

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

AD-A156 412

PISCATAQUA RIVER BASIN FARMINGTON, NEW HAMPSHIRE

BERRY BROOK DAM
NH 00313

STATE NO 83.06

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM





DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

DECEMBER 1979

The release Unlimited #

85 06 17 020

OTIC FILE COPY

DISCLAIMER NOTICE

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

SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM	
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER	
NH 00313			
Berry Brook Dam		S. TYPE OF REPORT & PERIOD COVERED	
		INSPECTION REPORT	
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		6. PERFORMING ORG, REPORT NUMBER	
7. AUTHOR(a)		S. CONTRACT OR GRANT NUMBER(*)	
U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION			
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE	
DEPT. OF THE ARMY, CORPS OF ENGINEERS		December 1979	
NEW ENGLAND DIVISION, NEDED		13. NUMBER OF PAGES	
424 TRAPELO ROAD, WALTHAM, MA. 0225		47	
14. MONITORING AGENCY NAME & ADDRESS(If ditteren	I from Controlling Office)	18. SEGURITY CLASS, (of this report)	
		UNCLASSIFIED	
		184. DECLASSIFICATION/DOWNGRADING	

6. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the obstract entered in Black 20, If different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

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

DAMS, INSPECTION, DAM SAFETY,

Piscataqua River Basin Farmington, New Hampshire Berrys River

20 ABSTRACT (Continue on reverse side il necessary and identity by block number)

The dam is a concrete gravity dam with a hydraulic height of 24 ft. and in 269 ft. long. The dam is in fair condition. There are a few concerns which should be remedied. It is small in size with a significant hazard potential. A major breach at top of dam would probably result in no loss of lives but could cause appreciable property damage.

DEPARTMENT OF THE ARMY

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

NEÕED

APR 18 1888

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 Berry 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, the city of Rochester.

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,

Incl As stated

Colonel, Corps of Engineers

Division Engineer

NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT

Identification No.: NH00313

Name of Dam: Berry Brook Dam

Town: Farmington

County and State: Strafford, New Hampshire

Stream: Berrys River
Date of Inspection: October 25, 1979

BRIEF ASSESSMENT

Berry Brook Dam is a concrete gravity dam with a hydraulic height of 24 feet and totaling 269 feet in length. The spillway is 128 feet long, 2 feet wide at crest, with a sloping (lH:lV) downstream face. A gatehouse is located atop the east spillway abutment and houses the operating mechanisms for a 14-inch high-level outlet pipe and a 24-inch low-level outlet pipe. A dike, with a concrete core wall 43 feet in length, is located 150 feet west of the west abutment of the dam. The dam impounds a reservoir with a maximum storage capacity of about 200 acre-feet. The reservoir is 0.25 mile in length with a surface area of about 15 acres, and is an upstream regulating reservoir for use in the water supply system for the City of Rochester. The dam is located centrally near the eastern boundary of the State of New Hampshire.

The dam is in fair condition. Concerns are the spalling and erosion of the downstream face and construction joint of the training wall at the east end and the construction joint of the concrete spillway, the large birch tree growing out of the retaining wall on the east bank, and the overhanging trees and brush in the downstream channel.

Based on small size and significant hazard classification the allowable range for the test flood is from the 100-year to \$\frac{1}{2}\$ Probable Maximum Flood (PMF) in accordance with the Recommended Guidelines for Safety Inspection of Dams. The test flood selected is \$\frac{1}{2}\$ PMF. The watershed is moderately to steeply sloping and wooded with numerous small storage areas present. The test flood inflow was determined to be 775 cfs. Routing of this inflow to determine the modifying effects of surcharge storage resulted in an insignificant reduction. The routed test flood outflow for Berry Brook Dam, having a drainage area of 3.1 square miles, was determined to be 775 cfs (250 csm) at elevation 478.6' NGVD. Spillway capacity at top of dam is 1255 cfs which is 162 percent of the routed test flood outflow. A major breach at top of dam would probably not result in the loss of any lives but could cause appreciable property damage.

The owner, City of Rochester, should implement the results of the recommendation and remedial measures given in Sections 7.2 and 7.3 within one year after receipt of this Phase I Inspection Report.

Warren A. Guinan
Project Manager
N.H. P.E. 2339

This Phase I Inspection Report on Berry 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 judgment and practice, and is hereby submitted for approval.

Chroman attach

ARAMAST MAHTESIAN, MEMBER Geotechnical Engineering Branch Engineering Division

Carney M. Tazion

CARNEY M. TERZIAN, MEMBER Design Branch Engineering Division

RICHARD DIBUONO, CHAIRMAN

Water Control Branch Engineering Division Accession For

NTIS GRA&I
DTIC T'B
Unan neumond
Justification

By
Distribution/
Availability Codes

Avail and/or
Dist Special



APPROVAL RECOMMENDED:

DE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under quidance 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.

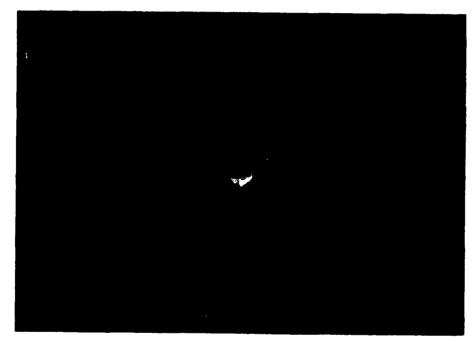
In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving 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 there be any chance that unsafe conditions be detected.

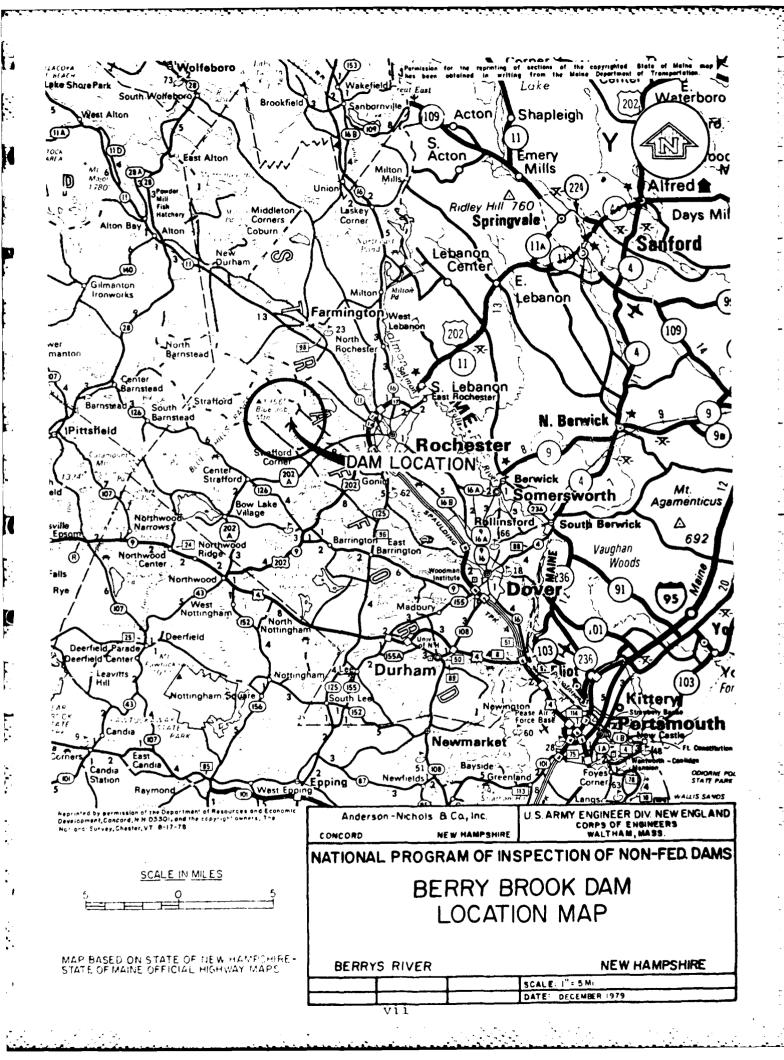
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because 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.

TABLE OF CONTENTS

Title	Page
LETTER OF TRANSMITTAL BRIEF ASSESSMENT. REVIEW BOARD PAGE. PREFACE. TABLE OF CONTENTS. OVERVIEW PHOTO. LOCATION MAP.	iv v vi vii
REPORT	
Section	
1 PROJECT INFORMATION. 1.1 General	2-1 3-1 3-2 4-1 4-1 4-1 4-1 5-1 5-1 6-1 7-1 7-1
7.3 Remedial Measures	7-1 7-2
APPENDICES	
Designa VISUAL INSPECTION CHECKLIST	A B C D



October 1979 Figure 1 - Overview of Berry Brook Dam.



NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT BERRY 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 supervising the inspection of dams within the New England Region. Anderson-Nichols & Company, Inc. 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 Anderson-Nichols under a letter of March 22, 1979 from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0050, as changed, has been assigned by the Corps of Engineers for this work.

b. Purpose

- (1) To 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) To encourage and prepare the States to initiate quickly effective dam safety programs for non-Federal dams.
- (3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

- a. Location. Berry Brook Dam is located in the Town of Farmington, New Hampshire and impounds a reservoir of a small size on Berry's River. After discharging at damsite, Berry's River flows into Rochester Reservoir 3.1 miles downstream of the dam. Howard Brook flows out of the Rochester Reservoir and converges with Rickers Brook 1.7 miles downstream to form Axe Handle Brook. Axe Handle Brook flows 2.2 miles to its confluence with the Cocheco River, a major tributary in the Piscataqua River Basin. The dam is shown on U.S.G.S. 15-Minute Quadrangle, Alton, New Hampshire, with coordinates approximately at N 43° 18' 56", W 71° 04' 56", Strafford County, New Hampshire. (See Location Map page vii.)
- b. Description of Dam and Appurtenances. Berry Brook Dam is a concrete gravity dam, with a hydraulic height of 24 feet, and totaling about 269 feet in length. The east abutment of the dam consists of a concrete wall 2.2 feet in width and about 102 feet in length. This wall extends east 42 feet to a change

in alignment and then extends northeast 60 feet. A 12-foot gatehouse is constructed on the east spillway abutment. This gatehouse contains the operating facilities for a 24-inch low-level outlet pipe and a 14-inch high level outlet pipe. A concrete retaining wall extends downstream of the gatehouse and contains the high and low-level outlet pipes. The east abutment ties into a graveled roadway which runs perpendicular to the dam. The spillway is concrete gravity, 128 feet in length, with a sloping downstream face (lH:lV). The west spillway abutment is 39 feet in length, 2.2 feet wide, and ties into natural ground.

A dike is located 150 feet west of the dam. The dike is 43 feet long and has a 1-foot wide concrete core wall along its entire length. The crest elevation is 2.2 feet above the spillway crest. The dike itself is about 3 feet in height. The upstream and downstream slopes are 3H:1V.

