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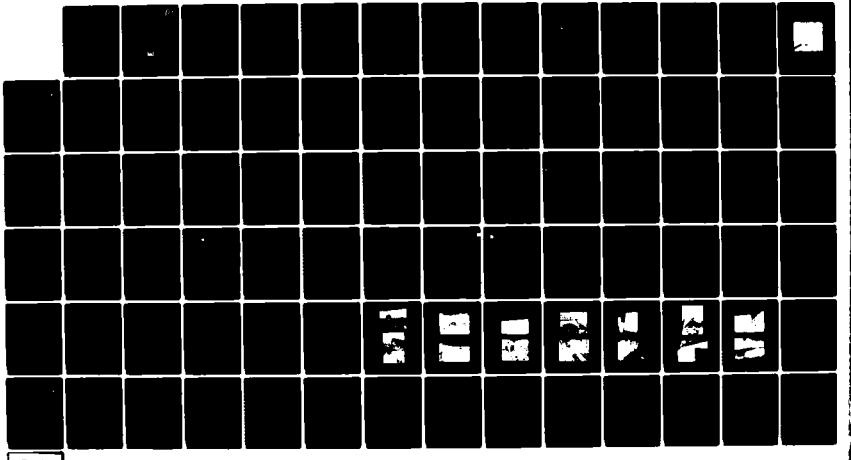

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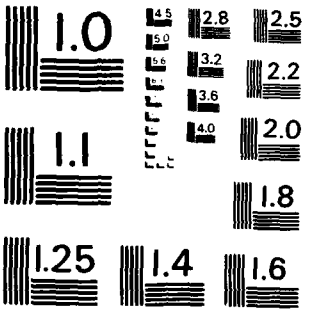

CONNECTICUT RIVER BASIN
WILLIAMSBURG, MASSACHUSETTS

MOUNTAIN STREET RESERVOIR DAM
MA 00082

MOUNTAIN STREET RESERVOIR DIKES
MA 01295

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

OCTOBER 1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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1. REPORT NUMBER MA 00082 MA 01295	2. GOVT ACCESSION NO. AD-A145328	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Mountain Street Reservoir Dam/Dikes 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 October 1980 13. NUMBER OF PAGES 65
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,

Connecticut River Basin
Williamsburg, Massachusetts

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

Mountain Street Reservoir Dam is a 1,300 foot long earth fill dam. The maximum height is 33 feet and consists of an embankment, spillway and gatehouse. The dam has been classified in the small size and high hazard categories. A test flood equal to ½ the PMF was used to evaluate the capacity of the spillway.

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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

MAR 20 1981

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

Dear Governor King:

Inclosed is a copy of the Mountain Street Reservoir Dam (MA-0082)and Mountain Street Reservoir Dikes (MA-01295) 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, Town of Northampton Water Department, Northampton, MA..

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,

C. E. EDGAR, III
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

MOUNTAIN STREET RESERVOIR DAM AND DIKES

MA 00082

MA 01295

CONNECTICUT RIVER BASIN
WILLIAMSBURG, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA 00082 and MA 01295

Name of Dam: Mountain Street Reservoir

Town: Williamsburg

County and State: Hampshire County, Massachusetts

Stream: Beaver Brook, tributary of the Connecticut River

Date of Inspection: August 21, 1980

Mountain Street Reservoir Dam is a 1,300-foot long earth fill dam built in 1905 and used for public water supply. The dam has a maximum height of 33 feet and consists of an embankment, spillway and gatehouse. The top of the dam varies from Elevation (El) 462.3 to 462.8 (National Geodetic Vertical Datum of 1929). The spillway is a flat-crested weir, 12 feet long, with the crest at El 458.0. A stoplog which is in place on the spillway has a crest at El 459.0. The low-level outlet is a 24-inch diameter pipe controlled by a gate valve in the gatehouse. The invert of the low- level outlet is at El 430.0. There are also two earth fill dikes located on the east side of the reservoir. Dike No. 1 is 160 feet long and 16 feet high. Dike No. 2 is 180 feet long and 8 feet high. The top of both dikes is at El 462.0.

There are deficiencies which must be corrected to assure the continued performance of this dam. This conclusion is based on the visual inspection of the site and a review of the available data. Generally the dam is in fair condition.

The following deficiencies were observed at the site: an inoperable low-level outlet; seepage along the downstream slope; erosion and animal burrows on the downstream slope; riprap missing from the upstream slope; cracked and spalled concrete on the gatehouse service bridge and spillway; a heavy growth of brush and trees on the lower downstream slope; and an accumulation of debris on the crest and discharge channel of the spillway.

Based on the Corps of Engineers' guidelines, the dam has been classified in the small size and high hazard categories. A test flood equal to one-half the probable maximum flood (PMF) was used to evaluate the capacity of the spillway. The test flood outflow with the stoplog on the spillway is 240 cfs, resulting in a pond level at El 462.4. The test flood would overtop the dam by 0.1 feet. Hydraulic analyses indicate that the spillway with the stoplog can discharge 220 cfs, or 92 percent of the test flood outflow before the dam is overtopped. Without the stoplog, the test flood outflow is 240 cfs with the pond at El 461.4. In this case, the spillway can discharge 300 cfs or 125 percent of the test flood outflow, and the dam would not be overtopped.

It is recommended that the Owner employ a qualified registered professional engineer to evaluate the stability of the dam and investigate the seepage at the downstream toe. In addition, the Owner should remove the stoplog on the spillway and repair the deficiencies listed above, as described in Section 7.3. The Owner should also implement a program of annual technical inspections, a plan for surveillance of the dam during and after periods of heavy rainfall, and a plan for notifying downstream residents in the event of an emergency at the dam.

The measures outlined above and in Section 7 should be implemented by the Owner within a period of one year after receipt of this Phase I Inspection Report.

Edward M. Greco, P.E.
Project Manager
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 29800

Approved by:

Stephen L. Bishop, P.E.
Vice President
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 19703

This Phase I Inspection Report on Mountain Street Reservoir Dam (MA-00082) and Mountain Street Reservoir Dike (MA-01295) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

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

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. 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 investigations, 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 will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general conditions and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

MOUNTAIN STREET RESERVOIR DAM AND DIKES

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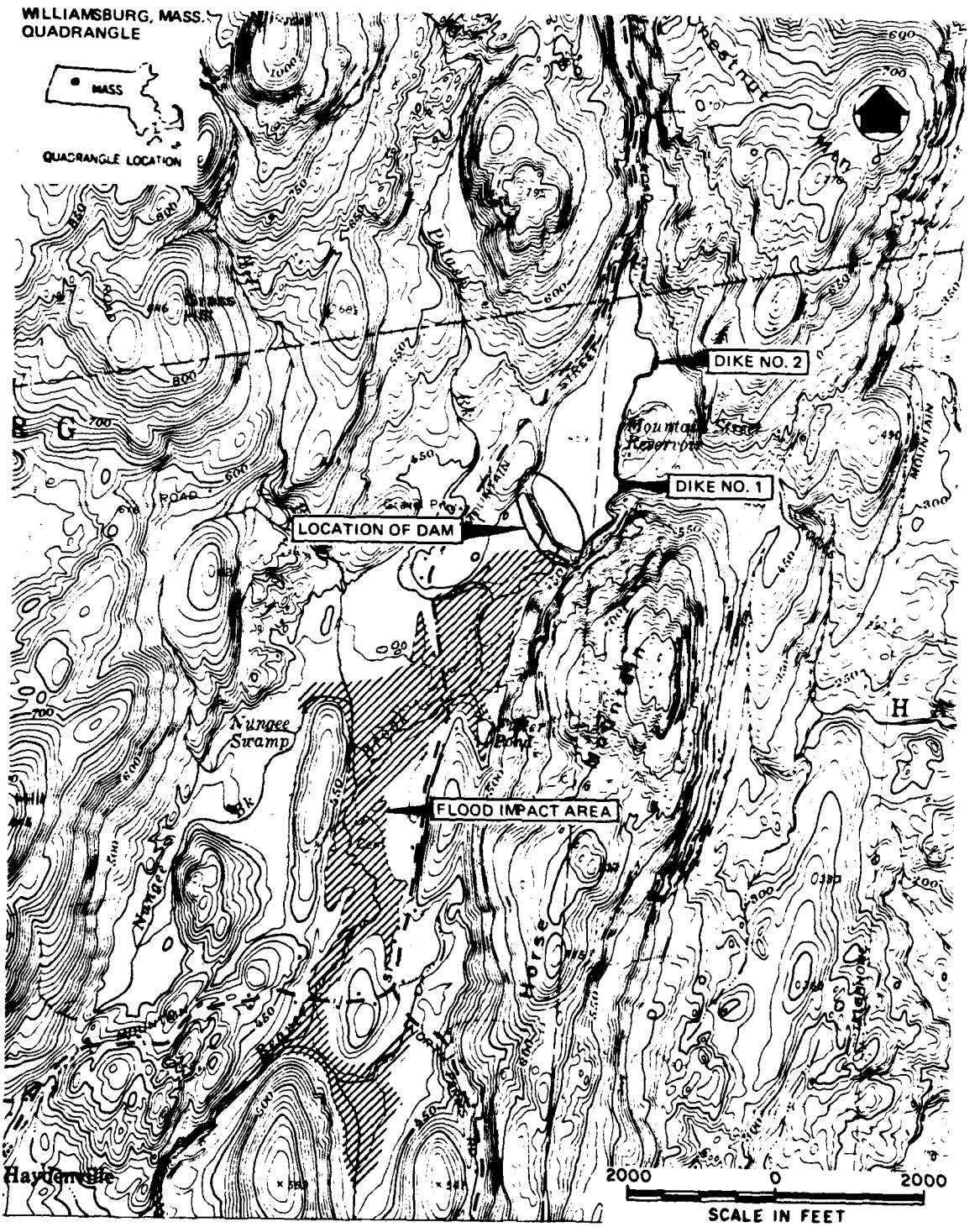
OVERVIEW
MOUNTAIN STREET RESERVOIR DAM
WILLIAMSBURG, MASSACHUSETTS



LOCATION MAP – MOUNTAIN STREET RESERVOIR DAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

MOUNTAIN STREET RESERVOIR DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-80-C-0054, dated April 18, 1980, 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 assist the States to quickly initiate 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. The dam is located on Beaver Brook about 3.5 miles upstream of the confluence with the Mill River in the Connecticut River Basin. The dam is in the Town of Williamsburg, Hampshire County, Massachusetts (see Location Map). The coordinates of this location are Latitude 42 deg. 24.0 min. north and Longitude 72 deg. 40.2 min. west.

b. Description of Dam and Appurtenances. Mountain Street Reservoir Dam is a 1,300-foot long, earth fill dam with

MOUNTAIN STREET RESERVOIR DAM AND DIKES

a maximum height of 33 feet (see Plan of Dam and Sections in Appendix B and photographs in Appendix C). The top of the dam is 13 feet wide and varies from El 462.3 to 462.8. The top is unpaved and covered with grass. The upstream face is a 1.5:1 (horizontal: vertical) slope above the normal pool and a 2:1 slope below the pool. The 1.5:1 slope is covered with grass and the 2:1 slope is covered with riprap. The downstream face consists of an upper 1:1 slope, a bench on which an unpaved access road is located, and a lower 3:1 slope. The slopes are covered with grass and some vegetation. Available drawings indicate that the dam is a zoned embankment with a concrete cutoff wall. The drawings also show that the dam is founded on natural soil with a cutoff trench 10 feet below the base of the dam.

The spillway, located at the east end of the dam, is a 12-foot long, flat-crested concrete weir. A wooden stop log 1 foot high is mounted with steel brackets on the crest of the spillway. Sediment has accumulated on the crest of the spillway upstream of the stoplog to the top of the stoplog. The crest of the spillway is at El 458.0, and the top of the stoplog is at El 459.0.

The discharge channel below the spillway is 12 feet wide. The right side of the channel is a 2-foot high concrete wall for a distance of 65 feet downstream. The left side is a steep natural slope containing rock outcrops. The floor of the channel is lined with concrete and stone and slopes at 7 percent.

The gatehouse contains screens, a 20-inch water main and the low-level outlet. The water main is controlled by a sluice gate in the gatehouse. Water flows from the reservoir into the water supply system. The low-level outlet is a 24-inch diameter cast-iron pipe which is located in the gatehouse and extends through the embankment to the toe of the downstream slope. The invert of the outlet is shown on the drawings to be at El 430.0 at the upstream end. Flow into the outlet is controlled by a gate valve located in the gatehouse. The outlet pipe discharges at El 429.6, and the water flows downstream in Beaver Brook.

Two earth fill dikes that also impound the reservoir are located about 1,000 feet and 3,000 feet north of the east abutment of the dam. Dike No. 1 is 160 feet long and 16 feet high. Dike No. 2 is 180 feet long and 8 feet high. Both dikes are constructed with the top at El 462.0. The side slopes are 2:1 upstream and 1.5:1 downstream. The dikes were constructed to prevent flooding land not owned by the Water Department.

The slopes on the reservoir side are covered with riprap. The downstream slopes are covered with brush and trees. There is no information on the zoning or cutoff in these embankments. A 20-inch diameter pipe extends from the upstream toe of Dike No. 1, under the dike embankment, across the reservoir, and connects to the low-level outlet within the dam embankment. This pipe, which is always open, is used to drain surface water from the area behind Dike No. 1 and Dike No. 2 (See Drainage Area Map, Figure D-1 in Appendix D).

c. Size Classification. Mountain Street Reservoir Dam has a maximum height of 33 feet and a maximum storage capacity of 761 acre-feet. The dam is, therefore, placed in the "small" size category which corresponds to a height of 25 to 40 feet or a storage capacity of 50 to 1,000 acre-feet.

d. Hazard Classification. There are six residential structures located along the stream 1,500 to 8,000 feet downstream of the dam (see Flood Impact Area shown on the Locaton Map). The foundations of these structures are approximately 5 to 15 feet above the bottom of the stream. An assumed failure of the dam would result in a flood wave 16 feet high 1,200 feet downstream of the dam as compared to a channel flow of 3.5 feet deep prior to failure. It is possible that more than a few lives could be lost and an excessive amount of property damage could occur. Accordingly, the dam has been placed in the "high" hazard category.

e. Ownership. The dam is owned by the City of Northampton Water Department, 237 Prospect Street, Northampton, Massachusetts 01060. Mr. Robert Kozash (telephone 413-586-6950) granted permission to enter the property and inspect the dam.

f. Operator. The dam is operated by personnel from the City of Northampton Water Department.

g. Purpose of the Dam. The water in Mountain Street Reservoir is currently used as a primary water supply by the Town of Northampton.

h. Design and Construction. Construction of Mountain Street Reservoir Dam was completed in 1905. Drawings dated 1901 and prepared by the Northampton Water Works are available. The drawings show that the proposed construction of the dam was essentially as it appears today, except that the locations of the spillway and gatehouse were changed.

Previous inspection reports indicate that since construction, the dam has been in fair condition. The latest inspection report prepared in 1975 stated that the dam was in "safe condition", but major repairs were needed to correct seepage at the downstream toe and erosion on the downstream slope.

1. Normal Operating Procedures. Personnel from the Water Department reportedly visit the dam at least once a month. At that time, they check the screens and mow the grass. The stoplog has never been removed. The low-level outlet was last operated in 1940 when the reservoir was drained to repair the drain pipe at Dike 1.

1.3 Pertinent Data

a. Drainage Area. The drainage area is approximately 410 acres (0.64 square miles) and consists of hilly land with watershed elevations ranging from 795 to 459 (see Figure D-1 in Appendix). There are no ponds or swamps located within the drainage area during periods of low flow into the reservoir. A 20-inch pipe from Northampton Reservoir in West Whately discharges about 150 cfs into the brook which flows into Mountain Street Reservoir. In general, the undeveloped portions of the drainage area consist of 90 percent woodland and 10 percent open fields. Residential development was recently begun in the northern portion of the watershed.

b. Discharge. Discharge from Mountain Street Reservoir Dam flows over the stoplog on the spillway and into a discharge channel lined with concrete and stone. Flow from the channel discharges into Beaver Brook. Water from the low-level outlet discharges directly into Beaver Brook.

(1) Outlet: Size - 24-inch diameter. Invert El - 430.0. Discharge Capacity - 110 cfs with pool at El 458.

(2) Maximum known flood at damsite: unknown.

(3) Ungated spillway capacity at top of dam:
300 cfs at El 462.3 (without stoplog)
220 cfs at El 462.3 (with stoplog).

(4) Ungated spillway capacity at test flood elevation:
240 cfs at El 461.4 (without stoplog)
225 cfs at El 462.4 (with stoplog).

(5) Gated spillway capacity at normal pool elevation:
Not applicable (N/A).

(6) Gated spillway capacity at test flood elevation: N/A.

(7) Total spillway capacity at test flood elevation
240 cfs at El 461.4 (without stoplog)
225 cfs at El 462.4 (with stoplog).

(8) Total project discharge at top of dam elevation:
300 cfs at El 462.3 (without stoplog)
220 cfs at El 462.3 (with stoplog)

(9) Total project discharge at test flood elevation:
240 cfs at El 461.4 (without stoplog)
240 cfs at El 462.4 (with stoplog).

c. Elevation (feet above National Geodetic Vertical Datum of 1929 (NGVD)). A bench mark was established at El 459.0 at the top of the stop log. This elevation was based on the pool elevation shown on the United States Geological Survey (U.S.G.S.) topographic map.

