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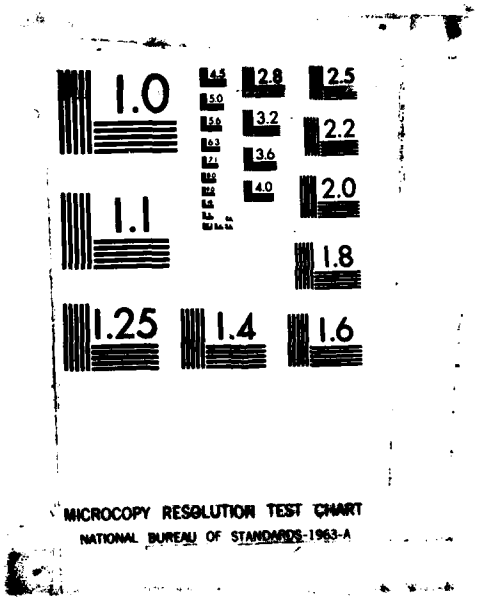
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MERRIMACK RIVER BASIN
WESTMINSTER, MASSACHUSETTS

MEETINGHOUSE POND DAM
MA 01018

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

NOVEMBER 1978

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MA 01018	2. GOVT ACCESSION NO. AD-A155745	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Meetinghouse Pond Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE November 1978 13. NUMBER OF PAGES 60
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 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,

Merrimack River Basin
Westminister, Massachusetts
Smith Brook

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

The dam comprises two earthen embankments with an included spillway, The dam is about 230 ft. long and 15 ft. high. The dam is in good to fair condition. It was determined that the dike at the dike at the spillway was a crest elevation lower than the dam. Additional investigations are recommended to determine if the seepage is present at high water levels and to determine and modify as necessary freeboard.

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

REPLY TO
ATTENTION OF:

NEDED

JAN 9 1979

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

I am forwarding to you a copy of the Meetinghouse 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 Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, the City of Fitchburg, ATTN: Mr. Joseph Levanti, Commissioner of Public Works, 718 Main Street, Fitchburg, Massachusetts 01420.

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 Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

MEETINGHOUSE POND DAM
MA 01018

MERRIMACK RIVER BASIN
WESTMINSTER, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.: MA 01018
Name of Dam: MEETINGHOUSE POND
Town: WESTMINSTER
County and State: WORCESTER COUNTY, MA
Stream: SMITH BROOK
Date of Inspection: 22 August 1978

BRIEF ASSESSMENT

Meetinghouse Pond Dam comprises two earthen embankments with an included spillway. The major embankment, the dam, is approximately 230 feet long and 15 feet high. The gate house and water intakes are located at this embankment. The dam was constructed on or about 1893 according to records obtained from the City of Fitchburg. The other embankment, the dike, is approximately 170 feet long and approximately 6 feet high. It is located to the north of the dam and includes a masonry spillway with wooden flashboards. Ledge outcrops are adjacent to the spillway and form a part of the spillway channel floor. No information was located pertaining to the date the spillway was constructed but it is assumed that it was built during the same time as the dam.

The dam is in good to fair condition. The reservoir water level was low during the site examination and, therefore, no true indication of seepage could be observed. It was determined that the dike at the spillway has a crest elevation lower than the dam. The crest of the dike and the adjacent terrain is so heavily covered with vegetation that low points may have been obscurred.

Based on the size and hazard classification in accordance with the Corps of Engineers guidelines, the spillway test flood is the 1/2 Probable Maximum Flood (1/2 PMF). Hydraulic analyses indicate that the spillway can safely pass the test flood provided the flashboards are not in place; otherwise the spillway dike will be overtopped.

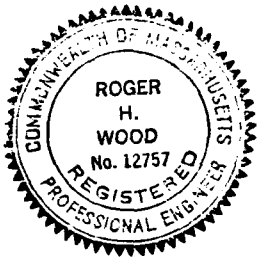
Recommendations for remedial work include the clearing of brush and trees from the dike, dam, spillway and discharge channel; the filling of animal burrows; the providing of additional riprap protection; the re-shaping of the dam crest to limit vehicle traffic; and performing maintenance work on the spillway and gate house. Additional investigations of the spillway dike are recommended to determine if seepage is present at high water

levels and to determine and modify as necessary the freeboard. The investigations and remedial work be carried out by the Owner within two years of the receipt of this report.

CAMP DRESSER & McKEE INC.

Roger H. Wood

Roger H. Wood
Vice-President



This Phase I Inspection Report on Meetinghouse 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.

Richard F. Doherty

RICHARD F. DOHERTY, MEMBER
Water Control Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph A. McElroy

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

APPROVAL RECOMMENDED:

Joe B. Fryar

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 Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), or a 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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1. OVERVIEW OF MAIN DAM AND GATE HOUSE.

DAM: MEETINGHOUSE POND

IDENTIFICATION NO.: MA.01018

N

LOCATION MAP
USGS QUADRANGLE
GARDNER, MA.
SCALE: 1" = 2000'

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
MEETINGHOUSE POND DAM
MA 01018

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.

Camp Dresser & McKee Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Camp Dresser & McKee Inc. under a letter of July 12, 1978, from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-78-C-0354 has been assigned by the Corps of Engineers for this work. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for the soils and geological portions of the work.

b. Purpose - The primary purpose of the investigation is to:

(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 assist the States to initiate quickly effective dam safety programs for non-Federal dams.

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

1.2 Description of Project

a. Location - Meetinghouse Pond Dam and Spillway are located along the eastern shore of Meethinghouse Pond, in the Town of Westminster as shown on the report's Location Map. The spillway is located approximately 450 feet north of the dam and gatehouse, all of which are west of West Princeton Road. Meetinghouse Pond forms the headwaters of Smith Brook which flows in a southeasterly direction to Wyman Pond.

b. Description of Dam and Appurtenances - Meetinghouse Pond Spillway consists of a relatively small earth embankment dike with an ungated concrete and rock spillway at the left end. There is also a separate larger earth embankment dam with a gate house structure at roughly the left one-third point. The total length of the dike is approximately 170 ft., including the spillway, while the dam is approximately 230 ft. long. Available plans and profiles obtained from the City of Fitchburg Department of Public Works, Engineering Division, and sketches prepared from inspection records are shown in Appendix B.

The dike embankment is approximately 6 ft. high and has a somewhat irregular cross section covered by trees and brush. The downstream slope appears to be on the order of 2 horizontal to 1 vertical. The crest has a pronounced slope down toward the pond, and the short upstream face is typically flatter than the downstream slope. There is riprap slope protection on the upstream face.

To the left of the spillway structure, the spillway wall backfill apparently merges with an area of natural ground that is close to the dike crest elevation. A low profile field stone wall, approximately 18-in. high and 50 feet long is located on top of the natural ground.

The dam embankment has the nearly parallel West Princeton Road embankment as part of its downstream slope, and has a maximum height of nearly 15 ft. relative to the roadway embankment toe. For most of its height, the upstream slope of the dam is approximately 2 to 1 while the downstream face has a wide horizontal step for the road and then a steep slope down to a stone masonry retaining wall. There is riprap slope protection in the form of rock slabs on the upstream face up to slightly above spillway crest elevation; most of the remaining slopes have a growth of either trees or brush.

The spillway consists of a grouted rubble apron approximately 30 feet long with training walls on either side which are 24'-6" apart. Approximately 24-in of flashboards are located across the 24'-6" wide crest which drops approximately 18-in to the downstream toe. Plan and sections of the spillway are shown in Appendix B.

The Pond's outlet consists of a long, narrow channel to the gate house on the dam embankment. Enclosed within the gate house is a mechanically cleaned bar screen which is located at the entrance to a 30-in diameter conduit which passes through the dam. On the downstream toe of the dam, the 30-in conduit connects to a 36-in conduit and a 20-in blow off pipe. The 20-in blow off has a gate value and the 36-in conduit connects directly to the City of Fitchburg's water distribution system.

c. Size Classification - The height of the dam is approximately 15 feet and the estimated total storage capacity at the top of the left spillway dike is 2,530 acre-feet. According to guidelines established by the Corps of Engineers, the dam is classified in the intermediated category based on the storage capacity.

d. Hazard Classification - The dam was originally classified by the Corps of Engineers as having a "high" hazard potential. The results of the dam failure analysis indicate that a flood wave resulting from a failure of the right spillway embankment would cause damages to three roads and culverts and possibly some minor damage to 2 to 4 private residences along Patricia Road. Consequently, it is recommended that the hazard be reduced to significant.

e. Ownership - The pond and dam are owned by the Fitchburg Water Department. The Owner's address is: Fitchburg Water Department, City Hall, 718 Main Street, Fitchburg, MA 01420 (Phone: 617/342-5722). The Superintendent of the Water Department, Mr. J. Andre Provencial, acted as the owner representative during this investigation.

f. Operator - Operation of the dam is the responsibility of the Fitchburg Water Department. Mr. Norman Cormier is the Head Operator. Mr. Raymond Desjeans is the individual designated as the contact person. His address is: Water Shop, 78 River Street, Fitchburg, MA 01420 (Phone: 617/342-4212).

g. Purpose of Dam - Meetinghouse Pond serves as a water supply reservoir for the City of Fitchburg.

h. Design and Construction History - The dam was designed in 1893 and constructed shortly thereafter. No records of the construction are available. The gate house and spillway were repaired in 1968 by placing "qunite" over rubble and stone masonry. During recent times, a mechanical bar screen was installed in the gatehouse.

i. Normal Operational Procedure - Water from Meetinghouse Pond is released by gravity feed through a mechanically cleaned bar screen located within the gate house and is conveyed through the dam via a 30" conduit. In the past, the water was discharged to Smith Brook which conveyed it to the Smith Distributing Reservoir and then via a 20" diameter conduit to the City's distribution system. Today, the water is fed directly into the distribution system via a 36" diameter conduit which is connected directly to the 30" conduit which passes through the dam. A gate valve, "Y" branch, and 25 ft. of 20" diameter blowoff pipe is located at the connection between the 30" and 36" diameter pipes. The 20" blow-off pipe discharges to the dry stream bed of Smith Brook.

A maximum of 6 MGD can be pumped into Meetinghouse Pond via a 16" and 20" force main from the Mare Meadow and Bickford Storage reservoirs.

1.3 Pertinent Data

Elevations given in this report are on National Geodetic Vertical Datum (NGVD) formerly referred to as Mean Sea Level (MSL).

a. Drainage Area - The 1.47 square mile watershed surrounding Meetinghouse Pond is sparsely developed and heavily wooded. The contour of the terrain is steep to rolling. The surface area of the pond (152.7 acres) represents approximately 16 percent of the drainage basin.

b. Discharge at Dam Site - There are no records of discharges at the dam site or for Smith Brook. Record Drawings of the dam and gatehouse report a "high water" elevation of 1,033.0 which corresponds to the spillway crest.

(1) Outlet conduit size 30" and Invert Elev. 1017.5.

(2) Maximum known flood at damsite _____ UNKNOWN

(3) Ungated spillway capacity at top of dam.
420 cfs @ 1,036.0 elev.

(4) Ungated spillway capacity at test flood pool elevation
350 cfs @ 1,035.6 elev.

(5) Gated spillway capacity at top of dam with flashboards
86 cfs @ 1,036.0 elev.

(6) Gated spillway capacity at test flood pool elevation with flashboards 50 cfs @ 1,035.6 elev.

(7) Total spillway capacity at test flood pool elevation
350 cfs @ 1,035.6 elev.

(8) Total project discharge at test flood pool elevation
350 cfs @ 1,035.6 elev.

c. Elevation (ft. above MSL)

(1) Top of dam 1,037+; top of dikes at spillway 1,037 Rt. & 1,036 Lt.

(2) Test flood pool-design surcharge _____ 1,035.6

(3) Design surcharge-original design _____ UNKNOWN

(4) Full flood control pool _____ N/A

(5) Normal pool for water supply _____ 1,033

(6) Spillway crest _____ 1,033.0

(7) Upstream portal invert diversion tunnel _____ None

(8) Streambed at centerline of dam _____ 1,022 (Est.)

(9) Maximum tailwater _____ 1,031.1

d. Reservoir

(1) Length of test flood _____ 5,300 feet (Est.)

(2) Length of normal pool _____ 5,300 feet (Est.)

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

e. Storage (acre-feet)

(1) Top of left spillway dike _____ 2,530(Est.)

(2) Test flood pool _____ 2,455(Est.)

(3) Flood-control pool _____ N/A

(4) Normal pool _____ 2,010 max.

(5) Spillway crest _____ 2,010

f. Reservoir Surface (acres)

(1) Top of left spillway dike _____ 170 (Est.)

(2) Test flood pool _____ 168 (Est.)

(3) Flood control pool _____ N/A

(4) Normal pool _____ 152.7 max.

(5) Spillway crest _____ 152.7

g. Embankments:

	Dike	Dam
(1) Type	Earth embankment	Earth embankment
(2) Length	Approx. 170 ft., incl. Spillway	Approx. 230 ft.
(3) Height	Approx. 6 ft.	Approx. 15 ft.
(4) Top width	24 to 30 ft., sloped down toward pond	Approx. 25 ft.; road approx. 35 ft. additional

(5)	Side slopes	Approx. 3:1 U/S and 2:1 D/S	Approx. 2:1 U/S; irregular with road and masonry wall downstream
(6)	Zoning	Unknown	"Rolled earth" U/S and D/S
(7)	Impervious core	Unknown	"Rubble core wall laid in cement"
(8)	Cutoff	Unknown	Unknown
(9)	Grout curtain	Probably none	Probably none

h. Diversion and Regulating Facilities ----------None

i. Spillway

(1) Type_____Grouted Rubble Apron

(2) Length of weir_____24'-6"

(3) Crest elevation_____1,033.0; 1,035.0 with flashboards

(4) Gates _____None

(5) U/S channel_____9-ft. rise in 500 ft.

(6) D/S channel_____9-ft. drop in 275 ft.

(7) General_____D/S channel overgrown with vegetation

j. Regulating Outlets - The reservoir drain and the water supply intake pipes at the dam gate house are the only regulating outlets for this reservoir. The intake channel is a fieldstone channel and extends out to the reservoir itself. Two 24-inch pipes connect the intake channel to the main chamber within the gate house. Both pipes are controlled by manually operated 24-inch gate valves. These gates are normally left in the open position. An electric powered, mechanically cleaned bar screen is contained within the main chamber. Leading from the main chamber is a 30-inch water supply pipeline also controlled by a 30-inch manually operated gate valve normally left in the open position. An old 10-inch pipeline controlled by a manually operated 10-inch gate valve extends from the main chamber downstream. This valve is normally left in the closed position. Downstream of the dam, there is a 20-inch blow-off on the 30-inch water supply line. This 20-inch blow-off

pipe is controlled by a 20-inch gate valve. This line presently serves as the reservoir drain. The water supply pipeline is normally controlled by throttling the valves at the lower terminus of the line. All gates above this point, that is the gate at Meetinghouse Pond, are normally left in the open position. The invert elevation of the regulating outlets at Meetinghouse Pond is elevation 1,017.5

SECTION 2: ENGINEERING DATA

2.1 Design Records - The only design record located was a plan and section of the dam found in the files of the Department of Public Works, Engineering Division, Fitchburg, MA. A copy of this plan was also located at the Worcester County Engineering Department. No plans were located showing the original spillway configuration. A copy of a plan showing repair work on the gatehouse and spillway was also located at the Department of Public Works in Fitchburg, MA.

2.2 Construction Records - No records of the original construction were located.

2.3 Operation Records - No operational records are available other than reservoir water level readings.

2.4 Evaluation

a. Availability - Documents described above are available at the offices of the Public Works Department, Engineering Division, City of Fitchburg, MA.

b. Validity - The general configuration of the dam and gatehouse as shown in the 1893 plan of the dam is in good agreement with the configuration observed in the field. However, the intake channel and the downstream conditions are not in agreement with those shown on the plan. It must be assumed that modifications of the intake line and the repositioning of the adjacent highway took place at a later date.

c. Adequacy - While the available records provide useful information, the evaluation of the dam for the purpose of this investigation must be based primarily on the visual examination described in the following section.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General - The visual examination of the Meetinghouse Pond Dam and spillway was conducted on 22 August 1978. In general, the earth embankments, spillway and outlet facilities were observed to be in good to fair condition. The low water level in the reservoir precluded an examination for seepage and the heavy vegetation growth may have concealed problems.

Visual inspection checklists for both the dam and spillway locations are included in Appendix A and selected photographs are given in Appendix C.

b. Dam - The earth embankments of the dam and dike are generally in fair condition. There is no visual evidence of lateral movement or seepage, or major settlement or erosion, but the heavy growth of brush and trees obscures much of the embankment surface. Also, the pond level was below the upstream toe of both the dam and dike at the time of inspection so that the possibility of seepage problems could not be evaluated. The following specific items were noted:

(1) The dike has a heavy cover of brush and trees that limits visual observation of its condition, as shown in Photos 10 and 11.

