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NATIONAL DAM SAFETY PROGRAM. PINE LAKE PARK DAM (NJ00091), ATLA--ETC(U)
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ATLANTIC COAST BASIN
UNION BRANCH TOMS RIVER
OCEAN COUNTY
NEW JERSEY

PINE LAKE PARK DAM

NJ00091

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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

March, 1979

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PineLake Park

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

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

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

IN REPLY REFER TO
NAPEN-D

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

9 APR 1979

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Pine Lake Park Dam in Ocean 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, Pine Lake Park Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The combined capacity of the spillway and emergency spillway is considered adequate. To insure the safety of structures in the vicinity of the dam and the adequacy of the structure, the following actions are recommended:

a. Within twelve months from the date of approval of this report, engineering studies should be initiated to develop remedial measures to prevent the four buildings in the emergency spillway area from being inundated during periods of high runoff. Any remedial measures found necessary should be initiated in calendar year 1980. In the interim, a warning system should be implemented so that the sluice gates are opened on an emergency basis to increase the spillway capacity during floods.

b. Within twelve months of the date of this report, the following remedial actions should be completed:

(1) Repair or replace the deteriorated walkway and broken chain link fence adjacent to the spillway.

(2) Remove trees and brush on the dam's embankment.

(3) Eroded areas on both sides of the dam's embankment should be filled and compacted.

(4) Riprap the upstream slope of the dam's embankment.

(5) Drain the lake in order to inspect and repair the concrete spillway as necessary.

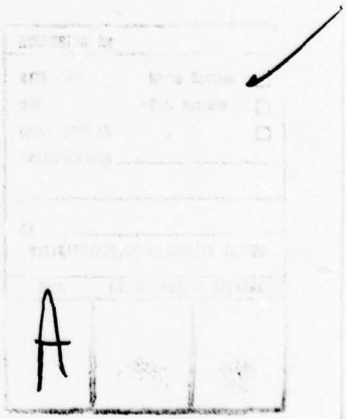
c. The owner should upgrade the operating and maintenance procedures by issuing a manual and check list for recommended procedures. Inspection and maintenance visits should be logged. Records of lake levels should be kept during routine visits and during severe storms. An annual site inspection should be conducted using a visual inspection check list similar to the one used in this report.

d. A more extensive topographic survey of the dam and vicinity, especially the flood plain of the emergency spillway, should be made within twelve months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman William J. Hughes of the Second District. Under the provisions 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.

An important aspect of the Dam Safety Program will be the implementation



of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

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

John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
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P. O. Box CN029
Trenton, NJ 08625

PINE LAKE PARK DAM (NJ00091)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 5 December 1978 by Storch Engineers, 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.

Pine Lake Park Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The combined capacity of the spillway and emergency spillway is considered adequate. To insure the safety of structures in the vicinity of the dam and the adequacy of the structure, the following actions are recommended:

a. **Within twelve months from the date of approval of this report, engineering studies should be initiated to develop remedial measures to prevent the four buildings in the emergency spillway area from being inundated during periods of high runoff.** Any remedial measures found necessary should be initiated in calendar year 1980. In the interim, a warning system should be implemented so that the sluice gates are opened on an emergency basis to increase the spillway capacity during floods.

b. **Within twelve months of the date of this report, the following** remedial actions should be completed:

(1) Repair or replace the deteriorated walkway and broken chain link fence adjacent to the spillway.

(2) Remove trees and brush on the dam's embankment.

(3) Eroded areas on both sides of the dam's embankment should be filled and compacted.

(4) Riprap the upstream slope of the dam's embankment.

(5) Drain the lake in order to inspect and repair the concrete spillway as necessary.

c. **The owner should upgrade the operating and maintenance procedures** by issuing a manual and check list for recommended procedures. Inspection and maintenance visits should be logged. Records of lake levels should be kept during routine visits and during severe storms. An annual site inspection should be conducted using a visual inspection check list similar to the one used in this report.

d. A more extensive topographic survey of the dam and vicinity, especially the flood plain of the emergency spillway, should be made within twelve months from the date of approval of this report.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 26 June 1979

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Pine Lake Park Dam, I.D. NJ00091
State Located: New Jersey
County Located: Ocean
Drainage Basin: Atlantic Coastal
Stream: Union Branch, Toms River
Date of Inspection: December 5, 1978

Assessment of General Condition of Dam

Pine Lake Park Dam is an earthfill dam with a concrete ogee-crested spillway. The dam crest length is 260 feet and the spillway crest length is 49 feet. Two 3' x 3' gated sluices pass through the spillway. An emergency spillway, in the form of a beach area is adjacent to the dam embankment.

Based on the visual inspection, available records, past operational performance and engineering analyses, the dam is judged to be in fair overall condition.

The downstream path of the emergency spillway (beach) includes 4 buildings. Remedial measures to correct this condition should be undertaken in the near future. These measures include detailed hydrologic and hydraulic studies to further refine the spillway design flood (SDF) and spillway capacity.

Until remedial measures are effected, the sluices should be used to augment the capacity of the spillway during times of high lake stage. This measure, which would involve installation of a warning device to alert personnel who would be prepared to open the sluice gates, should be implemented soon.

The concrete spillway, although appearing structurally sound, contains a significant number of cracks and spalls which should be repaired in the near future. In addition, the walkway and fences appurtenant to the spillway should be repaired in the near future by sandblasting, coating with epoxy and grouting where needed.

The embankment is generally free of settlement and appears to be structurally sound. However, it contains detrimental vegetation as well as erosion on its upstream and downstream faces and lacks slope protection on its upstream face. These conditions should be repaired in the near future and thereafter maintained. The repairs include the removal of trees and brush, the filling of eroded areas and the installation of riprap on the upstream face.

The owner should implement in the near future a program of periodic inspection and maintenance for the dam which would include an initial topographic survey to provide a record of existing conditions. As a part of the maintenance program, the lake would be lowered at least every five years at which time the lake would be cleaned and submerged portions of the dam and spillway inspected and repaired.

Richard J. McDermott

Richard J. McDermott, P.E.

OVERVIEW PHOTO - PINE LAKE PARK DAM

5 DEC. 1978

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 30214. 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 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 the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an 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.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PINE LAKE PARK DAM, I.D. NJ00091

SECTION 1 PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (DEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the DEP to inspect and report on a selected group of these dams. The DEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of Pine Lake Park Dam was made on December 5, 1978. The purpose of the inspection was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtenances

Pine Lake Park Dam is an earth fill dam with an uncontrolled concrete spillway having an ogee type crest and two gated sluice outlet works. The embankment surface is sandy with some vegetative cover including sparse brush and trees on the side slopes. A timber core wall runs along the entire length of the embankment, according to plans prepared by Valentine Pasvolsky, dated April, 1940. Secured to the north end of the core wall is a timber wingwall buried in the embankment as indicated by correspondence subsequent to its construction, and a buried timber bulkhead extends 40 feet beyond the wing wall. The bulkhead is in an area now used as a public beach. The beach area is at a lower elevation than the crest of dam embankment in order to serve as an emergency spillway.

The embankment, which has an overall length of 260 feet, has a top width of 10 feet as measured in the field, and upstream and downstream slopes of 3:1 and 4:1 respectively. The spillway has an overall width of 50.5 feet with a 1.5 foot wide pier in the center. Its crest lies 5.9 feet below the top of the earth embankment and 10.1 feet above the invert of the downstream channel.

The two sluice outlets each have dimensions of 3 feet x 3 feet and have submerged inlets and outlets. Each gate is manually operated by means of a vertical stem with provision for a portable key at the top. The stems are secured to a 4 foot wide timber walkway spanning the spillway.

b. Location

Pine Lake Park Dam is situated at the east end of Pine Lake in the Pine Lake Park section of Manchester Township, Ocean County, New Jersey. Water released from Pine Lake passes into the Union Branch of Toms River.

Private lakeside homes lie to the south of the dam while its north end blends into a public beach area. Lake Drive parallels the beach and provides the principal access to the dam.

c. Size and Hazard Classification

Size and hazard classification criteria presented in "Recommended Guidelines for Safety Inspection of Dams," published by the U. S. Army Corps of Engineers are as follows:

SIZE CLASSIFICATION

	IMPOUNDMENT	
Category	Storage (Ac-Ft)	Height (Ft)
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and < 50,000	≥ 40 and < 100
Large	≥ 50,000	≥ 100

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (No permanent structures for human habitation	Minimal (Undeveloped to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than few	Excessive (Extensive community, industry or agriculture)

The characteristics of Pine Lake Park Dam are:

Storage = 809 acre-feet

Height = 16 feet

Potential Loss of Life: One home with an adjacent house house trailer within 300' of dam.

Potential Economic Loss: Bridge 400' from dam, 7 homes approximately 1/2 mile downstream of dam.

Therefore, Pine Lake Park Dam is classified as "Small" size and "Significant"hazard potential.

d. Ownership

Pine Lake Park Dam is owned by the Township of Manchester, One Colonial Drive, Lakehurst, N. J. 08733.

e. Purpose of Dam

Reportedly, the dam was originally constructed to form a lake in connection with the development of the Pine Lake Park residential community. The 1939 Application for Permit for Construction or Repair of Dam by the Township of Manchester listed the purpose as "recreation and conservation of water." The current purpose of the dam is for impoundment of a recreational lake facility.

f. Design and Construction History

No design information or drawings of the original dam, which was constructed during the 1930's, are available. However, plans for repairs and reconstruction of the dam following a 1938 washout of the embankment north of the spillway were obtained. The plans were prepared by Valentine Pasvolsky and dated April, 1940.

In 1941, the embankment was reconstructed as described in (a) above and other repairs were affected. No additional significant alterations were made since that time.

g. Normal Operational Procedures

The dam and appurtenances are maintained by the Manchester Township Department of Public Works. There is no fixed schedule of maintenance rather, the Department of Public Works (DPW) repairs the embankment, spillway, appurtenances and lake as needed.

The two outlet gates are used to drain the lake to facilitate repairs and sediment and debris removal. They are not used for emergency purposes during storms. The lake reportedly was lowered most recently during the summer of 1978 at which time the gates were repaired and the lake cleaned. It was lowered 5 to 6 feet which required 2 to 3 days to accomplish.

