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NATIONAL DAM INSPECTION PROGRAM. PROMISED LAND DAM (NDI-PA 0030--ETC(U)
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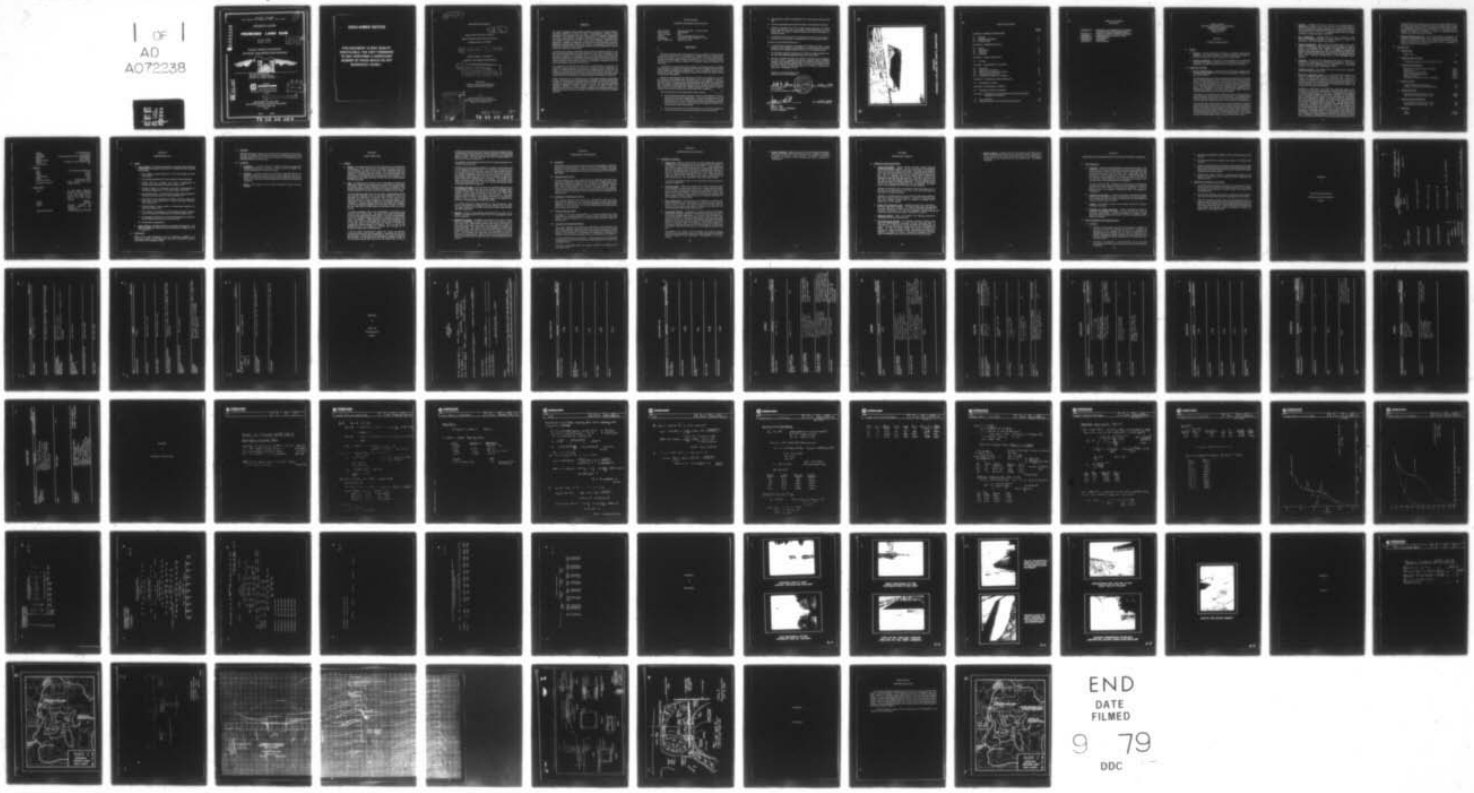

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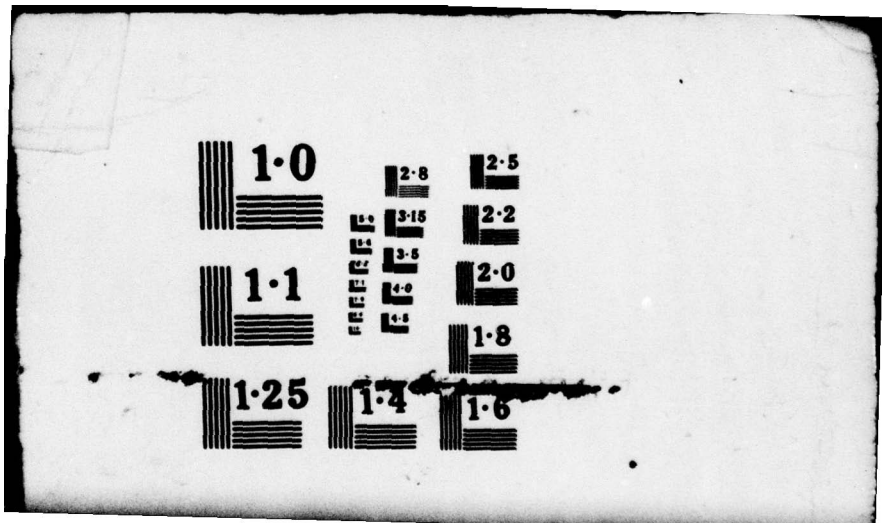
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DELAWARE RIVER BASIN
EAST BRANCH WALLENPAUPACK CREEK, PIKE COUNTY

PENNSYLVANIA

PROMISED LAND DAM

NDI-PA 00308
PA DER 52-12

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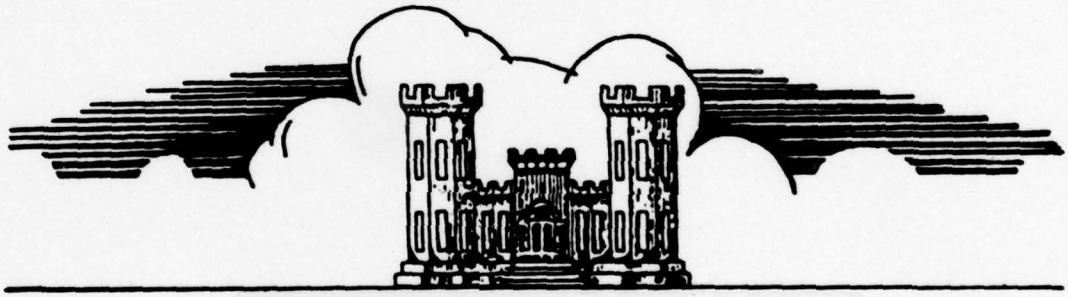
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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DEPARTMENT OF THE ARMY
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MAY 1979

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(11) May 79

DELAWARE RIVER BASIN

(12) 78 p.

Name of Dam: Promised Land Dam

County and State: Pike County, Pennsylvania

Inventory Number: PA 00308

(15) DACW31-79-C-0010

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

(6) Nationa Dam Inspection Program. Promised Land Dam (NDI-PA 00308, PA DER 52-12), Delaware River Basin, East Branch Wallenpaupack Creek, Pike County, Pennsylvania. Phase I Inspection Report.

Prepared by:

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

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For:

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of 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 investigations, 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. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

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 frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design 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 REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Promised Land Dam ID # PA 00308
State Located:	Pennsylvania
County Located:	Pike
Stream:	East Branch Wallenpaupack Creek
Coordinates:	Latitude 41° 19.1', Longitude 75° 12.6'
Date of Inspection:	December 6, 1978

ASSESSMENT

Promised Land Dam is an earth embankment approximately 125 feet long with a maximum height of 16 feet. The spillway is a broadcrested weir, approximately 33 feet long, located in the center of the embankment. The reservoir drain system consists of a 48 inch square conduit controlled by means of a stop-log structure. The dam impounds a 422 acre reservoir for recreation within the Promised Land State Park.

Examination of the results of the hydrologic and hydraulic analyses indicates that the spillway is capable of passing 45 percent of the Probable Maximum Flood (PMF) without overtopping the embankment. Since the spillway cannot pass 50 percent of the PMF, which is the Spillway Design Flood (SDF), the spillway system is classified as "inadequate".

Based on visual observations made during the date of the inspection, the dam and its appurtenant structures are considered to be in fair condition. There is a low area at the top of dam near the right abutment, and bulges in the dry stone wall are evident. Seeps exist near the downstream toe on the right side of the dam. A large (50 foot high, 24 inch diameter) tree is adjacent to the downstream toe of the dam on the right side. Riprap protection on the upstream slope is missing. Some concrete surfaces have deteriorated due to spalling.

Recommendations and remedial measures are as follows:

1. Detailed analyses should be initiated to determine the stability of the dam and need for structural improvements. Evaluate the significance of the seepage and the cause of discoloration of seepage downstream of the dam to the right of the spillway. The stability analyses and seepage evaluation should be performed by a licensed professional engineer experienced in the design and construction of dams.

2. The large tree adjacent to the downstream toe of the right embankment should be cut below ground level and the hole filled and compacted.

3. The parking lot should be regraded so that runoff drains away from the dam.

4. The stop-logs should be provided with means to facilitate their removal.

5. Decisions concerning the need to place riprap protection, fill settled areas, raise the top of dam, and construct additional spillway facilities should await the results of stability analyses and further hydrologic and hydraulic studies.

6. Consideration could be given to increasing the capacity of the spillway in accordance with the results of detailed hydrologic and hydraulic studies.

Operation and Maintenance Procedures :

1. A warning system should be developed for Promised Land Dam. During periods of heavy rainfall or rapid snowmelt the dam should be monitored and downstream residents alerted in the event of an impending failure.

2. The stop-logs should be removed every 6 months to remove sediment that may have been deposited against the stop-logs in the conduit.

3. Until the necessary remedial work has been performed and consideration has been given to increasing the spillway capacity based on detailed hydraulic and hydrologic studies, lake levels should be monitored during periods of heavy rain or rapid snowmelt. If during those periods, the lake level rises rapidly, the stop-logs should be removed to minimize the possibility of overtopping the dam.

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

Will M. Heiser

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
WILL M. HEISER
ENGINEER
No. 6926E

Date: 14 June 1979

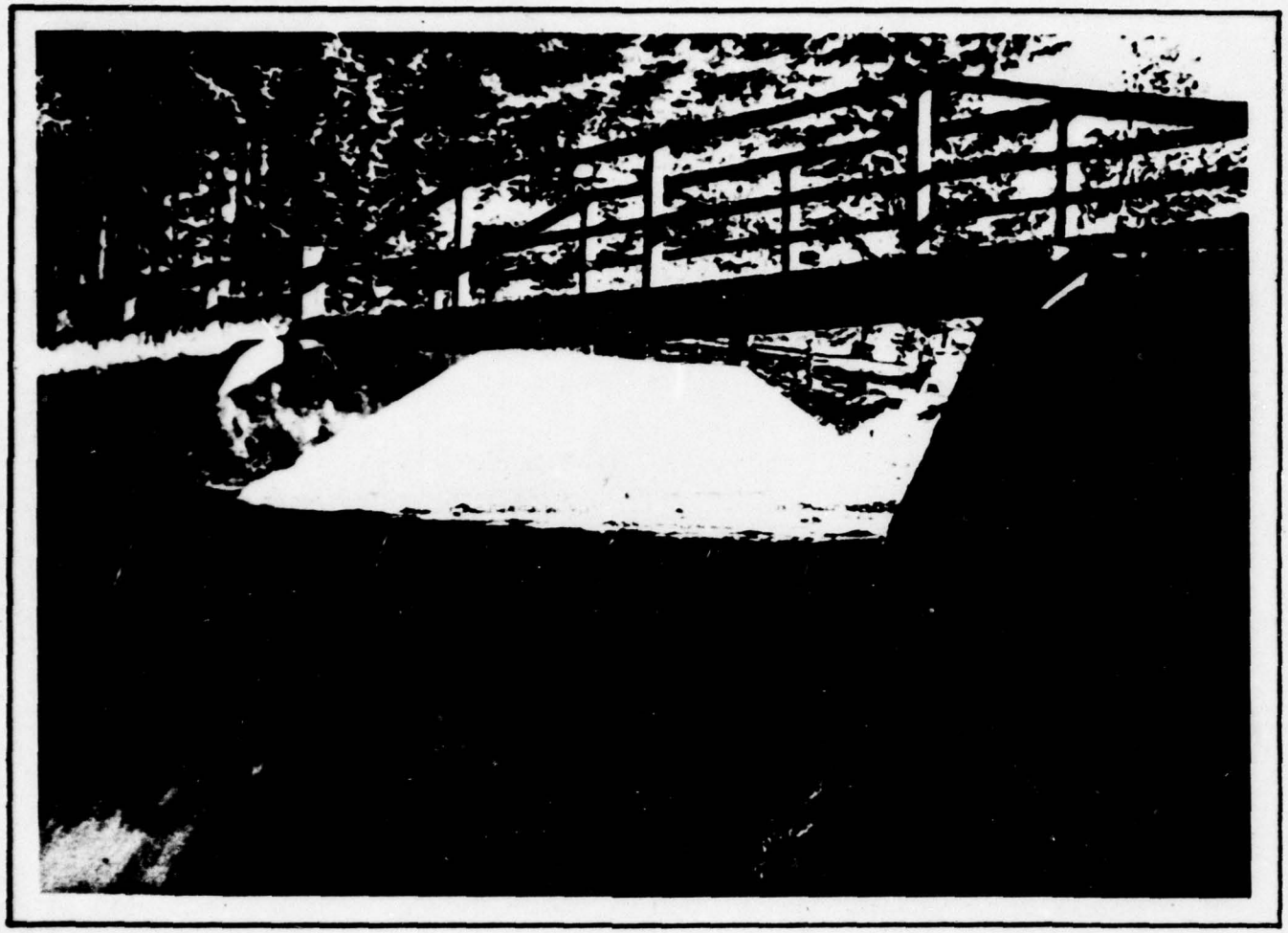
Will M. Heiser, P.E.
Vice-President
Pennsylvania Registration #006926E

