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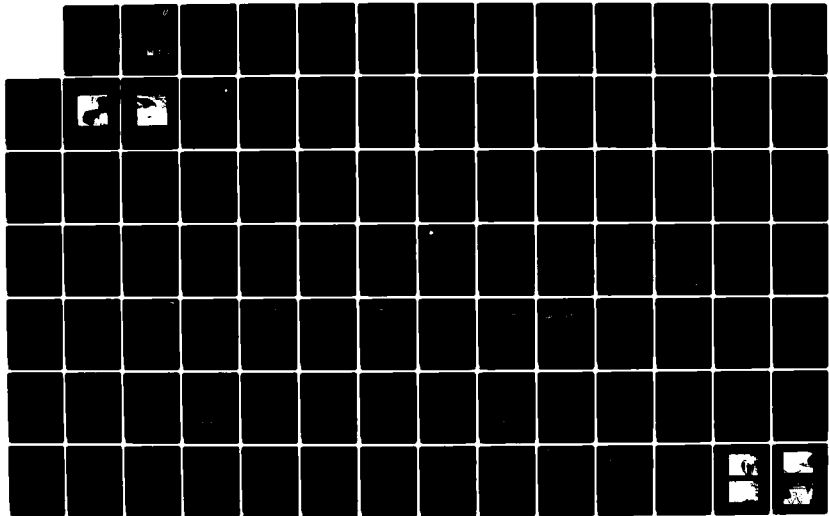
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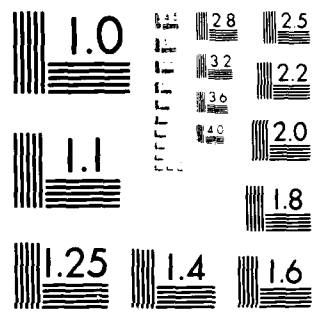
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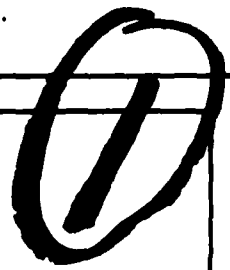




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CONNECTICUT RIVER BASIN
BARRE, MASSACHUSETTS



BARRE RESERVOIR DAM AND DIKE
MA 00094

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

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

JUNE 1980

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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		6. PERFORMING ORG. REPORT NUMBER
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9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE June 1980
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18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut River Basin Barre, Massachusetts		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The impoundment structures on Barre Reservoir consist of a 225 foot long earthfill dam and a 410 foot long earthfill dike; the existing dam has a maximum height of 15.1 feet. The dam and dike have been classified in the "small" size and "high" hazard categories. A test flood equal to 1/2 the 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-E

DEC 10 1980

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

Dear Governor King:

Inclosed is a copy of the Barre Reservoir Dam & Dike (MA-00094) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment is included at the beginning of the report.

The visual inspection has revealed several deficiencies at the site including seepage along the downstream toe of both the dam and dike. In addition the preliminary hydrologic analysis has indicated that the spillway capacity for the Barre Reservoir Dam would likely be exceeded by floods greater than 46 percent of the Probable Maximum Flood (PMF), the test flood for spillway adequacy. Our screening criteria specifies that a dam of this class which does not have sufficient spillway capacity to discharge fifty percent of the PMF, should be adjudged as having a seriously inadequate spillway. Due to the seepage and the inadequacy of the spillway the dam has been assessed as unsafe, non-emergency until corrective measures outlined in Section 7 are completed or more detailed studies provide otherwise.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy precipitation, round-the-clock surveillance should be provided.

DEC 16 1987

NEDED-E

Honorable Edward J. King

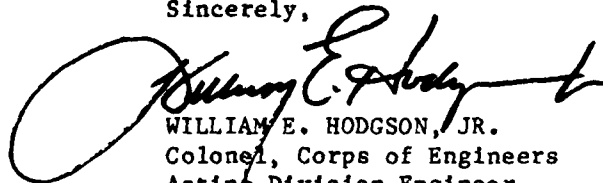
I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. This report has also been furnished to the owner of the project, Prince River Corporation, Worcester, Mass.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, 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 the cooperation extended in carrying out this program.

Sincerely,



WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

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BARRE RESERVOIR DAM AND DIKE

MA 00094

CONNECTICUT RIVER BASIN
BARRE, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00094

Name of Dam: Barre Reservoir Dam and Dike

Town: Barre, Massachusetts

County and State: Worcester County, Massachusetts

Stream: Prince River, tributary of the Ware River

Date of Inspection: May 5, 1980

The impoundment structures on Barre Reservoir consist of a 225-foot long earthfill dam and a 410-foot long earthfill dike; both were originally constructed around the year 1855. The existing dam has a maximum height of 15.1 feet. The present dike, which was breached during the 1938 hurricane and rebuilt in 1941, has a maximum height of 21.1 feet. The top of the dam is at El 951.1 and the top of the dike is at El 951.5. The spillway consists of a flat-crested, concrete weir 68.3 feet long with a crest elevation of 948.0. The low-level outlet is a 12-inch diameter iron pipe located at the dike, approximately 70 feet to the right of the left abutment. The invert of the outlet pipe is at El 931.2. Flow through the low-level outlet is regulated by a manually operated gate valve located at the discharge end of the pipe.

There are numerous 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 and dike are in poor condition.

BARRE RESERVOIR DAM AND DIKE

The following deficiencies were observed at the site: severe seepage from the downstream toe of the dike at the left abutment; seepage along almost the entire length of both the dam and dike, at the downstream toe; heavy growth of vegetation on the crest and slopes of both the dam and dike; seepage through the vertical downstream stone spillway wall and beneath both left and right sidewalls of the spillway channel; minor bulging of the vertical stone spillway wall; spalling of the concrete approach apron, spillway crest, and splash apron; slight to heavy spalling of concrete along the upstream face of the spillway sidewalls; and an accumulation of debris in the spillway discharge channel.

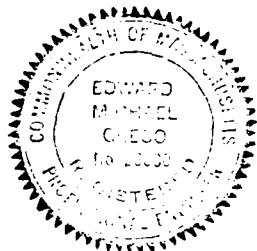
Based on Corps of Engineers' guidelines, the dam and dike have been classified in the "small" size and "high" hazard categories. A test flood equal to one-half the probable maximum flood (PMF) was used to evaluate the capacity of the spillway. The test flood outflow is 1,470 cfs, resulting in a pond level at El 951.2. The test flood would overtop the dam by 0.1 feet but would not overtop the dike. Hydraulic analyses indicate that the spillway can discharge 1,370 cfs, or 93 percent of the test flood outflow before the dam is overtopped.

Upon receipt of this report, the Owner should immediately lower the reservoir to El 938.0, which is below the elevation of the most severe seepage, and repair the deficiencies listed above, as described in Section 7.3. It is recommended that the Owner employ a qualified registered professional engineer to evaluate the stability of the dam and dike. The Engineer should also conduct a thorough investigation of the severe seepage occurring at the toe of both embankments, as well as the seepage occurring through the dry stone masonry walls of the spillway. The Engineer should redesign the outlet with the control valve on the upstream face of the dike.

The Owner should also implement a program of annual technical inspections, a plan for surveillance of the dam during and after periods of heavy rainfall, and a plan for notifying downstream residents in the event of an emergency at the dam.

BARRE RESERVOIR DAM AND DIKE

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.



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

Massachusetts Registration
No. 29800

Approved by:

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

Massachusetts Registration
No. 19703



BARRE RESERVOIR DAM AND DIKE

This Phase I Inspection Report on Barre Reservoir Dam and Dike 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 J. Di Bruno

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

Aramast Mahtesian

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
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

BARRE RESERVOIR DAM AND DIKE

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.

BARRE RESERVOIR DAM AND DIKE

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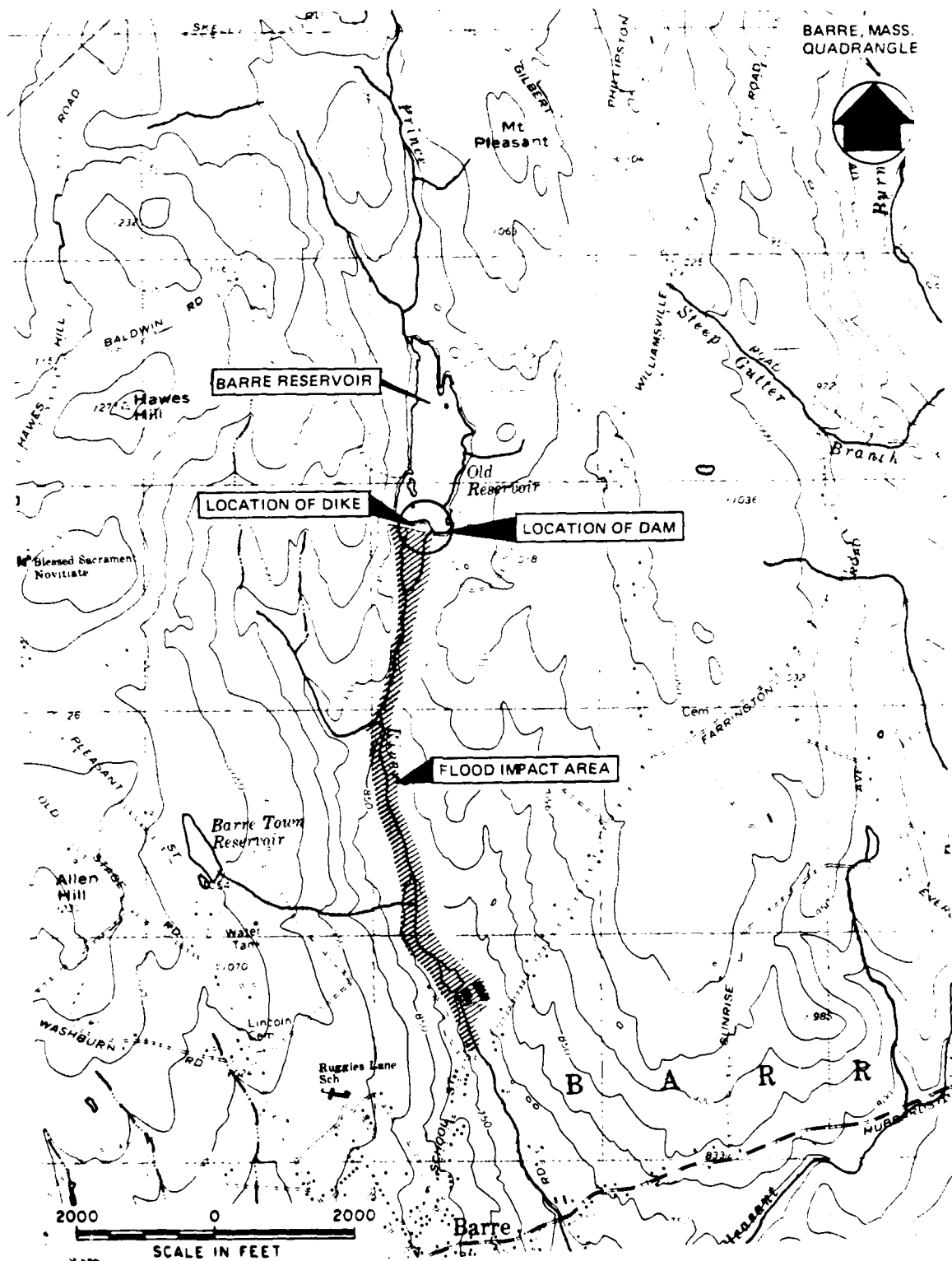
BARRE RESERVOIR DAM AND DIKE

OVERVIEW
BARRE RESERVOIR DAM
BARRE, MASSACHUSETTS



OVERVIEW
BARRE RESERVOIR DIKE
BARRE, MASSACHUSETTS





LOCATION MAP - BARRE RESERVOIR DAM AND DIKE

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BARRE RESERVOIR DAM
BARRE RESERVOIR DIKE

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 the Prince River in the Town of Barre, Worcester County,
BARRE RESERVOIR DAM AND DIKE

Massachusetts, in the Connecticut River Basin (see Location Map). The coordinates of this location are Latitude 42 deg. 27.4 min. north and Longitude 72 deg. 06.2 min. west.

- b. Description of Dam and Appurtenances. The impoundment structures consist of a 225-foot long earthfill dam and a 410-foot long earthfill dike. The dam and dike are separated by a point of natural ground approximately 100 feet wide. The maximum height of the dam is 15.1 feet; and the maximum height of the dike is 21.1 feet. The elevation of the top of the dam is 951.1 and the minimum elevation of the top of the dike is 951.3. Both dam and dike are approximately 10 feet wide at the top. (See Figures B-1 and B-2 in Appendix B). The upstream face of the dam is a 1:1 (horizontal: vertical) slope covered with stone. Above approximate El 948, however, a heavy growth of trees and brush obscures the stone. The downstream face of the dam is a 2:1 earth slope. At the dike, the upstream face slopes at 1.6:1 and the downstream slope is at 2:1.

Available drawings and inspection reports indicate that the dam is an unzoned embankment containing a concrete core wall upstream and wood sheeting driven to an impervious layer immediately downstream of the core wall. A portion of the dike was breached during the 1938 hurricane, and reconstructed with a zoned embankment. Notes on a 1941 plan of the reconstruction indicate an upstream core wall of compacted layers of "blue clay", and a cut-off trench of unknown depth and material. Wood sheeting was driven to bedrock below the clay and concrete placed on both sides of the sheeting (see Figure B-3, Appendix B).

The spillway, located near the center of the dam, is a flat-crested, concrete weir with sloping sidewalls. The effective length of the spillway is 68.3 feet at the crest and 80.3 feet at the top of the sidewalls (see Section 2-2, Figure B-2, Appendix B). The sidewalls of the spillway extend laterally for approximately

BARRE RESERVOIR DAM AND DIKE

15 and 25 feet (right and left) to form a partial retaining wall along the upstream face of the dam (see Figure B-1 and Photo No. 4). The crest of the weir is at El 948.0. The approach channel reportedly consists of a 1-1/2-foot thick concrete apron with a 2.5:1 slope. The downstream face of the spillway is a vertical dry stone masonry wall 10.8-feet high. There is a 12-foot wide, stone and mortar splash apron at the toe of this wall. The 80-foot wide spillway discharge channel is contained by dry stone masonry training walls which extend from the top of the dam, El 951.1, to natural ground at an approximate slope of 1.7:1. Beyond the splash apron the spillway discharge channel is a poorly defined, unlined water course which flows through woodland. The slope of the upper reach of the channel is 4 percent. The spillway discharge joins flow from the outlet approximately 900 feet downstream of the dam.

The low-level outlet is a 12-inch diameter iron pipe located at the dike, 70 feet to the right of the left abutment. The invert of the outlet is at El 931.2 at the downstream end. Flow through the outlet is manually controlled by a gate valve located at the downstream end of the outlet pipe. The low-level outlet discharges into a 25-foot wide channel bounded by trees and heavy vegetation. Farther downstream the channel narrows to 10 feet wide but debris obstructs the flow, causing some ponding.

- c. Size Classification. Barre Reservoir Dam and Dike are classified in the "small" category. The dam has a maximum height of 15.1 feet, and the dike a maximum height of 21.1 feet. The maximum storage capacity of the dam and dike is 359 acre-feet.
- d. Hazard Classification. There are four wood frame manufacturing buildings belonging to the Charles G. Allen Co. located 6,700 feet below Barre Reservoir Dam (See Flood Impact Area on the Location Map). A 13-foot high dam is immediately upstream of this area. In the event of complete failure of the Barre
BARRE RESERVOIR DAM AND DIKE

Reservoir Dam or Dike, this lower dam would be overtopped and the buildings severely damaged.

Stream flow resulting from the spillway discharging its maximum capacity of 1,370 cfs would be 4.8 feet deep 3,000 feet downstream of the dam.

Failure of the dam would raise the stream level 1.7 feet above the spillway flow level thereby producing a stream depth of 6.5 feet. Attenuation of the pond at the Allen Factory would reduce the depth of flow with the result that the factory would be flooded to a depth of 1 foot (El 761.5).

Failure of the dike would raise the water in the stream 5.2 feet above the spillway flow level resulting in a stream depth of 10 feet, 3,000 feet downstream of the dam. Attenuation by the Allen Factory pond would result in the factory being flooded to a depth of 3.2 feet (El 763.5).

More than a few lives could be lost and considerable amount of property damage could occur. Accordingly, the dam has been placed in the "high" hazard category.

- e. Ownership. The dam is owned by the Prince River Corporation, c/o Mr. George T. Dewey, Jr., 311 Main Street, Worcester, Massachusetts 01608. Mr. Dewey (telephone 617-753-5410) granted permission to enter the property and inspect the dam.
- f. Operator. The dam is operated by a representative of the Prince River Corporation who lives in Barre, Massachusetts.
- g. Purpose of the Dam. Barre Reservoir is used for recreational purposes by members of the Prince River Corporation.
- h. Design and Construction. Construction of Barre Reservoir Dam and Dike was completed in the 1850's. No drawings or specifications of the original dam have been found. A June 10,
BARRE RESERVOIR DAM AND DIKE

1932 plan by the Worcester County Engineer is available showing the proposed reconstruction of the spillway and sidewalls. The drawing shows the dam essentially as it appears today, except that the masonry wing walls were redesigned, and sidewalls aligned with the spillway crest were substituted at the time of construction.

Flooding during the 1938 hurricane caused the dike embankment to fail. Plans for the proposed reconstruction of the dike were approved in 1941 by the Worcester County Engineering Department and are available through that office. Figure B-3 is a 1961 tracing of portions of the reconstruction plans. The drawing shows the dike essentially as it appears today.

Inspection reports over the years have cited seepage and leaks occurring in both the dam and the dike. This condition was also noted after both the 1932 and 1941 reconstructions. The inspectors repeatedly recommended removing the heavy growth of trees and vegetation, and grubbing out tree roots along the embankments of both the dam and the dike. Available inspection reports have indicated that both the dam and dike are in poor condition, with no recent repairs.

