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NEW ENGLAND DIV APR 79

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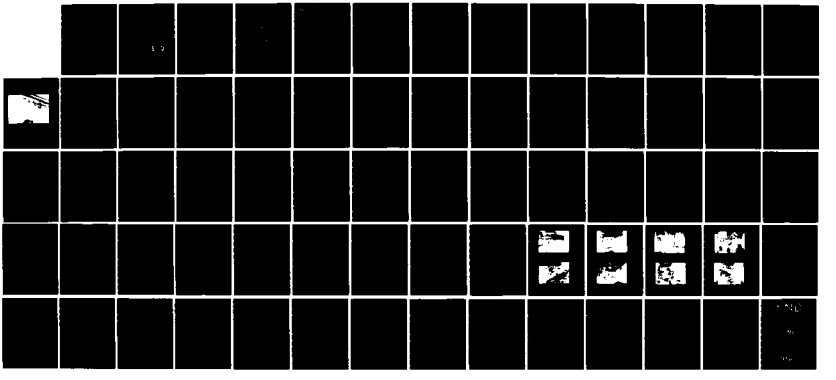

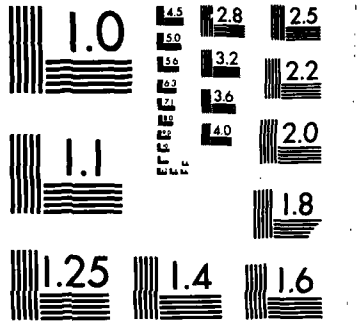

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NATIONAL BUREAU OF STANDARDS-1963-A

CONNECTICUT RIVER BASIN
LITTLETON NEW HAMPSHIRE

ICE POND DAM
N.H.00145

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

APRIL, 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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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
Littleton, New Hampshire
Alder Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a masonry earth fill dam with cut stone spillway, 125 ft. long and 20 ft. high. It is small in size with a significant hazard classification. The dam was judged to be in fair condition. The downstream spillway training walls are partially collapsed. The owner should implement a systematic maintenance program consisting of various items.

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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

OCT 2 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 Ice Pond 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, Town of Littleton, Municipal Office, Littleton, New Hampshire 03561.

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,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

ICE POND DAM

NH 00145

LITTLETON, NEW HAMPSHIRE

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No:	NH00145
Name of Dam:	Ice Pond Dam
Town:	Littleton
County and State:	Grafton County, New Hampshire
Stream:	Alder Brook
Date of Inspection:	November 14, 1978

BRIEF ASSESSMENT

The Ice Pond Dam is a masonry-earth fill dam with cut stone spillway, 125 feet long and 20 feet high. The dam and impoundment are part of the "Dells" conservation and picnic area. The reservoir surface area is approximately five acres and it drains an area of 3.9 square miles. The water level is controlled by the overflow spillway and there are no other operational outlets.

Based on a size classification of small and a significant hazard classification, in accordance with "Recommended Guidelines for Safety Inspection of Dams, Department of the Army, November 1976" the test flood for this dam is the 100-year exceedance interval storm. The test flood of 1400 CFS overtops the dam by approximately 1.8 feet. The spillway has a capacity of 735 CFS without overtopping which is 52 percent of the test flood.

The dam was judged to be in fair condition. The following significant conditions were observed:

1. The downstream spillway training walls are partially collapsed.

2. Trees are growing in the earth embankments.

3. The downstream wall of the dam is experiencing some deterioration.

A detailed assessment and recommendations for remedial measures are contained in Section 7. In summary, it is recommended that the following actions be taken under the guidance of a qualified engineer within one year of the receipt of this report:

1. Reconstruct the spillway training walls.

2. Repair the downstream face of the dam.

3. Remove the flashboard pins in the spillway.

4. Activate the 12-inch drain valve.

5. Design and construct increased spillway capacity or stabilization of downstream face to withstand continuous overtopping.

In addition, the owner should implement a systematic maintenance program consisting of the following items:

1. Remove trees and brush from the dam embankments and walls as required.

2. Remove debris from the reservoir and downstream channel.

3. Institute a program of annual periodic technical inspection.

4. Institute a formal warning system.

DUFRESNE - HENRY ENGINEERING CORP. INCORPORATED 1961 SPRINGFIELD, VT.

THE STATE OF NEW HAMPSHIRE WALTER A. HENRY No. 1236 REGISTERED PROFESSIONAL ENGINEER

Walter A. Henry

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

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

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

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, 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.

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SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General

The Ice Pond Dam spillway is a cut stone broad crested weir with upstream and downstream training walls. The spillway functions as a weir until a height of 4.2 feet where the flow contacts the underside of the bridge beams, after which orifice flow will govern.

b. Design Data

There is no known design data concerning the hydraulic and hydrologic features of the Ice Pond Dam.

c. Experience Data

There is no confirmed overtopping of the dam in any of the file data.

d. Test Flood Analysis

The dam is classified as small with a significant hazard classification. Since two homes would be directly impacted by a flood wave resulting from a dam failure, the 100-year exceedance interval flood was selected as the test flood.

The computations of the test flood were carried out using a computer program of the procedures presented in Geological Survey Water-Supply Paper 1580-B, which is a study of the relation of annual peak discharges to hydrologic factors in New England. The input data computations and results are contained in Appendix D of this Report. Since the area contains a significant amount of storage, a flow reduction due to storage routing was calculated using USDA Soil Conservation Service guidelines. The inflow flood of 1,440 CFS was reduced to an outflow of 1,400 CFS.

The spillway capacity of 735 CFS represents 52 percent of the calculated test. The test flood would overtop the dam by approximately 1.8 feet.

The low point of the dam is located approximately 65 feet left of the spillway and is roughly one foot lower than the access bridge surface. The overtopping flow would flow around the

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

There are no known operational procedures for this dam.

4.2 Maintenance

Maintenance of the dam is minimal and related only to the aesthetical appearance of the recreational area. Debris which collects on the spillway is removed on an as-needed basis.

There was some evidence observed during the visual inspection, also indicated in the file data, that some minor repairs were performed on the dam in recent years. These repairs consisted of pointing of the loose stone joints in the training walls.

During the inspection of the dam, an area resident was interviewed. He indicated that several truck loads of clay were placed on the upstream face of the dam approximately four years ago.

4.3 Maintenance of Operating Facilities

None exists for this dam.

4.4 Description of Warning System

None exists for this dam.

4.5 Evaluation

The lack of routine maintenance on the dam could contribute to increase deterioration of the dam in the future. Recommendations for an improved maintenance program are outlined in Section 7.

The downstream training walls are in poor condition. High flows over the spillway have eroded the streambed material to the point where the training walls have partially collapsed into the downstream channel (see Photos 4, 5 and 6). It appears that further erosion is likely and complete collapse of the training walls may occur in the near future.

A 12-inch cast-iron drain pipe is located at the base of the spillway. The drain inlet and operating valve are presumed to be located in the reservoir. The outline of a box-type structure can be seen approximately 25 feet upstream of the dam. Because of the depth and poor clarity of the water, the dimensions and contents of the structure could not be determined.

d. Reservoir Area

The reservoir area is a small pond used for recreational purposes. The banks are well formed and covered with trees. There are no signs of erosion or slope instability. A marshy area exists at the upstream portal where sedimentation has occurred.

e. Downstream Channel

The downstream channel is the natural streambed. Stone retaining walls extend approximately 25 feet downstream of the training walls. The stream runs southerly for about 500 feet before encountering a roadway culvert. There is a considerable amount of debris in the channel consisting of fallen trees and branches.

3.2 Evaluation

The significant findings of the visual inspection are as follows:

a. The downstream training walls of the spillway are in poor condition, the downstream end of the walls having collapsed. If the walls continue to collapse closer to the dam, the flow from the spillway can produce undermining of the base of the dam. The severity of such underminimg depends on the depth at which the dam is founded and on the type of foundation material.

b. The roots of a tree growing on the upstream slope and of several trees growing near the downstream wall of the dam can cause seepage channels to develop. A limited sapling growth from cracks on the downstream wall can accelerate deterioration of the wall.

c. The left end of the downstream wall of the dam has lost some stones.

d. There are some voids in the left training wall at the spillway entrance.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The dam is judged to be in fair condition based on the visual inspection. Although the spillway training walls have been damaged severely by erosion of the foundation material, there were no signs of unstable conditions. Water was flowing over the spillway at the time of inspection, preventing the examination of the downstream spillway face for leaks.

b. Dam

The dam consists of a downstream stone masonry wall and an upstream earth embankment.

The upstream slope has no visible slope protection (see Photo 7). The part of the slope above the water level shows some indication of erosion resulting in local areas with an almost vertical face and with a height on the order of 2 feet. A large tree is growing on the upstream slope near the right abutment.