- c. Size Classification. Small (hydraulic height 24 feet; storage 200 acre-feet) based on storage (≥ 50 to ≤ 1000 acre-feet) as given in the Recommended Guidelines for Safety Inspection of Dams.
- d. <u>Hazard Classification</u>. Significant hazard. A breach at top of dam would probably not result in loss of life, but could cause appreciable property damage. The loss of this reservoir would result in the loss of the upstream regulating reservoir for use in the water supply for the City of Rochester and would therefore interrupt the services of a public utility. (See Section 5.1 f.)
- e. Ownership. The dam was built in 1930 by the Rochester Water Works within the City of Rochester's Public Works Division for the purpose of creating an upstream regulating reservoir for use in the water supply. It is presently owned by the City of Rochester and administered by the Public Works Division.
- f. Operator. The current operator of the dam is the Rochester Public Water Works Division, Rochester, New Hampshire 03867. Phone: (603) 332-4096.
- g. <u>Purpose of Dam</u>. The dam was built to provide a regulating reservoir for use in water supply to the City of Rochester, New Hampshire.
- h. Design and Construction History. Two sheets of plans were found for Berry Brook Dam. One was entitled "Plan of Proposed Dam on Berry Brook" to be constructed by Rochester Water Works, designed by G.D. Dame, Engineers, 1930. These were the design plans for the dam. The other plan entitled "Plan of Dam on Berry Brook" drawn by the same engineer and dated 1930 is a plan of the dam as constructed. Construction was performed by the Rochester Water Works. No construction records were disclosed.

i. Normal Operating Procedures. Two outlet pipes, one 14-inch and one 24-inch were noted by visual inspection. According to Rochester's Public Works Division only the 24-inch pipe is operated for the water supply. When the water behind the dam falls below the 24-inch pipe level the outlet is closed. When the water level rises above the outlet elevation it is reopened. This pipe discharges water into the downstream channel which empties into the Rochester Reservoir. No formal or written maintenance program was disclosed. However, the dam is visited often and conditions are checked. Maintenance is performed on an as needed basis.

1.3 Pertinent Data

a. Drainage Area. The drainage area consists of 3.1 square miles (1984 acres) of moderately to steeply sloping mostly forested terrain. The normal pool has a surface area of 15 acres which constitutes less than 1 percent of the watershed. Numerous storage areas, including the largest, Oxbow Pond, are present in the upstream watershed.

b. Discharge at Damsite.

- (1) Outlet works (conduits) one 14-inch pipe @ invert elevation 462.1' NGVD; discharge capacity at spillway crest 26 cfs @ 477.0' NGVD. One 24-inch pipe @ invert elevation 455.6' NGVD; discharge capacity at spillway crest 90 cfs @ 477.0' NGVD.
 - (2) The maximum discharge at the damsite is unknown.
- (3) Ungated spillway capacity at top of dam 1255 cfs @479.2' NGVD
- (4) Ungated spillway capacity at test flood elevation 775 cfs @ 478.6' NGVD
- (5) Gated spillway capacity at top of dam not applicable
- (6) Gated spillway capacity at test flood elevation not applicable
- (7) Total spillway capacity at test flood elevation 775 cfs @ 478.6' NGVD
- (8) Total project discharge at test flood elevation 775 cfs @ 478.6' NGVD
- c. Elevation (ft. above NGVD of 1929; formerly called Mean Sea Level (MSL); see (6) below).
- (1) Streambed at centerline of dam 455.6 (downstream invert low-level outlet)

- (2) Maximum tailwater unknown
- (3) Upstream gate inverts unknown
- (4) Recreation pool not applicable
- (5) Full flood control pool not applicable
- (6) Spillway crest 477.0 (estimated from USGS Quadrangle)
 - (7) Original design surcharge unknown
 - (8) Top of dam 479.2 (dike crest elevation)
 - (9) Test flood pool 478.6
 - d. Reservoir Length (miles)
 - (1) Maximum pool .30
 - (2) Spillway crest pool .25
 - (3) Flood control pool not applicable
 - e. Storage (acre-feet)
 - (1) Recreation pool not appliable
 - (2) Flood control pool not applicable
 - (3) Spillway crest pool 160
 - (4) Top of dam 200
 - (5) Test flood pool 190
 - f. Reservoir Surface Area (acres)
 - (1) Recreation pool not applicable
 - (2) Flood control pool not applicable
 - (3) Spillway crest 15
 - (4) Test flood pool 20 (estimated)
 - (5) Top of dam 22 (estimated)
 - g. Dam
 - (1) Type concrete gravity dam

- (2) Length 269'
- (3) Height 24' (structural)
- (4) Topwidth 2.2 (concrete abutments)
- (5) Side slopes upstream, vertical; downstream, sloping.
 - (6) Zoning unknown
 - (7) Impervious core unknown
 - (8) Cutoff unknown
 - (9) Grout curtain unknown

i. Spillway

- (1) Type concrete gravity spillway with a sloping downstream face (1H:1V).
 - (2) Length of weir 128'
 - (3) Crest elevation 477.0' NGVD (See 1.3 c (6) above)
 - (4) Gates none
- (5) U/S Channel Berry's River. No structures are located on the reservoir slope. The banks are heavily wooded. The eastern side of the lake is paralleled by a gravelled road for 0.1 of a mile.
- (6) D/S Channel Immediately below the spillway the channel is about 6 feet wide with a rocky bottom and heavily wooded overbanks. A small wooden bridge is located about 100 feet downstream of the dam. A stone box culvert is located about 300 feet downstream of the dam and carries a gravel road. Downstream of this road crossing is a large swampy area which extends to the State Route 202A crossing that is located 2 miles downstream of the dam.
- j. Regulating Outlets. Two outlet pipes, one 14" with an invert elevation 462.1' NGVD and one 24" with an invert elevation 455.6' NGVD are located below the gatehouse on the east abutment of the dam. The mechanical operating facilities for these pipes are located above the openings. Each pipe has its own mechanical operating mechanism.

SECTION 2 ENGINEERING DATA

2.1 Design

Two sheets of plans were found for Berry Brook Dam. One was entitled "Plan of Proposed Dam on Berry Brook" to be constructed by Rochester Water Works, designed by G.D. Dame, Engineers, 1930. These were the design plans for the dam. The other plan entitled "Plan of Dam on Berry Brook" drawn by the same engineer and dated 1930 is a plan of the dam as constructed. No construction records were disclosed. Blueline copies are on file in the New Hampshire Water Resources Board (NHWRB).

2.2 Construction

No records of construction were disclosed.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

- a. Availability. A search of the files of the New Hampshire Water Resources Board and direct contact with the owner revealed a limited amount of recorded engineering information.
- b. Adequacy. The final assessments and recommendations of this investigation are based primarily on visual inspection, the hydrologic and hydraulic calculations and the plans in NHWRB files.
- c. Validity. The structure, as seen at the time of the visual inspection, is generally consistent with the 1930 as-built plans by the G.D. Dame, Engineers.

SECTION 3 VISUAL INSPECTION

3.1 Findings

- a. General. Berry Brook Dam impounds a reservoir of small size. The watershed above the reservoir is moderately to steeply sloping and heavily wooded. The downstream area is flat to moderately sloping and heavily wooded.
- b. Dam. Berry Brook Dam is a concrete gravity dam with a hydraulic height of 24 feet, 269 feet long, and 2.2 feet wide at the crest of the abutments. (See Appendix C figure 2.) Earthfill has been placed against the upstream and downstream sides of the concrete gravity section between the east end of the overflow section and the east abutment. (See Appendix C Figure 3.) The earthfill is covered with grass which has been mowed. One large pine tree is growing in this fill near the east abutment. (See Appendix C Figure 2.) A number of small trees are growing on the west abutment. (See Appendix C Figure 4.) No evidence of seepage through the abutments was observed. A gravelled roadway runs perpendicular to the dam east of the east abutment. (See Appendix C Figure 5.)

Available records indicate that the dam is founded on "ledge". Extensive bedrock exposures in the west bank of the discharge channel immediately downstream of the dam are consistent with these records. (See Appendix C - Figure 6.) Water was discharging over the overflow section of the dam at the time of the inspection and, consequently, it was not possible to observe whether any leakage was taking place through the foundation of the dam. The report of an inspection made on 7/31/50 indicates that "minor seepage under spillway on ledge foundation" was occurring at that time.

A dike is located 150 feet west of the west abutment. (See Appendix C - Figure 7.) The crest consists of a one foot wide concrete wall. The upstream and downstream slopes are earth and slope at 3H:1V.

c. Appurtenant Structures.

(1) The concrete spillway, 128 feet long and 2 feet wide at the crest, is surface eroded with minor erosion at the vertical construction joints to a depth of approximately one-half inch. With the water flowing over the crest it was not possible to inspect the downstream face of the weir. Considerable debris has collected on the crest of the spillway. (See Appendix C - Figure 2.)

The downstream face of the east training wall has considerable surface spalling and efflorescence. (See Appendix C - Figure 8.) The construction joint at the break in the wall is eroded to a depth of approximately 3 inches. Also, three areas on the face are seeping and were wet at the time of the inspection. The joint material in the construction joint was observed to be deteriorated and eroded.

- (2) The control tower, which is constructed integrally with the concrete dam and spillway, was observed to be in good condition. Only minor surface spalling was observed on top of the concrete walls. The wooden building, which houses the gate operating equipment, was observed to be weathered on the exterior with no indication of structural deterioration. The gate operating mechanism could not be inspected because the gatehouse was locked.
- (3) The downstream outlet structure walls were observed to be in good condition except for some minor spalling of the concrete face at the construction joint approximately 6 feet down from the top. (See Appendix C Figure 8.) The two outlet pipes could not be inspected because of the limited accessibility. A large birch tree is growing out of the fieldstone retaining wall on the east bank of the channel immediately downstream of the gatehouse. (See Appendix C Figure 9.)
- (4) The exposed portion of the dike core wall was observed to be in good condition with no indication of deterioration or movement.
- d. Reservoir Area. The watershed above the reservoir is moderately to steeply sloping and is heavily wooded. (See Appendix C Figure 10). No structures were observed on the shore of the reservoir. No evidence of significant sedimentation was observed.
- e. <u>Downstream Channel</u>. Two logs were lodged in the channel at the base of the overflow section of the dam. Trees overhang the downstream channel. (See Appendix C Figure 9.)

3.2 Evaluation

Based on the visual inspection Berry Brook Dam is in fair condition.

- a. The large birch tree growing out of the retaining wall on the east bank of the discharge channel immediately downstream of the gatehouse could blow over and cause the retaining wall to fail.
- b. The spalling and erosion of the downstream face and construction joint of the east training wall will continue to worsen if not corrected and could affect the stability of the dam in the future.

- c. The spalling and erosion of the concrete spillway construction joints could eventually effect the stability of the dam as the erosion worsens, if not corrected.
- d. Trees overhanging the discharge channel may blow over into the channel or drop over into the channel as a result of erosion during periods of large discharges from the reservoir. These trees then will cause temporary damming of the channel or they may plug the bridges downstream.

SECTION 4 OPERATIONAL PROCEDURES

4.1 Procedures

No written procedures exist for Berry Brook Dam. In contacting the Public Works Division of Rochester the following "procedures" were noted. In the spring season while the lake stage is near the crest elevation the 24" outlet pipe is opened. During the winter months the lake stage drops to a very low level and the outlet is closed until spring runoff raises the reservoir again.

