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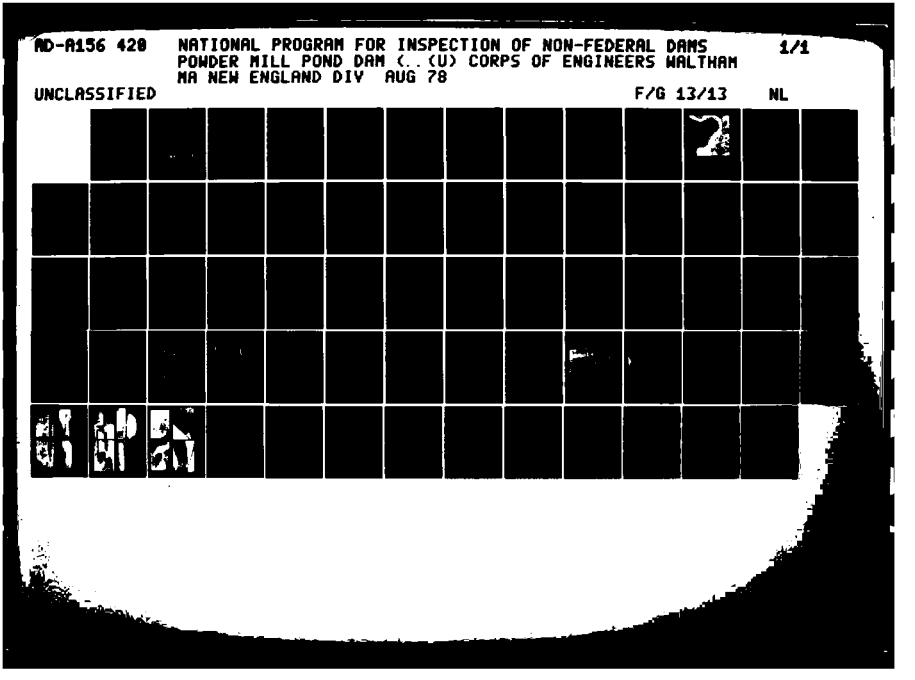

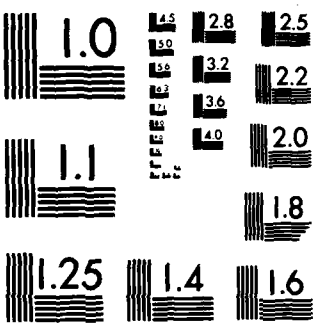

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AD-A156 420

MERRIMACK RIVER BASIN

BENNINGTON, NEW HAMPSHIRE

POWDER MILL POND DAM
NH 00248

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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

AUGUST 1978

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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
Bennington, New Hampshire
Contoocook River

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

The dam is a concrete on stream dam. The dam is 366 ft. long and 19 ft. high. The dam is assessed to be in overall fair condition. The principle concern is the apparently high overtopping potential and the apparently high risk of dam fairlure during such an event. THere is a need to perform a more detailed hydrological study due to thelarge watershed area, the many dams upstream, and the nature of the downstream channel.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

OCT 11 1979

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

Dear Governor Gallen:

I am forwarding to you a copy of the Powder Mill Pond 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, Monadnock Paper Mills, Bennington, New Hampshire 03442.

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

POWDER MILL DAM

NH 00248

MERRIMACK RIVER BASIN
BENNINGTON, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam Powder Mill Dam

State Located New Hampshire

County Located Hillsborough

City or Town Bennington

Stream Contoocook River

Date of Inspection 6/23/78

Brief Assessment

Powder Mill Dam is a concrete on-stream dam, situated on the Contoocook River at the north end of Power Mill Pond in the Town of Bennington, New Hampshire. Overall length is 366 feet and height is 19 feet. The watershed area is 184 square miles. It was originally constructed in 1924 and rebuilt after being partially destroyed in the 1938 Flood. The dam is used to store water and regulate flow to hydroelectric and process water facilities for a paper manufacturing plant 1-1/2 miles downstream. The dam is in the intermediate size class and in the high hazard class.

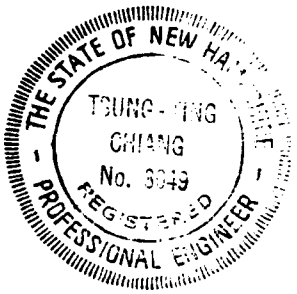
Powder Mill Dam is assessed to be in overall fair condition. The principle concern is the apparently high overtopping potential and the apparently high risk of dam failure during such an event. Other concerns include lack of erosion protection for both embankments and moderate erosion of concrete flow surfaces.

By the simplified hydrologic methods used for this report, a spillway test flood (equal to the probable maximum flood) of about 133,000 cfs would overtop the dam by about 19 feet. Spillway capacity is about 20% of the probable maximum flood. There is a need to perform a more detailed hydrologic study due to the

large watershed area, the many dams upstream, and the nature of the downstream channel.

Recommended actions include providing erosion protection and seeking advice on repairing the concrete spillway surface. The recommendations and remedial measures are described in Section 7 and should be implemented by the owner within 24 months after receipt of this Phase I Report.

WHITMAN & HOWARD, INC.



T. T. Chiang, Ph.D., P.E.

John L. Scott, P.E.

This Phase I Inspection Report on Powder Mill Pond 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.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control 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 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 fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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POWDER MILL POND DAM

Bennington, N.H.

Approx. Scale 1" = 280'

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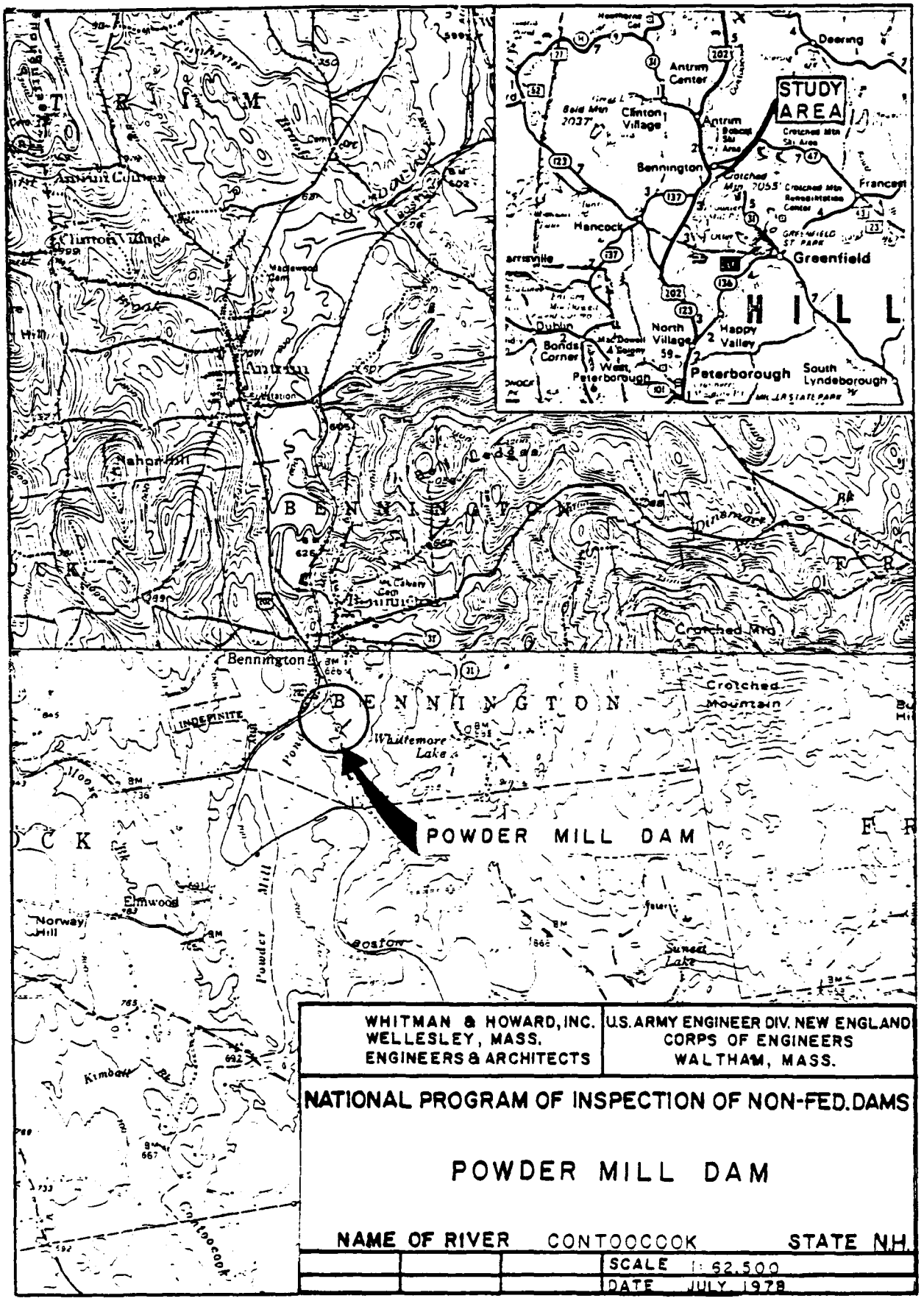
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Deering
Antrim Center
Clinton Village
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Bennington
Francestown
Hancock
Greenfield
HILL
Dublin
North Village
Happy Valley
Bonds Corner
Peterborough
South Lyndeborough
BENNINGTON
Crotched Mtn
Bennington
Whittemore Lake
POWDER MILL DAM
Elmwood
Norway Hill
Powder Mill
Contoocook
Kimball Pd
Sunset Lake
INDEFINITE
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ENGINEERS & ARCHITECTS
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
POWDER MILL DAM
NAME OF RIVER CONTOOCOOK
STATE N.H.
SCALE 1:62,500
DATE JULY 1978

PHASE I INSPECTION REPORT

POWDER MILL POND DAM I.D. NO. NH00248

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. Whitman & Howard, 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 was issued to Whitman & Howard, Inc. under a letter of May 1, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0313 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 quickly initiate 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

Powder Mill Dam is located on the Contoocook River in the Town of Bennington, N.H., about 0.8 mile upstream (south) of the village area of Bennington, and 1-1/2 miles from the Monadnock Paper Mills Manufacturing Plant. The dam appears on the USGS quadrangle "Peterborough, N.H."

b. Description of Dam and Appurtenances

Powder Mill Dam is a concrete gravity on-stream dam, with nearly the entire crest acting as the spillway. The valley on each side rises gently and the abutments on both sides are quite short. A gatehouse, controlling a four-foot diameter discharge pipe is located on the right end of the spillway a short distance from the abutment. This discharge pipe is the principal device for flow regulation. A 4' x 4' sluice is located on the left end of the spillway with a hand wheel operator located on a concrete walkway 10' above the crest. This sluice is used for rapidly draining the impoundment when this operation is needed. Two-foot high flashboards are employed regularly.

Reports indicated that "hardpan" or "blue clay" was encountered during excavation and probably no ledge was encountered. Details are absent on foundation geology.

Height from the crest to the downstream apron is 19 feet, overall length is 366 feet, and the drainage area is 184 sq. mile. The impoundment, Powder Mill Pond, is totally artificial. Several significant dams exist upstream, including the McDowell Reservoir Flood Control Dam in Peterborough.

