AD-A142 613 NATIONAL DAM INSPECTION PROGRAM BRISTOL RESERVOIR DAM (CT 00008) CONNECTI..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV SEP 78 1/1

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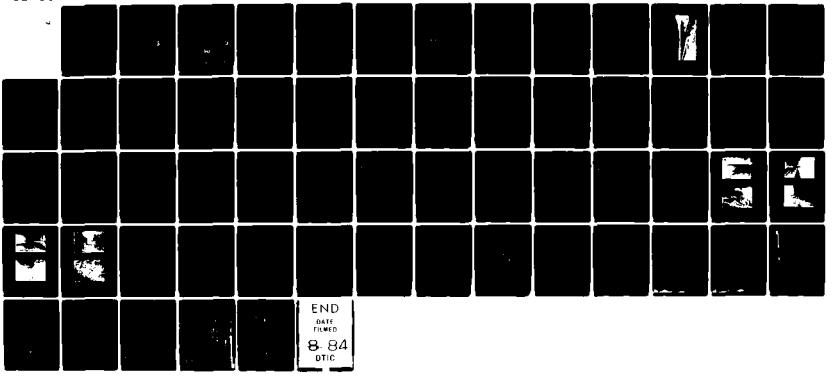

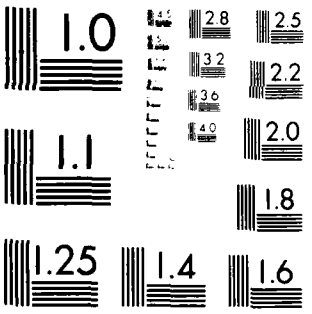

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut River Basin
Bristol, Connecticut

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

The Bristol Reservoir Dam is an earthfill embankment with a stone masonry core that is 250 ft. long and 25 ft. high. It has a 200 ft. long, 12 ft. wide stone masonry spillway channel and a 10 inch cast iron diversion conduit. The dam is classified as small in size and has a high hazard potential based on downstream habitation. Based on the visual inspection data and past operational performance, the dam is judged to be in fair condition. There are areas which should be studied in order to monitor the dam's behavior such as the excessive seepage at the base of the spillway channel and the seepage through the body of the dam.

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AD-A142 613

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CONNECTICUT RIVER BASIN

BRISTOL, CONNECTICUT

BRISTOL RESERVOIR DAM
CT. 00008

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPA
NEW ENGLAND
W

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

REPLY TO
ATTENTION OF
NEDED

MAY 23 1979

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

I am forwarding to you a copy of the Bristol 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 Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, the City of Bristol, Bristol Water Department, Bristol, Connecticut 06450.

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 Protection for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NAT[illegible] NSPECTI[illegible] PROGRAM

PHASE 1 INSPECTION REPORT

Identification Number:	CT 00008
Name:	Bristol Reservoir Dam
Town:	Bristol
County and State:	Hartford County, Connecticut
Stream:	Pequabuck River
Date of Inspection:	September 21, 1978

BRIEF ASSESSMENT

The Bristol Reservoir Dam is an earthfill embankment with a stone masonry core that is 250 feet long and 25 feet high. It has a 200 foot long, 12 foot wide stone masonry spillway channel and a 10 inch cast iron diversion conduit. The dam is classified as small in size and has a high hazard potential based on downstream habitation.

Based on the visual inspection data and past operational performance, the dam is judged to be in fair condition. There are areas which should be studied in order to monitor the dam's behavior such as the excessive seepage at the base of the spillway channel and the seepage through the body of the dam.

The drainage area contributing to the dam is 0.359 square miles. The routed test flood outflow (one-half Probable Maximum Flood) is 404 cfs and would overtop the dam by 1.15 feet. The project will pass only 50 percent of the routed test flood peak outflow before overtopping the dam.

Recommended measures to be undertaken by the owner should include monitoring seepage, establishing an inspection program and increasing the spillway capacity. The owner shall implement the recommendations and remedial measures described in Section 7 within two years after receipt of this Phase I Inspection Report.

Joseph F. Merluzzo
Connecticut P.E. #7639
Project Manager

Richard F. Lyon
Connecticut P.E. #8443
Project Engineer

The Phase I Inspection Report on Bristol 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.

Charles G. Tiersch

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

Fred J. Ravens Jr.

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

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

This report is prepa[illegible]er guidance contained in the Recommended Guidelines fo[illegible]y Inspection of Dams, for Phase I Investigations. [illegible]f these guidelines may be obtained from the Office of [illegible] of Engineers, Washington, D.C. 20314. The purpose of [illegible]hase I Investigation is to identify expeditiously those [illegible]ams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface evaluations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify the 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.

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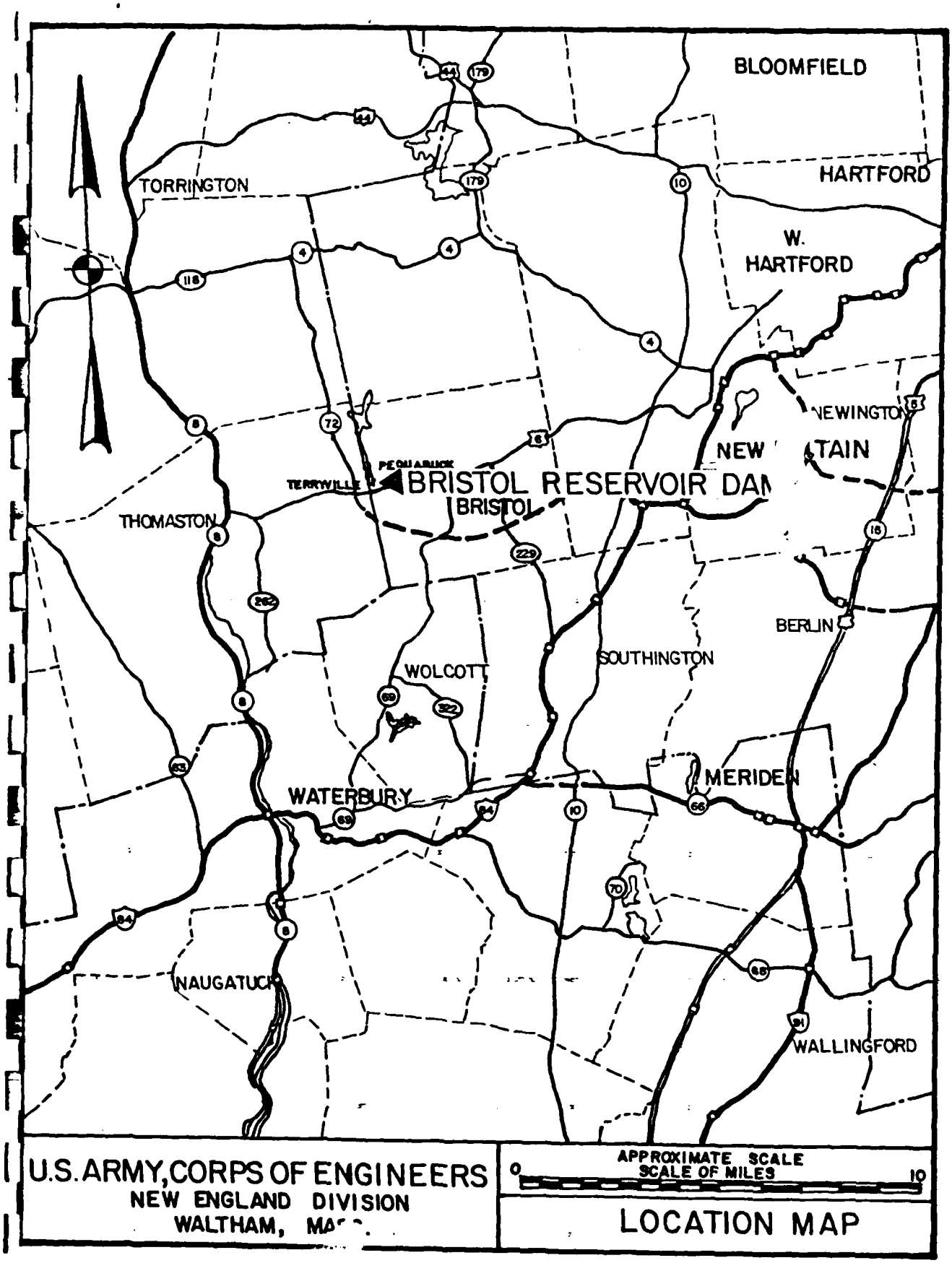
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MERIDEN
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NAUGATUCK
WALLINGFORD
U.S. ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MA
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LOCATION MAP

PHASE I INSPECTION REPORT

BRISTOL RESERVOIR DAM CT 00008

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. Storch Engineers has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Storch Engineers under a letter of May 3, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0000 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.

