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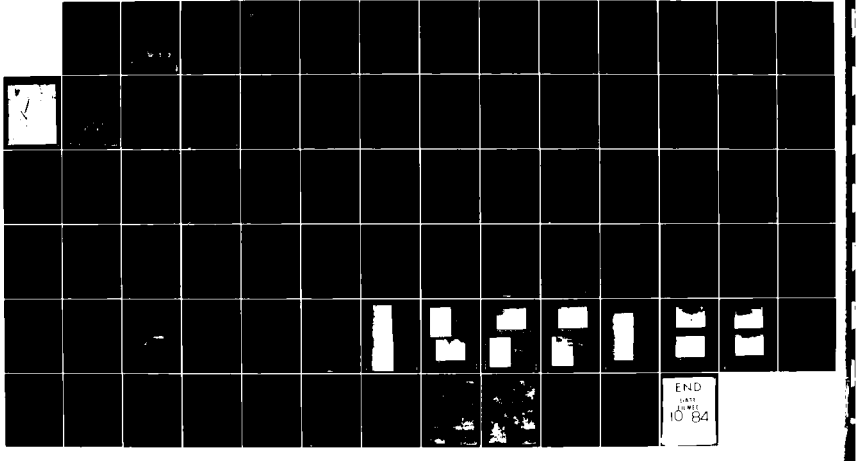

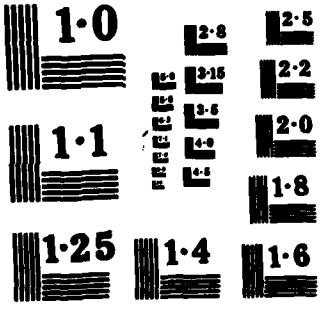
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AD-A146 098

MERRIMACK RIVER BASIN
WESTFORD, MASSACHUSETTS

STONY BROOK DAM
MA 00132

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

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JANUARY 1980

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MA 00132	2. GOVT ACCESSION NO. A146098	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Stony Brook 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 January 1980 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
Westford, Mass.

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

The dam is a 350 foot long, 24 foot high, gravity, earth embankment structure with a 20 foot long masonry spillway and two sealed outlets. The dam is in generally fair condition. The dam has a size classification of small and a hazard classification of high. The test flood has a range between a ½ and full PMF.

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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

MAR 21 1980

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

Dear Governor King:

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

A copy of this report has been forwarded to the 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, C.G. Sargents & Son, Westford, Massachusetts 01829.

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,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

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NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
BRIEF ASSESSMENT

COPY INSPECTED

Identification No.: MA 00132

Name of Dam: Stony Brook Dam

Town: Westford

County and State: Middlesex County, Massachusetts

Stream: Stony Brook

Date of Inspection: October 24, 1979

The dam is a 350 foot long, 24 foot high, gravity, earth embankment structure with a 20 foot long masonry spillway and two sealed outlets. The dam was built in the late 1800's for water supply, however, presently the purpose is recreation. The dam is owned and maintained by C.G. Sargents & Son of Westford, Massachusetts.

The visual inspection indicated the dam to be in generally fair condition. The deficiencies noted during the inspection include the presence of roots of trees growing on the upstream and downstream faces which could cause internal erosion of the dam; the spillway gates have not been operated in several years; and there is no draw down facility.

The dam has a size classification of small and a hazard classification of high. Based on Corps Guidelines, the test flood has a range between a ½ and full Probable Maximum Flood (PMF). The test flood used was the ½ PMF. This flood would produce an inflow of 5,400 cfs. The storage capacity of the

reservoir would reduce the outflow to 4,910 cfs.

Considering the reservoir to be at its normal elevation of 183.5, the spillway can pass 485 cfs or 10 percent of the outflow, resulting in the dam being overtopped by about 3.3 feet. Raising and or removal of gates will increase discharge capacity to 25 percent..

Indepth engineering data was not available and assessment is based primarily on visual inspection, past performance history and sound engineering judgement.

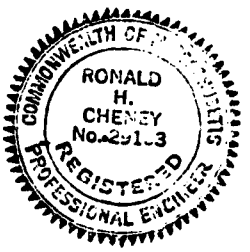
The dam is in generally fair condition. It is felt, however, that certain items which are generally maintenance and operational procedures need attention. These include periodic removal and maintenance of trees and bushes growing on the dam, periodic testing of spillway gates and establishment of a formal warning system. The spillway gates should be operated in a raised position until further hydraulic assessment of the spillway is made.

Furthermore, it is recommended that the Owner engage a qualified, registered professional engineer to investigate the following:

1. Removal of existing trees and roots growing on the dam and backfilling the resulting voids.
2. Design adequate slope protection for the upstream slope.
3. Evaluate the potential for overtopping and the adequacy of the spillway.
4. Investigate the condition of the spillway gates.
5. Investigate the present condition of the sealed outlets.

6. Design a draw down facility for the dam.

The Owner should carry out the above remedial measures and recommendations within one year after receipt of this Phase I Inspection Report.



Ronald H. Cheney, P.E.
Vice President

Hayden, Harding & Buchanan, Inc.
Boston, Massachusetts

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

ARAMAST MAHTESIAN, MEMBER
Foundation & Materials Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to

assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

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

The Phase I Investigation does <u>not</u> 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.

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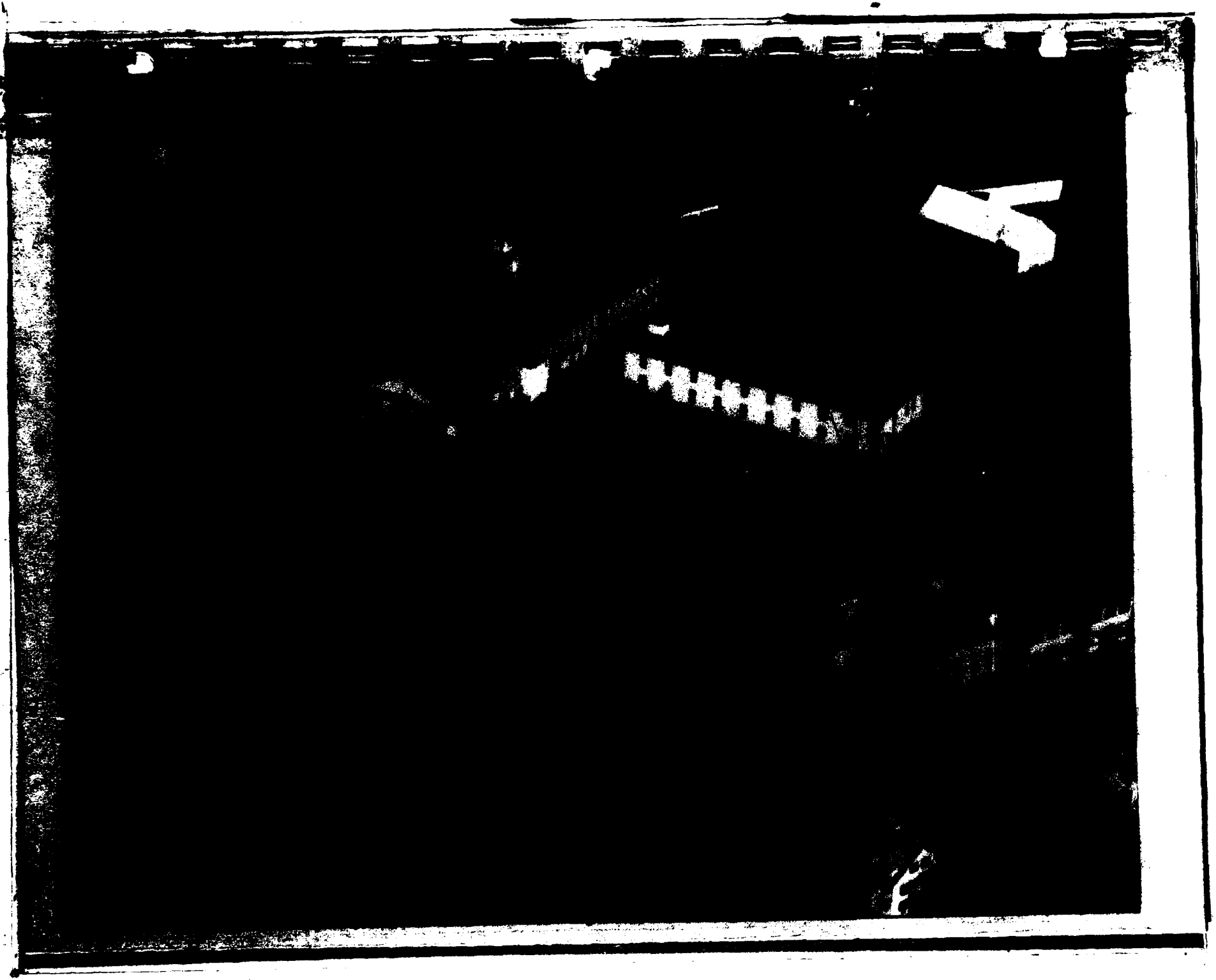
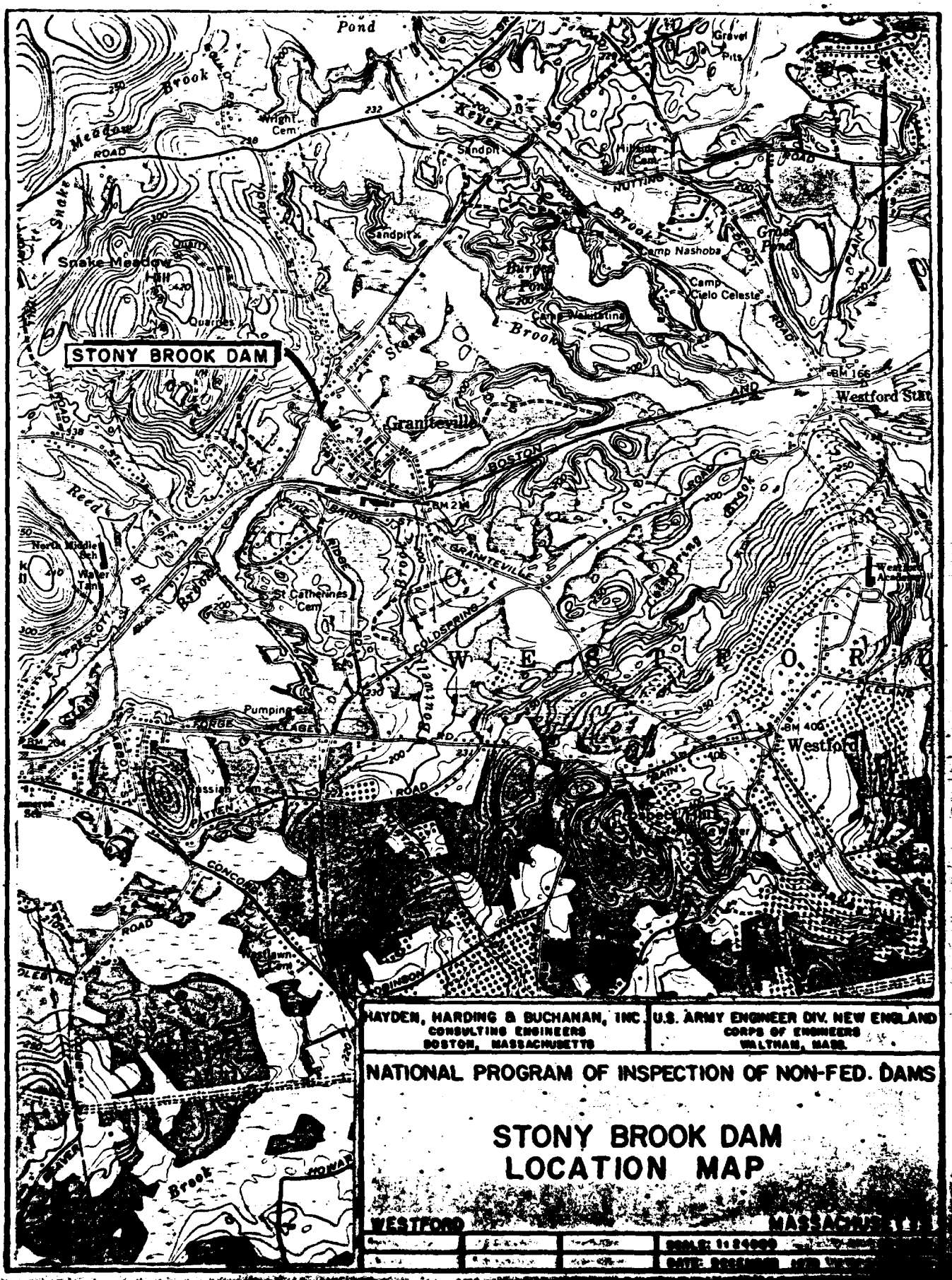




HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

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

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

STONY BROOK DAM
LOCATION MAP

WESTFORD MASSACHUSETTS

SCALE: 1:24000

DATE: REVISED AND UPDATED

PHASE I
NATIONAL DAM INSPECTION PROGRAM

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. Hayden, Harding & Buchanan, 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 Hayden, Harding & Buchanan, Inc. under a letter of 24 October 1979 from William E. Hodgson Jr., Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0006 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 initiate quickly effective dam safety programs for non-Federal dams.