Normal hydraulic head (difference between pool & tailwater elevations) is about 9.5 feet. Another dam, known as Monadnock Power Dam, is located about 0.8 miles downstream and controls the tailwater at Powder Mill Pond Dam.

c. Size Classification

The height of the dam and the volume of impounded water places this project in the "Intermediate" category.

d. Hazard Classification

Powder Mill Dam is situated a short distance upstream from the village of Bennington. Several dwellings lie in the threatened area, as well as three downstream dams and several bridges. A large paper mill (owners of the dam) is situated on the floodplain about 1-1/2 miles downstream. The stream drops over 60 feet in this stretch, so flow velocities would be quite high.

Based on the simplified procedures used in this Phase I report, Powder Mill Pond Dam is placed in the "High" hazard category, due to the large volume of water which would be released in a failure and the threatening position of the dam relative to the three downstream dams.

However, study of previous flood profiles (See App. B) suggests that high flows may tend to submerge the dam, thus lessening the dam's contribution to the general destruction. A more complete hydraulic analysis, well beyond the scope of this report, would be necessary to fully ascertain the hazard potential of this dam site.

e. Ownership - Monadnock Paper Mills
Bennington, NH
Sole owners since dam's construction.

f. Operator - Gordon Bishop, Plant Engineer
Monadnock Paper Mills
Bennington, NH 03442
603/588-3311

g. Purpose of Dam

The purpose of the project is to store and regulate flow for hydroelectric power genera-

tion and process water for the mill, located about 1.5 miles downstream.

h. Design and Construction History

The present Powder Mill Dam was constructed in 1924. It was built across the Contoocook River on the site of a former dam also owned by Monadnock Paper Mills, and constructed about 1910. The new dam raised the crest about 6' above the former level, thereby about tripling the impounded volume and pond surface area.

The dam suffered considerable damage in the flood of September, 1938. The entire left abutment and about 30 feet of the spillway adjacent to the left abutment were destroyed. Reports indicate that the maximum head of water was about 9 feet over the spillway, exceeding the then 6 feet of freeboard.

Immediately thereafter a reconstruction was begun which lengthened the spillway crest from 206 to 228 feet, increased the freeboard from 6 to 10 feet and added a 4' x 4' sluice gate on the left abutment. The new spillway section was considerably more massive than the original section. The reconstruction work was completed in the spring of 1939.

No significant problems have been reported since that time. Ownership remains in the hands of Monadnock Paper Mills.

i. Normal Operational Procedure

The flashboards are left on through the winter and are employed to store the spring runoff, though ice damage to the boards is usually extensive. When the level drops below the top of the flashboards, the gate on the 4 foot discharge pipe is adjusted to release water in a steady flow for the owner's hydroelectric facility downstream. Usually during summer the water level drops below the spillway crest and at that time a work crew is employed to check and restore the flash-boards.

1.3 Pertinent Data

a. Drainage Area - 184.09 sq. mi. Predominant basin terrain is rolling land.

b. Discharge at Damsite

(1) Maximum known flood at damsite - reported as 22,900 cfs, September '38.

(2) Capacities of discharge conduits:

	Q, cfs		
W.L.	4' Diam. Pipe	4' x 4' Sluice	Total
At spillway	260	280	540
At max. pool	340	400	740

(3) Spillway capacity at maximum pool elev. - 26,600 cfs

(4) Total discharge capacity of facility - 27,400 cfs

c. Elevation (ft. above MSL)

(1) Top Dam - 685.44

(2) Maximum pool-design surcharge - 684.5 (elev. that '38 flood would have reached on present dam)

(3) Full flood control pool - N/A

(4) Recreation pool - Top of flashboards 677.5

(5) Spillway crest - 675.44

(6) Discharge conduit inverts:

4' Diam. pipe - approx. 660

4' x 4' Sluice - 663.44

(7) Streambed at centerline of dam - approx. 656

(8) Tailwater: Monadnock Power Dam located 0.8 mile downstream, crest 665.85, generally controls tailwater at Power Mill Dam. Tailwater in '38 flood reported as approx. 678.

d. Reservoir

(1) Length of maximum pool - est. 20,000 ft.

(2) Length of normal pool - 19,000 ft.

(3) Length of flood control pool - N/A

e. Storage (acre-feet)

(1) Pool at spillway crest - 2,400

(2) Flood Control Pool - N/A

(3) Design surcharge - est. 6,200

(4) Top of Dam - est. 8,600

f. Reservoir Surface (acres)

(1) Pool at spillway crest - 435

(2) Flood Control Pool - N/A

(3) Design Surcharge - est. 650

(4) Top of dam - est. 670

g. Dam

(1) Type - Concrete gravity dam, ogee spillway across crest, earth abutment with concrete core walls.

(2) Length - 366 ft. total

(3) Height - Crest to apron - 18.6 Top of dam to bottom of deepest part of foundation -approx. 45 ft.

(4) Top Width - Crest width 2 ft.

(5) Side slopes
Upstream Face batter - 1:10
Steepest part of spillway - approx. 1:1.6

(6) Zoning - N/A

(7) Impervious Core - concrete dam

(8) Cutoff - Small concrete key at base

(9) Grout curtain - N/A

Distance from crest to downstream edge of apron -30 ft.

h. Discharge Conduits

		4' Diam. Pipe	4' x 4' Sluice
(1)	Type	Steel	Cast in concrete
(2)	Length	Thru Dam	Thru Dam
(3)	Closure	Shear gate	Sluice gate
(4)	Access	Gate house	Open Walkway
(5)	Regulating Facilities	Electrically operated gate - not remote control.	Handwheel - manual operation

i. Spillway

(1) Type - Concrete ogee

(2) Length of weir - 227.8 ft.

(3) Crest elevation - 675.44

(4) Gates - N/A

(5) U/S Channel - Former natural streambed of Contoocook River.

(6) D/S Channel - Streambed. Another dam 0.8 miles downstream substantially controlls tailwater level.

j. Regulating Outlets - Flow regulated with 4' diameter discharge pipe.

SECTION 2: ENGINEERING DATA

2.1 Design

Powder Mill dam is designed as a concrete gravity dam. A sketch of the typical cross section, as designed in 1924, is available plus some correspondence. The original spillway was designed to carry a peak flow of 47.3 cfs per sq. mi., or 8,700 cfs. (This was greatly exceeded in the flood of 1938). The N.H. Public Service Commission, forerunner of today's N.H. Water Resources Board, rejected the design as first submitted since the resultant of overturning resisting force fell outside the middle third of the base of the foundation under full spillway flow. A redesign was promptly prepared and approved.

After the partial collapse in the 1938 flood, the rebuilt dam was designed to pass the 1938 peak flow with about 1.5 feet of freeboard to spare. The new section was far more massive than the original, extending as much as 16 feet deeper into the bottom than the original. A wider and thicker apron was cast in the new section and was extended all the way across the portion of the original dam which was not destroyed. Freeboard was raised from 6 feet to 10 feet.

The few drawings and correspondence that exists refers to some of the excavated material as being "hardpan" or "blue clay". Apparently no ledge was encountered. A reference is made to a series of foundation "soundings" to be made, but no data exist and it is not known if they were in fact performed. The data are not sufficient to draw firm conclusions about the foundation material.

2.2 Construction

Two photographs of the excavation stage are the only data available of the original 1924 construction.

A dimensioned sketch of the excavation stage are the only data available of the reconstruction in 1938-39. There are also several photographs, including a 3-photo sequence from the downstream

left abutment, which give a good visual record of the work performed. No hard written data exist, however.

2.3 Operation

The general philosophy of the operation is to store water during time of abundant flow for later release to provide a steadier flow through the power and process water facilities downstream. Detailed operation records are not generally kept. The principle variable is the opening on the gate to the 4 foot discharge conduit, operated from the gatehouse.

2.4 Evaluation

a. Availability

Fair. Not much data is available, however what material does exist is generally useful.

b. Adequacy

Fair. The photos, drawings and correspondence are sufficient to give a good general picture of the project features, but lack the detail necessary to draw firm conclusions.

c. Validity

Fair. Though some inconsistencies are present, most of the available data are in reasonable agreement with existing conditions.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The over-all impression is that of a dam laid across a narrow part of the stream valley with nearly the maximum amount of spillway crest length that the valley allows.

No overwhelming problems are present.

b. Dam

The concrete on the spillway face shows a fair amount of erosion, and some pitted areas running horizontally. Construction joints are eroded about 6" to 8" and are worse on the old section. None of the joints were leaking. The joint formed between the old and the new section on the left end of the dam is easily seen and appears to have held together well. Some spalling exists on the ends of the abutment walls on both sides and on the concrete walkway to the gatehouse. The worst section of concrete surface is on the downstream face below the gatehouse, an area that receives intermitent flow. Freeze-thaw action has spalled the surface considerably and some vegetation is growing in a horizontal joint.

Flashboards were in place and could be readily inspected, since the spillway crest was dry and accessable during the inspection visit. Many old bent-over pins lie in the bottom of the downstream channel - evidence that the pins release under load as they should.

The concrete core wall for the north (left) abutment is visible. The upstream face of the north embankment is devoid of vegetation (trespass appears to be the cause) and considerable erosion has taken place. The downstream slope has more vegtation but there are also some erosion paths on this slope.

The concrete core wall for the south (right) abutment is visible. The upstream face is bare, loose soil and some deep erosion paths have become established. Trees and brush are growing on the downstream slope. Some riprap is in place at and above the tailwater, and is in fair condition.

There is no evidence of seepage downstream of the embankment sections.

c. Appurtenant Structures

The railings on both abutments are in sound condition. The lower two rungs of the access ladder from the walkway to the crest on the left abutment are rusted badly and distorted, probably from ice impact. The gatehouse is of brick masonry construction and is in good condition, though some of the metal work is rusting.

d. Reservoir Area

Remnants of the cofferdam used in the 1938-39 reconstruction are still in place on the left side of the dam in the upstream area. The top of the timber sheeting is about level with the spillway crest, and a considerable amount of sand and gravel has accumulated.

The shore line of Powder Mill Pond is only sparsely developed with cottages.

e. Downstream Channel

The downstream channel is the natural streambed of the Contoocook River and is wide and clear except for a small island on the south side. There is another dam 0.8 miles downstream. The tailwater at Powder Mill Dam is substantially controlled from this other dam.

3.2 Evaluation

No evidence of overwhelming problems was uncovered during the visual inspection, though some areas bear watching.

Powder Mill Pond Dam is assessed to be in overall fair condition. See Section 7.

The spalling on the downstream face below the gatehouse may become a problem if allowed to progress unchecked. The construction joints will continue to erode faster than the spillway face and will eventually require repair.

Trespassing, lack of vegetation, and erosion on embankment sections must be controlled in order to preserve their long-term stability. Trees and brush should be cut, and roots removed and backfilled properly.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

During times when no water is discharging over the spillway, the gate on the 4' diameter discharge pipe is opened. The amount of opening depends on flow required and upstream surface elevation.

Frequent visits are paid to the dam to check conditions and to adjust the gate opening.

Powder Mill Dam is the uppermost of a series of four dams owned by Monadnock Paper Mills, and the operations of all are coordinated.

4.2 Maintenance of Dam

The flashboards are checked and replaced as necessary once per year, usually in summer when the pond recedes below the spillway crest. General clean-up and routine maintenance is performed as needed.

4.3 Maintenance of Operating Facilities

The gate for the 4' diameter discharge pipe is operated by electric motor, and is frequently exercised and maintained. The gate for the 4' square sluice is operated far less frequently and appears to receive much less attention.

4.4 Description of Any Warning System in Affect

There is no formal warning system in effect.

4.5 Evaluation

The flow regulation procedures are adequate, though a continuous record should be kept.

