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LANGAN ENGINEERING ASSOCIATES INC CLIFTON NJ
NATIONAL DAM SAFETY PROGRAM. SWANNANOA LAKE DAM
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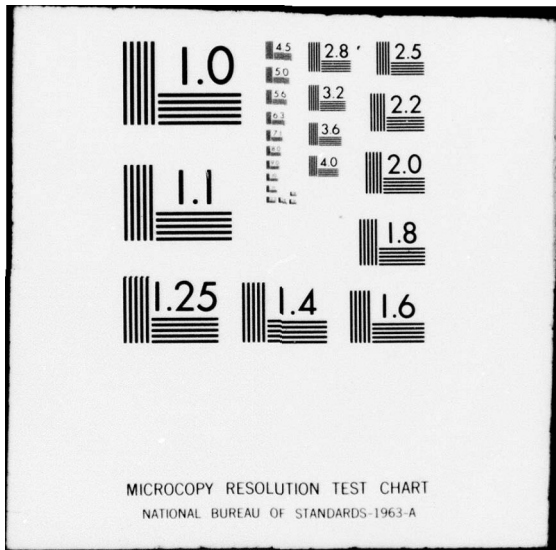
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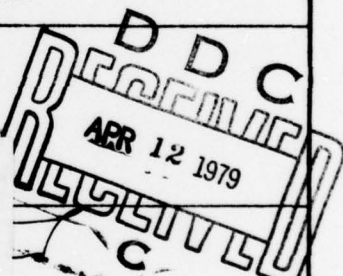
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dams Embankments Structural Analysis Safety Visual inspection			
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.			

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

IN REPLY REFER TO
 NAPEN-D

6 APR 1979

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

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Swannanoa Lake Dam No. 2 in Morris County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Swannanoa Lake Dam No. 2, a high hazard potential structure, is now judged to be in an UNSAFE, non-emergency condition. The spillway for Swannanoa Lake is located in Dam No. 1, (NJ 00311). The dam's stability is considered questionable by the personnel (consulting engineer's staff, State and Federal Engineers) who inspected this structure. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Within six months from the date of approval of this report, the following engineering studies and analysis should be performed:

(1) Determine the foundation conditions of the dam and evaluate the need for and type of under seepage cutoff that may be required.

(2) Determine by means of core borings and tests the material characteristics of the dam and the engineering properties of the foundation materials, and evaluate the requirements for strengthening the dam.

(3) Evaluate the need for additional downstream support of the dam and measures for relieving hydrostatic pressure from within and below the dam.

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NAPEN-D

Honorable Brendan T. Byrne

(4) Determine whether or not a low level outlet exists and, if so, make this outlet functional.

b. A more extensive topographic survey of the dam and vicinity should be made within six months from the date of approval of this report.

c. Within three months from the date of approval of this report, the following remedial actions should be performed:

(1) The trash rack should be made functional in order to prevent the drop inlet from becoming clogged with debris.

(2) Investigate and evaluate the condition of the drop inlet and make necessary repairs.

(3) Repair and make functional the operator and gate for the 3.5-foot diameter lift gate so that the drop-box can function properly.

(4) Investigate and, if necessary, correct water flowing from the floor of the abandoned pump house.

(5) Make necessary modifications to the former generator area to permit discharge directly from the 3.5-foot diameter pipe into the discharge flume.

(6) Remove sedimentation and debris from the downstream channel.

(7) Remove flashboards from the discharge flume.

(8) Repair spalled and cracked concrete areas on the crest of the dam.

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

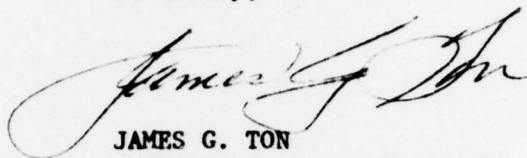
Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-D

Honorable Brendan T. Byrne

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

Sincerely,



JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N. J. Dept. of Environmental Protection
P. O. Box CNO29
Trenton, NJ 08625

John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N. J. Dept. of Environmental Protection
P. O. Box CNO29
Trenton, NJ 08625

SWANNANOA LAKE DAM NO. 2 (NJ00310)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 30 November and 1, 11, 12 and 16 December 1978 by Langan Engineering Associates, Inc. under contract to the State of New Jersey. The state, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, P.L. 92-367.

Inspection of Swannanoa Lake Dam No. 2 on December 12, 1978 by Corps, State and Langan Engineering personnel revealed the dam to be in an UNSAFE, non-emergency condition. This condition, a recent collapse of a portion of the downstream face of the dam, if left uncorrected, could have resulted in failure of the dam with subsequent possible loss of life and property damage. Until further study could determine the full extent of the problem and possible permanent remedial actions, temporary measures were recommended to preclude serious property damage and possible loss of life. The District Engineer notified the Governor's representative by telegram of the UNSAFE condition on 19 December 1978 (Copy attached to this assessment) (Also, "UNSAFE DAM" data sheets were submitted to the U.S. Army Engineer Division, North Atlantic on 15 December 1978 and 23 March 1979. Copies of these sheets are attached). Meanwhile, the State notified the owner by letter of the recommendations. The owner has lowered the level of the lake and repaired the masonry facing wall as recommended.

Swannanoa Lake Dam No. 2, a high hazard potential structure, is now judged to be in an UNSAFE, non-emergency condition. The spillway for Swannanoa Lake is located in Dam No. 1, (NJ 00311). The dam's stability is considered questionable by the personnel (Consulting Engineer's Staff, State and Federal Engineers) who inspected this structure. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Within six months from the date of approval of this report, the following engineering studies and analysis should be performed:

(1) Determine the foundation conditions of the dam and evaluate the need for and type of under seepage cutoff that may be required.

(2) Determine by means of core borings and tests the material characteristics of the dam and the engineering properties of the foundation materials, and evaluate the requirements for strengthening the dam.

(3) Evaluate the need for additional downstream support of the dam and measures for relieving hydrostatic pressure from within and below the dam.

(4) Determine whether or not a low level outlet exists and, if so, make this outlet functional.

b. A more extensive topographic survey of the dam and vicinity should be made within six months from the date of approval of this report.

c. Within three months from the date of approval of this report, the following remedial actions should be performed:

(1) The trash rack should be made functional in order to prevent the drop inlet from becoming clogged with debris.

(2) Investigate and evaluate the condition of the drop inlet and make necessary repairs.

(3) Repair and make functional the operator and gate for the 3.5-foot diameter lift gate so that the drop-box can function properly.

(4) Investigate and, if necessary, correct water flowing from the floor of the abandoned pump house.

(5) Make necessary modifications to the former generator area to permit discharge directly from the 3.5-foot diameter pipe into the discharge flume.

(6) Remove sedimentation and debris from the downstream channel.

(7) Remove flashboards from the discharge flume.

(8) Repair spalled and cracked concrete areas on the crest of the dam.

APPROVED: _____

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

DATE: 6 April 1979

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MR. JOHN O'DOWD, P.E., CHIEF

BUR. FLOOD PLAIN MGT,

NJ DEPT OF ENV PROT.

P.O. BOX 2809

RENTON, NJ 0825

Engr
Design

INSPECTION OF SWANMANOA LAKE DAM NO. 2 (U.S. NO. 00310), LOCATED ABOUT FOUR MILES NORTH OF WOODSTOCK, MORRIS COUNTY, NEW JERSEY, REVEALED THE DAM TO BE IN AN UNSAFE, NON-EMERGENCY CONDITION. THIS CONDITION, RECENT COLLAPE OF PORTION OF DOWNSTREAM FACE OF DAM, IF LEFT UNCORRECTED, COULD RESULT IN FAILURE OF THE DAM WITH SUBSEQUENT POSSIBLE LOSS OF LIFE AND PROPERTY DAMAGE. UNTIL FURHTER STUDY CAN DETERMINE FULL ECTENT OF THE PROBLEM AND POSSIBLE PERMANENT REMEDIAL ACTIONS, THE FOLLOWING TEMPORARY MEASURES, AS A MINIMUM, ARE RECOMMENDED TO PRECLUDE SERIOUS PROPERTY LAMAGE AND POSSIBLE LOSS OF LIFE:

- A. DRAWDOWN LAKE THREE FEET WITHIN NEXT THIRTY DAYS BE PREFERABLY OPENING FOUR FOOT DIA. VALVE IN DAM NO. 2. IF VALVE CANNOT BE OPENED, THEN A SUITABLE SIZED NOTCH SHOULD BE MADE IN THE SPILLWAY OF DAM NO. 1 TO EFFECT THE SPECIFIED DRAWDOWN.
- B. REBUILD COLLAPSED SECTION OF COBBLED FACING WALL, ALLOWING FOR NUMEROUS SMALL WEEP HOLES IN THE MORTARED JOINTS.

C. UTILIZE A PROFESSIONAL CONSULTANT, QUALIFIED IN THE DAM INSPECTION PROGRAM, TO INSPECT THE DAM WEEKLY AND FURNISH THE STATE A WRITTEN REPORT OF THE INSPECTION.

~~D. LOCAL AUTHORITIES SHOULD PREPARE AN EMERGENCY WARNING AND~~
EVACUATION PLAN, IMMEDIATELY, IN EVENT THE CONDITION WORSENS.
A LETTER IS BEING SENT TO GOVERNOR BYRNE FULLY EXPLAINING THE
SITUATION. AS REQUESTED, THIS TELEGRAM IS SENT SO YOU MAY
EXPEDITE ACTION.

BT

JAMES G. TON, COLONEL, CORPS OF ENGINEERS, DISTRICT ENGINEER,
ARMY CORPS OF ENGINEERS, 2ND & CHESTNUT STREETS, PHILA., PA. 19106

ACCEPTED

00001

J-PC

UNSAFE DAM
NATIONAL PROGRAM OF INSPECTION OF DAMS


- a. NAME: Swannanoa Lake b. ID NO.: NJ00310 c. LOCATION State: New Jersey County: Morris
- d. HEIGHT: 9 Feet e. MAXIMUM IMPOUNDMENT CAPACITY: 800 ac. ft.
- f. TYPE: Masonry; Built 1914
- g. OWNER: Mrs. Gertrude A. Norton Bohenna, President, Ringling Manor Inc. Developers, Oak Ridge, N.J.
- h. DATE GOVERNOR NOTIFIED OF UNSAFE CONDITIONS: See Note K & M
- i. URGENCY CATEGORY: UNSAFE, Non-Emergency
- j. EMERGENCY ACTIONS TAKEN:
Wire being sent to Governor's representative, as he requested, so State can give owner letter of direction. Letter to Governor will follow.
- k. REMEDIAL ACTIONS TAKEN: None to Date.
- l. REMARKS: As actions and additional information become available, this report will be promptly updated.

River or Stream: West Branch of Rockaway River
Nearest D/P City or Town: Woodstock

DESCRIPTION OF DAMAGE:
Seepage through masonry caused bulging of downstream stone wall facings at four locations. One bulge has broken open exposing deteriorated rubble concrete interior.

1) The only road through the valley passes about 300 feet downstream of dam.
2) Approximately 150 ft. d.s. of road (in flood plane) is a commercial establishment with about 20 employees.

RECOMMENDATIONS GIVEN TO GOVERNOR: Letter being prepared to Governor stating full extent of problem. Governor's representative notified of situation and recommended temporary remedial measures by telephone on 13 Dec 78, the day following the joint CE, State and State A/E inspection. Recommended temporary remedial actions are as follows:
1) Drawdown lake three (3) feet within next 30 days.
2) Rebuild bulged and collapsed section of rubble masonry facing wall allowing for numerous small weep holes in mortared joints.
3) Utilize a qualified professional consultant to inspect the wall weekly and furnish the State a written report of the inspection.
4) Prepare an emergency warning and evacuation plan immediately, in event the condition worsens.


W. H. ZINK
Coordinator, Dam Inspection Program
U.S.A.E.D., Philadelphia
15 December 1978

SECOND REPORT
UNSAFE DAM

NATIONAL PROGRAM OF INSPECTION OF DAMS

a. NAME: Swannasa Lake b. ID NO.: NJ 00310 c. LOCATION State: New Jersey County: Morris
d. HEIGHT: 9 feet e. MAXIMUM IMPOUNDMENT CAPACITY: 800 ac. ft. River or Stream: West Branch of Rockaway River

f. TYPE: Masonry, Built 1914 Nearest D/D City or Town: Woodstock
g. OWNER: Mrs. Gertrude A. Norton Bohenna, President, Ringling Manor Inc. Developers, Oak Ridge, N.J.
h. DATE GOVERNOR NOTIFIED OF UNSAFE CONDITIONS: CONDITION OF DAM RESULTING IN UNSAFE ASSESSMENT
i. URGENCY CATEGORY: UNSAFE, Non-Emergency Seepage through masonry caused bulging of downstream stone wall facings at four locations. One bulge has broken open exposing deteriorated rubble concrete interior

j. EMERGENCY ACTIONS TAKEN: Wire sent to Governor's representative, as he requested. State sent owner letter of direction.

k. REMEDIAL ACTIONS TAKEN: Owner has lowered lake level and repaired masonry facing wall as recommended.

l. REMARKS: No more reports will be issued unless there is a change in the present conditions.

j. DESCRIPTION OF DANGER INVOLVED:
1) The only road through the valley passes about 300 feet downstream of dam.
2) Approximately 150 ft. d.s. of road (in flood plane) is a commercial establishment with about 20 employees.

k. RECOMMENDATIONS GIVEN TO GOVERNOR:
Recommended temporary remedial action are as follows:
1) Drawdown lake three (3) feet within next 30 days.
2) Rebuild bulged and collapsed section of rubble masonry facing wall allowing for numerous small weep holes in mortared joints.
3) Utilize a qualified professional consultant to inspect the wall weekly and furnish the State a written report of the inspection.
4) Prepare an emergency warning and evacuation plan immediately, in event the condition worsens.

J. H. Zink

W. H. Zink
Coordinator, Dam Inspection Program
U.S.A.E.D., Philadelphia
23 March 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	SWANNANOA LAKE DAM #2
ID NUMBER:	FED ID No. NJ00310
STATE LOCATED:	NEW JERSEY
COUNTY LOCATED:	MORRIS
STREAM:	TRIBUTARY OF ROCKAWAY RIVER
RIVER BASIN:	PASSAIC
DATE OF INSPECTION:	30 November and 1,11,12 & 16 December 1978

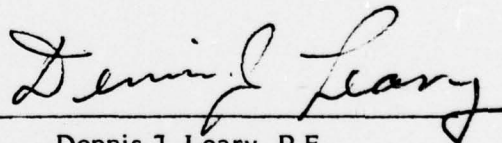
ASSESSMENT OF GENERAL CONDITIONS

Lake Swannanoa Dam #2 was determined to be UNSAFE, non-emergency, on 12 December 1978. The available information on Swannanoa Lake Dam #2 is not sufficient to draw a conclusion concerning the actual degree of stability of the dam. Based on our observations it is our opinion the dam is in poor condition and marginally stable. We are concerned about the bulging of the downstream face of the dam and seepage through and under the dam. Conditions can be expected to become worse if they remain uncorrected and under an extreme flood.

