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NATIONAL DAM SAFETY PROGRAM. OLIPHANTS MILL LAKE DAM (NJ-00397)--ETC(U)
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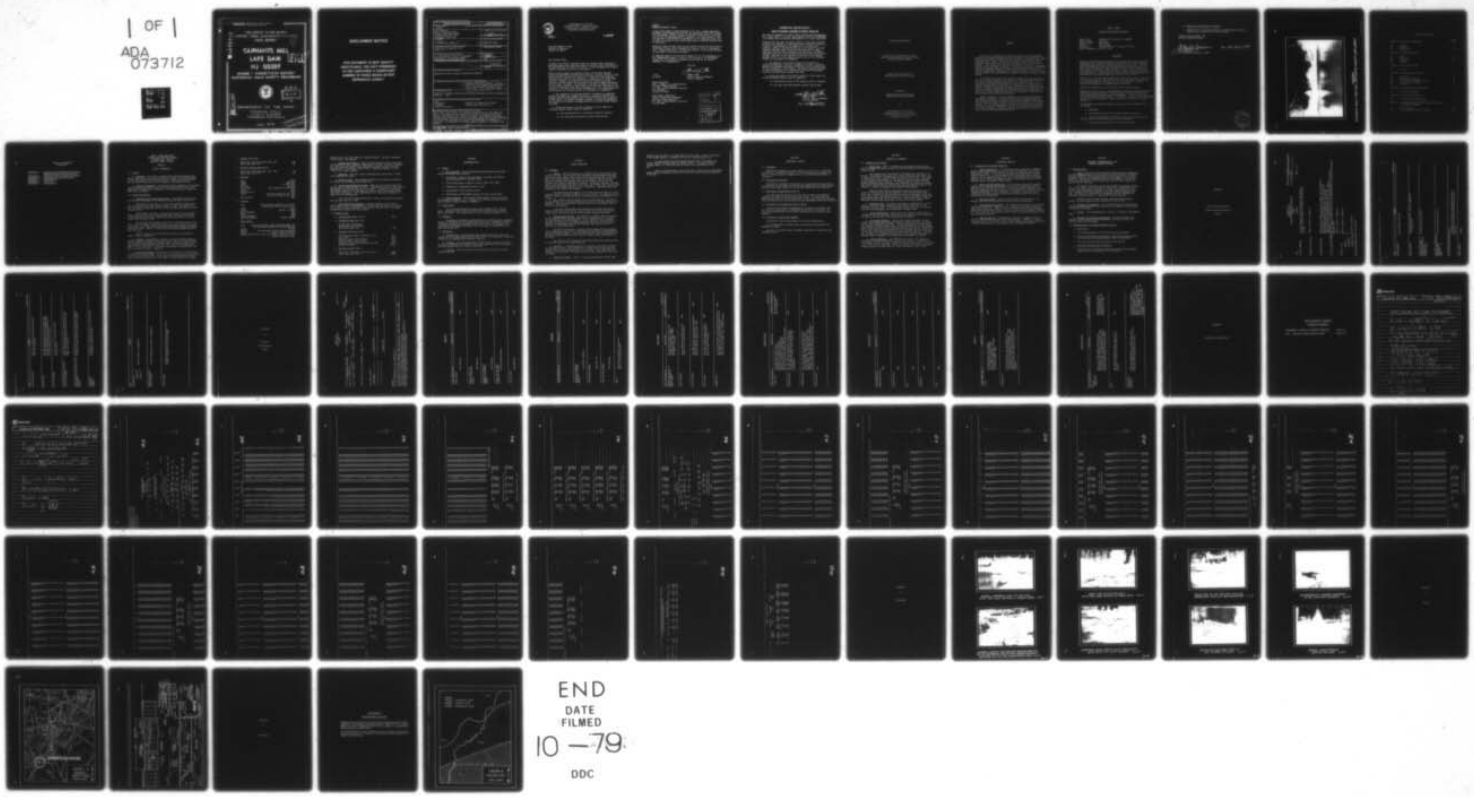

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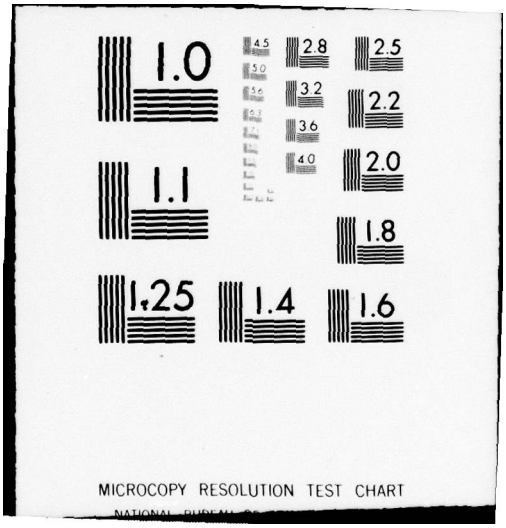
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DELAWARE RIVER BASIN
HAYNES CREEK, BURLINGTON COUNTY
NEW JERSEY

OLIPHANTS MILL LAKE DAM NJ 00397

LEVEL II

PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

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

June, 1979

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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READ INSTRUCTIONS BEFORE COMPLETING FORM

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Oliphants Mill Lake Dam
Burlington County, N.J.

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Phila. Pa.

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Custom House, 2d & Chestnut Streets
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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)

Dams
Embankments
Spillways
Structural analysis
National Dam Inspection Act Report
Oliphants Mill 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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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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

IN REPLY REFER TO
NAPEN-D

10 AUG 1979

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

Dear Governor Byrne:

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

Based on visual inspection, available records, calculations and past operational performance, Oliphants Mill Lake Dam, initially listed as a high hazard potential structure but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in overall good condition. However, the overflow portion of the headwall is in poor condition with many boards severely deteriorated and the timber sheeting of the weir crest is missing. The spillway is considered inadequate since 19% 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 adequacy of the spillway should be determined by a qualified professional consultant, engaged by the owner, 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 of the date of approval of this report the following remedial actions should be completed:

(1) The overflow portion of the spillway should be repaired.

(2) All trees and brush should be removed from the dam.

NAPEN-D
Honorable Brendan T. Byrne

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Edwin B. Forsythe of the Sixth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

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

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

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

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

John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029

OLIPHANTS MILL LAKE DAM (NJ00397)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 13 April 1979 by O'Brien and Gere Engineers, Inc., under contract to the U.S. Army Engineer District, Philadelphia, in accordance with the National Dam Inspection Act, Public law 92-367.

Oliphants Mill Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in overall good condition. However, the overflow portion of the headwall is in poor condition with many boards severely deteriorated and the timber sheeting of the weir crest is missing. The spillway is considered inadequate since 19% 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 adequacy of the spillway should be determined by a qualified professional consultant, engaged by the owner, 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 of the date of approval of this report the following remedial actions should be completed:

(1) The overflow portion of the spillway should be repaired.

(2) All trees and brush should be removed from the dam.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 27 August 1979

DELAWARE RIVER BASIN

Name of Dam: Oliphants Mill Lake Dam
County & State: Burlington County, New Jersey
Inventory Number: NJ 00397

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 reasonable possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE 1 REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Oliphants Mill Lake Dam ID #NJ00397
State Located:	New Jersey
County Located:	Burlington
Stream:	Haynes Creek
Coordinates:	Latitude 39° 53.1', Longitude 74° 49.9'
Date of Inspection:	April 13, 1979

ASSESSMENT

Based on visual observations made of the Oliphants Mill Lake Dam (owned by the Oakwood Lakes Colony Club, Medford, New Jersey) during the inspection, information made available by New Jersey DEP, and conversations with the Owner's representative the earth embankment portion of the structure and the sidewall and headwall extension members of the creosoted timber spillway appear to be in overall good condition. However, the overflow protion of the headwall is in relatively poor condition with many boards severly deteriorated and the timber sheeting of the weir crest is missing.

The dam is an earth embankment approximately 200 feet long and 11 feet high at its maximum section. The spillway is a creosoted timber structure with a weir approximately 64 feet long. The 30 acre reservoir is used for recreation by members of the Oakwood Lakes Colony Club.

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 18 percent of the Spillway Design Flood (SDF) without overtopping of the embankment. The SDF is 50 percent of the Probable Maximum Flood (PMF). The spillway is classified as "Inadequate" but not "Seriously Inadequate" because the dam is a "Significant" hazard structure.

Recommendations and remedial measures which should be initiated soon are as follows:

a. Facilities

1. The overflow portion of the spillway should be repaired.

2. A detailed hydrologic and hydraulic study should be made and the need and type of mitigating measures should be determined.

3. All trees and brush should be removed from the dam.

b. Operation and Maintenance Procedures

1. Continuation of the present operation and maintenance procedures appears to be satisfactory for this structure.

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

John J. Williams

Date: 30 JULY 1979

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

OVERVIEW
OLIPHANTS MILLS LAKE DAM, BURLINGTON COUNTY, NEW JERSEY

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(Continued)

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
OLIPHANTS MILL LAKE DAM
INVENTORY NUMBER - NJ00397

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. This report is authorized by the Dam Inspection Act, Public law 92-367, and has been prepared in accordance with contract #DACW 61-78-C-0052 between O'Brien & Gere Engineers, 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 Oliphants Mill Lake Dam and appurtenant structures and to determine if the dam constitutes a hazard to human life of property.

1.2 Project Description.

a. Description of Dam and Appurtenances. (Information obtained from the New Jersey Department of Environmental Protection (DEP) Trenton, NJ)

Oliphants Mill Lake Dam is an earth fill embankment approximately 200 feet long with a maximum height of about 11 feet. The width of the top of the dam averages about 26 feet and the upstream and downstream slopes are about 2H:1V.

The spillway is 64 feet- 7 inches wide and consists of creosoted timber sheeting with rock fill (average one cubic foot) on a 2H:1V slope on the downstream side of the sheeting and sandy clay backfill on the upstream side on a 2H:1V slope.

The reservoir drain system consists of a reinforced concrete inlet race, a 36-inch diameter seating head sluice gate on the downstream endwall of the race, and 25 feet of 36-inch diameter, bituminous coated, corrugated metal outlet pipe. There is a steel trash rack on the upstream opening of the inlet race.

Further details of the spillway and reservoir drain system are shown on Sheet 2, Appendix E.

b. Location. Oliphants Mill Lake Dam is located on Haynes Creek in Medford Township, Burlington County, New Jersey. The site is approximately one mile upstream of Medford, a community with a 1970 population of 1,448, and is shown on USGS Quadrangle entitled, "Mt. Holly, NJ" at coordinate N39° 53.1' and W 74° 49.9'. A regional location map of Oliphants Mill Lake Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. Oliphants Mill Lake Dam has a maximum height of about 11 feet which places it in the "Small" size dam category for height because it is less than 40 feet high. It has a maximum storage capacity of about 180 acre-feet which places it in the "Small" size dam category for storage

e. Storage (Acre-Feet).

Normal Pool, Recreation Pool, Elev. 29.0	90
Top of Dam, Elev. 31.2	182

f. Reservoir Surface Area (Acres).

Normal Pool, Recreation Pool, Elev. 29.0	30
Top of Dam, Elev. 31.2	50

g. Dam Data.

Type	Earth
Length	±200 feet
Height	11.2 feet (Max)
Top Width	±26 feet
Side Slopes	2H:1V (upstream & downstream)
Zoning	None
Impervious core	None
Cutoff	Creosoted Timber Wall 108 feet long in the middle of the dam.
Grout Curtain	None

h. Spillway.

Type	Creosoted timber sheeting; for further description refer to Section 1.2.a.
Width	1-foot
Length	64 feet -7 inches
Crest Elevation	29.0
Gates	None
Upstream Channel	None
Downstream Channel	Natural Channel

i. Outlet Works.

Type	36 inch bituminous coated corrugated metal pipe with reinforced concrete race on upstream end.
Length	25 feet
Closure	36-inch diameter seating head sluice gate
Access	Across crest of spillway.
Regulating facilities	Hoist with wheel to regulate 36-inch seating head sluice gate.

because it has less than 1,000 Ac.Ft.maximum storage. The dam is therefore in the "Small" size category.

d. Hazard Classification. There are three residences within the flood plain within the first 1,500 feet downstream of the dam. Failure of Oliphants Mill Lake Dam would probably cause appreciable property damage, but there would be little likelihood of loss of life. Therefore, the dam is in the "Significant" hazard category.

e. Ownership. The dam is owned by Oakwood Lakes Colony Club, 7 Cedar Trail, Medford, NJ 08055.

f. Purpose of Dam. The impoundment behind the dam provides recreation for members of the Oakwood Lakes Colony Club.

g. Design and Construction History. There are no records of when the original dam at Oliphants Mill was built. Sometime prior to 1954, the original dam breached leaving a 90-foot gap in the center. In 1954 the S & F Realty Development Company had the dam rebuilt to provide lake front properties for real estate development. Earl Higginbotham (P.E., New Jersey) prepared the design for the reconstruction.