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

1.2 Description of Project

a. Location

The Stony Brook Dam is located in the Graniteville section of the Town of Westford, Middlesex County Massachusetts. The crest of the dam is Broadway Street, Graniteville and the dam is bound on the left side by East Prescott Street. The dam impounds Stony Brook. It is located on the Westford, Massachusetts Quadrangle with the approximate coordinates of North 42° 35'45", West 71°28'00".

b. Description of Dam and Appurtenances

The dam is a 350 foot long, 24 feet high, gravity, earth embankment structure with a masonry spillway and two blocked off outlets (photograph 1). The crest of the dam has a varying width ranging from 20 to 35 feet and serves as a roadway for the Town of Westford (photograph 3). The spillway is 20 feet long with an effective ungated height of 4.5 feet. The spillway contains two manually operated controls for five 2.5 feet high by 4 feet wide wood gates. The upstream face of the dam is lined with vegetation and trees and slopes at approximately a 1½ Hor. to 1 Vert. slope. The downstream face is made up of several varying height concrete and masonry vertical retaining walls. The two blocked outlets were previously used for water supply for the two downstream factories. According to C.G. Sargents and Son personnel, there are no records as to how and when these outlets were sealed or their composition.

c. Size Classification

The dam is classified as small based on its storage capacity of 408 acre-feet and its height of 24 feet.

d. Hazard Classification

The hazard potential from flooding due to the failure of this structure is classified as high. According to Corps Guidelines, the outflow from dam failure would be about 5930 cfs and would result in a failure flood stage of about 7 feet. Twenty-one homes and five industrial buildings are located within the impact area and could be damaged by flood water from 1 to 5 feet deep. Base flow flooding conditions cause a flood stage of about 2 feet.

e. Ownership

The dam is owned by C.G. Sargents and Son. There were no records located indicating previous owners.

f. Operator

The dam is maintained by C.G. Sargents and Son. The designated caretaker is Mr. C.G. Fletcher. The address is Broadway Street, Graniteville, Westford, Massachusetts 01829, telephone (617) 692-6371.

g. Purpose of Dam

The original purpose of this dam was water supply. Presently the purpose is recreation.

h. Design and Construction History

No records were located confirming when the dam was built. The 1973 State Inspection Report indicates the dam was built in 1870. No records of subsequent repairs or modifications to the dam were located.

i. Normal Operational Procedures

There are no apparent formal operational procedures for this dam. According to C.G. Sargents and Son personnel, the spill-

way gates are operational, however there are no records indicating when they were last operated.

1.3 Pertinent Data

a. Drainage Area

Stony Brook Dam is located in the Graniteville section of the Town of Westford, Massachusetts. The drainage area is 16 s.m. (10,240 acres). The main drainage paths, Bennett and Stony Brooks (8.5 miles long) have a very flat slope (0.002± feet per foot) with many swamps and large pond areas. Also, there are many small culverts, roadway embankments and dams located along the drainage path. These factors will reduce the peak storm discharge that flows to the dam.

The area downstream of the dam is also very long, flat and swampy. Little development occurs near Stony Brook except at the Graniteville area, where there are several homes and factories located near the brook. All other development occurs along the perimeter of the outlet brook flood plain.

See Appendixes D and C for drainage area map and photographs.

b. Discharge at Damsite

1. Outlet Works

The pond at Stony Brook has three outlets. They are the main spillway and two gated outlets. These gated outlets were used to supply water to the adjacent mills, but have been blocked-off and are no longer in use. There are no other known outlet works.

2. Maximum Known Flood at Damsite

There is no record of the maximum known flood at the dam. United States Weather Bureau records indicate that about 8 inches of

rainfall occurred near the project location from August 17 to 20, 1955 and September 17 to 22, 1938.

3. Ungated Spillway Capacity

With the wooden gates removed, the spillway has a capacity of about 934 cfs, with water at elevation 188± top of dam (and roadway). This assumes the roadway bridge, which forms a constriction reducing the discharge, is not washed away. At the test flood elevation of 191.3±, the capacity of the spillway is 1210± cfs, with gates removed. This is 25 percent of the 4,910± cfs test flood outflow.

Considering 2.5 feet of gates in place (normal operating level of 183.5), with the water level at the top of road, elevation 188, the spillway's capacity is 350± cfs. With the water level at test flood elevation of 191.3, the spillway's capacity (with 2.5 feet of gates in place) is 485± cfs, or 10 percent of the test flood outflow.

The total project discharge at the test flood elevation of 191.3 is 4,910± cfs. Water would be discharged through the spillway and over the top of dam by about 3.3 feet.

c. Elevation (ft. above MSL)

(1) Streambed at toe of dam ---------- 164±

(2) Bottom of cutoff ---------- unknown

(3) Maximum tailwater ---------- 177±

(4) Recreation pool ---------- 183.5±

(5) Full flood control pool ---------- N/A

(6) Spillway crest (gated) ---------- 183.5±

(7) Design surcharge (Original Design) - unknown

(8) Top of dam ---------- 188±

(9) Test flood surcharge ---------- 191.3±

d. Reservoir (Length in feet)

(1) Normal pool ---------- 4000±

(2) Spillway crest pool ---------- 4000±

(3) Top of dam ---------- 4000±

(4) Test flood pool ---------- 6000±

(5) Flood control pool ---------- N/A

e. Storage (acre-feet)

(1) Spillway crest pool ---------- 175

(2) Normal pool ---------- 253

(3) Top of dam ---------- 408

(4) Test flood pool ---------- 726

(5) Flood control pool ---------- N/A

f. Reservoir Surface (acres)

(1) Spillway crest ---------- 30

(2) Normal pool ---------- 32

(3) Top of dam ---------- 35

(4) Test flood pool ---------- 139

(5) Flood-control pool ---------- N/A

g. Dam

(1) Type - gravity, stone masonry & earth fill

(2) Length ---------- 350'±

(3) Height ---------- 24'±

(4) Top Width ---------- 20-35'

(5) Side Slopes ---------- vary

(6) Zoning ---------- unknown

(7) Impervious Core ---------- unknown

(8) Cutoff ---------- unknown

(9) Grout curtain ---------- unknown

h. Diversion and Regulating Tunnel ---------- none

i. Spillway

(1) Type ---------- stone masonry

(2) Length of weir ---------- 20'±

(3) Crest elevation -------- 181± without gates
183.5 with gates

(4) Gates ------- 5 sections, 2.5' x 4'

(5) U/S Channel ---------- pond

(6) D/S Channel ------- natural stream banks lined with stone near dam

j. Regulating Outlets

The spillway is the only functioning outlet. The gates no longer are used. They function as stoplogs and 2.5± feet are presently used. The spillway crest is at elevation 181±.

There are two unused outlets which formerly provided water to the mill buildings. These outlet gates are no longer operable.

The dam has no known outlets which can be used as a draw down facility.

SECTION 2

ENGINEERING DATA

2.1 Design Data

A 1973 State Inspection Report indicates that the dam was built in 1870. No additional information relating to when or by whom the dam was designed or any indepth design calculations were located.

2.2 Construction Data

The dam was constructed in 1870 according to a State Inspection Report. No data on the construction and subsequent modifications of this dam were found.

2.3 Operation Data

No formal operational manual exists for this structure. The caretaker is the owner, C.G. Sargents and Son.

2.4 Evaluation of Data

a. Availability

No engineering data was located regarding the Stony Brook Dam. A State Inspection Report for 1973 was made available at the State Department of Environmental Quality Engineering, Division of Waterways, Boston Office.

b. Adequacy

The lack of indepth engineering data does not allow for a definitive review. Therefore, the adequacy of this dam, structurally and hydraulically, can not be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history, and sound engineering judgement.

c. Validity

The visual inspection of this facility showed no reason to question the validity of the information supplied on the State Inspection Report.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General

The dam was inspected on October 24, 1979. At that time the pool water level was approximately 4 feet below the crest of the dam.

b. Dam

The dam is a complex structure which, while basically an earth fill, consists of industrial building structures and vertical stone retaining walls forming an integral part of the structure.

An operating spillway is located near the left abutment of the dam. Between the left abutment and the spillway is an inoperable outlet leading to an industrial building on the downstream slope. A second inoperable outlet is located near the right abutment. Photograph 1 is a panorama of the upstream face showing these three outlets which pass through the dam.

Visual inspection of the dam indicated that it is in generally fair condition.

Upstream Slope

Approximately 3 ft. of the upstream slope was visible above the reservoir level. In some areas near the left abutment, the upstream slope is formed by a vertical granite block wall, as shown in photograph 4.

The condition of these walls is good; no misalignment of the walls was observed.

The remainder of the upstream face is sloped earth fill. The slope is locally uneven due to small slumps and erosion. The earth slope has no riprap slope protection and is covered with grass and small bushes.

Numerous large trees are growing on the slope, as shown in photographs 5 and 6.

Crest

The crest of the dam is an asphalt-paved roadway, photograph 3. The roadway surface is undulating in some areas and cracks were observed in the pavement on the bridge spanning the spillway, photograph 2.

Downstream Slope

As shown in photograph 4, a mill building forms the downstream face of the dam to the left of the spillway. There is a stone masonry wall on the right side of the mill building which forms part of the left training wall for the spillway and outlet channel.

To the right of the spillway there is another mill building. A portion of the downstream face which is between the mill building and the crest is supported by a vertical stone masonry wall. The top of the wall appeared to be leaning slightly downstream, photograph 7. Between the mill building and the spillway, the downstream face of the dam is formed by a stone masonry wall, photograph 8. The wall appeared to be in good condition. Large trees up to about 1 ft. diameter are on the crest of the dam above the wall and downstream of the wall close to the base of the wall, photograph 8.

c. Appurtenant Structures

The spillway consists of stone masonry in a stepped construction, photograph 8. The training walls of the spillway also consist of stone masonry. At the time of the inspection, water was flowing over the spillway and the downstream face of the spillway could, therefore, not be observed. The training walls of the spillway appeared to be in good condition. The spillway gates have not been operated for several years and their condition is questionable.

The two outlets located in the left and right section of the dam are inoperable and sealed.

d. Reservoir Area

The banks of the reservoir are tree lined and sparsely populated, photograph 9. There are no indications of instability along the banks of the reservoir in the vicinity of the dam.

e. Downstream Channel

The downstream channel is the natural streambed, photograph 10. For a section of the channel downstream from the dam, stone masonry walls form the sides of the channel, photograph 8 and 11. No significant obstructions existed in the channel at the time of inspection.

3.2 Evaluation

Visual inspection indicates that the dam is in generally fair condition. Roots of trees growing on the upstream face could create seepage paths which could lead to internal erosion of the dam. The roots of the trees growing near the top and the base of the stone masonry wall on the downstream face of the dam to the

right of the spillway could cause movement of the blocks in the wall. The roots of these trees could also create seepage paths which could lead to erosion in or under the dam.

The spillway gate has not been operated in several years. The two abandoned outlets are sealed.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General

The Stony Brook Dam is owned by C.G. Sargents and Son. The designated caretaker is Mr. C.G. Fletcher. There are no formal operational procedures for this structure. The spillway is operated with 2.5 feet of gates in place. The manually operated gates are reported to be functional, but have not been operated in recent years.

b. Description of Warning Systems

There are no warning systems in effect at this dam.

4.2 Maintenance Procedures

a. General

The owner, C.G. Sargents and Son, is responsible for maintenance of this dam. There is no formal maintenance procedure for the dam.

b. Operating Facilities

The spillway gates are manually operated. Employees of the owner indicated these facilities are operational, but have not been operated for some time. Little maintenance has been undertaken during the past few years.

4.3 Evaluation

There are no formal operational or maintenance procedures for this dam.

The structure should be inspected every year by a qualified registered professional engineer who can identify conditions of concern

which, if left unchecked could jeopardize the safety of the structure. Existing trees and brush should be removed from the dam embankment and future vegetation growth cut on a regular basis.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

Stony Brook Dam is located in the Graniteville section of the Town of Westford, Massachusetts. It has a drainage area of 16 s.m. (10,240 acres). It is an area of low, steep hills with long, flat valleys. The area contains many large swamps, ponds and flow constrictions, which will influence peak storm inflow at the project.

Stony Brook Pond was formed by constructing the dam across the narrow brook channel. The pond area immediately upstream of the dam is small but the flood plain area beyond is much larger. The pond's water surface covers an area of about 35 acres. The flood plain area is about 125 acres.

The pond outlet is Stony Brook. It flows about 7 miles northeast to the Merrimac River near North Chelmsford. Stony Brook has a very flat slope. The normal channel section is about 20 feet wide with banks 5 feet high or less, immediately downstream of the dam. It flows into a long, flat swampy area. These conditions will act to retard the stream's ability to transport storm water runoff away from the project.

See Appendixes B, C, D and E for drainage area maps, drawings and photographs of the project.

5.2 Design Data

Hydraulic/hydrologic criteria used for the original design of this project were not located.

5.3 Experience Data

There are no records of past flood experience or dam overtopping. United States Weather Bureau records indicate that about 8 inches of rainfall occurred near the project location from August 17 to 20, 1955.

5.4 Test Flood Analysis

The dam has a small size classification and a high hazard potential. Based upon Corps Guidelines the test flood would be in the range of ½ PMF to full PMF. Due to the rural conditions of the area, the test flood was based upon the ½ PMF having an inflow of 5,400 cfs.

The spillway is the only functioning outlet. It is 20 feet long and 4.5 feet high. It originally had five 4 foot by 4.5 sluice gates. About 2.5 feet of gates are in place and act as stoplogs.

The test flood outflow was determined considering the 2.5 foot gates (elevation 183.5) are in place. The peak inflow of 5,400 cfs would surcharge the pond to elevation 191.3, about 3.3 feet above the top of dam. The outflow would be 4,910 cfs. The pond would be providing stage storage for 0.86 inches of runoff or 726 acre feet between elevations 183.5 and 191.3. The spillway will pass 485 cfs or 10± percent of the outflow.

5.5 Dam Failure Analysis

Stony Brook Dam was assumed to have failed with the water surface at elevation 188, top of dam and roadway. See photograph 4. Water would be discharging from the spillway, photograph 8, at 350± cfs (assumes 2.5 feet of gates in place). The

downstream channel, photograph 10, would be flooded to elevation 171.5± at Graniteville Road, photograph 12, due to the channel characteristics of flat slope and constrictions. Water would be about 1.5 to 2 feet deep over the roadway. Some flooding would occur to a maximum depth of 2 feet at the homes shown in photograph 12. Several mill buildings near Graniteville Road (photograph 12) would also have similar flooding conditions, as would buildings adjacent to the dam, photograph 11.