PHASE I INSPECTION REPORT

BRISTOL RESERVOIR DAM CT 00008

SECTION 1 - PROJECT INFORMATION

1.1 General

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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 Bristol Reservoir Dam is located just off U.S. Route 6 approximately 10 miles west of Hartford in the City of Bristol, Connecticut (See Location Map).

b. Description of the Dam and Appurtenances - The structure is an earth embankment with a stone masonry core. The dam is 250 feet long and 25 feet high (Appendix B, Plates 1 and 2). It has a combined emergency spillway and channel as well as a diversion conduit with a gate valve.

c. Size Classification - The size classification of the dam is small. Both the height and storage (25 feet high and 348 acre-feet of storage) governs the classification per the criteria set forth in the Recommended Guidelines for Safety Inspection of Dams (small - greater than 25 and less than 40 feet high and greater than 50 and less than 1,000 acre-feet of storage) by the Corps of Engineers.

d. Hazard Classification - The hazard classification is high per criteria set forth in the guidelines mentioned in Section 1.2.c above. Failure of this dam would affect approximately 20 houses as well as portions of Bristol's downtown business district (Appendix D, Plate 4).

e. Ownership - The Bristol Reservoir Dam is owned by the Bristol Water Department, City of Bristol, Connecticut.

f. Operator - The person in charge of day to day operation of the dam is John Burns, Bristol Water Department, Bristol, Connecticut 06010; Telephone Number: 582-7431.

g. Purpose of Dam - The dam impounds the Bristol Reservoir No. 1 and serves as a drinking water supply for the City of Bristol.

h. Design and Construction History - The Bristol Reservoir Dam was built around the year 1885 and was taken over in 1910 by the Bristol Water Department. There is one contract drawing available of the original construction but no other design calculations had been done. Neither the contractor nor the details of construction were known by any of the Bristol Water Department's personnel.

i. Normal Operational Procedures - There is a regular staff of maintenance personnel from the Bristol Water Department available. Regular maintenance includes the cutting of grass on the embankment of the dam.

1.3 Pertinent Data

a. Drainage Area - A 229 acre drainage area contributes to the dam. The terrain is rolling with mixed amounts of open space and residential development.

b. Discharge at Damsite - The maximum known spillway discharge was approximately 200 cfs during the flood of August, 1955.

(1) Outlet works: (conduits) size 10 inch and invert elevation 582.5.

(2) Maximum known flood at damsite: 200 cfs.

(3) Ungated spillway capacity at maximum pool elevation: 200 cfs at 603 elevation.

(4) Gated spillway capacity at pool elevation: N/A cfs at N/A elevation.

(5) Gated spillway capacity at maximum pool elevation: N/A cfs at N/A elevation.

(6) Total spillway capacity at maximum pool elevation: 200 cfs at 603 elevation.

c. Elevation (Feet above MSL)

(1) Top of dam: 603

(2) Maximum pool-design surcharge: 603

(3) Full flood-control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 599

(6) Upstream portal invert diversion tunnel: 582.5

(7) Streambed at centerline of dam: 582

(8) Maximum tailwater: 584

d. Reservoir

(1) Length of maximum pool: 3,200 feet ±

(2) Length of recreation pool: N/A

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

e. Storage (Acre-Feet)

(1) Recreation pool: N/A

(2) Flood-control pool: N/A

(3) Design surcharge: 348 ±

(4) Top of Dam: 348 ±

f. Reservoir Surface (Acres)

(1) Top of dam: 55 ±

(2) Maximum pool: 55 ±

(3) Flood-control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 27.5

g. Dam

(1) Type: Earth embankment

(2) Length: 250 feet ±

(3) Height: 25 feet ±

(4) Top Width: 22 feet ±

(5) Side Slopes: 1:1.5

(6) Zoning: see section (Plate 2)

(7) Impervious Core: Stone masonry

(8) Cutoff: unknown

(9) Grout curtain: unknown

(10) Other: N/A

h. Diversion and Regulating Tunnel

(1) Type: Cast iron

(2) Length: 55 feet ±

(3) Closure: N/A

(4) Access: None

(5) Regulating Facilities: manually operated gate valve, (10" blowoff)

i. Spillway

(1) Type: Stone masonry channel

(2) Length of weir: 12 feet

(3) Crest elevation: 599 feet

(4) Gates: none

(5) U/S Channel: underwater

(6) D/S Channel: overgrown with brush

(7) General: N/A

j. Regulating Outlets

Regulating outlet is a 10 inch blowoff that discharges just below the dam.

(1) Invert: 582.5

(2) Size: 10 inch

(3) Description: Cast iron

(4) Control Mechanism: manually operated gate valves

(5) Other: N/A

SECTION 2 - ENGINEERING DATA

2.1 Design

The facility was built around 1885. There is no design information available. The Bristol Water Department took over the dam in 1910.

2.2 Construction

There are no records or photographs available of the 1885 construction.

2.3 Operation

The water level in this reservoir is controlled by valves that are in valve boxes at the toe of the dam.

2.4 Evaluation

a. Availability - A schematic drawing of the dam prepared by the Bristol Water Department was readily available. Because of the age of the dam, there was no design information. The dam has no emergency procedures in case of overtopping.

b. Adequacy - The information that was made available was only a minor factor in the assessment which was based mainly on the visual inspection, past performance history and hydrologic and hydraulic assumptions.

c. Validity - The schematic drawing provided by the Bristol Water Department was accurate to the extent that the visual inspection did not reveal any new features.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General - The visual inspection was conducted on September 21, 1978 by members of the engineering staff of Storch Engineers. A copy of the visual inspection check list is contained in Appendix A of this report.

Before the inspection, a contract drawing of the dam that was made available by the Bristol Water Department was studied. A compact sketch of the dam was made for orientation during the inspection (Appendix B, Plate 1).

In general, the overall appearance and condition of the dam is fair.

b. Dam - According to the data sheet supplied from the Bristol Water Department, the body of the dam is composed of earth fill with a stone masonry core. The crest of the dam has no visible bulges or cracks (Appendix B, Plates 1 and 2). Several rodent holes were found on the dam face and soft ground was noted on the downstream slope of the dam (Appendix C, Photo 2). Inspection of the toe showed some seepage, which included several marshy areas that are noted in Appendix B on Plate 1. The seepage water was clear and did not appear to be carrying any sediment. There is an extensive seepage source at the downstream zone of the

spillway channel with a discharge of approximately 1 gallon per second (Appendix C, Photo 8). Seepage from the drainage pipe through the masonry headwall and at the toe of the dam totals approximately 6 to 8 gallons per minute (Appendix C, Photo 7).

c. Appurtenant Structures - The appurtenant structures are the spillway, the diversion conduit and the spillway channel. The fieldstone spillway shown in Appendix C, Photos 3 and 4, appears to be in fair condition with a considerable amount of grass growing through the mortar joints.

There is need for some restoration of the spillway because there are some areas of structural distress. This distress is the cracking of walls and some spalling. There are two valves at the toe of the dam. The upper valve is always open.

d. Reservoir Area - Inspection of the area adjacent to the embankment of the dam indicated a very rolling wooded terrain.

e. Downstream Channel - The downstream channel (Appendix C, Photo 6) of the spillway is overgrown with brush and it is very difficult to define its actual location. The channel seems to follow the natural fall and presently has no form of slope protection. It stays moist from the seepage flows out of the body of the dam (Appendix C, Photo 8). There is

a concentrated seepage flow at the end of the spillway channel with a discharge of approximately 1 gallon per second. This flow along with other flows results in a total seepage flow of 2 to 3 gallons per second.

3.2 Evaluation

Overall, the general condition of the dam and appurtenant structures based on the results of the visual inspection is fair. The observation of the extensive zones of seepage on the downstream slope of the dam and the spillway channel indicates a need for further study so that the extent of this problem can be defined.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The responsibility for maintenance is with the Bristol Water Department with engineering and construction assistance from the City of Bristol, Public Works Department. There is no formal procedure for lowering the reservoir during seasons of heavy rain. The reservoir is essentially filled and lowered depending on the requirements of the adjacent Water Treatment Plant.

4.2 Maintenance of Dam

There are tasks of routine maintenance performed, however, it primarily consists of cutting the grass on the face of the dam. Items such as clearing the downstream and upstream embankment of trees and brush have not been undertaken for years. The maintenance of the spillway channel and weir has been neglected.

4.3 Maintenance of Operating Facilities

There are no procedures for maintenance of the operating facilities.

4.4 Description of Warning System

There is no warning system in effect.

4.5 Evaluation

In view of the limited routine maintenance procedures, it is suggested that an expanded program be established.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data - The 12 foot spillway and 10 inch blowoff are the only means of transmitting water past the dam. Under conditions of the test flood (1/2 the Probable Maximum Flood), the spillway will carry only a portion of the flood water.

