AD-A154 494 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS CLEVELAND BROOK RESER..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV JUN 79 1/2

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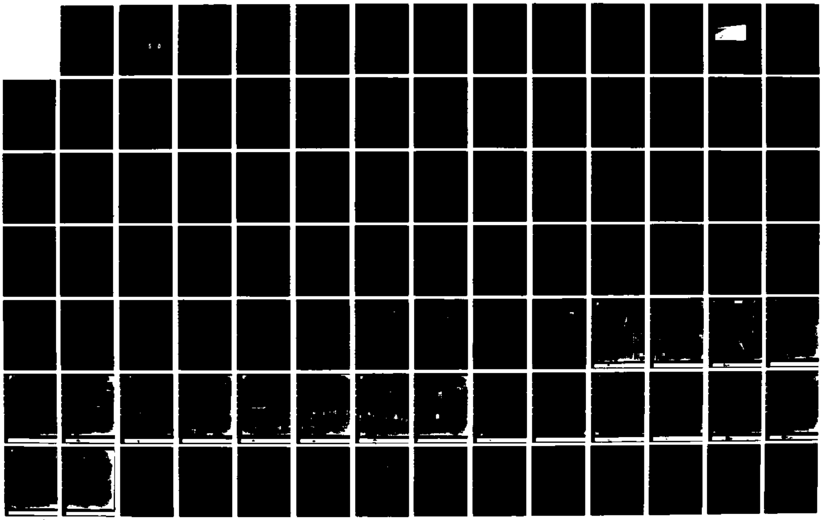

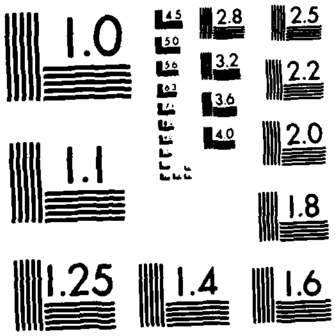

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AD-A154 494

HOUSATONIC RIVER BASIN
HINSDALE, MASSACHUSETTS

CLEVELAND BROOK RESERVOIR DAM
MA 00225

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

JUNE 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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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,

Housatonic River Basin — Cleveland Brook

Hinsdale, Massachusetts

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

The facility at Cleveland Brook Reservoir includes a 1,650 foot long earth dam approximately 71 feet high and 1140 feet of earth dikes, including a 80 foot long concrete spillway. The dam is considered to be in fair condition. It is classified as being intermediate in size and high in potential hazard. Investigations are recommended to determine the significance of the seepage.

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

NEDED

OCT 11 1979

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

Inclosed is a copy of the Cleveland Brook 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 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 Pittsfield, City Hall, Pittsfield, Massachusetts 01202.

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,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

CLEVELAND BROOK RESERVOIR
MA 00225

HOUSATONIC RIVER BASIN
HINSDALE, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No. : MA 00225
Name of Dam: CLEVELAND BROOK RESERVOIR DAM
Town: HINSDALE
County and State: BERKSHIRE, MA
Stream: CLEVELAND BROOK
Date of Inspection: 1 MAY 1979

BRIEF ASSESSMENT

The facility at Cleveland Brook Reservoir includes a 1,650 foot long earth dam approximately 71 feet high and 1140 feet of earth dikes, including a 80 foot long concrete spillway. Dike A is approximately 17 feet high and is perpendicular to the dam's right abutment. The earth embankments on each side of the concrete spillway, which are located approximately 1700 feet southeast of Dike A, are known as Dike B and Dike C. A portion of the crest of Dike B is depressed for 135 feet in length to form an overflow spillway. The crest elevation of the remaining portion of Dike B and all of Dike C is 1 foot lower than both the main dam and Dike A. Intakes are present at the gatehouse on the main dam for water supply to the City of Pittsfield. A reservoir drain is present beneath the main dam, but this structure has not been maintained. A blowoff pipe from the 30-in. water transmission main presently serves as a reservoir drain. The facility was originally constructed in 1949 to provide water to the City of Pittsfield. The dam was raised in height a total of 5 feet in 1963.

The dam is considered in fair condition due to observed seepage at the main dam, as well as at Dikes B and C. A 1977 report by the firm of Metcalf and Eddy is available on the seepage observed at the right abutment of the main dam. No prior investigations are known of the seepage at other locations.

Based on the size classification, intermediate, and hazard classification, high, in accordance with Corps of Engineers Guidelines, the spillway test flood is the Probable Maximum Flood (PMF). Hydraulic analysis indicates that the spillways can pass the routed test flood outflow of 2,200 cfs with approximately 0.65 feet of freeboard remaining with respect to Dikes B and C. The combined discharge capacity of both the main and overflow spillways was estimated to be 6,480 cfs with the water surface at the top of dam.

Investigations are recommended to determine the signifigance of the seepage observed along the toe of the main dam and downstream from Dikes B and C and to continue the monitoring of the piezometers and implement remedial measures for control of the seepage at the right abutment of the main dam. Remedial measures recommended for this facility include the continued mowing of slopes, the filling of animal burrows, the repair of the protective casing at piezometer B-4, the removal of weed growth from spillway concrete joints, removal of debris from spillway apron, repair of deteriorated concrete at the reservoir drain, the clearing of debris from the invert of the reservoir drain, the cleaning and painting of the reservoir drain flap valve, the placing of stones at the end of the access bridge to the gatehouse, the removal of soil and vegetation from the top of the blowoff structure and the cleaning of the blowoff structure outlet channel. The Owner should develop a formal maintenance program, operational procedure, emergency preparedness plan, and institute a program of annual technical inspections. The remedial measures and recommendations should be performed within one year of receipt of this report by the Owner.

CAMP DRESSER & McKEE INC.

Roger H. Wood

Roger H. Wood
Vice President

COMMONWEALTH OF MASSACHUSETTS
ROGER
H.
WOOD
No. 12757
REGISTERED
PROFESSIONAL ENGINEER

This Phase I Inspection Report on Cleveland Brook 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.

Joseph W. Finegan

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

Joseph A. McElroy

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

Carney M. Terzian

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

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

ıis report is prepared under guidance contained in the Recommended Guide-
ines for Safety Inspection of Dams, for Phase I Investigations. Copies of
ıese guidelines may be obtained from the Office of Chief of Engineers,
ıshington, D.C. 20314. The purpose of a Phase I Investigation is to
lentify expeditiously those dams which may pose hazards to human life or
·operty. The assessment of the general condition of the dam is based upon
ailable data and visual inspections. Detailed investigation, and analyses
ıvolving topographic mapping, subsurface investigations, testing, and de-
ıiled computational evaluations are beyond the scope of a Phase I Investi-
ıtion; however, the investigation is intended to identify any need for such
udies.

