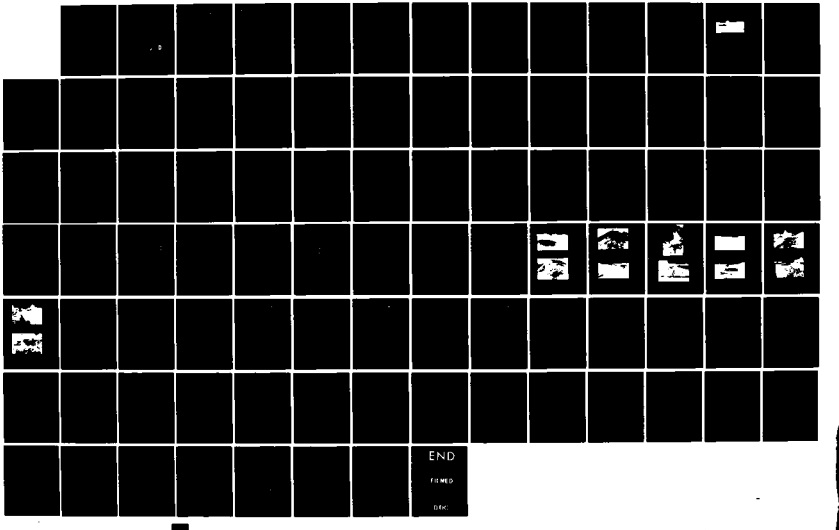
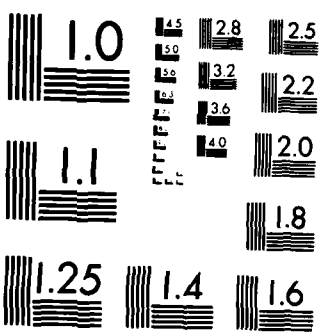
AD-A154 526 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS STONY BROOK RESERVOIR.. (U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV JUN 79 1/1

UNCLASSIFIED F/G 13/13 NL





CHARLES RIVER BASIN
WESTON, MASSACHUSETTS

STONY BROOK RESERVOIR DAM
MA 00293

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

JUNE 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: MA 00293	2. GOVT ACCESSION NO.: A154526
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): Stony Brook Reservoir 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: June 1979 13. NUMBER OF PAGES: 62
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,

Charles River Basin
Weston, Massachusetts
Stony Brook

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

This dam is a 830 foot long, 32 foot high earth dam with a 40 foot wide stone masonry spillway near its right. The dam is in fair condition. The size of the dam is intermediate and the hazard classification is high. Also various remedial measures should be taken by the owner.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

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

REPLY TO
ATTENTION OF:
NEDED

SEP 24 1979

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

Dear Governor King:

I am forwarding to you a copy of the Stony Brook Reservoir 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, City of Cambridge, Massachusetts.

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,

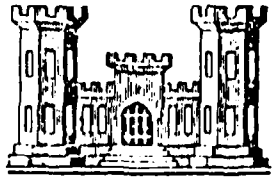
MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

CHARLES RIVER BASIN
WESTON, MASSACHUSETTS

STONY BROOK RESERVOIR DAM
MA 00293

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



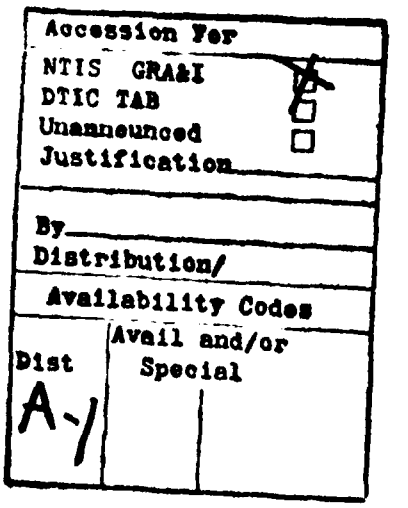
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JUNE 1979

STONY BROOK RESERVOIR DAM
MA 00293

CHARLES RIVER BASIN
WESTON, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.: MA 00293
Name of Dam: STONY BROOK RESERVOIR DAM
Town: WESTON AND WALTHAM
County and State: MIDDLESEX COUNTY, MA
Stream: STONY BROOK
Date of Inspection: 8 NOVEMBER 1978

BRIEF ASSESSMENT

Stony Brook Reservoir Dam is a 830 foot long, 32 foot high earth dam with a 40 foot wide stone masonry spillway near its right abutment. An earth dike approximately 400 feet long extends from the dam along the west side of the reservoir. Water supply intakes and a low flow outlet are controlled from the gatehouse near the right end of the dam.

The dam is in fair condition. There is evidence of former sloughing and erosion at the downstream toe of the embankment and local erosion and displacement of riprap at the upstream face. Overtopping of the dam was indicated when the spillway was checked against the test flood.

Based on the size, intermediate, and hazard classification, high in accordance with the Corps of Engineers Guidelines, the spillway test flood is the Probable Maximum Flood (PMF). The test flood peak outflow was estimated to be 8,400 cfs and would result in overtopping the dam by approximately 2.0 feet. Hydraulic analysis indicates that the spillway, with flashboards removed, will only pass 1,850 cfs or 22 percent of the test flood. However, with the wasteway open, the combined capacity of the spillway and wasteway is 3,280 cfs or 39 percent of the PMF. The opening of the wasteway will reduce the overtopping to 1.7 feet.

Recommended additional investigations by the Owner include a detailed hydrologic-hydraulic study of spillway capacity, an investigation of the seismic stability of the dam and an investigation of potential seepage at the downstream slope. Recommended remedial measures include the cutting of brush and weeds on the dam, spillway and low flow discharge channel, the repair of local eroded areas and displaced riprap at the upstream face of the dam, the establishment of vegetation on bare areas, the repointing of joints at the spillway and gatehouse, the repair of an inoperative intake, the development of a formal maintenance program, operational procedure, emergency procedures plan and warning system and the instituting of a program of annual technical inspections. The recommendations and remedial measures should be undertaken by the Owner within one year of receipt of the report.

CAMP DRESSER & McKEE INC.

Roger H. Wood

Roger H. Wood
Vice President

This Phase I Inspection Report on Stony Brook Reservoir 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.

Joseph W. Finegan

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

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

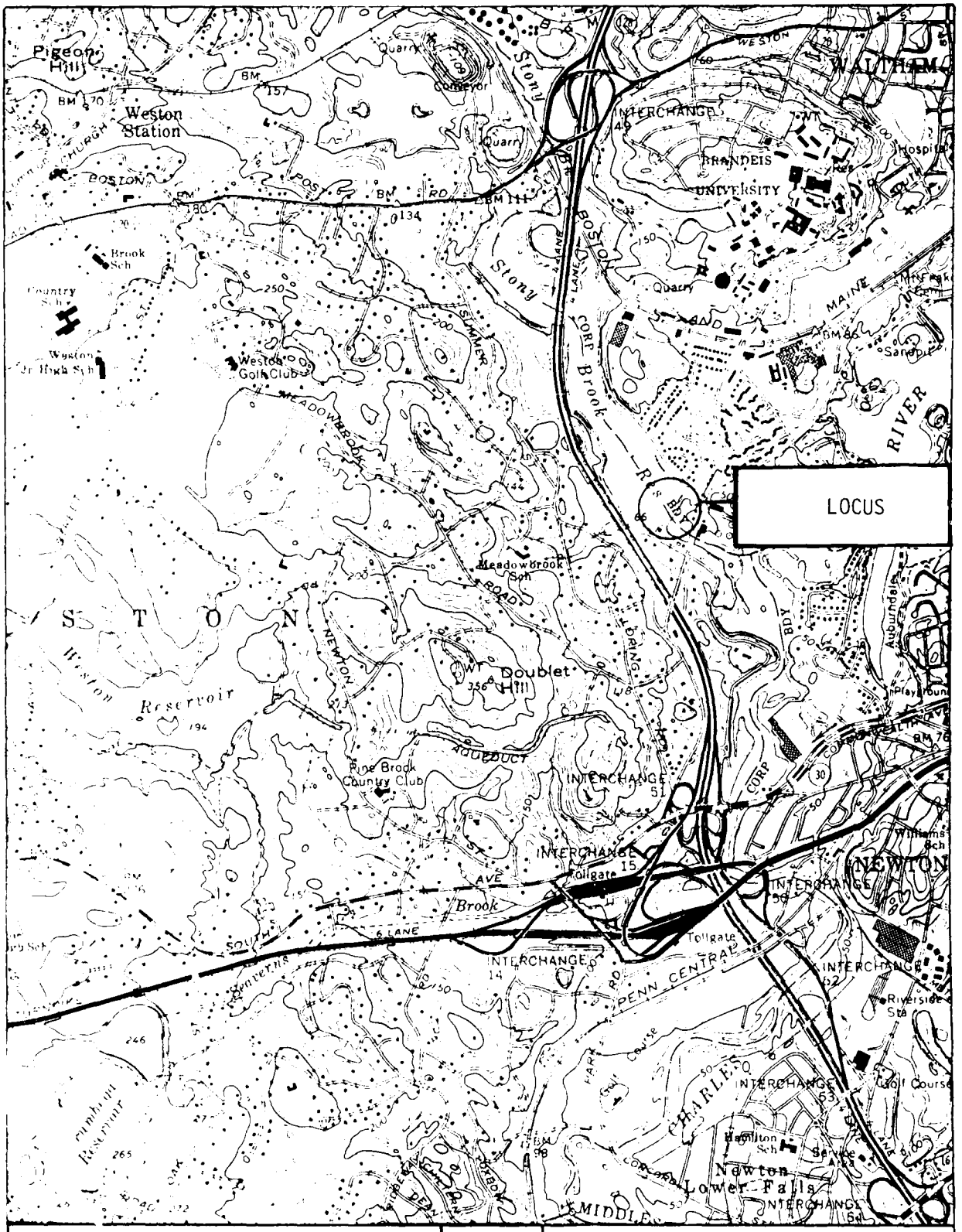
Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), or a fraction thereof. Because of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

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

APPENDIXES

1. OVERVIEW OF DAM AND SPILLWAY FROM RIGHT ABUTMENT. (MARCH 1979)



DAM STONY BROOK RESERVOIR IDENTIFICATION NO. MA 00293		LOCATION MAP USGS QUADRANGLE NATICK, MASS. APPROX. SCALE: 1" = 2000'

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation - There was no visible evidence of dam, spillway or dike instability during the site examination on 8 November 1978. The observed eroded areas at the crest and downstream toe of the dam showed no evidence of active soil movement, and are not considered to pose an immediate hazard to the stability of the embankments. However, it should be noted that the reservoir level was about 18 feet below the top of the embankment at the time of the observations, with the result that the forces tending to cause instability were much lower than design levels.

b. Design and Construction - There are neither complete design drawings nor construction data which would detail the embankment cross sections or the physical properties of the materials in the embankments. Thus, theoretical analyses of the structural stability of the embankments and spillway are not possible.

The riprapped upstream slope is relatively steep, but the dam and dike embankments have had a long period of service. The spillway is a relatively low structure. In the absence of seepage or erosion problems, the embankments would be expected to be adequately stable under static loading conditions. In the absence of observed indications of movement of portions of the spillway, it would also be expected to be adequately stable under static loading conditions.

c. Operating Records - No operating records other than inspection reports by the State and records of reservoir water levels were located.

d. Post-Construction Changes - Without complete detailed design or "as-built" drawings the extent of post-construction changes to the dam and dike embankments is not known.

e. Seismic Stability - Stony Brook Reservoir Dam is located in Seismic Zone 3. Pertinent data needed for a theoretical seismic stability analysis of the embankments and spillway are not available. Therefore, the stability of the structures during an earthquake is unknown.

Approximately 6 residential structures are located within this area, as shown on the Dam Failure Impact Area Map presented in Appendix D, which would experience considerable water depths. There is no residential development between South Street and the confluence of Stony Brook with the Charles River, which would be flooded by a failure of the dam. The potential loss of life would be high and accordingly this dam is classified as having a "high" hazard potential. Considerable overland flow will occur to the left of the South Street Culvert.

d. Visual Observation - At the time of inspection on November 8, 1978, the water surface elevation for the Stony Brook Reservoir was substantially below the spillway crest elevation. The spillway and downstream channel appear to be in good hydraulic condition. Flashboards were in place, raising the spillway crest elevation from 69.8 to 72.2. Present Water Department practice is to remove the flashboards in late fall and reinstall them in the spring (March 1 to April 1) as soon as the runoff from snowpack and spring flows has occurred.

e. Test Flood Analysis - Based upon Corps of Engineers Guidelines, the recommended test flood for the size (intermediate) and hazard potential (high) is a full PMF (Probable Maximum Flood). The PMF was checked using the Corps of Engineers Guideline curves for "Estimating Maximum Probable Discharges" in the Phase I, Dam Safety Investigations. The watershed was determined to be very flat. Approximately 30 percent of the 23.6 sq. mi. drainage area is tributary to Hobbs Brook Reservoir.

Flow from the Hobbs Brook watershed was then routed through Hobbs Brook Reservoir and the peak inflow rate of 2,780 cfs reduced to a maximum outflow of 2,290 cfs. This outflow hydrograph was then combined with a comparable storm hydrograph for the Stony Brook portion of the total watershed and this summation hydrograph routed through Stony Brook Reservoir. The routing indicated that there is virtually no reduction of the peak inflow rate of 8,400 cfs into Stony Brook Reservoir and as a result, water level in the reservoir will rise to Elev. 77.7, thus overtopping the dam by 1.7 ft.

An analysis was also conducted to determine the impact of the test flood with the wasteway tunnel assumed fully open as an auxiliary spillway. It was found that the maximum water level in the reservoir would be lowered 0.3 ft. while the duration that the dam would be overtopped would decrease from more than 50 hours to about 40 hours.

f. Dam Failure Analysis - Based on Corps of Engineers Guidelines for Estimating Dam Failure hydrographs and assuming that the breach width would be 40 percent of the dam with the water level at the top of the dam (elev. 76.0), the failure would result in a peak outflow of 74,900 cfs. This flow will result in considerable flooding downstream, especially between the dam and South Street, approximately 450 feet downstream. Ground elevations in parts of this area are below El. 50. Due to constrictions caused by South Street, the estimated water surface at South Street prior to failure of the dam is elevation 53. This assumes a full spillway discharge wtih no flashboards as well as full discharge through the wasteway tunnel. Following the assumed dam failure, the water level at South Street will approach elev. 61, an increase in flooding depths of approximately 8 feet.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General - The Stony Brook Reservoir Dam is located on Stony Brook on the boundary between the Town of Weston and the City of Waltham. The dam is an earth fill structure having a maximum height of approximately 32 feet and a total length of approximately 890 feet. The spillway has a maximum width of 40 feet and is approximately 26 feet above the downstream stream bed. The dam creates an impoundment of approximately 57 acres and an estimated total storage capacity of 1,060 acre-feet at a spillway crest elevation of 69.8. The pool at the top of dam (approx. elev. 76.0) comprises approximately 62 acres and an estimated total storage capacity of 1,530 acre-feet.

b. Design Data - No hydraulic/hydrologic design data were located for this dam. All hydraulic and hydrologic criteria used in this report were developed by utilizing the USGS quadrangle maps, flood records, and other data gathered for this investigation.

c. Experience Data - There is no evidence that any severe flooding has occurred at the Stony Brook Reservoir Dam. The highest flood flow on record according to the City of Cambridge is the August 1955 flood. During this period the water level rose from elev. 65.96 on August 17 to elev. 73.56 on August 21. This elevation is approximately 4 feet above the spillway crest. However, flashboards were in place and resulted in a higher water level than would have otherwise been recorded. Actual flow rates were not obtainable. During a brief period, the water level in the reservoir was kept at a higher level than at present, and high wave action caused a slight scour at one location. The water level was lowered and no serious overtopping occurred.

The highest water level ever observed at the dam occurred during the March 17-19, 1968 storm when a small section of the embankment about 15-20 ft. in length just east of the gatehouse was topped by water flowing 4-6 inches deep over this slightly lower section, despite the use of sandbags during the peak levels of the flood. It is not known what depth of flashboards, if any, were in place during this storm, but the wasteway tunnel reportedly was not used as an auxiliary spillway in an attempt to lower the water level.

During late January, 1979 two storms occurred (Jan. 21st and Jan. 25th) which caused the water level in the reservoir to rise to spillway level and begin spilling over the concrete crest. Operational procedure has resulted in the flashboards having been removed in late fall and included the operation of the tunnel wasteway to a partially open position, thereby minimizing the duration or period that spillage occurred at the dam.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures - Although there is an informal routine for the operation of the dam, there is no written procedure. Since 1978, the procedure has been to remove the flashboards in late fall and to replace same in the spring after melting of the snowpack and high water levels associated there with have passed. The wasteway tunnel is also used as necessary to provide additional spillway or release capacity during periods of high water when flow over spillway exceeds 2-3 ft.