(1) Streambed at toe of dam: 429.0

(2) Bottom of cutoff: 420 (deepest point)

(3) Maximum tailwater: 431.4 (water surface at outlet)

(4) Normal pool: 459.0 (with stoplog)

(5) Full flood control pool: N/A

(6) Spillway crest: 458.0 (without stoplog)

(7) Design surcharge (Original design): unknown

(8) Top of dam: 462.3 to 462.8

(9) Test flood surcharge: 462.4 with stoplog.

d. Reservoir (Length in feet)

(1) Normal pool: 4,000

(2) Flood control pool: N/A

(3) Spillway crest pool: 4,000

(4) Top of dam: 4,000

(5) Test flood pool: 4,000

e. Storage (acre-feet)

(1) Normal pool: 550

(2) Flood control pool: N/A

(3) Spillway crest pool: 486

(4) Top of dam: 761

(5) Test flood pool: 785

f. Reservoir Surface (acres)

(1) Normal pool: 64

(2) Flood control pool: N/A

(3) Spillway crest: 64

*(4) Test flood pool: 64

*(5) Top of Dam: 64

g. Dam

(1) Type: earth fill

(2) Length: 1,300 feet

(3) Height: 33 feet

(4) Top width: 13 feet

(5) Side slopes: Upstream - 1.5:1 (above pool)
2:1 (below pool)
Downstream - 1:1 (upper)
3:1 (lower)

(6) Zoning: unzoned

(7) Impervious core: concrete cutoff wall

(8) Cutoff: concrete cutoff trench 10 feet below dam
dikes unknown

(9) Grout curtain: none

*Based on the assumption that the surface area will not significantly increase with changes in pool elevation from 458.0 to 462.4.

(10) Other: two earthfill dikes, 160 and 180 feet long, and 16 and 8 feet high respectively, are located on the east side of the reservoir. The tops of the dikes are at El 462.0. The side slopes are 2:1 downstream and 1.5:1 upstream. No data is available on zoning or cutoffs.

h. Diversion and Regulation Tunnel N/A

i. Spillway

(1) Type: flat crested

(2) Length of weir: 12 feet

(3) Crest elevation: 459.0 with stoplog
458.0 without stoplog

(4) Gates: none

(5) Upstream channel: floor of sand and gravel

(6) Downstream channel: lined with concrete and stone.

j. Regulating Outlets

(1) Invert El: 430.0

(2) Size: 24-inch diameter

(3) Description: cast-iron pipe

(4) Control mechanism: gate valve

(5) Other: outlet 2-foot diameter for 10 feet, then 30-inch diameter to toe of dam.

SECTION 2

ENGINEERING DATA

2.1 General. The engineering data available for this Phase I inspection includes drawings of proposed construction dated 1901 prepared by the Northampton Water Works. The drawings are posted in the Northampton Water Department and at the gatehouse. There are no other drawings, specifications, or computations available from the Owner, State, or County agencies. A listing of previous inspection reports dated 1965 to 1973, prepared by Tighe and Bond Consulting Engineers of Holyoke, Massachusetts, and the Massachusetts Department of Public Works, is included in Appendix B. The most recent inspection was conducted in 1975 by the Massachusetts Department of Public Works. A copy of that report is also given in Appendix B.

We acknowledge the assistance and cooperation of personnel from the Massachusetts Department of Environmental Quality Engineering, Division of Waterways; the Massachusetts Department of Public Works; and the Hampshire County Engineers Office. In addition, we acknowledge the assistance of the personnel of Northampton Water Department who provided information on the history and operation of the dam.

2.2 Construction Records. There are no construction records or as-built drawings available for the dam or appurtenances.

2.3 Operating Records. No operating records are available, and there is no daily record kept of the elevation of the pool or rainfall at the dam site.

2.4 Evaluation

a. Availability. There is limited engineering data available for this dam.

b. Adequacy. The lack of detailed hydraulic, structural and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based on the visual inspection, past performance history, and engineering judgment.

c. Validity. Comparison of the available drawings with the field survey conducted during the Phase I inspection indicates that most of the available information is valid. However, the present locations of the spillway and the gatehouse are different than those proposed on the 1901 drawings.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The Phase I inspection of the dam at Mountain Street Reservoir was performed on August 21, 1980. A copy of the inspection checklist is included in Appendix A. Previous inspections were conducted from 1965 to 1969, and by the Massachusetts Department of Public Works in 1973 and 1975. Copies of those reports are given in Appendix B. Selected photographs taken during our visual inspection are included in Appendix C.

b. Dam. The dam is an earth fill structure with a spillway and a low-level outlet which is in the gatehouse. Evidence of seepage was noted at three locations on the downstream slope of the dam adjacent to and in the spillway discharge channel. The seepage is indicated by streams of clear water. The maximum flow at any one location was approximately 3 gpm (see Photograph No. 6). No boils were observed as indicated in a previous inspection report (see page B-8).

Severe erosion was noted on the upper downstream slope of the dam (see Photograph No. 5). There are also localized areas where the turf has slumped as the slope is relatively steep. Evidence of trespassing on the slope was also observed at the bend in the embankment.

Many pieces of riprap are dislodged from the upstream face of the embankment adjacent to the service bridge abutment (see Photograph No. 3). The erosion of soil in this area has undermined the bridge abutment (see Photograph No. 13). The riprap on the remainder of the upstream face of the embankment appears to be intact.

A thick growth of brush is covering the lower downstream slope of the dam. There are also several trees from 0.5 to 1.5 feet in diameter growing on the lower downstream slope adjacent to the spillway and discharge channel (see Photographs No. 7 and 8). Several small animal burrows were also observed on the upper downstream slope on the west half of the dam.

c. Appurtenant Structures. The spillway is a flat-crested weir with one stoplog held in place by brackets attached to the training walls. At the time of the

inspection, water was not discharging over the spillway. The concrete and stone masonry on the crest of the spillway was covered with soil up to the top of the stoplog. The concrete of the training walls is spalled and eroded at and below the normal pool level. A 1-inch wide horizontal crack extends completely across the right training wall (see Photograph No. 7). The timber vehicular bridge over the spillway was in fair condition. There is access to the stoplog from both spillway training walls which would permit removal of the boards during periods of high flow. At the present time the stoplog could not be removed because of the sediment in the spillway channel. The crest of the spillway contained some rubbish and wood debris.

As shown in Photograph No. 1, the gatehouse is in poor condition, with heavy spalling, some stains and cracks in the concrete. The gatehouse service bridge is in very poor condition; major cracks exist in the pier and abutment (see Photographs No. 11, 12 and 13). Severe spalling and cracking was observed in the concrete bridge deck. Exposed reinforcing steel was also observed.

The gate valve on the outlet is assumed to be inoperable. Reportedly, it has not been opened since about 1940.

The visible portion of the cast-iron outlet conduit is shown in Photograph No. 10. The discharge end of the outlet is clear of debris, and a moderate amount of flow was discharging at the time of inspection (see Photograph No. 10). This may be either leakage through the gate valve or discharge from the drain that extends from Dike 1.

The dikes are in fair condition. A swampy area extends from the downstream toe of Dike No. 1 to Dike No. 2 and is a result of runoff collecting on the upstream side of the dikes. The riprap on the upstream slopes of both dikes is in good condition. The drain at Dike No. 1 was clear of debris; however, at both dikes the downstream slopes were covered with brush and trees (18 inches average diameter). There was no observable sloughing of the slopes.

d. Reservoir Area. The reservoir area is not well developed. Most of the land is wooded with gently rolling slopes. Residential development was recently started in the northern portion of the drainage area. However, there is little potential that significant development will occur in the reservoir area.

e. Downstream Channel. The spillway discharges into a separate channel that joins the main channel about 100 feet below the dam. The concrete and stone masonry wall on the right side of the channel is in fair condition (see Photograph No. 8). There are several thin vertical cracks and some growth of vegetation on the wall. The left side is densely overgrown with brush and trees. Rock has sloughed off the outcrops and into the channel. The floor of the channel is lined with mortared stone with the lower portion of the channel in bedrock. There is a slight accumulation of soil, brush, and pieces of bedrock in the floor of the channel. Vegetation and trees are overhanging the sides of the channel (see Photograph No. 8).

The main channel below the dam is a broad swamp. There is no lined channel for the outlet, and the downstream gradient is nearly flat. There is a thick growth of brush around and downstream of the outlet.

About 2,500 feet downstream of the dam, a road embankment across the channel restricts the flow from the dam. Water flows under a vehicular bridge.

3.2 Evaluation. The visual inspection indicates that the dam is in fair condition. The stated deficiencies which must be corrected to assure the continued performance of this dam and measures to improve these conditions are outlined in Section 7.

SECTION 4

OPERATING AND MAINTENANCE PROCEDURES

4.1 Operating Procedures

a. General. There are no regular operating procedures for this dam. Personnel from the Water Department reportedly visit the dam once a month to check the screens and mow the grass.

b. Warning System. There is no warning system in effect at this dam.

4.2 Maintenance Procedures

a. General. The dam is not adequately maintained. The Northampton Water Department is responsible for maintenance of the facility. Periodic inspections have been conducted in the past. Typical maintenance procedures have included backfilling eroded areas on the dam, clearing debris from the spillway, and mowing the grass.

b. Operating Facilities. The only maintenance of the operating facilities at the dam consists of cleaning screens in the gatehouse. The operating condition of the outlet works is not checked periodically.

4.3 Evaluation. The program for maintaining the embankment and appurtenant structures is inadequate, and there is no program of regular technical inspections. There are also no plans for surveillance of the embankment during and after periods of heavy rainfall, or for warning people in downstream areas in the event of an emergency at the dam. This is undesirable, considering that the dam is in the high hazard category. These programs should be implemented, as recommended in Section 7.3.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General. Mountain Street Reservoir Dam has a drainage area of 0.64 square miles. There are no ponds or swamps located within the drainage area (see Figure D-1, Drainage Area Map). The land is hilly and undeveloped. There is a 20-inch pipe from the Northampton Reservoir in West Whately which discharges about 150 cfs into the brook which flows into Mountain Street Reservoir.

Mountain Street Reservoir has a surface area of approximately 64 acres, and a maximum storage capacity of 761 acre-feet at El 462.3.

The low-level outlet can discharge a flow of 110 cfs when the reservoir is at El 458, which is the crest of the spillway. At this reservoir elevation and with no additional inflow, the outlet can lower the reservoir by 1 foot in about 7.1 hours.

The crest of each dike is at El 462.0. To prevent flooding of private property upstream of the dikes, water in the swamp upstream (east) of the dikes discharges into a 20-inch drain at the upstream (east) toe of Dike No. 1. The 20-inch drain extends under the reservoir, through the dam embankment and discharges downstream of the dam.

5.2 Design Data. There are no hydraulic computations available for the design of the spillway at Mountain Street Reservoir Dam.

5.3 Experience Data. There is no record of overtopping of the dam, which was constructed in 1905. No records of past discharge are available.

5.4 Test Flood Analysis. Mountain Street Reservoir Dam has been classified in the "small" size and "high" hazard categories. According to the Corps of Engineers' guidelines, a test flood ranging from one-half the PMF (Probable Maximum Flood) to the full PMF should be used to evaluate the capacity of the spillway. The one-half PMF rate was selected because of the small size of the reservoir.

The PMF rate for the Mountain Street Reservoir watershed was calculated to be 2,300 cfs per square mile of drainage area. This calculation is based on the average slope of 2.35 percent in the drainage area, and the U.S. Army Corps of

Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December 1977). For this analysis, the peak flow rate was determined to be slightly below the guide curve for rolling topography. The peak test flood inflow does not include the discharge from the 20-inch diameter piping from Northampton Reservoir as this pipeline would only be used during a low flow condition or low reservoir levels.

Applying one-half the PMF rate to the 0.64 square mile drainage area results in a peak test flood inflow of 736 cfs. By adjusting the test flood inflow for surcharge storage, the peak test flood outflow was calculated to be 240 cfs (375 cfs per square mile) with the stoplog on the spillway. Assuming no flow over the dikes the pond level would rise to El 462.4. Without the stoplog, the test flood outflow would be 240 cfs and the pond level would rise to El 461.4.

Hydraulic analyses indicate that with the stoplog in place, the spillway can discharge 220 cfs or 92 percent of the test flood outflow with the pond at El 462.3, which is the low point on the top of the dam. Without the stoplog, the spillway could discharge 300 cfs, or 125 percent of the outflow, and the dam would not be overtopped.

Table 5-1 below summarizes the discharge from the pond during the test flood.

TABLE 5-1.

	Stoplog in place	Stoplog Removed
Maximum height of water above dam, ft:	0.1	0
Discharge over spillway, cfs:	225	240
Discharge over dam, cfs:	15	0
Depth of critical flow, ft:	0.06	-
Velocity at critical flow, fps:	1.4	-

5.5 Dam Failure Analysis. The peak discharge rate due to failure of the dam was calculated to be 28,740 cfs with the pond at El 462.3. This calculation is based on a maximum head of 7.1 feet and an assumed 120-foot wide breach occurring in the embankment west of the spillway. Failure of the dam would produce a downstream flood wave 16 feet deep as compared to a channel flow 3.5 feet deep prior to failure.

There are six homes located along the stream 1,500 to 8,000 feet downstream of the dam. The foundations of these structures are approximately 5 to 15 feet above the bottom of the stream. An assumed failure of the dam could result in a flood wave that would rise above the foundation level of these houses resulting in the possible loss of more than a few lives and an excessive amount of property damage. Accordingly, the dam has been placed in the "high" hazard category.

SECTION 6

STRUCTURAL STABILITY

6.1 Visual Observations. The evaluation of the structural stability of Mountain Street Reservoir Dam is based on a review of previous inspection reports, a review of available drawings, and the visual inspection conducted on August 21, 1980.

As discussed in Section 3, Visual Inspection, the dam is in fair condition. Seepage was observed adjacent to the spillway discharge channel at the downstream toe of the embankment. No boils were observed as indicated in a previous inspection (see Page B-8). Areas of erosion were observed on the upstream and downstream slopes of the dam. A thick growth of trees and vegetation exists on the lower downstream slope of the dam within and adjacent to the spillway discharge channel. The gatehouse service bridge is in very poor condition with major structural cracks in the pier and abutment.

6.2 Design and Construction Data. Construction of Mountain Street Reservoir Dam was completed in 1905. Computations for design of the dam, spillway and outlet are not available.

Drawings dated 1901 prepared by Northampton Water Works show the proposed construction of the dam . The drawings show that the dam is a zoned earth fill embankment founded on natural soil. An impervious cutoff wall made of concrete is located in the center of the embankment. A cutoff trench extends 10 feet below the base of the dam. The side slopes of the embankment are 1.5:1 and 2:1 upstream and 1:1 and 3:1 downstream.

Specifications for construction of the dam are not available.

There is no information on the shear strength or permeability of the soil and/or rock materials of the embankment.

6.3 Post Construction Changes. Since the original construction of the dam, repairs to the drain from Dike No. 1 were made about 1940. The drawings of the proposed construction, dated 1901, show the gatehouse and spillway at different locations from where they were constructed. There are no as-built drawings for the dam.

6.4 Seismic Stability. The dam is located in Seismic Zone No. 2, and in accordance with Corps of Engineers' guidelines does not warrant further seismic analysis at this time.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. As a result of the visual inspection, the review of available data, and limited information on operation and maintenance, the dam is considered to be in fair condition. The following deficiencies must be corrected to assure the continued performance of this dam: seepage along downstream toe of the embankment adjacent to the spillway discharge channel; erosion and animal burrows on the downstream slope of the dam; riprap missing from the upstream slope adjacent the gatehouse service bridge; a dense growth of brush and some trees on the lower downstream slope; spalled concrete on the gatehouse service bridge; cracked concrete on the right training wall of the spillway; and an accumulation of debris on the crest of spillway and in the discharge channel. The downstream slopes of both dikes are covered with brush and large trees.

The gate valve on the low-level outlet has not been used since about 1940 and is assumed to be inoperable.

The peak test flood (one-half PMF) outflow with the stoplog on the spillway is estimated to be 240 cfs with the pond at El 462.4. The test flood would overtop the low point on the dam by 0.1 feet. Hydraulic analyses indicate that the spillway with the stoplog can discharge 220 cfs or 92 percent of the test flood outflow before the dam is overtopped. Without the stoplog, the test flood outflow is 240 cfs with the pond at El 461.4. Without the stoplog, the spillway can discharge 300 cfs or 125 percent of the test flood outflow.

b. Adequacy. The lack of detailed design and construction data did not allow for a definitive review. Therefore, the evaluation of this dam is based on a review of the available data, the visual inspection, past performance and engineering judgment.

c. Urgency. The recommendations and remedial measures outlined below should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

7.2 Recommendations. It is recommended that the Owner employ a qualified registered engineer to:

a. Evaluate the stability of the dam and spillway. This should include an investigation of the seepage noted at the toe of the embankment as well as the boils observed by personnel from State of Massachusetts Department of Public Works during the 1975 inspection (see page B-8). The investigation should be conducted after the embankment is cleared of brush.

b. Develop procedures for clearing brush and trees from the dam and dikes, and for backfilling the embankment.

c. Design repairs for the service bridge, pier and abutment.