1.3 Pertinent Data

a. Drainage Area - 63 square miles

b. Discharge at Damsite

Maximum known flood at damsite	Unknown
Outlet works at pool elevation	253 c.f.s.
Diversion tunnel low pool outlet at pool elevation	N.A.
Diversion tunnel outlet at pool elevation	N.A.
Gated spillway capacity at pool elevation	N.A.
Gated spillway capacity at maximum pool elevation	N.A.
Ungated spillway capacity at maximum pool elevation	
a. Spillway	2430 c.f.s.
b. Emergency Spillway (beach)	1716 c.f.s.
Total spillway capacity at maximum pool elevation	4146 c.f.s.

c. Elevation (Feet above MSL)

Top of Dam	36.8
Maximum pool-design surcharge	36.8
Full flood control pool	N.A.
Recreation pool	31±
Spillway crest	30.9
Upstream portal invert diversion tunnel	N.A.
Stream bed at centerline of dam	20.8
Maximum tailwater	28± (Estimated)

d. Reservoir

Length of maximum pool	4,490 feet (Estimated)
Length of recreation pool	3,750 feet (Scaled)
Length of flood control pool	N.A.

e. Storage (Acre-feet)

Recreation pool	267 acre-feet
Flood control pool	N.A.
Design surcharge	809 acre-feet
Top of dam	809 acre-feet

f. Reservoir Surface (Acres)

Top of dam	130 acres (Estimated)
Maximum pool	130 acres (Estimated)
Flood control pool	N.A.
Recreation pool	56 acres
Spillway crest	56 acres

g. Dam

Type	Earthfill
Length	260 feet
Height	16 feet
Sideslopes - Upstream	3 horiz. to 1 vert.
- Downstream	4 horiz. to 1 vert.
Zoning	Unknown
Impervious core	Timber sheet piles
Cutoff	None
Grout curtain	None

h. Diversion and Regulating Tunnel — N.A.

i. Spillway

Type	Ogee crest
Length of weir	49 feet
Crest elevation	30.9
Gates	N.A.
Upstream channel	N.A.
Downstream channel	N.A.

j. Regulating Outlets

2 - 3' x 3' sluices controlled by manually operated gates

SECTION 2: ENGINEERING DATA

2.1 Design

No plans or calculations pertaining to the original construction of the dam could be obtained. However, a certain amount of information generated at the time of the repair and reconstruction in 1940 is available. As mentioned in Paragraph 1.2.f., plans were prepared in 1940 indicating the following:

1. Profile of dam showing spillway and core wall
2. Plan showing embankment, walkway and cribbed timber wingwall at north end of dam.
3. Cross section of spillway
4. Cross section of dam
5. Details of bulkhead, core anchor and wingwall
6. Location
7. Details of walkway

In addition, calculations pertaining to the reconstruction were obtained. These were prepared, apparently, by John N. Brooks, Acting Engineer in Charge, N. J. State Water Policy Commission. The calculations indicate that the Design Peak Flow to be handled by the spillway and emergency spillway was 2560 cfs. They also indicate that this peak flow was to be handled by the combined capacities of the spillway and a 200 foot long area north of the embankment left at a lower elevation to serve as an emergency spillway. According to the

calculations, when the lake stage is 5 feet above the crest of the spillway, it is 2.5 feet above that of the emergency spillway. At this stage, the combined capacity of the spillway and emergency spillway is 3800 c.f.s.

2.2 *Construction*

A report written by John Brooks in January, 1942 indicated that the construction of the embankment, sluice-gates and walkway was completed in accordance with the drawings and that the embankment was well constructed and thoroughly sodded both up and downstream. A subsequent letter by H. T. Critchlow, N.J. State Water Policy Commission, indicated that construction photographs existed depicting the timber wingwall at the north end of the embankment.

Monthly Progress Reports made by the State Water Policy Commission in 1941 and 1942 indicate that embankment, masonry and timber construction had been 100% completed during that period.

2.3 Operation

No records of operation of the lake or dam are available. Likewise, no records of the failure of the dam in 1938 could be found, except for a reference in past correspondence to the fact that a break or washout had taken place.

Four past inspection reports have been obtained. In February, 1942, John Brooks reported evidence of considerable seepage near the downstream toe of the embankment on both sides of the spillway.

In May, 1946, Norman C. Wittwer reported the following:

1. The seepage noted in 1942 was not present

2. The construction joint in the right (south) downstream wingwall was opened approximately 2-1/2"

3. The downstream concrete face of spillway was somewhat eroded

4. A small section of the downstream toe of the left (north) wingwall was cracked open

In September, 1970, John A. Ernst, Jr. reported that the dam and spillway were in fair condition. This report which noted evidence of settlement and cracking as well as erosion and some spalling of the wingwall concrete, concluded that the lake should be lowered to permit more complete inspection.

In August, 1971, John Ernst again inspected the dam and made the following recommendations:

1. Apply concrete to spalled areas in northwest and south east walls

2. Correct undermining of the northeast wall by placing crushed rock in the stream and around the end of the wall.

3. Fill joints which have opened.

It is not known whether corrective action referred to in (2) above was taken.

His report also made the following observations:

1. There was no evidence of seepage

2. The dam had not been overtopped during the period of the report

3. All wood was in good condition with no rotting or broken boards.

4. The spillway apron was in good condition

2.4 Evaluation

a. Availability

Engineering information was not available except that which is on file at the DEP. The DEP file contains plans, calculations, correspondence and photographs and is available for inspection at the offices of the Bureau of Flood Plain Management, 1474 Prospect Street, Trenton, N. J.

b. Adequacy

The available information forms a fairly complete description of subject dam with a few exceptions which are listed in paragraph 7.1.b.

c. Validity

That information which was able to be verified was valid within a reasonable allowance for error. Data found in the DEP file which is at variance with the findings of this inspection and evaluation are noted in paragraph 7.1.b.

Hydraulic design computations prepared in 1940 were found to be invalid for the following reason: the low area adjacent to the dam was designated as an emergency spillway, yet it was assumed that it would be utilized in passing floods with magnitude equal to the design flood. The emergency spillway should have been designed so that it would not be overtopped by such a flood. The improper design of the emergency spillway has resulted in a dangerous condition since homes have been constructed in its downstream flood plain.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspection of Pine Lake Park Dam took place on December 5, 1978 by members of the staff of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

1. The embankment of the dam, appurtenant structures and adjacent areas were examined.
2. The embankment and accessible appurtenant structures were measured and key elevations determined by hand level.
3. The embankment and appurtenant structures and adjacent areas were photographed.
4. A member of the staff of the Manchester Township Engineering Department was present to assist in the inspection.

b. Dam

The dam embankment appeared to be uniformly aligned both vertically and horizontally. The surface generally was sandy and bare with sparse growths of brush and trees. Erosion was present along the upstream face and to a limited extent on the downstream face. The embankment was deeply eroded in three of the four areas where it is adjacent to the spillway wingway.

There was no evidence of cracking, settling or seepage and no animal holes were noted.

The generalized soils description of the dam site consists of shallow surface alluvial deposits of stratified silty sands with varying amounts of gravel deposited during the Quaternary Period and known as the Cape May Formation in the Geologic Map of New Jersey prepared by Lewis and Kummel. The shallow surface deposits are underlain by alluvial deposits of stratified medium to coarse silty sands with local thin beds of gravel and clay deposited during the Tertiary Period and known as the Cohansey Sands. Bedrock is in excess of 100 feet below the ground surface.

It is assumed that the dam embankment is founded on the silty sands of the Cape May Formation.

c. Appurtenant Structures

Spillway

The crest of the spillway appeared uniformly aligned although it was completely submerged at the time of inspection. The center pier which supports the pedestrian bridge or walkway was in fair condition with spalling and erosion at the water line However, it appeared to be structurally sound. Spalled areas were noted on all wingwalls especially at the water line. Also, adjacent sections of the wingwalls were misaligned at construction joints in two places: 1. downstream south wingwall - vertical misalignment of 1 to 2 inches and 2. downstream, north wingwall - horizontal misalignment of 1 inch. The vertical construction joint in the downstream, south wingwall was open approximately 2 inches and partially filled with mortar.

Walkway

The timber portion of the walkway over the spillway was in good condition and structurally sound. The chain link fences forming its railings were in fair condition, needing minor repair. The chain link fences adjacent to the wingwalls also were in need of minor repair.

Sluices

The two sluice outlets and their gates were completely submerged and therefore could not be observed. However, the operating mechanisms were demonstrated by the Department of Public Works crew as being in satisfactory working condition.

d. Reservoir Area

Pine Lake is long and narrow, averaging 650 feet in width with an overall length of almost 3/4 mile. Along the west shore are scattered dwellings of the Pine Lake Park development while the east shore consists of a beach area at the southern (downstream) end with the remainder wooded.

The reservoir is located in a topographically flat area and consequentally has gradually sloping shores. There were no structures, such as docks, observed on or near the shoreline.

At the north end of the dam, the embankment blends into an adjacent beach area which is bordered by a public road. The beach slopes upward from the water to form a crest along its rear edge near the road. The elevation of the low point of the crest was found to be 34.6, which is 2.2 feet below the elevation of the top of the dam. The beach has an overall length of approximately 1000 feet, 200 feet of which adjacent to the dam serves as an emergency spillway. It was in the section of the beach that is used as an emergency spillway that elevations were determined. The remaining 800-foot length of beach also appeared to be relatively low.

e. Downstream Channel

The spillway outflows into the Union Branch of Toms River which is a shallow, wide stream in the proximity of the dam. It appears to have a fairly uniform bottom and is free of weeds, pools, obstructions and debris. It has gently sloping banks and is wooded to its edge. A bridge, supporting a local street, crosses the stream approximately 400 feet downstream from the dam.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in Pine Lake is naturally regulated by discharge over the spillway of Pine Lake Dam which has a fixed crest elevation. During intense storms which cause high water levels in the lake, discharge has occured over the emergency spillway (beach) adjacent to the dam in addition to the spillway.

The lake is lowered whenever necessary for maintenance and repair by opening the two sluice-gates in the spillway.

4.2 Maintenance of the Dam

There is no program of regular inspection and maintenance of the dam and appurtenant structures. Maintenance is performed by the Manchester Twp. DPW as the need arises.

The most recent maintenance to the lake and dam reportedly was performed during 1978 and consisted of the following:

1. Clean lake
2. Repair sluice-gates
3. Repair walkway

4.3 Maintenance of Operating Facilities

The sluice-gates and the operating mechanisms used to open and close them are maintained by the Manchester Twp. DPW as the need arises. It is not known when the sluice conduit was last serviced.

4.4 Description of Any Warning System in Effect

A warning system is not in use at present nor is one known to have been utilized in the past.

4.5 Evaluation

The operation of the spillway, since the 1941 repairs to the dam, has been successful to the extent that the dam has not been washed out nor overtopped since that time. However, it is reported by the DPW that on at least two occasions the lake rose to overtop the emergency spillway (beach).