4.2 Maintenance of Dam - The dam and dike embankments appear to have received routine maintenance in the past, although the presence of stumps, uncut brush, and eroded areas indicates that the maintenance is not up to date.

4.3 Maintenance of Operating Facilities - The maintenance of the operating facilities is performed primarily on a demand basis. There is no written formal procedure established for the maintenance of the operating facilities. The operating facilities are primarily for the transmission of water to the City of Cambridge and are operated as a part of performing this task.

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

4.5 Evaluation - This dam is kept under observation by City employees. In general, the maintenance on this dam is being attended to although there were areas observed during the site examination which require attention.

A formal Operations and Maintenance Manual and a formal warning system or emergency preparedness plan should be established for this dam.

The City's consultant periodically provides guidance towards operation and maintenance.

c. Appurtenant Structures - The stone masonry spillway is in good condition. Some of the masonry joints in the spillway weir as shown in Photo 11 have experienced a loss of mortar and need repointing. The flashboards at the weir crest are in good condition and require no corrective action at present. The spillway discharge channel has some vegetation in the form of brush present as shown in Photos 11 and 12. The masonry side walls need repointing as shown in Photo 13. The pedestrian bridge over the spillway is in good condition.

The gatehouse is in generally good condition. The brickwork needs repointing to minimize future deterioration. Only one intake was found to be inoperative at the gatehouse. However, there are two alternate operable intakes present. The low flow discharge channel as shown in Photo 12 is ponding water, and contains random stones and uncut brush and weeds.

The dike shown in Photo 7 is in good condition, with no major deficiencies noted.

d. Reservoir Area - The reservoir as shown in Photos 7 and 8 is surrounded by moderate to steeply sloped hills. There is no developemnt along the banks fo the reservoir, except for a portion of Route 128 which bisects the northwestern portion of the reservoir. Observation of the conduit beneath Route 128 indicates that there should be adequate capacity to convey test flood flows without appreciable constriction.

e. Downstream Channel - Flow from the spillway passes through a stone masonry discharge channel to a pond on the north side of South Street. The flow then passes through a twin barrel culvert in good condition, located at South Street approximately 450 feet from the dam. Downstream of the bridge is the remains of an abandoned dam. Approximately 750 feet furhter downstream, flow from Stony Brook enters the waters of the Charles River.

3.2 Evaluation

Except for the items noted in the visual examination, the Stony Brook Reservoir dam, spillway, gatehouse and dike appear to be in satisfactory condition. The previously cut stumps and the brush are not considered to compromise the integrity of the dam, and it is understood that the crest erosion occurred when the reservoir was maintained at a higher level than is current practice. The erosion or sloughing at the downstream berm could possibly be an indication of seepage problems during high water levels. However, according to the dam tender , it occurred during the March 17-19, 1968 storm when the dam was briefly overtopped. The remaining itmes noted are considered minor and could be taken care of in the maintenance program.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General - The Phase I visual examination of the Stony Brook Reservoir Dam was conducted on 8 November 1978.

In general, the earth embankment is in fair condition while the spillway and gatehouse were observed to be in good condition. The reservoir level at the time of the inspection was approximately 10 feet below the weir crest.

Visual inspection checklists for the site visit are included in Appendix A and selected photographs are given in Appendix C.

b. Dam - The earth embankment is generally in fair condition. There is no visual evidence of significant settlement or lateral movement, or major seepage, but there has been local erosion of the crest and downstream slope.

The following specific items were noted:

(1) Much of the dam embankment surface has been mowed, but there is considerable growth of brush and trees toward the left abutment and on the downstream face below the berm, as shown in Photos 4 and 5. Large old stumps, cut flush with the ground surface, are evident in the downstream face. A growth of brush is developing in the upper part of the upstream riprap of the dam, as shown in Photo 3. Small stumps indicate that this brush has been cut previously.

(2) There has been local erosion of the dam embankment along the upper edge of the upstream riprap, as shown in Photos 2 and 3. This erosion has cut back into the crest, and appears to have caused some loss of stone from the upper edge of the riprap.

(3) There is also apparent erosion or sloughing of the toe of the downstream dam slope at the berm, over a distance of approximately 70 ft. to the left of the gatehouse, as shown in Photo 5. Material has been deposited on the berm and there is a 2 foot high scarp at the toe of the slope. At the time of the site examination there was no water flow evident, but there was a hole extending 4.5 feet back into the scarp at one point as shown in Photo 6.

(4) The main dam has a bare footpath worn along the length of the crest, as shown in Photo 4.

SECTION 2: ENGINEERING DATA

2.1 Design Records

A portion of the original design drawings for the facility are available.

2.2 Construction Records

No records of the original construction other than a portion of the design drawings were located.

2.3 Operation Records

No operational records other than water transmission line flow records and former County and State inspection reports were located.

2.4 Evaluation

a. Availability - The records are generally available at Cambridge Water Board, Cambridge Water Filtration Plant, 250 Fresh Pond Parkway, Cambridge, Massachusetts 02138.

b. Validity - Recorded information is in good agreement with existing conditions observed during the site examination.

c. Adequacy - The available data, in combination with the visual inspection described in the following section, is adequate for the purposes of the Phase I investigation.

j. Regulating Outlet - There is a 5-ft. by 10-ft. high wasteway tunnel with arch top to the left of the spillway. The invert elevation of the gate is approximately at elevation 42.5. Original intent for this outlet was to provide water to Stony Brook during periods of no flow over the spillway. Controls for the outlet are located in the brick building adjacent to the spillway.

(5) Test flood pool----------1,670 (Est.)

f. Reservoir Surface (acres)

(1) Normal pool----------57 (Est.)

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

(3) Spillway crest----------57 (Est.)

(4) Test flood pool----------63 (Est.)

(5) Top dam----------62 (Est.)

g. Embankment	Dam	Dike
(1) Type	Gravel fill	Probably gravel fill, with stone masonry downstream face
(2) Length	Approx. 830 ft.	Approx. 400 ft.
(3) Height	Approx. 32 ft.	Est. 4 to 5 ft. maximum
(4) Top width & Elevation	20 ft. @ El 62	Est. 15 ft. @ El 62
(5) Side slopes	1-1/2:1 U/S & 2:1 D/S	Approx. 2:1 U/S, vertical D/S
(6) Zoning	Homogeneous	Probably homogeneous
(7) Impervious core	Stone masonry wall	Unknown
(8) Cutoff	Apparent sheeting below core wall	Unknown
(9) Grout curtain	Probably none	Probably none

h. Diversion and Regulating Tunnel ---------- NONE

i. Spillway

(1) Type---------- Broad crested stone masonry

(2) Length of weir---------- 40 ft.

(3) Crest elevation---------- 69.8 (Est.)

(4) Gates---------- Flashboards to 72.2 (removed in fall - replaced in spring)

(5) U/S Channel---------- Unobstructed approach from reservoir

(6) D/S Channel-------Stone masonry channel approx. 58 ft. wide and 180 ft. long at an 18% slope

(4) Ungated spillway capacity at test flood elevation.
2,880 cfs at elevation 78.0 (Flashboards removed)

(5) Gated spillway capactiy at normal pool elevation---1,250 cfs at Elev. 69.8

(6) Gated spillway capacity at test flood elevation ---1,250 cfs at Elev. 78.0

(7) Total spillway capacity at test flood elevation.
4,400 cfs at elevation 77.7 (wasteway open)
1,520 cfs at elevation 78.0 (wasteway closed)

(8) Total project discharge at test flood elevation.
8,400 cfs at elevation 78.0 (wasteway closed) 77.7 (wasteway open)

c. Elevation (ft. above MSL)

(1) Streambed at centerline of dam----------44.0 (Est.)

(2) Test flood tailwater----------53.8

(3) Upstream portal invert diversion tunnel----------N/A

(4) Normal pool----------69.8

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

(6) Spillway crest----------69.8 (72.2 with Flashboards)

(7) Design surcharge (Original Design)----------Unknown

(8) Top of dam----------76.0

(9) Test flood design surcharge----------78.0

d. Reservoir

(1) Length of test flood pool----------1.2 miles

(2) Length of normal pool----------1.1 miles

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

e. Storage (acre-feet)

(1) Normal pool----------1,060 (Est.)

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

(3) Spillway crest pool----------1,060 (Est.)

(4) Top of dam----------1,530 (Est.)

d. Hazard Classification - The results of the dam failure analysis indicate that a minimum of 6 homes would be affected by the flood wave and the potential loss of life would be greater than 10 persons. Consequently, the dam is the "high" hazard classification.

e. Ownership - The dam and reservoir are owned by the City of Cambridge. The owner is represented by Mr. J. H. Seites, Superintendent of the Water Department, Office of the Water Board, 250 Fresh Pond Parkway, Cambridge, Massachusetts 02138 (phone: (617) 864-5300).

f. Operator - Mr. Joseph Libitz, Caretaker, 1 Gatehouse Lane, Weston, Massachusetts 02193 (phone: (617) 891-7388) is assigned responsibility for operation of the dam.

g. Purpose of the Dam - Stony Brook Reservoir Dam is part of the water supply system for the City of Cambridge, Massachusetts.

h. Design and Construction History - The Stony Brook Reservoir Dam was constructed in 1887. While a portion of the original drawings were located, no other information on the construction was found. Observations of the dam indicated little or no major modification has been made to the facility.

i. Normal Operational Procedures - Maintenance at the dam is performed on a routine schedule. There is a caretaker permanently assigned to the reservoir who has responsibility for the operation of the sluice gate controls and weir flashboards on an as need basis.

1.3 Pertinent Data

Elevations given in this report are on National Geodetic Vertical Datum (NGVD) formerly referred to as Mean Sea Level (MSL). The elevation assigned to the spillway crest was taken from City of Cambridge documents.

a. Drainage Area - The dam impounds waters of Stony Brook in the Town of Weston and City of Waltham. The total watershed above the dam is 23.6 square miles of which 7.1 square miles contributes flow initially to Hobbs Brook Reservoir. The outflow from Hobbs Brook Reservoir joins Stony Brook and thence into Stony Brook Reservoir.

b. Discharge at Dam Site - There is no recorded information for discharge at the dam site.

(1) Outlet works size: 5 ft. wide by 10 ft. high wasteway tunnel with arch top culvert at approximate elevation 42.5

(2) Maximum known flood at damsite ----------In excess of Elev. 76.0 on March 20, 1968

(3) Ungated spillway capacity at top of dam. 1,850 cfs at elevation 76.0 (Flashboards removed)

b. Description of Dam and Appurtenances - Stony Brook Reservoir Dam consists of a 830 ft. long earth dam, with a gatehouse and overflow spillway structure at the right end, and a low earth dike extending from the right end of the dam along the west side of the reservoir.

The dam embankment is approximately 32 ft. high, with a 20 ft. wide crest and basic upstream and downstream slopes of 1.5 to 1 and 2 to 1 (horizontal to vertical), respectively. Drawings show the embankment to be constructed to gravel with a stone masonry core wall that extends through underlying "blue gravel" to a sand stratum. There is also an indication of sheeting extending down from the core wall foundation into the sand.

The upstream slope of the dam has riprap from about 2 ft. below the crest down at least to 18 ft. below the crest. Below this elevation, the drawings show a berm and a flatter earth slope without riprap. The crest and downstream slope of the embankment are grass-covered. There is a 20 ft. wide berm near the bottom. Below this downstream berm, cobble and boulder slope protection extends down to standing water at the toe.

The spillway is 40 ft. long and has provisions for flashboards between elevation 69.8 to elevation 72.2. Downstream of the spillway is a stone masonry channel approximately 58 feet wide and 4.5 feet deep. The average slope of this channel is approximately 18 percent. Adjacent to the spillway on the left embankment there is a stone and brick structure that contains the operating controls for three outlets from the reservoir. One control is for a 5 foot wide and 10 foot high intake sluice gate to allow discharge into Stony Brook during low flows. The culvert invert is at approximately elevation 42.5. The two other controls are for 36" diameter and 30" diameter water mains respectively that transmit water from Stony Brook Reservoir to Fresh Pond Reservoir and the City of Cambridge water treatment plant.

The dike that parallels Gatehouse Lane to the right of the spillway has a maximum height of only 4 or 5 feet. The sloping upstream face is protected by riprap similar to that on the main dam, while the vertical downstream face and a short upstream wall at the spillway are of mortared stone masonry. The crest of the dike has a grass cover.

c. Size Classification - The height of the dam is approximately 32 feet and the estimated storage capacity is 1,530 acre-feet at top of dam. According to guidelines established by the Corps of Engineers, the height of the dam is in the small category whereas the storage capacity is in the intermediate category. Therefore, the dam is classified in the intermediate category.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
STONY BROOK RESERVOIR DAM
MA 00293

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Camp Dresser & McKee Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Camp Dresser & McKee Inc. under letters of 12 July 1978 and 23 October 1978 from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-78-C-0354 has been assigned by the Corps of Engineers for this work. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for soils and geological portions of the work.

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

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

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

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

1.2 Description of Project

a. Location - Stony Brook Reservoir Dam is located on Stony Brook approximately 1,200 feet above the confluence with the Charles River. The dam is located on the boundary of the Town of Weston and the City of Waltham. The spillway and gatehouse are located on the Southwest end of the dam and accessible via Gatehouse Lane, in the Town of Weston, as shown on the report's location map.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - The visual examination of the Stony Brook Reservoir dam,spillway and dike did not reveal any evidence of failure or conditions which would warrant urgent remedial treatment. However, because of the need for maintenance and additional investigation that is outlined hereinafter, the project is considered to be in only fair condition.

b. Adequacy of Information - The limited available information, in conjunction with visual examination at the site, has been sufficient for the purpose of this Phase I investigation, but it does not permit detailed evaluation of stability or seepage potential.

c. Urgency - The recommended additional investigations and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken within one year of receipt of the report by the owner.

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

7.2 Recommendations

It is recommended that the owner engage a registered professional engineer to perform the following additional investigations:

(1) Investigate the area of sloughing and erosion at the downstream toe of the dam embankment during high reservoir levels to determine if there is any indication of seepage problems. If there is seepage, the investigation should be extended to the development of remedial measures.

(2) Investigate the seismic stability of the dam embankment.

(3) A detailed hydrologic-hydraulic investigation to determine the adequacy of the spillway and any necessary modifications to provide adequate capacity.

7.3 Remedial Measures

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

(1) Clear brush from the entire surface of the dam and dike embankments, spillway discharge channel and low flow discharge channel, and cut grass and weeds on the embankments at least once a year.

(2) Restore local eroded areas in the dam embankemnt, re-establish vegetative cover, and replace riprap stone as necessary. Work at the downstream toe would be subject to the results of the investigation under Section 7.2

(3) Repoint stone masonry at the spillway weir, side walls and apron. Repoint gatehouse brickwork.

(4) Repair the presently inoperative intake

(5) Develope a formal maintenance program, operational procedure, emergency procedures plan and warning system in cooperation with downstream officials.

(6) Institute a program of annual technical inspections.

7.4 Alternatives - *There are no recommended alternatives.*

APPENDIX A
INSPECTION TEAM ORGANIZATION AND CHECK LIST

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir

DATE: 8 November 1978

TIME: 1:30 p.m.

