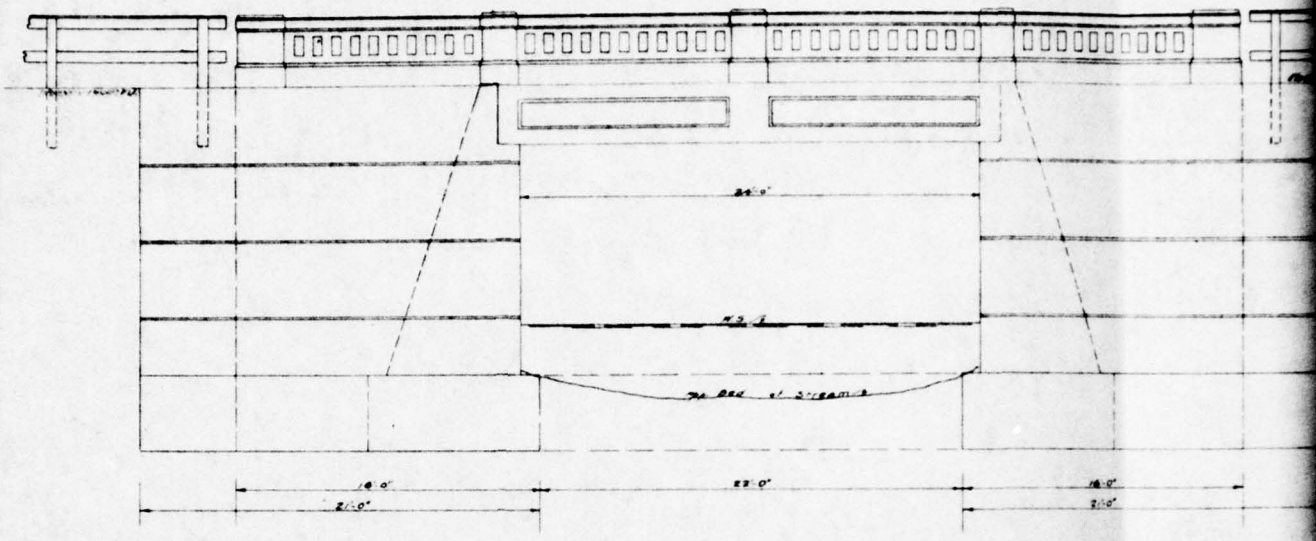
- A staff gage of substantial design should be affixed to the bridge abutment and lake levels routinely recorded during visits to the dam and at high water events. The gage should be indexed to the Mean Sea Level Datum.

- A communications line should be opened between the owner and Matawan Borough Police to barricade Aberdeen Avenue and Ravine Drive, in case of high stream discharges impending dam overtoppings or signs of distress in the dam embankment.

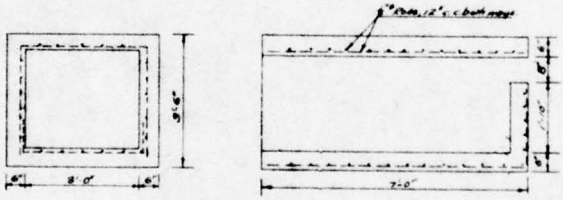
PLATES

DRAWING 1

VICINITY MAP

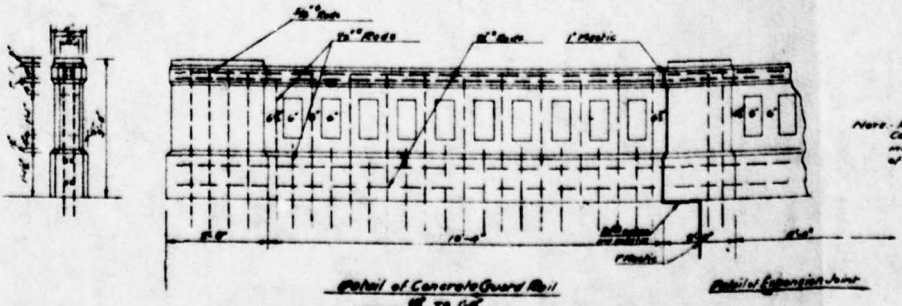


East Elevation
3/16" to 1'-0"



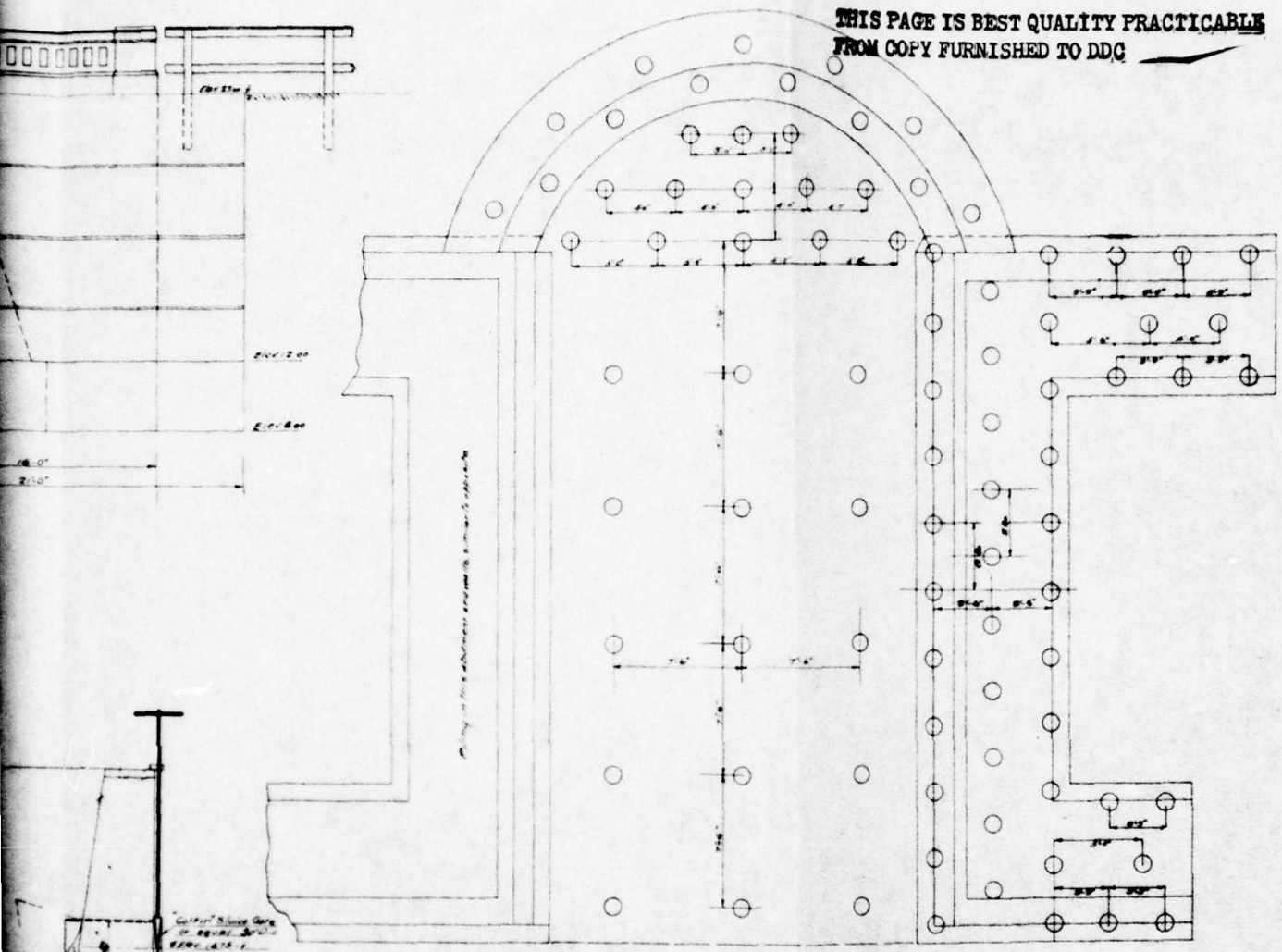
Concrete Drains
1/2" to 1'-0"

Detail of Floor Section
1/2" to 1'-0"

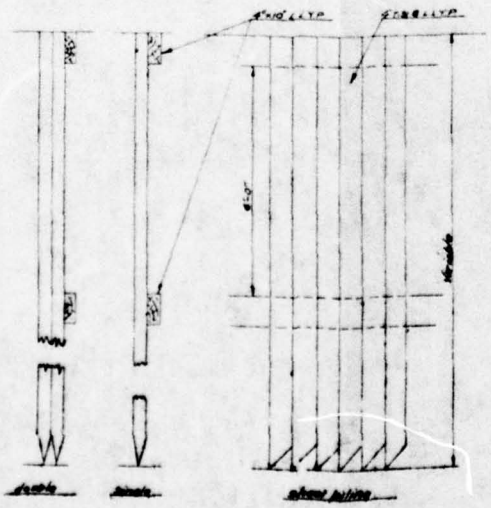


Detail of Concrete Guard Rail
1/2" to 1'-0"

Detail of Expansion Joint



PILE DIAGRAM
3/4" = 1'-0"



Note - Reinforcing Steel in Concrete Wall is not included in Estimate of Quantities

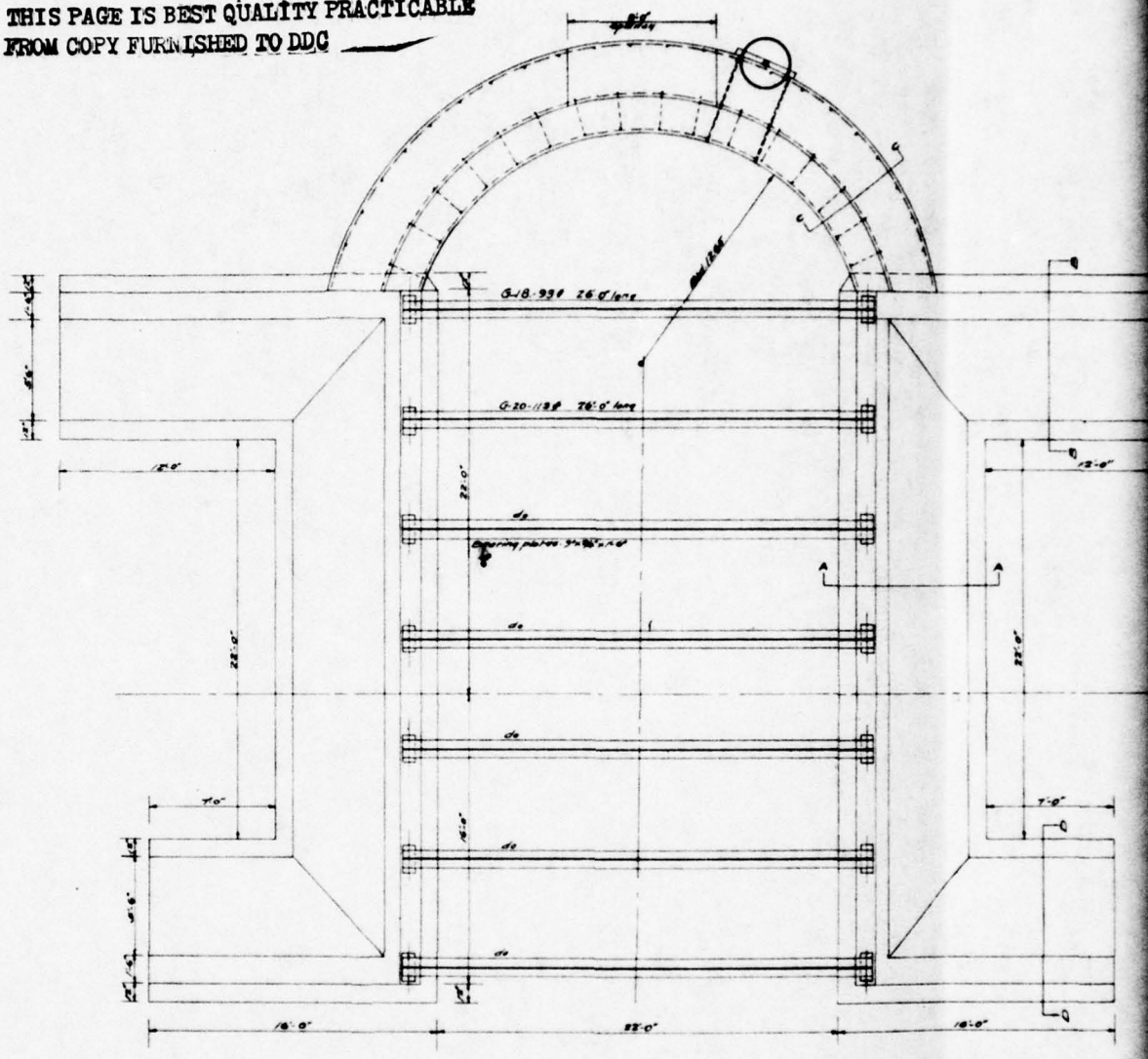
LAKE LEFFERTS
DWG. NO. 2

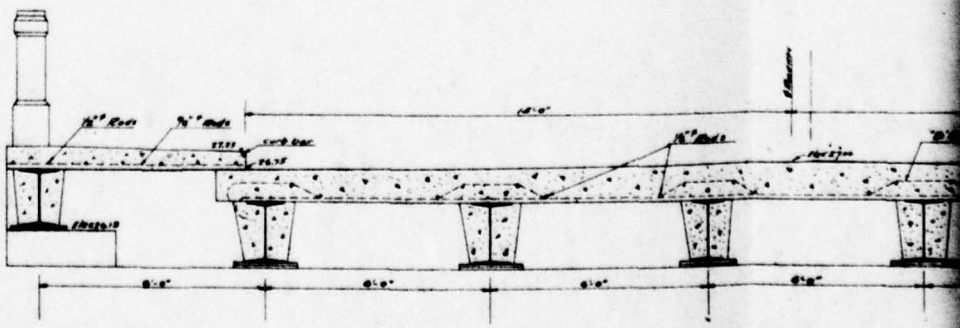
MONMOUTH COUNTY N. J.
GEORGE K. ALLEN JR. COUNTY ENGINEER

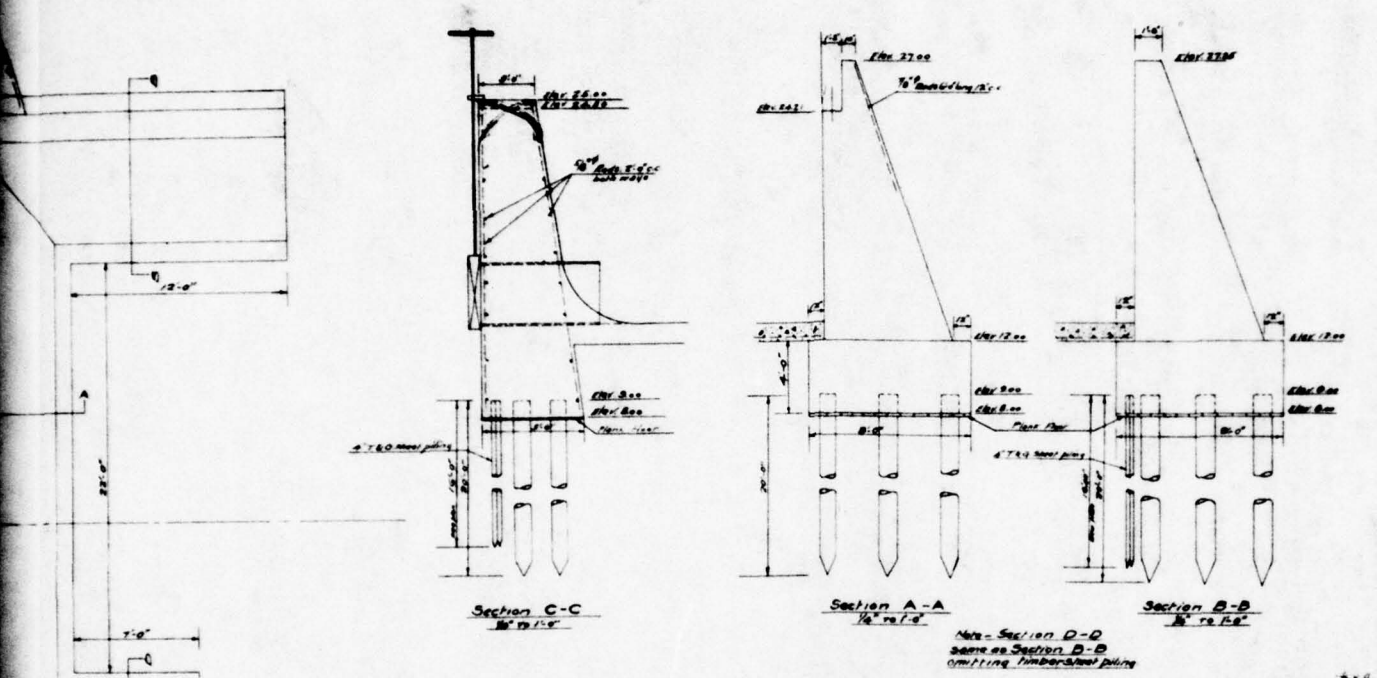
BRIDGE No M8 - 9
Elevation, - Pile Diagram
Details.