Upon failure, the outflow, using Corps Guidelines, would be 5,930 cfs. This assumes that a 30 foot long section of the 24 foot high dam, shown in photograph 8 fails. This flow would cause the flood stage at Graniteville Road to reach elevation 177±. Flood stage is 7 feet, including base flood stage.

Flood damage would begin to occur at homes located along the perimeter of the brook's flood plain, which are at "high ground elevations." About five homes could receive 1 to 5 feet of flood damage. About 16 homes and 5 other structures would receive 5 feet of flood water damage, depending upon the actual ground elevations, above the base flow flood condition. See dam failure impact area map in Appendix D.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation

The visual inspection did not disclose any immediate stability problems. However, the roots of the trees growing on the dam and at the base of the downstream face of the dam could lead to internal erosion of the dam.

6.2 Design and Construction Data

There is no available design and construction data.

6.3 Post Construction Changes

There are no known post construction changes of the dam. The left and right outlets which were previously used for water supply and are now sealed.

6.4 Seismic Stability

The dam is located in Seismic Zone 2 and in accordance with the recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

On the basis of the visual inspection, the dam is judged to be in generally fair condition. The future safety of the dam can be endangered by trees growing on the dam and at the base of the downstream face of the dam.

b. Adequacy of Information

The information available was very limited, and this assessment of the condition of the dam is based principally on the visual inspection.

c. Urgency

The recommendations presented in Section 7.2 should be implemented within one year after receipt of this Phase I Inspection Report by the Owner.

7.2 Recommendations

a. The Owner should engage a qualified, registered professional engineer to: (1) design an acceptable means of removing the trees and their roots from the dam and backfilling the voids with appropriate material and (2) design adequate slope protection for the upstream slope of the dam.

b. The dam's spillway does not have the capacity to pass the ½ PMF test flood. The Owner should engage a qualified, registered professional engineer to further evaluate the potential for overtopping and the adequacy of the spillway.

c. The condition of the spillway gate should be investigated.

d. There is no draw down facility. The Owner should engage a qualified, registered professional engineer to design an adequate draw down facility.

e. The abandoned outlets should be investigated to assure that they are properly sealed and will not allow leakage into the downstream buildings.

7.3 Remedial Measures

a. Operation & Maintenance Procedures

1. Existing trees and bushes growing on the dam should be removed as per Section 7.2.a, and later new growth cut every year.

2. The spillway gates should be operated periodically to assure they are in working condition. In the interim to recommendation 7.2.b the gates should be operated in a raised position or removed to increase spillway capacity.

3. The dam should be inspected every year by qualified registered professional engineers.

4. A formal warning system should be developed for warning downstream residents in case of emergency; and provide around the clock monitoring of the dam during periods of heavy rainfall.

5. Inspect spillway during a no flow condition.

7.4 Alternatives

There are no practical alternatives.

APPENDIX A

INSPECTION CHECKLIST

1

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Stony Brook Dam

DATE Oct. 24, 1979

TIME 1330

WEATHER Sunny

W.S. ELEV. 184+ U.S. ____ DN.S.

PARTY:

1. Ron Cheney - HHB
2. Dave Vine - HHB
3. Mike Angieri- HHB
4. Dan LaGatta - GEI
5. Steve Whiteside - GEI
6. ____
7. ____
8. ____
9. ____
10. ____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Embankment	All	
2.	Spillway	All	
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

2

PERIODIC INSPECTION CHECKLIST

PROJECT Stony Brook Dam DATE 10/24/79

PROJECT FEATURE Dam Embankment NAME D. LaGatta

DISCIPLINE Geotechnical Engineer NAME R. Cheney

Structural Engineer

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	188±
Current Pool Elevation	184±
Maximum Impoundment to Date	Unknown
Surface Cracks	Cracks in span over spillway.
Pavement Condition	Asphalt roadway on crest had some cracks and undulations in some areas.
Movement or Settlement of Crest	Some areas of road had settled.
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	Stone masonry wall on downstream face right of spillway is leaning slightly downstream.
Trespassing on Slopes	Driveway to industrial building on downstream slope.
Sloughing or Erosion of Slopes or Abutments	Erosion of soil evident on upstream slopes.
Rock Slope Protection - Riprap Failures	None observed on areas of upstream slope not protected by stone masonry walls.
Unusual Movement or Cracking at or Near Toe	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	None observed
Instrumentation System	None observed
Vegetation	Large trees up to 2½ ft diameter and brush on upstream slope.

PERIODIC INSPECTION CHECKLIST

PROJECT Stony Brook Dam DATE 10/24/79

PROJECT FEATURE Intake Structure NAME D. LaGatta

DISCIPLINE Geotechnical Engineer NAME R. Cheney

Structural Engineer

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE a. Approach Channel Slope Conditions Bottom Conditions Rock Slides or Falls Log Boom Debris Condition of Concrete Lining Drains or Weep Holes b. Intake Structure Condition of Concrete Stop Logs and Slots	**There is no operational intake structure. The intakes which previously provided water to the downstream factories have been sealed.**

5

PERIODIC INSPECTION CHECKLIST

PROJECT Stony Brook Dam DATE 10/24/79

PROJECT FEATURE Control Tower NAME Dan LaGatta

DISCIPLINE Geotechnical Engineer NAME R. Cheney
Structural Engineer

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	There is no control tower.
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

6

PERIODIC INSPECTION CHECKLIST

PROJECT Stony Brook Dam DATE 10/24/79

PROJECT FEATURE Outlet Works NAME D. LaGatta

DISCIPLINE Geotechnical Engineer / Structural Engineer NAME R. Cheney

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	There is no transition or conduit in operation.
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

7

PERIODIC INSPECTION CHECKLIST

PROJECT Stony Brook Dam DATE 10/24/79

PROJECT FEATURE Outlet Structure NAME D. LaGatta

DISCIPLINE Geotechnical Engineer NAME R. Cheney

Structural Engineer

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	The outlet structures from the sealed outlets are not operable.
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

8

PERIODIC INSPECTION CHECKLIST

PROJECT Stony Brook Dam DATE 10/24/79

PROJECT FEATURE Spillway NAME D. LaGatta

DISCIPLINE Geotechnical Engineer NAME R. Cheney

Structural Engineer

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	None observed
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	The general condition of the masonry spillway is good.
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	None observed.
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	Some trees observed overhanging channel.
Floor of Channel	Good condition
Other Obstructions	None observed

9

PERIODIC INSPECTION CHECKLIST

PROJECT Stony Brook Dam DATE 10/24/79

PROJECT FEATURE Service Bridge NAME D. LaGatta

DISCIPLINE Geotechnical Engineer NAME R. Cheney

Structural Engineer

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	There is no service bridge.
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Underside of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

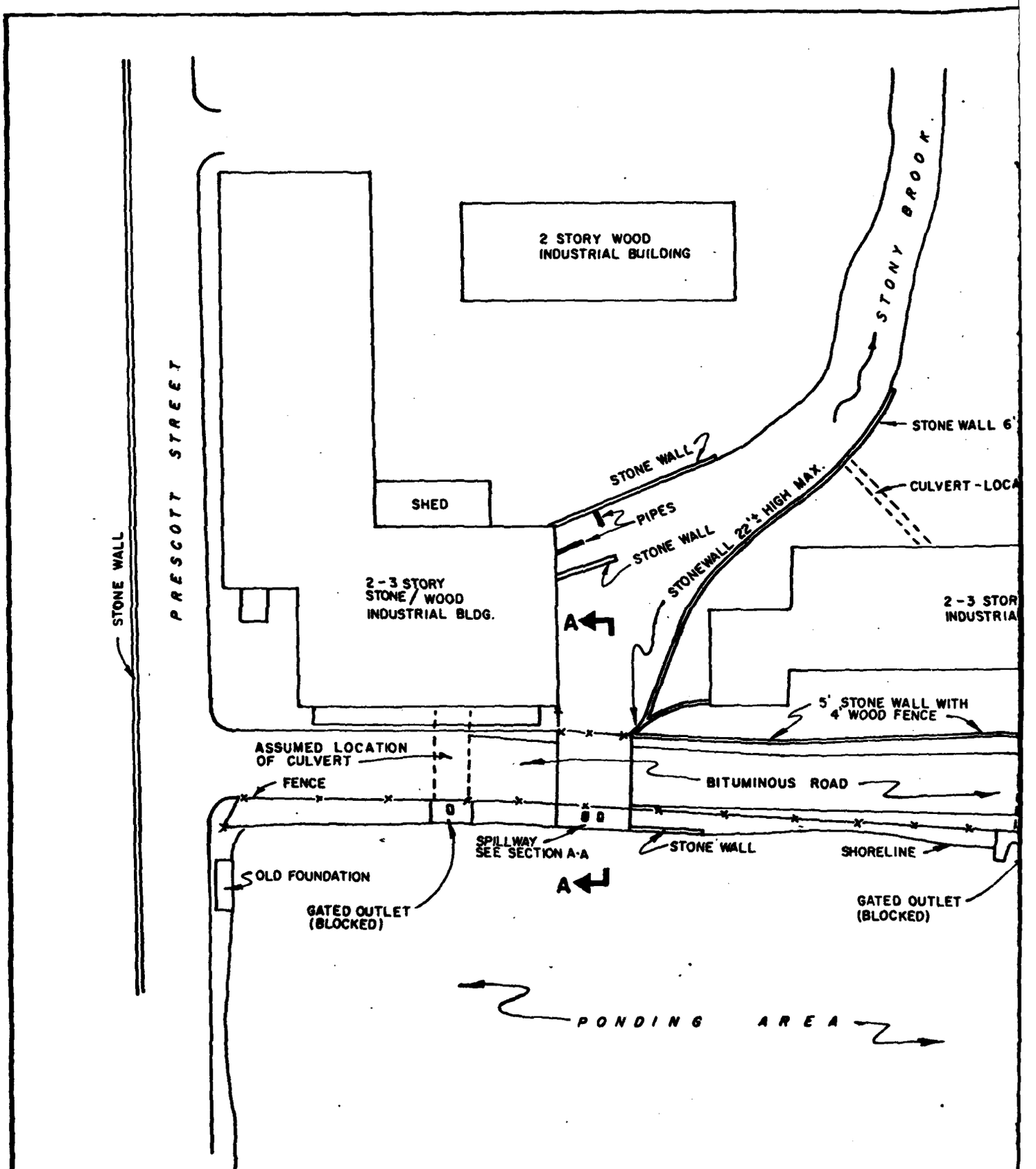
APPENDIX B

ENGINEERING DATA

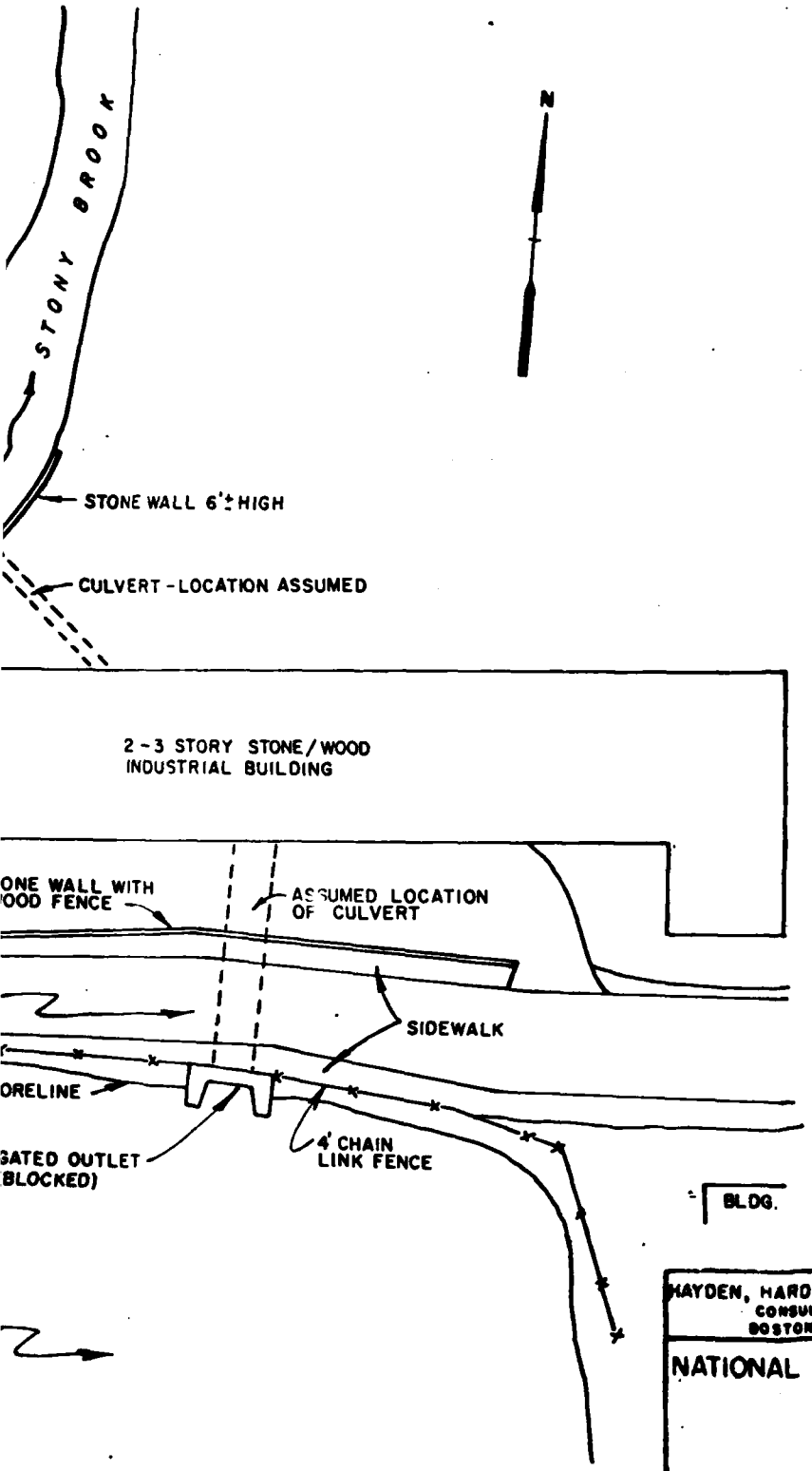
LIST OF ENGINEERING DATA

A State Inspection Report for 1973 was located at the State Department of Environmental Quality Engineering, Division of Waterways, Boston Office.