(2) The upstream riprap at the dike is partly concealed by brush, and does not appear to provide complete coverage on the slope.

(3) There are at least three recently-used animal burrows in the downstream slope of the dike.

(4) There appears to be a dip in the elevation of the dike crest near the right abutment, and there is an area in the woods to the left of the spillway where the highest ground is about a foot lower than the dike crest.

(5) The dam has a cover of weeds, brush and young trees on its slopes above the riprap, and some weed growth between riprap stones, as shown in Photos 1, 2, 4 and 5. The slope downstream from West Princeton Road has large trees.

(6) The upstream dam riprap is in generally good condition, although there are a few displaced slabs and there is evidence of several inches of surface settlement alongside

the Gate House foundation wall; there is also local slight erosion of the upstream slope immediately above the rip-rap.

(7) Vehicle traffic has considerably rutted the crest of the dam.

The channel portion of the spillway and the spillway walls have been covered with shotcrete as shown in Photo Nos. 10, 12 and 13. The shotcrete is becoming loose and local areas have spalled off, especially at the left wall. The weir flashboards are in good condition but they are mis-aligned vertically and form an irregular crest as shown in Photo No. 11. As stated above, heavy brush is present on the adjacent dike and it overhangs the spillway. The entrance channel is esentially clear with only minor vegetation present. The discharge channel contains young trees and brush.

c. Appurtenant Structures - The gate house shown in Photo Nos. 1 and 2 is in good condition. The wood trim on the structure requires maintenance and repainting. The parge coat at the base of the structure has some cracking present. The equipment shown in Photo Nos. 6 and 7 within the gate house, is operatinal with the exception of an abandoned 10-inch reservoir drain. All other valves within the structure are kept in the open position and the flow is controlled by valves at the downstream end of the pipeline. The blow-off valve and pipe shown in Photo Nos. 8 and 9, which are currently used as the reservoir drain, are operational. The field stone intake channel shown in Photo Nos. 1 and 3 was partially obscured by water but appeared to be in good condition.

d. Reservoir Area - The area surrounding Meetinghouse Pond is heavily wooded and for the most part undeveloped. There is no existing development which would be affected by shoreline flooding at test flood pool elevation.

The side slopes to the pond are moderately steep. However, there is no significant potential for landsides into the pond which could create waves that might overtop the dam. No conditions were noted that could result in a sudden increase in sediment load into the pond.

e. Downstream Channel - Smith Brook, which connects Meetinghouse Pond to Wyman Pond, was dry at the time of inspection and somewhat overgrown by brush immediately downstream of the dam site. This condition results from the lack of discharges from Meetinghouse Pond to Smith Brook as the pond is part of the City of Fitchburg's water supply system. Withdrawal from the pond is via a 36" diameter buried conduit which connects to the City's distribution system.

Approximately 275 feet downstream of the spillway is West Princeton Road and culvert. The stone arch box culvert is 36" wide and 45" high on the upstream face and is approximately 33 feet long. Top of road was estimated to be elevation 1,028.0 and the upstream invert of the culvert at elevation 1,020.75. In the event of an embankment failure, West Princeton Road would act as a secondary dam.

3.2 Evaluation - The Meetinghouse Pond dam and dike embankments appear to be performing satisfactorily at the present time. However, the apparent low areas at either end of the dike, the animal burrows on the downstream slope, and the possibility that other problems are concealed by heavy vegetation cover and low pond level at the time of inspection, could provide significant potential for dam or dike failure under conditions of higher than normal water levels. The gate house and spillway are in good condition. The wood trim on the gate house needs maintenance work and the spillway has some loose and spalled shotcrete. The spillway sidewalls are in fair condition. The shotcrete cover on the walls has become loose and contains a number of cracked and spalled areas.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures - In general there is no established routine for the operation of the dam other than those in effect for water supply purposes.

4.2 Maintenance of the Dam - The dam and spillway receive minimal maintenance. There is no established formal procedure for the maintenance of the dam. The present dam and spillway dike have become overgrown with tree and brush growth.

4.3 Maintenance of Operating Facilities - There is no formal procedure of maintenance of operating facilities. The mechanical bar screen is run at frequent intervals. The main portion of the gates within the structure are left in the open position. Maintenance is performed on the basis of need.

4.4 Description of any Warning System in Effect - There is no established warning system or emergency preparedness plan in effect for this structure.

4.5 Evaluation - Formal operational procedures, maintenance programs, warning systems and emergency preparedness plans should be established for this dam. The operational procedure should provide for the removal of flashboards during unusual discharges over the spillway. Periodic observations should be made at this dam and the tree and brush growth at the dam and spillway should be brought under control. Maintenance of the structures should be performed at regular intervals.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data - No hydraulic/hydrologic design data are available concerning this dam other than the following information which appears on Data Plan of Water Works System, City of Fitchburg Water Department dated March 11, 1943.

Year Completed: 1893
Dam Elevation: 1,037.00
Spillway Elevation: 1,033.0
Area at Spillway Elevation: 152.70 acres
Capacity: 655.05 x 10^6 gallons
Draw: 15 feet
Greatest Depth: 45 feet
Watershed: 1.47 acres

Based upon the Corps of Engineers guidelines, the recommended test flood for the size (intermediate) and hazard potential (significant) is within the range of 1/2 PMF to PMF (Probable Maximum Flood). Since the size classification is at the lower end of the intermediate category and the hazard potential is considered to be at the lower end of the significant range as well, the 1/2 PMF shall be adopted as the test flood.

b. Experience Data - The test flood was estimated using the Corps of Engineers Guidelines for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations. The watershed terrain was determined to be midway between Rolling and Mountanous and an inflow rate of 2,450 CSM was extrapolated for the drainage area of 1.47 square miles. This resulted in a test flood inflow of 1,800 cfs. Surcharge - storage routing was performed through Meetinghouse Pond with the watersurface assumed to be at spillway crest (Elev. 1,033.0) at the beginning of the storm. The resulting test flood outflow was estimated to be 350 cfs.

c. Visual Observations - The hydraulic condition of the spillway approach channel was observed to be in good condition. The flashboards consist of four 6-foot long sections. Each section contains three individual boards. Spaces were observed between each of the boards and between the bottom board and the spillway crest.

The discharge channel leading from the spillway to the stone arch culvert under West Princeton Road was overgrown with heavy vegetation which would significantly effect its hydraulic performance during periods of high discharge.

The natural embankment to the left of the spillway has a low profile wall made of field stone which is approximately 50 feet long. The top of this wall is about 3 feet above the spillway crest or approximately a foot lower than the right embankment.

d. Overtopping Potential - The maximum capacity of the spillway with the pool elevation at the top of the left spillway embankment (Elev. 1,036.0) is 420 cfs. Since the test flood outflow was determined to be 350 cfs, the spillway is considered to be adequate.

e. Evaluation - Embankment failure analysis was performed to determine the magnitude of downstream hazards in the event of such an occurrence. A peak failure outflow of 1,750 cfs was estimated based on a 40 percent breach width of the right spillway embankment. Field reconnaisance of the four culverts along Smith Brook between the dam site and Wyman Pond (West Princeton Road, unnamed road, Worcester Road - Rt. 140, and Patricia Road) indicate that each will be overtopped and the roadways could potentially be washed out. There is no existing development along Smith Brook which would be affected by a dam failure between the dam site and Patricia Road. Approximately 2 to 4 residential homes are located on Patricia Road which might experience some minor flooding in the event of a dam failure. Downstream of Patricia Road, the peak failure outflow would enter Wyman Pond which appears to have adequate capacity to attenuate the floodwave.

In conclusion, the Meetinghouse Pond spillway is adequate to pass the test flood and in the event of an embankment failure, damages would be limited to roads, culverts, and utilities with the potential for some minor flooding of 2 to 4 residences.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations - There was no visible evidence of dam or dike instability during the site examination on 22 August 1978. The 1975 State inspection report had noted ponded water and slight seepage at the downstream toe of the dike to the right of the spillway, but this condition would not have been evident during the site examination when the pond level was about 8 ft. below the dam crest.

b. Design and Construction Data - The drawings obtained from the City of Fitchburg appear to show the basic cross section of the dam without the superimposed roadway embankment. However, there is no data on the physical properties of the material in the dam embankment, and there is substantially no design or construction information on the dike embankment.

The Meetinghouse Pond dike is relatively low, and, in the absence of significant seepage, the greater than 20 ft. top width and 2 horizontal to 1 vertical or flatter slopes would be expected to provide adequate stability under static loading conditions. Whether or not the previously reported seepage is significant has not been determined.

The dam is somewhat higher than the dike, but the adjacent roadway has considerably widened the embankment; the dam would be expected to be adequately stable under static loading conditions.

The only data on the spillway is a 1968 sketch plan for the shotcreting of the structure.

c. Operating Records - There are no operating records for the dam other than reservoir water level readings.

d. Post-Construction Changes - Without complete design or "as-built" drawings, it is not known if there have been post-construction changes to the embankments. Currently-active city records appear from available drawings to date from about 1964, indicating that the embankments have probably not had significant changes since that time. The shotcreting of the spillway is shown on a 1968 sketch plan.

e. Seismic Stability - Meetinghouse Pond Dam is located in Seismic Zone No. 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - The visual examination of Meetinghouse Pond Dam, including the dike, did not reveal any evidence of failure or conditions which would warrant urgent remedial treatment. The spillway was found to be adequate to pass the test flood. Because of the need for maintenance and additional investigation that is outlined hereinafter, the project is considered to be in good to fair condition.

b. Adequacy of Information - Since there were only a few available drawings, nearly all of the information for the Phase I Investigation had to be obtained from visual examination and limited measurements at the site. This information has been sufficient for the purpose of this investigation, but it does not permit detailed evaluation of stability, seepage or available freeboard.

c. Urgency - The recommended additional investigations and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken within two years after receipt of this report by the Owner.

d. Need for Additional Investigations - Additional investigations should be performed by the Owner as outlined in the following section.

7.2 Recommendations

It is recommended that the following additional investigations be performed by the Owner:

1. An investigation to determine whether or not the previously reported seepage at the toe of the dike embankment can have a significant effect on dike stability. As a first step this would require examination of the area under conditions of high water level in the pond.

2. Topographic survey and assessment of the dike embankment, including the left and right abutment areas, to permit evaluation of the actual dike configuration, particularly with respect to available freeboard.

7.3 Remedial Measures

a. Operation and Maintenance Procedures - It is recommended that the following remedial work be undertaken by the Owner, in addition to the investigations outlined in Section 7.2, to correct deficiencies noted during the visual examination:

(1) Clear brush and trees from the dam and dike embankments, including stump removaland backfilling; establish vegetative cover; and cut grass and weeds on the embankments at least once ayear. It would be reasonable to exclude the area downstream from West Princeton Road from the clearing requirement.

(2) Provide additional riprap erosion protection where it is lacking or deficient on the upstream faces of the dam and dike.

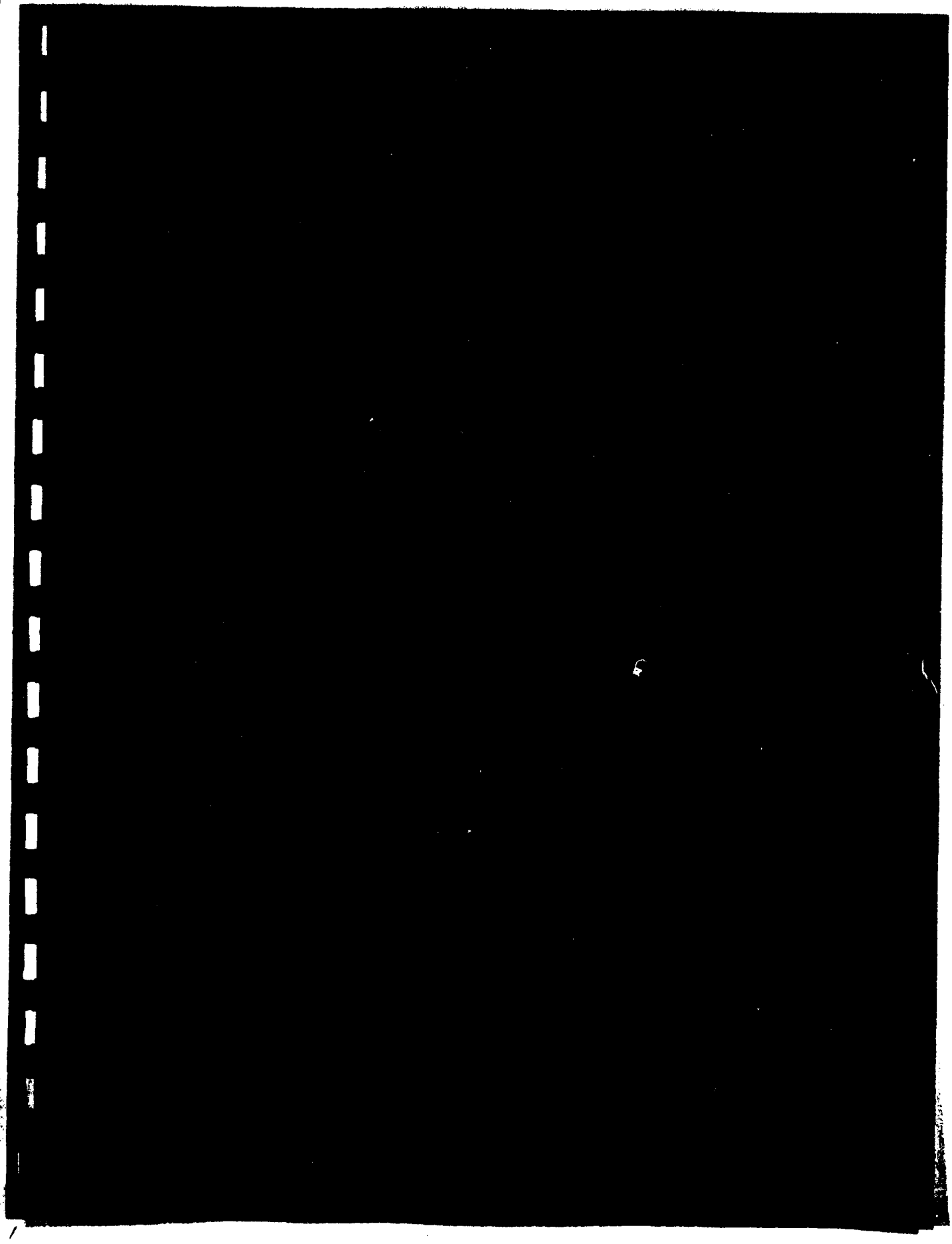
(3) Evict any occupants and fill the animal burrows in the downstream slope of the dike.

(4) Re-shape the dam crest and limit vehicle traffic to avoid possible slope erosion by concentrated storm water runoff from ruts.

(5) Remove and replace all loose shotcrete on the spillway structure.

(6) Perform maintenance work on the gate house wood trim and the foundation parge coat.

Due to formerly reported seepage during high reservoir levels, it is recommended that during high reservoir levels and unusually heavy precipitation the Owner should provide surveillance of the embankments. The Owner should also develop a formal emergency procedures plan and warning system in cooperation with local officials in downstream communities. Finally, it is recommended that the owner establish a formal program of annual technical inspections.



VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse Dam

DATE: August 22, 1978

TIME: 1:00 p.m.