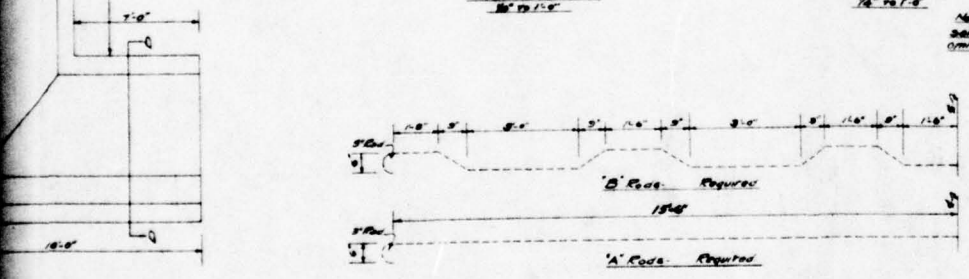
SCALE as shown
DATE June 1937
DRAWN BY [illegible]
TRACED [illegible]
CHECKED [illegible]

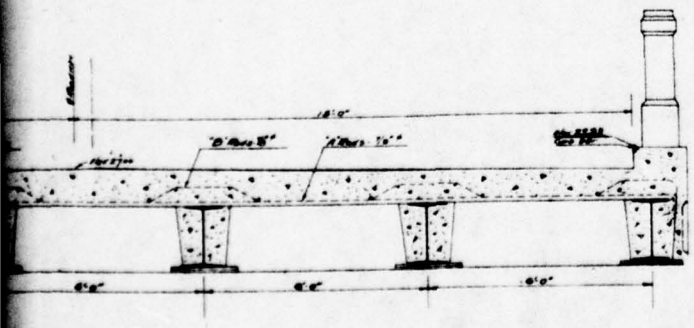
2

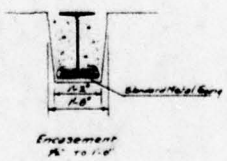


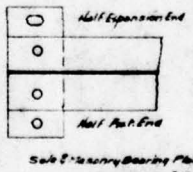












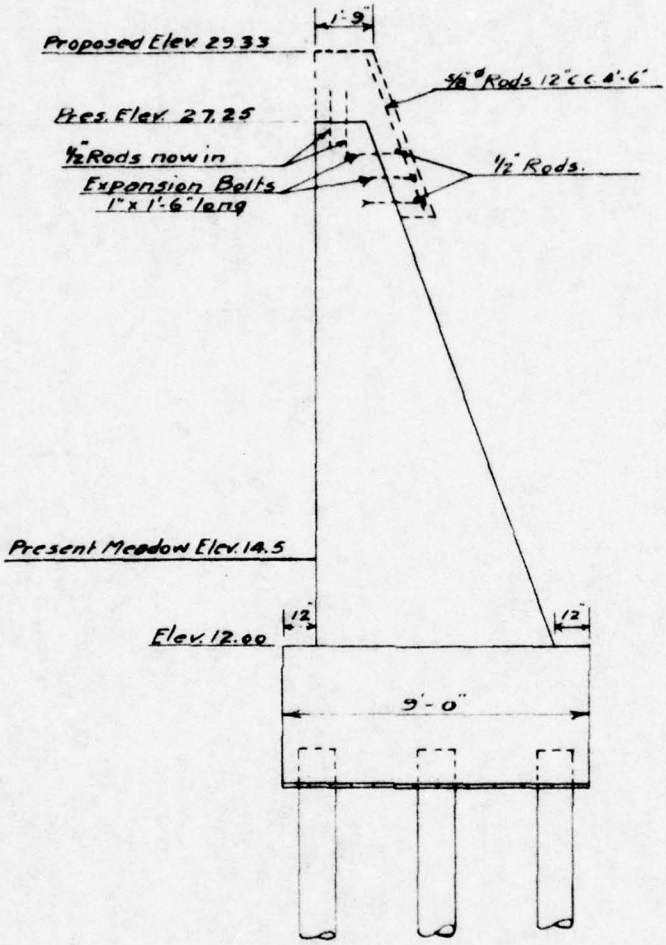
Sole 8"x Masonry Bearing Plates 9"x 16"x 1.0"
Anchor Bolts 3/4"x 12"

DWG. NO. 3

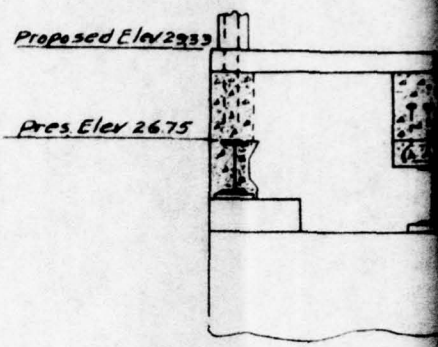
MONMOUTH COUNTY N. J.
GEORGE K. ALLEN JR. COUNTY ENGINEER
BRIDGE No M8 - 6
Plan - Sections

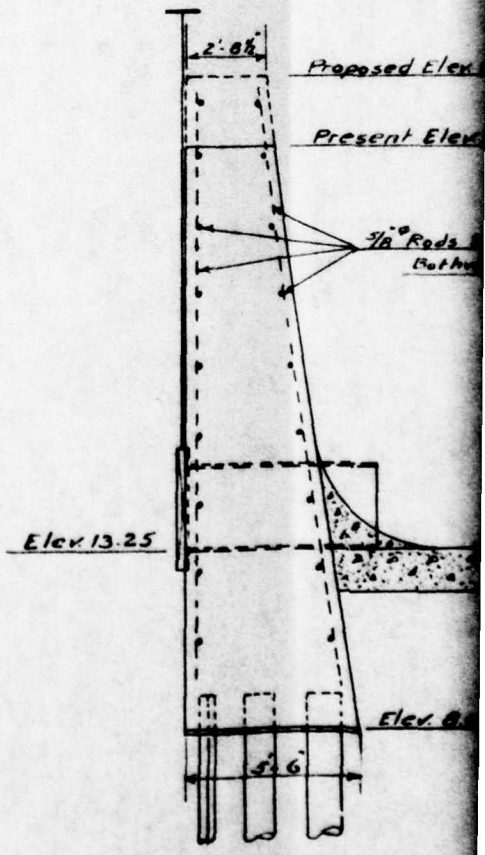
LAKE LEFFERTS

2



Wing Walls
Scale 1/2" to 1'-0"





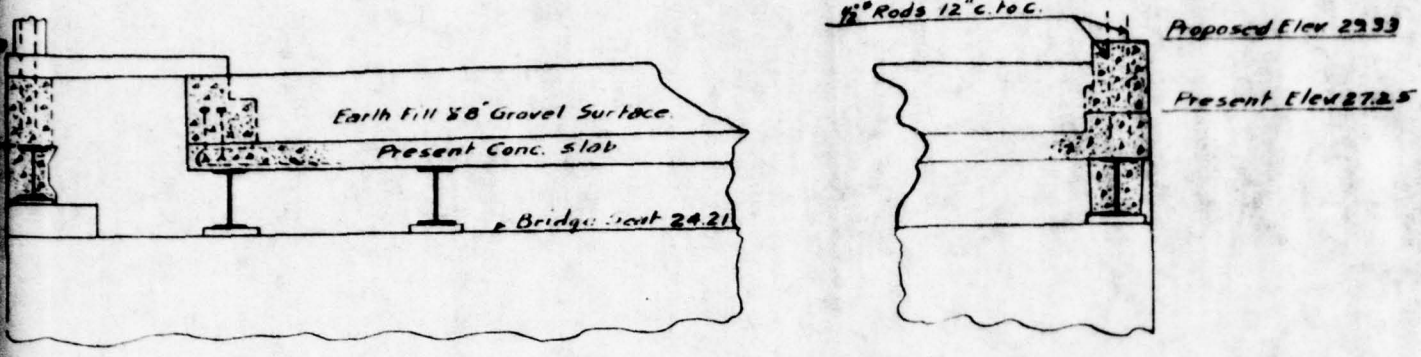
Section thru Dam
Scale 1/2 to 1'-0"

Approved March 21, 1928

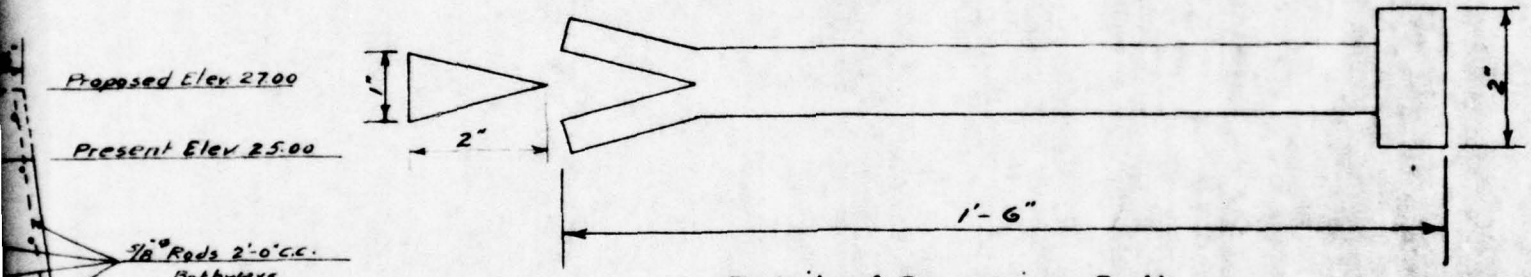
Director.

Clerk.

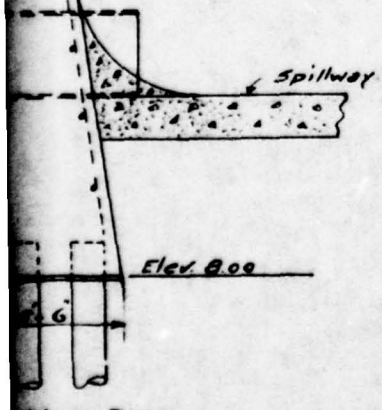
Accepted [redacted] Contractor.



Section thru Bridge
Scale ¼ to 1'-0"



Detail of Expansion Bolt.



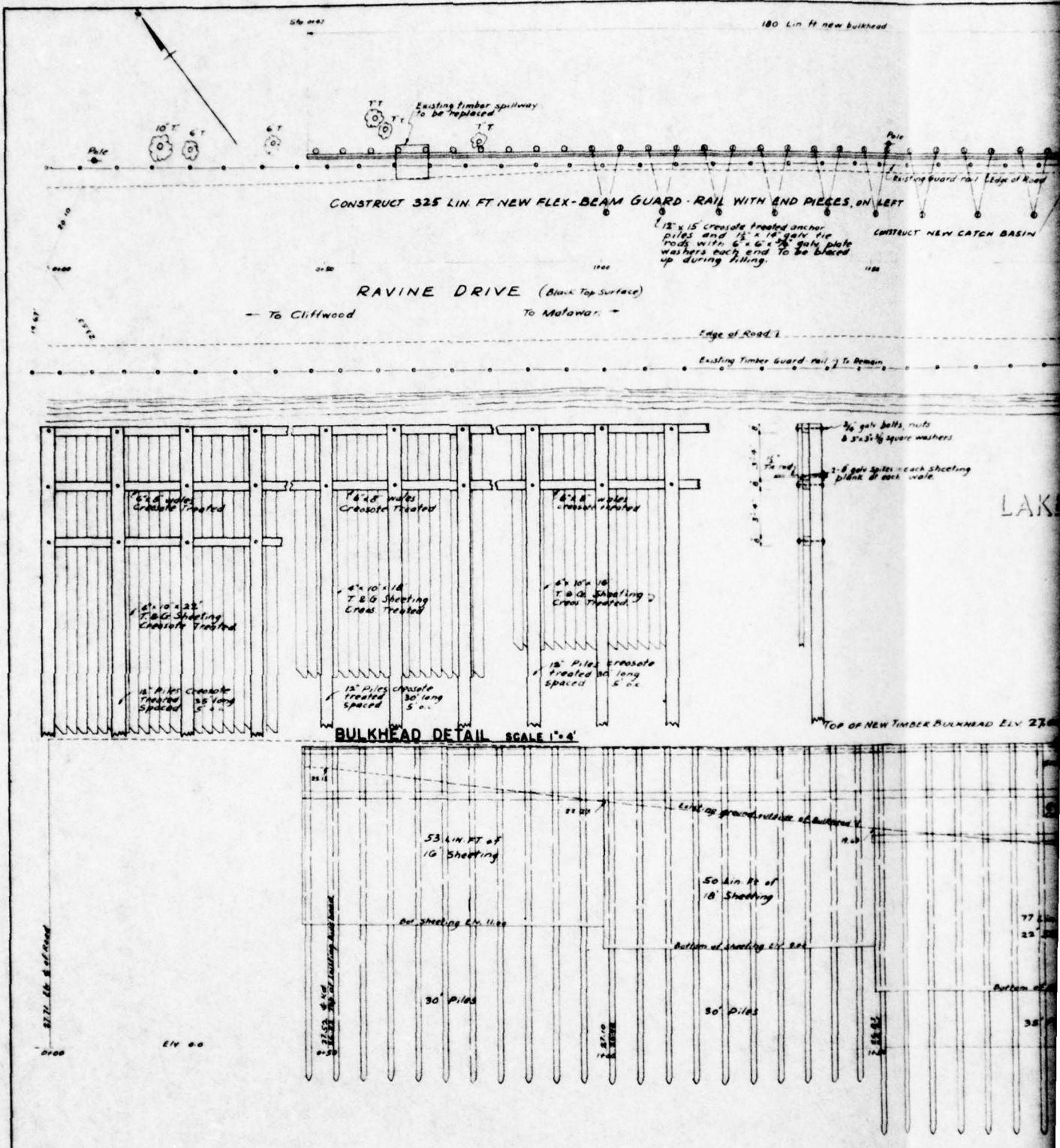
Thru Dam
to 1'-0"