Maintenance appears to be adequate, though the embankments have been neglected. The sluice gate should receive regular exercise.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The original dam built in 1924 was designed to carry a peak flow of 8,700 cfs. This was greatly exceeded in the Sept. '38 flood, estimated as 22,900 cfs, and part of the dam washed out.

The hydraulic criterion used in the 1939 reconstruction was to increase capacity to pass the '38 flood with 1.5 feet to spare. This increase in capacity was accomplished by lengthening the spillway and increasing the freeboard, as mentioned in Section 2.1.

b. Experience Data

The two highest floods recorded were those of March, 1936 (which the original dam apparently survived) and September, 1938. The Army Corps of Engineers prepared flood profiles of these two events in 1939, and a partial print covering the area of interest is included in Appendix B.

The steepness of the channel from Powder Mill Dam through Bennington village to the flood plain where the mill is located makes this area particularly susceptible to flood damage, even if the dam was not there.

c. Visual Observations

Lack of erosion protection on both embankments, particularly the upstream faces, seems to leave the dam vulnerable to failing in a manner similar to the 1938 failure.

The valley section is such that further increases in the spillway length are not practical.

Constrictions in the downstream channel, both natural (narrow valley) and man-made (dams, bridges, etc.) probably render the channel incapable of freely passing very high flows.

If this is in fact true (which can only be determined by a study beyond the scope of this report), the tailwater would tend to submerge Powder Mill Dam. This condition would lessen the danger of failure by lowering the height of the flood wave.

d. Overtopping Potential

Reference is made to Appendix D for the hydrologic computations performed as part of this report.

The Probable Maximum Flood (PMF) is computed to be about 147,000 cubic feet per second (cfs) inflow into Powder Mill Pond. The PMF is defined as the largest flood that can reasonably be expected to occur on a given stream at a selected point or the flood that may be expected from the severe combination of critical meteorologic & hydrologic conditions that are reasonably possible in the region.

For dams in the intermediate size and high hazard classification, the "test flood" is chosen as the full PMF. The test flood is that flood used to evaluate the hydraulic adequacy of a project.

During the test flood (equal to the PMF), peak outflow at the dam would be about 133,000 cfs, the reduction from the 147,000 cfs inflow being accounted for by the surcharge storage "cushioning" effect of Powder Mill Pond. The spillway capacity is about 27,000 cfs, or 20% of the test flood. Overtopping potential is considerable. A flow of 133,000 cfs would theoretically overtop the dam by about 19 feet in excess of available freeboard. It is doubtful that the dam could survive this degree of overtopping.

The existence of the McDowell flood control dam upstream would tend to lower the peak flows at Powder Mill Dam. However, it covers only a small percentage of the drainage area. Several upstream dams are in vulnerable positions (wholesale failure occured in the

'38 flood) and this situation tends to increase the peak flows at Powder Mill. A complete study is beyond the scope of this report.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

Reference is made to Section 3. Erosion from surface runoff is present on both embankments and could lead to problems if left uncorrected. No unusual movements, cracks, seeps, boils, or other evidence of structural instability were noted.

b. Design and Construction Data

Except for a few poorly detailed plans and some general correspondence, no design data has survived which would assist in evaluating structural stability. The small amount of construction information is not an adequate base on which to make firm conclusions.

The most important missing information regards foundation, soil borings, and other geologic information. Detailed structural drawings would also have been helpful.

c. Operating Records

No distress has been reported since the 1938-39 reconstruction.

d. Post Construction Changes

No significant changes have been performed since the 1938-39 reconstruction.

e. Seismic Stability

This dam is located in Seismic Zone 2 and hence does not have to be evaluated for seismic stability in accordance with the OCE Recommended Guidelines.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

Powder Mill Dam is assessed to be in overall fair condition. The most serious shortcoming of the dam is its apparent susceptibility to overtopping by high floods. Other problems include embankment erosion and erosion of the concrete surface of the spillway.

b. Adequacy of Information

The information available is suitable for getting a good general picture of the important features of the project, but lacks the detail necessary to arrive at firm conclusions. The assessment is based primarily on the visual observation using the available information as background data.

c. Urgency

The owner should carry out the recommendations and remedial measures mentioned below within two years after receipt of this Phase I Report.

d. Need for Additional Investigation

The simplified hydrologic methods used in this report indicate a high overtopping potential and suggest that the dam is vulnerable to destruction in high floods.

In order to gain a better understanding of the flood situation in the watershed and the downstream channel, a more detailed hydrologic study is necessary. Such a study is beyond the scope of this report due to the large watershed area and to the complexity introduced by the existence of the McDowell Flood Control Project and other dams in the watershed. Such a study would have to assess the affect of the upstream dams on the probable maximum flood, and determine detailed hydraulics at

the dam site and in the downstream channel through the steep drop for 1-1/2 to 2 miles downstream.

This dam should receive a thorough inspection by a competent engineer every two years, in addition to regular observation visits by maintenance personnel.

7.2 Recommendations

a. Cut the trees and brush on the earth embankments and to retain a competent engineer to supervise the removal of roots and proper backfill.

b. Repair the erosion damage on the earth embankments and seek professional advice on providing erosion protection (riprap, grass cover, etc.) on the embankment faces.

c. Seek professional advice to study the erosion of the concrete spillway and to suggest a remedy.

7.3 Remedial Measures

a. Alternatives - N/A

b. Operating and Maintenance Procedures

(1) A more aggressive program of preventing trespass on the dam should be adopted.

(2) A grass cover of other slope protection should be established and maintained on the embankments. The embankments should be maintained free of trees.

(3) Round the clock surveillance should be provided by the owner during periods of unusually high flows caused by heavy precipitation, rapid snowmelt, or other reasons. The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

POWDER MILL POND DAM

APPENDICES

Appendix	Description
A	Visual Inspection Checklist - 4 pp.
B	Engineering Data with Index
C	Inspection Photographs with Index - 12 photos
D	Hydrologic Computations
E	Information as Contained in the National Inventory of Dams

APPENDIX A
VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Powder Mill Dam DATE June 23, 1978

TIME 1:30 P.M.

WEATHER Sunny, warm

W.S. ELEV. 674.2 U.S. 666 DN.S.
(1'-3" below crest)

PARTY:

1. T. T. Chiang, W & H
2. J. Scott, W & H
3. R. Hirschfeld, GEI
4.
5.
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Soils & Geology	Hirschfeld	
2.	Other	Scott & Chiang	
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT Powder Mill Dam DATE June 23, 1978

PROJECT FEATURE Embankments NAME Hirschfeld

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None observed
Pavement Condition	Not paved
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Fair
Indication of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	Trespassing at both abutments
Sloughing or Erosion of Slopes or Abutments	Erosion of embankment slopes next to concrete section
Rock Slope Protection-Riprap Failures	N/A
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	None observed
Instrumentation System	

PERIODIC INSPECTION CHECK LIST

PROJECT Powder Mill Dam DATE June 23, 1978

PROJECT FEATURE Gatehouse & Conduits NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS-TRANSITION AND CONDUIT	
General Condition of Concrete	Fair
Rust or Staining on Concrete	Some rust
Spalling	Small amount
Erosion or Cavitation	None observed
Cracking	None observed
Alignment of Monoliths	N/A
Alignment of Joints	N/A
Numbering of Monoliths	N/A
	Gatehouse of brick masonry superstructure in good shape. Some misc. metal work rusting.
	Railings sound.
	Gate operation not observed - owner operates 4' diam. discharge pipe at gatehouse regularly. 4' x 4' sluice on north abutment used to lower pond quickly.
	Ladder from north platform to spillway has lower 2 rungs damaged.

PERIODIC INSPECTION CHECK LIST

PROJECT Powder Mill Dam DATE June 23, 1978

PROJECT FEATURE _____ NAME _____

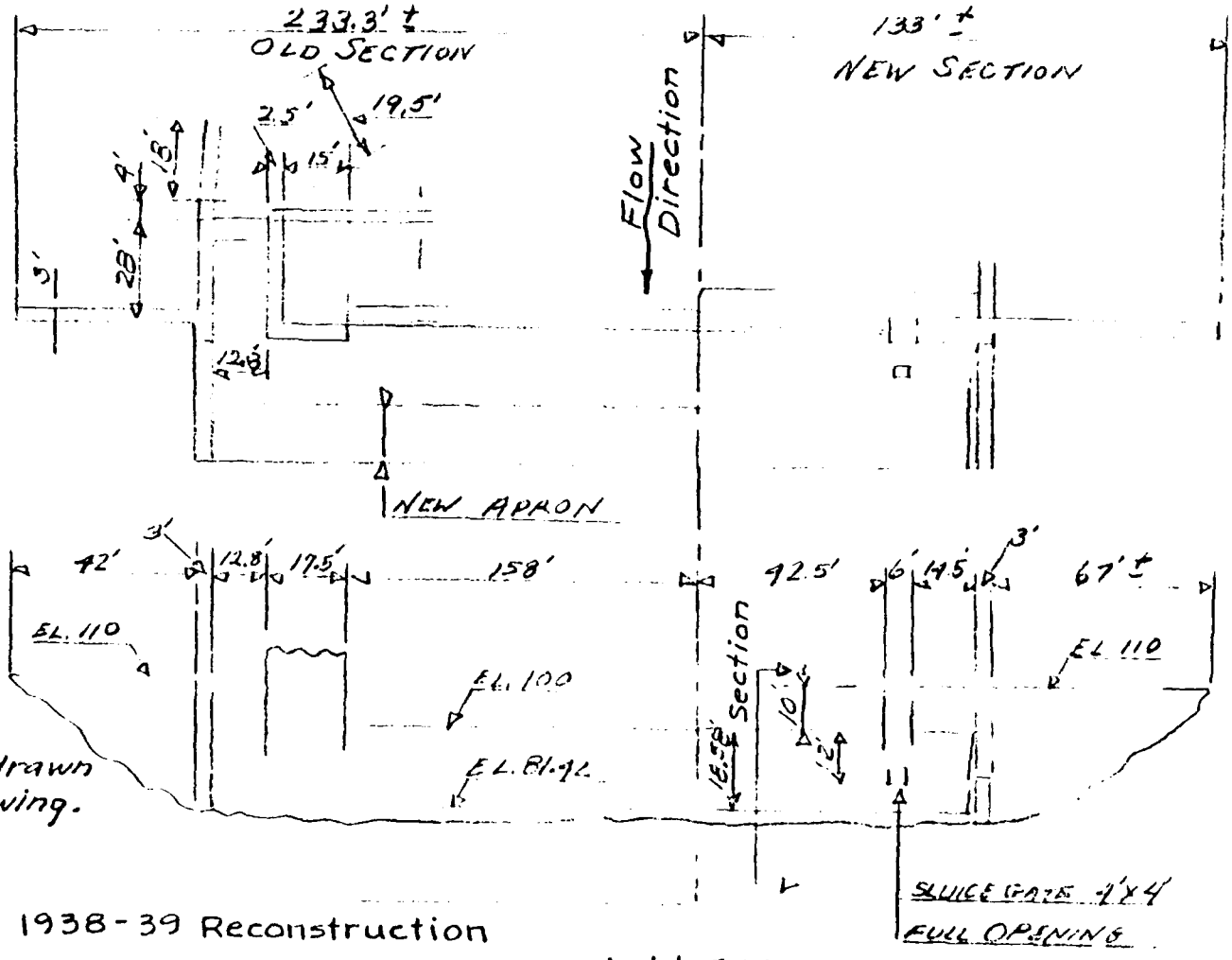
DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Approach channel is former natural streambed of Contoocook River.
General Condition	
Loose Rock Overhanging Channel	N/A
Trees Overhanging Channel	N/A
Floor of Approach Channel	Bottom not visible. Remnants of cofferdam used in 1938-39 rebuild. still in place. Much sand & gravel accumulation.
b. Weir and Training Walls	
General Condition of Concrete	Erosion is moderately advanced on spillway. Constr. joints eroded 6"-8". Some horizontal pitting.
Rust or Staining	None observed
Spalling	Ends of abutments & some sharp corners have spalled - not too bad.
Any Visible Reinforcing	None observed
Any Seepage or Efflorescence	No seepage. Constr. joints dry. Vegetation growing in area below gatehouse, which gets intermitent flow.
Drain Holes	
c. Discharge Channel	
General Condition	Natural river bottom - level controlled at another dam 0.8 mi. d.s.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Natural bottom - stony
Other Obstructions	Small island near south shore

APPENDIX B

ENGINEERING DATA

Sketch Plan - redrawn from old drawing
Sketch Section - redrawn from old drawing
N.H. Water Resources Board, Inspection Report, 7/28/77, 2 pages
Flood Profile, '38 & '36 floods, by Corps of Engineers, 1939
Photographs of 1938-39 reconstruction, 2 pages
Construction memo, 11/18/38
Report on dam damage, 10/7/38
Inspector's report, 6/23/24
Construction photos, 7/1/24, 2 pages
Notice of intent to construct dam, 5/23/24



This plan redrawn from old drawing.

