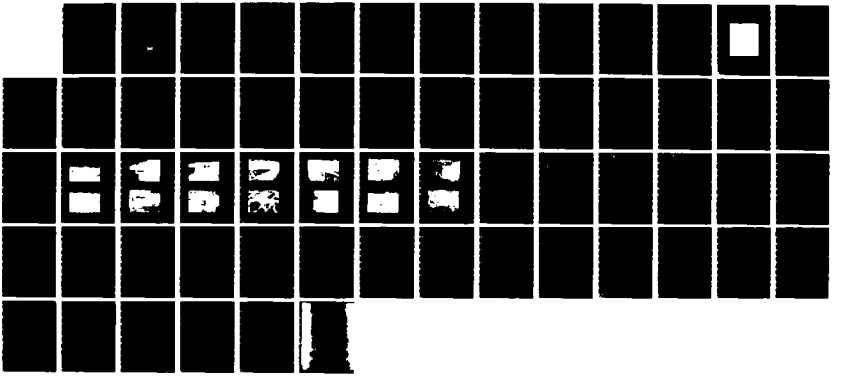
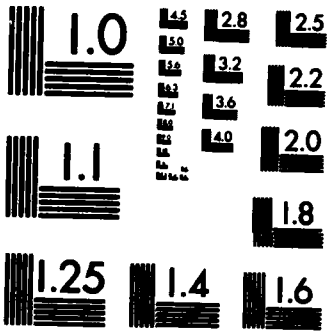
AD-A142 917 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/1
PUTMAN RESERVOIR DAM (... (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV AUG 78

UNCLASSIFIED F/G 13/13 NL





CONNECTICUT WESTERN COASTAL AREA
GREENWICH, CONNECTICUT

PUTNAM RESERVOIR DAM
CT 00041

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

AUGUST 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00041	2. GOVT ACCESSION NO. AD-A142917	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Conn. Western Coastal Area Greenwich, Conn., Putnam Reservoir 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 90
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,

Conn. Western Coastal Area
Greenwich, Conn.
Putnam Reservoir Dam

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

Putnam Reservoir dam consists of a rolled earth embankment with a concrete core wall, built originally in 1893 and modified in 1906 and 1922. The dam section is 640 ft. long with a maximum height of 35 ft. The spillway is 55 ft. long with an "Ogee" crest.

The maximum spillway capacity at top of dam is 35 per cent of the peak inflow rate of the test flood. Therefore, the test flood cannot be passed by the spillway without overtopping the dam. The overflow will be 1.1 ft. above the top of the dam.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

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

REPLY TO
ATTENTION OF

NEDED

JAN 20 1979

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

Dear Governor Grasso:

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

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, the Connecticut-American Waterworks Company, Inc., Greenwich, Connecticut 06830.

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

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

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

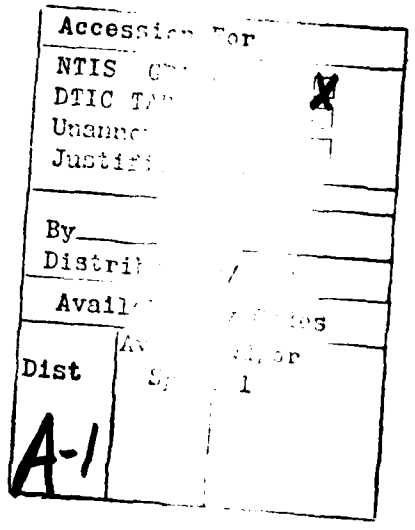
Incl
As stated

PUTNAM RESERVOIR DAM

CT 00041

CONNECTICUT WESTERN COASTAL AREA

GREENWICH, CONNECTICUT



PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam: PUTNAM RESERVOIR DAM

State Located: Connecticut

County Located: Fairfield County

Stream: Horseneck Brook

Date of Inspection: 1 JUNE 1978

BRIEF ASSESSMENT

Putnam Reservoir dam consists of a rolled earth embankment with a concrete core wall, built originally in 1893 and modified in 1906 and 1922. The dam section is 640 feet long with a maximum height of 35 feet. The spillway is 55 feet long with an "Ogee" crest.

Based on the visual inspection of the site, review of available information and past performance of the dam, the dam is judged to be in good condition.

The maximum spillway capacity at top of dam is 35 per cent of the peak inflow rate of the test flood. Therefore, the test flood cannot be passed by the spillway without overtopping the dam. The overflow will be 1.1 feet above the top of the dam.

It is recommended that detailed investigations be undertaken by the owner to determine the requirements and methods for obtaining additional spillway capacity. Additionally, surface spalling and cracking of the spillway should be repaired in order to prevent continued deterioration and a potentially hazardous condition. In addition to establishing a program of periodic inspections during times of unusually high runoff, an around the clock surveillance and warning program should be established and exercised by the owner.

S. Giavara, P.E.
Principal

Registered, CT 7634

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

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.

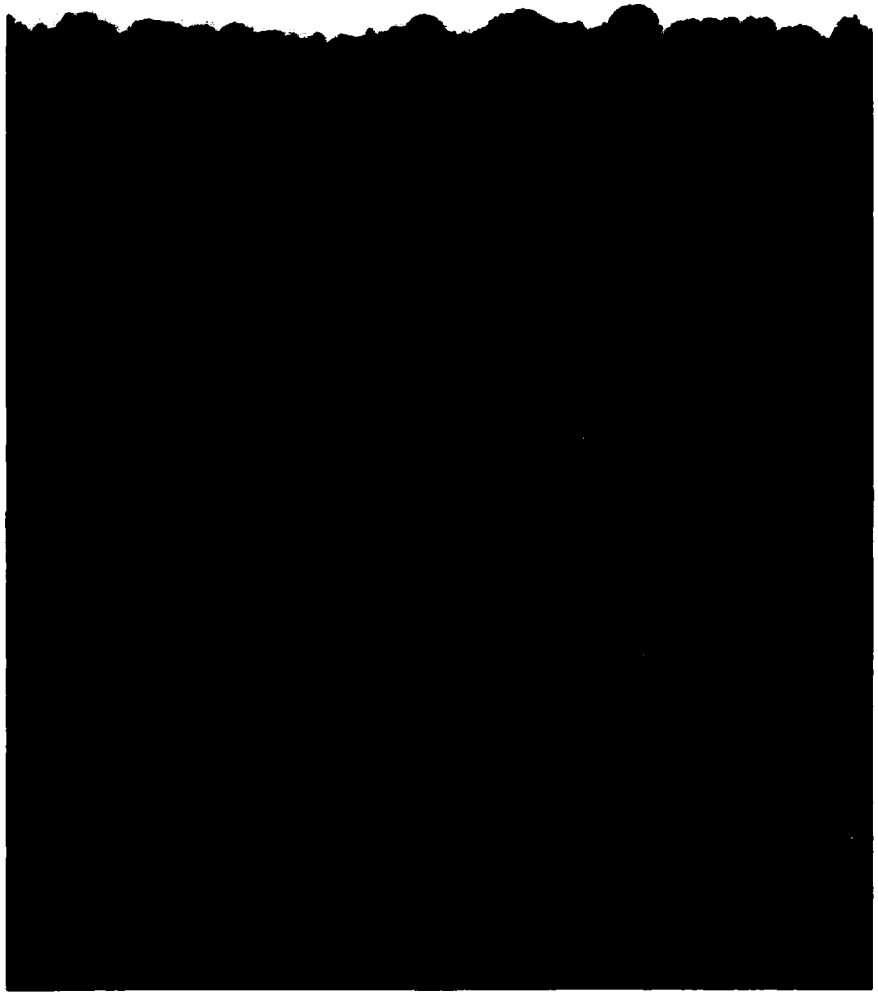
In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving 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.

