

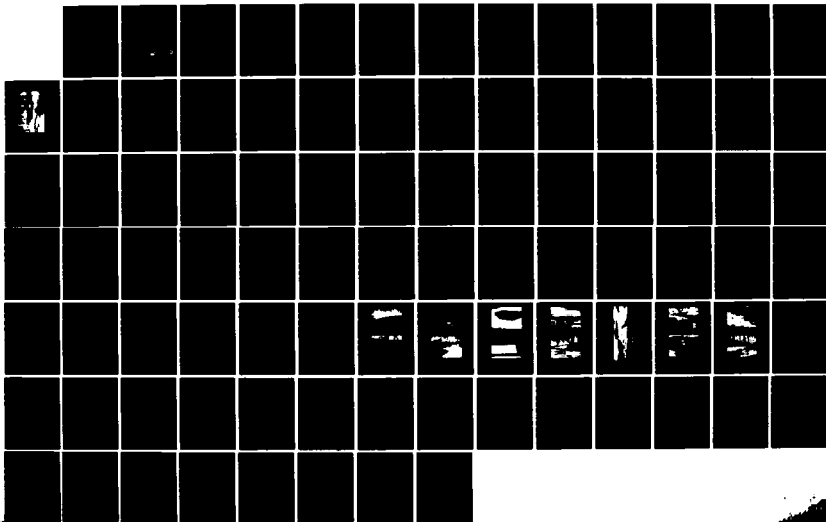
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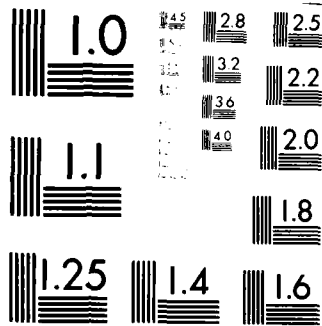
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
EASTMAN LAKE DAM (MN.) (U) CORPS OF ENGINEERS WALTHAM MA
NEW ENGLAND DIV MAY 79

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CONNECTICUT RIVER BASIN
GRANTHAM, NEW HAMPSHIRE

EASTMAN LAKE DAM
NH 00039

NHWRB 97.04

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

MAY 1979

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NH 00039	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Eastman Lake Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE May 1979
		13. NUMBER OF PAGES 55
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		16a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut River Basin Grantham, New Hampshire Eastman Brook		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam has a maximum height of 45 ft. and is about 415 ft. long. The dam is judged to be in good condition. Two wet patches were observed on the downstream side above the elevation of the permanent pool. The dam is classified as intermediate in size with a hazard potential of high. There is work which must be done on the remaining spillway to assure the continu- ed performance of the dam.		

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DEPARTMENT OF THE ARMY
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424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

JUN 29 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

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

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Controlled Environment Corporation, P.O. Box 1, Grantham, New Hampshire 03753, ATTN: Mr. Jonathan Burnham, Manager.

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 Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,


JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

EASTMAN LAKE DAM

NH 00039

NHWRB 97.04

CONNECTICUT RIVER BASIN
GRANTHAM, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.: NH 00039
Name of Dam: Eastman Lake Dam
Town: Grantham
County and State: Sullivan, New Hampshire
Stream: Eastman Brook
Date of Inspection: June 7, 1978

BRIEF ASSESSMENT

Eastman Lake Dam is an earth dam across the outlet of Eastman Brook in the central western part of New Hampshire about fifteen miles southeast of the city of Lebanon. The dam has a maximum height of 45 feet and is approximately 415 feet long with a 40-foot wide roadway at the top. The principal spillway is a 42-inch diameter concrete pipe which is located at the base of and near the center of the dam. The intake structure is a reinforced concrete riser with a single stage crest. Provision was made in the design for an emergency spillway with a crest length of 50 feet. The emergency spillway has been rough graded but not finished.

The dam is judged to be in good condition. Two wet patches were observed on the downstream side above the elevation of the permanent pool. On the upstream seeded slope four minor areas of erosion were observed. Continuance of this classification depends on proper operations and maintenance of the dam.

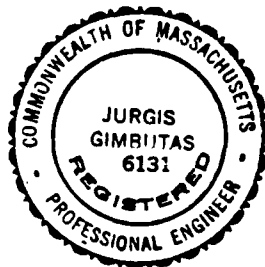
This dam falls under the category of high hazard potential, and it is intermediate in size. The test flood peak inflow is equal to the probable maximum flood, 15,560 cfs, and the test flood peak outflow is 3,548 cfs. Hydraulic analysis indicates that the surcharge height above the crest of the principal spillway is about 14.9 feet and above the crest of the emergency spillway is about 8.2 feet. The project will pass the test flood peak outflow without overtopping the dam, and therefore the spillway capacity is adequate.

The remaining work on the emergency spillway should be started within one year of receipt of Phase I report by the owner and the following recommended operation and maintenance measures, as stated in Section 7.3, should be implemented within 2 years.

1. The erosion areas on the upstream side should be corrected.

2. The soft patches on the downstream face should be monitored to determine the cause and then corrective measures taken.
3. An operating and maintenance manual for the project be prepared.
4. A program of technical bi-annual periodic inspections of the project features should be prepared and initiated.
5. Surveillance and a warning system be developed for periods of unusually heavy rains and runoff.

FAY, SPOFFORD & THORNDIKE, INC.
By:



Jurgis Gimbutas
Jurgis Gimbutas, P.E.
Project Engineer

Richard W. Albrecht
Richard W. Albrecht, P.E.
Vice President

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



CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

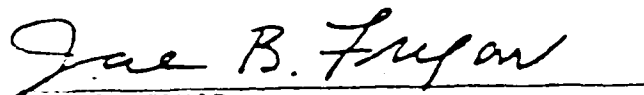


FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division



SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:



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

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

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

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest 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.

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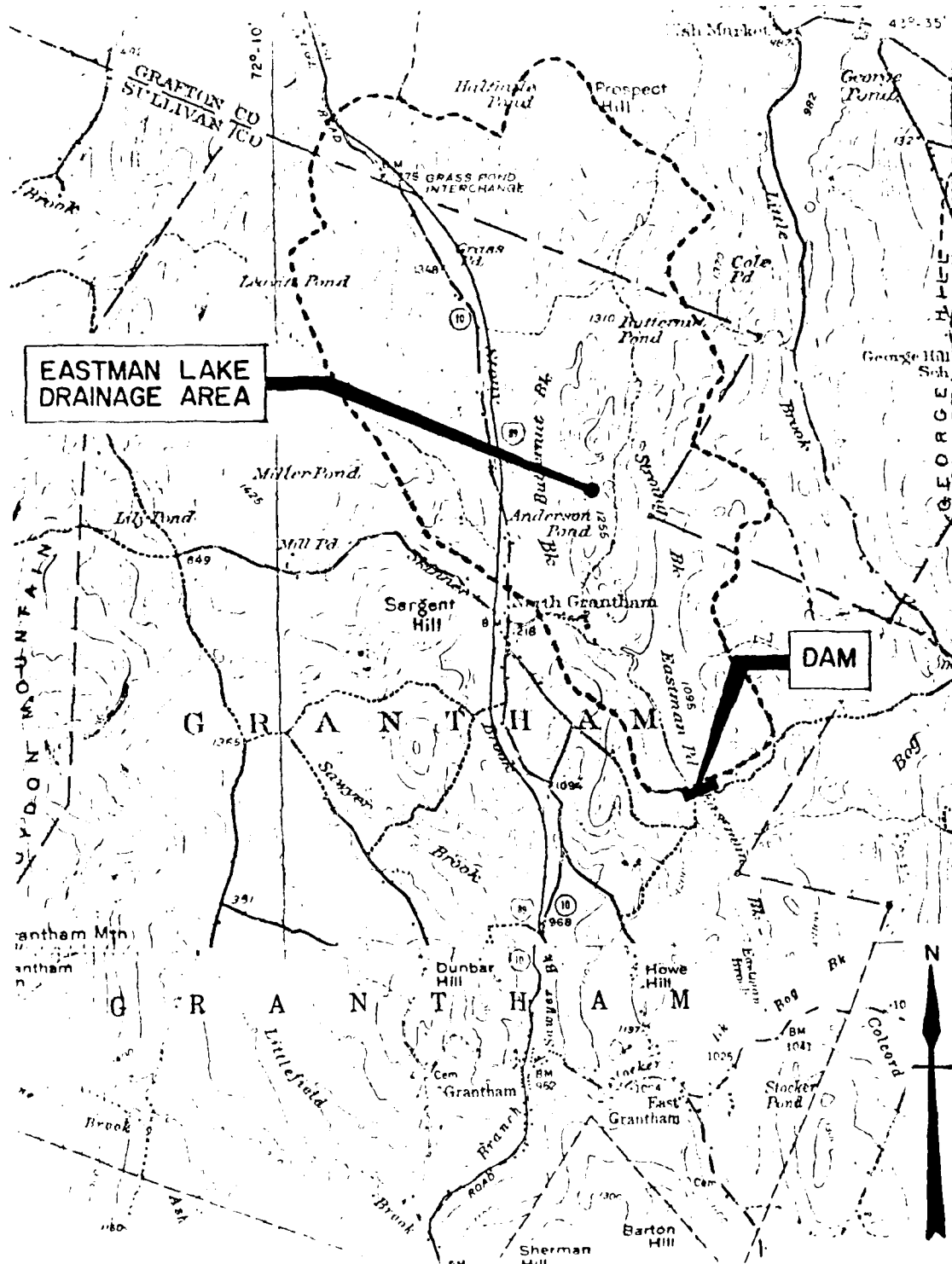
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OVERVIEW PHOTOGRAPH



EASTMAN LAKE DAM, LOOKING SOUTHWEST
Negative No. 5-26A



SCALE 1:62500 (ACTUAL)

UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

SUNAPEE, N.H. 1955
AMS 6570-I-SERIES V712
MASCOMA, N.H. 1927

EASTMAN LAKE DAM

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Fay, Spofford & Thorndike, Inc., Engineers, have been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed was issued to Fay, Spofford & Thorndike, Inc., under a letter of May 3, 1978, from Mr. Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0308 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 prepare 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 Project

a. Location

Eastman Pond is located in the central western part of New Hampshire and about 15 miles southeast of the city of Lebanon. Eastman Lake Dam is built on the south end of the lake, which is the outlet of Eastman Brook. This brook flows, via several other brooks, into Sugar River, which is tributary to the Connecticut River. About 2 1/2 miles downstream from the lake and situated on the banks of Stocker Brook, is the village of East Grantham. Another 1/2 mile

downstream, the village of Grantham is located at the confluence of the Stocker and North Branch Brooks. These villages are about 125 feet lower than the crest elevation of the spillway of this dam.

b. Description of Dam

The dam, built in 1972, is a compacted earth embankment dam with a length of 415 feet and a maximum height of 45 feet above the stream bed. The top of the dam is 40 feet wide and accommodates a two-lane paved roadway. It has a 15-foot wide berm on the upstream side which can be used as a mini-transit lane. The slopes are 1 vertical to 2.5 horizontal with riprap slope protection below a 15-foot wide berm on the upstream side (Photographs No. 1, 2, and 4, Appendix C).

The principal spillway is a 42-inch diameter concrete pipe placed at the base of the embankment near the middle length. This pipe is cantilevered at the outlet into a riprap stilling basin (Photograph No. 7, Appendix C).

The intake structure is a reinforced concrete covered riser with a single stage crest (Photographs No. 5 and 6, Appendix C). The reservoir (lake) drain is a 30-inch diameter concrete pipe from the upstream toe to the riser. Flow through this pipe is controlled by a sluice gate mounted inside of the riser.

The emergency spillway is a 50-foot wide earth channel, rough graded, and located east of the dam. This emergency channel joins Eastman Brook about 1,100 feet downstream of the dam (Photographs No. 9, 10, 11, 12, and 13, Appendix C).

c. Size Classification

The storage capacity at the spillway crest is 3,350 acre-feet which falls in the range $\geq 1,000$ and $< 50,000$ acre-feet. Therefore, on the basis of Table 1, Size Classification, in the guidelines furnished by the Corps of Engineers, the dam is classified as intermediate in size.

d. Hazard Classification

In the event of failure of this dam, East Grantham, which is at a distance of approximately 2 1/2 miles downstream of the dam, will be in danger of being flooded. Because the flood wave normally does not exceed more than two-thirds the height of the dam and on the basis of engineering judgment, it is estimated that in the event of failure of this dam loss of more than a few lives and excessive property damage would probably occur. Therefore, on the basis of Table 2, Hazard

Potential Classification, in the guidelines furnished by the Corps of Engineers, this dam falls in the category of high hazard potential. The approximate damage impact area is included in Appendix D.

e. Ownership

The owner of the Eastman Lake Dam is the Controlled Environment Corporation, P.O. Box 1, Grantham, New Hampshire 03753, telephone (603) 863-4444. They have initiated and executed the construction of this dam and developed a planned residential community around the lake.

f. Operator

Mr. Jonathan Burnham, Manager, Controlled Environment Corporation, P.O. Box 1, Grantham, New Hampshire 03753, telephone (603) 863-4444.

g. Purpose of Dam

The prime purpose of this dam is for recreation for the residential community located near the lake area. The secondary purpose is flood control of the inhabited valley of Eastman Brook.

h. Design and Construction History

Prior to construction of this dam by the present owner, there was a smaller dam and a bridge over Eastman Brook located north of the present dam. The water elevation of the smaller dam was approximately 1096 with a storage area of about 142 acres. With the new dam in place, the water level of the pond is at crest elevation, 1109.0, of the intake structure, which results in a storage area of approximately 335 acres.

Preliminary topography for the lake shores with a proposed dam at the south end was prepared in September 1971, by Hayes Engineering, Inc., Melrose, Massachusetts. This work was based on topographical plans prepared by the U.S. Department of Agriculture, Soil Conservation Service, with contour intervals of 4 feet.

Haley & Aldrich, Inc., Consulting Soil Engineers of Cambridge, Massachusetts, were engaged to provide engineering services for a new dam, approximately 350 feet south of the existing dam. Sub-surface explorations were made from September 3, to October 15, 1971, with soil borings drilled by C. L. Guild Company, Inc., Braintree, Massachusetts. The design drawings, specifications, soils analysis, and other supporting data were submitted for review to the New Hampshire Water Resources Board on January 17, 1972. The design was done

in accordance with the design criteria of the Soil Conservation Service. The Board requested some changes, which were incorporated in the final construction drawings.

Haley & Aldrich, Inc., provided engineering services in the field during construction from May, to September, 1972. As of September 22, 1972, the dam was substantially complete. The emergency spillway remained unfinished as it was rough graded only.

The dam has been functioning satisfactorily since its completion.

i. Normal Operational Procedure

This dam is checked regularly by Mr. Jonathan Burnham, Manager of Controlled Environment Corporation. The only control available to lower the level of the lake is a 30-inch concrete pipe drain regulated by a sluice gate. The sluice gate is manually operated from the top of the riser.

1.3 Pertinent Data

a. Drainage Area

Eastman Pond as shown on the U.S.G.S. Quadrangle Sheet is located on the headwaters of Eastman Brook. It has a total drainage area of 7.5 square miles. The watershed is highly wooded, undulated, and rolling.

b. Discharge at Dam Site

(1) Outlets Works (conduits) -

Size - 30-inch diameter and invert Elevation 1094.0

(2) Maximum known flood at dam site - Flood of September 21-24, 1938. The magnitude is unknown.

(3) Ungated spillway capacity at maximum pool elevation

(a) Principal spillway (42-inch diameter concrete pipe).

257 cfs at 1123.9 Elevation

261 cfs at 1125.0 Elevation (at top of dam)

(b) Emergency Spillway.

3346 cfs at 1123.9 Elevation

4041 cfs at 1125.0 Elevation (at top of dam)

- (4) Total Spillway Capacity (Principal and Emergency Spillways) at maximum pool elevation.