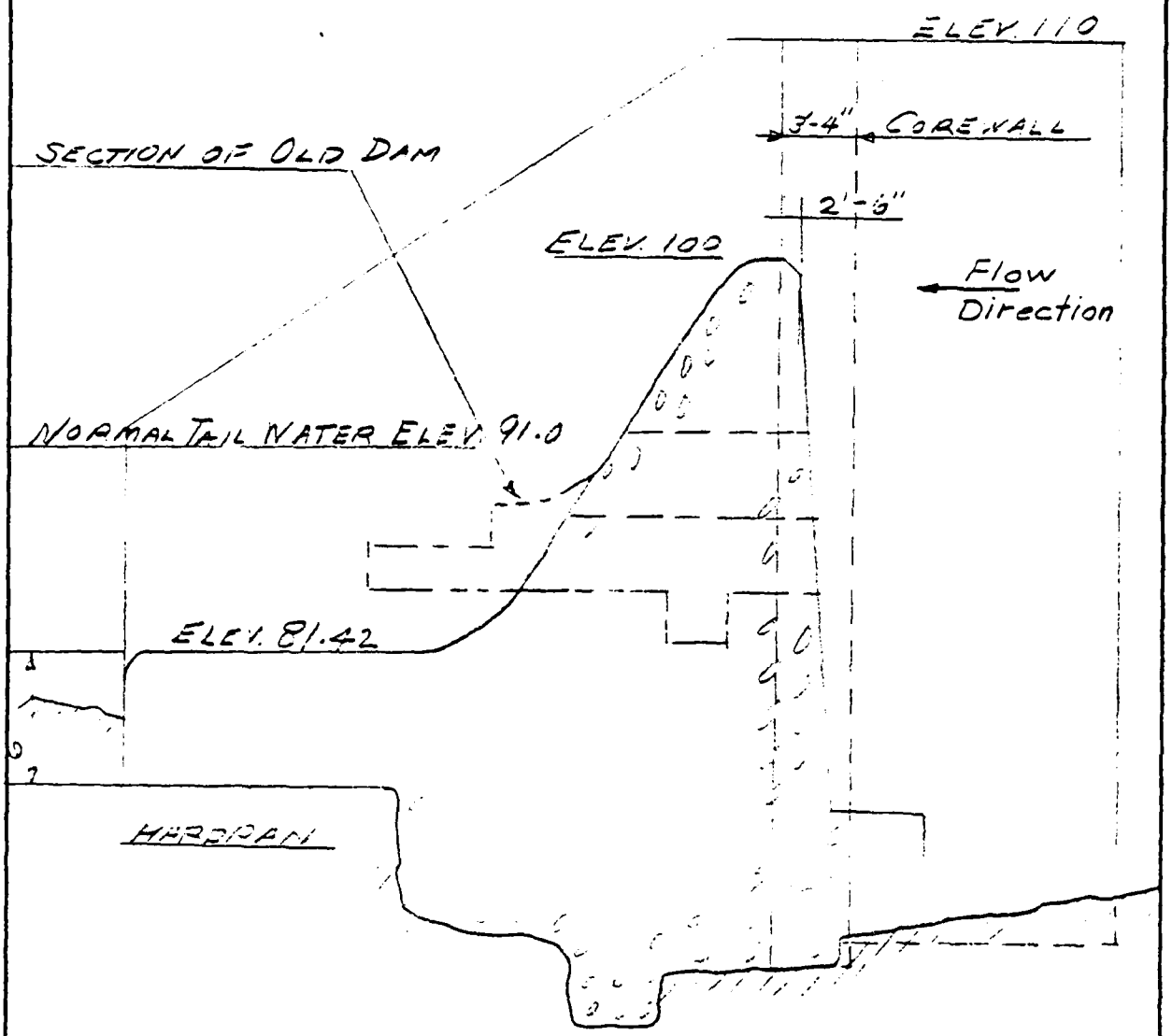
Plan of 1938-39 Reconstruction

POWDER MILL DAM

1 of 2

Add 575.44 to elevations shown for U.S.G.S. m.s.l. elevation.

This plan redrawn
from old drawing.



New Section
1938-39 Reconstruction

Add 575.44 to elevations shown for U.S.G.S. m.s.l. elevation.

POWDER MILL DAM

2 of 2

Approx. Scale: 1/8" = 1'-0"

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town: Bennington Dam Number: 22.22

Name of Dam, Stream and/or Water Body: Power mill dam Contoocook River

Owner: Monadnock Paper Mills Telephone Number:

Mailing Address:

Max. Height of Dam: 12' Pond Area: Length of Dam: 300'

FOUNDATION:

OUTLET WORKS: O-C concrete spillway 235' Long 10' Feet
2 gates 4 x 4
2' Flash boards

ABUTMENTS: Concrete in good shape

EMBANKMENT:

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

SPILLWAY: Length: 235 Freeboard: 10' w/o flashboards

SEEPAGE: Location, estimated quantity, etc.

Changes Since Construction or Last Inspection:

Tail Water Conditions:

Overall Condition of Dam: Good

Contact With Owner:

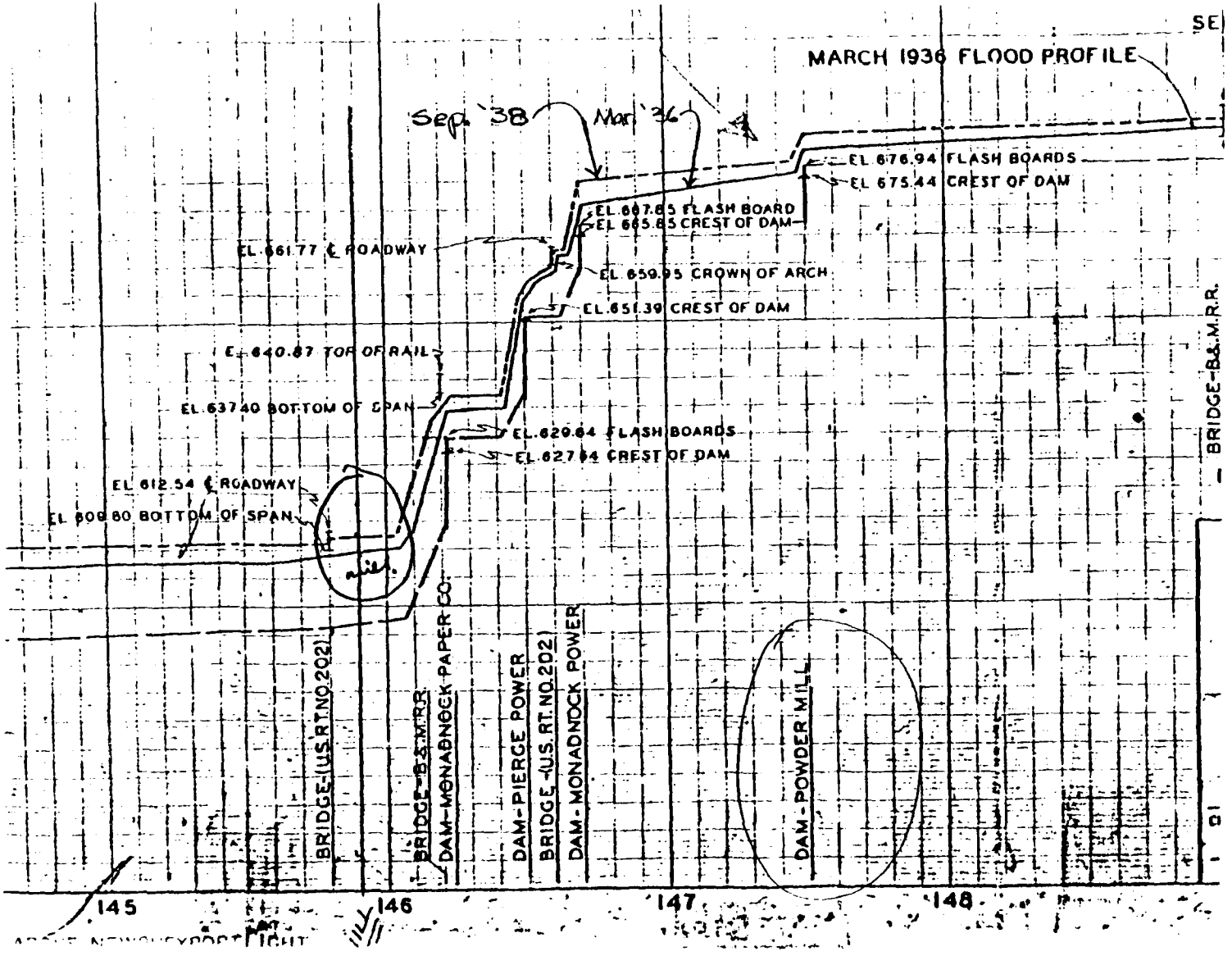
Date of Inspection: 28 July 77 Suggested Reinspection Date

Class of Dam: Menard C

Signature S. Burnett

Date

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


MARCH 1936 FLOOD PROFILE
Sep. '38
Mar '36
EL 676.94 FLASH BOARDS
EL 675.44 CREST OF DAM
EL 667.85 FLASH BOARD
EL 665.85 CREST OF DAM
EL 661.77 ℄ ROADWAY
EL 659.95 CROWN OF ARCH
EL 651.39 CREST OF DAM
EL 640.87 TOP OF RAIL
EL 637.40 BOTTOM OF SPAN
EL 629.64 FLASH BOARDS
EL 627.94 CREST OF DAM
EL 612.54 ℄ ROADWAY
EL 608.80 BOTTOM OF SPAN
BRIDGE-B.&M.R.R.
BRIDGE-(U.S.RT.NO.202)
DAM-MONADNOCK PAPER CO.
DAM-PIERCE POWER
BRIDGE-(U.S.RT.NO.202)
DAM-MONADNOCK POWER
DAM-POWDER MILL
BRIDGE-B.&M.R.R.
145
146
147
148

Form No. E61A

8442

NEW HAMPSHIRE WATER CONTROL COMMISSION 64 **RECORD OF DAM NO.** 22.02

Town Bennington : County Hillsboro : Local Name Powder Mill Dam

Function of Dam Storage - Industrial : Type Gravity - Solid concrete (O.G.)