James W. Peck

Date: 16 July 1979

Approved By

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer



OVERVIEW
PROMISED LAND DAM, PIKE COUNTY, PENNSYLVANIA

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
PROMISED LAND DAM
NDI I.D. NO. 00308
DER # 52-12

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose of Inspection. The purpose of this inspection is to evaluate the structural and hydraulic conditions of the Promised Land Dam and to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. (Supplemented by information obtained from the Pennsylvania Department of Environmental Resources (DER), Division of Dam Safety.)

Promised Land Dam is an earth embankment approximately 125 feet long with a maximum height of 16 feet. The dam impounds a reservoir with a volume of 2,554 acre-feet at normal pool level. The top of the dam is 12-14 feet wide; the downstream slope is approximately 0.25 horizontal to 1.0 vertical (0.25H:1V), and the upstream slope is approximately 3H:1V. No information is available concerning the properties of the embankment materials. A dry stone wall (wall built without mortar) is the only visible protection on the downstream slope.

The spillway is a concrete, broad-crested weir that is 33 feet long and 14 feet wide located in the center of the embankment. The discharge flows over the weir and down the dry stone wall to a sloped concrete apron. A wooden footbridge crosses above the weir at the top of the embankment.

The reservoir drain system consists of a conduit controlled by a stop-log structure located on the upstream slope of the left side of the embankment. The conduit is a 48 inch square reinforced concrete section from the outlet to a point 40 feet upstream of the outlet where it becomes a 49 inch square timber section. This section expands to a 72 inch wide by 48 inch high timber section about 23 feet further upstream. The stop-log structure is located approximately 33 feet upstream of the outlet.

b. Location. Promised Land Dam is located on the East Branch of Wallenpaupak Creek at a point 0.5 mile north of Promised Land, in Greene Township, Pike County, Pennsylvania. The dam site is shown on the USGS Quadrangle entitled "Promised Land, Pennsylvania" at coordinates N 41° 19.1', W 75° 12.6'. A regional location plan of Promised Land Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. Promised Land Dam has a maximum storage capacity of 5,048 acre feet and a maximum height of 16 feet. The structure is in the "Intermediate" size category.

d. Hazard Classification. There is one state owned cabin in the valley between Promised Land Dam and Lower Lake (a distance of about ½ mile). At the present time, Promised Land State park has plans to demolish this cabin this year. There is a possibility of appreciable property damage associated with the one home on the shores of Lower Lake in the event of a dam failure. However, there is little likelihood of loss of life. Therefore, the structure is in the "Significant" hazard category.

e. Ownership. The dam is owned and operated by the Commonwealth of Pennsylvania, Department of Environmental Resources. All correspondence should be addressed to the Department of Environmental Resources, P.O. Box 1467, Harrisburg, PA 17120.

f. Purpose of the Dam. The purpose of the dam is to provide a recreation site for Promised Land State Park.

g. Design and Construction History. The earliest record for Promised Land Dam is an inspection report made in November, 1919. There is no evidence that construction documents or design data prior to that date are available. According to available records, the dam at that time was an earth embankment with the downstream slope protected by riprap. The concrete spillway was a broad-crested weir located in the center of the embankment with concrete abutments.

According to information in the DER files, extensive repairs to the Promised Land Dam were made between November, 1930 and May, 1931, to correct serious defects in the structure. These defects were reported to include excessive leakage at the spillway, settlement of the embankment, inadequate spillway capacity, and a wall along the downstream slope which was about to collapse. The repairs involved the construction of a vertical reinforced concrete cut-off wall, 55 feet long and 15 inches thick, along the upstream edge of the spillway. The wall extends down to solid rock. Additional fill was placed on the upstream slope and the embankment was raised 3 feet to Elevation 1731.1. The dry stone wall on the downstream slope was reconstructed. A reinforced concrete slab was laid in the spillway and joined to the vertical cut-off wall, raising the spillway to Elevation 1726.1. Concrete abutment walls adjacent to the spillway were raised 2.5 feet to a height 5.0 feet above the spillway slab. According to correspondence in the DER files, riprap was placed on the upstream face and loose rockfill placed along the downstream toe.

In September, 1935, construction drawings for an outlet conduit for the Promised Land Dam were completed and construction began in 1936. The rectangular outlet conduit, constructed of timber and concrete, passes through the earth embankment to the left of the spillway. Flow through the conduit is controlled by means of a stop-log structure located on the upstream face of the dam.

h. Normal Operating Procedures. Under normal operating conditions, the overflow from Promised Land Lake is controlled by the spillway. Carl Rose, the Promised Land State Park foreman, stated that the outlet conduit is opened only to draw the lake down when it is necessary to repair the beaches or dock facilities.

1.3 Pertinent Data.

a. Drainage Area.

Square Miles	6.6

b. Discharge at Dam Site (cfs.).

Total spillway capacity at top of dam Elev. 1731.1	1,070

c. Elevation (feet above MSL).

Spillway Crest (Normal, Recreation Pool)	1726.1
Top of Dam	1731.1
Reservoir Drain Invert (Inlet)	1719.5
Reservoir Drain Invert (Outlet)	1719.5
Apron (Estimated)	1715.1
Streambed at Centerline of Dam (Estimated)	1715.1

d. Reservoir (miles).

Length of Normal, Recreation Pool	1.9
Length of Maximum Non-overtopping Pool	2.0

e. Storage (acre-feet).

Normal, Recreation Pool, Elev. 1726.1	2,554
Top of Dam at Low Point, Elev. 1731.1	5,048

f. Reservoir Surface Area (acres).

Normal, Recreation Pool, Elev. 1726.1	438
Top of Dam at Low Point, Elev. 1731.1	562

g. Dam Data

Type	Earth
Length	125 feet

Height	16 feet (maximum)
Top Width	12 to 14 feet
Side Slopes	3H:1V (upstream); 0.25H:1V (downstream)
Zoning	Not Available
Impervious Core	Not Available
Cutoff	Concrete to rock in spillway area
Grout Curtain	No

h. Spillway

Type	Concrete broad-crested weir
Width	14 feet
Length	33 feet
Crest Elevation	1726.1
Gates	None
Upstream Channel	Promised Land Lake
Downstream Channel	Rocky channel into large masonry culvert.

i. Outlet Works

Type	48 inch square reinforced concrete conduit connected to 49 inch square timber conduit which flares to a 48 inch by 72 inch timber conduit.
Length	68 feet ±
Closure	Stop-logs
Access	Concrete manhole on upstream slope of left embankment.
Regulating Facilities	Manual removal of stop-logs

SECTION 2

ENGINEERING DATA

2.1 Design

a. Data Available. The information available in the DER main office files in Harrisburg, Pennsylvania, for review of Promised Land Dam includes the following:

1. Dam inspection reports beginning in 1919 and through the intervening years.

2. Photographs beginning in 1921 and through the intervening years.

3. "Report Upon the Promised Land Dam", Commonwealth of Pennsylvania, Department of Forests and Waters, 1929.

4. "Proposed Repairs of Promised Land Dam", Commonwealth of Pennsylvania, Department of Forests and Waters, 1929, 1930.

5. "Promised Land Dam - Proposed Outlet Conduit", Commonwealth of Pennsylvania, Department of Forests and Waters, 1935.

6. Memorandums and correspondence between Horace H. Heller, the contractor, and the Department of Forests and Waters (October, 1930 to April, 1931).

7. "Progress Report", Commonwealth of Pennsylvania, Department of Forests and Waters, 1930.

8. "Final Report on the Repair of the Promised Land Dam", Commonwealth of Pennsylvania, Department of Forests and Waters, 1931.

9. Correspondence betweern Civil Conservation Corps, the contractor, and the Department of Forests and Waters (1936).

10. Miscellaneous correspondence.

b. Design Features. The design features are discussed in Section 1.2.a. The repair and additional construction drawings are shown on Plates 2, 3, and 4 of Appendix E.

2.2 Construction

Based on the field investigation and the information available in the construction reports, the dam appears to have been constructed in general conformance with the design drawings.

2.3 Operation

Operation procedures appear to be limited to those necessary to draw down the lake by removal of stop-logs located in the manhole structure on the upstream slope of the dam. There is no evidence that operating procedures have been written for this structure.

2.4 Evaluation

a. Availability. Limited material is available concerning embankment materials and subsurface conditions. However, data is available concerning inspections and construction history.

b. Adequacy. A Phase I evaluation is considered reasonable based on the revealing conditions observed during the field inspection and conversations with the owner's representative, although design and construction information is limited concerning embankment materials and subsurface conditions.

c. Validity. There appears to be no reason to doubt the validity of the data available.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of the Promised Land Dam was conducted on December 5, 1978. At the time of the inspection, water was flowing over the spillway at a depth of one to two inches. Additional water was observed flowing from the outlet conduit. No underwater areas were inspected. The observations and comment of the field inspection team are included in the checklist which is Appendix B of this report. The appearance of the facility indicates that the dam and its appurtenances are well maintained.

b. Dam. The upstream face of the dam has a mowed grass cover and is well maintained. Randomly-sized stone has been placed into the earth above the spillway level. Several footpaths, located on the upstream face, appear well compacted and are not causing any erosion at this time. One footpath, adjacent to the right wingwall, has caused some minor erosion.

Two low areas were noted in the top of the dam. Approximately 20 feet from the right wingwall, there is a noticeable depression (3 feet by 30 feet) about 6 inches deep. On the left side, 15 feet from the left wingwall, there is a low area reported to be caused by erosion. This area, about 2 feet by 2 feet, is drained by a hole eroded into the earth embankment. The park foreman stated that this problem is the result of runoff from a parking lot adjacent to the left side of the dam. A wooden and wire mesh fence is located along the downstream side of the top of the dam.

The entire downstream face of the embankment is covered by a dry stonewall with a concrete cap. The masonry has a slight outward bulge midway up the wall across its entire length. The bulge is more apparent in the wall immediately below the low area in the top of the dam to the right of the spillway. Sparse vegetation was observed growing in the masonry wall. Roots from the large tree located at the downstream toe, at the right side of the embankment, are growing in towards the embankment material beneath the stonewall. The roots may be the principal cause of the "bulging" or "heaving" that is evident on the downstream slope near the right abutment.

A flow of water, approximately 2 gallons per minute, was observed coming from the base of the wall adjacent to the spillway on the right side of the dam. On each side of the spillway, there was an ice layer on the stonework. On the right side of the spillway, seepage through the dam was noted flowing under the ice down the masonry wall. It was not

evident that this was due to water from the spillway or seepage through the embankment on the right side. Seepage was observed on the ground surface in several areas to the right of the spillway on the downstream side of the dam. The flow from each seep area is approximately 1/4 gallon per minute and is discolored.

The approach to the spillway has silted such that sandy sediments have reached the spillway crest.