1. Normal Operating Procedures. There are no written operating procedures for this dam. However, a representative of the Prince River Corporation reportedly visits the dam at times of heavy rainfall and during the spring and fall. At those times, the gate valve on the 12-inch outlet pipe is opened or closed as necessary. The low-level outlet was last operated in the fall of 1979 when the pond was lowered to an unknown elevation for the winter.

1.3 Pertinent Data

- a. Drainage Area. The drainage area is approximately 2,176 acres (3.40 square miles) and consists of flat to gently rolling land and

BARRE RESERVOIR DAM AND DIKE

includes Hemingway Pond (see Figure D-1 in Appendix). About 17.3 percent of the drainage area is ponds and swamps and the remaining portion consists of woodland. Light residential development, primarily summer cottages, occurs around Barre Reservoir.

- b. Discharge. Discharge from Barre Reservoir flows over the crest of the spillway onto a 12-foot wide concrete splash apron, and then into an unlined, natural watercourse. Water also discharges from the low-level outlet at the dike into an unlined channel.
- (1) Outlet: Size - 12-inch, Invert El 931.2. Capacity - 14 cfs.
 - (2) Maximum known flood at damsite: unknown (dike overtopped in 1938)
 - (3) Ungated spillway capacity at top of dam: 1,370 cfs at El 951.1.
 - (4) Ungated spillway capacity at test flood elevation: 1,460 cfs at El 951.2.
 - (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: 1,460 cfs at El 951.2.
 - (8) Total project discharge at test flood elevation: 1,470 cfs at El 951.2.
- c. Elevation (feet above National Geodetic Vertical Datum of 1929 (NGVD)). A benchmark was established at El 948 as the average elevation of the spillway crest. This elevation was estimated from a United States Geological Survey (U.S.G.S.) topographic map.
- (1) Streambed at toe of dam: 936.0;
streambed at toe of dike: 930.4

BARRE RESERVOIR DAM AND DIKE

- (2) Bottom of cutoff: unknown
- (3) Maximum tailwater: unknown
- (4) Normal pool: 948.0
- (5) Full flood control pool: N/A
- (6) Spillway crest (ungated); 948.0
- (7) Design surcharge (Original Design):
unknown
- (8) Top of dam: 951.1
Top of dike: 951.3
- (9) Test flood surcharge: 951.2

d. Reservoir (Length in feet)

- (1) Normal pool: 2,800
- (2) Flood control pool: N/A
- (3) Spillway crest pool: 2,800
- *(4) Top of dam: 2,800
- *(5) Test flood pool: 2,800

e. Storage (acre-feet)

- (1) Normal pool: 235
- (2) Flood control pool: N/A
- (3) Spillway crest pool: 235
- *(4) Top of dam: 359
- *(5) Test flood pool: 363.

*Based on the assumption that the surface area will not significantly increase with changes in pool elevation from 948.0 to 951.2.

BARRE RESERVOIR DAM AND DIKE

f. Reservoir Surface (acres)

- (1) Normal pool: 40
- (2) Flood-control pool: N/A
- (3) Spillway crest: 40
- (4) Test flood pool: 40
- (5) Top of dam: 40

g. Dam

- (1) Type: earthfill
- (2) Length: 225 feet
- (3) Height: 15.1 feet maximum
- (4) Top width: 10 feet
- (5) Side slopes: upstream - 1:1
- (6) Zoning: unknown
- (7) Impervious core: unknown. Concrete core at spillway.
- (8) Cutoff: unknown. Plans indicate wood sheeting driven to refusal.
- (9) Grout curtain: unknown.

Dike

- (1) Type: earthfill
- (2) Length: 410 feet
- (3) Height: 21.1 feet maximum
- (4) Top width: 10 feet
- (5) Side slopes: upstream - 1.3:1 to 1.9:1
downstream - 2:1

BARRE RESERVOIR DAM AND DIKE

- (6) Zoning: plans indicate zoning in reconstructed area
- (7) Impervious core: unknown except at breached section. Compacted blue clay and 3-inch wood sheeting (Figure B-3).
- (8) Cutoff: unknown. Plans indicate wood sheeting driven to refusal
- (9) Grout curtain: unknown
- (10) Other: reconstructed section on plans indicates cutoff trench but no information on material or depth of trench.

h. Diversion and Regulating Tunnel: N/A

i. Spillway

- (1) Type: flat-crested, concrete
- (2) Length of weir: 68.3 feet at crest of weir, 80.3 feet at top of sloping sidewalls
- (3) Crest elevation: 948.0
- (4) Gates: none
- (5) Upstream channel: concrete apron at a 2.5:1 slope
- (6) Downstream channel: vertical stone wall to 12-foot wide concrete and mortared stone splash apron, El 937.2
- (7) General: sloping concrete training walls on upstream sides of spillway crest, sloping stone sidewalls downstream of spillway crest

j. Regulating Outlets (located at the dike)

- (1) Invert El: 931.2
- (2) Size: 12-inch diameter

BARRE RESERVOIR DAM AND DIKE

- (3) Description: Iron pipe
- (4) Control mechanism: manually-operated wheel connected to a gate valve at the discharge end of the pipe.

BARRE RESERVOIR DAM AND DIKE

SECTION 2

ENGINEERING DATA

- 2.1 General. The engineering data available for this Phase I inspection includes drawings dated from 1932 to 1962, prepared by and obtained from the Worcester County Engineering Department. Two of these drawings are included in Appendix B as Figures B-3 and B-4. There are no other drawings, specifications, or computations available from the Owner, State, or County agencies. Copies of previous inspection reports dated 1925 to 1969, prepared by the Worcester County Engineering Department are included in Appendix B. The most recent inspection was conducted in 1972 by the Massachusetts Department of Public Works, Division of Waterways. 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. George T. Dewey, Jr. and Mr. Robert Perkins, representatives of the Prince River Corporation, who provided information on the history and operation of the dam.

- 2.2 Construction Records. There are no construction records or as-built drawings available for the dam, dike or appurtenances. Previous inspection reports by Worcester County Engineers 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 site.
- 2.4 Evaluation
- a. Availability. There is limited engineering data available for the dam and dike.

BARRE RESERVOIR DAM AND DIKE

- 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 the dam and dike is based on the visual inspection, past performance history, and engineering judgment.
- 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 and dike at Barre Reservoir was performed on May 5, 1980. A copy of the inspection checklist is included in Appendix A. Previous inspections were conducted by the Worcester County Engineering Department from 1924 to 1969, and by the Massachusetts Department of Public Works in 1972. 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 an earthfill structure with a concrete and stone spillway. Evidence of seepage or leakage of clear water was noted in two locations near the downstream toe of the dam (see Figure B-1, and Photos No. 2 and No. 8), in various places along the vertical stone wall of the spillway, and at the base of both discharge channel sidewalls. The seepage is indicated by marshy pools and streams of water flowing at approximately 1/2 gpm (gallons per minute). The concrete on the spillway sidewalls is spalled and eroded with minor efflorescence. The most severe spalling has occurred along the left upstream sidewall of the spillway (see Photo No. 5).

There is moderate erosion of the concrete of the spillway approach channel, as well as on the crest of the weir (see Photo No. 6). Reinforcing steel has been exposed along the crest of the weir and transverse cracking is also evident. The vertical stone wall of the spillway exhibits some minor bulging and some loose stone. The stone jointing in the spillway wall is open and loose; it is possible to probe 3 to 4 feet beyond the face of the wall at many of the joints.

BARRE RESERVOIR DAM AND DIKE

embankment slope is visible below the water line but is heavily overgrown from the water line to the top of the embankment. The stone appears to be intact. Brush and many trees from 2 to 18 inches in diameter are growing along the top and both slopes of the embankments of the dam (see Overview Photo and Photo No. 2).

- c. Dike. The dike is an earthfill structure with a low-level outlet. Evidence of seepage was noted in four locations along the downstream toe. The most severe seepage occurs at the toe of the left abutment with a maximum estimated flow of 10 to 15 gpm (see Photo No. 12). As indicated on Figure B-1, pools, streams, and marshy areas are all evident at the seepage points.

The small stone riprap along the upstream slope of the dike appears to be in place but is heavily overgrown with brush and trees (see Photo No. 9).

Brush and trees are growing along the crest and downstream slope of the dike embankment (see Photo No. 10).

- d. Appurtenant Structures. At the time of the inspection, water was discharging over the spillway so the vertical stone wall and the downstream toe could not be examined. The concrete on the crest of the spillway is eroded and cracked and the steel reinforcement exposed in places. The crest and approach apron of the spillway are clear of debris. The discharge splash apron is heavily eroded and debris has accumulated along and at one end of the apron (see Photo No. 1).

The headwall of the low level outlet is constructed of concrete and is in good condition, with minor erosion of the concrete surface below the water level. The wheel which operates the valve is slightly rusted, but the valve is submerged and could not be inspected.

BARRE RESERVOIR DAM AND DIKE

At the time of inspection, water was flowing from the outlet (see Photo No. 11). As no representative of the Prince River Corporation was present during the inspection, we did not attempt to operate the valve. According to personnel representing the Prince River Corporation, the outlet valve should have been closed but vandals may have opened it. The discharge end of the outlet is clear of debris. Trees and brush overhang the downstream channel, which is partially blocked by fallen logs.

- e. Reservoir Area. The reservoir area is sparsely developed. There are approximately three summer cottages abutting the reservoir and access is over unpaved trails. The general area around the reservoir is heavily wooded and accessible by foot trails only.
- f. Downstream Channel. The spillway channel and the low-level outlet channel converge some 800 feet downstream of the dam and dike. Both channels are narrow and unlined. Debris falling into either channel can cause pools of water to form.

Beyond the convergence of the two outlet channels, the downstream channel slopes at 2.7 percent to the dam behind the Charles G. Allen Company located 6,700 feet downstream of Barre Reservoir Dam. No roadways or bridges cross the channel as far as this lower dam (see Page D-8 in Appendix D for information on the lower dam). About 800 feet beyond the lower dam, the stream flows through a 21-foot wide and 15-foot high culvert beneath the roadway embankment.

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

BARRE RESERVOIR DAM AND DIKE

SECTION 4

OPERATING AND MAINTENANCE PROCEDURES

4.1 Operating Procedures

- a. General. According to representatives of the Prince River Corporation, there are standard procedures for operating the low-level outlet pipe at the dike. The gate valve on the low-level outlet is reportedly opened in the fall and closed in the spring. The valve is operated as necessary during periods of heavy rainfall. No other operating facilities are available at the dam or dike.
- b. Warning System. There is no warning system in effect at the dam or dike.

4.2 Maintenance Procedures

- a. General. The dam and dike are generally poorly maintained. The Prince River Corporation is responsible for maintenance of the facility. Periodic inspections by Personnel for Worcester County Engineering Office have been conducted in the past. Inspection reports indicate little or no maintenance has taken place at either the dam or the dike.
- b. Operating Facilities. The only operating facility at Barre Reservoir is the low-level outlet at the dike. There is no evidence of any maintenance having ever been performed at this outlet.

- 4.3 Evaluation. There are no regular programs of maintenance or technical inspections at the dam. There are also no plans for warning people in downstream areas in the event of an emergency at the dam. The lack of standard operating and maintenance procedures is undesirable, considering that the dam and dike are in the "high" hazard category. These programs should be implemented as recommended in Section 7.3.

BARRE RESERVOIR DAM AND DIKE

SECTION 5

EVALUATION OF HYDRAULIC/ HYDROLOGIC FEATURES

- 5.1 General. Barre Reservoir has a 3.4-square mile drainage area, about 17.3 percent of which is ponds and swamps (see Figure D-1, Drainage Area Map). The land is flat to gently rolling, and lightly developed.

Barre Reservoir has a surface area of approximately 40 acres, and a maximum storage capacity of 359 acre-feet at El 951.1.

The low-level outlet can discharge a flow of 14 cfs when the reservoir is at El 948.0 which is the crest of the spillway. At this reservoir elevation and with no additional inflow, the outlet can lower the reservoir by 1 foot in about 1-1/2 days.

- 5.2 Design Data. There are no hydraulic or hydrologic computations available for the design of the spillway at Barre Reservoir Dam.
- 5.3 Experience Data. The original dam and dike at this site were overtopped and the dike was breached during heavy rains of the September 1938 hurricane. There is no record of overtopping of the present dike since 1941 when it was reconstructed. Representative of the Prince River Corporation recalled no overtopping of the dam during any of the recent storm events.
- 5.4 Test Flood Analysis. Barre Reservoir Dam and Barre Reservoir Dike have been classified in the "small" size and "high" hazard categories. According to the Corps of Engineers guidelines, a test flood range between one-half and full PMF (Probable Maximum Flood) should be used to evaluate the capacity of the spillway. A test flood equal to one-half the PMF was used for this analysis since the height of the dam places it in the lower end of the "size" scale.

The PMF rate for the Barre Reservoir watershed was calculated to be 950 cfs per square mile of drainage area. This calculation is based on the

BARRE RESERVOIR DAM AND DIKE

average slope of 1.3 percent in the drainage area, the pond-plus-swamp area to drainage area ratio of 17.3 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 slightly above the guide curve for "flat and coastal" topography.

Applying one-half the PMF rate to the 3.4 square mile drainage area results in a peak test flood inflow of 1,615 cfs. By adjusting the test flood inflow for surcharge storage, the peak test flood outflow was calculated to be 1,470 cfs (432 cfs per square mile). During the test flood, the pond level would rise to El 951.2.

Hydraulic analyses indicate that the spillway can discharge 1,370 cfs or 93 percent of the test flood outflow with the pond at El 951.1, which is the low point on the top of the dam.

During the test flood, the low point on the dam would be overtopped by 0.1 feet. About 1,460 cfs would discharge over the spillway, and about 20 cfs would discharge over the dam. The dike would not be overtopped during the test flood.

- 5.5 Dam Failure Analysis. The peak discharge rate due to failure of the dam was calculated to be 3,150 cfs with the pond at El 951.1. This calculation is based on a maximum head of 15.1 feet and an assumed 32-foot wide breach occurring in the spillway. Failure of the dam would produce a stream depth 6.5 feet deep 3,000 feet downstream of the dam as compared to channel flow 4.8 feet deep prior to failure. Attenuation by the pond at the Allen Factory located 6,700 feet downstream of Barre Reservoir Dam would reduce the depth of flow with the result that the factory would be flooded to a depth of 1 foot (El 761.5). It would take about 3 hours to drain the pond.
- 5.6 Dike Failure Analysis. The peak discharge rate due to the failure of the dike was based on the actual dike failure of 1938. Reportedly the 1938 breach was 70 feet wide. The discharge rate was calculated to be 11,080 cfs with the pond at

BARRE RESERVOIR DAM AND DIKE

El 951.1. An additional ongoing discharge of 1,370 cfs over the spillway produces a total failure flow of 12,450 cfs. This amount of flow would result in a stream depth of 10 feet at a point 3,000 feet downstream of the dam. Attenuation by the Allen Factory pond would result in the factory being flooded to a depth of 3.2 feet (El 763.5). It would take approximately 1 hour to drain Barre Reservoir.

An assumed failure of Barre Reservoir Dam or Dike would result in appreciable damage to property and the possible loss of more than a few lives. 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 Barre Reservoir Dam is based on a review of previous inspection reports, a review of available drawings, and the visual inspection conducted on May 5, 1980.

As discussed in Section 3, Visual Inspection, the dam is in poor condition. Severe seepage was noted along the toe of the dike, at the left abutment. Seepage was also observed along the toe of the embankments of almost the entire length of both the dam and dike.

No settlement of the embankments was noticed, but slight erosion of the top of the dam behind the right spillway sidewall was evident. Minor bulging in the vertical spillway wall was also noted and void spaces in the stone wall could be probed to depths of 3 to 4 feet. Thick growths of brush and small trees occur on the top and slopes of both the dam and the dike.

- 6.2 Design and Construction Data. Construction of Barre Reservoir Dam and Dike was completed in about 1855. Computations for design of the dam, spillway and outlet are not available.

Drawings dated 1932 to 1941 from the Worcester County Engineering Department show the proposed reconstruction of the dam and the breached section of the dike (see Figures B-3 and B-4). One drawing, not included in this report, shows that the dam is an unzoned earthfill embankment founded on glacial till or bedrock. An impervious core wall made of concrete is indicated along the reconstructed spillway, and a cutoff wall constructed of wood sheeting is shown immediately downstream of the core wall. Inspection reports during the 1932 reconstruction verify the placement of the concrete and the driving of the wood sheeting to refusal. The embankment slopes of the dam are 1:1 upstream and 2:1 downstream.

BARRE RESERVOIR DAM AND DIKE

The plan showing the proposed reconstruction of the dike indicates that it is a zoned embankment using compacted layers of blue clay as an impervious core. A wood sheeting cutoff wall driven to refusal (till or bedrock) is also mentioned on both the plan and in inspection reports. The dike reconstruction plan indicates a cutoff trench but the depth of the trench and the material encountered are not indicated. The embankment slopes of the dike range from 1.3 to 1.9:1 on the upstream face, and 2:1 downstream.

No specifications are available on materials used for either the original construction or for the reconstructions of the dam and dike.

- 6.3 Post-Construction Changes. Except as noted in Section 6.2, there is no evidence of or reports on recent repairs to Barre Reservoir Dam or Dike.
- 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 Assessment

- a. Condition. As a result of the visual inspection, the review of available data, and limited information on operation and maintenance, the dam and dike are considered to be in poor condition. The following deficiencies must be corrected to assure the continued performance of the dam and dike:
 - 1. Seepage from the toe of the dike at the left abutment; seepage along the toe of both abutments; heavy growth of trees and brush on all slopes of the embankments; spalled concrete on the spillway sidewalls; spalled concrete on the approach apron, weir crest, and discharge (splash) apron; minor bulging of the vertical stone spillway wall; and an accumulation of debris on the spillway splash apron and in the spillway discharge channel.