Primary Basin Merrimack R. Sec. Basin Contoocook R. Local Stream Contoocook R.

Drainage Area, Total 184.09 sq. mi.: Controlled 0.12 sq. mi.: Net Uncontrolled ..... sq. mi.:

Reservoir Area, Full Pond ..... acres: At Max. Drawdown ..... acres:

Reservoir Capacity 1.300 mcf.: 30 ac. ft.: ..... in. net D. A.: .003 in. Total D. A.:

Overall Length of Dam 366 ft.: Max. Depth Water at Dam 18.58 ft.:

Net Spillway Length 227.8 ft.: Minimum Freeboard 10 ft.:

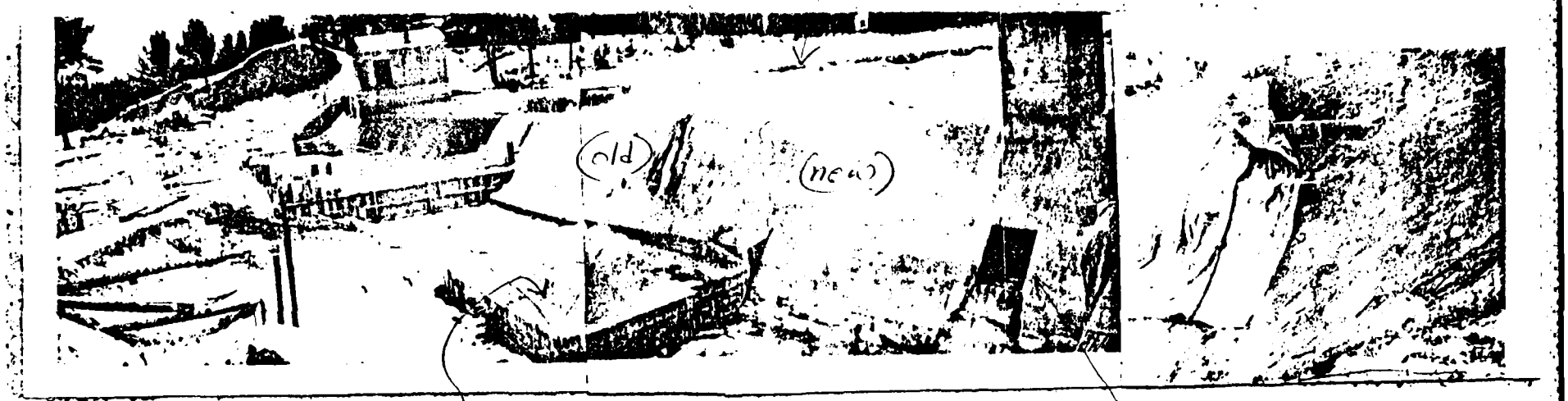
Spillway Capacity 25930 cfs.: 140.9 cfs. per sq. mi.:

Highest Flood Flow of Record 22900 cfs.: 124.4 cfs. per sq. mi.: Date Sept-21-1938

Estimated Maximum Probable Flood ..... cfs.:

REMARKS:

Card Prepared by C.F.O. : Checked by ..... : Approved for File ..... : Date 9/4/39

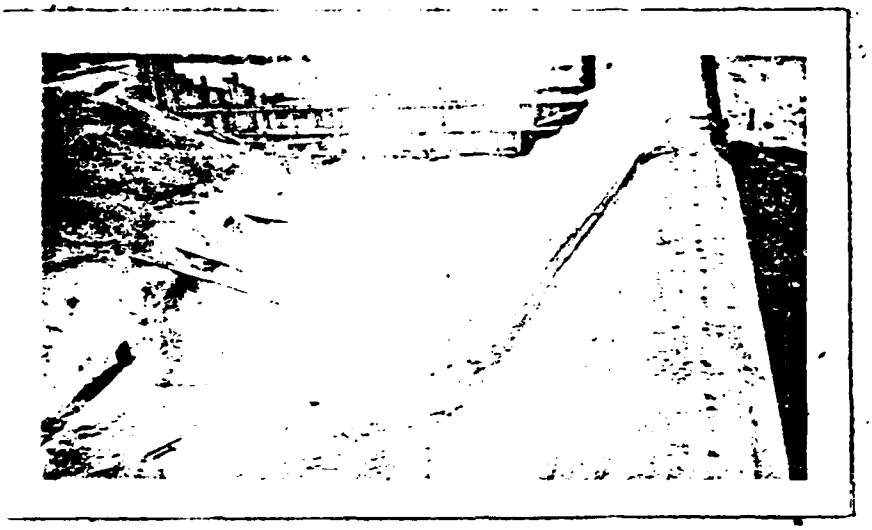


new, larger apron

Powder Mill Dam at Bennington

Dam No. 22.02
Case No. CHO-C

Owned by the Manadnock Paper Mills
Reconstruction work after flood damages of 1938



Powder Mill Dam at Bennington
Looking along crest of spillway.

MEMORANDUM

Case No. C80-C

TO: Richard S. Holmgren, Chief Engineer

RE: Powder Mill Dam of the Monadnock Paper Mill.

I visited the Powder Mill Dam on Friday November 18, 1938 in company with Mr. Pierce and Mr. Caughey of Pratt and Caughey, Contractors.

At the present time excavation is in progress to blue clay at the location where the section of the dam went out during the flood. The section will be exactly the same as at present with the exception that it will go approximately 20 feet deeper and the apron will be extended approximately 30 feet with a deep toe cutoff wall. A 4 x 4 gate will be installed in this section to allow drainage of the pond. The present length of the spillway is 206.5 feet. The new length of the spillway will be 235 feet. The abutments have been raised giving us a 10 feet freeboard as compared with the old 6 feet freeboard which will give ample discharge capacity in the event of future floods. This will give approximately 1½ feet of spill capacity above the 1938 discharge.

The Contractor plans to use a 1 - 2 - 4 mix with a duration of 1½ minute which is a standard 28 day 3000 pound test concrete. The apron has been extended approximately 10 feet on the other section of the dam and tied in to a toe cutoff wall going down approximately 12 feet into clay. The sand and aggregate are from a state tested pit.

I suggest that approval be given to this work subject to final inspection.

Charles D. Colman
Assistant Engineer

11/18/38

if this is true, 1938 discharge would be

$Q = \frac{3.6}{3.10} \cdot 235' \cdot (10-1.5)^{3/2}$

$= 18053$ cfs $\quad 20{,}965$

say ~~18,000~~ 21,000 cfs

$\frac{20{,}965 - 113.9}{184.09} = 98$ cfs/sq. mi

Jacobsen
Holmgren
Return to
Filed

WATER CONTROL COMMISSION

STATE OF NEW HAMPSHIRE

Concord, New Hampshire
October 7, 1938.

22.02

Monadnock Paper Mills,
Bennington N,H.

RE: Powder Mill Dam. W. C. C. No. 22.02

Gentlemen:

In order that we may determine the magnitude and extent of the flood of September 21-24 just passed, we are requesting the various dam owners in the State to supply us with the following information:

1. Was this dam injured? Ans. YES

2. If so, to what extent? Ans. 20/30 FT ON WEST END UNDERMINED AND TIPPED OVER

3. Did all flashboards go out? Ans. YES

4. What was the maximum height of water over the permanent crest of spillway? Ans. NINE FEET APPROX.

5. At what day and hour did the maximum flood height reach your dam? Ans. WEDNESDAY ABOUT 9 P M

6. Any other interesting information regarding the flood or rain fall may be given on the back of this sheet, or attach sheets.

Will you please return this letter with as much information as you can give us as promptly as possible. A self-addressed envelope is attached hereto.

We thank you for your cooperation.

Very truly yours,

Richard S. Holmgren

Richard S. Holmgren
Chief Engineer

CDC:GMB
Enc.

Printed on Back of [illegible] letter

WE THISK WE WOULD HAVE BEEN ALRIGHT

IF DAMS ABOVE US HELD.

PUBLIC SERVICE COMMISSION
OF
NEW HAMPSHIRE

22.02

INSPECTOR'S REPORT

Sheet#1

June 23 1924

Subject: Powder Mill Dam, Bennington

On June 13th Mr. Lord and I made an inspection of the Powder Mill Dam which the Monadnock Paper Mills is constructing on the Contoocook River at Bennington.

The excavation for the wheel pit and gates on the south side, has been made to about elevation 90.0. A coffer-dam has been built around this section.

A section of the dam about thirty feet in length has been removed on the north side, to take care of the water. In the middle of the river the dam has been left and they are now building a coffer-dam twenty feet up stream to divert the water around this section.

We took up with Mr. Pratt the question of the resultant falling outside the middle third. This is to be corrected and enough concrete added to bring the resultant within the middle third. As soon as the calculations have been made a new plan is to be filed showing the new section.

The sand to be used wil be taken from the same pit used last year by the Monadnock Paper Mills. Samples of both sand and cement are to be sent in and tested.

The excavation shows a gray clay with some boulders, but soundings are to be taken along the line of the dam to determine