The maintenance program for the dam appears to have been fairly adequate, yet lacks adequate documentation. The walkway, fences and top of dam all are in good condition or are scheduled to undergo minor repair. However, some areas of maintenance have not been adequately performed, such as the following:

1. Sod on embankment not maintained
2. Trees and brush allowed to grow on embankment
3. Erosion of embankment especially at junction with spillway wingwalls not treated
4. Spalls and cracks on concrete spillway not repaired

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The intensity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff intensity, called the spillway design flood (SDF) is described in terms of return frequency or probable maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army corps of Engineers, the SDF for Pine Lake Park Dam falls in a range of 100-year frequency to 1/2 PMF. In this case, the low end of the range, 100-year frequency, is chosen since the factors used to select size and hazard classification are on the low side of their respective ranges.

The peak 100-year flood is 2180 cfs, as calculated in accordance with analytical procedures contained in Report 38.

Computations used to determine the spillway discharge capacity as well as that of the emergency spillway (beach) are contained in Appendix 4 of this report. The spillway was assumed to have outflow characteristics of an ogee weir and the emergency spillway was assumed to perform as a broad creasted weir.

The spillway discharge (with water level at the dam crest) was computed to be 2430 c.f.s. and the emergency

spillway discharge (with water level at the dam crest) was computed to be 1716 c.f.s. The total discharge with water level at the dam crest was computed to be 4146 c.f.s. Since this value is greater than the computed peak SDF (2180 c.f.s.), the spillway is considered to be adequate according to criteria developed by the U.S. Army Corps of Engineers.

b. Experience data

According to personnel at the Manchester DPW, the emergency spillway(beach) was overtopped at least twice in the past 15 years; however the dam has not been overtopped during that period. When the beach was overtopped, no downstream homes were inundated.

c. Visual observations

There was no evidence at the time of inspection of overtopping of the dam. The beach was in good condition and its crest was found to be 2.2 feet below the level of the top of dam and 3.7 feet above the crest of the spillway. This is close to the conditions assumed in the 1941 calculations. It is our opinion that in the event of a 100-year storm, the present beach, in conjunction with the spillway, would perform essentially the same as intended in 1941.

There are 4 buildings including 3 homes in the immediate downstream area of the emergency spillway (beach) and a road adjacent to the beach. These could be effected by any overtopping of the beach (emergency spillway).

d. Overtopping potential

As indicated in paragraph 5.1.a, the dam would not be overtopped during a storm with a magnitude equivalent to either the 1941 design flood or the present SDF. This analysis is presented in the spillway stage-discharge rating contained in Appendix 4.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual observations

The embankment appeared, at the time of inspection, to be structurally sound with no evidence of cracks, displacement or differential settlement.

The misalignment of the spillway wingwalls noted in paragraph 3.1.c. did not appear to indicate a serious structural deficiency in that component of the dam. It could not be determined which side of the construction joint shifted. Furthermore, past inspection reports indicate that a similar state of misalignment and widening of constructions joints has existed since 1946. Therefore, it appears that these conditions have not significantly advanced during the past 30 years or more.

b. Design and construction data

Any analysis of structural stability apparently is not available. The only design and construction data available are the drawings prepared by Valentine Pasvolsky, dated April, 1940.

c. Operating Records

Operating records which would supply any information regarding structural stability are not available.

d. Post construction changes

Since Pine Lake Park Dam was reconstructed in 1941, there have been no changes to the dam or the area surrounding it that could have any effect on its structural integrity.

e. Seismic Stability

Pine Lake Park Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if stable under static loading conditions. Pine Lake Park Dam appears to be stable under static loading conditions.

2

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

The SDF applicable to Pine Lake Park Dam (100-year flood) has been calculated to have a peak magnitude of 2180 c.f.s. The Combined capacity of the spillway and emergency spillay (beach) when the lake stage equals the elevation of the dam crest is 4146 c.f.s. Thus, the spillways are considered adequate according to the criteria developed by the U. S. Army Corps of Engineers.

The structural integrity of the dam appears to be adequate based on field investigations. No reported nor written evidence was found that would contradict that assumption.

Therefore, based on hydraulic and structural considerations, Pine Lake Park Dam is assessed as being satisfactory in relation to guidelines developed by the U. S. Army Corps of Engineers. Although some information has not been determined (see paragraph 7.1.d.), this is not considered to have a significant effect on the overall assessment of the dam's general condition.

b. Adequacy of Information

Information was gathered from several sources, including: 1. field investigation, 2. plans, calculations and correspondence in DEP files, 3. USGS quadrangle sheet, 4. aerial photography from Ocean County, 5. consultation

with Manchester Twp. Engineering Department and DPW. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

1. Stream and lake elevation gauging records.
2. Description of dam embankment fill materials.
3. Boring logs of soils under the embankment.
4. Flood calculations and reservoir routing based on current engineering practices.
5. As-built drawings of the dam and appurtenances.

There is an identification found in the DEP file which should be corrected. Filed information indicates that Pine Lake Park Dam is located on the Ridgeway Branch of Toms River. However, the Coast and Geodetic Quadrangle for the area in which the dam is located indicates that the downstream channel is the Union Branch of Toms River.

Also, the N.J. State Water Policy Commission, Report on Dam Application dated December, 1940, indicates that the spillway crest length is 46 feet. Field measurements confirm the length to be 49 feet.

c. Necessity for Additional Data/Evaluation

Although some data pertaining to Pine Lake Park Dam are not available, additional data are not considered imperative for this evaluation due to the size and hazard potential classifications of the dam and its general appearance of structural integrity.

To provide an adequate record of existing conditions, a topographic survey should be undertaken as outlined in paragraph 7.2.c.

7.2 Recommendations

a. Remedial Measures

Since the establishment of the emergency spillway (beach, four buildings have been constructed in its downstream flood plain. At present, it is evident that the buildings could be inundated in the event that the beach is overtopped. Remedial measures should be initiated in the near future to correct this condition. Two alternative remedial measures to correct this condition are presented:

1. Increase the capacity of the main spillway by replacing the existing structure with one having a longer effective spillway crest length.

2. Improve the emergency spillway by constructing a downstream channel that will be able to adequately direct stormwater into the downstream channel of the spillway. This would probably involve the purchase of the land on which the channel would be located.

Each of these two alternatives requires additional hydrologic studies beyond the scope of that needed for the present Phase I analysis.

Until remedial measures are effected, the two sluices should be used on an emergency basis in order to increase the capacity of the spillway at the time of a major flood. To accomplish this, a warning device should soon be installed at the dam which would automatically alert designated personnel when the lake stage reaches a certain prescribed elevation. The personnel would be prepared to open the sluice gates if such action were warranted by an evaluation of meteorological conditions.

In addition to the remedial measures indicated above, it is recommended that the following measures be undertaken by the owner in the near future:

1. Repairs to the walkway, which had been initiated at the time of visual inspection, should be completed.

2. The chain link fences adjacent to the spillway wing walls should be straightened where needed and any damaged sections replaced.

3. Vegetation on the dam embankment should be removed. Trees and brush should be cut at the ground surface in a way that will cause minimal disturbance to the embankment.

4. The eroded areas on the dam embankment should be properly filled and compacted. Such work should be done immediately after the vegetation has been removed.

5. Riprap should be installed and longitudinally centered at the normal water line on the upstream face of the dam along the entire length of the embankment.

6. The concrete spillway should be thoroughly inspected and repaired as outlined below:

    a. Drain the lake to an elevation equal to the inverts of the sluices.
    b. Sand blast all concrete and apply an epoxy preservative coating to all surfaces.
    c. Pressure grout all major cracks and patach all spalls and eroded surfaces.

The implementation of the above measures will require proper detailed design and the obtaining of applicable DEP approvals.

b. Maintenance

In the near future, the owner of the dam should initiate a program of periodic inspection and maintenance, the complete records of which to be kept on file and made available to the public. A visual inspection by a qualified professional engineer should be made annually and reported on an standardized check-list form. Repairs should be made when required and the following maintenance should be performed annually: remove vegetation from the embankment, repair the riprap after it is installed on the upstream dam face, repair all fencing, fill any eroded surfaces of the embankment, and clear the downstream channel and the emergency spillway downstream channel if constructed. In

addition, the lake should be lowered at least every five years at which time sediment should be cleaned from the lake and the submerged portions of the dam and spillway inspected and repaired.

c. Additional Studies

A detailed topographic survey of the dam including the emergency spillway and area around the dam, especially the overflow path of the emergency spillway, should be undertaken in the near future by a qualified licensed land surveyor or professional engineer. The survey map should be related to existing construction drawings and should become part of the permanent record mentioned above.

