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NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. DELAWARE LAKE DAM (NJ 00127) DELAW--ETC(U)
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DELAWARE RIVER BASIN
DELAWANNA CREEK, WARREN COUNTY
NEW JERSEY

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DELAWARE LAKE DAM NJ 00127

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

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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. → p 1			



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

Dear Governor Byrne:

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

Based on visual inspection, available records, calculations and past operational performance, Delaware Lake Dam, initially listed as a high hazard potential structure, but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered adequate because it will pass the 100-year spillway design flood. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. For the same reason no further studies or increase of spillway capacity are recommended. To assure continued functioning of the dam and its impoundment, the following actions could be undertaken by the owner:

- a. Repair the erosion of the upstream slope of the dam, and provide erosion protection.
- b. Evaluate seepage at the downstream toe of the dam to the right of the low-level outlet and provide remedial measures as needed.
- c. Repair the erosion of the dam embankment on either side of the low-level outlet and the discharge channel downstream from the spillway.

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Honorable Brendan T. Byrne

- d. Remove trees and brush from the dam.
- e. Provide erosion protection for the toe of the dam from water flowing in the discharge channel downstream from the spillway and low-level outlet.
- f. Repair spalled and cracked concrete spillway training walls.
- g. Backfill animal burrows on the downstream slope.
- h. Remove the outhouse from the dam and oversee excavation and backfilling of resulting excavation with suitable material.
- i. Remove obstructions from the discharge channel downstream from spillway.
- j. Start a program of periodically checking the condition of the dam and monitor the seepage to the right of the low-level outlet.
- k. Control trespassing on the dam.
- l. Clear trees and brush for 25 feet on either side of the spillway discharge channel for 100 feet downstream from the end of the spillway and also 100 feet downstream of the low-level outlet or to the property line whichever is the lesser distance and maintain the area clear of brush.
- m. Replace the ladder rungs in the valve box. If this is not possible, remove them completely and provide other access to the gate valve as desired.
- n. Develop written operating procedures and a periodic maintenance plan.

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 Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

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

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Honorable Brendan T. Byrne

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

Sincerely,



ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

Incl

As stated

Copies furnished:

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

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

DELAWARE LAKE DAM (NJ00127)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 22 April 1981 by Anderson-Nichols and Co. Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Delaware Lake Dam, initially listed as a high hazard potential structure, but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered adequate because it will pass the 100-year spillway design flood. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. For the same reason no further studies or increase of spillway capacity are recommended. To assure continued functioning of the dam and its impoundment, the following actions could be undertaken by the owner:

- a. Repair the erosion of the upstream slope of the dam, and provide erosion protection.
- b. Evaluate seepage at the downstream toe of the dam to the right of the low-level outlet and provide remedial measures as needed.
- c. Repair the erosion of the dam embankment on either side of the low-level outlet and the discharge channel downstream from the spillway.
- d. Remove trees and brush from the dam.
- e. Provide erosion protection for the toe of the dam from water flowing in the discharge channel downstream from the spillway and low-level outlet.
- f. Repair spalled and cracked concrete spillway training walls.
- g. Backfill animal burrows on the downstream slope.
- h. Remove the outhouse from the dam and oversee excavation and backfilling of resulting excavation with suitable material.
- i. Remove obstructions from the discharge channel downstream from spillway.
- j. Start a program of periodically checking the condition of the dam and monitor the seepage to the right of the low-level outlet.
- k. Control trespassing on the dam.
- l. Clear trees and brush for 25 feet on either side of the spillway discharge channel for 100 feet downstream from the end of the spillway and also 100 feet downstream of the low-level outlet or to the property line whichever is the lesser distance and maintain the area clear of brush.

m. Replace the ladder rungs in the valve box. If this is not possible, remove them completely and provide other access to the gate valve as desired.

n. Develop written operating procedures and a periodic maintenance plan.

APPROVED:



ROGER L. BALDWIN

Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE:

26 Aug 81

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Delaware Lake Dam
Identification No.:	Fed ID No. NJ00127
State Located:	New Jersey
County Located:	Warren
Stream:	Delawanna Creek
River Basin:	Delaware
Date of Inspection:	April 22, 1981

ASSESSMENT OF GENERAL CONDITIONS

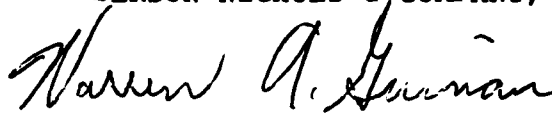
Delaware Lake Dam is a 53-year old structure, consisting of a concrete, broad-crested spillway and an earthfilled embankment with a concrete core wall. The dam is in fair overall condition. It is small in size and should be downgraded to low hazard from its initial classification of high hazard. Brush and small trees are growing on the upstream slope of the dam; the crest shows up to 8-in wheel ruts from trespass; and the downstream slope has many trees covering it with diameters up to 30 inches. Several deep animal burrows were found on the downstream slope. Both slopes have areas of erosion. The headwall of the 12-inch low-level outlet is cracked and spalled. Slight seepage was noted to the right (west) of the low-level outlet. The retreat channel from the spillway joins the low-level outlet channel and both discharge along the toe of the dam before turning a right angle away from the dam. The flowing water in this channel is cutting into the toe of the embankment. The spillway will pass the 100-year spillway design flood and is considered adequate.

Delaware Lake Dam does not pose a potential hazard to loss of life and only minimal property damage would occur if it should be breached. The downstream channel and bridge opening at the improved road crossing 1-1/2 miles downstream will pass the 100-year test flood but a small bridge on a dirt road about 1 mile downstream would be overtopped by about 2 feet. However, should the owner wish to maintain the integrity of the embankment he should retain the services of a professional engineer, qualified in the design and construction of dams to accomplish the following as specified and carry out the recommendations made by the engineer: In the near future: design or specify repairs for the erosion of the upstream slope of the dam, and design or specify erosion protection for the upstream slope of the dam; evaluate seepage at the downstream toe of the dam to the right of the low-level outlet and design remedial measures as needed; design or specify repairs for the erosion of dam embankment on either side of the low-level outlet and the discharge channel downstream from the spillway; specify and oversee procedures for removing trees and brush from the dam; design necessary remedial measures to prevent erosion of the toe of the dam by water flowing in the discharge channel downstream from the spillway and low-level outlet; design or specify

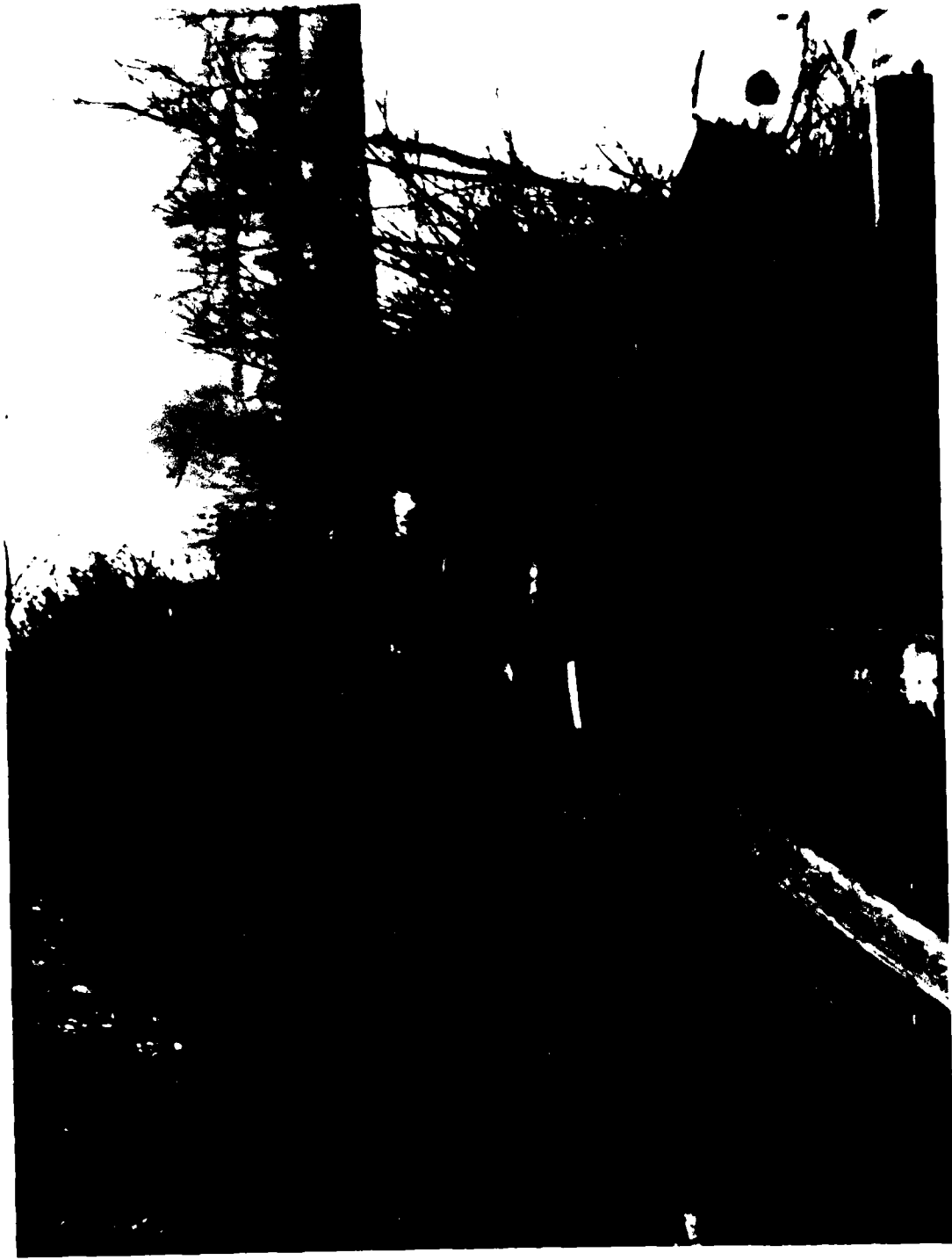
repairs to the spalled and cracked concrete spillway training walls; and backfill animal burrows on the downstream slope.