No additional Engineering Data was located.



PLAN DEVELOPED



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CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

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

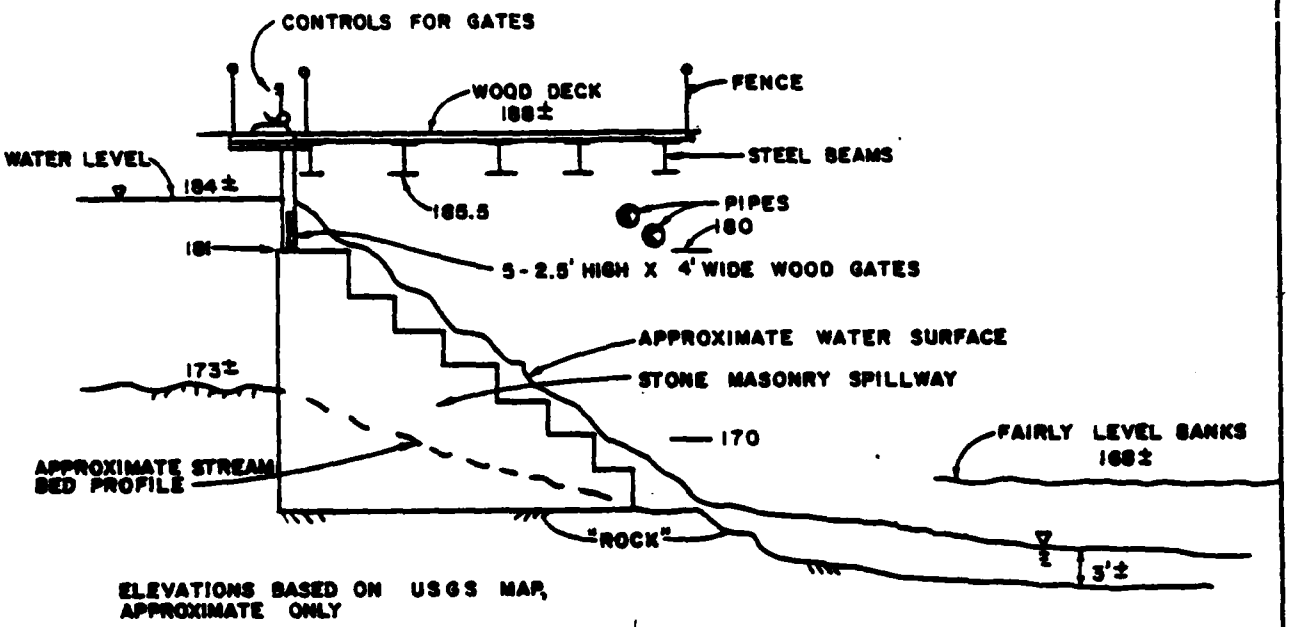
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

STONY BROOK DAM
PLAN VIEW

WESTFORD MASSACHUSETTS

SCALE NOT TO SCALE
DATE DECEMBER 1978

PLAN DEVELOPED FROM ON-SITE INSPECTION



SECTION A-A
(NO SCALE)

PLAN DEVELOPED FROM ON-SITE INSPECTION

HAYDEN, HARDING & BUCHANAN, INC. CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

STONY BROOK DAM SPILLWAY SECTION

WESTFORD MASSACHUSETTS

SCALE: NOT TO SCALE
DATE: DECEMBER 1978

OK FILE

INSPECTION REPORT - DAMS AND RESERVOIRS

(1) Location: Town WESTFORD

Name of Dam (STONY BROOK) ~~DAM~~ GRANITEVILLE DAM

Dam No. 4-9-330-3

Inspected by A.Z. PIZAN

Date of Inspection 10-11-'73

(2) Owners: per: Assessors ✓ Prev. Inspection _____

Reg. of Deeds _____ Pers. Contact _____

1 C.G. SARGENT'S SONS BROADWAY ST, GRANITEVILLE WESTFORD, MASS. 692-637
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. C.G FLETCHER, PLANT MGR, BROADWAY ST, GRANITEVILLE 692-6371
Name St. & No. City/Town State Tel. No.

(4) No. of Pictures taken 3

(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 FLASHBOARDS, MANUALLY OPERATED CONTROL

HEIGHT OF WATER

(7) Upstream Face of Dam: Condition:

1. Good ✓ 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

DAM NO. 7-7-330-3

8) Downstream Face of Dam: Condition: 1. Good ✓ 2 Minor Repairs ____

3. Major Repairs ___ 4 Urgent Repairs ___

Comments: ____

9) Emergency Spillway: Condition: 1. Good ____ 2. Minor Repairs ____

3. Major Repairs ____ 4. Urgent Repairs ___

Comments: EMERGENCY AND AUXILIARY SPILLWAYS NO LONGER FUNCTIONING, AND NO LONGER NEEDED.

10) Water level @ time of inspection ____ ft. above 0.2' below ____

top of dam ✓ Principal spillway ____

other ____

11) Summary of Deficiencies Noted: NONE NOTED.

Growth (Trees and Brush) on Embankment ____

Animal Burrows and Washouts ____

Damage to slopes or top of dam ____

Cracked or Damaged Masonry ____

Evidence of Seepage ____

Evidence of Piping ____

Erosion ____

Leaks ____

Trash and debris impeding flow ____

Clogged principal spillway ____

Other: ____

DAM NO. 4-9-330-3

(If Necessary, Describe Deficiencies Fully Explain)

DAM'S PURPOSE FOR MILL USE, NO LONGER IN OPERATION AND DAM SERVES ONLY FOR RECREATIONAL USE.

Photo indicates that pipes running beneath the bridge has reduced the effective spillway capacity. Stone masonry joints may require cleaning and pointing. (This may be a dry stone masonry wall)

(E.) Overall Condition:

A. Safe ✓

B. Minor repairs needed _____

C. Conditionally safe - major repairs needed _____

D. Unsafe _____

F. Reservoir impoundment no longer exists (explain)

Recommend removal from inspection list _____

DESCRIPTION OF DAM
DISTRICT #4

Submitted by FRANCIS H. PARÉ & ADAM Z. PIZAN
Date 10-11-73

Dam No. 4-9-330-3
~~City~~/Town WESTFORD
Name of Dam STONY BROOK; GRANITEVILLE D.

1. Location: Topo Sheet No. 25C
Provide 8½" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1870 Year/s of subsequent repairs UNKNOWN

3. Purpose of Dam: Water Supply ____. Recreational ✓
Irrigation ____. Other ____

4. Drainage Area: 0.5 SQ. MI. 300 ACRES.

5. Normal Ponding Area: 50 acres; Ave Depth 3'
impoundment: 50 thos gals; 150 acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir ____
i.e. summer homes etc. 2 BUSINESSES

7. Dimensions of Dam: Length 20' Max. Height 5' DEPTH @ BEARDS
Slopes: Upstream Face VERT.
Downstream Face VERT.
Width across top 5'

8. Classifications of Dam by Materials:
Earth ____. Conc. Masonary ✓. Stone Masonary ✓
Timber ____. Rockfill ____. Other ____

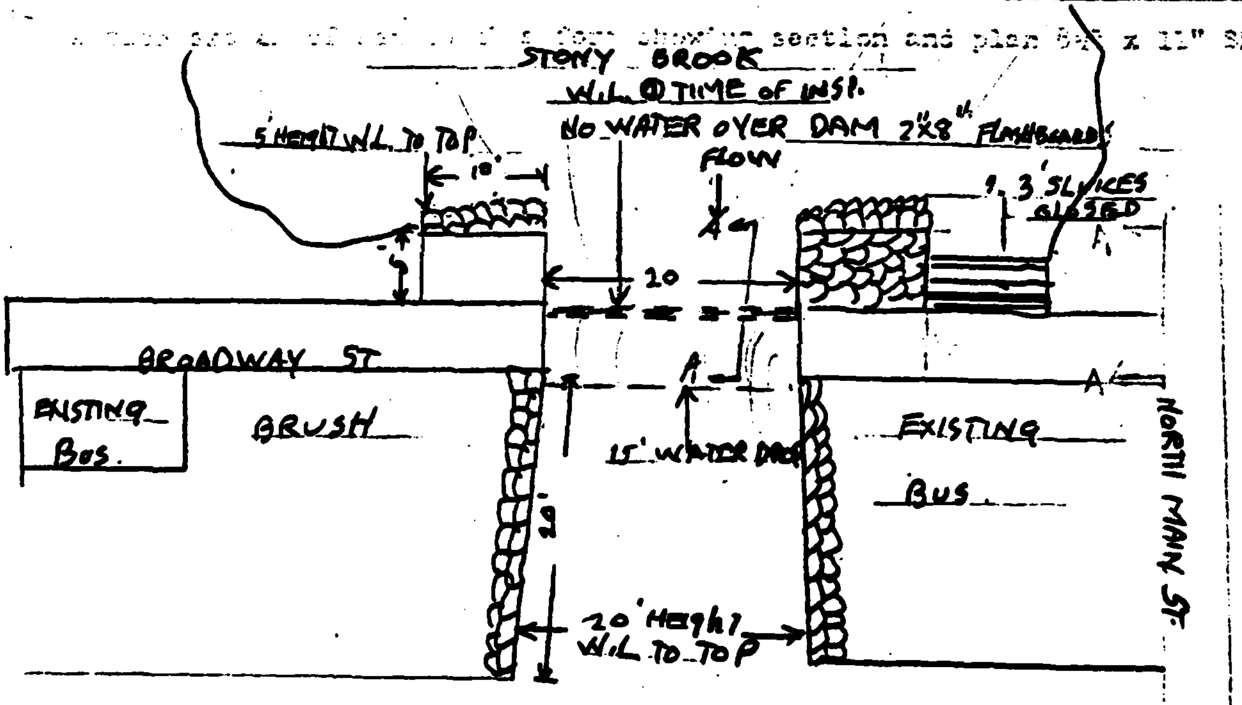
9. A. Description of present land usage downstream of dam: 80 % rural; 20 % urban
B. Is there a storage area or flood plain downstream of dam: which could accommodate the impoundment in the event of a complete dam failure no ✓. yes ____.

4-9-330-3

C. ... life and property ... event of complete failure.

... 100 EST. PER. 2 BUSINESSES
... 2 ADJ. TO DAM
... NONE
... "
... 1 OPERATING, 2000 ...
... 1 DAM 1 1/5 MILE DOWNSTREAM, WESTFORD DEPOT DAM 4-9-330-4

... showing section and plan 8½ x 11" Sheet.



