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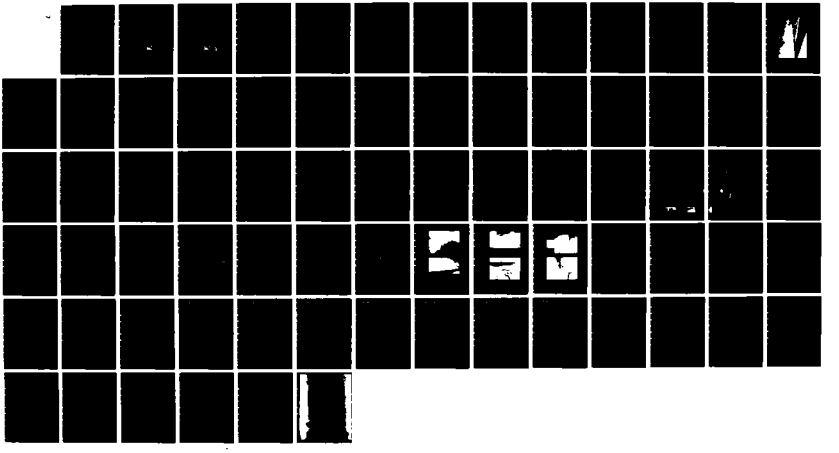

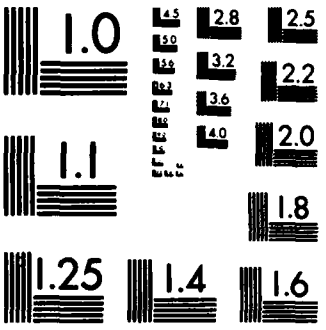

HOUSATONIC RIVER BASIN
DERBY, CONNECTICUT

LOWER ANSONIA RESERVOIR DAM
CT 00027

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

SEPTEMBER, 1980

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UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
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4. TITLE (and Subtitle): Housatonic River Basin Derby Conn. Lower Ansonia 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
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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,

River Basin, Derby, Conn.
Ansonia Reservoir Dam

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

The Lower Ansonia Reservoir Dam was built around 1887 and presently impounds a water supply reservoir. It is an earth and masonry embankment with a total length of approx. 423 ft., including a centrally located 20.3 ft.long broad-crested masonry spillway and a brick gatehouse. The top of the embankment, at elevation 279.2, is approx. 25 ft. wide, 2.2 ft. above the spillway crest and 17.8 ft. above the streambed at the downstream toe of the dam. With the reservoir level to the top of the dam the dam impounds approx. 94 acre-ft. of water.

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BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	LOWER ANSONIA RESERVOIR DAM
Inventory Number:	CT 00027
State:	CONNECTICUT
County:	NEW HAVEN
Town:	DERBY
Stream:	TRIBUTARY TO NAUGATUCK RIVER
Owner:	ANSONIA - DERBY WATER COMPANY
Date of Inspection:	AUGUST 8, 1980
Inspection Team:	PETER HEYNEN, P.E.
	HECTOR MORENO, P.E.
	THEODORE STEVENS
	ROBERT JAHN

The Lower Ansonia Reservoir Dam was built around 1887 and presently impounds a water supply reservoir. It is an earth and masonry embankment with a total length of approximately 423 feet, including a centrally located 20.3 foot long broad-crested masonry spillway and a brick gatehouse (See Sheet B-1). The top of the embankment, at elevation 279.2, is approximately 25 feet wide, 2.2 feet above the spillway crest and 17.8 feet above the streambed at the downstream toe of the dam. With the reservoir level to the top of the dam the dam impounds approximately 94 acre-feet of water.

In accordance with U.S. Army Corps of Engineers guidelines, Lower Ansonia Reservoir Dam is classified as a high hazard, small size dam. The test flood for the Lower Ansonia Reservoir Dam is equivalent to the Probable Maximum Flood (PMF). Peak inflow to the reservoir at test flood is 1,200 cubic feet per second (cfs); peak outflow is 1,100 cfs with the dam overtopped by 0.8 feet. The spillway capacity with the reservoir level to the top of the dam is 210 cfs, which is equivalent to 19% of the routed test flood outflow.

Based upon the visual inspection at the site and past performance, the project is judged to be in fair condition. No evidence of instability of the project was observed. However, there are items which require attention, such as sparse riprap in the spillway discharge channel, debris in the channel, maintenance of the downstream slope and top of dam, and possible seepage through the spillway section.

It is recommended that the owner retain the services of a registered professional engineer to perform a more detailed hydraulic/hydrologic analysis of the adequacy of the existing project discharge. Recommendations made by the engineer should be implemented by the owner.

The above recommendations and further remedial measures presented in Section 7 should be instituted within one year of the owner's receipt of this report.

Peter M. Heynen, P.E.
Project Manager - Geotechnical
Cahn Engineers, Inc.

C. Michael Horton, P.E.
Chief Engineer
Cahn Engineers, Inc.

A-1

This Phase I Inspection Report on Lower Ansonia 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.

ARAMAST MAHTESIAN, Member
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, Member
Design Branch
Engineering Division

RICHARD DIBUONO, Chairman
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. 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 would necessarily represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

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

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

The information contained in this report is based on the limited investigation described above and is not warranted to indicate the actual condition of the dam. The integrity of the dam can only be determined by a means of a monitoring program and/or a detailed physical investigation. The accuracy of available data is assumed where not in obvious conflict with facts observable during the visual inspection.

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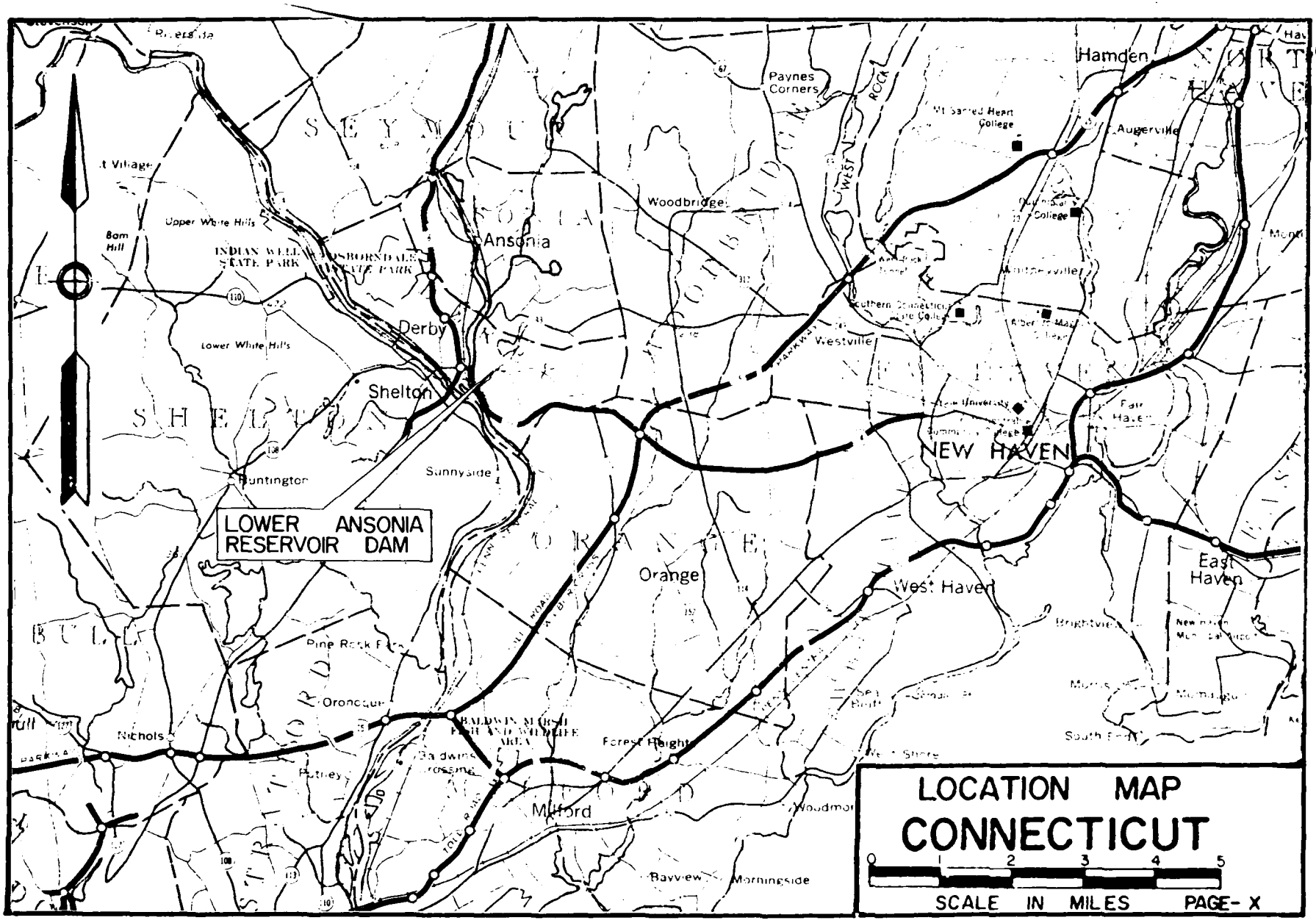
APPENDICES

OVERVIEW PHOTO
(August, 1980)

US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS CAHN ENGINEERS INC WALLINGFORD, CONN ENGINEER	NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	Lower Ansonia Res. Dam Tr-Naugatuck River	Derby CONNECTICUT	DATE Sept. '80 CE # 27 765 NC PAGE ia


LOWER ANSONIA
RESERVOIR DAM
Hamden
Paynes Corners
Woodbridge
Ansonia
Derby
Shelton
Huntington
Sunnyside
Westville
NEW HAVEN
Orange
West Haven
East Haven
Milford
Nichols
Oronoque
Forest Heights
Bayview
Morningside
Augerville
Upper White Hills
Lower White Hills
Bam Hill
LOCATION MAP
CONNECTICUT
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SCALE IN MILES
PAGE- X

PHASE I INSPECTION REPORT

LOWER ANSONIA RESERVOIR DAM

SECTION I - 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. Cahn Engineers, Inc. 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 were issued to Cahn Engineers, Inc. under a letter of April 14, 1980 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0052 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.

2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dam.

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

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

1. Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

2. A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

3. Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

4. An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located on an unnamed tributary to the Naugatuck River in the Housatonic River Basin in a suburban area of the Town of Derby, County of New Haven, State of Connecticut. The dam is shown on the Ansonia USGS Quadrangle Map, having coordinates latitude N41°19.2' and longitude W73°04.5'.

b. Description of Dam and Appurtenances - As shown on Sheet B-1, the dam is an earth embankment with a vertical masonry upstream face. The dam is 17.8 feet in height and approximately 423 feet in length with a 20.3 foot long spillway near the center of the embankment and a gatehouse adjacent to the upstream face of the dam.

The spillway, with an assumed NGVD elevation of 277.0 (See Notes, Sheet B-1), is a broad-crested masonry weir of rectangular cross-section located at the center of the dam. The spillway crest is approximately 30 feet wide and is capped with concrete with masonry training walls. At the upstream end of the crest are steel stanchions for support of stop planks; however, stop planks are not presently in place. The spillway has vertical upstream and downstream faces with tiered training walls on the downstream side. Discharge at the toe of the spillway is onto an area of small sized riprap, then through two 36 inch diameter concrete pipes under Academy Hill Road to the downstream channel.

The top of the embankment has a width of approximately 25 feet and, at elevation 279.2, is 2.2 feet above the spillway crest. There is a row of pine trees along the downstream edge of the top of the embankment. The vertical upstream face of the dam consists of a cut stone and mortar masonry wall with a later concrete resurfacing or repointing of the mortar joints. The top of the wall is approximately 4 feet wide and is flush with the top of the embankment. Existing drawings of the project show the wall to be founded on bedrock for most of its length with a maximum structural height of 27.0 feet and a base width of 6.0 feet. The downstream slope is vegetated and is at an inclination of approximately 1.5 horizontal to 1 vertical. At the toe of the slope is a low dry-laid stone wall and an approximately four foot high wire fence.

The gatehouse is located on the upstream side of the dam approximately 20 feet to the right of the right spillway training wall. It consists of a 14' x 14' brick superstructure atop a 6 foot wide masonry lined intake chamber which is open on the upstream side, thus allowing water to enter. The masonry intake chamber walls are each 4 feet wide, making the total width of the gatehouse substructure 14 feet. Inside the gatehouse, there are two gate screens across the upstream end of the intake chamber with a pulley hoist for lifting the screens attached to the roof truss. Two hand wheel gate valves control flow through two 12 inch intake pipes with estimated invert elevations between 266 and 272. Both of these connect to an 8 inch water supply main through the dam. A third hand wheel gate valve controls flow through a 4 inch

drainpipe which has an approximate invert elevation of 261.5 and outlets in the spillway discharge channel. The gate valve for a 12 inch low-level outlet pipe is located on the upstream face of the dam approximately 35 feet left of the spillway and the outlet for this pipe is located at the toe of the dam on the spillway discharge channel wall.

c. Size Classification - (SMALL) - The dam is 17.8 feet in height and with the reservoir level to the top of the dam, impounds approximately 94 acre-feet of water. According to recommended guidelines, a dam with this maximum storage is classified as small in size.

d. Hazard Classification - (HIGH) - If the dam were breached, there is potential for loss of more than a few lives and extensive property damage in an urban area of Derby approximately 2000 feet downstream of the dam.

e. Ownership - Ansonia - Derby Water Company
230 Beaver Street
Ansonia, Connecticut 06401
Mr. Fredrick Elliott (Superintendent)
(203) 735-1888 (Work)
(203) 734-0288 (Home)

The dam was built and owned by the now defunct Birmingham Water Company and acquired by the present owner around 1970.

f. Operator - Mr. William Clark (203) 734-6641

g. Purpose of Dam - The dam impounds a public water supply reservoir for the towns of Ansonia and Derby.

h. Design and Construction History - Very little is known of the orginal design and construction of the project. The dam appears today as it is shown on an undated drawing by Dan W. Brinsmade, Civil and Hydraulic Engineer. Evidently, Brinsmade's drawing was for some reconstruction work as it contains an elevation view of "New" Wall at the Lower Reservoir of the Birmingham Water Company. The storage of the reservoir is shown on an 1887 drawing by H.S. Whipple, Civil and Sanitary Engineer; however, it is not known if this date coincides with any construction at the site.

i. Normal Operational Procedures - One of the gates to the water supply main through the dam is normally kept partially or fully open. The reservoir receives a inflow through a pipe from the Upper Reservoir to compensate for outflow through the water supply main. Thus the reservoir level is maintained at about the elevation of the spillway crest.

1.3 PERTINENT DATA

a. Drainage Area - The drainage area is 0.56 square miles of sparsely to heavily developed rolling to mountainous terrain and includes the Upper Ansonia Reservoir which has an area of approximately 34 acres.

b. Discharge at Damsite - Discharge is over the spillway, through the 8 inch supply main, through the 4 inch intake chamber drain pipe and through the 12 inch low-level outlet pipe.

