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FRENCH RIVER BASIN  
LEICESTER, MASSACHUSETTS

STILES RESERVOIR DAM  
MA 00983

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

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  The dam is an earthfill dam about 500 ft. long and 29 ft. high. There are deficiencies which must be corrected to assure the continued performance of the dam. Generally the dam is in poor condition. The hazard classification for the dam is high. Severe leakage through the dam in the vicinity of the low-level outlet and upward seepage at the toe near the low level outlet was noted.		



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

REPLY TO  
ATTENTION OF:  
NEDED

JUN 29 1979

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

Dear Governor King:

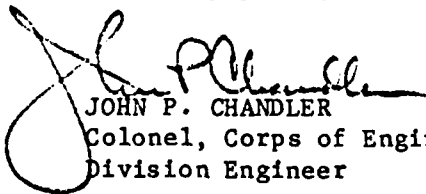
I am forwarding to you a copy of the Stiles Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological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

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, Central Water District, 14 Park Avenue, Worcester, Massachusetts 01069, ATTN: Mr. Raymond Shea, President.

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

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

Sincerely yours,

  
JOHN P. CHANDLER  
Colonel, Corps of Engineers  
Division Engineer

Incl  
As stated

STILES RESERVOIR DAM

MA 00983

FRENCH RIVER BASIN  
LEICESTER, MASSACHUSETTS

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION  
PROGRAM

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NATIONAL DAM INSPECTION  
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00983

Name of Dam: Stiles Reservoir Dam

Town: Leicester

County and State: Worcester County, Massachusetts

Stream: Bartons Brook - Tributary of the French River

Date of Inspection: November 16, 1978

Stiles Reservoir Dam is an earthfill dam about 500 feet long and 29 feet high. The upstream and downstream slopes are 1-1/4:1 and 2:1 (horizontal to vertical), respectively. A downstream stepped-stone masonry wall, which is part of the original dam structure, is incorporated within the downstream embankment. The spillway weir, which is 50 feet long, consists of a short ogee section with a stepped cascade. The discharge channel is partially riprapped and covered with brush and boulders. Two outlets exist at the dam; one is a 60-inch diameter flood control outlet installed after the 1955 flood, and the other is a 24-inch diameter low-level outlet.

There are deficiencies which must be corrected to assure the continued performance of this dam. This conclusion is based upon a visual inspection at the site, available engineering data, and limited evidence of operational and maintenance procedures. Generally, the dam is in poor condition. According to the Corps of Engineers' guidelines on classification of hazard potential, the dam has been placed in the "high" hazard category.

The following are visible signs of distress which indicate a potential hazard at the site: severe leakage through the dam in the vicinity of the low-level outlet; upward seepage at the toe near the low-level outlet; leak between the side wall and fill at

STILES RESERVOIR DAM

the spillway south abutment; leak beneath the 60-inch diameter outlet. Also, a possible seepage zone within the downstream area of the north abutment of the dam should be investigated.

Hydraulic analyses indicate that the spillway and floodgate at the dam can discharge a flow of 1,730 cfs with the water surface at El 845.6, which is the low point on the crest of the dam. An outflow test flood (full probable maximum flood) of 2,970 cfs at El 846.4 will overtop the dam by about 0.8 feet. The spillway and 60-inch outlet can discharge 58 percent of the test flood without overtopping the dam. Spillway discharge alone with water at El 845.6 is 1,370 cfs or 46 percent of the test flood.

It is recommended that the Owner employ the services of a qualified consultant to evaluate the severe leakage that is occurring at the dam as well as the possible seepage area. The consultant should also perform a detailed hydraulic/hydrologic analysis to evaluate the spillway capacity. In addition, the Owner should clear the dam of all trees and brush to at least 50 feet downstream of the toe. The low-level outlet should be repaired and made operable. After the evaluation, the leakage should be repaired. The joints within the 60-inch diameter outlet should be monitored for evidence of movement and repaired or further evaluated. All holes on the crest of the dam should be filled. The Owner should also implement a systematic program of inspection and maintenance.

The recommendations and remedial 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. In the interim, the 60-inch outlet should immediately be opened and the reservoir drained to the elevation of the invert (El 835.2). An alternative to these recommendations would be to breach the dam and drain the pond.



*Edward M. Greco*

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

Approved by:

*Stephen L. Bishop*

Stephen L. Bishop, P.E.  
Vice President

Metcalf & Eddy, Inc.

Massachusetts Registration  
No. 19703

Connecticut Registration  
No. 00000



STILES RESERVOIR DAM

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

*Joseph A. McElroy*

JOSEPH A. MCELROY, MEMBER  
Foundation & Materials Branch  
Engineering Division

*Carney M. Terzian*

CARNEY M. TERZIAN, MEMBER  
Design Branch  
Engineering Division

*Joseph W. Finegan, Jr.*

JOSEPH W. FINEGAN, JR., CHAIRMAN  
Chief, Reservoir Control Center  
Water Control 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 be detected.

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

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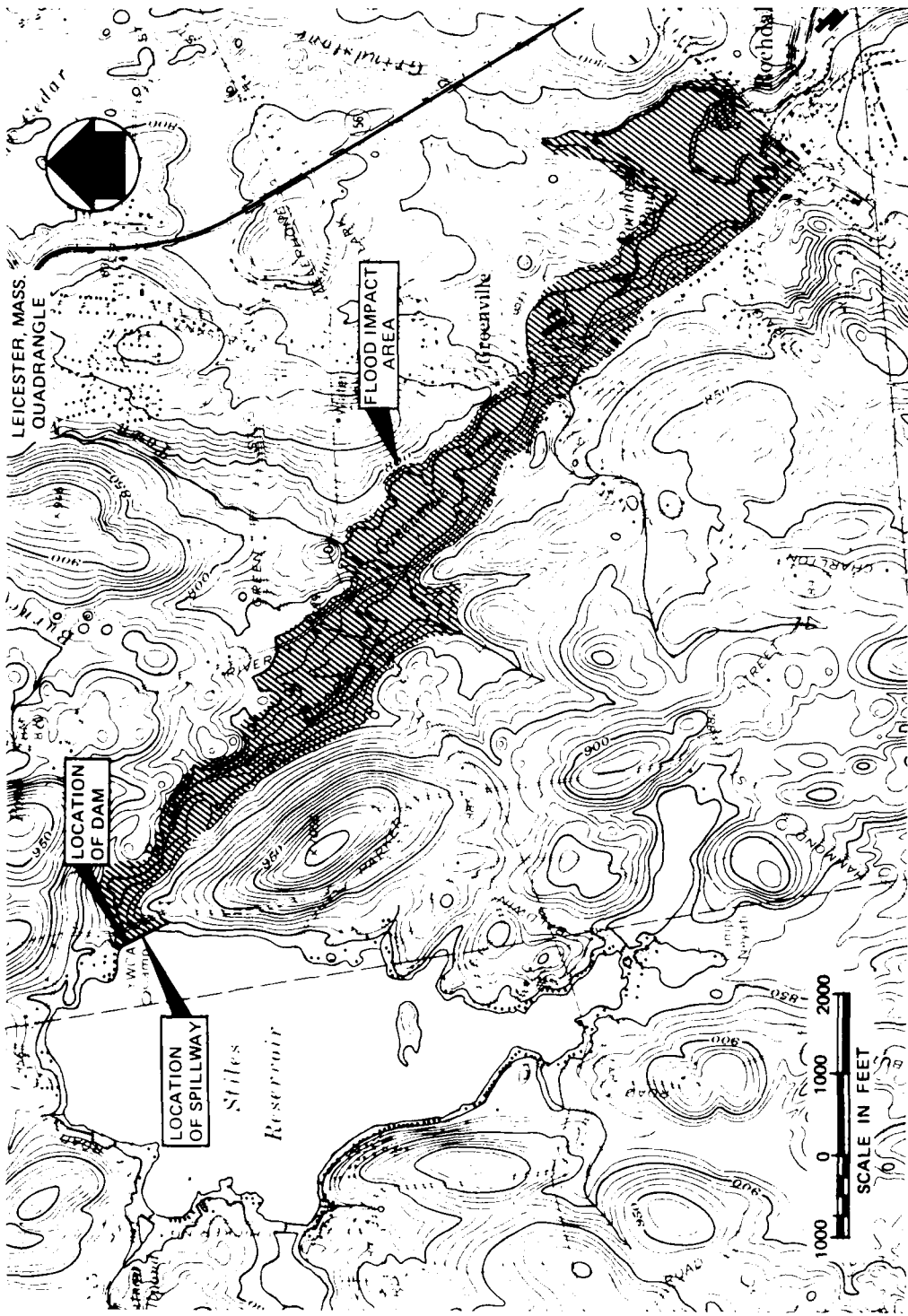
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**OVERVIEW  
STILES RESERVOIR DAM  
LEICESTER, MASSACHUSETTS**





LOCATION MAP - STILES RESERVOIR DAM

## SECTION 4

### OPERATING PROCEDURES

- 4.1 Procedures. According to the Owner, the dam is inspected weekly by representatives of the Central Water District. If flooding is anticipated, or large rainfalls are expected, the gates reportedly would be opened to lower the reservoir level. The Reservoir is drawn down 3+ feet every winter in anticipation of high spring runoff.
- 4.2 Maintenance of Dam. According to the Owner, the dam is maintained periodically, usually in the Spring by cutting brush and vegetation. Also, the dam is apparently examined for hazardous conditions and such conditions are repaired. However, the severe leakage observed during the inspection has been noted for several years in prior inspection reports.
- 4.3 Maintenance of Operating Facilities. The low-level outlet (24-inch diameter) is not used and apparently not maintained. It is assumed inoperable. The gates to the 60-inch outlet are reportedly maintained and cleaned when needed. During the inspection, some debris was observed lodged in the gate causing it to leak. The operating mechanism to the gates was in good condition and was operable.
- 4.4 Description of Any Warning Systems in Effect. There is no warning system in effect at this dam.
- 4.5 Evaluation. According to the owner, there is a regular program of maintenance for the dam. Based on the results of the visual inspection it is concluded that additional maintenance is required. A systematic and complete inspection, maintenance and surveillance program should be instituted at this dam.

STILES RESERVOIR DAM

adjacent to the Reservoir where there are numerous residences. The drainage area consists mainly of swamps and hills.

- e. Downstream Channel. Discharge from the spillway enters Bartons Brook which flows into Greenville Pond and then into Rochdale Pond, eventually ending in the French River about 2-1/2 miles downstream. The discharge channel immediately adjacent to the dam has trees and saplings lining the channel and within the channel. Baldwin Street crosses Bartons Brook and River Street crosses between Bartons Brook and Greenville Pond. Both roads form an obstruction to flow. The Village of Rochdale is immediately downstream of Rochdale Pond.

- 3.2 Evaluation. The above findings indicate that the dam is in poor condition, and there are several deficiencies which require attention. Although the owner stated that from time to time, the leaks which have occurred in the past are repaired by grouting, there still remain serious leaks within the dam that form a potential hazard. Recommended measures to improve these conditions are stated in Section 7.3.

STILES RESERVOIR DAM

Riprap on the upstream slope appeared to be in fair condition. Some slight depression along the crest at the downstream side was noted as well as some small holes less than 12 inches in diameter and 6 inches deep. There were trees and small brush along some areas of the downstream slope. The toe of the dam had many trees and saplings growing. A large area of standing water was noted in the downstream area to the north of the outlet discharge channel (see Figure B-1).

- c. Appurtenant Structures. The 50-foot long spillway and stepped cascade appeared to be in fair condition except for the leak previously noted. Small trees were growing within the discharge channels. In addition, the channels contained some small boulders.

The gate-operating mechanism to the low level, although apparently not operable, appeared in fair condition. The housing for the mechanism was also in fair condition. The mortared stone masonry wall built around the valve and stem was leaking through joints where mortar was missing.

The 60-inch gate and conduit appeared in fair condition. The gate was clogged with a piece of debris so the gate could not be fully closed and was leaking. The gate however is in operable condition and the mechanism appeared well maintained.

The outlet conduit, consisting of sections of 60-inch diameter concrete pipe, was in fair condition. Signs of movement at the joints of the pipes were noticed and the joints were stained. Water was observed seeping into the conduit at the joints within the lower third of the pipe.

A stone masonry wall at the toe of the dam deflects the spillway discharge to the stream bed and also protects the downstream toe area from erosion.

- d. Reservoir Area. The area around Stiles Reservoir is sparsely developed except immediately

STILES RESERVOIR DAM

SECTION 3  
VISUAL INSPECTION

3.1 Findings

- a. General. The Phase I Inspection of the dam at Stiles Reservoir was performed on November 16, 1978. A copy of the inspection checklist is included in Appendix A. Previous inspections of this dam and of the original dam at this site have been made by others since 1923. A partial listing of these inspections is in Appendix B. The latest inspection by others was made in 1977 by personnel from the Massachusetts Department of Public Works. A copy of their report is included in Appendix B.
- b. Dam. Stiles Reservoir Dam is an earthfill dam that has a history of leakage since at least 1923. Past inspection reports have documented various leaks at the dam. At the time of the Phase I inspection, there were three areas of leakage noted. A serious and apparently perennial leak occurs in the vicinity of the low-level outlet. Water, estimated flowing at 50 to 70 gpm is discharging immediately to the south of the 24-inch low-level outlet from beneath the dam. The water appears to be clear, however. Several feet downstream of the outlet and within the discharge channel, a small, approximately 6-inch diameter, upward seepage zone was noted. Water flowing to the surface did not appear to be dislodging soil particles. A second leak was noted within the south spillway abutment near the toe of the dam. A small cavity was noted between the training wall and earth abutment. A third small leak was noted flowing beneath the 60-inch concrete conduit.

Water was not observed to be flowing out of the 24-inch outlet. Apparently, the gate valve is fully closed. The 12-inch diameter corrugated metal toe drain appeared to be operable as a 1 to 2 gpm flow was estimated coming from the drain north of the low-level outlet and a trickle coming from the drain south of the outlet.