Using the guide curves supplied by the Corps of Engineers (rolling terrain), the test flood peak inflow into the reservoir is 600 cfs and the routed outflow is 404 cfs. The pond elevation at the test flood outflow is 604.15 or 1.15 feet over the top of the dam. The capacity of spillway at the top of the dam is only 200 cfs or approximately 50 percent of the routed test flood outflow (Appendix D).

b. Experience Data - The Bristol Reservoir Dam has experienced the floods of November, 1927; March, 1936; September, 1938 and August (maximum) and October, 1955. During the flood of August, 1955, the elevation of the pond was approximately 603 feet and the discharge was approximately 200 cfs.

c. Visual Observations - The spillway at the time of the inspection was in fair condition with evidence of water seepage at the lower end and grass and brush growing up through joints (Appendix C, Photo 4).

The channel downstream is overgrown with trees and brush and is not conducive to the free passage of flood flows.

The 10 inch blowoff is in good condition but the valves are hardly ever used.

d. Overtopping Potential - Calculations by Storch Engineers indicates that the test flood outflow will overtop the dam by 1.15 feet (Appendix D).

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation - There have been no routine inspections performed by the resident staff. In April, 1975, the dam was inspected by personnel of the State Department of Environmental Protection and a slight seepage was noted through the dam. The present visual inspection showed that the structural stability of the dam is satisfactory, however, the seepage and the wet spots on the downstream slope of the dam will require further examination.

b. Design and Construction Data - The only design and construction data available was one drawing prepared by a private company after the construction of the dam.

c. Operating Records - There are no operating records for the dam. The water level of the Bristol Reservoir is not monitored.

d. Post Construction Changes - The only change that has been noted since the completion of the dam construction in 1885 is the installation of a rock toe at the base of the dam about ten years ago. The installation was done by the Bristol Water Department and no plan or procedure for this work is available. The design consultant is not known.

e. Seismic Stability - The dam is located in Seismic Zone 1 and in accordance with Recommended Phase I Guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - After review of the available documents, the results of this inspection, meetings with resident staff and the hydraulic computations, the general condition of the Bristol Reservoir Dam is judged to be fair.

There is some concern over the soft ground on the downstream slope of the dam, the extensive seepage at the end of the spillway channel and the insufficient capacity of the spillway.

b. Adequacy of Information - The information available is such that the assessment of the safety of the dam should be based primarily on the visual inspection results, the past operational performance of the dam and its appurtenant structures.

c. Urgency - The owner shall implement the recommendations suggested below within two years after receipt of this Phase I Inspection Report.

d. Need for Additional Investigation - Additional investigations should be implemented by the owner as outlined in the following sections.

7.2 Recommendations

In view of the lack of engineering data for evaluating the dam's behavior, it is recommended that the following measures be undertaken:

a. Monitoring of the dam for seepage including any necessary seepage analyses or other pertinent studies.

b. Determination of the geometry of the dam, elevations of its top and base, properties of the soil of the dam and its foundation rock. This would permit an objective assessment of the structural stability of the dam.

c. Further detailed studies of the spillway capacity and an increase of the total project discharge capacity if found to be needed.

The above recommendations should be done by a qualified registered professional engineer or engineering firm.

7.3 Remedial Measures

It is considered important that the following items be attended to as early as practical:

a. Alternatives - Not applicable.

b. O & M Maintenance and Procedures -

1. Brush and trees on the downstream slopes, the face of the dam and the spillway channel

should be removed to facilitate the visual observation of existing and potential seepage and movement.

2. Loose materials and brush should be cleaned from the spillway channel.
3. Plans for around-the-clock surveillance should be provided for periods of unusually heavy rains and a formal warning system should be developed for use in the event of an emergency.
4. Seepage from the toe drain should be monitored.
5. A program of biennial periodic technical inspection should be established.

APPENDIX A

VISUAL INSPECTION CHECK LIST A-1 to A-4

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Bristol Reservoir Dam

DATE 9-21-78

TIME 11:00 a.m.

WEATHER Sunny

W.S. ELEV. 599.0± U.S. N/A DN.S.

PARTY:

1. Richard Lyon
2. Miron Petrovsky
3. Gary Giroux
4. John Schearer
5. Rodolfo Aloma
6. _____
7. _____
8. _____
9. _____
10. _____

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

PERIODIC INSPECTION CHECK LIST

PROJECT Bristol Reservoir Dam DATE 9-21-78

PROJECT FEATURE NAME R. Lyon

G. Giroux

DISCIPLINE NAME

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	Good
Current Pool Elevation	Good
Maximum Impoundment to Date	Good
Surface Cracks	Some tunneling by rodents
Pavement Condition	N/A
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	None observed
Horizontal Alignment	None observed
Condition at Abutment and at Concrete Structures	N/A
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	Not permitted
Sloughing or Erosion of Slopes or Abutments	None observed, however, there are several rodent holes
Rock Slope Protection - Riprap Failures	None observed
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	Wet swampy area downstream of toe drains
Piping or Boils	None observed
Foundation Drainage Features	Toe drains installed -
Toe Drains	nearly 10 years ago
Instrumentation	No

PERIODIC INSPECTION CHECK LIST

PROJECT Bristol Reservoir Dam DATE 9-21-78

PROJECT FEATURE _____ NAME M. Petrovsky

DISCIPLINE _____ NAME R. Aloma

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Conduit set in riprap headwall
Rust or Staining on Concrete	N/A
Spalling	N/A
Erosion or Cavitation	None
Cracking	Not observed
Alignment of Monoliths	Not observed
Alignment of Joints	Not observed
Numbering of Monoliths	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Bristol Reservoir Dam DATE 9-21-78

PROJECT FEATURE _____ NAME G. Giroux

DISCIPLINE _____ NAME J. Schearer

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Somewhat overgrown with weeds
b. Weir and Training Walls	
General Condition of Concrete	N/A, masonry walls
Rust or Staining	N/A
Spalling	Some holes observed
Any Visible Reinforcing	N/A
Any Seepage or Efflorescence	Minor spot
Drain Holes	None
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Floor overgrown with trees
Other Obstructions	None

APPENDIX B

LIST OF REFERENCES

1. Drawing: Cross section and plan of Bristol Reservoir Dam; Bristol Water Department, 1911.

2. Recommended Guidelines for Safety Inspection Of Dams; Department of the Army; Office of the Chief of Engineers; Washington, D.C.; November, 1976.

3. Guide Curves for the Probable Maximum Flood (PMF) for Regions of New England based on past Corps of Engineers' Studies; March, 1978.

4. Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations; New England Division; Corps of Engineers; March, 1978.

5. Rule of Thumb. Guidance for Estimating Downstream Dam Failure Hydrographs; Corps of Engineers; April, 1978.

6. Instrumentation of Earth and Rock Fill Dams. EM 1110-2-1908; Department of the Army, Corps of Engineers; August, 1971.