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

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

ıase I Investigations are not intended to provide detailed hydrologic and
draulic analyses. In accordance with the established Guidelines, the test
ood is based on the estimated "probable maximum flood" for the region
ȷreatest reasonably possible storm runoff), or a fraction thereof. Because
the magnitude and rarity of such a storm event, a finding that a spillway
11 not pass the test flood should not be interpreted as necessarily pos-
ıg a highly inadequate condition. The test flood provides a measure of
elative spillway capacity and serves as an aide in determining the need for
ore detailed hydrologic and hydraulic studies, considering the size of the
ım, its general condition and the downstream damage potential.

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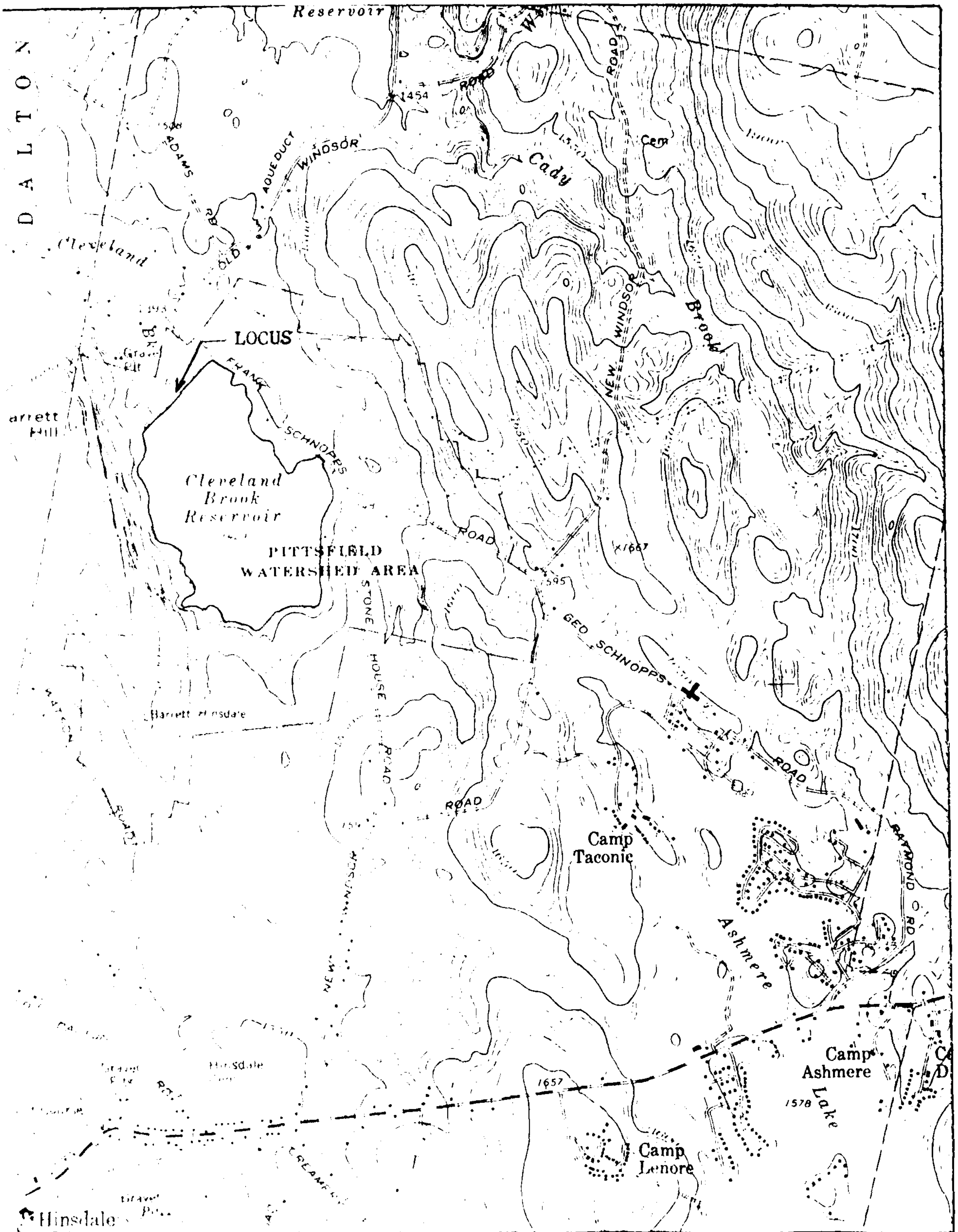
APPENDIXES

1. OVERVIEW OF DAM FROM RIGHT ABUTMENT.



CLEVELAND BROOK RESERVOIR IDENTIFICATION NO. MA 00225		LOCATION MAP USGS QUADRANGLE PERU, MASS APPROX. SCALE: 1" = 2000'

The gatehouse, spillway, reservoir drain structure and blowoff structure are in generally good condition. Minor items requiring attention were present at most of these structures. Seepage was noted around the concrete walls of the spillway and reservoir drain outlet structure. However, the flow at these locations appear to be seepage associated with the dikes and main dam rather than with the structures themselves.

d. Reservoir Area - The reservoir is surrounded by moderately sloping, heavily forested hills. There is no development within the watershed of the reservoir. There was no observed potential for major slope failure into the reservoir which could result in in waves that might overtop the dam or dikes. No conditions were noted which could cause a sudden increase in sediment load into the reservoir. There have been no apparent alterations to the surface of the watershed which could extensively effect the runoff characteristics as they existed during the design of the facility.

e. Downstream Channel - The channel immediately downstream of the spillway is a flat, grassed waterway flowing to a drop inlet about 50 feet from the spillway. The spillway outflow enters the drop inlet and is carried under Frank Schnopps Brook via two 18-in. culverts. The culvert capacity is normally exceeded during the spring runoff season and the road is frequently overtopped. Beyond Frank Schnopps Road the downstream channel proceeds through an undeveloped swampy area to a culvert under Old Windsor Road before joining Cleveland Brook which originates at the downstream toe of the reservoir's main dam. The main dam is about 2,000 ft upstream of the confluence of Cleveland Brook and Schnopps Brook. Cleveland Brook follows a steep grade through a slightly developed area to a flat area better known as the Wachonah Country Club where it joins the East Branch of the Housatonic River. The Wachonah Regional High School is located in this flat area on the left bank of the river. The channel proceeds to Center Pond, through the middle of the Town of Dalton, and then through a series of mill dams to a gravel pit and railroad yard area on the east side of the City of Pittsfield. It then flows through the City of Pittsfield before joining with the West Branch of the Housatonic River to become the Housatonic River. The Housatonic River meanders through the southeastern portions of Pittsfield before entering the Town of Lenox. There is moderate to high density development along the river banks through the Town of Dalton and the City of Pittsfield.

3.2 Evaluation

The present performance of the main dam and dike embankments appears to be generally satisfactory. However, because of seepage conditions observed at the Main Dam and at Dikes B and C, the overall condition of the project can be considered only fair. No conditions requiring urgent remedial action were observed.

The observed seepage conditions at the Main Dam and at Dikes B and C are not considered serious at this time. However, changes in the quality or pattern of seepage could indicate the development of problems within the embankments.

2. The crest of each dike has a mowed grass cover as shown in Photo No. 19. The crest elevation appears to be up to about 0.5 ft. below the top of the spillway training walls.