WEATHER: Overcast, 50-55°

WATER SURFACE ELEVATION UPSTREAM: Elev. 68.68 (Cambridge Datum)

STREAM FLOW: No discharge

INSPECTION PARTY:

1. Robert P. Howard - CDM - Structural/Operations
2. Francis E. Luttazi - CDM - Structural/Operations (Ass't)
3. Charles E. Fuller - CDM - Hydraulic/Hydrology
4. Joseph E. Downing - CDM - Hydraulic/Hydrology (Ass't)
5. Peter L. LeCount - Haley and Aldrich - Soils
6. _____

PRESENT DURING INSPECTION:

1. William Brennan, City of Cambridge
2. _____
3. _____
4. _____

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir DATE: 8 November 1978
EMBANKMENT: Main Dam

CHECK LIST	CONDITION
1. Upstream Slope	1.
a. Vegetation	a. Scattered brush & stumps to 4 in. dia. in top 10 ft. of slope.
b. Sloughing or Erosion	b. Top 2 to 3 ft. of much of dam length, above riprap, eroded 2 to 3 ft. into embankment.
c. Rock Slope Protection - Riprap Failures	c. Riprap generally intact, local minor loss at top adjacent to erosion.
d. Animal Burrows	d. None observed
2. Crest	2.
a. Vegetation	a. Grass except along path
b. Sloughing or Erosion	b. Erosion above riprap has cut into upstream corner of crest.
c. Surface cracks	c. None observed
d. Movement or Settlement	d. None observed
3. Downstream Slope	3.
a. Vegetation	a. Generally grass, except brush beyond fence near left abutment and between berm and water at toe. Scattered stumps to 36 in. dia. remain flush with main slope.
b. Sloughing or Erosion	b. 2 ft. high eroded scarp along approx. 70 ft. of toe of main slope above berm and near gate house; apparent deposited soil on berm.
c. Surface cracks	c. None observed
d. Animal Burrows	d. Poss. 4.5 ft. deep burrow in eroded scarp.
e. Movement or Cracking near toe	e. None observed
f. Unusual Embankment or Downstream Seepage	f. No signifcant indication of seepage along downstream shoreline.
g. Piping or Boils	g. None observed
h. Foundation Drainage Features	h., i. None known
i. Toe Drains	
4. General	4.
a. Lateral Movement	a. None evident
b. Vertical Alignment	b., c. Appears good
c. Horizontal Alignment	d. No indication of problems
d. Condition at Abutments and at Structures	e. None observed
e. Indications of Movement of Structural Items	f. Is minor problem for dam tender
f. Trespassing	g. None known
g. Instrumentation Systems	

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir Dam DATE: November 8, 1978

SPILLWAY:

CHECK LIST	CONDITION
1. Approach Channel	1.
a. General Condition	a. Good to Excellent
b. Obstructions	b. None
c. Log Boom etc.	c. None
2. Weir	2.
a. Flashboards	a. Wooden flashboards and supports are in good condition.
b. Weir Elev. Control (Gate)	b. See Outlet Works
c. Vegetation	c. None
d. Seepage or Efflorescence	d. None - Water level was far below overflow crest.
e. Rust or Stains	e. Minor staining
f. Cracks	f. None
g. Condition of Joints	g. Good, some joints need regrouting
h. Spalls, Voids or Erosion	h. None
i. Visible Reinforcement	i. N/A
j. General Struct. Condition	j. Good
3. Discharge Channel	3.
a. Apron	a. First ten feet downstream of the spillway crest appears to have been grouted heavy stone riprap. Most of grout has been washed away.
b. Stilling Basin	b. None
c. Channel Floor	c. Placed heavy stone riprap channel bottom in good condition.
d. Vegetation	d. Minor bush growth in channel. Heavy bush growth at channel exit.
e. Seepage	e. None observed
f. Obstructions	f. None
g. General Struct. Condition	g. Good
4. Walls	4.
a. Wall Location-Left & Right	a.
(1) Vegetation	(1) None observed
(2) Seepage or Efflorescence	(2) None observed
(3) Rust or Stains	(3) None observed
(4) Cracks	(4) None observed
(5) Condition of Joints	(5) The joints, in general, are in good condition. Joints need repointing.
(6) Spalls, Voids or Erosion	(6) None observed
(7) Visible Reinforcement	(7) N/A

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir Dam DATE: November 8, 1978

SPILLWAY:

CHECK LIST	CONDITION
(8) General Struct. Condition	(8) Good - Last section of left wall downstream has been dislodged.
5. Pedestrian Bridge a. Steel Support b. Wood Plank Deck c. Railing	5. a. Good b. Good c. Good

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Stony Brook Reservoir Dam DATE: November 8, 1978

OUTLET WORKS:

CHECK LIST	CONDITION
1. Inlet	1.
a. Obstructions	a. None observed
b. Channel	b. Submerged
c. Structure	c. Grouted stone walls are in good condition. Joints need repointing in some areas.
d. Screens	d. Reinforcing bar trash rack in excellent condition.
e. Stop Logs	e. None
f. Gates	f. None
2. Control Facility	2.
a. Structure	a. Super structure in good condition. Joints in brick work need repointing.
b. Screens	b. Two mechanical screens in good working condition.
c. Stop Logs	c. None
d. Gates	d. Three sluice gates to draw water from three levels. Two in good operating condition, one could not be opened. One sluice gate to outfall channel in good operating condition.
e. Condiut	e. Submerged
f. Seepage or Leaks	f. None observed
3. Outlet	3.
a. Structure	a. Vaulted tunnel of grouted stone joints need repointing.
b. Erosion or Cavitation	b. None observed. Channel floor submerged.
c. Obstructions	c. Outfall channel cluttered with vegetation and stones.
d. Seepage or Leaks	d. None observed. Channel floor submerged.
4. Mechanical and Electrical	4.
a. Crane Hoist	a. None
b. Hydraulic System	b. None
c. Service Power	c. From power line - OK
d. Emergency Power	d. None
e. Lighting	e. Good
f. Lightning Protection	f. None observed

APPENDIX B
LIST OF AVAILABLE DOCUMENTS AND PRIOR INSPECTION REPORTS

PRIOR INSPECTION REPORTS

DRAWINGS

LIST OF DOCUMENTS

STONY BROOK RESERVOIR DAM

DOCUMENT	LOCATION
1. Report on Needed Improvements to the Cambridge Water System, July 1970.	City of Cambridge Water Department 250 Fresh Pond Parkway Cambridge, MA 02138
2. Miscellaneous References (see note below)	City of Cambridge City Hall Engineering Office 795 Massachusetts Ave. Cambridge, MA 02139

Note: An index was obtained listing descriptive titles of over 250 references pertaining to Stony Brook Reservoir dating back to 1887. A search was made for approximately 20 percent of the drawings which were deemed relevant based on their descriptive titles. Only one third of these could be located of which one half were found to be useful. Four pertinent drawings are included in Appendix B of this report.

OK FILE LCH

INSPECTION REPORT - DAMS AND RESERVOIRS

(1.) Location: ~~City~~/Town WESTON Dam No. 4-9-333-1

Name of Dam STONY BROOK RES. DAM Inspected by A. Z. PIZANO & D. KILPATRICK

Date of Inspection 1-2-'73

(2) Owners: part Assessors ✓ Prev. Inspection

Reg. of Deeds Pers. Contact

1 CITY OF CAMBRIDGE, 250 FRESH POND PKWY, CAMBRIDGE, MASS. 02140 864-5300
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.

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

(4) No. of Pictures taken NONE

(5) Degree of Hazard: (If dam should fail completely)
1. Minor 2. Moderate

3. Severe ✓ 4. Disastrous

This rating may change if land use changes (future development)

(6) Outlet Control: Automatic ✓ Manual

Operable ✓ Yes: No.

(7) Observations and Remarks

✓

DAM NO. 4-9-333-1

(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: ____

(10) Water level @ time of inspection ____ ft. above 0.2' below ____
top of dam ____ Principal spillway ✓
other ____

(11) Summary of Deficiencies 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/or debris impeding flow ____
Clogged or blocked spillway ____
Other ____

DAM NO 4-9-333-1

(12) Remarks & Recommendations: (Fully Explain)

DAM IS IN GOOD CONDITION.

(13) Overall Condition:

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

Recommend removal from inspection list _____

DESCRIPTION OF DAM
DISTRICT 4

Submitted by D. KILPATRICK & A.Z. PIZAN
Date 1-2-74

Dam No. 4-9-333-1
~~City~~/Town WESTON
Name of Dam STONY BROOK RES. DAM

1. Location: Topo Sheet No. 26 D
Provide ~~8½" x 11" in clear~~ copy of topo map with location of Dam clearly indicated.

2. Year built: 1887 Year/s of subsequent repairs

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

4. Drainage Area: 1 NO SQ. MI. 640 ACRES.

5. Normal Ponding Area: 57 acres: Ave. Depth 12
Impoundment: 228 MIL. gals; 684 acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir i.e. summer homes etc. 1 PUMP HOUSE

7. Dimensions of Dam: Length 1500' Max. Height 40'
Slopes: Upstream Face 4:1
Downstream Face 2:1
Width across top 20'

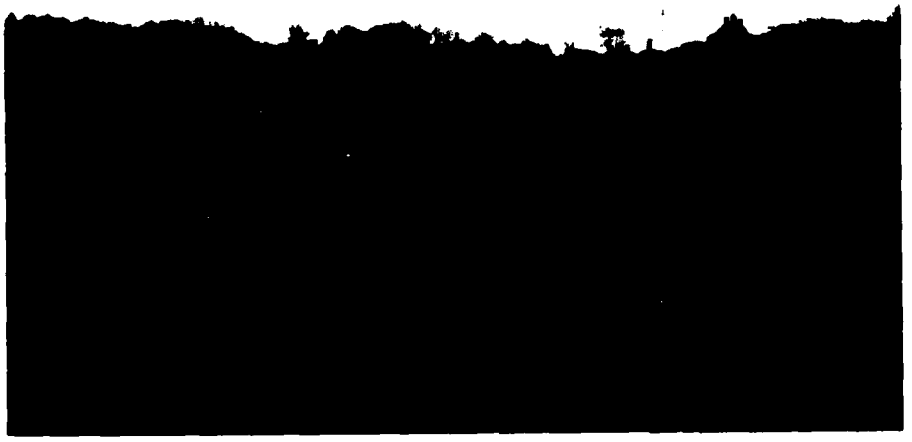
8. Classifications of Dam by Materials:
Earth ✓ Conc. Masonary Stone Masonary
Timber Rockfill Other

9. A. Description of present land usage downstream of dam: 75 % rural; 25 % urban
B. To create a storage site or flood plain downstream of dam which could accept flow of impoundment in the event of a total loss dam failure
no ✓

APPENDIX B-5

10. OVERVIEW OF SPILLWAY APPROACH CHANNEL AND INLET TO GATE HOUSE.

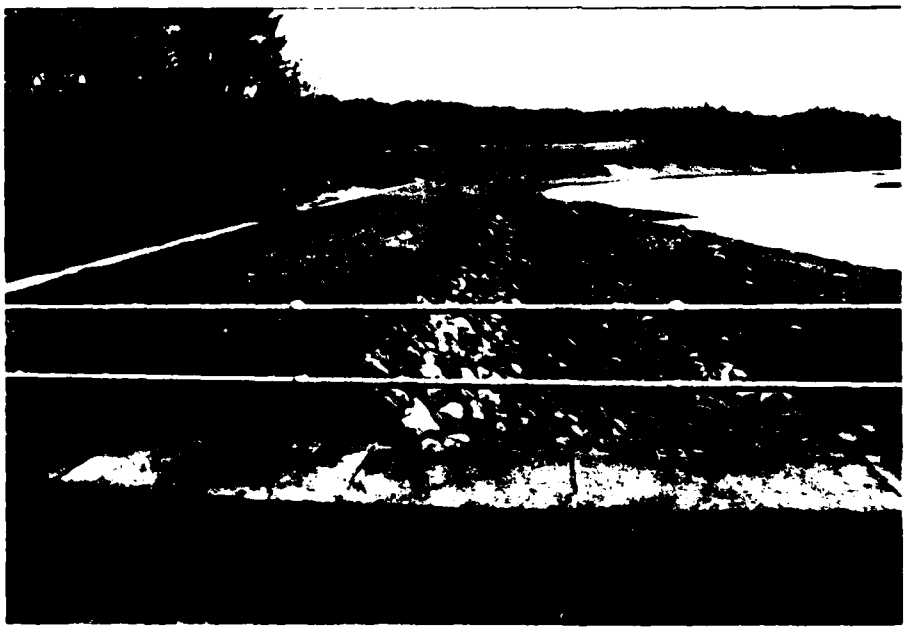
11. OVERVIEW OF SPILLWAY WEIR FROM RIGHT DOWNSTREAM CHANNEL WALL.



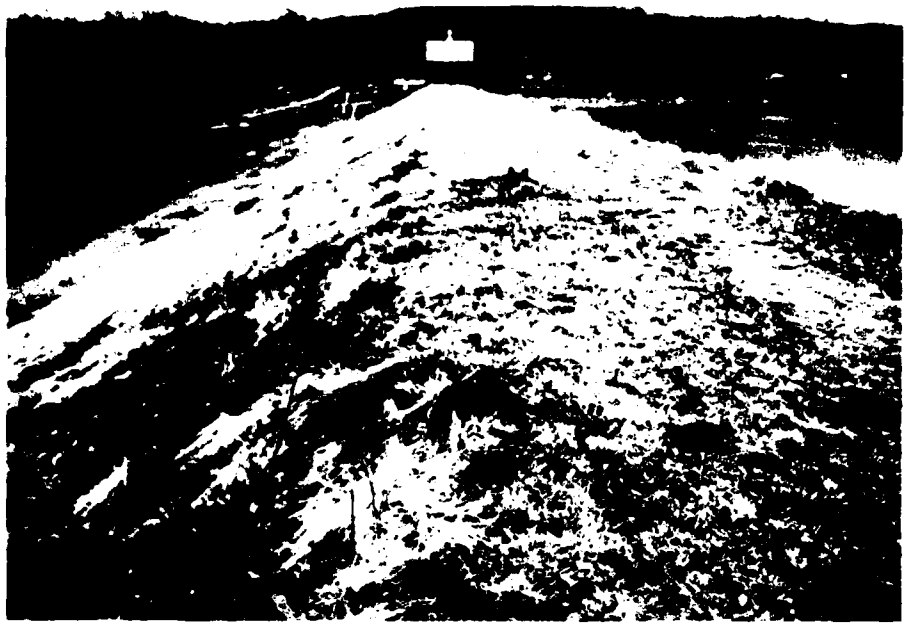
8. OVERVIEW OF DAM AND RESERVOIR FROM ROUTE 128 EMBANKMENT.

9. CHANNEL AND DEVELOPMENT DOWNSTREAM OF DAM.

6. RULE EXTENDING 4.5 FEET INTO HOLE AT TOE OF DAM. SEE PHOTO 5 FOR LOCATION OF ERODED AREA.



7. OVERVIEW OF DIKE ON RIGHT BANK FROM RIGHT SPILLWAY ABUTMENT. ROUTE 128 EMBANKMENT IS IN BACKGROUND.

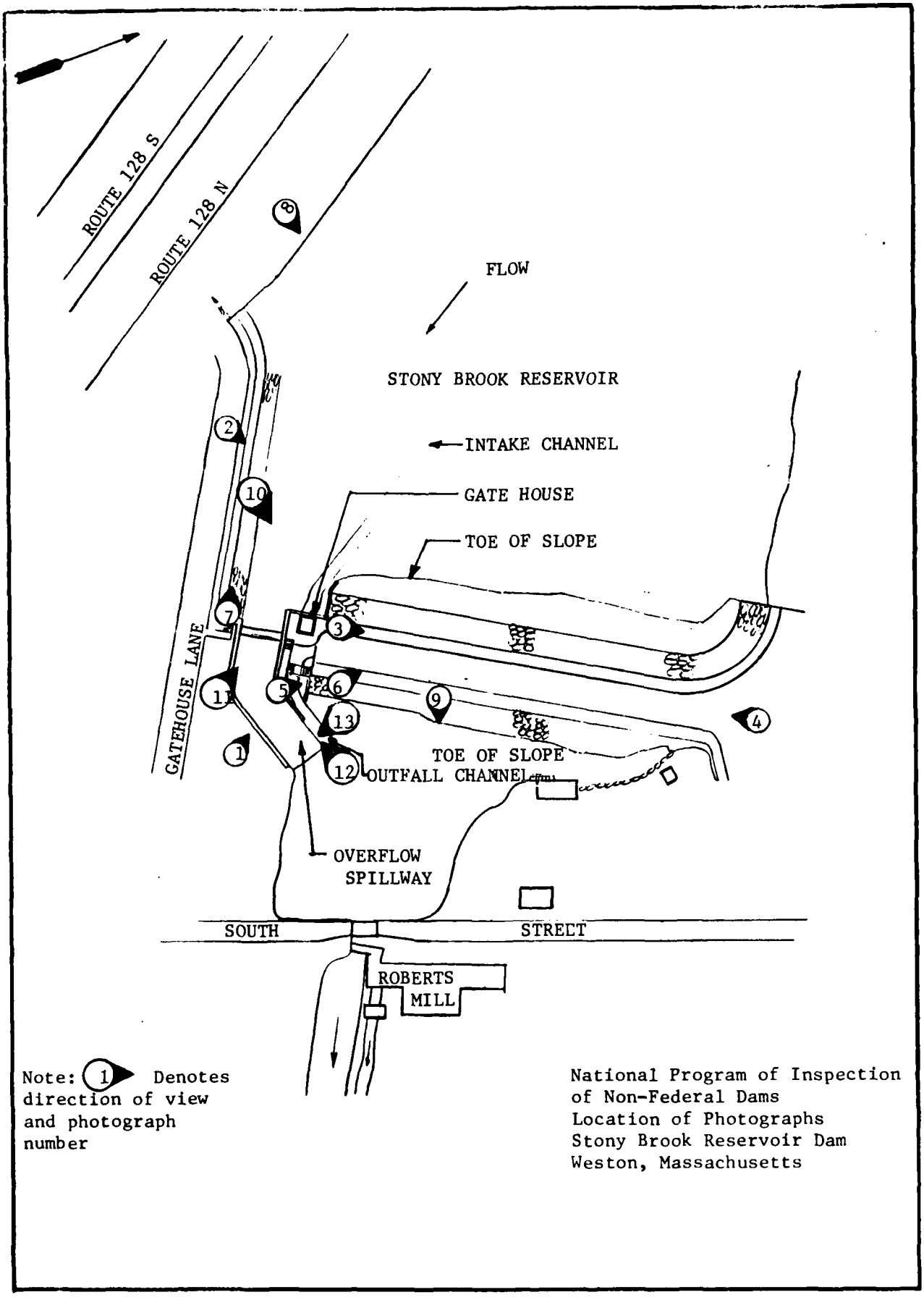


4. DOWNSTREAM EDGE OF DAM CREST FROM LEFT ABUTMENT. NOTE CUT-OFF STUMPS IN FOREGROUND AND PATH ALONG CREST.

5. DOWNSTREAM FACE OF DAM SHOWING ERODED AREA AT TOE.

2. UPSTREAM FACE OF DAM FROM RIGHT BANK.

3. EROSION OF UPSTREAM EDGE OF DAM CREST NEAR GATE HOUSE.



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

National Program of Inspection of Non-Federal Dams
Location of Photographs
Stony Brook Reservoir Dam
Weston, Massachusetts