APPENDIX C

PHOTO 1
CREST OF DAM

PHOTO 2
DOWNSTREAM FACE OF DAM

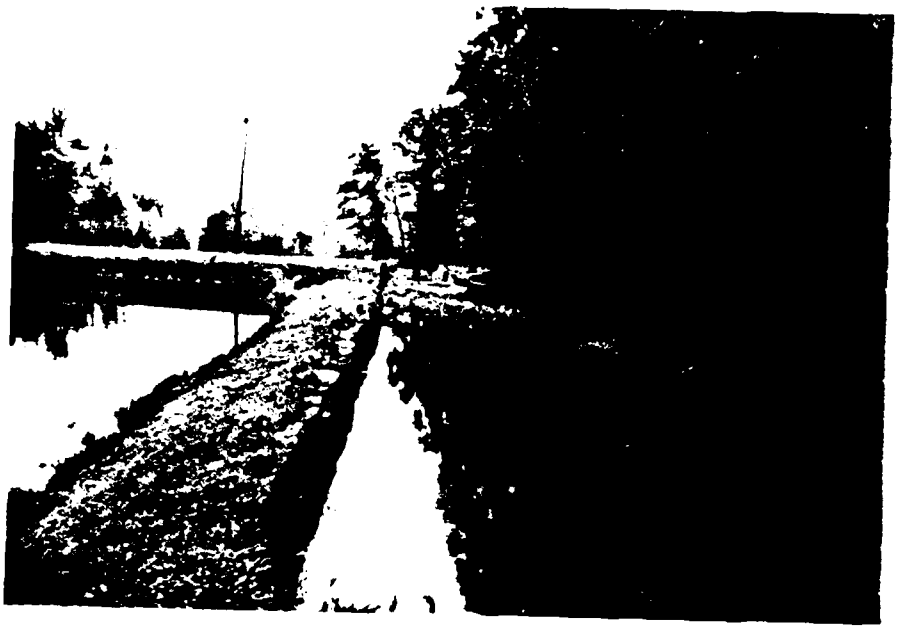


PHOTO 3

SPILLWAY LOOKING DOWNSTREAM

PHOTO 4

SPILLWAY LOOKING UPSTREAM

PHOTO 5

UPSTREAM FACE DAM

PHOTO 6

DOWNSTREAM CHANNEL

PHOTO 7

SEEPAGE FROM TOE DRAIN

PHOTO 8

SEEPAGE FROM BOTTOM OF SPILLWAY

APPENDIX D

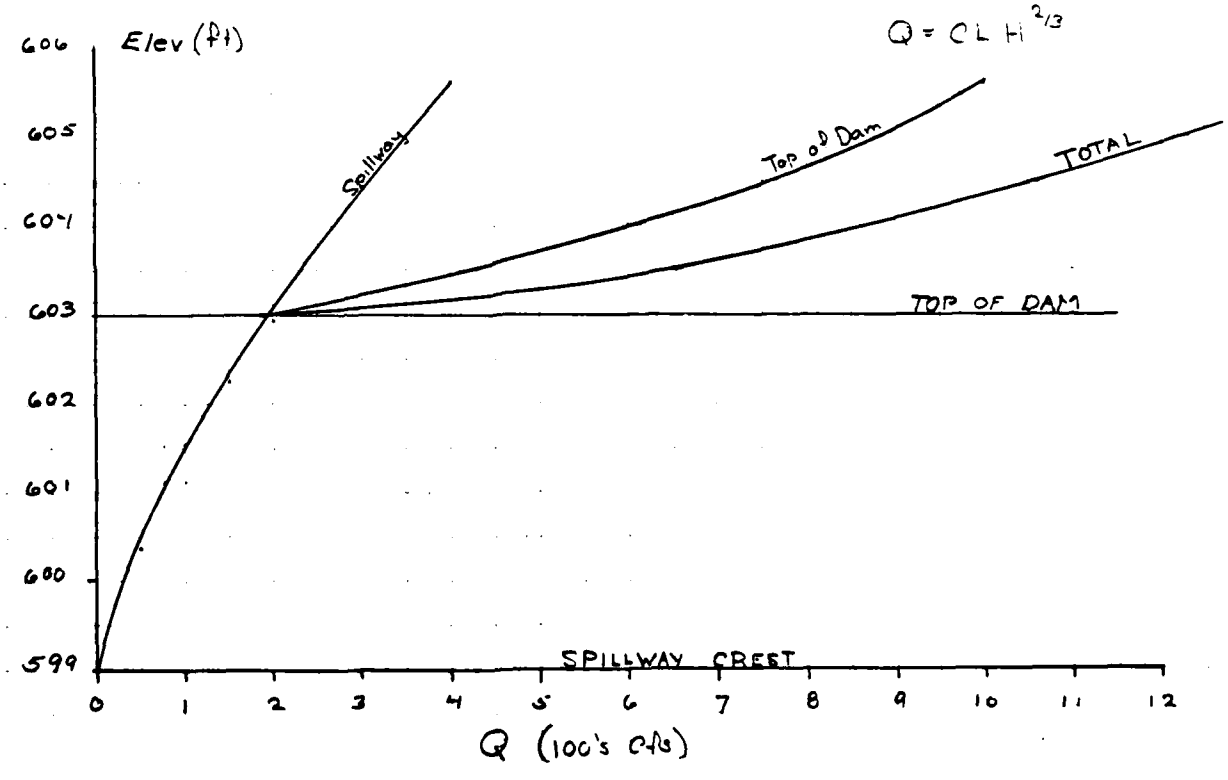
STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

Bristol Reservoir Dam.
Stage Discharge

SPILLWAY					DAM		
Q	d	V	$(1+k)H_v$	Elev	H	C	Q
50	0.7	6.0	.67	600.37			
75	1.2	7.0	.91	601.11			
100	1.4	7.8	1.13	601.53			
150	1.8	8.9	1.47	602.27			
175	2.05	9.25	1.59	602.64			
200	2.2	9.7	1.75	602.95			
300	3.0	11.5	2.46	604.46	1.46	2.64	717
400	3.7	12.5	2.91	605.61	2.61	2.63	1097
500	4.2	13.0	3.1	606.3	3.3	2.63	1283
600	4.8	13.5	3.39	607.19	4.19	263	1500

$L = 220'$

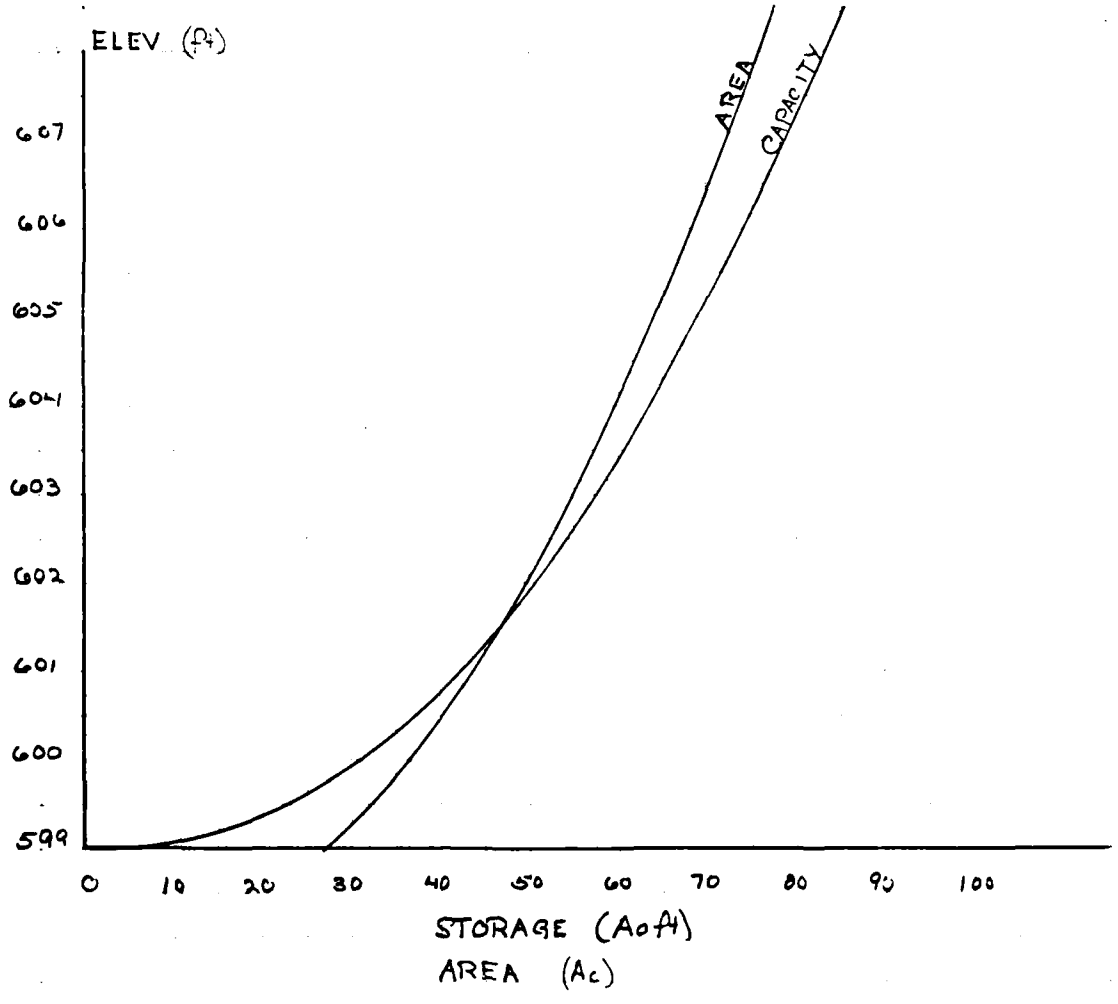
$Q = C L H^{3/2}$



STORCH ENGINEERS
Engineers · Landscape Architects
Planners · Environmental Consultants

BRISTOL RESERVOIR DAM
AREA-CAPACITY

Elev	Depth	Area	Avg Area	Vol	Σ Vol
599		27.5			0
	1		32.1	32.1	
600		36.7			32.1
	10		59.65	596.5	
610		82.6			91.75



STORCH ENGINEERS
Engineers · Landscape Architects
Planners · Environmental Consultants

BRISTOL RESERVOIR DAM
DETERMINATION OF SDF & PMF

Drainage Area .359 SM

Inflow · 3350 cfs/SM

½PMF = ½3350(.359) = 600 cfs

Determine the effect of surcharge on the Maximum Probable Discharge

① Q_{P1} = 600 cfs
② a. H_1 = 603.41 (elev)
b. STOR = 3.14"
c. $Q_{P2} = Q_{P1}(1 - STOR/9.5) = 600(1 - 3.14/9.5) = 401.0$ cfs
③ a. H_2 = 603.2
b. STOR = 3.06"
$STOR_A$ = 3.1"