The downstream face of the dam is of stone masonry construction. The surface is irregular and shows no apparent seepage. There is some growth of vegetation out of cracks in the wall. At the left abutment there are some voids in the wall, and apparently some stones are missing (see Photo 2). The cause of the deterioration of the wall at the left abutment is probably erosion due to runoff from the access road. An inspection along the toe of the downstream wall revealed no indications of seepage. There are several trees growing immediately downstream of the dam.

c. Appurtenant Structures

The cut stone spillway (see Photo 3) contains pins which are assumed to be flashboard supports. Although no flashboards were present, the pins were preventing several driftwood planks and other floating debris from flowing over the spillway. The spillway is spanned by a vehicle bridge, providing access to the picnic area.

The upstream training walls are stone masonry with several voids and loose stones. Several small trees are growing from the top of the wall (see Photo 1).

SECTION 2 - ENGINEERING DATA

2.1 Design

There is no design information available for this dam.

2.2 Construction

There is no significant construction information available for this dam other than the year of construction - 1938, and some correspondence on file with the New Hampshire Water Resources Board. The correspondence indicates that the design of the dam was reviewed and approved by the Public Service Commission of New Hampshire and that the dam was constructed by the Fish and Game Department.

2.3 Operation

There are no operating records available for this dam.

2.4 Evaluation

a. Availability

The design and construction records for this dam are not available.

b. Adequacy

The lack of in-depth engineering data does not allow for a comprehensive review. Therefore this evaluation, structurally and hydraulically cannot be made from the standpoint of review of design calculations but must be based primarily on the visual inspection, past performance history and sound hydrologic and hydraulic engineering judgment.

c. Validity

Not applicable.

(5) Upstream Channel

Reservoir - approach channel.

(6) Downstream Channel

Natural stream bed.

(7) General

Vehicle access bridge across approach channel.

j. Regulating Outlets

12" drain (not functioning).

(3) Height

Overall - 20 feet.
Spillway - 14 feet.

(4) Top Width

Variable.

(5) Side Slopes

Upstream - 1H:1V.
Downstream - Vertical stone wall.

(6) Zoning

None known.

(7) Impervious Core

None known.

(8) Cutoff

None known.

(9) Grout Curtain

None known.

h. Diversion and Regulating Tunnel

Not applicable.

i. Spillway

(1) Type

Broad crested weir/orifice.

(2) Length of Weir

20 feet.

(3) Crest Elevation

93.6.

(4) Gates

None.

(2) Flood Control Pool

Not applicable.

(3) Test Flood Pool

90 acre-feet.

(4) Spillway Crest Pool

50 acre-feet.

(5) Top of Dam

80 acre-feet.

f. Reservoir Surface

(1) Recreation Pool

5 acres ±

(2) Flood Control Pool

Not applicable.

(3) Spillway Crest

5 acres ±

(4) Test Flood Pool

5.5 acres ±

(5) Top of Dam

5 acres ±

g. Dam

(1) Type

Masonry-earth dam with cut stone spillway.

(2) Length

Overall - 125 feet.
Spillway - 20 feet.

(2) Maximum Tailwater

Unknown.

(3) Upstream Portal Invert Diversion Tunnel

Not applicable.

(4) Recreation Pool

93.6

(5) Full Flood Control Pool

Not applicable.

(6) Spillway Crest

93.6

(7) Design Surcharge

Unknown.

(8) Top of Dam

99.0

(9) Test Flood Surcharge

100.8

d. Reservoir Data

(1) Length of Maximum Pool

1000 feet ±.

(2) Length of Recreation Pool

1000 feet ±.

(3) Length of Flood Control Pool

Not applicable.

e. Storage

(1) Recreation Pool

50 acre-feet.

h. Design and Construction History

The original dam was constructed in 1936 by the New Hampshire Fish and Game Department as a fish rearing pond. The site of the dam was formerly a mill pond which had been washed away. There are no design or construction records available for the dam.

It was reported by an area resident that several truck loads of clay were placed on the upstream face of the dam four or five years ago.

i. Normal Operational Procedures

There are no routine operational procedures associated with this dam other than normal maintenance connected with the recreation area which includes clearing of floating debris from the spillway.

1.3 Pertinent Data

a. Drainage Area

The drainage basin of the Ice Pond Dam includes approximately 3.9 square miles of variable terrain located northwest of the Town of Littleton. Elevations vary from 800 at the dam to 1900 at the higher basin ridges. The area is approximately 80 percent wooded with the remainder in open fields and residential development.

The main channel has a slope of 172 feet per mile and contains several small ponds with significant natural storage potential.

b. Discharge at the Dam Site

The only outlet from the reservoir is an ungated cut stone spillway, which is spanned by a vehicle access bridge. The spillway functions as a weir until the flow contacts the underside of the bridge beams after which orifice flow will govern. The maximum capacity of the spillway is 735 CFS at elevation 99.

c. Elevations

(Based on an assumed elevation of 100.0 at the center of the access bridge.)

(1) Streambed at Centerline of Dam

79 feet $\pm$.

trees. Several large pine trees are located near the embankment with root systems extending into the embankment. The split stone spillway which controls the reservoir level is in poor condition because of deterioration and erosion of the training walls.

An intake and/or drain structure can be seen in deep water approximately 25 feet upstream of the dam. Contents of the structure could not be determined through the water. It is assumed that the 12-inch drain line terminating at the downstream spillway face (see Photo 3) begins in the structure with a drain valve.

c. Size Classification

The Ice Pond Dam has a maximum height of 20 feet and a maximum storage volume of 80 acre-feet. The USCE Guidelines place dams with maximum heights lower than 40 feet and maximum storage between 50 and 1000 acre-feet in the small classification. Therefore the size classification of Ice Pond Dam is small.

d. Hazard Classification

A failure of the Ice Pond Dam would route a significant flood wave into the lower stream channel. The natural streambed would not be sufficient to contain the flood wave and extensive overland flow would result. At least two homes would receive some damage with potential for loss of life. Therefore the hazard classification for this dam is significant.

e. Ownership

The present owner of the dam is:

Town of Littleton
Municipal Office
Littleton, New Hampshire 03561

f. Operator

The dam is currently being maintained by the Town of Littleton, through the Park and Conservation Commission. The contact is Mr. James Hannigan, Town Manager. Telephone 603-444-3996.

g. Purpose

The dam was originally constructed by the New Hampshire Fish and Game Department in 1936 as a fish rearing pond. The current purpose of the dam is recreational, as the focal point of the "Dells" conservation and picnic area.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
NAME OF DAM: ICE POND

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. Dufresne-Henry Engineering Corporation has 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 were issued to Dufresne-Henry Engineering Corporation under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0010 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 nonfederal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for nonfederal dams.

(3) To update, verify and complete the National Inventory of Dams.