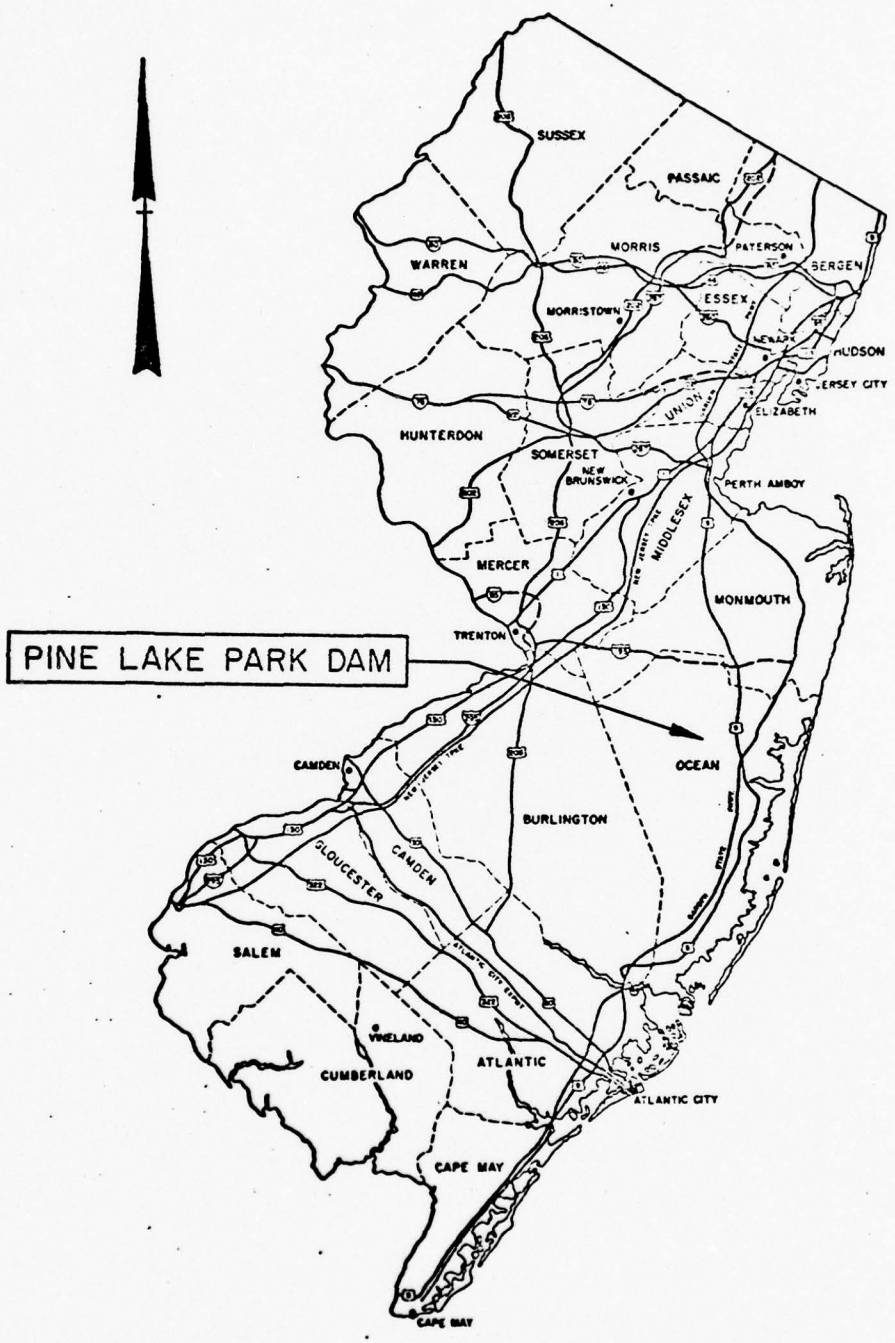


PLATE 1

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS KEY MAP PINE LAKE PARK DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00091 / SCALE: NONE DATE: JANUARY, 1979