WEATHER: Clear-Calm-75-80°F

WATER SURFACE ELEVATION UPSTREAM: Down 4.75' from spillway El. 1028 - Fitchburg Datum

STREAM FLOW: No spillage or seepage

INSPECTION PARTY:

1. Roger H. Wood
2. Joseph E. Downing
3. Charles E. Fuller

} CDM

4. Peter LeCount - Haley & Aldrich
5.
6.

PRESENT DURING INSPECTION:

1. Andy Provencial, Water Supt.
2. Ernie Cormier, Operator
3.
4.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse Pond DATE: 8/22/78

EMBANKMENT: Dike at Spillway

CHECK LIST	CONDITION
1. Upstream Slope	1.
a. Vegetation	a. Brush, brambles, weeds
b. Sloughing or Erosion	b. Not evident
c. Rock Slope Protection - Riprap Failures	c. Scattered riprap in brush
d. Animal Burrows	d. None observed
2. Crest	2.
a. Vegetation	a. Brush, brambles, young trees
b. Sloughing or Erosion	b. Not evident
c. Surface cracks	c. Not evident
d. Movement or Settlement	d. Not evident, slope toward pond
3. Downstream Slope	3.
a. Vegetation	a. Brush, brambles, trees to 5" dia. (typ. 1-1/2" dia.)
b. Sloughing or Erosion	b. None observed
c. Surface cracks	c. None observed
d. Animal Burrows	d. Three animal burrows, each approx. 5" dia.
e. Movement or Cracking near toe	e. None observed
f. Unusual Embankment or Downstream Seepage	f. None observed (ground damp @ toe but no water observed-pond 4.75' below spillway crest)
g. Piping or Boils	g. None observed
h. Foundation Drainage Features	h. None observed
i. Toe Drains	i. None observed
4. General	
a. Lateral Movement	4. a., b., c. Embankment obscured by growth, seems irreg. but no indication of movement.
b. Vertical Alignment	
c. Horizontal Alignment	
d. Condition at Abutments and at Structures	d. Seems low near right abut. & low area (1.5') behind stone wall between spillway & left abutment.
e. Indications of Movement of Structural Items	e. Spillway gunite cracked, but no indication of significant movement.
f. Trespassing	f. None evident
g. Instrumentation Systems	g. None evident

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse Pond DATE: 8/22/78
EMBANKMENT: Dam

CHECK LIST	CONDITION
1. Upstream Slope	
a. Vegetation	1. a. Weeds, brush, young trees (1-2" dia.)
b. Sloughing or Erosion	b. Local slight erosion above riprap (≈ 6")
c. Rock Slope Protection - Riprap Failures	c. Slab riprap generally good, slight settlement along side gate house.
d. Animal Burrows	d. None observed
2. Crest	
a. Vegetation	2. a. Weeds & grass along gravel roadway.
b. Sloughing or Erosion	b. Slight rutting in gravel
c. Surface cracks	c. None evident
d. Movement or Settlement	d. None evident
3. Downstream Slope	
a. Vegetation	3. a. Weeds & brush between road & dam, brush & trees (up to 24"dia.) downstream from road.
b. Sloughing or Erosion	b. None evident
c. Surface cracks	c. None evident
d. Animal Burrows	d. None observed
e. Movement or Cracking near toe	e. None evident
f. Unusual Embankment or Downstream Seepage	f. None evident
g. Piping or Boils	g. None evident
h. Foundation Drainage Features	h. None evident
i. Toe Drains	i. None evident
4. General	4. a., b., c. Dam somewhat irregular, but no indication of movement.
a. Lateral Movement	d. Dam grades into earth & rock @ abutments, apparent 1-4" settlement alongside gate house.
b. Vertical Alignment	e. None observed
c. Horizontal Alignment	f. Vehicle traffic on dike
d. Condition at Abutments and at Structures	g. None evident
e. Indications of Movement of Structural Items	
f. Trespassing	
g. Instrumentation Systems	

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse DATE: 8-22-78

SPILLWAY:

CHECK LIST	CONDITION
1. Approach Channel	
a. General Condition	1.a. Good-natural ground to shotcreted ledge-shotcrete becoming loose.
b. Obstructions	b. Minor vegetation-grass, weeds.
c. Log Boom etc.	c. None
2. Weir	
a. Flashboards	2.a. Good-misaligned vertially.
b. Weir Elev. Control (Gate)	b. No gate
c. Vegetation	c. Grass & weeds adjacent
d. Seepage or Efflorescence	d. None observed
e. Rust or Stains	e. None observed
f. Cracks	f. Some cracks
g. Condition of Joints	g. None observed
h. Spalls, Voids or Erosion	h. Some areas rounded-loose
i. Visible Reinforcement	i. None
j. General Struct. Condition	j. Good
3. Discharge Channel	
a. Apron	3.a. Shotcrete over ledge
b. Stilling Basin	b. None
c. Channel Floor	c. Natural ground
d. Vegetation	d. Young trees & brush downstream
e. Seepage	e. None observed-reservoir low
f. Obstructions	f. Vegetation
g. General Struct. Condition	g. Good
4. Walls	
a. Wall Location Rt & Lt	4 a.
(1) Vegetation	(1) Trees overhanging. Some weed growth
(2) Seepage or Efflorescence	(2) None observed
(3) Rust or Stains	(3) None observed
(4) Cracks	(4) Cracks present in surface especially left wall.
(5) Condition of Joints	(5) No joints
(6) Spalls, Voids or Erosion	(6) Shotcrete surface starting to spall especially left wall.
(7) Visible Reinforcement	(7) None
(8) General Struct.Condition	(8) Left wall fair, right wall fair.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse DATE: 8-22-78
OUTLET WORKS: _____ _____

CHECK LIST	CONDITION
1. Inlet	
a. Obstructions	1.a. None observed
b. Channel	b. Field stone channel underwater-good
c. Structure	c. None
d. Screens	d. None
e. Stop Logs	e. None observed
f. Gates	f. None observed
2. Control Facility	
a. Structure	2.a. Wood trim needs repainting. Concrete base has been parged-some cracking present.
b. Screens	b. Mechanically cleaned bar screen-good condition.
c. Stop Logs	c. None observed
d. Gates	d. 1-30", 2-24", & 1-10" valves. Both 24" and 30" valves in open position. 10"drain valve is old. Estimated to be inoperable. See also 3e.
e. Conduit	e. Outlet is 30" pipe
f. Seepage or Leaks	f. Not visible
3. Outlet	
a. Structure	3.a. None
b. Erosion or Cavitation	b. Not visible
c. Obstructions	c. None observed
d. Seepage or Leaks	d. None observed
e. Gate	e. 20" gate valve & blow off downstream of dam, operable & in good condition. Blowoff is off of 30" pipe.
4. Mechanical and Electrical	
a. Crane Hoist	4.a. None
b. Hydraulic System	b. None observed
c. Service Power	c. Ok.
d. Emergency Power	d. None observed
e. Lighting	e. None observed
f. Lightning Protection	f. None observed

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse Pond DATE: August 22, 1978

HYDROLOGIC-HYDRAULIC CONSIDERATIONS:

CHECK LIST	CONDITION
1. Upstream Watershed a. Type of Terrain b. Hydrologic Controls	1. a. Rolling to steep @ watershed boundaries. b. No perennial streams tributary to pond per USGS map. Swampy area of 30+ acre @ SW end of pond. Development in watershed is sparse with less than 25 homes in tributary area.
2. Reservoir a. Type of Terrain b. Development	2. a. & b. Same as above.
3. Spillway a. Adjacent Low Points b. Spillway Approach (Slope) c. Spillway Discharge (Slope) d. Spillway Type	3. a. Gunited riprap spillway with 2" thick stoplogs 24" high. Approach is very flat (grouted riprap) while downstream channel is not well defined with drop of 11 ft. in 200' (5+ %) to West Princeton Rd. culvert.
4. Downstream Watershed a. Reach No. 1 (1) Control (Bridge, dam, culvert, etc.) (2) Channel Characteristics (3) Development (4) Visible Utilities (5) Special Problems (Hospital, etc.)	4. a. Reach No. 1 (1) W. Princeton Rd. culvert. (2) Overgrown channel in ledge. (3) None (4) None (5) None

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT
PROJECT
DETAIL Meetinghouse

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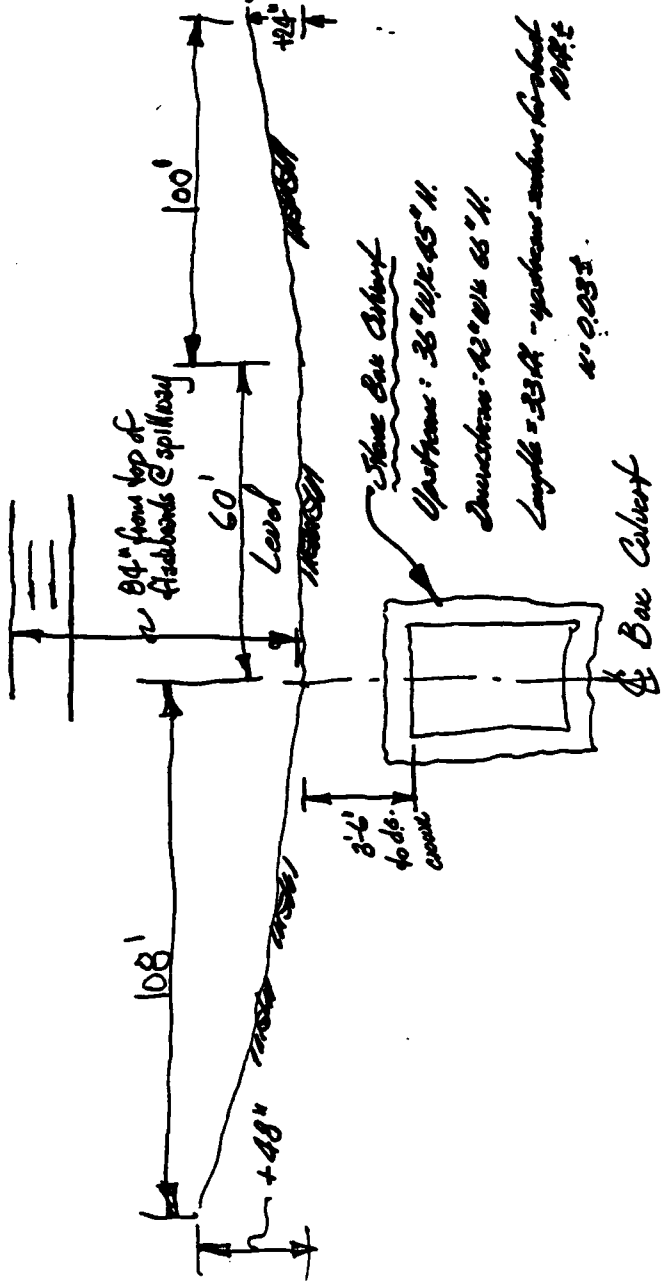
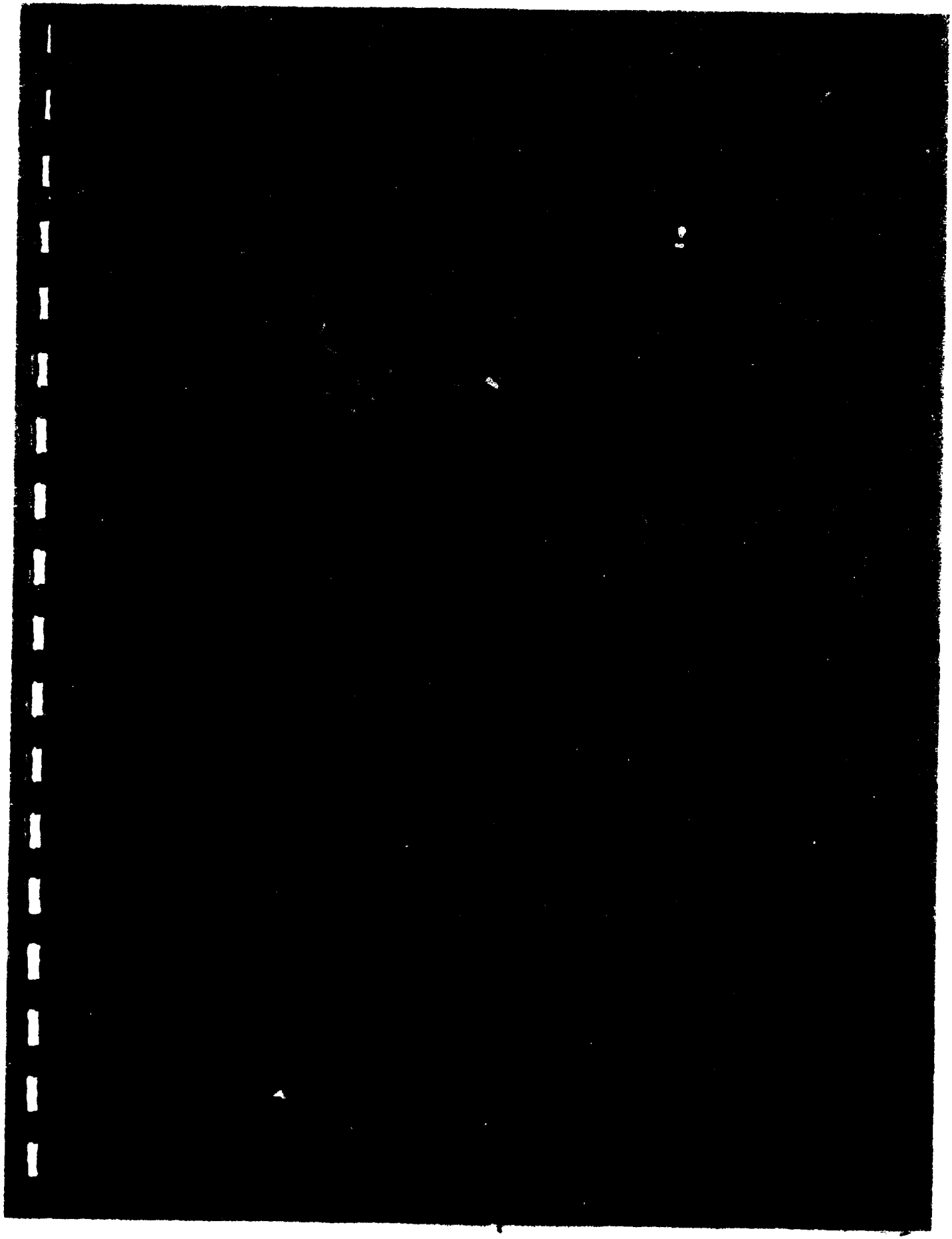




LIST OF PLANS AND SKETCHES

MEETINGHOUSE POND DAM

DOCUMENT	CONTENTS	LOCATION
1. Meetinghouse Reservoir	Location & Elevation of Flume	City of Fitchburg Dept. of Public Works Engineering Division City Hall 718 Main Street Fitchburg, MA 01420
2. Land Plans	Westminster Watershed System	City of Fitchburg Water Dept. Department of Public Works Engineering Division City Hall 718 Main Street Fitchburg, MA 01420 (Location of Documents No. 2 & 3)
3. Location Map	Location of Reservoir Watersheds, Principal Conduits, Data Plan of Water Works System	

TOWN OR CITY WESTMINSTER DECREE NO. 178 PLAN NO. DAM NO. 59-19 F

LOCATION Meeting House Pond. Note Book 1- Page 05

DESCRIPTION OF DAM

El. 100' Laidin

Type Earth Rubble Core Wall Concrete

Length 220'

Height 14'

Thickness top 20'

" bottom 70'

Downstream Slope 1½:1

Upstream " 2:1 Rip-rap

Length of Spiliway Is in another section of dam. - 20'

Size of Gates 1- 10" Pipe Drain & 1- 30" Pipe outlet.

Location of Gates Gate House Left center of dam.

Flashboards used Yes

Width Flashboards or Gates 20"

Dam designed by City Engineer

" constructed by " of Fitchburg

Year constructed 1894

GENERAL REMARKS

Owned by City of Fitchburg W. D.
Vol. 28 P. 178 - June 14, 1893
March Meeting 1893.
Dec. 19. 1923 - L.O. Marden.
2nd Inspection: May 24, 1926. - L.O. Marden.
12-16-28 - " : Dec. 10, 1934 - " "
Spillway is in natural ground about ½ mile from Main embankment

DESCRIPTION OF RESERVOIR & WATERSHED

Name of Main Stream Meeting House Pond.

" " any other Streams

Length of Watershed

Width " "

Is Watershed Cultivated

Percent in Forests

Steepness of Slope

Kind of Soil Loamy

No. of Acres in Watershed 97.0

" " " " Reservoir 1913 M. 152.

Length of Reservoir

Width " "

Max Flow Cu. Ft. per Sec.

Head or Flashboards-Low Water

" " " -High "

GENERAL REMARKS

Docket #178. Mar. 1893 Meeting. Filed: June 14, 1893.
Traced by: L. H. Sarty - Feb. 14, 1936. Checked: Feb. 15 - L. H. Spofford
Attested by: William C. Bowen, C. of C. Feb. 21, 1936

Inspected: Oct. 6, 1938 - L. H. Spofford

" Oct. 11, 1943 L.O.M.

" Aug. 22, 1960 " - PROVINCIAL

" Dec. 21, 1948 "

2-Library Bureau 10-92200

APPENDIX B-2

inspected: Aug. 22, 1960 - LOM - Provincial

APPENDIX B-3

COUNTY OF WORCESTER, MASSACHUSETTS
OFFICE OF COUNTY ENGINEER

Neg. Nos. .....

INSPECTION OF DAMS, RESERVOIR DAMS AND RESERVOIRS

Town Westminster Date May 24, 1926 Dam No. 59-19

Location near E. Princeton Rd. Name of Pond or Stream Westinghouse Pond

Inspected by L.O. Marden

Owner City of Fitchburg. Use Storage.