3603 cfs at 1123.9 Elevation

4302 cfs at 1125.0 Elevation (at top of dam)

c. Elevation (Feet above MSL)

- (1) Top of dam - 1125.0.
- (2) Maximum pool elevation caused by the test flood - 1123.9.
- (3) Recreation pool - 1109. It is assumed that the recreation pool elevation is the same as the normal conservation level and the spillway crest elevation.
- (4) Spillway crest - 1109.
- (5) Upstream portal invert diversion tunnel - 1094.0.
- (6) Stream bed at centerline of dam - 1090.
- (7) Maximum tail water - 1089.0 (estimated).

d. Reservoir

- (1) Length of maximum pool - 2 miles (estimated).
- (2) Length of recreation pool - 1.6 miles (estimated).
- (3) Length of flood control pool - 1.8 miles (estimated).

e. Storage (Acre-Feet)

- (1) Recreation pool - 3,350 acre-feet.
- (2) Flood control pool - 5,170 acre-feet (estimated).
- (3) Design surcharge - 5,675 acre-feet (estimated) at a surcharge elevation of 1115.4 during passage of the Soil Conservation Service emergency spillway hydrograph.

(4) Top of dam - 9,225 acre-feet (estimated).

f. Reservoir Surface (Acres)

(1) Top of dam - 435 acres (estimated).

(2) Maximum pool - 513 acres (estimated).

(3) Flood control pool - 369 acres.

(4) Recreation pool - 335 acres. It is assumed that the recreation pool elevation is the same as the spillway crest elevation.

(5) Spillway crest - 335 acres.

g. Dam

(1) Type Earth embankment.

(2) Length 415 feet.

(3) Height 45 feet.

(4) Top width 40 feet.

(5) Side slopes 1 vertical to 2.5 horizontal.

(6) Zoning Essentially, it is a homogeneous type of dam consisting of impervious glacial till. Drawings allowed material having less than 30 per cent finer than No. 200 mesh sieve to be placed in the downstream portion of the dam.

(7) Impervious core None.

(8) Cutoff Compacted earth, cut-off trench with a minimum width of 12 feet.

h. Intake Structure

- | | |
|---------------------|----------------------------|
| (1) Type | Reinforced concrete riser. |
| (2) Length of weir | 10.5 feet. |
| (3) Crest elevation | 1109. |
| (4) Gates | None. |
| (5) U/S channel | Pond. |

i. Emergency Spillway

According to visual observations made on June 6, 1978, this spillway has been rough-graded but not finished. Plans prepared for the construction of this dam indicate the following:

- | | |
|---------------------|---|
| (1) Type | Vegetated earth channel. |
| (2) Dimensions | 50 feet wide and approximately 1,100 feet long. |
| (3) Crest elevation | 1115.7. |
| (4) Gate | None. |
| (5) U/S channel | Pond. |

j. Reservoir Drain

- | | |
|-----------------------|----------------------------------|
| (1) Invert | 1094.0. |
| (2) Size | 30-inch diameter. |
| (3) Description | Concrete pipe. |
| (4) Control mechanism | Gate control, manually operated. |

SECTION 2 - ENGINEERING DATA

2.1 Design

Drawings indicating plans, elevations, and sections of the dam and appurtenant structures, including the details of the discharge facilities, such as outlet works, and emergency spillways, were obtained from Haley & Aldrich, Inc. Selected drawings are included in Appendix B. The design report which includes the logs of the borings and the design summary sheet was also obtained from Haley & Aldrich, Inc. See Appendix B for detailed listing.

2.2 Construction

a. Concrete Properties

Source, type of aggregate, cement used, mix design data, and result of testing are not available from project records. Available records indicate that Haley & Aldrich, Inc., had full-time representation at the site between May, and September, 1972. Therefore, data pertaining to the concrete properties may be filed in the office of Haley & Aldrich, Inc., Cambridge, Massachusetts.

b. Construction History

- (1) Initially during construction, Eastman Brook was diverted into a 10-foot wide riprap channel along the east abutment. After the completion of the reservoir drain, the riser, and the 42-inch conduit, this brook was rediverted into the principal spillway.
- (2) Available design drawings have been revised to indicate the modifications made during construction due to field conditions.
- (3) Construction sequence, pertinent construction problems, and maintenance repair are not available from project records.

c. Testing

Construction control test are not available from project records. Since there was a representative of Haley & Aldrich, Inc., on the site, these tests were probably performed.

2.3 Operation

Records of operation of this dam and of performance observations are not available.

2.4 Evaluation

a. Availability

Pertinent structural, geotechnical, hydrologic, and hydraulic data, which formed the basis of the design of the dam, are available at the office of Haley & Aldrich, Inc., who designed this dam.

b. Adequacy

Sufficient engineering data are available for a Phase I inspection.

c. Validity

The available engineering data is considered valid on the basis of the results of the visual inspection.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

The Phase I inspection of the Eastman Lake Dam was performed on June 6, 1978. A copy of the inspection check list is included in Appendix A.

a. General

In general, the soil and rock features are in good condition. The concrete structure of this dam was observed to be in good condition, see subparagraph c.

b. Dam

The 40-foot wide paved roadway on the crest is in excellent condition with no visible signs of horizontal or transverse cracks. The wood guardrail is also in good condition with no apparent vertical or horizontal misalignments. The upstream and downstream seeded slopes on each side of the dam are in good condition. The riprap slope protection below the 15-foot wide berm on the upstream side is also in good condition, and there is no indication of sloughing, bulging, or movement of the slopes. No evidence of piping was observed.

Two wet patches were observed on the downstream side approximately 150 feet east of the existing catch basin above the elevation of the permanent pool. These patches were also observed in 1976, by the New Hampshire Water Resources Board.

On the upstream seeded slopes, four areas of erosion, minor in nature, were observed.

c. Appurtenant Structures

At the time of our inspection, the water level was at Elevation 1109 msl. The concrete of the riser above the reservoir water surface was observed to be in excellent condition. The sluice gate in the riser controlling flow through the 30-inch reservoir (lake) drain is in operable condition. The 42-inch diameter outlet pipe is in excellent condition. The joint alignment is generally good. No erosion was noted. The wooden footbridge over the outlet channel, approximately 20 feet from the outlet structure, is in good condition. The wooden railings on either side of the bridge are also in good condition. It appears that this bridge was built for scenic reasons and will not impede the flow in the channel.

The inspection indicated that the emergency spillway has not been completed; and the existing alignment is offset, approximately 25 feet, at the roadway crossing. Along the east side of the spillway there is a sewer line which terminates at a treatment plant that contains lagoons. The channel of this spillway is being used as a construction roadway and, therefore, the channel and its side slopes have not been seeded. This situation was also observed in 1976, by the New Hampshire Water Resources Board. In this report, the inspecting engineer stated the following: "If spillway used, there would be a tremendous amount of silt going downstream, needless to say what would happen to the sewer line."

Field observation indicates that the lake level is controlled by the intake structure, concrete riser. The only control available to lower the level of the lake is the 30-inch drain.

d. Reservoir Area

Eastman Pond is at the head of Eastman Brook and south of North Grantham, which is located near the west shore of the pond.

Eastman Pond has an area of 335 acres at Elevation 1109. There is a planned residential area and some cottages around the pond. The shoreline is heavily wooded.

e. Downstream Channel

The downstream channel and side slopes are in good condition.

Debris was observed in this channel. The quantity of debris is small and will not impede the flow in the channel.

3.2 Evaluation

The observed condition of the dam is good. The potential problems observed during the visual inspection are:

- a. Unfinished emergency spillway.
- b. Two soft spots on the downstream face.
- c. Erosion areas on the upstream slope.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The Controlled Environment Corporation has operated the Eastman Lake Dam since it was constructed in 1972. The lake level is controlled by the intake structure which is a reinforced concrete riser with a single stage crest. The only control available to lower the level of the lake is a 30 inch concrete pipe drain which connects to a concrete riser. The flow through the drain is regulated by a sluice gate manually operated from the top of the riser.

4.2 Maintenance of Dam

The maintenance of Eastman Lake Dam is the responsibility of the Controlled Environment Corporation.

4.3 Maintenance of Operating Facilities

No written maintenance procedures were disclosed for Eastman Lake Dam.

The maintenance of the manually operated gate controlling flow in the 30-inch diameter reservoir drain is good.

4.4 Description of any Warning System in Effect

A flood warning system is non-existent.

4.5 Evaluation

The current operation and maintenance procedures for Eastman Lake Dam are on ad hoc basis.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

- (1) This dam falls under the category of high hazard potential, and it is intermediate in size. Using the "Recommended Guidelines for Safety Inspection of Dams," the recommended spillway test flood peak inflow is equal to the probable maximum flood. The spillway test flood inflow hydrograph, estimated, is furnished in Appendix D. The spillway test inflow flood peak is 15,560 cfs.
- (2) The computed peak outflow is 3,548 cfs, corresponding to the routed spillway test flood peak inflow. Refer to Appendix D for details.
- (3) The lake storage capacity versus the elevation, an estimated capacity curve, is included in Appendix D.
- (4) The estimated composite discharge rating curve for the principal spillway and emergency spillway is furnished in Appendix D.
- (5) The hydrologic map of the watershed above the dam site, including reservoir area, watercourse, is furnished in Appendix D.

b. Experience Data

This dam has not been exposed to any unusual floods.

c. Visual Observations

The crest of the earth dam is 9.1 feet above the crest of the emergency spillway or 16 feet above the crest of the principal spillway. The hydraulic design of the principal spillway is good. The outlet of the principal spillway cantilevers into a stilling basin at the toe of the dam. The emergency spillway has been rough-graded but not finished at the time of the inspection. It must be noted here that the New Hampshire Water Resources Board has taken a serious view of the lapse on the part of the owner for not carrying out all the requirements of the construction permit.

d. Overtopping Potential

The spillway test flood peak inflow is 15,560 cfs. When this test flood is routed by an approximate method through the lake, it is found that the maximum surcharge water surface elevation in the lake would be 1123.9. Therefore, the earth dam will not be overtopped. Surcharge height above the crest of the principal spillway would be about 14.9 feet, and the surcharge height above the crest of the emergency spillway would be 8.2 feet.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The upstream slope could not be seen due to the fact that it was underwater. The slopes of the embankment do not show any weak areas. The visual inspection revealed no evidence of stability problems.

b. Design and Construction Data

Design drawings and the design report for this project were obtained from project records. These drawings have been revised by the design engineer to indicate modifications made due to field conditions. The design report indicates that stability analysis for sudden drawdown and long-term condition was performed by the Design Engineer. The design report contained no computations but listed the minimum factor of safety of 2.5.

c. Operating Records

Except for memorandums and correspondence listed in Appendix B, other records are not available.

d. Post-Construction Changes

Available records indicate that this dam has not been modified since its construction.

e. Seismic Stability

The dam is located in Seismic Zone 2 and, in accordance with the recommended Phase I guidelines, does not warrant seismic analyses

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

Examination of available documents and visual inspection of Eastman Lake Dam and its appurtenant structures did not reveal any defects which would render the project inadequate from the standpoint of structural stability and the dam is judged to be in good condition.

b. Adequacy of Information

An adequate assessment of the dam consistent with the scope of a Phase I investigation has been made based upon the visual inspection and available information.

c. Urgency

The remaining work on the emergency spillway should be started within one year of receipt of Phase I report by the owner and the operational and maintenance measures, enumerated in Section 7.3 below, should be implemented within 2 years.

d. Need for Additional Investigation

At this time, there are no problems which would require additional investigation.

7.2 Recommendations

No major modification or engineering investigation is recommended at this time.

7.3 Remedial Measures

Although the dam is generally maintained in good condition, it is considered important that the following operating and maintenance procedures be attended to as early as practical:

a. The emergency spillway should be completed as per approved plans and specifications.

b. Erosion areas on the upstream slope should be corrected as continued erosion could develop into a serious problem.

c. The two soft patches on the downstream face should be monitored and the cause should be explored for correction.

d. An operating and maintenance manual for the project should be prepared.

e. A program of technical bi-annual periodic inspection of the project feature should be prepared and initiated.

f. As the dam is upstream of a populated area, round-the-clock surveillance should be provided during periods of high precipitation.

g. The owner should develop a formal warning system. An operational procedure to follow in the event of an emergency should also be adopted.

7.4 Alternatives

None recommended.

APPENDIX A
VISUAL INSPECTION CHECK LISTS

APPENDIX A

VISUAL INSPECTION CHECK LIST PARTY ORGANIZATION

PROJECT Eastman Lake Dam DATE June 7, 1978
 TIME 830 - 1200
 WEATHER Sunny
 W.S. ELEV. 1109 U.S. DN.S.

PARTY:

1. <u>Jurgis Gimbutas, P.E.</u>	<u>Team Captain - Structural and Concrete</u>
2. <u>Harvey H. Stoller, P.E.</u>	<u>Soils, Geology, & Foundations</u>
3. <u>V. Rao Maddineni, P.E.</u>	<u>Hydraulics & Hydrology</u>

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Dam Embankment</u>	<u>H. H. Stoller</u>	<u>Good</u>
2. <u>Intake Channel</u>	<u>H. H. Stoller</u> <u>V. R. Maddineni</u>	<u>Good</u>
3. <u>Intake Structure - Riser</u>	<u>J. Gimbutas</u>	<u>Excellent</u>
4. <u>Outlet Works - Conduit</u>	<u>J. Gimbutas</u> <u>H. H. Stoller</u>	<u>Excellent</u>
5. <u>Outlet Channel</u>	<u>V. R. Maddineni</u>	<u>Good</u>
6. <u>Pond and Downstream Channel</u>	<u>V. R. Maddineni</u>	<u>Good</u>

PERIODIC INSPECTION CHECK LIST

PROJECT Eastman Lake Dam DATE June 7, 1978
 PROJECT FEATURE Dam Embankment
 DISCIPLINE Soils & Foundations NAME Henry J. Stille
 PROJECT FEATURE _____
 DISCIPLINE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	1125.0 msl
Current Pool Elevation	1109 msl
Maximum Impoundment to Date	1110.8 msl
Surface Cracks	None observed
Pavement Condition	Excellent
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	No visual vertical misalignment observed
Horizontal Alignment	No visual horizontal misalignment observed
Condition at Abutment and at Concrete Structures	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Eastman Lake Dam DATE June 7, 1978

PROJECT FEATURE Dam Embankment

DISCIPLINE Soils & Foundations

NAME Henry H. Hill

PROJECT FEATURE _____

DISCIPLINE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	None observed
Sloughing or Erosion of Slopes or Abutments	Minor erosion (see narrative)
Rock Slope Protection - Riprap Failures	Good condition
Unusual Movement or Cracking at or Near Toes	None
Unusual Embankment or Downstream Seepage	None (see narrative)
Piping or Boils	None observed
Foundation Drainage Features	Could not be observed
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Eastman Lake Dam DATE June 7, 1978

PROJECT FEATURE Riser

DISCIPLINE Structures

NAME _____

PROJECT FEATURE Intake Channel

DISCIPLINE Soils & Foundations

NAME John H. Hall

DISCIPLINE Hydraulics & Hydrology

NAME L. A. M. Smith

AREA EVALUATED

CONDITION

OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE (RISER)

a. Intake Channel

Slope Conditions

Slopes above water level in
good condition

Bottom Conditions

Could not be observed

Rock Slides or Falls

None observed above water line

Log Boom

None

Debris

None observed

b. Intake Structure (Riser)

Condition of Concrete

Excellent

Stop Logs and Slots

None

PERIODIC INSPECTION CHECK LIST

PROJECT Eastman Lake Dam DATE June 7, 1978

PROJECT FEATURE Conduit

DISCIPLINE Structures NAME _____

PROJECT FEATURE Outlet Channel

DISCIPLINE Soils & Foundations NAME Henry H. Hill

DISCIPLINE Hydraulics & Hydrology NAME W. P. ...

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONDUIT</u>	
Size	42-inch concrete pipe
General Condition of Concrete	Excellent
Erosion or Cavitation	None observed
Outlet Channel	
Loose Rock or Trees Overhanging Channel	None observed
Condition of Discharge Channel	Good

APPENDIX B
EXISTING AVAILABLE INFORMATION

APPENDIX B

1. Listing of Design, Construction, and Maintenance Records:

Haley & Aldrich, Inc., 238 Main Street, Cambridge, Massachusetts, have the tracings of their design drawings dated January 14, 1972 to March 9, 1972. There are twelve sheets, including Sheet 6A.

The general title of the drawings, design report, and specifications listed above is: Controlled Environment Corporation, Grantham, New Hampshire, Eastman Lake Dam.