STILES RESERVOIR DAM

## 2.4 Evaluation

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

STILES RESERVOIR DAM

## SECTION 2

### ENGINEERING DATA

- 2.1 General. There are three drawings dated June, 1957, showing Plan of Repairs to Stiles Reservoir Dam, and one drawing dated April, 1958, titled Revised Plan of Repairs to Stiles Reservoir Dam. Copies of the drawings, which are included in Appendix B of this report, were obtained from the Worcester County Engineering Department. The drawings show proposed repairs to the embankment and spillway and addition of toe drains and flood gates.

According to the Owner, the reservoir and dam have been part of a study for possible hydroelectric power generation. As part of this study, hydraulic computations have been completed.

No other plans, specifications, or computations are available from the Owner, State or County relative to the design, construction or repair of this dam.

We acknowledge the assistance and cooperation of personnel of the Massachusetts Department of Public Works: Messrs. Willis Regan and Raymond Rochford, and of the Massachusetts Department of Environmental Quality Engineering, Division of Waterways: Messrs. John J. Hannon and Joseph Iagallo.

Also, we acknowledge the cooperation and assistance of personnel from the Worcester County Engineer's Office: Messrs. John O'Toole and Joseph Brasauskas and Mr. Raymond Shea, who answered questions for the owner.

- 2.2 Constructon Records. The only construction records are the Plans referred to in Section 2.1 and included in Appendix B. There are no as-built drawings for the dam, spillway or outlet structures.
- 2.3 Operating Records. No operating records are available, and there is no daily record kept of the elevation of the pool or rainfall at the dam site.

STILES RESERVOIR DAM

- (5) Upstream channel: bottom is gravel fill
- (6) Downstream channel: flat, stone-lined boulder covered
- (7) General: 11 foot wide by 4-1/2 foot high concrete box culvert and two 5-foot concrete pipe culverts under gravel road, 200 feet downstream

j. Regulating Outlets. There are two regulating outlets at the dam. The first, a 60-inch diameter pipe conduit controlled by a steel sluice gate, was installed after the flood of 1955. The control gate operating mechanism (hand crank) is located in a locked structure at the south abutment of the spillway. The second (low-level) outlet, which is assumed to be inoperable since it has not been operated for many years, is located about 160 feet from the north abutment of the dam within the embankment. The outlet consists of a 24-inch diameter cast-iron pipe with a corrugated metal extension. The outlet is controlled by a valve situated in a well on the upstream slope. The operating mechanism is housed in a locked structure.

f. Reservoir Surface (acres)

- \* (1) Top dam: 325
- \* (2) Test flood pool: 325
- (3) Flood-control pool: N/A
- (4) Recreation pool: 325
- (5) Spillway crest: 325

g. Dam

- (1) Type: earthfill
- (2) Length: 500 feet
- (3) Height: 29 feet
- (4) Top width: 15 feet
- (5) Side slopes: upstream - 1-1/4:1  
downstream - 2:1
- (6) Zoning: Unknown
- (7) Impervious core: Unknown
- (8) Cutoff: Unknown
- (9) Grout curtain: Unknown

i. Spillway

- (1) Type: ogee
- (2) Length of weir: 50 feet
- (3) Crest elevation: 842.0 MSL (assumed benchmark)
- (4) Gates: None

\*Based on the assumption that the surface area will not increase significantly with changes in reservoir elevation from 842.0 to 845.6.

STILES RESERVOIR DAM

the United States Geological Survey (USGS) topographic map (1969) water surface elevation for Stiles Reservoir.

- (1) Top dam: 845.6 to 846.8
- (2) Test flood pool: 846.4
- (3) Design surcharge: Unknown
- (4) Full flood control pool: Not Applicable (N/A)
- (5) Recreation pool: 842.0
- (6) Spillway crest (ungated): 842.0
- (7) Upstream portal invert diversion tunnel: N/A
- (8) Stream bed at centerline of dam: 817.1
- (9) Maximum tailwater: N/A

d. Reservoir

- (1) Length of maximum pool: 9,700 feet
- (2) Length of recreation pool: 9,700 feet
- (3) Length of flood control pool: N/A

e. Storage (acre-feet)

- (1) Test flood surcharge: 1,450 (Net) at El 846.4
- (2) Top of dam: 3,100
- (3) Flood control pool: N/A
- (4) Recreation pool: 2,700 (Approximate)
- (5) Spillway crest: 2,700

STILES RESERVOIR DAM

### 1.3 Pertinent Data

- a. Drainage Area. The approximately 2,880 acre (4.5 square mile) drainage area includes numerous swamps and brooks in both Spencer and Leicester, Massachusetts. The area is largely undeveloped, wooded and swampy. Several elongated hills are located within the drainage area. Several residences occur within the drainage area although most of the residences are situated along the shores of the reservoir.
  
- b. Discharge. Normal discharge is over an ungated spillway. The spillway, which is about 50 feet long, consists of a short ogee section with a stone cascade. The crest of the spillway is at El 842.0. The excavated channel at the spillway is at El 831.0. Flow is directed parallel to the toe of the dam where it intersects the natural stream bed downstream from the low-level outlet. Flow passes under a gravel road and continues to Bartons Brook, about 400 feet downstream. Flow discharges to Greenville and Rochdale Ponds further downstream.

The flow discharges into the French River at Rochdale, about 2-1/2 miles downstream from the dam.

The spillway and 60-inch outlet can discharge an estimated 1,730 cfs with the water surface at El 845.6, which is assumed to be the low point on the crest of the dam. Under the full PMF, the dam will discharge 2,970 cfs at El 846.4 and the crest would be overtopped by about 0.8 feet. The spillway alone can discharge 1,370 cfs while the 60-inch outlet will discharge 360 cfs.

The maximum flood level at the dam is unknown. Past inspection records infer that the dam was not overtopped during the 1938 flood. There is no evidence that the dam was overtopped in the 1955 flood, although there was some reported damage to the dam.

- c. Elevation (feet above Mean Sea Level (MSL)). A benchmark at El 842.0 was established at the spillway crest. This elevation was based upon

STILES RESERVOIR DAM

stand is over a wood platform in poor condition. The mechanism is also housed in a locked structure, which is on the crest of the dam.

- g. Purpose of Dam. Water is stored in Stiles Reservoir to provide process water for Rochdale Mill which is also owned by the Central Water District. Local residents and campers at a YWCA camp also use the reservoir for recreational purposes.
- h. Design and Construction History. Available records did not indicate the exact date of construction. The owner stated the dam was constructed between 1863 and 1865. Past inspection reports mention reconstruction work in 1887. Drawings (three sheets) dated June, 1957, show a plan of repairs to Stiles Reservoir Dam. These drawings show proposed repairs to the spillway embankment and addition of a toe drain. A second drawing dated April, 1958, shows revisions and also includes a proposed 60-inch outlet. No other plans and records are available on the design and construction of the dam.

Past inspection records dating back to 1923, which were reviewed at the Worcester County Engineering Department, indicate a history of leaks at the dam. Correspondence ordering repairs at the dam was also examined. At one time during 1956, emergency repairs were made to the spillway by the U.S. Army Corps of Engineers. Guillio Construction Company reportedly reconstructed the downstream slope in 1957 and also extended the 24-inch diameter low-level outlet pipe.

Further, the Owner stated that when leaks occurred in the dam, they had been repaired by grouting. No specific information is available on this grouting.

- 1. Normal Operating Procedures. The dam is maintained by personnel of the Central Water District. Weekly visits are made to the dam according to the owner. During the winter, the reservoir is reportedly lowered about 3 feet below the spillway crest in preparation for the high spring runoff.

STILES RESERVOIR DAM

Drawings, available at the Worcester County Engineering Department, as well as past inspection reports indicate that 12-inch diameter perforated toe drains were installed when the downstream embankment was extended over the masonry wall. Outlets to these pipes are visible at the headwall for the low-level outlet.

Four drawings, which were obtained from the Worcester County Engineering Department, are included in Appendix B. These drawings, dated June, 1957, and April, 1959, show plans of the original dam with downstream stepped-stone wall as well as proposed repairs to the dam.

- c. Size Classification. Stiles Reservoir Dam is classified in the "intermediate" category since it has a maximum height of 29 feet and a maximum storage capacity of 3,100 acre-feet.
- d. Hazard Classification. Although the immediate downstream area of the dam along Pine Street and River Street is sparsely populated, most of the residents along River Street would be effected by a failure of the dam. Further downstream, the villages of Greenville and Rochdale could also be impacted. Were the dam to fail, numerous lives could be lost and significant property damage would occur. Accordingly, the dam has been placed in the "high" hazard category.
- e. Ownership. The dam is owned by the Central Water District, a private utility company, 44 Park Avenue, Worcester, Massachusetts 01609. Mr. Raymond Shea, President (617-752-5416), gave permission to inspect the dam.
- f. Operators. The dam is operated by personnel of the Central Water District. The flood outlet at the spillway can be opened by a hand crank located at the abutment of the spillway. The mechanism is located within a locked structure. The low-level outlet has apparently not been operated in recent years and is assumed inoperable. Moreover, access to the operating

STILES RESERVOIR DAM

- b. Description of Dam and Appurtenances. Stiles Reservoir Dam consists of an earthfill dam about 500 feet long and 29 feet high (see Figures B-1 and B-2). The upstream and downstream faces are sloped about 1-  $\frac{1}{4}$ :1 (horizontal to vertical) upstream and 2:1 downstream. Drawings and records of past correspondence available at the Worcester County Engineering Department indicate that the original downstream stepped-stone masonry wall has been incorporated in the present embankment. The crest of the dam averages 15 feet wide with an average elevation (El) about 846.0. The upstream slope has riprap protection. The abutments of the dam tie into natural ground at each end.

The spillway, located at the south end of the dam, is ungated, without flashboards and consists of a 50-foot wide short ogee-type crest which discharges to a stepped cascade. The spillway crest is at El 842.0 while the streambed at the spillway is at El 831.0. The discharge channel, which is stone lined, directs the flow to a natural streambed which extends through a 4- $\frac{1}{2}$ -foot by 11-foot box culvert and two 5-foot reinforced concrete pipe culverts under a private gravel road.

There are two outlets within the dam. The first outlet consists of a steel sluice gate controlling discharge through a 60-inch diameter concrete pipe. The gate-operating mechanism is housed in a locked structure. The outlet discharges into the downstream spillway channel, which is south of the spillway and was constructed shortly after the 1955 storm.

A second outlet, which is the low-level outlet, consists of a 24-inch diameter pipe. The original 24-inch pipe ended at the stepped stone wall within the embankment and was later extended by installing a 24-inch diameter corrugated metal pipe. The low-level outlet now terminates at a stone headwall at the toe of the downstream embankment. The invert of the low-level outlet at the discharge end is about at El 817.0. The outlet gate-operating mechanism is housed in a locked gate house.

STILES RESERVOIR DAM

NATIONAL DAM INSPECTION  
PROGRAM

PHASE I INSPECTION REPORT

STILES RESERVOIR DAM

SECTION 1

PROJECT INFORMATION

1.1 General

- a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-79-C-0016, dated November 28, 1978, has been assigned by the Corps of Engineers for this work.
- b. Purpose:
- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
  - (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
  - (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

- a. Location. The dam is located on Bartons Brook, a tributary of the French River, in the Town of Leicester, Worcester County, Massachusetts (see Location Map).

STILES RESERVOIR DAM

## SECTION 5

### HYDRAULIC/HYDROLOGIC

#### 5.1 Evaluation of Features

- a. General. Drainage to Stiles Reservoir originates principally in wooded hills and swampy areas in the Town of Spencer to the west of the reservoir. The drainage area consists of about 2,880 acres (4.5 square miles) of sparsely populated areas. The dam at Stiles Reservoir is an earthfill dam. The spillway weir, situated at the south abutment, is about 50-foot long, short ogee-type with a crest at El 842.0. There are no provisions for flashboards on the spillway.  
  
Overtopping will occur over the low point on the crest of the dam at El 845.6. A 24-inch diameter low-level outlet apparently not operated in past years, is located within the embankment and has an invert of El 817.1. A flood outlet consisting of a 60-inch diameter pipe and manually operated sluice gate is located at the south abutment of the spillway. The gate is operable. The invert of the outlet at the entrance is approximately El 835.8. The capacity of this outlet is 360 cfs with a water surface at El 845.6. The reservoir level could be lowered 1 foot below spillway crest by this outlet (to El 841.0) in about 14 hours.
- b. Design Data. There are no hydraulic computations available for the design of this dam. The Owner reportedly has hydraulic computations for the facilities completed by personnel from Worcester Polytechnical Institute for a proposed hydroelectric project.
- c. Experience Data. Hydraulic records are not available for this dam. Past inspection reports infer that the dam was not overtopped in 1938. The records are unclear about the 1955 flood. However, past records mention sandbags were placed on top of the dam during the 1955 flood and later the embankment was raised

STILES RESERVOIR DAM

1 foot. This indicates that the dam may have been very close to being overtopped.

- d. Visual Observations. The spillway appears in good condition except for the leak within the south abutment. The training walls have been repaired in the past and consist of concrete and mortared stone masonry. There is a concrete cap on top of the walls. Some cracks at the joints of the stone wall were noted.

The spillway which is ungated has no provisions for flashboards. The crest is a short ogee type section discharging to a stepped cascade. The approach channel to the spillway is unobstructed. The discharge channel is riprapped for a short distance below the spillway and is filled with some boulders and small brush.

A 60-inch diameter outlet was constructed after the 1955 storm. The outlet is operable, and discharges into the spillway channel located in the south abutment of the dam.

A 24-inch low level outlet within the dam apparently has not been operated recently. The operating mechanisms for each outlet are housed in locked structures.