Since the major reconstruction work of 1954, only general maintenance work has been done on the dam.

h. Normal Operating Procedures. Periodic opening of the reservoir drain gate to lower the impoundment for cleaning the lake bottom, maintenance work on the dam, and inspection of the dock and floating raft is the extent of operating procedures for the structure.

1.3 Pertinent Data.

a. Drainage Area (Square miles).	25.5
b. Discharge at Dam site (cfs).	
No high pool or discharge records were made available.	
Top of Dam, Elev. 31.2	750
c. Elevation (Feet above MSL).	
Spillway Crest (normal, recreation pool)	29.0
Top of Dam	31.2
Reservoir Drain Invert (inlet)	20.5
Reservoir Drain Invert (outlet)	20.4
Streambed at the downstream toe of the dam	20.0±
Maximum Tailwater	24.0±
d. Reservoir Length (Feet).	
Normal Pool, Recreation Pool, Elev. 29.0	3,800
Top of Dam, Elev. 31.2	3,800

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. The engineering data made available by the New Jersey DEP includes the following:

1. Application, report on the application, and permit for repairs on the Oliphants Mill Lake Dam (1959).

2. State of New Jersey inspection reports (1954, 1957, 1970).

3. Dewatering of impoundment approval (1973).

4. Two pictures of the spillway section.

5. Miscellaneous correspondence between the State and the Owner.

b. Design Features. The principal design features for the structure are discussed in Section 1.2.a. Drawings of the spillway and the reservoir drain system are shown on Sheet 2, Appendix E.

2.2 Construction.

It is not known when the original dam at Oliphants Mill Lake was built. Sometime prior to 1954 the original dam breached leaving a 90-foot gap in the center. The reconstruction in 1954 is discussed Section 1.2.g.

2.3 Operation.

According to the Owner's representative, Mr. Steven Corcoran, operating records are maintained by the Oakwood Lakes Colony Club. Operation is limited to periodic opening of the reservoir drain gate to lower the impoundment for cleaning the lake bottom, maintenance work on the dam, and inspection of the dock and floating raft.

2.4 Evaluation.

a. Availability. The engineering data reproduced for this report and studied for this investigation were provided by DEP. No information is available concerning the embankment and foundation materials.

b. Adequacy. The information made available by DEP, conversations with the Owner's representative and observations made during the field investigation provided adequate data for a Phase I evaluation.

c. Validity. There is no reason to question the validity of the data obtained from DEP.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The field inspection of Oliphants Mill Lake Dam took place on April 13, 1979. At the time of the inspection, the impoundment was being drawn down so that repairs could be made on the overflow portion of the headwall of the timber spillway, the debris on the bottom of the lake in the vicinity of the dock and floating raft could be cleared, and the dock and floating raft could be inspected by the Owner. During the inspection the water level in the impoundment was about 4 feet below the spillway crest and the drawdown operation continued during the entire inspection. Underwater areas were inspected to the limit of the drawdown.

The observations and comments of the field inspection team are in the checklist which is included in Appendix B of this report. The appearance of the facility indicates that the dam and its appurtenances are satisfactorily maintained.

b. Dam. Overall, the dam appears to be in good condition. The top of the dam and both the upstream and downstream slopes are for the most part well vegetated. There are a few minor erosion gullies on the downstream slope towards the right abutment.

A few trees with maximum trunk diameters of 6 inches and maximum heights of 20 feet are located on the top of the dam and along the upstream slope between the spillway and the right abutment (looking downstream).

c. Appurtenant Structures. The sidewall and headwall extension members of the creosoted timber spillway appear to be in good concition. However, the overflow portion of the headwall is in poor condition with many boards severely deteriorated and the timber sheeting of the weir crest is missing. The Owner's representative stated that the weir crest sheeting was torn loose by ice during the winter.

The rock fill which has a surface slope of about 2H:1V with angular units averaging one cubic foot in size appears to be stable on the downstream side of the timber headwall. The sandy clay backfill on the upstream side of the timber headwall which also has a surface slope of about 2H:1V appears to be stable.

The reservoir drain system was functioning during the inspection and, as observed, seems to be in good condition.

d. Reservoir. A reconnaissance of the reservoir disclosed no evidence of excessive siltation, slope instability, or other features that would adversely effect the storage capacity of the reservoir. The slopes along the perimeter of the reservoir are vegetated and on gentle gradients of less than 10 percent.

e. Downstream Channel. There is a bridge opening about 250 feet down-

stream of the dam which is 40 feet wide and 10 feet high. Because of the size of the bridge opening, it probably will not be an obstruction to flow.

For approximately one mile between Oliphants Mill and Medford, the channel meanders through wooded and swampy terrain. The channel gradient averages about 2 to 3 feet per mile for several miles downstream of the dam.

There are approximately a dozen homes which could experience appreciable damage during the passage of the SDF in the 2 miles along the creek downstream of the dam.

SECTION 4

OPERATIONAL FEATURES

4.1 Procedures.

Operational procedures have been covered in Section 1.2.h. According to the Owner's representative, there are no written operating procedures for the dam. Normal operating procedures for this structure do not require a dam tender.

4.2 Maintenance of the Dam.

According to the Owner's representative, the Oakland Lakes Colony Club is responsible for and maintains the dam which appears to be in good condition except for the timber headwall of the spillway which needs to be repaired.

4.3 Maintenance of Operating Facilities.

The only operating facility associated with the dam is the handwheel operated sluice gate of the reservoir drain system. The sluice gate and appurtenances appear to be well maintained and seem to be functioning properly since the gate was fully open and draining the impoundment during the inspection.

4.4 Description of any Warning System in Effect.

According to the Owner's representative, the local Civil Defense (CD) has a warning system which is implemented during times of high flow. CD also has evacuation plans which could be implemented if such measures were necessary.

4.5 Evaluation of Operational Adequacy.

The reservoir drain system appears to function satisfactorily.

It is assumed the CD warning system and evacuation plan would be implemented as needed.

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

SECTION 5

HYDRAULICS & HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. There is no hydraulics and hydrology design information available from DEP for either the original design or the reconstruction design of 1954.

The drainage basin contributing to Oliphants Mill Lake Dam is "V" shaped. The length of the longer leg is about 8 miles and the shorter leg is about 5 miles long. Ground elevations range from 219 to 24. The slopes of the drainage basin adjacent to the reservoir are gentle with gradients varying between 2 and 10 percent. The drainage basin is about 70 percent wooded, 20 percent lakes and swamps, and 10 percent open fields and meadows. The runoff characteristics of the drainage basin may undergo changes in the future as a result of residential and commercial development.

There are more than 60 impoundments within the drainage basin upstream of Oliphants Mill Lake Dam ranging in size from Centennial Lake which has a surface area of about 50 acres down to small ponds and marshes of an acre or two. The surface elevations for these impoundments range from approximately Elevation 130 to Elevation 35. Most of the lakes and ponds have been formed by dams which have a variety of spillway systems.

b. Experience Data. According to the Owner's representative, no discharge or reservoir stage records are maintained for this site and no estimates could be given. From experiences through the years, Mr. Corcoran said that the impoundment can be drawn down in about 2 days.

c. Visual Observations. On the day of the inspection there were no indications that the spillway could be obstructed other than the accumulation of trash on the reservoir drain system hoist and pedestal.

d. Overtopping Potential. The Spillway Design Flood (SDF) for the "Small" size "Significant" hazard structure has been selected as 50 percent of the Probable Maximum Flood (PMF). The SDF hydrograph was routed through the reservoir with the starting water surface Elevation 29.10. The maximum water surface elevation in the reservoir resulting from the SDF routing would be 4.7 feet above the spillway crest and 2.5 feet above the top of the dam. The SDF has a peak inflow of 3870 and a peak outflow of 3850 cfs. The spillway is capable of discharging 18 percent of the SDF without overtopping of the dam (Refer to Appendix C for computations and computer printouts).

e. Spillway Adequacy. Even though the spillway is only capable of discharging 18 percent of the SDF (0.5 PMF) the spillway 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 property damage, but there would be little likelihood of loss of life.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. It is assumed the dam's stability is adequate based on the fact that there has been no signs of instability since it was constructed in 1954. At the time of the inspection the dam had no visible signs of instability. In the spillway section of the dam the well graded rock fill with a surface slope of 2H:1V on the downstream side of the timber headwall and the sandy clay embankment with a surface slope of 2H:1V on the upstream side of the headwall appear stable.

b. Design and Construction Data. The spillway cross-section geometry appears to be in general conformance with the As-Built drawings for the reconstruction of the spillway in 1954. There are no drawings available for the earth embankment portion of the dam. No information on stability analysis, seepage computations, or soil properties is available. There also is no information available concerning construction supervision for the 1954 reconstruction of the spillway.

c. Operating Records. According to the Owner's representative, the Oakwood Lakes Colony Club maintains operating records for the dam.

d. Post Construction Changes. Since there are no records of the original design and construction, there is no way of knowing exactly what constituted the original structure. Sometime prior to 1954 the S & F Realty Development Company had the dam rebuilt with a creosoted timber spillway (Sheet 2, Appendix E). Since the major reconstruction work of 1954, only general maintenance work has been done on the dam.

e. Seismic Stability. Oliphants Mill Lake Dam is located in Seismic 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. Safety. Based on visual observations made during the inspection, the earth embankment portion of the structure and the sidewall and headwall extension members of the creosoted timber spillway appear to be in good condition. However, the overflow portion of the headwall is in poor condition with many boards severely deteriorated and the timber sheeting of the weir crest is missing.

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 indicate that the spillway is capable of passing 18 percent of the SDF without overtopping the dam. The spillway is classified as "Inadequate" but not "Seriously Inadequate" because the dam is a "Significant" hazard structure.

Failure of the dam would probably cause appreciable property damage, but there would be little likelihood of loss of life.

b. Adequacy of Information. The information available from DER and observation made during the field inspection, are adequate to make a Phase 1 evaluation of the dam.

c. Urgency. The recommendations in Section 7.2 should be implemented soon.

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

7.2 Recommendations and Proposed Remedial Measures.

a. Facilities.

1. The overflow portion of the spillway should be repaired.

2. A detailed hydrologic and hydraulic study should be made and the need and type of mitigating measures should be determined.

3. All trees and brush should be removed from the dam.

b. Operation and Maintenance Procedures.

1. Continuation of the present operation and maintenance procedures appears to be satisfactory for this structure.

APPENDIX

A

Check List Engineering Data

Design, Construction, Operation

Phase I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Oliphants Mill Lake Dam

ID # NJ 00397

ITEM	REMARKS
AS-BUILT DRAWINGS	The only As-Build drawings available from DEP are for the creosoted timber spillway as reconstructed in 1954
REGIONAL VICINITY MAP	Refer to Plate 1, Appendix E
CONSTRUCTION HISTORY	There are no records of when the original dam at Oliphants Mill was built. Sometime prior to 1954, the original dam breached leaving a 90-foot gap in the center. In 1954 the S&F Realty Development Co. had the dam rebult to provide lake front properties for real estate development. E. Higginbotham (P.E., New Jersey) prepared the design for the reconstruction. Since the major reconstruction, only general maintenance has been done.
TYPICAL SECTIONS OF DAM	Refer to Sheet 2, Appendix E
OUTLETS - PLAN	Refer to Sheet 2, Appendix E
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	Refer to Appendix C
RAINFALL/RESERVOIR RECORDS	Not recorded

ITEM	REMARKS
DESIGN REPORTS	None available from DEP
GEOLOGY REPORTS	None available from DEP. Refer to Appendix F of this report
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No data available from DEP
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	No data available from DEP
POST-CONSTRUCTION SURVEYS OF DAM	According to the Owner's representative, there has not been any post-reconstruction surveys of the dam.
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	There are no monitoring systems associated with this structure.
MODIFICATIONS	The major modification to the original dam was the installation of the creosoted timber spillway in 1954 following a breaching of the dam sometime prior to 1954.
HIGH POOL RECORDS	There are no pool records maintained for this site.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	An engineering study of the structure was made in 1968. This was when Oakwood Lakes Colony Club bought the structure.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Sometime prior to 1954 the original dam breached leaving a 90-foot gap in the center of the dam.
MAINTENANCE OPERATION RECORDS	Maintenance & operating records are maintained by the Oakwood Lakes Colony Club.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Refer to Sheet 2, Appendix E
OPERATING EQUIPMENT PLANS & DETAILS	Limited information on Sheet 2, Appendix E
MISCELLANEOUS	Engineering data available from the DEP files is listed in Section 2.1.a of this report.

APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam Oliphants Mill Lake Dam County Burlington State New Jersey National ID # 00397

Type of Dam Earth Fill Hazard Category Significant

Date(s) Inspection 4/13/79 Weather Cool, Cloudy Temperature 40^{s} (F)

Pool Elevation at Time of Inspection 25± M.S.L. Tailwater at Time of Inspection 22± M.S.L.