PUBLIC SERVICE COMMISSION
OF
NEW HAMPSHIRE

2202

INSPECTOR'S REPORT

Sheet #2

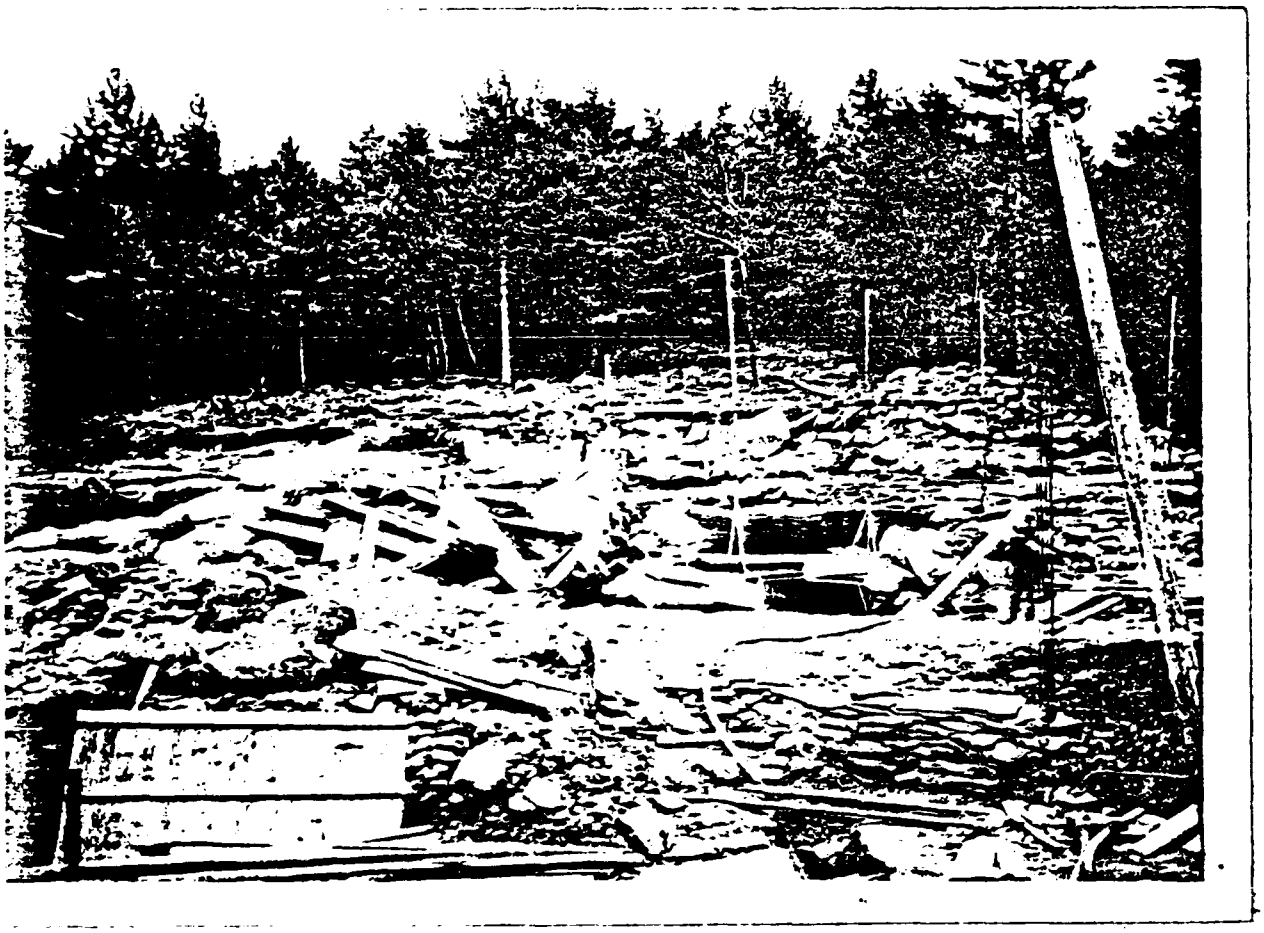
19

Subject: Powder Mill Dam continued

the underlying strata. When the excavation is completed we will be notified and it can be inspected if necessary.

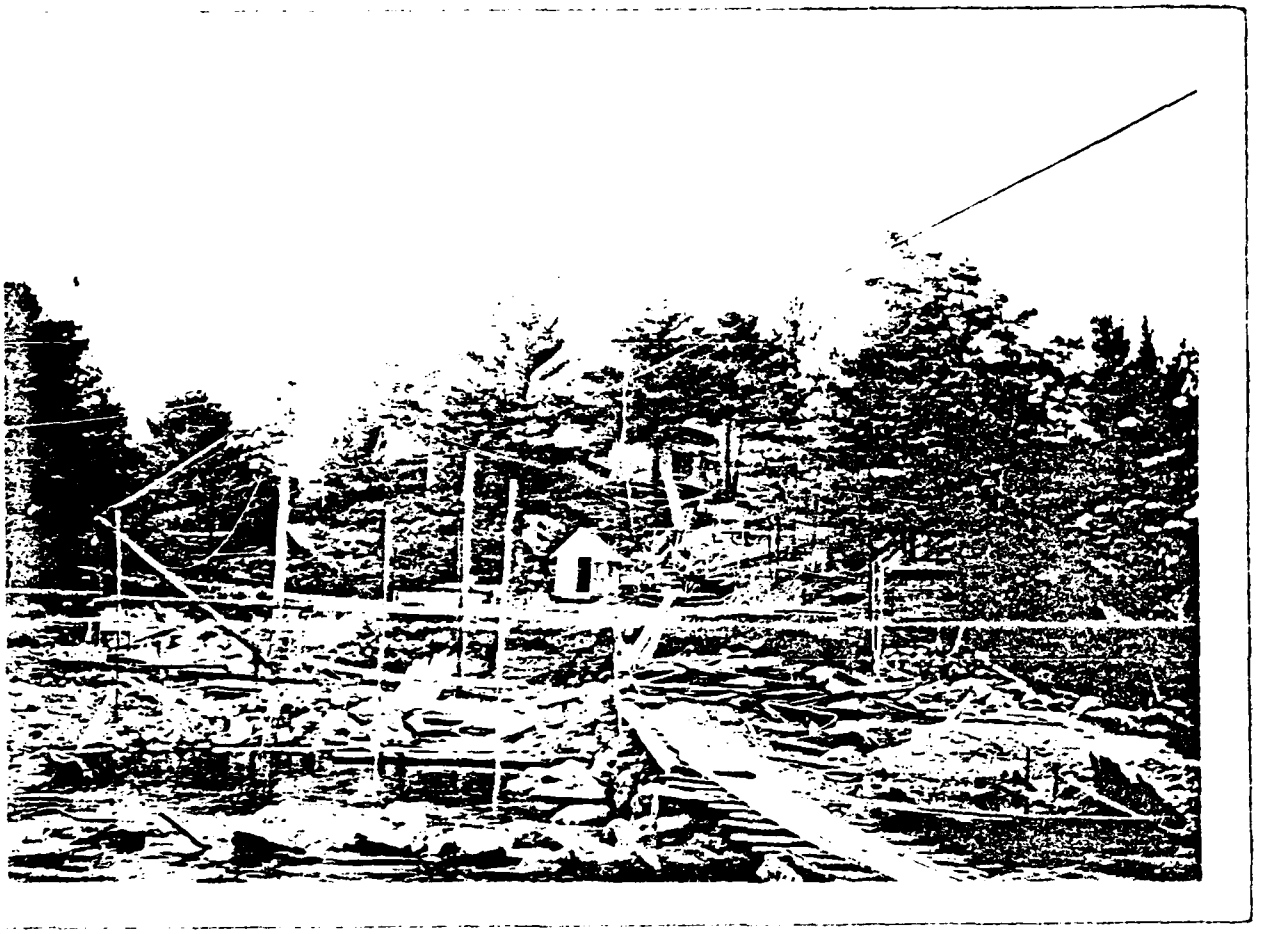
Respectfully submitted,

Engineer.



No. 1. Bennington Dam. Taken from the southerly bank of the river, looking northerly along proposed crest line of dam. July 1, 1924, 10:50 A.M.

22.02



No. 2. Bennington Dam. Taken from the northerly bank of the river, looking southerly along proposed crest line of dam. July 1, 1924, 10:55 A.M.

22.02

STATE OF NEW HAMPSHIRE.

To the Public Service Commission:

The Monadnock Paper Mills of Bennington in said State hereby informs the Commission that it proposes to rebuild substantially on the existing location thereof, the dam known as the Powder Mill Dam, across the Contoocook River situated on land of said corporation in the town of Bennington about one-half mile upstream from the village of Bennington.

The crest of said new dam when completed will be substantially six feet above the crest of the old dam as existing on May 13, 1910, and the proposed dam will be substantially fifteen feet in height above the bed of the river at its deepest point and will extend four and one-half feet below said river bottom.

The new dam will raise the water in the river six feet higher than the old dam as a maximum.

There is filed herewith a blueprint showing the dimensions and construction of the new dam.

Said company is prepared to proceed under the provisions of Chapter 47 of the Laws of 1913 as amended.

Dated this twenty-third day of May, 1924.

MONADNOCK PAPER MILLS,

By its Attorney,

Allen Hollis

APPENDIX C

INSPECTION PHOTOGRAPHS
(All photos taken 6/23/78)

Photo No.	Description
1 - 4	Four photo clockwise sequence looking upstream at dam face, showing in photo 1: south abutment core wall (upper center), trees on embankment, portion of spillway, gatehouse, and turbulence in water from discharge conduit; in photo 2: spalling on concrete below gatehouse from freeze-thaw action due to intermitent wet-dry condition, vegetation growing in concrete joint, south end of main spillway; in photo 3: main spillway with flashboards, some horizontal pitting & deeply eroded construction joint; in photo 4: north end of spillway, sluice way (at the tailwater line) and concrete access walkway, north abutment beyond.
5 - 8	Four photo clockwise sequence looking downstream from north end showing in photo 5: eroded and mostly bare face of north embankment and concrete access walkway; in photo 6: sluice gate operator on pier and flashboards in place; in photo 7: central portion of spillway and part of cofferdam remnants in upstream area; in photo 8: gatehouse, cofferdam remnants in foreground, and south embankment in background.
9	Looking at upstream face of north embankment adjacent to concrete abutment showing lack of erosion protection and active erosion. Lack of vegetation probably caused by trespass.

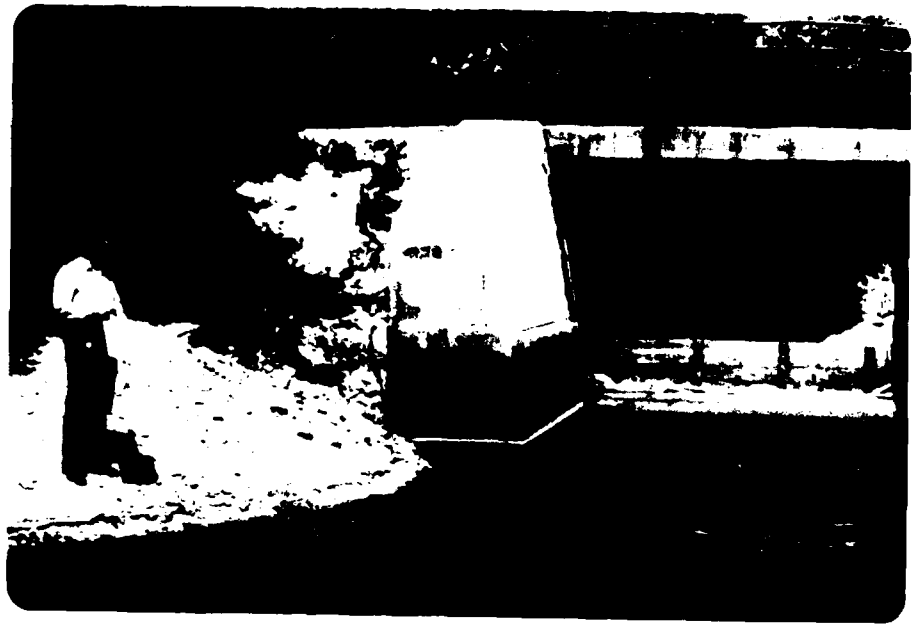
Photo No.	Description
10	Erosion channel viewed from concrete core wall looking downstream along downstream slope of north embankment.
11	Upstream face of south embankment taken from gatehouse, showing lack of erosion protection and an active erosion channel.
12	Typical construction joint on spillway face - eroded 6 inches at crest.