The Owner should implement the recommendations of the Engineer.

7.3 Remedial Measures

a. Operating and Maintenance Procedures. It is recommended that the Owner accomplish the following:

(1) Repair the gate valve on the outlet and restore it to working condition. Exercise the valve at least twice a year.

(2) To prevent continued erosion, backfill and seed eroded areas and fill animal burrows on the downstream slope of the dam.

(3) Replace missing riprap on the upstream face of the embankment near the gatehouse service bridge.

(4) Clear trees, brush and roots from the dam and dike embankments, and to a distance of 25 feet from the toe of the dam. All stumps and roots removed should be backfilled with select materials in accordance with the recommendations of the Engineer.

(5) Repair all spalled and deteriorated concrete on the gatehouse and the crack in the right training wall of the spillway.

(6) Remove accumulated soil, brush, vegetation, debris and loose stone from the crest and discharge channel of the spillway. The stoplog should also be removed.

(7) Institute a definite plan for surveillance of the dam, dikes and spillway during and after periods of heavy rainfall and a plan to warn people in downstream areas in the event of an emergency at the dam.

(8) Implement a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam, dikes and appurtenances and be supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in compliance with all applicable State regulations. The maintenance program should include removal of any debris caught on the spillway weir to prevent clogging of the spillway.

(9) Institute a program of technical inspections of this dam and dikes on an annual basis.

7.4 Alternatives. There are no practical alternatives to the above recommendations.

APPENDIX A

PERIODIC INSPECTION CHECKLIST

MOUNTAIN STREET RESERVOIR DAM AND DIKES

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT MOUNTAIN STREET RESERVOIR DAM

DATE August 21, 1980

TIME 0800

WEATHER Cloudy

W.S. ELEV. 458.1* U.S. 431.4 D.S.

*Based on U.S.G.S. water level

ABBREVIATIONS:

U.S. = Upstream
D.S. = Downstream
N.A. = Not applicable

PARTY:

1.	Lyle Branagan	Metcalf & Eddy - Hydraulics
2.	William Checci	Metcalf & Eddy - Geotechnical
3.	Francis Gordon	Metcalf & Eddy - Geotechnical
4.	Ed Greco	Metcalf & Eddy - Geotechnical
5.	A. Scott Nagel	Metcalf & Eddy - Geotechnical
6.	Marie Nowak	Metcalf & Eddy - Hydraulics
7.	John Risitano	Metcalf & Eddy - Geotechnical
8.		
9.		
10.		

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Dam	Risitano/Greco	
2.	Spillway	Risitano/Branagan	
3.	Outlet	Risitano/Nowak	
4.	Gatehouse	Risitano/Greco	
5.			

PERIODIC INSPECTION CHECK LIST

PROJECT MOUNTAIN STREET RESERVOIR DAM DATE August 21, 1980

PROJECT FEATURE Embankment NAME John Risitano

DISCIPLINE Geotechnical NAME A. Scott Nagel

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	461.2 to 462.8
Current Pool Elevation	458.1
Maximum Impoundment to Date	Unknown
Surface Cracks	None visible; grass covered
Pavement Condition	Unpaved
Movement or Settlement of Crest	None visible
Lateral Movement	None visible
Vertical Alignment	Flat
Horizontal Alignment	Dogleg west of gatehouse
Condition at Abutment and at Concrete Structures	Left abutment spillway ties into hillside; Right abutment ties into natural ground
Indications of Movement of Structural Items on Slopes	None visible Except stairs are cracked Grass - hummocky D/S slope
Trespassing on Slopes	Driving cars on downstream embankment at dogleg. Animal burrows-brush on D/S slope
Sloughing or Erosion of Slopes or Abutments	D.S. dirt bike trail at road entrance U.S. adjacent bridge riprap failure and washout
Rock Slope Protection - Riprap Failures	Adjacent service bridge failure apparently caused by washout
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	Seepage area at toe of D.S. embankment wes of spillway discharge channel; swamp area D.S. of gatehouse and embankment
Piping or Boils	None visible Moist D/S slope-ferns and moss s. end slight surface slumping
Foundation Drainage Features	None visible
Toe Drains	None visible
Instrumentation System	None visible

PERIODIC INSPECTION CHECK LIST

PROJECT MOUNTAIN STREET RESERVOIR DAM DATE August 21, 1980

PROJECT FEATURE Spillway NAME John Risitano

DISCIPLINE Hydraulics/Geotechnical NAME Lyle Branagan

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Partly submerged
General Condition	Fair
Loose Rock Overhanging Channel	None visible
Trees Overhanging Channel	None visible
Floor of Approach Channel	Accumulation of silt, sand & gravel 10" deep
b. Weir and Training Walls	Riprap slope left side concrete wall on right
General Condition of Concrete	Poor with heavy spalling 1" crack 3' long thru right side wall
Rust or Staining	Stained
Spalling	Heavy at and below water line
Any Visible Reinforcing	None visible
Any Seepage or Efflorescence	None visible
Drain Holes	None visible
c. Discharge Channel	Right side concrete wall; floor riprap Left side hillside, riprap and portion concrete.
General Condition	Fair to poor overgrown with brush Vertical crack 3/8"wide & 3' high in right side wall 22' D/S of weir.
Loose Rock Overhanging Channel	Outcrops on left side-fragments fallen into channel - also outcrops on right side and floor
Trees Overhanging Channel	Several larger than 12" diameter 16" diameter and many small trees
Floor of Channel	Riprap lined and in fair condition accumulation of soil,esp.on left side
Other Obstructions	Brush and boulders

Note: Timber vehicular bridge over spillway; spillway has provisions for flashboards; 1 flashboard in place 12-inches high. Debris, logs, boulders in discharge channel; sediment deposited U/S of flashboard.

PERIODIC INSPECTION CHECK LIST

PROJECT MOUNTAIN STREET RESERVOIR DAM DATE August 21, 1980

PROJECT FEATURE Outlet Pipe NAME John Risitano

DISCIPLINE Hydraulics/Geotechnical NAME Marie Nowak

AREA EVALUATED	CONDITION
LOW-LEVEL OUTLET	Pipe in gatehouse
a. Approach Channel	Submerged
Slope Conditions	Submerged
Bottom Conditions	Submerged
Rock Slides or Falls	Submerged
Log Boom	Submerged
Debris	Submerged
Condition of Concrete Lining	Submerged
Drains or Weep Holes	Submerged
b. Intake Structure	Submerged
Condition of Concrete	Submerged
Stop Logs and Slots	None

PERIODIC INSPECTION CHECK LIST

PROJECT MOUNTAIN STREET RESERVOIR DAM DATE August 21, 1980

PROJECT FEATURE Outlet NAME John Risitano

DISCIPLINE Hydraulics/Geotechnical NAME Marie Nowak

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT General Condition of Concrete	Piping inside gatehouse and embankment submerged; not visible
Rust or Staining on Concrete	Submerged; not visible
Spalling	Submerged; not visible
Erosion or Cavitation	Submerged; not visible
Cracking	Submerged; not visible
Alignment of Monoliths	Submerged; not visible
Alignment of Joints	Submerged; not visible
Numbering of Monoliths	Submerged; not visible

PERIODIC INSPECTION CHECK LIST

PROJECT MOUNTAIN STREET RESERVOIR DAM DATE August 21, 1980

PROJECT FEATURE Outlet NAME John Risitano

DISCIPLINE Geotechnical/Hydraulics NAME Lyle Branagan

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Pipe from gatehouse to d.s. slope
General Condition of Concrete	N.A.
Rust or Staining	None visible
Spalling	None visible
Erosion or Cavitation	None visible
Visible Reinforcing	None visible
Any Seepage or Efflorescence	None visible
Condition at Joints	None visible
Drain Holes	None visible
Channel	Choked with brush and trees
Loose Rock or Trees Overhanging Channel	Several trees
Condition of Discharge Channel	Poor

PERIODIC INSPECTION CHECK LIST

PROJECT MOUNTAIN STREET RESERVOIR DAM DATE August 21, 1980

PROJECT FEATURE Gatehouse NAME John Risitano

DISCIPLINE Geotechnical NAME A. Scott Nagel

AREA EVALUATED	CONDITION
GATEHOUSE	
a. Concrete and Structural	
General Condition	Poor
Condition of Joints	Fair with minor erosion
Spalling	Along water line & heavy at corners
Visible Reinforcing	None visible
Rusting or Staining of Concrete	Some staining at bridge seat
Any Seepage or Efflorescence	None visible
Joint Alignment	Good
Unusual Seepage or Leaks in Gate	None visible
Cracks	Minor
Rusting or Corrosion of Steel	N.A.
b. Mechanical and Electrical	
Air Vents	None other than windows
Float Wells	None
Crane Hoist	None
Elevator	None
Hydraulic System	None
Service Gates	Submerged
Emergency Gates	Submerged
Lightning Protection System	None
Emergency Power System	None
Wiring and Lighting System in Gate Chamber	None

PERIODIC INSPECTION CHECK LIST

PROJECT MOUNTAIN STREET RESERVOIR DAM — DATE August 21, 1980

PROJECT FEATURE Gatehouse Service Bridge — NAME John Risitano

DISCIPLINE Geotechnical — NAME A. Scott Nagel

AREA EVALUATED	CONDITION
GATEHOUSE - SERVICE BRIDGE	
a. Super Structure	pedestrian service bridge of beam and deck design
Bearings	Bears on concrete, pile supported piers
Anchor Bolts	None visible
Bridge Seat	Rests on gatehouse poor cond. with heavy cracking and spalling
Longitudinal Members	15" cast beam fair condition heavy efflorescence
Under Side of Deck	Fair condition with wood forms still in place
Secondary Bracing	None visible
Deck	Very poor, heavy cracking spalling, stains and visible reinforcing
Drainage System	None visible
Railings	Steel with minor rusting
Expansion Joints	None visible
Paint	On railing deteriorating
b. Abutment and Piers	Pile supported piers; middle pier has major horizontal crack
General Condition of Concrete	Poor; spalling, undermining and steel exposed
Alignment of Abutment	good
Approach to Bridge	From top of dam stairs on D.S. slope
Condition of Seat and Backwall	Undermined; some steel exposed

Note: Washout 10' west of bridge; 4'x10' area; failure of riprap.

PERIODIC INSPECTION CHECK LIST

PROJECT MOUNTAIN STREET RESERVOIR DAM DATE August 21, 1980

PROJECT FEATURE Dikes NAME John Risitano

DISCIPLINE Geotechnical NAME A. Scott Nagel

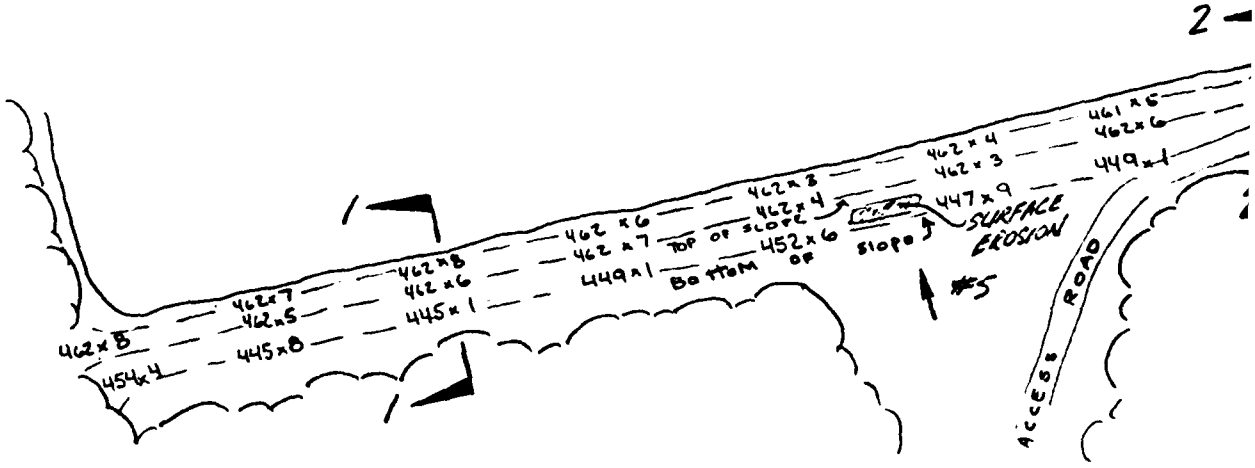
AREA EVALUATED	CONDITION
DIKE EMBANKMENT Crest Elevation	Dike #1 El. 462.0 Dike #2 El. 462.0
Current Pool Elevation	458.1
Maximum Impoundment to Date	Unknown
Surface Cracks	None visible
Pavement Condition	Grass on crest trees on d.s. slope largest 18-inches in diameter
Movement or Settlement of Crest	None visible
Lateral Movement	None visible
Vertical Alignment	Flat
Horizontal Alignment	Straight
Condition at Abutment and at Concrete Structures	Natural ground on both sides rock outcrops
Indications of Movement of Structural Items on Slopes	None visible
Trespassing on Slopes	None visible
Sloughing or Erosion of Slopes or Abutments	None visible
Rock Slope Protection - Riprap Failures	Good condition
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	Swampy area D.S. drained thru dike #1 w/20" pipe
Piping or Boils	None visible
Foundation Drainage Features	None visible
Toe Drains	None visible
Instrumentation System	None visible

APPENDIX B

PLANS OF DAM AND PREVIOUS
INSPECTION REPORTS

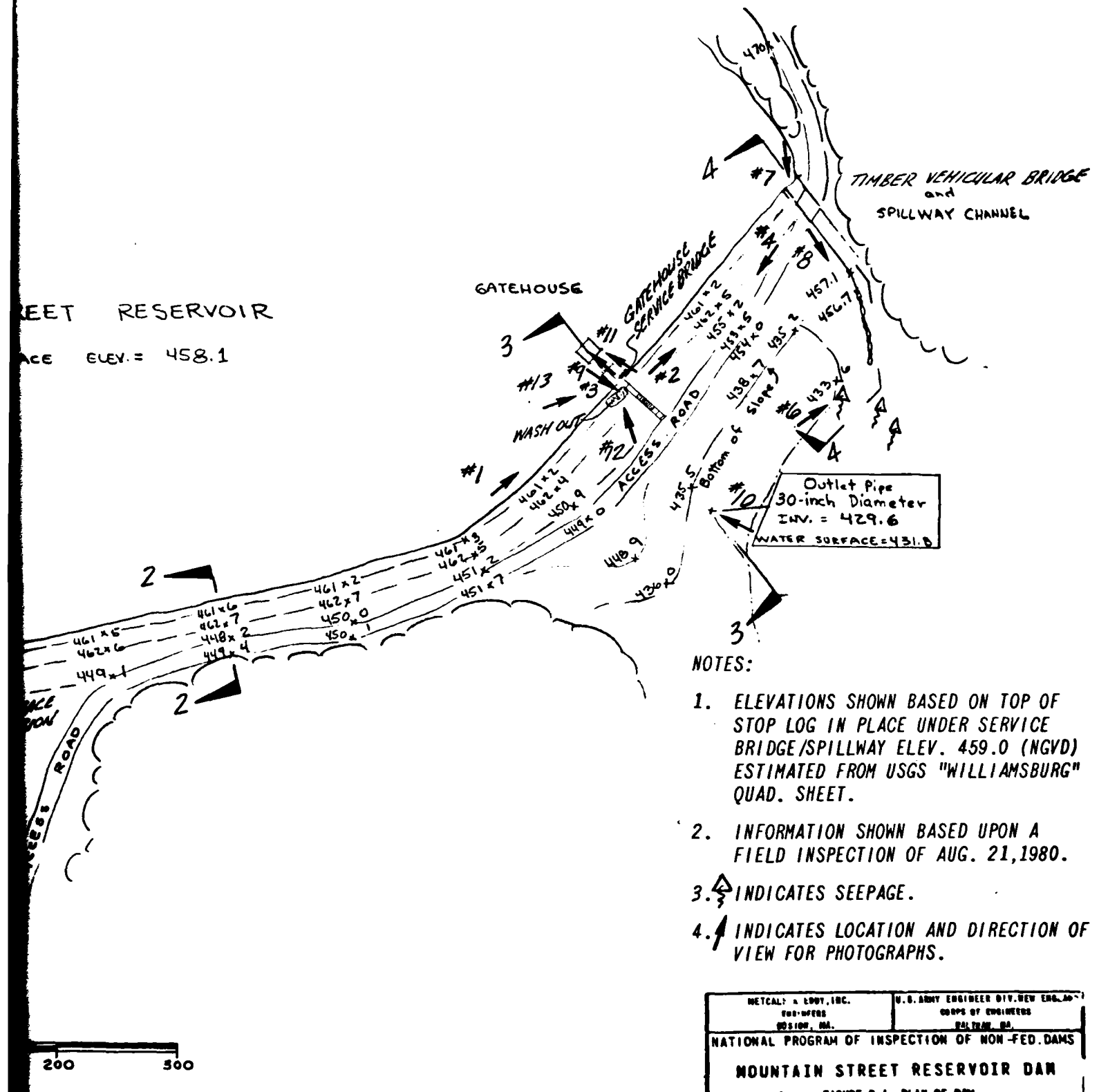
MOUNTAIN STREET RESE

WATER SURFACE ELEV. = 45



SCALE
IN FEET

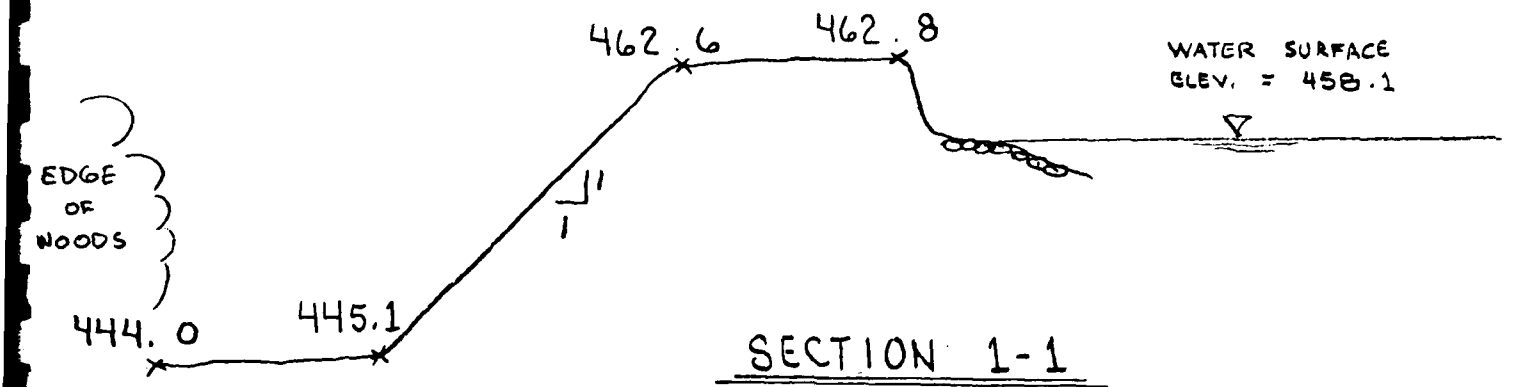
0 100 200



NOTES:

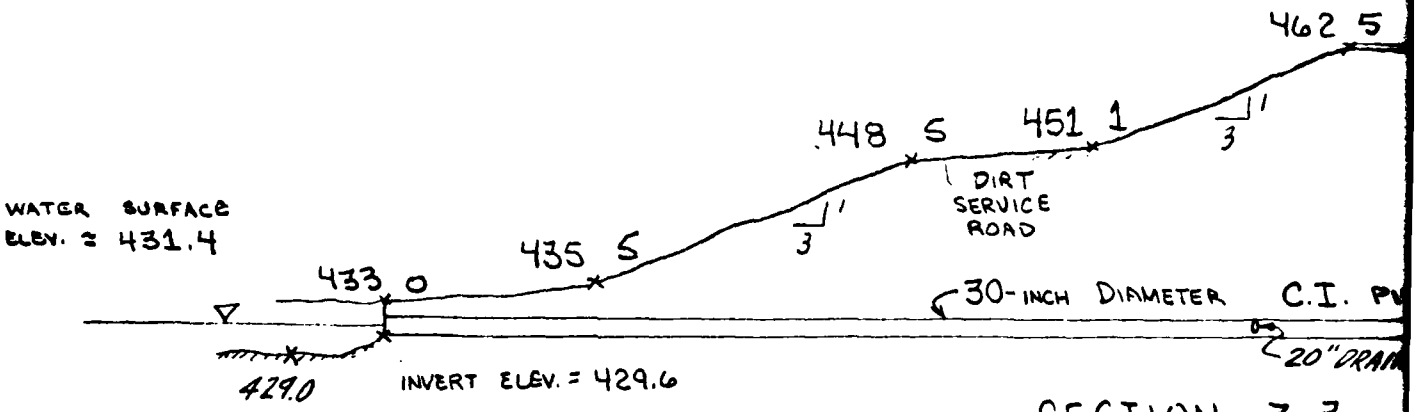
1. ELEVATIONS SHOWN BASED ON TOP OF STOP LOG IN PLACE UNDER SERVICE BRIDGE/SPILLWAY ELEV. 459.0 (NGVD) ESTIMATED FROM USGS "WILLIAMSBURG" QUAD. SHEET.
2. INFORMATION SHOWN BASED UPON A FIELD INSPECTION OF AUG. 21, 1980.
3. INDICATES SEEPAGE.
4. INDICATES LOCATION AND DIRECTION OF VIEW FOR PHOTOGRAPHS.

METCALF & EDDY, INC. ENGINEERS BOSTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENG. CORPS OF ENGINEERS WALTHAM, MA.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
MOUNTAIN STREET RESERVOIR DAM	
FIGURE B-1 PLAN OF DAM	
TRIBUTARY CONNECTICUT RIVER	MASSACHUSETTS
SCALE: AS SHOWN	DATE: SEPTEMBER, 1980



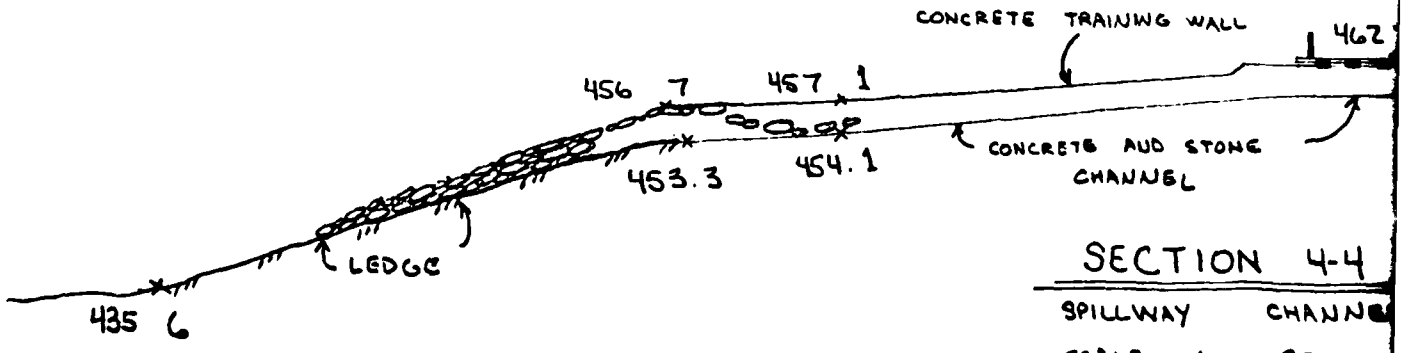
SECTION 1-1

DAM EMBANKMENT
SCALE 1 IN = 10 FT



SECTION 3-3

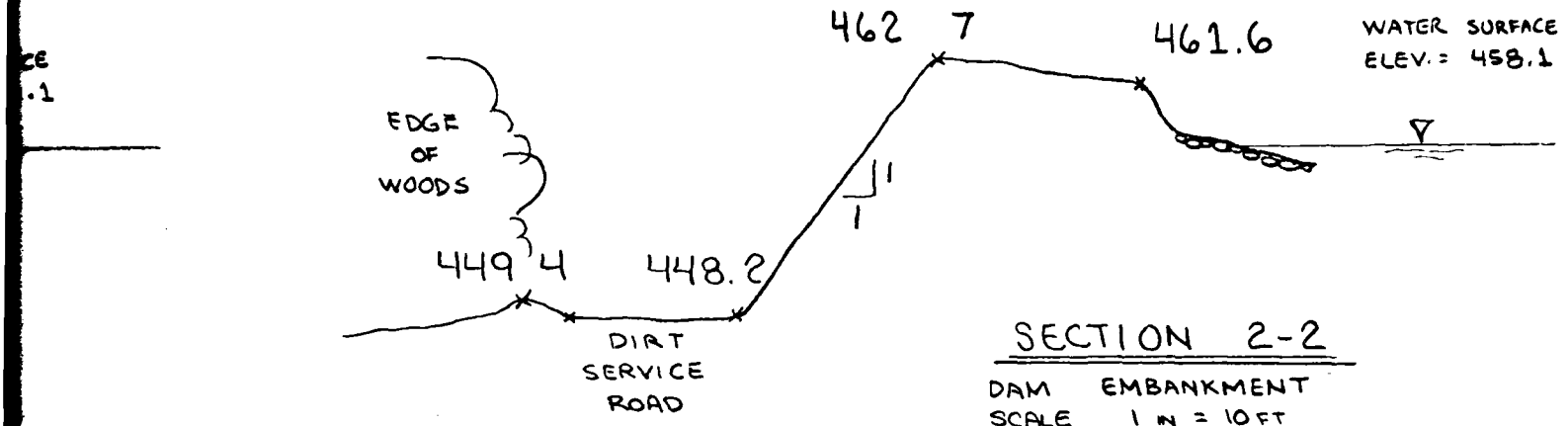
LOW LEVEL OUTLET
SCALE 1 IN = 20 FT.



SECTION 4-4

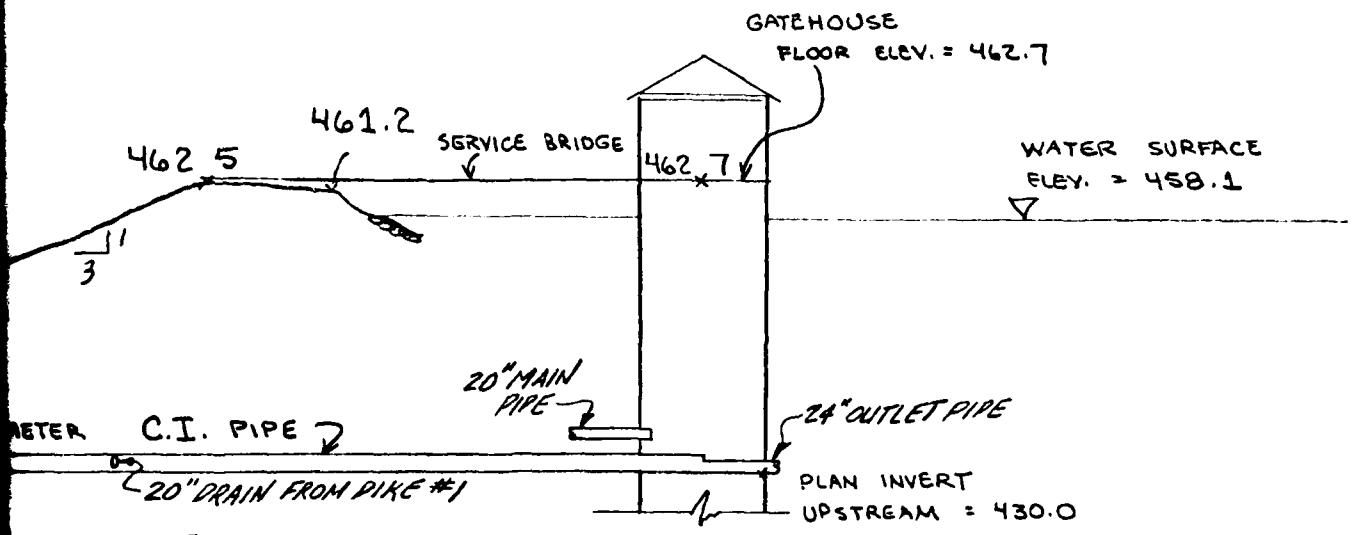
SPILLWAY CHANNE
SCALE 1 IN = 20 FT

(1)



SECTION 2-2

DAM EMBANKMENT
SCALE 1 IN = 10 FT



ON 3-3

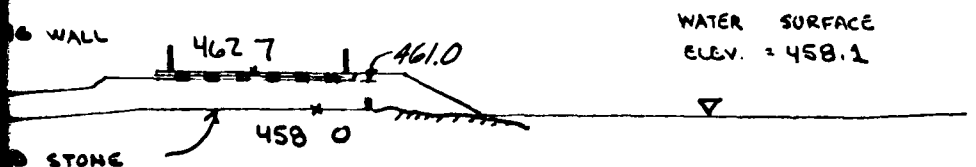
VEL OUTLET

1 IN = 20 FT.

SECTION SCALE

IN FEET

0	10	20	30
0	20	40	60



TOP OF STOPLOG = 459.0
TOP OF BRIDGE = 462.7
BOTTOM OF BRIDGE BEAM = 461.0

TION 4-4

AY CHANNEL

1 IN = 20 FT

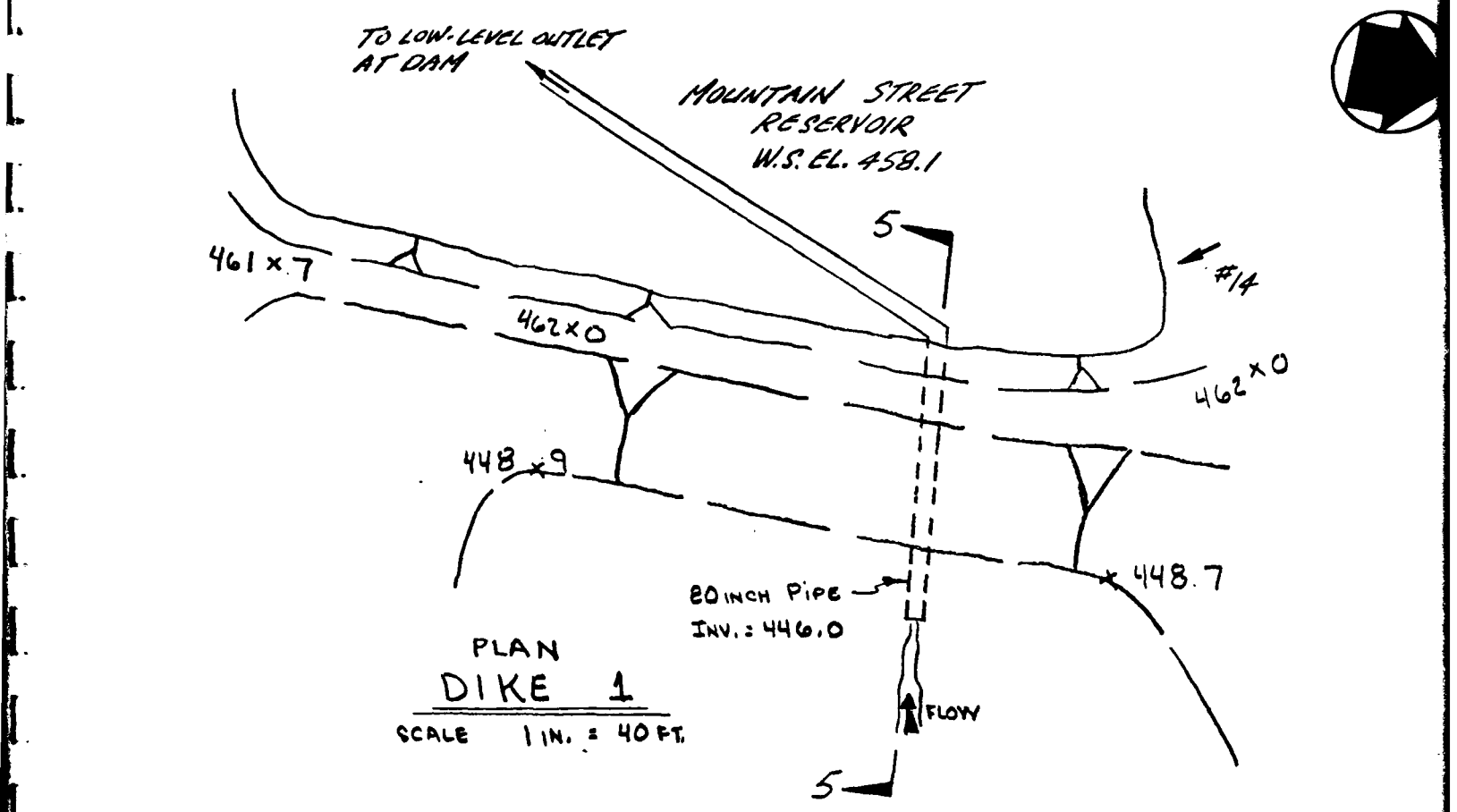
METCALF & EDDY, INC. ENGINEERS BOSTON, MA.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS BOSTON, MA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MOUNTAIN STREET RESERVOIR DAM

FIGURE B-2 SECTIONS THROUGH DAM

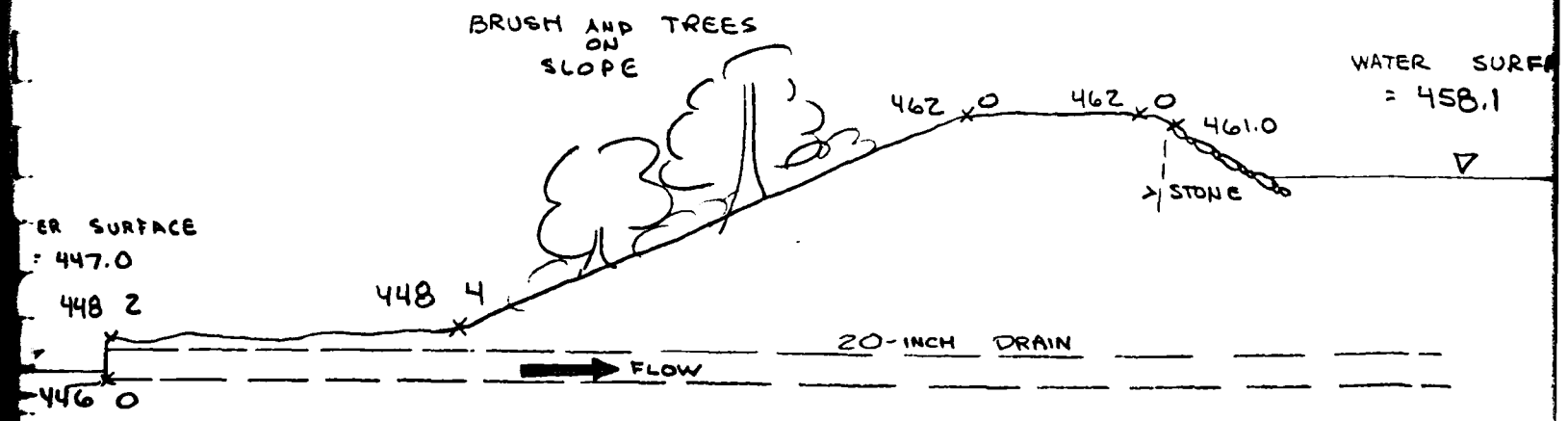
TRIBUTARY CONNECTICUT RIVER	MASSACHUSETTS
SCALE: AS SHOWN	DATE: SEPTEMBER, 1980



PLAN

DIKE 1

SCALE 1 IN. = 40 FT.



