AD-A144 162 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS RICHARD'S CORNER DAM (..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV SEP 78 1/2

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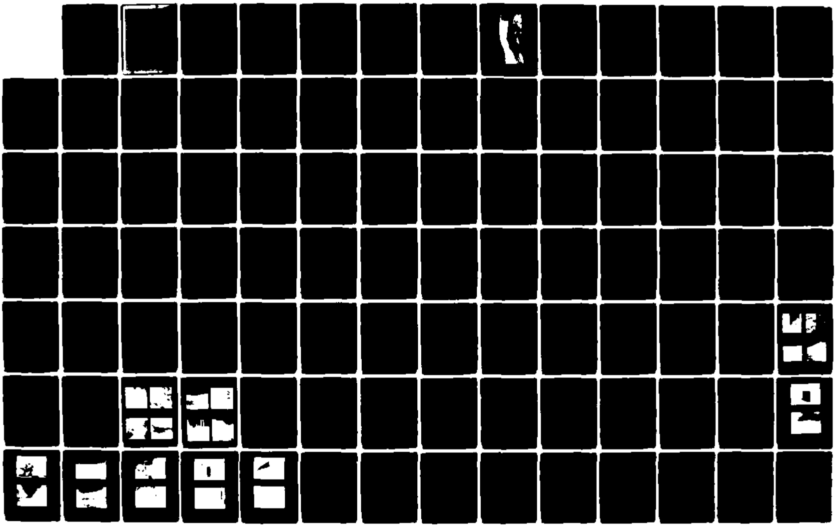

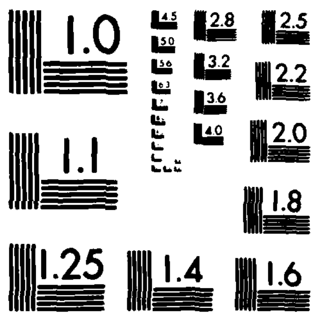

MICROCOPY RESOLUTION TEST CHART
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AD-A144 162

FARMINGTON RIVER BASIN
NEW HARTFORD, CONNECTICUT

RICHARD'S CORNER DAM
CT. 00371

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PR...

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

SEPTEMBER 1978

07 079

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Farmington River Basin
New Hartford, Connecticut

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

The Richard's Corner Dam is an earth embankment with a concrete core and is 950 feet long and 75 feet high. It has an emergency spillway, channel, gate house and diversion tunnel. The dam and its appurtenant structures are generally in good condition. The dam will pass the Probable Maximum Flood without overtopping the dam.

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NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification Number:	CT 00371
Name:	Richard's Corner Dam
Town:	New Hartford
County and State:	Litchfield County, Connecticut
Stream:	East Branch of the Farmington River
Date of Inspection:	May 30, 1978

BRIEF ASSESSMENT

The Richard's Corner Dam is an earth embankment with a concrete core and is 950 feet long and 75 feet high. It has an emergency spillway, channel, gate house and diversion tunnel. The dam and its appurtenant structures are generally in good condition.

The dam will pass the Probable Maximum Flood (Recommended Spillway Design Flood) without overtopping the dam.

Some recommended measures to be undertaken by the owner include establishment of metering points for seepage measurements and periodic inspections of the dam. It is not urgent to implement these recommendations. However, it is recommended that the owner implement them within two to three years after receipt of this Phase I Inspection Report.

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

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

PREFACE

This report is prepared under quidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed 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 varity 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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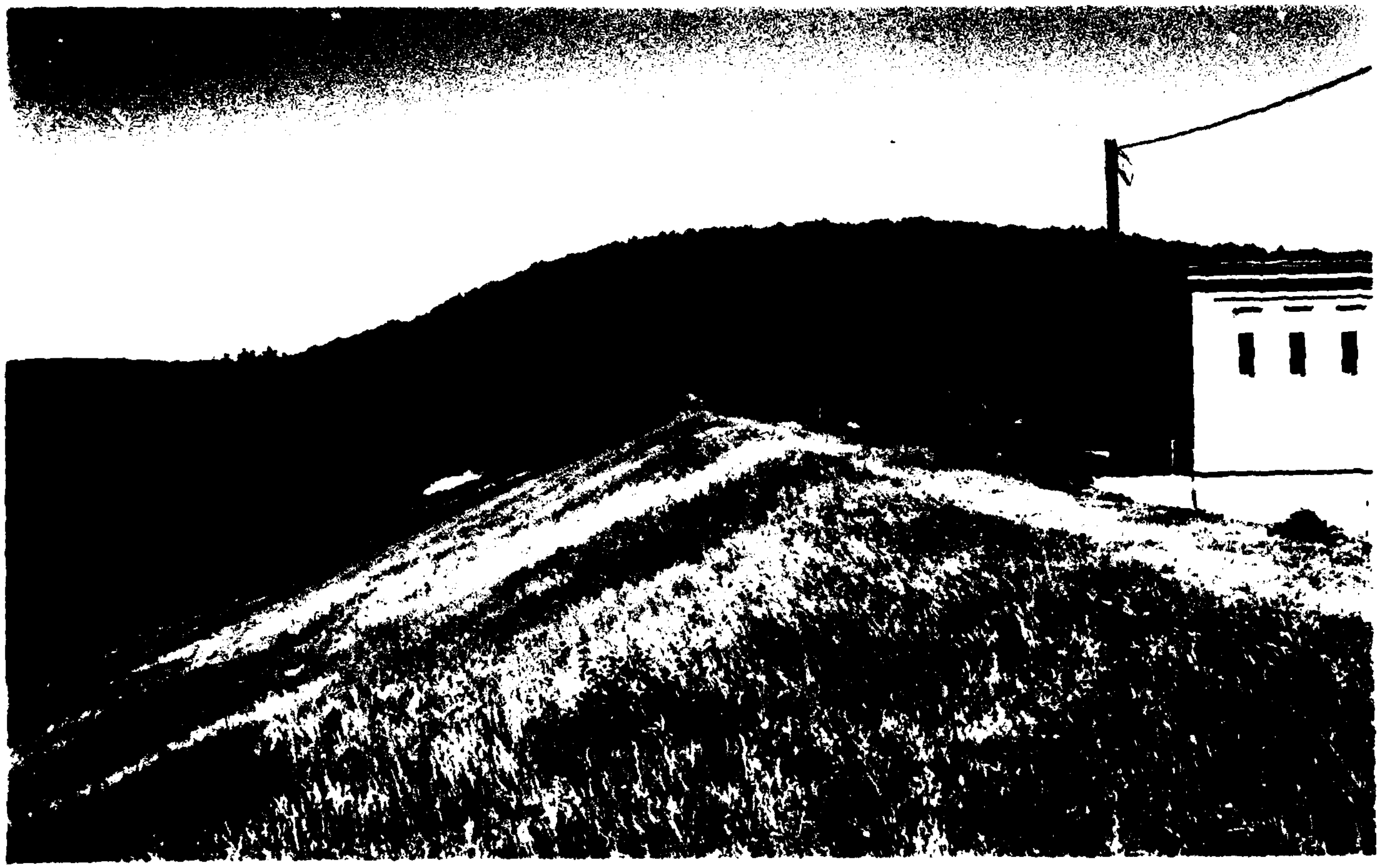
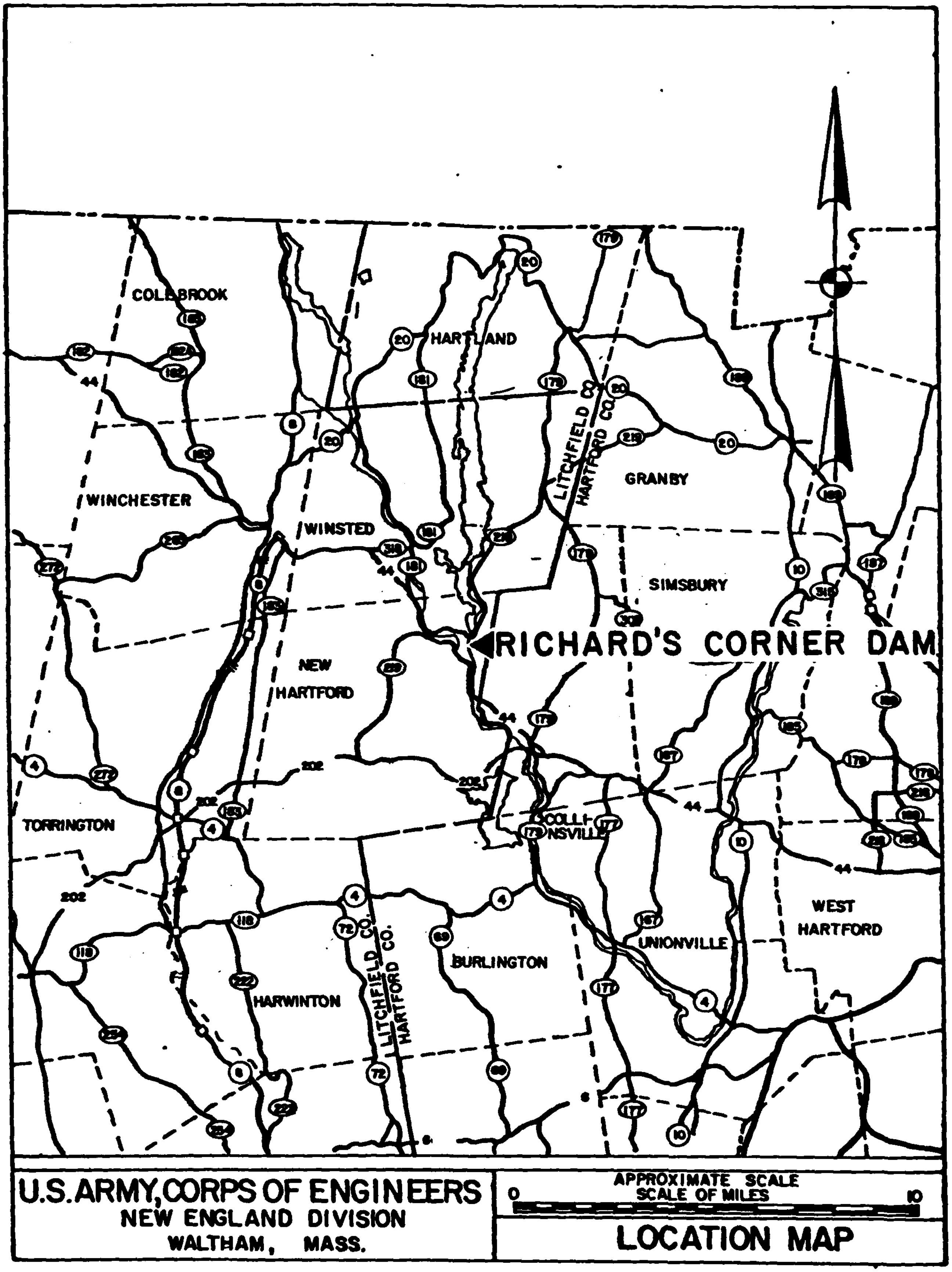


OVERVIEW PHOTO - RICHARDS CORNER DAM (COMPENSATING)


COLEBROOK
HARTLAND
WINCHESTER
WINSTED
GRANBY
LITCHFIELD CO.
HARTFORD CO.
SIMSBURY
NEW HARTFORD
RICHARD'S CORNER DAM
TORRINGTON
COLLINSVILLE
UNIONVILLE
WEST HARTFORD
BURLINGTON
HARWINTON
U.S. ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASS.
APPROXIMATE SCALE
SCALE OF MILES
0
10
LOCATION MAP

PHASE I INSPECTION REPORT

RICHARD'S CORNER DAM CT 00371

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.

(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

The Richard's Corner Dam is one of 18 dams owned by the Metropolitan District of Hartford County, Connecticut. The structure is an earth dam with a concrete core and is 950 feet long and 75 feet high (Appendix B, Plate 1). It has an emergency spillway and channel, upper gate house and diversion tunnel. The facility serves as a compensating reservoir for riparian owners. It is located in the Town of New Hartford, Litchfield County, Connecticut (Location Map) and is approximately 16 miles northwest of Hartford, Connecticut on the East Branch of the Farmington River.

The size classification of the dam is intermediate (75 feet high and 11,510 acre feet of storage) and the hazard classification is high per the criteria set forth in the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers. The immediate downstream area that will be affected by the dams failure as shown on Plates 6 and 7 includes parts of New Hartford, Collinsville, Unionville as well as numerous homes and farms outside these communities.

The period of construction for this dam was between 1915 and 1920, with C. W. Blakeslee & Sons of New Haven, serving as the general contractor. After the flood of September, 1938, the upstream slope was reinforced with additional riprap material and the spillway weir was repaired.

The Richard's Corner Dam was designed by the Engineering Section of the Metropolitan District under the direction of Caleb M. Saville, Chief Engineer. The original design for this dam began in 1912 when geologist Herbert Gregory, who was hired as a special consultant, submitted his geology report for the Damsites at Nepaug, Phelps Brook, Richard's Corner and the Talcott Mountain Tunnel (Appendix B, Reference 5). In this report, two sites were considered and ultimately the Richard's Corner site was chosen because of its geological superiority. Other consultants such as Frederic P. Stearns and John R. Freeman contributed to formulation of the design concepts which were used for these dams.

The person in charge of day to day operation of the dam is Irv Hart, MDC Supply Division Headquarters, Beach Rock Road, Barkhamsted, Connecticut; Telephone No. 379-0938.

1.3 Pertinent Data

a. Drainage Area - A 61.2 square mile drainage area contributes to the dam of which 53.8 square miles is controlled by the Saville Dam. The terrain is steep and forested with very little development and is a fairly tight and responsive watershed.

b. Discharge at Damsite - Spillway discharge during the flood of August, 1955 was 15,700 cfs at elevation 426.5, MSL.

(1) Outlet works (two conduits), size 36" x 60" both at invert elevation 362.0.

(2) Maximum known flood at damsite 15,700 cfs.

(3) Ungated spillway capacity at maximum pool elevation 21,000 cfs at 427.9 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 21,000 cfs at 427.9 elevation.

c. Elevation (Feet above MSL)

(1) Top of dam: 433.0

(2) Maximum pool-design surcharge (MDC): 427.9

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

(4) Recreation pool: N/A

(5) Spillway crest: 420.5

(6) Upstream portal invert discharge tunnel: 362.0

(7) Streambed at centerline of dam: 362.0

(8) Maximum tailwater: 382.0

d. Reservoir

(1) Length of maximum pool: 11,700 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 (MDC): 11,510 ±

(4) Top of dam: 13,470±

f. Reservoir Surface (Acres)

(1) Top of dam: 455.0±

(2) Maximum pool: 427.0±

(3) Flood-control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 392.0±

g. Dam

(1) Type: Earth embankment with concrete core

(2) Length: 950 feet ±

(3) Height: 75 feet ±

(4) Top width: 15 feet ±

(5) Side slopes: Varies; upstream - 1:2 to 1:3
downstream - 1:2.2 to 1:3
(See cross section, Appendix B, Plate 4).

(6) Zoning: See cross section, Appendix B, Plate 4.

(7) Imprevious core: Concrete

(8) Cutoff: Not less than three feet

(9) Grout curtain: 20 to 25 feet

(10) Other: N/A

h. Diversion and Regulating Tunnel

(1) Type: Concrete

(2) Length: 315 feet ±

(3) Closure: N/A

(4) Access: Outlet

(5) Regulating facilities: Electrically or manually operated gates

i. Spillway

(1) Type: Fixed weir

(2) Length of weir: 302 feet

(3) Crest elevation: 420.5 feet

(4) Gates: None

(5) U/S channel: Earth approach underwater - 5 feet

(6) D/S channel: 700 feet rock channel

(7) General: N/A

j. Regulating Outlets

Regulating outlets consist of two, 36 inch x 60 inch sluice gates.

(1) Invert: 362 ±

(2) Size: 36 inch x 60 inch

(3) Description: N/A

(4) Control mechanism: Electrically or manually operated gates

(5) Other: N/A

SECTION 2 - ENGINEERING DATA

2.1 Design

The design information for the dam is in the form of contract drawings, reports of consultants, design-discharge curves and a spillway capacity analysis. As in the case of other dams built prior to 1940, the "state of the art" for slope stability analysis had not been developed. There was much dependence given to the opinion of expert consultants. As a result of reports and discussions with these consultants, designs were completed and contract plans were developed.

2.2 Construction

The construction of this dam is well documented with photographs that are on file at the Metropolitan District Engineering Section. This information along with recollections of personnel that remembered the repair project of 1939 provided the only information about the construction history of this dam.

2.3 Operation

The operation of the sluice gates and stop logs in the upper gate house structure is manual. In 1952, the west service gate that discharges into the outlet conduit was considerably repaired (Appendix C, Photo 10) and as a result, water was channeled through the east gate. Because the design does not depend on the operation of the diversion tunnel for safety, there is no formal operation procedure established.

2.4 Evaluation

a. Availability - Design, construction and operation information was readily available. The one area which was lacking in terms of design information was for embankment slope stability. As was previously discussed, analysis methods available during the design period were limited. A list of references for this dam is contained in Appendix B.

b. Adequacy - The information made available for this inspection along with the visual inspection, past performance history and hydrologic and hydraulic assumptions were more than adequate to assess the condition of the dam.

c. Validity - The validity of the information made available is not questionable and the history of this dam seems to bear this out.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General - The visual inspection was conducted on May 30, 1978 by members of the engineering staff of Storch Engineers with the help of Peter Revill of the Metropolitan District. A copy of the visual inspection check list is contained in Appendix B.

The following procedure was used for the inspection of this dam:

1. The top and side slopes of the dam, appurtenant structures and their parts were examined.
2. The banks in the downstream area were visually surveyed.
3. The upstream surfaces of the dam, outside of gate house and weir, as well as the banks of the reservoir were inspected by boat.
4. The dam crest was level surveyed by instrument.
5. Areas were checked for show of seepage discharge.
6. The temperatures of seepage water, water in the reservoir and water downstream were measured.
7. Areas that show evidence of leaking, leaching or some damage were sketched or noted.

8. The dam and its appurtenant structures (Appendix C, Plate 5) were photographed.

Before the inspection commenced, the design, construction, operation and maintenance documentation, results of repair and prior inspections were compiled and studied. A compact sketch of the main structures was used for orientation during the period of inspection (Appendix B, Plate 1). In general, the overall appearance and condition of the dam and appurtenant structures is good.

b. Dam - The downstream face of the dam was inspected so that any areas of seepage through the dam could be observed. The face of the dam shows evidence of some irregularities or hollows in the area of the diversion tunnel. These irregularities have been noted by the Metropolitan District and have been in existence for many years. There is only one underdrain that serves the body of the dam. A thorough search of the downstream area revealed no outlet for this underdrain. There was no sign of dampness or seepage at either the toe or in the area immediately downstream of the face.