1. Outlet Works (Conduits)

12 inch low-level outlet @ invert el. 261.5±:	18± cfs (reservoir level at top of dam)
4 inch drain pipe @ invert el. 261.5±:	2± cfs (reservoir level at top of dam)
2. Maximum flood at damsite:	N/A (water released through low-level outlet if reservoir level rises above spillway crest)
3. Ungated spillway capacity @ top of dam el. 279.2:	210 cfs
4. Ungated spillway capacity @ test flood el. 280.0:	340 cfs
5. Gated spillway capacity @ normal pool:	N/A
6. Gated spillway capacity @ test flood:	N/A
7. Total spillway capacity @ test flood el. 280.0:	340 cfs
8. Total project discharge @ top of dam el. 279.2:	228 cfs
9. Total project discharge @ test flood el. 280.0:	1,100 cfs

c. Elevations - Elevations are on National Geodetic Vertical Datum (NGVD), based on an assumed spillway crest elevation of 277.0 corresponding to reservoir water surface elevation shown on USGS Ansonia Quadrangle Map, 1972.

1. Streambed at toe of dam:	261.4±
2. Bottom of cutoff:	252.2±
3. Maximum tailwater:	Not known
4. Normal pool:	277.0±
5. Full flood control pool:	N/A
6. Spillway crest (ungated):	277.0 (Assumed datum)
7. Design surcharge (original design):	Not known

8. Top of dam:	279.2±
9. Test flood surcharge:	280.0
d. Reservoir Length	
1. Normal pool:	900± ft.
2. Flood control pool:	N/A
3. Spillway crest pool:	900± ft.
4. Top of dam pool:	970± ft.
5. Test flood pool:	1000± ft.
e. Reservoir Storage	
1. Normal pool:	71± acre-ft.
2. Flood control pool:	N/A
3. Spillway crest pool:	71± acre-ft.
4. Top of dam pool:	94± acre-ft.
5. Test flood pool:	103± acre-ft.
f. Reservoir Surface	
1. Normal pool:	9.6± acres
2. Flood control pool:	N/A
3. Spillway crest pool:	9.6± acres
4. Top of dam pool:	11.3± acres
5. Test flood pool:	11.9± acres
g. Dam	
1. Type:	Earth embankment with masonry wall on upstream side
2. Length:	423± ft.
3. Height:	17.8 ft.
4. Top width:	25± ft.
5. Side slopes:	Vertical upstream 1.5H to 1V downstream
6. Zoning:	Low embankment (submerged) upstream of masonry wall.

7. Impervious core:	Masonry wall
8. Cutoff:	Wall founded on rock, except in area of spillway and at right end of dam.
9. Grout curtain:	N/A
10. Other:	Dry laid stone wall at toe of downstream slope.
h. Diversion and Regulating Tunnel	N/A
i. Spillway	
1. Type:	Broad-crested masonry weir of rectangular cross-section
2. Length of weir:	20.3 ft.
3. Crest elevation:	277.0 (Assumed datum)
4. Gates:	N/A
5. Upstream channel:	None
6. Downstream channel:	15± ft. vertical drop to streambed
7. General:	Concrete cap on crest
j. Regulating Outlets	
Low-level outlet	
1. Invert:	261.5±
2. Size:	12 inch diameter
3. Description:	Cast iron
4. Control mechanism:	Hand operated valve on upstream face of dam
5. Other:	Handle not kept on valve stem
Supply main	
1. Invert:	Not known
2. Size:	8 inch diameter
3. Description:	Cast iron

4. Control mechanism:	Two hand-cranked pedestal lifts in gatehouse. (probably one high-level and one low-level)
5. Other:	Two 12 inch pipes to 8 inch supply main
Intake chamber drain pipe	
1. Invert:	261.5±
2. Size:	4 inch diameter
3. Description:	Cast iron
4. Control mechanism:	Hand-cranked pedastal lift in gatehouse
5. Other:	N/A

SECTION 2: ENGINEERING DATA

2.1 DESIGN DATA

The available data consists of inventory data by the State of Connecticut, a 1971 inspection report by William H. O'Brien, III, and correspondence concerning placement of flashboards at the dam in 1942. Drawings of the project consist of an undated drawing entitled "Plan and Elevation of Dam at the Lower Reservoir of the Birmingham Water Company" by Dan W. Brinsmade, Civil and Hydraulic Engineer, and an 1887 drawing by H.S. Whipple, Civil and Sanitary Engineer showing the storage of the reservoir. (See Appendix B).

The drawings and correspondence indicate the design features stated previously in this report.

2.2 CONSTRUCTION DATA - No information is available.

2.3 OPERATIONS

Reservoir level readings are taken daily at the dam. No formal operations records are known to exist.

2.4 EVALUATION OF DATA

a. Availability - Available data was provided by the State of Connecticut and the owner. The owner made the project available for visual inspection.

b. Adequacy - The limited amount of detailed engineering data available was inadequate to perform an in-depth assessment of the dam, therefore, the final assessment of this dam must be based primarily on visual inspection, performance history, hydraulic computations of spillway capacity and hydrologic estimates

c. Validity - A comparison of record data and visual observations reveals no significant discrepancies in the record data.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General - The project is in fair condition. The inspection revealed several areas requiring maintenance and monitoring. At the time of inspection, the reservoir level was at elevation 277.0+, with a very thin sheet of water flowing over the spillway crest. The reservoir was being aerated by two small electric compressors attached to perforated air hoses in the reservoir.

b. Dam

Top of Dam - The top of the dam is in fair condition. To the left of the spillway, it is covered with low weedy vegetation (Photo 1). Two small saplings near the upstream side were also noted. To the right of the spillway, the top of the dam is grass covered, with vehicle tracks evident. Along the downstream edge of the top of the dam is a row of pine trees. In some areas, pine needles cover the surface of the dam, choking the low vegetation on the dam. The top of the embankment appears to be uniform in elevation, at about the top of the upstream masonry wall. At the left end of the dam, where the wall ends, there appears to be a localized low area. This area is heavily overgrown, therefore its true configuration could not be positively ascertained.

Upstream Face - The masonry upstream face of the dam is in good condition with the stone blocks exhibiting almost no weathering. An inscription and a coin emplaced in the mortar indicate that the wall joints were repointed in 1969. The mortar joints are in fair condition with minor cracking and spalling noted. Weedy vegetation is growing from cracks in the mortar on the upstream face and top of the wall (Photo 1).

Downstream Slope - The downstream slope appears to be uniform in inclination and no evidence of sloughing or surface erosion was noted. However, much of the slope is heavily brush covered and difficult to inspect, especially to the left of the spillway (Photo 2, Overview Photo). A wet condition immediately to the left of the left spillway training wall is indicated by the presence of reeds and swamp grass in this area (Photo 3). This wet condition could be the result of surface runoff from the street along the toe of the dam and/or minor seepage through the dam. Vegetation is sparse in a few places on the downstream slope of the right side of the embankment, due to disposal of dead branches and grass cuttings on the slope. The dry laid stone wall and fence along the toe of the dam are in fair condition.

Spillway - The masonry spillway section appears to be in good condition. Minor cracking of the mortar joints of the training walls was noted. No deterioration of the concrete cap on the spillway crest was observed. There is some grass growing near the upstream end of the spillway crest, where steel stanchions for

support of stop planks are located (Photo 4). The minor seepage from the spillway section noted in a 1971 inspection report (Appendix B-5) was not observable at the time of our inspection due to flow over the spillway. Riprap at the downstream toe of the spillway is small-sized and sparse. The spillway channel to the two 36 inch pipes under Academy Hill Road contains much vegetation and some debris (Photo 3), and approximately 75% of the cross-sectional area of one of the 36 inch pipes is filled with debris.

c. Appurtenant Structures - The gatehouse, intake chamber, and operating facilities appear to be in good condition. Some areas of the masonry substructure were resurfaced with mortar which does not exhibit any cracking or spalling. Leaching of some of the mortar joints of the superstructure brickwork and deterioration of a few bricks was noted (Photo 5). The operating facilities for the supply main and the intake chamber drain pipe appeared to be well lubricated and are operable (Photo 6). The gate screens and the steel brackets in which they slide are in poor condition, exhibiting considerable corrosion. The wood deck over the intake chamber is in good condition. The gate valve stem for the low-level outlet, located 35 feet to the left of the spillway, is corroded. The owner reports that the handle for this gate valve is kept in the gatehouse and that the gate is operable.

d. Reservoir Area - The area surrounding the reservoir is wooded and undeveloped,, except for an unimproved access road to the Upper Dam along the right side of the reservoir.

e. Downstream Channel - From the two 36 inch reinforced concrete pipes under Academy Hill Road, the stream passes through a residential area in a V-shaped channel with a slope of approximately 5%.

3.2 EVALUATION

Based upon the visual inspection, the project is in fair condition. The manner in which the features identified in Section 3.1 could affect the future condition and/or stability of the project is as follows:

1. Brush and saplings on the downstream slope of the dam could cause damage to the slope if left unmaintained. Also, they prevent adequate inspection of the slope.

2. Continued cracking of the mortar joints could weaken the wall on the upstream face of the dam and the spillway training walls.

3. Continued deterioration of bricks and leaching of the mortar joints of the brick walls of the gatehouse could weaken these walls.

4. The lack of adequate riprap at the downstream toe of the spillway could lead to erosion in this area, possibly undermining the spillway section.

5. The vegetation and debris in the spillway channel and the debris in the pipes under Academy Hill Road could cause blockage of flow to the downstream channel.

6. The possible low area at the left end of the dam is susceptible to erosion should the reservoir level approach the top of the dam.

7. Continued corrosion of the gate screens in the intake chamber and the low-level valve stem could cause these components to become unusable or inoperable.

8. Possible seepage through the spillway section and the embankent could cause internal erosion of the dam.

9. Areas on the top of the dam and downstream slope where vegetation is sparse are susceptible to surface erosion.

SECTION 4: OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

a. General - Water released through the eight inch supply main is gravity fed to a chlorination station and pump house approximately 500 feet downstream of the dam on High Street. Since it is continually fed by the Upper Reservoir, the level of the Lower Reservoir is maintained at the spillway crest. However, should the reservoir level rise above the spillway crest due to heavy precipitation, the low-level outlet is opened. Reservoir level readings are taken daily.

b. Description of Any Warning System in Effect - The owner maintains surveillance of the dam during unusually high precipitation and/or reservoir levels. Should a problem arise at the dam, the owner would contact the local Civil Defense.

4.2 MAINTENANCE PROCEDURES

a. General - The grass and brush on the dam are cut twice a year.

b. Operating Facilities - The operating facilities are exercised and lubricated on a regular basis.

4.3 EVALUATION

The operational and maintenance procedures are fair. A formal program of operational and maintenance procedures should be implemented, including documentation to provide records for future reference. Remedial operational and maintenance procedures are presented in Section 7.3.

SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The Lower Ansonia Reservoir Dam watershed is 0.56 square miles of rolling to mountainous wooded terrain. Upper Ansonia Reservoir, an upstream impoundment, contributes a significant reduction in peak inflows to Lower Ansonia Reservoir.

The dam is a masonry and earthfill dam with a masonry spillway. The available storage reduces the outflow from a Probable Maximum Flood (PMF) of 1,200 cubic feet per second (cfs) to 1,100 cfs and the ½ PMF outflow from 500 cfs to 450 cfs.

5.2 DESIGN DATA

No computations were available for the original design of the dam.

5.3 EXPERIENCE DATA

Although reservoir level readings have been taken daily since the dam was acquired by the Ansonia-Derby Water Company, they do not necessarily reflect peak flows at the dam because the Water Company opens the low-level outlet whenever water flows over the spillway.

5.4 VISUAL OBSERVATIONS

The top of the dam embankment has an elevation of 279.2 for most of its length.

5.4 TEST FLOOD ANALYSIS

Based upon the U.S. Army Corps of Engineers "Preliminary Guidance for Estimating Maximum Probable Discharges" dated March, 1978; the watershed classification (Rolling to Mountainous), the watershed area of 0.56 square miles, and a reduction in flow of approximately 300 cfs contributed by Upper Ansonia Reservoir, a PMF of 1,200 cfs or 2,100 cfs per square mile is estimated at the damsite. In accordance with the size (small) and hazard (high) classification, the range of test floods to be considered is from the ½ PMF to the PMF. Based on the degree of hazard associated with a breach of the dam, the test flood for Lower Ansonia Reservoir Dam is equivalent to the PMF. The reservoir level at the start of the test flood is considered to be at spillway crest elevation 277.0. The peak outflow for the test flood is estimated at 1,100 cfs and this flow will overtop the dam by 0.8 feet. Based on hydraulics computations, the spillway capacity to the top of the dam is 210 cfs which is equivalent to 19% of the routed test flood outflow (Appendix D-6).

5.5 DAM FAILURE ANALYSIS

The dam failure analysis is based on the April, 1978 Army Corps of Engineers "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs". With the reservoir level at the top of the dam, peak outflow before failure of the dam would be about 210 cfs and the peak failure outflow from the dam breaching would total about 9,200 cfs. A breach of the dam would result in a rise in the water level of the stream at the initial impact area, from a depth of 0.8 feet just before the breach to a depth of about 6 feet shortly after the breach. This rapid, 5.2 foot increase in water level will inundate numerous houses by up to 5 feet, possibly causing the loss of more than a few lives as well as substantial economic loss. Based on the dam failure analysis, Lower Ansonia Reservoir Dam is classified as a high hazard dam (Appendix D-10).

SECTION 6: EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS

The visual inspection did not reveal any indications of stability problems. Items described in Section 3, such as trees and brush on the embankment, possible minor seepage through the embankment and spillway, slight deterioration of mortar joints, and lack of adequate riprap at the toe of the spillway are not stability concerns at the present time.

There is a row of 14" to 18" diameter pine trees along the downstream edge of the top of the dam. These trees do not appear to affect the stability of the structure, unless the embankment were left unmaintained and other trees were to seed themselves and grow.

6.2 DESIGN AND CONSTRUCTION DATA

The existing drawing of the project is the undated drawing by Dan W. Brinsmade which is reproduced as Sheet B-1. The drawing indicates that the dam has a structural height of 27 feet, which is 9.2 feet greater than its hydraulic height; i.e., the lowest footing of the masonry wall is 9.2 feet below the streambed at the toe of the dam. The wall is shown to be founded on bedrock for its entire length, except beneath the spillway section and at the right end of the dam, where the bedrock surface drops off. Sectional views of the dam on the drawing show a submerged embankment with a top elevation of 270± on the upstream side of the masonry wall. All of these design features enhance the structural stability of the project.

6.3 POST-CONSTRUCTION CHANGES

As mentioned in Section 1.2.h, Brinsmade's drawing probably depicts reconstruction work at the dam, but the date of the drawing is not known. The only other known post-construction work is the repointing of the masonry wall in 1969, which probably enhanced the stability of the structure.

6.4 SEISMIC STABILITY

The dam is in Seismic Zone 1, and according to U.S. Army Corps of Engineers Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 PROJECT ASSESSMENT

a. Condition - Based upon the visual inspection at the site and past performance, the project is in fair condition. No evidence of instability was observed in the spillway, embankment or appurtenant structures; however, there are several items which require maintenance, repair and monitoring.

