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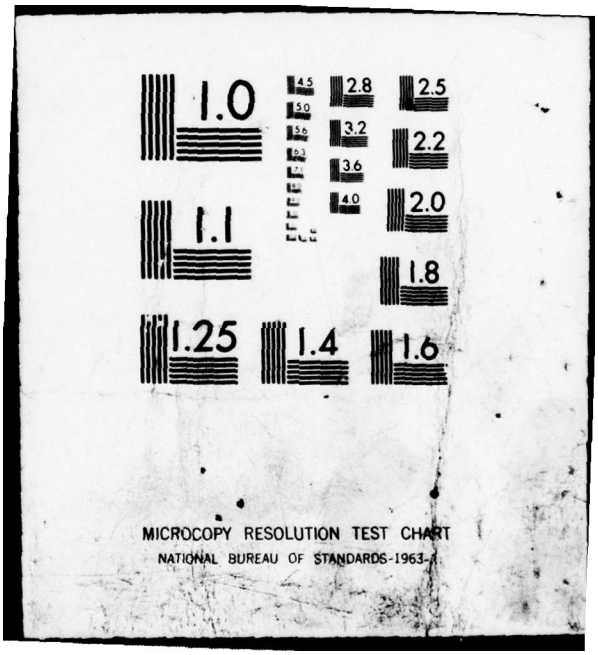
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DELAWARE RIVER BASIN
EAST BRANCH WALLENPAUPACK CREEK, PIKE COUNTY

PENNSYLVANIA

LOWER LAKE DAM

NDI - PA 00306

PA DER 52-144

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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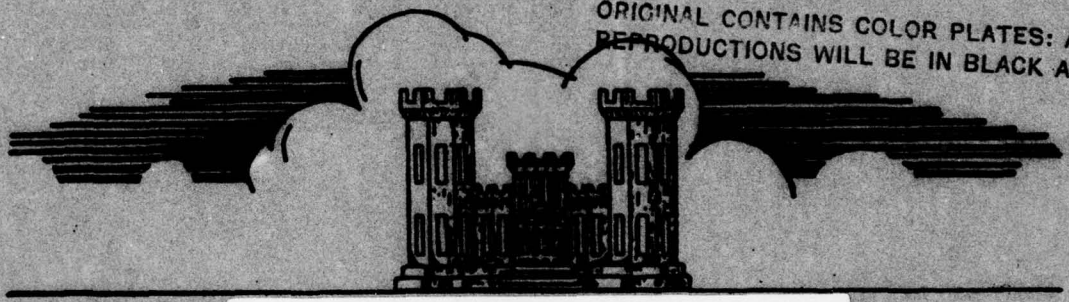

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Prepared By
O'BRIEN & GERE
Justin & Courtney Division
PHILADELPHIA, PENNSYLVANIA
19103

FOR
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

MAY 1979

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(12) 94p.

(11) May 79

DELAWARE RIVER BASIN

Name of Dam: Lower Lake Dam

County and State: Pike County, Pennsylvania

Inventory Number: PA 00306

(15) DACW31-79-C-0014

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

(6) National Dam Inspection Program. Lower Lake Dam (NDI-PA 00306, PA DER 52-144), Delaware River Basin, East Branch Wallenpaupack Creek, Pike County, Pennsylvania. Phase I Inspection Report.

Prepared by:

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

For:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

410760 Hm

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 PROGRAMS

Name of Dam:	Lower Lake Dam ID # PA 00306
State Located:	Pennsylvania
County Located:	Pike
Stream:	East Branch Waullenpaupack Creek
Coordinates:	Latitude 41° 19.1', Longitude 75° 12.6'
Date of Inspection:	December 6, 1978

ASSESSMENT

Lower Lake Dam is an earth embankment with a concrete gravity spillway. The embankment is approximately 340 feet in length with a maximum height of 22.5 feet. The spillway is a broad crested weir, 140 feet in length, divided into three sections. The reservoir drain system consists of two 72" x 44" corrugated metal pipes controlled by means of 36-inch diameter sluice gates. The dam impounds a 250 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 the 0.5 PMF, therefore, the spillway is classified as adequate.

Based on visual observations made on the date of the inspection, the dam and its appurtenant structures are considered to be in good condition. Riprap on the upstream side of the embankment is missing or covered by grass and earth. Minor settlement has occurred in an area adjacent to the downstream side of the right wingwall. A crack and movement of the left wingwall at the tie-in with the upstream slope of the embankment has occurred. Erosion has created depressions on the upstream side of the embankment, particularly the lower half of the right side of the embankment and along both wingwalls.

Recommendations and remedial measures are as follows:

a. Facilities

1. Eroded areas on the upstream face of the embankment should be filled; graded filter and riprap should be provided where wave protection is inadequate.

2. The area of settlement adjacent to the right wingwall on the downstream side should be excavated several feet and the backfill

material compacted. Monthly observations should be made to check for settlement.

3. The crack in the upstream side of the left wingwall and the adjacent construction joint should be monitored for further movement.

b. Operation and Maintenance Procedures

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

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

Will M. Heiser

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

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

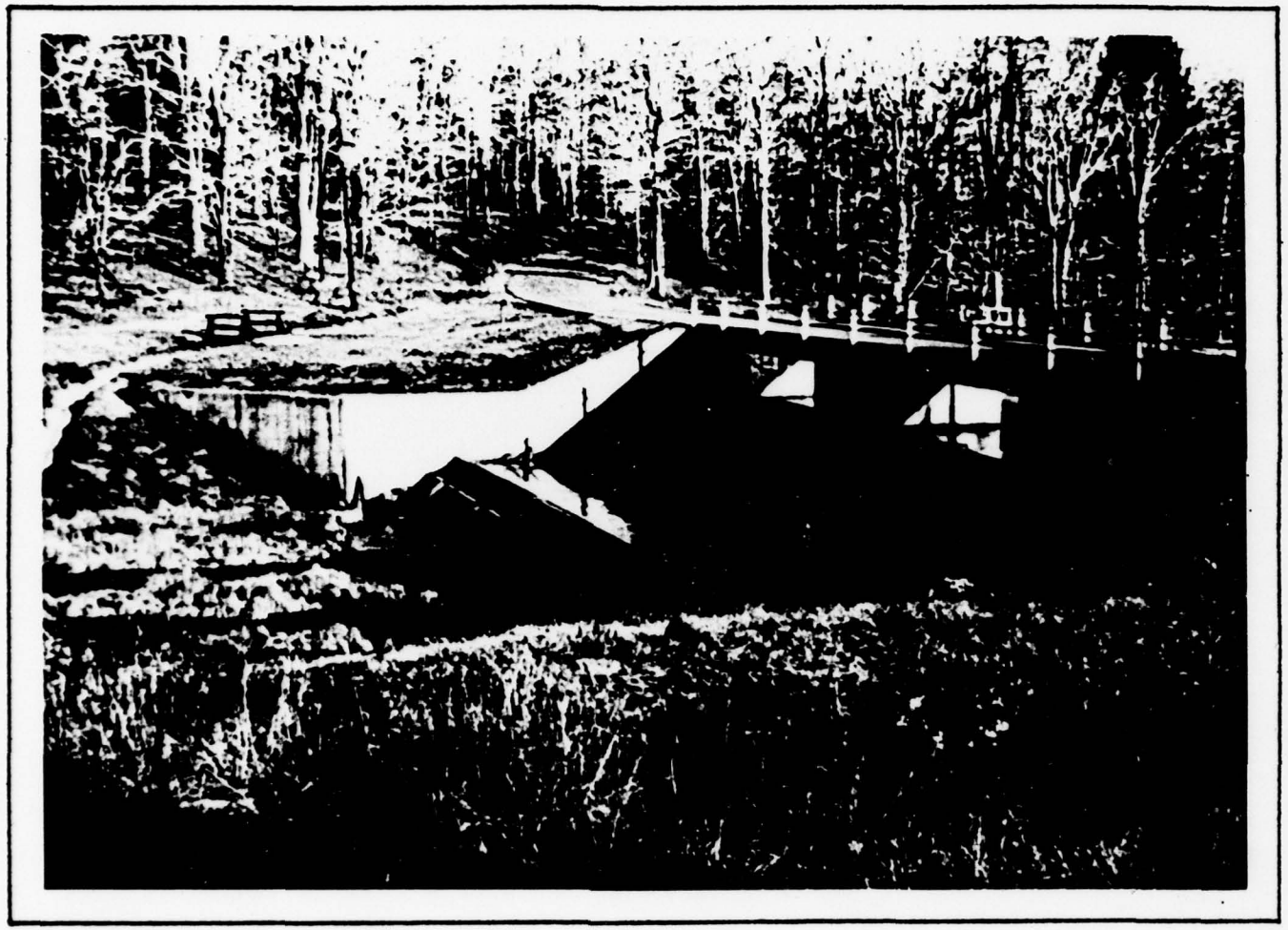
Date: June 8, 1979

James W. Peck

Approved By

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 16 JULY 1979



OVERVIEW
LOWER LAKE DAM, PIKE COUNTY, PENNSYLVANIA

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(Continued)

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LOWER LAKE DAM
NDI ID NO. PA-00306
DER # 52-144

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 Lower Lake Dam and appurtenant structures, 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.)

ABSTRACT

Lower Lake Dam is an earth embankment with a concrete gravity spillway. The embankment is approximately 340 feet in length with a maximum height of 22.5 feet. The dam impounds a reservoir with a surface area of 250 acres and a storage capacity of 1,085 acre-feet at normal pool level. The top of the dam is 20 feet wide; the upstream and downstream side slopes are approximately 2.5 horizontal to 1.0 vertical (2.5H:1V). No information is available concerning the properties of the embankment materials. Within the embankment is a tapered reinforced concrete cutoff wall that extends from bedrock to 3.5 feet below the top of the embankment.

The reinforced concrete spillway, which has a maximum height of 13 feet from base to crest, consists of 3 sections separated by bridge piers. Each section is a broad-crested weir with a vertical upstream face and a flat, sloping downstream face. The crest of the center section is 48.5 feet long and the crest of each of the two end sections is 45.75 feet long. The crest of the center section, which is 3 feet wide, is 0.5 feet below the crest of the end sections; each of the end sections is 2.5 feet wide. At the base of the weir is a stilling basin with baffle blocks. The stilling basin slab, which has six 3-inch weep holes, overlays a 6-inch layer of

ABSTRACT

stone. Approximately 26 feet downstream of the toe of the spillway is a 2 foot high weir or end sill with six 3"x6" semicircular drains. The stilling basin floor extends an additional 3 feet downstream from the toe of the end sill. This additional section is cantilevered above an apron located 4 feet below the overhang. Seven 4-inch pipes pass through the end wall supporting the stilling basin slab to provide drainage for the 6-inch layer of stone that is under the stilling basin slab.

The reservoir drain system consists of two 72"x44" corrugated metal pipes located near the base of the two bridge piers. Flow through the pipes discharges on the apron. The flow is controlled by means of 36 inch diameter sluice gates located at the upstream end of the pipes. The sluice gates are operated from the bridge deck.

The underside of the concrete bridge structure is located approximately 7 feet above the crest of the spillway and has an 18-foot wide asphalt roadway.

b. Location. Lower Lake Dam is located on the East Branch of Waullenpaupack Creek at a point about 1 mile west of Promised Land, in Green 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 Lower Lake Dam is included as Plate 1, Appendix E.

c. Size Classification. Lower Lake Dam has a maximum capacity of 1,347 million gallons (4,140 acre-feet) and a maximum height of 22.5 feet. The structure is in the intermediate size category.

d. Hazard Classification. There are approximately 40 private residences on Lake Paupack, which is located 1.5 miles downstream of Lower Lake Dam. The topography downstream of the dam is such that flood waters would not be directed toward these homes. Therefore, the structure is in the "Significant" hazard category.

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

f. Purpose of the Dam. The dam was built to provide a reservoir for recreation in the Promised Land State Park.

g. Design and Construction History. The dam was designed by L. Robert Kimball, a consulting engineer, and was constructed by the Pocono Mountains Construction Company, Inc. between 1958 and 1959. Repairs to the abutment wingwalls to correct structural deficiencies and drainage problems were made in 1963 and 1964.

h. Normal Operating Procedures. According to the Park Foreman, the lake is normally maintained at Elevation 1707.0 which is the elevation of the center spillway crest. Operating procedures are limited to the operation of the two sluice gates, which are normally in a partially open position. A minimum release of 1.6 cfs. is required by DER.

1.3 Pertinent Data

a. Drainage Area.

Square Miles	10.6

b. Discharge at Dam Site (cfs.).

Total Spillway Capacity at top of dam Elev. 1717.0	14,620

c. Elevation (Feet above MSL).

Spillway Crest, Center Section (Normal, Recreation Pool)	1707.0
Spillway Crest, Outer Sections	1707.5
Top of Dam (at low point of top of dam)	1717.0
Reservoir Drain Invert	1694.5
Streambed at Centerline of Dam	1694.5

d. Reservoir (Miles).

Length of Normal, Recreation Pool	1.2
Length at Maximum Non-overtopping Pool	1.4
Fetch at Normal Pool	0.5

e. Storage (acre-foot).

Normal, recreation pool, Elev. 1707.0	1,085
Top of Dam at Low Point, Elev. 1717.0	4,140

f. Reservoir Surface Area (acres).

Normal, Recreation Pool, Elev. 1707.0	250
Top of Dam at Low Point, Elev. 1717.0	365

g. Dam Data.

Type	Earth
Length	340 feet
Height	22.5 feet (maximum)
Top Width	20 feet
Side Slopes	2.5H:1V (upstream and downstream)
Zoning	No
Impervious Core	No
Cutoff	Yes
Grout Curtain	No

h. Spillway.

Type	Broad-crested weir
Length	48.5 feet (center sections) 45.75 feet (outer sections)
Width	3.0 feet (center section) 2.5 feet (outer sections)
Crest Elevation	1707.0 (center section) 1707.5 (outer sections)
Gates	None
Upstream Channel	Lower Lake
Downstream Channel	Follows a natural draw through a heavily wooded region.

i. Outlet Works.

Type	Two 72"x44" CMP's
Length	50 feet
Closure	Two 36-inch diameter sluice gates at upstream end.
Access	Intake is submerged; Hand-operated mechanism for sluice gate on deck of bridge.
Regulating Facilities	Hand operated sluice gates

SECTION 2

ENGINEERING DATA

2.1 Design

a. Data Available. The information available for review of Lower Lake Dam includes the following (all information obtained from the Pennsylvania DER main office files in Harrisburg, Pennsylvania):

1. Dam inspection reports beginning in 1962 and through the intervening years.

2. Photographs beginning in 1958 and through the intervening years.

3. Application, Report Upon the Application and Permit for construction of Lower Lake Dam.

4. Seven design drawings - L. Robert Kimball, consulting Engineer.

5. Miscellaneous correspondence.

b. Design Features. The design features are discussed in Section 1.2.a and shown on Plates 2, 3, 4 and 5 of Appendix E.

2.2 Construction

The construction data available in the Pennsylvania DER offices in Harrisburg, Pennsylvania, are several photographs, construction reports and correspondence. The dam was constructed by the Pocono Mountains Construction Company, Inc. between 1958 and 1959. Repairs to the downstream wingwalls were made in 1963 or 1964 to correct structural deficiencies. Saturated earth loads on the wingwalls had caused deflections of the walls, openings in joints, and fracturing in the south abutment wingwall. The repairs to the wingwalls were made, additional weepholes were drilled in the walls, and a drainage system constructed to carry the runoff below the wingwalls.

2.3 Operation

Operation procedures appear to be limited to those necessary to maintain a minimum flow of 1.6 cfs. or to draw the lake down by means of the sluice gates, which are operated from the bridge deck. There is no evidence that operating procedures have been written for this structure.

