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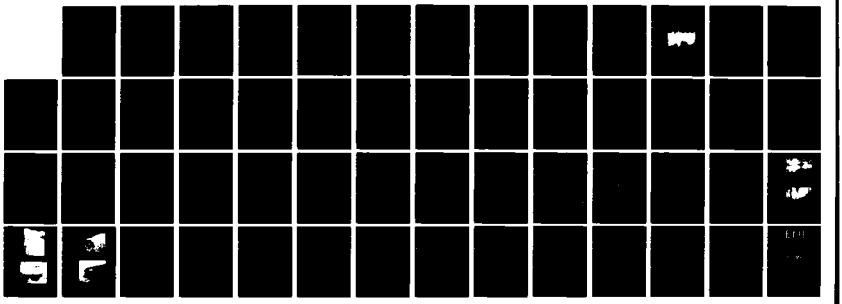

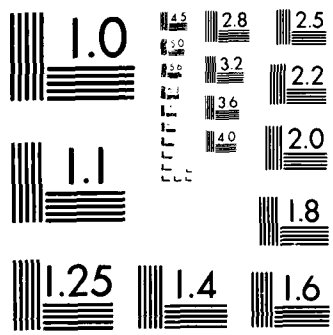

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

(1)

COASTAL BASIN
LYNN, MASSACHUSETTS

BIRCH POND DAM

MA 00237

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

AUGUST 1978

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MA 00237	2. GOVT ACCESSION NO. AD-A154 957	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Birch Pond Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE August 1978 13. NUMBER OF PAGES 59
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,
Coastal Basin
Lynn, Massachusetts
Birch Brook

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

The dam is "L" shaped, about 80 ft. long and 27 ft. high. The dam is in poor condition. The upstream face is overgrown and eroded, the embankment crest deteriorated and abused by improper usage. It falls within the small size category and in the high hazard category. Failure of the dam would cause a flood through a thickly settled area.

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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

Honorable Michael S. Dukakis
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

NOV 28 1975

Dear Governor Dukakis:

I am forwarding to you a copy of the Birch 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 Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, City of Lynn, Department of Public Works, Lynn, Massachusetts 01901, ATTN: Mr. Patrick McGrath, Superintendent of Water.

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

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

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

BIRCH POND DAM

MA 00237

COASTAL BASIN
LYNN, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.:	MA 00237
Name of Dam:	Birch Pond Dam
Town:	Lynn, Massachusetts
County and State:	Essex County, Massachusetts
Stream:	Birch Brook
Date of Inspection:	July 7, 1978

BRIEF ASSESSMENT

The Birch Pond Dam is an over 100 year old earthfill structure with a core of puddled clay. It is "L" shaped, about 850 feet long and 27 feet high at maximum section. It has an 8-foot wide by 4-foot deep ungated sidehill spillway in the left abutment. The reservoir is part of the City of Lynn water supply system. Birch Pond receives water from another reservoir and pipes water to a City pumping station.

The dam is in poor condition. The upstream face is overgrown and eroded, the embankment crest deteriorated and abused by improper usage. The spillway contains growth and debris. Apart from an occasional motorbike trail, the downstream slopes are not eroded.

Owing to its height and impoundment volume, the dam falls within the small size classification. It is in the high hazard category and thus hydraulically analyzed using the full probable maximum flood.

Reservoir storage will reduce the maximum probable discharge of 613 cfs to a test flood of 420 cfs. The spillway can carry, before overtopping, about 190 cfs (45 percent of a test flood). In the event of a test flood, the embankment section would be overtopped by less than 3 inches, if at all. The threat of damage from overtopping at this dam is considered minimal.

A failure of the dam could result in a Peak Failure Outflow in the order of 42,500 cfs. Such a failure flood would flow through a thickly settled residential area and would undoubtedly cause much destruction and endanger human life.

Additional investigations or major modifications are not necessary. Remedial measures that should be implemented by the owner within one year after receipt of this Phase I Inspection Report are described in Section 7. The dam is in serious need of extensive maintenance. The upstream face should be restored, the crest brought to true grade and surfaced, erosion on the downstream face eliminated, and the spillway cleaned and improved.

The owner should also institute a regular inspection and maintenance program and develop a flood warning system.

Gustav A. Diezemann, P. E.
New York State Lic. 027062

This Phase I Inspection Report on the Birch 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.

Charles G. Tiersch

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

Fred J. Ravens Jr

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

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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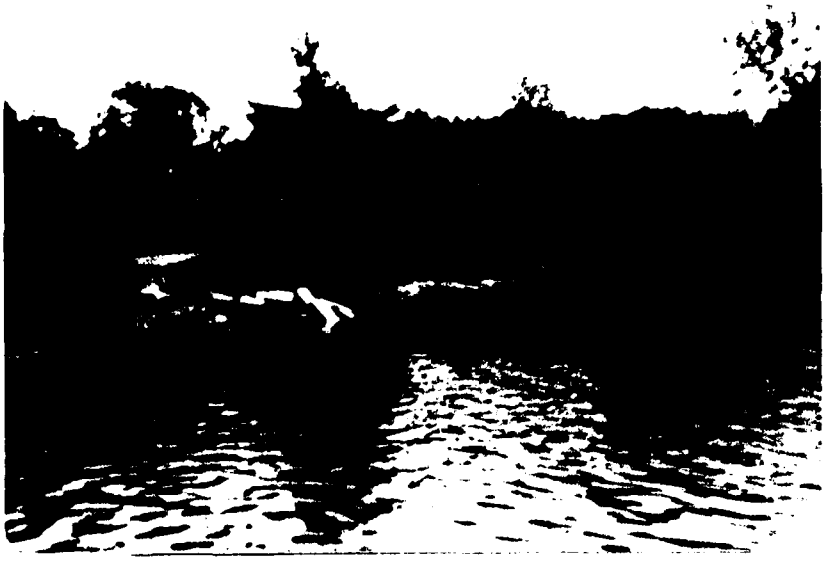
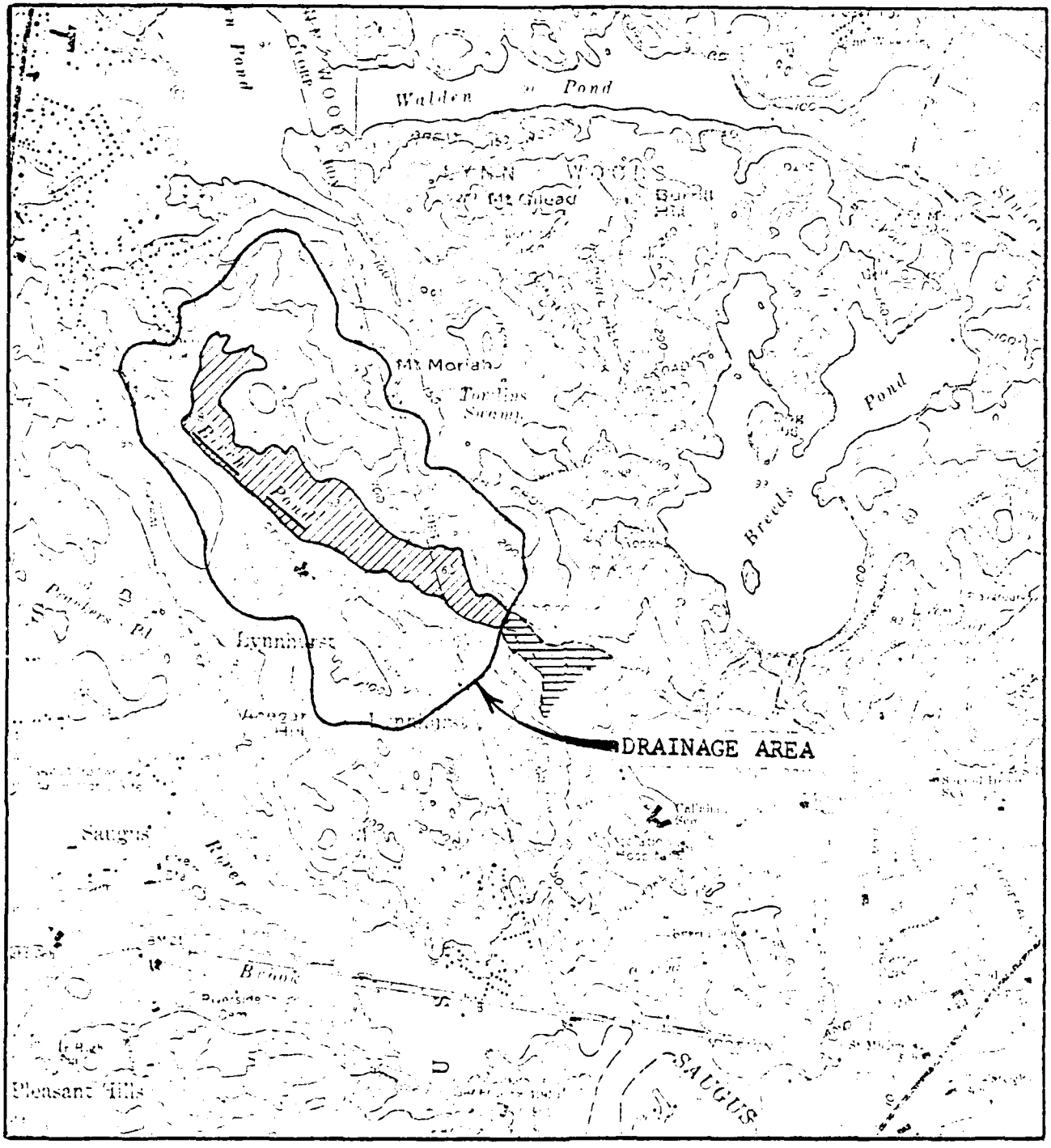


