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NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON  
NATIONAL DAM SAFETY PROGRAM. AMPHIBIOUS LAKE DAM (NJ 00457), DE--ETC(U)  
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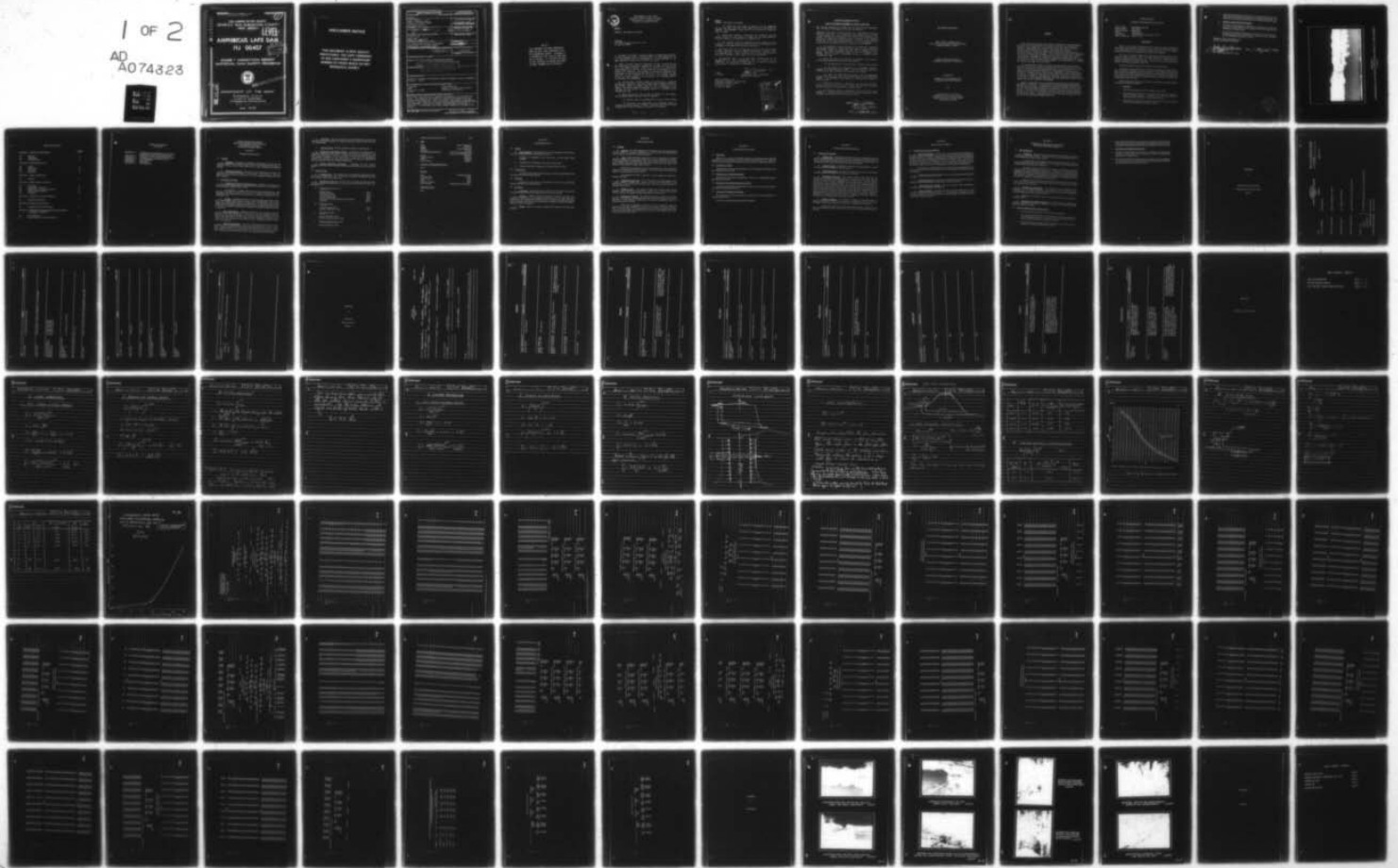
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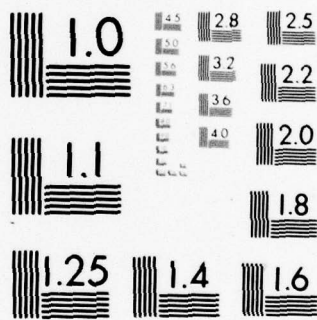
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DELAWARE RIVER BASIN  
NEWBOLD RUN, BURLINGTON COUNTY  
NEW JERSEY

LEVEL II

AMPHIBIOUS LAKE DAM

NJ 00457

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PHASE 1 INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM



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DEPARTMENT OF THE ARMY

Philadelphia District  
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June, 1979

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NJ00457	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program Amphibious Lake Dam Burlington County, N.J.	5. TYPE OF REPORT & PERIOD COVERED <b>9</b> FINAL rept.	
	6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s) Williams, John J. / <b>10</b> Williams	8. CONTRACT OR GRANT NUMBER(s) <b>15</b> DACW61-79-C-0011	
9. PERFORMING ORGANIZATION NAME AND ADDRESS O'Brien & Gere Engineers Inc. Suite 1760 1617 J.F. Kennedy Blvd. Phila. Pa. 19103	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, Pennsylvania 19106	12. REPORT DATE <b>11</b> June 1979 13. NUMBER OF PAGES 90	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) <b>12</b> 105p.	15. SECURITY CLASS. (of this report) Unclassified	
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE		
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATE	<b>6</b> National Dam Safety Program. Amphibious Lake Dam (NJ 00457), Delaware River Basin, Newbold Run, Burlington County, New Jersey. Phase I Inspection Report.	
18. SUPPLEMENTARY NOTES Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Embankment Dams Structural Analysis Safety Visual inspection National Dam Inspection Act Report Amphibious Lake Dam, N.J.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		



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IN REPLY REFER TO

NAPEN-D

SUBJECT: Dam Inspection Program

Commander  
U.S. Army Training Center at Ft. Dix  
Ft. Dix, NJ 08640

1. Inclosed is the Phase I Inspection Report for Amphibious Lake Dam, Ft. Dix, Burlington County, New Jersey which has been prepared for the U.S. Army Engineer District, Philadelphia. A brief assessment of the dam's condition is given in the front of the report.

2. Based on visual inspection, available records, calculations and past operational performance, Amphibious Lake Dam, initially listed as a high hazard potential structure but reduced to a significant hazard potential as a result of this inspection is considered to be in overall fair condition. The spillway is considered inadequate since 20 percent of the Spillway Design Flood -SDF- would overtop the dam. (The SDF, in this instance is one half of the Probable Maximum Flood.) To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980.

b. Within six months from the date of approval of this report, the following remedial actions should be completed.

(1) The dam should be provided with a reservoir drain system.

(2) The marshy area downstream of the embankment should be regraded to provide adequate drainage. Discharge from the area should be monitored to detect turbidity or increases in discharge.

79 09 24 035

NAPEN-D

SUBJECT: Dam Inspection Program

(3) Trees and brush should be removed from the embankment and the area where trees have been removed should be backfilled and regraded. The embankment slopes should be protected with vegetative cover or riprap.

c. Develop and implement a maintenance and inspection checklist similar to the one in this report, to insure that all items associated with the structure are maintained on a regular basis.

d. The structure should be monitored during periods of heavy discharge. A warning system should be developed and implemented when necessary for the downstream area used for bivouac.

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

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

1 Incl  
As stated

*James G. Ton*  
JAMES G. TON  
Colonel, Corps of Engineers  
District Engineer

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AMPHIBIOUS LAKE DAM (NJ00457)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 12 April 1979 by O'Brien & Gere Engineers, Inc. for the U.S. Army Engineer District, Philadelphia.

Amphibious Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential as a result of this inspection is considered to be in overall fair condition. The spillway is considered inadequate since 20 percent of the Spillway Design Flood -SDF- would overtop the dam. (The SDF, in this instance is one half of the Probable Maximum Flood.) To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant, using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980.

b. Within six months from the date of approval of this report, the following remedial actions should be completed.

(1) The dam should be provided with a reservoir drain system.

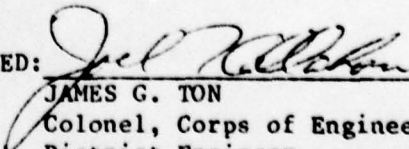
(2) The marshy area downstream of the embankment should be regraded to provide adequate drainage. Discharge from the area should be monitored to detect turbidity or increases in discharge.

(3) Trees and brush should be removed from the embankment and the area where trees have been removed should be backfilled and regraded. The embankment slopes should be protected with vegetative cover or riprap.

c. Develop and implement a maintenance and inspection checklist similar to the one in this report, to insure that all items associated with the structure are maintained on a regular basis.

d. The structure should be monitored during periods of heavy discharge. A warning system should be developed and implemented when necessary for the downstream area used for bivouac.

APPROVED:

  
JAMES G. TON  
Colonel, Corps of Engineers  
District Engineer

DATE: 13 September 1979

**DELAWARE RIVER BASIN**

**Name of Dam: Amphibious Dam  
County & State: Burlington County, New Jersey  
Inventory Number: NJ 00457**

**PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM**

**Prepared by:**

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

**For**

**DEPARTMENT OF THE ARMY  
Philadelphia District, Corps of Engineers  
Custom House-2nd & Chestnut Streets  
Philadelphia, PA 19106**



## PREFACE

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

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

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

## PHASE I REPORT

### NATIONAL DAM INVENTORY PROGRAM

Name of Dam: Amphibious Lake Dam  
State Located: New Jersey  
County Located: Burlington  
Stream: Newbold Run  
Coordinates: Latitude 39° 59.9', Longitude 74° 36.1'  
Date of Inspection: April 12, 1979

### ASSESSMENT

Based on the visual observations made during the field investigation, information made available by the Directorate of Facilities Engineering, Fort Dix and conversations with the Owner's representative, Mr. Harry E. Colbert, Amphibious Lake Dam is considered to be in overall fair condition.

The dam is an earth embankment approximately 300 feet long with a maximum height of about 13 feet. A 35-foot wide paved road (Route 545) is constructed along the crest of the dam. The spillway is a wooden drop inlet structure located near the right abutment of the dam. The 9 acre normal pool is used for recreation by personnel of Fort Dix.

The dam is considered to be in the "Significant" hazard category.

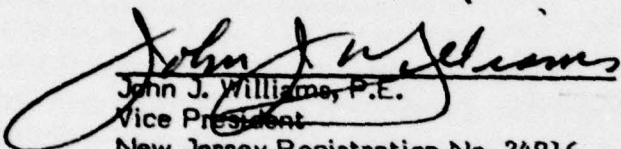
Examination of the results of the hydrologic and hydraulic analyses indicate that the spillway is capable of passing 19 percent of the Spillway Design Flood (SDF) without overtopping the earth embankment. The SDF chosen for use on this site is 50 percent of the Probable Maximum Flood (PMF). The Spillway is classified as "Inadequate" but not "Seriously Inadequate" because the dam is a "Small" size, "Significant" hazard structure.

Several deficiencies noted, require further investigation, remedial measures or maintenance as soon as possible:

- a. Facilities.
  1. The dam should be provided with a reservoir drain system.
  2. The marshy area downstream of the embankment should be regraded to provide adequate drainage. Discharge from the area should be monitored to detect turbidity or increases in discharge.
  3. The capacity of the spillway should be increased in accordance with the results of the hydrologic and hydraulic studies.

4. Trees and brush should be removed from the embankment and the areas where trees have been removed should be backfilled and regraded. The embankment slopes should be protected with vegetative cover or riprap.
- b. Operation and Maintenance Procedures.
  1. The Owner should develop and implement a maintenance and inspection checklist to insure that all items associated with the structure are maintained on a regular basis.
  2. The structure should be monitored during periods of heavy discharges. A warning system should be developed and implemented when necessary for the downstream area used for bivouac.

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

  
John J. Williams, P.E.  
Vice President  
New Jersey Registration No. 24916

Date: 1 August 1979







OVERVIEW  
AMPHIBIOUS LAKE DAM, BURLINGTON COUNTY, NEW JERSEY  
4/11/79

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PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM  
AMPHIBIOUS LAKE DAM  
INVENTORY NUMBER NJ00457

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. This report is authorized and prepared in accordance with contract #DACW 61-78-C-0052 between O'Brien & Gere Engineers, Inc., Justin & Courtney Division and the United States Army Corps of Engineers, Philadelphia District.

b. Purpose of Inspection. The purpose of this inspection is to evaluate the structural and hydraulic condition of the Country Lakes Number 1 Dam and appurtenant structures and to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Description of Dam and Appurtenances. Amphibious Lake Dam is an earth embankment approximately 13 feet high and 300 feet long. The top width of the embankment is approximately 50 feet.

The spillway is a wooden drop inlet structure located near the right abutment of the dam. The outlet of the drop inlet consists of a 48-inch steel pipe embedded in the embankment and provided with a concrete retaining wall at the downstream end.

b. Location. Amphibious Lake Dam is located on Burlington County Route 545 (Texas Avenue) approximately 3 miles south of Wrightstown, New Jersey. Route 545 is constructed on top of the embankment. The dam site is shown on the USGS Quadrangle entitled "Browns Mills, New Jersey" at coordinates N 39° 59.7', W 74° 36.1'. A regional location plan of Amphibious Lake Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. Amphibious Lake Dam has a maximum height of approximately 13 feet which places it in the "Small" size dam category for height because it is less than 40 feet high. The dam has a maximum storage capacity of 38 acre-feet which places it in the "Small" size dam category for storage because it has a maximum storage less than 1,000 acre-feet. Therefore, the dam is in the "Small" size category.

d. Hazard Classification. There are no permanent structures for human habitation within the downstream area that could be affected by a failure of the dam. However, failure may cause appreciable damage to Route 545 and there could possibly be loss of life in the bivouac area in the valley downstream of the dam. Therefore, the dam should be placed in the "Significant" hazard category.

e. Ownership. The dam is owned by the United States Army. Records are maintained at the Directorate of Facilities Engineering, Building 5320, Fort Dix, New Jersey 08640.

f. Purpose of Dam. The dam was built to create a recreation lake.

g. Design and Construction History. Personnel at the Directorate of facilities Engineering were unable to locate any information pertaining to the design and construction of the dam. It appears that the impoundment may have been created subsequent to the construction of the Route 545 embankment, through the construction of a drop inlet spillway and the placing of additional fill along the upstream face of the roadway embankment.

h. Normal Operating Procedures. According to the Owner's representative, Mr. Harry E. Colbert, no operating procedures are in force at this dam.

### 1.3 Pertinent Data

a. Drainage Area. The drainage area of Amphibious Lake Dam is 0.40 square miles. Meadow Lake Dam is located just upstream of Amphibious Lake and has a drainage area of 0.29 square miles.

b. Discharge at Dam Site. No high pool or discharge records were made available. The spillway capacity at the low point of the top of dam is 27 cubic feet per second (cfs).

c. Elevation (feet above MSL).

Spillway Crest	115.0
Design Top of Dam	117.0
Low Point top of dam	116.9
Outlet Conduit Invert	103.5
Streambed at the downstream toe of the dam	104.0
Tailwater	+104.5

d. Reservoir (miles).

Length of Normal Pool	0.25
Length of Pool (top of dam)	0.35

e. Storage (acre-feet).

Normal Pool (Elev. 115.0)	18
Design Top of Dam (Elev. 117.0)	38

f. Reservoir Surface Area (acres).

Normal Pool (Elev. 115.0)	9
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Design Top of Dam (Elev. 117.0)

11.0

g. Dam.

Type	Earth Embankment
Length	300 feet+
Height	13 feet (maximum)
Top width	50 feet+
Side Slope (approximately)	3H:1V to 2H:1V (upstream); 2H:1V to 1H:1V (downstream)
Zoning	Unknown
Impervious Core	Unknown
Cutoff	Unknown
Grout Curtain	Unknown

h. Diversion and Regulating Structure.

None

i. Spillway.

Type	Wooden drop inlet
Length of Weir	3 feet
Crest Elevation	115.0
Gates	None
Upstream Channel	None
Outlet Conduit	Steel pipe 48 inch diameter.

j. Regulating Outlets.

None

SECTION 2  
ENGINEERING DATA

2.1 Design

a. Data Available. The engineering data made available by the Directorate of Facilities Engineering includes the following:

1. Extension of Amphibious Lake, dated April 4, 1963 (never implemented).
2. Contour Map of Amphibious Lake dated March 6, 1961.
3. Proposed spillway for Amphibious Lake dated March 7, 1961.

2.2 Construction

According to the Owner's representative, no information pertaining to the construction of this dam was available.

2.3 Operation

According to the Owner's representative, there are no operational features associated with this structure.

2.4 Evaluation

a. Availability. The engineering data utilized in this report was provided by the Directorate of Facilities Engineering, Fort Dix, New Jersey.

b. Adequacy. Although design information is minimal and there is no construction information, the conditions observed during the field inspection, information made available by the Directorate of Facilities Engineering, Fort Dix and conversations with the Owner's representative, appear to provide an adequate basis for a Phase I evaluation.

c. Validity. There is no reason to question the validity of the data made available.

SECTION 3  
VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Amphibious Lake Dam took place on April 12, 1979. At the time of inspection, the water surface was approximately one inch above the crest of the drop inlet spillway.

b. Dam. During the visual survey, there were no indications or evidence observed of distortions in alignment or grade that would be indicative of movement of the embankment or the foundation. The upstream face of the dam has a sparse cover of grass, weeds, and small rocks and stones in some areas. The slope of the upstream face varies from about 3H:1V to 2H:1V.

Route 545 is constructed on top of the embankment. The downstream slope of the embankment is heavily overgrown with trees and bushes and the slope varies from approximately 2H:1V to 1H:1V.

