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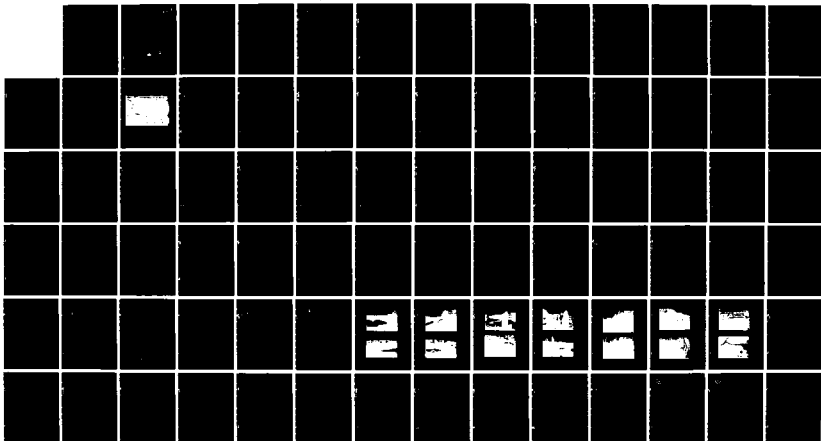
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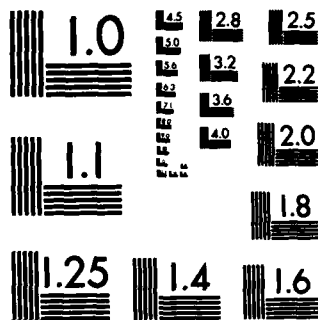
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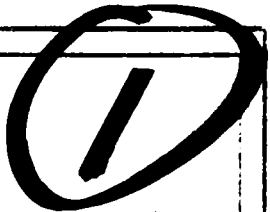
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THAMES RIVER BASIN
GRISWOLD, CONNECTICUT

AD-A144 664

STONE HILL RESERVOIR DAM
CT 00436

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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4. TITLE (and Subtitle) Stone Hill Reservoir Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
		6. PERFORMING ORG. REPORT NUMBER
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9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Thames River Basin Griswold, Connecticut		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Stone Hill Reservoir Dam is an earth dam. It has a maximum height of 21 feet and is approximately 500 feet in length. Based upon the visual inspection at the site and the lack of engineering, operational and maintenance data, there are areas of concern which must be corrected to assure the long-term performance of this dam. The dam is considered to be in FAIR condition. The dam is classified as SMALL in size and a SIGNIFICANT hazard structure. The test flood outflow for this dam is equal to 1/2 the PMF.		



DEPARTMENT OF DEFENSE
 NEW ENGLAND DIVISION, CORPS OF ENGINEERS
 424 TRAFALGAR ROAD
 WALTHAM, MASSACHUSETTS 02154

REPLY TO
 ATTENTION OF:
 NEDED-E

AUG 15 1979

Jewett City Water Company
 45 Moulton Street
 Cambridge, Massachusetts 02138

Gentlemen:

Forwarded herewith for your information and use is a copy of the Phase I Inspection Report on the Stone Hill Reservoir Dam. This inspection was made under the authority of Public Law 92-367 by the firm of C-E Maguire, Inc., Providence, Rhode Island under the direction and supervision of the Corps of Engineers. Copies of the finished report have been forwarded to the Governor and the Department of Environmental Protection, the cooperating agency for the State of Connecticut.

Section 7 of the report contains an evaluation and recommendations. If you have any questions concerning this report, we suggest that you contact the Department of Environmental Protection first. Then, if there are further questions contact the Project Management Branch, Engineering Division of this office. We thank you for your cooperation and assistance in carrying out this program.

Sincerely yours,

Joe B. Fryar

JOE B. FRYAR
 Chief, Engineering Division

Incl
 As stated

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ARMY
CORPS OF ENGINEERS
ROAD
MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED-E

AUG 15 1979

Mr. Stanley J. Pac, Commissioner
Department of Environmental Protection
State of Connecticut
Hartford, Connecticut 06115

Dear Commissioner Pac:

Forwarded herewith for your information and use is a copy of the Phase I Inspection Report on Stone Hill Reservoir Dam. This inspection was performed in accordance with Public Law 92-367 under the direction of the Corps of Engineers. Copies of the finished report have been forwarded to the Governor and the owner. We thank you for your cooperation and assistance in carrying out this program and hope this report will help you to develop an effective dam safety program.

Sincerely yours,

A handwritten signature in cursive script that reads "Joe B. Fryar".

JOE B. FRYAR
Chief, Engineering Division

Incl
As stated

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



REPLY
ATTENTION

NEDED

AUG 15 1979

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

Dear Governor Grasso:

I am forwarding to you a copy of the Stone Hill 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 Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Jewett City Water Company, 45 Moulton Street, Cambridge, Massachusetts 02138.

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

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

Sincerely yours,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

THAMES RIVER BASIN
GRISWOLD, CONNECTICUT

STONE HILL RESERVOIR DAM
CT 00436

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

Identification No.: CT 00436
Name of Dam: Stone Hill Reservoir Dam
Town: Griswold
County and State: New London County, Connecticut
Stream: Reservoir Brook
Date of Inspection: 7 December 1978

BRIEF ASSESSMENT

Stone Hill Reservoir Dam is an earth dam constructed about 1894 and is used as a water supply for Jewett City, Connecticut. The dam has a maximum height of 21 feet and is approximately 500 feet in length. The spillway structure is located on an excavated channel leading to the reservoir and permits flows to enter the impoundment at low stage and discharge from the reservoir at high stage. This spillway is located about 600 feet left of the left dam abutment. The outlet works for the dam consists of a control tower and wet well chamber and two 16 inch diameter conduits through the dam. One 16 inch diameter conduit is used to withdraw water for treatment and use in the distribution system and a second conduit discharges at the downstream toe of the dam. Due to its age, Stone Hill Reservoir Dam was neither designed nor constructed by present state-of-the-art procedures.

Based upon the visual inspection at the site and the lack of engineering, operational and maintenance data, there are areas of concern which must be corrected to assure the long-term performance of this dam. The dam is considered to be in FAIR condition. Deficiencies include trees growing on the dam embankment, the potential for overtopping due to the inadequate discharge capacity of the overflow spillway; the spillway approach, discharge channel, and the outlet channel downstream from the dam embankment require clearing of brush and trees; and a seepage monitoring program should be implemented.


The dam is classified as SMALL in size and a SIGNIFICANT hazard structure in accordance with the recommended guidelines established by the Corps of Engineers. The test flood outflow for this dam is equal to one-half the Probable Maximum Flood (PMF) or approximately 768 CFS (985 CSM) and would overtop the dam by about 0.36 feet; therefore, the existing spillway capacity is considered to be inadequate. The maximum spillway discharge of 410 CFS represents only 53 percent of the test flood outflow assuming no outlet conduit discharge. Overtopping could result in the failure of this earth embankment.

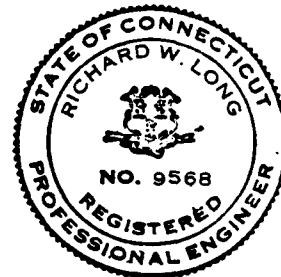
It is recommended that the Owner engage the services of an engineer experienced in the design of earth dams to accomplish the following: evaluate and design a monitoring system to collect and record the seepage flow; establish a procedure for removal of large trees and roots from the dam embankment; develop a plan of clearing vegetation from the downstream channel, spillway, spillway approach and discharge channels, and maintaining them free of vegetation, analyze the spillway requirements and commence corrective measures to reduce the overtopping potential and improve the discharge capacity of the dams; riprap the upper portion of the embankment.

Recommendations and remedial measures listed above and detailed in Section 7 should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

C-E MAGUIRE, INC.

BY:


Richard W. Long, P.E.
Vice President



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

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

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

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 reasonable possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

	<u>Page</u>
LETTER OF TRANSMITTAL	
BRIEF ASSESSMENT	
REVIEW BOARD PAGE	
PREFACE	i
TABLE OF CONTENTS	ii
OVERVIEW PHOTO	vi
LOCATION MAP	vii

REPORT

SECTION 1 - PROJECT INFORMATION

1.1 General	1
a. Authority	
b. Purpose of Inspection	
1.2 Description of Project	1
a. Location	
b. Description of Dam and Appurtenances	
c. Size Classification	
d. Hazard Classification	
e. Ownership	
f. Operator	
g. Purpose of Dam	
h. Design and Construction History	
i. Normal Operating Procedures	
1.3 Pertinent Data	3
a. Drainage Area	
b. Discharge at Dam Site	

- c. Elevations
- d. Reservoir Length
- e. Storage
- f. Reservoir Surface Areas
- g. Dam
- h. Diversion and Regulating Tunnel
- i. Spillway
- j. Regulating Outlet

SECTION 2 - ENGINEERING DATA

- 2.1 Design Data 8
- 2.2 Construction Data 8
- 2.3 Operation Data 8
- 2.4 Evaluation of Data 8
 - a. Availability
 - b. Adequacy
 - c. Validity

SECTION 3 - VISUAL INSPECTION

- 3.1 Findings 9
 - a. General
 - b. Dam
 - c. Appurtenant Structures
 - d. Reservoir Area
 - e. Downstream Channel
- 3.2 Evaluation 13

SECTION 4 - OPERATIONAL PROCEDURES

- 4.1 Procedures 14
- 4.2 Maintenance of Dam 14
- 4.3 Maintenance of Operating Facilities 14

	<u>Page</u>
4.4 Description of any Warning System in Effect	14
4.5 Evaluation	14
SECTION 5 - HYDRAULIC/HYDROLOGIC	
5.1 Evaluation of Features	16
a. General	
b. Design Data	
c. Experience Data	
d. Visual Observations	
e. Test Flood Analysis	
f. Dam Failure Analysis	
SECTION 6 - STRUCTURAL STABILITY	
6.1 Evaluation of Structural Stability	20
a. Visual Observations	
b. Design and Construction Data	
c. Operating Records	
d. Post-Construction Changes	
e. Seismic Stability	
SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES	
7.1 Dam Assessment	21
a. Condition	
b. Adequacy of Information	
c. Urgency	
d. Need for Additional Investigation	
7.2 Recommendations	22
7.3 Remedial Measures	22
a. Operation and Maintenance Procedures	
7.4 Alternatives	23