Inspection Personnel:

Lee DeHeer Leonard R. Beck David Campbell

Leonard Beck Recorder

Remarks:
We are accompained on our inspection by:

Steven Corcoran, President, Oakwood Lakes Colony Club, 7 Cedar Trail, Medford, N.J. 08055

George Rankin, Vice-President, Oakwood Lakes Colony Club

Harold Eastlick, Township Administrator & Clerk, Medford, Township, N.J.
"Kip" Feiffer, Medford Township Civil Defense Coordinator

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None Observed	None
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Observed	None
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None Observed	None
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No Misalignment Observed	None
RIPRAP FAILURES	None Observed	None

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems observed	None
ANY NOTICEABLE SEEPAGE	None observed	None
STAFF GAGE AND RECORDER	None observed	None
DRAINS	According to available information there is no drainage system	None

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable because the outlet conduit is bituminous coated corrugated metal pipes (BCCMP) 36 inches in diameter.	None
INTAKE STRUCTURE	The reinforced concrete inlet race appears to be in good condition.	None
OUTLET STRUCTURE	The BCCMP outlets into a pool approximately 200 feet long and 100 feet wide. The banks of the pool appear to be stable	None
OUTLET CHANNEL	The outlet channel appears stable. It is on a very gentle gradient of about 10 feet in 3 miles	None
EMERGENCY GATE	The 36 inch diameter seating head sluice gate is operational since it was opened to draw the lake down during the inspection. The gate hoist and stem appear to be in good condition	None

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
WOOD WEIR	The wooden weir needs to be repaired. The timber sheeting which makes up the weir crest is missing. The Owner's representative stated that the weir crest sheeting was torn loose by ice forces during the winter	The spillway headwall must be repaired.
APPROACH CHANNEL	The only possible obstruction to flow over the spillway weir would be the accumulation of trash on the reservoir drain system hoist and pedestal.	None
DISCHARGE CHANNEL	Flow over the weir of the spillway outlets into a pool approximately 200 feet long and 100 feet wide. The banks of the pool appear stable. The discharge channel flows through a bridge opening about 40 feet wide and 10 feet high about 250 feet downstream of the dam.	None
BRIDGE AND PIERS	N/A	None

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	None
OBSERVATION WELLS	None	None
WEIRS	None	None
PIEZOMETERS	None	None
OTHER	None	None

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes along the perimeter of the reservoir are vegetated and on gentle gradients. From observations, there does not appear to be any unstable slopes	None
SEDIMENTATION	For the most part, the perimeter of the reservoir is residentially developed. There is no evidence of excessive siltation, slope instability, or other features that would adversely affect the storage capacity of the reservoir.	None

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	There is a bridge opening about 250 feet downstream of the dam which is 40 feet long and 10 feet high. The approximately one mile of channel between Oliphants Mill and Medford meanders through wooded and swampy terrain.	Because of the size of the bridge opening, it probably will not be an obstruction to flow.
SLOPES	The channel gradient averages about 2 to 3 feet per mile for many miles downstream of the dam.	None
APPROXIMATE NO. OF HOMES AND POPULATION	There are approximately a dozen homes which would be affected by flood flows in the 2 miles along the creek downstream of the dam	According to the Owner's representative and the Civil Defense Coordinator, Civil Defense (CD) has a warning system which is implemented during times of high flow. CD also has evacuation plans should such be needed.

APPENDIX

C

Hydrologic & Hydraulic Data

TABLE OF CONTENTS - APPENDIX C

HYDRAULICS & HYDROLOGY

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Chapin's Mill Lake Dam	1	SM	4/23/79	1300-005-113
			5/25/79	

INPUT VALUES FOR CLARK HYDROGRAPH

$$T_c + R = 21\left(\frac{DA}{S}\right)^{.22} \times St^{.33} \times (1+0.3I)^{-0.28}$$

DA = drainage area = 25.5 Sq Miles

S = avg. channel slope measured from the 10% and 85% points along the stream length (ft/mile)

I = % impervious surface within the drainage area.

$R/(T_c+R) = 0.76$

St = storage (% of lakes and swamps)

$L = 24.6 \times 2000 = 49{,}200$ ft

$0.1L = 4920$ ft (EL = 40.00)

$0.15L = 7380$ ft (EL = 120)

$L' = 49{,}200 - (7380 + 4920) = 36900$ ft ≈ 7 miles

$$S = \frac{120 - 40}{7} = 11.4 \text{ feet/mile}$$

$(A_{rea})_{swp\,\&\,lake} = 4.5$ Sq. Miles

$$St = \frac{4.5}{25.5} = 0.177 = 17.7\%$$

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Oliphants Mill Lake Dam	2	SM	4/23/79	1600-005-113

VLB 5/25/79

$$I = 0.117 \times D^{0.792 - 0.039 \log D}$$ (USGS - Special Report 38)

D = population density in persons per square mile

$$D = \frac{2000}{25.5} = 78 \text{ persons/Sq. Mile}$$

$$I = 0.117 \times 78^{0.792 - 0.039 \log 78} = 2.7$$

$$T_c + R = 21 \left(\frac{25.5}{11.4}\right)^{.22} \times 17.7^{.33} \times \left(1 + 0.3 \times 2.70\right)^{-0.28} = 53.4 \quad 54.6$$