These drawings show the dam site plan, principal spillway, dam section with cutoff trench and drainage blanket, emergency spillway, riser and gate house details, conduit details, cradle and bent details. Reservoir Drain Sheets 1 to 6, 7, 10, and 11 have revisions (construction notes) dated September 22, 1972. The revision for Sheet 6A is dated March 9, 1972. Haley & Aldrich, Inc., file number is 2786.

Three sets of blueprints of the above drawings are filed at the New Hampshire Water Resources Board in Concord, New Hampshire.

Haley & Aldrich, Inc., and the New Hampshire Water Resources Board also have the design report, dated January 17, 1972, which contains the design data, foundation and soils data, and project specifications; all of which are found in two books.

Other records filed at the New Hampshire Water Resources Board are:

- (1) Eastman Pond topographical plan, dated September 22, 1971, showing the old existing dam, and the proposed dam, made by Hayes Engineering, Inc., 828 Lynn Fells Parkway, Melrose, Massachusetts.

Note: A copy of this plan is also included with the Haley & Aldrich, Inc., design report of 1972.

- (2) February 18, to December 12, 1972. Exchange of letters between Mr. Donald M. Rapoza, Water Resources Engineer, New Hampshire Water Resources Board, and Mr. Peter L. LeCount, P.E., of Haley & Aldrich, Inc., containing various design changes and additions, and finishing up the construction.

Note: These changes are added to the design drawings and revisions.

- (3) July 8, 1976. Memorandum from Mr. Vernon A. Knowlton, Water Resources Engineer, to the Board of Directors, New Hampshire Water Resources Board. This memorandum explains the potentially dangerous situation since the owner of the dam had not completed the construction of the emergency spillway. It recommends that the spillway be completed during the summer of 1976.

2. Copies of Past Inspection Reports Included Are:

July 2, 1976, by Mr. Donald M. Rapoza, New Hampshire Water Resources Board (four pages).

3. Drawings included with this appendix are the following sheets selected from the design plans made by Haley & Aldrich, Inc., in 1972:

Sheet No. 1. Dam Site Plan, including General Notes.

Sheet No. 2. Principal Spillway and Dam Section.

Sheet No. 3. Cutoff Trench and Drainage Blanket.

Sheet No. 4. Emergency Spillway Alignment and Details.

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORTTown: COXN - HAM Dam Number: 7704Name of Dam, Stream and/or Water Body: EDSMAN LAKEOwner: CONTROLLED ENVIRONMENT CORP Telephone Number: _____Mailing Address: 100 ELM STREET, MANCHESTER NHMax. Height of Dam: 40 FT. Pond Area: 335 ACRES Length of Dam: 415 FT.FOUNDATION: BPM FOUND ON SOIL (SEE PLAN)OUTLET WORKS:

PIPE (PRINCIPAL) SPIG-WAY DISCHARGING
INTO SLOPED STILLING BASIN
OUTLET WORKS EXCELLENT CONDITION

ABUTMENTS:

STRUCTURE BUILT NATURAL EARTH
ON BOTH ENDS.

EMBANKMENT: EARTH EMBANKMENT WITH MUD

TRANSIT LANE ON UPSTREAM SIDE
OF EMBANKMENT. ONE ^{VERY SMALL} SECT AREA WAS
FOUND ON THE DOWN STREAM SIDE OF
THE EMBANKMENT AT THE RIGHT ABUTMENT *

Note: Give Sizing, Condition and detailed description for each item, if applicable.

SPELLWAY: Length: SEE PLANS Freeboard: _____

SEEPAGE: Location, estimated quantity, etc.

SEE COMMENT ON

Changes Since Construction or Last Inspection:

NONE

Tail Water Conditions:

NORMAL STREAM FLOW BELOW SPILLING BASIN

Overall Condition of Dam: DAM EXCELLENT, ^{EMERGENCY} SPILLWAY POOR

Contact With Owner: L/C

Date of Inspection: JUNE 25, 1976 Suggested Reinspection Date AFTER ES
CONDITIONS RECTIFIED

Class of Dam: HEAVY CLASS C

Signature Donald M. Ryan

Date JULY 2, 1976

EMERGENCY SPILLWAY: SEE #2 IN COMMENT SHEET

Reproduced from
best available copy.



COMMENTS:

*1 THIS PIPE WAS ABOVE THE LEVEL OF THE PERMANENT PILE. MAY BE SERVICE FROM ADJACENT WELLS OR FROM SEWER LINE. SAW TWO COUPERS AT THE OF EMBANKMENT DISAPPEARED INTO ROCK RIPRAP. SHOULD BE REMOVED BEFORE THEY CAUSE ANY DAMAGE TO THE EMBANKMENT.

*2 THE EMERGENCY SPILLWAY IS NOT COMPLETED AND THE EXISTING ALIGNMENT IS OFFSET APPROXIMATELY 25 FEET AT THE ROADWAY CROSSING. THERE ARE Pools OF WATER STANDING IN THE E.S. THE ES IS BEING USED AS A SERVICE ROAD. NO VEGETATION GROWS AT END OF E.S. AND SEWER LINE RUNNING THE LENGTH OF SPILLWAY. IF SPILLWAY USED THE WOULD BE A TERRIFIC AMOUNT OF SILT COME DOWN STREAM. NEEDS TO SEE WHAT WOULD HAPPEN TO THE SEWER LINE.

RECOMMENDATIONS

1. HAVE THE SCS. DETERMINE THE DISCHARGE CAPACITY OF SPILLWAY WITH EXISTING ALIGNMENT
2. BEFORE GOING TO ~~CONSTRUCTION~~ CONDUCT E.S. ACCORDING TO PROPOSED PLANS IF DISCHARGE CAPACITY WILL BE AFFECTED BY EXISTING ALIGNMENT.

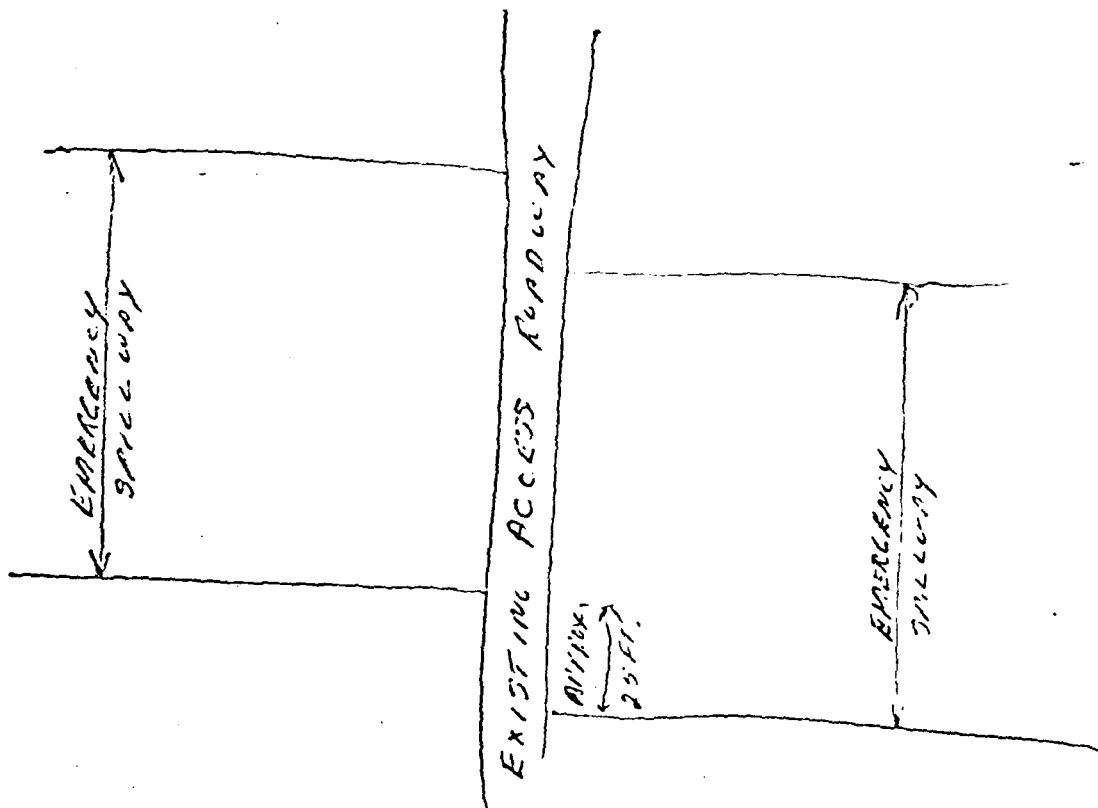
D-5

2. DUE TO POOR LAY OUT AT END OF SPILLWAY

SKETCH OF DAM

(Show Plan, Elevation & Cross Sections)

SEE PLANS IN FILE





TELEPHONE
DIMENSIONS
FROM ADJACENT
CAM-AREA
ELEVATION

ENTIRE AREA OF DAM
EMBANKMENT TO BE
CLEARED, STRIPPED AND
STRIPPED BACK TO
TOPSOIL

INSTALL A ROAD GUTTER
ACROSS THE ROADWAY
ELEVATION 4.11 TO STREAM
TIE OF 6.000

INSTALL CATCH BASIN TO
INTERCEPT ROADWAY DITCH
CONDUIT WATER TO DOWN
STREAM RIPRAP GUTTER

0.50

ROADWAY DITCH TO DISCHARGE
INTO RIPRAP GUTTER

GRABED THIS AREA
AND A GUTTER
TO EXISTING
THAT IN THE GUTTER
AT DAM

APPROX. LOCATION OF
DIVERSION CHANNEL
SEE TYPICAL SECTION
THIS SHEET

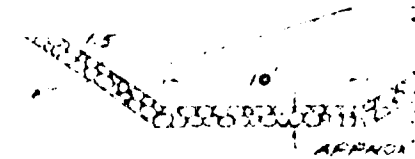
PROVIDE SETTLING BASIN
IN THIS AREA TO TRAP
SUSPENDED SEDIMENTS

PROVIDE CHECK DAMS TO
REDUCE VELOCITY

LEGEND

- Existing Easment Boundary
- XXXX Existing Stone Wall
- XXXX Existing ground surface spillway elevation
- Existing ground surface spillway
- 2 1/2" dia test boring location
- Machine-excavated test pit location

PROPOSED EMBANKMENT
OR ADJACENT



TYPICAL SECTION
DIVERSION CHANNEL
SCALE 1\"/>

NOTES ON TEMPORARY STREAM

1. Diversion Channel to be lined with boulders and to be 10' wide at mouth and be in alignment with layer.
 2. Check Dams and Settling Basins to be provided at velocities where gradients are high.
 3. Return stream into Principal Spillway following Basin, 42" dia conduit, bottom of River and Re.
 4. Following diversion of, remove channel lining, earth and collect material from channel excavation and
 5. Backfill channel excavation with embankment material composition of fill.
- Within dam area flatter excavation sides to 3' high before backfilling.

GENERAL NOTES

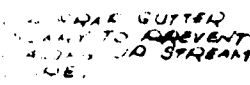
1. Soil test explorations made between 1/1/71 and 12/1/71. Logs of explorations, soil profiles, and laboratory test results are available from the Engineer. Locations of test borings and logs are shown on Sheet 1. Locations of engineering soil tests and below is a table of test results are shown on Sheet 4.
2. Project design and construction materials are to be in accordance with criteria established by the U.S. Department of Agriculture, Soil Conservation Service, Applicable for Conservation Service standards. All materials to be used are to be approved by the Conservation Service. Materials to be used are:
3. Gravel, sand, and silt to be provided by design.
4. Embankment materials to be used in the project are to be in accordance with the excavation shown on Sheet 4. Alternative materials may be used after prior testing and approval of the materials by the Engineer, and to the acceptability of the materials as determined by design.
5. Bedding material and drainage to be provided in the area of the source subject to uniformity and the materials specified in the design requirements.
6. Principal spillway conduit to be ANSWA C-121 reinforced concrete steel cylinder pipe designed for:
 - a. Min. 3-edge bearing strength of 12,000 lb./sq. ft. (40 ft. of conduit pipe above outlet may have min. 3-edge bearing strength of 50,000 lb./sq. ft.)
 - b. Max. pressure head - 200 ft.
 - c. Min. pressure head - 0 ft.
7. Cement for concrete shall be Type 1 or Type 2, where not otherwise indicated concrete shall be Class 4000.
8. Rock riprap may be "equipment-placed" material to be obtained from off-site source and or by separating acceptable on-site material from strip-mining or embankment material. Boulders may be broken in place to meet maximum size requirement. Compacted riprap to be well-graded without segregation.
9. Topsoiling, fertilizing, seeding and weeding to meet requirements to overall project development. Seed for dam and emergency spillway areas to be blended of predominantly perennial grasses for permanent vegetative cover. Mulch and or matting to be used on all slopes and areas subject to erosive water flow, in order to effectively prevent erosion until growth is fully established.
10. Revised section not according to Soil Conservation Service standard drawing.

SHEET NO.

- 1
- 2
- 3
- 4
- 5-7
- 8
- 9
- 10
- 11

NUMBER

CONT.

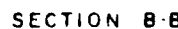


1. Excavation Channel to be lined with 12" tiles and boulders 3' diam. size to 1/2 mile size which can be incorporated into layers.
2. Check Flows and Settling Basin to be provided as required to reduce velocity where gradients are high.
3. Reduct stream into Principal Spillway following completion of Stilling Basin, 42" dia. conduit, bottom of Riser and Reservoir Drain System.
4. Following red version, remove channel lining, earth close and a soft and covered material from channel excavation within 100 yards 1 area.
5. Backfill channel excavation with embankment material for forming completion of cutoff.

SHEET NO	TITLE
1	DAM SITE PLAN
2	PRINCIPAL SPILLWAY AND DAM SECTION
3	CUTOFF TRENCH AND DRAINAGE BLANKET
4	EMERGENCY SPILLWAY ALIGNMENT AND DETAILS
5-7	RISER DETAILS
8	RISER ACCESSORIES
9	CONDUIT DETAILS
10	CRADLE AND BENT DETAILS
11	RESERVOIR DRAIN DETAILS