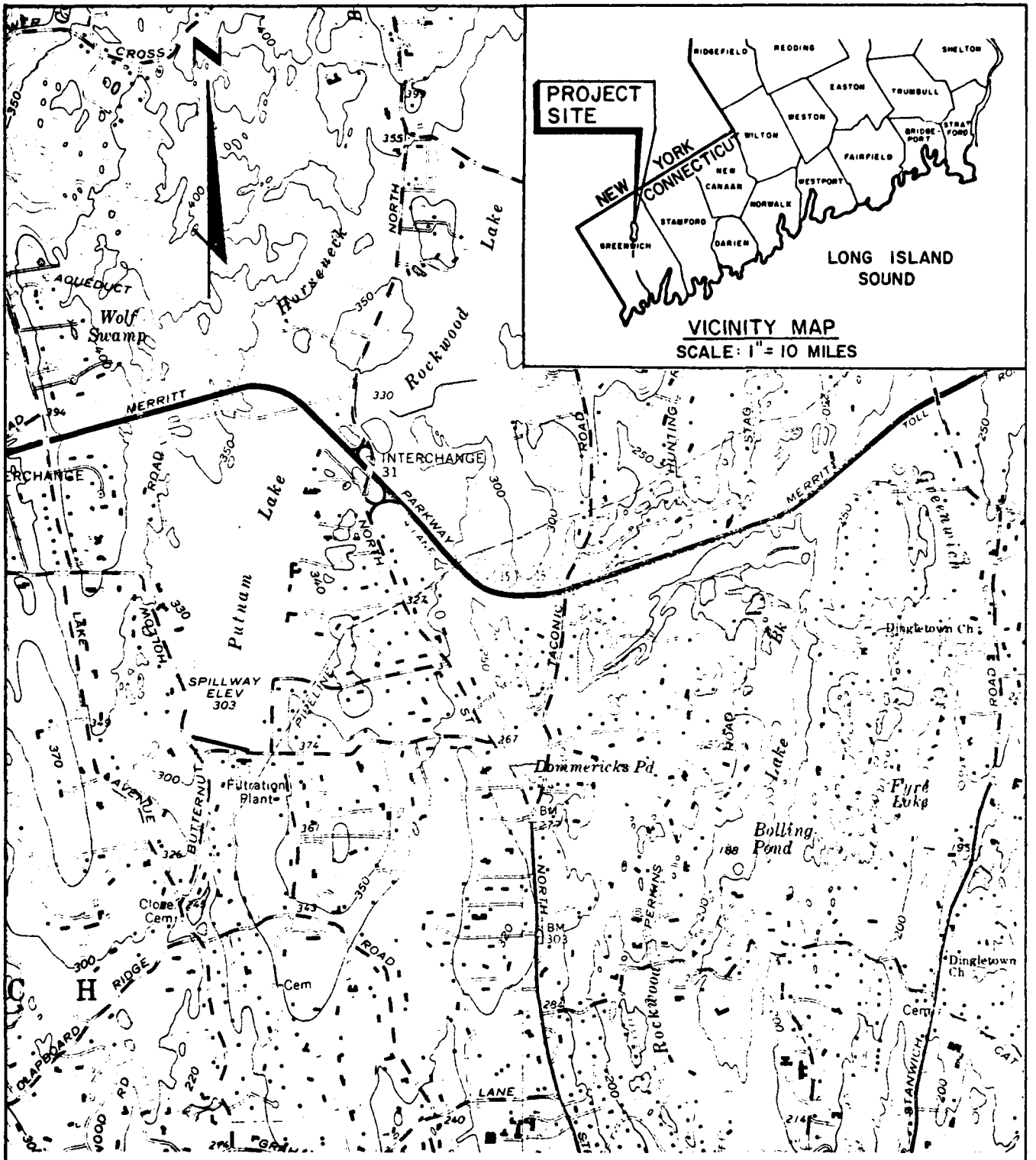
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because 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 aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

LIST OF APPENDICES



PUTNAM RESERVOIR DAM



SCALE IN FEET

2000 0 1000 2000

LOCATION MAP

PUTNAM RESERVOIR DAM

GREENWICH , CONNECTICUT

PHASE I INSPECTION REPORT
PUTNAM RESERVOIR DAM CT 00041

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 through 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. Flaherty Giavara Associates, P.C. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Flaherty Giavara Associates, P.C. under a letter of 25 April 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0309 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 assist the States to initiate quickly effective dam safety programs for non-federal dams.

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

1.2 DESCRIPTION OF PROJECT:

a. Description of Dam and Appurtenances. Earth embankment with concrete core wall, built 1893, and modified in 1906 and 1922. The dam section is 640 feet long with a maximum height of 35 feet. The top of the dam is 30 feet wide. The downstream side slopes of the rolled earth embankment are 2 horizontal to 1 vertical. The upstream slope is 1-1/4 horizontal on 1 vertical. Riprap is in place on the upstream face. The spillway is 55 feet long, with an "Ogee" crest.

b. Location. The dam is located approximately 5 miles north of the Town of Greenwich on Horseneck Brook within the Connecticut western coastal area. The Putnam Lake water filtration plant is just downstream of the dam.

c. Size Classification. The applicable guideline indicates that for an intermediate category the storage in acre-feet for the impoundment must be greater than or equal to 1,000 and less than 50,000. The size classification may be determine by either storage or height, whichever gives the larger size category. Based on the storage capacity of the dam, the size classification is intermediate. The top of dam storage for Putnam Reservoir Dam is 1,775 acre-feet.

d. Hazard Classification. The dam is classified as having a high hazard potential. This classification is based on the 10 or more houses situated along the narrow valley through which Horseneck Brook flows and the fact that Haithcock School is located within the valley. Horseneck Brook also flows through a heavily built up commercial section of the Town of Greenwich.

e. Ownership. Putnam Reservoir Dam is owned by the Connecticut-American Waterworks Company, Inc. - Greenwich District.

f. Purpose of Dam. The dam was constructed to form an impounding reservoir. The reservoir forms part of the water company's supply and distribution system, providing potable water to the residents of Greenwich. The natural yield is augmented by flow from Rockwood Reservoir, which delivers through a 20-inch pipe 500 feet long, and by diversion from the east branch of the Byram River. Supply is diverted through an unlined tunnel, 4,191 feet in length to the upper end of Putnam Lake.

g. Design and Construction History. The dam was originally built in 1880, the dam was raised 5 feet in 1889, and 9.5 feet in 1910. The designers of the original dam and its subsequent modifications are unknown.

h. Normal Operating Procedures. Water is taken through the intake structure through three 24-inch by 36-inch sluice gates and delivered to the water filtration plant through a 30-inch diameter water supply main. A 24-inch blow off is provided.

1.3 PERTINENT DATA:

a. Drainage Area -	2.1 sq. miles
b. Discharge at Dam Site -	
Maximum Known Flood	Unknown
Warm Water Outlet	Not Available
Div. Tunnel Low Pool Outlet	None
Diversion Tunnel Outlet	None
Gated Spillway	None
Ungated Spillway at Max. Pool	1,000 CFS @ 1 Ft. freeboard
Total Spillway Cap. at Max. Pool	1,560 CFS @ no freeboard
c. Elevation (above (M.S.L.) -	
Top of Dam	304
Max. Design Pool	Not Available
Full Flood Control Pool	Not Available
Recreation Pool	Not Available
Spillway Crest Ungated	300
Upstream Portal Invert. Div. Tunnel	Not Applicable
Downstream Portal Invert. Div. Tunnel	Not Applicable
Streambed at Centerline of Dam	270
Maximum Tailwater	275±
d. Reservoir -	
Length of Max. Pool	4,800
Length of Recreation Pool	Not Applicable
Length of Flood Control Pool	Not Applicable
e. Storage -	
Recreation Pool	Not Applicable
Flood Control Pool	Not Applicable
Design Surcharge	Not Applicable
Top of Dam	1,775 Acre-Feet
f. Reservoir Surface (acres) -	
Top of Dam	Not Available
Max. Pool	Not Available
Flood Control Pool	Not Applicable
Recreation Pool	Not Applicable
Spillway Crest	105

g. Dam -

Type:	Earth embankment, concrete core
Length:	640 feet
Height:	35 feet
Top width:	30 feet
Side slopes:	Downstream: 1 vertical to 2 horizontal
	Upstream: 1 vertical to 1-1/4 horizontal
Zoning:	Rolled earth shell

Impervious core: Concrete core
Grout Curtain: Unknown

h. Diversion and Regulating Tunnel -
Type: Not Applicable
Length: Not Applicable
Diameter: Not Applicable
Access: Not Applicable
Regulation: Not Applicable

i. Spillway -
Type: Ogee
Length of Weir: 50 feet
Crest Elevation: 300
Gates: Ungated
Upstream Channel Reservoir
Downstream Channel: Concrete lined, bedrock bottom
Spillway is founded on: Unknown

j. Regulating Outlets -
Gates: 3 24-inch x 36" sluice gates
Conduits: 30" diameter cast iron pipe to water filtration plant
24" drain cast iron pipe to blow off/drain

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

No engineering data has been found to provide any information about the design of the Putnam Lake Dam.