PLAN VIEW

SKETCH NOT TO SCALE

4-9-330-3

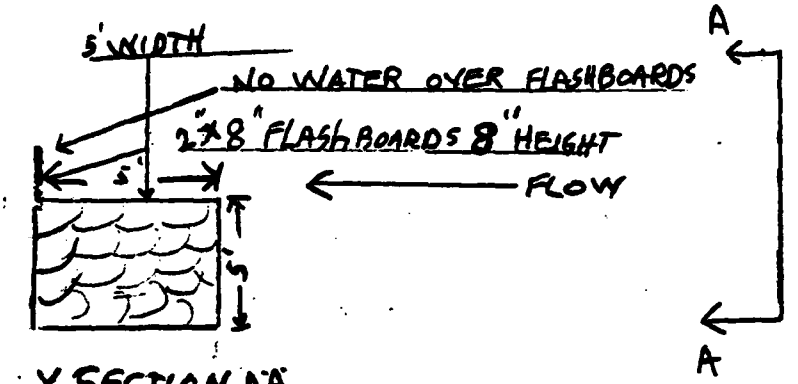
100 EST. PER 2 BUSINESSES

2 ADJ. TO DAM

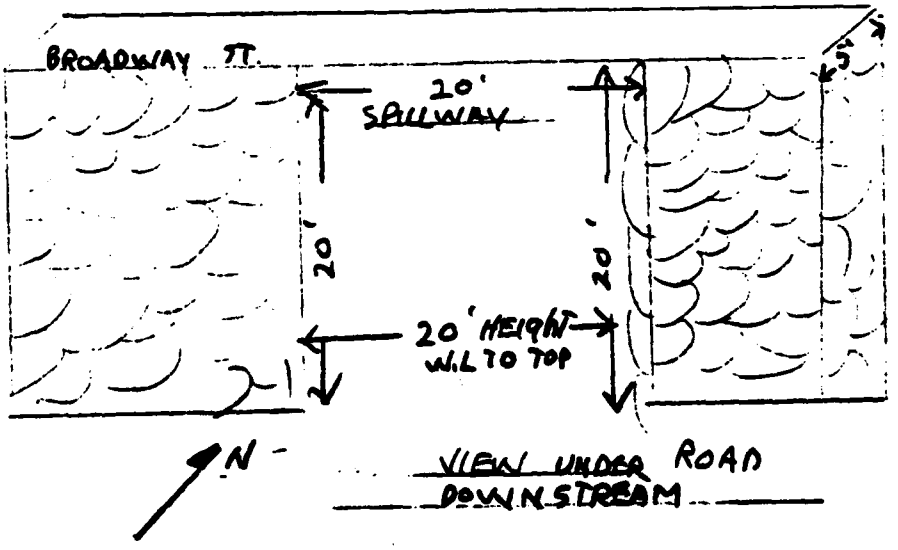
NONE

" OPERATING 2000' ELY

2 DAMS DOWNSTREAM

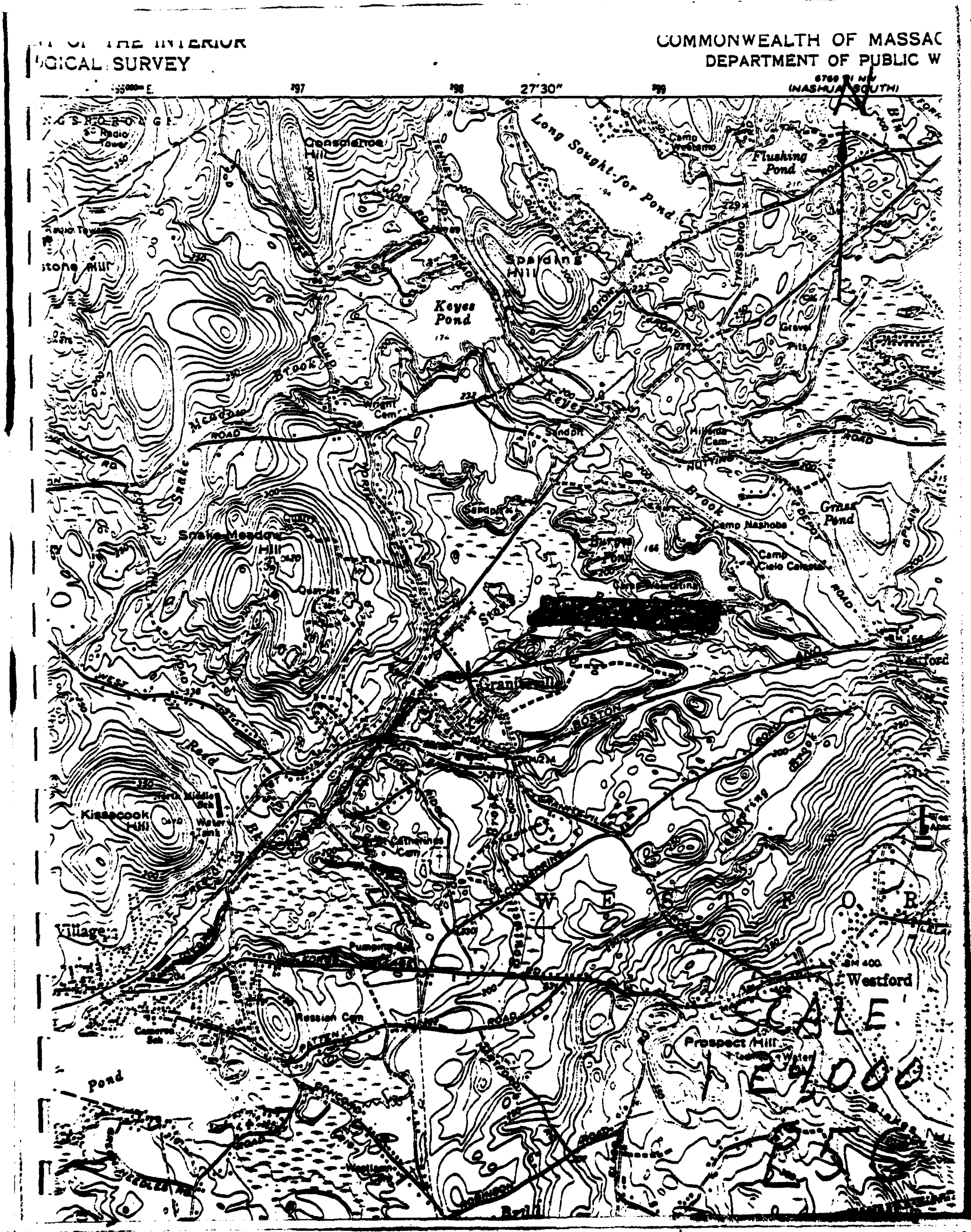


XSECTION AA



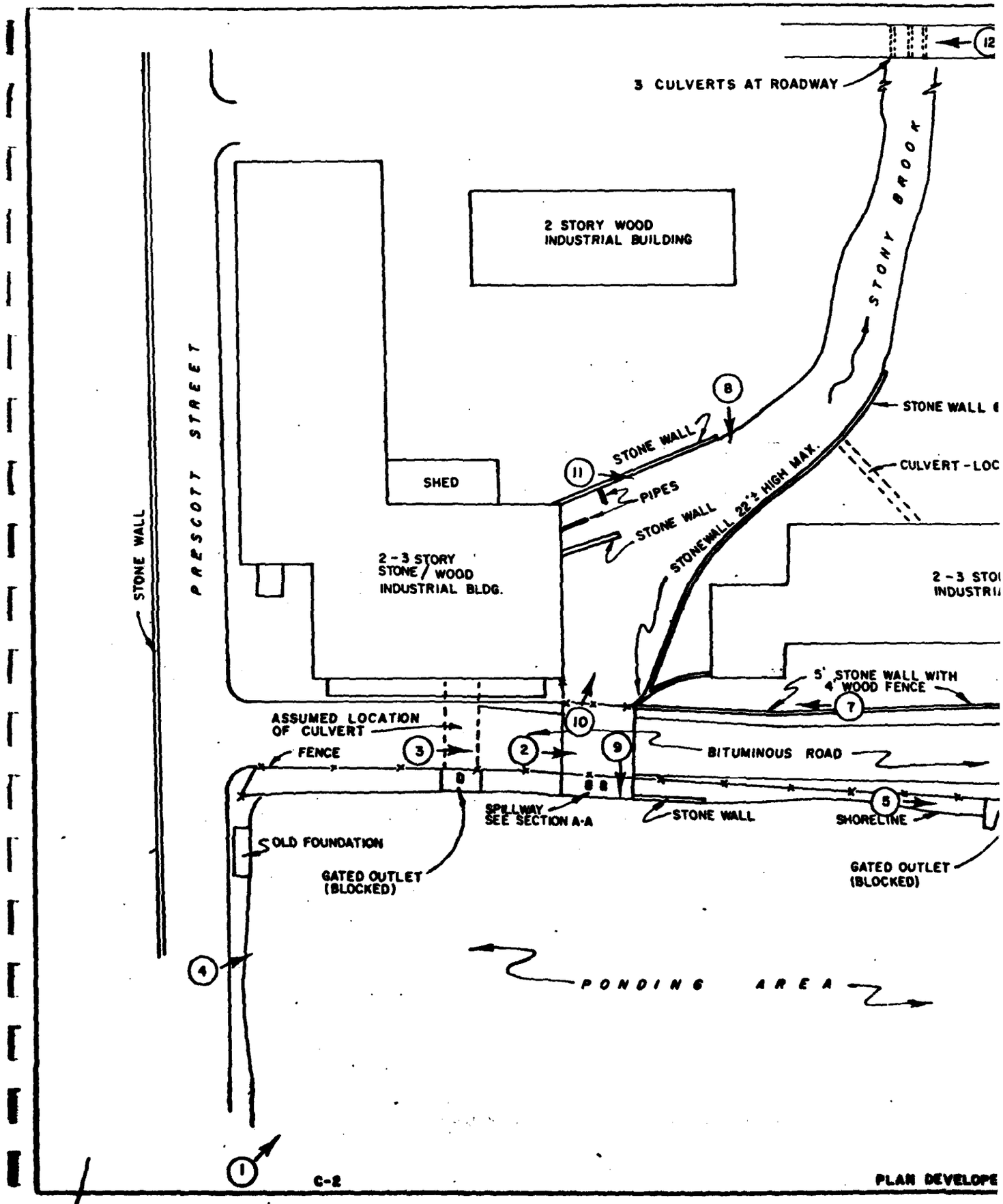
VIEW UNDER ROAD DOWNSTREAM

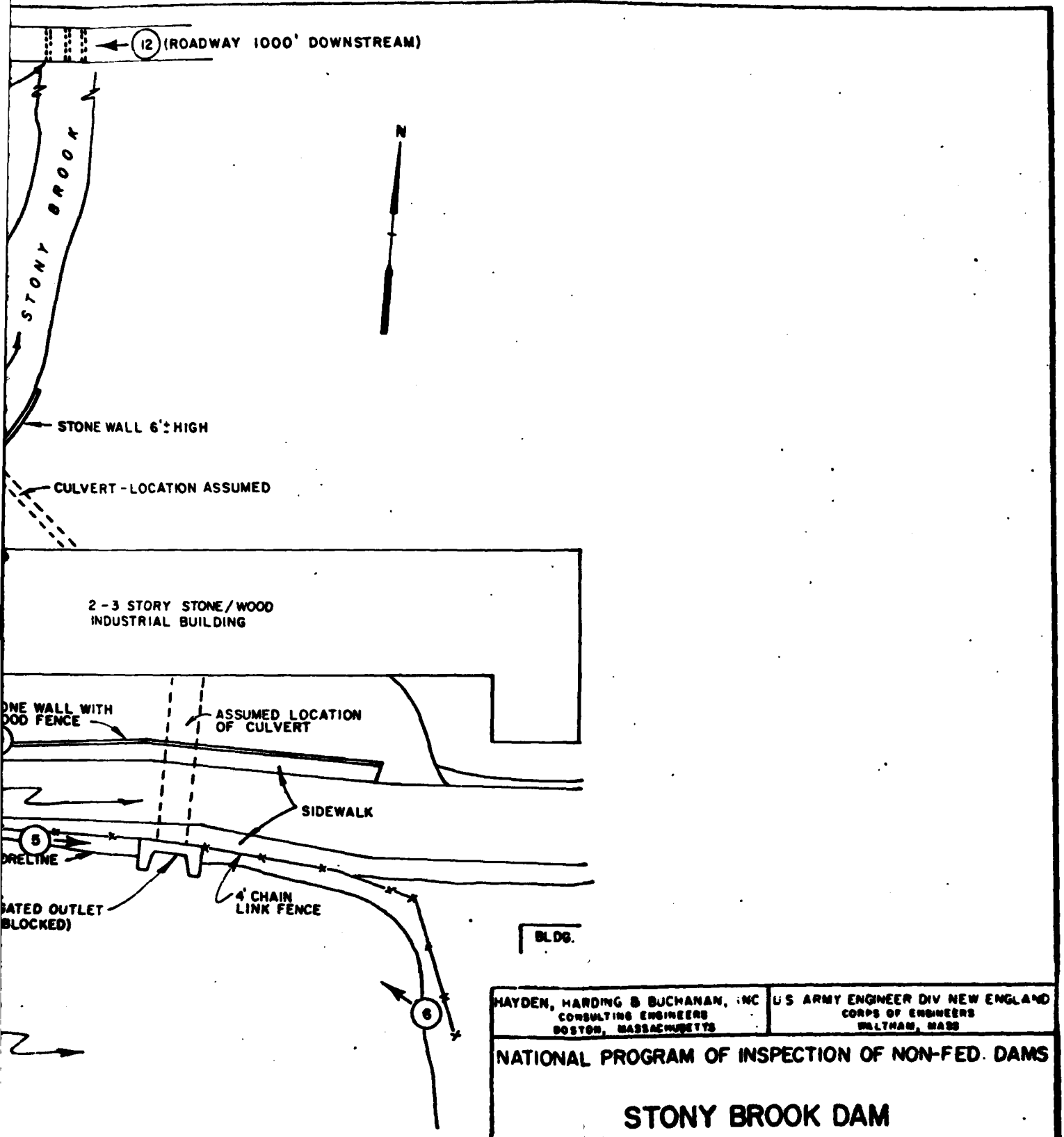
SKETCH NOT TO SCALE


COMMONWEALTH OF MASSAC
DEPARTMENT OF PUBLIC W
GICAL SURVEY
27'30"
Long Sought-for Pond
Conscience Hill
Flushing Pond
Spalding Hill
Keyes Pond
Camp Wuttamo
Gravel Pits
Meadow Brook
Snake
Wright Cem
Sandpit
Keyes
Hillside Cem
Brook
Grass Pond
Camp Nashoba
Snake Meadow Hill
Burges Pond
Camp Cielo Celeste
Westford
Graniteville
BOSTON
ROAD
Kissacook Hill
North Middle Sch
Water Tank
St Catherines Cem
W E S T F O R D
Village
Westford
Prospect Hill
Water
Cameron Sch
Pond
SCALE
1:24000

APPENDIX C

PHOTOGRAPHS


3 CULVERTS AT ROADWAY
STONY BROOK
2 STORY WOOD
INDUSTRIAL BUILDING
PRESCOTT STREET
STONE WALL
SHED
STONE WALL
PIPES
STONE WALL
STONEWALL 22'± HIGH MAX.
2 - 3 STORY
STONE / WOOD
INDUSTRIAL BLDG.
5' STONE WALL WITH
4' WOOD FENCE
ASSUMED LOCATION
OF CULVERT
FENCE
BITUMINOUS ROAD
SPILLWAY
SEE SECTION A-A
STONE WALL
SHORELINE
OLD FOUNDATION
GATED OUTLET
(BLOCKED)
GATED OUTLET
(BLOCKED)
PONDING AREA
C-2



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NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