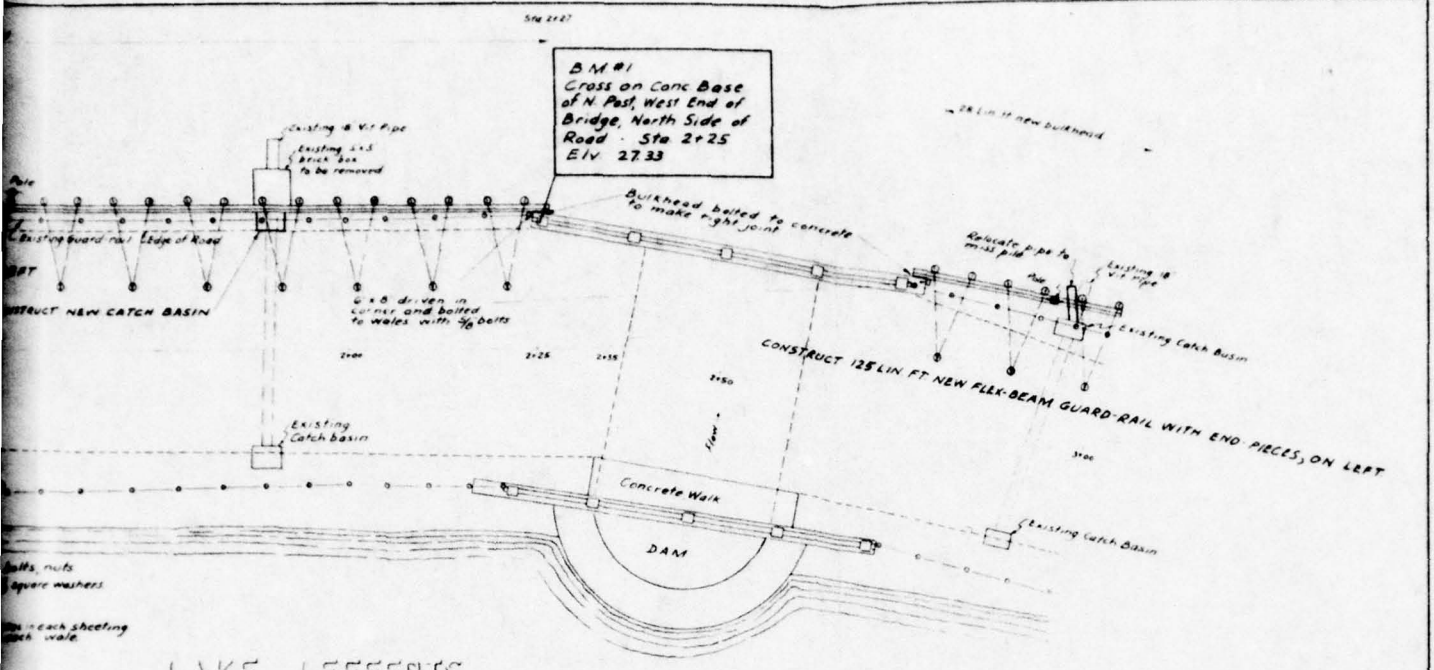
LAKE LEFFERTS
DWG. NO. 4

N. J.

Ma 9
Detail for proposed increase of Water Elev.

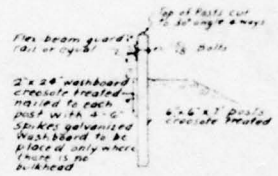
As shown C.W.
C.W.
March 1928 G.K.A.
SHEET NO. 1 1





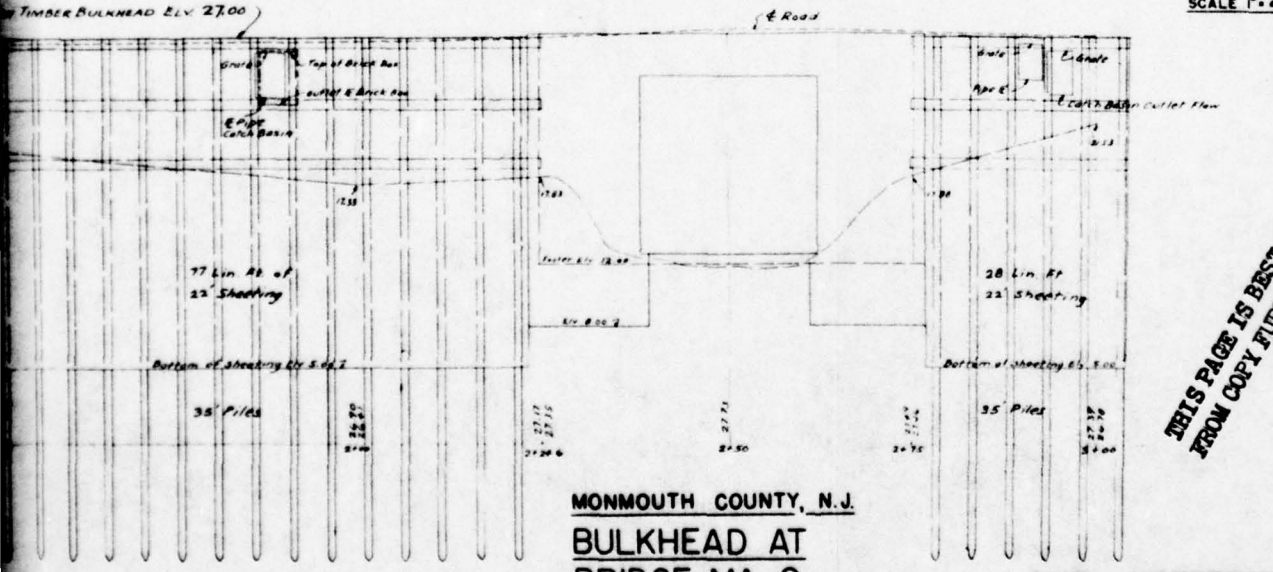
LAKE LEFFERTS

PLAN



GUARD - RAIL

SCALE 1" = 4'



PROFILE

SCALE HORIZ. 1" = 10'
SCALE VERT. 1" = 5'

MONMOUTH COUNTY, N.J.

BULKHEAD AT BRIDGE MA-9

MATAWAN

OTIS R. SEAMAN, COUNTY ENGINEER

SURVEYED JUNE 24, 1949.

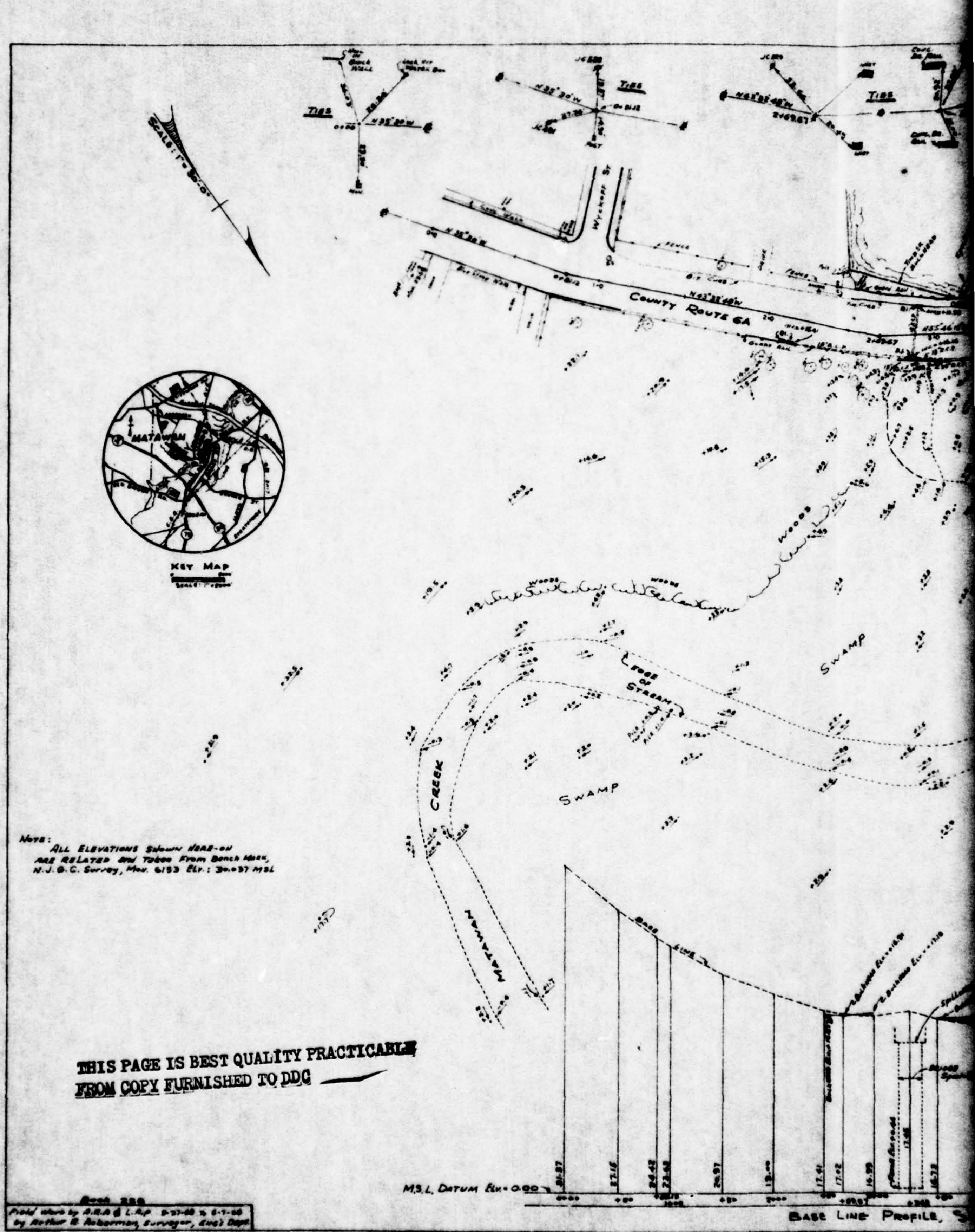
APPROVED BY THE DIRECTOR OF BRIDGES

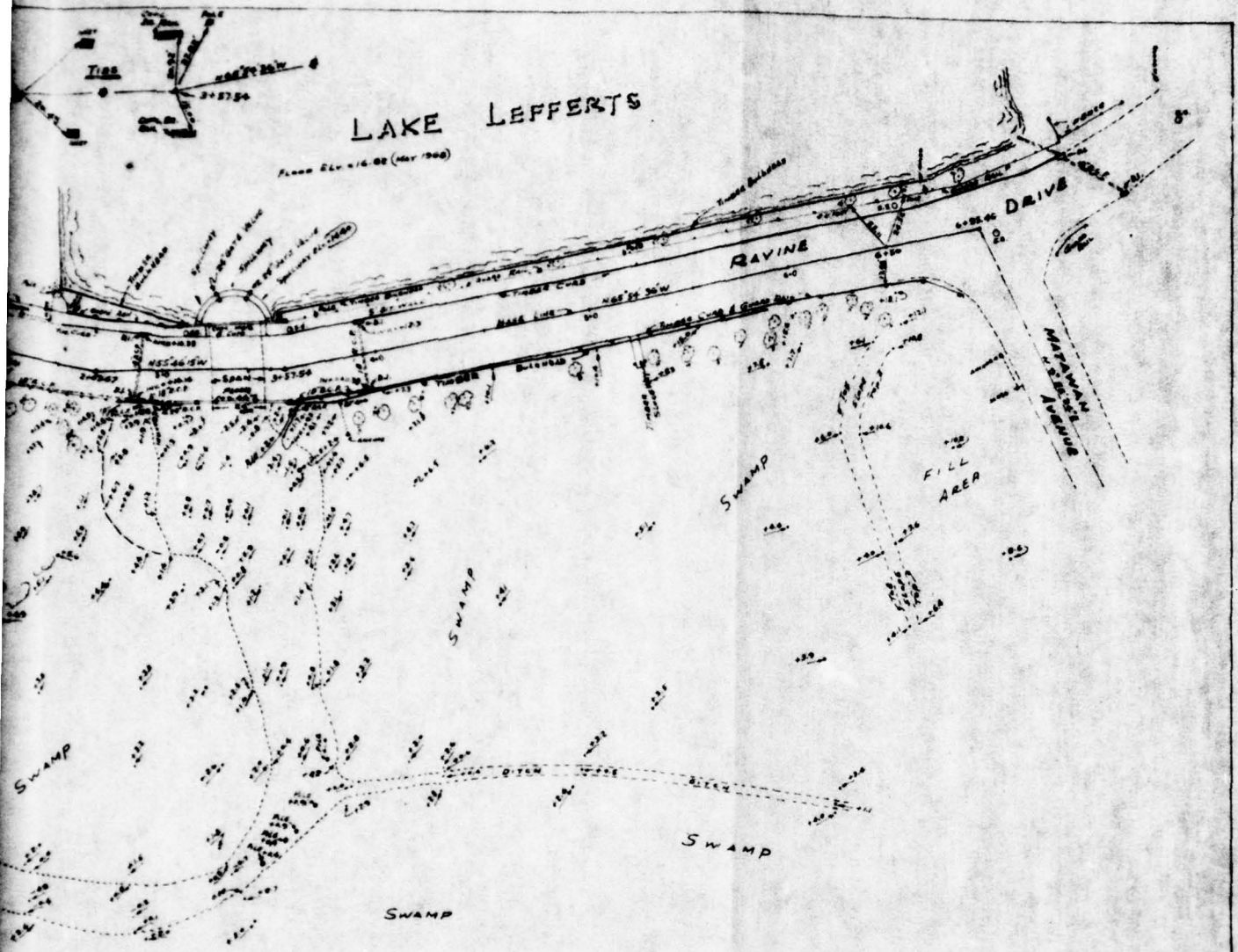
J. C. Lawrence

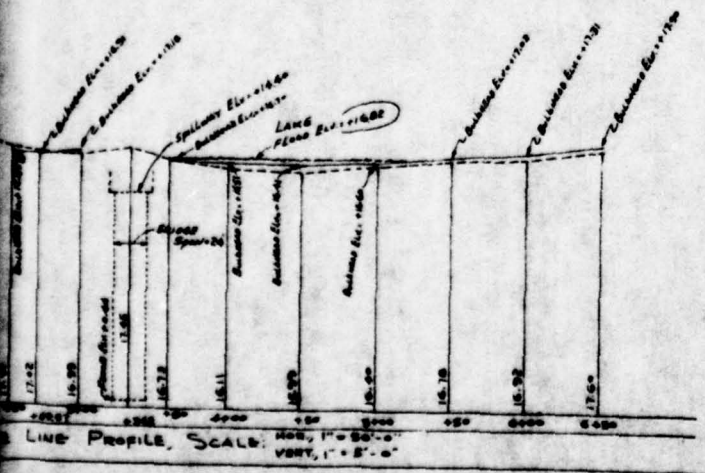
LAKE LEFFERTS

DWG. NO. 5

B.189 - P.150







LAKE LEFFERTS

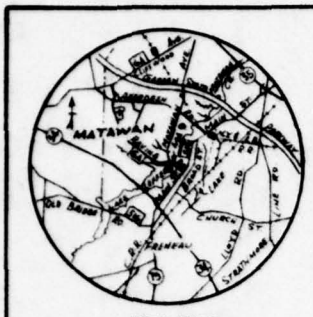
DWG. NO. 6

MONMOUTH COUNTY, N. J.
H. LEROY MARTIN, COUNTY ENGINEER

TOPOGRAPHICAL SURVEY
AT BRIDGE MA-9
SITUATED IN THE
BOROUGH OF MATAWAN

MAY 27, 1960

Approved, _____ County Engr.
Approved, _____ Director
Date: _____ 1960



NOTE: ALL ELEVATIONS SHOWN HEREON ARE RELATED and Taken From Bench Mark; N.J.C.&G. SURVEY, MON 6153 ELEV = 30.037 M.S.L.
+ Sign is above MSL, Thusly
− Sign is below M.S.L.