It is further recommended that the owner accomplish the following tasks as part of operational and maintenance procedures: Starting very soon: remove the outhouse from the dam and oversee excavation and backfilling of resulting excavation with suitable material; remove obstructions from the discharge channel downstream of the spillway; start a program of periodically checking the condition of the dam and monitor the seepage to the right of the low-level outlet; control trespassing on the dam; clear trees and brush for 25 feet on either side of the spillway discharge channel for 100 feet downstream of the low-level outlet or to the property line whichever is the lesser distance and maintain the area clear of brush; and replace the ladder rungs in the valve box or if this is not possible, remove them and provide other access to the gate valve as desired.

ANDERSON-NICHOLS & COMPANY, INC.

A handwritten signature in dark ink, appearing to read "Warren A. Guinan". The signature is fluid and cursive, with the first name "Warren" being more prominent than the last name "Guinan".

Warren A. Guinan, P.E.
Project Manager
New Jersey 16848



22 April 1981

OVERVIEW PHOTO
DE LAWARE LAKE DAM

PREFACE

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

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

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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DELAWARE LAKE DAM FED ID NO. NJ00127

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM
DELAWARE LAKE DAM
FED ID NO. #NJ00127

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Authority to perform the Phase I Safety Inspection of Delaware Lake Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 12 December 1980 under Basic Contract No. FPM-39 and Contract No. A01093 dated 10 October, 1979. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the U.S. Army Engineers District, Philadelphia. The inspection discussed herein was performed by Anderson-Nichols & Company, Inc.

b. Purpose: The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to the safety of Delaware Lake Dam and appurtenances. Conclusions are based upon available data and visual inspection. The results of this study are used to determine any need for emergency measures and to conclude if additional studies, investigations, and analyses are necessary and warranted.

1.2 Project Description

a. Description of Dam and Appurtenances. Delaware Lake Dam is a 18.3-foot high 515-foot long earthfill and concrete dam with a concrete core wall extending almost the entire length. The dam crest is approximately 10 feet wide with 2H:1V sloped earthen embankments upstream and downstream. The upstream embankment is grass and brush covered, while the downstream embankment has large trees growing along the entire length of the embankment. The dam crest is grass-covered with no trees or brush. The ungated concrete spillway extends from the concrete at the left abutment 50 feet to the right concrete training wall. There are four 0.8-foot piers spaced approximately 9 feet apart across the length of the spillway. The spillway is broadcrested with the upstream face vertical and the downstream face sloped 2H:1V. The downstream face has a concrete apron attached that extends about 40 feet downstream. The training wall on the right side extends 62 feet downstream to an earth berm that extends another 60 feet downstream. An operable 12-inch low level outlet is present. The control valve is on the downstream side of the core wall and located about 140 feet to the right (west) of the right spillway training wall.

b. Location. Delaware Lake Dam is located on Delawanna Creek in Knowlton Township, Warren County, New Jersey. The dam is shown on U.S.G.S. Quadrangle, Portland, New Jersey, with approximate coordinates of N40° 55.1' W75° 03.9'. The dam is located off of Interstate Route 80. A location map has been included as Figure 1.

c. Size Classification. Delaware Lake Dam is classified as being small in size on the basis of storage at top of dam of 370 acre-feet, which is less than 1000 acre-feet but more than 50 acre-feet, and on the basis of its height of 21.4 feet, which is less than 40 feet, in accordance with criteria given in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Delawanna Creek flows by a residential structure, located about 0.4 miles downstream of Delaware Lake Dam and elevated about 15 feet above the channel. There are also two roads, located about 0.9 miles and 1.5 miles downstream of the dam. It was determined that the 100-year test flood stage would be below the residential structure and below the top of the roads. Because there is not likely to be any significant property damage or loss of life, Delaware Lake Dam should be classified as low hazard.

e. Ownership. The dam is owned by Harold Buckman of Knowlton, Township, New Jersey; for information he can be reached by writing to Bridgeville Road, Belvidere, New Jersey, Box #185, 07823.

f. Purpose. The Delaware Lake Dam was built to increase the scenic beauty of the area and for recreation.

g. Design and Construction History. There are reproducible plans for Delaware Lake Dam dated 1929 and prepared by Edmund R. Halsey on file at the New Jersey Department of Environmental Protection, Prospect Street, Trenton, New Jersey 08625. The plans were verified in the field and are generally accurate. The only discrepancy is that the plans do not show the piers that are present in the spillway. These were put in during construction of the dam, apparently to be used in the construction of a bridge across the spillway. The bridge was not constructed and the piers were never taken out; however, four steel I-beam stringers have been laid over the piers and are used as a footbridge.

h. Normal Operational Procedure. No operational procedures exist for the dam. The owner regulates the level of the lake through use of a low level outlet. He has drawn the lake level down in the past when top soil was dredged from the upper end of the lake for loaming highway embankments during I-80 construction.

i. Site Geology. No site specific geologic information (such as borings) was available at the time the dam was inspected. Information derived from the Geologic Map of New Jersey (Kummel and Johnson, 1912) Geologic Map and Sections of Parts of the Portland and Belvidere Quadrangle, New Jersey-Pennsylvania (Drake, Epstein and Aaron, 1969) and Glacial Drift of New Jersey (Salisbury, Kummel, Peet and Whitson, 1902) indicates soils within the immediate site consist of stratified drift which may be comprised of sand and gravel plains, deltas, eskers, kames, and terraces.

No bedrock outcrops were observed during the dam inspection. The previously mentioned geologic map indicates that bedrock in this area consists of dark gray thin bedded claystone slate interbedded with medium to thick bedded graywacke and graywacke siltstone of Upper Ordovician age.

1.3 Pertinent Data

a. Drainage Area

2.60 square miles

b. Discharge at Damsite (cfs)

Maximum flood at damsite - unknown

Total ungated spillway capacity at maximum pool elevation (Top of dam) - 389

c. Elevation (ft. above NGVD)

Top of dam - 462.1

Design surcharge (unrouted) (100-year peak flow) - 461.8

Recreation pool (at time of inspection) - 460.0

Spillway crest - 460.0

Streambed at centerline of spillway - 441.7

Maximum tailwater (estimated) - 446

d. Reservoir (feet)

Length of maximum pool - 2500 (estimated)

Spillway crest - 2000

e. Storage (acre-feet)

Spillway crest - 307

Design surcharge (unrouted) (100-year peak flow) - 360

Top of dam - 370

f. Reservoir Surface (acres)

Top of dam - 50 (estimated)

Spillway crest - 38.4

g. Dam

Type - earthfill and concrete

Length - 515 feet

Height - 20.4 feet (hydraulic)

- 21.4 feet (structural)

Top width - 10 feet

Side slopes - upstream 2H:1V, downstream 2H:1V

Zoning - unknown

Impervious core - concrete

Cutoff - unknown

Grout curtain - unknown

h. Spillway

Type - Broadcrested concrete

Length of weir - 50 feet

Crest elevation - 460.0 feet NGVD

Low level outlet - One 12-inch reinforced concrete
pipe (see 1.2i. below)

U/S Channel - Delaware Lake

D/S Channel - Delawanna Creek

i. Regulating Outlets

Type - one 12-inch diameter reinforced concrete
low level outlet pipe

Length (estimated) - 70 feet

Access - along crest of dam to valve box on downstream
side of core wall.

SECTION 2 ENGINEERING DATA

2.1 Design

No hydraulic, hydrologic, or other engineering design data were disclosed. The design plans on file at NJDEP show a 470 foot long earthfill dam with a concrete core wall 457 feet long. The plans also show a 12-inch reinforced concrete pipe for a low level outlet with a 4-inch RC pipe for a drain. The spillway for Delaware Lake Dam is also given in detail, excluding the four 0.8-foot piers which are present today. The design elevation of the dam is 463 feet NGVD with the spillway elevation at 460 feet NGVD. The plans also include cross sections and detail drawings for the entire dam.

2.2 Construction Highway

The original plans contain the estimated quantities of materials to be used for the dam construction. The spillway apron was recently repaired with 25 yards of concrete.