4.2 Maintenance of Dam

The Public Works Division of the City of Rochester is responsible for the maintenance of the dam. Maintenance is on an as needed basis.

4.3 Maintenance of Operating Facilities

Maintenance is on an as needed basis.

4.4 Description of Any Warning System in Effect

No warning system exists for the dam.

4.5 Evaluation

The present operational and maintenance procedures are adequate to ensure that minor problems encountered are remedied within a reasonable amount of time. Reliance on oral instructions for maintenance and operations is not altogether satisfactory. Written procedures should be drawn up and utilized.

SECTION 5 HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

- a. General. Berry Brook Dam is a concrete gravity dam which impounds a reservoir of small size. The total length of the dam is 269 feet with a hydraulic height of 24 feet. East of the east end of the dam is a gravelled road. The east abutment is 101 feet in length with a change in alignment after 60 feet. The 12-foot gatehouse is built on the edge of the east spillway abutment. The spillway is 128 feet in length with a sloping downstream face. The west abutment is 39 feet long and is built into sloping natural ground. The watershed above the reservoir is moderate to steeply sloping and heavily wooded. Numerous small storage areas are present in the upstream watershed.
- b. Design Data. Plan of proposed dam designed by G.D. Dame, Engineers, 1930 was found. Another plan by same engineer was found of Berry Brook Dam as constructed by Rochester Water Works dated 1930.
- c. Experience Data. The Public Works Division of Rochester reported a high water level of 6 inches above the spillway. No other hydrologic or hydraulic data were obtained.
- d. <u>Visual Observations</u>. At the time of inspection, no visual evidence of damage to the dam caused by excessive discharges were noted.
- e. Test Flood Analysis. Berry Brook Dam is classified as being small in size having a hydraulic height of 24 feet and a maximum storage capacity of 200 acre-feet. The dam was determined to have a significant hazard classification. Using the Recommended Guidelines for Safety Inspection of Dams, the test flood ranges from the 100-year to 5 the Probable Maximum Flood (PMF).

Because the dam's size is in the lower range of the small size classification and there would probably be no loss of life with a breach of the dam, the test flood was chosen to be & PMF.

an calculating a CSM value for this 3.1 square mile drainage area, several upstream storage areas were taken into account. Based on the drainage area noted in 5.1 a. above and the guide curves, a point between "flat and coastal" and "rolling" was used to compute a PME CSM value of 1000. This resulted in a test flood inflow of 775 cts. Routing of this inflow to determine the modifying effects of surcharge storage resulted in an insignificant reduction. Therefore, the routed test flood outflow was determined to be 775 cts at elevation 478.6' NGVD. The test flood analysis indicates the spillway could pass this flow without causing overtopping of the dam. During the test flood, the depth over the spillway would be 1.6 feet.

f. Dam Failure Analysis. The impact of failure of the dam with the reservoir level at the top of dam was assessed using the Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to the State Route 202A bridge crossing, a distance of about 2 miles because of the conditions downstream as described in the following paragraph.

A breach of Berry Brook Dam would cause an increase in stage of 8 feet in addition to the 7-foot tailwater stage. The gravel road crossing, located 300 feet downstream of the dam, would be overtopped along its lowest point to a depth of about 8.2 feet. Some damage may result to this roadway hindering its use as an access road. A large swampy area downstream of this crossing, extending to the State Route 202A crossing would attenuate any further effects of a breach.

This reservoir is utilized as the upstream regulating reservoir for use in the Rochester Water Supply System. The Rochester Reservoir is located 3.1 miles downstream. Therefore, loss of Berry Brook Dam may pose a hazard to a public utility and was classified Significant Hazard.

SECTION 6 STRUCTURAL STABILITY

6.1 Visual Observations

The visual examination indicates the following potential structural problems:

- a. A large birch tree is growing out of the retaining wall on the east bank of the discharge channel immediately downstream of the gatehouse. If the tree blows over, it could cause the retaining wall to fail.
- b. The spalling and erosion of the downstream face and construction joint of the east training wall will continue to worsen if not corrected and could affect the stability of the dam in the future.
- c. The spalling and erosion of the concrete spillway construction joints could eventually effect the stability of the dam as the erosion worsens, if not corrected.
- d. Trees overhanging the discharge channel may blow over into the channel or drop over into the channel as a result of erosion during periods of large discharges from the reservoir. These trees then will cause temporary damming of the channel or they may plug the bridges downstream.

Because water was flowing over the overflow section of the dam at the time of the inspection it was not possible to determine whether any water was leaking through the foundation of the dam. The report of an inspection made on 7/31/50 indicates that minor seepage under the dam was occurring at that time.

6.2 Design and Construction Data

An inventory report dated 7/24/35 indicates that the dam is founded on "ledge".

6.3 Operating Records

No operating records pertinent to the structural stability of the dam are available.

6.4 Post-Construction Changes

No record of post-construction changes is available.

6.5 Seismic Stability

This dam is located in Seismic Zone 2 and, in accordance with the Phase I quidelines, does not warrant seismic analysis.

SECTION 7 ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. <u>Condition</u>. The visual examination indicates that Berry Brook Dam is in fair condition. The major concerns with respect to the condition of the dam, if left uncorrected, are:
- (1) A birch tree growing out of the fieldstone retaining wall on the east bank of the discharge channel immediately downstream of the gatehouse.
- (2) Spalling and erosion of the downstream face and construction joint at the east training wall.
- (3) Surface erosion of the downstream face of the concrete spillway.
- (4) Trees overhanging the discharge channel may blow over into the channel or drop over into the channel as a result of erosion during periods of large discharges from the reservoir. These trees then will cause temporary damming of the channel or they may plug the bridges downstream.
- b. Adequacy of Information. The information available is such that the assessment of this dam must be based primarily on the results of the visual inspection.
- c. Urgency. The owner should implement the recommendations in 7.2 and 7.3 within one year after receipt of this Phase I report.
- d. Need for Additional Investigation. The information available from the visual inspection is adequate to identify the potential problems which are listed in 7.2 a below. These problems require the attention of a professional engineer experienced in the design and construction of dams who will have to make additional engineering studies to design or specify remedial measures to rectify the problems.

7.2 Recommendations

The owner should retain the services of a registered professional engineer to:

- (1) Design repairs for the spalling and erosion of the downstream face of the east training wall.
- (2) Inspect the concrete spillway face when no water is flowing over the crest and design repairs to correct the erosion of the concrete spillway face.

7.3 Remedial Measures

a. Operating and Maintenance Procedures. The owner should:

- (1) Maintain clear of trees and brush an area within 25 feet of the downstream toe of the dam and a zone 25 feet wide on both sides of the downstream channel for a distance of 100 feet downstream from the dam.
- (2) Repair the joint sealant material in the vertical construction joint in the east training wall.
 - (3) Ensure the operability of the low-level outlet.
 - (4) Check the condition of the gate machinery.
 - (5) Remove debris from the spillway crest.
- (6) Inspect for seepage beneath spillway during no flow and monitor if necessary.
- (7) Visually inspect the dam and appurtenant structures once a month.
- (8) Engage a professional engineer experienced in the design and construction of dams to make a comprehensive technical inspection of the dam once every year.
- (9) Establish a surveillance program for use during and immediately after heavy rainfall and also a downstream warning program to follow in case of emergency conditions.

7.4 Alternatives

None recommended.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST PARTY ORGANIZATION

1

PROJECT Berry Brook Dam, N.H.	
	TIME 11 AM
	WEATHER Clear, cool
	W.S. ELEV. U.S. DN.S. 477.1 457.1
· 基础的图片	(1000)
· ' Alinan (AHCo)	6. Kenneth Stern (NHWRB)
3 Stephen Bilman (ANCo)	7. Ronald Hirschfeld (GEI)
hesine Williams (ANCo)	8
4. Terri Sapp (ANCo)	9
5. Mehdi Miremadi (ANCo)	10
PROJECT FEATURE	INSPECTED BY REMARKS
l. Hydrology/Hydraulics	L. Williams/T. Sapp
	S. Gilman
Soils and Geology	R. Hirschfeld
4	
<u> </u>	
y	
10	

PERIODIC INSPECTION CHECKLIST ______DATE__October 25, 1979 Berry Brook Dam, N.H. Dam Embankment PROJECT FEATURE ____ ___ NAME ____ DISCIPLINE _____ ____ NAME _____ AREA EVALUATED CONDITION DAM EMBANKMENT Embankment on both sides of concrete section between east end of overflow section Crest Elevation and east abutment. Current Pool Elevation Maximum Impoundment to Date None observed. Surface Cracks Pavement Condition Not paved. Movement or Settlement of None observed. Crest None observed. Lateral Movement Vertical Alignment Good. Horizontal Alignment Good. Condition at Abutment and Good. at Concrete Structures Indications of Movement of None observed. Structural Items on Slopes None observed. Trespassing on Slopes Sloughing or Erosion of None observed. Slopes or Abutments No riprap. Rock Slope Protection -Riprap Failures Unusual Movement or Cracking None observed. at or Near Toe Unusual Embankment or Down-None observed. stream Seepage None observed. Piping or Boils Foundation Drainage Features None observed. Toe Drains None observed. Instrumentation System None observed. Vegetation One tree near east abutment.

PERIODIC INSPEC	CTION CHECKLIST	
PROJECT BERRY BROOK DAM, N.H	. DATE October 25, 1979	
PROJECT FEATURE Dike Embankment	NAME	
DISCIPLINE	NAME	
AREA EVALUATED	CONDITION	
DIKE EMBANKMENT		
Crest Elevation - 479.2' MSL	Dike has concrete core wall with earth embankment on both sides.	
Current Pool Elevation-477.1' M	SL	
School and Ispain dent to Date	Unknown•	
Surrace: Cracks	None observed.	
Pavement Condition	Not paved.	
Movement or Settlement of Orest	None observed.	
Lateral Movement	None observed.	
Vertical Alignment	Good.	
Horizontal Alignment	Good.	
Condition at Abutment and at Concrete Structures	Good.	
Indications of Movement of Structural Items on Slopes	None observed.	
Trespassing on Slopes	None observed.	
Sloughing or Erosion of Slopes or Abutments	None observed.	
Rock Slope Protection - Riprap Failures	No riprap.	
Unusual Movement or Cracking at or Near Toes	None observed.	
Unusual Embankment or Down- stream Seepage	None observed.	
Cipina or Boils	None observed.	
Foundation Drainage Features	None observed.	
Two Drains	None observed.	
Instrumentation System	None observed.	
Verpetation	Small trees growing on upstream side o core wall. Large trees growing in chadownstream of dike.	

