

AD-A145 339

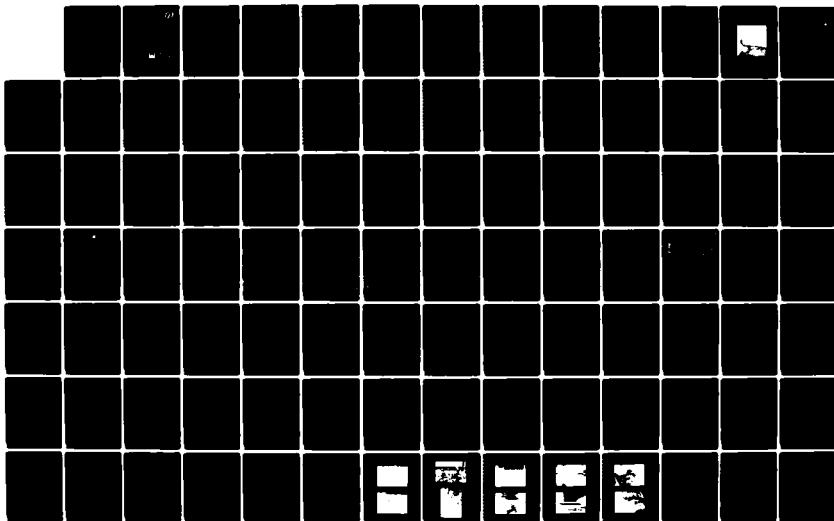
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
WINNEKEAG LAKE DAM (M..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUN 80

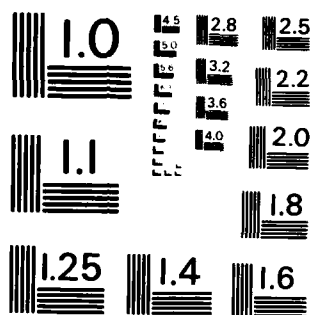
1/2

UNCLASSIFIED

F/G 13/13

NL

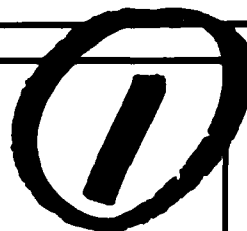




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD-A145 339

MERRIMACK RIVER BASIN
ASHBURNHAM , MASSACHUSETTS



WINNEKEAG LAKE DAM
MA 00007

**PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**

DTIC FILE COPY



DTIC
ELECTE
SEP 6 1984
S D

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

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

JUNE 1980

84 09 05 061

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MA 00007	2. GOVT ACCESSION NO. AD A-45 339	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Winnekeag Lake Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE June 1980
		13. NUMBER OF PAGES 85
		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, Merrimack River Basin Ashburnham, Massachusetts		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Winnekeag Lake Dam is a 260-foot long dry-stone masonry and earth dam. The dam has a maximum height of 21 feet and consists of a spillway and separate outlet structure. The dam is in fair condition. The dam has been classified in the intermediate size and high hazard categories. A test flood equal to the full PMF was used to evaluate the capacity of the spillway.		



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDED

OCT 28 1980

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

Dear Governor King:

Inclosed is a copy of the Winnekeag 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 Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, James River-Massachusetts, Inc., Fitchburg, Mass.

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

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

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A/1	

WINNEKEAG LAKE DAM

MA 00007

MERRIMACK RIVER BASIN
ASHBURNHAM, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00007

Name of Dam: Winnekeag Lake

Town: Ashburnham

County and State: Worcester County, Massachusetts

Stream: Phillips Brook, tributary of the Nashua River

Date of Inspection: May 8, 1980

Winnekeag Lake Dam is a 260-foot long dry-stone masonry and earth dam built prior to 1878. The dam has a maximum height of 21 feet and consists of a spillway and separate outlet structure. The downstream slope of the dam is a vertical dry-stone masonry wall. The top of the dam is at Elevation (El) 1132.7. The spillway is a modified broad crested weir, 27.9 feet long, with the crest at El 1126.0. The outlet is a 12-inch pipe controlled by a gate valve. The invert of the outlet is about El 1110. The outlet control is located in a wooden gatehouse on the crest of the dam.

There are deficiencies which must be corrected to assure the continued performance of this dam. This conclusion is based on the visual inspection of the site and a review of the available data. Generally the dam is in fair condition.

The following deficiencies were observed at the site: bulging of downstream stone wall; seepage discharging from the stone culvert low-level outlet; seepage downstream of the toe of the dam; several sinkholes on the crest of the dam adjacent to the downstream stone wall; animal burrows on the crest of the dam; voids between the stones on the downstream wall; erosion of the crest adjacent to the spillway right training wall; riprap missing from the upstream face of the dam; cracked concrete at the upstream end of the spillway left training wall; and an accumulation of debris in the low level outlet culvert and spillway discharge channel.

WINNEKEAG LAKE DAM

Based on Corps of Engineers' guidelines, the dam has been classified in the intermediate size and high hazard categories. A test flood equal to the full probable maximum flood (PMF) was used to evaluate the capacity of the spillway. The test flood outflow is 1860 cfs, resulting in a pond level at El 1133.1. The test flood would overtop the dam by 0.4 feet. Hydraulic analyses indicate that the spillway (without stoplogs) can discharge 1530 cfs, or 83 percent of the test flood outflow before the dam is overtopped. With stoplogs (1.4 feet high) the spillway can discharge 1,150 cfs or 57 percent of the test flood outflow before the dam is overtopped.

It is recommended that the Owner employ a qualified registered professional engineer to evaluate the stability of the dam and the spillway and to conduct a more detailed hydraulic and hydrologic study of the spillway if the stoplogs on the spillway are not removed. In addition, the Owner should repair the deficiencies listed above, as described in Section 7.3. The Owner should also implement a program of annual technical inspections, and prepare a written plan for (1) surveillance of the dam during and after periods of heavy rainfall, and (2) for notifying downstream residents in the event of an emergency at the dam.

The measures outlined above and in Section 7 should be implemented by the Owner within a period of one year after receipt of this Phase I Inspection Report.



A handwritten signature in cursive script, reading "Edward M. Greco".

Edward M. Greco, P.E.
Project Manager
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 29800

Approved by:

A handwritten signature in cursive script, reading "Stephen L. Bishop".

Stephen L. Bishop, P.E.
Vice President
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 19703



WINNEKEAG LAKE DAM

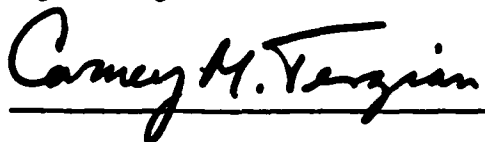
This Phase I Inspection Report on Winnekeag Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.



RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division



ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division



CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:



JOE B. FRIAR
Chief, Engineering Division

PREFACE

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

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions 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 aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general conditions and the downstream damage potential.

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

TABLE OF CONTENTS

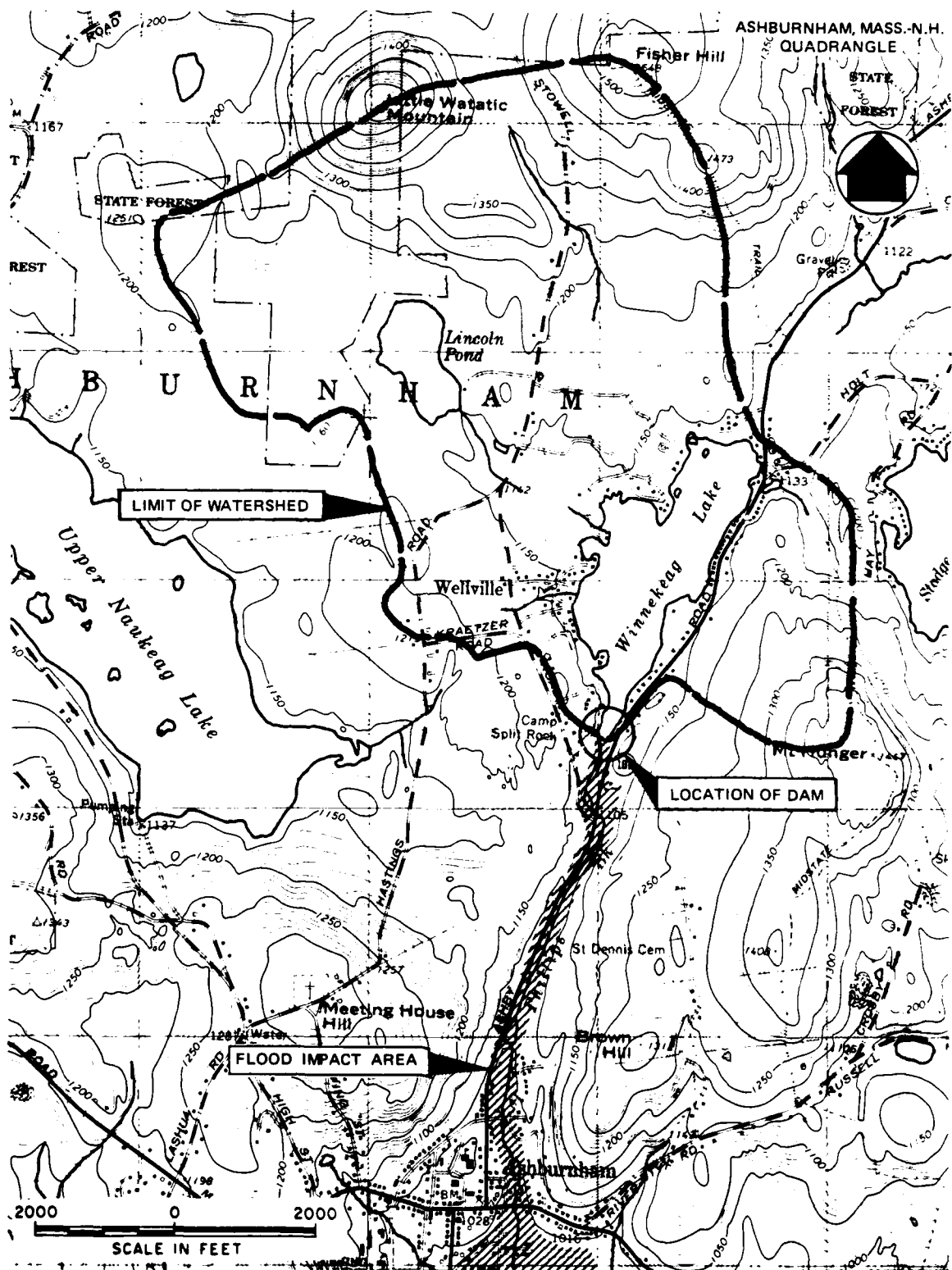
	<u>Page</u>
BRIEF ASSESSMENT	i
PREFACE	iv
OVERVIEW PHOTO	vii
LOCATION MAP	viii
REPORT	
SECTION 1 - PROJECT INFORMATION	1
1.1 General	1
1.2 Description of Project	1
1.3 Pertinent Data	4
SECTION 2 - ENGINEERING DATA	6
2.1 General	8
2.2 Construction Records	8
2.3 Operating Records	8
2.4 Evaluation	8
SECTION 3 - VISUAL INSPECTION	10
3.1 Findings	10
3.2 Evaluation	12
SECTION 4 - OPERATING AND MAINTENANCE PROCEDURES	13
4.1 Operating Procedures	13
4.2 Maintenance Procedures	13
4.3 Evaluation	13
SECTION 5 - EVALUATION OF HYDRAULIC/ HYDROLOGIC FEATURES	14
5.1 General	14
5.2 Design Data	14
5.3 Experience Data	14
5.4 Test Flood Analysis	14
5.5 Dam Failure Analysis	15

TABLE OF CONTENTS (Continued)

	<u>Page</u>
SECTION 6 - STRUCTURAL STABILITY	17
6.1 Visual Observations	17
6.2 Design and Construction Data	17
6.3 Post Construction Changes	17
6.4 Seismic Stability	18
SECTION 7 - ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES	19
7.1 Dam Assessment	19
7.2 Recommendations	20
7.3 Remedial Measures	20
7.4 Alternatives	21
APPENDIXES	
APPENDIX A - PERIODIC INSPECTION CHECKLIST	
APPENDIX B - PLANS OF DAM AND PREVIOUS INSPECTION REPORTS	
APPENDIX C - PHOTOGRAPHS	
APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS	
APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS	

OVERVIEW
WINNEKEAG LAKE DAM
ASHBURNHAM, MASSACHUSETTS





LOCATION MAP - WINNEKEAG LAKE DAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

WINNEKEAG LAKE DAM

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. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-80-C-0054, dated April 18, 1980, has been assigned by the Corps of Engineers for this work.
- b. Purpose
 - (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
 - (2) Encourage and assist the States to quickly initiate 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. The dam is located on Phillips Brook in the Town of Ashburnham, Worcester County, Massachusetts (see Location Map) in the Merrimack River Basin. The coordinates of this location are Latitude 42 deg. 39.3 min. north and Longitude 71 deg. 54.3 min. west.
- b. Description of Dam and Appurtenances. Winnekeag Lake Dam is a 260-foot long, dry-stone masonry and earth dam with a maximum height of 21 feet (see Plan of Dam and Sections in Appendix B and photographs in Appendix C). The top of

WINNEKEAG LAKE DAM

the dam is 28 feet wide and varies from El 1132.7 to 1132.8. A gatehouse is located on the top of the dam. The upstream face is a 1.8:1 (horizontal to vertical) slope covered with riprap. Generally, the downstream stone face is relatively vertical although the upper portion of the wall has a batter of about 1:4. Available drawings indicate that the dam is a zoned embankment with a select material central core containing a vertical timber sheet pile cutoff wall (see Figure B-3 and B-4). The drawings also show that the timber sheet pile and core extend into a cutoff trench below the base of the dam. A concrete core wall is located in the embankment west of the spillway.

The spillway, located at the right abutment of the dam, is a 27.9-foot long, broad-crested concrete weir. The approach channel consists of a timber and rock crib wall along the right shoreline. Wooden stoplogs 1.4 feet high are mounted on concrete filled steel pipe on the crest of the spillway. A steel H column is located behind one pipe.

The crest of the spillway is at El 1126.0, and the top of the stoplogs is at El 1127.4. The stoplogs are 27.9 feet long. There is a vertical drop of about 4 feet at the downstream end of the weir. The maximum training wall height is 6.7 feet above the spillway crest.

The discharge channel below the spillway is about 14 feet wide. The left side of the channel is a 10-foot high vertical concrete wall which extends 22 feet downstream and also serves as a retaining wall for the embankment. The floor of the channel is covered with rock, loose stones and debris and slopes at 13 percent.

The low-level outlet for the dam is a 12-inch pipe controlled by a gate valve. The gate valve may be operated from within the wooden gatehouse which is located 60 feet from the upstream end of the dam (see Figure B-3 and B-4). There is a cast-iron grating on the intake end of the 12-inch pipe. The invert of the downstream end of the outlet is about El 1110. The outlet pipe discharges into a stone culvert just downstream of the slide gate. The stone culvert is 3 feet wide by 2 feet high and discharges the base of the vertical stone wall which forms the downstream side of the dam.

- c. Size Classification. Winnekeag Lake Dam is classified in the "intermediate" category since it has a maximum height of 21 feet and a maximum storage capacity of 1,284 acre-feet.

- d. Hazard Classification. There are more than 20 houses located along the stream downstream of the dam (see Flood Impact Area shown on the Location Map). This includes three houses within 3,500 feet and the other houses within 7,000 feet downstream of the dam. The foundations of these structures are approximately 3 to 10 feet above the bed of the stream. An assumed failure of the dam could cause the possible loss of more than a few lives and an excessive amount of property damage could occur. Accordingly, the dam has been placed in the "high" hazard category.
- e. Ownership. The dam is owned by James River-Massachusetts, Inc., 701 Westminister Street, P.O. Box 310, Fitchburg, Massachusetts, 01420. Mr. Norman Burt (telephone 617-343-3051) granted permission to enter the property and inspect the dam.
- f. Operator. The dam is operated by personnel from James River-Massachusetts, Inc.
- g. Purpose of the Dam. Winnekeag Lake is used for recreation purposes.
- h. Design and Construction. Construction of Winnekeag Lake Dam was completed prior to 1878. Drawings and specifications dated October 29, 1878 and other drawings dated May 21, 1895 as prepared by Thomas C. Sheldon are available (see Figures B-3 and B-4). A drawing (see Figure B-5) dated August, 1931 shows the addition of wooden flashboards 2 feet above the spillway. The latest drawing (see Figure B-6) dated June 1, 1950, prepared by Howard M. Turner, indicates raising the elevation of the crest of the dam, addition of a concrete retaining wall on the left abutment and a concrete cut-off wall on the right embankment, removal of the existing wood flashboard structure, and addition of concrete to both spillway training walls. The drawings show that the dam was constructed essentially as it appears today. However a timber and rock crib wall now extends along the shoreline upstream of the right spillway training wall and backfill was placed behind the concrete wall west of the spillway.

Previous inspection reports (as listed in Appendix B) indicate since the first inspection in 1924 the dam has been in good condition. Repairs have been made such as filling in a hole and riprapping on the upstream embankment slope in 1948 and 1949, rebuilding the spillway in 1950, raising the dam 2 feet in 1951, placing concrete facing on the downstream end of the left spillway training wall in 1958, adding a timber crib stone retaining wall upstream of the right spillway

training wall in 1963, and adding a new concrete wall along Water Street also in 1963. A bulge in the downstream stone wall was intermittently reported during inspections from 1924 to 1963.

According to the 1949 inspection report, "the 1936 and 1938 flood could not be handled. Embankment sandbagged after each flood". In the 1936 flood the water level was reported at El 1129.7.

1. Normal Operating Procedures. Personnel from James River-Massachusetts, Inc. reportedly visit the dam once a month. At that time, they inspect the dam and appurtenances for vandalism, storm damage and deterioration. The stoplogs are normally left in place to maintain water in the reservoir for recreation purposes. Some of the stoplogs are removed to augment flow in Phillips Brook for a swimming pond located less than a mile downstream. The low-level outlet was last operated in 1979 as part of the annual inspection.