2.4 Evaluation

a. Availability. All information made available was obtained from DER.

b. Adequacy. Information supplied by DER, observations made during the field inspection, and discussions with the park foreman provided sufficient material to perform a Phase I evaluation.

c. Validity. There appears to be no reason to question the validity of the information available.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of the Lower Lake Dam took place on December 6, 1978. The reservoir water surface elevation was approximately an inch above the spillway crest of the center section during the inspection. No underwater areas were inspected. The observations and comments of the field inspection team are 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 riprap on the upstream side of the embankment is missing or covered by grass and earth. There is an area of minor settlement of up to 3 inches in the embankment adjacent to the downstream right wingwall tie-in. This area is approximately 3 feet wide and 30 feet long. Erosion has created depressions up to 12 inches deep along both upstream wingwalls and depressions up to 3 inches deep on the lower half of the upstream slope on the right side of the embankment. The depressions along the wingwalls cover a 2 to 3 feet wide strip from the top of the dam to the waterline. The eroded area of the embankment covers a 7 foot wide strip starting at the wingwall and extending approximately 40 feet.

c. Appurtenant Structures. A crack at the upstream end of the left wingwall at the tie-in was observed as well as a differential movement of approximately 1/4 inch of an adjacent construction joint. Occassional hairline cracking and spalling of the wingwalls were noted.

The park foreman, Carl Rose, opened both sluice gates further to demonstrate that they were fully operational.

d. Reservoir. Area reconaissance of the reservoir disclosed no evidence of excessive siltation, slope instability, or other features that would significantly affect the storage capacity of the reservoir. The slopes along the perimeter are heavily vegetated and on gradients of less than 15 percent. Promised Land Dam is located immediately upstream of the reservoir.

e. Downstream Channel. Below Lower Lake Dam, the East Branch of Waullenpaupack Creek flows through heavily wooded areas for 1.5 miles before reaching Lake Paupack. The channel gradient averages about 1.1% for this section of the creek.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

Operational procedures have been covered in section 1.2.h. According to the owner's representative, written operating procedures are not available. 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 reported to be conducted on a regular basis by both the Park Superintendent and personnel from the Division of Completed Projects, DER. Records and photographs of these inspections are available. Regular maintenance performed has consisted of minor concrete repairs and debris removal.

4.3 Maintenance of Operating Facilities

According to the maintenance records, the sluice gates are checked, lubricated, and operated on a regular basis by Promised Land State Park personnel.

4.4 Warning System in Effect

According to the Park Superintendent, no formal warning systems or procedures have been established for periods of high lake levels.

4.5 Evaluation of Operational Adequacy

The current operating and maintenance procedures for the Lower Lake Dam appear to be adequate, even though there are no formal operating procedures.

A warning system should be developed. During periods of heavy rainfall or rapid snowmelt, 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. No original design data is available. The drainage area contributing to Lower Lake Dam is about 5.0 miles long and averages about 2.1 miles wide. Ground elevations range from 2012 to 1707. The slopes of the watershed adjacent to the reservoir are all less than 15 percent. The watershed is nearly 100 percent wooded.

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

b. Experience Data. According to the owner's representative, no regular records of reservoir water levels are maintained. However, during Hurricane Agnes in June, 1972, the stage in the reservoir was observed to be 18 inches above the crest of the spillway. 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 that the spillway capacity would be reduced during a flood. Further observations are given in Appendix B.

d. Overtopping Potential. The spillway is capable of handling a discharge of 11,700 cfs. The SDF for this "Intermediate" size dam, with a "Significant" hazard classification, is the 0.5 PMF which has a peak inflow of 4,570 cfs. and a peak outflow of 3,190 cfs. The 0.5 PMF hydrograph for the Promised Land Dam drainage area was routed through that reservoir with a starting water surface elevation at 1726.3, 0.2 above the crest of the spillway, and into Lower Lake. At this point, the routed Promised Land Dam hydrograph was combined with the 0.5 PMF hydrograph for the Lower Lake drainage area and routed through Lower Lake with a starting water surface elevation of 1707.3, 0.3 feet above the crest of the center section of the spillway. The maximum water surface elevation in the Lower Lake Reservoir resulting from this routing is 4.0 feet above the spillway crest of the center section and 6.0 feet below the lowest point of the top of the dam.

Examination of the results of the hydrologic and hydraulic analyses indicates that the spillway is capable of passing the 0.5 PMF without overtopping the embankment (See Appendix C for computations).

e. Spillway Adequacy. The Lower Lake Dam spillway is classified as adequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. Riprap facing on the upstream slope of the embankment is missing or covered by grass and earth. Minor settlement of up to 3 inches of the embankment adjacent to the downstream right wingwall tie-in could be due to poor compaction of earth adjacent to wingwall.

A crack at the upstream end of the left wingwall at the tie-in and movement of an adjacent construction joint of approximately 1/4 inch were observed. However, this should have minor effect on the overall stability of the structure. Occasional hairline cracking and spalling of the wingwalls were noted.

Based on the available information and field observations, the embankment and spillway appear to be in good condition with no visible signs of structural instability.

b. Design and Construction Data. A partial set of design drawings is available. No design calculations or soil data are available. Lists of the design and construction data reviewed are given in Section 2.1.a and 2.2.

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

d. Post-Construction Changes. The available information indicates that the only major modifications to the original structure were made in 1963 or 1964 on the wingwalls to correct deflections of the walls, openings in joints, and fracturing of concrete in the south abutment wingwall. The wingwalls were repaired, additional weepholes drilled in the walls, and a drainage system constructed to carry the runoff below the wingwalls. Information is available in the DER files on maintenance work done on the dam through the years.

e. Seismic Stability. Lower Lake 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 on the date of the inspection, the dam and its appurtenant structures are considered to be in good condition. Riprap on the upstream side of the embankment is missing or covered by grass and earth. Minor settlement has occurred in an area adjacent to the downstream side of the right wingwall. A crack and movement of the left wingwall at the tie-in with the upstream slope of the embankment has occurred. Erosion has created depressions on the upstream side of the embankment, particularly the lower half of the right side of the embankment and along both wingwalls.

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 the 0.5 PMF and, therefore, is adequate.

b. Adequacy of Information. A Phase I evaluation is considered reasonable based on observations made during the field inspection, information supplied by DER, and conversations with the owner's representative.

c. Urgency. The remedial measures recommended in Section 7.2 should be effected as soon as possible.

d. Necessity for Further Evaluation. No further investigations are recommended at this time.

7.2 Recommendations and Proposed Remedial Measures

a. Facilities

1. Eroded areas on the upstream face of the embankment should be filled; graded filter and riprap should be provided where wave protection is inadequate.

2. The area of settlement adjacent to the right wingwall on the downstream side should be excavated several feet and the backfill material compacted. Monthly observations should be made to check for settlement.

3. The crack in the upstream side of the left wingwall and the adjacent construction joint should be monitored for further movement.

b. Operation and Maintenance Procedures

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

APPENDIX

A

Check List Engineering Data

Design, Construction, Operation

Phase I

APPENDIX

A

Check List Engineering Data

Design, Construction, Operation

Phase I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Lower Lake Dam

ID # PA - 00306

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	There are no "As-Built" drawings available. There are 7 Design drawings in DER file. See Plates 1, 3, 4, and 5 in Appendix E.
REGIONAL VICINITY MAP	Refer to Appendix E, Plate 1
CONSTRUCTION HISTORY	The dam was built in 1958-1959 by the General State Authority of Pennsylvania for the purpose of creating a recreation pool. The structure was designed by L. Robert Kimball, P.E. & constructed by Pocono Mountains Construction Co., Inc.. Repairs to the abutment wingwalls to correct fracture and drainage problem were made in 1961 or 1962.
TYPICAL SECTIONS OF DAM	Refer to Plates 2, 3, 4, and 5 in Appendix E.
OUTLETS - PLAN DETAILS CONSTRAINTS	Refer to Plate 2, Appendix E. 72" x 44" CMP pipes controlled by 36" diameter sluice gates.
DISCHARGE RATINGS	Not available.
RAINFALL/RESERVOIR RECORDS	Rainfall records available at Promised Land State Park office.

ITEM	REMARKS
DESIGN REPORTS	"Report Upon The Application of the Department of Forests and Waters" for Lower Lake Dam available in DER files.
GEOLOGY REPORTS	None provided in DER files. Refer to Appendix F of this report
DESIGN COMPUTATIONS	No data available
HYDROLOGY & HYDRAULICS	No data available
DAM STABILITY	No data available
SEEPAGE STUDIES	No data available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY } FIELD }	Brief descriptions of boring logs and excavation in "Report Upon the Application of the Department of Forests and Waters" for Lower Lake Dam and in construction reports.
POST-CONSTRUCTION SURVEYS OF DAM	May, 1961 inspection of dam by G.S.A. engineer
BORROW SOURCES	There is no record of the source of the borrow material.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Additional weep hole added to downstream retaining walls.
HIGH POOL RECORDS	June, 1972 - Hurricane Agnes - 18 inches of water on top of weir
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Fracturing, deflection, and separation of retaining walls on downstream side - noted May, 1961 - repaired walls and weep holes added.
MAINTENANCE OPERATION RECORDS	Regular maintenance inspections from June, 1962 to present date. Maintenance performed noted in reports. Information available in DER files.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Refer to Appendix E
OPERATING EQUIPMENT PLANS & DETAILS	No information available.
MISCELLANEOUS	Material in DER files: 1. Engineering Drawings 2. Construction Reports 3. Dam inspection reports through the years. 4. Photographs taken during dam inspections. 5. Miscellaneous correspondence. 6. Application, Report upon the Application, and Permit for Construction of Lower Lake Dam

APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam Lower Lake Dam County Pike State *Pennsylvania* National ID # PA-00306

Type of Dam Earth Fill/Conc. Gravity Hazard Category High

Date(s) Inspection Dec. 6, 1978 Weather clear, cold Temperature ≈ 32°

Pool Elevation at Time of Inspection 1707.1 M.S.L. Tailwater at Time of Inspection 1694 M.S.L.

Inspection Personnel:

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

David B. Campbell Recorder

Remarks:

Carl Rose, Promised Land State Park foreman, accompanied inspection personnel.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	None Observed	—
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No separation observed	—
DRAINS	Drains for 6" stone layer under stilling basin slab are working? Weep holes in stilling basin slab drain into 6" stone layer	—
WATER PASSAGES	N/A	
FOUNDATION	Not Observed	—

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Occasional hairline cracking of wingwalls, some minor spalling.	Patch cracks & spalls
STRUCTURAL CRACKING	slight cracking at upstream end on left wingwall at tie-in,	Continue to observe, no problem now.
VERTICAL AND HORIZONTAL ALIGNMENT	No alignment problems observed.	—
MONOLITH JOINTS	No problems observed	—
CONSTRUCTION JOINTS	small differential movement of construction joint on upstream side of left wingwall separation between left end of weir wall and south wingwall	Continue to observe

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	—
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	—
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion along upstream side of left wingwall. Erosion has created depression about 1.5' deep along upstream side of right wingwall. General erosion of lower half of upstream slope on right side.	Fill eroded areas and reseed
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No misalignments observed	—
RIPRAP FAILURES	Upstream slope supposed to have 1 foot thick rip-rap layer. Riprap is missing or under grass and earth.	Restore riprap facing of upstream slope.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DRAINS	Weep holes on both wingwalls drain portion of embankment, weep holes are discolored, some discharging water (est. 0.1 gpm)	—
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Some minor settlement adjacent to right wingwall (3" ±), both upstream and downstream.	—
ANY NOTICEABLE SEEPAGE	None observed	—
STAFF GAGE AND RECORDER	None	—

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A	-
INTAKE STRUCTURE	Not observed, under water Park foreman opened both sluice gates	-
OUTLET STRUCTURE	72" x 44" CMP, couldn't observe interior (CMP controlled by 36" diam. sluice gates)	-
OUTLET CHANNEL	CMP's empty onto concrete apron, then to natural channel which enters heavy woods about 300 feet away	-
EMERGENCY GATE	2 - 36" diam sluice gates controlling 2 - 72" x 44" CMP's	-
BRIDGE	Steel bridge with 2 - 1'-6" piers (conc.) on spillway, bridge 7'-3" above center section of spillway, bridge has asphalt roadway.	-

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	broad-crested weirs (2'-6" wide), 3 sections, crest elevation of outer sections about 6" higher than center section, weir has vertical upstream face and flat sloping downstream face	—
APPROACH CHANNEL	Lower Lake	—
DISCHARGE CHANNEL	water flows over weir into stilling basin with baffle blocks water from stilling basin discharged through and over end sill (retaining wall) and drops to concrete apron, then to natural channel	—
BRIDGE AND PIERS	See sheet 6a/11	

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	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	N/A	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	All slopes less than 15%, shoreline generally heavily wooded, park facility areas are partially cleared	—
SEDIMENTATION	None observed	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Channel flows through heavily wooded areas for 1.5 miles to Lake Paupack. No bridges or man-made obstructions.	—
SLOPES	The channel gradient averages about 1.1% for the 1.5 miles from Lower Lake Dam to Lake Paupack.	—
APPROXIMATE NO. OF HOMES AND POPULATION	There are approximately 40 home on Lake Paupack with an estimated population of 200.	A formal warning system should be developed and implemented. Procedures for evacuating people within the potential flood area should be implemented.

APPENDIX

C

Hydrologic & Hydraulic Data

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO

TABLE OF CONTENTS APPENDIX C

Hydraulics & Hydrologic Data

Promised Land Dam

Lower Lake Dam

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Copper Promised Land Dam	1	DRP	12/14/78	1841-010

D.A. = Area I + Area II

Area I = $1.015\ in^2/unit \times 27.78\ units \times 4\times10^6 \frac{ft^2}{in^2} \times 3.587\times10^{-8} \frac{mi^2}{ft^2}$

= $4.04\ mi^2$

Area II = $1.015\ in^2/unit \times 19.53\ units \times 4\times10^6 \frac{ft^2}{in^2} \times 3.587\times10^{-8} \frac{mi^2}{ft^2}$

= $2.84\ mi^2$

D.A. = $6.88\ mi^2$ ≈ $6.9\ mi^2$ by planimeter

$6.57\ mi^2$ by reports use $6.57\ mi^2$

Hydrograph Parameters (Snyder method)

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

C_t = 1.23 } supplied by COE
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.

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

Probable Maximum Storm (PMS) (Hydromet 33)

Zone 1 (Fig. 1)

Probable Max. Precip (PMP) = 22.2 in. ($200\ mi^2$, 24 hr)

Depth - Area - Duration Relationships:

Maximum 6 hr = 111% PMP
Maximum 12 hr = 123% PMP
Maximum 24 hr = 133% PMP

Loss Rate

initial loss = 1"
uniform loss = 0.05 in/hr

O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
Upper Promised Land Dam	1	DRP	12/15/73	1841-010

Base flow

$1.5 \text{ cfs/mi}^2 \times 6.57 \text{ mi}^2 = 9.9 \text{ cfs}$

Elevation - Area - Capacity Data

Elev.	Area (mi^2)	Area (acres)	
1725.6		422.0	- data
1727	0.72	460.8	} planimeter
1740	1.27	812.8	
1760	1.90	1216.0	
1720.4		287	} extension of data see next page
1715.1 (Streambed elev.)		0	

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

$r = \sqrt{A/\pi} = \sqrt{18,382,320\,ft^2/\pi} = 2418.9\,ft$

$V = \pi(2418.9)^2 \frac{(10.5)}{3} = 64,335,954$ cf (single cone) too low

Break into 2 cones

① assume area at h/2 is 1/2 area at h

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

Bottom Cone Volume = $\pi r^2 \frac{h}{3} = A\frac{h}{3} = 211\,\frac{(5.25)}{3} = 369.3$ ac-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 = $\pi r^2 \frac{h}{3} = (232)\frac{(5.25)}{3} = 406$ 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

$$\text{Volume} = \left(\frac{5.23}{3}\right)\left(422 + 2(287) + \sqrt{(422)(287)}\right)$$

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

O'BRIEN & GERE

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

Rev. 4/15/79

Spillway Discharge Rating

$Q = CLH^{3/2}$ broadcrested 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 (ft)	L (ft)	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

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

$B = 12$ to 14 ft

$C = 3.1$

Elev 1731 $L = 140 - 33 = 107$ ft

1734.6 $L = 160 - 33 = 127$

1740 $L = 360$

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Upper Promised Land Dam	4	DRP	12/20/78 4/15/79	1841-010

