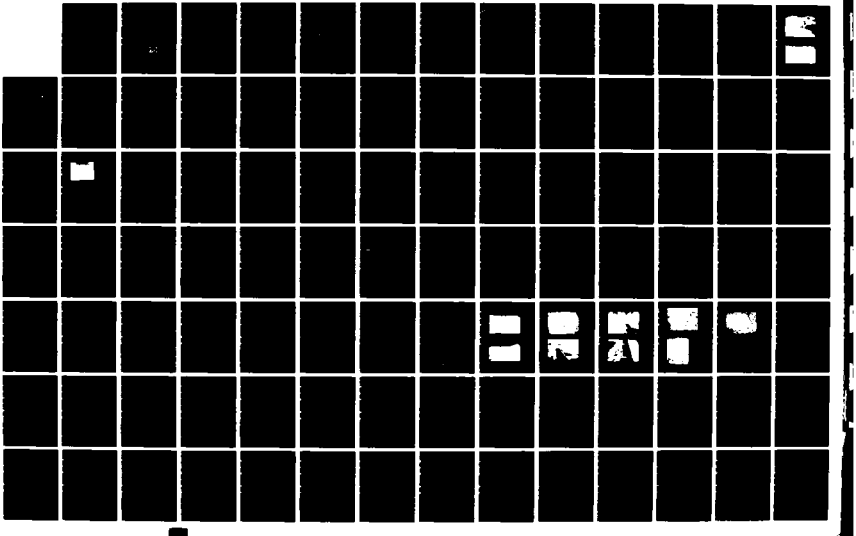
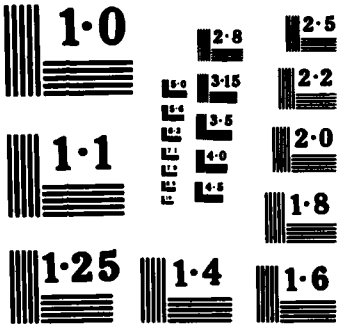
AD-A144 551 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/2
ANDOVER LAKE DAM (CT.. (U) CORPS OF ENGINEERS WALTHAM MA
NEW ENGLAND DIV DEC 79

UNCLASSIFIED F/G 13/13 NL




1·0
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·5
2·8
3·15
3·5
4·0
4·5

THAMES RIVER BASIN
ANDOVER, CONNECTICUT

ANDOVER LAKE DAM

CT. 00624

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

DECEMBER 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00624	2. GOVT ACCESSION NO. AD-A144	3. RECIPIENT'S CATALOG NUMBER 537
4. TITLE (and Subtitle) Andover Lake Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE December 1979 13. NUMBER OF PAGES 6
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

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

18. SUPPLEMENTARY NOTES

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

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

DAMS, INSPECTION, DAM SAFETY,

Thames River Basin
Andover, Connecticut

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

Andover Lake Dam is an earth embankment dam with a concrete parapet wall along most of its crest. The dam is about 454 ft. long and 20 ft. high. The dam is judged to be in generally fair condition. Based on the intermediate size and significant hazard, the range for the test flood is ½ PMF to a full PMF.

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

ANDOVER LAKE DAM

CT 00624

THAMES RIVER BASIN
ANDOVER, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

This Phase I Inspection Report on Andover Lake 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.

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Foundation & Materials Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRIAR
Chief, Engineering Division

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	CT 00624
Name of Dam:	Andover Lake Dam
Town:	Andover
County and State:	Tolland, Connecticut
Stream:	Blackman Brook
Date of Inspection:	25 October 1979

BRIEF ASSESSMENT

Andover Lake Dam is an earth embankment dam with a concrete parapet wall along most of its crest. The dam is about 454 ft. long and 20 ft. high. To the right of the dam the reservoir rim has a saddle whose low point is 1.25 ft. below the level of the parapet. A 39 ft. wide concrete spillway with a 7 ft. wide stop-log notch is located about 50 ft. from the left abutment. A 24 in. dia. outlet pipe through the embankment is controlled by a gate valve, which at the time of the inspection was completely submerged. A superstructure and access bridge for the outlet are scheduled to be built in 1980.

Andover Lake is a privately owned recreational facility. The lake is about 4,500 ft. long and has a surface area of 156 acres at spillway crest level. The drainage area is 3.95 sq. mi. (2,528 acres) and the maximum storage to top of the low point in the right abutment is 1,355 acre-ft.; the size classification is thus intermediate. Failure of the dam would cause severe flooding of three roadways, including a State Highway, and a service station, a commercial building and three homes would sustain minor flood damage. Consequently, the dam has been classified as having a significant hazard potential. Based on intermediate size and significant hazard, the range for the test flood is ½ PMF to a full PMF. The selected test flood for the project is a ½ PMF (4,350 cfs).

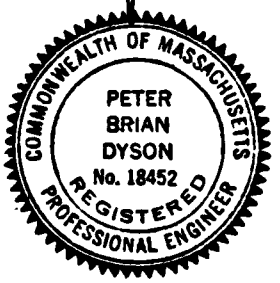
The routed test flood outflow of 2,950 cfs would overtop the low point near the right abutment saddle by 2.3 ft. and the top of the parapet by 1.05 ft. The spillway can pass about 280 cfs or about 9 percent of the routed test flood outflow without overtopping the low point near the right abutment.

The dam is judged to be in generally fair condition. At the time of the inspection vegetative growth had invaded the embankment, there were cracks in the abutment walls of the spillway, and the spillway's discharge channel was encroaching on the toe of the dam embankment for a distance of about 150 ft. The discharge channel for the low level outlet was in need of repair and had an area of persistent seepage. The top of the embankment was lower than the top of the concrete parapet wall. There was some displacement of riprap on the upstream slope and areas of local erosion on the downstream slope.

Within one year after receipt of this Phase I Inspection Report, the owner, Andover Lake Management Association, Inc., should retain the services of a registered professional engineer and implement the results of his evaluation of the following: (1) evaluate further the potential for overtopping and the adequacy of the spillway; (2) determine the feasibility of raising the embankment and the saddle in the reservoir rim to the level of the top of the parapet wall; (3) determine the advisibility of providing a graded filter and channel for the seepage in the low level outlet channel; (4) evaluate the structural implications of cracks through the abutment walls of the spillway; and (5) study the need for reinforcement of the toe where the spillway discharge channel traverses close to it, or for rechanneling the spillway outlet to direct flows away from the toe of the dam.

The owner should also implement the following operating and maintenance measures: (1) remove brush and trees from the embankment on a regular basis of not less than once per year; (2) remove overhanging trees and brush in the downstream channel; (3) clean out and backfill abandoned animal burrows and erosion troughs on the downstream slope and restore area to grade; (4) dislodged riprap in the outlet channel should be reset or replaced; (5) restore the embankment immediately west of the spillway to grade and protect the upstream slope with riprap; (6) caulk cracks in the spillway training walls, pending results of investigations recommended in Section 7.2; (7) repair deteriorated concrete on parapet wall; (8) monitor seepage in the low level outlet channel and marshy areas at toe of dam on a monthly basis; (9) develop a formal surveillance and flood warning plan, including round-the-clock monitoring during periods of heavy precipitation; and (10) institute procedures for an annual inspection of the dam and its appurtenant structures.

Peter B. Dyson
Project Manager



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

REPLY TO
ATTENTION OF
NEDED

MAR 05 1980

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

Dear Governor Grasso:

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

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Andover Lake Management Association, Inc., Andover, Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

PREFACE

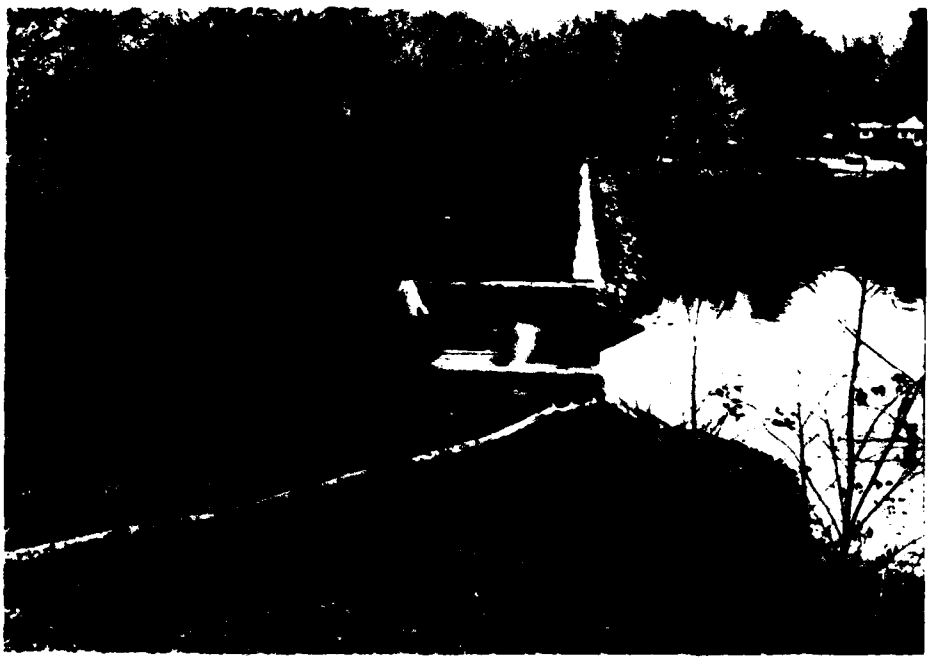
This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously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

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

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

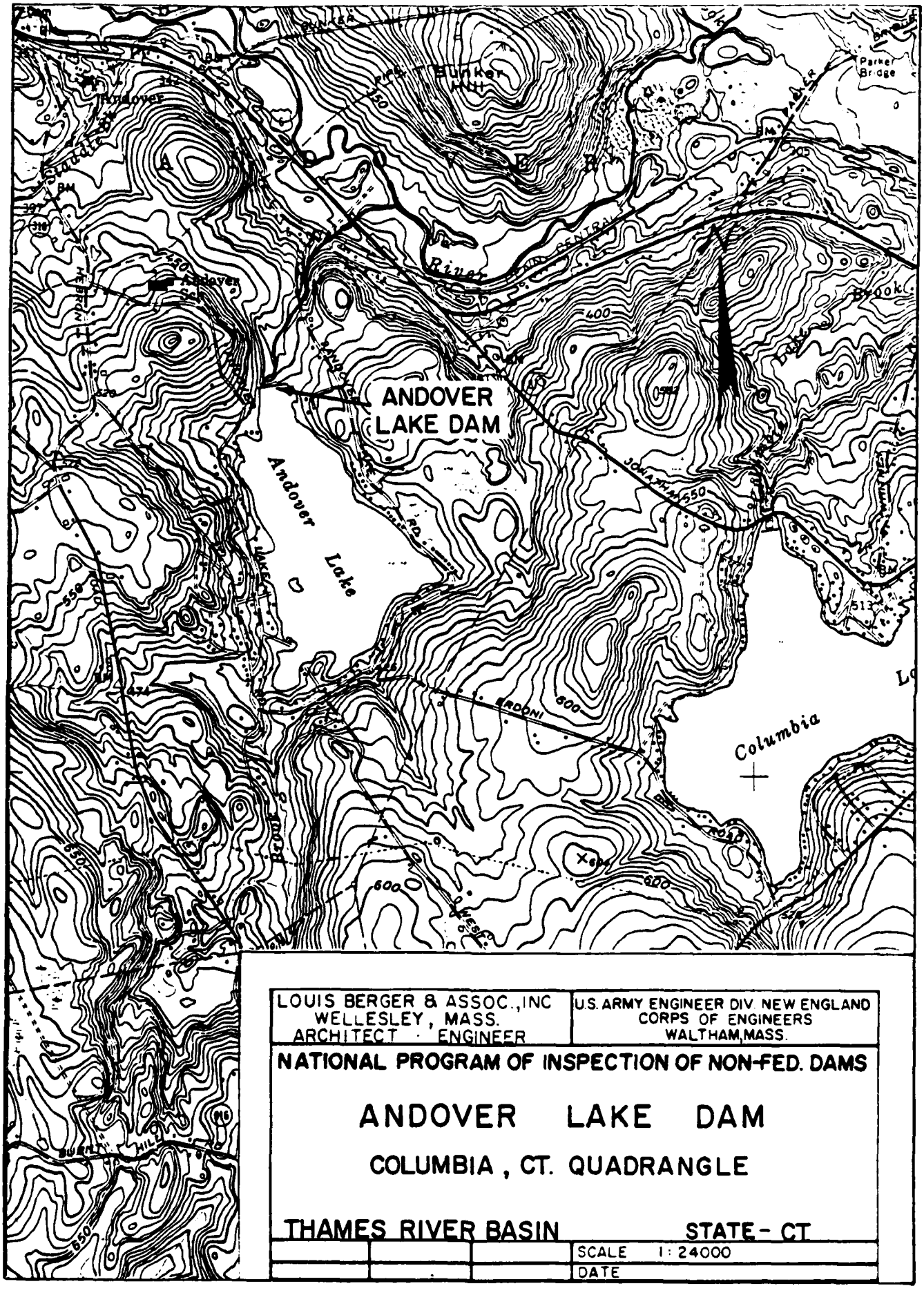
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because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

TABLE OF CONTENTS



Overview of spillway and dam from left abutment.

Overview of right abutment and saddle area.



LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

ANDOVER LAKE DAM

COLUMBIA, CT. QUADRANGLE

THAMES RIVER BASIN STATE - CT

			SCALE 1:24000
			DATE

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT ANDOVER LAKE DAM DATE 25 October 1979

TIME 2:45 PM

WEATHER Sunny/Warm

W.S. ELEV. 414.6 U.S. ____ DN.S.

PARTY:

1. Peter B. Dyson
2. Pasquale E. Corsetti
3. Roger F. Berry
4. Carl J. Hoffman
5. James Reynolds
6. Arthur Horn (owner's representative)
7. ____
8. ____
9. ____
10. ____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Hydrologic	Roger F. Berry	LBA
2.	Hydraulics/Structures	Carl J. Hoffman	LBA
3.	Soils/Geology	James Reynolds	GZD
4.	General Features	Peter B. Dyson	LBA
5.	General Features	Pasquale E. Corsetti	LBA
6.			
7.			
8.			
9.			
10.			

LBA - Louis Berger & Associates, Inc.
GZD - Goldberg, Zoino, Dunnicliff & Assoc., Inc.

PERIODIC INSPECTION CHECKLIST

PROJECT ANDOVER LAKE DAM DATE 25 October 1979

PROJECT FEATURE Earth Embankment NAME

DISCIPLINE Soils/Geology NAME James Reynolds

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	417.9 (Top of Parapet)
Current Pool Elevation	414.6
Maximum Impoundment to Date	Unknown
Surface Cracks	Abandoned animal burrows on downstream slope. Sloughing on slope.
Pavement Condition	N.A.
Movement or Settlement of Crest	Yes; varies by about 0.7 ft.
Lateral Movement	None
Vertical Alginment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Concrete side walls on spillway cracked.
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Yes; upstream slope
Sloughing or Erosion of Slopes or Abutments	Several erosion sloughs, 150 to 200 ft. from spillway on right side and erosion left of spillway.
Rock Slope Protection - Riprap Failures	See Note (1) on next page
Unusual Movement or Cracking at or near Toes	None, but erosion evident between riprap.
Unusual Embankment or Downstream Seepage	Wet marshy zones at toe of embankment 100 to 200 ft. right of spillway. Seep from right bank of drawdown outlet channel, 0.5 to 1.0 gpm.
Piping or Boils	None; seep shows no turbidity
Foundation Drainage Features	Unknown
Toe Drains	Unknown
Instrumentation System	Unknown

Note (1): Toe riprap appears inadequate to protect against discharge channel from spillway. Riprap appears inadequate in size and extent on embankment left of spillway.

PERIODIC INSPECTION CHECKLIST

PROJECT ANDOVER LAKE DAM DATE 25 October 1979

PROJECT FEATURE Outlet Pipe NAME

DISCIPLINE Hydraulics/Structures NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Outlet Head Wall (Fair)
Rust or Staining on Concrete	None
Spalling	None
Erosion or Cavitation	None
Cracking	None
Alignment of Monoliths	N.A.
Alignment of Joints	N.A.
Numbering of Monoliths	N.A.

Outlet pipe is a 24 inch, circular, steel pipe.

PERIODIC INSPECTION CHECKLIST

PROJECT ANDOVER LAKE DAM DATE 25 October 1979

PROJECT FEATURE Outlet Channel NAME

DISCIPLINE Hydraulics/Structures NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Riprap lined
Rust or Staining	N.A.
Spalling	N.A.
Erosion or Cavitation	Riprap and earth severely eroded
Visible Reinforcing	N.A.
Any Seepage or Efflorescence	Yes, in right bank, 0.5 to 1.0 gpm
Condition at Joints	N.A.
Drain Holes	N.A.
Channel	Severely eroded
Loose Rock or Trees Overhanging Channel	Random boulders, many trees
Condition of Discharge Channel	Undefined

PERIODIC INSPECTION CHECKLIST

PROJECT ANDOVER LAKE DAM DATE 25 October 1979

PROJECT FEATURE Spillway NAME

DISCIPLINE Hydraulics/Structures NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	No
Trees Overhanging Channel	No
Floor of Approach Channel	Unknown
b. Weir and Training Walls	
General Condition of Concrete	Cracks in both training walls
Rust or Staining	Yes
Spalling	Yes, especially right training wall
Any Visible Reinforcing	No
Any Seepage or Efflorescence	Yes, along horizontal spillway joint
Drain Holes	None
c. Discharge Channel	
General Condition	Fair; poorly defined, close to toe of dam
Loose Rock Overhanging Channel	No
Trees Overhanging Channel	Yes, many
Floor of Channel	Boulders
Other Obstructions	Partially overgrown

PERIODIC INSPECTION CHECKLIST

PROJECT ANDOVER LAKE DAM DATE 25 October 1979

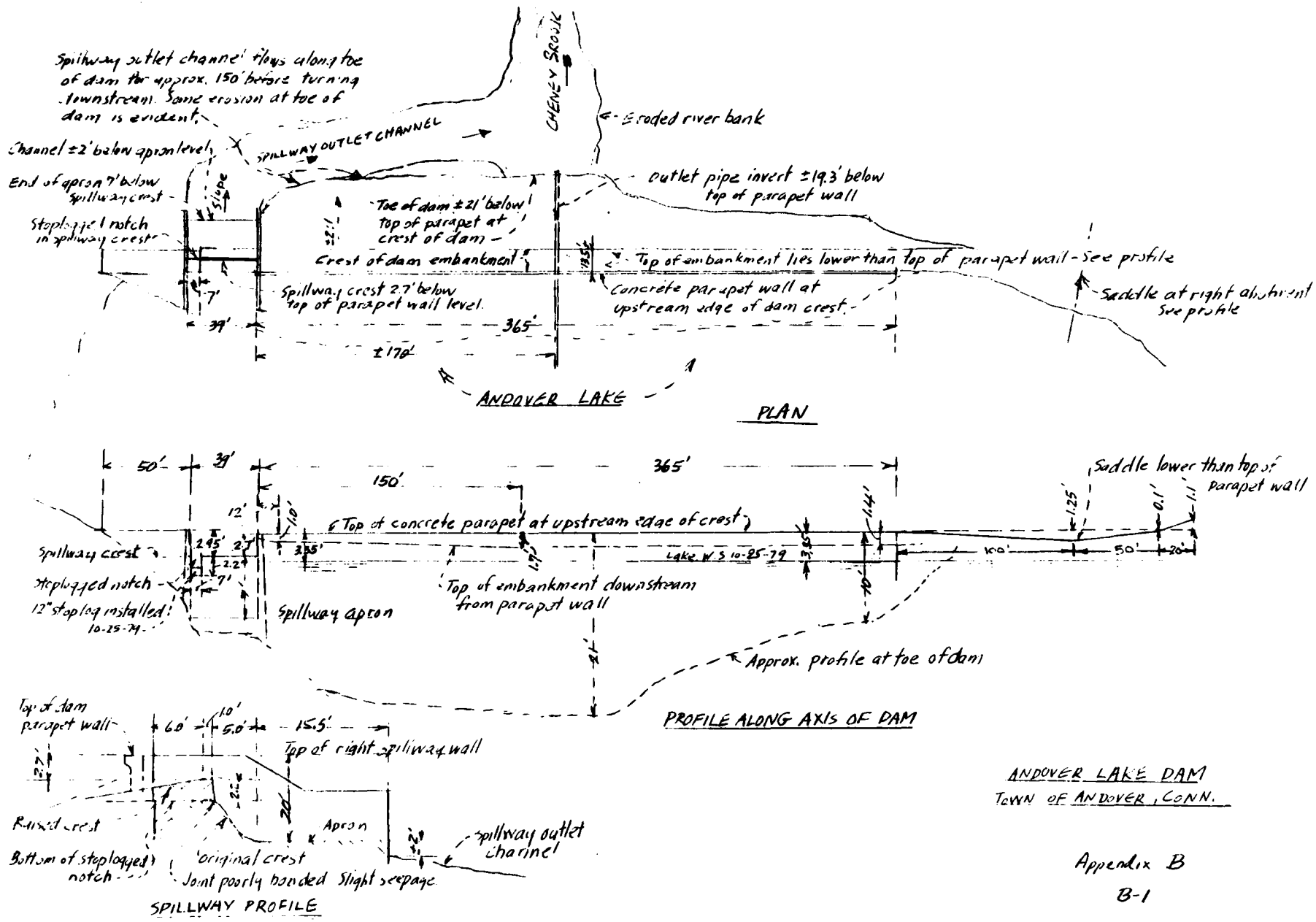
PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITIONS
Dike Embankment	N.A.
Outlet Works - Control Tower	N.A.
Outlet Works - Intake Channel and Intake Structure	N.A.
Outlet Works - Service Bridge	N.A.