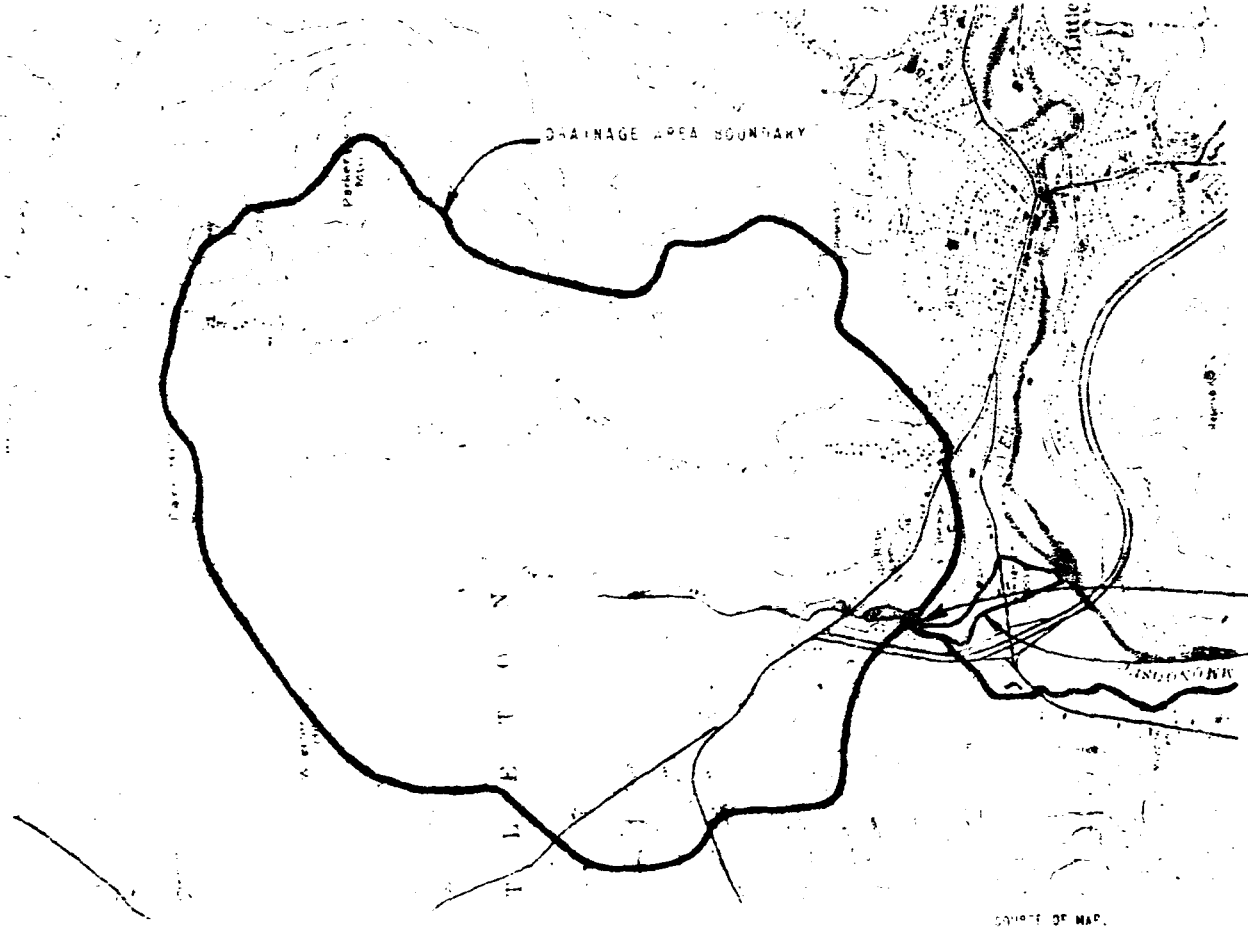
1.2 Description of Project

a. Location

The Ice Pond Dam is located in the Town of Littleton, Grafton County, New Hampshire. More specifically, the dam is approximately 1 mile west of the City of Littleton, near the intersection of Interstate 93 and State Route 18.

b. Description of Dam and Appurtenances

The Ice Pond Dam is a 125-foot long, 20-foot high earth fill dam with a split stone downstream wall. The earth portions of the dam embankment are covered with grass and some small



SOURCE OF MAP:
U.S. GEOLOGICAL SURVEY
LITTLETON, N.H.
SERIES 7½'
SCALE 1:24,000 1971

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION MAP
ICE POND DAM

OVERVIEW OF
ICE POND DAM
LITTLETON, NEW HAMPSHIRE

left abutment where the stone wall contacts the abutment (see Photo 2). As noted in Section 3, some erosion has occurred in this area.

e. Dam Failure Analysis

If the Ice Pond Dam were to fail with the water at the top of the dam a flood wave 13 feet high flowing at a rate of 7,520 CFS would result. 500 feet downstream the channel makes a right angle turn and the stream flows through a bridge with an opening 11 feet wide and 5 feet high. The channel and bridge capacity would not contain the flood wave so that it would then continue to flow southerly along Dells Road and the flood plain east of it. The flood plain is about 2 feet lower than the road and the houses are built up at least a foot above road level. At this point the flood wave would be 4 feet deep on the flood plain (7 feet overall) or as much as a foot into the dwellings.

The flood wave would be between one to two feet deep when it finally crosses Route 302 prior to entering the channel of the Ammonoosuc River. With the anticipated spreading of the flood wave over the flood plain 53 acre-feet of storage would be available reducing the peak flow to approximately 2,000 CFS. This wave would be flowing at a rate of less than 1 foot per second in the inundated areas including restaurants and other commercial establishments. This would cause substantial economic loss and would pose some risk to life as homes could be partially inundated.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The visual observations did not disclose any findings indicating immediate stability problems. However, some of the observations indicate the potential for future stability problems, particularly the condition of the spillway training walls, as discussed in Section 3. If the undermining and collapse of these walls continues, an unstable condition may result.

b. Design and Construction Data

None exists for this dam.

c. Operating Records

None exists for this dam.

d. Post-Construction Changes

None of the available records indicate any post-construction changes.

e. Seismic Stability

The dam is located in seismic zone 2 and in accordance with recommended Phase I Guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/ REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The dam is in fair condition as judged from the visual inspection. There are no evidences of an immediate unsafe condition. However, the condition of the downstream section of the spillway training walls can lead to an unsafe dam in the future if the recommendations and remedial measures recommended in Sections 7.2 and 7.3 are not taken.

b. Adequacy of Information

The information available on this dam is minimal and therefore, the assessment of the dam is based primarily on the visual inspection.

c. Urgency

The recommendations presented in Sections 7.2 and 7.3 should be carried out within one year of receipt of this report.

d. Need for Additional Investigation

None required.

7.2 Recommendations

It is recommended that the following items be performed under the guidance of a qualified engineer:

1. Design and construct increased spillway capacity or stabilize downstream face to withstand continuous overtopping.

2. Reconstruct the downstream sections of the spillway training walls to their original configuration with particular attention given to the foundation to prevent future undermining.

3. Repair the left end of the dam.

4. Fill voids in the left wall at the spillway entrance.

5. Activate the 12-inch drain line.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

The following items are recommended:

1. Formulate a plan to remove all trees growing on the upstream slope and all trees within 20 feet of the downstream stone face of the dam. Also remove any growth out of the cracks in the downstream wall. Fill all holes or voids resulting from tree removal.

2. Remove debris from the downstream channel.

3. Remove debris along the edges of the reservoir and the pins for flashboards in the spillway to avoid accumulation of debris in the spillway during high flows, and prevent flashboards from being installed.

4. Institute a yearly technical inspection and maintenance program. The inspection program should include a search for seeps through the downstream wall, including the spillway section and inspection of the spillway at low flow conditions along with control of brush and tree growth around and on the dam, and in addition removal of debris from the spillway channel.

5. Establish a formal warning system.

7.4 Alternatives

None.

APPENDIX A

VISUAL INSPECTION CHECK LIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT ICE POND DAM

DATE November 14, 1978

TIME A.M.

WEATHER Cool

W.S. ELEV. U.S. DN.S.

PARTY:

1. Gonzalo Castro GEI
2. Jim Maynes D-H
3. Jim Dohrman D-H
4. Vern Clifford D-H
5. Ken Sterns, N.H. Board of Water Resources
6.
7.
8.
9.
10.

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

PERIODIC INSPECTION CHECK LIST

PROJECT ICE POND DAM **DATE** November 14, 1978

PROJECT FEATURE _____ **NAME** _____

DISCIPLINE _____ **NAME** _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None observed.
Pavement Condition	Soil - good.
Movement or Settlement of Crest	None observed. Slight erosion at low point in road.
Lateral Movement	None observed.
Vertical Alignment	Good.
Horizontal Alignment	No misalignment observed.
Condition at Abutment and at Concrete Structures	At left abutment wall has settled, undermined by flow.
Indications of Movement of Structural Items on Slopes	None.
Trespassing on Slopes	Recreational area - none observed.
Sloughing or Erosion of Slopes or Abutments	Erosion at left abutment due to road drainage. Upstream face has eroded to Vermont face 4 feet high.
Rock Slope Protection - Riprap Failures	None observed - under water.
Unusual Movement or Cracking at or near Toes	None.
Unusual Embankment or Downstream Seepage	None observed - downstream wall of spillway was under water.
Piping or Boils	None.
Foundation Drainage Features	None known.
Toe Drains	None known.
Instrumentation System	None.
Vegetation	Trees growing from downstream wall and o top of wall.

PERIODIC INSPECTION CHECK LIST

PROJECT ICE POND DAM DATE November 14, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

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

PERIODIC INSPECTION CHECK LIST

PROJECT ICE POND DAM DATE November 14, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Outline of intake box is visible in 5+ feet of water. Dimensions and contents could not be obtained.
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT ICE POND DAM DATE November 14, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	NONE.
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

PERIODIC INSPECTION CHECK LIST

PROJECT ICE POND DAM DATE November 14, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Approach Channel	Silted.
b. Weir and Training Walls	Fair - some erosion - openings in stone joints.
General Condition of Stonewalls	
Rust or Staining	None.
Spalling	Mortar facing on stone walls - slight spalling.
Any Visible Reinforcing	None observed.
Any Seepage or Efflorescence	None observed.
Drain Holes	None observed.
c. Discharge Channel	Channel walls eroded for 10 feet both sic
General Condition	Poor. Spillway wingwalls partially collapsed and settling, large cracks.
Loose Rock Overhanging Channel	Some.
Trees Overhanging Channel	Yes.
Floor of Channel	Natural stream eroded (no riprap); debris downstream of pool.
Other Obstructions	None.
d. Reservoir Drain	12" C.I.P. at base of spillway wall - old valve pit observed under water (see sketch) not easily assessable.