1

2

3

4



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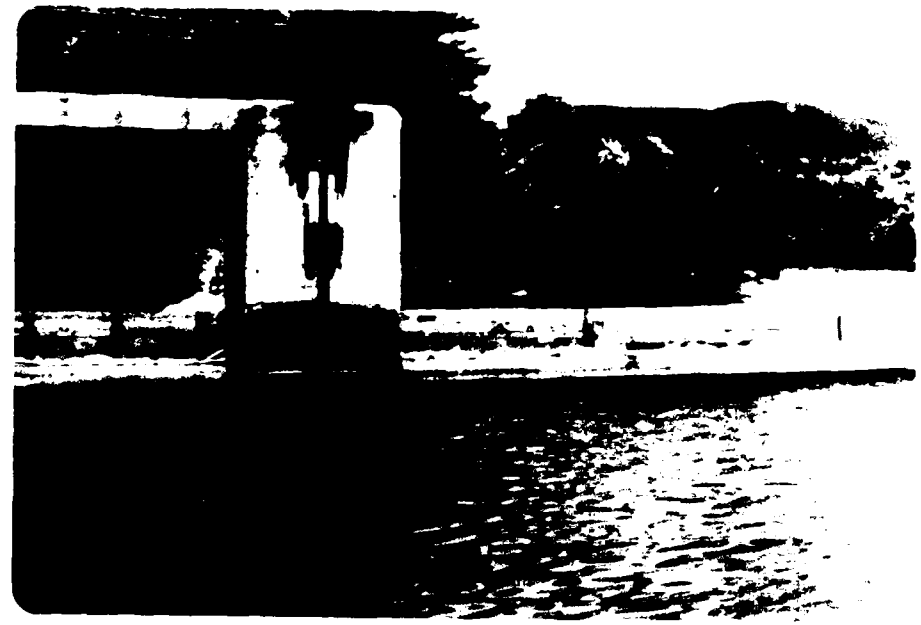

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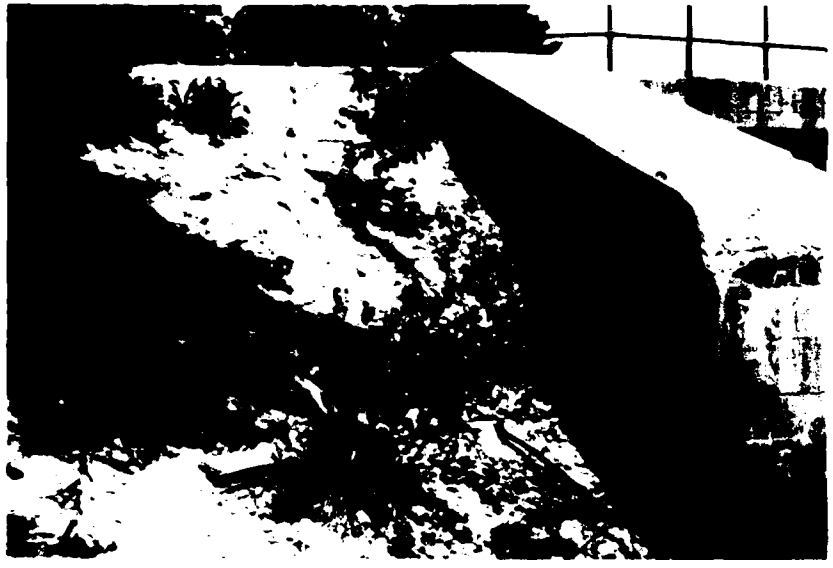

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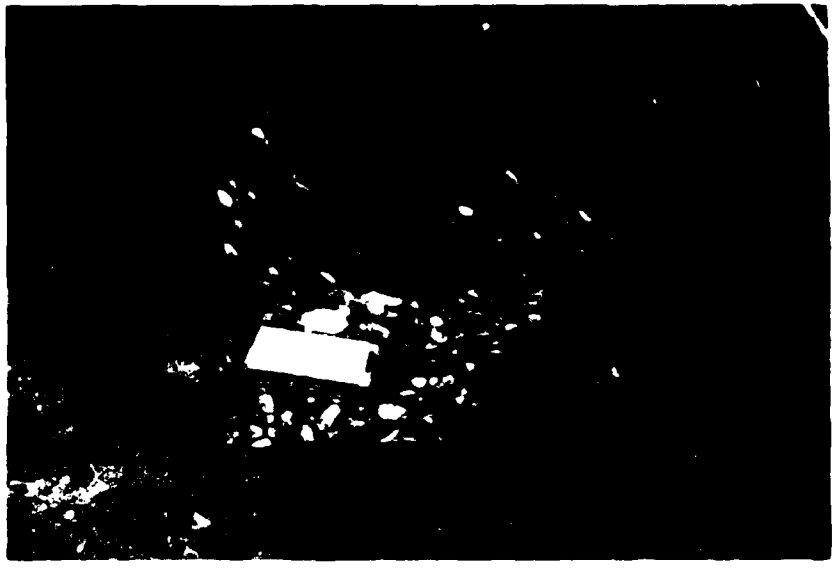

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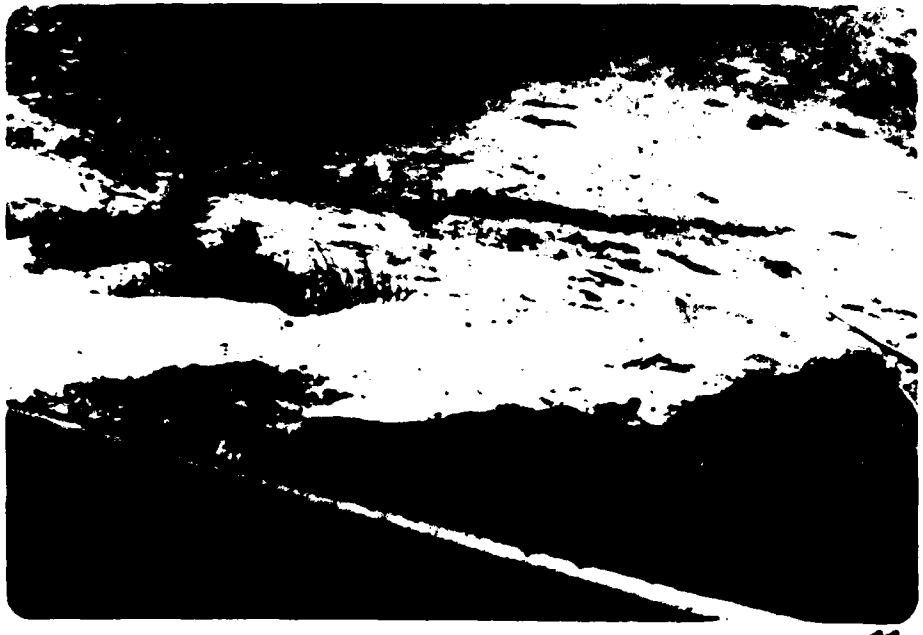

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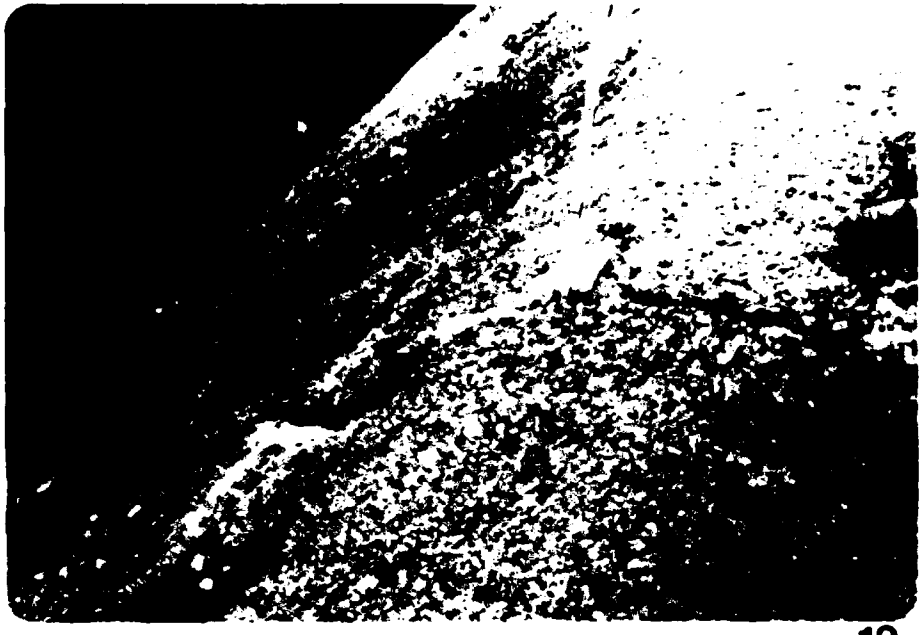


12

APPENDIX D

HYDROLOGIC COMPUTATIONS

WATERSHED MAP

BY I.I.C. DATE July 78 PROJECT Army Corps Eval. SHEET NO. 1 OF 5

CHKD. BY ..... DATE ..... Dam Safety Inspection — Powder Mill Pd JOB NO. 8-089

Powder Mill Dam Hillsborough, N.H.

A concrete gravity dam, with almost entire length of ogee spillway. Top of spillway = El. 675.44; Top of Dam = El. 685.44
Height of Dam = 28.58 ± max. Spillway length = 227.8 ±.

I. Hydrology & Hydraulic Conditions.

a) Drainage Area = 104.09 sq. miles

b) Basin Characteristics: Generally, the basin can be classified as rolling land type. The dam is on stream down (Contoocook River) with over two-thirds of the dam being ogee spillway. Approximately one mile downstream, is the Town of Bennington, with population under one thousand.

c) Water surface Area = About 435 acres, at spillway crest elevation of 675.44 and about 554 Acres, at elevation of 680. (Based on U.S.G.S. Map with planimeter measurement)

d) Storage Capacity = No data available about the storage below the crest of the old spillway which is 6 ft. Lower than the existing spillway. Though, there has been mentioned that the storage were 30.30 acre-ft; it seems incorrect. Based on the flood flow by raising the dam 6 ft. from the old dam to present elevation, the storage of the reservoir should be at least 760 Acre-Ft.

Drawdown Ft	Water Area in addition to old reservoir
0	281.17
1	239.16
2	166.05
3	104.81
4	54.12
5	22.08
6	old reservoir

(old reservoir should have water surface area = 154 acre)

WHITMAN & HOWARD, INC.
48 WILLIAM STREET, WELLESLEY, MASS.
Engineers and Architects

Estimated storage based on water surface area of 435 acre would be about 2400 acre-ft below the spillway crest.

Storage between the elevation of spillway crest to top of dam estimated at about 6200 acre-ft

The maximum storage capacity, then, would be about 8,600 acre-ft with water level at top of dam (Elv. 665.4)

e) Size & Hazard Classification:

Based on storage and hight of structure, Powder Mill dam belongs to intermediate dam category.

With the town of Bennington only a mile away, downstream, the potential damage, if the dam were to fail, would be high.

f) Probable Max. Flood Flow

Estimated P.M.F. peak flow would be about 800 cfs per sq. mile of drainage area. So the peak flow rate of P.M.F at Power Mill Dam would be about 147,272 cfs

g) Surcharge storage Effect.

With gates open, the two outlets (one on each end of the dam) should have capacity of about 800 cfs when water level reaches the top of dam. Thus, the spillway should have capacity of 146,500 cfs, neglecting surcharge storage effect.

The spillway capacity by neglecting wave effect
$= 3.7 \times 227.8 \times (10)^{3/2} = \underline{26,654}$ cfs Maximum

Consider wave height with wind velocity at 70 MPH

$W_h = 0.17\sqrt{VF} + 2.5 - \sqrt[4]{F}$

$= 0.71 + 2.5 - .71 = 2.5$ ft

Spillway capacity $= 26,654\,(7.5/10)^{3/2} = \underline{17,312}$ cfs Normal

Surcharge effect:

$QP1 = 146,500$ cfs $\quad H_1 = \left(\frac{146,500}{3.7 \times 2278}\right)^{0.6667} = 31.15$ ft

$STOR1 = 31.15 \times 554 \times 12 \times 1.562 \times 10^{-3} / 1840.9$

$= 1.76$ inch

$QP2 = 146,500\left(1 - \frac{1.76}{19}\right) = 132,852$ cfs

$H_2 = \left(\frac{132,952}{3.7 \times 2278}\right)^{0.6667} = 29.2$ ft

$STOR2 = 29.2 \times 1.76 / 31.15 = 1.65$ inch

$STOR_{ave} = \frac{1.65 + 1.76}{2} = 1.7$ inch

$QP3 = 146,500\left(1 - \frac{1.7}{19}\right) = 133,354$ cfs.