$$\frac{R}{T_c + R} = 0.76 \quad \text{(from Phila COE)}$$

$$R = 0.76\left(T_c + R\right) = 0.76 \times 54.6 = 41.5$$

$$T_c + 41.5 = 54.6$$

$$T_c = 13.1 \quad \text{Say} \quad \underline{13.0}$$

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

RUN  DATE= 07/12/79.
     TIME= 10.04.38.
```

NATIONAL DAM INSPECTION PROGRAM
OLIPHANTS MILL DAM
PMF HYDROGRAPH

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JOB SPECIFICATION

NO	NMH	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	2	0	0	0	0	0	0	3	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 7 LRTIO= 1

RTIOS= .05 .10 .15 .20 .30 .40 .50

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

SUB-AREA RUNOFF COMPUTATION

RUNOFF TO OLIPHANTS MILL DAM RESERVOIR

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	25.50	0.00	25.50	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.50	104.00	114.00	124.00	135.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .831

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
1	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 13.00 R= 40.60 NTA= 0

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

UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG= 13.44 HOURS, CP= .28 VOL= .99

17.	64.	131.	208.	277.	325.	340.	330.	314.	299.
285.	271.	258.	245.	234.	222.	212.	202.	192.	183.
174.	165.	158.	150.	143.	136.	129.	123.	117.	112.
106.	101.	96.	92.	87.	83.	79.	75.	72.	68.
65.	62.	59.	56.	53.	51.	48.	46.	44.	42.

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40.	38.	36.	34.	33.	31.	29.	28.	27.	25.		
24.	23.	22.	21.	20.	19.	18.	17.	16.	16.		
15.	14.	13.	13.	12.	12.	11.	10.	10.	9.		
9.	9.	8.	8.	7.	7.	7.	6.	6.	6.		
6.	5.	5.	5.	5.	4.	4.	4.	4.	4.		

Q — END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	2.00	1	.02	0.00	.02	36.	1.13	14.00	151	0.00	0.00	0.00	8.
1.01	4.00	2	.02	0.00	.02	33.	1.13	16.00	152	0.00	0.00	0.00	7.
1.01	6.00	3	.02	0.00	.02	31.	1.13	18.00	153	0.00	0.00	0.00	7.
1.01	8.00	4	.06	0.00	.06	29.	1.13	20.00	154	0.00	0.00	0.00	6.
1.01	10.00	5	.06	0.00	.06	27.	1.13	22.00	155	0.00	0.00	0.00	6.
1.01	12.00	6	.06	0.00	.06	25.	1.14	0.00	156	0.00	0.00	0.00	6.
1.01	14.00	7	.47	0.00	.47	24.	1.14	2.00	157	0.00	0.00	0.00	5.
1.01	16.00	8	.95	.60	.36	32.	1.14	4.00	158	0.00	0.00	0.00	5.
1.01	18.00	9	.38	.28	.10	63.	1.14	6.00	159	0.00	0.00	0.00	5.
1.01	20.00	10	.03	0.00	.03	115.	1.14	8.00	160	0.00	0.00	0.00	4.
1.01	22.00	11	.03	0.00	.03	179.	1.14	10.00	161	0.00	0.00	0.00	4.
1.02	0.00	12	.03	0.00	.03	240.	1.14	12.00	162	0.00	0.00	0.00	4.
1.02	2.00	13	.26	.16	.10	289.	1.14	14.00	163	0.00	0.00	0.00	3.
1.02	4.00	14	.26	.16	.10	320.	1.14	16.00	164	0.00	0.00	0.00	3.
1.02	6.00	15	.26	.16	.10	338.	1.14	18.00	165	0.00	0.00	0.00	3.
1.02	8.00	16	.65	.55	.10	365.	1.14	20.00	166	0.00	0.00	0.00	3.
1.02	10.00	17	.65	.55	.10	420.	1.14	22.00	167	0.00	0.00	0.00	3.
1.02	12.00	18	.65	.55	.10	510.	1.15	0.00	168	0.00	0.00	0.00	2.
1.02	14.00	19	5.28	5.18	.10	711.	1.15	2.00	169	0.00	0.00	0.00	2.
1.02	16.00	20	10.76	10.66	.10	1248.	1.15	4.00	170	0.00	0.00	0.00	2.
1.02	18.00	21	4.26	4.16	.10	2262.	1.15	6.00	171	0.00	0.00	0.00	2.
1.02	20.00	22	.39	.29	.10	3637.	1.15	8.00	172	0.00	0.00	0.00	2.
1.02	22.00	23	.39	.29	.10	5126.	1.15	10.00	173	0.00	0.00	0.00	2.
1.03	0.00	24	.39	.29	.10	6442.	1.15	12.00	174	0.00	0.00	0.00	2.
1.03	2.00	25	0.00	0.00	0.00	7331.	1.15	14.00	175	0.00	0.00	0.00	2.
1.03	4.00	26	0.00	0.00	0.00	7660.	1.15	16.00	176	0.00	0.00	0.00	1.
1.03	6.00	27	0.00	0.00	0.00	7549.	1.15	18.00	177	0.00	0.00	0.00	1.
1.03	8.00	28	0.00	0.00	0.00	7260.	1.15	20.00	178	0.00	0.00	0.00	1.
1.03	10.00	29	0.00	0.00	0.00	6940.	1.15	22.00	179	0.00	0.00	0.00	1.
1.03	12.00	30	0.00	0.00	0.00	6617.	1.16	0.00	180	0.00	0.00	0.00	1.
1.03	14.00	31	0.00	0.00	0.00	6300.	1.16	2.00	181	0.00	0.00	0.00	1.
1.03	16.00	32	0.00	0.00	0.00	5997.	1.16	4.00	182	0.00	0.00	0.00	1.
1.03	18.00	33	0.00	0.00	0.00	5709.	1.16	6.00	183	0.00	0.00	0.00	1.
1.03	20.00	34	0.00	0.00	0.00	5434.	1.16	8.00	184	0.00	0.00	0.00	1.
1.03	22.00	35	0.00	0.00	0.00	5173.	1.16	10.00	185	0.00	0.00	0.00	1.
1.04	0.00	36	0.00	0.00	0.00	4924.	1.16	12.00	186	0.00	0.00	0.00	1.
1.04	2.00	37	0.00	0.00	0.00	4687.	1.16	14.00	187	0.00	0.00	0.00	1.
1.04	4.00	38	0.00	0.00	0.00	4462.	1.16	16.00	188	0.00	0.00	0.00	1.
1.04	6.00	39	0.00	0.00	0.00	4247.	1.16	18.00	189	0.00	0.00	0.00	1.
1.04	8.00	40	0.00	0.00	0.00	4043.	1.16	20.00	190	0.00	0.00	0.00	1.
1.04	10.00	41	0.00	0.00	0.00	3849.	1.16	22.00	191	0.00	0.00	0.00	0.
1.04	12.00	42	0.00	0.00	0.00	3664.	1.17	0.00	192	0.00	0.00	0.00	0.
1.04	14.00	43	0.00	0.00	0.00	3487.	1.17	2.00	193	0.00	0.00	0.00	0.
1.04	16.00	44	0.00	0.00	0.00	3320.	1.17	4.00	194	0.00	0.00	0.00	0.
1.04	18.00	45	0.00	0.00	0.00	3160.	1.17	6.00	195	0.00	0.00	0.00	0.
1.04	20.00	46	0.00	0.00	0.00	3008.	1.17	8.00	196	0.00	0.00	0.00	0.
1.04	22.00	47	0.00	0.00	0.00	2864.	1.17	10.00	197	0.00	0.00	0.00	0.
1.05	0.00	48	0.00	0.00	0.00	2726.	1.17	12.00	198	0.00	0.00	0.00	0.
1.05	2.00	49	0.00	0.00	0.00	2595.	1.17	14.00	199	0.00	0.00	0.00	0.
1.05	4.00	50	0.00	0.00	0.00	2470.	1.17	16.00	200	0.00	0.00	0.00	0.
1.05	6.00	51	0.00	0.00	0.00	2351.	1.17	18.00	201	0.00	0.00	0.00	0.
1.05	8.00	52	0.00	0.00	0.00	2238.	1.17	20.00	202	0.00	0.00	0.00	0.
1.05	10.00	53	0.00	0.00	0.00	2131.	1.17	22.00	203	0.00	0.00	0.00	0.

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1.05	12.00	54	0.00	0.00	0.00	2029.	1.18	0.00	204	0.00	0.00	0.00	0.
1.05	14.00	55	0.00	0.00	0.00	1931.	1.18	2.00	205	0.00	0.00	0.00	0.
1.05	16.00	56	0.00	0.00	0.00	1838.	1.18	4.00	206	0.00	0.00	0.00	0.
1.05	18.00	57	0.00	0.00	0.00	1749.	1.18	6.00	207	0.00	0.00	0.00	0.
1.05	20.00	58	0.00	0.00	0.00	1665.	1.18	8.00	208	0.00	0.00	0.00	0.
1.05	22.00	59	0.00	0.00	0.00	1585.	1.18	10.00	209	0.00	0.00	0.00	0.
1.06	0.00	60	0.00	0.00	0.00	1509.	1.18	12.00	210	0.00	0.00	0.00	0.
1.06	2.00	61	0.00	0.00	0.00	1436.	1.18	14.00	211	0.00	0.00	0.00	0.
1.06	4.00	62	0.00	0.00	0.00	1367.	1.18	16.00	212	0.00	0.00	0.00	0.
1.06	6.00	63	0.00	0.00	0.00	1302.	1.18	18.00	213	0.00	0.00	0.00	0.
1.06	8.00	64	0.00	0.00	0.00	1239.	1.18	20.00	214	0.00	0.00	0.00	0.
1.06	10.00	65	0.00	0.00	0.00	1179.	1.18	22.00	215	0.00	0.00	0.00	0.
1.06	12.00	66	0.00	0.00	0.00	1123.	1.19	0.00	216	0.00	0.00	0.00	0.
1.06	14.00	67	0.00	0.00	0.00	1069.	1.19	2.00	217	0.00	0.00	0.00	0.
1.06	16.00	68	0.00	0.00	0.00	1017.	1.19	4.00	218	0.00	0.00	0.00	0.
1.06	18.00	69	0.00	0.00	0.00	968.	1.19	6.00	219	0.00	0.00	0.00	0.
1.06	20.00	70	0.00	0.00	0.00	922.	1.19	8.00	220	0.00	0.00	0.00	0.
1.06	22.00	71	0.00	0.00	0.00	878.	1.19	10.00	221	0.00	0.00	0.00	0.
1.07	0.00	72	0.00	0.00	0.00	835.	1.19	12.00	222	0.00	0.00	0.00	0.
1.07	2.00	73	0.00	0.00	0.00	795.	1.19	14.00	223	0.00	0.00	0.00	0.
1.07	4.00	74	0.00	0.00	0.00	757.	1.19	16.00	224	0.00	0.00	0.00	0.
1.07	6.00	75	0.00	0.00	0.00	721.	1.19	18.00	225	0.00	0.00	0.00	0.
1.07	8.00	76	0.00	0.00	0.00	686.	1.19	20.00	226	0.00	0.00	0.00	0.
1.07	10.00	77	0.00	0.00	0.00	653.	1.19	22.00	227	0.00	0.00	0.00	0.
1.07	12.00	78	0.00	0.00	0.00	622.	1.20	0.00	228	0.00	0.00	0.00	0.
1.07	14.00	79	0.00	0.00	0.00	592.	1.20	2.00	229	0.00	0.00	0.00	0.
1.07	16.00	80	0.00	0.00	0.00	563.	1.20	4.00	230	0.00	0.00	0.00	0.
1.07	18.00	81	0.00	0.00	0.00	536.	1.20	6.00	231	0.00	0.00	0.00	0.
1.07	20.00	82	0.00	0.00	0.00	510.	1.20	8.00	232	0.00	0.00	0.00	0.