APPENDICES

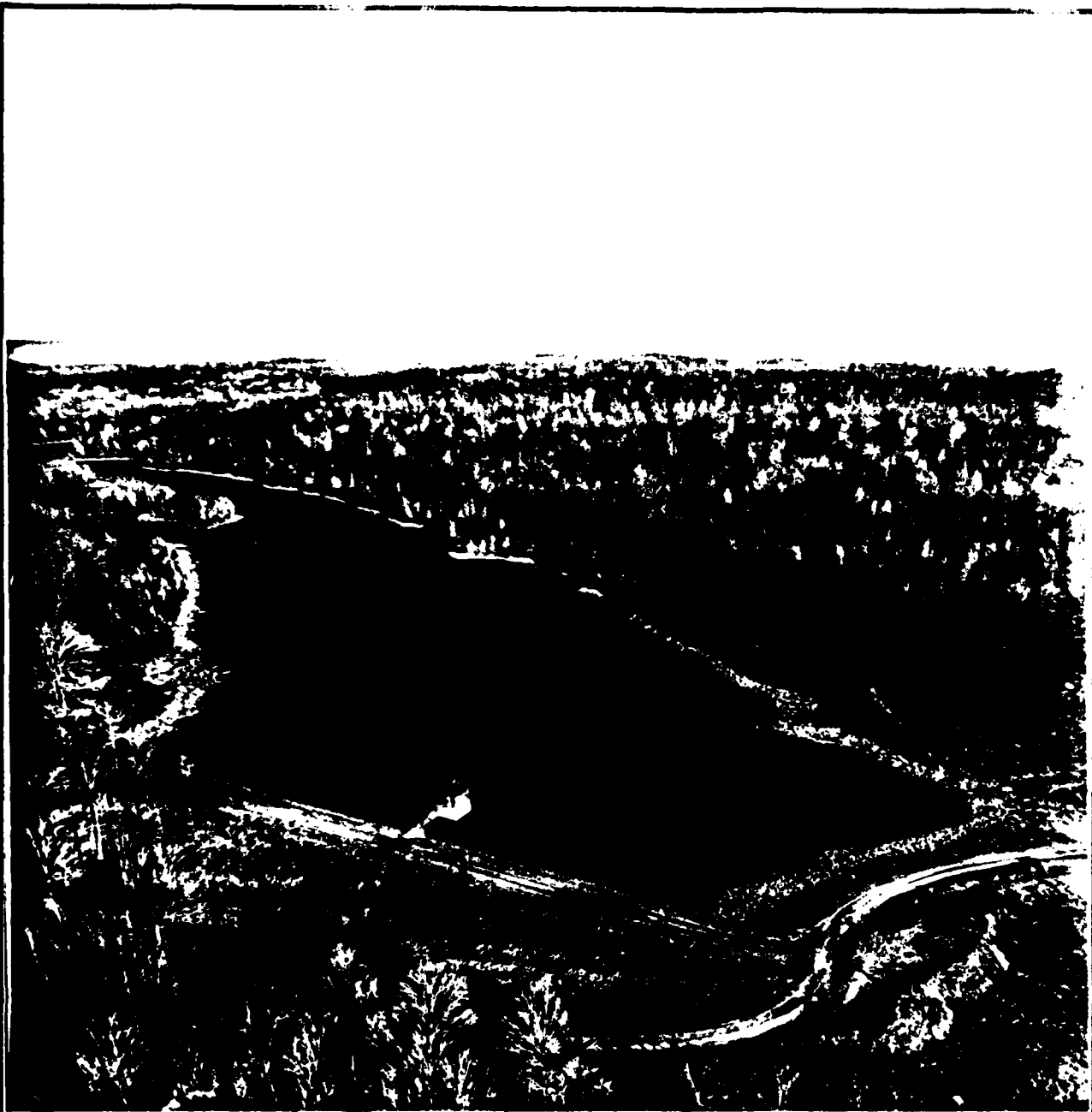
APPENDIX A - Inspection Check List

APPENDIX B - Engineering Data

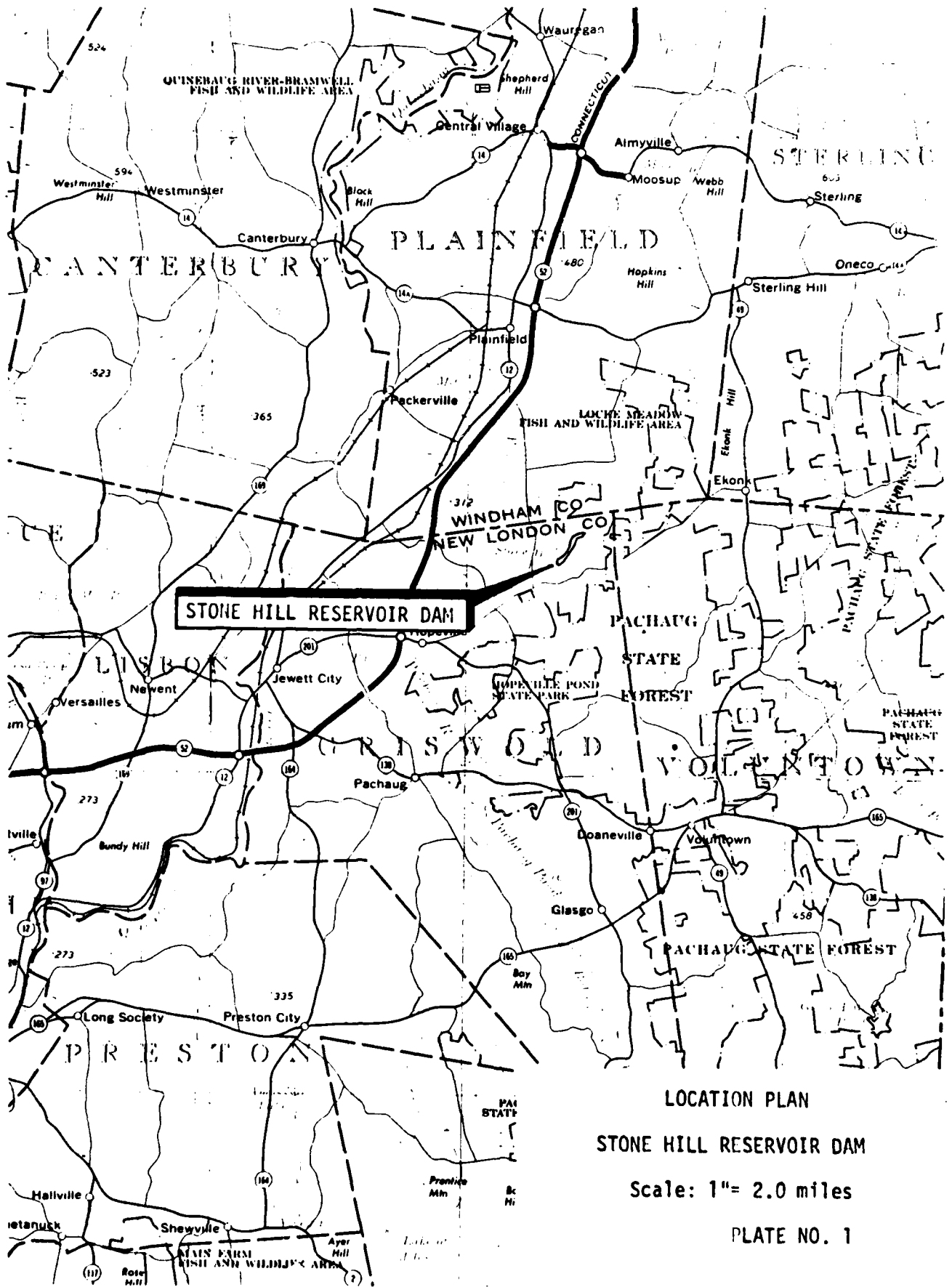
APPENDIX C - Photographs

APPENDIX D - Hydrologic and Hydraulic
Computations

APPENDIX E - Information as contained in the National
Inventory of Dams



OVERVIEW PHOTO - STONE HILL RESERVOIR DAM



STONE HILL RESERVOIR DAM

LOCATION PLAN
 STONE HILL RESERVOIR DAM
 Scale: 1" = 2.0 miles
 PLATE NO. 1

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

NAME OF DAM: STONE HILL 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. C-E Maguire, Inc., has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to C-E Maguire, Inc., under a letter from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0015 has been assigned by the Corps of Engineers for this work.
- b. Purpose of Inspection
 1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
 2. Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
 3. To update, verify and complete the National Inventory of Dams.

1.2 Description of the Project

- a. Location. Stone Hill Reservoir Dam is located in the Town of Griswold, New London County, Connecticut (See Plate No. 1). The reservoir is located approximately two miles east of the intersection of Route 52 and 201 along Route 201 and lies in the northeast corner of the Town of Griswold. The dam impounds water from Reservoir Brook which drains a

0.78 square mile watershed of rolling terrain. The reservoir has a total surface area of 26 acres. The impoundment is aligned in a northeast-southwest axis, with the dam located at the southwest extremity.

- b. Description of Dam and Appurtenances. The Dam at Stone Hill Reservoir is approximately 500 feet in length and is an earth embankment that is 21 feet high with a crest width of about 16 feet. The typical slope upstream is about 1V on 2.5H and downstream 1V on 2H. An unpaved roadway traverses the crest of the embankment over the length of the dam. A concrete spillway is located several hundred feet left of the left abutment of the dam. The spillway is on a stream which normally fills the reservoir at low stages and empties the reservoir at high stages. The outlet control structure consists of a gatehouse with a stone masonry wet well foundation and timber superstructure. The superstructure houses control gates on three cast iron conduits, which pass through the dam embankment. There are also gated high and low level intakes which admit water from the reservoir to the wet well of the gatehouse. The invert elevations of the intakes is unknown. All gates are manually operated.

A small water treatment building is located just below the toe of the dam. This facility contains metering and chlorination equipment.

Water is normally withdrawn from Stone Hill Reservoir through a 16-inch diameter cast iron pipe into the Jewett City water distribution system. When the reservoir stage is high, flows will discharge over the spillway weir into Reservoir Brook below the dam. Water may also be released through a second 16-inch diameter cast iron pipe outlet conduit which discharges near the toe of the dam. A 4 inch diameter conduit from the gatehouse is used as a by-pass to allow maintenance on the 16 inch pipeline to the system.

- c. Size Classification. With the pool level at the top of the dam the impoundment capacity is 380 Ac-Ft. With the pool level at the top of the dam the dam's height is 36 feet. The dam is therefore classified as a SMALL structure in accordance with the recommended guidelines of the Corps of Engineers.
- d. Hazard Classification. The dam is classified as having a SIGNIFICANT hazard potential because it is located in a

rural area where the failure discharge can cause damage due to high velocity, impact from debris and flooding to homes (3), roads (Sullivan Road) and public utilities (adjacent to the secondary roads). Loss of this surface water supply will cause a health and economic impact on Jewett City. The estimated water depths due to the possible dam failure discharge of 36290 cfs may range from 24.0 feet at the dam to 5.0 feet at a distance of 7500 feet downstream.

- e. Ownership. The Stone Hill Reservoir Dam is owned by the Jewett City Water Company, 45 Moulton Street, Cambridge, Massachusetts.
- f. Operator. Operating personnel are under the direction of:

Mr. Raymond Archibald
Jewett City Water Company
57 Slater Avenue
Jewett City, Connecticut 06351
(203) 376-2963
- g. Purpose of Dam. The Dam at Stone Hill Reservoir impounds water from Reservoir Brook that is used as water supply for the Town of Griswold, Connecticut.
- h. Design and Construction History. The dam was reportedly constructed about 1894 by the Jewett City Water Company. No construction records are available regarding the history of construction, repair work or maintenance.
- i. Normal Operating Procedures. Water is released into the municipal distribution system through a 16-inch diameter cast iron conduit. The flow is metered and treated with chlorine in a treatment facility at the dam site.

Excess water in the reservoir passes over the spillway crest and into Reservoir Brook, or may be regulated by discharging water through the 16-inch diameter outlet works conduit which discharges at a headwall about 50 feet downstream from the dam. Normal operating procedures do not provide low flow releases to the stream below the dam.

1.3 Pertinent Data

- a. Drainage Area. Stone Hill Reservoir is located in New London County in eastern Connecticut. The basin is generally oval in shape with a length of approximately two

miles, a width of about 0.5 miles, and a total drainage area of 0.78 square miles (See Drainage Basin Map in Appendix D). The topography is generally steep with elevations ranging from a high of 587 feet (National Geodetic Vertical Datum) NGVD to 409 feet at the spillway crest. Basin slopes are steep to moderate with grades of 0.02 feet/foot to 0.4 feet/foot. The average time of concentration for the entire drainage basin is estimated to be 45 minutes, and is considered relatively small; resulting in the probability that all surface runoff will peak simultaneously at the reservoir site during a high intensity rainfall event. There are no storage areas in the watershed to dampen and delay the peak of the surface runoff.

- b. Discharge at Dam Site. Discharge records are maintained only for flow into the water distribution system. No records of spillway or outlet works discharges are available. Listed below are calculated discharge data for the spillway and outlet works:
1. Gated Outlet Works: 16-inch diameter cast iron conduit: upstream invert elevation 382.50.
 2. Gated Outlet to water distribution - 16-inch diameter cast iron conduit.
 3. Maximum Known Flood at Dam Site - Discharge unknown, Highest Reservoir Level approximately 410.1, January, 1978.
 4. Overflow spillway capacity @ top of Dam - 410 cfs at Elevation 411.5.
 5. Overflow spillway capacity at "Test Flood Level" - 768 cfs at Elevation 411.86.
 6. Gated outlet capacity at normal pool level - 36 cfs at Elevation 409 (spillway crest).
 7. Gated outlet capacity at maximum pool level - 38 cfs at Elevation 411.5.
 8. Total discharge capacity at "Top of Dam" - 448 cfs @ Elevation 411.5.
 9. Gated outlet capacity at test flood level - 38.5 cfs at Elevation 411.86.

10. Total outflow discharge capacity at "Test Flood Level"- 806 cfs @ Elevation 411.86.

c. Elevations (Feet above National Geodetic Vertical Datum, NGVD)

1. Streambed at centerline of dam -	Upstream - not observable Downstream - 375.5
1a. Streambed downstream of spillway	405.0
2. Maximum Tailwater	Unknown
3. Downstream Invert	382.46
4. Recreation Pool	N/A
5. Flood Control Pool	N/A
6. Spillway Crest	409.0
7. Top of Dam	411.5
8. Test Flood Level	411.86

d. Reservoir (Length in Feet)

1. Maximum Pool	3200
2. Recreation Pool	N/A
3. Flood Control Pool	N/A

e. Storage (Ac-Ft.)