2.3 Operation

No data pertaining to the operation of the dam were found. The current owner stated that he operated the low-level outlet occasionally. He lowered the reservoir during construction of I-80 to enable dredging, in the upper end of the reservoir, for loam for highway embankments.

2.4 Evaluation

a. Availability. A search of the New Jersey Department of Environmental Protection Files, contact with community officials and contact with the owner revealed a limited amount of information. All disclosed information with a copy of the plans was retrieved.

b. Adequacy. The plans, supplemented by visual inspection, are deemed adequate to complete this inspection.

SECTION 3 VISUAL INSPECTION

3.1 Findings

a. Dam. Trees are growing on the crest of the dam, on the downstream slope and in the area of the downstream toe of the dam. The roots of several trees on the crest near the right abutment extend from the downstream edge of the crest to the upstream edge of the crest. Tire tracks up to 8-inches deep have developed along the crest of the dam. The crest surface is grass covered except for an area approximately 10 feet wide near the center of the dam which is covered with concrete, sand and gunite. The purpose of the gunite and sand repair was not determined during the site visit. Considerable erosion and sloughing has occurred on the upstream slope at and above the waterline. The upstream slope had extensive brush growing above the waterline and was only partially covered with riprap. An outhouse was constructed at the crest of the downstream slope near the right abutment.

Trees up to 2.5 feet in diameter are growing on the downstream slope and adjacent to the downstream toe of the dam. A series of three animal burrows up to 16 inches in diameter and up to 2.5 feet deep were observed on the downstream slope near the right side of the dam.

Erosion has occurred at the toe of the downstream slope adjacent to and right (west) of the low-level discharge pipe. A slight amount of seepage was noted at the toe of the slope where the discharge channel comes in contact with the embankment causing an 8-inch vertical escarpment to develop. The flow was clear with some orange staining present but no visible evidence of suspended fines.

b. Appurtenant Structures.

1. Ungated Spillway. The upstream end of the right spillway framing wall has cracked and the upstream end has been displaced by settlement. The upstream face of the left training wall is badly eroded at the waterline. Four vertical thru-wall cracks were observed in the right training wall downstream of the spillway. Also, the downstream end of the spillway at the junction with the downstream channel is broken. The surface of the left spillway training wall in the vicinity of crest is spalled and eroded up to 1/4" deep. The service footbridge, consisting of wideflange beam laid flat, is rusted.

2. Low Level Outlet. The 12" gate valve was reported operable at the time of inspection. The steel ladder rungs descending into the valve pit are badly rusted. The concrete headwall at the downstream end of the low-level outlet is cracked and eroded. Erosion has occurred on the downstream slope in the vicinity of the low-level outlet.

c. Reservoir Area. The watershed above the lake is gently to moderately sloping, with open fields and woods. The reservoir slopes appear to be stable. No evidence of significant sedimentation was observed.

d. Downstream Channel. Erosion of the soil bank has occurred on both sides of the spillway discharge channel immediately downstream of the spillway. Some trees and brush overhang the channel and portions of a concrete apron have broken off and been displaced downstream in the channel. Approximately 200 feet downstream from the dam, the discharge channel spreads out to cover a larger area and meanders adjacent to the downstream toe of the dam for approximately 75 feet to the right (west) of the low-level outlet.

SECTION 4 OPERATIONAL PROCEDURES

4.1 Procedures

No formal operating procedures were disclosed. Water level is controlled as the situation dictates.

4.2 Maintenance of Dam

No formal maintenance procedures for the dam were disclosed; but from its condition, it is apparent that some maintenance has been done on the dam to prevent serious deterioration of the structure. Trees were removed from the upstream embankment and 25 yards of concrete were applied to the downstream apron at the left side of the spillway. The upstream embankment has brush and small trees growing. The downstream embankment has large trees growing along the entire embankment.

4.3 Maintenance of Operating Facilities

No formal maintenance procedures for the operating facilities were disclosed. From the condition of the steel rungs of the ladder in the valve box leading to the low-level outlet valve, it appeared that a limited amount of maintenance had been done.

4.4 Warning System

No description of any warning system was disclosed.

4.5 Evaluation of Operational Adequacy

Because of the lack of operation and maintenance procedures, the remedial measures described in Section 7.2 should be implemented as prescribed.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. Design Data. Because no original hydrologic design data were revealed, an evaluation of such data could not be performed.

b. Experience Data. No experience data were revealed.

c. Visual Inspection. The spillway for Delaware Lake Dam consists of a 50 foot long concrete weir. No visual evidence was found of damage to the structure caused by overtopping. However, past discharges had been sufficient to cause the need for recent placement of about 25 yards of concrete to repair severe erosion in the downstream left (east) side of the spillway apron. At the time of inspection, approximately 0.1 foot of water was flowing over the spillway crest.

d. Delaware Lake Dam Overtopping Potential. The hydraulic/hydrologic evaluation for the dam is based on a selected Spillway Design Flood (SDF) equal to the 100-year flood in accordance with the range of test floods given in the evaluation guidelines, for dams classified as low hazard and small in size. The 100-year flood discharge was determined by Stephen J. Stankowski's method as outlined in "Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization", Special Report #38, 1974. Hydrologic computations are given in Appendix 3. The 100-year discharge for the subject watershed is 343 cfs. The spillway capacity is 389 cfs and thus it can pass the 100-year flood without overtopping the dam embankment and is considered adequate.

e. Drawdown Capacity. If the low-level outlet currently in place is fully operable and free of siltation, it is estimated that the pond can be drained in approximately 20 days, assuming no significant inflow. This time period is considered very marginal for draining the reservoir under emergency conditions and drawdown should be supplemented by pumping.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The slight seepage taking place through the dam to the right of the low-level outlet is indicative of seepage through the dam which, if not properly controlled, could lead to failure of the dam by piping or sloughing of the downstream slope. Similarly continued erosion of the toe by flow from the discharge channel could lead to continued sloughing of the toe and result in a failure of the embankment. Trees growing on the crest of the dam may blow over and pull out their roots, and this could lead to breaching of the dam because the crest is only several feet above the lake level. Similarly on the downstream slope, if a tree dies and its roots rot, seepage and erosion may take place along the root channels. Erosion of the upstream slope at the waterline will eventually lead to breaching of the dam if it is not controlled. Continued erosion of the right spillway banks, if not properly controlled, could cause undermining of the downstream toe of the dam.

6.2 Design and Construction Data

No design or construction data pertinent to the structural stability of the dam are available.

6.3 Operating Records

No operating records pertinent to the structural stability of the dam were available.

6.4 Post-Construction Changes

No records of post-construction changes are available except the recent repair to the spillway apron mentioned in Sections 4 and 5 above.

6.5 Seismic Stability

This dam is in Seismic Zone 1. According to the Recommended Guidelines, dams located in Seismic Zone 1 "may be assumed to present no hazard from earthquake provided static stability conditions are satisfactory and conventional safety margins exist." None of the visual observations made during the inspection are indicative of unstable slopes. However, because no data are available concerning the engineering properties of the embankment and foundation materials for this dam, it is not possible to make an engineering evaluation of the stability of the slopes or the factor of safety under static conditions.

SECTION 7
ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Delaware Lake Dam is 53 years old and is in fair condition.

b. Adequacy of Information. The information available is such that the assessment of the dam must be based primarily on the results of the visual inspection.

c. Urgency. The recommendations made in 7.2.a and 7.2.b should be implemented by the owner as prescribed.

d. Necessity for Additional Data/Evaluation. The information available from the visual inspection is adequate to identify the potential problems which are listed in 7.2.a. These problems require the attention of a professional engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problems. If left unattended, the problems could lead to instability of the structure. Because the dam is low hazard, no further hydrologic studies are considered necessary.

7.2 Recommendations/Remedial Measures

a. Recommendations. The owner should retain a professional engineer qualified in the design and construction of dams to accomplish the following in the near future:

1. Design or specify repairs for the erosion of the upstream slope of the dam, and design or specify erosion protection for the upstream slope of the dam.
2. Evaluate seepage at the downstream toe of the dam to the right of the low-level outlet and design remedial measures as needed.
3. Design or specify repairs for the erosion of the dam embankment on either side of the low-level outlet and the discharge channel downstream from the spillway.
4. Specify and oversee procedures for removing trees and brush from the dam.

5. Design necessary remedial measures to prevent erosion of the toe of the dam by water flowing in the discharge channel downstream from the spillway and low-level outlet.
6. Design or specify repairs to the spalled and cracked concrete spillway training walls.
7. Backfill animal burrows on the downstream slope.

The owner should carry out the recommendations made by the engineer.

b. Operating and Maintenance Procedures. The owner should accomplish the following very soon:

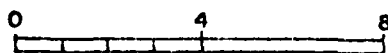
1. Remove the outhouse from the dam and oversee excavation and backfilling of resulting excavation with suitable material.
2. Remove obstructions from discharge channel downstream from spillway.
3. Start a program of periodically checking the condition of the dam and monitor the seepage to the right of the low-level outlet.
4. Control trespassing on the dam.
5. Clear trees and brush for 25 feet on either side of the spillway discharge channel for 100 feet downstream from the end of the spillway and also 100 feet downstream of the low-level outlet or to the property line whichever is the lesser distance and maintain the area clear of brush.
6. Replace the ladder rungs in the valve box. If this is not possible, remove them completely and provide other access to the gate valve as desired.