1.07	22.00	83	0.00	0.00	0.00	486.	1.20	10.00	233	0.00	0.00	0.00	0.
1.08	0.00	84	0.00	0.00	0.00	462.	1.20	12.00	234	0.00	0.00	0.00	0.
1.08	2.00	85	0.00	0.00	0.00	440.	1.20	14.00	235	0.00	0.00	0.00	0.
1.08	4.00	86	0.00	0.00	0.00	419.	1.20	16.00	236	0.00	0.00	0.00	0.
1.08	6.00	87	0.00	0.00	0.00	399.	1.20	18.00	237	0.00	0.00	0.00	0.
1.08	8.00	88	0.00	0.00	0.00	380.	1.20	20.00	238	0.00	0.00	0.00	0.
1.08	10.00	89	0.00	0.00	0.00	361.	1.20	22.00	239	0.00	0.00	0.00	0.
1.08	12.00	90	0.00	0.00	0.00	344.	1.21	0.00	240	0.00	0.00	0.00	0.
1.08	14.00	91	0.00	0.00	0.00	328.	1.21	2.00	241	0.00	0.00	0.00	0.
1.08	16.00	92	0.00	0.00	0.00	312.	1.21	4.00	242	0.00	0.00	0.00	0.
1.08	18.00	93	0.00	0.00	0.00	297.	1.21	6.00	243	0.00	0.00	0.00	0.
1.08	20.00	94	0.00	0.00	0.00	283.	1.21	8.00	244	0.00	0.00	0.00	0.
1.08	22.00	95	0.00	0.00	0.00	269.	1.21	10.00	245	0.00	0.00	0.00	0.
1.09	0.00	96	0.00	0.00	0.00	256.	1.21	12.00	246	0.00	0.00	0.00	0.
1.09	2.00	97	0.00	0.00	0.00	244.	1.21	14.00	247	0.00	0.00	0.00	0.
1.09	4.00	98	0.00	0.00	0.00	232.	1.21	16.00	248	0.00	0.00	0.00	0.
1.09	6.00	99	0.00	0.00	0.00	221.	1.21	18.00	249	0.00	0.00	0.00	0.
1.09	8.00	100	0.00	0.00	0.00	210.	1.21	20.00	250	0.00	0.00	0.00	0.
1.09	10.00	101	0.00	0.00	0.00	200.	1.21	22.00	251	0.00	0.00	0.00	0.
1.09	12.00	102	0.00	0.00	0.00	190.	1.22	0.00	252	0.00	0.00	0.00	0.
1.09	14.00	103	0.00	0.00	0.00	181.	1.22	2.00	253	0.00	0.00	0.00	0.
1.09	16.00	104	0.00	0.00	0.00	173.	1.22	4.00	254	0.00	0.00	0.00	0.
1.09	18.00	105	0.00	0.00	0.00	164.	1.22	6.00	255	0.00	0.00	0.00	0.
1.09	20.00	106	0.00	0.00	0.00	156.	1.22	8.00	256	0.00	0.00	0.00	0.
1.09	22.00	107	0.00	0.00	0.00	149.	1.22	10.00	257	0.00	0.00	0.00	0.
1.10	0.00	108	0.00	0.00	0.00	140.	1.22	12.00	258	0.00	0.00	0.00	0.
1.10	2.00	109	0.00	0.00	0.00	132.	1.22	14.00	259	0.00	0.00	0.00	0.
1.10	4.00	110	0.00	0.00	0.00	126.	1.22	16.00	260	0.00	0.00	0.00	0.
1.10	6.00	111	0.00	0.00	0.00	120.	1.22	18.00	261	0.00	0.00	0.00	0.
1.10	8.00	112	0.00	0.00	0.00	114.	1.22	20.00	262	0.00	0.00	0.00	0.
1.10	10.00	113	0.00	0.00	0.00	108.	1.22	22.00	263	0.00	0.00	0.00	0.
1.10	12.00	114	0.00	0.00	0.00	102.	1.23	0.00	264	0.00	0.00	0.00	0.
1.10	14.00	115	0.00	0.00	0.00	97.	1.23	2.00	265	0.00	0.00	0.00	0.

Sh 5

1.10	16.00	116	0.00	0.00	0.00	90.	1.23	4.00	266	0.00	0.00	0.00	0.
1.10	18.00	117	0.00	0.00	0.00	84.	1.23	6.00	267	0.00	0.00	0.00	0.
1.10	20.00	118	0.00	0.00	0.00	79.	1.23	8.00	268	0.00	0.00	0.00	0.
1.10	22.00	119	0.00	0.00	0.00	73.	1.23	10.00	269	0.00	0.00	0.00	0.
1.11	0.00	120	0.00	0.00	0.00	68.	1.23	12.00	270	0.00	0.00	0.00	0.
1.11	2.00	121	0.00	0.00	0.00	64.	1.23	14.00	271	0.00	0.00	0.00	0.
1.11	4.00	122	0.00	0.00	0.00	60.	1.23	16.00	272	0.00	0.00	0.00	0.
1.11	6.00	123	0.00	0.00	0.00	56.	1.23	18.00	273	0.00	0.00	0.00	0.
1.11	8.00	124	0.00	0.00	0.00	52.	1.23	20.00	274	0.00	0.00	0.00	0.
1.11	10.00	125	0.00	0.00	0.00	48.	1.23	22.00	275	0.00	0.00	0.00	0.
1.11	12.00	126	0.00	0.00	0.00	45.	1.24	0.00	276	0.00	0.00	0.00	0.
1.11	14.00	127	0.00	0.00	0.00	42.	1.24	2.00	277	0.00	0.00	0.00	0.
1.11	16.00	128	0.00	0.00	0.00	39.	1.24	4.00	278	0.00	0.00	0.00	0.
1.11	18.00	129	0.00	0.00	0.00	37.	1.24	6.00	279	0.00	0.00	0.00	0.
1.11	20.00	130	0.00	0.00	0.00	34.	1.24	8.00	280	0.00	0.00	0.00	0.
1.11	22.00	131	0.00	0.00	0.00	32.	1.24	10.00	281	0.00	0.00	0.00	0.
1.12	0.00	132	0.00	0.00	0.00	30.	1.24	12.00	282	0.00	0.00	0.00	0.
1.12	2.00	133	0.00	0.00	0.00	28.	1.24	14.00	283	0.00	0.00	0.00	0.
1.12	4.00	134	0.00	0.00	0.00	26.	1.24	16.00	284	0.00	0.00	0.00	0.
1.12	6.00	135	0.00	0.00	0.00	24.	1.24	18.00	285	0.00	0.00	0.00	0.
1.12	8.00	136	0.00	0.00	0.00	23.	1.24	20.00	286	0.00	0.00	0.00	0.
1.12	10.00	137	0.00	0.00	0.00	21.	1.24	22.00	287	0.00	0.00	0.00	0.
1.12	12.00	138	0.00	0.00	0.00	20.	1.25	0.00	288	0.00	0.00	0.00	0.
1.12	14.00	139	0.00	0.00	0.00	18.	1.25	2.00	289	0.00	0.00	0.00	0.
1.12	16.00	140	0.00	0.00	0.00	17.	1.25	4.00	290	0.00	0.00	0.00	0.
1.12	18.00	141	0.00	0.00	0.00	16.	1.25	6.00	291	0.00	0.00	0.00	0.
1.12	20.00	142	0.00	0.00	0.00	15.	1.25	8.00	292	0.00	0.00	0.00	0.
1.12	22.00	143	0.00	0.00	0.00	14.	1.25	10.00	293	0.00	0.00	0.00	0.
1.13	0.00	144	0.00	0.00	0.00	13.	1.25	12.00	294	0.00	0.00	0.00	0.
1.13	2.00	145	0.00	0.00	0.00	12.	1.25	14.00	295	0.00	0.00	0.00	0.
1.13	4.00	146	0.00	0.00	0.00	11.	1.25	16.00	296	0.00	0.00	0.00	0.
1.13	6.00	147	0.00	0.00	0.00	11.	1.25	18.00	297	0.00	0.00	0.00	0.
1.13	8.00	148	0.00	0.00	0.00	10.	1.25	20.00	298	0.00	0.00	0.00	0.
1.13	10.00	149	0.00	0.00	0.00	9.	1.25	22.00	299	0.00	0.00	0.00	0.
1.13	12.00	150	0.00	0.00	0.00	9.	1.26	0.00	300	0.00	0.00	0.00	0.
									SUM	26.35	23.88	2.47	196211.
										(669.)	(606.)	(63.)	(5556.08)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7660.	7502.	6532.	4311.	196197.
CMS	217.	212.	185.	122.	5556.
INCHES		2.74	9.53	18.87	23.86
MM		69.51	242.12	479.36	605.98
AC-FT		3720.	12957.	25653.	32429.
THOUS CU M		4588.	15982.	31643.	40001.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	383.	375.	327.	216.	9810.
CMS	11.	11.	9.	6.	278.
INCHES		.14	.48	.94	1.19
MM		3.48	12.11	23.97	30.30
AC-FT		186.	648.	1283.	1621.
THOUS CU M		229.	799.	1582.	2000.

SH 6

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	764.	750.	653.	431.	19620.
CMS	22.	21.	18.	12.	556.
INCHES		.27	.95	1.89	2.39
MM		6.95	24.21	47.94	60.60
AC-FT		372.	1296.	2565.	3243.
THOUS CU M		459.	1598.	3164.	4000.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1149.	1125.	980.	647.	29430.
CMS	33.	32.	28.	18.	833.
INCHES		.41	1.43	2.83	3.58
MM		10.43	36.32	71.90	90.90
AC-FT		558.	1944.	3848.	4864.
THOUS CU M		688.	2397.	4746.	6000.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1532.	1500.	1306.	862.	39239.
CMS	43.	42.	37.	24.	1111.
INCHES		.55	1.91	3.77	4.77
MM		13.90	48.42	95.87	121.20
AC-FT		744.	2591.	5131.	6486.
THOUS CU M		918.	3196.	6329.	8000.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2298.	2251.	1960.	1293.	58859.
CMS	65.	64.	55.	37.	1667.
INCHES		.82	2.86	5.66	7.16
MM		20.85	72.63	143.81	181.79
AC-FT		1116.	3887.	7696.	9729.
THOUS CU M		1377.	4795.	9493.	12000.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3064.	3001.	2613.	1724.	78479.
CMS	87.	85.	74.	49.	2222.
INCHES		1.09	3.81	7.55	9.54
MM		27.80	96.85	191.75	242.39
AC-FT		1488.	5183.	10261.	12972.
THOUS CU M		1835.	6393.	12657.	16000.

Sh 7

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME

CFS	3830.	3751.	3266.	2156.	98099.
CMS	108.	106.	92.	61.	2778.
INCHES		1.37	4.77	9.44	11.93
MM		34.75	121.06	239.68	302.99
AC-FT		1860.	6478.	12827.	16215.
THOUS CU M		2294.	7991.	15822.	20000.

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HYDROGRAPH ROUTING

ROUTING THROUGH OLIPHANTS MILL DAM RESERVOIR

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

ROUTING DATA

OLOSS	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	-29.	0

SURFACE AREA=	0.	30.	250.
CAPACITY=	0.	90.	1434.
ELEVATION=	20.	29.	40.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
29.0	63.0	3.4	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
31.2	3.1	1.5	136.

STATION OUTFLO, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

5.	4.	3.	3.	2.	2.	2.	2.	2.	3.
4.	7.	10.	12.	14.	16.	18.	21.	26.	40.
72.	126.	197.	270.	330.	366.	377.	372.	358.	342.
327.	311.	296.	282.	269.	256.	244.	232.	221.	210.