OVERVIEW PHOTO



BIRCH POND

BOSTON NORTH and LYNN, MASS.
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PHASE I INSPECTION REPORT

BIRCH POND DAM

SECTION I

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. Chas. T. Main, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Chas. T. Main, Inc. under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-D328 has been assigned by the Corps of Engineers for this work.

b. Purpose.

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

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

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

1.2 Description of Project

a. Location. The Birch Pond Dam is in the City of Lynn, Essex County, Massachusetts.

b. Description of Dam and Appurtenances. The 105 year old dam, which was raised 94 years ago (1884), is an earthfill embankment with a puddled clay core, a 27-foot maximum height, and 850 feet long. The spillway structure narrows to a channel about 8 feet wide and 4 feet deep before discharging into a steep, rock-lined channel. The outlet

INSPECTION CHECK LIST

PROJECT Birch Pond DATE July 6, 1978

PROJECT FEATURE _____ NAME _____

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	72± El [redacted]
Current Pool Elevation	El. 62 ±
Surface Cracks	none
Pavement Condition	none
Movement of Settlement of Crest	none
Lateral Movement	none
Vertical Alignment	O.K.
Horizontal Alignment	O.K.
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	[redacted] crest blocks moved on U/S face
Trespassing on Slopes	
Sloughing or Erosion of Slopes or Abutments	Trees growing on U/S slope
Rock Slope Protection - Riprap Failures	Rip rap sloughed off
Unusual Movement or Cracking at or near Toes	-
Unusual Embankment or Downstream Seepage	none
Piping or Boils	none
Foundation Drainage Features	-
Toe Drains	-
~~Instruments on System~~	

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Birch Pond

DATE JULY 6, 1978

TIME 1:30 P.M.

WEATHER WARM & SUNNY

W.S. ELEV. 62± U.S. ____ DN.S

PARTY:

1. J. GOODRICH
2. D. FISCHER
3. ____
4. ____
5. ____

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

1

APPENDIX A

(5) The owner should then develop and implement procedures which would include annual inspection of the dam and the initiation of repairs, including the repair of all spalled concrete and the repair and painting of the service bridge as required.

(6) Around the clock surveillance should be provided by the owner during periods of unusually heavy precipitation.

(7) The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The condition of Birch Pond Dam must be considered poor.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and engineering judgment.

c. Urgency. The required repair and maintenance work should be accomplished within one year of the receipt of this report by the owner.

d. Need for Additional Investigation. There is no need for additional investigation.

7.2 Recommendations

Additional engineering investigations or major modifications to the dam are not required.

7.3 Remedial Measures

a. Alternatives. Not applicable.

b. Operating and Maintenance Procedures.

(1) Growth should be removed from the upstream face of this dam and the slope maintained against further erosion by the application of a heavy rock facing.

(2) The crest should be brought to true and level grade and surfaced.

(3) The spillway channel should be cleaned up and hydraulically improved as much as practicable.

(4) Motorbike trails on the downstream face should be filled and seeded and motorbiking on the dam should be stopped.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. Nothing was noted which would indicate that the dam is unstable.

b. Design and Construction Data. No design or construction data are available.

c. Operating Records. Not applicable.

d. Post Construction Changes. No data concerning any post construction changes are available.

e. Seismic Stability. This dam is located in Seismic Zone 3. Because of its configuration and condition and the low head of water retained, a seismic analysis is not considered warranted.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data. The hydraulic/hydrologic analysis was made in accordance with "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations", "Estimating Effect of Surcharge Storage on Maximum Probable Discharges", and "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" as furnished by the New England Division, Corps of Engineers and "Recommended Guidelines for Safety Inspection of Dams" as issued by the Department of the Army, Office of the Chief of Engineers.

U.S.G.S. Quadrangle maps were used to determine reservoir and drainage areas. Where practicable, spillway dimensions were obtained by direct measurement. Hydraulic coefficients were assigned on the basis of experience and engineering judgment.

b. Experience Data. No specific experience data with respect to the hydraulic/hydrological characteristics of the project are known to exist.

c. Visual Observations. Spillway channel is very rough. It could be cleaned up and improved. Beyond the dam, the rock-lined spillway channel is steep. Discharge would not threaten the dam.

d. Overtopping Potential. A Probable Maximum Flood (PMF) of 613 cfs was determined. Owing to its small size and high hazard classification, the PMF was used to determine the Peak Outflow (or test flood) of 420 cfs. The spillway can discharge 190 cfs before the embankment section is overtopped. The test flood would cause the spillway to be overtopped by about 3 inches. This height would actually not be achieved as spill during the flood period was not considered in the calculations. Despite its poor condition, the dam can be considered relatively safe from failure due to overtopping.

The Peak Failure Outflow, considering a 180-foot breach of the dam, is of an altogether different magnitude - about 42,500 cfs. This flood would discharge through a thickly settled residential area, resulting in flows as much as 5 feet in depth in the earlier reaches, much property destruction and, potentially, the loss of human life before it flowed into the Saugus River about a mile away.

The areas of impact immediately downstream of the dam are shown on the location map.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

Birch Pond receives water by means of gravity flow from Walden Pond. Water level is maintained by gravity feed to the Walnut Street pumping station.

4.2 Maintenance of Dam

There appear to be no definite maintenance procedures of the dam in effect.

4.3 Maintenance of Operating Facilities

The gates controlling the outflows are maintained on a yearly basis, according to the owner.