3. The downstream slope of the non-overflow portion of Dike B is grass and weed covered. No evidence of sloughing or other instability was noted. The area below the overflow section is broad, flat and mostly grass covered. There are some bare spots and slight rutting on the downstream slope.

4. The downstream face of Dike C has a mowed grass cover. No evidence of sloughing or other instability was observed.

5. Seepage was noted at the toe of Dike B, at the contact with the left spillway training wall as shown in Photo No. 17. Slight flow was evident but no evidence of soil particle movement was discernible. The area below the spillway was wet and soft.

6. Seepage was observed along both sides of the road below Dike C. Slight flow was noted but no evidence of soil particle movement was observed. A portion of this seepage may originate within the right abutment area.

The main spillway shown in Photos 16 and 18 is in very good condition. Some minor weed growth was observed in the concrete joints, minor debris is present on the spillway apron and minor cracking was noted at some of the construction joints. The downstream channel appears to be overgrown with many young trees as shown in Photo 19. However, the growth does not appear to be a significant obstruction to flow at this time.

The intake gatehouse (control tower) as shown in Photos 8 and 9 appears to be in very good condition. The only deficiency noted was that the approach to the service bridge at the dam end is low as shown in Photo 8.

The reservoir drain outlet structure shown in Photo 5 is in fair condition. The base slab contains debris, which may prevent the flap valve from operating. The top of the right concrete wall has started to deteriorate. Moss growth is present at the top of the concrete head wall. The flap valve is rusted. A flow of water was noted to be exiting from behind both side walls. The downstream channel is overgrown with marsh grass and some young trees.

The chamber containing the manually operated blowoff valve downstream of the dam, as shown in Photo 10, was not accessible for inspection. The top slab is covered with leaves, soil and minor vegetation. The outlet pipe from the blowoff shown in Photo 11 has its invert silted in. The outlet channel from the blowoff contains fallen branches.

6. Seepage which apparently exits from the toe drains was noted near the drain outlet structure shown in Photo 5 and in the low area below the gatehouse. Both areas were wet and marshy below the toe, within 50 to 100 ft. of the base of the slope. Flow was evident but no indication of soil profile movement was observed.

7. Seepage was also evident at the embankment contact with the right abutment, at the level of the berm, as shown in Photo 7. Seepage flow at this location was estimated to be approximately 1 to 2 gpm. No evidence of soil particle movement was observed. The seepage condition at this location has been investigated by Metcalf & Eddy. The seepage observed on 1 May 1979 appeared to be similar to the condition described by Metcalf & Eddy in a report dated 28 December 1976. The protective casing at piezometer B-4 is broken.

c. Appurtenant Structures - The condition of the appurtenant structures are as follows:

Dike A appears to be in good condition, based on the visual observations outlined in the following remarks:

1. The visible portion of the upstream face has riprap wave protection consisting of cobbles to 5 ft. pieces, extending to the crest as shown in Photo No. 12. There are a few weeds growing in the riprap. Otherwise, the riprap appears sound and in stable condition.

2. The crest is an asphalt-paved roadway, with grass and weed covered shoulders as shown in Photo No. 13. the pavement appears to be in good condition, except for minor cracking.

3. The downstream slope has a mowed grass and weed cover. No evidence of sloughing, erosion or other instability was observed.

4. There is a wet, soft area downstream of the toe along the right half of the embankment. The wet area is defined by the presence of thick brush and small trees. This wet zone extends downstream about 200 ft. to a swampy area where there is ponded water. No evidence of flow or movement of soil particles was discernible.

The performance of Dikes B and C appears to be generally satisfactory. However, because of the presence of downstream seepage, the overall condition can be considered only fair. The observed conditions at Dikes B and C area are outlined by the following remarks:

1. The visible portion of the upstream face of each dike and the overflow portion of Dike B have riprap wave protection consisting of cobbles to 5 ft. pieces as shown by Photos 14 and 19. There are a few weeds growing in the riprap but generally the stones appear to be sound and in stable arrangement.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General - The Phase I visual examination of Cleveland Brook Reservoir Dam was conducted on 1 May, 1979.

In general, the dam, dikes and spillway can only be considered in fair condition due to observed seepage at various locations. The reservoir level at the time of the site examination was at elevation 1436.9.

Visual inspection checklist for the site visits are included in Appendix A and selected photographs are given in Appendix C.

b. Dam - Visual observations indicate that the present performance of the Main Dam is, generally, satisfactory. However, because of seepage conditions observed at the right abutment, the overall condition of the dam can be considered only fair. The following remarks outline the observed condition of the Main Dam embankment.

1. The visible portion of the upstream slope has riprap consisting of cobbles to 5-ft. pieces extending to the crest as shown by Photo No. 3. Weeds were noted growing between the stones and a few stones were locally dislodged but generally the riprap appeared to be sound and in a stable arrangement.

2. The crest has a mowed grass cover and is slightly rutted as shown by Photo No. 2. There may be up to 0.5 ft. variation in crest elevation. The grassed portion of the crest is about 13 to 14 ft. wide.

3. The downstream slope, as shown in Photo No. 4, has a mowed grass cover with occasional cut weeds and stumps on the lower portion. There is some uncut brush on the rock toe, near the right end. Paved gutters along the berm are overgrown.

4. Two abandoned animal burrows were noted in the downstream slope. One was located just below the berm, near the gatehouse and one was about 300 ft. left of the gatehouse about 15 ft. below the crest. The latter hole was probed about 7 ft. horizontally into the embankment.

5. The lower portion of the downstream slope is somehwat irregular and varies an estimated 0.5 to 1.0 ft. from plane. However, no evidence of sloughing or other slope movement was discernible.

SECTION 2: ENGINEERING DATA

2.1 Design - Design records for this dam are available at the offices of Metcalf & Eddy, 50 Staniford Street, Boston, Ma. Record drawings of this facility are available at both the offices of Metcalf & Eddy and the Department of Public Works, Pittsfield, Massachusetts. The record drawings contain the subsurface exploration performed at the site prior to construction. Copies of pertinent data on this facility are included in Appendix B of this report.

2.2 Construction - Construction reports for this project are located at the offices of Metcalf & Eddy, 50 Staniford Street, Boston, MA.

2.3 Operation - No operation records other than the inspection reports on the facility and water level readings at the reservoir were located. The design engineer, Metcalf & Eddy, completed a detailed investigation of seepage occurring near the east abutment of the existing dam and submitted their report in December 1976.

2.4 Evaluation

a. Availability - Documents described above are available at the offices of Metcalf & Eddy, 50 Staniford Street, Boston, MA. A portion of these documents are on microfilm and require time to be made available. The original plans pertaining to the design and construction of the facility in 1948 are available at the Department of Public Works, Pittsfield, MA. The documents pertaining to the alteration to the dam and appurtenances which were done in 1963 are available at the offices of Metcalf & Eddy.

b. Validity - The record drawings for this project were in excellent agreement with the features observed in the field.

c. Adequacy - The available data, in combination with the visual inspection described in the following section, is adequate for the purposes of the Phase I investigation.