As delineated on Plate 5, Appendix E some seepage was noted downstream of the dam.

c. Appurtenant Structures. The wooden drop inlet spillway appears to be in good condition, including the concrete retaining wall constructed at the downstream end of the 48-inch steel outlet pipe. The dam is not provided with a reservoir drain system.

d. Reservoir Area. The reservoir slopes are relatively flat varying between 2 and 10 percent with satisfactory vegetative cover. No significant slope stability problems are apparent along the periphery of the reservoir.

e. Downstream Channel. The spillway discharge channel is the natural channel of Newbold Run. The channel overbanks are heavily overgrown with trees and brush. A small unnamed impoundment is located on Newbold Run about 1.5 miles downstream of the dam.

There are no permanent structures of human habitation along the Newbold Run between Amphibious Lake Dam and the above mentioned impoundment. However, failure of Amphibious Lake Dam could cause appreciable damage to Route 545 and there could possibly be loss of life in the bivouac area in the valley downstream of the dam.



SECTION 4  
OPERATIONAL FEATURES

4.1 Procedures

Based on the review of information provided by the Directorate of Facilities Engineering and conversation with the Owner's representative, Mr. Harry E. Colbert, no formal operating procedures are established for Amphibious Lake Dam.

4.2 Maintenance of Dam

According to the Owner's representative, no maintenance procedures have been established for this dam.

4.3 Maintenance of Operating Facilities

According to the Owner's representative, there are no operational features associated with this dam.

4.4 Description of any Warning Systems in Effect

According to the Owner's representative, there is no formal warning system in effect for Amphibious Lake Dam.

4.5 Evaluation of Operational Adequacy

The reservoir can not be drawn down because the dam is not provided with a reservoir drain system.

The dam is accessible under all weather conditions.

## SECTION 5

### HYDRAULICS AND HYDROLOGY

#### 5.1 Evaluation of Features

a. Design Data. Amphibious Lake Dam which has a drainage area of 0.4 square miles impounds a reservoir of 18 acre-feet at the spillway crest elevation of 115.0. The spillway facilities consist of a timber drop inlet with a three foot wide one sided weir and a steel outlet conduit 48-inches in diameter.

b. Experience Data. According to the Owner's representative, no records of reservoir level or rainfall are kept for this dam.

c. Visual Observations. The lack of a reservoir drain system could present a problem should a drawdown of the reservoir be required.

d. Overtopping Potential. The Spillway Design Flood (SDF) for this "Small" size, "Significant" hazard structure is given as a range from 100-year frequency to one-half of the Probable Maximum Flood (PMF). The SDF selected for use is 0.5 PMF. The SDF hydrograph was routed through the reservoir with the initial water surface Elevation 115.06. The maximum water surface elevation in the reservoir resulting from the SDF routing would be about 2.4 feet above the spillway crest elevation of 115.0 and about 0.5 feet above the low point of the top of the dam, Elevation 116.94. The low point of the dam crest was determined by a survey of the dam crest profile during the field investigation. The SDF routing has a peak inflow of 343 cfs and a peak outflow of 333 cfs. The spillway is capable of discharging 19 percent of the SDF without overtopping of the dam. Refer to Appendix C for computations and computer printouts.

e. Spillway Adequacy. The spillway is capable of discharging only 19 percent of the SDF (0.5 PMF) and is considered as "Inadequate" but not "Seriously Inadequate" because the structure is a "Small" size, "Significant" hazard dam.

Failure of the dam could cause appreciable damage to Route 545 and there could possibly be loss of life in the bivouac area in the valley downstream of the dam.

SECTION 6  
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. On the date of the inspection, the embankment appeared to be in fair condition. There was no evidence of slope stability problems or unusual settlements. However, a marshy area with seepage and areas of discolored standing water was located along the downstream toe of the dam. The source of the water could not be determined, but could be the result of seepage through or beneath the embankment. The heavy cover of large trees and bushes on the downstream slope may increase the seepage potential through the embankment.

The spillway, including the concrete retaining wall constructed at the end of the 48 inch outlet pipe, appeared to be in good condition and showed no signs of instability.

b. Design and Construction Data. There is no construction and design data available.

c. Operating Records. According to the Owner's representative, Harry E. Colbert, there are no official operating records kept for this dam.

d. Post-Construction Changes. There is no record of any modifications subsequent to the completion of construction.

e. Seismic Stability. The dam is located in Seismic Risk Zone 1 of the "Seismic Zone Map of Contiguous States". A dam located in Seismic Zone 1 is generally considered to be safe under any expected earthquake loading if it is safe under static loading conditions.



## SECTION 7

### ASSESSMENT, RECOMMENDATIONS AND PROPOSED REMEDIAL MEASURES

#### 7.1 Dam Assessment

a. Evaluation. Based on the visual inspection the Amphibious Lake Dam is considered to be in fair condition. The reservoir can not be drawn down since it is not provided with a reservoir drain system.

A marshy area with seepage and areas of discolored standing water was located along the downstream toe of the dam. The source of the water could not be determined during the visual inspection.

As stated in Section 5.1.d, the SDF selected is 50 percent of the PMF for this "Small" size, "Significant" hazard dam. Examination of the results of the hydrologic and hydraulic analyses indicates that the spillway is capable of passing approximately 19 percent of the SDF without overtopping of the earth embankment. The spillway is classified as "Inadequate" but not "Seriously Inadequate" because the dam is a "Small" size "Significant" hazard structure.

Failure of the structure by overtopping could cause appreciable damage to the Route 545 and there could possibly be loss of life in the bivouac area in the valley downstream of the dam.

b. Adequacy of Information. The information made available by the Directorate of Facilities Engineering, conversations with the Owner's representative, Harry E. Colbert, and observations made during the field investigation provided adequate data for a Phase I evaluation.

c. Urgency. The remedial measures recommended in Section 7.2 should be initiated soon.

d. Necessity for Further Investigation. Further detailed hydrologic and hydraulic studies should be made to determine the extent to which the spillway capacity should be increased.

#### 7.2 Recommendations and Remedial Measures

1. The dam should be provided with a reservoir drain system.
2. The marshy area downstream of the embankment should be regraded to provide adequate drainage. Discharge from the area should be monitored to detect turbidity or increases in discharge.
3. The capacity of the spillway should be increased in accordance with the results of the hydrologic and hydraulic studies.

4. Trees and brush should be removed from the embankment and the areas where trees have been removed should be backfilled and regraded. The embankment slopes should be protected with vegetative cover or riprap.

b. Operation and Maintenance Procedures

1. The Owner should develop and implement a maintenance and inspection checklist to insure that all items associated with the structure are maintained on a regular basis.

2. The structure should be monitored during periods of heavy discharges. A warning system should be developed and implemented when necessary for the downstream area used for bivouac.



APPENDIX

A

Check List Engineering Data  
Design, Construction, Operation  
Phase I

NAME OF DAM Amphibious Lake Dam  
ID # NJ 00457

Sheet 1 of 4

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

REMARKS

ITEM

AS-BUILT DRAWINGS

Not available

REGIONAL VICINITY MAP

Refer to Appendix E, Plate 1

CONSTRUCTION HISTORY

No information available

TYPICAL SECTIONS OF DAM

Not available for existing structure

OUTLETS - PLAIN

DETAILS

CONSTRAINTS

DISCHARGE RATINGS

RAINFALL/RESERVOIR RECORDS

No information available for existing structure

None available

None available

ITEM \_\_\_\_\_ REMARKS \_\_\_\_\_

DESIGN REPORTS No design reports available

GEOLOGY REPORTS None provided. 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 } No information available  
FIELD }

POST-CONSTRUCTION SURVEYS OF DAM None

BORROW SOURCES There is no record of where borrow material came from.



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

ITEM

REMARKS

SPILLWAY PLAN

SECTIONS

DETAILS

There is no information on the existing spillway.

OPERATING EQUIPMENT  
PLANS & DETAILS

None available

MISCELLANEOUS

APPENDIX

B

Check List  
Visual Inspection  
Phase I



CHECK LIST  
VISUAL INSPECTION  
PHASE I

Sheet 1 of 8

Name Dam Amphibious Lake Dam County Burlington State New Jersey National ID # NJ 00457  
Type of Dam Earth Hazard Category Significant  
Date(s) Inspection 04/12/79 Weather Clear Temperature 60° F

Pool Elevation at Time of Inspection + 115.1 M.S.L. Tailwater at Time of Inspection + 104.5 M.S.L.

Inspection Personnel:

Mr. Lee DeHeer \_\_\_\_\_ Mr. Stefan Manea \_\_\_\_\_ Mr. David B. Campbell \_\_\_\_\_  
\_\_\_\_\_ Mr. David B. Campbell \_\_\_\_\_ Recorder \_\_\_\_\_

Remarks:

Mr. Harry E. Colbert from the Directorate of Facilities Engineering was present at the time of the inspection (Fort Dix).  
\_\_\_\_\_  
\_\_\_\_\_

EMBANKMENT

Sheet 2 of 8

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                      Small erosion channels were observed  
on the upstream slope.

The embankment faces should be  
protected with vegetative cover  
or riprap.

VERTICAL AND HORIZONTAL  
ALIGNMENT OF THE CREST                      No apparent deformations observed.

RIPRAP FAILURES                      N/A



EMBANKMENT

Sheet 3 of 8

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
------------------------------	---------------------	-----------------------------------

JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No discontinuities observed	
---	-----------------------------	--

ANY NOTICEABLE SEEPAGE	A marshy area with seepage and areas of discolored standing water was located along the downstream toe of the dam.	This area should be regraded to provide adequate drainage. Flow should be monitored to detect turbidity or increases in flow.
------------------------	--	---

STAFF GAGE AND RECORDER	None	
-------------------------	------	--

DRAINS	None observed	
--------	---------------	--

OUTLET WORKS

Sheet 4 of 8

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed	
INTAKE STRUCTURE	Not observed beneath reservoir surface	
OUTLET STRUCTURE	48-inch diameter steel pipe	
OUTLET CHANNEL	Natural channel of Newbold Run with no outlet basin.	
EMERGENCY GATE	None	

UNGATED SPILLWAY

Sheet 5 of 8

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE WEIR	Timber box in good condition	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	The 48-inch diameter steel pipe spillway outlet discharges into the natural channel of Newbold Run.	
BRIDGE AND PIERS	None	



INSTRUMENTATION

Sheet 6 of 8

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION

MONUMENTATION/SURVEYS

NONE

OBSERVATION WELLS

NONE

WEIRS

NONE

PIEZOMETERS

NONE

OTHER

NONE

RESERVOIR

OBSERVATIONS

VISUAL EXAMINATION OF

SLOPES

The reservoir slopes are relatively flat (2 to 10 percent) and well vegetated around the entire perimeter of the reservoir.

SEDIMENTATION

There does not appear to be any excessive accumulation of sediment in the reservoir. Because of the flat graients around the entire perimeter of the reservoir there is little sediment accumulation even though there is poor vegetative cover around the entire reservoir.

DOWNSTREAM CHANNEL

Sheet 8 of 8

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is the natural channel of Newbold Run which flows through a heavily overgrown valley. There are numerous obstructions to flow.	
SLOPES	The channel is on a gradient of about 0.1 percent. The banks are heavily overgrown with trees and brush. Channel bank slopes vary anywhere from 1:1 to 10:1	
APPROXIMATE NO. OF HOMES AND POPULATION	There are no permanent structures for human habitation for more than 2 miles downstream of Amphibious Lake Dam. However, failure of Amphibious Lake Dam could cause appreciable damage to Route 545 and bivouac areas downstream.	The structure should be monitored during periods of heavy discharges. A warning system should be developed and implemented when necessary for the downstream area used for bivouac.



APPENDIX

C

Hydrologic & Hydraulic Data

TABLE OF CONTENTS - APPENDIX C

TIME LAG DETERMINATION	SHEETS 1 - 8
SPELLWAY DISCHARGE CAPACITY	SHEETS 9 - 16
HEC-I DAM SAFETY VERSION COMPUTER PRINTOUT	SHEETS 17 - 49

PROJECT	AMPHIBIOUS LAKE DAM	SHEET	1	BY	SM	DATE	4/26/79	JOB NO	1800-005-110
---------	---------------------	-------	---	----	----	------	---------	--------	--------------

A. UPPER RESERVOIR

I. SCS CURVE NUMBER METHOD

$$T_e = \frac{L^{0.8}(S+1)^{0.7}}{1900 Y^{0.5}}$$

$$L = 6000 \text{ ft}$$

$$S = \frac{1000}{CN} - 10 = \frac{1000}{10} - 10 = 4.29$$

(CN = runoff curve number)

$$Y = \frac{170 - 121}{6000} = 0.0083 = 0.83\%$$

$$T_e = \frac{6000^{0.8}(4.29+1)^{0.7}}{1900 \times 0.83^{0.5}} = 2.0 \text{ hrs}$$



PROJECT	SHEET	BY	DATE	JOB NO.
Amphibious Lake Dam	2	SM	4/26/79	1800.005.110

II. BUREAU OF PUBLIC ROADS

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

$L$  = hydraulic length of watershed (miles)

$$L = 6000 \text{ ft} = 1.14 \text{ mile}$$

$H$  = basin relief (feet)

$$H = 49 \text{ ft}$$

$$T_c = \left( \frac{11.9 \times 1.14^3}{49} \right)^{0.385} = 0.7 \text{ hrs} \quad \text{Say } 1 \text{ hr}$$

$$T_e = 0.6 \times T_c = \underline{0.6 \text{ hrs}}$$

Amphibious Lake Dam

SHEET

3

BY

SM

DATE

July 16, 79

JOB NO

1800-005-110

III. KIRPICH EQUATION<sup>1)</sup>

$$T_c = 0.00013 \frac{L^{.77}}{S^{.385}}$$

$L$  = the length of the longest waterway from the outlet, in feet.

$S$  = the slope of the channel, in ft/ft

$T_c$  = the time of concentration, in hours.

$$S = \frac{49}{6000} = 0.008$$

$$T_c = 0.00013 \frac{6000^{.77}}{0.008^{.385}} = 0.68 \text{ hrs.}$$

Say 1 hr.

$$\bar{T}_e = 0.6 \times T_c = 0.6 \text{ hrs}$$

1) Kirpich, Z.P. "Time of concentration of small agricultural watersheds", Civil

Eng. V. 10, No. 6 p. 362, June 1940. Also in E. F. Schulz: Problems in Applied Hydrology, Water Resources Publications, Fort Collins, Colorado, 1976

Amphibious Lake Dam

SHEET

4

BY

SM

DATE

7/16/79

JOB NO

1800.005.110

Since SCS Curve Number Method gives a result that differs too much from those obtained with the other two methods it seems reasonable to take in consideration only the values obtained with Kirpich and Bureau of Public Roads methods.

So,

$$T_e = 0.6 \text{ hrs.}$$



PROJECT	SHEET	BY	DATE	JOB NO
Amphibious Lake Dam	5	SM	4/26/79	1800.005.110

B. LOWER RESERVOIR

I. SCS CURVE NUMBER METHOD

$$T_e = \frac{L^{0.8} (S+1)^{0.7}}{1900 Y^{0.5}}$$

$$L = 1600 \text{ ft}$$

$$S = \frac{1000}{CN} - 10 = 4.29$$

$$Y = \frac{116 - 115}{1600} = 0.0006 = 0.06\%$$

$$T_e = \frac{1600^{0.8} (4.29+1)^{0.7}}{1900 \times 0.06^{0.5}} = \underline{\underline{2.5 \text{ hrs}}}$$

PROJECT	Amphibious Lake Dam	SHEET	6	BY	SM	DATE	4/26/79	JOB NO.	1800-005-110
---------	---------------------	-------	---	----	----	------	---------	---------	--------------