2.2 CONSTRUCTION:

A sketch map showing a plan view of the dam, a section through the proposed dam and a plan for a new gate house (all undated) are the only known construction information available. Information presented in this report was primarily obtained by interviews and direct measurements of the existing structures.

2.3 OPERATION:

Formal operation records are not available for this dam.

2.4 EVALUATION:

a. Availability. Only minimal engineering information is available for this dam.

b. Adequacy. The adequacy of design, construction and operation cannot be evaluated.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

a. General. The downstream embankment slope appeared to be in good condition. A slight bulge was noted near mid-slope at the western portion of the dam. No seepage or wet areas were noted. The crest was level. The upstream embankment and riprap were in good condition. The spillway section was in disrepair, with major spalling, vertical cracks, and several wet spots noted. Water was not passing over the spillway during the inspection (June 14, 1978). The Gate House and operating facilities were in good condition. All valves were operated with the exception of the blow-off valve. Water company personnel did not allow operation since they were concerned with low flow conditions in the outlet and the possibility of rusty blow-off piping. Inspection personnel were unable to locate the blow-off control.

b. Dam.

1) Upstream Slope - At the time of the visual inspection of the dam, the reservoir level was approximately 1 foot below the spillway crest, and thus only the upper few feet of slope could be observed. The riprap protection inspected was generally in good shape with an occasional small window exposed through the riprap. Near Station 7+00 on the left side of the dam, there is some erosion and settling of the riprap.

2) Crest - The condition of the crest was generally good with the exception of two small ruts near the centerline of the crest which were apparently due to foot traffic and motor bikes.

3) Downstream Slope - No evidence of seepage or wet areas were found on the downstream slope or downstream of the dam adjacent to the existing road. Several small animal holes were located near the toe of the slope in the vicinity of Station 1+60 and Station 3+00. The slope appeared in good shape with only a small bulge in the vicinity of Station 2+25 near mid-slope.

4) Spillway - The spillway has extensive spalling throughout most of the downstream face. There are several vertical cracks in the downstream face, and an eroded hole in the top of the spillway. There were several wet spots noted on the face of the spillway at the horizontal construction joints which indicate that water is seeping through the concrete section. There is a vertical crack in the east wall from the top of the wall to its junction with the spillway on its upstream face.

c. Appurtenant Structures. The intake structure appears to be in good condition. All gates and valves were cracked open and are operable. The 24-inch blow-off was not operated during the visual inspection, although a request was made to attempt operation of the valve. All visable electrical facilities were in good condition, free of dirt and corrosion.

d. Reservoir Area. The reservoir has well vegetated banks at slight to moderate slopes. There was no indication of slides or sloughing. The depth of sediment and rate of accumulation in the reservoir are unknown.

e. Downstream Channel. The spillway channel is 30 to 50 feet wide, has a rough rock bottom, and both concrete and stone-mortar vertical walls. The channel directs flow into a culvert which passes underneath the adjacent roadway. Both walls are in fairly good condition with several small seeps coming from the base of the east wall. The channel contains many large boulders and there are some tree branches which have fallen into the channel. Overhanging trees and brush growth can result in additional trees and branches falling into the channel.

3.2 EVALUATION:

Visual observation revealed that the dam and attendant structures are structurally sound and that no immediate actions to remedy any serious problems should be taken.

a. The spillway section shows considerable deterioration and stress and this condition should be corrected before it becomes hazardous.

b. The seeps along the base of the training wall are not considered to have an adverse effect on the structural integrity of the dam at this time, but should be closely monitored to insure that any future flow increase be observed.

c. Animal holes in the embankment and toe should be filled and plugged.

d. The bottom of the spillway channel which contains tree branches and other debris can reduce its flow capacity.

e. The control valve for the 24-inch diameter blow off should be located, and exercised on a regular basis.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES:

Water is taken from Putnam Lake through the gate house to the filtration plant just downstream. The plant at Putnam Lake can provide 17 mgd (peak capacity) to customers in Greenwich. It was reported that the intake point from the lake is periodically changed, however, the blow-off is operated only once a year at high flow conditions.

4.2 MAINTENANCE OF DAM:

The dam is well maintained with a regular program of grass mowing and general maintenance in effect. The associated spillway structure needs maintenance to insure continued safe serviceability.

4.3 MAINTENANCE OF OPERATING FACILITIES:

The regulating gates and valves were tested and appear to be in mechanically good operating condition and are completely functional. The blow-off valve was not located due to overgrown condition.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

There was no warning system of any kind in effect at the time of the inspection. The Connecticut-American Waterworks Company is currently developing procedures which will provide for surveillance during peak flow conditions and a warning system.

4.5 EVALUATION:

The Putnam Reservoir Dam which is over 70 years old is well operated and maintained. Although not designed for rapid drawdown, it should be noted that if the need should arise, drawdown could be effected only through the operational procedure of opening the 24-inch blow-off. Therefore, this valve should be located and periodically exercised to insure proper functioning.

SECTION 5 - HYDRAULICS/HYDROLOGY

5.1 EVALUATION OF FEATURES:

a. Design Data. There is no available information on the hydraulic design criteria for this dam and appurtenances. Under established criteria (OCE Guidelines) the recommended spillway design flood for the size (intermediate) and hazard potential (high) classification is the probable maximum flood (PMF). The PMF is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The PMF is the applicable "test flood" for this dam.

An estimate of the magnitude of the test flood at the site is based on an analysis of several sets of regional flood frequency data as presented in Appendix II.

As a conservative approach to the investigation, the more critical design hydrograph was used throughout. The peak discharge of the test flood of 4,400 CFS was therefore utilized.

A stage-discharge relationship was calculated for the spillway and indicates the following flows, based upon a coefficient of 3.9 and a length of 50 feet.

Stage - Discharge Relationship

Stage	Head, Ft.	Discharge Rate, CFS
301	1	190
302	2	550
303	3	1,010
304	4	1,560

The maximum spillway capacity, with no freeboard, is 35 percent of the peak inflow rate of the test flood. (Compare 4,400 CFS with 1,560 CFS.) In order to determine the effect of the reservoir storage capacity, a hydrograph of the test flood was routed through the reservoir.

The hydrograph was formed by assuming the test flood had a duration of 24 hours, with the peak of 4,400 CFS occurring at 8 hours from the beginning of runoff. The rising and falling limbs of the hydrograph were assumed to be changing at a constant rate, forming a triangle. The routing operation indicated that the peak rate of discharge would not be reduced and would result in a stage elevation of 305.1 (1.1 feet above top of dam).

b. Experience Data. During major storm events all augmenting flow from the Byram River diversion is eliminated. Discussion with water company personnel indicate that since 1950 the dam has safely discharged the floods that have hit the western Connecticut coastal area. The maximum stage was reported to have been about 18 inches above the top of the spillway (elevation 301.5 MSL).

c. Visual Observations. The on-site inspection of the dam provided the data for the hydraulic/hydrologic evaluation of the spillway.

d. Overtopping Potential. The maximum spillway capacity is equal to less than one-half the test flood. The peak rate of discharge would overtop the embankment (1.1 feet). For a test flood duration of 24 hours, the embankment would be overtopped for an 8-hour period.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY:

a. Visual Observations. No evidence was observed indicating structural instability of the embankment dam. The concrete spillway section showed signs of deterioration, including major spalling, cracking and seepage.

b. Design and Construction Data. Sufficient data is not available on the soil properties and design and construction of the earth embankment to permit a formal evaluation of stability. No stability analyses calculations were available for the concrete spillway section.

c. Operating Records. No recorded information was reviewed that indicated a stability problem. No major operational problems were reported, notwithstanding the several tropical storms and hurricanes since that time. As the Putnam Dam is used as a water supply dam and has been subjected to a full head of water most of the time, its stability is considered to be adequate based on performance.

d. Post-construction Changes. Storm drainage facilities have been constructed on the roadway just south of the dam embankment. No evidence indicates that this construction has had a detrimental effect on dam stability. Records indicate that the dam height was raised in 1889 and again in 1910.

e. Seismic Stability. This dam is in Seismic Zone 1, and therefore a seismic analysis is not warranted.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

a. Condition. Based on the visual inspection, records available and past operational performarce, the dam is judged to be in good condition.