(8) Cutoff ---Trench filled with "select impervious material"---

(9) Grout Curtain ---------------None known---------------

h. Diversion and Regulating Tunnel ------------------------None

i. Spillways

Main Spillway

(1) Type-----------------Conc. broad crested weir w/provisions for flashboards

(2) Length of weir---------------------------------------80 ft

(3) Crest elevation------------------1435 (1437 w/flashboards)

(4) Gates--None

(5) U/S Channel------------------------Inv. El. 1425.7 (Level)

(6) D/S Channel---------------------------------Stilling basin

Overflow Spillway

(1) Type--------------------------earth embankment with riprap protection on 16 ft. wide crest

(2) Length of weir-------------------------------------135 ft.

(3) Crest Elevation--------------------------------------1439

j. Regulating Outlets - The 30-in. pipe reservoir drain is located at approximately the center of the drain. A reinforced concrete structure is located at the inlet end of the drain. The structure contains an inlet formed of concrete, a sluicegate at the upstream end of the pipe and the gate operator. The operating level for the valve is at elevation 1390 which is below the reservoir water level at the normal pond elevation. The inlet invert elevation is 1372. The reservoir drain discharges at the downstream toe of the dam through a flap valve into a reinforced concrete structure with concrete energy dissipators. The reservoir drain has not been maintained and since the gate operator is below the normal reservoir level, the facility is not considered to be operational. A blowoff pipe from the 30-in. water transmission main located approximately 450 feet from the downstream toe of the dam presently serves as the reservoir drain.

d. Reservoir Length (feet)

(1) Length of test flood pool------------------------------3550

(2) Length of Normal pool---------------------------------3440

(3) Length of flood control pool---------------------------N/A

e. Storage (acre-feet)

(1) Normal pool--4,928

(2) Flood control pool------------------------------------N/A

(3) Spillway crest pool with 2-ft of flashboards---------5,230

(4) Top of dam---6,022

(5) Test flood pool--------------------------------------5,741

f. Reservoir Surface (acres)

(1) Normal pool--151

(2) Flood-control pool------------------------------------N/A

(3) Spillway crest with 2-ft of flashboards---------------153

(4) Test flood pool--157

(5) Top of dam---162

g. Embankments

		Dam	Dike A	Dikes B & C
(1)	Type	-----------Earth embankment-----------		
(2)	Length	1650 ft	690 ft	415 ft
(3)	Height	71 ft max	17 ft max	11 ft max
(4)	Top width & elev.	17.5 ft at elev. 1442.0	22 ft at elev. 1442.0	8 ft at elev. 1441.0
(5)	Side slopes	7, 3 & 2:1 U/S 2.5 w/10 ft berm D/S	2:1	2:1
(6)	Zoning	Impervious core w/semi-impervious and pervious D/S zones	----Impervious core----- w/pervious D/S zone	

(7) Impervious Core-----central core of "select impervious material"------

a. Drainage Area - The drainage area consists of 1.5 square miles of heavily forested and predominantly mountainous terrain. About 6 percent of the drainage area is flat upland marsh and 16 percent of the drainage area is Cleveland Brook Reservoir itself.

b. Discharge at Dam Site - There are no records of discharges at the dam site.

(1) Outlet works size..........30-inch diameter at invert elevation 1372.

(2) Maximum known flood at damsite.....Unknown

(3) Ungated spillway capacity at top of dam (no flashboards) 4,850 cfs @ 1442 elev.

(4) Ungated spillway capacity at test flood elev. (with 2 ft. flashboards) 1,630 cfs @ 1440.35 elev.

(5) Overflow spillway capacity at top of dam 1910 cfs @ 1442 elev.

(6) Overflow spillway capacity at test flood elevation 570 cfs @ 1440.35 elev.

(7) Combined spillway capacity at test flood elev. (with 2 ft. flashboards) 2,200 cfs @ 1440.35 elev.

(8) Total project discharge at test flood elevation (with 2 ft. flashboards) 2,200 cfs @ 1440.35 elev.

c. Elevation (NGVD)

(1) Streambed at centerline of dam------------------------1371

(2) Test flood tailwater------------------------------ below elev. 1435

(3) Upstream portal invert diversion tunnel----------------N/A

(4) Normal pool--1435

(5) Full flood control pool-------------------------------- -N/A

(6) Spillway crest-----------------without flashboards---1435
with flashboards---1437

(7) Design surcharge (Original Design)------------------1438.7
(assume center 30-ft of flashboards collapsed (el. 1435), and remaining 50 ft. at el. 1437)

(8) Top of dam--1442

(9) Test flood design surcharge------------------------1440.35

h. Design and Construction History - The present Cleveland Brook Reservoir Dam was designed in 1948 by Metcalf & Eddy Engineers, Boston, Massachusetts and constructed by Tuller Construction Co. in 1949. A note on the record drawing titled Main Dam - West Section Plan states the following: "Sheeted cut-off trench back-filled with selected impervious material. Trench abandoned between Sta. 10+46 and Sta. 11+76 because of flowing sand. Effective cut-off made at 160 ft (-) upstream from centerline of dam". In a letter dated February 10, 1949 from the design engineer to the Berkshire County Engineer, a copy of which is included in Appendix B, the following statement is made: "A previous formation of sand and gravel encountered under the upstream cutoff west of the brook has made it seem advisable to deepen the cutoff excavation to a depth of some 20 ft. below the brook level for a short distance west of the brook. It is expected that the work on this cutoff will proceed as soon as weather is favorable. In the west abutment, the Contractor has elected to use open cut excavation in lieu of the sheeted trench contemplated by the Contract drawings, and this will be carried somewhat deeper than originally planned to reach satisfactory impervious material."

In 1963, the firm of Metcalf & Eddy designed a modification to the facilities to increase the reservoir height 5 feet. Shortly thereafter, the dam, dikes and spillway were raised accordingly. Due to observed seepage near the right abutment in the Winter of 1975, the same firm investigated the condition and prepared a report for the City of Pittsfield in 1977.

i. Normal Operational Procedures - There are no formal operational procedures currently in effect for this facility. The dam is operated as a water supply dam according to the need for water in the City of Pittsfield. It appears to be well maintained and there appears to be dialogue about the dam between the City and design engineers on an as need basis.

1.3 Pertinent Data - The elevation for the reservoir shown on USGS Quadrangle Peru, Mass., 1973 is elevation 1429. The spillway crest elevation prior to raising the dam was elevation 1430. It is not known whether the USGS Quadrangle shows the reservoir outline for the spillway crest prior to 1966 in which case there is a 1 foot differential or the reservoir outline after 1966 in which case the differential between the contract plans and the Quadrangle Sheet would be 6 feet. All elevations shown in this report, therefore, are based on the elevations shown on the record plans for the dam, dikes and spillway which are assumed to be on NGVD (National Geodetic Vertical Datum).

feet below normal dike crest. The crest width in the overflow section is 16 feet and protected by riprap placed on bank run gravel. The upstream and downstream slopes are also protected by riprap placed on washed stone and bank run gravel. The approach and discharge slope to the overflow section is 2 horizontal to 1 vertical, and is in the same plane as the non-overflow portions of the dike.

The two dikes, Dike B and C, are separated by a reinforced concrete spillway. The spillway has a weir length of 80 feet and a crest elevation of 1435.0. There are provisions for placing stoplogs to elevation 1437. The concrete weir and sidewalls of the spillway are gravity sections. The approach channel has an impervious soil blanket invert protected by 6 inches of bank run gravel. Immediately in front of the weir, rock ballast has been placed on approximately a 1 to 1 slope. Immediately downstream of the weir, the invert of the channel is a reinforced concrete slab abutting up against the former spillway weir for the reservoir. The former weir has a crest elevation of 1430 and serves somewhat as an energy dissipator. The concrete apron of the former weir extends down the channel another 12 feet from the old weir.

c. Size Classification - The hydraulic height of the dam is approximately 70 feet and the estimated total storage capacity at the top of the dam is 6,022 acre-feet. According to guidelines established by the Corps of Engineers, the dam is classified in the intermediate category based on both the storage capacity and the height of dam.

d. Hazard Classification - The results of the dam failure analysis indicates a high potential for loss of life and property. The flood wave would pass through moderate to high density development areas in the Town of Dalton and the City of Pittsfield. Scores of residential homes, industrial and commercial buildings, and at least one high school would be affected. Over ten roadway bridges and about 7 mill dams would be overtopped. Consequently, the dam is in the "high" hazard classification.

e. Ownership - The dam is owned by the City of Pittsfield, Massachusetts. The Owner is represented by Mr. Gerald Doyle, Commissioner of Public Works, 70 Alden Street, City Hall, Pittsfield, MA 01201 (Phone: 413/499-1100).

f. Operator - Mr. Alfonso Yovis, Superintendent of Water Department is assigned responsibility for operation of the dam. His address is Water Department, City of Pittsfield, 235 Tyler Street, Pittsfield, MA 01201 (Phone: 413/443-6112).

g. Purpose of the Dam - Cleveland Brook Reservoir is part of the water supply system for the City of Pittsfield, Massachusetts.

formed by a piece of 24-inch cast iron pipe through the control tower walls. Reinforced concrete structures with 2-inch cast iron pipe screens in front form the inlets to the 30-inch pipe intakes. The 24-inch cast iron pipe intake is protected with a piece of cast iron grading. The intake invert elevations are 1385, 1400 and 1415. The gate structure or control tower is divided into 2 chambers by a reinforced concrete wall. Three openings protected by screens, each 5 feet 4 inches high and 3 feet 6 inches wide penetrate the concrete dividing wall. The invert elevation for the openings is elevation 1385. The 30-inch water transmission main leading from the downstream chamber is gated within the control tower. The floor stands for the gate valves are manually operated and located on the operating floor within the control tower at elevation 1438. A bridge from the crest of the dam provides access to the control tower. The 30-inch water supply transmission main has a blowoff approximately 450 feet from the downstream toe of the dam. The 30-inch transmission main is also valved just downstream of the blowoff pipe.

Dike A has a maximum height of approximately 17 feet and a crest width of 22 feet. A paved roadway goes over the crest of the dike. The upstream and downstream slopes are 1 vertical to 2 horizontal. The upstream face of the dike is protected by riprap placed on washed stone. The downstream face of the dike is loamed and seeded. The core of the dike is constructed of impervious material with pervious material at the downstream toe. A cutoff trench filled with impervious material to a point 6 feet below the normal foundation of the dam is present at or near the center of the dike.

A 78-inch RCP diversion conduit, which may provide additional flow into the reservoir from Cady Brook and the East Branch of the Housatonic River, passes under Dike A and outlets into Cleveland Brook Reservoir. A reinforced concrete energy dissipator structure, having an invert elevation of 1408.0, forms the transition between conduit and reservoir. The structure is located approximately 70 feet into the reservoir from the toe of Dike A. Flow regulation is accomplished at the diversion structures located on Cady Brook (inv. elev. 1471.0) and at the East Branch of the Housatonic River (inv. elev. 1471.5). No means of flow regulation is present at Cleveland Brook Reservoir.

Dikes B and C at the spillway structure have a maximum height of approximately 11 feet. Dike C and the non-overflow portions of Dike B have a crest width of 8 feet and side slopes of 1 vertical to 2 horizontal. The upstream portion of these dikes are protected by riprap placed on washed stone and bank run gravel. The crest and downstream faces of the dikes are loamed and seeded. The core of the dikes are constructed of impervious material with a small area of pervious material at the downstream toe. A cutoff of select impervious material extending approximately 3 feet below the normal foundation of the dike is present at the centerline. Dike B, the most northerly of the two dikes, has a 135 foot long overflow section. The crest elevation of the overflow section is elevation 1439, which is 2

b. Description of Dam and Appurtenances - The impoundment structures at Cleveland Brook Reservoir include a 1,650 foot long earth dam, an adjacent 690 foot long earth dike (Dike A) and a 415 foot long earth dike and spillway complex. The water supply intakes, the water supply gate structure and the reservoir drain are located at the main dam. A diversion conduit passes under Dike A and discharges into Cleveland Brook Reservoir near the dike's upstream face. The earth embankments on each side of the 80 foot long concrete spillway are known as Dike B and Dike C. A portion of Dike B is depressed for 135 feet in length to form an overflow spillway.

The main dam is a zoned earth embankment with a maximum height of 71 feet and a crest width of 17-1/2 feet. The upstream slope varies with a 1 vertical to 7 horizontal slope below elevation 1390, 1 vertical to 3 horizontal below elevation 1420 and 1 vertical to 2 horizontal below the crest of the dam at elevation 1442. The slope of the downstream face of the dam is 1 vertical to 2-1/2 horizontal with a 10-foot berm approximately at mid-height of the dam. The upstream face of the dam is protected with riprap bedded on washed stone in the upper regions and bank run gravel in the lower regions, all founded on a selected impervious blanket. The crest of the dam and the downstream face of the dam is loamed and seeded. The main core of the dam is of impervious material with a semi-impervious material and impervious material towards the downstream base. Selected pervious material is utilized as a toe drain for the dam. A cutoff trench of selected impervious material was placed along the upstream toe of the dam and at the higher portions of the dam an additional cutoff trench of selected impervious material was placed near the center of the dam.

A reservoir drain passes under the dam at approximately the center of the dam. The drain is a 30-inch pipe with concrete seep collars. A reinforced concrete structure is located at the inlet end of the drain. The structure contains an inlet formed of concrete, a sluicegate at the upstream end of the pipe and a manual gate operator. The operating level for the valve is at elevation 1390 which is below the reservoir water level at the normal pond elevation. The inlet invert elevation is 1372. The reservoir drain discharges at the downstream toe of the dam through a flap valve into a reinforced concrete structure with concrete energy dissipators.

A 30-inch water supply transmission main passes under the dam at approximately 1/3 of the distance in from the right abutment to a 15-foot internal diameter gate structure or control tower. There are three intakes to the structure. The two lower intakes are 30 inch diameter cast iron pipes while the upper intake is

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

CLEVELAND BROOK RESERVOIR DAM
MA 00225

SECION 1: PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, 8 August 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.

Camp Dresser & McKee 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 was issued to Camp Dresser & McKee Inc. under a letter of 27 March 1979, from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-79-C-0053 has been assigned by the Corps of Engineers for this work. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc.for the soils and geological portions of the work.

b. Purpose - The primary purpose of the investigation is to:

(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) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location - Cleveland Brook Reservoir Dam is located on the south side of Frank Schnopps Road between Old Winsor Road and Stone House Road in the Town of Hinsdale, Massachusetts, as shown on the report's Location Map. The dam is at the headwaters of Cleveland Brook approximately 2 miles upstream of its confluence with the East Branch of the Housatonic River in Dalton, Massachusetts. The coordinates for the dam are 73 degrees-06.9 minutes longitude and 42 degrees-28.2 minutes latitude.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures - Although there is an informal routine for the operation of the dam, there is no written procedure.

4.2 Maintenance of Dam - It appears that there has been systematic maintenance of the dam and dike embankments.

4.3 Maintenance of Operating Facilities - The maintenance of the operating facilities is performed primarily on a demand basis. There is no written formal procedure established for the maintenance of the operating facilities. The operating facilities are primarily for the transmission of water to the City of Pittsfield and are operated as a part of performing this task. It was reported that the reservoir drain is not used on a regular basis and it is not maintained in operating condition. The center 30-ft. of the 80-ft. long by 2-ft high flashboards were designed to fail under an 0.5-ft. head.

4.4 Description of Any Warning System in Effect - There is no formal established warning system or emergency preparedness plan in effect for this structure.

4.5 Evaluation - Maintenance of the facility is being performed on an informal basis. The dam, dikes and spillway appear to have had systematic maintenance. It is recommended that a written maintenance procedure be compiled based on the maintenance work currently being performed in an informal manner. The maintenance procedure should include the maintenance of the reservoir drain. Formal operational procedures and warning systems and emergency preparedness plans should be established for the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General - The impoundment structures at Cleveland Brook Reservoir include a 1,650 foot long earth dam, a 690 foot long earth dike and a 415 foot long earth dike including an 80 foot long concrete spillway. The earth embankments on each side of the concrete spillway are known as Dike B and Dike C. The crest of Dike B is depressed (El. 1439) for 135 feet in length to form an overflow spillway. Crest elevation of Dike B and C is 1441 while the crest of Dike A and the main dam is at elevation 1442. The spillway crest is at elevation 1435 with no flashboards. Up to 2 feet of flashboards may be placed at the spillway.

Cleveland Brook Reservoir is located about at the headwaters of Cleveland Brook, approximately 2 miles upstream of its confluence with the East Branch of the Housatonic River. The reservoir serves as a water supply to the City of Pittsfield located about 7 miles downstream. Basically, the reservoir is a high-surcharge-low spillage project.

b. Design Data - Metcalf & Eddy Inc., 50 Stanford Street, Boston, Massachusetts designed Cleveland Brook Reservoir in 1948, as well as the subsequent modifications in 1963. Hydraulic and hydrologic design data for the reservoir is in storage and not readily available. Some hydraulic/hydrologic information was retrieved and is presented in Section 1.3 and in Appendix B. In addition, a complete set of plans for the project was obtained from the City of Pittsfield and selected drawings are included in Appendix B. According to the design data included in Appendix B-19 and B-20, the design flood peak inflow was 2,000 cfs.

c. Experience Data - No records of past floods are available for the dam site. Frank Schnopps Road, located about 90 feet downstream of the spillway, is normally flooded during the spring runoff.

d. Visual Observation - At the time of the inspection in 1 May 1979, there was 2 feet of flashboards in place at the spillway. Both the main spillway and the overflow spillway appeared in good hydraulic condition. It was noted that the twin 18-inch culverts under Frank Schnopps Road provide limited hydraulic capacity and major discharges would flow over the roadway.

e. Test Flood Analysis - Based upon the Corps of Engineers Guidelines, the recommended test flood for the size (intermediate) and hazard potential (high) is the the PMF (Probable Maximum Flood). The PMF was determined using the Corps of Engineers Guidelines for "Estimating Maximum Probable Discharges" in Phase I Dam Safety Investigations. The watershed terrain is generally "rolling" with a small marshy area in the southwest corner. The peak inflow rate for the 1.5 square mile watershed was determined to be 2,200 cfs/sq. mi. which yields a PMF inflow of about 3,350 cfs.

The evaluation of the effects of the test flood inflow is based on a spillway crest elevation of 1437. This assumes 2 feet of flashboards in place and corresponds to field conditions at the time of the inspection. Given this assumption, and the storage and spillway characteristics of the reservoir, the routed test flood outflow is about 2,200 cfs at a stage of 1440.35. The test flood overtops the overflow spillway by 1.35 feet with 1.65 feet of freeboard remaining with respect to the main dam and Dike A, and 0.65 feet of freeboard with respect to Dikes B and C. The depth of water above the flashboards is about 3.35 feet.

The immediate downstream channel has adequate capacity to carry the test flood without creating tailwater effects at the main and overflow spillways. Some flooding will occur at Frank Schnopps Road and at areas further downstream.

f. Dam Failure Analysis - Based on Corps of Engineers Guidelines for estimating Dam Failure Hydrographs, and assuming a failure would occur along 40 percent of the mid-height length of the dam structure (434 feet), the peak failure outflow is estimated to be about 427,000 cfs. As a result of a dam failure, Old Windsor Road would be over-topped by about 25 feet in the flatter reaches and about 20 feet in the steeper reaches. About twelve (12) dwellings would be affected along the reach where Cleveland Brook winds around Old Windsor Road to the Wahconah Country Club. Cleveland Brook joins the East Branch of the Housatonic River at the Wahconah Country Club. The depth of flow through the country club would be about 25 feet at the center-line of the channel. The Wahconah Regional High School and several dwellings on the left bank plus over forty (40) dwellings on the right bank would be affected. The water depth over the bridge on the road connecting Routes 8 and 9 just downstream of the country club would be in excess of 10 ft. The dam failure outflow would then flow through Center Pond affecting scores of dwellings on both sides of the channel the Town of Dalton affecting scores of dwellings on both sides of the channel banks. The dam at Center Pond, as well as the six (6) mill dams downstream, would be overtopped. Five mills, together with many homes and a sewage disposal area would be affected between Center Pond and Hubbard Avenue. In the reach between Hubbard Avenue and East Street, several industrial buildings and a few dwellings would be affected. The estimated water surface elevation at the Penn Central Railroad bridge, which is just upstream of East Street, would be about 994 feet but the bridge would not be overtopped.

Downstream of East Street the dam failure outflow would wind through the City of Pittsfield overtopping several bridges and affecting development on both banks of river before reaching a point beyond Holmes Road where no further hazard would be expected.

It is clear that the dam failure outflow resulting from the failure of the Cleveland Brook Reservoir Dam would create a high potential for loss of life and property. Accordingly, the dam is classified in the high hazard category.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations - There was no visible evidence of dam, dike or spillway instability during the site examination on 1 May, 1979. Seepage was observed at the downstream toe of the right abutment of the main dam and at dikes B and C. The condition at the first main dam was first reported late in 1975 and observed during the site examination. Based on the report on the seepage and obervations made during the visual examination, it is not considered to pose an immediate hazard to the stability of the downstream slope.

b. Design and Construction Data - The design drawings for the construction and later modification of Cleveland Brook Reservoir Dam, copies of which are included in Appendix B, show cross-sections for the dam and dikes that incorporate the various usual features of dam design. While construction data for this project has not been reviewed, the design configuration appears reasonable. Assuming that the dam was constructed in accordance with the drawings, using materials with satisfactory permeability and filter characteristics, it would be expected to be adequately stable under static loading conditions.

c. Operating Records - No records of embankment performance under prior maximum loading conditions are available. No instrumentation observations are available except for piezometer data obtained by Metcalf & Eddy in connection with their investigations of seepage at the right abutment of the Main Dam. These piezometer data, as reported by Metcalf & Eddy, do not indicate the need for urgent remedial measures with regard to stability of the Main Dam embankment.

d. Post-Construction Changes - The height of the dam, dikes B and C and the spillway were raised 5 feet in 1966. Dike A was raised 6 feet during the same modification. No other post-construction changes are known.

e. Seismic Stability - Cleveland Brook Reservoir Dam is located near the boundary between Seismic Zones 1 and 2 and in accordance with Recommended Phase I Guidelines does not warrant seismic analysis.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - The visual examination of the Cleveland Brook Reservoir Dam and dike embankments revealed no conditions which warrant urgent remedial action. However, because of seepage conditions observed at Main Dam and at Dikes B and C, the overall condition of the project can be considered only fair.

b. Adequacy of Information - The evaluation of the dam and dike embankments has been based primarily on the visual examination, consideration of available documents and past performance and application of engineering judgement. Generally, the information available or obtained was adequate for the purposes of the Phase I assessment. However, it is recommended that additional information relative to embankment seepage be obtained as outlined in Section 7.2.

c. Urgency - The recommendations for additional investigations and remedial measures, outlined in Sections 7.2 and 7.3, respectively, should be undertaken by the Owner within one year after receipt of this report.

d. Need for Additional Investigations - Additional investigations should be performed as outlined in Section 7.2.

7.2 Recommendations

It is recommended that the Owner arrange for the following investigations to be performed by a qualified registered professional engineer.

1. Evaluate the significance of the seepage conditions observed along the toe of the Main Dam and downstream from Dikes B and C. Consideration should be given to the effects of seepage conditions relative to long term embankment stability and an assessment of the need for remedial measures should be made.

2. Continue monitoring of piezometers installed near the right abutment of the Main Dam and implement remedial measures to control the seepage condition at that location.

The Owner should implement corrective measurse as required, based on the results of the above engineering evaluations.

7.3 Remedial Measures

a. Operation and Maintenance Procedures - It is recommended that the following remedial work be undertaken by the owner to correct deficiencies noted during the visual examination.

1. Continue to mow slopes at least once a year to permit visual inspection.

2. Animal burrows in the embankments should be filled. An annual inspection should be made to check for burrowing activity and corrective action should be taken as required.

3. Seepage conditions should be visually monitored on a regular basis at least until an assessment of the need for remedial measures is completed.

4. Repair protective casing at piezometer B-4.

5. Remove weed growth from concrete joints at the main spillway and remove debris from spillway apron.

6. Repair deteriorated concrete, clean debris from the base slab and clean and paint the flap valve at the reservoir drain outlet structure. Check the outlet valve to ensure it is operational.

7. Place stone at the dam end of the access bridge to the gatehouse to bring approach to walkway grade.

8. Remove soil and vegetation from the top of the blowoff structure and clean the outlet channel.

9. Develop a formal maintenance program, operational procedure, emergency preparedness plan and warning system in cooperation with downstream communities.

10. Institute a program of annual technical inspections.

7.4 Alternatives

There are no practical alternatives recommended.

APPENDIX A

INSPECTION TEAM ORGANIZATION AND CHECK LIST

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM

DATE: 1 MAY 1979

TIME: 1345

WEATHER: Broken Clouds - 65° F 10 to 15 mph wind

WATER SURFACE ELEVATION UPSTREAM: 2' of flashboards in place - water is one inch below top of flashboards

STREAM FLOW: No Flow

INSPECTION PARTY:

1. Roger H. Wood, CDM
2. Joseph E. Downing, CDM
3. John Critchfield, H&A
4. Douglas G. Gifford, H&A
5.

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Spillway and Gatehouse	Roger H. Wood	
2. Embankments	Douglas G. Gifford	
3.		
4.		

PRESENT DURING INSPECTION:

1. John Razzano - Pittsfield Water Dept.
2.
3.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM DATE: 1 MAY 1979
EMBANKMENT: DAM BY: DGG & JWC

CHECK LIST	CONDITION
1. Upstream Slope	1.
a. Vegetation	a. Few weeds growing in riprap.
b. Sloughing or Erosion	b. None observed.
c. Rock Slope Protection - Riprap Failures	c. Riprap (cobbles to 5 ft. pieces) to crest. Generally good condition, a few stones locally dislodged.
d. Animal Burrows	d. None.
2. Crest	2.
a. Vegetation	a. Grass, mowed.
b. Sloughing or Erosion	b. Slightly rutted.
c. Surface Cracks	c. None observed.
d. Movement or Settlement	d. Crest elevation varies up to ± 0.5 ft. (est.).
3. Downstream Slope	3.
a. Vegetation	a. Grass, mowed on upper portion. Lower portion has grass, weeds (cut) with occasional stump cut flush, up to 8 in. dia. Some brush on rock toe near right end. Paved gutters overgrown.
b. Sloughing or Erosion	b. Slope surface is irregular (est. 0.5 to 1.0 ft. variation from plane), esp. lower portion. No apparent sloughing.
c. Surface Cracks	c. None observed.
d. Animal Burrows	d. Two abandoned burrows noted. One just below berm, below gatehouse, one about 300 ft. left of gatehouse and about 15 ft. below crest. The later hole about 7 ft. into slope.
e. Movement or Cracking near toe	e. None observed.
f. Unusual Embankment or Downstream Seepage	f. Seepage from toe drain exits in area of drain outlet structure and in low area below gatehouse. Both areas wet and marshy, within 50 to 100 ft. of toe. Flow evident but no apparent soil movement. Seepage also emerging at embankment contact with right abutment, at level of berm. Seepage flowing along contact at toe at 1-2 gpm. No apparent soil movement.
g. Piping or Boils	g. None observed.
h. Foundation Drainage Features	
i. Toe Drains	
4. General	
a. Lateral Movement	
b. Vertical Alignment	
c. Horizontal Alignment	
d. Condition at Abutments and at Structures	
e. Indications of Movement of Structural Items	
f. Trespassing	
g. Instrumentation Systems	