PERIODIC INSPECTION CHECK LIST

)JECT ICE POND DAM DATE November 14, 1978

)JECT FEATURE NAME

SCIPLINE NAME

AREA EVALUATED	CONDITION
TLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	NONE OBSERVED.
Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT ICE POND DAM DATE November 14, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	NONE.
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat and Backwall	

PERIODIC INSPECTION CHECK LIST

ECT ICE POND DAM DATE November 14, 1978

ECT FEATURE _____ NAME _____

IPLINE _____ NAME _____

AREA EVALUATED	CONDITION
VOIR	
lity of Shoreline	Eroding, trees, sandy slope.
ientation	Extensive.
ges in Watershed Runoff Potential	None known.
eam Hazards	None.
stream Hazards	
Facilities	None.
ometeorological Gages	None.
itional and Maintenance gulations	None.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

#7. VIEW OF RESERVOIR AREA

#8. VIEW OF DOWNSTREAM [illegible]

#5. VIEW OF LEFT TRAINING WALL

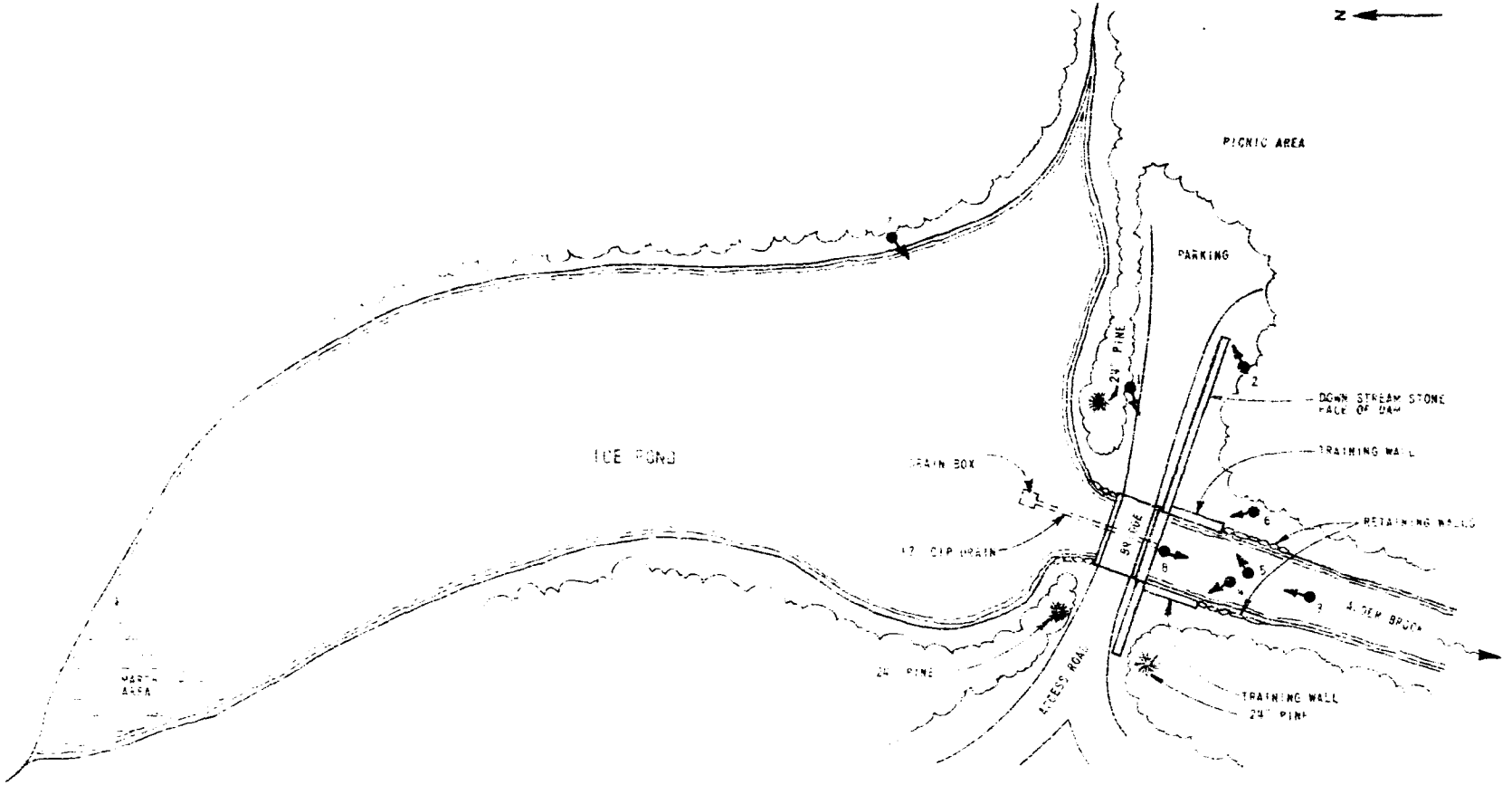
#6. CLOSE-UP OF LEFT TRAINING WALL

#3. VIEW OF DOWNSTREAM SPILLWAY FACE AND TRAINING WALL

#4. VIEW OF RIGHT TRAI[illegible] WALL SHOWING UNDERMINING AND COL[illegible]

#1. VIEW OF TOP OF DAM AND ACCESS BRIDGE OVER THE SPILLWAY

#2. VIEW OF EROSION AND SETTLEMENT AT LEFT ABUTMENT



DUFRESNE-HENRY ENGINEERING CORP.	U.S. ARMY ENGINEER DIV., NEW ENGLAND
ARCHITECT-ENGINEER	CORPS OF ENGINEERS WALTHAM, MASS.

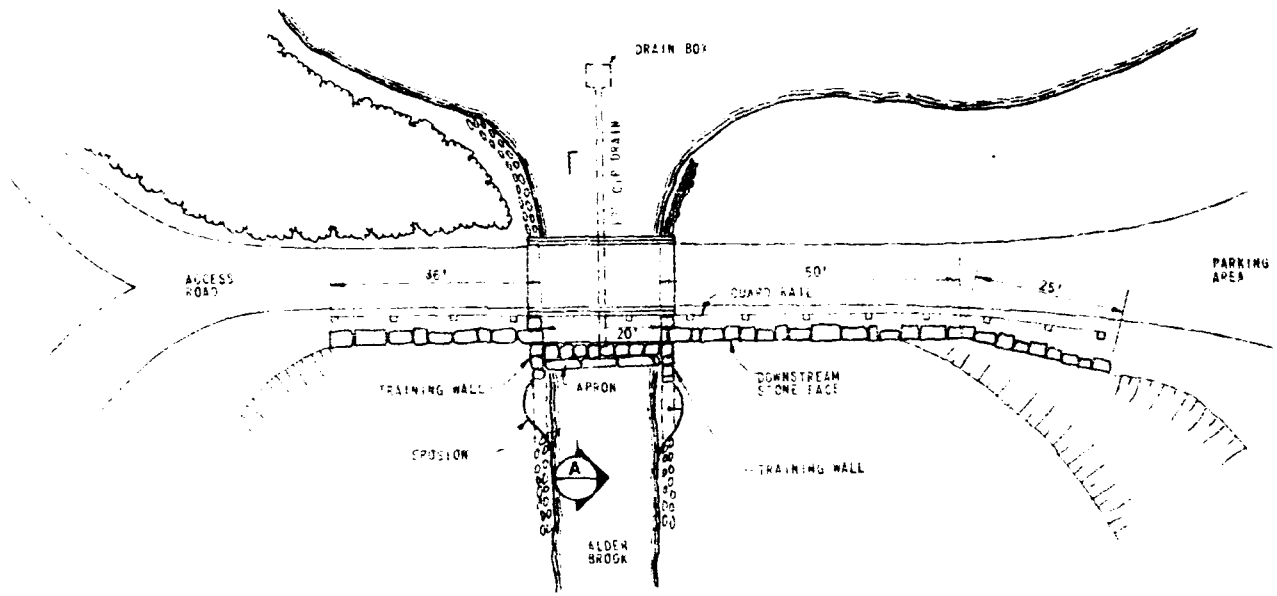
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