II. BUREAU OF PUBLIC ROADS

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

$$L = 1600 \text{ ft} = 0.3 \text{ mile}$$

$$H = 116 - 115 = 1 \text{ ft}$$

$$T_c = \left( \frac{11.9 \times 0.3^3}{1} \right)^{0.385} \approx 1.0 \text{ hrs}$$

$$T_L = 0.6 \times T_c \approx 0.6 \text{ hrs.}$$

Amphibious Lake Dam

SHEET

7

BY

SM

DATE

July 16, 79

JOB NO

1600-005-110

III. KIRPICH EQUATION

$$T_c = 0.00013 \frac{L^{0.77}}{S^{0.385}}$$

$$L = 1600 \text{ ft}$$

$$S = \frac{5}{1600} = 0.003$$

$$T_c = 0.00013 \frac{1600^{0.77}}{0.003^{0.385}} \approx 0.5 \text{ hrs}$$

$$T_l = 0.6 \times T_c = 0.3 \text{ hrs}$$

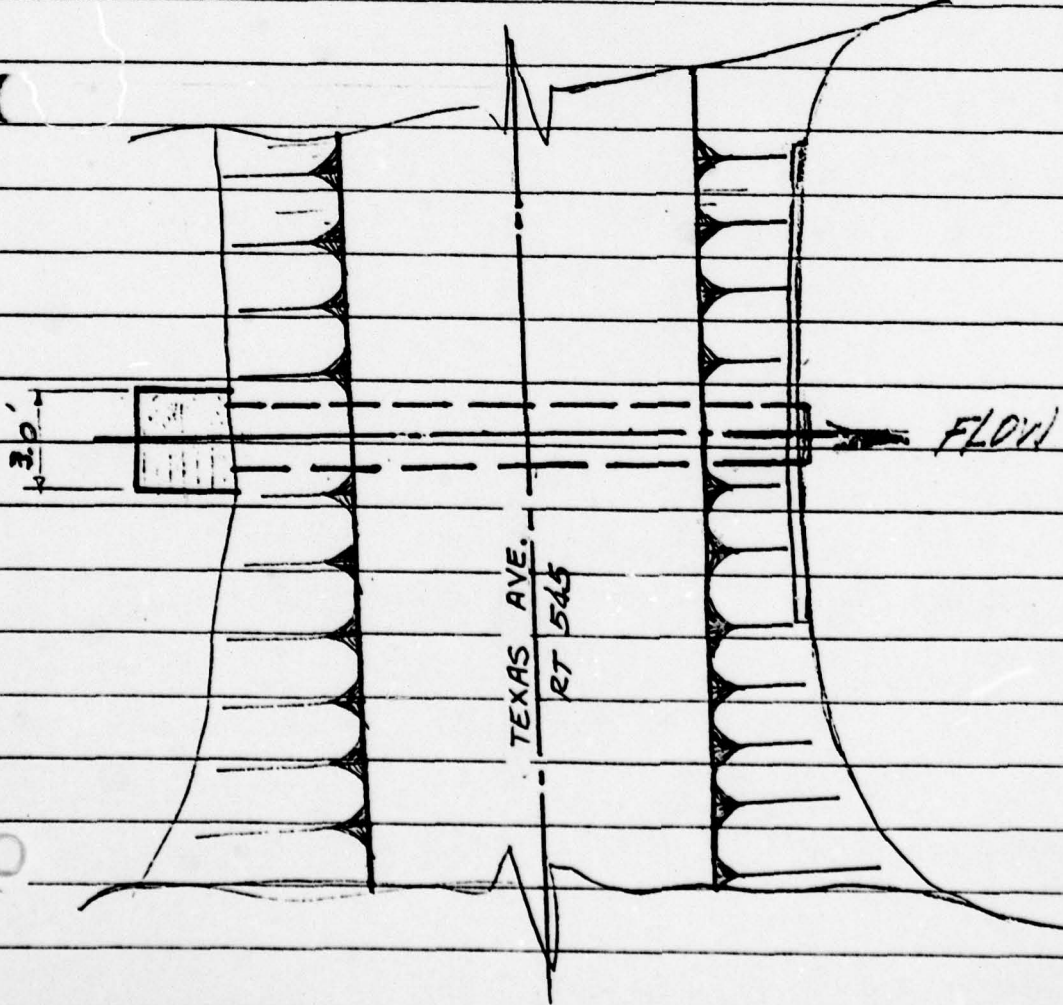
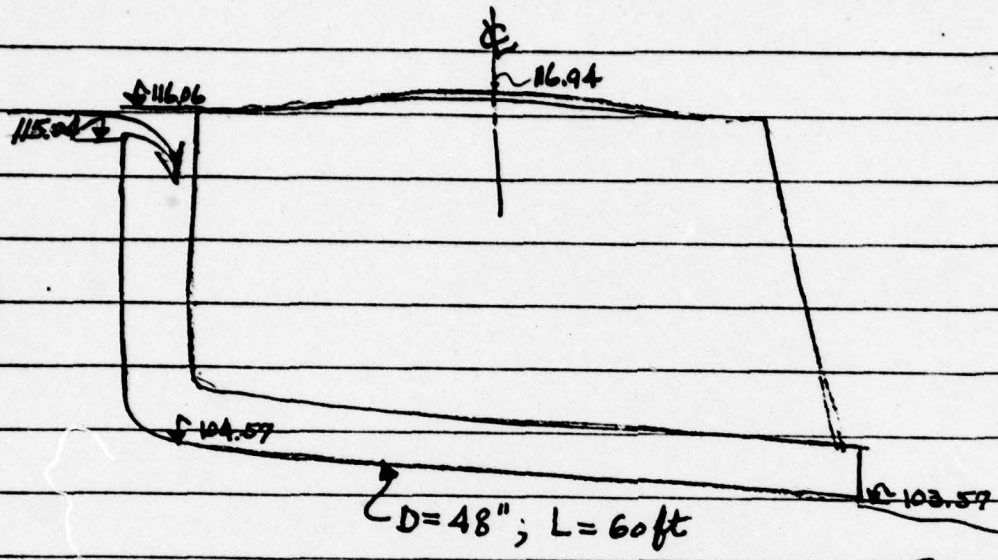
Based on <sup>the</sup> same judgment we did for the upper reservoir,

$$T = \frac{0.6 + 0.3}{2} \approx \underline{\underline{0.5 \text{ hrs}}}$$



JECT	Amphibious Lake Dam	SHEET 8	BY SM	DATE 4/20/79	JOB NO 1800.005.110
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### AMPHIBIOUS LAKE DAM



### I. CREST DISCHARGE / CONTROL

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

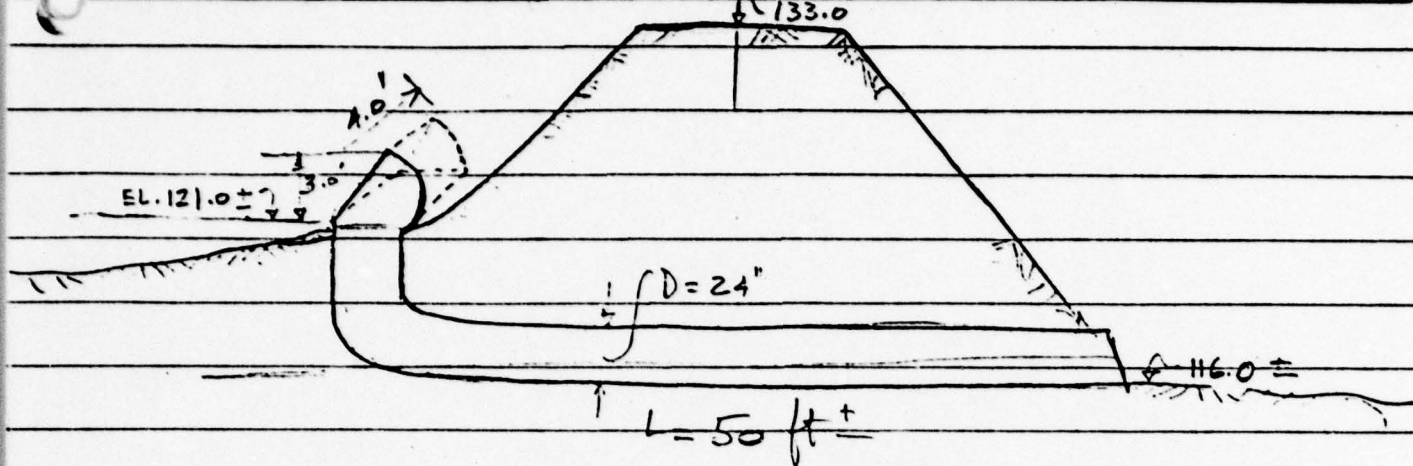
$$Q = 0.34 \times 3 \times 2^{3/2} \approx 3.0 \text{ cfs}$$

Therefore, it is obvious\* that the flow phenomenon that would always occur is that of weir flow type; the orifice flow or the full pipe flow would never occur in the existing circumstances. Consequently, although the spillway is of a drop inlet type, it should be modeled as a simple sharp-crested weir.

\* Because: For small heads, flow over the drop inlet spillway is governed by the characteristics of crest discharge. In our case the max. available head (2 ft) would never give a flow higher than that related to a 0.7" full pipe at d/s end, which is about 130 cfs


\* Crest control condition generally prevails for heads at which tunnel flows approx. 0.7 full at d/s end.

PROJECT	Amphibious Lake Dam	SHEET	10	BY	SM	DATE	4/25/79	JOB NO.	1800-005-110
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I CREST DISCHARGE (CONDITION I)

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

Equiv. Circular  $\Rightarrow$  

$$R_s = 1.75$$

$$Q = C_o (2\pi R_s) H_o^{3/2}$$

$$C_o = \frac{Q}{2\pi R_s H_o^{3/2}}$$

$\frac{H_o}{R_s} = 0.45 \Rightarrow$  the limit up to which weir control governs.

$$\frac{P}{R_s} = \frac{2.0}{1.75} = 1.14$$

From fig. 283 page 417 - Design of Small Dams, U.S. Civ. Engrs. will result:



PROJECT: Amphibious Lake Dam. SHEET: 11 BY: SM DATE: 4/25/79 JOB NO: 1800-005-110

Elev.	$H_o/R_s$	$H_o \approx H$	$C_o = \frac{Q}{2\pi R_s H_o^{3/2}}$	$Q = C_o (2\pi R_s) H_o^{3/2}$
121.17	0.1	0.175	4.0	3.2
121.35	0.2	0.35	3.9	8.9
121.53	0.3	0.525	3.75	15.7
121.7	0.4	0.70	3.56	22.9

II. ORIFICE CONTROL (THROAT CONTROL)

$$Q = \left( \frac{R}{0.204} \right)^2 H_a^{1/2} \quad R_t = 1$$

$H_o \approx H$ (ft)	$H_a$	$Q = \left( \frac{R}{0.204} \right)^2 H_a^{1/2}$ (cfs)	Elev.
1.0	2.0	33.8	122.0
2.0	3.0	41.5	123.0

PROJECT	SHEET	BY	DATE	JOB NO.
<i>Amphibious Lake Dam</i>	<i>12</i>	<i>SM</i>	<i>4/25/79</i>	<i>1800.005-110</i>

pillways

417

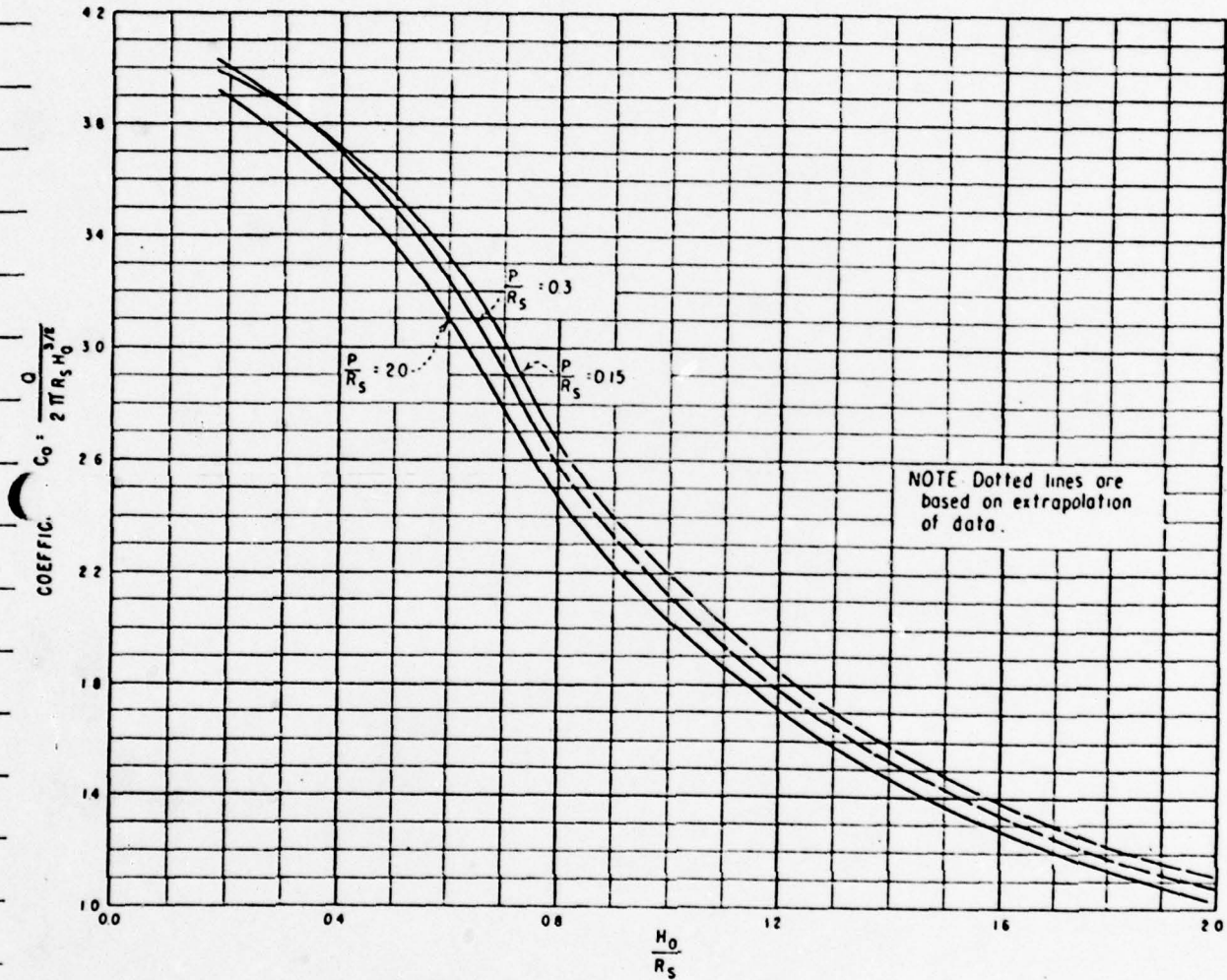


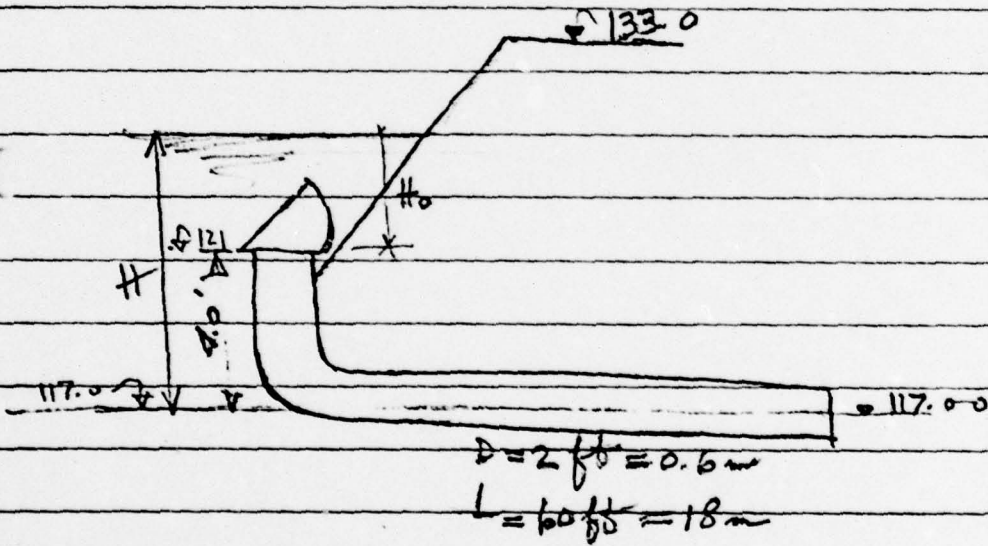
Figure 283. Relationship of circular crest coefficient  $C_0$  to  $\frac{H_0}{R_s}$  for different approach depths (aerated nappe). 288-D-2441.

*From B. of Reclamation - Design of Small Dams.*

III. FULL PIPE FLOW

$$\left( Q_{full} \right) = K_{full} V S = 3.3 \times \sqrt{0.02} = 0.47 \frac{m^3}{sec}$$

$$= 0.47 \times 35.31 = \underline{16.6 \text{ cfs}}$$





Amphibious Lake Dam

SHEET

14

BY

SM

DATE

4/25/79

JOB NO

1300-005.110

$$Q = VA = \rho \sqrt{2gH^*} A$$

$$f = \frac{1}{\sqrt{\alpha - \frac{e}{f}}}$$

$$\frac{e}{f} = \frac{fL}{D}$$

$$f = \frac{0.021}{D^{0.3}} \approx 0.024 \quad (\text{complete turbulence})$$

$$\frac{e}{f} = \frac{0.024 \times 18}{0.6} = 0.72$$

$$f = \frac{1}{\sqrt{1.1 + 0.72}} = 0.74$$

$$Q = 0.74 \sqrt{19.62} \times \frac{\pi (0.6)^2}{4} \sqrt{H^*}$$

$$Q = 3.27 \times 0.28 \sqrt{H^*}$$

$$Q = 0.9 \sqrt{H^*}$$

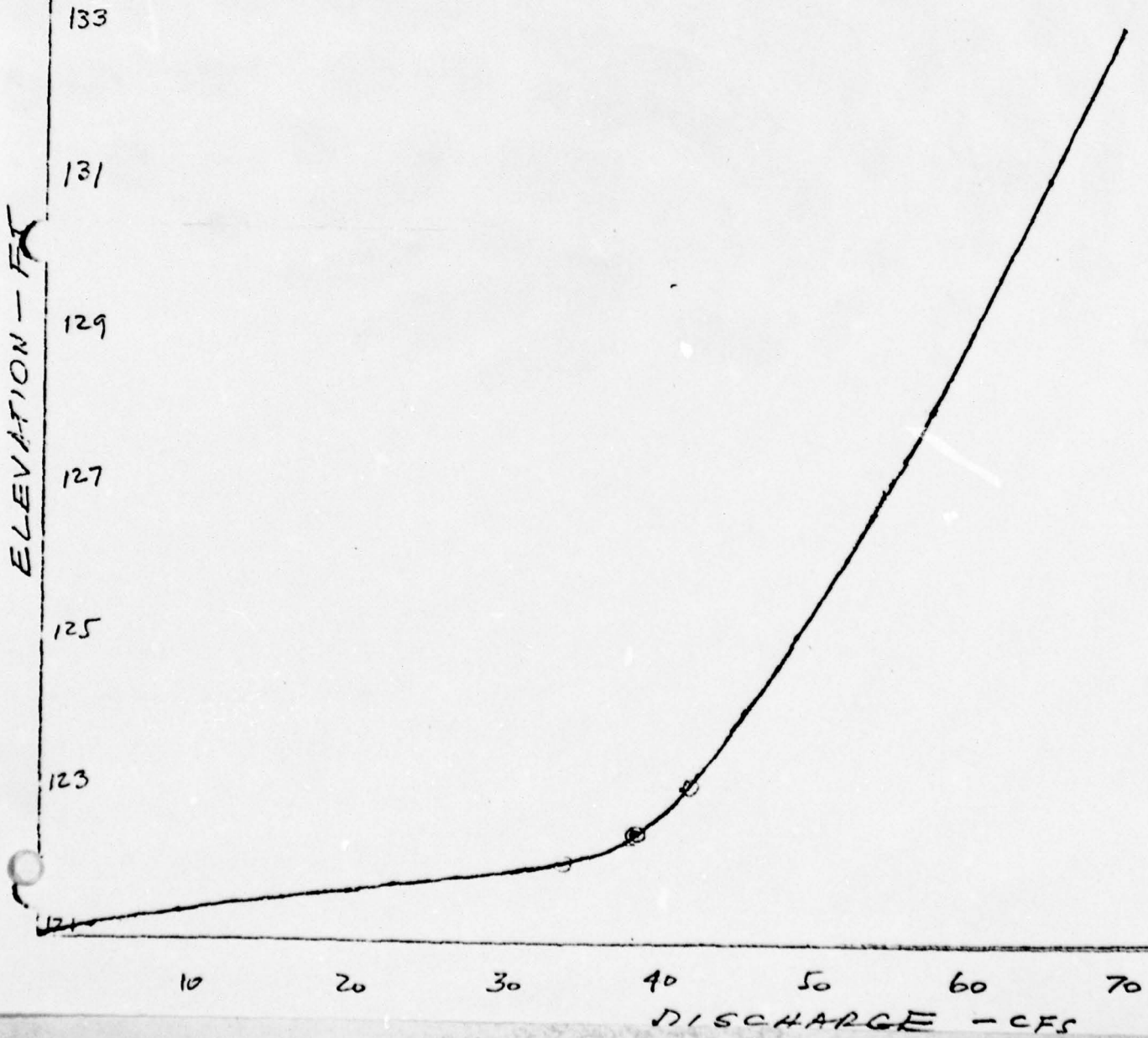
PROJECT: Amphibious Lake Dam      SHEET: 15      BY: SM      DATE: 4/25/79      JOB NO: 1800-005-110

H <sub>0</sub> (ft)	H*		Q = 0.9√H* m <sup>3</sup> /sec	Q (cfs)	Elev.
	(ft)	(m)			
3	7	2.1	1.3	45.9	124
4	8	2.4	1.39	49.0	125
5	9	2.7	1.478	52.21	126
6	10	3.0	1.56	55.0	127
7	11	3.3	1.63	57.7	128
8					
9					
( 10	14	4.2	1.84	65.0	131
11					
12	16	4.8	1.97	69.6	133

Sh 16

AMPHIBIOUS LAKE DAM  
SPILLWAY DISCHARGE CAPACITY  
OF THE RESERVOIR O/S OF  
PEMBERTON RD. (UPPER RESERVOIR)

SM  
4/25/79





.....  
 FLOOD HYDROGRAPH PACKAGE (HEC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 26 FEB 79  
 .....