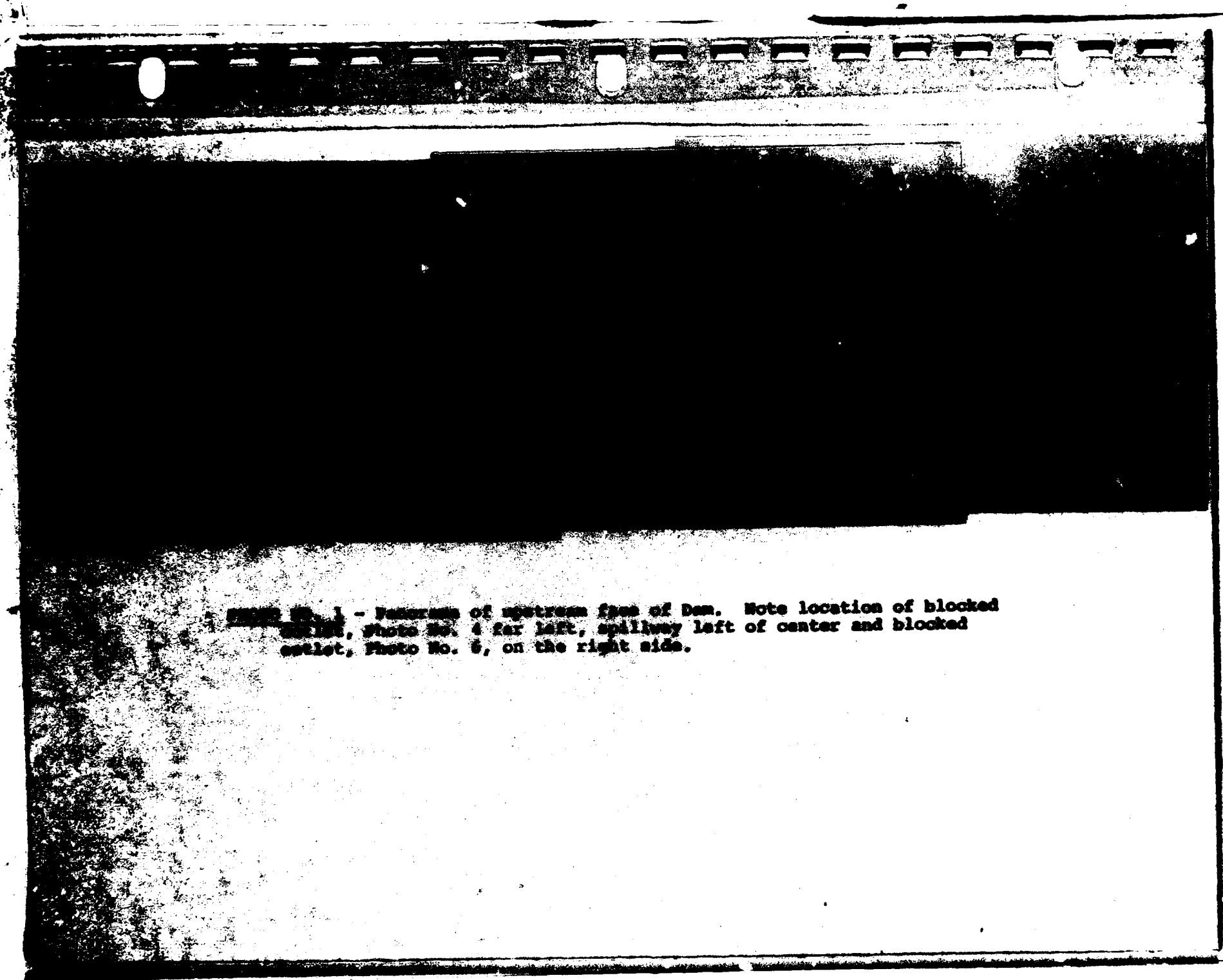
STONY BROOK DAM
PHOTO LOCATIONS

WESTFORD MASSACHUSETTS

SCALE NOT TO SCALE
DATE DECEMBER 1978

2

PLAN DEVELOPED FROM ON-SITE INSPECTION



[illegible] - Panorama of upstream face of Dam. Note location of blocked [illegible], Photo No. 4 far left, spillway left of center and blocked outlet, Photo No. 6, on the right side.

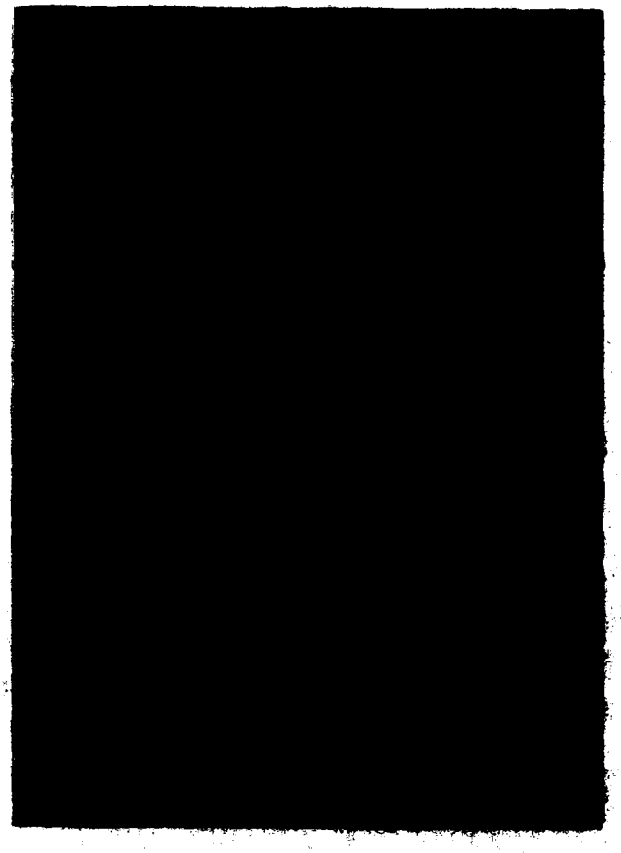
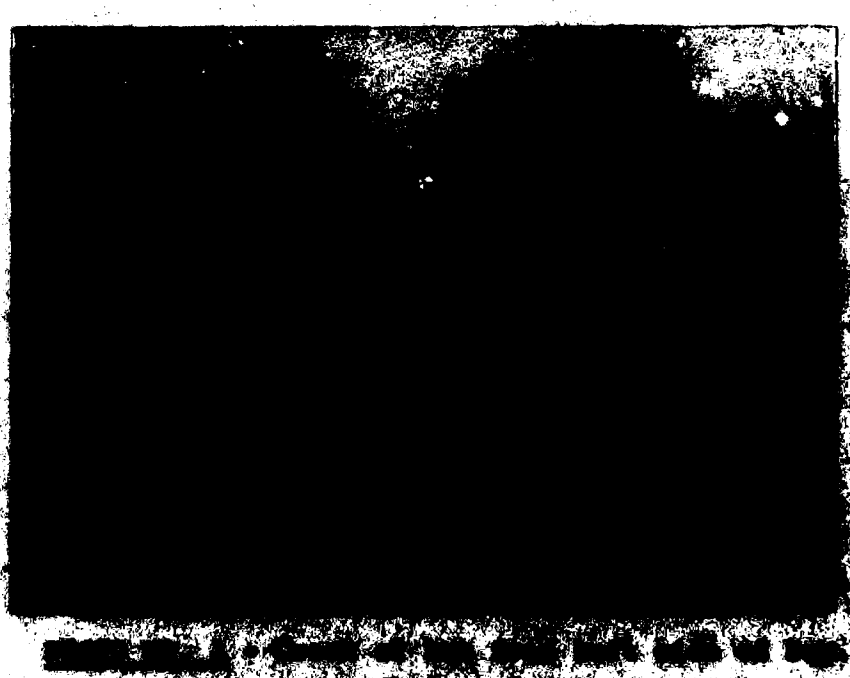


PHOTO NO. 2 - Cracks in asphalt roadway spanning over spillway.



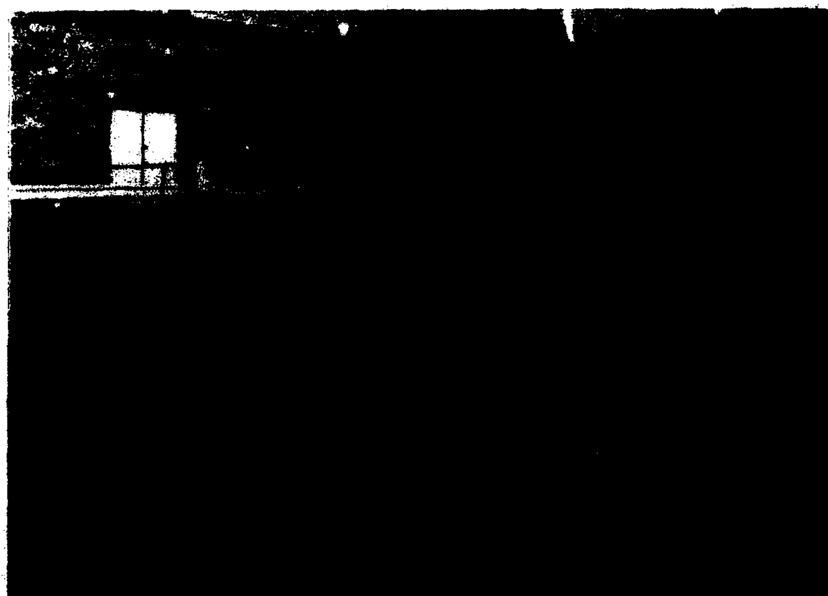


PHOTO NO. 4 - View of upstream spillway entrance and closed-off outlet on left side of Dam. The closed outlet supplied water to the mill building in the left background. Note corbels for spillway gates and steel beams at spillway entrance.

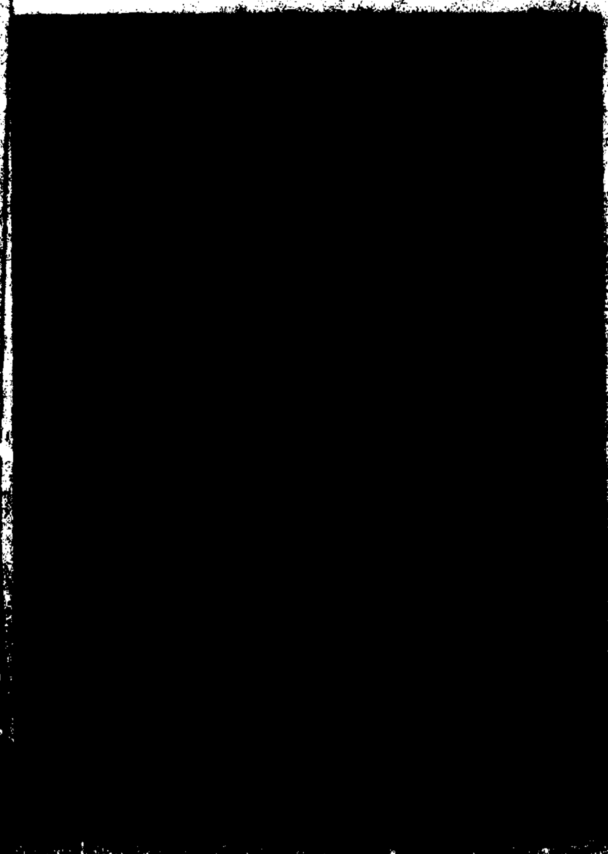


PHOTO NO. [illegible] - [illegible] See Photos Nos. [illegible].

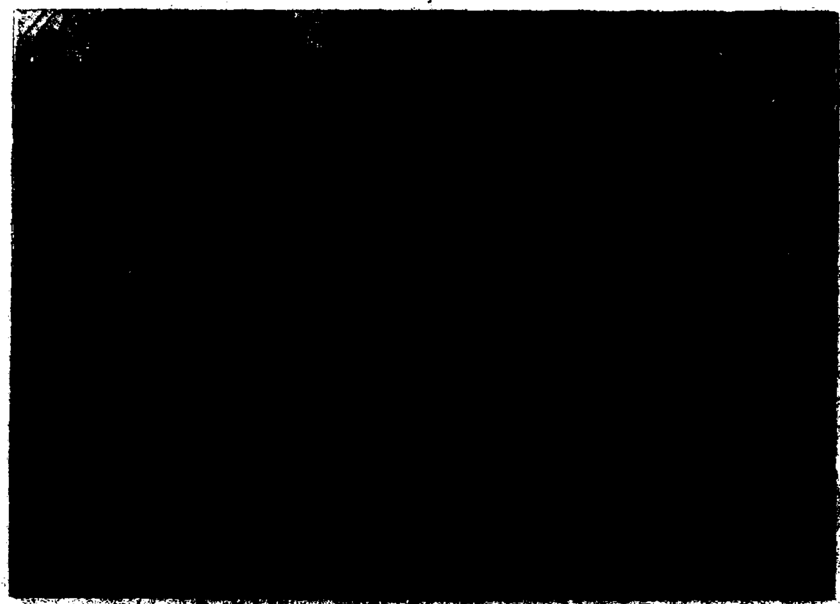


PHOTO NO. 6 - Upstream face of Dam to right of spillway from right abutment. Note closed off outlet and tree shown in Photo No. 3.

PHOTO NO. 7 - Stone masonry wall of downstream face of Dam to right of spillway. Wall leaning slightly downstream.

PHOTO NO. 2 -- View of downstream spillway channel and face of Dam. Note building on right side of Photo and masonry walls on left. Upper masonry wall about 8 ft. high extends along Dam and ends at mill building shown in Photos Nos. 1 & 3. Lower masonry wall at bottom left of Photo continues downstream as shown in Photos Nos. 10 & 11. Note trees adjacent to 8 ft. high wall.

PHOTO NO. 2 - View of Stony Brook Pond and taken from right side of Dam.

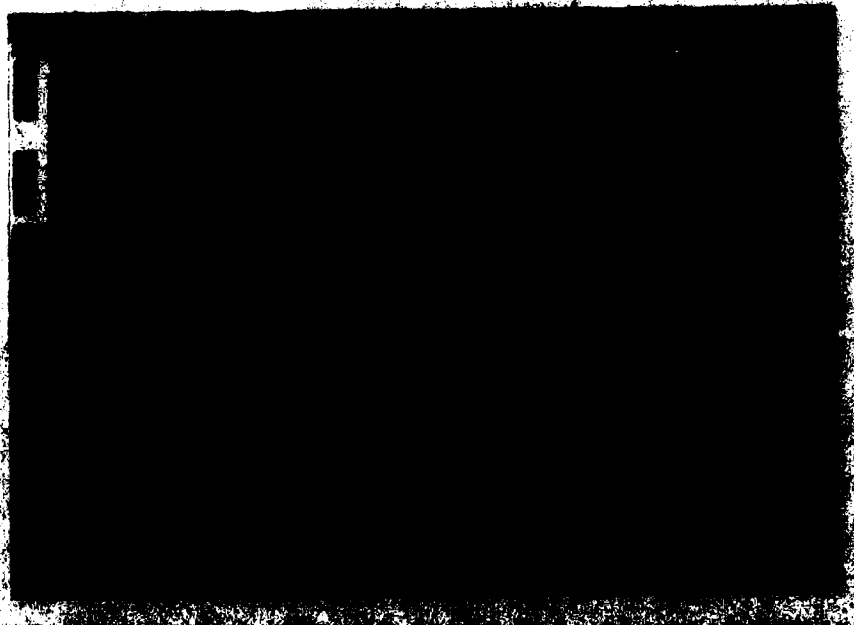


PHOTO NO. 11 - View of lower yard area at rear of mill buildings shown in Photo No. 3. Note masonry wall and stone culvert at center of the wall.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

JOB NO. 79.2061
DATE 10-26-79
BY [illegible]
CH'D BY FDD
[illegible] 1-21-80

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. D2
JOB Ldms
SUBJECT Stony Brk
CLIENT CoE

Drainage Area contributing storm runoff 10,240 acres (16 s.m.) to Stony Brook Pond. Drainage path "flat" and long with many ponds & swamps.
Height of dam 24'± feet (d.s.), 15'± (u.s.)