1. Recreation Pool	N/A
2. Flood Control Pool	N/A
3. Test Flood Pool	370
4. Spillway Crest	315

5. Top of Dam (Elevation 411.5) 380
 6. Net storage between top of dam (Elevation 411.5) and spillway crest is 65 Ac.-Ft. and represents 1.56 inches of runoff from the drainage area of 0.78 square miles.
 7. One foot of surcharge storage equals 0.625 inches of runoff from the drainage area of 0.78 square miles.
- f. Reservoir Surface Areas (Acres)
1. Top of Dam 26
 2. Test Flood Pool 26
 3. Flood Control Pool N/A
 4. Normal Pool 26
 5. Spillway Crest 26
- g. Dam
1. Type Earth Embankment
 2. Length 500 feet
 3. Height 36 feet
 4. Top Width 16 feet
 5. Side Slopes Upstream 2.5H:1V
Downstream 2H:1V
 6. Zoning Unknown
 7. Impervious Core Unknown
 8. Cutoff Unknown
 9. Grout Curtain Unknown
- h. Diversion and Regulating Tunnel N/A
- i. Spillway

- | | | |
|----|------------------|---------------------------------------|
| 1. | Type | Overflow, broad crest, vertical fall. |
| 2. | Length of Weir | 16 feet |
| 3. | Crest Elevation | 409 (from USGS)
Topographic sheet) |
| 4. | Gates | Flashboards |
| 5. | U/S Channel | Natural bed |
| 6. | D/S Channel | Natural bed |
| 7. | Design Surcharge | Unknown |

j. Regulating Outlet

Refer to paragraph 1.2b
"Description of Dam and Appurtenances"
for description of outlet works.

- | | | |
|----|-------------------|--|
| 1. | Downstream Invert | 382.46 |
| 2. | Size | 16-inch diameter
cast iron pipe |
| 3. | Control mechanism | Manually operated
gate in gatehouse
upstream end of
outlet conduit. |

SECTION 2

ENGINEERING DATA

- 2.1 Design Data. No design data is available for this dam.
- 2.2 Construction Data. No record of construction is available for this dam.
- 2.3 Operation Data. Water surface records and charts of quantity of discharge to the Jewett City Water Lines are maintained at the Caretaker's house at the dam site.
- 2.4 Evaluation of Data.
 - a. Availability. There are no plans, specifications or computations available from the Owner, County, State or Federal Offices regarding the design, construction or any repairs or modifications to this dam.
 - b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance and sound engineering judgment.
 - c. Validity. The validity of the limited data must be verified.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

- a. General. As a result of the visual inspection, a review of the history and the general appearance, the dam at Stone Hill Reservoir and its appurtenances are judged to be in fair condition.

Most of the embankment consists of grassed surfaces, however, the right dam abutment is overgrown with many large trees, and unchecked erosion areas exist. The approach and discharge channels for the spillway are overgrown with vegetation and require maintenance. Seepage is emerging at several locations, riprap is sparse along the upstream slope of the dam embankment, trespass on the embankment is beginning to show wear and possible erosion.

The control mechanism for the inlet gates to the wet well of the gatehouse structure appeared to be in good working order. Flashboards are used to increase storage by raising the effective spillway crest. The service bridge leading to the gate structure needs painting but otherwise appeared to be in good condition.

A caretaker for the dam and treatment facility lives at the site.

- b. Dam. The dam is an earth embankment. No construction drawings are available, nor are the details of design known. Plans dated 1894 and 1895 show the existence of two additional dams located near the vicinity of the existing structure. It appears from the old plans that the location of the two previous dams did not coincide with the location of the present dam. It is not known whether these dams were removed. There is no record of any extensive repair work or renovations to the existing dam.

1. Crest. The crest of the dam is covered with grass, as shown in Photo C-3. The upstream edge of the crest lies at an elevation about six inches lower than the downstream edge. There are two five-inch deep ruts along the axis of the dam caused by vehicles trespassing across the crest. Along the downstream edge of the crest, there are two power

line poles. There is a slight settlement of the crest observed in the vicinity of station 3+50. Reference stationing is indicated on the Photo Index Sheet in Appendix C.

2. Upstream Slope. The upstream slope is partially covered with riprap as shown in Photos C-1,2, and in the sketches (Appendix B). The riprap ranges from six inches to three feet in size. The riprap is in good condition with only a few windows evident. No grass is growing on this section of the slope.

The gatehouse for the outlet works is located at station 2+80 on the upstream slope of the dam. A concrete foundation on the crest supports the access bridge to the gatehouse (Photo C-1, 2, 5). The area around the concrete foundation is covered with grass and riprap.

3. Downstream Slope. The downstream slope of the dam is covered with grass except in the area next to the right abutment where tree growth is abundant. Remnants of a sawmill are located downstream of the dam.

The limits of tree growth are from station 0+00 to 1+70, the downstream slope and trees range from three inches to approximately one foot in diameter (Photo C-3). At station 2+00, there is an apparent erosion channel about 20 feet wide. Downstream of the dam, this erosion channel is filled with cut bushes and small trees and joins the discharge channel from the 16-inch outlet pipe. Extensive brush had been cut on the downstream slope at the time of the visual inspection.

At station 2+30, downstream of the apparent erosion channel at the right abutment described above, water is flowing from beneath a large rock downstream from the toe (Photo C-13). The water is clear and contains no fines. This could possibly be some form of toe drain outlet. The channel downstream of the exit point is lined with large stones. It is not apparent whether the water originates from the reservoir or from the right abutment. At Sta 2+80, a path exists on the downstream slope which is a result of motorcycle and pedestrian traffic. The path extends from the crest to the toe of the dam.

There is a mound of soil and/or rock located approximately 75 feet downstream of the dam at station 2+80 (See sketch in Appendix B). The mound is clearly visible beyond the pickup truck in Photo C-4. The origin or purpose of this feature is unknown. The outlet works pipe from the gatehouse exits at the left of the knob. A small water treatment building is located downstream of the dam at station 3+00. At station 3+10, approximately 20 feet downstream from the toe of the dam, there is a 4-foot high and 30-foot long stone wall (Photo C-14).

At station 3+50, at the downstream toe of the dam, there is a wet area about 20 feet long which is an apparent zone of seepage. No flow of water was observed at the time of the inspection. At station 3+60, there is a depression approximately 75 feet downstream of the toe. This depression is about ten feet deep with its walls lined with large rocks up to three feet in diameter. The soil in the bottom of the ditch is wet and very soft to a depth of about 12 inches. Water emerges and begins flowing at a point farther downstream in this depression. It is not apparent whether the water is coming from the reservoir or through the left abutment.

The left abutment of the dam is located at station 5+00 where an unpaved roadway extends from the crest along the downstream slope to the small treatment building located approximately 100 feet downstream of the toe at station 3+00.

- c. Appurtenant Structures. The appurtenant structures for this dam are the overflow spillway, the gatehouse outlet works structure, and the treatment facility downstream of the dam.
 1. Overflow Spillway and Spillway Approach Channel. The approach channel to the overflow spillway is a stone-lined channel which exits from the southeast corner of the reservoir (Photo C-8). Inflow from a brook located southeast of the reservoir is diverted through this channel into the reservoir when the reservoir pool level is at a low stage (Photo C-9). At the time of the visual observation, water was flowing from the channel into the reservoir (Photo C-9). There is a stone masonry arched bridge over the channel about 50 feet downstream from the reser-

voir pool. The crest of the spillway is located about 500 feet downstream of the reservoir (Photo C-10). The crest consists of low stone wing walls and a concrete weir section oriented parallel to the stream channel. The spillway weir is 16 feet long and at Elev. 409.0. The spillway abutments and adjacent land areas are at approximate Elev. 411.50. It is estimated that flows exceeding 210 cfs will not be confined to the spillway weir section but will cause some overland flooding in this location. The channel downstream of the spillway crest is relatively steep with overhanging trees (Photo C-11) and joins the original stream (Reservoir Brook) approximately 600 feet downstream from the dam. The access road to the dam passes over the spillway discharge channel approximately 400 feet downstream of the spillway.

2. Outlet Works. The outlet works is located on the upstream slope of the dam and is a structure with a stone masonry wet well foundation with a timber superstructure which appears to be in good condition (See Photo C-5). The outlet works consist of two sixteen inch diameter cast iron outlet pipes and one 4 inch diameter outlet pipe which are controlled by manually operated vertical sluice gate mechanisms. One of the 16 inch pipes connects to the water treatment facility downstream of the dam while the other pipeline serves as the outlet works conduit, which discharges into a rock channel at the toe of the dam (See Photo C-6, 12). The 4 inch diameter conduit is used as a by-pass during periods of maintenance on the 16 inch diameter supply pipe. The gate mechanisms appear to be in good condition and the outlet conduit is reportedly operated once or twice a year. An additional gate is located on the outlet conduit. This gate appears to be in poor condition, inoperable and permanently fixed in the open position. (See Photo C-7). Trash screens are located at the outlet works in the control tower wet well and are cleaned periodically. No seepage was observed at the emergency outlet pipe.
3. Treatment Facility. A water treatment facility is a wooden structure located approximately 100 feet downstream from the toe of the dam.

- d. Reservoir Area. No specific detrimental features in the reservoir area were observed during the visual inspection. The slopes of the watershed are well-covered with growth to preclude sloughing of shoreline material (See overview photo).
- e. Downstream Channel. The downstream channel for the Stone Hill Reservoir Dam is a natural stream called Reservoir Brook. Directly below the dam, the channel is in rock and earth. The flow from the spillway discharge channel joins the brook approximately 600 feet downstream of the dam. The downstream channel is steeply sloped below the dam.

3.2 Evaluation. Based on the visual inspection, the overall condition of the dam appears to be fair but with several areas that require attention.

Trees and shrubs on the downstream slope of the embankment can create future seepage problems. The tree roots, if allowed to grow, provide seepage paths for water. Uprooting of large trees in storms can also cause serious "piping" problems by creating pathways through the embankments.

The visible seepage exiting downstream of the toe should be monitored regularly for the presence of fines as well as for changes in quantity.

Riprap is almost absent on the upper two to three feet of the upstream slope. This is where it is important to have a well-placed dense layer of riprap to protect the crest against wave action.

There are vehicle ruts on the crest and downstream slope of the dam which need attention so that they will not lead to erosion.

SECTION 4

OPERATIONAL PROCEDURES

- 4.1 Procedures. Stone Hill Reservoir is operated as a water supply for the Jewett City Water Company. The reservoir is normally maintained as full (to spillway crest elevation 409.00) to provide water for distribution to the the system. Excess water is wasted through the 16-inch outlet pipe at the base of the dam in the event of high reservoir stages. During summer months flashboards are also used to raise the pool level approximately 10 inches for additional storage. The gates are operated under the direction of Mr. Raymond Archibald of the Jewett City Water Company.
- 4.2 Maintenance of Dam. Maintenance of the dam has been limited to trimming the brush growth on the dam about once a year and painting of the gatehouse.
- 4.3 Maintenance of Operating Facilities. Operational checks of the 16-inch outlet valve other than for required water level adjustment, are not performed. In general, water level adjustment with the 16-inch outlet gate is required one or two times a year (storm runoff, excess spring runoff, etc.). No separate maintenance checks other than visual inspections are performed. The trash screens at the outlet works are cleaned daily.
- 4.4 Description of Any Warning System in Effect. Emergency action and/or warning would be coordinated through Mr. Raymond Archibald, Supervisor, Jewett City Water Company. There are no written emergency procedures or formal plans for lowering the pool level in anticipation of severe storms. Monitoring of the approach of intense storm activity is normally through the U.S. Weather Service, or local weather forecasts. In case of emergency, the State Police or local Civil Defense Agency would be notified.
- 4.5 Evaluation. A program of regular operational checks of the gate valves at the outlet works and treatment has not been developed or implemented. The high level and low level intake gates, the various valves on the 16-inch diameter feeder line and the shutoff valve at the exit of the 16-inch diameter outlet conduit have not been operated in recent history to insure that they are operational. The shut-off valve at the exit of the 16-inch outlet conduit pipe is badly rusted and inoperative.

In view of the overgrown condition of the right embankment, it is important that the Owner institute a program of tree and root removal and trimming of vegetative growth before the trees become excessively large.

Freeboard at the dam is only 2.5 feet when the water level is at spillway crest, and could be as little as 1.7 ft. if the water level was at the top of the flashboards. When wave action is considered, the lack of riprap up to the crest elevation creates a very great erosion danger. Riprap should, as a minimum, be redressed "to grade" on the entire upstream face of the dam and should extend to the top of dam.

An "Emergency Action Plan" should be prepared to prevent or minimize the impact of failure. This plan should list the expedient action to be taken and authorities to be contacted.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features.