The overtopping potential analysis shows that the dam will be overtopped by the test flood. The spillway capacity therefore is inadequate. The project will pass 35 per cent of the test flood without overtopping and thus the spillway capacity is considered seriously inadequate.

b. Adequacy of Information. The information available is such that the evaluation of the dam must be based primarily on the visual inspection and the past operational performance of the structure.

c. Urgency. The recommendations and remedial measures recommended should be implemented by the owner in the near term.

d. Need for Additional Investigation. A detailed investigation to further assess the requirements for obtaining additional spillway capacity is necessary.

7.2 RECOMMENDATIONS:

It is recommended that the following measures be undertaken by the owner:

1) Detailed investigations be initiated to determine the requirements and methods for obtaining additional spillway capacity.

2) Surface spalling and cracking of the spillway should be repaired in order to prevent continued deterioration and a potentially hazardous condition.

3) Boulders, debris, overhanging trees which were observed to be obstructing both the outlet channel and discharge spillway channel should be removed.

7.3 REMEDIAL MEASURES:

Although the dam is generally maintained in good condition, it is considered important that the following items be accomplished:

a. Alternatives. Not applicable.

b. Operation and Maintenance and Procedures.

1) Arrangements should be made to locate, operate and maintain the blow-off control valve.

2) Animal holes in the embankment and toe should be filled and plugged.

3) The seepage in the outlet channel should be monitored to determine any increase in discharge.

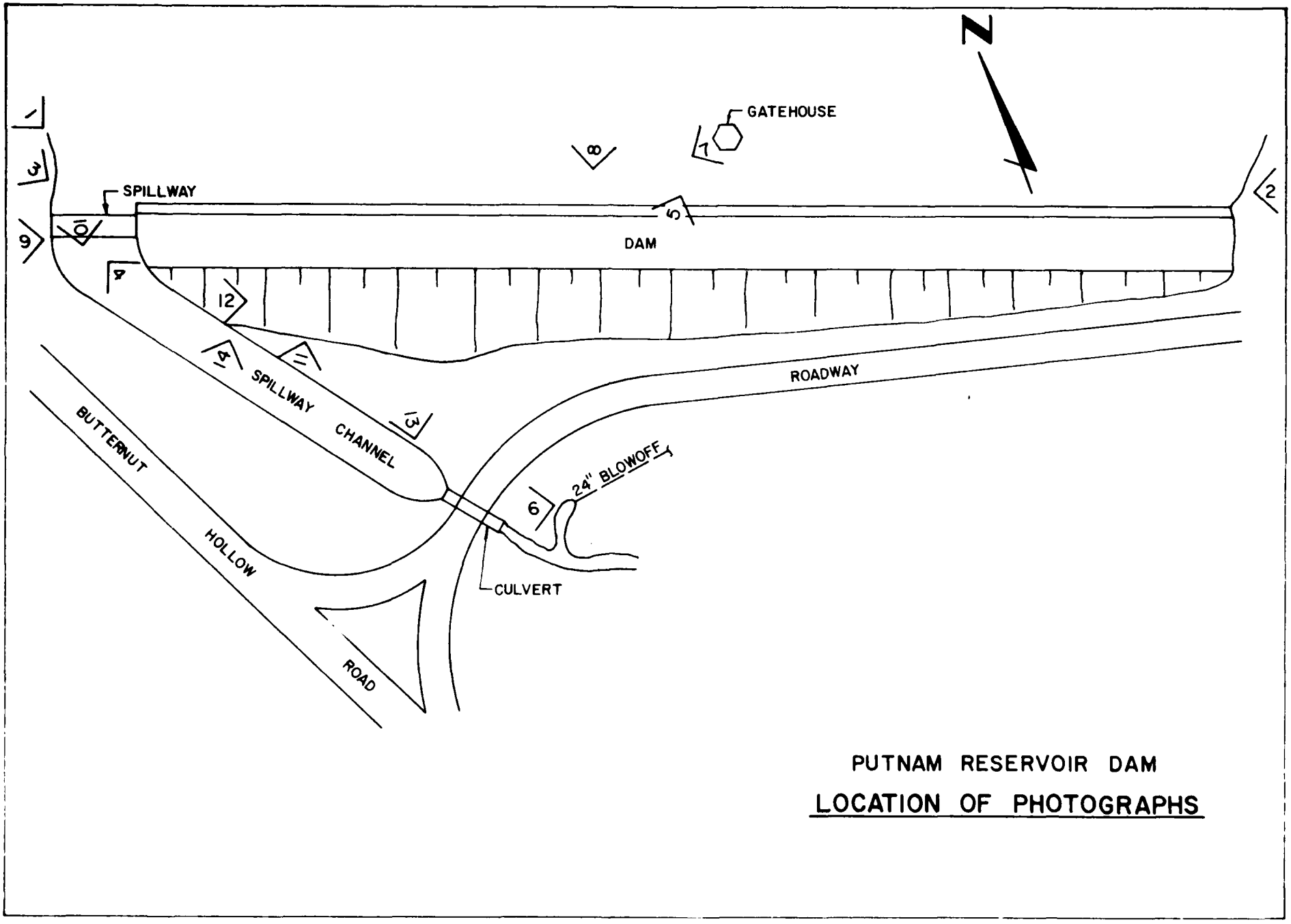
4) Operation and maintenance manual for the project should be prepared.

5) A program of periodic inspections of the project features should be established.

6) In periods of unusually high runoff an around the clock surveillance and warning program should be exercised.

APPENDIX I

PHOTOGRAPHS



PUTNAM RESERVOIR DAM

LOCATION OF PHOTOGRAPHS

PHOTO #1: Upstream Face of Dam, looking East.

PHOTO #2: Upstream Face of Dam, looking West.

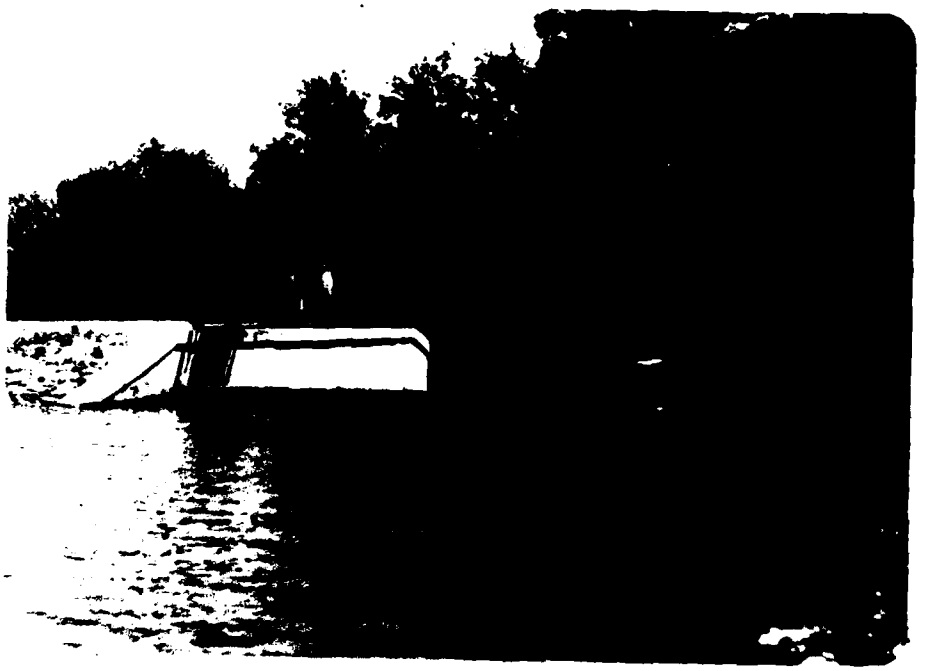


PHOTO #3: Upstream Face of Spillway.