RUN DATED 07/17/79.  
 TIME 07.54.08.

NATIONAL DAM INSPECTION PROGRAM  
 AMPHIBIOUS LAKE DAM  
 PHF HYDROGRAPH

JOB SPECIFICATION  
 NO NHR MMIN IOAY IMR IMIN METRC IPLT IPRT NSTAN  
 300 0 15 0 0 0 0 0 3 0  
 JOPEL MWT LRDT TRACE  
 5 0 0 0

MULTI-PLAN ANALYSES TO BE PERFORMED  
 MPLAN= 1 MRTIO= 5 LRTIO= 1  
 RTIOS= .10 .20 .30 .40 .50

.....

SUB-AREA RUNOFF COMPUTATION  
 RUNOFF TO UPPER RESERVOIR

ISTAG ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUTO  
 INFLOW 0 0 0 0 0 0 1 0 0

HYDROGRAPH DATA  
 IHDG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL  
 1 2 .29 0.00 .40 0.00 0.000 0 1 0

PRECIP DATA  
 SPFE PMS R6 R24 R48 R72 R96  
 0.00 23.50 113.00 123.00 132.00 142.00 0.00 0.00  
 TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA  
 LHOPT STRKR DLTRM HTIOL ERAIN STRKS RTIUK STRTL CMSTL ALSM4 RTIMP  
 0 0.00 0.00 1.00 0.00 0.00 1.00 1.00 0.05 0.00 0.00

UNIT HYDROGRAPH DATA  
 IC= 0.00 LAG= .60

54 17

RECESSION DATA  
 STRIUM= -1.50 WRCSM= -.05 RTIO= 2.00

UNIT HYDROGRAPH 14 END OF PERIOD ORIGINATES, TC= 0.00 HOURS, LAG= .60 VOL= 1.00  
 1. 154. 193. 154. 154. 28. 16. 9.  
 2. 1. 0. 0. 0. 0. 0. 0.  
 3. 0. 0. 0. 0. 0. 0. 0.

MO.DA HR,MM PERIOD RAIN EXCS LOSS COMP 0 MO.DA HR,MM PERIOD RAIN EXCS LOSS COMP 0

1.01	.15	1	.00	.00	.00	0.	1.02	13.45	151	.64	.62	.01	413.
1.01	.30	2	.00	.00	.00	0.	1.02	14.00	152	.64	.62	.01	437.
1.01	.45	3	.00	.00	.00	0.	1.02	14.15	153	.80	.78	.01	458.
1.01	1.00	4	.00	.00	.00	0.	1.02	14.30	154	.80	.78	.01	490.
1.01	1.15	5	.00	.00	.00	0.	1.02	14.45	155	.80	.78	.01	525.
1.01	1.30	6	.00	.00	.00	0.	1.02	15.00	156	.80	.78	.01	552.
1.01	1.45	7	.00	.00	.00	0.	1.02	15.15	157	.81	.79	.01	568.
1.01	2.00	8	.00	.00	.00	0.	1.02	15.30	158	1.61	1.60	.01	616.
1.01	2.15	9	.00	.00	.00	0.	1.02	15.45	159	4.52	4.51	.01	885.
1.01	2.30	10	.00	.00	.00	0.	1.02	16.00	160	1.13	1.12	.01	1336.
1.01	2.45	11	.00	.00	.00	0.	1.02	16.15	161	.74	.73	.01	1478.
1.01	3.00	12	.00	.00	.00	0.	1.02	16.30	162	.74	.73	.01	1283.
1.01	3.15	13	.00	.00	.00	0.	1.02	16.45	163	.74	.73	.01	976.
1.01	3.30	14	.00	.00	.00	0.	1.02	17.00	164	.74	.73	.01	792.
1.01	3.45	15	.00	.00	.00	0.	1.02	17.15	165	.58	.57	.01	679.
1.01	4.00	16	.00	.00	.00	0.	1.02	17.30	166	.58	.57	.01	595.
1.01	4.15	17	.00	.00	.00	0.	1.02	17.45	167	.58	.57	.01	530.
1.01	4.30	18	.00	.00	.00	0.	1.02	18.00	168	.58	.57	.01	486.
1.01	4.45	19	.00	.00	.00	0.	1.02	18.15	169	.04	.03	.01	435.
1.01	5.00	20	.00	.00	.00	0.	1.02	18.30	170	.04	.03	.01	337.
1.01	5.15	21	.00	.00	.00	0.	1.02	18.45	171	.04	.03	.01	224.
1.01	5.30	22	.00	.00	.00	0.	1.02	19.00	172	.04	.03	.01	135.
1.01	5.45	23	.00	.00	.00	0.	1.02	19.15	173	.04	.03	.01	86.
1.01	6.00	24	.00	.00	.00	0.	1.02	19.30	174	.04	.03	.01	71.
1.01	6.15	25	.01	.00	.01	0.	1.02	19.45	175	.04	.03	.01	66.
1.01	6.30	26	.01	.00	.01	0.	1.02	20.00	176	.04	.03	.01	62.
1.01	6.45	27	.01	.00	.01	0.	1.02	20.15	177	.04	.03	.01	58.
1.01	7.00	28	.01	.00	.01	0.	1.02	20.30	178	.04	.03	.01	54.
1.01	7.15	29	.01	.00	.01	0.	1.02	20.45	179	.04	.03	.01	50.
1.01	7.30	30	.01	.00	.01	0.	1.02	21.00	180	.04	.03	.01	47.
1.01	7.45	31	.01	.00	.01	0.	1.02	21.15	181	.04	.03	.01	44.
1.01	8.00	32	.01	.00	.01	0.	1.02	21.30	182	.04	.03	.01	41.
1.01	8.15	33	.01	.00	.01	0.	1.02	21.45	183	.04	.03	.01	38.
1.01	8.30	34	.01	.00	.01	0.	1.02	22.00	184	.04	.03	.01	36.
1.01	8.45	35	.01	.00	.01	0.	1.02	22.15	185	.04	.03	.01	33.
1.01	9.00	36	.01	.00	.01	0.	1.02	22.30	186	.04	.03	.01	31.
1.01	9.15	37	.01	.00	.01	0.	1.02	22.45	187	.04	.03	.01	29.
1.01	9.30	38	.01	.00	.01	0.	1.02	23.00	188	.04	.03	.01	27.
1.01	9.45	39	.01	.00	.01	0.	1.02	23.15	189	.04	.03	.01	25.
1.01	10.00	40	.01	.00	.01	0.	1.02	23.30	190	.04	.03	.01	23.
1.01	10.15	41	.01	.00	.01	0.	1.02	23.45	191	.04	.03	.01	22.
1.01	10.30	42	.01	.00	.01	0.	1.03	0.00	192	.04	.03	.01	22.
1.01	10.45	43	.01	.00	.01	0.	1.03	.15	193	0.00	0.00	0.00	21.
1.01	11.00	44	.01	.00	.01	0.	1.03	.30	194	0.00	0.00	0.00	19.
1.01	11.15	45	.01	.00	.01	0.	1.03	.45	195	0.00	0.00	0.00	18.
1.01	11.30	46	.01	.00	.01	0.	1.03	1.00	196	0.00	0.00	0.00	17.
1.01	11.45	47	.01	.00	.01	0.	1.03	1.15	197	0.00	0.00	0.00	16.
1.01	12.00	48	.01	.00	.01	0.	1.03	1.30	198	0.00	0.00	0.00	15.
1.01	12.15	49	.04	.00	.04	0.	1.03	1.45	199	0.00	0.00	0.00	14.
1.01	12.30	50	.04	.00	.04	0.	1.03	2.00	200	0.00	0.00	0.00	13.
1.01	12.45	51	.04	.00	.04	0.	1.03	2.15	201	0.00	0.00	0.00	12.
1.01	13.00	52	.04	.00	.04	0.	1.03	2.30	202	0.00	0.00	0.00	11.
1.01	13.15	53	.05	.00	.05	0.	1.03	2.45	203	0.00	0.00	0.00	10.
1.01	13.30	54	.05	.00	.05	0.	1.03	3.00	204	0.00	0.00	0.00	10.
1.01	13.45	55	.05	.00	.05	0.	1.03	3.15	205	0.00	0.00	0.00	9.
1.01	14.00	56	.05	.00	.05	0.	1.03	3.30	206	0.00	0.00	0.00	8.
1.01	14.15	57	.06	.00	.06	0.	1.03	3.45	207	0.00	0.00	0.00	8.
1.01	14.30	58	.06	.00	.06	0.	1.03	4.00	208	0.00	0.00	0.00	7.
1.01	14.45	59	.06	.00	.06	0.	1.03	4.15	209	0.00	0.00	0.00	7.
1.01	15.00	60	.06	.00	.06	0.	1.03	4.30	210	0.00	0.00	0.00	6.
1.01	15.15	61	.06	.00	.06	0.	1.03	4.45	211	0.00	0.00	0.00	6.

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1.02	7.00	124	.08	.07	.01	39.	1.03	20.30	274	0.00	0.00	0.
1.02	7.15	125	.08	.07	.01	44.	1.03	20.45	275	0.00	0.00	0.
1.02	7.30	126	.08	.07	.01	46.	1.03	21.00	276	0.00	0.00	0.
1.02	7.45	127	.08	.07	.01	47.	1.03	21.15	277	0.00	0.00	0.
1.02	8.00	128	.08	.07	.01	48.	1.03	21.30	278	0.00	0.00	0.
1.02	8.15	129	.08	.07	.01	49.	1.03	21.45	279	0.00	0.00	0.
1.02	8.30	130	.08	.07	.01	49.	1.03	22.00	280	0.00	0.00	0.
1.02	8.45	131	.08	.07	.01	49.	1.03	22.15	281	0.00	0.00	0.
1.02	9.00	132	.08	.07	.01	49.	1.03	22.30	282	0.00	0.00	0.
1.02	9.15	133	.08	.07	.01	49.	1.03	22.45	283	0.00	0.00	0.
1.02	9.30	134	.08	.07	.01	49.	1.03	23.00	284	0.00	0.00	0.
1.02	9.45	135	.08	.07	.01	49.	1.03	23.15	285	0.00	0.00	0.
1.02	10.00	136	.08	.07	.01	49.	1.03	23.30	286	0.00	0.00	0.
1.02	10.15	137	.08	.07	.01	49.	1.03	23.45	287	0.00	0.00	0.
1.02	10.30	138	.08	.07	.01	49.	1.04	0.00	288	0.00	0.00	0.
1.02	10.45	139	.08	.07	.01	49.	1.04	.15	289	0.00	0.00	0.
1.02	11.00	140	.08	.07	.01	49.	1.04	.30	290	0.00	0.00	0.
1.02	11.15	141	.08	.07	.01	49.	1.04	.45	291	0.00	0.00	0.
1.02	11.30	142	.08	.07	.01	49.	1.04	1.00	292	0.00	0.00	0.
1.02	11.45	143	.08	.07	.01	49.	1.04	1.15	293	0.00	0.00	0.
1.02	12.00	144	.08	.07	.01	49.	1.04	1.30	294	0.00	0.00	0.
1.02	12.15	145	.53	.52	.01	141.	1.04	1.45	295	0.00	0.00	0.
1.02	12.30	146	.53	.52	.01	141.	1.04	2.00	296	0.00	0.00	0.
1.02	12.45	147	.53	.52	.01	228.	1.04	2.15	297	0.00	0.00	0.
1.02	13.00	148	.53	.52	.01	298.	1.04	2.30	298	0.00	0.00	0.
1.02	13.15	149	.64	.62	.01	342.	1.04	2.45	299	0.00	0.00	0.
1.02	13.30	150	.64	.62	.01	380.	1.04	3.00	300	0.00	0.00	0.

SUM 26.70 24.30 2.40 18730.  
( 678.)( 617.)( 61.)( 530.37)

PEAK	1478.	630.	187.	65.	18743.
CFS					
CMS	42.	18.	5.	2.	531.
INCHES		20.21	24.00	25.05	25.05
MM		513.22	609.55	636.27	636.28
AC-FT		312.	371.	387.	387.
THOUS CU M		385.	456.	476.	478.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 1

PEAK	148.	63.	19.	7.	1874.
CFS					
CMS	4.	2.	1.	0.	53.
INCHES		2.02	2.40	2.50	2.51
MM		51.32	60.96	63.63	63.63
AC-FT		31.	37.	39.	39.
THOUS CU M		39.	46.	48.	48.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 2

PEAK	296.	126.	37.	13.	3749.
CFS					
CMS	8.	4.	1.	0.	106.
INCHES		4.04	4.80	5.01	5.01
MM		102.64	121.91	127.25	127.26
AC-FT		62.	74.	77.	77.
THOUS CU M		77.	92.	96.	96.

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HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	443.	189.	56.	20.	5823.
CMS	13.	5.	2.	1.	159.
INCHES		6.06	7.20	7.51	7.52
MM		153.96	182.87	190.88	190.88
AC-FT		94.	111.	116.	116.
THOUS CU M		116.	137.	143.	143.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	591.	252.	75.	26.	7497.
CMS	17.	7.	2.	1.	212.
INCHES		8.08	9.60	10.02	10.02
MM		205.29	243.82	254.51	254.51
AC-FT		125.	148.	155.	155.
THOUS CU M		154.	183.	191.	191.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	739.	315.	94.	33.	9371.
CMS	21.	9.	3.	1.	265.
INCHES		10.10	12.00	12.52	12.52
MM		256.61	304.78	318.13	318.14
AC-FT		156.	185.	194.	194.
THOUS CU M		193.	229.	239.	239.

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HYDROGRAPH ROUTING

ROUTING THROUGH UPPER RESERVOIR

STAGE	121.00	121.20	121.30	121.50	121.70	123.00	127.00	133.00
FLOW	0.00	10.00	20.00	34.00	38.50	42.00	55.00	69.50
SURFACE AREA	0.	18.	32.					

SA 21













0.	0.	1.	2.	3.	4.	5.	6.
7.	7.	6.	6.	6.	6.	5.	5.
8.	4.	3.	4.	3.	3.	3.	3.
9.	2.	2.	2.	2.	2.	2.	2.
10.	2.	2.	2.	2.	2.	2.	2.
11.	3.	3.	3.	3.	3.	3.	3.
12.	3.	3.	3.	3.	3.	3.	3.
13.	4.	4.	5.	5.	6.	7.	7.
14.	9.	10.	10.	10.	11.	12.	12.
15.	13.	16.	16.	16.	25.	31.	35.
16.	37.	39.	40.	40.	41.	42.	42.
17.	43.	45.	47.	48.	48.	48.	48.
18.	49.	49.	48.	48.	48.	48.	48.
19.	48.	47.	47.	47.	47.	47.	47.
20.	46.	46.	46.	46.	46.	46.	46.
21.	45.	45.	45.	45.	45.	45.	45.
22.	44.	43.	43.	43.	43.	43.	43.
23.	42.	42.	42.	42.	42.	42.	42.
24.	41.	41.	41.	41.	41.	41.	41.
25.	40.	40.	40.	40.	40.	40.	40.
26.	39.	39.	38.	37.	36.	35.	34.
27.	27.	23.	21.	18.	16.	14.	12.
28.	9.	8.	7.	6.	6.	6.	6.
29.	5.	4.	4.	3.	3.	3.	3.
30.	2.	2.	2.	2.	2.	1.	1.