The downstream slope of the face had just been mowed (Appendix C, Photo 5) and showed every evidence of being maintained on a regular basis. The condition of the spillway, embankment of the reservoir area and exterior of the gate house is discussed in paragraphs c, d and e.

c. Appurtenant Structures - The upper gate house contains a hand operated chain hoist, stop logs, sluice gates, operators and a device for measuring the level of the reservoir. This chamber was full of water, however, the visible concrete and equipment appeared to be in good condition. The inspection of the diversion tunnel showed only minor cracks (Appendix C, Photos 9, 10, 11 and 12) with seepage that appears to have been at the same rate for many years. The joints of the diversion tunnel in the areas of the core wall, as well as the interface between the diversion tunnel and the gate house appears to have had a steady seepage flow for some time. The amount of erosion and scour that the concrete of the diversion conduit has experienced is remarkably minor. The general condition of this conduit is very good.

A visual survey of the ground immediately around the upper gate house showed the parapet walls (Appendix C, Photo 1) have settled. This settlement was experienced shortly after its initial construction.

d. Reservoir Area - An inspection of the upstream reservoir area by boat showed the embankment area to be in good condition. The reconstruction of the upstream dam slope in 1939 seems to have held a fairly straight alignment. The area immediately upstream of the dam embankment seem to be in a very natural state with no visible signs of erosion, sloughing or distress.

e. Downstream Channel - The spillway and downstream channel are cut into ledge rock (Appendix C, Photos 3, 4, and 6) and are in good condition. There is no visible erosion or sloughing of the floor or walls. Within recent years, there has been consideration given to grouting the spillway area. There does not appear to be any immediate need for this project but monitoring of its condition continues. The spillway channel seems to be functioning as an ideal channel with hardly any loose rocks or overhanging trees.

3.2 Evaluation

The hollow or irregularity near the diversion tunnel appeared soon after its construction in 1915 and has been monitored very closely thereafter. There appears to have been no significant movement since the repairs in 1939. The continued monitoring of this flaw is important but at this time it should not be considered a major area of distress. If additional movements develop in the future, then further study should be initiated.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The operation of this facility is only necessary when repairs are required or drawdown prior to the fall season. There is no instruction manual stating that this has to be done. The maintenance staff of the Metropolitan District serves to perform the required maintenance of the dam as well as the operating facilities.

There is no written standard operating procedure or emergency operating instructions for this dam.

4.2 Maintenance of the Dam

Since there is no surface drainage system for the dam, the only routine maintenance function is the cutting of the grass and trees in the area of the dam. Any other tasks which are more substantial must be funded separately.

4.3 Maintenance of Operating Facilities

The maintenance of the facilities which operate the dam consists of operating the sluice gates manually, the stop logs with a crane hoist and servicing the water surface level indicator. The maintenance of the appurtenant structures such as the gate house, diversion tunnel and spillway is discussed in Section 6.

A detailed list of mechanical and electrical code deficiencies was made during this inspection and the list has been made available to the Engineering Department of the Metropolitan District. Since there were no items noted which affect the safety of this dam, the list is not included in this report.

4.4 Description of Warning System

There is no warning system for the dam in effect.

4.5 Evaluation

In view of the simplicity of the operation, the maintenance of the dam and its operating equipment seems quite adequate.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data - The 302 foot long spillway and the diversion tunnel are the only means of transmitting water past the dam. Under flood conditions, the spillway carries a majority of the flow and, therefore, is the most critical hydraulic feature. A review of the calculations indicate that the spillway is capable of passing the Probable Maximum Flood (PMF) (Appendix D). The PMF is 24,360 cfs and the pond elevation is 428.95 feet.

b. Experience Data - The Richard's Corner 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 depth of water over the spillway was five feet and the discharge was 15,700 cfs. According to observations at the time of the flood, the spillway and channel performed adequately.

c. Visual Observations - The spillway and channel at the time of inspection were in good condition. The spillway has been gunited in the past and is presently in good condition.

The twin sluice gates in the diversion tunnel can be fully opened in the event of an emergency. The gates do leak when closed but do not hinder the safety of the dam. The outlet channel is in good condition.

d. Overtopping Potential - The PMF will not overtop the dam. There is approximately four feet of freeboard between the top of the dam and the maximum pond elevation.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structual Stability

a. Visual Observations - The flaw or irregularity in the embankment near the diversion tunnel occurred very soon after the initial construction of the dam. Since the contract of 1939, which provided a correction to this problem, there appears to be very little or no movement of the embankment in the vicinity of the upper gate house. Because there are no detailed records of the horizontal and vertical movement of the embankment, it is not possible to tell the inital severity of the movement.

Since the spillway was rebuilt there does not appear to be any major signs of distress (Appendix C, Photo 3). There are signs, however, of settlement in the area of the upper gate house.

b. Design and Construction Data - As mentioned in Section 2, there is very little design information available concerning the structural stability of the dam. When the alterations and repairs were completed, a stability analysis was performed for the reconstructed spillway (Appendix B). The factor of safety against sliding was 2.1 to 1.0 and the factor of safety against overturning was 3.0 to 1.0 (minus uplift). The assumptions for these computations were with 5.5 feet of water on the spillway crest.

c. Operating Records - The only records of operation that are available are of the water surface elevation, that was recorded during the August, 1955 storm. There is no record of a stability or structural problem with the embankment during this storm.

d. Post Construction Changes - The contract of 1939 corrected the only slippage of the embankment that was experienced. In addition, the spillway was reconstructed because of the deteriorated condition of the concrete. The contract drawings of 1940 deliniate the areas that were repaired. The embankment after this repair does not appear to have undergone any further slippage.

e. Seismic Stability - The dam is located in seismic zone nubmber 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 studying the available documents, calculations, results of this inspection and meetings with resident staff personnel and MDC's engineers, the conclusion is that the general condition of the Richard's Corner Dam is good. However, there are some recommendations that are listed in Section 7.2.

b. Adequacy of Information - The assessment of the dam's condition can be based on the information available as well as the visual inspection.

c. Urgency - The owner should implement the recommendations and remedial measures described in the following sections within two to three years after receipt of this Phase I Inspection Report.

d. Need for Additional Investigation - There is no need for additional investigation.

7.2 Recommendations

After consideration of the results of this inspection, the following recommendations are offered:

1. The implementation of a regular schedule of inspection, with special attention being given to the critical

areas identified herein. The time interval for these inspections is recommended to be no greater than five years.

2. The installation of instrumentation for permanent monitoring of the following items:

   a. The seepage discharge in the diversion tunnel, especially in the area near the gate house, bi-monthly.

   b. Settlement or movement of the parapet walls near the gate house, yearly.

   c. Temperature of the seepage water and the upstream and downstream water, bi-monthly and simultaneously.

Any of the above recommendations that require additional investigation should be done by a qualified engineering firm.

7.3 <u>Remedial Measures</u>

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

a. Alternatives - Not Applicable.

b. O & M Maintenance and Procedures -

   1. Grass, brush and trees around the walls of downstream channel of the gate house should be removed to facilitate the visual observation of potential seepage.

2. The spillway weir should be cleaned of the swimming trees.

3. Because of the location of the dam, upstream of a populated area, round-the-clock surveillance should be provided during periods of unusually heavy precipitation.

4. The owner should develop a formal system for warning downstream residents in case of emergency.

APPENDIX A

VISUAL INSPECTION CHECK LIST A-1 to A-7

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Richard's Corner Dam
Compensating Reservoir

DATE 5-30-78
TIME ______
WEATHER Sunny
W.S. ELEV. 421.01 U.S. ____ DN.S.

PARTY:

1. Richard Lyon
2. Miron Petrovsky
3. Gary Giroux
4. Peter Revill (MDC)
5. Otis Matthews
6. John Pozzato
7. John Schearer
8. ______
9. ______
10. ______

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

Air Temperature 88° F
Downstream Temperature (Diversion Tunnel) 50° F
Downstream Temperature (Spillway) 68° F
Upstream Temperature near Gate House 73° F

PERIODIC INSPECTION CHECK LIST

PROJECT Richard's Corner Dam DATE 5-30-78

PROJECT FEATURE ____________ NAME R. Lyon

DISCIPLINE ____________ NAME G. Giroux

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	Good condition with some irregularities
Current Pool Elevation	Fair condition with some small tree growth
Maximum Impoundment to Date	Good condition
Surface Cracks	None observed
Pavement Condition	None
Movement or Settlement of Crest	Some movement or settlement in area of gate house
Lateral Movement	Not observed with transit
Vertical Alignment	Two" ± movement at gate house
Horizontal Alignment	Not observed
Condition at Abutment and at Concrete Structures	Eight" ± settlement seems apparent at gate house location
Indications of Movement of Structural Items on Slopes	Pulling away of foundation wall from gate house
Trespassing on Slopes	Trespassing not permitted
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	The riprap failures of 1959 were repaired
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	No underdrain system in foundation
Toe Drains	None
[illegible]	None
Toe	Peat Moss

PERIODIC INSPECTION CHECK LIST

PROJECT Richard's Corner Dam DATE 5-30-78

PROJECT FEATURE ______ NAME M. Petrovsky

DISCIPLINE ______ NAME P. Revill

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channe	Under water
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	Good
Stop Logs and Slots	Good Condition

PERIODIC INSPECTION CHECK LIST

PROJECT Richard's Corner Dam

DATE 5-30-78

PROJECT FEATURE

NAME J. Pozzato

DISCIPLINE

NAME J. Schearer

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Inside - Good Outside - Fair
Condition of Joints	Satisfactory
Spalling	Inside - Satisfactory Outside - Some
Visible Reinforcing	None
Rusting or Staining of Concrete	Some
Any Seepage or Efflorescence	None
Joint Alignment	Distortion observed at gate house front face
Unusual Seepage or Leaks in Gate Chamber	Under water
Cracks	Minor
Rusting or Corrosion of Steel	None visible
b. Mechanical and Electrical	
Air Vents	None
Float Wells	None
Crane Hoist	Good - Hoist operated chain
Elevator	None
Hydraulic System	None
Service Gates	Good - leak observed in tunnel
Emergency Gates	None
Lightning Protection System	None
Emergency Power System	None
Wiring and Lighting System in [illegible]	Needs some rewiring but not relating to safety of dam.

PERIODIC INSPECTION CHECK LIST

PROJECT Richard's Corner Dam	DATE 5-30-78
PROJECT FEATURE	NAME R. Lyon
DISCIPLINE	NAME O. Matthews

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Fair to good
Rust or Staining on Concrete	Some observed at joints
Spalling	Some observed outside tunnel on wingwall
Erosion or Cavitation	Minor erosion on floor of tunnel
Cracking	Minor
Alignment of Monoliths	Very good
Alignment of Joints	Very good
Numbering of Monoliths	Five ±

PERIODIC INSPECTION CHECK LIST

PROJECT Richard's Corner Dam

DATE 5-30-78

PROJECT FEATURE

NAME G. Giroux

DISCIPLINE

NAME P. Revill

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Fair to good
Rust or Staining	Some to fair amount
Spalling	Some
Erosion or Cavitation	Concrete - none Downstream Channel - some riprap
Visible Reinforcing	None
Any Seepage or Efflorescence	Good amount
Condition at Joints	Fair
Drain holes	Some - water flowing
Channel	Fair
Loose Rock or Trees Overhanging Channel	Tree overhanging partially down
Condition of Discharge Channel	Fair

PERIODIC INSPECTION CHECK LIST

PROJECT Richard's Corner Dam DATE 5-30-78

PROJECT FEATURE NAME M. Petrovsky

DISCIPLINE NAME J. Schearer

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	Several birch trees
Floor of Approach Channel	Good
b. Weir and Training Walls	
General Condition of Concrete	Gunite job of 1939 in fair condition - branches on spillway
Rust or Staining	None
Spalling	Minor
Any Visible Reinforcing	No
Any Seepage or Efflorescence	None
Drain Holes	Yes - not inspected
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Several
Floor of Channel	Good condition - mica-schist
Other Obstructions	

APPENDIX B

References 1 and 5 are on file in MDC Headquarters, 555 Main Street, Hartford, Connecticut.

1. "Data on Safety of Metropolitan District Dams". The Metropolitan District; Hartford County, Connecticut; Water Bureau.

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

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

4. Rule of Thumb - Guidance for estimating downstream dam failure hydrographs; Corps of Engineers; April, 1978.

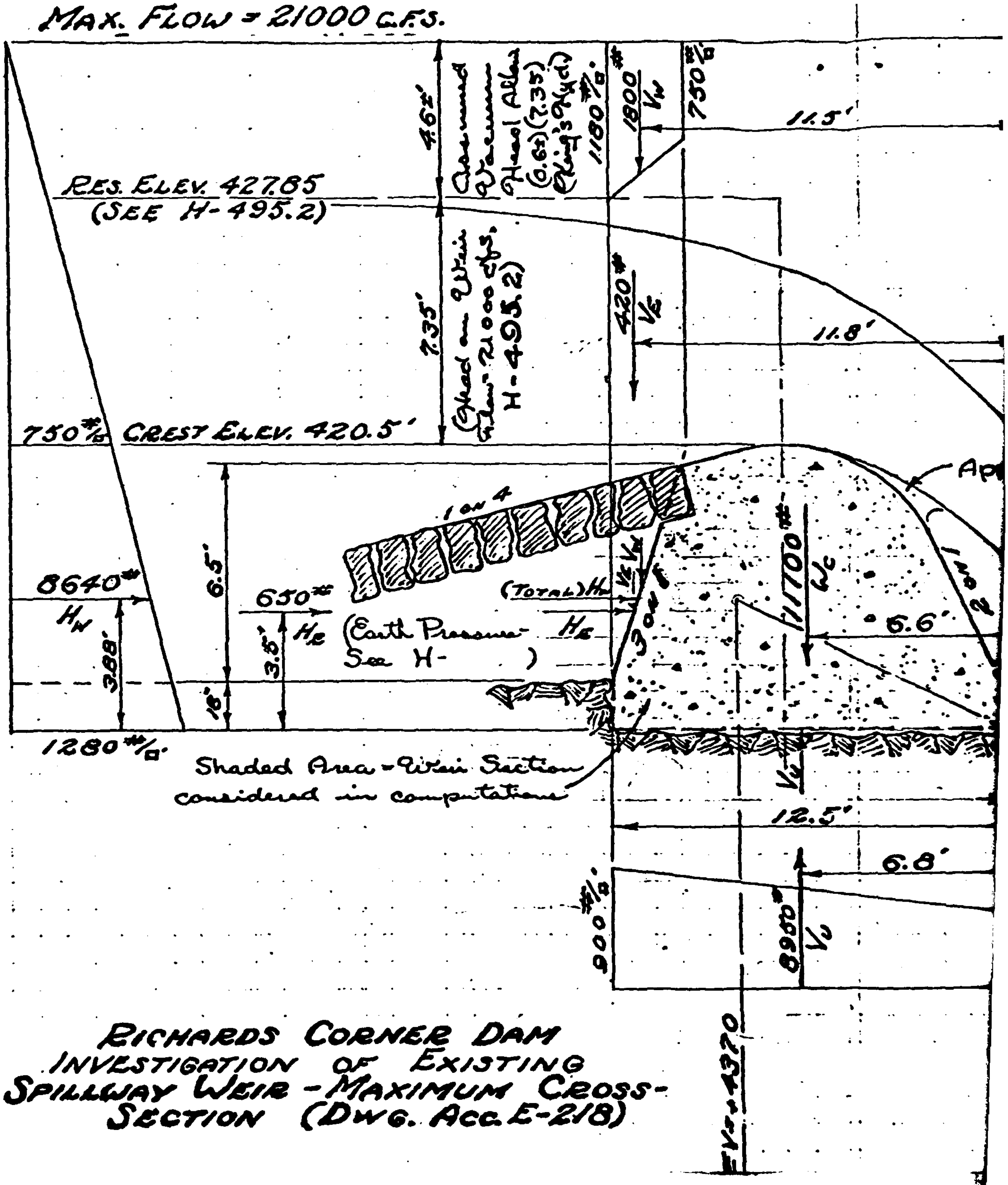
5. "Nepaug System - Reports of Consultants". The Metropolitan District; Hartford County, Connecticut; Water Bureau.

6. "Instrumentation of Earth and Rockfill Dams". EM 1110-2-1908, 21 August 1971; Department of the Army, Corps of Engineers.

COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

MAXIMUM WEIR CROSS-SECTION (SEE DWG. ACC. 218) 2100
(MAX. R

(See Computations H- -H-)



RICHARDS CORNER DAM
INVESTIGATION OF EXISTING
SPILLWAY WEIR - MAXIMUM CROSS-SECTION (DWG. ACC. E-218)

ON

218) 21000 C.F.S. MAX. FLOW

(MAX. RUN-OFF = 500 C.F.S./SQ. MI.)

