HOCKANUM RIVER BASIN
MANCHESTER, CONNECTICUT

CASE POND UPPER DAM
CT 00560

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

MAY 1980

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Case Pond Upper Dam is a 110-year old earth embankment, with an approximate length of 300 feet and a maximum height of 16 feet. The spillway is 87 feet long with a crest elevation about 2 feet below the top of the dam. The dam appears to be in poor condition. The maximum storage capacity of 52 acre-feet along with the maximum height of 16 feet place the dam in the "Small" size category. The dam is classified as "Significant" hazard potential. The recommended test flood ranges from the 100-year flood to one-half of the PMF.

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

REPLY TO
ATTENTION OF:
NEDED

JUN 19 1980

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

Dear Governor Grasso:

Inclosed is a copy of the Case Pond Upper 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, Mr. Robert C. Dennison & Mr. Andrew Ansaldi, Manchester, Connecticut 06040.

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,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

CASE POND UPPER DAM

CT 00560

HOCKANUM RIVER BASIN

MANCHESTER, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.:	CT 00560
Name of Dam:	Case Pond Upper Dam
City:	Manchester
County and State:	Hartford County, Connecticut
Stream:	Birch Mountain Brook
Date of Inspection:	November 14, 1979

BRIEF ASSESSMENT

Case Pond Upper Dam is a 110-year old earth embankment, used to impound water of the Birch Mountain Brook for recreational purposes. The dam is irregularly shaped in plan and section with an approximate length of 300 feet and a maximum height of 16 feet. The spillway is 87 feet long with a crest elevation about 2 feet below the top of the dam.

The drainage area for Case Pond Upper Dam is approximately 1.6 square miles. The maximum storage capacity of 52 acre-feet along with the maximum height of 16 feet place the dam in the "Small" size category. A breach of the dam could cause appreciable damage to a highway bridge located approximately 600 feet downstream of the dam, but it is unlikely that any lives would be lost. Therefore, the dam is classified in the "Significant" hazard potential category. The recommended test flood for a "Small" size, "Significant" hazard dam ranges from the 100-year flood to one-half of the Probable Maximum Flood (PMF). The selected test flood for this structure is one-half of the PMF.

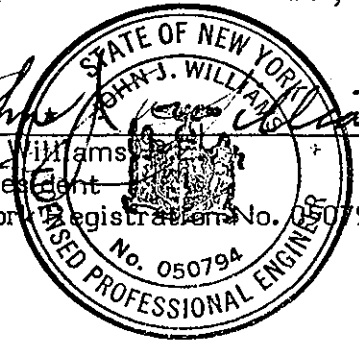
The peak test flood inflow for Case Pond Upper Dam is 1,470 cfs. The routed test flood outflow of 1,460 cfs overtops the dam by 0.5 feet. The spillway is capable of discharging 810 cfs, or about 56 percent of the routed test flood outflow, prior to overtopping of the dam. A breach of the dam would result in a 3.1-foot depth (contained within the channel banks) of flow at the first residential area (an apartment complex), located about 4,400 feet downstream of the dam.

The dam appears to be in poor condition. Many trees, with trunks up to 3 feet in diameter, are growing on both the upstream and downstream faces of the dam as well as on the crest. No erosion protection is provided on the upstream face. Seepage (about 2 gpm) was observed during the inspection about 10 feet downstream of the dam. No emergency low level outlet exists for drawing down the impoundment.

Within one year after receipt of this Phase I Inspection Report, the Owners should retain the services of a qualified, registered professional engineer, experienced in the design and construction of dams to: 1) investigate the cause of the seepage located in the vicinity of the downstream toe of the embankment and assess the need for remedial action; 2) direct the removal of trees and root systems from the dam and within a 20-foot wide area surrounding the dam; 3) design a low level outlet for emergency drawdown of the pond; and 4) investigate the abandoned 12-inch diameter pipe to insure that the pipe is not under pressure through the embankment.

In addition, the Owners should perform the following operation and maintenance work: 1) install riprap or other means of protecting the upstream face of the dam; 2) repair all deteriorated concrete and masonry surfaces; 3) repair the cracks between the spillway wall and the rock foundation; 4) develop and implement an ongoing operation and maintenance program; 5) initiate a program of annual technical inspection; and 6) develop a flood warning plan so that downstream residents will be notified in the event of possible overtopping and/or failure of the dam.

O'BRIEN & GERE ENGINEERS, INC.



John J. Williams
Vice President
New York Registration No. 050794

Date 16 May 1980

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

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of theses guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed 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 reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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

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DOWNSTREAM OVERVIEW AS OBSERVED FROM THE RIGHT ABUTMENT. (11/14/79)

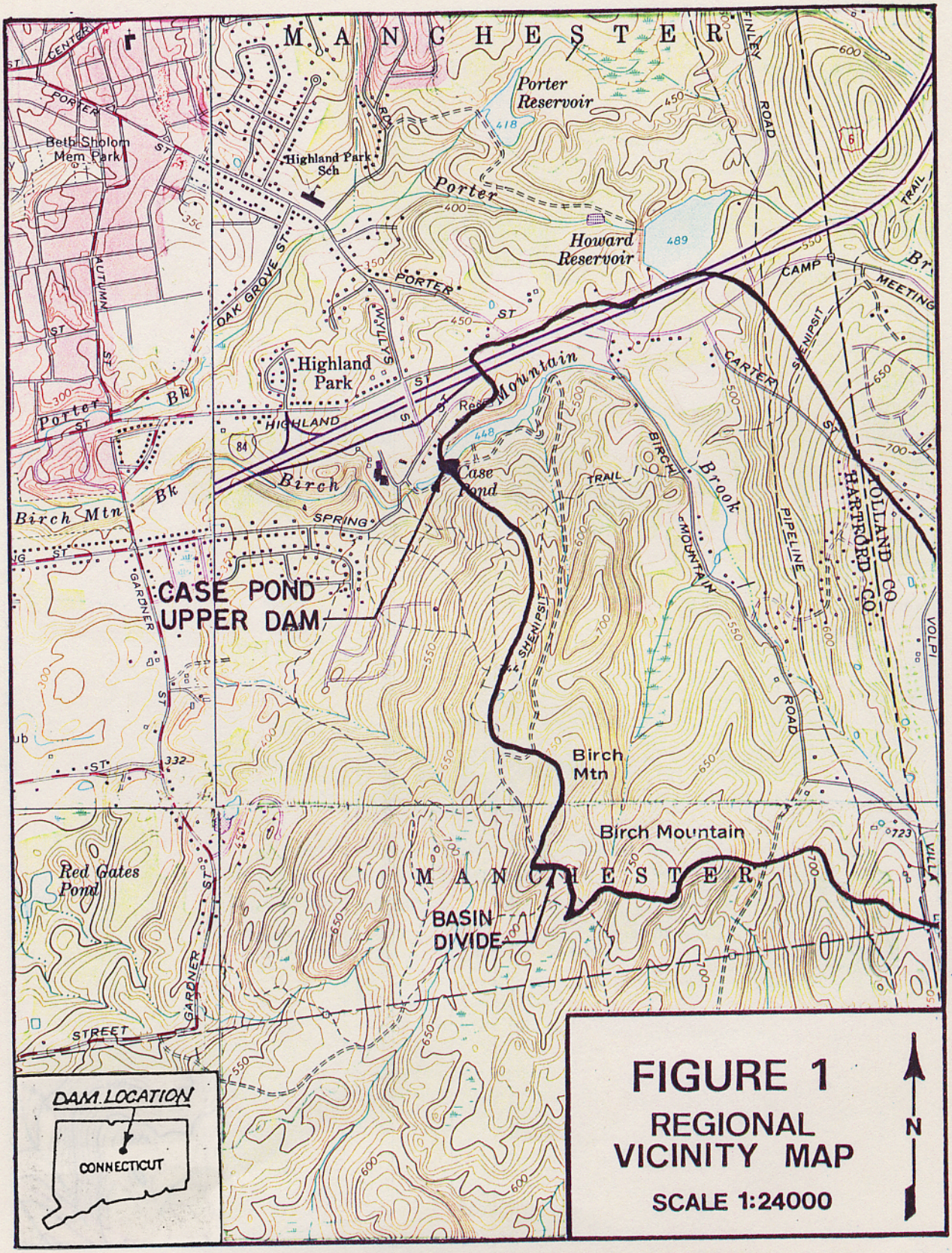


FIGURE 1

REGIONAL VICINITY MAP

SCALE 1:24000

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
CASE POND UPPER DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. The National Dam Inspection Act (Public Law 92-367) was passed by Congress on August 8, 1972. Under this Act, the Secretary of the Army was authorized to initiate, through the Corps of Engineers, the National Program for Inspection of Dams throughout the United States. Responsibility for supervising inspection of dams in the New England Region has been assigned to the New England Division of the Corps of Engineers.

O'Brien & Gere Engineers, Inc. has been retained by the New England Division to inspect and report on selected non-federal dams in the State of Connecticut. Authorization and Notice to Proceed were issued to O'Brien & Gere by a letter dated November 6, 1979 and signed by Col. William E. Hodgson, Jr. Contract No. DACW33-80-C-0014 has been assigned by the Corps of Engineers for this work.

b. Purpose. The purpose of inspecting and evaluating non-federal dams is to:

1. Identify conditions which threaten public safety and make the Owner aware of any deficiencies so that he may correct them in a timely manner.

2. Encourage and prepare the states to initiate an effective dam safety program for non-federal dams as soon as possible.

3. Update, verify and complete the National Inventory of Dams.

1.2 Description of Project (information with regard to this dam was obtained from Mr. Robert C. Dennison, co-Owner of Case Pond Upper Dam)

a. Location. Case Pond Upper Dam is located on Birch Mountain Brook in the southeastern corner of the City of Manchester, Connecticut. The dam is shown on the USGS Quadrangle entitled "Manchester, Conn." at coordinates N41°45.7; W72°29.3'. A regional location plan of Case Pond Upper Dam is enclosed as Figure 1 on page vi.

Birch Mountain Brook merges with Porter Brook to form Hop Brook about 1.5 miles west of the damsite. Hop Brook continues westward for approximately four miles where it joins the Hockanum River at Laurel Lake.

The potential damage area is the highway bridge located about 600 feet downstream of Case Pond Upper Dam. The initial residential area is an apartment complex located approximately 4,400 feet downstream of the dam.

b. Description of Dam and Appurtenances. Case Pond Upper Dam is an irregular earth embankment with an approximate length of 300 feet and a maximum height of about 16 feet with a variable crest width ranging from 15 feet to 65 feet. The unprotected upstream face of the dam is on a slope of about 1H:1V. The downstream face of the dam is partially retained by a vertical stone masonry wall about 100 feet long and 16 feet high. The remainder of the downstream face of the dam is on a slope which averages 2H:1V.