4.4 Warning System

There is no warning system.

4.5 Evaluation

Apart from the daily operation to meet the water supply demands, the operational procedures are minimal. Maintenance of the dam and spillway could be improved. Recommendations for improving this situation are given in Section 7.3.

3.2 Evaluation

The visual inspection indicates that the Birch Pond Dam and appurtenances with the exception of the gate house structure, have been neglected with respect to maintenance. The dam and spillway are badly deteriorated and must be considered in poor condition. The reservoir itself is not a factor in evaluating the dam. The watercourse below the dam is inhabited to the extent that property and life would be in jeopardy if the dam failed.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The Phase I visual inspection of the Birch Pond Dam was conducted on July 7, 1978. The dam is located at the end of a bowl, the left bank of which is hilly and wooded, and the right bank primarily a residential area. The dam is adjacent to a major artery and is unprotected and obviously misused by the public. The project is in obviously poor condition and state of maintenance.

b. Dam. The dam appears to be in poor condition. There are many areas on the upstream face where the riprap is sloughed off. In addition, the upstream slope is overgrown with vegetation. The downstream slope is eroded by an occasional motorbike trail. The embankment crest is deteriorated due to improper usage by motorbikes. Other than that caused by general deterioration, there appear to be no serious horizontal or vertical misalignments. There is no evidence of seepage through the embankment.

c. Appurtenant Structures. The spillway is somewhat deteriorated and overgrown and is hydraulically inefficient. The spillway channel immediately downstream of the dam is stone lined. Owing to releases through the gate house, the spillway has probably not seen much use over the years. It contains growth and debris.

The brick gate house appears to be in fair conditon and, as releases are made to the Walnut Street pumping station, the gates and conduits are in operable condition.

d. Reservoir Area. The banks surrounding the reservoir area present little or no possibility of landslides into the reservoir or are there conditions which might result in a sudden increase of sediment load into the reservoir. There are no houses immediately adjacent to the reservoir.

e. Downstream Channel. Below the dam and the stone-lined spillway channel there is no defined watercourse. Flows resulting from a failure of the dam would pass over Walnut Street and through thickly settled residential areas before reaching the Saugus River.

SECTION 2

ENGINEERING DATA

2.1 Design

There are no known existing design data.

2.2 Construction

The Birch Pond dam was built in 1873 and raised in 1884. There are no detailed construction records available.

2.3 Operation

Some flow data are kept but are not relevant to this investigation.

2.4 Evaluation

a. Availability. There are no engineering data available.

b. Adequacy. The lack of in-depth engineering data does not allow for a definitive review. Therefore, the adequacy of this dam, structurally and hydraulically, cannot be assessed 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. N/A

g. Dam

(1)	Type	Earthfill
(2)	Length	850 ± feet
(3)	Height	27 ± feet
(4)	Top Width	17 ± feet
(5)	Side slope	Unknown
(6)	Zoning	Unknown
(7)	Impervious core	Puddled clay
(8)	Cutoff	Unknown
(9)	Grout curtain	Unknown
(10)	Other	N/A

h. Spillway

(1)	Type	Sidehill Channel
(2)	Length of weir	N/A
(3)	Crest elevation	El. 63 ±
(4)	Gates	None
(5)	U/S Channel	Stone
(6)	D/S Channel	Stone-lined
(7)	General	N/A

i. Regulating Outlets. The regulating outlets consist of two gated conduits of 22 and 30-inch diameter, operated from a gate house.

c. Elevation (Feet Above MSL)

(1)	Top of dam	El. 67 ±
(2)	Maximum design surcharge	El. 67 ±
(3)	Full flood control pool	N/A
(4)	Recreation pool	N/A
(5)	Spillway crest (gated)	El. 63 (ungated)
(6)	Upstream portal invert diversion tunnel	N/A
(7)	Streambed at centerline of dam	El. 40 ±
(8)	Maximum tailwater	N/A

d. Reservoir (Feet)

(1)	Length of maximum pool	5,000
(2)	Length of recreation pool	N/A
(3)	Length of flood control pool	N/A

e. Storage (Acre-Feet)

(1)	Recreation pool	950 ±
(2)	Flood control pool	N/A
(3)	Design surcharge	1,300 ±
(4)	Top of dam	1,300 ±

f. Reservoir Surface (Acres)

(1)	Top of dam	96
(2)	Maximum pool	96
(3)	Flood control pool	N/A
(4)	Recreation pool	N/A
(5)	Spillway crest	82

works offshore of the dam provide gravity flow to the City's Walnut Street pumping station. Birch Pond receives gravity flow from Walden Pond.

c. Size Classification. Owing to its height of 27 feet and its impoundment of approximately 950 acre feet below the crest, the dam falls within the small category.

d. Hazard Classification. The area below the dam which would be endangered if the dam failed is urban in nature. The dam is considered to have a high hazard potential.

e. Ownership. The dam is owned by the City of Lynn, Massachusetts.

f. Operator. Mr. Patrick McGrath, Superintendent of Water, Department of Public Works, Lynn, Massachusetts, (617) 592-7900, Ext. 242.

g. Purpose of Dam. The reservoir impounded by the dam is part of the City of Lynn's water supply system.

h. Design and Construction History. Nothing is known of the design and construction history of this project except that the original dam was raised almost a hundred years ago.

i. Normal Operating Procedures. The water level is normally kept below the spillway level by means of releases to the City's Walnut Street pumping station. Inflows exceeding outflow and storage capabilities would discharge through the spillway.

1.3 Pertinent Data

a. Drainage Area. The Birch Pond Reservoir has a drainage area of approximately 0.7 square miles of partly residential and partly wooded areas.

b. Discharge at Damsite.

(1) The outlet structure houses gates controlling 22 and 36-inch lines to the Walnut Street pumping station.

(2) The maximum known flood at the damsite is unknown.

(3) The ungated spillway capacity at maximum pool is about 190 cfs, or approximately 45 percent of the test flood.

(4) There is no gated spillway capacity.

(5) There is no gated spillway capacity.

(6) The total spillway capacity at maximum pool is 190 cfs.

INSPECTION CHECK LIST

PROJECT BIRCH POND DATE JULY 6, 1978

PROJECT FEATURE _____ NAME _____

AREA EVALUATED	CONDITION
CONCRETE DAM	
Concrete Surfaces	
Structural Cracking	
Movement -- Horizontal & Vertical Alignment	
Junctions	NOT APPLICABLE
Drains -- Foundation, Joint, Face	
Water Passages	
Seepage or Leakage	
Monolith Joints -- Construction Joints	
Foundation	

INSPECTION CHECK LIST

PROJECT BIRCH POND DATE JULY 6, 1978

PROJECT FEATURE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	NOT APPLICABLE
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

INSPECTION CHECK LIST

PROJECT BIRCH POND DATE JULY 6, 1978

PROJECT FEATURE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	NOT APPLICABLE
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

INSPECTION CHECK LIST

PROJECT BIRCH POND DATE July 6, 1978

PROJECT FEATURE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	Some spalling
Rust or Staining	
Spalling	Some
Any Visible Reinforcing	-No
Any Seepage or Efflorescence	No
Drain Holes	—
c. Discharge Channel	
General Condition	} debris & vegetation in channel
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Channel	
Other Obstructions	

INSPECTION CHECK LIST

PROJECT BIRCH POND DATE JULY 6, 1978

PROJECT FEATURE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	NOT APPLICABLE
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	