APPENDIX B

ENGINEERING DATA



ANDOVER LAKE DAM
TOWN OF ANDOVER, CONN.

Appendix B
B-1

B (according to file) 20

CT 624

STATE BOARD FOR THE SUPERVISION OF DAMS
INVENTORY DATA

19 Apr 1963 9.20

Name of Dam or Pond #2 Andover Lake

Code No. HP 8.0 CY 0.8 LAT. 41° 43.6'

Location of Structure: LONG. 72° 21.7'

Town Andover

Name of Stream Cheney Br

U.S.G.S. Quad. Columbia

Owner Andover Lake Management Assoc. at 6/73

Address c/o Edward Yeomans

Lake Road

Andover

1920?

Pond Used For R 0.A. 895 sm

Dimensions of Pond: Width ______ Length ______ Area 155.0

Total Length of Dam ± 400' Length of Spillway 40'

Depth of Water Below Spillway Level (Downstream) = 10'

Height of Abutments Above Spillway 3' ±

Type of Spillway Construction [illegible] at end of dike

Type of Dike Construction [illegible] parapet

Downstream Conditions [illegible]

Summary of File Data Inspection Report by Stephen Kusnik Nov 7 '58 recommending maintenance & repairs

Remarks [illegible] of scouring [illegible]

[illegible] outlet in thin fill [illegible] deteriorated

springs [illegible] (deposition brown scum)

sand [illegible] (possibly to cause settlement)

Vic

ANDOVER LAKE MANAGEMENT ASSOCIATION, INC.

ANDOVER, CONNECTICUT 06232

June 6, 1977

20

Edward J. Daly, Director
Water Resources Unit
Department of Environmental Protection
State Office Building
Hartford, Conn. 06115

Dear Sir:

This is in reference to your letter of May 6, 1977 concerning dam maintenance work or deficiencies that require attention.

Item one concerning eroded fill and stone rip on the west side of the dam has been replaced.

Item two concerning brush growth on dam slope is in the process of being cut and will be completely shortly.

Item three concerning concrete deterioration in the eastern downstream wing wall of the spillway will be repaired within the next two months.

Sincerely,

Robert S. Rancourt

Robert J. Rancourt, President
Andover Lake Management Assoc.

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OFFICE BUILDING HARTFORD, CONNECTICUT 06115

6 May 1977

Andover Lake Management Association
c/o Edward Yeomans
Lake Road
Andover, Connecticut 06232

Re: Andover Lake Dam
Andover 1

Gentlemen:

According to records maintained in this office, the above-mentioned dam is under your ownership.

Section 25-110 (Public Law No. 571, 1975 Revision of the General Statutes), a copy of which is enclosed, places under the jurisdiction of this department all dams, which by breaking away or otherwise, might endanger life or property. It has been determined that this dam is under our jurisdiction.

In accordance with Section 25-111 (1975 Revision of the General Statutes) this dam has been inspected. In order to maintain your dam in a safe condition, the following maintenance work or deficiencies should receive attention:

1. The fill and stone rip rap eroded from the section near the upstream spillway abutment on the west side of the dam should be replaced.

2. Brush growth on dam slope should be cut.

3. Concrete deterioration in the eastern downstream wing wall of the spillway should be attended to.

The Water Resources Unit of the Department of Environmental Protection shall be notified within two weeks as to what steps you plan to take to accomplish this work.

If you have any questions, please contact Victor Galgowski, Supt. of Dam Maintenance, at 566-7245.

Sincerely,

Edward J. Daly, Director
Water Resources Unit

EJD:ljk
Enclosure

Dam Inspection Report

Town: Andover

Date of Inspection: May 28, 1975

Name of Impoundment: Andover Lake #1

Remarks: The flashboards have been replaced in the spillway for the summer season. The owner has had rip-rap placed over the upstream slope paving to protect it and fill any voids. This appears to have been quite an effective repair. That is the apparent extent of repairs to the structure to this time however. The concrete cap is still falling apart in sections. The earth embankment section east of the dam is still 12"-18" lower than the concrete cap. This area has been slope protected like the apron slope paving was. This area is some what lower than the dike itself and would overtop first. Since it is an area seperate from the dike it is also the most desirable area to have overtopping first.

The downstream slope of the dam was covered with a thick growth of brush, poison ivy and briars, making it impossible to make an inspection of the toe area or the outlet of the dam downstream structure.

It doesn't appear that any more than this rip-rap dumping has been done. There is concrete deterioration in the eastern wing-wall of the spillway section - not noted in Tim Thompsons report that should be patched when the deteriorated cap slabs are replaced.

Recommendations: None.

Owner Notified: Phone _____ (date) Letter: _____ (date)

_____ (Inspector's Signature)

Robt. E. Smeaton

B-5

AD A019 624

5/29/75

Andover Lake Dam

2

49 Greenhurst Road
West Hartford, Conn. 06107

Mr. Charles Minicucci
C & M Oil Service
Bolton, Conn., 06040

Inspection
Andover Lake Dam
Andover, Conn.

The inspection of Andover Lake earth dam, concrete apron, concrete spillway and weir section was completed on April 30th, 1975, and found to be in excellent condition.

Inspection:

1.) The flash boards in the weir section of the dam had not been replaced after removalfor the winter season. Flow through this areaapproximated five (5) inches.

2.) With the flash boards omitted, this provided an excellent opportunity to inspect the upstream face of the dam, while the lake level was approximately 2½ two and one half below summer levels.

3.) The full face of the concrete apron, for the completelength of the dam was riprapped and extended to high ground west of the spillway, and the area east of the dam was also riprapped to high ground.

4.) The concrete spillway with its weir section are in good condition.

5.) The 24" cast iron drain through the dam showed no signs of leakage.

6.) An inspection of the downstream face of the dam failed to show any signs of animal burrows .

7.) The brush on the downstream face of the dam, which had been cut at the previous inspection in December 1972 has grown up again.

8.) The low spot adjacent to the west abutment has been filled to the top of the abutment and riprap was added on the upstream face. Fishermen have apparently used this area for fishing and the riprap has been dislodged down the face.

Recommendations:

A.) Additional riprap should be placed adjacent to the west abutment to the height of the abutment for the 35 feet or so of shoreline at this end of the dam. (Note: See #8 under inspection)

B.) The brush on the downstream face of the dam should be cut, preferrably before the leaves out. This should be a routine procedure at least every other year.

Very truly yours,

Stephen Kusmik
Civil Engineer

c.c. Environmental Protection Agency
Water resources Area
Capitol Avenue
Hartford, Conn.
c.c. S. Kusmik

BUCK & BUCK
ENGINEERS
98 WADSWORTH STREET, HARTFORD, CONNECTICUT 06106

JAMES A. THOMPSON
ROBINSON W. BUCK
LAWRENCE P. BUCK

HENRY WOLCOTT BUCK
1921-1966
ROBINSON D. BUCK
1928-1950

COMM. 5713-94

May 8, 1974

Mr. Victor Galgowski
Supt. of Dams
Water & Related Resources Section
Dept. of Environmental Protection
State Office Building
Hartford, Conn. 06106

RE: Lake Andover

Dear Vic:

The following is a report on our April 25, 1974 inspection of the subject dam.

1. The rubble stone masonry retaining wall at the outlet pipe has fallen down. This wall must be replaced to stabilize the downstream slope of the dam in the vicinity of the outlet pipe.

2. Upstream slope paving is disintegrating in many areas and is starting to develop hollow spaces under the remaining concrete paving. These hollow spaces should be filled to prevent further erosion and the slope paving repaired to prevent its complete disintegration.

3. The concrete cap near the east end is disintegrating. This cap should be replaced or repaired.

4. The top of the earth embankment at the east abutment is approximately 18" below the top of the concrete cap. The top of the embankment should be raised so that it is no lower than the top of the concrete cap.

Sincerely,
BUCK & BUCK

James A. Thompson

JAT:dlb

49 Greenhurst Road
West Hartford, Connecticut
December 20, 1972

Mr. Roland E. D'Amour
321 Lake Road
Andover, Connecticut 06232

Dear Mr. D'Amour:

Inspection
Andover Lake Dam
Andover, Connecticut

An inspection of the Andover Lake earth dam, concrete spillway, concrete apron and wier section was made on December 15, 1972 and found to be in generally satisfactory condition.

Inspection

1) The flash boards in the wier section of the dam had been removed. Flow through this area approximated 6 inches.

2) The lowering of the lake level by approximately 2½ feet due to the removal of the flash boards provided an excellent opportunity to inspect the concrete apron, particularly in the area between normal and the existing lowered level.

3) The concrete apron on the upstream face of the dam has shown additional deterioration due to frost, ice and wave action. There are now about six areas where the concrete has washed out exposing the surface below. This broken up concrete has deposited at the base of the apron below the water line. There were no signs of erosion in the areas where the concrete has washed out.

4) The riprap toe at the concrete apron was in excellent condition and, even in the areas where the concrete apron had deteriorated, there were no signs of undercutting.

5) The concrete spillway with its wier section are in good condition.

6) The 24" cast iron drain through the dam showed no signs of leakage.

7) The brush which covered the top and downstream slope of the dam had been cut and piled up on the downstream slope.

Mr. Roland E. D'Amour December 20, 1972

Inspection - Andover Lake Dam

8) The inspection of the downstream face of the dam failed to show any signs of animal burrows.

9) The area immediately adjacent to the west abutment of the spillway is about a foot lower than the top of the abutment and about two feet in width. The area is grass covered, with moss showing on the concrete abutment, indicating no recent overflow in this area. However, it was noted that there has been more erosion at the upstream face adjacent to the abutment. The riprapped slope just west of this area was in good condition.

Recommendations

A. The "channel" adjacent to the west abutment of the spillway should be filled in to the height of the abutment. This plus the eroded pocket at the upstream face at the abutment could be a gravel fill. The upstream face should then be riprapped for a distance of 15 to 20 feet to meet the existing riprap thus reinforcing that existing. Rather than handle two materials it might be more economical to use 4" to 8" quarry run stone for the complete repair.

B. While it does not seem necessary during this inspection to warrant doing any repairs in the deteriorated areas of the concrete apron, it could be more economical if this were done in conjunction with the other riprap recommended. If riprap were dumped on the concrete apron, where the deterioration is severe, this would prevent further concrete erosion and the possibility of undercutting the apron and causing further deterioration.

C. The earth area east of the dam, partially riprapped, although about three feet above the spillway, could under unusually severe flood conditions be breached, additional riprap should be placed in this area.

D. At time goes on, I can visualize additional deterioration of the concrete apron to the point where its function as a protection will no longer be valid. If there is no washing out of the underlying material, there will be no problem; however, if there is any such indication, the complete area of the concrete apron should be riprapped.

Very truly yours,

Stephen Kusmik

Stephen Kusmik
Civil Engineer

SK:fj

cc: State of Connecticut
Water Resources Commission
Capitol Avenue
Hartford, Connecticut

November 20, 1970

Mr. Roland E. D'Amour
32 Lake Road
Andover, Connecticut 06232

Dear Mr. D'Amour:

Inspection
Andover Lake Dam
Andover, Connecticut

An inspection of the Andover Lake earth dam, concrete spillway, concrete apron and weir section was made on November 8, 1970 and found to be in satisfactory condition.

Inspection

1) The joints in the concrete apron on the upstream face previously sealed with rubber base joint filler are generally intact above the water line but have all but disappeared at or below the water line.

2) Frost and ice action on the open joints of the concrete apron at or below the water line resulted in additional deterioration. There are several areas along the apron at and below the water line, where portions of the concrete has broken off, exposing the rip rap under the concrete. The largest of these few areas is about three square feet.

3) There is no evidence of undercutting of the concrete apron, the exposed rip rap under the deteriorated concrete apron areas or at the rip rap toe below the apron. The accumulation of light scum in these areas would preclude the possibility of any leakage in these areas.

4) Since the previous inspection in 1967, the concrete spillway has been rebuilt. The joint between the apron section and the spillway section has been eliminated by the removal of the top portion of the latter and replaced with a concrete cap. This repair has eliminated the seepage through the joint to the downstream construction joint.

5. The weir section is in good condition.

6. Leakage, which appeared to be under the spillway boards, was found to be the result of the flow over the boards, concentrated to one end, due to the boards not being level.

7) The 24 inch cast iron drain through the dam showed no signs of leakage.

8) A two or three year growth of brush has covered the top and downstream slope of the dam. The light growth indicates cutting since the last inspection.

9) The inspection of the downstream face of the dam failed to show evidence of any animal burrows.

10) The area immediately adjacent to the west abutment of the spillway is about 12" to 15" lower than the top of the dam or the adjacent ground. This "trench", about 24 inches wide on the average, is grass covered and moss is apparent on the adjacent concrete. This would indicate no recent overflow in this area.

Recommendations

A) The new weir boards are in good condition except for the uneven flow over the boards. A tapered 1" x 2" spline should be attached to the top board of the weir to distribute the overflow evenly across the weir and avoid the erosive effect of the concentrated flow at the east end of the weir.

B) The "channel" adjacent to the west spillway abutment should be filled in to the height of the spillway abutment. Additional riprap should be placed along the shore in this area. This would extend from the abutment to the existing riprap, possibly 15 feet along the shore.

C) Brush on top and the back slope of the dam should be cut this year. As a result of fairly constant clearing these past 6 years, brush growth has been reduced and, if continued on a regular schedule, should be practically eliminated in time.

D) There does not seem to be any erosion of the bank east of the dam to the property line where about 60% of the shore line has riprap. However, under heavy flood conditions and heavy wave action, similar to the flood of 1955, this area could be vulnerable to breaching through erosion.

Mr. Roland E. D'Amour November 20, 1970

Riprap should be added to this area to complete the protection. This should extend from the top of slope on a natural slope of the material into the water.

Very truly yours,

S. Kusmik

Stephen Kusmik
Civil Engineer

SK:fj

cc: State of Connecticut
Water Resources Commission
Capitol Avenue
Hartford, Connecticut

December 18, 1970

Mr. Roland E. D'Amour
32 Lake Road
Andover, Connecticut 06232

Re: Andover Lake Dam
Andover

Dear Mr. D'Amour:

We have received a copy of the November 20, 1970 report by your engineer, Mr. Stephen Kusmik.

We note under Item 4 of this report that apparently some work has been done to the spillway on this dam since 1967. We find no record of a construction permit being issued for any work for this dam since 1967. We enclose a copy of the General Statutes of Connecticut as they apply to dams and direct your attention to Section 25-112 "Permits for Construction". This statute specifies that before any work is done to a dam an application shall be made to the Water Resources Commission describing any such work. A decision is made at that time on whether or not a construction permit is necessary for the work. It appears that some of the work as recommended in Mr. Kusmik's report may require a construction permit from this office. You are therefore requested to submit plans of whatever work you intend to do on this structure.

We would suggest in preference to your engineer's recommendation No. A that the top board be planed off on the high side to distribute the flow evenly over the boards. All brush and trees growing on or within ten feet of the dam should be removed and can be done at any time without a permit.

We are having a consultant engineer to this Commission inspect this dam and it is expected that his report will be forthcoming. When we have received this report, we will send you a copy thereof.

Very truly yours,

William H. O'Brien, III
Civil Engineer

WHOIII:mh

Enclosure

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

GLASTONBURY, CONN.
217 HEBRON AVENUE
PHONE 633-9401

PROVIDENCE 3, R. I.
200 DYER STREET
PHONE GASPEE 1-0420

JOHN J. MOZZOCHI
ASSOCIATES
OWEN J. WHITE
JOHN LUCHS, JR.
ECTOR L. GIOVANNINI

May 2, 1963

REPLY TO: Glastonbury

William S. Wise-Director
Water Resources Commission
State Office Building
Hartford 15, Connecticut

Re: Our File 57-73-40
Andover Lake Dam
Andover, Connecticut

Dear Mr. Wise:

In accordance with instructions from Robert McCabe, I made an inspection of the referenced dam on April 24, 1963.

This dam is an earthen dam about 400' long by 12' high with a concrete facing on the lake side and a concrete spillway 40 ft. wide having a freeboard of 3 ft. For about 100 feet at the east end and 20 feet at the west ends of the dam, the original ground surface is lower than the dam by about 1-1/2 ft. and therefore would act as additional emergency spillways when the discharge over the spillway was greater than 1-1/2 feet.

There is a drainage area of 3.9 sq. mi. with a lake surface of 160 acres. A 100-year storm would create a discharge of about 2 feet in the spillway with a consequent overflowing of the low areas at each end of the dam by about 6 inches.

This dam appears to be in sound condition and does not require any work, at this time.

Very truly yours,

John J. Mozzochi and Associates
Civil Engineers

JJM:hk

keep in file — File in ...

Carter Lake Dam — Analysis — 5/20/69

1. Kusnik's (engineer) letter of 8/2/65 mentioning rip-rapping of causeway(s?) [illegible] of dam to prevent erosion

2. Ratio $\frac{D.A.}{\text{pond area}} = \frac{3.9(640)}{160} = 15.6$ 35×347

1 CFS = 1.98 acre-ft/day

60 MPH = 88'/sec   6 MPH = 8.8   3 MPH = 4.4

Assume discharge of weir @ H = 2' = 35 × 2 × 5 = 350 CF

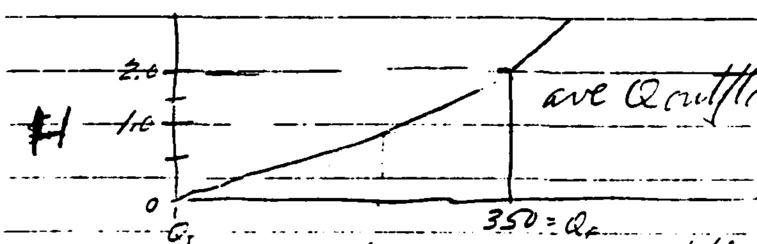
350 CFS = 350 acre-in/hr.