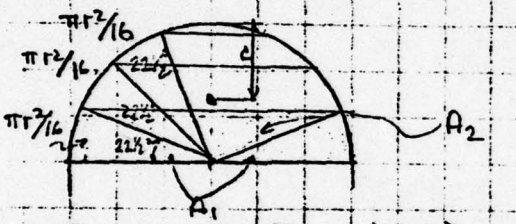
Hwair	Lwair	Qwair	Hamb	Lamb	Qamb	Qwair + Qamb	Elev.
5	31	1074	0	0	0	1074	1731.1
6.5	31	1593	1.5	116	661	2254	1732.6
8	31	2174	3.0	124	1997	4171	1734.1
9.5	31	2814	4.5	170	5030	7844	1735.6

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
$d_c = \frac{2}{3}H$
$Q_c = A_c\sqrt{gD_c}$
$A_c = A_1 + A_2$ ∴ $A_1 = \frac{\pi r^2}{8} = 57\,ft^2$
$A_2 = 2\left(\frac{(\sqrt{r^2 - D_c^2})}{2}\right)D_c = 51\,ft^2$

θ	D_c (ft)	A_c (ft^2)	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 & Wiggert)

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

$A = 226.2\,Q^{-1}$

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

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

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

When $H_e \geq 13.9$ 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 at 1740
" " " " 800 at 1760

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Upper Atomized Land Dam	7	DRP	12/20/78	1841-010

Rev 4/13/79

$H_p > 13.9$

H_p (ft)*	Pressure Flow Q_p (cfs)	$H_w = H_p - 13.9$	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 390 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	8887

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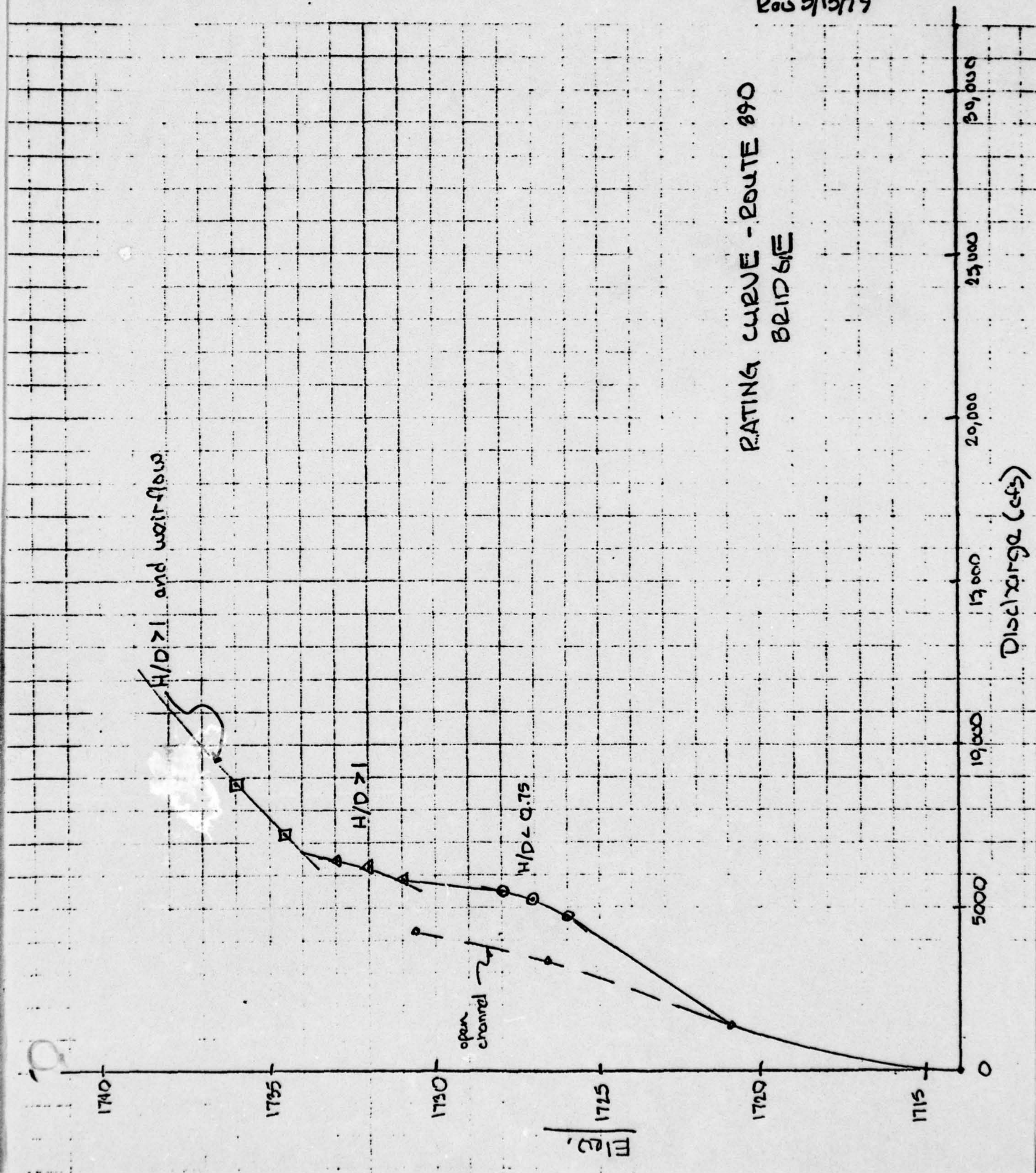
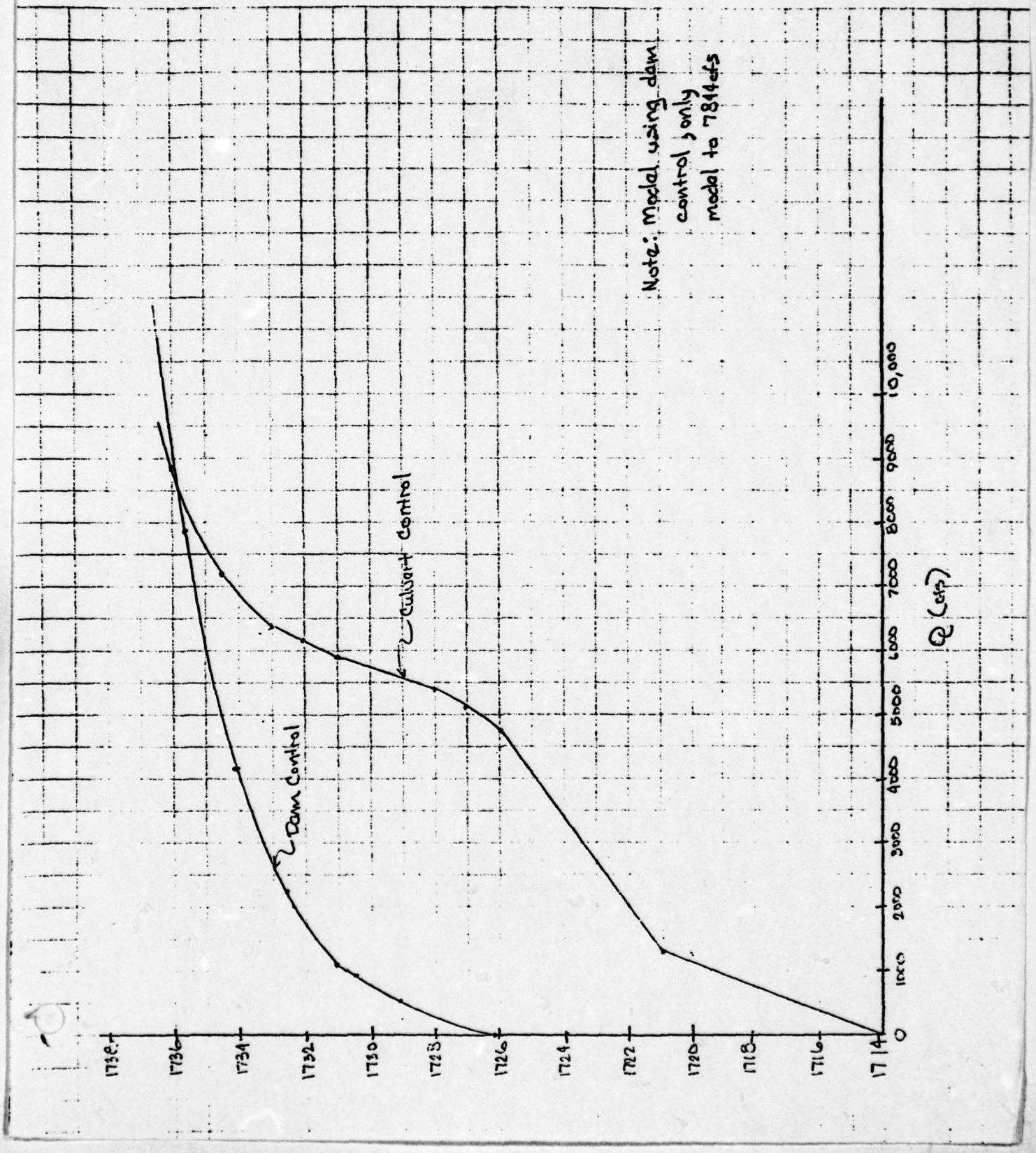
SUBJECT	SHEET	BY	DATE	JOB NO
Upper Promised Land Dam.	8	DRP	1/2/78	1341-010

Rev 3/15/79



O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Upper Promised Land Dam	9	DRP	5/13/79	1841-010

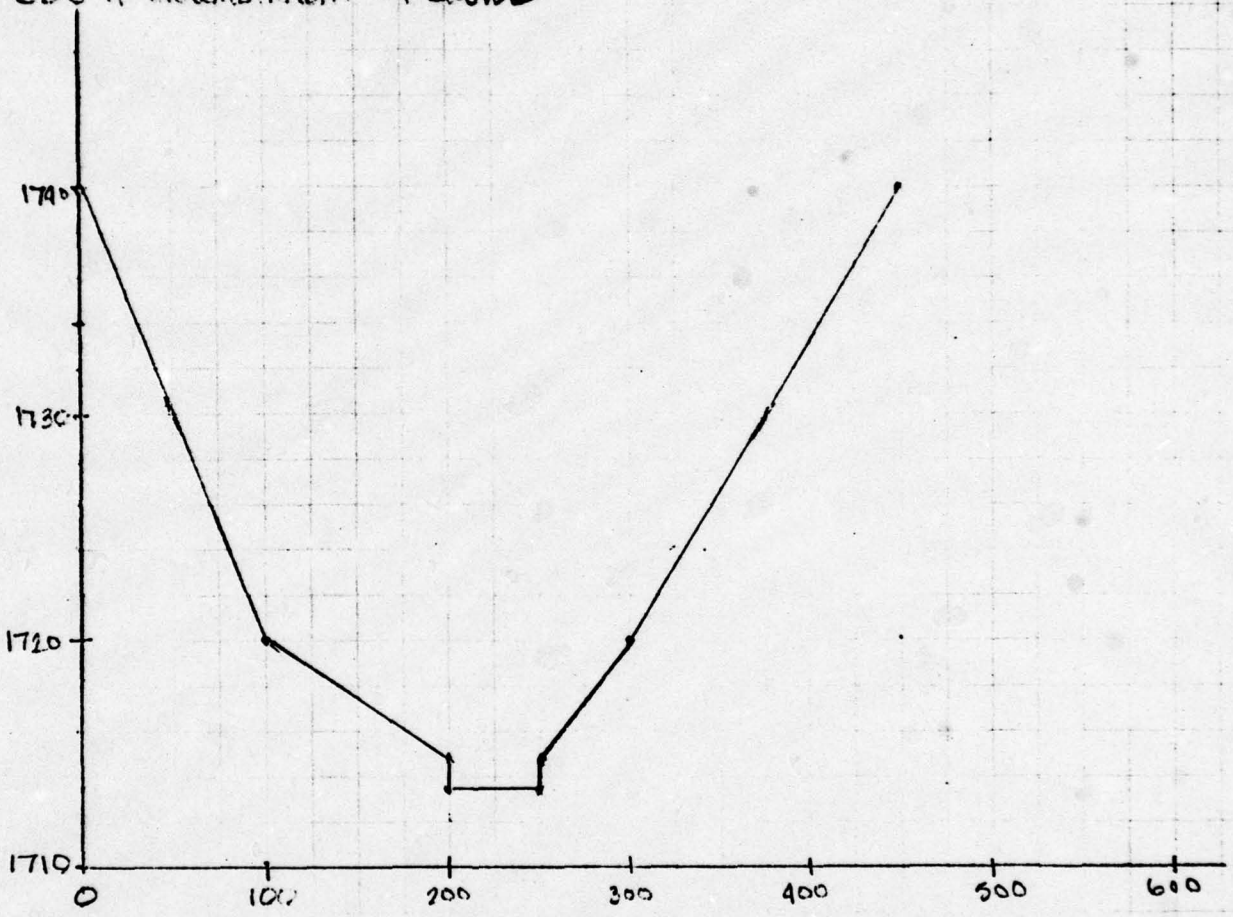


O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Lower Promised Land Dam	9a	DRP	6/5/79	1841-010

Cross-Section at Downstream Residence

Streambed elevation estimated at 1713.7, 100 ft downstream at Route 350 Bridge, streambed slope = 0.3%
250 ft downstream of dam



Channel n = 0.040
Overbank n = 0.120

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Lower Promised Land Dam	10	DRP	12/14/73	1841-010

D.A. = Area I + Area II + Area III

= $4.04\,mi^2 + 2.84\,mi^2 + [1.015\,cm^2/unit \times 22.52\,units \times 4\times10^{+6}\,\frac{ft^2}{cm^2} \times 3.557\times10^{-8}\,mi^2/ft^2]$

= 4.04 + 2.84 + 3.28

= $10.2\,mi^2$

$10.56\,mi^2$ (by report)

below Upper Promised Land Dam $3.3\,mi^2$

" " " " " $3.99\,mi^2$

Hydrograph Parameters (Snyder method)

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

$C_t = 1.23$ } supplied by COE
$C_p = 0.45$ } Zone 1

L = 3.0 miles

L_c = 1.2 miles

$t_p = 1.23((3)(1.2))^{0.3} = 1.8$ hr.

$t_r = \frac{t_p}{5.5} = \frac{1.8}{5.5} = 0.3$ hr.