200.	191.	182.	173.	165.	157.	149.	142.	136.	129.
123.	117.	111.	106.	101.	96.	92.	87.	83.	79.
75.	72.	68.	65.	62.	59.	56.	54.	51.	49.
46.	44.	42.	40.	38.	36.	35.	33.	32.	30.
29.	27.	26.	25.	24.	22.	21.	20.	19.	19.
18.	17.	16.	15.	15.	14.	13.	13.	12.	11.
11.	10.	10.	9.	9.	9.	8.	8.	7.	7.
7.	6.	6.	6.	5.	5.	5.	5.	4.	4.
4.	4.	3.	3.	3.	3.	3.	2.	2.	2.
2.	2.	2.	2.	2.	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.

SH 8

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.	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.	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.	0.	0.	0.	0.

STORAGE

92.	92.	92.	92.	91.	91.	91.	91.	91.	92.
92.	93.	94.	94.	95.	95.	96.	96.	98.	100.
106.	114.	123.	132.	139.	144.	145.	145.	143.	141.
139.	137.	135.	134.	132.	130.	129.	127.	126.	125.
123.	122.	121.	120.	119.	118.	117.	116.	115.	114.
113.	112.	111.	111.	110.	109.	109.	108.	107.	107.
106.	106.	105.	105.	104.	104.	103.	103.	102.	102.
101.	101.	101.	100.	100.	100.	99.	99.	99.	98.
98.	98.	98.	97.	97.	97.	97.	96.	96.	96.
96.	96.	95.	95.	95.	95.	95.	95.	94.	94.
94.	94.	94.	94.	94.	94.	93.	93.	93.	93.
93.	93.	93.	93.	93.	93.	92.	92.	92.	92.
92.	92.	92.	92.	92.	92.	92.	92.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.

STAGE

29.1	29.1	29.1	29.1	29.0	29.0	29.0	29.0	29.0	29.1
29.1	29.1	29.1	29.1	29.2	29.2	29.2	29.2	29.2	29.3
29.5	29.7	29.9	30.2	30.3	30.4	30.4	30.4	30.4	30.4
30.3	30.3	30.2	30.2	30.2	30.1	30.1	30.0	30.0	30.0
30.0	29.9	29.9	29.9	29.8	29.8	29.8	29.8	29.7	29.7
29.7	29.7	29.6	29.6	29.6	29.6	29.6	29.5	29.5	29.5
29.5	29.5	29.5	29.4	29.4	29.4	29.4	29.4	29.4	29.4
29.4	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3
29.3	29.3	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

Sh 9

29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

PEAK OUTFLOW IS 377. AT TIME 54.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	377.	370.	324.	215.	9841.
CMS	11.	10.	9.	6.	279.
INCHES		.14	.47	.94	1.20
MM		3.43	12.03	23.93	30.39
AC-FT		184.	644.	1281.	1627.
THOUS CU M		227.	794.	1580.	2006.

STATION OUTFLO, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

6.	5.	4.	4.	3.	3.	3.	3.	3.	6.
10.	15.	21.	26.	30.	33.	37.	43.	55.	84.
152.	264.	405.	548.	664.	740.	760.	741.	711.	682.
652.	621.	592.	563.	536.	510.	486.	463.	440.	419.
399.	380.	362.	344.	328.	312.	297.	283.	270.	257.
245.	233.	222.	211.	201.	191.	182.	174.	165.	157.
150.	143.	136.	129.	123.	117.	112.	106.	101.	97.
92.	88.	83.	79.	76.	72.	69.	65.	62.	59.
57.	54.	51.	49.	47.	44.	42.	40.	38.	37.
35.	33.	32.	30.	29.	27.	26.	25.	24.	23.
21.	20.	20.	19.	18.	17.	16.	15.	14.	14.
13.	12.	12.	11.	11.	10.	10.	9.	8.	8.
7.	7.	6.	6.	6.	5.	5.	5.	4.	4.
4.	4.	3.	3.	3.	3.	3.	2.	2.	2.
2.	2.	2.	2.	2.	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.	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.	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.	0.	0.	0.	0.	0.	0.	0.

Sh 10

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
				STORAGE					
93.	92.	92.	92.	92.	92.	92.	92.	92.	93.
94.	95.	97.	98.	98.	99.	100.	101.	103.	108.
117.	131.	149.	165.	179.	187.	189.	187.	184.	181.
178.	174.	171.	167.	164.	161.	158.	155.	153.	150.
148.	145.	143.	141.	139.	137.	135.	134.	132.	131.
129.	128.	126.	125.	123.	122.	121.	120.	119.	118.
117.	116.	115.	114.	113.	112.	112.	111.	110.	109.
109.	108.	107.	107.	106.	106.	105.	105.	104.	104.
103.	103.	102.	102.	101.	101.	101.	100.	100.	100.
99.	99.	99.	98.	98.	98.	98.	97.	97.	97.
97.	96.	96.	96.	96.	96.	95.	95.	95.	95.
95.	95.	94.	94.	94.	94.	94.	94.	94.	93.
93.	93.	93.	93.	93.	93.	92.	92.	92.	92.
92.	92.	92.	92.	92.	92.	92.	92.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
				STAGE					
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.2	29.2	29.2	29.3	29.3	29.3	29.3	29.4	29.5
29.8	30.1	30.5	30.9	31.1	31.3	31.3	31.3	31.2	31.2
31.1	31.0	31.0	30.9	30.8	30.8	30.7	30.7	30.6	30.6
30.5	30.5	30.4	30.4	30.3	30.3	30.2	30.2	30.2	30.1
30.1	30.1	30.0	30.0	30.0	29.9	29.9	29.9	29.8	29.8
29.8	29.8	29.7	29.7	29.7	29.7	29.6	29.6	29.6	29.6
29.6	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.4	29.4
29.4	29.4	29.4	29.4	29.4	29.3	29.3	29.3	29.3	29.3
29.3	29.3	29.3	29.3	29.3	29.3	29.2	29.2	29.2	29.2
29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
29.2	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

PEAK OUTFLOW IS 760. AT TIME 54.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	760.	742.	649.	431.	19653.
CMS	22.	21.	18.	12.	557.
INCHES		.27	.95	1.88	2.39
MM		6.88	24.07	47.87	60.70
AC-FT		368.	1288.	2562.	3248.
THOUS CU M		454.	1589.	3160.	4007.

STATION OUTFLO, PLAN 1, RATIO 3

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

6.	6.	5.	5.	5.	4.	4.	4.	5.	9.
15.	24.	33.	41.	46.	50.	56.	65.	84.	130.
233.	402.	612.	849.	1049.	1133.	1141.	1108.	1060.	1012.
965.	919.	875.	834.	794.	757.	722.	690.	660.	628.
598.	570.	542.	516.	491.	466.	445.	424.	404.	384.
366.	348.	331.	316.	300.	286.	273.	260.	247.	235.
224.	213.	203.	194.	184.	176.	167.	159.	152.	144.
137.	131.	125.	119.	113.	108.	103.	98.	93.	89.
84.	80.	77.	73.	69.	66.	63.	60.	57.	54.
52.	49.	47.	45.	43.	41.	39.	37.	35.	34.
32.	30.	29.	28.	26.	25.	24.	23.	21.	20.
19.	18.	18.	17.	16.	15.	14.	13.	12.	12.
11.	10.	9.	9.	8.	8.	7.	7.	6.	6.
6.	5.	5.	5.	4.	4.	4.	4.	3.	3.
3.	3.	3.	2.	2.	2.	2.	2.	2.	2.
2.	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.	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.	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.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

STORAGE

93.	93.	93.	93.	92.	92.	92.	92.	93.	94.
95.	97.	99.	100.	101.	102.	103.	105.	107.	114.
128.	148.	173.	196.	209.	215.	216.	213.	210.	207.
204.	201.	197.	194.	191.	188.	185.	182.	179.	175.
171.	168.	165.	162.	159.	156.	153.	151.	148.	146.
144.	142.	140.	138.	136.	134.	132.	131.	129.	128.
126.	125.	124.	123.	121.	120.	119.	118.	117.	116.

Sh 12

115.	114.	113.	113.	112.	111.	110.	110.	109.	108.
108.	107.	106.	106.	105.	105.	104.	104.	103.	103.
102.	102.	102.	101.	101.	100.	100.	100.	99.	99.
99.	99.	98.	98.	98.	97.	97.	97.	97.	96.
96.	96.	96.	96.	95.	95.	95.	95.	95.	94.
94.	94.	94.	94.	93.	93.	93.	93.	93.	93.
93.	93.	92.	92.	92.	92.	92.	92.	92.	92.
92.	92.	92.	92.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.

STAGE

29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.2	29.2	29.3	29.3	29.4	29.4	29.4	29.4	29.5	29.7
30.1	30.5	31.0	31.4	31.6	31.7	31.7	31.7	31.6	31.6
31.5	31.5	31.4	31.4	31.3	31.3	31.2	31.2	31.1	31.0
31.0	30.9	30.8	30.8	30.7	30.7	30.6	30.6	30.5	30.5
30.4	30.4	30.3	30.3	30.2	30.2	30.2	30.1	30.1	30.1
30.0	30.0	30.0	29.9	29.9	29.9	29.8	29.8	29.8	29.8
29.7	29.7	29.7	29.7	29.6	29.6	29.6	29.6	29.6	29.6
29.5	29.5	29.5	29.5	29.5	29.5	29.4	29.4	29.4	29.4
29.4	29.4	29.4	29.4	29.3	29.3	29.3	29.3	29.3	29.3
29.3	29.3	29.3	29.3	29.2	29.2	29.2	29.2	29.2	29.2
29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

PEAK OUTFLOW IS 1141. AT TIME 54.00 HOURS

Sh 13

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1141.	1118.	974.	646.	29465.
CMS	32.	32.	28.	18.	834.

INCHES	.41	1.42	2.83	3.58
MM	10.36	36.11	71.82	91.01
AC-FT	554.	1931.	3843.	4870.
THOUS CU M	684.	2384.	4741.	6007.

STATION OUTFLO, PLAN 1, RATIO 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

7.	7.	7.	6.	6.	6.	5.	5.	7.	12.