The gate valve on the low-level outlet is submerged, its condition is unknown.

The peak test flood (one-half the PMF) outflow is estimated to be 1,470 cfs with the pond at EL 951.2. The test flood would overtop the low point on the dam by 0.1 feet. The dike would not be overtopped. Hydraulic analyses indicate that the spillway can discharge 1,370 cfs or 93 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 the dam and dike 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

BARRE RESERVOIR DAM AND DIKE

by the Owner within one year after receipt of this Phase I Inspection Report, except as noted in Section 7.3.a.(1).

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

- a. Conduct a thorough investigation of the severe seepage occurring at the toe of the dike, and seepage at other locations.
- b. Develop procedures for clearing brush, trees and roots, and backfilling on both embankments, to a distance of 25 feet from the toe of the dam and dike.
- c. Evaluate the embankment stability of the dam and dike.
- d. Evaluate the stability of the spillway and design repairs for the deteriorated concrete sections. This should include an inspection of the spillway under a no-flow condition.
- e. Relocate the control valve on the outlet to the upstream face of the dike.

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) Upon receipt of this report, immediately lower the reservoir level to El 938, which is below the elevation of the most severe seepage at the dike. This water level should be maintained until the recommendations of the Engineer are carried out.

BARRE RESERVOIR DAM AND DIKE

- (2) Repair all spalled and deteriorated concrete on the spillway in accordance with the recommendations of the Engineer.
- (3) Remove all brush, trees, debris and loose stone in the floor of the spillway discharge channel.
- (4) Remove debris from the channel downstream of the low-level outlet pipe in the dike.
- (5) Institute a definite plan for surveillance of the dam and dike during and after periods of heavy rainfall and a plan to warn people in downstream areas in the event of an emergency
- (6) Implement 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.
- (7) Institute a program of technical inspections on an annual basis.

7.4 Alternatives. The alternative to implementing the recommendations and remedial measures listed above would be to drain the pond completely and remove the dam and dike.

1

APPENDIX A
PERIODIC INSPECTION CHECKLIST

BARRE RESERVOIR DAM AND DIKE

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT BARRE RESERVOIR DAM & DIKE

DATE May 5, 1980

TIME 08:30

WEATHER Clear

W.S. ELEV. 948.0 U.S. 936.2*

*Water surface downstream of spillway.

PARTY:

- 1. L. Branagan (Metcalf & Eddy - Hydraulics)
- 2. W. Checchi (Metcalf & Eddy - Geotechnical)
- 3. W. Diesl (Metcalf & Eddy - Geotechnical)
- 4. A.S. Nagel (Metcalf & Eddy - Geotechnical)
- 5. E.M. Greco (Metcalf & Eddy - Geotechnical)

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	<u>Dam and Dike</u>	<u>Branagan, Checchi, Nagel</u>	
2.	<u>Low-level outlet and spillway</u>	<u>Branagan, Checchi, Nagel</u>	
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT BABBE RESERVOIR DAM & DIKE DATE May 5, 1980
 PROJECT FEATURE Dam NAME W. Checchi
 DISCIPLINE Geotechnical NAME A.S. Nagel

u s = upstream d s = downstream

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	951.1 Earthfill embankment with wood sheeting. Heavily overgrown with trees and brush.
Current Pool Elevation	948.2
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	No pavement
Movement or Settlement of Crest	None visible
Lateral Movement	None visible
Vertical Alignment	Good
Horizontal Alignment	Relatively straight
Condition at Abutment and at Concrete Structures	Abutments tie into natural ground Some erosion of crest behind right and left spillway training walls.
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Minor evidence of foot traffic along left abutment crest.
Sloughing or Erosion of Slopes or Abutments	Slight d s slope erosion behind spillway (discharge) training walls.
Rock Slope Protection - Riprap Failures	Riprap intact and visible in u s slope below water level, above water level heavy vegetation obscures riprap.
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	Severe seepage along embankment cutoffs (both left and right) both streams and pooling of water, estimated 1/2 gpm.
Piping or Boils	None visible
Foundation Drainage Features	Unknown
Toe Drains	None visible, unknown.
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT BARRE RESERVOIR DAM & DIKE DATE May 5, 1980
 PROJECT FEATURE Spillway NAME W. Checchi
 DISCIPLINE Geotechnical NAME A.S. Nagel

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	U/s concrete training walls, concrete weir on dry stone vertical wall; conc. core wall & wood sheeting as cutoff wall in spillway, d/s training walls of drystone sloping at 2.5:1 Concrete, submerged.
a. Approach Channel	
General Condition	Poor-heavily eroded, cracking transverse to weir crest direction.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Concrete, submerged
b. Weir and Training Walls	
General Condition of Concrete	U/s concrete training walls, conc. weir crest on vertical dry stone wall, d/s stone training walls sloping at 2.5:1. Poor aggregate exposed along u/s face of left & right training walls.
Rust or Staining	None
Spalling	Along u/s face of training walls left training wall has 1.3' deep eroded area
Any Visible Reinforcing	Reinforcement visible along weir crest & in "hole" in left training wall.
Any Seepage or Efflorescence	Efflorescence, minor, along training walls. Seepage thru vertical weir wall & beneath lt. & rt. d/s stone training walls.
Drain Holes	None
c. Discharge Channel	
General Condition	12-foot long dry stone with conc. grout remainder of channel is natural. Heavy erosion of concrete grout, erosion holes in apron.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Many small trees in channel d/s of apron and overhanging channel.
Floor of Channel	Unlined - natural
Other Obstructions	None

PERIODIC INSPECTION CHECK LIST

PROJECT BARRE RESERVOIR DAM & DIKE DATE May 5, 1980
 PROJECT FEATURE Dike NAME W. Checchi
 DISCIPLINE Geotechnical NAME A.S. Nagel

AREA EVALUATED	CONDITION
<u>DIKE EMBANKMENT</u>	Earthfill embankment-breached section zoned with blue clay and sheeting of wood.
Crest Elevation	951.5 average
Current Pool Elevation	948.2
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	No pavement
Movement or Settlement of Crest	None visible
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Straight
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	No movement
Trespassing on Slopes	Overgrown with trees and brush.
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	U's riprap in place, visible below water line, heavy vegetation above water line.
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	Heavy seepage at left cutoff 10 to 15 gpm est. 3 additional seepage points noted along toe of slope.
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT BARRE RESERVOIR DAM & DIKE DATE May 5, 1980
 PROJECT FEATURE Low-level outlet NAME W. Checchi
 DISCIPLINE Geotechnical NAME A.S. Nagel

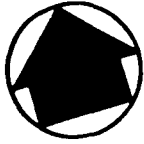
AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	Manually operated wheel and gate valve in 12-inch iron low-level outlet, 70 feet± right of left abutment of dike. Concrete headwall good.
<u>General Condition of Concrete</u>	
<u>Rust or Staining</u>	None
<u>Spalling</u>	None
<u>Erosion or Cavitation</u>	Slight erosion of concrete below water level.
<u>Visible Reinforcing</u>	None
<u>Any Seepage or Efflorescence</u>	Unknown, outlet below water level.
<u>Condition at Joints</u>	None
<u>Drain Holes</u>	None
<u>Channel</u>	Natural channel
<u>Loose Rock or Trees Overhanging Channel</u>	Many small trees overhanging channel.
<u>Condition of Discharge Channel</u>	Channel susceptible to blockage by debris and fallen trees.

APPENDIX B

PLANS OF DAM AND PREVIOUS
INSPECTION REPORTS

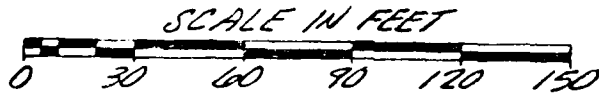
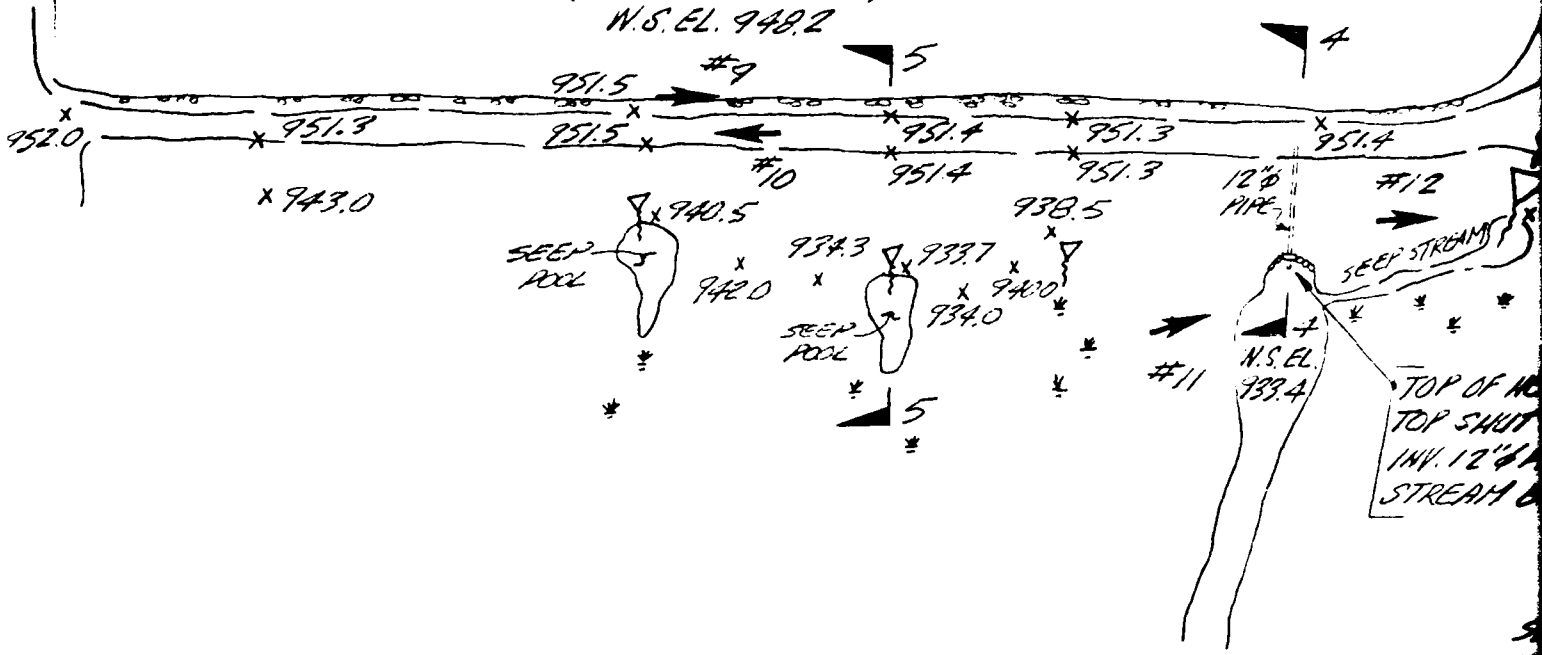
	<u>Page</u>
Figure B-1, Plan of Dam and Dike	B-1
Figure B-2, Sections through Dam and Dike	B-2
Figure B-3, Plan of Proposed Repairs Traced 1-11-62	B-3
Figure B-4, Plan of Spillway Traced 3-6-39	B-4
File Card for Barre Reservoir Dam from Worcester County Engineer's Office	B-5
Previous Inspection Reports dated 1925 through May, 1969 by Worcester County Engineer's Office	B-7
Previous Inspection Report dated March 20, 1972 by Massachusetts Department of Public Works	B-40

BARRE RESERVOIR DAM AND DIKE



DIKE

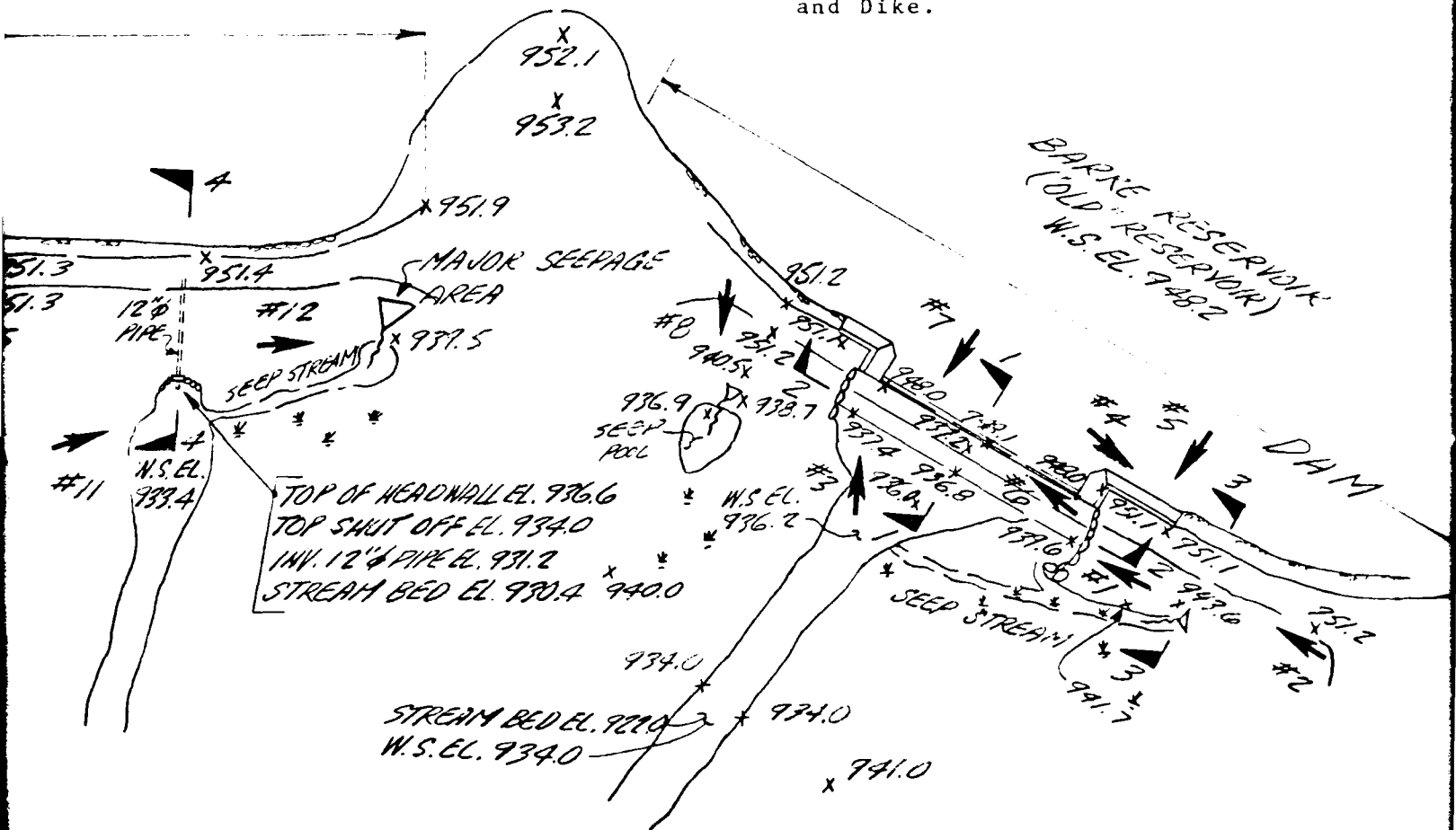
BARRE RESERVOIR
("OLD" RESERVOIR)
N.S. EL. 948.2



METCALF & EDDY, INC.

NOTES:

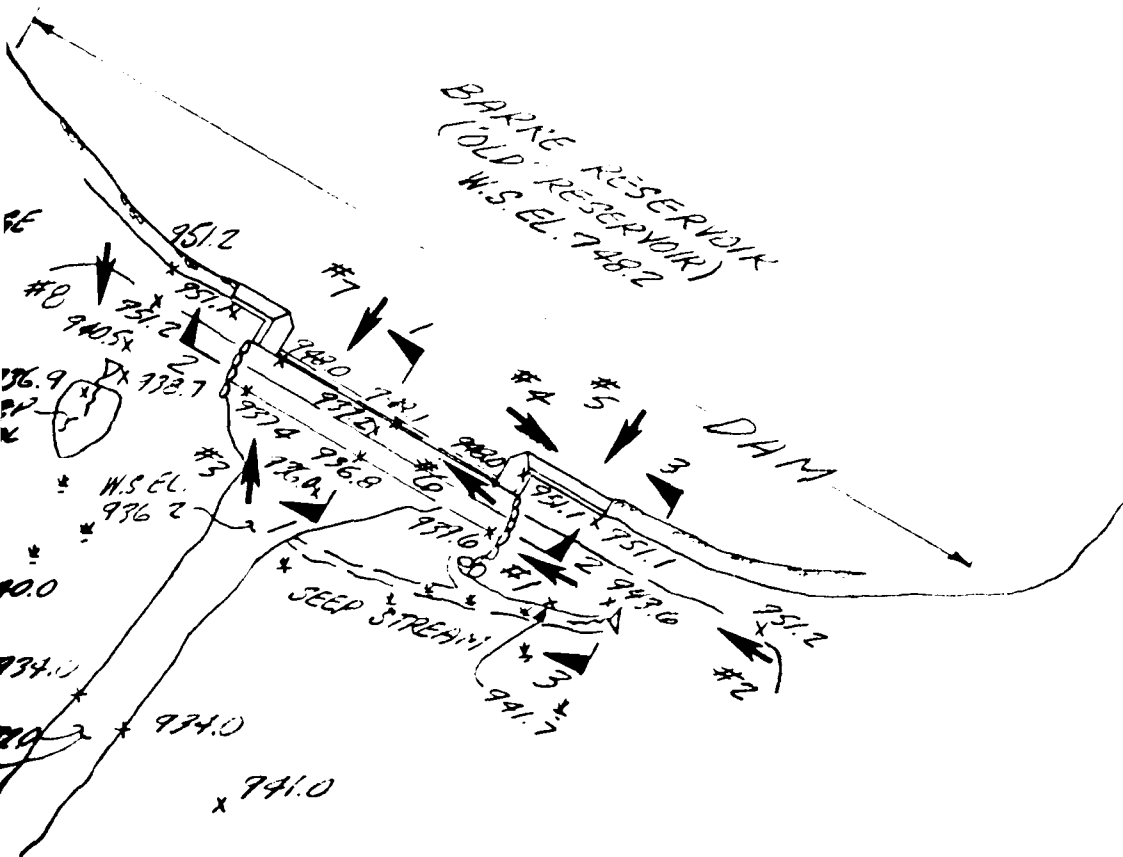
1. Elevations shown based on assumed spill crest Elevation 948.0; estimated from United States Geological Survey Quadrangle sheet
2. Information shown based on field inspection of May 5, 1980 and plans shown in Appendix
3. ∇ denotes seepage
4. ♣ denotes wet or marshy area
5. #2 Indicates location and direction of view for photographs.
6. See Figure B-2 for sections through Dam and Dike.