SECTION 5-5

DIKE 1

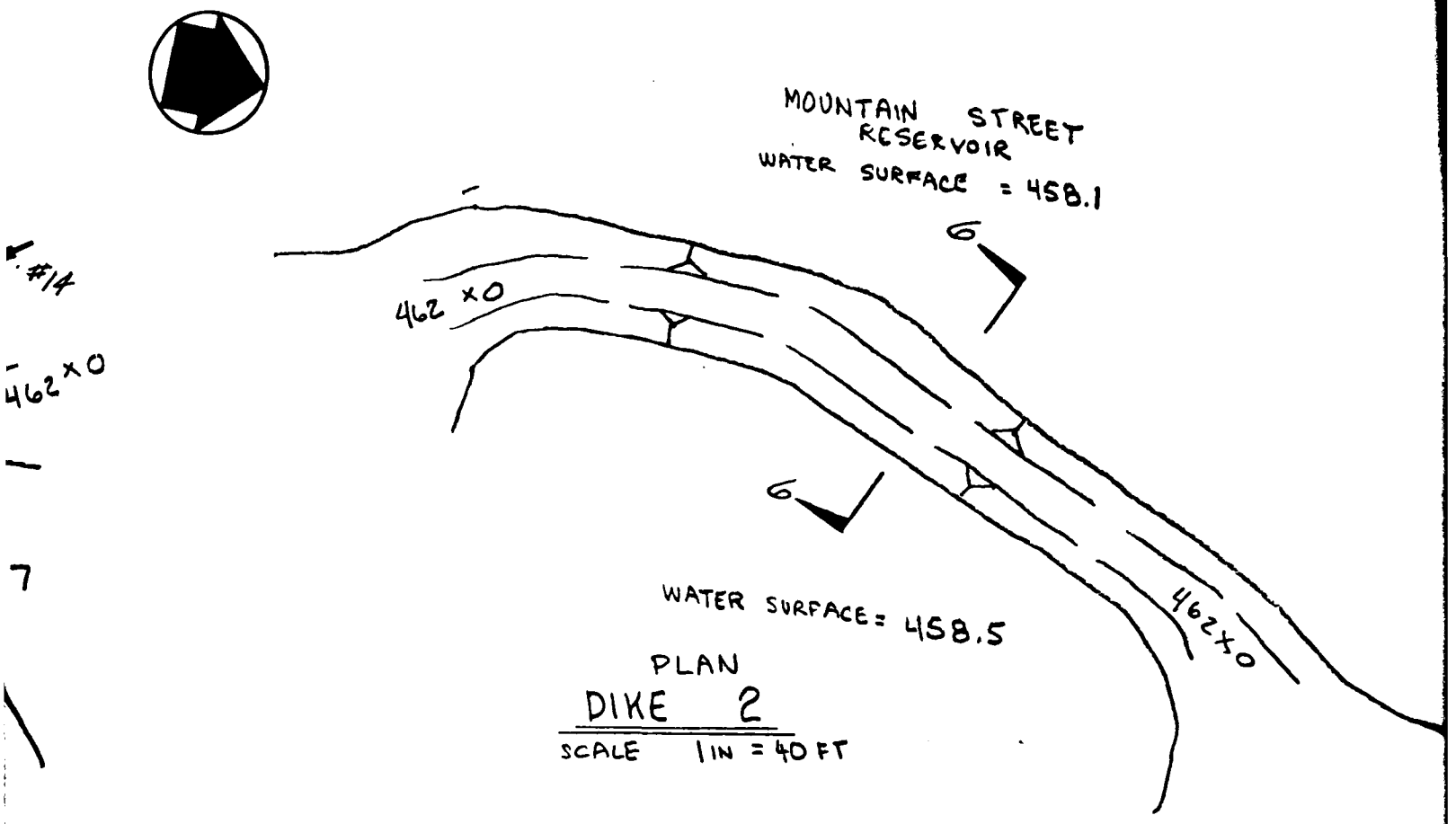
SCALE 1 IN = 10 FT

SCALES IN FEET

0 10 20

0 40 80

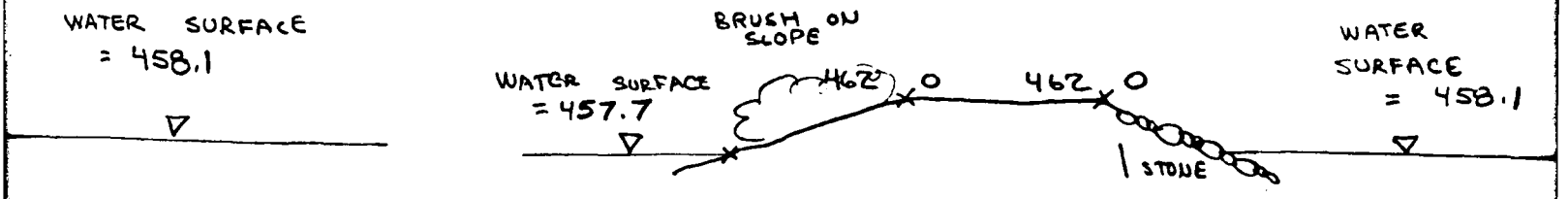
(1)



PLAN

DIKE 2

SCALE 1 IN = 40 FT



SECTION 6-6

DIKE 2

SCALE 1 IN = 10 FT

NOTE: #2 INDICATES LOCATION AND DIRECTION OF VIEW FOR PHOTOGRAPHS.

SCALES IN FEET

10 20 30

40 80 120

METCALF & EDDY, INC. ENGINEERS BOSTON, MA.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
MOUNTAIN STREET RESERVOIR DAM	
FIGURE B-8 PLANS AND SECTIONS OF DIKES	
TRIBUTARY CONNECTICUT RIVER	MASSACHUSETTS
SCALE: AS SHOWN	DATE: SEPTEMBER, 1980

SUMMARY OF PREVIOUS INSPECTIONS
AT MOUNTAIN STREET RESERVOIR
NOT INCLUDED IN THIS REPORT

DATE	INSPECTION BY	CONDITIONS AND REMARKS
August 6, 1973	Mass. DPW	Safe; Wet Area @ Toe
July, 1969	Tighe & Bond*	Safe; burrow holes; Remove stop logs until after Fall rains
August, 1967	Tighe & Bond	Safe; some burrow holes
July 21, 1965	Tighe & Bond	Safe; remove vegetation in spillway

*Tighe & Bond--Consulting Engineers, Holyoke, Massachusetts for the Hampshire County, Board of Commissioners.

INSPECTION REPORT - DAMS AND RESERVOIRS

1. LOCATION:

City/Town Williamsburg. County Hampshire. Dam No. 2-8-340-6.

Name of Dam Mountain Street Reservoir.

Topo Sheet No. 11 A. Coordinates: Mass. Rect. N 512,500, E 283,500.

Inspected by: Harold T. Shumway, On Oct. 9-10, 1975. Date Last Inspection 8-6-73.

---

2. OWNER/S: As of October 9, 1975

per: Assessors ____, Reg. of Deeds ____, Prev. Insp. X, Per. Contact X.

City of Northampton

1. B.P.W., Water Division, 237 Prospect St., Northampton, Mass.

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

2. _____

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.

Mr. Leon Murray

Supt. of Water Division, 237 Prospect St., Northampton, Mass.

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

---

4. DATA:

No. of Pictures Taken none. Sketches See description of Dam.

Plans, Where Plans for 1901 construction at Co. Comm.'s office

Plans for later alteration not located.

---

5. DEGREE OF HAZARD: (if dam should fail completely)*

1. Minor ____.
2. Moderate X.
3. Severe ____.
4. Disastrous ____.

Comments: Approx. impoundment is 211 million gallons - area downstream is relative undeveloped.

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

(6.) OUTLETS: OUTLET CONTROLS AND DRAWDOWN

No. 1 Location and Type: side chute spillway channel easterly end of embankment - 12'W.x 3'-2"H.

Controls yes, TYPE: stoplogs - 1' high in place on inspection day.

Automatic ____. Manual X. Operative Yes X, No ____.

Comments: Chute sidewalls are conc. - floor is grouted stone paved - wood bridge over top of chute channel.

No. 2 Location and Type: 200' ± from east end dam - 30" dia. C.I. waste pipe.

Controls yes, Type: sluice gate - located in wet well gate house.

Automatic ____. Manual X. Operative Yes X, No ____.

Comments: controls in gate house - operable per N.W.D. Supt.

No. 3 Location and Type: Intake for 20" dia. C.I. water main to Gate House wet well - Northampton water system.

Controls yes, Type: sluice gate

Automatic ____. Manual X. Operative Yes X, No ____.

Comments: Controls in Gate House - operable per word of N.W.D. Supt.

Drawdown present Yes X, No ____. Operative Yes X, No ____.
Comments: see item No. 2 above.

(7.) DAM UPSTREAM FACE: Slope Top 4' of turf is 1 1/2:1 2:1 below W.L. Depth Water at Dam 29 1/2' at gate house

Material: Turf X. Brush & Trees ____. Rock fill X. Masonry ____. Wood ____.

Other ____.

Condition: 1. Good X. 3. Major Repairs ____.

2. Minor Repairs ____. 4. Urgent Repairs ____.

Comments: Well turfed - good grade and alignment and appears stable.

(8.) DAM DOWNSTREAM FACE: Slope 1 1/2:1.

Material: Turf X. Brush & Trees ____. Rock Fill ____. Masonry ____. Wood ____.

Other ____.

Condition: 1. Good ____. 3. Major Repairs X.

2. Minor Repairs ____. 4. Urgent Repairs ____.

Comments: some erosion - considerable seepage on extreme lower slope - also small boils in swampy area - see sketches for location.

(9.) EMERGENCY SPILLWAY: Available No. Needed No.

Height Above Normal Water_____Ft.

Width_____Ft. Height_____Ft. Material_____

Condition: 1. Good_____. 3. Major Repairs_____.

2. Minor Repairs_____. 4. Urgent Repairs_____.

Comments: Major part of inflow is from water main from Northampton Reservoir Dam No. 2-6-337-2 in Whately.

(10.) WATER LEVEL AT TIME OF INSPECTION: 3 1/2 Ft. Above_____. Below X_____.

Top Dam X F.L. Principal Spillway_____.

Other_____.

Normal Freeboard 4 Ft.

(11.) SUMMARY OF DEFICIENCIES NOTED:

Growth (Trees and Brush) on Embankment none found

Animal Burrows and Washouts none found

Damage to Slopes or Top of Dam yes - see sketch and remarks. erosion - disturbed turf - and severe seepage

Cracked or Damaged Masonry minor spalling on cat walk and gate house.

Evidence of Seepage yes - see sketch for location - severe in some areas.

Evidence of Piping yes - small boils noted at toe of lower slope below roadway - deposit of fines noted around one of boils - very wet area.

Leaks none found

Erosion yes - on downstream slope - see remarks.

Trash and/or Debris Impeding Flow none found

Clogged or Blocked Spillway none found

Other_____.

(12.) OVERALL CONDITION:

1. Safe_____.
2. Minor repairs needed_____.
3. Conditionally safe - major repairs needed__X__.
4. Unsafe_____.
5. Reservoir impoundment no longer exists (explain)

   Recommend removal from inspection list_____.

(13.) REMARKS AND RECOMMENDATIONS: (Fully Explain)

The earthen embankment on upper level of this dam has a good alignment and grade and top and slopes are mowed regularly. No burrows or washouts were found anywhere along this embankment. Approx. 150' westerly from junction of toe of slope on upper level with edge of Reservoir Road there is a 3'± diameter area - see sketch - where turf is missing and bare soi is soft. This area is located halfway up slope from toe to top. Approx. 25' westerly of this area this is a section of embankment slope 12' ± in width extending from toe of slope to top of dam that is becoming eroded from wear of unauthorized motor bike traffic - see sketch. 50' ± west of junction of toe of slope and Reservoir Road - see sketch - is an area 75'± long by 30' wide at toe of slope that is soft and wet indicating some seepage. This area was noted on last inspection and does not appear to be a problem at present time.

A chain link gate and fencing has been erected on cat walk to prevent public access to gate house. Some minor spalling of concrete was noted on cat walk and gate house well structure. The chute spillway structure appeared sound and channel was clear of any debris. One 12" hig stop log was in place at intake end of chute.

The slope and ground at toe of slope southerly of Reservoir Road - see sketches - is very v and swampy. There is standing water in much of the area and upon attempting to walk along tc of slope one would sink into ground 5" or 6". A short distance westerly of outlet end of draw down pipe is an area where boils were noted. One boil of 3" to 4" in diameter - see sketch ha built up a 6 inch high deposit of fines around boil. The flow of water from this is small but constant and fines were noted in the flow at time of inspection. A stick was easily inserted in this boil to a depth of one foot at which point it seemed to hit something solid such as a rock.

Three other boils were noted in area but these were smaller and did not have any fines buil up around them. The water table is extremely high in this area and the outlet end of draw dov pipe is under 6" ± of water. The ground saturation extends upward on slope for two feet, ±, above elevation of toe. Vegetation on this portion of slope and on ground at toe of slope is of t marsh type grasses and ferns.

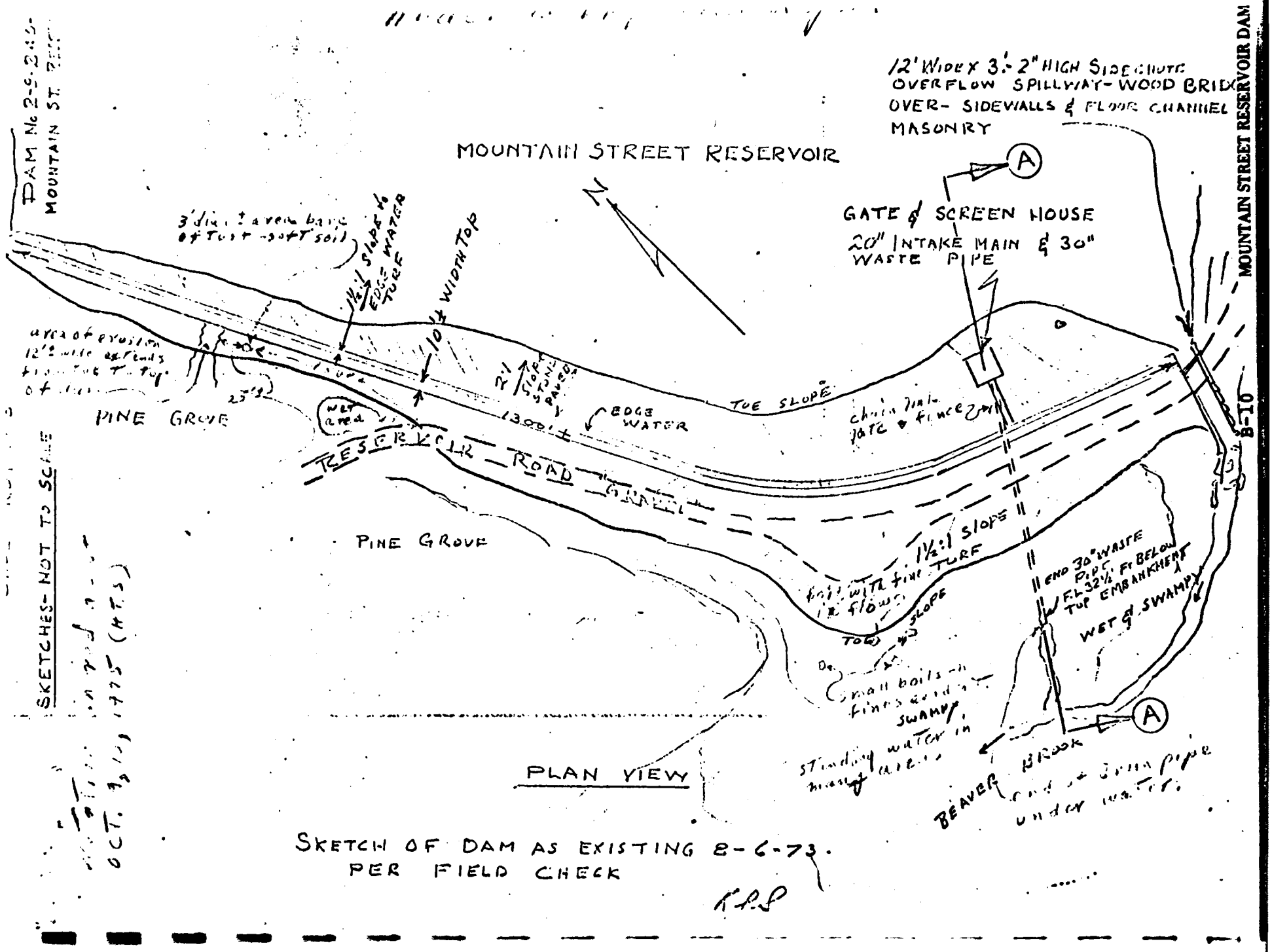
On October 10, 1975 Mr. Leon Murray, Supt. of Northampton Water Division, and his assistant met with Mr. Shumway at the dam site and together they went over the problems listed in this report. Mr. Murray stated that a partial reason for high water table level in ar was a beaver dam downstream which has caused a backup on brook. He also stated that he wa attempting to have beaver removed and beaver pond drained. Mr. Murray felt that this actior