Currents may have removed the sands from a beach a few hundred yards from the spillway and deposited them at the spillway. Spalling is evident at the waterline on both wingwalls. Significant spalling, approximately 1/4 inch deep is apparent on the downstream side of the right wingwall in the spillway channel and where the wingwall contacts the stonework. Minor spalling and erosion has occurred at the downstream edge of the spillway slab, which overhangs the dry stonewall. The concrete underneath the spillway slab and above the stonework has recently been replaced during remedial work. This work included resurfacing portions of the apron slab below the spillway.

c. Appurtenant Structures. It is reported by the owner's representative that the rectangular channel below the outlet conduit has undergone recent remedial concrete work. The wall on the left side of the channel shows evidence of recent concrete patching, and the last 3 to 4 feet of the concrete channel appear to have been placed recently. The earth adjacent to the left wall of the channel has eroded in an area approximately 2 feet by 15 feet. The probable cause of this erosion is the runoff from the parking area to the left of the dam.

The stop-log structure, which controls the flow through the outlet conduit, was locked and no inspection of these facilities could be made. The water flowing from the outlet conduit may indicate that the stop-logs need replacement.

d. Reservoir. Siltation of the reservoir was observed in the vicinity of the spillway. The slopes around the reservoir are on mild gradients and are heavily vegetated.

e. Downstream Channel. Immediately downstream of the dam, the East Branch of Wallenpaupack Creek enters a large stone masonry culvert under Route 390. Approximately one-half mile beyond the culvert, the flow enters Lower Lake. The stream overbanks beyond the culvert are heavily vegetated. The stream channel has a gradient of approximately 0.3 percent in this area. There is one state owned cabin in the valley between Promised Land Dam and Lower Lake (a distance of one-half mile). At the present time, Promised Land State Park has plans to demolish the cabin this year. There is one home on the shores of Lower Lake. During the summer months, as many as a dozen people would be involved.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

Operational procedures appear to be limited to those necessary to draw the level of the Promised Land Lake down to perform maintenance on the park beaches and dock facilities. There is no evidence of written operating procedures. Normal operating procedures for this structure do not require a dam tender.

4.2 Maintenance of the Dam

The dam appears to be well maintained by the Promised Land State Park personnel. Maintenance inspections are conducted on a regular basis by the Park Superintendent and personnel from the Division of Completed Projects; DER records and photographs of those inspections are available. Maintenance and remedial work to date include: the replacement of masonry, concrete repair, backfill and reseeding of eroded areas of the embankment, and the removal of logs, debris, trees, and brush from the embankment and reservoir area.

4.3 Maintenance of Operating Facilities

The stop-log structure was locked and no inspection could be made. However, this appurtenance was evaluated during the regular maintenance inspections of the dam and the records and photographs of the dam include information of this structure. The records indicate that the stop-logs have been replaced when necessary.

4.4 Warning Systems in Effect

According to the Park Superintendent, no formal procedures have been established for warning downstream residents during periods of high lake levels. However, observations of high lake levels have been recorded in recent years.

4.5 Evaluation of Operational Adequacy

The current operating and maintenance procedures for the Promised Land Dam appear adequate. Operating procedures could be improved by providing for the opening of the stop-log structure during periods of high lake levels to minimize the possibility of overtopping the embankment. Presently, the stop-logs must be removed manually, which is a slow and difficult procedure.

A warning system should be developed. During periods of heavy rainfall the dam should be monitored and downstream residents alerted in the event of an impending failure.

The dam is accessible under all weather conditions for inspection and emergency action.

SECTION 5

HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. There is reported to be no original design data available. Hydraulic and hydrologic calculations accompany the "Final Report in the Repair of the Promised Land Dam" (1931). These calculations determine the capacity of the spillway after the repairs and estimate the time for the reservoir level to rise from the spillway crest to the top of the dam. The drainage area contributing to the Promised Land Dam is about 3.7 miles long and averages 1.8 miles wide. Ground elevations range from 2012 to 1726. The slopes of the reservoir watershed are all less than ten percent. The watershed is nearly 100 percent wooded.

For further information, refer to the computation, data and printouts included in Appendix C.

b. Experience Data. There is no evidence that records of reservoir water levels have been maintained until recent years. During Hurricane Agnes, in June, 1972, the stage in the reservoir was reported to be 18 inches above the crest of the spillway. Observations during heavy rains of June 28-29, 1973, indicate that the depth of water over the spillway was approximately 12 inches. Rainfall records for Promised Land State Park are maintained at the Park Office.

c. Visual Observations. On the date of the inspection, no adverse conditions were observed that would indicate the spillway capacity would be reduced during a flood. The outlet capacity of the dam could be improved by providing a lifting device to expedite the removal of the stop-logs during periods of high reservoir levels.

d. Overtopping Potential. The spillway is capable of handling a discharge of 1,070 cfs. However, the SDF for this "Intermediate" size dam, with a "Significant" hazard classification, is 50 percent of the Probable Maximum Flood (0.5 PMF), which has a peak inflow of 5,950 cfs. and a peak overflow of 1,430 cfs. The 0.5 PMF hydrograph was routed through the reservoir with the starting water surface 0.2 feet above the crest of the spillway at elevation 1726.3. The maximum water surface elevation in the reservoir resulting from the 0.5 PMF routing would be 5.5 feet above the spillway crest and 0.5 feet above the lowest point at the top of the dam.

Examination of the results of the hydrologic and hydraulic analysis indicates that the spillway is capable of passing 45 percent of the PMF without overtopping of the embankment. (See Appendix C for computations.)

e. Spillway Adequacy. Based on the results of the hydrologic and hydraulic analysis, the spillway of the Promised Land Dam is capable of handling 45 percent of the PMF while the SDF is 50 percent of the PMF. Therefore, the spillway of the Promised Land Dam is classified as "Inadequate".

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. Several existing conditions indicate potential embankment stability problems. The dry stone wall on the downstream face of the dam has a slight outward bulge. The bulge is more apparent on the right of the dam where a low area is evident along the top of the dam. The tree roots from the large tree located near the downstream toe, may be a principal cause of the heaving action noted on the downstream slope near the right abutment. The hole in the top of the left side of the dam indicates that runoff from the parking lot has removed portions of the earth embankment. Previous reports indicate that this is a reoccurring problem and must be corrected. The visible portion of the upstream face of the dam is in good condition.

Seepage and discolored water were observed near the downstream toe on the right side in several areas. The rate of flow from each area was estimated to 1/4 gallon per minute.

Inspection of exposed concrete work revealed that significant spalling of the concrete has occurred on the spillway. Although no reinforcing steel bars were exposed, remedial work is necessary to prevent further deterioration of the concrete.

b. Design and Construction Data. Available documentation, calculations, and other data were reviewed. No original design data are available. Structural drawings for repairs to the dam are available; however, no structural calculations or soil data are available. Lists of design and construction data reviewed are given in Sections 2.1.a and 2.2.

c. Operating Records. There is no evidence that operating records are maintained for the Promised Land Dam.

d. Post-Construction Changes. The available information indicates that two major modifications to the original structure have been made. In 1930 and 1931, a vertical cut-off wall was added, the embankment was raised 3 feet, and the spillway reconstructed for the new embankment height. In 1935, the outlet conduit and stop-log structure were constructed. Design drawings for these modifications are included in Appendix E as Plates 2, 3, and 4. Information is available in the DER files on maintenance repair work done on the dam through the years.

c. Seismic Stability. Promised Land Dam is located within Seismic Risk Zone 1 of the "Seismic Zone Map of Contiguous States". Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected Zone 1 earthquake conditions.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Evaluation. Based on visual observations made during the date of the inspection, the dam and its appurtenant structures are considered to be in fair condition. There is a low area at the top of dam near the right abutment and bulges in the dry stone wall. Seeps exist near the downstream toe on the right side of the dam. A large (50 foot high, 24 inch diameter) tree is adjacent to the downstream toe of the dam on the right side. Riprap protection on the upstream slope is missing. Some concrete surfaces have deteriorated due to spalling.

The SDF is the 0.5 PMF. Examination of the results of the hydrologic and hydraulic analysis indicates that the spillway is capable of passing 45 percent of the PMF without overtopping the embankment. Since the spillway system is not capable of handling the SDF, it is classified as "Inadequate".

b. Adequacy of Information. A Phase I evaluation is considered reasonable based on the revealing conditions observed during the field inspection and conversations with the owners representative, although design and construction information is limited.

c. Urgency. The remedial measures recommended in Section 7.2 should be effected immediately.

d. Necessity for Further Evaluation. Further investigations should be performed to determine the stability of the dam and the need for structural improvements. Detailed hydrologic and hydraulic studies should be made to determine the extent to which the spillway system should be increased.

7.2 Recommendations and Remedial Measures

a. Facilities.

1. Detailed analyses should be initiated to determine the stability of the dam and need for structural improvements. Evaluate the significance of the seepage and the cause of discoloration of seepage downstream of the dam to the right of the spillway. The stability analyses and seepage evaluation should be perfromed by a licensed professional engineer experienced in the design and construction of dams.

2. The large tree adjacent to the downstream toe of the right embankment should be cut below ground level and the hole filled and compacted.

3. The parking lot should be regraded so that runoff drains away from the dam.

4. The stop-logs should be provided with means to facilitate their removal.

5. Decisions concerning the need to place riprap protection, fill settled areas, raise the top of dam, and construct additional spillway facilities should await the results of the stability analysis and further hydrologic and hydraulic studies.

6. Consideration could be given to increasing the capacity of the spillway in accordance with the results of detailed hydrologic and hydraulic studies.

b. Operation and Maintenance Procedures.

1. A warning system should be developed for Promised Land Dam. During periods of heavy rainfall or rapid snowmelt the dam should be monitored and downstream residents alerted in the event of an impending failure.

2. The stop-logs should be removed every 6 months to remove sediment that may have been deposited against the stop-logs in the conduit.

3. Until the necessary remedial work has been performed and the spillway capacity has been increased based on detailed hydraulic and hydrologic studies, lake levels should be monitored during periods of heavy rain or rapid snowmelt. If during these periods, the lake level rises rapidly, the stop-logs should be removed to minimize the possibility of overtopping the dam.

APPENDIX

A

Check List Engineering Data

Design, Construction, Operation

Phase I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Promised Land

ID # PA 00308

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	Not Available.
REGIONAL VICINITY MAP	See Plate 1, Appendix E
CONSTRUCTION HISTORY	Refer to Section 1.2.g
TYPICAL SECTIONS OF DAM	Refer to Appendix E
OUTLETS - PLAN	Refer to Appendix E for plan and details
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	Not Available
RAINFALL/RESERVOIR RECORDS	Rainfall records available at Promised Land State Park

ITEM	REMARKS
DESIGN REPORTS	Refer to Section 2.1
GEOLOGY REPORTS	Not Available, Refer to Appendix F of this report
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Not Available Refer to Section 5.1 a No dam stability analysis or seepage studies available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Refer to Section 6.1d
HIGH POOL RECORDS	Refer to Section 5.1 b
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Inspection reports made on a regular basis are available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported
MAINTENANCE OPERATION RECORDS	Maintenance performed and records kept on a regular basis. No operational records available. Refer to Section 4.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Refer to Appendix E
OPERATING EQUIPMENT PLANS & DETAILS	Refer to Appendix E for stop-log details
MISCELLANEOUS	Material in Data files - refer to Section 2.1a vol 2.2

APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam Promised Land County Pike State Pennsylvania National ID # PA 00303

Type of Dam Earth Hazard Category Significant

Date(s) Inspection 12/5/79 Weather Clear Temperature 30's-40's

Pool Elevation at Time of Inspection 1726.3 M.S.L. Tailwater at Time of Inspection 1716 ± M.S.L.