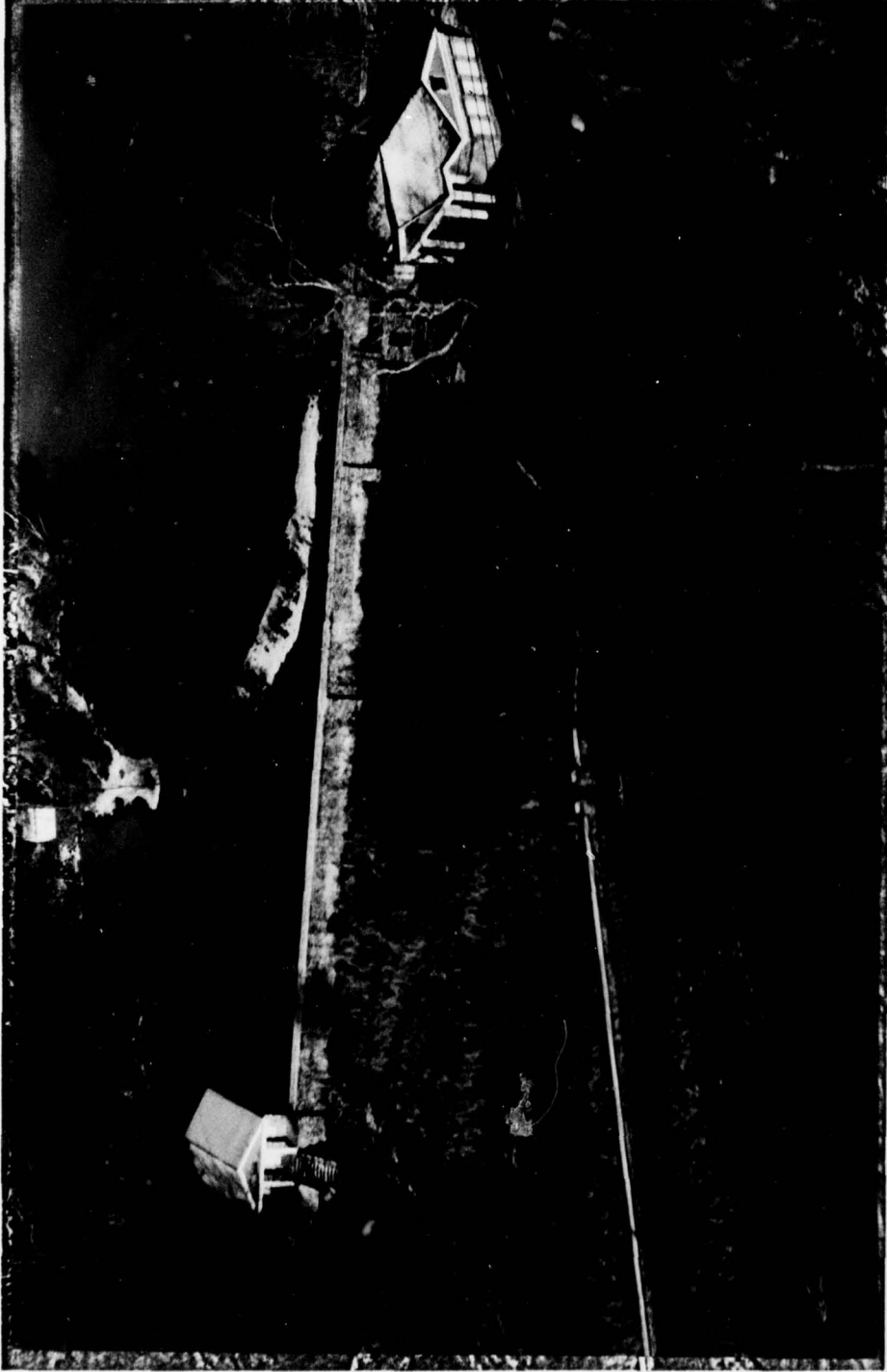
We recommend a determination be made as to the existence of a low level outlet and if necessary, measures be developed to make the outlet functional. In any case a low level outlet should be provided. This should be done very soon. Determine the foundation conditions of the dam and the need for and type of under seepage cutoff that may be required should be evaluated. By means of

core borings and tests the condition of the concrete in the dam and the engineering properties of the foundation should be determined, and, an evaluation made of the requirements for strengthening the dam. The need for additional downstream support of the dam and measures for relieving hydrostatic pressure from within and below the dam should also be evaluated. The trash rack should be made functional and an investigation and evaluation should be made of the conditions and necessary repair of the drop inlet spillway. The operator and gate for the 3.5-ft-dia lift gate should be repaired and made permanently functional so that the drop-box spillway can function properly. Water flowing from the floor of the abandoned pump house should be investigated and if necessary corrected. The preceding recommendations should be done very soon. Modifications to the former generator area to permit discharge directly from the 3.5-ft-dia pipe into the discharge flume should be made. This will permit controlled discharge and reduce the potential for erosion. This should be done soon.

The spillway capacity which is governed by the spillway provided in Dam #1 (NJ 00311), as determined by CE screening criteria is inadequate. We estimate the Swannanoa Lake dam system can adequately pass only 3.9% of the PMF. The capacity of the spillway and SDF should be determined using more precise and sophisticated methods and procedures. A more extensive topographic survey of the dam and vicinity should be made. The need for and type of mitigating measures should be determined. Around the clock surveillance during periods of unusually heavy precipitation should be provided, and a warning system established. This should be done very soon.

A handwritten signature in cursive script that reads "Dennis J. Leary". The signature is written in dark ink and is positioned above a horizontal line.

Dennis J. Leary, P.E.



OVERVIEW
SWANNANOA LAKE DAM #2
1 DECEMBER 1978

RED

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	SWANNANOA LAKE DAM #2
ID NUMBER:	FED ID No. NJ00310
STATE LOCATED:	NEW JERSEY
COUNTY LOCATED:	MORRIS
STREAM:	TRIBUTARY OF ROCKAWAY RIVER
RIVER BASIN:	PASSAIC
DATE OF INSPECTION:	30 November and 1,11,12 & 16 December 1978



LANGAN ENGINEERING ASSOCIATES, INC.

Consulting Civil Engineers
990 CLIFTON AVENUE
CLIFTON, NEW JERSEY
201-472-9366

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NATIONAL DAM SAFETY REPORT
SWANNANOA LAKE #2 FED ID NO NJ00310

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PREFACE

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

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

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an 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.

SECTION I PROJECT INFORMATION

1.1 General

Authority to perform the Phase I Safety Inspection of Swannanoa Lake Dam #2 was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 20 November 1978. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the US Army Engineer District, Philadelphia.

The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to safety of Swannanoa Lake Dam #2 and appurtenances based upon available data and visual inspection, and, determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted. The assessment is made using screening criteria established in Recommended Guidelines for Safety Inspection of Dams prepared by the Department of Army, Office of the Chief of Engineers. It is not the purpose of the inspection report to imply that a dam meeting or failing to meet the screening criteria, is per se, certainly adequate or inadequate.

1.2 Project Description

Swannanoa Lake Dam #2 and appurtenances are located north of Swannanoa Lake Dam #1 at the southeast end of Lake Swannanoa across a tributary of the Rockaway River. It is located immediately upstream from Berkshire Valley Road, about one mile north of Woodstock in Jefferson Township, Morris County, New Jersey. A regional vicinity map is given in Figure 1.

The Dam is a 380-ft-long, 11-ft-high masonry gravity dam with a cobble stone downstream facing. It was constructed in 1914. At the right abutment there is an abandoned pump house and a boat house. At the left abutment area is a former power house that was used to provide power for lights. There is an 8-ft drop inlet spillway that leads to a 3.5-ft lift gate at the location of the power house. These structures are no longer used. Normal discharge is maintained through the spillway provided at Dam #1. Available drawings indicate the downstream face to have been constructed 1 hor to 12 vert and the upstream face to be vertical with an upstream earthfill. The fill is shown to be riprapped and sloped 6 hor to 1 vert. The dam is at latitude $41^{\circ} 0.5'$ north and longitude $74^{\circ} 31.1'$ west. Essential features of the dam are given in Fig 2.

The area of the Lake is approximately 51 acres. Lake Swannanoa Dam #2 is classified as being "small" on the basis of its reservoir storage volume 539 Ac-ft which is less than 1,000 acre feet, but more than 50-acre feet. It is also classified as "small" on the basis of its total height 11 ft, which is less than 40 feet. Accordingly the dam is classified as "small" in size.

In the National Inventory of Dams, Lake Swannanoa Dam #2 has been classified as having "High Hazard Potential" on the basis that failure of the dam would cause excessive property damage to residences downstream, and could potentially cause more than a few deaths. Visual inspection of the downstream shows that breach of the dam would cause little damage to residences which are located on high ground but could be hazardous to people utilizing the low lying Berkshire Valley Road and commercial building on the other side of the road. Accordingly, it is proposed not to change the Hazard Classification Potential.

Swannanoa Lake Dam #2 is owned by Ringling Manor Inc., c/o Mrs. Gertrude Bohenna, 28 Manor Drive, Lake Swannanoa, Oak Ridge, New Jersey, 07438.

The original purpose of the dam was recreation and power generation for lights. Its present purpose is recreation. The dam was constructed in 1914 by E.R. Headley & Sons for Mr. A.T. Ringling.

Stone masons are engaged as necessary to replace cobbles in the stone facing when they fall out. Operating procedures appear to be limited to the placement and removal of flash boards at Swannanoa Lake Dam #1 which is located about 1000 ft south of Swannanoa Lake Dam #2. This is done during the summer to increase the depth of the lake for swimming.

1.3 Pertinent Data

a. Drainage Areas

At dam site, the drainage area is 13.0 sq mi

b. Discharge at Dam Site

Maximum known flood at dam site occurred 25 Aug. 1955, magnitude not known.

Spillway capacity at pool elevation equal to crest of dam (governed by spillway at Dam #1): 560 cfs

c. Elevation (ft above MSL)

Top Dam: 773.0

Normal pool: 770.4

Spillway crest: El. 770.4 at Dam #1

Streambed at centerline of dam: 762.0

d.	Reservoir	
	Length of Maximum pool:	3530 ft (estimated)
	Length of normal Pool:	3500 ft (estimated)
e.	Storage (acre-feet)	
	Normal pool:	400 AF
	Top of dam:	539 AF
f.	Reservoir Surface (acres)	
	Top dam:	56 A
	Maximum pool:	56 A
	Recreation pool:	51 A (assumed)
	Spillway crest:	51 A
g.	Dam	
	Type:	Masonry Gravity Dam
	Length:	380 ft
	Height:	11 ft
	Top Width:	4.8 ft
	Side Slopes:	d/s 6 hor to 1 vert: u/s 1 hor to 12 vert
	Impervious core:	None Observed
	Cutoff:	None Observed
	Grout curtain:	None Observed

SECTION 2 ENGINEERING DATA

2.1 Introduction

No essential information has been made available concerning the design, construction and operation of the dam. Consequently, available information is inadequate. It is also not possible to make an evaluation of the validity of the information that is available beyond limited confirmation by observation of the materials and geometry of the dam.

2.2 Regional Geology

Swannanoa Lake Dam #2 is located in the New Jersey Highlands physiographic province. The New Jersey Highlands extend across the state in a northeast southwest direction from the border of New York to the Delaware River and includes the northwest portions of Hunterdon, Passaic, and Morris Counties and the southeastern parts of Warren and Sussex Counties. This province is part of the New England Physiographic Province and lies between the Appalachian Ridge and Valley Province to the northwest and the Piedmont Province to the southeast. See Fig 3.

The Highlands are characterized by rounded and flat topped northeast southwest ridges and mountains up to 1,400 ft high separated by narrow valleys. The orientation of the valleys are usually, but not always controlled by the underlying geologic structure.

The regional geologic structure reflects the very old age of bedrock. A number of regional faults cross the area in northeast southwest direction, including the Ramapo Fault; the more than 30 mile long fault scarp forms the eastern border of the province. Faults control many of the river valley orientations. The relatively uniform slope of the mountain elevations, from northwest to southeast, is a direct result of the faulting. The entire area is part of the now dissected Schooley Peneplain.

The Pleistocene Age Wisconsin glacier covered all of the dam site area.

The glacier stripped most of the existing overburden and weathered rock and uncovered the numerous hard bedrock knobs and ridges seen throughout the province. Most of the side-slopes in the area are covered with heavy boulder tills (ground moraine), whereas glacial outwash and recent alluvium cover the valleys.

SECTION 3 VISUAL INSPECTION

Swannanoa Lake Dam #2 was inspected on 14 May 1974 by the N.J.D.E.P. Division of Water Resources. This inspection concluded the general condition of the dam to be good, however, there were a few places where slight bulges of about 3 to 5 inches beyond the plane of the downstream faces of the dam were observed. Some of these areas showed seepage. The total amount of seepage was difficult to determine but was estimated at about 1 second foot. At the time of the inspection there had been a rainfall the previous day of approximately 2.5 inches. The inspection recommended that a complete inspection be made by a qualified engineer. This was followed by an inspection on 20 September 1974 by William S. Kowalski P.E. A copy of both inspection reports is given in Appendix 1.

The results of our inspection indicate Swannanoa Lake Dam is in Poor Condition. The lower part of the downstream face of the dam is bulging over the major portion of its length. The bulge varies from about 1 inch to 10 inches. Leakage is occurring through the face of the dam at many locations and along the toe. The immediate downstream area is very wet and spongy and the dam has a slight downstream bow particularly in the area of maximum bulging. An approximately 3 ft by 4 ft area of the face of the dam has fallen away leaving a 10 inch to 18 inch deep void in the face of the dam. At this location the concrete was observed to have become a very weakly cemented sand with embedded stone.

Water is flowing from the floor of the abandoned pump house at about 40 gpm. Its source is reported to be an artesian well drilled to a depth of 100 ft. The entrance to the drop-inlet spillway is clogged and the wooden trash rack has rotted. At the time of our inspection the 3.5-ft-dia lift gate was inoperable and there was no low level outlet. Our visual inspection checklist and photographs are given in Appendices 2 and 3.

Lake Swannanoa Dam #2 was determined to be unsafe and in a non-emergency condition on 12 December 1978 following an inspection by representatives of Langan Engineering Assoc., the N.J.D.E.P. and the U.S. Army Corps of Engineers. On 18 January 1979 the 3.5-ft-dia pipe was observed to be flowing at about, 40 cfs and we were informed the lift gate had been opened for about a week. In addition, the concrete slab covering the former generator discharge into the flume had been removed. This allowed the water to flow from the pipe into the flume.

SECTION 4 OPERATIONAL PROCEDURES

No essential information is available concerning operational procedures for the dam. Maintenance of the dam consisted of replacement of stone facing and removal of flashboards from the spillway of Swannanoa Lake Dam #1. No warning system is in effect.