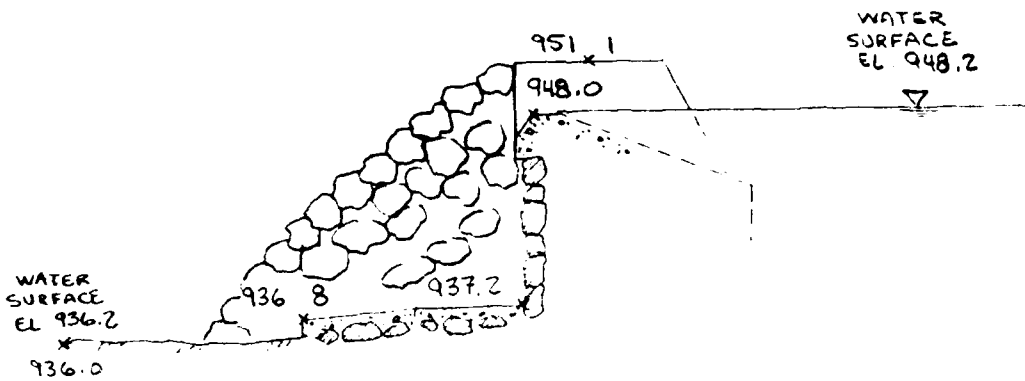
MTCAL & SONS, INC.	
NATIONAL PROGRAM OF INSPECTION	
BARRE RESERVOIR	
FIGURE B-1 PLAN	
TRIBUTARY WARE RIVER	
SCALE: AS SHOWN	DATE

NOTES:

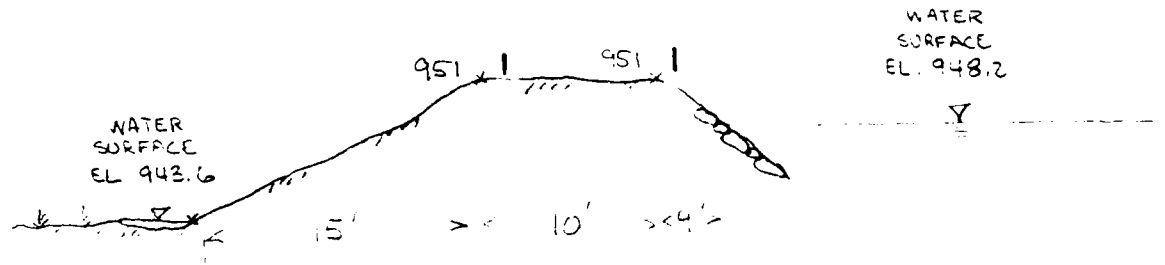
1. Elevations shown based on assumed spillway crest Elevation 948.0; estimated from United States Geological Survey Quadrangle sheet.
2. Information shown based on field inspection of May 5, 1980 and plans shown in Appendix B.
3. ∇ denotes seepage
4. Ψ denotes wet or marshy area
5. \nearrow #2 Indicates location and direction of view for photographs.
6. See Figure B-2 for sections through Dam and Dike.



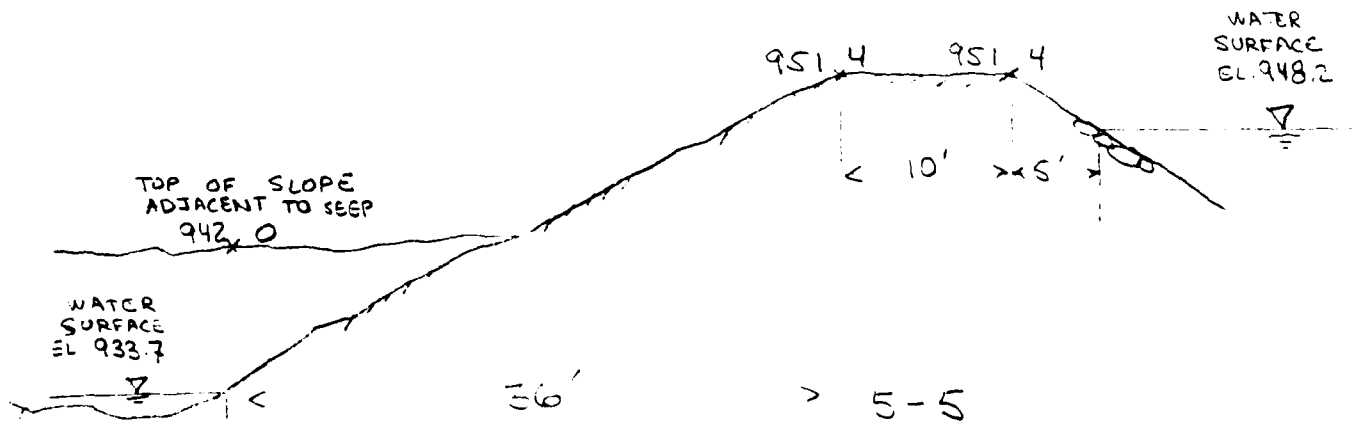
WETCAL & ERBY, INC.	U.S. ARMY ENGINEER DIV. NEW ENGLAND
BOSTON, MA.	CONTRACT NO. 34-148-01
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	
BARRE RESERVOIR DAM AND DIKE	
FIGURE B-1 PLAN OF DAM AND DIKE	
TRIBUTARY WARE RIVER	MASSACHUSETTS
SCALE: AS SHOWN	DATE: MAY, 1980



1-1
 SPILLWAY
 CROSS SECTION
 SCALE 1 in. = 10 FT.

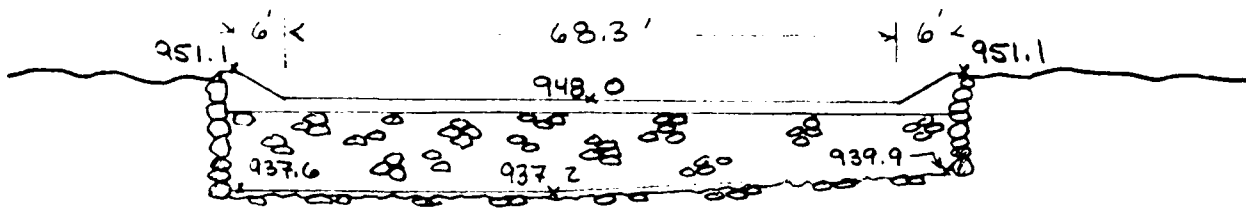


3-3
 DAM
 EMBANKMENT
 CROSS SECTION
 SCALE 1 in. = 10 FT.



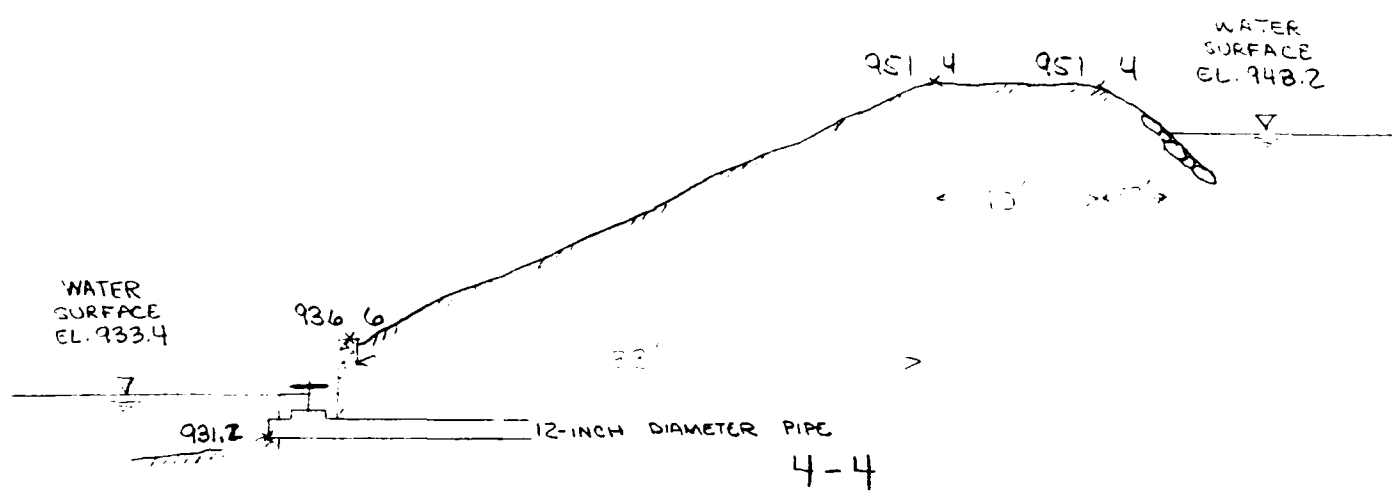
5-5
 DIKE EMBANKMENT
 CROSS SECTION
 SCALE 1 in. = 10 FT.

METCALF & EDDY, INC.



2-2
SPILLWAY
PROFILE

SCALE 1 in. = 20 FT.

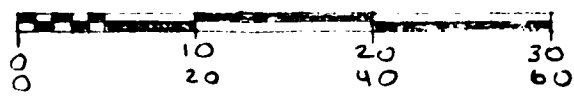


4-4
LOW LEVEL OUTLET
CROSS SECTION

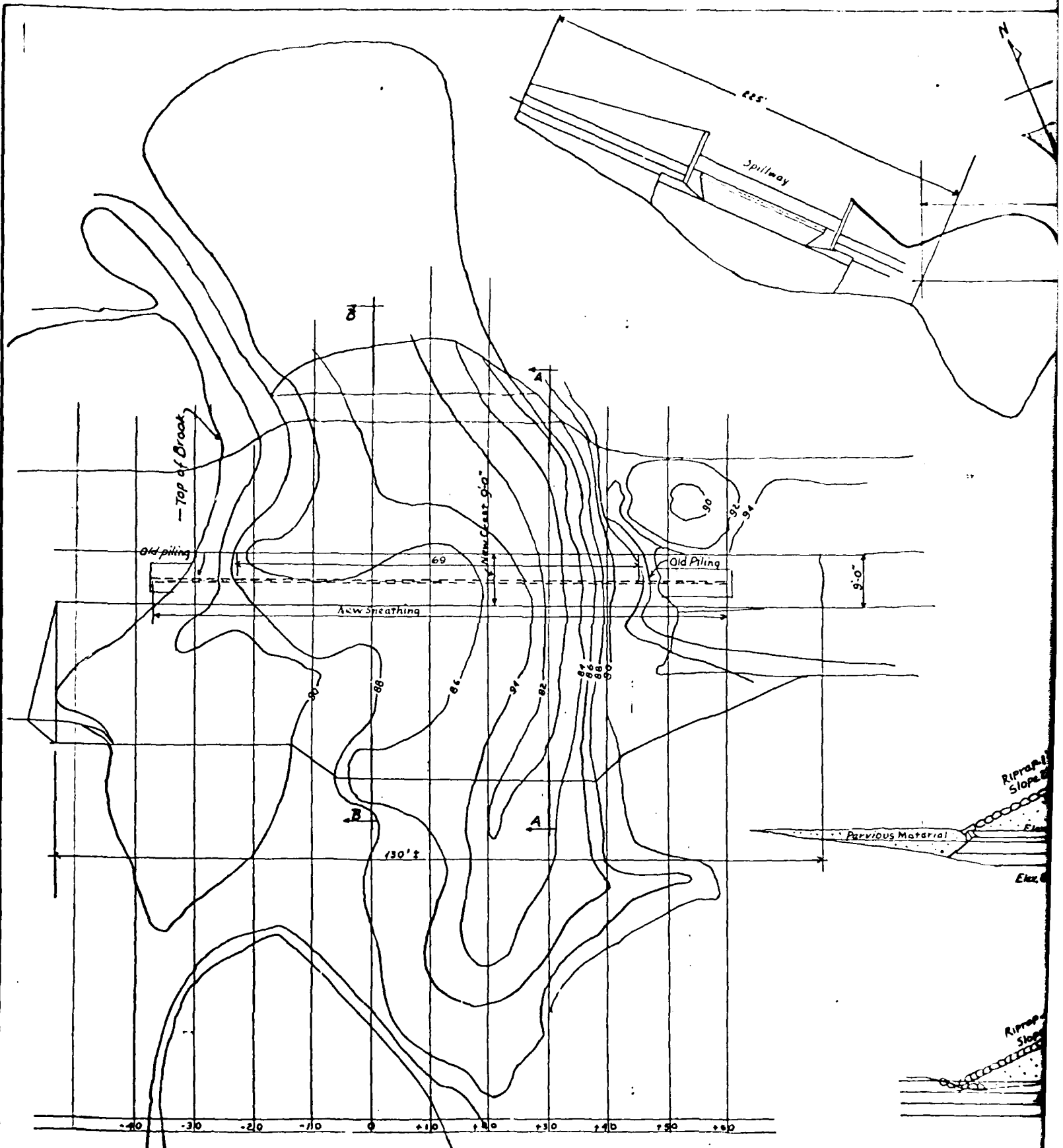
SCALE 1 in. = 20 FT.

WATER SURFACE EL. 948.2

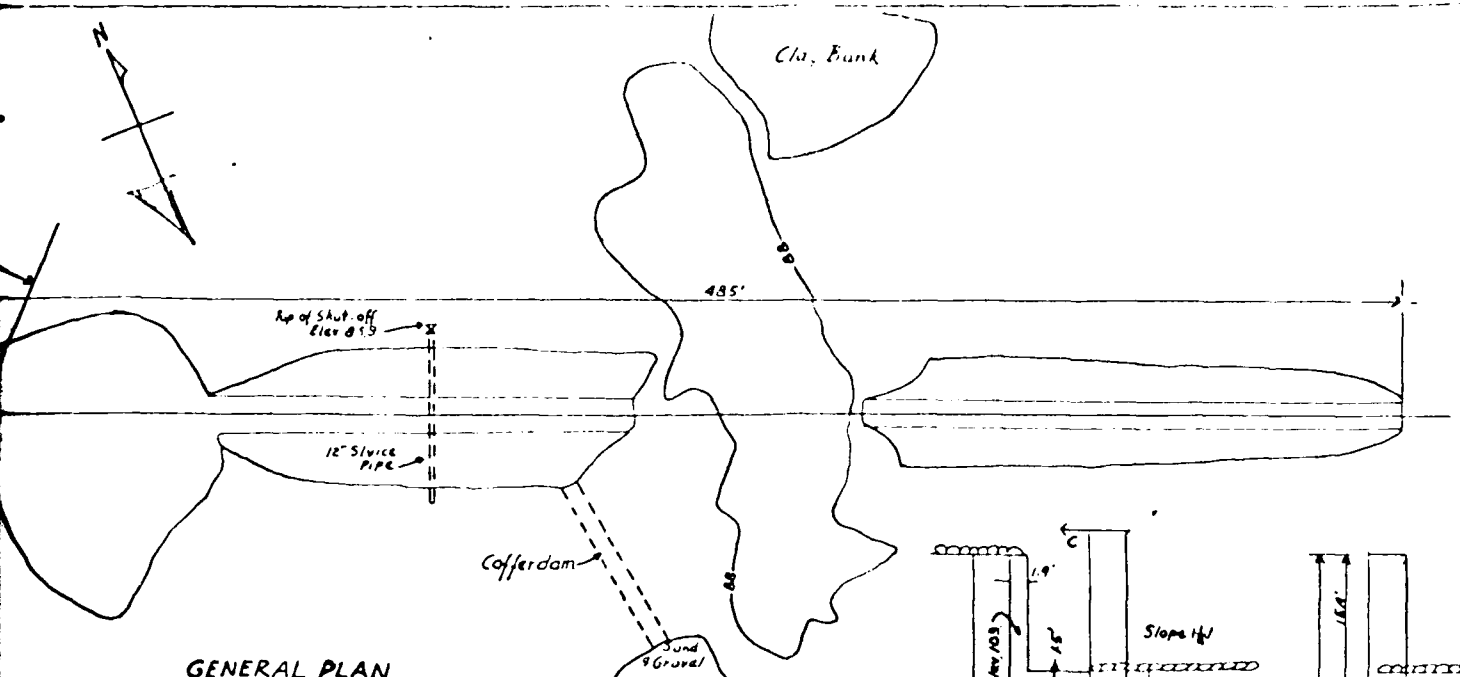
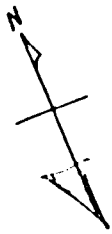
SCALE
in feet



