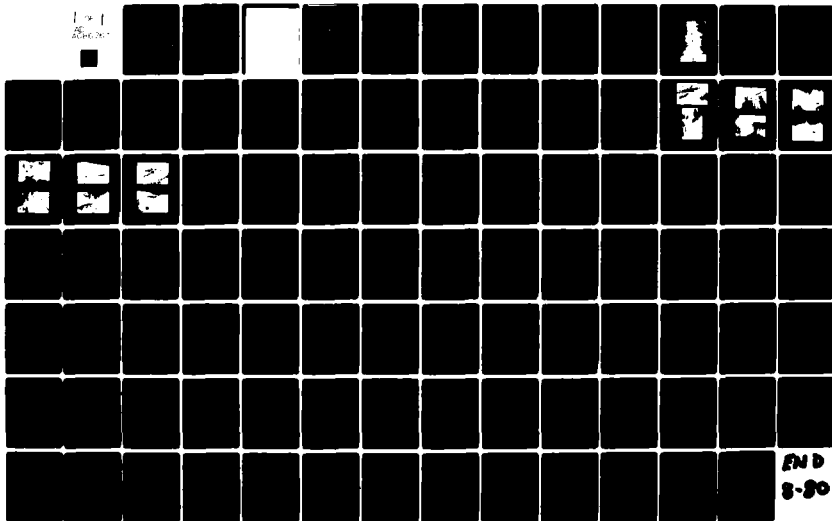


AD-A006 267

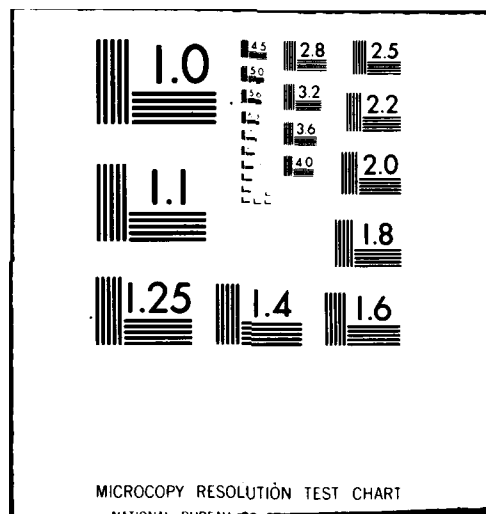
NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/0 13/13
NATIONAL DAM SAFETY PROGRAM. RAINBOW LAKE DAM (INVENTORY NUMBER--ETC(U)
DEC 79 6 KOCH DACV51-79-C-0001
NL

UNCLASSIFIED

1-1
AD-A006 267



END
8-80



SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS
BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

AD-A086267

4. TITLE (and Subtitle)

Phase I Inspection Report

Rainbow Lake Dam

Upper Hudson River Basin, Hamilton County, NY

Inventory No. NY 18

5. TYPE OF REPORT & PERIOD COVERED

Phase I Inspection Report

National Dam Safety Program

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)

George/Koch P.E.

11 Dec 79

8. CONTRACT OR GRANT NUMBER(s)

DACW 51-79-C-0001

9. PERFORMING ORGANIZATION NAME AND ADDRESS

New York State Department of Environmental

Conservation 50 Wolf Road

Albany, NY 12233

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBER

11. CONTROLLING OFFICE NAME AND ADDRESS

New York State Department of Environmental Con-

servation/ 50 Wolf Road

Albany, New York 12233

12. REPORT DATE

Dec 1979

13. NUMBER OF PAGES

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

Department of the Army

26 Federal Plaza/ New York District, CofE

New York, New York 10007

15. SECURITY CLASS. (of this report)

UNCLASSIFIED

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; Distribution unlimited.

National Dam Safety Program.

Rainbow Lake Dam (Inventory

Number NY18), Upper

Hudson River Basin,

Hamilton County, New

York. Phase I Inspection

17. DISTRIBUTION STATEMENT (of the abstract entered here) (if different from Report)

18. SUPPLEMENTARY NOTES

Report

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DDC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety

National Dam Safety Program

Visual Inspection

Hydrology, Structural Stability

Rainbow Lake Dam

Hamilton County

Indian Lake

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

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Visual inspection of this dam and engineering analyses which have been performed revealed conditions which constitute a hazard to human life or property. As a result of these determinations the dam has been assessed as unsafe, emergency.

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

393970

LSM

ADAU86267

DDC FILE COPY

LEVEL II

DTIC
SELECTED
JUL 7 1980

Serious leaks through the dam and along the interface between the dam and its foundation were noted. There was overall deterioration of the concrete and masonry sections. A void near the top of the masonry section provides evidence of past overtopping. Stability analyses performed for the structure indicate that under extreme loading conditions ice loading, $\frac{1}{2}$ PMF, PMF safety factors against both sliding and overturning are unacceptable (below 1.0).

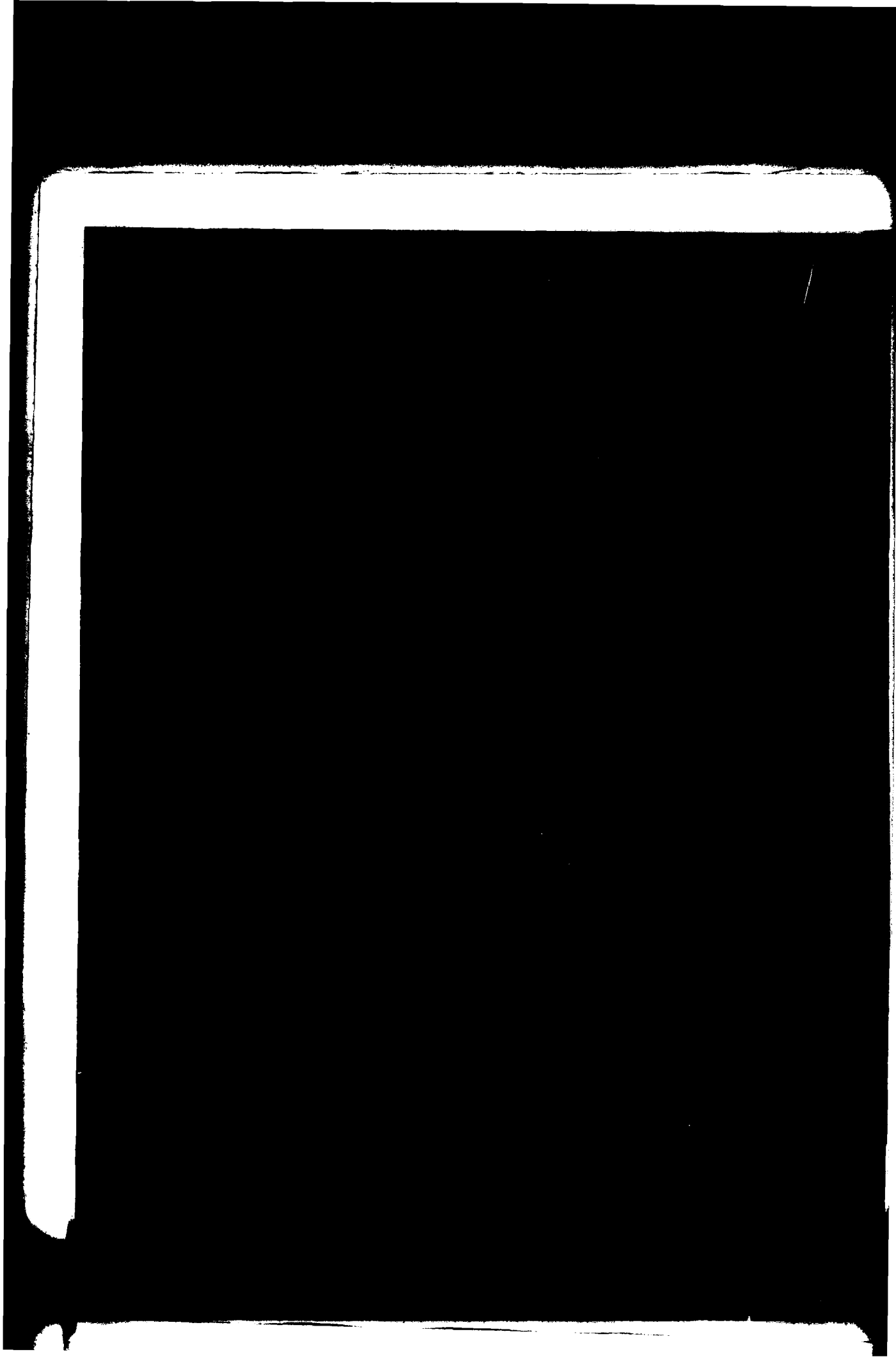
Using the Corps of Engineer's Screening Criteria for the initial review of the spillway adequacy, it has been determined that the structure would be overtopped for all storms exceeding 4% of the Probable Maximum Flood (PMF). Due to the condition of the structure, it is questionable as to whether it could withstand a substantial flow over the crest. Therefore, a flood-wave analysis was performed. This analysis indicates that in the event of a complete breaching of the dam water surface levels downstream could reach depths which pose significant danger to residents. The spillway is, therefore, adjudged as seriously inadequate.

Due to the serious nature of the deficiencies on this dam, it is recommended that as soon as possible, the water surface in the lake be lowered to a level at least 10 feet below the top of the dam. For the time, until this action is taken, a detailed emergency operation plan and warning system should be developed and around the clock surveillance should be provided during periods of unusually heavy precipitation.

Within 3 months of the notification of the owner, additional hydrologic/hydraulic investigations should be commenced. These investigations should attempt to more accurately define the site specific characteristics of the watershed and determine appropriate mitigating measures to be taken in response to the seriously inadequate spillway capacity. Further investigation into structural stability, including subsurface and structural explorations, should be commenced within the same time frame. An investigation into the treatments required to repair the other deficiencies which exist on this structure should also be commenced within 3 months. Within 18 months of the date of notification, appropriate remedial measures should be completed.

Accession For	
NTIS	ORAAI
DDC	TAB
Unannounced	
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or special
A	23

(Att. Due 1979)
per 5. cond. 11-12



DISCLAIMER NOTICE

**THIS DOCUMENT IS BEST QUALITY
PRACTICABLE. THE COPY FURNISHED
TO DTIC CONTAINED A SIGNIFICANT
NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.**

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. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide 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.

This document has been approved
for public release and sale; its
distribution is unlimited.

80 7 3 057

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
RAINBOW LAKE DAM
I.D. No. NY-18
UPPER HUDSON RIVER BASIN
HAMILTON COUNTY, NEW YORK

TABLE OF CONTENTS

	<u>PAGE NO.</u>
- ASSESSMENT	-
- OVERVIEW PHOTOGRAPH	-
1 PROJECT INFORMATION	1
1.1 GENERAL	1
1.2 DESCRIPTION OF PROJECT	1
1.3 PERTINENT DATA	2
2 ENGINEERING DATA	4
2.1 GEOTECHNICAL DATA	4
2.2 DESIGN RECORDS	4
2.3 CONSTRUCTION RECORDS	4
2.4 OPERATION RECORDS	4
2.5 EVALUATION OF DATA	4
3 VISUAL INSPECTION	5
3.1 FINDINGS	5
3.2 EVALUATION OF OBSERVATIONS	6
4 OPERATION AND MAINTENANCE PROCEDURES	7
4.1 PROCEDURE	7
4.2 MAINTENANCE OF DAM	7
4.3 WARNING SYSTEM IN EFFECT	7
4.4 EVALUATION	7

	<u>PAGE NO.</u>
5 HYDROLOGIC/HYDRAULIC	8
5.1 DRAINAGE AREA CHARACTERISTICS	8
5.2 ANALYSIS CRITERIA	8
5.3 SPILLWAY CAPACITY	8
5.4 RESERVOIR CAPACITY	8
5.5 FLOODS OF RECORD	8
5.6 OVERTOPPING POTENTIAL	8
5.7 EVALUATION	8
6 STRUCTURAL STABILITY	9
6.1 EVALUATION OF STRUCTURAL STABILITY	9
7 ASSESSMENT/RECOMMENDATIONS	11
7.1 ASSESSMENT	11
7.2 RECOMMENDED MEASURES	11

APPENDIX

- A. PHOTOGRAPHS
- B. VISUAL INSPECTION CHECKLIST
- C. HYDROLOGIC/HYDRAULIC ENGINEERING DATA AND COMPUTATIONS
- D. STABILITY COMPUTATIONS
- E. REFERENCES
- F. DRAWINGS

PHASE 1 REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Rainbow Lake Dam I.D. No. NY 18
State Located:	New York
County Located:	Hamilton
Watershed:	Upper Hudson River Basin
Date of Inspection:	October 18, 1979

ASSESSMENT

Visual inspection of this dam and engineering analyses which have been performed revealed conditions which constitute a hazard to human life or property. As a result of these determinations the dam has been assessed as "unsafe, emergency".

Serious leaks through the dam and along the interface between the dam and its foundation were noted. There was overall deterioration of the concrete and masonry sections. A void near the top of the masonry section provides evidence of past overtopping. Stability analyses performed for the structure indicate that under extreme loading conditions ice loading, $\frac{1}{2}$ PMF, PMF safety factors against both sliding and overturning are unacceptable (below 1.0).