- a. General. Stone Hill Reservoir Dam, constructed about 1894 by the Jewett City Water Company, is located on Reservoir Brook about 2 miles east of the intersection of Routes 52 and 201 in the Town of Griswold, Connecticut. The reservoir serves as the main surface water supply to the distribution system of Jewett City. The reservoir has a total storage capacity of 315 Ac-Ft. at spillway crest elevation 409.0 and can accommodate 7.56 inches of runoff from the drainage area of 0.78 square miles. Every foot of depth in the reservoir above spillway crest is equivalent to 0.625 inches of runoff from the basin. Because the total surcharge storage available is equal to 65 Ac-Ft., this dam is considered a small storage facility. Since the maximum spillway capacity of 410 cfs represents only 53.4 percent of the test flood discharge, this dam is also considered to be a high spillage project. The dam, being an earth embankment, is less stable to withstand overtopping.

- b. Design Data. No specific data is available for the watershed or structures of Stone Hill Reservoir Dam. In lieu of existing design information, U.S.G.S. Topographic Maps (Scale 1" = 2000') were utilized to develop hydrologic parameters such as drainage areas, reservoir surface areas, basin slopes, time of concentration, and other runoff characteristics. Elevation - storage relationships for the reservoir were approximated. Surcharge was computed assuming that the surface area remained constant above the spillway crest. Some of the pertinent hydraulic design data was obtained and/or confirmed by actual field measurements at the time of visual field inspection.

Outflow values (routing procedures) and dam failure profiles were computed in accordance with the guidelines developed by the Corps of Engineers. Final values as detailed in this report are quite approximate and are no substitute for actual detail analysis.

- c. Experience Data. No historical data for recorded discharges or water surface elevations is available for this dam or the watershed.

d. Visual Observations.

1. Freeboard at the dam is minimal (2.5 ft. at spillway crest elevation assuming stillwater conditions) and has very little allowance for wave action.
2. Riprap is lacking along the upper part of the upstream slope of the embankment.
3. Flashboard controls on the spillway crest are in poor condition and subject to vandalism.
4. The stone arch bridge on the approach channel to the spillway weir from the reservoir will not act as a control structure because overtopping of the dam will occur prior to the bridge constricting flows. See General Plan, Appendix B.

e. Test Flood Analysis. Recommended guidelines for the Safety Inspection of Dams by the Corps of Engineers were used for the selection of the "Test Flood." The dam at Stone Hill Reservoir was classified as small in size, having a storage capacity of 380 Ac-Ft. at the top of the dam and a height of 36 feet. It was also classified as a significant hazard structure based on the potential damage outlined in Section 1.2d. Guidelines indicate that a range from one half the Probable Maximum Flood (PMF) to the 100-year frequency storm be used as the test flood. The watershed has a total drainage area of 0.78 square miles, of which a negligible area is swampy. The average basin slope is 0.02 - 0.04 feet/feet, and is considered steep to moderate, with rolling terrain. A "test flood" equal to the one half of the PMF was calculated to be 1,000 CSM, or 780 CFS for this drainage area. Outflow discharges were also developed using criteria of the Corps of Engineers. The outflow discharge for the test flood inflow was equal to 768 CFS. Additional design data developed for this investigation is listed in tabular form at the end of this section.

The spillway capacity is hydraulically inadequate to pass the "test flood" (1/2 PMF). This test flood would overtop the dam approximately 0.36 feet. The inflow and outflow discharge values for this test flood are 780 CFS and 768 CFS, respectively. The maximum outflow capacity of the spillway in a still reservoir condition without overtopping the dam is 410 CFS, which represents 53 percent of the test flood overtopping discharge. A spillway and

outlet rating curve are included in Appendix D of this report.

At the spillway crest elevation of 409.0 (NGVD), the capacity of the outlet structure is equal to 36 CFS. It will require approximately eight hours to lower the reservoir level one foot assuming a pool surface area of 26 acres.

- f. Dam Failure Analysis. Applying the calculated dam failure discharge of 36,290 CFS when the impounded water level in the reservoir is at the top of the dam will produce an approximate water surface elevation of 400.0 immediately downstream from the dam. Normal uniform flow, based on Manning's formulae will occur approximately 7500 feet downstream from the dam when the depth of flow will equal 5.0 feet. Depths of flow will range from 24.0 feet at the dam to 5.0 feet at a distance of 7,500 feet below the dam. The dam is classified as a significant hazard structure because it is located in a predominantly rural area where the failure discharge can cause damage due to high velocity, impact from debris and flooding to homes (3), roadways (Sullivan Road) and utilities adjacent to Sullivan Road. In addition, loss of this water supply will cause a severe health and economic impact on Jewett City. Water surface elevations due to failure of the dam are computed and are listed in Appendix D.

STONE HILL RESERVOIR DAM

Inflow, Outflow and Surcharge Data

FREQUENCY IN YEARS	24-HOUR TOTAL RAINFALL IN INCHES	24-HOUR* EFFECTIVE RAINFALL IN INCHES	MAXIMUM INFLOW IN C.F.S.	MAXIMUM** OUTFLOW IN C.F.S.	SURCHARGE HEIGHT IN FEET	SURCHARGE STORAGE ELEVATION
10	5.0	2.6	214	142	1.70	410.70
50	6.5	4.1	336	261	2.20	411.20
100	7.0	4.6	380	300	2.40	411.40
1/2 PMF	11.9	9.5	780	768	2.86	411.86

= Test Flood

*Infiltration assumed as 0.1"/hour.

**Lake assumed initially full at spillway crest elevation 409.0
(top of dam = 411.50)

NOTES:

1. Q_{10} ; Q_{50} ; Q_{100} ; inflow discharges were computed by the approximate methodology of the Soil Conservation Service.
2. 1/2 PMF and the "test flood" computation based on COE instructions and guidelines.
3. The maximum capacity of the spillway without overtopping the dam elevation (411.50) is equal to 410 C.F.S.
4. Surcharge storage is allowed to overtop the dam when exceeding the spillway capacity.
5. Test flood = one half PMF = 1000 CSM = 780 CFS
(D.A. = 0.78 square miles.)

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

- a. Visual Observations. The visual inspection did not disclose any immediate stability problems.
- b. Design and Construction Data. There is no design and construction data available to permit a formal evaluation of the stability of the dam. There is, for example, no information concerning zoning materials, if any, in the earth dam.
- c. Operating Records. Reportedly, the water level in the pond rises to within one foot of the crest of the dam during large storms. When the water rises to this level, the Owner opens the outlet works gate valve in the gatehouse to lower the level.
- d. Post-Construction Changes. Two power line poles were installed on the downstream edge of the crest of the dam to bring power to the control tower structure.
- e. Seismic Stability. The Stone Hill Reservoir Dam is in Seismic Zone I and therefore does not require evaluation for seismic stability according to the Corps of Engineers Recommended Guidelines.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment.

- a. Condition. The visual inspection indicated that the Stone Hill Reservoir Dam is in FAIR condition. The major concerns regarding the long-term performance of this dam include:
1. Tree growth on the downstream slope of the embankment near the right abutment.
 2. Seepage emerging at various locations downstream of the embankment.
 3. Overtopping of the dam by the test flood flows as well as storms of lesser magnitude.
 4. Lack of complete riprap coverage on the upstream slope.
 5. The spillway approach channel is overgrown with vegetation.
 6. The use of spillway flashboards, which could raise the water level to within 1.5 feet of the dam crest and infringe on an existing minimal freeboard allowance.
- b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data; but is based primarily on the visual inspection, past performance history and sound engineering judgment.
- c. Urgency. The recommendations and remedial measures described below should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.
- d. Need For Additional Investigation. No data was recovered for this inspection that indicates that formal engineering analyses were ever performed for this dam. The visual inspection and operational history indicate that attention should be given to the collection of current data in order that the recommendations listed below may be implemented.

7.2 Recommendations. The Owner should engage the services of an engineer experienced in the design of earth dams to accomplish the following:

- a. Further hydrologic studies are required to determine what alternative measures are necessary to significantly improve the discharge capabilities at the dam, reduce the overtopping potential and provide adequate freeboard allowances.
- b. Develop a program for monitoring of the seepage observed along the downstream toe of the dam. Monitoring should include a photographic record and should evaluate the turbidity of the water and provide a method to determine whether substantial changes in the volume or size of suspect areas occurs. Presence of suspended solids in the water or substantial changes in flow not related to changes in reservoir level should be considered as indications of a critical condition.
- c. Trees and brush on the downstream slope should be trimmed. The stumps of the trees should be removed only after a procedure has been developed by a competent engineer for proper backfill and compaction. In addition, an area below the toe of the dam of at least 30 feet should be cleared and maintained.
- d. The riprap protection on the upstream slope should be restored and new stone armor placed up to the top of the dam.
- e. Evaluate the condition of spillway surfaces, structural condition and the procedure for installation of flashboards.
- f. A topographic survey of the dam and its appurtenances should be made that will result in drawings of the existing facility to be used in the monitoring and maintenance program and also to serve as a record for the Owner.

7.3 Remedial Measures.

a. Operating and Maintenance Procedures

1. Trees and brush on the downstream slope of the dam should be removed and the excavations backfilled with suitable material. Grass should be planted in these disturbed areas to protect the embankment from erosion.

2. The vehicle ruts on the crest and downstream slope of the dam should be backfilled with suitable material. Grass should be planted in these areas.
3. Provisions should be taken to prevent trespassing on the crest and along the downstream slope. Vehicle traffic on the crest of the dam should not be allowed unless a paved or other suitable surface is installed.
4. Emergency procedures consisting of an operations plan and warning system for downstream residents should be developed and implemented.
5. Discontinue the use of spillway flashboards since this constitutes a serious encroachment of the water level on the available freeboard.
6. Paint and maintain the service bridge. Include in the regular maintenance program operational checks of all valves.
7. Continue technical inspections of this facility on an annual basis.
8. Develop a system for the recording of data with regard to items such as: water levels, discharges, time and drawdown, to assist those responsible for the monitoring and operation of the structure.
9. Implement and institute a program of regular clearing of the spillway approach and discharge channels and the discharge channel below the outlet structure.

7.4 Alternatives

None

APPENDIX A
INSPECTION CHECK LIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Stone Hill Reservoir Dam DATE December 7, 1978
 TIME AM
 WEATHER Partly cloudy
 W.S.ELEV. _____ U.S. _____ D.S. _____

PARTY:

- | | |
|---|---|
| 1. <u>R. Brown</u> | 6. <u>C. Davis, Jewett City Water Co. and dam caretaker</u> |
| 2. <u>D. Sluter</u> | 7. <u>A. Reed</u> |
| 3. <u>R. Murdock</u> | 8. _____ |
| 4. <u>S. Whiteside</u> | 9. _____ |
| 5. <u>R. Archibald, Jewett City Water Co.</u> | _____ |

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

PERIODIC INSPECTION CHECK LIST

PROJECT Stone Hill Reservoir DATE December 7, 1978
 INSPECTOR _____ DISCIPLINE _____
 INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	411.42
Current Pool Elevation	403.42
Maximum Impoundment to Date	410.11 Jan. 1978
Surface Cracks	None observed
Pavement Condition	Grass surface rutting due to vehicular traffic.
Movement or Settlement of Crest	Slight settlement of crest at about station 3+50.
Lateral Movement	None observed.
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	No unusual animal burrows observed, path worn on DS slope, opposite gatehouse.
Sloughing or Erosion of Slopes or Abutments	Slight
Rock Slope Protection - Riprap Failures	Some windows in riprap.
Unusual Movement or Cracking at or near Toes	None observed.

PERIODIC INSPECTION CHECK LIST

PROJECT Stone Hill Reservoir DATE December 7, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
<p><u>DAM EMBANKMENT</u> (Cont.)</p> <p>Unusual Embankment or Downstream Seepage</p> <p>Piping or Boils</p> <p>Foundation Drainage Features</p> <p>Toe Drains</p> <p>Instrumentation System</p> <p>Vegetation</p>	<p>Wet zone near station 3+50 at toe, water flowing 75 ft. DS of dam at station 3+50 and 2+30.</p> <p>None observed.</p> <p>None observed.</p> <p>None observed.</p> <p>None</p> <p>Brush recently cut on DS slope, extensive tree growth between station 0+00 and 2+00.</p>

PERIODIC INSPECTION CHECK LIST

PROJECT Stone Hill Reservoir DATE December 7, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>DIKE EMBANKMENT</u>	Not applicable.