$Q_{P3} = 600(1 - 3.1/9.5) = 404$ cfs

H_a = 603.16 $STOR_A$ = 3.02" Ok

½PMF = 404 cfs

Capacity of the spillway when the pond is at top of dam

Q = 200 cfs or 50 % of PMF

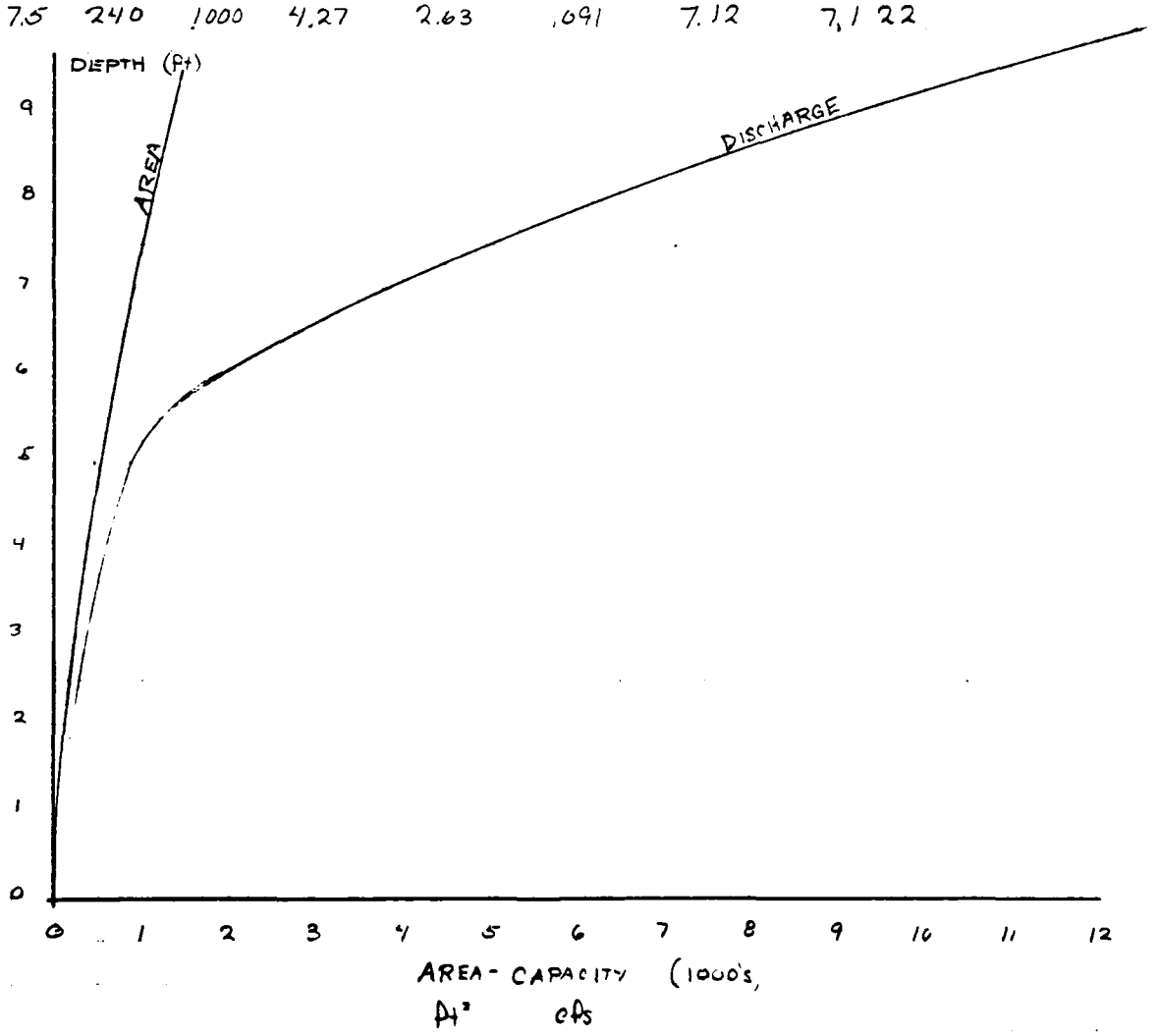
STORCH ENGINEERS
Engineers · Landscape Architects
Planners · Environmental Consultants

BRISTOL RESERVOIR DAM
TYPICAL SECTION

SCALE
1"=200'
1"=200'

n=.05 S=.83%

D	WP	A	R	$R^{2/3}$	$S^{1/2}$	V	Q
5	170	450	2.64	1.91	.091	5.16	878
10	330	1600	4.84	2.87	.091	7.76	12,419
20	590	6000	10.16	4.69	.091	12.68	76,105
7.5	240	1000	4.27	2.63	.091	7.12	7,122



"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS

SECTION I @ DAM

① $S = 353$ Ac-ft

② $Q_{p1} = 8/27\,(80)\sqrt{32.2}\,21^{5/2} = 12944$ cfs

SECTION II @ Terryville Sta

③ see Rating Curve

④ a. $H_1 = 10.2'$ $A_1 = 1650\ ft^2$ $L_1 = 4{,}300'$

$V_1 = 162.87$ Ac-ft

b. $Q_{p1} = 12944\left(1 - {}^{162.87}/_{353}\right) = 6971$ cfs

c. $H_2 = 8.25$ $A_2 = 1200\ ft^2$

$A_A = 1425\ ft^2$ $V_2 = 1410.6$

$Q_{p2} = 12944\left(1 - {}^{1410.6}/_{353}\right) = 7788$ cfs

$H_2 = 8.6'$ $A_2 = 1425\ ft^2$

SECTION III @ 4000' D/S from Terryville Sta.

④ a. $H_2 = 8.6'$ $A_2 = 1425\ ft^2$ $L_2 = 4000$

$V_2 = 130$ Ac-ft

b. $Q_{p3} = 7785\left(1 - {}^{130}/_{353}\right) = 4920$ cfs

c. $H_3 = 7.5'$ $A_3 = 1000\ ft^2$

$A_A = 1212\ ft^2$ $V_3 = 111.3$ Ac-ft

$Q_{p3} = 7785\left(1 - {}^{111}/_{353}\right) = 5339$ cfs

$H_3 = 7.6'$ $A_3 = 1050\ ft^2$

SECTION IV @ Muzzy Field

④ a. $H_3 = 7.6'$ $A_3 = 1050$ $L = 5000'$ $V_3 = 120'$

b. $Q_{p4} = 5330\left(1 - {}^{120}/_{353}\right) = 3524$ cfs

c. $H_4 = 6.75'$ $A_4 = 950\ ft^2$

$A_A = 950\ ft^2$ $V_4 = 109$ Ac-ft

$Q_{p4} = 5339\left(1 - {}^{109}/_{353}\right) = 3690$ cfs

$H_4 = 6.8'$

LEGEND

DENOTES DRAINAGE AREA

FROM U.S.G.S. QUAD. SHEET

BRISTOL, CONNECTICUT

PLATE 5

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

SCALE
0 1 MILE

DRAINAGE AREA MAP

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST	(7) STATE	(8) COUNTY	(9) CONGR DIST	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY | MO | YR
T	A	NED	CT	003	04				HRISTOL RESERVOIR DAM	4140.6	7259.5	20DEC78

CT

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT
	HRISTOL RESERVOIR NO 1

(16) REGION	(17) BASIN	(18) RIVER OR STREAM	(19) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(20) DIST FROM DAM (MI)	(21) POPULATION
01	08	PEQUABUCK RIVER	PEQUABUCK	1	700

(22) TYPE OF DAM	(23) YEAR COMPLETED	(24) PURPOSES	(25) STRUCTURAL HEIGHT (FT)	(26) HYDRAULIC HEIGHT (FT)	(27) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT)	(27) NORMAL (ACRE-FT)	(28) DIST	(29) OWN	(30) FED R	(31) PRV/FED	(32) SCS A	(33) VER/DATE
RFRGPG	1885	S	25	21	340	290	NED	N	N	N	N	15JAN79