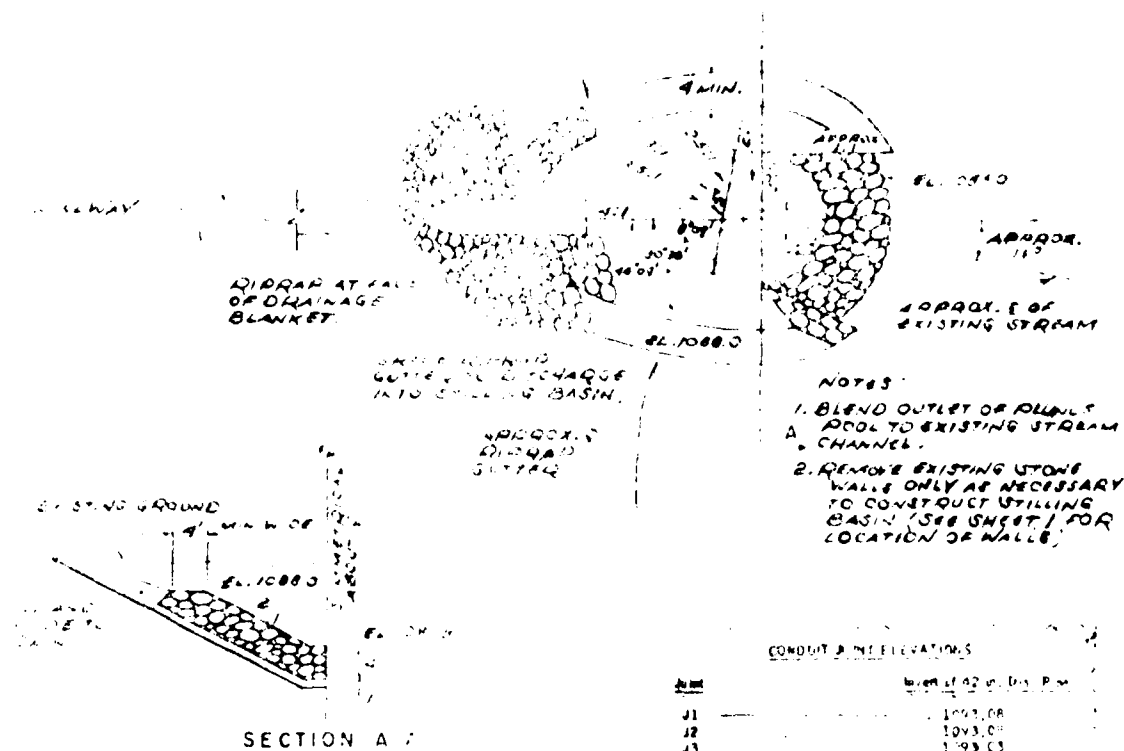
1. Subgrade explorations made between 3' and 17' from edge of road on both sides of road, and not less than 10' from edge of road from the Engineer's location of proposed embankment. Soil test locations are shown on sheet 4. Temporary soilways and subgrade explorations are shown on sheet 4.
2. Project design and construction materials are to be supplied by the contractor established by the U.S. Department of Agriculture, Soil Conservation Service, and approved by the State Department of Soil Conservation Service. Materials to be used are to be incorporated in the construction documents. (See Appendix A-20)
3. Survey control and layout to be provided by the contractor.
4. Embankment materials to be obtained from approved sources and all areas excavated shown on sheet 4. Alternative areas may be used after the contractor has tested and approved the materials for the project and the acceptability of the materials is determined by the State.
5. Bedding material and drain for the embankment shall be 12" thick, unless subject to conformance with the material specifications of the Department.
6. Final soilway conduit to be 48" x 48" reinforced concrete steel cylinder pipe designed for:
 - a. Min. 3-edge bearing strength for:
 - 0.001 in. crack - 12,000 lb. per ft. (50 kN/m)
 - b. Max. pressure head - 20.0 ft.
 - c. Min. pressure head - 0 ft.
7. Concrete for concrete shall be Type 1 concrete, minimum compressive strength concrete shall be Class 4000.
8. Rock riprap may be permanent-placed material to be obtained from off-site source and/or by separating acceptable material from final structure and embankment material. Boundaries may be determined by the maximum size requirement. Completed riprap to be approved without siting equal.
9. Topsoil, fertilizing, liming and seeding to meet requirement for normal project development. Seed for grass and emergency grass may be substituted for predominantly perennial grasses for permanent cover. Topsoil and fertilizing to be used on all slopes and areas to be seeded to develop water flow in order to effectively prevent erosion and washouts.
10. Riprap section not according to Soil Conservation Service standard drawing.

REVISIONS		
CONTROLLED ENVIRONMENT CORPORATION GASTHAVEN, MASSACHUSETTS		
EASTMAN LAKE DAM DAM SITE PLAN		
HALEY & ALDRICH, INC. CONSULTING SOIL ENGINEERS CAMBRIDGE, MASSACHUSETTS		
DRAWN BY <i>JM</i>	CHECKED BY <i>GRB</i>	APPROVED BY <i>PLL</i>
DATE <i>11/1/72</i>	SCALE <i>1" = 30'</i>	SHEET NO. <i>1</i>



Concise

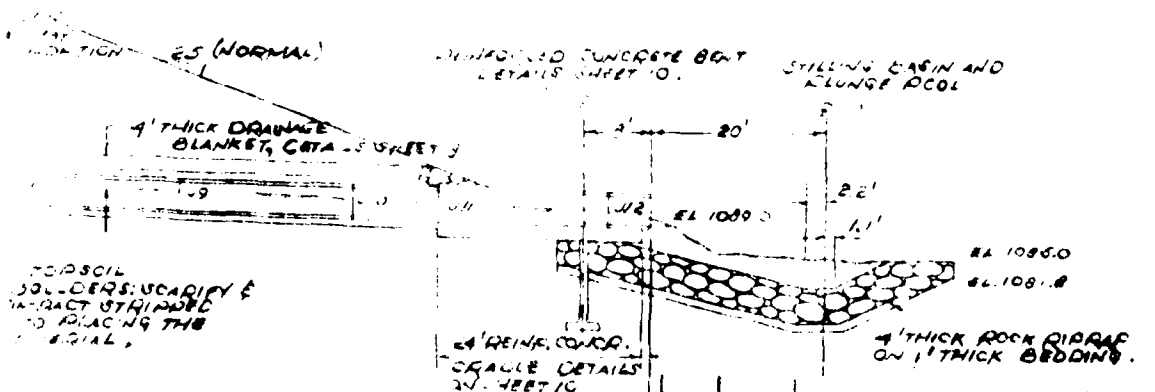
Note: Oversize cobbles and boulders to be mechanically removed.



SECTION A :

THE EARTH SLOVES TO BE
FILL, TILED, SEEDS AND
PLANTED.

CONDUIT POINT ELEVATIONS	
Point	Height of 42 in. Box Pave
J1	1093.08
J2	1093.08
J3	1093.03
J4	1092.82
J5	1092.83
J6	1092.78
J7	1091.84
J8	1091.78
J9	1090.67
J10	1090.36
J11	1089.76
J12	1089.15
Outlet	1089.00



1	3/31/72	400 R-100 BERM AND JOINT ELV
NO	DATE	DESCRIPTION
REVISION		
HALEY & ALDRICH, INC. CONSULTING SOIL ENGINEERS CAMBRIDGE, MASSACHUSETTS		
DRAWN BY JY	CHECKED BY GRB	APPROVED BY PLL
DATE 1/14/72	SCALE 1" = 10'	SHEET NO 2

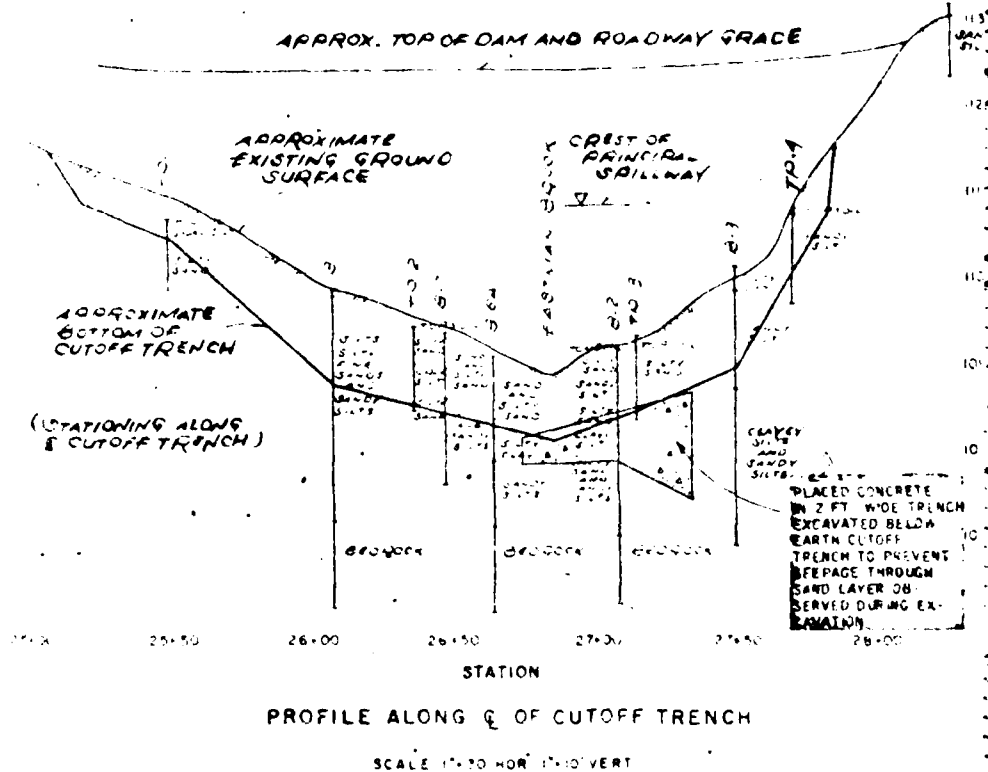
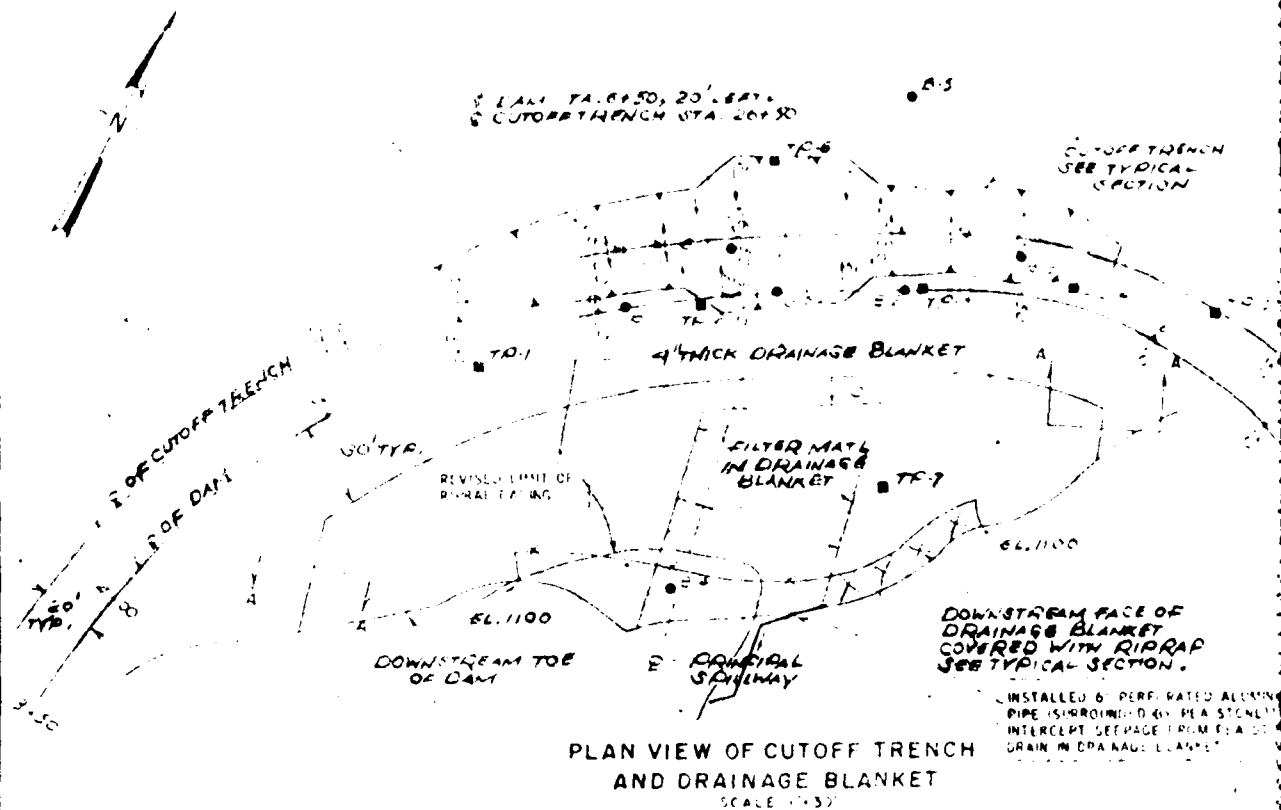
CONTROLLED ENVIRONMENT CORPORATION
GRANTHAM, NEW HAMPSHIRE

EASTMAN LAKE DAM
PRINCIPAL SPILLWAY
AND DAM SECTION

REVISION

HALEY & ALDRICH, INC.
CONSULTING SOIL ENGINEERS
CAMBRIDGE, MASSACHUSETTS

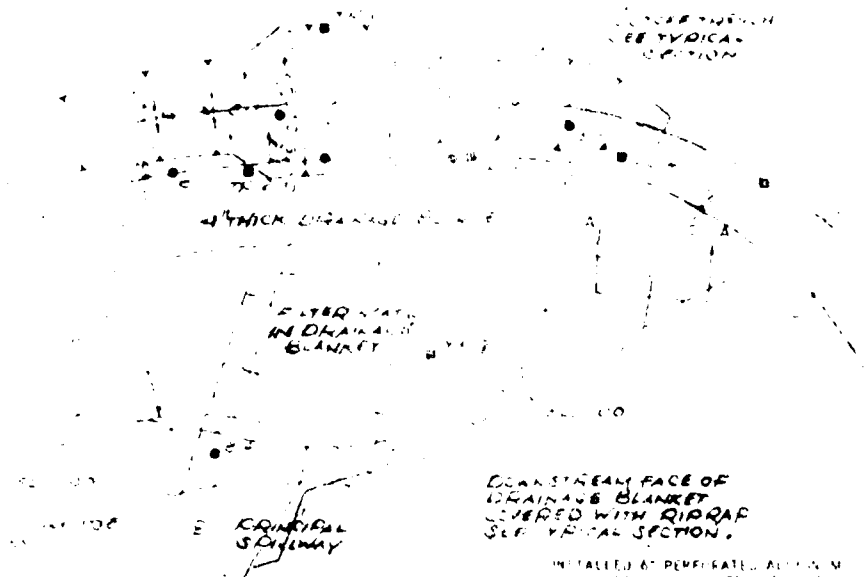
DRAWN BY JY	CHECKED BY GRB	APPROVED BY PLL
DATE 1/14/72	SCALE 1" = 10'	SHEET NO. 2



FILE NO. 2786

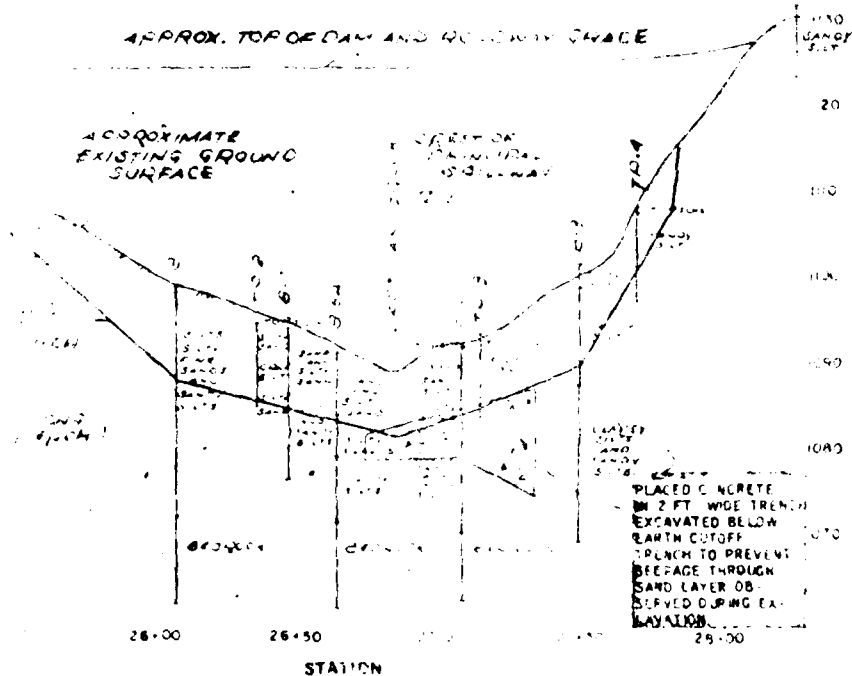
HALEY & ALDRICH, INC.