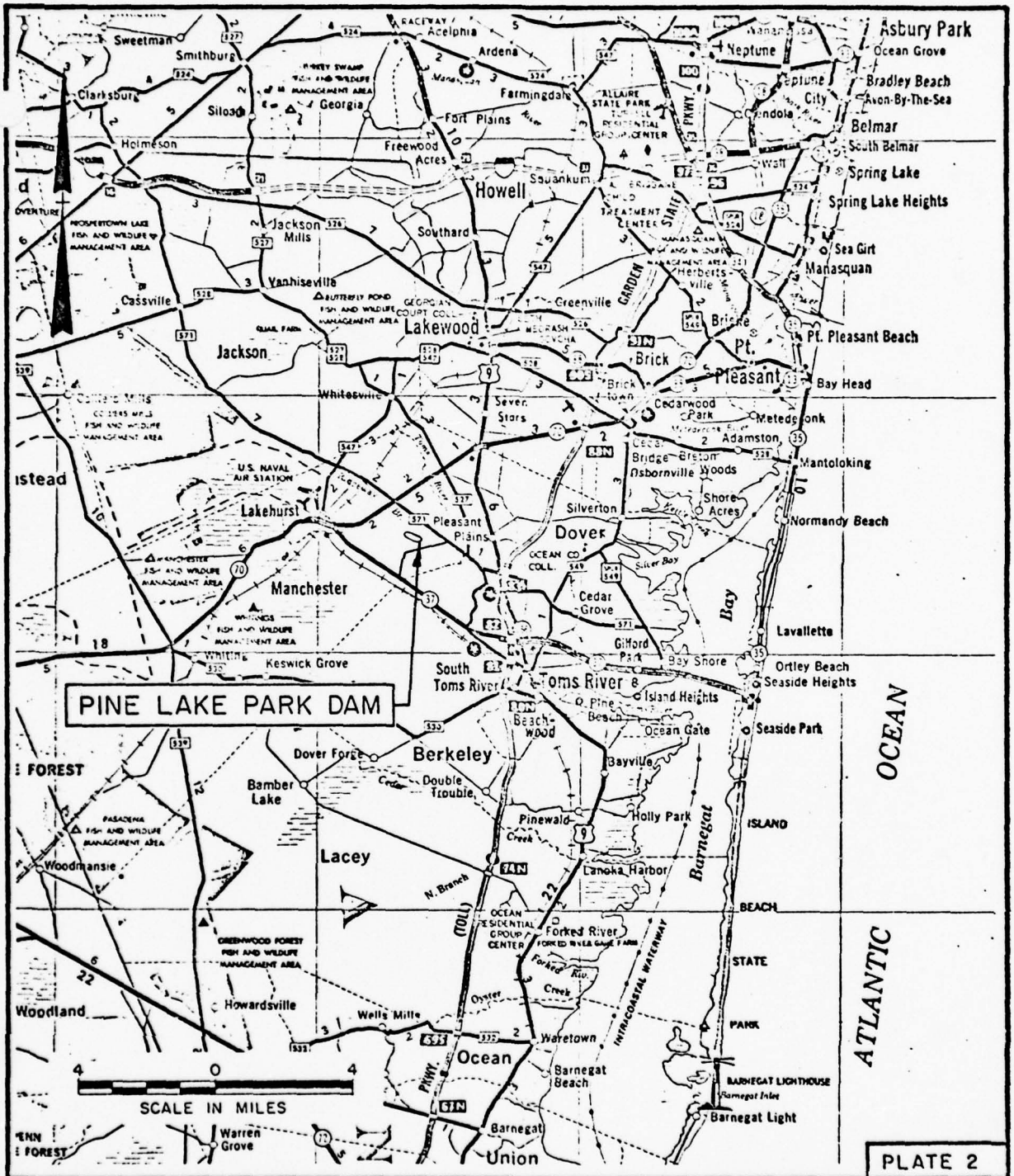


PLATE 2

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

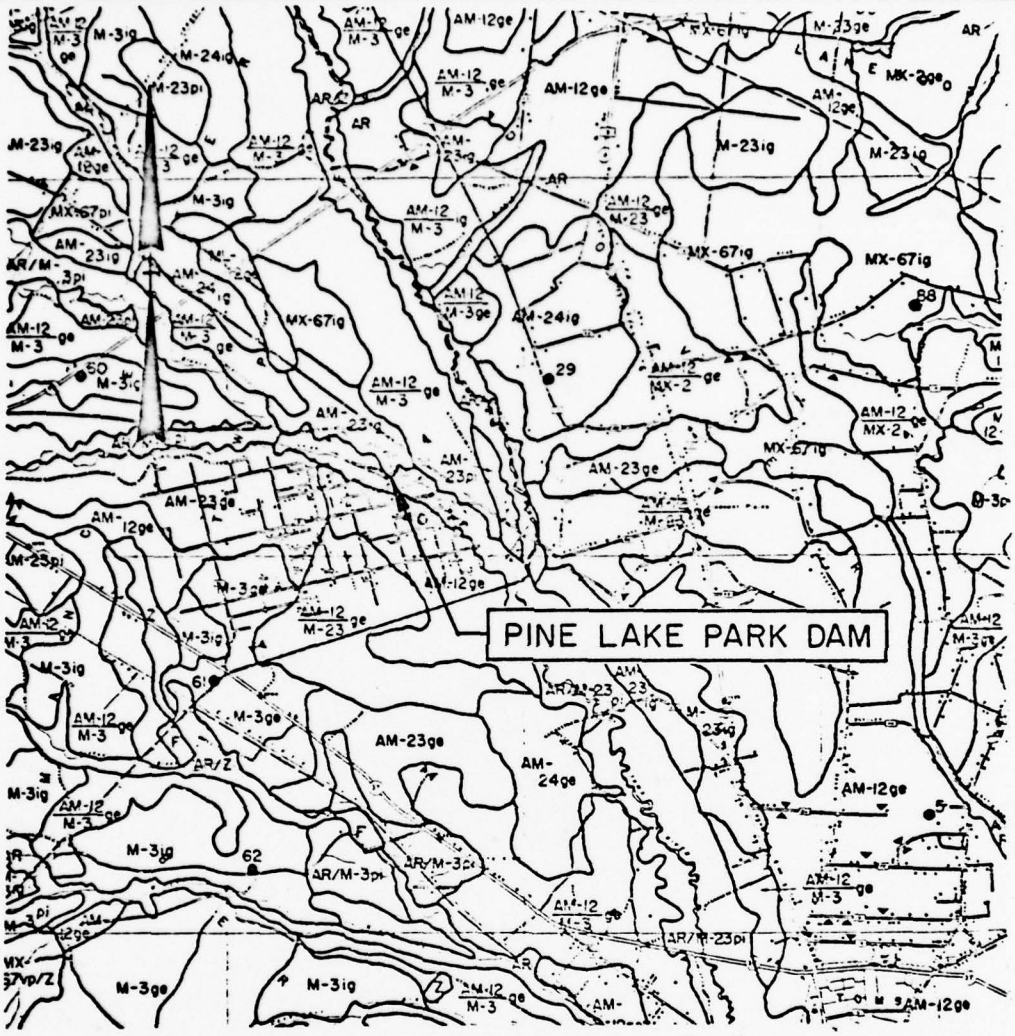
VICINITY MAP

PINE LAKE PARK DAM

I.D. N.J. 00091

SCALE: AS SHOWN

DATE: JANUARY, 1979



Legend

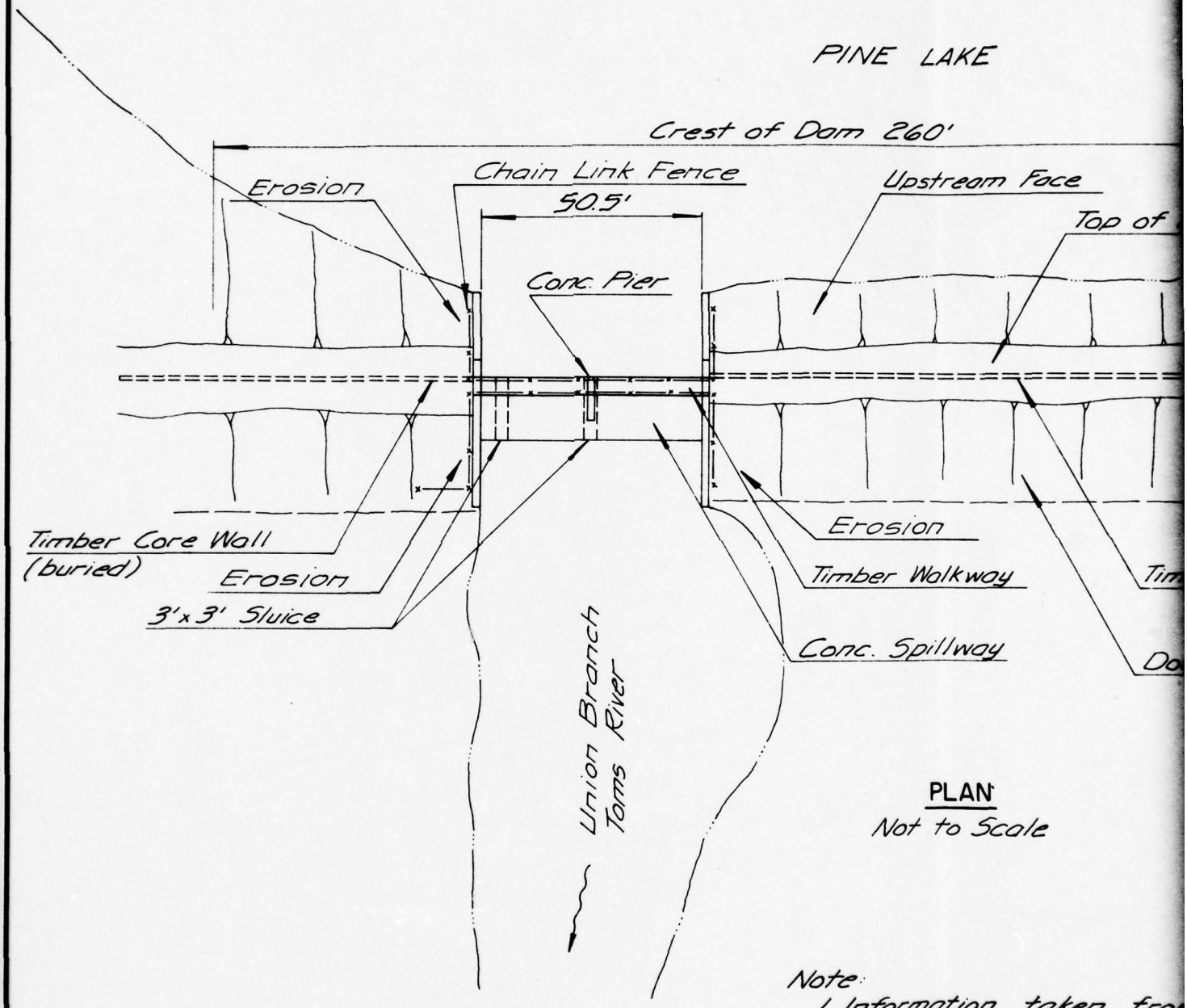
AM-23 — Alluvial, stratified materials deposited during the Quaternary period. (Cape May formation)

AR/M-23 — Stratified, recent alluvium and stratified materials deposited during the Tertiary period. (Cohansey Sand)

NOTE: Information taken from Rutgers University Soil Survey of New Jersey, Report No. 8 and Geologic Map of New Jersey prepared by Lewis and Kummel.

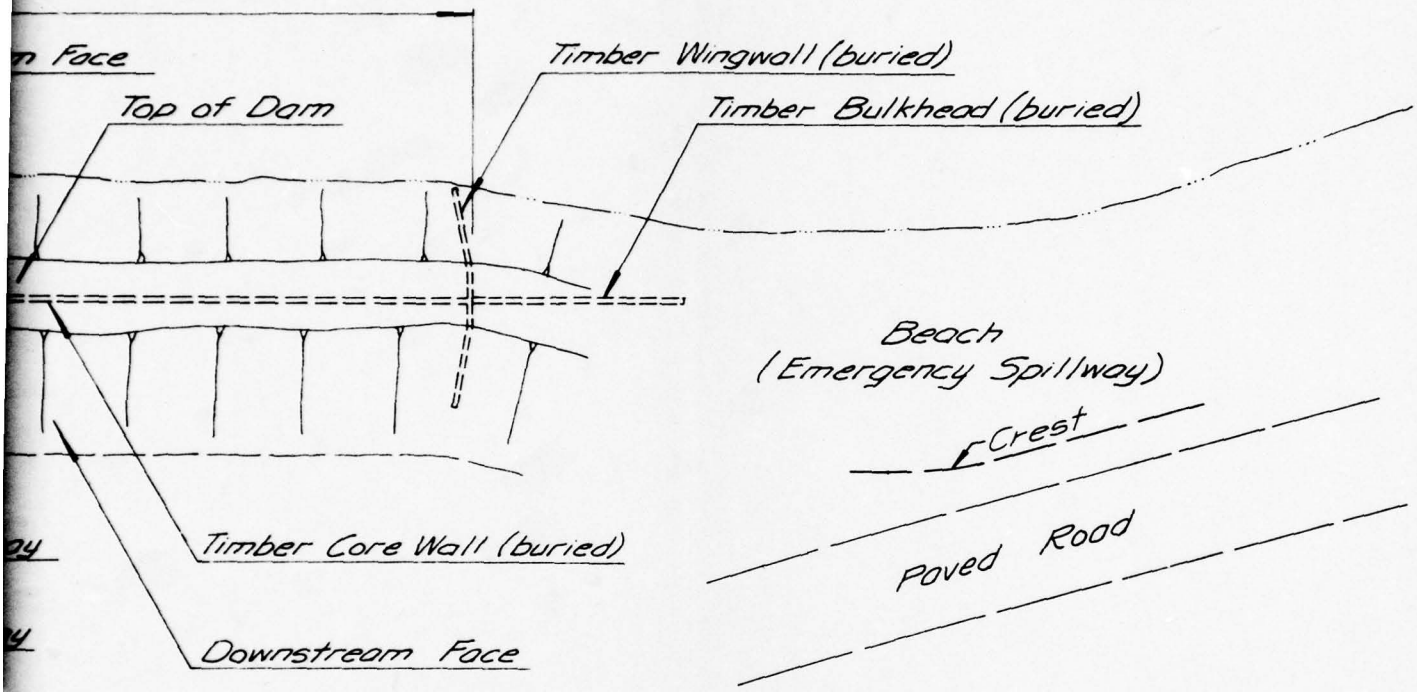
PLATE 3

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS **SOIL MAP** PINE LAKE PARK DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00091 — SCALE: NONE DATE: JANUARY, 1979



PLAN
Not to Scale

Note:
1. Information taken from
Valentine Posvolsky, Apr
field inspection Decemb



cale

taken from plan by
Posvolsky, April 1940 and
ction December 5, 1978

PLATE 4

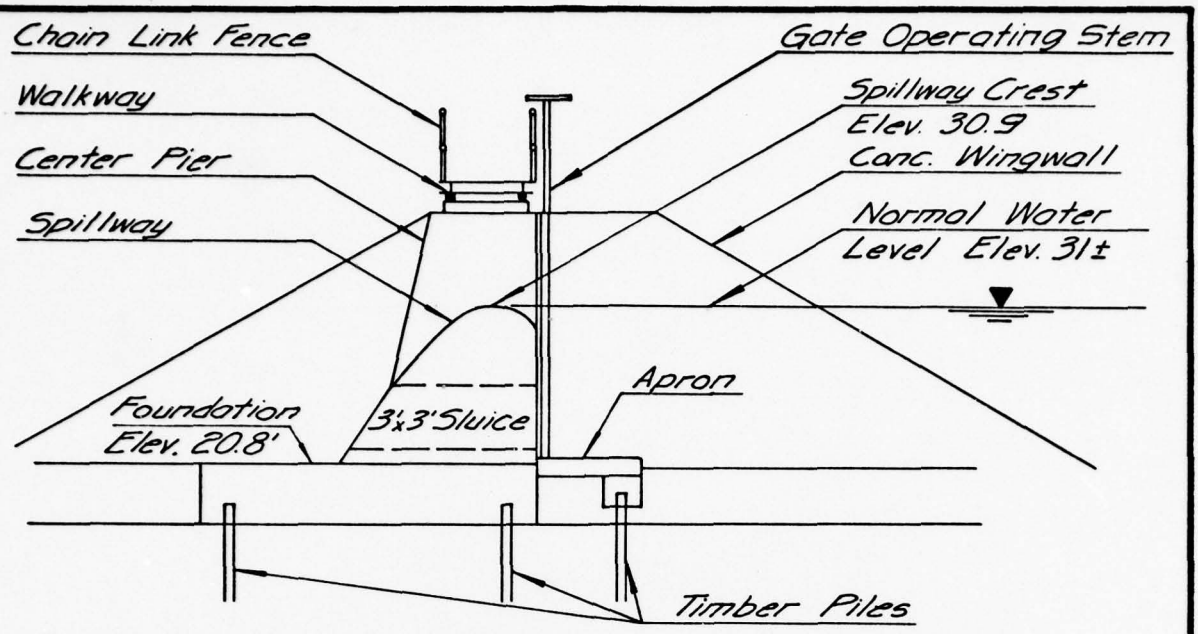
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