Based upon the U.S. Army Corps of Engineers' "Preliminary Guidance for Estimating Maximum Probable Discharges" dated March, 1978, the watershed area and classification, and hydraulic/-hydrologic computations, peak inflow to the reservoir at test flood is 1,200 cfs; peak outflow is 1,100 cfs, with the dam overtopped by 0.8 feet. Based upon hydraulics computations, the spillway capacity to the top of the dam is 210 cfs, which is equivalent to 19% of the routed test flood outflow. This indicates an inadequate spillway capacity.

b. Adequacy of Information - The information available is such that an assessment of the condition and stability of the project must be based on visual inspection, past performance and sound engineering judgement.

c. Urgency - It is recommended that the measures presented in Section 7.2 and 7.3 be implemented within one year of the owner's receipt of this report.

7.2 RECOMMENDATIONS

It is recommended that further studies be made by a registered professional engineer qualified in dam design and inspection pertaining to the following item. Recommendations made by the engineer should be implemented by the owner.

1. A detailed hydraulic/hydrologic analysis to determine the adequacy of the project discharge and outlet facilities.

2. Determination of the true configuration of the top of the dam, specifically the possible low area at the left end of the dam.

3. Removal of all trees from the dam. This should include removal of root systems and proper backfilling.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures - The following measures should be undertaken by the owner within the length of time indicated in Section 7.1.c, and continued on a regular basis:

1. Round-the-clock surveillance should be provided during periods of heavy precipitation or high project discharge. A formal downstream warning system should be developed, to be used in case of emergencies at the dam.

2. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.

3. A comprehensive program of inspection by a registered professional engineer qualified in dam inspection should be instituted on an annual basis.

4. Brush and saplings should be removed and grassy vegetation established on the embankment.

5. Repointing of the cracked or leached mortar joints of the masonry walls and the brick gatehouse walls should be continued as part of the regular maintenance procedures at the dam.

6. Additional larger sized riprap should be placed in the spillway discharge channel and the vegetation and debris in the channel and in the two pipes under Academy Hill Road should be cleared.

7. The intake chamber screens and the low-level outlet valve stem should be treated to protect them from further corrosion.

8. Reported seepage through the spillway and embankment should be monitored.

7.4 ALTERNATIVES

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Lower Ansonia Reservoir Dam

DATE: Aug. 8, 1980

TIME: 8:30 am

WEATHER: Humid, 70°

W.S. ELEV. 277.0 U.S. 259.5± DN.S

PARTY:	INITIALS:	DISCIPLINE:
1. Peter Heynen	PH	Geotechnical
2. Theodore Stevens	TS	Geotechnical
3. Hector Moreno	HM	Hydraulics
4. Robert Jahn	RJ	Hydraulics
5.		
6.		

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Masonry & Earth Embankment	PH, TS, HM, RJ	
2.	Intake Chamber	PH, TS, HM, RJ	
3.	Gatehouse	PH, TS, HM, RJ	
4.	Spillway	PH, TS, HM, RJ	
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

PERIODIC INSPECTION CHECK LIST

PROJECT Lower Ansonia Res. Dam DATE 8-8-80

PROJECT FEATURE Masonry & Earth Embank. BY PH, TS, HM, RJ

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	279.2
Current Pool Elevation	277.0
Maximum Impoundment to Date	277.1±
Surface Cracks	Minor cracking of mortar joints
Pavement Condition	N/A
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Appears good
Horizontal Alignment	Appears good
Condition at Abutment and at Concrete Structures	Possible low area-left abut.
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	Vehicle tracks on top
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection-Riprap Failures	N/A
Unusual Movement or Cracking at or Near Toes	None observed
Unusual Embankment or Downstream Seepage	wet area to left of spillway
Piping or Boils	None observed
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Lower Ansonia Res. Dam DATE 8-8-80

PROJECT FEATURE Intake Chamber BY PH, TS, HM, RJ

AREA EVALUATED	CONDITION
OUTLET WORKS-INTAKE CHANNEL AND INTAKE STRUCTURE	
a) Approach Channel	
Slope Conditions	Could not observe
Bottom Conditions	
Rock Slides or Falls	None
Log Boom	None
Debris	None observed
Condition of ~~Concrete~~ Masonry Lining	Good
Drains or Weep Holes	6" C.I. - Appears good
b) Intake Structure	
Condition of ~~Concrete~~ Masonry	Appears good
Stop Logs and Slots	Corrosion of screens and slots

PERIODIC INSPECTION CHECK LIST

PROJECT Lower Ansonia Res. Dam DATE 8-8-80

PROJECT FEATURE Gatehouse BY PH, TS, HM, RJ

AREA EVALUATED		CONDITION
OUTLET WORKS-CONTROL TOWER		
a) Brick ~~Concrete~~ and Structural		
General Condition		Good
Condition of Joints		Some leaching of mortar
Spalling		Litte weathering of bricks
Visible Reinforcing		N/A
Rusting or Staining of Brick ~~Concrete~~		Minor
Any Seepage or Efflorescence		None observed
Joint Alignment		Appears good
Unusual Seepage or Leaks in Gate Chamber		None observed
Cracks		Minor
Rusting or Corrosion of Steel		N/A
b) Mechanical and Electrical		- All gates are manual - electricity only for lighting and two small compressors for aeration of reservoir
Air Vents		
Float Wells		
Crane Hoist		
Elevator		N/A
Hydraulic System		
Service Gates		Appear good - well lubricated
Emergency Gates		N/A
Lightning Protection System		Appears adequate
Emergency Power System		None
Wiring and Lighting System		Appears good

PERIODIC INSPECTION CHECK LIST

PROJECT Lower Ansonia Res. Dam DATE 8-8-80

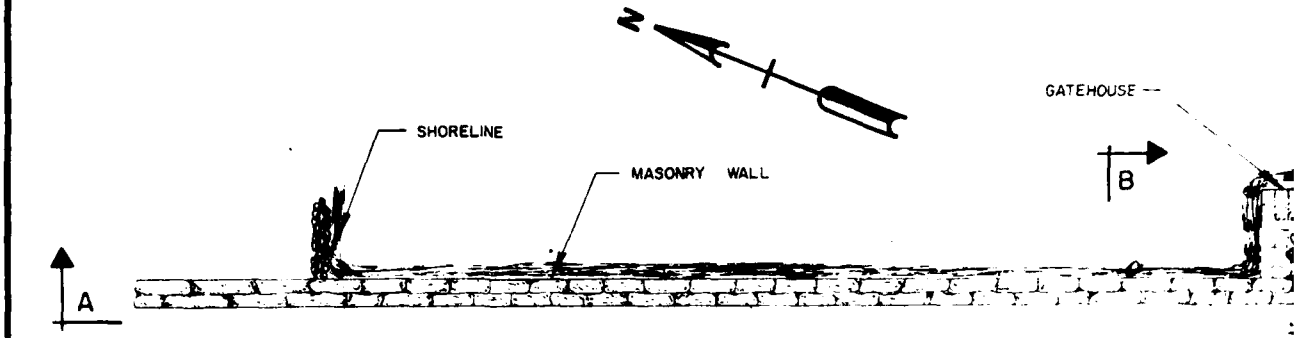
PROJECT FEATURE Spillway BY PH, TS, HM, RJ

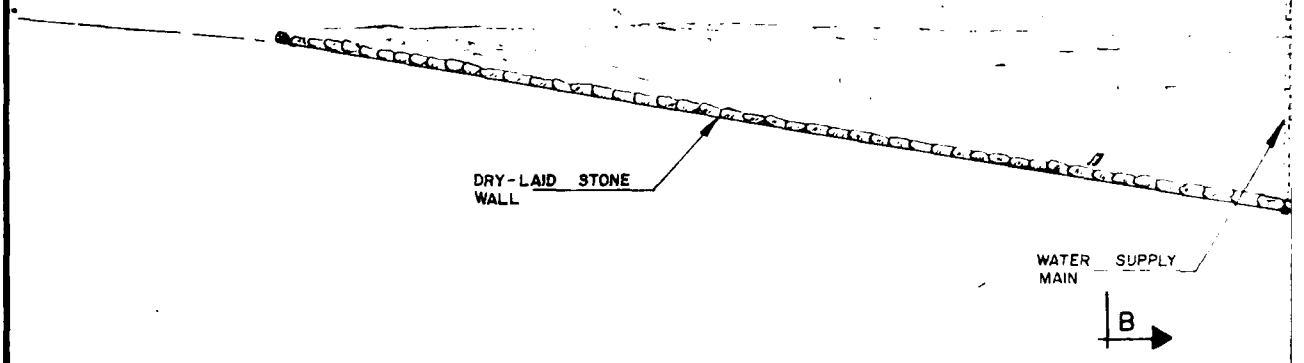
AREA EVALUATED	CONDITION
OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a) Approach Channel	
General Condition	Appears good
Loose Rock Overhanging Channel	No
Trees Overhanging Channel	No
Floor of Approach Channel	Reservoir bottom
b) Weir and Training Walls	
General Condition of ~~Concrete~~ Masonry	Good
Rust or Staining	None observed
Spalling	None observed
Any Visible Reinforcing	N/A
Any Seepage or Efflorescence	None observed
Drain Holes	No
c) Discharge Channel	
General Condition	Poor
Loose Rock Overhanging Channel	No
Trees Overhanging Channel	yes
Floor of Channel	silt, sand
Other Obstructions	overgrown, debris in culvert under road