- e. Test Flood Analysis. The Probable Maximum Flood (PMF) rate was determined to be 950 cfs per square mile. This calculation is based on the average slope of the drainage area of 1.5 percent, the pond-plus-swamp area to drainage area ratio of 21 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December 1977). Applying the full PMF to the 4.5 square miles of drainage area results in a calculated peak flood flow of 4,300 cfs as the inflow test flood. By adjusting the inflow test flood for surcharge storage, the maximum discharge rate was established as 2,970 cfs (600 cfs per square mile), with a water surface at El 846.4. This assumes the low-level outlet is inoperable.

Hydraulic analyses indicate that the spillway and flood gate could discharge 1,730 cfs when

STILES RESERVOIR DAM

the water surface is at El 845.6 which is the low point on the crest of the dam. The spillway alone could discharge 1,370 cfs with water at the same elevation. The maximum discharge rate established for the full PMF is 2,970 cfs. The crest of the dam will be overtopped by about 0.8 feet under these conditions.

- f. Dam Failure Analysis. Assuming a failure of the dam with the water surface at El 845.6, which is the low area on the crest of the dam, the peak discharge flood flow would be about 34,800 cfs. At El 845.6, the spillway and 60-inch outlet would be discharging 1,730 cfs which would produce a 5 foot depth of flow. Failure of the dam would produce a total depth of 18.5 feet in the channel. It is probable that the resulting flood would have a severe impact on many residences along River Street. Also, the Village of Rochdale could be impacted by flooding.

STILES RESERVOIR DAM

## SECTION 6

### STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability

- a. Visual Observations. The evaluation of the structural stability of Stiles Reservoir Dam is based on a review of available drawings and the visual inspection conducted on November 16, 1978. A detailed discussion of the visual inspection appears in Section 3, Visual Inspection. Based on this inspection, the dam is judged to be in poor condition.

Those factors which are considered of major importance to the stability of the dam include the three areas of leakage observed during the inspection. Severe leakage through the dam at the area of the low-level outlet appears serious. Also of concern is the leakage at the foot of the south training wall to the spillway. The leakage beneath the 60-inch diameter outlet also presents a hazard. The upward seepage condition at the downstream toe within the low-level outlet discharge channel could present a hazard to the stability of the dam.

- b. Design and Construction Data. Discussions with the Owner, County and State personnel indicate that there are no available plans, specifications or computations on the design, or construction of the original dam.

Drawings of repairs made to the spillway and embankment are included in Appendix B.

Information does not appear to exist on the type, shear strength, and permeability of the soil and/or rock materials of the embankment.

- c. Operating Records. There is no instrumentation of any type in Stiles Reservoir Dam, and no instrumentation was ever reported installed in this dam. The performance of this dam under prior loading can only be inferred from physical evidence at the site.

STILES RESERVOIR DAM

- d. Post-Construction Changes. There are no as-built drawings available for Stiles Reservoir Dam. Based on visual evidence, and field measurements, the dam appears to have been repaired essentially as shown on the 1957 and 1958 drawings.
- e. Seismic Stability. The dam is located in Seismic Zone No. 2 and in accordance with Phase I "Recommended Guidelines" does not warrant seismic analyses.

## SECTION 7

### ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

#### 7.1 Dam Assessment

- a. Condition. Based upon a review of available drawings, the visual inspection of the site and limited operational or maintenance information, there are deficiencies which must be corrected to assure the continued performance of this dam. Generally, the dam is considered to be in poor condition. Several signs of distress were observed at the site: severe leakage beneath the embankment at the low-level outlet area; upward seepage of water near the downstream toe of the dam at the low-level outlet area; seepage at the south spillway training wall; seepage beneath the 60-inch diameter outlet. Possible seepage and standing water downstream of the north abutment should also be investigated. In addition, other maintenance functions such as control of vegetation on the dam and repairing low-level outlet should be undertaken.

Hydraulic analyses indicate that the spillway and 60-inch outlet can discharge a flow of 1,730 cfs with the water surface at El 845.6 which is the low point on the crest of the dam. An outflow test flood of 2,970 cfs (full probable maximum flood) will overtop the dam by 0.8 feet. The spillway alone will only discharge 1,370 cfs with the water surface at El 845.6.

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

STILES RESERVOIR DAM

- d. Need for Additional Investigation. Additional investigations to further assess the adequacy of the dam are outlined below in Section 7.2 Recommendations.

7.2 Recommendations. In view of the concerns over the continued performance of the dam, it is recommended that the Owner employ a qualified consultant to investigate and evaluate the leakage and upward flow of water at the dam within the downstream toe area and spillway. In the interim, the 60-inch outlet should be opened to reduce the pressure head within the embankment and foundation. The consultant should also perform a detailed hydraulic/hydrologic analysis to evaluate the spillway capacity.

Recommendations on repairs and maintenance procedures are outlined below under Section 7.3, Remedial Measures.

### 7.3 Remedial Measures

- a. Operating and Maintenance Procedures. The dam and appurtenant structures are not adequately maintained. It is recommended that the Owner accomplish the following:
- (1) Immediately open the 60-inch outlet and drain the pond to the invert elevation (El 835.2).
  - (2) Repair the leaks indicated in Section 3, Visual Inspection, based on recommendations by a qualified consultant.
  - (3) Clear the trees and brush from the dam and within 50 feet of the downstream toe. The discharge channel should also be kept clear of trees and brush.
  - (4) Repair the low-level outlet.
  - (5) Monitor the joints of the 60-inch diameter outlet for evidence of further movement and repair.

STILES RESERVOIR DAM

- (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, supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in accordance with all applicable State regulations.
- (7) periodic technical inspections of this dam should be continued on an annual basis
- (8) institute a definite plan for surveillance and a warning system during periods of unusually heavy rains and/or runoff.

7.4 Alternatives. An alternative to implementing the recommendations listed above and the maintenance procedures itemized would be to breach the dam and drain the pond. However, this may be an undesirable alternative because of water required at Rochdale Mill as well as for the aesthetic value of the area and property adjacent to the Reservoir.

STILES RESERVOIR DAM

APPENDIX A  
PERIODIC INSPECTION CHECKLIST

STILES RESERVOIR DAM

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT STILES RESERVOIR DAM

DATE Nov. 16, 1978

TIME 2:30 p.m.

WEATHER Clear & cool

W.S. ELEV. 841.4 U.S.        DN.S.

PARTY:

Assumed benchmark El. 842  
Top of spillway crest

- |                      |           |
|----------------------|-----------|
| 1. <u>R. Weber</u>   | 6. _____  |
| 2. <u>H. Lord</u>    | 7. _____  |
| 3. <u>D. Cole</u>    | 8. _____  |
| 4. <u>W. Checchi</u> | 9. _____  |
| 5. <u>E. Greco</u>   | 10. _____ |

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

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM DATE Nov. 16, 1978  
 PROJECT FEATURE Dam NAME R. Weber  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	Varies from 845.6 to 846.8
Current Pool Elevation	841.4
Maximum Impoundment to Date	Unknown
Surface Cracks	None visible
Pavement Condition	Grassed slopes-maintained on crest
Movement or Settlement of Crest	None along crest, top of slope periodic surface depressions
Lateral Movement	None visible
Vertical Alignment	Fairly level except for depressions at top of slope
Horizontal Alignment	Straight from abutment to abutment
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None visible-small brush and sapplings on slope indicate no movement
Trespassing on Slopes	Footpaths
Sloughing or Erosion of Slopes or Abutments	Slight sloughing visible near top of slope in some areas
Rock Slope Protection - Riprap Failures	Riprap on upstream slope vegetation and small brush in riprap
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	Leak in downstream toe within area of 15" outlet 50-70 GPM (estimated)
Piping or Boils	Upward flow of water in seepage area
Foundation Drainage Features	Unknown
Toe Drains	Partial 12-inch diameter
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM DATE Nov. 16, 1978

PROJECT FEATURE Control Tower at Spillway NAME R. Weber

DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	None visible
Visible Reinforcing	None visible
Rusting or Staining of Concrete	None visible
Any Seepage or Efflorescence	None visible
Joint Alignment	-
Unusual Seepage or Leaks in Gate	Debris caught in gate causes leakage
Cracks	None visible
Rusting or Corrosion of Steel	None visible
b. Mechanical and Electrical	
Air Vents	-
Float Wells	-
Crane Hoist	-
Elevator	-
Hydraulic System	-
Service Gates	Good
Emergency Gates	-
Lightning Protection System	-
Emergency Power System	-
Wiring and Lighting System in Gate Chamber	-

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM DATE Nov. 16, 1978

PROJECT FEATURE Control Tower at Embankment NAME R. Weber

DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	Mortared stone masonry
General Condition	Fair
Condition of Joints	-
Spalling	Some mortar missing
Visible Reinforcing	-
Rusting or Staining of Concrete	-
Any Seepage or Efflorescence	Well around gate valve leaks
Joint Alignment	-
Unusual Seepage or Leaks in Gate	
Cracks	Minor at joints
Rusting or Corrosion of Steel	-
b. Mechanical and Electrical	
Air Vents	-
Float Wells	-
Crane Hoist	-
Elevator	-
Hydraulic System	-
Service Gates	Assumed inoperable
Emergency Gates	-
Lightning Protection System	-
Emergency Power System	-
Wiring and Lighting System in Gate Chamber	-

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM DATE Nov. 16, 1978  
 PROJECT FEATURE Outlet Pipe NAME R. Weber  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	-
Rust or Staining	-
Spalling	-
Erosion or Cavitation	-
Visible Reinforcing	-
Any Seepage or Efflorescence	
Condition at Joints	-
Drain Holes	-
Channel	
Loose Rock or Trees Overhanging Channel	Small sapplings and brush within channel
Condition of Discharge Channel	Fair - bounded by masonry wall and earth slope

\*for spillway discharge channel see Spillway check sheet.

Said embankment shall be raised at least one foot higher than the present gravel fill placed by the town of Leicester. The top of the abutment of the spillway should be raised to equal the elevations of this fill.

The gate shall be inspected and new timbers, gate frame, gate or stop shall be installed if found necessary. A modern hoisting apparatus shall be placed on the gate frame.

The reconstruction of the spillway shall be completed by November 1, 1955.

The repairs to the embankment should be completed by December 1, 1955.

And the owners of said dam are hereby ENJOINED and ORDERED not to allow any water in said Reservoir until the aforesaid alterations and repairs are made to said dam.

If the owner refuses or neglects to make the above alterations and repairs as ordered above, the County Commissioners in accordance with section 47 of Chapter 253 of the General Laws, may at the expense of the County, cause said dam to be altered and repaired as ordered above, or the water draw off, whichever they may consider necessary for the safety of life, property, roads or bridges on streams below. The Commissioners may further make such orders as they may deem just as to the payment by the owner of the costs and expenses incurred by them in case the owner refuses or neglects to make such alterations or repairs, said costs and expenses to be ordered paid by the owner with interest from the time they were paid by the County (Section 48 of Chap. 253 of the General Laws).

Joseph A. Acy, Jr.  
Chairman

Edward P. Binney, Jr.  
Attorney

LEICESTER RESERVOIR DAM

( REMARKS:

The washed out stone step apron of the spillway will be replaced. The two abutment walls will be reconstructed. The spillway will be widened in accordance with letter sent you on August 26, 1955 relative to plans and specifications for reconstruction of dams removed by the flood of August 19, 1955.

Your consulting engineer shall confer with the Massachusetts Department of Public Works, Division of Waterways, 100 Nashua Street, Boston, Massachusetts regarding the size of the cross section opening of the spillway for this dam as specified in Chapter 513 of the Acts of 1939. The Division of Waterways shall if the opening is correct give your engineer a certificate so that he can proceed to complete the plan and specifications for the reconstruction of this spillway.

REMARKS:

Water is leaking in several places through the embankment. The water shall be drawn down in the Reservoir so that the location of these leaks throughout the embankment may be found by the use of analyzing dyes.

The sand bags placed on the embankment after the flood of August 19, 1955 shall be removed and a selected earth fill shall be laid in layers in their place. The leaks shall be traced through the dam and removed by the use of a layer of concrete placed on the upstream side or fill as specified by Engineer.

The upstream embankment slope shall be flattened to 2 1/2: 1; the present slope cleaned off, and interlocking sheet piling shall be driven as directed by the Engineer, and selected earth fill placed in 6" layers. Rip rap shall be placed 8 feet below the top of the embankment and extend to its top.

No. IWM NO. 25-07

ORDER ISSUED TO STILES RESERVOIR CORPORATION FOR ALTERATIONS AND REPAIRS TO A DAM ON BARTON'S BROOK IN LEICESTER, MASSACHUSETTS.

COMMISSIONER'S RETURN

SEPTEMBER Meeting

Filed September 6, A. D. 1955

Attest Arthur H. Sheedy,

Ast. Clerk

A true copy!  
Attest:

*Arthur H. Sheedy*  
Clerk

Commonwealth of Massachusetts

Worcester, S.S.

At a meeting of the County Commissioners of the County of Worcester, begun and held at Worcester, within and for said County, on the First Tuesday of September, A.D. 1955, being the 6th day of September, A.D. 1955, at which meeting were present

Joseph A. Aspero  
Edward P. Bird  
WORCESTER COUNTY COMMISSIONERS

ORDERED by said County Commissioners that an order be drawn up for the alterations and repairs necessary to be made on a dam owned by the STILES RESERVOIR CORPORATION, Att: Mr. Henry J. Hoff, President, Stiles Reservoir Corporation, c/o Associated Industries, Webster, Massachusetts; said dam is located on Barton Brook in the town of Leicester, Massachusetts.