STORAGE

14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.
13.	13.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	13.	13.
15.	15.	15.	15.	15.	15.	15.	15.
14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.
16.	16.	16.	16.	16.	16.	16.	16.
16.	17.	17.	17.	17.	17.	17.	17.
24.	25.	29.	32.	34.	37.	40.	44.
57.	65.	76.	79.	82.	85.	87.	89.
91.	91.	91.	90.	89.	88.	88.	87.
86.	85.	84.	83.	82.	81.	80.	80.
78.	77.	76.	75.	74.	73.	72.	71.
70.	69.	67.	66.	65.	64.	63.	62.
61.	60.	58.	57.	56.	55.	54.	53.
56.	51.	50.	49.	48.	47.	46.	45.
44.	43.	42.	41.	40.	39.	38.	37.
35.	35.	34.	32.	31.	30.	29.	28.
27.	26.	26.	24.	23.	22.	21.	20.
20.	19.	18.	18.	17.	17.	16.	16.
16.	16.	16.	15.	15.	15.	15.	15.
15.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.

STAGE

121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.0
121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0

5126







PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
121.8	122.0	122.5	122.7	123.1
124.3	124.8	125.6	125.8	126.1
126.4	126.4	126.4	126.3	126.2
126.2	126.2	126.0	126.0	125.9
125.8	125.8	125.7	125.6	125.5
125.4	125.4	125.3	125.2	125.1
125.0	124.9	124.8	124.7	124.6
124.6	124.5	124.4	124.3	124.2
124.1	124.0	123.9	123.8	123.7
123.7	123.6	123.5	123.4	123.3
123.2	123.1	123.0	122.9	122.8
122.8	122.7	122.6	122.5	122.4
122.3	122.3	122.2	122.1	122.0
121.9	121.8	121.7	121.6	121.5
121.5	121.4	121.4	121.3	121.3

PEAK OUTFLOW IS 53. AT TIME 43.00 HOURS

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
53.	52.	48.	26.	1400.
2.	1.	1.	1.	210.
	1.68	6.20	9.84	9.89
	42.63	157.38	249.98	251.20
	26.	91.	152.	153.
	32.	113.	186.	189.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

STATION OUTFLO, PLAN 1, RATIO 5  
END-OF-PERIOD HYDROGRAPH UOINMATES

OUTFLOW	OUTFLOW	OUTFLOW	OUTFLOW	OUTFLOW
5.	4.	3.	3.	3.
2.	2.	2.	2.	1.
1.	1.	1.	1.	1.
0.	0.	0.	0.	0.
0.	0.	0.	0.	0.
0.	0.	0.	0.	0.
0.	0.	0.	0.	0.
0.	0.	0.	0.	0.
11.	11.	10.	10.	10.
8.	7.	6.	6.	9.
4.	4.	3.	3.	5.
3.	3.	4.	4.	3.
4.	5.	5.	5.	4.
5.	7.	9.	10.	5.
15.	18.	19.	20.	13.
22.	22.	23.	25.	11.
39.	40.	41.	42.	21.
49.	51.	52.	55.	21.
57.	57.	57.	57.	39.
56.	56.	56.	56.	45.
55.	55.	55.	55.	47.
54.	54.	54.	54.	56.
53.	53.	52.	52.	56.
51.	51.	51.	51.	55.
50.	50.	49.	49.	53.
49.	48.	48.	48.	52.
47.	47.	46.	46.	50.
46.	45.	45.	45.	49.
44.	44.	44.	44.	47.
				46.
				45.
				43.
				43.

5429

43.	41.	43.	41.	42.	41.	42.	41.	42.	41.	42.	41.	42.	41.	42.	41.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.
16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
17.	17.	17.	17.	17.	17.	17.	17.	17.	17.	17.	17.	17.	17.	17.	17.
18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.
18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.
31.	31.	35.	38.	42.	47.	51.	56.	62.	68.	79.	88.	99.	112.	124.	145.
92.	106.	153.	154.	149.	141.	136.	131.	124.	118.	111.	107.	108.	108.	105.	104.
149.	149.	140.	131.	130.	129.	128.	127.	126.	124.	122.	121.	119.	118.	115.	114.
132.	131.	120.	119.	118.	117.	116.	115.	114.	113.	112.	111.	110.	109.	108.	107.
121.	110.	100.	99.	98.	97.	96.	95.	94.	93.	92.	91.	90.	89.	88.	87.
51.	90.	80.	74.	78.	77.	76.	75.	74.	73.	72.	71.	70.	69.	68.	67.
71.	70.	61.	60.	59.	58.	57.	56.	55.	54.	53.	52.	51.	50.	49.	48.
53.	52.	44.	43.	42.	41.	40.	39.	38.	37.	36.	35.	34.	33.	32.	31.
45.	44.	35.	33.	32.	31.	30.	29.	28.	27.	26.	25.	24.	23.	22.	21.

STORAGE

STAGE

43.	41.	43.	41.	42.	41.	42.	41.	42.	41.	42.	41.	42.	41.	42.	41.
121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1
121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0
121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2
121.2	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1
121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1
121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1	121.1
121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3
121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3
122.0	122.2	122.4	122.4	122.6	122.6	122.6	122.6	122.6	122.6	122.6	122.6	122.6	122.6	122.6	122.6
125.1	125.7	127.1	127.7	127.7	127.7	127.7	127.7	127.7	127.7	127.7	127.7	127.7	127.7	127.7	127.7
127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5
127.2	127.1	127.1	127.1	127.1	127.1	127.1	127.1	127.1	127.1	127.1	127.1	127.1	127.1	127.1	127.1
126.8	126.7	126.7	126.7	126.7	126.7	126.7	126.7	126.7	126.7	126.7	126.7	126.7	126.7	126.7	126.7
126.4	126.3	126.3	126.3	126.3	126.3	126.3	126.3	126.3	126.3	126.3	126.3	126.3	126.3	126.3	126.3
125.9	125.9	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8
125.5	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4	125.4
125.0	125.0	124.9	124.9	124.9	124.9	124.9	124.9	124.9	124.9	124.9	124.9	124.9	124.9	124.9	124.9
124.6	124.5	124.5	124.5	124.5	124.5	124.5	124.5	124.5	124.5	124.5	124.5	124.5	124.5	124.5	124.5

24 30

124.1 124.1 124.0 123.9 123.8 123.7 123.7 123.7  
 123.7 123.6 123.5 123.4 123.4 123.3 123.3 123.2  
 123.2 123.1 123.0 122.9 122.9 122.9 122.8 122.8  
 122.8 122.7 122.6 122.6 122.5 122.5 122.4 122.4

PEAK OUTFLOW IS 57. AT TIME 43.00 HOURS

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME  
 57. 56. 52. 29. 8285.  
 2. 1. 1. 235.  
 1.80 6.73 11.03 11.07  
 45.78 170.66 280.04 281.26  
 28. 104. 170. 171.  
 34. 128. 210. 211.  
 TMUS CU M

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SUB-AREA RUNOFF COMPUTATION

RUNOFF TO LOWER RESERVOIR

ISTAU ICOMP IECON ITAPE JPLI JPHT IMAHE ISTAGE IAUTO  
 INFLOW 0 0 0 0 0 0 0 0  
 IHYDG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL  
 1 2 .11 0.00 0.40 0.00 0.00 0 0 1 0  
 HYDROGRAPH DATA

SPFE PMS M48 M48 M48 M48 M48 M48 M48 M48  
 0.00 23.50 113.00 123.00 132.00 142.00 0.00 0.00  
 TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LHOPT STRKN DLTKR RTIOL ERAIN STRKS RTIOL SIRTOL CWSL ALSMA RTIMP  
 0 0.00 0.00 1.00 1.00 0.00 0.00 1.00 1.00 1.00 0.00 0.00 0.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .50

RECESSION DATA

SIRTUE -1.50 QKCSN= -.05 RTIOL= 2.00

UNIT HYDROGRAPH 12 END OF PERIOD ORIGINATES, TC= 13. 0.00 HOURS, LAG= .50 VOL= 1.00 1.  
 27. 80. 48. 24. 7. 3. 2. 1.

END-OF-PERIOD FLOW

MO.DA	HK.MN	PERIOD	RAIN	EACS	LOSS	COMP 0	MU.DA	HK.MN	PERIOD	RAIN	EACS	LOSS	COMP 0
1.01	.15	1	.00	0.00	.00	0.	1.02	13.45	151	.64	.62	.01	164.
1.01	.30	2	.00	0.00	.00	0.	1.02	14.00	152	.64	.62	.01	170.
1.01	.45	3	.00	0.00	.00	0.	1.02	14.15	153	.80	.78	.01	178.
1.01	1.00	4	.00	0.00	.00	0.	1.02	14.30	154	.80	.78	.01	192.
1.01	1.15	5	.00	0.00	.00	0.	1.02	14.45	155	.80	.78	.01	206.
1.01	1.30	6	.00	0.00	.00	0.	1.02	15.00	156	.80	.78	.01	214.
1.01	1.45	7	.00	0.00	.00	0.	1.02	15.15	157	.81	.79	.01	218.

JK 31



1.01	2.00	8	.00	0.00	.00	1.02	15.30	159	1.61	1.60	.01	243.
1.01	2.15	9	.00	0.00	.00	1.02	15.45	159	4.52	4.51	.01	386.
1.01	2.30	10	.00	0.00	.00	1.02	16.00	160	1.13	1.12	.01	593.
1.01	2.45	11	.00	0.00	.00	1.02	16.15	161	.74	.73	.01	583.
1.01	3.00	12	.00	0.00	.00	1.02	16.30	162	.74	.73	.01	442.
1.01	3.15	13	.00	0.00	.00	1.02	16.45	163	.74	.73	.01	328.
1.01	3.30	14	.00	0.00	.00	1.02	17.00	164	.74	.73	.01	270.
1.01	3.45	15	.00	0.00	.00	1.02	17.15	165	.58	.57	.01	236.
1.01	4.00	16	.00	0.00	.00	1.02	17.30	166	.58	.57	.01	208.
1.01	4.15	17	.00	0.00	.00	1.02	17.45	167	.58	.57	.01	187.
1.01	4.30	18	.00	0.00	.00	1.02	18.00	168	.58	.57	.01	175.
1.01	4.45	19	.00	0.00	.00	1.02	18.15	169	.04	.03	.01	155.
1.01	5.00	20	.00	0.00	.00	1.02	18.30	170	.04	.03	.01	108.
1.01	5.15	21	.00	0.00	.00	1.02	18.45	171	.04	.03	.01	63.
1.01	5.30	22	.00	0.00	.00	1.02	19.00	172	.04	.03	.01	36.
1.01	5.45	23	.00	0.00	.00	1.02	19.15	173	.04	.03	.01	29.
1.01	6.00	24	.00	0.00	.00	1.02	19.30	174	.04	.03	.01	27.
1.01	6.15	25	.01	0.00	.01	1.02	19.45	175	.04	.03	.01	25.
1.01	6.30	26	.01	0.00	.01	1.02	20.00	176	.04	.03	.01	23.
1.01	6.45	27	.01	0.00	.01	1.02	20.15	177	.04	.03	.01	22.
1.01	7.00	28	.01	0.00	.01	1.02	20.30	178	.04	.03	.01	20.
1.01	7.15	29	.01	0.00	.01	1.02	20.45	179	.04	.03	.01	19.
1.01	7.30	30	.01	0.00	.01	1.02	21.00	180	.04	.03	.01	18.
1.01	7.45	31	.01	0.00	.01	1.02	21.15	181	.04	.03	.01	16.
1.01	8.00	32	.01	0.00	.01	1.02	21.30	182	.04	.03	.01	15.
1.01	8.15	33	.01	0.00	.01	1.02	21.45	183	.04	.03	.01	14.
1.01	8.30	34	.01	0.00	.01	1.02	22.00	184	.04	.03	.01	13.
1.01	8.45	35	.01	0.00	.01	1.02	22.15	185	.04	.03	.01	12.
1.01	9.00	36	.01	0.00	.01	1.02	22.30	186	.04	.03	.01	12.
1.01	9.15	37	.01	0.00	.01	1.02	22.45	187	.04	.03	.01	11.
1.01	9.30	38	.01	0.00	.01	1.02	23.00	188	.04	.03	.01	10.
1.01	9.45	39	.01	0.00	.01	1.02	23.15	189	.04	.03	.01	9.
1.01	10.00	40	.01	0.00	.01	1.02	23.30	190	.04	.03	.01	9.
1.01	10.15	41	.01	0.00	.01	1.02	23.45	191	.04	.03	.01	8.
1.01	10.30	42	.01	0.00	.01	1.03	0.00	192	.04	.03	.01	8.
1.01	10.45	43	.01	0.00	.01	1.03	.15	193	0.00	0.00	0.00	8.
1.01	11.00	44	.01	0.00	.01	1.03	.30	194	0.00	0.00	0.00	7.
1.01	11.15	45	.01	0.00	.01	1.03	.45	195	0.00	0.00	0.00	7.
1.01	11.30	46	.01	0.00	.01	1.03	1.00	196	0.00	0.00	0.00	6.
1.01	11.45	47	.01	0.00	.01	1.03	1.15	197	0.00	0.00	0.00	6.
1.01	12.00	48	.01	0.00	.01	1.03	1.30	198	0.00	0.00	0.00	6.
1.01	12.15	49	.04	0.00	.04	1.03	1.45	199	0.00	0.00	0.00	5.
1.01	12.30	50	.04	0.00	.04	1.03	2.00	200	0.00	0.00	0.00	5.
1.01	12.45	51	.04	0.00	.04	1.03	2.15	201	0.00	0.00	0.00	5.
1.01	13.00	52	.04	0.00	.04	1.03	2.30	202	0.00	0.00	0.00	5.
1.01	13.15	53	.05	0.00	.05	1.03	2.45	203	0.00	0.00	0.00	4.
1.01	13.30	54	.05	0.00	.05	1.03	3.00	204	0.00	0.00	0.00	4.
1.01	13.45	55	.05	0.00	.05	1.03	3.15	205	0.00	0.00	0.00	3.
1.01	14.00	56	.05	0.00	.05	1.03	3.30	206	0.00	0.00	0.00	3.
1.01	14.15	57	.06	0.00	.06	1.03	3.45	207	0.00	0.00	0.00	3.
1.01	14.30	58	.06	0.00	.06	1.03	4.00	208	0.00	0.00	0.00	3.
1.01	14.45	59	.06	0.00	.06	1.03	4.15	209	0.00	0.00	0.00	3.
1.01	15.00	60	.06	0.00	.06	1.03	4.30	210	0.00	0.00	0.00	2.
1.01	15.15	61	.06	0.00	.06	1.03	4.45	211	0.00	0.00	0.00	2.
1.01	15.30	62	.12	0.00	.12	1.03	5.00	212	0.00	0.00	0.00	2.
1.01	15.45	63	.34	.30	.04	1.03	5.15	213	0.00	0.00	0.00	2.
1.01	16.00	64	.09	.07	.01	1.03	5.30	214	0.00	0.00	0.00	2.
1.01	16.15	65	.06	.04	.01	1.03	5.45	215	0.00	0.00	0.00	2.
1.01	16.30	66	.06	.04	.01	1.03	6.00	216	0.00	0.00	0.00	2.
1.01	16.45	67	.06	.04	.01	1.03	6.15	217	0.00	0.00	0.00	1.
1.01	17.00	68	.06	.04	.01	1.03	6.30	218	0.00	0.00	0.00	1.
1.01	17.15	69	.04	.03	.01	1.03	6.45	219	0.00	0.00	0.00	1.