Using the Corps of Engineer's Screening Criteria for the initial review of the spillway adequacy, it has been determined that the structure would be overtopped for all storms exceeding 4% of the Probable Maximum Flood (PMF). Due to the condition of the structure, it is questionable as to whether it could withstand a substantial flow over the crest. Therefore, a flood-wave analysis was performed. This analysis indicates that in the event of a complete breaching of the dam water surface levels downstream could reach depths which pose significant danger to residents. The spillway is, therefore, adjudged as seriously inadequate.

Due to the serious nature of the deficiencies on this dam, it is recommended that as soon as possible, the water surface in the lake be lowered to a level at least 10 feet below the top of the dam. For the time, until this action is taken, a detailed emergency operation plan and warning system should be developed and around the clock surveillance should be provided during periods of unusually heavy precipitation.

Within 3 months of the notification of the owner, additional hydrologic/hydraulic investigations should be commenced. These investigations should attempt to more accurately define the site specific characteristics of the watershed and determine appropriate mitigating measures to be taken in response to the seriously inadequate spillway capacity. Further investigation into structural stability, including subsurface and structural explorations, should be commenced within the same time frame. An investigation into the treatments required to repair the other deficiencies which exist on this structure should also be commenced within 3 months. Within 18 months of the date of notification, appropriate remedial measures should be completed.

George Koch

George Koch
Chief, Dam Safety Section
New York State Department
of Environmental Conservation
NY License No. 45937

Approved By:

Clark H. Benn

Col. Clark H. Benn
New York District Engineer

Date:

19 February 80



OVERVIEW
RAINBOW LAKE DAM
I.D. No. NY 18

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
RAINBOW LAKE DAM
I.D. No. NY 18
#186-849
UPPER HUDSON RIVER BASIN
HAMILTON COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase 1 inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam

The Rainbow Lake Dam is a masonry and concrete dam with the spillway located in the center of the structure, and a small bridge crossing over the spillway.

The dam is approximately 75 feet long and a maximum of 25 feet high of the dam. The lower portion of the central section dam on either side of the spillway is composed of a mixture of concrete and cobbles. The upper portion of the dam is laid up stone with mortar in the joints between stones. The stones near the center of the structure are predominantly cobble sized while at either end of the dam larger stones are present.

The spillway is 19 feet wide. The crest of the spillway is approximately 4 feet below the top of the dam. The water flowing over the crest plunges 7 feet onto a 4 foot long inclined concrete section. At the end of the inclined section, there is another verticle drop of about 10 feet to the base of the dam.

The plans for the structure indicate that there is a reservoir drain in the center of the spillway section. This drain consists of a sluice gate 2 feet wide by 1.5 feet high. The existence of this drain could not be verified during the visual inspection. No apparent means of controlling the drain sluice gate was found.

A small corrugated metal pipe arch (13"x22") located on the southern end of the dam provides a small amount of additional spillway capacity. The invert of this pipe is approximately 1 foot below the crest of the dam.

A steel truss bridge with a timber plank deck crosses over the spillway. There are concrete piers on either end of the spillway. Piers do not extend the full width of the bridge, so a steel frame has been constructed to support the downstream edge of the bridge. The concrete bridge abutments are approximately 5 feet beyond the piers and are a part of the main dam.

b. Location

This dam is located in the Town of Indian Lake on Wilderness Road, which is off County Route 4. It is just downstream of Wilderness Rainbow Lake Lodge. The dam is approximately 5 miles southeast of the village of Indian Lake.

c. Size Classification

The dam is 25 feet high and the lake has a storage capacity of 97.4 acre-feet. Therefore, the dam is in the small size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

The dam is classified as "high" hazard due to the presence of 10 to 15 houses and mobile home trailers along the banks downstream of the dam.

e. Ownership

The dam is owned by 208633 Holdings Ltd. of Hawley, Pennsylvania. The administrator for this company is Mr. Art Lemp, Mr. Lemp's address is Box 1000, Hemlock Farms, Hawley, Pennsylvania 18428 and his phone number is (717) 775-7393. The caretaker for the property is Mr. Jerry Campbell. His phone number is (518) 648-5151.

f. Purpose of Dam

The dam is used to maintain the water surface of Rainbow Lake for recreational purposes.

g. Design and Construction History

No information about the original construction of the dam was available. The dam was reconstructed in 1929 and except for minor repairs has remained essentially unchanged since that time.

h. Normal Operating Procedures

Water flows over an ungated spillway. There are provisions for up to 3 feet of stoplogs. These stoplogs are added during the summer months to raise the level of the lake.

1.3 PERTINENT DATA

<u>a. Drainage Area (acres)</u>	5626
<u>b. Discharge at Dam (cfs)</u>	
Spillway at Top of Dam	370
13"x22" Pipe Arch at Top of Dam	3
<u>c. Elevation (plan datum)</u>	
Top of dam	117.5
Spillway Crest (With 6"x6" Timber)	114.2
Invert of 13"x22" Pipe Arch	116.5

Lake Surface Elevation-(USGS Datum)	1680
(USGS-Thirteenth Lake, NY Quad, 1954)	
<u>d. Reservoir - Surface Area</u>	(acres)
Top of Dam	26.6
Spillway Crest	14.7
<u>e. Storage Capacity</u>	(acre-feet)
Top of Dam	97.4
Spillway Crest	37.7
<u>f. Dam</u>	
Type: Concrete and Masonry	
Dam Length (ft.)	75
Crest Elevation (Plan Datum)	117.5
Crest Width (ft.)	12.4
<u>g. Spillway</u>	
Type: Uncontrolled concrete rectangular weir. Provisions for up to 3.3 feet of flashboards. Possibly several timbers still in place below flashboards	
Length (ft.)	19
<u>h. Reservoir Drain</u>	
Type: Sluice gate 2 feet wide by 1.5 feet high	
Control: No apparent means of control	

SECTION 2: ENGINEERING DATA

2.1 GEOTECHNICAL DATA

a. Geology

The Rainbow Lake Dam is located in the Adirondack Highlands physiographic province of New York State. The original rock was sedimentary with large intrusions of igneous rocks (anorthosites, granites, gabbros). Much of this rock has been metamorphosed by heat, pressure, folding and faulting. Surface features of the rock reflects the effects of glaciation. A review of the "Brittle Structures Map of the State of New York" indicated that there are no faults in the immediate vicinity of the dam.

The surficial soils are the result of glaciations during the Cenozoic Era, the last of which was the Wisconsin glaciation.

b. Subsurface Investigations

No records of any subsurface investigations were available either from the original construction or the 1929 reconstruction. In the application for the reconstruction, it was stated that the dams would be founded on rock which contained no porous seams or fissures.

2.2 DESIGN RECORDS

No records from the original construction of the dam were available. An application for the 1929 reconstruction provided certain design data concerning the structure. This design data included sketches of the structure. However, measurements made during the visual inspection did not agree with these sketches. A sketch of the field measurements has been included in Appendix F.

2.3 CONSTRUCTION RECORDS

No construction records were available.

2.4 OPERATION RECORDS

No operation records were available.

2.5 EVALUATION OF DATA

Data available for the preparation of this report was very limited. The primary source of information was the Department of Environmental Conservation files. Due to the limited data available, certain assumptions had to be made concerning the structure. Within these limitations, the available data was adequate for the purpose of the Phase 1 inspection.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of the Rainbow Lake Dam was conducted on October 18, 1979. The weather was generally overcast with the temperature in the fifties. The water surface at the time of inspection was 3 feet below the crest of the dam. Water was flowing over the spillway at a depth of several inches.

b. Dam

The main dam can be considered to consist of three sections differentiated by the composition. There is a central section on either side of the spillway which will be discussed as lower and upper portions. The third section is the low masonry portions on either end of the dam.

The concrete on the lower portion of the central section was badly deteriorated. The surface was extensively worn with boulders and cobbles protruding from all exposed faces. Seepage was noted coming through this segment in several locations. In addition, there was extensive seepage along the interface between the concrete and the rock foundation.

The upper portion of the central section is laid-up stone with a small amount of mortar between stones. The stones appeared to be slightly larger than those in the lower section, but they were still predominantly cobble size. Mortar was missing in some of the joints between stones at the northern end of the spillway. The top layers of stones had been removed on the section beyond the southern end of the spillway, leaving a void under the bridge deck. The void is approximately 1 foot deep and 3 feet wide and extends from the downstream face to within 2 feet of the upstream face. As a temporary repair measure, the upstream portion of this void had been filled with sand bags, stone, plastic and some concrete. This had returned the crest at the face of this section to its previous elevation.

Due to the bedrock elevation, the height of the dam is less on either end than it is in the central section. This lower section on the southern end of the dam is deteriorated and leaking in several locations. Three areas of substantial leakage were noted along the base of the section. The low section on the northern end of the dam is composed of large boulders and random fill. No leaks were observed on this section.

c. Spillway

Visual inspection of the spillway was hindered by water flowing over the crest. There are provisions for up to 3 feet of stop logs above the spillway crest. At the time of the inspection, all these stop logs had been removed. It is possible that there are several timbers in place which raise the spillway crest. The flow over the spillway prevented inspection of these timbers. This dam had previously been inspected on October 4, 1979. Some of the stop logs had been in place at that time. Photographs from that inspection seem to indicate that the spillway is in satisfactory condition.

The small pipe arch at the southern end of the dam was in satisfactory condition. Water flowing over the spillway prevented any observation of the reservoir drain. Its existence could not be verified.

d. Downstream Channel

The channel immediately downstream of the dam was cut into bedrock and was in good condition. The stream then proceeded in a westerly direction in a meandering rock-filled channel.

e. Reservoir

There were no signs of soil instability in the reservoir area.

f. Appurtenant Structures-Bridge

The steel truss bridge with the wood plank deck across the spillway is in good condition. The device for removing the stop logs, which is located on the top of the bridge, appears to be operable. The legs of the frame founded in the stream channel which supports the downstreamside of the bridge were bowed in the downstream direction. The abutments to the bridge are formed by the dam itself. The seepage and deterioration of the dam on either end of the spillway was previously discussed. Seepage has resulted in the downstream corner of the southern abutment being undermined.

3.2 EVALUATION OF OBSERVATIONS

Visual observations revealed several serious deficiencies on this structure. The following items were noted.

- (1) The overall deterioration of the concrete and masonry sections which compose the dam.
- (2) The seepage through the dam and along the interface between the dam and bedrock.
- (3) The void at the top of the masonry section under the bridge deck.
- (4) The undermining of the corner of the southern bridge abutment.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

There are no formal operating procedures for this dam. Stop logs are removed in the fall to provide additional spillway capacity. They are replaced during the summer months to provide a higher lake level.

4.2 MAINTENANCE OF DAM

No regular maintenance is performed on this structure.

4.3 WARNING SYSTEM IN EFFECT

No apparent warning system for evacuation of downstream residents is present.

4.4 EVALUATION

The operation and maintenance procedures on this dam are unsatisfactory. The overall poor condition of the dam is evidence of the deficiency in maintenance procedures. The installation of flashboards decreases the spillway capacity which is rated as seriously inadequate even with no flashboards in place. This in turn increases the possibility of overtopping.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

Delineation of the watershed draining into the reservoir pool area was made using the U.S.G.S. 15 minute quadrangles for Thirteenth Lake and Newcomb, NY. The 8.79 square mile drainage area consists primarily of wooded lands with several ponds located in the lower portion of the drainage area. Relief in the drainage area is relatively steep with slopes ranging from 10 to 36%. Mountain peaks occur at elevations from 500 to 1600 feet above the normal lake level.

5.2 ANALYSIS CAPACITY

The analysis of the floodwater retarding capability of this dam was performed using the Corps of Engineers HEC-1 computer program, Dam Safety version. This program incorporates the "Snyder Synthetic Unit Hydrograph" method and the "Modified Puls" flood routing procedure. The spillway design flood selected for analysis was the PMF in accordance with recommended guidelines for the U.S. Army Corps of Engineers.

5.3 SPILLWAY CAPACITY

The dam has an ungated rectangular spillway which provides the almost all of the available spillway capacity. A small corrugated metal pipe arch located on the southern end of the dam provides an insignificant amount of additional spillway capacity. The spillway operates under weir flow conditions and was analyzed as a sharp crested weir having a discharge coefficient (c) of 3.32.

5.4 RESERVOIR CAPACITY

Normal storage capacity of the reservoir between the spillway crest and the top of the dam is 60 acre feet which is equivalent to a runoff depth of 0.13 inches over the drainage area. Total storage capacity of the dam is 97.4 acre feet.

5.5 FLOODS OF RECORD

No information was available regarding the occurrence of the maximum known flood.

5.6 OVERTOPPING POTENTIAL

Analysis using the PMF and one-half the PMF indicates that the dam does not have sufficient spillway capacity. For a PMF peak outflow of 11,132 cfs, the dam would be overtopped to a computed depth of 6.30 feet. For the peak outflow from one-half the PMF, the depth of overtopping would be 3.81 feet. All storms exceeding 4% of the PMF will result in the dam being overtopped. The spillway only has sufficient capacity to discharge 373 cfs.