As a result the determination of the unsafe condition of the dam the owner has been directed to implement temporary remedial measures. These measures are recommended in a Mailgram from the U.S. Army Corps of Engineers to the N.J.D.E.P. A copy of the Mailgram is given in Appendix 6.

SECTION 5 HYDRAULIC/HYDROLOGIC

Information regarding flood waters overtopping the dam was obtained from Mrs. Bohenna, President of Ringling Manor, Inc. To the best of her knowledge the dam was overtopped on 3 occasions:

1. During a hurricane in 1940,
2. 25 August 1955 during hurricane Doria, and
3. June 1972 during hurricane Agnes.

On these occasions the dam was reported to have been overtopped with 1 to 2 inches, causing no erosion on the downstream side or below the dam, nor inflicting damage to the spillway. It is reported the August 1955 overtopping was increased as a result of failure of two earth dams located upstream of the lake.

The hydraulic/hydrologic evaluation is based on a Spillway Design Flood (SDF) equal to the full Probable Maximum Flood (PMF) chosen in accordance with the evaluation guidelines for dams classified as high hazard and small in size. Hydrologic design data for this dam is not available. The PMF has been determined by developing a synthetic hydrograph based on the maximum probable precipitation of 22.2 inches (200 square mile - 24 hour). The 8 ft drop-box spillway was not functioning properly at the time of the inspection. Therefore, discharge capacity is considered to be governed by the spillway provided at Dam #1. Hydrologic computations are presented in Appendix 4. The PMF determined for the subject watershed is 17,177 cfs.

The capacity of the spillway at Dam #1 is 560 cfs which is significantly less than SDF.

Flood routing for both the PMF and 1/2 PMF indicates the dam will overtop by 4.5 ft and 2.9 ft respectively. We estimate the dam can adequately pass only 3.9% of the PMF.

The downstream potential damage center (a reasonably well traveled road and nearby commercial buildings), is located a few hundred feet from the dam. Based on our visual inspection of the immediately downstream topography and knowledge of the degree of overtopping potential it is our opinion that dam failure resulting from overtopping would increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

Drawdown of the lake has been evaluated considering the drop-box spillway structure is altered and the 42 inch outlet pipe serves as a low level outlet. Our calculations indicate that the lake level could be lower than 6 ft in approximately 5 days.

SECTION 6 STRUCTURAL STABILITY

The stability of Swannanoa Lake Dam #2 is marginal and the dam has been determined to be unsafe. The structures are nearly 65 years old and no information is available concerning the foundation or material characteristics of the dam. Consequently, analytical methods cannot be used to reasonably evaluate factors of safety with respect to present day requirements. On the other hand our inspection observations indicate the dam is in poor condition. It is our opinion the dam has safety factors that are considerably less than acceptable under present day standards, and requires immediate remedial work to ensure stability of the dam.

Swannanoa Lake Dam #2 is located in Seismic Zone 1 of the Seismic Zone Map of Contiguous States. The static stability of the dam is marginal and not within conventional safety margins. Therefore, the dam is considered unstable under both static and earthquake loading.

SECTION 7 ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Assessment

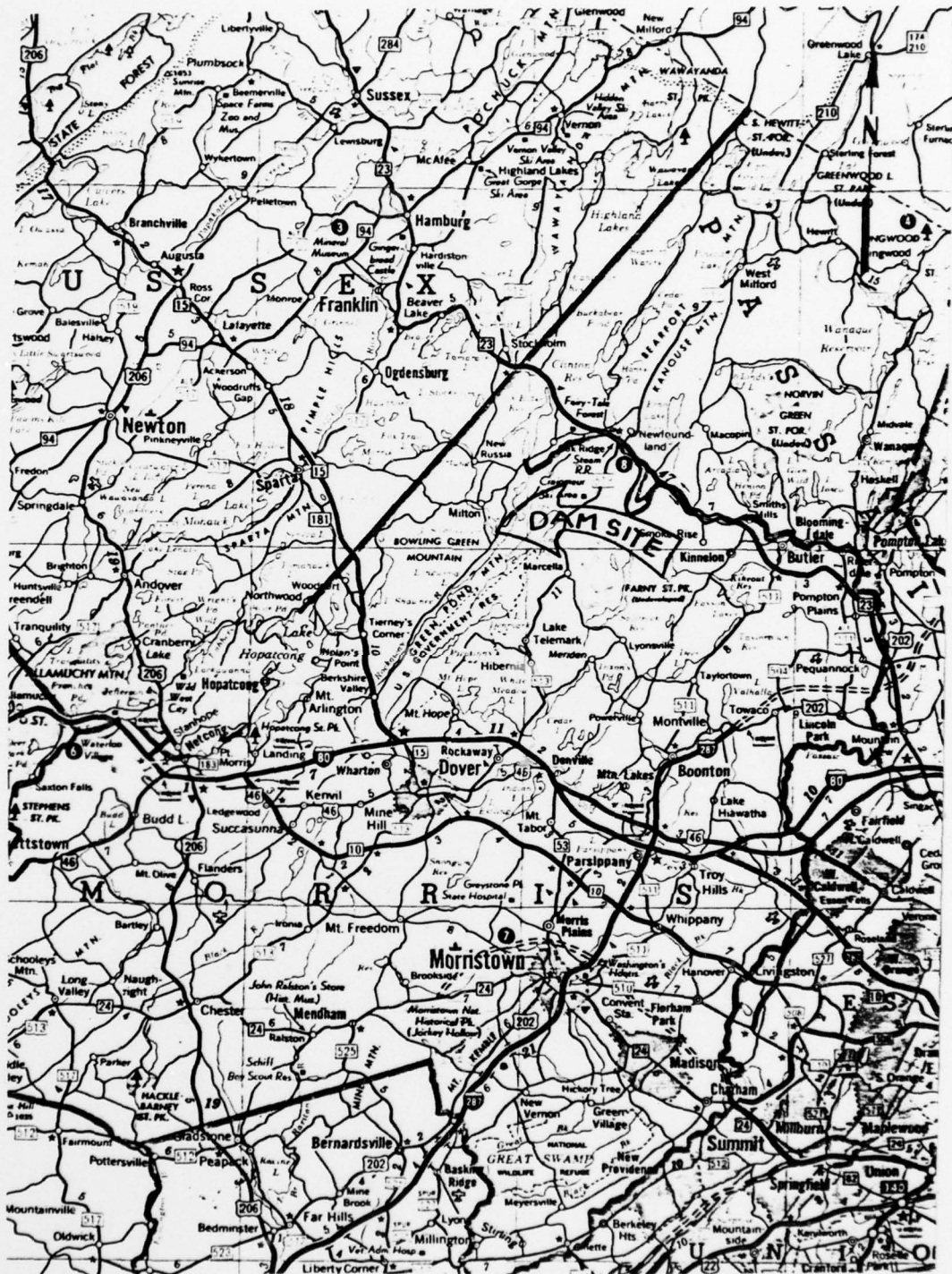
Lake Swannanoa Dam #2 was determined to be UNSAFE, non-emergency, on 12 December 1978. The available information on Swannanoa Lake Dam #2 is not sufficient to draw a conclusion concerning the actual degree of stability of the dam. Based on our observations it is our opinion the dam is in poor condition and marginally stable. We are concerned about the bulging of the downstream face of the dam and seepage through and under the dam. Conditions can be expected to become worse if they remain uncorrected and under an extreme flood.

7.2 Recommendations/Remedial Measures

We recommend the following remedial measures:

1. Determine the existence of a low level outlet, and if necessary, measures should be developed to make the outlet functional. In any case a low level outlet should be provided. This should be done very soon.
2. Determine the foundation condition of the dam and evaluate the need for and type of under seepage cutoff that may be required. This should be done very soon.
3. Determine by means of core borings and tests the condition of the concrete in the dam and the engineering properties of the foundation materials. This information should be used to evaluate the requirements for strengthening the dam. This should be done very soon.
4. Evaluate the need for additional downstream support of the dam and measures for relieving hydrostatic pressure from within and below the dam. This should be done very soon.
5. The trash rack should be made functional and thereby prevent the drop inlet from becoming clogged with debris. This should be done very soon.
6. Investigate and evaluate the condition of the drop inlet spillway and make necessary repairs. This should be done very soon.

7. Repair and make permanently functional the operator and gate for the 3.5-ft-dia lift gate so that the drop-box spillway can function properly. This should be done very soon.
8. Investigate and if necessary, correct water flowing from the floor of the abandoned pump house. This should be done very soon.
9. Make necessary permanent modifications to the former generator area to permit discharge directly from the 3.5-ft-dia pipe into the discharge flume. This should be done soon.
10. The spillway capacity which is governed by the spillway provided in Dam #1, as determined by CE screening criteria is inadequate. We estimate the dam can adequately pass only 3.9% of the PMF. The capacity of the spillway and SDF should be determined using more precise and sophisticated methods and procedures. A more extensive topographic survey of the dam and vicinity should be made. The need for and type of mitigating measures should be determined. Around the clock surveillance during periods of unusually heavy precipitation should be provided, and a warning system established. This should be done very soon.

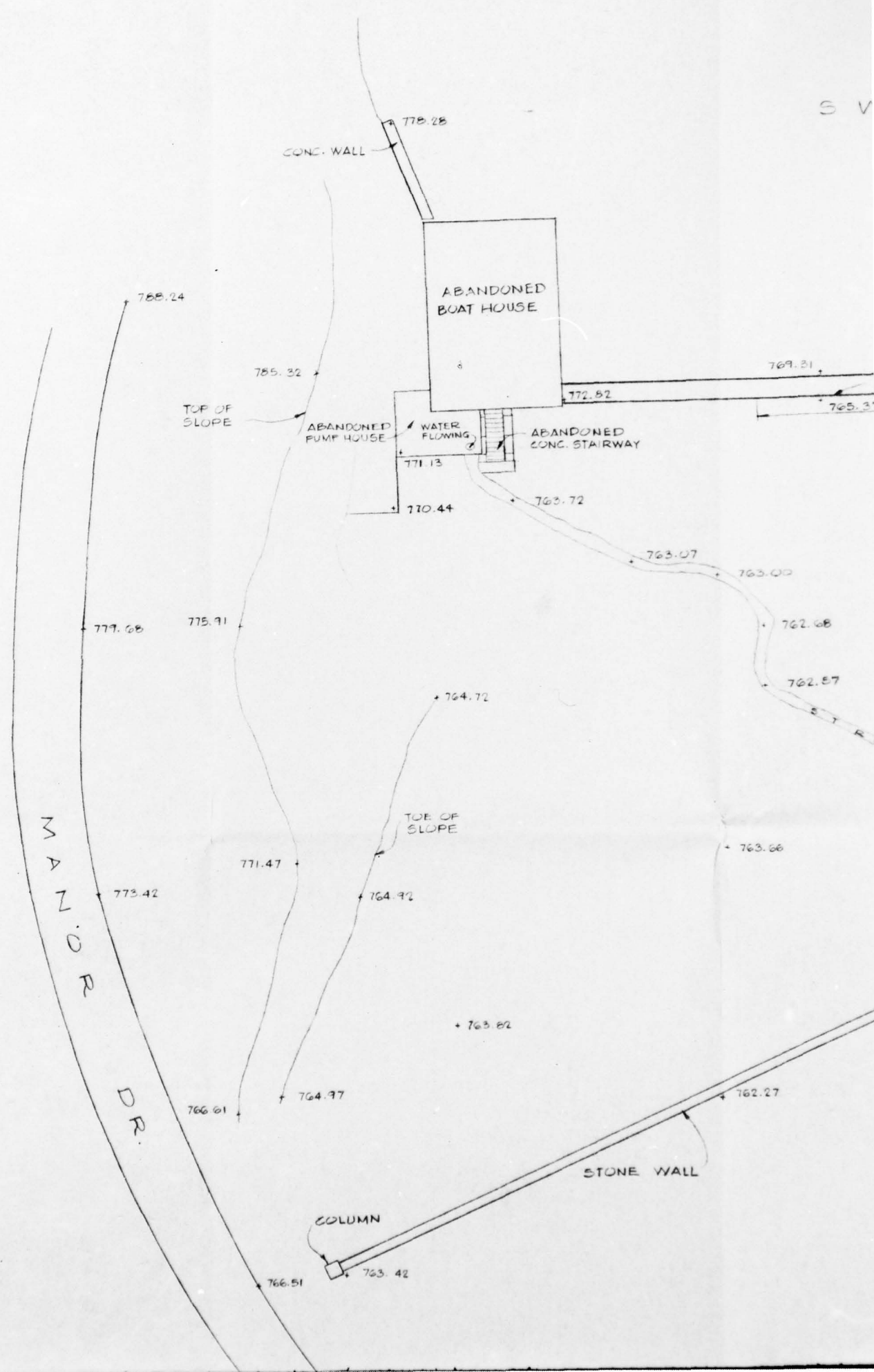


lin. \approx 5.2 mi

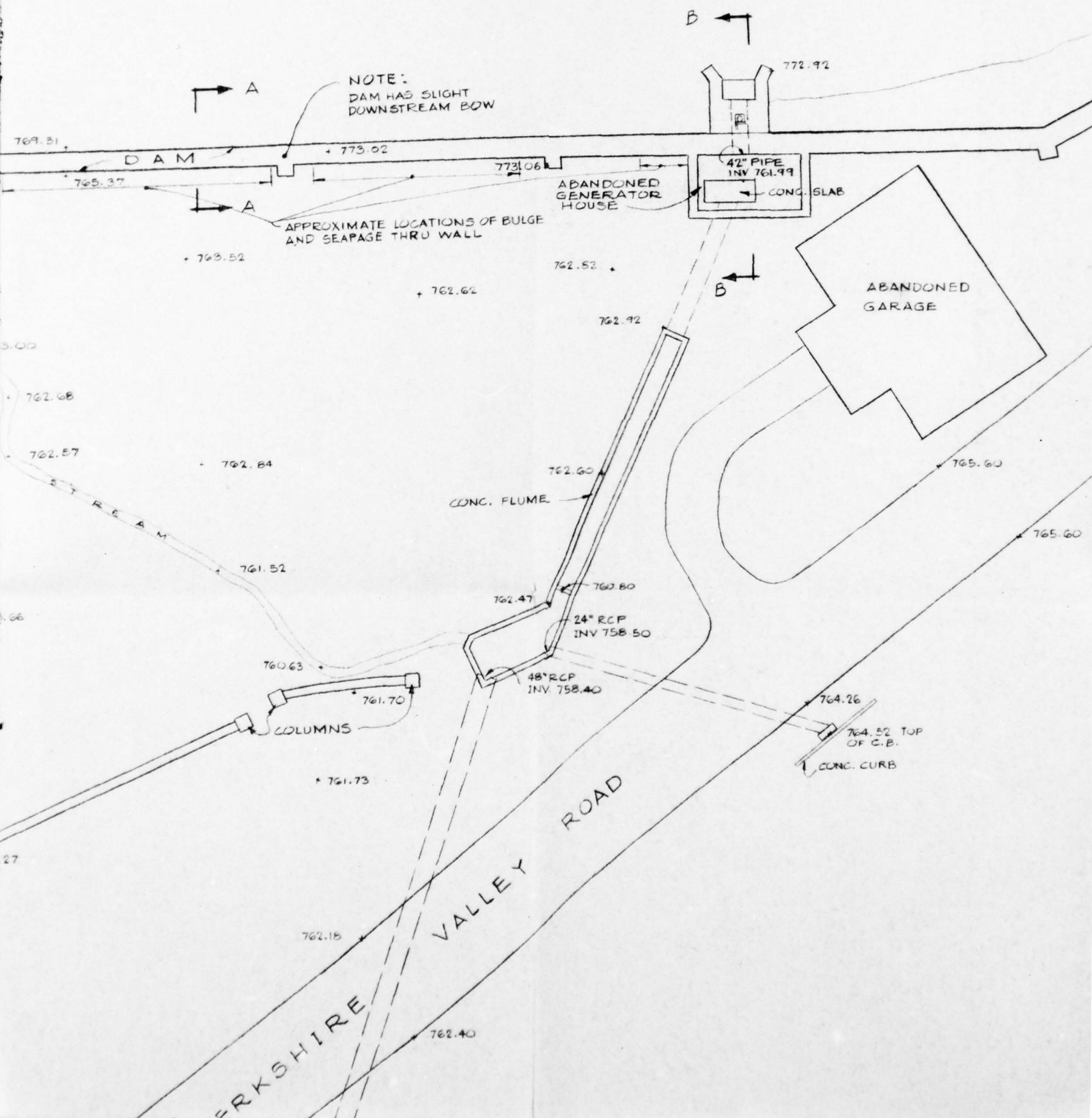
REGIONAL VICINITY MAP
SWANNANOA LAKE DAM #2

Fig.1

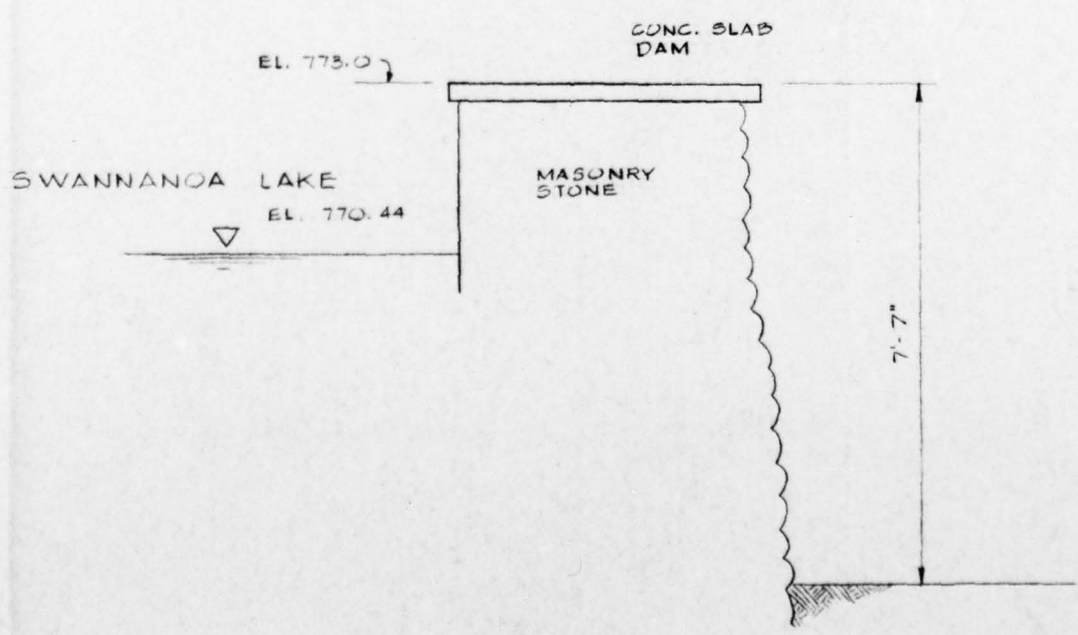
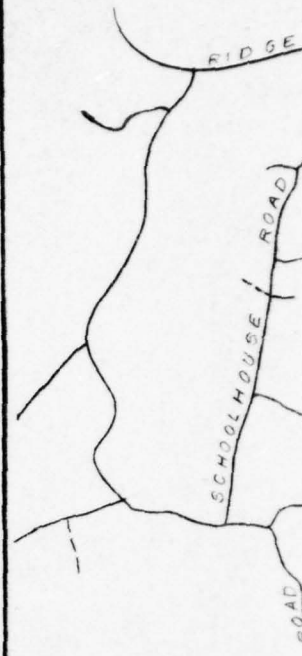
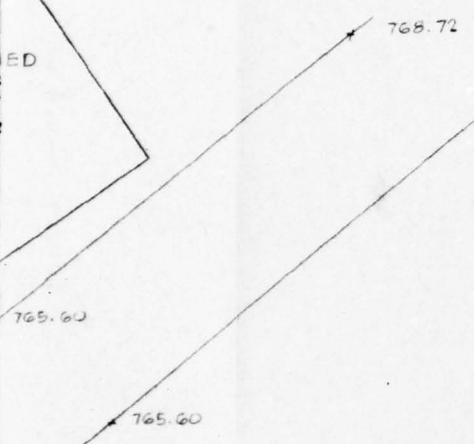
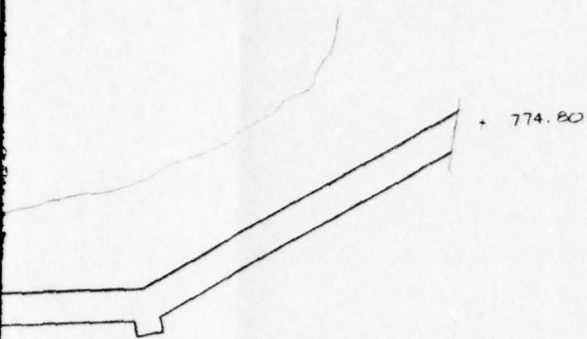
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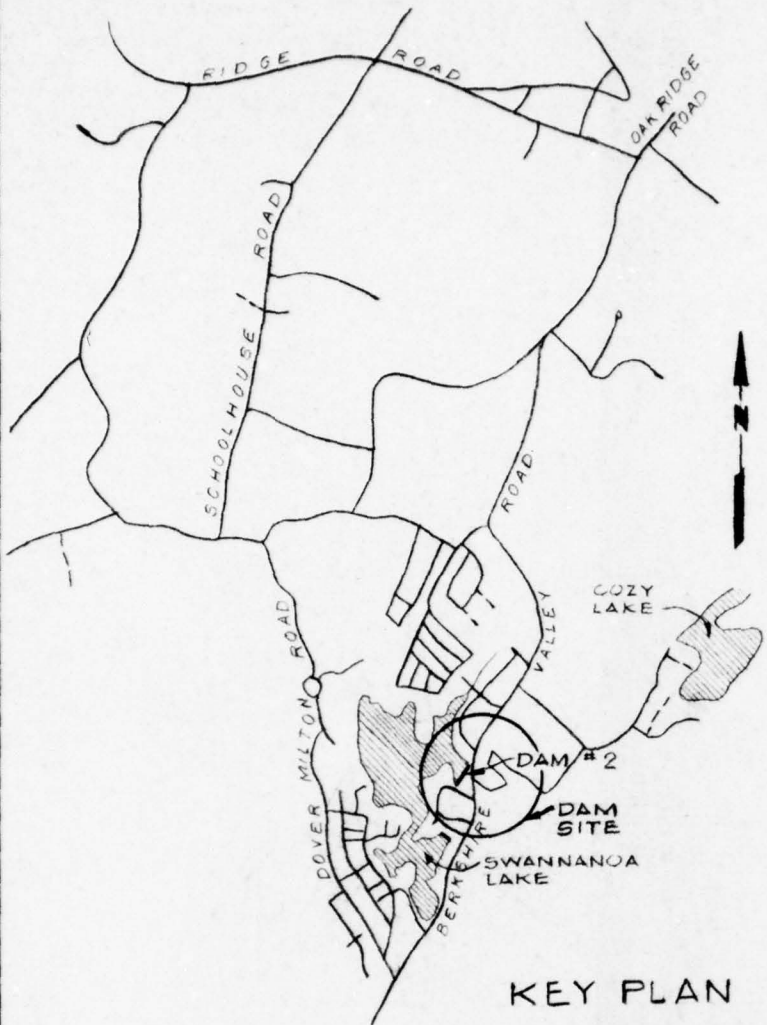


SWANNANOA LAKE EL 770.44

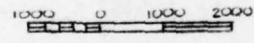


3

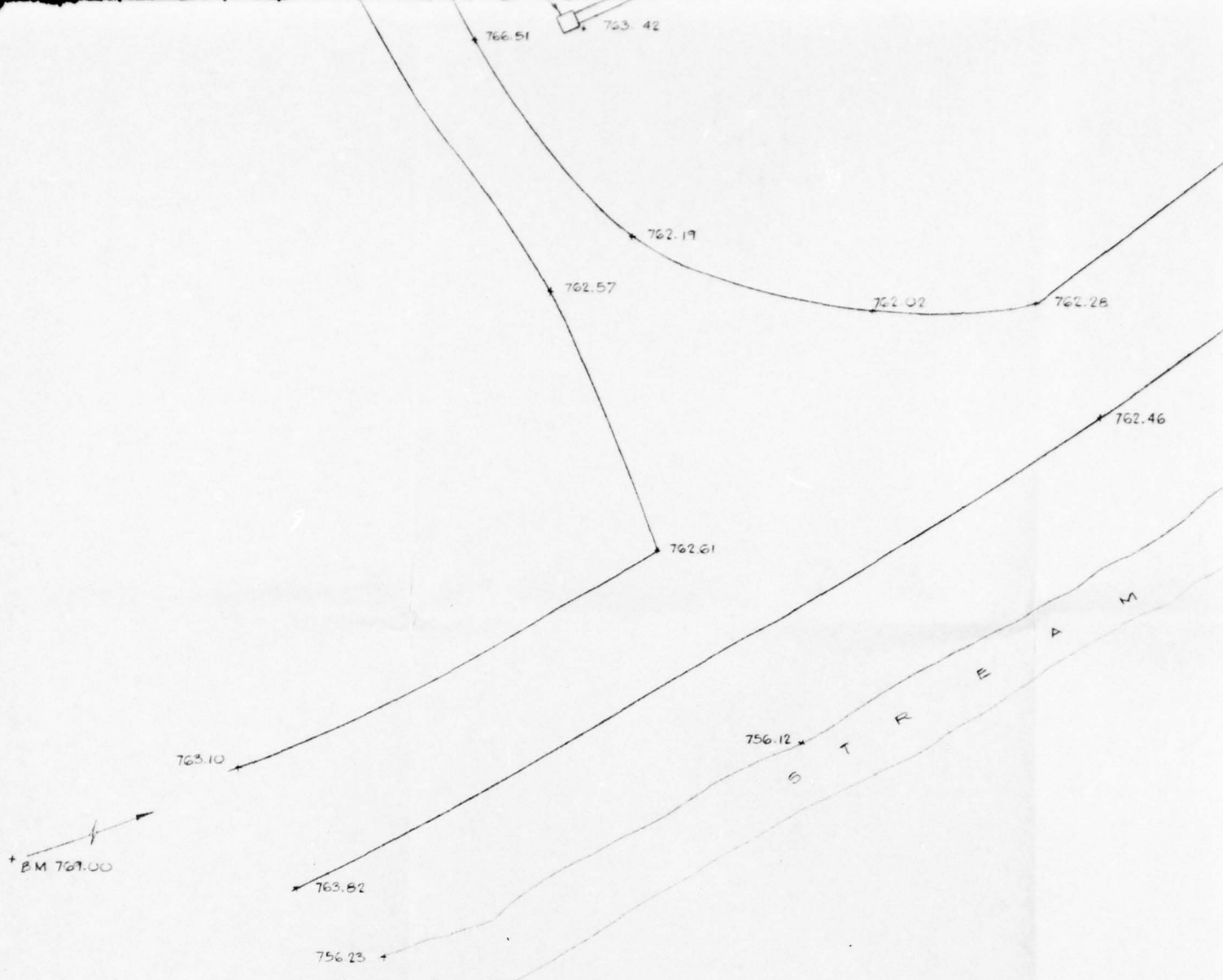




KEY PLAN



7'-7"



5

BERKSHIRE

762.40

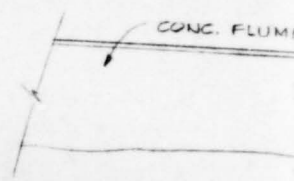
762.28

762.46

CONC HEADWALL

48" CONC. PIPE
INV. EL. 757.78

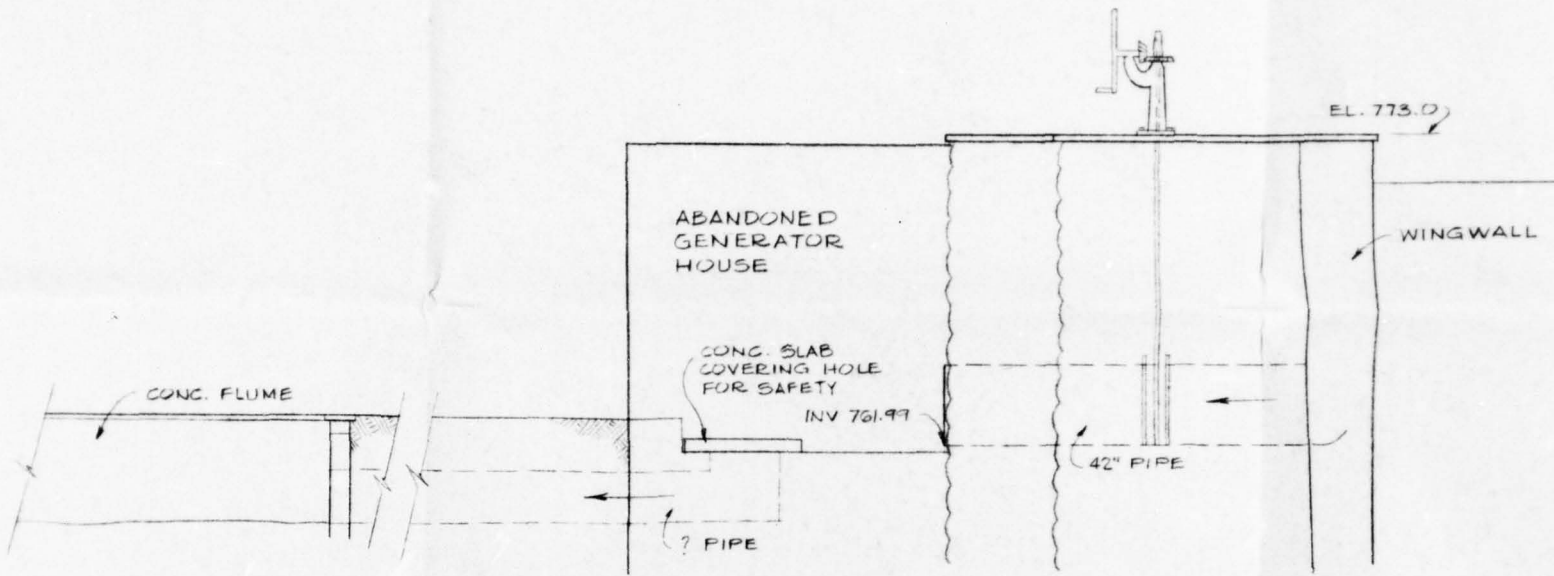
PLAN
SCALE: 1"=20'



4

SECTION A-A

SCALE 1" = 2'



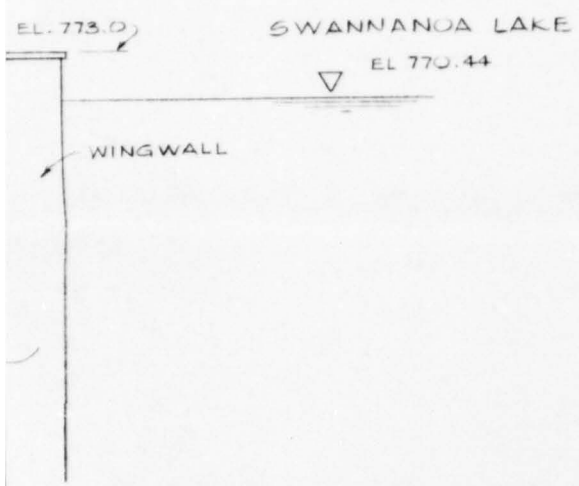
SECTION B-B

N. T. S.

NOTE:

THE ELEVATIONS SHOWN WERE
TRANSIT AND LEVEL AND THE U.S.G.S.
QUADRANGLE, A SELECTED BENCH ELEVATION
OF BERKSHIRE VALLEY ROAD WAS USED.
MAP. THESE ELEVATIONS ARE APPROXIMATE

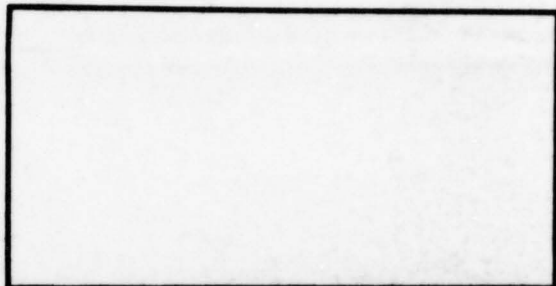
7



ELEVATIONS SHOWN WERE OBTAINED USING A SURVEYOR'S
 LEVEL AND THE U.S.G.S. MAP FOR FRANKLIN, N.J.
 ELECTED BENCH ELEVATION OF 769.00 AS THE PAVEMENT
 LEVEL ROAD WAS USED. THIS IS INDICATED ON SAID U.S.G.S.
 MAP. ELEVATIONS ARE APPROXIMATE.

6

DATE	DESCRIPTION	NO.
REVISIONS		

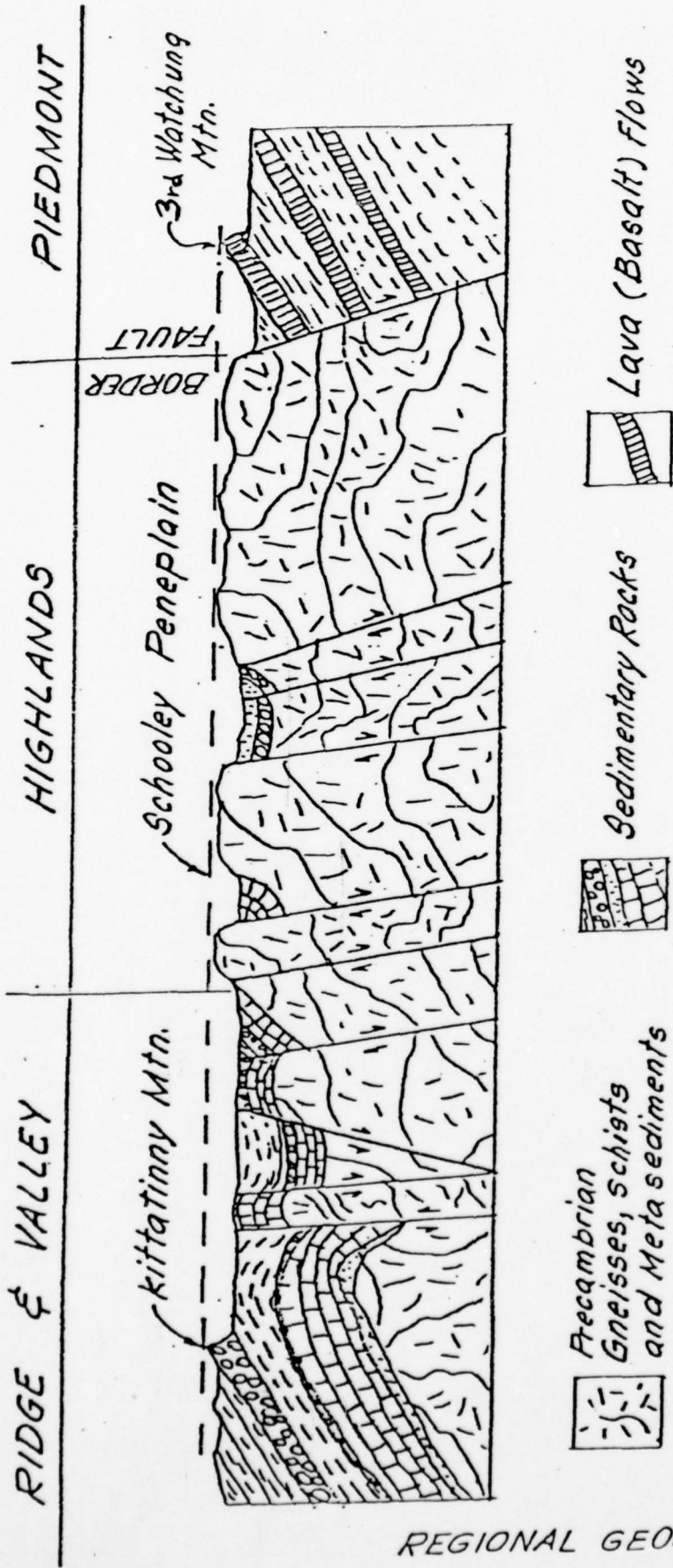


ENGINEERING COUNCIL OF NEW JERSEY
 170 GENESEE AVENUE, SUITE 200, NEW JERSEY, N.J. 07102-4211

PROJECT
PHASE I
 INSPECTION & EVALUATION
 NEW JERSEY DAMS

DRAWING TITLE
 SWANNANOA LAKE
 DAM # 2
 NOVEMBER 1978
 FED. I.D. NO. NJ00310

JOB NO. J-811	FIG. 2
DATE 27 DEC 1978	
SCALE AS NOTED	
DRN. BY J. R.	
CHKD BY D. J. L.	



Schematic Cross-section of
New Jersey Highlands
Physiographic Province
(After Wolfe, 1977)

REGIONAL GEOLOGIC FEATURES

Fig. 3

APPENDIX 1

INSPECTION REPORTS

SWANNANOVA LAKE DAM #2

Swannanoa Lake
Dam No. 8
Morris County
Inspection Report

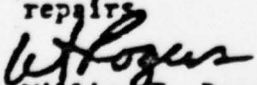
On May 14, 1974, at about 1300 hours, an inspection was made in company with Mr. Robert Fonte of the north and south dams of Swannanoa Lake across tributaries of the Rockaway River and located immediately upstream from Berkshire Valley Road in Jefferson Township, Morris County.

The inspection was made at the request of Mr. Fonte, Director of the D.P.W. of Jefferson Township who stated that the dam appeared in need of repair.

The structures were built about 1914 by E.R. Headley and Sons as contractors for Ringling Brothers. A recent phone call to the office of the Tax Assessor revealed that the entire lake to a point 10 feet beyond the waterline is still the property of Ringling Manor, Inc.

The general condition of both the north and south dams is good, however, there are a few places where slight bulges of about 3 to 5 inches beyond the plane of the downstream faces of the dams have appeared. Some of these areas also show seepage. The total amount of seepage was difficult to determine but is estimated at about 1 second foot at each dam. At the time of the inspection there was at least a 6 inch head on the 50 foot south spillway due to a rainfall the previous day of approximately 2.5 inches. The northerly spillway has an 8 foot drop inlet and leads into a 4 foot diameter clam type lift gate that enters a flume leading to a 4 foot R.C.P. under Berkshire Valley Road. The capacity of the south spillway assuming a 2 foot head available would be 438 second feet.

It is recommended that a letter be sent to the owner requesting a complete inspection of the structure by a qualified engineer, with such inspection submitted to this office along with recommendations for repairs.


William F. Rogers
Dam Analysis Section

WFR:M:A18
cc: Dirk C. Hofman

received
710 Oct 21 1975

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
BUREAU OF WATER CONTROL
P.O. BOX 2809
TRENTON, NEW JERSEY 08625

CONDITION REPORT - DAMS

Dam Application No. _____ Date of Inspection 9/20/74

Name of Dam Lake Swannanoa (North)

Owner's Name Ringling Manor, Inc.

Address Lake Swannanoa, Oak Ridge, Morris County, New Jersey

Comment on the following items in accordance with the instructions enclosed:

A. Earthfill and/or Timber Dams — NOT APPLICABLE

1. Maintenance

2. Condition

3. Other

B. Masonry and Concrete Dams

1. No abnormal settlement, heaving, tilting or lateral movement of the structure was observed.
2. There is definite evidence of spalling and deterioration of portions of the stone facing. Also, the top walkway and coping are spalling and deteriorating and are in need of repair and replacement.
3. Erosion and cavitation along the structure was not observed.
4. See Supplemental Sheet
5. On the downstream side of the dam the ground is wet, but does not have any evidence of running water with the exception of the well house mentioned in Item 4.

6. Applicable comments are made under subsequent sections.

C. Channels, Stilling Basins and Surrounding Areas

1. In general, the effluent channel is in fair to good condition with the exception of minor general improvements needed.

2.

3.

4.

5.

6.

D. Mechanical Equipment

1. See Supplemental Sheet

2. See Supplemental Sheet

E. Miscellaneous

1. See Supplemental Sheet

2.

CONCLUSION

A. I certify that the above dam was personally inspected by me and was found to be in (good, fair, poor) condition. (Circle one)

B. I recommend that the following repairs be made immediately.

1. See Supplemental Sheet
2. See Supplemental Sheet
3. See Supplemental Sheet

C. The following improvements should also be undertaken.

1. The old generator room should be demolished and the 36" discharge pipe connected positively to the effluent channel. The walls of the structure now serve no purpose.
2. The old structure on the westerly side of the dam should be demolished and removed as it now serves no purpose and is very deteriorated.
3. The existing railings along the North Dam effluent channel should be repaired or replaced as required, and new railings installed where none exist.

Inspected by: William S. Kowalski, P.E.

Consulting Engineer: _____

Address: 27 Cedar Grove Parkway

_____ Cedar Grove

_____ New Jersey 07009

Telephone: 201-239-0528

N.J.P.E. License No. 12070

Date: March 17, 1975

S E A L

LAKE SWANNANOA (NORTH)

B. Masonry and Concrete Dams

4. Some seepage through the stone masonry between the ground level to about 30" above was observed, but all minor in nature. However, on the westerly side of the dam exists a small well house and pump room where a considerable amount of water was observed flowing through the concrete floor. At this time, it is not known whether this is seepage from the dam or an artesian condition from the abandoned well.

D. Mechanical Equipment

1. The inlet structure is in poor physical condition requiring masonry repairs. The outlet works is in fair condition but some modifications should be made because of a change in operations to be mentioned later.
2. The trash racks are not functional and are almost entirely rotted and in need of replacement.

The sluice gate which formerly controlled the flow for the generator is somewhat operational, and in need of reconditioning and repair, but at this time serves no real purpose. Further, the discharge from this dam formerly passed through the generator then to the effluent channel. Because of the elimination of the generator, modifications are needed here.

E. Miscellaneous

1. The only information which I was able to obtain regarding flood waters overtopping the dam was from Mrs. Bohenna, President of Ringling Manor, Inc., who informed me that to the best of her knowledge the dam was overtopped on two occasions only:
 - a) During a hurricane in 1940.
 - b) During Hurricane Doria in the early 1970's.

On both occasions the dam was overtopped with 1 to 2 inches, causing no erosion on the side or below the dam, nor inflicting any damage to the spillway.

CONCLUSION

- B. 1. Masonry repairs should be made to the top walkway, or coping, as required.
2. Where seepage is occurring through the face of the structure, the spalling should be repaired, and the leakage could probably best be repaired by using a pressure application of concrete. I would recommend that this be done from the ground line or below as required, to about 30" above. This should accomplish the sealing without taking away too much from the stone aesthetics.

LAKE SWANNANOA (NORTH)CONCLUSION

- B. 3. The well house and pump room should be closed and secured, and the leakage be determined; if seepage, it should be sealed.
4. The outlet structure should be repaired and the trash rack replaced.
5. The sluice gate operating wheel should be removed and the sluice gate placed in a fully open position.
6. The wet condition along the toe of the dam could possibly be alleviated by a reverse filter and drain system.

APPENDIX 2

CHECK LIST

VISUAL INSPECTION

SWANNANOVA LAKE DAM 2

CHECK LIST
VISUAL INSPECTION

Phase I

NAME DAM Swannanoa Lake Dam #2 COUNTY Morris County STATE New Jersey COORDINATORS N.J. DEP

DATE(s) INSPECTION See Below WEATHER Clear TEMPERATURE 40° F

POOL ELEVATION AT TIME OF INSPECTION el 770* M.S.L. TAILWATER AT TIME OF INSPECTION el 760.8 M.S.L.

* Elevations based on PK nail in Berkshire Valley Road assumed EL 769.00

INSPECTION PERSONNEL:

D. Leary	11/30/78	J. Rizzo	12/6/78	B. Langan	11/12/78
	1/12/78	C. Campbell	12/6/78		
J. Richards	12/12/78	L. Woscyna	12/12/78 (NJDEP)	W. Zink	12/12/78 (Corps. of Eng.)
	11/30/78	L. Lindgrin	12/12/78 (NJDEP)		H. Rubright 12/12/78 (Corps. of Engineers)
P. Yu	12/6/78				

James Richards RECORDER

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Debris algae, plywood sheet & wood in channel.	Downstream channel should be cleaned of all debris.
SLOPES	Vertical mortared stone flume wall has several stones dislodged. 4' I.D. culvert extends under roadway, 5' I.D. culvert extends along roadway. Earth slopes approx. 2 Hor. 1 Vert.	Cavities where stones missing should be repaired. Considerable sedimentation in 5' culvert along roadway, which should be cleaned out.
APPROXIMATE NO. OF HOMES AND POPULATION	One commercial building and swamp area. Over 100 homes 2 miles downstream. Town of Woodstock's population estimated more than 300 people.	Alarm system should be installed.
OUTLET FLUME	Two-ft-high flashboards increase flume discharge height so that no flow occurs. Culvert under road 1/3 full of sedimentation.	Flashboards should be removed from discharge flume.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE	Seepage coming out mortared joints. Seepage quantity ranges from dripping to 10 gpm. Seepage occurring along toe of dam.	Seepage should be repaired.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Appears satisfactory.	
DRAINS	None Observed	
WATER PASSAGES	Closed by gate. Gate leaking 1/4 gpm.	
FOUNDATION		

MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Several areas along top of dam cracked. Some have been previously patched but have cracked again.	In several remortared areas face of wall is bulging or has failed.
STRUCTURAL CRACKING	Cobble surface bulge in stone wall. Joints recently mortared have cracked again. Wall has localized downstream failure of face with seepage.	Repair failed areas. Seepage rates should be monitored.
VERTICAL AND HORIZONTAL ALIGNMENT	Crest concrete badly spalled and chipped. Dam out of plumb and has slight downstream bow.	Crest should be repaired. Dam material and condition should be investigated.
MONOLITH JOINTS	Majority of top of crest cracked.	Concrete should be repaired.
CONSTRUCTION JOINTS	Majority of joints in need of repair. Calcium deposit observed on downstream face of dam.	Leaking cobble joints should be corrected.

DOWNSTREAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM		
ANY NOTICEABLE SEEPAGE	Seepage observed downstream of dam. Ground wet and spongy at toe and beyond face of dam.	Area should be investigated.
STAFF GAGE AND RECORDER	None Observed.	
DRAINS		

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT		
INTAKE STRUCTURE	Concrete spalled on edges of side walls. Side walls cracked in several locations.	Concrete should be repaired.
OUTLET STRUCTURE	Seepage coming out between mortared cobbles. Outlet 48" conduit rusted badly & gate leaking approx. 1/4 gpm.	Repair leaking areas. Outlet gate should be repaired and made operable.
OUTLET CHANNEL	4 ft and 5 ft dia. pipes have sedimentation up to 15 inches deep.	Sedimentation in pipes should be removed.
EMERGENCY GATE	Concrete broken under and around operator base. Gate cannot be operated.	Concrete and gate should be repaired.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARK OR RECOMMENDATIONS
SLOPES	Localized erosion and undermining to 1 Hor. 1 Vert. of some banks observed. Slopes generally vary from 30 Hor. to 1 Vert.	Rapid reservoir drawdown may cause damage to some homes surrounding reservoir.
SEDIMENTATION	Sedimentation estimated to be nigh.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Concrete badly deteriorated, cracked and spalled.	Concrete should be repaired.
APPROACH CHANNEL	Could not observe.	
DISCHARGE CHANNEL	Channel has sedimentation and debris. Approximately 6' x 4' deep rectangular channel. Cavities with side wall from dislodged stones.	Channel should be cleaned and cavities repaired.
BRIDGE AND PIERS		
GATES AND OPERATION EQUIPMENT	4-ft-dia lift gate (DDO 199 model) does not operate.	

APPENDIX 3

PHOTOGRAPHS

SWANNANOVA LAKE DAM 2



Crest of dam and left abutment. Looking North.

30 November 1978



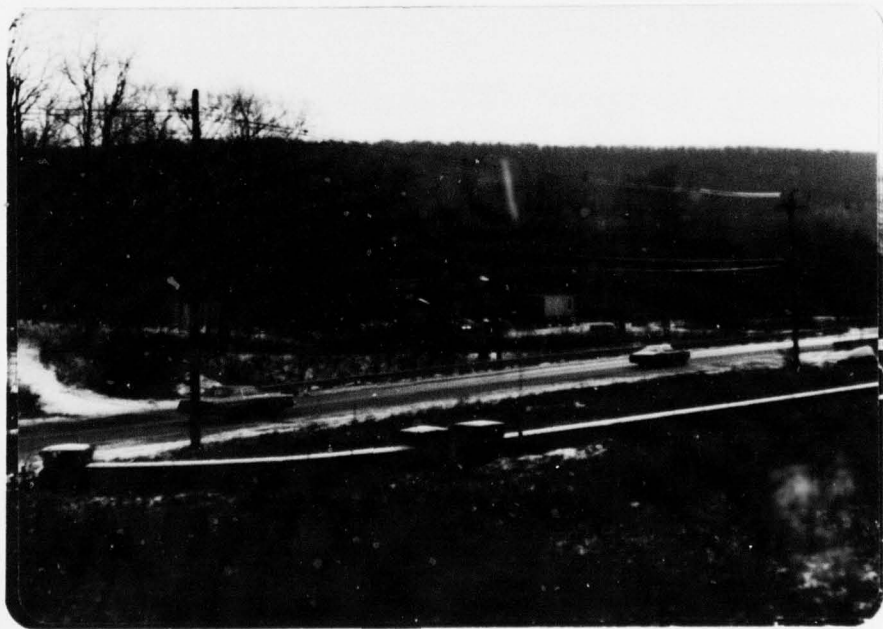
Right abutment. Looking South.

30 November 1978



Downstream face of dam.

30 November 1978



Berkshire Valley Road and
Office Building. Looking downstream.

30 November 1978



Discharge gate structure .

30 November 1978



Abandoned boat house at right side of dam.

30 November 1978



Wooden trash rack at spillway inlet.

30 November 1978



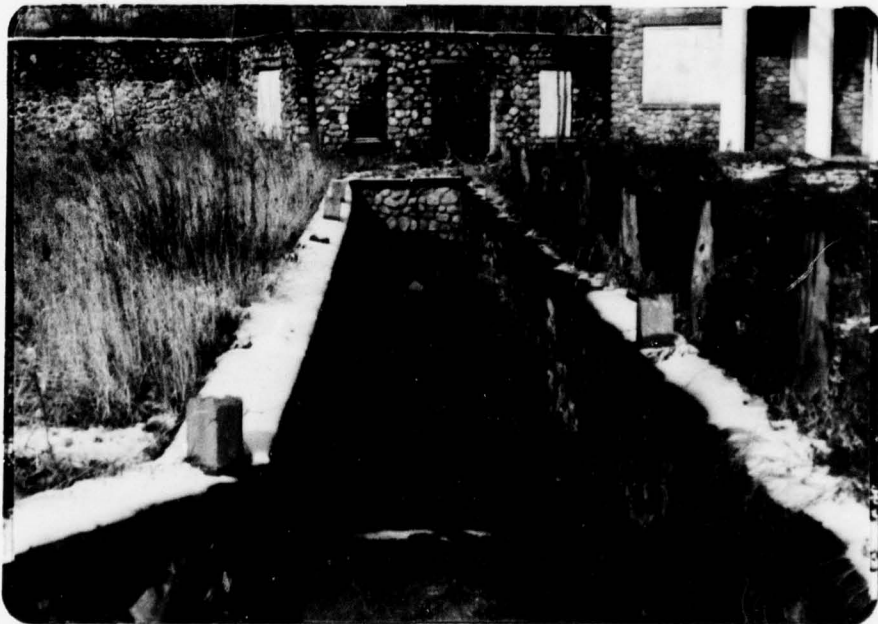
Operator to 4-ft-dia lift gate.

30 November 1978



42-in-dia steel pipe leading
from 8-ft drop inlet spillway.

30 November 1978



Flume leading to 4-ft-dia RCP
under Berkshire Valley Road.

30 November 1978



Clear water flowing from hole in
concrete floor of former pump house.

30 November 1978



Seepage along downstream face of
cobble-faced masonry dam.

30 November 1978



Bulging of lower portion of dam.

30 November 1978



Bulging 5 in. to 10 in. of lower portion
of dam. Looking down.

30 November 1978



Bulge collapse and loss of interior
portion of downstream face of dam.

30 November 1978



Seepage at downstream face
of dam in abandoned
generator house.

30 November 1978



Seepage at base of dam.

30 November 1978



Seepage at base of dam.

30 November 1978

APPENDIX 4

HYDROLOGIC COMPUTATIONS

SWANNANOVA LAKE DAM 2

HYDROLOGICAL COMPUTATIONS
SWANNAHOA LAKE DAMS

A. Location Morris County

B. Drainage Basin 13.9 sq mi
Area of Lake 51 acres

C. Classification
Size - Small
Hazard - High

D. Spillway Design Flood (SDF) PMF
In accordance with evaluate guideline, use PMF

E. PMP -

1. Dam Located in Zone 1
PMP = 22.2 inches

2. PMF must be adjusted for basin size

Duration - hr	% 24 hr (for 14 sq mile)	Reduction Factor *
0-6	108	.805
0-12	120	
0-24	130	
0-48	139	

* P. 48 D.S.D.

F. UNIT HYDROGRAPH

Corp of Engineers has indicated that Snyder Method be used. The follow coefficients are recommended :

$$C_t = 2.0 \quad C_p = 0.55$$

Snyder Lag time :

$$t_p = C_t (L \cdot L_{ca})^{0.3}$$

from drainage area

$$L \doteq 32000 \text{ ft} \doteq 6 \text{ mi}$$

$$L_{ca} \doteq 16000 \text{ ft} \doteq 3 \text{ mi}$$

$$\therefore t_p = 2.0 (6 \times 3)^{0.3}$$

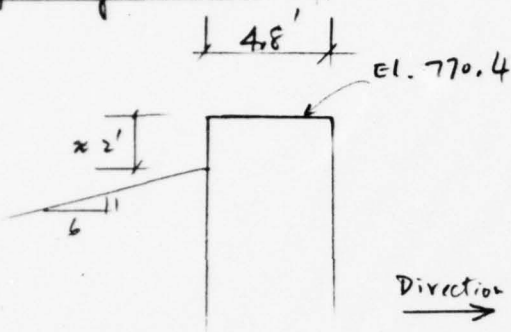
$$= \underline{4.76}$$

$$\underline{C_p = 0.55}$$

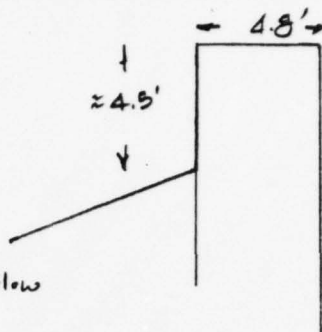


SPILLWAY CAPACITY

Spillway section



Dam Section (Typ)



Shape of weir is similar to broad-crested weir
 $Q = CLH^{3/2}$
 L = length (varies)
 H = head, ft above crest

Take C from Table 5-3 on page 5-46 of
 'Handbook of Hydraulics' by King & Brater

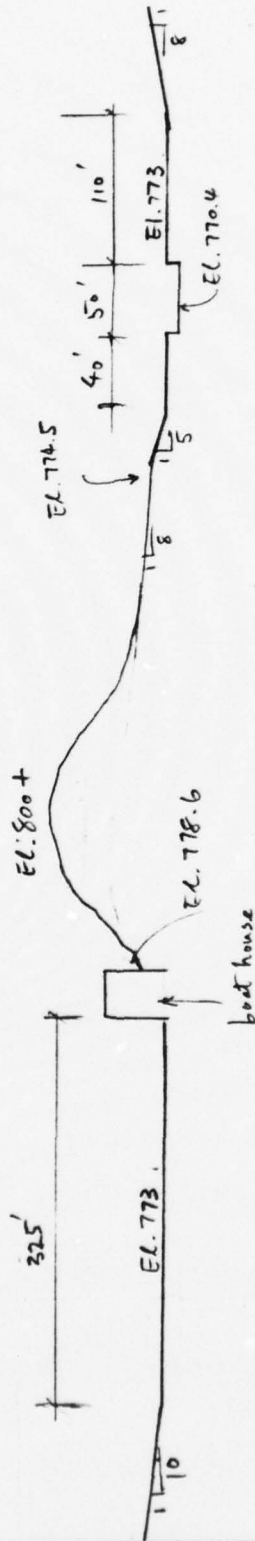
There are two dams in this lake - north dam and south dam, the spillway is located at the south dam. The top of both dams are at about El. 773.0 therefore if the dam ever overtopped, the outflow will consist of those from both dams.

Both dams have a similar section as the spillway.
 ∴ use correspond value of C from the same table

The gate for the sluiceway in the north dam is not operating. Therefore, for the purpose of analysis, no outlet is assumed for the north dam.

See Sheet No 3 for Schematic profile of the two dams

Approx. 700 ft.



NORTH DAM (#2)

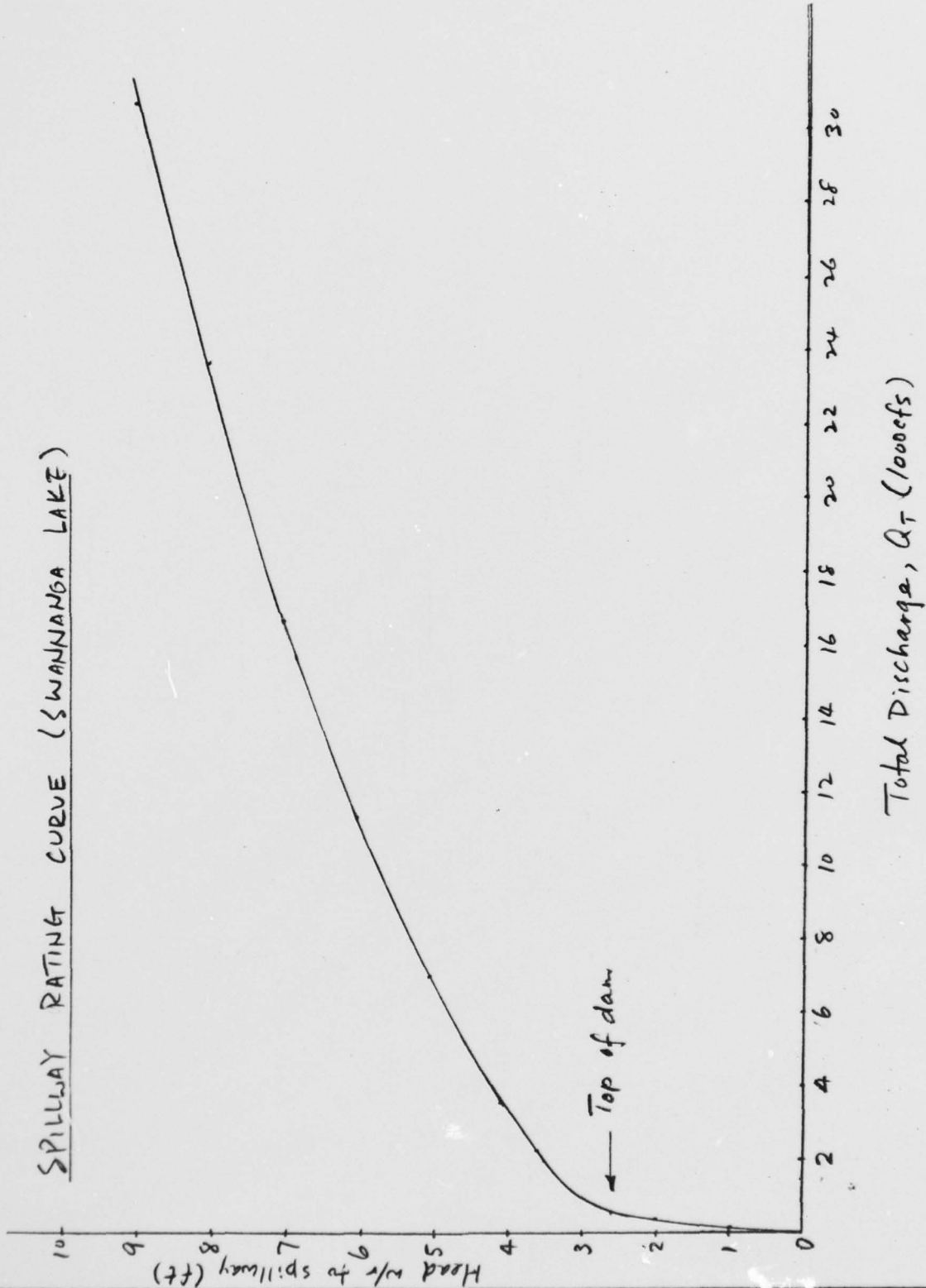
SOUTH DAM (#1)

SWANNANOVA LAKE DAMS
(Direction: Looking downstream)

Elev. (ft)	South Spillway			South Dam			North Dam			Total (cfs) $Q_T = Q_S + Q_{SD} + Q_{ND}$	
	H(ft)	C	L(ft)	H(ft)	C	L(ft)	H(ft)	C	L(ft)		Q_{ND} (cfs)
770.4	0										0
771.4	1	2.68	50								134
772.4	2	2.65	50								375
773.0	2.6	2.67	50	0			0				560
774.0	3.6	2.68	50	1	2.68	157	1	2.68	330	884	2220
774.5	4.1	2.70	50	1.5	2.65	160	1.5	2.65	332	1616	3516
775.5	5.1	2.79	50	2.5	2.67	169	2.5	2.67	337	3557	6948
776.5	6.1	2.88	50	3.5	2.68	176	3.5	2.68	342	6002	11260
777.5	7.1	2.88	50	4.5	2.74	185	4.5	2.74	347	9076	16639
778.5	8.1	2.88	50	5.5	2.88	194	5.5	2.88	352	13076	23603
779.5	9.1	2.88	50	6.5	2.88	203	6.5	2.88	357	17038	30680

← Top of dam

SPILLWAY RATING CURVE (SWANNANGA LAKE)



BY <u>PJ</u>	DATE <u>1-5-79</u>	<u>Spillway Rating Curve</u>	JOB NO. <u>J-7835</u>
CKD <u>TED</u>	DATE <u>1-5-79</u>	<u>Swannanga Lake</u>	SHEET NO. <u>6</u> OF <u>12</u>
	<u>2-13-79</u>		

Reservoir Storage Capacity

Assume a linear distribution for the increase of the area with elevation. Start at a zero storage at the crest of the spillway.

Area of Lake \approx 51 acres

Perimeter of Lake \approx 14,500 ft. (measured from USGS Topo maps)

Ave. side slope of lake (from site inspection) \approx 1 V : 6 H.

\therefore for every foot of water above the crest of spillway, the area of the lake increases by

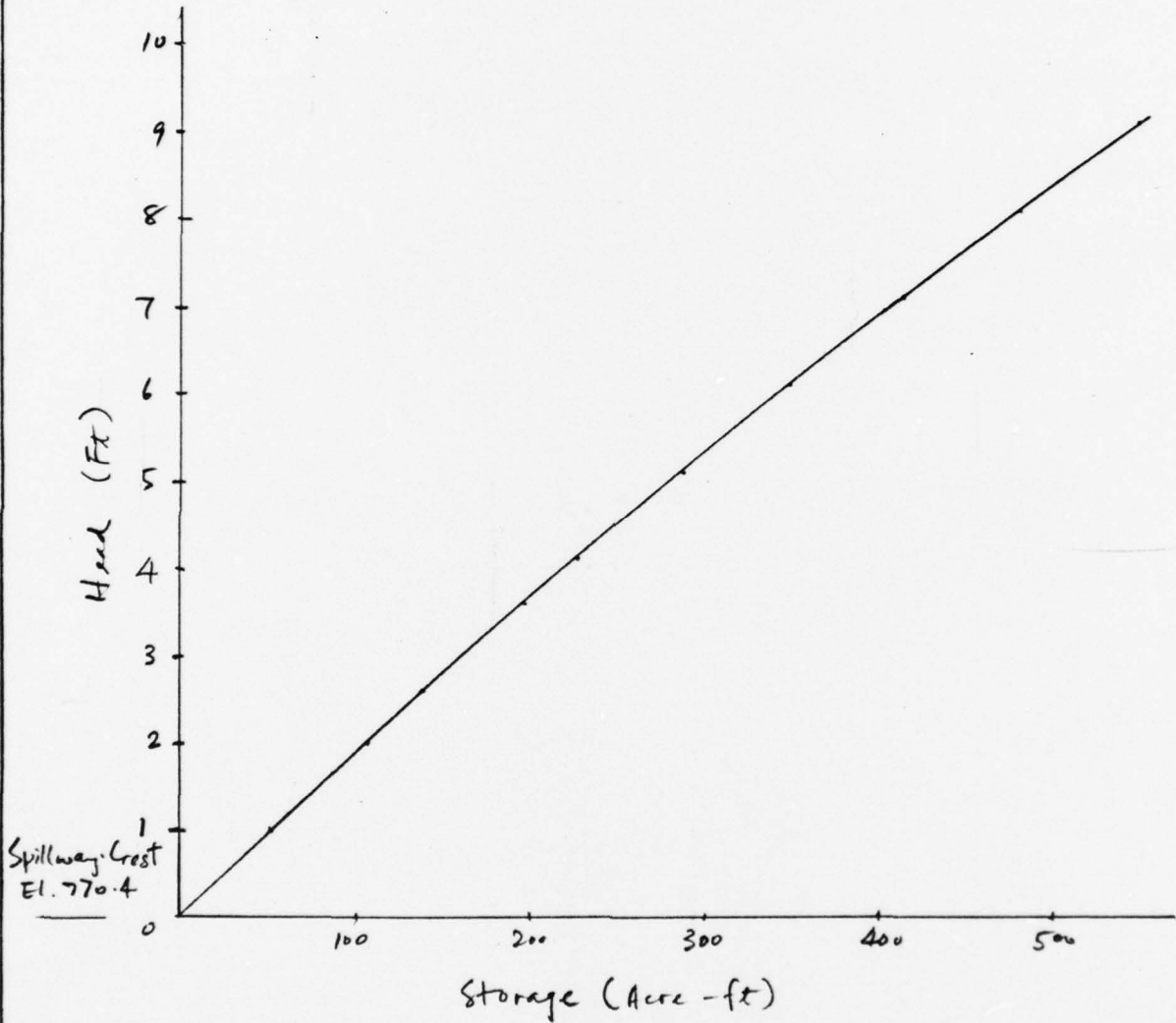
$$\frac{6(14500)}{43560} \approx 2 \text{ acres}^*$$

Elev. (ft)	H (ft)	Increase in Lake area (Ac)	Area of the lake (Acres)	Average Area (Acres)	Increase in Storage (Ac-ft)
770.4	0		51	51	
771.4	1	2	53	52	52
772.4	2	4	55	54	106
773.0	2.6	5.2	56.2	55.6	139
774.0	3.6	7.2	58.2	57.2	196
774.5	4.1	8.2	59.2	58.7	226
775.5	5.1	10.2	61.2	60.2	286
776.5	6.1	12.2	63.2	62.2	348
777.5	7.1	14.2	65.2	64.2	412
778.5	8.1	16.2	67.2	66.2	479
779.5	9.1	18.2	69.2	68.2	547

* Since perimeter of lake at spillway crest is approximate (measured from USGS map to the nearest hundred-foot), \therefore assume perimeter constant with head.

BY Py DATE 12/19/26 Reservoir Storage Capacity JOB NO. J-783 B
 CKD GED DATE 1.4.79 SHEET NO. 7 OF 12
 2.13.79

Storage - Capacity Curve



BY Pyg

DATE 1-5-79

Storage capacity curve

JOB NO. J-783B

CKD GED

DATE 1-5-79

SHEET NO. 8 OF 12

2-13-79

STORAGE - OUTFLOW SUMMARY

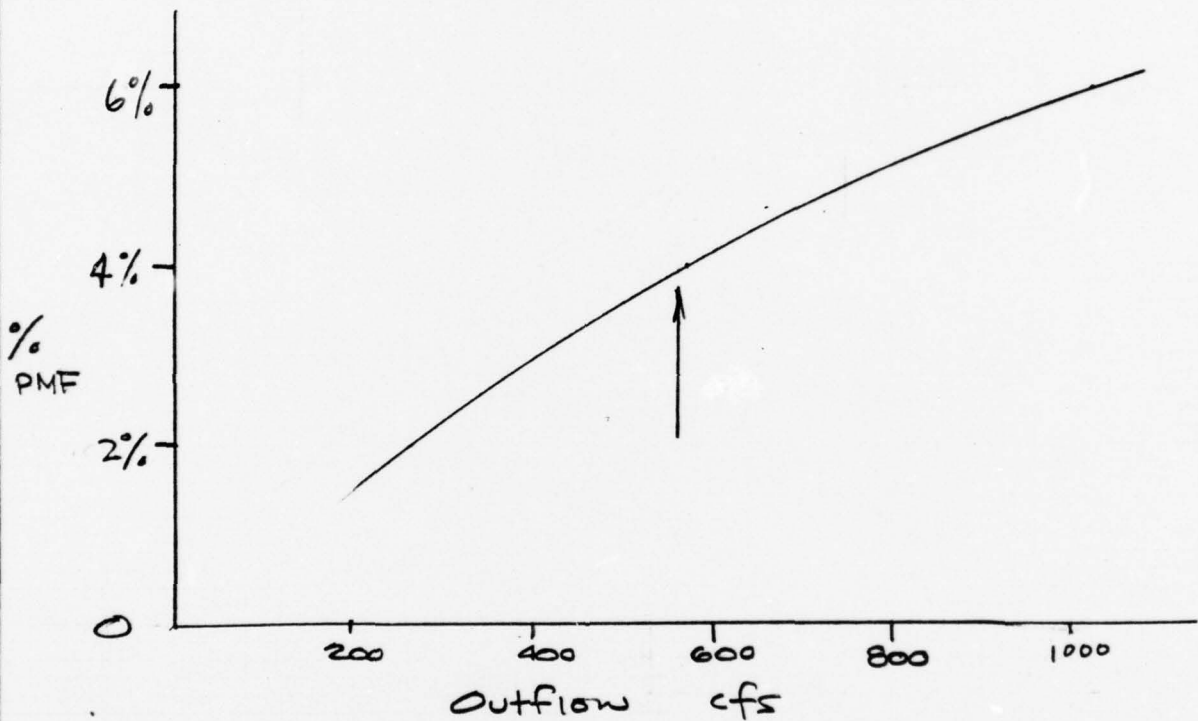
	Elev	Storage ac ft	Outflow cfs
spillway crest →	770.4	0	0
	771.4	52	134
	772.4	106	375
top of dam	773.0	139	560
	774.0	196	2220
	774.5	226	3516
	775.5	286	6948
	776.5	348	11260
	777.5	412	16639
	778.5	479	23603
	779.5	547	30680

SUMMARY OF HYDROGRAPH AND FLOOD ROUTING

1. Hydrograph and routing calculated using HEC-1
2. PMF for Swannanoa Lake is 17,177 cfs
(routed to 17,064 cfs)
3. Routing indicates dam will overtop by approximately 4.5 ft
for PMF

OVERTOPPING POTENTIAL

1. Various % of PMF have been routed using HEC 1
2. Plot peak outflow vs % PMF



3. Dam overtops at approx el 773 with $Q = 560$ cfs
 \therefore dam can pass approx 3.9% the PMF

DRAWDOWN ANALYSIS

1. Outlet Structure

Dam #1 (South) - no outlets work found

Dam #2 (North) - 42" ϕ Steel Pipe with gate (non-operating)

[Note For this analysis assume gate is repaired]

2. Outlet Capacity

a. Invert of pipe = el 762

b. el of lake = 770.4

c. Pipe capacity based on culvert flow (short culvert)
Use BPR Hydraulic Circular #10

Elev	Head	Q cfs
770.4	8.4	120
770.0	8.0	115
768.0	6.0	92
766.0	4.0	62
764.0	2.0	25
762.0	0	

3. Storage Capacity

a. Estimated storage below spillway is 400 ac ft

b. Assume area varies linearly with height and area @ 8.4 ft is 51 ac

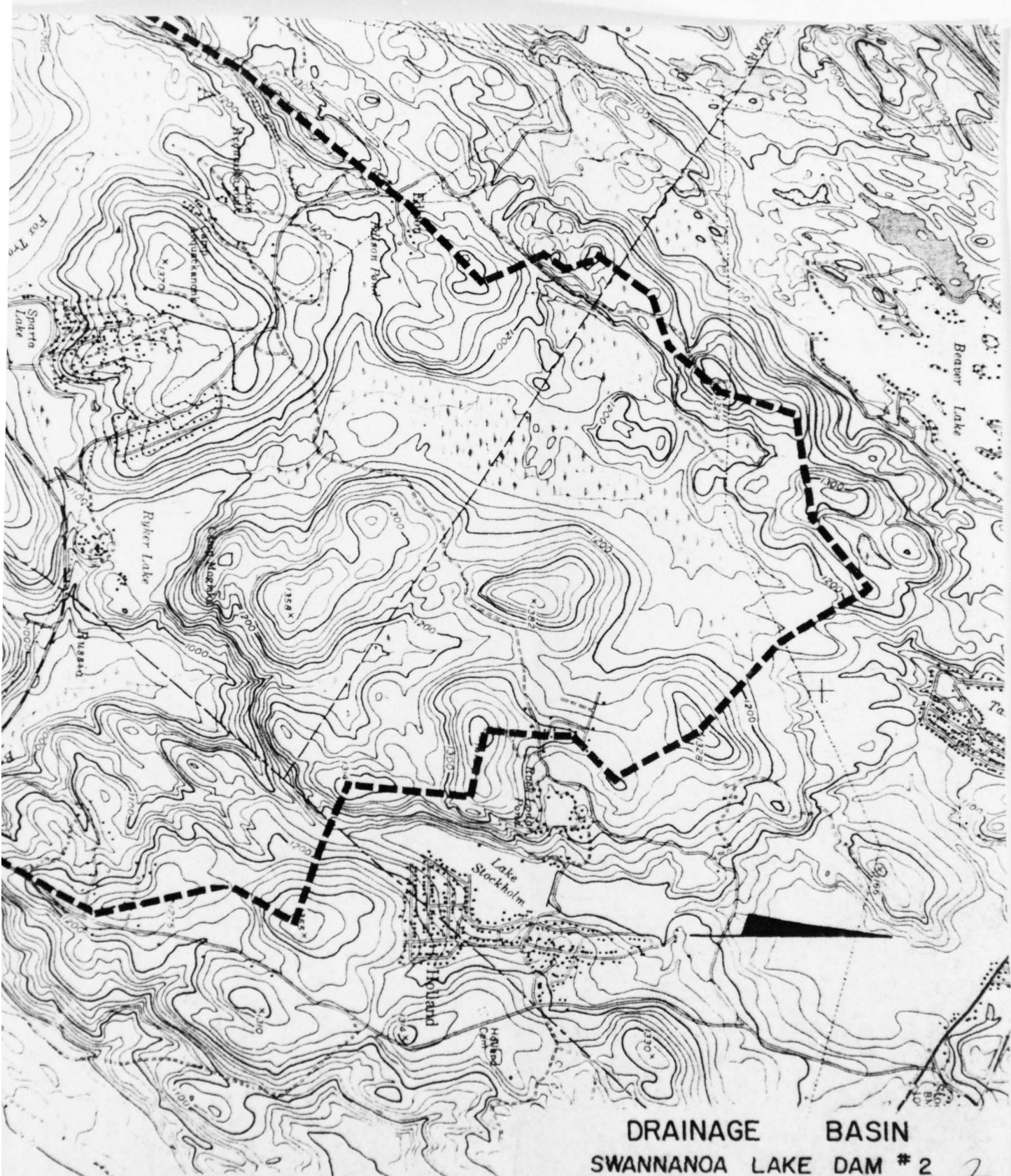
Elevation	Acres	Δ Storage	Total Storage
770.4	51		400 ac ft
770	50.6	20.32	
768	49.0	99.6	
766	47.4	96.4	
764	45.8	93.2	
762	44.2	90.0	0

4. Assume inflow to be 2 cfs/sq mi
 $13.9 \times 2 = 27.8$

Elev	Q _{out}	Q _{avg}	Q _{net}	Storage	Δt hr	Σ Δt hr	days
770.4	120	117.5	90	20.32	2.7		
770.0	115	103.5	76	99.6	15.9	19	
768.0	92	77	49	96.4	23.8	42	
766.0	62	43.5	16	93.2	70.5	113	4.70
764.0	25		**	90.0			
762.0	0						

* Q_{net} = Q_{out avg} - 28

** below elev 764 inflow exceeds outflow



MAP SOURCE: U.S.G.S.
FRANKLIN
SCALE 1" = 2000'

DRAINAGE BASIN
SWANNANOA LAKE DAM # 2

LANGAN ENGINEERING ASSOCIATES, INC.

CONSULTING ENGINEERS
990 CLIFTON AVE @ CLIFTON, N.J. 07013 201-472-9388

HEC-1 OUTPUT

SWANNANOVA LAKE DAM 2

```

***** FLOOD HYDROGRAPH PACKAGE (HEC-1) *****
***** DAM SAFETY VERSION JULY 1978 *****
***** LAST MODIFICATION 25 SEP 78 *****
*****
1 SWANNANOA LAKE DAMS
2 DETERMINE INFLOW HYDROGRAPH AND ROUT
3 N.J. DAM INSPECTION 0 0 0 0 0 0 0
4 100
5 3
6 COMPUTE HYDROGRAPH
7 1
8 1 13.9
9 22.2 108 120 130
10 4.76 0.55 1
11 -2
12 1
13 ROUTING COMPUTATIONS
14 1
15 52 106 139 196
16 0 547
17 0
18 134 375 560 2220 3516 6948 11260 16639 412 479
19 30680
20 59
21 K

```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 1
ROUTE HYDROGRAPH TO 2
END OF NETWORK

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

RUN DATE 73/02/06
 TIME 17.28.25

SWANANOA LAKE DAMS
 DETERMINE INFLOW HYDROGRAPH AND ROUT
 N.J. DAM INSPECTION

NQ NHR NMIN IDAY JOPER NWT LROPT TRACE
 100 1 0 0 3 0 0 0
 IHR IMIN METRC
 0 0 0
 IPRI NSTAN
 0 0

JOB SPECIFICATION
 IPLT
 0

***** SUB-AREA RUNOFF COMPUTATION *****

COMPUTE HYDROGRAPH

ISTAQ ICOMP IFCON ITAPE JPLT JPRI INAME ISTAGE IAUTO
 1 0 0 0 0 10 0 0 0
 IHYDG IUHG IAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
 1 1 13.90 0.00 .81 0.000 0 0 0
 PRECIP DATA
 R12 R24 R48
 120.00 130.00 135.00
 LOSS DATA
 STRKS RTIOK CNSTL ALSMX RTIMP
 0.00 0.00 1.00 0.00 0.00 0.00
 UNIT HYDROGRAPH DATA
 NTA= 0
 TP= 4.76 CP= .55

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 5.25 AND RE= 5.55 INTERVALS
 STRIG= -2.00 GRCSM= 0.00 RTIOR= 1.00
 RECUSSION DATA
 87. 319. 281. 46. 8.
 403. 337. 281. 46. 8.
 66. 55. 9.
 11. 59. 9.

UNIT HYDROGRAPH 33 END-OF-PERIOD ORDINATES, LAGE= 4.79 HOURS, CP= .55 VOLE 1.00
 87. 319. 281. 46. 8.
 403. 337. 281. 46. 8.
 66. 55. 9.
 11. 59. 9.

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	END-OF-PERIOD FLOW	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
0														
1.01	1.00	1	.01	0.00	.01	28.	1.03	1.03	3.00	51	0.00	0.00	0.00	6334.
1.01	2.00	2	.01	0.00	.01	28.	1.03	4.00	52	0.00	0.00	0.00	0.00	5304.
1.01	3.00	3	.01	0.00	.01	28.	1.03	5.00	53	0.00	0.00	0.00	0.00	4435.

STORAGE 547.00
 OUTFLOW 37680.00
 STORAGE 52.00
 OUTFLOW 134.00
 IECON 0
 IRES 1
 LAG 0
 139.00
 560.00
 ICOMP 1
 AVG 0.70
 NSTDL 0
 106.00
 375.00
 ISTAQ 2
 CLOSS 0.00
 NSTPS 1
 52.00
 134.00
 JPLT 0
 IOPT 0
 X 0.00
 196.00
 2220.00
 JPRI 0
 IPMP 0
 ISK 0.00
 226.00
 3516.00
 INAME 1
 LSTR 0
 STORA 0.00
 286.00
 6948.00
 IAU0 0
 348.00
 11260.00
 16639.00
 23603.00
 479.00

MO.DA	HR.MN	PERIOD	EOP STOR	AVG IN	EOP IN	EOP OUT	STAGE	AVG PUMP
1101	00	1	2	288	88	5	0	0
1101	00	2	4	288	288	13	0	0
1101	00	3	5	288	288	16	0	0
1101	00	4	6	288	288	18	0	0
1101	00	5	7	288	288	22	0	0
1101	00	6	8	288	288	23	0	0
1101	00	7	8	288	288	25	0	0
1101	00	8	9	288	288	25	0	0
1101	00	9	10	288	288	25	0	0
1101	00	10	10	288	288	25	0	0
1101	00	11	10	288	288	25	0	0
1101	00	12	10	288	288	25	0	0
1101	00	13	11	288	288	25	0	0
1101	00	14	11	288	288	25	0	0
1101	00	15	11	288	288	25	0	0
1101	00	16	11	288	288	25	0	0
1101	00	17	11	288	288	25	0	0
1101	00	18	11	288	288	25	0	0
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1101	00	20	11	288	288	25	0	0
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1101	00	22	11	288	288	25	0	0
1101	00	23	11	288	288	25	0	0
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1101	00	92	11	288	288	25	0	0
1101	00	93	11	288	288	25	0	0
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1101	00	95	11	288	288	25	0	0
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1101	00	97	11	288	288	25	0	0
1101	00	98	11	288	288	25	0	0
1101	00	99	11	288	288	25	0	0
1101	00	100	11	288	288	25	0	0

RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PFR SECOND)
 AREA IN SQUARE MILES(SQUARE KILOMETERS)

HYDROGRAPH AT	PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
1	17177	18338	7049	2507	13.90
(486.41)	420.15)	200.47)	70.99)	36.00)
ROUTED TO	17064	14863	7075	2507	13.90
2	483.20)	420.68)	200.33)	70.98)	36.00)

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

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

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS
RUNOFF HYDROGRAPH AT
ROUTE HYDROGRAPH TO
END OF NETWORK

1

2

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

RUN DATE# 75/02/06
TIME# 18.16.50

SWARNANDA LAKE DAMS
1 PMF
N.J. DAM INSPECTION

NO NHR NMIN IDAY JOPER NWT LROPT TRACE IPLI IPRT NSTAN
100 1 0 0 5 0 0 0 0 4 0

JOB SPECIFICATION
IHR IMIN METRC
0 0 0
NWT LROPT TRACE
0 0 0

RTIOS= 1.00 .50
MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRATIO= 6 LRTIO= 1
.10 .06 .04 .02

***** SUB-AREA RUNOFF COMPUTATION *****

COMPUTE HYDROGRAPH

ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUTO
1 0 0 0 0 0 10 0 0

IHYDG IUNG IAREA SNAP TRSDA TRSPC RATIO ISHOW ISAME LOCAL
1 1 13.90 0.00 13.90 .81 0.000 0 0 0

SPFE 0.00 PMS 22.20 R6 108.00 R12 120.00 R24 130.00 R48 135.00 R72 0.00 R96 0.00

LROPT STRKR DLTKR RILOL ERAIN STRKS RIIOK STRIL CNSIL ALSMX RTIMP
0 0.00 0.00 1.00 0.00 0.00 1.00 1.00 .15 0.00 0.00

UNIT HYDROGRAPH DATA
TP= 4.76 CP= .55 NTA= 0

RECESSION DATA
STRTO= -2.00 ORCSM= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 33 END-OF-PERIOD ORDNATES, LAGE 4.79 HOURS, CP= .55 VOLE= 1.00
87. 319. 62.6 1031. 982. 830. 693. 579. 483.
463. 337. 281. 197. 163. 136. 114. 95. 79.
66. 55. 46. 32. 27. 22. 19. 16. 13.
11. 9. 8.

MO.DA HR.MN PERIOD RAIN EXCS LOSS MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP 0

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

OPERATION	STATION	AREA	PLAN	RATIO	RATIOS APPLIED TO FLOWS					
					RATIO	RATIO	RATIO	RATIO	RATIO	RATIO
				1.00	.50	.10	.06	.04	.02	
HYDROGRAPH AT	1	13.90 (36.00)	1	17177. (486.41)	8589. (243.20)	1718. (48.64)	1031. (29.18)	687. (19.46)	344. (9.73)	
ROUTED TO	2	13.90 (36.00)	1	17064. (483.20)	8527. (241.46)	1698. (48.09)	1024. (29.00)	570. (16.13)	263. (7.46)	

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

APPENDIX 5

REFERENCES

SWANNANOVA LAKE DAM 2

APPENDIX 5

REFERENCES

SWANNANOA LAKE DAM # 2

1. Letter to Mr. Sherrard, Chief Engineer, State Water Supply Comm. from E.R. Headley & Sons. 6 July 1914.
2. Letter to Mr. S. Aziz, N.J.D.E.P. from Ringling Manor Inc., 2 September 1972.
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MAP SOURCE: U.S.G.S.
FRANKLIN
SCALE 1" = 2000'

LANGAN ENGINEERING ASSOCIATES, INC.

CONSULTING ENGINEERS
990 CLIFTON AVE CLIFTON, N.J. 07013 201-472-9366

APPENDIX 6
LETTER TO N.J. DEP FROM
U.S. ARMY CORPS OF ENGINEERS
SWANNANOA LAKE #2

MAILGRAM SERVICE CENTER
MIDDLETOWN, VA. 22645

western union Mailgram®



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MR. JOHN O'DOWD, P.E., CHIEF
BUR. FLOOD PLAIN MGT,
NJ DEPT OF ENV PROT.
P.O. BOX 2309
TRENTON, NJ 08625

*Letter to this effect already
sent to the owner of the Dam.*

*NZA
12/22/78*

JG.

INSPECTION OF SWANNANOA LAKE DAM NO. 2 (U.S. NO. 00310), LOCATED ABOUT FOUR MILES NORTH OF WOODSTOCK, MORRIS COUNTY, NEW JERSEY, REVEALED THE DAM TO BE IN AN UNSAFE, NON-EMERGENCY CONDITION. THIS CONDITION, RECENT COLLAPSE OF PORTION OF DOWNSTREAM FACE OF DAM, IF LEFT UNCORRECTED, COULD RESULT IN FAILURE OF THE DAM WITH SUBSEQUENT POSSIBLE LOSS OF LIFE AND PROPERTY DAMAGE. UNTIL FURTHER STUDY CAN DETERMINE FULL EXTENT OF THE PROBLEM AND POSSIBLE PERMANENT REMEDIAL ACTIONS, THE FOLLOWING TEMPORARY MEASURES, AS A MINIMUM, ARE RECOMMENDED TO PRECLUDE SERIOUS PROPERTY DAMAGE AND POSSIBLE LOSS OF LIFE:

A. DRAWDOWN LAKE THREE FEET WITHIN NEXT THIRTY DAYS BE PREFERABLY OPENING FOUR FOOT DIA. VALVE IN DAM NO. 2. IF VALVE CANNOT BE OPENED, THEN A SUITABLE SIZED NOTCH SHOULD BE MADE IN THE SPILLWAY OF DAM NO. 1 TO EFFECT THE SPECIFIED DRAWDOWN.

B. REBUILD COLLAPSED SECTION OF COBBLED FACING WALL, ALLOWING FOR NUMEROUS SMALL WEEP HOLES IN THE MORTARED JOINTS.

C. UTILIZE A PROFESSIONAL CONSULTANT, QUALIFIED IN THE DAM INSPECTION PROGRAM, TO INSPECT THE DAM WEEKLY AND FURNISH THE STATE A WRITTEN REPORT OF THE INSPECTION.

D. LOCAL AUTHORITIES SHOULD PREPARE AN EMERGENCY WARNING AND EVACUATION PLAN, IMMEDIATELY, IN EVENT THE CONDITION WORSENS. A LETTER IS BEING SENT TO GOVERNOR BYRNE FULLY EXPLAINING THE SITUATION. AS REQUESTED, THIS TELEGRAM IS SENT SO YOU MAY EXPEDITE ACTION.

BT

JAMES G. TON, COLONEL, CORPS OF ENGINEERS, DISTRICT ENGINEER,
ARMY CORPS OF ENGINEERS, 2ND & CHESTNUT STREETS, PHILA., PA. 19106

150 EST

MGMCOMP MGM

VERIFIED BY STATE
REGISTRATION DIVISION