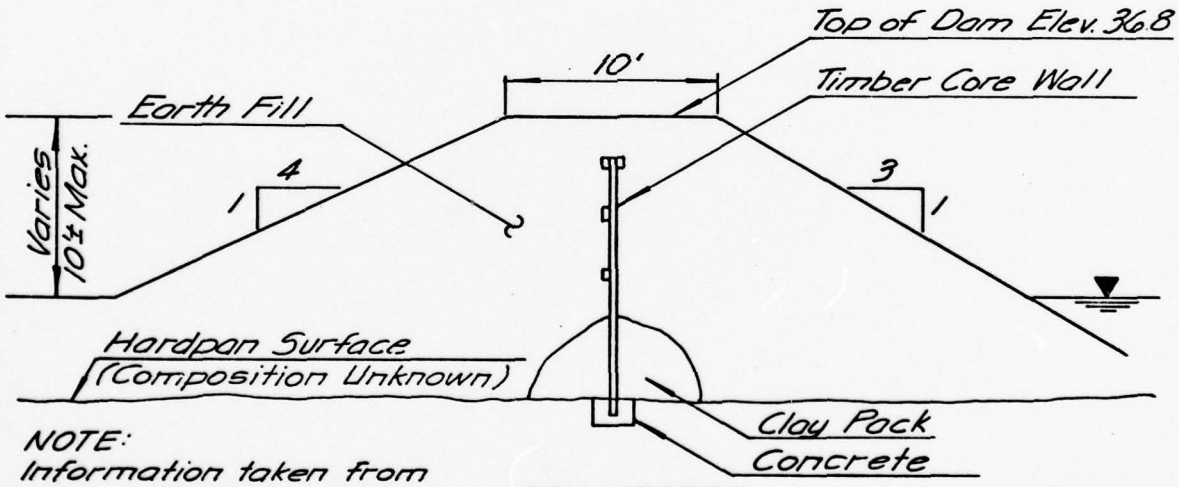
PLAN

PINE LAKE PARK DAM

I.D. N.J. 00091	SCALE: AS SHOWN
	DATE: JANUARY, 1979



SPILLWAY SECTION
Not to Scale

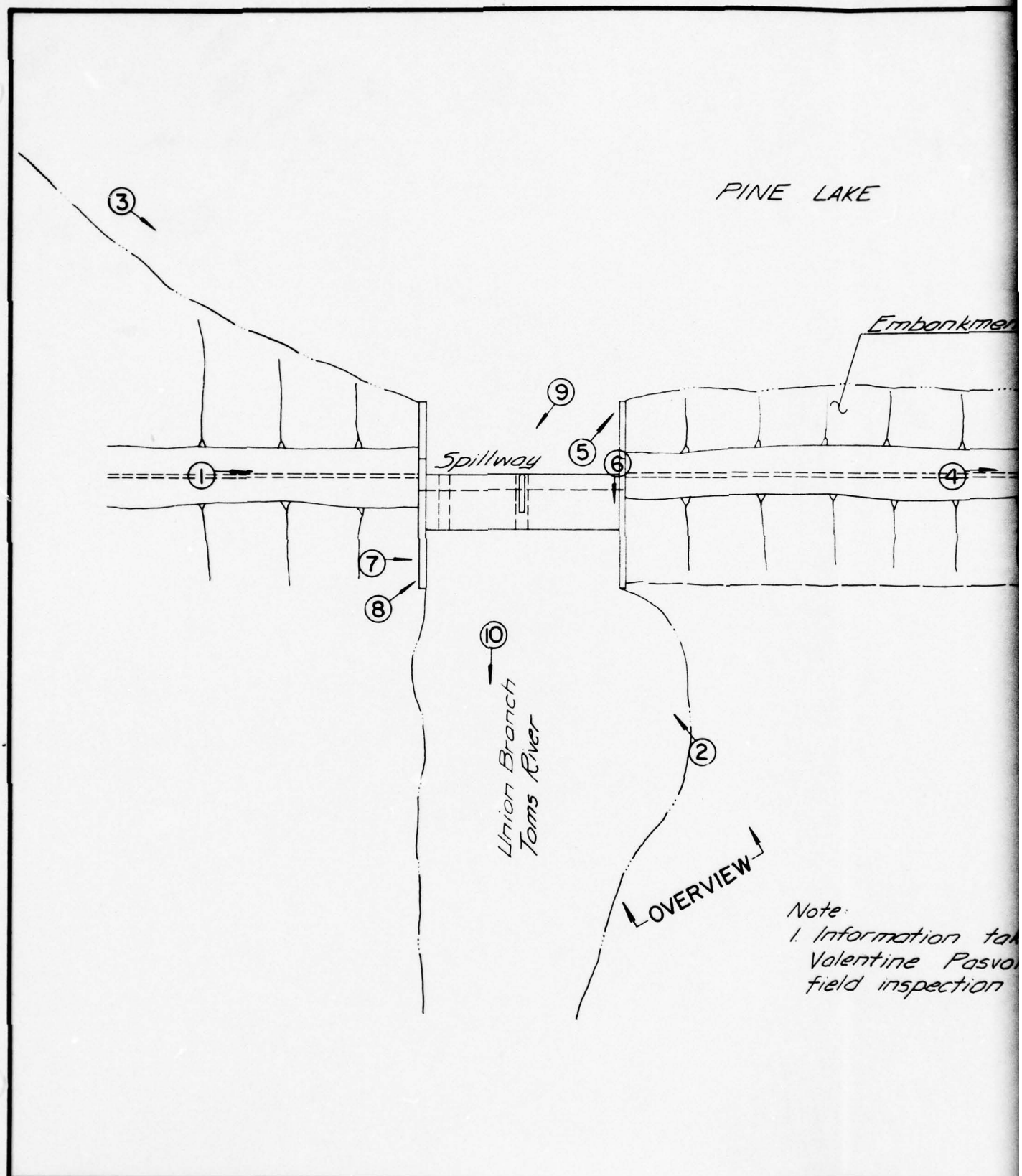


NOTE:
Information taken from plan by Valentine Pasvolsky, April, 1940 and field inspection December 5, 1978.

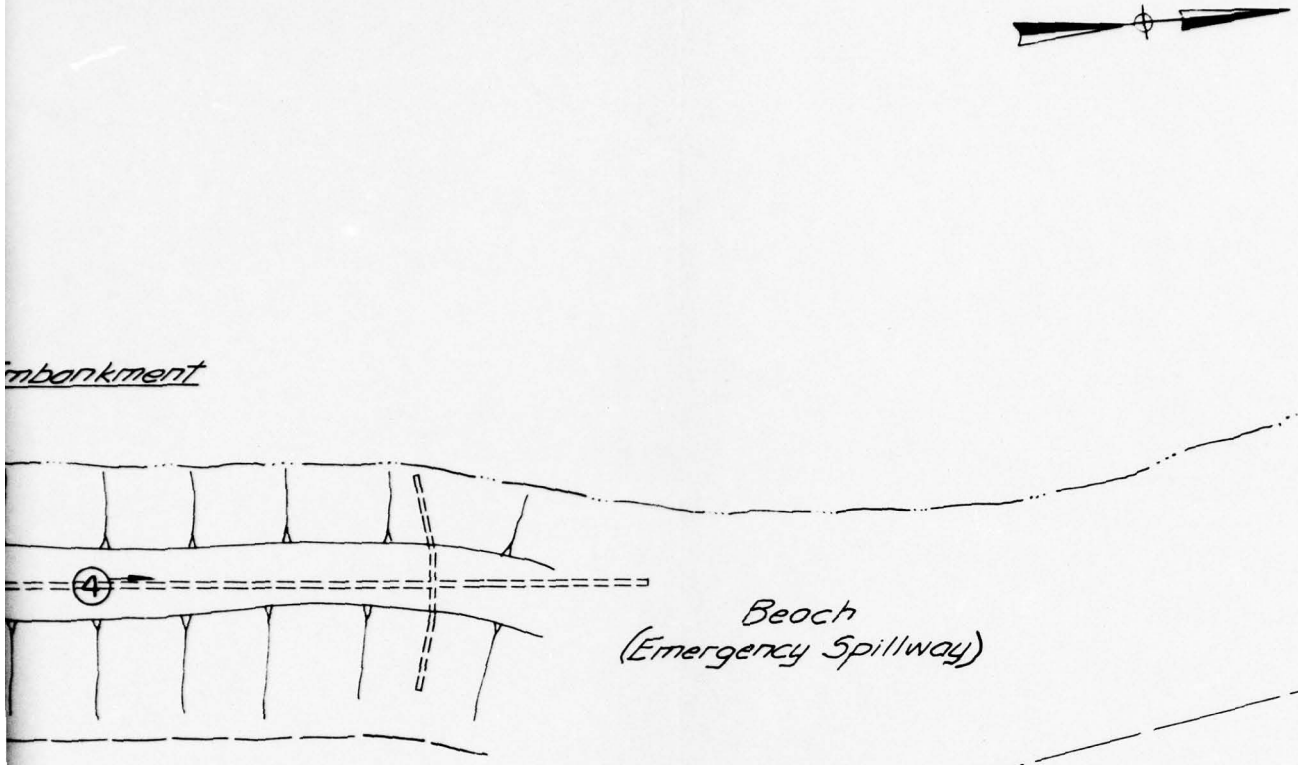
DAM SECTION
Not to Scale

PLATE 5

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS **SECTIONS** PINE LAKE PARK DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00091 — SCALE: AS SHOWN DATE: JANUARY, 1979


PINE LAKE
Embankmen
Spillway
Union Branch
Toms River
OVERVIEW
Note:
1. Information tak
Valentine Pasvo
field inspection

2



ation taken from plan by
e Pasvolsky, April 1940 and
spection December 5, 1978.

PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

PINE LAKE PARK DAM

I.D. N.J.00091	SCALE: NOT TO SCALE
	DATE: JANUARY, 1979

Check List
Visual Inspection
Phase 1

Name Dam Pine Lake Park County Ocean State N.J. Coordinators NJDEP

Date(s) Inspection 12/5/78 Weather Cloudy Temperature 53°F

Pool Elevation at Time of Inspection 31.6 M.S.L. Tailwater at Time of Inspection 26.5 M.S.L.

Inspection Personnel:

Richard McDermott Miron Petovski

John Gribbin

Dinesh Patel

John Gribbin Recorder

Present: Carl Sten, Manchester Twp. Engr. Dept. and members of maintenance crew

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEE PAGE ON LEAKAGE	N.A.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N.A	
DRAINS	N.A	
WATER PASSAGES	N.A.	
FOUNDATION	N.A.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBERSVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N.A.	
STRUCTURAL CRACKING	N.A.	
VERTICAL AND HORIZONTAL ALIGNMENT	N.A.	
MONOLITH JOINTS	N.A.	
CONSTRUCTION JOINTS	N.A.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Deep furrow on upstream, south emb. Deep furrow on downstream, north emb. Some erosion along upstream, north face of dam.	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Uniformly aligned vertically and horizontally	
RIPRAP FAILURES	N.A.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Upstream and downstream faces are predominantly sandy with some brush and tree growth	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Deep erosion adjacent to 3 of 4 wingwall projections of spillway: Upstream and downstream, south and downstream north Some soil washing into enlarged vertical joint opening in downstream, south wingwall	
ANY NOTICEABLE SEEPAGE	NONE	
STAFF GAGE AND RECORDER	NONE	
DRAINS	NONE	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Submerged	
INTAKE STRUCTURE	2 each 3' x 3' sluiceways-gates were operated satisfactorily by maintenance crew	
OUTLET STRUCTURE	Submerged	
OUTLET CHANNEL	N.A.	
EMERGENCY GATE	NONE	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Completely submerged. Appeared to be in good condition Crest uniformly aligned	
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	Stilling pool adequate	
BRIDGE AND PIERS	Center pier spalled near water line Walkway in good condition	Some repairs have been done in 1978. Minor repairs still needed.
WING WALLS	Considerable spalling and cracking especially near water line South, downstream wingwall construction joint open approx. 2" and vertical misalignment noted.	Some surface concrete patches noted