PERIODIC INSPECTION CHECKLIST PROJECT Berry Brook Dam, N.H. DATE October 25, 1979 PROJECT FEATURE Outlet Structure NAME DISCIPLINE NAME AREA EVALUATED CONDITION OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL General Condition of Concrete Good condition. None visible Rust or Staining One chunk, and downstream end of concrete Spalling wall. None observed. Erosion or Cavitation None visible. Visible Reinforcing None visible. Any Seepage or Efflorescence Condition at Joints Good. None. Drain holes Channel Trees overhanging channel. Fieldstone Loose Rock or Trees retaining wall on left bank of channel Overhanging Channel immediately downstream of gatehouse. Condition of Discharge Good. Channel

PERIODIC INSPECTION CHECKLIST PROJECT Berry Brook Dam, N.H. PROJECT FEATURE Spillway Weir NAME DISCIPLINE ______NAME_____ AREA EVALUATED CONDITTON OUTLET WORKS - SEILLMAY WEIR, APPROACH AND DISCHABLE CHAINELS a. Approach Channel Good. General Condition None. Loose Rock Overhanging Channel Trees Overhanging Channel None. Floor of Approach Channel Not visible beneath reservoir surface. b. Weir and Training Walls Fair. General Condition of Concrete Only at embedded steel items Rust or Staining Minor spalling of surface 1/2"+ deep exposing Spalling coarse aggregate of weir and downstream face. Vertical construction joints spalled and Any Visible Reinforcing eroded to 3½ deep maximum. Spalling on several areas on training wall to 1" deep. Any Seepage or Efflorescence Three areas on downstream face of east training wall exhibit seepage & efflorescence. Drain Holes None visible. c. Discharge Channel General Condition Good. Fieldstone retaining wall on left bank of Loose Rock Overhanging Channel channel immediately downstream of gatehouse. Prees Overhanging Channel Some trees overhanging. Floor of Channel Boulders. Other Costructions None.

PERIODIC INSPECTION CHECKLIST PROJECT Berry Brook Dam, N.H. DATE October 25, 1979 Control Tower PROJECT FEATURE ____ ___ NAME __ DISCIPLINE __ NAME ___ AREA EVALUATED CONDITION OUTLET WORKS - CONTROL TOWER Part of concrete dam and spillway. Concrete and Structural Good. General Condition Condition of Joints Good, no indication of movement. Spalling A little surface spalling on top of concrete. Walls are good. Visible Reinforcing None. Rusting or Staining of Concrete Any Seepage or Efflorescence None visible. Joint Alignment Unusual Seepage or Leaks in Not open for inspection. Gate Chamber Cracks Rusting or Corrosion of Steel Mechanical and Electrical Air Vents Float Wells Crane Hoist Elevator Hydraulic System Service Gates Emergency Gates Lightning Protection System Emergency Power System Wiring and Lighting System

PROJECT Berry Brook Dam	DATE october 25, 1979
PROJECT FEATURE Reservoir	
AREA EVALUATED	REMARKS
Stability of Shoreline	Good.
Gedimentation	Not visible.
Changes in Watershed Runoff Potential	None.
Jpstream Hazards	None.
Downstream Hazards	Dirt road 300 feet downstream of the dam.
Alert Facilities	None posted.
Hydrometeorological Gages	None.
Operational & Maintenance Regulations	None posted.
•	

APPENDIX B

10

ENGINEERING DATA



State of Few Hampshire

WATER RESOURCES BOARD

37 Pleasant Street Concord, N.H. 03301

February 14, 1978

Rochester Water Board Rochester, NH 03867

Gentlemen:

Mach. The provisions of RSA Chapter 482, Sections 8 through 15, copy enclosed, on December 2, 1977 an Engineer of the Water Resources Board inspected your dam in Farmington. This dam, #83.06, is classified in the files of this office as a menace structure and as such must be maintained in a manuer not to endanger public safety nor become a dam in disrepair.

As a rusult of this inspection it was noted that several items of mainsandars are in need of attention.

- 1. To keep the spillway clear of trees and debris.
- 2. To check for any possible leaks on the downstream side of spillway during the summer and report it to this office.

If you have any questions, please contact us at your convenience.

Very truly yours,

rge me Lie Ir-

SMAU: PDK: njk

Ear.

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town:	tarming for Dam Number: 83.06
Name of Dam,	Stream and/or Water Body: Berry's River Excluster Water Board Telephone Number:
Owner:	Eccluster Water Board Telephone Number:
Mailing Addr	ess: Parlacient
Max. Height	of Dam: 27.5 Pond Area: 22.75 acros Length of Dam: 265
FOUNDATION:	correct on ledge
OUTLET WORKS	
	Gate Sections Water Supply for Rochester
	Water Suffy for Rochester
•	
-	
•	
ABUTMENTS:	Concrete
_	
-	
_	
EMBANKMENT:	Earth
~	
-	
-	B-2

Note: Give Sizing, Condition and detailed description for each item, if applicable.

SPILLWAY: Length: 124	Freeboard: 2.5
SEEPAGE: Location, estimated qu	
•	None

Changes Since Construction or Las	
	Non-
Tail Water Conditions:	
	Fair
Overall Condition of Dam:	great
Contact With Owner:	No
Date of Inspection:	Suggested Reinspection Date 1972
Class of Dam: Menace	Suggested Reinspection Date 1972
	Signature
	Date 19/2/77

COMMENTS:			Water	ے ر	about	5.11	over	Sprillway
	Can	mor	in 51	sect	an	<u>~</u>	leaks	v
	w	tre	foot	0}	the	36	illuray	
بالمنطقية بالأدام ويدام فياس ولد درد والكلوبيية بو						0	<i>Q</i>	
generating a more than a both a six sound fill a graduate								
andreas and the control of the contr								
-								
	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·				· · · · · · · · · · · · · · · · · · ·	
			····					
								
								
								
								
			······································					······································
						·		
<u> </u>								·
								······································
								
yer serverses (100 -100 et a sepagne et tota a serving servina baseguage								
The second section of the second section section of the second section								

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town:	taring for pom Number: 83.06
Name of Dam,	Stream and/or Water Body: Binand River
	Probater Water Board Telephone Number:
Mailing Addr	ess: <u>Pochester</u>
Max. Height	of Dam: 27.5 Pond Area: 22.75 ocusLength of Dam: 265
FOUNDATION:	convicte on ledge
OUTLET WORKS	: Gale Section Water Supply for Rochester
<u> </u>	Concrete
TMANTEN EX	Earth
	1;-5

NEW HAMPSHIRE WATER CONTROL COMMISSION

REPORT ON DAM INSPECTION

TOWN Far	mington	DAM NO.	83.06 STREAM	Branch Ree	rys River
City of Ru	cheeser unter De	et. AD	DRESS <u>Racla</u>	ester, N.t.	1
	cordance with Section by me on				
NOTES ON PI	HYSICAL CONDITION	no d	-		· · · · · · · · · · · · · · · · · · ·
Spilly	way ledge found	d - min	r selpag	urler s	ps//way or
Gates		able			
Other					
CHANGES SI	NCE LAST INSPECTION	Non	L		
FUTURE INSE	PECTIONS	1/25			
This o	dam (is) (is not) a	monace becau	so other	d & produce	<u>'C</u>
REMARKS	Wader	down at	cent 5' t	cam spi	Ylway.
	Copy to Owner	Date			
				INSPEC	CTOR

NEW HAMPSHIRE WATER CONTROL COMMISSION DATA ON DAMS IN NEW HAMPSHIRE

LOCATION		STATE NO	83.08
TownFarmington	: County	Strafford	• • • • • • • • • • • • • • • • • • • •
Stream Berry's River			•••••
Basin-PrimaryQcean/			
Local Name		***************************************	····
Local Name	Long	71° 5!400)V
GENERAL DATA			,
Drainage area: Controlled Sq. M	i.: Uncontrolled	Sq. Mi.: Total	.4.54 Sq. Mi.
Overall langth of dam 265, 24 ft. Date	of Construction		************
Height: Stream bed to highest elev27.	5 ft.: Max. Struct	ure 25.! ′	ft.
Cost-Dam	: Reservoir		
DESCRIPTION Gravity- Concrete-			
Waste Gates	reage		
Type			*******************
Number: Size			
Elevation Invert			
Hoist			
Waste Gates Conduit			
Number M	aterials		
Size ft.: Length			
Embankment			
Type			•
Height—Max.	ft · Min		ft
Top—Width			
Slopes—Upstream on			
Length—Right of Spillway			
Spillway		•	
Materials of Construction	crete		
Length—Total	ft · Net 12	11 108	ſi.
Height of permanent section—max	251 / ft : Min.		ft
Flashboards—Type			
Elevation—Permanent Crest			
Flood Capacity1890			
	015,,	_	.1
Abutments Materials:			
Freeboard: Max. 2.5			
Headworks to Power Devel.—(See "Data			
OWNER Rochester Water Works.	C 2227	41011 good	
REMARKS Use- Consertation	C 1 /		

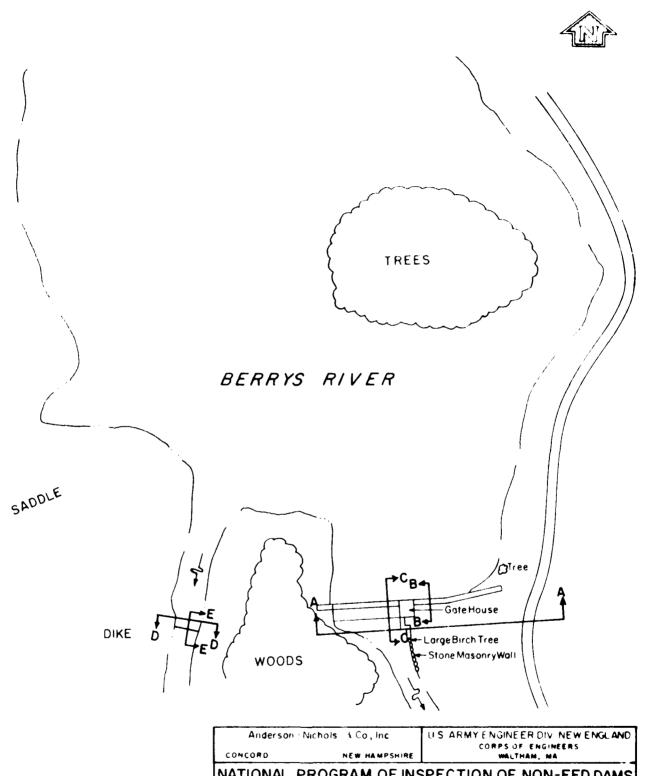
NEW HAMPSHIRE WATER CONTROL COMMISSION DATA ON RESERVOIRS & PONDS IN NEW HAMPSHIRE