5.7 EVALUATION

Using the Corps of Engineers screening criteria for initial review of spillway adequacy, it has been determined that the dam would be overtopped by all storms exceeding 4% of the PMF. A flood wave analysis, assuming complete breaching of the dam, indicates that the water surface levels downstream of the dam could reach depths which pose a significant danger to residents.

The spillway capacity is, therefore, adjudged to be seriously inadequate.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual observations revealed that the structure is in poor condition. Extensive deterioration and serious leaks were noted. The masonry near the top of dam was in poor condition and did not appear to be capable of withstanding severe or prolonged overtopping.

b. Data Review and Stability Evaluation

The primary source of structural information was two sheets prepared by H. Atkinson in 1929. These sheets contained sketches of the proposed reconstruction which was implemented in 1929.

Stability analyses were performed for both the main dam section and the spillway section. The following conditions were analyzed for each case:

- a. Normal conditions with the reservoir level at the spillway crest;
- b. Reservoir level at spillway crest with an ice load of 10,000 lb/ft;
- c. One-half PMF; water flowing over the top of dam to a depth of 3.81 ft.
- d. PMF; water flowing over the top of dam to a depth of 6.30 feet.

The analyses performed (See Appendix D) indicate that the factors of safety against overturning and sliding for each of the sections are as follows:

Main Dam Section

<u>Case</u>	<u>Factors of Safety</u>	
	<u>Overturning</u>	<u>Sliding</u>
a. Reservoir level at spillway crest,	1.58	1.16
b. Same as (a) plus an ice load of 10000 lb/ft	.43	.43
c. One-half PMF, water flowing 3.81 feet over top of dam	1.15	.78
d. PMF, water flowing 6.30 feet over top of dam	.97	.64

Spillway Section

<u>Case</u>	<u>Factors of Safety</u>	
	<u>Overturning</u>	<u>Sliding</u>
a. Reservoir level at spillway crest,	.80	.35
b. Same as (a) plus an ice load of 10,000 lb/ft	.15	.18
c. One-half PMF; water flowing 3.81 feet over top of dam	.67	.29
d. PMF; water flowing 6.30 feet over top of dam	.60	.27

The stability analyses indicate that the stability of both sections of the structure is seriously deficient. The safety factors fall to critical levels under extreme loading conditions (ice load, $\frac{1}{2}$ PMF, PMF).

Due to the lack of accurate data concerning the structure, the analyses were based on approximate dimensions. Field investigations are

required to obtain more information about the foundation bedrock and about the dimensions of the dam itself. This information should then be incorporated into a more detailed structural stability analysis for each of the sections of the dam. This analysis should be combined with studies of the other structural deficiencies noted on this structure. The studies should result in a coordinated design to correct the deficiency in the overall stability of the structure, as well as the localized defects (deteriorated concrete, leakage, etc.)

d. Seismic Stability

This dam is located in Seismic Zone 2. Due to the location, a seismic stability analysis was performed in accordance with Corps of Engineers guidelines. The seismic analysis was performed for normal conditions with the water level near the top of dam. For the main dam section the safety factor against overturning with seismic considerations included is 1.36 and against sliding is 1.16. For the spillway section, the safety factors against both overturning and sliding are below 1.0. These low safety factors further indicate that additional stability studies are required.

SECTION 7: ASSESSMENT/RECOMMENDATION

7.1 ASSESSMENT

a. Safety

The Phase 1 inspection of the Rainbow Lake Dam revealed that the dam is in poor condition with several serious deficiencies. Serious leaks and substantial deterioration of the structure were noted by the visual inspection. Engineering investigations indicated that the spillway capacity is seriously inadequate (unable to discharge outflow of 1/2 the PMF), and that the dam may be unstable under extreme loading conditions. For these reasons, this dam has been assessed as "unsafe".

b. Adequacy of Information

Information which was available concerning this structure was extremely limited. The 1929 sketches of the dam provided some information concerning the structure. However, the dimensions shown on these plans did not agree with measurements made during the visual inspection. Information about the lake was obtained from the 1971 plan of the area prepared by Edward C. Hess Associates, Inc. Due to the limited amount of information available, certain assumptions had to be made concerning both the dam and the reservoir.

c. Need for Additional Investigations

Since the spillway was assessed as seriously inadequate, additional hydrologic and hydraulic investigations are required to more accurately determine the site specific characteristics of the watershed.

Further investigation of the structural stability of the dam is also required. These studies should include subsurface and structural investigations to obtain information about the condition of the structure and its foundation. This information should then be incorporated into a detailed stability evaluation.

d. Urgency

Due to the poor condition of this structure, immediate attention is required. Until the required repairs are made, the water level should be lowered to a level at least 10 feet below the top of the dam. If the reservoir drain is operational and capable of lowering the level of the lake to the required elevation, it may be used. If it is not operational, some other method of lowering the water surface must be devised.

The additional hydrologic and hydraulic investigations which are needed should be commenced within 3 months of the date of final approval of this report. Investigation of the structural stability of the dam should also be commenced within 3 months.

Mitigating measures deemed necessary as a result of the investigations and repairs required due to the overall deterioration should be completed within 1 year of the date of final approval of this report.

7.2 RECOMMENDED MEASURES

- a. Lower the water surface to 10 feet below the top of dam until required repairs and modifications are made.
- b. The serious leaks both in the dam and along the interface between

the dam and bedrock should be repaired.

- c. Additional necessary repairs dealing with the overall deterioration of the dam should be made.
- d. After completing the hydrological investigations, mitigating measures dealing with the seriously inadequate spillway capacity should be determined.
- e. After the structural stability analysis has been completed, appropriate remedial work should be undertaken.
- f. The void at the top of the masonry section under the bridge deck should be repaired.

APPENDIX A
PHOTOGRAPHS



Upstream Face - Note Void to Left of Spillway



Downstream Face on South End of Spillway - Note Void at Top and Deterioration on Lower Portion



Area on Upstream Face to Left of Spillway in Which Void Had Been Partially Filled



Upper Portion of Central Section at Northern End of Spillway - Note Deterioration of Concrete and Seepage at the Base.



Southern End of Dam - Lower Portion of Central Section in Foreground -
Also Steel Frame which Supports Bridge



Outlet of Small Pipe Arch at Southern End of Dam



Downstream Face of Low Masonry Portion to South of Spillway -
Note Seepage Near Center of Picture



Close-up of Leak Shown in Picture Above



Upper Portion of Central Section to North of Spillway



Downstream Face of Northern Low Masonry Section



Dam and Spillway As It Appeared on 10/4/79 With Some Flashboards in Place



Downstream View of Spillway with Flashboards in Place on 10/4/79

APPENDIX B

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam RAINBOW LAKE DAM
Fed. I.D. # N.Y. 18 DEC Dam No. 186-849 - D. E.
River Basin UPPER HUDSON
Location: Town INDIAN LAKE County HAMILTON
Stream Name BIG BROOK
Tributary of _____
Latitude (N) 43° 44.4' Longitude (W) 74° 13'
Type of Dam MASONRY-LAID UP STONE WITH EARTH FILL FORMING CREST ROAD
Hazard Category C
Date(s) of Inspection 10/18/79
Weather Conditions 50'S PARTLY CLOUDY
Reservoir Level at Time of Inspection 3' BELOW BRIDGE DECK

b. Inspection Personnel R. WARRENDER; W. LYNICK

c. Persons Contacted (Including Address & Phone No.) _____

d. History:

Date Constructed _____ Date(s) Reconstructed 1929

Designer _____
Constructed By _____
Owner _____

(1) Erosion at Contact _____

(2) Seepage Along Contact _____

3) Drainage System

a. Description of System NONE

b. Condition of System _____

c. Discharge from Drainage System _____

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.) NONE

5) Reservoir

- a. Slopes SATISFACTORY
- b. Sedimentation NONE APPARENT
- c. Unusual Conditions Which Affect Dam SWAMPY AREA WITH LAKE IN CENTER - LAKE GOES BACK FOR A MILE OR TWO.

6) Area Downstream of Dam

- a. Downstream Hazard (No. of Homes, Highways, etc.) 10-15 HOMES NEAR STREAM (ABOUT 5 OF THESE ARE HOUSE TRAILERS)
- b. Seepage, Unusual Growth SEEPAGE - EXTENSIVE THROUGH DAM
- c. Evidence of Movement Beyond Toe of Dam ROCK FOUNDATION - NO MOVEMENT
- d. Condition of Downstream Channel ROCK FILLED; MEANDERING CHANNEL BEYOND DAM

7) Spillway(s) (Including Discharge Conveyance Channel)

- a. General CENTRAL SPILLWAY CHANNEL, 1.3' X 22" PIPE ARCH ON SOUTH ~~SEE~~ END - ~~NO~~ OUTLETS ON BEDROCK SLOPE
- b. Condition of Service Spillway - CHANNEL - PROVISIONS FOR UP TO 3' OF STOP LOGS ^{HAD BEEN} REMOVED AT TIME OF INSPECTION. 6" X 6" WOOD TIMBER ~~ON~~ SILL ON TOP OF CONCRETE WHICH FORMS CREST. POSSIBLY MORE TIMBERS BUT COULDN'T BE DETERMINED. INSPECTION COMPLICATED BY WATER FLOWING OVER SPILLWAY CREST.

6

c. Condition of Auxiliary Spillway SMALL PIPE ARCH - SATISFACTORY
CONDITION - INVERT ABOUT 1' BELOW DAM CREST

d. Condition of Discharge Conveyance Channel GOOD BED ROCK
FOR A DISTANCE THEN BOULDER FILLED & MEANDERING

8) Reservoir Drain/Outlet - DRAIN WAS INDICATED ON PLANS BUT COULD NOT
BE OBSERVED DUE TO WATER FLOWING IN SPILLWAY

Type: Pipe _____ Conduit _____ Other _____

Material: Concrete _____ Metal _____ Other _____

Size: _____ Length _____

Invert Elevations: Entrance _____ Exit _____

Physical Condition (Describe): _____ Unobservable _____

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

Hydraulic Capability: _____

Means of Control: NONE OBSERVED
Gate _____ Valve _____ Uncontrolled _____

Operation: Operable _____ Inoperable _____ Other _____

Present Condition (Describe): EVEN IF THE DRAIN DOES EXIST
IT IS UNLIKELY THAT IT IS OPERABLE

9) Structural

- a. Concrete Surfaces SPALLING - DETERIORATED - SERIOUS LEAKAGE
LOWER PART IS CONCRETE TYPE CONSTRUCTION - ~~LOWER PART~~ SUBSTANTIAL
DETERIORATION UPPER PART IS LAID UP STONE & MORTAR -
MUCH OF MORTAR IS MISSING & STONES ARE SITTING IN PLACE
- b. Structural Cracking SOME NOTED - MUCH CONCRETE HAS BEEN
ERODED ON LOWER PART OF DAM NEAR SPILLWAY - REMAINING MASONRY &
CONCRETE SEEMS TO BE ~~TO~~ ^{RELATIVELY SOLID} ~~CONCRETE~~ ^{CONCRETE}.
- c. Movement - Horizontal & Vertical Alignment (Settlement) NO MOVEMENT
BEDROCK FOUNDATION
- d. Junctions with Abutments or Embankments. ABUTMENTS GENERALLY
OKAY
- e. Drains - Foundation, Joint, Face NONE
- f. Water Passages, Conduits, Sluices SPILLWAY IN CENTER - SATISFACTORY
FROM WHAT CAN BE SEEN. WATER FLOWING OVER HINDERED
THE INSPECTION.
- g. Seepage or Leakage SUBSTANTIAL LEAKAGE. - SOME COMING THROUGH
THE DAM ITSELF - MOSTLY ALONG THE DAM-FOUNDATION
INTERFACE 3 MAJOR LEAKS ON SOUTH SIDE AT 6', 14' & 18'
FROM EDGE OF SPILLWAY CHANNEL. ANOTHER MAJOR LEAK AT
INTERFACE AT NORTHERN END OF SPILLWAY

- h. Joints - Construction, etc. JOINTS BETWEEN DIFFERENT TYPES OF CONSTRUCTION APPEARED OKAY
- i. Foundation LEDGE ROCK- SEEPAGE ALONG INTERFACE WITH DAM
- j. Abutments
- k. Control Gates NONE
- l. Approach & Outlet Channels OUTLET OKAY - EXCEPT FOR SLIGHT UNDERCUTTING OF DAM AT SOUTH D.S. CORNER OF SPILLWAY
- m. Energy Dissipators (Plunge Pool, etc.) NATURAL BEDROCK POOL
- n. Intake Structures NONE
- o. Stability QUESTIONABLE - NO SIGNS OF OVERALL MOVEMENT BUT LOCALIZED PROBLEMS
- p. Miscellaneous VOID AT TOP OF DAM AT SOUTH END OF SPILLWAY - UPSTREAM PART HAS BEEN FILLED WITH SAND BAGS & FILL AS TEMPORARY REPAIR

10) Appurtenant Structures (Power House, Lock, ~~Bathhouse~~, Other)

a. Description and Condition BRIDGE CROSSES SPILLWAY-

STEEL TRUSS BRIDGE WITH WOOD ~~AND~~ PLANK DECK.