1.3 Pertinent Data

- a. Drainage Area. The drainage area is approximately 1,331-acres (2.08 square mile) and consists of flat to steep hilly land (see Location Map). The drainage area includes drainage from Lincoln Pond. About 16 percent of the drainage area is ponds and swamps. In general, the undeveloped portions of the drainage area consist of 98 percent woodland, and 2 percent open fields. Moderate residential development occurs mostly around the shoreline.
- b. Discharge. Discharge from Winnekeag Lake Dam flows over the wooden stoplogs on the concrete spillway and into a combination bedrock and stone discharge channel. Water also discharges from the outlet into the spillway discharge channel about 15 feet downstream of the dam.
 - (1) Outlet: Size - 12-inch; Invert El. - about 1,110 - Discharge capacity 15 cfs at El 1127.4.
 - (2) Maximum known flood at damsite: El 1129.7 in 1936.
 - (3) Ungated spillway capacity (without stoplogs) at top of dam: 1530 cfs at El 1132.7.
 - (4) Ungated spillway capacity (without stoplogs) at test flood elevation: 1670 cfs at El 1133.1.

WINNEKEAG LAKE DAM

- (5) Gated spillway capacity at normal pool elevation:
N/A
- (6) Gated spillway capacity at test flood elevation:
N/A
- (7) Total spillway capacity at test flood elevation:
N/A 1670 cfs at El 1133.1
- (8) Total project discharge (without stoplogs) at test
flood elevation: 1860 cfs at El 1133.1.
- c. Elevation (feet above National Geodetic Vertical Datum of
1929 (NGVD)). A benchmark was established at El 1126.0
on the crest of the spillway. This elevation was
estimated from a United States Geological Survey
(U.S.G.S.) topographic map.
 - (1) Streambed at toe of dam: 1112.0
 - (2) Bottom of cutoff: unknown
 - (3) Maximum tailwater: unknown
 - (4) Normal pool: 1127.4 (stoplogs in place)
 - (5) Full flood control pool: N/A
 - (6) Spillway crest (ungated): 1126.0
 - (7) Design surcharge (Original Design): unknown
 - (8) Top of dam: 1132.7 to 1132.8
 - (9) Test flood surcharge: 1133.1 without stoplogs;
1133.6 with stoplogs
- d. Reservoir (Length in feet)
 - (1) Normal pool: 4,700
 - (2) Flood control pool: N/A
 - (3) Spillway crest pool: 4,700
 - (4) Top of dam: 4,700
 - (5) Test flood pool: 4,700

WINNEKEAG LAKE DAM

e. Storage (acre-feet)

- (1) Normal pool: 527
- (2) Flood control pool: N/A
- (3) Spillway crest pool: 527
- (4) Top of dam: 1284
- (5) Test flood pool: 1329

f. Reservoir Surface (acres)

- (1) Normal pool: 113
- (2) Flood-control pool: N/A
- (3) Spillway crest: 113
- *(4) Test flood pool: 113
- *(5) Top of dam: 113

g. Dam

- (1) Type: dry-stone masonry and earthfill
- (2) Length: 260 feet including spillway
- (3) Height: 21 feet
- (4) Top width: 28 to 55 feet
- (5) Side slopes: upstream about 1.8 to 1;
downstream vertical to 1:4
- (6) Zoning: select fill material containing timber
sheet piling in earth embankment
- (7) Impervious core: select fill material with timber
sheet piling
- (8) Cutoff: select fill and sheeting extend into a
cutoff trench
- (9) Grout curtain: unknown
- (10) Other: N/A

*Based on the assumption that the surface area will not significantly increase with changes in pool elevation from 1126.0 to 1133.1.

h. Diversion and Regulating Tunnel: N/A

i. Spillway

- (1) Type: concrete modified broad crested weir
- (2) Length of weir: 27.9 feet
- (3) Crest elevation: 1126.0 without stoplogs
1127.4 with stoplogs
- (4) Gates: none
- (5) Upstream channel: stone bottom except concrete for 3 feet upstream of stoplogs, right wall is timber and stone crib along shoreline
- (6) Downstream channel: rock bottom, with loose stones, stumps, logs and minor debris
- (7) General: a concrete culvert 8 feet wide by 6.3 feet high is located about 1,100 feet downstream beneath Water Street (State Highway 101)

j. Regulating Outlets

- (1) Invert El: About 1110
- (2) Size: 12-inch pipe discharges into 2 foot high by 3 foot wide stone culvert just downstream of gate valve
- (3) Description: gate valve located at base of shaft below wooden gatehouse
- (4) Control mechanism: the valve operating stem extends up through a 2.5 foot diameter mortared brick-lined shaft

WINNEKEAG LAKE DAM

SECTION 2

ENGINEERING DATA

- 2.1 General. The engineering data available for this Phase I inspection includes drawings and specifications dated October 29, 1878 and May 21, 1895 prepared by Thomas C. Sheldon (see Figures B-3 and B-4). Other drawings include one dated August, 1931 and another dated June 1, 1950 prepared by Howard M. Turner (see Figures B-5 and B-6). The drawings and specifications were obtained from the Worcester County Engineers office. There are no other drawings, specifications, or computations available from the Owner or State. Copies of previous inspection reports dated 1924 to 1969, prepared by the Worcester County Engineers office are included in Appendix B. The most recent inspection was conducted in 1971 by the Massachusetts Department of Public Works. A copy of that report is also given in Appendix B.

We acknowledge the assistance and cooperation of personnel from the Massachusetts Department of Environmental Quality Engineering, Division of Waterways; the Massachusetts Department of Public Works; and the Worcester County Engineers Office. In addition, we acknowledge the assistance of Mr. Leo Collette, Jr. of James River-Massachusetts, Inc., who provided information on the history and operation of the dam.

- 2.2 Construction Records. The only construction records are the 1878, 1895, 1931 and 1950 Plans referred to in Section 2.1. There are no as-built drawings available for the dam or appurtenances. Previous inspection reports by the Worcester County Engineers office provided some construction information, and a summary of repairs and post-construction changes at the site.
- 2.3 Operating Records. No operating records are available, and there is no daily record kept of the elevation of the pool or rainfall at the dam site.

2.4 Evaluation

- a. Availability. There is limited engineering data available for this dam.
- b. Adequacy. The lack of detailed hydraulic, structural and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based on the visual inspection, past performance history, and engineering judgment.

WINNEKEAG LAKE DAM

- c. Validity. Comparison of the available drawings with the field survey conducted during the Phase I inspection indicates that the available information is valid.

SECTION 3
VISUAL INSPECTION

3.1 Findings

- a. General. The Phase I Inspection of the dam at Winnekeag Lake was performed on May 8, 1980. A copy of the inspection checklist is included in Appendix A. Previous inspections were conducted by the Worcester County Engineers office from 1924 to 1969, and by the Massachusetts Department of Public Works in 1971. Copies of those reports are given in Appendix B. Selected photographs taken during our Visual Inspection are included in Appendix C.
- b. Dam. The dam is a dry-stone masonry earthfill structure with a spillway and outlet. Evidence of seepage was noted in one location and evidence of standing water was noted at a second location, each about 15 feet downstream of the downstream face of the dam (see Figure B-1). The seep is indicated by a stream of clear water flowing at approximately 1 gpm into the backwater near the left abutment. A pool of clear standing water was observed about 3 feet in diameter in line with the center of the dam.

Several minor sinkholes, some as deep as 13 inches, were observed on the crest of the dam adjacent to the downstream stone wall (see Photo No. 3). There are also several small animal burrows on the crest.

The dry stone masonry wall on the downstream face is in fair condition. Voids between the stones could be probed to as deep as 4.5 feet back into the dam. There is a bulge of the middle of the wall at the center and about halfway between the center and left abutment. There are several piles of random fill at or near the base of the stone wall (see Photo No. 4).

Moderate erosion was noted on the crest of the dam adjacent to the right spillway training wall (see Photo No. 6).

Some pieces of riprap are missing from the upstream face of the embankment (see Photo No. 7) including the area at and near the upstream end of the left training wall of the spillway. There are numerous bush and small tree stumps in the riprap.

- c. Appurtenant Structures. The spillway is a broad crested weir with stoplogs (see Photo No. 8). At the time of the inspection, water was discharging over the spillway, so the weir, stoplogs, and downstream toe could not be examined. The concrete on the crest of the spillway was in fair condition, although the concrete downstream of the stoplogs is slightly spalled. The concrete and stonework of the training walls are in good condition except for missing mortar at the downstream end of the left training wall. At the upstream end of the left training wall, there is a transverse crack (less than 1/32 inch) through the concrete. Some voids exist in the riprap at this location. There is an outward tilt of the top of the timber and stone crib approach wall along the right shore line. The wooden stoplogs are in fair condition. There is no access walkway to the stoplogs which would permit removal of the boards during periods of high flow. The crest of the spillway was clear of debris.

A portion of the discharge end of the outlet was visible during inspection. As shown in Photo No. 2, the wooden gatehouse is in good condition, including a 2.5 foot diameter brick lined shaft which extends to the gate valve. A seep was observed from the mortar about 11.5 feet (El 1121.5) below the floor.

The gate valve on the outlet, located at the base of the brick shaft, is in fair operating condition. The pipe and gate are submerged in about 0.6 foot of water. Slight leakage was noted from the discharge end of the outlet pipe.

The outlet conduit is a 12-inch pipe discharging into a stone culvert, 3 feet wide by 2 feet high, within the embankment (see Photo No. 5). The discharge end of the stone culvert outlet was probed to a depth of 6 feet into the embankment, indicating some stone obstructions within the culvert. The exposed end of the outlet was partly clogged with debris, and a moderate amount of flow was discharging at the time of inspection. At the time of inspection, the gate valve was closed.

- d. Reservoir Area. The reservoir area is moderately developed. Camp Split Rock is located on the west side of the reservoir abutting the dam. Residential development is located generally on the east and west sides of the reservoir. Most of the land is wooded with gentle to steep slopes. There is limited potential for future development in the reservoir area.

- e. Downstream Channel. The natural floor of the spillway channel is covered with mostly stone although bedrock was evident in some areas. There is a slight accumulation of wood and debris in the floor of the channel (see Photo No. 9). Several small to large trees are overhanging the spillway channel.

The spillway channel merges with the outlet channel about 15 feet downstream of the stone wall to form the downstream channel (see Photo No. 5). The natural floor of the downstream channel contains occasional loose stones and a number of logs. There are numerous trees overhanging this channel.

About 1,100 feet downstream of the dam, a road embankment about 10 feet high crosses the channel. Water flows through the embankment in an 8-foot wide by 6.3-foot high concrete culvert (see Photo No. 10).

- 3.2 Evaluation. The visual inspection indicates that the dam is in fair condition. The stated deficiencies which must be corrected to assure the continued performance of this dam and measures to improve this condition are stated in Section 7.

SECTION 4
OPERATING AND MAINTENANCE
PROCEDURES

4.1 Operating Procedures

- a. General. According to Mr. Leo Collette, Jr., Manager of Engineering, James River- Massachusetts, Inc. the standard procedure for operating the dam is to leave the stoplogs in place to maintain an adequate water level for recreational purposes. Discharge is regulated at the dam by adjusting the stoplogs to maintain flow, particularly in the summer when water is needed downstream in a swimming pond. Some of the stoplogs are then removed to augment flow in Phillips Brook.
- b. Warning System. The Owner of the dam, in cooperation with the Office of Civil Defense, Fitchburg has devised a plan for surveillance of the dam during and after periods of heavy rainfall, and for warning local residents in case of an emergency at the structure. This written plan is presently reportedly being upgraded.

4.2 Maintenance Procedures

- a. General. The dam is generally well maintained. The Manager of Engineering is responsible for maintenance of the facility. Monthly inspections by his staff have been conducted in the past. Typical annual maintenance procedures have included clearing brush and trees from the crest and upstream slopes, clearing debris from the spillway and outlet channel, and mowing grass on the crest of the dam.
- b. Operating Facilities. The operating condition of the outlet works is checked monthly by the Owner. In addition, the gate valve is opened and closed each year. The last time it was opened to about 3/4 capacity was in 1979. In 1978, the extension for the gate operating mechanism was replaced.

- 4.3 Evaluation. There is a program for maintaining the embankment and appurtenant structures in good operating condition. There is also a program of regular technical inspections, a plan reportedly for surveillance of the embankment during and after periods of heavy rainfall, and reportedly an emergency warning system in effect. The latter two items are reportedly included in a written emergency preparedness plan, which is presently being upgraded. This written program should be implemented, as recommended in Section 7.3.

SECTION 5
EVALUATION OF HYDRAULIC/
HYDROLOGIC FEATURES

- 5.1 General. Winnekeag Lake Dam has a 2.08-square mile drainage area, about 16 percent of which is ponds and swamps (see Location Map). The land is combined steep hilly terrain with flat swampy areas and essentially undeveloped except for moderate development along the reservoir shoreline.

Lincoln Pond upstream of Winnekeag Lake provides additional storage within the watershed.

Winnekeag Lake has a surface area of approximately 113 acres, and a maximum storage capacity of 1,284 acre-feet at El 1132.7.

The low-level outlet can discharge a flow of 14.4 cfs when the lake is at El 1126.0 which is the crest of the spillway. At this lake elevation and with no additional inflow, the outlet can lower the lake by 1 foot in about 4 days.

- 5.2 Design Data. There are no hydraulic or hydrologic computations available for the design of the spillway at Winnekeag Lake Dam.
- 5.3 Experience Data. There is no record of overtopping of the present dam, which was constructed prior to 1878. According to records of the Worcester County Engineers office, the 1936 "flood" was at El 1129.7. This resulted in an estimated freeboard of about 0.5 foot. Subsequently, the dam was raised about 2 feet in 1951. In the 1949 inspection report, it was noted that plans had been made to "deepen spillway as 1936 and 1938 flood could not be handled. Embankment sandbagged after each flood." The low level outlet was open during the 1938 hurricane.
- 5.4 Test Flood Analysis. Winnekeag Lake Dam has been classified in the "intermediate" size and "high" hazard categories. According to the Corps of Engineers guidelines, a test flood equal to the full PMF (Probable Maximum Flood) should be used to evaluate the capacity of the spillway.

The PMF rate for the Winnekeag Lake watershed was calculated to be 1,450 cfs per square mile of drainage area. This calculation is based on the average slope of 3.5 percent in the drainage area, the pond-plus-swamp area to drainage area ratio of 16 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December 1977). For this analysis, the peak flow

rate was determined to be between the guide curves for "flat and coastal" and "rolling" topography.

Applying the full PMF rate to the 2.08 square mile drainage area results in a peak test flood inflow of 3,016 cfs. By adjusting the test flood inflow for surcharge storage, the peak test flood outflow was calculated to be 1,860 cfs (900 cfs per square mile), without stoplogs and 2,020 cfs (971 cfs per square mile) with stoplogs.

Without stoplogs, the lake level would rise to El 1133.1. With stoplogs, the lake would rise to El 1133.6.

Hydraulic analyses indicate that the spillway without stoplogs can discharge 1,530 cfs or 83 percent of the test flood outflow with the pond at El 1132.7, which is the low point on the top of the dam. With stoplogs (1.4 feet high) the spillway could discharge 1,150 cfs, or 57 percent of the outflow before the dam is overtopped.

Table 5-1 below summarizes the discharge from the lake during the test flood.

TABLE 5-1.

	Stoplogs in place	Stoplogs removed
Maximum height of water above dam, ft:	0.9	0.4
Discharge over spillway, cfs:	1,450	1,670
Discharge over dam, cfs:	570	190
Depth at critical flow, ft:	0.53	0.23
Velocity at critical flow, fps:	4.1	2.7

- 5.5 Dam Failure Analysis. The total peak discharge rate due to failure of the dam was calculated to be 10,010 cfs with the pond at El 1132.7. This calculation is based on a maximum head of 20.7 feet and an assumed 56-foot wide breach occurring in the embankment. Failure of the dam would produce a downstream flood wave about 12.5 feet deep as compared to channel flow about 5 feet deep prior to failure. It would take about 4 hours to drain the pond.

WINNEKEAG LAKE DAM

Discharge due to failure of the dam could result in overflowing of the channel further downstream. Due to the topography, little attenuation of the flood flow is expected before it reaches residences. There are more than 20 houses located along the stream downstream of the dam. This includes three houses within 3,500 feet and the other houses within 7,000 feet downstream of the dam. The foundations of these structures are approximately 3 to 10 feet above the bed of the stream. Failure of the dam could result in excessive property damage and loss of more than a few lives in developed areas downstream of the dam. Accordingly, the dam has been placed in the "high" hazard category.

SECTION 6
STRUCTURAL STABILITY

- 6.1 Visual Observations. The evaluation of the structural stability of Winnekeag Lake Dam is based on a review of previous inspection reports, a review of available drawings, and the visual inspection conducted on May 8, 1980.

As discussed in Section 3, Visual Inspection, the dam is in fair condition. Seepage was observed at two locations about 15 feet downstream of the dam. There is some bulging of the dry stone masonry wall on the downstream face as well as sinkholes on the crest of the dam adjacent to the downstream stone wall. An area of erosion adjacent to the right spillway training wall was observed on the crest of the dam.

- 6.2 Design and Construction Data. Construction of Winnekeag Lake Dam was completed prior to 1878. Computations for design of the dam, spillway and outlet are not available.

Drawings dated October 29, 1878 and May 21, 1895 prepared by Thomas C. Sheldon, a drawing dated August, 1931, and a drawing dated June 1, 1950 prepared by Howard M. Turner show the proposed construction of the dam (see Figures B-3 through B-6). The drawings show that the dam is a stone masonry and zoned earthfill dam. An impervious core made of selected material containing a timber sheet pile cutoff wall is located near the middle of the embankment. The remaining earthfill and stone wall is shown on the drawings. A cutoff trench extends an unknown depth below the base of the dam. The side slopes of the embankment are 1.8:1 upstream and relatively vertical downstream although the upper portion of the wall has a batter of about 1:4.

Specifications dated October 29, 1878 for construction of the dam are available. They include details on the types of sheet piling, earth material, and mortar used in construction.

There is no information on the shear strength or permeability of the soil and/or rock materials of the embankment.

- 6.3 Post-Construction Changes. Since the original construction of the dam, the following repairs have been made: a hole was filled in and riprapped on the upstream slope in 1948 and 1949; the spillway was rebuilt in 1950; the dam was raised about 2 feet in 1951; concrete facing was added to the downstream end of the left spillway training wall in 1958; a timber stone crib retaining wall was added to the upstream approach area of the right training wall in 1963, and a new concrete wall along Water Street was constructed in 1963.