FORCES CONSIDERED

Results -

* Sliding Factor: $f = 2.1$

Ratio of Moments:

$\frac{\text{Resisting (Minus Uplift)}}{\text{Overturning}}$

$\frac{M_R}{M_o} = 1.06$

(a) WATER PRESSURE
(1) HEAD WATER
(2) TAIL WATER
(3) UPLIFT

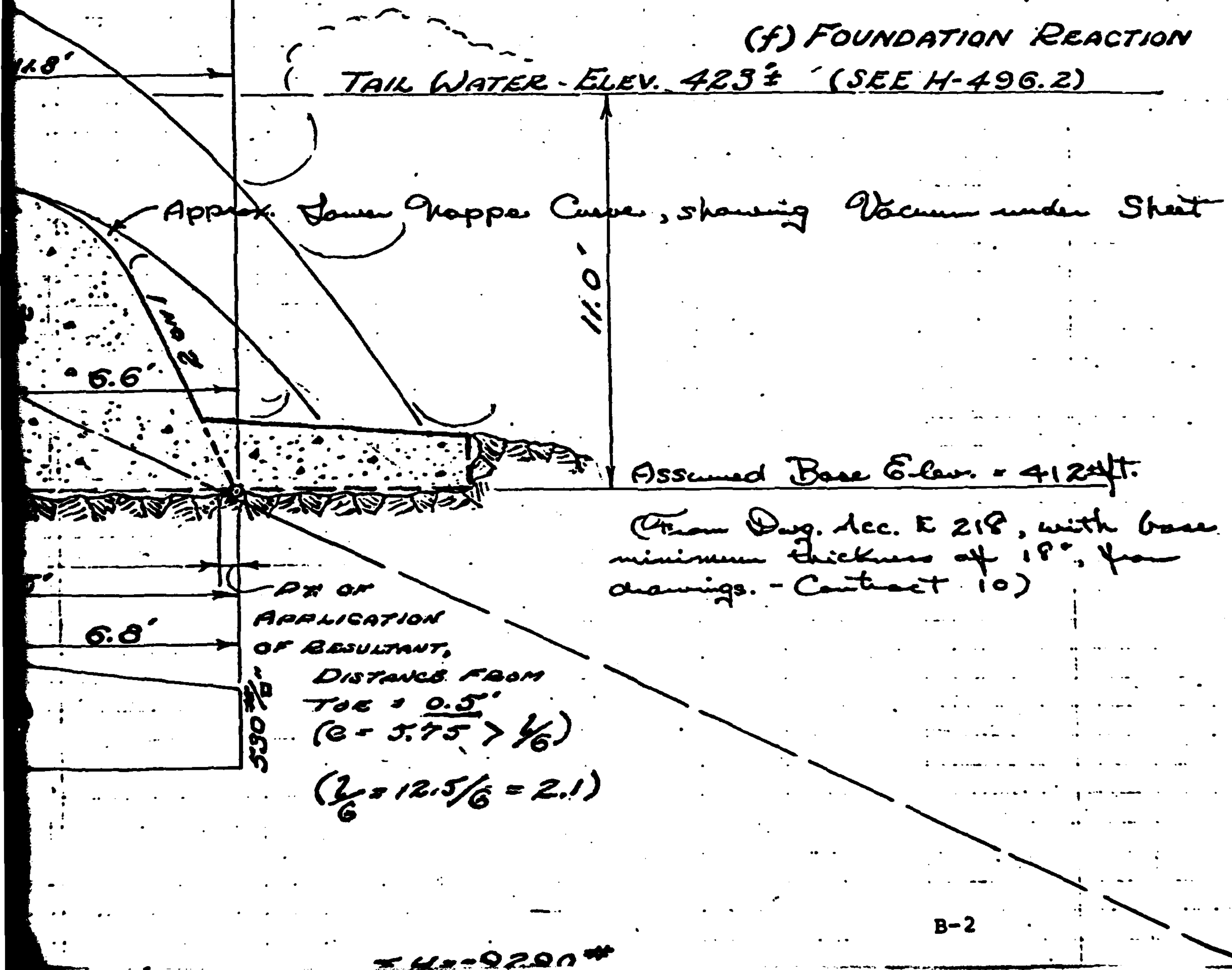
(b) EARTH PRESSURE

(c) ICE PRESSURE

(d) WEIGHT OF DAM

(e) IMPACT

(f) FOUNDATION REACTION



COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

(21,000 cfs)

(0) WATER PRESSURE

(1) HEAD WATER

VACUUM HEAD (KING'S HYD. HANDBOOK) = 60% HEAD ON WEIR

FOR LOWER NAPPE CURVES SEE H-

(7.35)(0.60) = 4.4'
SAY 4.6', MAKING
TOTAL HEAD ON WEIR
(7.4)(+)(4.6) = 12.02 FT (@ CREST)

(7.35' HEAD = MAX. FLOW OF 21,000 C.F.S. SEE H-387)

$$z \text{ (CENTER OF PRESSURE)} = \frac{a}{3}\frac{(C+2b)}{(C+b)} \quad \text{(K.H.H P.21)}$$

$$z = \frac{8.5}{3}\left(\frac{1250+2(750)}{1250+750}\right) = \frac{8.5}{3}\left(\frac{2750}{2030}\right)$$

1500 + 1250 = 2750; 1250 + 750 = 2030

$$= \underline{\underline{3.58'}}$$

$$\boxed{H_w} = \frac{(750+1250)}{2}(8.5) = \underline{\underline{8640}}\ \# = H_w$$

$$\boxed{V_w} = \frac{(460+1180)}{2}(2.2) = \underline{\underline{1800}}\ \# = V_w$$

1180 + 460 = 1640

920 + 1180 = 2100

$$z = \frac{2.2}{3}\left(\frac{1180+2(460)}{460+1180}\right) = \underline{\underline{0.94'}}$$

(21000 c/s)
(a) WATER PRESSURE
(2) TAIL WATER

Due to the probable turbulent nature of the channel flow behind the weir, and the previous allowance for vacuum head, to avoid conflicting theoretical assumptions and permit a more conservative analysis of the practical conditions likely to obtain at this (235') head, the horizontal and vertical hydrostatic pressure thrusts of the tail water were neglected, the only recognition of tail water being made in the uplift calculations. See computations below.

(a) WATER PRESSURE
(3) UPLIFT

From various sources of information, it appears that the foundation rock of the weir is not of very good quality, permitting even under ordinary conditions, the seepage of water beneath the weir in noticeable quantities. Under these circumstances, an uplift factor equal to the maximum used for rock footings is certainly warranted; and therefore, 0.70 of the head-water and tail water pressures under heel and toe were used, with a straight-line variation between these points under the dam.

(21 ... CYS)

(a) WATER PRESSURE

UPLIFT (CONT.)

$$\boxed{V_U} = \frac{(900 + 530)}{2}(12.5) = \underline{8950}^{\#}$$

$$\bar{x} = \frac{12.5}{3}\frac{(900 + 2(530))}{(900 + 530)} = \underline{5.7}$$

900
530
1430

1060
900
1960

$$\boxed{H_U} = \underline{0}$$ (Base assumed horizontal)

(b) EARTH PRESSURE

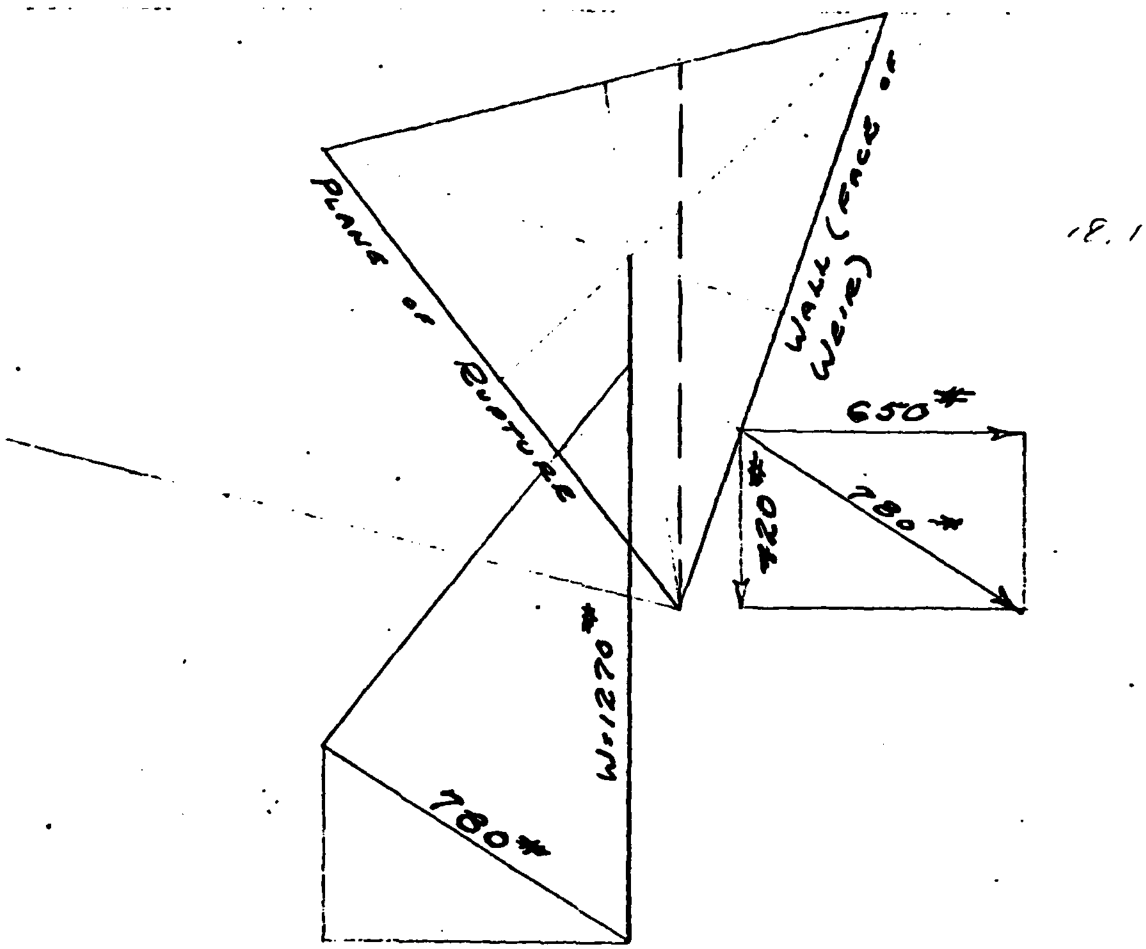
w_3 = WGT. ($^{\#}/_{\square^3}$) OF SUBMERGED EARTH
w_3' = " ($^{\#}/_{\square^3}$) IN AIR, OF "
w_2 = " ($^{\#}/_{\square^3}$) OF WATER
K = PROPORTION OF VOIDS IN EARTH

$$w_3 = w_3' - w_2(1 - K)$$

$$= 110 - 62.4(1 - 0.40)$$

$$= 72.6 \text{ say } 70\ ^{\#}/_{\square^3}$$

(b) EARTH PRESSURE (CONT.)



Forces assumed as acting at angle of friction with normals on wall and plane of rupture. Solution suggested by Trautwine p 607-609, study of Coulomb, Poncelet, Rankine theories.

(2100 c/s)

(c) Ice Pressure

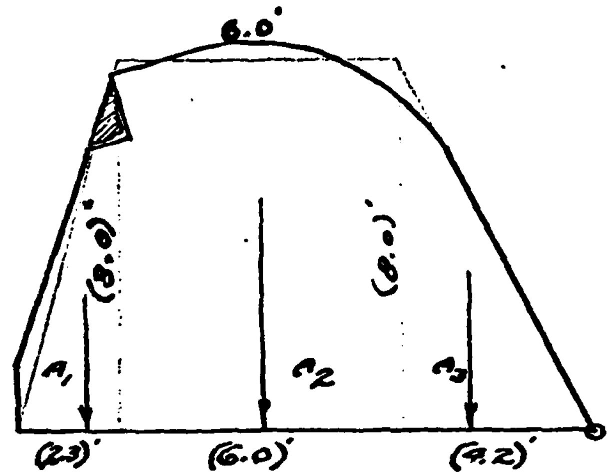
Due to the gradual approach slope (1 on 4) afforded by the riprap on the upstream face of the weir, ice sheets forming below the weir crest elevation will have the tendency to slide over the weir on this inclined plane, there being no vertical area or projection offering resistance to such (ice) movements. Frictional resistance, barring an unusual thickness of the ice sheet, is not deemed sufficient to produce thrust, and at any rate, exact analysis does not appear warranted, the weir to date not having been unduly strained by such pressures. No ice, of course, can exist under maximum flood conditions, or in combination with the stresses so induced.

(d) Weight of Dam

As contract, working, and record drawings fail to designate the amount, if any, of steel reinforcing in the apron section of the weir, any bending occurring at the toe was assumed as causing failure in tension at the point, resulting in the cross-section adopted for analysis. The "Weight of Dam" is the weight of this section only, without the apron, and revolving about the point shown. See H-

(21000 #s)

(d) <u>WEIGHT OF DAM</u>



$$A_1 = \left(\frac{8.0}{2}\right)(2.3) \times r_1\ (11.0) = 101.$$

$$A_2 = (6.0)(8.0) \times r_2\ (7.2) = 345.5$$

$$A_3 = \left(\frac{8.0}{2}\right)(4.2) \times r_3\ (2.7) = \underline{45.4}$$

$$\underline{491.9}$$

$$A_0 = A_1 + A_2 + A_3 = \left(\frac{12.5 + 6.0}{2}\right)(8.0) = 74.0 \quad = r_0$$

$$r_0 = \underline{\underline{6.6'}}$$

$$A_{0\,(WGT)} = (74.0)(150) = \underline{\underline{11100}}\ \# = W_c$$

(21,000 cfs)

(c) Impact

The dam being of the "low" type, with a rather large discharge, impact due to the velocity of approach of the large amount of water flowing over the crest must be noted. As in the case of ice pressure, there being no vertical face available for direct impingement of the water, only the projection of the riprap approach slope need be considered. The mass of material involved, and the certainly-present amount of frictional resistance against the reservoir flow, as provided by this riprap and the fill beneath, should prove sufficient to absorb and counterbalance much of this impact force, or at least reduce it to the point where it ceases to be a factor of any importance in comparison with the other more calculable stress-producing items.

(2115-40)

(f) FOUNDATION REACTION

ΣM_H (−)

$H_W = 8640^{\#} \times 3.9' = 33700'^{\#}$

$H_E = \underline{650}^{\#} \times \underline{3.5'} = \underline{2280}$

$9290^{\#}$ $35980'^{\#}$

ΣM_H (+)

0

$$\frac{\Sigma M_H}{\Sigma H} = -\frac{35980'^{\#}}{9290^{\#}} = \underline{\underline{3.87'}}$$

ΣM_V (−)

$V_U = \underline{8950} \times 6.8 = 60900$

-8950

ΣM_V (+)

$W_C = 11100 \times 6.6 = 7340$

$V_E = 420 \times 11.8 = 4960$

$V_W = \underline{1800} \times 11.5 = \underline{20700}$

13320 99060

$-\underline{8950}$ $\underline{60900}$

4370 38160

$$\frac{\Sigma M_N}{\Sigma V} = \frac{38160}{4370} = \underline{\underline{8.75'}}$$

COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

(21,000 c/s)

SLIDING FACTOR

$$\frac{\Sigma H}{\Sigma V} = f \qquad \frac{\Sigma H}{\Sigma V} = \frac{9290}{4370} = \underline{\underline{2.1}} \text{ N.G.}$$

(Maximum allowable sliding factor in rock not to exceed 0.75, for best foundation conditions)

OVERTURNING FACTOR OF SAFETY

$$\frac{\text{Moment of Resistance}}{\text{Overturning Moment}} = \frac{\Sigma M(+)}{\Sigma M(-)}$$

$$\Sigma M_{(+)} = \Sigma M_H(+) = 0$$
$$\Sigma M_V(+) = 99060 \text{ '}\#$$

$$\Sigma M_{(-)} = \Sigma M_H(-) = 35950$$
$$\Sigma M_V(-) = \underline{60900}$$
$$96850$$

① $$\frac{\Sigma M_{(+)}}{\Sigma M_{(-)}} = \frac{99060}{96850} = \underline{\underline{1.02}} \text{ N.G.}$$ (Minimum allowable 2.0)

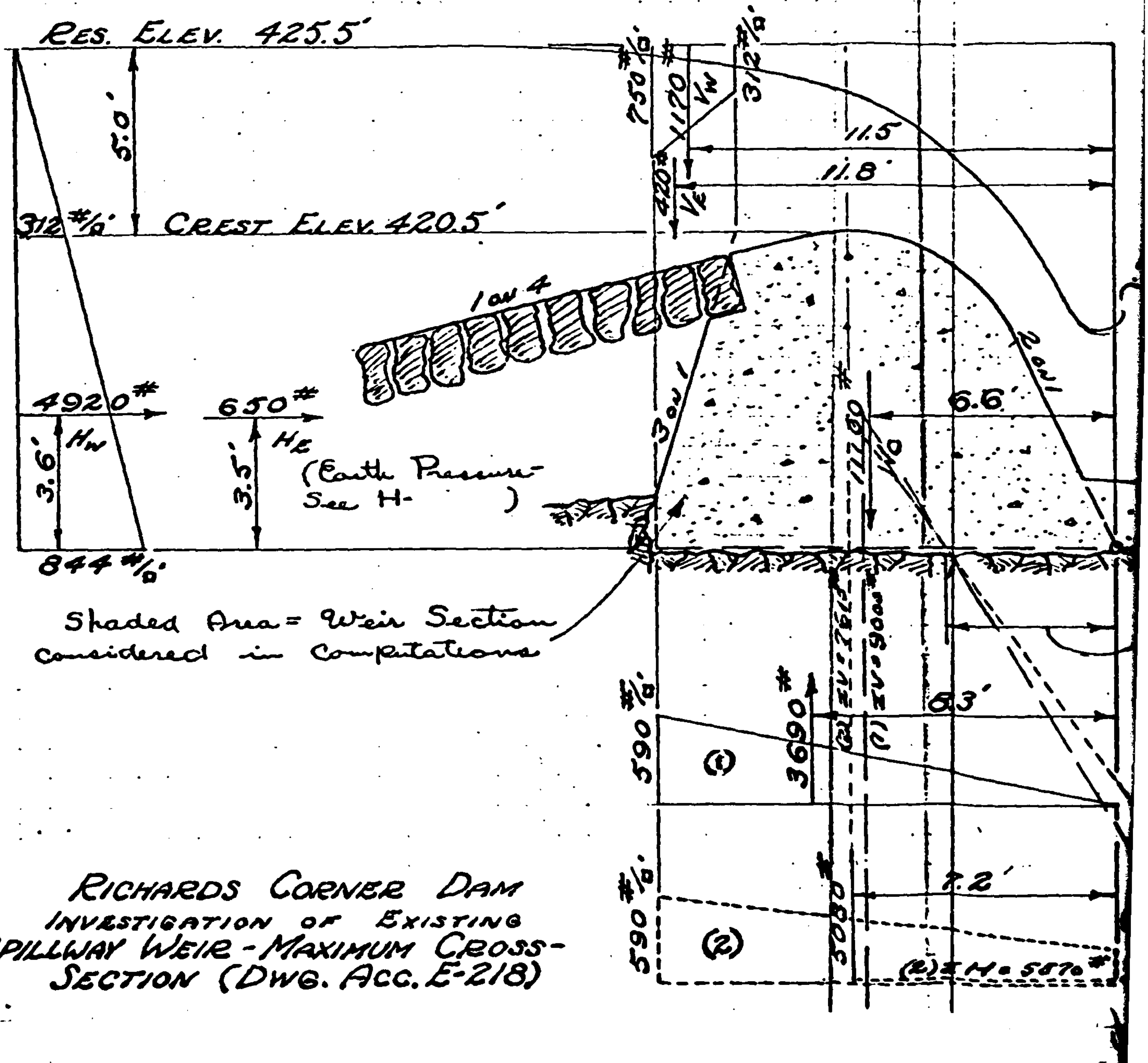
② $$\frac{\Sigma M_R - M_V}{\Sigma M_O} = \frac{38160}{35950} = \underline{\underline{1.06}}$$

COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

MAXIMUM WEIR CROSS-SECTION (SEE DWG. ACC. E-218) 5 (APPROX.

(See Computations H- -H-)

Note:
The slight vacuum existing at a 5.5' head (H- is assumed here as not being present under a 5.0' head, possible friction and turbulence losses being considered as decreasing the velocity sufficiently to prevent the water sheet from springing free at the crest and downstream face.