PERIODIC INSPECTION CHECK LIST

PROJECT Stone Hill Reservoir DATE December 7, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channel	Underwater, not observable.
Slope Conditions	Underwater
Bottom Conditions	Underwater
Rock Slides or Falls	None
Log Boom	None
Debris	Not observable
Condition of Concrete Lining	Not observable
Drains or Weep Holes	Not observable
b. Intake Structure	Mortared stone masonry
Condition of Stone Masonry	Good
Stop Logs and Slots	None

PERIODIC INSPECTION CHECK LIST

PROJECT Stone Hill Reservoir DATE December 7, 1978
 INSPECTOR _____ DISCIPLINE _____
 INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	Stone masonry foundation, timber, superstructure, timberfloor.
General Condition	Good
Condition of Joints	Good
Spalling	None observed.
Visible Reinforcing	Not Applicable
Rusting or Staining of Concrete	Minor staining of stonework noted.
Any Seepage or Efflorescence	Not observable
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	Not observable
Cracks	None observed.
Rusting or Corrosion of Steel	Not applicable
b. Mechanical	Manually operated rising stem gate mechanisms. Appeared to be in good condition. Trash screens in place at time of inspection
Service Gates	16 in. and 4 in. (bypass) diameter cast iron pipe to treatment facility and distribution system.
Emergency Gates	16 inch diameter cast iron pipe discharges at toe of dam.

PERIODIC INSPECTION CHECK LIST

PROJECT Stone Hill Reservoir DATE December 7, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	Not observable

PERIODIC INSPECTION CHECK LIST

PROJECT Stone Hill Reservoir DATE December 7, 1978
 INSPECTOR _____ DISCIPLINE _____
 INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u></p> <p>Erosion or Cavitation</p> <p>Seepage</p> <p>Channel</p> <p>Loose Rock or Trees overhanging Channel</p> <p>Condition of Discharge Channel</p>	<p>Small treatment facility DS from toe of dam. Timber structure houses chlorination and flow metering equipment.</p> <p>Outlet at toe of dam consists of 16 inch cast iron pipe and unmortared stone rubble headwall.</p> <p>None observed at stone discharge channel.</p> <p>None observed.</p> <p>Lined with rock rubble to old brook channel.</p> <p>Trees overhang channel.</p> <p>Overgrown, poorly defined.</p>

PERIODIC INSPECTION CHECK LIST

PROJECT Stone Hill Reservoir DATE December 7, 1978
 INSPECTOR _____ DISCIPLINE _____
 INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel General Condition Loose Rock Overhanging Channel Trees Overhanging Channel Floor of Approach Channel Other Obstructions	Bedrock channel. Good Some Yes - many Bedrock and loose rock. Arch bridge
b. Weir and Training Walls General Condition of Concrete Rust or Staining Spalling Any Visible Reinforcing Any Seepage or Efflorescence Drain Holes	Stone masonry training walls, concrete spillway crest. Fair None observed Yes None observed None observed. None
c. Discharge Channel General Condition Loose Rock Overhanging Channel Trees Overhanging Channel Floor of Channel Other obstructions	Overgrown None Yes - many Natural, stony Brush

PERIODIC INSPECTION CHECK LIST

PROJECT Stone Hill Reservoir DATE December 7, 1978
 INSPECTOR _____ DISCIPLINE _____
 INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SERVICE BRIDGE</u>	
a. Super Structure Anchor Bolts Bridge Seat Longitudinal Members Under Side of Deck Secondary Bracing Deck Drainage System Railings Expansion Joints Paint	Timber truss, wood deck, steel rod tension members None observed Concrete and stone masonry Timber Timber Timber Timber None required. None - truss forms railings None Poor condition
b. Abutment & Piers General Condition of Concrete Alignment of Abutment Approach to Bridge Condition of Seat	Concrete at dam embankment stone masonry at gatehouse. Concrete and stone masonry in good condition. Good Perpendicular to axis of dam. Good.

APPENDIX B
ENGINEERING DATA

APPENDIX B-1

OPERATING AND MAINTENANCE RECORDS LOCATION

Mr. Raymond Archibald
Jewett City Water Company
57 Slater Avenue
Jewett City, Connecticut 06351
(203) 376-2963

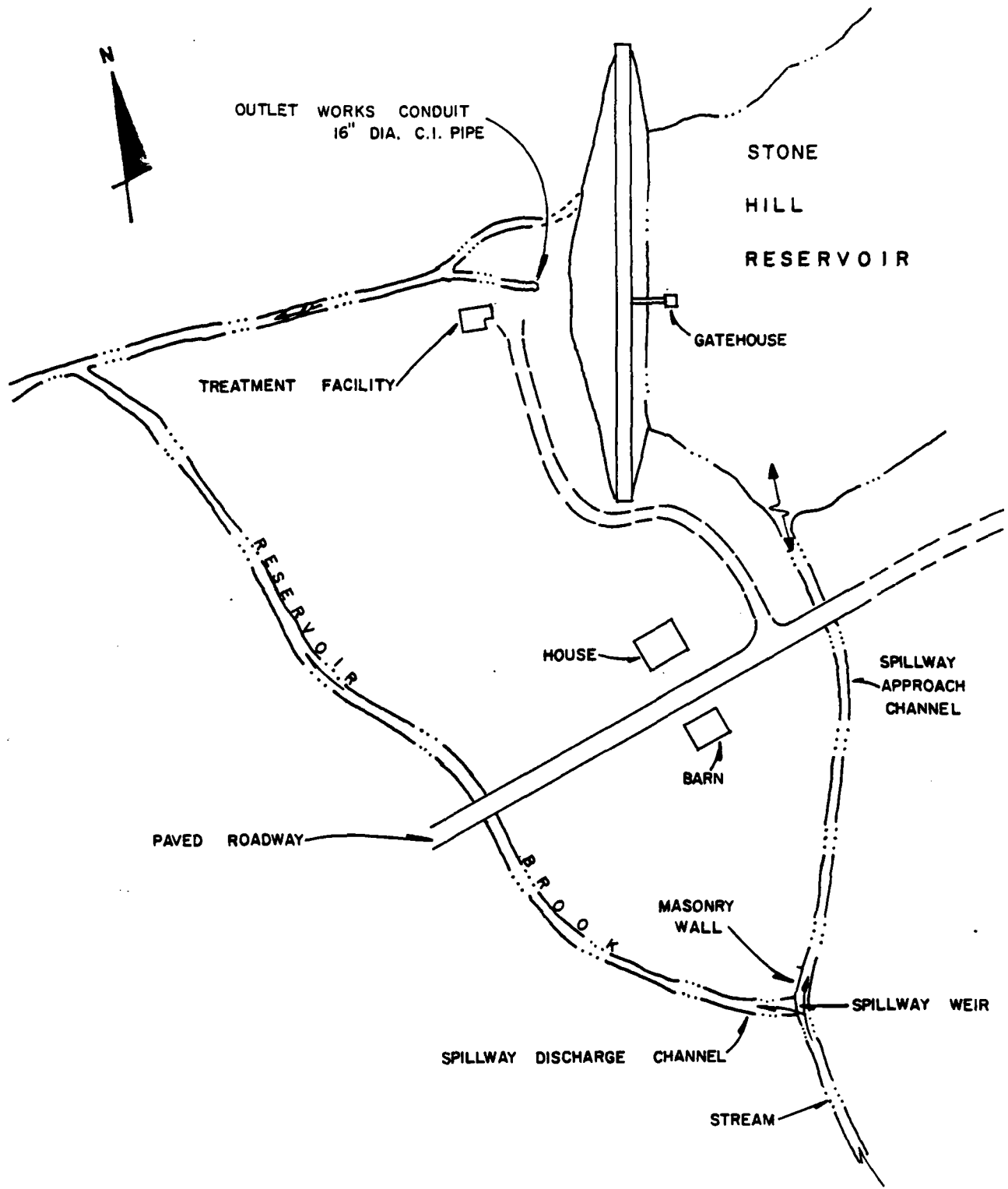
APPENDIX B-2

NO COPIES OF PAST INSPECTION REPORTS OR

CORRESPONDENCE AVAILABLE

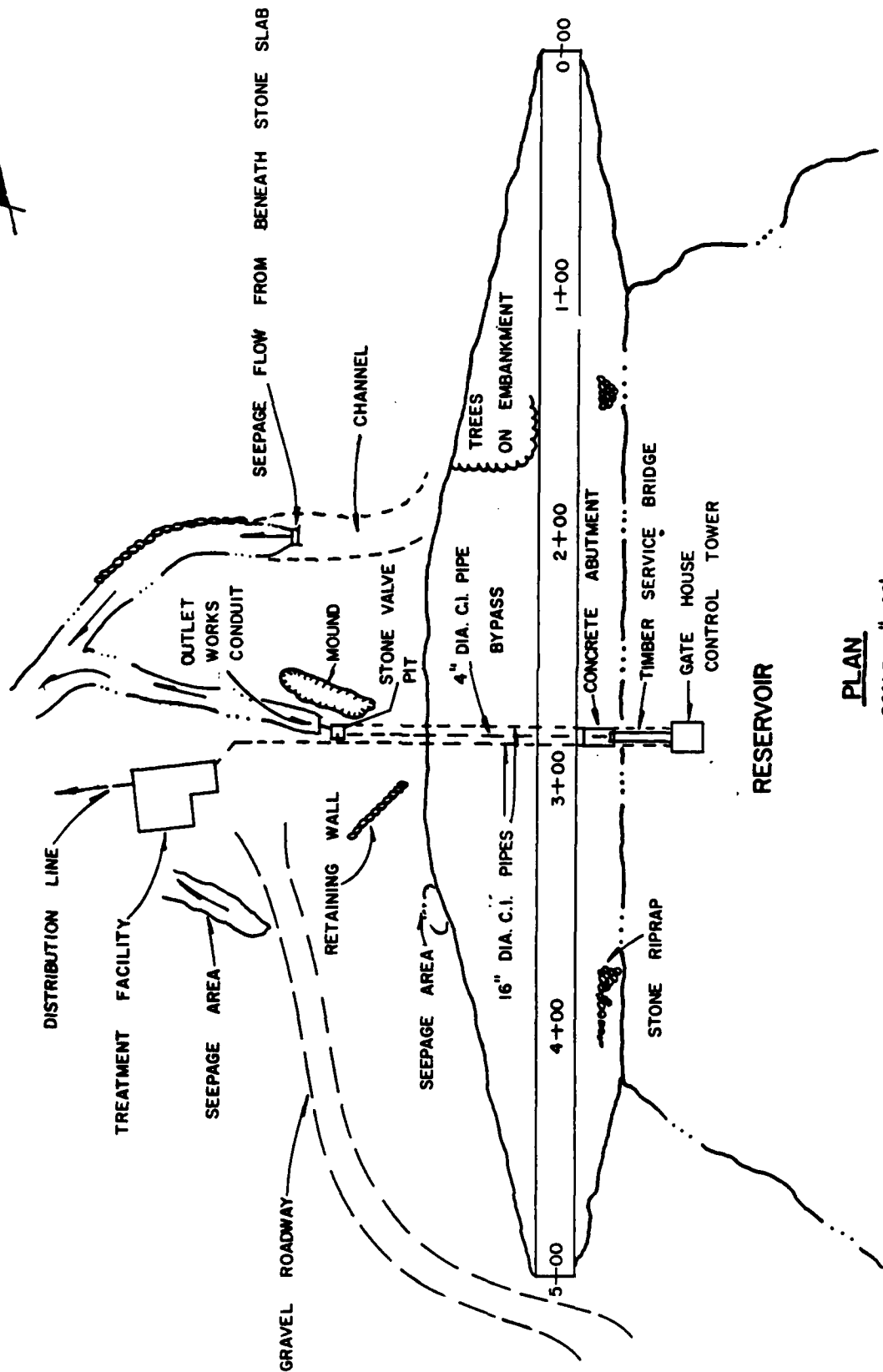
APPENDIX B-3

RECORD DRAWINGS AND SKETCHES



**STONE HILL RESERVOIR DAM
GENERAL PLAN**

SCALE 1" = 150'