Storage capacity 408 a-f

Size Class of dam = small.

Hazard Potential = High (21 homes, 5 Ind.)

Test Flood = 1/2 PMF to PMF range
USE 1/2 PMF (flat-coastal)
Inflow: $Q_1 = 1/2 \times 16 \times 675 = 5{,}400^{\pm}$ cfs inflow

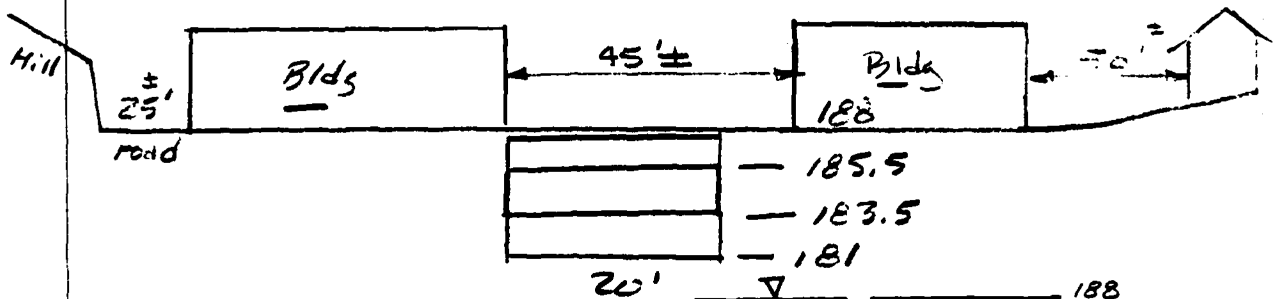
Condition	Inflow	Outflow	Spillway cfs	% outflow
Stoplogs in place	5400	4910 ±	485 ±	10 ±
Stop logs removed	5400	4910 ±	1210 ±	25 ±

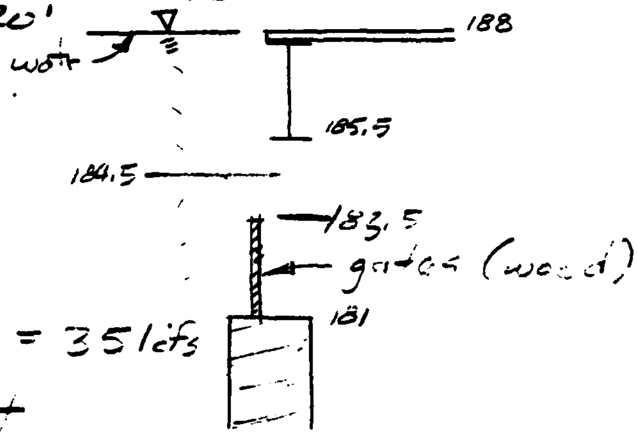
<u>Spillway Capacity</u> (plus over-flow) $Q = CLH^{3/2}$ $C = 3.22 + .44 \frac{H}{P}$

P = 2.5

Elev	D	L	C	$H^{3/2}$	Q	D	$H^{1.5}$	L	C	Q'	Q_T
184	0.5	19	3.42	.36	23						
	1.0	"	3.62	1	69						
	1.5	"	3.82	1.837	133						
	2.0	"	4.02	2.828	216						
185	2.5	"	4.22	3.953	317						
188	- .5				351						
[illegible]	5.[illegible]	Gates Hold			440	2	2.28	250	3	1710	2150
[illegible]					610						
19[illegible]					[illegible]	4	8	250	3	6000	6515
[illegible]					478	3	5.2	250	3	3900	4380

Spillway Capacity





Discharge: gates hold

5 gates = 20' × 2½ ±

$Q = Ca\sqrt{2gh}$

$= (.6)\,39^{sf}\sqrt{2 \times 32.2 \times 3.5} = 351\,cfs$

: gates washed-out

$Q = (.6)(89\,sf)\sqrt{64.4 \times 4.75} = 934^{\pm}\,cfs$ elev. 188 ±

$Q = (.6)(89)\sqrt{64.4 \times 9.5} = 1320^{\pm}\,cfs$ elev. 192.75

Dam Outflow: gates hold

$Q_{P1} = 5{,}400\ cfs$ $El_1 = 191.5$ $Stor_1 = \frac{740 \cdot 12}{16 \times 640} = .87$

$Q_{P2} = 5400\left(1 - \frac{0.87}{9.5}\right) = 4910 \pm$

$El_2 = 191.3$ $Stor_2 = \frac{726(12)}{16 \times 640} = 0.85$ $Stor_{ave} = 0.86$

$Q_{P3} = 5{,}400\left(1 - \frac{.86}{9.5}\right) = 4910 \pm$

$El_3 = 191.3 \pm$ roadway overtopped

JOB NO. 79.206.1
DATE 10-25-79
BY MA
CH'D BY FDD
rev 1-21-80

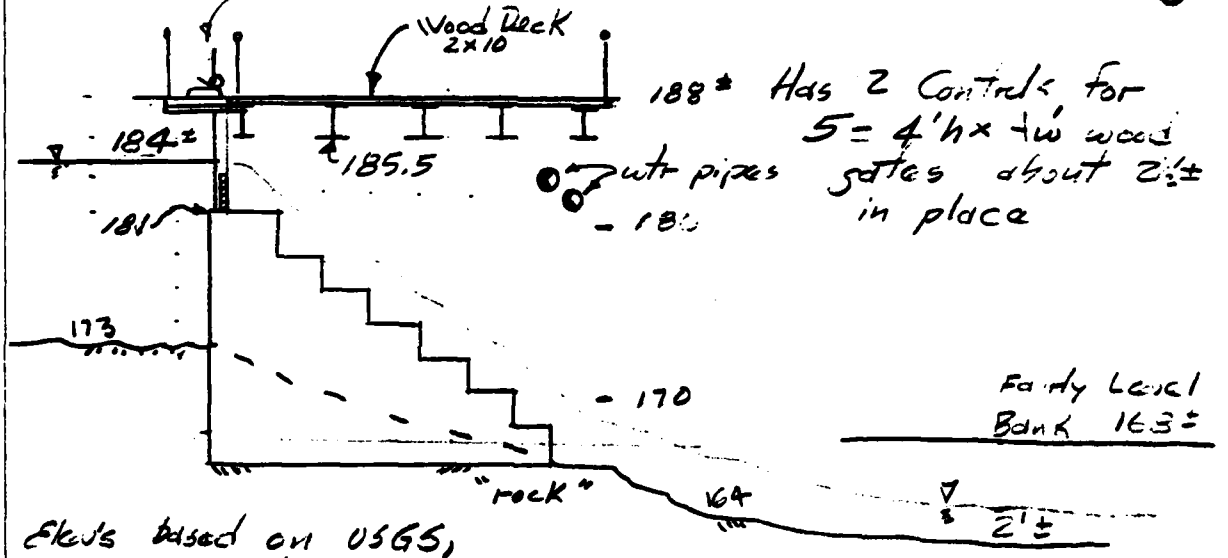
HH&B HAYDEN, HARDING & BUCHANAN, INC
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO D4
JOB Dams
SUBJECT Stony Brk
CLIENT COE

Inflow to Stony Brook Pond

Upstream R.R. Bridges (2) don't retard flow - large culvert openings

Controls for gates



Elevs based on USGS, approximate only

Storage Capacity

Elev	Area	Area Ave	D	Stor	Accum Stor	
170	2.				—	
175	28	15.	5.	75.	75.	(silted)
181	30	29.	6.	174	250	175
183.5	32	31.	2.5	78	328	253
185.5	35	335.	2.	67.	395	
188	35	35.	2.5.	88	483	408
190	125	80.	2.	160.	643	
192	148	114	2	228	871	800
196.3	139	132	1.2	158	801	726
200	292	202				

JOB NO. 79.206
DATE 10-12-79
BY
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. D5
JOB Dams
SUBJECT Stony Brk
CLIENT COE

Assuming Dam Fails
water at elev 188.0

$Q_F = \frac{8}{27} \times 30.' \times (32.2)^{1/2} \times (24.)^{1.5}$ wet weather

$= 5930.^{*}$ cfs outflow

downstream hazard already exists due to flooding from spillway discharge of either 35c or 934 cfs 2' or 5' Flood depth.

* dry weather dam failure will produce sudden release w/o dis. prior flooding hazard. water at elev. 184±.

$Q_b = \frac{8}{27} \times 30' \times (32.2)^{1/2} \times (20.)^{1.5} = 4,511.$ cfs

Continuation of Pg 5 stage-discharge chart.

8'	875	5205	3.3	0.35	1.16	6010
9'	925	6100	3.5	"	1.23	7473.

Sta 10+00

$Q_{P_1} = 5930$ $d_1 = 8'$ $Str_1 = 70$ of (60)

$Q_{P_2} = 5930 \left(1 - \frac{70}{408}\right) = 4914$ $d_2 = 7'$ $St_2 = 60$ of 7425 = 6 sta

$Q_{P_3} = 5930 \left(1 - \frac{65}{408}\right) = 5000 \pm$ cfs

Elev = 177 ±

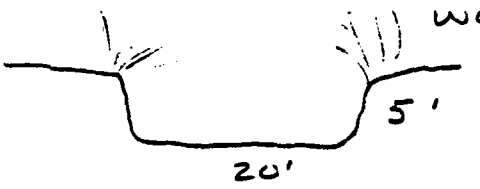
Wet Weather flow ≈ 5000 cfs d ≈ 7' ±
dry Weather flow ≈ 3500 d ≈ 6.25' ±

JOB NO. F.706.1
DATE 10-26-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON MASSACHUSETTS

SHEET NO. D6
JOB Dams
SUBJECT Stony Brook
CLIENT COE

Sta 10+00 (Graniteville Road)

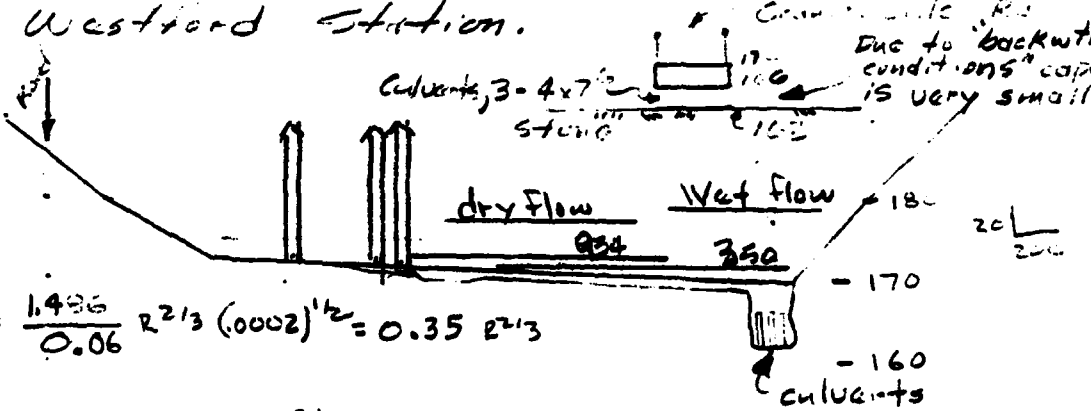


weeds & trees - heavy growth

$V = \frac{1.486}{.06} R^{2/3} (0.0002)^{1/2} = 0.35 R^{2/3}$

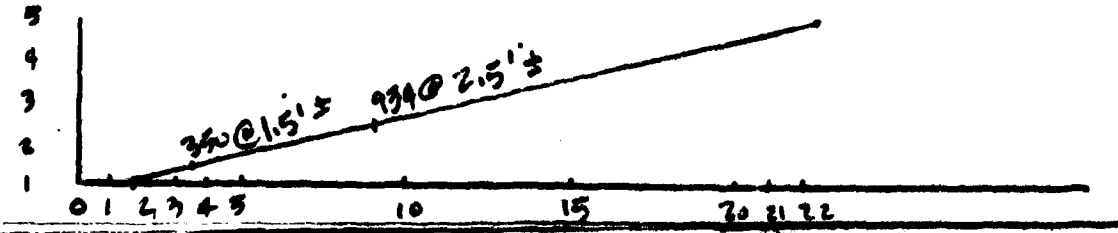
D	wp	A	$R^{2/3}$	F	V	Q
5.	30.	100.	2.24.	.35.	.78.	78± cfs channel cap.

Capacity of stony brook is not large, slope below Graniteville Road culverts is 0.0002 ft. - we have a flat swamp area for at least 10,000' to Westford Station.



$V = \frac{1.486}{0.06} R^{2/3} (.0002)^{1/2} = 0.35 R^{2/3}$

D	wp	A	$R^{2/3}$	F	V	Q	Q_T
1	310.	302	.98.	.35	.343.	103.	180.
5	800.	2700	2.26.	"	.79.	2136.	2200.
6	825.	3500.	2.63	"	.92	3221	3300
7	845.	9345.	3.	"	1.05.	4563.	4640.