6.4 Seismic Stability. The dam is located in Seismic Zone No. 2, and in accordance with Corps of Engineers' guidelines does not warrant further seismic analysis at this time.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition. As a result of the visual inspection, the review of available data, and limited information on operation and maintenance, the dam is considered to be in fair condition. The following deficiencies must be corrected to assure the continued performance of this dam: bulging of the downstream stone wall of the dam; seepage downstream of the toe of the embankment; voids between the stones on the downstream wall; several sinkholes on the crest of the dam adjacent to the downstream stone wall; animal burrows on the crest of the dam; erosion on the crest of the dam adjacent to the spillway right training wall; missing riprap from the upstream face of the embankment including some missing stone at the upstream end of the spillway left training wall; cracked concrete at the upstream end of the spillway left training wall; minor accumulation of debris in the spillway discharge channel; and an apparent accumulation of stones and/or debris within the low level outlet culvert and outlet discharge channel.

The gate valve on the low level outlet is partially submerged and reportedly operable, and the outlet is partially blocked. It is also submerged with water seeping from the stone culvert.

The peak test flood (full PMF) outflow is estimated to be 1,860 cfs with the pond at El 1133.1 (assuming the stoplogs are removed). The test flood would overtop the low point on the dam by 0.4 feet. Hydraulic analyses indicate that the spillway (without stoplogs) can discharge 1,530 cfs or 83 percent of the test flood outflow before the dam is overtopped. With the stoplogs in place, the spillway can discharge 1,150 cfs or 57 percent of the test flood outflow before the dam is overtopped.

- b. Adequacy. The lack of detailed design and construction data did not allow for a definitive review. Therefore, the evaluation of this dam is based on a review of the available data, the visual inspection, past performance and engineering judgment.
- c. Urgency. The recommendations and remedial measures outlined below should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

7.2 Recommendations. It is recommended that the Owner employ a qualified registered engineer to:

- a. Evaluate the stability of the dam. This should include an investigation of the seepage noted near the toe of the embankment. This should also include an inspection and evaluation of the downstream stone wall with regard to deep voids between stones, apparent outward bulging, and sinkholes on the crest just behind the wall. Consideration should be given to lowering the pond level to permit inspection of both sides of the dam. This investigation should also include an evaluation of the stability of the stone and timber crib wall along the shoreline just upstream of the spillway right training wall.
- b. Evaluate the stability of the spillway. This should include an inspection of the spillway under a no flow condition. Design repairs for the spillway as required.
- c. Evaluate the flow discharging from the stone culvert downstream from the gate valve to determine if the gate valve is or is not leaking, and whether or not the outlet discharge channel should be riprapped.
- d. Perform a detailed hydrologic/hydraulic analysis to evaluate the discharge capability of the spillway and the low level outlet, and the overtopping potential of the dam. However, if the stoplogs from the spillway are removed, then the spillway discharge capacity need not be evaluated. Consideration should be given to increasing the discharge capacity of the low-level outlet.

The Owner should implement the recommendations of the Engineer.

7.3 Remedial Measures

- a. Operating and Maintenance Procedures. It is recommended that the Owner accomplish the following:
 - (1) Clear trees, brush and roots to a distance of 25 feet downstream from the toe of the dam. All stumps and roots removed should be backfilled with select material.
 - (2) Fill in animal burrows on the crest of the dam.
 - (3) Seal the seep in the brick shaft beneath the gatehouse.

- (4) Replace missing riprap on the upstream face of the embankment including the area at the upstream end of the left spillway training wall.
- (5) To prevent continued erosion fill in the eroded area next to the right spillway training wall.
- (6) Remove all brush, trees, debris and loose stone in the floor of the spillway discharge channel.
- (7) Remove debris from the downstream end of the stone culvert outlet pipe.
- (8) Complete the written plan for surveillance of the dam and spillway during and after periods of heavy rainfall and a plan to warn people in downstream areas in the event of an emergency at the dam.
- (9) Continue a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam and appurtenances and be supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in compliance with all applicable State regulations. The maintenance program should include removal of any debris caught on the spillway weir to prevent clogging of the spillway.
- (10) Institute a program of technical inspections on an annual basis.

7.4 Alternatives. There are no recommended alternatives.

APPENDIX A
PERIODIC INSPECTION CHECKLIST

WINNEKEAG LAKE DAM

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT WINNEKEAG LAKE

DATE May 8, 1980

TIME 8:00 A.M.

WEATHER Rain, about 45°F

W.S. ELEV. 1127.8 U.S. 1112.0 N.S.

PARTY:

1. Michael Larson (Metcalf & Eddy - Geotechnical)
2. Scott Nagel (Metcalf & Eddy - Geotechnical)
3. Warren Diesl (Metcalf & Eddy - Geotechnical)
4. William Checchi (Metcalf & Eddy - Geotechnical)
5. Lyle Branagan (Metcalf & Eddy - Hydraulics)

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Dam</u>	<u>M. Larson</u>	
2. <u>Spillway</u>	<u>L. Branagan</u>	
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

PERIODIC INSPECTION CHECK LIST

PROJECT WINNEKEAG LAKE DATE May 8, 1980
 PROJECT FEATURE Dam NAME M. Larson
 DISCIPLINE Geotechnical NAME S. Nagel

u/s = upstream; d/s = downstream

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	Varies 1129.5 to 1132.8
Current Pool Elevation	1127.8
Maximum Impoundment to Date	1129.7
Surface Cracks	None visible
Pavement Condition	No pavement, grass covered
Movement or Settlement of Crest	None, several holes on crest just u/s of vertical stone face, as deep as 13". Also several animal burrows.
Lateral Movement	Slight bulging of middle of vertical stone wall at center and about halfway between (1)
Vertical Alignment	Two levels on crest, including a berm on the u/s portion of the crest.
Horizontal Alignment	Straight with a dogleg near left abutment.
Condition at Abutment and at Concrete Structures	Rt. abut.-earth and rock, one story wood cabin with concrete block walkout basement at base of hill. Lt. abut.-asphalt paved road at base of hill.
Indications of Movement of Structural Items on Slopes	No structural items except a 10" wide concrete core wall on rt. abutment which shows no movement.
Trespassing on Slopes	Yes. No fences. Tire tracks on rt. abutment.
Sloughing or Erosion of Slopes or Abutments	Erosion on outside of both spillway training walls includes d/s end of right wall and u/s end of left wall.
Rock Slope Protection - Riprap Failures	Below water level, several areas have missing stone. Above water level, occasional stones missing including area near left spillway training wall. (2)
Unusual Movement or Cracking at or near Toes	None visible.
Unusual Embankment or Downstream Seepage	Two areas d/s of vertical face. One near center is small pool; no moving water. Second is backwater from discharge channel near lt. abut., estimate flow at about 1 gpm.
Piping or Boils	None visible
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

(1) center and left abutment. (2) Numerous bush stumps between stones.

PERIODIC INSPECTION CHECK LIST

PROJECT WINNEKEAG LAKE DATE May 8, 1980
 PROJECT FEATURE Outlet Works NAME M. Larson
 DISCIPLINE Geotechnical NAME S. Nagel

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channel	Not visible, submerged.
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT WINNEKEAG LAKE DATE May 8, 1980
 PROJECT FEATURE Spillway NAME M. Larson
 DISCIPLINE Hydraulic NAME L. Branagan

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	Outlet structure is wood with padlock on door. A 2.5' diameter mortared brick lined shaft extends from floor to outlet pipe, about 20.6' deep. Brick is relatively dry except (1)
<u>General Condition of Concrete</u>	
<u>Rust or Staining</u>	NA
<u>Spalling</u>	NA
<u>Erosion or Cavitation</u>	None visible
<u>Visible Reinforcing</u>	None
<u>Any Seepage or Efflorescence</u>	Standing water at bottom of brick shaft. Seep from side of brick shaft.
<u>Condition at Joints</u>	Fair
<u>Drain Holes</u>	None visible
<u>Channel</u>	Submerged discharge through stone culvert flows into spillway discharge (2)
<u>Loose Rock or Trees Overhanging Channel</u>	Several trees adjacent to channel.
<u>Condition of Discharge Channel</u>	Fair. Some minor debris.

- (1) for a seep from mortar about 11.5' (elev. 1121.5) below wooden floor of structure. Exposed pipe at base of shaft is submerged with water at elev. 1113.0. One handwheel operator extends to outlet pipe held by one bracket on timber floor.
- (2) channel about 15 feet d/s of dam. Water was flowing from the outlet. The culvert was probed to a depth of 6 feet in from the stone face of the dam, indicating some stone obstructions.

PERIODIC INSPECTION CHECK LIST

PROJECT WINNEKEAG LAKE DATE May 8, 1980
 PROJECT FEATURE Spillway NAME M. Larson
 DISCIPLINE Hydraulic NAME L. Branagan

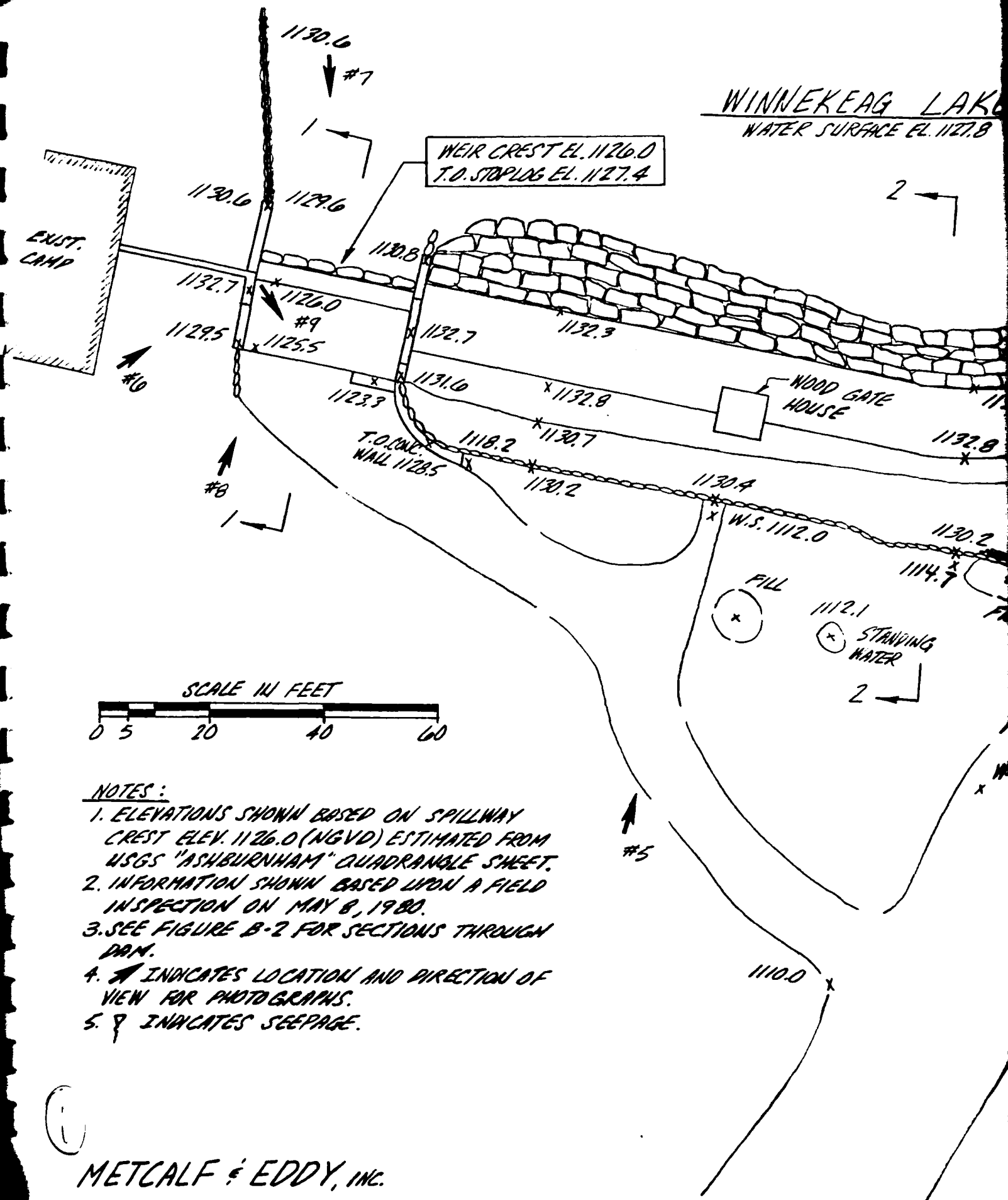
AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None. Timber and rock crib wall along right shoreline is 'bulging outward at top of wall.
Trees Overhanging Channel	None
Floor of Approach Channel	Submerged, stone base.
b. Weir and Training Walls	
General Condition of Concrete	Wooden flashboards 1.4 ft. high held in place with four steel pins. Concrete weir and concrete training walls. (1) Good. Two cracks on left training wall, one at each end. Crack on u/s end is full width with void underneath.
Rust or Staining	Slight stain below waterline.
Spalling	U/s end of left training wall has some spalling mostly below waterline. (2)
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Slight efflorescence at crack at d/s end of left training wall.
Drain Holes	None
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	Very little
Trees Overhanging Channel	Two large trees just d/s of right training wall, several trees farther d/s.
Floor of Channel	Mostly natural rock
Other Obstructions	Loose stones, minor debris, stumps and logs.

(1) D/s end of left concrete training wall curves 90 degrees around face of embankment. D/s end of right concrete training wall terminates mortared stone. Concrete weir extends about 3 feet u/s of flashboards.

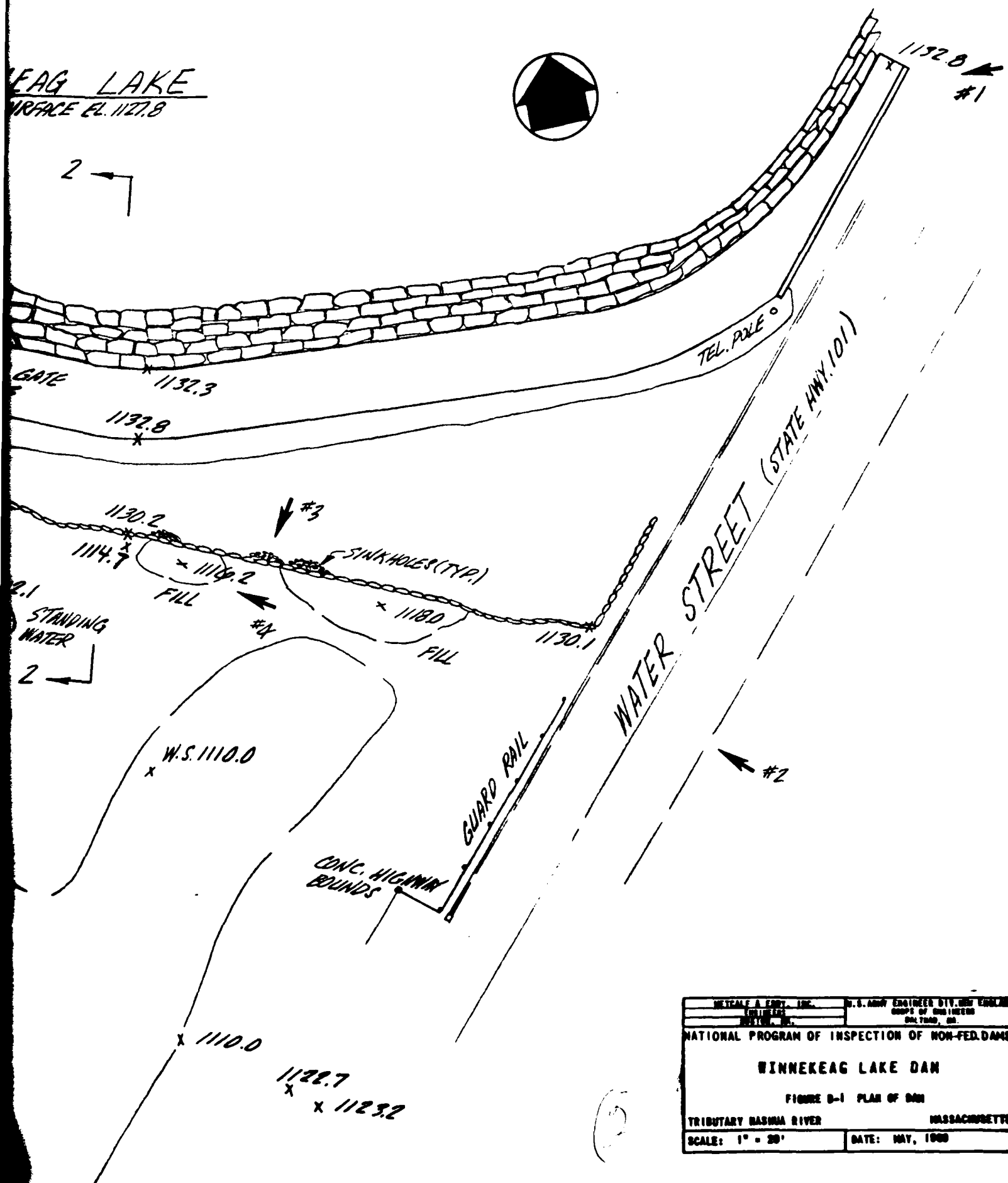
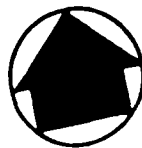
(2) Spalling of concrete weir d/s of flashboards.