PHOTO #4: Downstream Face of Spillway. Note Concrete Spalling.

PHOTO #5: Intake Structure and Gate House.

PHOTO #6: Stone Conduit housing the Blow-off Discharge Point. Note flow from 2-inch diameter drain near center of photo.

PHOTO #7: Riprap on Upstream Face of Dam, looking West from Intake Structure.

PHOTO #8: Riprap detail at Sta. 7+00. Note extent of coverage.

PHOTO #9: View of Earth Embankment, looking East from Spillway Discharge Channel.

PHOTO #10: Spillway Discharge Channel, looking downstream.

PHOTO #11: View of Animal Burrow Holes at Toe of Earth Embankment.

PHOTO #12: Downstream Face of Embankment. Note "bulge" in the slope at Sta. 2+20.

PHOTO #13: Culvert to carry Spillway Discharges under the road South of the Dam.

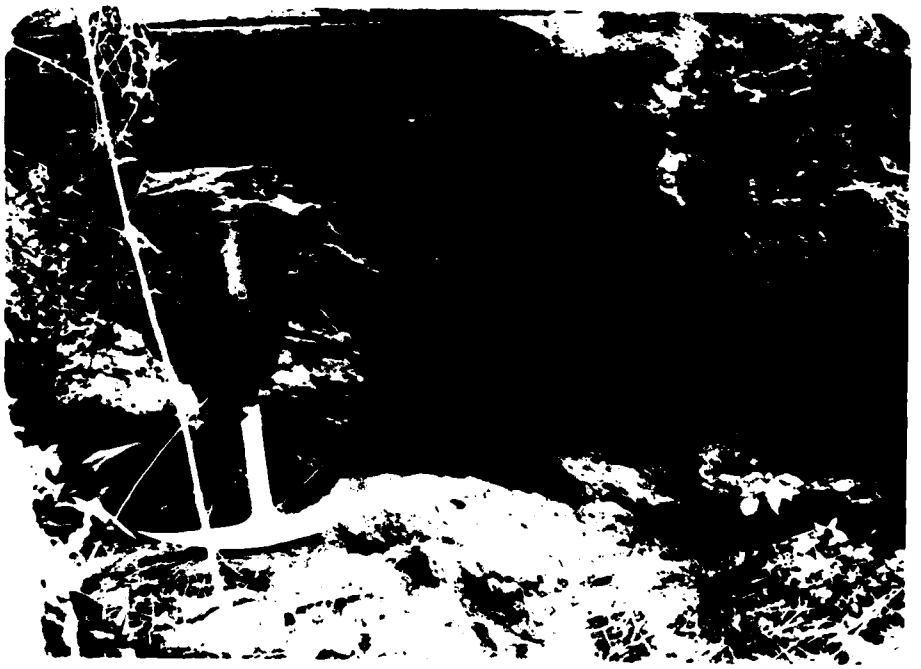
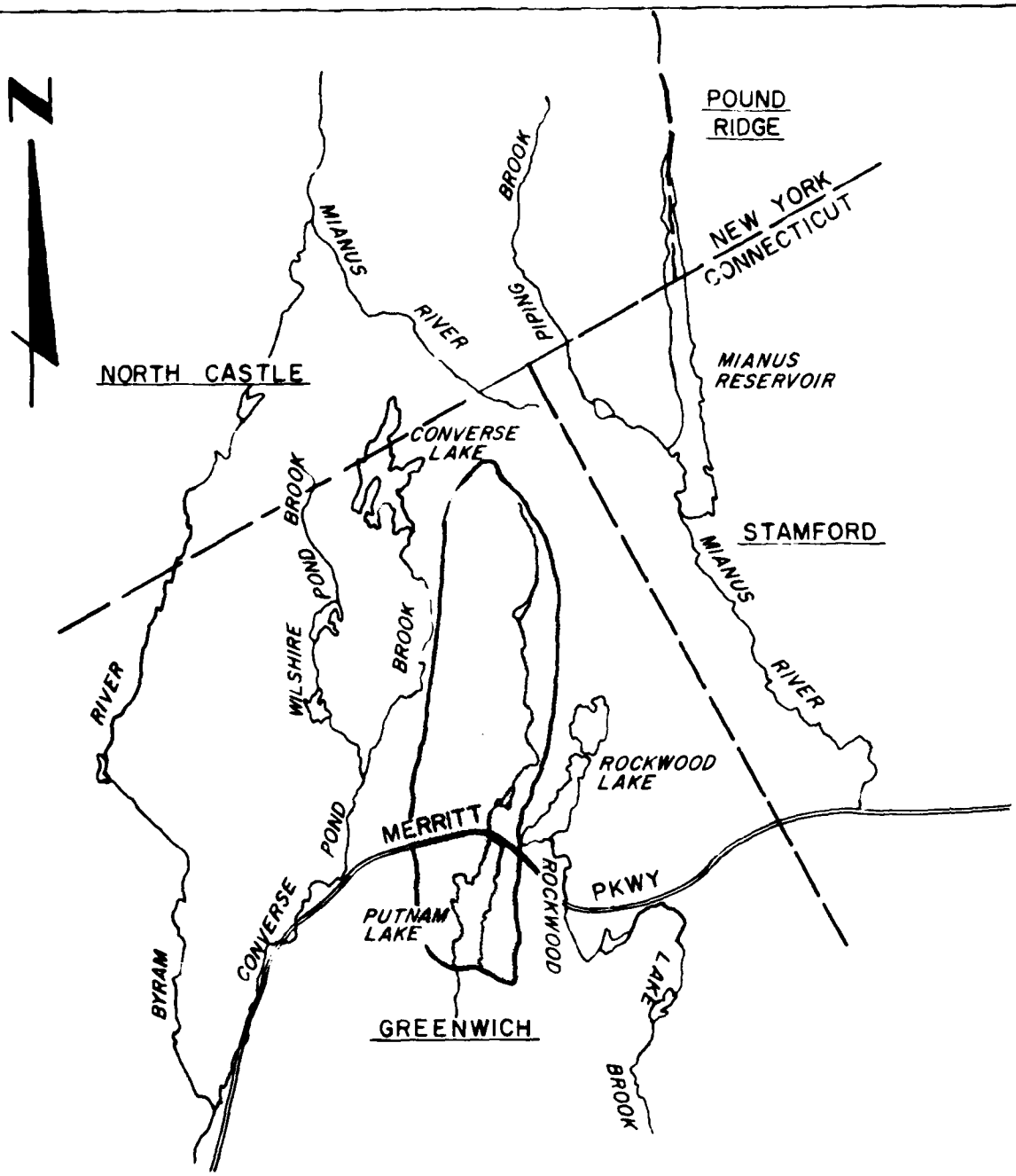


PHOTO #14: Drain Hole in East wall of Spillway Discharge Channel.