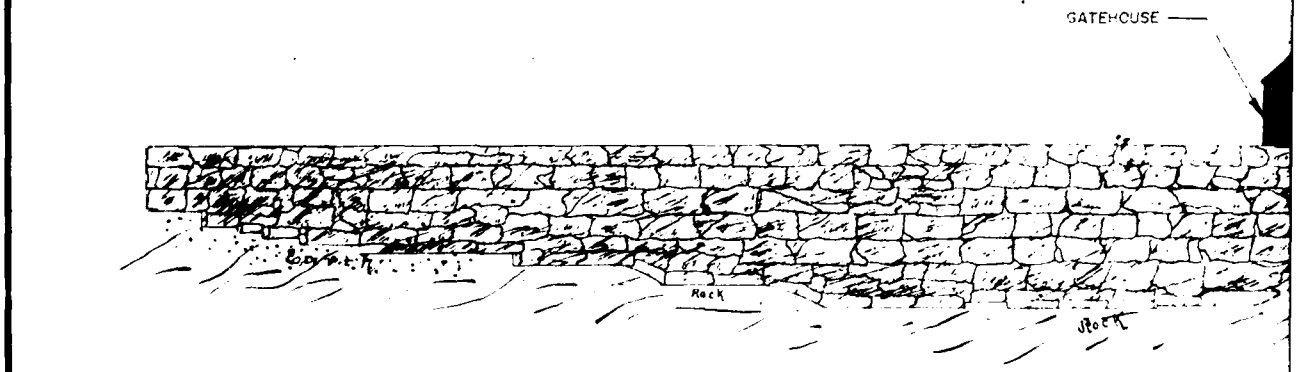
APPENDIX B

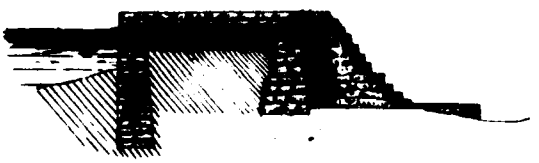
ENGINEERING DATA AND CORRESPONDENCE

— LOWER ANSONIA R



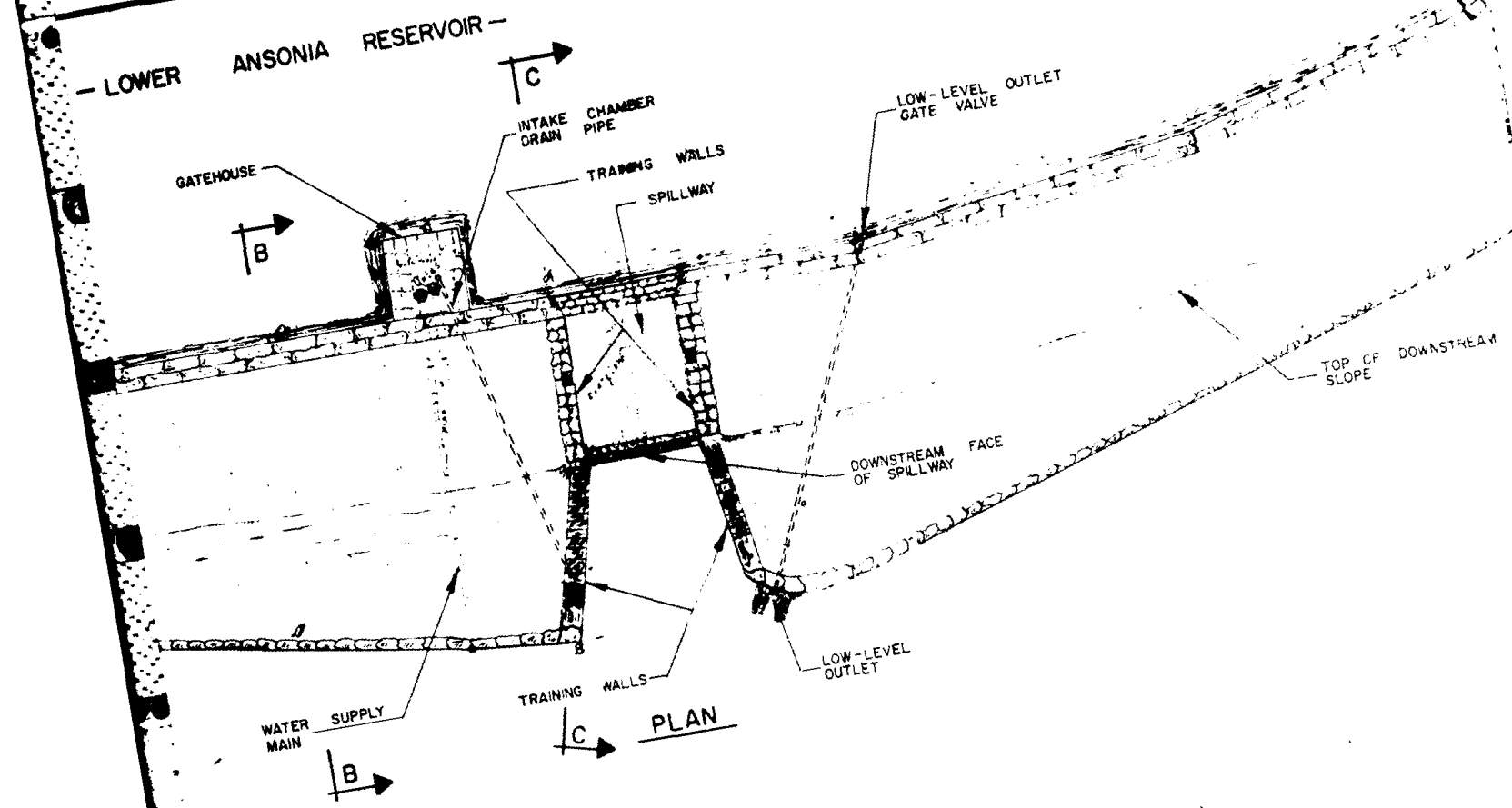


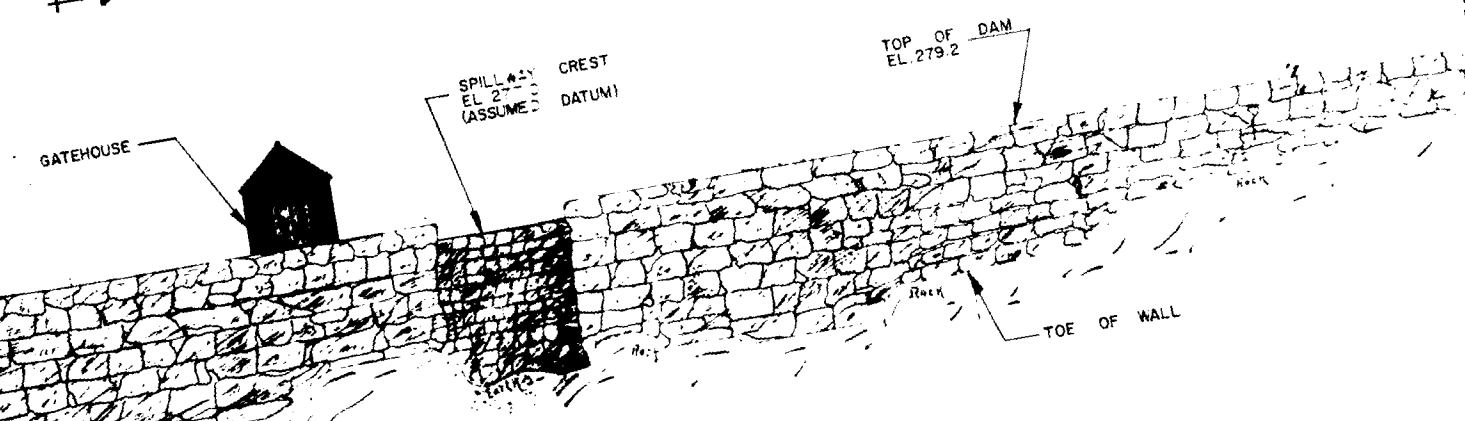




① SECTION C-C

SECTION B-B





SECTION A-A

SECTION B-B

(2)

NOTES:

1. THIS SHEET WAS COMPILED FROM AN UNDATED DRAWING BY DAN W BRINSMADE ENTITLED "PLAN AND ELEVATION OF DAM AT THE LOWER RESERVOIR OF THE BIRMINGHAM WATER CO." SCALE 1"=16'

2. NO ELEVATIONS WERE AVAILABLE FOR THE DAM, THEREFORE THE WATER SURFACE ELEVATION OF 277.0 FOR THE RESERVOIR SHOWN ON THE U.S.G.S. ANSONIA QUADRANGLE MAP WAS ASSUMED TO BE THE N.G.V.D ELEVATION OF THE SPILLWAY CREST. ALL OTHER ELEVATIONS SHOWN ARE REFERENCED TO THE ASSUMED SPILLWAY CREST ELEVATION.

(3)

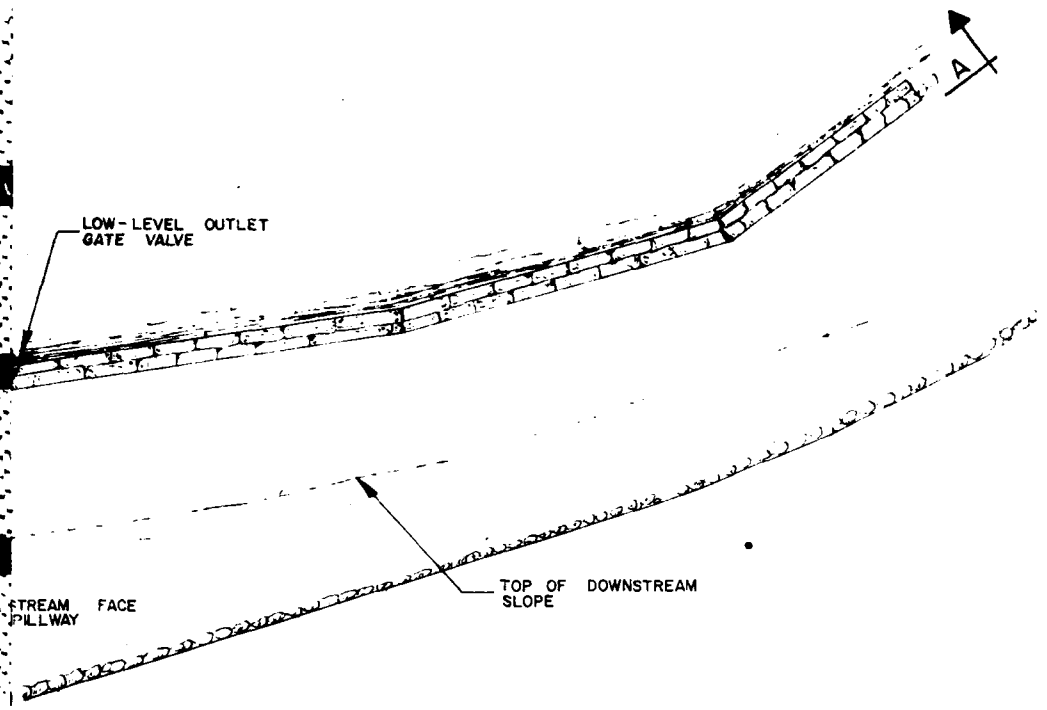
CAHN ENGINEERS INC.
WALLINGFORD CONNECTICUT
ENGINEER

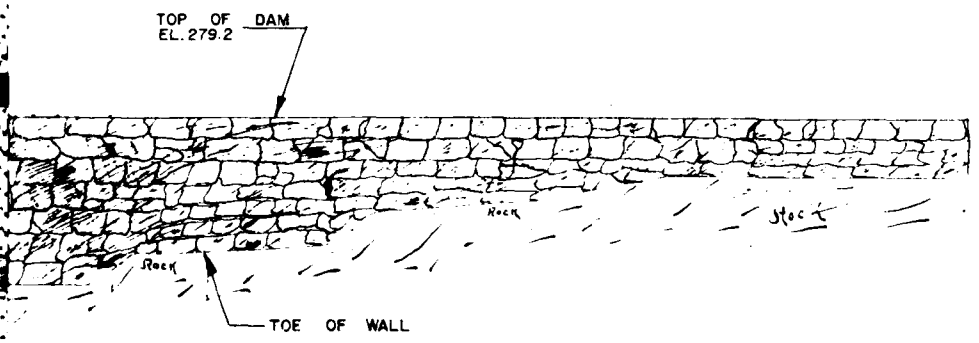
NATIONAL PROGRAM
PLAN

LOWER ANS

TR - NAUGATUCK RIVER

DWN. BY	CKD. BY	AP
W [illegible]	TSS	P





...D FROM AN UNDATED DRAWING BY
...ED "PLAN AND ELEVATION OF DAM AT
... THE BIRMINGHAM WATER CO." SCALE 1"=16'

...ILABLE FOR THE DAM, THEREFORE THE
...ON OF 277.0 FOR THE RESERVOIR SHOWN
... QUADRANGLE MAP WAS ASSUMED TO BE
...OF THE SPILLWAY CREST.
...SHOWN ARE REFERENCED TO THE ASSUMED
...TION.

CAHN ENGINEERS INC. WALLINGFORD CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

PLAN AND SECTIONS

LOWER ANSONIA RESERVOIR DAM

TR - NAUGATUCK RIVER DERBY, CONNECTICUT

DWN. BY	CKD. BY	APP. BY	SCALE: 1" = 30' H. & V.	
H. [illegible]	TJS	PWL	DATE: SEPT. 1980	SHEET 8-1

(3)

LOWER ANN[illegible]

EXISTING PLANS

"Reservoir No. 1"
(drawing shows storage capac[illegible]
H.S. Whipple, Civil and Sanit[illegible]
Feb. 26, 1887

"Plan and Elevation of Dam at the Lower Reservoir
of the Birmingham Water Co."
Dan W. Brinsmade. Civil and [illegible]
undated

SUMMARY OF DATA AND CORRESPONDENCE

DATE	TO	FROM	SUBJECT	PAGE
July 17, 1942	The Birmingham Water Company Derby, Conn.	V. B. Clarke, Engineer State Board for the Supervision of Dams	Permission to install flashboards	B-3
-	File	State Board for the Supervision of Dams	Inventory Data	B-4
Dec. 28, 1971	File	William H. O'Brien III Civil Engineer Water & Related Resources Dept. of Environmental Protection State of Connecticut	Inspection Report	B-5

July 17, 1942 V. B. Carke

The Birmingham Water Company
Derby, Conn.

Dear Sirs:

Through your Engineer, Mr. Clarence M. Blair a request has been made for permission to install flash boards on the #1 and #2 Dams at Derby Hill.

I have investigated this matter and permission is hereby granted for you to install these flash-boards not over 10 inches in height.

I believe you should make some provision so that if any appreciable amount of water flows over these flash boards they can be removed in sections so that there will not be over 10 inches of water over the masonry spillway.

Very truly yours,

Engineer, for
State Board of Supervision of Dams

VBC:M

Copies to: C.M. Blair, Engineer
General Sanford B. Wadhams, Chairman

STATE BOARD FOR THE SUPERVISION OF DAMS
INVENTORY DATA

NAME OF DAM OR POND Ansonia Reservoir (Lower)

CODE NO. [illegible]

LOCATION OF STRUCTURE:

Town Derby

Name of Stream Tributary of Naugatuck

U.S.C.S. Quad. Ansonia Long. 73-1.5 Lat. 41-19.1

OWNER: Ansonia & Derby Water Company

Address Derby of 6/73

Telephone

Pond Used For: Reservior DA 0.56 sq mi

Dimensions of Pond: Width _____ Length _____ Area [illegible]

Depth of Water below Spillway Level (Downstream) 15

Total Length of Dam 300' ± Length of Spillway 10

Height of Abutments above Spillway 1.5

Type of Soillway Construction Stone

Type of Dike Construction Earth

Downstream Conditions Road just below, then steep drop to built up area.

Summary of File Data

Remarks Because of size and location Board Member should inspect.

3-14-77 appeared to be in satisfactory condition VJA

INTERDEPARTMENT MESSAGE

SAVE TIME: Handwritten messages are acceptable. Use carbon if you really need a copy. If typewritten, ignore faint lines.

TO	AGENCY	DATE
File	Water & Related Resources	Dec. 28, 1971
FROM	**AGENCY**	**TELEPHONE**
William H. O'Brien, III Civil Engineer	Water & Related Resources	

SUBJECT: Birmingham Water Company Reservoir Dam, Derby H10.8 U0.6

The subject dam was inspected by the undersigned on December 16, 1971. This dam is immediately upstream from Academy Hill Road in Derby approximately 3/10 of a mile west of the junction of Academy Hill Road, David Humphrey Road, and Centinal Hill Road. This dam and reservoir is also approximately 1/10 of a mile south of a larger upper reservoir.

The water level was approximately 3½ feet below the concrete spillway level. There is an 8 inch board permanently fastened to and supported by 1 inch diameter pipes spaced approximately 4 feet apart on top of the concrete. The top of this board is about 20 inches below the top of the dam. The spillway is 20 feet in length and the breadth of the crest is a level section approximately 25 feet in breadth.

Some minor seepage noted along the bottom 2 feet of the masonry spillway section. This section is approximately 15 feet in overall height. The top of the grass embankment is approximately 2 feet above the spillway. The roadway immediately below this dam (about 50 feet) was approximately 8 feet below the spillway. The brook passes under the roadway in twin 36 inch pipes which are more than half full of debris.

The cut stone mortared masonry of the spillway section appeared to be in excellent condition. If this dam were to fail there would undoubtedly be some property damage and perhaps loss of life downstream as a result. There is only about 2 feet freeboard between spillway level and top of earth embankment, but there is a substantial vertical masonry wall with mortar some 5 feet in thickness on the upstream side of this dam which is level with the top of the earth embankment which itself is approximately 25 feet in width. The trees mentioned above are planted along the top of the downstream slope.

The dam appeared to be in good condition and no further action is indicated at this time.

W. H. O'Brien

Civil Engineer

WHO:ljg

APPENDIX C

DETAIL PHOTOGRAPHS

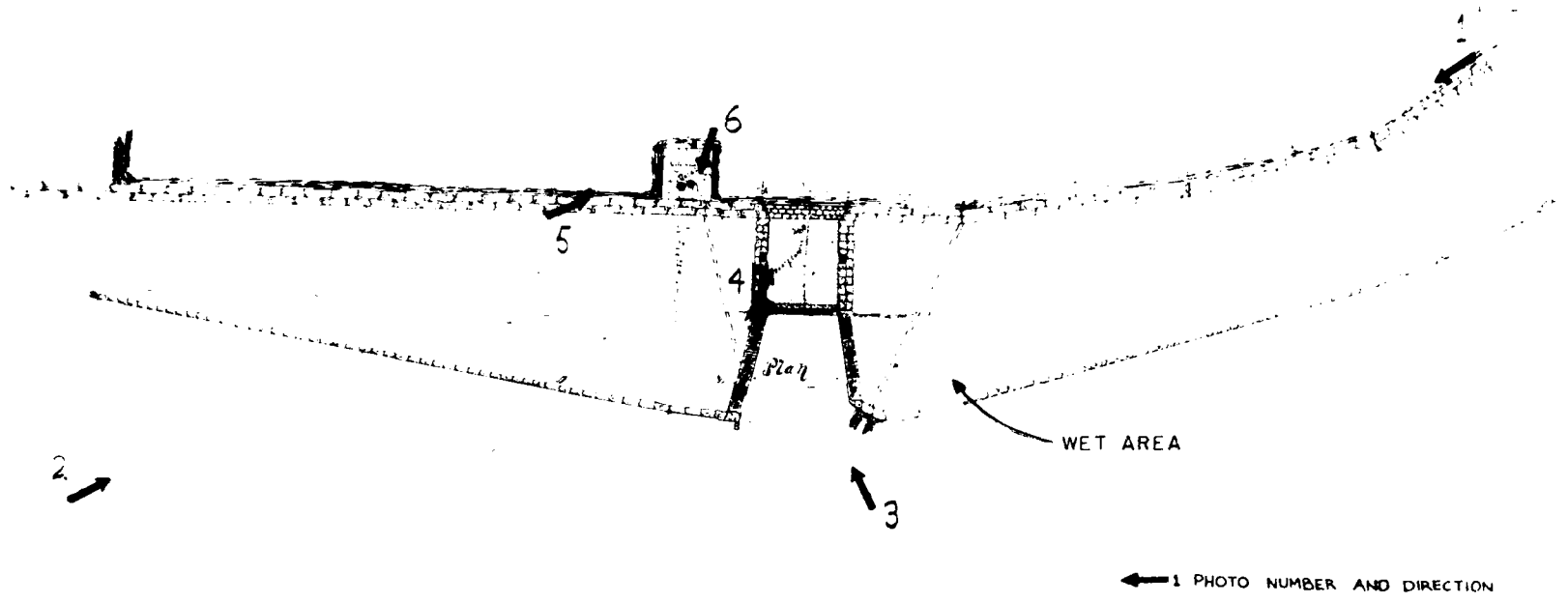


PHOTO LOCATION PLAN

LOWER ANSONIA RES. DAM

SHEET C-1

Photo 1 - Upstream face and top of dam viewed from left end (8/8/80).