HA 1750, 20' EASE
 CUTOFF TRENCH STA. 25+50



PLAN VIEW OF CUTOFF TRENCH
 AND DRAINAGE BLANKET

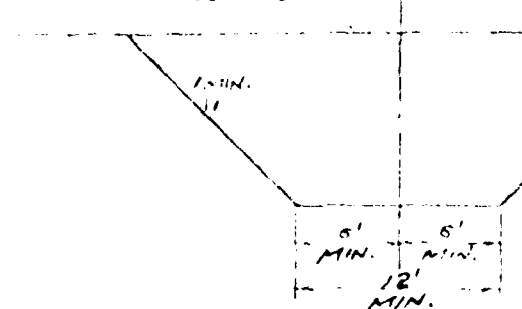
SCALE 1\"/>



PROFILE ALONG C OF CUTOFF TRENCH

SCALE 1\"/>

STRIPPED SHOULDER
 SURFACE

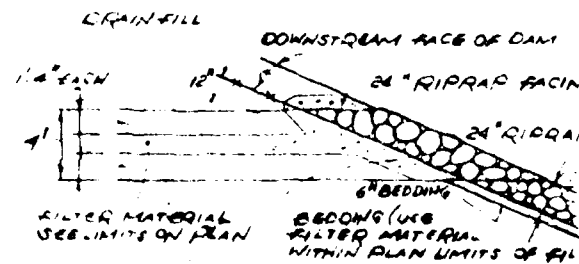


TYPICAL SECTION
 CUTOFF TRENCH

SCALE 1\"/>

CUTOFF NOTES

1. Following excavation of trench to planned grade, bottom and sides will be examined by Haley & Aldrich Soil Engineers to determine need for deepening.
2. Excavation and backfilling to be carried out in the dry.
3. Backfill with approved material, all material not less than 30% by dry weight finer than the No. 200 mesh sieve, maximum size 6\"/>

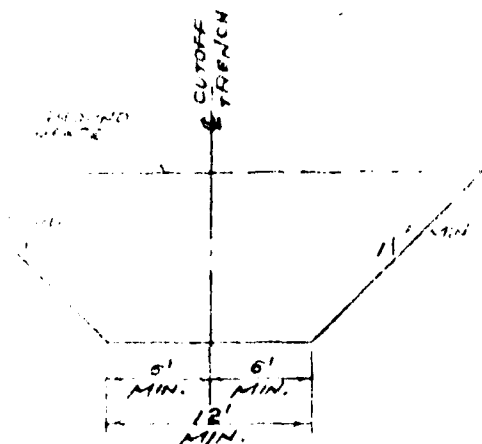


TYPICAL SECTION FOR RIP
 GUTTER AND DRAINAGE BLANKET

NOT TO SCALE

NOTES

1. FINAL LINE AND GRADE OF RIP GUTTERS TO BE DETERMINED BY ENGINEER
2. DRAIN FILL COMPACTION TO 98%
3. RIPRAP TO BE SET INTO GUTTER IN VICINITY OF STILLING BASIN NECESSARY FOR BASIN CONSTRUCTION



TYPICAL SECTION
CUTOFF TRENCH
SCALE 1"=5'

NOTES

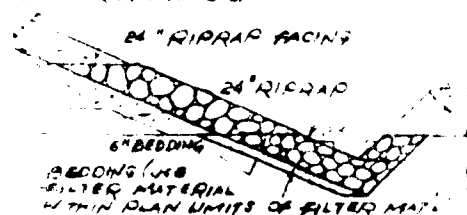
1. Trench to planned grades, bottom and sides
to be determined by Engineer to determine

2. To be carried out in the dry.

3. Riprap material not less than
No. 200 mesh sieve, maximum

4. Riprap material greater than 8 in. in loose
state, maximum moisture content,
ASTM D698, 100% of ASTM D698

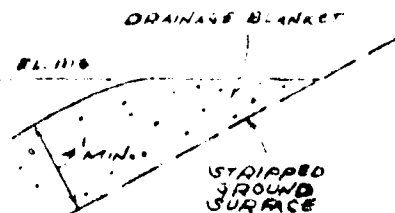
UPSTREAM FACE OF DAM



TYPICAL SECTION FOR RIPRAP
FILTER AND DRAINAGE BLANKET

NOT TO SCALE

1. ALL LINE AND GRADE OF RIPRAP
FACED TO BE DETERMINED BY
ENGINEER
2. ALL FILL COMPACTION TO BE CLASS 2
3. RIPRAP TO BE SET INTO DAM FACE
4. SLOPE OF STILLING BASIN AS
NECESSARY FOR BASIN CONSTRUCTION.



SECTION A-A
NOT TO SCALE

RIPRAP AND DRAINAGE BLANKET MATERIAL GRADATION REQUIREMENTS

RIPRAP

Stilling Basin: 4 max. size, at least 50% larger than 2", at least
15% smaller than 12 inches.

Dam Slopes &
Gutters: 2 max. size, at least 50% larger than 1 ft., at
least 15% smaller than 8'

RIPRAP BEDDING

Sieve Size	Percent Finer By Weight
6"	100
2"	65-85
3/4"	45-70
#4	15-50
#20	0-25
#200	0-5

DRAIN FILL

Sieve Size	Percent Finer By Weight
6"	100
2"	95-100
3/4"	80-100
#4	55-100
#20	15-80
#200	0-3

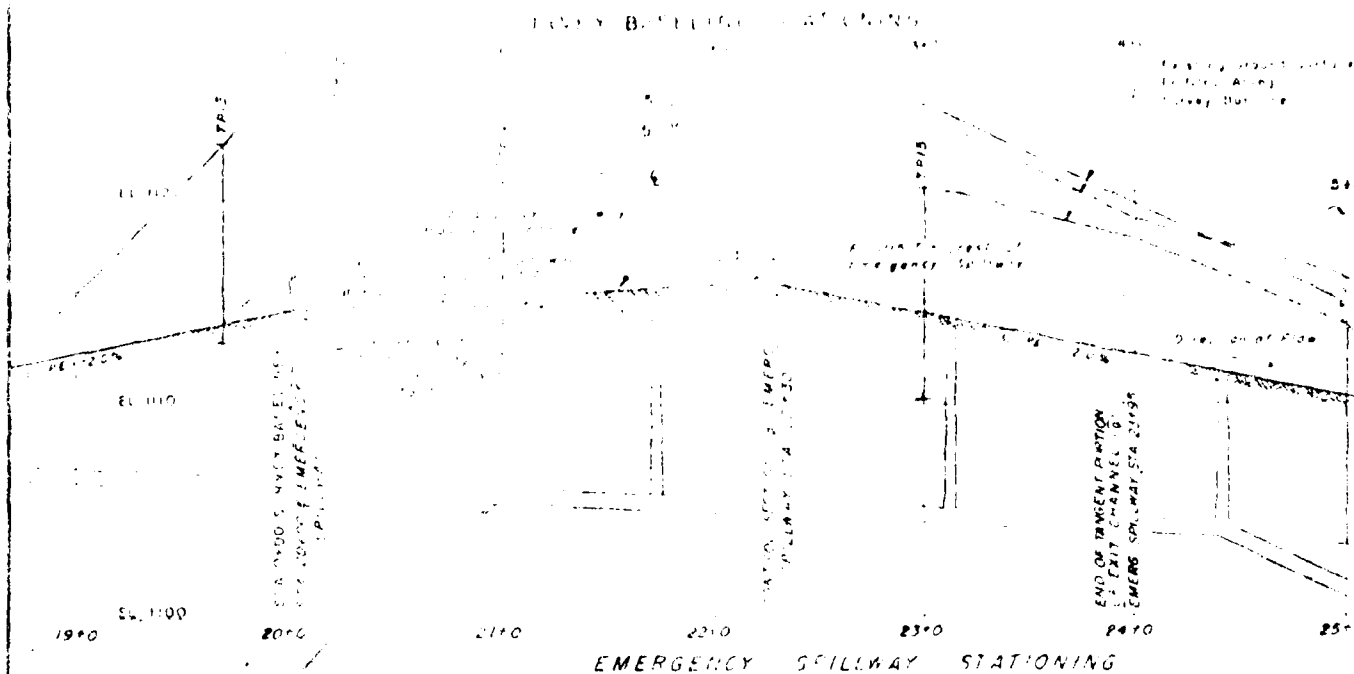
FILTER MATERIAL

Sieve Size	Percent Finer By Weight
1"	100
3/4"	90-100
3/8"	20-55
#4	0-10
#6	0-5

NOTE: Standard Stone Size #671

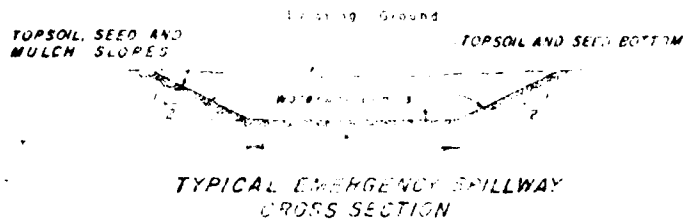
NOTE: Gradation limits subject to adjustment by Engineer to meet
filter criteria in relation to available borrow materials

9/22/72 CONSTRUCTION NOTES		
NUMBER	DATE	DESCRIPTION
1	9/22/72	CHANGE FROM 30340
REVISIONS		
CONTROLLED ENVIRONMENT CORPORATION GRANTHAM, NEW HAMPSHIRE		
EASTMAN LAKE DAM CUTOFF TRENCH AND DRAINAGE BLANKET		
MALEY & ALDRICH, INC. CONSULTING SOIL ENGINEERS CAMBRIDGE, MASSACHUSETTS		
DRAWN BY RM	CHECKED BY GGB	APPROVED BY F.L.
DATE 1/14/72	SCALE AS NOTED	SHEET NO 3



PROPOSED EMERGENCY SPILLWAY BOTTOM PROFILE

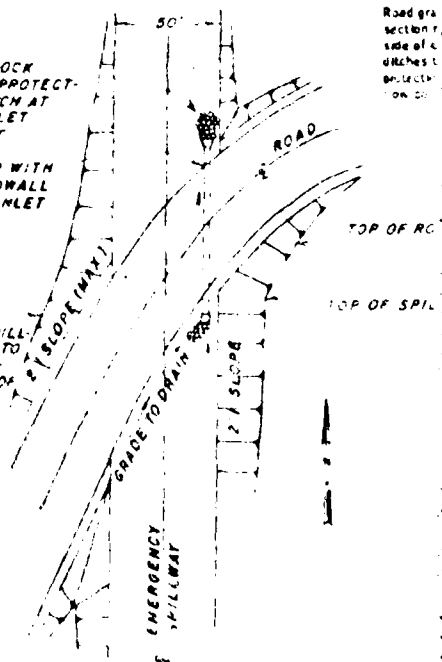
SCALES 1"=40' Horiz
1"=4' Vert



DUMPED ROCK
EROSION PROTECT-
ION IN DITCH AT
PIPE OUTLET
AND INLET

18" ACCMP WITH
METAL ENDWALL
AND DROP INLET

ROAD TO BE
CUT INTO SPILL-
WAY BANKS TO
AVOID OB-
STRUCTION OF
WATERWAY



NOTE

Road gra-
de section
side of
ditches
project
on di-

ROAD CROSSING DETAIL
SCALE 1"=40'

BASELINE STATIONING

2+0

4+0

5+0

EL 1120

6+0

7+0

EL 1110

22+0

23+0

24+0

25+0

26+0

EMERGENCY SPILLWAY STATIONING

PROPOSED EMERGENCY SPILLWAY BOTTOM PROFILE

SCALE: 1"=40' Horiz
1"=4' Vert

NOTE

Road grade to be such that entire roadway section rises above EL 1125 to either side of emergency spillway cut. Roadway ditches to have dumped rock erosion protection where grade is steep and/or flow concentrated.

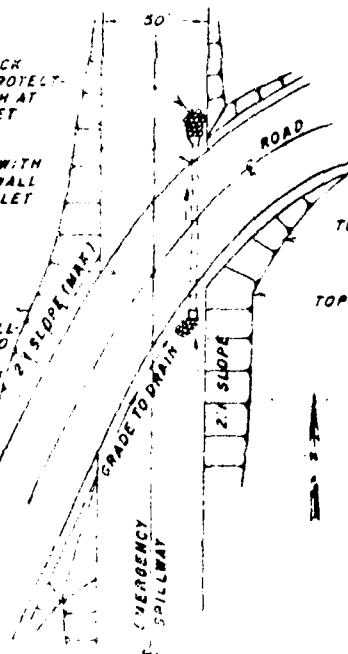
TOP SOIL AND SEED BOTTOM

SPILLWAY

DUMPED ROCK
EROSION PROTECTION
IN DITCH AT
PIPE OUTLET
AND INLET

18" ACCP WITH
METAL ENDWALL
AND DROP INLET

ROAD TO BE
CUT INTO SPILLWAY
BANKS TO
AVOID OBSTRUCTION
OF WATERWAY



ROAD CROSSING DETAIL

SCALE: 1"=40'

2

NOTE

Emergency spillway construction
not complete as of 9-22-72.

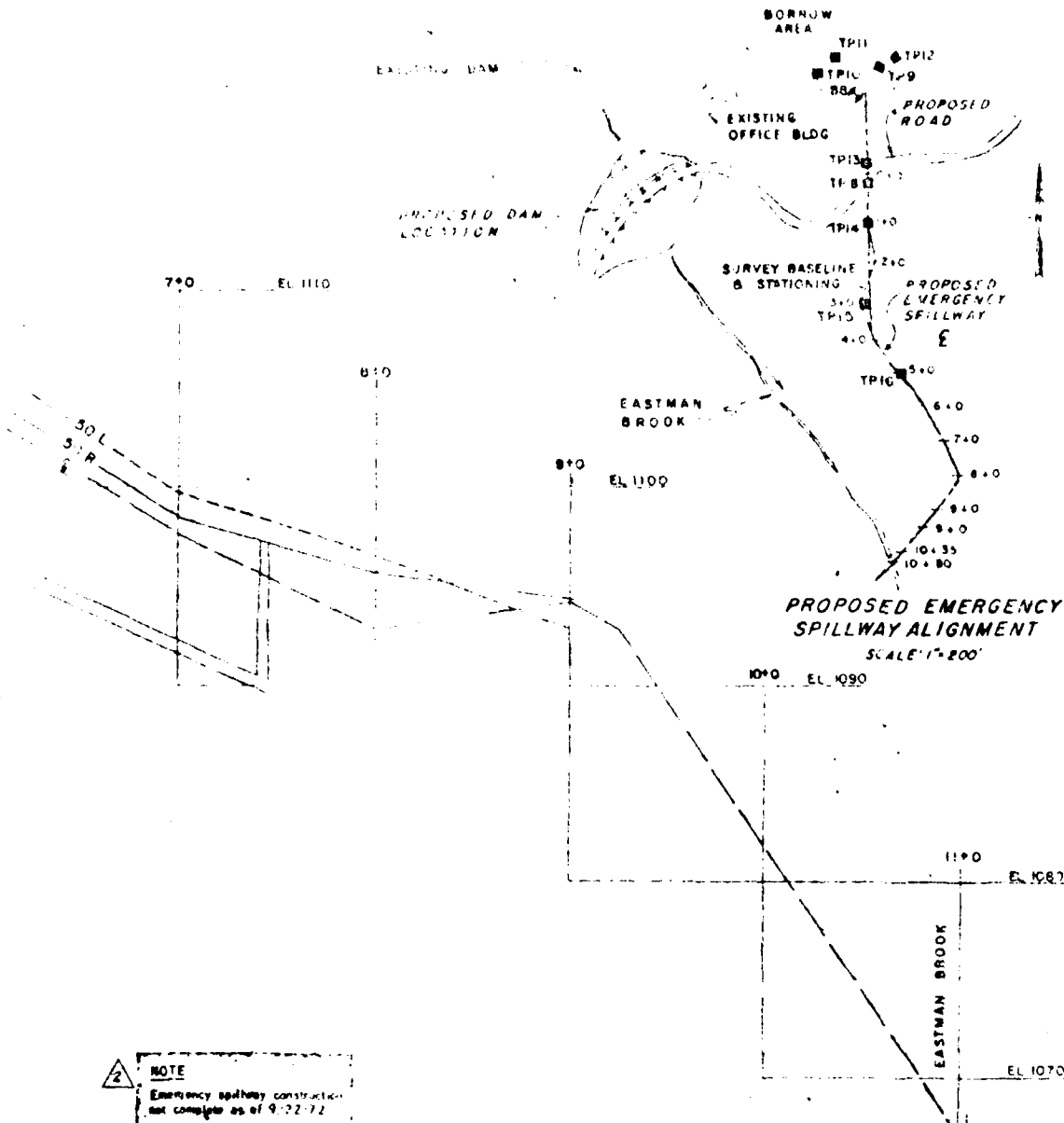
NOTES

1. Spillway baseline alignment and ground surface along existing grade provided by Hayes Eng., Inc.
2. Emergency spillway centerline and road alignment established in field by Hayes Engineering, Inc. to be verified from entrance at pond to Sta. 23+00.
3. Road crossing not to obstruct Emergency Spillway detail and grade requirement this sheet.
4. Elevation datum is U.S.G.S. Mean Sea Level.
5. Waterways and/or drainage riprap gutters to be as the direction of the Engineer in areas of concentrated flow. Slopes from cut slopes to be drain 18 in. thick blanket of Riprap Bedding material to blanket to extend down slope and 5 ft. out onto apr.