Probable Maximum Storm (PMS) (Hydromet 33)

Zone 1 (Fig. 1)

Probable Max. Precip. (PMP) = 22.2 in. (200 mi^2, 24 hr)

Depth - Area - Duration Relationships

Maximum	6 hr	=	111% PMP
Maximum	12 hr	=	123% PMP
Maximum	24 hr	=	133% PMP

Loss Rate

initial loss = 1"

uniform loss = 0.05 in/hr

O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
Lower Promised Land Dam	11	DRP	12/15/7	1841-010

Base flow

$1.5 \text{ cfs/mi}^2 \times 3.99 \text{ mi}^2 = 6.0 \text{ cfs}$

Elevation - Area - Capacity Data

Elev.	Area (mi^2)	Area (acres)
1715	0.19	185.6 **
1720	0.63	403.2
1740	1.11	710.4
1707		250*
1700	-	51 } see next page
1693		0 }

* from Inventory

** do not use conflicts with Inventory

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
LPLD	12	DRP	1/18/79	

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

Elev = 1707.0 A = 250 acres V = 353,000,000 gal = 47,192,513 cf
* from rough engineers calc on file & inventory

Top of Embankment = 1717
Base = 1693

Single Cone

$h = 1707 - 1693 = 14'$

$V = \pi r^2 \frac{h}{3} = \frac{Ah}{3} = \frac{250 \text{ acres}(14)}{3} = 1167 \text{ acre ft}$
$= 50,820,000$ cf
close break into 2 cones

2 cones assume areas at $h/2$ A = area at h p = %

$V = \frac{h/2}{3}\left(A + pA + \sqrt{pA(A)}\right) + \frac{h}{3}(pA)$

$= \frac{h/2}{3}(A + 2pA + \sqrt{pA^2})$

$47,192,513 \text{ cf} = \frac{7}{3}(250)(43,560)(1 + 2p + \sqrt{p})$

$1.86 = 1 + 2p + \sqrt{p}$
$2p + \sqrt{p} = 0.86$

p = 0.2	2(0.2) + (0.44) = 0.84	p = 0.205
p = 0.21	2(0.21) + 0.46 = 0.88	

A at break = 0.205(250) = 51.3 acres

check
$V = \frac{7}{3}(250 + 102.6 + \sqrt{250(313)}) = 1087 \text{ ac-ft}$
$= 47,348,740$ cf ✓
good

O'BRIEN&GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
Lower Promised Land Dam	12	DRP	12/19/78 5/15/79	1891-010

Spillway Discharge Rating

$Q = CLH^{3/2}$

broad crested weir (flat upstream, slope d/s, avg value between broad crested and triangular) $B = 2.5^{ft}$, $C = 3.2$

Reduce L for pier & abutment effects

3 weirs, 2 at same elevation

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

Center weir elev = 1707.0

2 pointed piers, no abutment, $L' = 48.5'$

$$L = 48.5 - 2(0) = 48.5'$$

H (A)	C	Q (cfs)	Elev.
0.3	3.2	26	1707.3
0.8	↓	110	1707.8
1.5		285	1708.5
3.0		806	1710.0
4.5		1482	1711.5
6.0		2281	1713.0
7.0		2874	1714.0

Upper chord elev ≈ 1717.0
Lower chord elev ≈ 1714.0

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Lower Pomeroy Land Dam.	14	DRP	12/19/78	1841-010

Rev 5/15/79

Fixed weirs elev 1707.5

1 pointed pier, abutment @ 4:1 approach, L = 45.75'

$L = 45.75' - 2(0+0)H_a = 45.75'$

H (ft)	C	Q_2 (cfs) *	Elev
0	3.2	0	1707.5
0.3	↓	14	1707.8
1.0		146	1708.5
2.5		579	1710.0
4.0		1171	1711.5
5.5		1858	1713.0
6.5		2426	1714.0

* values for single weir

Combined Spillway Discharge Rating - Weir flow

Elev.	Q_1	Q_2	$2Q_2$	$2Q_2 + Q_1$ (cfs)
1707.0	0	0	0	0
1707.2	26	0	0	26
1707.8	110	24	48	158
1709.5	285	146	292	577
1710.0	806	579	1158	1964
1711.5	1452	1171	2312	3824
1713.0	2281	1858	3776	6057
1714.0	2874	2426	4852	7726

O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
Lower Promised Land Dam 2	15	DRP	1/2/79	1841-010

Water surface level between 1714 and 1717

Pressure flow occurs with WSEL between 1714 & 1717

$Q = cA\sqrt{2gH}$ (Design of Small Dams)

$c = 0.62$

A = Area

H = Head on orifice

Area (center opening) = $48.5(7) = 339.5\ ft^2$

Area (end opening) = $45.75(6.5) = 297.4\ ft^2$

$Q_1 = 0.62(339.5)\sqrt{2(32.2)H} = 1089.2\sqrt{H}$

$Q_2 = 0.62(297.4)\sqrt{2(32.2)H} = 1479.7\sqrt{H}$

	Center Opening		End Openings			Total Q
WSEL	H_1	Q_1	H_2	Q_2	$2Q_2$	Q_1+2Q_2
1714	3.5	3160	3.25	2668	5335	8,495
1715	4.5	3583	4.25	3050	6100	9,683
1716	5.5	3962	5.25	3390	6780	10,742
1717	6.5	4307	6.25	3697	7395	11,705

* assumes reservoir level over orifice

Water surface level above 1717

Combination of pressure and weir flow

Weir

$Q = cLH^{3/2}$ broad crested weir $B \approx 15'$

$C = 3.1$

See next page

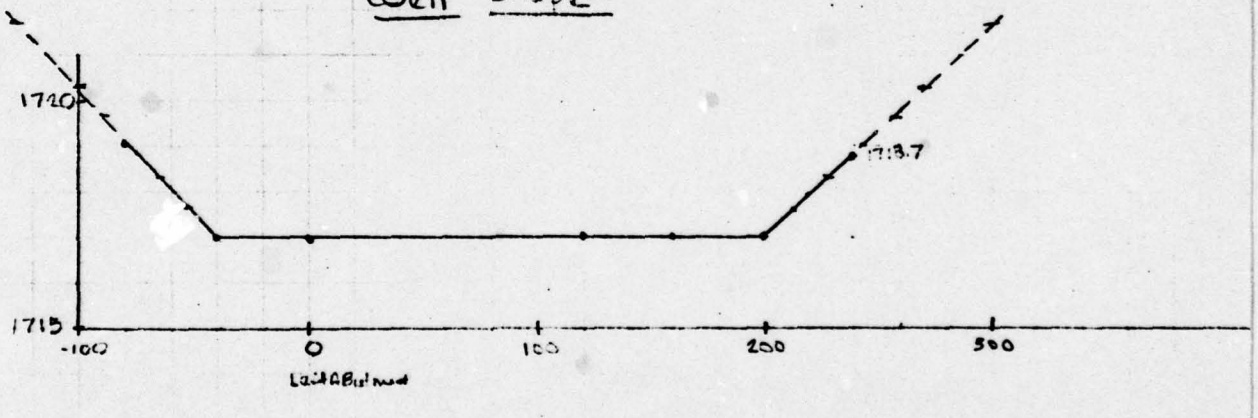
O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
Lower Promised Land Dam.	16	DRP	1/2/79 5/15/79	1841-010

	Pressure flow				Weir flow				Q total
WSEL	H_1	Q_1	H_2	Q_2	H_w	L_w	C	Q_w	$Q_1+2Q_2+Q_w$
1718	7.5	4624	7.5	4054	1	280	3.1	868	13,598
1719	8.5	4990	8.5	4814	2	325	3.1	2850	16403

* Assumes tailwater level out of the

Weir shape



O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Lower Promised Land Dam	17	DRP	1/3/79	1841-010

5/13/79

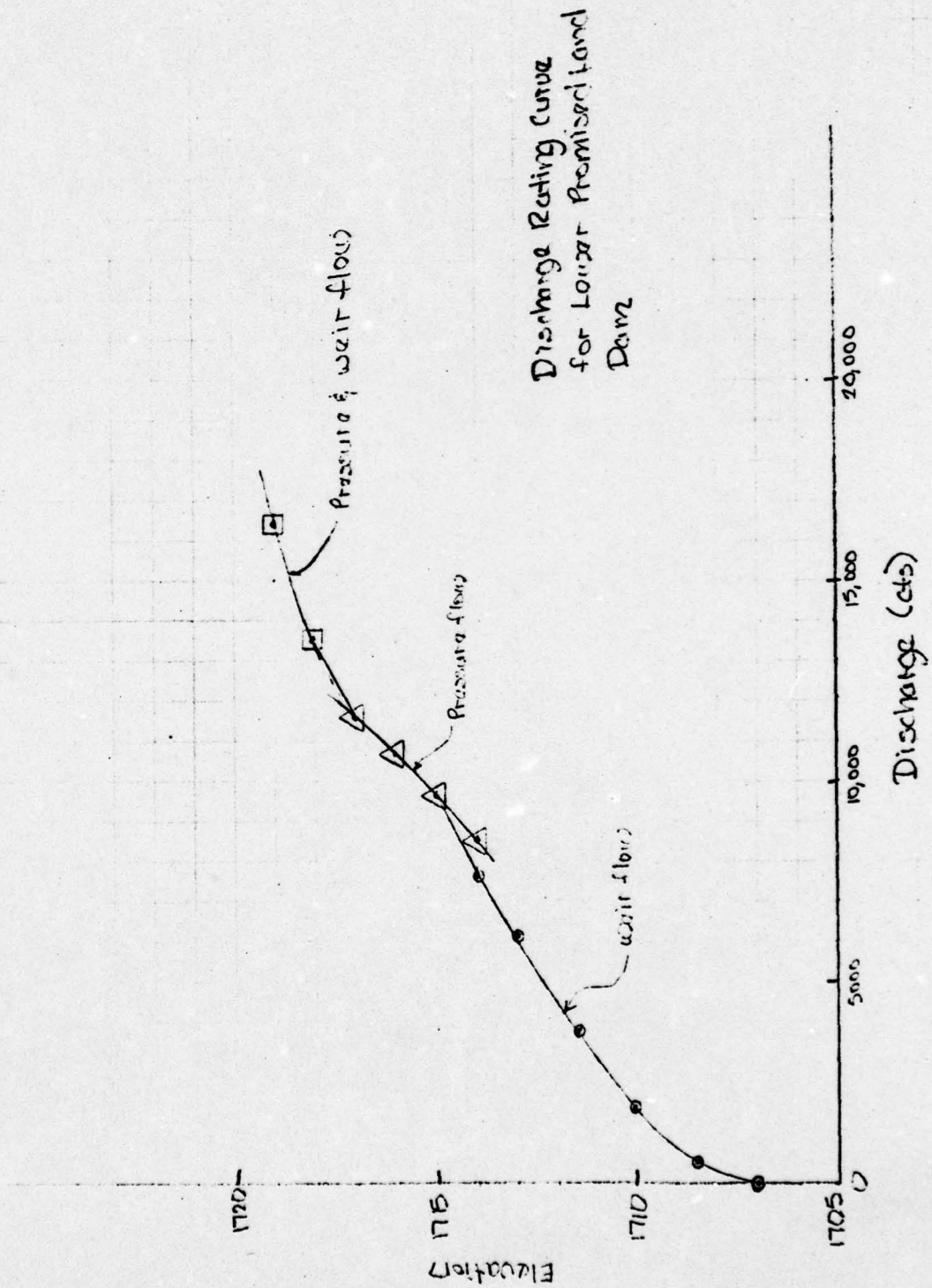
Combined Discharge Rating

Flow:	Q (cfs)
1707.0	0
1707.3	26
1707.8	158
1708.5	577
1710.0	1964
1711.5	3824
1713.0	6057
1714.0	7726
1715.0	9,683
1716.0	10,742
1717.0	11,705
1718.0	13,598
1719.0	16,403

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Lower Promised Land Dam	18	DRP	1/3/79	1541-010

Rev 5/15/79



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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                        LOWER LAKE 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               10.56       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                Y61726.1  1726.8  1727.6  1729.1  1730.6  1731.1  1732.6  1734.1  1735.6
    20                Y5      0      59     185     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                $S1726.1
    24                $D1731.1
    25                K       1      A3                                               1
    26                K1                                CHANNEL ROUTING
    27                Y                                        1       1
    28                Y1      1
    29                Y6   0.12    0.04    0.12  1713.7    1740     250   0.003
    30                Y7      0    1740     100    1720     200  1714.2     201  1713.7     249  1713.7
    31                Y7    250  1714.2     300    1720     450    1740
    32                K       0      B1                                               1
    33                K1                                RUNOFF TO LOWER PROMISED LAND LAKE
    34                M       1       1    3.99               10.56       0                       1
    35                P       0    22.2     111     123     133
    36                T                                                        1.0    0.05
    37                W     1.8    0.45
    38                X    -1.5    -.05       2
    39                K       2      B2                                               1
    40                K1          COMBINE INFLOW AND RUNOFF HYDROGRAPHS FOR LOWER PROMISED LAND LAKE
    41                K       1      B3                                               1
    42                K1                               ROUTING THROUGH LOWER PROMISED LAND LAKE
    43                Y                                        1       1
    44                Y1      1                                                -1707.3      -1
    45                Y61707.0  1707.3  1707.8  1708.5  1710.0  1711.5  1713.0  1714.0  1715.0  1716.0
    46                Y61717.0  1718.0  1719.0
    47                Y5      0      26     158     577    1964    3824    6057    7726    9683   10742
    48                Y5 11705   13598   16403
    49                $A      0      51     250   403.2   710.4
    50                $E   1693    1700    1707    1720    1740
```

3h.20