INSPECTION CHECK LIST

PROJECT Birch Pond DATE July 6, 1978

PROJECT FEATURE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL (Gate House)	
General Condition of Concrete	Poor
Rust or Staining	SOME
Spalling	SOME
Erosion or Cavitation	—
Visible Reinforcing	NONE
Any Seepage or Efflorescence	NONE
Condition at Joints	O.K.
Drain holes	NONE
Channel	N/A
Loose Rock or Trees Overhanging Channel	N/A
Condition of Discharge Channel	

INSPECTION CHECK LIST

PROJECT Birch Pond DATE July 6, 1978

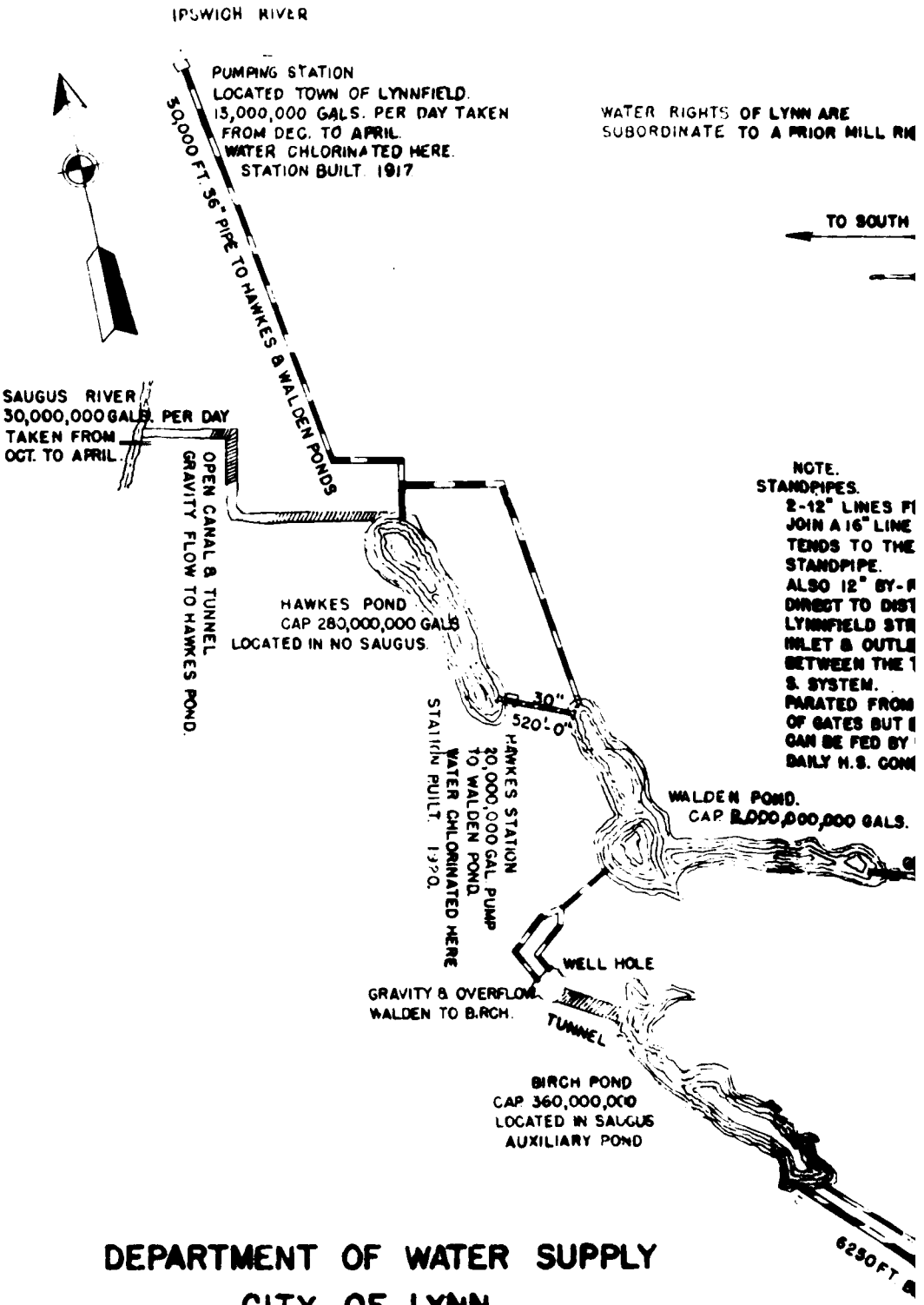
PROJECT FEATURE _____ NAME _____

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

APPENDIX B

Only a few drawings were available.

Excerpts from these drawings follow.