Due to its large drainage area, the surcharge storage effect amounts only to 10% of the MPF peak flow and surcharge height, about 30 ft total.

h. Conclusions:

The dam has a spillway almost equal to its entire length but still can not pass the estimated M.P.F.; Expansion of spillway length does not seem promising. If dam failure, the large amount of storage would create serious problem. Therefore detailed analysis of the dam stability, under high head of water, should be conducted. If the dam is safe under such high head, then repair of some concrete would be necessary.

BY T.I.C. DATE July 78 PROJECT Army Corps Engrs. SHEET NO. 4 OF 5

CHKD. BY. DATE Dam Safety Inspection - Powder Mill JOB NO. 8-089

II. Other Comments.

a) Part of the dam & spillway were washed out during the 1923 flood, which generally has been considered as a 100-year flood. New section has been added on, spillway length has been increased, but it only can pass the estimated 1938 flood, with about 1.5 freeboard left for wave protection.

b) The estimated 800 cfs per sq. mile of drainage area peak flood flow is a reasonable estimation. With the about 230 ft. long spillway, it would require about 30 ft of head on top of the spillway crest to pass it. Sure, the river channel has no such magnitude capacity, even without the dam; a flood of this magnitude would mean high hazard along the river. But, if the dam failed during such a flood, it would increase the flood flow much more; it would certainly increase the damage.

c) Except if a flood control project could be built at the upstream, the river basin would always be under the danger of being flooded.

d) There are two gaging stations upstream of the Powder Mill Reservoir. The recorded maximum flood flow for Nabanusit Brook, with 46.9 sq. mile drainage area upstream, is 1,130 cfs. Total recorded period is 40 years. For Contoocook River with 68.1 sq. mile of drainage area, the recorded maximum flood flow is 2520 cfs, since 1945.

III Discharge Rating Curve and Surcharge Storage Curve.

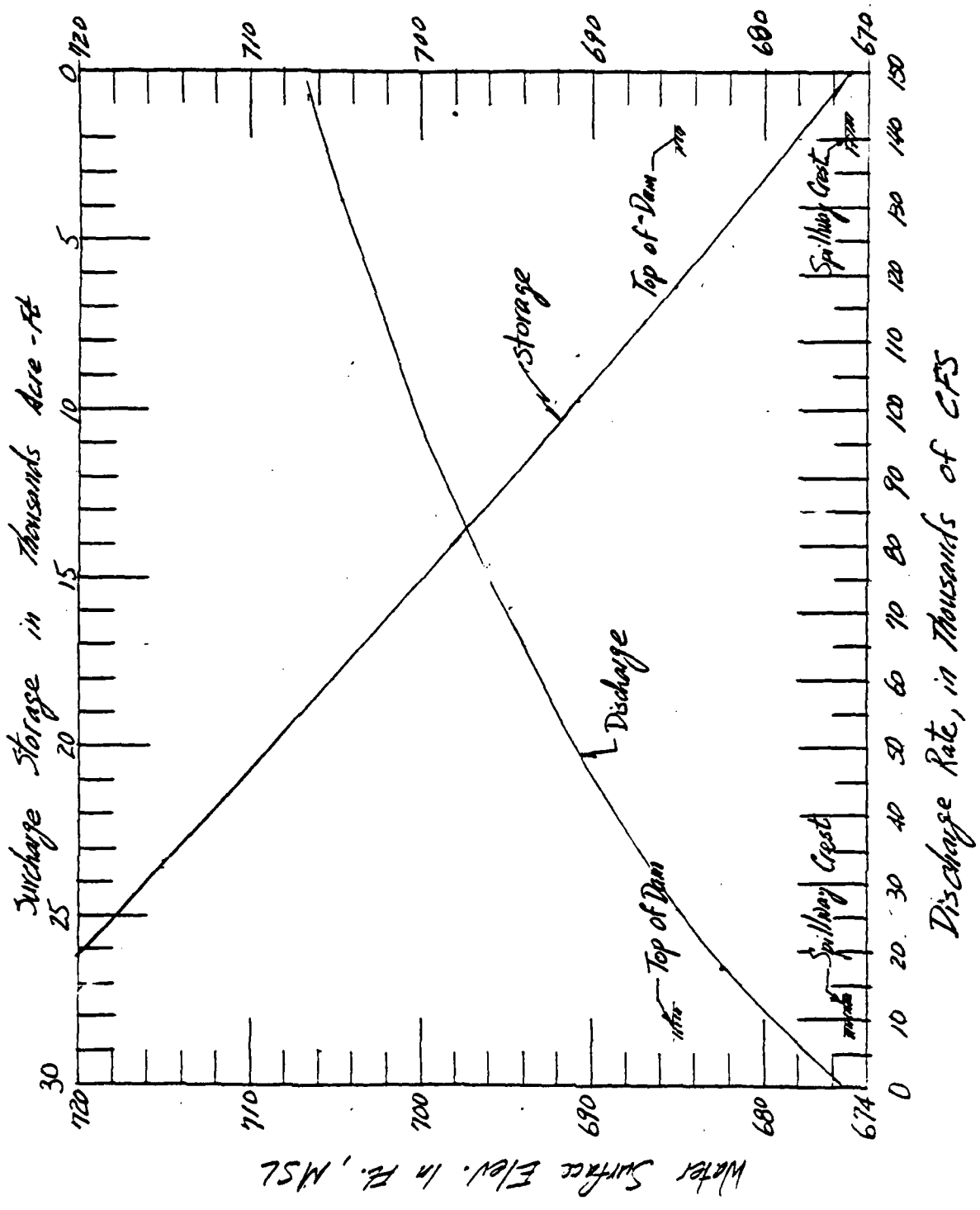
The spillway length already is close to equal to the whole valley width, therefore the discharge rating curve is the spillway discharge rating curve.

The Surcharge Storage Curves were computed based on the water surface area of 560 Acre. max. the actural area may

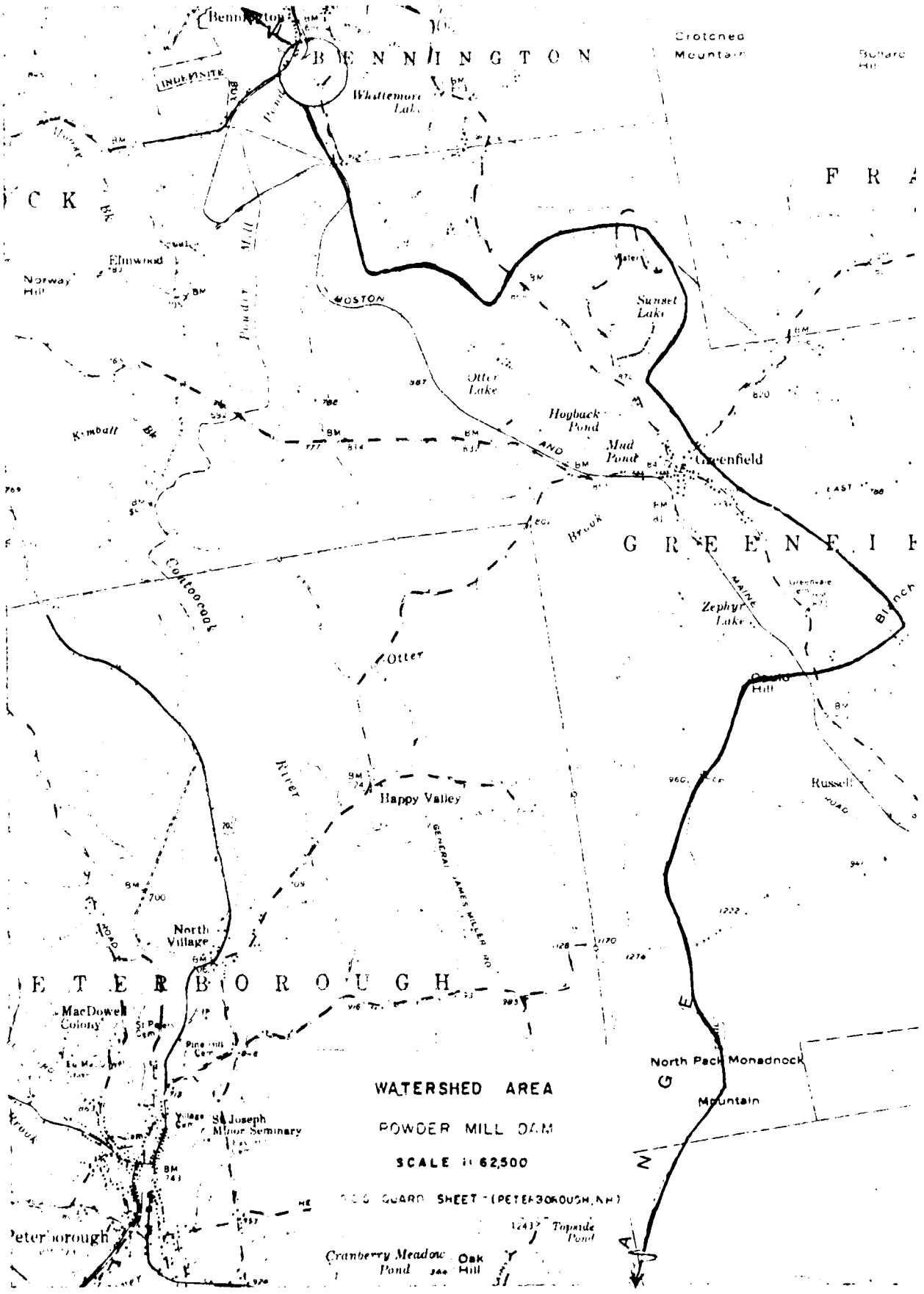
BY T.T.C. DATE Aug 78 PROJECT Army Corps Ests SHEET NO. 5 OF 5

CHKD. BY ..... DATE ..... Dam Safety Inspect. - Powder Mill JOB NO. 8-089

be higher.



WHITMAN & HOWARD, INC.
45 WILLIAM STREET, WELLESLEY, MASS.
Engineers and Architects


Bennington
BENNINGTON
Crotched Mountain
Whittemore Lake
Norway Hill
Elmwood
WOSTON
Sunset Lake
Otter Lake
Hogback Pond
Mud Pond
Greenfield
GREENFIELD
Zephyr Lake
Otter
Happy Valley
North Village
PETERBOROUGH
MacDowell Colony
St Joseph Minor Seminary
Peterborough
Cranberry Meadow Pond
Oak Hill
Temple Hill
Russell
North Pack Monadnock Mountain
WATERSHED AREA
POWDER MILL DAM
SCALE 1:62,500
USGS QUAD SHEET - (PETERBOROUGH, NH)

APPENDIX E

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY | MO | YR
NH	248	NED	NH	011	02				POWDER MILL POND DAM	4259.6	7155.5	01AUG78

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	POWDER MILL POND

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	05	CONTOOCOOK RIVER	BENNINGTON	1	639

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	(27) NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS	A	VER/DATE
	1924	OR	29	19	8600	2400	NED	N	N	N	N		01AUG78

(28) REMARKS

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	366	C	228	26600												

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
MONADNOCK PAPER MILLS	UNKNOWN	CAUGHEY AND PRATT

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BD	NH WATER RES BD	NH WATER RES BD	NH WATER RES BD

(50) INSPECTION BY	(51) INSPECTION DATE DAY | MO | YR	(52) AUTHORITY FOR INSPECTION
WHITMAN & HOWARD, INC.	23JUN78	PL92-367

(53) REMARKS

END

FILMED

8-85

DTIC