APPENDIX C-1

APPENDIX C

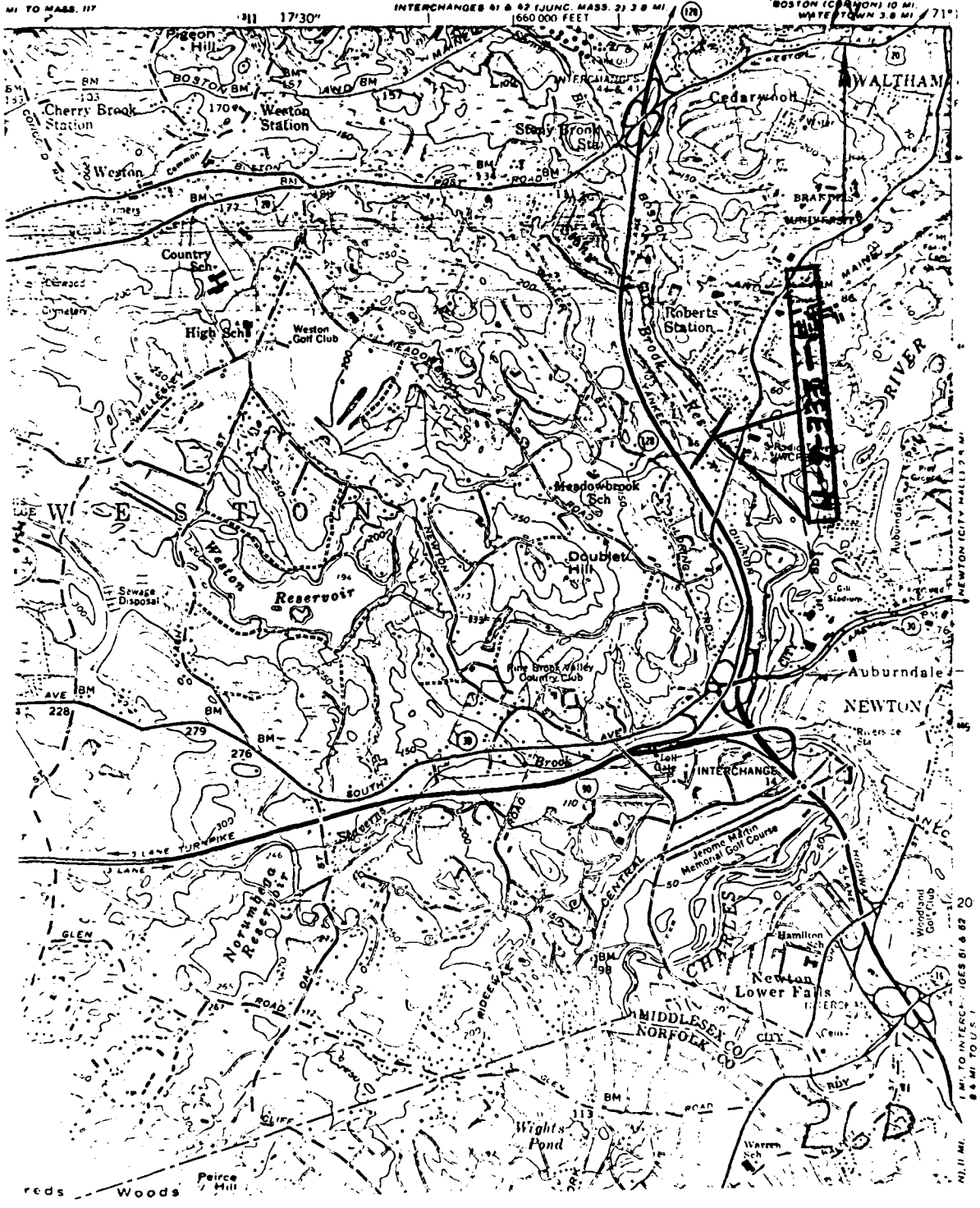
SELECTED PHOTOGRAPHS OF PROJECT

Front Elevation
Detail of Portico
1764

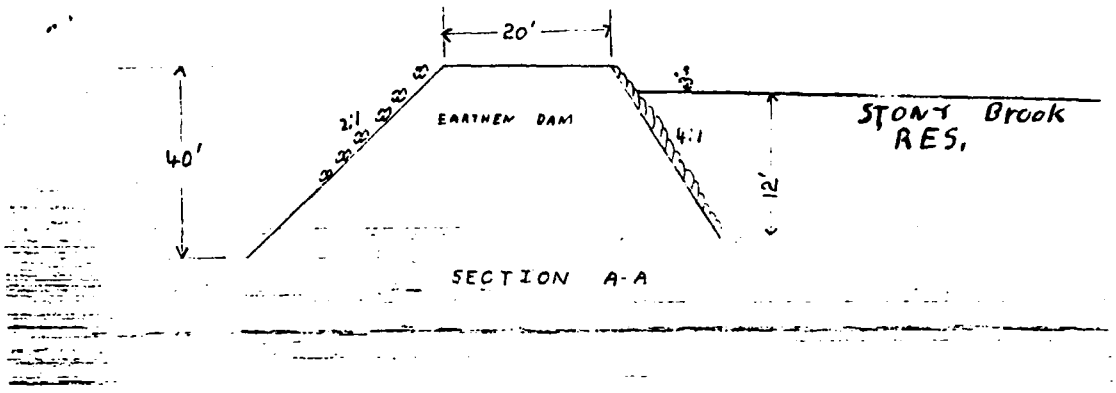
1756

CHUSETTS
IBLIC WORKS

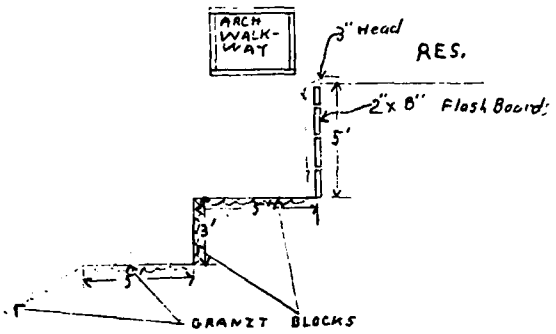
NATICK QUADRANGLE
MASSACHUSETTS
7.5 MINUTE SERIES (TOPOGRAPHIC)



4-9-333-1



SECTION A-A



SECTION B-B

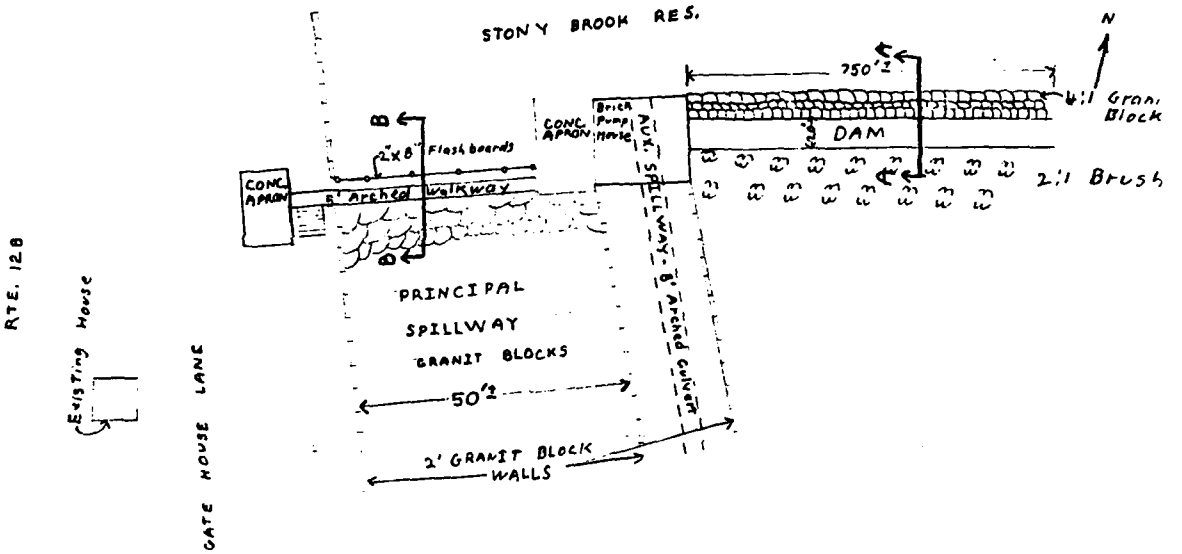
NOT TO SCALE

DAM NO. 4-9-333-1

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

No. of people 18
No. of homes 6
No. of businesses 1
No. of industries ____ Type ____
No. of utilities ____ Type ____
Railroads ____
Other dams ____
Other ____

11. Attach sketch of dam to b s form showing section and plan 8½" x 11" Sheet.



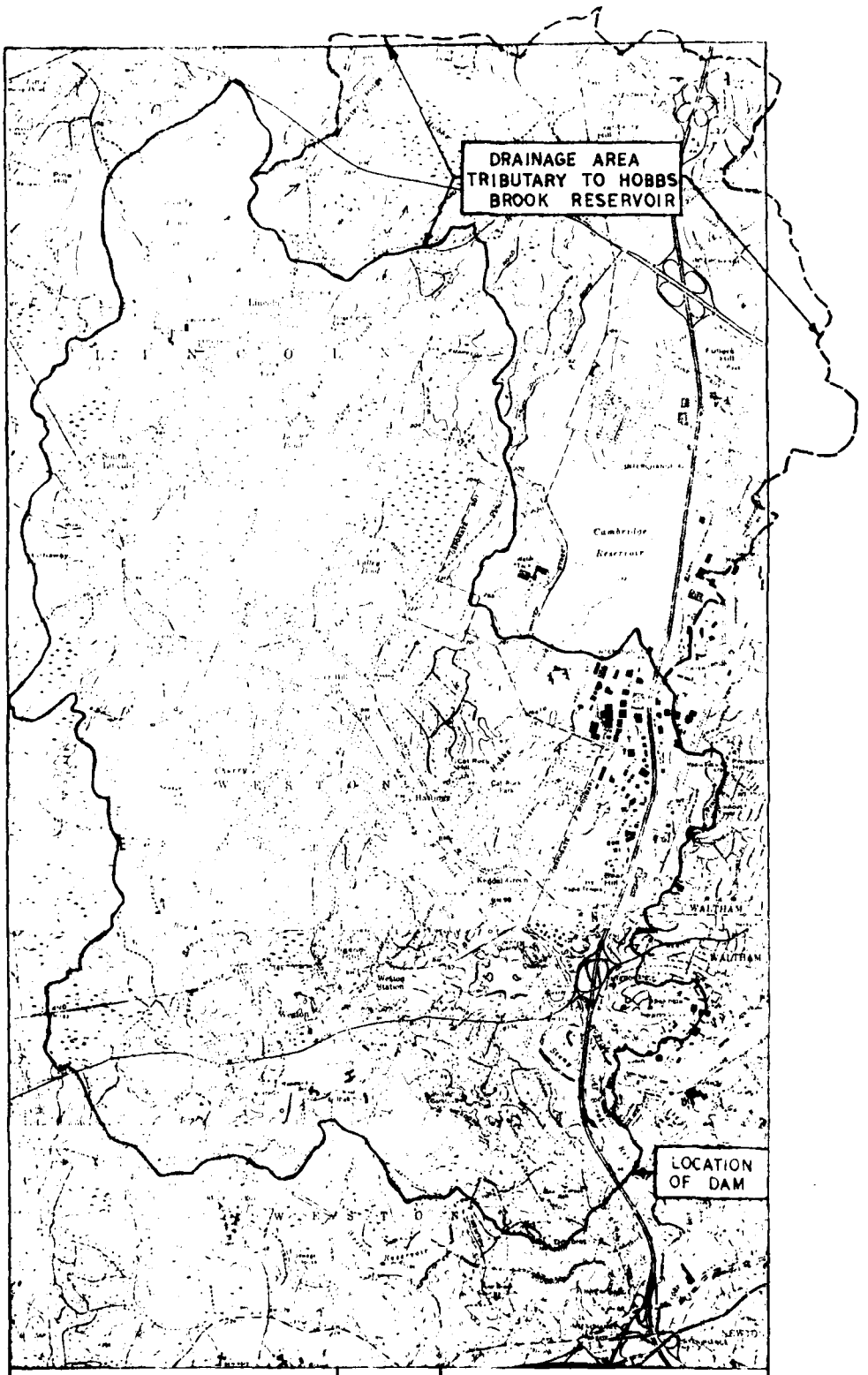
NOT TO SCALE

12. VIEW OF RESERVOIR OUTLET TUNNEL AND GATE HOUSE FROM SPILLWAY DISCHARGE CHANNEL.

13. END OF SPILLWAY RIGHT CHANNEL WALL. NOTE OPEN MASONRY JOINTS.

APPENDIX D

OUTLINE OF DRAINAGE AREA AND HYDRAULIC COMPUTATIONS



DAM STONY BROOK RESERVOIR

IDENTIFICATION NO. MA 00293

DRAINAGE AREA MAP

APPROX. SCALE: 1" = 3100'

APPENDIX 7

CAMP DRESSER & McKEE INC. CLIENT Corps of Engineers JOB NO 380-5-13 PAGE 1
PROJECT Dam Investigation DATE CHECKED 6-8-79 DATE 7/31/79
DETAIL Stony Brook CHECKED BY [illegible] COMPUTED BY WAK

Misc. Details- Stony Brook Reservoir

Capacity = 346 mg @ El. 80.66 (Cambridge Datum) = Spillway
or 69.82 (USGS Datum)

with flashboards

405 mg @ El. 83.06 (Cambridge Datum)
or 72.22 (USGS Datum)

Drainage Area = 16.50 mi.^{2}

Year Constructed = 1887

Normal Ponding Area = 57 acres

Average Depth = 12'

Length of Dam = 910' Total

Max Ht. 32'

Spillway Crest L = 39.9' total

Avg. Dam Elev. = 86.80 (Camb. Datum) or 75.96 (USGS)

Toe Dam = 54.6 (Camb. Datum) or 43.96 (USGS)

CAMP DRESSER & MCKEE INC. CLIENT C of E JOB NO 380-5-13 PAGE 2
PROJECT Stony Brook DATE CHECKED DATE 7 May 79
DETAIL Dam Fail Anay CHECKED BY COMPUTED BY WAK

Dam Failure Analysis

$$Q_{P_1} = \frac{8}{27} W_b \sqrt{g} Y_o^{3/2}$$

Dam Length = 590' (Assume left embankment only)

Y_o = 75.96 − 43.96 = 32.0'

W_b = .4 (590') = 236' say 240'

$$Q_{P_1} = \frac{8}{27} \times 240' \times \sqrt{32.2} \times 32.0^{3/2}$$

73,045 cfs

plus water over spillway

Spillway L = 40.0' less 7 uprights each .5' wide

∴ L = 36.5' H = 75.96 − 69.82 (flashboards out)

C = 3.33 = 6.14

$Q = 3.33 \times 36.5 \times 6.14^{3/2}$

= 1849 cfs

Total Q = 73,045 + 1849 = 74,894 cfs

CAMP DRESSER & MCKEE INC. CLIENT C of E JOB NO 380-5-13 PAGE 3
PROJECT Stony Brook DATE CHECKED 6-8-79 DATE 7/13/79
DETAIL Dam Fail Anal CHECKED BY [illegible] COMPUTED BY WAK

Flow at South Street Bridge

From USGS Quad sheet

Roadway elev. at the bridge is approx. 57

Stream invert = approx 48.4

When the w.s. is at the top of the culvert, there will be additional flow over the low portions of the roadway.