MATERIAL & TYPE For description see Note book 1 page 81.

Elevations in feet: above (+) or below (−) full pond or reservoir level.

FOR DAM Bed of stream below ..... top of spillway .....

FOR RESERVOIR

top of dam ..... top of flashboards ..... ground surface below .....

..... level of overflow pipe ..... length in feet .....

width top in feet ..... width bottom in feet ..... size pipe to mill .....

..... inches ..... length spillway in feet ..... head in feet .....

Size of wheel ..... H. P. developed .....

Size of gates ..... location of gates .....

Foundation and details of construction .....

..... condition of embankment .....

Constructed by ..... date .....

Designed by ..... location .....

Recent repairs and date .....

Evidence of leakage .....

Condition Dam in good condition .....

Topography of country below .....

Nature of buildings and roads below dam .....

.....

No. Acres in watershed ..... No. Acres in pond .....

Plans secured ..... Percent watershed in cultivation .....

Percent in forests ..... Note: Cross out word not applicable .....

.....

.....

.....

.....

.....

.....

APPENDIX B-4

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden Date 12-16-28 Dam No. 59-19

Town WESTMINSTER Location

Owner Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY -LENGTH- 20'

El. top Abutment 100.+ El. Crest 97.+ El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried 20" Kind Flashboards 2" plank

El. Flowline Cleanout Pipe none Size and Kind Cleanout Pipe none

Kind of Foundation under Spillway Ledge

Condition Cut out brush and stumps

EMBANKMENT

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap relay where needed

Material in Embankment Foundation

Condition cut off brush

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

APPENDIX B-5

March 6,1929.

59-19

City of Fitchburg Water Works,
Fitchburg, Mass.,
Attention Mr.Brown;-

Dear Mr. Brown;-

I recently made an inspection according to State Law, of your dam at Lootin house Pond, in Westminster, (our number 59-19), and found that ;

1. Brush and stumps should be cut out of spillway section.

Yours very truly,

County Engineer.

APPENDIX B-6

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O.Marden Date 12-10-34 Dam No. 59.12

Town Westminster Location Meeting House Pond.

Owner City of Fitchbrug W.D. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition O.K. clear out brush

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition cut off and grub out roots brush and small trees in rip rap and top of embankment regrade slope and reset riprap next to gate house.

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure none visible.

Recent Repairs and Date none

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

APPENDIX B-7

WORCESTER COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs

Inspected by L. H. Spofford Date 10-6-38 Dam No. 59-19

Town Westminster Location Meeting House Pond

Owner [illegible] Use Fitchburg Water Supply

SPILLWAY Heavy cut granite ~~water~~- with ledge apron 25' long x 3' high side walls.

Type top abutment El.Crest El.Apron El.St.Bed

Width top Abut. Width top Crest Width bottom Sp.way

Width flashboards Kind Flashboards

El.Flowline Cleanout Pipe Size and Kind Pipe

Kind of Foundation under Spillway

Condition Flashboards to the height of 2'1" are now in place and apparently were there when the flood came. High water mark is 15" above top of flashboards.

EMBANKMENT

El. Top El.Natural Ground Width Top

Width of Borrom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition Embankment ±100 ft. long is in good condition. Not topped by flood.

GATES in gate house on dike Location

Size Kind El.Flowline

Condition

Evidence of Leaks in Structure Dike - also inspected dike. Everything apparently in good condition there

Recent Repairs and Date

Number Acres in Pond Drainage Area in Sq. Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

APPENDIX B-8

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by LOM Date Oct. 11, 1943 Dam No. 59-9

Town Westminster Location Meeting House Pond.

Owner Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition Appears O.K.

EMBANKMENT

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition Appears OK

GATES Location

Size Kind El. Flowline

Condition Appears OK.

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Million Cubic Feet

APPENDIX B-9

LOCATION _____ STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT

WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Fitchburg Water Dept PLACE Fitchburg USE Storage

INSPECTED BY LDM DATE Dec 21, 1948

TYPE OF DAM _____ CONDITION GOOD

SPILLWAY

FLASHBOARDS IN PLACE _____ RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED _____

EMBANKMENT

RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED _____

GATES

RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED _____

LEAKS

HOW SERIOUS _____

DATE _____

_____

COUNTY ENGINEER

APPENDIX B-10

TOWN Westminster DAM NO. 59-19

LOCATION Meeting House Pond STREAM

WORCESTER COUNTY ENGINEERING DEPARTMENT

WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY City of Fitchburg PLACE Fitchburg USE Water Supply

INSPECTED BY LCM DATE March 29, 1957

TYPE OF DAM CONDITION

SPILLWAY

FLASHBOARDS IN PLACE RECENT REPAIRS

CONDITION

REPAIRS NEEDED OK - Cut brush in channel

EMBANKMENT

RECENT REPAIRS

CONDITION

REPAIRS NEEDED None - trim brush occ.

GATES

RECENT REPAIRS

CONDITION

REPAIRS NEEDED None

LEAKS

HOW SERIOUS None visible

DATE March 29 1957

APPENDIX B-11

L. A. Nearden
COUNTY ENGINEER

TOWN Westminster DAM NO. 54-14

LOCATION Meeting House Pond STREAM

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by City Fitchburg, W. D. Place Fitchburg Use water supply

Inspected by LOM Date March 4, 1958

Type of Dam Stone spillway natural ground Condition Cut out brush

SPILLWAY

Flashboards in Place None Recent Repairs None

Condition Good

Repairs Needed Cut brush

EMBANKMENT

Recent Repairs None

Condition Has raised road downstream

Repairs Needed None

GATES

Recent Repairs None

Condition appears ok

Repairs Needed None

LEAKS

Any Serious None visible

DATE: March 4, 1958

APPENDIX B-12

LO Marois

TOWN West-minster - DAM NO. Entered

LOCATION Meeting House Pond STREAM 59-19

Brook below pond shall be cleaned out.

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by City of Fitchburg Place Fitchburg Use ____

Inspected by L.O.M. A. Provincial Date Aug. 22, 1960

Type of Dam ____ Condition ____

SPILLWAY

Flashboards in Place None Recent Repairs ____

Condition Some brush in stone spillway channel

Repairs Needed Cut out brush & remove roots

EMBANKMENT

Recent Repairs none

Condition Some brush on Embankment

Repairs Needed cut brush - grub out roots and fill holes with loam, tamp in place and seed

Rip rap in poor condition.

GATES

Recent Repairs gates locked - could not inspect - in gate house

Condition Provincial said condition fair to good

Repairs Needed Place in A No. one working order

LEAKS

How Serious No leaks visible

DATE: Aug. 25, 1960 L. O. Marder County Engineer

APPENDIX B-13

DAM NO. 59-19

LOCATION East Princeton Rd. STREAM Meetinghouse Brook
"Meetinghouse Pond"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by City of Fitchburg. Place Water Dept. Use Water Supply

Inspected by WEOL Date Oct. 27 1964

Type of Dam Earth and cut stone Condition Good

SPILLWAY

Flashboards in Place 20" of boards Recent Repairs

Condition The spillway area is 24' x 25'. The granite stone crest is located on ledge. The abutment walls are concreted stone. This spillway is divided into 4 panels with steal uprights. The inlet

EMBANKMENT

Recent Repairs and outlet channel is partly blocked with brush.

Condition The embankment is covered with brush

Repairs Needed

GATES

Recent Repairs The gate is located in a locked brick gate house

Condition

Repairs Needed

BANKS

Any Serious

NOTE: County Engineer

TOWN Westminster DAM NO. 59-19

LOCATION NW side of W. Princeton Rd. STREAM (Meetinghouse) Brook

"Meetinghouse Pond"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by City of Fitchburg Place Water Dept. Use Water Supply

Inspected by WOL Date May 18, 1966

Type of Dam Earth - Stone - Concrete Condition Good

SPILLWAY

Flashboards in Place 48" of boards Recent Repairs

Condition Outlet channel is covered with brush.

Repairs Needed Granite stone crest - concrete stone chute walls - special design board supports can also be used for walkway supports.

EMBANKMENT

Recent Repairs

Condition Embankment at Gate House is good.

Repairs Needed Present water level is down 4'± below spillway crest.

GATES

Recent Repairs

Condition Brick Gate House is good

Repairs Needed

LEAKS

Any Serious No leaks visible.

BY: County Engineer

TOWN Westminster DAM NO. 59-19

LOCATION W1y(200')of W. Princeton Rd. STREAM "Meetinghouse Pond"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by City of Fitchburg Place Water Dept. Use Water Supply

Inspected by WOL Date Oct. 21, 1966.

Type of Dam Earth - Stone - Concrete Condition Good - to Fair

SPILLWAY

Flashboards in Place 20" of boards Recent Repairs _____

Condition Recent cement work (patching) has been done on crest

Repairs Needed and new pins installed to hold granite crest stones in place.

Channel outlet should be cleared of brush.

EMBANKMENT

Recent Repairs _____

Condition Embankment at spillway location is covered with brush.

Repairs Needed " " gate " " good.

GATES

Recent Repairs _____

Condition Gate looks good - Stone lined channel to gate

Repairs Needed house shows one didn't low water level in pond.

LEAKS

Serious _____

NOTE: _____ County Engineer

APPENDIX B-16

Westminster DAM NO. 59-19A

CATION West Princeton Rd STREAM Meetinghouse Pond Brook

"Meetinghouse Pond"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

ned by City of Fitchburg Place Water Dept. Use Water Supply

ported by W.O.L. Date Sept 1968

pe of Dam Earth-stone-concrete Condition Good

LLWAY

ashboards in Place 2 of boards in place Recent Repairs

dition Eastern Granite Co. is now completing the guniting of the

airs Needed abutment walls and the spillway crest.

outlet channel has been cleared of all brush and debris.

NT

nt Repairs The water level is down about 5' below the top of

ition the boards.

irs Needed The brush on the embankment has been cut

S

nt Repairs

ition

irs Needed

S

ious

County Engineer

TOWN Leominster DAM NO. Meetinghouse Reservoir 59-19

LOCATION _____ STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by City of Fitchburg Place _____ Use _____

Inspected by F.C.M. - M.B.R. Date 3-13-69

Type of Dam _____ Condition _____

SPILLWAY — water level normal — being watched by City

Flashboards in Place _____ Recent Repairs _____

Condition _____

Repairs Needed _____

EMBANKMENT

Recent Repairs _____

Condition _____

Repairs Needed _____

ABUTMENTS

Recent Repairs _____

Condition _____

Repairs Needed _____

LEAKS

APPENDIX B-18

Serious _____

DATE: _____ County Engineer

Owner: [illegible]
Mail Address: Public Works - Water Dept.
Function of Dam: Water Supply

Location & Access: Off West Princeton Rd.
0.15 Mile West of Rte. 140 Intersection
USGS Quad. Gardner-19c Lat. 42-32-00 Long. 71-54-15
Drain.Ar.: 1.91 Sq.Mi.; Ponds: ___ ac.; Res.@dam: 15.0
Character of D.A.:

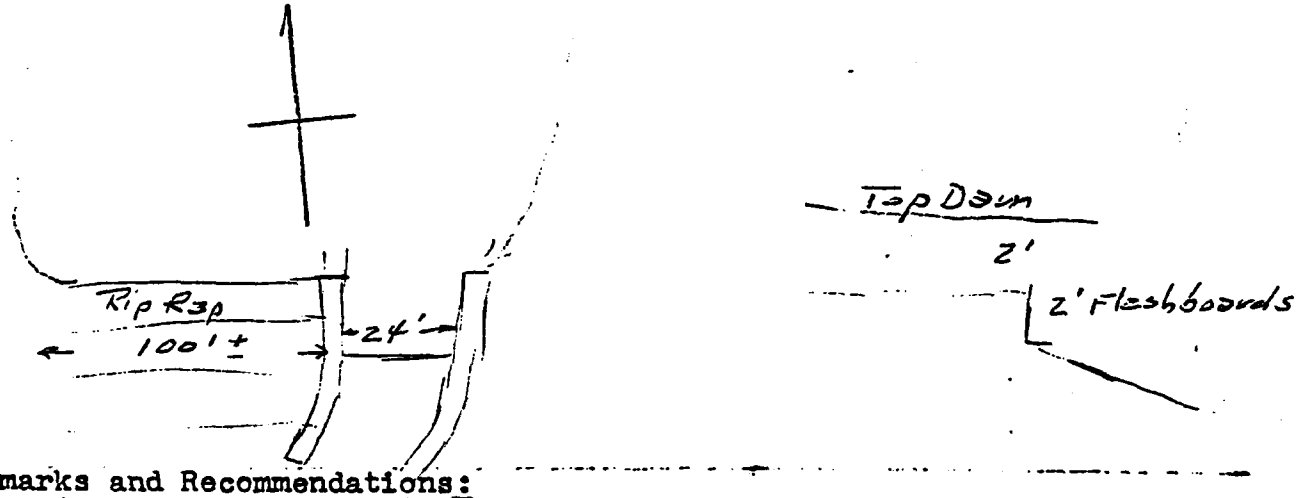
Estimated Discharge Capacity:

Stream: Meetinghouse Brook
Pond: Meetinghouse Pond
Date: 2-23-72
By: Eaton & Conu

CONDITION RATING
Structural: Good
Hydraulic: 24 X 4'
General: Good
PRIORITY: *

General Description of Dam and Discharge Control:
Rip rapped earth dam with gunited stone spillway 24' wide
2" of boards in place + stone walls are 2 additional feet higher
No gate at this location

Sketch (Not to Scale):

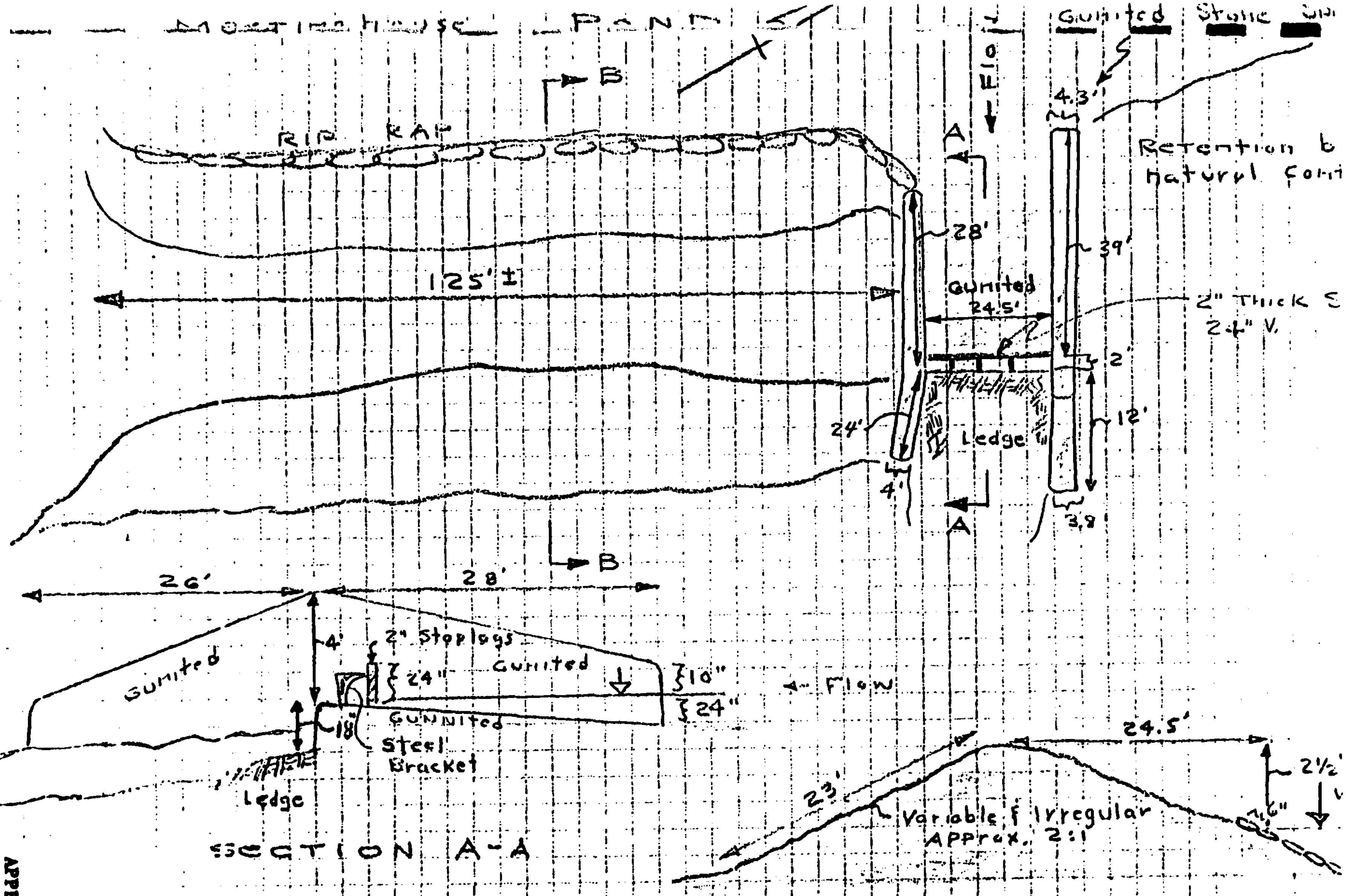


Remarks and Recommendations:
* Brush on dam should be cut

Date 2-23-72 By Eaton & Conu Comment

Dam No. 3-14-332-19

APPENDIX B-19



Westminster
Meetinghouse Pond
DAM No. 3-14-332-19

1. Location: ~~City~~/Town WESTMINSTER Dam No. [illegible]

Name of Dam Meetinghouse Pond Inspected by REGAN, RIZKALLA

Date of Inspection 5/14/75

2. Owner/s: per: Assessors _____ Prev. Inspection _____

Reg. of Deeds _____ Pers. Contact ✓

1. The Hon. Hedley Bray-MAYOR-City HALL- 718 MAIN St. Fitchburg MASS.
Name St. & No. City/Town State Tel. No.

2. George LANIDES, Public Works Commissioner & City Engineer - City HALL
Name St. & No. City/Town State Tel, No.

3. _____
Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: St. & No.:

City/Town: State: Tel.No.:

4. No. of Pictures taken _____

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate ✓

3. Severe _____ 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ✓

Operative ✓ yes; _____ No.

Comments: Isolated Gate house located on Shore 450'± W. OF This dam

7. Upstream Face of Dam: Condition:

1. Good _____ 2. Minor Repairs ✓

3. Major Repairs ____ 4. Urgent Repairs ____

8. Comments: ① Remove Trees & brush
② Augment Slope Protection (more RIP RAP needed on Face)

. Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs ✓

3. Major Repairs To ✓ 4. Urgent Repairs _____

Comments: ① Remove Trees & brush. ② 1 ANIMAL Burrow Noted ③ 12" Wide x 1" deep x 25' long Pool of Standing water 15' W. OF Spillway (From d.s. To To d.s. Brook). No Flow Visible ON day of INSPECTION

. ~~Emergency~~ PRINCIAL Spillway:

Condition: 1. Good _____ 2. Minor Repairs ✓

3. Major Repairs To ✓ 4. Urgent Repairs _____

Comments: GUNITE ON Stone MASONRY IS failing. This IS Very Seepa Pronounced at the U.S. Spillway Floor. Very little WATER WAS ~~Flowing~~ over The Spillway Crest, and There WAS a TRICKLE Flow emerging From the d.s. To of The Vert. 18" Wier Face

. Water Level at time of inspection: 2.5 ft. above ✓ below ____

top of dam Emb. principal spillway ____

other @ Spillway INVert

. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment ✓

Animal Burrows and ~~Washouts~~ 1 Noted on d.S. Face

Damage to slopes or top of dam —

Cracked or Damaged Masonry Gunite Treatment IS SPALLING off Spillway Surface

Evidence of Seepage Just West of Spillway @ d.S. Toe

Evidence of Piping —

Erosion —

Leaks Flow IS INTO SPALLED Spillway & OUT of d.S. Toe 18" Vert Spillway Wier Fac

Trash and/or debis impeding flow —

Clogged or blocked spillway —

Other UPSTREAM face NEEDS ADDITIONAL R.R. PAP

12. Remarks & Recommendations: (Fully Explain)

Notify City To Rectify foregoing deficiencies.
Since The City Should have a Consultant INSPect Scott and Lovell Reservoirs, and Since There IS Seepage But Not Imperative in evidence at This dam it may be desireable To have This Consultant INSpect This dam.

13. Overall Condition:

1. Safe _____
2. Minor repairs needed ✓
3. Conditionally safe To - major repairs necded ✓
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain) —

Recommend removal from inspection list _____

DESCRIPTION OF DAM

DISTRICT 3

Submitted by W. REGAN Dam No. 3-14-332-19

Date 5/28/75 ~~City~~/Town WESTMINSTER

Name of Dam Meetinghouse Pond

1. Location: Topo Sheet No. 19C

Provide 8½" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1893 Year/s of subsequent repairs N/A

3. Purpose of Dam: Water Supply ✓ Recreational _____

Irrigation _____ Other _____

4. Drainage Area: 1.5 ± sq. mi. _____ acres

5. Normal Ponding Area: 155 acres; Ave. depth _____

MAX DRAW = 15'

Impoundment: 655 million gals.; _____ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir

15 ± Residences i.e. summer homes, etc. 1 Pumping Station

7. Dimensions of Dam: Length 150'± Max. Height 10'±

Slopes: Upstream Face See Sketch

Downstream Face 2:1

Width across top See Sketch

8. Classification of Dam by Material:

Earth ✓ Conc. Masonry _____ Stone Masonry (GUNITED) ✓

Timber _____ Rockfill _____ Other RIP RAP U.S. FACE

9. A. Description of present land usage downstream of dam:

100 % rural; _____ % urban.

B. Is there a storage area or flood plain downstream of dam which could accomodate the impoundment in the event of a complete dam failure? yes _____ no _____.

See Note for (10)

10. Risk to life and property in event of complete failure.

See Note below

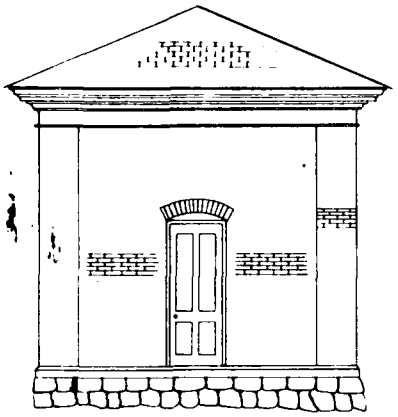
No. of people _____.
No. of homes _____.
No. of Businesses _____.
No. of industries _____. Type _____
No. of utilities _____. Type _____
Railroads _____.
Other dams _____.
Other _____.

11. Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet.

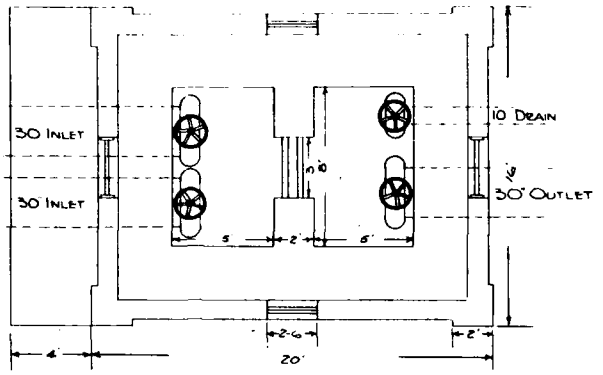
12. How to Locate: Rte. 140 N.B. Westminster. Turn LT. onto old Worcester Rd ("T" intersection). Travel ½± mile To a point 450'± N. of Brick Gate House, where Stream Crosses Rd Through a Stone Box Culv. Head Upstream on Foot To dam

The failure passes Through a 2'H x 4'V GRAN Box Culv Just D.S. on old Princeton Rd. Its highly Probable That This Road would wash out. after This location,

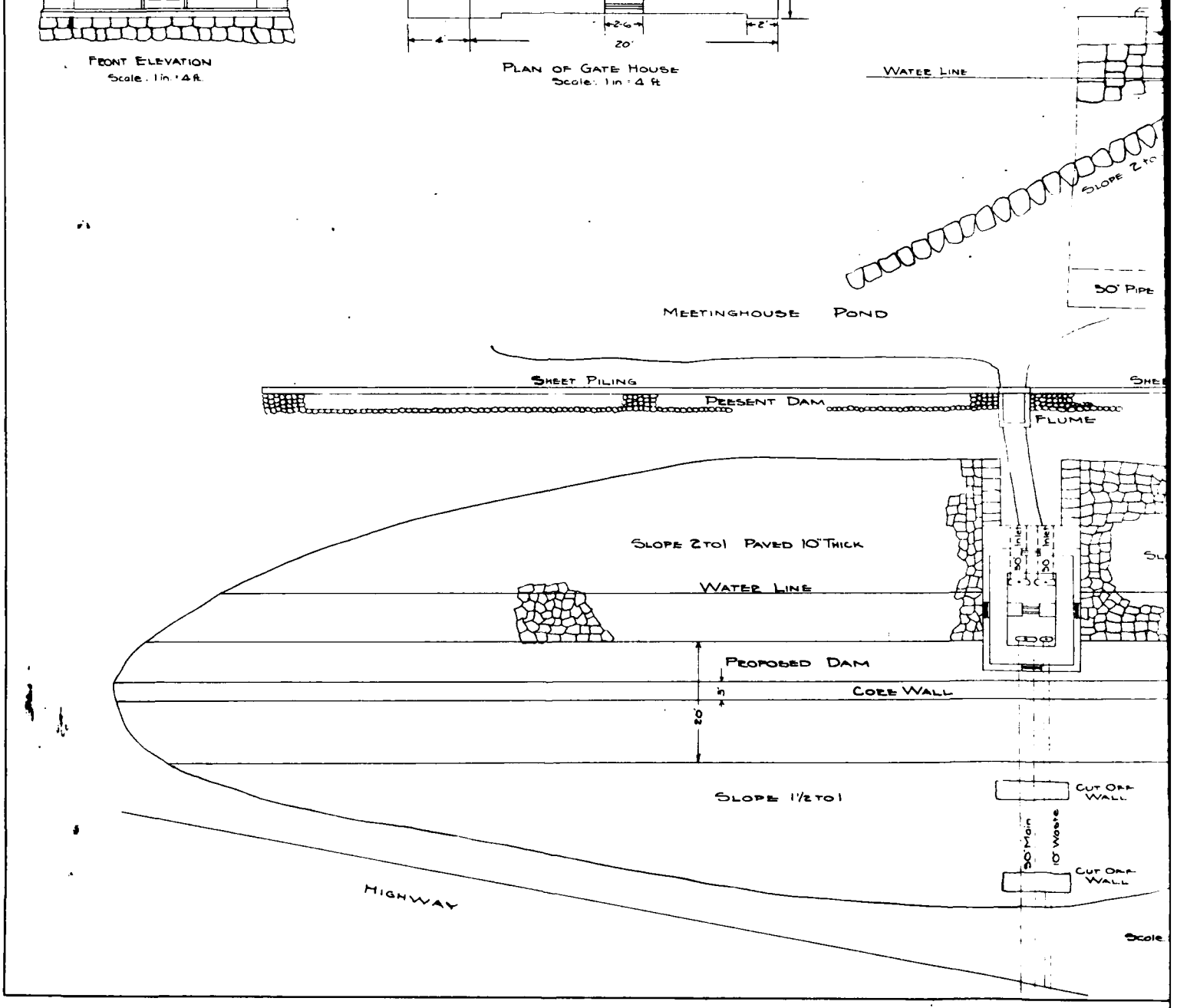
Note (10): The failure discharge passes Through an 0.8± mile Undeveloped stretch and Then Under Rte. 140 Through a bridge built after The '55 Flood. Property damage To Same is Probable. IT Then passes over Dam No. 3-14-332-13 and damage To Same (poss. Complete failure) IS Probable. ½± beyond This Storage is reached IN Wyman Pond In The event of an exceptional Storm it's a Possibility That The Elev. of Wyman Pond Could be raised Sufficiently To Cause Property damage at scores of Shoreline residences

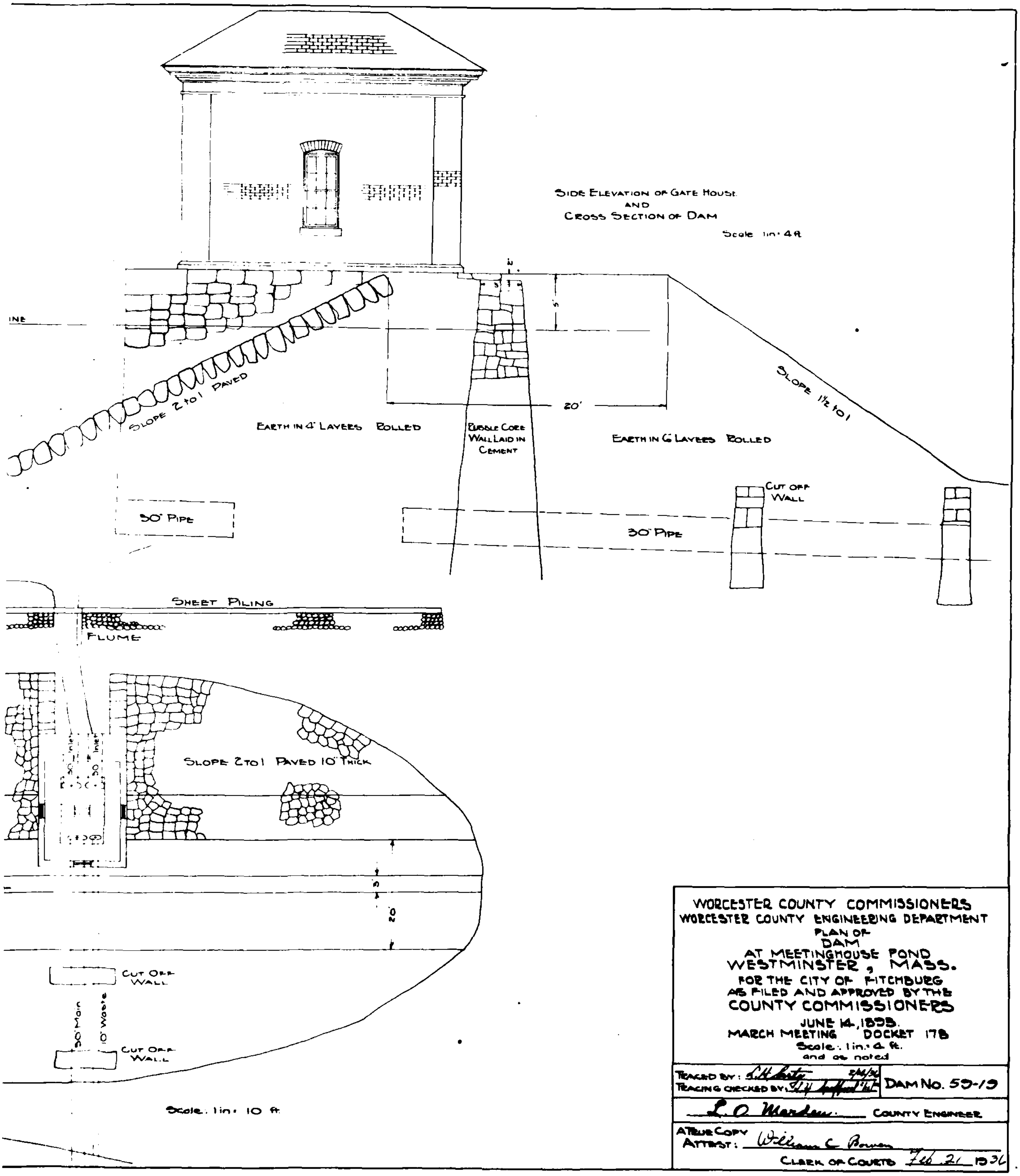


FRONT ELEVATION
Scale. 1 in. : 4 ft.



PLAN OF GATE HOUSE
Scale: 1 in : 4 ft





WORCESTER COUNTY COMMISSIONERS
WORCESTER COUNTY ENGINEERING DEPARTMENT
PLAN OF
DAM
AT MEETINGHOUSE POND
WESTMINSTER, MASS.
FOR THE CITY OF FITCHBURG
AS FILED AND APPROVED BY THE
COUNTY COMMISSIONERS
JUNE 14, 1895.
MARCH MEETING DOCKET 178
Scale: 1 in: 4 ft.
and as noted

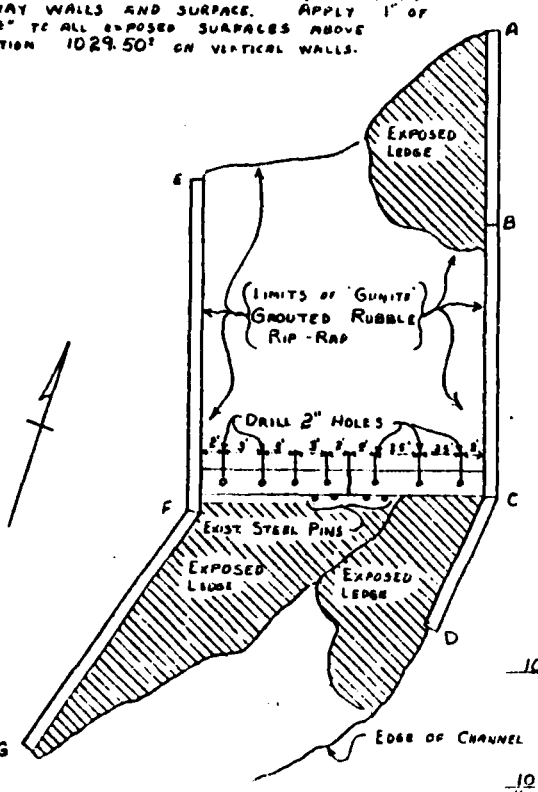
Traced by: | Tracing checked by: | DAM No. 59-19

L. O. Marden — County Engineer

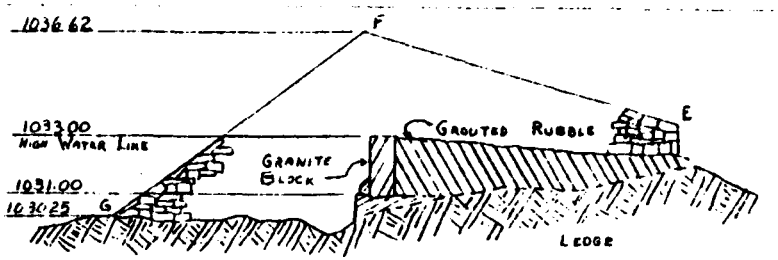
A True Copy
Attest: William C. Bowen
Clerk of Courts Feb. 21 1936

WINGWALLS & SPILLWAY

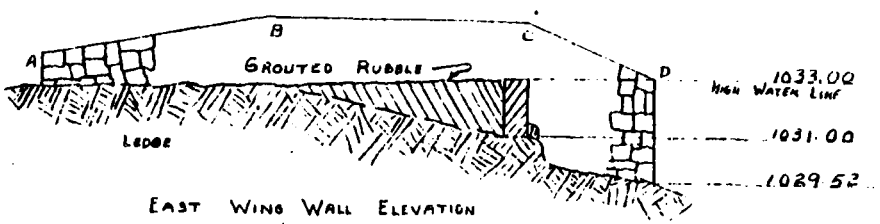
REMOVE ALL VEGETATION AND LOOSE MORTAR FROM SPILLWAY WALLS AND SURFACE. APPLY 1" OF "GUNITE" TO ALL EXPOSED SURFACES ABOVE ELEVATION 1029.50' ON VERTICAL WALLS.



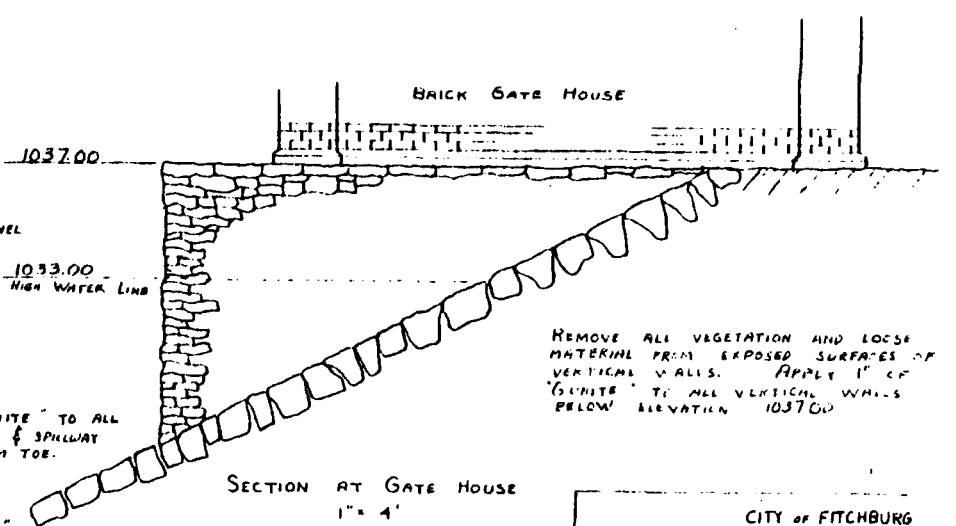
SPILLWAY PLAN
1" = 10'



WEST WING WALL ELEVATION
1" = 10' HOR 1" = 4' VERT

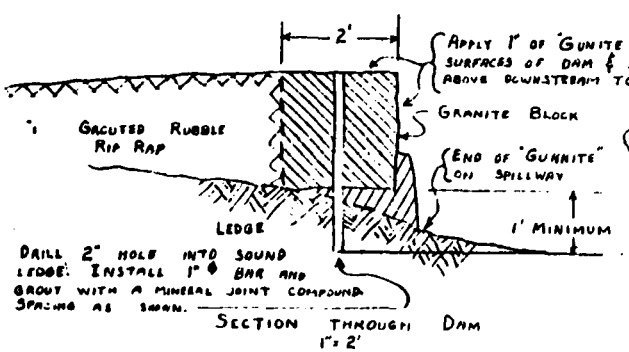


EAST WING WALL ELEVATION
1" = 10' HOR 1" = 4' VERT



REMOVE ALL VEGETATION AND LOOSE MATERIAL FROM EXPOSED SURFACES OF VERTICAL WALLS. APPLY 1" OF "GUNITE" TO ALL VERTICAL WALLS BELOW ELEVATION 1037.00

SECTION AT GATE HOUSE
1" = 4'



SECTION THROUGH DAM
1" = 2'

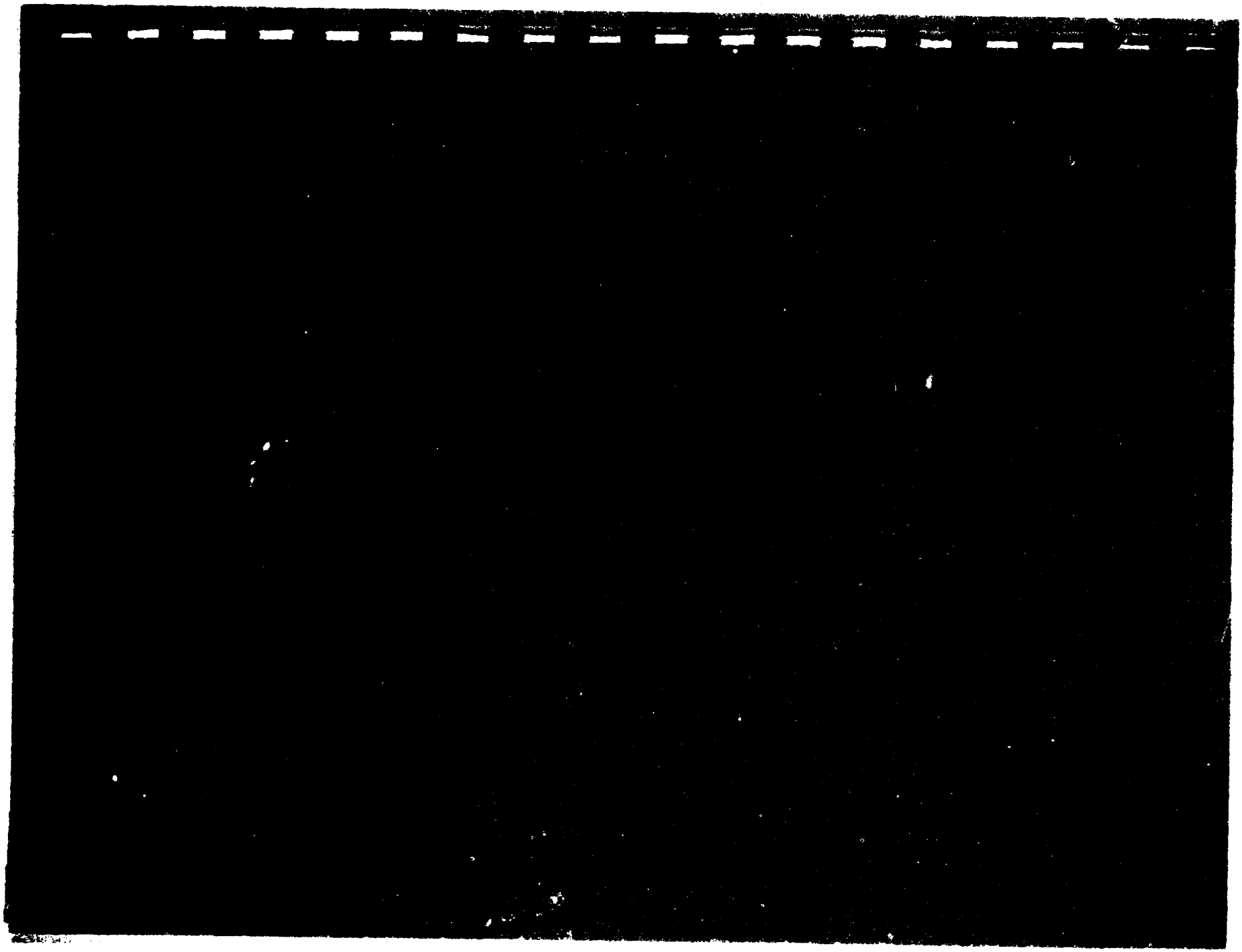
NOTE: THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT DEBRIS FROM CLEANING OR "GUNITING" OPERATIONS FROM ENTERING WATER INTAKE AT GATEHOUSE.

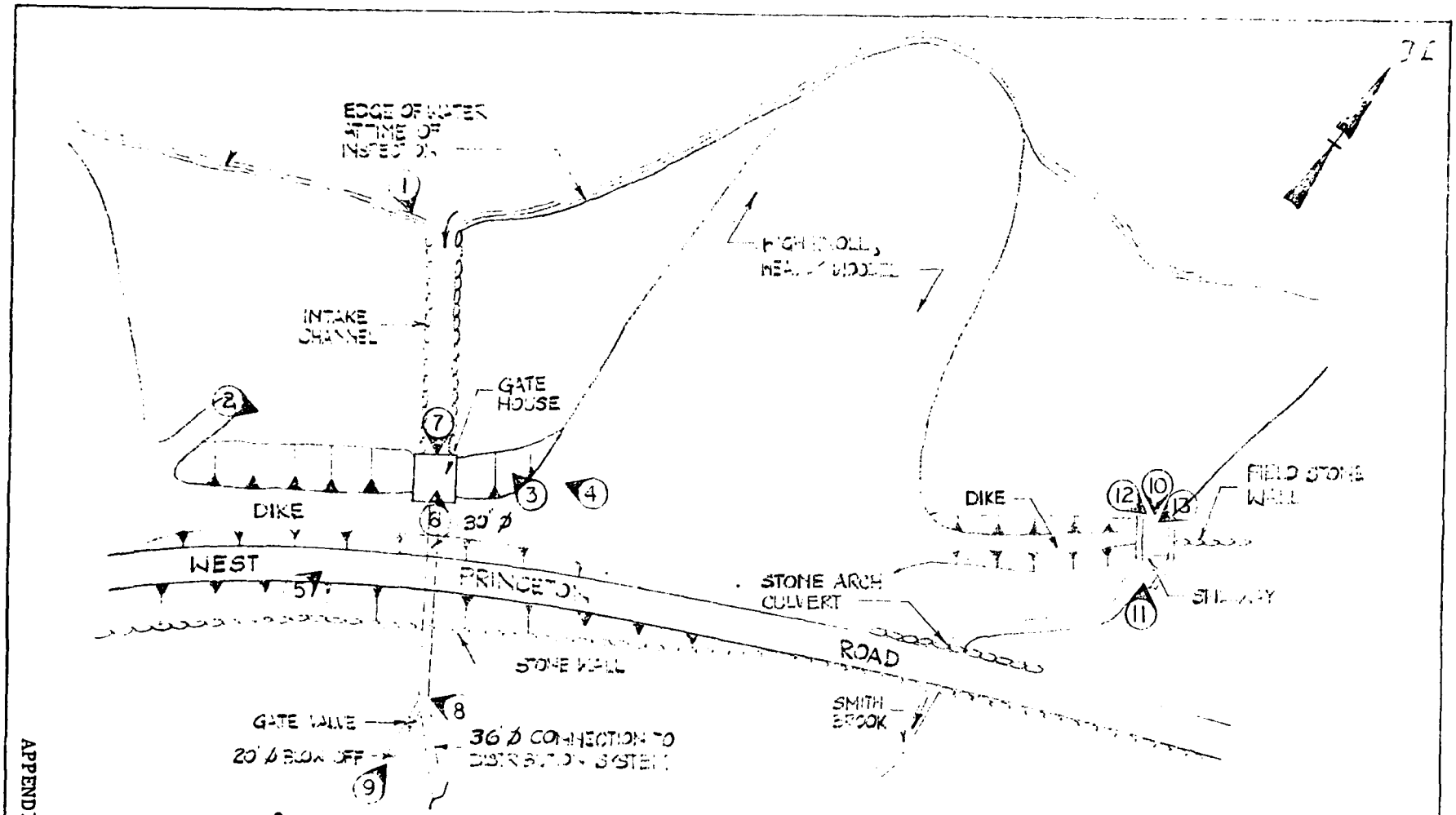
CITY OF FITCHBURG
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

REPAIRS TO MEETINGHOUSE SPILLWAY AND GATE HOUSE

SCALE: AS SHOWN 1968

APPENDIX B-27





PLAN

Note: (1) Denotes direction of view and photograph number.

National Program of Inspection of Non-Federal Dams
Location of Photographs
Meetinghouse Pond Dam
Westminster, Massachusetts

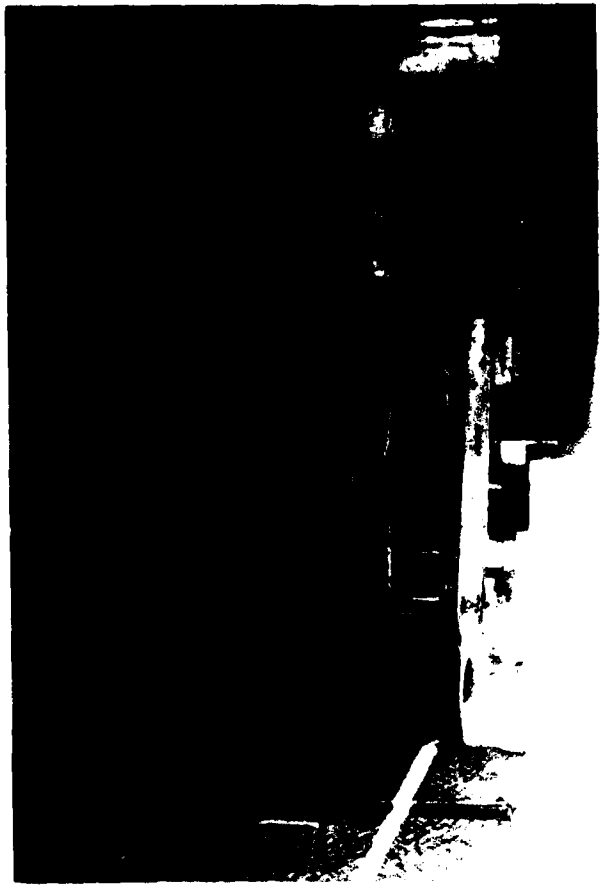
APPENDIX C-1

2. DAM RIGHT EMBANKMENT AND GATE HOUSE.

3. INTAKE CHANNEL TO GATE HOUSE.

4. CREST OF LEFT DAM EMBANKMENT AND GATE HOUSE.

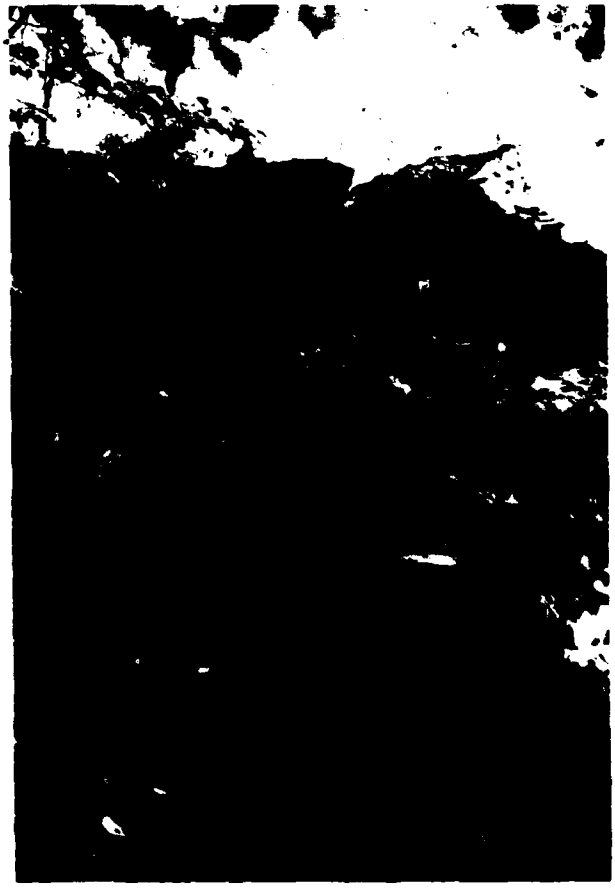
5. VIEW OF LEFT DAM EMBANKMENT FROM ROAD DOWNSTREAM AND PARALLEL TO DAM.



6. FRONT VIEW OF MECHANICAL BAR SCREEN CLEANER INSIDE GATE HOUSE.

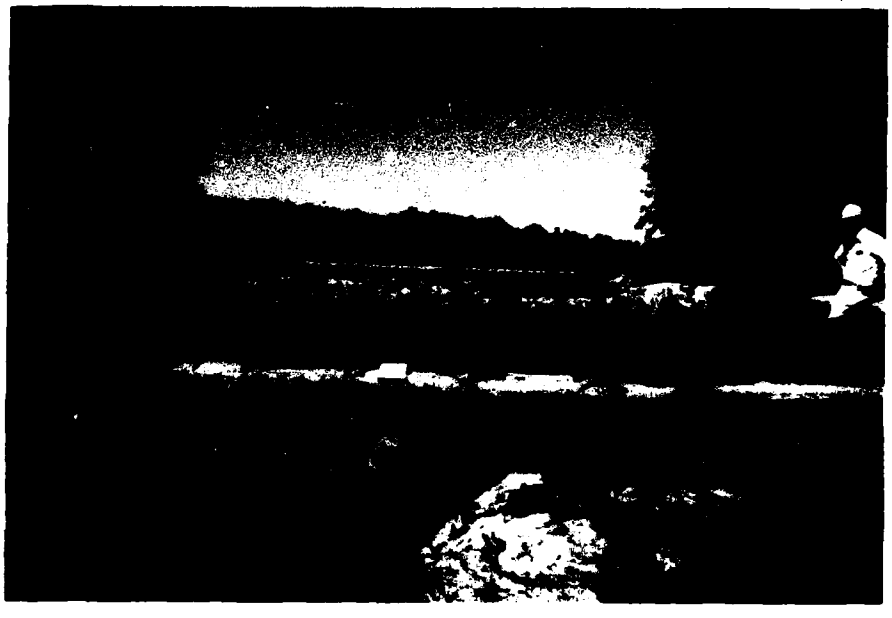
7. MECHANICAL BAR SCREEN MOTOR OPERATOR AND REAR OF BAR SCREEN CLEANER HOUSING.

8. BLOWOFF PIPE VALVE STEM DOWNSTREAM OF DAM.



9. BLOWOFF PIPE OUTLET.

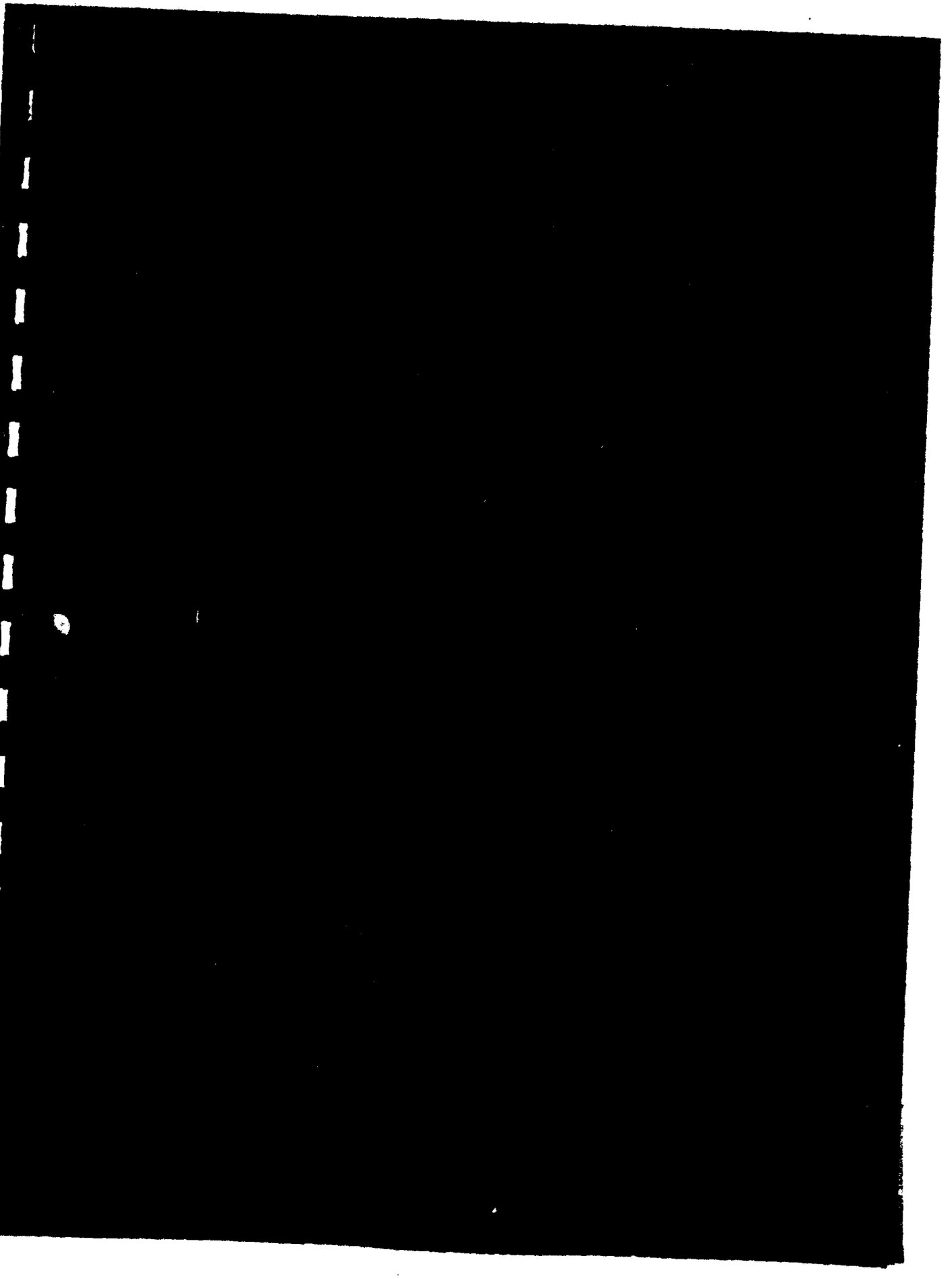
10. APPROACH VIEW OF SPILLWAY.

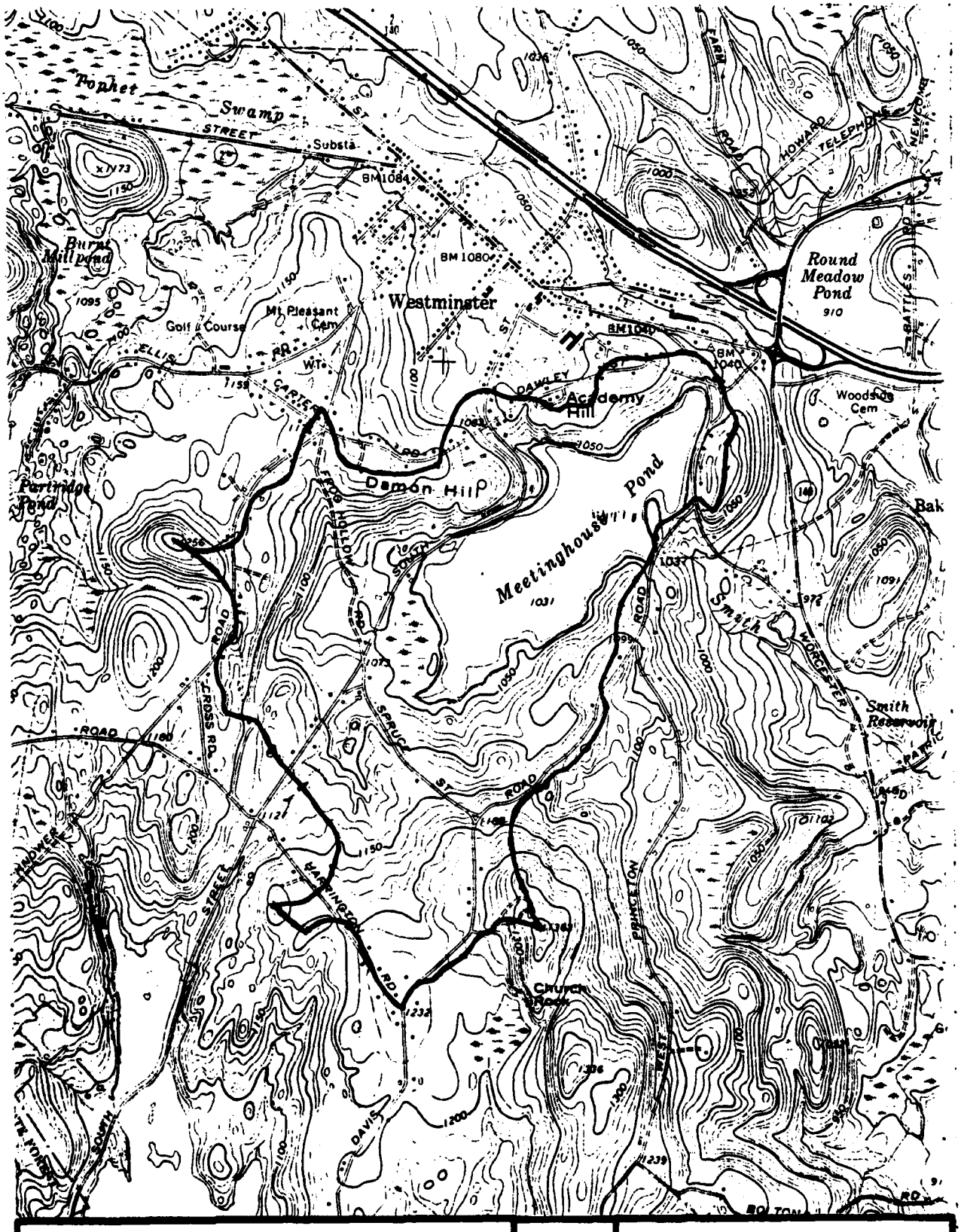


11. DOWNSTREAM FACE OF SPILLWAY AND FLASHBOARDS WITH POND IN BACKGROUND.

12. SPILLWAY LEFT APPROACH WALL.

13. SPILLWAY RIGHT APPROACH WALL.





CAMP DRESSER & McKEE Inc. **Consulting Engineers** **Boston, Mass.**	N	MEETINGHOUSE POND DAM DRAINAGE AREA MAP SCALE: 1" = 2000'

APPENDIX D-1

ELEVATIONS

Plans & sketches report spillway crest @ 1033.0 and top of dam @ gate house @ 1037.0. Levels made by City Engr Dept. @ the request of CDM found: spillway = 1032.63 and top of dam @ G.H. = 1037.83; difference = 5.2 ft.

Use: SPILLWAY CREST = 1033.0 ; TOP OF DAM @ G.H. = 1033+5.2 = 1038.2
EMBANKMENTS ADJACENT TO SPILLWAY: RIGHT = 1033+4 = 1037.0
LEFT = 1033+3 = 1036.0
TOE OF SPILLWAY = 1029.5 (from plans)

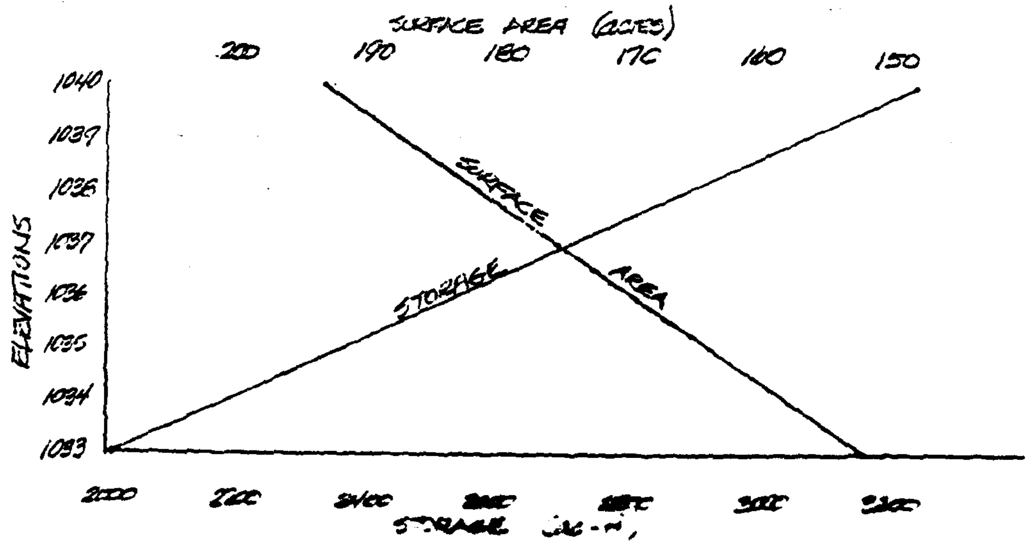
SURFACE AREAS

At El. 1033.0 = 152.7 acres (from City records)
At El. 1040 = 193.6 acres } from USGS Quads
At El. 1050 = 265.4 acres }

STORAGE CAPACITIES

At Spillway Crest El. 1033.0 = 655,050,000 gals/325,851 = 2,010 ac-ft (from City Records)

At El. 1040, 2,010 + (152.7 + 193.6)/2 × 7 = 2,010 + 1,213 = 3,223 ac-ft



APPENDIX D-2

SIZE CLASSIFICATION

HYDRAULIC HEIGHT: Top of Embankment Right of Spillway = 1037.0
Toe of Spillway = 1029.5
7.5 ft.

STORAGE CAPACITIES:
@ Elev. 1035.0 = 2,300 ac-ft.
@ Elev. 1037.0 = 2,700 ac-ft.

∴ Size classification, based on storage, is INTERMEDIATE

HAZARD CLASSIFICATION

Discharges from Meetinghouse Pond are conveyed approx. 1.5 miles by Smith Brook to Wyman Pond. There are three culverts and one extremely small pond between the damsite and Wyman Pond. Existing development is located only along Patrick Road, the last of the three culverts. Existing development consists of 2 to 4 homes which might experience minor water damage in the event of a dam failure.

∴ hazard classification is a "low" - SIGNIFICANT

TEST FLOOD

INTERMEDIATE size & SIGNIFICANT hazard → 1/2 PMF to PMF range.

Since the size is a "small" - Intermediate and the hazard a "low" - Significant, the 1/2 PMF will be adopted as the TEST FLOOD

DRAINAGE AREA

The 1.47 sq. mi. drainage area (from city records) is sparsely developed and heavily wooded. The terrain is steep to rolling.

Meetinghouse Pond (132.7 acres surface area) is ~14% of the total D.A.

PROBABLE MAXIMUM FLOOD (PMF)

Peak Inflow from extrapolation of COE curves, mid-range between ROLLING & MOUNTAINOUS TERRAIN IS 2450 CSM.

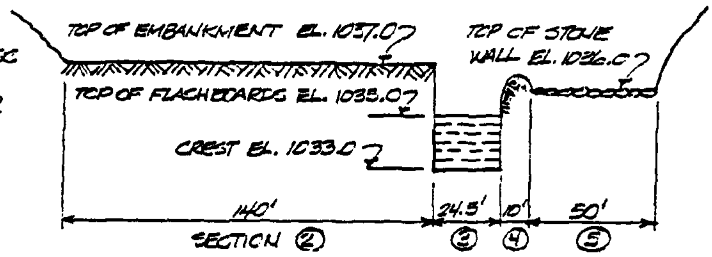
Then PMF INFLOW = 2450 CSM × 1.47 mi² = 3,600 cfs

1/2 PMF INFLOW = 3600/2 = 1,800 cfs

STAGE - DISCHARGE RELATIONSHIPS

$Q = CLH^{3/2}$; Let C = 3.3 for concrete spillway ; 3.5 for sharp crested flashboards ; and 2.2 for earth and stone embankments with trees and vegetation and 2.5 without trees or vegetation

SECTION ① = Dam & Gate House L = 220 ft. Crest El. 1038.2



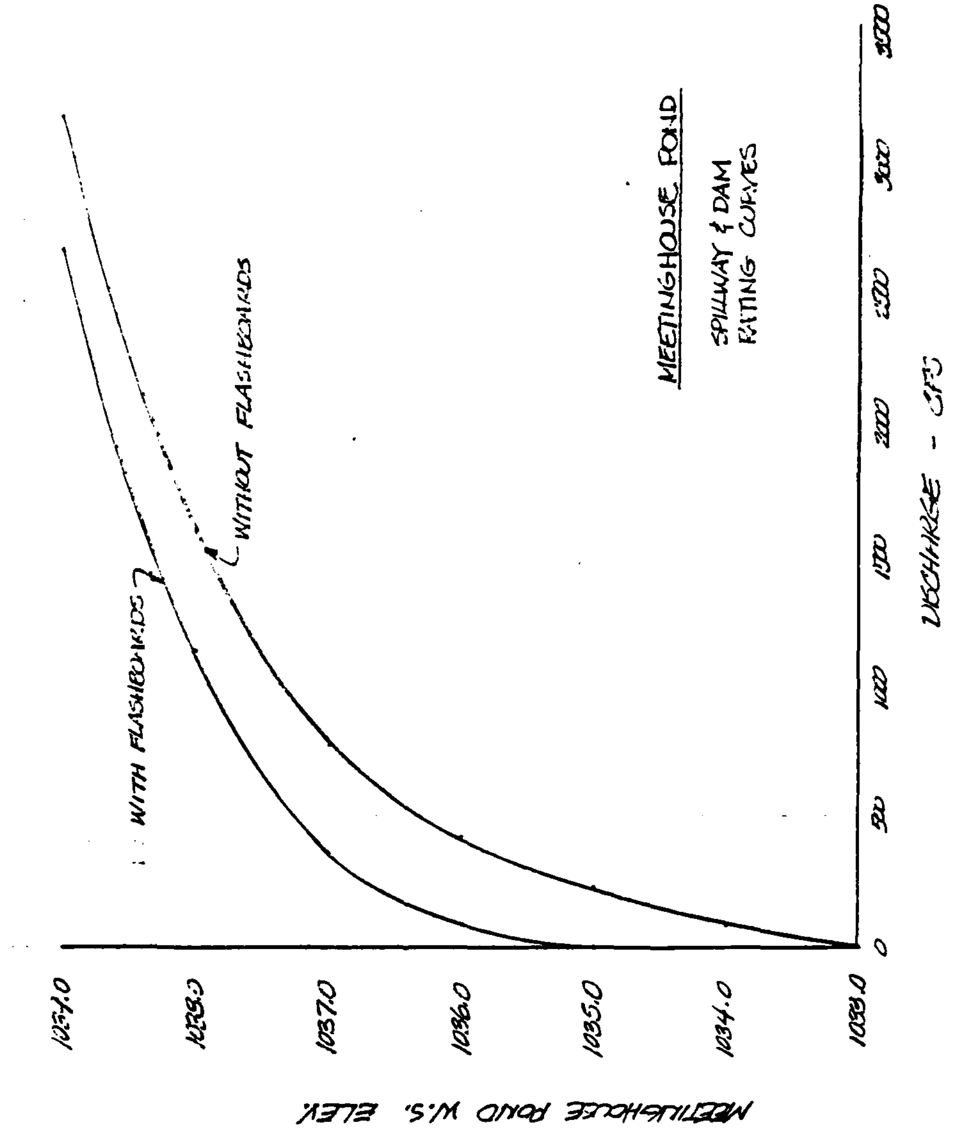
ELEVATION	① C=2.5	② C=2.2	③ C=3.3/3.5	④ C=2.2	⑤ C=2.2	TOTAL w/o/w FLASH.
1033.0	-	-	0/-	-	-	0/-
1034.0	-	-	81/-	-	-	81/-
1035.0	-	-	229/0	-	-	229/0
1036.0	-	-	420/86	0	0	420/86
1037.0	-	0	647/243	11	110	768/364
1038.0	-	308	904/446	62	311	1585/1127
1039.0	411	871	1188/666	114	572	3156/2654

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT ____
PROJECT ____
DETAIL MEETINGHOUSE POND

JOB NO 380-5-IG
DATE CHECKED 10-24-78
CHECKED BY [signature]

PAGE 4 of 8
DATE 10-6-78
COMPUTED BY JED



APPENDIX D-5

SURCHARGE - STORAGE ROUTING (Without Flashboards)

Q_{PA} = 1/2 PMF INFLOW = 1,800 cfs

Surcharge Ht_1 = 1032.0 + (1800 - 1565)/(3156 - 1585) x 1.0
= 1032.0 + 0.14 = 1032.14

STOR, @ EL. 1032.14 = (3223 - 2010)/7 x (1032.14 - 1025.0)
= 173.3 x 5.14 = 890.6 ac-ft.
then $STOR_1$ = 890.6/(53.3 x 1.47) = 11.4 inches

Q_{P_2} = 1800 x (1 - 11.4/9.5) = 1800 x (>1) → Say Q_{P_2} = 0

then Surcharge $Ht._2$ = 1033.0

$STOR_2$ @ EL. 1033.0 = 0

AVG. STOR. = (0 + 890.6)/2 = 445.4 ac.-ft.

Surcharge Ht_3 @ 445.4 ac-ft STOR = 445.4/(3223 - 2015) x 7 + 1032.0
= 0.37 x 7 + 1032.0
= 1035.57, Say 1035.6

then Q_{P3} = (420 - 229) x 0.6 + 229 = 344 cfs

Say 1/2 PMF OUTFLOW = 350 cfs

SPILLWAY CAPACITIES

@ Test Flood EL. 1035.57, without flashboards:
(420 - 229) x (.6) + 229 = 344 cfs → 350 cfs ✓

@ Test Flood EL. 1035.57, with flashboards:
86 x .57 = 49 cfs, Say 50 cfs

Revised
11-30-76
JED

TAILWATER ANALYSIS

Tailwater elevation will be controlled by downstream culvert @ West Princeton Road. See field sketch, next page.

Top of Road El. 1033 + 2.0 - 84" = 1028.0

Culvert Opening = 36" W x 45" H
Inv. = 1028.0 - 3.5' - 3.75' = 1020.75
Area = 3' x 3.75' = 11.25 ft²

1. Let W.S. = El. 1028.0 (Top of Road)

$Q = CA(2gh)^{1/2} = (0.8)(11.25)(2 \times 32.2 \times 3.5)^{1/2} = 135$ cfs

2. Let W.S. = El. 1029.0 ← weir length from next page

$Q = (0.8)(11.25)(64.4 \times 4.5)^{1/2} + (2.5)(137)(1)^{3/2}$
$= 153 + 342 = 495$ cfs

3. Let W.S. = El. 1029.5

$Q = (0.8)(11.25)(64.4 \times 5)^{1/2} + (2.5)(176)(1.5)^{3/2}$
$= 161 + 808 = 969$ cfs

4. Let W.S. = El. 1030.0

$Q = (0.8)(11.25)(64.4 \times 5.5)^{1/2} + (2.5)(214)(2)^{3/2}$
$= 167 + 1513 = 1682$ cfs

Then stage @ Test Flood (340 cfs) is

$(340 - 135)/(495 - 135) \times 1.0 + 1028.0 = 1028.57$ @ W. Princeton Rd.

TRIAL #1
Assume EGL slope equals slope from toe of spillway +5' to W.S. El. @ W. Princeton Rd. culvert.

@ Spillway El. 1034.50
@ Culvert El. 1030.00
4.5 ft. ÷ ~275' (spillway to culvert) = 0.0164

Downstream channel ~25' wide, n = 0.025, find depth, y.

$Q = 340 = \frac{1.49}{.025} \times (25y) \times \left(\frac{25y}{25 + 2y}\right)^{2/3} (.0164)^{1/2}$

CAMP DRESSER & McKEE	CLIENT COE	JOB NO 3C-5-03	PAGE 7 of 8
Environmental Engineers	PROJECT DAM INSP	DATE CHECKED [illegible]	DATE 11-30-78
Boston, Mass.	DETAIL MEETINGHOUSE POND	CHECKED BY [illegible]	COMPUTED BY [illegible]

$Q = 340 = 1?.6 (y)(25y/25+2y)^{2/3}$

$1.76 = (y)(25y/25+2y)^{2/3}$

let $y = 3$ ft.

$(3)(25\times3/25+2\times3)^{2/3} = (3)(1.8) = 5.4 > 1.76$

let $y = 1$ ft.

$(1)(25\times1/25+2\times1)^{2/3} = 0.95 < 1.76$

let $y = 1.5$ ft.

$(1.5)(25\times1.5)/25+2\times1.5)^{2/3} = 1.59 < 1.76$

@ 340 cfs, $y = (1.76-1.59)/(5.4-1.59) \times (3-1.5) + 1.5 = 1.57$ ft.

Say W.S. @ Toe of Spillway = 1029.5 + 1.6 = 1031.1

Velocity @ " " = 340/25 × 1.6 = 8.5 fps

$V^2/2g = (8.5)^2/64.4 = 1.12$

EGL = 1031.1 + 1.12 = 1032.22 @ Toe of Spillway

EGL @ W. Princeton Rd. = 1028.0 + 0.57 × 3/2 = 1028.86

Then new EGL Slope = (1032.22 - 1028.86)/575' = 0.012
compares well with 0.0164

∴ TAILWATER ELEV. @ Spillway Toe = 1031.1

APPENDIX D-8

CAMP DRESSER & McKEE Environmental Engineers Boston, Mass	CLIENT COE PROJECT NAT'L DAM INSP DETAIL [illegible]	JOB NO [illegible] DATE CHECKED [illegible] CHECKED BY [illegible]	PAGE 8 of 8 DATE 10-10-78 COMPUTED BY JED

Revised 11-30-78 JED

DAM FAILURE ANALYSIS

Assume 40% Breach Width (W_b) of Embankment to right of spillway

W_b = 140 ft. x 40% = 56 ft.
Y_o = 1037.0 - 1029.5 = 7.5 ft - use 7 ft.

$Q_{P1} = 8/27 \times 56 \times (32.2)^{1/2} (7)^{3/2} = 1,750$ cfs

From Tailwater Analysis, West Princeton Rd. will be overtopped by more than 2 ft. of water.

The remaining culverts between the breach and Wachusett Pond are also inadequate to pass a peak discharge of 1,750 cfs. These include:

1. Old Rd. immediately u/s of Worcester Rd. (Rt. 140)

4 ft. wide x 4.5 ft. high conc. culvert, L = 45'

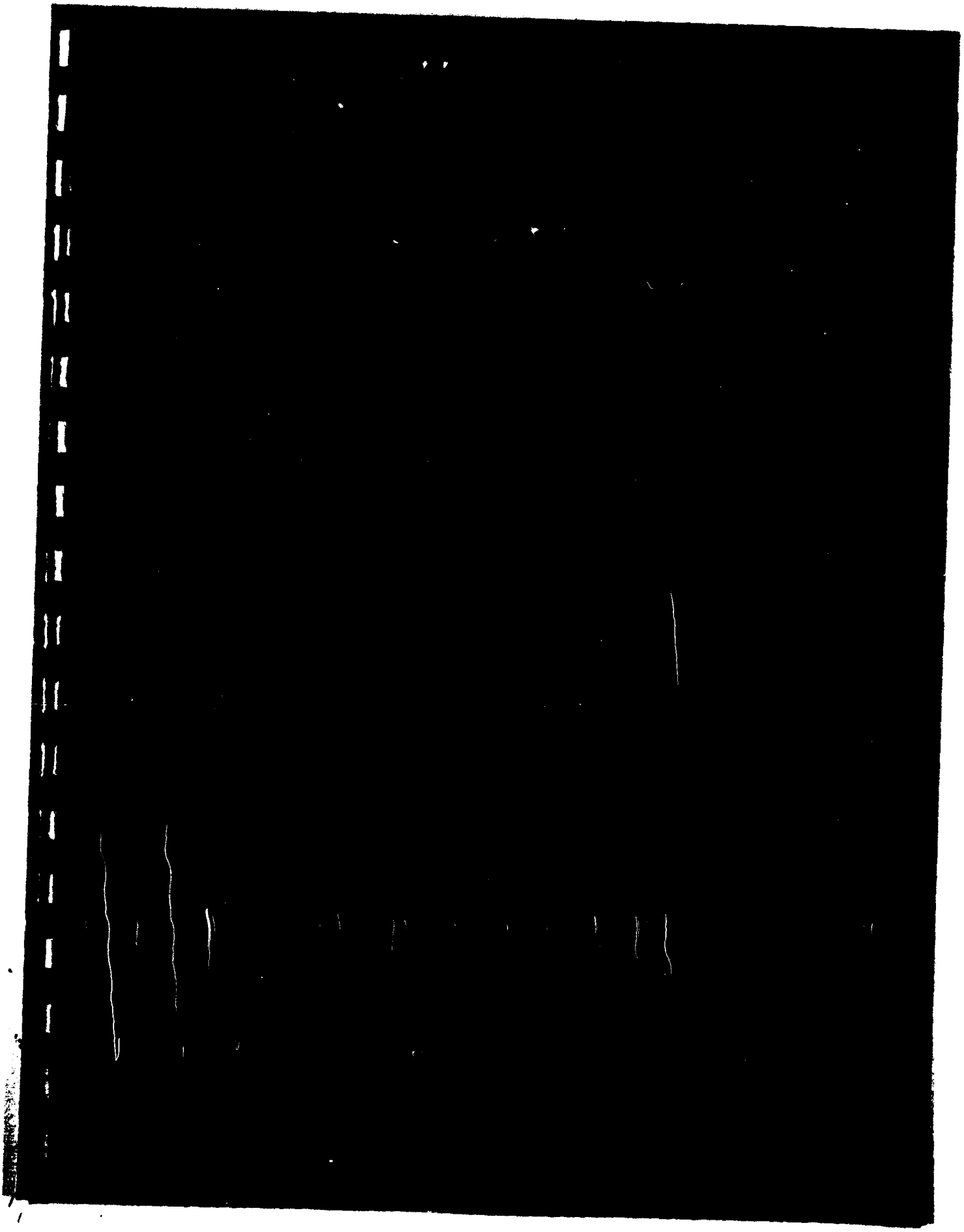
2. Worcester Rd. (Rt. 140)

78" ϕ conc. culvert, L = 80'

3. Patricia Rd.

Small, unmeasured C.M.P.

Existing development which might be affected by overtopping of culverts is limited to 2 to 4 residences along Patricia Rd.



INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE CODE	COUNTY CODE	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
MA	1018	NED	MA	027	04				MEETINGHOUSE POND DAM	4232.0	7154.3	22	AUG	78

POPULAR NAME	NAME OF IMPOUNDMENT
	MEETINGHOUSE POND

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	05	SMITH BROOK	WESTMINSTER	0	4525

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
RECTPG	1893	S	8	7		2010	NED	N	N	N	N	4DEC78

REMARKS

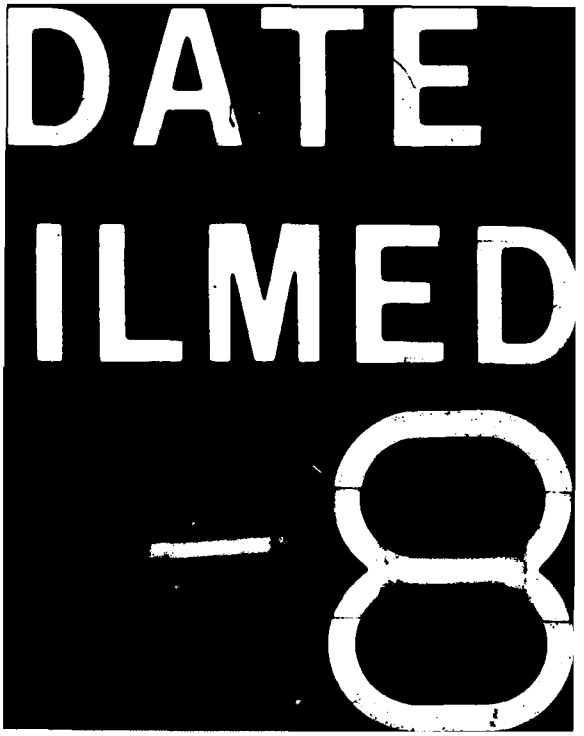
O/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	225		25	420												

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF FITCHBURG	CHARLES A ALLEN CONSULT	

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
CAMP DRESSER & MCKEE INC	22	AUG	78	PL 92-367

REMARKS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-8