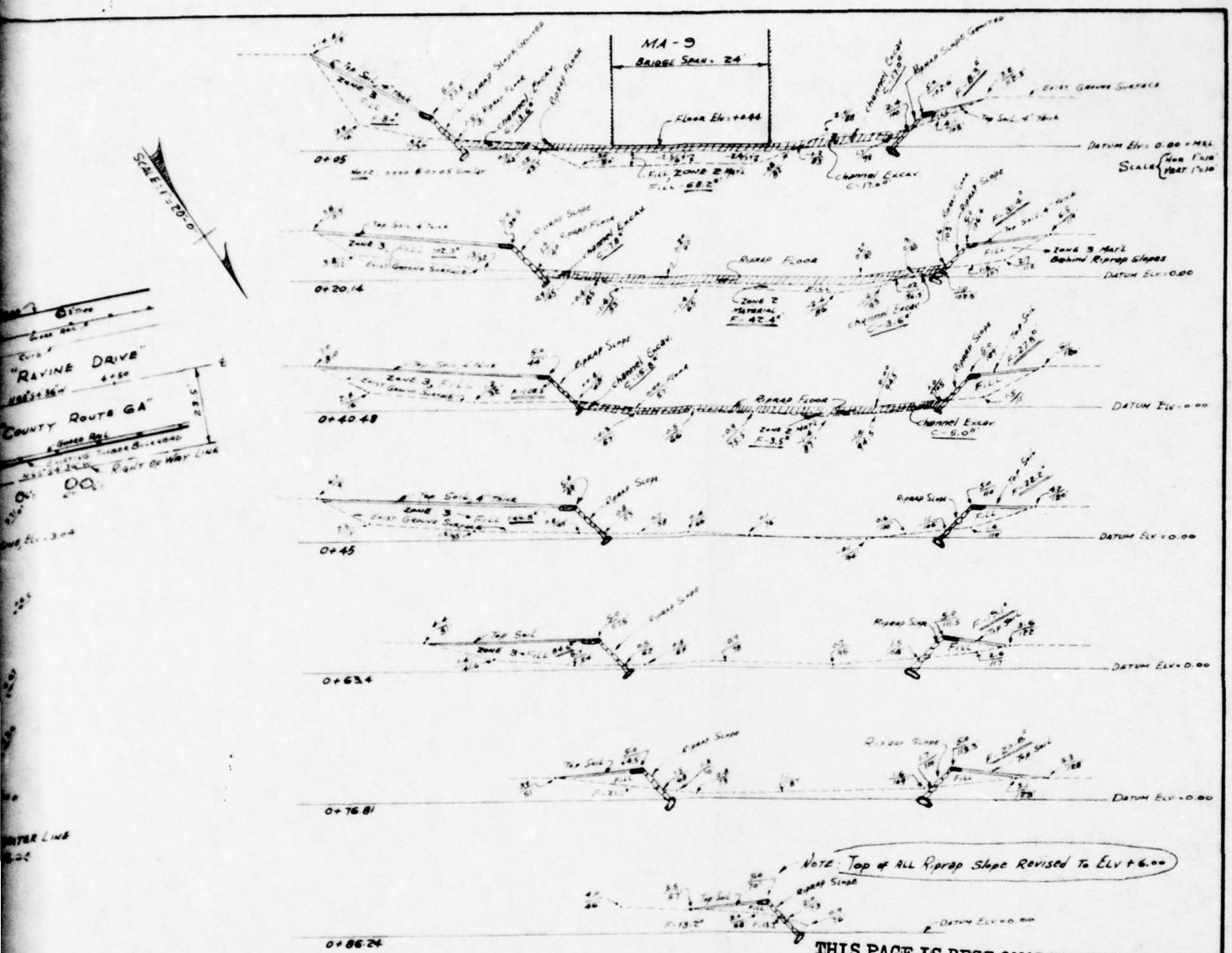
NOTE: High Water Line based on M.S.L. datum, Sandy Hook based on surveys prepared for and by the N.J. Parkway Authority.

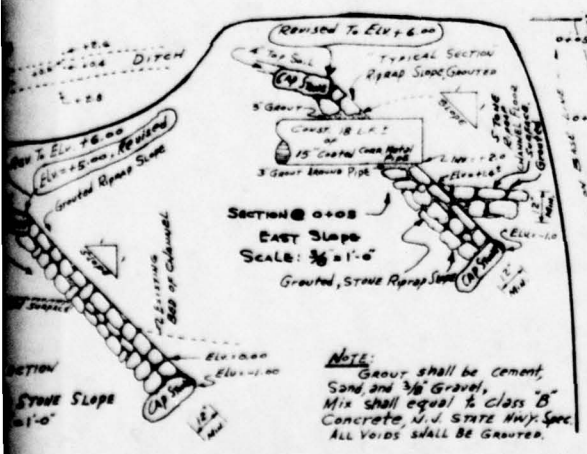
ESTIMATE OF QUANTITIES

35 Cu.Yds., Channel Excavation
72 Cu. Yds., Borrow Excavation, Zone 2 Type 4, Class B
284 Sq. Yds., Riprap - Grouted, Floor of Channel
212 Sq. Yds., Riprap - Grouted, Slopes
480 Cu. Yds., Borrow Excavation Zone 3, Type 4, Class D
18 L.F. 15" Coated Corr. Metal pipe
400 Sq. Yds. Top Soil & Seeding

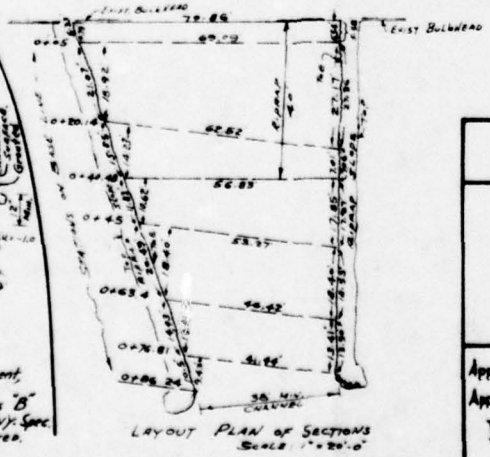
No	REVISIONS	DATE	APPROVED
1	Top of Riprap Stone Slope To Be Elv +6.0	Aug 5/70	

Book 258
DRAWN & DESIGN BY A.R. ACKERMAN





Note: Grout shall be cement, Sand, and 3/8" Gravel, Mix shall equal 1 to class "B" Concrete, N.J. STATE HWY. SPEC. ALL VOIDS SHALL BE GROUTED.



LAYOUT PLAN of SECTIONS
SCALE 1"=20'-0"

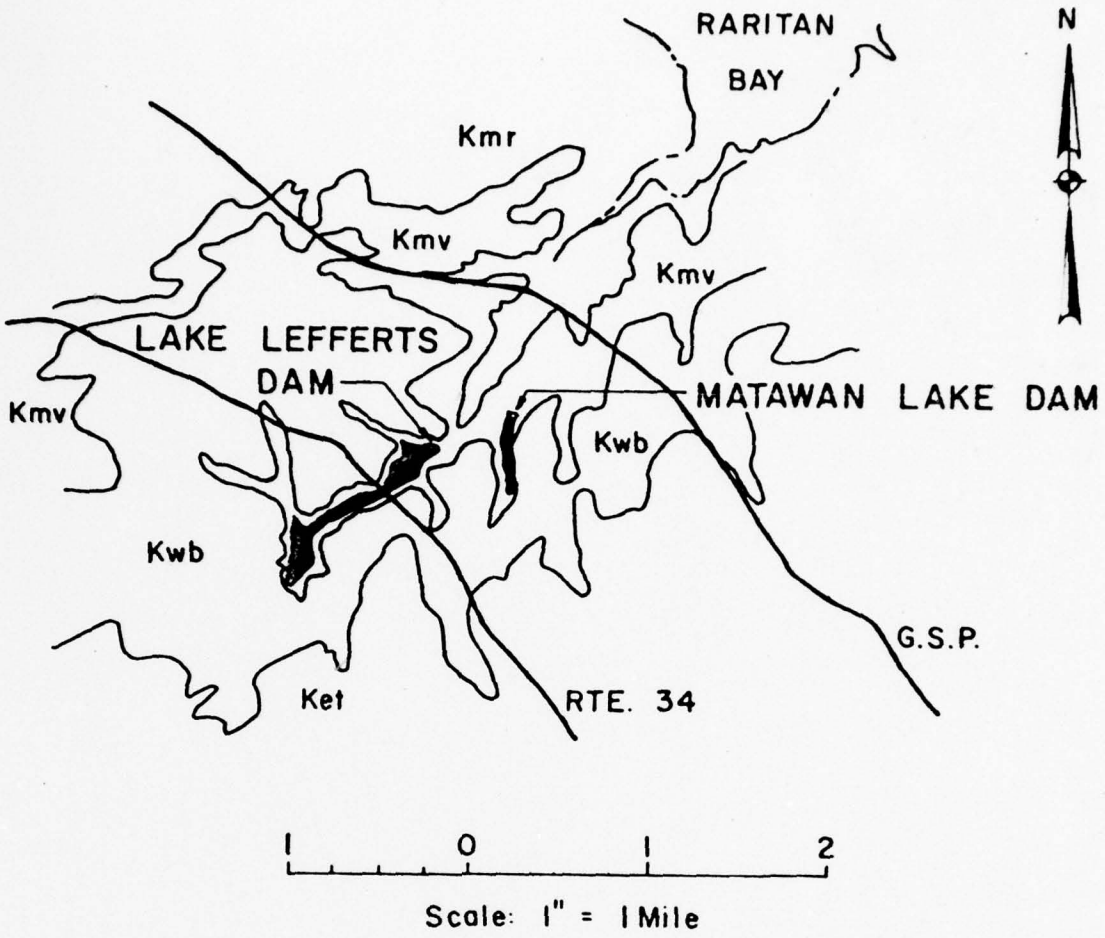
LAKE LEFFERTS

DWG. NO. 7

MONMOUTH COUNTY, N.J.
HENRY J. NEY, COUNTY ENGINEER

PROPOSED CONSTRUCTION
OF
STONE SLOPE PROTECTION
AT CHANNEL AREA
ADJACENT TO BRIDGE MA-9
BOROUGH OF MATAWAN

APPROVED, _____ COUNTY ENG'R.
APPROVED, _____ DIRECTOR, BRIDGES
DATE: July 7, 1970



LEGEND:

CRETACEOUS

Ket Englishtown Sand
White or Yellow Quartz and with Some Mica, and Fine Lamiae of clay.

Kwb Woodbury Clay
Dark Gray Clay

Kmv Merchantville Formation
Interstratified Glauconitic Sands and Thin Beds of Clayey Silt.

Kmr Magothy and Raritan Formations
Dark Silty Clays and Light-Colored Sands(Km); Alternating Layers of Sand and Clays(Kr)

——— Contact

GEOLOGIC MAP

LAKE LEFFERTS–MATAWAN LAKE

DWG. NO. 8

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION

PHASE 1

Name Dam LAKE LEFFERTS DAM County Monmouth State New Jersey Coordinators

Date(s) Inspection May 8, 1978 / May 10, 1978 Weather Cloudy / Sunny, Clear Temperature 55°F / 65°F

Pool Elevation at Time of Inspection on 5/8 12.2± / on 5/10 13.0± M.S.L. Tailwater at Time of Inspection on 5/8 0.40± / on 5/10 2.0± M.S.L.

Inspection Personnel:

Seymour Roth, May 8 and 10
David Kerkes, May 8 and 10
William Flynn, May 8
Lynn Brown, May 8
Henry King, May 10
Lawrence Woscyna, NJ-DEP, May 8

Recorder: Seymour M. Roth

Representing Monmouth County, on May 1978: Mr. William V.W. Cokelet, Assistant County Engineer

CONCRETE/MASONRY DAMS

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

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	NA	
STRUCTURAL CRACKING	NA	
VERTICAL & HORIZONTAL ALIGNMENT	NA	
MONOLITH JOINTS	NA	
CONSTRUCTION JOINTS	NA	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Top of roadway embankment impounding Lake Lefferts is called Ravine Drive. Black top paving show a crack parallel to dam axis at a point where downstream face of retained embankment has moved from 6 to 12 inches downstream.	Monitor roadway cracking with a semi-annual inspection.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	The timber pile supported downstream face of the left embankment has moved from 6 to 12 inches downstream, deflecting the vertical timber piles and punching down the batter piles. Area of movement is 125 to 200 feet to left of bridge.	Monitor deflections at half yearly intervals.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The area downstream of the left abutment timber pile supported embankment face is poorly graded, and retains normal drainage. Erosion at base of wall is believed to be due to roadway embankment overtoppings. Timber retaining walls are all in good condition.	Regrade downstream area of left embankment to drain water away from base of retaining wall.
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST	The embankment is a county road and is on a vertical grade. The horizontal alignment of the downstream left embankment face has moved downstream from 6 to 12 inches.	
RIPRAP FAILURES	NA	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No visible signs of leakage or distress in the timber wingwall structures joining the bridge to the embankment. There is no leakage observed at the juncture of the spillway and the concrete bridge structure.	
ANY NOTICEABLE SEEPAGE	The water observed at the base of one pile on the downstream left embankment retaining wall is believed to be due to recent rainfall and not seepage through the embankment.	
STAFF GAGE AND RECORDER	Not currently in operation, former U.S.G.S. gage on upstream left abutment is discontinued.	
DRAINS	None observed.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	NA	
INTAKE STRUCTURE	None	
OUTLET STRUCTURE	Consists of two water passages through the semi-circular weir controlled by upstream valves, one 30-inch diameter on right and one 24-inch diameter on left. Valves are operated by means of operating stands on top of weir crest. Crank extension have been added to operate the valve from the bridge sidewalk. 24-inch valve is considered inoperable.	Rehabilitate 24-inch dia. centerline gate to full operating capability.
OUTLET CHANNEL	The outlet channel includes the area under the bridge and a grouted riprap basin downstream of the bridge. The outlet channel is affected by tidal fluctuations.	
EMERGENCY GATE	None	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	Massive semi-circular weir, modified ogee shaped on top crest is higher at the two valve operating stand pedestals and at ends of spillway crest at juncture to bridge abutment. The top of the spillway crest is eroded, some steel reinforcing bars are exposed. The crest is not fully level, variations of 1-1.5" are detectable. There is minor vertical and horizontal cracking visible on the downstream face and local spalling at the right low level outlet.	No action required.
APPROACH CHANNEL	No formal approach channel.	
DISCHARGE CHANNEL	The spillway discharges into the bridge opening approximately 24-foot wide, with paved invert slab and continues into a grouted, riprapped outlet channel with grouted riprapped bank extending approximately 90 feet downstream of the bridge. Discharge channel is tidal.	
BRIDGE AND PIERS	Massive concrete abutments on fair serviceable condition, no major distress noted. There is some local spalling evident on the downstream face. The superstructure is in acceptable condition. The bridge abutments absorb and deflect the force of existing water from the low level outlets which are aimed at an angle to channel centerline. The upstream left parapet wall of the bridge is leaning into the pool at an approximate angle of 5 degrees from the vertical.	