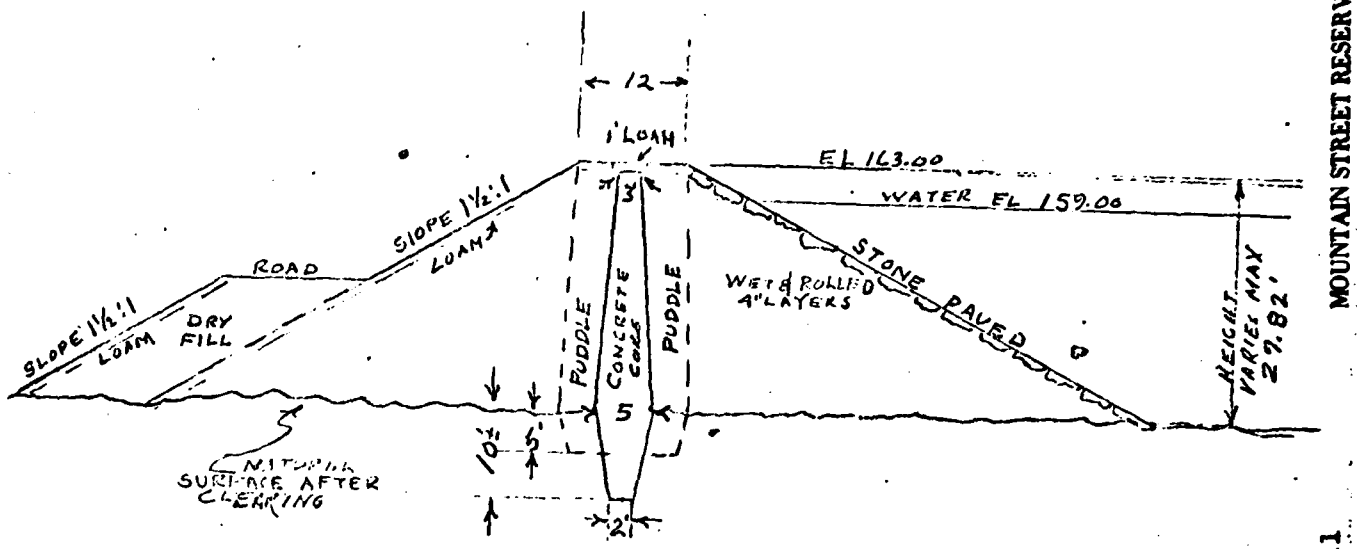
would dry out land in area of toe of dam embankment to a great extent.

Mr. Murray also said the water division would attempt to correct the erosion area on upper slope and reseed the area where turf is missing.

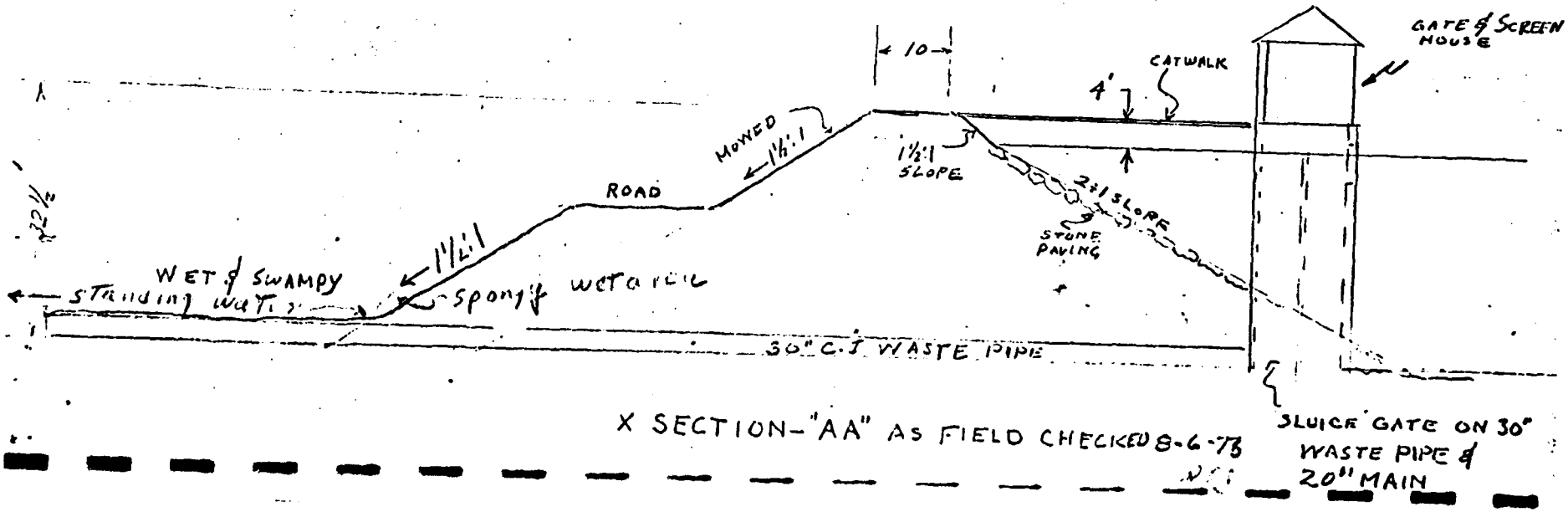
Due to the heavy water saturation of ground in area of draw down pipe and other areas shown on sketch and the existence of boils at toe of slope the District rates this dam as conditionally safe, major repairs needed. Mr. Leon Murray, Supt. of Northampton Water Division, has stated he will contact our District office as soon as he has accomplished draining excess surface water from swampy area and has determined cause of boils noted on inspection.

HTS/bk


DAM No 2-6-2-1-5-
MOUNTAIN ST. RESV.
MOUNTAIN STREET RESERVOIR
12' WIDE x 3'-2" HIGH SIDE CHUTE OVERFLOW SPILLWAY - WOOD BRIDGE OVER - SIDEWALLS & FLOOR CHANNEL MASONRY
GATE & SCREEN HOUSE
20" INTAKE MAIN & 30" WASTE PIPE
MOUNTAIN STREET RESERVOIR DAM
8-10
3' dia. ± tree base of Tuft - soft soil
1½:1 SLOPE to EDGE WATER
WIDTH TOP
10'
2:1 SLOPE to STONE PAVED
EDGE WATER
TOE SLOPE
chain link fence
PINE GROVE
WET area
RESERVOIR ROAD GRAVEL
1300'±
PINE GROVE
1½:1 slopes
turf with fine turf
END 30" WASTE P.I.P.C. FL 32½' Ft BELOW TOP EMBANKMENT
WET & SWAMPY
TOE SLOPE
Small boils in fines and in SWAMP
standing water in marsh area
BEAVER BROOK
end of 30" pipe under water
SKETCHES - NOT TO SCALE
PLAN VIEW
SKETCH OF DAM AS EXISTING 8-6-73.
PER FIELD CHECK
K.P.P



TYPICAL CROSS SECTION PER 1901 PROPOSAL ON FILE AT COUNTY COMMISSIONERS OFFICE - DIMENSIONS SCALED



X SECTION - "AA" AS FIELD CHECKED 8-6-73

January 6, 1976

Honorable Sean M. Dunphy
Mayor of Northampton
City Hall
Northampton, Mass. 01060

RE: Inspection - Dam #2-8-340-6
Williamsburg
Mountain Street Reservoir Dam

Dear Mayor Dunphy:

On October 9-10, 1975, an engineer from the Massachusetts Department of Public Works made a visual inspection of the above dam. Our records indicate that this dam is owned by the City of Northampton and that the Water Division has the maintenance responsibility. Will you please notify this office if this information is not current.

The inspection was made in accordance with the provisions of Chapter 253 of the Massachusetts General Laws, as amended (Dams-Safety Act). Chapter 706 of the Acts of 1975 transferred the jurisdiction of the so-called "Dams-Safety Program" to the Commissioner of the Department of Environmental Quality Engineering.

The results of the inspection indicate that repairs are needed. Superintendent Murray was present at the October 10, 1975 meeting and was made aware of the following:

1. Approximately 150 ft. westerly from the junction of the toe of slope on the upper level with the edge of Reservoir Road there is an area where the turf cover is missing and the exposed soil is soft. Motor traffic in this area has eroded the embankment. These areas as per Superintendent Murray would be tended.

2. The slope and ground at the toe of slope southerly of Reservoir is very wet. There is standing water and spongy areas. Westerly of the outlet end of the drawdown pipe is an area where boils were noted and fines have been deposited by as much as 6 inches. Mr. Murray indicated beaver activity downstream has caused a backwater condition which would account for the wet areas; however, the boils should be investigated promptly and then followed by the necessary corrective action.

We call these conditions to your attention so that you will take the necessary action before they become serious and more expensive to correct. If we may be of assistance, contact us. With any correspondence, please include the number of the dam as indicated above.

Very truly yours,

DAVID STANDLEY
Commissioner

LRA:jmp
cc: Leon Murray, Supt.
F. J. Hoey
R. Sallis

APPENDIX C

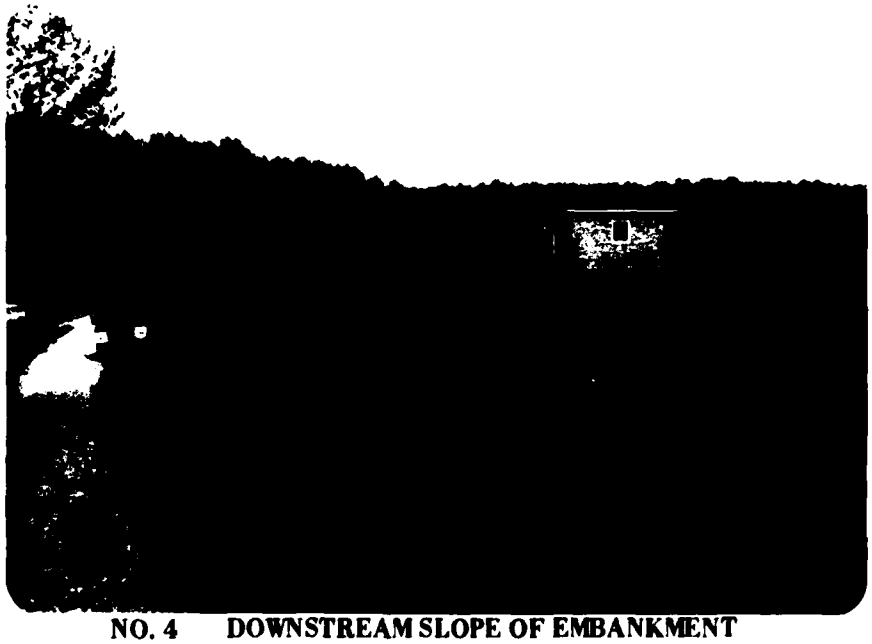
PHOTOGRAPHS

Note: Location and Direction of Photographs are shown on Figures B-1 and B-3 in Appendix B.

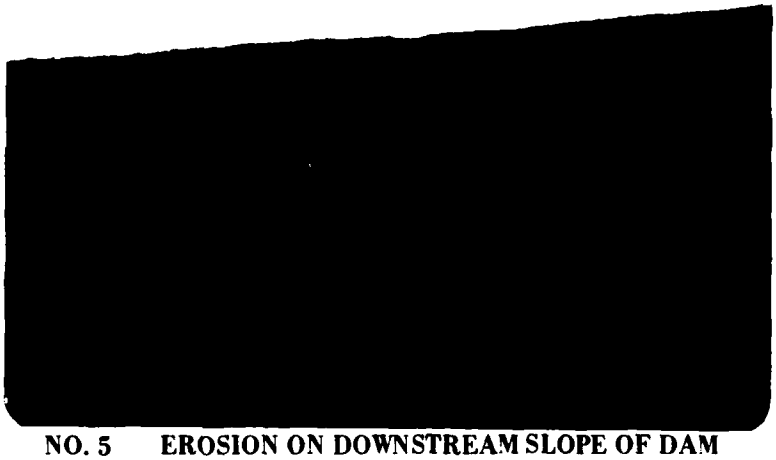
NO. 1 GATEHOUSE

NO. 2 UPSTREAM SLOPE OF THE EMBANKMENT

NO. 3 VIEW OF RIPRAP FAILURE AND EROSION ON UPSTREAM SLOPE ADJACENT TO SERVICE BRIDGE



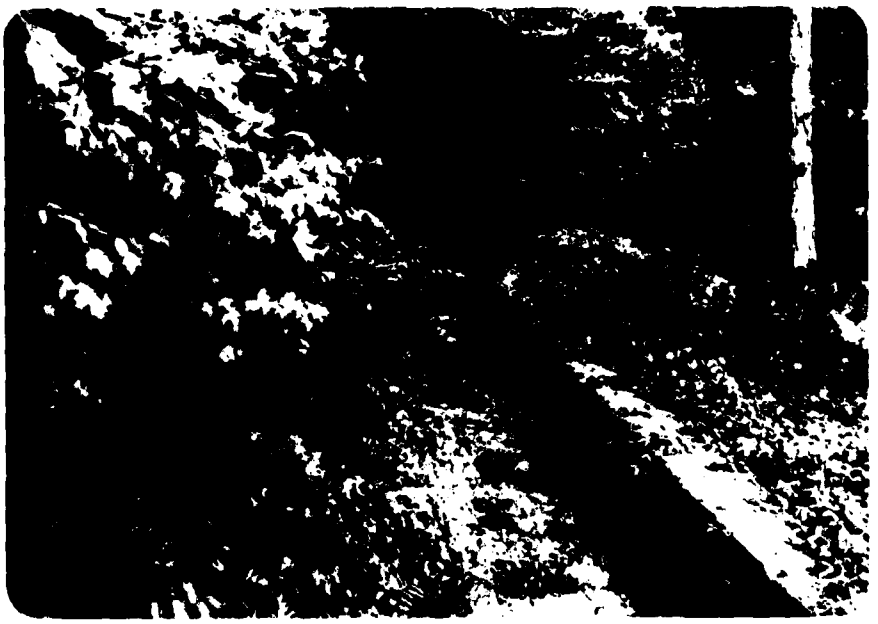
NO. 4 DOWNSTREAM SLOPE OF EMBANKMENT



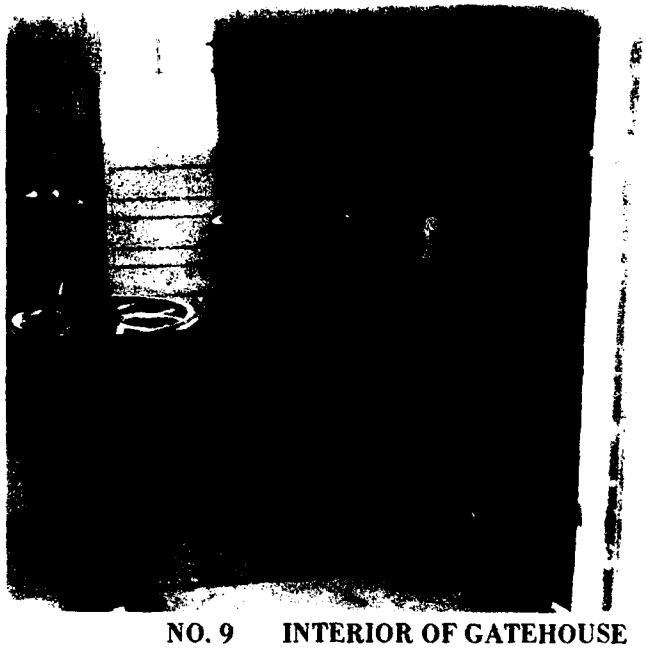
NO. 5 EROSION ON DOWNSTREAM SLOPE OF DAM

NO. 6 SEEPAGE IN DOWNSTREAM SLOPE ADJACENT SPILLWAY CHANNEL

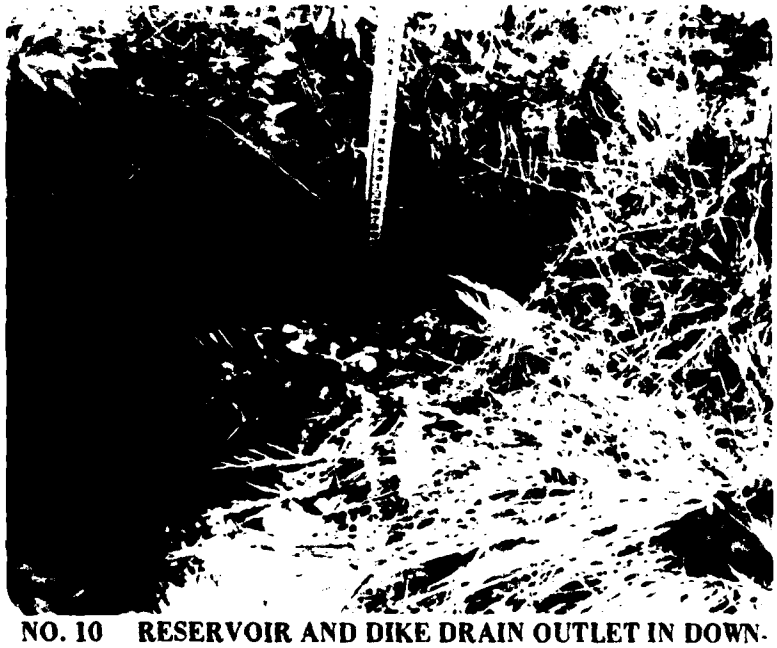
NO. 7 SPILLWAY (NOTE CRACK IN TRAINING WALL)