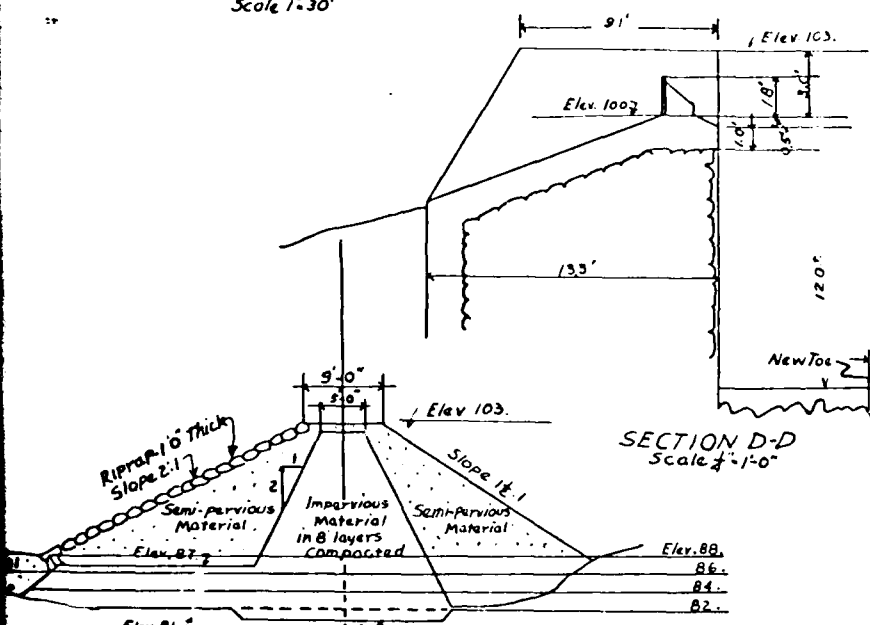
WETZEL & PART, INC.	U.S. ARMY ENGINEER DIVISION
ENGINEER	GROUP OF ENGINEERS
ROSELAND, MA.	WALTHAM, MA.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
BARRE RESERVOIR DAM AND DIKE	
FIGURE B-2 SECTIONS THROUGH DAM AND DIKE	
TRIBUTARY WARE RIVER	MASSACHUSETTS
SCALE: AS SHOWN	DATE: MAY, 1980



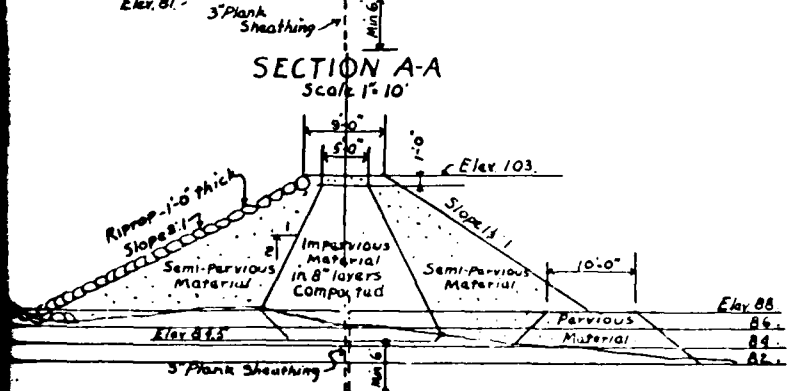
PLAN OF REPAIRS
Scale 1"=10'



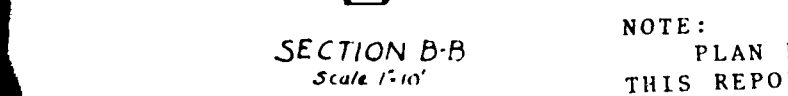
GENERAL PLAN
Scale 1:30'



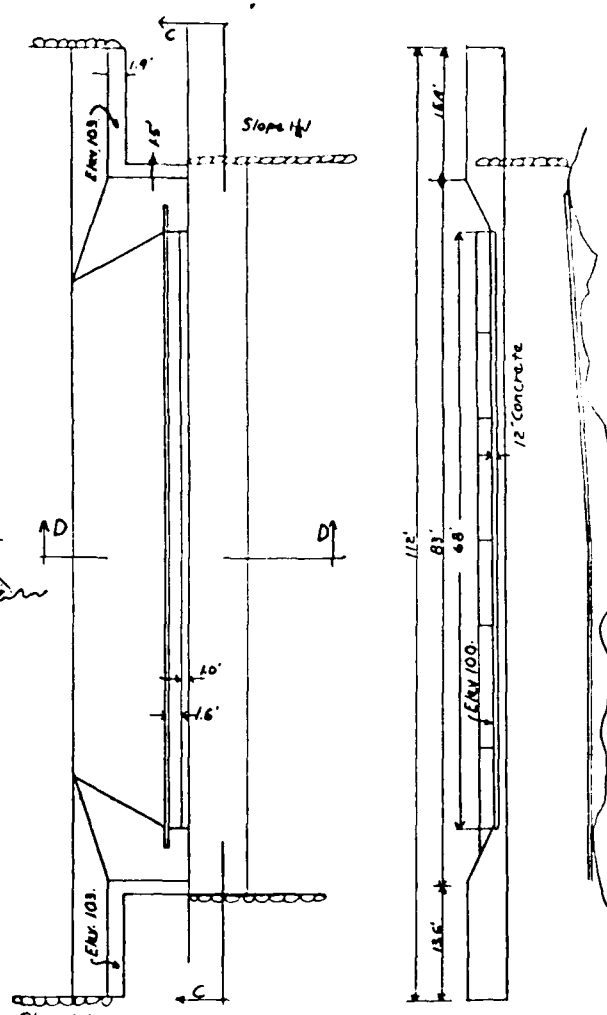
SECTION D-D
Scale 1/4\"/>



SECTION A-A
Scale 1\"/>



SECTION B-B
Scale 1\"/>

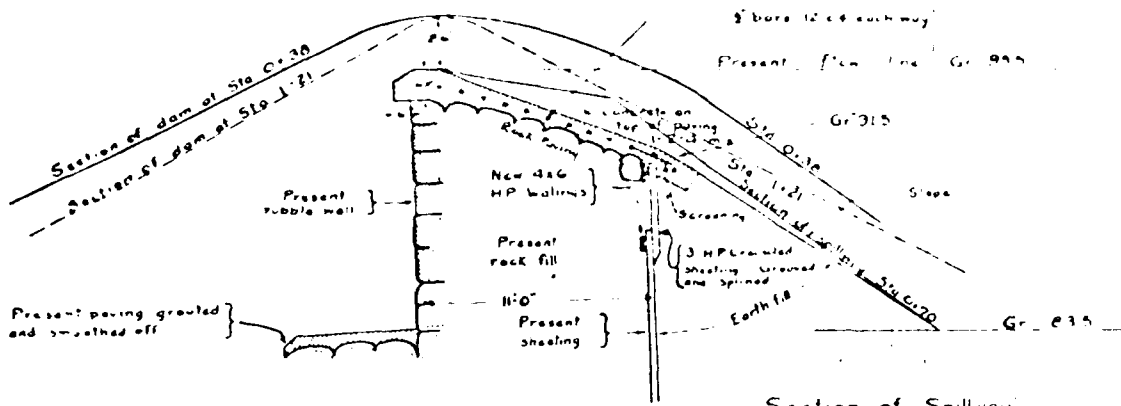


DETAIL OF SPILLWAY
Scale 1\"/>

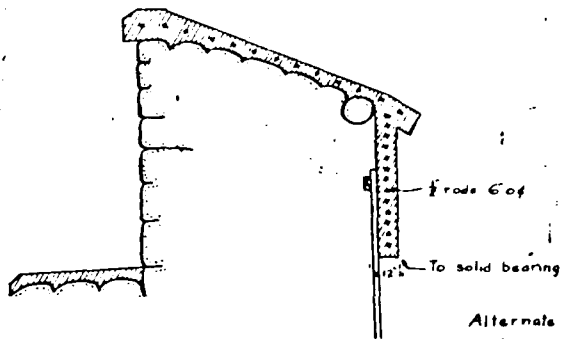
SECTION C-C

NOTE:
PLAN REDUCED FOR
THIS REPORT.

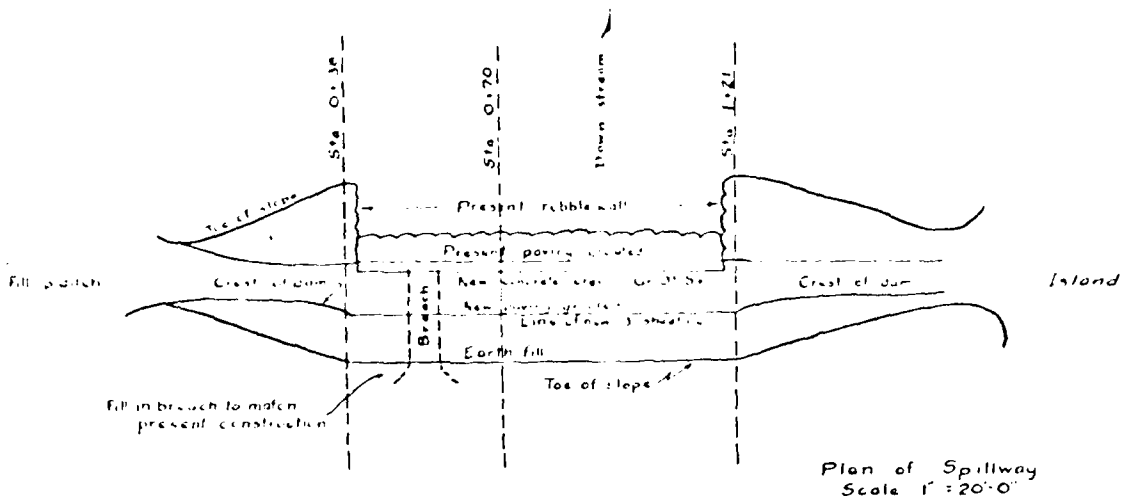
WORCESTER COUNTY COMMISSIONERS
 WORCESTER COUNTY ENGINEERING DEPARTMENT
 PLAN OF
 PRINCE RIVER RESERVOIR
 BARRE, MASS
 PROPOSED REPAIRS TO EARTH DAM, & SPILLWAY OF DAM
 COUNTY COMMISSIONERS
 SCALES AS NOTED
 TRACED BY: *[Signature]*
 TRACING CHECKED BY: *[Signature]* DAM NO'S D4 14



Section of Spillway
Scale 1" = 40'



Alternative section of Spillway
showing use of concrete
core wall instead of sheet piling
Scale 1" = 40'



Plan of Spillway
Scale 1" = 20'-0"

WORCESTER COUNTY COMMISSIONERS
 WORCESTER COUNTY ENGINEERING DEPARTMENT
 PLAN OF
 SPILLWAY
 AT BARRE RESERVOIR
 BARRE, MASS.

SCALES AS NOTED

TRACED BY M.A. GUNDEL 3-6-39 DAM NO. 04-14
 TRACING CHECKED BY 3-11-39

COUNTY ENGINEER

NOTE:
 PLAN REDUCED FOR
 THIS REPORT.

Location **Barre**

DECREE NO.

PLAN NO.

DAM NO. **6**

STATION **Along Chas. G. Allen Co. - Off Williamsville Road**

C. C. DOCKET NO.

DESCRIPTION OF DAM

EL 100'

DESCRIPTION OF RESERVOIR & WATERSHED

Type **Earthen dam - Vert. rubble wall**
 Length **300'**
 Height **16'**
 Thickness top **12'**
 " bottom **30'-40'**
 Downstream Slope **Part 1 1/2 - Part vertical wall.**
 Upstream " **1:1 Riprap**
 Length of Spillway **85' El. crest 100'**
 Size of Gates **Waste 10" iron pipe - EL 84.1**
 Location of Gates
 Flashboards used **None**
 Width Flashboards or Gates
 Dam designed by
 " constructed by
 Year constructed

Name of Main Stream **Reservoir head**
 " " any other Streams **Prince River**
 Length of Watershed
 Width " **THIS CARD SUPERSEDED**
 Is Watershed Cultivated **USE FOIL REFERENCE ONLY**
 Percent in Forests
 Steepness of Slope
 Kind of Soil **Rocky (3.51 Sq. M)**
 No. of Acres in Watershed **29 Sq. Miles**
 " " " Reservoir **1, 0.56 A**
 " " " " **170 "**
 Length of Reservoir
 Width " "
 Max Flow Cu. Ft. per Sec.
 Head of Flashboards - Low Water
 " " " " - High "

GENERAL REMARKS

Barre Reservoir Co. - owners.
Foundation: Rocky soil
Recent repairs: None
Leakage: Spill section
Condition: Good
Topography: Wooded valley
Inspected: Oct. 28, 1924 - L.O. Marden
" June 16, 1927 " "

GENERAL REMARKS

Traced: Oct. 1937
1937 - Owned by the Prince River Corp.
Inspected: Aug. 31, 1928 - L.O. Marden
 " **May 13 1929**
 " **19 " "**
 " **15 " "**
 " **16 " "**
 " **18 " "**
 " **24 " (over)**

Inspected: Oct. 24, 1929 - L.O.M. & C. Wood of Thayer, Eastill & Smith
Nov. 4, 1929 - L.O.M. & B. P. S.J. - Breach made in spillway
May 9, 1932 - " and Prof. Allen
" " " - Messrs. Whitall, Allen and Lord
July 13, " - Approved plan for reconst. of spillway.
" 29, " - Finlayson - Levels. Spillway - Book 22. P. 77
Aug. 6, " "
" 13, " "
" 19, " - L.O. Marden & F.E. Windsor
April 20, 1933 - " "
Oct. 24, 1935 - " "
Aug. 3, 1936 - " "
Owner: Charles N. Dewey
Prince River Corporation
Nov. 10, 1937 - L.O. Marden
" Sept. 26, 1938 - L.W. Spofford
" 23, 1941 - L.O.M. - L.H. 37 & Allen & Wm. Gorman
Oct. 1, 1941 - " "
Jan. 12, 1942 - L.O.M.
Nov. 10, 1941 - L.H. 37 Ponds concrete
" 11 - " "
" 12 - " - 8-12

Survey - X-sections Oct 3 Oct 1 1941. L.H. 37 POND CONCRETE. BR TO Pgs 42-43

04-14

TOWN OR CITY **BARRE**

DECREE NO.

PLAN NO.

DAM NO. **04-14**

LOCATION **Barre Reservoir - above Chas G Allen Co**

C. C. DOCKET NO.

DESCRIPTION OF DAM	DESCRIPTION OF RESERVOIR & WATERSHED
<p>Type Earth Embankment - 3' Plank & Clay Core</p> <p>Length ± 350' Elev Top 102.5</p> <p>Height ± 16' except at breach where height = ± 21'</p> <p>Thickness top 11'</p> <p>" bottom ± 7.5' at breach</p> <p>Downstream Slope 2:1</p> <p>Upstream " 2:1</p> <p>Length of Spillway 60' Crest Elev = 100.0</p> <p>Size of Gates 9' Gate valve in 12" Discharge Pipe</p> <p>Location of Gates Top of Down stream Slope</p> <p>Flashboards used None - 6" Fish Screen on Spillway Crest</p> <p>Width Flashboards or Gates</p> <p>Dam designed by 1941 Repairs - Mr J. Gorman</p> <p>" constructed by " " Mr J. Gorman</p> <p>Year constructed 1941</p>	<p>Name of Main Stream PRINCE RIVER</p> <p>" any other Streams</p> <p>Length of Watershed</p> <p>Width " "</p> <p>Is Watershed Cultivated</p> <p>Percent in Forests</p> <p>Steepness of Slope</p> <p>Kind of Soil</p> <p>No. of Acres in Watershed 2.9 Sq Miles (3.51 Sq M)</p> <p>" " " Reservoir</p> <p>Length of Reservoir</p> <p>Width " "</p> <p>Max Flow Cu. Ft per Sec.</p> <p>Head or Flashboards Low Water</p> <p>" " " High "</p>
<p>GENERAL REMARKS</p> <p>Owner: Prince River Corp (Stanley Miller - Geo Deary - Geo Allen et al)</p> <p>1941 Construction consisted of rebuilding embankment which was breached in 1938 Flood - Breach was approx 70' wide. ± 2' of loose material was excavated from bottom of breach. Bad condition of line running sand encountered - 3" T&G Shoring driven by pneumatic hammer to absolute refusal - Greatest length of shoring 24'</p> <p>Entire top of embankment raised to Cr 102.5. Both upstream and downstream slopes of entire embankment improved to 2:1 slope.</p> <p>Discharge pipe lengthened 12' on upstream and splash apron below crest</p>	<p>GENERAL REMARKS</p> <p>and extended 26' and increased where undercut. Concrete abutment 16' long installed at west abutment to stop old leak at this point</p> <p>Chas H Dewey 18 Hope St - Barre</p>

Inspected: Mar 26, 1950 - LWS

Aug 3, 1959 - LWS WOL

" 4 " - LWS - FCP & Gordon Esley

Survey Stake - Nov. 4 1959 - WOL, GJC RJP - B&S P 9 68

Inspected - 22 1960 - LWS

1961 - " - WOL

County of Worcester

Copy

OFFICE OF COUNTY ENGINEER

Court House, Worcester, Mass.

L. O. Marden
County Engineer

Town Barre

1925.

Dam no. 04-14

Charles G. Allen,
Barre, Mass.

Location ~~above Chas. G.~~
Allen Co.

The County Commissioners of Worcester County, acting under Chapter 253, General Laws, as amended by Chapter 178 of the Acts of 1924, said section being headed "Safety of Dams and Reservoirs". Have ordered an inspection of your dam. The above Acts states in part regarding the inspection of dams,--

"The county commissioners shall as often as once in two years cause a thorough examination to be made of every reservoir, reservoir dam and mill dam by the breaking of which loss of life or damage to a road or bridge is likely to be caused,--

The commissioners shall cause every examination to be made by a competent engineer who shall report in detail and the work or the changes required for safety and the public good." The County Commissioners hereby order that the following repairs

be made to your dam:- (Note:- Repairs to be made are marked with a cross.)