GATED SPILLWAY

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

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/ SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	U.S.G.S. gage on upstream right embankment has been discontinued. The corrugated metal gage well is abandoned.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENTATIONS
SLOPES	Reservoir slopes are moderately steep to a level of approximately 15-20 feet above lake level in the reach between Ravine Drive and the lake crossing at State Route 34. There is no shoreline protection, the Route 34 bridge has ample clearances hydraulically and is not a hydraulic constraint. Upstream of Route 34, the lake rim is sparsely developed with residences on higher ground; the reservoir rim slopes range from flat to moderately steep.	
SEDIMENTATION	Some sedimentation is evident at the upstream end of the reservoir. The frequent use of the low level outlet(s) had apparently reduced the siltation adjacent to the dam.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	There are no immediate obstructions to stream flow but the tailwater level at PMF or one half PMF levels could be controlled by the capacity of a triple 10-foot diameter corrugated plate arch culvert. The tidal flat is bounded on the left by moderately steep banks and on the right by steeper (1H on 2 or 3V) slopes, passing under a very high railroad embankment formerly part of the New York and Long Branch system. The flood plain tailwater levels are also in part affected by the discharges of Matawan Lake Dam on a tributary of Matawan Creek, named Gravelly Brook, that discharges into the tidal flat between Lake Lefferts Dam and the railroad embankment.	
SLOPES	The downstream channel has low banks and meanders in a very wide (700 feet or more) tidal flat.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	There is some development on the right downstream channel bank, approximately at the level of the top of dam including an apartment house with approximately 30 units. Because of its elevation, the apartment house would not be endangered by an overtopping event.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not fully defined from available drawings. Embankment has been modified several times.
REGIONAL VICINITY MAP	Available.
CONSTRUCTION HISTORY	Extensive data in N.J. Department of Environmental Protection is episodic and disjointed. No coherent concise account of the construction history is available.
TYPICAL SECTIONS OF DAM	Not available.
HYDROLOGIC/HYDRAULIC DATA	U.S.G.S. gage at dam has been discontinued, period of record is 1932 to 1955.
OUTLETS - PLAN - DETAILS	Available plans do not reflect current installation for one of the two outlets.
- CONSTRAINTS - DISCHARGE RATINGS	Information available in N.J. Department of Environmental Protection.
RAINFALL / RESERVOIR RECORDS	None in immediate vicinity of dam.

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

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available, foundation conditions noted in construction inspection data in N.J. Department of Environmental Protection.
DESIGN COMPUTATIONS	None available.
HYDROLOGY & HYDRAULICS	Basis for original spillway capacity is in NJ-DEP files.
DAM STABILITY	None available.
SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	Topographic mapping of area downstream of dam made in 1968 in connection with improvements to channel downstream of spillway bridge.
BORROW SOURCES	Unknown.
SPILLWAY PLAN - SECTIONS - DETAILS	Original construction plans available; additional data on proposed crest raisings and lowerings are in files of N.J. Dept. of Environmental Protection. Actual crest varies somewhat from descriptions in NJ-DEP files.

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

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	Original installation plans available for outlets. Does not correspond to actual observed installation.
MONITORING SYSTEMS	None observed.
MODIFICATIONS	Lefferts Dam has been repeatedly modified and repaired. The embankment was rebuilt in 1944 and 1955. The 1955 repairs and modifications are not documented. The spillway crest has been repeatedly modified.
HIGH POOL RECORDS	Available from U.S.G.S. gage data for years 1932 to 1955.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	No formal reports. Some memorandum data available in files of Department of Environmental Protection.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	Memorandums on washouts occurring in 1944 and 1955 are in NJ-DEP files. No formal reports uncovered.
MAINTENANCE OPERATION RECORDS	None uncovered.

APPENDIX B

PHOTOGRAPHS

PHOTOGRAPHS TAKEN DURING MAY 1978

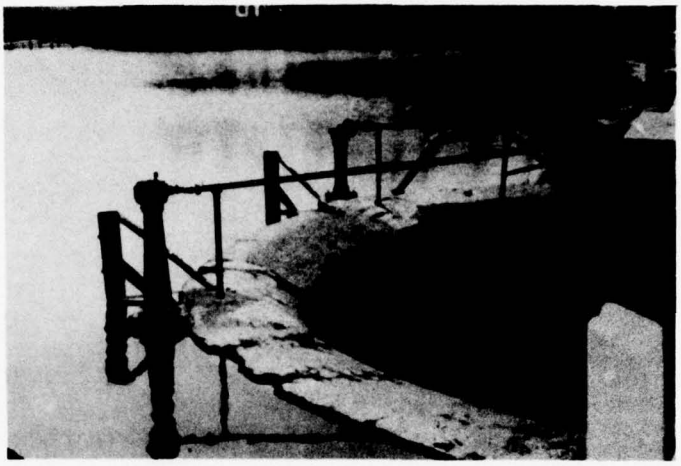


Photo 1 - View of semi-circular concrete spillway weir abutting the reinforced concrete spillway bridge structure over Matawan Creek; the low level outlets are operated by crank extensions from the side walk (see Photo 5)

Photo 2 - View of the concrete spillway and one of two low level outlets

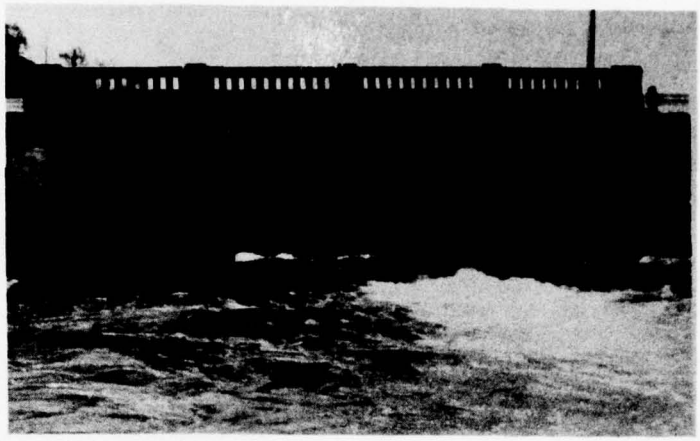


Photo 3 - View of the downstream face of the spillway bridge over Matawan Creek; the concrete spillway is in back; the right low level outlet is fully open; discharging water strikes the left bridge abutment before continuing downstream;Matawan Creek is tidal and the picture was taken near high tide

Photo 4 - Left bridge abutment, at low tide, low level outlets closed; showing timber pile supported downstream retaining wall

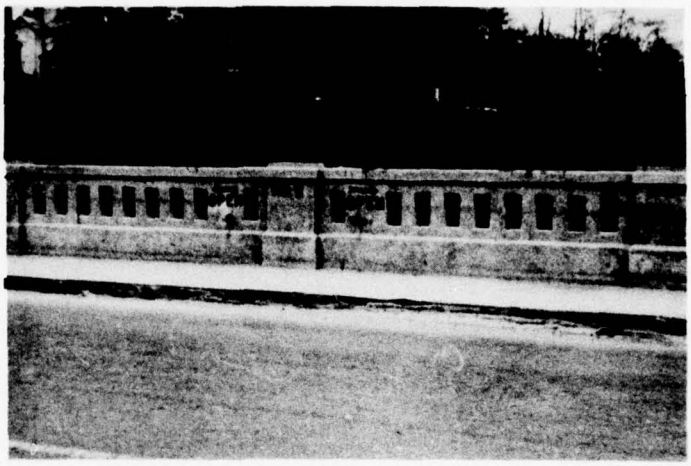


Photo 5 - View of the upstream spillway bridge railing, where the low level outlet gate crank extensions pass through

Photo 6 - Upstream view of the left abutment embankment and upstream timber sheeting

Photo 7 - View of the left upstream face of the abutment and embankment looking toward the right abutment

Photo 8 - View of the right upstream face of the embankment and right abutment

Photo 9 - View of the roadway forming the dam crest, looking toward the left abutment; the guardrail on the downstream face has moved with the timber pile supported downstream retaining wall; the roadway paving has cracks paralleling the dam axis, also indicating downstream movement

Photo 10 - Downstream face of the left embankment retaining wall showing the deflected portion of the wall in the background; note the poor drainage at the base of the wall

Photo 11 - View of the downstream timber pile supported retaining wall on the left abutment, looking toward the spillway

Photo 12 - Close-up of the downstream timber pile supported retaining wall; the wood structure visible at the top of the wall is a roadway drainage trough

Photo 13 - Downstream face of the right abutment embankment

Photo 14 - Timber wingwall connecting the concrete bridge to the right abutment embankment

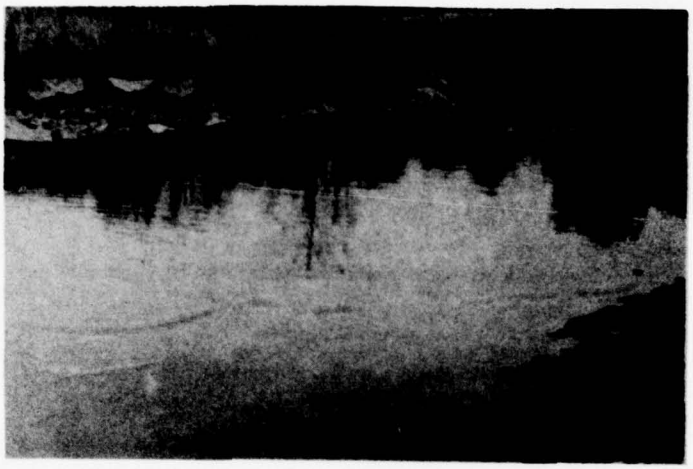


Photo 15 - Downstream channel adjacent to the bridge; channel bottom and sides have been protected by grouted riprap armoring; photo taken at low tide, no flow over spillway

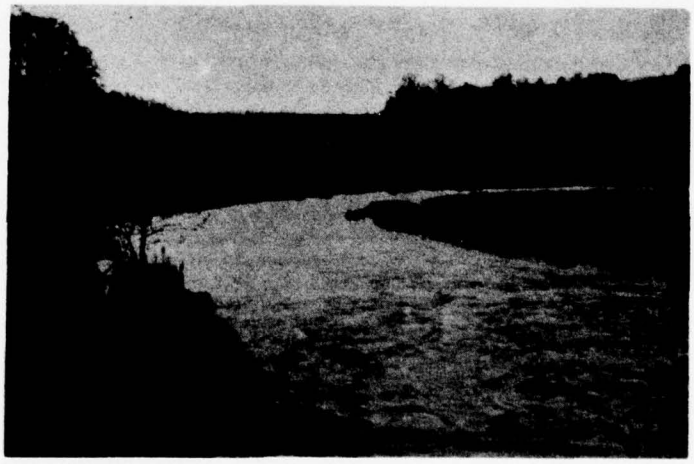


Photo 16 - Downstream channel of Matawan Creek, taken near high tide with the right low level outlet fully open; end of channel riprap is visible on the left

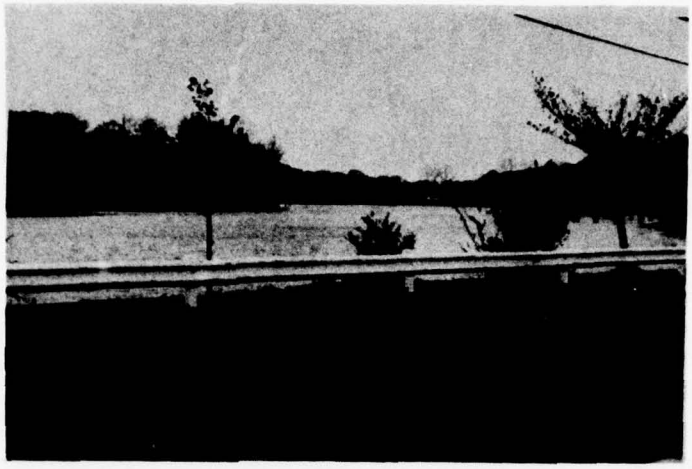


Photo 17 - View of Lake Lefferts, looking upstream from the roadway embankment

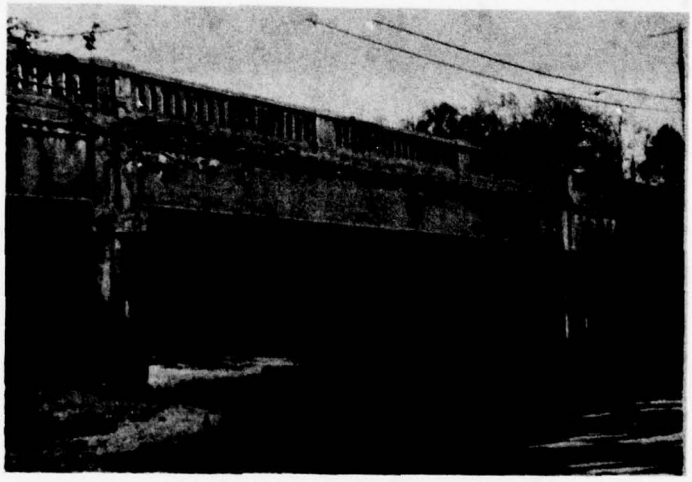


Photo 18 - State Route 34 crossing Lake Lefferts. 2,500 ft. upstream of dam embankment at Ravine Drive

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: LAKE LEFFERTS DAM

Drainage Area Characteristics: 6.1 square miles

Elevation Top Normal Pool (Storage Capacity): 14.40 (1450 AF)

Elevation Top Flood Control Pool (Storage Capacity): NA

Elevation Maximum Design Pool: 16.5 ±

Elevation Top Dam: 16.5

SPILLWAY CREST:

a. Elevation 14.40
b. Type Uncontrolled concrete overflow board crest weir
c. Width 2 ft. - 8.5 inches
d. Length 38 feet approximately
e. Location Spillover Center of dam
f. No. and Type of Gates None

OUTLET WORK:

a. Type One 30-inch dia. and one 24-inch dia.
b. Location Spillway
c. Entrance Inverts 3.25
d. Exit Inverts 3.25
e. Emergency Draindown Facilities None