Inspection Personnel:

George C. Elias
Thomas C. Ahn
David B. Campbell
David B. Campbell
Dana R. Pizarro

David B. Campbell Recorder

Remarks:

Earth embankment protected by dry stone wall on downstream side.
Carl Rose, Promised Land State Park foreman, accompanied inspection personnel.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	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	OBSERVATIONS	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 Observed	—
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Observed	—
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Minor erosion adjacent to wingwalls, Erosion through embankment crest on left side, Erosion next to left outlet conduit wingwall	change drainage pattern of adjacent parking area, Fill and reseed eroded areas
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment- Good Vertical alignment- 6 in. depression on right side, depression eroded on left side of dam	Initiate boring program to determine composition and in situ properties of embankment and foundation materials & to determine dam stability, install piezometers in bore holes to evaluate pore pressure development
RIPRAP FAILURES	None Observed	Place rip-rap on upstream face of embankment

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DRAINS	N/A	—
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junction of embankment and abutment appear to be in good condition, Concrete between spillway slab and stonework on embankment has been patched,	—
ANY NOTICEABLE SEEPAGE	Seepage coming from stonework on right side of dam at toe, Several seepage areas observed downstream at toe on right side. Seepage has established flow.	Monitor seepage for changes in rate of flow and turbidity. Install piezometers to aid in determination of source of seeps
STAFF GAGE AND RECORDER	None	—

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Interior of outlet conduit not inspected	Draws down lake so that reservoir drain system can be examined
INTAKE STRUCTURE	Not observed, under water	"
OUTLET STRUCTURE	Wingwall on left side has been patched recently	—
OUTLET CHANNEL	Recent concrete patching observed, some flow in outlet channel	—
EMERGENCY GATE	stop-logs function as emergency gate - not observed, manhole was locked	inspect stop logs
BRIDGE	Wooden foot bridge over spillway in good condition	—

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Spalling on wingwalls at waterline. Slight amount spalling on channel side of right wingwall. Minor spalling at downstream edge of spillway slab.	Patch spalled areas.
APPROACH CHANNEL	Sandy sediment up to spillway crest level.	Remove sediment when lake is drawn-down
DISCHARGE CHANNEL	Rocky channel to large culvert under Route 350 mild slope	—
BRIDGE AND PIERS	Wooden foot bridge over spillway in good condition, no piers	—

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	None	Install monuments on crest to observe settlement
OBSERVATION WELLS	None	—
WEIRS	None	—
PIEZOMETERS	None	Install piezometers in embankment, particularly on right side, to determine source of seeps
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Heavily covered with Trees and brush, mild slopes	—
SEDIMENTATION	Sandy sediment up to spillway level at reservoir outlet, probably from beach near outlet	Remove when lake is drawn down

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Route 390 culvert approx. 100 feet downstream of dam, culvert is middle of natural stream channel light brush in overbanks rocky channel	
SLOPES	Mild Slopes	—
APPROXIMATE NO. OF HOMES AND POPULATION	one state owned cabin between Promised Land Dam and Lower Lake, 1 private residence on Lower Lake. Maybe a dozen people involved during the summer months when residences are occupied.	Develop & implement formal warning system.

APPENDIX

C

Hydrologic & Hydraulic Data

O'BRIEN & GERE ENGINEERS INC.

SUBJECT	SHEET	BY	DATE	JOB NO

TABLE OF CONTENTS APPENDIX C

Hydraulics & Hydrologic Data

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Upper Promised Land Dam	1	DRP	12/14/78	1541-010

D.A. Area I + Area II

Area I = 1.015 cm²/unit × 27.75 units × $4 \times 10^{6} \frac{ft^2}{cm^2}$ × $3.587 \times 10^{-8} \frac{m}{ft}$

= 4.04 mi²

Area II = 1.015 cm²/unit × 19.53 units × $4 \times 10^{6} \frac{ft^2}{cm^2}$ × 3.587×10^{-8}

= 2.84 mi²

D.A. = 6.88 mi² ≈ 6.9 mi² by planimeter
6.57 mi² by reports use 6.57 mi²

Hydrograph Parameters (Snyder method)

$t_p = C_t (L L_c)^{0.3}$

C_t = 1.23 } supplied by CCE
C_p = 0.45 } Zone 1

L = 4.1 miles
L_c = 1.9 miles

$t_p = 1.23 ((4.1)(1.9))^{0.3} = 2.3$ hr.

$t_r = \frac{2.3 \text{ hr}}{5.5} = 0.4$ hr

Probable Maximum Storm (PMS) (Hydromet 33)

Zone 1 (Fig. 1)

Probable Max. Precip. (PMP) = 22.2 in. (200 mi², 24 hr)

Depth-Area-Duration Relationships:
Maximum 6 hr = 111% PMP
Maximum 12 hr = 122% PMP
Maximum 24 hr = 133% PMP

Loss Rate
initial loss = 1"
uniform loss = 0.22"/hr

O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
Upper Promised Land Dam	2	DKP	12/15/73	1841-010

Base flow

1.5 cfs/mi^2 x 6.57 mi^2 = 9.9 cfs

Elevation - Area - Capacity Data

Elev.	Area (mi^2)	Area (acres)	
1715.6		422.0	- data
1727	0.72	460.8	
1740	1.27	812.8	} planimeter
1760	1.90	1216.0	
1720.4		287	
1715.1 (streambed elev.)		0	- extension of data see next page

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
PLD	2a	DRP	1/18/79	1841-010

Extend Elevation-Area-Capacity Data below spillway crest using conic method

V = 765,000,000 gallons at Elev 1725.6 A = 422 acres
h = 1725.6 - 1715.1 (streambed elev) = 10.5 ft A = 18,382,320 ft²
V = 102,272,727 cf = 2347 acre-ft

$r = \sqrt{A/\pi} = \sqrt{18,382,320\,ft^2/\pi} = 2415.9\,ft$

$V = \pi(2415.9)^2 \frac{(10.5)}{3} = 64,335,954$ cf (single cone) too low

Break into 2 cones

(1) assume area at h/2 is 1/2 area at h

Upper Cone Volume: $\left(\frac{5.25}{3}\right)(422 + 211 + \sqrt{(422)(211)})$
= 1629.9 acre-ft ≈ 71,000,000 cf

Bottom Cone Volume: $\pi r^2 \frac{h}{3} = A\frac{h}{3} = 211\left(\frac{5.25}{3}\right) = 369.3$ acre ft
= 16,000,000 cf

Total: 87,000,000 cf
too low

(2) assume area at h/2 is 55% area at h

Upper Cone Volume: $\left(\frac{5.25}{3}\right)(422 + 232 + \sqrt{(422)(232)})$
= 1692 ac-ft = 73,700,000 cf

Bottom Cone Volume: $\pi r^2 \frac{h}{3} = (232)\left(\frac{5.25}{3}\right) = 406$ ac-ft
= 17,700,000 cf

Total = 91,400,000 too low

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
PLD	2b	DRP	1/13/79	1841-010

(3) assume area at h/2 is 65% area at h

$$\text{Upper Cone Volume} = \left(\frac{5.25}{3}\right)\left(422 + 274 + \sqrt{(422)(274)}\right)$$

$$= 1813 \text{ ac-ft} = 79{,}000{,}000 \text{ cf}$$

$$\text{Bottom Cone Volume} = \left(\frac{5.25}{3}\right)(274) = 479.5 \text{ ac-ft}$$

$$= 20{,}900{,}000 \text{ cf}$$

$$\text{Total} = 99{,}900{,}000 \text{ cf}$$

(4) assume area at h/2 is 68% area at h

$$\text{Volume} = \left(\frac{5.25}{3}\right)\left(422 + 2(287) + \sqrt{(422)(287)}\right)$$

$$= 2343 \text{ ac-ft} = 102{,}064{,}000 \text{ cf} \quad \underline{\text{good}}$$

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Upper Premixed Land Dam	3	DRP	12/18/79	1841-010

Rev. 4/15/79

Spillway Discharge Rating

$Q = CLH^{3/2}$ broad crested weir (trapezoidal section)

B = 14 ft (width of weir)

C = 3.1 (Brater & King)

Reduce L for abutment effects, no piers:

$L = L' - 2(NK_p + K_a)H_e$ (Design of Small Dams, 1977)

N = 0 (no piers)

$K_a = 0.2$

$H_e = H$

weir elev = 1726.1

embankment elev = 1731.1

$L = 33 - 0.4H$

$Q = 3.1LH^{3/2}$

H(a)	L(a)	Q (cfs)	WSEL
0.7	32.7	59	1726.8
1.5	32.4	185	1727.6
3.0	31.8	512	1729.1
4.5	31.2	923	1730.6
5.0	31.0	1074	1731.1

Embankment Discharge Rating

$Q = CLH^{3/2}$ broad crested weir (trapezoidal)

B = 12 + 14 ft

C = 2.1

Flow 1731 L = 140 - 33 = 107 ft

1739.6 L = 160 - 33 = 127

1740 L = 560

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Upper Promised Land Dam	4	DRP	12/10/75 4/15/77	1541-010

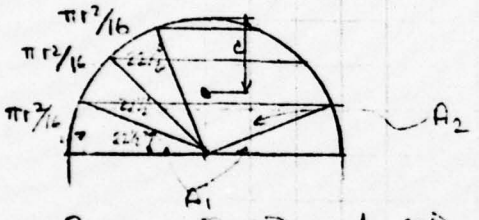
Hwir	Lwir	Qwir	Hcmb	Lcmb	Qcmb	Qwir + Qcmb	Elev.
5	31	1074	0	0	0	1074	1731.1
6.5	31	1593	1.5	116	661	2254	1732.6
8	31	2174	3.0	124	1997	4171	1734.1
9.5	31	2814	4.5	170	5030	7844	1735.6

O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
Upper Promised Land Dam	5	DRP	12/19/73	1841.010

Rte 390 Bridge
located downstream of dam
could act as a control structure
top of road approx 1733, bottom of culvert approx 1714
semicircular opening $r = 12'$
crown elev = 1726

Headwater Below Crown (Open Channel flow)



assume critical depth occurs in channel

$d_c = \frac{2}{3}H$

$Q_c = A_c\sqrt{gD_c}$

$A_c = A_1 + A_2$ ∴ $A_1 = \frac{\pi r^2}{8} = 57\,ft^2$

$A_2 = 2\frac{(\sqrt{r^2 - D_c^2})\,D_c}{2} = 51\,ft^2$

θ	D_c (ft)	A_c (ft²)	Q_c (cfs)	Elev*
22½°	4.6	57+51 = 108	1314	1720.9
45°	8.5	113+72 = 185	3061	1726.6
67½°	11.1	170+51 = 221	4178	1730.6

centroid = 0.576 R = c
= 6.9

* 1714 + H = Elev

Headwater Above Crown, H/D < 0.75

assume well rounded inlet $C_c = 1$, $K_c = 0$ (Morris & Wiggin)

$$Q = A\sqrt{2g\left(H + \frac{V_a^2}{2g}\right)}$$

$A = 226.1\,ft^2$

Assume $\frac{V_a^2}{2g} \approx 0$

H_f	H/D	Q (cfs)	Elev.
6.9	0.575	4768	1726
7.9	0.67	5102	1727
8.9	0.75	5415	1728

O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
Upper Promised Land Dam	6	DRP	12/19/25	1841-010

Rev. 4/15/79

Headwater Above Crown, $H/D > 1^*$

* For $0.75 < H/D < 1$ oscillating heads occur, producing slug flow the curve will be interpolated in this region.

$$Q = A\sqrt{\frac{2g\left(H + \frac{V_a^2}{2g} + S_bL\right)}{1 + f\left(\frac{L}{D}\right)}}$$

$$R^{4/3} = \left(\frac{\frac{1}{2}\pi R^2}{\pi r + 2r}\right)^{4/3} = 5.65$$

$$f\left(\frac{L}{D}\right) \approx \frac{29.1\, n^2 L}{R^{4/3}} = \frac{29.1\,(.025)^2(36)}{5.65} = 0.12$$

$$\frac{V_a^2}{2g} \approx 0 \qquad S_bL \approx 0$$

$$Q = A\sqrt{\frac{2gH}{1.12}}$$

H_p	H/D	Q (cfs)	Elev
11.9	0.99	5916	1731
12.9	>1	6160	1732
13.9	>1	6395	1733

When $H_p \geq 13.9$ ft a combination of weir & pressure flow occurs, see following page for computations

weir length is assumed to be 50 ft at 1733
" is approx. 200 ft 1740
" " " " 800 ft 1760

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Upper Atomized Land Dam	7	DEF	12/20/78	1941-010

Rev 4/13/79

$H_p > 13.9$

H_p (ft)*	Q_p (cfs) (Pressure flow)	$H_w = H_p - 13.9$	L	Q_{weir}	$Q_p + Q_w$	Elev
15.4	6731	1.5	82	467	7198	1734.5
16.9	7051	3.0	114	1836	8887	1736.0