Joseph A. Aspero  
Chairman

Edward P. Bird  
WORCESTER COUNTY COMMISSIONERS

TOWN OR CITY *Leicester*

DECREE NO. *STORAGE* PLAN NO. *Flood*

DAM NO. *25-07*

LOCATION *Stiles Reservoir - Storage - 201,000,000 Cu. Ft.*

C. C. DOCKET NO.

DESCRIPTION OF DAM *El. 100*

Type *Granite Block Earth Embankment*  
 Length *675.0*  
 Height *27.0 at waste gate invert.*  
 Thickness top *26.0 to 32.0 - abt. 22' but 40'*  
 " bottom *71.0 to 77.0*  
 Downstream Slope *Large granite blocks stepped - 1:1*  
 Upstream " *1:1 riprap*  
 Length of Spillway *49.5 - width crest 46'*  
 Size of Gates *waste only - 24" c.i. pipe El. 75.8*  
 Location of Gates *313' to North of spill section.*  
 Flashboards used *None*  
 Width Flashboards or Gates *-*  
 Dam designed by *-*  
 " constructed by *-*  
 Year constructed *-*

DESCRIPTION OF RESERVOIR & WATERSHED

Name of Main Stream *Reservoir*  
 " " any other Streams  
 Length of Watershed *(Traced - No dimensions)*  
 Width " "  
 Is Watershed Cultivated  
 Percent in Forests  
 Steepness of Slope  
 Kind of Soil *ledge - boulders*  
 No. of Acres in Watershed *2560. - 434 40 Sq Miles*  
 " " " Reservoir *401. - 9300. Acre Storage*  
 Length of Reservoir  
 Width " "  
 Max Flow Cu. Ft per Sec.  
 Head or Flashboards - Low Water *23.0 Draft.*  
 " " " High "

GENERAL REMARKS

*Owned by Stiles Reservoir Co. of Oxford, Mass. - David N. Tatt - Oxford. Write David N. Tatt - Oxford. Inspected 9-15-23 - L.O.M. See Notebook 3 - P. 32. 4th Annual Report. Inspected: Oct. 4, 1925. L.O. Marden July 1926. To Carlton Woollen Mills, Inc Rutland Plan filed in Book of Dam Plans March, 1928 Hooper. 60' 4" crest. 5' 0" abutment*

GENERAL REMARKS

*David N. Tatt - Oxford Storage. Inspected: July 18, 1928. L.O. Marden, A.H. Jeolow, W.B. Knowlton } Am Water Co. Jan 21, 1928 L.O.M. Sunway #1 (1823 Pgs 33-11) - 23, " FEB, KMF May 13, 1929 " Aug. 26, 1932 " Sept. 25, 1934 " Aug. 15, 1936 - " (over)*

*Inspected: Oct. 10, 1938 - L. H. Spofford  
 Patrol : Mar. 16, 1939 - W. C. Lindquist.  
 Inspected : Dec. 10, 1940 - L. H. Spofford  
 " : Mar. 19, 1941 - L.O.M.  
 " : Dec. 9, 1942 - L.H. SPARTY  
 " : Feb. 23, 1943 - L.H. Spofford  
 " : Sept. 16, 1943 - L.O.M. WOL  
 " : Dec. 10, 1945 - M.F.N.*

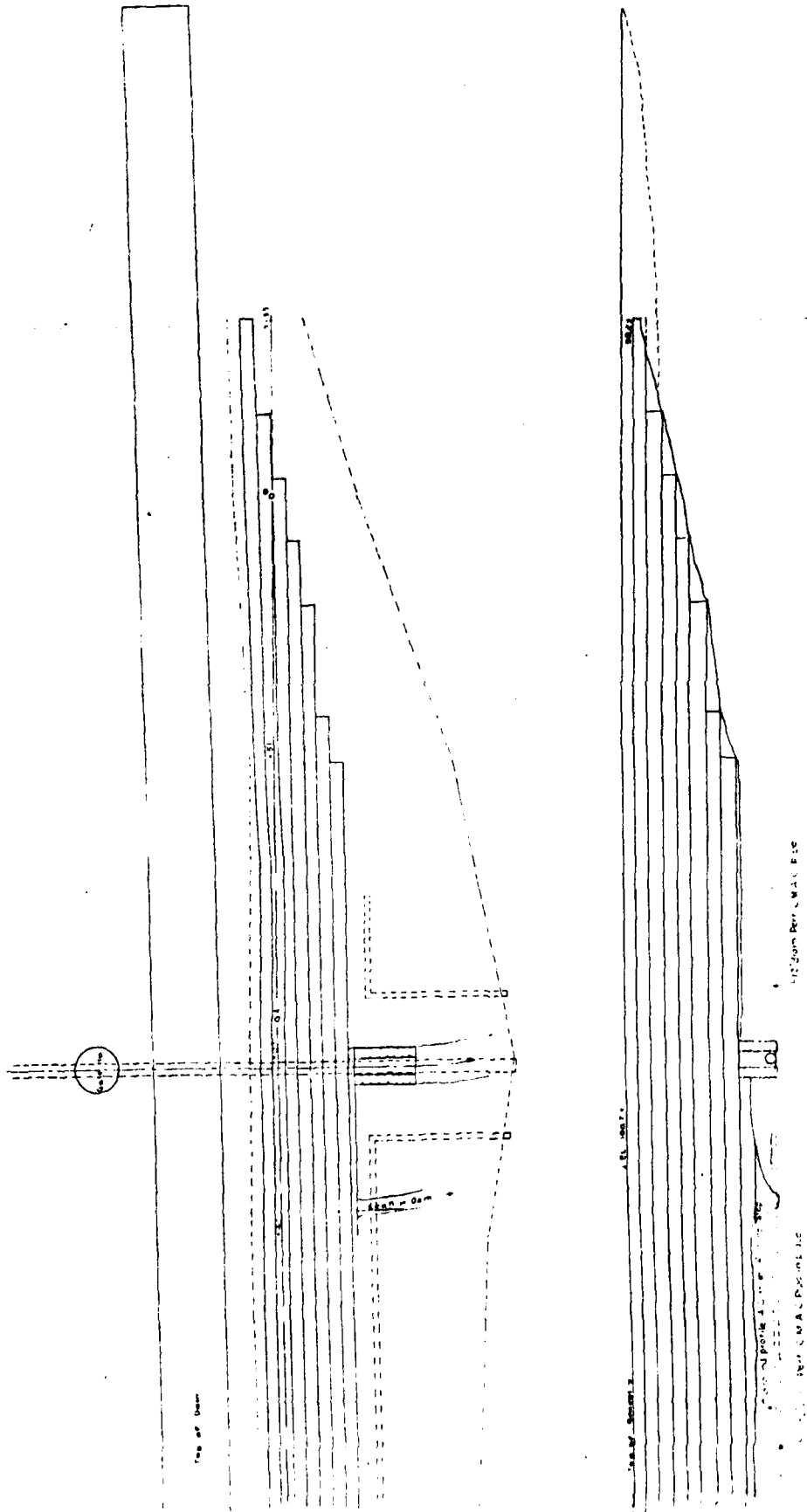
*25-07*

*Mar. 20, 1951 - LOM  
 Mar. 30, 1953 - JAH  
 Plans Dec 7 1955 LOM WOL (AR 3 Pgs 33)  
 Survey Jan 18, 1956 RST, JAH, SRT, PPP - PL 242 Pgs 141  
 " Sept 10 1956 Tokarz, Jolda, Martak, O'Connell - PL 242 Pgs 157.*

*Spillway Plans Oct 27, 1957 LOM, WOL - PL 242 Pgs 160.  
 Survey - Parker St - below spillway - 1959 SAJ, LHS, PPP. PL 314 Pgs 101 to 109  
 Measurements - Emb Spillway - Mar 2 1956 WOL, SRT - PL 3 Pgs 79-80*

*Inspected Dam: 25-07 - June 27, 1962 with Elmer W. Latham M.M. Carlton Woollen Co.  
 OWNER - STILES RESERVOIR TRUST - EDWARD F. LEVEEN, JR. TRUSTEE  
 40 CARLTON WOOLLEN MILLS, INC., STAFFORD ST., LEICESTER, MASS  
 CARETAKER - MR ELMER W. LATHAM*

STILES RESERVOIR DAM  
1912

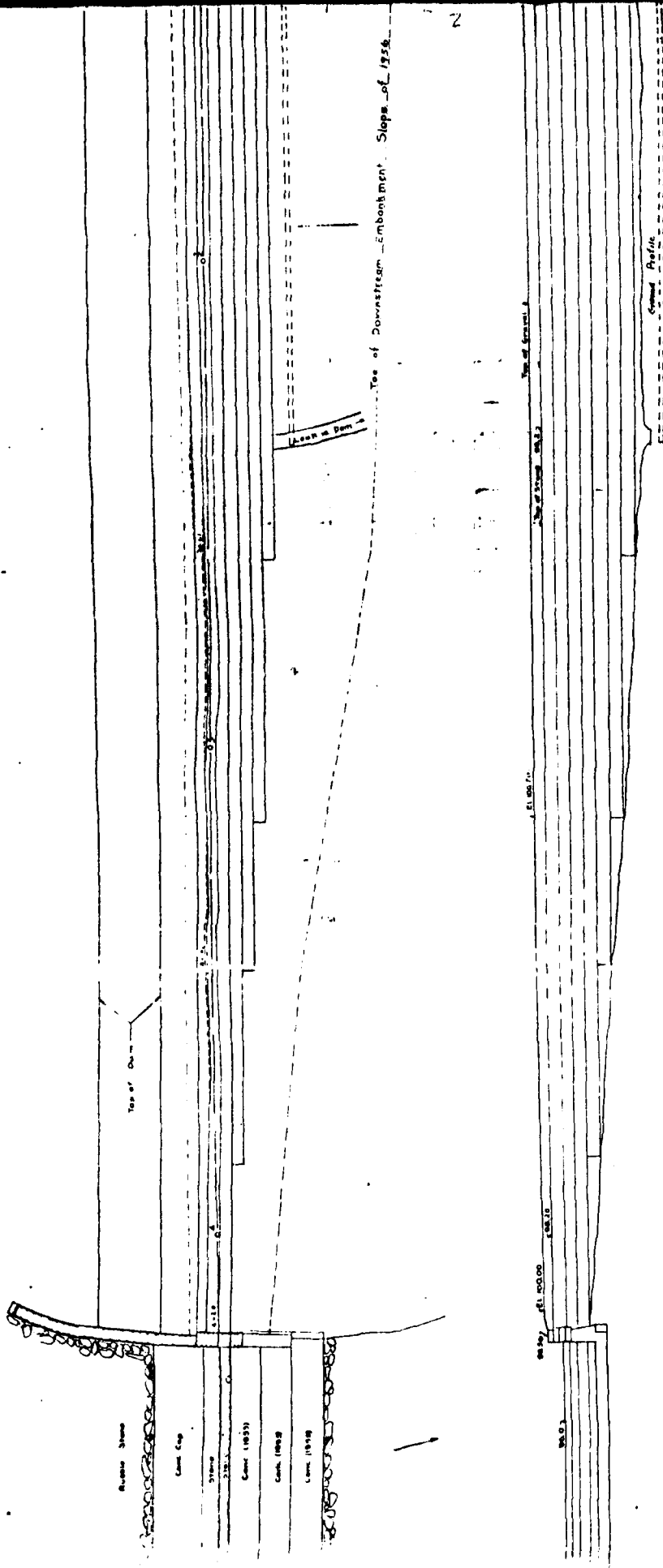


Top of Dam

1/2 Dam Base

1/2 Dam Base

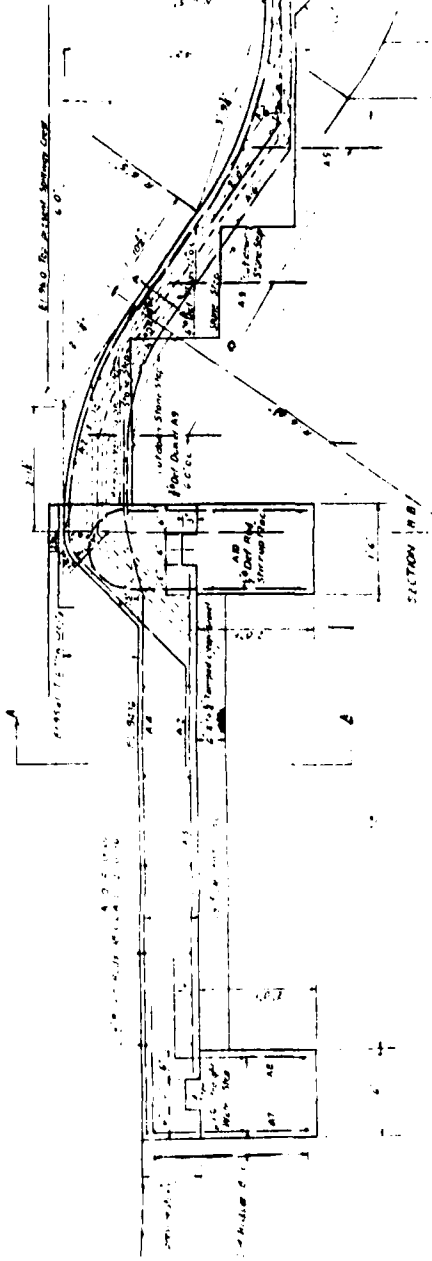
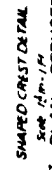
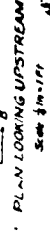
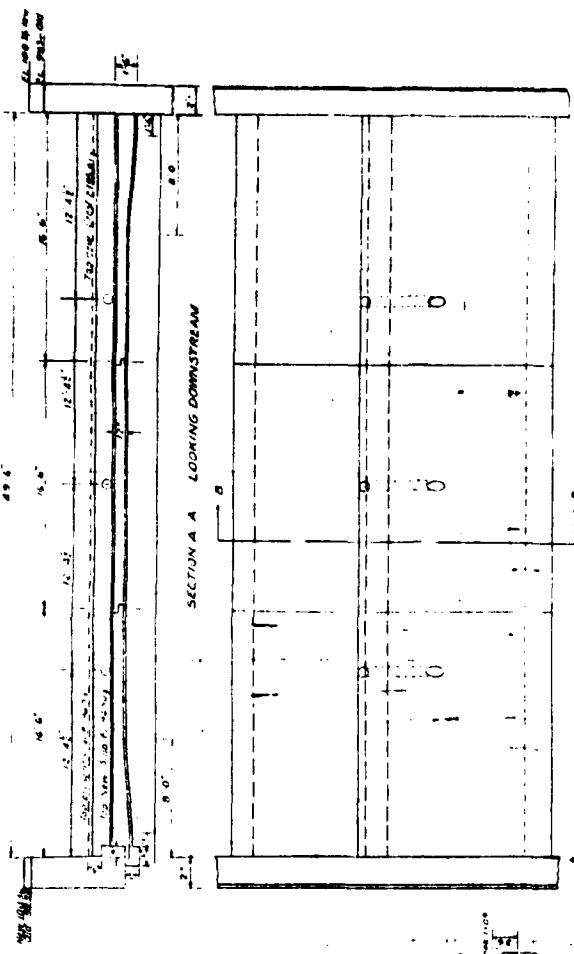
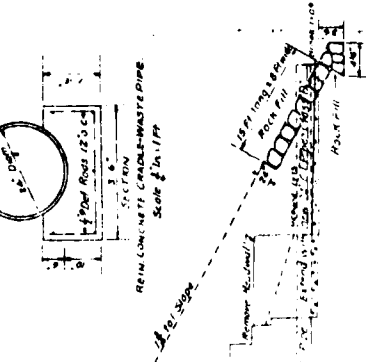
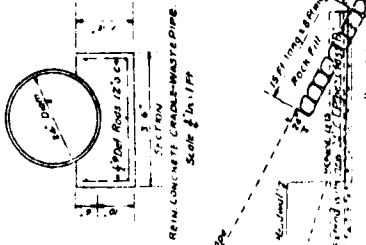
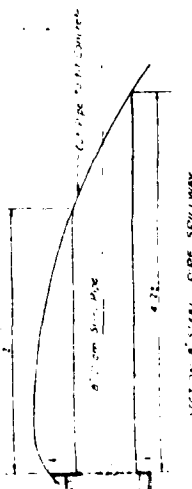
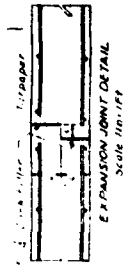
1/2 Dam Base