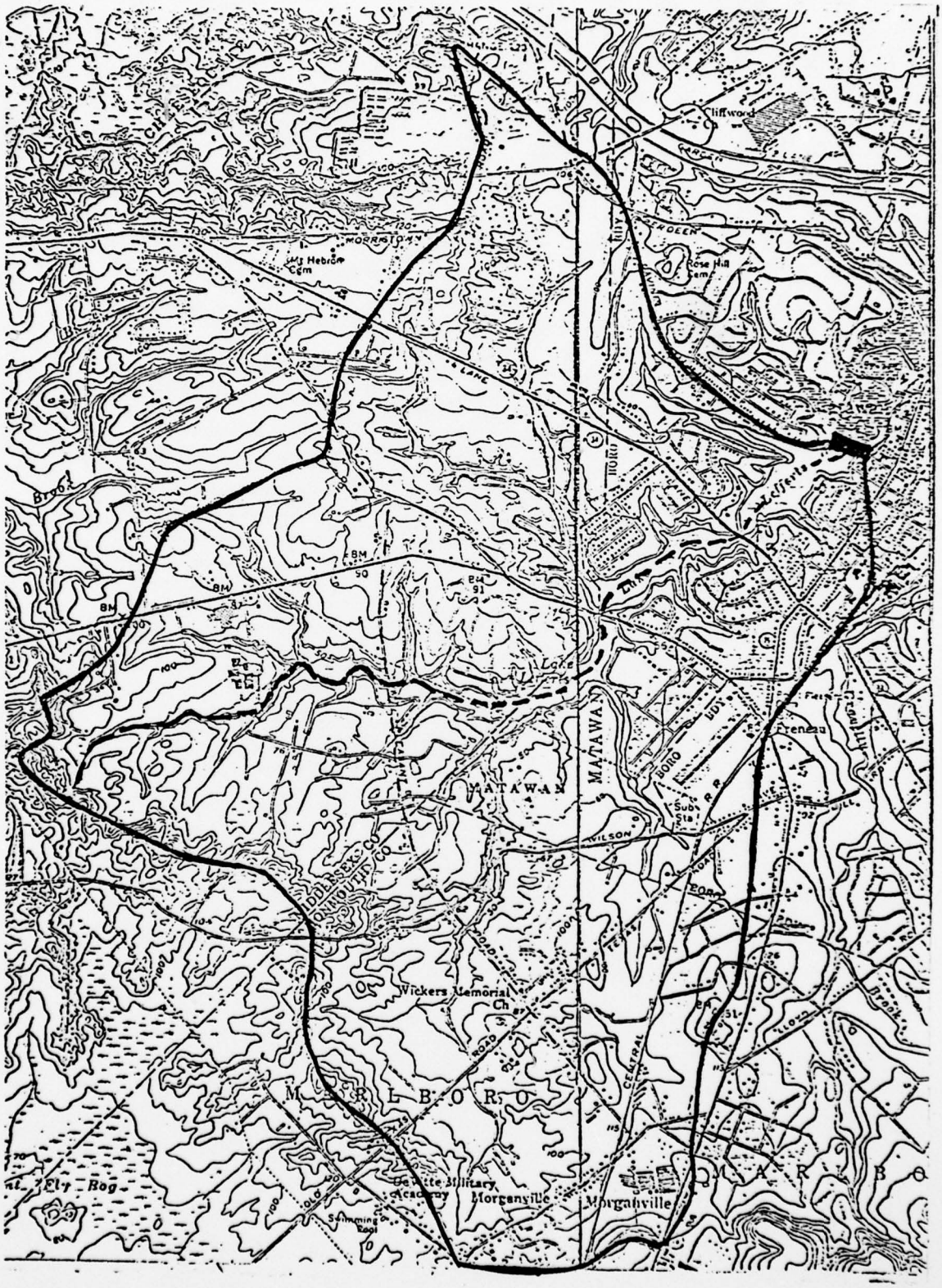
HYDROMETEOROLOGICAL GAGES:

a. Type U.S.G.S. gage Matawan Creek at Lake Lefferts
b. Location Right abutment
c. Records 1932 to 1955 (discontinued)

MAXIMUM NON-DAMAGING DISCHARGE Approximately 750 cfs (dam overtopped)

APPENDIX D

HYDROLOGIC COMPUTATIONS



LAKE LEFFERTS DAM
DRAINAGE BASIN

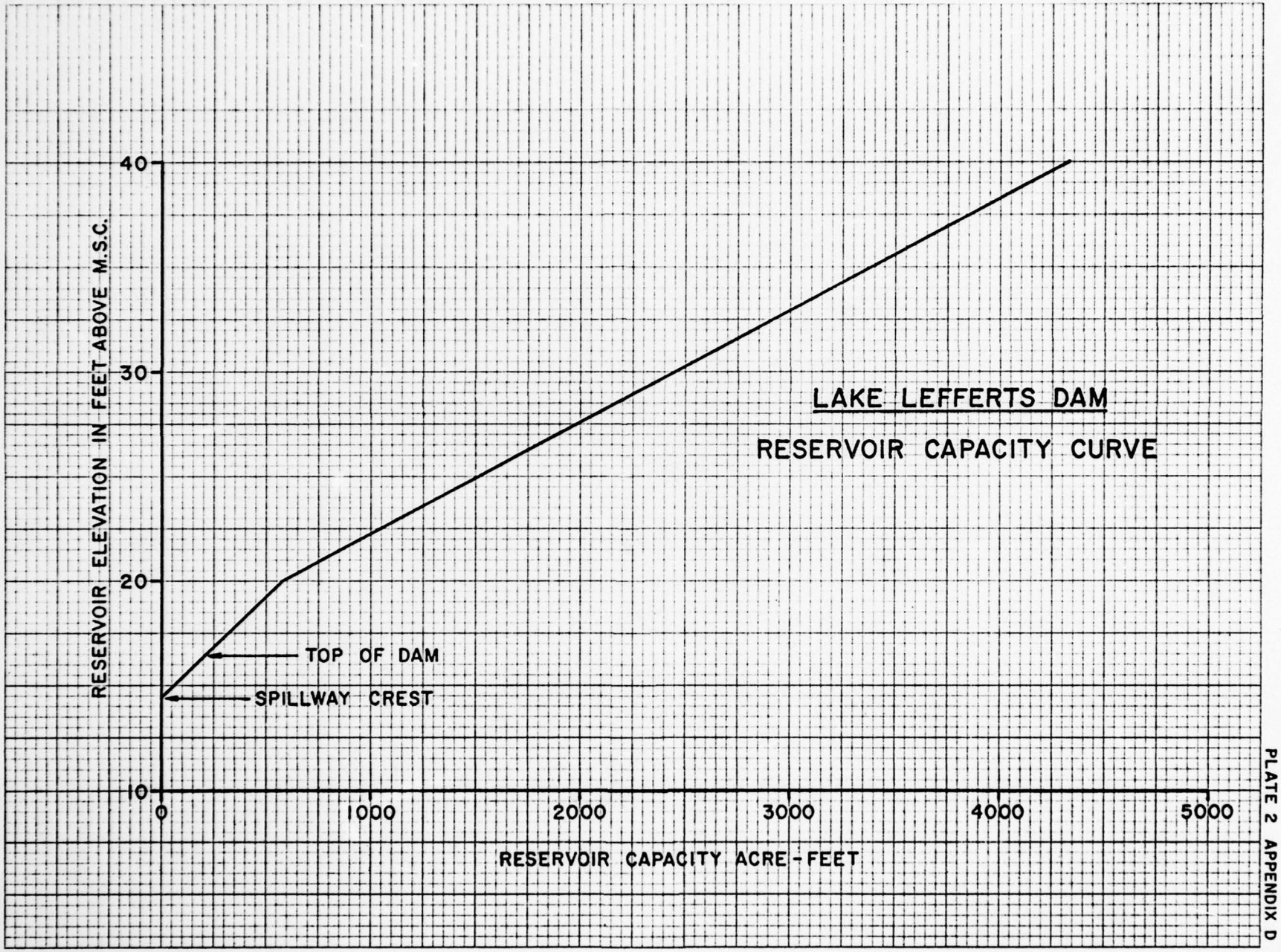


PLATE 2 APPENDIX D

2.

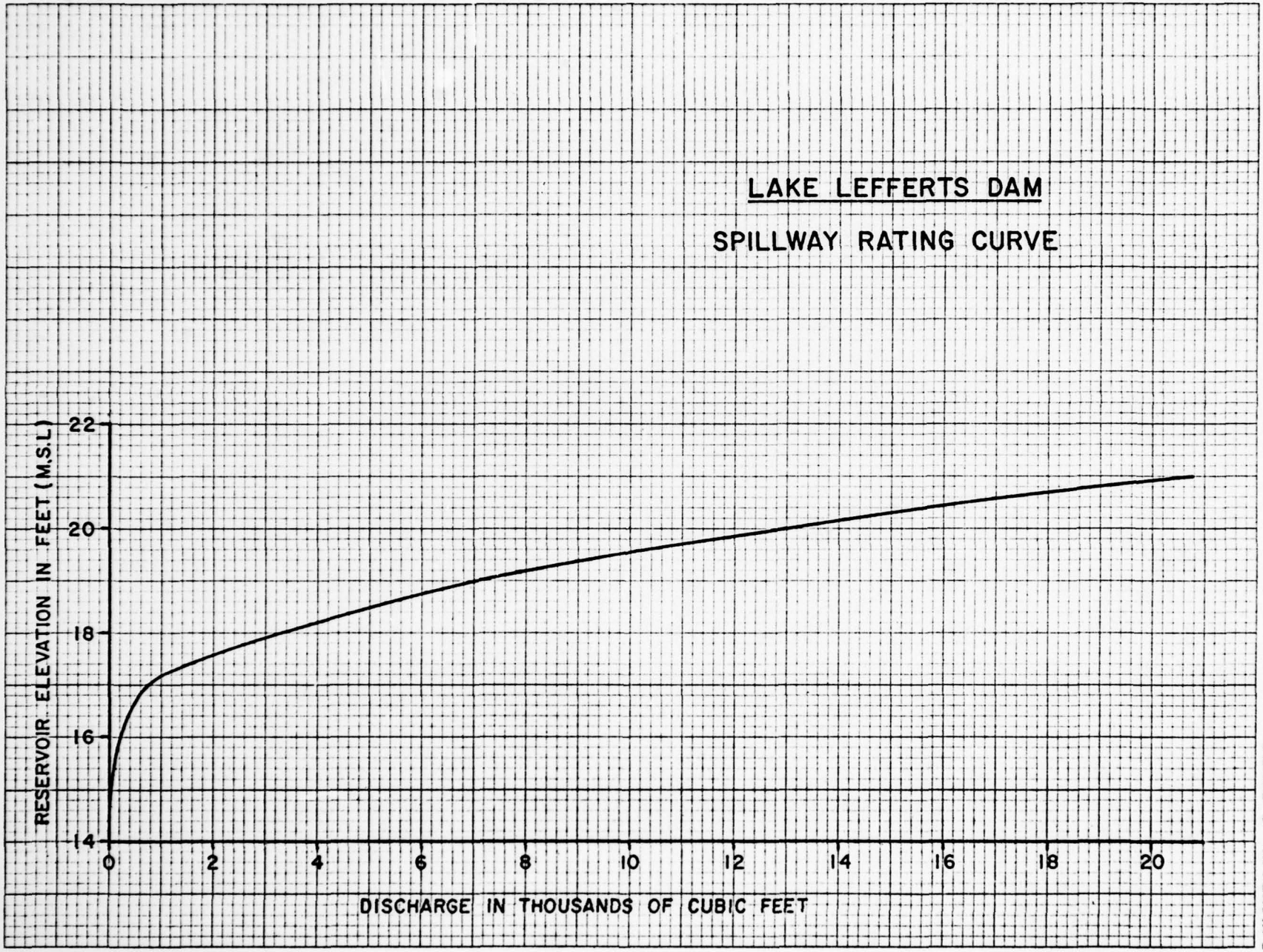


PLATE 3 APPENDIX D

HYDROLOGIC COMPUTATIONS

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N. J. Dam Inspection SHEET NO. 1 OF
Lake Lefferts JOB NO. 10-924
COMPUTED BY S.B CHECKED BY DATE Aug. 1978

Lake Lefferts Dam

1. D. A = 6.1 Sq Mile
2. zone = 6

6 hour 10 sq mile probable Max ppt = 26"
Reduction suggested by COE = 20 %
PMP = 20.8"

3. (a) Using figure 16 of "Design of Small Dams", obtain PMP for area of 6.1 sq miles for various duration

Duration Hrs	% of 10 sq mile 6 hr. value	Total PMP inches	Increamental PMP (inches)
0-6	100	20.8	20.8
0-12	108	22.5	1.7
0-24	117	24.3	1.8
0-48	127	26.4	2.1

(b) Hourly PMP 6 hour period (by % values of curve for zone e figure 18 (Design of Small Dams)

Time hrs	% of 6 hr PMP	Acc. PMP inches	Increamental PMP inches.
1	49	10.2	10.2
2	64	13.3	3.1
3	75	15.6	2.3
4	84	17.5	1.9
5	92	19.1	1.6
6	100	20.8	1.7

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Lake Lefferts
COMPUTED BY S.B CHECKED BY

SHEET NO. 2 OF
JOB NO. 10-924
DATE Aug, 1978

(c) 15 Min. PMP 1-hr. period (by % values of curve for zone c)

Time in Min	% of 1 hr. value	Acc. PMP	Incr. PMP
15	48	4.9	4.9
30	71	7.2	2.3
45	88	9.0	1.8
60	100	10.2	1.2

(d) PMP Design Arrangements

Time Ending	Incr. PMP	Acc. PMP	Direct Runoff Acc. PMF*	Incr. PMF	Adjust① PMF
1 hr	1.7	1.7	0.4	.4	.4
2 hr	1.9	3.6	1.7	1.3	1.3
3 hr.	3.1	6.7	4.4	2.7	2.7
15 min	1.8	8.5	6.1	1.7	1.7
30 min	4.9	13.4	10.8	4.7	4.7
45 min	2.3	15.7	13.1	2.3	2.2
4 hr	1.2	16.9	14.2	1.1	1.1
5 hr	2.3	19.2	16.5	2.3	2.2 ✓
6 hr	1.6	20.8	18.1	1.6	1.5 ✓
12 hr	1.7	22.5	19.8	1.7	1.6 ✓
24 hr	1.8	24.3	21.5	1.7	1.7
48 hr	2.1	26.4	23.6	2.1	2.0

① PMF is distributed for 15 min duration in HEC1

* Using Soil Group C & AMC II CN=80 Q = PMF, P = PMP

$$CN = \frac{1000}{10+S} \qquad S = 2.5$$

$$Q = \frac{(P-0.2S)^2}{P+0.8S} \quad \text{or,} \quad Q = \frac{(P-.5)^2}{P+2}$$

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Lake Lefferts
COMPUTED BY S.B. CHECKED BY

SHEET No. 3 OF
JOB No. 10-924
DATE Aug. 1978

(

(1) In the previous page the PMF is adjusted considering the minimum loss in the following rate

a) 1.4 inch/hr during and upto peak intensity of upto 4 hrs.

b) 0.1 inch/hr upto 6 hrs.

c) 0.1 inch/6 hr upto 12 hrs.

d) 0.1 inch/12 hrs upto 24 hrs.

e) 0.1 inch/24 hrs upto 48 hrs.

(

(

(

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Instruction
Lake Lefferts

SHEET No. 4 OF
JOB No. 10-924
DATE Aug. 1978

COMPUTED BY CHECKED BY

Time of Concentration

By California Highway Dept method

$$T_c = \left(\frac{11.9\ L^3}{H}\right)^{0.385}$$

Where T_c = Time of Concentration
L = Length of the longest watercourse in miles
H = Drop in height (Diff. in elevation)

Length = 19,200 ft = 3.64 miles

$H = 110 - 14.4 = 95.6$ ft

$$T_c = \left(\frac{11.9 \times (3.64)^3}{95.6}\right)^{0.385}$$

$= 1.99 \approx 2$ hrs.