```
51              $$1707.0
52              $D  1717
53              K     99
```

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

RUN DATE= 06/06/79.
TIME= 09.10.25.

NATIONAL DAM INSPECTION PROGRAM
LOWER LAKE DAM,PROMISED LAND,PA.
PMF HYDROGRAPH

JOB SPECIFICATION

NQ	NHR	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

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	6.57	0.00	10.56	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 .802

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..	267.	523.	736.	813.	759.	664.	581.	508.	444.
389..	340.	298.	260.	228.	199.	174.	153.	133.	117.
102..	89.	78.	68.	60.	52.	46.	40.	35.	31.
27..	23.	21.	18.	16.	14.	12.	11.	9.	8.
7..	6.	5.							

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	23.68	21.82	1.86	189142.
										(601.)	(554.)	(47.)	(5355.90)

sh.22

HYDROGRAPH ROUTING

ROUTING THROUGH UPPER PROMISED LAND LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A2	1	0	0	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	NSTOL	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	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1726.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1731.1	0.0	0.0	0.

PEAK OUTFLOW IS 421. AT TIME 26.00 HOURS

PEAK OUTFLOW IS 684. AT TIME 26.00 HOURS

PEAK OUTFLOW IS 956. AT TIME 25.50 HOURS

PEAK OUTFLOW IS 1432. AT TIME 25.00 HOURS

PEAK OUTFLOW IS 1986. AT TIME 24.50 HOURS

PEAK OUTFLOW IS 2636. AT TIME 24.00 HOURS

PEAK OUTFLOW IS 3353. AT TIME 23.50 HOURS

PEAK OUTFLOW IS 4042. AT TIME 23.00 HOURS

PEAK OUTFLOW IS 5472. AT TIME 22.00 HOURS

Sh. 42

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

HYDROGRAPH ROUTING

CHANNEL ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A3	1	0	0	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	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1200	.0400	.1200	1713.7	1740.0	250.	.00300

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1740.00 100.00 1720.00 200.00 1714.20 201.00 1713.70 249.00 1713.70
250.00 1714.20 300.00 1720.00 450.00 1740.00

STORAGE	0.00	.45	1.17	2.18	3.47	5.03	6.75	8.60	10.60	12.73
	15.00	17.41	19.95	22.63	25.45	28.41	31.50	34.73	38.10	41.61
OUTFLOW	0.00	176.72	600.84	1261.56	2169.00	3358.19	4833.72	6563.99	8548.27	10787.75
	13284.87	16042.86	19065.51	22357.00	25921.76	29764.46	33889.89	38302.97	43008.66	48012.03
STAGE	1713.70	1715.08	1716.47	1717.85	1719.24	1720.62	1722.01	1723.39	1724.77	1726.16
	1727.54	1728.93	1730.31	1731.69	1733.08	1734.46	1735.85	1737.23	1738.62	1740.00
FLOW	0.00	176.72	600.84	1261.56	2169.00	3358.19	4833.72	6563.99	8548.27	10787.75
	13284.87	16042.86	19065.51	22357.00	25921.76	29764.46	33889.89	38302.97	43008.66	48012.03

MAXIMUM STAGE IS 1715.9

MAXIMUM STAGE IS 1716.6

MAXIMUM STAGE IS 1717.2

MAXIMUM STAGE IS 1718.1

MAXIMUM STAGE IS 1719.0

MAXIMUM STAGE IS 1719.8

MAXIMUM STAGE IS 1720.6

MAXIMUM STAGE IS 1721.3

MAXIMUM STAGE IS 1722.5

Sh. 4

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

SUB-AREA RUNOFF COMPUTATION

RUNOFF TO LOWER PROMISED LAND LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
B1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	3.99	0.00	10.56	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 .802

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= 1.80 CP= .45 NTA= 0

RECESSION DATA

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

UNIT HYDROGRAPH 34 END-OF-PERIOD ORDINATES, LAG= 1.82 HOURS, CP= .45 VOL= 1.00