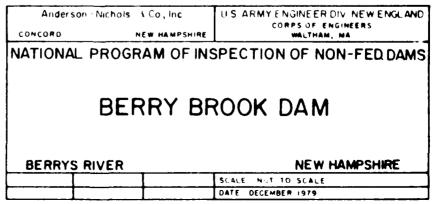
LOCATION J			AT DAM NO	83.06
Town Farmingt	on	ounty	trafford	
Stream Berry's	River			•••••
Basin—Primary Ocean	n: S	Secondary	Isinglass Ri	rer
Local Name	er ,		1, ▼	
DRAINAGE AREA		e my		
Controlled Sq. Mi.	: Uncontrolled	Sq. Mi.: Tot	al	Sq. Mi.
ELEVATION vs. WATER SUR	IFACE AREA vs. VOI	LUME		
Point	Head Feet	Surfa Ares Acre	1	Volume Acre Ft.
(1) Max. Flood Height	•••••		•••••	<u> </u>
(2) Top of Flashboards			••••••	• • • • • • • • • • • • • • • • • • •
(3) Permanent Crest	************************	*************	•••••	•
(4) Normal Drawdown	***************************************	22.	.75	***************************************
(5) Max. Drawdown	***************************************		• • • • • • • • • • • • • • • • • • • •	**************************************
(6) Original Pond	U.S.G.S5		•••••	***************************************
Base Used::	Coef. to change to U.	S.G.S. Base		
RESERVOIR CAPACITY				
	Total Volume		Usesble Volume	A Arrest
Drawdown	n: ft .		ft	A Market
Volume	ac	. ft.	a	c. ft.
Acre ft. per sq. mi.	9 (c.d.) 2 (c.d.)		18 18 18 18 18 18 18 18 18 18 18 18 18 1	
Inches per sq. mi.	1 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1			
USE OF WATER	Conservation		*************************	
OWNER Roches				* .
	***************************************		••••••	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
REMARKS				

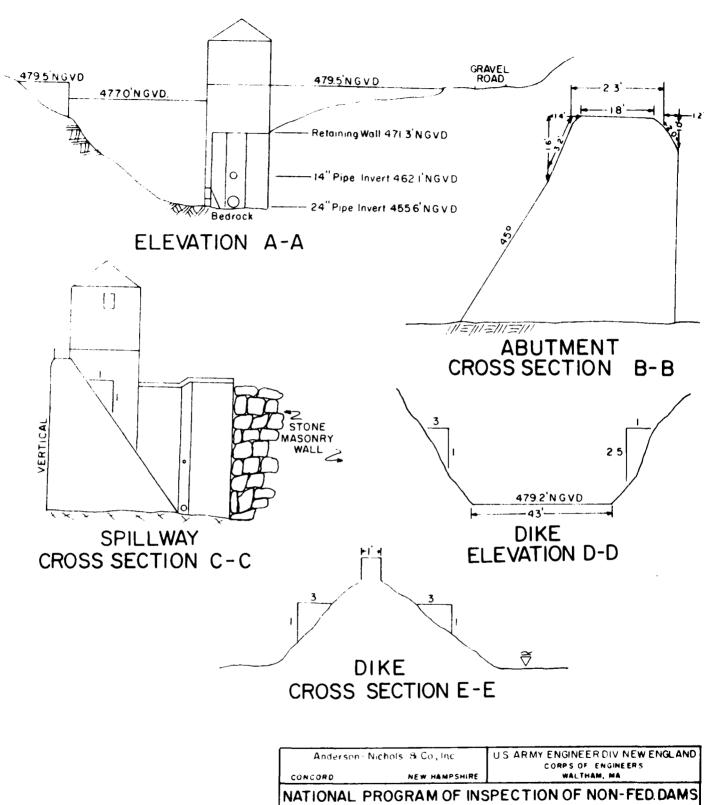
NEW HAMPSHIRE WATER RESOURCES BOARD

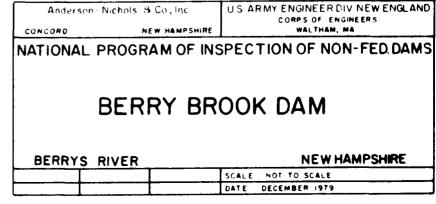
INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

PAM						
BASIN_	Deeau.		NO	FROM MOUTH Rochester	0 — I-	4510
RIVER	RPIRYK		MILES	FROM MOUTH_	D.A.SC).MI . 4 (. [
TOWN	AME OF DAM	17700	OWNER	Rocheston	WATER BOSTA	
BUILT	MAR OF DAT	DESCRIPTI	ON CONTRACTOR	ity - Conc	rete au (P	dar
50000			DAUD OUT T	G DOM	<u>ॹॱढ़ॎॶक़ढ़ढ़</u> ॗॗॗॗॗॗॗॗॗॗॗॗॗॗॗ	
POND AK	EA-AORES	22.75 D	RAMDOMN F	T. PUN	D CAPACITY-A	IORE FI.
UTTAUT.	HERE OF AUT.	Cr SINDAM	SC2 WHAX	MAX. FLOOD HEIGHT	APOVE CREST	- hú
PERMANE	NT OREST EI	EV.J.S.G.	S.	LOCAL	GAGE	• • • • • • • • • • • • • • • • • • • •
PATTILAP	ום ברי	THY H.S.A.	3.	LOCAL	GAGE	
SPILLWA	TENTHS-E	M. 124	8.33	FREEBO	ARD-FT. 2.5	
FL.SHB0	ARDS-CYPE,	HEIGHT AB	OVE CREST	None		
WASTE G	ARES-MC. Y	IIDTH MAX.	OPENING	FREEBO None DEPTH SILL	BELCW CREST	
	-				·,	هاه
************	- رست بر					
REMARKS	Courtit	1013 Gare	<u> </u>			
	1 = 151000 -					
	1 - 3 - 74 /2/3 -					
						
PCWER D	EVELOPMENT RALED	******	·			
ti si Timo				KW	MAKE	
UNITS	NO. HP	FEET FU	II. GATE	- IV AA	TEULE	
						
						
			 .			
			, , , , , , , , , , , , , , , , , , , 			
USE	Conson	777				
	o en escalador da esta esta como los e					
. —						
REMARK	:727	12 5 2 2 14				
		· · · · · · · · · · · · · · · · · · ·				



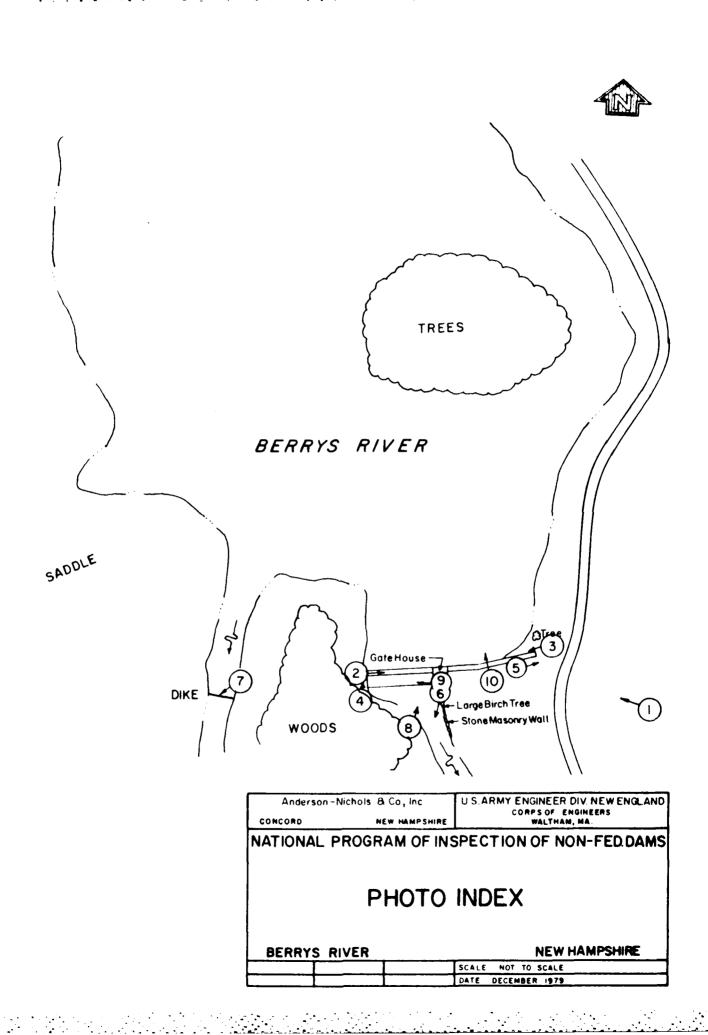






APPENDIX C

PHOTOGRAPHS





October 25, 1979
Figure 2 - Looking east along spillway crest from west abutment. Note large pine tree growing in earthfill near east abutment.



October 25, 1979
Figure 3 - Looking at the east abutment of the dam.



October 25, 1979
Figure 4 - Looking north at west abutment. Note trees.



October 25, 1979
Figure 5 - Looking at the east end of the dam. Note gravel roadway.



October 25, 1979
Figure 6 - Looking west across downstream
face of spillway. Note bedrock
exposures at toe.



October 25, 1979
Figure 7 - View of the dike located 150 feet west of the west abutment of the dam.



October 25, 1979 Figure 8 - View of the retaining wall.



October 25, 1979
Figure 9 - View of the downstream channel. Note large birch tree growing out of fieldstone retaining wall.

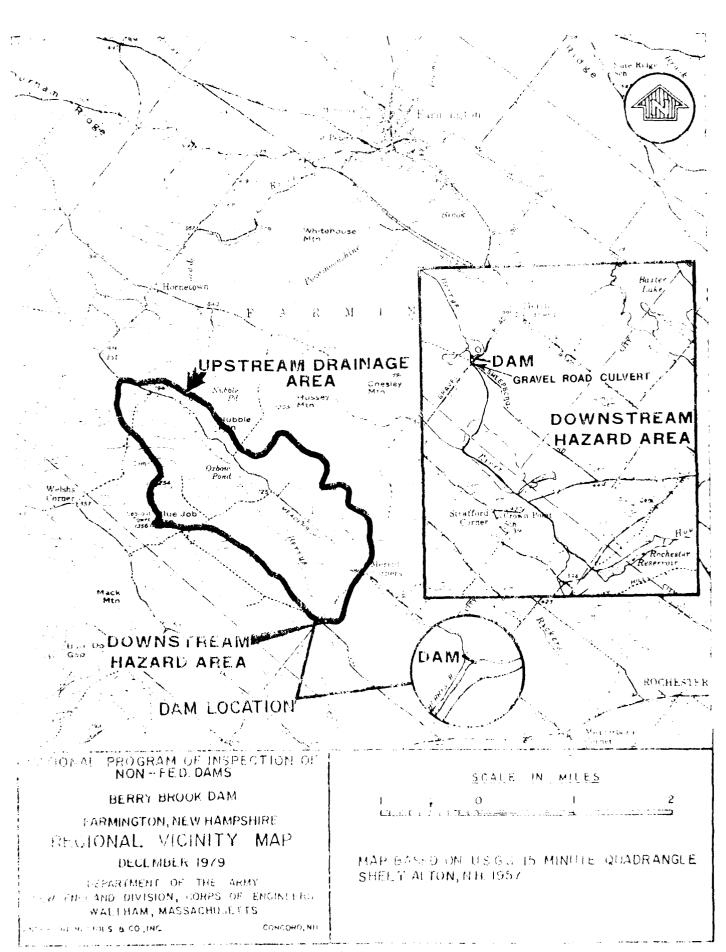


October 25, 1979
Figure 10 - Looking into upstream reservoir from the dam.