The concrete spillway located between the embankment and right abutment is 87 feet long. The downstream face of the spillway which extends a maximum of three feet above the irregular bedrock foundation, is vertical. The spillway is supported by four small concrete buttresses on the downstream side of the spillway. The spillway section has been integrated into three pre-existing stone masonry piers which supported a pedestrian bridge removed years ago.

c. Size Classification. Case Pond Upper Dam has a maximum height of approximately 16 feet and a maximum storage capacity of 52 acre-feet. The criteria for the "Small" size category includes dams which have less than 1,000 acre-feet of storage capacity and are less than 40 feet high. Therefore, Case Pond Upper Dam is classified as a "Small" size structure.

d. Hazard Classification. The potential damage area is considered to be a highway bridge (Spring St.) located approximately 600 feet downstream of the dam. Breach flows would travel through Case Pond Lower Dam then down a steep incline to the Spring Street Bridge. The first residential area is an apartment complex located about 4,400 feet downstream of the dam. The failure analysis indicated that breach floodwaters would be contained within the channel banks at this location. A failure of the dam could result in appreciable damage to the highway bridge, but it is unlikely that lives would be lost at any downstream location. Therefore, Case Pond Upper Dam is classified in the "Significant" hazard potential category.

e. Ownership. The co-Owners for Case Pond Upper Dam are:

Mr. Robert C. Dennison	Mr. Andrew Ansaldi
700 Spring Street	81 Battista Road
Manchester, Connecticut 06040	Manchester, Connecticut 06040
Telephone: 203-643-4986	Telephone: 203-649-5249

f. Operator. The dam is not equipped with any operating facilities other than an inoperable valve on an abandoned 12-inch diameter pipe which was used to provide water for a nearby mill. The Owners would perform any operations associated with the dam.

g. Purpose of Dam. The dam currently impounds water for recreational purposes.

h. Design and Construction History. The dam was originally built about 1870. Since that time, the spillway has been revised three times; in 1880, the masonry portion of the spillway wall was built; in 1890, the present spillway was constructed; and in 1962, the spillway was repaired.

i. Normal Operating Procedures. There are no operating procedures for this site.

1.3 Pertinent Data

a. Drainage Area. A 1.6 square mile watershed, ranging from Elevation 785 at Birch Mountain to Elevation 448 at normal pool, drains to Case Pond Upper Dam. The area is primarily forested with some upstream residential development.

b. Discharge at Damsite.

1. Outlet Works. The only known outlet is an abandoned 12-inch diameter valve and pipe which used to provide water for a nearby mill. According to Mr. Dennison, the valve has been inoperable for at least 10 years.

2. Maximum Known Flood. According to Mr. Dennison, the embankment was overtopped in September, 1938, but he does not recall the depth of overtopping. Details associated with this event, as it related to Case Pond Upper Dam, are not recorded.

3. Ungated Spillway Capacity at Top of Dam. The capacity of the spillway at the top of dam Elevation 450.0, is approximately 812 cfs.

4. Ungated Spillway Capacity at Test Flood Elevation. At the test flood Elevation 450.5, the spillway capacity is 1,134 cfs.

5. Gated Spillway Capacity at Top of Dam. Not Applicable.

6. Gated Spillway Capacity at Test Flood Elevation. Not Applicable.

7. Total Spillway Capacity at Test Flood Elevation. (See 4 above)

8. Total Project Discharge at Top of Dam. The total project discharge, with the pool elevation at the top of dam Elevation 450.0, is estimated to be 812 cfs.

9. Total Project Discharge at Test Flood Elevation. The total project discharge at the test flood Elevation 450.5 is estimated to be 1,458 cfs.

c. Elevation. (NGVD)

1. Streambed at Toe of Dam	434±
2. Bottom of Cutoff	Unknown
3. Maximum Tailwater	Unknown
4. Recreation Pool	448
5. Full Flood Control Pool	N/A
6. Spillway Crest (Ungated)	448
7. Design Surcharge (Original Design)	Unknown
8. Top of Dam	450
9. Test Flood Surcharge	450.5

d. Reservoir Length. (Feet)

1. Normal Pool	1,800
2. Flood Control Pool	N/A
3. Spillway Crest Pool	1,800
4. Top of Dam Pool	3,100
5. Test Flood Pool	3,200

e. Storage. (Acre-Feet)

1. Normal Pool	30
2. Flood Control Pool	N/A
3. Spillway Crest Pool	30
4. Top of Dam Pool	52
5. Test Flood Pool	61

f. Reservoir Surface Area. (Acres)

1. Normal Pool	6.0
2. Flood Control Pool	N/A
3. Spillway Crest Pool	6.0
4. Top of Dam Pool	17.5
5. Test Flood Pool	19.0

g. Dam Data.

1. Type	Earth Embankment
2. Length	300 feet
3. Height	16 feet
4. Top Width	Variable, 15 feet to 65 feet
5. Side Slopes (Upstream)	1H:1V
(Downstream)	2H:1V
6. Zoning	Unknown
7. Impervious Core	Unknown
8. Cutoff	Unknown
9. Grout Curtain	Unknown

h. Diversion and Regulating Tunnel.

Not Applicable

i. Spillway.

1. Type	Concrete Overflow
2. Length of Weir	87 feet
3. Crest Elevation	448
4. Gates	None
5. Upstream channel	Case Pond Upper
6. Downstream Channel	Case Pond Lower and steep rock gorge

j. Regulating Outlet.

1. Invert Elevation	435±
2. Size	12-inch diameter
3. Description	Cast Iron Pipe
4. Control Mechanism	Gate Valve (Inoperable)
5. Other	Abandoned Outlet

SECTION 2

ENGINEERING DATA

2.1 Design

According to the co-Owners, there is no design information available.

2.2 Construction

No construction information exists except for knowledge of approximate construction dates. The dam was originally constructed in about 1870 and since that time, modifications have been made to the spillway (see Section 1.2-h).

2.3 Operation

Other than the abandoned 12-inch diameter outlet, which was used to convey water to a nearby mill, there are no operating facilities at this site.

2.4 Evaluation

a. Availability. There is no information available with respect to the design and construction of the Case Pond Upper Dam.

b. Adequacy. Although no drawings or engineering information with respect to Case Pond Upper Dam is available, it is believed that sufficient information has been obtained during the field inspection and through conversations with the Owners, to conduct a Phase I dam evaluation.

c. Validity. There is no reason to question the validity of the information obtained from the Owners.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. Case Pond Upper Dam was inspected on November 14, 1979. At the time of inspection, the pool elevation was approximately at the spillway crest (Elevation 488.0). Underwater areas were not inspected.

A checklist of observations and comments made during the inspection is included as Appendix A.

b. Dam. The dam is an earth embankment partially retained on the downstream slope by a vertical stone masonry wall in the vicinity of the left abutment. It is irregular in plan and section and is almost completely obscured by large trees and brush growing on the dam. The following conditions were observed during the field inspection:

1. The unprotected upstream face of the embankment is on a slope of 1H:1V and there is evidence of some erosion at several locations.

2. The dam crest to the left of the spillway is almost completely overgrown with large trees and brush. A few of the trees have trunk diameters of at least three feet. The larger trees range up to 50 feet in height. No evidence of settlement, cracks, or other indication of surface deficiency, was observed.

3. About 100 feet of the downstream face of the dam, towards the left abutment, is retained by a vertical 16-foot high stone masonry wall. The wall appears to be in fair condition with some loss of mortar, but no evidence of leakage through the wall or vertical or horizontal misalignments were observed. Rust-colored seepage, with a flow estimated to be about two gallons per minute, was observed in the old streambed about 10 feet downstream of the retaining wall (Page C-4). The soil in the area of the seepage is very soft. According to Mr. Dennison, this condition has remained unchanged for many years.

4. The downtream face of the dam, between the retaining wall and spillway, is on a slope which averages about 2H:1V with some portions as steep as 1H:1V. The surface is heavily overgrown with brush and large trees. The seepage described above has created minor sloughing and erosion of the slope in the vicinity of the toe.

Several photos of the conditions described above are included in Appendix C.

c. Appurtenant Structures. The spillway consists of a concrete wall, approximately three feet high and 87 feet long. The concrete generally appears to be in fair condition except for some spalling along the downstream face of the wall. In addition, some leakage was observed at the base of the wall near the right abutment.

The valve house is in fair condition. The valve on the 12-inch diameter outlet pipe has not been operable for at least 10 years. The 12-inch diameter outlet pipe also has not been used for at least 10 years.

d. Reservoir Area. The area bordering the pond is well vegetated but indications of erosion were observed on the banks. According to the Owners, the pond has appreciable sediment accumulation. They do not believe that the water is any more then 6 feet deep at any point in the impoundment.

e. Downstream Channel. The channel immediately downstream of the spillway is formed by an outcropping of bedrock. Water flowing over the spillway discharges down the bedrock and into Case Pond Lower. The dam for Case Pond Lower is a stone masonry structure with a stone masonry bridge built on its crest. The gradient of Birch Mountain Brook for about 4,000 feet downstream of Case Pond Lower Dam is relatively steep. The stream channel drops about 170 feet in this reach. The stream channel is overgrown with trees and brush but, due to the slope, the flow of water is not significantly impeded.

An estimated 1.5 miles downstream of Case Pond Upper Dam, Birch Mountain Brook joins Porter Brook to form Hop Brook. Hop Brook continues westward for approximately 4 miles where it joins the Hockanum River at Laurel Lake. Beyond the initial 4,000 feet downstream of Case Pond Upper Dam, the stream channel is on an estimated gradient of 0.4 percent with few obstructions aside from numerous bridges.

3.2 Evaluation

The dam is considered to be in poor condition. All of the trees and brush, especially the large trees, should be removed from the embankment crest and both the upstream and downstream faces. Erosion protection should be provided for the upstream face of the dam. The seepage condition and the necessity for a low-level outlet should be investigated.

SECTION 4

OPERATION AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. Since there are no operating facilities currently in use at the site, there is no designated operator. However, co-Owner Mr. Dennison, lives close to the dam and is familiar with past operation of the abandoned outlet, which used to furnish water to a nearby mill. According to Mr. Dennison, the outlet has been inoperable for at least 10 years.

b. Description of Any Warning System in Effect. According to Mr. Dennison, there is no formal warning system which would alert downstream property owners of an impending dam failure.

4.2 Maintenance Procedures

a. General. According to Mr. Dennison, no maintenance has been performed on the dam for several years.

b. Operating Facilities. According to Mr. Dennison, the 12-inch diameter outlet has been inoperable for at least 10 years.

4.3 Evaluation

The lack of an operation and maintenance program is reflected by conditions observed at the dam. A program should be established which would include periodic removal of vegetation from the dam, and repair of structural and operational elements of the dam.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

The 1.6 square-mile area draining to Case Pond Upper Dam consists primarily of steep, forested terrain with some residential development. Topography within the watershed ranges from Elevation 785 at Birch Mountain to Elevation 448 at normal pool.

5.2 Design Data

Hydraulic and hydrologic data used for the design of Case Pond Upper Dam are not available, according to the Owners.