APPENDIX B
PLANS OF DAM AND PREVIOUS
INSPECTION REPORTS

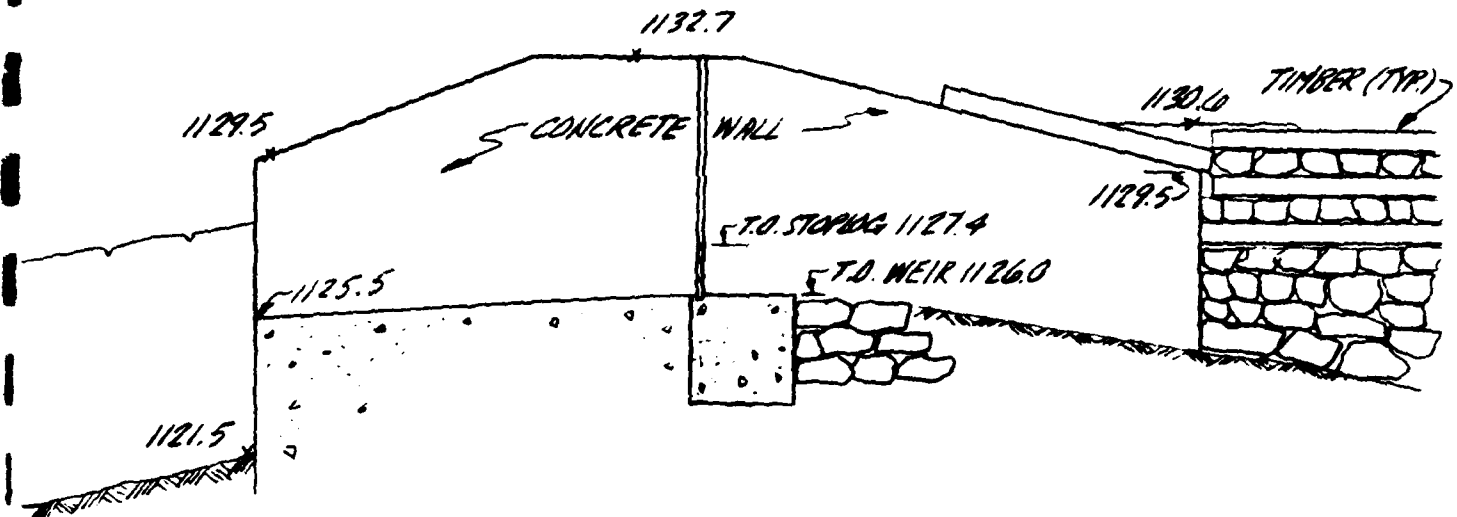
	<u>Page</u>
Figure B-1, Plan of Dam	B-1
Figure B-2, Sections of Dam	B-2
Figure B-3, Drawing of Dam, dated October 29, 1878	B-3
Figure B-4, Drawing of Dam, dated May 21, 1895	B-4
Figure B-5, Drawing of Spillway, dated August, 1931	B-5
Figure B-6, Drawing of Dam, dated June 1, 1950	B-6
File card for Winnekeag Lake Dam from Worcester County Engineer's Office	B-7
Previous Inspection Reports Dated October 9, 1924 through March 6, 1969 by Worcester County Engineer's Office	B-8
Dated December 16, 1971 by Massachusetts Department of Public Works	B-42



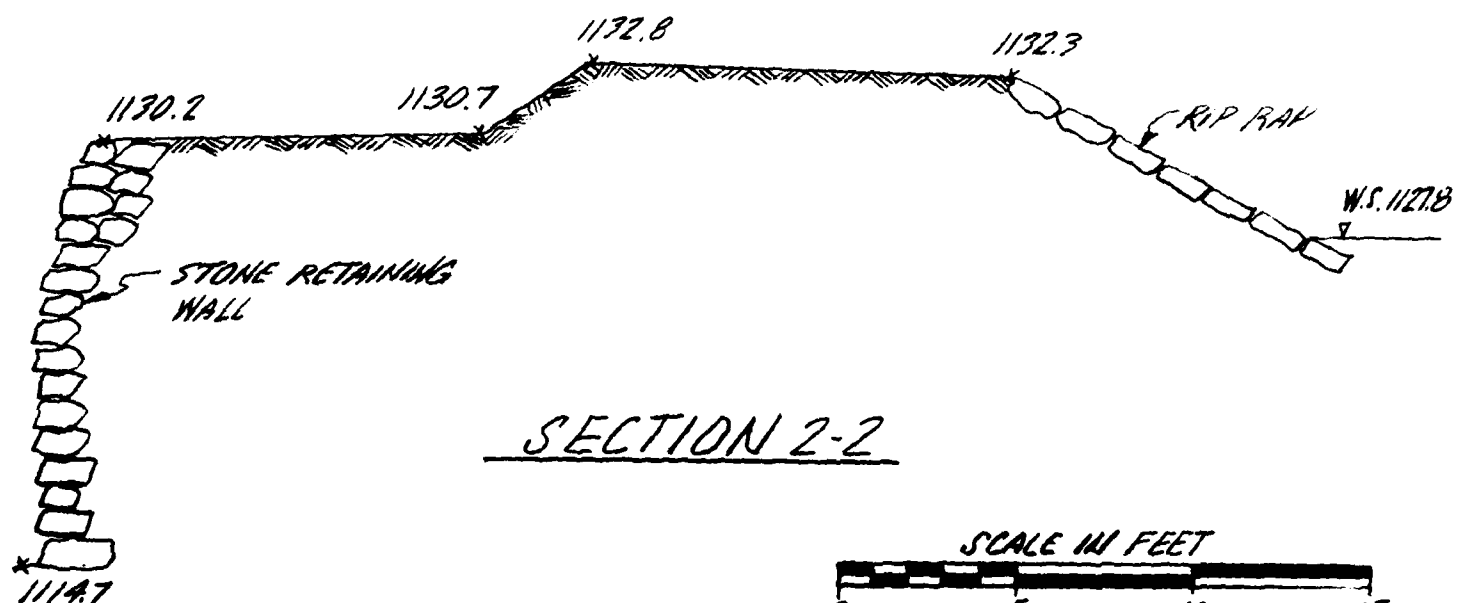
WAG LAKE
SURFACE EL. 1127.8



DETALF & EDDY, INC. ENGINEERS BOSTON, MA.	U.S. ARMY ENGINEER DIVISION GROUP OF ENGINEERS CHICAGO, ILL.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
WINNEKEAG LAKE DAM	
FIGURE B-1 PLAN OF DAM	
TRIBUTARY BASHUA RIVER	MASSACHUSETTS
SCALE: 1" = 20'	DATE: MAY, 1960



SECTION 1-1



SECTION 2-2

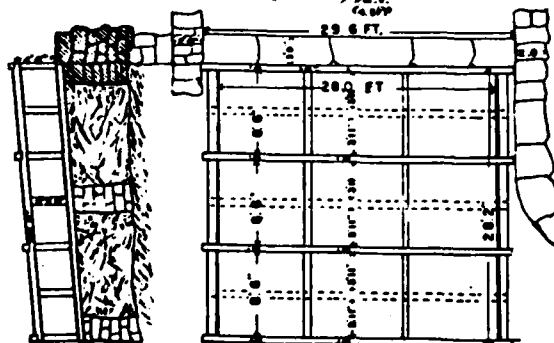
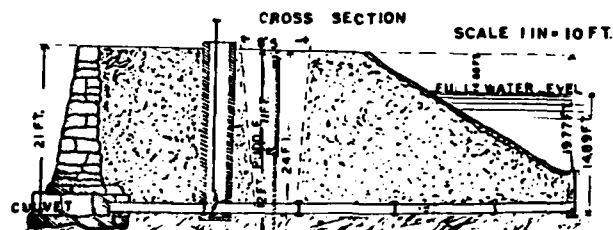
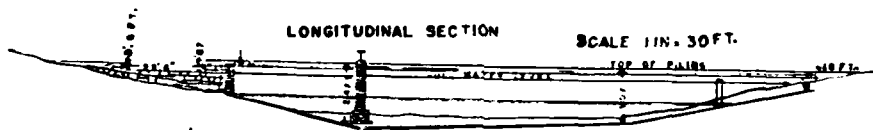
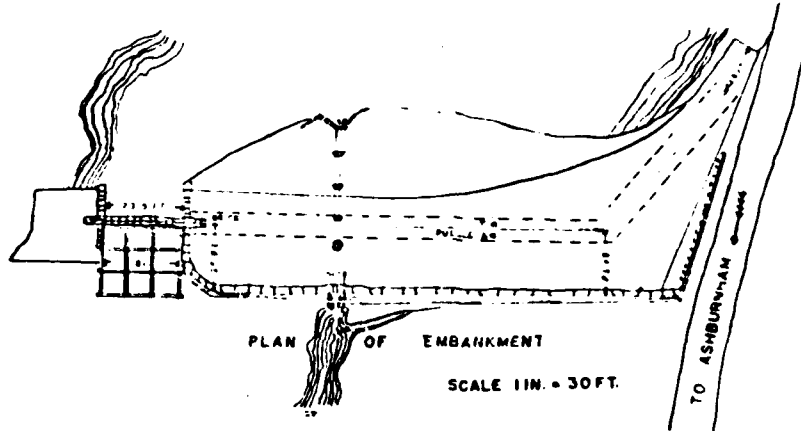


- NOTES:
1. ELEVATIONS SHOWN BASED ON SPILLWAY CREST ELEV. 1126.0 (NGVD) ESTIMATED FROM USGS "ASHBURNHAM ALUNDORANGE" SHEET.
 2. INFORMATION SHOWN BASED UPON A FIELD INSPECTION ON MAY 8, 1980.
 3. SEE FIGURE B-1 FOR PLAN OF DAM.

METCALF & EDDY, INC.	U.S. ARMY ENGINEER DIV. NEW ENGLAND
BOSTON, MA.	CONTRACT NO. 11-80-001
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
WINNEKEAG LAKE DAM	
FIGURE B-2 SECTIONS OF DAM	
FRONTIARY WASHUA RIVER	MASSACHUSETTS
SCALE: 1" = 5'	DATE: MAY, 1980

METCALF & EDDY, INC.

RICE POND RESERVOIR
ASHBURNHAM, MASS.
OCT. 29, 1878.



THOMAS C. SHELDON, ENGINEER
PITCHBURG, MASS.

NOTE:
PLAN REDUCED
FOR THIS REPORT

WORKS

C

TRACED

TRACING

APPROVED

DAM NO. 01

WINNEKEAG LAKE DAM

1 SHEET

ASHBURNHAM MASS
OCT 29, 1878.



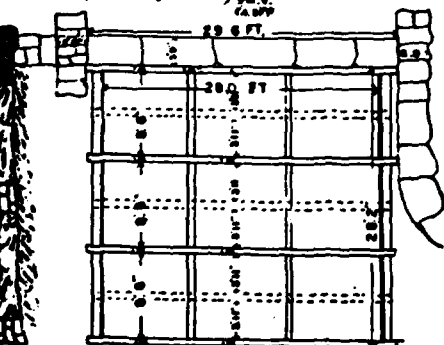
SCALE 1 IN. = 30 FT.



SCALE 1 IN. = 30 FT.



SCALE 1 IN = 10 FT



PLAN & ELEVATION OF WASTEWAY

**THOMAS C. SHELDON. ENGINEER
FITCHBURG, MASS.**

NOTE:

**PLAN REDUCED
FOR THIS REPORT**

RICE POND RESERVOIR

ASHBURNHAM, MASS.

FOR GEORGE BLACKBURN & CO.

AS FILED AND APPROVED BY THE
COUNTY COMMISSIONERS

DEC. MEETING DOCKET

SCALES AS NOTED

TRACED BY: R. PIZZELLA

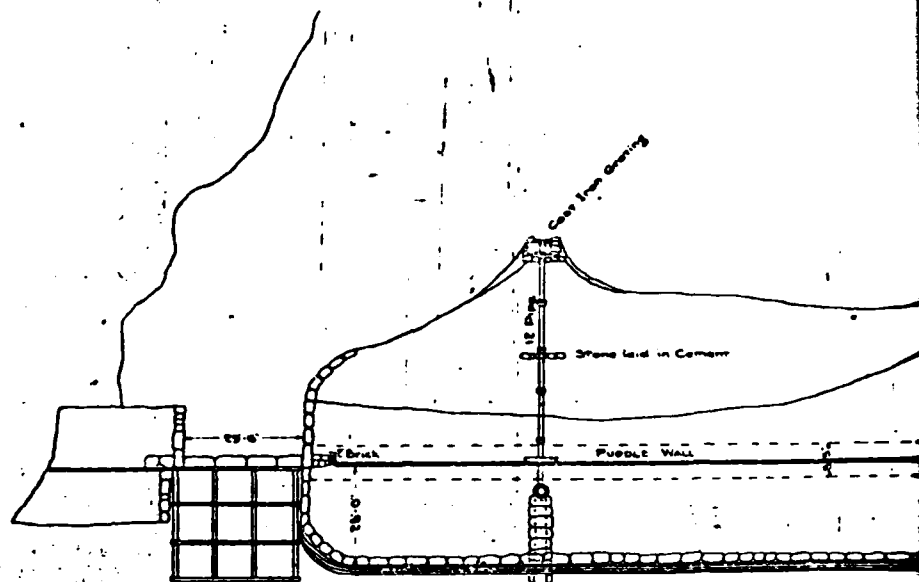
TRACING CHECKED BY: W.D.L.

APPROVED: DEC. 1978 BY:

DAM NO. 01-32

DAM NO. 01-32

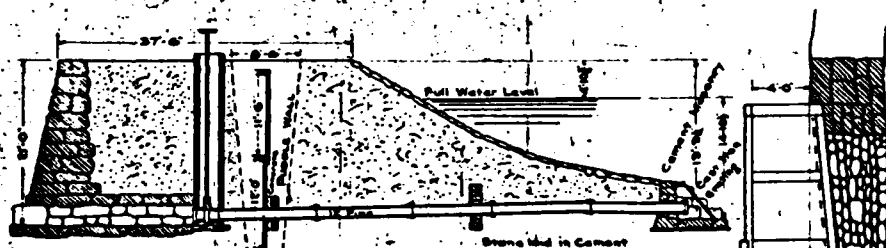
WINNEKEAG LAKE DAM FIGURE B-3



PLAN OF EMBANKMENT Scale 1 inch = 20 Ft.



LONGITUDINAL SECTION Scale 1 inch = 20 Ft.

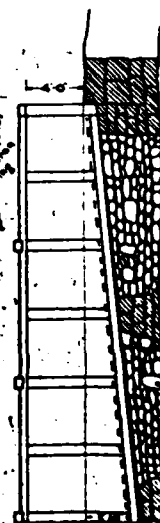


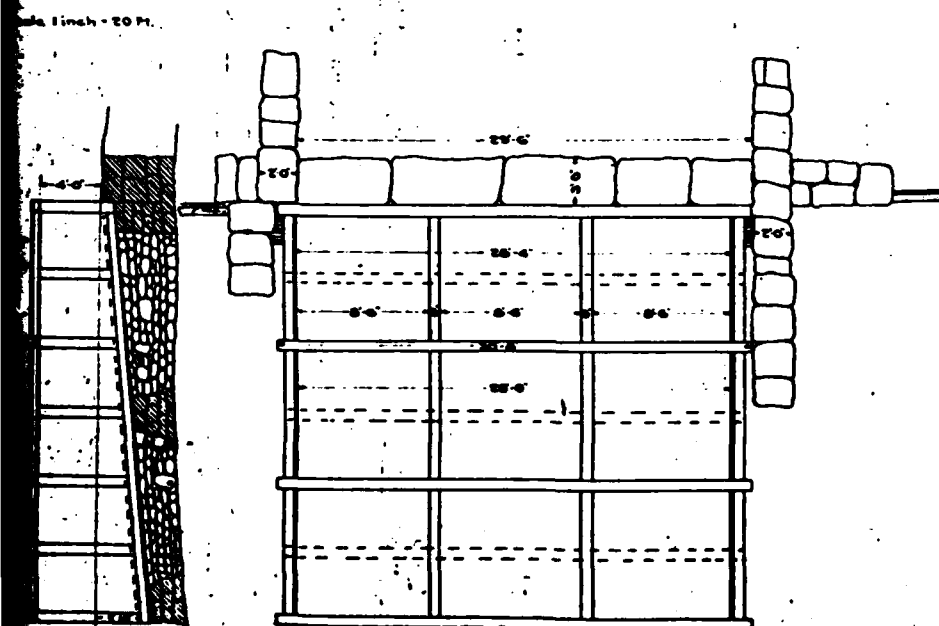
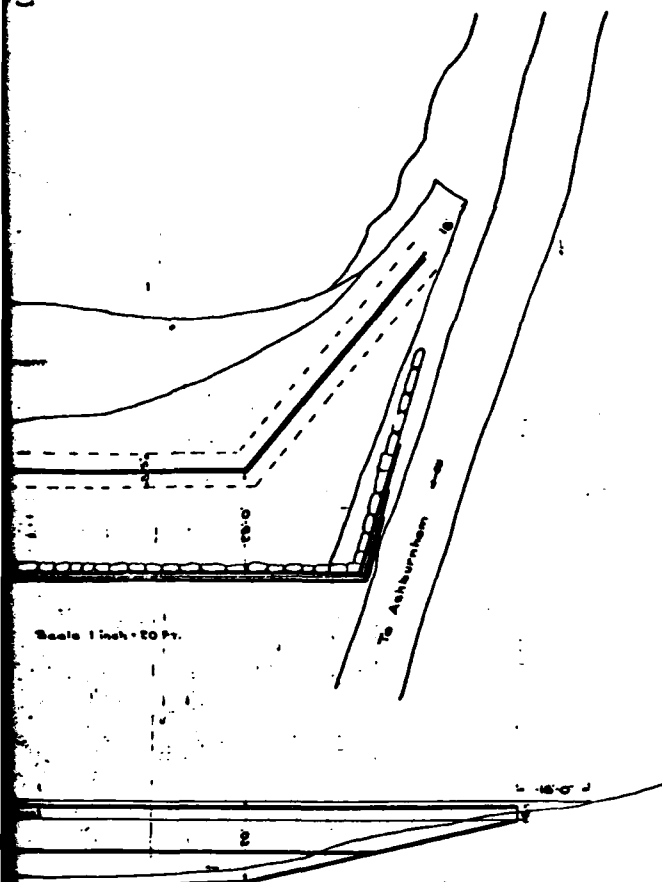
CROSS SECTION Scale 1 inch = 10 Ft.