* assumes reservoir level over orifice

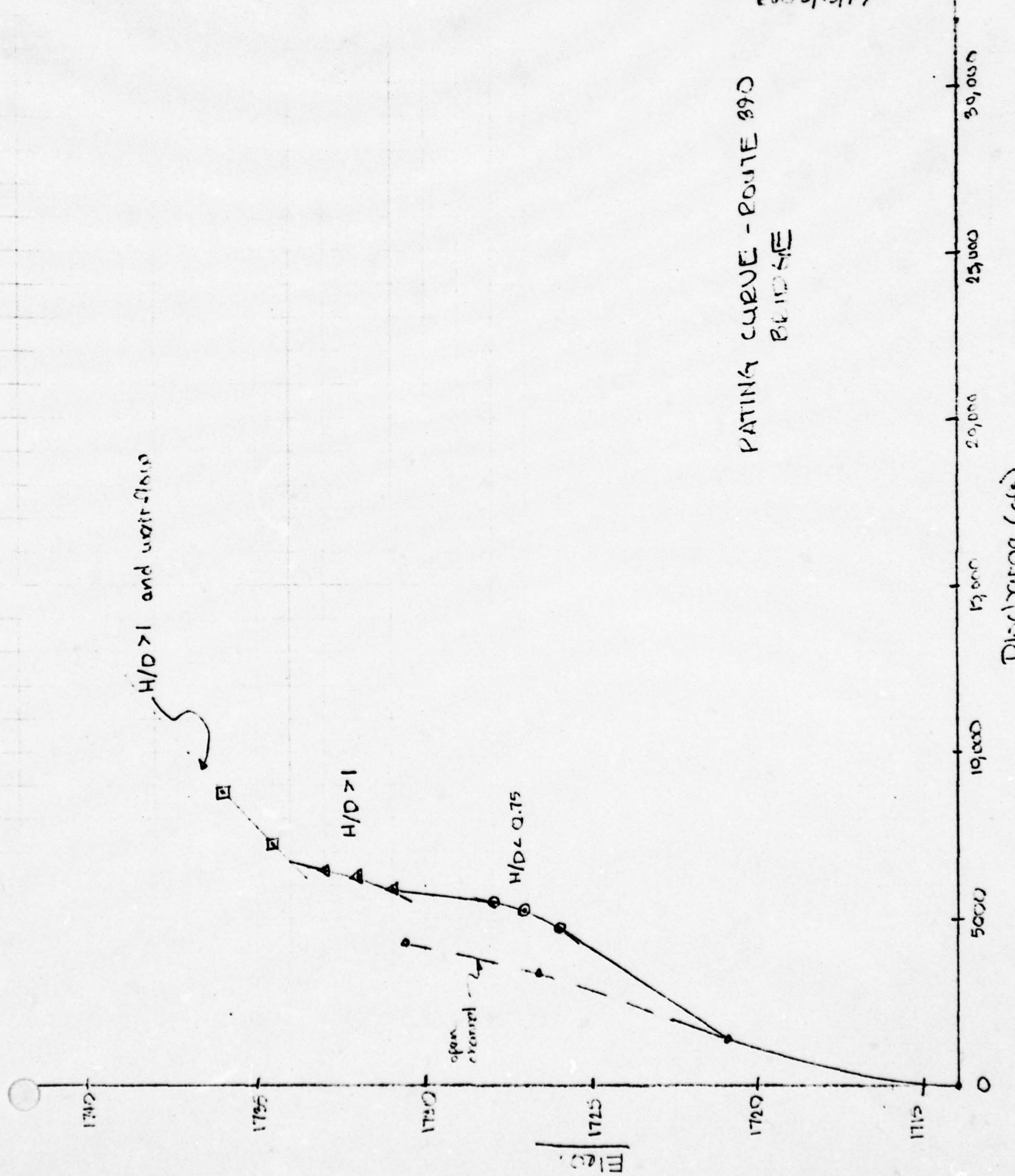
Combined Discharge Rating Curve for Route 300 Bridge

Elev.	Q (cfs)
1714.0	0
1720.9	1314
1726.0	4768
1727.0	5102
1728.0	5415
1731.0	5916
1732.0	6160
1733.0	6395
1734.5	7198
1736.0	8857

O'BRIEN & GERE ENGINEERS

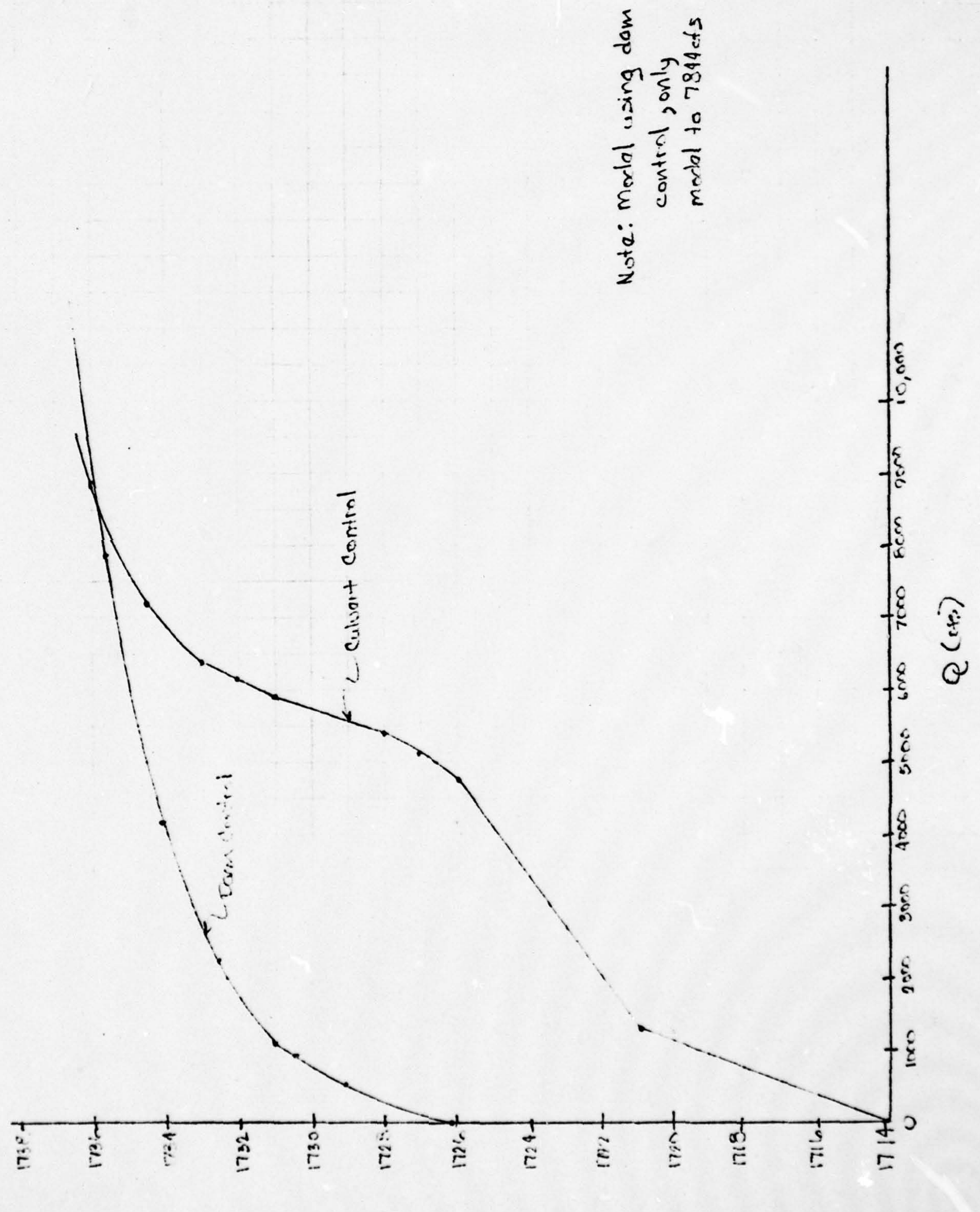
SUBJECT	SHEET	BY	DATE	JOB NO
Upper Promised Land Dam	8	DRP	1/7/75	1341-010

Rev 5/15/79



O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Upper Promised Land Dam	9	DRP	5/15/79	1541-010



Sh. 10

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  25 SEP 78
**********************************
    1              A1
    2              A2                        NATIONAL DAM INSPECTION PROGRAM
    3              A3                        PROMISED LAND DAM.PROMISED LAND.PA.
    4              R    150       0       30        0        0        0        0        0       -4        0
    5              B1     5
    6              J      1       9        1
    7              J1   0.2     0.3      0.4      0.5      0.6      0.7      0.8      0.9      1.0
    8              K      0      A1                                                  1
    9              K1                                RUNOFF TO UPPER PROMISED LAND LAKE
   10              M      1       1    6.57                0        0                          1
   11              P      0    22.2      111      123      133
   12              T                                                          1.0     0.05
   13              W    2.3    0.45
   14              X   -1.5    -.05        2
   15              K      1      A2                                                  1
   16              K1                                ROUTING THROUGH UPPER PROMISED LAND LAKE
   17              Y                                          1        1
   18              Y1     1                                                -1726.3       -1
   19              Y41726.1  1726.8   1727.6   1729.1   1730.6   1731.1   1732.6   1734.1   1735.6
   20              Y5     0      59      165      512      923     1074     2254     4171     7844
   21              $A     0     287      422    460.8    812.8     1216
   22              $E1715.1  1720.4   1725.6     1727     1740     1760
   23              $$1726.1
   24              $D1731.1
   25              K     99
```

Sh. 11

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  25 SEP 78
**********

RUN  DATE= 06/06/79.
     TIME= 08.14.03.
```

NATIONAL DAM INSPECTION PROGRAM
PROMISED LAND DAM.PROMISED LAND.PA.
PMF HYDROGRAPH

JOB SPECIFICATION

NO	NMH	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	30	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS=	.20	.30	.40	.50	.60	.70	.80	.90	1.00

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

SUB-AREA RUNOFF COMPUTATION

RUNOFF TO UPPER PROMISED LAND LAKE

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A1	0	0	3	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	6.57	0.00	6.57	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.20	111.00	123.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 2.30 CP= .45 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 43 END-OF-PERIOD ORDINATES, LAG= 2.30 HOURS, CP= .45 VOL= 1.00

72.	287.	523.	736.	813.	759.	664.	581.	508.	444.
389.	340.	298.	260.	228.	199.	174.	151.	133.	117.
102.	89.	78.	68.	60.	52.	46.	40.	35.	31.
27.	83.	21.	18.	16.	14.	12.	11.	9.	8.
7.	6.	5.							

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
							SUM			23.62	21.76	1.86	188666.
										(600.)	(553.)	(47.)	(5342.43)

Sh. 12

HYDROGRAPH ROUTING

ROUTING THROUGH UPPER PROMISED LAND LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A2	1	0	6	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1726.	-1

STAGE	1726.10	1726.80	1727.60	1729.10	1730.60	1731.10	1732.60	1734.10	1735.60
FLOW	0.00	59.00	185.00	512.00	923.00	1074.00	2254.00	4171.00	7844.00
SURFACE AREA=	0.	287.	422.	461.	813.	1216.			
CAPACITY=	0.	507.	2339.	2957.	11128.	31281.			
ELEVATION=	1715.	1720.	1726.	1727.	1740.	1760.			

CREL	SPWID	COOW	EXPW	FLEVL	COOL	CAREA	EXPL
1726.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1731.1	0.0	0.0	0.