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1.01	17.30	70	.04	.03	.01	12.	1.03	7.00	220	0.00	0.00	0.00	0.00	1.
1.01	17.45	71	.04	.03	.01	11.	1.03	7.15	221	0.00	0.00	0.00	0.00	1.
1.01	18.00	72	.04	.03	.01	10.	1.03	7.30	222	0.00	0.00	0.00	0.00	1.
1.01	18.15	73	.00	0.00	.00	9.	1.03	7.45	223	0.00	0.00	0.00	0.00	1.
1.01	18.30	74	.00	0.00	.00	6.	1.03	8.00	224	0.00	0.00	0.00	0.00	1.
1.01	18.45	75	.00	0.00	.00	3.	1.03	8.15	225	0.00	0.00	0.00	0.00	1.
1.01	19.00	76	.00	0.00	.00	2.	1.03	8.30	226	0.00	0.00	0.00	0.00	1.
1.01	19.15	77	.00	0.00	.00	1.	1.03	8.45	227	0.00	0.00	0.00	0.00	1.
1.01	19.30	78	.00	0.00	.00	1.	1.03	9.00	228	0.00	0.00	0.00	0.00	1.
1.01	19.45	79	.00	0.00	.00	1.	1.03	9.15	229	0.00	0.00	0.00	0.00	1.
1.01	20.00	80	.00	0.00	.00	1.	1.03	9.30	230	0.00	0.00	0.00	0.00	1.
1.01	20.15	81	.00	0.00	.00	1.	1.03	9.45	231	0.00	0.00	0.00	0.00	1.
1.01	20.30	82	.00	0.00	.00	1.	1.03	10.00	232	0.00	0.00	0.00	0.00	1.
1.01	20.45	83	.00	0.00	.00	1.	1.03	10.15	233	0.00	0.00	0.00	0.00	0.
1.01	21.00	84	.00	0.00	.00	1.	1.03	10.30	234	0.00	0.00	0.00	0.00	0.
1.01	21.15	85	.00	0.00	.00	1.	1.03	10.45	235	0.00	0.00	0.00	0.00	0.
1.01	21.30	86	.00	0.00	.00	1.	1.03	11.00	236	0.00	0.00	0.00	0.00	0.
1.01	21.45	87	.00	0.00	.00	1.	1.03	11.15	237	0.00	0.00	0.00	0.00	0.
1.01	22.00	88	.00	0.00	.00	1.	1.03	11.30	238	0.00	0.00	0.00	0.00	0.
1.01	22.15	89	.00	0.00	.00	1.	1.03	11.45	239	0.00	0.00	0.00	0.00	0.
1.01	22.30	90	.00	0.00	.00	1.	1.03	12.00	240	0.00	0.00	0.00	0.00	0.
1.01	22.45	91	.00	0.00	.00	1.	1.03	12.15	241	0.00	0.00	0.00	0.00	0.
1.01	23.00	92	.00	0.00	.00	1.	1.03	12.30	242	0.00	0.00	0.00	0.00	0.
1.01	23.15	93	.00	0.00	.00	0.	1.03	12.45	243	0.00	0.00	0.00	0.00	0.
1.01	23.30	94	.00	0.00	.00	0.	1.03	13.00	244	0.00	0.00	0.00	0.00	0.
1.01	23.45	95	.00	0.00	.00	0.	1.03	13.15	245	0.00	0.00	0.00	0.00	0.
1.02	0.00	96	.00	0.00	.00	0.	1.03	13.30	246	0.00	0.00	0.00	0.00	0.
1.02	.15	97	.03	.02	.01	0.	1.03	13.45	247	0.00	0.00	0.00	0.00	0.
1.02	.30	98	.03	.02	.01	2.	1.03	14.00	248	0.00	0.00	0.00	0.00	0.
1.02	.45	99	.03	.02	.01	3.	1.03	14.15	249	0.00	0.00	0.00	0.00	0.
1.02	1.00	100	.03	.02	.01	4.	1.03	14.30	250	0.00	0.00	0.00	0.00	0.
1.02	1.15	101	.03	.02	.01	4.	1.03	14.45	251	0.00	0.00	0.00	0.00	0.
1.02	1.30	102	.03	.02	.01	4.	1.03	15.00	252	0.00	0.00	0.00	0.00	0.
1.02	1.45	103	.03	.02	.01	4.	1.03	15.15	253	0.00	0.00	0.00	0.00	0.
1.02	2.00	104	.03	.02	.01	4.	1.03	15.30	254	0.00	0.00	0.00	0.00	0.
1.02	2.15	105	.03	.02	.01	4.	1.03	15.45	255	0.00	0.00	0.00	0.00	0.
1.02	2.30	106	.03	.02	.01	4.	1.03	16.00	256	0.00	0.00	0.00	0.00	0.
1.02	2.45	107	.03	.02	.01	4.	1.03	16.15	257	0.00	0.00	0.00	0.00	0.
1.02	3.00	108	.03	.02	.01	4.	1.03	16.30	258	0.00	0.00	0.00	0.00	0.
1.02	3.15	109	.03	.02	.01	4.	1.03	16.45	259	0.00	0.00	0.00	0.00	0.
1.02	3.30	110	.03	.02	.01	4.	1.03	17.00	260	0.00	0.00	0.00	0.00	0.
1.02	3.45	111	.03	.02	.01	4.	1.03	17.15	261	0.00	0.00	0.00	0.00	0.
1.02	4.00	112	.03	.02	.01	4.	1.03	17.30	262	0.00	0.00	0.00	0.00	0.
1.02	4.15	113	.03	.02	.01	4.	1.03	17.45	263	0.00	0.00	0.00	0.00	0.
1.02	4.30	114	.03	.02	.01	4.	1.03	18.00	264	0.00	0.00	0.00	0.00	0.
1.02	4.45	115	.03	.02	.01	4.	1.03	18.15	265	0.00	0.00	0.00	0.00	0.
1.02	5.00	116	.03	.02	.01	4.	1.03	18.30	266	0.00	0.00	0.00	0.00	0.
1.02	5.15	117	.03	.02	.01	4.	1.03	18.45	267	0.00	0.00	0.00	0.00	0.
1.02	5.30	118	.03	.02	.01	4.	1.03	19.00	268	0.00	0.00	0.00	0.00	0.
1.02	5.45	119	.03	.02	.01	4.	1.03	19.15	269	0.00	0.00	0.00	0.00	0.
1.02	6.00	120	.03	.02	.01	4.	1.03	19.30	270	0.00	0.00	0.00	0.00	0.
1.02	6.15	121	.08	.07	.01	6.	1.03	19.45	271	0.00	0.00	0.00	0.00	0.
1.02	6.30	122	.08	.07	.01	10.	1.03	20.00	272	0.00	0.00	0.00	0.00	0.
1.02	6.45	123	.08	.07	.01	16.	1.03	20.15	273	0.00	0.00	0.00	0.00	0.
1.02	7.00	124	.08	.07	.01	16.	1.03	20.30	274	0.00	0.00	0.00	0.00	0.
1.02	7.15	125	.08	.07	.01	17.	1.03	20.45	275	0.00	0.00	0.00	0.00	0.
1.02	7.30	126	.06	.07	.01	18.	1.03	21.00	276	0.00	0.00	0.00	0.00	0.
1.02	7.45	127	.08	.07	.01	18.	1.03	21.15	277	0.00	0.00	0.00	0.00	0.
1.02	8.00	128	.08	.07	.01	19.	1.03	21.30	278	0.00	0.00	0.00	0.00	0.
1.02	8.15	129	.08	.07	.01	19.	1.03	21.45	279	0.00	0.00	0.00	0.00	0.
1.02	8.30	130	.08	.07	.01	19.	1.03	22.00	280	0.00	0.00	0.00	0.00	0.
1.02	8.45	131	.08	.07	.01	19.	1.03	22.15	281	0.00	0.00	0.00	0.00	0.

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1.02	9.00	132	.08	.07	.01	19.	1.03	22.30	262	0.00	0.00	0.00	
1.02	9.15	133	.08	.07	.01	19.	1.03	22.45	263	0.00	0.00	0.00	
1.02	9.30	134	.08	.07	.01	19.	1.03	23.00	284	0.00	0.00	0.00	
1.02	9.45	135	.08	.07	.01	19.	1.03	23.15	285	0.00	0.00	0.00	
1.02	10.00	136	.08	.07	.01	19.	1.03	23.30	286	0.00	0.00	0.00	
1.02	10.15	137	.08	.07	.01	19.	1.03	23.45	287	0.00	0.00	0.00	
1.02	10.30	138	.08	.07	.01	19.	1.04	0.00	288	0.00	0.00	0.00	
1.02	10.45	139	.08	.07	.01	19.	1.04	.15	289	0.00	0.00	0.00	
1.02	11.00	140	.08	.07	.01	19.	1.04	.30	290	0.00	0.00	0.00	
1.02	11.15	141	.08	.07	.01	19.	1.04	.45	291	0.00	0.00	0.00	
1.02	11.30	142	.08	.07	.01	19.	1.04	1.00	292	0.00	0.00	0.00	
1.02	11.45	143	.08	.07	.01	19.	1.04	1.15	293	0.00	0.00	0.00	
1.02	12.00	144	.08	.07	.01	19.	1.04	1.30	294	0.00	0.00	0.00	
1.02	12.15	145	.53	.52	.01	31.	1.04	1.45	295	0.00	0.00	0.00	
1.02	12.30	146	.53	.52	.01	67.	1.04	2.00	296	0.00	0.00	0.00	
1.02	12.45	147	.53	.52	.01	103.	1.04	2.15	297	0.00	0.00	0.00	
1.02	13.00	148	.53	.52	.01	125.	1.04	2.30	298	0.00	0.00	0.00	
1.02	13.15	149	.64	.62	.01	138.	1.04	2.45	299	0.00	0.00	0.00	
1.02	13.30	150	.64	.62	.01	152.	1.04	3.00	300	0.00	0.00	0.00	
SUM										26.70	24.30	2.40	7122.
										( 678.1)	( 617.1)	( 61.1)	( 201.67)

PEAK	593.	71.	25.	TOTAL VOLUME
	17.	2.	1.	7134.
CFS				202.
CMS	20.28	24.07	25.14	25.14
INCHES	515.12	611.42	638.53	638.53
MM				147.
AC-FT	114.	141.	147.	182.
THOUS CU M	147.	174.	182.	

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 1

PEAK	59.	7.	2.	TOTAL VOLUME
	2.	0.	0.	713.
CFS				20.
CMS	1.	2.41	2.51	2.51
INCHES	2.03	61.14	63.85	63.85
MM	51.51	14.	15.	15.
AC-FT	12.	17.	18.	18.
THOUS CU M	15.			

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 2

PEAK	114.	14.	5.	TOTAL VOLUME
	3.	0.	0.	1427.
CFS				40.
CMS	4.06	4.81	5.03	5.03
INCHES	103.02	122.28	127.71	127.71
MM	24.	28.	29.	29.
AC-FT	29.	35.	36.	36.
THOUS CU M				

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 3

PEAK	178.	21.	0.	TOTAL VOLUME
	5.	1.	0.	2140.
CFS				61.
CMS	72.	7.	7.	7.

44 34



INCHES  
 MM  
 AC-FT  
 THOUS CU M

6.08 7.22 7.54  
 154.54 183.43 191.56  
 36. 42. 44.  
 44. 52. 55.

7.54  
 191.56  
 44.  
 55.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 4

CFS  
 CMS  
 INCHES  
 MM  
 AC-FT  
 THOUS CU M

PEAK 237.  
 7.  
 8.11  
 206.05  
 48.  
 59.

24-HOUR 28.  
 1.  
 9.63  
 244.57  
 56.  
 70.

72-HOUR 10.  
 0.  
 10.06  
 255.41  
 59.  
 73.

TOTAL VOLUME  
 2854.  
 81.  
 10.06  
 255.41  
 59.  
 73.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 5

CFS  
 CMS  
 INCHES  
 MM  
 AC-FT  
 THOUS CU M

PEAK 297.  
 8.  
 10.14  
 257.56  
 54.  
 73.

24-HOUR 36.  
 1.  
 12.04  
 305.71  
 71.  
 87.

72-HOUR 12.  
 0.  
 12.57  
 319.27  
 74.  
 91.

TOTAL VOLUME  
 3567.  
 101.  
 12.57  
 319.27  
 74.  
 91.

CUMBIENE HYDROGRAPHS

CUMBINING RUNOFF AND UPPER RESEVOIR OUTFLOW

ISTAO ICOMP 2 IECON 0 ITAPE 0 JPLI 0 JPRT 0 INAME 1 IAUO 0  
 CUMBIN 2 0 0 0 0 0 0 0 0

SUM OF 2 HYDROGRAPHS AT CUMBIN PLAN 1 RTIO 1

CFS  
 CMS  
 INCHES  
 MM  
 AC-FT  
 THOUS CU M

PEAK 97.  
 3.  
 1.33  
 33.79  
 28.  
 35.

24-HOUR 25.  
 1.  
 2.36  
 60.04  
 50.  
 62.

72-HOUR 9.  
 0.  
 2.57  
 65.27  
 55.  
 68.

TOTAL VOLUME  
 2652.  
 75.  
 2.57  
 65.27  
 55.  
 68.

SUM OF 2 HYDROGRAPHS AT CUMBIN PLAN 1 RTIO 2

CFS  
 CMS  
 INCHES

PEAK 154.  
 4.  
 86.  
 2.00  
 4.53

24-HOUR 49.  
 1.  
 4.9  
 4.53

72-HOUR 18.  
 1.  
 1.1  
 5.07

TOTAL VOLUME  
 5239.  
 108.  
 5.08

MM 50.80 115.05 128.90 128.95  
 AC-FI 4.3 97. 106.  
 THOUS CU M 53. 119. 133. 136.

SUM OF 2 HYDROGRAPHS AT COMBIN PLAN 1 RTIO 3

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME  
 220. 113. 63. 27. 7813.  
 CFS 6. 3. 2. 1. 221.  
 CMS 2.64 5.88 7.55 7.57  
 INCMS 87.01 144.34 191.77 192.28  
 MM 56. 125. 161. 161.  
 AC-FI 64. 155. 199. 199.  
 THOUS CU M

SUM OF 2 HYDROGRAPHS AT COMBIN PLAN 1 RTIO 4

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME  
 282. 140. 74. 35. 10253.  
 CFS 4. 2. 1. 290.  
 CMS 3.26 6.88 9.90 9.94  
 INCMS 82.76 174.75 251.47 252.36  
 MM 69. 147. 211. 212.  
 AC-FI 86. 181. 260. 261.  
 THOUS CU M

SUM OF 2 HYDROGRAPHS AT COMBIN PLAN 1 RTIO 5

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME  
 343. 167. 84. 41. 11852.  
 CFS 10. 5. 2. 1. 336.  
 CMS 3.87 7.85 11.45 11.48  
 INCMS 98.37 199.34 290.81 291.71  
 MM 83. 167. 244. 245.  
 AC-FI 102. 206. 301. 302.  
 THOUS CU M

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HYDROGRAPH ROUTING

ROUTING THROUGH LOWER RESERVOIR

JK

ISTAU ICOMP IECUM IITAPE JPLT JPMT INAME ISTAGE IAUTU  
 0 0 0 0 0 0 0 0 0  
 UINFLO  
 CLOSS CROSS AVG ROUTING DATA IOPT IPMP LSTR  
 0.0 0.00 0.00 1 1 0 0 0  
 NSTPS NSTUL LAG AMSKK X TSK STORA ISPRAT  
 1 0 0 0.000 0.000 0.000 -115. 0







STATION OUTFLO, PLAN 1, MATIU 2  
 END-OF-PERIOD HYDROGRAPH ORDINATES

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	1.	1.	1.	1.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
3.	3.	3.	3.	3.	3.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	5.	5.	5.	5.	5.	5.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
11.	12.	14.	16.	18.	20.	22.	25.	28.	32.	36.	41.	48.	58.	72.	90.	110.	138.	162.	186.
67.	80.	95.	110.	126.	142.	159.	176.	194.	212.	230.	249.	268.	288.	308.	328.	348.	368.	388.	408.
47.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.	44.
42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
27.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.
22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.
17.	17.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.	16.
13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.	13.
10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
8.	8.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
18.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.	14.
19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.	19.
20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.	21.
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22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.
24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.	24.
28.	29.	31.	32.	33.	34.	35.	37.	40.	44.	50.	58.	69.	84.	103.	127.	156.	191.	232.	279.
34.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.	39.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
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3432

38. 38. 37. 37. 37. 37. 36. 36. 36.  
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 116.7 116.7 116.7 116.7 116.7 116.7 116.7 116.7 116.7  
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 115.7 115.7 115.7 115.7 115.7 115.7 115.7 115.7 115.7

STAGE  
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 117.1 117.1 117.1 117.1 117.1 117.1 117.1 117.1 117.1  
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 116.9 116.9 116.9 116.9 116.9 116.9 116.9 116.9 116.9  
 116.7 116.7 116.7 116.7 116.7 116.7 116.7 116.7 116.7  
 116.5 116.5 116.5 116.5 116.5 116.5 116.5 116.5 116.5  
 116.2 116.2 116.2 116.2 116.2 116.2 116.2 116.2 116.2  
 116.0 116.0 116.0 116.0 116.0 116.0 116.0 116.0 116.0  
 115.9 115.9 115.9 115.9 115.9 115.9 115.9 115.9 115.9  
 115.7 115.7 115.7 115.7 115.7 115.7 115.7 115.7 115.7

PEAK 142. 142. 142. 142. 142. 142. 142. 142. 142.  
 CFS 1.72 4.10 4.10 4.10 4.10 4.10 4.10 4.10 4.10  
 INCHES 37. 88. 88. 88. 88. 88. 88. 88. 88.  
 AC-FT 37. 88. 88. 88. 88. 88. 88. 88. 88.  
 THOUS CU M 45. 108. 108. 108. 108. 108. 108. 108. 108.

6-HOUR 14. 14. 14. 14. 14. 14. 14. 14. 14.  
 24-HOUR 44. 44. 44. 44. 44. 44. 44. 44. 44.  
 72-HOUR 17. 17. 17. 17. 17. 17. 17. 17. 17.  
 TOTAL VOLUME 5007. 5007. 5007. 5007. 5007. 5007. 5007. 5007. 5007.

STATION OUTFLOW PLAN 1, RATIO 3  
 END-OF-PERIOD HYDROGRAPH ORDINATES  
 OUTFLOW  
 0. 0. 0. 0. 0. 0. 0. 0. 0.  
 0. 0. 0. 0. 0. 0. 0. 0. 0.  
 1. 1. 1. 1. 1. 1. 1. 1. 1.

9440















117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0  
 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0  
 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0  
 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0  
 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0 117.0

PEAK OUTFLOW IS 333. AT TIME 40.25 HOURS

CFS	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
333.	161.	62.	38.	10878.
9.	5.	2.	1.	304.
	3.76	7.65	10.54	10.54
	95.39	194.23	267.67	267.73
	60.	163.	225.	225.
	99.	201.	277.	277.

.....

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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)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS				
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5
				.10	.20	.30	.40	.50
HYDROGRAPH AT INFLOW	(	.29	1	148.	296.	443.	591.	739.
	)	.75)	(	4.19)	8.37)	12.56)	16.74)	20.93)
ROUTED TO OUTFLOW	(	.29	1	40.	44.	49.	53.	57.
	)	.75)	(	1.12)	1.24)	1.38)	1.50)	1.61)
HYDROGRAPH AT INFLOW	(	.11	1	59.	119.	178.	237.	297.
	)	.28)	(	1.68)	3.36)	5.04)	6.72)	8.40)
2 COMBINED	(	.40	1	97.	159.	220.	282.	343.
	)	1.04)	(	2.74)	4.49)	6.23)	7.98)	9.72)
ROUTED TO OUTFLOW	(	.40	1	52.	142.	210.	271.	333.
	)	1.04)	(	1.48)	4.02)	5.94)	7.68)	9.43)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

ELEVATION  
STORAGE  
OUTFLOW

INITIAL VALUE  
121.10  
15.  
5.

SPILLWAY CREST  
121.00  
13.  
0.

TOP OF DAM  
133.00  
305.  
70.

RATIO  
OF  
PMF

MAXIMUM  
RESERVOIR  
W.S.ELEV

MAXIMUM  
STORAGE  
AC-FT

MAXIMUM  
OUTFLOW  
CFS

DURATION  
OVER TOP  
HOURS

TIME OF  
MAX OUTFLOW  
HOURS

TIME OF  
FAILURE  
HOURS

0.10 122.08 32. 40. 0.00 42.25 0.00

0.20 123.56 60. 44. 0.00 42.75 0.00

0.30 125.02 91. 49. 0.00 43.00 0.00

0.40 126.40 122. 53. 0.00 43.00 0.00

0.50 127.70 154. 57. 0.00 43.00 0.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

INITIAL VALUE      SPILLWAY CREST      TOP OF DAM  
 115.06            115.04            116.94  
 18.                18.                38.  
 0.                0.                27.