NO. 8 SPILLWAY DISCHARGE CHANNEL

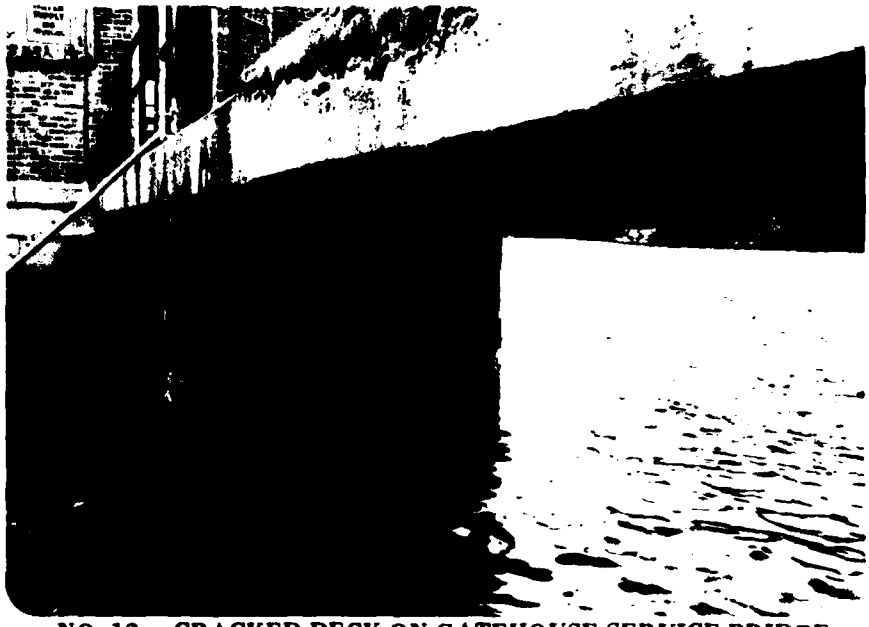


NO. 9 INTERIOR OF GATEHOUSE



NO. 10 RESERVOIR AND DIKE DRAIN OUTLET IN DOWNSTREAM SLOPE OF EMBANKMENT

NO. 11 CRACKED DECK ON GATEHOUSE SERVICE BRIDGE



NO. 12 CRACKED DECK ON GATEHOUSE SERVICE BRIDGE TO GATEHOUSE

NO. 13 UNDERMINED SERVICE BRIDGE ABUTMENT

NO. 14 DIKE 1

APPENDIX D

HYDROLOGIC AND HYDRAULIC
COMPUTATIONS

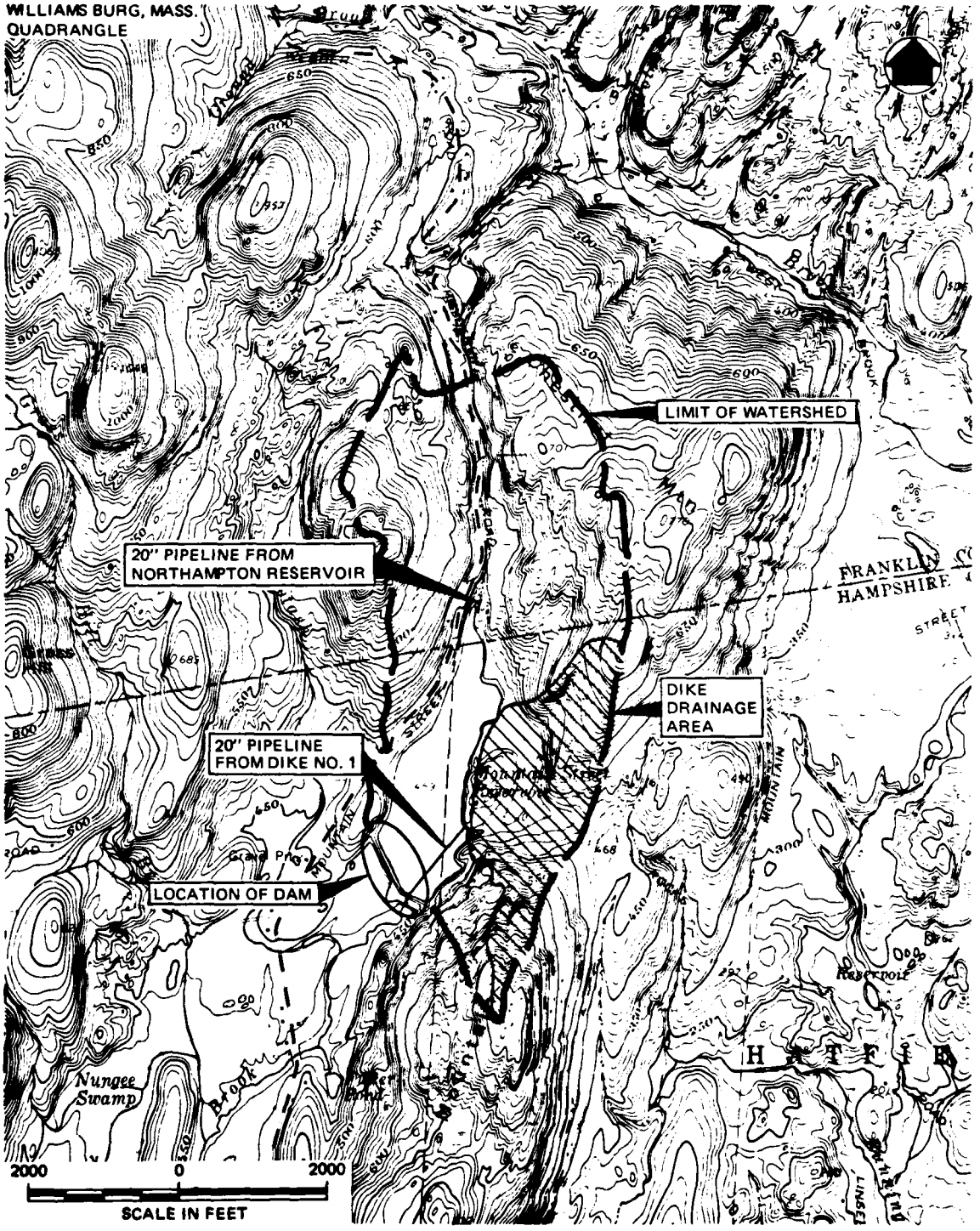


FIG. D-1 DRAINAGE AREA MAP

Project NATIONAL REVIEW OF NON-FED DAMS Acct No J6920 Page 1 of 11
Subject MT. STREET RESERVOIR Compld By MANowak Date 9-4-80
Detail HAMPSHIRE Co., MA Ck'd By LEB RF Date 10/6/82

I. TEST FLOOD, STORAGE & STORAGE FUNCTION

A. THE TOTAL DRAINAGE AREA IS 0.64 SQ MI

B. AREA OF PONDS - NONE
SWAMPS - NONE

∴ % OF PONDS & SWAMPS IS ZERO

C. AVERAGE SLOPE OF WATERSHED

$$\frac{\Delta \text{ ELEVATION}}{\text{DISTANCE}} = \frac{61 \text{ FT}}{2600 \text{ FT}} \times 100 = 2.35\%$$

D. USING THE USCOE CURVES FOR PEAK FLOW RATES ALONG WITH THE ABOVE INFORMATION, THE PEAK FLOW RATE WAS ESTABLISHED SOMEWHAT BELOW ROLLING. THE VALUE USED FOR HYDRAULIC CALCULATIONS WAS 2300 CFS/SQ MI

SIZE CLASS: SMALL
HAZARD POTENTIAL: HIGH

THIS CORRESPONDS TO A ½ PMF TEST FLOOD

E. TEST FLOOD INFLOW = $\frac{1}{2}(2300)(.64) = 736$ CFS

F. POND STORAGE: THE POND AREA IS 64 ACRES (0.10 SQ. MI) AT ELEVATION 459. BASED ON A CONSTANT AREA, STORAGE INCREASES AT 64 AC-FT PER FOOT OF DEPTH INCREASE.

G. THE MAIN SPILLWAY CREST IS AT ELEVATION 459

H. THE STORAGE FUNCTION IS BASED ON $Q_{OUT} = Q_{IN}[1 - S_{OUT}/R]$

S_{OUT} = STORAGE VOLUME IN RESERVOIR RELATED TO FINAL Q_{OUT} IN TERMS OF INCHES OF RAIN OVER THE DRAINAGE AREA

$S(\text{inches}) = 12D\,(0.10/0.64) = 1.875\,D$; R = 6HR RAIN OF STORM

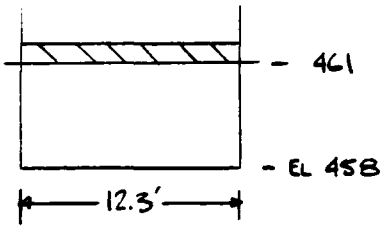
D = STORAGE DEPTH IN FT ABOVE SPILLWAY CREST IN RESERVOIR

STORAGE FUNCTION (½ PMF)

$F(\frac{1}{2}\ PMF) = 736 - 77.5 = 736 - 145.3\ D$

II DISCHARGE RATINGS

A. SPILLWAY WITHOUT STOPLOG



① CHANNEL FLOW CONTROL

$Q_1 = \frac{1.49}{n} A R^{2/3} S^{1/2}$ where $n = .035$

& $S = \frac{458 - 453.3}{69} = .0681$

$Q_1 = \frac{1.49}{.035} (12.3\,y) \left\{\frac{12.3\,y}{12.3 + 2y}\right\}^{2/3} (.0681)^{1/2}$

$Q_1 = 136.7\,y \left\{\frac{12.3\,y}{12.3 + 2y}\right\}^{2/3}$

② CRITICAL DEPTH CONTROL AT CREST

$Q_2 = A\,V_c$

$= 12.3\,(\frac{2}{3})\,y \sqrt{\frac{2}{3} y g}$

$= 38.0\,y^{1.5}$

RES ELEV	Y	Q_1	Q_2 (cfs)
458.0	0	0	0
458.5	.5	40	10
459.0	1.0	120	40
459.5	1.5	230	70
460.0	2.0	360	110
460.5	2.5	500	150
461.0	3.0	650	200

- Q_2, flow at critical depth, controls.

③ ORIFICE CONTROL, above elevation 461.0

h = RES. EL − 459.5

$Q_3 = 0.6\ A\ \sqrt{2gh}$ where $A = (12.3)(3)$

$Q_3 = 177.7\ \sqrt{h}$

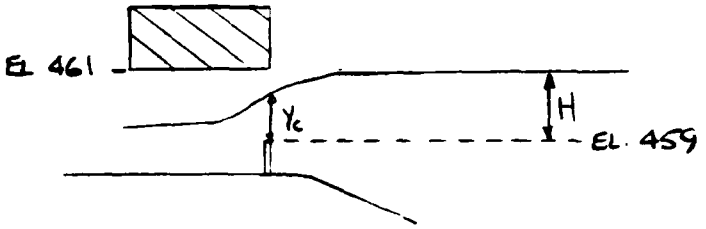
RES ELEV	h	Q_3 (cfs)
461.0	1.5	220
461.5	2.0	250
462.0	2.5	280
462.3	2.8	300
462.5	3.0	310
463.0	3.5	332
464.0	4.5	380
465.0	5.5	420

④ CREST FLOW - EL 462.3 is low point of dam crest

$Q_4 = 2.55\ L\bar{H}^{1.5}$ where $\bar{H}$ is the average head over the length, L.

RES ELEV	h	L	Q_4 (cfs)
462.3	0	0	0
462.5	.1	556	40
462.7	.20	950	215
463.0	.43	1300	940
463.5	.93	1300	2970

B. SPILLWAY WITH STOPLOG



⑤ WEIR DISCHARGE FROM EL 459 to 462, ASSUMING $Y_c \simeq \frac{2}{3}H$. THUS, ORIFICE CONTROL OCCURS WHEN $H > 3'$.

$Q_5 = 3.3 L H^{1.5}$

RES ELEV	H	Q (cfs)
459.0	0	0
459.5	.5	10
460.0	1.0	40
460.5	1.5	70
461.0	2.0	110
461.5	2.5	160
462.0	3.0	210

⑥ ORIFICE CONTROL, above elevation 462.0

$h = \{\text{RES ELEV} - 459.0\}$

$Q_6 = 0.70 A \sqrt{2gh}$ Where $A = (12.3)(2.5) = 30.75$ SQ F

$Q_6 = 172.7 \sqrt{h}$

NOTE: 2.5' IS THE DISTANCE BETWEEN THE TOP OF WEIR AND BOTTOM CORNER OF BRIDGE

RES ELEV	h	Q_6 (cfs)
462.0	1.5	210
462.3	1.65	220
462.5	1.75	230
462.7	1.85	235
463.0	2.0	240
463.5	2.25	260
462.4	1.70	225

Project NAT. REVIEW OF NON-FED DAMS Acct. No. 6928 Page 5 of 11

Subject HAMPSHIRE Co. MA Comptd By M. DOWAK Date 10-3-80

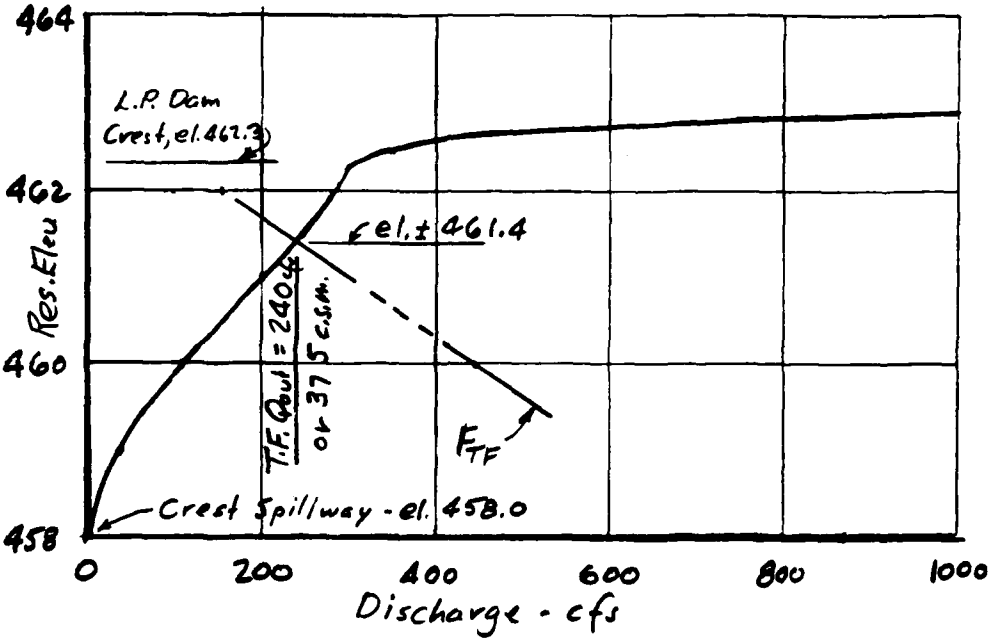
Detail MOUNTAIN ST RESERVOIR Ck'd. By LEB Date 10/6/80

C. TOTAL DISCHARGE

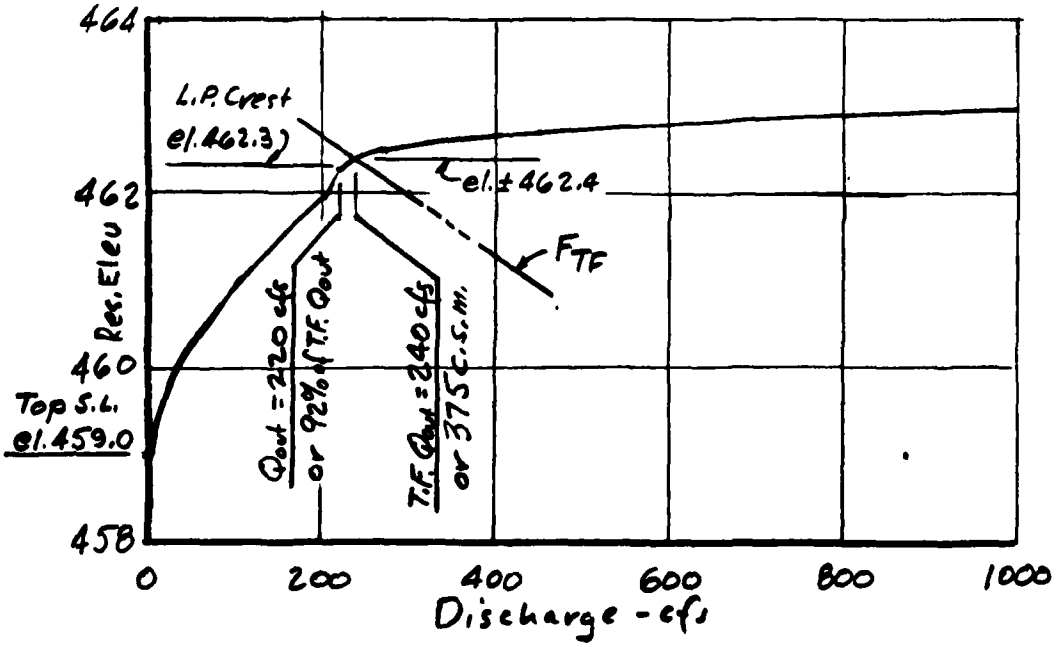
RES ELEV	Q (CFS) NO SL	W SL
458.0	0	
459.0	40	0
460.0	110	40
461.0	200	110
462.0	280	210
462.3	300	220
462.5	350	270
462.7	490	450
463.0	1270	1180
463.5	3330	3230
462.4	—	240
461.4	290	—

III Discharge & Storage Function vs. Res. Elev.

A - No Stoplogs

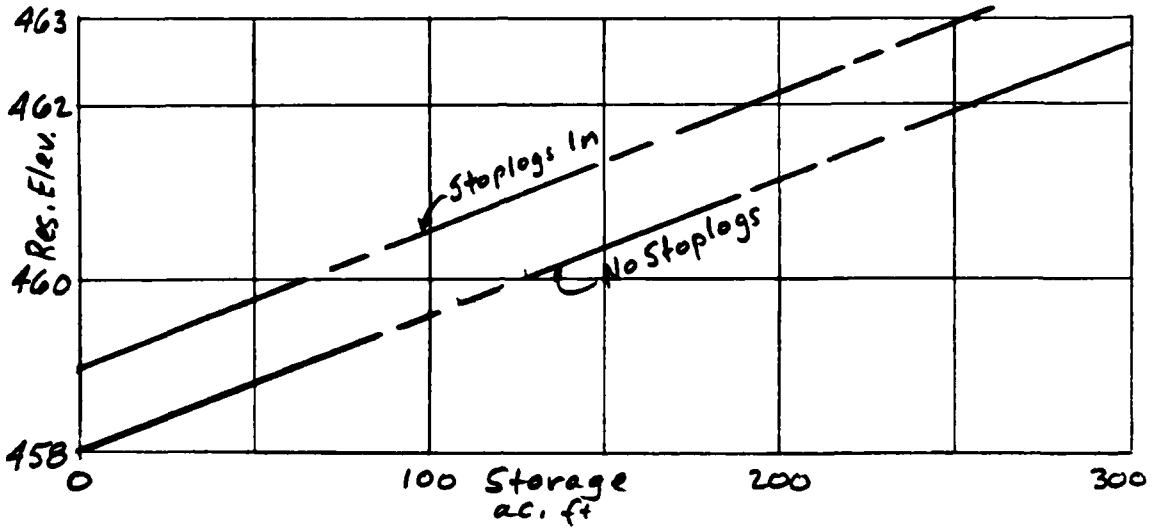


B - With Stoplogs



IV Storm Storage

Res. is assumed full to spillway crest or top of stoplogs at start of storm. Pond area of 64 acres is assumed constant as depth increases



V Crest Flow

Crest flow only when stoplogs in place

Max. head = 462.4 - 462.3 = 0.1 ft

$q = 2.55(0.1)^{1.5} = 0.08$ cfs/ft

As critical flow: $y_c = 0.06$ ft ; $V_c = 1.4$ fps

VI Low Level Outlet

172'-30"CIP ℄ ±10'-24"; ℄ Outlet el. 430.85; $f \simeq .0155$; $V_{24}^2 = 2.445\, V_{30}^2$

$$H = \frac{V_{30}^2}{2g}\left(0.5 \times 2.445 + .0015\,\frac{10(2.445)}{2} + 1.0 + .015\,\frac{172}{2.5}\right) = \frac{V_{30}^2}{2g}(3.44)\ ;\ Q = 21.2\sqrt{H}$$

Lower Res. 1 foot from el. 458 to 457. Ave. H = 26.65 ft.

$$\text{Time to Lower 1 ft.} = \frac{64(43560)}{21.2\sqrt{26.65}(3600)} = 7.1 \text{ hours}$$

(VI) Failure of Dam

A- Peak Failure Flow:

Pond Elevation - 462.3 (L.P. Crest)
Toe Elevation — 435.2
Y_o = 27.1 ft.
Dam Length Subject to Breaching = 300'
$W_o = 40\%(300) = 120$ ft

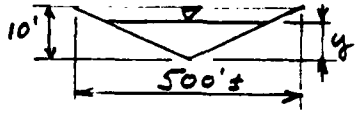
$$Q_{P_1} = 1.68\, W_o (Y_o)^{1.5} = 1.68(120)(27.1)^{1.5} = 28440 \text{ cfs}$$

Continuing Spill. Disch.: 300 cfs (no stoplogs)
Peak Failure Flow: 28740 cfs.

B- Storage Volume Released:

Storage Above Spillway	64(4.3)	= 275 ac. ft.
Storage below Spillway	1/3 64(22.8)	= 486 " "
Total Storage		761 " "

C- Channel Hydraulics (±1200' below dam)



$S = \frac{10'}{5400'}$; $n = .08$; $R \simeq y/2$; $V = 0.505\, y^{2/3}$
$A = 25y$

y	5	10	15	20	18	3
V	1.48	2.34	3.07	3.72	3.47	1.05
Q	920	5860	17270	37200	28090	240

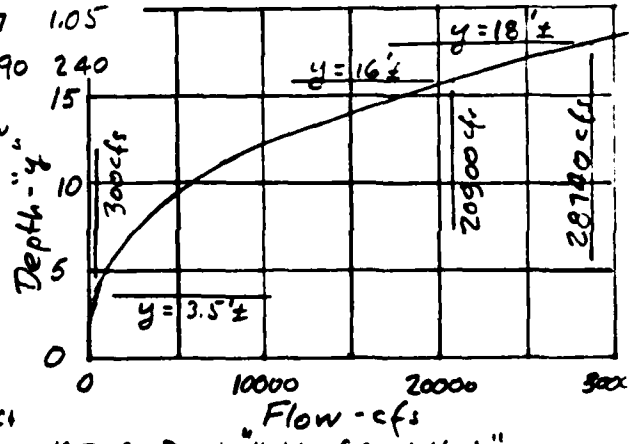
Immediately below dam outflow, depth rises from ± 3.5 ft to ± 18 ft.

This high tailwater would reduce total disch.

* $d/H = \frac{18}{27} = .67$; $n^{1.5} = (.808)^{1.5} = .73$

$Q_{out} = .73(28740) \cong 20900$ cfs.
This indicates a depth of ± 16 ft

See Next Pages

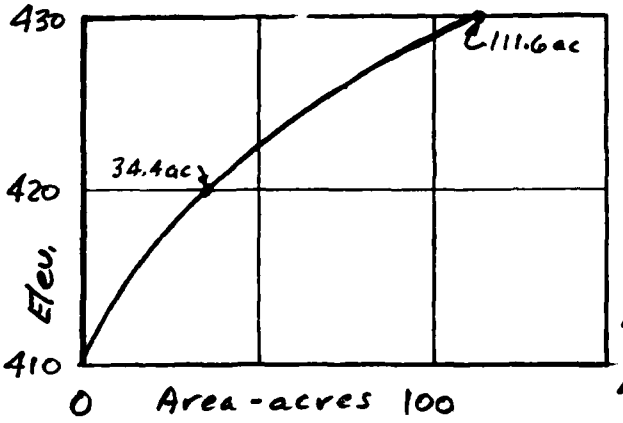


** Ref.: Davis, "Hnbk of Appl. Hydr" pg 1224, Table 11.

VI. Failure of Dam - Cont.

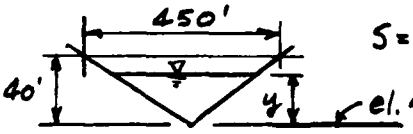
Failure water would inundate the flat floodplain below the dam with flow controlled at the entrance to the steeper reach of Beaver Br., about 8400 ft (st. line) below the dam.

E. Floodplain Storage



El.	Area (ac.)	Δ Vol (ac ft.)	Vol. (ac. ft.)
410	0		0
		20	
414	10		20
		70	
418	25		90
		142	
422	46		232
		242	
426	75		474
		373	
430	111.6		847

F - "Steeper" Channel (±8400' below dam)

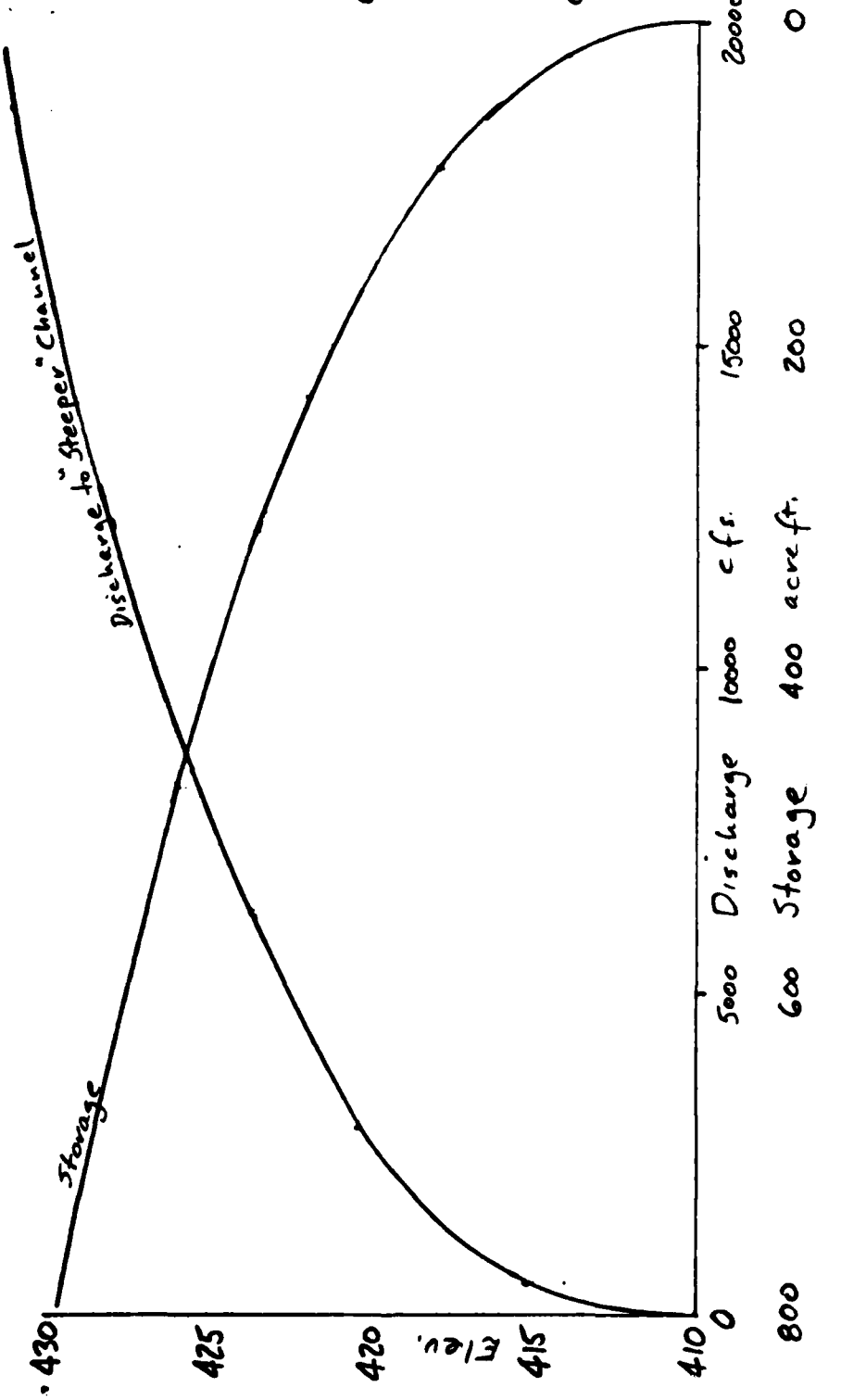


$S = \frac{10}{700}$; $n = 0.10$, $A = 5.62y^2$, $R \simeq \frac{1}{2}y$, $V = 1.122y^{2/3}$

y	V	Q	h_v	Floodplain Depth	Elev. Water in Floodplain
5	3.28	500	0.2	5.2'	415.2
10	5.21	2900	0.4	10.4'	420.4
15	6.82	8600	0.7	15.7'	425.7
20	8.27	18600	1.1	21.1'	431.1

VI - Failure of Dam - Cont.

G - Flood Plain: Storage & Discharge vs Water Elev.



VI Failure of Dam - Cont.

H - Peak Discharge from Floodplain Storage

$$^{*}Q_{out} = Q_{in}\left(1 - \frac{\text{Floodplain Storage}}{\text{Reservoir Storage}}\right) = Q_{in}\left(1 - \frac{V}{S}\right)$$

Ref.: U.S.C. of E. "Rule of Thumb" Guidance for Est. Downstream Dam Failure Hydrographs"

also - while floodplain fills, steeper channel is flowing

$$V_{sc} \cong \left(\tfrac{1}{2}\ \underline{\max}\ Q_{out}\right)(54\ \text{min.})\left(\frac{60}{43560}\right) = 0.0372\ Q_{out}$$

let $V = V_{Fl.Plain} + V_{sc}$

then: $Q_{out} = 20600\left(1 - \frac{V}{761}\right) = 20600\left(1 - \frac{V_{FP} + .0372\,Q_{out}}{761}\right)$

$$Q_{out} = f(V_{FP}, Q_{out}) = \text{"A"}$$

Use VI-G, and "cut & try" method for Q_{out}, max.

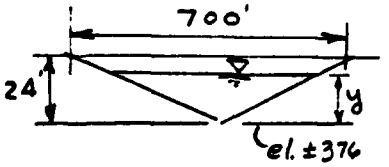
V_{FP} (ac ft)	Water Elev.	Q_{out} (cfs)	"A" (cfs)
310		±6000	6166
320		±6200	5694
315		±6100	5930
312	423.7	±6050	6060 ←

Time to drain floodplain =

$$= \frac{761 - .0372(6060)}{6060}(24.2) =$$

= 2.1 hours or 128 min.

I - Beaver Bk. near Hayden ville Road



$S = \frac{10}{4600}$; $n = .06$, $R \cong \frac{1}{2}y$; $V = .73y^{2/3}$; $A = 14.6y^{2}$

y	V	Q
5	2.13	780
10	3.38	4940
12	3.82	8040
11	3.61	6380 ←
3	1.52	200
4	1.84	430 ←

Failure flow is ±11' deep, occuring after flow with ±3.5' depth

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

MOUNTAIN STREET RESERVOIR DAM AND DIKES

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.	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY	MO	YR
MA	82	NED	MA	015	01				MOUNTAIN STREET RESERVOIR DAM	4224.0	7240.2			00NOV80

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT
	MOUNTAIN STREET RESERVOIR

(16) REGION	(17) BASIN	(18) RIVER OR STREAM	(19) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(20) DIST FROM DAM (MI.)	(21) POPULATION
01	08	BEAVER BROOK	WILLIAMSBURG (HAYDENVILLE)	2.0	23000

(22) TYPE OF DAM	(23) YEAR COMPLETED	(24) PURPOSES	(25) STRUCTURAL HEIGHT (FT.)	(26) HYDRAULIC HEIGHT (FT.)	(27) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	NORMAL (ACRE–FT.)
REPG	1905	S	35	33	741	550

(28) DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
NED	N	N	N	N	

(29) REMARKS

(30) DIS MAS	(31) SPILLWAY CREST LENGTH	TYPE	WIDTH (FT.)	(32) MAXIMUM DISCHARGE (FT.)	(33) VOLUME OF DAM (CY)	(34) POWER CAPACITY INSTALLED (MW)	PROPOSED (MW)	(35) NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	1300	U	12	300	41000											

(36) OWNER	(37) ENGINEERING BY	(38) CONSTRUCTION BY
TOWN OF NORTHAMPTON	NORTHAMPTON WATER WORKS	UNKNOWN

(39) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	MA DEQE	MA DEQE

(40) INSPECTION BY	(41) INSPECTION DATE DAY | MO | YR	(42) AUTHORITY FOR INSPECTION
METCALF & EDDY INC	21AUG80	PL 92-367

(43) REMARKS
WATER DEPARTMENT


TE
MED