GATED SPILLWAY

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

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	USGS Monument #5266 Elev. 36.76 MSL (Located on top of south wingwall)	
OBSERVATION WELLS	NONE	
WEIRS	NONE	
PIEZOMETERS	NONE	
OTHER	N.A.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle slopes to water surface with forest cover. Approx. 1000' of beach along southeast shore	
SEDIMENTATION		Lake reportedly was lowered and cleaned of sediment and debris in summer of 1978.
EMERGENCY SPILLWAY	Bathing beach located north of dam serves as emergency spillway. Overflow elevation at 2.2± feet below the crest of dam or 3.7± feet above spillway crest	Four buildings located immediately downstream from emergency spillway

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Natural Stream fee of obstructions and debris	
SLOPES	Gentle slopes thickly wooded on both sides	
APPROXIMATE NO. OF HOMES AND POPULATION	Pine Lake Park (section of Manchester Twp) approx 730 homes Immediate downstream area of dam: 1 home with house trailer	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Plans of proposed repair to dam, bulkhead, and wingwall by Valentine Pasvolsky, Lakewood Municipal Engineer, April 1940
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Avilable (limited)
TYPICAL SECTIONS OF DAM	Not Available
HYDROLOGIC/HYDRAULIC DATA	Some data available in connection with 1940 repair
OUTLETS - PLAN	See Plan referenced above
- DETAILS	
-CONSTRAINTS	Not available
-DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	None available

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

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	N.A.
HIGH POOL RECORDS	Not available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	4 Inspection Reports available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Reference to 1938 washout - no description
MAINTENANCE OPERATION RECORDS	Not Available

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	See 1940 Plan referenced above
OPERATING EQUIPMENT PLANS & DETAILS	See 1940 Plan referenced above

PHOTO 1

WALKWAY OVER SPILLWAY.
TOP OR CREST OF DAM.

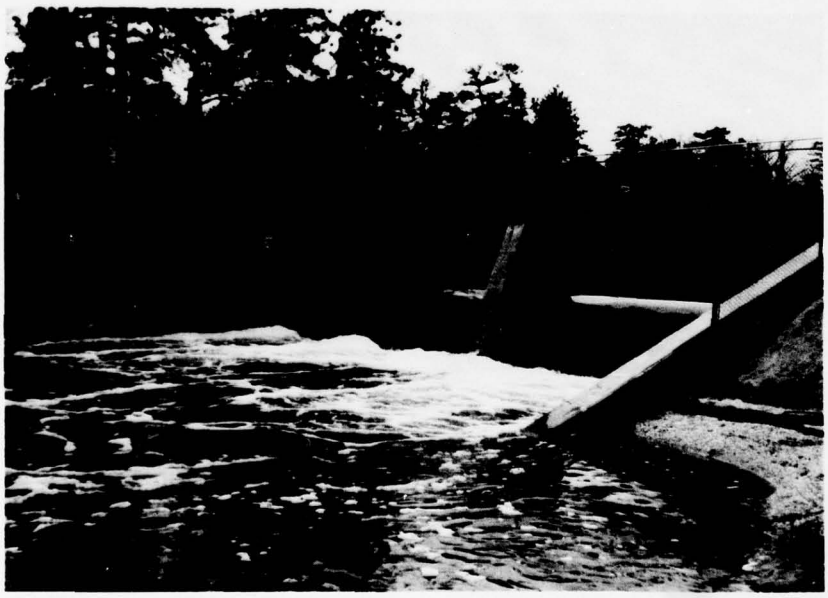


PHOTO 2

SPILLWAY.

5 DEC. 1978

PHOTO 3

VEGETATION ON UPSTREAM FACE OF DAM.

PHOTO 4

CREST OF DAM AND EROSION ON UPSTREAM FACE. BEACH NORTH OF DAM (EMERGENCY SPILLWAY).

5 DEC. 1978

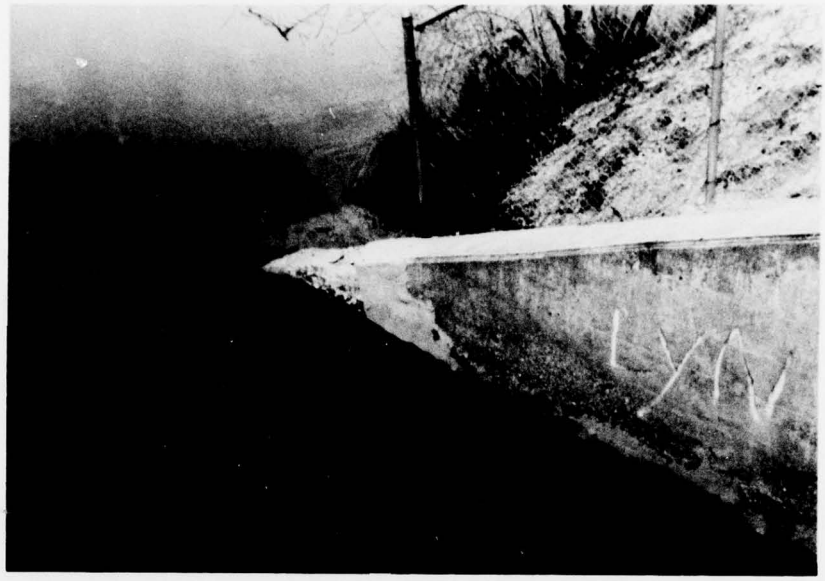


PHOTO 5

CONCRETE SPALL AND REPAIRS ON NORTH-UPSTREAM WINGWALL.

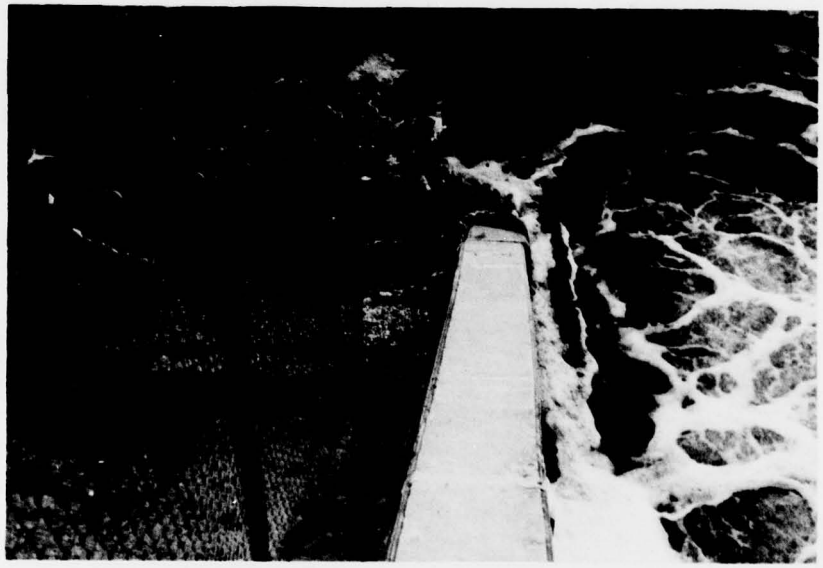


PHOTO 6

HORIZONTAL DISPLACEMENT AT CONSTRUCTION JOINT AND
REPAIRS ON NORTH-UPSTREAM WINGWALL.

5 DEC. 1978

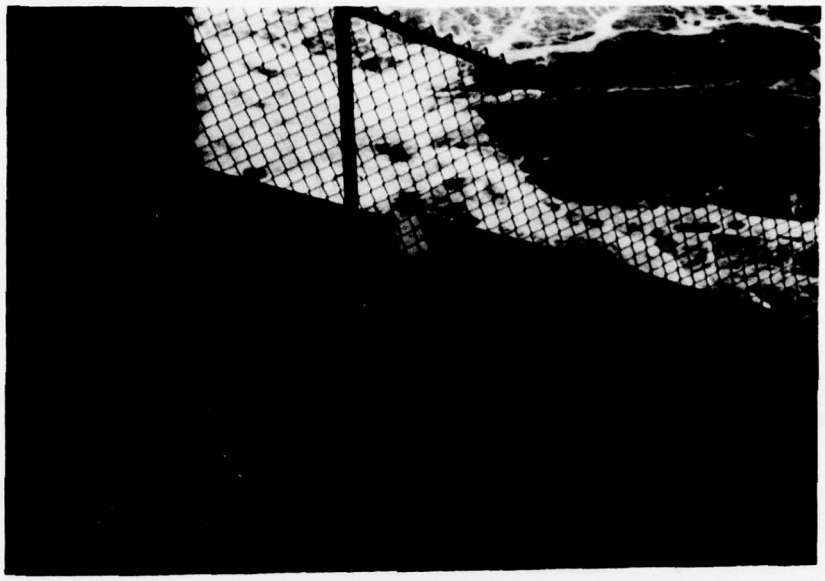


PHOTO 7

VERTICAL DISPLACEMENT AND REPAIRS AT CONSTRUCTION JOINT ON SOUTH-DOWNSTREAM WINGWALL.

PHOTO 8

SPALL ON PIER. CRACKS AND SPALL ON SOUTH-DOWNSTREAM WINGWALL. EROSION AT WINGWALL.

5 DEC. 1978

PHOTO 9

REPAIRS ON SOUTH WINGWALLS. SHAFTS FOR OUTLET GATES. SPALL ON PIER.

PHOTO 10

VIEW LOOKING DOWNSTREAM. ROAD BRIDGE OVER STREAM.

5 DEC. 1978

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Predominately wooded

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 31± (267 acre-feet)

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

ELEVATION MAXIMUM DESIGN POOL: 36.8 (Field measured)

ELEVATION TOP DAM: 36.8 (Field measured)

SPILLWAY CREST: Straight, reinforced concrete

a. Elevation 30.9

b. Type Ogee

c. Width N.A.

d. Length 49 feet

e. Location Spillover Entire length of spillway

f. Number and Type of Gates None

OUTLET WORKS: 2 - 3' x 3' sluices

a. Type Box culvert

b. Location Through spillway

c. Entrance inverts submerged

d. Exit inverts submerged

e. Emergency draindown facilities: Gates operated from walkway

HYDROMETEOROLOGICAL GAGES: None

a. Type N.A.

b. Location N.A.

c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake stage equal to top of dam) 4146 cfs (combined spillway and emergency spillway)

SPILLWAY DISCHARGE

The discharge over the crest will be calculated by the following formula,

$$Q = C L H_e^{3/2}$$

where Q = discharge,
C = a variable coefficient of discharge
L = effective length of crest, and
H_e = total head on the crest, including velocity of approach head, h_a.

The pier and abutment effects will be accounted for by the following formula,

$$L = L' - 2(NK_p + K_a) He$$

where, L = effective length of crest
L' = net length of crest
N = number of piers
K_p = pier contraction coefficient
K_a = abutment contraction coefficient, and
He = total head on crest.