(34) REMARKS
20=ESTIMATE 22=APPROXIMATE

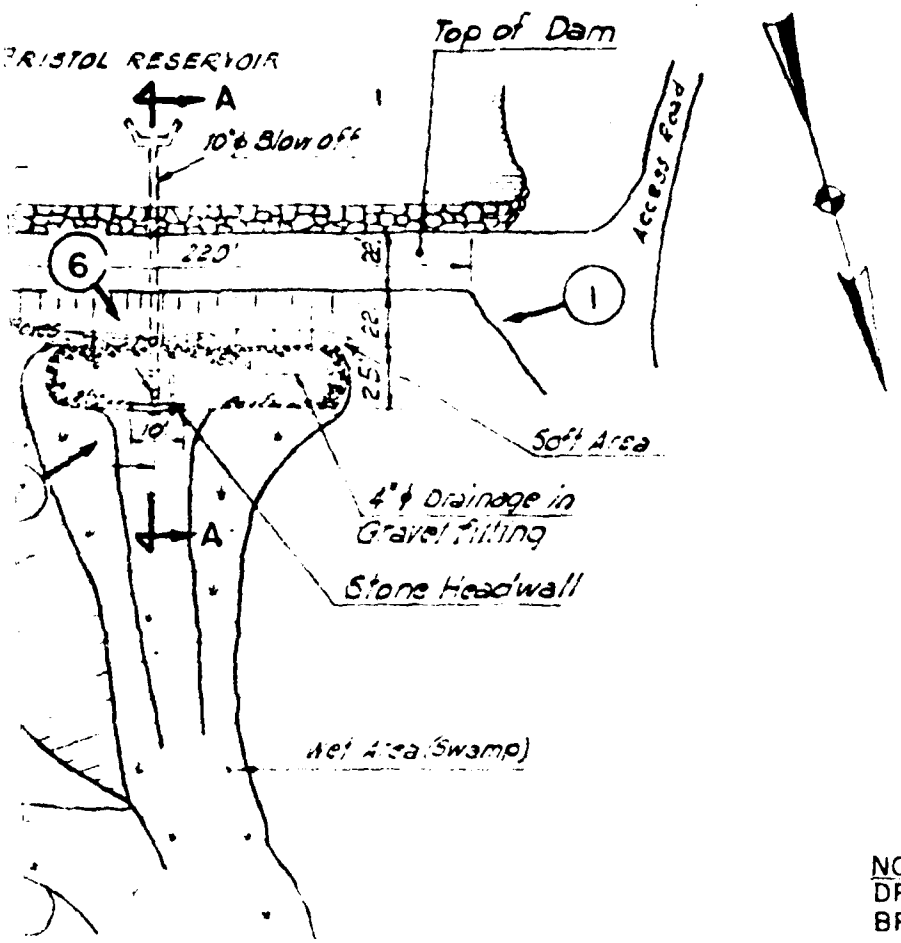
(35) DIS HAS	(36) SPILLWAY CRES LENGTH	(37) SPILLWAY TYPE	(38) SPILLWAY WIDTH (FT)	(39) MAXIMUM DISCHARGE (FT)	(40) VOLUME OF DAM (CY)	(41) POWER CAPACITY INSTALLED (MW)	(42) POWER CAPACITY PROPOSED (MW)	(43) NAVIGATION LOCKS NO	LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)
1	250	U	12	200	12A00											

(44) OWNER	(45) ENGINEERING BY	(46) CONSTRUCTION BY
CITY OF HRISTOL CT	NOT KNOWN	NOT KNOWN

(47) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(48) INSPECTION BY	(49) INSPECTION DATE DAY | MO | YR	(50) AUTHORITY FOR INSPECTION
STORCH ENGINEERS	21SEP78	PL92-367

(51) REMARKS
20=APPROXIMATE



NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE BRISTOL WATER DEPARTMENT

GENERAL PLAN

ENOTES PHOTO LOCATION

PLATE-3

STORCH ENGINEERS	US ARMY ENGINEER DIV NEW ENGLAND
WETHERSFIELD, CONNECTICUT	CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

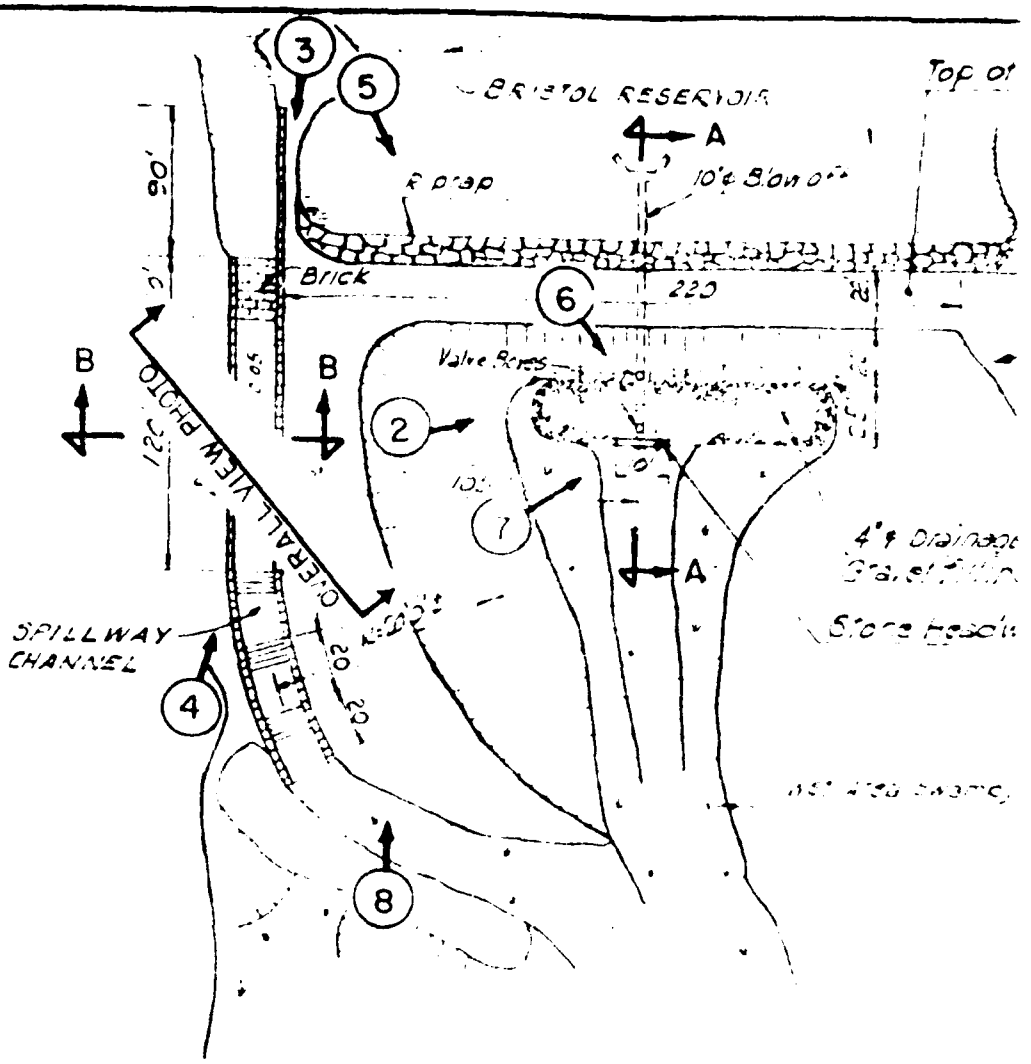
BRISTOL RESERVOIR DAM

PEQUABUCK RIVER CONNECTICUT

SCALE: NOT TO SCALE

DATE: Nov. 1978

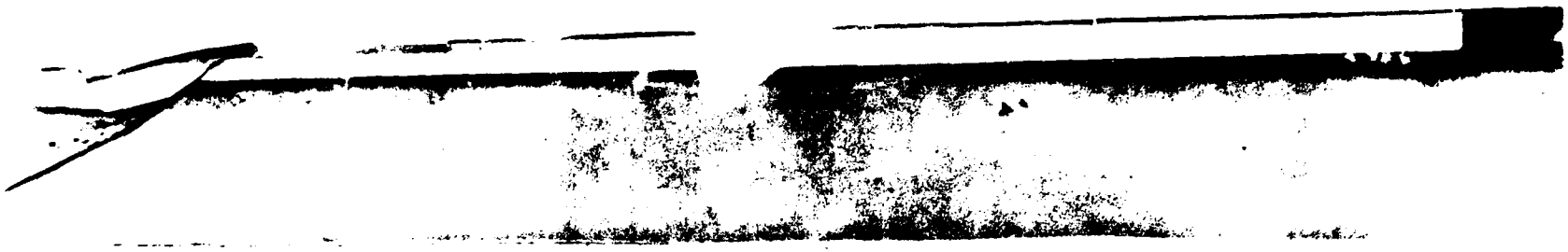
(2 of 2)