ELEVATION  
 STORAGE  
 OUTFLOW

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
.10	117.03	.09	39.	52.	7.00	42.50	0.00
.20	117.18	.24	41.	142.	18.00	40.50	0.00
.30	117.27	.33	42.	210.	27.75	40.25	0.00
.40	117.34	.40	43.	271.	36.25	40.25	0.00
.50	117.41	.47	44.	333.	37.75	40.25	0.00



APPENDIX

D

Photographs



*UPSTREAM FACE AND THE TOP OF THE DAM  
FROM THE RIGHT ABUTMENT 4/11/79*



*UPSTREAM FACE AND THE TOP OF THE DAM  
FROM THE LEFT ABUTMENT 4/31/79*



UPSTREAM ENTRANCE TO THE  
DROP INLET SPILLWAY 4/11/79

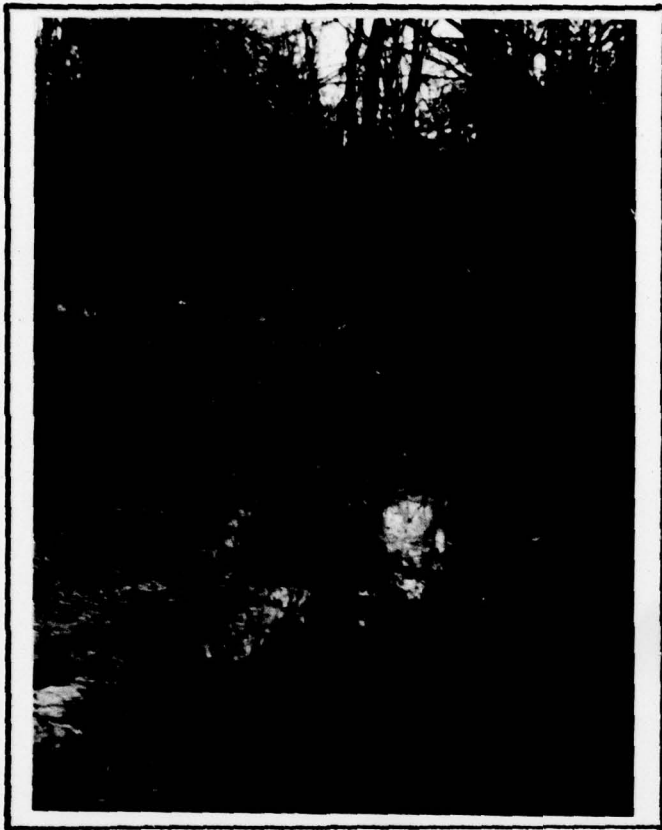


SEEPAGE AND STANDING WATER AT THE DOWNSTREAM  
TOE OF THE EMBANKMENT NEAR THE RIGHT ABUTMENT

4/11/79

D-2





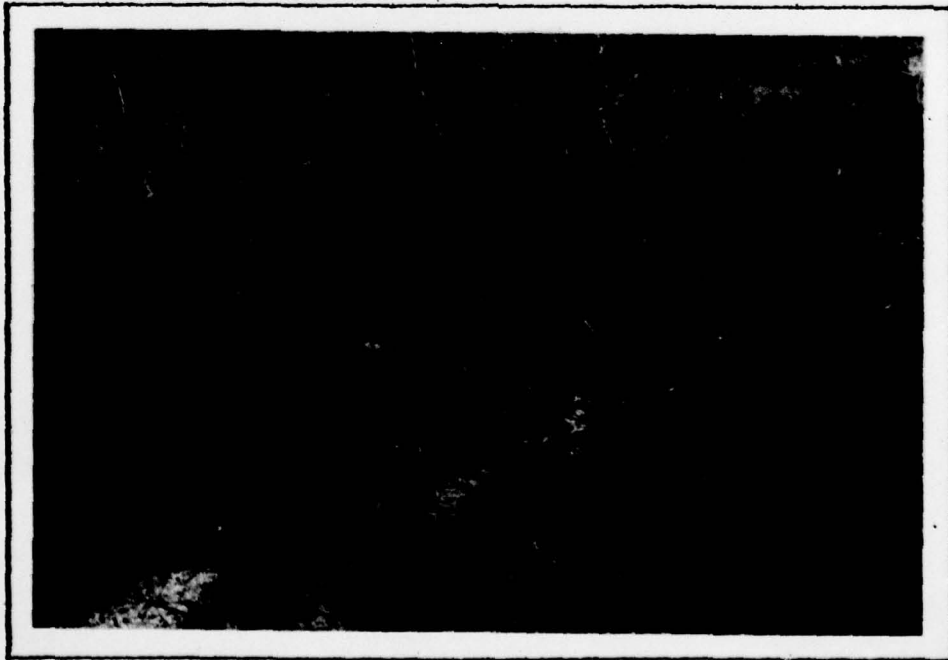
SEEPAGE AND STANDING  
WATER NEAR THE DOWN-  
STREAM RIGHT ABUTMENT  
4/11/79



SEEPAGE AND STANDING  
WATER AT THE CENTER  
OF THE EMBANKMENT  
DOWNSTREAM 4/11/79



*GENERAL VIEW OF THE DOWNSTREAM  
SLOPE OF THE EMBANKMENT 4/11/79*



*DOWNSTREAM CHANNEL FROM  
THE TOP OF THE DAM 4/13/79*

APPENDIX

E

Drawings



TABLE OF CONTENTS - APPENDIX E

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PROPOSED EXTENSION OF AMPHIBIOUS LAKE (1973)	PLATE 2
PROPOSED SPILLWAY	PLATE 3
CONTOUR MAP	PLATE 4
PROBLEM AREA DRAWING	PLATE 5

AD-A074 323

NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON

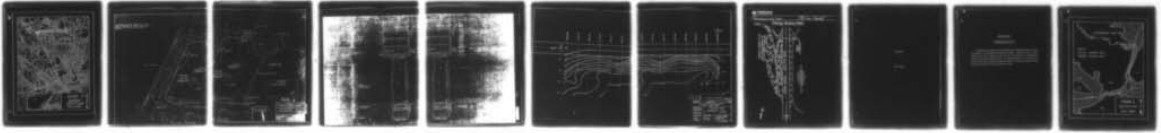
F/G 13/2

NATIONAL DAM SAFETY PROGRAM. AMPHIBIOUS LAKE DAM (NJ 00457), DE--ETC(U)  
JUN 79 J J WILLIAMS

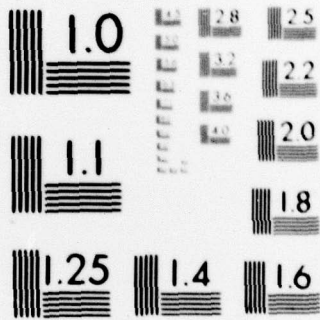
DACW61-79-C-0011  
NL

UNCLASSIFIED

2 OF 2  
AD  
A074323



END  
DATE  
FILMED  
10-79  
DDC



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A



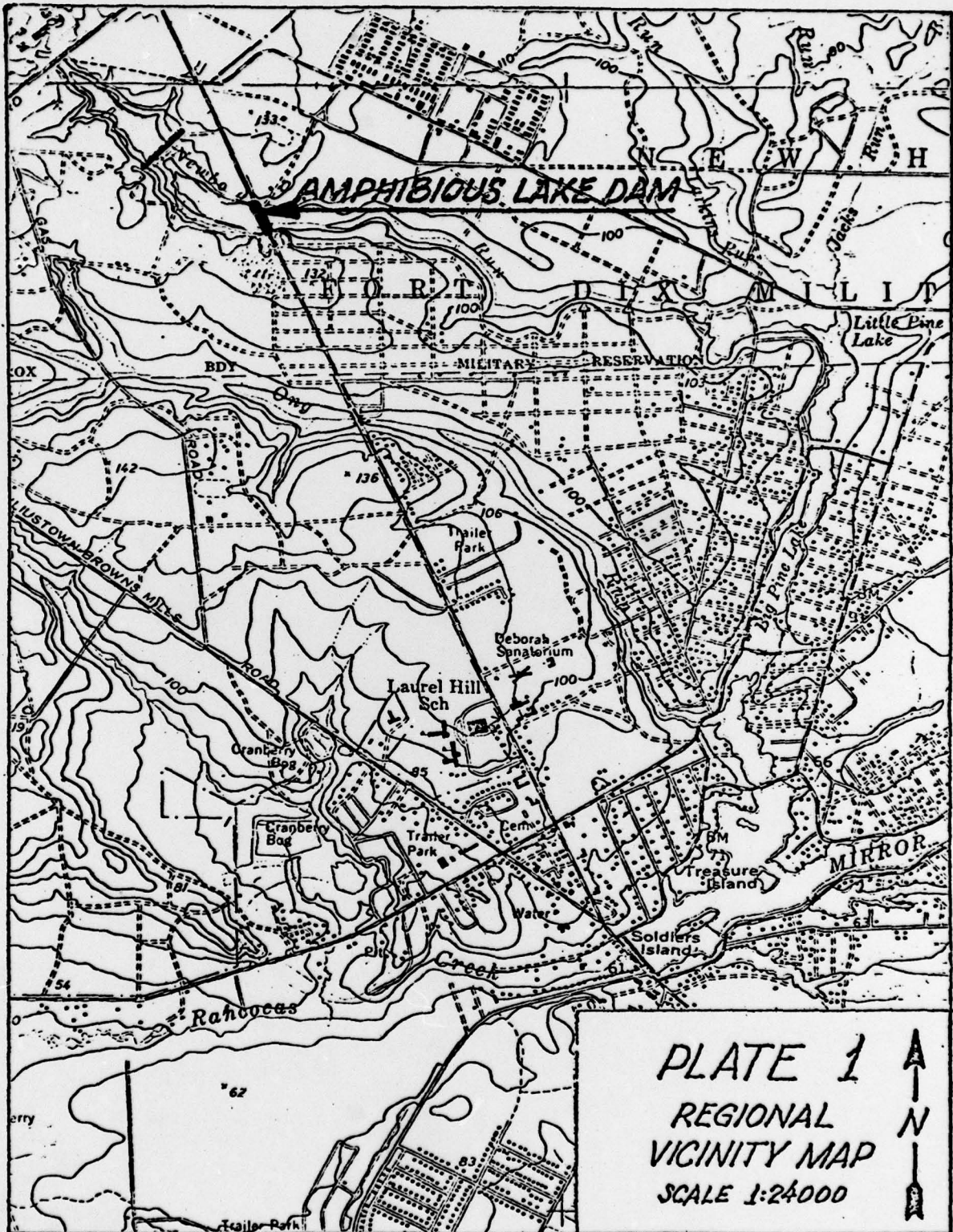
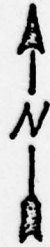
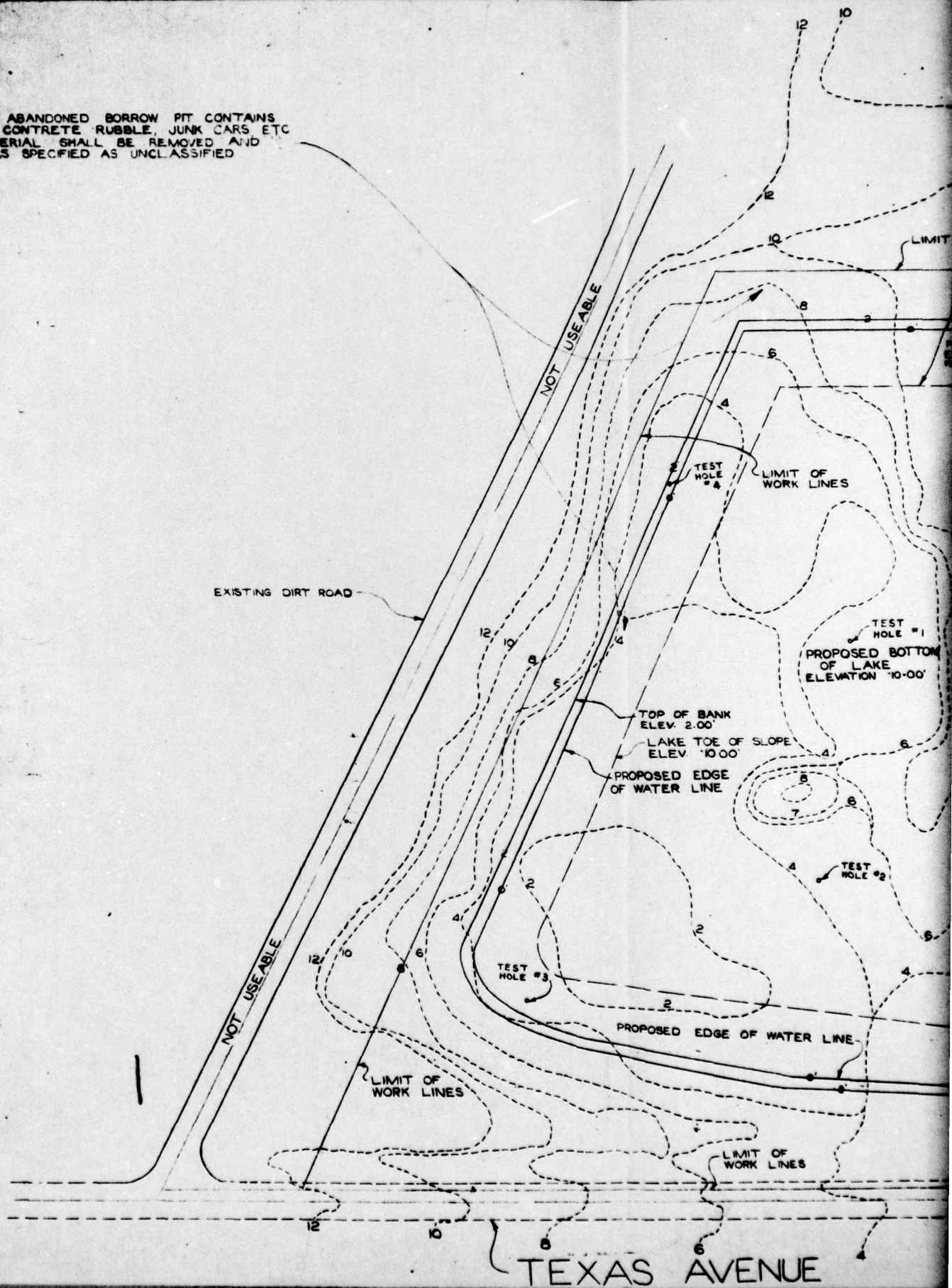


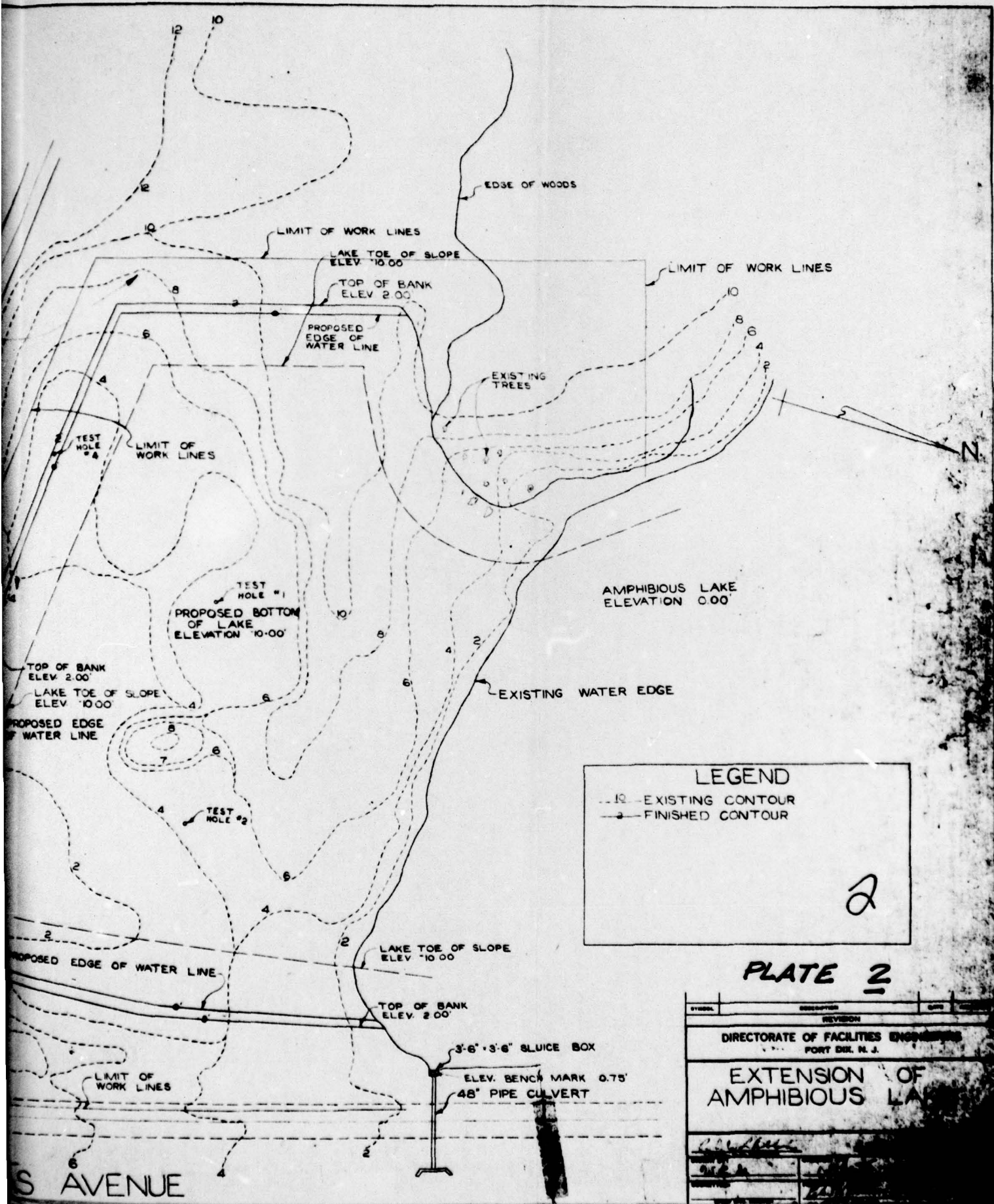
PLATE 1  
 REGIONAL  
 VICINITY MAP  
 SCALE 1:24000



PORTIONS OF ABANDONED BORROW PIT CONTAINS  
BURIED TRASH, CONCRETE RUBBLE, JUNK CARS ETC  
ALL SUCH MATERIAL SHALL BE REMOVED AND  
DISPOSED OF AS SPECIFIED AS UNCLASSIFIED  
MATERIAL.