If $\frac{12''}{24 \text{ hrs}} = \frac{0.5''}{hr}$ over 2500 acres = 1250 acre-in/hr.

if 100% run-off max. inflow = 1250 acre-in.

Assume T.C. = 10 hrs.

To raise pond 2' (24") would take $\frac{24}{15.6} = 1.54''$ over watershed



ave Q outflow ≈ $\frac{Q_F - Q_I}{2} = \frac{350}{2}$ = 175 CFS

Q (inflow = outflow) CFS

when max inflow = 1250 and max outflow = 350 (H = 2')

rate of [illegible] = 900 CFS = 900 acre-in/hr

or $\frac{900}{160} \approx 5.6$ inches per hour

Field Check - at project trailer card

~~Harry~~ May 2, 1963 report says that 100-yr storm would create a 2' [illegible] and 6" over floor at lead end of [illegible].

8/9/67 - Report indicates that 2' [illegible] are occasionally installed freeboard = 0.??

49 Greenhurst Road
West Hartford, Connecticut 06107
August 9, 1967

Mr. Walter T. Ford
Lakeside Drive
Andover, Connecticut 06232

Dear Walter:

Inspection
Andover Lake Dam
Andover, Connecticut

An inspection of the Andover Lake earth dam, concrete spillway, concrete apron and weir section was made on August 1, 1967 and found to be in satisfactory condition.

Inspection

1. The joints in the concrete apron on the upstream face of the dam, previously sealed with rubber base joint sealer, appears to have washed away at and below the water line.

2. Open joints in the concrete apron showed some deterioration from frost damage but no signs of undermining of the apron.

3. There was no evidence of undercutting of the concrete apron at the rip rap rock toe which is covered with a light scum, indicating very little, if any, circulation under the apron and through the rip rap.

4. The leakage in the joint between the main spillway and the concrete portion above the weir bottom has increased since the last inspection in 1965.

5. There is evidence that this concrete portion above the weir bottom, about 24" in height, has moved downstream very slightly - possibly, as much as ½ inch in one location since 1961.

6. Leakage under the spillway boards was in the order of 12-15 gallons a minute. Sand bags against the upstream face of the weir section helped decrease the flow.

7. There was no leakage through the 24" cast iron drain.

8. The top and downstream face of the dam has overgrown with brush which appears about two years growth.

cf

Mr. Walter T. Ford August 9, 1967

Inspection (Continued)

9. The downstream face and base of the dam showed no signs of animal burrows.

10. About 60% of the shore line at the end of the dam, furthest removed from the spillway, has been stoned to prevent further erosion.

Recommendations

A. The weir boards which are in very poor condition should be replaced as soon as the lake level is lowered for maintenance.

B. The weir boards should be four, 3 inch by 6 inch, boards, with top and bottom edges square and with matching board shiplapped. A section of 2 inch fire hose should be nailed to the bottom of the board in contact with the concrete using galvanized nails to provide better contact between boards and concrete.

C. During off season, particularly during ice conditions in the lake, a minimum of two of the four weir boards should be removed to prevent undue pressure on the concrete block above the weir section as noted in items #4 and #5 above.

D. Cutting of the brush on top and the downstream face of the dam should be done this fall after the leaves have fallen and all cuttings burned.

E. The remainder of the shore line mentioned in item 10 should be protected as far as the property line with stone similar to the existing protection.

Very truly yours,

Steve Kusmik

Stephen Kusmik
Civil Engineer

SK:fj

cc: Mr. W. S. Wise
State of Connecticut
Flood Control & Water Policy Commission
Capitol Avenue
Hartford, Connecticut

August 2, 1965

Mr. George W. Hannon
45 Connecticut Boulevard
East Hartford, Connecticut

Dear Mr. Hannon

Inspection - Andover Lake Dam
Andover, Connecticut

An inspection was made on July 15, 1965 of the Andover Lake earth dam, concrete spillway and concrete apron and found to be in good condition.

INSPECTION

1) The joints in the concrete apron, sealed with hot rubber base joint sealer in 1961, have been washed away to some extent.

2) Open joints in the concrete apron showed no signs of undermining of the concrete.

3) The rip rap placed at the toe of the concrete apron is doing an excellent job in preventing circulation between the open concrete apron joints and the pond, thus preventing undercutting of the apron.

4) Minor leakage was noted at one spot in the concrete spillway. This leakage has decreased considerably since the repairs in 1961.

5) Leakage under the spillway weir boards was in the order of 20 gallons per minute.

6) The catwalk and platform installed for the pulling of weir boards in time of high water over the spillway is an excellent job.

7) There were no signs of leakage through the 24 inch cast iron drain.

8) The top of the dam has overgrown with brush that appears to be about two years growth.

9) The downstream face of the dam shows heavier growth and appears to be up to a four year growth.

10) Inspection of the downstream face and base of the dam did not reveal any animal burrows in the face.

11) The causeway leading to the end of the dam, furthest removed from the spillway, has not been faced with stone on the lake slope as previously recommended.

It was noted this area has a sand beach type shore line as a result of the lake being 8 to 12 inches below normal.

RECOMMENDATIONS

A) Cutting and disposing of the brush on the top and downstream side of the dam should be done this year. This cutting is light enough to be done with scythes and machetes. Delayed maintenance until next year will about double the cost of removal.

A yearly program should be initiated to perform this cutting which would result in maximum overall economies.

B) The lake side of the causeway, adjacent to the end of the dam furthest removed from the spillway, should be rip rapped for the full length of the causeway to prevent scouring in times of very high water, with the possibility of breaching the causeway adjacent to the dam.

This area is accessible to trucking and, one or two loads of graded rip rap, up to 12 inches, could be placed easily and economically to cover the most critical narrow area which extends about 50 feet from the end of the dam.

Very truly yours,

Steve Kusmik

Stephen Kusmik
Civil Engineer

SK:fj

cc: Mr. W. S. Wise
State of Connecticut
Flood Control & Water Policy Commission
Capitol Avenue
Hartford, Connecticut

Lid Service Inc

November 17, 1958

Mr. R. N. Burnham, Secretary
Andover Lake Management
Association, Inc.
Andover, Connecticut

Dear Mr. Burnham:

Inspection of Andover Lake Dam
Andover, Connecticut

The earth dam, concrete spillway, and the 20" waste gate discharge of Andover Lake in the Town of Andover, Connecticut, was inspected on October 12, 1958, with the following observations:

1. Water level in the lake was down about two (2) feet as a result of the removal of the flashboards in the spillway opening.

2. The scrub and sapling growth on the crest of the dam, which had been cut the previous year, has not been mowed or cut, and is starting to make growth.

3. The heavier growth on the downstream side of the dam has not been removed as recommended after previous inspections.

4. The 20" waste gate outfall was undercut as a result of the 1955 floods. The east side of the stream bed at the discharge has not been stoned as previously recommended.

5. A thorough inspection of the downstream face of the dam revealed no sign of seepage through the dam.

6. Joints in the concrete apron on the upstream face of the dam appeared in poorer condition than formerly.

DISCUSSION

Your verbal remark about seepage on the downhill side of the dam in the vicinity of the discharge pipe disturbed me and a thorough inspection was made, but no signs of seepage were found. This could be because the lake level was and had been down for some time.

It would not have been surprising if such seepage was found. Some of the growth on the downstream slope of the dam is large enough to have root growth into the face of the dam, and once this happens, water will follow along the roots and through the dam. When this occurs, corrective measures are costly and, if neglected long enough, breaching of the dam could occur under unusual conditions.

RECOMMENDATIONS

1. The downstream slope of the dam should be cleared of all undergrowth, saplings, etc.

2. The 20" tail gate discharge area should be backfilled with riprap, after the slopes are cleared, to prevent additional scour, which could become serious during unusual flood conditions.

The following observations are for your consideration:

1. If mowed twice a year, the scrub growth on the crest of the dam would not only keep the scrub growth down, but would present a pleasant appearance.

2. The downhill face of the dam, when cleared, should be cleared to ground level, and could be mowed in conjunction with the crest.

3. The concrete apron joints should be filled with hot bituminals to prevent further deterioration of the protective apron.

Very truly yours,

Stephen Kusmik
Civil Engineer

SK/mr

cc: Mr. W. S. Wise

June 18, 1957

Andover Lake Property Owners Association
c/o Mr. James J. Syme
Lakeside Drive
Andover, Connecticut

Dear Mr. Syme:

Inspection Andover Lake Dam
Andover, Conn.

The earth dam, concrete spillway and the 20" waste gate discharge of Andover Lake in the Town of Andover, Connecticut, was inspected on June 16, 1957 and found to be in good condition except as follows:

1. The 20" waste gate which was opened during the fall floods of 1956 caused a minor amount of undercutting in the stream bed and the east side of the discharge pipe. There are some signs that gravel has been placed east of the discharge pipe which is ineffectual protection.

2. The minor scrub and sapling growth at the crest of the dam has been removed during the year, but the heavier growth on the downstream side of the dam has not been removed as recommended.

3. The lake appeared to be 12 to 15 inches low due to lack of recent rains. There is a loss of water estimated at 75 gallons per minute under the removable flash boards at the spillway opening.

4. Some of the joints in the concrete apron on the upstream side of the dam have lost their bituminous filler above water level.

The following safety precautions are recommended:

1. The downstream slope of the dam should be cleared of all undergrowth, saplings, etc. to prevent root growth through the dam which could cause structural damage to the dam.

2. The 20 inch tail gate discharge area and the undercut east bank should be backfilled with rip rap to prevent further erosion whenever it becomes necessary to open the tail gate valve.

The following observations are made for your consideration:

1. Since the removal of scrub growth on the crest of the dam during the past year, new growth has appeared which could be removed with a scythe and if repeated annually would prevent regrowth.

2. The loss of water under the removable flashboards in the spillway of the dam should be stopped by any suitable means to keep the lake at a more pleasing level during periods of low rainfall.

3. The filling of the joints in the concrete apron of the dam at this time with hot bituminals will prevent more serious and expensive maintenance in the future caused by wave and frost action in the exposed joints.

Very truly yours,

Stephen Kusmik

Stephen Kusmik
Civil Engineer

SK/ec
cc: Mr. J. J. Syme
Mr. Wm. S. Wise, Exec. Secy.
State of Connecticut
Flood Control & Water Policy Commission
Hartford, Conn.

July 9, 1956

Andover Lake Property Owners' Association
c/o Mr. James J. Syme
Lakeside Drive
Andover, Connecticut

Dear Mr. Syme:

Inspection Andover Lake Dam
Andover, Conn.

The earth dam, concrete spillway and the 20" waste gate discharge of Andover Lake in the Town of Andover, Connecticut, was inspected on June 10, 1956, and found to be in good condition with the following exceptions:

1. The 20" waste gate which was opened during the fall floods of 1956 caused a minor amount of undercutting in the stream bed and the east side of the discharge pipe.

2. The crest of the dam has some minor scrub brush and sapling growth, while the growth on the downstream side of the dam is somewhat thicker and heavier.

The following safety precautions are recommended:

1. Rip rap or field stone should be dumped in the bed of the 20" tail gate discharge and the undercut bank should be backfilled with rip rap to prevent further erosion.

2. The crest and downstream slope of the dam should be cleared of all undergrowth, saplings, scrub growth, etc., to prevent root growth through the dam, thereby causing paths for water leakage through the dam.

Very truly yours,

S. Kusmik

Stephen Kusmik, C.E.

SK:vs

cc: Mr. J. J. Syme
Mr. William S. Wise, Exec. Secretary
State of Connecticut
Flood Control & Water Policy Commission

B-28

James H. Hendry

CONSULTING ENGINEER SURVEYOR CITY AND TOWN PLANNER
REDEVELOPING EASTERN CONNECTICUT

BOSTON HILL ROAD
ANDOVER, CONNECTICUT
TEL. 7-6879 COVENTRY EXCH.
PIlgrim 2-6879

WILLIMANTIC, CONNECTICUT
TEL. 3-3205
HArrison 3-9736

Andover, Connecticut
September 16,1953

State Board of Supervision of Dams
Room 317, State Office Building
Hartford, Connedticut
Attention : Engineer William S. Wise, Chairman

Dear Bill : Re : ANDOVER LAKE DAM

This will confirm my visit to your office yesterday and my dis-dussion with your Mr. Hupfer, who will report to you upon your return on Friday.

The Andover Lake Property Owners Association has recently acquired the above property and its proprietorship is now vested in The Andover Lake Management Association, Inc., whose officers are:- President,William Manierre, 30 Walter Place, East Hartford; Vice President, Harry Erickson, Mathieson Road, Andover Lake; and Secretary-Treasurer, Arthur J. Piller, 475 Tolland Street, East Hartford, Connecticut.

We have lowered the level of the lake and exposed the entire concrete aprons of the dam and spillway preparatory to making some maintenance repairs.

Will you kindly advise me whether your Board will require the Contractor to obtain a permit before starting the repair work?

Very truly yours,
Jas Hendry.
James H. Hendry
Consulting Engineer for
The Andover Lake Management Assoc'n.

JHH/j

cc. Mr. Manierre
Mr. Erickson
Mr. Piller

James H. Hendry

CONSULTING ENGINEER SURVEYOR CITY AND TOWN PLANNER
REDEVELOPING EASTERN CONNECTICUT

BOSTON HILL ROAD
ANDOVER. CONNECTICUT
TEL. 7-6879 COVENTRY EXCH.
PIlgrim 2-6879

WILLIMANTIC. CONNECTICUT
TEL. 3-3205
HArrison 3-9736

Andover, Connecticut
September 16,1953

State Board of Supervision of Dams
Room 317, State Office Building
Hartford, Connedticut
Attention : Engineer William S. Wise, Chairman

Dear Bill : Re : ANDOVER LAKE DAM

This will confirm my visit to your office yesterday and my disdussion with your Mr. Hupfer, who will report to you upon your return on Friday.

The Andover Lake Property Owners Association has recently acquired the above property and its proprietorship is now vested in The Andover Lake Management Association, Inc., whose officers are:- President,William Manierre, 30 Walter Place, East Hartford; Vice President, Harry Erickson, Mathieson Road, Andover Lake; and Secretary-Treasurer, Arthur J. Piller, 475 Tolland Street, East Hartford, Connecticut.

We have lowered the level of the lake and exposed the entire concrete aprons of the dam and spillway preparatory to making some maintenance repairs.

Will you kindly advise me whether your Board will require the Contractor to obtain a permit before starting the repair work?

Very truly yours,
James H. Hendry
James H. Hendry
Consulting Engineer for
The Andover Lake Management Assoc'n.

JHH/j

cc. Mr. Manierre
Mr. Erickson
Mr. Piller

THANK YOU FOR YOUR REPORTS ON THE DAM

J. LESLIE GOODIER

Arthur D. Little, Inc.

ACORN PARK · CAMBRIDGE MASSACHUSETTS 02140 · (617) 864-5770

ANDOVER LAKE
ANDOVER

V1C

July 15, 1977

Mr. E. Sammartino, President
Andover Lake Property Owners Association
School Road
Andover, Connecticut 06232

Dear Gene:

A trip to California prevented my attendance at the ALPOA Annual Meeting. I have learned, however, that discussions ensued that indicated that the cost of dredging contaminated sediments from the lake coves, and in the shoreline area, would be in the vicinity of $250,000. My engineering estimate of $29,390 (as contained in my letter of June 24, 1977) was based on costing information given directly to me by National Car Rental/ Mudcat Division, Minneapolis, Minnesota. The following cost breakdown is factual, and as I reported previously, could be greatly reduced if the owners and/or users of another lake in the Andover area would utilize the dredge and its support equipment during the two-month lease period.

Minimum 2-month rental	$13,000
Floating pontoon line - 3000 ft., (polyethylene pipe) floats, hoses, valves, etc.	4,840
Two harness kits, cable pullers and anchors	626
Tool set (purchase only)	250
Spare part kit (purchase only)	250
Wide beam flat bottom boat to position dredge 9.5 HP outboard	264
Pontoon line pipe ring bank locks	92
Pontoon line floats	304
Insurance (2 months)	500
Labor/operator and helper (est. 30 days including down time)	4,500
Crane rental (2 half days)	764
Transportation of dredge to and from work site	4,000
TOTAL	$29,390

I am very familiar with the Mudcat type dredge having conducted a technical evaluation of the entire fleet while operating at various geographical locations within the U.S. I have also viewed a number of lakes that have been restored through the medium of Mudcat dredging. A continuity of flat bottom is obtained by two horizontal rotating augers that cut into

the bottom sediments at a regulated depth. The augers feed the sediments to a center suction after which the sediments pass through the pump and a floating or land located pontoon/discharge line to the selected on land disposal site. Water turbidity is controlled by a hydraulically operated shroud, or cover, that is lowered over the operating augers to confine sediments raised into water suspension and direct them toward the suction intake.

I can assure you that my past experience in dredging, water quality control, marine pollution and contaminated lake restoration spans a period of 30 years. My services in this respect have been provided to federal, state, and municipal governments and private clients all over the nation.

I trust that some action can be gained to correct adverse environmental conditions that exist and are increasing in Andover Lake. Failing this we could readily be placed in a position, similar to other lakes in our vicinity, where swimming has been terminated due to degraded water quality and biological conditions.

Yours very truly,

Les Goodier

J. Leslie Goodier, P.E.

JLG:km

cc: Mr. Cody, ALMA
Mr. Victor Galgowski Conn. DEP (with copy of original letter)

June 24, 1977

Mr. E. Sammartino, President
Andover Lake Property Owners Association
School Road
Andover, Connecticut 06232

Dear Gene:

Through the medium of this letter, I am providing my report on adverse environmental and physical factors presently affecting Andover Lake.

BACKGROUND

Andover Lake is a shallow man-made lake. It has a surface area of 155.4 acres, a maximum depth of 16 feet and an average depth of 10.9 feet. The State of Connecticut, in part, describes the lake as having a bottom consisting of "...sand, coarse rubble, boulders and mud. The water is stained a dark tea color, and the transparency is approximately five feet. Submerged vegetation is scarce in all areas of the pond. This lake is too shallow to stratify..."

ALPOA members are of the opinion that the quality of the lake water and conditions, at the shoreline and in various coves, has deteriorated extensively over the past ten years, to the extent that accumulations of mud and decaying vegetation have made the water and shoreline very distasteful to body contact. When the water level is lowered by manual manipulation of the dam spillway, the coves become odorous mudflats, conducive to the breeding of mosquitos. It is impossible for property owners within the coves to navigate boats out into the lake proper. In effect, dues-paying members of ALPOA have restricted lake access. They have an objectionable view and are paying property taxes based on waterfront ownership when, for many months of the year, the coves are practically drained of water.

Many of the Town's storm sewers drain directly into the lake, transporting sediments and other objectionable materials and debris into the lake waters. One waterfront resident reports having viewed an individual draining waste automobile sump oil into the storm sewer -- this oil would ultimately pollute, and environmentally degrade, the waterbody. Another resident complains that an underwater sluice valve on the water level control dam has been inoperative for a period of some 17 years. A majority of ALPOA members who recently attended a joint ALPOA/ALMA meeting contended that previous motions to correct adverse environmental conditions have been either stalled or ignored. For the reasons described, I volunteered my professional engineering services to assess present lake conditions and to provide recommendations for the effective control of conditions presently detrimental to the natural beauty of the lake and to its continued recreational use. My findings are as follows.