5.3 Experience Data

According to Mr. Dennison, the embankment was overtopped in September 1938, but he does not recall the depth of the overtopping. Details associated with this event, as it relates to Case Pond Upper Dam, are not recorded.

5.4 Test Flood Analysis

The recommended test flood range for a "Small" size, "Significant" hazard dam is from the 100-year flood to one-half of the Probable Maximum Flood (PMF). Based upon the potential for appreciable damage to the downstream highway bridge, one-half of the PMF has been selected as the test flood.

Hydraulic and hydrologic calculations were performed with the assistance of the HEC-1-DB computer program. The flood hydrographs were constructed from Snyder unit hydrographs using average coefficients, an initial infiltration of zero, and a constant loss rate of 0.05 inches per hour. The Hop Brook Adjustment Factor was used to reduce the Probable Maximum Precipitation (PMP) based on the drainage area.

Stage vs. discharge and stage vs. storage relationships were developed for Case Pond Upper Dam for routing of the test flood through the pond and to the downstream flood impact area. The water surface elevation for Case Pond Upper was assumed to be at the spillway crest elevation at the beginning of the hypothetical storm event.

The test flood peak inflow to Case Pond Upper Dam was computed as 1,470 cfs. The routed test flood outflow of 1,460 cfs corresponds to a stage elevation of approximately 450.5 or 0.5 feet above the top of the dam. The spillway is capable of discharging 810 cfs or about 56 percent of the routed test flood outflow prior to overtopping of the dam.

5.5 Dam Failure Analysis

Failure of Case Pond Upper Dam was simulated through the use of the HEC-1-DB computer program. It was assumed that a 75-foot wide by 15-foot deep breach with vertical side slopes would develop over a two-hour period. Furthermore, failure was assumed to occur with the pool elevation at the top of the dam.

The maximum breach discharge of 812 cfs was routed to the initial residential area which consists of an apartment complex located about 4,400 feet downstream of the dam. The analysis indicates that the depth of flow in the stream channel would increase from about 0.5 feet to 3.1 feet and would remain within the channel banks.

However, the breach outflow could cause appreciable damage to a highway bridge (Spring St.) located across the channel approximately 600 feet downstream of the dam. Since no residential areas would be endangered by a breach flood, the highway bridge is considered to be the flood impact area.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

The roots of large trees growing on the embankment may be providing seepage paths through the dam and could be dislodging joint material from the downstream masonry retaining wall. High winds could uproot the trees causing removal of significant volumes of embankment material. The rust-colored seepage in the vicinity of the downstream toe of the embankment indicates that seepage paths may have developed through the embankment or foundation. Although the condition has remained constant for many years, according to Mr. Dennison, the potential remains for piping of fine-grained soil from the embankment.

6.2 Design and Construction Data

No design and construction data are available according to Mr. Dennison.

6.3 Post Construction Changes

Since the original construction of the dam around 1870, the spillway has been revised three times; in 1880, the masonry portion of the spillway wall was built, in 1890, the present spillway was constructed; and in 1962, the spillway was repaired.

6.4 Seismic Stability

Case Pond Upper Dam is located in Seismic Zone 1 on the "Seismic Zone Map of Contiguous States". Therefore, according to the Recommended Guildelines for Phase I dam inspections, the dam need not be evaluated for seismic stability.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The dam is considered to be in poor condition. The following observations help to substantiate this assessment:

1. A significant amount of seepage (about 2 gpm) was observed in the vicinity of the downstream toe of the embankment about 10 feet from the downstream embankment retaining wall.

2. The dam is almost completely overgrown with large trees (up to 3 feet in diameter and 50 feet high) and brush.

3. No means of protecting the upstream face of the dam has been provided.

4. The impoundment cannot be lowered because of the lack of a low level outlet.

5. Leakage is occurring under the spillway wall near the right abutment.

6. Mortar between stones in the retaining wall is cracked or missing.

7. The concrete spillway wall and buttresses are spalled.

b. Adequacy of Information. Sufficient information has been obtained through field observations and through discussions with the Owners to conduct a Phase I dam evaluation.

c. Urgency. The recommendations and remedial measures presented in this Section should be implemented within one year of receipt of this Phase I Inspection Report.

7.2 Recommendations

It is recommended that the Owners retain the services of a qualified, registered professional engineer, experienced in the design and construction of dams, to perform the following services:

1. Investigate the causes of the seepage located in the vicinity of the downstream toe of the embankment (about 10 feet downstream of the retaining wall) and at the base of the spillway wall and assess the need for remedial action at each location.

2. Direct the removal of trees and root systems from the dam and within a 20-foot wide area surrounding the dam. Voids left in the embankment as a result of such removal should be backfilled with suitable thoroughly compacted material.

3. Design a low level outlet for emergency drawdown of the pond.

4. Investigate the abandoned 12-inch diamater pipe to insure that the pipe is not under pressure through the embankment. If the pipe is under pressure, then it should be plugged.

7.3 Remedial Measures

a. Operation and Maintenance Procedures. The Owners should also implement the following operation and maintenance procedures:

1. Riprap or other means of protecting the upstream slope of the dam should be provided.

2. All deteriorated concrete and masonry surfaces should be repaired.

3. Cracks between the spillway wall and the rock foundation should be repaired.

4. An ongoing operation and maintenance program should be developed and implemented.

5. A program of annual technical inspection should be instituted.

6. A flood warning plan should be developed so that downstream residents will be notified in the event of possible overtopping and/or failure of the dam.

7.4 Alternatives

As an alternative to the above recommendations and remedial measures, the pond could be drained and the dam removed.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST

INSPECTION TEAM ORGANIZATION

Project: Case Pond Upper Dam

National I.D. #: CT 00560

Location: Manchester, Connecticut

Type of Dam: Earth Embankment/ Masonry

Inspection Date(s): November 14, 1979

Weather: Overcast, 40's

Pool Elevation: 448 ± MSL

Inspection Team

Leonard Beck	O'Brien & Gere	Structures
Steven Snider	O'Brien & Gere	Foundations & Materials
Alan Hanscom	O'Brien & Gere	Structures
Rodney Georges	Bryant & Associates	Hydrology/Hydraulics

*Mr. John J. Williams, Vice-President, O'Brien & Gere has visited the site but not necessarily in conjunction with the inspection team.

Owner's Representative

Mr. Robert C. Dennison and Mr. Andrew Ansaldi, Co-owners.

VISUAL INSPECTION CHECK LIST

Project: Case Pond Upper Dam

National I.D. #: CT 00560

Date(s): November 14, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	450 NGVD
Current Pool Elevation	448 NGVD
Maximum Impoundment to Date	52 Acre-feet
Surface Cracks	None Observed
Pavement Condition	N/A
Movement or Settlement of Crest	None Observed
Lateral Movement	None Observed
Vertical Alignment	No misalignment observed
Horizontal Alignment	No misalignment observed
Condition at Abutment and at Concrete Structures	Slight erosion at spillway abutments
Indications of Movements of Structural Items on Slopes	None Observed
Trespassing on Slopes	Not significant
Vegetation on Slopes	Erosion on u/s face Trees, brush over entire dam
Sloughing or Erosion of Slopes or Abutments	Sloughing on u/s and d/s slopes of eastern portion of embankment
Rock Slope Protection - Riprap Failures	No riprap observed

VISUAL INSPECTION CHECK LIST

Project: Case Pond Upper Dam

National I.D. #: CT 00560

Date(s): November 14, 1979

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT (Con't)	
Unusual Movement or Cracking at or near Toes	None Observed
Unusual Embankment or Downstream Seepage	~1 gpm deep orange - colored seepage ~20 feet d/s of retaining wall
Piping or Boils	Seepage is "boiling"
Foundation Drainage Features	Unknown
Toe Drains	Unknown
Instrumentation System	None

VISUAL INSPECTION CHECK LIST

Project: Case Pond Upper Dam

ıtional I.D. #: CT 00560

Date(s): November 14, 1979

AREA EVALUATED	CONDITIONS
JTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None Observed
Trees Overhanging Channel	None Observed
Floor of Approach Channel	Much sediment - several feet per Mr. Dennison
Weir and Training Walls	
General Condition of Concrete	Good
Rust or Staining	None Observed
Spalling	d/s side - scattered
Any Visible Reinforcing	None Observed
Any Seepage or Efflorescence	At base of weir wall near western abutment
Drain Holes	None Observed
Discharge Channel	
General Condition	Rock ledge - good slope. Not likely to submerge weir.

VISUAL INSPECTION CHECK LIST

Project: Case Pond Upper Dam

National I.D. #: CT 00560

Date(s): November 14, 1979

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS (Con't)	
Loose Rock Overhanging Channel	Not significant
Trees Overhanging Channel	Several in Channel
Floor of Channel	Very rough, ledge and loose stones
Other Obstructions	Trees