TWO CHANNELS WHICH SUPPORT DOWNSTREAM PORTION
OF BRIDGE ARE BOWED OUTWARD SLIGHTLY.

BRIDGE IN SATISFACTORY CONDITION, BUT ABUTMENTS
PIERS WHICH ARE FORMED BY THE DAM ITSELF
ARE RATHER DETERIORATED.

DEVICE ON TOP OF BRIDGE CAN BE USED FOR
REMOVING STOP LOGS

APPENDIX C

HYDROLOGIC/HYDRAULIC
ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

1

AREA-CAPACITY DATA:

	<u>Elevation</u> (ft.)	<u>Surface Area</u> (acres)	<u>Storage Capacity</u> (acre-ft.)
1) Top of Dam	<u>117.5</u>	<u>26.6</u>	<u>142.5</u>
2) Design High Water (Max. Design Pool)	<u> </u>	<u> </u>	<u> </u>
3) ~~Auxiliary~~ Spillway Crest	<u>114.2</u>	<u>14.7</u>	<u>62.7</u>
4) Pool Level with Flashboards	<u> </u>	<u> </u>	<u> </u>
5) Service Spillway Crest	<u> </u>	<u> </u>	<u> </u>

DISCHARGES

	<u>Volume</u> (cfs)
1) Average Daily	<u> </u>
2) Spillway @ Maximum High Water	<u>370</u>
3) Spillway @ Design High Water	<u> </u>
4) ~~Spillway @ Auxiliary Spillway Crest Elevation~~ PIPE ARCH @ MAX. HIGH WATER	<u>3</u>
5) Low Level Outlet	<u> </u>
6) Total (of all facilities) @ Maximum High Water	<u>373</u>
7) Maximum Known Flood	<u> </u>

CREST:

ELEVATION: 117.5Type: MASONRY AND EARTHWidth: 12.4 ft. Length: 75 ft.Spillover CONCRETE CHANNELLocation CENTER OF DAM

SPILLWAY:

PRINCIPAL

EMERGENCY

114.2

Elevation

CONCRETE - VERTICAL DROP

Type

19 ft

Width

Type of Control

4

Uncontrolled

Controlled:

FLASHBOARDS - UP TO 3 FT.

Type

(Flashboards; gate)

UP TO 3 FT

Number

Size/Length

Invert Material

Anticipated Length
of operating service

Chute Length

4Height Between Spillway Crest
& Approach Channel Invert
(Weir Flow)

OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES: - ACCORDING TO PLANSType: Gate _____ Sluice ✓ Conduit _____ Penstock _____Shape: RECTANGULARSize: 2 ft x 1.5 ftElevations: Entrance Invert UNKNOWNExit Invert UNKNOWN

Tailrace Channel: Elevation _____

HYDROMETEROLOGICAL GAGES:

Type: NONE

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: NONE

Method of Controlled Releases (mechanisms):

NONE - EXCEPT FOR REMOVAL OF FLASHBOARDS

DRAINAGE AREA: 8.79 SQ. MI.

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: FORESTED

Terrain - Relief: STEEP

Surface - Soil: RELATIVELY PERMEABLE

Runoff Potential (existing or planned extensive alterations to existing
(surface or subsurface conditions)

NONE

Potential Sedimentation problem areas (natural or man-made; present or future)

POSSIBLY SUBSTANTIAL SEDIMENTATION IN
RESERVOIR NEAR DAM

Potential Backwater problem areas for levels at maximum storage capacity
including surcharge storage:

NONE

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the
Reservoir perimeter:

Location: NONE

Elevation: -

Reservoir:

Length @ Maximum Pool _____ (Miles)

Length of Shoreline (@ Spillway Crest) _____ (Miles)

PROJECT GRID

JOB	RAINBOW LAKE DAM	SHEET NO.	1	CHECKED BY		DATE	
SUBJECT	HYDROLOGIC / HYDRAULIC COMPUTATIONS			COMPUTED BY	RLW	DATE	10/25/79
DRAINAGE AREA = 8.79 SQ. MI. = 8.79 SQ. MI.							
SNYDER SYNTHETIC UNIT HYDROGRAPH:							
L = 4.75 mi.		L _{ca} = 2.24 mi.					
PMP = 17.5 in		C _t = → USE 2.0					
$t_p = C_t(L - L_{ca})^3 = 2.0(4.75 - 2.24)^3 = 4.06$ hours							
$t_r = \frac{t_p}{5.5} = \frac{4.06}{5.5} = .74$ hours (USE 1/2 hour hydrograph)							
$t_{pr} = t_p + .25(t_r - t_p) = 4.06 + .25(.5 - .74) = 4.0$ hours							
H.R.#33 PMP RAINFALL							
ZONE 1		PMP RAIN = 17.5" (200 mi ² - 24 hr)					
6 hr = 111%		24 hr = 132%					
12 hr = 123%		48 hr = 142%					
$TRSPC = T.R. = 1 - \frac{2008}{(8.79)^{1.978}} = .795$							
LOSS DATA: 1.0"				CONTINUOUS = .1"			
BASE FLOW = 2 cfs / sq. mi. 2(8.79) = 17.6 USE 15 cfs							

PROJECT GRID

JOB RAINBOW LAKE DAM		SHEET NO. 2	CHECKED BY	DATE
SUBJECT HYDROLOGIC/HYDRAULIC COMPUTATIONS		COMPUTED BY RLW		DATE 10/25/79
SURFACE AREAS OF LAKE AT VARIOUS ELEVATIONS				
(TAKEN FROM EDWARD HESS ASSOCIATES PLAN)				
AREA AT WATER SURFACE ELEVATION (113.4)				
SEGMENT	MEASUREMENT	AREA		
①	11.17 IN ²	111,700 FT ²		
②	28.64 IN ²	286,400 FT ²		
③	16.45 IN ²	164,500 FT ²		
		$\frac{562,600 \text{ FT}^2}{43,560} = 12.91 \text{ ACRES}$		
CONTOUR 116				
SEGMENT	MEASUREMENT	AREA		
①	12.89	128,900		
②	33.42	334,200		
③	41.22	412,200		
		$\frac{875,300 \text{ FT}^2}{43,560} = 20.09 \text{ ACRES}$		
CONTOUR 118				
SEGMENT	MEASUREMENT	AREA		
①	14.62	146,200		
②	36.00 + 6.79 + .53	433,200		
③	66.42	664,200		
		$\frac{1,243,600}{43,560} = 28.55 \text{ ACRES}$		

PROJECT GRID

JOB	SHEET NO.	CHECKED BY	DATE
RAINBOW LAKE DAM	3		
SUBJECT	COMPUTED BY		DATE
HYDROLOGIC / HYDRAULIC COMPUTATIONS	RLW		10/25/79
VOLUME CALCULATIONS - CONIC METHOD - ASSUME DEPTH OF LAKE = 12'			
ELEVATION	AREA (ACRES)	VOLUME (ACRE-FT)	
113.4 (LAKE SURFACE)	12.91	29.69	
116	20.09	63.62	
118	28.55	109.42	
117.5	26.55	97.35	
ELEVATIONS (PLAN DATUM)			
TOP OF DAM	117.5	LAKE LEVEL (USGS DATUM) 1680	
SPILLWAY CHANNEL CREST	114.2		
INVERT OF PIPE ARCH	116.5		
SPILLWAY CAPACITY			
MAIN SPILLWAY CHANNEL			
			
$Q = C L H^{3/2} =$			
USE $C = 3.32$ (FROM TABLE 5-3 - HANDBOOK OF HYDRAULICS)			
$L = 18.6'$			
ELEVATION 114.2	$H = 0$	$Q = 0$	
ELEVATION 116.5	$H = 2.3$	$Q = (3.32)(18.6)(2.3)^{1.5} = 215.4 \text{ CFS}$	
ELEVATION 117.5	$H = 3.3$	$Q = (3.32)(18.6)(3.3)^{1.5} = 370.2 \text{ CFS}$	

PROJECT GRID

JOB	RAINBOW LAKE DAM	SHEET NO.	4	CHECKED BY		DATE	
SUBJECT	HYDROLOGIC/HYDRAULIC COMPUTATIONS	COMPUTED BY	RLW	DATE	10/25/79		
CAPACITY OF PIPE ARCH (13" x 22")							
BY MANNING FORMULA							
$Q = A \left(\frac{1.486}{n} \right) r^{3/4} S^{1/2}$							
$r = \frac{108}{32} = 4.42 \text{ in}$							
$A = 235.6 \text{ in}^2$							
$n = .035$							
$S = .01$							
$Q = \left(\frac{235.6}{144} \right) \left(\frac{1.486}{.035} \right) \left(\frac{4.42}{12} \right)^{3/4} (.01)^{1/2} = 3.54 \text{ cfs}$							

 FLOW BY THE API PACKAGE (HRC-1)
 DAN SAFETY SYSTEM JUL 7 1979
 LAST MODIFICATION 26 APR 79
 MODIFIED BY: HALLIBELL APR 79

 THIS PROGRAM IS CURRENTLY BEING MODIFIED
 TO CORRECT THE HALLIBELL SYSTEM

PLEASE REPORT ANY UNUSUAL OPERATING PROBLEMS
 TO THE FOLLOW (405 423) ext 7-5665

 1 ALTAIR/DA LK LK DAN
 2 4 PAF WITH RATIOS - ANALYSIS
 3 AS DATE
 4 5 FLOW 0 20 0 0 0 0 0 0
 5 01 5

6 J 1 3 1
 7 J1 .04 .5 1
 8 K 0 1 1

INFLOW HYDROGRAPH

9 K1
 10 H 1 1 8.79 .795 1

11 P 0 17.5 111 123 132 142

12 T
 13 W 4.06 .625 1

14 X 15 15 1

15 K 1 1 1

16 K1 MODIFIED HYDROGRAPH
 17 Y 1 1 1

18 V1 1 -11472

19 Y4 114.2 116.5 117.5

20 Y5 0 215.4 372.8

21 Y6 0 29.7 63.6 97.4

22 Y7 106.5 113.4 116 117.5

23 Y8 114.2

24 Y9 117.5 3.087 1.5 200

25 K 1 1000 1

26 K1 LOCATION TIME OF DAN

[illegible]

42-95730-800-11001-10-19
Q 911 72 20100101 15
EL61 1700 1614. 81305 000

THIS PROGRAM IS CURRENTLY BEING MODIFIED
TO ALLOW THE BUS MASTER LOCK SYSTEM

PL *81 APOE BY PERSON OPERATING PEOPLE45
TO JAG FILM (00923) P: 7-5666

66-1571-2100 FOR DATE 12-7-79

4/3/82 ajm

SISATRON - SCLERITE LITHOID
HMC 20017101102

JOB SPECIFICATION								
	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN	
PRI LCJ	0	0	0	0	2	0	0	
JDEPR	5	0	0	TRACE				

MULTI-PLAN ANALYSES TO BE PERFORMED
PLAN= 1 NRTIN= 3 LATID= 1
RTIDS= 0.74 0.50 1.00

SJC-AREA RUNOFF COMPUTATION									
I-FLOW HYDROGRAPH									
ISTAG	ICD:IP	IFCON	ITAPE	JPLT	JPRY	INANE	ISTAGE	IAUTO	
1	0	0	0	0	0	1	0	0	

ISIAQ	ICD:P	I-FLOW HYDROGRAPH				
1	0	IFCON	ITAPE	JPLT	JPRY	INANE ISTAGE IAUTO
		0	0	0	0	1 0 0
HYDROGRAPH DATA						

HYDROGRAPH DATA									
INVS	TIME	TAPEA	SNAP	TKSDA	TKSPC	RATIO	ISNM	ISAME	LOCAL
1	1	6.79	0.	8.79	0.00	0.	0	1	0

PRECIP DATA		R48	R72	R96
SPFE	F15	R8	R24	
0	17.50	122.00	122.00	122.00

LOSS DATA										
LOST	STRT	DLTR	RTIM	EMAIN	STRS	RTOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.	0.	1.00	0.	0.	1.00	1.00	0.10	0.	0.

UNIT HYDROGRAPH DATA			
UNIT	IP	NTA	CP
4-04	0	0.63	0.63

APR UTMATE CLACK COEFFICIENTS FROM GIVEN SLYDEM CP AND TP ARE TC= 9.05 AND R= 7.41 INTERVALS

ST.TQ= 15.00 URCSN= 15.00 RTIUR= 1.00

RECESSION DATA

APR UPDATE CLARK COEFFICIENTS FROM GIVEN SLYDEM CP AND TP ARE TC= 9.05 AND R= 7.41 INTERVALS

HYDROGRAPH AT STA I FOR PLAN 1, RTD 1.

[illegible]

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	449.	367.	136.	66.	6596.
CMS	13.	10.	4.	2.	187.
INCHES		0.39	0.57	0.58	0.58
MI		9.87	14.60	14.77.	14.77
AC-FT		182.	269.	273.	273.
THOUS CU M		225.	332.	336.	336.

HYDROGRAPH AT STA. 1 FOR PLAN 1, RTIO 2

1900	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5611.	4502.	1697.	824.	82449.
CNS	159.	130.	48.	23.	2335.
PHONES		4.86	7.18	7.27	7.27
FM		123.43	182.45	184.69	184.69
AC-FT		2277.	3366.	3407.	3407.
THINUS CUN		2408.	4151.	4202.	4202.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

[illegible]

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11221.	9123.	3394.	1649.	164896.
CNS	318.	260.	96.	47.	4689.
PHIES		9.72	14.37	14.54	14.54
MM		246.85	364.90	369.37	369.37

END-OF-PERIOD HYDROGRAPH ORDINATES

[illegible]

PEAK Wavelength is 580. At T14, 43.50 HOURS

	PRAN	5-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
CPS	5525.	4571.	1656.	805.	30383.	
CPS	152.	120.	47.	23.	2276.	
PLACES		4.86	7.01	7.09	7.09	
IN		123.42	178.05	180.05	180.06	
OUT		2277.	3284.	3322.	3322.	
PLACES		2366.	4051.	4097.	4097.	

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

OUTFLOW		STORAGE	
1.	2.	3.	4.
12.	13.	14.	15.
15.	16.	17.	18.
15.	16.	17.	18.
23.	24.	25.	26.
102.	103.	104.	105.
42.	43.	44.	45.
63.	64.	65.	66.
93.	94.	95.	96.
122.	123.	124.	125.
152.	153.	154.	155.
181.	182.	183.	184.
219.	220.	221.	222.
286.	287.	288.	289.
378.	379.	380.	381.
480.	481.	482.	483.
540.	541.	542.	543.

STORAGE	
41.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.
42.	42.

[illegible]

LOCN	LOCN	ITAF	JPLT	JPRY	ISTAGE	IAUTO
199C	1	0	0	0	1	0

	ISAC	ICOMP	ICONN	ITAFE	JPLT	JPRT	INAME	ISTAGE	IAUTO
0000	1000	1	0	0	0	0	1	0	0
				SORTING DATA					
		AVS	IRFS	ISARE	IUPT	IPHP		LSTR	
0000		0.	1	1	0	0			
		LTDL	LAG	AUSKK	X	TSK	STORA	ISPRAT	
0000	1	0	0	0.	0.	0.	0.	0	

Q(1)	Q(2)	Q(3)	ELIQT	FLIAX	RLIHT	SEL
0.0000	0.0000	0.0000	07.0	12.0	15.	0.00000

120.00	115.00	110.00	120.00	100.00	122.00	97.00	131.00	97.00
130.00	131.00	116.00	205.00	118.00				

STORAGE	0.00	0.01	0.02	0.03	0.04	0.05	0.06
0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06
0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.07
0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.08
0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.10
0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.11
0.06	0.06	0.07	0.08	0.09	0.10	0.11	0.12
0.07	0.07	0.08	0.09	0.10	0.11	0.12	0.13
0.08	0.08	0.09	0.10	0.11	0.12	0.13	0.14
0.09	0.09	0.10	0.11	0.12	0.13	0.14	0.15
0.10	0.10	0.11	0.12	0.13	0.14	0.15	0.16
0.11	0.11	0.12	0.13	0.14	0.15	0.16	0.17
0.12	0.12	0.13	0.14	0.15	0.16	0.17	0.18
0.13	0.13	0.14	0.15	0.16	0.17	0.18	0.19
0.14	0.14	0.15	0.16	0.17	0.18	0.19	0.20
0.15	0.15	0.16	0.17	0.18	0.19	0.20	0.21
0.16	0.16	0.17	0.18	0.19	0.20	0.21	0.22
0.17	0.17	0.18	0.19	0.20	0.21	0.22	0.23
0.18	0.18	0.19	0.20	0.21	0.22	0.23	0.24
0.19	0.19	0.20	0.21	0.22	0.23	0.24	0.25
0.20	0.20	0.21	0.22	0.23	0.24	0.25	0.26
0.21	0.21	0.22	0.23	0.24	0.25	0.26	0.27
0.22	0.22	0.23	0.24	0.25	0.26	0.27	0.28
0.23	0.23	0.24	0.25	0.26	0.27	0.28	0.29
0.24	0.24	0.25	0.26	0.27	0.28	0.29	0.30
0.25	0.25	0.26	0.27	0.28	0.29	0.30	0.31
0.26	0.26	0.27	0.28	0.29	0.30	0.31	0.32
0.27	0.27	0.28	0.29	0.30	0.31	0.32	0.33
0.28	0.28	0.29	0.30	0.31	0.32	0.33	0.34
0.29	0.29	0.30	0.31	0.32	0.33	0.34	0.35
0.30	0.30	0.31	0.32	0.33	0.34	0.35	0.36
0.31	0.31	0.32	0.33	0.34	0.35	0.36	0.37
0.32	0.32	0.33	0.34	0.35	0.36	0.37	0.38
0.33	0.33	0.34	0.35	0.36	0.37	0.38	0.39
0.34	0.34	0.35	0.36	0.37	0.38	0.39	0.40
0.35	0.35	0.36	0.37	0.38	0.39	0.40	0.41
0.36	0.36	0.37	0.38	0.39	0.40	0.41	0.42
0.37	0.37	0.38	0.39	0.40	0.41	0.42	0.43
0.38	0.38	0.39	0.40	0.41	0.42	0.43	0.44
0.39	0.39	0.40	0.41	0.42	0.43	0.44	0.45
0.40	0.40	0.41	0.42	0.43	0.44	0.45	0.46
0.41	0.41	0.42	0.43	0.44	0.45	0.46	0.47
0.42	0.42	0.43	0.44	0.45	0.46	0.47	0.48
0.43	0.43	0.44	0.45	0.46	0.47	0.48	0.49
0.44	0.44	0.45	0.46	0.47	0.48	0.49	0.50
0.45	0.45	0.46	0.47	0.48	0.49	0.50	0.51</

UNITED STATES	1922-23	1923-24	1924-25	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50	1950-51	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05	2105-06	2106-07	2107-08	2108-09	2109-10	2110-11	2111-12	2112-13	2113-14	2114-15	2115-16	2116-17	2117-18	2118-19	2119-20	2120-21	2121-22	2122-23	2123-24	2124-25	2125-26	2126-27	2127-28	2128-29	2129-30	2130-31	2131-32	2132-33	2133-34	2134-35	2135-36	2136-37	2137-38	2138-39	2139-40	2140-41	2141-42	2142-43	2143-44	2144-45	2145-46	2146-47	2147-48	2148-49	2149-50	2150-51	2151-52	2152-53	2153-54	2154-55	2155-56	2156-57	2157-58	2158-59	2159-60	2160-61	2161-62	2162-63	2163-64	2164-65	2165-66	2166-67	2167-68	2168-69	2169-70	2170-71	2171-72	2172-73	2173-74	2174-75	2175-76	2176-77	2177-78	2178-79	2179-80	2180-81	2181-82	2182-83	2183-84	2184-85	2185-86	2186-87	2187-88	2188-89	2189-90	2190-91	2191-92	2192-93	2193-94	2194-95	2195-96	2196-97	2197-98	2198-99	2199-00	2200-01	2201-02	2202-03	2203-04	2204-05	2205-06	2206-07	2207-08	2208-09	2209-10	2210-11	2211-12	2212-13	2213-14	2214-15	2215-16	2216-17	2217-18	2218-19	2219-20	2220-21	2221-22	2222-23	2223-24	2224-25	2225-26	2226-27	2227-28	2228-29	2229-30	2230-31	2231-32	2232-33	2233-34	2234-35	2235
---------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

STAGE		97.00	98.31	99.00	100.63	101.34	103.05	104.26	105.47	106.68	107.89
	100.11	100.32	101.53	112.74	113.95	115.16	116.37	117.58	118.79	120.00	

F. 68	1025.56	2169.88	3776.15	5745.26	8063.51	10722.49	13717.02	17044.03
B.	25077.02	34043.07	42236.10	51504.13	62630.87	77465.79	98162.66	124293.02
20711.93	25355.03							

[illegible][illegible]

STATION 1010, PLAY 1, RTIO 2

[illegible]

STOK

[illegible]

	FRAP	0-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
CFS	557.	4531.	1656.	804.	80383.	80383.
CMS	150.	130.	47.	23.	2276.	2276.
INDICES		4.86	7.01	7.09	7.09	7.09
MI		123.42	178.05	180.06	180.06	180.06
AC-FT		2277.	3284.	3322.	3322.	3322.
EXP. CUM		2808.	4031.	4097.	4097.	4097.

MAXIMUM STORAGE - 0.

MAXIMUM STRENGTH 103.1

STATION 1000, PLAN 1, RTID 3

	DOWNFLOW	15.	17.	10.	18.	10.
1.	7.	15.	17.	10.	18.	10.
2.	11.	17.	19.	11.	19.	11.
3.	11.	19.	19.	11.	19.	11.
4.	18.	27.	45.	50.	71.	76.
5.	101.	106.	95.	83.	84.	71.
6.	49.	52.	41.	34.	39.	29.
7.	46.	72.	95.	142.	222.	283.
8.	758.	941.	1217.	1639.	2900.	3784.
9.	3941.	10060.	10823.	11190.	10625.	9796.
10.	6145.	5405.	4744.	4178.	3235.	2840.

	STOR	0.	0.	0.	0.	0.
1.	0.	0.	0.	0.	0.	0.
2.	0.	0.	0.	0.	0.	0.
3.	0.	0.	0.	0.	0.	0.
4.	0.	0.	0.	0.	0.	0.
5.	0.	0.	0.	0.	0.	0.
6.	0.	0.	0.	0.	0.	0.
7.	0.	0.	0.	0.	0.	0.
8.	0.	0.	0.	0.	0.	0.
9.	0.	0.	0.	0.	0.	0.
10.	0.	0.	0.	0.	0.	0.

	STAGE	27.0	27.1	27.0	27.1	27.0
1.	97.1	97.1	97.1	97.0	97.1	97.0
2.	97.1	97.1	97.1	97.0	97.1	97.0
3.	97.1	97.1	97.1	97.0	97.1	97.0
4.	97.1	97.1	97.1	97.0	97.1	97.0
5.	97.1	97.1	97.1	97.0	97.1	97.0
6.	97.1	97.1	97.1	97.0	97.1	97.0
7.	97.1	97.1	97.1	97.0	97.1	97.0
8.	97.1	97.1	97.1	97.0	97.1	97.0
9.	97.1	97.1	97.1	97.0	97.1	97.0
10.	97.1	97.1	97.1	97.0	97.1	97.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
1.	1117.	9146.	3343.	1623.	162285.
2.	317.	240.	95.	46.	4595.
3.		9.72	14.15	14.31	14.31
4.		246.93	359.49	363.52	363.52
5.		4555.	6632.	6706.	6706.
6.		5619.	6180.	8272.	8272.

MAXIMUM STORAGE = 0.

MAXIMUM STAGE IS 105.7

STATION 1600, PLAT 1, RT10 3

[illegible][illegible]

STAGE									
87.6	87.7	87.3	87.7	87.5	87.7	87.6	87.7	87.6	87.6
87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7
87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7
87.7	87.7	87.8	87.9	88.0	88.3	88.5	88.7	88.9	88.9
88.1	89.2	89.2	89.2	89.2	89.1	89.0	88.9	88.8	88.8
88.7	88.6	88.5	88.4	88.4	88.3	88.2	88.2	88.1	88.1
88.1	89.2	89.4	89.4	89.2	89.7	90.0	90.3	90.5	90.5
90.4	91.6	91.6	91.9	92.2	92.6	93.1	93.5	94.0	94.1
95.1	95.5	95.9	96.2	96.4	96.5	96.5	96.3	96.1	96.1
95.1	95.2	95.2	94.7	94.4	94.2	94.0	93.7	93.5	93.5

	PTAC	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
CFS	111.5.	9117.	3342.	1622.	---	162213.
CIS	317.	240.	95.	46.	---	4593.
FIRES		9.72	14.15	14.31	---	14.31
NI		240.94	359.33	363.36	---	363.36
AC-FT		4555.	6629.	6703.	---	6703.
TOTALS		5619.	8176.	8269.	---	8269.

MAXIMUM STORAGE = 8,

MAXIMUM STAG: 15
95.5

STAINING 14°C, PLAIN 1, RTID 2

[illegible][illegible][illegible]

	PTAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
CFS	55.0	4591.	1655.	803.		80329.
CIS	1.0	110.	47.	23.		2275.
TRACES		6.86	7.01	7.09		
MI		123.41	177.94	179.96		179.96
AC-FT		2277.	3283.	3320.		3320.
TOTALS		2608.	4049.	4095.		4095.

MAXIMUM STORAGE = 5.

MAXIMUM STAGE: 15
9+0.1

STATION: 207C, PLAIN 1, RTIO 2

[illegible]

MAXIMUM STORAGE =

2.

MAXIMUM STAGE 10 71.3

MAXIMUM STRESS 81.2

[illegible]

STAT17, 3700, PLAN 1, RTIO.2

[illegible]

MAXIMUM STORAGE = 31.

MAXIMUM STAGE IS 67.3

STATION 3700, PLAN 1, RTID 3

INLET	OUTFLOW	12.	13.	14.
27.	10.	12.	13.	14.
10.	15.	15.	15.	15.
15.	15.	15.	15.	15.
15.	21.	23.	38.	63.
16.	103.	99.	88.	76.
17.	50.	46.	39.	34.
18.	61.	90.	129.	211.
19.	491.	1151.	1544.	2081.
20.	734.	10752.	11163.	2766.
21.	4783.	4436.	4263.	10703.
22.	5262.			3303.
23.				2906.

STOR

INLET	STOR	0.	0.	0.
3.	0.	0.	0.	0.
4.	0.	0.	0.	0.
5.	0.	0.	0.	0.
6.	0.	0.	0.	0.
7.	1.	1.	1.	1.
8.	1.	1.	1.	1.
9.	1.	1.	1.	1.
10.	1.	1.	1.	1.
11.	1.	1.	1.	1.
12.	7.	11.	14.	22.
13.	49.	52.	51.	48.
14.	30.	25.	20.	18.

STAGE

INLET	STAGE	57.4	57.5	57.6
57.4	57.4	57.5	57.6	57.6
57.6	57.6	57.6	57.6	57.6
57.6	57.6	57.6	57.6	57.6
57.7	57.7	58.0	58.2	58.7
58.2	58.2	59.1	59.1	59.0
58.4	58.4	58.3	58.2	58.1
58.6	58.6	59.1	60.0	60.7
58.1	58.1	62.8	63.9	65.3
62.1	62.1	63.3	64.6	66.1
62.3	62.3	69.7	69.9	69.4
63.2	63.2	66.9	66.5	65.8
63.2	63.2			

PEAK	5-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
11163.	9125.	3331.	1617.	161692.
315.	240.	94.	46.	4579.
	9.72	14.10	14.26	14.26
	246.90	358.18	362.20	362.20
	4555.	6607.	6681.	6681.
	5618.	8150.	8241.	8241.

MAXIMUM STORAGE = 52.

MAXIMUM STAGE IS 63.9

PLAN-RATIO SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE FEET (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN-RATIO	RATIO 1	RATIO 2	RATIO 3
				0.04	0.50	1.00
HYDROGRAPH AT	1	0.79 (0.00213)	1	649.	511.	1121.
			(	12.71)	159.07)	317.75)
ROUTED TO	1	0.79 (0.00213)	1	335.	5536.	11187.
			(	11.72)	156.17)	316.76)
ROUTED TO	1000	0.79 (0.00213)	1	335.	5597.	11190.
			(	11.71)	158.21)	315.89)
ROUTED TO	1000	0.79 (0.00213)	1	335.	5580.	11185.
			(	11.71)	158.02)	316.73)
ROUTED TO	2000	0.79 (0.00213)	1	335.	5576.	11186.
			(	11.71)	157.91)	316.76)
ROUTED TO	3700	0.79 (0.00213)	1	387.	5581.	11163.
			(	10.95)	158.04)	316.11)

..... 1941

INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
114.20	114.20	117.50
40.	40.	97.
0.	0.	373.

RATING	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION RIVER TOP HOURS	TIME OF	
					MAX GUTFLOW HOURS	FAILURE HOURS
0-F	117.55	99.	389.	1.50	45.00	0.
0-1/4	121.32	183.	5586.	12.50	43.50	0.
0-3/4	123.42	6.32	11187.	14.50	43.50	0.

PLAN 1 STATION 1000-

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE, FT	TIME HOURS
0.02	359.	98.3	45.00
0.50	5567.	103.0	43.50
1.00	11190.	105.7	43.50

PLAIN 1 STATION 1400

FATID	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.04	389.	90.9	45.00
0.30	5580.	94.8	43.50
1.00	11185.	96.5	43.50

PLAY 1	STATION	2000
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
17	17	17
18	18	18
19	19	19
20	20	20
21	21	21
22	22	22
23	23	23
24	24	24
25	25	25
26	26	26
27	27	27
28	28	28
29	29	29
30	30	30
31	31	31
32	32	32
33	33	33
34	34	34
35	35	35
36	36	36
37	37	37
38	38	38
39	39	39
40	40	40
41	41	41
42	42	42
43	43	43
44	44	44
45	45	45
46	46	46
47	47	47
48	48	48
49	49	49
50	50	50
51	51	51
52	52	52
53	53	53
54	54	54
55	55	55
56	56	56
57	57	57
58	58	58
59	59	59
60	60	60
61	61	61
62	62	62
63	63	63
64	64	64
65	65	65
66	66	66
67	67	67
68	68	68
69	69	69
70	70	70
71	71	71
72	72	72
73	73	73
74	74	74
75	75	75
76	76	76
77	77	77
78	78	78
79	79	79
80	80	80
81	81	81
82	82	82
83	83	83
84	84	84
85	85	85
86	86	86
87	87	87
88	88	88
89	89	89
90	90	90
91	91	91
92	92	92
93	93	93
94	94	94
95	95	95
96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

FATTY	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
0.04	329.	74.3	45.00
0.50	5576.	79.3	43.50
1.00	11166.	81.2	43.50

PLANT	STATION	3700
1	1	1

STATION	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME, HOURS
0.04	367.	61.4	45.00
0.50	5561.	67.3	44.00
1.00	11163.	69.9	43.50

1

100

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	52
--	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----

1

1. *Adiantum* 2. *Asplenium* 3. *Polypodium* 4. *Marattia* 5. *Isotriaena* 6. *Adiantum* 7. *Asplenium* 8. *Polypodium* 9. *Marattia* 10. *Isotriaena* 11. *Adiantum* 12. *Asplenium* 13. *Polypodium* 14. *Marattia* 15. *Isotriaena* 16. *Adiantum* 17. *Asplenium* 18. *Polypodium* 19. *Marattia* 20. *Isotriaena* 21. *Adiantum* 22. *Asplenium* 23. *Polypodium* 24. *Marattia* 25. *Isotriaena* 26. *Adiantum* 27. *Asplenium* 28. *Polypodium* 29. *Marattia* 30. *Isotriaena* 31. *Adiantum* 32. *Asplenium* 33. *Polypodium* 34. *Marattia* 35. *Isotriaena* 36. *Adiantum* 37. *Asplenium* 38. *Polypodium* 39. *Marattia* 40. *Isotriaena* 41. *Adiantum* 42. *Asplenium* 43. *Polypodium* 44. *Marattia* 45. *Isotriaena* 46. *Adiantum* 47. *Asplenium* 48. *Polypodium* 49. *Marattia* 50. *Isotriaena* 51. *Adiantum* 52. *Asplenium* 53. *Polypodium* 54. *Marattia* 55. *Isotriaena* 56. *Adiantum* 57. *Asplenium* 58. *Polypodium* 59. *Marattia* 60. *Isotriaena* 61. *Adiantum* 62. *Asplenium* 63. *Polypodium* 64. *Marattia* 65. *Isotriaena* 66. *Adiantum* 67. *Asplenium* 68. *Polypodium* 69. *Marattia* 70. *Isotriaena* 71. *Adiantum* 72. *Asplenium* 73. *Polypodium* 74. *Marattia* 75. *Isotriaena* 76. *Adiantum* 77. *Asplenium* 78. *Polypodium* 79. *Marattia* 80. *Isotriaena* 81. *Adiantum* 82. *Asplenium* 83. *Polypodium* 84. *Marattia* 85. *Isotriaena* 86. *Adiantum* 87. *Asplenium* 88. *Polypodium* 89. *Marattia* 90. *Isotriaena* 91. *Adiantum* 92. *Asplenium* 93. *Polypodium* 94. *Marattia* 95. *Isotriaena* 96. *Adiantum* 97. *Asplenium* 98. *Polypodium* 99. *Marattia* 100. *Isotriaena*

10

7

1

1

1

[illegible]

100

100

100

1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

100

7

1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

100

1

1

1

The diagram shows a rectangular domain with a central square hole. The domain is defined by the region $-L \leq x \leq L$ and $-H \leq y \leq H$. The central square hole is defined by the region $-1 \leq x \leq 1$ and $-1 \leq y \leq 1$. The domain is divided into four quadrants by the lines $x=0$ and $y=0$. The outer boundary is a rectangle with width $2L$ and height $2H$. The inner boundary of the hole is a square with side length 2 . The domain is labeled with x and y axes, and the hole is labeled with x and y axes.

1. The first part of the document is a list of references. The references are listed in alphabetical order of the author's name. The references are as follows:

100

100

1

1

1

1

7

1

1

Year	Percentage of Respondents
1990	85
1991	90
1992	88
1993	85
1994	88
1995	85
1996	88
1997	85
1998	88
1999	85
2000	88

1

10

7

1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

[illegible]

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FORMULTIPLE 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
				0.04	0.50	1.00
HYDROGRAPH AT	1	8.79 (0.30E 19)	1	449.	5611.	11221.
				(12.71)	(158.87)	(317.75)
ROUTED TO	1	8.79 (0.30E 19)	1	1370.	5585.	11188.
				(38.79)	(158.15)	(316.81)
ROUTED TO	1000	8.79 (0.23E 19)	1	1370.	5586.	11191.
				(38.79)	(158.10)	(316.90)
ROUTED TO	1400	8.79 (0.23E 18)	1	1315.	5600.	11159.
				(37.25)	(159.58)	(315.94)
ROUTED TO	2000	8.79 (0.42E 18)	1	1252.	5600.	11165.
				(35.46)	(158.56)	(316.17)
ROUTED TO	3700	8.79 (0.61E 18)	1	1191.	5581.	11174.
				(33.73)	(158.05)	(316.41)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1			INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION			114.20	114.20	117.50
STORAGE			40.	40.	97.
OUTFLOW			0.	0.	373.
RATIO	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF
OF	RESERVOIR	STORAGE	OUTFLOW	OVER TOP	FAILURE
P1-	J.S.ELEV	AC-FT	CFS	HOURS	HOURS
0.04	117.53	98.	1370.	1.64	44.50
0.50	120.32	161.	5585.	10.44	38.00
1.00	122.60	217.	11186.	12.39	36.00

PLAN 1 STATION 1000		
RATIO	MAXIMUM	TIME
	FLOW,CFS	HOURS
0.04	1370.	45.00
0.50	5586.	43.50
1.00	11191.	43.50

PLAN 1 STATION 1400		
RATIO	MAXIMUM	TIME
	FLOW,CFS	HOURS
0.04	1315.	45.00
0.50	5600.	44.00
1.00	11159.	43.50

PLAN 1 STATION 2000		
RATIO	MAXIMUM	TIME
	FLOW,CFS	HOURS
0.04	1252.	45.00
0.50	5600.	44.00
1.00	11165.	43.50

PLAN 1 STATION 3700		
RATIO	MAXIMUM	TIME
	FLOW,CFS	HOURS
0.04	1191.	45.50
0.50	5581.	43.50
1.00	11174.	43.50

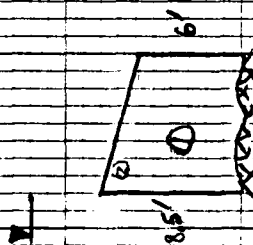
APPENDIX D
STABILITY COMPUTATIONS

RAINBOW LAKE DAM

10/23/79

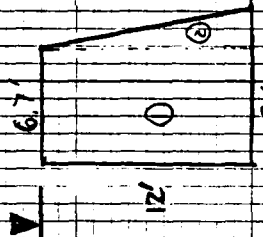
SECTIONS BASED ON 1979 PLANS & FIELD MEASUREMENTS

SPILLWAY SECTION



No.	AREA	DISTANCE TO CENTROID
①	$6(8) = 48$	4
②	$\frac{1}{2}(2)(8.5) = 8.5$	5.33

MAIN DAM SECTION



No.	AREA	DIST TO CENTROID
①	$6.7(12) = 80.4$	5.65
②	$\frac{1}{2}(2.3)(12) = 13.8$	1.53

INPUT TO STABILITY ANALYSIS PROGRAM

<u>INPUT ENTRY</u>	<u>PROGRAM No.</u>
Unit Weight of Dam (K/ft^3)	0
Area of Segment No. 1 (ft^2)	1
Distance from Center of Gravity of Segment No. 1 to Downstream Toe (ft)	2
Area of Segment No. 2 (ft^2)	3
Distance from Center of Gravity of Segment No. 2 to Downstream Toe (ft)	4
Area of Segment No. 3 (ft^2)	5
Distance from Center of Gravity of Segment No. 3 to Downstream Toe (ft)	6
Base Width of Dam (Total) (ft)	7
Height of Dam (ft)	8
Ice Loading (K/L ft.)	9
Coefficient of Sliding	10
Unit Weight of Soil (K/ft^3)	11
Active Soil Coefficient - K_a	12
Passive Soil Coefficient - K_p	13
Height of Water over Top of Dam or Spillway (ft)	14
Height of Soil for Active Pressure (ft)	15
Height of Soil for Passive Pressure (ft)	16
Height of Water in Tailrace Channel (ft)	17
Weight of Water (K/ft^3)	18
Area of Segment No. 4 (ft^2)	19
Distance from Center of Gravity of Segment No. 4 to Downstream Toe (ft)	20
Height of Ice Load or Active Water (ft)	46

MAIN DAM SECTION
NORMAL CONDITIONS

0.15
80.4
80.4
5.65
5.65
13.8
13.8
1.53
1.53
0.
0.
0.
0.
9.
9.
12.
12.
0.
0.
0.65
0.65
0.055
0.055
0.33
0.33
3.
3.
0.
0.
12.
12.
0.
0.
2.
2.
0.0624
0.0624
0.
0.
0.
0.
12.

RCL
1
RCL
2
RCL
3
RCL
4
RCL
5
RCL
6
RCL
7
RCL
8
RCL
9
RCL
10
RCL
11
RCL
12
RCL
13
RCL
14
RCL
15
RCL
16
RCL
17
RCL
18
RCL
19
RCL
20
RCL
46

MAIN DAM SECTION
ICE" LOADING - 10000 lb/ft

0.15
80.4
80.4
5.65
5.65
13.8
13.8
1.53
1.53
0.
0.
0.
0.
9.
9.
12.
12.
10.
10.
0.65
0.65
0.055
0.055
0.33
0.33
3.
3.
0.
0.
12.
12.
0.
0.
2.
2.
0.0624
0.0624
0.
0.
0.
0.
12.

RCL
1
RCL
2
RCL
3
RCL
4
RCL
5
RCL
6
RCL
7
RCL
8
RCL
9
RCL
10
RCL
11
RCL
12
RCL
13
RCL
14
RCL
15
RCL
16
RCL
17
RCL
18
RCL
19
RCL
20
RCL
46

1.50288323
2.577607169
1.164566322

F.S. VS. OVERTURNING

F.S. VS. SLIDING

4203982682
-5.188402959
4274804425

MAIN DAM SECTION 1/2 PMF FLOW

0.15	RCL
80.4	1
80.4	RCL
5.65	2
5.65	RCL
13.8	3
13.8	RCL
1.53	4
1.53	RCL
0.	5
0.	RCL
0.	6
0.	RCL
9.	7
9.	RCL
12.	8
12.	RCL
0.	9
0.	RCL
0.65	10
0.65	RCL
0.055	11
0.055	RCL
0.33	12
0.33	RCL
3.	13
3.	RCL
3.81	14
3.81	RCL
12.	15
12.	RCL
0.	16
0.	RCL
2.	17
2.	RCL
0.0624	18
0.0624	RCL
0.	19
0.	RCL
0.	20
0.	RCL
12.	46

MAIN DAM SECTION PMF FLOW

0.15	RCL
80.4	1
80.4	RCL
5.65	2
5.65	RCL
13.8	3
13.8	RCL
1.53	4
1.53	RCL
0.	5
0.	RCL
0.	6
0.	RCL
9.	7
9.	RCL
12.	8
12.	RCL
0.	9
0.	RCL
0.65	10
0.65	RCL
0.055	11
0.055	RCL
0.33	12
0.33	RCL
3.	13
3.	RCL
5.3	14
5.3	RCL
12.	15
12.	RCL
0.	16
0.	RCL
2.	17
2.	RCL
0.0624	18
0.0624	RCL
0.	19
0.	RCL
0.	20
0.	RCL
12.	46

1.147299109 ——— F.S. VS. OVERTURNING — .9725341882

.8942167706 ——— .1976840410

.7800834318 ——— F.S. VS. SLIDING — .6421478047

MAIN DAM SECTION SEISMIC ANALYSIS

0.142	0
0.142	RCL 1
80.4	
80.4	RCL 2
5.65	
5.65	RCL 3
13.8	
13.8	RCL 4
1.53	
1.53	RCL 5
0.	
0.	RCL 6
0.	
0.	RCL 7
9.	
9.	RCL 8
12.	
12.	RCL 9
0.	
0.	RCL 10
0.65	
0.65	RCL 11
0.055	
0.055	RCL 12
0.33	
0.33	RCL 13
0.	
3.	RCL 14
0.	
0.	RCL 15
12.	
12.	RCL 16
0.	
0.	RCL 17
2.	
2.	RCL 18
0.0624	
0.0624	RCL 19
0.	
0.	RCL 20
0.	
0.	RCL 46
12.	
12.	RCL 50
0.05	

1.498561179

2.380628044

1.000195525

SEISMIC ANALYSIS { F.S. OVERTURNING 1.300593995
F.S. SLIDING 1.00005707
1.000000000

SPILLWAY SECTION NORMAL CONDITIONS

0.15	RCL
48.	1
48.	RCL
4.	2
4.	RCL
3.5	3
3.5	RCL
5.33	4
5.33	RCL
0.	5
0.	RCL
0.	6
0.	RCL
8.	7
8.	RCL
8.5	8
8.5	RCL
0.	9
0.	RCL
0.65	10
0.65	RCL
0.055	11
0.055	RCL
0.33	12
0.33	RCL
3.	13
3.	RCL
0.	14
0.	RCL
8.5	15
8.5	RCL
0.	16
0.	RCL
2.	17
2.	RCL
0.0634	18
0.0634	RCL
0.	19
0.	RCL
0.	20
0.	RCL
18.5	46

SPILLWAY SECTION ICE LOADING 10000 PSF

0.15	RCL
48.	1
48.	RCL
4.	2
4.	RCL
3.5	3
3.5	RCL
5.33	4
5.33	RCL
0.	5
0.	RCL
0.	6
0.	RCL
8.	7
8.	RCL
8.5	8
8.5	RCL
10.	9
10.	RCL
0.65	10
0.65	RCL
0.055	11
0.055	RCL
0.33	12
0.33	RCL
3.	13
3.	RCL
0.	14
0.	RCL
8.5	15
8.5	RCL
0.	16
0.	RCL
2.	17
2.	RCL
0.0634	18
0.0634	RCL
0.	19
0.	RCL
0.	20
0.	RCL
13.5	46

.791341516 — F.S. VS. OVERTURNING — 0.199208516

-1.55006542 — -33.15209009

.3407509715 — F.S. VS. SLIDING — .1840159329

SPILLWAY SECTION PMF

0.15	RCL 1
48.	
48.	RCL 2
4.	
4.	RCL 3
8.5	
8.5	RCL 4
5.33	
5.33	RCL 5
0.	
0.	RCL 6
0.	
0.	RCL 7
8.	
8.	RCL 8
8.5	
8.5	RCL 9
0.	
0.	RCL 10
0.65	
0.65	RCL 11
0.055	
0.055	RCL 12
0.33	
0.33	RCL 13
3.	
3.	RCL 14
3.81	
3.81	RCL 15
8.5	
8.5	RCL 16
0.	
0.	RCL 17
2.	
2.	RCL 18
0.0624	
0.0624	RCL 19
0.	
0.	RCL 20
0.	
0.	RCL 46
18.5	

SPILLWAY SECTION PMF

0.15	RCL 1
48.	
48.	RCL 2
4.	
4.	RCL 3
8.5	
8.5	RCL 4
5.33	
5.33	RCL 5
0.	
0.	RCL 6
0.	
0.	RCL 7
8.	
8.	RCL 8
8.5	
8.5	RCL 9
0.	
0.	RCL 10
0.65	
0.65	RCL 11
0.055	
0.055	RCL 12
0.33	
0.33	RCL 13
3.	
3.	RCL 14
6.3	
6.3	RCL 15
8.5	
8.5	RCL 16
0.	
0.	RCL 17
2.	
2.	RCL 18
0.0624	
0.0624	RCL 19
0.	
0.	RCL 20
0.	
0.	RCL 46
18.5	

.663002284 — F.S. VS. OVERTURNING — .605.372195
 -3.000103263 — .3708949
 0.204200215 — F.S. VS. SLIDING — .2671973252

SPILLWAY SECTION SEISMIC ANALYSIS

0.142	RCL 1
48.	
48.	RCL 2
4.	
4.	RCL 3
8.5	
8.5	RCL 4
5.33	
5.33	RCL 5
0.	
0.	RCL 6
0.	
0.	RCL 7
8.	
8.	RCL 8
8.5	
8.5	RCL 9
0.	
0.	RCL 10
0.65	
0.65	RCL 11
0.055	
0.055	RCL 12
0.33	
0.33	RCL 13
3.	
3.	RCL 14
6.3	
6.3	RCL 15
8.5	
8.5	RCL 16
0.	
0.	RCL 17
2.	
2.	RCL 18
0.0624	
0.0624	RCL 19
0.	
0.	RCL 20
0.	
0.	RCL 46
18.5	
18.5	RCL 50
0.05	

.5729347071

-4.63059961

.241774216

SEISMIC ANALYSIS

- F.S. VS. OVERTURNING .514759012
- F.S. VS. SLIDING .475947111
- F.S. VS. SLIDING .462111111

APPENDIX E

REFERENCES

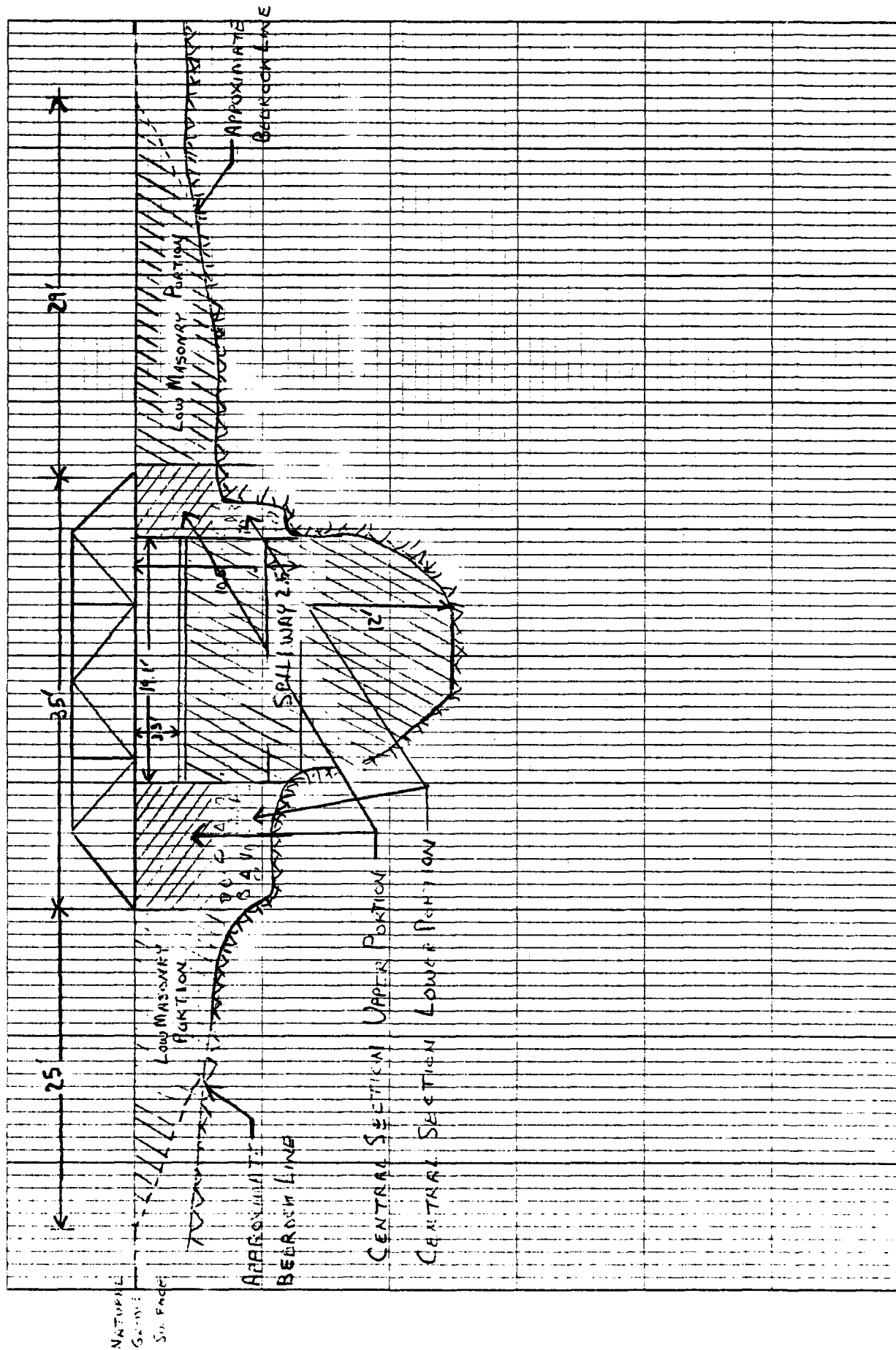
APPENDIX E

REFERENCES

- 1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.
- 2) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963.
- 3) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.
- 4) Elwyn E. Seelye, Design, 3rd edition, John Wiley and Sons, Inc., 1960
- 5) U.S. Department of the Interior, Bureau of Reclamation; Design of Small Dams, 2nd edition (rev. reprint), 1977.

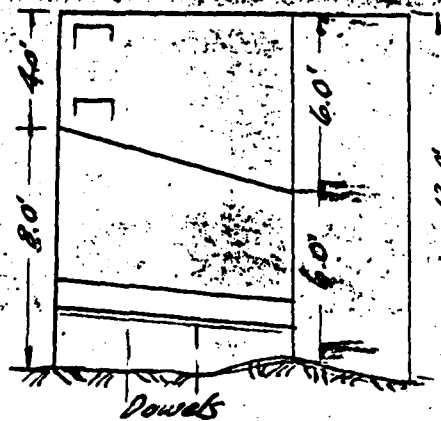
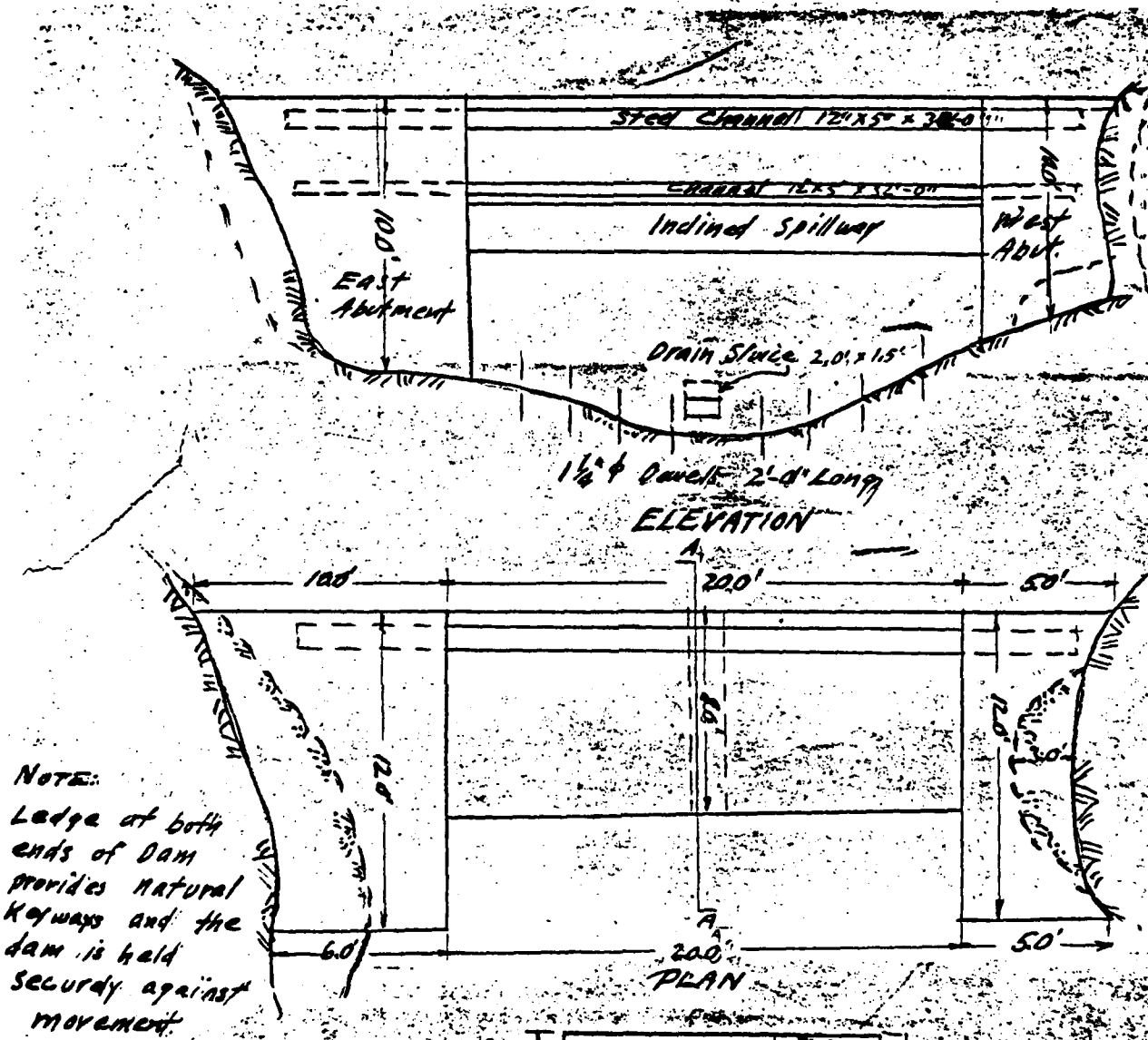
APPENDIX F

DRAWINGS



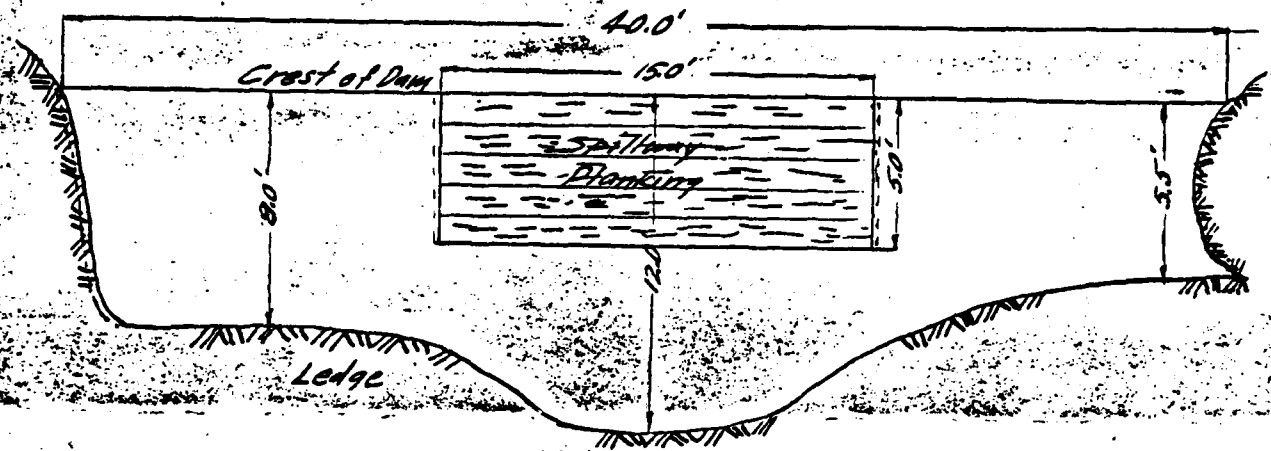
RAINBOW LAKE DAM - N.Y. 18 SKETCH BASED ON FIELD MEASUREMENTS SCALE 1"=10'

PROPOSED DAM RECONSTRUCTION

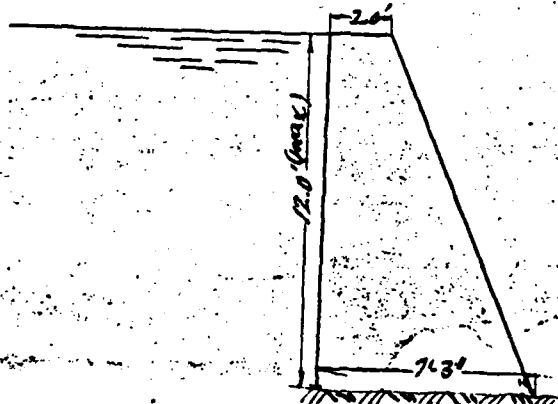


Drawn by: H. B. Atkinson
7-4-29.

PROPOSED DAM RECONSTRUCTION



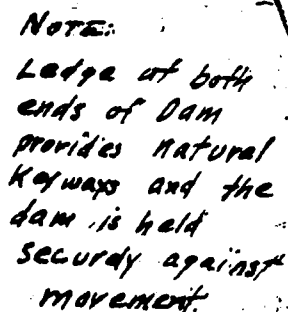
FRONT ELEVATION



SECTION

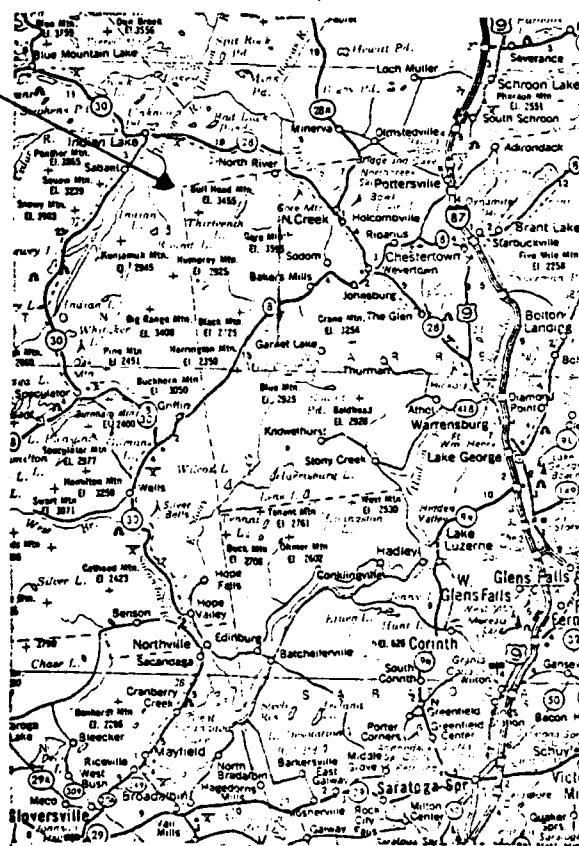
Drawn by: H. B. Thompson
7-2-29

ACTUAL MEASUREMENTS ARE CIRCLED



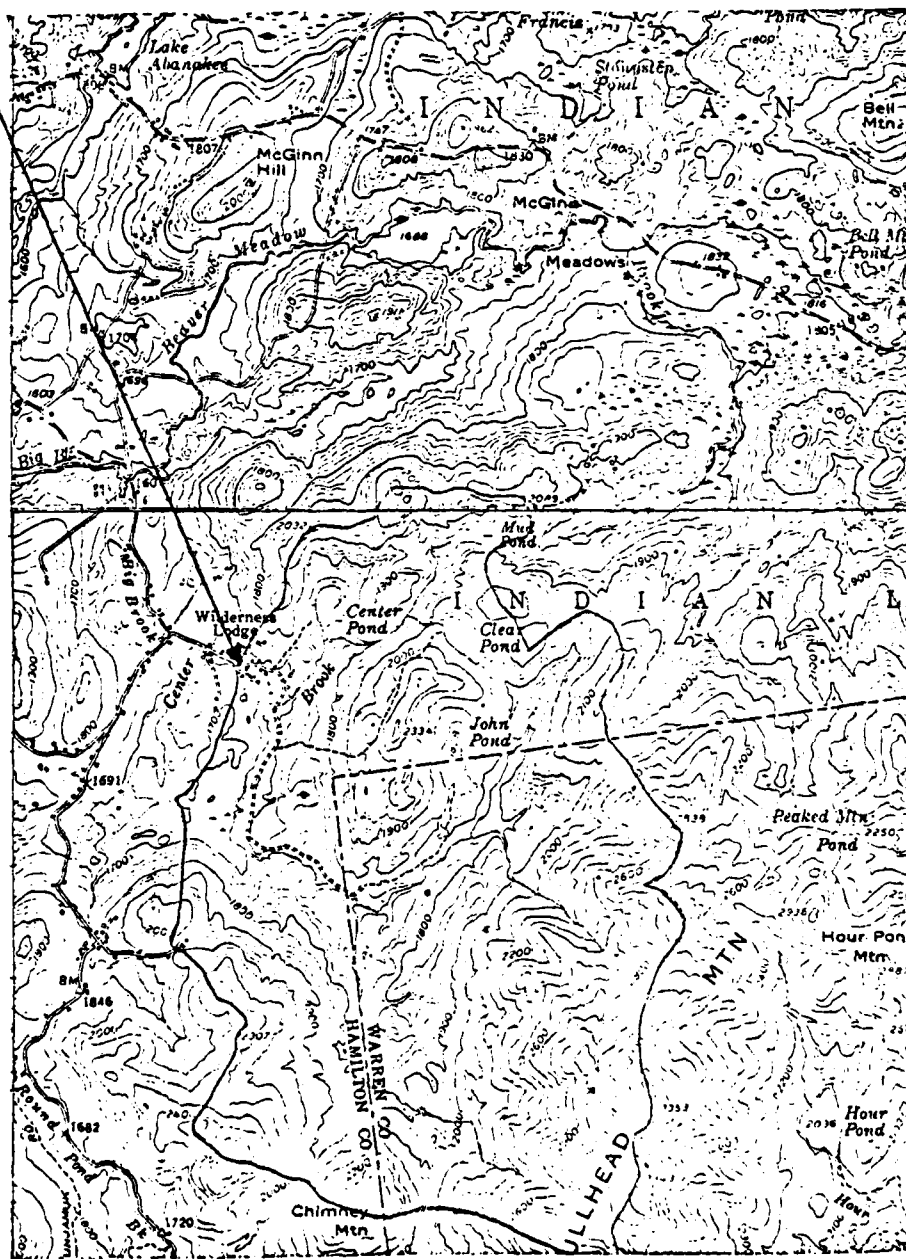
Drawn by H. O. Githin

DAM SITE



VICINITY MAP
RAINBOW LAKE DAM
I.D. No. N.Y. 18

DAM SITE



TOPOGRAPHIC MAP
RAINBOW LAKE DAM
I.D. No. N.Y.18

END

END

8-80