81.	296.	527.	619.	566.	478.	403.	340.	287.	242.
204.	172.	145.	123.	104.	87.	74.	62.	52.	44.
37.	32.	27.	22.	19.	16.	13.	11.	10.	8.
7.	6.	5.	4.						

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	23.68	21.82	1.86	115907.
										(601.)	(554.)	(47.)	(3282.12)

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

COMBINE HYDROGRAPHS

COMBINE INFLOW AND RUNOFF HYDROGRAPHS FOR LOWER PROMISED LAND LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
B2	2	0	0	0	0	1	0	0

Sh 25

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

HYDROGRAPH ROUTING

ROUTING THROUGH LOWER PROMISED LAND LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
83	1	0	0	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	-1707.	-1

STAGE	1707.00	1707.30	1707.80	1708.50	1710.00	1711.50	1713.00	1714.00	1715.00	1716.00
	1717.00	1718.00	1719.00							
FLOW	0.00	26.00	158.00	577.00	1964.00	3824.00	6057.00	7726.00	9683.00	10742.00
	11705.00	13598.00	16403.00							
SURFACE AREA=	0.	51.	250.	403.	710.					
CAPACITY=	0.	119.	1085.	5291.	16283.					
ELEVATION=	1693.	1700.	1707.	1720.	1740.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1707.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1717.0	0.0	0.0	0.

PEAK OUTFLOW IS 1097. AT TIME 21.00 HOURS

PEAK OUTFLOW IS 1740. AT TIME 21.00 HOURS

PEAK OUTFLOW IS 2458. AT TIME 21.00 HOURS

PEAK OUTFLOW IS 3189. AT TIME 20.50 HOURS

PEAK OUTFLOW IS 3945. AT TIME 21.00 HOURS

PEAK OUTFLOW IS 4846. AT TIME 21.00 HOURS

PEAK OUTFLOW IS 5786. AT TIME 21.50 HOURS

PEAK OUTFLOW IS 6837. AT TIME 21.50 HOURS

PEAK OUTFLOW IS 8254. AT TIME 22.00 HOURS

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)

Sh. 26

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS 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	2386.	3579.	4772.	5966.	7159.	8352.	9545.	10738.	11931.
		(17.02)	(	67.57)(	101.36)(	135.14)(	168.93)(	202.71)(	236.50)(	270.28)(	304.07)(	337.85)
ROUTED TO	A2	6.57	1	421.	684.	956.	1432.	1986.	2636.	3353.	4042.	5472.
		(17.02)	(	11.91)(	19.38)(	27.06)(	40.56)(	56.22)(	74.65)(	94.95)(	114.47)(	154.94)
ROUTED TO	A3	6.57	1	421.	684.	956.	1431.	1985.	2637.	3355.	4040.	5498.
		(17.02)	(	11.91)(	19.38)(	27.07)(	40.53)(	56.19)(	74.66)(	94.99)(	114.41)(	155.67)
HYDROGRAPH AT	B1	3.99	1	1662.	2493.	3324.	4155.	4986.	5817.	6648.	7478.	8309.
		(10.33)	(	47.06)(	70.59)(	94.12)(	117.65)(	141.18)(	164.71)(	188.24)(	211.77)(	235.30)
2 COMBINED	B2	10.56	1	1788.	2709.	3640.	4568.	5509.	6458.	7405.	8351.	9487.
		(27.35)	(	50.62)(	76.70)(	103.08)(	129.35)(	155.99)(	182.87)(	209.68)(	236.47)(	268.63)
ROUTED TO	B3	10.56	1	1097.	1740.	2458.	3189.	3945.	4846.	5786.	6837.	8254.
		(27.35)	(	31.05)(	49.28)(	69.61)(	90.30)(	111.71)(	137.22)(	163.83)(	193.62)(	233.74)

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.

Sh. 27

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	3765.	421.	0.00	26.00	0.00
.30	1729.73	0.00	4303.	684.	0.00	26.00	0.00
.40	1730.71	0.00	4831.	956.	0.00	25.50	0.00
.50	1731.56	.46	5307.	1432.	9.50	25.00	0.00
.60	1732.26	1.16	5716.	1986.	14.50	24.50	0.00
.70	1732.90	1.80	6100.	2636.	17.00	24.00	0.00
.80	1733.46	2.36	6446.	3353.	19.00	23.50	0.00
.90	1734.00	2.90	6786.	4042.	20.50	23.00	0.00
1.00	1734.33	3.23	6996.	5472.	21.50	22.00	0.00

PLAN 1 STATION A3

RATIO	MAXIMUM FLOW.CFS	MAXIMUM STAGE.FT	TIME HOURS
.20	421.	1715.9	26.00
.30	684.	1716.6	26.00
.40	956.	1717.2	26.00
.50	1431.	1718.1	25.00
.60	1985.	1719.0	24.50