PLAN REDUCED APPROXIMATELY 50 %

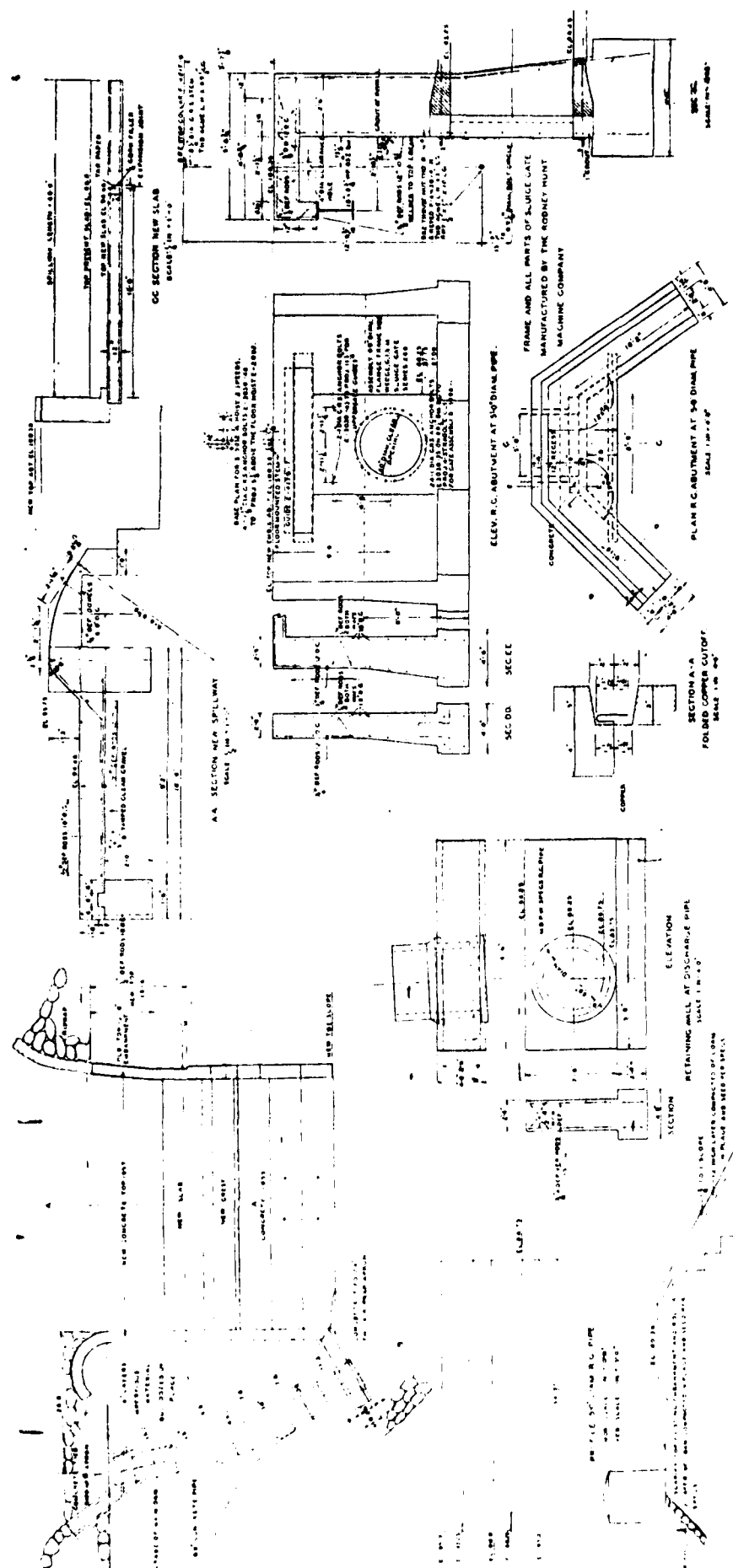
WORCESTER COUNTY COMMISSIONERS  
 WORCESTER COUNTY ENGINEERING DEPARTMENT  
 PLAIN OF  
 STILES RESERVOIR DAM  
 LEICESTER, MASS.  
 FOR STILES RESERVOIR COMPANY  
 AS FILED AND APPROVED BY THE  
 COUNTY COMMISSIONERS

DATE: 11/15/1918  
 DRAWN BY: J. P. BROWN  
 DAB NO 25-07



FOR STILES RESERVOIR CORPORATION  
 AS FILED AND APPROVED BY THE  
 COUNTY COMMISSIONERS  
 WORCESTER COUNTY COMMISSIONERS  
 WORCESTER COUNTY ENGINEERING DEPARTMENT  
 PLAN OF REPAIRS TO STILES RESERVOIR DAM  
 STILES RESERVOIR  
 LEICESTER, MASS.  
 PLAN REDUCED APPROXIMATELY 50%

APPROVED: [Signature] [Date]  
 [Signature] [Date]



PLAN REDUCED APPROXIMATELY 50 %

WORCESTER COUNTY COMMISSIONERS  
 WORCESTER COUNTY ENGINEERING DEPARTMENT  
 REVISED PLAN OF SPILLWAY TO STILES RESERVOIR DAM  
 STILES RESERVOIR  
 LEICESTER, MASS  
 FOR STILES RESERVOIR COMPANY  
 AS FILED AND APPROVED BY  
 COUNTY COMMISSIONERS

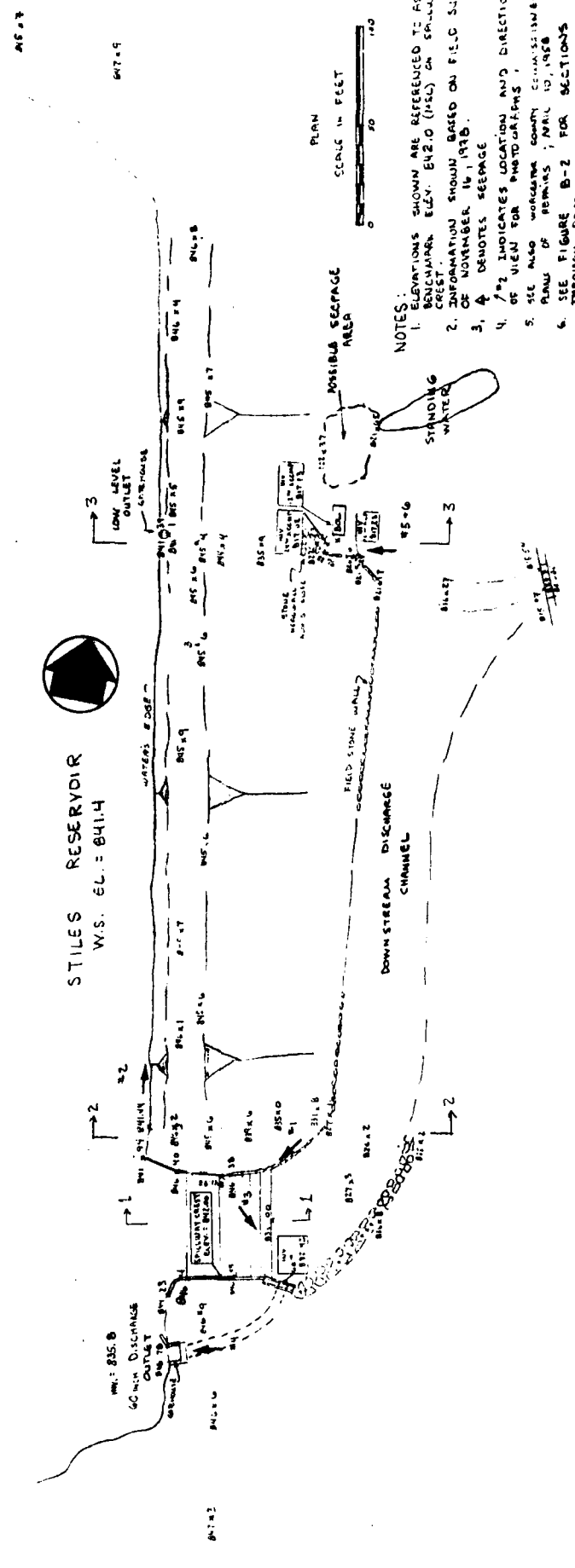
STRUCTURES APPROVED ON PLANS BY THE  
 WORCESTER COUNTY ENGINEERING DEPARTMENT  
 SMALL LETTERS INDICATE THE REVISIONS MADE  
 IN THE ORIGINAL PLANS

APPROVED: *[Signature]*  
 DATE: *[Date]*





STILES RESERVOIR  
W.S. EL. = 841.4



- NOTES:
1. ELEVATIONS SHOWN ARE REFERENCED TO ASSUMED BENCHMARK ELEV. 842.0 (H.C.) ON SHOULDER
  2. INFORMATION SHOWN BASED ON FIELD SURVEY OF NOVEMBER 16, 1978.
  3. 4 DENOTES SEEPAGE
  4. 7/2 INDICATES LOCATION AND DIRECTION OF VIEW FOR PHOTOGRAPHS.
  5. SEE ALSO WORCESTER COUNTY COMMUNITY SERVICES PLANS OF REMARKS; MAR. 10, 1968
  6. SEE FIGURE B-2 FOR SECTIONS THROUGH DAM

PROJECT: STILES RESERVOIR DAM AND OUTLET	DATE: JANUARY 1979
DESIGNED BY: METCALF & EDDY, INC.	SCALE: AS SHOWN
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
STILES RESERVOIR DAM	
FIGURE B-1 PLAN OF DAM	
TRIBUTARY: FRANCIS RIVER	STATE: MASSACHUSETTS
SECTION: B-1	DATE: JANUARY 1979

METCALF & EDDY, INC.

APPENDIX B

PLANS OF DAM AND PREVIOUS  
INSPECTION REPORTS

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STILES RESERVOIR DAM

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM DATE Nov. 16, 1978  
 PROJECT FEATURE Spillway NAME R. Weber  
 DISCIPLINE Geotech/Hyd. NAME L. Branagan

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	Fair-erosion on right wall some on left wall
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Concrete and cobble
b. Weir and Training Walls	
General Condition of Concrete	Stone masonry, slight cracks, some stones missing
Rust or Staining	None
Spalling	Some mortar at joints missing
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Rt. side between sidewall and abutment at toe
Drain Holes	None
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Some small trees
Floor of Channel	Boulders, debris, vegetation
Other Obstructions	None

PERIODIC INSPECTION CHECK LIST

PROJECT STILES RESERVOIR DAM DATE Nov. 16, 1978  
 PROJECT FEATURE Spillway NAME R. Weber/L. Branagan  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	
General Condition of Concrete	Fair to good
Rust or Staining on Concrete	Staining at joints within conduit
Spalling	None visible-mortar displaced from joints
Erosion or Cavitation	None visible
Cracking	None visible
Alignment of Monoliths	-
Alignment of Joints	Some displacement of pipes
Numbering of Monoliths	-

Leak into joints of conduit at bottom <sup>1/</sup>3rd of most joints.



COMMONWEALTH OF MASSACHUSETTS  
**Worcester County Commissioners**

COURT HOUSE, WORCESTER, MASSACHUSETTS

TELEPHONE PLEASANT 6-2441

JOSEPH A. ASPERO, WORCESTER, CHAIRMAN  
 FRANCIS E. CASSIDY, WEBSTER  
 EDWARD P. BIRD, FITCHBURG

August 15, 1956

John A. Volpe, Commissioner  
 Massachusetts Department of Public Works  
 100 Nashua Street  
 Boston, Massachusetts

Re: Stiles Reservoir Dam, Leicester, Massachusetts.