APPENDIX B

ENGINEERING DATA

APPENDIX B

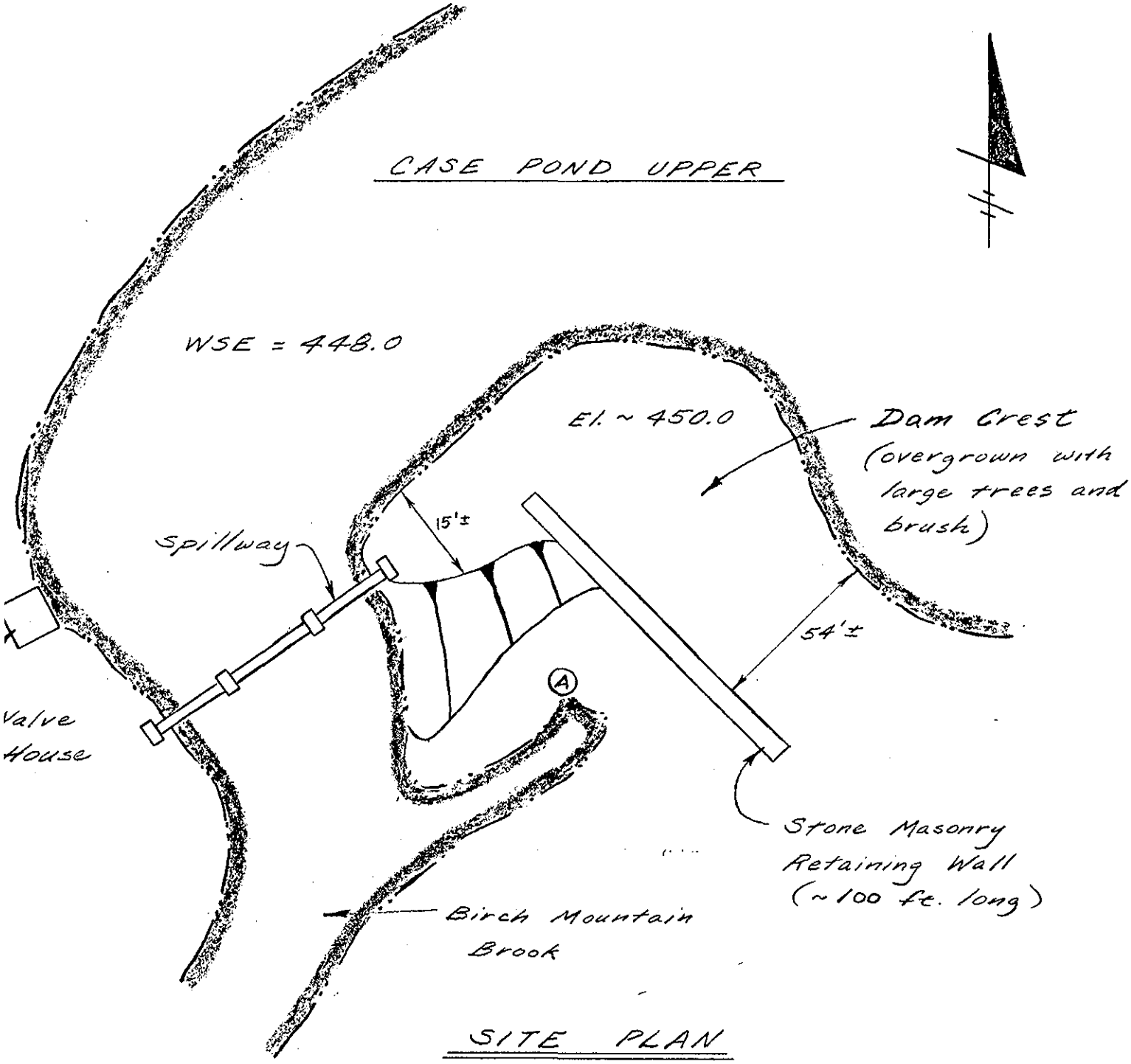
ENGINEERING DATA*

TABLE OF CONTENTS

*Note: All elevations refer to National Geodetic Vertical Datum (NGVD).

O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Case Pond Upper Dam	B-1	A.H.	3/80	2060-001



SITE PLAN

Not To Scale

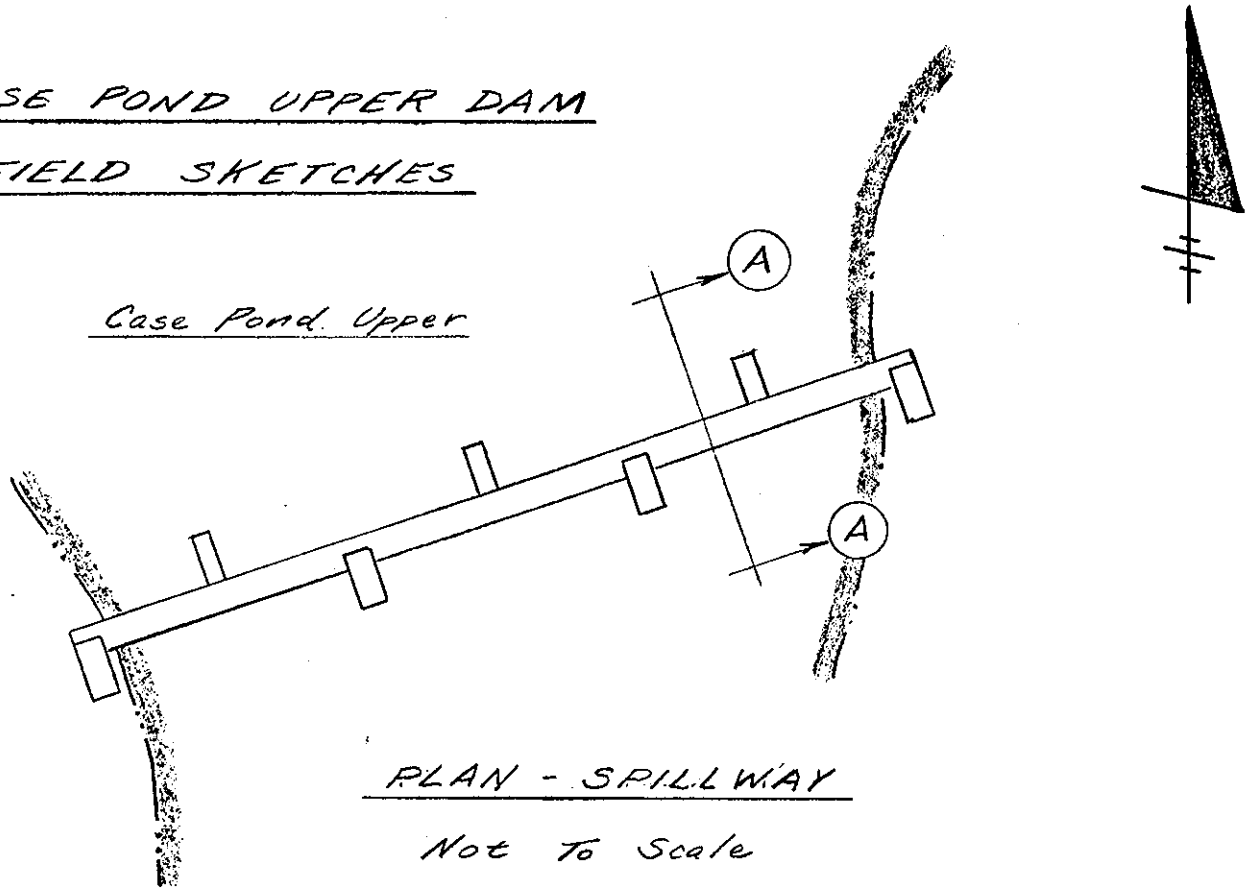
(A) Approximate location of "boiling" seepage.

O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO.
Case Pond Upper Dam	B-2	A. H.	3/80	2060-001

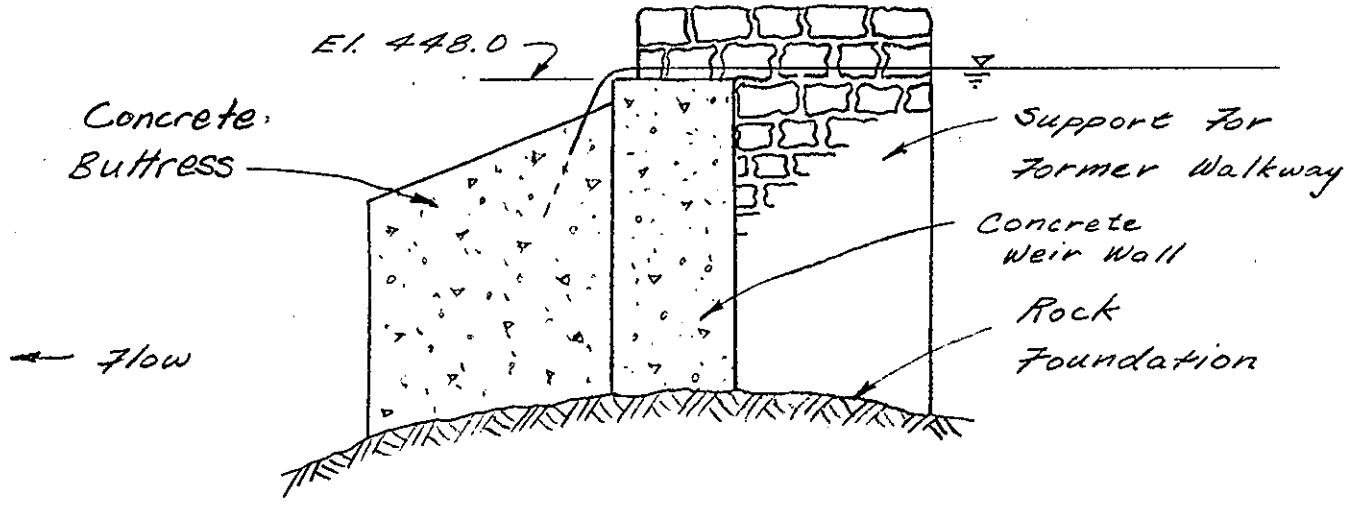
CASE POND UPPER DAM

FIELD SKETCHES



PLAN - SPILLWAY

Not To Scale



SECTION A-A

Not To Scale

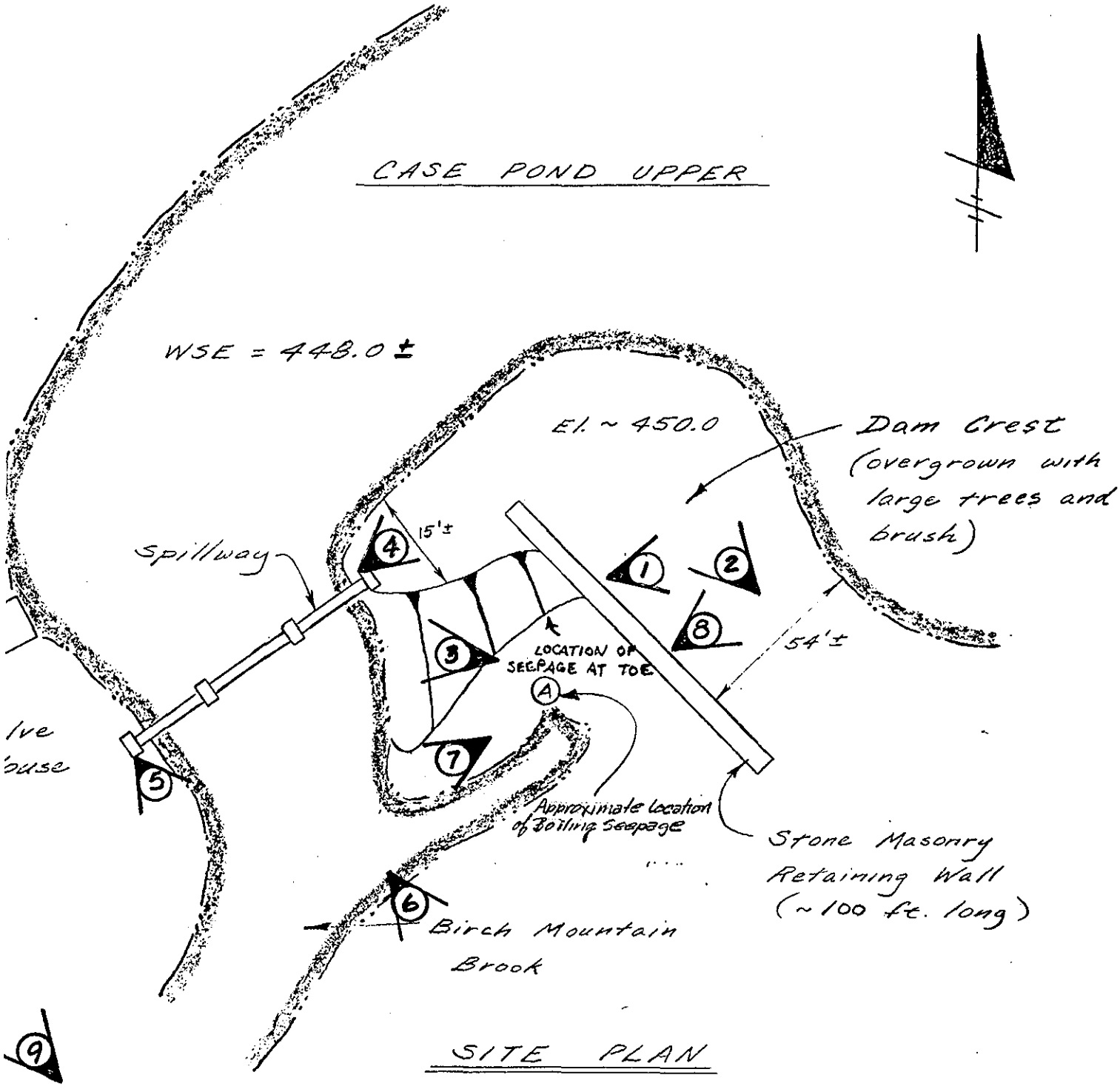
APPENDIX C

PHOTOGRAPHS

APPENDIX C
SELECTED PHOTOGRAPHS OF PROJECT

O'BRIEN & GERE
ENGINEERS, INC.