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Lake Letherts

COMPUTED BY _____ CHECKED BY _____

SHEET No. 5 OF ...
JOB No. 10-924
DATE Aug, 1972

DEVELOPE UHG

$\Delta D = 0.133\ Tc = 0.133 \times 2.00 = .27$ hrs

Take 0.25 hrs or, 15 Min.

$$Tp = \frac{\Delta D}{2} + (0.6 \times Tc)$$

$$= \frac{.25}{2} + (0.6 \times 2.06) = 1.36$$

$$q_p = \frac{484\ A\ Q}{Tp} = \frac{484 \times 6.1 \times 1}{1.36} = 2171\ cfs$$

Computation of coordinates of curvilinear UHG

See next page (page 6)

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

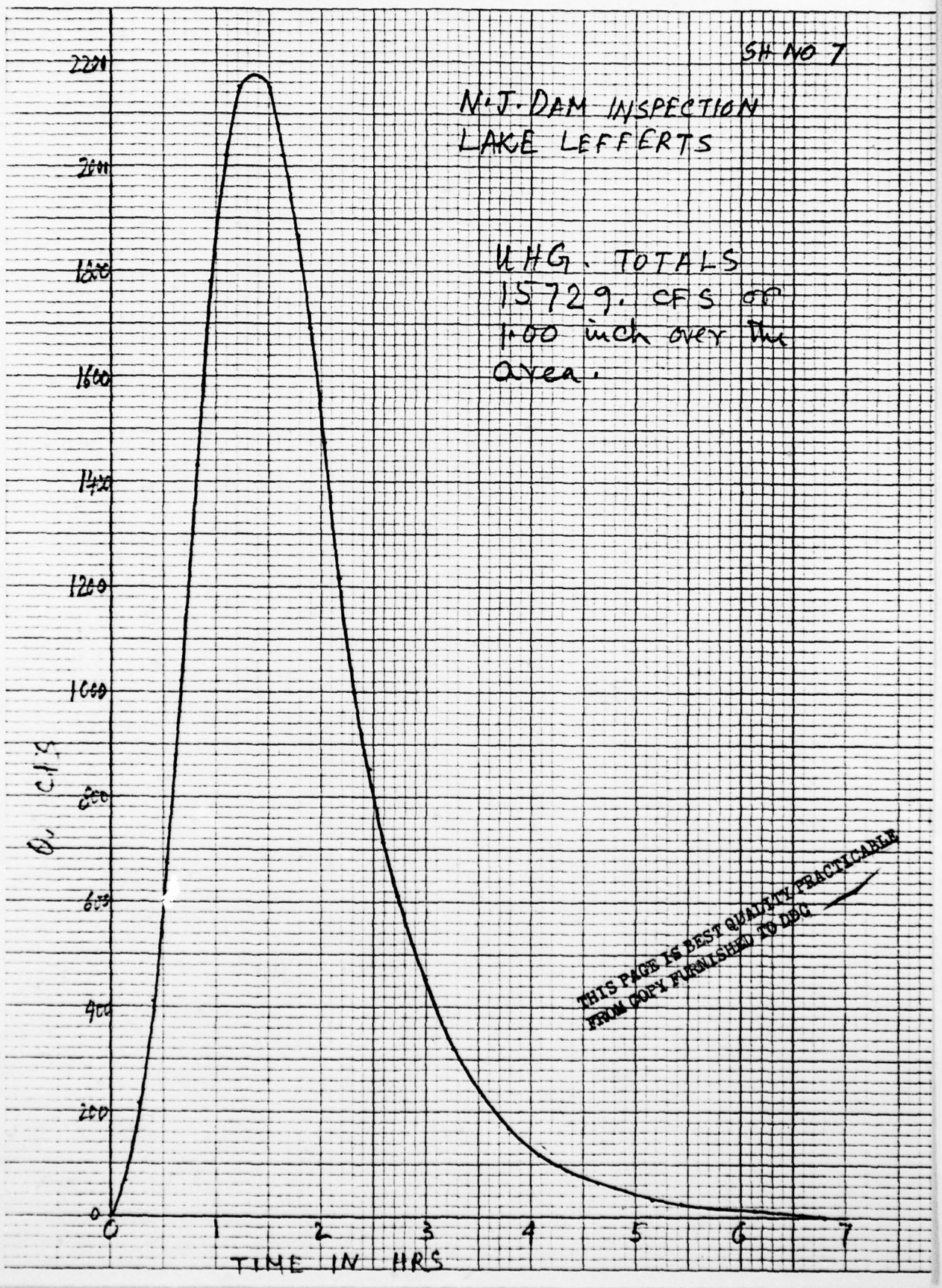
SUBJECT N.J. Dam Inspection
COMPUTED BY S.B. CHECKED BY
SHEET No. 6 OF
JOB No. 10-924
DATE Aug. 1972

Time Ratios t/Tp (1)	Time (1)×1.36 (2)	Discharge ratios q/qp (3)	Discharge (3)×2171 (4)
0	0	0	0
.1	.14	.03	65
.2	.27	.1	217
.3	.41	.19	412
.4	.54	.31	673
.5	.68	.47	1020
.6	.82	.66	1433
.7	.95	.82	1780
.8	1.09	.93	2019
.9	1.22	.99	2149
1.0	1.36	1.0	2171
1.1	1.50	.99	2149
1.2	1.63	.93	2019
1.3	1.77	.86	1867
1.4	1.90	.78	1693
1.5	2.04	.68	1476
1.6	2.17	.56	1216
1.7	2.31	.46	999
1.8	2.44	.39	847
1.9	2.58	.33	716
2.0	2.72	.28	608
2.2	2.99	.207	449
2.4	3.26	.147	319
2.6	3.54	.107	232
2.8	3.81	.077	167
3.0	4.08	.055	119
3.2	4.35	.04	87
3.4	4.62	.029	63
3.6	4.90	.021	46
3.8	5.17	.015	33
4.0	5.44	.011	24
4.5	6.12	.005	11
5.0	6.8	0	0

SH NO 7

N.J. DAM INSPECTION
LAKE LEFFERTS

U.H.G. TOTALS
1572 9. CFS OF
1.00 inch over the
area.



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Lake Lefferts
COMPUTED BY S.B. CHECKED BY

SHEET No. 8 OF
JOB No. U-924
DATE Aug, 1972

Unit Hydrograph Ordinates at 15 min. Interval Used in HEC 1

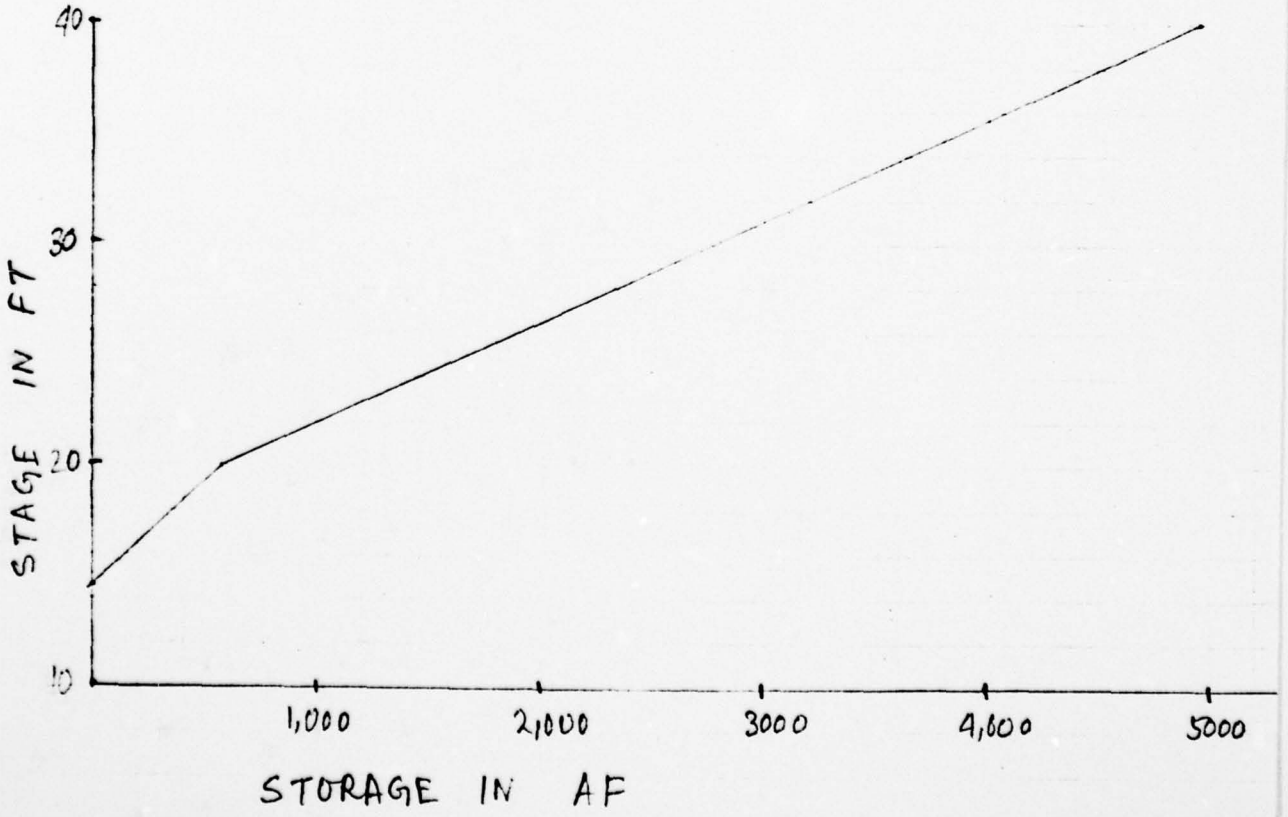
End of period	time	Discharge
1	15 min	170
2	30 min	560
3	45 min	1220
4	1 hr	1880
5	15 min	2171
6	30 min	2155
7	45 min	1900
8	2 hr	1500
9	15 min	1080
10	30 min	790
11	45 min	600
12	3 hr	445
13	15 min	330
14	30 min	245
15	45 min	180
16	4 hr.	130
17	15 min	100
18	30 min	75
19	45 min	60
20	5 hr	44
21	15 min	25
22	30 min	21
23	45 min	18
24	6 hr	15
25	15 min	10
26	30 min	5
27	45 min	0

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Lake Le Herts Dam
COMPUTED BY S.B CHECKED BY

SHEET No. 9 OF
JOB No. 10-924
DATE Aug, 1978

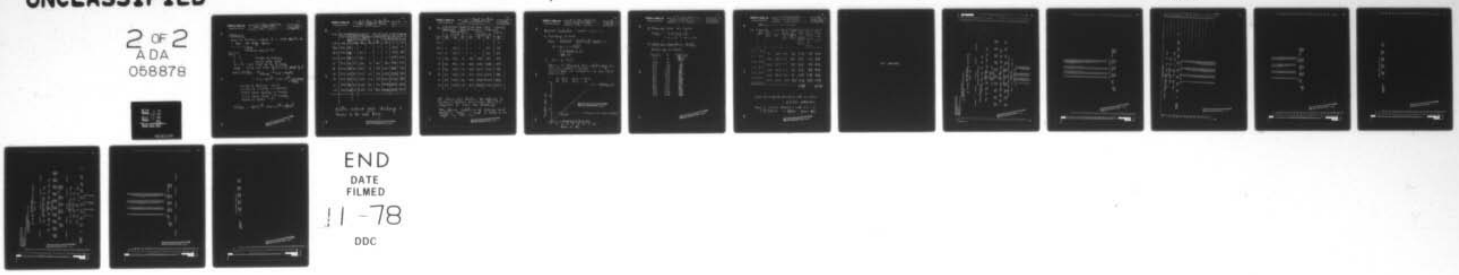
Pool level	Plan Reading	Area	Storage (incremental)	Storage
14.4	.82	$\frac{.82 \times 4 \times 10^6}{43,560}$ = 75.3 AC	0	0
20	1.47	$\frac{1.47 \times 4 \times 10^6}{43,560}$ = 135.0 AC	$\frac{75.3+135}{2} \times 5.6$ = 589 AF	589
40	3.26	$\frac{3.26 \times 4 \times 10^6}{43,560}$ = 299.4	$\frac{135+299.4}{2} \times 20$ = 4344 AF	4933



AD-A058 878 HARRIS ECI ASSOCIATES WOODBRIDGE NJ F/G 13/2
NATIONAL DAM SAFETY PROGRAM. LAKE LEFFERTS DAM (NJ00089). RARIT--ETC(U)
JUL 78 R GERSHOWITZ DACW61-78-C-0100

UNCLASSIFIED NL

2 OF 2
ADA
058878



END
DATE
FILMED
11-78
DDC

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

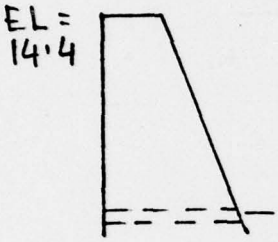
SUBJECT N. J. Dam Inspection
Lake Lefferts Dam
COMPUTED BY S.B CHECKED BY

SHEET NO. 10 OF
JOB NO. 10-924
DATE Aug, 1978

Spillway

From the previous reports it is seen that the ga is open at high flow.

— — — — Road
(Minimum Road El = 16.4



Length of roadway varies with dipth

Gate = 24" ϕ and 30" ϕ = $\frac{\pi}{4}(2^2+2.5^2) = 8.05$ sq ft

Total Outflow = $O_{spillway} + O_{road} + O_{gate}$

$= 3.3 \times 38\, H^{3/2} + 2.65\, L\, h^{3/2} + 0.9 + 8.05 \times \sqrt{2gh_o}$

Length of Spillway = 38 Ft
Length of roadway = L (varies)
Hight above spillway = H (varies)
Hight above Road = h (varies)
Head of gate = O

$$\text{Outflow} = 125.4\, H^{3/2} + 2.65\, L\, h^{3/2} + 58\, h_o^{\frac{1}{2}}$$

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N. J. Dam Inspection
Lake Lefferts Dam
COMPUTED BY S.B. CHECKED BY
SHEET No. 11 OF
JOB No.
DATE

W.L (1)	Ht at Gate (2)	Gate disch $58 L h^{1/2}$ (3)	H at spill-way H (4)	Disch at spill $125.4 H^{3/2}$ (5)	Ht above Rd h (6)	Length of Road L (7)	Disch over rd. $2.65 L h^{3/2}$ 8	Total Outflow (3)+(5)+(8) 9	Storage A Ft (curve 10
14.4	10.75	191	-	-	-	-	-	242	0
15.4	11.75	198	1	125	-	-	-	379	105
16.4	12.75	208	2	355	-	-	-	619	210
17	13.35	211	2.6	526	.6	165	203	999	273
18	14.35	219	3.6	857	1.6	472	2531	3668	379
19	15.35	227	4.6	1,237	2.6	520	5,777	7,304	383
20	16.35	235	5.6	1,662	3.6	625	11,313	13,274	589
21	17.35	241	6.6	2,126	4.6	713	18,641	21,075	806
22	18.35	248	7.5	2,627	5.6	802	28,164	31,108	1023

Outflow without gate discharge is shown in the next page.