APPENDIX D

T 13

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



Sheet No. 1 of 25 Date 10 27 79 Subject BREACH ANALYSIS Anderson-Nichols & Company, Inc. BERRY BROOK DAM JOB NO. 3273 -21 13 14 15 18 17 18 19 20 21 BREACH ANALOW - home wroch with water surface elevation @ top of dam (479.2 MSL) to determine doin theory hazard potential. ASSINE WILL SO A19.2' MOL Upstream liver 1 4 34614' Mil Donne tream and spilling & 457 MEL (reft end)
Donnetream end spilling & 469' MEL (rightend) QF1=8/27 W6/2 33/2 wiere: Atom vansvol = olul 13 2 = 32,2 ft/sec2 For Berry Brook Doin: Exessin Wiath would most likely occur at the spillway soction. Therefore the livery of the levery of the spillway of the spill of the be nearbord from pool elect of FIGEINSL synthesis withdown is snoot 4621 1831 201=81(128) 10 (6.2)3/2 =14,030 GE 27

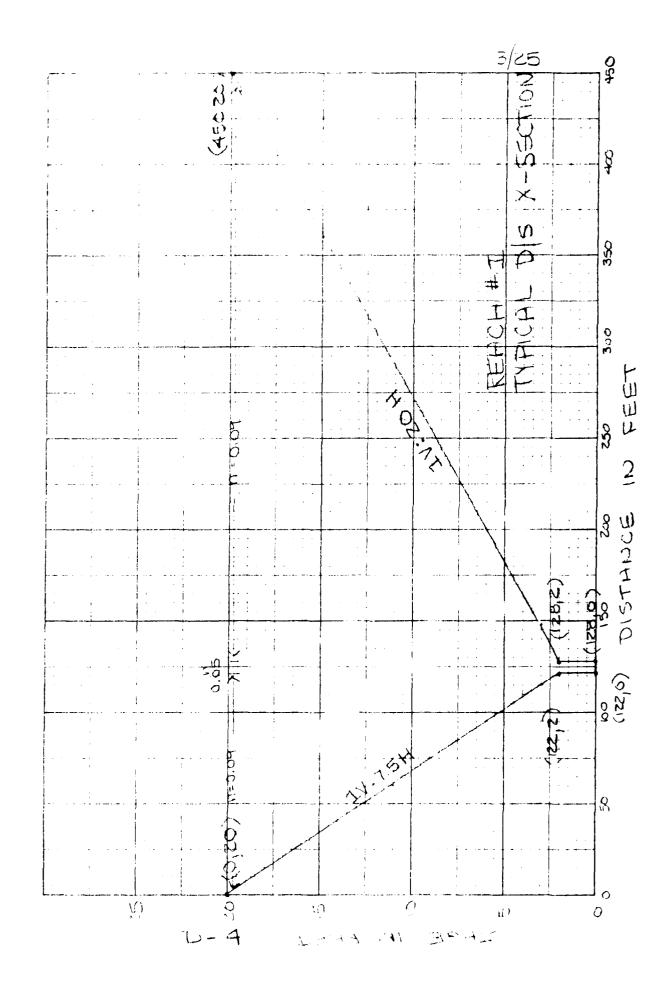
The series cross of the cost of the time of a second cost of the contract of a second cost of the cost

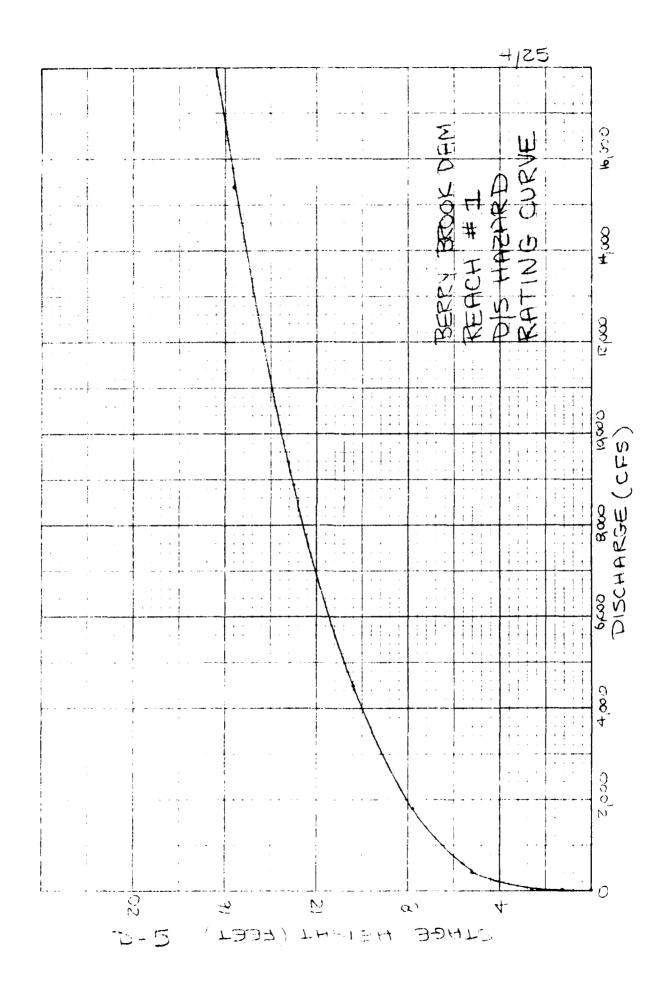
D-Z

: '

Sheet No. 2 of 25 Date 112179 Anderson-Nichols & Company, Inc. JOB NO. UARES 10 11 12 13 14 15 16 17 18 19 20 this section using the Minimus of Equation ei Noider 0 = 1.49 AR735/2 where r = n' value roughness coefficient A = area of section in square feet R = avea/wetters perimeter S = slope of reach Lington of reach 2000 feet The foe of dam = 457' MSL stream invert end of reach #1 = 440' MSL Slope of reach = 0.009 n' for channel = 0.05 WI for Overrance = 0.09 The following table was generated using a commodore Pet zool dock computer. Monnings Equation for open channel

21 floro de financia. AREÃ DEPTH 0 0 0 1.3 8 21 25 8,05 37 2.6 5.2 160.3 437 7.8 466,7 1775 28 939.8 4477 10,4 1579.6 8908 13.0 15,397 2386.2 ما رقا pero ne ocore doto in my books wire. 35 D-3 36 37





Ĭ.

Subject ____

Sheet No. 5 of 75
Date 1176 79
Computed Last
Checked

JOB NO.

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

1 Refer to Rating Curve - REACH #1 2 Artecedent discharge = 1255 cfs 3 Stage @ 1255 cfs = 1 fact

15 com Q = 14 0000 do 12 cogs @ 14,000 cfs = 15 toot

extends or reductions threach, Q.
Thurstone an increase in stage of 8 fort
teach to have be maricipated you harach.

throtize the capacity of the stone box confuert located about 300 feet downstream of the downstream of the downstream about 100 feet downstream of the down will not be arabjeed. It was assumed this structure would be washed out and not provide any storage.)

cross section shown on page.

113 0' Q : 0 CH'S

100 1.0' Low How Alroway Colvert just 100 to 100 to 100 this flow 100 to 100 this flow 100 to 100 this flow 100 to 100 to 100 this flow 100 to 100 to

Sheet No	<u>م</u>		or 25	
Sheet No Date 11	105	19		
Compute	<u>منا</u> ہ	7		
Checked				

JOB NO.

10

12

15 16

17

19

20 21 22

23

25 26 27

28

29

36 37

IN. SCALE

2 Stare @ 8.5' Presions flow through 3 whilet and weir flow over 4 roadway.

> Pressure flow: Q = CAVZah Q = 0.8(113.4)(VZ(32.2)4.3 Q = 1500 cfs

Weir flow: Q = CLH3/2 Q = 2.7(1/218)(1.3)/2+2.7(40)(1.3)3/2+ 2.7(1/232)(1.3)3/2 = 260 cfs

Total Q = 1760 cfs

Stage @ 10.0' Pressure flow through culvert and we're flow over roadway.

Q = 0.8(113.4)(V64.4×5.8) Q = 1755 CFS

Q=7.7(1/240)(2.81/2+2.7(40)(2.8)3/2+ 2.7(1/270)(2.8)3/2 =1200 cfs

Total Q = 2955 cfs

Store @ 15.0' Presource flow through colvert and weir flow out from they.

D-7

Subject _____

Sheet No. 7 of Z5 of Z5 Computed UNJ

JOB NO.

13

15 16

18

31

34

36 37 38

EUARES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 26 26 27 28 2

Stage 15.0' contr.

Were flows = 711(2110)(1.8)/2+

2.7(40)(7.8)/2+71(210)(5.1)/2+

2.7(25)(5.1)/2+71(70)(6.4)/2

Q = 10,050 cfs

Total Q = 12,4.40 cfs

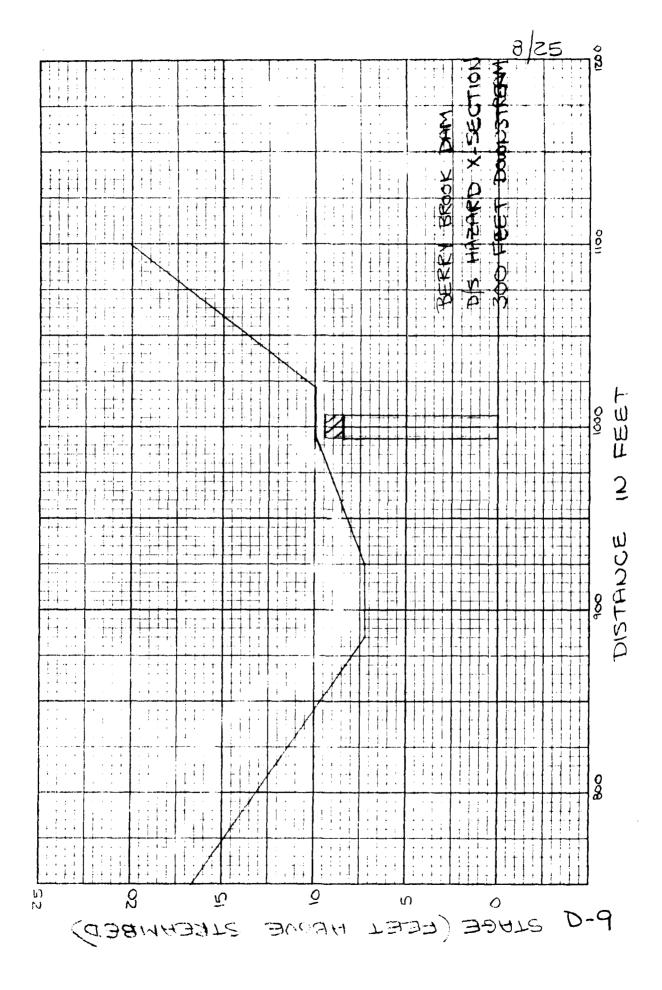
Use the above trials to develop a reting curve for this road crossing breated about 300 feet downstream of the down.

Refer to the rating curve:
Antecedent discharge = 1255 cfs
Stage @ 1255 cfs = 7.8 Feet

Breach discharge = 14,030 cfs Stage @ 14,030 cfs = 15,4 feet

Therefore, branch uso Ad covers and covers and proved the start of 7.6 feet.