ECT	SHEET	BY	DATE	JOB NO
Case Pond Upper Dam	A	A.H.	4/80	2060-001



SITE PLAN

Not To Scale

LEGEND (1) LOCATION & DIRECTION IN WHICH EACH PHOTO WAS TAKEN & THE NUMBER OF THE PHOTO

1. DENSE TREE COVER ON THE DOWNSTREAM FACE OF THE DAM. (11/14/79)

2. DENSE TREE COVER ON THE TOP OF THE DAM LOOKING TOWARDS THE LEFT ABUTMENT. (11/14/79)

3. VERTICAL DOWNSTREAM MASONRY WALL NEAR THE LEFT ABUTMENT. (11/14/79)

4. VIEW ALONG THE SPILLWAY CREST LOOKING TOWARDS THE RIGHT ABUTMENT. (11/14/79)

5. SEEPAGE THROUGH THE SPILLWAY WALL. (11/14/79)

6. DISCHARGE IMMEDIATELY DOWNSTREAM OF THE SPILLWAY. (11/14/79)

7. SEEPAGE WHICH BEGINS ABOUT 10 FEET DOWNSTREAM OF THE VERTICAL DOWNSTREAM MASONRY WALL OF THE DAM. (11/14/79)

8. SEEPAGE FLOW AS VIEWED FROM THE CREST OF THE DOWNSTREAM VERTICAL MASONRY WALL OF THE DAM. (11/14/79)

9. MASONRY BRIDGE BUILT OVER THE CASE POND LOWER DAM APPROXIMATELY 600 FEET DOWNSTREAM OF THE CASE POND UPPER DAM. (11/14/79)

10. DISCHARGE OVER THE CASE POND LOWER DAM SPILLWAY. (11/14/79)

11. REGION APPROXIMATELY 100 FEET UPSTREAM OF THE SPILLWAY WHERE WATER HAS IN THE PAST OVERTOPPED THE RIGHT BANK OF THE POND. (11/14/79)

12. REGION TO THE RIGHT OF THE CASE POND LOWER DAM WHERE DISCHARGE WOULD BE CONCENTRATED DURING PERIODS OF EXCESSIVE FLOW. (11/14/79)

13. FACTORY COMPLEX ABOUT 900 FEET DOWNSTREAM OF CASE POND UPPER DAM. (11/14/79)

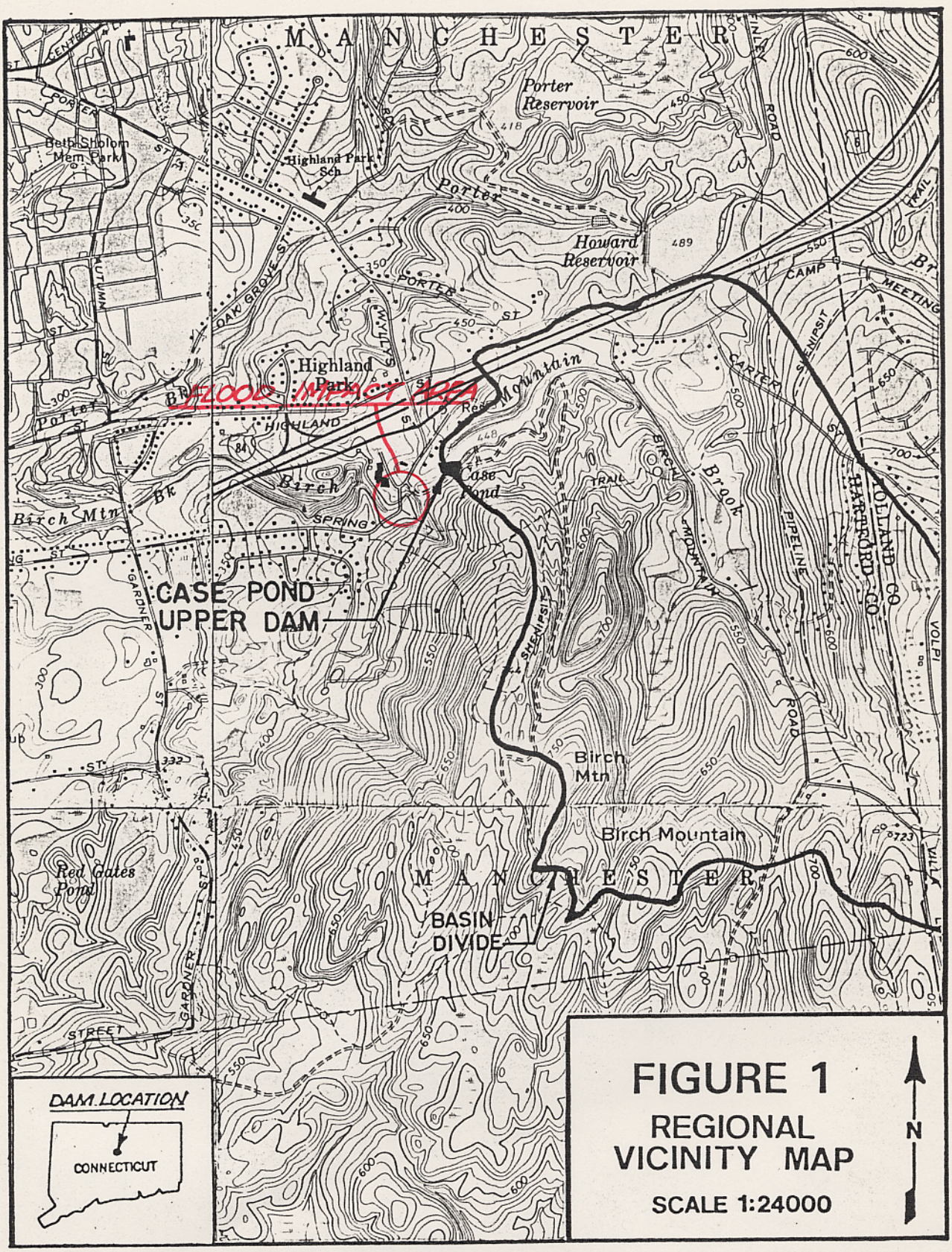
14. APARTMENT COMPLEX ABOUT ONE MILE DOWNSTREAM OF CASE POND UPPER DAM. (11/14/79)

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

CASE POND UPPER DAM

APPENDIX D
HYDROLOGIC & HYDRAULIC COMPUTATIONS
TABLE OF CONTENTS


M A N C H E S T E R
Porter Reservoir
Beth Sholom Mem Park
Highland Park Sch
Howard Reservoir
Highland Park
Case Pond
CASE POND UPPER DAM
FLOOD IMPACT AREA
Birch Mtn
Birch Mountain
Red Gates Pond
BASIN DIVIDE
Hollard Co
Hartford Co
DAM LOCATION
CONNECTICUT
FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24000
N

D-1

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 2060-001
SHEET NO D-2 OF
CALCULATED BY R.G. DATE 1/80
CHECKED BY R.R.B DATE 3/80
SCALE

CASE POND UPPER DAM - H & H

DRAINAGE AREA = 1.59 Sq. Mi.

SNYDER HYDROGRAPH COEFFICIENTS

$C_t = 2.0$ $C_p = 0.5$

T_p COMPUTATIONS

$L = 2.0$ MILES $L_{ca} = 1.1$ MILES

$T_p = C_t \cdot (L \times L_{ca})^{.3}$

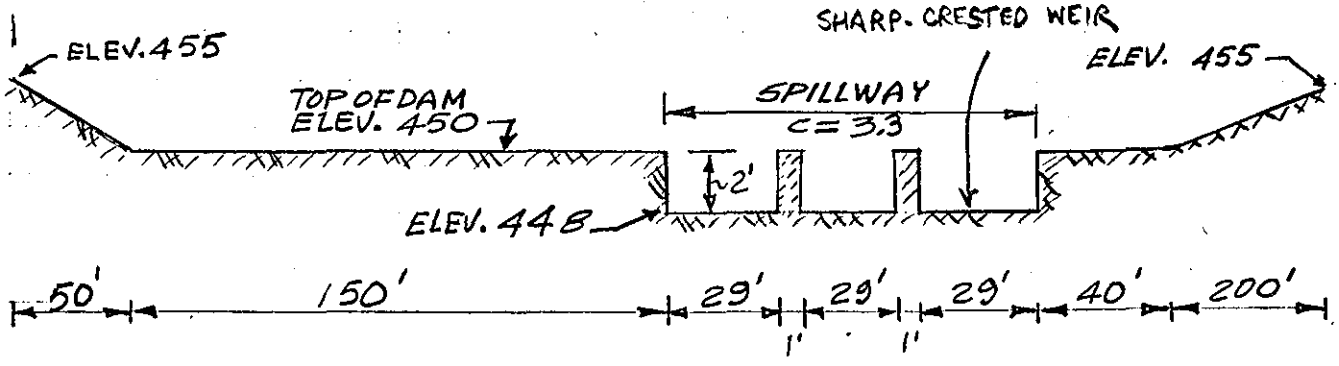
$T_p = 2 \times (2.0 \times 1.1)^{.3} \cong$ 2.50 Hours

PMP DATA

FROM HMS #33 THE 24 HOUR 200 SqMi INDEX RAINFALL IS 21.5

6hr. % OF INDEX FOR THIS BASIN = 111
12hr. % " " " " " = 124
24hr. % " " " " " = 133

DAM ELEVATION & LENGTH and SPILLWAY DIMENSIONS SKETCH



C = 2.8 TOP OF DAM

BRYANT ASSOCIATES, INC.
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 2060.001
SHEET NO. D-3 OF
CALCULATED BY R.G. DATE 1/80
CHECKED BY R.R.B. DATE 3/80
SCALE

CASE POND UPPER DAM H&H cont'd.