In the near future:

Develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.



SCALE IN MILES



MAP BASED ON STATE OF NEW JERSEY
OFFICIAL MAP & GUIDE.

FIGURE 1

Anderson-Nichols & Co., Inc.

BOSTON

MASSACHUSETTS

U.S. ARMY ENGINEER DIST. PHILADELPHIA
CORPS OF ENGINEERS
PHILADELPHIA, PA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

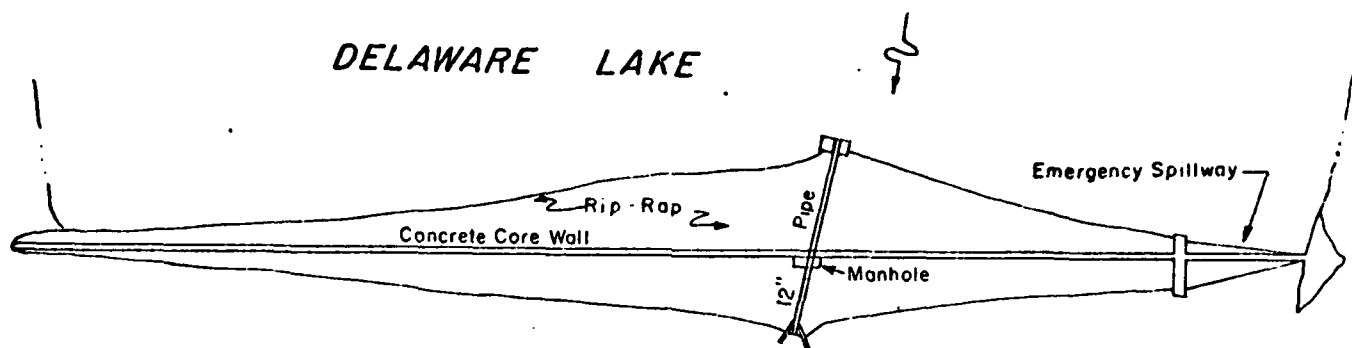
DELAWARE LAKE DAM LOCATION MAP

DELAWAREANNA CREEK

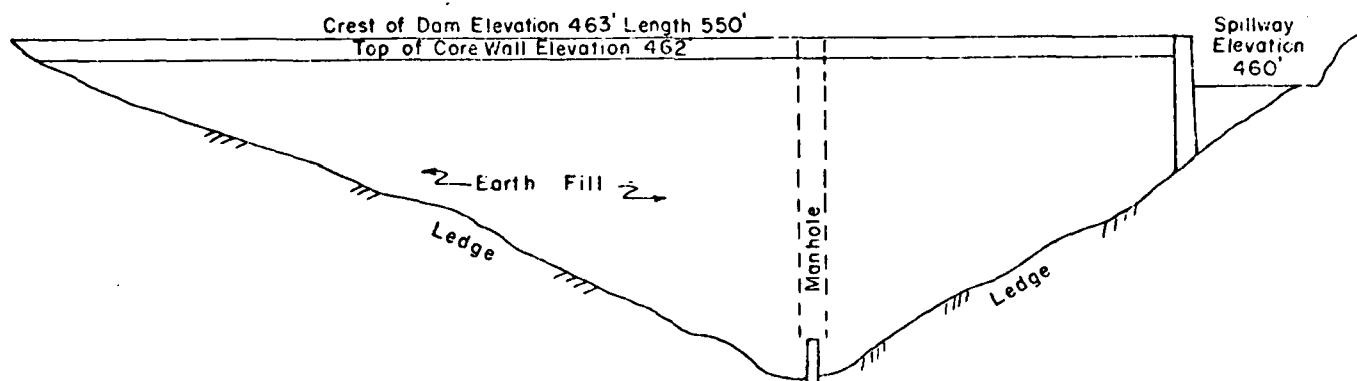
NEW JERSEY

SCALE: 1" = 4 Miles Approx.

DATE: 1964

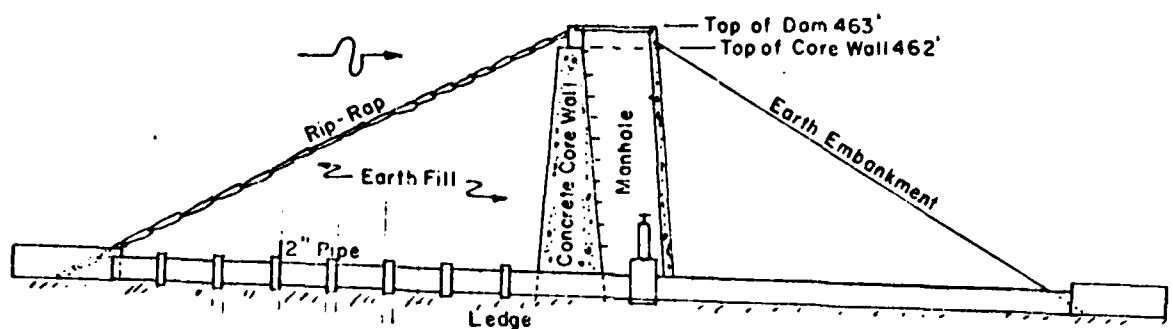


PLAN

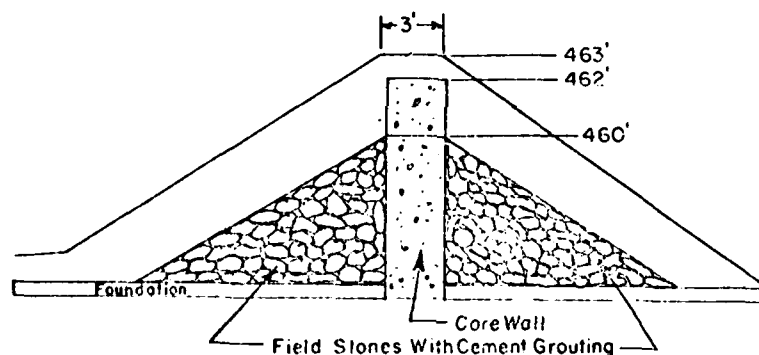


ELEVATION

Anderson-Nichols & Co, Inc		U.S. ARMY ENGINEER DIST PHILADELPHIA	
BOSTON		CORPS OF ENGINEERS	
MASSACHUSETTS		PHILADELPHIA, PA	
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS			
DELAWARE LAKE DAM			
DELAWANNA CREEK		NEW JERSEY	
		SCALE NOT TO SCALE	
		DATE JUNE 1981	



PIPE CROSS-SECTION



SPILLWAY CROSS-SECTION

Anderson-Nichols & Co., Inc.		U.S. ARMY ENGINEER DIST. PHILADELPHIA	
BOSTON		CORPS OF ENGINEERS	
MASSACHUSETTS		PHILADELPHIA, PA.	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
DELAWARE LAKE DAM			
CROSS-SECTIONS			
DELAWANNA CREEK		NEW JERSEY	
		SCALE: NOT TO SCALE	
		DATE: JUNE 1981	

APPENDIX 1

ENGINEERING AND EXPERIENCE DATA

DELAWARE LAKE DAM

SAX

G Hiram BUCHMAN, Inc. RECEIVED
PUMP & WELL SUPPLIES

DELRIDGE, N. J. 07022

SEP 24 1969

PHONE: 670-0100

BRIDGE, PA. & WYOMING, WY.
EQUIPMENT & SUPPLIES
WATER PUMP & WELL SUPPLIES

September 22, 1969

State of New Jersey
Dept. of Conservation
Div. of Water Policy
Box 1390
Trenton, N. J. 08625

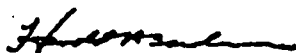
Attention: Mr. Robert Hardman

Dear Sir:

Re: Delaware Lake - Dam
Application #141

In accordance with your recent letter, this is to
inform you that the repairs on the above mentioned
dam have been completed.

Very truly yours,


Harold A. Buchman

Mr. Peter L. Heinbach
96 Johnston Drive Ext.
North Plainfield, New Jersey 07060

March 3, 1968

RECEIVED

1003

State of New Jersey
Department of Conservation & Economic Development
Trenton, New Jersey

Attention: Mr. Robert L. Hardman

REF. Application No. 141
Delaware Lake Dam

Gentlemen:

In regards to the above Dam Inspection, I would like to further clarify Item 7c General, "The crack in the southwest abutment face between the spillway and the earth dam shall be repaired in the near future". I intended that the repairs would be made within a year of the inspection, the owner has assured me that this will be done this summer.

I hope that this will allow the owner the necessary time to make the repair without further notification from the State.

Very truly yours,

Peter L. Heinbach
Peter L. Heinbach, P.E.