PLAN OF DAM RICE POND RESERVOIR

Ashburnham Mass.
Mrs. Harriette F. Nevins
May 21, 1895

Har. L. Shelden





PLAN REDUCED FOR THIS REPORT

WORCESTER COUNTY COMMISSIONERS
 WORCESTER COUNTY ENGINEERING DEPARTMENT
 PLAN OF
 DAM
 AT RICE POND
 ASHBURNHAM, MASS.
 FOR MRS. HARRIETTE F. NEVINS
 AS FILED AND APPROVED BY THE
COUNTY COMMISSIONERS
 MAY 28, 1895
 MARCH MEETING DOCKET 212
 SCALES AS NOTED

TRACED BY: E. J. E. [Signature] 2-2-94
 TRACING CHECKED BY: [Signature] 2-2-94

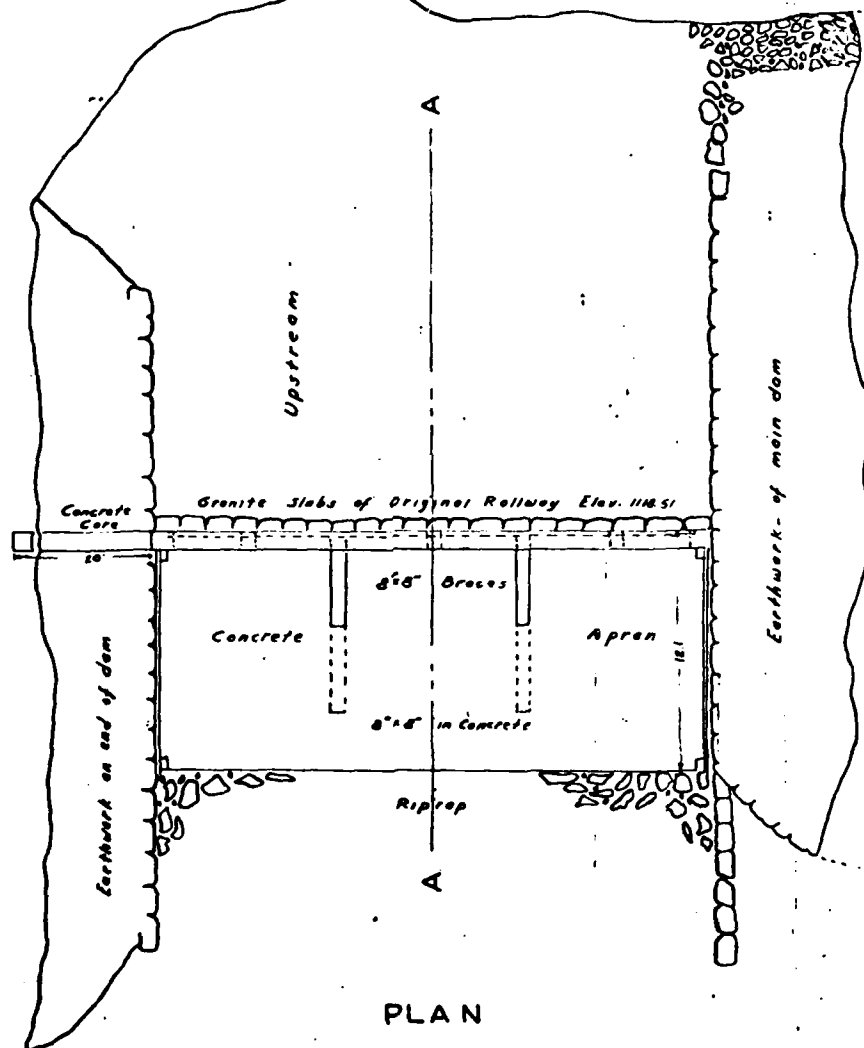
DAM NO. 01-32

[Signature] COUNTY ENGINEER

Attest William C. [Signature]
 Clerk

PLAN & ELEVATION OF ROADWAY
 Scale 1 inch = 10 Ft.

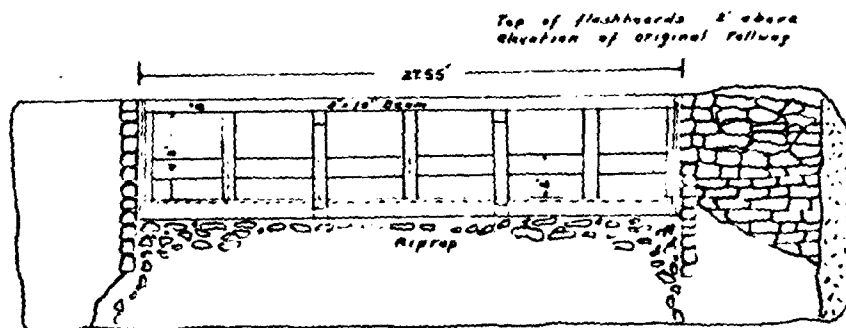
New Winnepesaukee Lake



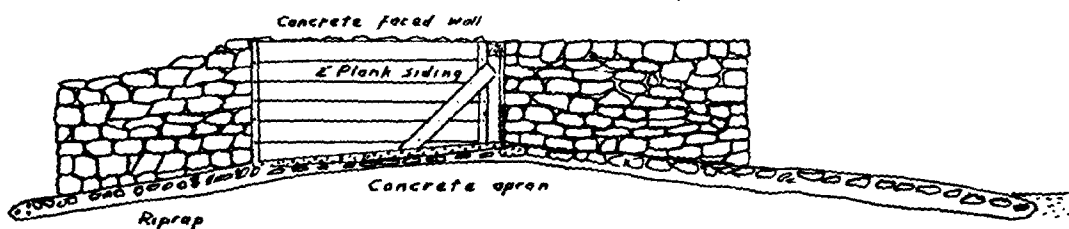
PLAN

PLAN OF ROLLWAY RICE
 SCALE: 1" = 4' A.M.
 PARKER BATEMAN AND CO.

Note: Filed and Approved Plan gives Right of Storage & Flooded Railway or to the tide to



ELEVATION



SECTION A-A

NOTE:
PLAN REDUCED
FOR THIS REPORT

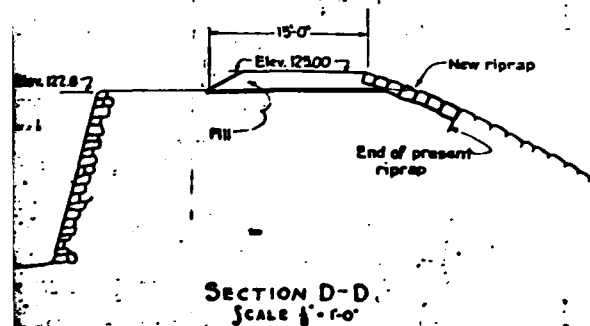
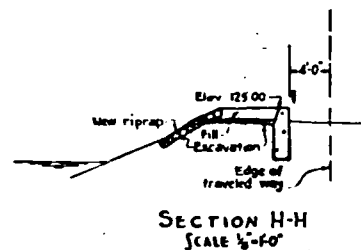
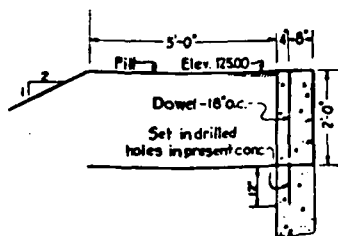
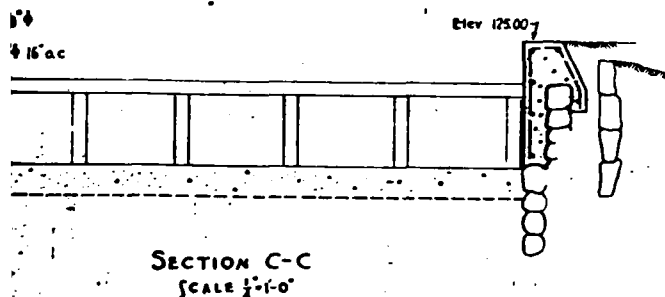
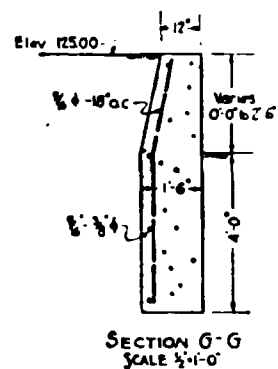
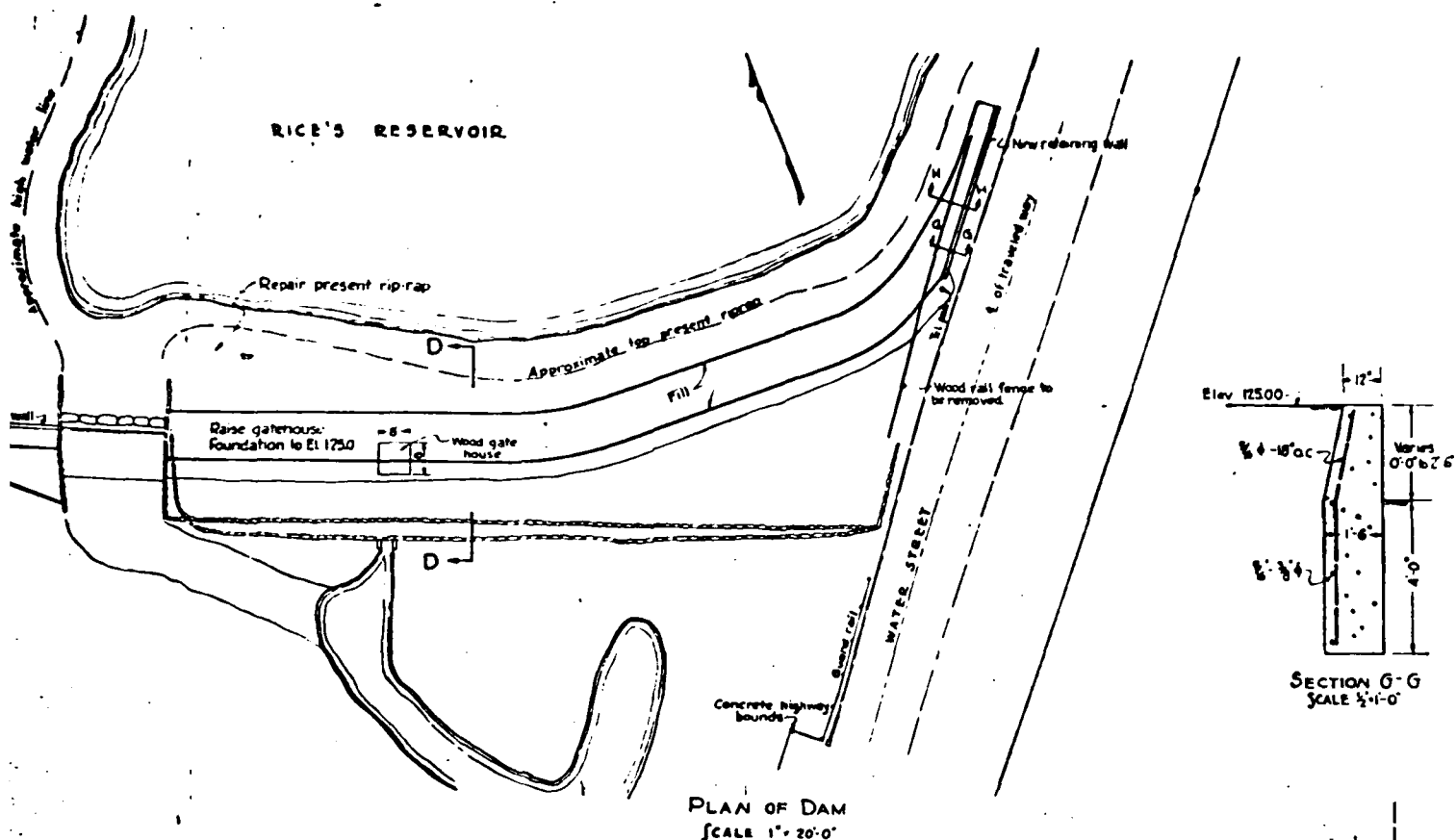
WORCESTER COUNTY COMMISSIONERS
WORCESTER COUNTY ENGINEERING DEPARTMENT
PLAN OF
RICE RESERVOIR
ASHBURNHAM, MASS.
FOR NASHUA RIVER RESERVOIR CO.
AS FILED AND APPROVED BY THE
COUNTY COMMISSIONERS

SCALES AS NOTED
TRACED BY: S.D. THARZ
TRACING CHECKED BY: ST. J.
APPROVED SEPT. 1931
DAM NO. 01-32

ROLLWAY RICE RESERVOIR

SCALE: 1"=4' AUG. 1931

BY BAFEMAN AND CHASE



PLAN REDUCED FOR THIS REPORT

**NASHUA RIVER RESERVOIR CO.
CHANGES IN
RICE'S RESERVOIR DAM**

**HOWARD M. TURNER
CONSULTING ENGINEER
BOSTON**

SCALES-As shown

JUNE 1, 1930
No. 1

**WORCESTER COUNTY COMMISSIONERS
WORCESTER COUNTY ENGINEERING DEPARTMENT
PLAN OF
CHANGES IN
RICE'S RESERVOIR DAM
IN ASHBURNHAM, MASS.
FOR NASHUA RIVER RESERVOIR CO.
AS FILED AND APPROVED BY THE
COUNTY COMMISSIONERS
SCALES AS NOTED**

APPROVED - JUNE 1, 1930
CHARLES E. Smith
CHAIRMAN, BOARD OF COUNTY ENGINEERS

FOR APPROVAL JUNE 1, 1930
COUNTY ENGINEER
COUNTY COMMISSIONER

FOR APPROVAL JUNE 1, 1930
COUNTY ENGINEER

DRAWN BY: HOWARD TURNER
CONSULTING ENGINEER, BOSTON
DAM NO. 01-32

TOWN OR CITY Ashburnham		DEGREE NO. 212	FILE NO. 19	DAM NO. 81-32
LOCATION Rice Pond Reservoir		C. DOCKERY NO.		
DESCRIPTION OF DAM		DESCRIPTION OF RESERVOIR & WATERSHED		
Type Earth dam - 1st Rubble Face - Concrete Spillway		Name of Main Stream Phillips Brook		
Length 190.5		" " " " " "		
Height 20'-1"		Length of Watershed		
Thickness top 37'-4"		Width		
" bottom 30'-00"		Is Watershed Cultivated		
Downstream Slope 100:1		Percent in Forests		
Upstream " 100:1		Steepness of Slope		
Length of Spillway 223'-11.54 Top Elev. 1124.0		Kind of Soil Ledge - Hardpan		
Height of Gates 3'-2" Wide Opening El. 82.0		No. of Acres in Watershed (2172.9)		
Location of Gates Left center 50' east spillway		" " " " Reservoir (2.27 sq. mi)		
Flashboards used None		Length of Reservoir		
With Flashboards or Gates None 1124.0 if on El. 98.0		Width " "		
Designed by Thomas C. Sheldon		Max Flow Cu. Ft. per Sec. 1180 cfs High		
Constructed by 1928		Head or Flashboards-Low Water Oct. 29, 1928		
Completed 1928		" " " " High Top Elev. 1124.0		
GENERAL REMARKS		GENERAL REMARKS		
Pl. 28, P. 323- May 29, 1895. Mr. Harriette F. Mayne. Owned by Nashua Reservoir Co. Crocker-Burbank Co., Fitchburg, Mass. District C. 212. Meeting March 1895. Filed May 29, 1895. Traced by: K.M. Finleyson - Mar. 3, 1936 Checked by: L.O. Marden - Mar. 6, 1936 Attended by: William C. Bowen, C.E.C. North meeting 1936		Foundation - Ledge Recent repairs - None Leaks - near bulge in wall below Condition - Slight bulge in wall 65 ft from top Inspected: Oct. 9, 1904 Oct. 28, 1927 Sept. 26, 1928 Aug. 12, 1931 1936 1124.0		

Inspected: **Dec. 3, 1931**
 " **Sept. 17, 1933** - L.O. Marden.
 " **Apr. 14, 1935** - L.O. Marden.
 " **Oct. 14, 1938** - M.A. Cassida
 " **Jan. 6, 1939** - L.H. Spafford
 " **June 6, 1939** - L.O. Marden.
 " **March 4, 1939** - Dr. P. St. John & Patrol
 Patrol " **16, 1939** - M.F. Hunt.
 Inspected: **April 7, 1941** - L.O. M.
 " **Dec. 19, 1942** - M.F. Hunt.
 " **Feb. 28, 1944** - L.O. Marden
 " **Sept. 29, 1945** - L.O.M. & M.F.H.
 " **July 8, 1948** - L.O.M.
 " **Jan 14, 1949** - L.O.M.
 " **Jan 26, 1950** - "
 " **Mar. 15, 1951** - "
 June 1960 Repairs to Spillway
 Inspected - Sept 26 1928 LOM, LCF - 24 SF P, 66 (shodown below-bulld berm along rd.

1961

801-32

Decree No.

Dam No. 01-~~31~~
32

COUNTY OF WORCESTER, MASSACHUSETTS
OFFICE OF COUNTY ENGINEER

Neg. Nos.

INSPECTION OF DAMS, RESERVOIR DAMS AND RESERVOIRS

Town Ashburnham Date Oct. 9. 1924 Dam No. _____
Location N. Ash. Cent. Name of Pond or Stream Phillips Brook
(Blackburn Reservoir or Rice Res.
or Winnakea Lake)
Inspected by L. O. Marden
Owner Cresker Burbank Fitchburg Use Reservoir
MATERIAL & TYPE Earth, downstream, rubble wall concrete spill, stone sides
Elevations in feet: above (+) or below (-) full pond or reservoir level.
FOR DAM Bed of stream below 80 top of spillway 95.4
FOR RESERVOIR
top of dam 100 top of flashboards 98 if on ground surface below 81
level of overflow pipe 322 opening Fl. 6' length in feet 185
width top in feet 38 & more width bottom in feet 68 size pipe to mill
inches length spillway in feet 24.3 head in feet draft 24
Size of wheel _____ H. P. developed _____
Size of gates _____ location of gates 500' east spill section
Foundation and details of construction ledge granite block walls laid back
condition of embankment good cut off brush & trees
Constructed by _____ date _____
Designed by _____ location _____
Recent repairs and date none
Evidence of leakage possible leak near bulge wall 45' from Hy. recommend
Condition fill with gunite at this point.
Topography of country below wooded valley - need to steep slopes
Nature of buildings and roads below dam none 1/2 mile below
No. Acres in watershed _____ No. Acres in pond _____
Plans secured _____ Percent watershed in cultivation _____
Percent in forests _____ Note: Cross out word not applicable

Decree No.

Dam No.

COUNTY OF WORCESTER, MASSACHUSETTS
OFFICE OF COUNTY ENGINEER

Neg. Nos.

2nd INSPECTION OF DAMS, RESERVOIR DAMS AND RESERVOIRS

Town **Ashburnham** Date **Oct. 28, 1927** Dam No. **01-32**
Location **Ashburnham Center** Name of Pond or Stream **Phillips Brook**
Blackburn Reservoir.
Inspected by **L. O. Marden**
Owner **Nashua Reservoir Co., Fitchburg** Use **Storage reservoir.**

MATERIAL & TYPE **See first report.**

Elevations in feet: above (+) or below (-) full pond or reservoir level.