21.	33.	45.	56.	62.	68.	75.	88.	113.	176.
315.	540.	842.	1188.	1404.	1514.	1522.	1475.	1411.	1347.
1244.	1222.	1164.	1108.	1055.	1005.	957.	911.	868.	827.
788.	751.	716.	685.	654.	623.	594.	565.	538.	512.
487.	464.	442.	421.	400.	381.	363.	345.	329.	313.
298.	284.	271.	258.	245.	234.	222.	212.	202.	192.
183.	174.	166.	158.	150.	143.	136.	130.	124.	118.
112.	107.	102.	97.	92.	88.	84.	80.	76.	72.
69.	66.	63.	60.	57.	54.	51.	49.	47.	45.
42.	40.	38.	37.	35.	33.	32.	30.	28.	27.
26.	24.	23.	22.	21.	20.	19.	17.	16.	15.
14.	13.	13.	12.	11.	10.	10.	9.	8.	8.
7.	7.	6.	6.	6.	5.	5.	5.	4.	4.
4.	4.	3.	3.	3.	3.	3.	2.	2.	2.
2.	2.	2.	2.	2.	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.	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.	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.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

STORAGE

93.	93.	93.	93.	93.	93.	93.	93.	93.	94.
97.	99.	101.	103.	104.	105.	106.	108.	112.	120.
134.	165.	195.	219.	232.	238.	239.	234.	232.	228.
224.	221.	217.	213.	210.	207.	203.	200.	197.	194.
191.	188.	185.	182.	178.	174.	171.	167.	164.	161.
158.	156.	153.	150.	148.	146.	143.	141.	139.	137.
136.	134.	132.	131.	129.	128.	126.	125.	124.	122.
121.	120.	119.	118.	117.	116.	115.	114.	113.	112.
112.	111.	110.	109.	109.	108.	107.	107.	106.	106.
105.	105.	104.	104.	103.	103.	102.	102.	101.	101.
101.	100.	100.	100.	99.	99.	99.	98.	98.	98.
98.	97.	97.	97.	97.	96.	96.	96.	96.	95.
95.	95.	95.	94.	94.	94.	94.	94.	94.	93.
93.	93.	93.	93.	93.	93.	92.	92.	92.	92.
92.	92.	92.	92.	92.	92.	92.	92.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	90.	90.	90.	90.	90.	90.

Sh 14

90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.

STAGE

29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.2	29.3	29.4	29.4	29.4	29.5	29.5	29.5	29.6	29.9
30.3	30.8	31.4	31.8	32.0	32.1	32.1	32.0	32.0	31.9
31.9	31.9	31.7	31.7	31.6	31.6	31.5	31.5	31.4	31.4
31.3	31.3	31.2	31.2	31.1	31.0	31.0	30.9	30.8	30.8
30.7	30.7	30.6	30.6	30.5	30.5	30.4	30.4	30.3	30.3
30.2	30.2	30.2	30.1	30.1	30.1	30.0	30.0	30.0	29.9
29.9	29.9	29.8	29.8	29.8	29.8	29.7	29.7	29.7	29.7
29.6	29.6	29.6	29.6	29.5	29.5	29.5	29.5	29.5	29.5
29.5	29.5	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.3
29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.2
29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
29.2	29.2	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

PEAK OUTFLOW IS 1522. AT TIME 54.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1522.	1492.	1300.	861.	39276.
CMS	43.	42.	37.	24.	1112.
INCHES		.54	1.90	3.77	4.78
MM		13.82	48.19	95.77	121.31
AC-FT		740.	2579.	5125.	6492.
THOUS CU M		913.	3181.	6322.	8008.

Sh 15

STATION OUTFLO, PLAN 1, RATIO 5

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

8.	9.	9.	9.	9.	8.	8.	8.	11.	19.
33.	52.	70.	85.	95.	102.	114.	133.	171.	268.
479.	437.	1368.	1795.	2114.	2273.	2283.	2211.	2115.	2019.
1923.	1831.	1743.	1659.	1580.	1504.	1432.	1363.	1298.	1236.
1177.	1121.	1067.	1016.	968.	922.	878.	836.	797.	759.
724.	691.	662.	630.	600.	571.	544.	518.	493.	469.
447.	425.	405.	385.	367.	349.	333.	317.	301.	287.
274.	261.	248.	236.	225.	214.	204.	194.	185.	176.
168.	160.	152.	145.	138.	131.	125.	119.	113.	108.
103.	98.	93.	89.	85.	81.	77.	73.	70.	66.
63.	60.	57.	55.	52.	50.	47.	45.	42.	40.
38.	36.	35.	33.	31.	29.	28.	26.	24.	23.
21.	20.	19.	17.	16.	15.	14.	13.	12.	12.
11.	10.	10.	9.	8.	8.	7.	7.	6.	6.
6.	5.	5.	5.	4.	4.	4.	4.	3.	3.
3.	3.	3.	2.	2.	2.	2.	2.	2.	2.
2.	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.	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.	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.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

STORAGE

94.	94.	94.	94.	94.	94.	93.	93.	94.	96.
99.	102.	105.	108.	109.	110.	112.	114.	120.	132.
157.	195.	230.	255.	273.	283.	283.	279.	274.	268.
263.	257.	252.	247.	242.	238.	234.	229.	225.	222.
218.	214.	211.	207.	204.	201.	198.	195.	192.	189.
186.	182.	179.	175.	172.	168.	165.	162.	159.	156.
153.	151.	148.	146.	144.	142.	140.	138.	136.	134.
133.	131.	129.	128.	127.	125.	124.	123.	121.	120.
119.	118.	117.	116.	115.	114.	113.	113.	112.	111.
110.	110.	109.	108.	108.	107.	106.	106.	105.	105.
104.	104.	103.	103.	102.	102.	102.	101.	101.	100.
100.	100.	99.	99.	99.	98.	98.	98.	97.	97.
97.	96.	96.	96.	95.	95.	95.	95.	95.	94.
94.	94.	94.	94.	93.	93.	93.	93.	93.	93.
93.	93.	92.	92.	92.	92.	92.	92.	92.	92.
92.	92.	92.	92.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.

Sh 16

90.	90.	90.	90.	90.	90.	90.	90.	90.	90.

STAGE

29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.2
29.3	29.4	29.5	29.5	29.6	29.6	29.7	29.7	29.9	30.2
30.7	31.4	31.9	32.3	32.5	32.7	32.7	32.6	32.5	32.5
32.4	32.3	32.3	32.2	32.1	32.1	32.0	31.9	31.9	31.8
31.5	31.7	31.6	31.6	31.5	31.5	31.4	31.4	31.3	31.3
31.2	31.2	31.1	31.0	31.0	30.9	30.8	30.8	30.7	30.7
30.5	30.6	30.5	30.5	30.4	30.4	30.3	30.3	30.2	30.2
30.2	30.1	30.1	30.1	30.0	30.0	30.0	29.9	29.9	29.9
29.9	29.9	29.8	29.8	29.7	29.7	29.7	29.7	29.7	29.6
29.6	29.5	29.6	29.6	29.5	29.5	29.5	29.5	29.5	29.5
29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.3	29.3
29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.2	29.2	29.2
29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

PEAK OUTFLOW IS 2283. AT TIME 54.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2283.	2240.	1953.	1292.	58893.
CMS	65.	63.	55.	37.	1668.
INCHES		.82	2.85	5.66	7.16
MM		20.75	72.40	143.67	181.92
AC-FT		1111.	3874.	7688.	9735.
THOUS CU M		1370.	4779.	9484.	12008.

STATION OUTFLO, PLAN 1, RATIO 6

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

10.	12.	12.	12.	12.	11.	11.	11.	15.	26.
46.	71.	96.	115.	127.	137.	152.	178.	230.	360.
641.	1200.	1840.	2399.	2821.	3031.	3044.	2947.	2820.	2691.
2563.	2449.	2323.	2211.	2105.	2004.	1908.	1815.	1729.	1646.
1567.	1492.	1421.	1352.	1288.	1226.	1167.	1112.	1059.	1008.
960.	914.	871.	830.	790.	753.	718.	687.	657.	625.
595.	567.	540.	515.	489.	465.	443.	422.	402.	382.
364.	347.	330.	314.	299.	285.	271.	258.	246.	234.
223.	212.	202.	193.	183.	175.	166.	158.	151.	144.
137.	130.	124.	118.	113.	107.	102.	97.	93.	88.

Sh 17

84.	80.	76.	73.	69.	66.	63.	60.	56.	53.
51.	43.	46.	44.	41.	39.	37.	34.	32.	30.
28.	25.	24.	23.	21.	20.	19.	17.	16.	15.
14.	13.	13.	12.	11.	10.	10.	9.	8.	8.
7.	7.	6.	6.	6.	5.	5.	5.	4.	4.
4.	4.	3.	3.	3.	3.	3.	2.	2.	2.
2.	2.	2.	2.	2.	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.	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.	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.	0.	0.	0.	0.	0.	0.	0.

STORAGE

94.	94.	95.	95.	94.	94.	94.	94.	95.	98.
101.	105.	109.	112.	114.	115.	117.	121.	127.	143.
176.	217.	258.	290.	314.	326.	326.	321.	314.	306.
249.	292.	285.	279.	273.	267.	262.	256.	251.	246.
242.	237.	233.	229.	225.	221.	217.	214.	210.	207.
203.	200.	197.	194.	191.	188.	185.	182.	178.	175.
171.	165.	164.	161.	158.	156.	153.	151.	148.	146.
144.	141.	139.	138.	136.	134.	132.	131.	129.	128.
126.	125.	124.	122.	121.	120.	119.	118.	117.	116.
115.	114.	113.	112.	112.	111.	110.	109.	109.	108.
107.	107.	106.	106.	105.	105.	104.	104.	103.	103.
102.	102.	101.	101.	101.	100.	100.	99.	99.	98.
98.	98.	97.	97.	97.	96.	96.	96.	96.	95.
95.	95.	95.	94.	94.	94.	94.	94.	94.	93.