For Pine Lake Park Dam spillway,

K_p (round-nosed piers) = 0.01

K_a (square abutments) = 0.20

N = 1

C (From DEP) = 3.7

L' = 49 ft.

COEFFICIENT OF DISCHARGE

Ref: Design of Small Dams

U.S. Department of The Interior.

2nd Edition 1973.

H_o = Design Head

H_e = Total head on the crest, including velocity of approach head, h_a.

Stream bed elevation = 20.8

Crest of spillway elevation = 30.9

Top of embankment elev. = 36.8

(Ref: Page 372 : C Hydraulics of Control Structures)

$P = 30.9 - 20.8 = 10.1$ Ft

Max $H_o = 36.8 - 30.9 = 5.9$ Ft

$\therefore$ Minimum value of $\frac{P}{H_o} = \frac{10.1}{5.9} = 1.71$

From fig. 249, assuming $\frac{H_e}{H_o} = 1$; $\frac{C}{C_o} = 1$

Minimum value of $C = 3.92$.

When $\frac{P}{H_o} > 2.5$. $C = 3.95$.

From DEP $C = 3.7$

For calculations use $C = 3.7$

STORCH ENGINEERS

Sheet 3 of 9

Project # 1132

Made By DMP Date

PINE LAKE PARK DAM

Chkd By JG Date

Elevation	Hc in Ft	L' Ft	$2(NK_p + K_a)$	L $= L' - 2(NK_p + K_a)Hc$
30.9	0	49	0.42	49
31.4	0.5	49	0.42	48.79
31.9	1.0	49	0.42	48.58
32.4	1.5	49	0.42	48.37
32.9	2.0	49	0.42	48.16
33.4	2.5	49	0.42	47.95
33.9	3.0	49	0.42	47.74
34.4	3.5	49	0.42	47.53
34.9	4.0	49	0.42	47.32
35.4	4.5	49	0.42	47.11
35.9	5.0	49	0.42	46.90
36.4	5.5	49	0.42	46.69
36.8	5.9	49	0.42	46.52

Elevation	He in Ft	L Ft	Q CFS
30.9	0	49.00	0
31.4	0.5	48.79	63.8
31.9	1.0	48.58	179.7
32.4	1.5	48.37	328.8
32.9	2.0	48.16	504.0
33.4	2.5	47.95	701.3
33.9	3.0	47.74	917.8
34.4	3.5	47.53	1,152
34.9	4.0	47.32	1,401
35.4	4.5	47.11	1,664
35.9	5.0	46.90	1,940
36.4	5.5	46.69	2,228
36.8	5.9	46.48	2,430

EMERGENCY SPILLWAY DISCHARGE

Reference: King, Handbook of Hydraulics

Assume emergency spillway (beach) acts as broad crested weir.

$$Q = C L H^{3/2}$$

where $C = 2.63$, $L = 200'$, H = height of water over crest of weir.

Elevation	H (ft)	Q (cfs)
34.6	0	0
35.1	0.5	186
35.6	1.0	526
36.1	1.5	966
36.8	2.2	1716

STORCH ENGINEERS

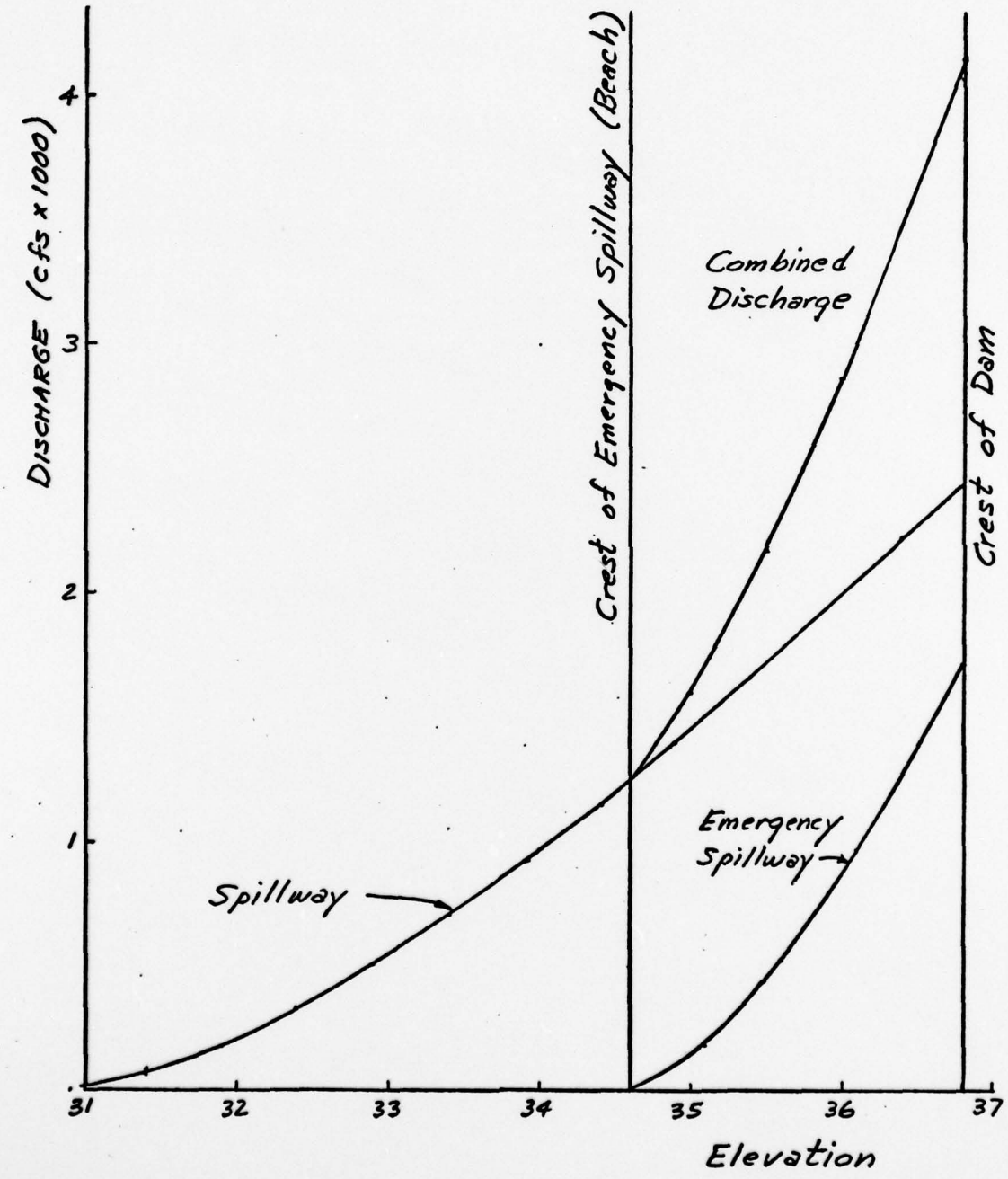
Sheet 6 of 9

Project 1132

Made By JG Date

Pine Lake Park Dam

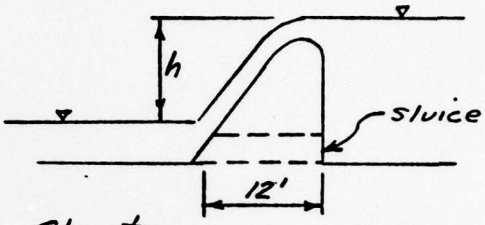
Chkd By Date



Capacity of Outlet Works

Outlet works: 2 - 3' x 3' sluices

Based on outlet control
Assume tail water elev.
5' below spillway crest



Calculations based on "Hydraulic Charts for the Selection of Highway Culverts," U.S. Dept. of Transportation

$L = 12'$
$K_e = 0.5$
$R = 0.75$
$n = 0.015$

Water Elevation	h (feet)	Q (cfs)
30.9	5.0	253
31.9	6.0	278
32.9	7.0	300
33.9	8.0	321
34.9	9.0	340
35.9	10.0	358
36.8	11.0	376

100 YEAR FLOOD - PEAK DISCHARGE

From Special Report 38.

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

1. Area = 64 Sq. Mi

2. Main Channel Slope (S) :-

Length of main-channel = 16.15 Mi.

10% of Stream Length = 1.62 Mi

85% of Stream Length (0.85)(16.15) = 13.73 Mi.

Elevation at 13.73 Mi upstream from Dam } = 130

Elevation at 1.62 Mi upstream from Dam } = 40.

$$S = \frac{130 - 40}{13.73 - 1.62} = \frac{90}{12.11} = 7.43 \text{ Ft/Mi}$$

3. Manmade - impervious cover Index

Population :

Boro of Lakehurst	3,500
Township of Manchester	24,000
Jackson Township	24,000
Total	51,500

Population Density = $\frac{51,500}{64}$ = 800 Persons/Sq. Mi

Impervious Cover Index I = 11%

4 Areas of Lakes and Swamps :-

Area as measured from geological survey maps } = 9.304 x 10 x 0.1435 Sq. Mi

= 13.35 Sq. Mi

Storage Index (S_t) = $\frac{13.35}{64} \times 100 + 1$

= 22. percent.

5 $Q_{100} = 136\, A^{0.84}\, S^{0.26}\, S_t^{-0.51}\, I^{0.14}$

$= 136\,(64)^{0.84}\,(7.43)^{0.26}\,(22)^{-0.51}\,(11)^{0.14}$

$= 136 \times 32.9 \times 1.68 \times 0.207 \times 1.4$

= 2,180 CFS.

1. "Recommended Guidelines for Safety Inspection of Dams," Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20314.

2. Design of Small Dams, Second Edition, United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, 1973.

3. Holman, William W. and Jumikis, Alfreds R., Engineering Soil Survey of of New Jersey, Report No. 8, Ocean County, Rutgers University, New Brunswick, N. J. 1953.

4. "Geologic Map of New Jersey" prepared by J. Volney Lewis and Henry B. Kummel, dated 1910 - 1912.

5. Stankowski, Stephen J., Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization, Special Report 38, State of New Jersey Department of Environmental Protection, Division of Water Resources, 1974.

6. Herr, Lester A., Hydraulic Charts for the Selection of Highway Culverts, U.S. Department of Transportation, Federal Highway Administration, 1965.

7. Safety of Small Dams, Proceedings of the Engineering Foundation Conference, American Society of Civil Engineers, 1974.

8. Plans titled "Public Park, Manchester Township, Ocean County, N. J." (3 sheets) prepared by Valentine Pasvolski, dated April, 1940.