FOR DAM Bed of stream below top of spillway

FOR RESERVOIR

top of dam top of flashboards ground surface below
..... level of overflow pipe length in feet
width top in feet width bottom in feet size pipe to mill
..... inches length spillway in feet head in feet

Size of wheel H. P. developed

Size of gates location of gates

Foundation and details of construction

..... condition of embankment **out off trees and brush**

Constructed by date

Designed by location

Recent repairs and date **none.**

Evidence of leakage

Condition **same bulge in wall - is no worse - has been there for years**
according to the Crocker-Burbank Co.

Topography of country below
Nature of buildings and roads below dam

No. Acres in watershed No. Acres in pond

Plans secured Percent watershed in cultivation

Percent in forests Note: Cross out word not applicable

**COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER**

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by Marden-Farrar Date 9-26-1928 Dam No. 01-32

Town Ashburnham Location Winnekeag Lake or Rice Res.

Owner Nashua River Res. Co. Use _____

Material and Type _____

Dam Designed by _____ Constructed by _____ Year _____

SPILLWAY

El. top Abutment _____ El. Crest _____ El. Apron _____ El. Streambed _____

Width top Abutment _____ Width top Crest _____ Width bottom Spillway _____

Width Flashboards carried _____ Kind Flashboards _____

El. Flowline Cleanout Pipe _____ Size and Kind Cleanout Pipe _____

Kind of Foundation under Spillway _____

Condition clean brush out of spillway-keep flashboards off remainder of winter-

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____

Width of Bottom _____ Upstream Slope _____ Downstream Slope _____

Kind of Corewall _____ Riprap _____

Material in Embankment _____ Foundation _____

Condition repair bulge in embankment with concrete retaining wall.

GATES _____ Location _____

Size _____ Kind _____ El. Flowline _____

Condition _____

WHEEL _____ Kind _____ Size _____ Rated H. P. _____

Location _____ Ave. Head _____

Evidence of Leaks in Structure _____

Recent Repairs and Date _____

Topography of Country below Dam _____

Nature of Buildings and Roads below Dam _____

Number Acres in Pond _____ Drainage Area in Square Miles _____

Discharge in Second Feet per Square Mile _____

Estimated Storage Million Cubic Feet _____

**COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER**

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by Farrar-Grover-Herholz Date 8-12-31 Dam No. 01-32

Town Ashburnham Location Winnekeag Lake or Rice Reservoir.

Owner Nashua River Res. Co. Use _____

Material and Type measured-Field Book X49-Page 68

Dam Designed by _____ Constructed by _____ Year _____

SPILLWAY

El. top Abutment _____ El. Crest _____ El. Apron _____ El. Streambed _____

Width top Abutment _____ Width top Crest _____ Width bottom Spillway _____

Width Flashboards carried _____ Kind Flashboards _____

El. Flowline Cleanout Pipe _____ Size and Kind Cleanout Pipe _____

Kind of Foundation under Spillway _____

Condition _____

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____

Width of Bottom _____ Upstream Slope _____ Downstream Slope _____

Kind of Corewall _____ Riprap _____

Material in Embankment _____ Foundation _____

Condition _____

GATES _____ Location _____

Size _____ Kind _____ El. Flowline _____

Condition _____

WHEEL _____ Kind _____ Size _____ Rated H. P. _____

Location _____ Ave. Head _____

Evidence of Leaks in Structure _____

Recent Repairs and Date _____

Topography of Country below Dam _____

Nature of Buildings and Roads below Dam _____

Number Acres in Pond _____ Drainage Area in Square Miles _____

Discharge in Second Feet per Square Mile _____

Estimated Storage Million Cubic Feet _____

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O.Marden Date Aug.12,1951 Dam No. 02-21

Town Ashburnham Location River Res. or Lake Winnakeag.

Owner Nashua River Res. Use Storage.

Material and Type Conference with C.T.Creeker of Creeker-Burbank Co., re
flashboards-old deed states 24 inches-will use.

Dam Designed by _____ Constructed by _____ Year _____

SPILLWAY—Length _____ Feet. Depth _____ Feet

El. top Abutment _____ El. Crest _____ El. Apron _____ El. Streambed _____

Width top Abutment _____ Width top Crest _____ Width bottom Spillway _____

Width Flashboards carried _____ Kind Flashboards _____

El. Flowline Cleanout Pipe _____ Size and Kind Cleanout Pipe _____

Kind of Foundation under Spillway _____

Condition east abutment wall has fallen in - will need wall relaid.

EMBANKMENT—Length overall _____ Feet

El. Top _____ El. Natural Ground _____ Width Top _____

Width of Bottom _____ Upstream Slope _____ Downstream Slope _____

Kind of Corewall _____ Riprap _____

Material in Embankment _____ Foundation _____

Condition _____

GATES _____ Location _____

Size _____ Kind _____ El. Flowline _____

Condition _____

WHEEL _____ Kind _____ Size _____ Rated H. P. _____

Location _____ Ave. Head _____

Evidence of Leaks in Structure _____

Recent Repairs and Date _____

Topography of Country below Dam _____

Nature of Buildings and Roads below Dam _____

Number of Acres in Pond _____ Drainage Area in Square Miles _____

Discharge in Second Feet per Square Mile _____

Estimated Storage Million Cubic Feet _____

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden Date 8-17-1933 Dam No. 01-21 32

Town Ashburnham Location Rice Reservoir.

Owner Crocker-Burbank & Co. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition flashboards in place on dam-water at waiting level-is not flow-
ing over boards.

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition bulge in downstream wall is no worse. brush has been cut off of
embankment.

GATES Location

Size Kind El. Flowline

Condition open

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure none visible.

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L. O. Marden Date April 14, 1935 Dam No. 01-32

Town Ashburnham Location Rice Reservoir.

Owner Nashua River Res. Co. Use storage.

Material and Type.....

Dam Designed by..... Constructed by..... Year.....

SPILLWAY—Length..... Feet. Depth..... Feet

El. top Abutment..... El. Crest..... El. Apron..... El. Streambed.....

Width top Abutment..... Width top Crest..... Width bottom Spillway.....

Width Flashboards carried..... Kind Flashboards.....

El. Flowline Cleanout Pipe..... Size and Kind Cleanout Pipe.....

Kind of Foundation under Spillway.....

Condition OK

EMBANKMENT—Length overall..... Feet

El. Top..... El. Natural Ground..... Width Top.....

Width of Bottom..... Upstream Slope..... Downstream Slope.....

Kind of Corewall..... Riprap.....

Material in Embankment..... Foundation.....

Condition recommend that bulge mentioned in reports in past, be buttressed by concrete wall.

GATES..... Location.....

Size..... Kind..... El. Flowline.....

Condition OK

WHEEL..... Kind..... Size..... Rated H. P.....

Location..... Ave. Head.....

Evidence of Leaks in Structure.....

Recent Repairs and Date.....

Topography of Country below Dam.....

Nature of Buildings and Roads below Dam.....

Number of Acres in Pond..... Drainage Area in Square Miles.....

Discharge in Second Feet per Square Mile.....

Estimated Storage Million Cubic Feet.....

**COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER**

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by N. H. Casella Date Oct 14, 38 Dam No. 01-32

Town Ashburnham Location Lake Winnekeag

Owner Nashua River Reservoir Co. Use

Material and Type.....

Dam Designed by..... Constructed by..... Year.....

SPILLWAY HW about 15' above flashboards

El. top Abutment..... El. Crest..... El. Apron..... El. Streambed.....

Width top Abutment..... Width top Crest..... Width bottom Spillway.....

Width Flashboards carried 20" high Kind Flashboards Plank in 4 sects 28' total

El. Flowline Cleanout Pipe..... Size and Kind Cleanout Pipe.....

Kind of Foundation under Spillway Little water flows under the foundation

Condition OK

EMBANKMENT

El. Top..... El. Natural Ground..... Width Top.....

Width of Bottom..... Upstream Slope..... Downstream Slope.....

Kind of Corewall..... Riprap.....

Material in Embankment..... Foundation.....

Condition 15' of stone wall is down should be repaired

GATES were open during flood 2x3 box under embankment

Size..... Kind..... El. Flowline.....

Condition OK

WHEEL..... Kind..... Size..... Rated H. P.

Location..... Ave. Head.....

Evidence of Leaks in Structure.....

Recent Repairs and Date None

Topography of Country below Dam.....

Nature of Buildings and Roads below Dam.....

Number Acres in Pond..... Drainage Area in Square Miles.....

Discharge in Second Feet per Square Mile.....

Estimated Storage Million Cubic Feet.....

EXAMINED 4-10-39
P. O. Mearns
COUNTY ENGINEER

**COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER**

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L. H. Spafford Date 1/6/89 2 PM Dam No. 01-32

Town Fitchburg Location Lake Winnepesaukee
Owner Wachusett River Reservoir Co. Use Improving
Material and Type Earth Embankment

Dam Designed by _____ Constructed by _____ Year _____

SPILLWAY

El. top Abutment _____ El. Crest _____ El. Apron _____ El. Streambed _____
Width top Abutment _____ Width top Crest _____ Width bottom Spillway _____
Width Flashboards carried 20" Kind Flashboards Manually operated in wooden frames
El. Flowline Cleanout Pipe _____ Size and Kind Cleanout Pipe _____

Kind of Foundation under Spillway

Condition Good Condition - It is about 3 ft below crest of spillway -
when regulation by gates - Pond level has suddenly been reduced about
3 feet since formation of ice.

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____
Width of Bottom _____ Upstream Slope _____ Downstream Slope _____
Kind of Corewall _____ Riprap _____
Material in Embankment _____ Foundation _____
Condition Good

GATES

Location In gate house
Size _____ Kind _____ El. Flowline _____
Condition Appearing good

WHEEL

Kind _____ Size _____ Rated H. P. _____
Location _____ Ave. Head _____

Evidence of Leaks in Structure On very small leak mid way of the
embankment - not serious

Recent Repairs and Date None

Topography of Country below Dam _____

Nature of Buildings and Roads below Dam _____

Number Acres in Pond _____ Drainage Area in Square Miles _____

Discharge in Second Feet per Square Mile _____

Estimated Storage Million Cubic Feet _____

COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by B. L. John Date March 1 '39 Dam No. 01-32

Town Ashburnham Location Pine Reservoir
Owner Hatch River Reservoir Co Use _____
Material and Type _____

Dam Designed by _____ Constructed by _____ Year _____

SPILLWAY

El. top Abutment _____ El. Crest _____ El. Apron _____ El. Streambed _____
Width top Abutment _____ Width top Crest _____ Width bottom Spillway _____
Width Flashboards carried None Kind Flashboards _____
El. Flowline Cleanout Pipe _____ Size and Kind Cleanout Pipe _____
Kind of Foundation under Spillway _____
Condition Good. No water going over spillway. Water about
3 1/2 or 4' below crest.

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____
Width of Bottom _____ Upstream Slope _____ Downstream Slope _____
Kind of Corewall _____ Riprap _____
Material in Embankment _____ Foundation _____
Condition Water about 8 feet below top of dam

GATES

Location _____
Size _____ Kind _____ El. Flowline _____
Condition A small stream of water coming through gates

WHEEL

Kind _____ Size _____ Rated H. P. _____
Location _____ Ave. Head _____
Evidence of Leaks in Structure _____

Recent Repairs and Date _____

Topography of Country below Dam _____

Nature of Buildings and Roads below Dam _____

Number Acres in Pond _____ Drainage Area in Square Miles _____

Discharge in Second Feet per Square Mile _____

Estimated Storage Million Cubic Feet _____

WORCESTER COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs

Inspected by B. P. St. John Date March 1, 1939 Dam No. 01-32
.....

Town Ashburnham Location Rice Reservoir (Winnekeag Lake)

Owner Nashua River Res. Assn. Use _____

SPILLWAY

El. top abutment _____ El. Crest _____ El. Apron _____ El. St. Bed _____

Width top Abut. _____ Width top Crest _____ Width bottom Sp. way _____

Width flashboards _____ Kind Flashboards _____

El. Flowline Cleanout Pipe _____ Size and Kind Pipe _____

Kind of Foundation under Spillway _____

Condition no water passing crest of spillway

no flashboards in place.

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____

Width of Borrom _____ Upstream Slope _____ Downstream Slope _____

Kind of Corewall _____ Riprap _____

Material in Embankment _____ Foundation _____

Condition _____

GATES

Location _____

Size _____ Kind _____ El. Flowline _____

Condition water going thru gate gate about one-half open.

Evidence of Leaks in Structure _____

Recent Repairs and Date _____

Number Acres in Pond _____ Drainage Area in Sq. Miles _____

Discharge in Second Feet per Square Mile _____

Estimated Storage Million Cubic Feet _____

**COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER**

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by J. F. Dwyer Date March 16, 1939 Dam No. 21-24

Town Schubert Location Pine Reservoir

Owner _____ Use _____

Material and Type _____

Dam Designed by _____ Constructed by _____ Year _____

SPILLWAY

El. top Abutment _____ El. Crest _____ El. Apron _____ El. Streambed _____

Width top Abutment _____ Width top Crest _____ Width bottom Spillway _____

Width Flashboards carried _____ Kind Flashboards _____

El. Flowline Cleanout Pipe _____ Size and Kind Cleanout Pipe _____

Kind of Foundation under Spillway _____

Condition Water 4 ft below spillway crest

Gate open

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____

Width of Bottom _____ Upstream Slope _____ Downstream Slope _____

Kind of Corewall _____ Riprap _____

Material in Embankment _____ Foundation _____

Condition _____

GATES _____ Location _____

Size _____ Kind _____ El. Flowline _____

Condition _____

WHEEL _____ Kind _____ Size _____ Rated H. P. _____

Location _____ Ave. Head _____

Evidence of Leaks in Structure _____

Recent Repairs and Date _____

Topography of Country below Dam _____

Nature of Buildings and Roads below Dam _____

Number Acres in Pond _____ Drainage Area in Square Miles _____

Discharge in Second Feet per Square Mile _____

Estimated Storage Million Cubic Feet _____

WORCESTER COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs

Inspected by L. O. Marden Date April 7, 1941 Dam No. 01-32

Town Ashburnham Location Winnekeag Lake
 Owner Nashua River Res Co Use _____

SPILLWAY

El. top abutment _____ El. Crest _____ El. Apron _____ El. St. Bed _____
 Width top Abut. _____ Width top Crest _____ Width bottom Sp. way _____
 Width flashboards _____ Kind Flashboards _____
 El. Flowline Cleanout Pipe _____ Size and Kind Pipe _____
 Kind of Foundation under Spillway _____
 Condition Spilling not deepened as recommended by the County
com -

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____
 Width of Bottom _____ Upstream Slope _____ Downstream Slope _____
 Kind of Corewall _____ Riprap _____
 Material in Embankment _____ Foundation _____
 Condition Bulged stone wall not supported by a concrete
bottom as recommended - otherwise ok.

GATES

Location _____
 Size _____ Kind _____ El. Flowline _____
 Condition ok.

Evidence of Leaks in Structure _____

Recent Repairs and Date _____

Number Acres in Pond _____ Drainage Area in Sq. Miles _____
 Discharge in Second Feet per Square Mile _____
 Estimated Storage Million Cubic Feet _____

COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by M. F. Hunt Date 12-19-42 Dam No. 01-32

Town Ishburnham Location Lake Winnekeag
Owner..... Use.....

Material and Type.....

Dam Designed by..... Constructed by..... Year.....

SPILLWAY

El. top Abutment..... El. Crest..... El. Apron..... El. Streambed.....

Width top Abutment..... Width top Crest..... Width bottom Spillway.....

Width Flashboards carried..... Kind Flashboards.....

El. Flowline Cleanout Pipe..... Size and Kind Cleanout Pipe.....

Kind of Foundation under Spillway.....

Condition O.K. 2.5' flashboards on - Pond full - Bottom Engine
recommended the spillway to be deepened at least 2 1/2
feet. Low

EMBANKMENT

El. Top..... El. Natural Ground..... Width Top.....

Width of Bottom..... Upstream Slope..... Downstream Slope.....

Kind of Corewall..... Riprap.....

Material in Embankment..... Foundation.....

Condition O.K. No leaks visible - snow

GATES..... Location.....

Size..... Kind..... El. Flowline.....

Condition O.K. Partly open

WHEEL..... Kind..... Size..... Rated H. P.

Location..... Ave. Head.....

Evidence of Leaks in Structure.....

Recent Repairs and Date.....

Topography of Country below Dam.....

Nature of Buildings and Roads below Dam.....

Number Acres in Pond..... Drainage Area in Square Miles.....

Discharge in Second Feet per Square Mile.....

Estimated Storage Million Cubic Feet.....

COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by LOM B.P. - J Date 1-3-94 Dam No. 01-32

Town Ashburnham Location

Owner Nashua River Pledge Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition Flashboards removed - logs in spillway

EMBANKMENT

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition OK

GATES Location

Size Kind El. Flowline

Condition appears OK

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure none appears

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O.M. M.F.H. Date 9-29-45 Dam No. 01-32

Town Ashburnham Location Winnekeag Lake

Owner M. R. R. - Ins. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition No alterations should deepen some masonry part

EMBANKMENT

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition about 20' East Gate Wash out earth & riprap

fix - cut out & grade out brush & roots in riprap wall & emb

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure None visible

Recent Repairs and Date None

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

TOWN Ashburnham

DAM NO. 01-72

LOCATION Winnekeag Lake

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT

WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Nasnuh River Reservoir Company Fitchburg USE storage

INSPECTED BY L.O. Marden DATE July 8, 1948

TYPE OF DAM earth dam CONDITION good

SPILLWAY

FLASHBOARDS IN PLACE one row RECENT REPAIRS none

CONDITION cement joints-spillway should be enlarged.

REPAIRS NEEDED enlarge spillway according to approved plans

EMBANKMENT

RECENT REPAIRS filled hole upstream side with riprap

CONDITION cut off brush and grub out roots.

REPAIRS NEEDED cut off brush and grub out roots

GATES

RECENT REPAIRS none

CONDITION gate house locked

REPAIRS NEEDED tnink none.

LEAKS

HOW SERIOUS some seepage

DATE _____

COUNTY ENGINEER

TOWN Ashburnham

DAM NO. 01-32

LOCATION Winnekeag Lake

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Nashua River Res. Co. PLACE Ritchburg USE storage

INSPECTED BY L. O. M. S. Foss DATE Jan. 14, 1949

TYPE OF DAM Erath-downstream dry support wall CONDITION good except spillw
never deepened

SPILLWAY

FLASHBOARDS IN PLACE yes RECENT REPAIRS none

CONDITION same-H-M-Turner of Boston made plans to deepen spillway as
1976 & 1978 flood could not be handled. Emb. sandbagged after each flood
REPAIRS NEEDED should rebuild spillway

EMBANKMENT

RECENT REPAIRS none, except placed two loads of stone where riprap
washed out. Should have backfilled embankment, and then placed riprap.
CONDITION otherwise good

REPAIRS NEEDED none except above.