Photo 2 - Downstream slope and top of right side of dam (8/8/80).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	Lower Ansonia Res. Dam Tr-Naugatuck River Derby, Connecticut
CAHN ENGINEERS INC. WALLINGFORD, CONN ENGINEER	INSPECTION OF NON-FED. DAMS	CE # 27 785 KC DATE Sept. '80 PAGE C-1

Photo 3 - Downstream face of spillway and spillway discharge channel (8/8/80).

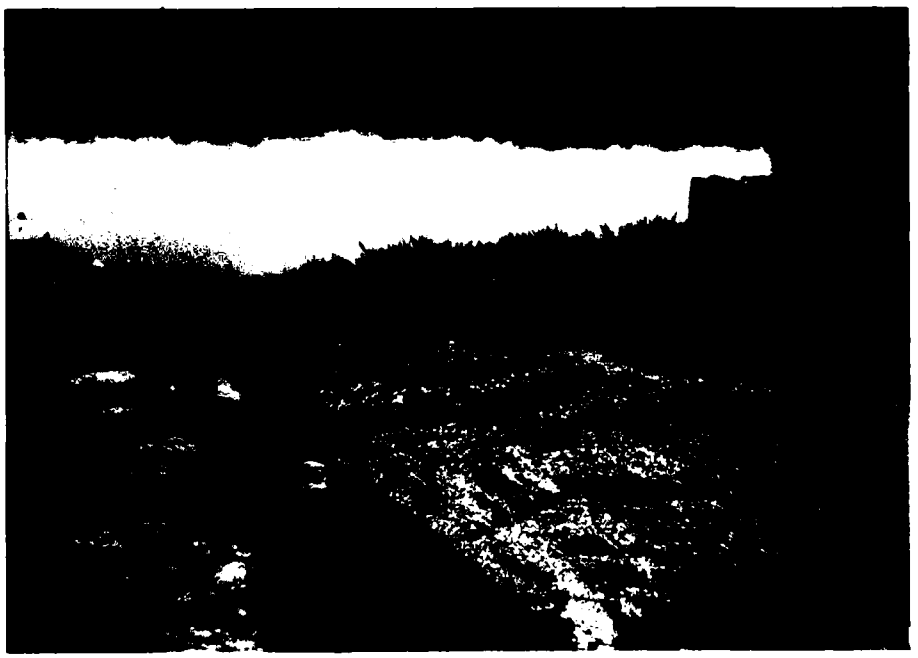


Photo 4 - Spillway crest (8/8/80).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS CAHN ENGINEERS INC. WALLINGFORD, CONN ENGINEER	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	Lower Ansonia Res. Dam Tr-Naugatuck River Derby, Connecticut CE # 27 785 KC DATE Sept. '80 PAGE C-2

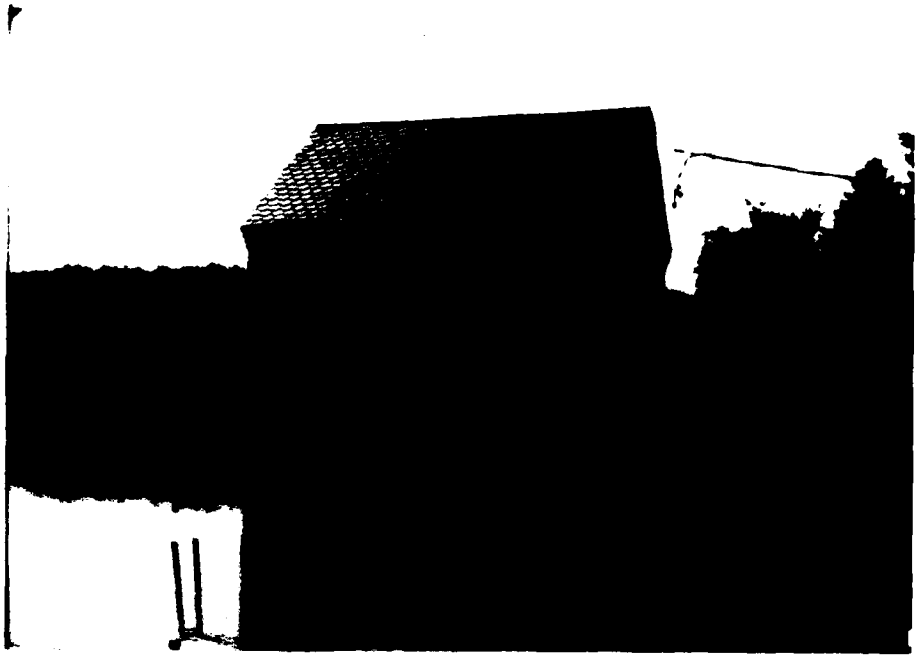


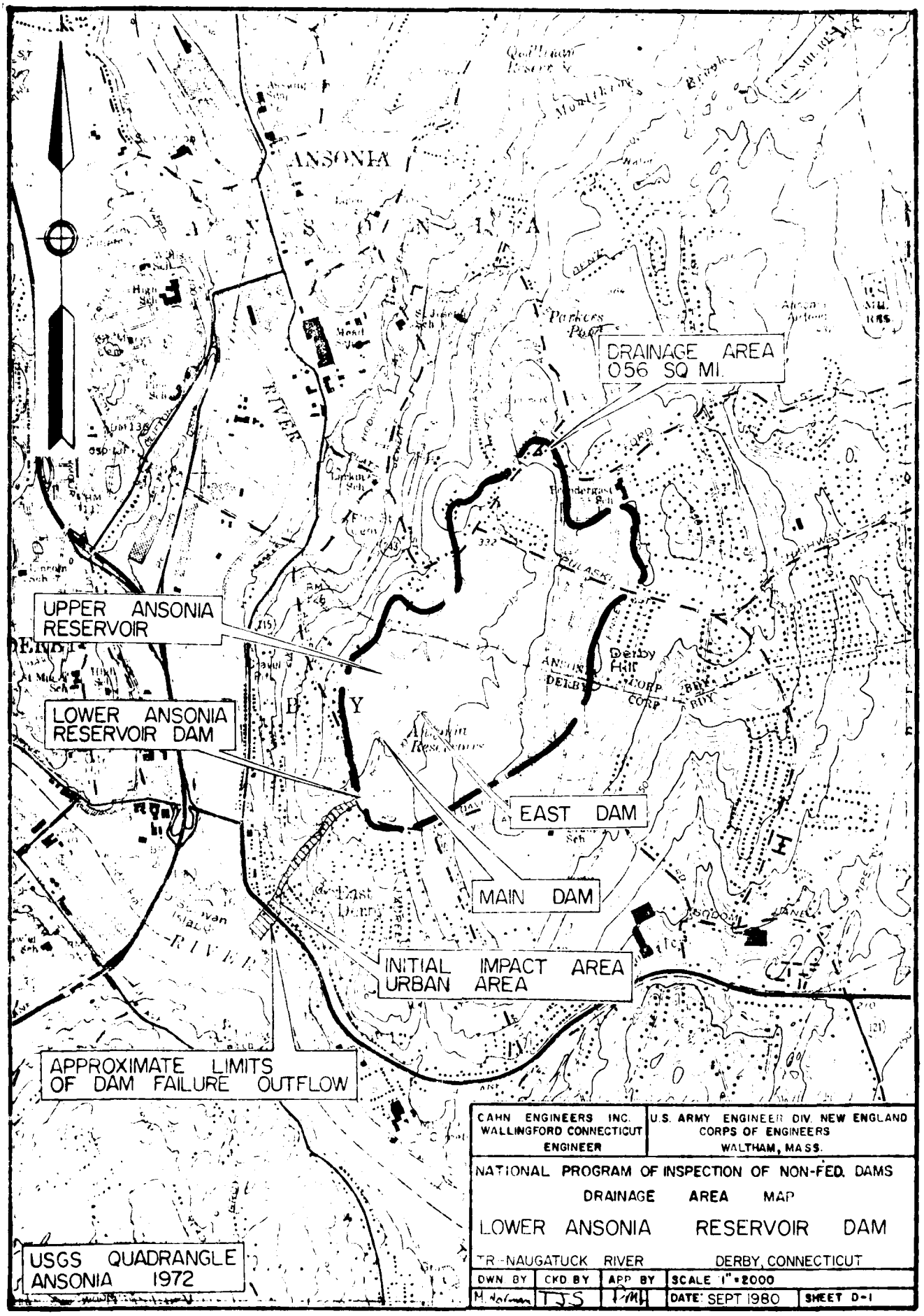
Photo 5 - Gatehouse (8/8/80).

Photo 6 - Interior of gatehouse (8/8/80).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	Lower Ansonia Res. Dam Tr-Naugatuck River Derby, Connecticut
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	INSPECTION OF NON-FED. DAMS	CE# 27 785 KC DATE Sept. '80 PAGE C-3

APPENDIX D

HYDRAULICS/HYDROLOGIC COMPUTATIONS



CAHN ENGINEERS INC. WALLINGFORD CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DRAINAGE AREA MAP

LOWER ANSONIA RESERVOIR DAM

TR-NAUGATUCK RIVER DERBY, CONNECTICUT

DWN BY	CKD BY	APP BY	SCALE 1"=2000	
M. Hofman	TJS		DATE: SEPT 1980	SHEET D-1

HYDROLOGIC / HYDRAULIC INSPECTION

LOWER ANSONIA (DERBY) RESERVOIR, DERBY, CT.

I) PERFORMANCE AT PEAK FLOOD CONDITIONS

1) PROBABLE MAXIMUM FLOOD (PMF)

a) WATERSHED CLASIFIED AS "ROLLING" TO "MOUNTAINOUS"

b) WATERSHED AREA:

THE DAM IS LOCATED JUST D/S FROM THE UPPER ANSONIA RESERVOIR. THE TOTAL WATERSHED IS SUBDIVIDED AS FOLLOWS:

i) D.A. TO UPPER ANSONIA RESERVOIR DAM: $(DA)_{UA} = 0.43$ sq mi
ii) INCREMENT TO LOWER ANSONIA RESERVOIR DAM: $\Delta(DA)_{LA} = 0.13$ sq mi
iii) TOTAL D.A. TO LOWER ANSONIA RESERVOIR DAM: $(DA)_{LA} = 0.56$ sq mi

NOTE: D.A.'S FROM CONN. D.E.P. BULLETIN No. 1, 1972 (GAZETTEER OF NATURAL DRAINAGE AREAS) p. 66

c) PEAK FLOODS (FROM NED-ACE GUIDELINES - GUIDE CURVES FOR PMF).

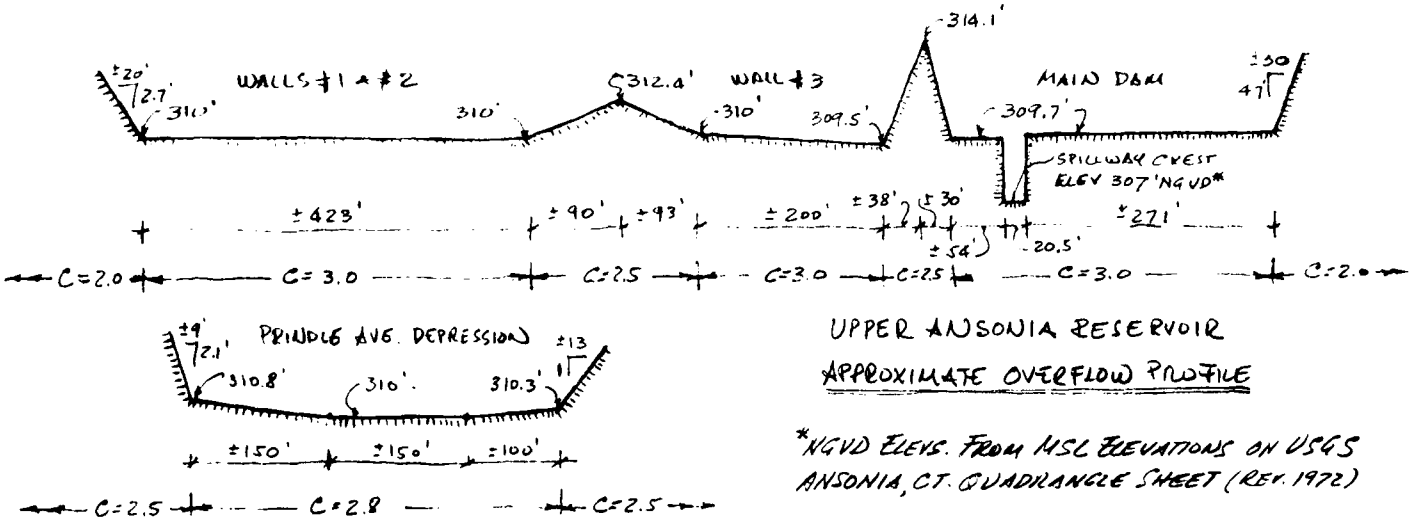
THE UPPER ANSONIA RESERVOIR ($A_{WL} = 34$ ac.) COVERS (±) 12% OF ITS WATERSHED AND HAS POTENTIALLY A SIGNIFICANT EFFECT IN THE REDUCTION OF PEAK INFLOWS TO LOWER ANSONIA RESERVOIR (SEE CE H/H COMPS. FOR UPPER ANSONIA RESERVOIR DAM PHASE I INSPECTION REPORT).

THIS PEAK INFLOW REDUCTION HAS BEEN ESTIMATED BY THE APPROXIMATE ROUTING NED-ACE GUIDELINES ALTERNATE METHOD "SURCHARGE-STORAGE ROUTING" AND 19" MAX. PROBABLE R.O. IN NEW ENGLAND.

THE FOLLOWING SUMMARIZES THE ESTIMATE OF PMF AND ½ PMF PEAK

OUTFLOWS FOR THE UPPER ANSONIA RESERVOIR

(i) OVERFLOW PROFILE



UPPER ANSONIA RESERVOIR
APPROXIMATE OVERFLOW PROFILE

*NGVD ELEVS. FROM MSL ELEVATIONS ON USGS ANSONIA, CT. QUADRANGLE SHEET (REV. 1972)

NOTE: DATA FROM THE ANSONIA WATER CO. MAPS "PLAN OF OVERFLOW DAM AT STORAGE RESERVOIR OF BIRMINGHAM WATER CO." AND "PLAN OF MASONRY IN ADDITION TO THAT OF MAIN DAM OF BIRMINGHAM WATER CO."; AND, C.E. FIELD OBSERVATIONS ON 5/28/80 BY [illegible] & R.J.

(ii) RATING CURVE

THE UPPER ANSONIA RESERVOIR DAM OUTFLOW IS APPROXIMATED BY THE FOLLOWING RATING CURVE EQUATION (SEE SIMILAR EQ. DEVELOPMENT ON P. D-4)

$$Q_{UA} = 61.5H^{3/2} + 975(H-2.7)^{3/2} + 1690(H-3)^{3/2} + 488(H-2.5)^{5/2} + 11.9(H-2.7)^{5/2} + 185(H-3)^{5/2} - 360(H-3.3)^{5/2} - 206(H-3.8)^{5/2}$$

(iii) A SUMMARY OF THE ROUTING OF PEAK INFLOWS TO LOWER ANSONIA RESERV., FOLLOWS:

NAME/LOCATION OF ROUTED FLOOD	(1) D.A (SQ MI)	CSM (CFS/SQMI)	AVE LAKE AREA (AC)	PMF (CFS) PK INFLOW	PMF (CFS) PK OUTFLOW	½ PMF (CFS) PK INFLOW	½ PMF (CFS) PK OUTFLOW
UPPER ANSONIA RES.	*0.43	2800	37.7	1200	(2) 840	600	310
LOWER ANSONIA RES.	Δ0.13	(4) 2700	—	1200	(3) 1100	500	(3) 450

(1) DRAINAGE AREA (*) TOTAL; (Δ) INCREMENTAL. (2) FLOW TO L. ANSONIA RES. (30 ACRES PRINDLE AVE. TO OTHER D.A.). (3) SEE P. D-6
(4) BASED ON TOTAL D.A.

THE FLOOD FLOW THE INCREMENTAL DRAINAGE AREA D/S FROM UPPER ANSONIA RESERVOIR HAS BEEN ASSUMED TO PEAK SIMULTANEOUSLY WITH THE RESERVOIR'S PEAK OUTFLOW.

THEREFORE, THE PEAK INFLOWS TO LOWER ANSONIA RESERVOIR, ESTIMATED AT PMF ≈ 1500 CFS AND ½PMF ≈ 750 CFS, ARE REDUCED BY THE UPPER ANSONIA RESERVOIR TO (±) 1200 CFS AND 500 CFS, RESPECTIVELY. i.e., A PEAK FLOW REDUCTION OF (±) 20% FOR THE "PMF" AND (±) 33% FOR THE "½ PMF".

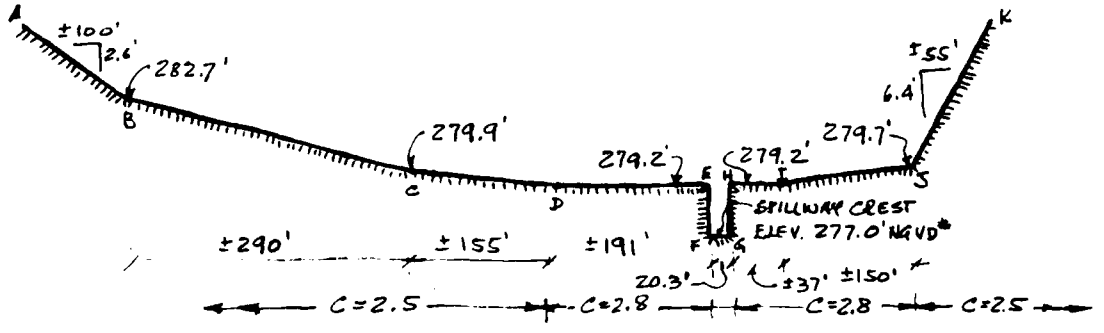
2) SURCHARGE AT PEAK INFLOWS (PMF & ½ PMF)

a) OUTFLOW RATING CURVE:

i) SPILLWAY AND OUTFLOW PROFILE FOR SURCHARGES OVERTOPPING THE DAM:

SPILLWAY (±) 20.3' LONG, BROAD CRESTED (W ≈ 30'), VERTICAL U/S FACE, SIDE WALLS ROUNDED AT ENTRANCE. STONE MASONRY, EARTH DAM, (±) 20' TO 30' WIDE AT THE TOP.

ASSUME C=3.2 FOR THE "SPILLWAY FLOW", C=2.8 FOR THE DAM AND C=2.5 FOR THE ADJACENT TERRAIN OVERFLOWS. (SEE OVERFLOW PROFILE).



DATA FROM THE ANSONIA WATER CO. DWG. "PLAN AND ELEVATION OF DAM AT THE LOWER RESERVOIR OF THE BIRMINGHAM WATER CO." AND C.E. OBSERVATIONS ON 5/28/80 BY HLL & R.J.

LOWER ANSONIA RESERVOIR DAM
APPROXIMATE OVERFLOW PROFILE

*NOTE: WS ELEV 277' NSL ON THE USGS ANSONIA, CT QUADRANGLE SHEET (REV. 1972) IS ASSUMED TO BE THE SPILLWAY CREST ELEVATION ON NATIONAL GEODETIC VERTICAL DATUM (NGVD).

(c) THEREFORE, THE OVERFLOW RATING CURVE FOR THE RANGE OF FLOWS, SURCHARGES CONSIDERED CAN BE APPROXIMATED AS FOLLOWS:

1') SECTION AB*: $Q_{AB} = 0.4 \times 100/2.6 \times 2.5 (H-5.7)^{5/2} = \underline{38.5 (H-5.7)^{5/2}}$

2') SECTION BC: $(Q_{BC})_1 = 0.4 \times 290/2.8 \times 2.5 (H-2.9)^{5/2} = \underline{104 (H-2.9)^{5/2}}$; $H \leq 5.7'$

$(Q_{BC})_2 = \underline{104 [(H-2.9)^{5/2} - (H-5.7)^{5/2}]}$; $H > 5.7'$

3') SECTION CD: $(Q_{CD})_1 = 0.4 \times 155/0.7 \times 2.5 (H-2.2)^{5/2} = \underline{221 (H-2.2)^{5/2}}$; $H \leq 2.9'$

$(Q_{CD})_2 = \underline{221 [(H-2.2)^{5/2} - (H-2.9)^{5/2}]}$; $H > 2.9'$

4') SECTIONS DE, HI: $Q_{DE,HI} = 2.8 \times 228 (H-2.2)^{3/2} = \underline{638 (H-2.2)^{3/2}}$

5') SPILLWAY (SECTION FG): $Q_{FG} = 3.2 \times 20.3 H^{3/2} = \underline{65 H^{3/2}}$

6') SECTION IJ: $(Q_{IJ})_1 = 0.4 \times 150/0.5 \times 2.8 (H-2.2)^{5/2} = \underline{336 (H-2.2)^{5/2}}$; $H \leq 2.7'$

$(Q_{IJ})_2 = \underline{336 [(H-2.2)^{5/2} - (H-2.7)^{5/2}]}$; $H > 2.7$

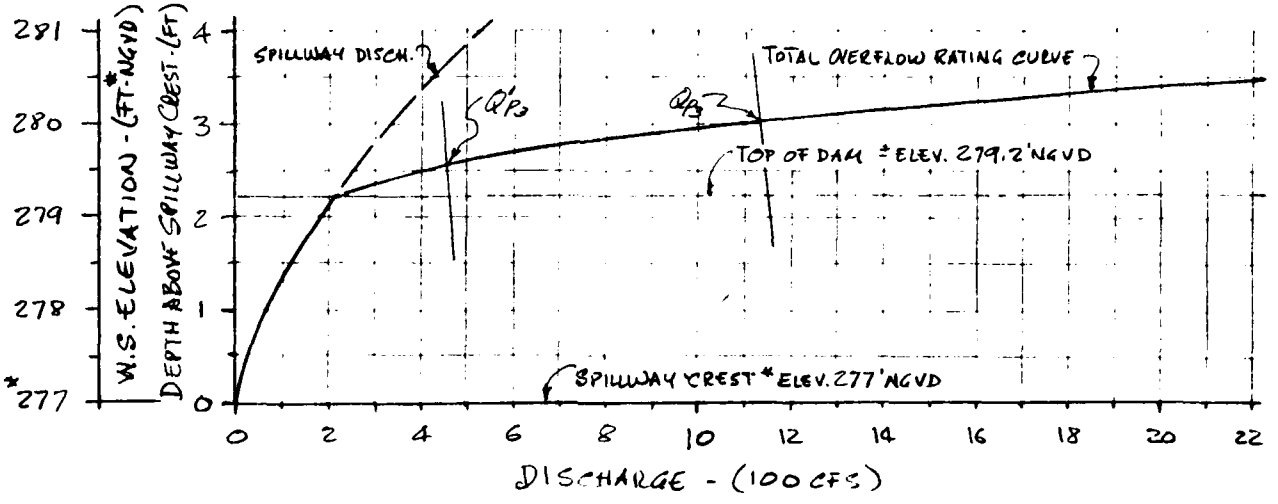
7') SECTION JK: $Q_{JK} = 0.4 \times 55/6.4 \times 2.5 (H-2.7)^{5/2} = \underline{8.6 (H-2.7)^{5/2}}$

THE TOTAL OVERFLOW IS APPROXIMATED BY THE SUM OF ALL THE APPLICABLE FORMULAE ON ITEMS (1') THRU (7') AND THE CORRESPONDING OVERFLOW RATING CURVE IS PLOTTED ON P. D-5.

*NOTE FLOW OVER SLOPED SECTIONS: BY APPLICATION OF FORMULA GIVEN BY THE USGS ON "MEASUREMENT OF PEAK DISCHARGES AT DAMS BY INDIRECT METHODS" BY H. HULSING (APPLICATIONS OF HYDR.)

$Q = \frac{2Cb}{5(h_b - h_a)} [h_b^{5/2} - h_a^{5/2}]$ WHERE. Q = DISCH.; C = DISCH COEFF.; b = LENGTH; h_a & h_b = STATIC HEAD REFERED TO HIGH & LOW ENDS OF WEIR, RESPECTIVELY.

iii) LOWER ANSONIA RESERVOIR DAM - OUTFLOW RATING CURVE



*SEE NOTE p. D-3

b) SURCHARGE HEIGHTS TO PASS PEAK INFLOWS (Q_{P_1} & Q'_{P_1})

i) @ $Q_{P_1} \cong$ PMF = 1200 CFS $H_1 \cong \underline{3.1}'$

ii) @ $Q'_{P_1} \cong$ "½ PMF" = 500 CFS $H'_1 \cong \underline{2.6}'$

c) EFFECT OF SURCHARGE STORAGE - PEAK OUTFLOWS:

i) AVE. LAKE AREA ($\bar{A}$) WITHIN EXPECTED SURCHARGE:

1') LAKE AREA AT FLOW LINE (EL. 277' NGVD)* $A_{WL} \cong 9.6$ AC
2') AREA AT CONTOUR 280' NGVD (MSL)*: $A_{280} \cong 11.9$ AC
3') AREA AT CONTOUR 290' NGVD (MSL)*: $A_{290} \cong 18.4$ AC

∴ AVE. AREA WITHIN EXPECTED SURCHARGE (MAX. (±)3'): $\bar{A} \cong \underline{10.8}$ AC

*NOTE: AREAS FROM USGS ANSONIA, CT. QUADRANGLE SHEET (REV. 1972) - SCALE 1"=2000' AND THE ANSONIA WATER CO. DWG. "RESERVOIR No 1" (FILE No 270T-27-FF1). SEE CURVE p. D-7

(ii) ASSUME NORMAL POOL AT FLOWLINE ELEV. 277' NGVD

(iii) WATERSHED D.A. = 0.56 sq mi (SEE p. D-1)

(iv) PEAK OUTFLOWS (Q_{P_3} & Q'_{P_3})

(DETERMINED ON THE OUTFLOW RATING CURVE p. D-5, BY USING THE APPROX. ROUTING NED-ACE GUIDELINES "SURCHARGE STORAGE ROUTING" ALTERNATE METHOD AND 19" MAX. PROBABLE P.O. IN NEW ENGLAND).

$Q_{P_3} = 1130^{cfs}$ SAY, $Q_{P_3} = \underline{1100}^{cfs}$ $H_3 = \underline{3.0}'$ (ELEV. 280' NGVD)

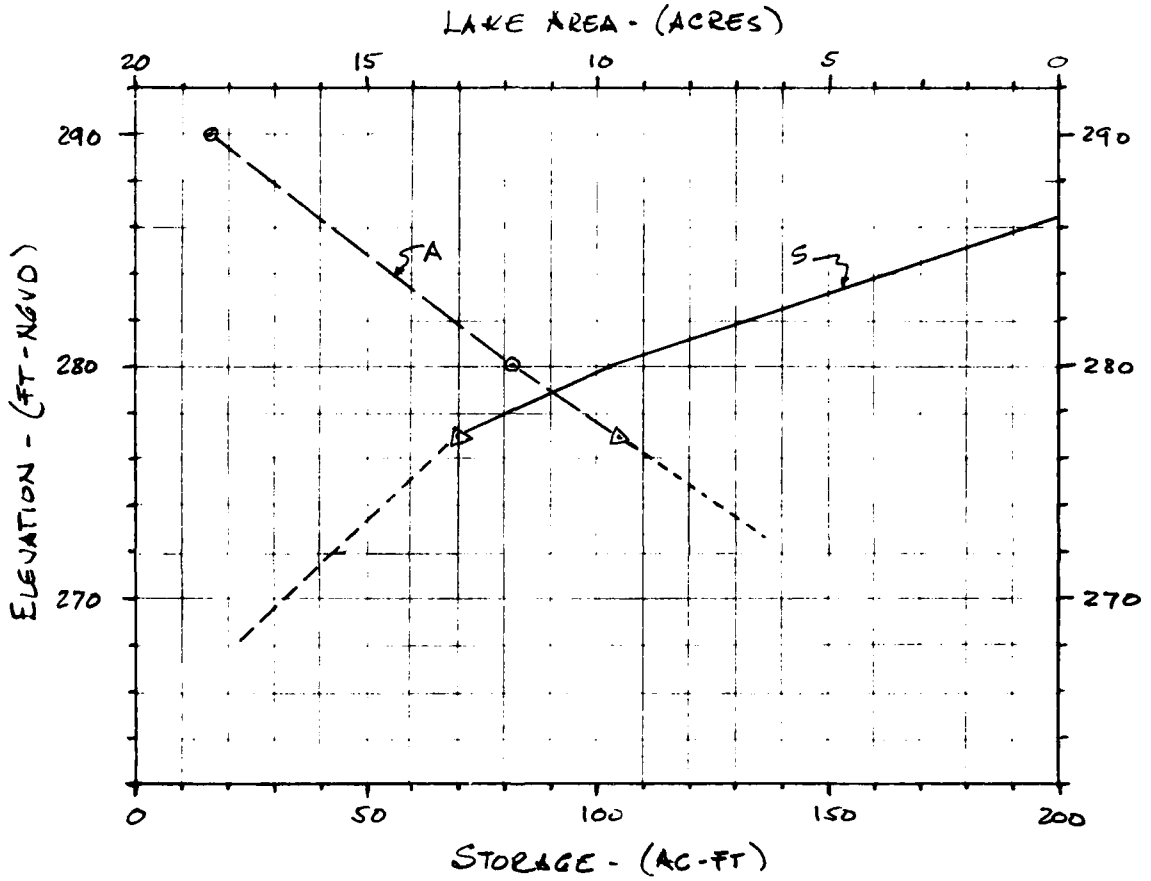
$Q'_{P_3} = \underline{450}^{cfs}$ $H'_3 = \underline{2.6}'$ (ELEV 279.6' NGVD)

3) SPILLWAY CAPACITY RATIO TO PEAK OUTFLOWS:

SPILLWAY CAPACITY TO:	SURCH* H (FT)	W.S. ELEV. (FT-NGVD)	SPILLWAY CAPACITY (CFS)	SPILLWAY CAPACITY AS % OF PEAK OUTFLOWS	
				Q_{P_3} (1100 CFS)	Q'_{P_3} (450 CFS)
TOP OF DAM	2.2	279.2	210	19	47
½ PMF	2.6	279.6	270	—	60
PMF	3.0	280.0	340	31	—

*SURCHARGE ABOVE THE SPILLWAY CREST

4) RESERVOIR AREA/STORAGE CURVES - LOWER ANSONIA RESERVOIR



△ DATA FROM ANSONIA WATER CO. DWG. "RESERVOIR N°1" (FILE N° 270T-27-FF1)
⊙ AREAS FROM USGS ANSONIA, CT. QUADRANGLE SHEET (REV. 1972)
NOTE: SEE pp. D-5 (AREAS) AND D-9 (STORAGE)

LOWER ANSONIA RESERVOIR DAM

II) DOWNSTREAM FAILURE HAZARD

1) POTENTIAL IMPACT AREA

LOWER ANSONIA RESERVOIR DISCHARGES INTO AN UNNAMED STREAM WHICH RUNS PARALLEL TO HIGH ST., DERBY, FOR (±)500'. THEN, AFTER FALLING (±) 200' ON A VERY STEEP COURSE, (±)1200' LONG, THE STREAM IS PIPED TO ITS OUTLET IN THE NAUGATUCK RIVER, CROSSING A FULLY DEVELOPED SECTION OF DERBY, CT. ONE HOUSE WITH FIRST FLOOR ELEV. (±)8.6' ABOVE THE STREAM IS LOCATED ON HIGH ST. NUMEROUS HOMES, HOWEVER, ARE LOCATED IN THE LOWER SECTION OF DERBY (WHERE THE STREAM IS PIPED) AND THEREFORE, IS CONSIDERED TO BE A POTENTIAL IMPACT AREA IN CASE OF FAILURE OF THE DAM.

2) FAILURE AT LOWER ANSONIA RESERVOIR DAM.

ASSUME SURCHARGE TO TOP OF DAM ELEV. 279.2' NGVD.

a) HEIGHT OF DAM*: $H \doteq 17.8'$ (TOP EL. [u] 279.2'; STREAMBED EL. [u] 261.4')

b) MID-HEIGHT LENGTH*: $L \doteq 177'$

c) BREACH WIDTH (SEE NED-ACE D/S DAM FAILURE GUIDELINES)

$W = 0.4 \times 177 \doteq 71'$ ∴ ASSUME $W_b = \underline{71'}$

d) ASSUMED WATER DEPTH AT TIME OF FAILURE: $Y_o = 17.8'$

e) SPILLWAY DISCHARGE AT TIME OF FAILURE: $Q_s = 210$ CFS (SEE p. D-6)

*FROM C.E. FIELD MEASUREMENTS ON 5/28/80 BY HLL & R.J.

f) BREACH OUTFLOW (SEE NED-ACE GUIDELINES)

$$Q_b = \frac{8}{27} w_b \sqrt{g}\, y_o^{3/2} \approx 8960 \text{ CFS}$$

g) PEAK FAILURE OUTFLOW (Q_{p_1}) TO STREAM NEAR HIGH ST., DERBY.

$$Q_{p_1} = Q_s + Q_b \approx 9170 \text{ CFS} \quad \text{SAY, } Q_{p_1} = \underline{9200} \text{ CFS}$$

3) FLOOD DEPTH* IMMEDIATELY D/S FROM DAM:

$$y = 0.94\, y_o \approx \underline{7.8}'$$

*(FROM RETREATING WAVE THEORY APPLIED TO DAM FAILURE)

4) ESTIMATE OF D/S FAILURE CONDITIONS AT POTENTIAL IMPACT AREAS:

(SEE NED-ACE GUIDELINES FOR ESTIMATING D/S FAILURE HYDROGRAPHS)

a) THE CHANNEL D/S FROM THE LOWER ANSONIA RESERVOIR IS DIVIDED IN 3 REACHES (SEE P. D-8, SECT. 1). THE U/S REACH IS (±) 500' LONG, V-SHAPED WITH (±) 15" AND 5" TO 1' SIDE SLOPES AND AN AVE. REACH SLOPE OF (±) 5%. THE SECOND REACH IS VERY STEEP (±) 18% SLOPE, (±) 1200' LONG AND V-SHAPED WITH (±) 3" TO 1' SIDE SLOPES. THE LOWER REACH, WHERE THE STREAM IS PIPED, FORMS A VALLEY (±) 100' WIDE WITH (±) 10" TO 1' SIDE SLOPES AND AN AVE. REACH SLOPE OF (±) 2%. (ASSUME $n = 0.070$ FOR ALL 3-REACHES AT FLOOD STAGE)

b) RESERVOIR STORAGE AT TIME OF FAILURE:

$$*S_{MAX} \approx 94 \text{ AC-FT} \qquad S/2 = 47 \text{ AC-FT}$$

*FROM STORAGE DATA ON THE ANSONIA WATER CO. DWG. "RESERVOIR No 1" (FILE No 270T-27-FF1): $S_{WL} = 22.766^{MG} = 69.8^{AC-FT}$ AND C.E. ESTIMATE OF SURCHARGE STORAGE TO TOP OF DAM: $S_s = 23.8^{AC-FT}$ ∴ $S_{MAX} = 93.6^{AC-FT}$ SAY, $S_{MAX} = \underline{94}^{AC-FT}$ (SEE CURVE P. D-7)

C) APPROXIMATE STAGE AT POTENTIAL IMPACT AREAS AFTER FAILURE:

i) 1ST REACH D/S FROM DAM (HIGH ST. AREA)

$(Q_p)_1 = 9200^{CFS}$; $^*Y_1 \approx 8.58'$; $V_1 \approx 8.45^{FPS}$ $\angle \frac{S}{2}$ (ON REACH OF (±)1500'; $^*n = 0.070$)

$\therefore Q_{P_2} \approx 8370^{CFS}$; $Y_2 = 8.28'$; $V_2 \approx 7.87^{FPS}$ $\therefore \bar{V} = 8.16^{FPS}$; $(Q_p)_1 \approx \underline{8400}^{CFS}$; $(Y_3)_1 \approx \underline{8.3'}$
($Y_{c_3} \approx 8.5'$ $V_{n_3} \approx 12^{FPS}$)

ii) 2ND REACH D/S FROM DAM

$(Q_p)_2 = 8400^{CFS}$; $Y_1 \approx 10.4'$; $V_1 \approx 8.87^{FPS}$ $\angle \frac{S}{2}$ (ON REACH OF (±)1200'; $^*n = 0.070$)

$\therefore Q_{P_2} \approx 7600^{CFS}$; $Y_2 \approx 9.98'$; $V_2 = 8.23^{FPS}$ $\therefore \bar{V} = 8.55^{FPS}$; $(Q_p)_2 \approx 7600^{CFS}$; $(Y_3)_2 \approx 10'$
($Y_{c_3} \approx 13.2'$; $V_{n_3} \approx 26^{FPS}$)

iii) LOWER (3RD) REACH D/S FROM DAM (LOWER DERBY AREA)

$(Q_p)_3 = (Q_p)_3 \approx \underline{7600}^{CFS}$ $\therefore (Y_3)_3 \approx \underline{6.0'}$

d) APPROXIMATE STAGE BEFORE FAILURE

$Q_s = \underline{210}^{CFS}$

i) 1ST REACH: $(Y_s)_1 \approx \underline{2.1'}$

ii) 2ND REACH: $(Y_s)_2 \approx 2.6'$ ($Y_c \approx 3.1'$; $V_n \approx 10^{FPS}$)

iii) 3RD REACH: $(Y_s)_3 \approx 0.8'$ (CAPACITY OF EXISTING CONDUIT IS NEGLECTED)

e) RAISE IN STAGE AT IMPACT AREAS:

i) 1ST REACH: $(\Delta Y)_1 \approx \underline{6.2'}$ (HIGH ST. AREA)

ii) 2ND REACH: $(\Delta Y)_2 \approx 7.4'$

iii) 3RD REACH: $(\Delta Y)_3 \approx \underline{5.2'}$ (LOWER DERBY AREA)

III) SELECTION OF TEST FLOOD

1) CLASSIFICATION OF DAM ACCORDING TO NED-ACE GUIDELINES:

a) SIZE: *STORAGE (MAX) ≈ 94 ACFT (50 < S < 1000 ACFT)
*HEIGHT ≈ 17.8' (H < 25 FT)

*STORAGE: SEE P. D-9; HEIGHT: SEE P. D-8

∴ SIZE CLASSIFICATION: SMALL

b) HAZARD POTENTIAL: AS A RESULT OF THE D/S FAILURE ANALYSIS AND IN VIEW OF THE IMPACT THAT FAILURE OF LOWER ANSONIA RESERVOIR DAM MAY HAVE ON THE POTENTIAL IMPACT AREAS (p. D-8), THE DAM IS CLASSIFIED AS HAVING:

HAZARD CLASSIFICATION: HIGH

2) TEST FLOOD · PMF = 1200 CFS

THIS SELECTION IS BASED ON THE RESULTS OF THE PREVIOUS ANALYSIS AND CLASSIFICATION.

LOWER ANCONIA RESERVOIR DAM

IV) SUMMARY

1) TEST FLOOD = PMF ≅ 1200 CFS
(PARALLEL COMPUTATIONS HAVE BEEN MADE FOR "½ PMF" ≅ 500 CFS AND ARE ALSO SUMMARIZED BELOW)

2) PERFORMANCE AT PEAK FLOOD CONDITIONS:
a) PEAK INFLOWS: Q_{P_1} = PMF ≅ 1200 CFS Q'_{P_1} = "½ PMF" ≅ 500 CFS
b) PEAK OUTFLOWS: Q_{P_3} ≅ 1100 CFS Q'_{P_3} ≅ 450 CFS
c) SPILLWAY CAPACITY: (SEE TABLE P. D-6)
d) PERFORMANCE:
i) AT TEST FLOOD: OVERTOPPED (±) 0.8' (W.S. ELEV. 280.0 'NGVD)
ii) AT "½ PMF": OVERTOPPED (±) 0.4' (W.S. ELEV. 279.6 'NGVD)

3) DOWNSTREAM FAILURE CONDITIONS:
a) PEAK FAILURE OUTFLOW: Q_{P_1} = 9200 CFS
b) FLOOD DEPTH IMMEDIATELY D/S FROM DAM: Y_0 ≅ 7.8'
c) CONDITIONS AT THE HIGH ST. AREA:
STAGE BEFORE FAILURE: Y_S ≅ 2.1' (Q_S ≅ 210 CFS)
STAGE AFTER FAILURE: Y_3 ≅ 8.3' (Q_{P_3} ≅ 8400 CFS)
RAISE IN STAGE AFTER FAILURE: ΔY ≅ 6.2'
d) CONDITIONS AT THE INITIAL IMPACT AREA (LOWER SECTION OF DERBY):
STAGE BEFORE FAILURE: Y_S ≅ 0.8' (Q_S ≅ 210 CFS)
STAGE AFTER FAILURE: Y_3 ≅ 6.0' (Q_{P_3} ≅ 7600 CFS)
RAISE IN STAGE AFTER FAILURE: ΔY ≅ 5.2'

PRELIMINARY GUIDANCE

FOR ESTIMATING

MAXIMUM PROBABLE DISCHARGES

IN

PHASE I DAM SAFETY

INVESTIGATIONS

New England Division
Corps of Engineers

March 1978

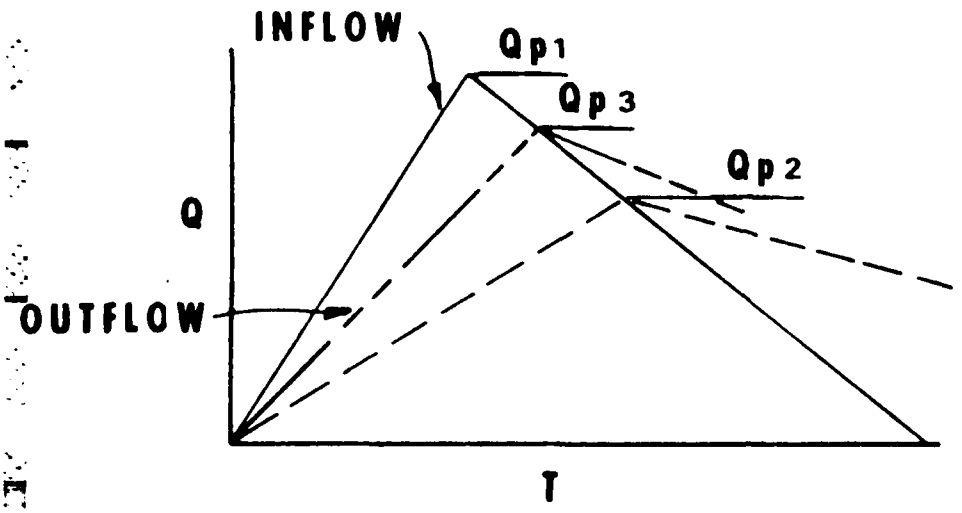
MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

	Project	Q (cfs)	D.A. (sq. mi.)	MPF cfs/sq. mi.
1.	Hall Meadow Brook	26,600	17.2	1,546
2.	East Branch	15,500	9.25	1,675
3.	Thomaston	158,000	97.2	1,625
4.	Northfield Brook	9,000	5.7	1,580
5.	Black Rock	35,000	20.4	1,715
6.	Hancock Brook	20,700	12.0	1,725
7.	Hop Brook	26,400	16.4	1,610
8.	Tully	47,000	50.0	940
9.	Barre Falls	61,000	55.0	1,109
10.	Conant Brook	11,900	7.8	1,525
11.	Knightville	160,000	162.0	987
12.	Littleville	98,000	52.3	1,870
13.	Colebrook River	165,000	118.0	1,400
14.	Mad River	30,000	18.2	1,650
15.	Sucker Brook	6,500	3.43	1,895
16.	Union Village	110,000	126.0	873
17.	North Hartland	199,000	220.0	904
18.	North Springfield	157,000	158.0	994
19.	Ball Mountain	190,000	172.0	1,105
20.	Townshend	228,000	106.0(278 total)	820
21.	Surry Mountain	63,000	100.0	630
22.	Otter Brook	45,000	47.0	957
23.	Birch Hill	88,500	175.0	505
24.	East Brimfield	73,900	67.5	1,095
25.	Westville	38,400	99.5(32 net)	1,200
26.	West Thompson	85,000	173.5(74 net)	1,150
27.	Hodges Village	35,600	31.1	1,145
28.	Buffumville	36,500	26.5	1,377
29.	Mansfield Hollow	125,000	159.0	786
30.	West Hill	26,000	28.0	928
31.	Franklin Falls	210,000	1000.0	210
32.	Blackwater	66,500	128.0	520
33.	Hopkinton	135,000	426.0	316
34.	Everett	68,000	64.0	1,062
35.	MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS
BASED ON TWICE THE
STANDARD PROJECT FLOOD
(Flat and Coastal Areas)

	River	SPF (cfs)	D.A. (sq. mi.)	MPF (cfs/sq. mi.)
1.	Pawtuxet River	19,000	200	190
2.	Mill River (R.I.)	8,500	34	500
3.	Peters River (R.I.)	3,200	13	490
4.	Kettle Brook	8,000	30	530
5.	Sudbury River.	11,700	86	270
6.	Indian Brook (Hopk.)	1,000	5.9	340
7.	Charles River.	6,000	184	65
8.	Blackstone River.	43,000	416	200
9.	Quinebaug River	55,000	331	330

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Qp_1) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Qp_1".

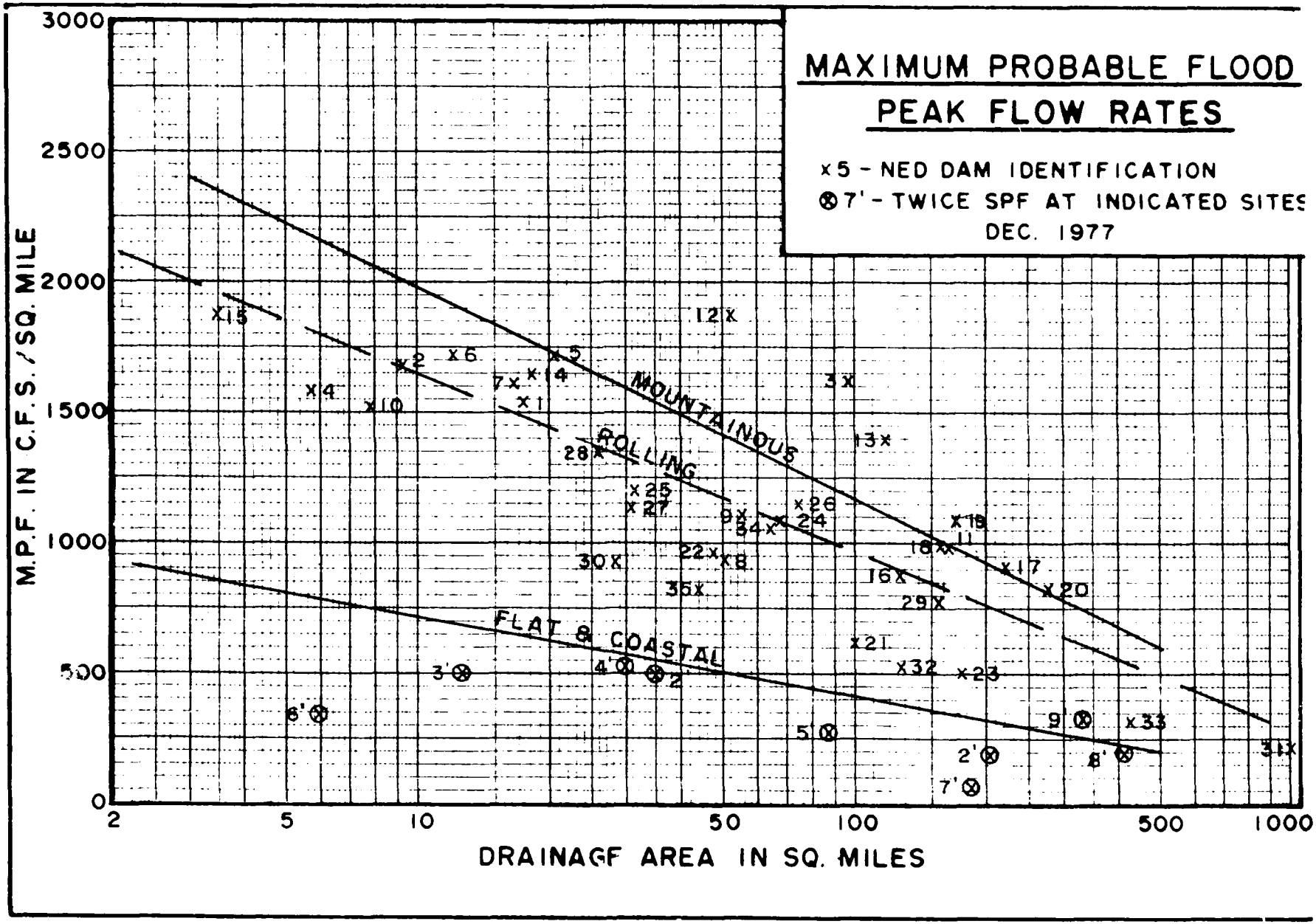
b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore:

$$Qp_2 = Qp_1 \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Average "$STOR_1$" and "$STOR_2$" and Determine Average Surcharge and Resulting Peak Outflow "Qp_3".


MAXIMUM PROBABLE FLOOD
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
⊗7' - TWICE SPF AT INDICATED SITES
DEC. 1977
M.P.F. IN C.F.S./SQ. MILE
DRAINAGE AREA IN SQ. MILES
3000
2500
2000
1500
1000
500
0
2
5
10
50
100
500
1000
MOUNTAINOUS
ROLLING
FLAT & COASTAL
x15
x4
x10
x2
x6
7x
x14
x1
x5
12x
3x
13x
28x
x25
x27
x26
9x
54x
x24
x19
18x
x11
x17
x20
30x
22x
x8
16x
29x
35x
x21
x32
x23
3'⊗
4'⊗
2'⊗
6'⊗
5'⊗
9'⊗
x33
2'⊗
8'⊗
7'⊗
31x

SURCHARGE STORAGE ROUTING SUPPLEMENT

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Avg "$STOR_1$" and "$STOR_2$" and Compute "Qp_3".

c. If Surcharge Height for Qp_3 and "$STOR_{AVG}$" agree O.K. If Not:

STEP 4: a. Determine Surcharge Height and "$STOR_3$" To Pass "Qp_3"

b. Avg. "Old $STOR_{AVG}$" and "$STOR_3$" and Compute "Qp_4"

c. Surcharge Height for Qp_4 and "New $STOR_{Avg}$" should Agree closely

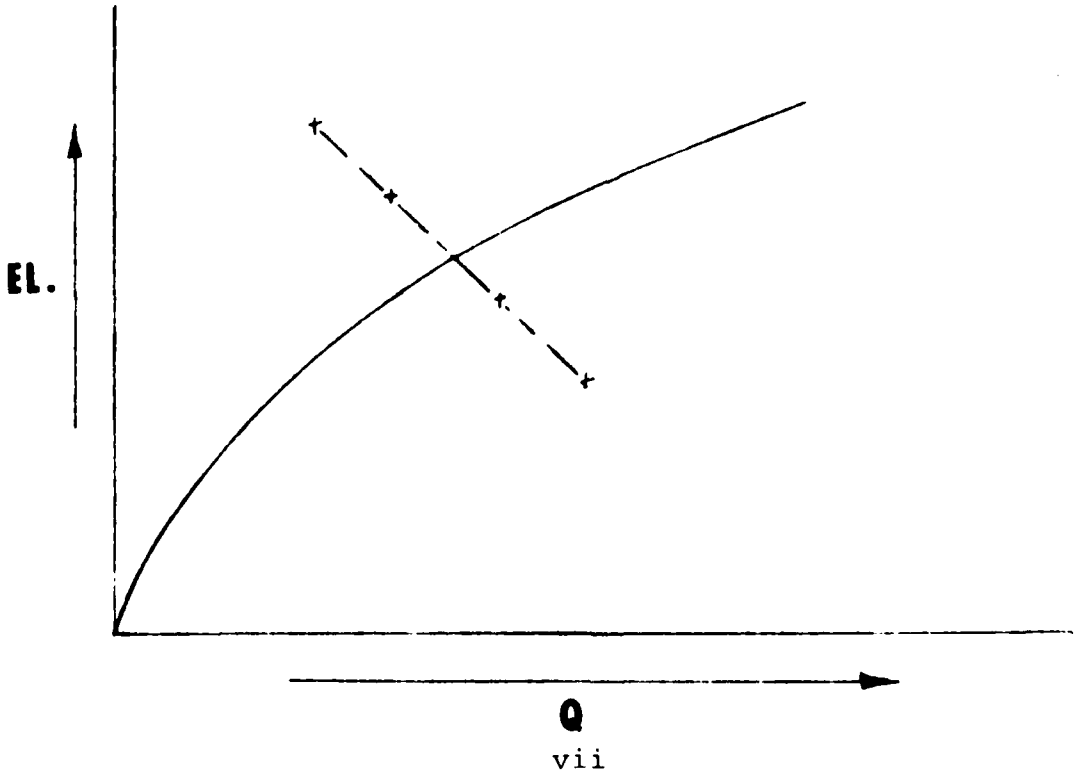
SURCHARGE STORAGE ROUTING ALTERNATE

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR}{19}\right)$$

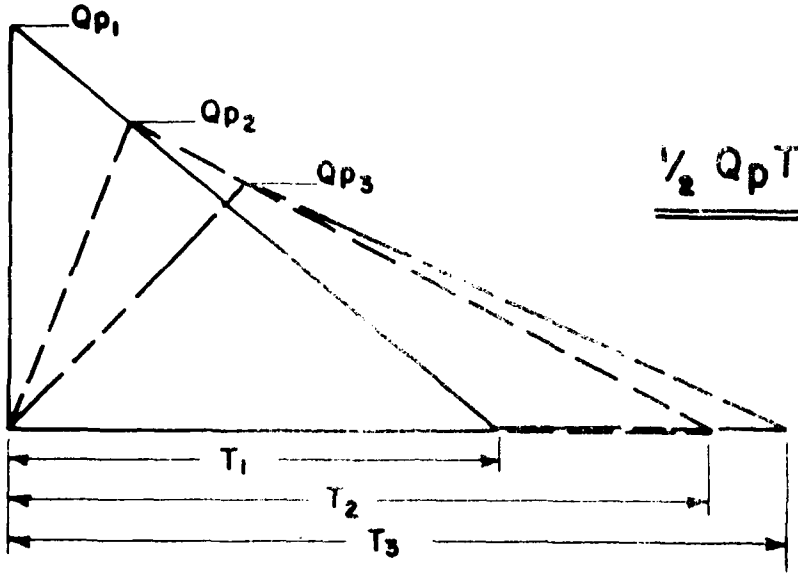
$$Q_{p2} = Q_{p1} - Q_{p1}\left(\frac{STOR}{19}\right)$$

FOR KNOWN Q_{p1} AND 19" R.O.

Q_{p2} ≡≡≡ STOR ≡≡≡ EL. ≡≡≡



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



$\frac{1}{2} Q_p T = 12 S$

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Qp_1 = \frac{8}{27} W_b \sqrt{g} Y_o^{\frac{3}{2}}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_o = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOMPANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Qp_2(\text{TRIAL}) = Qp_1 \left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

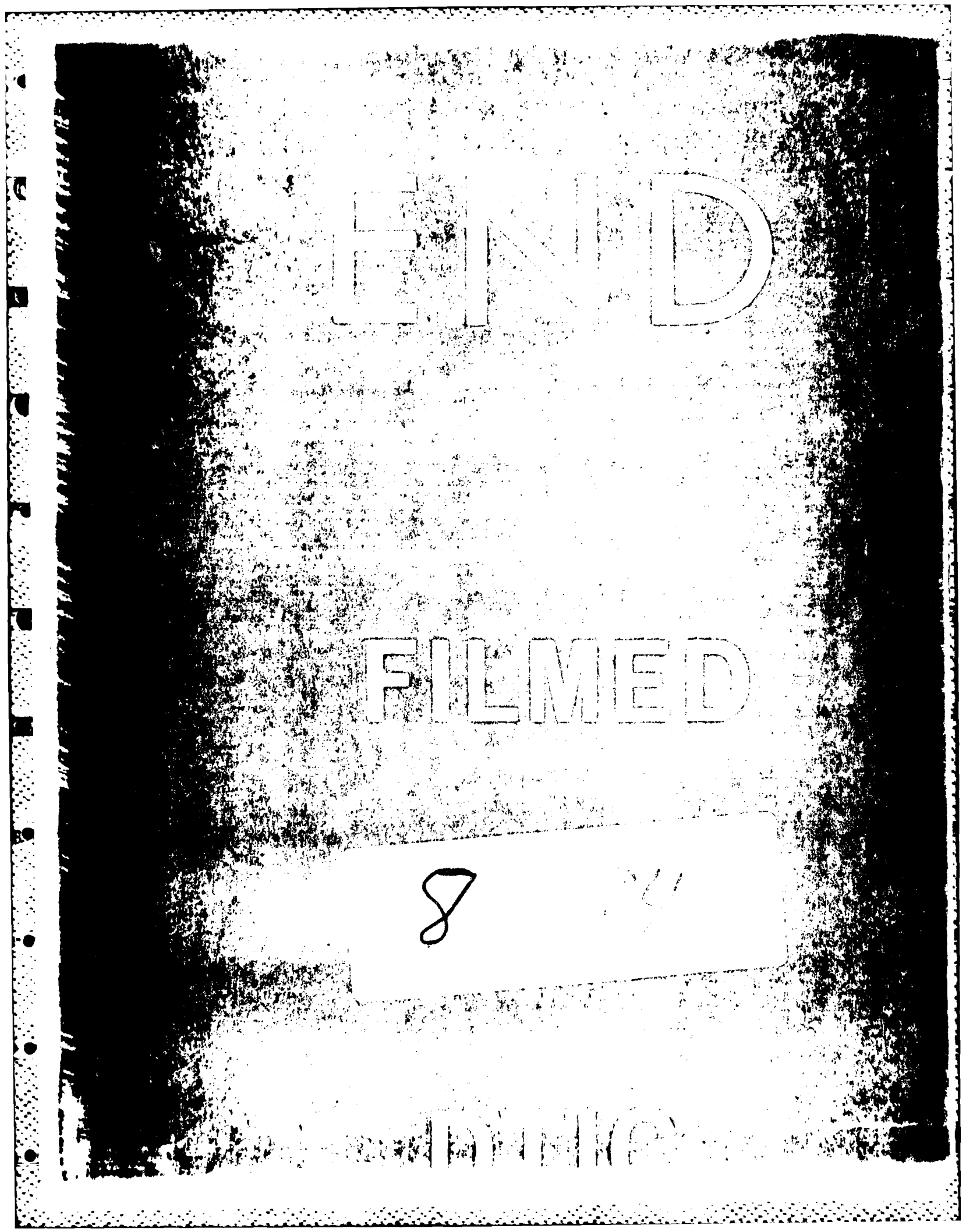
$$Qp_2 = Qp_1 \left(1 - \frac{V_{AVG}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS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