APPENDIX II

HYDROLOGIC COMPUTATIONS



SCALE IN FEET

6000 0 3000 6000

DRAINAGE AREA MAP

PUTNAM RESERVOIR DAM

GREENWICH, CONNECTICUT

PUTNAM RESERVOIR DAM

FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/789-1260

SHEET NO. 1 OF 2
BY JGM DATE 7/5/72
CHK'D. BY RCS DATE 8/1/72

PMF PEAK FLOW ESTIMATE

WATERSHED AREA IS 2.1 SQUARE MILES

METHOD #1

REFER TO "PRELIMINARY GUIDANCE FOR ESTIMATING PMF DISCHARGES" by NEW ENGLAND DIVISION, CORPS OF ENGINEERS

UNIT FLOW = 2100 CFS/MI^2 (ROLLING)
PMF $\approx$ 2.1 MI^2 (2100 CFS) = 4410 CFS
SAY $\approx$ 4400 CFS

METHOD #2

REFER TO "CONN WATER RESOURCE BULLETIN #17, PART 4" by USGS

MEAN ANNUAL FLOOD = 120 CFS (FIG 13)
Q_{100} = 5 × MAF = 5(120) = 600 CFS (FIG 14)

PMF $\approx$ 5 × Q_{100} (APPROXIMATE)
PMF $\approx$ 5 × 600 CFS = 3000 CFS

METHOD #3

REFER TO FAIRFIELD, CT FLOOD INSURANCE STUDY, "FREQUENCY DISCHARGE, DRAINAGE AREA CURVES

Q_{100} = 950 CFS (FIG. 2)
PMF $\approx$ 5 × Q_{100} $\approx$ 5 × (950 CFS) = 4750 CFS

FOR SPILLWAY EVALUATION, USE 4400 CFS

FLAHERTY-CIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN 06510/203/789-1260

SHEET NO. 6 OF 6
BY JGM DATE 7/5/78
CHK'D. BY RCS DATE 8/1/78

FORMATION OF INFLOW HYDROGRAPH

1) P.M.F. ≈ 4400 CFS (see previous sheet)

2) FORM A TRIANGULAR HYDROGRAPH 24 HOURS DURATION, PEAK AT 8 HOURS

TIME HOURS	UNIT FLOW RATE	FLOW RATE CFS
0	0.00	0
2	0.25	1100
4	0.50	2200
6	0.75	3300
8	1.00	4400
10	0.875	3850
12	0.75	3300
16	0.50	2200
20	0.25	1100
24	0.00	0

JTNAM DAM 78-36-10 FLOOD ROUTING JGM 7/13/78

IPUT DATA: UNSUBMERGED WEIR
EGMENT 1 DISCHARGE COEFFICIENT = 3.9 LENGTH OF WEIR = 50 ELEVATION OF WEIR = 300
EGMENT 2 DISCHARGE COEFFICIENT = 3 LENGTH OF WEIR = 640 ELEVATION OF WEIR = 304
IE=300 IV= 0.0 E=300 A=105.00 E=310 A=105.00

HOUR	INFLOW	MASS INFLOW	WATER EL.	TAIL WATER	OUTFLOW	MASS OUTFLOW	STORAGE(R)	STORAGE(A)
0.00	0CFS	0.00AC-F	300.00FT	0.00FT	0CFS	0.00AC-F	0.00AC-F	0.00AC-F
2.00	1,100CFS	90.90AC-F	300.76FT	0.00FT	130CFS	10.74AC-F	80.15AC-F	80.16AC-F
4.00	2,200CFS	363.63AC-F	302.61FT	0.00FT	822CFS	89.48AC-F	274.14AC-F	274.14AC-F
6.00	3,300CFS	818.18AC-F	304.43FT	0.00FT	2,363CFS	352.84AC-F	465.33AC-F	465.33AC-F
8.00	4,400CFS	1,454.54AC-F	305.10FT	0.00FT	4,480CFS	918.49AC-F	536.05AC-F	536.05AC-F
10.00	3,850CFS	2,136.36AC-F	304.95FT	0.00FT	3,955CFS	1,615.69AC-F	520.67AC-F	520.67AC-F
12.00	3,300CFS	2,727.27AC-F	304.79FT	0.00FT	3,404CFS	2,223.94AC-F	503.33AC-F	503.33AC-F
16.00	2,200CFS	3,636.36AC-F	304.41FT	0.00FT	2,333CFS	3,172.31AC-F	464.05AC-F	464.05AC-F
20.00	1,100CFS	4,181.81AC-F	303.72FT	0.00FT	1,404CFS	3,790.19AC-F	391.62AC-F	391.62AC-F
24.00	0CFS	4,363.63AC-F	302.22FT	0.00FT	648CFS	4,129.60AC-F	234.02AC-F	234.02AC-F
30.00	0CFS	4,363.63AC-F	300.52FT	0.00FT	73CFS	4,308.75AC-F	54.88AC-F	54.88AC-F
36.00	0CFS	4,363.63AC-F	300.28FT	0.00FT	28CFS	4,334.19AC-F	29.43AC-F	29.43AC-F
48.00	0CFS	4,363.63AC-F	300.11FT	0.00FT	7CFS	4,352.08AC-F	11.55AC-F	11.55AC-F

APPENDIX III

VISUAL INSPECTION

CHECK LIST

PERIODIC INSPECTION CHECK LIST

PROJECT _____ DATE _____

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
CONCRETE DAM STRUCTURE	
General Condition Concrete Surfaces	
Movement or Settlement of Crest	
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and Other Structures	
Structural Cracking	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Condition of Monolith/ Construction Joints	
Drains - Foundation, Joint, Faces	
Any Seepage or Efflorescence	
Foundation Damage, Undermining	
Water Passages	
Abutments	

PERIODIC INSPECTION CHECK LIST

PROJECT Putnam Reservoir Dam DATE June 14, 1978

INSPECTOR Richard Murdock DISCIPLINE Geotechnical

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	304±
Current Pool Elevation	299±
Maximum Impoundment to Date	301.5±
Surface Cracks	None observed
Pavement Condition	Shallow ruts along crest due to foot traffic
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	A few small stumps were observed near Sta. 2+50
Sloughing or Erosion of Slopes or Abutments	A few woodchuck holes were observed on slope. One large hole was observed near Sta. 2+90.
Rock Slope Protection - Riprap Failures	Riprap has a few small open windows.
Unusual Movement or Cracking at or near Toes	None observed
Ususual Embankment or Downstream Seepage	None observed

PERIODIC INSPECTION CHECK LIST

PROJECT Putnam Reservoir Dam **DATE** June 14, 1978

INSPECTOR Richard Murdock **DISCIPLINE** Geotechnical

INSPECTOR _____ **DISCIPLINE** _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT - (continued)	
Piping or Boils	None observed
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Putnam Reservoir Dam — DATE June 14, 1978

INSPECTOR Anthony Rummo — DISCIPLINE Structural

INSPECTOR James MacBroom — DISCIPLINE Hydraulics/ Hydrology

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	The control tower is in good 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	

PERIODIC INSPECTION CHECK LIST

PROJECT Putnam Reservoir Dam **DATE** June 14, 1978

INSPECTOR Anthony Rummo **DISCIPLINE** Structural

INSPECTOR James MacBroom **DISCIPLINE** Hydraulics/ Hydrology

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER (continued)	
Service Gates	All gates and valves were operable and in good condition. Blow-off valve not operated.
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System In Gate Chamber	Good condition

PERIODIC INSPECTION CHECK LIST

PROJECT Putnam Reservoir Dam **DATE** June 14, 1978

INSPECTOR _____ **DISCIPLINE** _____

INSPECTOR _____ **DISCIPLINE** _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT Putnam Lake Dam DATE June 14, 1978

INSPECTOR Richard Murdock DISCIPLINE Geotechnical

INSPECTOR Anthony Rummo DISCIPLINE Structural

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	Highly eroded, cracking and generally poor condition
Rust or Staining	
Spalling	Major spalling
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Seepage noted through face of spillway
Drain Holes	None
c. Discharge Channel	
General Condition	
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Several trees adjacent to west side of channel
Floor of Channel	Loose rock, logs, debris
Other Obstructions	None

PERIODIC INSPECTION CHECK LIST

PROJECT _____ DATE _____

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Putnam Reservoir Dam DATE June 14, 1978

INSPECTOR Richard Murdock DISCIPLINE Geotechnical

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
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	Debris, loose rock, some brush overhanging right training wall.
Condition or Discharge Channel	One small seep was observed near Sta. 1+07 at the toe of the left training wall at approximately El. 288.