WS 1' over top. culv. El. 55.4

Culv flow

$Q = CA\sqrt{2gh}$

$= .8 \times 199.2 \times \sqrt{64.4 \times 1} = 1279$ cfs

Weir flow

$Q = C \times L \times H^{3/2}$

where C = 2.5 L = Weir length H = avg. ht over road

three sections

① L = 120 H = 1.70

$Q = 2.5 \times 120 \times 1.7^{3/2} = 665.0$ cfs

② L = 685 H = 3.4

$Q = 2.5 \times 685 \times 3.4^{3/2} = 10,736$ cfs

③ L = 840 H = 1.70

$Q = 2.5 \times 240 \times 1.7^{3/2} = 1330$ cfs

Total Flow with WS Elev. 55.4 = 14,010 cfs

WS at El. 56.0

Pressure flow ht = 1.6

$Q = .8 \times 199.2 \times \sqrt{64.4 \times 1.6}$

$= 1618$ cfs

Weir flow

① L = 145 H = 2.0

$Q = 2.5 \times 145 \times 2^{1.5} = 1025$ cfs

② L = 685' H = 4

$Q = 2.5 \times 685 \times 4^{1.5} = 13,700$ cfs

③ L = 290' H = 2

$Q = 2.5 \times 290 \times 2^{1.5} = 2050$ cfs

Total Flow with w.s. @ El. 56 = 18,393 cfs

W.S. at El. 57

Pressure flow ht = 2.6'

$Q = .8 \times 199.2 \times \sqrt{64.4 \times 2.6}$

$= 2062$ cfs

Weir flow

① L = 160 H = 2.5

$Q = 2.5 \times 160 \times 2.5^{1.5} = 1581$ cfs

② L = 685 H = 5.0

$Q = 2.5 \times 685 \times 5^{1.5} = 19,146$ cfs

③ L = 360' H = 2.5

$Q = 2.5 \times 360' \times 2.5^{1.5} = 3,558$ cfs

Total Flow with w.s. = 57 = 26,347 cfs

CAMP DRESSER & MCKEE INC. CLIENT C of E JOB NO 380-5-13 PAGE 5
PROJECT Stony Brook DATE CHECKED DATE 27 May 79
DETAIL Dam Fail Anal CHECKED BY COMPUTED BY WAK

W/S at El 58

Pressure flow ht = 3.6

$Q = .8 \times 199.2 \times \sqrt{64.4 \times 3.6}$ =

= 2426 cfs

Weir flow

① L = 200' Ht = 3.0'

$Q = 2.5 \times 200 \times 3.0^{1.5}$

= 2598 cfs

② L = 685' Ht = 8.0'

$Q = 2.5 \times 685 \times 8.0^{1.5}$

= 25,168 cfs

③ L = 490' Ht. = 3.0'

$Q = 2.5 \times 490 \times 3.0^{1.5}$

= 6365 cfs

Total flow with w.s. @ El. 58.0 = 86,557 cfs

ws at El. 59

Pressure flow ht = 4.6'

$Q = .8 \times 199.2 \times \sqrt{64.4 \times 4.6}$

= 2743 cfs

Weir flow

① L = 230 Ht = 3.5'

$Q = 2.5 \times 230 \times 3.5^{3/2}$ = 3765 cfs

② l = 685' Ht = 7.0'

$Q = 2.5 \times 685 \times 7.0^{1.5}$ = 31,715 cfs

(1) L= 540' Ht= 2.5'

Q = 2.5 x 540' x 2.5$^{3/2}$ = 8840 cfs

Total Q at El 57.0 = 47,063 cfs

ws at El. 60

Press. flow ht= 5.6

Q = .8 x 199.2 x $\sqrt{64.4 \times 5.6}$ = 3026 cfs

Weir flow

(1) L= 280 ht= 4.0'

Q= 2.5 x 280 x 4.0$^{1.5}$ = 5600 cfs

(2) L= 685 Ht= 8.0'

Q= 2.5 x 685 x 8$^{1.5}$ = 38,750 cfs

(3) L= 630 Ht= 4.0'

Q= 2.5 x 630 x 4$^{1.5}$ = 12,600 cfs

Total Q with w.s at El 60 = 59,976 cfs

ws at El. 61

Press flow Ht= 6.6

Q = .8 x 199.2 x $\sqrt{64.4 \times 6.6}$ = 3285 cfs

Weir flow

(1) L= 300 ht= 4.5

Q= 2.5 x 300 x 4.5$^{3/2}$ = 7160 cfs

(2) L= 685 ht= 9.0

Q= 2.5 x 685 x 9$^{3/2}$ = 46,238 cfs

(3) L= 660 ht= 4.5

Q= 2.5 x 660 x 4.5$^{3/2}$ = 15,750 cfs

CAMP DRESSER & McKEE INC. CLIENT Corf E JOB NO 380-5-12 PAGE 7
PROJECT Stony Creek Anal DATE CHECKED 6-29 DATE 8-[illegible]
DETAIL Dam Fail Anal CHECKED BY [signature] COMPUTED BY WPL

Total Q with w.s. @ El 61 = 72,433

W.S at El. 61.5'

Press. flow Ht: 7.1

$Q = .8 \times 199.2 \times \sqrt{64.4 \times 7.1}$ = 3408 cfs

Weir flow

① L= 310 ht = 4.25'

$Q = 2.5 \times 310 \times 4.25^{3/2}$ = 8023 cfs

② L= 685' ht = 9.5'

$Q = 2.5 \times 685' \times 9.5^{3/2}$ = 50,144 cfs

③ L= 680 ht = 4.75'

$Q = 2.5 \times 680 \times 4.75^{3/2}$ = 17,600 cfs

Total Q with ws @ El 61.5 = 79,125 cfs

W.S. Elev. at South St. prior to failure:

[1] Spillway Capacity at top of dam = 1850 cfs

[2] Waterway tunnel capacity fully open = 1430 cfs

3280 cfs

[3] W.S. Elev. at South St. for 3,280 cfs ≅ Elev. 53

Notes: 1. from page 13

2. from page

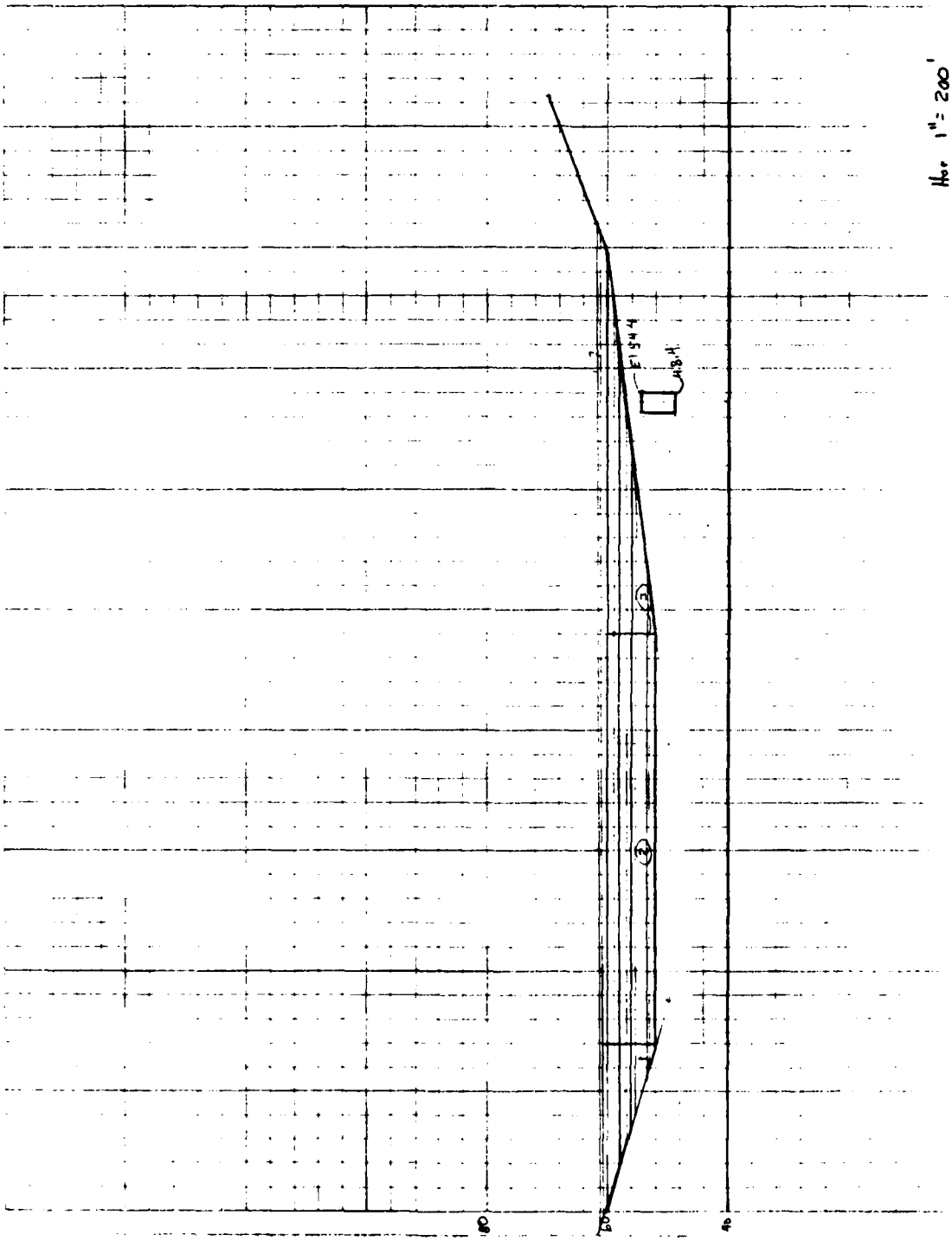
3. from page 9

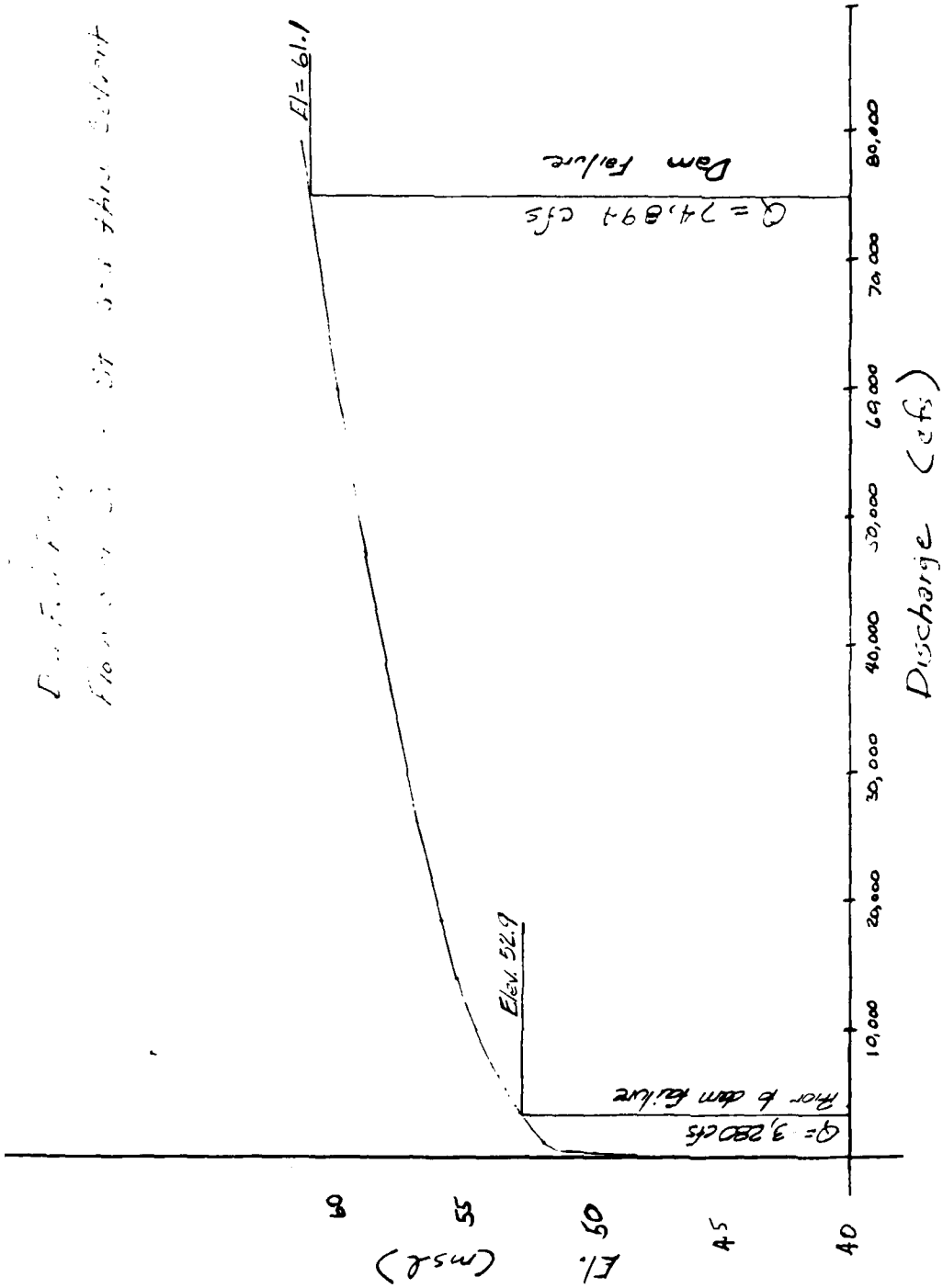
CAMP DRESSER & MCKEE INC.

CLIENT C of E.
PROJECT Stony Brook
DETAIL Dam Fail Anal

JOB NO 380-13
DATE CHECKED 6 Jun 79
CHECKED BY WAK

PAGE 8
DATE 8 May 79
COMPUTED BY WAK





APPENDIX D-10

With a Q of approximately 74,900 cfs and the geographical configuration of the downstream topography, the water surface will rise to approximately El. 61.1 South St., approximately 450' downstream of Stony Brook Dam has a culvert approximately 6.0' high by 34' wide, with a 1 foot center wall. Due to the large volume of water resulting from a dam failure, the amount of flow passing through the culvert will be somewhat insignificant. The majority of the flow will pass over the roadway, with a large amount passing to the left of the culvert. It is apparent from the dam failure analysis that should the dam fail, serious downstream flooding will occur, especially along South Street north of the existing culvert.

Between the dam and South St., several homes have been constructed. Should the dam fail, these homes will be seriously inundated!
Approx. W.S. Elev. at South St. prior to dam failure is elev. 53. Failure of the dam would result in an 8-ft. rise in water depth over South St.

CAMP DRESSER & MCKEE INC. CLIENT C of E JOB NO 380-S-13 PAGE 11
PROJECT Stony Brook DATE CHECKED 6-29 DATE 10/12/79
DETAIL Hazard Class CHECKED BY [illegible] COMPUTED BY WAK

Size Classification

Storage at top of dam = 1531.4 ac-ft

Ht = 75.96' - 43.96 = 32.0'

Based on storage, this dam is placed in the INTERMEDIATE category.