EXISTING SHORELINE

EASTMAN POND

PROPOSED SHORELINE



NOTE
Emergency spillway construction not complete as of 9-22-72

NOTES

1. Spillway baseline alignment and ground surface profiles along existing embankment provided by Hayes Engineering, Inc., Cambridge, Mass.
2. Emergency spillway, dam, and road alignment to be established in field by Hayes Engineering, Inc., Cambridge, Mass. to be straight from entrance of pond to the spillway.
3. Road crossing not to obstruct Emergency Spillway. See detail and grade measurement this sheet.
4. Elevation datum is U.S.G.S. Mean Sea Level.
5. Underways and/or development riprap gutters to be provided at the discretion of the Engineer in areas of concentrated overbank flow. Sediment from cut slopes to be drained by min. 18 in. sheet piling of Riprap Bedding material below support. Riprap to extend down slope and 5 ft. into water bottom.

9-22-72 CONSTRUCTION NOTES		
3-3-72 ROAD CROSSING SLOPE NOTES		
NUMBER	DATE	DESCRIPTION
REVISIONS		
CONTROLLED ENVIRONMENT CORPORATION GRANTHAM, NEW HAMPSHIRE		
EMERGENCY SPILLWAY ALIGNMENT AND DETAILS		
HALEY & ALDRICH, INC. CONSULTING SOIL ENGINEERS CAMBRIDGE, MASSACHUSETTS		
DRAWN BY RM	CHECKED BY GPB	APPROVED BY PLL
DATE 1/14/72	SCALE AS NOTED	SHEET NO 4

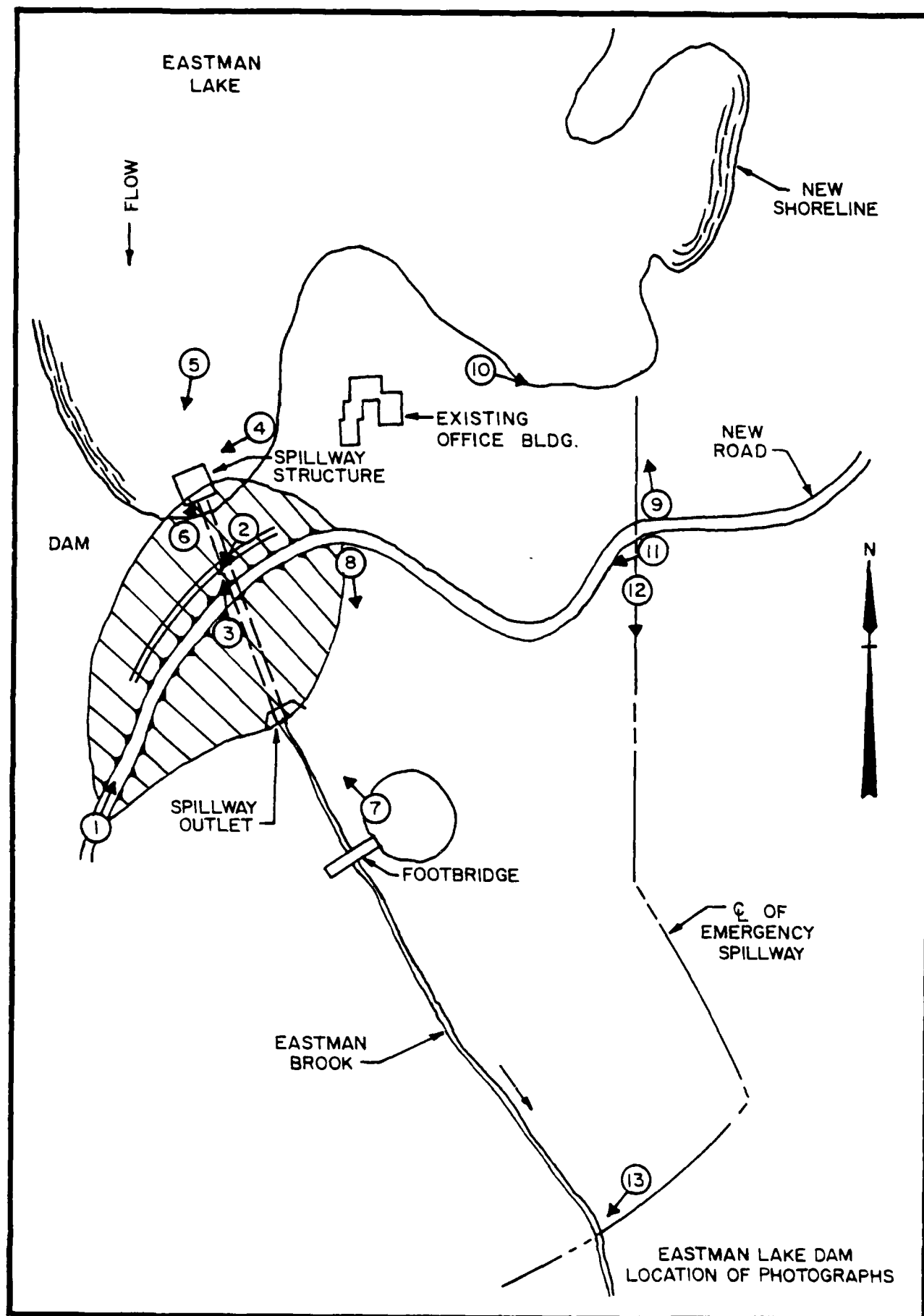
APPENDIX C
PHOTOGRAPHS

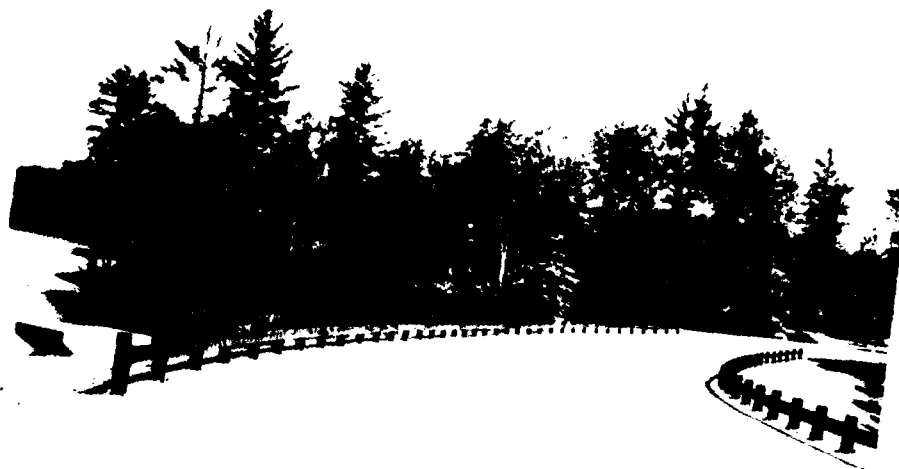
APPENDIX C

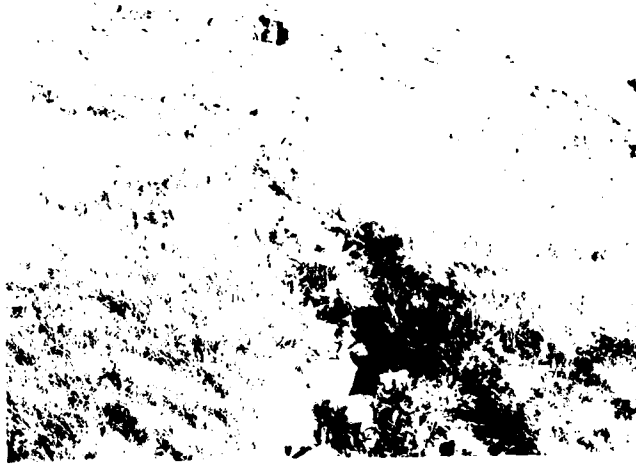
REPRESENTATIVE PHOTOGRAPHS OF PROJECT

<u>LOCATION PLAN</u>		<u>Page</u>
Plan 1 - Location of Photographs Taken June 7, 1978		C-3
<u>PHOTOGRAPHS</u>		
<u>No.</u>	<u>Negative No.</u>	<u>Page</u>
1. Roadway along top of Eastman Lake Dam, looking northeast.	5-32	C-4
2. Erosion of seeded slope between the upstream berm and top of dam.	5-28	C-4
3. Erosion of surface drain on the upstream slope, above the berm.	5-30	C-5
4. Riprap protection of upstream slope and intake structure.	5-27	C-5
5. Intake structure riser with two crests, looking northwest.	5-29	C-6
6. Crest is inside of intake riser.	6-13A	C-6
7. Spillway pipe outlet and riprap protection of stilling basin.	6-4A	C-7
8. Outlet channel and footbridge, looking downstream from top of dam.	5-33	C-7
9. Emergency spillway, unfinished, looking north towards the lake.	6-7A & 8A	C-8
10. Lake outlet to the emergency spillway.	5-35	C-9
11. Service road crossing the emergency spillway, looking west.	6-10A	C-9

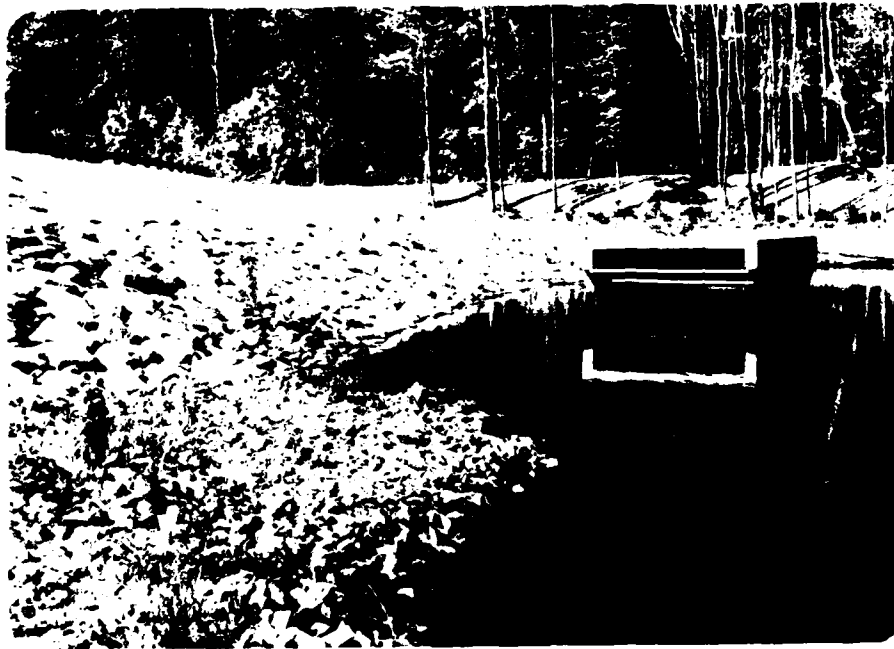
<u>No.</u>	<u>Negative No.</u>	<u>Page</u>
12. Emergency spillway, unfinished, looking downstream, south	6-9A	C-10
13. End of emergency spillway near Eastman Brook.	6-6A	6-10



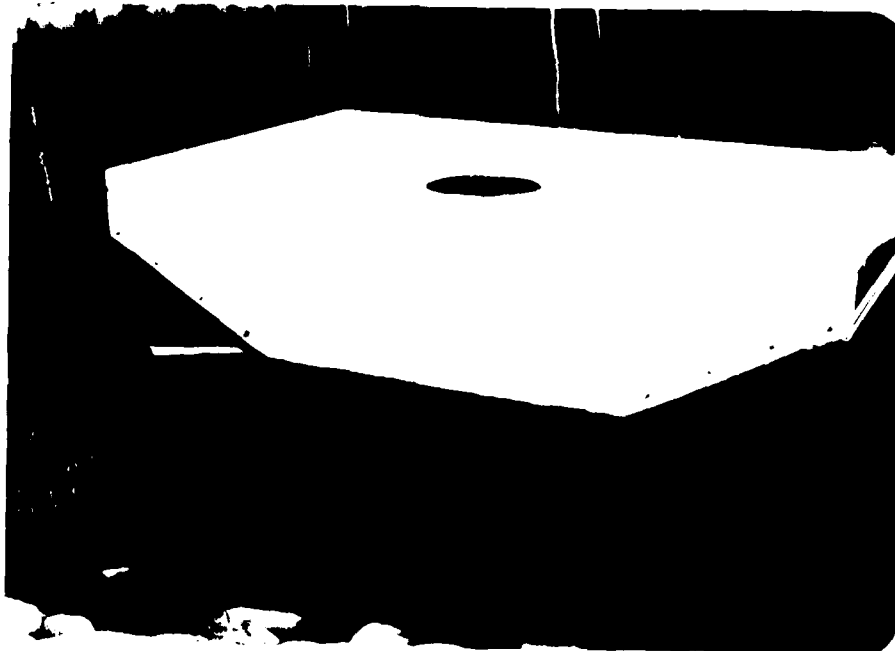




4. Erosion of surface drain in the upstream direction from the berm.



5. The same section as in the previous photograph, but from a different angle, showing the road and the forest.



5. Intake Structure: Riser with Two Crests, Looking Northeast.

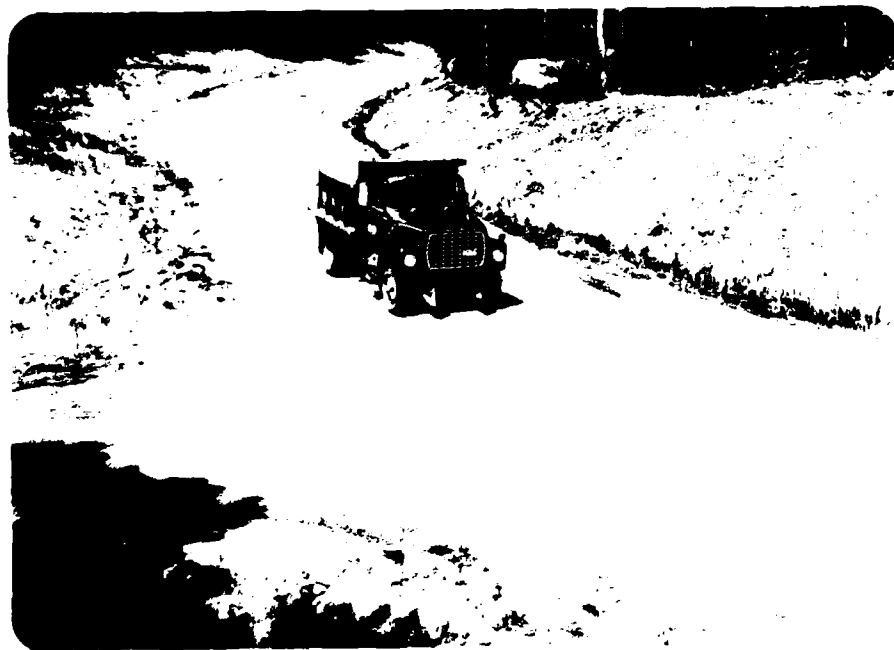


6. Crest is inside of intake riser.





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20. Monterey Highway, Unfinished, Looking Downstream.



21. Monterey Highway, Unfinished, Looking Downstream.

APPENDIX D
HYDROLOGIC & HYDRAULIC COMPUTATIONS

SUBJECT NATIONAL HAZARD INSP. PROGRAM
NATIONAL HAZARD INSP.

Total drainage area of Eastman Pond 200.0
= 15.5 cfs (avg)

The drainage area of Eastman Pond 200.0 is characterized by minimum rainfall of 1.0 in. per hour. Therefore, the guide curves for rainfall of 1.0 in. per hour & 1.0 in. per hour, it is found that

PEAK FLOOD MAXIMUM FLOOD PEAK INFLOW
= 7.5×20.75
= 15.5625 cfs.
= 15.560 cfs (avg)

According to Size Classification in TABLE 1
and the recommended Guidelines for Safety
Inspection of Earth, Eastman Pond 200.0 is
intermediate size.

According to Hazard Potential Classification in
TABLE 2, it follows that the category of
high hazard dam.

SUBJECT NATIONAL DAM INSPECTION PROGRAM
ENGINEERED FLOOD DAM

FILE NUMBER PA-01

SHEET NUMBER 15

DATE 2-17-77

COMPUTED BY J. J.

CHECKED BY

a. According to H-55 design evaluation.

Guidance as given in Table 3.

SPILLWAY TEST FLOOD PEAK INFLOW

= 15,560 cfs.

SUBJECT FATTIN LAKE DAM

SPILLWAY TEST FLOOD INFLOW BY 11.6 CFS
(BASED ON 806 DIMENSIONLESS UNIT HYDROGRAPH)

max. length of flood = 25,400 feet

difference in elevation = 300 feet

$$T = \frac{25,400^{1.15}}{7700 \times (300)^{0.35}} = \frac{116,294}{7700 \times 8.736}$$

$$= 1.728 \text{ hrs.}$$

$$\text{or } 2.0 \text{ hrs. (20\%)}.$$

SPILLWAY TEST FLOOD PEAK INFLOW
= 15,560 cfs

SUBJECT SPILLWAY LAKE DAM

SPILLWAY TEST FLOOD INFLOW HYDROGRAPH
(BASED ON 100 DIMENSIONLESS UNIT HYDROGRAPH)

$$T_p = 2.0 \text{ hrs}$$

SPILLWAY TEST FLOOD PEAK INFLOW (Q_p) = 15,560 cfs

T (hrs)	T/T_p	Q/Q_p	Q (cfs)
0.50	0.25	0.15	776
1.00	0.50	0.18	2800
1.50	0.75	0.73	11358
2.00	1.00	1.00	15560
2.50	1.25	0.80	12448
3.00	1.50	0.40	6227
3.50	1.75	0.25	3890
4.00	2.00	0.17	2645
5.00	2.50	0.06	934
7.00	3.50	0.02	311
8.00	4.00	0.01	156

SUBJECT EMERGENCY FLOODING
DRAINAGE LATERAL TO BERM EMERGENCY FLOODING

Length of emergency flooding = 50 feet

2. ft depression of emergency flooding = 1115.7

Assume a coefficient of discharge = 2.85

$$Q = 2.85 \cdot L \cdot H^{3/2}$$

H	EL.	Q (cfs)
1.0	1115.7	143.0
2.0	1117.7	463.0
3.0	1118.7	745.0
4.0	1119.7	1140.0
5.0	1120.7	1575.0
6.0	1121.7	2094.0
7.0	1122.7	2639.0
8.0	1123.7	3224.0
10.0	1125.7	4506.0
15.0	1130.7	8275.0
20.0	1135.7	12746.0
25.0	1140.7	17512.0

SUBJECT EASTON LAKE DAMDATE 8-9-1978ENTIRE CIRCLE EL 102.5 FT DIAMETER
PRINCIPAL SPILLWAY.COMPUTED BY W.M.

CHECKED BY

$$C \times \frac{\pi}{4} \times (3.5)^2 \times 8 \times \sqrt{h} = 225$$

$$h = 1115.7 - 1089.0 = 26.7 \text{ ft}$$

$$\therefore C \times \frac{\pi}{4} \times (3.5)^2 \times 8 \times \sqrt{26.7} = 225$$

$$\therefore C = \frac{225}{377.648} = 0.566$$

$$\begin{aligned} Q_{PS} &= 0.566 \times \frac{\pi}{4} \times (3.5)^2 \times 8 \times \sqrt{h} \\ &= 43.564 \sqrt{h} \end{aligned}$$

DISCHARGE THROUGH DRAIN:

$$\begin{aligned} Q &= 0.6 \times \frac{\pi}{4} \times (2.5)^2 \times 8 \times \sqrt{h} \\ &= 23.56 \sqrt{h} \end{aligned}$$

At Reservoir EL. 1109

$$\begin{aligned} Q &= 23.56 \times \sqrt{75} \\ &= 91.25 \text{ cfs} \end{aligned}$$

$$= 90.0 \text{ cfs (cont.)}$$

At Reservoir EL. 1115.7

$$Q = 23.56 \times \sqrt{26.7}$$

$$= 109.75 \text{ cfs}$$

$$= 110.0 \text{ cfs (cont.)}$$

SUBJECT EASTMAN LAKE DAM

COMPOSITE DISCHARGE RATING TABLE
FOR PRINCIPAL SPILLWAY AND EMERGENCY
SPILLWAYS.

ELEV.	H (ft)	Q _{PS} (cfs)	Q _{E.S.}	Q _{TOTAL}
1105	16	174.0		174.0
1107	18	185.0		185.0
1109	20	195.0		195.0
1110	21	200.0		200.0
1112	23	209.0		209.0
1114	25	218.0		218.0
1115.7	26.7	225.0		225.0
1116.7	27.7	229.0	143.0	372.0
1117.7	28.7	233.0	400.0	636.0
1118.7	29.7	237.0	720.0	957.0
1119.7	30.7	241.0	1140.0	1381.0
1120.7	31.7	245.0	1593.0	1838.0
1121.7	32.7	249.0	2094.0	2343.0
1122.7	33.7	253.0	2629.0	2882.0
1123.7	34.7	257.0	3224.0	3481.0
1125.7	36.7	264.0	4506.0	4770.0
1130.7	41.7	281.0	8470.0	8751.0
1135.7	46.7	298.0	12746.0	13044.0
1140.7	51.7	313.0	17812.0	18125.0

SUBJECT SEATTLE LAKE DAM

WATER TABLE CALCULATION SHEET

ELE.

WATER TABLE (W.T. - FEET)

1110.0

2.71

1115.0

2.500

1120.0

4.000

1125.0

4.800

SUBJECT ESTIMATED DAM
TO DETERMINE PEAK OUTFLOW

SPILLWAY TEST FLOOD PEAK INFLOW (Q_R) = 15,500 cfs

TRIAL #1

Assume unit volume = 19" of runoff from DA
available surcharge storage up to the top of dam

$$= \frac{3.55 \times 16}{7.5 \times 640} \times 12$$

$$= 15.4 \text{ inches of runoff from DA}$$

$$\frac{\text{Surcharge Storage Vol.}}{\text{Inflow Runoff Vol.}} = \frac{15.4}{19} = 0.81$$

Referring to Figure 17-11 in SEC NEH, Section 4

Corresponding

$$\frac{\text{OUTFLOW PEAK RATE}}{\text{INFLOW PEAK RATE}} = 0.27$$

$$\text{OUTFLOW PEAK RATE} = 0.27 \times 15,500$$

$$= 4211 \text{ cfs} \quad (1)$$

TRIAL #2:

SUBJECT WASTEWATER TREATMENT
TO DETERMINE PEAK OUTFLOW

From the composite discharge rating curve,
the above outflow peak rate corresponds
ELE. 1125.0

∴ Surchance height above principal
spillway crest = 16 feet.

$$\begin{aligned} \text{Vol. of Surchance} &= \frac{3.85 \times 16 \times 12}{7.5 \times 140} \\ (\text{STOR}_1) &= 15.4 \text{ inches of runoff.} \end{aligned}$$

$$\begin{aligned} \therefore \text{PEAK OUTFLOW } Q_{P_2} &= Q_{P_1} \left(1 - \frac{\text{STOR}_1}{19}\right) \quad (A) \\ &= 15,560 \left(1 - \frac{15.4}{19}\right) \\ &= 15,560 (1 - 0.810) \\ &= 2956 \text{ cfs.} \quad (2) \end{aligned}$$

TRIAL #3:

From the composite discharge rating curve, the
above outflow peak rate corresponds to
ELE. 1122.7

∴ Surchance height above principal spillway crest
= 13.7 feet

SUBJECT EARTH FILLED DAM
TO DETERMINE PEAK CUTOFF

$$\begin{aligned} \text{Vol. of surcharge (STIR}_1) &= \frac{365 \times 13.7 \times 12}{7.5 \times 640} \\ &= 13.17 \text{ inches of surch.} \end{aligned}$$

Now, apply the above eqn (ii)

$$\begin{aligned} \therefore \text{PEAK CUTOFF } Q_p &= 15,560 \left(1 - \frac{13.17}{19}\right) \\ &= 15,560 (1 - 0.694) \\ &= 15,560 \times 0.306 \\ &= 4761 \text{ cfs.} \end{aligned} \quad (3)$$

TRIAL # 4:

From the composite discharge rating curve,
the above cutoff peak rate corresponds to
ELE. 1125.8

i.e. surcharge height = 16.8 feet.

$$\begin{aligned} \therefore \text{Vol. of surcharge (STIR}_2) &= \frac{385 \times 16.8 \times 12}{7.5 \times 640} \\ &= 16.17 \text{ inches of surch.} \end{aligned}$$

$$\text{Average of STIR}_1 \text{ and STIR}_2 = \frac{13.17 + 16.17}{2} = 14.68''$$

$$\therefore \text{PEAK CUTOFF } Q_p = 15,560 \left(1 - \frac{14.68}{19}\right)$$

SUBJECT FRANKLIN POND DAM
TO DETERMINE PEAK OUTFLOW

PROJECT EN-511(6)

FILE NUMBER EN-511
SHEET NUMBER 12 OF 12
DATE 10-5-1966
COMPUTED BY THL
CHECKED BY

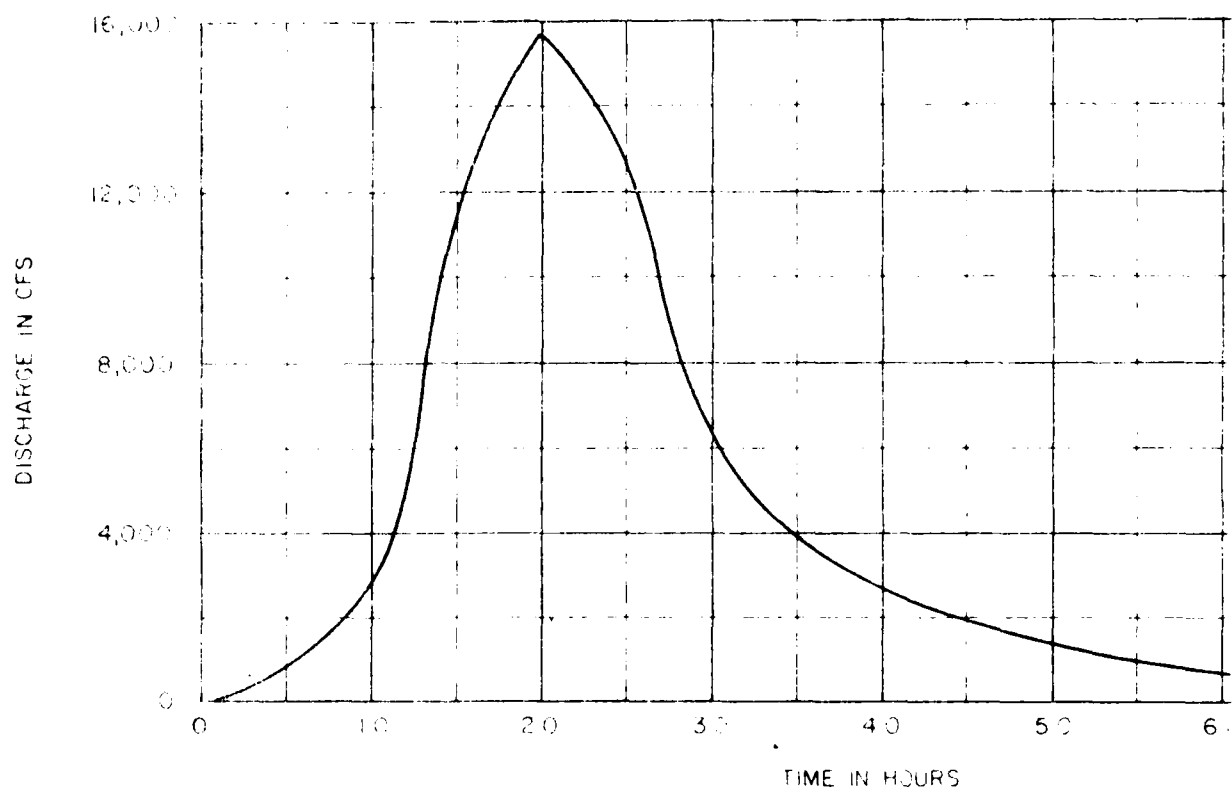
1. PEAK OUTFLOW $Q_3 = 15,560 (1 - .772)$
 $= 3,548 \text{ cfs}$

The crest of pond at ELE. 1123.9 from the
Composite Rating Curve. (4)
2. Surge hgt. above crest of
principal spillway

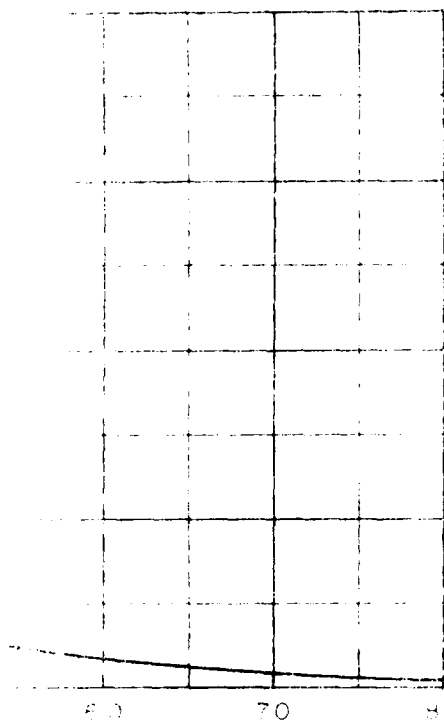
Surge hgt. above crest of
Emergency Spillway $= 14.9 \text{ ft.}$
 $= 8.2 \text{ ft.}$

ELL. of Top of Dam $= 1125.0$. Hence the
dam is not overtopped due to spillway
Tall inflow Flood.

3. PEAK OUTFLOW = 3,548 cfs.

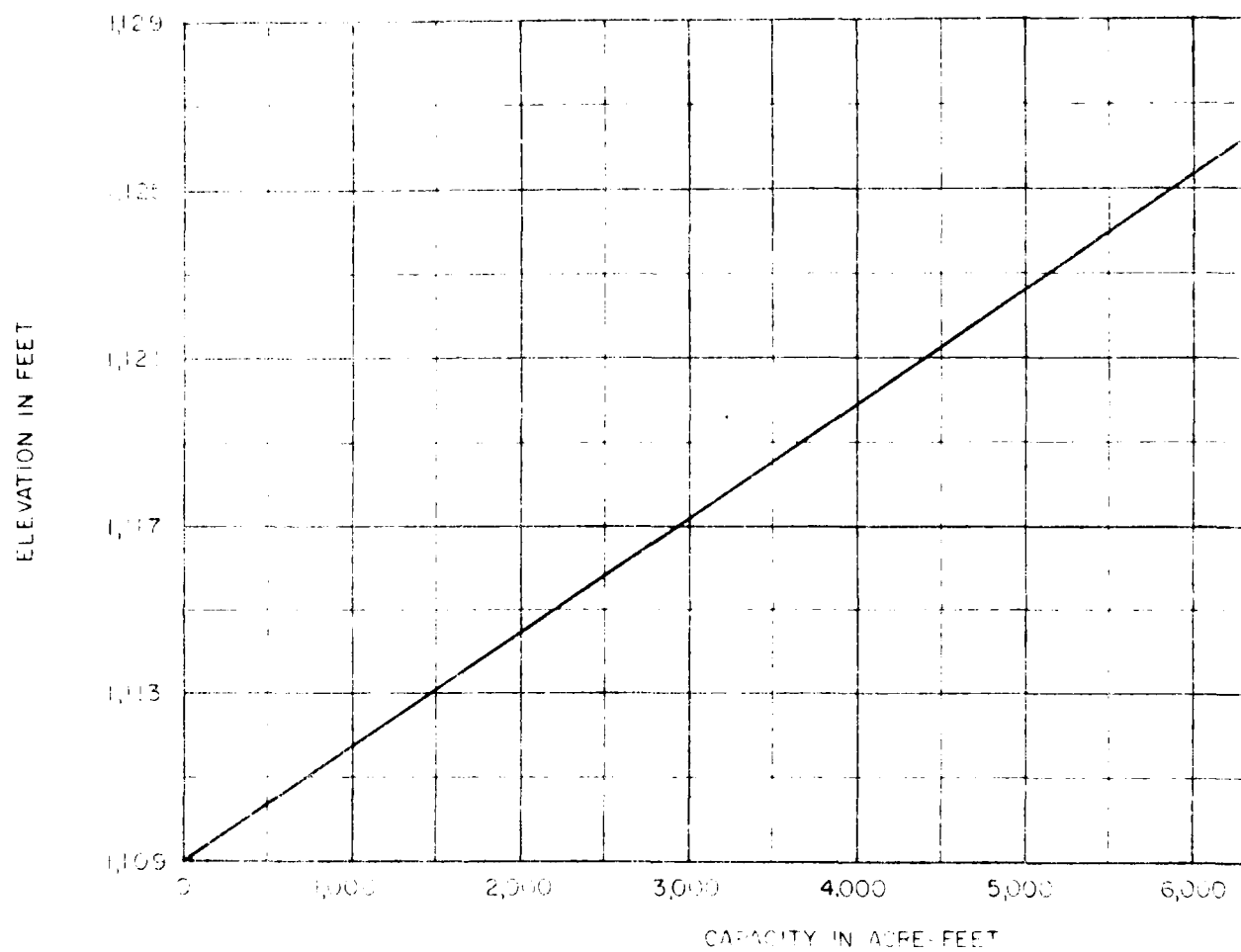


SPILLWAY TEST FLOOD INFLOW HYDROGRAPH

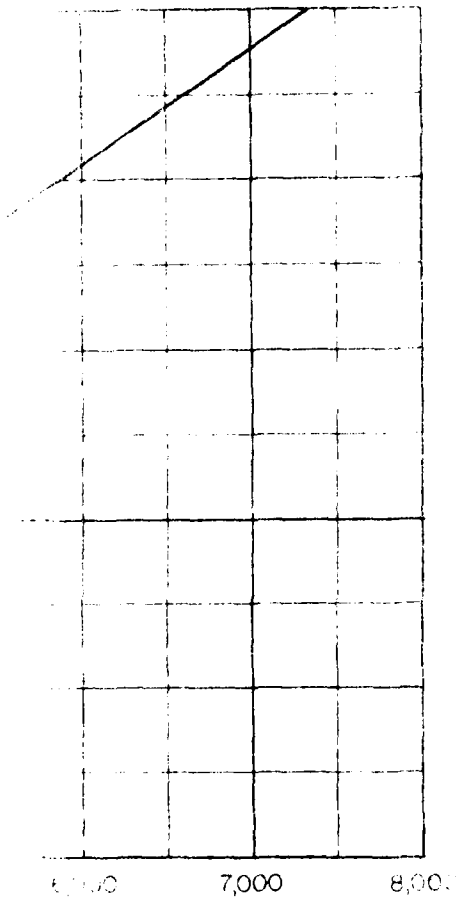


GRAPH

FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS		U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS			
EASTMAN POND DAM			
EASTMAN POND		NEW HAMPSHIRE	
		SCALE	AS SHOWN
		DATE	AUGUST, 1974

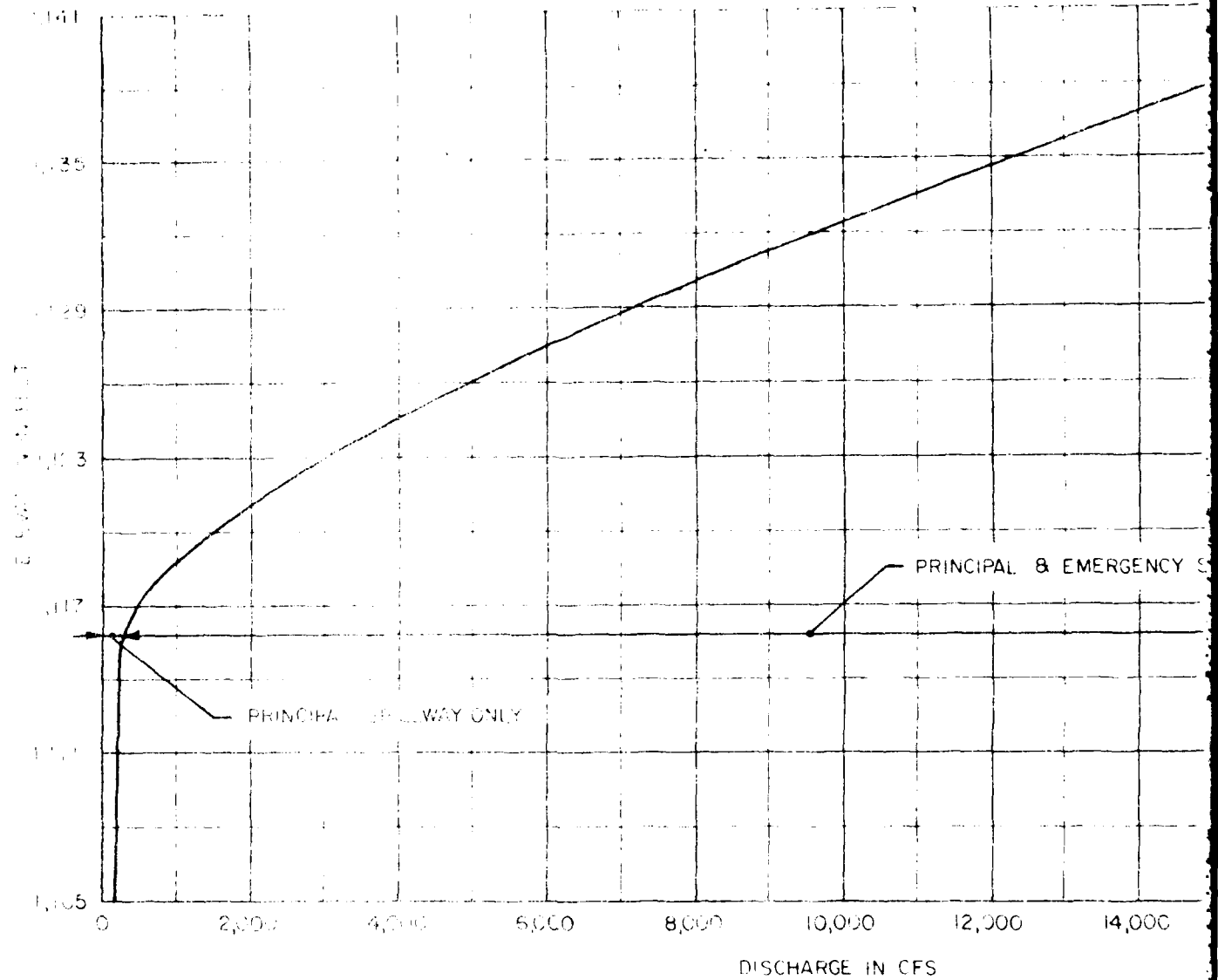


STORAGE CAPACITY - ELEVATION CURVE

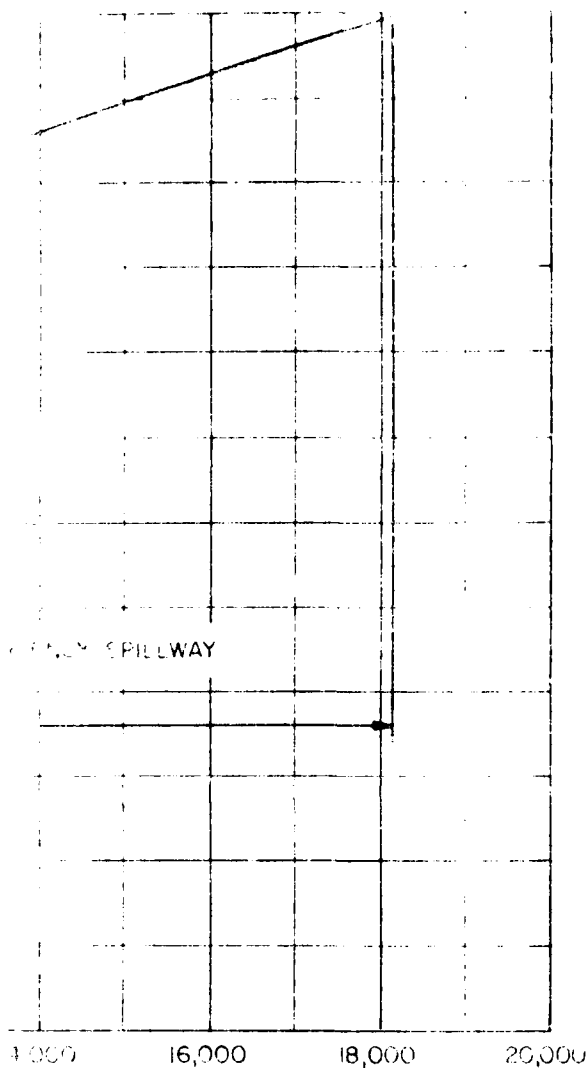


IVE

FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS.		U. S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS			
EASTMAN POND DAM			
EASTMAN BROOK		NEW HAMPSHIRE	
		SCALE	AS SHOWN
		DATE	AUGUST, 1978

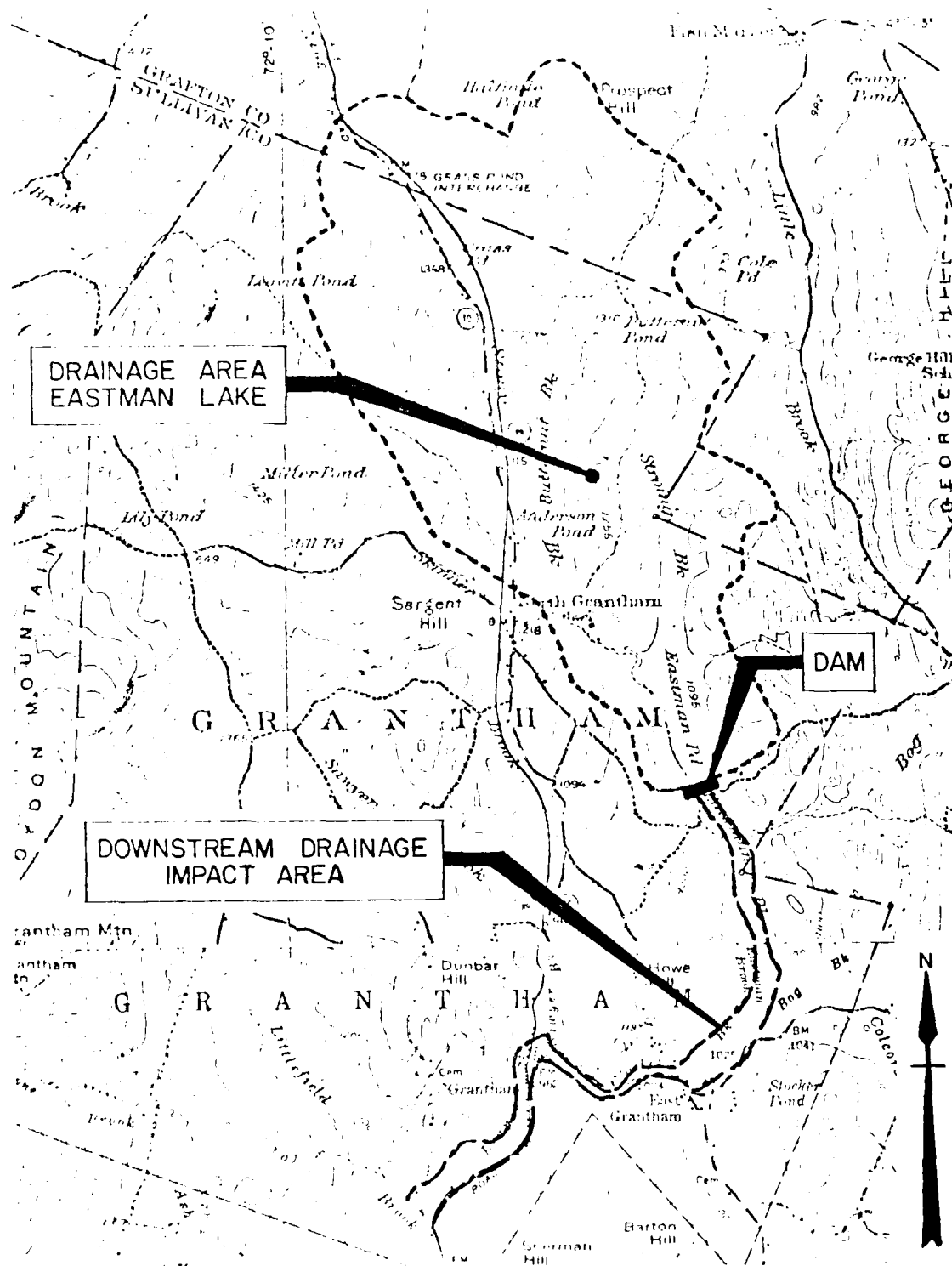


COMPOSITE RATING CURVE FOR SPILLWAY AND EMERGENCY SPILLWAY



SPILLWAY

FAY, SPOFFORD & THORNDIKE, INC ENGINEERS BOSTON, MASS.		U S ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
EASTMAN POND DAM			
EASTMAN BROOK		NEW HAMPSHIRE	
		SCALE	AS SHOWN
		DATE	AUGUST, 1978



UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

SCALE 1:62500 (ACTUAL)

SUNAPEE, N.H. 1955
AMS 6570-I-SERIES V712
MASCOMA, N.H. 1927

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) NAME OF DAM	(2) LOCATION	(3) STATE	(4) COUNTY	(5) DISTRICT	(6) FLOOD CONTROL DISTRICT	(7) FLOOD CONTROL DISTRICT	(8) FLOOD CONTROL DISTRICT	(9) FLOOD CONTROL DISTRICT	(10) FLOOD CONTROL DISTRICT
EASTMAN POND DAM	EASTMAN POND	MAINE	MAINE	MAINE	MAINE	MAINE	MAINE	MAINE	MAINE

(11) TYPE OF DAM	(12) YEAR COMPLETED	(13) PURPOSES	(14) STAGE	(15) POWER CAPACITY	(16) NAVIGATIONAL LOCKS
EASTMAN POND	1972	RC	45	40	

(17) TYPE OF DAM	(18) YEAR COMPLETED	(19) PURPOSES	(20) STAGE	(21) POWER CAPACITY	(22) NAVIGATIONAL LOCKS
EASTMAN POND	1972	RC	45	40	

(23) TYPE OF DAM	(24) YEAR COMPLETED	(25) PURPOSES	(26) STAGE	(27) POWER CAPACITY	(28) NAVIGATIONAL LOCKS
EASTMAN POND	1972	RC	45	40	

(29) TYPE OF DAM	(30) YEAR COMPLETED	(31) PURPOSES	(32) STAGE	(33) POWER CAPACITY	(34) NAVIGATIONAL LOCKS
EASTMAN POND	1972	RC	45	40	

(35) TYPE OF DAM	(36) YEAR COMPLETED	(37) PURPOSES	(38) STAGE	(39) POWER CAPACITY	(40) NAVIGATIONAL LOCKS
EASTMAN POND	1972	RC	45	40	

(41) TYPE OF DAM	(42) YEAR COMPLETED	(43) PURPOSES	(44) STAGE	(45) POWER CAPACITY	(46) NAVIGATIONAL LOCKS
EASTMAN POND	1972	RC	45	40	

(47) TYPE OF DAM	(48) YEAR COMPLETED	(49) PURPOSES	(50) STAGE	(51) POWER CAPACITY	(52) NAVIGATIONAL LOCKS
EASTMAN POND	1972	RC	45	40	

(53) TYPE OF DAM	(54) YEAR COMPLETED	(55) PURPOSES	(56) STAGE	(57) POWER CAPACITY	(58) NAVIGATIONAL LOCKS
EASTMAN POND	1972	RC	45	40	

(59) TYPE OF DAM	(60) YEAR COMPLETED	(61) PURPOSES	(62) STAGE	(63) POWER CAPACITY	(64) NAVIGATIONAL LOCKS
EASTMAN POND	1972	RC	45	40	

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