PERIODIC INSPECTION CHECK LIST

PROJECT Putnam Reservoir Dam **DATE** June 14, 1978

INSPECTOR Anthony Rummo **DISCIPLINE** Structural

INSPECTOR _____ **DISCIPLINE** _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	Both service bridges, (across top of spillway, dam to inlet structure) show some rusting but are in good condition.
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutments & Piers	
General Condition of Concrete	Generally good condition
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	Crack at west and east end (spillway) considerable spalling of concrete wall east side

APPENDIX IV

ENGINEERING DATA

CHECK LIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Putnam Reservoir Dam

I.D. NO. 41

ITEM	REMARKS
AS-BUILT DRAWINGS	None exist
REGIONAL VICINITY MAP	From U.S.G.S.
CONSTRUCTION HISTORY	Not available
TYPICAL SECTIONS OF DAM	Sketch Map
OUTLETS - Plan	None available
- Details	None available
- Constraints	Unknown
- Discharge Ratings	None
RAINFALL/RESERVOIR RECORDS	None
DESIGN REPORTS	None
GEOLOGY REPORTS	None
DESIGN COMPUTATIONS	
HYDROLOGY & HYDRAULICS	None
DAM STABILITY	None
SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS	
BORINGS RECORDS	None
LABORATORY	None
FIELD	None

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

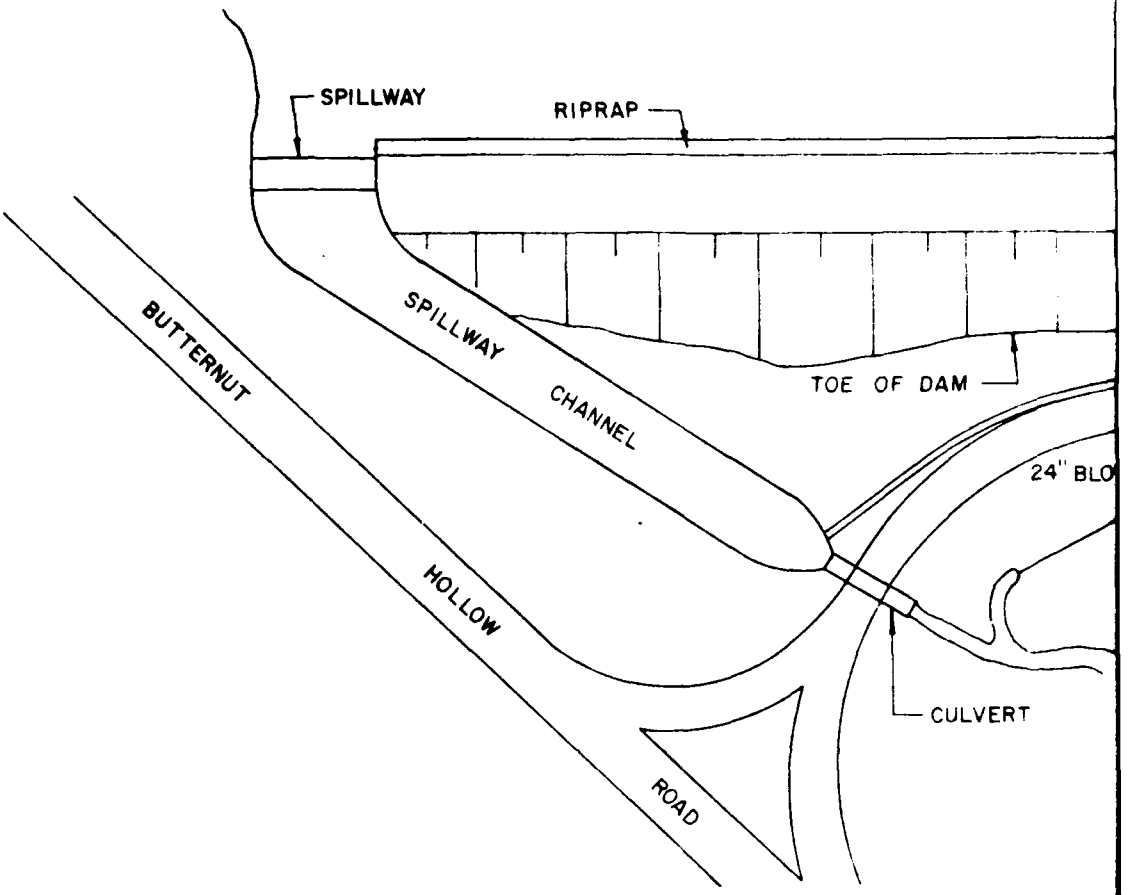
NAME OF DAM Putnam Reservoir Dam

I.D. NO. 41

ITEM	REMARKS
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Unknown
MONITORING SYSTEMS	None
MODIFICATIONS	Sketch Map
HIGH POOL RECORDS	None
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	From Connecticut American Waterworks Company
SPILLWAY PLAN	
SECTIONS	From field measurements
DETAILS	None
OPERATING EQUIPMENT PLANS & DETAILS	None