PEAK OUTFLOW IS 419. AT TIME 26.00 HOURS

PEAK OUTFLOW IS 682. AT TIME 26.00 HOURS

PEAK OUTFLOW IS 953. AT TIME 26.00 HOURS

PEAK OUTFLOW IS 1625. AT TIME 25.00 HOURS

PEAK OUTFLOW IS 1977. AT TIME 24.50 HOURS

PEAK OUTFLOW IS 2623. AT TIME 24.00 HOURS

PEAK OUTFLOW IS 3339. AT TIME 23.50 HOURS

PEAK OUTFLOW IS 4027. AT TIME 23.00 HOURS

PEAK OUTFLOW IS 5469. AT TIME 22.00 HOURS

•••••••••• •••••••••• •••••••••• •••••••••• ••••••••••

Sh. 14

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

				RATIOS APPLIED TO FLOWS								
OPERATION	STATION	AREA	PLAN	RATIO 1 .20	RATIO 2 .30	RATIO 3 .40	RATIO 4 .50	RATIO 5 .60	RATIO 6 .70	RATIO 7 .80	RATIO 8 .90	RATIO 9 1.00
HYDROGRAPH AT	A1	6.57	1	2380.	3571.	4761.	5951.	7141.	8332.	9522.	10712.	11902.
	(	17.02)	(	67.41)(	101.11)(	134.82)(	168.52)(	202.22)(	235.93)(	269.63)(	303.33)(	337.04)
ROUTED TO	A2	6.57	1	419.	682.	953.	1425.	1977.	2623.	3339.	4027.	5449.
	(	17.02)	(	11.88)(	19.32)(	26.98)(	40.35)(	56.00)(	74.28)(	94.56)(	114.03)(	154.29)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

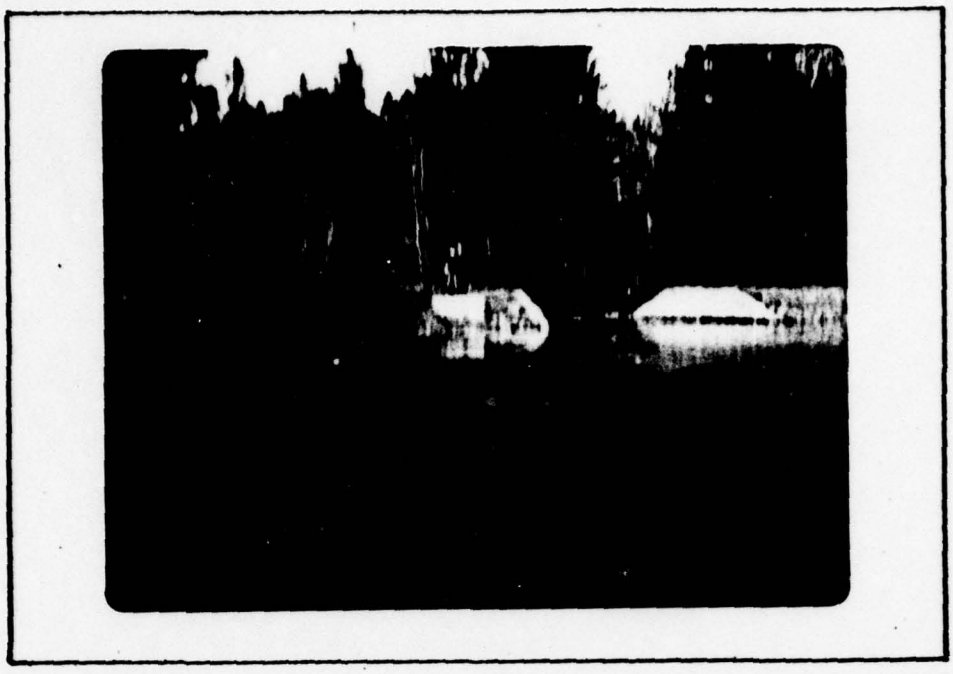
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1726.30	1726.10	1731.10
STORAGE	2641.	2554.	5048.
OUTFLOW	17.	0.	1074.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	1728.68	0.00	3762.	419.	0.00	26.00	0.00
.30	1729.72	0.00	4299.	682.	0.00	26.00	0.00
.40	1730.70	0.00	4825.	953.	0.00	26.00	0.00
.50	1731.55	.45	5301.	1425.	9.00	25.00	0.00
.60	1732.25	1.15	5710.	1977.	14.00	24.50	0.00
.70	1732.89	1.79	6094.	2623.	17.00	24.00	0.00
.80	1733.45	2.35	6439.	3339.	19.00	23.50	0.00
.90	1733.99	2.89	6778.	4027.	20.50	23.00	0.00
1.00	1734.31	3.21	6988.	5449.	21.50	22.00	0.00

APPENDIX

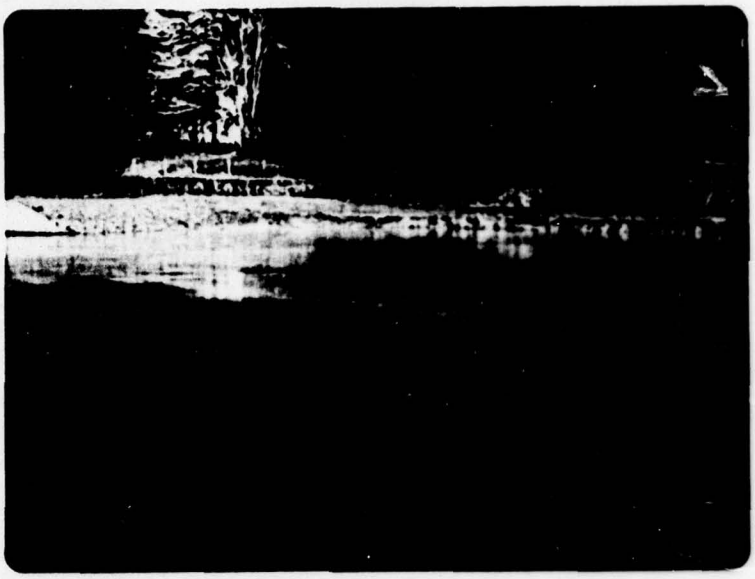
D

Photographs

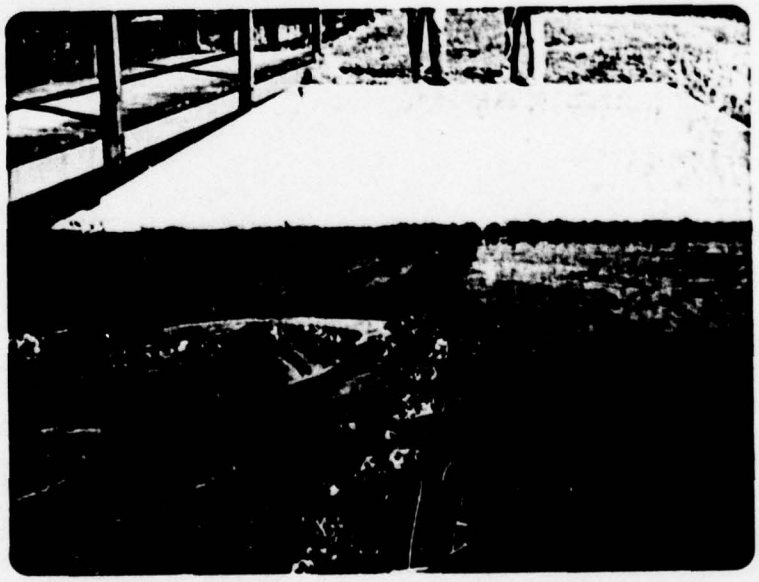


UPSTREAM FACE OF DAM
LOOKING TOWARDS THE SPILLWAY

LEFT ABUTMENT OF THE
UPSTREAM FACE OF THE DAM



RIGHT ABUTMENT OF THE
UPSTREAM FACE OF THE DAM



VIEW OF THE SPILLWAY SHOWING
SPALLING ON THE RIGHT SIDEWALL

VIEW OF THE RESERVOIR FROM THE RIGHT SIDE OF THE DAM LOOKING UPSTREAM

EROSION ALONG THE RIGHT WINGWALL OF THE SPILLWAY LOOKING DOWNSTREAM

DOWNSTREAM FACE AND TOE AT THE
RIGHT SIDE OF THE DAM

CHANNEL DOWNSTREAM OF THE DAM
SHOWING THE CULVERT UNDER STATE ROUTE 390

VIEW OF THE OUTLET CONDUIT

APPENDIX

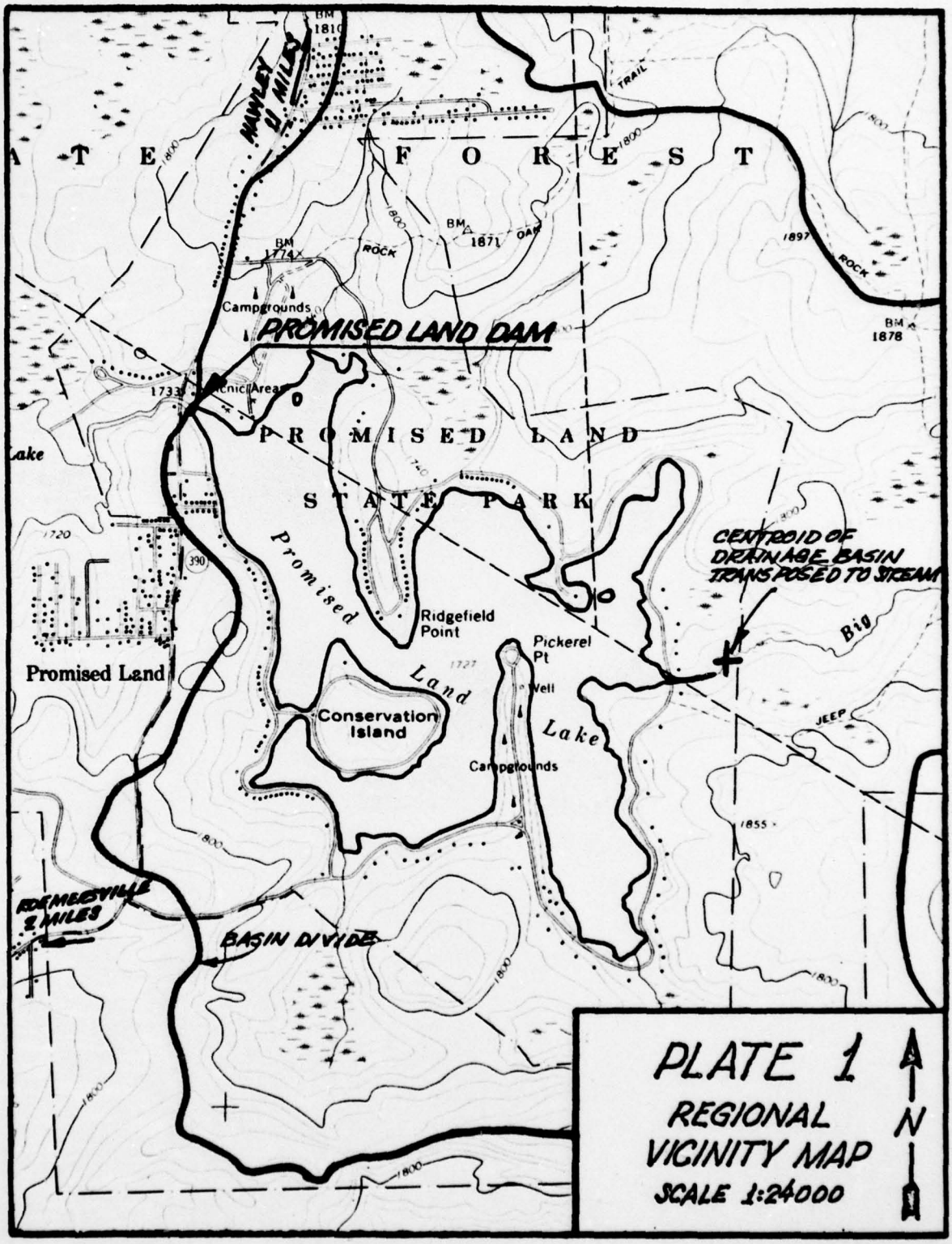
E

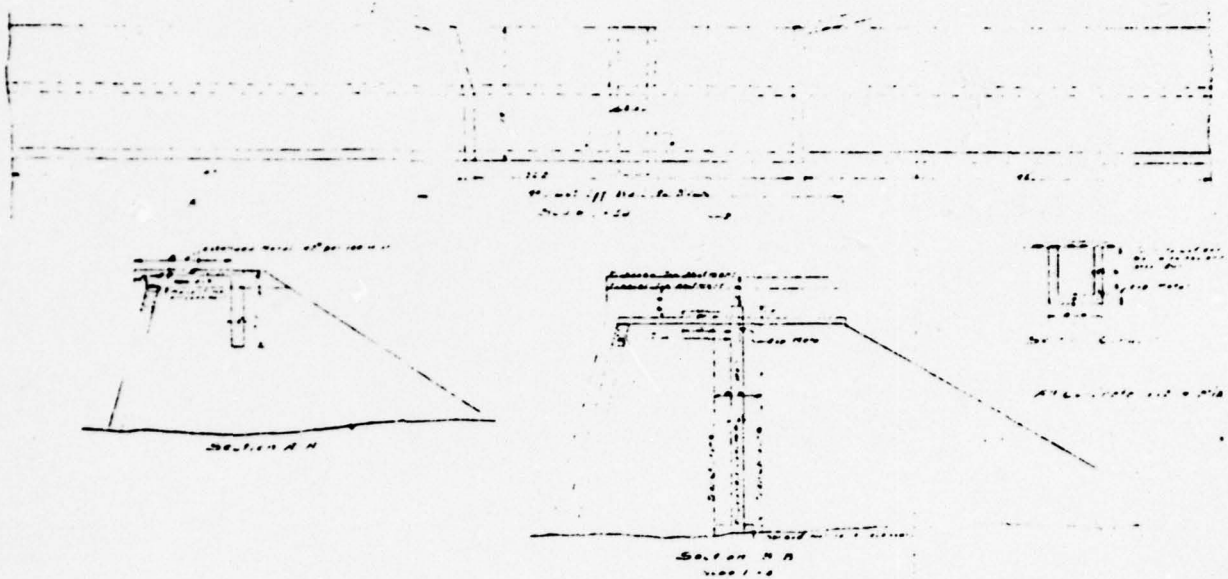
Drawings

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Promised Land Dam				

TABLE OF CONTENTS APPENDIX E


PROMISED LAND DAM
PROMISED LAND STATE PARK
Campgrounds
Picnic Area
Promised Land
Ridgefield Point
Pickerel Pt
Well
Conservation Island
Campgrounds
Promised Land Lake
Big
CENTROID OF DRAINAGE BASIN TRANSPOSED TO STREAM
BASIN DIVIDE
ROCKMESSVILLE 2 MILES
HAWLEY 11 MILES
TRAIL
JEEP
ROCK
OAK
BM 1810
BM 1774
BM 1871
BM 1878
1733
1720
1727
1855
1897
390
PLATE 1
REGIONAL VICINITY MAP
SCALE 1:24000
N



PROPOSED REPAIRS

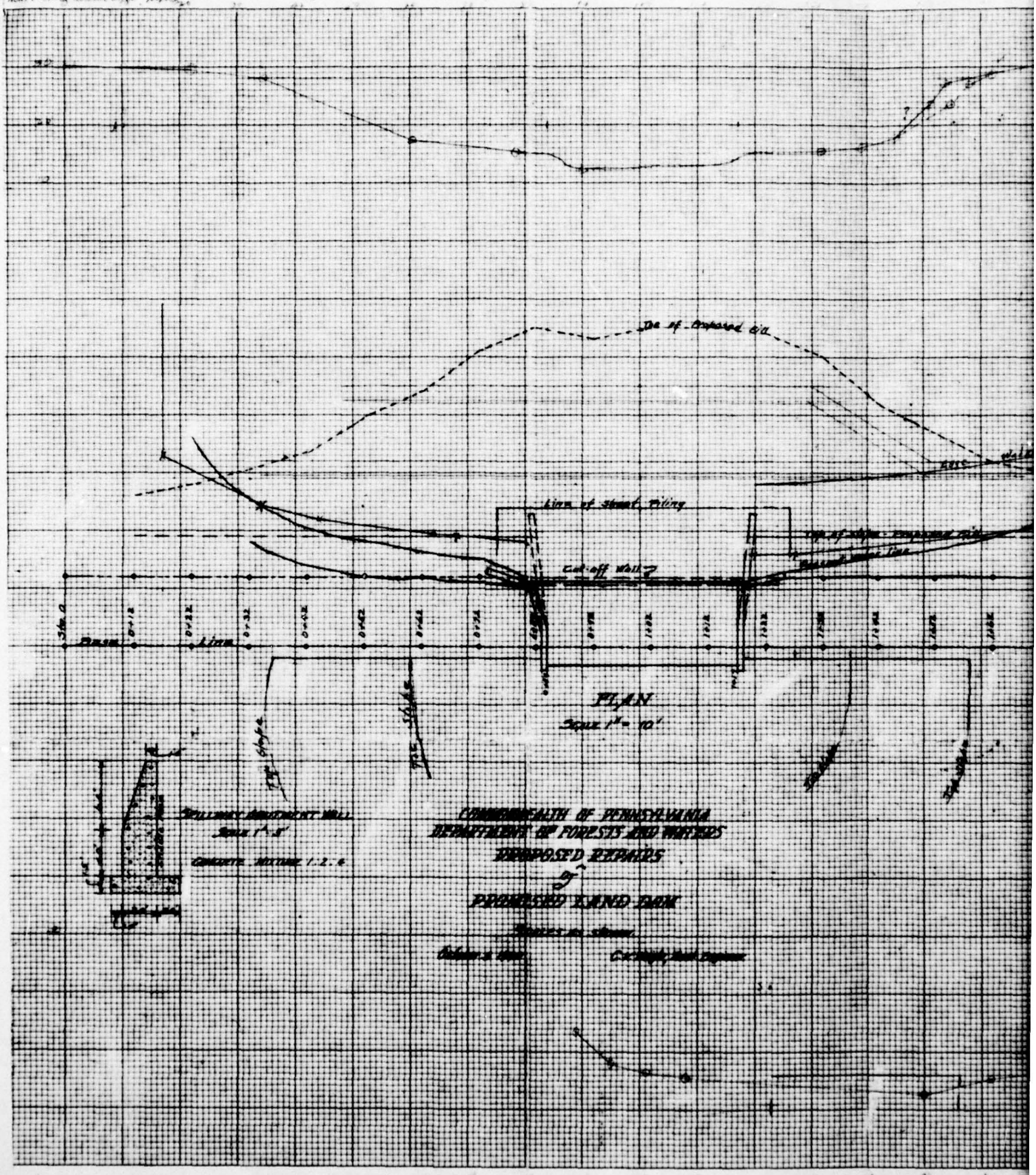
PROMISED LAND DAM

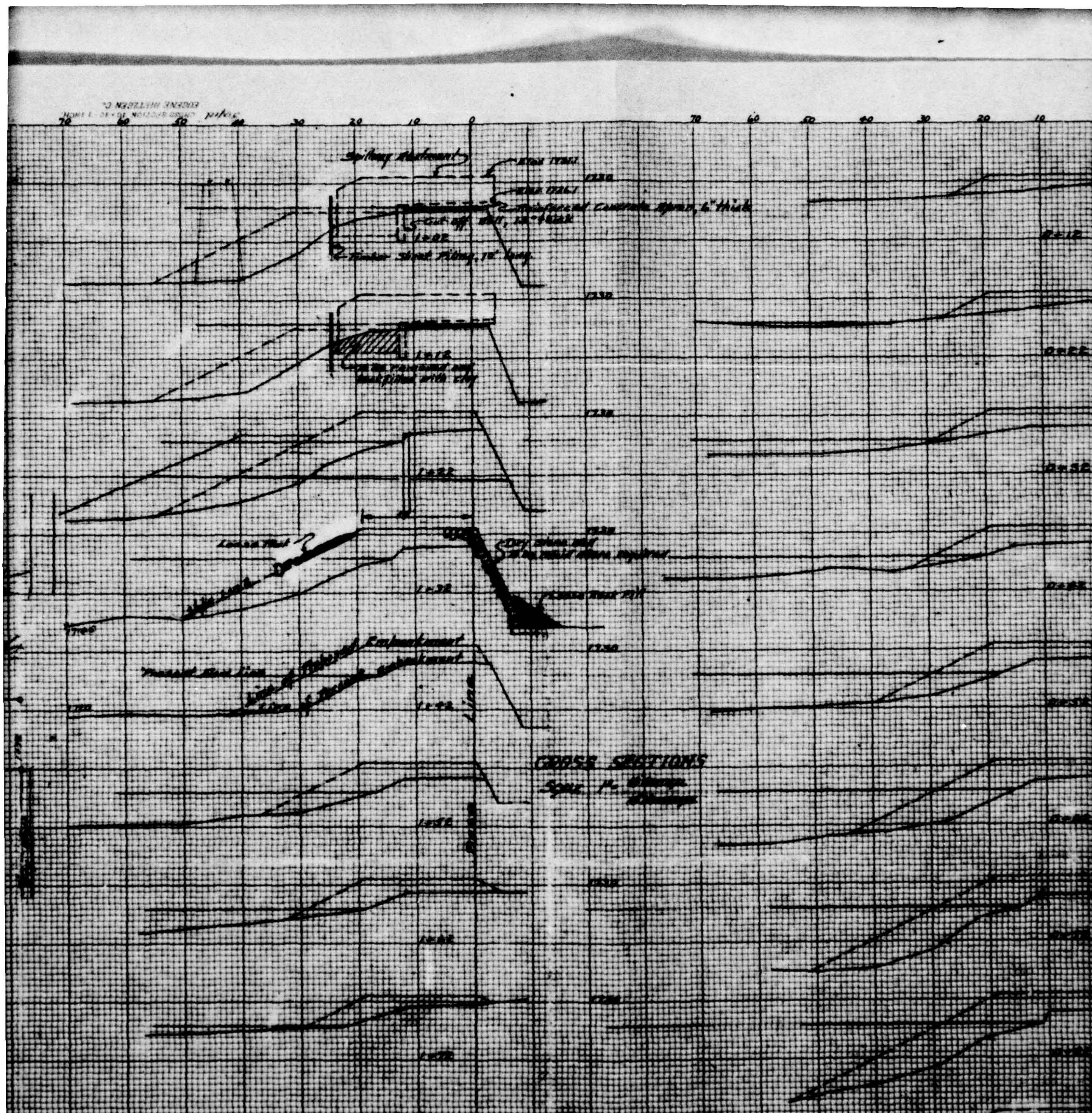
PIKE COUNTY PENNA.

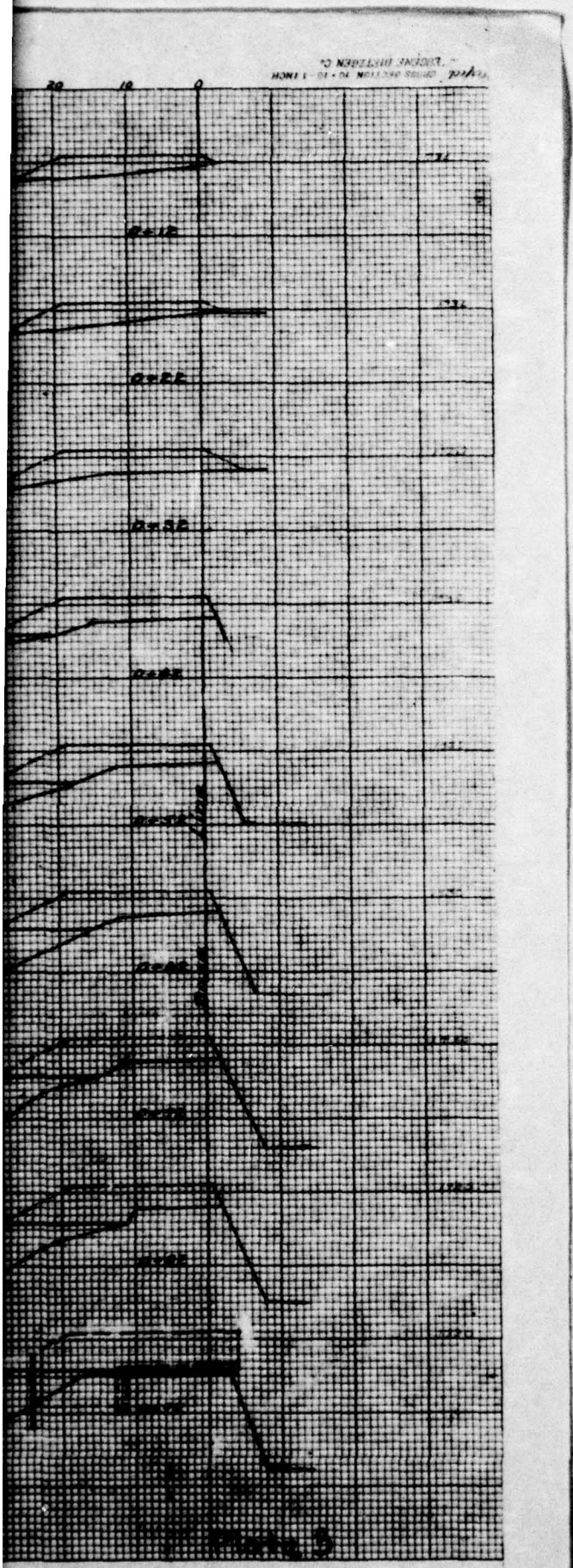
FILE NO 32-12

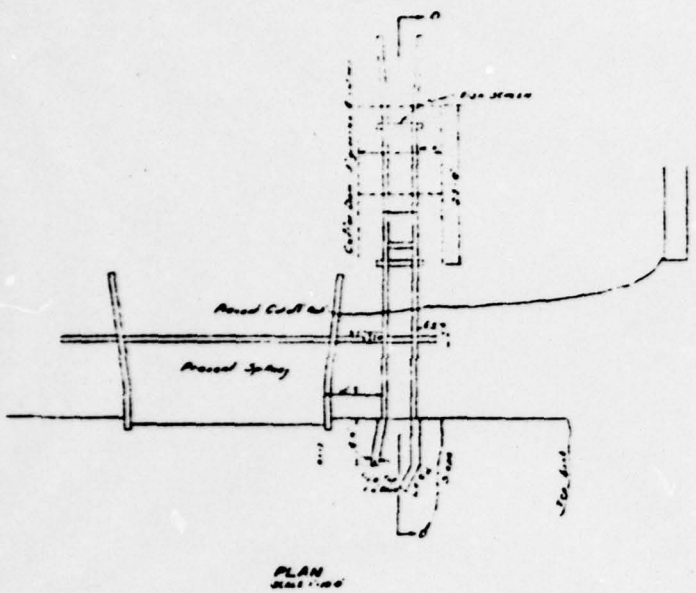
SEPT 30, 1939

Plate 2

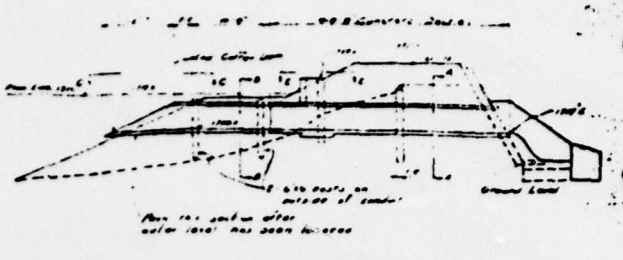

Top of Proposed Dam
Line of Sheet Piling
Cut-off Wall
PLAN
Scale 1" = 10'
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS
PROPOSED REPAIRS
OF
PROPOSED LAND DAM