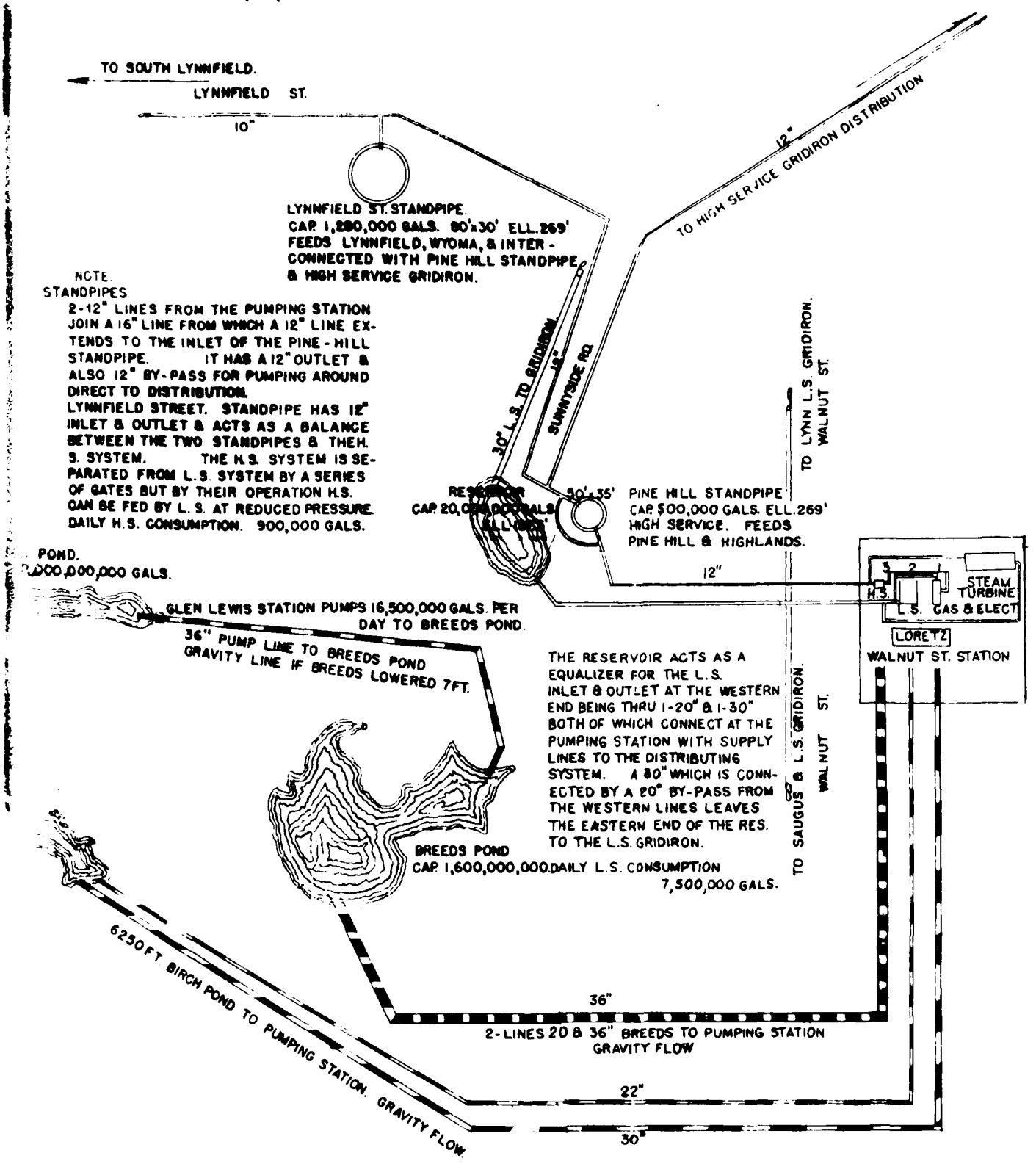


DEPARTMENT OF WATER SUPPLY
CITY OF LYNN

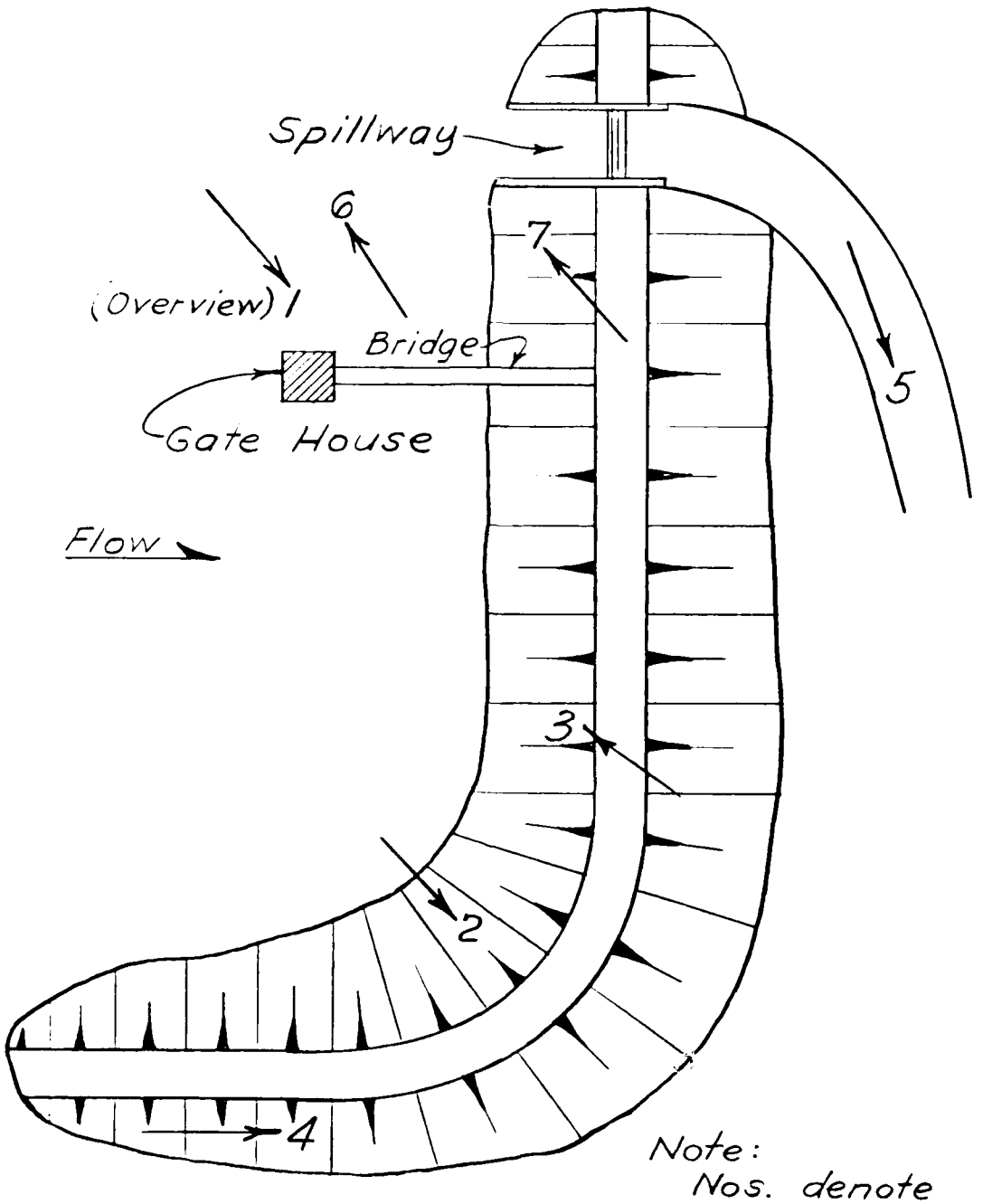
THOMAS W. HEATH, COMMISSIONER.

OPERATION OF SUPPLY SYSTEM
1940

OF LYNN ARE
TO A PRIOR MILL RIGHT TO 10,000,000 GALS. PER DAY.



APPENDIX C

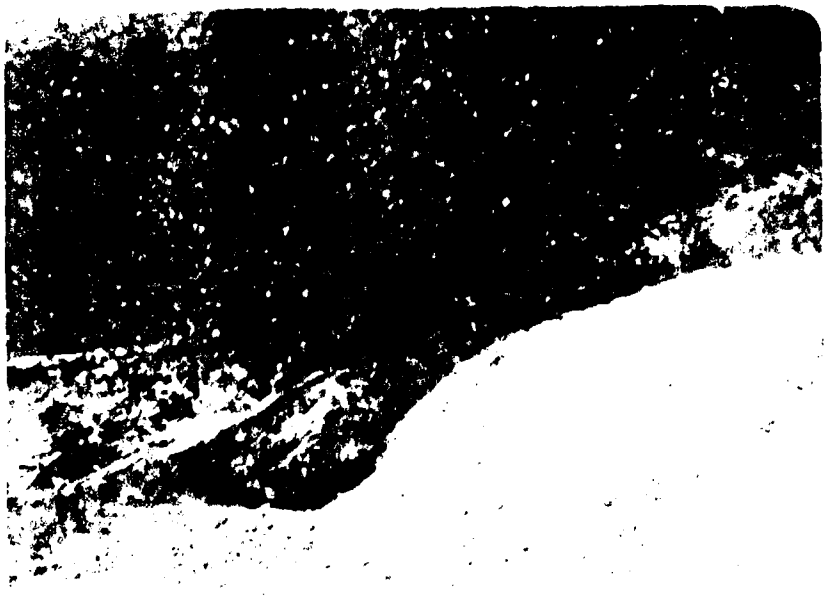


PLAN

BIRCH POND

2

Upstream Face of Dam



3

Collapse of Upstream Block

4

Downstream Embankment

5

Downstream Spillway Channel

6

View of Reservoir and Shoreline from Dam

7

Hole at Junction of Granite Block and Crest

APPENDIX D

Client C OF ENG Job No. 1345-065 Sheet 1 of 8

Subject - BIRCH POND - By WEITZEL Date 10 AUG 1976

Ckd. Rev.