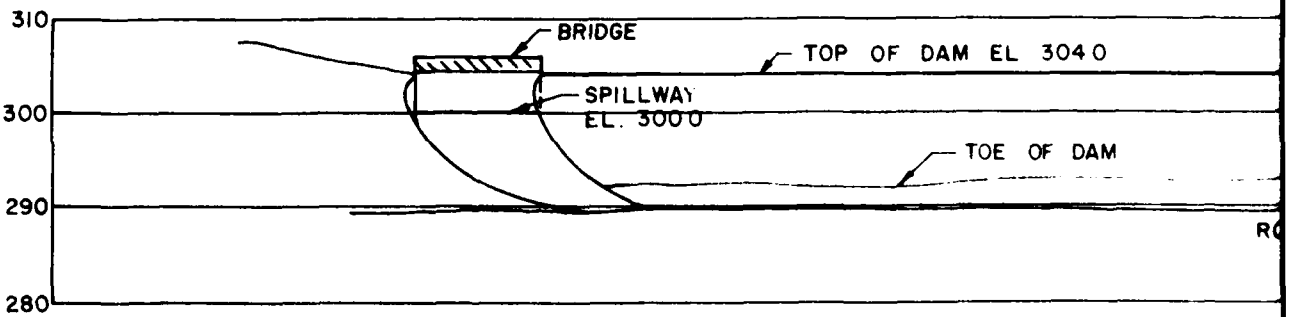
APPENDIX V

DRAWINGS



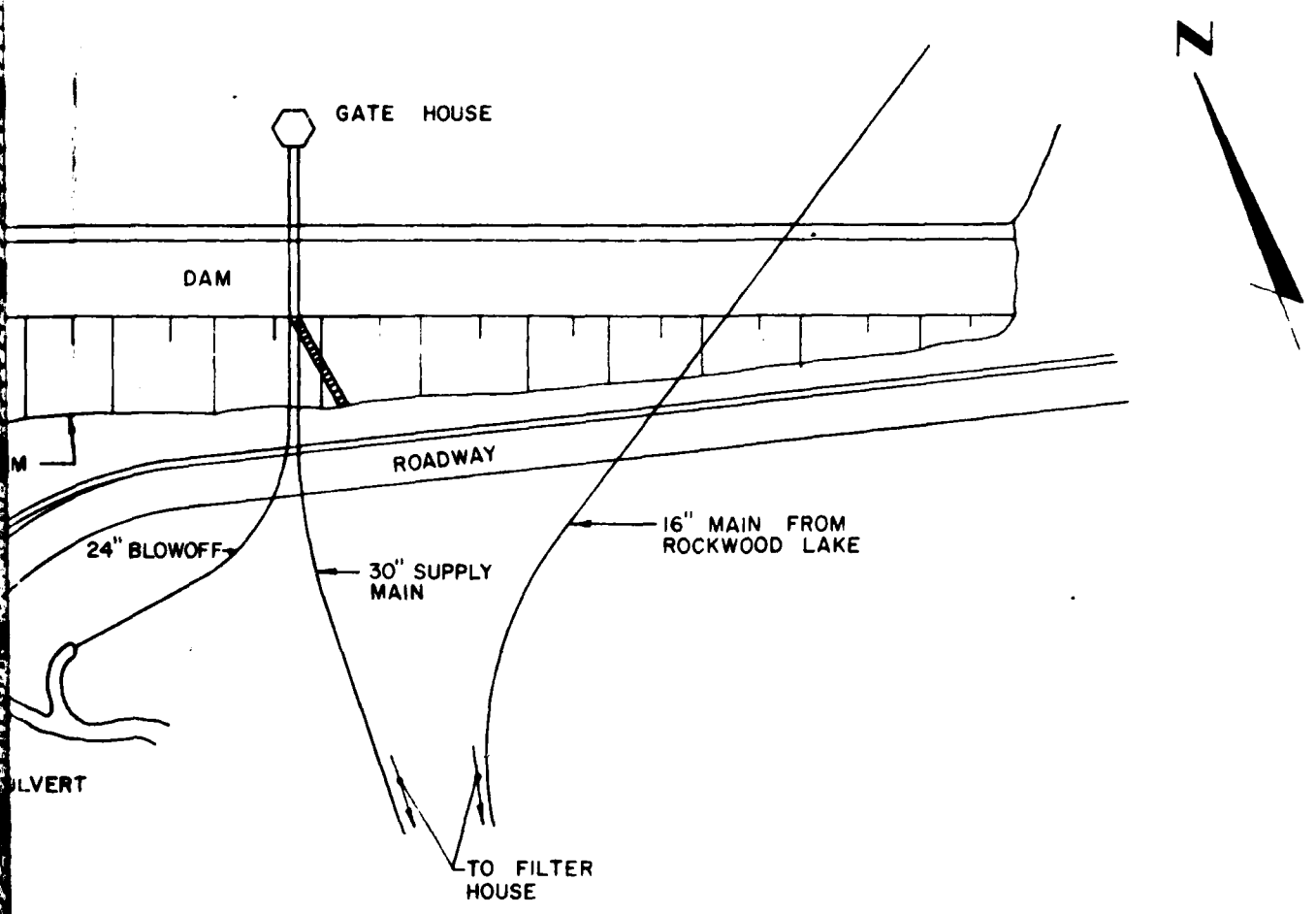
PL

N

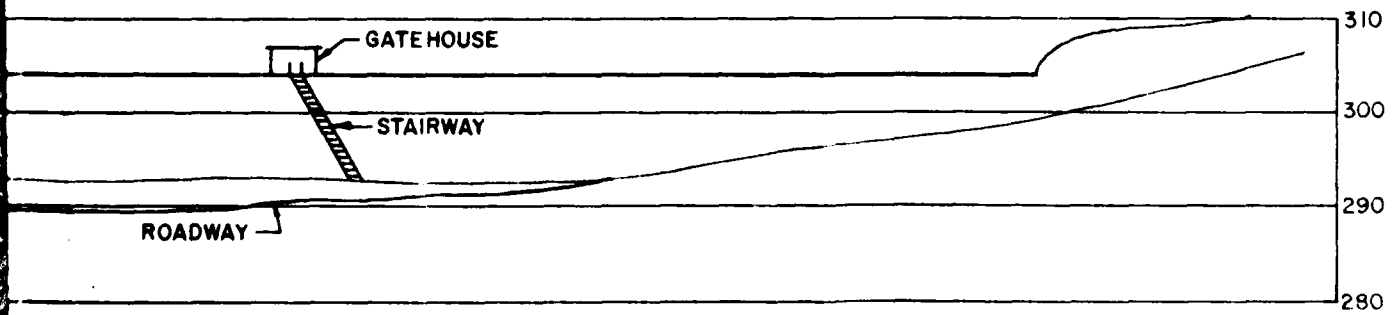


DOWNSTREAM EL

NT



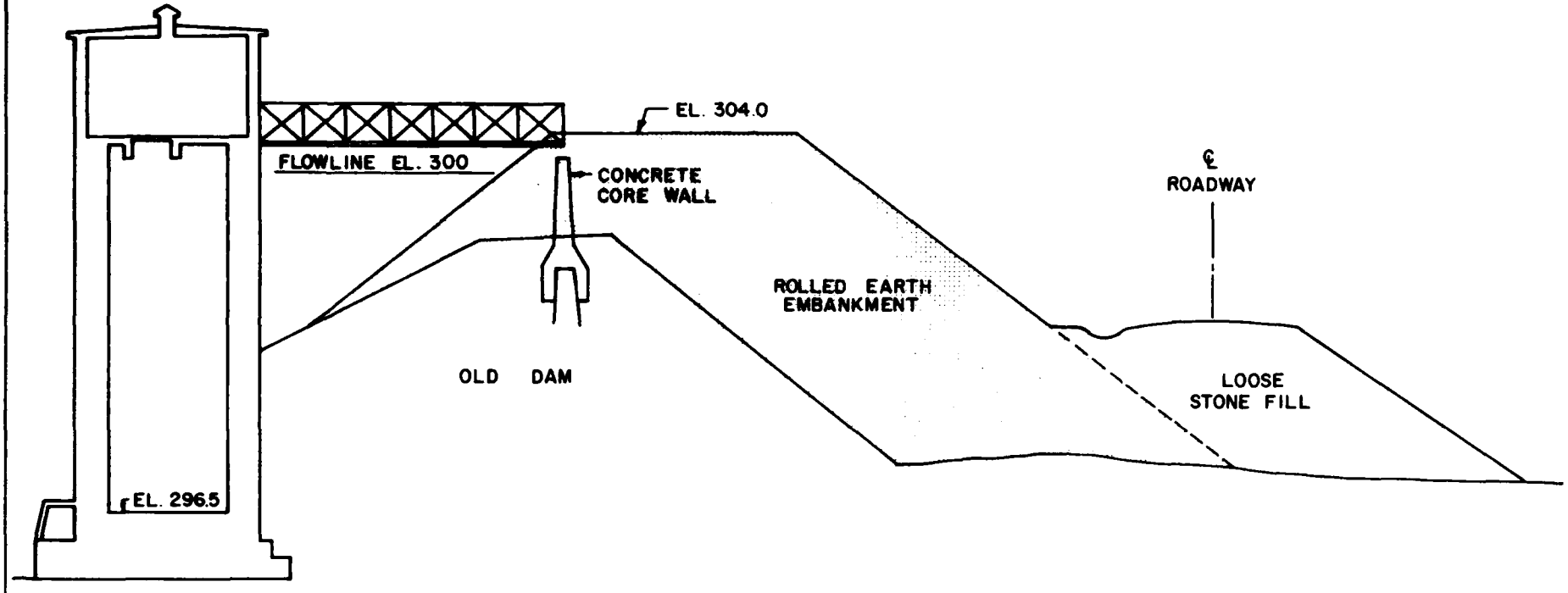
PLAN
NTS



AM ELEVATION OF DAM
NTS

PUTNAM RESERVOIR DAM
HORSENECK BROOK

II



SECTION OF DAM AND GATE HOUSE

NTS

PUTNAM RESERVOIR DAM

HORSENECK BROOK

APPENDIX VI

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY | MO | YR
CT	41	NED	CT	001	04				PUTNAM RESERVOIR DAM	4104.3	7338.4	18AUG78

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT
PUTNAM LAKE	PUTNAM RESERVOIR

(16) REGION	(17) BASIN	(18) RIVER OR STREAM	(19) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(20) DIST FROM DAM (MI.)	(21) POPULATION
01	07	HORSENECK BROOK	GREENWICH	4	60100

(22) TYPE OF DAM	(23) YEAR COMPLETED	(24) PURPOSES	(25) STRUCTURAL HEIGHT (FT.)	(26) HYDRAULIC HEIGHT (FT.)	(27) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	(27) IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPG	1910	S	39	37	1715	1400	NED	N	N	N	N	16AUG78

(28) REMARKS

(29) O/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	640	U	50	1560	43000											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
CONN AMER WATERWORKS CO		

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(50) INSPECTION BY	(51) INSPECTION DATE DAY | MO | YR	(52) AUTHORITY FOR INSPECTION
FLAHERTY-GIAVARA, ASSOC, PC	14JUN78	PL 92 367

(53) REMARKS

END

FILMED

8

DTIC