STAGE DISCHARGE

H=0 @ CORRESPONDING CREST $Q = CLH^{1.5}$
SPILLWAY CREST ELEV. = 448 (NGVD) Q_1 $C = 3.3$
TOP OF DAM ELEV. = 450 (NGVD) Q_2 $C = 2.8$

ELEVATION (NGVD)	H Ft.	Q_1 CFS.	H Ft.	Q_2 CFS.	ΣQ CFS
448	0	0			0
449	1	287			287
450	2	812	0	0	812
451	3	1,492	1	553	2,045
452	4	2,297	2	1,638	3,935
453	5	3,210	3	3,154	6,364
454	6	4,219	4	5,086	9,305
455	7	5,317	5	7,437	12,754

STAGE STORAGE

	ELEVATION (NGVD)	AREA (AC.)	STORAGE (AC.FT.) (COMP. BY HEC-1 PROGRAM)
	433	0	
SPILLWAY CREST	448	5.9	
TOP OF DAM	450	17.5	
	460	35.0	

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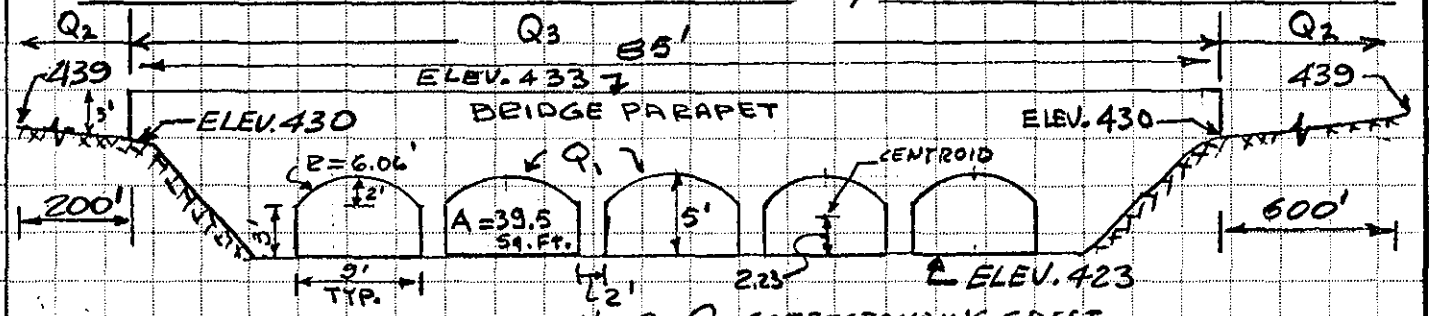
648 Beacon Street
BOSTON, MASSACHUSETTS 02215
(617) 247-1800

JOB 2060-001
SHEET NO. D-4 OF
CALCULATED BY R.G. DATE 1/80
CHECKED BY R.R.B. DATE 3/80
SCALE

CASE POND UPPER H&H cont'd.

CASE POND LOWER STAGE DISCHARGE & SURCHARGE STORAGE CAPACITY



Q_1) FOR $0<H<5$ $\quad Q_1 = C \times 5 \times L \times H^{1.5}$ $\quad C = 3.0$

FOR $H \geq 7$ $\quad Q_1 = 5 \times .65 \times A \times \sqrt{2g} \times (H-2.23)^{\frac{1}{2}}$

Q_2) $\quad Q_2 = CLH^{1.5}$ $\quad C = 2.8$

Q_3) $\quad Q_3 = CLH^{1.5}$ $\quad C = 3.0$

ELEVATION (NGVD)	H_1 FT	Q_1 CFS.	H_2 FT.	Q_2 CFS	H_3 FT.	Q_3 CFS	ΣQ CFS
423	0	0					0
425	2	382					382
426	3	701					701
428	5	1,715					1,509
430	7	2,250	0	0			2,250
433	10	2,872	3	908	0	0	3,780
436	13	3,381	6	5,136	3	1,325	9,842
439	16	3,823	9	15,726	6	3,748	23,297

SURCHARGE STORAGE

	ELEVATION (NGVD)	AREA (AC.)	SURCHARGE STORAGE (AC.FT.)
NORMAL POOL	423	0.5	
	430	1.0	
	440	3.6	

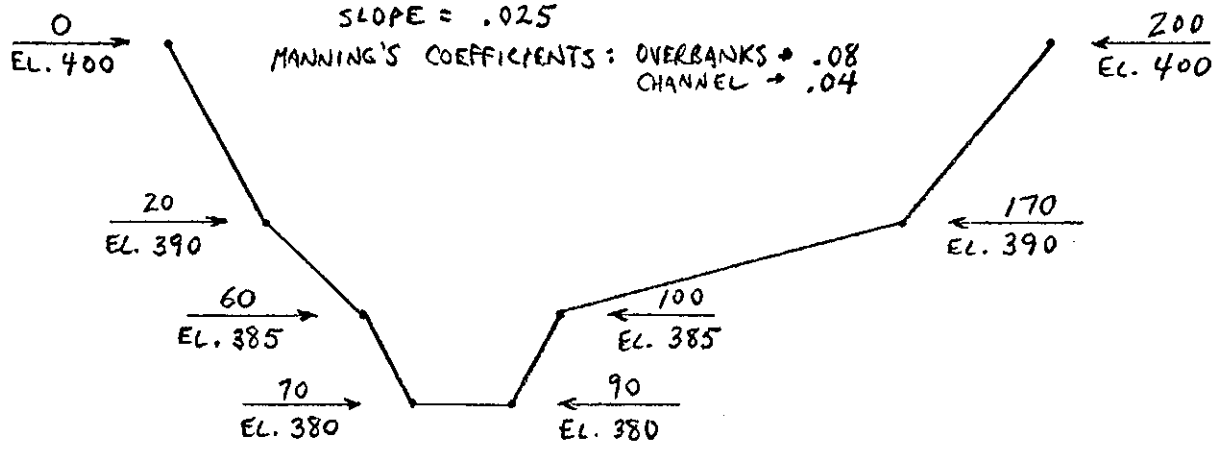
O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO.
CASE POND UPPER DAM	D-5	RRE	3/80	2060-001