ICE POND DAM

PHOTO LOCATION PLAN

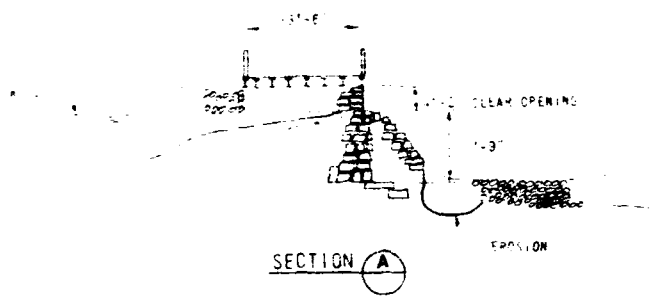
APPENDIX C

PHOTOGRAPHS



PLAN

SCALE: 1" = 20'

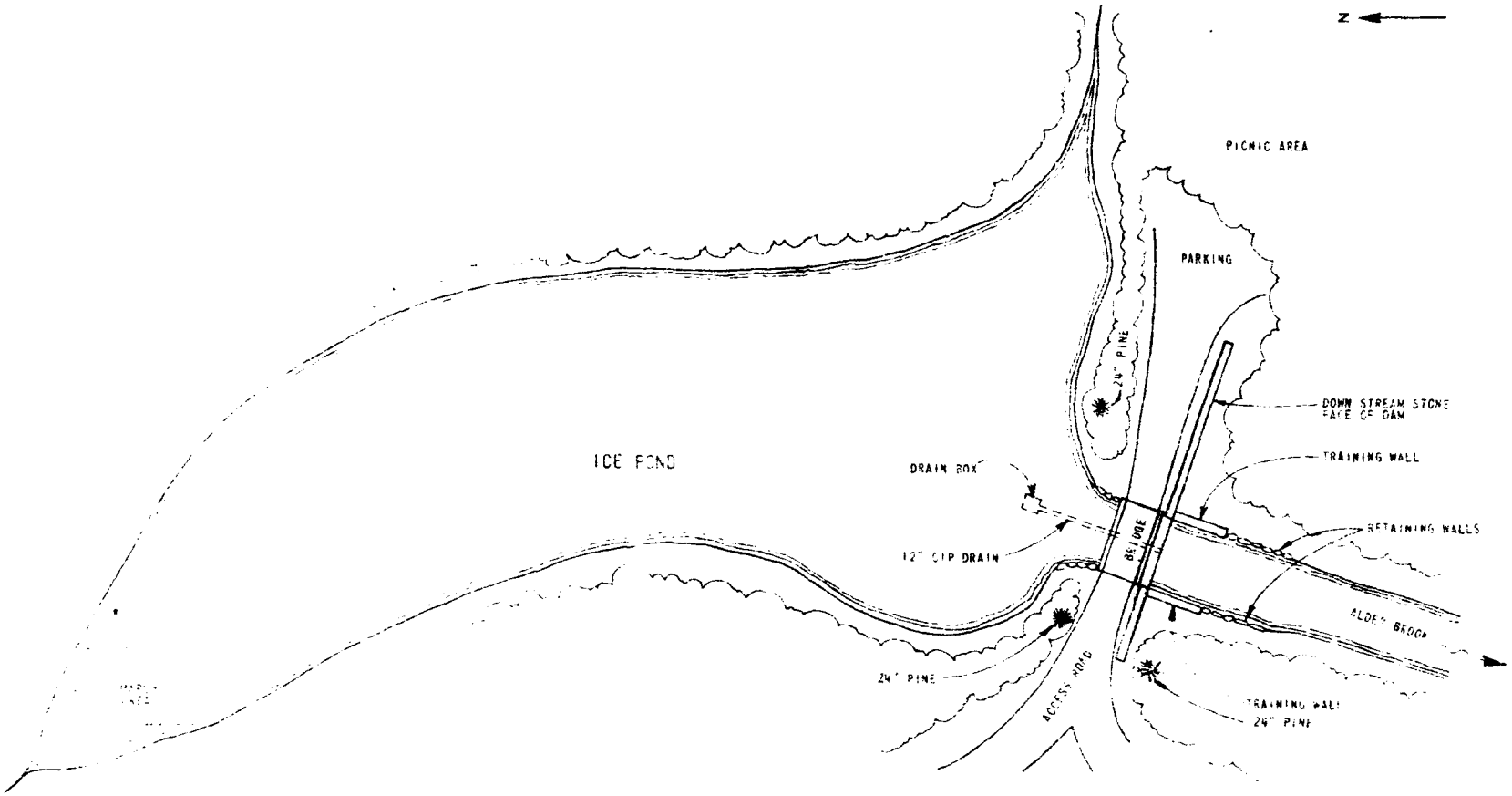


SECTION A

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

ICE POND DAM

DETAILS



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

ICE POND DAM
SITE PLAN

N. H. WATER RESOURCES BOARD
Concord, N. H. 03301

DAM SAFETY INSPECTION REPORT FORM

Town: Littleton Dam Number: 140.10

Inspected by: SCB Date: 6 Sept 1974

Local name of dam or water body: _____

Owner: _____ Address: _____

Owner was/was not interviewed during inspection.

Drainage Area: _____ sq. mi. Stream: _____

Pond Area: _____ Acre, Storage _____ Ac-Ft. Max. Head _____ Ft.

Foundation: Type _____, Seepage present at toe - Yes/No, _____

Spillway: Type _____, Freeboard over perm. crest: _____,

Width _____, Flashboard height _____,

Max. Capacity _____ c.f.s.

Embankment: Type Earth & Stone, Cover Road Width 20' T,

Upstream slope 2 to 1; Downstream slope 0 to 1

Abutments: Type Stone, Condition: Good, Fair, Poor

Gates or Pond Drain: Size _____ Capacity _____ Type _____

Lifting apparatus _____ Operational condition _____

Changes since construction or last inspection: _____

_____

_____

Downstream development: _____

This dam would/would not be a menace if it failed.

Suggested reinspection date: _____

Remarks: Leaks at Spillway Wing walls

_____

_____

_____

WATER CONTROL COMMISSION

DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. 140.10

Town Littleton ✓ : County Grafton

Stream Ice Pond

Basin-Primary Conn R. : Secondary Ammonoosuc R.

Local Name "Dells"

Coordinates—Lat. 44° 20 - 78.0 : Long. 71° 50' - 93.0 DEF

GENERAL DATA

Drainage area: Controlled ..... Sq. Mi.: Uncontrolled ..... Sq. Mi.: Total 3± Sq. Mi.

Overall length of dam 125 ✓ ft.: Date of Construction .....

Height: Stream bed to highest elev. 22 ✓ ft.: Max. Structure 15' 10" ✓ ft.

Cost—Dam .....: Reservoir .....

DESCRIPTION Gravity— Split Stone— Earth Foundation ✓

Waste Gates

Type .....

Number .....: Size ..... ft. high x ..... ft. wide

Elevation Invert .....: Total Area ..... sq. ft.

Hoist .....

Waste Gates Conduit

Number .....: Materials .....

Size ..... ft.: Length ..... ft.: Area ..... sq. ft.

Embankment

Type .....

Height—Max. ..... ft.: Min. ..... ft.

Top—Width .....: Elev. ..... ft.

Slopes—Upstream ..... on .....: Downstream ..... on .....

Length—Right of Spillway .....: Left of Spillway .....

Spillway

Materials of Construction .....

Length—Total ..... ft.: Net 12' 3" ✓ ft.

Height of permanent section—Max. 15'10 ft.: Min. ..... ft.

Flashboards—Type None : Height ..... ft.

Elevation—Permanent Crest .....: Top of Flashboard .....

Flood Capacity 610 cfs.: ..... cfs/sq. mi.

Abutments

Materials: .....

Freeboard: Max. 6' 2" ft.: Min. ..... ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Town of Littleton

REMARKS Use— Domestic

Not used

Tabulation By A A N & R L T Date January 25, 1939

B. 21284

PUBLIC SERVICE COMMISSION OF NEW HAMPSHIRE—DAM RECORD I-5322

TOWN	LITTLETON	TOWN NO. 10	STATE NO. 140.1
RIVER STREAM	Ice Pond at ("D-11s")		
DRAINAGE AREA	3+	POND AREA	
DAM TYPE	Gravity	FOUNDATION NATURE OF	Earth
MATERIALS OF CONSTRUCTION	Split Stone, Earth		
PURPOSE OF DAM	POWER—CONSERVATION—DOMESTIC—RECREATION—TRANSPORTATION—PUBLIC UTILITY		
HEIGHTS, TOP OF DAM TO BED OF STREAM	Approx. 22'	TOP OF DAM TO SPILLWAY CRESTS	6'-2"
SPILLWAYS, LENGTHS DEPTHS BELOW TOP OF DAM	12'-3" 6'-2"	LENGTH OF DAM	Approx.
FLASHBOARDS TYPE, HEIGHT ABOVE CREST	None		
OPERATING HEAD CREST TO N. T. W.		TOP OF FLASHBOARDS TO N. T. W.	
WHEELS, NUMBER KINDS & H. P.			
GENERATORS, NUMBER KINDS & K. W.			
H. P. 90 P. C. TIME 100 P. C. EFF.		H. P. 75 P. C. TIME 100 P. C. EFF.	
REFERENCES, CASES, PLANS, INSPECTIONS			

REMARKS

OWNER: Town of Littleton

CONDITION: Good

MENACE: Yes. Will be subject to periodic inspection.