**LEGEND**

--- 10 --- EXISTING CONTOUR  
 ——— 2 ——— FINISHED CONTOUR

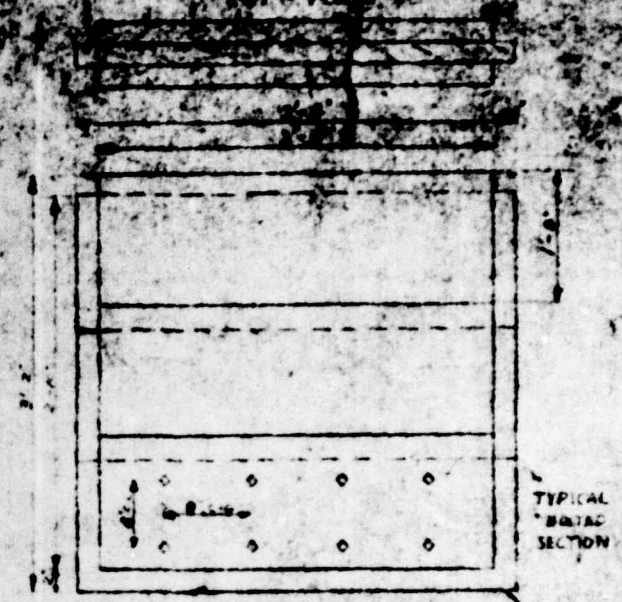
2

**PLATE 2**

SYMBOL	REVISION	DATE	BY
DIRECTORATE OF FACILITIES ENGINEERING PORT DIR. N. J.			
<b>EXTENSION OF AMPHIBIOUS LAKE</b>			
<div style="display: flex; justify-content: space-between;"> <div> <p>DATE: 9/2/48</p> <p>BY: [Signature]</p> </div> <div> <p>SCALE: 1" = 40'</p> </div> </div>			

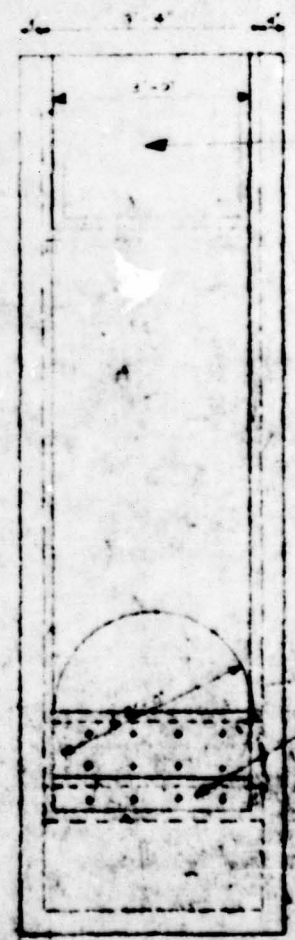


TOP VIEW



TYPICAL  
SECTION

DETAIL OF FLASHBOARDS  
SCALE 1/4" = 1'-0"



FLASHBOARDS

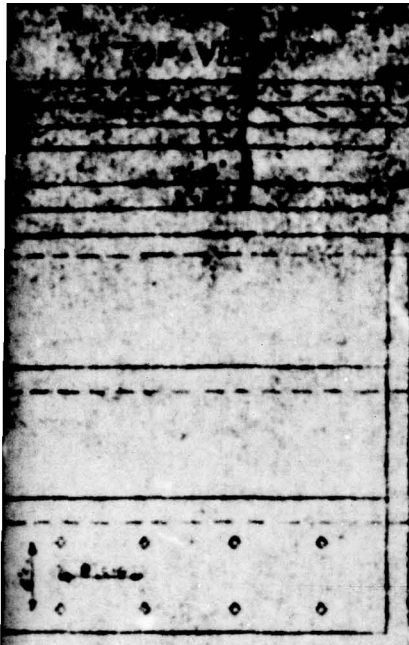
FRONT VIEW

NO. 1 PLY 5/8" x 2 1/2" x 10'

NO. 2 PLY 5/8" x 2 1/2" x 10'

NO. 3 PLY 5/8" x 2 1/2" x 10'

ECG 10074



DETAIL OF FLASHBOARDS  
SCALE 1/2" = 1'-0"



SIDE VIEW

TYPICAL  
BOLT  
SECTION

NOTE THIS SECTION  
ALL BOLTS  
PLACED ON



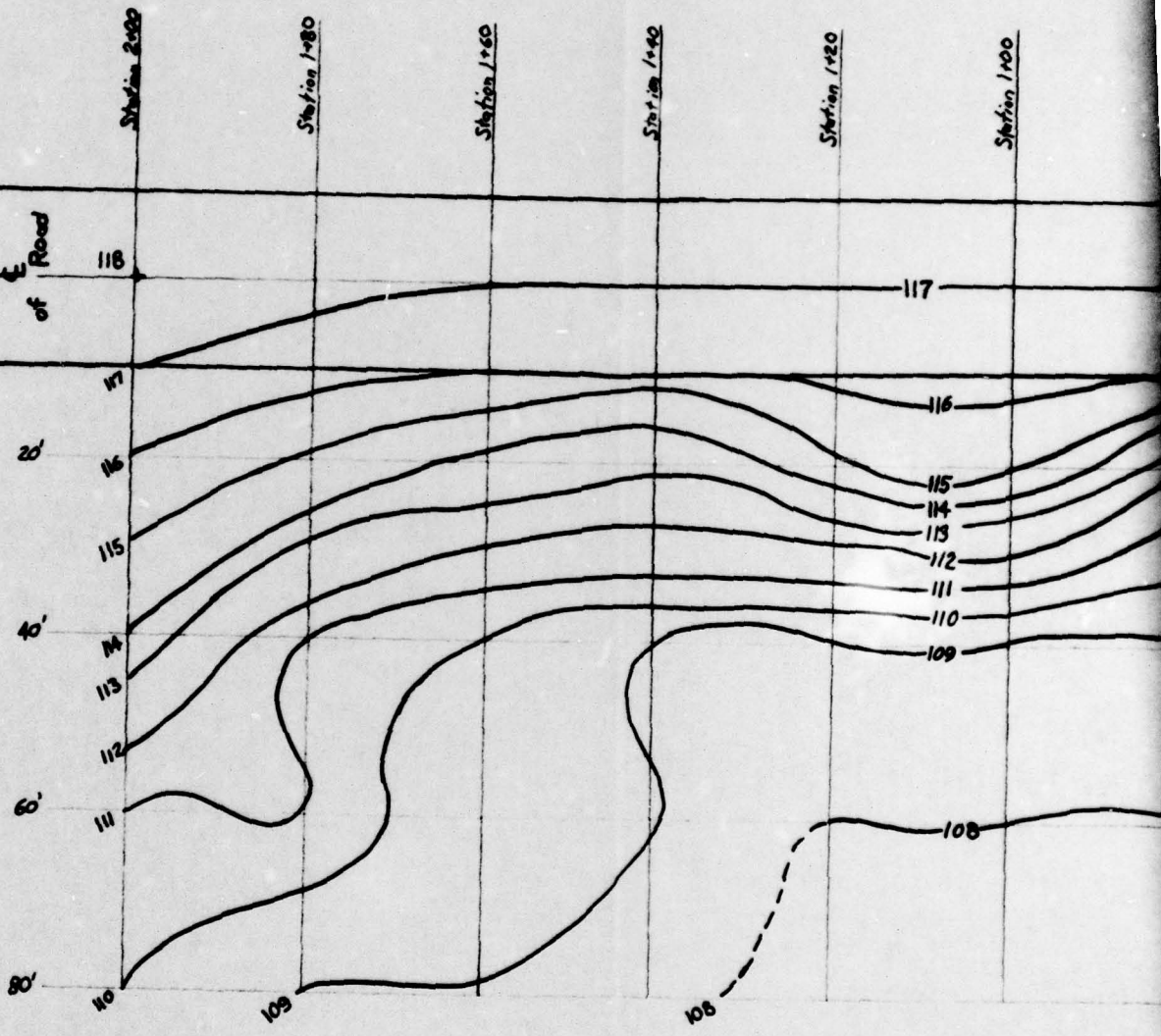
FLASHBOARD OPENING

BOTTOM FLASHBOARD SHOWN IN FIG. 2  
2 1/2" x 3'-0" 2 BOARDS PER  
2 1/2" x 17'-0" 1 BOARD PER

PLATE 3

FRONT VIEW

A N  
E of Road



1



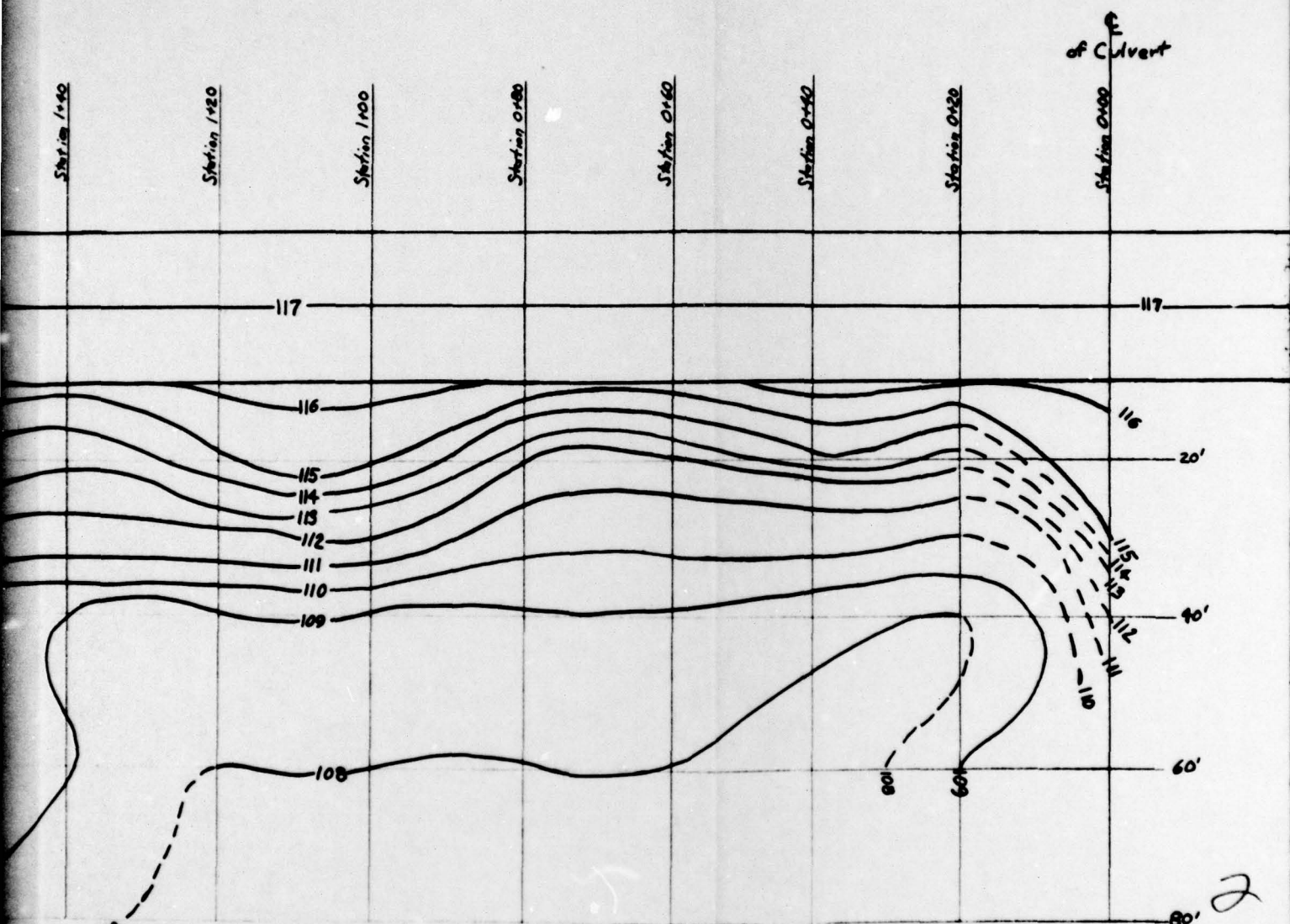


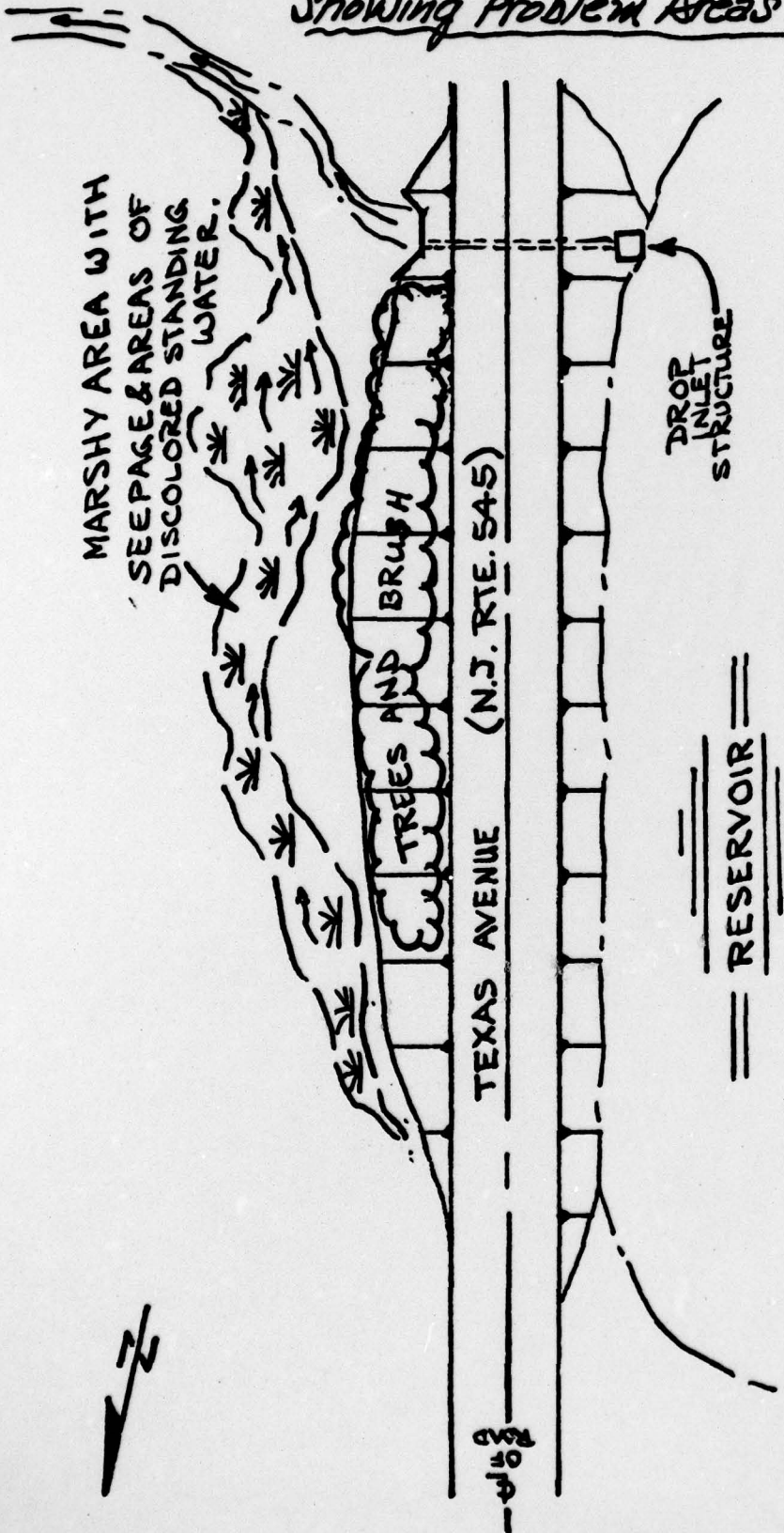
PLATE 4

Contour Interval = 1 Ft 13-0033

REV	DATE	DESCRIPTION	BY
86TH ENGINEER BATTALION (CONS) FT. DIX, NEW JERSEY			
DRAWN BY T. LANES		<b>CONTOUR MAP</b> <b>AMPHIBIAN LAKE</b> TEXAS AVE	
TRACED BY			
CHECKED BY			
SUBMITTED		APPROVED	DRAWING NUMBER 86-GI-14 SHEET 1 OF 1
DATE 6 MAR 61		SCALE 1" = 30'	

SUBJECT <b>AMPHIBIOUS LAKE DAM</b>	SHEET <b>5</b>	BY <b>DBC</b>	DATE <b>4/27/79</b>	JOB NO.
---------------------------------------	-------------------	------------------	------------------------	---------

Showing Problem Areas



APPENDIX

F

Site Geology



SITE GEOLOGY

AMPHIBIOUS LAKE DAM

Amphibious Lake is located in the Coastal Plain physiographic province which is composed of unconsolidated sedimentary deposits. These beds form a wedge-shaped mass that is exposed at the fall line and thickens in a southeasterly direction towards the Atlantic Ocean. The surficial deposit at the dam site is a bed of tertiary sands called the Cahanse formation. No faults or major structural defects are noted in the vicinity of the dam or lake.