- 1: Repair down stream wall.....
- 2. " up " ".....
- 3. " walls to spillway section **x**.....
- 4. " " canal or flume.....
- 5. " concrete walls.....
- 6. " apron to spillway.....
- 7. " Leaks at **S** spillway section.....
- 8. Renew planks and timbers.....
- 9. Clean out waster gate pipe or flume.....
- 10. " " canal to mill.....
- 11. Provide new waste pipe or flume.....
- 12. " " pipe to mill thru embankment.....
- 13. Remove flashboards.....
- 14. Lower ".....
- 15. Construct spillway section..... spillway to be..... feet long and..... feet deep..... at.....
- 16. Cut off brush and trees from embankment **x**.....
- 17. Fill up holes and regrade embankment..... **x**.....

Kindly notify us either in person or by letter after you have made these repairs.

Yours very truly,

Lom

County Engineer.

Decree No.

Dam No. 4-14

COUNTY OF WORCESTER, MASSACHUSETTS
OFFICE OF COUNTY ENGINEER

Neg. Nos.

INSPECTION OF DAMS, RESERVOIR DAMS AND RESERVOIRS

Town **Barre** Date **Oct, 28, 1924** Jan 1, 1928 - order water lowered
June 11, 1927 same condition Dam No. **Reservoir head
Prince River**
 Location **above Chas G allen** Name of Pond or Stream
 Inspected by **L.O.Marden**
 Owner **Chas. G. Allen Co.** Use **Storage**
 MATERIAL & TYPE **Earthen vert rubble wall downstream**
 Elevations in feet: above (+) or below (-) full pond or reservoir level.
 FOR DAM Bed of stream below **88 spill sect.** top of spillway **100-**
 FOR RESERVOIR **84. stream**
 top of dam **100-** top of flashboards **none** ground surface below **89-**
 level of overflow pipe **840** length in feet **300- 450**
 width top in feet **12-** width bottom in feet **30-40** size pipe to mill
 inches length spillway in feet **85-** head in feet
 Size of wheel **H. P. developed**
 Size of gates **waste 18" iron pipe** location of gates
 Foundation and details of construction **rocky soil**
 condition of embankment **cut off brush**
 Constructed by date
 Designed by location
 Recent repairs and date **none**
 Evidence of leakage **spillway section**
 Condition **good except leaks and brush**
 Topography of country below **weeded valley**
 Nature of buildings and roads below dam **none**

No. Acres in watershed

No. Acres in pond

Plans secured

Percent watershed in cultivation

Percent in forests

Note: Cross out word not applicable

Several leaks in spillway section.

1:1 slope rip rap up stream

**Earth embankment without downstream rubble wall
west of spillway.**

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by G. H. Fernald - U. B. Goss - R. A. A. RR. L. O. Marden Date May 13, 1928 Dam No. 24-74

Town Barre Location Barre Reservoir.

Owner Chas. G. Allen Co. prin. owner Use storage.

Material and Type Altho outlet pipe open, water withing 1' top spillway not excessive rains in April. Spillway in such poor condition, water should be drawn off as soon as possible.

Dam Designed by Mr. Allen to have men on premises to breach embankment. 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 poor-leaks

EMBANKMENT

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

Width of Bottom _____ Upstream Slope _____ Downstream Slope _____

Kind of Corewall _____ Riprap _____

Material in Embankment _____ Foundation _____

Condition Brush has been cut.

GATES

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. Hurdon Date May 14, 1929 Dam No. 88-14

Town Barre Location Barre Reservoir.
Owner Use
Material and Type Breached east emb, about 20' from end about 2/ feet
wide, bottom at breach about 18" lower than top of embankment.
Work done by Mr. Harrington, employed by Mr. Chas. G. Allen.
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 May 15, 1929 Dam No. 04-14

Town Barre Location Barre Reservoir.

Owner Use

Material and Type Work continues breaching embankment - opening new outlet
over 4' wide. water about same elevations Tuesday. Make two inspection
trips.

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. Hadden Date May 16, 1929 Dam No. 04-14

Town Barre Location Barre Reservoir.

Owner..... Use.....

Material and Type Visit dam with Mr. S. H. Pitcher, Consulting Engineer of Worcester, and Mr. John D. Baldwin of 19 Cedar St, of Worcester, who may buy dam. Mr. Pitcher to get authority Monday to get sections of dam and breach it for purpose of finding out cost of reconstruction for
Dam Designed by Mr. Baldwin. 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 May 18, 1929 Dam No. 64-14

Town Barre Location Barre 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.....

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 discharging thru breach in embankment - no wash-
pond lowered about 10" since hole made.

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. Mardon Date May 26, 1929 Dam No. 64-14

Town Barre Location Barre 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.....

EMBANKMENT

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

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

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

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

Condition Lowered breach about 6 inches. - water in pond lowered about 3-4 feet below crest of spillway.

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 LOMarden & B.P.St.John Date Nov.4,1929 Dam No. 04-14.....

Town Barre Location Barre Reservoir.....

Owner John D.Baldwin-Worcester Use abandoned.....

Material and Type..... water in stream only.....

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 Breach made 4-6' wide at bottom- about 7 feet from east abutment
..... practically completed at 3.P.M. To support opening with struts Nov5th.

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.
Messr's. Finlayson, Hunt and

Inspected by L. O. Marden Date July 29, 1932 Dam No. 04-14

Town Barre Location.....

Owner Barre Reservoir 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..... Inspected foundations excavated.

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 Aug. 13, 1932 Dam No. 04-14

Town Barre Location

Owner Barre Res. 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

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 Concrete core wall completed, cobbles placed on dam.

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

4

COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden Date 4-20-1933 Dam No. 04-14

Town Barre Location Barre Reservoir.

Owner James P. Whittall- et al 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. - as reconstructed 1932 - water over wasteway - appears to be leak under west abutment.

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. - west embankment not checked.

GATES Location

Size Kind El. Flowline

Condition gate in embankment repaired 1932

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure none visible.

Recent Repairs and Date spillway and embankment adjacent completed 1932

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 Oct. 24, 1935 Dam No. 04-14

Town Barre Location Barre Reservoir

Owner James P. Whittall et al Use pleasure

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 no water flowing over wasteway- bad leak thru westerly stone abutment, and under corner of concrete apron. at time dam was built recommended to Mr. Whittall that concrete core wall be constructed from w. abutment to island- this was not done recommend this be done now.

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 should cut all brush and small trees and grub out roots - leaks in several places due to seepage thru embankment to west of island.

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

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

Condition appears O.K. at time dam built recommended that gate be built on upstream side of pipe- owner used old pipe- I am again recommending that gate be built on upstream side of this pipe, to stop any possible leaks along pipe.

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

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

Evidence of Leaks in Structure..... thru embankment and under westerly abutment as indicated, above.

Recent Repairs and Date..... NONE.

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.....

Not Copied

COUNTY OF WORCESTER MASSACHUSETTS
COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.H. Spafford Date 9/26/38 Dam No. 04-14

Town Barre Location Barre Reservoir
Owner Whitall Associates Use Camp Site and stock fishing
Material and Type Earth Embankment
Plan

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.....

EMBANKMENT—Length overall ± 300 Feet

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

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

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

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

Condition.....

One Breach in Earth embankment about 150 feet from spillway. Spillway not visible from this position on account of brush and windfalls. Breach is about 60 ft long and 15 to 18 feet deep. View of spillway obtained at distance of 300 ft from island in pond - spillway appears to have suffered

WHEEL no damage. Width of earth embankment at base Location = ± 22 ft. Core protection was a double line of

Evidence of Leaks in Structure. 1" sheeting boards tight together. Bottom of sheeting was at least 3 ft above bottom of pond. Recent Repairs and Date. One sheeting board pulled out by hand.

Topography of Country below Dam. Top of sheeting about 8 ft below top of embankment. Little evidence of water flowing

Nature of Buildings and Roads below Dam. over top of embankment - apparently a leak started and cut its way down. The fish screen

Number of Acres in Pond..... on top of the spillway of a dam 5' or 12" high Discharge in Second Feet per Square Mile is still in place.

Estimated Storage Million Cubic Feet.....

WORCESTER COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs

Inspected by LON. L.H. Gorman ^{Aiken} Date 9-23-91 Dam No. 09-19

Town Barre Location Barre Res

Owner Prince River Corp 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 Dis cost method of rebuilding till to use 3" splined sheeting from place E. Templeton

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 _____

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 _____

WORCESTER COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs

Inspected by L.O.M. - L.H.S. Date 11-20-91 Dam No. 09-14

Town Barre Location Barre Res

Owner Prince River Corp. 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 Concrete corewall extended ^{8'} westerly wing of abut

fdn to hard pan - Mr. Gorman reminded that stream

channel must be opened up + water drained from pond.

EMBANKMENT

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

Width of Borrom _____ Upstream Slope _____ Downstream Slope _____

Kind of Corewall _____ Piprap _____

Material in Embankment _____ Foundation _____

Condition _____

GATES

Location _____

Size _____ Kind _____ El. Flowline _____

Condition _____

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 _____

WORCESTER COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs

Inspected by LAM. CHS Date 12-4-41 Dam No. DA-18

Town Barre Location Barre Res
Owner Pine River Corp 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 _____

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____
Width of Bottom _____ Upstream Slope _____ Downstream Slope _____
Kind of Core Wall _____ Riprap _____
Material in Embankment _____ Foundation _____
Condition Quick sand under ^{where} sheeting to be driven -
decide to excavate as far as possible and to
drill into quick sand at least 3'

GATES

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

Evidence of Leaks in Structure _____

Recent Repairs and Late _____

Number Acres in Pond _____ Drainage Area in Sq. 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 Lom Date 12-21-41 Dam No. 04-14
.....

Town Barre Location _____
Owner _____ 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 _____

EMBANKMENT

El. Top _____ El. Natural Ground _____ Width Top _____
Width of Bottom _____ Upstream Slope _____ Downstream Slope _____
Kind of Core wall _____ Riprap _____
Material in Embankment _____ Foundation _____
Condition Plowing Shading

GATES

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

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 _____

TOWN BARRE

DAM NO. 09-19

LOCATION Barre Reservoir

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 Practic Rivers Corp - Chas Denny
Geo. Denny - Bradley Grant Place _____ Use Practic
Robert Perkins

Inspected by L. O. Marden - W. A. C. Date June 26, 1958

Type of Dam Stone - Concrete Spillway Condition Poor
Earth Emb - Needs more free bd.

SPILLWAY

Flashboards in Place None Recent Repairs None

Condition Large in ground Earth Emb - Leaks under about 20' - Spillway
Could hear water flowing under

Repairs Needed _____

EMBRANKMENT

Recent Repairs None - Grass up with trees

Condition Poor - Leaks at Note Ground - Extent - Leaks resisted

Repairs Needed Cut off leaks - strip down near
slope and place new slope at flatter angle - use clay
and cover with gravel

PILES

Recent Repairs None - Apparently works

Condition Abt 1/2 open

Repairs Needed Check when closed to see if leaks
along pipe - construct gate 4' dia - cut end of
spillway

LEAKS

How Serious Several places - Bad.

DATE: June 26, 1958

L. O. Marden
County Engineer

TOWN Barre

DAM NO. 04-14

LOCATION Barre Res

STREAM Prince R.

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 Prince River Corp Place Worcester Use Pleasant

Inspected by L.O. M. Julian White with Date June 30, 1958

Type of Dam H. M. Turner Cons. Eng. Borta Condition Poor

SPILLWAY

Flashboards in Place None Recent Repairs None

Condition large hole in inside angle of East Spillway goes down into bed of stream. Leaks over 1/3 width spillway

Repairs Needed West end

EMBANKMENT

Recent Repairs None

Condition Should cut out trees and grub out roots.

Repairs Needed Same leak near intersection natural ground and East end embankment. - Leaks different spots along embankment. Large stream valley east end new emb.

GATES

Recent Repairs None

Condition Gate open. Leaks along east side pipe

Repairs Needed Gate open slightly.

LEAKS

How Serious Serious leaks under spillway and as per above

Safe Leakage - west dike say 1/3 cfs
Spill way = 1/3 cfs
= 400,000 gal. per day

DATE: June 30, 1958.

$\frac{400,000}{1440} = 280 \text{ gal. per min.}$

L.O. Marden

County Engineer

Safe Leakage $450 \times 20 = 13500 \text{ gal. per sq. ft.}$

TOWN Barre

DAM NO. 04-14

LOCATION Barre Res

STREAM Prince R.

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 Prince River Corp Place Worcester Use Pleasant

Inspected by L.O. M. Julian White with Date June 30, 1958.
H. M. Turner Cons. Eng. Boston

Type of Dam _____ Condition Poor

SPILLWAY

Flashboards in Place None Recent Repairs None

Condition large hole in inside angle of East Spillway goes down into bed of stream. Leaks over 1/3 width spillway

Repairs Needed West end

EMBANKMENT

Recent Repairs None

Condition Should cut out trees and grub out roots.

Repairs Needed same leak near intersection natural ground and East end embankment. - leaks different spots along embankment. large stream walk east end new emb.

GATES

Recent Repairs None

Condition Gate open. leaks along east side pipe

Repairs Needed Gate open slightly.

LEAKS

How Serious Serious leaks under spillway end as per above
safe leakage - west dike say 1/3 cfs DATE: June 30, 1958.
spillway = 1/3 "
= 400,000 gal. per day

400,000 = 200 gal. per min.
1880

L. O. Marden
County Engineer

Safe leakage 450 x 21 = 13,500 @ 5 gal per sq. ft

TOWN Barre DAM NO. 04-11

LOCATION Barre Res Dam STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

Perkins furnished plan.

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

Owned by Barre Res Corp Place Worcester Use _____

Inspected by L.O.M. - Perkins and Date July 11, 1958

Type of Dam Bradley Gilman Condition _____

SPILLWAY

Flashboards in Place _____ Recent Repairs _____

Condition Discussed cut off leak upstream side after

Repairs Needed gate constructed hole on inside concrete at East

Abt at base - Place Clay Blanket where leak

and core with gravel on upstream side

EMBANKMENT

Recent Repairs None - Covered with small trees

Condition Discuss flatter slopes per instructions G. Eng

Repairs Needed worst leak at west end of island - cut off

leak - cut off brush and grub out roots - refill

with good clay filling

GATES

Recent Repairs Discuss new gate to be constructed East

Condition end spillway leaks along East side pipe

Repairs Needed New 4' x 6" gate

LEAKS

How Serious Have been there many years but should

investigate - along east side 12" outlet pipe

DATE: July 11, 1958 J.O. Madsen County Engineer

TOWN Barre DAM NO. 04-14
LOCATION Barre Res. Dam 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 Barre Reservoir Co. - Robert Place _____ Use _____
B. F. Marsh Co. Worcester

Inspected by L.O.M. - W. S. L. Date Aug. 3, 1959

Type of Dam Earth - old stone Condition Leaks under at
Spill way with low concrete top Foot downstream wall.

SPILLWAY

Flashboards in Place N/A Recent Repairs _____

Condition Hole still in East Concrete Abt. - Reconstructed

Repairs Needed Reconstruct in accordance with a plan to
be submitted. - Plan in Eng. Office

EMBANKMENT

Recent Repairs _____

Condition Brush growing on Embankment East of Spillway

Repairs Needed Cut off brush and grub out roots. Place new
fill where needed.

GATES

Recent Repairs None - gate spaced and pond drawn down - Last Fall

Condition In West Emb, 8" Pipe with downstream gate -

Repairs Needed At East end of Concrete Abt Wall, Excavate for
36" dia. cor. pipe, Place Arched Gate & Hoist on Pond Side Dam

LEAKS

How Serious under spillway and at intersection East
end emb on west side of Island

DATE: Aug. 3, 1959 J. O. Marsh - County Engineer

TOWN Barre DAM NO. 04-14
LOCATION Barre Res. Dam 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

See Aug. 3, 1959 Report

Owned by Peace River Corp Place Worcester Use _____
Inspected by LOM. FCP. - LA Bolton Date Aug. 4, 1959
R. Hunt Mach Co. + R.C. Perkins work
Type of Dam Earth Emb. Stone + Conc. Spillway Condition Fair

SPILLWAY

Flashboards in Place None Recent Repairs None
Condition Poor - leaks underneath entire length -
Repairs Needed Raise abt. 2'-0" - draw pond and check
leak and grout

EMBANKMENT

Recent Repairs None -
Condition Leak w. side 1/4 way
Repairs Needed Flatten downstream slope

GATES

Recent Repairs None
Condition Downstream gate - at 8" pipe 2 1/2' let.
Repairs Needed Need new 36" pipe and gate N.E. end emb
East side spillway

LEAKS

How Serious under entire length spillway

DATE: Aug 4, 1959 J. O. Marden County Engineer

TOWN Barre DAM NO. 44-14

LOCATION Wills Massachusetts STREAM Prince River

Williamsville Rd

"Barre Reservoir"

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

Prince River Association

Owned by Robert C. Perkins Place Worcester Use Storage Pond

Inspected by W.C. - Runne's - R. Perkins Date Dec 23 1959

Type of Dam Earth stone and concrete Condition Fair

S P I L L W A Y

Flashboards in Place _____ Recent Repairs _____

Condition _____

Repairs Needed _____

E M B A N K M E N T

Recent Repairs Excavation of the site for a proposed new 30" x 20"

Condition stone gate and outlet pipe

Repairs Needed A sign of this proposed 24" x 20" gate will be submitted

by W.C. Runne's.