To the Public Service Commission:

The foregoing memorandum on the above dam is submitted covering inspection made July 27, 1936, according to notification to owner dated July 20, 1936, and bill for same is enclosed.

D. Waldo White
Chief Engineer

Aug. 7, 1936
Copy to Owner

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN *Connecticut* NO. *10* — — I-5322

RIVER *Ice Pond* MILES FROM MOUTH D.A.SQ.MI.

TOWN *Littleton* OWNER *Town of Littleton*

LOCAL NAME OF DAM *Dell's*

BUILT DESCRIPTION *Gravity — Split Stone & Earth ...*

POND AREA-ACRES DRAWDOWN FT. POND CAPACITY-ACRE FT.

HEIGHT-TOP TO BED OF STREAM-FT. *22 ±* MAX. MIN.

OVERALL LENGTH OF DAM-FT. *125 ±* MAX.FLOOD HEIGHT ABOVE CREST-FT.

PERMANENT CREST ELEV.U.S.G.S. LOCAL GAGE

TAILWATER ELEV.U.S.G.S. LOCAL GAGE

SPILLWAY LENGTHS-FT. *12.25* FREEBOARD-FT. *6.167*

FLASHBOARDS-TYPE, HEIGHT ABOVE CREST *None*

WASTE GATES-NO. WIDTH MAX. OPENING DEPTH SILL BELOW CREST

REMARKS *Condition Good*

4D Into Nameless Bk., Ammonoosuc R.

POWER DEVELOPMENT

UNITS	NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

USE *Domestic*

REMARKS *Village Ice Pond*

DATE *[illegible]*

APPENDIX B

PROJECT RECORDS AND PLANS

1. Listing of Design, Construction and Maintenance Records:

   None.

2. Copies of Past Inspection Reports

   a. Public Service Commission - July 27, 1936.
   b. Water Resources Board - September 6, 1974.

3. Plans:

   a. Site Plan.
   b. Details-Sections.

DUFRESNE-HENRY ENGINEERING CORPORATION

W.A. LEONARD
DATE 3-7-79
SUBJECT ICE POND DRAINAGE AREA & AVERAGE SLOPES
SHEET NO. 1 OF
JOB NO. 04-085

TOTAL DRAINAGE AREA

PLANIMETER 27.36 IN^2

SCALE 1:24000

27.36 (.14348) = 3.926 SQ MI

SUB-AREA 1

PLANIMETER 17.18 IN^2

17.18 (.14348) = 2.465 SQ MI

SUB AREA 2

3.926 - 2.465 = 1.461 SQ MI

AVERAGE SLOPES

SUB-AREA 1

ELEV @ 10% 798
ELEV @ 85% 1118

$\frac{1118 - 798}{(4.76 \times .38\ MI/IN)} = 176.9\ FT/MILE$

SUB-AREA 2

ELEV @ 10% 795
ELEV @ 85% 1020

$\frac{1020 - 795}{2.74 (.38\ MI/IN)}$ 216.1 FT/MILE

SUB-AREA 1

$$T_p = 2.2\left(\frac{L-L_a}{\sqrt{S}}\right)^{.37}$$

$$T_p = 2.2\left[\frac{\left(\frac{6.35(24,000)}{12(5,280)}\right)(.6)\left(\frac{6.35(24,000)}{12(5,280)}\right)}{\sqrt{176.9}}\right]^{.37} = 1.34$$

SUB-AREA 2

$$T_p = 2.2\left[\frac{\left(\frac{3.65(24,000)}{12(5,280)}\right)(.6)\left(\frac{3.65(24,000)}{12(5,280)}\right)}{\sqrt{216.1}}\right]^{.37} = .86$$

SOIL CLASSIFICATION

PREDOMINANT SOILS ARE CLASS C

LAND USE - MAJORITY IS WOODED - APPROXIMATELY 10% EITHER RESIDENTIAL OR CLEARED

SLOPES - GENTLE

RUNOFF CURVE NUMBER FROM S.C.S IS 73

USING A WET CONDITION INITIAL RAINFALL LOSSES = .30 IN

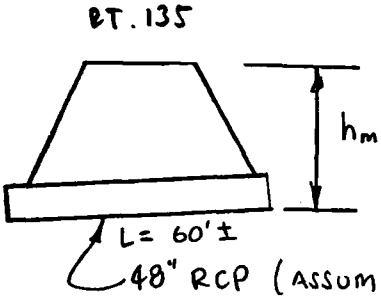
UNIFORM RAINFALL LOSSES FOR CLASS C SOIL = .12 IN/HR

DUFRESNE-HENRY ENGINEERING CORPORATION

SUBJECT ICE POND
DETENTION SITE @ PT 135

DATE

SHEET NO. ____ OF ____
JOB NO. 04-0095



$Q = C_d A \sqrt{2gh}$

$A = 12.56$
$C_d = 1.61$

h (FT)	Q (CFS)	STOR AREA (AC)	AV DEPTH (FT)	STORAGE (AC-FT)
4	260	.5	1.0	.5
5	290	1.0	1.5	1.5
6	325	1.3	1.8	2.3
7	363	1.6	2.1	3.4
8	397	2.0	2.4	4.8
9	429	2.3	2.7	6.2
10	459	2.6	3.0	7.8
11	487	3.0	3.3	9.9
12	513	3.3	3.6	11.9
13	538	3.6	3.9	14.0
14	562	4.0	4.2	16.8
15	585	4.3	4.5	19.3
16	607	4.6	4.8	22.1
17	628	5	5.1	25.5
18	649	5.3	5.4	28.6

TEST FLOOD DEVELOPMENT

DRAINAGE AREA = 3.9 SQ. Mi = 2496 ACRES

MAIN CHANNEL SLOPE = 172 FEET/MILE

STORM INTENSITY = 6 INCHES/24 HR.