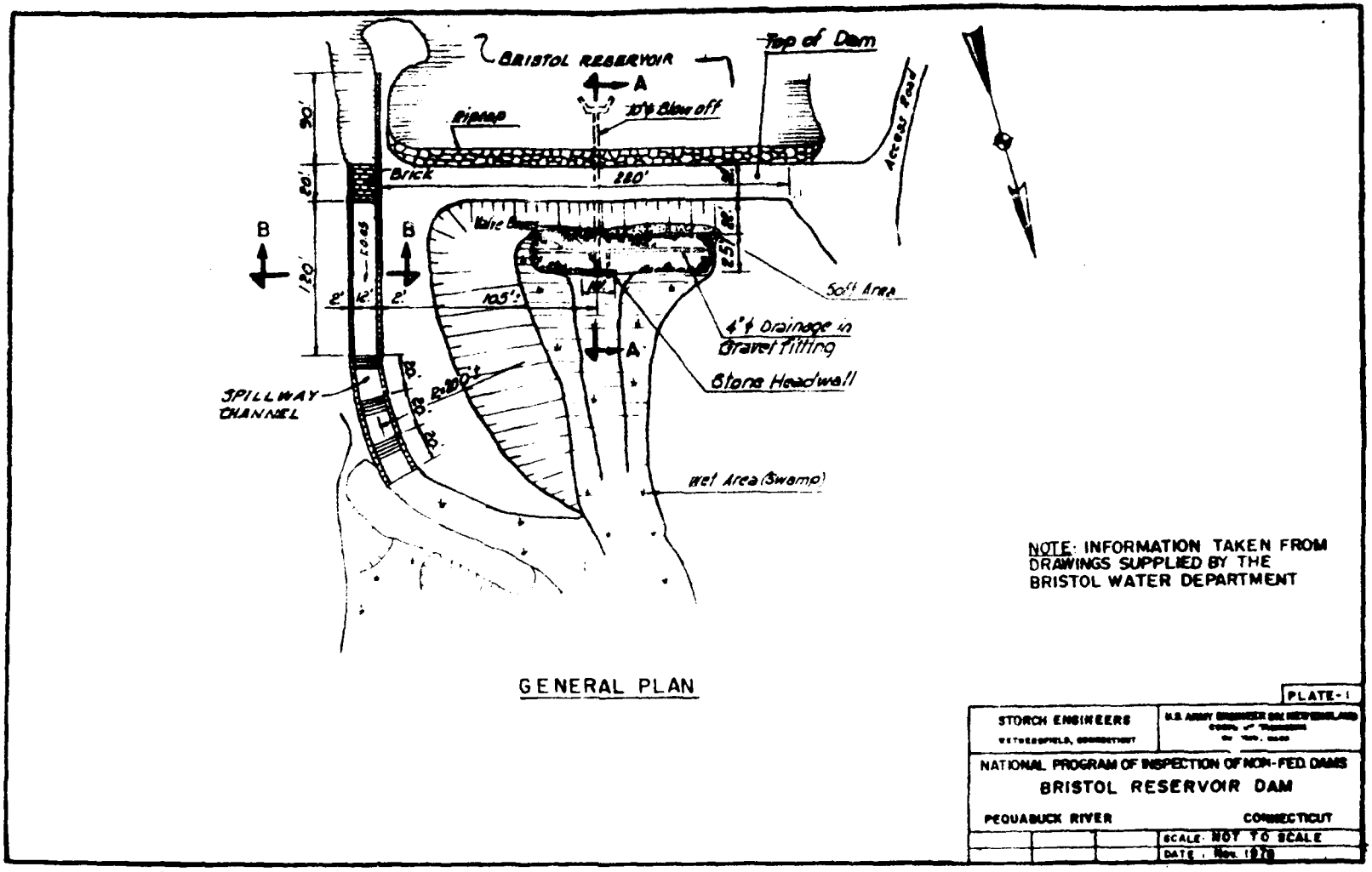


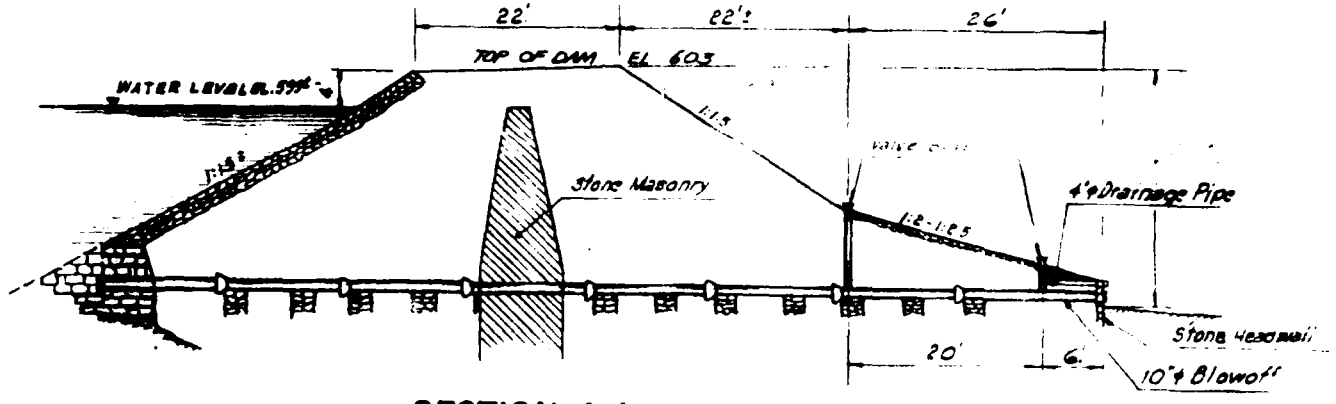
GENERAL PLAN

(2) → DENOTES PHOTO LOCATION

1 of (2)

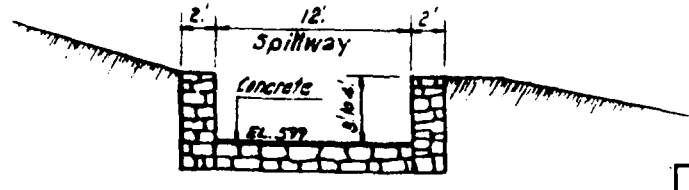



BRISTOL RESERVOIR
Top of Dam
A
10"ϕ Blow off
Riprap
Brick
280'
Access Road
B
B
30'
20'
120'
2'
12'
2'
105'
125'
8'
50' Area
4"ϕ Drainage in Gravel Filling
Stone Headwall
A
SPILLWAY CHANNEL
R=30'
Wet Area (Swamp)
NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE BRISTOL WATER DEPARTMENT
GENERAL PLAN
PLATE-1
STORCH ENGINEERS
WETHERSFIELD, CONNECTICUT
U.S. ARMY ENGINEER DIVISION NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
BRISTOL RESERVOIR DAM
PEQUABUCK RIVER
CONNECTICUT
SCALE: NOT TO SCALE
DATE: Nov. 1978



SECTION A-A

Not to Scale



SECTION B-B

Not to Scale

PLATE-2

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

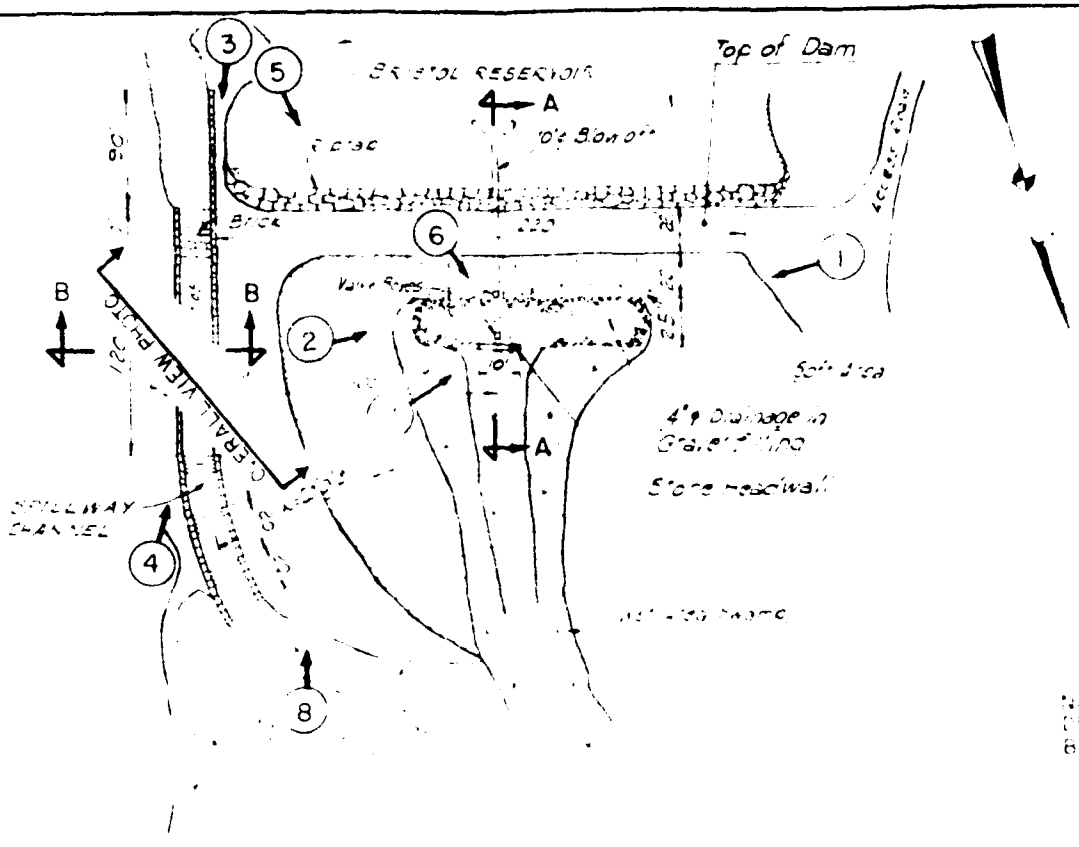
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