Therefore, branch uso Ad covers and feet.



L

JOB NO.

10

11 12

18 19

20

33

UARES 0 1 2 3 4 5 6 7 8

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 28 27 29 29

REACH #7 Douglass & Stage - History av

REACH #Z Devolot à stroit discharge relationship for à typical cross sections through the surain discharge at the crossive of State Route 202A, a distance of about 8700 feet. A

typical cross within is shown

Lenath of viary, = 8700 foot Elev. Start of verce = 4401 MSL Elev. End of verce = 4151 MSL Slope of veacy = 0.003

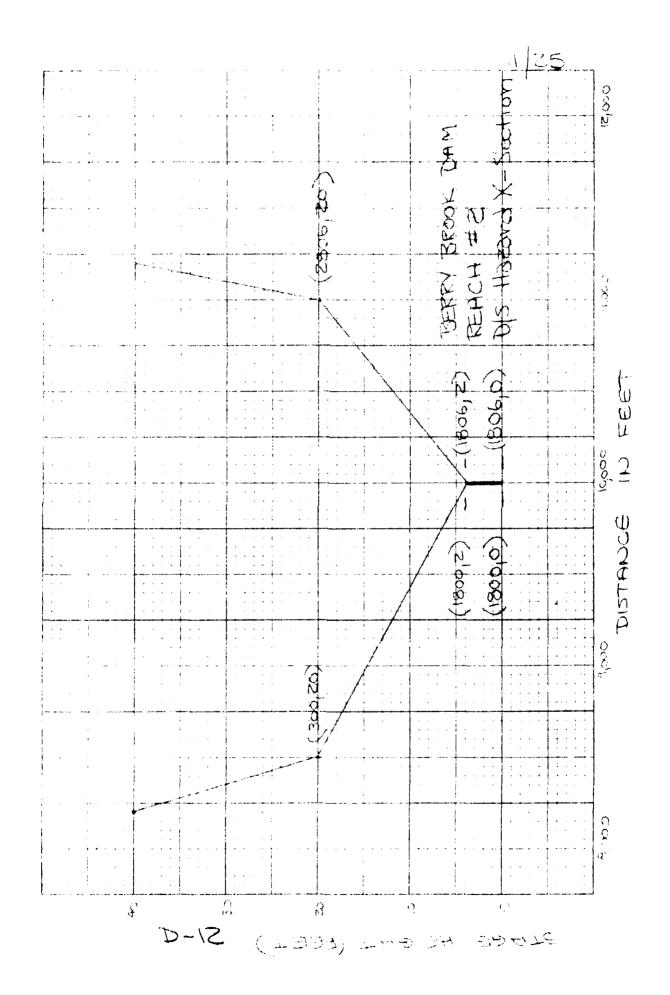
Due to examply nature of section a composite in value of 0.055

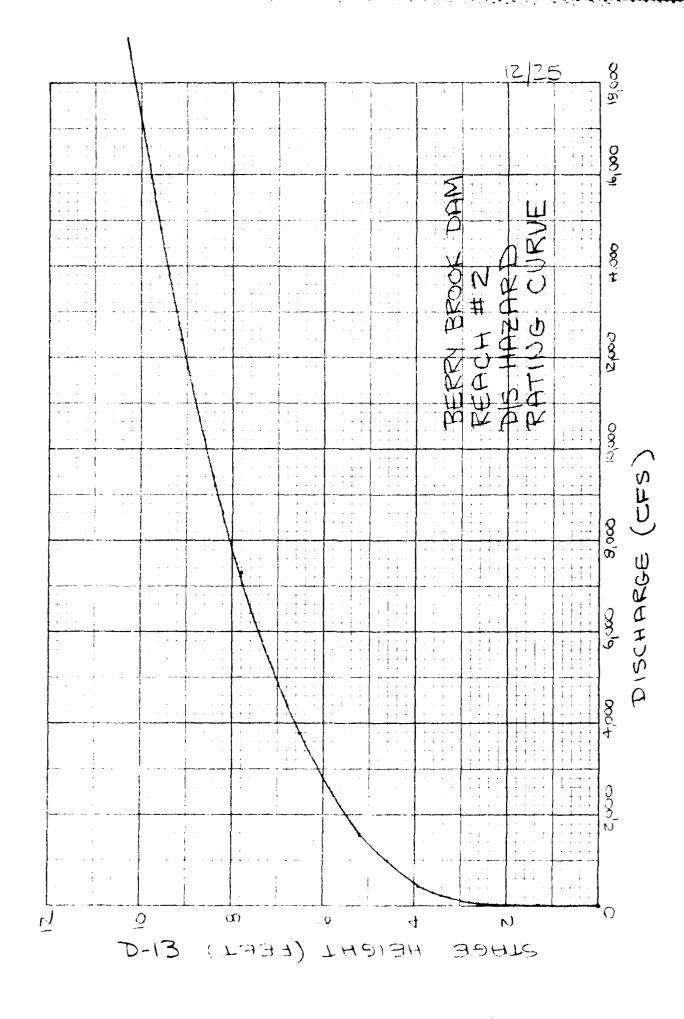
The following table was generated using a Commodore Pet 2001 desk computer, programmed vita the Manings Equation.

22	DEPTH	AREA	DISCHARGE
23	0	0	0
24	\.3	3	11
25	4. 6 5. 2	757.4	424 1563
26	5, Z 6,5	171.4	3761
27	7,8	2410.04	7283
28	9.1	3588.44	12,367
29	10.4	5001.56	19,235
30			

Use the about trials to develop a stage discharge curve for REACH #2.

D-11





ť

D-14

3.1

D-15

to a poblic mines

33

18

13

20

36

Checked

JOBNO 3273-21 BERKY BROOK DAM

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

RERRY BROOK DEIN

estion execut 18 = 60 H space miles The draw rage and for And dam to ided to he AFA square miles. Assist injection of the over west out the love, where wellow is a out From a maker take revealed the Fallow -:

1, The main a days or that for this LOS BY SEE IN LETTER FRY SONA ON HIGHOUTH SINGLESS COLON The south is located at the southern ing if the lake, not at the environ tip as shown in good. Theorewas +10: the dawn enters Berrys River day stream of Berry Errow Dan. Duhere the outlet is mount on the apad exists a 2.5'H X 4'W Stone masonry box culvert. A road runs over this culiert. The only flow which would enter the modal to the man train cons was through this wheet. Flow over Association and no down they into channel. The DH for this smaller lake was plan metered to be 0,8 square miles.

122 Classification: Small Maximum Charace Capacity = 200 ac-ft Hydraulic Holast (4742-455.6) = 24 feet

Sheet No. 17 of 25

JOB NO.

12

16

20

21 28

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

States, the New England Person was utilized on the Fin, orea.

the equation follows:

Q = a Ab 5° Std I e t f 03 where

Qr=T-year annual pear discussor (de)

EDVE GOODEND = A 5 - warm charmed stope (foot per mule)

St = percent of surface storage area

plus 0,5 percent

I = T-year Z4-hour rainfall in-oughty in indices 13 t = average To will degrees below

freezina in consec Farirer neit 15

O = orcographic factor

For Berry Brook Dawn

Q = 100 - year A = 3.1 miz

5 = 102 ft/mil et = 7.5 percent I = 6.3 molles *

 $\tau = 10$

 $C_{i} = 1.0$ 26

Frequency Atlas of the United States, prepared

[David Herstifield for Engineering Division]

33 555, 1). S. Dopt of Hoxis, Wir north, DC May 1961.

D-18

Subject _____

Date 11 28 19 Of Computed Checked

JOB NO.

14

15 16

17

29

30

31

32

33

34

36 37 38

IARES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 26 1N. SCALE

Q₇ = a A⁶5°5t⁴I²L^fO⁹ 100 yr = 138(3.1)⁹(102)⁴(7.5)³(6.3)¹¹(10)⁶(1.0)¹² 100 yr = 400 cfs

" Use to the large difference these two " Nethods obtained another regional" wethod was used. The State of "N.H., Dept. of Pullic Ularks and Highways Utilizes the NEHL Method "(New England Hill and Lowland Area)." (New England Hill and Lowland Area). "Using this wothod the following results were obtained:

 $Q_{10} = 280 \text{ cfs}$ $Q_{50} = 1.74(Q_{10})^{1.007} = 1.74(280)^{1.007} = 507 \text{ cfs}$ $Q_{100}(\text{extrapolated}) = 620 \text{ cfs}$

18 Both regional equations show that a
19 CSM value of 2000 is too large for
20 this particular basin. Analysis of
21 these results shows that a csm value
22 of 1000 would be reasonable. Therefore:
23 FMF Inflow = 3.1 × 1000 = 3100 cfs
24 APMF(Test Flood) = 775 cfs (Qpi)

*STEP # Za. Determine Surcharge Height
to pass Qp. = 775 cfs

To do this a voting curve for Berry Brook Down must be calculated. Flow would begin over the gillway; higher water would outflow at other low outlets around the lake The write spection and

D-10

D-50

34

35 36 37 JOB NO.

5

16

18

24

34

35 36 37

IARES IN. SCALE

> 4) A roadway runs northeast aboug the reservoir shore the crest of this road where outflow could OCCUR IS 479 4' MSL.

DISCHARGE CALCULATIONS

Hosume elen +77.0'11st

Q=0 cfs

Assume elev. @477.5 MSL Q = 3.0(128)(0.5)3/2 = 135 cfs 11 12

13 Assume eles. 0478,0'115L Q=3.0(128)(10) 12=385 cfs 15

Assume elw.@478.8' MSL-To saddle crest Q-3.0(128)(1.8)3/2=930 cfs

19 Assume elev. @479.2' MSL-To dike crest which Will be referred to as 'top of dam'

(REWLINAY) = 3.0(128) /2.2) 3/2 = 1255 cfs

(REWLINAY) = 2.6(30)(0.4) 3/2 = 20 cfs

Total Q = 1275 cfs 20 21 22

25 Assume eless. @ 479.4' MSL-To low voodway crest 26 Q(541mm) = 3.0(128)(2.4) /2 = 1430 Cfs 27 Q(same)=7.6(30)(0.6)== 35 cfs 28 Q(OIKE)=2.7(43)0.2)72= 29 30