Spillway Abutment
1230
Reinforced Concrete Apron, 6" thick
Timber Sheet Piling, 10' long
CROSS SECTIONS

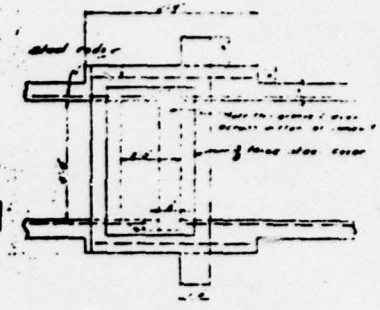

20
10
0
Plate 3



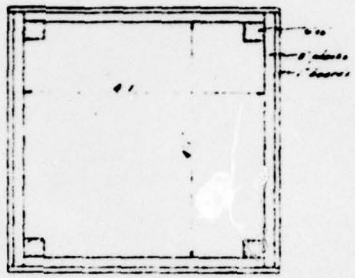
PLAN



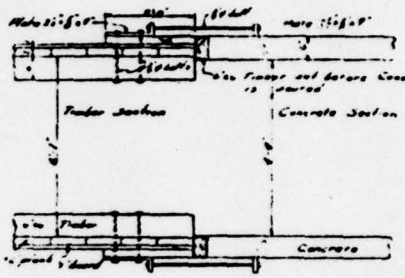
SECTION D-D



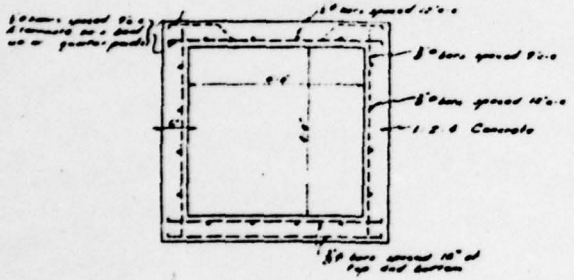
VIEW E-E



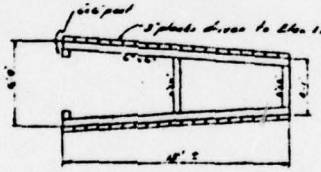
SECTION B-B



DETAIL OF CONNECTOR BETWEEN CONCRETE AND TIMBER SECTIONS



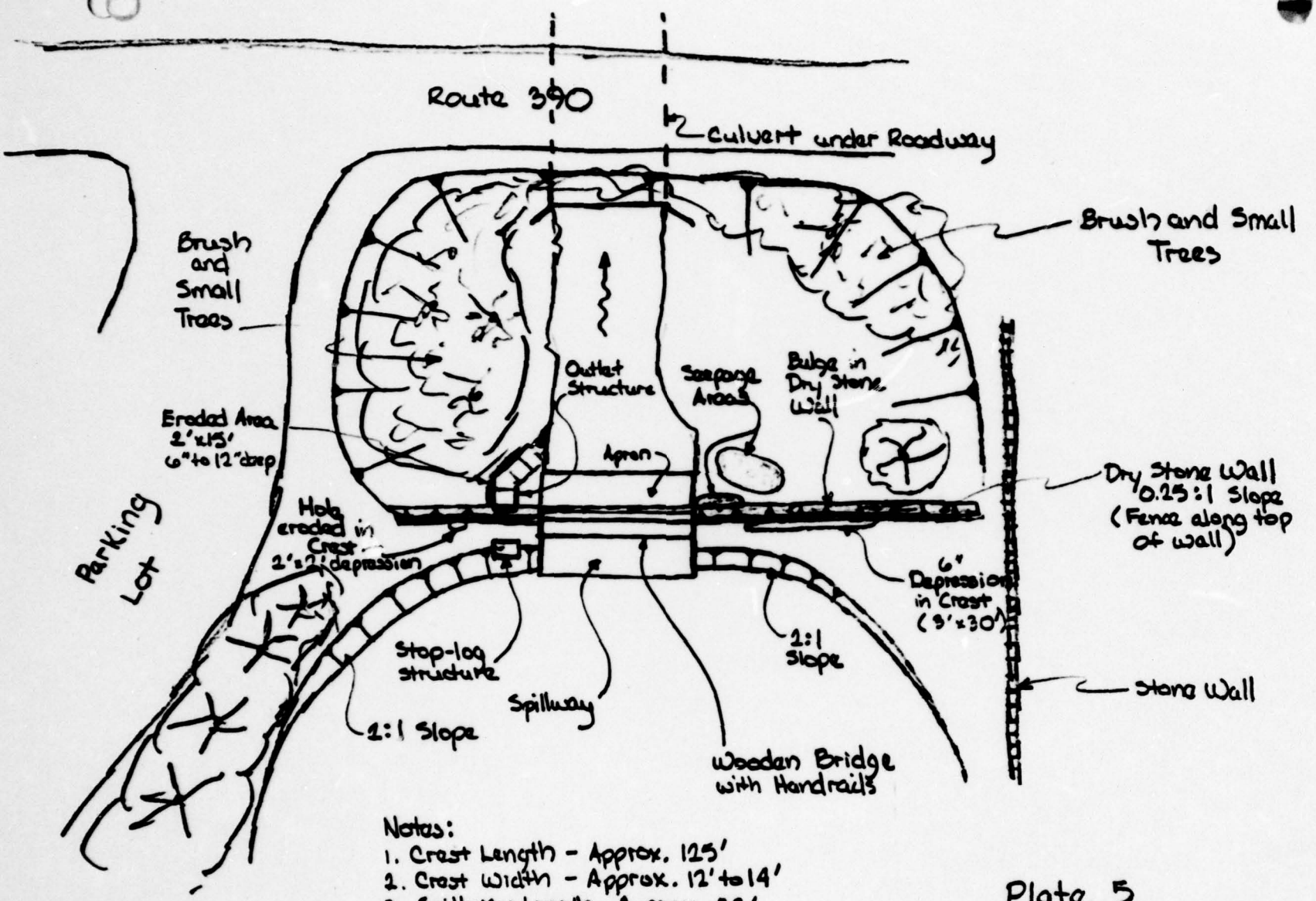
SECTION A-A



VIEW C-C

Plate 4

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS
PROMISED LAND DAM
PROPOSED OUTLET CONDUIT
GREENE TWP PIKE CO
FILE 32-12



Notes:
1. Crest Length - Approx. 125'
2. Crest Width - Approx. 12' to 14'
3. Spillway Length - Approx. 33'

Plate 5
Promised Land Dam
NOT TO SCALE

APPENDIX

F

Site Geology

SITE GEOLOGY

PROMISED LAND DAM

Promised Land Dam is situated in Pike County and within the limits of the Eastern Glaciated section of the Appalachian Plateau physiographic province. Thick deposits of glacially derived debris and till cover the nearly horizontally bedded, red, gray and green shale and sandstone units of the Devonian Catskill group of marine and continental sediments. The dam and lake both rest on glacial till and ground moraine deposits which are dense, compact and relatively impermeable. Prior to construction of the lake the area was covered with high valley swamps and bogs, attesting somewhat to the compactness and impervious nature of the dense, glacial till mantle.

No known faults or major structural defects occur in the bedrock in the vicinity of the dam and lake.

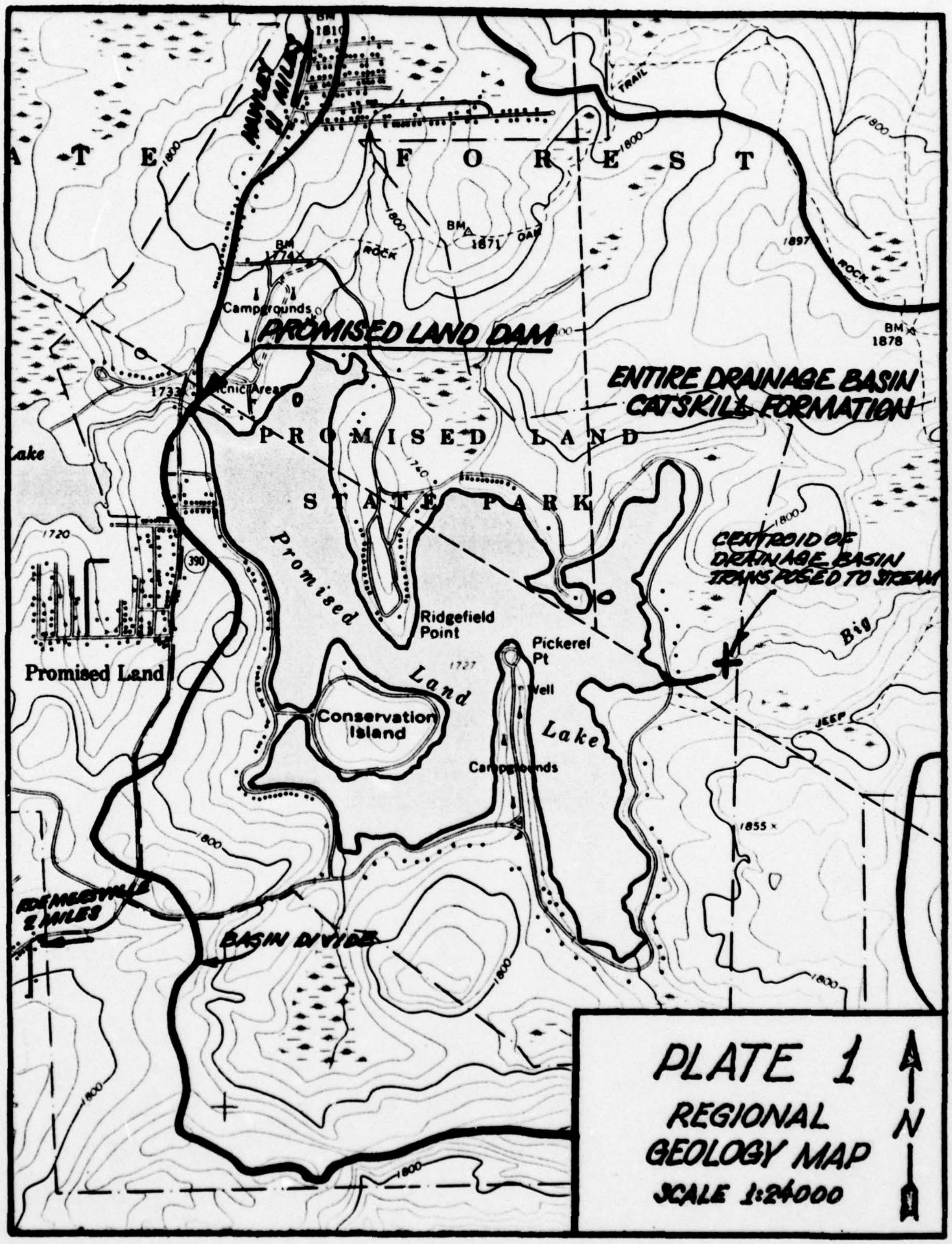


PLATE 1
REGIONAL GEOLOGY MAP
SCALE 1:24000