Hazard Classification

Loss of life - More than a few

∴ HIGH

Economic Loss - Appreciable

∴ SIGNIFICANT

USE HIGH

Spillway Design Flood

Hazard = HIGH , Size = INTERMEDIATE

Q_{Test} = PMF

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT Corps of Engineers New Eng. JOB NO 530-5-15 PAGE
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79 DATE
DETAIL Flood Routing CHECKED BY JED COMPUTED BY

Stony Brook Reservoir - Flood Routing

Time No.	Observed Inflow (cfs)	Average Inflow (cfs)	$\frac{S}{\Delta T} - \frac{Q}{2}$	$\frac{S}{\Delta T} + \frac{Q}{2}$	Head above Spillway Crest (ft)	Water Surface Elev. (ft)	Q Outflow (cfs)
0	0	0			0	69.00	0
4 hrs.	45	22	54.3	76.0	0.29	70.10	16.85
8	96	70	53.4	123.4	0.45	70.27	34.7
12	140	118	56.7	201.7	0.73	70.55	71.5
16	234	187	130.9	317.8	1.09	70.91	150.4
20	540	387	186.0	559.0	1.56	71.38	288.5
24	905	722	165.4	674.4	1.75	71.57	326.5
28	1800	1354	-52.9	1291.1	2.02	71.84	164.3
32	5160	3480	-357.4	3477	6.48	76.30	3956.
36	7420	6325	-479.3	5916	7.75	77.57	6022.
40	8280	7855	-225	5630	7.66	77.48	7772.
44	8350	8315	-209	6284	7.91	77.73	7772.
48	7820	8085	-256.9	5516	7.61	77.43	7211.
52	6970	7395	-199.2	5408	7.56	77.38	7211.
56	6240	6605	-193	4702	7.23	77.05	6711.
60	5430	5835	-153	4482	7.11	76.93	6511.
64	4490	4955	-109.3	3768	6.71	76.53	5911.
68	3530	4011	-64.0	3336	6.36	76.15	5411.
72	2840	3185	-39.6	2789	5.51	75.53	3911.
76	2320	2580	-23.5	2342.5	4.53	74.55	2911.
80	1910	2115	-24.7	1868.3	3.45	73.47	2211.
84	1660	1785	-27.4	1512.6	2.59	72.41	1611.
88	1420	1540	-25.5	1234.5	1.96	71.78	1211.4
92	1230	1325	-31.5	1011.5	1.65	71.65	1011.
96	1080	1155	-16.4	954.6	1.53	71.53	911.0
100	1000	1040	-14.6	930.4	1.76	71.55	911.4
104	920	960	-14.7	885.6	1.76	71.53	911.4
108	870	895	-11.0	854.0	1.72	71.54	841.0
112	820	845	-26.5	813.5	1.72	71.54	811.0
116	780	800	-22.6	777.4	1.70	71.52	751.0
120	740	760	+7.1	767.1	1.68	71.45	751.0

Peak reservoir elevation

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT Corps of Engineers Jan Insp. JOB NO 320-5-13 PAGE
PROJECT Stony Brook Reservoir DATE CHECKED 1/20/79 DATE
DETAIL Flood Routing CHECKED BY MED COMPUTED BY

Stony Brook Reservoir — Flood Routing

Water Surface Elev.	Head on Spillway (ft)	Calculated Outflow Q (cfs) Spillway	Gate	Tunnel	Total	Calculated Storage, S above spillway (ac-ft)	S / Δt	O / 2	S/Δt + O/2
69.82	0	0		0	0				
70.32	0.5	90.4		40.1	130.5	38.2	115.6	65.2	180.8
70.82	1.0	114.6		114.6	229.2	76.4	231.1	114.6	345.7
71.32	1.5	210.6		210.6	421.2	114.7	347.0	210.6	557.6
71.82	2.0	324.2	+ 1319 =	1643		153.0	462.8	821.5	1284.3
72.32	2.5	461.7	+ 1336 =	1798		191.2	578.7	899.0	1477.7
72.82	3.0	618.3	+ 1353 =	1971		229.4	693.9	985.5	1679.4
73.32	3.5	791.1	+ 1369 =	2160		267.7	809.9	1080.0	1889.9
73.82	4.0	987	+ 1386 =	2370		305.9	925.8	1185.0	2110.
74.32	4.5	1174	+ 1401 =	2575		344.2	1041.2	1287.5	2328.7
74.82	5.0	1375	+ 1417 =	2792		382.4	1156.8	1396.0	2552.
75.32	5.5	1587	+ 1433 =	3020		420.7	1272.6	1510.0	2782.
75.82	6.0	1808	+ 1449 =	3257		459.9	1389.2	1628.5	3017.
75.96	Top of Gate 6.14	1871	+ 1453 =	3324		469.6	1420.5	1662.0	3082.
76.0	6.16	1905	+ 1455 =	3360		472.7	1429.9	1680.0	3110.
76.5	6.68	2883	+ 1471 =	4354		511.0	1545.8	2177.0	3722.
77.0	7.18	4395	+ 1487 =	5882		549.3	1661.6	2941.0	4605.
77.5	7.68	6273	+ 1503 =	7776		587.7	1777.8	3888.0	5666.
78.0	8.18	8450	+ 1520 =	9970		626.0	1893.6	4985.0	6879.

Note:
Assume westbranch tunnel is operated as an auxiliary spillway as follows:

Water Surface Elev.	Gate Opening
69.82 – 71.32	Gate closed
Above El. 71.32	Gate fully open

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT Corps of Engineers - New York
PROJECT Upper Brook Reservoir
DETAIL Westerly Tunnel Capacity

JOB NO 330-5-15
DATE CHECKED 7/20/78
CHECKED BY JRD

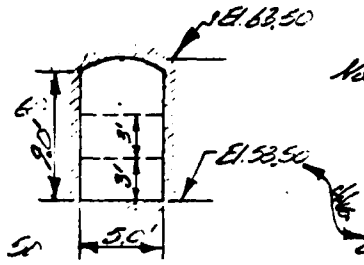
PAGE C-4
DATE 7/19/78
COMPUTED BY [illegible]

APPENDIX D-24

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT Corps of Engineers - New England JOB NO 350-5-13 PAGE
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79 DATE
DETAIL Westerly Tunnel Spillway CHECKED BY JED COMPUTED BY

Consider hydraulic capacity of 5.0' wide x 10' high [illegible] tunnel
down as a supplemental spillway



L = 60 ft. (Tunnel length)

Note: See Drawing measurements between [illegible]
spillway crest to invert outlet of tunnel.

Elev. 81.0 Spillway crest or flow line per [illegible]
-22.5'
Elev. 58.5 Invert outlet in tunnel

Area = (5.0)(5.0) = 49.5 ft²
WP = 5+5+5 = 15.5'
R = 1.6667

Q = CA√RS = 0.70(49.5)√1.6667(0.0167) = 204 cfs

Water Surface Elev. (Contour Datum)	Head on tunnel spillway crest	Discharge with tunnel fully open	Assume weir control, tunnel fully open	Head on tunnel spillway crest	Discharge with h=15.5 ft C=0.70	Head on tunnel spillway crest	Discharge with h=[illegible] C=0.70
					Gate opening = 5 ft.		10 ft. = Gate opening
64.5	1.0 ft.	301.1 cfs	63 cfs	8.0 ft.	262.2 cfs	5.0 ft.	[illegible]
65.5	2.0	425.9		9.0	278.1	6.0	[illegible]
66.5	3.0	521.6		10.0	293.1	7.0	[illegible]
67.5	4.0	602.3	126.8	11.0	307.4	8.0	[illegible]
[illegible]	5.0	673.2		12.0	321.1	9.0	[illegible]
69.5	6.0	737.6		13.0	334.2	10.0	[illegible]
70.5	7.0	796.7		14.0	346.8	11.0	[illegible]
71.5	8.0	851.7		15.0	359.0	12.0	[illegible]
72.5	9.0	903.4	190.2	16.0	370.8	13.0	[illegible]
73.5	10.0	952.3		17.0	382.2	14.0	[illegible]
75.5	12	1043.2		19	404.0	16	[illegible]
77.5	14	1126.8		21	424.8	18	[illegible]
79.5	16	1207.5		23	444.5	20	[illegible]
→ 81.0	17.5	1260	265.3	24.5	458.8	21.5	[illegible]
81.5	18.0	1278		25.0	463.4	22.0	[illegible]
82.0	18.5	1295		25.5	468.1	22.5	[illegible]
82.5	19.0	1313		26.0	472.6	23.0	[illegible]
83.0	19.5	1330		26.5	477.1	23.5	[illegible]
83.5	20.0	1347	283.6	27.0	481.6	24.0	[illegible]
84.0	20.5	1363		27.5	486.1	24.5	[illegible]
84.5	21.0	1380		28.0	490.5	25.0	[illegible]
85.0	21.5	1396		28.5	494.8	25.5	[illegible]
85.5	22.0	1412		29.0	499.1	26.0	[illegible]
86.0	22.5	1428	300.6	29.5	503.4	26.5	[illegible]

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT Corps of Engineers Waltham Engr. JOB NO 385-5-13 PAGE 1 of 1
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/78 DATE 7/19/78
DETAIL Flood Routing CHECKED BY JED COMPUTED BY [illegible]

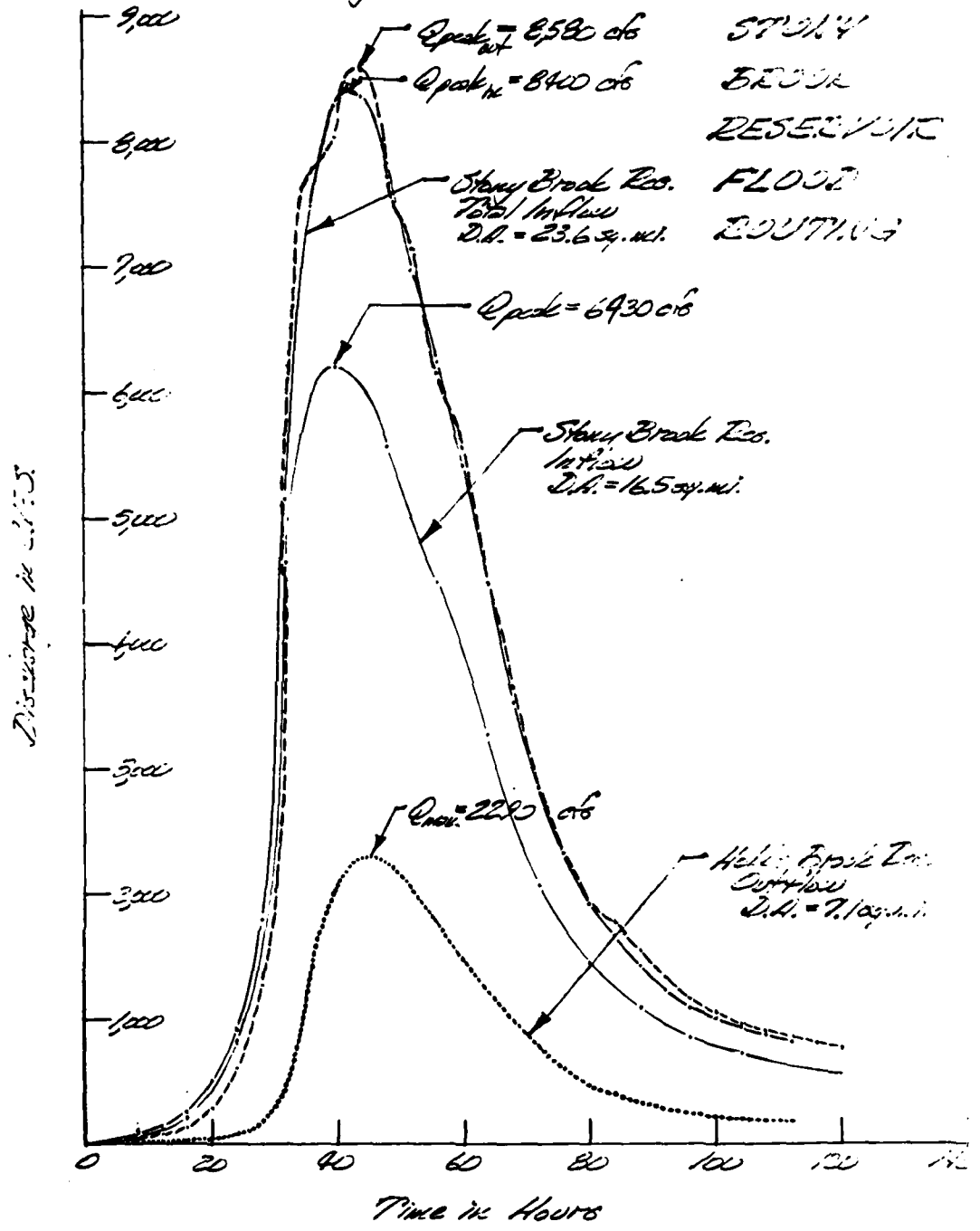
Stony Brook Reservoir - Flood Routing

Time No.	Observed Inflow (cfs)	Average Inflow (cfs)	$\frac{S}{\Delta T} - \frac{Q}{2}$	$\frac{S}{\Delta T} + \frac{Q}{2}$	Head above Spillway Crest (ft)	Water Surface Elev.	
0	0	0			0	[illegible]	
4 hrs.	45	22	54.0	76.0	0.53	720.15	
8	96	70	52.4	123.4	0.95	721.29	3.45
12	140	116	86.7	204.7	0.73	720.99	2.15
16	234	187	130.8	317.8	1.09	721.41	1.24
20	510	372	186.0	558.0	1.81	722.63	2.01
24	908	709	277.5	986.9	2.96	723.72	
28	1800	1354	381.6	1735.6	4.75	725.57	
32	5160	3490	451.7	3941	7.20	728.04	
36	7490	6325	-609.6	5724	6.02	726.84	
40	8280	7885	-797.9	5871	8.08	728.90	
44	8350	8315	-973.1	6465	6.21	727.03	
48	7820	8085	-1393	5791	6.01	726.83	
52	6970	7395	-1994.3	5400	7.68	728.50	
56	6740	6605	-1751.1	4854	7.65	728.47	
60	5430	5585	-1311.3	4273	7.49	728.31	
64	4440	4935	-1092.5	3842	7.20	728.02	
68	3520	4000	-557.7	3443	6.93	727.75	2.5
72	2540	3180	-[illegible]	[illegible]	6.66	727.48	
76	2320	2590	122.1	2708	6.44	727.26	
80	1910	2115	320.0	3395	6.19	727.01	
84	1660	1785	469.4	2254	5.92	726.74	
88	1420	1540	483.4	2023	5.40	726.22	
92	1230	1325	477.2	1802	4.90	725.72	13.4
96	1080	1155	466.4	1621	4.48	725.30	11.2
100	1000	1040	453.5	1493.5	4.18	725.00	10.1
104	920	960	440.9	1400.9	3.96	724.78	
108	870	895	431.5	1326.5	3.79	[illegible]	
112	820	845	425.1	1270.1	3.65	[illegible]	5.3
116	780	800	420.0	1220.0	3.53	724.35	5.1
120	740	760	415.5	1175.5	3.43	724.25	4.8

Zone combination begins

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT Corps of Engineers - New Eng. JOB NO 330-21-15
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79
DETAIL Flood Routing CHECKED BY JCD COMPUTED BY [illegible]
PAGE [illegible] DATE [illegible]



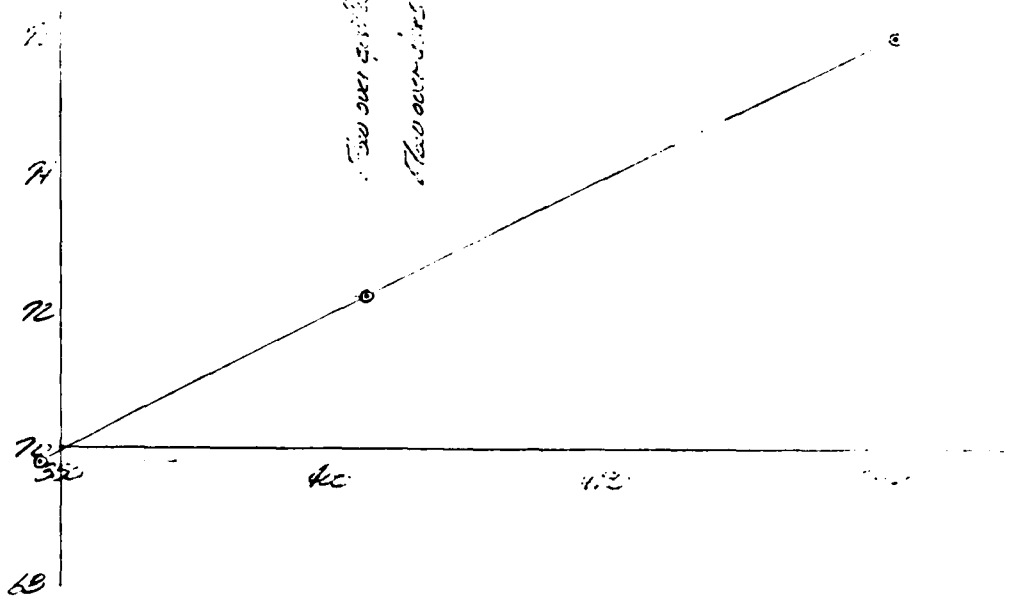
APPENDIX D-21

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT Corps of Engineers Dam Insp. JOB NO 332-5-13 PAGE 5 of
PROJECT Stony Brook Reservoir DATE CHECKED 2/20/79 DATE
DETAIL Flood Routing CHECKED BY MED COMPUTED BY

Stony Brook Reservoir - Flood Routing ΔT = 240 min.