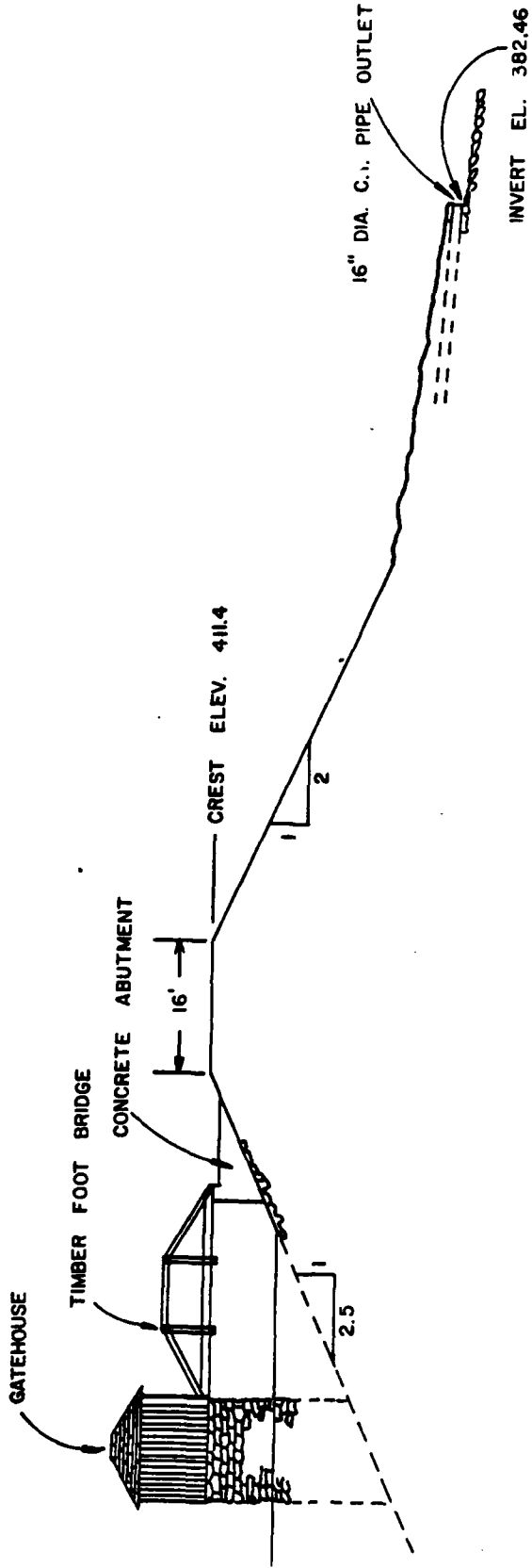


PLAN

SCALE 1" = 60'

STONE HILL RESERVOIR DAM

RESERVOIR



TYPICAL SECTION AT GATEHOUSE

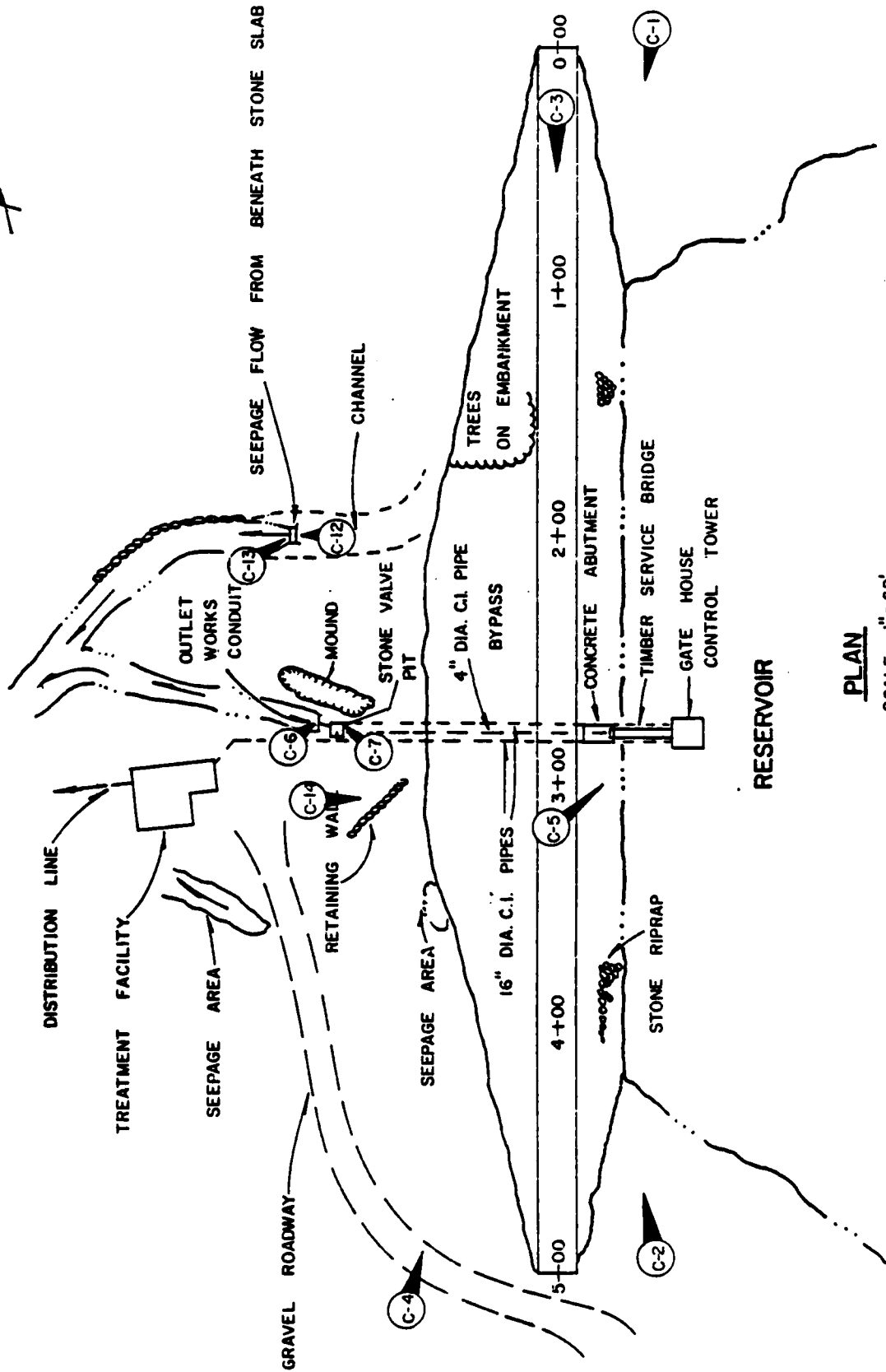
STA. 2+80

SCALE 1" = 20' ±

STONE HILL RESERVOIR DAM

APPENDIX C

PHOTOGRAPHS

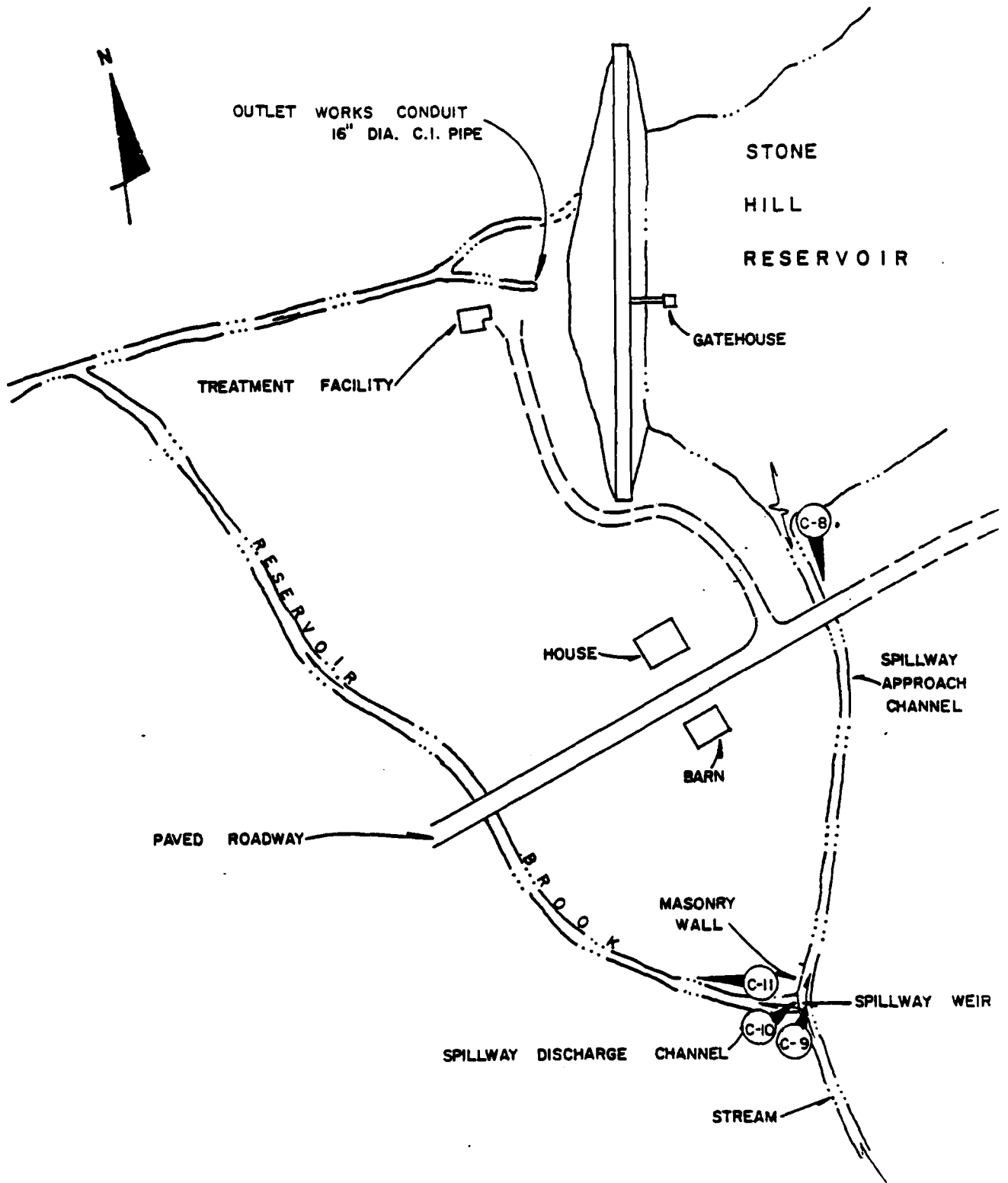


PLAN

SCALE 1" = 60'

STONE HILL RESERVOIR DAM

PHOTO INDEX



STONE HILL RESERVOIR DAM

PHOTO INDEX

SCALE 1" = 150'



C-1 UPSTREAM EMBANKMENT SLOPE - LOOKING FROM RIGHT ABUTMENT.



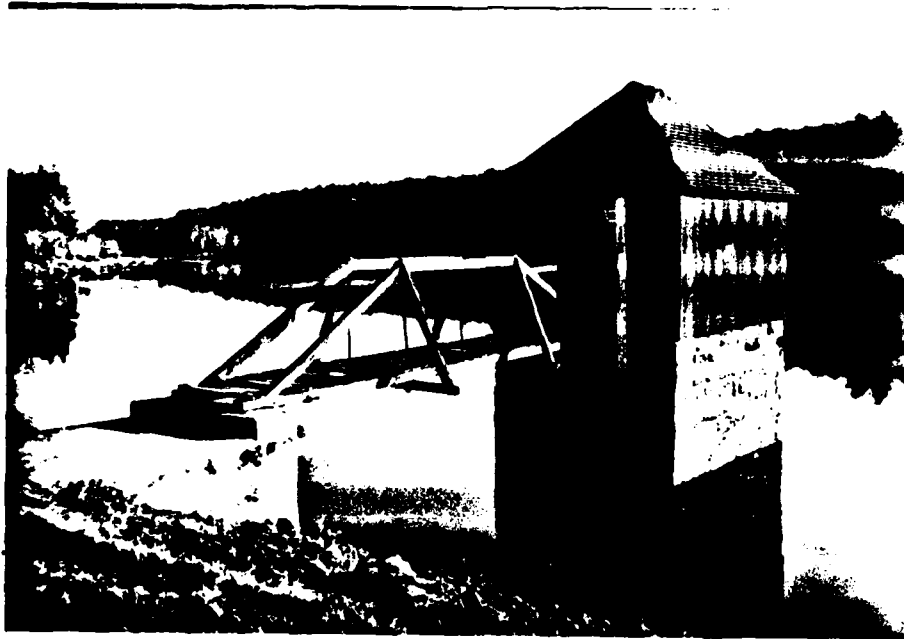
C-2 UPSTREAM EMBANKMENT SLOPE - LOOKING FROM LEFT ABUTMENT



C-3 CREST OF MAIN EMBANKMENT.