93.	93.	93.	93.	93.	93.	92.	92.	92.	92.
92.	92.	92.	92.	92.	92.	92.	92.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.

STAGE

29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.2	29.2
29.4	29.5	29.6	29.7	29.7	29.7	29.8	29.9	30.0	30.4
31.1	31.8	32.3	32.7	33.0	33.2	33.2	33.1	33.0	32.9
32.4	32.4	32.7	32.6	32.7	32.5	32.4	32.3	32.2	32.2
32.1	32.0	32.0	31.9	31.9	31.8	31.7	31.7	31.6	31.6
31.5	31.5	31.4	31.4	31.3	31.3	31.2	31.2	31.1	31.0
31.0	30.9	30.8	30.8	30.7	30.7	30.6	30.6	30.5	30.5
30.4	30.4	30.3	30.3	30.2	30.2	30.2	30.1	30.1	30.1

Sh 18

30.0	30.0	30.0	29.9	29.9	29.9	29.8	29.8	29.8	29.8
29.7	29.7	29.7	29.7	29.6	29.6	29.6	29.6	29.6	29.6
29.5	29.5	29.5	29.5	29.5	29.5	29.4	29.4	29.4	29.4
29.4	29.4	29.4	29.3	29.3	29.3	29.3	29.3	29.3	29.3
29.3	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2
29.2	29.2	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
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29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

PEAK OUTFLOW IS 3044. AT TIME 54.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3044.	2986.	2605.	1723.	78521.
CMS	86.	85.	74.	49.	2223.
INCHES		1.09	3.80	7.54	9.55
MM		27.67	96.56	191.58	242.52
AC-FT		1481.	5167.	10253.	12979.
THOUS CU M		1827.	6374.	12647.	16009.

STATION OUTFLO, PLAN 1, RATIO 7

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLO

12.	14.	15.	15.	15.	14.	13.	13.	19.	34.
59.	91.	121.	144.	160.	172.	191.	224.	289.	453.
824.	1554.	2303.	3002.	3526.	3789.	3805.	3684.	3525.	3364.
3264.	3050.	2903.	2764.	2631.	2504.	2384.	2270.	2160.	2057.
1958.	1864.	1775.	1689.	1608.	1531.	1458.	1388.	1322.	1258.
1198.	1141.	1086.	1034.	985.	938.	894.	851.	811.	773.
737.	703.	673.	642.	611.	582.	554.	527.	502.	478.
455.	433.	412.	392.	374.	356.	339.	322.	307.	292.
279.	265.	253.	240.	229.	218.	208.	198.	188.	179.
171.	163.	155.	147.	140.	134.	127.	121.	115.	110.
105.	100.	95.	91.	86.	82.	78.	74.	70.	66.
63.	60.	57.	54.	51.	49.	46.	43.	40.	37.
35.	33.	30.	28.	27.	25.	23.	22.	20.	19.
18.	17.	16.	15.	14.	13.	12.	11.	10.	10.
9.	9.	8.	7.	7.	7.	6.	6.	5.	5.
5.	4.	4.	4.	4.	3.	3.	3.	3.	3.
2.	2.	2.	2.	2.	2.	2.	2.	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.

Sh 19

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.	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.	0.	0.	0.	0.	0.	0.

STORAGE

94.	95.	95.	95.	95.	95.	95.	95.	96.	99.
104.	108.	113.	116.	118.	120.	122.	126.	134.	154.
194.	241.	284.	324.	354.	369.	369.	363.	354.	344.
335.	327.	318.	310.	303.	296.	289.	282.	276.	270.
265.	259.	254.	249.	244.	240.	235.	231.	227.	223.
219.	215.	212.	209.	205.	202.	199.	196.	193.	190.
187.	184.	180.	176.	173.	169.	166.	163.	160.	157.
154.	152.	149.	147.	145.	143.	141.	139.	137.	135.
133.	132.	130.	128.	127.	126.	124.	123.	122.	121.
120.	118.	117.	116.	116.	115.	114.	113.	112.	111.
111.	110.	109.	108.	108.	107.	107.	106.	105.	105.
104.	104.	103.	103.	102.	102.	101.	101.	100.	100.
99.	99.	98.	98.	98.	97.	97.	97.	96.	96.
96.	96.	95.	95.	95.	95.	94.	94.	94.	94.
94.	94.	93.	93.	93.	93.	93.	93.	93.	92.
92.	92.	92.	92.	92.	92.	92.	92.	92.	92.
92.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.

STAGE

29.1	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.3
29.4	29.5	29.7	29.8	29.8	29.9	29.9	30.0	30.2	30.6
31.4	32.1	32.7	33.1	33.5	33.6	33.6	33.6	33.5	33.4
33.3	33.2	33.1	33.0	32.9	32.8	32.7	32.7	32.6	32.5
32.4	32.3	32.3	32.2	32.1	32.1	32.0	32.0	31.9	31.8
31.5	31.7	31.7	31.6	31.6	31.5	31.5	31.4	31.3	31.3
31.2	31.2	31.1	31.1	31.0	30.9	30.9	30.8	30.8	30.7
30.6	30.6	30.5	30.5	30.4	30.4	30.3	30.3	30.3	30.2
30.2	30.1	30.1	30.1	30.0	30.0	30.0	29.9	29.9	29.9
29.9	29.9	29.8	29.8	29.7	29.7	29.7	29.7	29.7	29.6
29.6	29.6	29.6	29.6	29.5	29.5	29.5	29.5	29.5	29.5
29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.3	29.3	29.3
29.3	29.3	29.3	29.3	29.2	29.2	29.2	29.2	29.2	29.2
29.2	29.2	29.2	29.2	29.2	29.2	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1
29.1	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

Sh 20

29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
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29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

PEAK OUTFLOW IS 3805. AT TIME 54.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3805.	3733.	3257.	2155.	98143.
CMS	108.	106.	92.	61.	2779.
INCHES		1.36	4.75	9.43	11.93
MM		34.59	120.71	239.59	303.13
AC-FT		1851.	6460.	12822.	16222.
THOUS CU M		2283.	7968.	15815.	20010.

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

Sh 21

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 .05	RATIO 2 .10	RATIO 3 .15	RATIO 4 .20	RATIO 5 .30	RATIO 6 .40	RATIO 7 .50
HYDROGRAPH AT	INFLOW	25.50	1	383.	766.	1149.	1532.	2294.	3064.	3830.
		(66.04)		(10.85)(	21.69)(	32.54)(	43.38)(	65.07)(	86.76)(	108.46)(
ROUTED TO	OUTFLO	25.50	1	377.	760.	1141.	1522.	2283.	3044.	3805.
		(66.04)		(10.69)(	21.53)(	32.32)(	43.10)(	64.64)(	86.19)(	107.74)(

SH 22

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	29.10	29.00	31.17
STORAGE	93.	90.	182.
OUTFLOW	7.	0.	691.

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
.05	30.45	0.00	145.	377.	0.00	54.00	0.00
.10	31.28	.11	189.	760.	8.00	54.00	0.00
.15	31.72	.55	216.	1141.	28.00	54.00	0.00
.20	32.07	.90	239.	1522.	42.00	54.00	0.00
.30	32.66	1.49	283.	2283.	62.00	54.00	0.00
.40	33.17	2.00	326.	3044.	72.00	54.00	0.00
.50	33.64	2.47	369.	3805.	84.00	54.00	0.00

SH 23

APPENDIX

D

Photographs

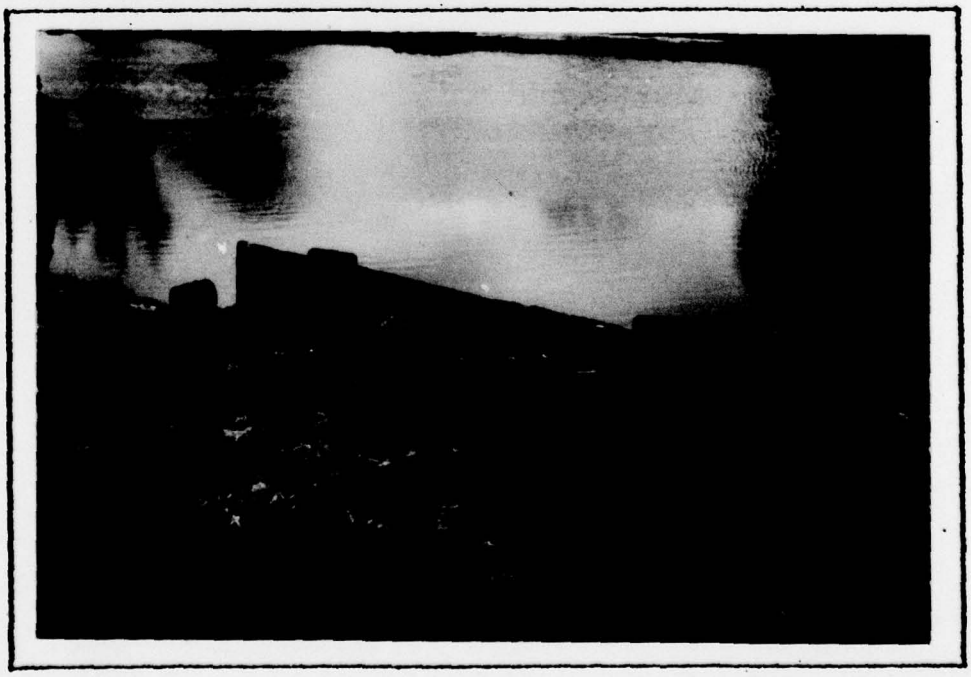
OVERALL UPSTREAM VIEW OF THE DAM
WITH THE LAKE PARTIALLY DRAWN DOWN 4/13/79

OVERALL VIEW OF THE SPILLWAY SHOWING SAND FILL
ON THE UPSTREAM SIDE OF THE TIMBER HEADWALL
AND ROCK FILL ON THE DOWNSTREAM SIDE 4/13/79

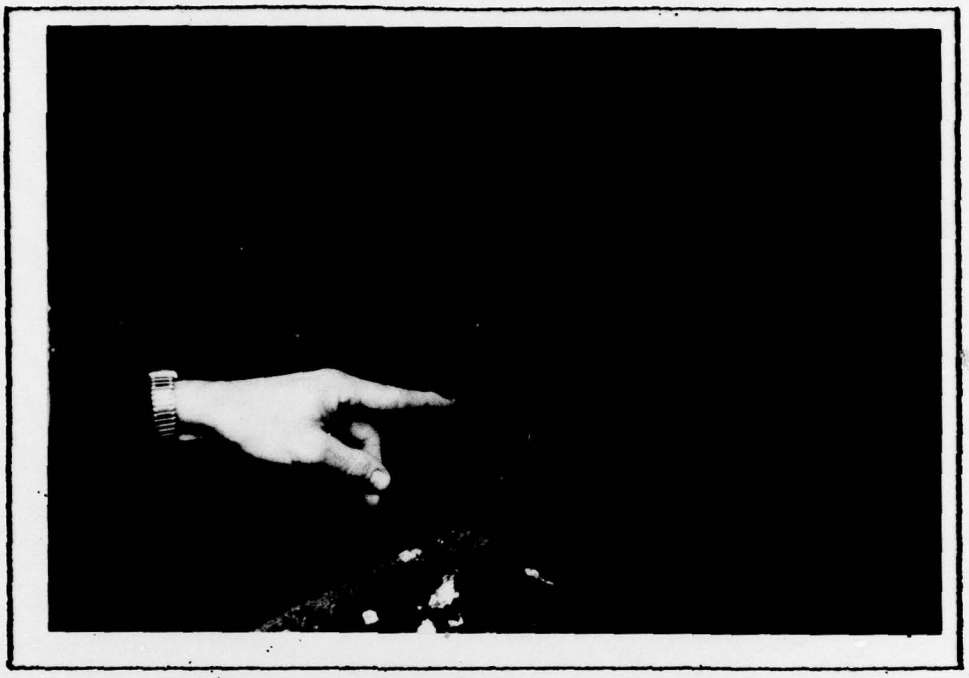
RIGHT SIDE OF THE SPILLWAY
WITH THE LAKE PARTIALLY DRAWN DOWN 4/13/79

RESERVOIR DRAIN SYSTEM INLET TRASH RACK
GATE HOIST AND HOIST SUPPORT 4/13/79

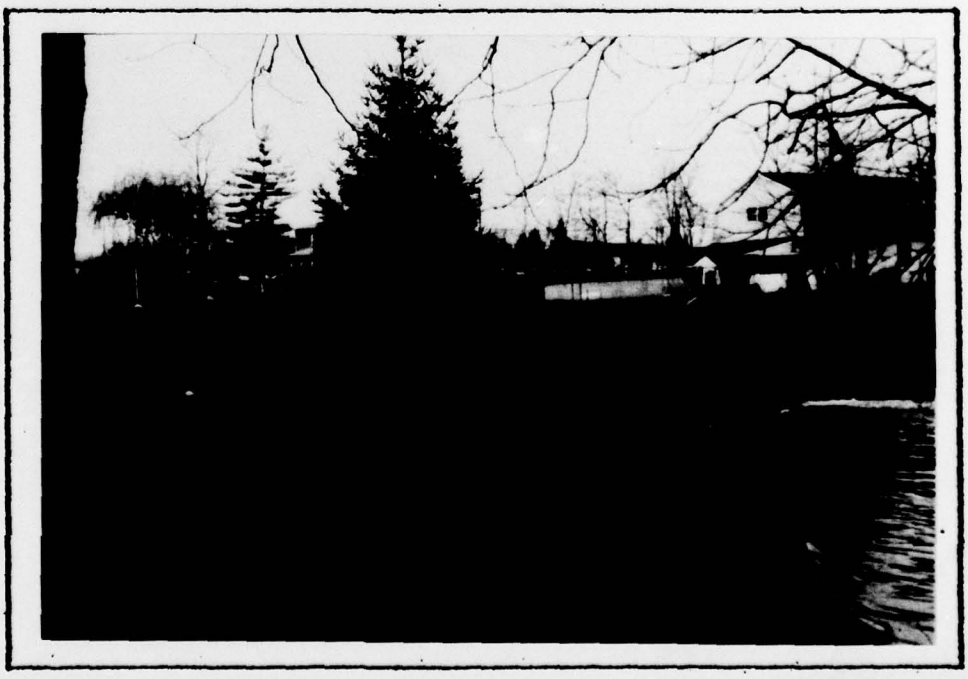
RIGHT SIDE OF THE SPILLWAY WITH THE RESERVOIR DRAIN IN THE FOREGROUND 4/13/79



DETAILS OF THE RIGHT SIDE OF THE TIMBER SPILLWAY 4/13/79



DETERIORATED TIMBER MEMBERS
IN THE SPILLWAY HEADWALL 4/13/79

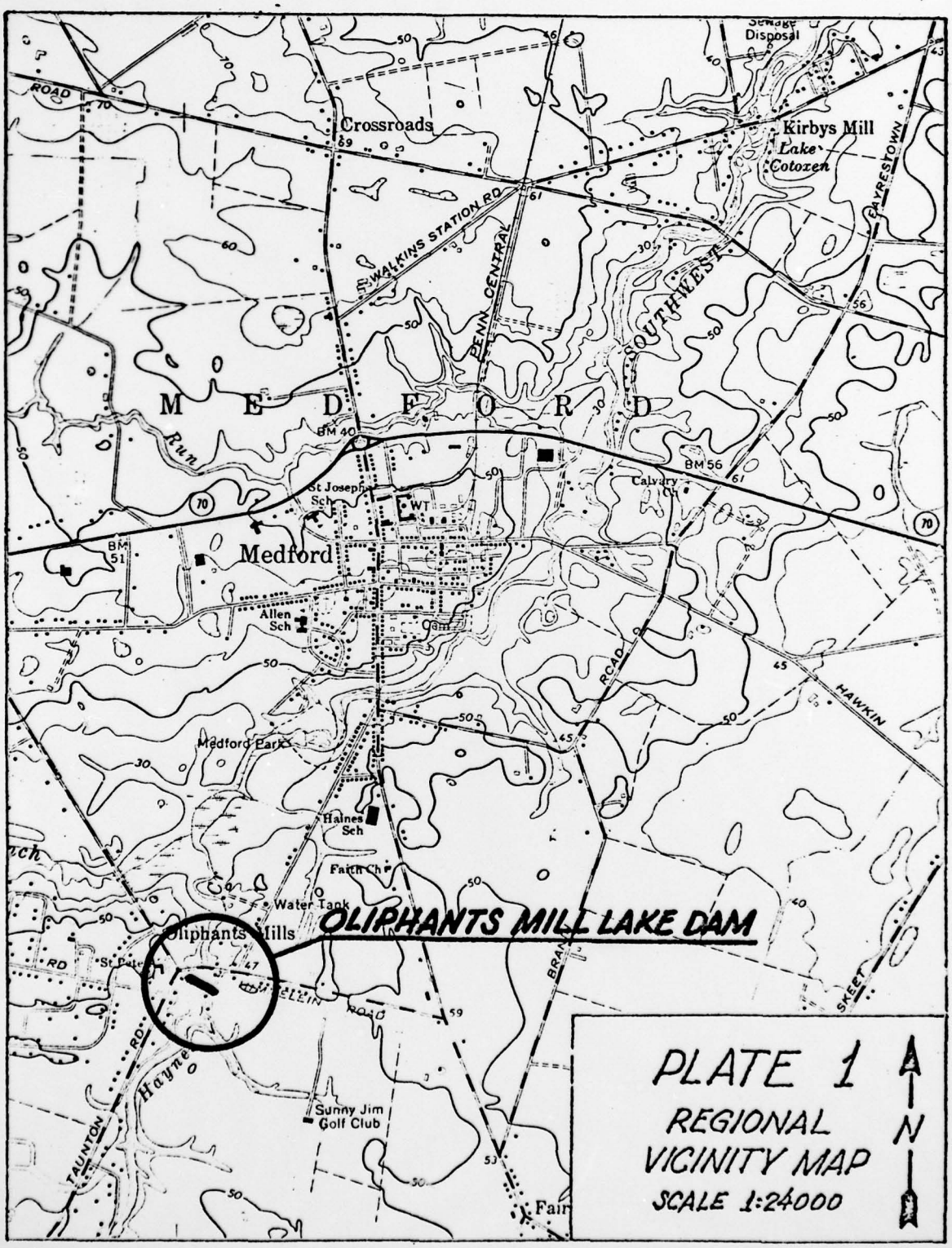


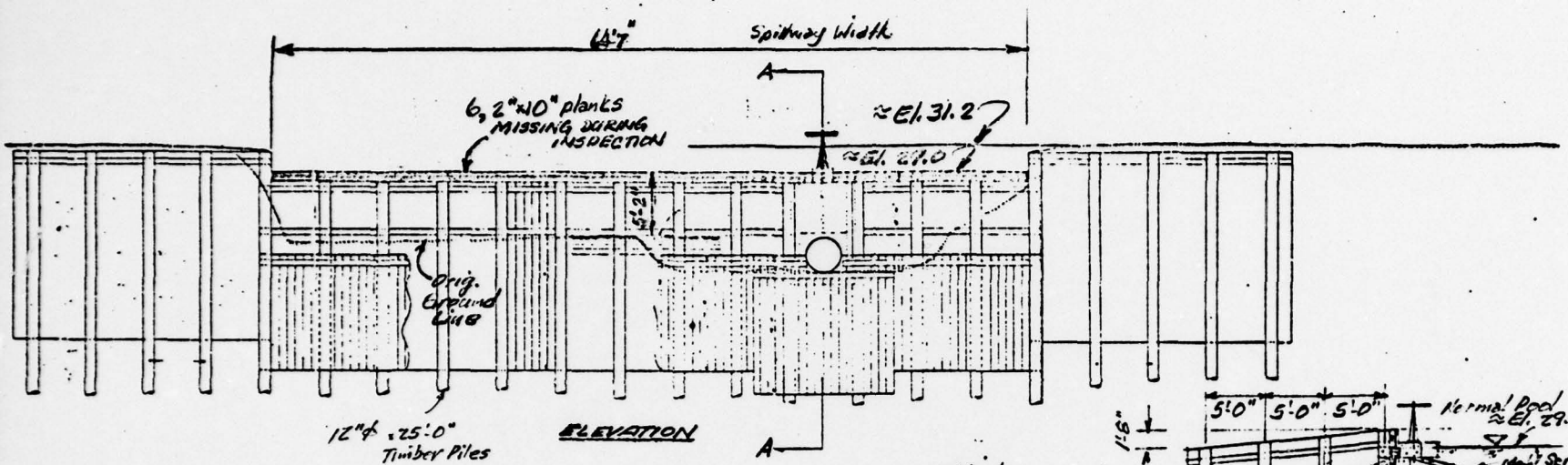
OVERALL DOWNSTREAM
VIEW OF THE DAM 4/13/79

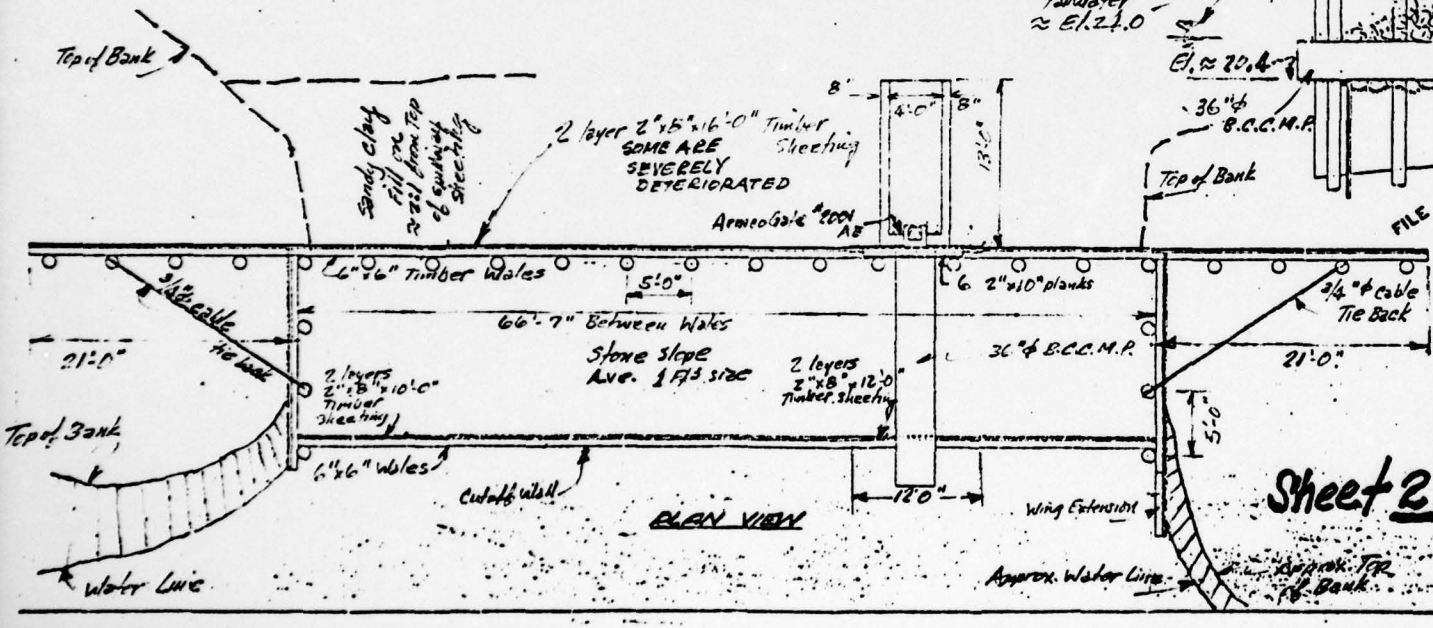
APPENDIX

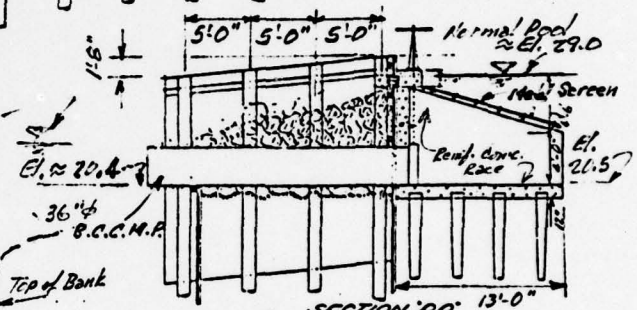
E

Drawings


Crossroads
Kirbys Mill
Lake Cotoxen
WALKINS STATION RD.
PENN CENTRAL
SOUTHWEST
M E D F O R D
Run
BM 40
BM 56
BM 51
St Joseph Sch
WT
Calvary Ch
Medford
Allen Sch
Gym
Medford Park
Haines Sch
Faith Ch
Water Tank
Oliphants Mills
OLIPHANTS MILL LAKE DAM
Sunny Jim Golf Club
TAUNTON RD.
Hayne
HAWKIN
SKEET
PLATE 1
REGIONAL
VICINITY MAP
SCALE 1:24000
N







FILE

FILE

525

ASBUILT PLAN
OF
OLIPHANT'S MILL DAM

Sheet 2

D.L.I. APPLICATION No. 525

APPENDIX

F

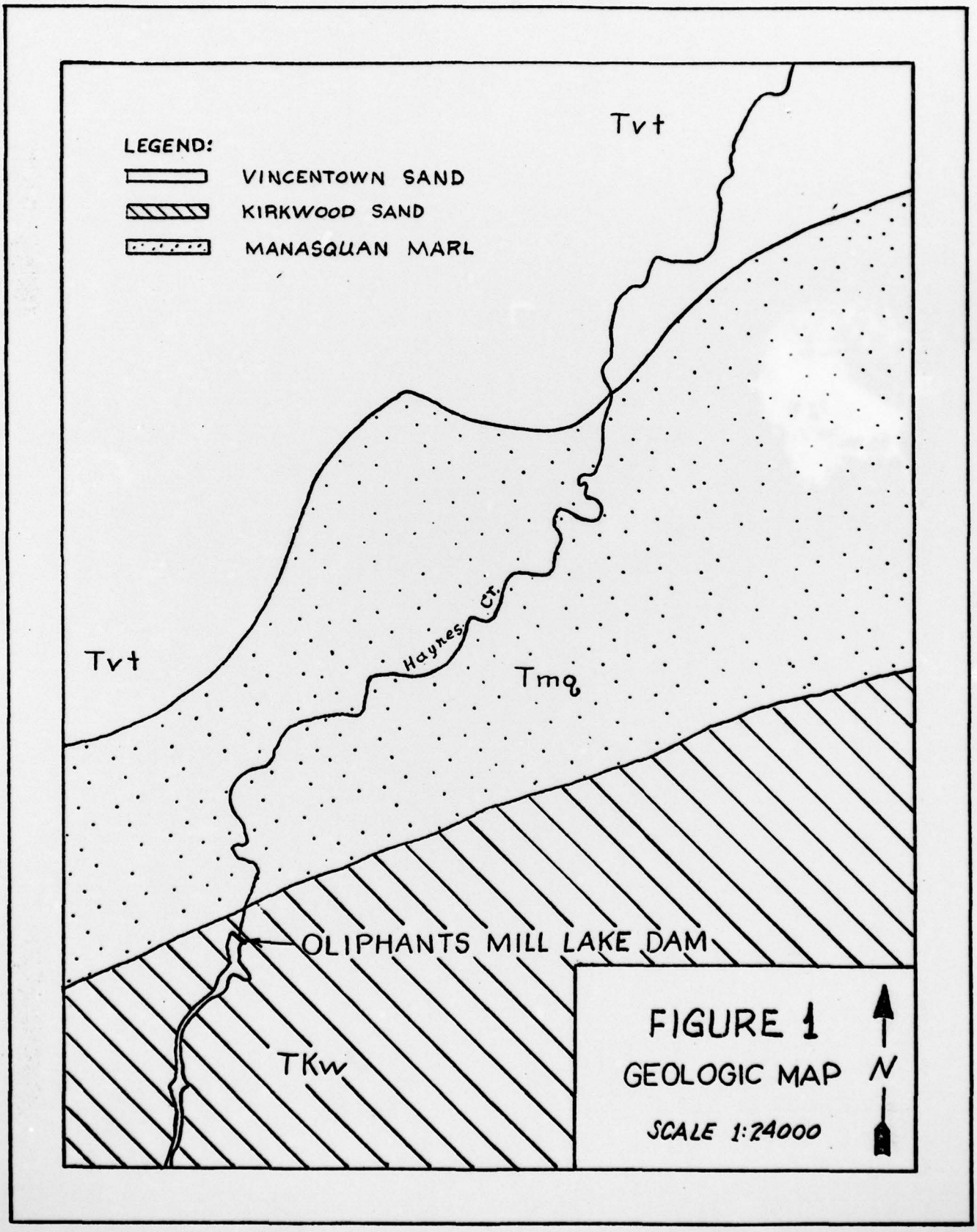
Site Geology

SITE GEOLOGY

OLIPHANTS MILL LAKE DAM

Oliphants Mill 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 consists of a series of Tertiary sands comprising the Kirkwood formation. No faults or major structural defects are noted in the vicinity of the dam or lake.


LEGEND:
VINCENTOWN SAND
KIRKWOOD SAND
MANASQUAN MARL
Tvt
Tvt
Haynes Ct.
Tmq
OLIPHANTS MILL LAKE DAM
TKw
FIGURE 1
GEOLOGIC MAP
SCALE 1:24000
N