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Flood Ins. Study
Lake Lefferts Dam

COMPUTED BY S.B CHECKED BY

SHEET NO. 11 A OF
JOB NO. 10-924
DATE Aug, 1978

W.L	Ht. at Spillway H	Disch. at Spillway $125.4 H^{3/2}$	Hight above Road h	Length of Road L	Disch. over Road $2.65 L h^{3/2}$	Total out flow ③ + ⑥	Storage AF (Curve)
①	②	③	④	⑤	⑥	⑦	⑧
14.4	-	-	-	-	-	-	0
15.4	1	125	-	-	-	125	105
16.4	2	355	-	-	-	355	210
17	2.6	526	.6	165	203	729	273
18	3.6	857	1.6	472	2,531	3,388	379
19	4.6	1,237	2.6	520	5,777	7,014	383
20	5.6	1,662	3.6	625	11,313	12,975	589
21	6.6	2,126	4.6	713	18,641	20,767	806
22	7.6	2,627	5.6	802	28,164	30,791	1023

At higher pool elevation the capacity of bridge (pressure flow + wier flow) is adequate to pass the discharge)

The above relations of storage and outflow curve is used in HEC 2 as Reqd. by COE, Phila.

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Lake Lefferts Dam
COMPUTED BY S.B CHECKED BY

SHEET NO. 12 OF
JOB NO. D-924
DATE Aug, 78

Reservoir Evaluation - Drawdown calculation

a) Discharge Vs Head

Gate = 24" and 30" = $\frac{\pi}{4}(2^2+2.5^2) = 8.05$ sq. ft

$Q = C_d \times A \times \sqrt{2gh}$

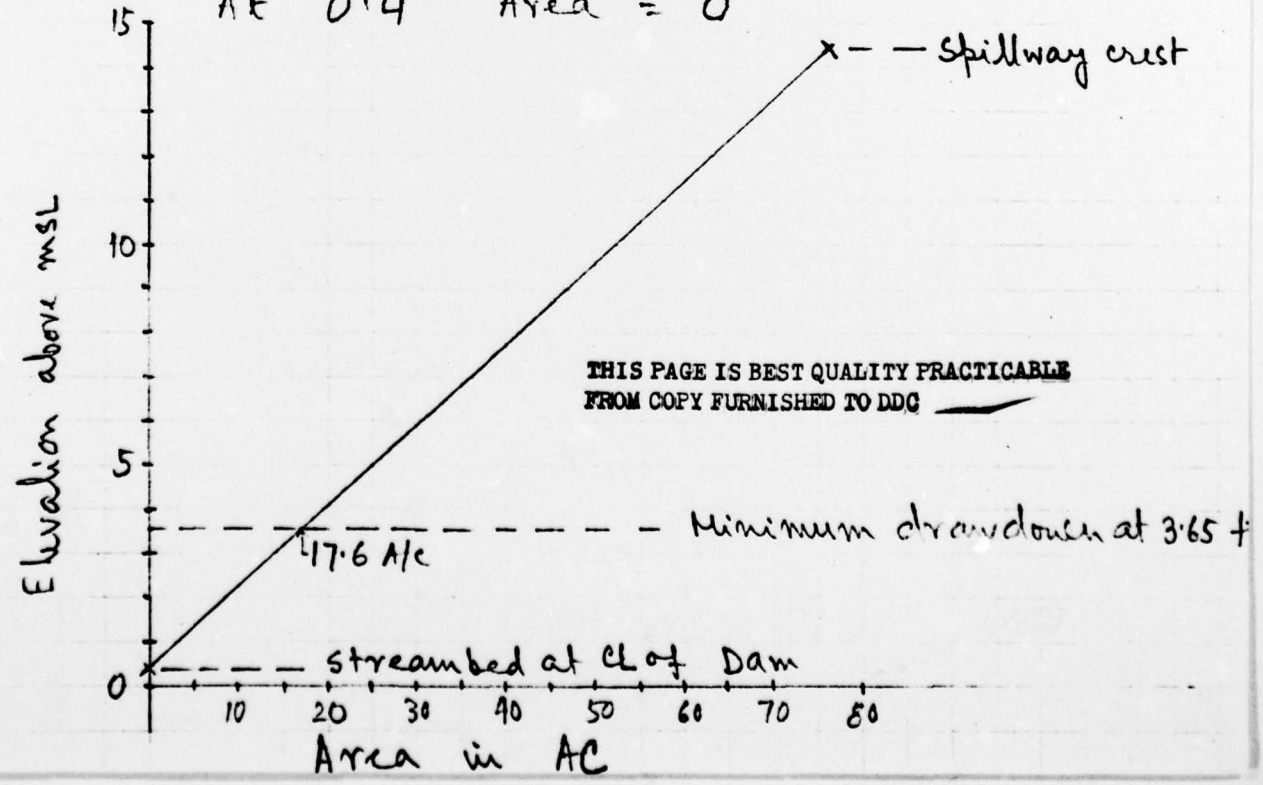
$= 0.9 \times 10.25 \times 8\sqrt{h}$

$= 58\sqrt{h}$

b) Area Vs. Head.

Assume a straight line relationship from normal water surface ... ft
Streambed at centerline of dam (El: 0.4 estimated)

At 14.4 Area = 75.3
At 0.4 Area = 0



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Lake Lefferts Dam
COMPUTED BY S.B. CHECKED BY

SHEET No. 13 OF
JOB No. 16-924
DATE Aug, 78

c) Drainage area = 6.1 sq mi

Inflow = 2 cfs / sq miles
= 2 × 6.1 = 12.1 cfs

d) Reservoir drawdown study

discharge Vs Head

Elevation (ft)	h ft	Discharge $58\sqrt{h}$ (cfs)
3.65	0	0
4.0	.35	34
5.0	1.35	67
6.0	2.35	89
7.0	3.35	106
8.0	4.35	121
9.0	5.35	134
10.0	6.35	146
11.0	7.35	157
12.0	8.35	167
13.0	9.35	177
14.0	10.35	187
14.4	10.75	190

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Lake Le Herts Dam
COMPUTED BY S.B. CHECKED BY

SHEET No. 14 OF
JOB No. 12-924
DATE Aug, 1978

DRAWDOWN TIME COMPUTATIONS

EL	Area (AC)	Av. Area (AC)	Vol (AF)	Head on Outlet ↑ (Ft)	Outlet Q $58\sqrt{h}$ (cfs)	Time to draw t_1 $\frac{Vol \times 24}{1.98 \times Q}$ (hrs)	Time to draw 2 cfs/SM $\frac{12.2 \times t_1}{Q}$ t_2 (hrs)	Total time t_1+t_2 (hrs)
14.4	75.3							
		70	140.0	9.75	181	9.37	.63	10.00
12.4	64.6							
		59.2	118.4	7.75	161	8.91	.67	9.58
10.4	53.8							
		48.5	97.0	5.75	139	8.46	.74	9.20
8.4	43.1							
		37.7	75.4	3.75	112	8.16	.89	9.05
6.4	32.3							
		27.0	54.0	1.75	77	8.50	1.35	9.85
4.4	21.6							
		19.6	39.2	.375	355	13.38	4.59	17.97
3.65	17.6							
						56.78		65.65

Time of complete drawdown with no inflow
= 57 hrs = 2 days 9 hr

Time of complete drawdown with inflow of
2 cfs / sq mile = 66 hrs = 2 days 18 hrs

HEC-1 COMPUTATIONS

```
**********
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
**********
```

N.J. DAM INSPECTION
DETERMINE INFLOW HYDROGRAPH FOR PMP
LAKE LAFFERTS DAM

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
50	0	15	0	0	0	0	2	0	0

JOPER	NWT
3	0

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

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH FOR PMP

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	0	0	1	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	6.10	0.0	6.10	0.0	0.0	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
30	0.0	0.0	0.0

PRECIP PATTERN

0.10	0.10	0.10	0.10	0.30	0.30	0.40	0.60	0.70
0.70	0.70	1.70	4.70	2.20	1.10	0.60	0.60	0.50	0.50
0.40	0.40	0.40	0.30	0.07	0.07	0.07	0.07	0.07	0.07

LOSS DATA

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

GIVEN UNIT GRAPH, NUHGO# 27

170.	560.	1220.	1880.	2171.	2155.	1900.	1500.	1080.	790.
600.	445.	330.	245.	180.	130.	100.	75.	60.	44.
25.	21.	18.	15.	10.	5.	0.			

UNIT GRAPH TOTALS 15729. CFS OR 1.00 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	0.10	0.10	17.
2	0.10	0.10	73.
3	0.10	0.10	195.
4	0.10	0.10	383.
5	0.30	0.30	634.
6	0.30	0.30	962.
7	0.30	0.30	1396.
8	0.40	0.40	1939.
9	0.60	0.60	2571.
10	0.70	0.70	3332.
11	0.70	0.70	4260.
12	0.70	0.70	5319.

13	1.70	1.70	6576.
14	4.70	4.70	8667.
15	2.20	2.20	12025.
16	1.10	1.10	16678.
17	0.60	0.60	21259.
18	0.60	0.60	23988.
19	0.50	0.50	24516.
20	0.50	0.50	23156.
21	0.40	0.40	20549.
22	0.40	0.40	17535.
23	0.40	0.40	14953.
24	0.30	0.30	12929.
25	0.07	0.07	11229.
26	0.07	0.07	9716.
27	0.07	0.07	8277.
28	0.07	0.07	6891.
29	0.07	0.07	5627.
30	0.07	0.07	4557.
31	0.0	0.0	3674.
32	0.0	0.0	2980.
33	0.0	0.0	2395.
34	0.0	0.0	1869.
35	0.0	0.0	1447.
36	0.0	0.0	1107.
37	0.0	0.0	832.
38	0.0	0.0	608.
39	0.0	0.0	434.
40	0.0	0.0	301.
41	0.0	0.0	214.
42	0.0	0.0	154.
43	0.0	0.0	110.
44	0.0	0.0	78.
45	0.0	0.0	56.
46	0.0	0.0	40.
47	0.0	0.0	28.
48	0.0	0.0	18.
49	0.0	0.0	11.
50	0.0	0.0	7.
SUM	18.22	18.22	286572.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	24516.	11303.	5731.	5731.	286569.
INCHES		17.24	18.21	18.21	18.21
AC-FT		5607.	5924.	5924.	5924.

HYDROGRAPH ROUTING

ROUTING BY MODIFIED PULS(FULL FLOW)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IHES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	2	0.0	0.0	0.0	-1.

STORAGE#	0.	105.	210.	273.	379.	383.	589.	806.	1023.	0.
OUTFLOW#	0.	125.	355.	729.	3388.	7014.	12975.	20767.	30791.	0.

TIME	EOP STOR	AVG IN	EOP OUT
1	14.	17.	17.
2	14.	17.	17.
3	14.	17.	17.
4	15.	45.	18.
5	17.	134.	21.
6	23.	289.	27.
7	33.	509.	39.
8	48.	798.	57.
9	71.	1179.	84.
10	103.	1667.	123.
11	146.	2255.	215.
12	202.	2951.	337.
13	269.	3796.	707.
14	337.	4790.	2330.
15	381.	5948.	5280.
16	405.	7621.	7650.
17	448.	10346.	8891.
18	535.	14352.	11404.
19	652.	18969.	15222.
20	763.	22623.	19227.
21	836.	24252.	22175.
22	860.	23836.	23248.
23	840.	21853.	22347.
24	793.	19042.	20302.
25	732.	16244.	18106.
26	669.	13941.	15852.
27	612.	12079.	13810.
28	560.	10472.	12149.
29	510.	8996.	10698.

30	461.	7584.	9265.			
31	413.	6259.	7881.			
32	381.	5092.	5379.			
33	376.	4116.	3322.			
34	376.	3327.	3324.			
35	366.	2688.	3062.			
36	351.	2132.	2679.			
37	334.	1658.	2259.			
38	318.	1277.	1855.			
39	303.	970.	1490.			
40	291.	720.	1173.			
41	280.	521.	905.			
42	271.	368.	716.			
43	262.	258.	663.			
44	253.	184.	608.			
45	243.	132.	553.			
46	234.	94.	500.			
47	226.	67.	450.			
48	218.	48.	403.			
49	211.	34.	361.			
50	204.	23.	342.			
SUM			277558.			

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	23248.	11077.	5551.	5551.	277558.
INCHES		16.89	17.64	17.64	17.64
AC-FT		5496.	5738.	5738.	5738.

RUNOFF SUMMARY, AVERAGE FLOW

HYDROGRAPH AT		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
ROUTED TO						
	2	24516.	11303.	5731.	5731.	6.10
	4	23248.	11077.	5551.	5551.	6.10

****
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
****

N.J. DAM INSPECTION
ROUTING BY MODIFIED PULLS (HALF OF PMF)
LAKE LAFFERTS DAM

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
40	0	15	0	0	0	0	0	0	0

JOPER	NWT
3	0

****

SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	6.10	0.0	6.10	0.0	0.0	0	0	0

INPUT HYDROGRAPH

9.	37.	98.	192.	317.	481.	698.	970.	1286.	1666.
2130.	2660.	3288.	4334.	6013.	8339.	10630.	11994.	12258.	11578.
10275.	8768.	7477.	6465.	5615.	4858.	4139.	3446.	2814.	2279.
1837.	1490.	1197.	935.	724.	554.	416.	304.	217.	151.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12258.	5652.	3573.	3573.	142939.
INCHES		8.62	9.08	9.08	9.08
AC-FT		2804.	2955.	2955.	2955.

****

HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	2	0.0	0.0	0.0	-1.

STORAGE#	0.	105.	210.	273.	379.	383.	589.	806.	1023.	0.
OUTFLOW#	0.	125.	355.	729.	3388.	7014.	12975.	20767.	30791.	0.

TIME	EOP STOR	AVG IN	EOP OUT
1	8.	9.	9.
2	8.	9.	9.
3	8.	9.	9.
4	8.	23.	9.
5	9.	68.	11.
6	12.	145.	14.
7	17.	255.	20.
8	24.	399.	29.

9	36.	590.	43.
10	52.	834.	62.
11	74.	1128.	88.
12	102.	1476.	122.
13	130.	1898.	197.
14	182.	2395.	295.
15	236.	2974.	507.
16	296.	3811.	1298.
17	359.	5174.	2893.
18	400.	7176.	7508.
19	432.	9485.	8418.
20	478.	11312.	9750.
21	515.	12126.	10844.
22	532.	11918.	11338.
23	526.	10927.	11149.
24	500.	9522.	10400.
25	464.	8123.	9352.
26	426.	6971.	8256.
27	391.	6040.	7236.
28	380.	5237.	4272.
29	380.	4499.	4681.
30	376.	3793.	3317.
31	373.	3130.	3240.
32	362.	2547.	2954.
33	347.	2058.	2585.
34	332.	1664.	2206.
35	318.	1344.	1851.
36	305.	1066.	1528.
37	293.	830.	1240.
38	284.	639.	993.
39	275.	485.	784.
40	267.	360.	695.
SUM			130211.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11338.	5337.	3255.	3255.	130211.
INCHES		8.14	8.27	8.27	8.27
AC-FT		2648.	2692.	2692.	2692.

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

RUNOFF SUMMARY, AVERAGE FLOW

HYDROGRAPH AT		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
	2	1225H.	5652.	3573.	3573.	6.10
ROUTED TO	4	11338.	5337.	3255.	3255.	6.10