.70	2637.	1719.8	24.00
.80	3355.	1720.6	23.50
.90	4040.	1721.3	23.00
1.00	5498.	1722.5	22.50

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1707.30	1707.00	1717.00
STORAGE	1160.	1085.	4140.
OUTFLOW	26.	0.	11705.

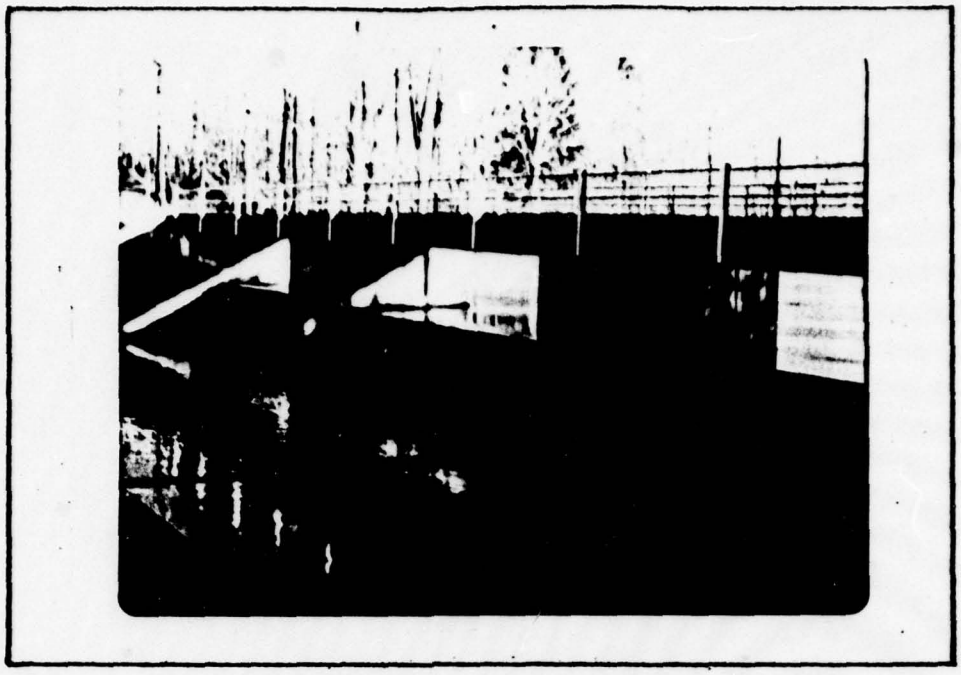
Sh. 23

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	1709.06	0.00	1623.	1097.	0.00	21.00	0.00
.30	1709.76	0.00	1815.	1740.	0.00	21.00	0.00
.40	1710.40	0.00	1996.	2458.	0.00	21.00	0.00
.50	1710.99	0.00	2167.	3189.	0.00	20.50	0.00
.60	1711.58	0.00	2343.	3945.	0.00	21.00	0.00
.70	1712.19	0.00	2526.	4846.	0.00	21.00	0.00
.80	1712.82	0.00	2722.	5786.	0.00	21.50	0.00
.90	1713.47	0.00	2929.	6837.	0.00	21.50	0.00
1.00	1714.27	0.00	3190.	8254.	0.00	22.00	0.00

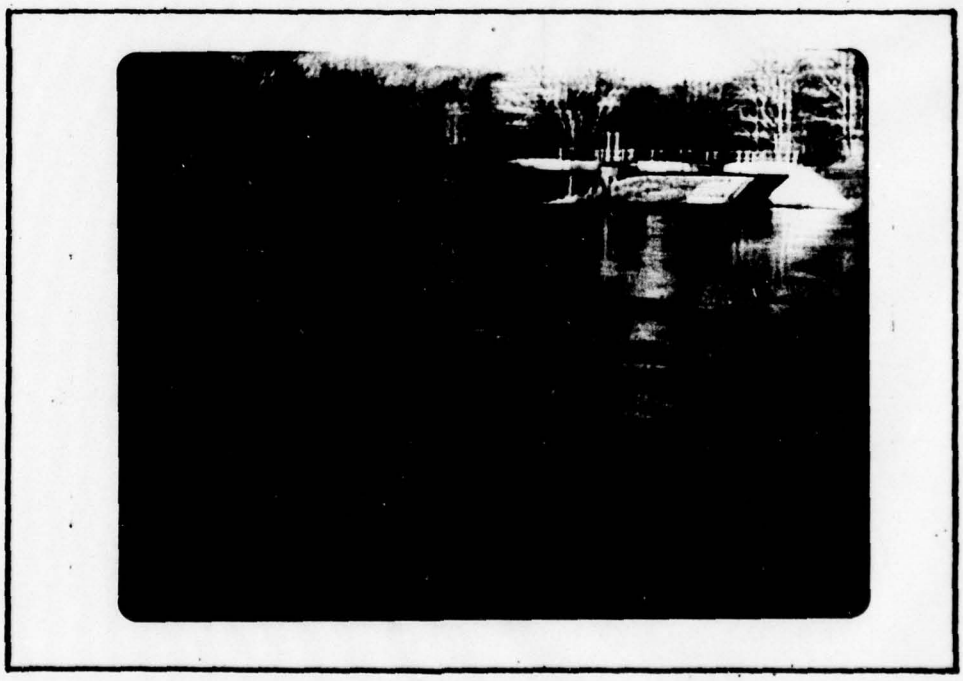
APPENDIX

D

Photographs



VIEW OF THE SPILLWAY, STILLING BAS.. AND BRIDGE STRUCTURE

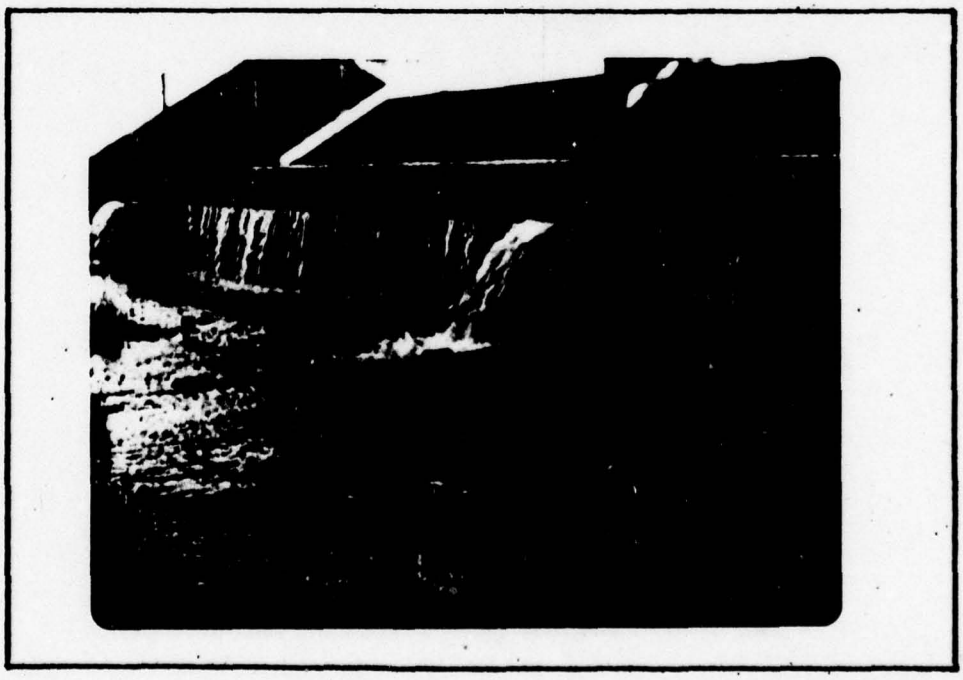


VIEW OF THE SPILLWAY AND BRIDGE FROM THE UPSTREAM SIDE

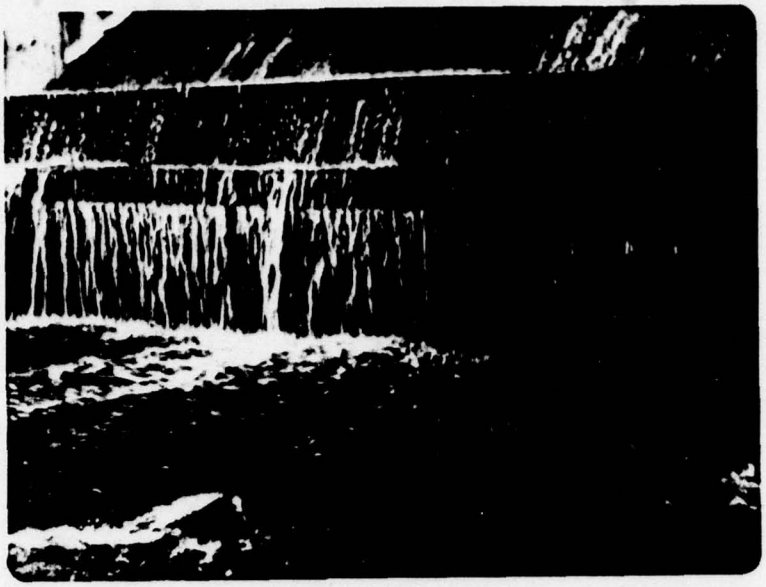
THE UPSTREAM SIDE OF THE DAM SHOWING THE SPILLWAY STRUCTURE, BRIDGE, AND THE EMBANKMENT

VIEW OF LOWER LAKE FROM THE LOWER LAKE DAM BRIDGE

VIEW OF THE UPSTREAM SLOPE OF THE RIGHT ABUTMENT SHOWING EROSION ALONG THE WINGWALL



APRON AND ENDSILL OF THE STILLING BASIN



OUTLET CONDUIT
EMBEDDED IN THE ENDSILL

WALLENPAUPACK CREEK
DOWNSTREAM OF THE DAM

APRON AND ENDSILL OF
THE STILLING BASIN

APPENDIX

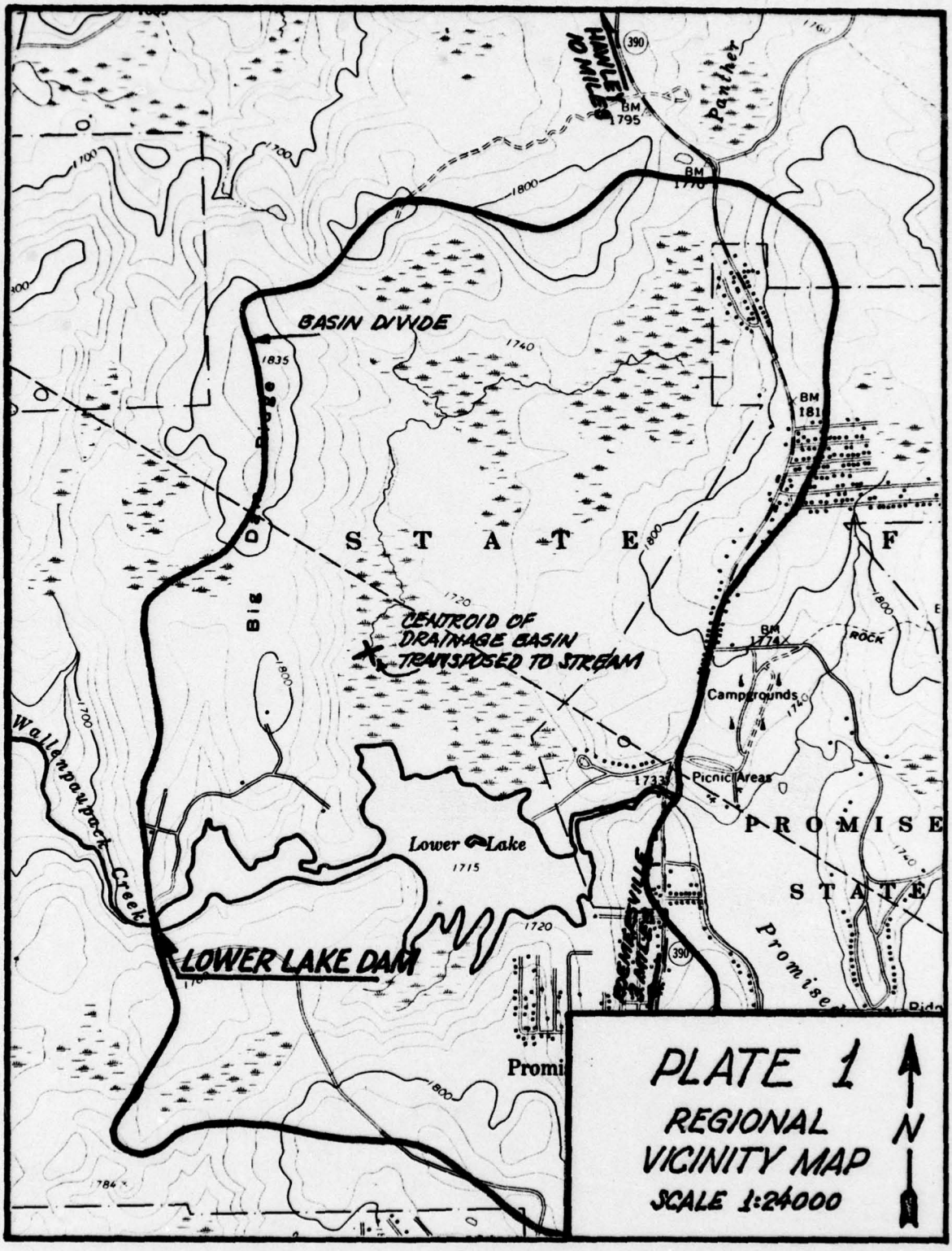
E

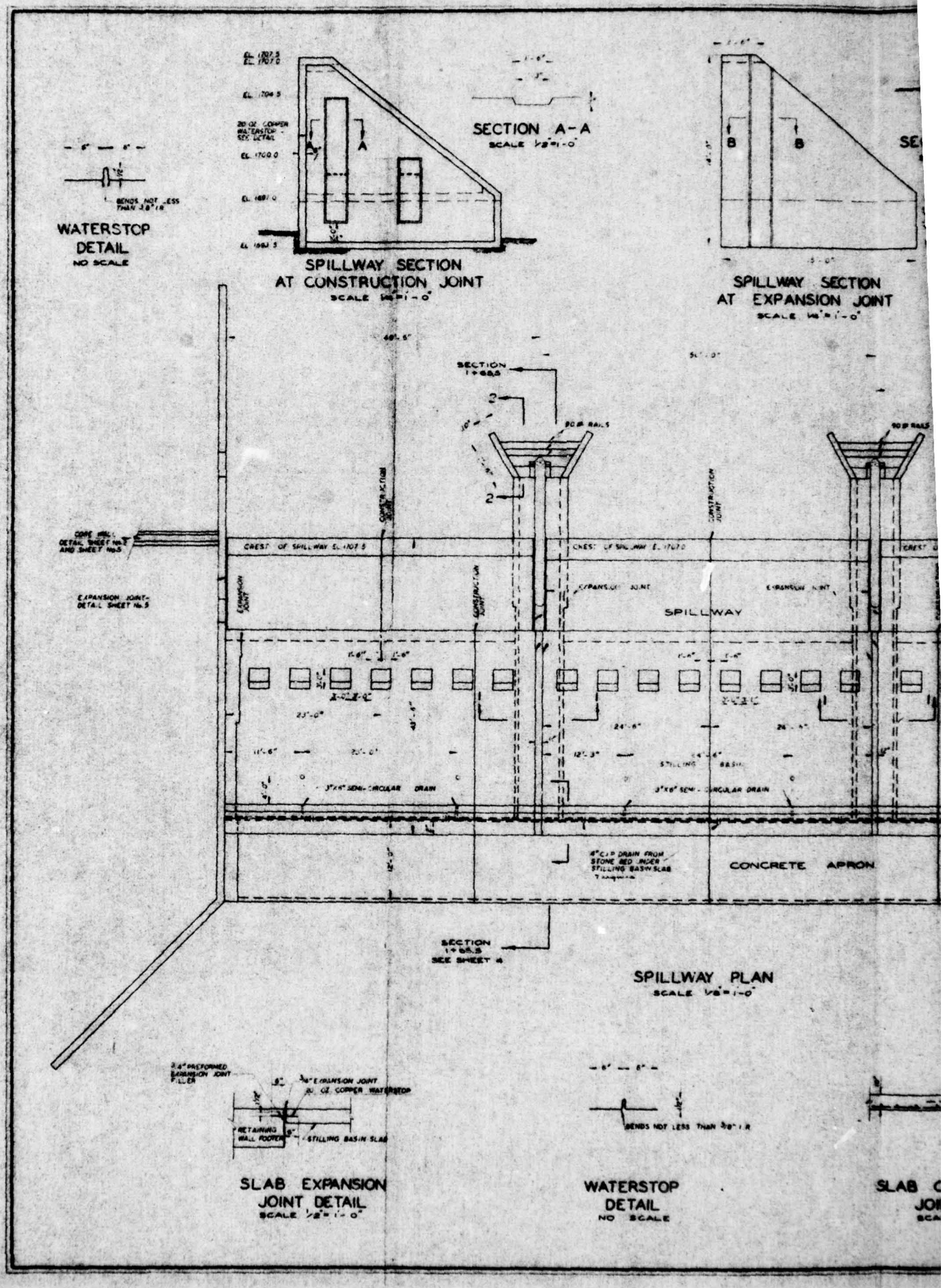
Drawings

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Lower Lake Dam				

TABLE OF CONTENTS APPENDIX E


HAWLEY 10 MILES
390
BM 1795
Panther
BM 1770
BASIN DIVIDE
1835
1740
BM 181
STATE F
Big
CENTROID OF DRAINAGE BASIN TRANSPOSED TO STREAM
BM 1774
ROCK
Campgrounds
1733
Picnic Areas
Wallenpaupack Creek
Lower Lake
1715
PROMISE
STATE
LOWER LAKE DAM
Promise
Promi
PLATE 1
REGIONAL VICINITY MAP
SCALE 1:24000
N


WATERSTOP DETAIL
NO SCALE
SECTION A-A
SCALE 1/8"=1'-0"
SPILLWAY SECTION AT CONSTRUCTION JOINT
SCALE 1/8"=1'-0"
SPILLWAY SECTION AT EXPANSION JOINT
SCALE 1/8"=1'-0"
SECTION 1+68.5
CREST OF SPILLWAY EL. 1707.5
CREST OF SPILLWAY EL. 1707.0
EXPANSION JOINT
CONSTRUCTION JOINT
SPILLWAY
STILLING BASIN
3"X6" SEMI-CIRCULAR DRAIN
CONCRETE APRON
SECTION 1+65.5 SEE SHEET 4
SPILLWAY PLAN
SCALE 1/8"=1'-0"
SLAB EXPANSION JOINT DETAIL
SCALE 1/8"=1'-0"
WATERSTOP DETAIL
NO SCALE

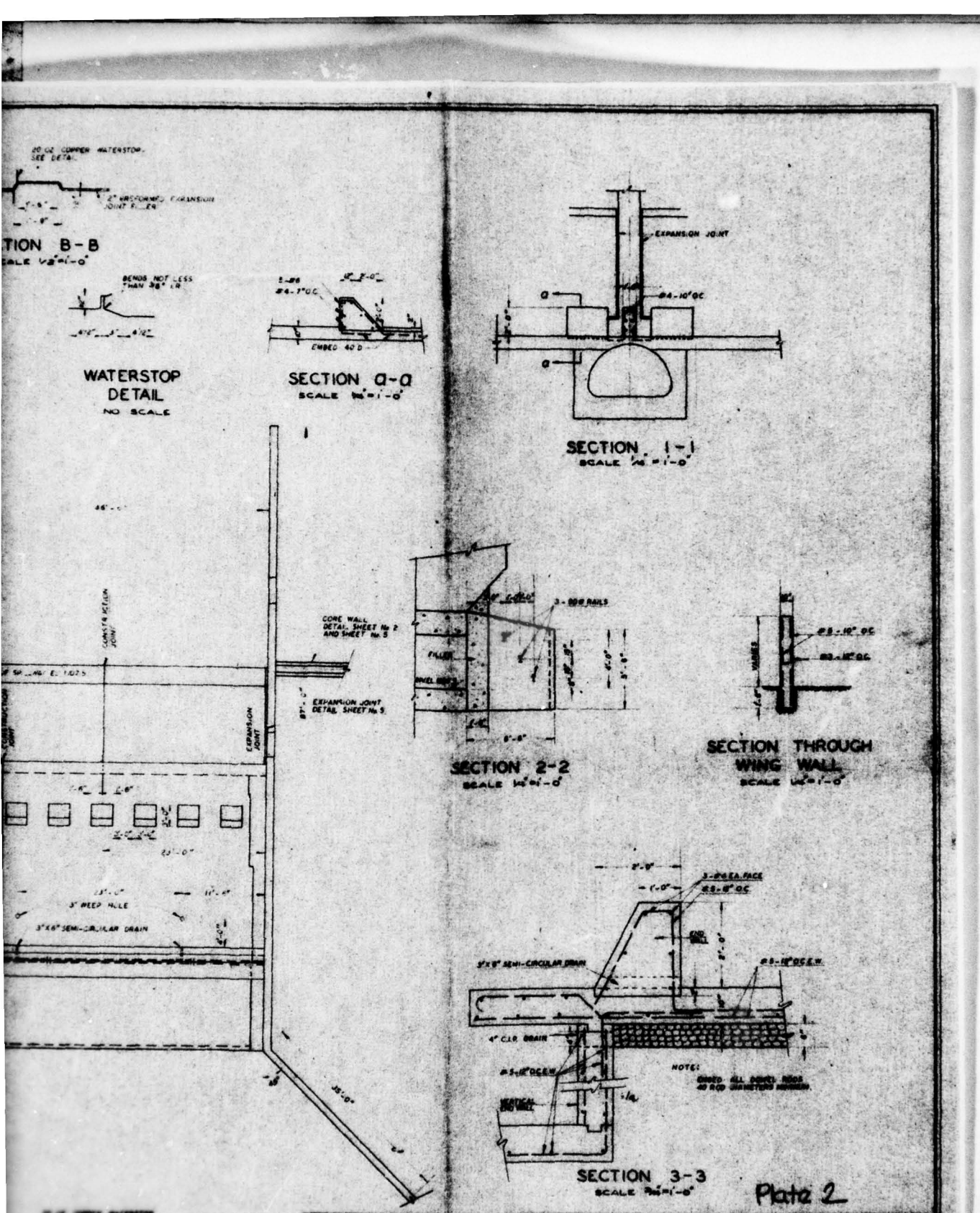


Plate 2

REVISED

SUBMITTED: ARCHITECT				
SUBMITTED: ENGINEER				
APPROVED: DEPARTMENT OF FORESTS & WATERS - BUREAU OF RECREATION				
APPROVED: SUPERVISING ENGINEER, ARCHITECTURAL - ENGINEERING UNIT G.S.A.				
CHECKED BY THE GENERAL STATE AUTHORITY				
ARCH.	STRUCT.	HEAT.	PLUMB.	ELECT.

PROJECT NO.- G.S.A.- 121-1

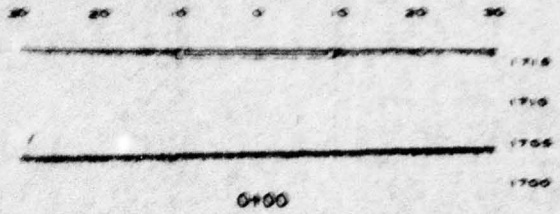
PROMISED LAND PARK

PIKE COUNTY PENNSYLVANIA

SPILLWAY PLAN & DETAILS

DATE

SCALE



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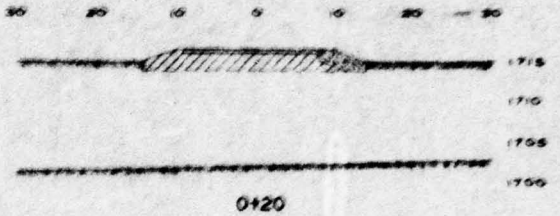

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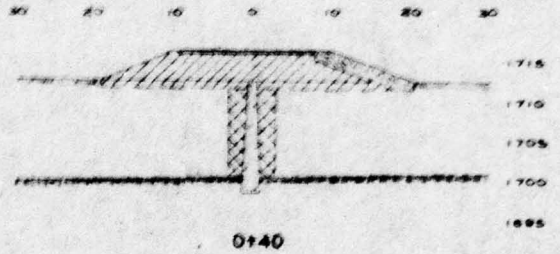

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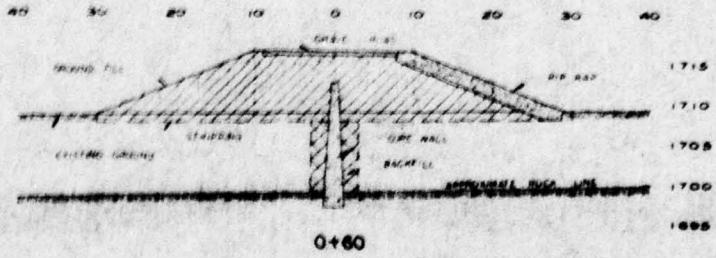

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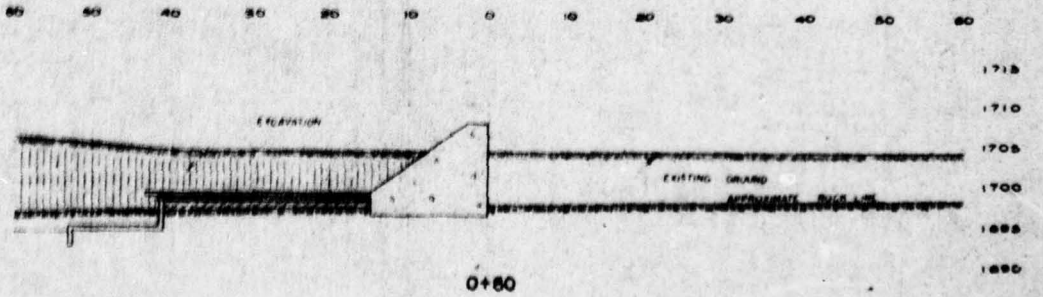

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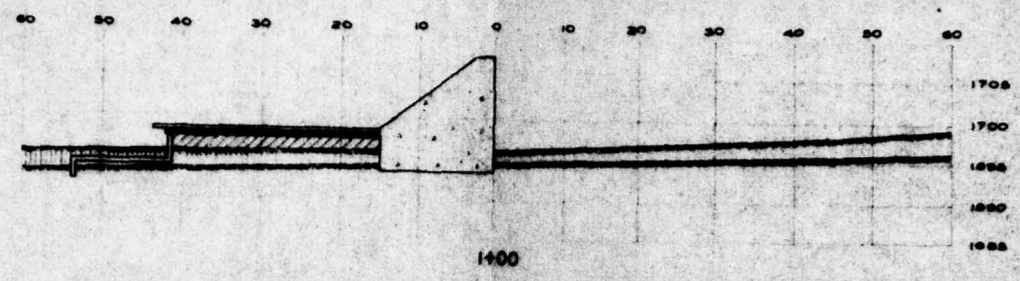

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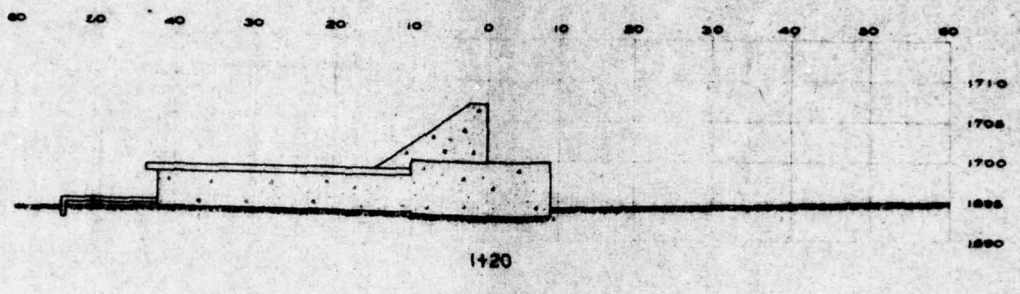