SEE COMPUTER PRINTOUT FOR FLOOD FLOW CALCULATIONS FOR 1.2, 2.33, 5, 10, 25, 50, 100, 200 AND 300 YEAR STORMS

100 YEAR STORM FLOW IS CALCULATED USING SIX VARIABLES

MAX. 100 YEAR FLOW IS APPROX. 1,444 CFS

STORAGE ROUTING

STORAGE AREA = 5± ACRES

DRAINAGE AREA = 2496

$5/2496$ = .2 PERCENT STORAGE/DRAINAGE AREA

IN ACCORDANCE WITH USDA SOIL CONSERVATION SERVICE GUIDELINES Q OUTFLOW WILL BE .98 Q INFLOW FOR .2 PERCENT STORAGE AREA

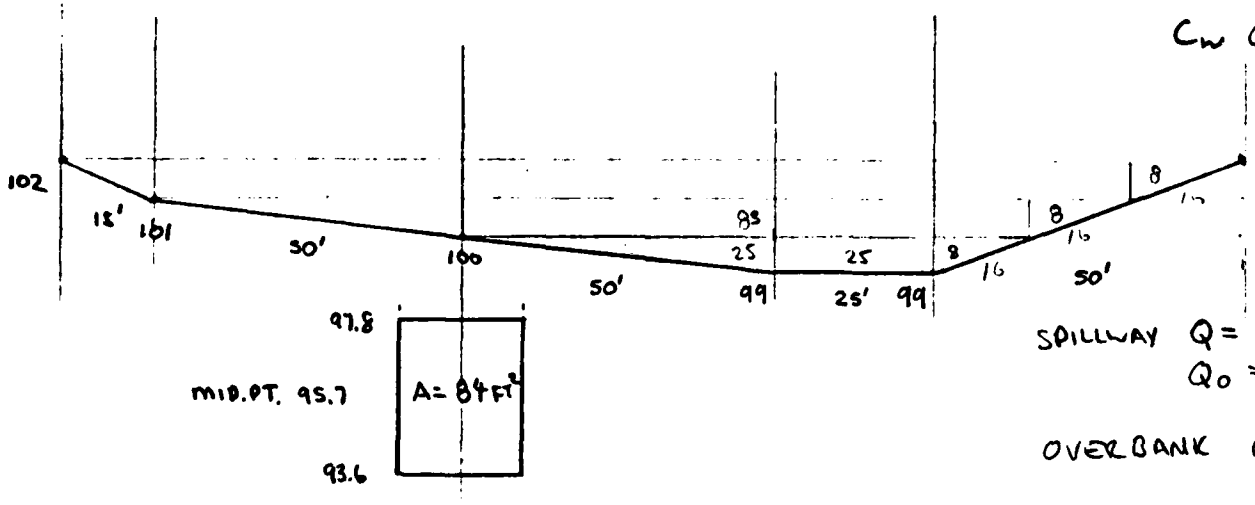
∴ Q OUT = .98(1444 = 1414 SAY 1,400 CFS

STORAGE – ASSUME 6 AC.FT. PER FOOT OF WATER INCREASE

C_W SPILLWAY = 2.63

C_O SPILLWAY = .60

C_W OVERBANK = 2.50



SPILLWAY $Q = CLH^{3/2}$

$Q_O = CA\sqrt{2gh}$

OVERBANK $Q = CAH^{1/2}$

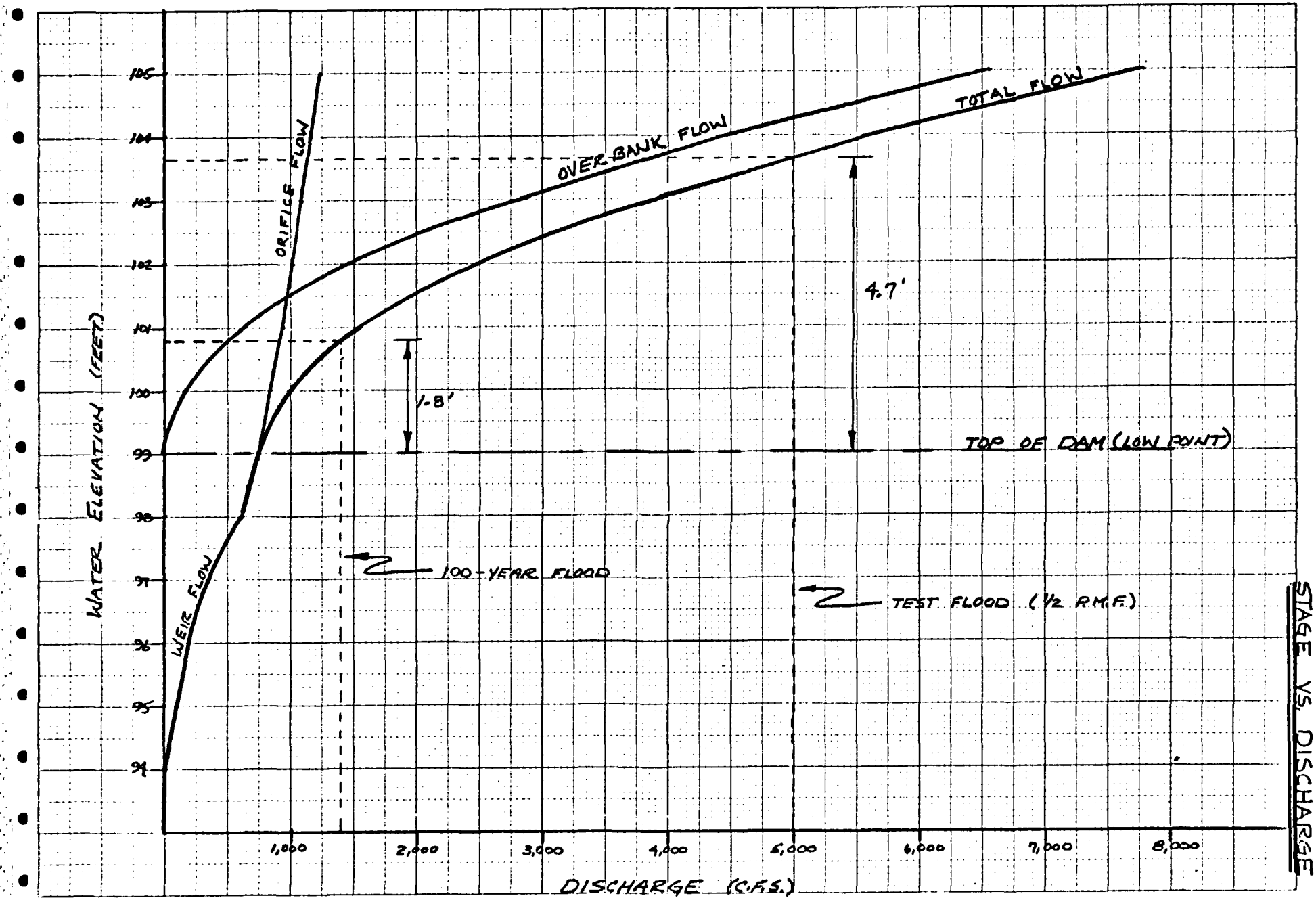
ELEV	SPILLWAY			OVER BANK WEIR			TOTAL Q	STORAGE
		h	Q (CFS)	h	A (FT²)	Q (CFS)	(CFS)	(AC-FT)
94	WEIR	.4 (w)	13				13	50
95	WEIR	1.4 (w)	87				87	56
96	WEIR	2.4 (w)	196				196	62
97	WEIR	3.4 (w)	330				330	68
98	ORIFACE	2.3 (o)	613				613	74
99	ORIFACE	3.3 (o)	735				735	80
100	ORIFACE	4.3 (o)	839	1	58	145	984	86
101	ORIFACE	5.3 (o)	931	2	174	615	1546	92
102	ORIFACE	6.3 (o)	1015	3	339	1468	2483	98
103	ORIFACE	7.3 (o)	1093	4	563	2815	3908	104
104	ORIFACE	8.3 (o)	1165	5	801	4478	5643	110
105	ORIFACE	9.3 (o)	1233	6	1070	6552	7785	116