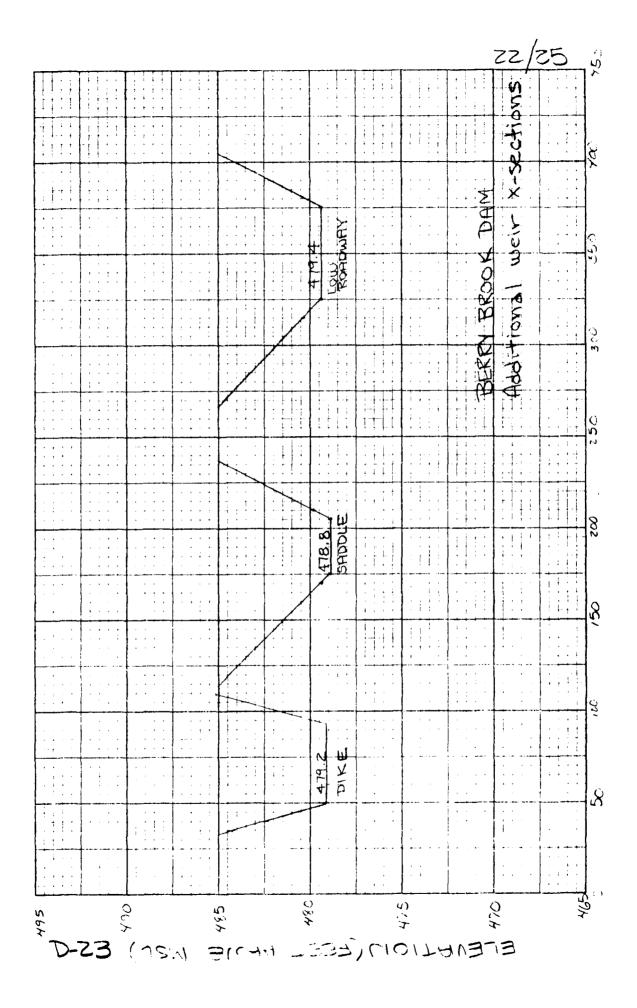
Using the above trials establish a discharge rating curve for Berry Brook Dam. 32 33

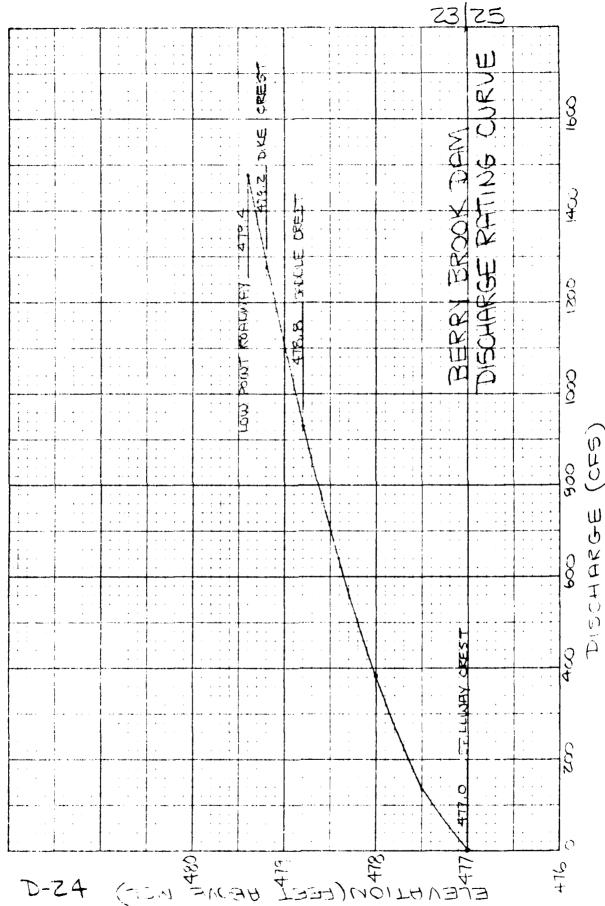
15-C

1

. .

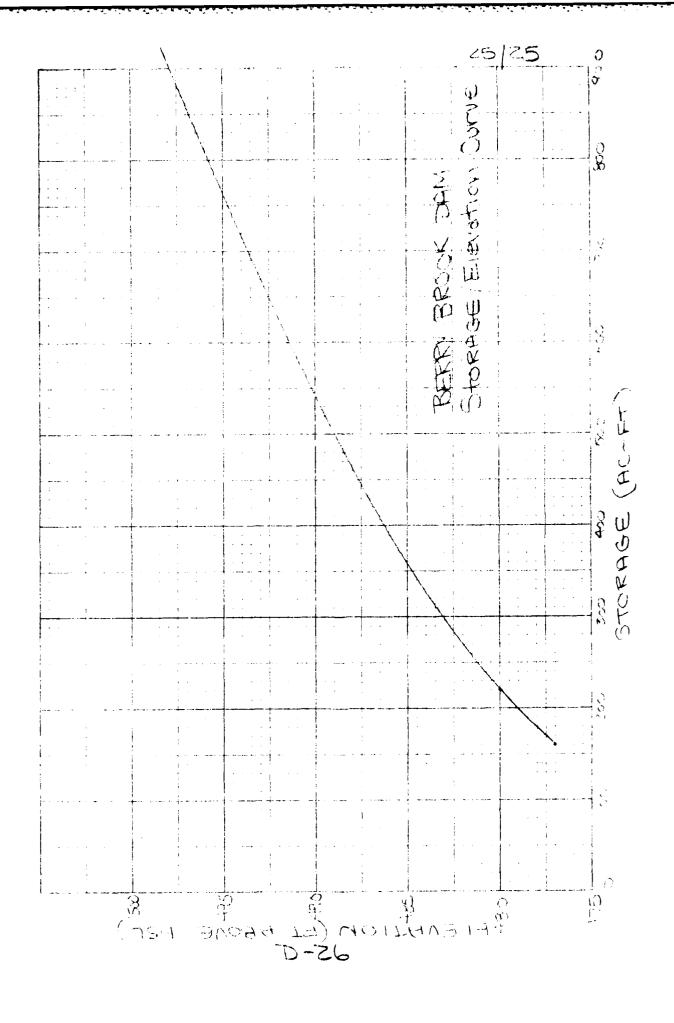
•





(cES)

Ander	son-Nichols & Company, Inc.	Sheet No. 24 of 25 Date 11/20/19
	JOB NO.	Checked
RES . SCAL	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 \mathbb{C} 1 \mathbb{C} 2 \mathbb{C} 1 \mathbb{C} 2 \mathbb{C} 1 \mathbb{C} 2 \mathbb{C} 1 \mathbb{C} 2 \mathbb{C} 3 \mathbb{C} 3 \mathbb{C} 4 \mathbb{C} 5 \mathbb{C} 6 \mathbb{C} 1 \mathbb{C} 1 \mathbb{C} 2 \mathbb{C} 3 \mathbb{C} 6 \mathbb{C} 1 \mathbb{C} 1 \mathbb{C} 2 \mathbb{C} 3 \mathbb{C} 6 \mathbb{C} 1 \mathbb{C} 1 \mathbb{C} 2 \mathbb{C} 3 \mathbb{C} 6 \mathbb{C} 1 \mathbb{C} 1 \mathbb{C} 2 \mathbb{C} 3 \mathbb{C} 4 \mathbb{C} 6 \mathbb{C} 1 \mathbb{C} 1 \mathbb{C} 2 \mathbb{C} 3 \mathbb{C} 4 \mathbb{C} 6 \mathbb{C} 6 \mathbb{C} 8 9 10 11 12 13 14 15 16 17 18 19 20 \mathbb{C}	21 22 23 24 25 26 27
	STEP# 26 Determine volume of 5	nervose
	" the breach archies sheet 13.	ad for
	9 @ 477 MEL (HOLV) = 160 30 10 @ 480 MSL Stange = 720 30	1. 1. 1. 1. 1. 1.
	Find Strain 37 500' MSL = 1000 AC-FT	
	18 Use the above points to estab 19 storage elevation curve.	(ish a
	21 Qp,=775 cfs >> 478.6' MSL >> 190	ac- f t
	23 30 ACFT - 3.1 m. 2 - 640 AC - FFT = 0.18" NOV	10ff (STORI)
	25 STEP # ZC	
	$Q_{PZ} = Q_{P_1} (1 - \frac{STJR_1}{19}) = 775 (1 - \frac{0.18}{19}) = 775 (1 - 0.$	
	Surcharge storage is realiquely. To Les inflow soutflow.	therefore
	The dain will not be overtopped test flood. Test flood will discharge feet over spillway crest. D-25	by the rose 1.6
	36 37	



Sheet No.	of
Date 12/5/79	
Computed	
Chacked	

JOH NO

SQUARES

arministe pipe capacities

and the participation of

Q=UL 1200 =(08(107)(144X143Z) = 26 cfs

Z4-inch (low-level outlet) Invert \$ 455.6'MS_ & = 456.6'MSL

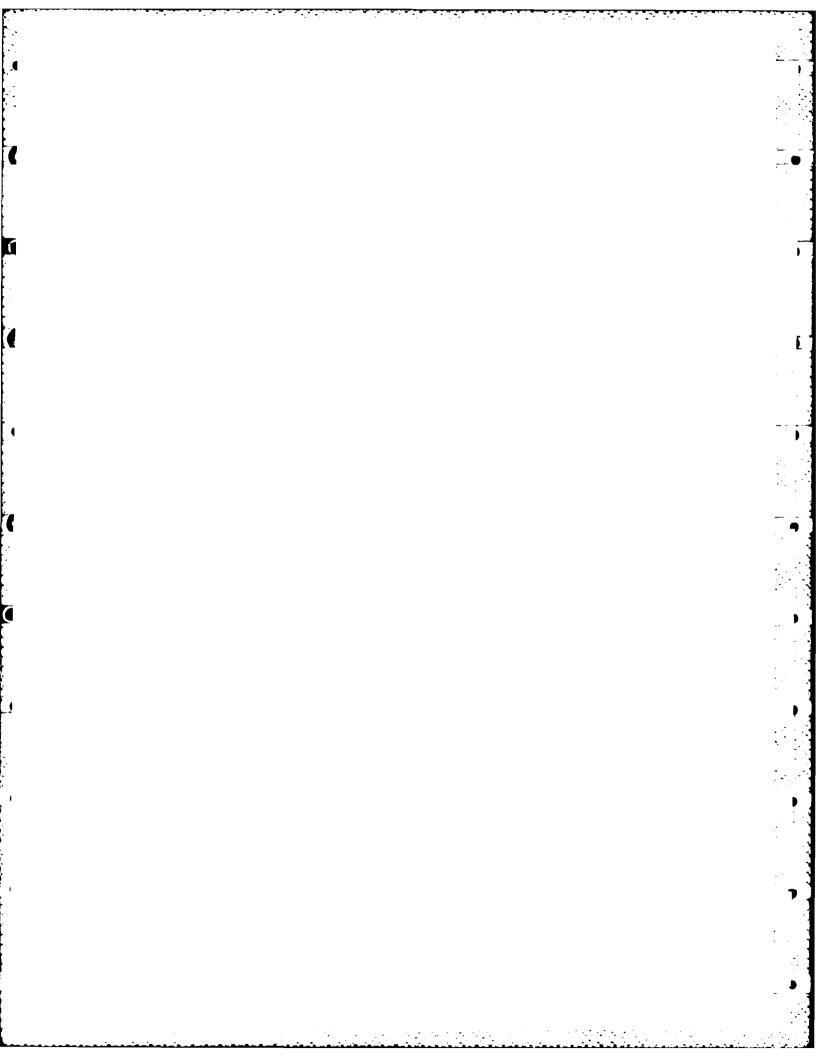
Avea = 3.14 Q = (0.8)(3.4)(V6+.4 x 20.4) = 90 Cfs

D-27

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME



END

FILMED

8-85

DTIC