BRISTOL RESERVOIR DAM

PEQUABUCK RIVER — CONNECTICUT

SCALE: NOT TO SCALE

DATE: Nov. 1978



NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE BRISTOL WATER DEPARTMENT

GENERAL PLAN

PLATE-3

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

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

BRISTOL RESERVOIR DAM

PEQUABUCK RIVER — CONNECTICUT

SCALE: NOT TO SCALE

DATE: Nov 1978

(2) → DENOTES PHOTO LOCATION

BRISTOL WATER DEPARTMENT

GENERAL PLAN

PLATE-1

STORCH ENGINEERS — WATERBURY, CONNECTICUT

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

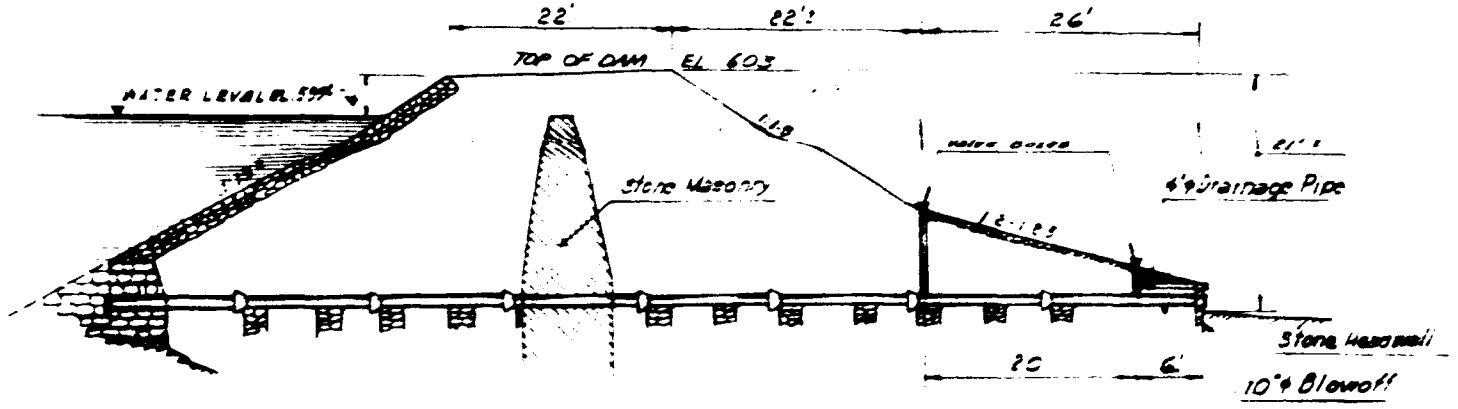
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

BRISTOL RESERVOIR DAM

PEQUABUCK RIVER — CONNECTICUT

SCALE: 1" = 70' SCALE

DATE: DEC. 1978



SECTION A-A

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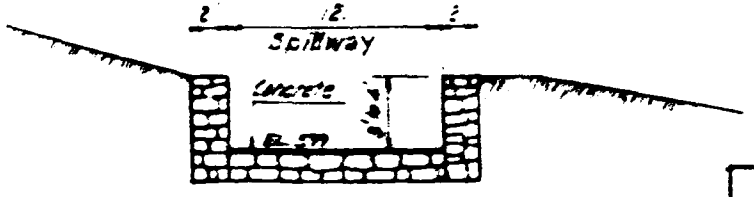


SECTION B-B

Not to Scale

PLATE-2

STORCH ENGINEERS — WATERBURY, CONNECTICUT

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

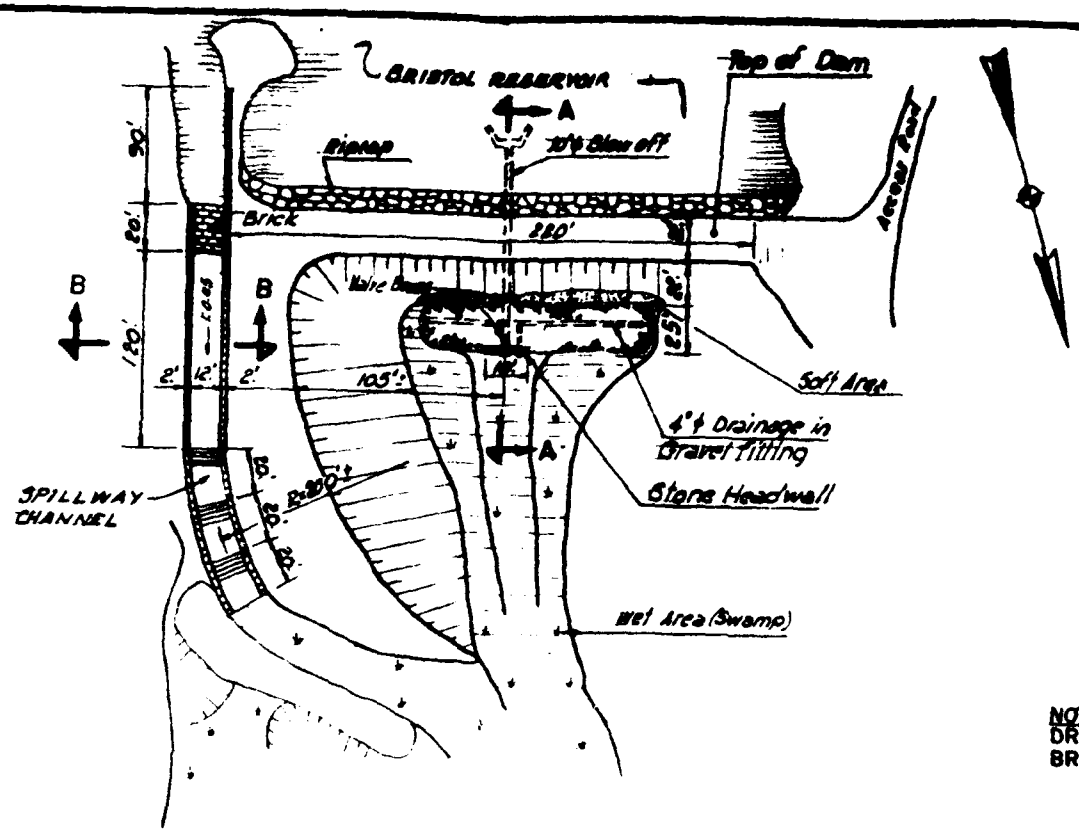
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

BRISTOL RESERVOIR DAM

PEQUABUCK RIVER — CONNECTICUT

SCALE: 1" = 70' SCALE

DATE: DEC. 1978



NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE BRISTOL WATER DEPARTMENT

GENERAL PLAN

PLATE-1

STORCH ENGINEERS
WETHERSFIELD, CONNECTICUT

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

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

BRISTOL RESERVOIR DAM

PEQUABUCK RIVER CONNECTICUT

SCALE: NOT TO SCALE

DATE: DEC. 1978

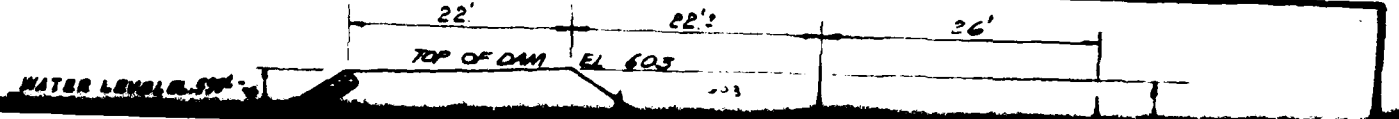


PLATE-4

STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS BRISTOL RESERVOIR DAM PEQUABUCK RIVER — CONNECTICUT	
	SCALE AS SHOWN DATE Nov 1978

LEGEND

——— DENOTES LIMITS OF FLOODING IN CASE OF DAM FAILURE