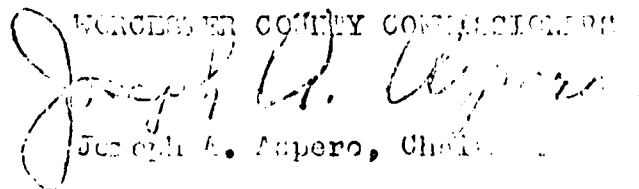
Dear Sir:

We have been deluged with inquiries and complaints from residents of Worcester and surrounding areas who have summer homes on Stiles Reservoir, as well as by the residents of the town, who feel that the County Commissioners are responsible for the delay in rebuilding a new Stiles Reservoir Dam. We have also had inquiries from mill owners who are disturbed about the situation, and the possibility of closing down their mills because the water level is now quite low.

It is getting to be a rather serious situation, and we have been holding off sending these people with their complaints to your office since we have felt that it is to our mutual advantage and interest to get this situation straightened out; in fact, the present situation is very likely to develop into a serious one should we suddenly get an extreme downfall of rain. We have plans drawn by the Worcester County Engineering Department (a copy of which is in your office), and which appears to meet with the approval of all parties concerned, it would seem advisable that we arrange a conference in Boston, if possible, and we will get the Attorney for the Stiles Reservoir Corporation to attend. We all here are extremely worried about the responsibility; in case anything serious does develop and it would be well we feel, to get the reconstruction of this dam completed by the early part of this fall.

Will you please let me hear from you at once if a conference to resolve this matter can be arranged.

Very truly yours,

WORCESTER COUNTY COMMISSIONERS  
  
 Joseph A. Aspero, Chairman

Worcester, Mass. ( )  
 Worcester, Mass. ( )  
 Worcester, Mass. ( )



COMMONWEALTH OF MASSACHUSETTS

WORCESTER COUNTY ENGINEERING DEPARTMENT

COURT HOUSE, WORCESTER, MASSACHUSETTS

TELEPHONE WORCESTER 6-2441

LESLIE O. MARDEN  
COUNTY ENGINEER

January 24, 1957

*Have member prepare rough draft of letter on page with - but paragraph*

*L. E. C.*

Board of County Commissioners  
Court House  
Worcester, Massachusetts

Re: Stiles Reservoir Dam - No. 25.07 - Leicester.

Gentlemen:

Eighteen months have elapsed since the 1955 hurricane. The stepped stone apron of this dam was washed out by the hurricane, and the dam was left in a weakened condition.

The United States Army Engineering Corps rebuilt this apron and the spillway. The spillway, however, will have to be enlarged to handle future flood flows. Mill owners below this dam on the French River own shares of stock in the Stiles Reservoir Corporation.

Mr. Edward Loveen, Manager of the Carleton Woolen Company, Needham, has spent about \$3500.00 of its' firms money to make repairs to the embankment of the dam.

Mr. Loveen called yesterday and told me that he will complete the repairs to the dam if the other stockholders will turn their stock over to him. So far, only Textron Inc., Krintman, and H. & V. Specialties have stated they would give him their stock. Mr. Harry Siff made no reply.

Section 45 of the General Laws, Chapter 253 and amendments thereto states in part: "Every examination shall be made by a competent engineer who shall report to the commissioners in writing whether he considers the structure safe and in good condition, and if not, its condition in detail and the work or the changes required for safety and the public good."

Section 47 states in part: "If, after notice in writing to the owner of a reservoir or dam which has been examined, the said owner refuses or neglects to make such repairs as the commissioners order, they may, at the expense of the county, cause such reservoir or dam to be altered and repaired or by any means thereof removed or the water drawn off, whichever they deem necessary for the safety of life, property, and the stream below."

Cont'd.

2. County Commissioners

January 24, 1957

Section 48 states "The commissioners shall make such orders as they may deem just as to the payment by the owner, county or other party of the costs and expenses incurred by them under the three preceding sections, and if the reservoir or dam was adjudged to be unsafe, said costs and expenses may be ordered paid by the owner, with interest, from the time they were paid by the county."

It is my opinion that a letter should be sent to each stockholder of the Stiles Reservoir Corporation that these alterations must be made in accordance with the above General Laws.

Very truly yours,

WORCESTER COUNTY ENGINEERING DEPT.

*L. O. Marden*  
L. O. Marden, County Engineer

LCM:es

STILES RESERVOIR DAM

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: ~~City/Town~~ LEICESTER Dam No. 3-14-151-07

Name of Dam STILES Reservoir Inspected by W. REGAN

Date of Inspection 7/9/76

2. Owner/s: per: Assessors \_\_\_\_\_ Prev. Inspection \_\_\_\_\_

Reg. of Deeds \_\_\_\_\_ Pers. Contact

1. CHARLTON Woolen Mills Inc., STAFFORD St. LEICESTER MASS.

Name (Stiles Reservoir TRUST- Ed LAVERN - TRUSTEE) St. & No. \_\_\_\_\_ City/Town State Tel. No. \_\_\_\_\_

2. Name \_\_\_\_\_ St. & No. \_\_\_\_\_ City/Town State Tel. No. \_\_\_\_\_

3. Name \_\_\_\_\_ St. & No. \_\_\_\_\_ City/Town State Tel. No. \_\_\_\_\_

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: \_\_\_\_\_ St. & No.: \_\_\_\_\_  
City/Town: \_\_\_\_\_ State: \_\_\_\_\_ Tel. No.: \_\_\_\_\_

4. No. of Pictures taken \_\_\_\_\_

5. Degree of Hazard: (if dam should fail completely)\*

1. Minor \_\_\_\_\_ 2. Moderate   
3. Severe \_\_\_\_\_ 4. Disastrous \_\_\_\_\_

\* This rating may change as land use changes (future development)

6. Outlet Control: Automatic \_\_\_\_\_ Manual

Operative  yes; \_\_\_\_\_ No.

Comments: Mod. to heavy leakage Around but Not Through North Set of Sluices indicates more of a Problem than just NoU Seating of GATES - some Silt transported (deposits visible) but leakage visibly Clear

7. Upstream Face of Dam: Condition: \_\_\_\_\_

1. Good  2. Minor Repairs \_\_\_\_\_  
3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments: R.I.P. RAP & Turf in Very good condition - No growth of Trees, brush on U.S. Face

Downstream Face of Dam:

Conditions: 1. Good \_\_\_\_\_ 2. Minor Repairs  \_\_\_\_\_  
3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments: Remove Trees & brush. No leakage  
Through main embankment noted except  
as described in (6) & (12) (at Gates & Spillway)

9. Emergency Spillway:

Conditions: 1. Good \_\_\_\_\_ 2. Minor Repairs  \_\_\_\_\_  
3. Major Repairs  \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments: Upper level - U.S. End South Cheekwall cracked -  
at high water level

10. Water Level at time of inspection: \_\_\_\_\_ ft. above \_\_\_\_\_ below \_\_\_\_\_  
top of dam \_\_\_\_\_ principal spillway <sup>AT</sup> invert  
other \_\_\_\_\_

11. Summary of Deficiencies Noted:

- Growth (Trees and Brush) on Embankment  - Downstream Slope only
- Animal Burrows and Washouts \_\_\_\_\_
- Damage to slopes or top of dam \_\_\_\_\_
- Cracked or Damaged Masonry  So. Cheekwall (See 9)
- Evidence of Seepage  \_\_\_\_\_
- Evidence of Piping \_\_\_\_\_
- Erosion \_\_\_\_\_
- Leaks  \_\_\_\_\_
- Trash and/or debris impeding flow \_\_\_\_\_
- Clogged or blocked spillway \_\_\_\_\_
- Other \_\_\_\_\_

Remarks & Recommendations: (Fully Explain)

The main embankment is in generally in very good condition. There are some trees & brush on the d.s. slope. Only slight dampness was noted at the downstream toe.

The upstream side of the South Spillway Checkwall has a vertical 1"± wide crack, and at the downstream side of this checkwall adjacent to the intersection of the checkwall and Sluice Tailwall a vertical crack was noted - Approx 1/3± c.y. cavity noted behind this crack. apparently at higher pool elevation water enters the U.S. Crack, flows through the embankment behind the South Checkwall to the lower d.s. Crack causing embankment material to wash. If not corrected cavity will enlarge & progress toward U.S. Crack. There is heavy leakage through the North gates - Very small flow through the Sluice pipes; heavy

(Continued on 3A)

13. Overall Condition:

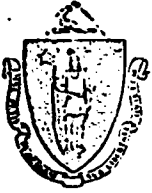
- 1. Safe \_\_\_\_\_
- 2. Minor repairs needed \_\_\_\_\_
- 3. Conditionally safe - major repairs needed  \_\_\_\_\_
- 4. Unsafe \_\_\_\_\_
- 5. Reservoir impoundment no longer exists (explain)  
Recommend removal from inspection list \_\_\_\_\_

(3A)

Dam No. 3-14-151-07

leakage emerges from the toe of the  
tail wall. The discharge is visibly  
clear, but large deposits of obviously  
transported material were noted  
downstream.

The owner should retain a  
consultant engineer experienced in dam  
work to trace out these percolation  
paths and prepare application, ~~for~~  
plans etc. for rectification of this  
condition.



*The Commonwealth of Massachusetts*

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS  
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGR.  
DIVISION OF WATERWAYS

*100 Nashua Street, Boston 02114*

November 8, 1976

Charlton Woolen Mills, Inc.  
Stafford Street  
Leicester, Massachusetts

RE: Inspection Dam #3-14=151-07  
Stiles Reservoir Dam  
Leicester

Gentlemen:

On July 9, 1976, an Engineer from the Massachusetts Department of Public Works made a visual inspection of the above dam. Our records indicate the owner to be Stiles Reservoir Tr., Ed Lareen, Tr. If this information is incorrect, will you please notify this office.

The inspection was made in accordance with the provisions of Chapter 253 of the Massachusetts General Laws as amended (Dams Safety Act). Chapter 706 of the Acts of 1975 transferred the jurisdiction of the so-called "Dams Safety Program" to the Commissioner of the Department of Environmental Quality Engineering.

The results of the inspection indicate that this dam is conditionally safe. The following conditions were noted that require attention:

The District Dams Engineer, Mr. Willis Regan, recommends that this dam receive a consultant inspection. Enclosed is an application form which should be filled out and mailed to the above address.

We call these conditions to your attention before they become serious and more expensive to correct. With any correspondence please include the number of the dam as indicated above.

Very truly yours,

John V. Hannon, P.E.  
Chief Engineer

*AW*  
Enclosure  
cc: J.J. Lyons  
W. Regan  
Leicester, Selectman

June 15, 1977

Mr. Willard Regan  
Department of Internal Affairs  
Commonwealth of Massachusetts  
403 Belmont Street  
Worcester, MA 01605

Dear Sir:

I have been requested, as Town Counsel for the Town of Leicester, to examine and make recommendations to the Selectmen relative to the lowering or controlling of the water level at the Burncoat Pond, Stiles Reservoir and Cedar Meadow Lake in the Town of Leicester.

Today I have conferred with Mr. William Griffin, Chairman of the Town Conservation Commission, Mr. Terence Finan, Executive Secretary of the Board of Selectmen and Mr. Raymond Shea, who has succeeded to the property interest of the Carlton Woolen Mills.

We have been advised by Mr. Shea that your office has authorized Mr. Shea to lower the dam at Burncoat in order to effect repairs which were recommended by you following an inspection in August of 1976. We are further advised that, within the past week, you have orally advised Mr. Shea that these repairs are presently in order and that you made specific recommendations relative to additional repairs.

Mr. Willard Regan  
Department of Internal Affairs  
June 15, 1977  
Page Two.

The current posture of the situation is that the dam has been lowered and a quantity of water has left the Pond. This has been represented by Robert Tivnan, representing a coalition of property owners, to be about fifteen and one-half inches.

Today, Mr. Shea has voluntarily agreed to raise the dam to prevent further loss of water.

It becomes apparent that all parties, for various reasons, must know the current degree of hazard at the dam.

Accordingly, we respectfully ask that your Division conduct an immediate inspection of the dam and make an appropriate report.

This request is made by the Board of Selectmen and by the Conservation Commission, as well as Mr. Shea.

We would greatly appreciate your immediate attention to a situation which we consider to have some urgency.

Very truly yours,

ROBERT V. MULKERN,  
Town Counsel

smm

pc: State Water Control Commission  
Mr. Edward Hannon, Chief Engineer,  
Office of Environmental Affairs  
Board of Selectmen, Town of Leicester  
Raymond Shea  
Robert Tivnan  
William Griffin, Chairman, Conservation Commission

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town LEICESTER Dam No. 3-14-151-07

Name of Dam STILES Reservoir, Inspected by W. REGAN

Date of Inspection 6/17/77

2. Owner/s: per: Assessors \_\_\_\_\_ Prev. Inspection \_\_\_\_\_

Reg. of Deeds \_\_\_\_\_ Telephone \_\_\_\_\_  
Pers. Contact

1. RAYMOND E. SHEA CENTRAL NEW ENGLAND REALTY,  
Name St. & No. City/Town State Tel. No.

2. 44 PARK AVE. WORCESTER  
Name St. & No. City/Town State Tel. No.

3. \_\_\_\_\_  
Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: \_\_\_\_\_ St. & No.: \_\_\_\_\_

City/Town: \_\_\_\_\_ State: \_\_\_\_\_ Tel.No.: \_\_\_\_\_

4. No. of Pictures taken 0

5. Degree of Hazard: (if dam should fail completely)\*

1. Minor \_\_\_\_\_ 2. Moderate \_\_\_\_\_

3. Severe  4. Disastrous \_\_\_\_\_

\* This rating may change as land use changes (future development)

6. Outlet Control: Automatic \_\_\_\_\_ Manual

Operative \_\_\_\_\_ yes;  No.