DOWNSTREAM CROSS-SECTIONS FOR BREACH ROUTING

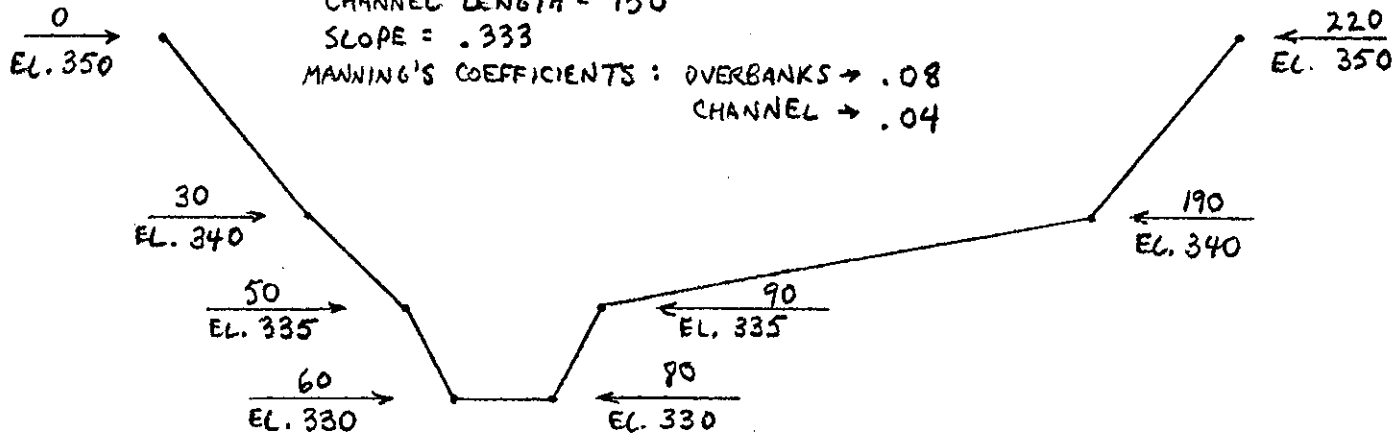
CROSS-SECTION AT TOP OF WATERFALL

CHANNEL LENGTH = 1000'
SLOPE = .025
MANNING'S COEFFICIENTS : OVERBANKS → .08
CHANNEL → .04



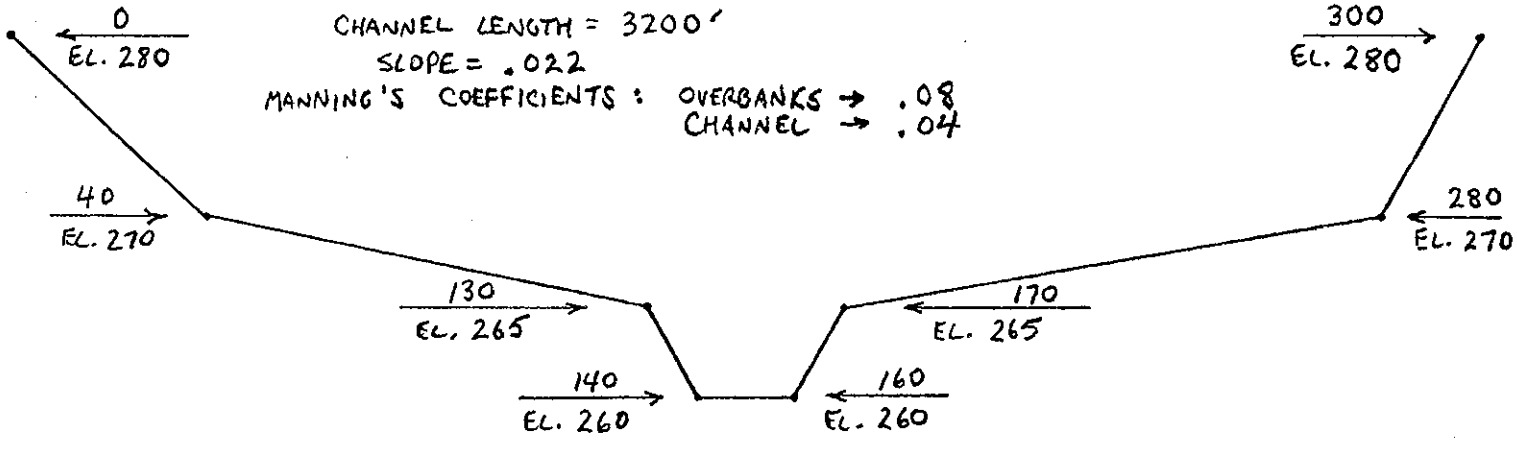
CROSS-SECTION AT BOTTOM OF WATERFALL

CHANNEL LENGTH = 150'
SLOPE = .333
MANNING'S COEFFICIENTS : OVERBANKS → .08
CHANNEL → .04



CROSS-SECTION AT HAZARD AREA

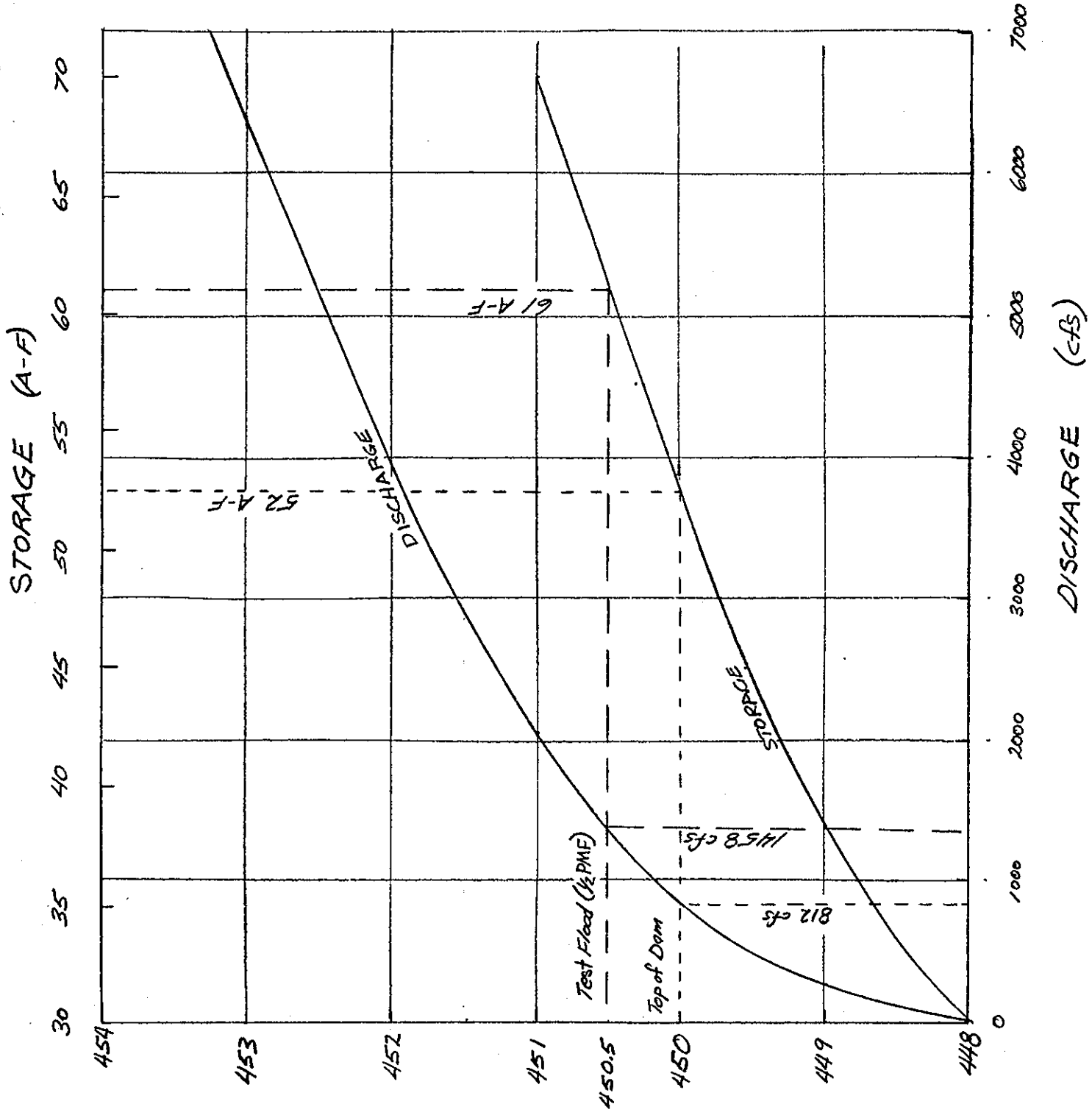
CHANNEL LENGTH = 3200'
SLOPE = .022
MANNING'S COEFFICIENTS : OVERBANKS → .08
CHANNEL → .04



O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
CASE POND UPPER DAM	D-6	SHS	3/80	2060-001

STAGE vs. STORAGE
STAGE vs. DISCHARGE

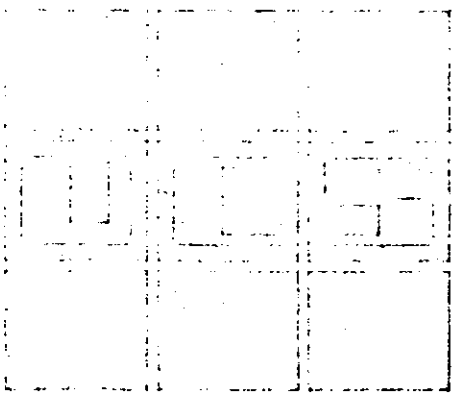


FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
~~LAST MODIFICATION 26 FEB 79~~

FLOOD ROUTING OVER CASE POND UPPER DAM

INPUT

```
  1  A1          HYDROLOGIC ANALYSIS OF  CASE POND UPPER DAM
  2  A2              ~~NATIONAL DAM INSPECTION PROGRAM~~
  3  A3            NEW ENGLAND DIVISION - CORPS OF ENGINEERS
  4  B   300    0     15     0     0     0     0     0    -4     0
  5  B1   5
  6  J    1     9     1
  7  J1  .2    .3    .4    .5    .6    .7    .8    .9   1.0
  8  K    0  CAS-U                                  1
  9  K1     INFLOW TO CASE POND UPPER DAM
 10  M    1     1  1.59                                        1
 11  P    0  21.5   111   124   133
 12  T                                              0  0.05
 13  W 2.50   0.5
 14  X -1.7  -0.1     2
 15  K    1  CAS-U                                  1
 16  K1     ROUTED OUTFLOW FROM CASE POND UPPER
 17  Y                          1     1
 18  Y1   1                                       -448    -1
 19  Y4 448   449   450   451   452   453   454   455
 20  Y5   0   287   812  2045  3935  6364  9305 12754
 21  $A   0   5.9  17.5  35.0
 22  $E 433   448   450   460
 23  $F 448
 24  $D 450
 25  K   99
```



UNITED COMPUTING SYSTEMS, INC.

D-7

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

RUN DATE= 03/17/80.
TIME= 15.21.08.

HYDROLOGIC ANALYSIS OF CASE POND UPPER DAM
NATIONAL DAM INSPECTION PROGRAM
NEW ENGLAND DIVISION - CORPS OF ENGINEERS

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

Percentages of PMF → RTIOS= .20 .30 .40 .50 .60 .70 .80 .90 1.00

INFLOW HYDROGRAPH DEVELOPMENT FOR CASE UPPER POND

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO CASE POND UPPER DAM

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	CAS-U	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.59	0.00	1.59	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.50	111.00	124.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.50 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.70 QRCSN= -.10 RTIOR= 2.00

UNIT HYDROGRAPH 78 END-OF-PERIOD ORDINATES, LAG= 2.52 HOURS, CP= .50 VOL= 1.00

6.	22.	45.	73.	103.	135.	163.	185.	201.	209.
207.	195.	181.	169.	157.	145.	135.	126.	117.	108.
101.	94.	87.	81.	75.	70.	65.	60.	56.	52.
48.	45.	42.	39.	36.	33.	31.	29.	27.	25.
23.	21.	20.	19.	17.	16.	15.	14.	13.	12.
11.	10.	10.	9.	8.	8.	7.	7.	6.	6.
5.	5.	5.	4.	4.	4.	3.	3.	3.	3.
3.	2.	2.	2.	2.	2.	2.	2.		

UNITED COMPUTING SYSTEMS, INC.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.88	21.68	1.20	89182.
										(581.)	(551.)	(30.)	(2525.35)

28

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTED OUTFLOW FROM CASE POND UPPER

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
CAS-U	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-448.	-1

STAGE	448.00	449.00	450.00	451.00	452.00	453.00	454.00	455.00
FLOW	0.00	267.00	812.00	2045.00	3935.00	6364.00	9305.00	12754.00

Stage - Discharge Data for Case Upper Pond

SURFACE AREA=	0.	6.	18.	35.
CAPACITY=	0.	30.	52.	309.
ELEVATION=	433.	448.	450.	460.

Stage - Storage Data

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
448.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
450.0	0.0	0.0	0.

0.2 PMF
PEAK OUTFLOW IS 578. AT TIME 18.50 HOURS

0.3 PMF
PEAK OUTFLOW IS 874. AT TIME 18.50 HOURS

0.4 PMF
PEAK OUTFLOW IS 1164. AT TIME 18.50 HOURS

0.5 PMF
PEAK OUTFLOW IS 1458. AT TIME 18.50 HOURS

0.6 PMF
PEAK OUTFLOW IS 1749. AT TIME 18.50 HOURS

0.7 PMF
PEAK OUTFLOW IS 2040. AT TIME 18.50 HOURS

UNITED COMPUTING SYSTEMS, INC.

0.8 PMF
PEAK OUTFLOW IS 2340. AT TIME 18.25 HOURS

0.9 PMF
PEAK OUTFLOW IS 2632. AT TIME 18.25 HOURS

PMF
PEAK OUTFLOW IS 2924. AT TIME 18.25 HOURS

D-6

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .20	RATIO 2 .30	RATIO 3 .40	RATIO 4 .50	RATIO 5 .60	RATIO 6 .70	RATIO 7 .80	RATIO 8 .90	RATIO 9 1.00
HYDROGRAPH AT	CAS-U	1.59	1	587.	880.	1173.	1467.	1760.	2054.	2347.	2640.	2934.
		(4.12)	(	16.61)(	24.92)(	33.23)(	41.54)(	49.84)(	58.15)(	66.46)(	74.77)(	83.07)
ROUTED TO	CAS-U	1.59	1	578.	874.	1166.	1458.	1749.	2040.	2340.	2632.	2924.
		(4.12)	(	16.37)(	24.75)(	33.02)(	41.28)(	49.52)(	57.77)(	66.26)(	74.54)(	82.81)

Test Flood Peak Inflow

Routed Test Flood Outflow

TEST FLOOD RESULTS AT CASE POND UPPER DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	448.00	448.00	450.00
	STORAGE	30.	30.	52.
	OUTFLOW	0.	0.	812.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	449.55	0.00	45.	578.	0.00	18.50	0.00
.30	450.05	.05	53.	874.	1.50	18.50	0.00
.40	450.29	.29	57.	1166.	3.75	18.50	0.00
.50	450.52	.52	61.	1458.	5.00	18.50	0.00
.60	450.76	.76	66.	1749.	6.00	18.50	0.00
.70	451.00	1.00	70.	2040.	6.75	18.50	0.00
.80	451.16	1.16	73.	2340.	7.75	18.25	0.00
.90	451.31	1.31	76.	2632.	8.50	18.25	0.00
1.00	451.47	1.47	79.	2924.	9.25	18.25	0.00