GATES

RECENT REPAIRS none

CONDITION Foss says OK

REPAIRS NEEDED none

LEAKS

HOW SERIOUS None visible.

DATE _____

COUNTY ENGINEER

TOWN Ashtabham

DAM NO. 01-32

LOCATION Winnekeag Lake

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Nashua River Res Assn PLACE Fitchburg USE Storage

INSPECTED BY LOM DATE Jan. 26, 1950

TYPE OF DAM Earth-downstream stone wall CONDITION Good
Rebuilt Concrete Spillway

SPILLWAY

FLASHBOARDS IN PLACE None - can use RECENT REPAIRS Yes rebuilt

CONDITION Rebuilt deeper, so that it will handle flood H₂O in 1950

REPAIRS NEEDED None

EMBANKMENT

RECENT REPAIRS None

CONDITION Covered with brush

REPAIRS NEEDED Grub out roots - remove brush - fill holes
relay riprap where needed.

GATES

RECENT REPAIRS None

CONDITION appears good.

REPAIRS NEEDED None

LEAKS

HOW SERIOUS None visible

DATE Jan. 26, 1950

W. O. Marden
COUNTY ENGINEER

TOWN Ashburnham

DAM NO. 01-32

LOCATION Winnekeag Lake

STREAM

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Nashua R. Res Co. PLACE Fitchburg USE storage

INSPECTED BY LOM-B-Crocker-Foss DATE March 15, 1951.

TYPE OF DAM CONDITION good

SPILLWAY

FLASHBOARDS IN PLACE RECENT REPAIRS

CONDITION

REPAIRS NEEDED spillway rebuilt from plans by H.M. Turner.

EMBANKMENT

RECENT REPAIRS

CONDITION

REPAIRS NEEDED

GATES

RECENT REPAIRS

CONDITION

REPAIRS NEEDED

LEAKS

HOW SERIOUS

DATE

.....
COUNTY ENGINEER

COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by B. Crocker - S. Foss
L. O. Harden Date Mar. 15, 51 Dam No. 01-32

Town Winnekeag Lake Location
Owner Nashua River Res. Co. Use water supply storage
Material and Type This dam is in good condition-spillway deepened in
accordance with H.M. Turner approved plan.
Dam Designed by Constructed by Year

SPILLWAY

El. top Abutment El. Crest El. Apron El. Streambed
Width top Abutment Width top Crest Width bottom Spillway
Width Flashboards carried Kind Flashboards
El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe
Kind of Foundation under Spillway
Condition See above

EMBANKMENT

El. Top El. Natural Ground Width Top
Width of Bottom Upstream Slope Downstream Slope
Kind of Corewall Riprap
Material in Embankment Foundation
Condition upstream slope rebuilt. all brush cut and roots grabbed out.
top regraded where necessary-re-riprapped.

GATES

Location
Size Kind El. Flowline
Condition

WHEEL

Kind Size Rated H. P.
Location Ave. Head
Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number Acres in Pond Drainage Area in Square Miles
Discharge in Second Feet per Square Mile
Estimated Storage Million Cubic Feet

TOWN Abbeysham

DAM NO. 01-32

LOCATION _____

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS
DAM INSPECTION REPORT

OWNED BY Nathan River Res Co. PLACE Fitchburg USE _____

INSPECTED BY S. Felt L.O.M. DATE 3-15-51

TYPE OF DAM _____ CONDITION _____

SPILLWAY

FLASHBOARDS IN PLACE 20" Flashboards per RECENT REPAIRS spilling deepened
H.W. Turner
CONDITION Rebuilt OK
REPAIRS NEEDED None

EMBANKMENT

RECENT REPAIRS Raised 2' New Rip rap entire slope
CONDITION Very Good
REPAIRS NEEDED None

GATES

RECENT REPAIRS None
CONDITION Good
REPAIRS NEEDED None

LEAKS

HOW SERIOUS No leaks

DATE 3-15-51

S.O. Marden
COUNTY ENGINEER

TOWN Ashbyham DAM NO. 01-32

LOCATION Ashby Riv. STREAM Phillips Brook

"Lake Winnekeag"
WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by Crocker Burbank Co. Place Fitchburg Use Storage Pond

Inspected by W.O.L. Date Dec. 19, 1954

Type of Dam Earth, stone and concrete Condition Good

SPILLWAY

Flashboards in Place 24" of boards Recent Repairs _____

Condition The piers are bent and should be removed

Repairs Needed New concrete work has been done at the spillway

EMBANKMENT

Recent Repairs _____

Condition Good

Repairs Needed There is a slight ridge in the downstream wall

The present water level is 6" below the top of the dam

GATES

Recent Repairs _____

Condition Good

Repairs Needed The gate is partly open

LEAKS

How Serious _____

DATE: _____ County Engineer

TOWN Ashburnham

DAM NO. 01-32

LOCATION Rice Lake

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Nashua River Reservoir PLACE _____ USE Impounding

INSPECTED BY R. H. Gifford DATE 10/18/54

TYPE OF DAM _____ CONDITION _____

SPILLWAY

FLASHBOARDS IN PLACE 2' RECENT REPAIRS none

CONDITION Good

REPAIRS NEEDED none

EMBANKMENT

RECENT REPAIRS none

CONDITION good

REPAIRS NEEDED _____

GATES

RECENT REPAIRS In gate house - apparently OK

CONDITION _____

REPAIRS NEEDED _____

LEAKS

HOW SERIOUS _____

DATE _____

COUNTY ENGINEER

TOWN Ashby DAM NO. 01-35

LOCATION Ashby, Mass. STREAM Phillips Brook

"Lake Winnepesaukee"
WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by Crocker Bucknam Co. Place Fitchburg Use Storage Pond

Inspected by L. O. H. - W. H. L. Date 11-2-59

Type of Dam Earth, stone and concrete Condition Good

SPILLWAY

Flashboards in Place 21" of pin boards Recent Repairs _____

Condition Good condition

Repairs Needed New concrete facing work has been done on the

downstream abutment wall - this work was done in 1954

EMBANKMENT

Recent Repairs There is a slight sink in the embankment

Condition embankment wall. Two large holes have been found

Repairs Needed same for many years

GATES

Recent Repairs _____

Condition Good condition

Repairs Needed _____

LEAKS

How Serious 1/2 leak

DATE: _____ County Engineer

TOWN Ashburnham DAM NO. 01-72

LOCATION Winnekeag Res STREAM Phillipi Brook

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by Nashua River Res Co Place _____ Use _____

Inspected by L O M - W A L Date June 8, 1957

Type of Dam _____ Condition _____

SPILLWAY

Flashboards in Place _____ Recent Repairs _____

Condition _____

Repairs Needed _____

EMBANKMENT

Recent Repairs _____

Condition _____

Repairs Needed _____

GATES

Recent Repairs _____

Condition _____

Repairs Needed _____

LEAKS

How Serious _____

DATE: _____ County Engineer

TOWN Ashburnham DAM NO. 01-32

LOCATION W. side of Ashby Rd STREAM Phillips Brook

"Lake Winnekeag"
WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by Weyerhaeuser Co. Inc Place Fitchburg Use Storage Reservoir

Inspected by MFH-ECC-TCM Date Oct. 5, 1962

Type of Dam Earth-Stone-Concrete Condition Good

SPILLWAY

Flashboards in Place Pin Boards in Place Recent Repairs _____

Condition _____

Repairs Needed _____

EMBANKMENT

Recent Repairs _____

Condition Good

Repairs Needed _____

GATES

Recent Repairs _____

Condition _____

Repairs Needed _____

LEAKS

How Serious _____

DATE: _____ County Engineer

TOWN Ashburnham DAM NO. 21-32

LOCATION Westerly side Ashby Rd. STREAM Phillips Brook

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by Massachusetts Turnpike Authority Place Highway 2 Use Storage Pond

Inspected by W.C. Date Nov. 10, 1963

Type of Dam Earth, stone, concrete Condition Good

SPILLWAY

Flashboards in Place 24" of pine boards Recent Repairs None

Condition This spillway is located on exposed ledge. The crest is made of

Repairs Needed a row of granite stones. The concrete abutment walls are
good. A new timber crib retaining wall has been built ^{up} along the N. side.

EMBANKMENT

Recent Repairs There is a slight bulge in the downstream wall.

Condition The upstream riprap slope is good. There is a new

Repairs Needed concrete wall along Ashby Rd.

The present water level is about 4' below the spillway crest.

GATES

Recent Repairs None

Condition The gate house is locked. The gate is open.

Repairs Needed None

LEAKS

How Serious No gate

DATE: _____ County Engineer

TOWN Ashburnham DAM NO. 01-32

LOCATION W. side of Ashby Rd STREAM Phillips Brook

"Lake Winnepesaukee"
WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by Weyerhaeuser Co. Inc Place Fitchburg Use Storage Reservoir

Inspected by FEP - 606 Tony Kubec Date Nov. 9, 1964

Type of Dam Earth Stone - Concrete Condition Good

SPILLWAY

Flashboards in Place 22" of boards Recent Repairs _____

Condition Good - Spillway repaired in 2 yrs ago.

Repairs Needed _____

EMBANKMENT

Recent Repairs _____

Condition Good

Repairs Needed _____

GATES

Recent Repairs _____

Condition Good - Gate open

Repairs Needed _____

LEAKS

How Serious None visible

DATE: _____ County Engineer

TOWN Ashburnham

DAM NO. 21-32

LOCATION Weymouth at Ashby Rd

STREAM Phillips Brook

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by Weymouth Co. Inc Place Fitchburg Use Storage Reservoir

Inspected by W.C. Date Oct 15 1967

Type of Dam Earthment Stone Dam Condition Good condition

(Inspected this by J. F. and will come back soon)

SPILLWAY

Flashboards in Place 24" x 12" boards Recent Repairs None

Condition Good condition, except that boards are old and need to be replaced

Repairs Needed Replanning to determine if they should be replaced
Water level is about 12" below top of boards

EMBANKMENT

Recent Repairs None

Condition Good condition

Repairs Needed None

GATES

Recent Repairs None

Conditions Good condition Gate is located in a small hole

Repairs Needed Gate house and is partly open and time to be replaced

LEAKS

How Serious Leakage is visible in old stream bed just below dam

DATE:

TOWN Leicester

DAM NO. 01-32

LOCATION on Weymouth River Rd.

STREAM Phillips Brook

Lake Winnepesaukee

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by Nashua River Res. Co. Place Weymouth Use Storage Reservoir

Inspected by E. J. Concoran Date 5/9/67

Type of Dam Earth and stone dam Condition ok

SPILLWAY

Flashboards in Place _____ Recent Repairs _____

Condition: _____

Repairs Needed _____

EMBANKMENT

Recent Repairs _____

Condition _____

Repairs Needed _____

GATES

Recent Repairs _____

Conditions _____

Repairs Needed _____

LEAKS

How Serious _____

DATE: _____

County Engineer

TOWN Ashburnham DAM NO. 31-32

LOCATION Ashby Rd STREAM Phillips Brook

"Lake Winnepesaukee"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by C. Pater Hughes 545 Westminster Rd
Meyerhauser Co Inc. Place Fitchburg Use Storage Pond
Inspected by WOL Date Oct 17, 1968
Type of Dam Earth-stone and concrete Condition Good

SPILLWAY

Flashboards in Place 20 1/2" boards - 19" Recent Repairs _____

Condition Good

Repairs Needed New 2" plating and new 1 1/2" standard pipe - pin

EMBANKMENT

Recent Repairs _____

Condition Good

Repairs Needed Grass and brush has been recently cut.

GATES

Recent Repairs Gate is closed

Condition New paint etc on gate boxes

Repairs Needed _____

LEAKS

How Serious Small seepage

DATE: _____ County Engineer

TOWN Actonham DAM NO. 01-32

LOCATION Winnekeag Lake STREAM Phillips Brook

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by Nashua River Res. Co. Place _____ Use _____

Inspected by MF Hunt Date Nov 15 1968

Type of Dam _____ Condition _____

SPILLWAY New 2 1.5-ft. permanent flashboards in place.

Flashboards in Place _____ Recent Repairs _____

Condition Boards holding 6"±

Repairs Needed _____

FUNDAMENT

Recent Repairs _____

Condition OK

Repairs Needed _____

GATES

Recent Repairs _____

Condition OK

Repairs Needed _____

LEAKS

How Serious _____

DATE: _____ County Engineer _____

TOWN Ashburnham DAM NO. Winnekeag Lake
01-32
LOCATION _____ STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by Nesque River Reservoir Co. Place _____ Use _____
Inspected by _____ Date 3-6-69
Type of Dam Earth Condition _____

SPILLWAY

Flashboards in Place Yes 2 new boards holding back 16" of water +
Recent Repairs _____
Condition clear of obstructions
Repairs Needed _____

EMBANKMENT

Recent Repairs _____
Condition _____
Repairs Needed _____

GATES - closed - water 2' + from high water
Recent Repairs Reinspected 3-13-69 same conditions exist
Condition _____
Repairs Needed _____

re-check 3-13-69

LEAKS

How Serious _____

DATE: _____ County Engineer _____

INSPECTION REPORT & DATA FOR DAMS

Owner: Weyerhaeuser Co. Inc.
His Address: 515 Westminster Rd., Fitchburg
Function of Dam: Storage

Location & Access: 200 ft. westerly off Ashby Rd.

USGS Quad. Ashburnham Lat. 42°39'15" Long. 71°54'10"
Drain. Ar.: 2.6 Sq. Mi.; Ponds: 118 ac.; Res. @ dam: ---
Character of D.A.: ---

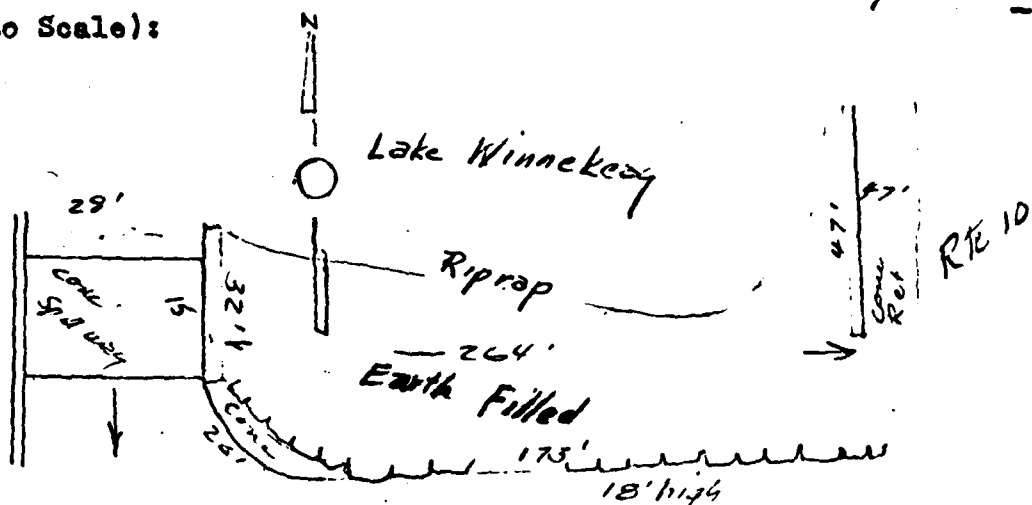
3-14-11-32
Dam No. 01-32
Town: Ashburnham
Stream: Phillips Brook
Pond: Winnekeag Lake
Date: 12-16-71
By: Eaton & Camu
CONDITION RATING
Structural: Ex
Hydraulic: 2B X 2C
General: Ex
PRIORITY: ---

Estimated
Discharge: ---
Capacity: ---

General Description of Dam and Discharge Control:

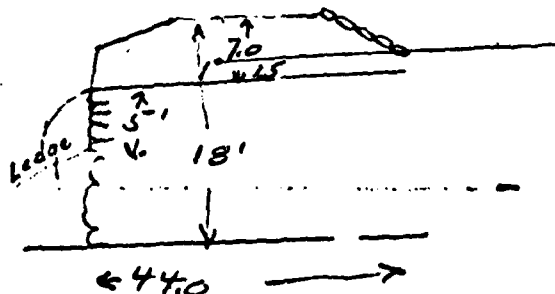
Cutstone retaining wall Earth filled with riprap on face to
water, concrete spillway with 1.5' fishboards in place +
provision for another 5' Gate mechanism in locked gate house

Sketch (Not to Scale):



Remarks and Recommendations:

Sign on gate house says Nashua River Water Co owner
Profile



Date 12/16/71 By Eaton & Camu Comment ---

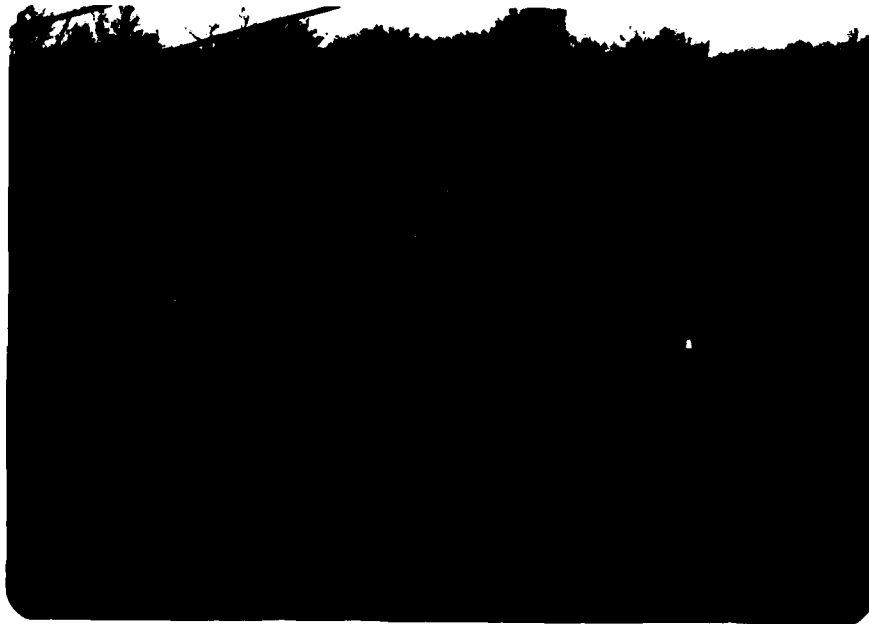
Dam No. 3-14-11-32

APPENDIX C

PHOTOGRAPHS

Note: Location and direction of photographs shown on
Figure B-1 in Appendix B.