PLH:ter

Mr. Harold A. Buchanan
O. Mine Building, 1100
Belvidere, New Jersey 07015

Re: Dulles Lake
Box Application No. 141

Dear Mr. Buchanan:

Your attention is called to my letters of September 9 and December 1, 1961, in which I advised you that the crack in the wall of the building at the subject was the first January 11, 1962.

We have had no further information as to the repair of the crack in the wall of the building at the subject. It is noted by the Bureau of Water Control that the repair has been made to the wall.

Very truly yours,

Robert J. Harcourt, P.E.
Chief, Bureau of Water Control

Enclosure



December 10, 1960

Mr. Harold A. Buchman
G. Hiram Buchman, Inc.
Belvidere, New Jersey 07003

Re: Delaware Lake
Dep Application No. 161

Dear Mr. Buchman:

Your attention is invited to my letter of September 9, advising you to repair the crack in the southwest abutment before November 15, 1960 and report the completion thereof.

We have not received the report to date and with this reminder, you are asked to submit the report on the completion of the repair of the crack in the southwest abutment before January 31, 1961.

Very truly yours,


Robert L. Hardman, P.E.
Chief, Bureau of Water Control

SAAL:G



November 9, 1963

Mr. Harold A. Bushman
O. Hirsch Engineering, Inc.
Belvidere, New Jersey 07003

RE: Dam No. 1-1
Dam Application No. 141

Dear Mr. Bushman:

Thank you for your letter of August 31, forwarding a report, by Mr. Hirsch, Professor of Civil Engineering, on the existing condition of the subject dam.

Mr. Hirsch in his report states that "There are several small southeast cracks in the face of the spillway which do not appear to require immediate repairs. These cracks should be checked periodically and any increase in size would require further study. The crack in the southeast abutment face between the spillway and the dam should be repaired in the near future. This crack appears to allow water to seep into the earth south of the dam then there is several inches of water standing over the spillway. The seepage of this water and standing in this crack could lead to damage of both the earthfill section of the dam and to the spillway."

Please arrange to repair the crack in the southeast abutment before November 30, 1963 and report the completion, thereof, to this office, and also keep the small cracks under surveillance and advise this office if you notice any increase in their size.

Very truly yours,


Robert L. Hardman, P.E.
Chief, Bureau of Water Control

RAA:ph



ANNUAL REPORT - DAM

Application No. 141
Belmonte Lake Dam

For 1968
Inspected on
August 17, 1968

Owner: Harold A. Buchman
O. Miron Buchman, Inc.
Belvidere, New Jersey

RECEIVED

SEP 3-68

SEPT. COME & SCOM. DEPT.
DIVISION OF
SHARED POLICY AND SUPPORT

Description of condition of the following:

1. Embankment. There is no evidence of erosion and no evidence of water seepage in any area of the dam. The entire earth fill section of the dam is overgrown with trees and brush.

2. Spillway. The concrete structure is generally in good condition. There are some cracks in the concrete floor of the spillway. Also, one large crack in the concrete abutment on the southwest end of the spillway between the spillway and the earth fill dam. No timber is used in the spillway. Minor seepage from one settlement crack in the spillway concrete floor was noted. No under spillway seepage was seen.

3. Emergency spillway. None.

4. Outlet works. The dam has a gate valve and outlet pipe through the base of the dam to the outlet stream. The valve is contained in a concrete vault and is operable.

5. Inlet stream. The inlet end of the lake is silted for an area of approximately 3 acres. Average depth in this area is 3 feet.

6. Outlet stream. There are no signs of scouring or undercutting of the dam. No stilling basin is incorporated in the spillway, however, the boulder stream stream bed

prevents scouring of the stream and the toe of the dam. The dam is protected by a concrete wall and dike downstream of the spillway where the outlet stream flows generally parallel to the toe of the dam.

7. General.

a. The owner reports that the dam has never been overtopped.

b. None

c. There are several small settlement cracks on the floor of the spillway which do not appear to require immediate repair. These cracks should be checked periodically and any increase in size would require further study. The crack in the southwest abutment face between the spillway and the earth dam should be repaired in the near future. This crack appears to allow water to seep into the earth section of the dam when there is several inches of water flowing over the spillway. The action of this water and freezing in this crack could lead to damage of both the earth fill section of the dam and to the spillway.

Inspected By

Peter L. Heimback

Peter L. Heimback
S.J.P.E. # 15518

Report on inspection.

RAJCEY UPPER DAM

Application No. 111.

Location 21.2.1.4.4.

On October 15, 1929 inspection was made of this dam.

The dam has been completed in accordance with the plans approved February 13, 1929 with the following exception:

The downstream fill has not yet been graded and settled and some additional fill remains to be placed behind the right wing wall at the spillway.

Eight inch piers for the support of a bridge have been placed in the spillway. These piers were not shown on the approved plan, but the length of the spillway has been increased, and now has a clear opening of 52.8 ft. This construction gives a spillway capacity of 200 sec. ft. per square mile as compared with 141 provided by the approved design.

It is recommended that the dam be not accepted until the work on the downstream slope is completed.

Water stand 2' below the spillway crest.

Trenton, N. J.,
October 16, 1929

John H. Brooks
John H. Brooks,
Assistant Division Engineer.



State of New Jersey

Department of Conservation and Forestry

To the Board of Conservation and Forestry,
State of New Jersey.

Gentlemen:

The application of **Edmund N. Halsey**
 filed February 1, 1929 for approval of plans and for a permit to construct a dam
 known as **Halsey Upper Dam** near **Delaware** on **Delaware Brook**, tributary
 to **Delaware River** in **Warren** County, New Jersey, has been examined by
John H. Brooks, Hydraulic Engineer.

PRINCIPAL FEATURES

Location S4.S.2.4.4 Site Inspected February 5, 1929.

Purpose of dam beautification of private estate.

Drainage area 2.6 sq. mi.

Area of lake 30 acres.

Capacity of lake 53 Mill. gal.

Type of dam earth fill, concrete core-wall Top width 6 feet.

Upstream slope 8:1 Downstream slope 2:1

Length of dam 470 feet *Remains of old dam 201429* Max. height 17 feet *Remains of old dam 201429*

Foundation material slate rock.

Type of spillway masonry notch. ca 2.6 Length of spillway 50 feet.

Max. head on spillway 2.5 feet with 6" freeboard.

Spillway capacity 198 sec. ft. per sq. mi.

Outlets other than spillway 1-12" terra cotta pipe with reinforced concrete envelope. ~~Gates not used down stream end.~~

It has been found that the site for the dam is suitable and the plans adequate to insure the construction of a structure which will not be a menace to life or property. It is therefore recommended that the plans be approved and that a permit be issued, subject, however to the following terms and conditions:—

1. That this permit does not give any property rights, either in real estate or material, nor any exclusive privileges; neither does it authorize any injury to private property nor invasion of private rights, nor any infringement of Federal, State or local laws or regulations; nor does it waive the obtaining of Federal assent, when necessary.

2. That the work shall at all times be subject to supervision and inspection by representatives of the Department of Conservation and Development and that the contractor shall keep a station at all times and be ready at all times to furnish a statement of the work done and the amount of material used and the cost thereof and to furnish a statement of the work done and the amount of material used and the cost thereof and to furnish a statement of the work done and the amount of material used and the cost thereof.

3. That the work shall be under the direction of a competent engineer, and that he or a competent representative shall be on the ground daily during the construction and until the completion of the dam.

4. That the Department shall be notified in advance of the proposed time of the commencement of this work, that no material shall be placed on any portion of the foundation until such portion of the foundation has been approved in writing by a representative of the Department.

5. That a report, on forms to be submitted by the Department, on the status of the construction work shall be mailed to the Department of Conservation and Development, State House Building, Trenton, New Jersey, on the 2nd day of each month until the work upon the dam has been completed.

6. That no brush or waste timber cleared from the area under this approval shall be burned unless and until the party doing the work shall have obtained a permit from the Firewarden of the district in which the burning is to be done, in accordance with Section II, Chapter 122, T. L. 1924.

7. That the work shall be started within six months from date of this permit and completed within one year from said date; otherwise, this permit, if not previously revoked or specifically extended, shall cease and be null and void.

8. That the top of the core-wall shall be carried up to elevation 459.0 and the top of the earth fill ~~to elevation 459.0~~ and spillway wing wall to elevation 460.0 making the depth of the spillway notch 3.0 feet.

9. That the gate valve in the blow-off pipe shall be placed in a concrete manhole at the downstream side of the core-wall.

10. That no flash boards or other obstruction shall be placed or permitted to remain on the crest of the spillway.

Trenton, New Jersey,

February 6, 1922

Recommended by Water Committee

Feb. 13, 1922.

10

John H. Brooks
Hydraulic Engineer.
H. T. Catchlon
Chief, Division of Waters.

Report on the Inspection of

MAINTENANCE DAM

Application No. 111

Location 11.2.2.1.1

On February 5, 1929, in company with Mr. Edmund R. Halsey, owner, and Mr. W. E. Johnson, Assistant State Geologist, inspection was made of this dam site.

The site is in a rather narrow valley and the watershed hilly and about one-tenth wooded, the remainder being in hay.

The foundation material is a sandy slate rock which outcrops in the stream bed and on the side hills. The overburden of glacial till with boulders appears to be light and there should be no difficulty in reaching bed rock with the footing for the core wall.

The site is approved for an earth dam having a concrete core wall.

John H. Brooks

John H. Brooks
Hydraulic Engineer.

Trenton, New Jersey.

February 6, 1929.



Dam Application No. 141
Halsey Upper dam

2/11/59

Core wall, center slopes and measured
of Compaction OK.

Spillway

Water shed 2.6 sq mi.

Spillway 33' long elev. 507

Total core wall 458

Total dam 458

C. 2.6

Capacity with water at top of core wall

$Q = 2.6 \times 50 \times 12 = 1560$ cu ft

1560 cu ft

Water dam area

$Q = 2.6 \times 50 \times 2 = 260$ cu ft

260 cu ft

Too small

Raise concrete to elev. 457

" Top of dam to " 460

Capacity with water at top of core wall 141 cu ft

141 cu ft

With 6" free board

$Q = 2.6 \times 50 \times 2.5 = 325$ cu ft

325 cu ft

198 cu ft

EDMUND H. HALLEY
CIVIL ENGINEER AND SURVEYOR
15 ALBANY STREET
NEWARK, N.J.

MEMORANDUM FOR THE BOARD OF PUBLIC WORKS, NEW JERSEY

The Department of Conservation
and Forestry,
Division of Waters, State Office Building,
Trenton, New Jersey.
Gentlemen:-

There is a brook running through my property at
Delaware, Franklin Township, New Jersey, upon
which I wish to construct the proposed dam. The
property is about 100 ft. wide at the dam site, but
the same would not be the case at the top of the
dam, and therefore, I would request that you
issue permits for the dam. The dam will be
well within my property and will not cause any one else to any
extent. The following is the data concerning the same:

Area of watershed	1.50 sq. mi.	1.50 sq. mi.
Maximum depth of pond	16 feet	16 feet
Area of water surface	20 acres	20 acres
Capacity of spillway by Q=3.0 cfs	1 ft head Q=100 cfs	1.5 ft head Q=100 cfs
Capacity of drain pipe by Hoskey's formula, Jul. 608, U.S. Dept of Agri.	15 ft head 12" pipe Q=13 cfs	25 ft head 18" pipe Q=66 cfs
The character of foundation is	Slate	Slate

*See
Spec.
Div.*

I expect to build these dams myself, using native
gravel of these parts in the proportion of 1 - 2 - 4, unless I
can get a run of gravel which will be satisfactory without
screening the same. I also wish to make the earth fill by
spreading the same in about six inch layers and running over it
with tractors in the course of filling, which will thoroughly
compact the same.

I would like to start this work at as early a date as
the weather permits, and therefore, would like to have you act as
soon as you can conveniently do so.

Very truly yours,

Edmund H. Halley
Civil Engineer and Surveyor
License Number 155

APPENDIX 2

CHECK LIST

VISUAL INSPECTION

DELAWARE LAKE DAM

Check List
Visual Inspection
Phase 1

Name Dam Delaware Lake County Warren State NJ (00127) Coordinators NJDEP
2/18/81
 Date(s) Inspection 4/22/81 Weather' Sunny Temperature 35°
65°
 Pool Elevation at Time of Inspection 460 ft NGVD Tailwater at Time of Inspection 442 ft NGVD

Inspection Personnel:

<u>W. Guinan</u>	<u>C. Plaud</u>
<u>K. Stewart</u>	<u>J. Stone</u>
<u>D. Deane</u>	<u>S. Gilman</u>
	<u>R. Murdock</u>

K. Stewart/S. Gilman Recorder

Harold Buckman, the owner, was present during the April 22 inspection.

UNGATED SPILLWAY

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

CONCRETE WEIR

Surface of weir - Good condition
ogee shape - apron broken at d/s
end.

Recently capped

APPROACH CHANNEL

U/s end of left abutment training
wall is spalled and eroded at waterline -
4-in deep. Face of abutment wall (left)
is spalled. Right training wall has
section cracked and settled and moved
horizontally.

Repair spalling, erosion
and cracks

DISCHARGE CHANNEL

Boulders, broken concrete, brush, and
trees in channel. On right side, 18-in
training wall for 52 ft d/s, concrete and
earth training wall for 60 ft more. Right
training wall has 4 vertical thru wall cracks.
Surface of bottom of spillway - good.
Lower end has a 2-in spalled off top.

Repair cracks

BRIDGE AND PIERS OVER SPILLWAY

Piers are in good condition. Steel girders
are rusted.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed.	
INTAKE STRUCTURE	Not visible.	
OUTLET PIPE	12-in gate valve. Concrete valve pit.	
OUTLET CHANNEL	Steep, rocky bottom unobstructed.	
EMERGENCY GATE	12-in pipe with valve in concrete pit is in good condition. Bottom is dry. Wood plank cover is weathered.	In pit 18.5 ft deep

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion of both upstream and downstream trees on downstream slope.	Repair erosion and provide adequate erosion protection.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - good. Vertical - slight undulation of crest.	
RIPRAP FAILURES	Riprap missing at many locations along upstream face.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RAILINGS	None.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good.	
ANY NOTICEABLE SEEPAGE	Apparent seepage along toe near outlet pipe.	Investigate cause of seepage and specify appropriate remedial measures.
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	

RESERVOIR

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

SLOPES

Gradual to steeply sloped, wooded, open fields.

SEDIMENTATION

No significant sedimentation observed.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Rocky - 12-in dia. trees	
SLOPES	Steep to moderate heavily wooded.	
APPROXIMATE NO. OF HOMES AND POPULATION	One house with four people.	House is well above test flood elevation.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Plan #141 on record, NJ00127, from NJDEP files, New Jersey Department of Environmental Protection, Prospect Street, Trenton, New Jersey 08625. Used for plan and profile in Report - Figures 2 & 3.
REGIONAL VICINITY MAP	Prepared for this report.
CONSTRUCTION HISTORY	No recorded detailed description. Reference data, dams in New Jersey, NJ00127 from NJDEP files, is available in Appendix 1, ENGINEERING and EXPERIENCE DATA.
TYPICAL SECTIONS OF DAM	Plans filed 1 February 1929, approved 13 February 1929, and completed work in October 1929 were used for this report and are available from NJDEP files.
HYDROLOGIC/HYDRAULIC DATA	Available data found in Appendix 1, ENGINEERING and EXPERIENCE DATA.
OUTLETS - PLAN	Available from NJDEP files - see TYPICAL SECTIONS OF DAM above.
- DETAILS	Same as above.
- CONSTRAINTS	None found
- DISCHARGE RATINGS	None found

RAINFALL/RESERVOIR RECORDS None found

ITEM	REMARKS
DESIGN REPORTS	None found
GEOLOGY REPORTS	None found
DESIGN COMPUTATIONS	Available data in Appendix 1, ENGINEERING and EXPERIENCE DATA
HYDROLOGY & HYDRAULICS	Same as above
DAM STABILITY	None found
SEEPAGE STUDIES	None found
MATERIALS INVESTIGATIONS	
BORING RECORDS	
LABORATORY	None found
FIELD	
POST-CONSTRUCTION SURVEYS OF DAM	None found
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	None
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None

ITEMS	REMARKS
SPILLWAY PLAN	Prepared for this report from field inspection
SECTIONS	None
DETAILS	1 gate valve Plan available from NJDEP files. See TYPICAL SECTIONS OF DAMS. on page 2-8.
OPERATING EQUIPMENT PLANS & DETAILS	

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 2.6 square miles, moderate slope,
woods and fields

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 460' NGVD (307 acre-
feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY: Not applicable

ELEVATION SDF POOL: 461.8' NGVD (100-year unrouted)

ELEVATION TOP DAM: 462.1' NGVD

SPILLWAY CREST: Free overflow concrete spillway

a. Elevation 460' NGVD

b. Type Broadcrested concrete weir

c. Width 4 feet

d. Length 50 feet

e. Location Spillover At left abutment of dam

f. Number and Type of Gates None

OUTLET WORKS: One low-level outlet pipe

a. Type One 12-inch reinforced concrete pipe

b. Location 190 feet right of left abutment through base of
dam

c. Entrance Invert Estimated at 442.3' NGVD

d. Exit Inverts 442.2' NGVD

HYDROMETEOROLOGICAL GAGES: None

MAXIMUM NON-DAMAGING DISCHARGE: 389 cfs

APPENDIX 3

PHOTOGRAPHS

DELAWARE LAKE DAM



April 22, 1981

Downstream face of overflow spillway. Note repaired concrete at left (east) side (right edge of photo).



April 22, 1981

Right Spillway training wall running outward parallel to chute of spillway on downstream face of dam. Wall actually is for the spillway chute.



April 22, 1981

Crack in training wall downstream of spillway.



April 22, 1981

Trees adjacent to right spillway wingwall. Tree in foreground 10-in diameter.



April 22, 1981

Scoured and eroded concrete at water line on upstream training wall wing (left [east] side).



April 22, 1981

Repaired concrete near discharge point on left side of chute from spillway.



April 22, 1981

Apparent repairs to upstream face using concrete and sand.
Note 8-inch ruts on dam crest from tire tracks.



April 22, 1981

Suggestion of sloughing or erosion near crest of downstream
slope in vicinity of valve box, 17-inch escarpment.



April 22, 1981

Valve box near center, downstream, near crest. Ladder rusted and dangerous.



April 22, 1981

Looking upstream at exit portal of low-level outlet.



April 22, 1981

Erosion adjacent to low-level outlet (left [east] side).



April 22, 1981

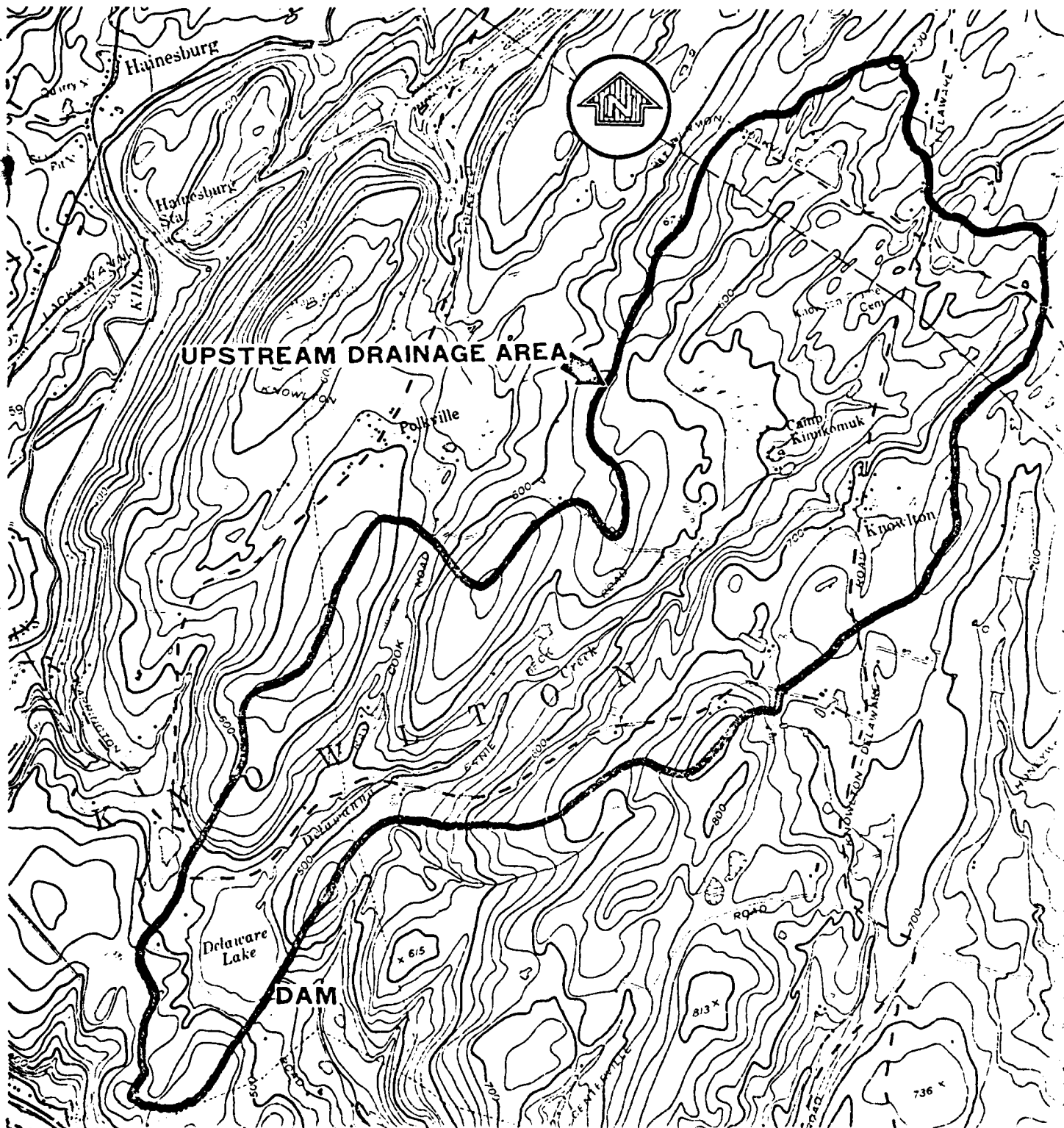
Erosion on downstream face adjacent to outhouse; roots up to 2 inches in diameter exposed in erosion gully.



April 22, 1961

Downstream slope near outlet chamber, stream flow along the toe of dam. Note outlet pipe at foot of dam and valve box behind the trees near the crest.

APPENDIX 4
HYDROLOGIC COMPUTATIONS
DELAWARE LAKE DAM



**NATIONAL PROGRAM OF INSPECTION OF
NON-FED. DAMS**

**DELAWARE LAKE DAM
KNOWLTON TOWNSHIP, NEW JERSEY**

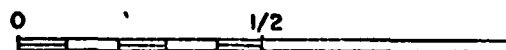
**REGIONAL VICINITY MAP
JUNE 1981**

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

Anderson-Nichols & Company, Inc.

BOSTON, MA.

SCALE IN MILES



**MAP BASED ON U.S.G.S. 7.5 MINUTE QUADRANGLE
SHEET. PORTLAND, N.J., PA. 1955, REVISED 1971.**

JOB NO. 3670-07SQUARES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
1/4 IN. SCALE

STANKOWSKI EQUATION

$$Q_{100} = 136 A^{0.84} S^{0.26} S_t^{-0.51} I^{0.14}$$

$$A = 2.58 \text{ mi}^2$$

$$S = \frac{605 - 470}{13200} = 0.01 \text{ ft/ft} = 5.3 \text{ ft/mi}$$

$$S_t = \frac{80372.2111 \text{ cfs}}{16510000 \text{ D.A.}} = .048 = 4.8\% + 1\% = 5.8\%$$

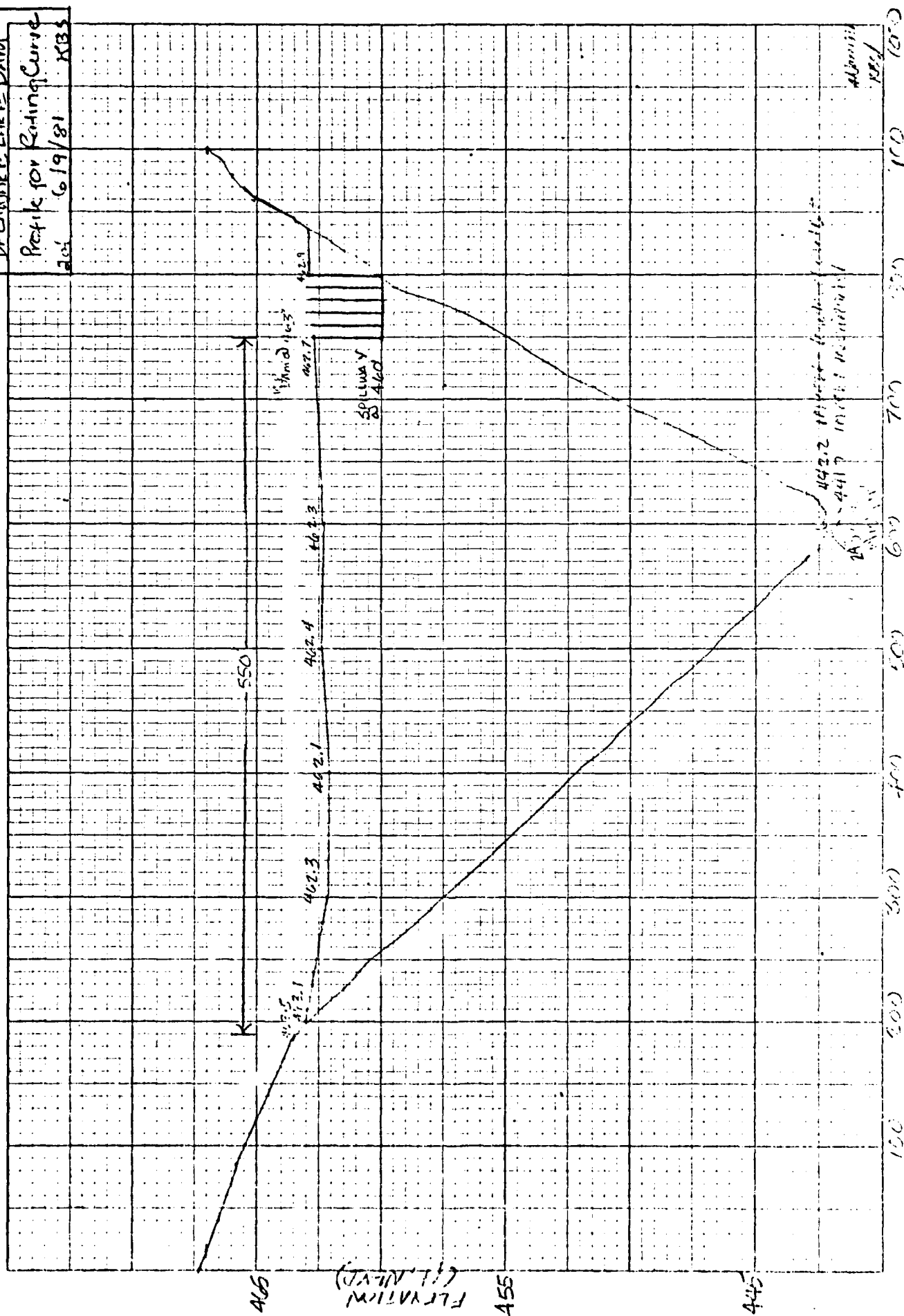
$$I = 1\%$$

$$Q_{100} = 136 (2.58)^{0.84} (5.3)^{0.26} (5.8)^{-0.51} (1)^{0.14} = 343$$

$$Q_{100} = 343 \text{ cfs}$$

Spillway capacity from rating curve = 389 CFS

6/19/81	KB
---------	----



JOB NO. SQUARES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
1/4 IN. SCALE