DM, F = 613 cfs
Res A = 82 AC
Dr. A = .686 mi² = 439 AC

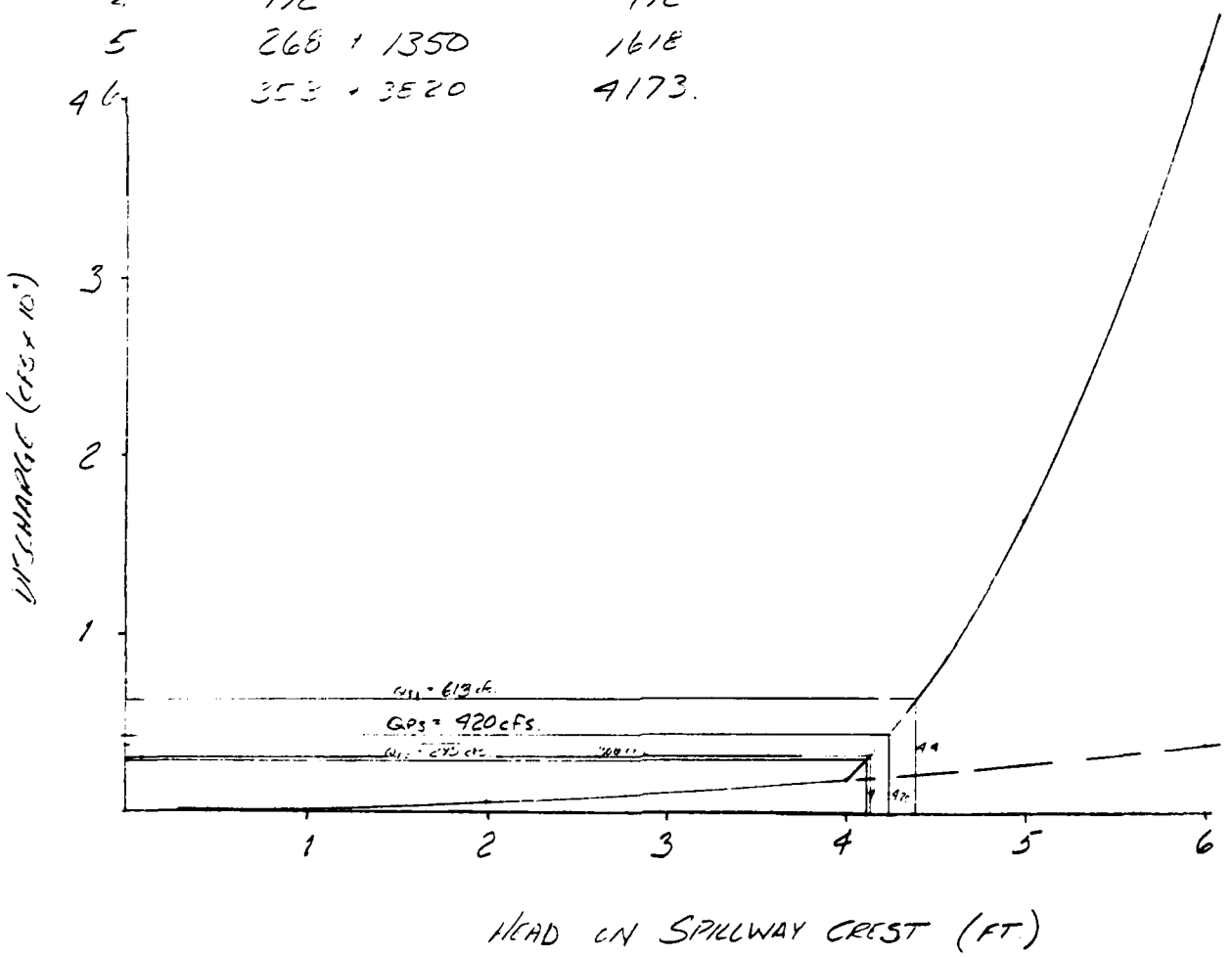
SPILLWAY RATING

EFF L = 600'

C = 2.25

ENTRANCE & CHANNEL VERY ROUGH C = 3.0

N	Q	Q_{TOT}
1	6E	6E
2	18Z	18Z
5	268 + 1350	1618
6	353 + 3820	4173.



Client COE ENG Job No. 1345-065 Sheet 2 of 8

Subject BIRCH POND - By J. VEITCH Date 10 AUG. 1976

Ckd. Rev.

$S_1 = 4.4'$

$STOR_1 = \frac{4.4(12)(82)}{439} = 9.86''$

$Q_{P2} = 613\left(1 - \frac{9.86}{19}\right) = 295$ cfs.

$S_2 = 4.10'$

$STOR_2 = \frac{4.10(12)(82)}{439} = 9.19''$

$STOR_{AVE} = 9.53''$

$S_{AVE} = \frac{(9.53)(439)}{(12)(82)} = 4.25'$

DAM OVERTOPPED by ONLY .25' however this DAM seemed to be in VERY BAD REPAIR - much erosion has taken place already

$Q_{P3} = 420$ cfs (NOT A GOOD EST.)

USING ANOTHER ITERATION

$Q_{P3} = 613\left(1 - \frac{9.53}{19}\right) = 306$ cfs. $S = 4.13'$

$STOR_3 = \left(\frac{4.13}{4.10}\right) 9.19'' = 4.22''$ $STOR_{AVE} = 9.56''$

$Q_{P4} = 613\left(1 - \frac{9.56}{19}\right) = 305$ cfs

PEAK FAILURE OUTFLOW $H = 27'$ $L = 600'$

$S = 27(82)(.5) = 1107$ AC.FT.

$Q_{P1} = \frac{8}{27}(180)\sqrt{32.2}(27)^{1.5} = 42{,}460$ cfs

$Y_o = 27$

$W_b = .3(600) = 180$

$P.F.O. = 42{,}460 + 192 = 42{,}652$ cfs.

Client C of E Job No. 1345-065 Sheet 3 of 8

Subject CATCH POND By J. VEITCH Date 10 AUG 1976

Ckd. Rev.

		A	E A	WP
I	50	-	-	200
	55	1625	1625	450
	60	2750	4375	650
	65	3375	7750	700
II	50	1000	1000	350
	55	2975	3975	640
	60	3263	7236	665
	65	3913	10650	700
III	40	2500	2500	1000
	45	5375	7875	1150
	50	6000	13875	1250
	55	6375	20250	1300
	60			

Reach # I EL. $Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$S = .01$, $n = .028$

50 $Q = \frac{1.49}{.028}\left(500\right)\left(\frac{500}{275}\right)^{2/3}\sqrt{.01} = 3,970$ cfs.

55 $Q = \frac{1.49}{.028}\left(2800\right)\left(\frac{2800}{595}\right)^{2/3}\sqrt{.01} = 49,600$ cfs.

60 $Q = \frac{1.49}{.028}\left(5807\right)\left(\frac{5807}{658}\right)^{2/3}\sqrt{.01} = 132,925$ cfs.

Reach # 2 $S = .017$, $n = .028$

40 $Q = \frac{1.49}{.028}\left(1250\right)\left(\frac{1250}{500}\right)^{.67}\sqrt{.017} = 16,025$ cfs.

45 $Q = \frac{1.49}{.028}\left(3938\right)\left(\frac{3938}{575}\right)^{.67}\sqrt{.017} = 99,170$ cfs.