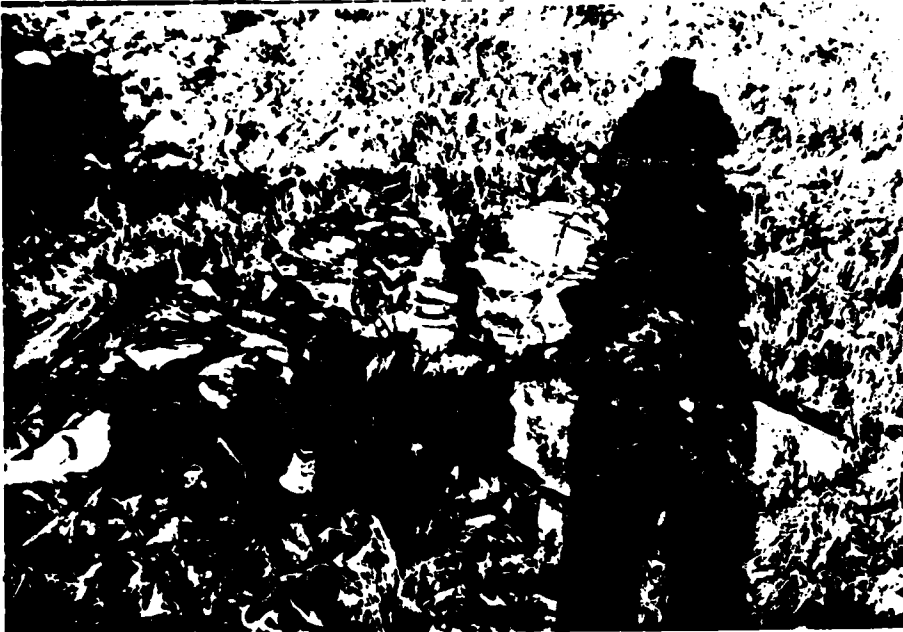
C-4 DOWNSTREAM SLOPE OF MAIN EMBANKMENT.



C-5 GATEHOUSE AND SERVICE BRIDGE



C-6 16" DIA. CAST IRON OUTLET CONDUIT



C-7 OUTLET PIPE VALVE CONTROL (INOPERABLE).



C-8 RESERVOIR BROOK INLET TO RESERVOIR AND APPROACH CHANNEL FOR SPILLWAY.



C-9 RESERVOIR BROOK INLET TO RESERVOIR, AND APPROACH CHANNEL FOR SPILLWAY.



C-10 SPILLWAY CREST



C-11 SPILLWAY DOWNSTREAM CHANNEL



C-12 DOWNSTREAM CHANNEL BELOW OUTLET



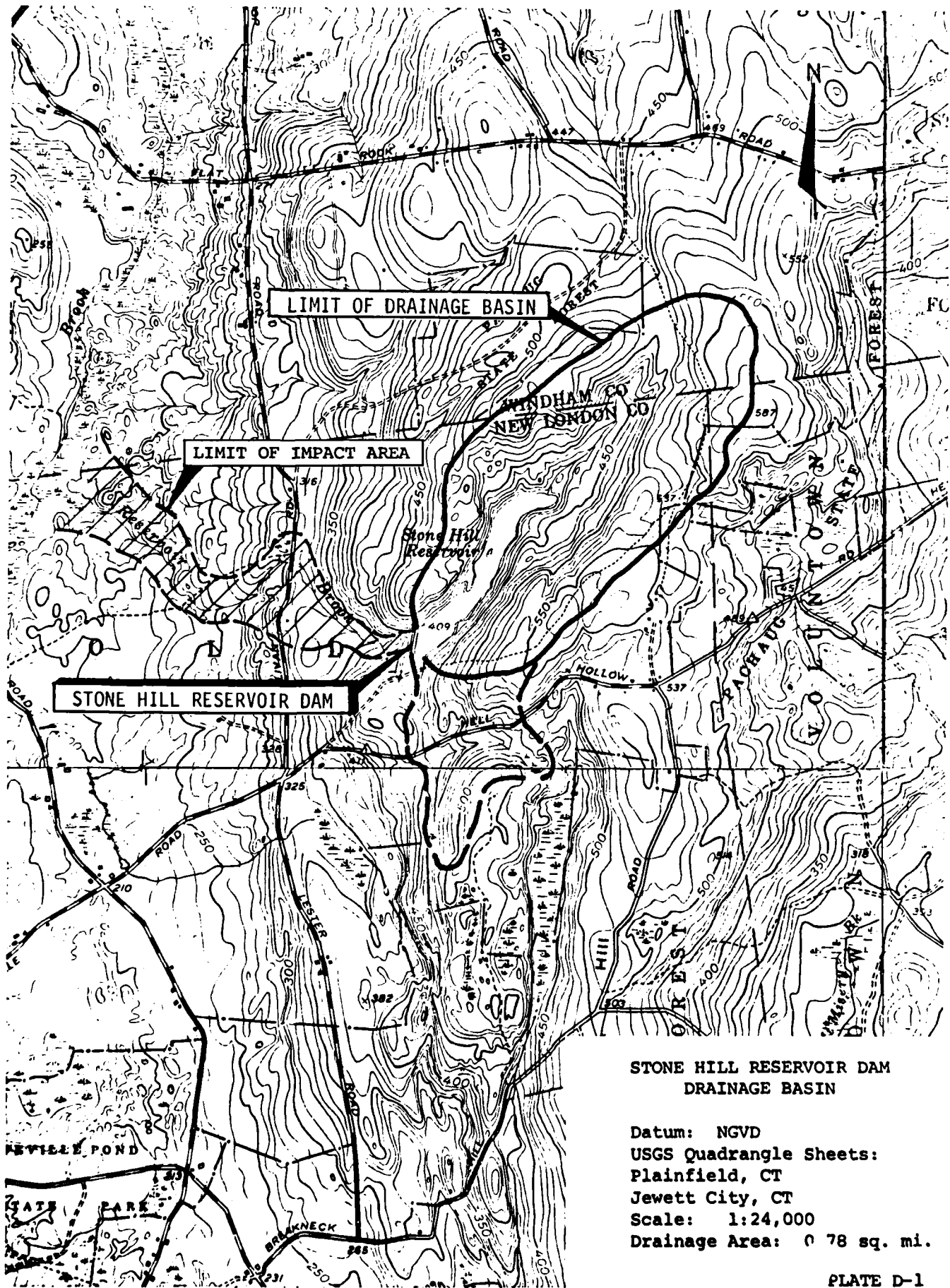
C-13 POSSIBLE TOE DRAIN OUTLET



C-14 FIELD STONE STRUCTURE AT TOE OF DAM.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



**STONE HILL RESERVOIR DAM
DRAINAGE BASIN**

Datum: NGVD
 USGS Quadrangle Sheets:
 Plainfield, CT
 Jewett City, CT
 Scale: 1:24,000
 Drainage Area: 0 78 sq. mi.

"Rule of Thumb Guidance for Estimating
Downstream Dam Failure Discharge"

BASIC DATA

Name of dam Stone Hill Reservoir Dam Name of town Voluntown

Drainage area = 0.78 sq. mi., Top of dam 411.50 NGV

Spillway type = Overflow - Broad Crest Crest of spillway 409.0 NGV

Surface area at crest elevation = 0.04 Sq. Mi = 26 Acres

Reservoir bottom near dam = 375.5 NGV

Assumed side slopes of embankments _____

Depth of reservoir at dam site 36.0 = y_0 = 36.0 ft

Mid-height elevation of dam = 393.5 NGV

Length of dam at crest = 500 Ft.

Length of dam at mid-height = 428 Ft.

23.3% of dam length at mid-height = W_b = 100

Step 1:

Elevation (NGVD)	Estimated Storage in AC-FT
409.0	315
410.0	341
411.0	367
411.5	380
412.0	393

Step 2:

$$Q_{p1} = \frac{8}{27} W_b \sqrt{g} y_0^{3/2}$$

$$= \underline{1.68} W_b y^{3/2} = \underline{36290} \text{ CFS}$$

NOTE: Failure of dam is assumed to be instantaneous when pool reaches top of dam.

Estimating Maximum Probable Discharges - Inflow and Outflow Values

Date of Inspection: 3/ /79

Name of Dam Stone Hill Reservoir Dam, Location of Dam Reservoir Brook, Town Voluntown

Watershed Characterization Moderate to steep, rolling terrain

Adopted "test" flood = one-half PMF = 1000 CSM = 780 CFS, Re = Effective Rainfall = 9.50 inches

D.A. = Drainage Area (Gross) = 0.78 Square Miles; Basin Slope = 0.02-0.04 hence; Steep to Moderate

S.A. = Surface Area of Reservoir = 0.04 Square Miles; Time of Concentration 45 minutes

Shape and Type of Spillway = Overflow, broad crest, vertical overfall with flashboards

B = Width of Spillway = 16.0 feet; C = Coefficient of Discharge = (3.33-Friction) = 3.33

Maximum Capacity of Spillway Without Overtopping = 410 CFS = 53 % of test flood

Top of Dam Elevation = 411.50, Spillway Crest Elevation = 409.0

Overflow portion of Length of Dam = 500 feet; C = Coefficient of discharge for Dam = 3.0

Name of Dam	Test Flood		Inflow Characteristics		Outflow Characteristics First Approximation		Outflow Characteristics Second Approximation		Outflow Characteristics Third Approximation (Adopted)				
	Op CSM	CFS	h ₀ in feet	S ₀ in in.	Op ₁ CFS	h ₁ in ft.	S ₁ in in.	S ₂ in in.	h ₂ in ft.	Op ₂ CFS	S ₃ in in.	h ₃ in ft.	Op ₃ CFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Stone Hill Reservoir Dam	1 in 100 yrs. = 487	380	2.3	1.44	380	2.3	1.44				1.5	2.40	300
1000 feet PMF flood		780	2.90	1.81	780	2.9	1.81				1.65	2.86	768

C = Discharge; h = Surge height; S = Storage in inches NOTE: Outflow discharge values are computed as per COE guidelines.

A. Size Classification

Stone Hill Reservoir Dam

Height of dam = 36.0 ft.; hence Small
 Storage capacity at top of dam (elev. 411.50) = 380 AC-FT.; hence Small
 Adopted size classification Small

B.i) Hazard Potential

Failure of this dam can cause an economic loss due to disruption of
water supply utility operations.

ii) Impact of Failure of Dam at Maximum Pool (Top of Dam)

It is estimated from the rule of "thumb" failure hydrograph, that the following adverse impacts are a possibility by the failure of this dam.

- a) Loss of life No ; 1 to 3 lives can be lost.
- b) Loss of homes Yes ; 1 to 3 homes can be lost.
- c) Loss of buildings NO ; 1 to 3 buildings can be lost.
- d) Loss of highways or roads Yes ; Sullivan roads can be damaged.
- e) Loss of bridges Yes ; 1 to 2 bridges can be lost.
- f) Miscellaneous Yes ; Loss of Chlorination Plant.

The failure profile can affect a distance of 7500 feet from the dam. For water surface elevation, see next page in Appendix D.

C. Adopted Classifications

<u>HAZARD</u>	<u>SIZE</u>	<u>TEST FLOOD RANGE</u>
<u>Significant</u>	<u>Small</u>	<u>One-half PMF to 100-yr. frequenc.</u>
Adopted Test Flood =	<u>one-half</u>	PMF = <u>1000</u> CSM
		= <u>780</u> CFS

D. Overtopping Potential

Drainage Area = 0.78 sq. miles
 Spillway crest elevation = 409.0 NGVD
 Top of Dam Elevation = 411.50 CFS

Maximum spillway discharge
 Capacity without overtopping of dam = 410.0 CFS
 "test flood" inflow discharge = 780 CFS
 "test flood" outflow discharge = 768 CFS

% of "test flood" overflow carried
 by spillway without overtopping = 53%

"test flood" outflow discharge portions
 which overflows over the dam = 358 CFS

% of test flood which overflows over the dam = 47%

Dam Failure Analysis

1. Failure discharge with pool at top of dam (elev.) = 36290 CFS
2. Depth of water in reservoir at time of failure = 36 ft.
3. Maximum depth of flow downstream of dam)
at time of failure) = 24 ft.
4. Water surface elevation just downstream)
of dam at time of failure) = 400 NGVD

The failure discharge of 36290 CFS will enter Reservoir Brook and flow downstream 7,500 feet until the brook crosses Sullivan Road. There is significant valley storage in this 7,500 feet length of brook to reduce the discharge substantially. Also due to roughness characteristics, obstructions and frictional losses, it is very likely that the unsteady dam failure flow will dissipate its wave and kinetic energy and thus convert to steady and uniform flow obeying Manning's formulae further downstream. The failure profile will have the following hydraulic characteristics:

DISTANCE FROM THE DAM	WATER SURFACE ELEVATION NGVD	REMARKS
0+00	411.50	Upstream of dam Downstream of dam
0+00	400.00	
3+00	390.0	
6+00	380.0	
9+00	370.0	
12+00	360.0	
15+00	350.0	
18+00	340.0	
21+00	330.0	
22+50	315.0	
75+00	175.0	

Beyond 7,500 feet and until the brook joins Mill Brook, the failure discharge will flow in the below given channel characteristics:

Q = 2,000 CFS; S = 0.01
 n = 0.065; b = varies; d = 5.0

Side slopes = 1V or 2H.