RICHARDS CORNER DAM
INVESTIGATION OF EXISTING
SPILLWAY WEIR - MAXIMUM CROSS-SECTION (DWG. ACC. E-218)

E-218) <u>5' HEAD ON WEIR</u> (180 C.F.S./SQ.MI.)
(APPROX. MAX. RUN-OFF = 200 C.F.S./SQ.MI.)
@ 5.5' HEAD

FORCES CONSIDERED

(SEE H-

(a) WATER PRESSURE
(1) HEAD WATER
(2) TAIL WATER
(3) UPLIFT

(b) EARTH PRESSURE

(d) WEIGHT OF DAM

(f) FOUNDATION REACTION

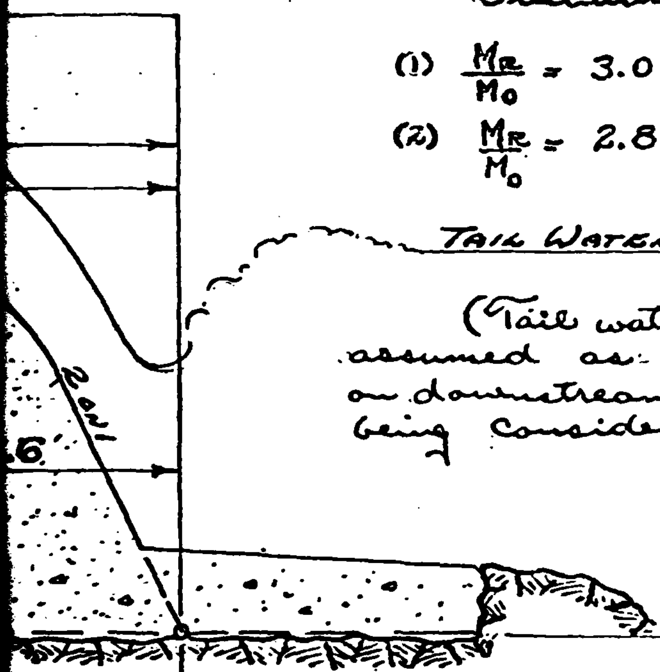
<u>Results</u>-
*
Sliding Factor:
(1) $f = 0.62$
(2) $f = 0.73$

Ratio of Moments:

$\frac{\text{Resisting (Minus Uplift)}}{\text{Overturning}} =$

(1) $\frac{M_R}{M_O} = 3.0$

(2) $\frac{M_R}{M_O} = 2.8$



<u>TAIL WATER ELEV. 420.5± (ACC. 1290)</u>

(Tail water, due to its velocity, is not assumed as contributing static pressure on downstream face, <u>uplift</u> effect only being considered.)

Assumed Base Elev. 412± ft.

PTS. OF APPLICATION OF RESULTANTS
(1) 4.6' (2) 4.65'; DISTANCES FROM TOE.. ($e = 1.6' < \frac{l}{6}$) ($\frac{l}{6} = \frac{12.5}{6} = 2.1$)

<u>Note</u>:
<u>Case (1)</u> Uplift at toe = 0, perhaps as originally computed, or as possible due to high velocity of water directly over that point.

<u>Case (2)</u> Uplift assumed as resulting from action of full tail water head.

(a) WATER PRESSURE (11000 c/s)

$$P_H = 8.5 \frac{(312 + 844)}{2} = \underline{\underline{4920}}^{\#} = \boxed{H_W}$$

$$\bar{z} = \frac{8.5}{3}\left(\frac{844 + 624}{844 + 312}\right) = \underline{\underline{3.6}}'$$

$$P_V = 2.2 \frac{(312 + 750)}{2} = \underline{\underline{1170}}^{\#} \quad \boxed{V_W}$$

$$\bar{z} = \frac{2.2}{3}\frac{(750 + 624)}{(750 + 312)} = \underline{\underline{0.9}}'$$

312
844
1156

624
844
1468

312
750
1062

624
750
1374

No tail water assumed as being present at this section. $\boxed{H_{TW}} = 0$ $\boxed{V_{TW}} = 0$

Assumed Uplift Factor = 0.66 say 0.7
(Poor Rock)

(b) EARTH PRESSURE
SEE H-

(c) ICE PRESSURE
SEE H

(d) WEIGHT OF DAM
SEE H-

(e) IMPACT
SEE H-

COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

FOUNDATION REACTION (11000 cfs)

(1)

H_W	4920	17800
H_E	650	2270
	5570 #	20070 '#

$$r = \frac{20070}{5570} = \underline{\underline{3.62'}}$$

W_C	11100	73400
V_W	1170	13460
V_E	420	4960
	12690	91820
V_U	3680	30600
	9000	61220

$$r = \frac{61220}{9000} = \underline{\underline{6.8'}}$$

(2)

H_W	4920	17800
H_E	650	2270
	5570 #	20070 '#

$$r = \frac{20070}{5570} = \underline{\underline{3.62'}}$$

W_C	11100	73400
V_W	1170	13460
V_E	420	4960
	12690	91820
V_U	5080	36600
	7610	55220

$$r = \frac{55220}{7610} = \underline{\underline{7.2}}$$

COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

FOUNDATION REACTION (11000 c/s)

(1)

(+)	91820 #	$\frac{41150}{9000}$ = 4.6'	Inside Middle Third
(-)	50670		($\frac{12.5}{3}$ = 4.2)
	41150		

ΣV = 9000

(2)

(+)	91820	$\frac{35150}{7610}$ = 4.6'	Inside Middle Third
	56670		(12.5 = 4.2)
	35150		

ΣV = 7610

COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION

SLIDING FACTOR (11000 c/s)

$$\frac{\Sigma H}{\Sigma V} = \frac{5570}{8000} = f$$

ΣH = 4920
660
5570 #

$f = \underline{0.62}$

o.k. (Rather close)

ΣV = 1170
420
11100
12690

With tail water (See Stevens, ASCE 1290)

12690 − 3690 = 8000; 12690 − 5080 = 7610

$f = \frac{5570}{7610} = \underline{0.73}$ (Allowable for bedrock & workmanship too high in this case)

OVERTURNING FACTOR OF SAFETY

Without tail water

ΣM (−)			ΣM (+)		
H_w	4920 x 3.6	= 17800	W_c	11100 x 6.6	= 73400
H_c	650 x 3.5	= 2270	V_w	1170 x 11.5	= 13460
V_u	3690 x 8.3	= 30600	V_E	420 x 11.5	= 4860
		50670			91520

$\frac{R.M.}{O.M.} = \frac{91520}{50670} = \underline{1.8}$ (Allowable = 2.0)

or $\frac{R.M.-(U.M.)}{O.M.} = \frac{61220}{20070} = \underline{3.0}$

With tail water

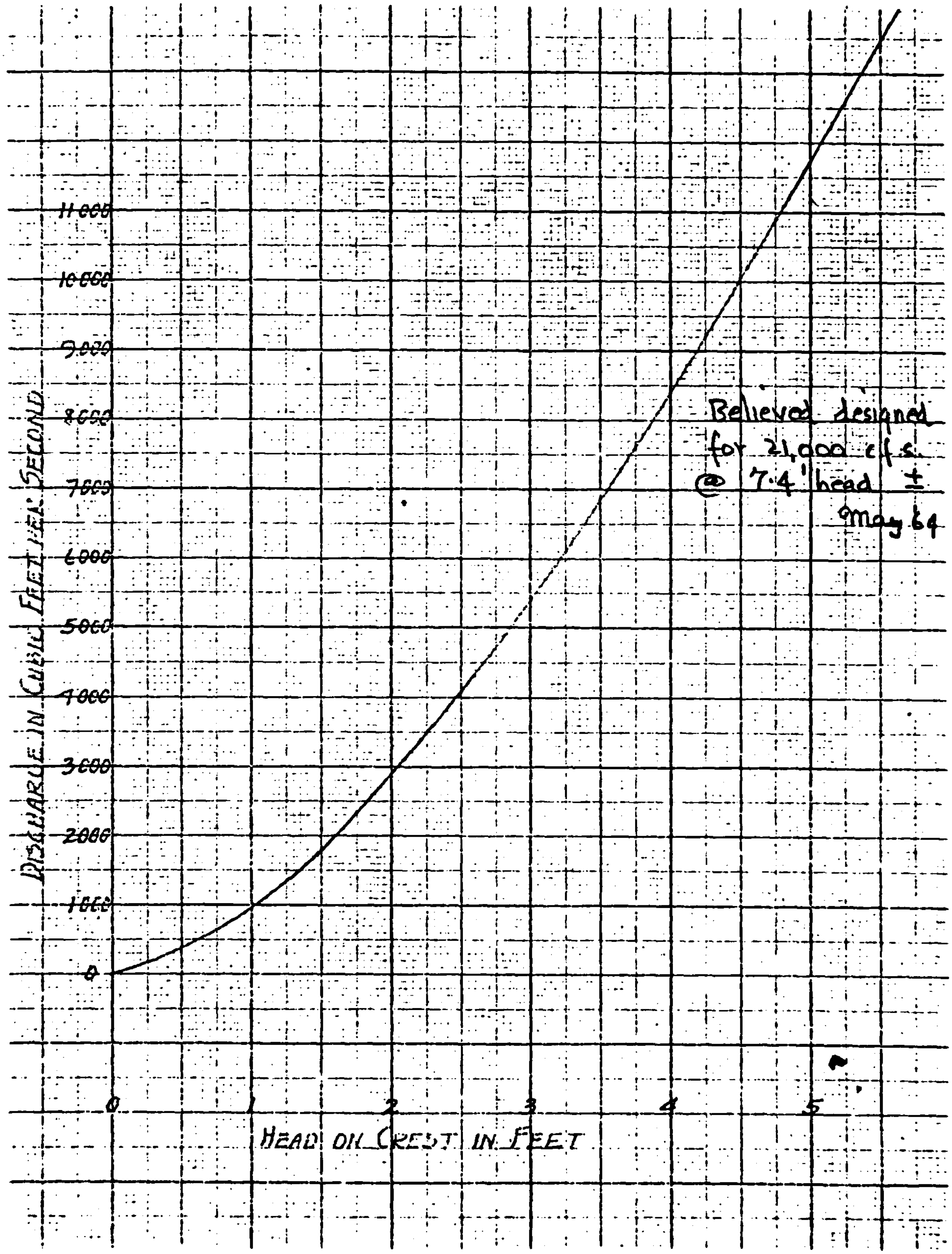
$\frac{R.M.}{O.M.} = \frac{91520}{56670} = \underline{1.6}$ N.G.

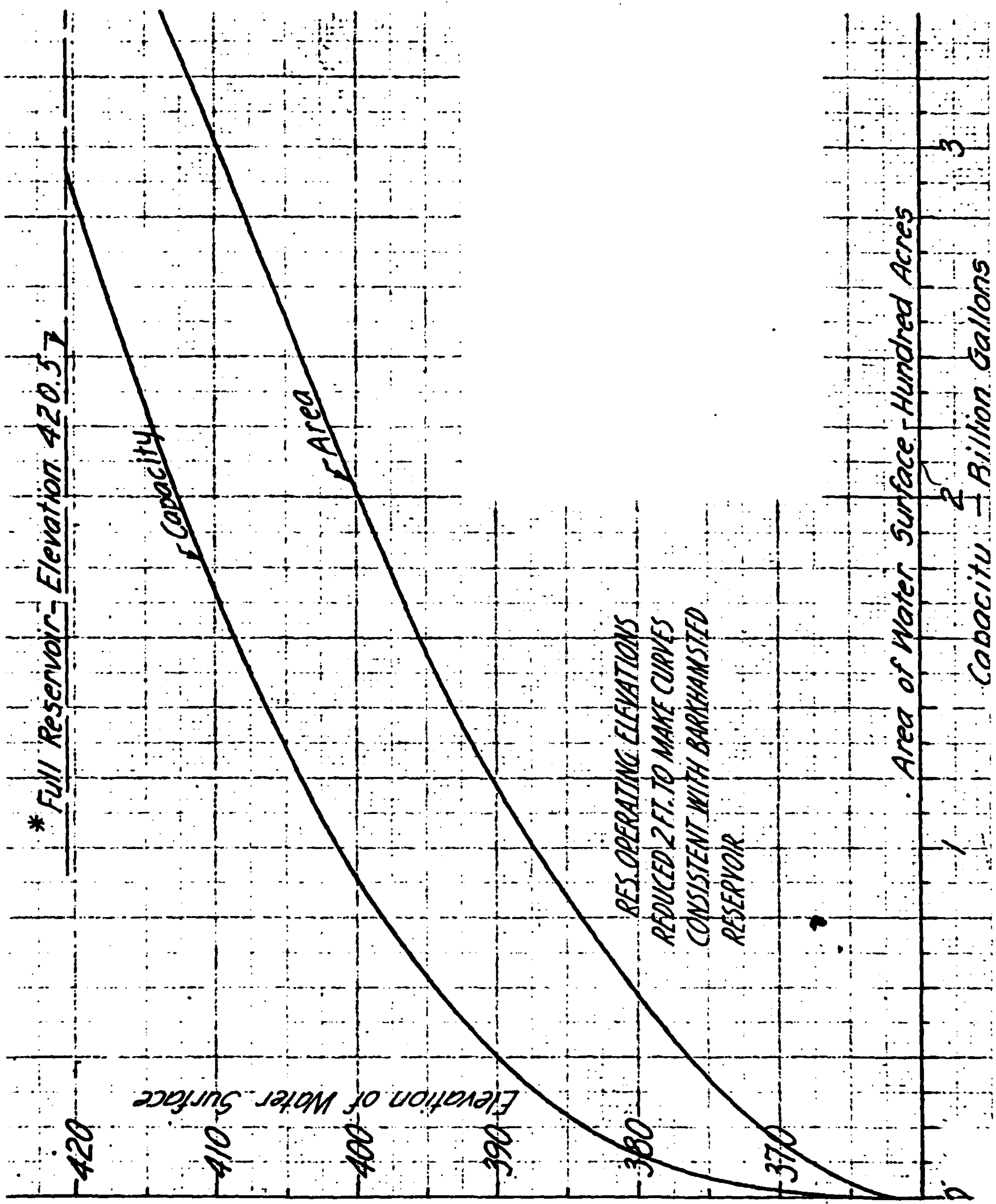
36600 V_u (Rain
30600 V_u (Orig
6000 V increase in O.M.

or $\frac{R.M.-(U.M.)}{O.M.}$

$= \frac{55220}{20070} = \underline{2.8}$

COMPUTATIONS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION




* Full Reservoir - Elevation 420.5
Capacity
Area
RES. OPERATING ELEVATIONS
REDUCED 2 FT. TO MAKE CURVES
CONSISTENT WITH BARKHAMSTED
RESERVOIR
Area of Water Surface - Hundred Acres
Capacity - Billion Gallons
0
1
2
3
Elevation of Water Surface
420
410
400
390
380
370

The Metropolitan District
Hartford County, Connecticut
Water Bureau
Designing Division

Des. Div. Ref. No. S- 1406
Date 10-17-73

INSPECTION OF DAMS AND SPILLWAYS

NAME OF DAM Richards Corner Dam

LOCATION (Town, River, Reservoir) New Hartford

INSPECTORS	Name	Title	Div./Dept.
	Dick Allen	Asst. Engineer	S & P
	Dick Conopask	Sr. Engineer	Design

In filling out this form, please enter full information on conditions, and on location of any defects.

A. GENERAL

1) Were any photographs taken of the dam during this inspection Yes

2) Reservoir level, Elev. 404.40

3) Weather (including comment on humidity) Cool, dry, sunny (beautiful fall day).

B. EARTH DAMS

1) Note any depressions in crest Minor ruts from maintenance vehicles

2) Slides and/or erosion, upstream face None

3) Slides and/or erosion, downsteam face No slides or erosion. 6± woodchuck holes.

4) Cracks in embankment No

5) Surfacing on crest and condition Grass - fair to good

6) Condition of parapet walls, if any None

7) Seepage on downstream face, especially at toe, (location and quantity)
None

8) Soft ground at toe (locate) None

9) Signs of settlement at gate house and/or gate house bridge Retaining walls-east wall settled 8"±, west wall settled 8"± and leans west. See Pictures #1 and #2

10) Downstream drainage system (clear or blocked, etc.) Catch basins covered w/cut brush - could not find outfall.

11) Type and condition of downstream face planting natural groundcover, good - scattered scrub pine, OK - Picture #3

12) Is planting and/or debris etc. a fire hazard? No

13) Do plantings obscure toe of dam and other points where monitoring inspection is necessary? No

14) Damage or vandalism (to lights, plaques, etc.) Broken windows in gate house

15) Other

C. CONCRETE DAMS

1) Any signs of motion

2) Deterioration noted:

Upstream face ______

Downstream face ______

Road/walk on crest ______

Parapets ______

Spillway ______

Other (excluding gate houses) ______

3) Inspection Gallery:

General condition ______

Leakage ______

Lime accumulation ______

Flooding & drainage ______

Other ______

4) Damage or vandalism (to lights, plaques, etc.) ______

5) Other comments ______

D. GATE HOUSES

f) Upper House

1) Exterior: walls Minor spalling of belt course (South side) Poor appearance, Structurally OK

windows OK - 2 broken

doors Good

roof Good

2) Superstructure Interior:

walls Good

floor Good

ceiling Good

3) Leakage into superstructure None

4) Substructure, interior:

* Leakage and condensation None observed in East Well; West Well not dewatered

Condition of metal work (stairs, etc.) Good

5) Equipment condition:

*Sluice gates Fair - E. Gate switch gear is being replaced
W. Gate - OK

Gate valves

Piping

Electrical gear OK being replaced (updated).

Other

6) Do all electric lights work Yes

7) Condition of stop logs in storage well Excellent

8) Operating personnel comments on functional condition of all equipment (valves, hoists, selector gates, trash racks, screens, etc.)

See sluice gate above - Some difficulty in operating gates being investigated at this time.

*Leakage of west gate adequately stopped w/ashes. East gate leakage not observed, however wear patterns indicate leakage at both upper corners; no wear observed on brass seat surfaces. Concrete at lower corners of east gate is eroded (6"± depressions) and should be patched.

9) Last time various wells and other underwater portions were unwatered and examined (Give name of well and date in case of multiple wells).

East Well Jan. 1974

West Well Aug. 1967

10) Other comments

ii) Lower House

1) Exterior: walls

windows

doors

roof

2) Superstructure Interior:

walls

floor

ceiling

3) Leakage into superstructure

4) Substructure, interior:

Leakage and condensation

Condition of metal work (stairs, etc.)

5) Equipment condition:

Sluice gates

Gate valves

Piping

Electrical gear

Other

6) Do all electric lights work

7) Condition of stop logs in storage well

8) Operating personnel comments on functional condition of all equipment (valves, hoists, selector gates, trash racks, screens, etc.)

9) Other comments

iii) ~~Conduit between gate houses~~ Streamflow conduit

1) Concrete condition Did not inspect.

2) Leakage from sluice gates

3) Condition of metal work and piping interior not inspected, iron gate rusty but structurally appears OK

4) Other comments Ladder down face of conduit endwall extremely wobbly - replace w/aluminum ladder - whole area is hazardous - 6' fence along top of all walls desireable.

E. PRINCIPLE SPILLWAY

(If spillway is part of dam, enter information in C only).

1) Weir Good - minor spalling at construction joints.

2) Channel OK Slopes stable.

3) Outlet of channel OK

4) Note any obstructions to flow None

5) Bridge None

6) Is water spilling None

7) Other comments Guniting of rock surfaces generally good, however some spalling is occurring - See Picture #4. Suggest fence along west side at top of channel cut from spillway wier south to end of vertical channel wall.

F. EMERGENCY SPILLWAY

1) Channel

2) Obstructions

3) Other comments

G. APPURTENANT STRUCTURES

List structure (such as stilling pools, discharge weir structures, stream diversion works, etc. and give conditions.

H. OVERALL ASSESSMENTS

Is this dam with its appurtenances maintained in a condition satisfactorily to the Inspectors? Yes - storage facilities desireable instead of using gate house for miscellaneous item storage.

#1 West wall settlement at Upper Gate House.

#2 East wall settlement at Upper Gate House.

#3 Down stream face planting.

#4 Gunnite on spillway wall is spalling.

FORD COUNTY, CONNECTICUT
WATER BUREAU
DESIGNING DIVISION

DATE Aug 6, 1975

INSPECTION OF WATER BUREAU FACILITIES

SYSTEM Compensating Res FACILITY Richard's Cor. Dam

NAME OF FACILITY Richard's Corner Dam Spillway

LOCATION

INSPECTORS:

NAME	TITLE	DIVISION/DEPT.
Dave Lugman	Asst. Engr.	Design
Dick Cernyasch	Sr. Engr.	"

CONDITION OF FACILITY:

Gunite on spillway inspected. Some deterioration evident - see attached report and photographs

Also see formal report PJR to AJM & HAP dated Aug. 18, 1975 in Misc. report files S-1406

WORK SUGGESTED BY OPERATING AUTHORITY:

RECOMMENDATIONS:

See attached report

1-ReC/dac

Richard's Corner Dam
Spillway Gunite Inspection
August 6, 1975

On August 6, 1975 D. C. Layman and R. E. Conopask of the Designing Division examined the condition of the gunite on the spillway and easterly face of the spillway channel of the Richard's Corner Dam. A two-pound hammer was used to make an attempt to ascertain the extent and magnitude of gunite deterioration.

Gunite on the spillway crest appears to be in excellent condition, with only minor areas of spalling occurring on the downstream ends of the construction joints. No areas of "hollowness" were heard when using the two-pound hammer.

Gunite deterioration becomes evident on the "vertical" downstream surface of the spillway (i.e. the rock section of the spillway). Of approximately 7200 sq. ft. of vertical gunited rock surface, it appears that well under 10% (eyeball guess) of the surface has deteriorated to the extent that the gunite has fallen off the rock or is able to be dislodged by striking it with a two-pound hammer.

In only two instances was any deteriorated rock found. In both cases the bad rock was exposed after chipping off the cracked gunite.

None of the areas where the gunite had spalled off showed any evidence that the exposed rock had weathered off. There was no rock or gunite debris in the spillway channel below the gunited area (undoubtedly washed away).

The top surfaces of the retaining wall/abutments at the west end of the dam are spalling.

RECOMMENDATIONS:

It does not seem likely that re-guniting the spillway and east channel surfaces is necessary at this time. However they should be monitored (say every 3 years) to ascertain the rate of gunite deterioration. Perhaps photographing the surfaces in a grid pattern would be desirable.

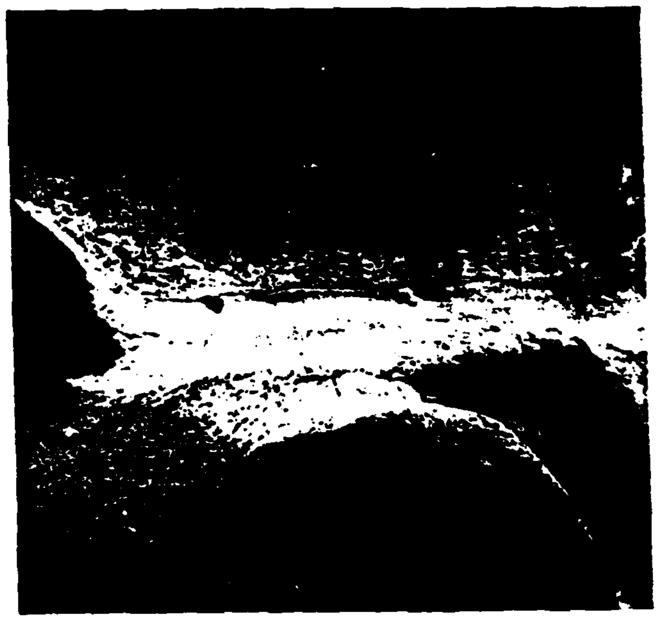
The spalled tops of the retaining wall/abutments should be capped with good concrete to prevent further spalling.

RICHARD'S CORNER DAM
SPILLWAY GUNITE INSPECTION
AUGUST 6, 1975

NORTH END OF SPILLWAY CHANNEL

DETERIORATED GUNITE
BROKEN OFF BY INSPECTOR

RUNNING WEEPER
GUNITE IN GOOD CONDITION

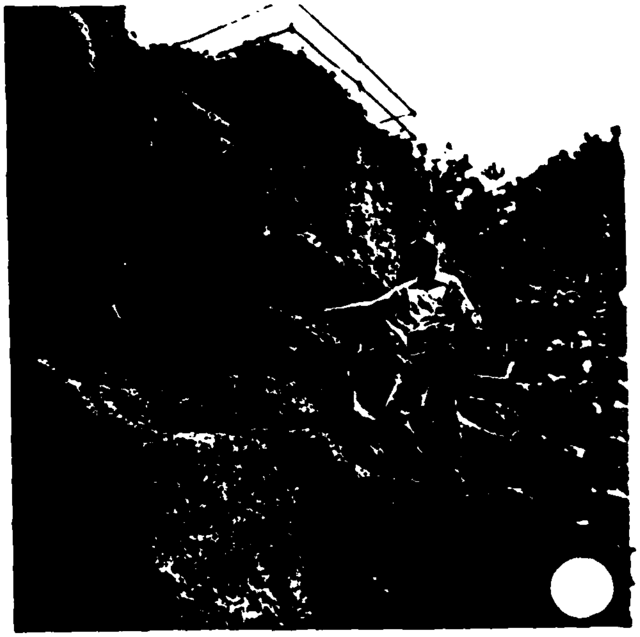


DRY WEEPERS
GUNITE IN GOOD CONDITION

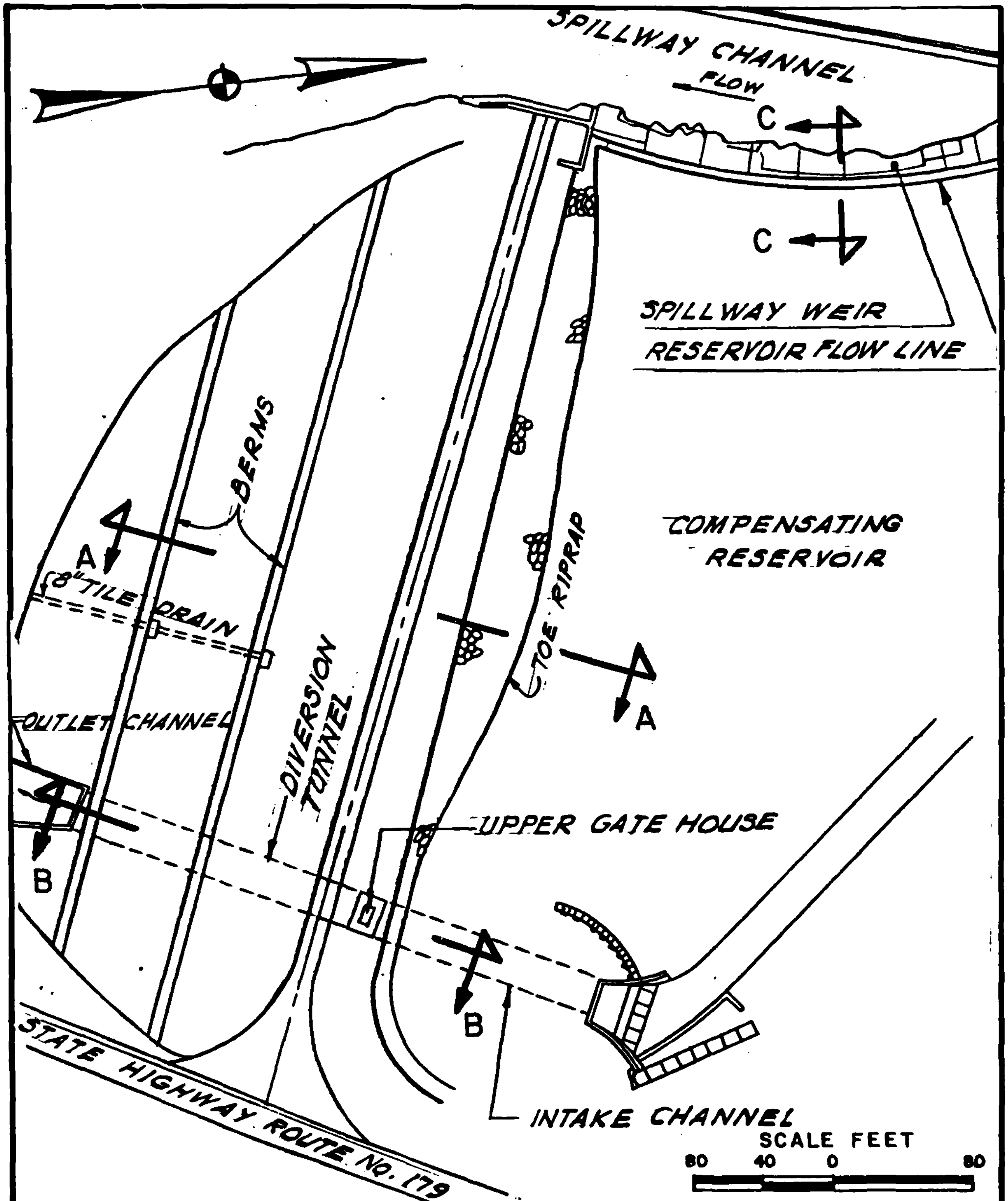
RICHARD'S CORNER DAM
SPILLWAY GUNITE INSPECTION
AUGUST 6, 1975

UPPER SECTION OF SPILLWAY

SPILLWAY CREST



DETERIORATED GUNITE
BROKEN OFF BY INSPECTOR

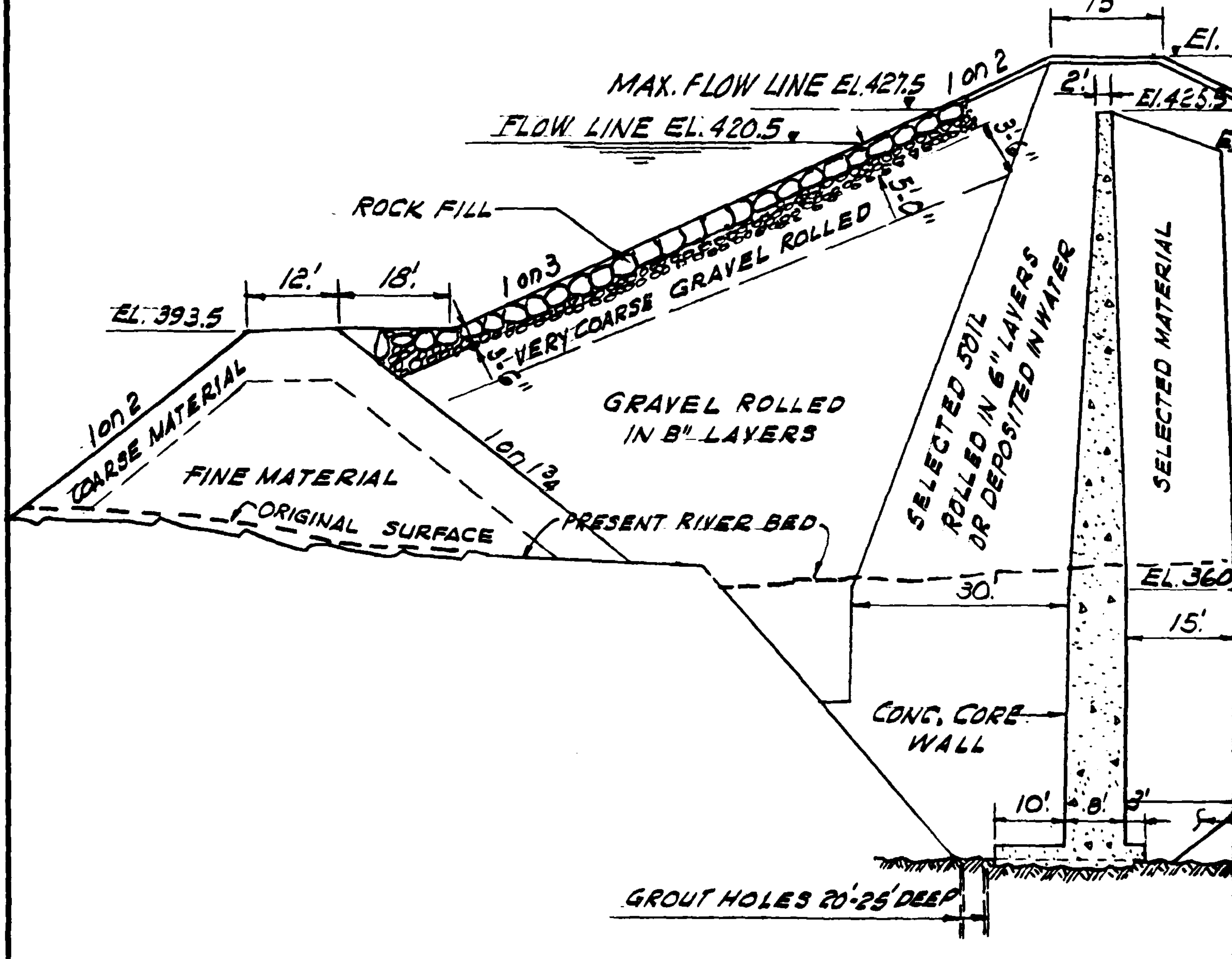


U.S. ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASS.

RICHARD'S CORNER DAM

GENERAL PLAN

PLATE-1

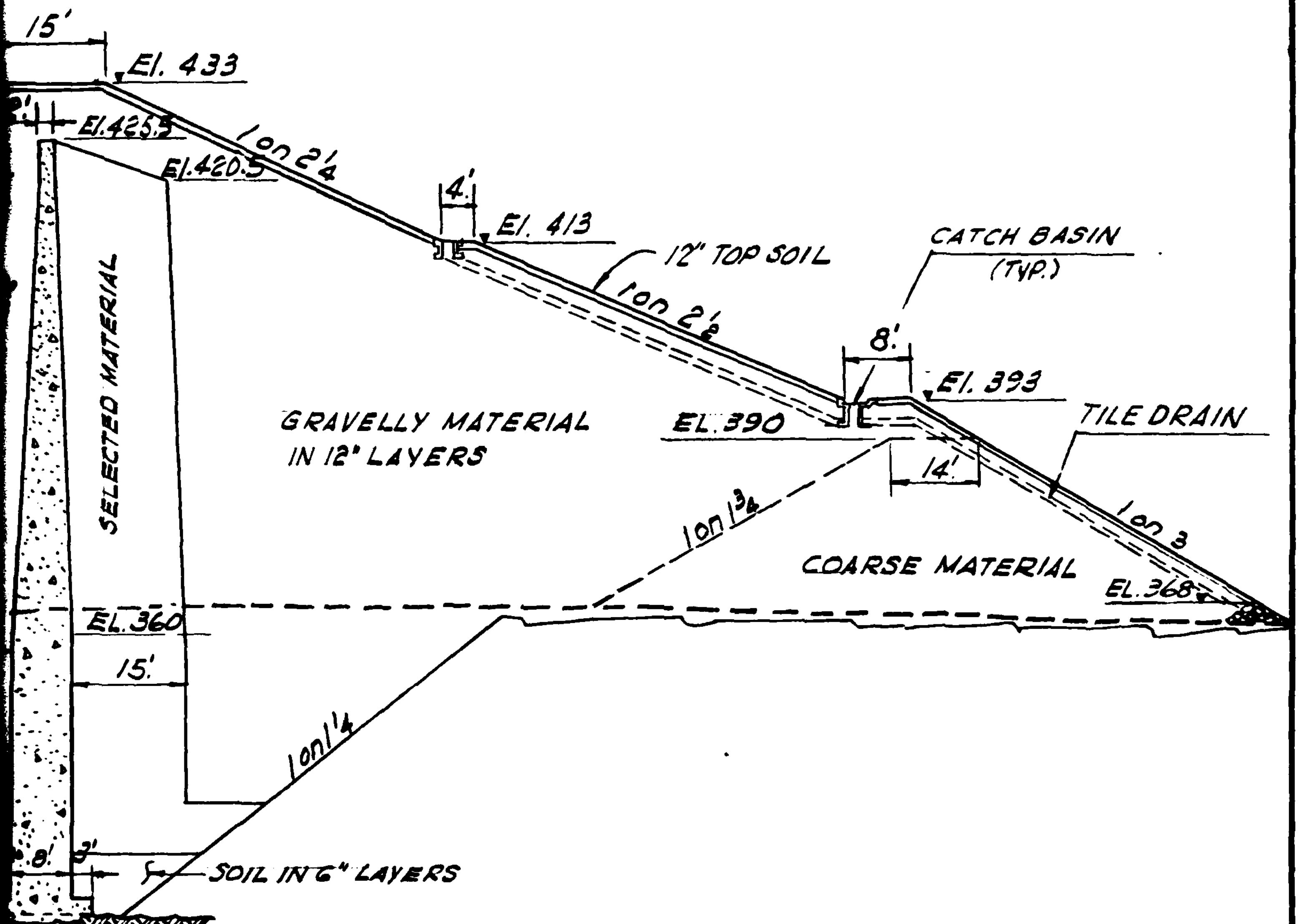


SECTION A-

Not to Scale

NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION OF HARTFORD.

2



TION A-A

to Scale

PLATE-2

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

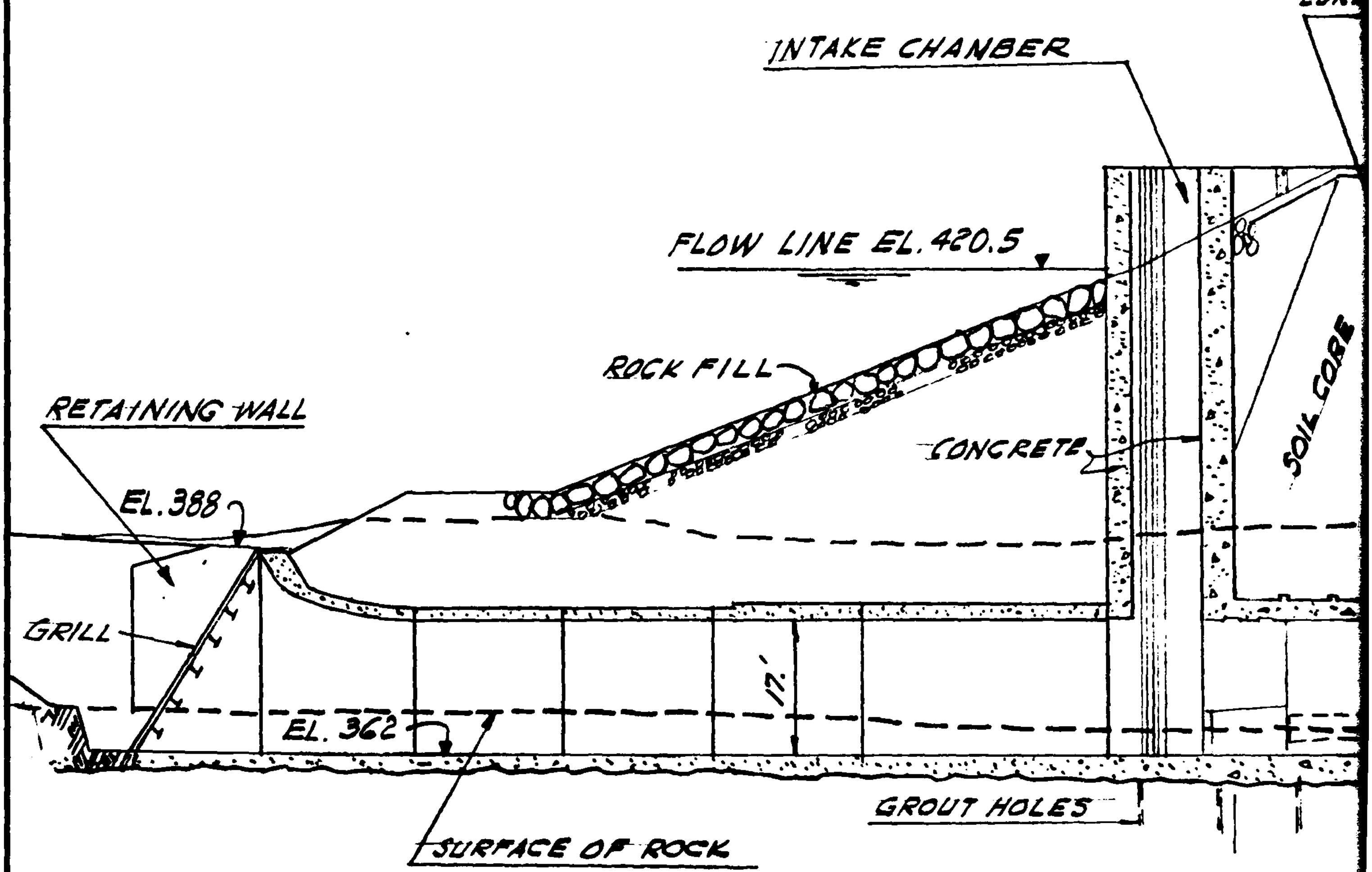
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

RICHARD'S CORNER DAM

FARMINGTON RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE: SEPTEMBER 1978

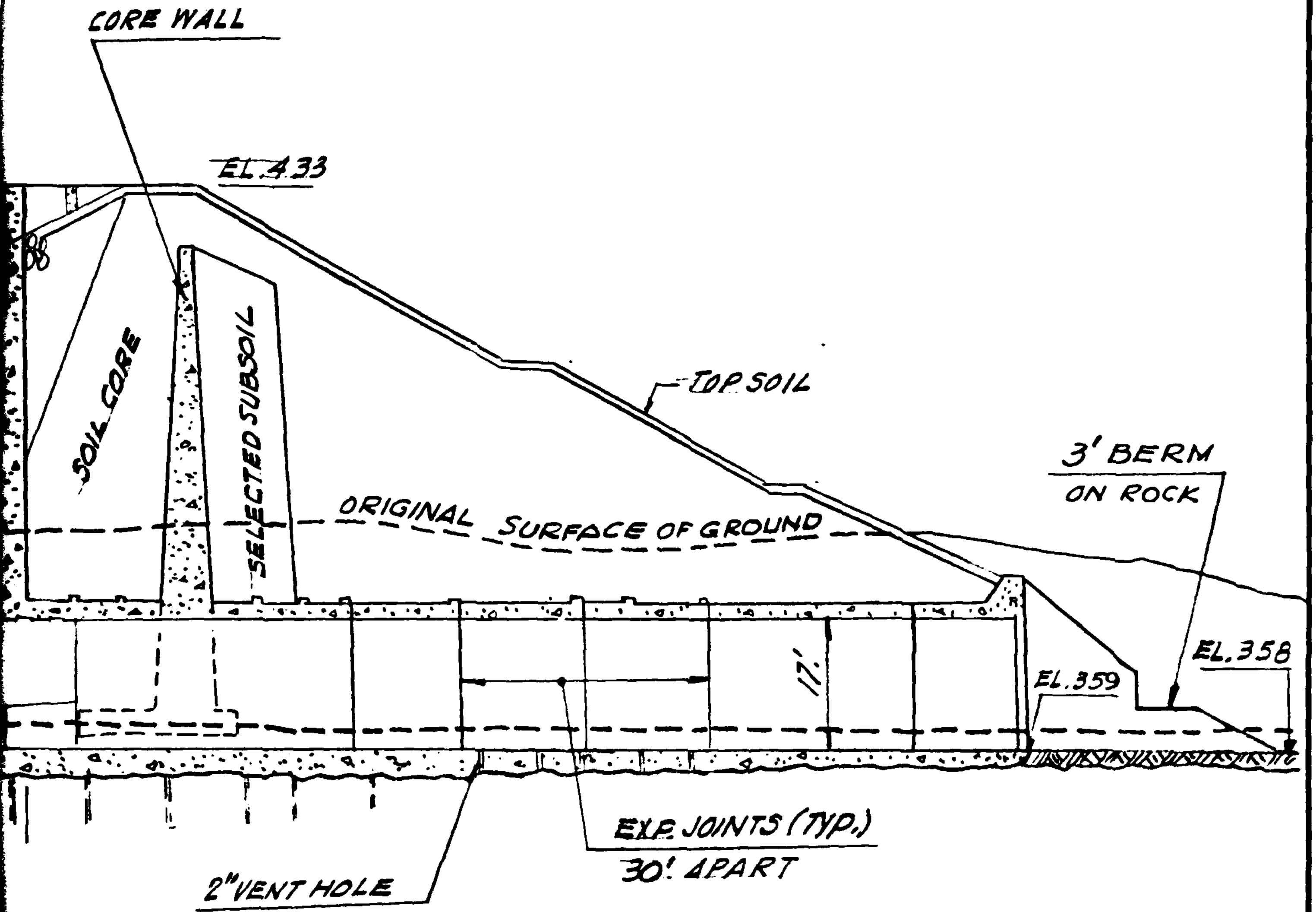


SECTION

Not to Sca

NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION OF HARTFORD.

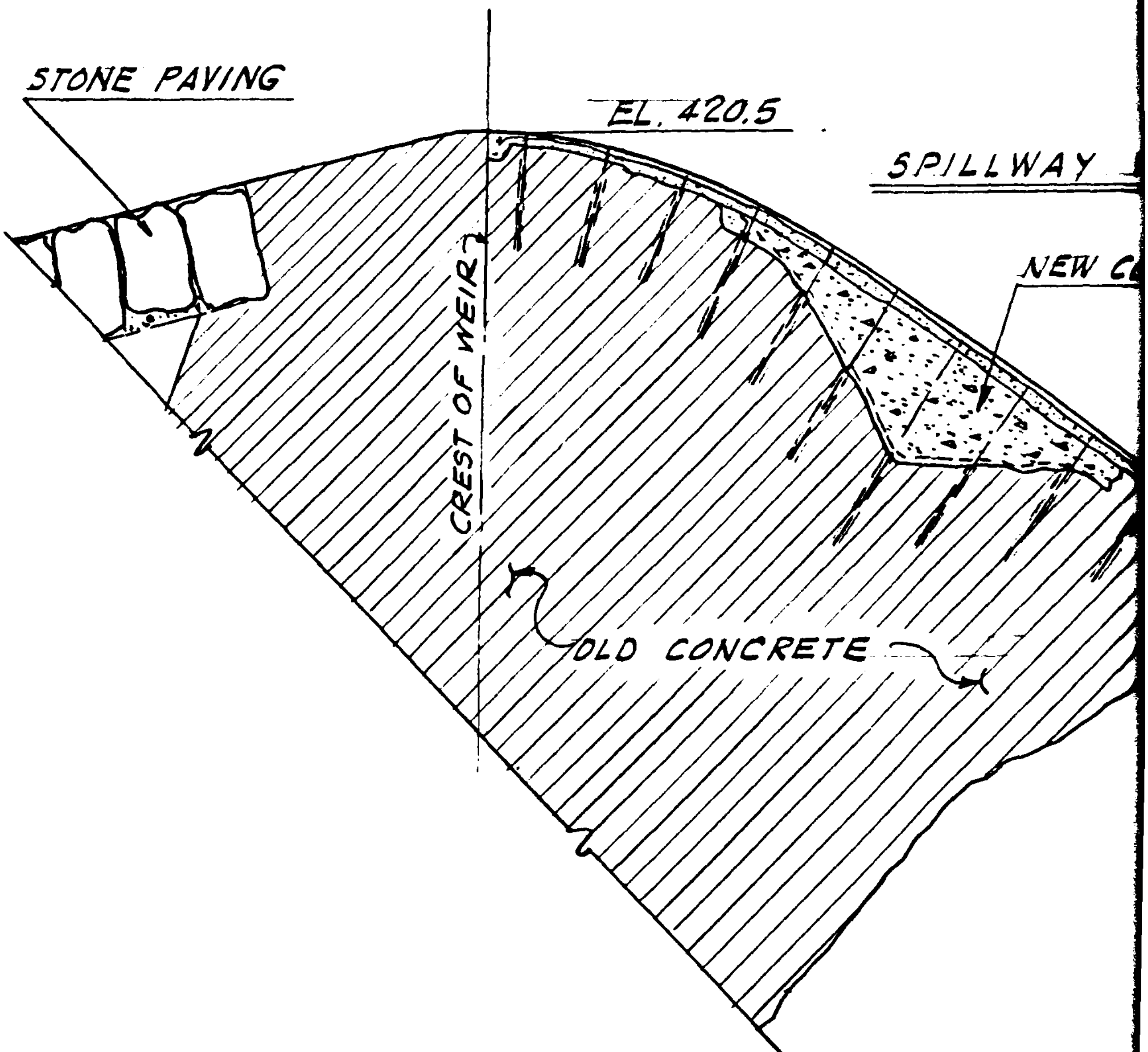
2



TION B-B

ot to Scale

PLATE-3	
STORCH ENGINEERS WETHERSFIELD, CONNECTICUT	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS RICHARD'S CORNER DAM FARMINGTON RIVER CONNECTICUT	
	SCALE: AS SHOWN
	DATE: SEPTEMBER 1978

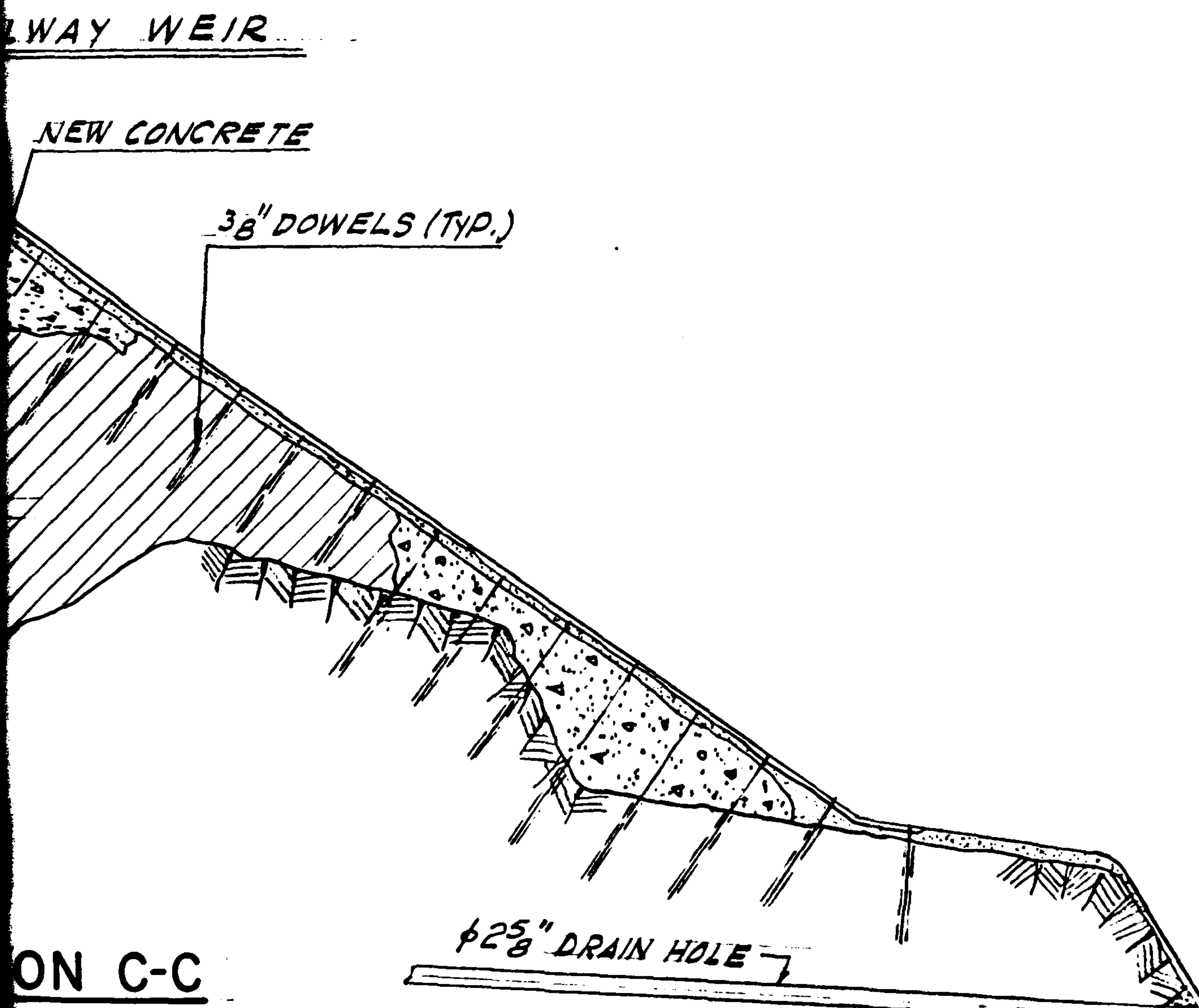


SECTION C

Not to Scale

NOTE: INFORMATION TAKEN FROM DRAWINGS SUPPLIED BY THE METROPOLITAN DISTRICT COMMISSION OF HARTFORD.

2



ON C-C
o Scale

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

RICHARD'S CORNER DAM

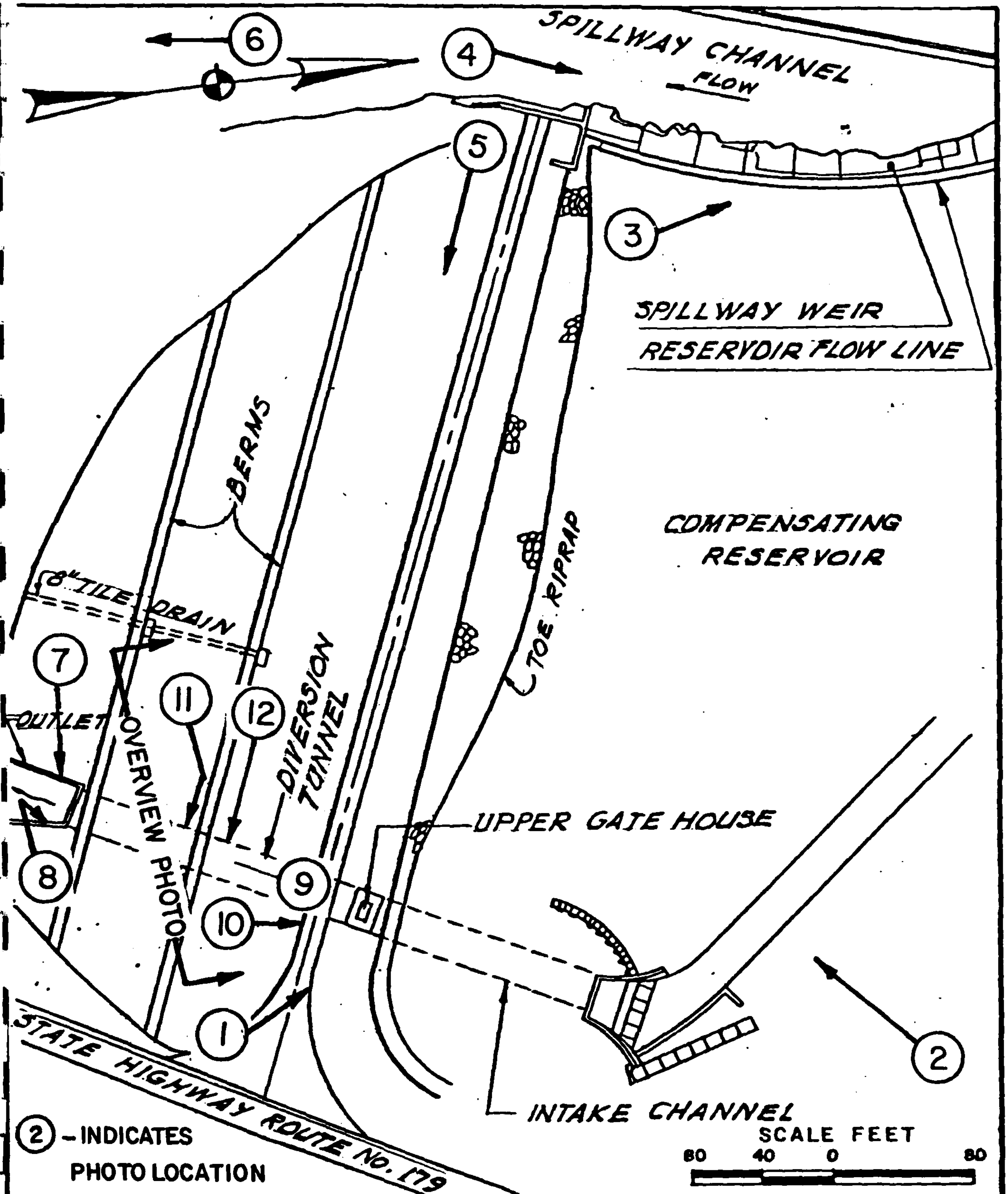
FARMINGTON RIVER CONNECTICUT

SCALE: AS SHOWN

DATE : SEPTEMBER-1978

APPENDIX C

PHOTO LOCATION MAP	Plate 5
PHOTOGRAPHS	II-1 to II-6



U.S. ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION WALTHAM, MASS.	RICHARD'S CORNER DAM PHOTO LOCATION PLAN	PLATE-5

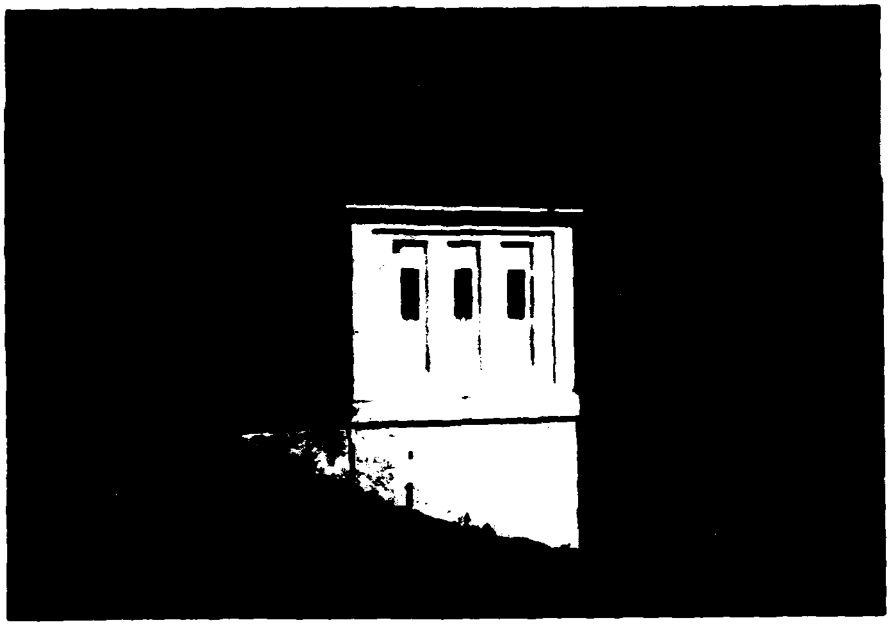


PHOTO 1
GATE HOUSE

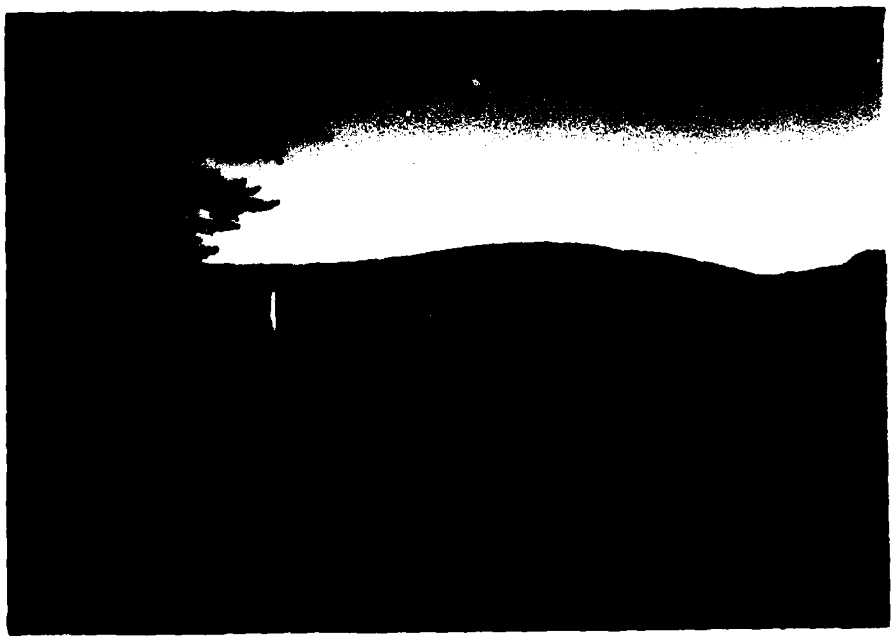


PHOTO 2
UPSTREAM FACE OF DAM

PHOTO 3
SPILLWAY WEIR

PHOTO 4
SPILLWAY CHANNEL

PHOTO 5

TOP OF DAM - LOOKING EAST FROM SPILLWAY

PHOTO 6

DOWNSTREAM CHANNEL

PHOTO 7

DIVERSION TUNNEL OUTLET

PHOTO 8

DIVERSION TUNNEL OUTLET CHANNEL WALL

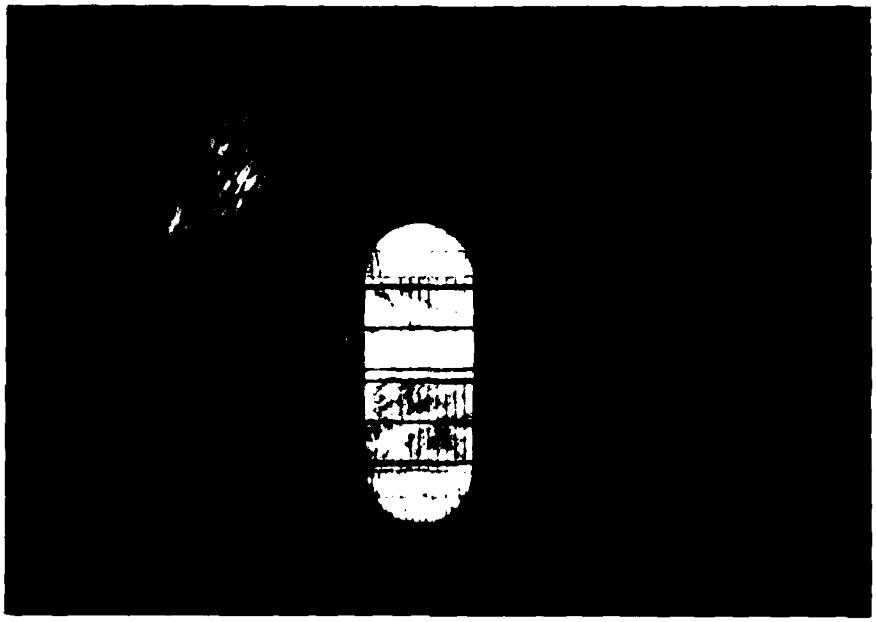


PHOTO 9

DIVERSION TUNNEL LOOKING TOWARD OUTLET

PHOTO 10

DIVERSION TUNNEL LOOKING AT GATE HOUSE WALL

PHOTO 11

EFFLORESCENCE THROUGH CRACK IN CEILING OF DIVERSION TUNNEL

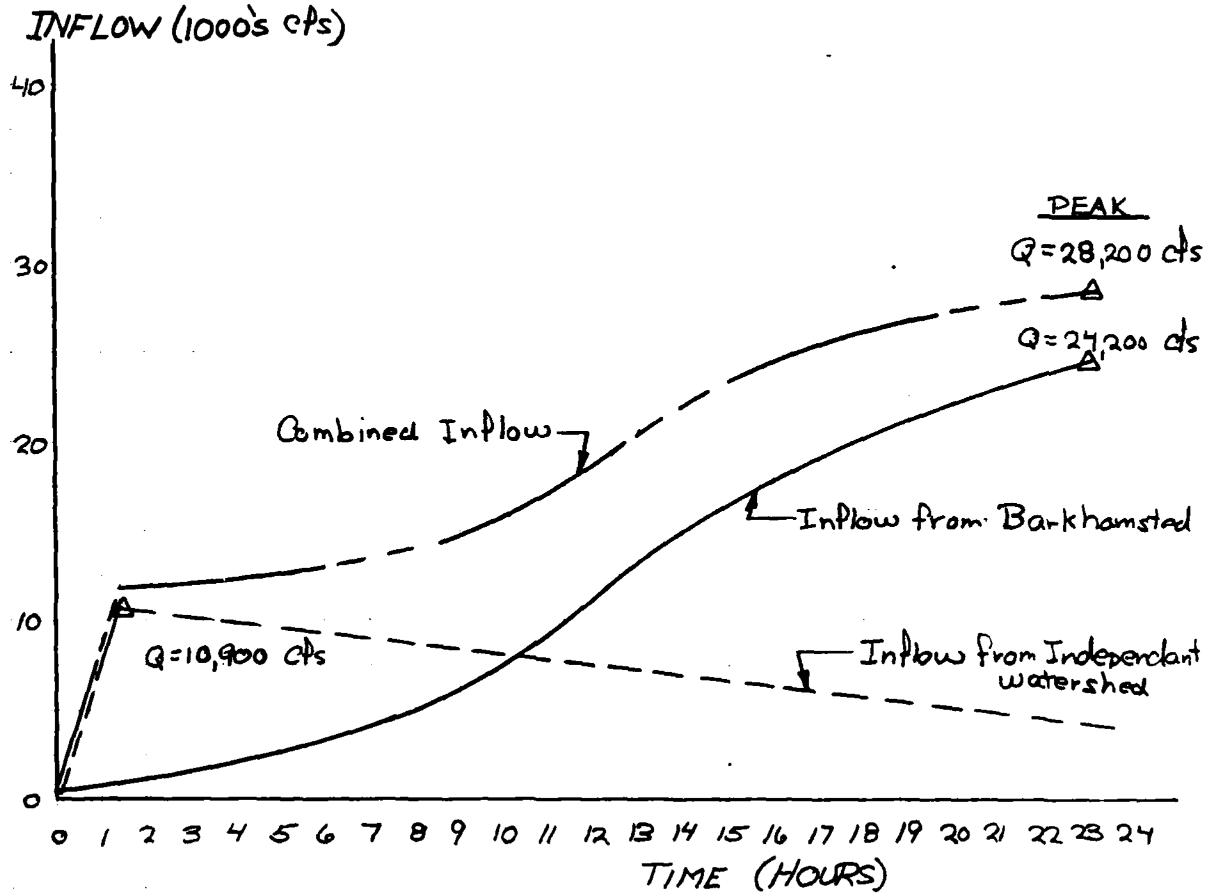
PHOTO 12

SEEPAGE THROUGH WALL OF DIVERSION TUNNEL

APPENDIX D

STORCH ENGINEERS
Engineers · Landscape Architects
Planners · Environmental Consultants

Inflow Hydrograph - based on outflow from Barkhamsted Reservoir and an independant watershed of 7.4 SM.



<u>Routed Outflow</u>: from "Preliminary Guidance for Estimating Maximum Probable Discharges"

① $Q_{P_1} = 28{,}200$ cfs

② a. $H_1 = 9.5'$

b. $STOR_1 = 2.7''$

c. $Q_{P_2} = Q_{P_1}(1 - STOR_1/19) = 28200(1 - 2.7/19) = 24{,}164$ cfs

③ a. $H_2 = 8.7'$

$STOR_2 = 2.47''$

b. $STOR_{avg} = (2.47 + 2.7)/2 = 2.585''$

$Q_{P_3} = 28200(1 - 2.585/19) = 24{,}360$ cfs

$H_3 = 8.45'$ = Elev 428.95 < Top of Dam Elev 433 <u>OK</u>

STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWN STREAM DAM FAILURE HYDROGRAPHS

I Section @ Rte 44 Crossing, New Hartford

① $S = 13{,}470$ Ac-ft

② $Q_{P_1} = 8/27(W_b\sqrt{g})\, Y_0^{3/2} = 8/27(380)(\sqrt{32.2})(75)^{3/2} = 414{,}980$ cfs

③ See stage discharge sheet

II ④ A. $D_1 = 31.5'$, $A_1 = 16{,}800\ ft^2$

$L_1 = 10{,}000'$

$V = 3{,}856$ Ac-ft

B. $Q_{P_2} = Q_{P_1}(1 - V/S) = 414980(1 - 3856/13470) = 296{,}160$ cfs

C. $D_2 = 27'$ $A_2 = 12{,}000\ ft^2$

D. $A_{avg} = 14{,}400\ ft^2$ $V_{avg} = 3305$ Ac-ft

$Q_{P_2} = 414980(1 - 3305/13470) = 313{,}160$ cfs

$D_2 = 28'$

III Section @ Rte 25 Crossing, Canton

④ A. $D_2 = 28'$, $A = 12{,}800\ ft^2$

$L_2 = 12{,}000'$

$V_2 = 3526$ Ac-ft

B. $Q_{P_3} = 313160(1 - 3526/13470) = 231{,}185$ cfs

C. $D_3 = 24'$ $A_3 = 9{,}600\ ft^2$

D. $A_{avg} = 11{,}200\ ft^2$ $V_3 = 3085$ Ac-ft

$Q_{P_3} = 313{,}160(1 - 3085/13470) = 241{,}440$ cfs

$D_3 = 25'$ $A_3 = 10{,}400\ ft^2$

IV Section @ Rte 179 Crossing, Collinsville

④ A. $D_3 = 25'$ $A_3 = 10{,}400\ ft^2$

$L_3 = 10{,}000'$

$V_3 = 2387$ Ac-ft

B. $Q_{P_4} = 241{,}440(1 - 2387/13470) = 198{,}650$ cfs

C. $D_4 = 23'$ $A_3 = 8710\ ft^2$

D. $A_{avg} = 9555\ ft^2$ $V_4 = 2193$ Ac-ft

$Q_{P_4} = 241440(1 - 2193/13470) = 202{,}132$ cfs

$D_4 = 23.5'$ $A_4 = 8{,}800\ ft^2$

V Section @ Rte 177 crossing Unionville

(4) A. $D_4 = 23.5'$ $A_4 = 8800\ ft^2$

$L_5 = 28000\ ft$

$V_5 = 5656\ Ac\text{-}ft$

B. $Q_{P5} = 202132(1 - 5656/13470) = 117{,}260\ cfs$

C. $D_5 = 18.5'$ $A_5 = 4{,}800\ ft^2$

D. $A_{avg} = 6800\ ft^2$ $V_{avg} = 4370\ Ac\text{-}ft$

$Q_{P5} = 202132(1 - 4370/13470) = 136{,}555\ cfs$

$D_5\ 20'$ $A_5 = 5{,}600\ ft^2$

VI Section @ NYNH&H RR crossing, River Glen

(4) A. $D_5 = 20'$ $A_5 = 5{,}600\ ft^2$

$L_6 = 8{,}500'$

$V_6 = 1092\ Ac\text{-}ft$

B. $Q_{P6} = 136555(1 - 1092/13470) = 125{,}485\ cfs$

C. $D_6 = 19'$ $A_6 = 5{,}280\ ft^2$

D $A_{avg} = 5{,}440\ ft^2$ $V_{avg} = 1061\ Ac\text{-}ft$

$Q_{P6} = 136555(1 - 1061/13470) = 125{,}800\ cfs$

$D_6 = 19.5'$

STORCH ENGINEERS
Engineers - Landscape Architects
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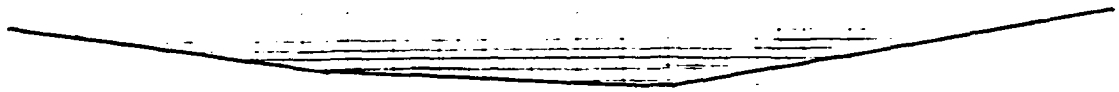
TYPICAL SECTION- FARMINGTON RIVER

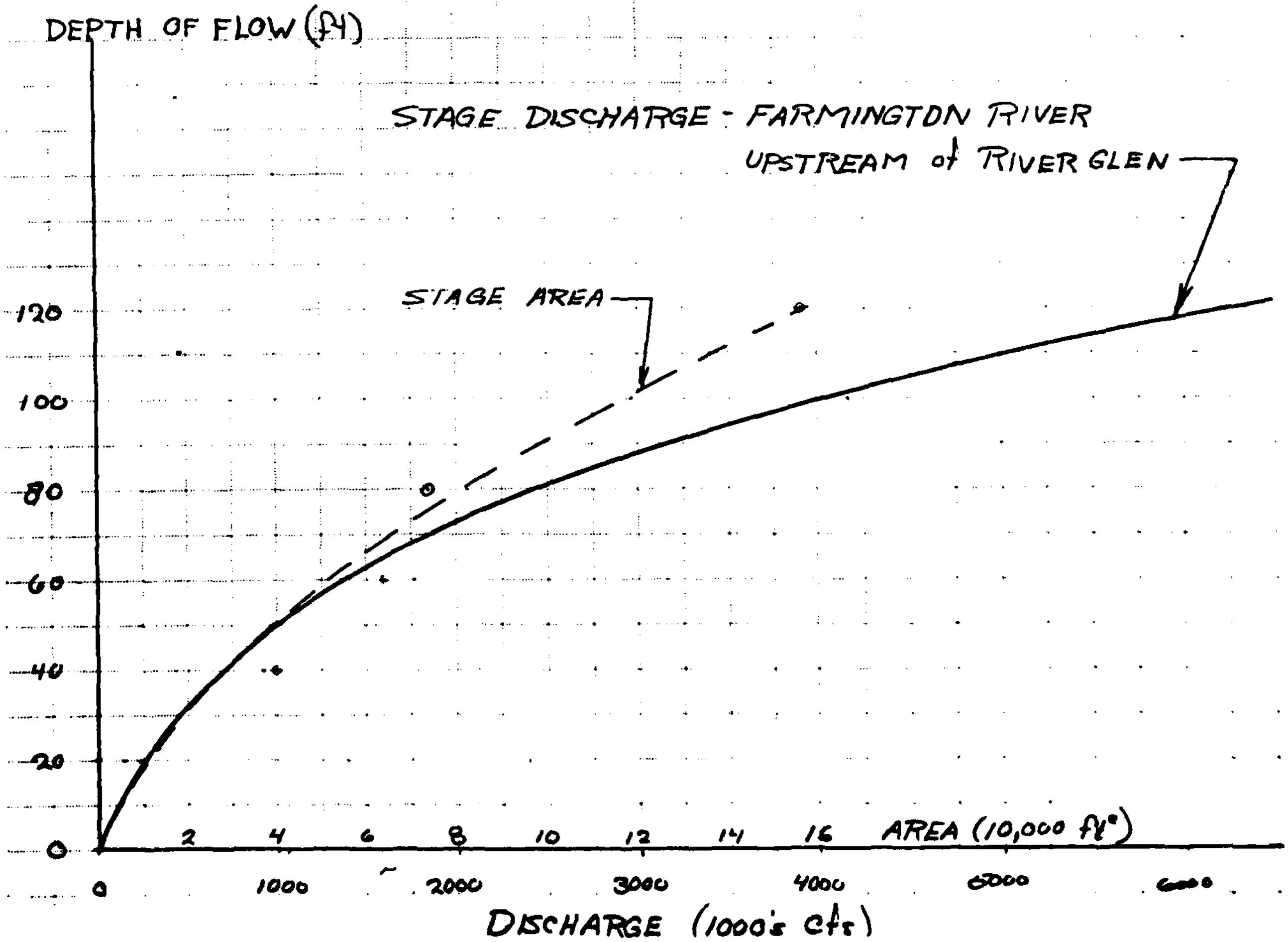
$V = \frac{1.486}{n} R^{2/3} S^{1/2}$

$S = .0028$

$n = .035$ (avg)



D_{ft}	WP_{ft}	A_{ft^2}	R	$R^{2/3}$	$S^{1/2}$	V_{fps}	Q_{cfs}
10	300	2000	6.67	3.54	.0527	7.92	15,840
20	590	9600	16.27	6.43	.0527	14.4	138,240
40	1230	40,000	32.52	10.2	.0527	22.8	912,000
60	1480	64000	43.24	12.33	.0527	27.62	1,767,680
80	1670	73600	44.08	12.49	.0527	27.98	2,059,151
100	1890	118,400	62.65	15.79	.0527	35.37	4,187,760
120	2100	156,800	74.67	17.75	.0527	39.76	6,234,368



STORCH ENGINEERS
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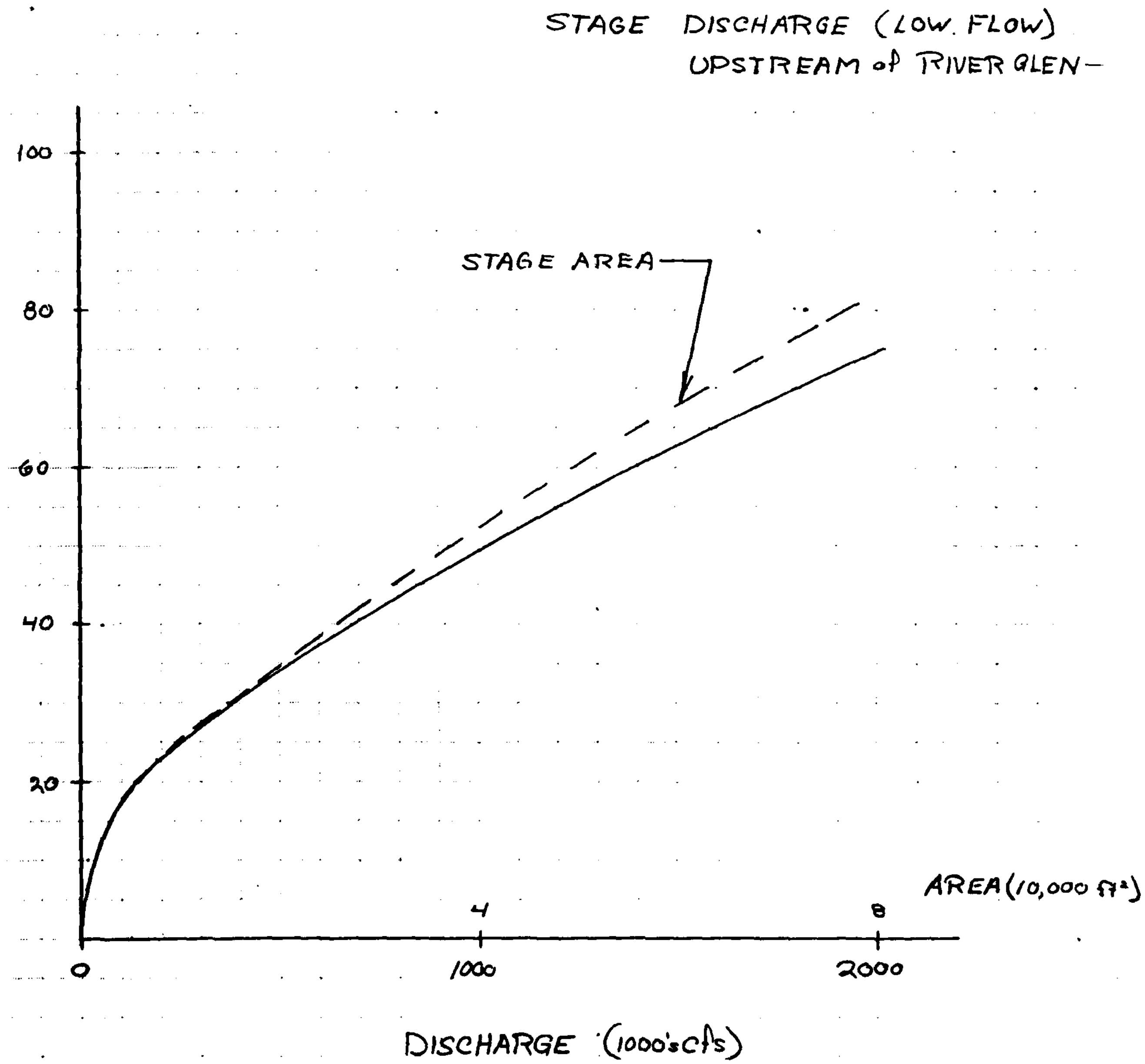
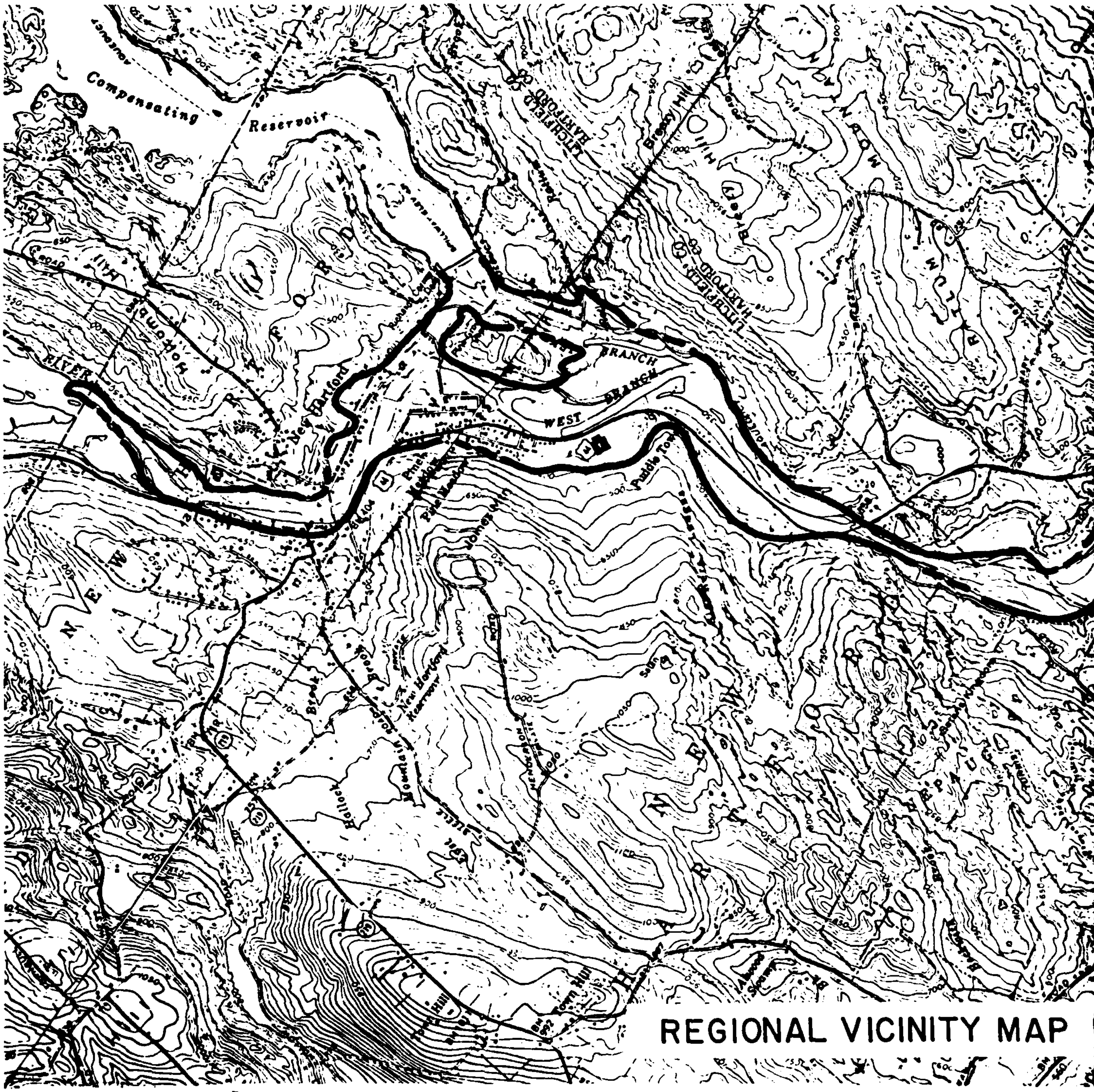
Planners - Environmental Consultants

TYPICAL SECTION - FARMINGTON RIVER





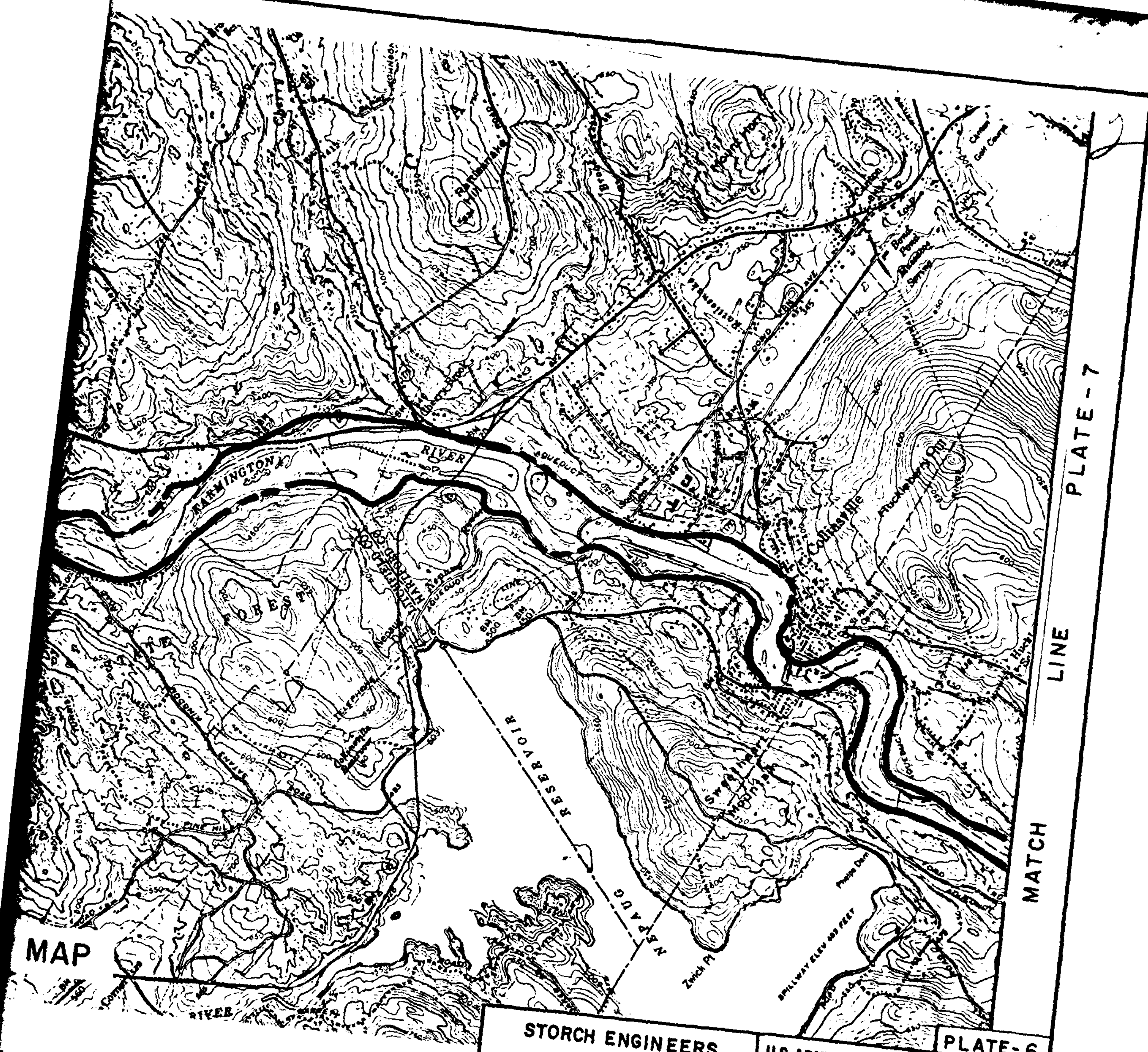
LEGEND

DENOTES LIMITS OF FLOODING IN CASE OF DAM FAILURE

SCALE 1:24000

CONTOUR INTERVAL 10 FEET

DATUM IS MEAN SEA LEVEL



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

PLATE- 6

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

RICHARD'S CORNER DAM

FARMINGTON RIVER

CONNECTICUT

SCALE: AS SHOWN

DATE : SEPTEMBER- 1978

MATCH LINE PLATE - 6

REGIONAL VICINITY MAP

SCALE 1:24000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

DENOTES LIMITS OF FLOODING IN CASE OF DAM FAILURE

AD-A144 162 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS RICHARD'S CORNER DAM (..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV SEP 78

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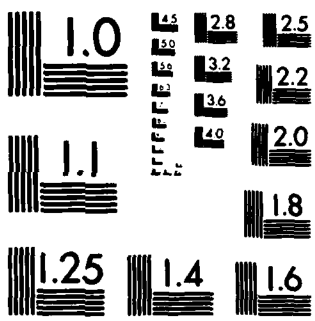

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

2

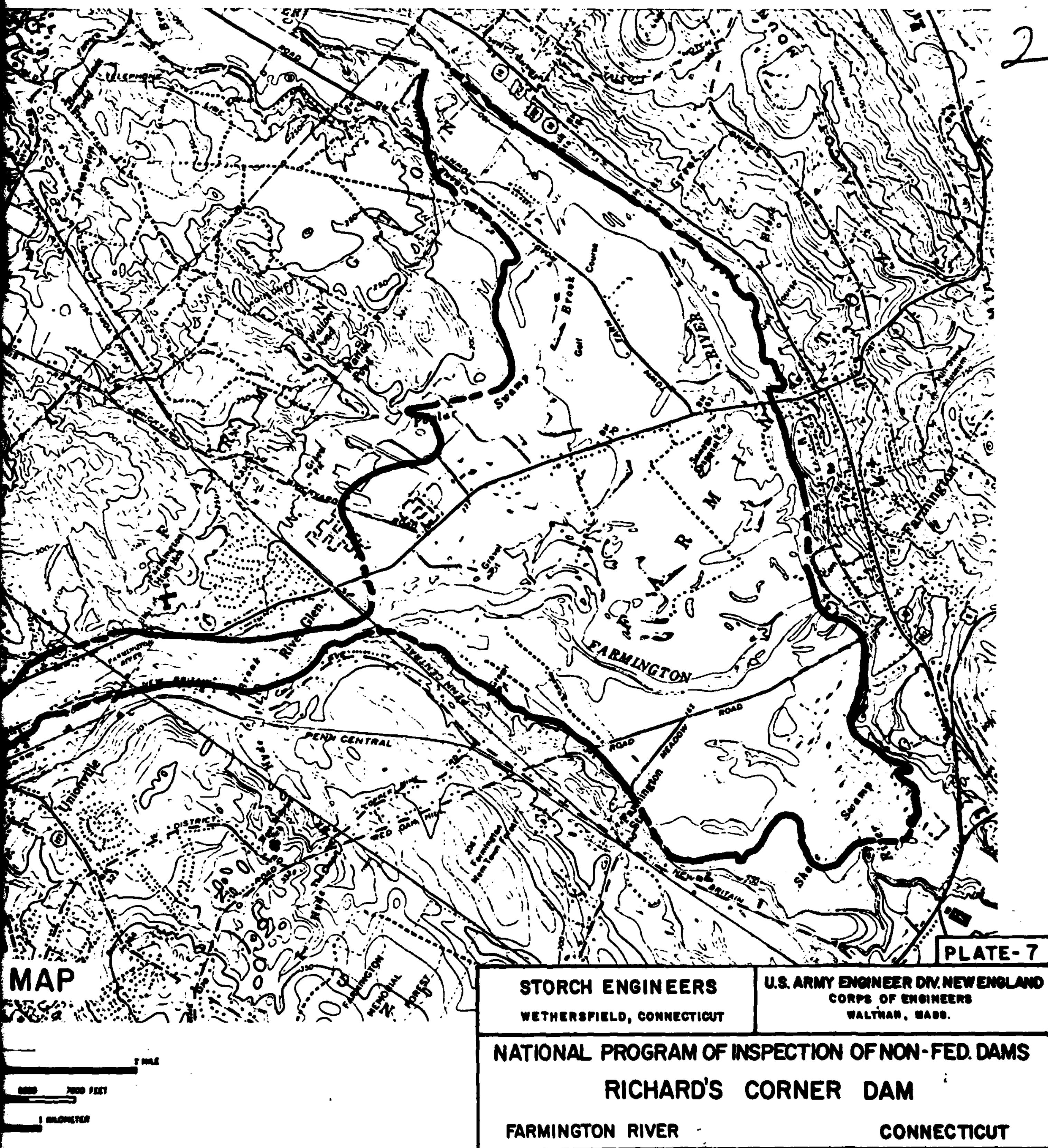

PLATE-7

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

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

RICHARD'S CORNER DAM

FARMINGTON RIVER — CONNECTICUT

SCALE: AS SHOWN

DATE: SEPTEMBER-1978