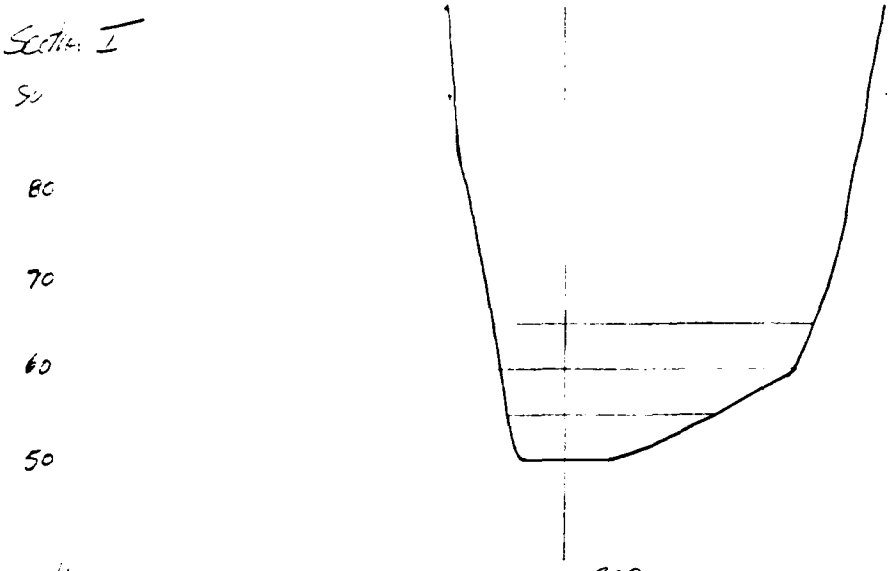
50 $Q = \frac{1.49}{.028}\left(7438\right)\left(\frac{7438}{800}\right)^{.67}\sqrt{.017} = 229,890$ cfs.

Client C of E Job No. 1345-065 Sheet 4 of 8

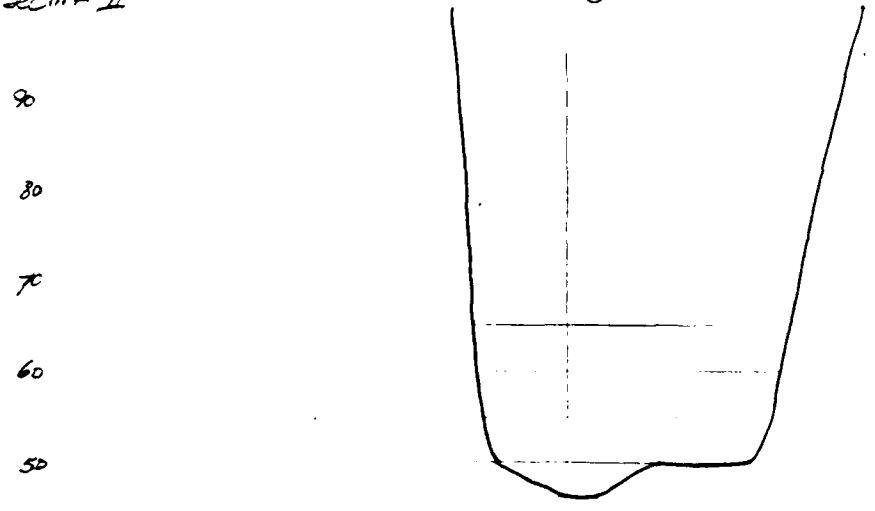
Subject BIRCH POND By J. Veitch Date 10 AUG 1978

Ckd. Rev.

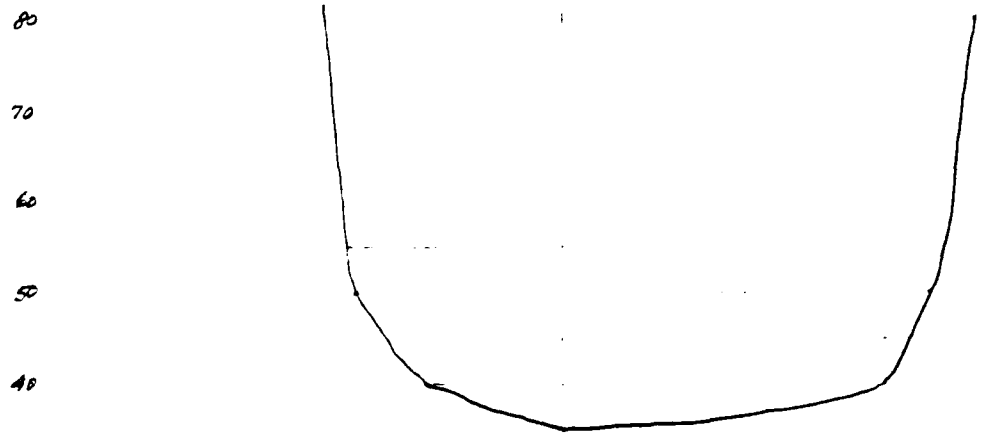
Section I



Section II



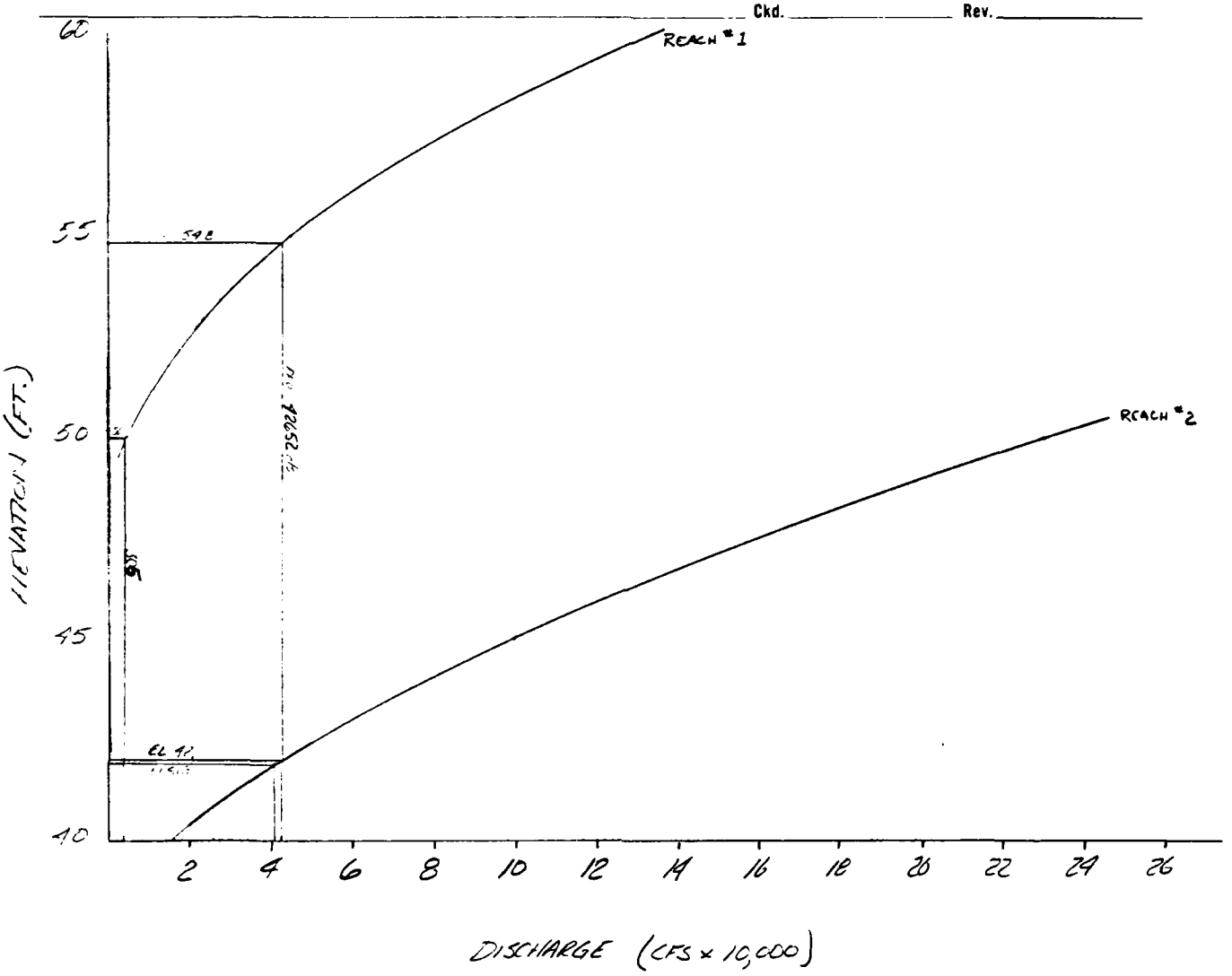
Section III



Client C of E Job No. 1345-065 Sheet 5 of 8

Subject BIRCH POND By J. VEITCH Date 10 AUG. 1978

Ckd. Rev.