COMPUTATIONS FOR
SPILLWAY RATING CURVE AND
OUTLET RATING CURVE COMPUTATIONS

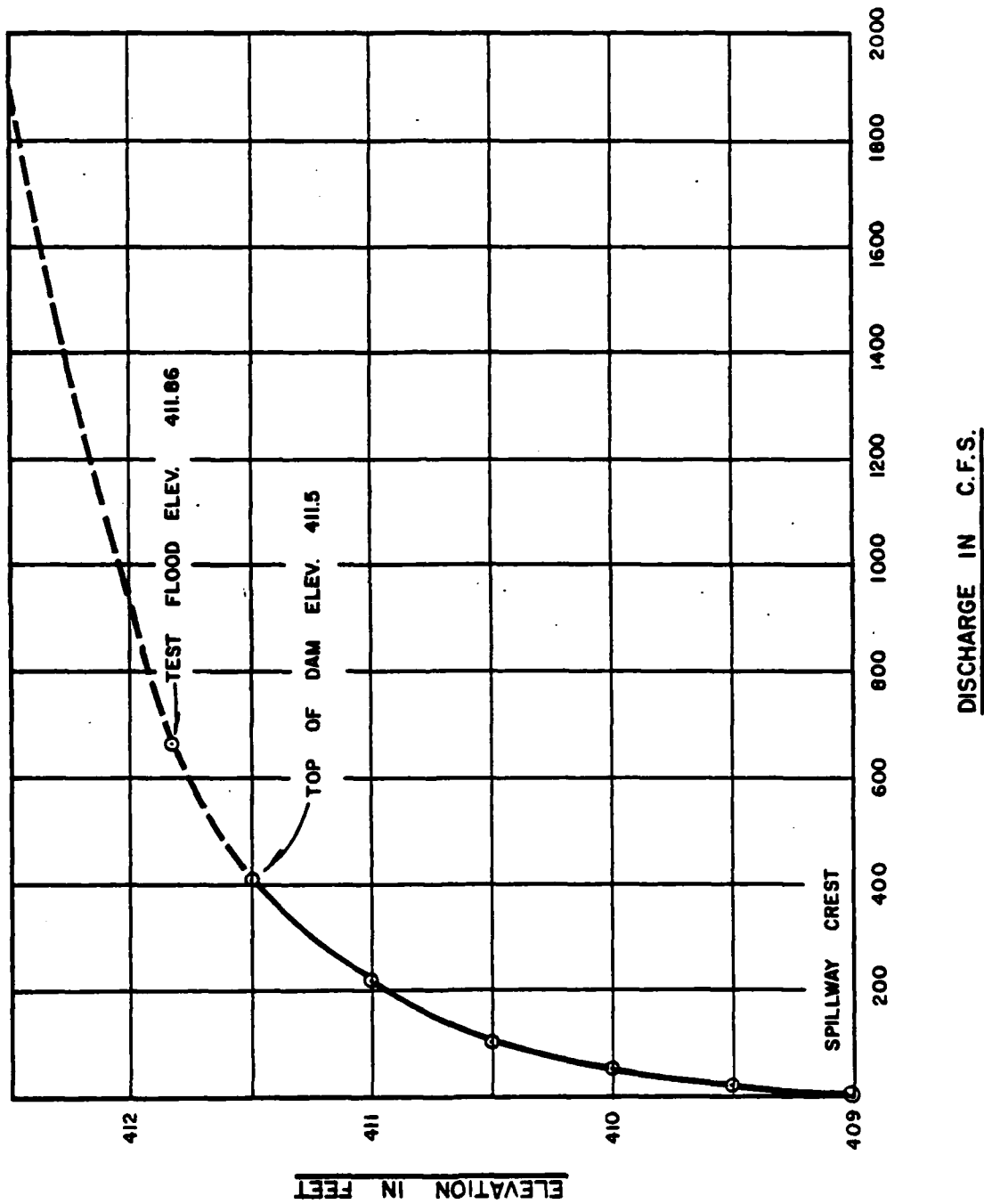
Spillway width = 76 feet; Spillway crest elevation = 409.00 NGVD
 Length of dam = 500 feet; Top of dam elevation = 411.50 NGVD
 C = 3.33 for spillway and 3.0 for the dam overflow

i) SPILLWAY RATING CURVE COMPUTATIONS

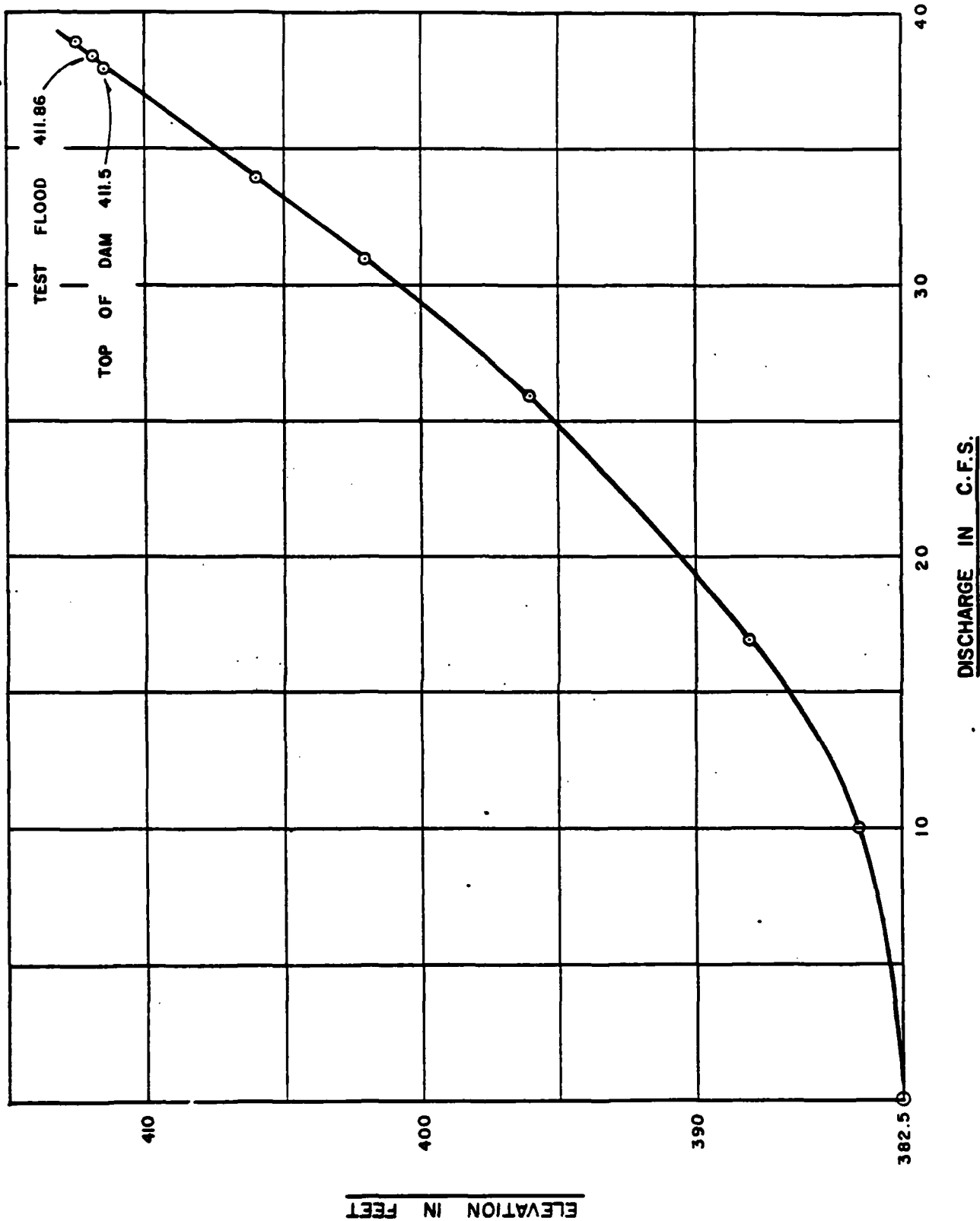
Elevation (ft.) NGVD	Spillway Discharge (CFS)	Remarks
409.0	0	Crest of spillway
409.5	20	
410.0	53	
410.5	97	
411.0	220	
411.5	410	Top of Dam
411.86	768	Test Flood
412.0	940	
412.5	1,910	

ii) OUTLET RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Discharge (CFS)	Remarks
412.5	39	
411.86	38.5	Test Flood
411.5	38	Top of Dam
409.0	36	Crest Elevation
406.0	34	
402.0	31	
396.0	26	
392.0	21	
388.0	17	
384.0	10	
382.5	0	Invert of Outlet 24" C.I. Pipe



STONE HILL RESERVOIR DAM
 SPILLWAY RATING CURVE



STONE HILL, RESERVOIR
 OUTLET CONDUIT RATING CURVE

APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS



INVENTORY OF DAMS IN THE UNITED STATES

STATE	DIVISION	COUNTY	COUNTY DIST.	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE
CT	436	WED	011	02	STONE HILL RESERVOIR DAM	41 57.4	73 54.0	01 MAY 79

POPULAR NAME	NAME OF IMPONDMENT		
STONE HILL RESERVOIR	STONE HILL RESERVOIR		
REGION BASIN	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 07	PACKER	4	150

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCT. HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPONDING CAPACITIES (ACRES-FT.)	DIST UWN	FED R	PRV/FED	SCS A	VER/DATE
RECIPRO	1994	S	16	36	380	315	N	N	N	19APR79

REMARKS

DIS WAS LENGTH	SPILLWAY TYPE	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CY)	POWER CAPACITY (MW)	INSTALLED PROPOSED	NAVIGATION LOCKS	
						NO.	DEPTH (FT.)
2	500 C	16	410	32350			

OWNER	ENGINEERING BY	CONSTRUCTION BY
JEFF CITY WATER CO	UNKNOWN	UNKNOWN

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	CT DEP

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
CE MAGUINE INC	07DEC78	PL 92-367

REMARKS

This Phase I Inspection Report on Stone Hill 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



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

REPLY TO
ATTENTION OF:
NEDED-E

AUG 15 1979

Jewett City Water Company
45 Moulton Street
Cambridge, Massachusetts 02138

Gentlemen:

Forwarded herewith for your information and use is a copy of the Phase I Inspection Report on the Stone Hill Reservoir Dam. This inspection was made under the authority of Public Law 92-367 by the firm of C-E Maguire, Inc., Providence, Rhode Island under the direction and supervision of the Corps of Engineers. Copies of the finished report have been forwarded to the Governor and the Department of Environmental Protection, the cooperating agency for the State of Connecticut.

Section 7 of the report contains an evaluation and recommendations. If you have any questions concerning this report, we suggest that you contact the Department of Environmental Protection first. Then, if there are further questions contact the Project Management Branch, Engineering Division of this office. We thank you for your cooperation and assistance in carrying out this program.

Sincerely yours,

A handwritten signature in cursive script that reads "Joe B. Fryar".

JOE B. FRYAR
Chief, Engineering Division

Incl
As stated



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

REPLY TO
ATTENTION OF:

NEDED-E

AUG 15 1979

Mr. Stanley J. Pac, Commissioner
Department of Environmental Protection
State of Connecticut
Hartford, Connecticut 06115

Dear Commissioner Pac:

Forwarded herewith for your information and use is a copy of the Phase I Inspection Report on Stone Hill Reservoir Dam. This inspection was performed in accordance with Public Law 92-367 under the direction of the Corps of Engineers. Copies of the finished report have been forwarded to the Governor and the owner. We thank you for your cooperation and assistance in carrying out this program and hope this report will help you to develop an effective dam safety program.

Sincerely yours,

A handwritten signature in cursive script that reads "Joe B. Fryar".

JOE B. FRYAR
Chief, Engineering Division

Incl
As stated



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

REPLY TO
ATTENTION OF

NEDED

AUG 15 1979

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

Dear Governor Grasso:

I am forwarding to you a copy of the Stone Hill 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 Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Jewett City Water Company, 45 Moulton Street, Cambridge, Massachusetts 02138.

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

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

Sincerely yours,

A handwritten signature in cursive script, reading "Max B. Scheider", is written over the typed name.

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

END

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