LAKE DEGRADATION

Since the lake was constructed in the 1920's, the waters have been increasingly degraded by the leachate from septic tanks that surround the waterbody. The quantity of leachate, consisting of human sewage and phosphatic detergents, has increased annually with the population and the gradual conversion of summer homes and weekend cottages to year-round residences.

The State's report of turbid water conditions ("water is stained a dark tea color") has, to a great extent, resulted from the great quantity of leaves that enter the lake during the Fall of each year. The leaves further contribute to the rotting vegetation that greatly degrades the shallow waters of the lake. Another adverse impact that has directly resulted from the described conditions is the high level of algae within the lake due to nutrient runoff. In the coves the dense algae bloom; in the Spring and Fall of the year this dense algae deprives the lake water of its oxygen content and further contributes to the rotting vegetation problem.

There is no doubt that the storm sewer system is poorly engineered and is a major contributing factor to the degradation of the lake water. The sewers transport sediments and other foreign materials directly into the lake. The solid runoff accumulates at the point of discharge and, depending on the water flow rate, fans out and disperses throughout a wide section of the water column.

Natural surface (rain) water runoff further degrades the water, transporting sediment and agricultural fertilizers into the shallow waters in the shoreline area. There is no doubt that, along with many Connecticut lakes, Andover Lake has a rapidly declining water quality.

Eutrophication, which can be broadly defined as the process of enrichment of a waterbody by nutrients and organic matter (which results in high biological productivity) and filling-in by sediments (which results in a decreased volume of a waterbody) has become a major problem within the lake waters.

Whereas the State once contended that "...Submerged and emergent vegetation is scarce in all areas of the pond...", a dense increase in vegetation is now apparent at most locations with dense grass growth viewed during dives into the deeper waters.

Coliform bacteria sampling has, to my knowledge, indicated acceptable levels in the swimming beach area. At other locations, where residences are evident, levels range between 230 to 320 mpn. The present federal EPA criterion for bathing waters is normally based on a minimum of not less than five samples taken over a 30-day period. The fecal coliform bacterial level should not exceed a log mean of 200 per 100 ml, nor should more than 10 percent of the total samples taken during any 30-day period exceed 400 per 100 ml. In essence, fecal coliform counts at areas other than in the beach area are high and the present sampling frequency does not meet federal criteria.

THE DAM

I am personally concerned about the dam since my residence would be in the path of released water in the event of dam failure. I made a close examination of the structure and contacted both State of Connecticut and U. S. Corps of Army Engineers personnel in Waltham, Massachusetts, to gain information on the findings of other inspectors. The most recent governmental inspection was made by Mr. Victor Galgowski, Supt. of Dam Maintenance, State of Connecticut Department of Environmental Protection, on May 28, 1977. The following adverse conditions were relayed to Mr. Edward Yeomans as ALMA's in-town representative.

1. The fill and stone riprap eroded from the section near the upstream spillway abutment on the west side of the dam should be replaced.

2. Brush growth on the dam slope should be cut.

3. Concrete deterioration in the eastern downstream wing wall of the spillway should be attended to.

My own findings are such that the dam appears physically sound; however, the boards controlling the water level at the spillway are somewhat "punky" due to extended submersion in water. My fingernail penetrated the wood for a depth of at least 1/8 inch. The submerged sluice valve was not visible for examination. Should its condition be as reported -- inoperative for a period of 17 years -- it should definitely be replaced.

ENGINEERING RECOMMENDATION FOR LAKE IMPROVEMENT

A. Storm and Surface Water Runoff

1. The storm water drains should be modified to the extent that they drain into a sediment retention basin. There are a number of designs for retention basins which are constructed primarily for the purpose of trapping and storing sediments and debris produced by storm runoff from tributary watersheds. The cost of such a device at the final discharge of a storm sewer should be in the vicinity of $1500 each. On a regular frequency, the Town of Andover would have to clean out the sediment retention basins and dispose of the accumulated sediments in a nonpolluting manner. It is my personal opinion that the cost of modifying the storm sewer outfall discharges and the cleaning of the sediment retention basins (on an as-needed frequency) should be borne by the Town of Andover. Some federal or state financial assistance may be available for the construction of the sediment retention basins. There are two US/EPA reports devoted to this type of marine pollution control, i.e.:

   a. "Guidelines for Erosion and Sediment Control Planning and Implementation." EPA Publication R2-72-015, August 1972.

ENGINEERING RECOMMENDATION FOR LAKE IMPROVEMENT (Cont'd.)

A. Storm and Surface Water Runoff (Cont'd.)

b. "Comparative Costs of Erosion and Sediment Control Construction Activities." EPA Publication 430/9-73-016.

2. Lake property owners should be encouraged and/or requested to hold lawn fertilizing to a minimum to reduce storm water runoff into the lake waters.

3. Lake property owners should be encouraged and/or requested to maintain a dense vegetative cover of grass, weeds, shrubs, vines or trees at the water's edge to prevent erosion at the land and lake water interface. The vegetative cover will serve as a soil stabilizer and as a filter for sediment-laden water flowing into the lake. The most effective natural filters are thick stands of grasses and legumes. In essence, do not mow the grass all the way down to the edge of the lake.

B. Lake Bottom Improvements

1. The coves and underwater land should be dredged free of accumulated mud, ooze and decaying vegetation through the medium of a National Car Rental Corp. portable "Mudcat" dredge. There are a number of water-front property owners who have low-lying land who have indicated that they would accept the dredged material as "fill" on their property. Once dredged and pumped ashore, the dredged material will have high nutritional value, conducive to the rapid growth of vegetation. On land the "drying out" process will eliminate objectionable odor and mosquito spawning conditions.

The estimated cost of the dredging process would be $29,390. I can provide a complete breakdown of cost upon request. The minimal rental period for the dredge is two months. The cleansing of Andover Lake should only take one month. On this basis, by negotiating for joint use with another lake such as Coventry, Bolton, Hebron or Columbia, the cost can be appreciably reduced -- almost to one-half.

I should indicate, however, that to maintain the lake in a desirable condition for bathing and to eliminate the in-cove mudflat situation, maintenance dredging may be warranted on a basis of at least every ten years.

C. The Dam

1. The State of Connecticut recommendations for lake improvement should be promptly complied with (see page 3).

ENGINEERING RECOMMENDATIONS FOR LAKE IMPROVEMENT (Cont'd.)

C. The Dam (Cont'd.)

2. The inoperative sluice valve should be replaced at the earliest opportunity.

3. The spillway boards should be replaced at the next lowering of the lake using timbers impervious to continued submergence, such as cypress or oak.

D. Fecal Coliform Bacteria Sampling

The services of a water quality testing laboratory (possibly UConn) should be retained to accurately monitor lake water quality. The findings should be relayed on a regular basis to all ALPOA members.

I will be happy to provide additional details of my findings upon request and I trust that my effort in the preparation of this report will benefit all lake property owners and users.

Yours very truly,

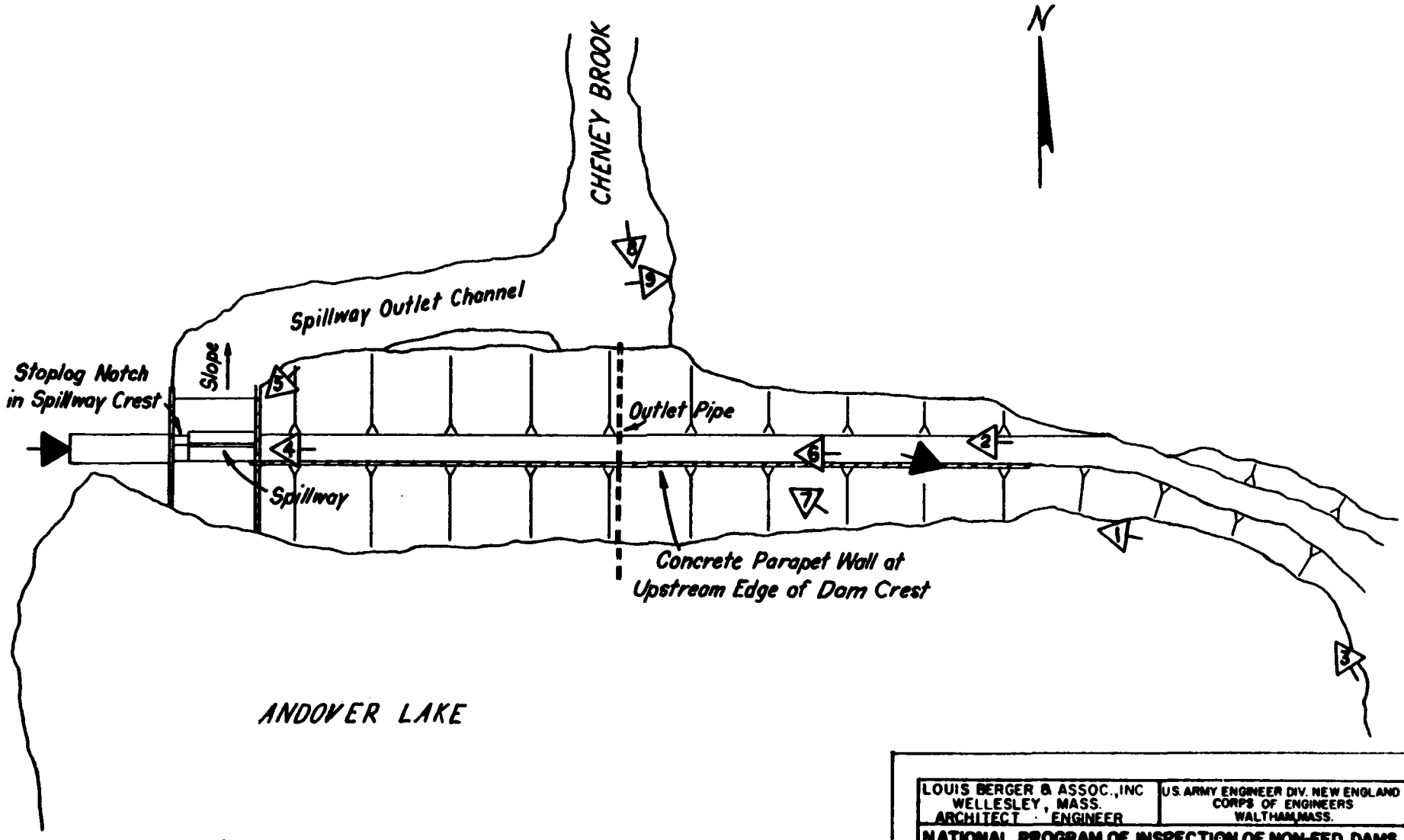
Leo Goodier

J. Leslie Goodier, P.E.

JLG:cs

APPENDIX C

PHOTOGRAPHS



Overview Photos →

Appendix 'C' Photos →

LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

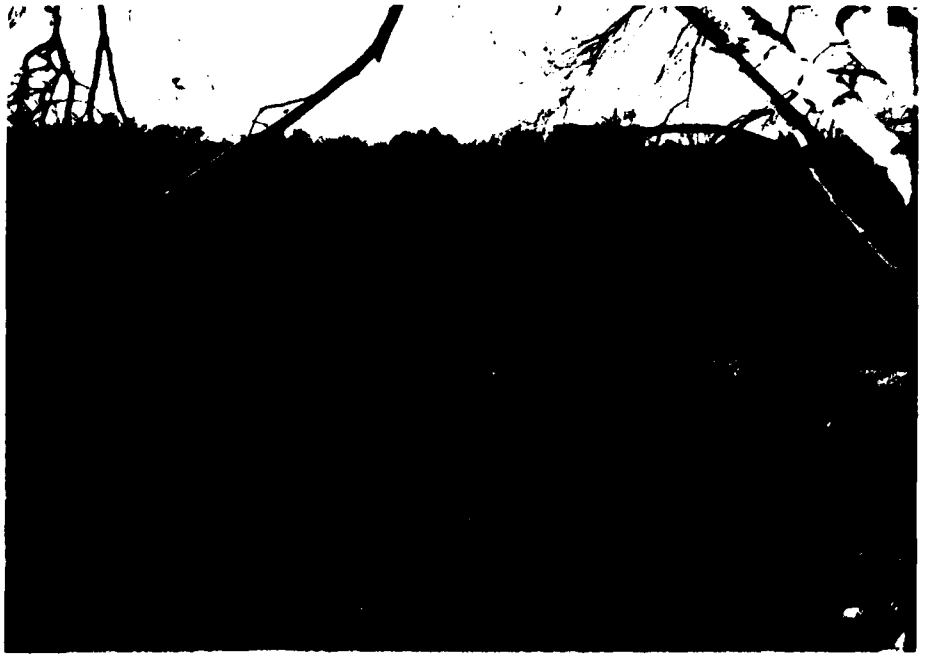
ANDOVER LAKE DAM

SKETCH PLAN SHOWING LOCATION & ORIENTATION OF PHOTOS

STATE - CT.

SCALE NONE

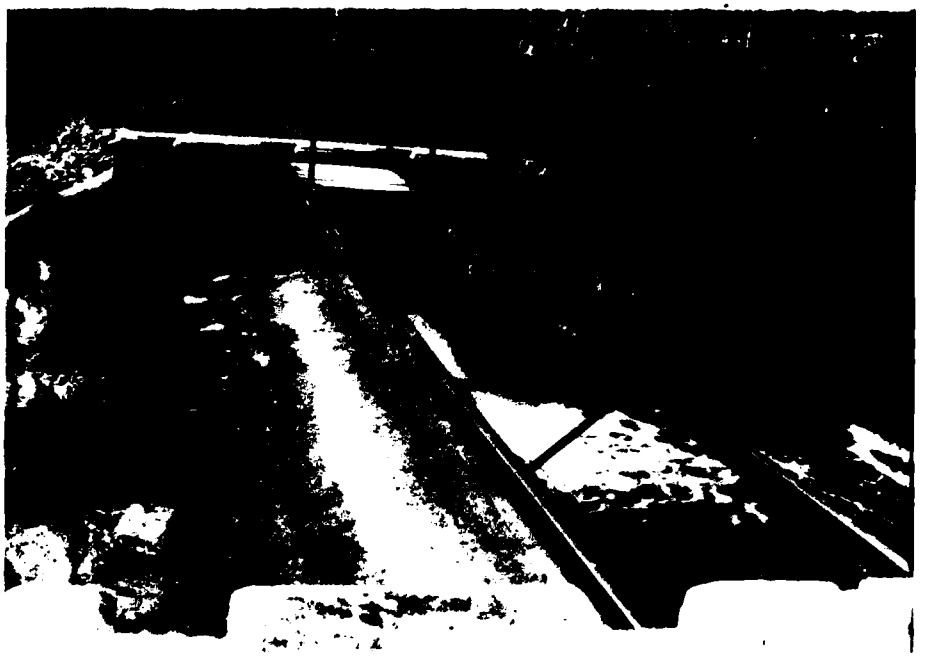
DATE



1. Upstream face of dam and concrete parapet wall.

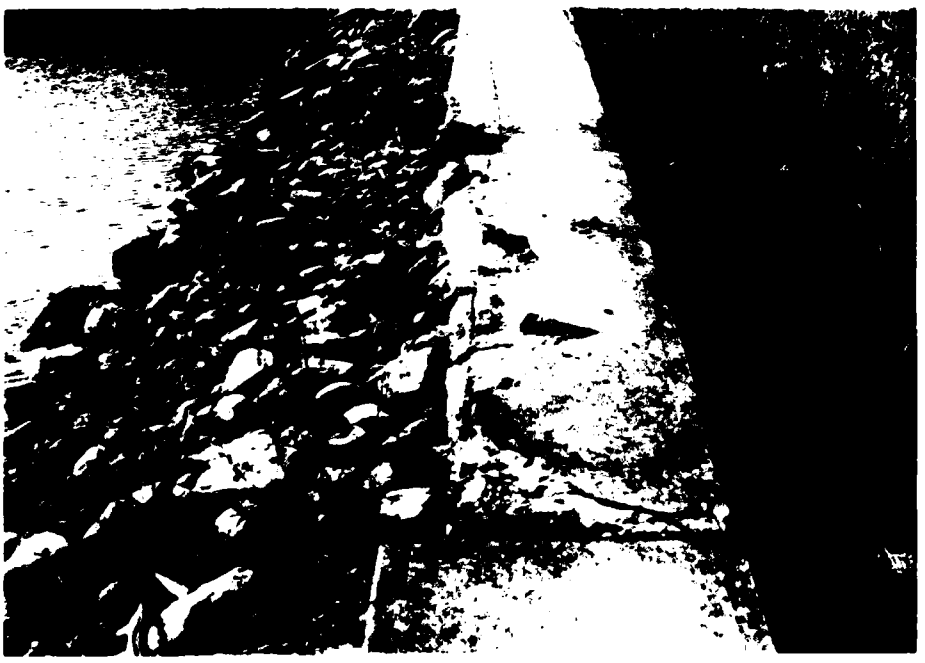
2. Crest and downstream face of dam.

3. Saddle in reservoir rim near right abutment

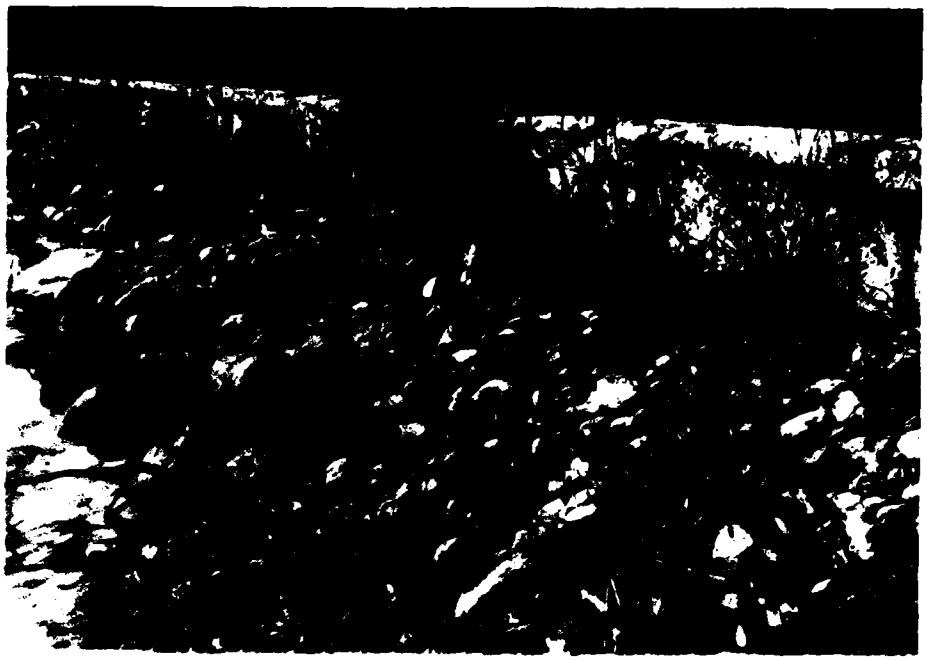


4. Spillway crest with stoplog notch

5. Downstream face of spillway showing raised weir with stoplog notch.



6. Deterioration of concrete parapet wall.



7. Riprapped upstream face and concrete parapet wall.

8. Outlet headwall and riprapped channel.

9. Seepage from eroded bank of outlet channel.

PHASE I INSPECTION REPORT

ANDOVER LAKE DAM CT 00624

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. Louis Berger & Associates, 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 was issued to Louis Berger & Associates, Inc. under a letter of 28 September 1979 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-79-C-0051, Job Change No. 2, has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

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

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

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

1.2 Description of Project

a. Location. Andover Lake and Dam are located in Tolland County in the Town of Andover in east-central Connecticut. Andover Lake forms the headwaters of Blackman Brook (also known as Cheney Brook) approximately 0.7 miles upstream from the confluence of Blackman Brook and Hop Brook. About 8.6 miles below the dam, the Hop Brook joins the Willimantic River. The dam is reached via Connecticut Route 87 and Andover Lake Road. It is shown on U.S.G.S. Quadrangle, Columbia, Connecticut with coordinates approximately at N 41° 43' 32", W 72° 21' 38".

b. Description of Dam and Appurtenances

(1) Description of Dam. The dam is an earth embankment closing off the outlet channel to Andover Lake, about 20 ft. high and 454 ft. long. Between the right abutment and the spillway, at the upstream edge of the embankment crest, there is a concrete parapet wall 365 ft. long and about 2 ft. wide. The crest of the dam is about 13.5 ft. wide and uneven, the distance between the earth and the top of parapet varying from about 1 ft. to a maximum of about 1.7 ft. The

downstream slope of the embankment varies, but averages about 1½ horizontal to 1 vertical, while the riprapped upstream slope is approximately 2 horizontal to 1 vertical. To the left of the spillway there is an embankment about 50 ft. long and its crest is about 3 in. higher than the parapet wall. The rim of the reservoir to the right of the dam has a saddle which is about 1.25 ft. lower than the top of the parapet. Riprap protects the shore line in the saddle area.

(2) Spillway. The spillway for Andover Lake Dam is located in the embankment about 50 ft. from the left abutment. The width of the spillway is 39 ft. The original broad crested concrete weir has been raised 2.2 ft., except for the left 7 ft., where provision has been made for the use of stoplogs. The stoplog slots will accommodate up to three aluminum stoplogs having a maximum height of 2.2 ft. The spillway has concrete training walls, a downstream concrete apron about 15 ft. long, and it is spanned by a partially planked steel rail bridge.

(3) Low Level Outlet. The low level outlet for Andover Lake is a 24 in. dia. pipe through the embankment located about 200 ft. left of the right abutment. At the time of the inspection the outlet was in the process of being reconstructed. The gate at the upstream end was submerged below the surface of the lake and inaccessible except by diving. The owners are planning to built a gate structure in the near future. The outlet of the pipe is located near the toe of the downstream embankment, with a concrete headwall. A partially riprapped channel extends below the outlet.

c. Size Classification. Andover Lake Dam is about 20 ft. high above downstream toe level, impounding a maximum of about 918 acre-ft. of storage to spillway crest and about 1,355 acre-ft. to the top of the low point near the right abutment. In accordance with height and storage capacity criteria given in Recommended Guidelines for Safety Inspection of Dams, storage capacity governs and therefore the project is classified as intermediate in size.

d. Hazard Classification. A breach failure of Andover Lake Dam would release a surge of water down Blackman Brook into Hop Brook, then to the confluence of Hop Brook and the Willimantic River, at which point the flood surge should be fairly well dissipated. Andover Lake Road, Old Route 87 and New Route 87 cross Blackman Brook in the reach between the dam and Hop Brook. It is estimated that the stage would rise about 11 ft. in this reach and that all three roadways would be flooded and sustain severe damage. A service station on New Route 87 would sustain some flood damage. Along Hop Brook, between New Route 87 and Parker Bridge Road, it is estimated that the stage would rise between 8 and 11 ft. and that one house would be flooded. About 4.2 miles below the dam at Hop River Road a commercial building would probably be subject to minor flooding. U.S.G.S. Gaging Station 01120000 is located below Hop River Road. At the gage it is estimated that the stage would rise about 11 ft. Between the gage and the Willimantic River it is probable that two houses west of Pucker Street would sustain minor damage. Consequently, Andover Lake Dam has been classified as having a significant hazard potential in accordance with the Recommended Guidelines for the Safety Inspection of Dams.

e. Ownership. The dam is owned by the Andover Lake Management Associations, Inc., Andover, Connecticut 06232.

f. Operator. Mr. Arthur Horn, President, Andover Lake Management Association, Inc., Andover, Connecticut 06232. Telephone: 203-742-8910.

g. Purpose of Dam. The dam impounds a lake used for recreational purposes.

h. Design and Construction History. It is not known by whom the dam was designed and constructed. It is believed that the dam was built in the year 1920. Correspondence in the State's files indicates that the dam originally had a concrete apron on its upstream face, but because of deterioration of the apron, riprap was placed on the upstream face in 1974 or 1975. Because the right abutment area had been eroded by high water, it was also riprap protected. The files also indicate that the spillway was repaired between 1967 and 1970, but it is not clear when the spillway was raised by about 2.2 ft.

i. Normal Operating Procedure. Operation of the dam consists of installing and removing stoplogs in the spillway notch and occasionally drawing down the reservoir by means of the low level outlet. The water level in the Lake is controlled seasonally for recreational and maintenance purposes. At the time of the inspection the low level outlet structure was in the process of being reconstructed, the only access to the control gate being by diver.

1.3 Pertinent Data

a. Drainage Area. The drainage area contributing to Andover Lake is situated at the headwaters of Blackman Brook*. The drainage area encompasses a total of about 3.95 sq. mi. (2,528 acres), of which 156 acres are occupied by the lake. The longest circuitous stream course contributing to the lake is about 2.48 miles long with an elevation difference of about 300 ft., or at a slope of about 121 ft. per mile. The drainage area has a length of about 3 miles and a maximum width of about 2 miles. The basin consists of both open fields and forested areas, with a sparse population except in the area around the lake itself, where the population is dense.

b. Discharge at Damsite.

(1) Outlet Works Conduit. Low level discharges from Andover Lake are provided for by a 24 in. circular pipe. The location of the intake end of the pipe and its invert elevation could not be determined as the gate was submerged and had no superstructure. It is estimated that the outlet pipe would be capable of discharging about 70 cfs with the gate wide open and the water surface at the top of the parapet wall.

(2) Maximum Known Flood at Damsite. No records are available of flood inflows into Andover Lake, nor of spillway releases and surcharge heads during such inflows. It was reported by the owners' representative that the surcharge height reached the level of the low point in the saddle near the right abutment during the storms of January 1979.

*Per sign on Route 87; USGS Columbia lists as Cheney Brook.

Records in the USGS water supply papers show discharges at gaging station #01120000, about 4 miles below the dam in the Hop River hear Columbia, CT (drainage area = 76.2 square miles):

March 12, 1936	-	3,300 cfs
Sept. 21, 1938	-	6,450 cfs (maximum)
Aug. 19, 1955	-	5,570 cfs

(3) Ungated Spillway Capacity at Top of Dam. The total spillway capacity at top of right abutment, elevation 416.65, is 280 cfs.

(4) Ungated Spillway Capacity at Test Flood Elevation. The ungated spillway capacity is about 1,020 cfs at test flood elevation 418.95.

(5) Gated Spillway Capacity at Normal Pool Elevation. Not applicable

(6) Gated Spillway Capacity at Test Flood Elevation. Not applicable

(7) Total Spillway Capacity at Test Flood Elevation. The total spillway capacity at the test flood elevation is the same as (4) above, 1,020 cfs at elevation 418.95.

(8) Total Project Discharge at Test Flood Elevation. The total project discharge at test flood is 2,950 cfs at elevation 418.95.

c. Elevations (Ft. above NGVD)

(1) Streambed at centerline of dam - 396.9

(2) Maximum tailwater - Not available

(3) Upstream portal invert diversion tunnel - Not applicable

(4) Recreation pool - Not applicable

(5) Full flood control pool - Not applicable

(6) Ungated spillway crest - 414.0 (lake elevation from USGS Columbia - all other elevations relative to spillway crest)

(7) Design surcharge (original design) - Unknown

(8) Top of right abutment - 416.65

(9) Top of parapet - 417.9

(10) Test flood design surcharge - 418.95

d. Reservoir

(1) Length of maximum pool - 4,500 ft.

(2) Length of recreation pool - Not applicable

(3) Length of flood control pool - Not applicable

e. Storage (acre-ft.)

(1) Recreation pool - Not applicable

(2) Flood control pool - Not applicable

(3) Spillway crest pool El. 414.0 - 918

(4) Top of right abutment El. 416.65 - 1,355

(5) Top of parapet El. 417.9 - 1,575

(6) Test flood pool El. 418.95 - 1,686

f. Reservoir Surface (acres)

(1) Recreation pool - Not applicable

(2) Flood control pool - Not applicable

(3) Spillway crest El. 414 - 156

(4) Top of right abutment El. 416.65 - 174

(5) Top of parapet, El. 417.9 - 183

(6) Test flood pool El. 418.95 - 190

g. Dam

(1) Type - Earth embankment with concrete parapet along upstream side of crest.

(2) Length - 454 ft.

(3) Height - 19.75 ft. ±

(4) Top width - 13.5 ft.

(5) Side slopes - Downstream 1½ horizontal to 1 vertical (approximate)
Upstream 2 horizontal to 1 vertical (approximate)

(6) Zoning - Unknown

(7) Impervious core - Unknown, however, concrete parapet wall may be an extension of a corewall.

(8) Cutoff - Unknown

(9) Grout curtain - Unknown

h. Diversion and Regulating Tunnel - Not applicable

i. Spillway

(1) Type - Concrete weir, with 7 ft. wide stoplog notch

(2) Length of weir - 39 ft.

(3) Crest elevation - 414 on 1 ft. stoplog in notch (assumed)

(4) Gates - None, provision for stoplogs in 7 ft. notch.

(5) Upstream channel - Natural

(6) Downstream Channel - 15 ft. concrete apron, then natural river channel.

j. Regulating Outlets

(1) Invert - Inlet invert unknown, outlet invert 398.6

(2) Size - 24 inch diameter

(3) Description - Circular pipe, 170 ft. right of spillway

(4) Control Mechanism - Hand operated valve, submerged (owners propose new gate structure in 1980)

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No data on the design of the dam or appurtenances has been recovered and probably none exists. In the course of the inspection, some measurements were taken and a sketch plan and profile layout of Andover Lake Dam and appurtenances was prepared, which is included in Appendix B.

2.2 Construction Data

No records or correspondence regarding construction have been found. Periodic inspection reports indicate that repair work has been performed from time to time (Appendix B). Major repairs since the present owners acquired the dam in 1953 include: rebuilding and raising the spillway; placing riprap over the concrete apron on the upstream face; and, the current reconstruction of the low level outlet.

2.3 Operation Data

The dam is operated by the Andover Lake Management Association, Inc. There appear to be no formal operating instructions or records. It is said that the spillway stoplogs are removed in the fall and replaced in the spring.

2.4 Evaluation of Data

a. Availability. Since no engineering data is available, it is not possible to make an assessment of the safety of the embankment. The basis of the information presented in this report is principally the visual observations of the inspection team.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General. The visual inspection of Andover Lake Dam took place on 25 October 1979. Water was flowing about 7 in. above the 12 in. aluminum plank installed in the stoplog notch in the spillway. The spillway discharge was estimated to be about 9 cfs. The spillway outlet channel flows along the toe of the dam for about 150 ft. and some erosion of the toe was evident. There was a low point in the Lake's rim near the right abutment which was about 1.25 ft. lower than the dam's parapet. A seep was found on the eroded right bank of the low level outlet channel and cracks were noted in the abutment walls of the spillway. There was no evidence of any major problems, but some items require attention. On the basis of the Phase I visual examination, Andover Lake Dam appears to be in generally fair condition.

b. Dam. Andover Lake Dam is an earth embankment about 454 ft. long and 20 ft. high. It has a concrete parapet wall at the upstream edge of its crest, which extends for 365 ft. from the right side of the spillway to the right abutment (Appendix C, Photo No. 1). The crest of the embankment is about 13.5 ft. wide and the parapet wall is about 2 ft. wide. The top of the parapet appeared to be level, but it protruded above the embankment by a variable amount, with a maximum of about 1.7 ft. near the mid-point of the dam (Appendix C, Photo No. 2). The embankment to the left of the spillway was about 3 in. higher than the top of the parapet wall. About 100 ft. to the right of the right end of the parapet there is a saddle in the reservoir rim which is about 1.25 ft. lower than the top of the parapet (Appendix C, Photo No. 3). The downstream slope of the embankment has a slope of about 1½ horizontal to 1 vertical. The upstream slope is about 2 horizontal to 1 vertical and is riprapped with random stone averaging about 1 ft. in diameter, which according to inspection reports on file, covers a deteriorated concrete apron (Appendix C, Photo Nos. 6 & 7).

Brush growth had invaded the upstream riprap and was well established on the crest and downstream slope (Appendix C, Photo Nos. 2, 7 & 8). About 100 ft. to the right of the spillway, there were several areas where brush had recently been cut. In this area there was evidence of erosion on the slopes in the form of shallow troughs some 10 ft. long and about 8 ft. down from the crest. In this vicinity, between the toe and the spillway discharge channel, there was standing water with an oily sheen.

The discharge channel parallels the toe of the embankment for about 150 ft. Boulders, as much as a cubic yard in volume, have been randomly placed between the toe and the discharge channel. However, there were several places where erosion between the boulders had created large voids, which could be expected to increase in extent. Several other areas at the toe of the dam some 100 to 150 ft. east of the spillway were wet and boggy, although no definable seeps could be seen. There was also evidence of undercutting of the toe, possibly caused by spillway discharges. In the next 50 ft. to the right at the toe of the dam, there were three holes, leaf filled and about 1 ft. in diameter and depth, which were probably abandoned animal burrows.

Left of the spillway, the upstream slope of the embankment was sparsely covered with rather small stone, averaging about 4 in. dia. (Appendix C, Photo No. 4). Some loss of the material, apparently used to repair erosion reported in 1972 (see Appendix B), had taken place next to the spillway abutment wall.

The concrete parapet wall was badly spalled in several locations, and near the right abutment, major deterioration revealed reinforcing steel (Appendix C, Photo Nos. 6 & 7).

Near the right abutment of the dam, along the shoreline of the lake in the vicinity of the saddle, random stone riprap has been placed for shore protection. A stand of mature birches extends for some 100 ft. along the shoreline in this area (Appendix C, Photo No. 3).

c. Appurtenant Structures. The spillway is located in the embankment about 50 ft. from the left abutment. It is a concrete structure 39 ft. wide consisting of a 32 ft. wide broad crested weir and a 7 ft. wide stoplog notch which is 2.2 ft. lower than the main weir (Appendix C, Photo No. 4). The stoplog notch can be fitted with stoplogs up to the crest of the weir. The spillway was reconstructed at an undetermined time when a concrete cap was placed on the original ogee spillway, forming a broad crested weir 2.2 ft. higher, with a 7 ft. wide stoplog notch at the original crest elevation (Appendix C, Photo No. 5). At the time of the inspection the stoplog structure was fitted with a 12 in. aluminum plank stoplog. The spillway has concrete training walls in which there were deep cracks extending through the walls at mid length. A partially planked steel rail bridge spans the spillway. On the downstream side of the spillway, a concrete apron extends a distance of about 15 ft. (Appendix C, Photo No. 5).

The low level outlet for the dam is located about 200 ft. left of the right abutment. It is a 24 in. circular pipe through the embankment controlled by a gate valve at the upstream end. The inlet and control gate were submerged. The gate was recently replaced and the owner's representative advised that a superstructure with access walkway would be provided in the spring of 1980. There was no leakage through the outlet near the toe of the dam, which has a concrete headwall (Appendix C. Photo No. 8). The riprap in the outlet channel, though fairly massive, had been displaced as much as 3 or 4 ft. by discharges from the pipe. The right side of the outlet channel was badly scoured and undercut to about 5 ft. above channel invert. From this area a steady seep issued, with the odor of hydrogen sulphide and surrounded by extensive rust colored algae and slime. The owner's representative stated that this seep had been present for many years.

d. Reservoir Area. The shores of the reservoir are gently sloping with many residences situated along the perimeter; they appear to be stable. There is a sand beach at the south end of the lake.

e. Downstream Channel. Beyond the spillway's concrete apron the discharge channel turns to the right and parallels the toe of the dam for about 150 ft. before turning downstream. Some erosion of the toe was evident. There

was also evidence of the channel flooding beyond its ill-defined banks. Heavy underbrush and mature trees encroached upon the stream valley in the vicinity of the dam. The brook flows down a rather steep gradient for a distance of about 0.7 miles before joining Hop Brook.

3.2 Evaluation

The visual inspection has adequately revealed key characteristics of the dam as they may relate to its stability and integrity. The dam and appurtenant works are judged to be in fair condition. Erosion of the toe of the dam was evident where the spillway discharge channel flows along the toe. A low point in the reservoir rim near the right abutment of the dam was about 1.25 ft. below the top of the dam's parapet wall. A seep was found in the low level discharge channel, which was somewhat eroded, and cracks were noted in the training walls of the spillway. Brush growth was well established on the embankment, and there was some severe spalling of the concrete parapet wall.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

Andover Lake Dam is operated by the Andover Lake Management Associates, Inc. Lake levels are controlled by a stoplog notch in the left side of the spillway weir and a low level outlet pipe. The lake is lowered in the fall of the year by removal of the stoplogs. It is drained periodically for maintenance work.

4.2 Maintenance of Dam

There is no specific maintenance program in effect at Andover Lake Dam. However, frequent inspections have been carried out, the reports of which indicate that the dam has had maintenance and repair work carried out on several occasions (Appendix B).

4.3 Maintenance of Operating Facilities

The wooden stoplogs were recently replaced with aluminum planks. At the time of the inspection the low level outlet was being reconstructed. This work should be completed in 1980, according to the owner's representative.

4.4 Description of any Warning System in Effect

No warning system is in effect at Andover Lake Dam.

4.5 Evaluation

Although little is known about the construction of the facility, it has simple operating devices and requires no detailed operating procedures. General maintenance involves periodic growth removal from the embankment and surveillance regarding seeps, slope damage, animal burrows, etc. The planned superstructure for the low level outlet should be constructed as soon as practical. A formal warning system should be developed.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. Andover Lake Dam is an earth embankment spanning the outlet to Andover Lake. It impounds a normal storage of about 918 acre-ft. with provision for an additional 437 acre-ft. of capacity in its surcharge space to the top of the low point near the right abutment. It is basically a low surcharge - low spillage facility used for recreational purposes. The spillway is capable of discharging about 280 cfs with surcharge to the top of the low point near the right abutment. The general topographic characteristics of the 3.95 sq.mi. (2,528 acres) drainage basin is best described as rolling terrain. The drainage area measures about 3 miles long and 2 miles wide and rises from elevation 414 ft. at spillway crest level to elevation 730. The area contains both open fields and forests, but is generally forested.

b. Design Data. There is no design data available for the dam.

c. Experience Data. No records are available in regard to past operation of the reservoir, nor of surcharge encroachments and spills through the spillway. The maximum past inflows are unknown. The owner's representative said that the surcharge following the January 1979 storm encroached upon the low point near the right abutment and that repairs were made after this occurrence.

d. Visual Observations. There is considerable evidence of the spillway discharge channel flooding beyond its banks. It is not known when this flooding occurred.

e. Test Flood Analysis. Reservoir area and capacity curves and tables for use in flood routing are shown on Sheets D-2 and D-3 of Appendix D. For determining surface areas and surcharge capacities, planimetered areas were taken from contours delineated on U.S.G.S. 2,000 ft. per in. quadrangle sheets.

The test flood chosen to evaluate the hydrologic and hydraulic capacities of Andover Lake Dam was selected in accordance with the criteria presented in the Recommended Guidelines for Safety Inspection of Dams. Since this dam is classified as intermediate in size with a significant hazard potential, a test flood with a range of ½ PMF to a full PMF could be selected for the evaluation. In consideration of the downstream hazard potential, a test flood of a magnitude corresponding to ½ PMF was selected.

Precipitation data were obtained from Hydrometeorological Report No. 33, which for the Connecticut area approximates 24.0 in. of 6 hour point rainfall over a 10 square mile area. This value was reduced by 20 percent to allow for basin size, shape and fit factors and an additional 2 percent for infiltration losses. The six hour rainfall was distributed into one hour incremental periods as suggested in COE Publication EC 1110-2-1411. Net rainfall excesses for developing a runoff hydrograph are shown on Sheet D-9, Appendix D.

A triangular incremental unitgraph was assumed for the inflow hydrographs, using a computed lag time value of 3.28 hours to derive a time-to-peak for a triangular hydrograph of 3.10 hours (see computations on Sheets D-7 and D-8, Appendix D). A PMF inflow hydrograph is shown on Sheet D-10, Appendix D, indicating a peak inflow of about 8,700 cfs or a CSM of about 2,200. The peak inflow was divided by two to arrive at the test flood inflow value of 4,350 cfs.

Discharge tables and curves for the spillway and for over the top of the dam are shown on Sheets D-4 thru D-6, Appendix D.

A flood routing was performed for the test flood. The results of this routing are shown on Sheets D-11 and D-12, Appendix D, and are summarized as follows:

Test Flood Magnitude	Maximum Inflow cfs	Max. Res. El. ft.	Maximum Head Over Parapet ft.	Max. Head Over Low Point Rt. Abut. ft.	Max. Routed Test Flood Outflow cfs
½ PMF	4,350	418.95	1.05	2.3	2,950

From the above table, it can be seen that the project will not pass the routed test flood outflow without overtopping the low point near the right abutment by 2.3 ft. and the top of the parapet by 1.05 ft. The dam, however, can handle about 9 percent of the routed test flood outflow without overtopping the low point near the right abutment.

f. Dam Failure Analysis. A breach owing to structural failure of the dam by piping or sloughing is a possibility. For this analysis a breach was assumed with the water level in the lake at the top of the low point near the right abutment. The "rule of thumb" criteria suggested in the NED March 1978 Guidance Report was used for the breach analysis. With a breach width of 40 percent of the embankment length to the right of the spillway, equal to 146 ft., an outflow of about 21,800 cfs would be realized, including 280 cfs from the spillway (see Sheets D-13 thru D-21, Appendix D).

In the reaches below the dam the outflow first drops rather steeply in a distance of 0.7 miles to Hop Brook. This first reach is crossed by three roadways, Andover Lake Road, Old Route 87 and New Route 87. It is estimated that the stage in the brook would rise about 11 ft. in this reach and all three roads would be overtopped and severly damaged. A service station on New Route 87 would also probably sustain minor flood damage. In the reach between New Route 87 and Parker Bridge Road, it is estimated that the stage of Hop Brook would rise between 8 and 11 ft., and that one house would be flooded to a depth not exceeding 3 ft. over the first floor. About 4.2 miles below the dam at Hop River Road, a commercial building would probably sustain minor flood damage. U.S.G.S. Gaging Station 01120000 is located a short distance below Hop River Road. At the gage it is estimated that the stage would rise about 11 ft. Between the gage and the Willimantic River two houses west of Pucker Street would probably sustain minor flood damage. In summary, three roadways would suffer severe flooding and damage; one service station, one commercial building and three houses would sustain minor flood damage. Appendix D, Sheet D-22 shows the area of potential flooding.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation. There are no design calculations available for review of the structural stability of the dam and appurtenant structures. However, the investigations and findings described herein do not indicate any displacement and/or distress which would warrant the preparation of structural stability calculations. The dam is stable, but is in only fair condition.

The field investigation revealed the following items relating to structural stability:

(1) Spillway discharges have eroded the toe of the dam.

(2) The top of the embankment is lower than the top of the concrete parapet wall.

(3) Seepage in the outlet channel below the toe of the dam.

(4) Some displacement of riprap on the upstream slope and local erosion of the downstream slope. Erosion of gravel on upstream slope adjoining left abutment wall of spillway.

(5) Cracks in concrete abutment walls of spillway.

b. Design and Construction of Dam. While no design data or construction history has been recovered, records indicate the dam to have been constructed sometime in the 1920's. A drawdown and inspection in 1953 and periodic inspections since then are on file (see Appendix B).

c. Operating Records. No operating records are known to exist.

d. Post Construction Changes. From the inspection reports it is evident that there has been a series of post construction changes, including work on the spillway. The current program includes improvement of outlet controls. There are no known changes which would adversely affect stability.

e. Seismic Stability. The dam is located in Seismic Zone No. 1 and in accordance with Phase I Guidelines, does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. On the basis of the Phase I visual examination, Andover Lake Dam appears to be in generally fair condition. The deficiencies revealed indicate that a further investigation should be carried out and that some remedial work is needed. The major concerns with the overall integrity of the dam are as follows:

(1) The spillway will only pass about 8 percent of the routed test flood outflow.

(2) The spillway discharge channel is encroaching on the toe of the embankment for a distance of about 150 ft.

(3) There are cracks in the concrete abutment walls of the spillway.

(4) There is seepage in the right side of the low level outlet channel.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Urgency. The recommendations and remedial measures enumerated below should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

d. Need for Additional Investigations. Additional investigations are required as recommended in Para. 7.2.

7.2 Recommendations

It is recommended that the owner, Andover Lake Management Association, Inc., should retain the services of a competent registered professional engineer to make further investigations of the following, and should implement the results:

(1) Make a thorough study of the hydrology of the drainage basin and evaluate further the potential for overtopping and the adequacy of the spillway.

(2) Determine the feasibility of raising the embankment and the low section of the reservoir rim near the right abutment to the level of the top of the parapet (or to such other elevation as may be determined from the study in (1) above).

(3) Investigate the need for providing a graded filter for improved control of the seepage on the right side of the low level outlet channel.

(4) Evaluate the structural implications of cracks through the abutment walls of the spillway and take appropriate corrective measures.

(5) Study the need for reinforcement of the toe of the dam where the spillway discharge channel traverses close to the toe to safeguard against an undermining of the embankment, or for rechanneling the outlet to direct flows away from the toe of the dam.

7.3 Remedial Measures

(1) Remove brush and trees from the embankment on a regular basis, not less than once per year.

(2) Remove overhanging trees and brush in the downstream channel.

(3) Clean out and backfill abandoned animal burrows and erosion troughs on the downstream slope and restore the area to grade.

(4) Dislodged riprap in the drawdown channel should be reset or replaced.

(5) Restore the embankment immediately west of the spillway to grade and protect the upstream slope with riprap.

(6) Caulk cracks in spillway training walls, pending results of investigations recommended in Section 7.2.

(7) Cut away deteriorated concrete on parapet and repair with appropriate materials.

(8) Monitor seepage in the low level outlet channel and marshy areas at toe of dam on a monthly basis.

(9) Develop a formal surveillance and flood warning plan, including round-the-clock monitoring during periods of heavy precipitation.

(10) Institute procedures for an annual technical inspection of the dam and its appurtenant structures.

7.4 Alternatives

There are no practical alternatives to the above recommendations and remedial measures.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

BY JKH DATE 4/5/79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF ...

CHKD. BY ... DATE ... INSPECTION OF DAMS - VOL. 4 & 5 PROJECT ...

SUBJECT ALDER LAKE - DRAINAGE AREA

FIND : ENTIRE AREA ABOVE LAKE PLANIMETER NO SUB-INDEX @ 399
(0 = 169)

USGS Sheet	Ave Reading (sq. in.)
Columbia, Conn	4.99
Marlborough, Conn	2.54
	7.53

Scale $(1")^2 = (2{,}000')^2$ 4,000,000 sq ft/sq in.

$$\text{Area} = \frac{27.53 \text{ sq in} \times 4{,}000{,}000 \text{ sq ft/sq in}}{43{,}560 \text{ sq ft/Acre}} = \boxed{2{,}529.3 \text{ Ac}}$$

2,529.3 Acres ÷ 640 Acres/sq mi = 3.95 sq mi

BY REB DATE 11-14-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT ANDOVER LAKE DAM - CAPACITY CURVE

AREA AT SPILLWAY CREST ELEV 414

READ #2 16.67 READ #3 18.36 AVE = 1.70 IN
" #1 14.96 " #2 16.67 AREA = 156 ACRES
1.71 1.69

AREA AT ELEV. @ 420

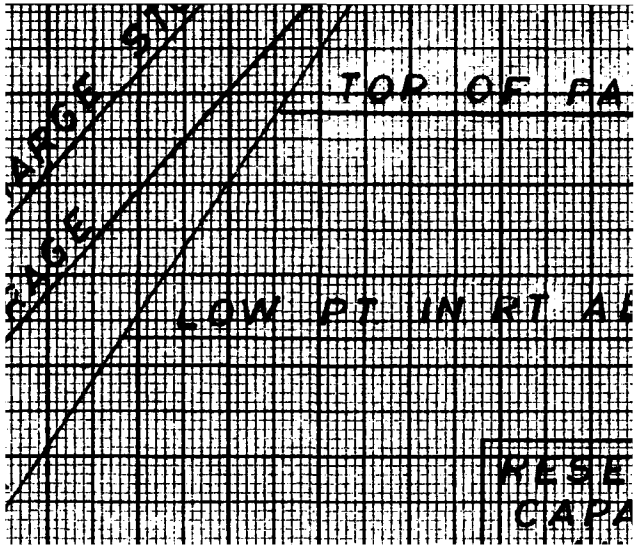
READ #2 20.46 READ #3 22.59 AVE = 2.15 IN
" #1 18.29 " #2 20.46 AREA = 197 ACRES
2.17 2.13

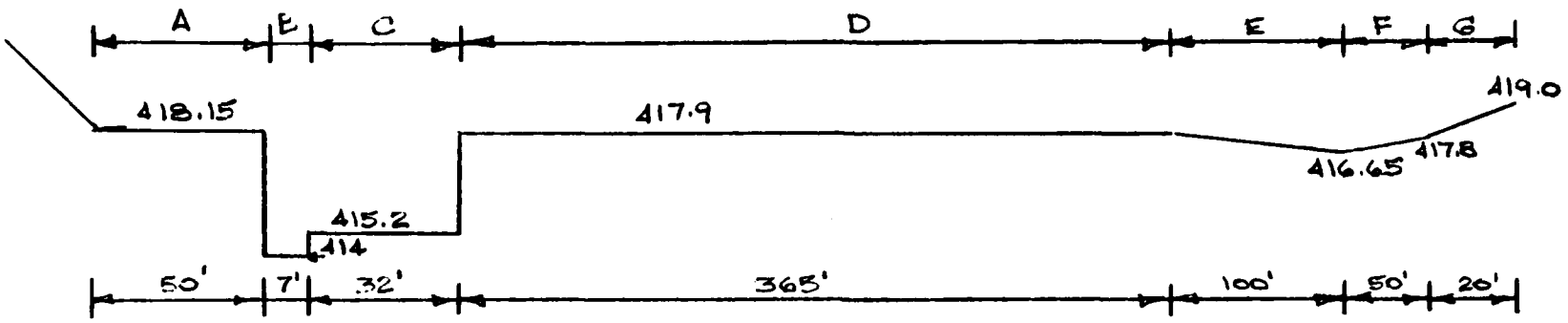
CHECK VOL @ ELEV 414 VOL = 1/3 h. x(156) = 1/3 (17.65)(156)

VOL = 918 ACRE-FT FROM COE INVENTORY 1160 AC-FT

SAY VOL = 918 ACRE-FT

ELEV	AREA	AVE. AREA	ΔH	Δ STORAGE	TOTAL STORAGE	USABLE STORAGE
414	156				918	0
415	162.8	159.4	1	159.4	1077	159
416	169.7	166.2	1	166.2	1244	326
417	176.5	173.1	1	173.1	1417	499
418	182.2	179.9	1	179.9	1597	679
419	190.2	186.8	1	186.8	1783	865
420	197	193.6	1	193.6	1977	1059


TOP OF FA
LOW PT IN RT AI
RESE
CAPA



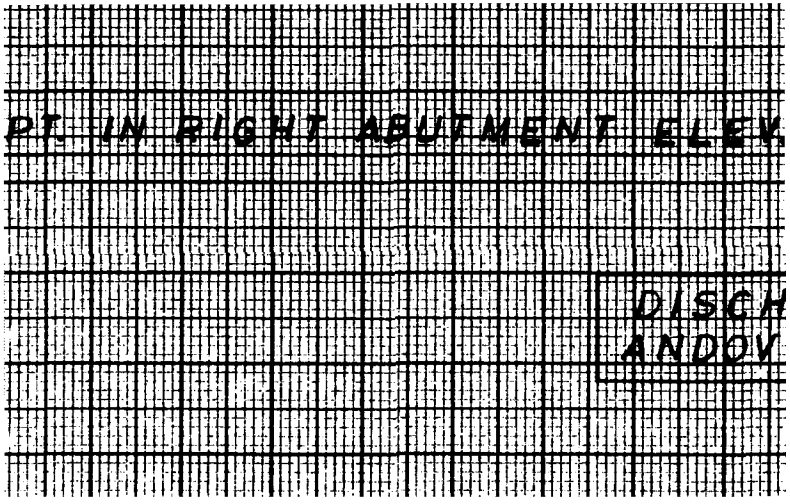
ELEV	A, C = 2.6			B, C = 3.1			C, C = 3.3			D, C = 2.7		
FT	L	H	Q	L	H	Q	L	H	Q	L	H	Q
414.0	50	0	0	7	0.6	10	32	0	0	365	0	0
415.2		0	0		1.2	28		0	0		0	0
416		0	0		2.0	61		0.8	76		0	0
416.65		0	0		2.65	94		1.45	184		0	0
417.8		0	0		3.8	161		2.6	443		0	0
417.9		0	0		3.9	167		2.7	468		0	0
418.15		0	0		4.15	183		2.95	535		0.25	123
419		0.85	102		5.0	243		3.8	782		1.1	1137
420		1.85	327		6.0	319		4.8	1110		2.1	2499
421	50	2.85	625	7	7.0	402		5.8	1475	365	3.1	5318

BY RFB DATE 11-16-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF ...

CHKD. BY ... DATE ... INSPECTION OF DAMS PROJECT ...

SUBJECT ANDOVER LAKE DAM, DRAINAGE AREA

ELEV. FT	E, C=2.5			F, C=2.6			G, C=2.3			TOTAL
	L	H	Q	L	H	Q	L	H	Q	Q
414.16	1	0	0	1	0	0	1	0	0	10
415.12	1	0	0	1	0	0	1	0	0	30
416	1	0	0	1	0	0	1	0	0	140
416.65	1	0	0	1	0	0	1	0	0	280
417.56	42	0.18	102	50	0.58	55	1	0	0	760
417.7	100	0.63	125	50	0.68	70	2	0.05	0	830
418.12	100	0.88	206	50	0.92	110	6	0.18	0	1160
419.	107	1.72	564	50	1.78	247	20	0.6	21	3150
420	103	2.72	1121	50	2.78	580	37	1.1	98	6550
421	100	3.72	1794	50	3.78	918	51	1.6	256	10850


PT. IN RIGHT ABUTMENT ELEV.
DISCH
ANDOV

BY REB DATE 9-12-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. ____ OF ____

CHKD. BY ____ DATE ____ INSPECTION OF DAMS PROJECT ____

SUBJECT ANDOVER LAKE DAM, INFLOW HYDROGRAPH

DRAINAGE AREA (TOTAL) = 3.95 sq MI = 2528 ACRES

BY INSPECTION LAKE AREA < 25% OF TOTAL AREA

NOW LENGTH OF LONGEST WATER COURSE, L = 13,100'
L = 2.48 MI

Δ ELEV DIFFERENCE = 715 - 414 = 301 FT

$\therefore$ SLOPE = $\frac{301}{2.48}$ = 121.4 FT/MI $\&$ $\sqrt{S}$ = 11.02

NOW $\frac{LL_c}{\sqrt{S}} = \frac{(2.48)(2.48)}{2(11.02)} = 0.279$

$LAG = K\left(\frac{LL_c}{S}\right)^{0.33} = 0.656K$

ASSUME K = 5.0 HRS (REFER TO "CURVE B", MOUNTAINOUS REGION, MIXED TERRAIN, BUREAU OF RECLAMATION

LAG = 5.0 (0.656) = 3.28 HRS

$T_p = 0.41D + 0.82\,LAG$, WHERE D = 1.0

$T_p = 0.41(1) + 0.82(3.28)$

$T_p = 0.41 + 2.69 = 3.10$ HRS

CHECK VELOCITY $\quad T_c = \frac{T_p - .5D}{0.6}$

$T_c = \frac{3.1 - .5}{0.6} = 4.33$ HRS

$V = \frac{13,100}{(4.33)(3600)} = 0.84$ O.K.

$T_R = 1.67\,T_p = 1.67(3.10) = 5.18$ HRS

$T_B = T_p + T_R = 3.10 + 5.18 = 8.28$ HRS

---

q_p = PEAK RATE IN CFS

$$q_p = \frac{484AQ}{T_p}$$

A = DRAINAGE AREA
Q = RUNOFF IN INCHES

$$q_p = \frac{(484)(3.95)(1)}{3.10} = 617 \text{ CFS}$$

PMP = PROBABLE MAXIMUM PRECIPITATION

= (24")(0.8) = 19.2" FOR CONNECTICUT

= 18.8" CONSIDERING INFILTRATION FOR OVERLAND FLOW.

BY RFB DATE 1-12-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. ____ OF ____

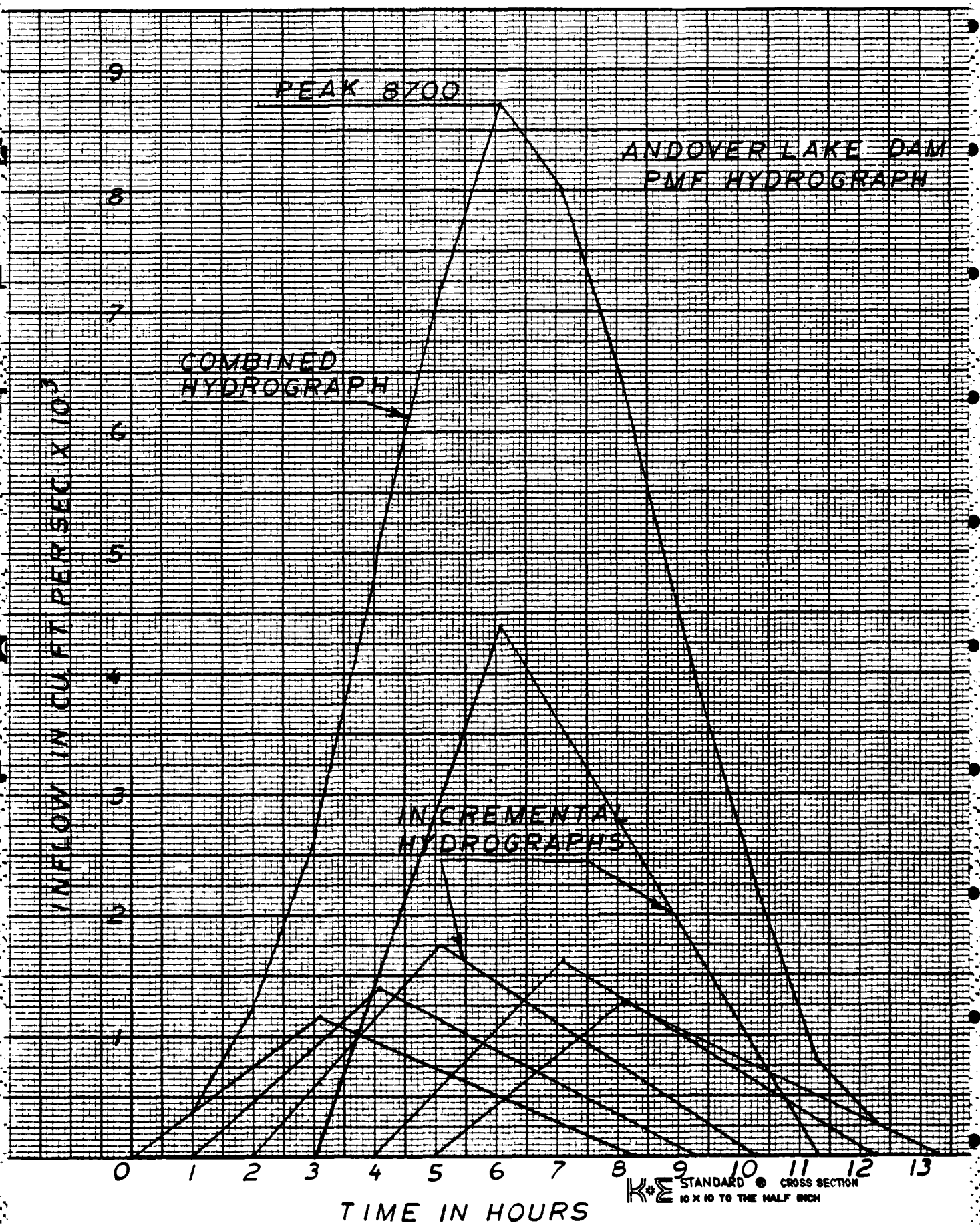
CHKD. BY ____ DATE ____ INSPECTION AND SAFETY ____ PROJECT ____

SUBJECT ANDOVER LAKE DAM, INFLOW [illegible]

FLOOD HYDROGRAPH FOR PMF

q_p = 617

TIME (HOURS)	RAINFALL *%	RAINFALL INCHES	Q_p CFS	TIME BEGIN	TIME PEAK	TIME END
0.0	-					
1.0	10	1.88	1160	0	3.1	9.08
2.0	12	2.26	1394	1	4.1	9.08
3.0	15	2.82	1740	2	5.1	[illegible]
4.0	38	7.14	4405	3	6.1	11.28
5.0	14	2.63	1623	4	7.1	[illegible]
6.0	11	2.07	1277	5	8.1	[illegible]


PEAK 8700
ANDOVER LAKE DAM
PMF HYDROGRAPH
COMBINED
HYDROGRAPH
INCREMENTAL
HYDROGRAPHS
INFLOW IN CU.FT.PER SEC. X 10³
9
8
7
6
5
4
3
2
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13
TIME IN HOURS
K&E STANDARD ® CROSS SECTION
10 X 10 TO THE HALF INCH

BY RFB DATE 11-16-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT ANDOVER LAKE DAM, RESERVOIR ROUTING

DRAINAGE AREA = 3.95 SQ MI = 2528 ACRES
MAXIMUM STORAGE = 1355 ACRE-FT
HEIGHT OF DAM = 19.75 FT
SIZE CLASSIFICATION = INTERMEDIATE
HAZARD CLASSIFICATION = SIGNIFICANT
TEST FLOOD IS 1/2 PMF TO FULL PMF

USE 1/2 PMF FOR TEST FLOOD

STEP 1 FROM INFLOW HYDROGRAPH PMF = 8,700 CFS

Q_{P1} = 1/2 PMF = 1/2 (8,700) = 4,350 CFS

STEP 2 a. SURCHARGE HEIGHT = 419.41

b. VOLUME OF SURCHARGE = 904 ACRE-FT

$$STOR_1 = \frac{904 \text{ ACRE-FT}}{2528 \text{ ACRES}} \times 12 \text{ IN/FT} = 4.29 \text{ INCHES}$$

c. $Q_{P2} = Q_{P1} \times \left(1 - \frac{\text{STOR}_1}{9.5}\right)$

$= 4,350 \left(1 - \frac{4.29}{9.5}\right)$

$= 2386$ CFS

STEP 3 a SURCHARGE HT FOR Q_{P2} = 419.73

b VOLUME OF SURCHARGE = 812 ACRE-FT

$$STOR_2 = \frac{812 \text{ ACRE-FT}}{2528 \text{ ACRES}} \times 12 \text{ IN/FT} = 3.85 \text{ IN}$$

BY REB DATE 11-16-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT ANDOVER LAKE DAM, RESERVOIR ROUTING

$$\text{AVE STORAGE} = \frac{4.01 + 3.85}{2} = 4.07 \text{ INCHES}$$

$$\text{VOL} \quad \frac{4.07 \text{ IN} \times 2523 \text{ ACRES}}{12 \text{ IN/FT}} = 857 \text{ ACRE-FT}$$

FOR 857 ACRE-FT

SURCHARGE HEIGHT = 418.95

Q_{PS} = 2950 CFS

SPILLWAY INADEQUATE TO PASS ½ PMF

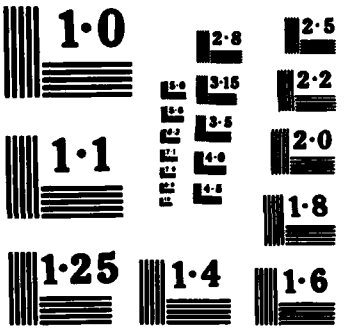
LOW POINT IN RIGHT ABUTMENT OVERTOPPED BY 418.95 - 416.65 = 2.3 FT

TOP OF PARAPET OVERTOPPED BY 418.95 - 417.9 FT = 1.05 FT

AD-A144 551 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
ANDOVER LAKE DAM (CT.. (U) CORPS OF ENGINEERS WALTHAM MA
NEW ENGLAND DIV DEC 79

UNCLASSIFIED F/G 13/13 NL

END
FILMED
DTIC


1·0
1·1
1·25
2·8
3·15
3·5
4·0
1·4
2·5
2·2
2·0
1·8
1·6

BY RFE DATE 11-16-74 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF
CHKD. BY DATE INFLUENCE OF JAMS PROJECT
SUBJECT ANDOVER LAKE DAM, FAILURE ANALYSIS

STEP 1 ASSUME DAM FAILS WHEN WATER LEVEL IS AT LOW POINT IN RIGHT ABUTMENT

STORAGE : S = 1480 ACRE-FT

STEP 2 FIND PEAK FLOW = Q_{P_1}

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

W_b = 40% OF (454 - 50 - 39) = 146 FT
Y_o = 19.75 FT

$$Q_{P_1} = 1.68\,(146)\,(19.75)^{3/2}$$

Q_{P_1} = 21,528 CFS

ASSUME SPILLWAY STILL INTACT

Q SPILLWAY = 280 CFS

Q TOTAL = 21,528 + 280 ≈ 21,800 CFS

REACH 1 STA 0+00 TO 30+00

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

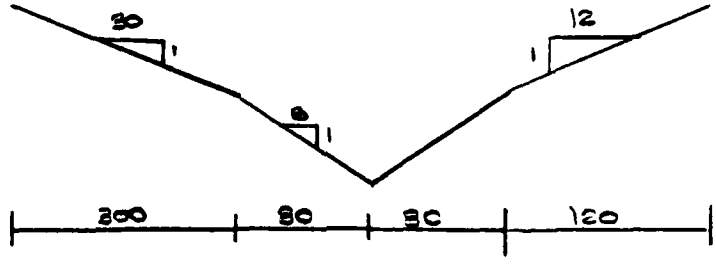
n = 0.08

$$Q = 3.40\, A R^{2/3}$$

$$S = \frac{400 - 300}{3000}$$

S = 0.033

S = 0.183

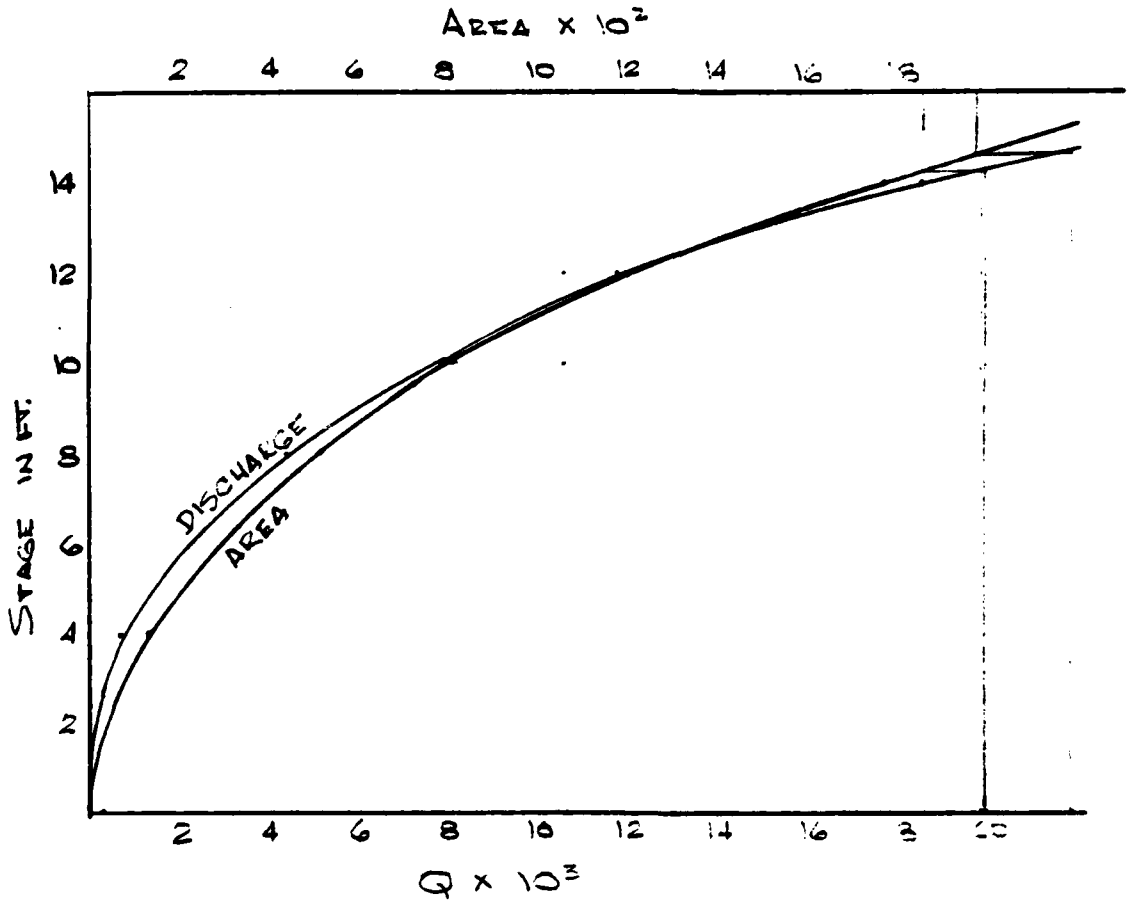


BY RFE DATE 11-16-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF

CHKD. BY DATE Inspection of Dams PROJECT

SUBJECT Andover Lake Dam, Failure Analysis

Stage	Area	P	R	$R^{2/3}$	Q
4	128	64.5	1.98	1.58	688
5	512	129.0	3.97	2.51	4370
10	800	161.3	4.96	2.91	7915
12	1204	245.4	4.91	2.89	11830
16	2516	413.6	6.08	3.32	28436
20	4500	581.8	7.73	3.91	
14	1776	329.5	5.39	3.07	18553



FOR $Q_{P1} = 21{,}800$, STAGE = 14.8', AREA = 1970 FT²

$$VOL_1 = \frac{1970 \times 3000}{43{,}560} = 136 \text{ ACRE-FT}$$

$$Q_{P2\,(TRIAL)} = 21{,}800\left(1 - \frac{136}{1480}\right)$$

$$= 19{,}797 \text{ CFS}$$

FOR $Q = 19{,}800$, STAGE = 14.3, AREA = 1950 ACRE-FT

$$VOL_2 = \frac{1850 \times 3000}{43{,}560} = 127 \text{ ACRE-FT}$$

$$V_{AVE} = \frac{127 + 136}{2} = 132 \text{ ACRE-FT}$$

$$Q_{P2} = 21{,}800\left(1 - \frac{132}{1480}\right) = 19{,}856 \text{ CFS}$$

FOR $Q = 19{,}856$, STAGE = 14.3 FT, ΔH = 11.5 FT

REACH 2, STA 30+00 TO 158+00

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

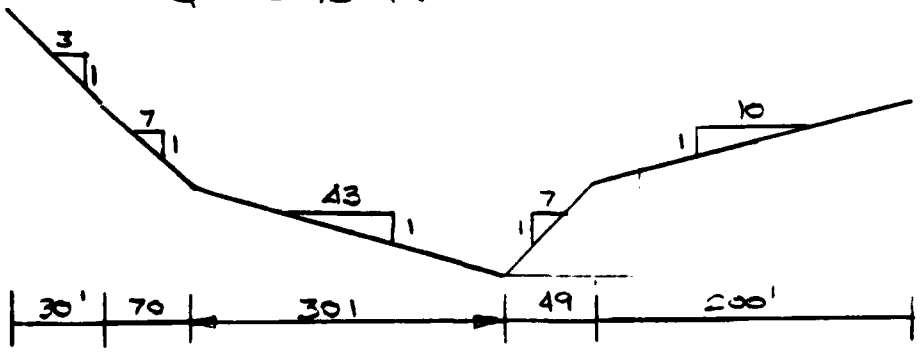
$$S = \frac{280 - 270}{12{,}500}$$

$n = 0.045$

$S = .00078$

$S^{1/2} = .02780$

$$Q = 0.92\, A R^{2/3}$$

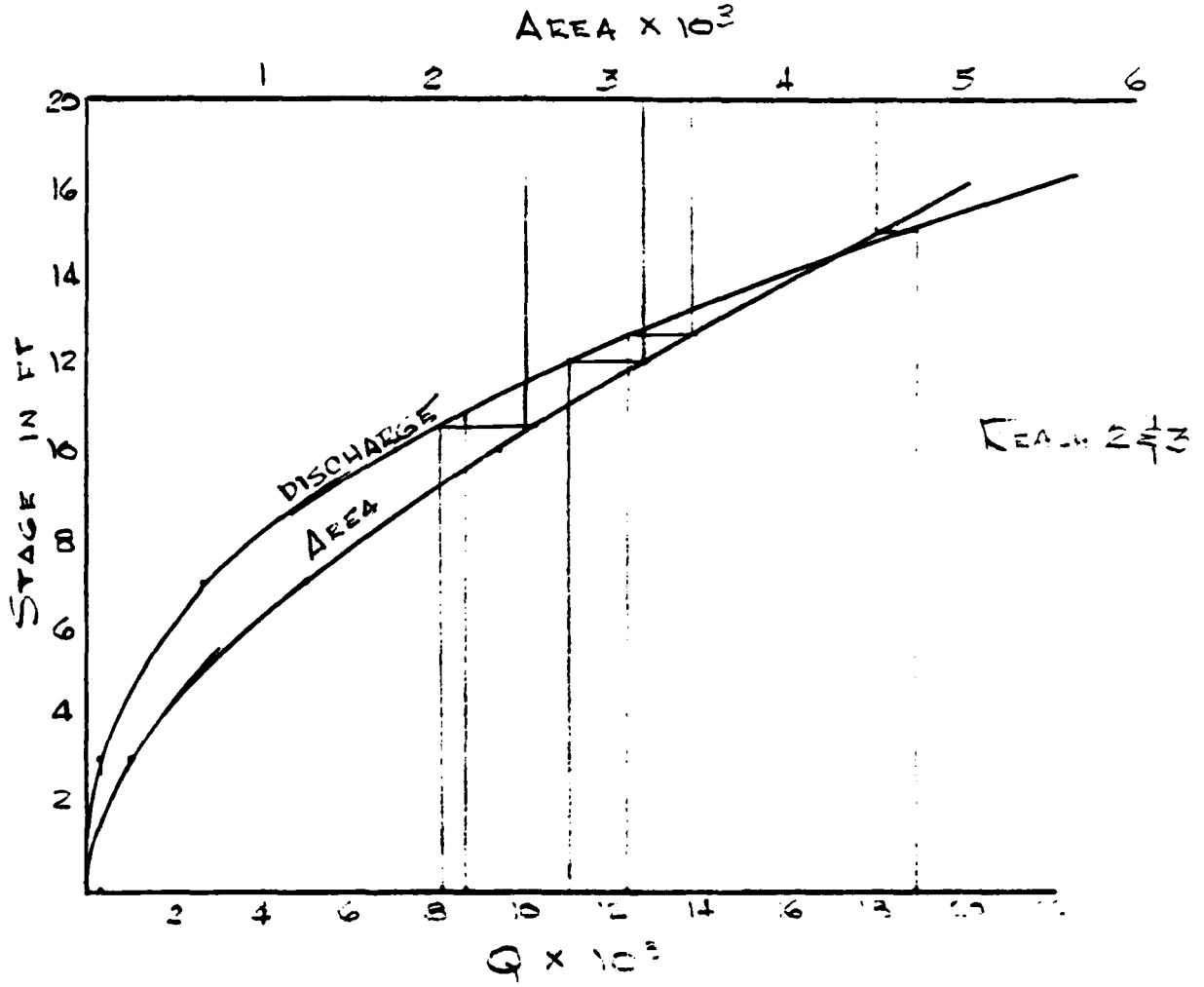


BY REB DATE 11-19-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 4 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT ANDOVER LAKE DAM, FAILURE ANALYSIS

STAGE	AREA	P	R	$R^{2/3}$	Q
3	225	150.2	1.49	1.31	271
7	1225	350.5	3.49	2.30	2542
10	2352	401.9	5.85	3.25	7032
12	3188	436.1	7.21	3.77	11,077
15	4569	487.4	9.37	4.45	15,700



FOR Q = 19,856 CFS, STAGE = 15.0 FT, AREA = 4500 FT

$$VOL_1 = \frac{4500 \times 12900}{43,560} = 1,332 > \tfrac{1}{2} =$$

USE SHORTER REACH ∴ 30+00 TO 94+00

$$VOL_1 = \frac{4500 \times 6400}{43,560} = 661 \text{ ACRE-FT}$$

$$Q_{P2\,(TRIAL)} = 19,856\left(1 - \frac{661}{1480}\right) = 10,998 \text{ CFS}$$

FOR Q = 10,998 CFS, STAGE 12.0 FT, AREA = 3180 FT

$$VOL_2 = \frac{3180 \times 6400}{43,560} = 467 \text{ ACRE-FT}$$

$$V_{AVE} = \frac{661 + 467}{2} = 564 \text{ ACRE-FT}$$

$$Q_{P2} = 19,856\left(1 - \frac{564}{1480}\right) = 12,290 \text{ CFS}$$

FOR Q = 12,290, STAGE = 12.6' ΔH = 3.6'

REACH 3, STA 94+00 TO STA 158+00

FOR Q = 12,290, STAGE = 12.6, AREA = 3,450 FT

$$VOL_1 = \frac{3,450 \times 6400}{43,560} = 507 \text{ ACRE-FT}$$

$$Q_{P2\,(TRIAL)} = 12,290\left(1 - \frac{507}{1480}\right) = 8,080 \text{ CFS}$$

FOR Q = 8,080 CFS, STAGE = 10.6, AREA = 2,500 FT

$$VOL_2 = \frac{2,500 \times 6400}{43,560} = 367 \text{ ACRE-FT}$$

$$V_{AVE} = \frac{507 + 367}{2} = 437 \text{ ACRE-FT}$$

BY REB DATE 11-8-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 9 OF

CHKD. BY DATE INSPECTION OF DAM PROJECT

SUBJECT ANDOVER LAKE DAM, FAIRLEE, VT.

$Q_{FR} = 12,290\left(1 - \frac{437}{1485}\right) =$ 8,[illegible] CFS

FOR 8,661 CFS, STAGE = 10.8 ΔH = 7.8 FT

REACH 4 STA 158+00 TO STA 220+00

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

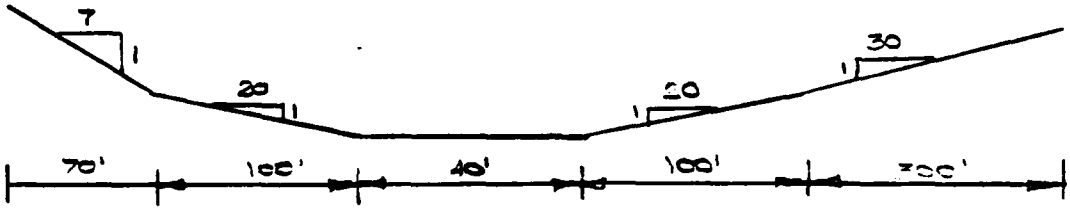
$n = .045$

$Q = 1.32\, A R^{2/3}$

$S = \frac{270 - 260}{6200}$

$S = 0.0016$

$S^{1/2} = 0.04$



STAGE	AREA	P	R	$R^{2/3}$	Q
2	160	120.1	1.33	1.21	256
5	700	240.2	2.91	2.04	1825
8	1586	351.3	4.51	2.73	5715
10	2262	425.6	5.55	3.14	7790

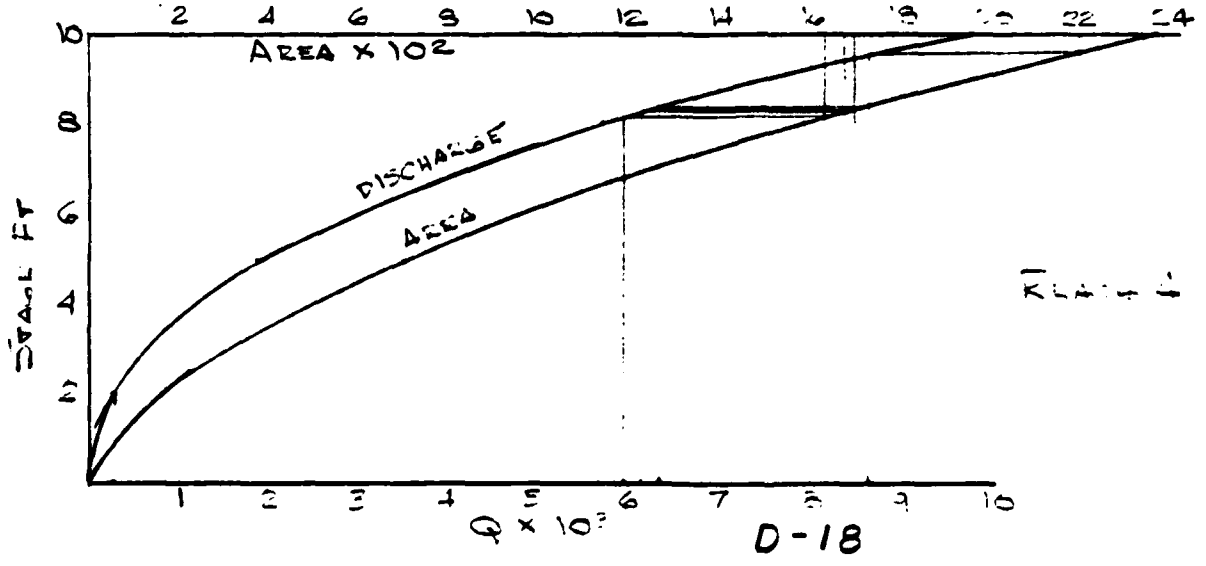


FIGURE 4

D-18

BY REE DATE 11-29-77 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT ANDOVER LAKE DAM, FAILURE ANA

FOR Q_{p1} = 8,661 STAGE = 9.5 FT, AREA = 2950 FT

$$Vol_1 = \frac{2950 \times 6200}{43,560} = 461$$

$$Q_{p2(TRIAL)} = 8,661\left(1 - \frac{461}{1180}\right) = 5,263 \text{ CFS}$$

FOR Q = 5,963, STAGE = 8.1, AREA = 1630 FT

$$Vol_2 = \frac{1630 \times 6200}{43,560} = 232 \text{ ACRE-FT}$$

$$V_{AVE} = \frac{461 + 232}{2} = 346 \text{ ACRE-FT}$$

$$Q_{p2} = 8,661\left(1 - \frac{346}{1480}\right) = 6636 \text{ CFS}$$

FOR Q = 6,636 CFS, STAGE = 8.3 FT, ΔH = 0.2 FT

REACH #5 STA 220+00 ± TO STA 250+00

ASSUME FOR VOLUME COMPUTATIONS, AREA CURVE IS THE SAME AS REACH #4 USE SAME CURVE FOR STAGE.

FOR Q = 6,636, STAGE = 16.4, AREA = 1650 SQ FT

$$Vol_1 = \frac{1650 \times 3000}{43,560} = 114 \text{ ACRE-FT}$$

$$Q_{p2(TRIAL)} = 6,636\left(1 - \frac{114}{1420}\right) = 6124 \text{ CFS}$$

FOR Q = 6,124, STAGE = 15.8 FT, AREA = 1670 SQ FT

$$Vol = \frac{1670 \times 3000}{43,560} = 115 \text{ ACRE-FT}$$

SAY AT 15.8 = 6130 CFS

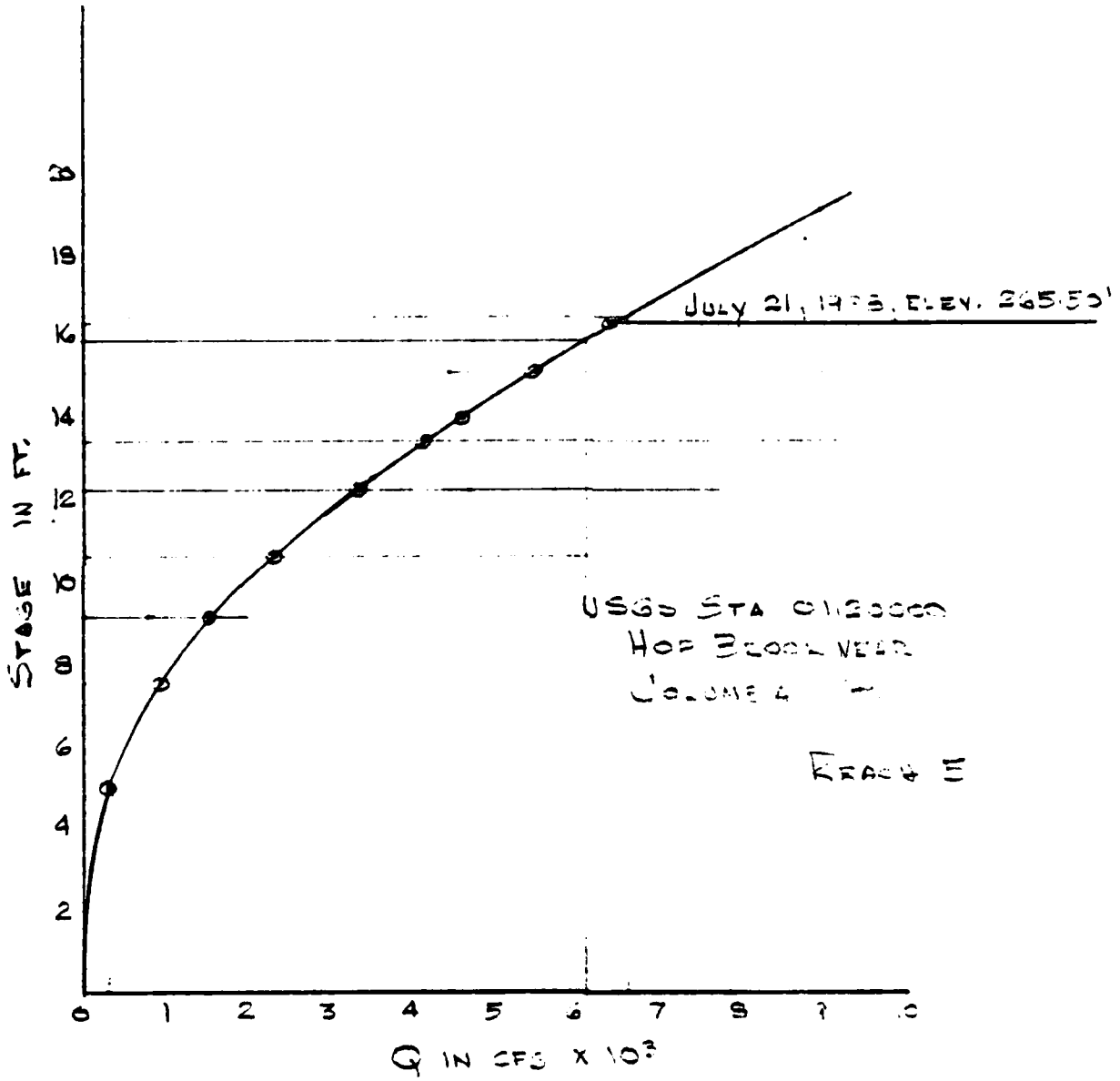
Q = 6130 CFS, STAGE = 15.8, ΔH = 10.4 FT

BY RFB DATE 11-30-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 8 OF

CHKD. BY ____ DATE ____ INSPECTION OF DAMS PROJECT ____

SUBJECT ANDOVER LAKE DAM, FAILURE ANALYSIS

18,800 MORE FT TO WILLIMANTIC RIVER
STA 438+00 = 8.30 MILES



BY RTE DATE 11-20-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 9 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT ANDOVER LAKE DAM - FAILURE ANALYSIS

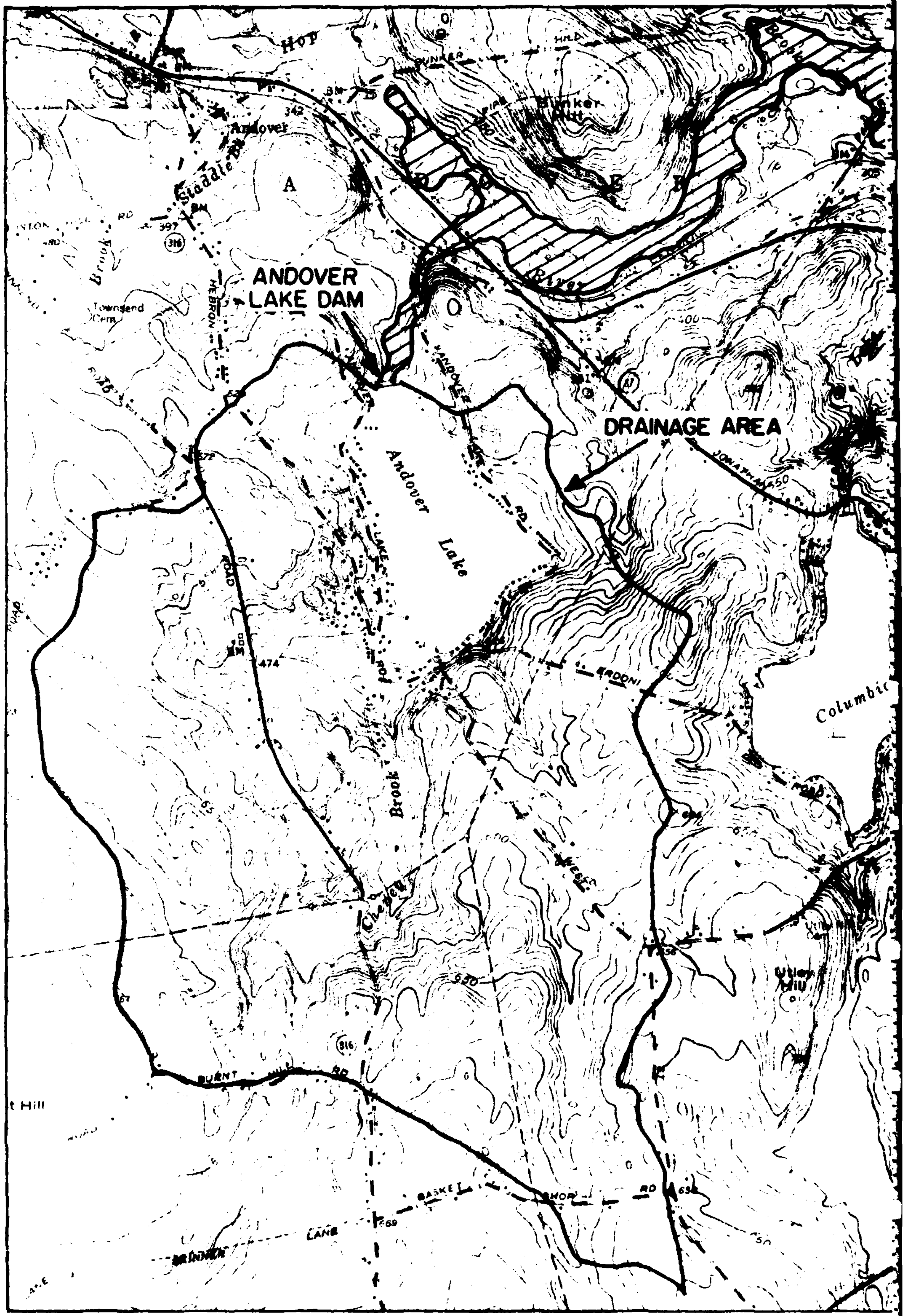
BEYOND USGS GAGE POTENTIAL MINOR
FLOODING OF TWO HOUSES WEST OF PLAINFIELD

SUMMARY OF FLOODING DOWNSTREAM

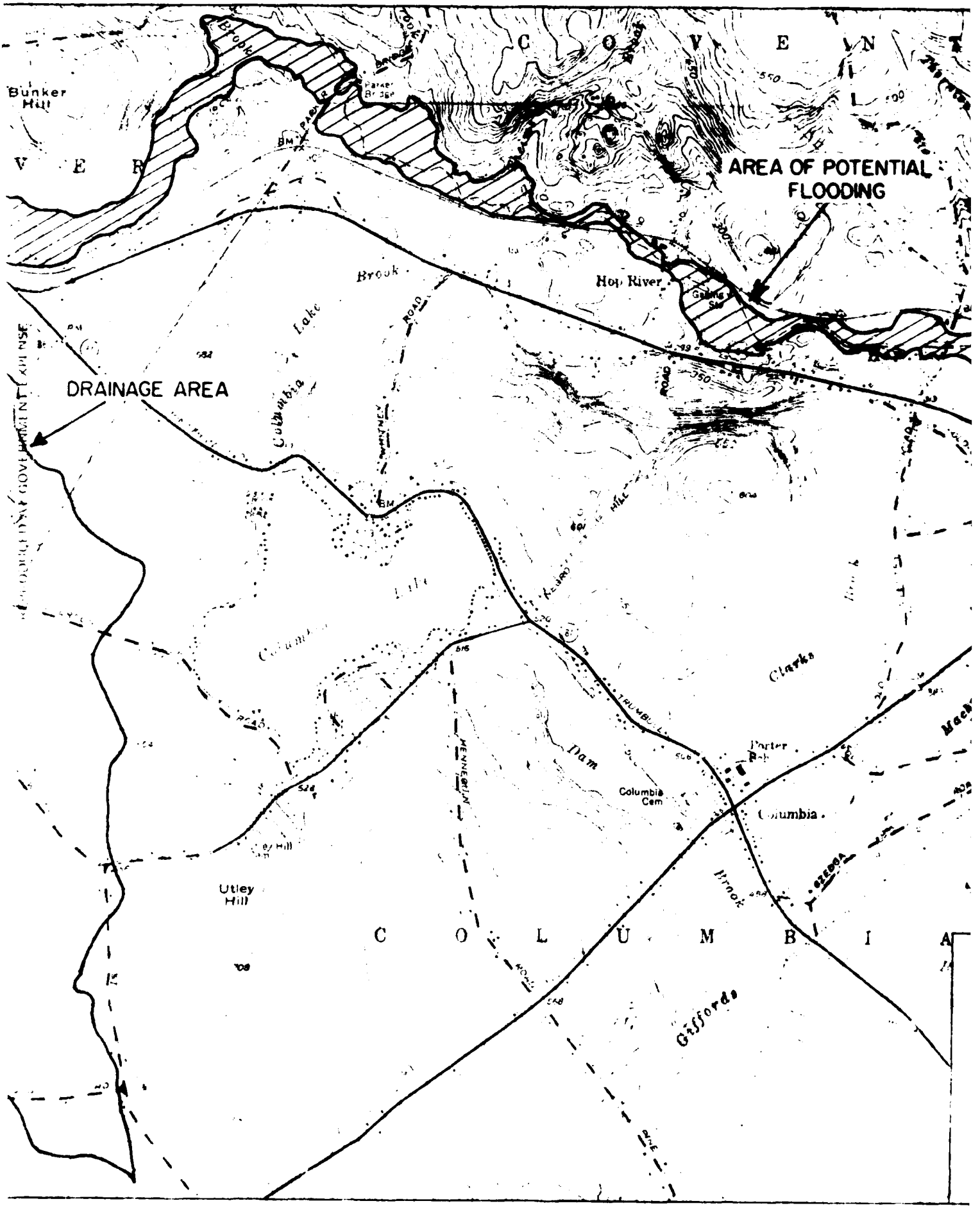
STA	Δ STAGE	DAMAGE
0+00	0	STAGE 14.8FT
30+00	11.3'	ANDOVER LAKE RD OLD ROUTE 57 NEW ROUTE 57
94+00	9.6'	NONE
158+00	7.8'	(MINOR) PARALLEL FLOODING 1 HOUSE
220+00	6.3'	(MINOR) HOUSE ROAD FLOOD (PRIMARY) INDUSTRIAL BLDG
USGS	10.8'	NONE
BEYOND	~	FLOODING AT WEST OF PLAINFIELD

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS



14/3


AREA OF POTENTIAL FLOODING
DRAINAGE AREA
Bunker Hill
Hop River
Lake
Columbia
Utley Hill
Dam
Clarks
Columbia
Gilfords
COVENTRY
COLUMBIA

LOUIS BERGER & ASSOC., INC. WELLESLEY, MASS ARCHITECT ENGINEER	US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

ANDOVER LAKE DAM

DRAINAGE AREA AND AREA OF POTENTIAL FLOODING

STATE - CT.

			SCALE 1" = 2000'
			DATE

3 of 3

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR. DIST.	(7) STATE	(8) COUNTY	(9) CONGR. DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY	MO	YR
CT	424	NED	CT	013	02				ANDOVER LAKE DAM	4143.5	7221.6	25	OCT	79

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	ANDOVER LAKE

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	07	BLACKMAN BROOK	ANDOVER	1	2200

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
MSRG	1920	R	21	20	1355	918	NED	N	N	N	: N	

(27) REMARKS
20=ESTIMATE 22=ESTIMATED

(28) D/S HAS	(29) SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	(30) MAXIMUM DISCHARGE (FT.)	(31) VOLUME OF DAM (CY)	(32) POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	(33) NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	464	U	39	280	6200											

(34) OWNER	(35) ENGINEERING BY	(36) CONSTRUCTION BY
ANDOVER LAKE MGT ASSOC.		

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

(38) INSPECTION BY	(39) INSPECTION DATE DAY	MO	YR	(40) AUTHORITY FOR INSPECTION
LOUIS BERGER & ASSOCIATES, INC.	25	OCT	79	PL92-367

(41) REMARKS