Client C OF E Job No. 1345-065 Sheet 6 of 8

Subject BIRCH POND By J Veitch Date 10 AUG 1978

Ckd. Rev.

PFC CRITICAL:

$Q_p = 42{,}652$ cfs REACH 1 EL. = 54.8'

$V_1 = \frac{55}{7}\left(2800\frac{(300)}{43560}\right) = 18.9$ AC FT

Q_{P2} (TRIAL) $= 42652\left(1 - \frac{18.9}{1107}\right) = 41{,}924$ cfs.

NEGLECT Vol.

$Q_{P\ REACH\ 2} = 42652$ cfs EL. 42.0

$V_1 = \frac{7}{10}\left(\frac{3840(700)}{43560}\right) = 44.3$ AC. FT.

Q_{P2} (TRIAL) $= 42652\left(1 - \frac{44.3}{1107}\right) = 40{,}857$ cfs.

$V_2 = \frac{6.9}{7}(44.3) = 43.7$ AC FT.

$V_{AVE} = 44$

$Q_{P2} = 42652\left(1 - \frac{44}{1107}\right) = 40{,}957$ cfs

BREACH. 42,460 cfs

Much flooding to residential AREA IN CHANNEL - heavily developed. Walnut St flooded, some HAZARD to life due to population density.

TEST flood 305 cfs.

Flooding BASIN below dam, eventually flooding Walnut St. Minor flooding to RESIDENCES IN close proximity.

Client CORP OF ENGRS Job No. 1345-065 Sheet 7 of 8

Subject - BIRCH POND - By J VEITCH Date 25 SEPT. 1978

Ckd. Rev.

TEST FLOOD.

$Q_{P3} = 305$ cfs REACH #1 EL. 50.0'

$V_1 = \frac{4.0}{4.0}(500)\frac{300}{43560} = 3.44$ AC FT.

$Q_{P2(TRIAL)} = 305\left(1 - \frac{3.44}{1107}\right) = 304$

Neglect Vol

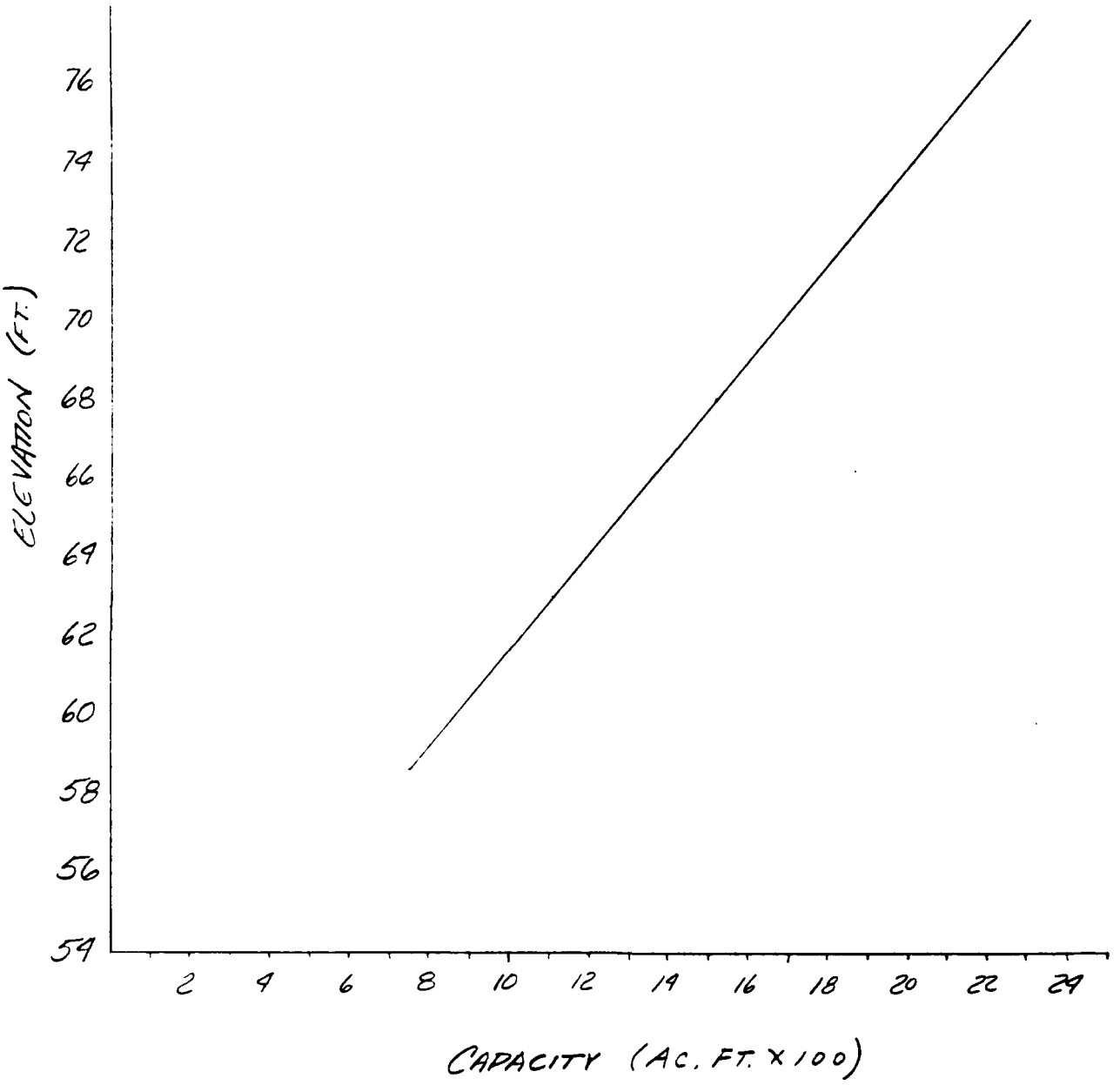
Q_{P1} (INTO REACH 2) = 305 cfs

the volume within the reaches at the flood level of this magnitude is minimal ∴ it is a fair approximation to assume a flow of 306 cfs. throughout.

Client COFE Job No. 1345-065 Sheet 8 of 8

Subject BIRCH By J VEITCH Date 25 AUG. 1978

CAPACITY CURVE Ckd. Rev.



APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY | MO | YR
MA	237	NED	MA	009	06				BIRCH POND DAM	4228.5	7056.8	08SEP78

POPULAR NAME	NAME OF IMPOUNDMENT
	BIRCH POND

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	06	TR SAUGUS RIVER	LYNN	0	90000

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
RECTPG	1872	S	27	27	1100	1100	NED	N	N	N	N	30AUG78

REMARKS

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.)
1	600	U	8	190	45000											

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF LYNN		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY | MO | YR	AUTHORITY FOR INSPECTION
CHAS.T.MAIN,INC	07JUL78	PL 92-367

REMARKS

END

FILMED

7-85

DTIC