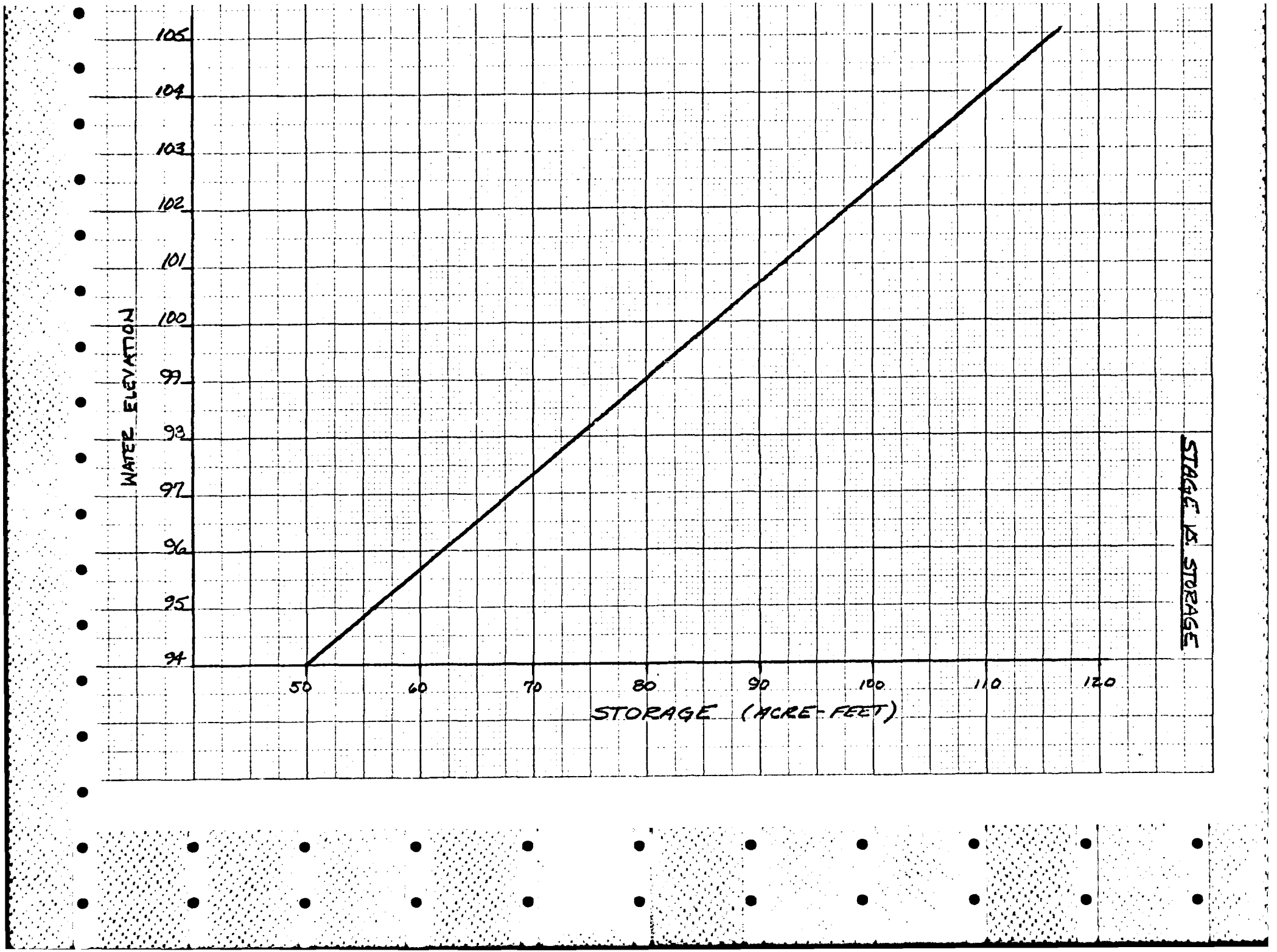
DUFRESNE-HENRY ENGINEERING CORPORATION

SUBJECT _____

SHEET NO. ____ OF ____

JOB NO. _____


STAGE VS. DISCHARGE
WATER ELEVATION (FEET)
105
104
103
102
101
100
99
98
97
96
95
94
ORIFICE FLOW
OVER-BANK FLOW
TOTAL FLOW
WEIR FLOW
1.8'
4.7'
TOP OF DAM (LOW POINT)
100-YEAR FLOOD
TEST FLOOD (½ P.M.F.)
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
DISCHARGE (C.F.S.)


STAGE VS. STORAGE
WATER ELEVATION
105
104
103
102
101
100
99
98
97
96
95
94
50
60
70
80
90
100
110
120
STORAGE (ACRE-FEET)

DUFRESNE-HENRY ENGINEERING CORPORATION

W.A.L. SUBJECT Ice Pond Dam SHEET NO. ___ OF ___
6-1-79 Dam Failure Analysis JOB NO. 04-0085

ASSUME TOP OF DAM IS THE LOW POINT IN THE EMBANKMENT
ELEV = 99.00

STREAMBED ELEV = 79.00 ∴ HEIGHT = 20'

WIDTH = 125'

FLOW AT FAILURE = $Q = 8/27\ W_b \sqrt{g}\ y_o^{3/2}$

$Q = 8/27\ (.4)(125)\sqrt{32.2}\ (20)^{3/2}$ = 7520 CFS

INITIAL FLOOD WAVE = 2/3 (20) = 13.33 FEET

FLOOD WAVE ROUTING:

VOLUME BETWEEN DAM AND DELLS ROAD CULVERT

$(13.33 \times 50 + 200 \times 7) \times 500$ = 12 Acre-feet
(at Dam; near Dells Road)

PEAK REDUCTION $\frac{12}{80}$ = 15%

550 CFS THROUGH FULL BOX CULVERT ASSUMING
55 SQ. FT. @ 10 FPS

FLOW REMAINING:

$(.85)(7520) - 550 = 5842$ CFS

DEPTH AT THIS POINT - SPILLS OVER 200' WIDE FLOOD PLAIN AND 50-100' OF ROAD $H = \left[\frac{5842}{(2m)(3.08)}\right]^{2/3}$ = 4.4' OVER FLOOD PLAIN.

FLOW WILL BACKUP AT I-93 CULVERTS AND TEND TO FLOW TOWARD ROUTE 302. HYDRAULIC CONTROL FOR MAJORITY OF FLOOD WAVE WILL BE AT ROUTE 302 & I-93 INTERCHANGE. FLOOD WAVE MAY SPREAD TO 500 → 1,000 FEET WIDE.

FOR $Q \geq 6{,}000$ CFS

$$H = \left[\frac{6{,}000}{(3.08)(750)}\right]^{2/3} = 1.89'$$

SAY WATER WILL BE 2' OVER AREA ROADS.

THIS PONDS 53 Acre-Feet IF AVERAGE DEPTH IS 4 FEET OVER GROUND WITH 200 TO 750 FOOT LIMITS OF INUNDATION ON 1,100' REACH LENGTH (53 Ac-Ft.)

$Q = 5842\left(1 - \frac{53}{80}\right) \approx 2000$ CFS $H = \left[\frac{2000}{(3.08)(750)}\right]^{2/3} = .91'$

******* REGIONAL FLOOD FREQUENCY METHOD BY M. BENSON ********
**** REFERENCE: U.S. GEOLOGICAL SURVEY W.S.P. 1580-B *******

ICE POND DAM
100 YEAR PEAK DISCHARGE

A = DRAINAGE AREA = 3.90 SQ. MI.
S = MAIN CHANNEL SLOPE = 172.00 FT./MI.
ST= STORAGE INDEX = 0.50
T = TEMPERATURE INDEX = 12
O = OROGRAPHIC FACTOR = 1.00
I = X-YEAR, 24-HOUR RAINFALL

RAINFALL DATA

RECURRENCE INTERVAL (YEARS)	24-HOUR RAINFALL (INCHES)
1.2	0.0
2.33	0.0
5	0.0
10	0.0
25	0.0
50	0.0
100	6.00
200	0.0
300	0.0

RECURRENCE INTERVAL (YRS)	NUMBER OF VARIABLES IN EQUATION	INDEPENDENT VARIABLES	PEAK DISCHARGE (CFS)
1.2	1	A	73
	2	A,S	96
	3	A,S,ST	125
	4	A,S,ST,O	106
	5	A,S,ST,O,T	124
	6	A,S,ST,O,T,I	-1
2.33	1	A	141
	2	A,S	189
	3	A,S,ST	242
	4	A,S,ST,O	201
	5	A,S,ST,O,T	233
	6	A,S,ST,O,T,I	-1
5	1	A	226
	2	A,S	309
	3	A,S,O	248
	4	A,S,O,ST	314
	5	A,S,O,ST,T	365
	6	A,S,O,ST,T,I	-1

10	1	A	329
	2	A,S	454
	3	A,S,O	351
	4	A,S,O,ST	440
	5	A,S,O,ST,T	511
	6	A,S,O,ST,T,I	-1
25	1	A	539
	2	A,S	756
	3	A,S,O	542
	4	A,S,O,ST	642
	5	A,S,O,ST,T	731
	6	A,S,O,ST,T,I	-1
50	1	A	859
	2	A,S	1178
	3	A,S,O	724
	4	A,S,O,ST	986
	5	A,S,O,ST,T	1048
	6	A,S,O,ST,T,I	-1
100	1	A	1015
	2	A,S	1444
	3	A,S,O	836
	4	A,S,O,T	890
	5	A,S,O,T,I	650
	6	A,S,O,T,I,ST	1150
200	1	A	1389
	2	A,S	2183
	3	A,S,O	806
	4	A,S,O,T	898
	5	A,S,O,T,I	-1
	6	A,S,O,T,I,ST	-1
300	1	A	1293
	2	A,S	2763
	3	A,S,O	1144
	4	A,S,O,T	2279
	5	A,S,O,T,I	-1
	6	A,S,O,T,I,ST	-1

ICE POND DAM
100 YEAR PEAK DISCHARGE

SUMMARY OF COMPUTED PEAK DISCHARGES

ECURRENCE ERVAL (YRS)	NUMBER OF VARIABLES USED IN EQUATION 1	2	3	4	5	6
1.2	73	96	125	106	124	-1
2.33	141	189	242	201	233	-1
5	226	309	248	314	365	-1
10	329	454	351	440	511	-1
25	539	756	542	642	731	-1
50	859	1178	724	986	1048	-1
100	1015	1444	836	890	650	1150
200	1389	2183	866	898	-1	-1
300	1293	2763	1144	2279	-1	-1

APPENDIX E

formation as Contained in the National Inventory of Dams

STATE	ID NUMBER	DIVISION	STATE	COUNTY	DIST.	STATE	COUNTY	DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
NH	149	NED	NH	9	2				ICE POND DAM	4418.7	7147.9	06APR79

POPULAR NAME	NAME OF IMPOUNDMENT
BELLS CONSERVATION-PICNIC AREA	ICE POND

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
1	1	ALDER BROOK	LITTLETON NH	0	5290

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPGPG	1935	R	20	20	80	50	ED	N	N	N	N	06APR79

REMARKS
22-GRPBOX

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	125	U	20	735												

OWNER	ENGINEERING BY	CONSTRUCTION BY
TOWN OF LITTLETON	WILL R RICHARDSON	

REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
WATER RES BD	NHWRB	NHWRB	NHWRB

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
DUFRESNE-HENRY ENG. CORP	14NOV78	PL92-367 AUGUST 8 1972

REMARKS
22-HOUSES LISTED

END

FILMED

8-85

DTIC