WINNEKEAG LAKE DAM



NO. 1 UPSTREAM VIEW OF DAM FROM LEFT ABUTMENT



NO. 2 DOWNSTREAM VIEW OF DAM FROM LEFT ABUTMENT



NO. 3 VIEW OF CREST OF DAM



NO. 4 VIEW OF DOWNSTREAM FACE FROM LEFT ABUTMENT

WINNIKEAG LAKE DAM



NO. 5 VIEW OF DOWNSTREAM FACE



NO. 6 VIEW OF RIGHT ABUTMENT



NO. 7 UPSTREAM VIEW OF SPILLWAY



NO. 8 DOWNSTREAM VIEW OF SPILLWAY



NO. 9 VIEW OF SPILLWAY DISCHARGE CHANNEL



NO. 10 VIEW OF CULVERT BENEATH STATE HIGHWAY 101

APPENDIX D
HYDROLOGIC AND HYDRAULIC
COMPUATIONS

	<u>Page</u>
Hydrologic and Hydraulic Computations	D-1

Project Nat. Review of Non Fed. Dams Acct No. 6426 Page 1 of 6
 Subject Worcester County, Mass. Comptd By LEB Date 6/5/60
 Detail WINNEKEAG LAKE Ckd By RNH Date 6/9/60

I Test Flood, Storage & Storage Function

1- Total Drainage Area - 2.08 mi²

2- Pond(s) Area:

Swamp(s) Area: $0.11 + .06 + .02 + .14 = 0.29$ mi²

Total Area Pond(s) & Swamp(s): 0.34 "

% Ponds & Swamps = $\frac{0.34}{2.08} = 16.3\%$

3- $\frac{1595-1126}{8600} = .0545$; $\frac{1251-1126}{8450} = .0148$ } Say Ave Slope = 3.5%

4- Using C. of E. Curves for Peak Flow Rate & above guide values the Peak Flow Rate was estimated to be between "Polling and Flat & Coastal" and taken at 1450 c.f.s./mi
 Size Class: Interm.; Hazard Pot.: High; Spill. Des. Flood: Full PMF
 Use: Test Flood = Full PMF

5- Test Flood Inflow = $(1450)2.08 = 3016$ c.f.s.

6- Pond Storage

The pond area is .176 sq. mi. at elev.
 Based on a const. area, storage increases at 113 ac. feet per foot of depth increase.

7- Spillway crest elev. is 1126.0 (no stoplogs)

8- Storage Functions are based on $Q_{out} = Q_{in} [1 - \frac{S_{out}}{R}]$

S_{out} = Storage Vol. in Reservoir related to final Q_{out}
 in terms of inches of rain over the drainage area.

$S(\text{in Inches}) = 12 D (\frac{.176}{2.08}) = 1.02$ D ; $R = 6$ hr rain of storm

D = Storage depth in feet above spillway crest in reservoir

9- Storage Functions: (Test Flood & $\frac{1}{2}$ PMF - if needed)

$F_{TF} = 3016 - 158.7 S = 3016 - 161.2 D$

$F_{\frac{1}{2}PMF} = 1508 - 158.7 S = 1508 - 161.2 D$

Project Nat. Review of Non-Federal Dams Acct No 6926 Page 6 of 6
 Subject Worcester County, Mass. Comptd By LEB Date 6/5/80
 Detail WINNEKEAG LAKE Ckd By RCH Date 6/5/80

II Discharge Relations

1- Spillway - No Stoplogs

Width - 29.6'; Effective Width = 28.5'; Critical Depth = 5.11 ft @ 1126.0

y_c	1	2	3	4	5	6
q	5.67	16.04	29.48	45.40	63.44	83.40
Q_1	160	460	840	1290	1810	2380
h_v	0.5	1.0	1.5	2.0	2.5	3.0
Lake El.	1127.5	1129.0	1130.5	1132.0	1133.5	1135.0

2- Spillway - With Stoplogs @ Elev. 1127.4

Use Williams & Hager "Hydraulic Tables"; Eff. width = 28.5'

Lake El.	1128	1129	1130	1131	1132	1133	1134	1135
q	1.57	6.69	13.80	22.45	32.53	43.83	55.87	67.66
Q_2	40	190	390	640	930	1250	1590	1930

3- Crest Flow

Use $q = 2.55 H^{1.5}$; 25' @ el 1132.7, 260' @ el. 1132.6

Lake El.	1133	1134	1135	1134.5
Q_A	10	90	220	150
Q_B	60	870	2160	1470
ΣQ_3	70	960	2380	1620

AD-A145 339

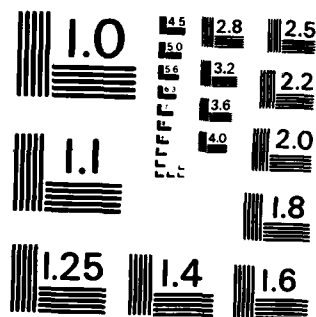
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
WINNEKEAG LAKE DAM (M..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUN 80

2/2

UNCLASSIFIED

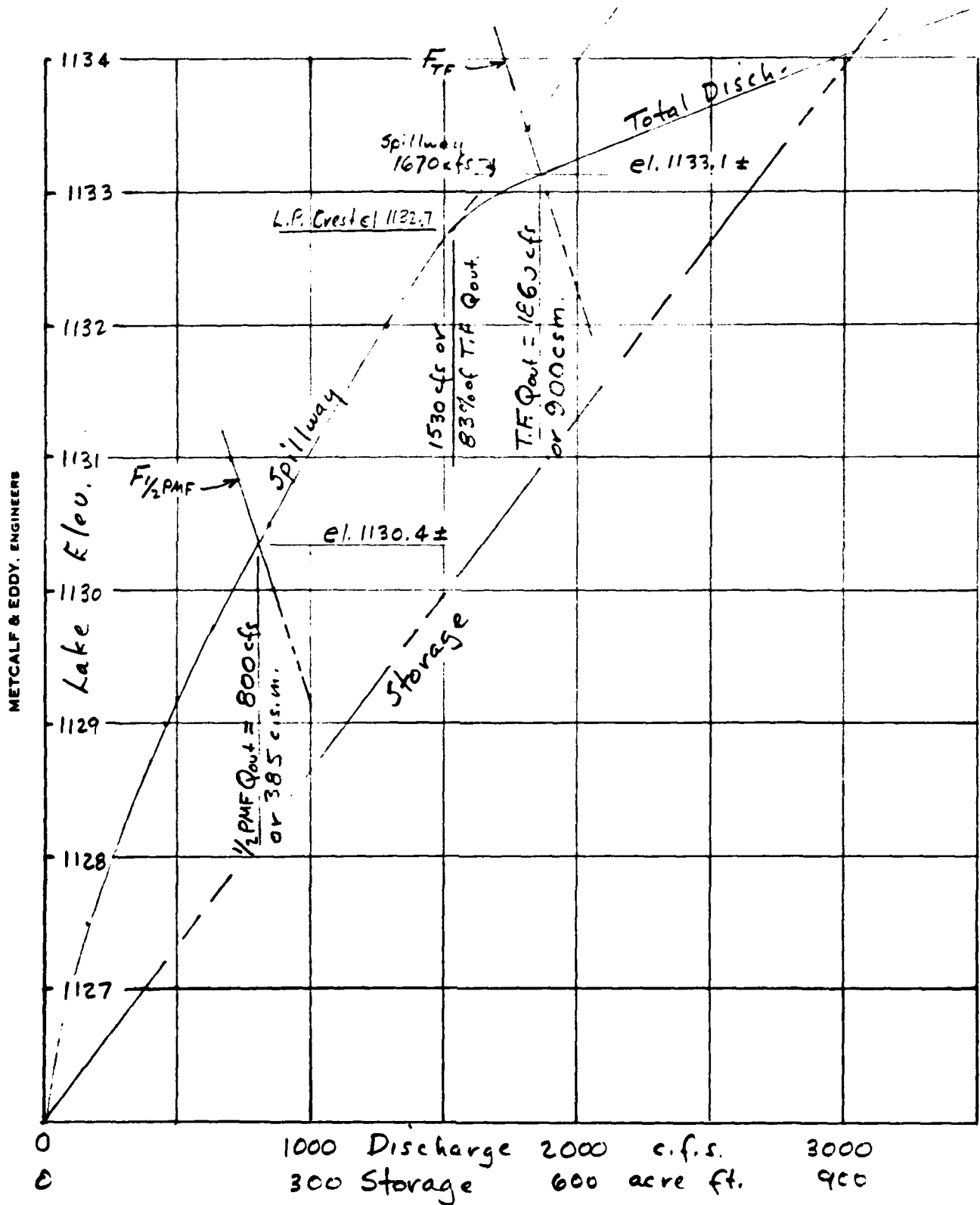
F/G 13/13 NL

							END
							DATE
							FORMED
							10 84
							DTIC



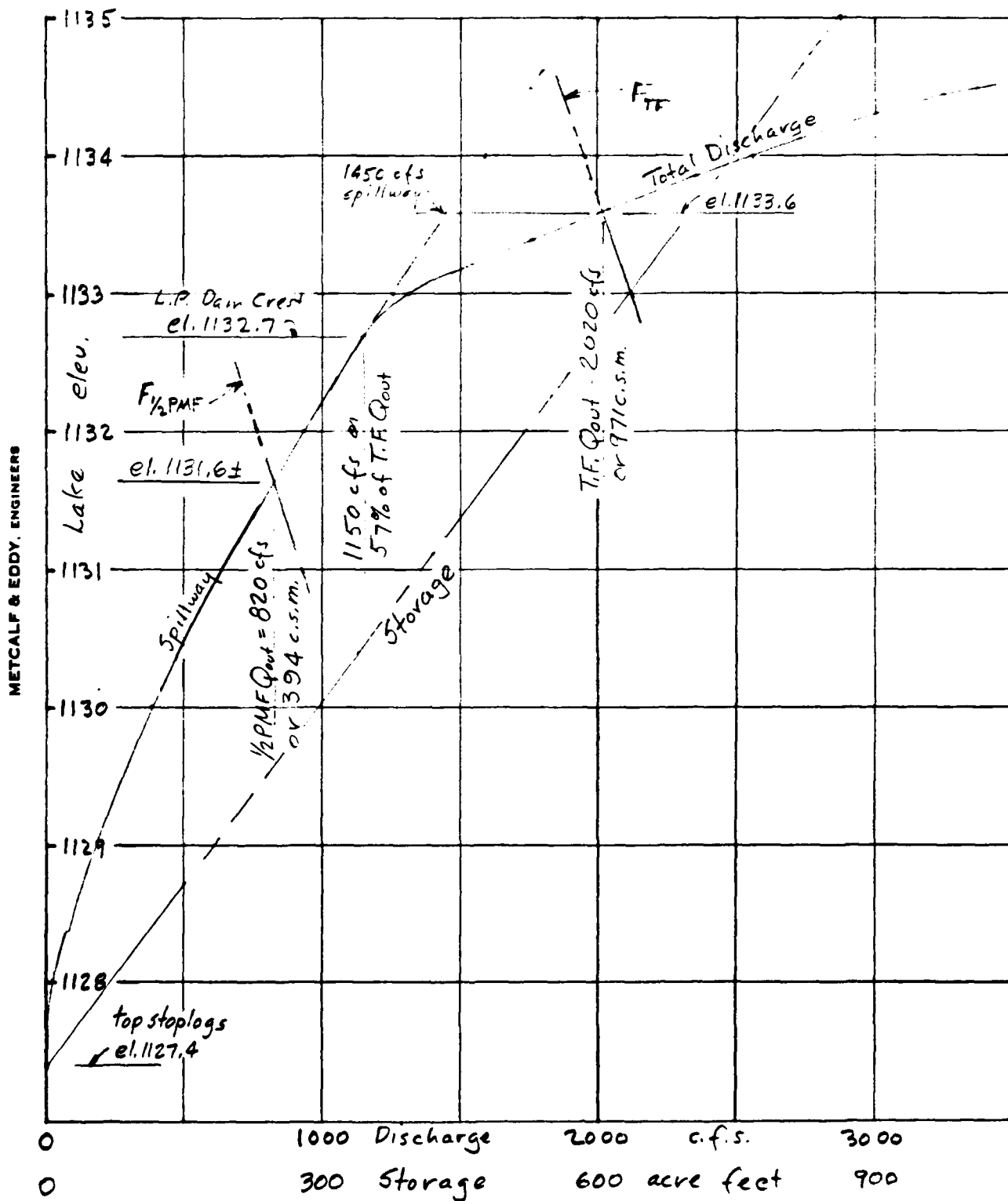
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(III) Discharge, Storage & Storage Funct. vs Lake Elev - No STOP LOGS



Project Nat. Review of Non-Federal Dams Acct No. 6926 Page 5 of 6
 Subject Worcester County, Mass. Comptd By LEB Date 6/5/50
 Detail WINNEKEAG LAKE Ck'd By RNN Date 6/9/50

IV Discharge, Storage & Storage Funct. vs Lake Elev. - WITH STOPLOGS



Project Nat. Review of Non Fed. Dams Acct No. 6926 Page 5 of 6
 Subject Worcester County, Mass Comptd By LEB Date 6/5/80
 Detail WINNEKEAG LAKE Ck'd By RNN Date 6/2/80

V Test Flood Crest Flow

1- No Stoplogs

$$\text{Max hd.} = 1133.1 - 1132.7 = 0.4'; \text{ Flow/ft} = q = 0.645 \text{ cfs/ft}$$

$$\text{As Critical Flow: } y_c = 0.23 \text{ ft; } V_c = 2.7 \text{ fps}$$

2- With Stoplogs

$$\text{Max. hd} = 1133.6 - 1132.7 = 0.9'; \text{ Flow/ft} = q = 2.18 \text{ cfs/ft}$$

$$\text{As Critical Flow: } y_c = 0.53 \text{ ft; } V_c = 4.1 \text{ fps}$$

VI Low Level Outlet

12" ϕ pipe - 61' long - $\pm$ exit el. 1111 $\pm$ - assume no backwater

$$\text{Head} = \frac{V^2}{2g} \left(0.5 + \frac{f L}{D} + 0.2 + \frac{61}{1} \cdot 0.019 \right) = 2.86 \frac{V^2}{2g}; V = 4.745 \sqrt{H}$$

$$\text{Lake Level - Top of Stoplogs - el. 1127.4 - } V = 19.2 \text{ ft/s; } Q = 15.1 \text{ cfs}$$

$$\text{" " - 1' Lower - el. 1126.4 - } V = 18.6 \text{ " ; } Q = 14.6 \text{ "}$$

$$\text{" " - Top of Spillway - el. 1126.0 - } V = 18.4 \text{ " ; } Q = 14.4 \text{ "}$$

$$\text{" " - 1' Lower - el. 1125.0 - } V = 17.8 \text{ " ; } Q = 13.9 \text{ "}$$

Time to Lower Lake One Foot:

$$\text{No Stoplogs - } T = \frac{113(43560)}{\frac{1}{2}(28.3)3600} = 96.6 \text{ hours or 5800 minutes}$$

$$\text{With Stoplogs - } T = \frac{113(43560)}{\frac{1}{2}(29.7)3600} = 92.1 \text{ hours or 5520 minutes}$$

Project Nat. Review of Non Fed. Dams Acct. No. 6926 Page 6 of 6
 Subject Worcester County, Mass. Comptd. By LEB Date 6/5/80
 Detail WINNEKEAG LAKE Ck'd By RON Date 6/9/80

(VII)

Failure of Dam

Peak Failure Flow:

Pond Elevation - 1132.7 (L.P. Dam -)

Toe Elevation - 1112.0

$$Y_0 = 20.7 \text{ ft.}$$

Dam Length Subject to Breaching = 140

$$W_0 = 40\%(140) = 56$$

$$Q_P = 1.68 W_0 (Y_0)^{1.5} = 1.68 (56) (20.7)^{1.5} = 8860 \text{ cfs}$$

Spillway disch. = 1150 cfs ; Total disch. = 10,010 cfs

Storage Volume Released:

Storage Above Spillway $113 \times 6.7 = 757 \text{ ac. ft.}$

Storage Below Spillway $113 \times 14 \times \frac{1}{3} = 527 \text{ " "}$

$S = \text{Total Storage} = 1284 \text{ ac. ft.}$

Channel Hydraulics:

$S = \frac{20}{2400}$; $n \approx 0.125$; $R \approx \frac{1}{2}y$; $V = 9.24 y^{2/3}$

$A = 12.5 y^2$

y	2	6	10	14	12	13
A	50	450	1250	2450	1800	2100
V	1.54	3.20	4.50	5.63	5.05	5.76
Q	80	1440	5620	13790	9140	11320

Flow depth in downstream channel would raise from 5' to 12 1/2'. Channel storage does not significantly reduce failure wave before it reaches Ashburnham.

Time to Drain:

$$\frac{43560 (1284)}{3600 (\frac{1}{2}) (8860)} = 3.5 \text{ Hours, or 210 Minutes}$$

APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF
DAMS

WINNEKEAG LAKE DAM

100-1000

STATE	COUNTY	CITY	CONCRETE	DATE	REPORT DATE
MA	027	J2			04 SEP 80
NAME				REPORT DATE	
MINNEKAUG LAKE DAM				04 SEP 80	

POPULAR NAME	NAME OF IMPROVEMENT
	MINNEKAUG LAKE

NEAREST DOWNSTREAM CITY - TOWN - VILLAGE	POPULATION
ASHBURNHAM	3834

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES (ACRE-FT.)	DIST FROM DAM (MI.)
RDOT	1975	M	21	21	1240	527

REMARKS						
21-LEATH + DRY STONE MASONRY						

OS	SPILLWAY	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CU YD)	POWER CAPACITY (KW)	INSTALLED	PROPOSED	NAVIGATION LOCKS
1	2-3	1150	7500				

OWNER	ENGINEERING BY	CONSTRUCTION BY
THOMAS WILFORD, INC.	THOMAS C. STELDON	UNKNOWN

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
WETCALF + EDDY INC	04 SEP 80	PL 97-307

REMARKS	
33 STEEL PILES IN PLACE	

100-1000

ATE
LME