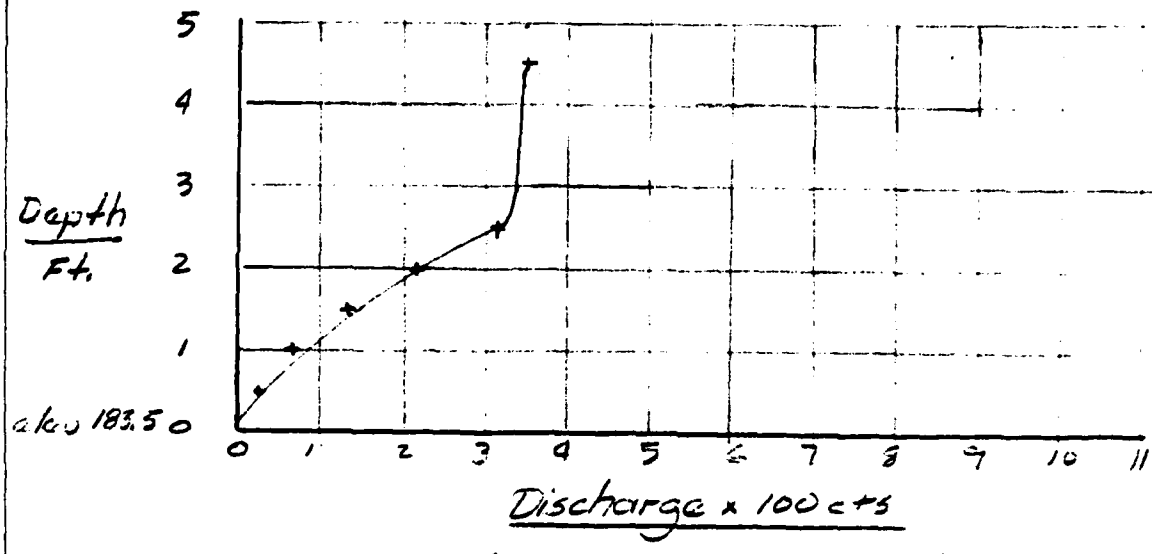


JOB NO. 76.306.1
DATE 6-24-76
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

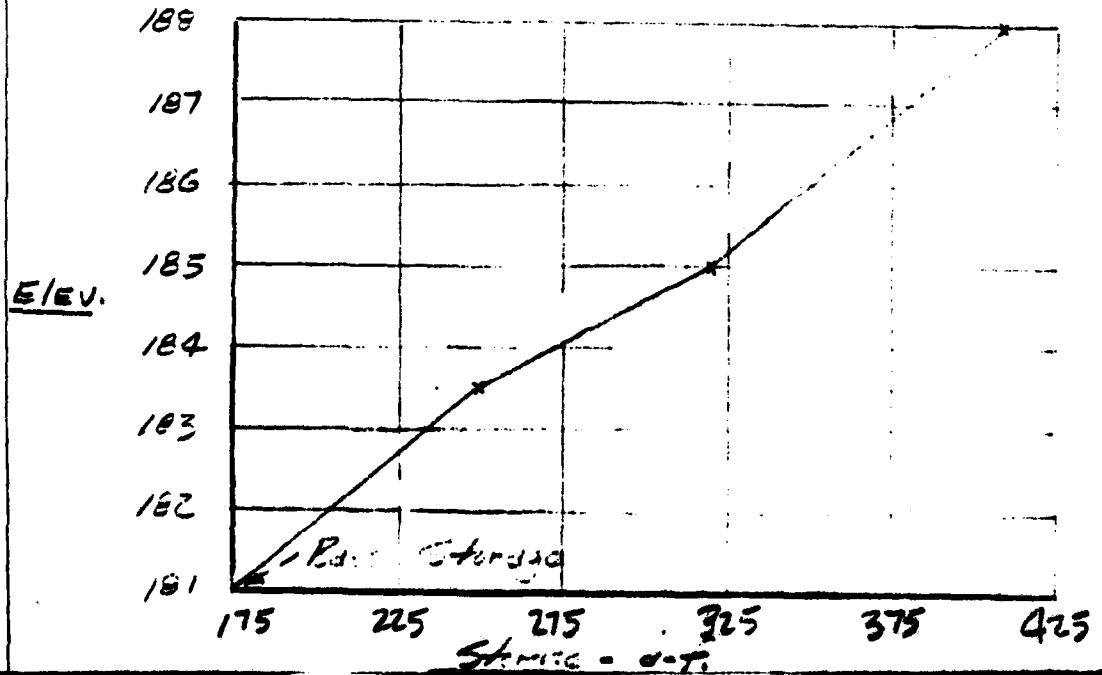
SHEET NO D7
JOB Dams
SUBJECT Stony Brook
CLIENT C.E

Stage Discharge



(Gates Do Not Fail)
Spillway Only

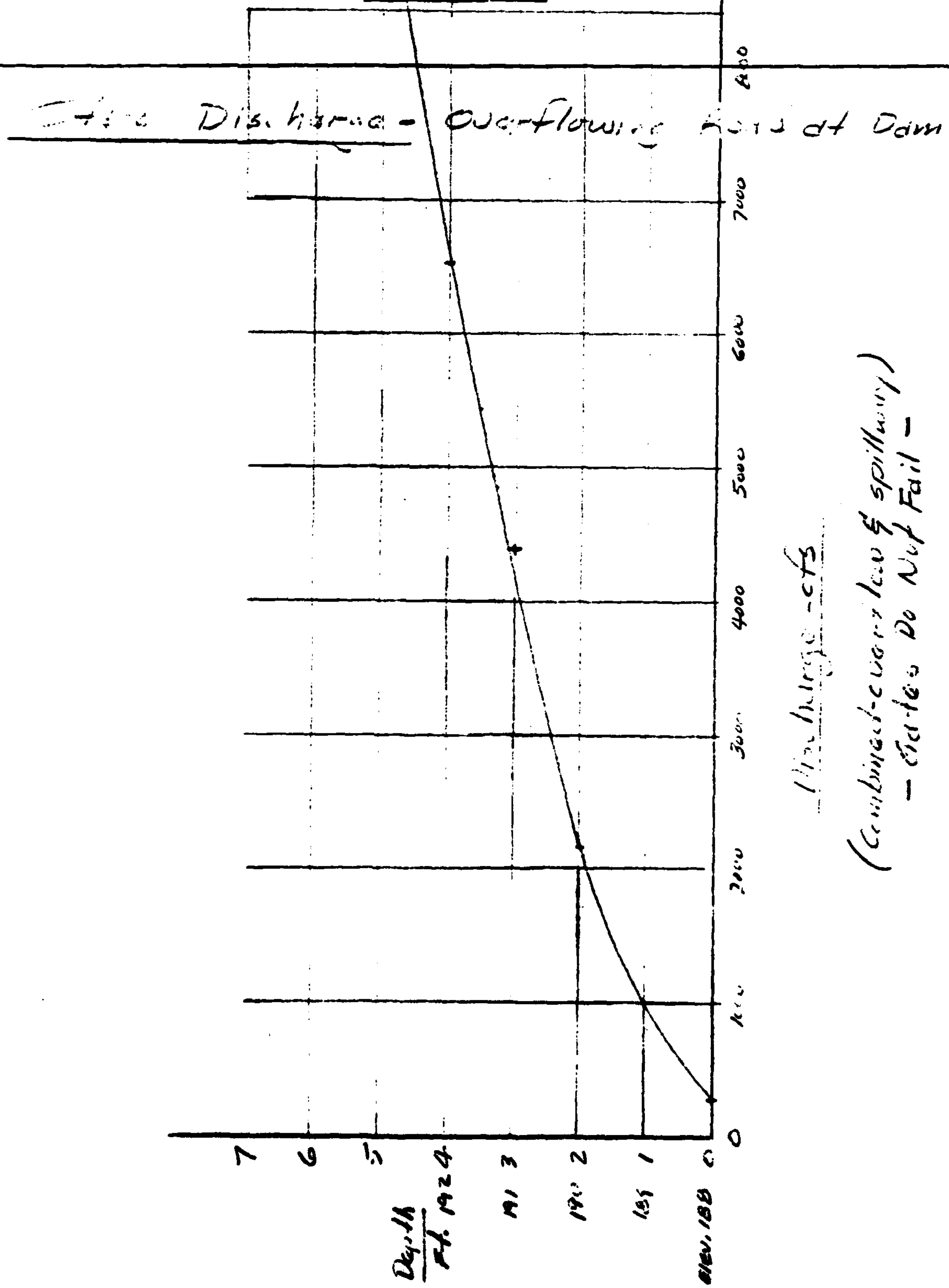
Stage Storage



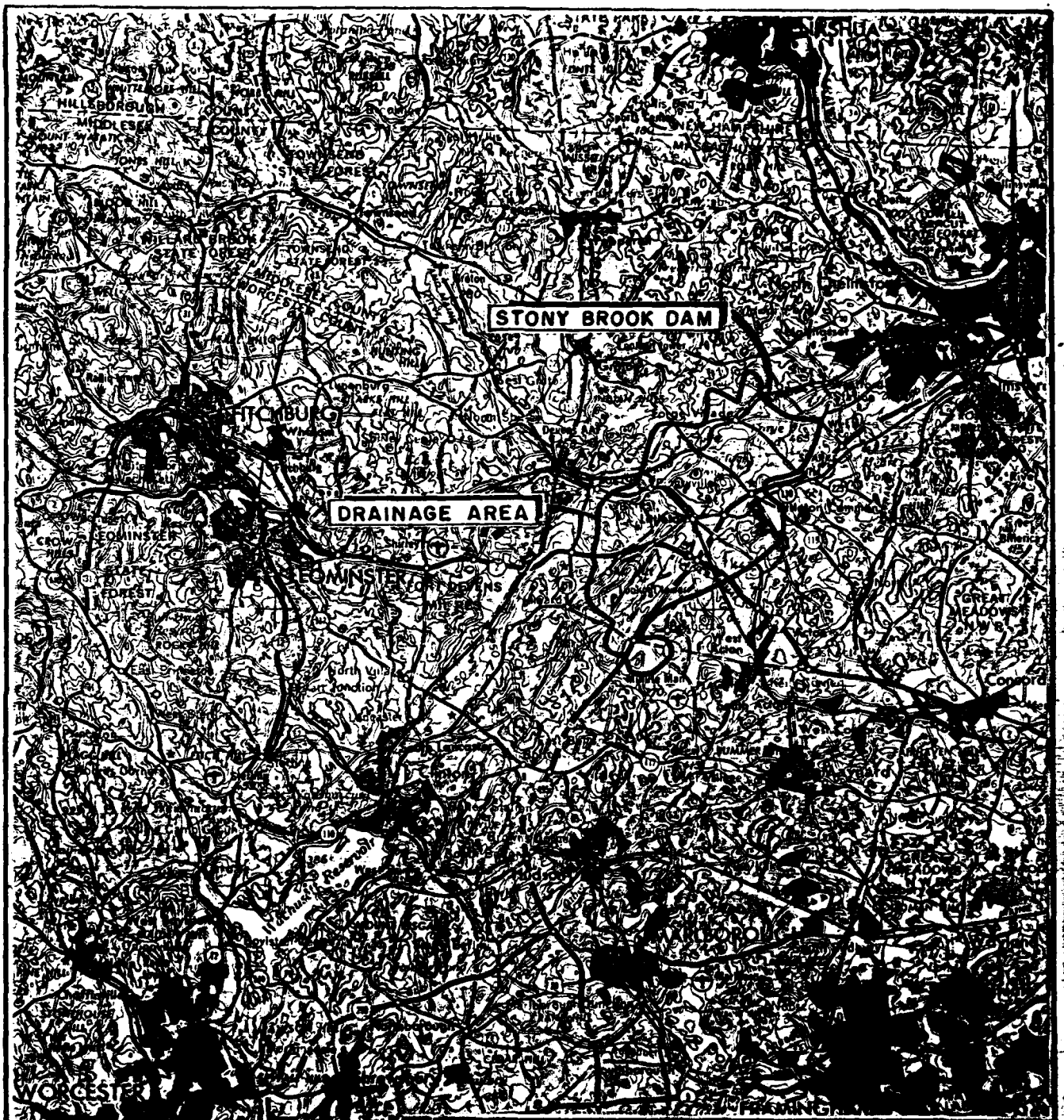
JOB NO. 79-[illegible]
DATE [illegible]
BY [illegible]
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. D8
JOB [illegible]
SUBJECT [illegible]
CLIENT [illegible]




DAM FAILURE IMPACT AREA
STONY BROOK DAM
STONY BROOK POND
Camp Nashoba
Camp Cielo Celeste
Westford Sta
Westford
Sandpit
Pumping
BOSTON
ROAD
ROBINSON
HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
STONY BROOK DAM
DAM FAILURE IMPACT MAP
WESTFORD


STONY BROOK DAM
DRAINAGE AREA
FITCHBURG
LEOMINSTER
WORCESTER
HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
STONY BROOK DAM
DRAINAGE AREA MAP

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE CODE	COUNTY CODE	CONGR. DIST. CODE	OTHER STATE CODE	OTHER COUNTY CODE	OTHER CONGR. DIST. CODE	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
MA	132	NED	MA	017	05				STONY BROOK DAM	4235.8	7128.0	28	DEC	79

POPULAR NAME	NAME OF IMPOUNDMENT
	STONY BROOK

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	06	STONY BROOK	WESTFORD	0	10400

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
REPGOT	1870	R	24	24	408	253	NED	N	N	N	N	

REMARKS
21 STONE AND CONCRETE 22 APPROX.

GATES	SPILLWAY LENGTH (FT.)	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROJECTED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	350	U	20	1320												

OWNER	ENGINEERING BY	CONSTRUCTION BY
C.G. BARGENTS & SONS	UNKNOWN	UNKNOWN

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
HAYDEN, HARDING & BUCHANAN, INC.	24	OCT	79	P.L. 92-367

REMARKS


DATE
ILMED
-8