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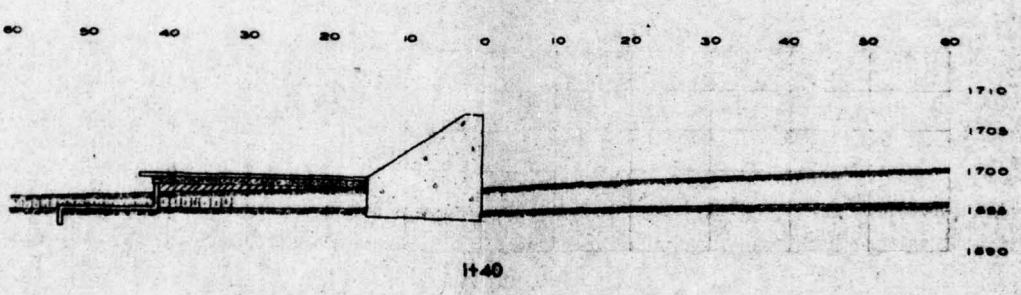

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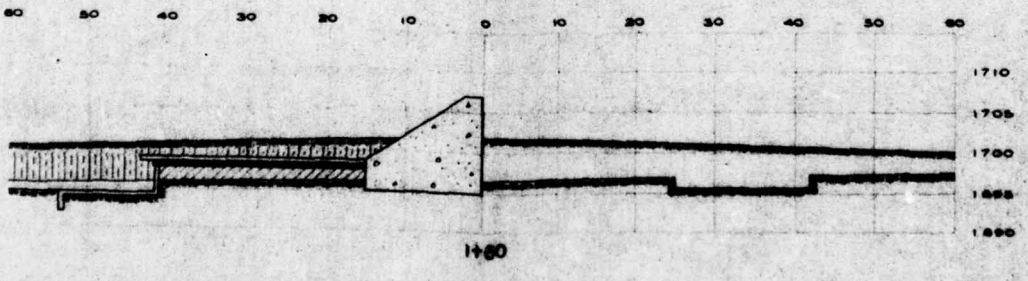


1+60

KEY

- BACKFILL
- CRUSHED STONE FILL
- CONCRETE
- RIP RAP
- EXISTING GRADE - SOIL
- EXISTING GRADE - ROCK
- FINISHED GRADE OR EXCAVATION LINE
- SELECT BACK FILL

Plate 3

REVISED

SUBMITTED: ARCHITECT

SUBMITTED: ENGINEER

APPROVED: DEPARTMENT OF FORESTS & WATERS-BUREAU OF RECREATION

APPROVED: SUPERVISING ENGINEER ARCHITECTURAL - ENGINEERING UNIT G.S.A.

CHECKED BY THE GENERAL STATE AUTHORITY

ARCH.	STRUCT.	HEAT	PLUMB	ELECT.

PROJECT NO. - G.S.A. - 121 - 1

PROMISED LAND PARK

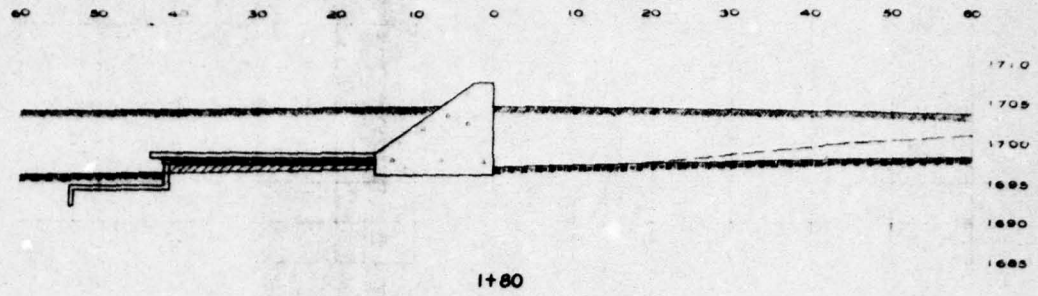
PIKE COUNTY PENNSYLVANIA

CROSS SECTIONS

STATION 0+00 TO 1+80

L. ROBERT KIMBALL
CONSULTING ENGINEER

DATE	THE GENERAL STATE AUTHORITY	SHEET NO.
SCALE 1"=5'	GEORGE N. LEADER PRESIDENT A. J. CARUSO EXECUTIVE DIRECTOR HARRISBURG PENNSYLVANIA	



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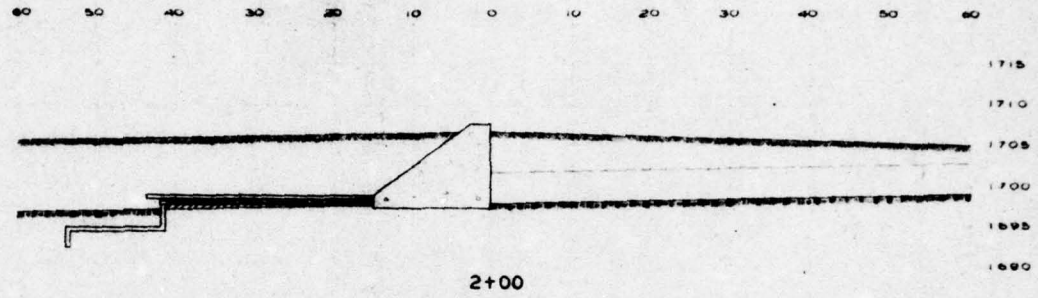

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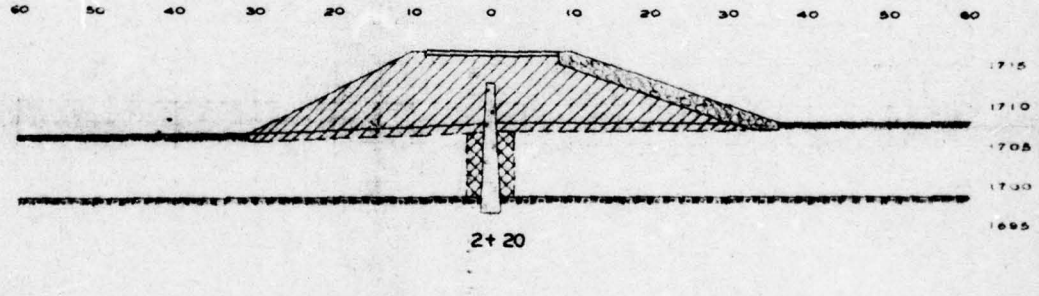

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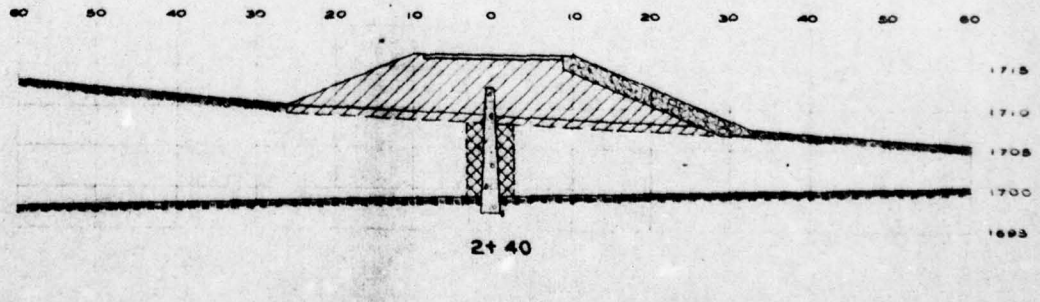

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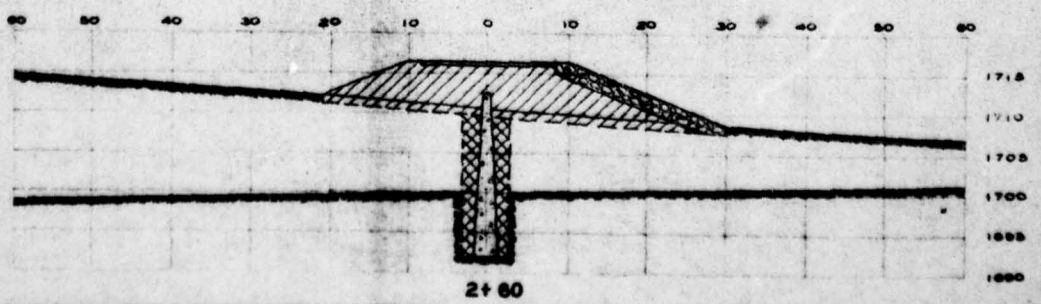

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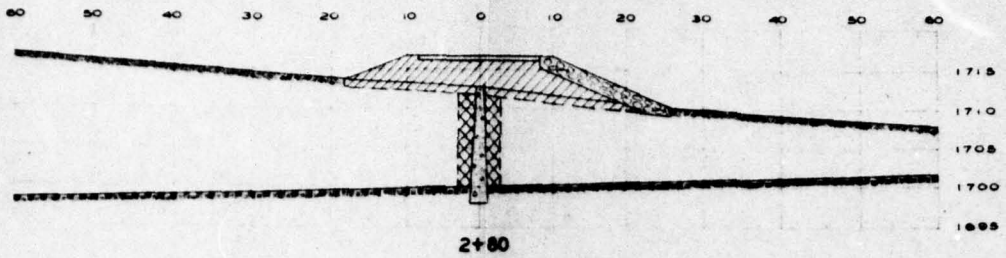

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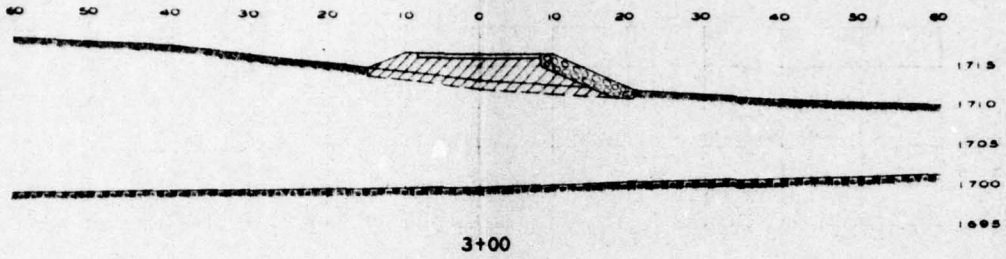
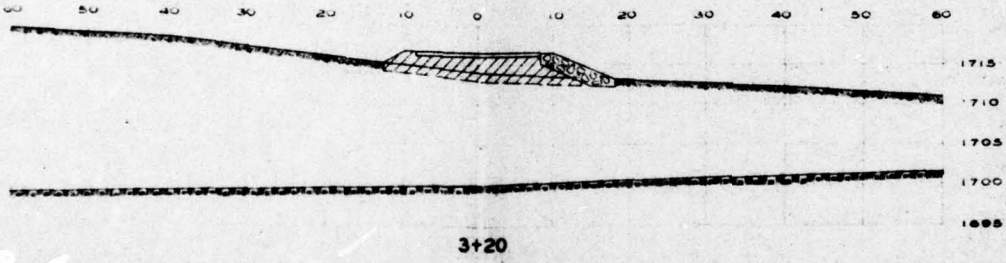


3+00



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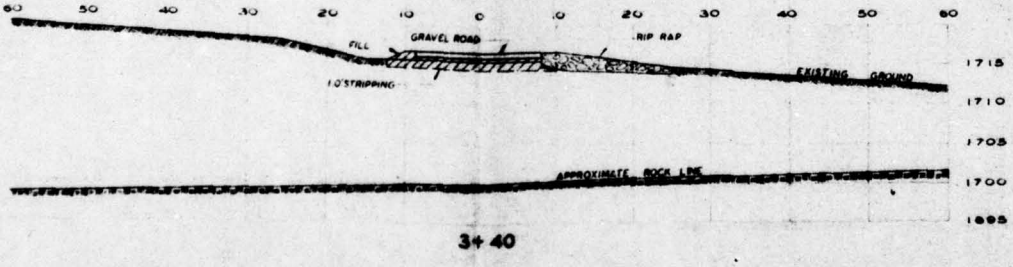


3+40

Plate 4

BACK FILL
CRUSHED STONE FILL
CONCRETE
RIP RAP
EXISTING GRADE SOIL
EXISTING GRADE ROCK
FINISHED GRADE OR EXCAVATION LINE
SELECT BACK FILL

REVISED					

SUBMITTED: ARCHITECT

SUBMITTED: ENGINEER

APPROVED: DEPARTMENT OF FORESTS & WATERS - BUREAU OF RECREATION

APPROVED: SUPERVISING ENGINEER ARCHITECTURAL - ENGINEERING UNIT G.S.A.

CHECKED BY THE GENERAL STATE AUTHORITY

ARCH	STRUCT	HEAT	PLUMB	ELECT

PROJECT NO.- G.S.A.- 121-1

PROMISED LAND PARK

PIKE COUNTY PENNSYLVANIA

CROSS SECTIONS
STATION 1+80 TO 3+40

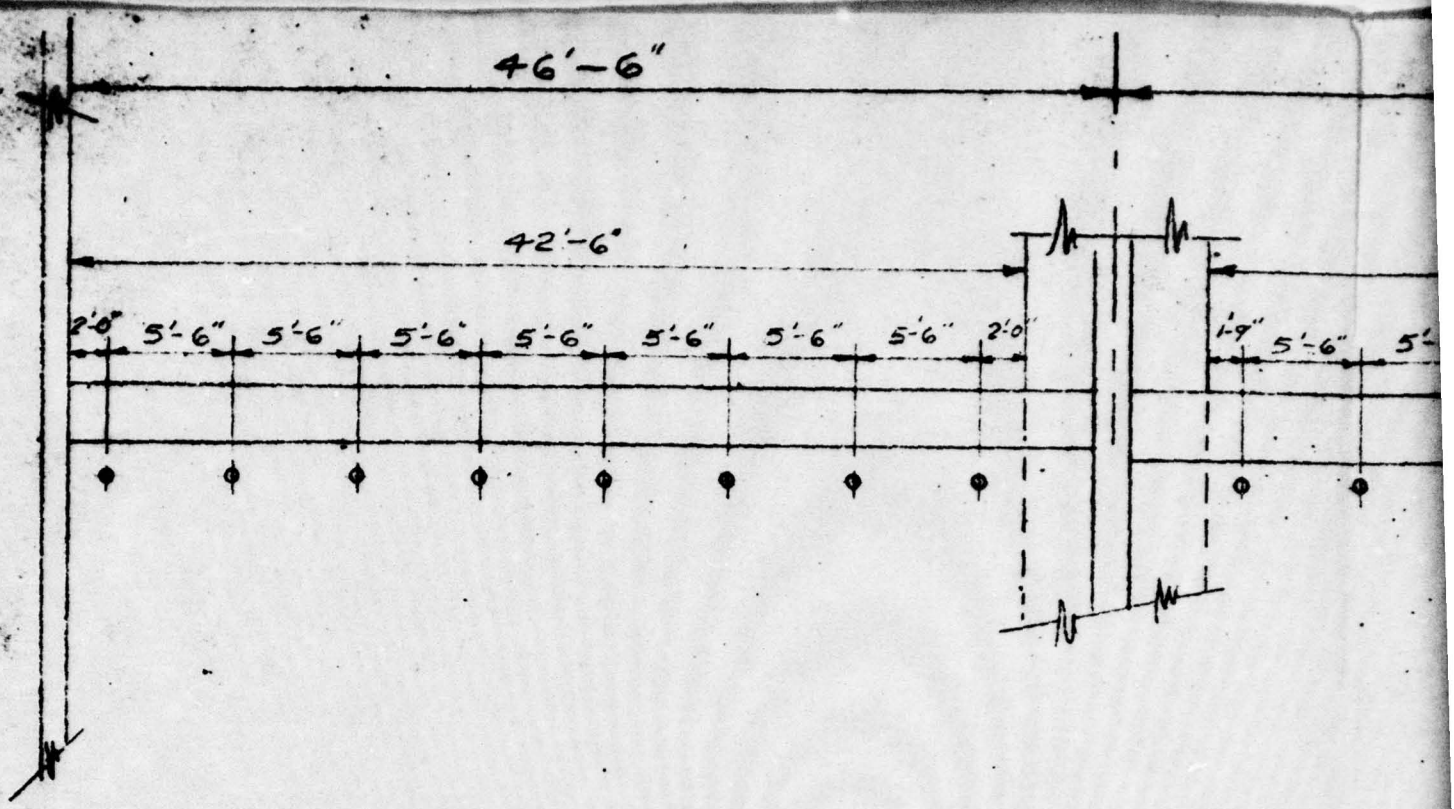
L. ROBERT KIMBALL
CONSULTING ENGINEER
PENNSYLVANIA

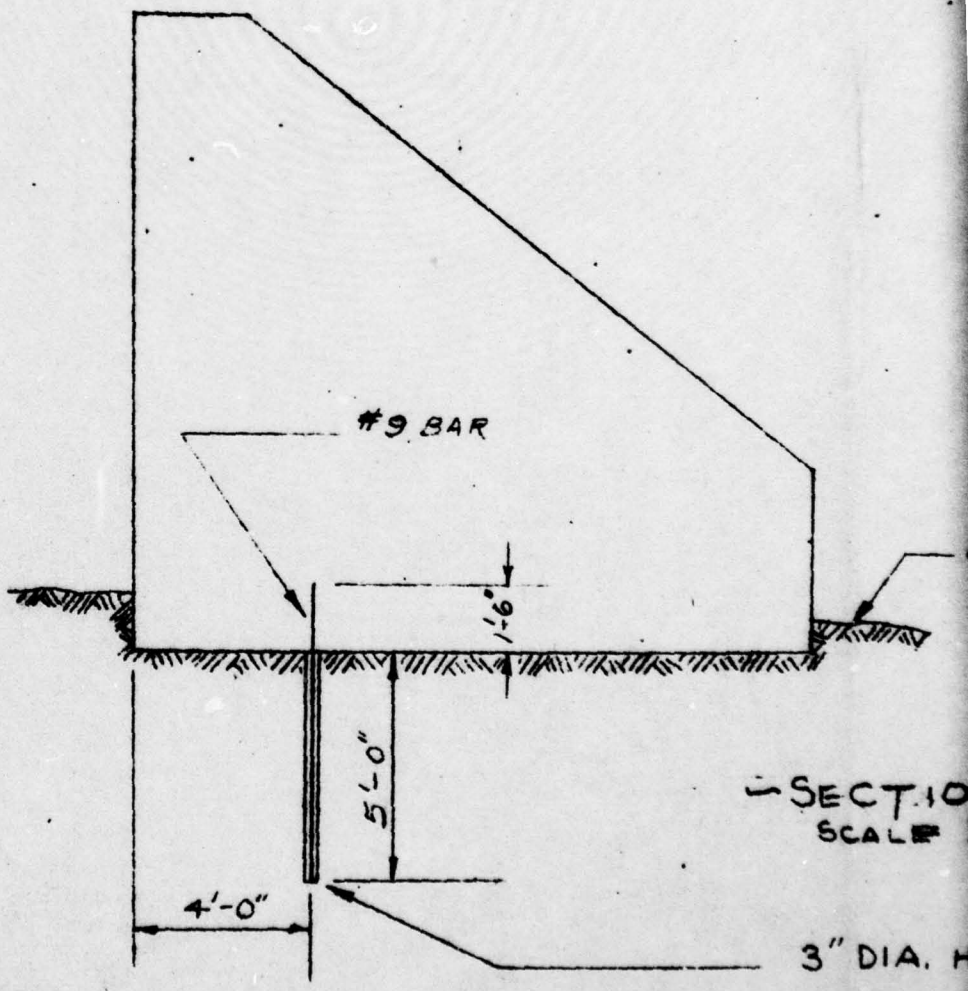
DATE

SCALE 1" = 10'

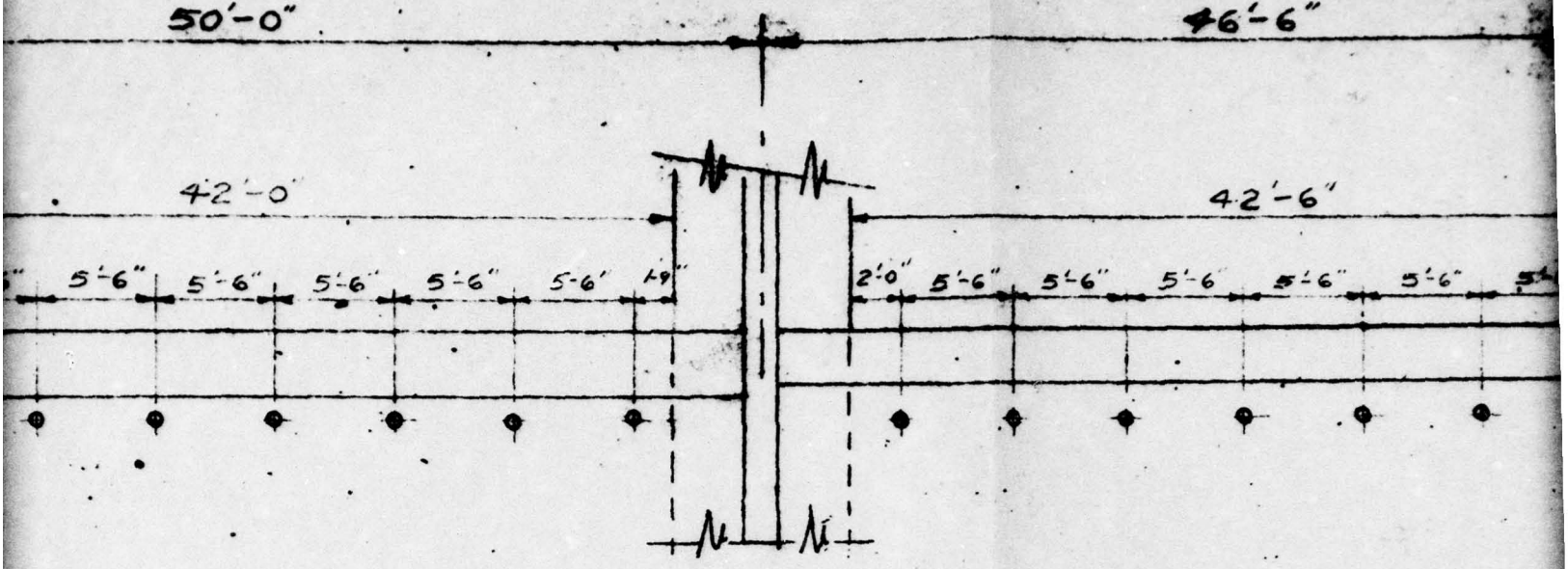
THE GENERAL STATE AUTHORITY
GEORGE M. LEADER PRESIDENT
A. J. CARUSO - EXECUTIVE DIRECTOR
HARRISBURG PENNSYLVANIA

SHEET NO. 9





SECTION
SCALE



PLAN

SCALE 1/8" = 1'-0"

NOTE:

#9 BARS TO BE GROUTED WITH NON-SHRINKING GROUT.

ROCK LINE

N

1/4" = 1'-0"

OLE

Plate

PLAN

SHOWING

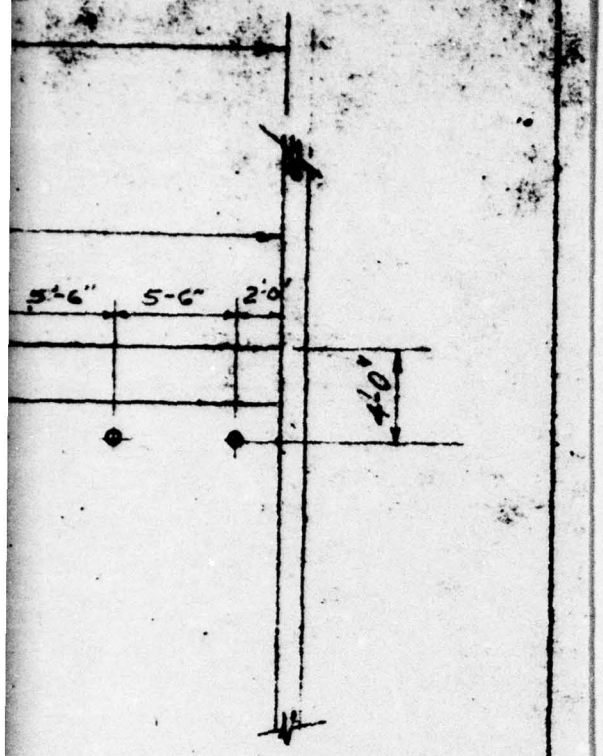
ANCHO

PROJECT

L. ROBE

CONSULT

2



late 5

E SKETCH

E LOCATION OF

HOR RODS

FO LAND DAM

CT Nº G.S.A. 121-1

BERT KIMBALL

LTING ENGINEER

9 1

3

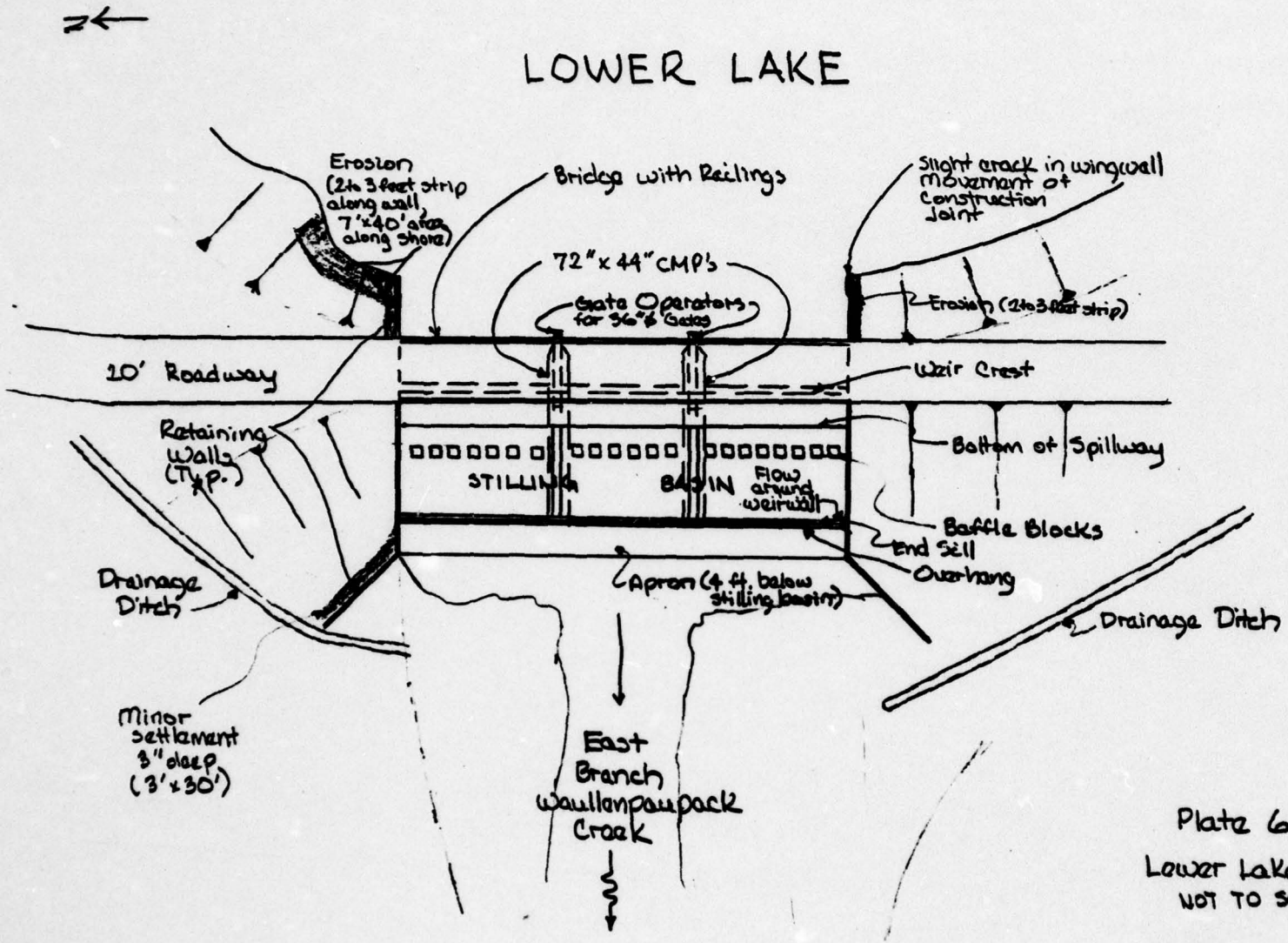


Plate 6

Lower Lake Dam

NOT TO SCALE

APPENDIX

F

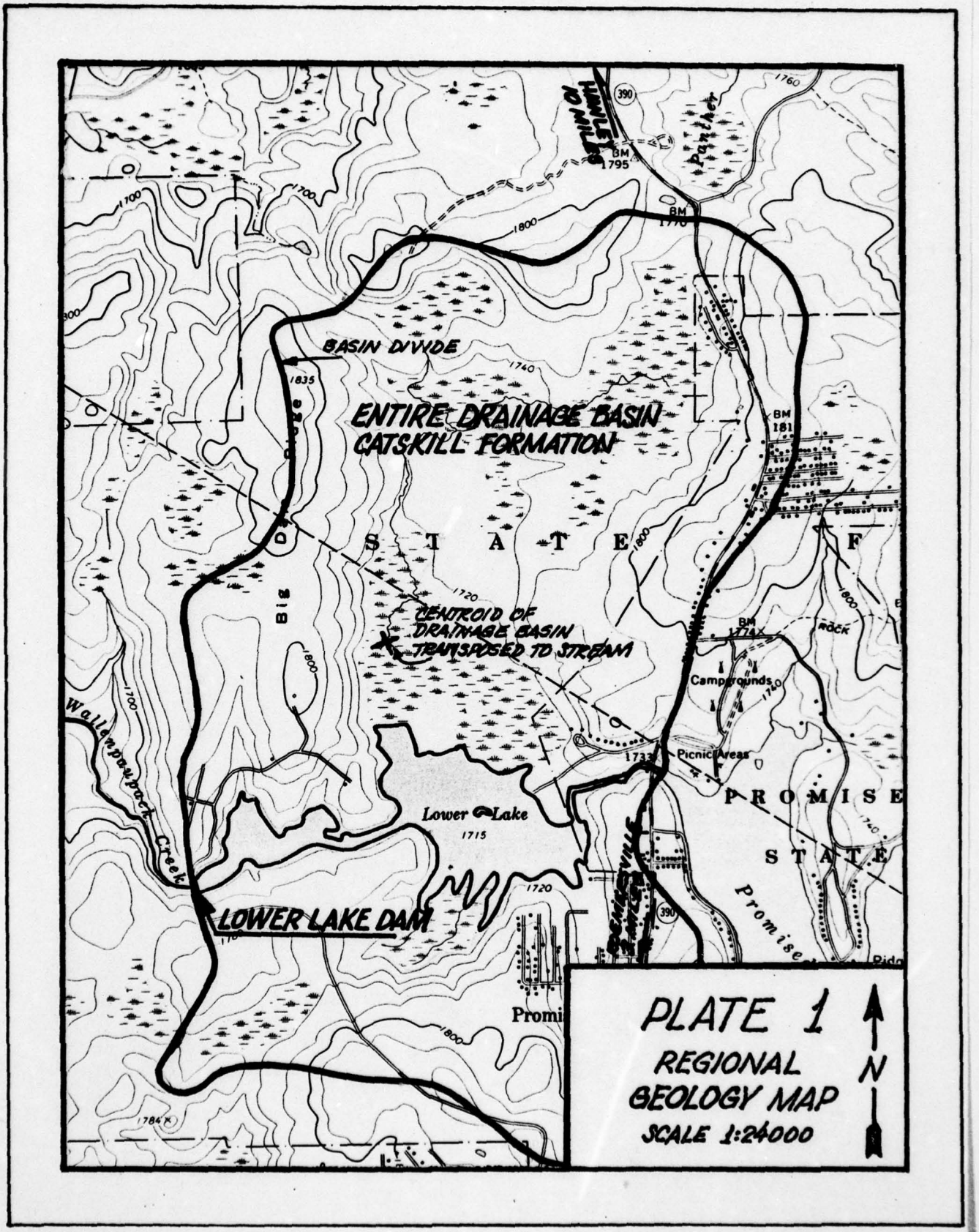
Site Geology

SITE GEOLOGY

LOWER LAKE DAM

Lower Lake 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.


BASIN DIVIDE
ENTIRE DRAINAGE BASIN
CATSKILL FORMATION
CENTROID OF
DRAINAGE BASIN
TRANSPOSED TO STREAM
Big
Lower Lake
1715
LOWER LAKE DAM
Wallenpaupack Creek
Campgrounds
Picnic Areas
PROMISE
STATE
Promise
Panther
BM
1795
BM
1770
BM
181
BM
1774
1733
1784
390
1700
1720
1740
1760
1800
1835
PLATE 1
REGIONAL
GEOLOGY MAP
SCALE 1:24000
N