Test Flood Elevation

Test Flood Routed Outflow

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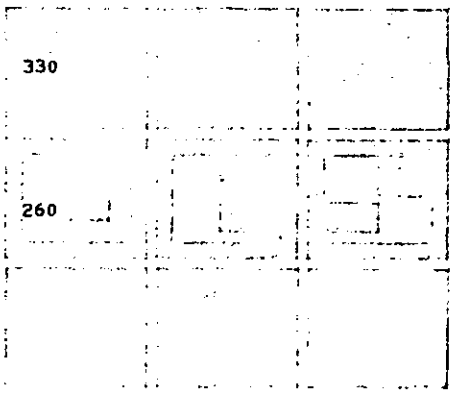
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  26 FEB 79    CASE UPPER POND DAM BREACH TO PRIMARY HAZARD AREA
**********                                  INPUT
     1          A1                HYDROLOGIC ANALYSIS OF  CASE POND UPPER DAM
     2          A2                    NATIONAL DAM INSPECTION PROGRAM
     3          A3                NEW ENGLAND DIVISION - CORPS OF ENGINEERS
     4          B    300       0       5       0       0       0       0       0      -4       0
     5          B1     5
     6          J      1       1       1
     7          J1     0
     8          K      1    CAS-U                                              1
     9          K1        ROUTED OUTFLOW FROM CASE POND UPPER
    10          Y                                       1       1
    11          Y1     1                                                   -450      -1
    12          Y4   448     449     450     451     452     453     454     455
    13          Y5     0     287     812    2045    3935    6364    9305   12754
    14          $A     0     5.9    17.5    35.0
    15          $E   433     448     450     460
    16          $S   448
    17          $D   450
    18          $B    75    0.01     435       2     450     450
    19          K      1    CAS-L                                              1
    20          K1        RESERVOIR ROUTING THROUGH CASE POND LOWER
    21          Y                                       1       1
    22          Y1     1                                                   -423      -1
    23          Y4   423     425     426     428     430     433     436     439
    24          Y5     0     382     701    1509    2250    3780    9842   23297
    25          $A   0.5     1.0     3.6
    26          $E   423     430     440
    27          $S   423
    28          $D   430
    29          K      1    DS-1                                               1
    30          K1        CHANNEL ROUTING TO TOP OF WATERFALL
    31          Y                                       1       1
    32          Y1     1                                                     -1
    33          Y6  0.08    0.04    0.08     380     400    1000    .025
    34          Y7     0     400      20     390      60     385      70     380      90     380
    35          Y7   100     385     170     390     200     400
    36          K      1    DS-2                                               1
    37          K1        CHANNEL ROUTING THROUGH WATERFALL
    38          Y                                       1       1
    39          Y1     1                                                     -1
    40          Y6  0.08    0.04    0.08     330     350     150    .333
    41          Y7     0     350      30     340      50     335      60     330      80
    42          Y7    90     335     190     340     220     350
    43          K      1    DS-3                                               1
    44          K1        CHANNEL ROUTING TO HAZARD AREA
    45          Y                                       1       1
    46          Y1     1                                                     -1
    47          Y6  .08     .04     .08     260     280    3200    .022
    48          Y7     0     280      40     270     130     265     140     260     160
    49          Y7   170     265     280     270     300     280
    50          K     99
```



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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

 RUN DATE= 03/17/80.
      TIME= 15.00.44.

                    HYDROLOGIC ANALYSIS OF  CASE POND UPPER DAM
                          NATIONAL DAM INSPECTION PROGRAM
                    NEW ENGLAND DIVISION - CORPS OF ENGINEERS

                                  JOB SPECIFICATION
        NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
       300       0       5       0       0       0       0       0      -4       0
                            JOPER     NWT   LROPT   TRACE
                                5       0       0       0

                    MULTI-PLAN ANALYSES TO BE PERFORMED
                    NPLAN= 1 NRTIO= 1 LRTIO= 1

 No INFLOW ---> RTIOS=    0.00

**********      **********      **********      **********      **********

                                HYDROGRAPH ROUTING

                    ROUTED OUTFLOW FROM CASE POND UPPER

                  ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  CAS-U       1       0       0       0       0       1       0       0
                                ROUTING DATA
                 QLOSS   CLOSS     AVG    IRES   ISAME   IOPT    IPMP            LSTR
                    0.0   0.000    0.00       1       1       0       0               0
                  NSTPS   NSTOL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                      1       0       0   0.000   0.000   0.000    -450.      -1

 STAGE     448.00    449.00    450.00    451.00    452.00    453.00    454.00    455.00
 FLOW        0.00    287.00    812.00   2045.00   3935.00   6364.00   9305.00  12754.00

 SURFACE AREA=      0.        6.       18.       35.
   CAPACITY=        0.       30.       52.      309.
  ELEVATION=      433.      440.      450.      460.

 Spillway Crest Elevation ---> CHEL    SPWID    COOW    EXPW    ELEVL    COOL   CAREA    EXPL
                               448.0      0.0     0.0     0.0      0.0     0.0     0.0     0.0

                                DAM DATA
 Top of Dam Elevation ---> TOPEL    COOD    EXPD   DAMWID
                           450.0     0.0     0.0       0.

                            DAM-BREACH DATA
 Breach Data                BRWID       Z   ELAM   TFAIL   WSEL  FAILEL
                              75.     .01  435.00    2.00  450.0  450.00

 BEGIN DAM FAILURE AT  0.00 HOURS
 PEAK OUTFLOW IS      812. AT TIME   0.00 HOURS
```

Stage - Discharge Data

Stage - Storage Data

UNITED COMPUTING SYSTEMS, INC.

BREACH FLOOD ROUTING THROUGH CASE POND LOWER

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

RESERVOIR ROUTING THROUGH CASE POND LOWER

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
CAS-L	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-423.	-1

STAGE	423.00	425.00	426.00	428.00	430.00	433.00	436.00	439.00
FLOW	0.00	382.00	701.00	1509.00	2250.00	3780.00	9842.00	23297.00
SURFACE AREA=		1.	1.	4.				
CAPACITY=		0.	5.	27.				
ELEVATION=		423.	430.	440.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
423.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
430.0	0.0	0.0	0.

PEAK OUTFLOW IS 805. AT TIME .08 HOURS

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING TO TOP OF WATERFALL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DS-1	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	380.0	400.0	1000.	.02500

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 400.00 20.00 390.00 60.00 385.00 70.00 380.00 90.00 380.00
100.00 385.00 170.00 390.00 200.00 400.00

STORAGE	0.00	.53	1.17	1.91	2.75	3.70	5.09	7.03	9.54	12.61
	16.18	19.93	23.81	27.81	31.95	36.21	40.60	45.11	49.75	54.52
OUTFLOW	0.00	131.67	433.08	885.98	1492.61	2298.66	3430.48	4843.88	6587.45	8702.99
	11304.08	14383.53	17842.62	21669.23	25855.37	30395.72	35286.83	40526.56	46113.80	52048.22
STAGE	380.00	381.05	382.11	383.16	384.21	385.26	386.32	387.37	388.42	389.47
	390.53	391.58	392.63	393.68	394.74	395.79	396.84	397.89	398.95	400.00
FLOW	0.00	131.67	433.08	885.98	1492.61	2298.66	3430.48	4843.88	6587.45	8702.99
	11304.08	14383.53	17842.62	21669.23	25855.37	30395.72	35286.83	40526.56	46113.80	52048.22

MAXIMUM STAGE IS 383.0

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HYDROGRAPH ROUTING

CHANNEL ROUTING THROUGH WATERFALL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OS-2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

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NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	330.0	350.0	150.	.33300

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00	350.00	30.00	340.00	50.00	335.00	60.00	330.00	80.00	330.00	
90.00	335.00	190.00	340.00	220.00	350.00					

STORAGE	0.00	.08	.18	.29	.41	.56	.77	1.07	1.47	1.96
	2.53	3.13	3.76	4.41	5.08	5.77	6.49	7.23	7.99	8.78

UNITED COMPUTING SYSTEMS, INC.

OUTFLOW	0.00	480.56	1580.59	3233.54	5447.50	8389.50	12533.91	17744.91	24219.00	32125.03
	41913.83	53578.41	66744.50	81372.06	97435.83	114920.09	133815.75	154118.51	175827.66	198945.29
STAGE	330.00	331.05	332.11	333.16	334.21	335.26	336.32	337.37	338.42	339.47
	340.53	341.58	342.63	343.68	344.74	345.79	346.84	347.89	348.95	350.00
FLOW	0.00	480.56	1580.59	3233.54	5447.50	8389.50	12533.91	17744.91	24219.00	32125.03
	41913.83	53578.41	66744.50	81372.06	97435.83	114920.09	133815.75	154118.51	175827.66	198945.29

MAXIMUM STAGE IS 331.4

BREACH FLOOD ROUTING TO HAZARD AREA

HYDROGRAPH ROUTING

CHANNEL ROUTING TO HAZARD AREA

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DS-3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	260.0	280.0	3200.	.02200

Channel Characteristics at Downstream Hazard Center

↑ Streambed Elevation at Hazard Area

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00	280.00	40.00	270.00	130.00	265.00	140.00	260.00	160.00	260.00	
170.00	265.00	280.00	270.00	300.00	280.00					

STORAGE	0.00	1.71	3.74	6.10	8.79	11.89	17.43	26.22	38.27	53.57
	71.78	90.43	110.37	130.39	150.90	171.90	193.39	215.37	237.84	260.79
OUTFLOW	0.00	123.52	406.26	831.13	1400.19	2156.78	3250.69	4700.34	6596.49	9016.70
	12176.38	16070.53	20512.44	25477.66	30948.96	36913.80	43362.85	50289.12	57687.42	65553.92
STAGE	260.00	261.05	262.11	263.16	264.21	265.26	266.32	267.37	268.42	269.47
	270.53	271.58	272.63	273.68	274.74	275.79	276.84	277.89	278.95	280.00
FLOW	0.00	123.52	406.26	831.13	1400.19	2156.78	3250.69	4700.34	6596.49	9016.70
	12176.38	16070.53	20512.44	25477.66	30948.96	36913.80	43362.85	50289.12	57687.42	65553.92

GT-0

MAXIMUM STAGE IS 293.1 Elevation of Breach Floodwaters at Damage Center

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	450.00	448.00	450.00
	STORAGE	52.	30.	52.
	OUTFLOW	812.	0.	812.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	449.84	0.00	52.	812.	0.00	0.00	0.00

CASE UPPER POND BREACH FLOOD RESULTS

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	423.00	423.00	430.00
	STORAGE	0.	0.	5.
	OUTFLOW	0.	0.	2250.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	426.26	0.00	2.	805.	0.00	.08	0.00

PLAN 1 STATION DS-1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	805.	383.0	.08

PLAN 1 STATION DS-2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	805.	331.4	.08

PLAN 1 STATION DS-3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.00	805.	263.1	.08

D-10

Peak Breach Flow at Damage Center

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME