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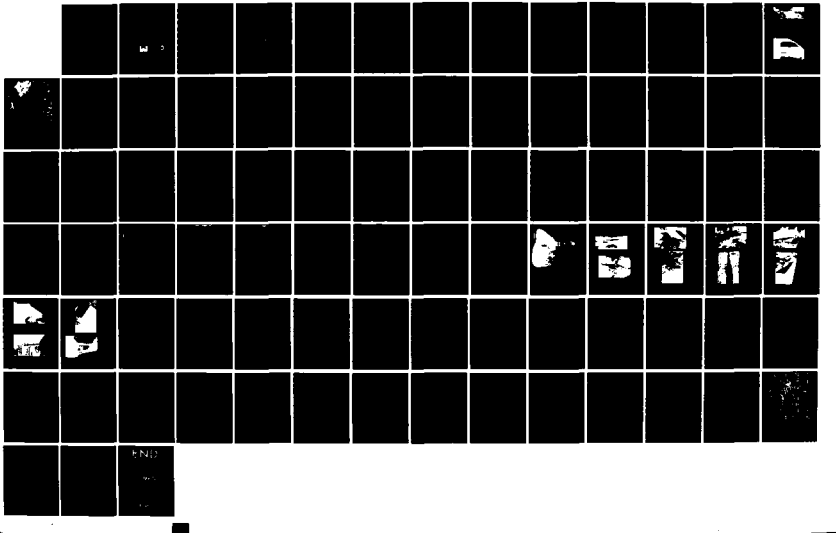

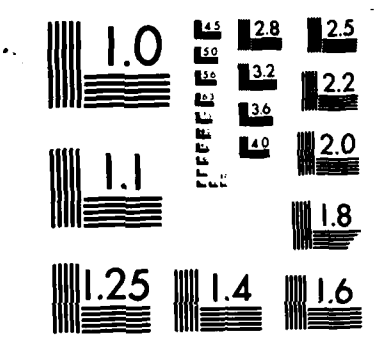

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MERRIMACK RIVER BASIN

JAFFREY, NEW HAMPSHIRE

MOUNTAIN BROOK DAM

NH 00099

NHWRB 124.17

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS. 02154

DECEMBER 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Jaffrey, New Hampshire
Contoocook River

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

The dam is an earth embankment, about 265 ft. long and 18.3 ft. high. The drainage area of the dam covers 14 square miles of mountainous woodland with some meadow and wetland area. It is intermediate in size with a significant hazard potential. The test flood for this dam is ½ of the PMF. The dam is in good condition at the present time. No conditions were observed which warrent further investigation.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED

FEB 4 1980

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Mountain Brook Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Van Wyck Realty, Boston, Massachusetts.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

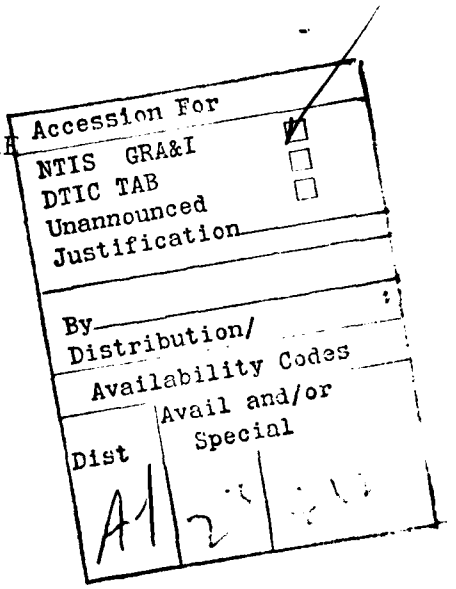
Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

MOUNTAIN BROOK DAM
NH 00099

MERRIMACK RIVER BASIN
CHESHIRE COUNTY, NEW HAMPSHIRE



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT

Idenfification No.:	NH 00099
NHWRB No.:	124.17
Name of Dam:	MOUNTAIN BROOK DAM
Town:	Jaffrey
County and State:	Cheshire County, New Hampshire
Stream:	Mountain Brook, tributary of the Contoocook River
Date of Inspection:	August 22, 1979

BRIEF ASSESSMENT

The Mountain Brook Dam is located on Mountain Brook where it passes under U.S. Route 202, approximately 1 mile upstream of Jaffrey, New Hampshire. The dam is an earth embankment, approximately 265 feet long and 18.3 feet high, with a 30.1 foot wide concrete overflow spillway. There is a 4.5 foot by 5 foot sluice gate which, if operable, could be used to regulate the reservoir.

The dam was originally constructed for storage for downstream mills but, at present, it serves only recreational purposes. The dam is owned by Mr. Peter Van Wyck of Boston, Massachusetts, but, the Town of Jaffrey, New Hampshire is presently considering purchase of the dam.

The drainage area of the dam covers 14 square miles of mountainous woodland with some meadow and wetland area. The dam normally impounds 200 acre-feet and has a maximum impoundment of 2,460 acre-feet. The dam is INTERMEDIATE in size and its hazard classification is SIGNIFICANT because of appreciable economic loss which may occur downstream in the event of a dam failure. Dam failure would likely cause 1 to 1.5 foot flooding of 3 or 4 commercial buidlings and 3 or 4 homes in Jaffrey. Also, U.S. Route 202 bridge would be seriously damaged.

The test flood for this dam is one-half of the Probable Maximum Flood (PMF). The test flood peak inflow would be 10,500 cfs and the routed test flood peak outflow would be 6,350 cfs. The routed test flood peak outflow would overtop the dam by 2.1 feet. Spillway capacity at top of dam (2,950 cfs) is only 46 percent of the routed test flood peak outflow.

The dam is in GOOD condition at the present time. No conditions were observed which warrant further investigation. Remedial measures to be undertaken by the owner include: dredge the reservoir behind sluice gate, rehabilitate the sluice gate and bench stand, install safety railing, remove trees and roots and backfill the resulting voids, remove flash boards and pins, repair spalled and cracked concrete on end walls, implement biennial inspections and annual maintenance programs, and develop a formal written downstream emergency warning system.

The remedial measures outlined above should be implemented by the owner within two years of receipt of this report by the owner.

William S. Zoino
N.H. Registration 3226

Nicholas A. Campagna. Jr.
California Registration 21006

This Phase I Inspection Report on Mountain Brook Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH A. MCELROY, CHAIRMAN
Chief, NED Materials Testing Lab.
Foundations & Materials Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

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 continued care and inspection can unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the 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 aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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Overview from left upstream side

Overview from downstream looking under the stone arch bridge

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Operational Procedures

No written operation procedures exist for this dam. It is normally self regulating.

4.2 Maintenance of Dam

No maintenance program exists for this dam.

4.3 Maintenance of Operating Facilities

No maintenance program exists for this dam.

4.4 Description of Warning System

There is no warning system if effect.

4.5 Evaluation

The present maintenance and operating policy is not satisfactory for continued long-term use of the dam. A formal written warning system is recommended because of the possibility of damage to downstream structures in the event of a dam failure.

(d) Reservoir Area (Photo No. 1)

The shore of the reservoir is generally shallow sloping woodland. It appears stable and in good condition.

(e) Downstream Channel (Photo No. 12)

After passing under the stone arch bridge, the downstream channel is a wide stream through a flood plain to the Contoocook River.

3.2 Evaluation

The dam and its appurtenances are in good condition at the present time. The potential problems observed during the visual inspection are listed below:

a) Trees and brush growing on embankment slopes.

b) Erosion gullies in upstream slopes.

c) Silting behind spillway.

d) No safety rail on walkway.

(c) Appurtenant Structures

1) End Walls (Photos No. 8, 9, and 11)

In general the concrete end walls are in good condition, however, they have been subjected to cracking and minor spalling. Efflorescence, is extremely minor. There is a construction joint in the left end wall between the spandrel wall of the bridge and the spillway. It is approximately 6 inches above the crest and it has opened over its full length to approximately 3/8 inch wide and 1/4 inch deep. A portion of this joint has spalled over an area 12 inches long, 2 inches high, and 1 inch deep. There is a series of transverse cracks located on the level and sloping sections of this wall. This is the result of differential temperatures.

Minor surface spalling, hairline cracking, and honeycombing have occurred on both walls. A construction joint has opened in the right wall which is similar to that in the left except that it extends into the sloping section of the wall.

2) Core Walls (Photos No. 5 and 6)

The tops of the core walls are in good condition with the exception of minor surface spalling.

3) Walkway (Photos No. 5 and 7)

The prestressed concrete walkway is in good condition with the exception of minor surface spalling and minor rusting of the anchorage system. There is no safety rail on this structure.

4) Gate Bench Stand (Photo No. 7)

The gate bench stand shows some surface rusting and has not been greased in the recent past. The pipe stem has also rusted.

5) Stone Arch Bridge

The springline of the bridge shows erosion from ice damage. Chinking stones and mortar have eroded out of the joints of this structure.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

(a) General

The Mountain Brook Dam is in GOOD condition at the present time.

(b) Dam

1) Embankment (Photos No. 2,3,4, and 5)

The upstream slopes of the earth embankment are very irregular with no riprap. The left embankment has approximately 6 trees up to 8" in diameter growing on the right upstream slope. Both slopes show heavy brush, erosion gullies, and dumping of debris and road dirt.

There is no evidence of bulges, sags, potholes, or seepage. The crest and downstream slopes appear stable and in good condition.

2) Spillway (Photos No. 9 and 10)

The concrete spillway is in good condition with the exception of minor surface erosion on its downstream face and localized spalling at the interface of the crest and the downstream face midway along the crest. This erosion and spalling is attributed to ice damage.

The 8-foot length of partially destroyed flashboards at the left end of the spillway accumulate considerable debris behind them. This debris consists primarily of small tree trunks and branches.

The downstream end of the sluiceway openings are in good condition, however, the openings themselves were not accessible for inspection. There appears to be considerable silting on the upstream side.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

None of the original design drawings or calculations are available for this dam. Significantly lacking are data concerning the length and depth of the concrete core wall, the character of the earth embankment, and the foundation conditions.

2.2 Construction Data

No construction records are available for this dam.

2.3 Operational Records

There are no operational records available for this dam.

2.4 Evaluation of Data

(a) Availability

The absence of design drawings and calcualtions is a significant shortcoming. An overall unsatisfactory assessment for availability is therefore warranted.

(b) Adequacy

The lack of in-depth engineering data does not permit a definitive review. Therefore, the adequacy of the dam cannot be assessed from the standpoint of reviewing design and construction data. This assessment of the dam is thus based primarily on the visual inspection, past performance, and sound engineering judgment.

(c) Validity

The observations of the inspection team have contradicted some of the information contained in the available data. Therefore only a fair evaluation for validity is assigned.

7) Impervious core: 12 inch thick concrete core wall to unknown depth

8) Cutoff: Unknown

9) Grout curtain: Unknown

(h) Diversion and Regulating Tunnel

Not Applicable

(i) Spillway

1) Type: Gravity, concrete, overflow sharp crested weir

2) Length of weir: 30.1 feet

3) Crest elevation: 1,010.4± feet (see section 1.3-C)

4) Gates: None

5) Upstream channel: Reservoir

6) Downstream channel: Stone arch bridge

(j) Regulating Outlet

The regulating outlet is a 4.5 foot by 5 foot sluice gate controlled by a wheel operated bench stand. The gate invert is at elevation 1,001.7± feet. It is normally closed.

(d) Reservoir

1) Length of maximum pool: No data

2) Length of normal pool: No data

3) Length of flood control pool: No data

(e) Storage (acre-feet)

1) Recreation pool: 300

2) Flood control pool: Not applicable

3) Spillway crest pool: 300

4) Top of dam: 2,460

5) Test flood pool: 3,100 (dam overtopped)

(f) Reservoir Surface (acres)

1) Recreation pool: 110

2) Flood control pool: Not applicable

3) Spillway crest pool: 110

4) Test Flood: 300+ (dam overtopped)

5) Top of dam: 300+

(g) Dam

1) Type: earth embankment

2) Length: 265 feet

3) Height: 18.3 feet

4) Top width: 50 feet

5) Side slopes: Upstream: 2± to 1
Downstream: Variable

6) Zoning: Unknown

6) Gated Spillway Capacity at Test Flood

Not applicable.

7) Total Spillway Capacity at Test Flood

The total spillway capacity at test flood elevation 1,022.1 is 3,980 cfs.

8) Project Discharge at Test Flood

The total project discharge at test flood elevation (1,022.1± feet) is 6,350 cfs.

(c) Elevation

The elevation of the top of the dam (1.020± feet) has been assumed based on the U.S.G.S. topographic data and available records. Other elevations are based on field measurements from the top of dam. The elevations are given in approximate feet above mean sea level.

1) Streambed at centerline of dam: 1,001.7

2) Maximum tailwater: Unknown

3) Upstream portal invert diversion tunnel: Not Applicable

4) Recreation Pool: 1,010.4±

5) Full flood control pool: Not Applicable

6) Spillway crest: 1,010.4±

7) Design surcharge: Unknown

8) Top dam: 1,020±

9) Test flood design surcharge: 1,022.1±

(h) Design and Construction History

The dam was constructed in 1948 as a storage dam for downstream mills. According to available records, it was designed by a Mr. James Young, a consulting engineer from Winchendon, Massachusetts.

(i) Normal Operating Procedure

The dam is normally self regulating.

1.3 Pertinent Data

(a) Drainage Area

The drainage area for this dam covers 14 square miles of mountainous woodland with some meadow and wetland areas.

(b) Discharge at Damsite

1) Outlet Works

Normal discharge at the site is over the 30.1 foot concrete spillway at elevation 1,010.4+ feet. (See section 1.3-C concerning elevations). A 4.5 feet by 5 feet sluice gate is located at the left end of the spillway. The invert elevation of this gate is 1.001.7+ feet.

2) Maximum Known Flood

There is no data available for the maximum known flood at this damsite.

3) Ungated Spillway Capacity at Top of Dam

The capacity of the spillway with the reservoir at top of dam elevation (1,020+ feet) is 2,950 cfs.

4) Ungated Spillway Capacity at Test Flood

The ungated spillway capacity at test flood elevation 1,022.1 is 3,980 cfs.

5) Gated Spillway Capacity at Normal Pool

Not applicable.

6) Stone Arch Bridge

This structure has a clear span of 29 feet. The spring lines are approximately 4 feet above the stream bed and the arch has a rise of 8.5 feet. The bridge is approximately 15 feet downstream of the spillway.

(c) Size Classification

The dam's maximum impoundment of 2,460 acre-feet and height of 18.3 feet place it in the INTERMEDIATE size catagory based on maximum impoundment.

(d) Hazard Potential Classification

The hazard potential classification for this dam is SIGNIFICANT because of the appreciable economic losses which may occur in the event of a dam failure. Failure would likely cause 1 to 1.5 feet of flooding in 3 to 4 commercial buildings and 3 to 4 homes in Jaffrey. Also, the U.S. Route 202 highway bridge would be seriously damaged. Section 5 of this report presents a more detailed discussion of the hazard potential.

(e) Ownership

The dam is presently owned by Mr. Peter Van Wyck of Van Wyck Realty at 20 Gloucester Street, Boston, Massachusetts 02115. However, the Town of Jaffrey is considering the purchase of the dam.

(f) Operator

The operation of the dam is controlled by the owner, Mr. Peter Van Wyck, who can be reached by telephone at (617) 262-0873.

(g) Purpose of the Dam

This reservoir serves only recreational purposes at the present time. It was originally constructed to provide supplementary flow to downstream mills during periods of dry weather.

2) Spillway

The concrete spillway crest is approximately 3 feet wide at its top surface and has a clear span of 30.1 feet. The downstream face slopes at approximately 2 horizontal to 1 vertical.

Flashboard stanchion sockets approximately 3 inches in diameter are located at approximately 2 feet on centers over the entire length of the crest. Remnants of wooden flashboards and metal stanchions are located for an approximate distance of 8 feet adjacent to the left end wall (Photo 10). A gated sluiceway opening approximately 5 feet wide and 4.5 feet high is located adjacent to the left end wall. The top of the opening is 14 feet below the top of the left end wall. A similar opening is located adjacent to the right end wall and has been permanently sealed with concrete.

3) End Walls

Both concrete end walls are 2 feet wide on their top surface and have a back batter of approximately 3 in 12. Their front faces are plumb. Both are level from the bridge spandrel walls to the upstream end of the spillway crest and then slope downwards into the impoundment pool at 1½ horizontal to 1 vertical.

4) Walkway

The walkway consists of a double Tee concrete section 8 feet wide and 24 inches deep with a 4 inch flange and is 34.1 feet long. This walkway is supported on the end walls. The concrete webs are anchored by means of 2-12 x 12 inch steel bent plates 18 inches long which are anchored into the end walls and through-bolted in the webs.

5) Sluice Gate

The bench stand on the walkway operates a rising stem confined within a protective pipe. The sluice gate has been estimated to be approximately 5.5 feet wide and 5.0 feet high. The type of gate construction is unknown.

1.2 Description of Project

(a) Location

The Mountain Brook Dam is located on Mountain Brook approximately 1 mile upstream of the Town of Jaffrey, New Hampshire. It can be reached from U.S. Route 202 which passes over the crest of the embankment. The dam is shown on U.S.G.S. Monadnock, New Hampshire Quadrangle with coordinates approximately at N42° 48.2', W72° 1.8' (see location map on page v). Page B-2 of Appendix B is a site plan for this dam.

(b) Description of Dam and Appurtances

The dam consists of an earth embankment with a concrete gravity spillway. U.S. Route 202 passes along the crest of the embankment with a stone arch bridge carrying it over the outlet channel of the spillway. The total length of the dam is approximatley 265 feet including the spillway. It is approximately 18.3 feet high.

1) Embankment

To the left of the spillway the embankment extends approximately 125 feet to the abutment. There is a concrete core wall extending from the spillway structure toward the left abutment for approximately 63 feet.

To the right of the spillway the embankment extends approximately 110 feet to the abutment. There is a concrete core wall extending the full length of this section of the embankment.

The core walls are approximately 12 inches thick and the tops of these walls are exposed at the crest of the embankment.

The upstream slope is approximately 2 horizontal to 1 vertical. The crest is approximately 50 feet wide including the U.S. Route 202 highway. The downstream slope is variable.

PHASE I INSPECTION REPORT

MOUNTAIN BROOK DAM

SECTION 1

PROJECT INFORMATION

1.1 General

(a) Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervision the inspection of dams within the New England Region. Goldberg, Zoino, Dunnicliff & Associates, Inc. (GZD) has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to GZD under a letter of August 28, 1979 from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW 33-79-C-0058 has been assigned by the Corps of Engineers for this work.

(b) Purpose

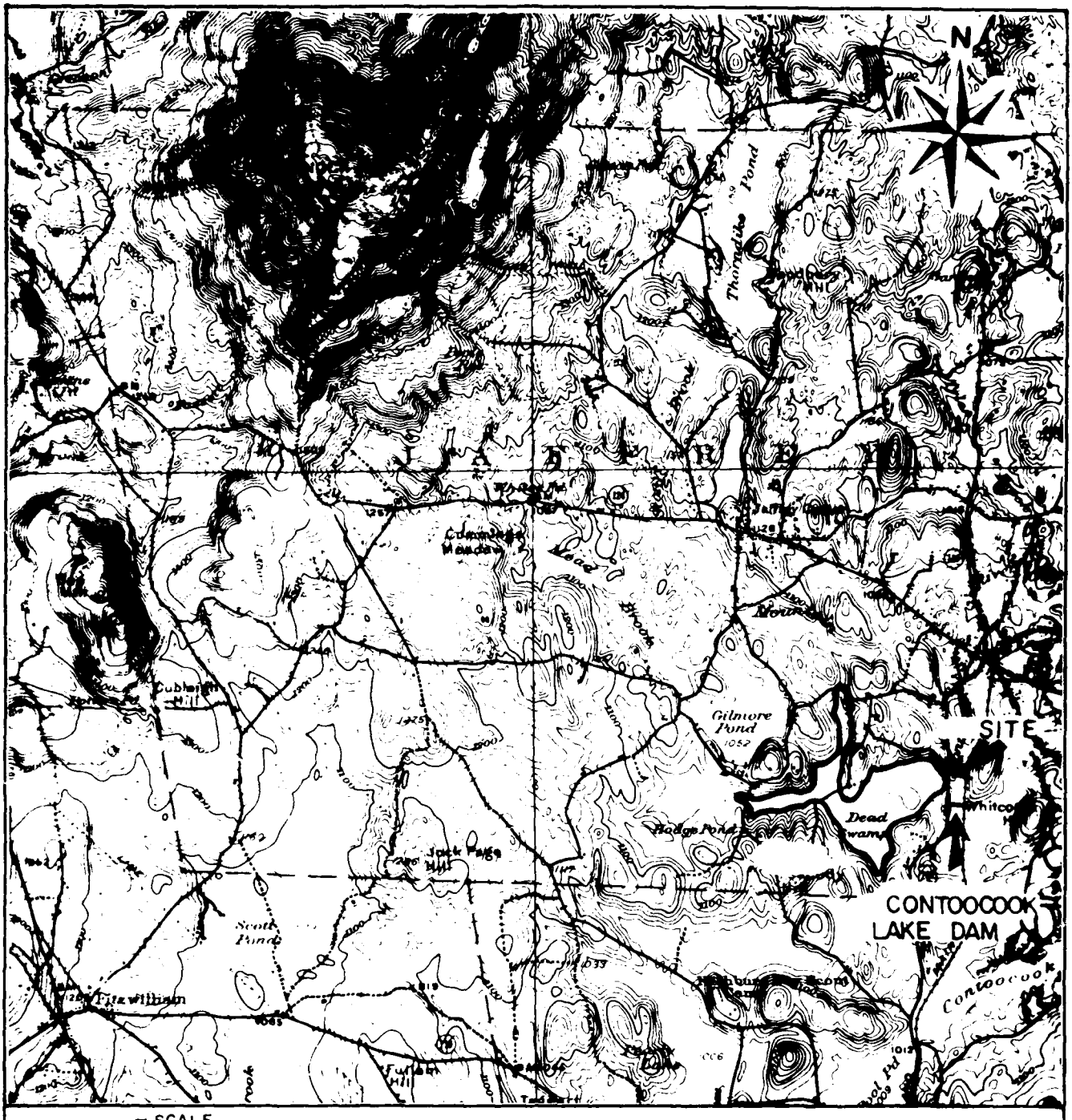
1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-federal dams.

3) Update, verify, and complete the National Inventory of Dams.

(c) Scope

The program provides for the inspection of non-federal dams in the high hazard potential category based upon location of the dams, and those dams in the significant hazard potential category believed to represent an immediate danger based on condition of the dams.



– SCALE –

0 1/2 1 2 (MILES)

FROM: USGS MONADNOCK - N H QUADRANGLE MAP

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCUS PLAN

FILE No. 2327

MOUNTAIN BROOK DAM — JAFFREY, NEW HAMPSHIRE

SCALE AS NOTED

DATE SEPT 1979

V

SECTION 5 - HYDRAULICS/HYDROLOGY

5.1 Evaluation of Features

(a) General

The dam is located on Mountain Brook just above its confluence with Contoocook River, about 1 mile upstream of Jaffrey, New Hampshire.

The water shed is predominantly mountainuous and forested, including much of the east slope of Monadnock Mountain, but also including sizeable wetland and meadow areas as well as a few ponds.

(b) Design Data

Data sources available for Mountain Brook Dam include a petition for approval of construction, dated 2 October 1947, and two inventory reports of the New Hampshire Water Control Commission (undated): "Data on Dams in New Hampshire" and "Data on Reservoirs and Ponds in New Hampshire".

None of the original hydrologic and hydraulic design records are available.

(c) Experience Data

No record of flow or stage is known to be available for Mountain Brook Dam.

(d) Visual Observations

Mountain Brook Dam adjoins U.S. Route 202 as it crosses Mountain Brook one mile upstream of Jaffrey, New Hampshire. It includes an earthen embankment and a concrete overflow spillway with a sluiceway at its base.

The embankment rises 18.3 feet above the streambed. At the crest, it extends roughly 125 feet to the left of the spillway structure and 110 feet to the right to meet the natural valley sideslopes. It is contiguous with the upstream side of the Route 202 highway embankment and has the same crest elevation.

The overflow spillway has a vertical upstream face with a sharp crest and a sloping downstream face. Spillway discharges flow over the downstream face on to a concrete apron which extends downstream to protect the streambed from scour. The spillway crest is 30.1 feet long, 8.7 feet above the streambed, and 9.6 feet below the top of the embankment. It is flanked by concrete sidewalls which rise 0.6 foot above the embankment crest and which support a concrete footbridge crossing above the spillway. The lower chord of this bridge is 9.8 feet above the spillway crest.

At the base of the spillway a 4.5 foot high by 5.0 foot wide gated sluiceway has been provided. The sluicegate is controlled from the footbridge above by a turning wheel which raises the threaded gate stem.

Immediately downstream of the spillway, approximately 15 feet, is the Route 202 highway bridge. This is a mortared stone arch bridge, with an opening 29 feet wide at the base and 12 feet high at the center with the spring line 4.3 feet above the streambed.

Downstream of Route 202, Mountain Brook continues approximately 500 feet to join the outflow from Contoocook Lake and form the Contoocook River. The Contoocook Lake Dam is about 500 feet upstream of this point.

The Contoocook River in this vicinity has a very mild gradient. At low stages flow is very slow, apparently controlled by a dam in Jaffrey 0.9 miles downstream. The bottom is sandy with a dense growth of grass. There is a 200+ foot wide flood plain to the left, while the valley wall rises steeply to the right. Boston and Maine railroad tracks follow close to the right bank approximately 10 feet above the streambed.

Except for the railroad, ther are no structures near the Contoocook River until Jaffrey, one mile downstream of Mountain Brook Dam. There is a mill dam in Jaffrey, 10 to 15 feet high, with a 34 foot long ogee overflow section. The overflow section is flanked by canal entrances which lead to mill buildings on each bank of the river just downstream (across a street). There are a number of structures in Jaffrey near the river and the mill dam. Three to four commercial buildings and a similar number of houses have first floor elevations about 7 feet above the spillway crest.

(e) Test Flood Analysis

The hydrologic conditions of interest in this Phase I investigation are those required to assess the dam's overtopping potential and its ability to safely allow an appropriately large flood to pass. This requires using the discharge and storage characteristics of the structure to evaluate the impact of an appropriately-sized Test Flood. The original hydraulic and hydrologic design records were not available for this study.

Guidelines for establishing a recommended Test Flood based on the side and hazard classifications of a dam are specified in the "Recommended Guidelines" of the Corps of Engineers. The impoundment of greater than 1,000 acre-feet and less than 50,000 acre-feet and height of less than 40 feet classify this dam as an INTERMEDIATE structure.

The hazard potential of Mountain Brook Dam is considered to fall within the SIGNIFICANT category. This is based on the fact that if the Contoocook River is at a very high stage prior to failure, flooding to three or four commercial buildings and three or four homes in Jaffrey would be increased to 1 to 1.5 feet by failure of the dam. Additionally, failure to Mountain Brook Dam implies serious damage to U.S. Route 202, an important secondary highway. The potential for loss of life is considered small. (See the Dam Failure Analysis section).

Based on the "Recommended Guidelines", the appropriate Test Flood for a dam classified as INTERMEDIATE in size with a SIGNIFICANT hazard potential would be between one-half the Probable Maximum Flood (PMF) and the PMF. The smaller Test Flood magnitude is selected because the hazard is on the low side of SIGNIFICANT. As stated above, loss of life potential is small and any flood damage incurred in Jaffrey would most likely be a small increment above conditions prior to dam failure.

Based on the Corps of Engineers, New England Division's chart for "Maximum Probable Flood Peak Flow Rates" for a mountainous watershed with a 10 percent reduction for attenuation in wetland areas, the one-half PMF inflow to Mountain Brook Reservoir is estimated to be 10,500 cfs. After accounting for the effect of storage in the reservoir, the routed Test Flood peak outflow at the dam is 6,350 cfs.

A stage-discharge curve has been developed by defining discharge as the sum of flow over the spillway, flow over the embankment crest, and flow over the sideslopes at the ends of the embankment. The calculations determining this curve are documented in Appendix D.

Using this stage-discharge curve, the peak test discharge of 6,350 cfs would result in a maximum stage of 11.7 feet above the spillway crest. This is 2.1 feet above the crest of the dam and highway embankment.

Increasing the spillway capacity alone would not prevent overtopping of the dam and highway embankment because the Route 202 bridge opening immediately downstream of the spillway is not sufficient to pass the routed peak test flood outflow. The capacity of the bridge opening with the pool at embankment crest is only 4,100 cfs.

(f) Dam Failure Analysis

The peak outflow at Mountain Brook Dam that would result from dam failure is estimated using the procedure suggested in the Corps of Engineers, New England Division's April 1978 "Rule of Thumb Guidelines for Estimating Downstream Dam Failure Hydrographs". Failure is assumed to occur as soon as the dam crest is overtopped. This is 18.3 feet above the natural streambed level. Just prior to failure, the normal outflow through the spillway would be 2,990 cfs, with a tailwater level estimated to be 9.2 feet below the dam crest. Assuming a 60 foot gap is opened in the dam, the peak failure outflow through this gap and through the spillway would be 5,850 cfs.

The assumed breaching of Mountain Brook Dam implies similar damage to Route 202, which is integrally joined to the dam. This breach may include removal of the highway bridge, or it may be to one side of it.

Approximately 500 feet downstream, the dam failure outflow will enter the Contoocook River and merge with the outflow from Contoocook Lake. This outflow is assumed to be similar to the prefailure outflow from Mountain Brook, adjusted for the relative drainage areas. The assumed Contoocook Lake outflow of 3,450 cfs combines with the 5,580 cfs dam failure outflow for a total Contoocook River discharge of 9,300 cfs.

Depth of flow after dam failure in the Contoocook River near Mountain Brook is estimated to be slightly greater than 10 feet. This might do minor damage to the railroad bed near the right bank.

Little attenuation of the dam failure flood wave can be expected in the 0.9 mile reach of the Contoocook River from Mountain Brook to Jaffrey. Channel storage of the flood wave would be negligible compared to the quantity of water released from the reservoir. The 9,300 cfs discharge would result in maximum flood depths in Jaffrey estimated to be greater than 3 feet. However, this would be only a 1 foot increase over the 2.5 feet of flooding estimated to exist prior to dam failure. Three or four commercial buildings and three or four homes would be affected.

The results of the dam failure analysis indicate that should failure occur with a pool elevation at the top of the embankment, the resulting flood wave would cause a minor incremental increase in flood damage downstream in Jaffrey, where a flooding condition is assumed to exist prior to failure. In addition, the Route 202 highway embankment, which forms a part of the dam, would also be damaged.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

(a) Visual Observations

The field investigations revealed no significant displacement or distress which would warrant the preparation of structural stability calcualations, based on assumed sectional properties and engineering factors.

There has been some horizontal cracking at construction joints on the end walls.

(b) Design Construction Data

There are no plans or calculations of value to a stability assessment available for this dam.

(c) Operating Records

There are no known operating records for this dam.

(d) Post Construction Changes

There have been no known contruction changes since the dam was completed.

(e) Seismic Stability

The dam is located in Seismic Zone No. 2 and, in accordance with the recommended Phase I Guidelines, does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

(a) Condition

The Mountain Brook Dam is in GOOD condition at the present time.

(b) Adequacy of Information

The lack of in-depth engineering data does not permit a definitive review. Therefore, the adequacy of the dam cannot be assessed from the standpoint of reviewing design and construction data. This assessment is based primarily on the visual inspection, past performance, and sound engineering judgement.

(c) Urgency

The remedial measures described herein should be implemented by the owner within 2 years of receipt of this Phase I Inpsection Report.

(d) Need for Additional Investigations

None

7.2 Recommendations

No conditions were observed which warrant further investigation.

7.3 Remedial Measures

It is recommended that the owner institute the following remedial measures:

1) Dredge the impoundment pool in order to allow the sluice gate to operate.

2) Grease the sluice gatebench stand, rehabilitate and operate the gate.

3) Install safety railing around the concrete walkway.

4) Remove trees and saplings, including their roots, from the slopes of the embankment. Backfill the resulting voids with suitable compacted material.

5) Remove flashboards and pins.

6) Repair spalled and cracked concrete on end walls.

7) Implement a program of biennial technical inspections of the dam and its appurtenances including operation of the sluice gate.

9) Develop a formal written downstream emergency warning system.

7.4 Alternatives

Breaching the dam is a possible alternative to the above measures.

APPENDIX A

INSPECTION CHECKLIST

INSPECTION TEAM ORGANIZATION

Date: August 22, 1979

Project: NH 00099
MOUNTAIN BROOK DAM
Jaffrey, New Hampshire
NHWRB 124.17

Weather: Sunny, 75-80°

INSPECTION TEAM

Nicholas A. Campagna	Goldberg, Zoino, Dunnicliff & Assoc. (GZD)	Team Captain
William S. Zoino	GZD	Soils
M. Daniel Gordon	GZD	Soils
Jeffrey M. Hardin	GZD	Soils
Andrew Christo	Andrew Christo Engineers (ACE)	Structures
Paul Razgha	ACE	Structures
Carl Razgha	ACE	Structures
Richard Laramie	Resource Analysis, Inc. (RAI)	Hydrology
Tom Gooch	RAI	Hydrology

Others Present

Gary Kerr - New Hampshire Water Resources Board

CHECK LISTS FOR VISUAL INSPECTION

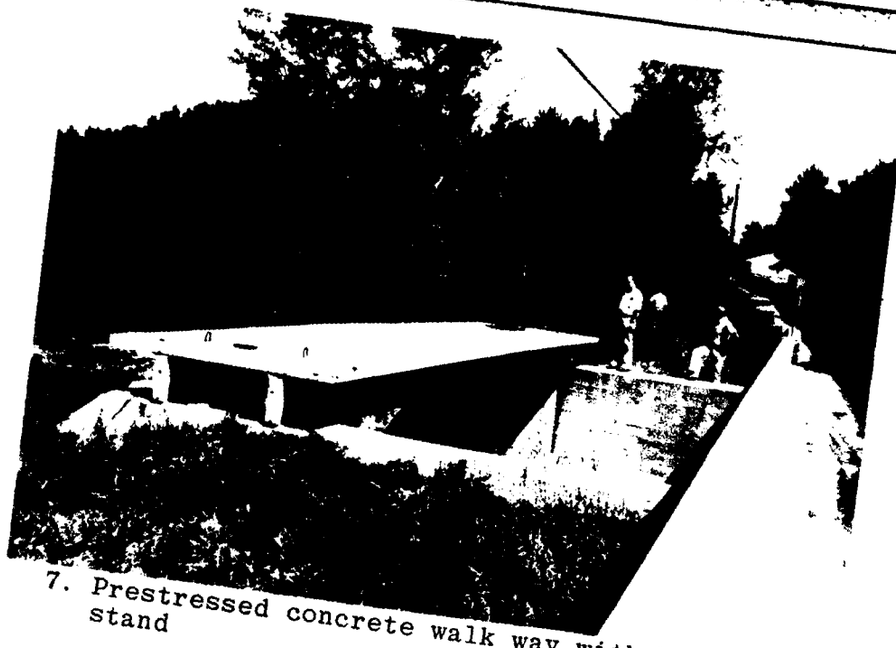
AREA EVALUATED	BY	CONDITION & REMARKS
E EMBANKMENT		
rest Elevation	NAC	1,020± feet
urrent Pool Elevation		1,010.5± feet
aximum Impoundment to Date		No Data
urface Cracks		None
avement Condition		Good
ovement or Settlement of rest		None
ateral Movement		None
ertical Alignment		Good
lorizontal Alignment		Good
ondition at Abutment and t Concrete Structures		Good
ndications of Movement of tructural Items on Slopes		None
respassing on Slopes		20-30 trees or saplings growing on embankment slopes much brush, road debris dumped on slopes
loughing or Erosion of of Slopes or Abutments		Erosion gullies in left and right upstream slopes up to 6 to [illegible]" deep
Rock Slope Protection - Riprap Failures	NAC	None

CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
usual Movement or Cracking at or near Toes	NAC	None
usual Embankment or Downream Seepage		None
ping or Boils		None
undation Drainage		None
e Drains		None
strumentation Systems	NAC	None
LWAY		
ndition of Concrete	AC	Good
palling		Minor on crest
osion		Minor on downstream surface
acking		None noted
sting or Staining of ncrete		Minor staining on surface
sible Reinforcing		None noted
florescence		None noted
ashboards		Destroyed
ashboard Stanchions		Majority missing, remainder bent
bris	AC	Accumulation of small tree trunks and vegetation at crest. Silt behind spillway.

CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
RTENANT STRUCTURES		
ALLS		
ndition of Concrete	PK	Good
alling		Minor on sloping top surface of left wall. Spalling at construction joint at left wall adjacent to bridge spandrel wall. 12"x2"x1".
osion		None noted
acking		Right wall crack from bridge spandrel wall, beyond spillway to sloping wall. Left wall - bridge spandrel wall to spillway, 3/8" wide x 1/4" deep. Minor hair line cracks.
sting or Staining of nerete		None noted
sible Reinforcing		None noted
florescence		Minor
neycombs		Minor
FF WALLS		
ndition of Concrete		Good
alling		Minor or localized
osion		None noted
acking	PK	None noted



7. Prestressed concrete walk way with bench stand

8. Upstream of left end wall

5. Crest of dam showing core wall, walk way, and highway bridge

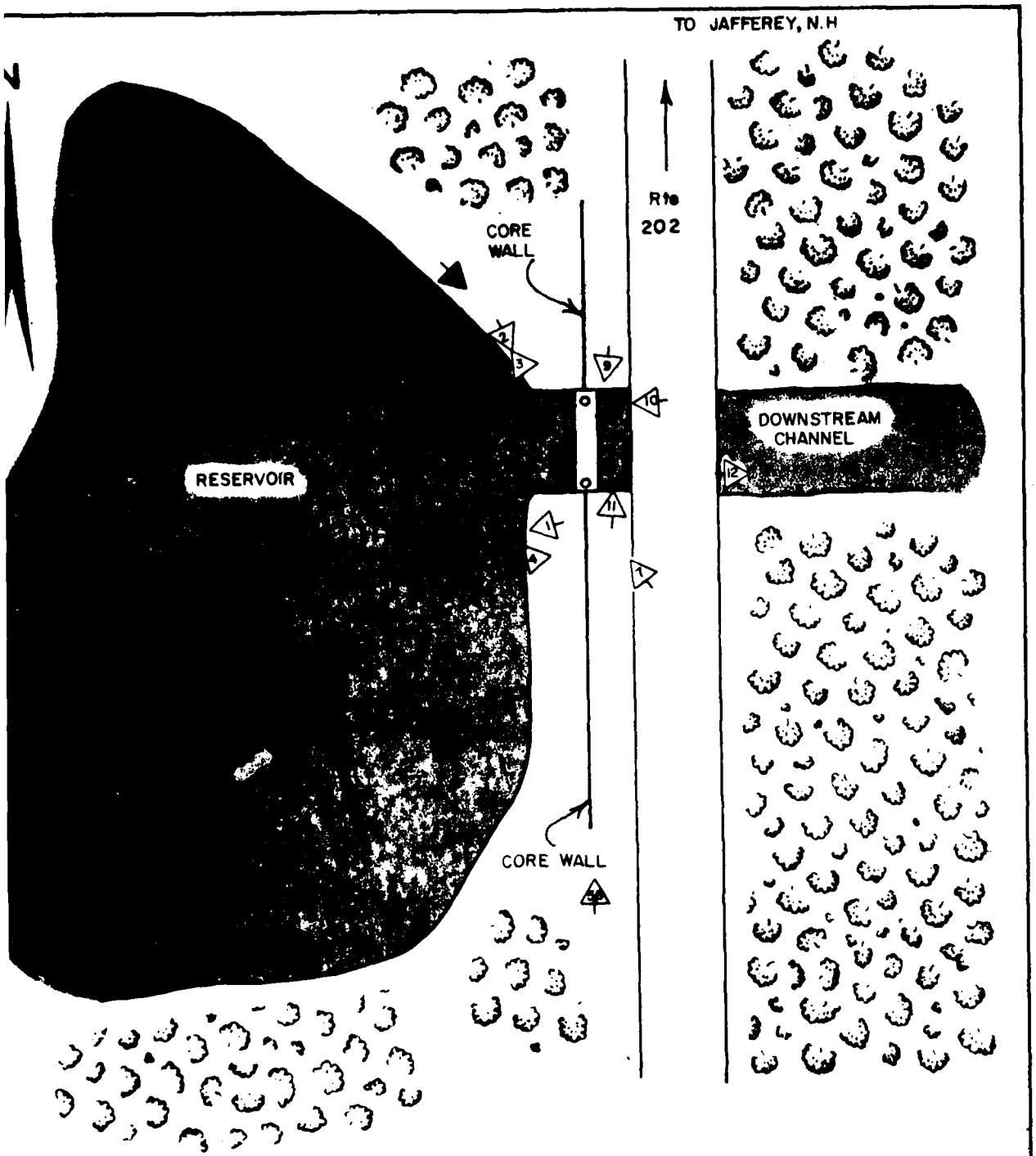
6. Close up of top of core wall

3. Erosion of left upstream slope near end wall

4. Erosion of right upstream slope

1. Reservoir area looking upstream

2. Right upstream slope showing tree and brush growth



GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC. GEOTECHNICAL CONSULTANTS NEWTON UPPER FALLS, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND ORIENTATION OF PHOTOS

OVERVIEW PHOTO

APPENDIX C PHOTO

FILE No.

MOUNTAIN BROOK DAM NEW HAMPSHIRE

SCALE 1" = 50'

DATE SEPT. 1979

APPENDIX C

PHOTOGRAPHS

Pertinent Data Not Included

The New Hampshire Water Resources Board maintains a file on this dam. Included in this file are:

(1) Correspondence relating to a proposed flood control dam on this site.

(2) Correspondence relating to the clearing of flowage areas after the mill storage dam was constructed.

(3) Miscellaneous correspondence relating to the dam.

Critical Maint

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. 124.17

Town Jaffrey : County Cheshire

Stream Mountain Brook

Basin-Primary Merrimack : Secondary Contoocook

Local Name Mountain Brook Reservoir

Coordinates—Lat. 42°-48'-12" : Long. 72°-01'-45"

GENERAL DATA

Drainage area: Controlled 1.1 Sq. Mi.: Uncontrolled 12.9 Sq. Mi.: Total 14.0 Sq. Mi.

Overall length of dam ..... ft.: Date of Construction 1946

Height: Stream bed to highest elev. 18.5 ft.: Max. Structure ..... ft.

Cost—Dam ..... : Reservoir .....

DESCRIPTION

Waste Gates

Type .....

Number 1 : Size 3'6" ft. high x 5' ft. wide

Elevation Invert 1023 1/6 : Total Area 3.75'x4'x5'x1= 18 3/4 sq. ft.

Hoist Rodney Hunt Roller Bearing Gate Hoist #No. S-5036

Waste Gates Conduit

Number ..... : Materials .....

Size ..... ft.: Length ..... ft.: Area ..... sq. ft.

Embankment

Type Earth

Height—Max. 12.5 ft.: Min. ..... ft.

Top—Width ..... : Elev. ..... ft.

Slopes—Upstream 1 1/2 on 1 : Downstream ..... on .....

Length—Right of Spillway ..... : Left of Spillway .....

Spillway

Materials of Construction Concrete

Length—Total 30 ft.: Net ..... ft.

Height of permanent section—Max. 5 ft.: Min. ..... ft.

Flashboards—Type Inflatable Rubber : Height ..... ft.

Elevation—Permanent Crest 5 : Top of Flashboard 9'?

Flood Capacity 2820 cfs.: 280 cfs/sq. mi. (1/2 PMF)

Abutments

Materials: .....

Freeboard: Max. ..... ft.: Min. ..... ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Mountain Brook Reservoir Corp., Jaffrey, N.H.

REMARKS Conservation

Dam classed as a menace subject to periodic inspections.

7205

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON RESERVOIRS & PONDS IN NEW HAMPSHIRE

LOCATION AT DAM NO. 124.17

Town Jaffrey : County Cheshire

Stream Mountain Brook

Basin—Primary Merrimack : Secondary Contoocook

Local Name Mountain Brook Reservoir

DRAINAGE AREA

Controlled 1.1 Sq. Mi.: Uncontrolled 12.9 Sq. Mi.: Total 14.0 Sq. Mi.

ELEVATION vs. WATER SURFACE AREA vs. VOLUME

Point	Head Feet	Surface Area Acres	Volume Acre Ft.
(1) Max. Flood Height (?)	11.?±	300	1820
(2) Top of Flashboards	9 (?)	230	950
(3) Permanent Crest	5	110	300
(4) Normal Drawdown			
(5) Max. Drawdown	0	10	0
(6) Original Pond			

Base Used USGS ?: Coef. to change to U.S.G.S. Base

RESERVOIR CAPACITY

	Total Volume	Useable Volume
Drawdown	ft.	9 ft.
Volume	ac. ft.	930 ac. ft.
Acre ft. per sq. mi.		72
Inches per sq. mi.		1.3

USE OF WATER Conservation

OWNER Mountain Brook Reservoir Corporation, Jaffrey, N.H.

REMARKS

Tabulation By Date

SOLOMON, SEARS, RUDOLPH & ASSOC.
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

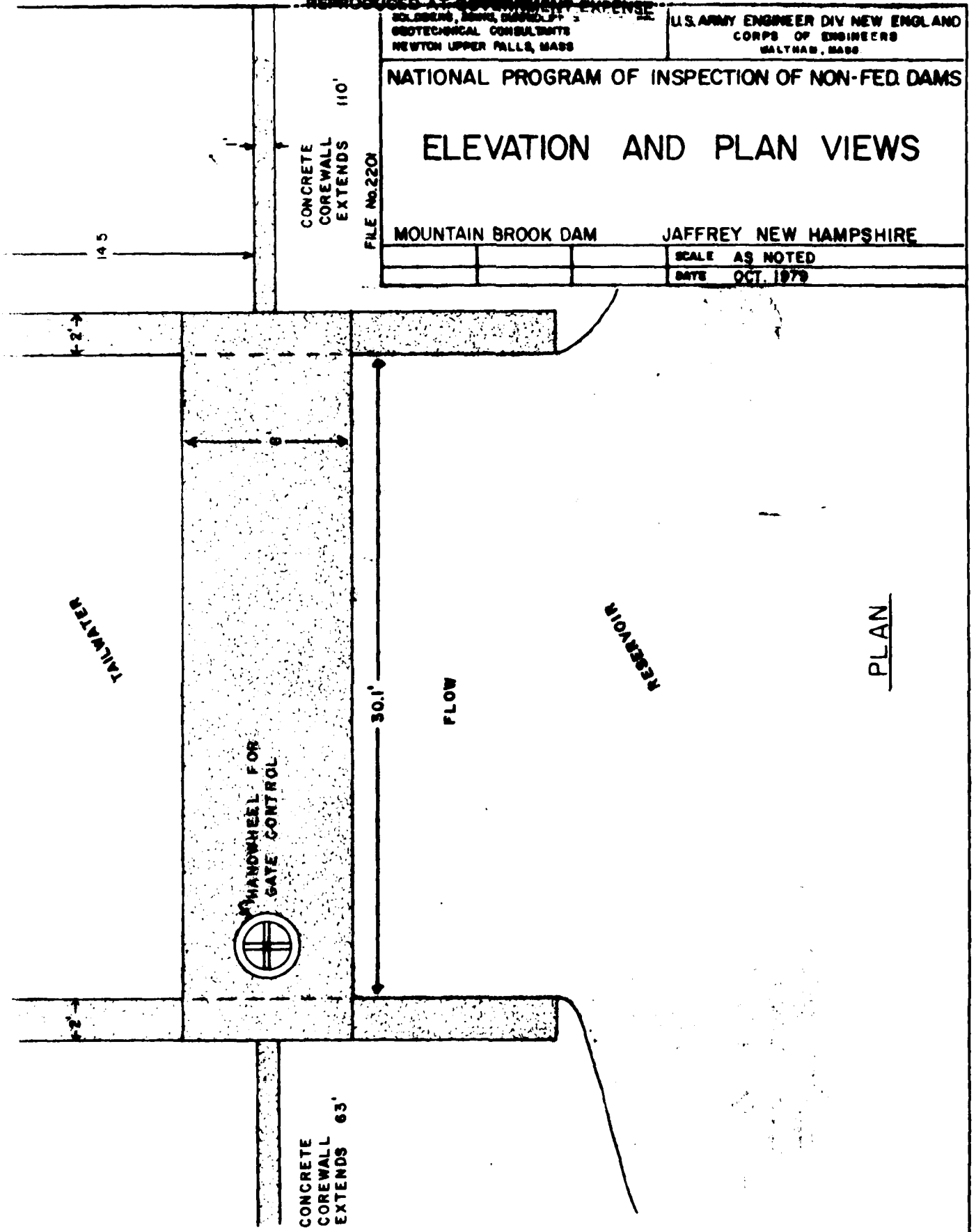
ELEVATION AND PLAN VIEWS

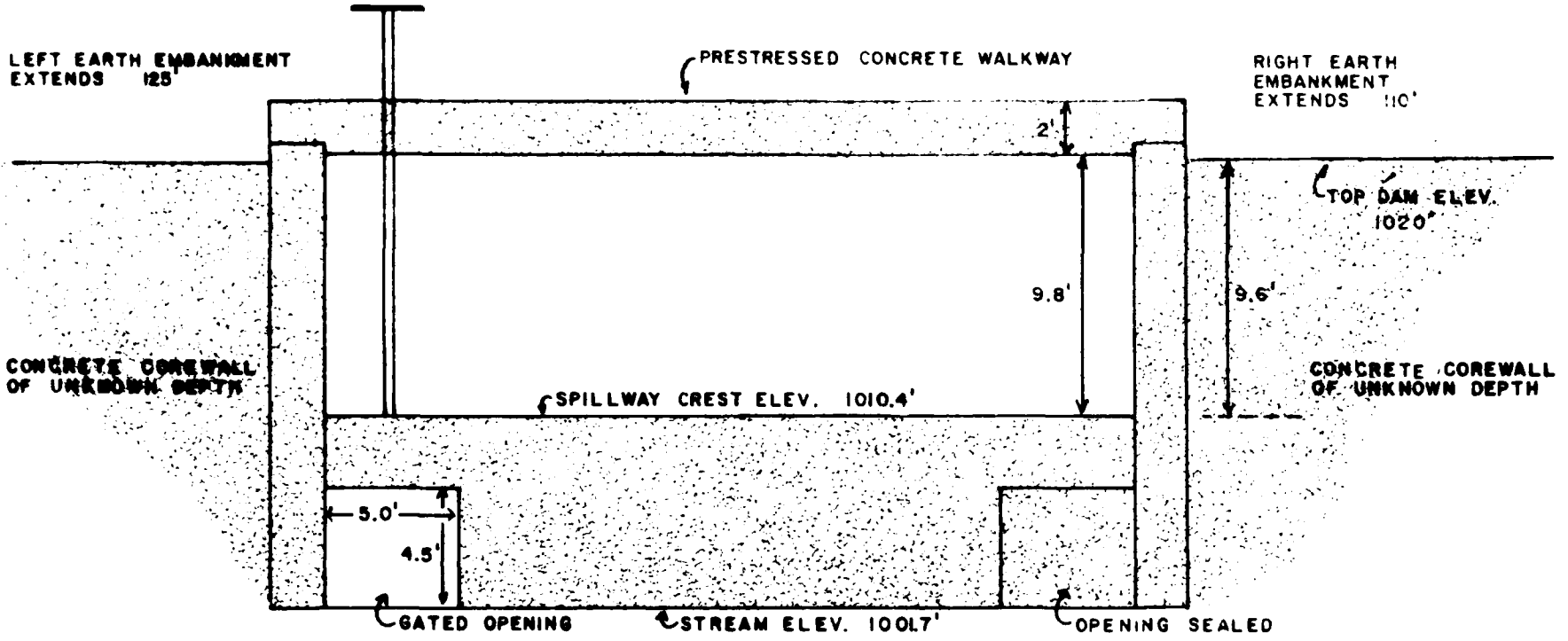
FILE No. 22.01

MOUNTAIN BROOK DAM JAFFREY NEW HAMPSHIRE

SCALE AS NOTED

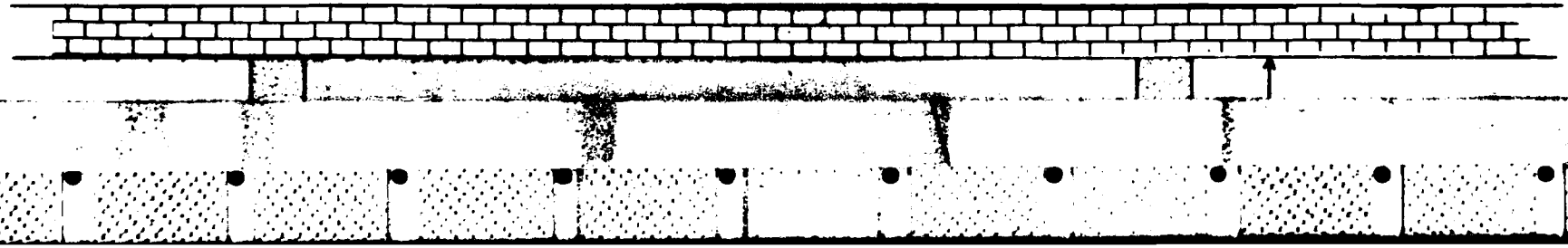
DATE OCT. 1979

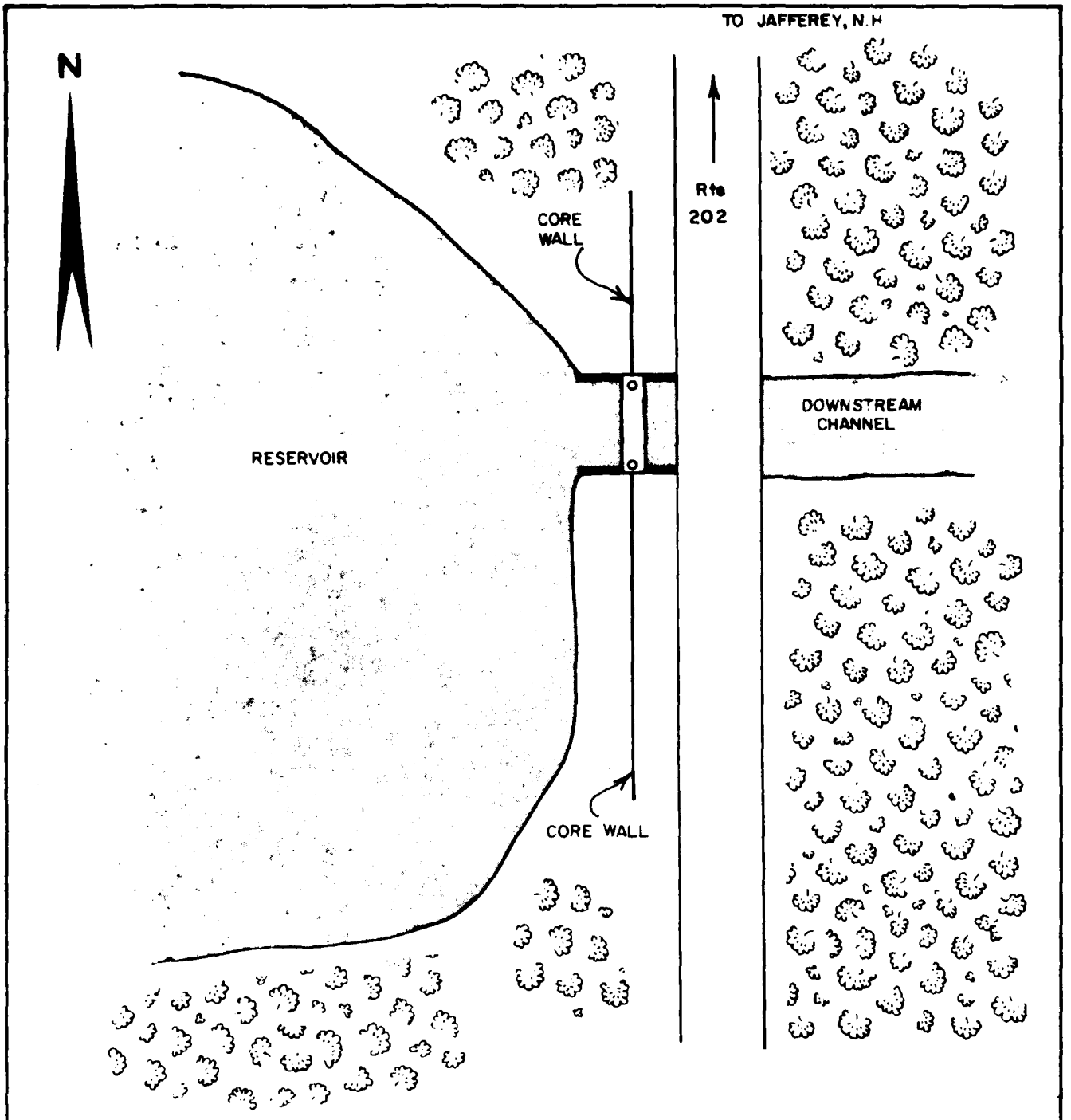




ELEVATION

N.H. STATE ROUTE 202 ON MORTARED STONE MASONRY BRIDGE





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NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SITE PLAN

FILE No. 2327

MOUNTAIN BROOK DAM NEW HAMPSHIRE

SCALE 1" = 50'

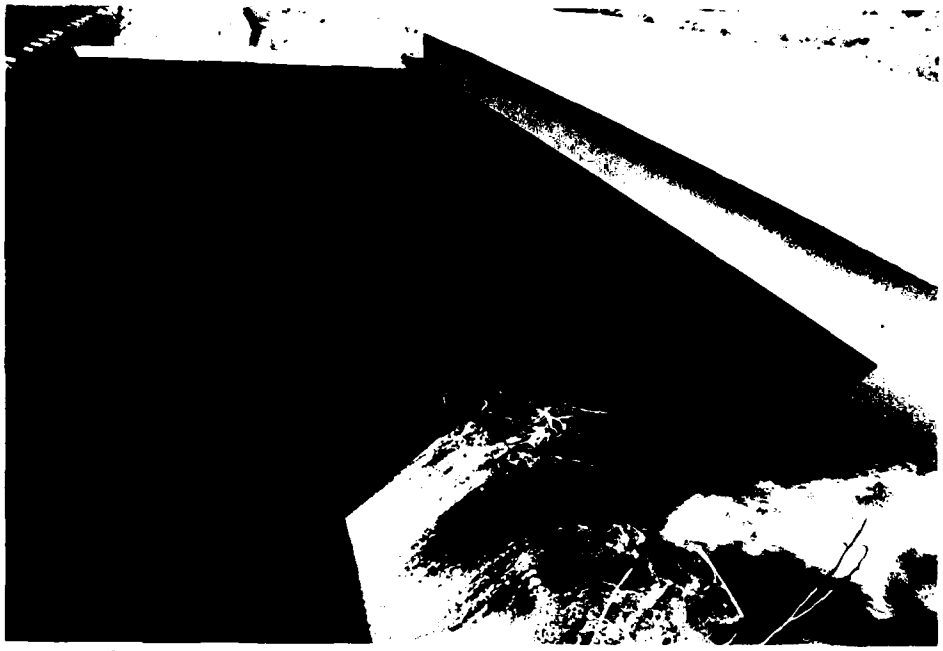
DATE SEPT. 1979

APPENDIX B

	Page
Site Plan	B-2
Elevation and Plan Views	B-3
New Hampshire Water Control Commission, "Data on Dams in New Hampshire"	B-4
New Hampshire Water Control Commission, "Data on Reservoirs and Ponds in New Hampshire"	B-5
Pertinent Data Not Included	B-6

CHECK LISTS FOR VISUAL INSPECTION

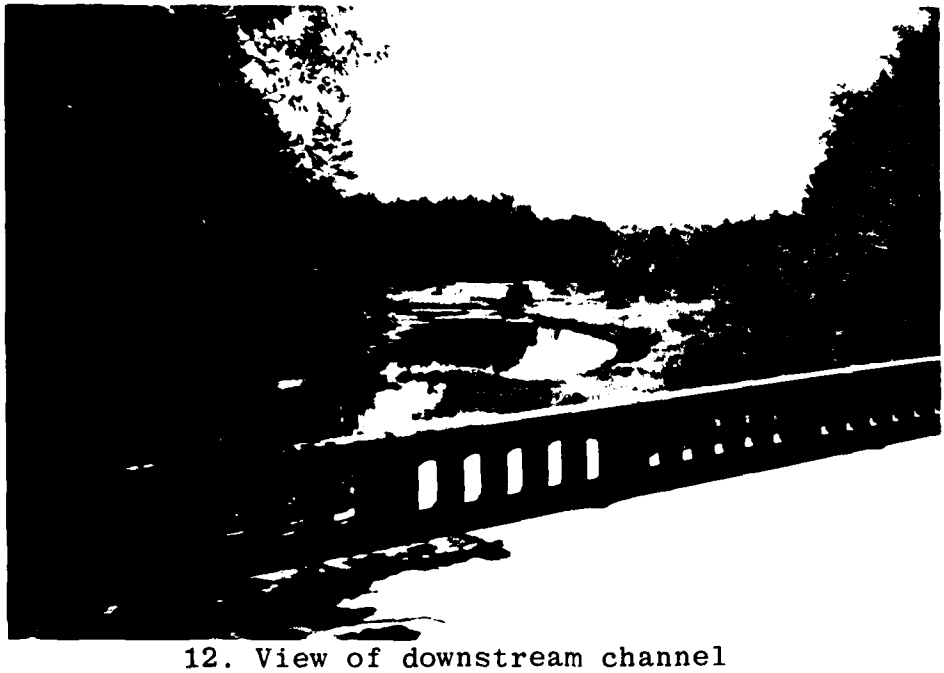
AREA EVALUATED	BY	CONDITION & REMARKS
Rusting or Staining of Concrete	PR	None noted
Visible Reinforcing		None noted
Efflorescence	PR	None noted
PRESTRESSED CONCRETE WALKWAY		
Condition of Concrete	AC	Good
Spalling		Surface laitance
Erosion		None noted
Cracking		None noted
Rusting or staining of Concrete		Minor at anchorages
Visible Reinforcing		None noted
Efflorescence		None noted
Anchorages		Minor surface rust
Gate Bench Stand		Inoperable (bound) minor surface rust. Stem guide partially rusted.
Stone Arch Bridge	AC	Erosion of mortar and chinking stones at spring line.



9. Right end wall and crest of spillway

10. Crest of spillway showing remains of pin boards and debris

11. View showing cracking of left end wall



12. View of downstream channel

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Dam Rating Curve

A schematic sketch of the overflow section of this dam is shown on the next page. This is based on recent field inspection.

Datum is Spillway Crest

Sluiceway Discharge

$Q1 = 0$ (Gate was closed at time of inspection. Assume, conservatively, that it is closed during a flood.)

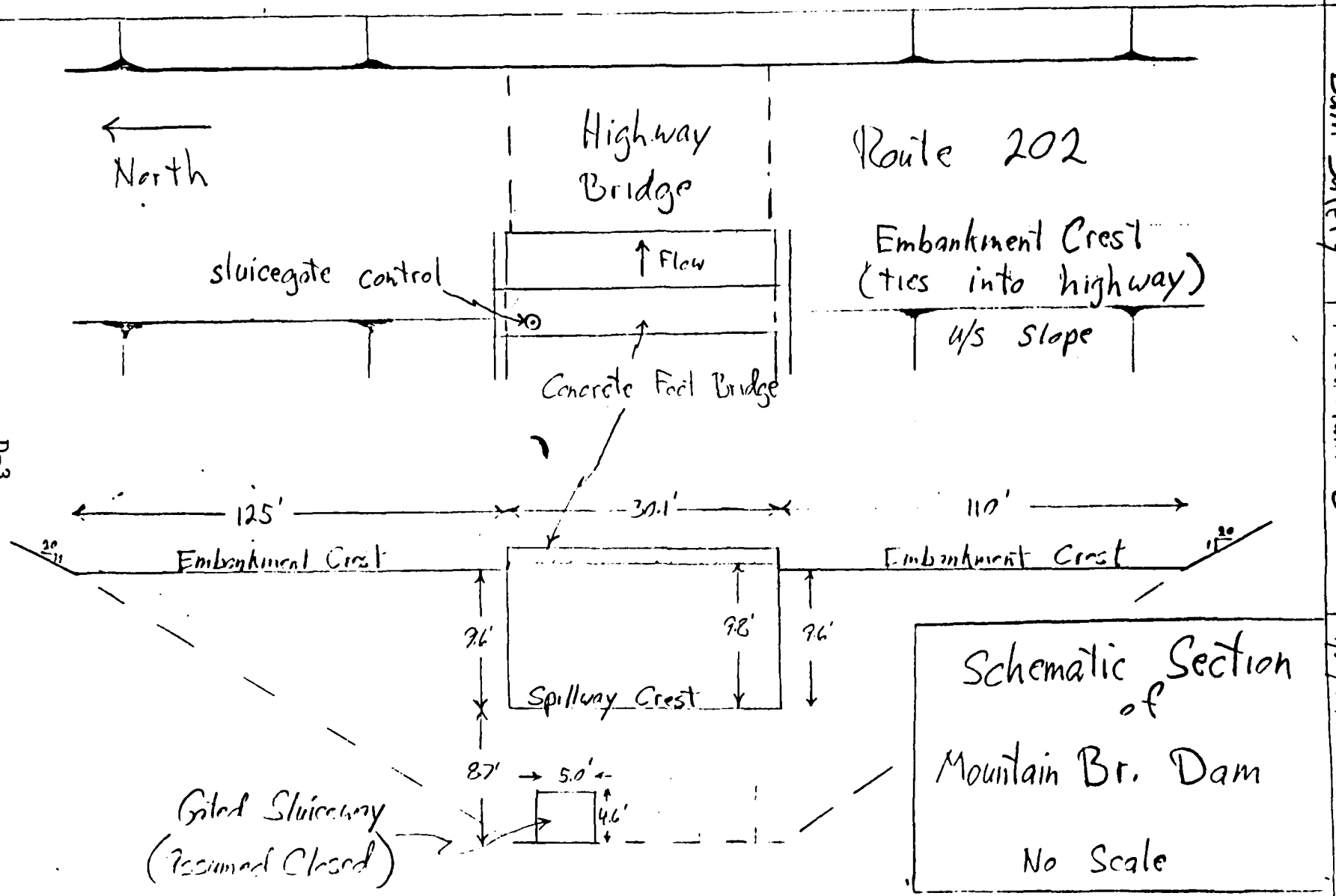
Spillway Discharge

$Q2 = CLH^{1.5}$

$C = 3.3$ (sharp crested weir)

$L = 39.1'$

$Q_2 = 3.3 \times 39.1 \times H^{1.5}$



Dam Safety | Mountain Br. | BHF 9/20/21 | 4/25

D-3

Embankment Discharge

$Q_3 = Q_{dam\ crest} + Q_{side\text{-}slopes}$

$= C_1 L_1 H_1^{1.5} + 2 \times C_2 L_2 H_2^{1.5}$

$C_1 = 3.0$ (Broad-crested weir)

$L_1 = 235'$

$H_1 = H - 9.6$

$C_2 = 2.8$ (Overgrown broad-crested weir)

$L_2 = 20(H-9.6)$

$H_2 = 0.5(H-9.6)$

$$Q_3 = 3 \times 235 \times (H-9.6)^{1.5} + 2 \times 2.8 \times (20 \times (H-9.6)) \times (0.5(H-9.6))^{1.5}$$

The foot bridge above the spillway does not affect the discharge significantly for reservoir stages up to 12' above the spillway crest, for flow acceleration in the vicinity of the spillway will have a drawdown effect there.

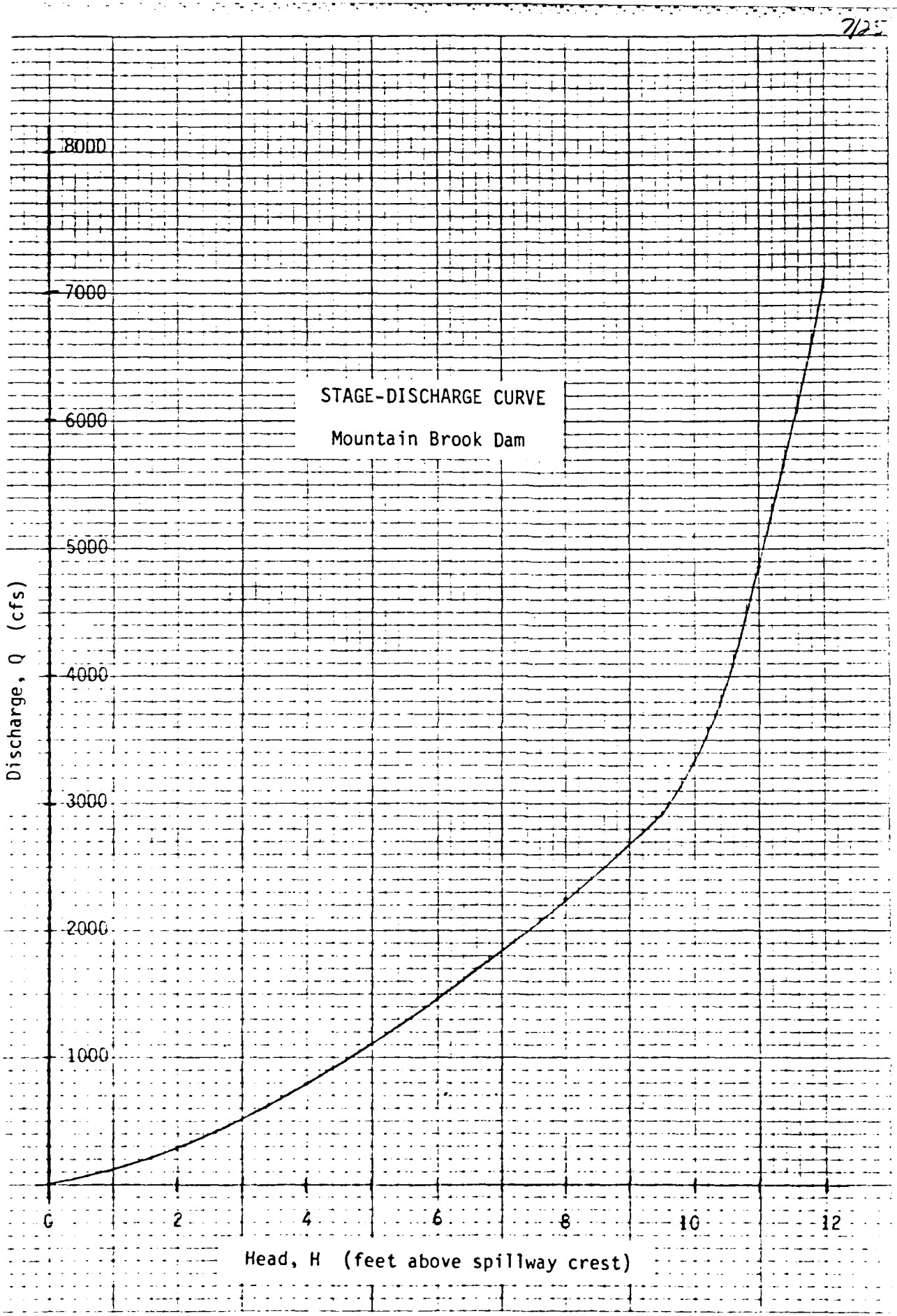
153 Dam Safety	Mountain Br.	INF 9/20/79	4/25

A BASIC program was written to calculate the stage-discharge function at the dam. A listing is shown on the next page, followed by tabulated output and a plotted curve.

```
LIST
100 REM - STAGE-DISCHARGE CURVE FOR MOUNTAIN BROOK DAM
110 REM - STORED ON TAPE 10 FILE 57
120 PAGE
130 PRINT USING 140:
140 IMAGE 10T"STAGE VS. DISCHARGE FOR MOUNTAIN BROOK DAM-GATE CLOSED"
150 PRINT USING 160:
160 IMAGE //12T"HEAD" 25T"DISCHARGE"
170 PRINT USING 180:
180 IMAGE 11T"(FEET)" 27T"(CFS)"
190 PRINT USING 200:
200 IMAGE 23T"TOTAL     GATE    SPILLWAY  EMBANKMENT"
210 PRINT " "
220 FOR H=0 TO 12 STEP 0.5
230 Q1=0
240 Q2=3.3*39.1*H↑1.5
250 Q3=0
260 IF H<9.6 THEN 450
270 Q3=3*235*(H-9.6)↑1.5+2*2.8*(20*(H-9.6))*(0.5*(H-9.6))↑1.5
450 T1=Q1+Q2+Q3
460 PRINT USING 470:H,T1,Q1,Q2,Q3
470 IMAGE 10T,2D.2D,12D,8D,10D,10D
480 NEXT H
490 END
```

STAGE VS. DISCHARGE FOR MOUNTAIN BROOK DAM-GATE CLOSED

HEAD (FEET)	DISCHARGE (CFS) TOTAL	GATE	SPILLWAY	EMBANKMENT
0.00	0	0	0	0
0.50	35	0	35	0
1.00	99	0	99	0
1.50	182	0	182	0
2.00	281	0	281	0
2.50	393	0	393	0
3.00	516	0	516	0
3.50	650	0	650	0
4.00	795	0	795	0
4.50	948	0	948	0
5.00	1111	0	1111	0
5.50	1281	0	1281	0
6.00	1460	0	1460	0
6.50	1646	0	1646	0
7.00	1840	0	1840	0
7.50	2040	0	2040	0
8.00	2248	0	2248	0
8.50	2462	0	2462	0
9.00	2682	0	2682	0
9.50	2908	0	2908	0
10.00	3323	0	3141	182
10.50	4012	0	3380	632
11.00	4884	0	3624	1260
11.50	5917	0	3874	2043
12.00	7104	0	4129	2975

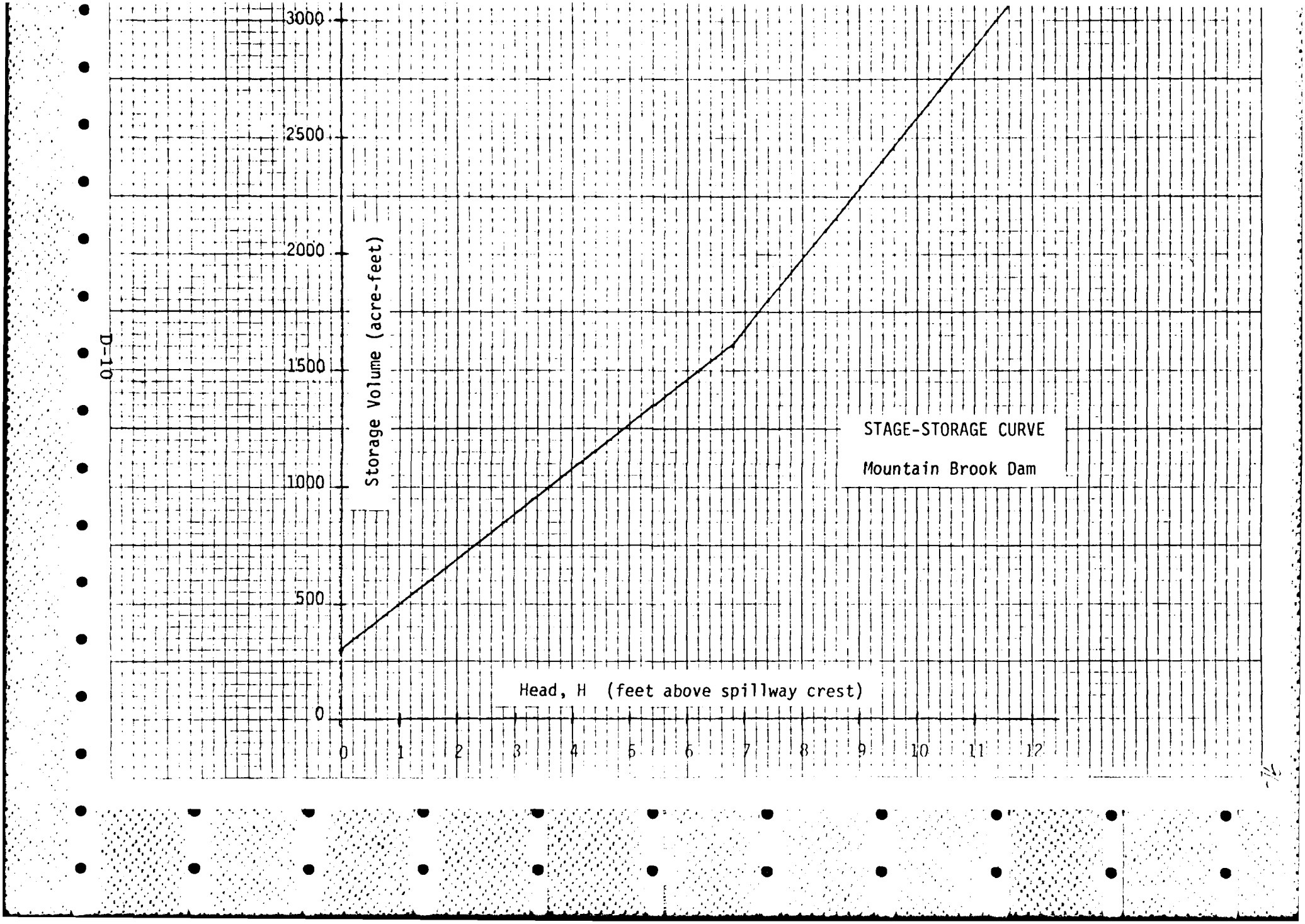

STAGE-DISCHARGE CURVE
Mountain Brook Dam
Discharge, Q (cfs)
8000
7000
6000
5000
4000
3000
2000
1000
0
2
4
6
8
10
12
Head, H (feet above spillway crest)

Stage - Storage Function

The New Hampshire Water Control Commission "Data on Reservoirs and Ponds" indicates a storage volume of 300 acre-ft. at the level of the spillway crest. At a stage 6.8' above the crest the volume is 1680 acre-ft. with a surface area of 300 acres.

Interpolate linearly from H=0 To H=6.8. Estimate storage volumes at higher elevations using $Vol = (H - 6.8) \times 300 + 1620$

H	Vol. (acre-ft.)
0	300
2	690
4	1050
6	1460
6.8	1620
8	1980
9.6	2460
10	2580
12	3120


3000
2500
2000
1500
1000
500
0
Storage Volume (acre-feet)
0
1
2
3
4
5
6
7
8
9
10
11
12
Head, H (feet above spillway crest)
STAGE-STORAGE CURVE
Mountain Brook Dam

2.1 Failure Analysis

Outflow at Failure = Outflow through breach + normal outflow at failure elev. of pool

Assume that the dam fails when it is overtopped with the pool at the level of the embankment crest -- 9.6' above the spillway crest

Normal Outflow

$Q = 2990$ cfs (dam rating curve w/ $H = 9.6$)

Tailwater Level at Failure

The tailwater level at Mountain Br. Dam depends not only on the outflow from that dam, but on the outflow from the Contoocook Lake Dam (which combines with Mountain Brook to form the Contoocook R.) and on backwater effect from the mill dam in Jaffrey 1 mile D/S.

Assume the following in order to estimate a reasonable tailwater level just prior to failure.

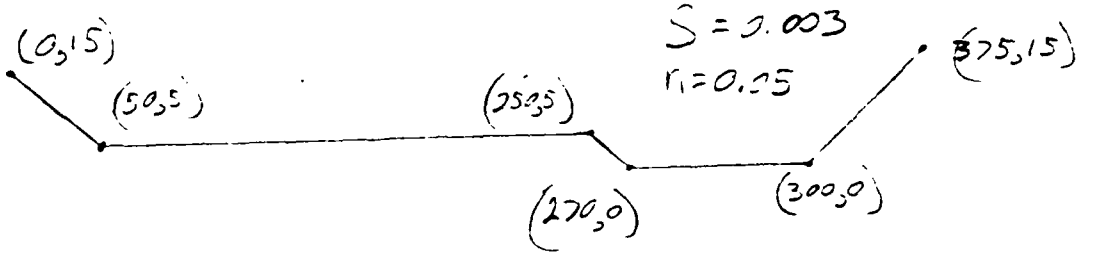
1) The outflow from Contoocook Lake is the same as from Mountain Brook, adjusted for relative drainage areas

2) At this (high) discharge, the backwater effect from the Jaffrey Dam is small.

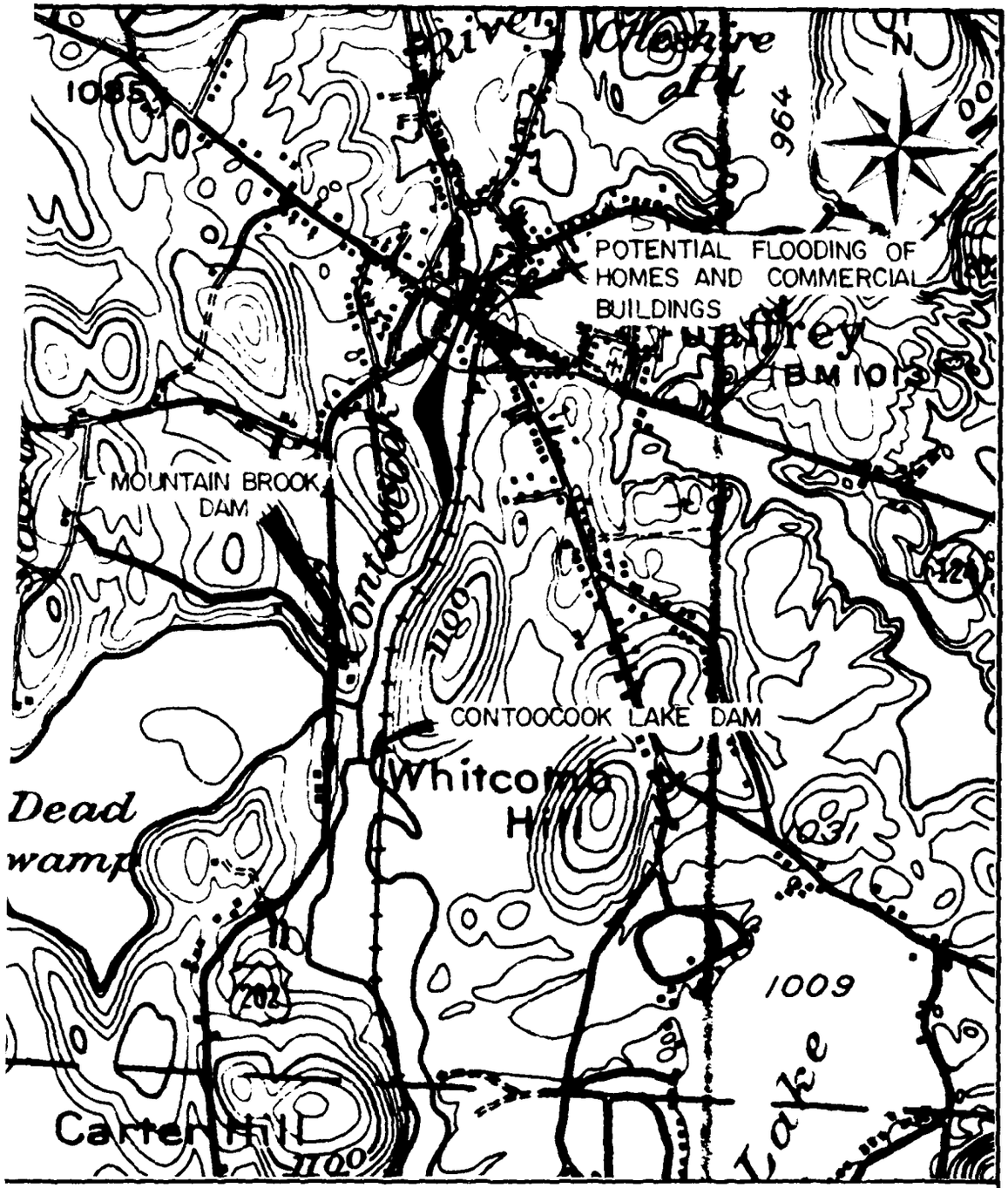
The drainage area at the Contoocook Lake Dam is listed variously as 14.25 and 20 square miles in NHWRB records. Using D.A = 17 sq. miles, the assumed Contoocook R. discharge

$$Q = 2990 + \left(\frac{17}{14}\right)^{0.75} \times 2990 = \underline{\underline{6450}} \text{ cfs}$$

Estimate flow depth using a normal flow rating calculation. A rating table based on the representative sketch below is shown on the next page.



Contoocook R. d/s of Mountain Br. Dam



1000 2000 (FT)

MONADNOCK - N. H
ORANGLE MAP

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC. GEOTECHNICAL CONSULTANTS NEWTON UPPER FALLS, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

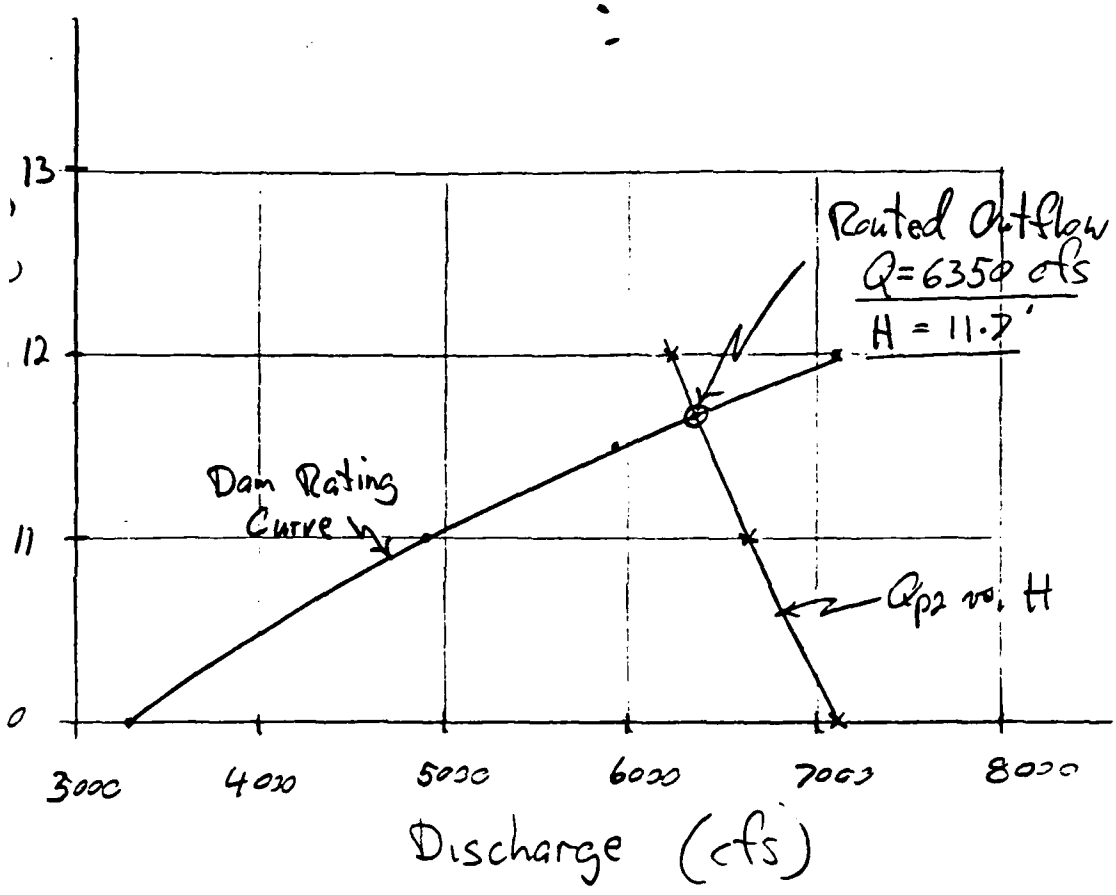
DOWNSTREAM HAZARD MAP

FILE No. 2327

MOUNTAIN BROOK DAM — JAFFERY, NEW HAMPSHIRE

SCALE AS NOTED

DATE



The routed Test Flood outflow equal 6350cfs occurs with H = 11.7', 2.1' above the dam crest.

Note that the capacity of the Route 202 bridge opening with the pool at the embankment crest

$Q_{ap} \cong 0.6 \times 29 \times 8 \sqrt{2g(18.3 - 0.6 \times 8)} = 4100$ cfs

is not sufficient to pass the Test Flood, even if the weir was expanded or removed.

Storage Routing (follow COE guidelines)

$Q_{p2} = Q_{p1}(1 - V/S)$

$Q_{p1} = 10500$ cfs (Test Flood inflow)

$S = 7090$ acre-ft. (Total Runoff)

V = vol. in reservoir above spillway crest

Q_{p2} = routed peak outflow with reservoir peak storage $= V$

$Q_{p2} = 10500(1 - V/7090)$

H	V*	Q_{p2}
10	2280	7120
11	2600	6650
12	2880	6230

* from stage-storage curve subtracting volume below spillway crest

Find H for which Q_{p2} is equal to the discharge as given by the dam rating curve

Select the smaller Test Flood as a dam break would probably cause a small increment of flood damage in Saffrey. Even for the most "critical" case hypothesized above, inhabitants would be alerted to the danger of flooding by high river stages.

1/2 Probable Maximum Flood

w/ COE NED "Maximum Probable Flood Peak Flow Rates"

Watershed - Mountainous, but with large wetland and meadow areas

Drainage Area - 14.0 square miles

PMF - reduce the 1850 CSM indicated for a mountainous watershed to 1500 CSM to account for the attenuating effect of the wetland areas

Test Flood = $\frac{1}{2} \times 1500 \times 14 = \underline{\underline{10500}}$ cfs

Total Runoff Volume (follow COE rule-of-thumb)

$\frac{1}{2} \times 19''$ runoff = $\frac{1}{2} \times \frac{1}{12} \times 19 \times 14 \times 640 =$

$= \underline{\underline{7090}}$ acre-ft.

Test Flood Analysis

Size Classification - INTERMEDIATE

Storage > 1000 acre-ft
< 50000 acre-ft.

Height < 40'

Hazard Classification - SIGNIFICANT

Failure to Mountain Br. Dam implies serious damage to U.S. Route 202, an important secondary highway, the embankment of which is integrally connected to the dam.

Additionally, if the Contoocook R. is at a high stage prior to failure, flooding to commercial buildings (4 or 5) and homes (3 or 4) in Saltfrey would be increased by 1' to 1.5'.

The potential for loss of life is considered small.

Test Flood Selection

Per COE guidelines, an INTERMEDIATE dam with SIGNIFICANT hazard potential should use a 1/2 PMF to PMF Test Flood.

After failure

Breach outflow =

$$Q_{p1} = 8/27 \times 60 \times \sqrt{9} \times (13.7 - 6.8)^{3/2}$$

$$= 1830 \text{ cfs}$$

Total Outflow

$$Q_{tot} = 2330 + 1830 = 4160 \text{ cfs}$$

Flood depth in Jaffrey

$H = 8.4'$

Flood Depth = $\underline{\underline{1.4'}}$

Under the revised pre-failure conditions, failure to Mountain Brook would cause flood depths in Jaffrey to increase from zero to an estimated 1.4' depth. (Note that overtopping of the dam is not assumed prior to failure.)

After Failure

$Q = 9300 \Rightarrow H = 10.6' \Rightarrow 3.6'$ flooding

Under the pre-failure conditions assumed above, the dam failure adds only an estimated 1'+ increment of flooding above the 2.5' depth already existing.

A more "critical" case of dam failure might assume a high river stage in Jaffrey, but no flooding, prior to the dam break. This situation will be easy to back-figure.

Prior to failure

Stage at Jaffrey Dam = 7' above crest

$\Rightarrow Q_{river} = 2330$ cfs

$\Rightarrow$ Tailwater depth below Mountain Br Dam

T.W. = 6.8'

Outflow from dam

$$Q_{dam} = Q_{river} / \left(1 + \left(\frac{17}{14}\right)^{0.75}\right) = 1080 \text{ cfs}$$

$\Rightarrow$ Pool level

H = 5'

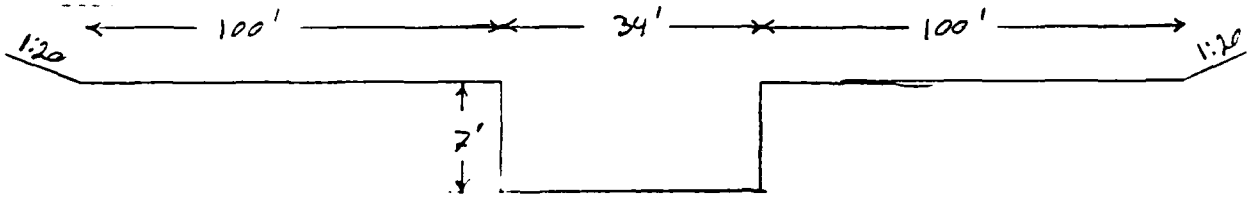
Depth = 8.7 + 5 = 13.7'

STAGE VS. DISCHARGE FOR JAFFREY DAM

HEAD (FEET)	DISCHARGE (CFS) TOTAL	SPILLWAY	EMBANKMENT
0.00	0	0	0
0.50	44	44	0
1.00	126	126	0
1.50	231	231	0
2.00	356	356	0
2.50	499	499	0
3.00	654	654	0
3.50	824	824	0
4.00	1006	1006	0
4.50	1201	1201	0
5.00	1406	1406	0
5.50	1623	1623	0
6.00	1849	1849	0
6.50	2085	2085	0
7.00	2330	2330	0
7.50	2804	2584	220
8.00	3489	2847	642
8.50	4337	3118	1219
9.00	5324	3987	1337
9.50	6475	3684	2791
10.00	7759	3978	3779
10.50	9181	4280	4901
11.00	10747	4590	6158
11.50	12456	4906	7550
12.00	14309	5229	9080
12.50	16309	5560	10749
13.00	18456	5897	12559
13.50	20753	6240	14513

Estimate Flood Depth in Jaffrey 1 mile d/s of Mountain Br. Dam

A schematic overflow section of the mill dam in Jaffrey is sketched below.



Spillway Overflow

$$Q_1 = 3.7 \times 34 \times H^{1.5} \quad \text{(Ogee weir)}$$

Flood Overflow in Street

$$Q_2 = 3.0 \times 200 \times (H-7)^{1.5} + 2 \times 3 \times (20(H-7)) \times (0.5(H-7))^{1.5}$$

A stage-discharge table is shown on the next page.

Prior to Failure

$Q = 6450 \Rightarrow H = 9.5' \Rightarrow 2.5'$ flooding of streets and buildings in Town

Estimate Flood Depth in Contoocook R. at Mountain Brook confluence

Based on normal flow channel rating table shown on page 12

Prior to Failure

$Q = 6450 \Rightarrow$ Depth $\cong 9'$

After Failure

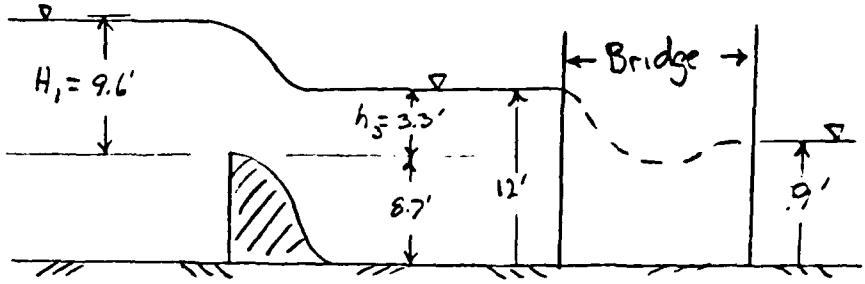
$Q = 9300 \Rightarrow$ Depth $\cong 10'$ to $10.5'$

This depth of flooding might do minor damage to the railroad bed at the right bank $10' \pm$ above the streambed

Attenuation Downstream

Over the first mile d/s of Mountain Br. Dam little attenuation of the dam failure flood wave can be expected. Channel storage of the $2' \pm$ high wave (~ 50 acre-ft.) would be negligible compared to the storage in the reservoir (~ 2050 acre-ft. above the tailwater level)

Check submergence effect on spillway u/s



$$h_3/H_1 = \frac{3.3}{9.6} = 0.34$$

⇒ Effect on spillway discharge is insignificant

(Based on Fig. 4.03, "Effect of weir geometry on submerged flow discharge coefficients" in H.E.C., Water Surface Profiles.)

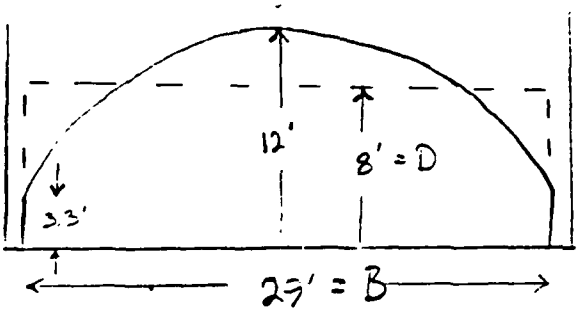
Prior to dam failure, the Route 202 bridge has no significant effect on outflow from Mountain Br. Dam

After dam failure

The gap assumed in the dam may include removal of the bridge or it may be to one side of the bridge. In either case, the bridge will have no effect on dam failure outflows.

Downstream Flooding (see Location Map on last page of this appendix)

Route 202 bridge 15' d/s of spillway



Prior to Dam Failure

$Q = 2990$ cfs

Assume bridge opening acts as an inlet control culvert and base calculation on an approximately equivalent opening (8'×29').

$Q = C_h B D \sqrt{2g(H - C_h D)}$ (Henderson, Open Channel Flow, p. 263)

$C_h = 0.6$

$B = 29'$

$D = 8'$

by trial $H = 12'$

$Q = 0.6 \times 29 \times 8 \sqrt{2g(12 - 0.6 \times 8)} = 2997$ cfs

Estimate Depth of flow u/s of bridge and d/s of spillway = 12' (Depth d/s of bridge and embankment assumed = 9')

$Q = 6450 \Rightarrow$ Tail Water Depth $\cong 9.0'$

Breach Outflow

$$Q_{pl} = 8/27 \times W_b \times \sqrt{g} \times Y_o^{3/2}$$

W_b = width of breach

$\leq 0.4 \times$ (width of dam at ½ height)

width at crest $\cong 265'$

estimate

width at ½ height $\cong 150'$

use $W_b = 0.4 \times 150 = 60'$

Y_o = pool depth − Tailwater depth

$= 18.3' - 9.0' = 9.3'$

$$Q_{pl} = 8/27 \times 60 \times \sqrt{3} \times 9.3^{1.5} = \underline{\underline{2860}}$$

Total Outflow in Contoocook Tc.

$$Q_{tot} = 6450 + 2860 = \underline{\underline{9300}} \text{ cfs}$$

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.5	16.1	34.6	0.5	9.7	15.8
1.0	1.0	34.5	39.2	0.9	31.7	51.7
1.5	1.5	55.1	43.8	1.3	64.2	104.8
2.0	2.0	78.0	48.4	1.6	107.2	174.9
2.5	2.5	103.1	53.1	1.9	160.7	262.2
3.0	3.0	130.5	57.7	2.3	225.0	367.3
3.5	3.5	160.1	62.3	2.6	300.6	490.7
4.0	4.0	192.9	66.9	2.9	387.9	633.2
4.5	4.5	226.1	71.5	3.2	487.4	795.5
5.0	5.0	262.5	76.1	3.4	599.5	978.5
5.5	5.5	401.7	281.2	1.4	508.6	830.2
6.0	6.0	542.5	286.3	1.9	830.9	1356.2
6.5	6.5	686.3	291.4	2.4	1215.0	1983.2
7.0	7.0	832.5	296.5	2.8	1657.4	2705.3
7.5	7.5	981.3	301.6	3.3	2155.3	3517.9
8.0	8.0	1132.5	306.7	3.7	2706.7	4417.9
8.5	8.5	1286.3	311.8	4.1	3310.0	5402.6
9.0	9.0	1442.5	316.9	4.6	3964.0	6470.0
9.5	9.5	1601.3	322.0	5.0	4667.6	7618.5
10.0	10.0	1762.5	327.1	5.4	5420.1	8846.7
10.5	10.5	1926.3	332.2	5.8	6220.7	10153.6
11.0	11.0	2092.5	337.3	6.2	7069.1	11539.3
11.5	11.5	2261.3	342.4	6.6	7964.7	13000.0
12.0	12.0	2432.5	347.5	7.0	8907.1	14538.3
12.5	12.5	2606.3	352.6	7.4	9896.1	16152.6
13.0	13.0	2782.5	357.7	7.8	10931.5	17842.6
13.5	13.5	2961.3	362.8	8.2	12013.1	19608.0
14.0	14.0	3142.5	367.9	8.5	13140.8	21448.6
14.5	14.5	3326.3	373.0	8.9	14314.5	23364.3

CHANNEL RATING CONTOOCOOK R. D/S OF MOUNTAIN BR. DAM

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
NH	99	NED	NH	005	02				MOUNTAIN BROOK DAM	4248.2	7201.8	09	OCT	79

POPULAR NAME	NAME OF IMPOUNDMENT
	MOUNTAIN BROOK RESERVOIR

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	MOUNTAIN BROOK	JAFFREY	1	3353

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)	DIST	OWN	FED H	PRV/FED	SCS A	VER/DATE
REPG	1948	R	19	14	2460	110	NED	N	N	N	N	

REMARKS

D/S HAS	SPILLWAY LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	265	U	30	2990												

OWNER	ENGINEERING BY	CONSTRUCTION BY
PETER VAN NYCK	JAMES E YOUNG CIVIL ENGR	

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NHWRB	NHWRB	NHWRB	NHWRB

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
GOLDBERG ZOINO DUNNICLIFF & ASSOC	22	AUG	79	PL92-367

REMARKS

END

FILMED

8-85

DTIC