DEVELOPMENT OF RATING CURVE

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

① SPILLWAY CURVE

$$C = 2.7 \quad \text{BREADTH} = 4'$$

$$\text{weir length} = 50 - 2.7(\text{piers}) = 47.3'$$

② TOP OF DAM

$$C = 2.6 \quad \text{BREADTH} = 6'$$

$$\text{weir length} = 550'$$

ELEVATION (FT-NGVD)	SPILLWAY		TOP DAM			TOTAL CFS
	HEAD (FT)	CFS	HEAD (FT)	LENGTH (FT)	Q (CFS)	
SPILLWAY 460	0	0				0
TOP DAM 462.1	2.1	389				389
462.7	2.7	567	0.6	520	623	1195
463.	3.0	664	0.9	550	1221	1935
463.5	3.5	836	1.4	600	2524	3420
464.	4.0	1022	1.9	630	4290	5312
464.5	4.5	1219	2.4	665	6429	7643
465	5	1428	2.9	690	9350	10778
466	6	1677	3.4	760	12533	14265
467	7	2265	4.4	830	19917	22235

DELAWARE LAKE DAM
RATING CURVE
6/9/81 KBS
page 4 of 8

470

FEET IN IN. (FUNKVO)

450

450

TOPOG DAM
COMBINED

SPILLWAY
TOPOG DAM
COMBINED

2800

2400

2000

1600

1200

800

400

FEET
WATER

Anderson-Nichols & Company, Inc.

Subject DEERHOLE LAKE DAM

Sheet No. 5 of 9
 Date 5/28/51
 Computed
 Checked

JOB NO.

SQUARES 1/4 IN. SCALE 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

STAGE - STORAGE DETERMINATIONS

TAKE DEPTH OF LAKE TO BE 6'

ELEVATION FT	SURFACE AREA ACRES	AVERAGE ACRES	INCREMENTAL STORAGE	
		38.4	307.2	
460	38.4			307
		54.4	1088	
480	70.4			1395
		99.2	1964	
500	128			3379

STAGE

STORAGE

441.7

0

460.0

307

462.1

370

465.0

475

470.0

725

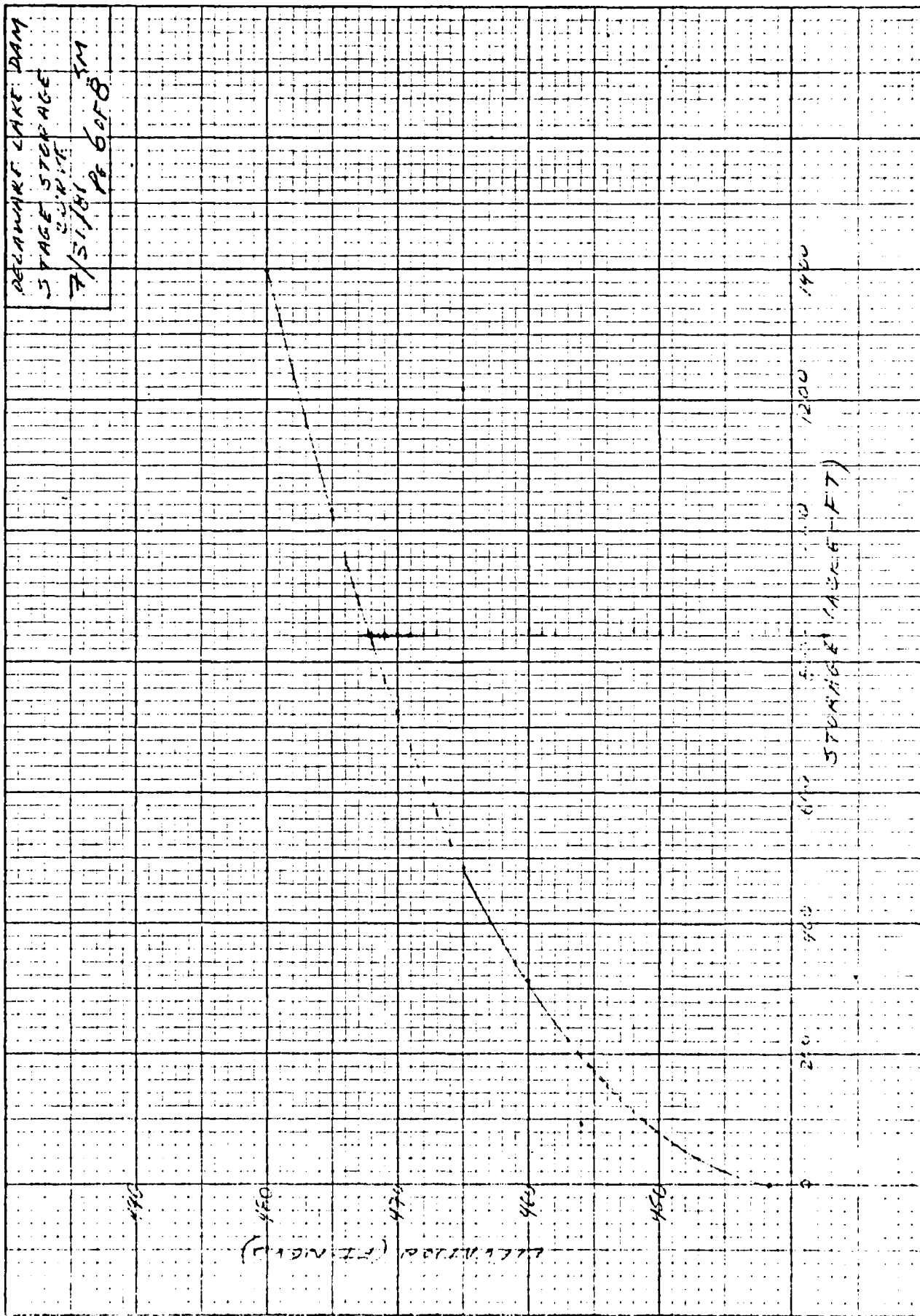
475.0

1030

480.0

1395

DELAWARE LAKE DAM
STAGE STORAGE
CURVE
7/51/61 PE 6058 SM



JOB NO.

SQUARES
1/4 IN. SCALE

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Determination of "C" for
low level outlet

$D = \text{diameter} = 12 \text{ inches}$

$n = 0.015$ reinforced concrete pipe (K & H 2-2)

$A_p = \text{area of pipe opening} = .77 \text{ ft}^2$

$L_p = 70'$

$K_f = \text{friction loss through pipe}$

$$K_f = \frac{5087 n^2}{D^{4.75}} = \frac{5087 (0.015)^2}{(12)^{4.75}} = 0.048$$

$K_L = \text{entrance loss to pipe} = 0.6$ (K & H 2-2)

$C_p = \text{Coefficient of discharge}$

$$C_p = A_p \sqrt{\frac{2g}{14K_L + K_f L_p}} = 0.79 \sqrt{\frac{64.4}{14(0.6) + 0.048(70)}} = 2.9$$

$$C = C_p / A_p / \sqrt{2g}$$

$$= 2.9 / .79 / \sqrt{64.4} = 0.46$$

JOB NO.

SQUARES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
1/4 IN. SCALE

Drawdown by low level outlet

Assume: ① no significant inflow

② one 12" reinforced concrete pipe

③ $Q_p = C_p H^{1/2} = 2.9 H^{1/2}$

④ $\text{Acft/day} = 19835 \times \text{Rate}$

⑤ $\text{Days} = \Delta \text{storage} / \text{Acft/day}$

Elev.	Storage (ac-ft)	ΔS	H ft	Q cfs	Ave Q cfs	Rate day	Days
460	307		17.3	12.1			
		127			11.2	27.2	5.7
455	180		12.3	10.2			
		90			9.0	17.8	5.1
450	90		7.3	7.8			
		70			6.1	12.1	4.8
445	20		2.3	4.4			
		20			2.2	4.4	4.5
442.7	0		0	0			

mid-point
of pipe21.1 day

APPENDIX 5

REFERENCES

DELAWARE LAKE DAM

APPENDIX 5
REFERENCES

DELAWARE LAKE DAM

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