Comments: see 12

7. Upstream Face of Dam: Conditions:

1. Good  2. Minor Repairs \_\_\_\_\_

3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments:

8. Downstream Face of Dam:

Condition: 1. Good  2. Minor Repairs \_\_\_\_\_  
3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments: Embankment Appears To be in very good Condition

9. Emergency Spillway:

Condition: 1. Good \_\_\_\_\_ 2. Minor Repairs \_\_\_\_\_  
3. Major Repairs  4. Urgent Repairs \_\_\_\_\_

Comments: Water Piping Through spillway's South Cheekwall, emerges @ Lower Elevation from hole at the intersection of d.s. End of Cheekwall & D.S. Wingwall - Penetrated this hole to a depth of 5'± length of this cavity probably greater than this. Probably couldn't penetrate further because of convoluted alignment.

10. Water Level at time of inspection: 0.1± ft. above  below  
top of dam \_\_\_\_\_ principal spillway crest  
other \_\_\_\_\_

11. Summary of Deficiencies Noted:

- Growth (Trees and Brush) on Embankment \_\_\_\_\_
- Animal Burrows and Washouts A few small burrows noted on d.s. Slope
- Damage to slopes or top of dam \_\_\_\_\_
- Cracked or Damaged Masonry
- Evidence of Seepage
- Evidence of Piping
- Erosion \_\_\_\_\_
- Leaks
- Trash and/or debris impeding flow \_\_\_\_\_
- Clogged or blocked spillway \_\_\_\_\_
- Other \_\_\_\_\_

12. Remarks & Recommendations: (Fully Explain)

The conditions noted in (12) on my 7/9/76 inspection report prevail. The condition noted at (9) should be corrected as soon as possible. A more serious condition was noted at the northerly sluice gate discharge. There is a trickle flow through the 2 A.C.C.M. sluice pipes, but there is a high velocity flow emerging at 2 locations from the toe of the tailwall. Silt deposits are located on the contiguous section of streambed.

Mitigating factors are:

- ① The discharge is clear
- ② These conditions have prevailed for at least one year with visible deterioration progressing only to a minor degree
- ③ The main embankment is in very good condition.

Given the high hazard rating of this dam (1 1/2 billion gallons passing 3 well developed areas & the Mass Turnpike) I would recommend that the owner immediately retain a consulting engineer experienced in dam restoration. This same owner owns Dams # <sup>Leicester</sup> 08, 09 which also need a consultant inspection.

13. Overall Condition: Needs a consultant inspection and a P.S. & E. for restoration

- 1. Safe \_\_\_\_\_
- 2. Minor repairs needed \_\_\_\_\_
- 3. Conditionally safe - major repairs needed \_\_\_\_\_
- 4. Unsafe \_\_\_\_\_
- 5. Reservoir impoundment no longer exists (explain) \_\_\_\_\_

Recommend removal from inspection list \_\_\_\_\_

Due to the situation at the northerly gates, I would recommend <sup>preferential</sup> use of the southerly gate

DEPARTMENT OF  
ENVIRONMENTAL QUALITY ENGINEERING  
DIVISION OF WATERWAYS  
DESCRIPTION OF DAM

RECEIVED JUN 21 1977

DISTRICT 3

Submitted by W. REGAN Dam No. 3-14-151-07

Date 6/20/77 City/Town LEICESTER

Name of Dam Stiles Reservoir

1. Location: Topo Sheet No. 21A - Leicester Quad.

Provide 8 1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1923 Year/s of subsequent repairs N/A  
N/A - Prior To

3. Purpose of Dam: Water Supply \_\_\_\_\_ Recreational \_\_\_\_\_  
Irrigation \_\_\_\_\_ Other originally M.L.L Storage

4. Drainage Area: 4 sq. mi. \_\_\_\_\_ acres

5. Normal Ponding Area: 400<sup>360±</sup> acres; Ave. depth \_\_\_\_\_  
Ft.<sup>3</sup>  
Impoundment: 201,000,000 gal.; \_\_\_\_\_ acre ft.

\* 6. No. and type of dwellings located adjacent to pond or reservoir  
\_\_\_\_\_ i.e. summer homes, etc. >100 Year Round dwellings

7. Dimensions of Dam: Length 700'± Max. Height 27'

Slopes: Upstream Face 1:1 - Riprap

Downstream Face 26' - 32'

Width across top 26' - 32'

8. Classification of Dam by Material:

Earth  Conc. Masonry \_\_\_\_\_ Stone Masonry

Timber \_\_\_\_\_ Rockfill \_\_\_\_\_ Other \_\_\_\_\_

9. A. Description of present land usage downstream of dam:

80 % <sup>Residential</sup> rural; 20 % urban Light & Med. Industry

B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure? yes \_\_\_\_\_ no

NOTE (6): According to The Chairman of The Leicester  
Con. Comm. Any draw down could affect adjacent  
Gravity wells

IV Crest Flow

Elev. for  $Q_{TF} = 846.35$   
" L.P. Crest = 845.6  
Max "Head" on Crest 0.75

$$q_c = 2.55(0.75)^{1.5} = 1.66 \text{ cfs/ft}$$

As Critical Flow:

$$y_c = 0.44', \quad V_c = 3.8 \text{ fps}$$

V Low Level Discharge 24 INCH PIPE

ASSUME Low Level Outlet OPERABLE

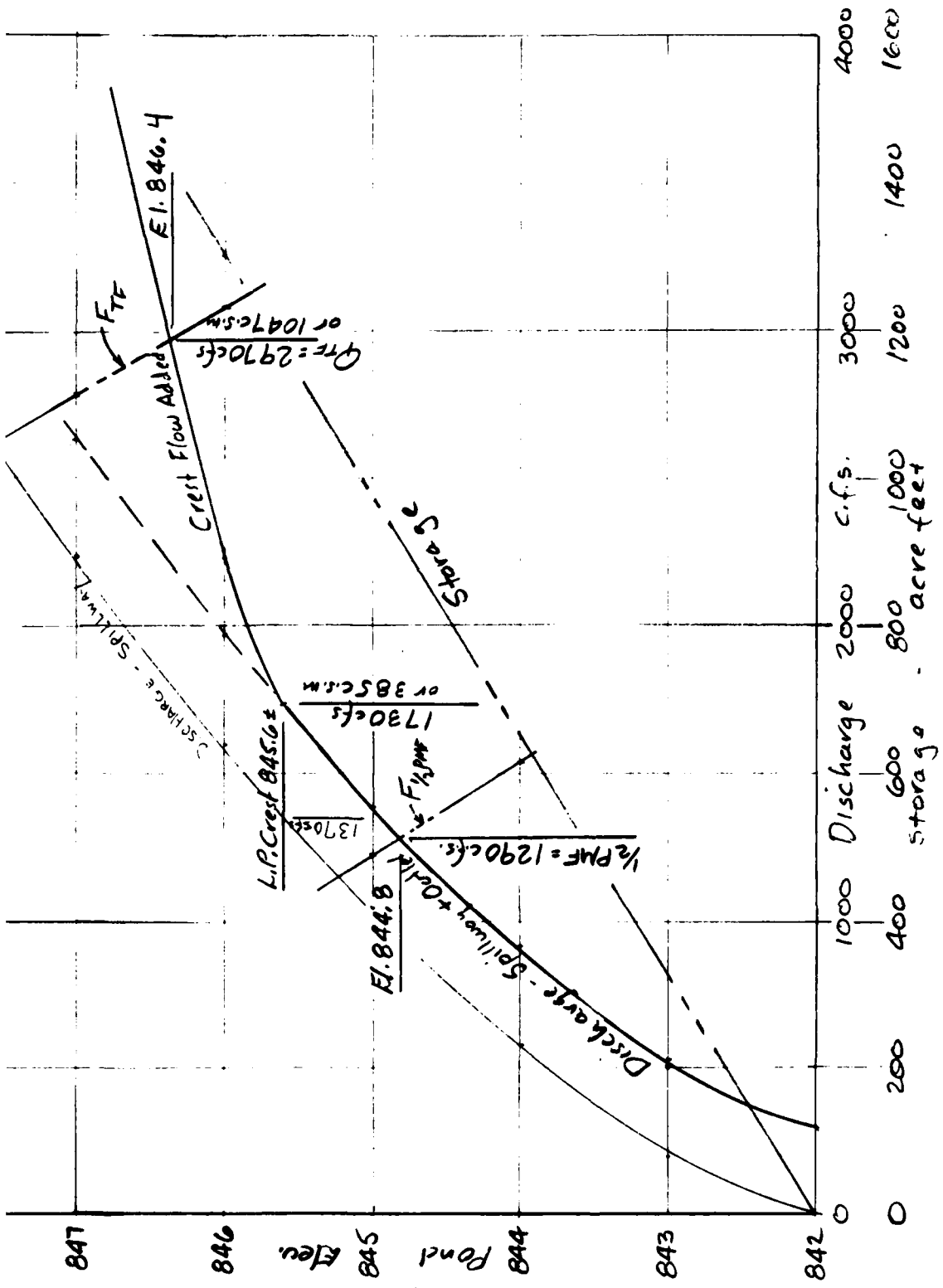
$$H_p = \frac{V_p^2}{2g} (3) \text{ [ENT + EXIT + FRICTION]} \quad \phi \text{ outlet} = 818$$

$$Q_p = 3.14 V_p = 3.14 (4.63) H_p^{1/2} = 14.5 H_p^{1/2}$$

WITH WS = 843 (1 ft above spillway crest)

$$Q_p = 14.5 (843 - 818)^{1/2} = 72.5 \text{ cfs}$$

Discharge, Storage & Storage Function vs Pond Eleu.



II Discharge Rating

A - Spillway

Length - 50'; Crest - sm. ogee; Crest el. 842, No Flap Gate Used

Use:  $Q_s = C L H_s^{1.5} = 4 \times 50 \times H_s^{1.5} = 200 H_s^{1.5}$

Pond El.	843	844	845	845.6	846	847	848
H <sub>s</sub>	1	2	3	3.6	4	5	6
Q <sub>s</sub>	200	570	1040	1370	1600	2240	2940

B - Southerly Outlet Pipe

Size 60" φ, Gate on entr. face of pipe, Distr. E eleu 834.9

$H_p = \frac{V_p^2}{2g} (2) [\text{ent. + exit + frict.}] \therefore Q_p = 19.6 V_p = 19.6 (5.67) H_p^{1/2} = 111.2 H_p^{1/2}$

Pond El.	843	844	845	845.6	846	847	848	848.5
H <sub>p</sub>	8.1	9.1	10.1	10.7	11.1	12.1	13.1	6.6
Q <sub>p</sub>	320	340	350	360	370	390	400	285

C - Crest Flow

Use  $q_c = 2.55 (H_c)^{1.5}$  [Ref.: V.T. Chow "Op. Chan Hydi" p. 52-53]

Lengths: 400' @ 845.6 for Q<sub>1</sub> = 1020 (H<sub>c1</sub>)<sup>1.5</sup>  
 170' @ 846.7 ± for Q<sub>2</sub> = 433.5 (H<sub>c2</sub>)<sup>1.5</sup>

Pond El.	846	847	848
Q <sub>1</sub>	260	1690	3790
Q <sub>2</sub>	—	70	640
Tot. Q <sub>c</sub>	260	1760	4430

D - Time to lower Pd from 842 to 841 using southerly outlet -

Time =  $\frac{320(43560)}{285(3600)} = 13.8 \text{ hours}$

Note: Central outlet pipe not presently operative.

I) Test Flood, Storage & Storage Functions

1- Total Drainage Area - 4.49 mi<sup>2</sup>

2- Pond(s) Area: 0.51 mi<sup>2</sup>  
 Swamp(s) Area: .07 + .04 + 0.27 + .04 + .03 = 0.45  
 Total Area Pond(s) & Swamp(s): 0.96 mi<sup>2</sup>

% Ponds & Swamps =  $\frac{0.96}{4.49} = 21\%$

3-  $\frac{1075 - 842}{15600} = .0149$  } Say Ave Slope = 1.5%

4- Using C of E Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be slightly above "Flat & Coastal" and taken at "950 c.f.s./mi"  
 Size Class: Interm.; Hazard Pot.: HIGH; Spill. Des. Flood: Full PMF  
 Use: Test Flood = Full PMF

5- Test Flood Inflow = (950) 4.49 = 4300 c.f.s.

6- Pond Storage

The pond area is 0.51 sq. mi. at elev. 842  
 Based on a const. area, storage increases at 326 ac. feet per foot of depth increase.  
 At pond elev. 846, 1304 ac. ft is stored above the spillway crest

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

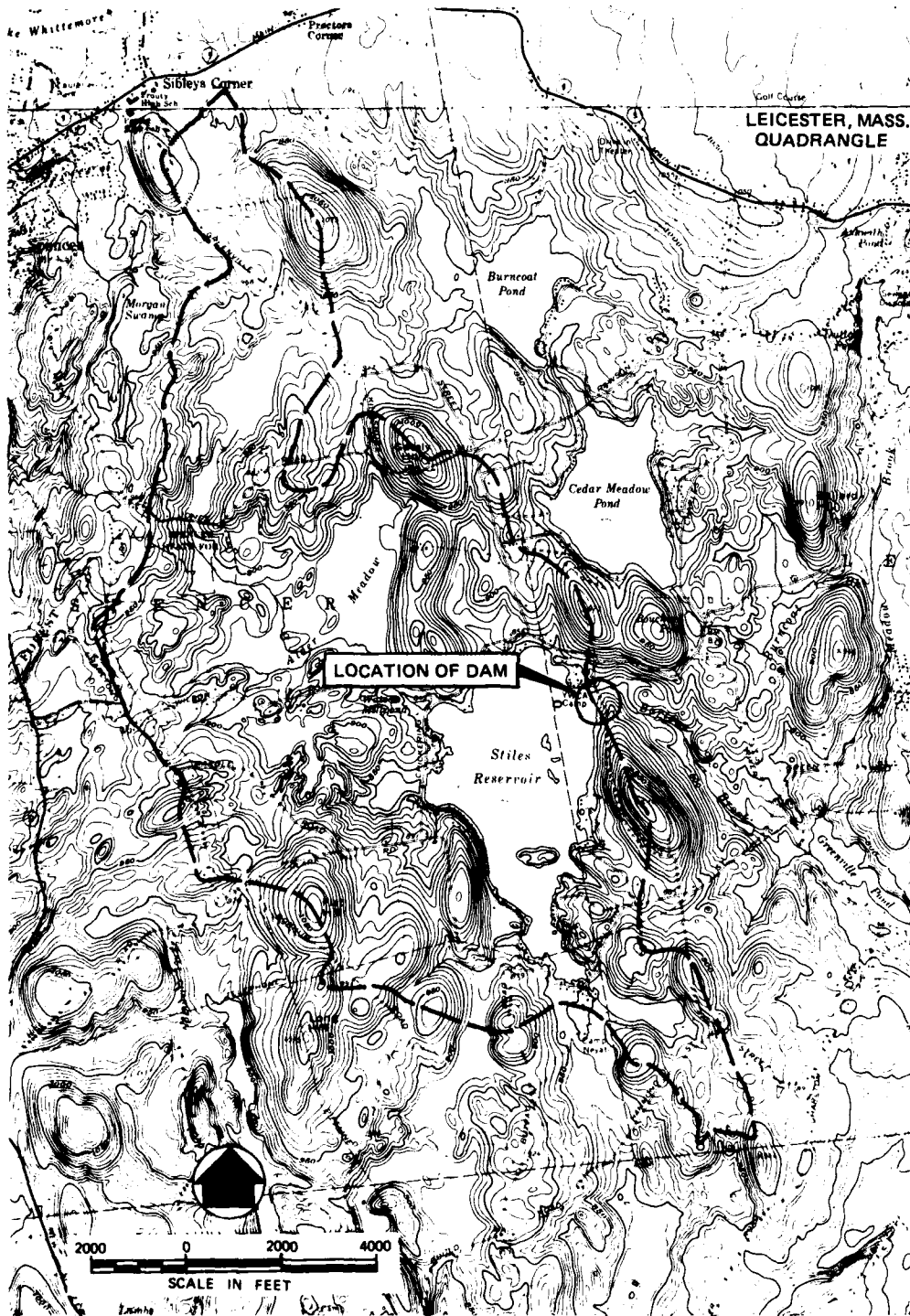
$S_{out}$  = Storage Vol. in Reservoir related to final  $Q_{out}$  in terms of inches of rain over the drainage area.

$S$  (in Inches) =  $12 D (\frac{0.51}{4.49}) = 1.36 D$ ;  $R$  = 6hr rain of 1" per hr

$D$  = Storage Depth (above spillway) on reservoir, in feet

8- Storage Functions: ( $F_{TF}$ );  $D = 0$  @ Pond El. 842

$F_{TF} = 4300 - 226 S = 4300 - 308 D$



**FIG. D-1 DRAINAGE AREA MAP – STILES RESERVOIR**

APPENDIX D  
HYDROLOGIC AND HYDRAULIC  
COMPUTATIONS

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

STILES RESERVOIR DAM



**NO. 5 VIEW OF DISCHARGE AT OUTLET PIPE**



**NO. 6 VIEW OF DISCHARGE IN VICINITY OF OUTLET PIPE**

STILES RESERVOIR DAM



**NO. 3 VIEW OF GATED DISCHARGE PIPE AT SPILLWAY**



**NO. 4 VIEW OF DOWNSTREAM SIDE OF SLUICE GATE AT SPILLWAY**

STILES RESERVOIR DAM



**NO. 1 VIEW OF SPILLWAY FROM DOWNSTREAM AREA**



**NO. 2 VIEW OF UPSTREAM SLOPE**

STILES RESERVOIR DAM

APPENDIX C  
PHOTOGRAPHS

STILES RESERVOIR DAM

Raymond E. Shea  
Re: Inspection of Dams


July 18, 1977

- 2 -

Enclosed are the necessary applications which should be filled out by the Registered Professional Civil Engineer retained by you and returned to this office.

Should you need additional information do not hesitate to contact this office.

Very truly yours,

  
JOHN J. HANNON, P.E.  
CHIEF ENGINEER

  
McC:eh

STILES RESERVOIR DAM

B-29



*The Commonwealth of Massachusetts*

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS  
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGR.  
DIVISION OF WATERWAYS

*100 Nashua Street, Boston 02114*

July 18, 1977

Mr. Raymond E. Shea  
Central New England Realty Trust  
44 Park Ave.  
Worcester, Mass.

Re: Inspection Dams #3-14-151-07-Stiles Reservoir Dam  
~~#3-14-151-08-Cedar Meadow Pond Dam~~  
#3-14-151-09-Burncoat Pond Dam  
Leicester

Dear Sir:

Our records indicate the ownership of the above mentioned dams has changed from Charlton Woolen Mills Inc. to Central New England Realty Trust. If this information is incorrect would you please notify this office.

Each of the above mentioned dams was visually inspected in July & August of 1976. All three dams were rated as only conditionally safe as the result of the inspections. In all three cases the owner (Charlton Woolen Mills Inc.) was notified of this rating, and was sent an "Application for Authorization to Construct or Alter a Reservoir, Reservoir Dam or Mill Dams" to be filled out by a Registered Professional Civil Engineer and returned to this office, we have received no response to this request.

On June 17, 1977 another visual inspection of the three dams in question was made, the conclusions were substantially similar to those derived from the previous inspections. Some indication of routine maintenance was evident but repairs requiring a much more detailed study and analysis appears to be warranted.

Therefore an in depth inspection by a Registered Professional Civil Engineer to make proper recommendations for corrective action is imperative. Please notify this office when you have retained a Registered Professional Civil Engineer.

DEPA

Spencer  
Leicester

Willow-Jericho  
Road

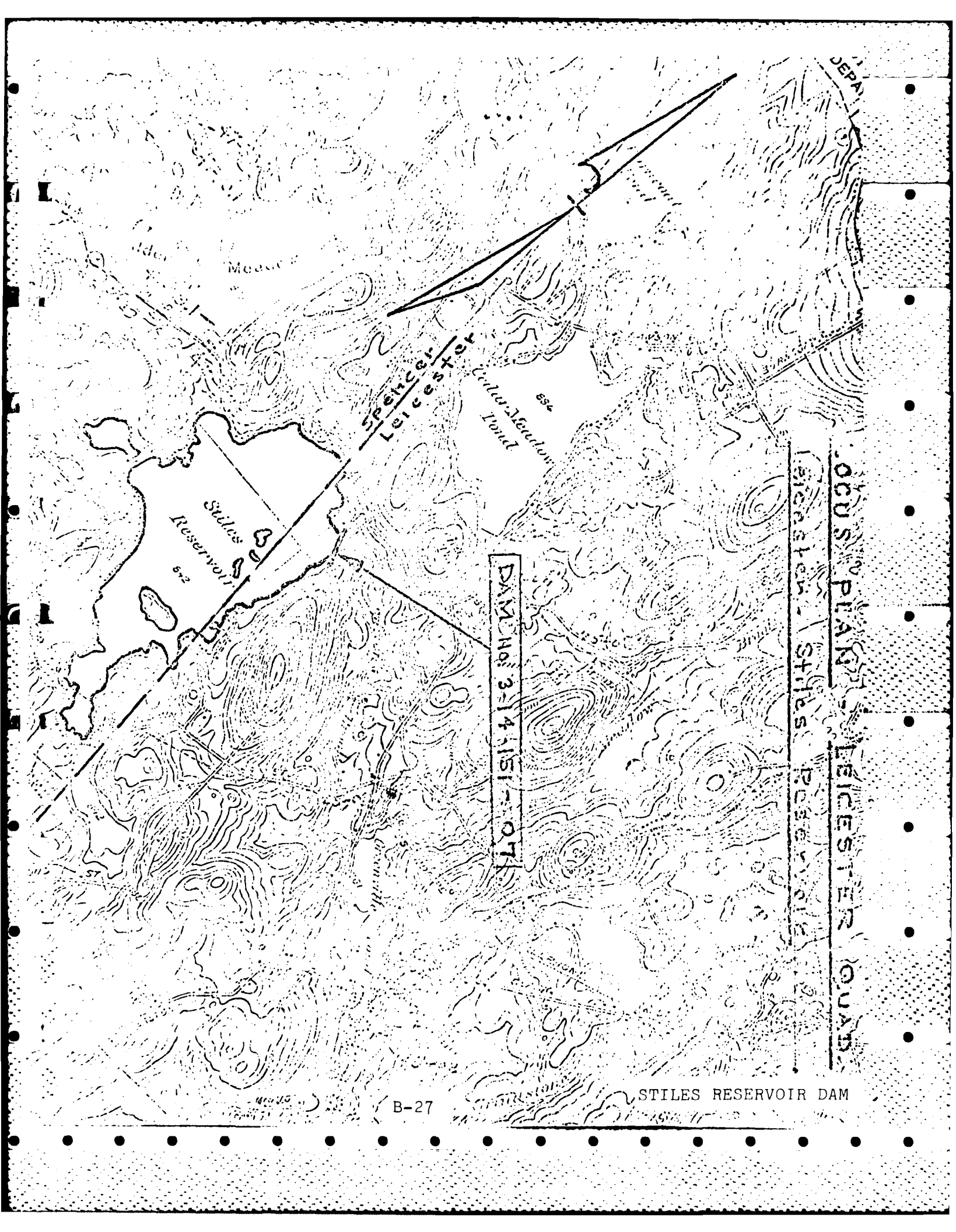
Stiles  
Reservoir

DAM No. 3-14-151-07

Stiles Reservoir  
Leicester Road

STILES RESERVOIR DAM

B-27



## 10. Risk to life and property in event of complete failure.

See Note  
Below

No. of people \_\_\_\_\_.

No. of homes \_\_\_\_\_.

No. of Businesses \_\_\_\_\_.

No. of industries \_\_\_\_\_ Type \_\_\_\_\_.

No. of utilities \_\_\_\_\_ Type \_\_\_\_\_.

Railroads \_\_\_\_\_.

Other dams \_\_\_\_\_.

Other \_\_\_\_\_.

11. Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet.

12. How to Locate: *V.I.B. ON RTE. ~~56~~<sup>20</sup> (CHARLTON), TURN Rt. onto Rte 56. Head Northerly for*

Note(10): *failure discharge passes several MAIN Roads (including MASS TURNPIKE) & through 3 Well Populated Areas (Rosedale, Cumminsville, North Oxford) before reaching storage in Cedar SWAMP ≈ 5 mi. downstream. Severe Property damage is certain & loss of life could easily occur.*

Ⓜ Failure of Dam

Peak Failure Flow:

Pond Elevation - 845.6 (L.P. on Crest)  
 Toe Elevation - 820.0± (Slightly above outlet pipe)  
 $Y_0 = 25.6$

Dam Length Subject to Breaching = 400  
 $W_0 = 40\%(400) = 160$

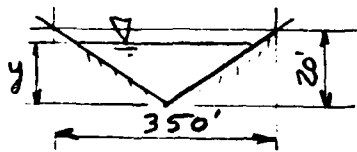
$Q_{P_1} = 1.68 W_0 (Y_0)^{1.5} = 1.68 (160) (25.6)^{1.5} = 34800 \text{ cfs}$

$Q_{P_2} = 1.68 (160) (25.6) =$

Storage Volume Released:

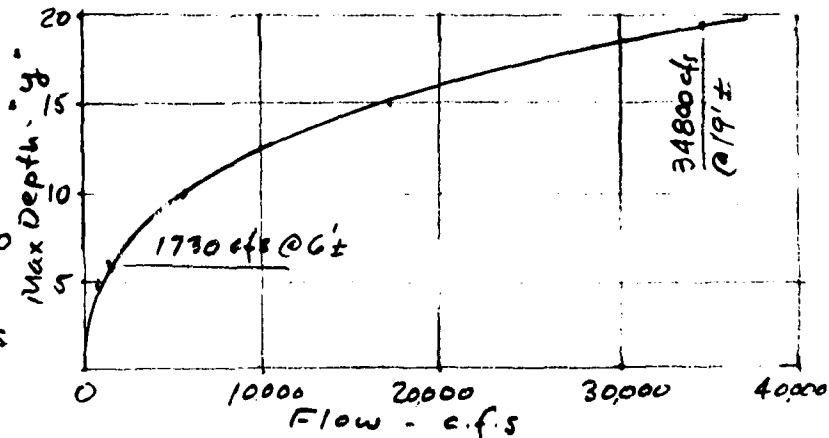
Storage Above Spillway  $3.6 \times 326 = 1174 \text{ ac. ft.}$   
 Storage Below Spillway  $326 \times \frac{1}{3} \times 22 = 2390 \text{ " "}$   
 $S = \text{Total Storage} = 3564 \text{ " "}$

Channel Hydraulics:



$S = \frac{30}{2000}$ ;  $n = 0.08$ ,  $R \approx \frac{1}{2} y$   
 $V = 2.28 R^{2/3} = 1.44 y^{2/3}$ ,  $A = \frac{1}{2} (17.5) y^2$

y	A	V	Q
5'	219	4.25	920
10'	875	6.7	5840
15'	1970	8.7	17200
20'	3500	10.6	37100



Trial  $Q_{P_2} = 34800 (1 - \frac{638}{3564}) = 28570$   
 $y_2 \approx 18'$

Final  $y = 18.5'$ ,  $Q_{P_2} = 30,000 \text{ cfs}$   
 Vel. = 10 fps

Time to Drain:

$\frac{43560 (3564)}{3600 (\frac{1}{2}) (34800)} = 2.5 \text{ Hours, or 149 minutes}$

APPENDIX E  
INFORMATION AS CONTAINED IN THE  
NATIONAL INVENTORY OF DAMS

STILES RESERVOIR DAM



**END**

**FILMED**

8-85

**DTIC**