G A T E S

Recent Repairs _____

Condition _____

Repairs Needed _____

L E A K S

How Serious _____

DATE: _____ County Engineer

TOWN Barre DAM NO. 44-14
LOCATION 2500' up Williamsville Rd. STREAM Prince River

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Prince River Ass'n.
Owned by Robert C. Perkins Place Worcester Use old storage pond
Inspected by W.O.L. - R.J.C. Date Nov. 22, 1960
Type of Dam Earth, stone & concrete Condition Fair

SPILLWAY

Flashboards in Place No boards Recent Repairs _____
Condition Good
Repairs Needed _____

EMBANKMENT

Recent Repairs _____
Condition The embankment is covered with small trees and brush.
Repairs Needed _____

GATES

Recent Repairs The gate at the westerly embankment is fair.
Condition The proposed new 30" steel gate has not been built.
Repairs Needed to date.

LEAKS

How Serious 2 small leaks are visible below this dam.

DATE: _____ County Engineer

TOWN Barre DAM NO. 04-14
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 Robert Perkins Care B. F. Marsh Co., 25 Crescent St. Worcester
Prince River Corp. Place Worcester Use _____

Inspected by LOM Date Nov. 22, 1960
Jan. 10, 1961

Type of Dam _____ Condition _____
Talked to PERKINS Feb. 21, 1961 - filled hole cut in

SPILLWAY embankment at East end.

Flashboards in Place None Recent Repairs None

Condition Spillway should be extended at East end embankment

Repairs Needed Leaks at 3 places under spillway

EMBANKMENT

Recent Repairs Filled hole dug 1960 at east end

Condition _____

Repairs Needed _____

GATES

Recent Repairs _____

Condition _____

Repairs Needed Gate opened - closed Thanksgiving time.

LEAKS

How Serious _____

DATE: _____ County Engineer _____

TOWN Barre DAM NO. 09-14
LOCATION Barre Reservoir 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 Lewis Perkins - Barre Place Worcester Use _____
Inspected by Sp. B.F. Marsh Co., Worcester Date Nov 24, 1960
L.A.M. - Perkins called Mr. Perkins
Type of Dam _____ Condition _____

SPILLWAY

Flashboards in Place _____ Recent Repairs _____
Condition _____
Repairs Needed cut hole through east end embankment

EMBANKMENT

Recent Repairs _____
Condition Hole through East end embankment
Repairs Needed _____

GATES

Recent Repairs _____
Condition _____
Repairs Needed _____

LEAKS

How Serious _____

DATE: _____ County Engineer

TOWN Barre DAM NO. 04-14

LOCATION 1/2 mile westerly - Williamsville Rd STREAM Prince River

"Barre Reservoir"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

- Only Prince River Assn ✓

Owned by 1/2 Robert C. Perkins Place Worcester Use old storage pond

Inspected by W.O.G. Date Aug. 10, 1967

Type of Dam Earth, stone and concrete Condition Fair

SPILLWAY

Flashboards in Place No boards Recent Repairs _____

Condition The concrete is beginning to spall. This spillway was built by

Repairs Needed Panaccione Bros. in 1932. This spillway has a concrete crest.

apex. The splash apron is cemented stone 9' 15" wide.

EMBANKMENT

Recent Repairs The embankment near the spillway is 10' wide on the top

Condition There is riprap on the upstream slope. There is a tail embank

Repairs Needed at the westerly abutment wall. The gravel ditch westerly of

the main dam has 1:1 to 1 1/2 slopes and is covered with brush. Riprap should be

GATES

Recent Repairs provided on the upstream slope.

Condition The draw down gate is located near the center of the

Repairs Needed ditch. The shut off is located at the bottom of the

downstream slope. This gate leaks.

LEAKS

How Serious There is an small leak below the spillway apron.

DATE: _____ County Engineer

Barre - "Barre Reservoir" or "Old Reservoir"

Dams 24-14

Apr. 29, 1968 - WDL - Chas G. Allan, Jr. says that this old dam is leaking quite badly and that his men are checking on it every week.

TOWN Barre DAM NO. 04-14
LOCATION 1/2 mile westerly Williamsville Rd. STREAM Prince River
"Barre Reservoir."

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by Prince River Association, 340 Main St. Worcester Use Recreation and storage pond.
C/O M. Perkins - B.F. Marsh Co. Place Worcester
Inspected by W.D.L.-J.G.T. - John Kocakland; Charles Allen Date Aug 14, 1968
Type of Dam Earth-stone-concrete Condition Fair

SPILLWAY

Flashboards in Place No boards Recent Repairs _____
Condition Good condition
Repairs Needed seepage is visible below the spillway breast wall

EMBANKMENT

Recent Repairs The embankment is covered with brush and trees
Condition There is a fairly large leak visible below the downstream slope
Repairs Needed east side of the gate outlet near the beginning of the dike.

GATES

Recent Repairs _____
Condition _____
Repairs Needed _____

LEAKS

How Serious see above

DATE: _____ County Engineer

TOWN Barre DAM NO. 04-14

LOCATION Old Reservoir 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 _____ Place _____ Use _____

Inspected by M.F. Hunt Date Dec 5, 1968

Type of Dam _____ Condition _____

SPILLWAY

Flashboards in Place None Recent Repairs _____

Condition Good - Walls spalling some

Repairs Needed _____

EMBANKMENT

Recent Repairs _____

Condition OK

Repairs Needed _____

GATES None

Recent Repairs _____

Condition _____

Repairs Needed _____

LEAKS

How Serious _____

DATE: _____ County Engineer _____

TOWN Barre DAM NO. 04-14

LOCATION off Williamsville Rd STREAM Prince River

WORCESTER COUNTY ENGINEERING DEPARTMENT Barre Reservoir
WORCESTER, MASSACHUSETTS

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

Owned by (Robert C.) Perkins & Co
BF Marsh Co, 340 Main St Place Worcester Use Storage Reservoir

Inspected by WEL Date Mar. 7, 1969

Type of Dam old earth, stone and concrete Condition Fair

SPILLWAY

Flashboards in Place _____ Recent Repairs _____

Condition _____

Repairs Needed _____

EMBANKMENT

Recent Repairs Talked to Mr. Perkins regards possible flood

Condition conditions at this Reservoir. He was told to open

Repairs Needed the gate and keep it open until late in May.

GATES

Recent Repairs _____

Condition _____

Repairs Needed _____

LEAKS

How Serious _____

DATE: _____ County Engineer

FORM 1 Barre

DAM NO. 24-14

LOCATION 1/2 mile west - Williamsville Rd

STREAM Prince River

"Barre Reservoir"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by Prince River Assn Place 540 Main St Use Storage Pond
40 Mr. Perkins, B.F. Marsh Co Worcester

Inspected by (Chas Allen Co. workmen) Date May 1969

Type of Dam Earth - stone and concrete Condition Fair

SPILLWAY

Flashboards in Place _____ Recent Repairs _____

Condition This pond is 2' to 3' below the crest

Repairs Needed _____

EMBANKMENT

Recent Repairs _____

Condition _____

Repairs Needed _____

GATES

Recent Repairs _____

Condition The gate is open

Repairs Needed _____

LEAKS

How Serious _____

DATE: _____ County Engineer

INSPECTION REPORT & DATA FOR DAMS

Owner: Prince River Association
 His Address: Barre
 Function of Dam: _____

Dam No. 21-14
 Town: Barre
 Stream: Prince River
 Pond: Barre Reservoir
 Date: 3-20-72
 By: Eaton & Conu

Location & Access: 5 mi West of Williamsville Road on
Access Rd 200' South of Fishery Rd.
 USGS Quad, Barre Lat. 42° 27' 40" Long. 72° 02' 15"
 Drain. Ar. 125 Sq. Mi. Ponds: _____ Res. Dam: _____
 Character of D.A.: _____

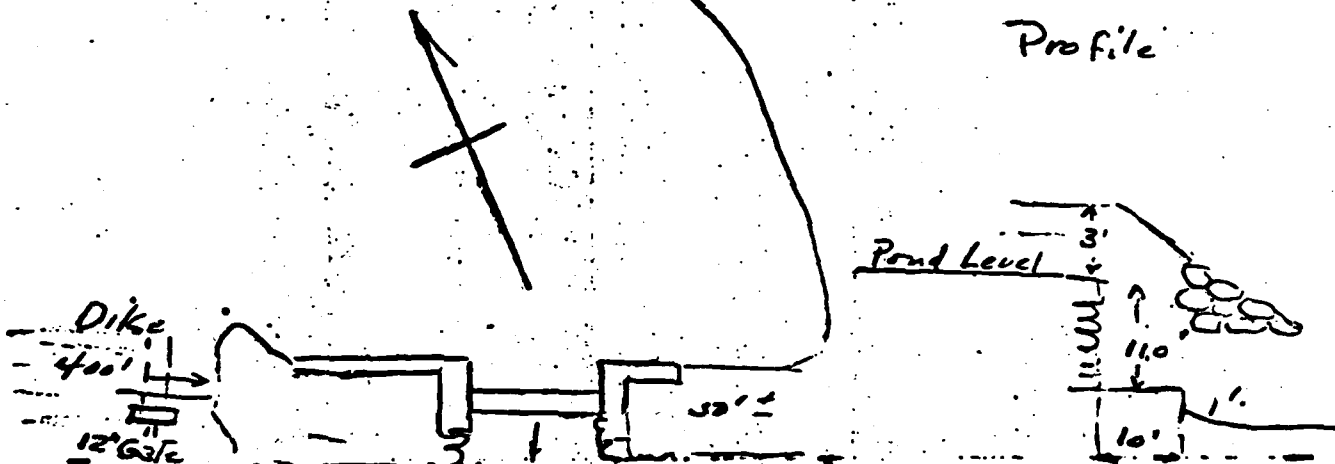
CONDITION RATING
 Structural: Good
 Hydraulic: 70% 2'
 General: Good
 PRIORITY: *

Estimated
 Discharge: _____
 Capacity: _____

General Description of Dam and Discharge Control:

Earth dam with stone & concrete spillway 70' wide
& 11' high. 3' to crest of dam above spillway, 400' ± Dike
to west of spillway has 12" metal pipe & screw gate

Sketch (Not to Scale):



Remarks and Recommendations:

* No turf on dike, several leaks noted, Trees & brush on dam should be cut

Date 3-20-72 By Eaton & Conu Comment _____

Dam No. 3-14-21-14

APPENDIX C

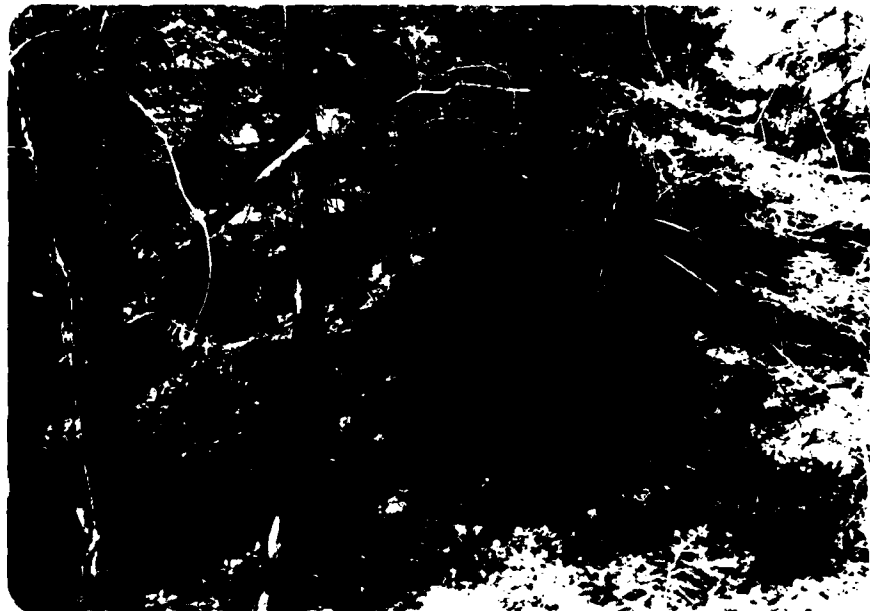
PHOTOGRAPHS

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

BARRE RESERVOIR DAM AND DIKE



**NO. 1 VIEW OF SPILLWAY WEIR, SIDEWALLS AND
DOWNSTREAM APRON**



**NO. 2 DOWNSTREAM SLOPE & CREST OF LEFT EMBANKMENT
OF DAM**



NO. 4 EXTENSION OF LEFT UPSTREAM
SIDE WALL OF SPILLWAY
(RETAINING WALL)



NO. 3 CHANNEL SIDE WALL AND
VERTICAL WALL OF SPILLWAY
AT RIGHT ABUTMENT

AD-A145 216

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
BARRE RESERVOIR DAM A... (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUN 80

3/2

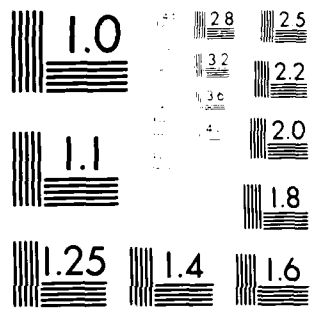
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MILWAUKEE RESOLUTION TEST CHART
 NATIONAL BUREAU OF STANDARDS-1963-A



NO. 5 SPALLED PORTION OF LEFT UPSTREAM SIDE
WALL OF SPILLWAY



NO. 6 SPALLED AND ERODED CONCRETE ALONG SPILLWAY
WEIR CREST



NO. 7 SPILLWAY DISCHARGE CHANNEL



NO. 8 SEEP LOCATION ALONG RIGHT TOE OF DAM EMBANKMENT



NO. 9 UPSTREAM SLOPE OF DIKE EMBANKMENT



NO. 10 CREST OF DIKE EMBANKMENT



NO. 11 LOW LEVEL OUTLET CONTROL AND HEADWALL
BELOW DIKE



NO. 12 SEEPAGE AREA AT LEFT TOE OF DIKE EMBANKMENT

APPENDIX D
HYDROLOGIC AND HYDRAULIC
COMPUTATIONS

	<u>Page</u>
Figure D-1, Drainage Area Map	D-1
Hydrologic and Hydraulic Computations	D-2

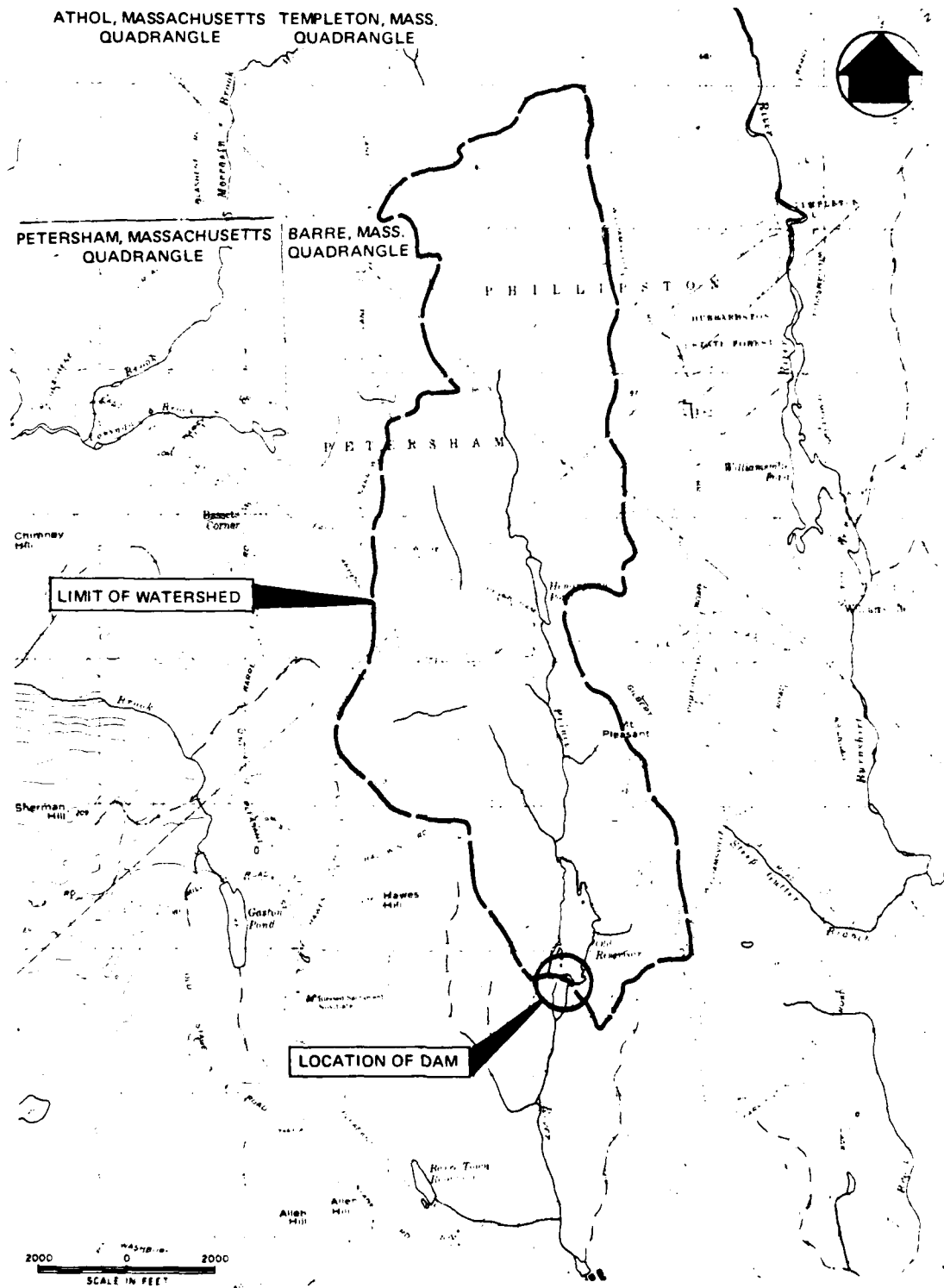


FIG. D-1 DRAINAGE AREA MAP

BARRE RESERVOIR DAM AND DIKE

I Test Flood, Storage & Storage Function

1- Total Drainage Area - 3.40 mi²

2- Pond(s) Area: = .03 mi²
Swamp(s) Area: $0.05 + .03 + .14 + .06 + .17 + .05 = .50$
Total Area Pond(s) & Swamp(s): = 0.53

% Ponds & Swamps: $= \frac{0.53}{3.40} = 15.6\%$

3- $\frac{62-048}{19000} = .0023$ } Say Ave Slope = 1.3%

4- Using C. of E. Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be 750 c.f.s. using "Flat & Coastal" and taken at 950 c.f.s./mi
 Size Class: Small; Hazard Pot.: High; Spill. Des. Flood: 1/2 P.M.F.
 Use: Test Flood = 1/2 P.M.F.

5- Test Flood Inflow = $\frac{1}{2} (750) 3.4 = 1275$ c.f.s.

6- Pond Storage
 The pond area is 0.06 sq. mi. at elev. 725.
 Based on a const. area, storage increases at 40 ac. feet per foot of depth increase.

7- Spillway crest elev. is 728

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 (in Inches) = $12 D \left(\frac{.06}{3.40} \right) = 0.22 D$; $R = 6$ hr rain of 5 in

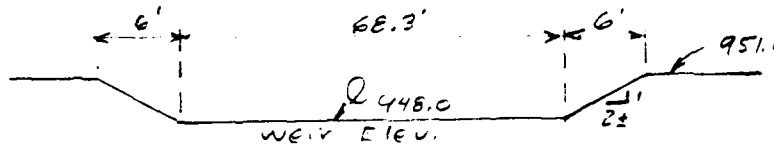
D = Storage depth in feet above spillway crest in reservoir

9- Storage Functions: (Test Flood & 1/2 P.M.F. if needed)

$F_{TF} = 1615$	$- 170$	$S = 1615 - 37.4 D$
$F_{1/2 P.M.F.} = F_{TF}$	$-$	$S = - / D$

② Discharge Ratings

1 - Spillway



Use Williams & Hazen Hydr. Tables for 68.3' of weir & for triangular ends (con. broad) use $Q = 4.83 h^{3/2}$ with $1.48 u = 4.75$, $1.48 u = 5.0$

Pond El.	949	950	951	952	951.1	951.2	951.3	951.4
Q_L	230	640	1170	1800	1230	1290	1350	1410
Q_R	10	50	130	270	130	150	170	180
ΣQ	240	690	1300	2070	1370	1450	1520	1590

2 - Crest Flow

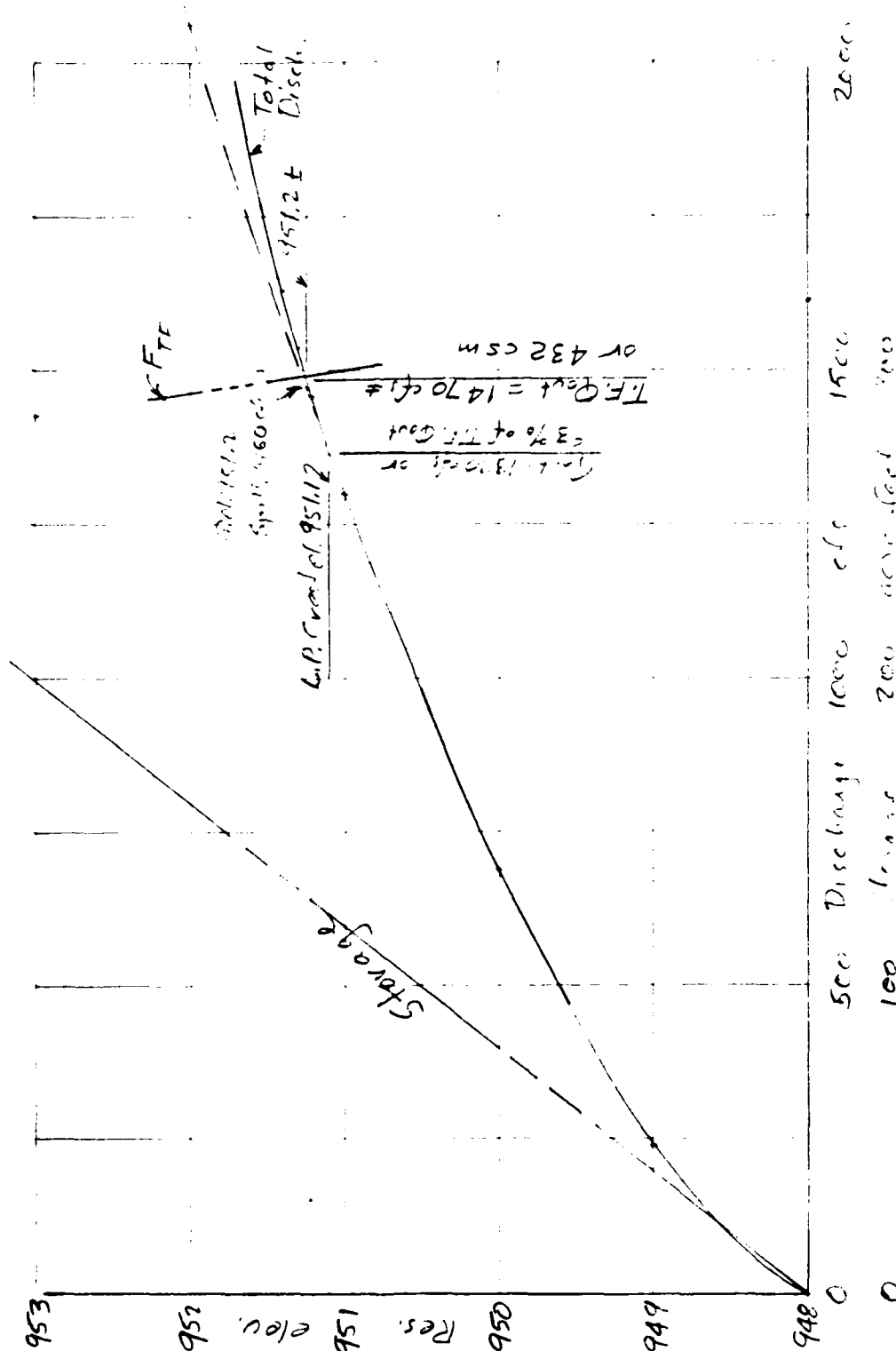
Use $q = 0.55 h^{1.5}$; 70' @ 951.1, 50' @ 951.2

Pond El.	951.2	951.3	951.4
Q_A	10	20	30
Q_B	—	0	10
ΣQ	10	20	40

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Project Wat Review of Non Federal Dams Acct No 6926 Page 3 of ---
 Subject Worcester County Mass Comptd By LEB Date 6/19/80
 Detail EARRE (OLD) RES Ckd By U.C. Date 6/22/80

III Discharge Storage & Storage Function vs Reservoir Elevation



Project Nat. Review of Non Federal Dams Acct No 6926 Page 4 of 7
 Subject Worcester County, Mass Comptd By LEB Date 6/19/80
 Detail FAKRE (OLD) RES Ckd By JCS Date 6/19/80

④ Test Flood Crest Flow

Test Flood Eleu. - 951.2
 Low Pt. or Crest - 951.1
 Max. Head 0.1 feet

Crest Flow - cfs/ft. = $g = 2.55(0.1)^{1.5} = 0.081$ cfs/ft.

Where flow is critical: $y_c = .06$ ft.; $V_c = 1.4$ fps

⑤ Low Level Outlet

Description: 12" ϕ straight pipe, $\pm 70'$ long, no bends, gate valve

$H = \frac{V^2}{2g} [0.5 + 1.0 + 0.2 + .019(\frac{70}{V})] = 3.03 \frac{V^2}{2g}$, ϕ outlet 42.7

$V = 4.61 \sqrt{H}$; $Q = 3.62 \sqrt{H}$

Water Eleu	948	947
Head	16.3'	15.3'
Q	14.6	14.2

Ave. Q over 12" range = 14.4 cfs.

Time to lower water 12" = $\frac{43560(40)}{3600(14.4)} = 33.6$ hours or 2017 min.

NONREPRODUCIBLE GRID FORM 145

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Ⓟ Failure of Dam

Peak Failure Flow:

Pond Elevation - 951.1

Toe Elevation - 936 ±

$Y_0 = 15.1'$

Dam Length Subject to Breaching = 55' (Spillway)

$W_0 = 40\% (80) = 32'$

$Q_P = 1.68 W_0 (Y_0)^{1.5} = 1.68 (32) (15.1)^{1.5} = 3150 \text{ cfs}$

Ongoing spillway flow absorbed in spillway structure

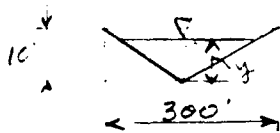
Storage Volume Released:

Storage Above Spillway $40(3.1) = 124 \text{ a.c.}$

Storage Below Spillway $40(17.6) = 704 \text{ a.c.}$

$S = \text{Total Storage} = 828 \text{ a.c.}$

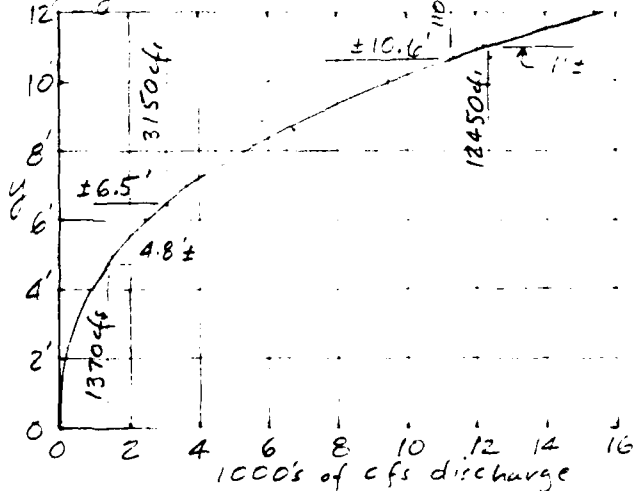
Channel Hydraulics:



Depth	A	V	Q
5'	375	4.0	1490
10'	1500	6.3	9470
15'	3375	8.3	27910
6'	540	4.5	2420
7'	736	5.0	3660
11'	1815	6.7	12210
12'	2160	7.1	15400

$S = \frac{40}{1900}, n = .10, R \approx \frac{1}{2}, V = 136 \text{ ft}^3$

$A = 154 \text{ ft}^2$



Time to Drain:

$\frac{43560 (359)}{3600 (\frac{1}{2}) (150)} = 2.76 \text{ Hours, or } 165 \text{ Minutes}$

NONREPRODUCIBLE GRID FORM 143

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Project Nat. Review of Non Fed. Dams Acct No 6926 Page 4 of 5
 Subject Worcester County, Mass. Comptd By LEE Date 1/15/54
 Detail BARRE (OLD) T.S. Ckd By J.C. Date 1/15/54



Failure of Dine

Peak Failure Flow:

Pond Elevation - 771.1
 Toe Elevation - 750.4
 $Y_0 = 20.7$

Dam Length Subject to Breaching = 75 Actual

$W_0 = 40\% (75) = 30$

$Q_{P1} = 1.68 W_0 (Y_0)^{1.5} = 1.68 (30) (20.7)^{1.5} = 11,000 \text{ cfs}$
 Capacity of sch. of 1370 cfs. Total Failure flow = 12,370

Storage Volume Released:

Storage Above Spillway 24
 Storage Below Spillway 22
 $S = \text{Total Storage} = 46$

Channel Hydraulics: - sec VI

Channel Attenuation - Dike Failure

$L_1 = \text{Reach Length to Factory} = 6700'$ For $S = 11000 \text{ cfs}$, $A_1 = 3870'$, $V_1 = 100 \text{ cfs}$
 Let $V_2 = \frac{1}{2} V_1 = 50$, $L_2 = \frac{17550 S}{V_2^2} = 4640'$, $Q_2 = 11000 (1 - \frac{50^2}{100^2}) = 8820 \text{ cfs}$
 $A_2' = 982$, $V_2 = 105 \text{ cfs}$, $V_3 = 142$, $Q_3 = 1000 (1 - \frac{142^2}{100^2}) = 6700 \text{ cfs}$, $A_3 = 1009$

$L_2 = 6700 - 4640 = 2060$, $V_3' = 2000 (11000) = 53.7 \text{ cfs}$, $Q_3' = 6700 (1 - \frac{53.7^2}{100^2}) = 5750 \text{ cfs}$
 $A_3' = 1009$, $V_4 = 47.7$, $V_3 = 50.7$, $Q_3 = 6700 (1 - \frac{50.7^2}{100^2}) = 5750 \text{ cfs}$

Dike failure results in peak flow of 5750 cfs at factory near School St. in Barre No. Factory pond elevation elev. ± 763.5 (see VII)

Channel Attenuation - Dam Failure:

$d_f = 6.5'$; $A_f = 633.75$; $V_f = 97.5$; $Q_{\text{Total}} = 3150 (1 - \frac{97.5^2}{100^2}) = 2295$

$d_2 = 5.9'$; $A_2 = 59'$; $V_2 = 80.3$; $V = 88.9$

$Q_2 = 3150 (1 - \frac{88.9^2}{100^2}) = 2370 \text{ cfs at factory. Pond rises to el. } 761.5 \pm$

Time to Drain:

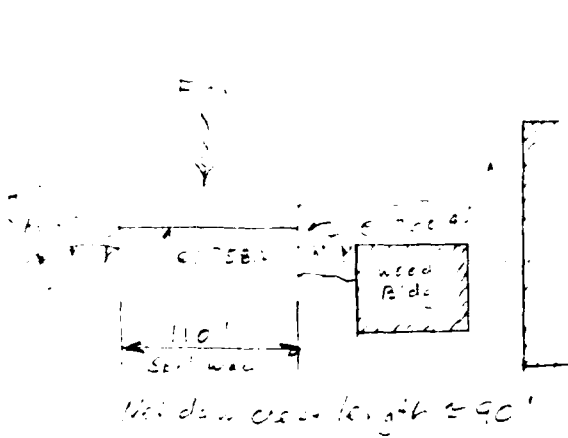
$\frac{43560 (359)}{3600 (\frac{1}{2}) (11000)} = 0.8 \text{ Hours, or } 47 \text{ minutes}$

NONREPRODUCIBLE GRID FORM 145

METCALF & EDDY, ENGINEERS

Project Ret Review of New Fed. Dams Acct No 6926 Page 7 of 7
 Subject Worcester County, Mass. Comptd By LEB Date 6/15/50
 Detail BARRE (OLD) RES Chkd By JW Date 2/20/50

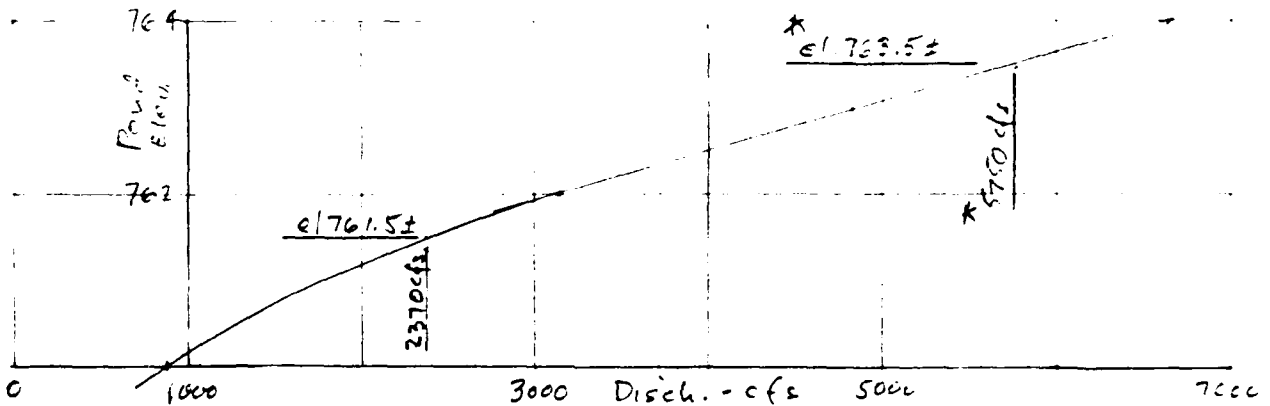
VIII Failure Flow at Factory (Chas. G. Allen, Co.)



weir flow - in flow direction
 "Hydro Turbine"
 for crest flow - 9 = 2.5 ft

Pond El	760	762	763	764
Weir	876	2683	3377	5024
Crest	-	222	934	1535
Total	876	3120	4311	6619

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* 1938 flood at factory resulted in pond elev. of 762.2
 This flood is presumably related to failure in
 Barre Res dike in same year.

APPENDIX E

INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF
DAMS

BARRE RESERVOIR DAM AND DIKE

INVENTORY OF DAMS IN THE UNITED STATES

CITY		COUNTY		STATE		DISTRICT		CONGR.		REPORT DATE	
NAME		NAME		NAME		NAME		NAME		DATE	
POPULAR NAME		RIVER OR STREAM		NEAREST TOWN/VILLAGE		POPULATION		NAME OF IMPROVEMENT		LATEST	
TYPE OF DAM		YEAR COMPLETED		PURPOSES		STORAGE CAPACITY (ACR.)		OPERATING CAPACITIES (ACR.)		REMARKS	
U.S. SPILLWAY	MAXIMUM OPERABLE	1952	13	IRRIGATION	POWER	150	250	150	250	1952	NOV/52
<p>REMARKS: ...</p>											
<p>DESIGN: ...</p>											
<p>CONSTRUCTION: ...</p>											
<p>OPERATION: ...</p>											
<p>MAINTENANCE: ...</p>											
<p>INSPECTION BY: ...</p>											
<p>INSPECTION DATE: ...</p>											
<p>AUTHORITY FOR INSPECTION: ...</p>											
<p>REMARKS: ...</p>											

DATE
FILME