Curve, I = 3.5" C	Water Surface Elev.	Head on Spillway (ft)	Calculated Outflow Q (cfs)	Storage, S, above spillway (acre-ft.)	S/ΔT	O/2 − S/ΔT	O/2 + S/ΔT
C	→ 69.62 Spillway crest	0	0	0			
3.13	70.32	0.5	40.4	32.2	115.6	-75.6	155.6
3.47	70.82	1.0	114.6	76.4	231.1	-116.5	346.1
	71.32	1.5	210.6	114.7	347.0	-136.4	557.6
3.14	71.82	2.0	324.2	153.0	462.5	-138.3	786.7
3.20	72.32	2.5	461.7	191.2	578.4	-116.7	1040.1
3.26	72.82	3.0	616.2	229.4	693.9	-77.7	1310.1
3.31	73.32	3.5	791.1	267.7	809.6	-18.5	1600.7
3.37	73.82	4.0	984.	305.9	925.3	59.3	1909.3
	74.32	4.5	1194.	344.2	1041.2	152.8	2235.6
	74.82	5.0	1375.	382.4	1156.8	259.6	2575.6
	75.32	5.5	1587.	420.7	1272.6	379.1	2931.1
	75.82	6.0	1809.	458.9	1388.2	510.4	3298.0
3.31 →	75.96 Top of Dam	6.14	1871.	468.6	1420.5	475.0	3365.5
	76.0	6.18	1892+1532=3424	472.7	1429.9	497.4	3427.4
	76.5	6.68	2134+1728=3862	511.0	1545.3	104.5	3966.5
	77.0	7.18	2384+1932=4316	549.3	1661.6	-535.7	4477.3
	77.5	7.68	2618+2125=4743	587.7	1777.8	-1359.7	4920.7
	78.0	8.18	2872+2332=5204	626.0	1893.6	-2331.4	6111.0



CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT Corps of Engineers - Baltimore JOB NO 380-5-13
PROJECT Stony Creek Reservoir DATE CHECKED 7/20/79
DETAIL Flood Routing - Hobbs Brook Res. CHECKED BY MED

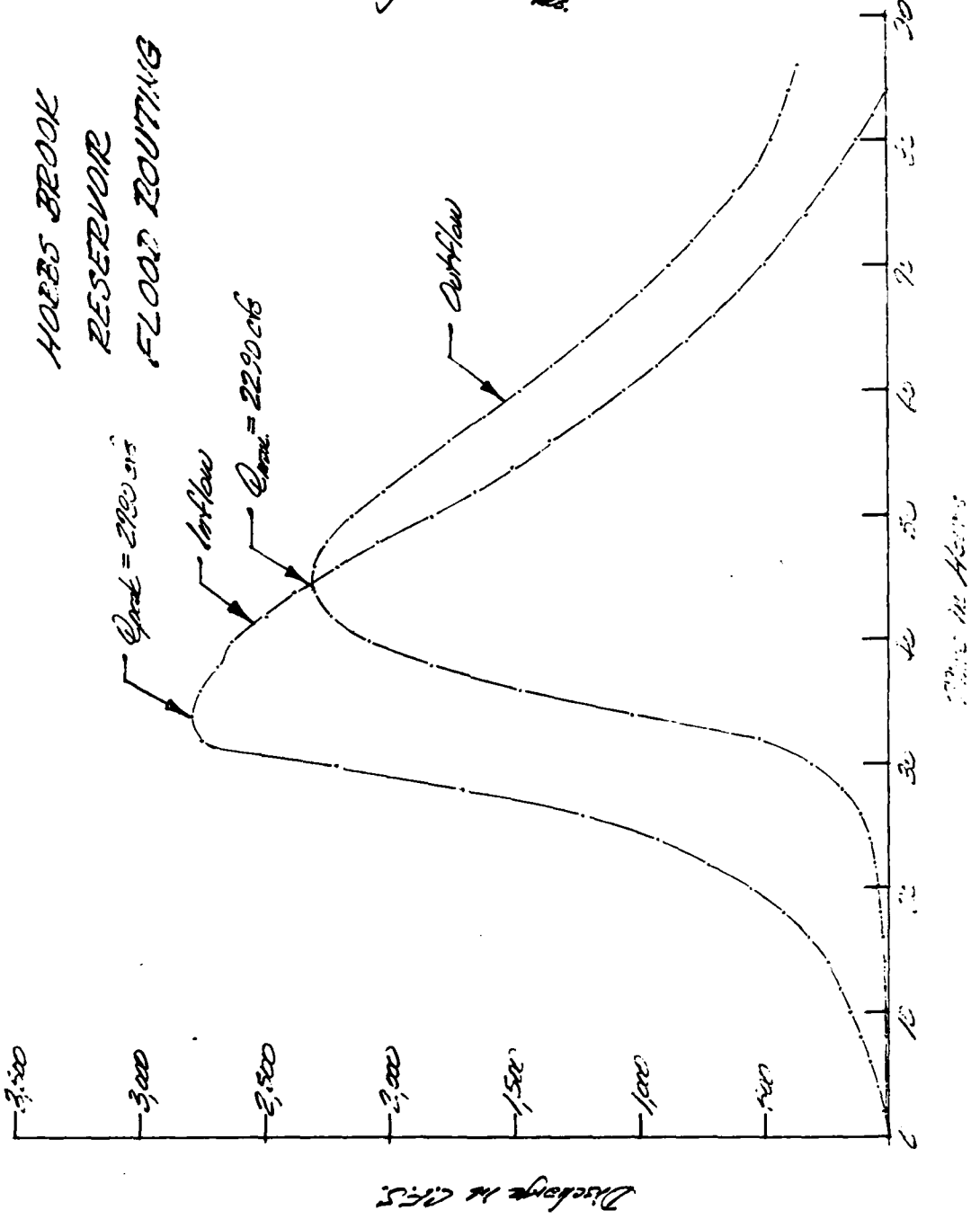
PAGE 4 of
DATE
COMPUTED BY

Hobbs Brook Reservoir - Flood Routing

Time Inc.	Observed Inflow (cfs)	Average Inflow (cfs)	$\frac{2}{\Delta T} - O$ (cfs)	$\frac{2}{\Delta T} + O$ (cfs)	Head above Spillway Crest (ft.)	Water Surface Elev. (ft.)	Outflow (cfs)
0	0	0					
2 hrs.	20	10	934.1	934.1	0.30	179.30	0.0
4	50	80	971.4	1036.4	0.306	179.306	10.15
6	80	65	992.4	1056.4	0.32	179.32	12.0
8	120	100	1044.3	1142.3	0.35	179.35	14.0
10	160	140	1130	1270	0.37	179.37	14.6
12	200	180	1354	1434	0.44	179.44	17.5
14	250	225	1415	1640	0.50	179.50	21.0
16	320	285	1619	1804	0.55	179.55	22.0
18	420	370	1871	2241	0.68	179.68	33.0
20	550	485	2212	2697	0.81	179.81	42.7
22	760	655	2651	3286	0.96	179.96	49.0
24	920	840	3207	4077	1.22	180.22	63.5
26	1270	1095	3945	5055	1.51	180.51	110
28	1700	1485	4951	6436	1.92	180.92	154.7
30	2200	1950	6251	8101	2.43	181.43	182.5
32	2740	2470	7913	10363	3.09	182.09	311
34	2980	2860	9856	12816	4.28	183.28	480
36	2950	2965	11,599	14363	5.17	184.17	740
38	2680	2815	12,893	15608	5.81	184.81	1057
40	2630	2650	13,790	16430	6.22	185.22	1320
42	2490	2560	14,355	16910	6.46	185.46	1477
44	2410	2450	14,814	17,114	6.56	185.56	1502
46	2300	2355	14,825	17,110	6.56	185.56	1502
48	2240	2270	14,822	16,942	6.48	185.48	1460
50	1820	1930	14,706	16636	6.32	185.32	2150
52	1650	1735	14,496	16231	6.12	185.12	2918
54	1500	1575	14,218	15793	5.90	184.90	3788
56	1350	1425	13,912	15337	5.67	184.67	4712
58	1190	1270	13,597	14857	5.42	184.42	5630
60	1050	1120	13,243	14365	5.17	184.17	6561
62	920	985	12,891	13879	4.93	183.93	7394
64	800	860	12,542	13402	4.68	183.68	8216
66	690	745	12,186	12921	4.44	183.44	8968
68	590	640	11,835	12475	4.20	183.20	9650
70	490	540	11,493	12033	3.97	182.97	9770
72	410	450	11,161	11,611	3.75	182.75	9751
74	320	365	10831	11,196	3.53	182.53	9682
76	250	285	10505	10790	3.31	182.31	9604
78	180	215	10187	10402	3.10	182.10	9508
80	120	150	9882	10,032	2.85	181.85	9375
82	60	90	9570	9660	2.84	181.84	9039
84	0	30	9231	9261	2.73	181.73	8.93
86	0	0	8868	8913	2.62	181.62	8853

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT Corps of Engineers-Waltham JOB NO 35-5-15
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79
DETAIL Flood Routing-Hobbs Brook Res. CHECKED BY ED
PAGE 3 of
DATE
COMPUTED BY



APPENDIX D-18

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT Corps of Engineers Providence JOB NO 320-5-15 PAGE
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79 DATE
DETAIL Flood Routing - Hobbs Brook Res. CHECKED BY JED COMPUTED BY

Hobbs Brook Reservoir - Flood Routing $\Delta T = 60$ min.

Water Surface Elev.	Reservoir Area (acres)	Calculated Outflow Q (cfs)	Calculated Storage, S above spillway (acre-ft.)	$\frac{S}{\Delta T}$	$\frac{S}{\Delta T} - \frac{Q}{2}$	$\frac{S}{\Delta T} + \frac{Q}{2}$
179.0		0	0			
179.5		21.2	270.1	5553	3252.4	3273.6
180.0		59.9	543.2	6573	6543	6603
180.5		110.1	816.4	9878	9823	9933
181.0		169.9	1092.6	13,302	13,217	13,387
181.5		320.1	1368.8	16,562	16,402	16,722
182.0		498.5	1648.1	19,943	19,725	20,161
183.0		892	1924.	23,286	22,840	23,732
184.0		1373	2204.	26,663	25,992	27,334
185.0		1939	2483.	30,044	29,095	30,993
186.0		2565	2762.	33,420	32,133	34,707
187.0		3251	3040.			

$\Delta T = 12$ min.

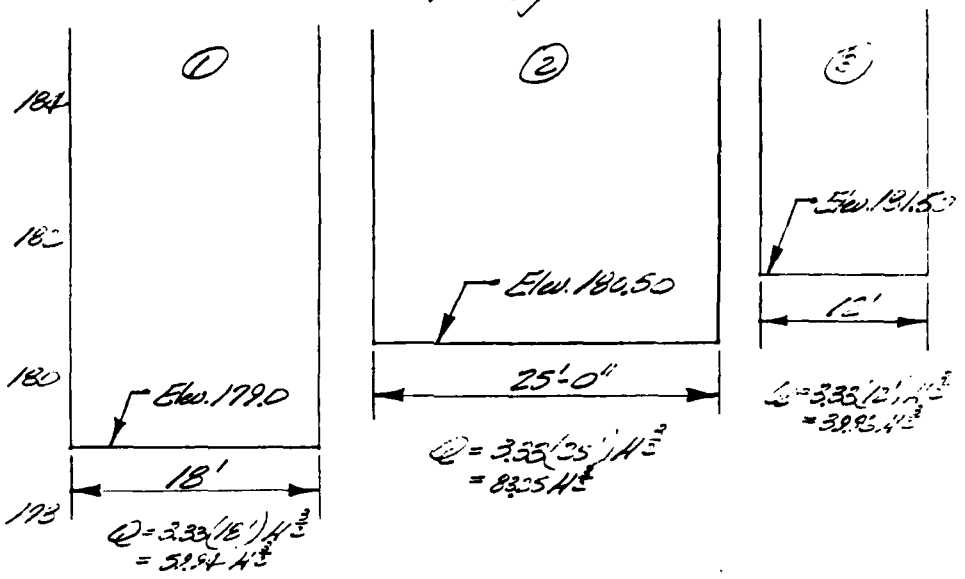
Water Surface Elev.	Reservoir Area (acres)	Calculated Outflow Q (cfs)	Calculated Storage, S above spillway (acre-ft.)	$\frac{S}{\Delta T}$	$\frac{S}{\Delta T} - \frac{Q}{2}$	$\frac{S}{\Delta T} + \frac{Q}{2}$
179.0		0	0			
179.5		21.2	270.1	1634.1	1623.5	1644.7
180.0		59.9	543.2	3284.5	3255.1	3314.0
180.5		110.1	816.4	4938.9	4883.8	4994.0
181.0		169.9	1092.6	6611	6526.1	6695.9
181.5		320.1	1368.8	8281	8121	8441
182.0		498.5	1648.1	9971	9722	10,220
183.0		892	1924.	11,640	11,194	12,086
184.0		1373	2204.	13,334	12,647	14,021
185.0		1939	2483.	15,022	14,053	15,991
186.0		2565	2762.	16,710	15,428	17,992
187.0		3251	3040.			

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT Corps of Engineers - Div. Eng. JOB NO 32-5-15
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79
DETAIL Hydrology / Test Flood Evaluation CHECKED BY JED

PAGE 6
DATE 7/20/79
COMPUTED BY [illegible]

Hobbs Brook Reservoir Spillway



Water Surf. Elevation	H_1	Q_1	H_2	Q_2	H_3	Q_3	Total Flow
179.0	0	0					0
179.5	0.5	21.2					21.2
180.0	1.0	59.9					59.9
180.5	1.5	110.1	0	0			110.1
181.0	2.0	169.5	0.5	20.8			190.3
181.5	2.5	236.9	1.0	83.2	0	0	320.1
182.0	3.0	311.5	1.5	187.2	0.5	14.1	472.8
183.0	4.0	480	2.5	329.1	1.5	73.4	882
184.0	5.0	670	3.5	545	2.5	139.0	1354
185.0	6.0	881	4.5	795	3.5	211.7	1888
186.0	7.0	1110	5.5	1074	4.5	291.	2475
187.0	8.0	1356	6.5	1380	5.5	375.	3111

CAMP DRESSER & McKEE INC.

CLIENT COE | JOB NO 350-5-13 | PAGE 15
PROJECT Stony Brook | DATE CHECKED 2-23-90 | DATE [illegible]
DETAIL Test Flood Det | CHECKED BY [illegible] | COMPUTED BY JET

TEST FLOOD DEVELOPMENT

Test flood = PMF

Based on data used to develop COE Guideline Lines for estimating Maximum Probable Flood Peak Flow Rates, for the characteristics of the Stony Brook watershed, select a CSM value between the plot of the Rocky River - Sudbury River and Indian Brook - Charles River. This gives a value of 390 cfs/mi² for a 23.6 mi² D.A. This is somewhat less than the Guidelines "Flat - Central" curve and is considered representative of the Stony Brook watershed.

Peak inflow to Hobbs Brook Reservoir:

7.1 sq. mi. x 390 CSM = 2,769 cfs

Peak inflow to Stony Brook Reservoir is the combination of the outflow hydrograph from Hobbs Brook and the inflow hydrograph to Stony Brook Res. from the 16.5 mi² intervening D.A.

Peak inflow contribution from 16.5 mi² D.A.:

16.5 sq. mi. x 390 CSM = 6430 cfs

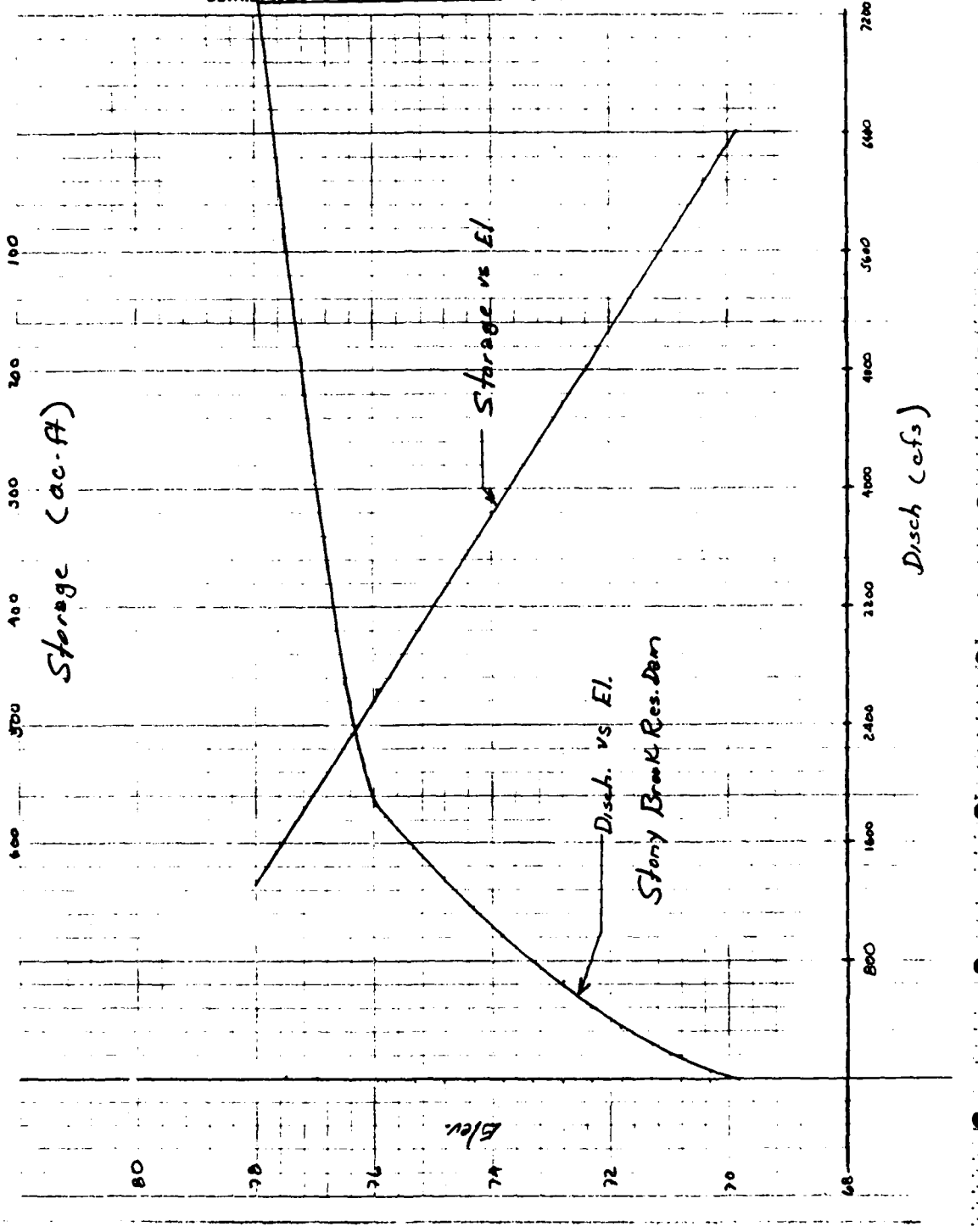
The following pages show the routings through Hobbs & Stony Brook Reservoirs

CAMP DRESSER & MCKEE INC.

CLIENT C of E
PROJECT Stony Brook
DETAIL Stor - Disch - El.

JOB NO 380-5-13
DATE CHECKED 6-8-79
CHECKED BY [illegible]

PAGE 14
DATE 11/17/12
COMPUTED BY WRK



CAMP DRESSER & McKEE INC. CLIENT C C E JOB NO 2-0-5-17 PAGE 12
PROJECT Story Brook DATE CHECKED 6-29 DATE 10 [illegible]
DETAIL Spillway Cap CHECKED BY [illegible] COMPUTED BY [illegible]

Stage - Discharge - Spillway Assume No Flashboards

L = 36.5' C = 3.33

	Spillway		Dam		
Elev.	Ht (ft.)	Q (cfs)	Ht (ft.)	Q (cfs)	TOTAL Q (cfs)
69.82	0	0			
70.32	.5	43.0			
70.82	1.0	121.5			
71.32	1.5	223.3			
71.82	2.0	343.8			
72.32	2.5	480.4			
72.82	3.0	631.6			
73.32	3.5	795.9			
73.82	4.0	972.4			
74.32	4.5	1160.3			
74.82	5.0	1358.9			
75.32	5.5	1567.8			
75.82	6.0	1786.3			
75.96	6.14	1849.2	0	0	1849.2
76.46	6.64	2079.6	0.5	603.9	2683.5
76.96	7.14	2318.9	1.0	1708.0	4026.9
77.46	7.64	2566.7	1.5	3137.8	5704.5
77.96	8.14	2822.0	2.0	4531.0	7353.0

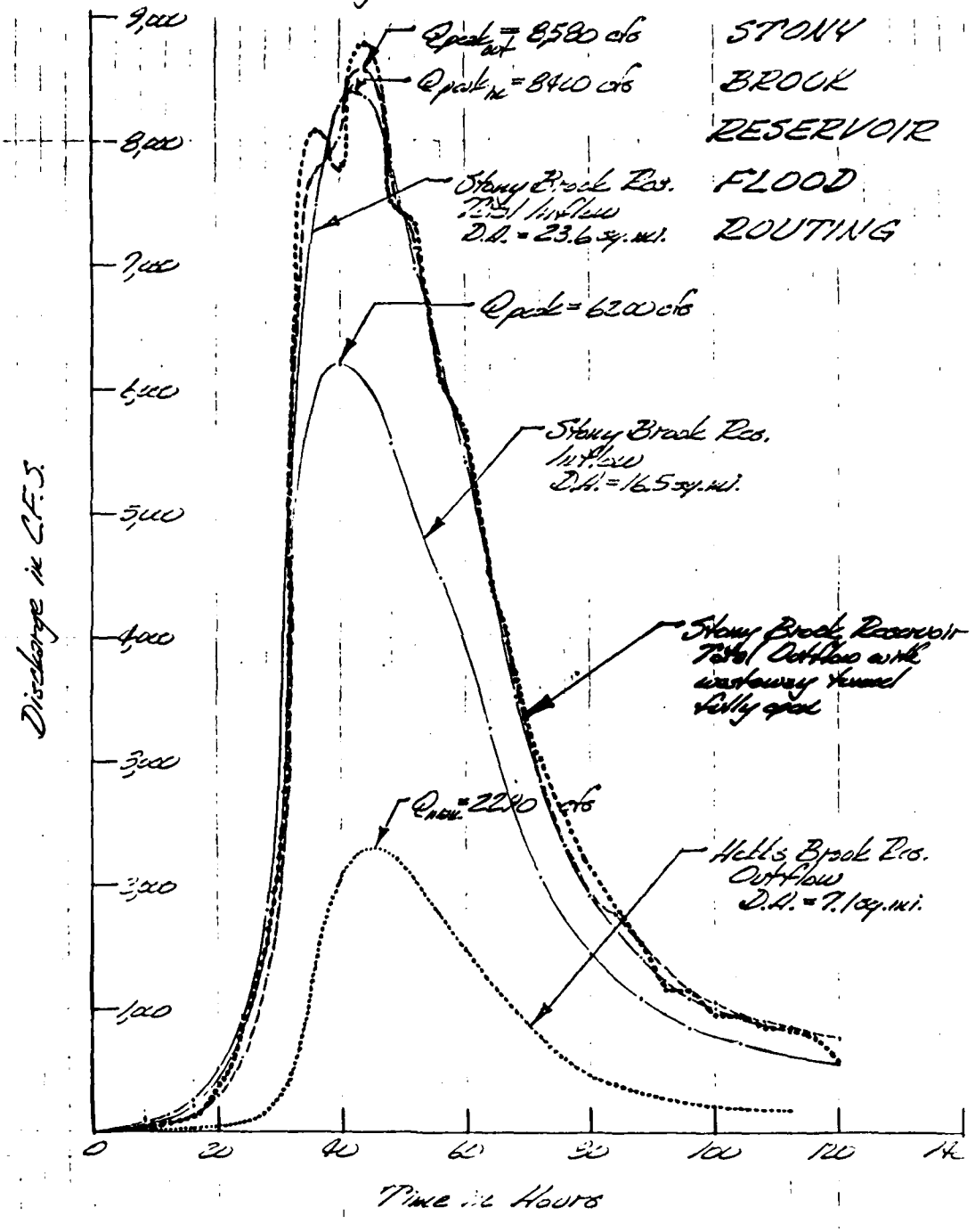
Storage:

@ El. 69.82 = 346 mg = 1061.8 ac-ft } Δ = 181.1 ac-ft
@ El. 72.22 = 405 mg = 1242.9 ac-ft }
Δ = 288.5 ac-ft
@ El. 75.96 = 499 mg = 1531.4 ac-ft
E = 470 ac-ft

AMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT [illegible] JOB NO [illegible]
PROJECT Stony Brook Reservoir DATE CHECKED 7/20/79
DETAIL Flood Routing CHECKED BY JED

PAGE 12 of
DATE July 1979
COMPUTED BY [illegible]



CAMP DRESSER & McKEE Environmental Engineers Boston, Mass.

CLIENT C of E | JOB NO 380-5-13 | PAGE 15
PROJECT Story Brook | DATE CHECKED [illegible] | DATE 11/19/79
DETAIL Test Flood | CHECKED BY [illegible] | COMPUTED BY WAK

From Corps of Engineers Guidelines, the PMF for the inflow to Story Brook will be 390 cfs / sq. mi.

D.A. = 16.5 mi^2

∴ PMF = 16.5 × 390 = 6435 cfs inflow.

Surcharge - Storage

Q_{P_1} = 6435 cfs

Surch Ht = 77.7'

Stor. @ Elev. 77.7 = 610 ac-ft

$$R.O. = \frac{610}{53.3 \times 16.5} = .69"$$

$$Q_{P_2} = 6435 \times \left(1 - \frac{.69}{19.0}\right)$$

= 6201 cfs

Surch Ht = 77.60'

$Stor_2$ @ Elev 77.6 = 605 ac-ft

Q_{P_2} = 6200 cfs

Q_{in} = 6435 cfs

Q_{out} = 6200

A flow of 6200 cfs will result in a height of flow at Elev. 77.60, or approx. 1.6 feet over the top of the dam.

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT C of E
PROJECT Stony Brook
DETAIL Tailwater Anal

JOB NO 280-5-13
DATE CHECKED 6-6-79
CHECKED BY [illegible]

PAGE 16
DATE 1/[illegible]/79
COMPUTED BY WA

Tailwater Analysis

Q_{out} = 8400 cfs

As indicated in the dam failure analysis, the ws elevation for a Q of 74,895 cfs would be approximately 61.1. With a Q out of only 8400 cfs, the w.s. would obviously be below 52.7, and therefore the dam as such would not be submerged.

Downstream Effects of PMF

Q_T = 8400 cfs Must pass this flow South St. Culvert.

Establish Rating Curve for culvert on South St.

Inv. culv. = 48.4'

w = 33.2' max ht = 6.0'

Assume ws = 50.0

d = 1.6

$R = \frac{33.2 \times 1.6}{33.2 + 1.6 + 1.6} = \frac{53.12}{36.4} = 1.4$

$Q = \frac{1.49}{.015} \times 1.46^{2/3} \times .002^{1/2} \times 53.12$

$= 99.3 \times 1.29 \times .0447 \times 53.12 = 304.2$ cfs

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT G of E
PROJECT Stacy Brook
DETAIL Test flood

JOB NO 380-5-12
DATE CHECKED 6-4-79
CHECKED BY Miller

PAGE 17
DATE 1/17/80
COMPUTED BY WAL

Assume W.S.= 52.0' $d = 3.6$ $R = \frac{119.5}{40.4} = 2.96$

$Q = 99.3 \times 2.96^{2/3} \times .0447 \times 119.5$

$= 1093.5$ cfs

Assume w.s. = 53.0 $d = 4.6$ $R = \frac{152.72}{42.4} = 3.60$

$Q = 99.3 \times 3.6^{2/3} \times .0447 \times 152.72 = 1592$ cfs

plus weir flow over South St

Sect ① $Q = 2.5 \times 40 \times .5^{1.5} = 35.4$ cfs

② $= 2.5 \times 685 \times 1^{1.5} = 1712.5$ cfs

③ $= 2.5 \times 60 \times .5^{1.5} = 53.0$ cfs

Total Q = 3292.9 cfs

Assume w.s. = 53.5 $d = 5.1$ $R = \frac{169.32}{43.4} = 3.9$

$Q = 99.3 \times 3.9^{2/3} \times .0447 \times 169.32$

$= 1862$ cfs

Plus weir flow

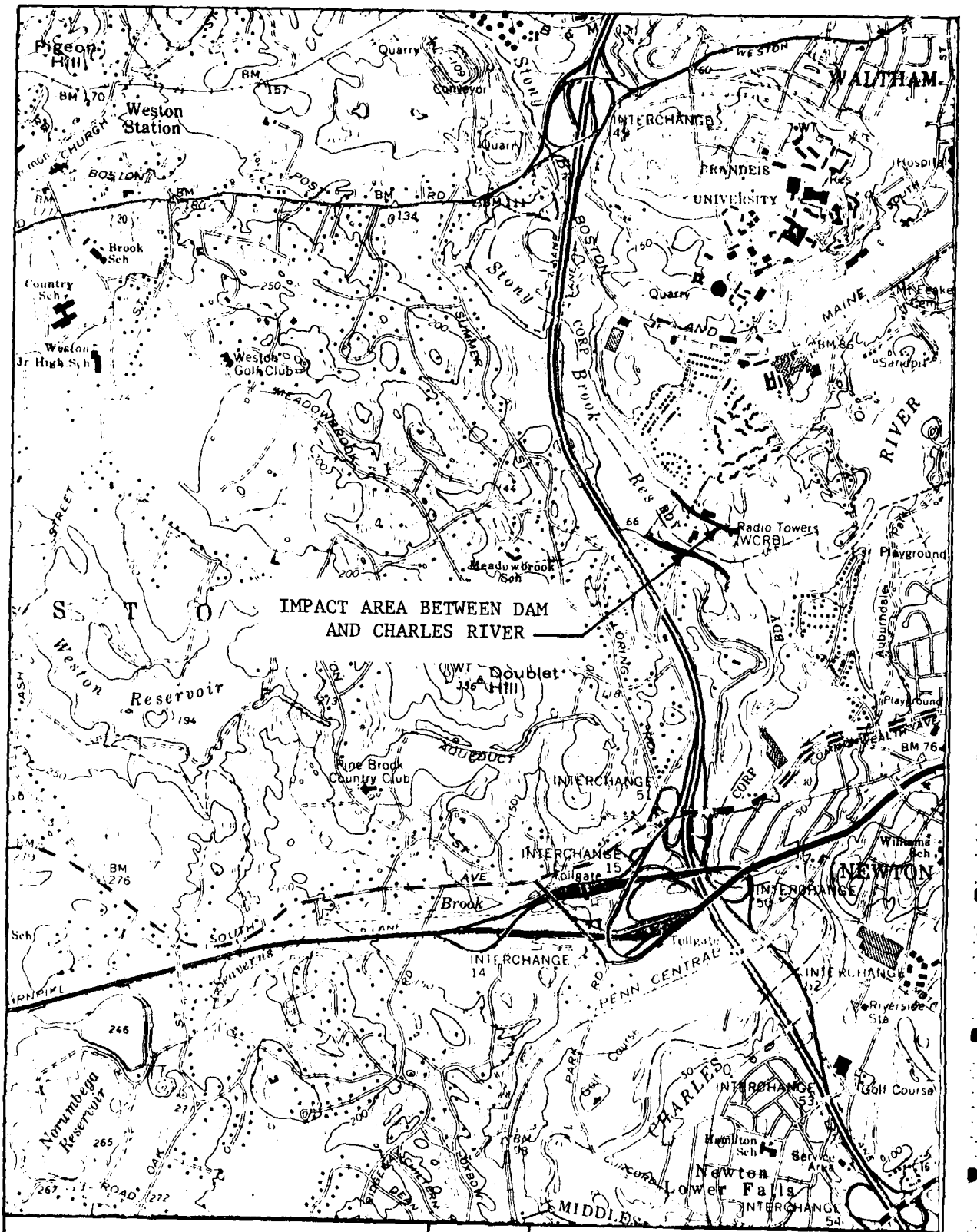
① $Q = 2.5 \times 50 \times .75^{3/2} = 81.2$

② $Q = 2.5 \times 685 \times 1.5^{3/2} = 3146.0$

③ $Q = 2.5 \times 100 \times .75^{3/2} = 162.4$

Total = 5251.6 c.f.s

From Rating Curve on Page 9, the Q_{out} = 8400 c.f.s will produce a w.s. elevation of 54.9' m.s.l.



DAM STONY BROOK RESERVOIR

IDENTIFICATION NO. MA 00293

DAM FAILURE
IMPACT AREA MAP

APPROX. SCALE: 1" = 2000'

APPENDIX E
INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1)	(2)	(3)	(4)	(5)	(6)	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
[illegible]	[illegible]	PA	017	[illegible]	[illegible]	STONY BROOK RESERVOIR DAM	4221.3	7115.4	22	JUN	77

POPULAR NAME	NAME OF IMPOUNDMENT
	STONY [illegible]

(7) REGION/BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	(8) DIST. FROM DAM (MI)	POPULATION
01	STONY [illegible]	[illegible]LTHAM	0	81502

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT)	HYDRAULIC HEIGHT (FT)	IMPOUNDING CAPACITIES (ACRE-FT)		DIST DAM	FED R	PRV/FED	SCS A	VER/DATE
[illegible]	1687	S	32	32	1550	1060	FED	N	N	N	22JUN79

REMARKS

DIST DAM	SPILLWAY LENGTH (FT)	WIDTH (FT)	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PRESENT (MW)	NAVIGATION LOCKS LENGTH (FT)	WIDTH (FT)
1	[illegible]	[illegible]	1650					

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF [illegible]		

REGULATORY AGENCY

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
[illegible]	[illegible]	[illegible]	[illegible]

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
[illegible] SASAKI & MCKEE INC	[illegible]	[illegible]	78	PL 92-367

REMARKS

[illegible]

END

FILMED

7-85

DTIC