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM — DATE: 1 MAY 1979

EMBANKMENT: DIKE A — BY: DGG & JWC

CHECK LIST	CONDITION
1. Upstream Slope	1.
a. Vegetation	a. Weeds growing in riprap.
b. Sloughing or Erosion	b. None observed.
c. Rock Slope Protection - Riprap Failures	c. Riprap to crest, cobbles to 5 ft. pieces, good condition.
d. Animal Burrows	d. None observed.
2. Crest	2.
a. Vegetation	a. Paved road 22 ft. wide, grass and weeds along edges.
b. Sloughing or Erosion	b. None observed.
c. Surface Cracks	c. Occasional cracks in asphalt pavement.
d. Movement or Settlement	d. None observed.
3. Downstream Slope	3.
a. Vegetation	a. Grass & weeds, mowed.
b. Sloughing or Erosion	b. None observed.
c. Surface Cracks	c. None observed.
d. Animal Burrows	d. None observed.
e. Movement or Cracking near toe	e. None observed.
f. Unusual Embankment or Downstream Seepage	f. Area extending D/S from right half of embankment is wet and soft. No evidence of flow or soil movement. Wet area extends about 200 ft. D/S to swampy area, where water is ponded.
g. Piping or Boils	g. None observed.
h. Foundation Drainage Features	h., i. None known.
i. Toe Drains	
4. General	4.
a. Lateral Movement	a. None observed.
b. Vertical Alignment	b. Good. Crest approx. 5.0 ft. above water.
c. Horizontal Alignment	c. Dike curved. Crest width approx. 25 ft. D/S slope approx. 2H to 1V.
d. Condition at Abutments and at Structures	d. Good.
e. Indications of Movement of Structural Items	e. None observed.
f. Trespassing	f. Minor.
g. Instrumentation Systems	g. None known.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM — DATE: 1 MAY 1979

EMBANKMENT: DIKE AT SPILLWAY (DIKES B & C) — BY: DGG & JWC

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows	1. a. Grass mowed. b. None observed. c. Riprap from cobble size to 3 ft. extends to crest level. d. None observed.
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface Cracks d. Movement or Settlement	2. a. Grass, mowed, central 3.0 ft. at dike B utilized as emergency spillway; riprap from cobble size to 3 ft. placed on spillway area. b., c., d. None observed.
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface Cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. Grass mowed. b., c., e., e. None observed. f. Subgrade of roadway below dike C saturated; source could be combination of seepage beneath dike C and runoff from marshy high ground beyond roadway. Some seepage at downstream toe at left training wall at dike B; no soil particle movement observed. g. None observed. h., i. None known.
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	4. a. None observed. b. Dike B crest 3.2 ft. above water level; emergency spillway top of riprap 2.0 $\pm$ ft. above water level; overtopping flow would begin 1.0 $\pm$ ft. below top of riprap. c. Consistent with design; no displacement noted. d. Good. e. None observed. f. Minor; tire tracks in grassed area downstream of emergency spillway. g. None observed.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM — DATE: 1 MAY 1979

SPILLWAY: MAIN — BY: R. WOOD

CHECK LIST	CONDITION
1. Approach Channel	1.
a. General Condition	a. Excellent.
b. Obstructions	b. None
c. Log Boom etc.	c. None
2. Weir	2.
a. Flashboards	a. 2' of flashboards in place good condition.
b. Weir Elev. Control (Gate)	b. None except flashboards.
c. Vegetation	c. Minor (grass in joints).
d. Seepage or Efflorescence	d. Surface wet - none observed.
e. Rust or Stains	e. Surface wet - none observed.
f. Cracks	f. Surface wet - none observed.
g. Condition of Joints	g. Generally good see also c.
h. Spalls, Voids Or Erosion	h. Laitance flaking off several locations.
i. Visible Reinforcement	i. None observed.
j. General Struct. Condition	j. Very good.
3. Discharge Channel	3.
a. Apron	a. Concrete apron - much grass in joints, some rocks on apron.
b. Stilling Basin	b. Concrete sill, few spalls left side - appears to be from vandals with rocks.
c. Channel Floor	c. Immeidate channel well grassed to road.
d. Vegetation	d. See c.
e. Seepage	e. Not observable.
f. Obstructions	f. Channel downstream of road overgrown many young trees.
g. General Struct. Condition	g. Spillway itself and drop inlet in good condition.
4. Walls	4.
a. Wall Location ________	a. Side Walls
(1) Vegetation	(1) None observed.
(2) Seepage or Efflorescence	(2) Seepage at junction of new & old concrete (at face). Seepage from behind or just below D/S end of walls.
(3) Rust or Stains	(3) None observed.
(4) Cracks	(4) Shrinkage cracks & surface crazing right wall.
(5) Condition of Joints	(5) Construction joints cracking.
(6) Spalls, Voids or Erosion	(6) None observed.
(7) Visible Reinforcement	(7) None observed.
(8) General Struct. Condition	(8) Good.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

AM: CLEVELAND BROOK RESERVOIR DAM — DATE 1 MAY 1979

UTLET WORKS: BLOW OFF — BY: R. WOOD

HECK LIST	CONDITION
. Inlet a. Obstructions b. Channel c. Structure d. Screens e. Stop Logs f. Gates	1. See control tower.
. Control Facility a. Structure b. Screens c. Stop Logs d. Gates e. Conduit f. Seepage or Leaks	2. a. Valve vaults - concrete moss covered. b. N/A c. N/A d. Valves not operated recently. e. Buried, not observable. f. None observed.
3. Outlet a. Structure b. Erosion or Cavitation c. Obstructions d. Seepage or Leaks	3. a. Concrete in good condition moss covered. b. None observed. c. Invert silted, branches in outlet channel. d. None observed.
4. Mechanical and Electrical a. Crane Hoist b. Hydraulic System c. Service Power d. Emergency Power e. Lighting f. Lightning Protection	4. Gates manually operated. a. - f. Not applicable.
5. Other	

12. Remarks & Recommendations: [Fully Explain]

Mr. L. Newbill, J. Pierce, and A. Gerlach, from the Pittsfield Water Department were present at the inspection.

The dam appears to be in good condition. There is no settlement in the embankment or sloughing on the slopes. The top of the dam and the down stream slope are well mowed. There is a fairly heavy brush growth on the lower level near the toe, but is of minor concern.

The spillway is in good condition, at the present time there are 24" of flash boards in place. There is no evidence of cracks, spalling, or seepage.

The Pittsfield Water Department is doing a good job in checking and maintaining this dam.

13. Overall Condition:

1. Safe ____X____________.
2. Minor repairs needed________________________
3. Conditionally safe - major repairs needed______________.
4. Unsafe________________.
5. Reservoir impoundment no longer exists [explain]

   Recommend removal from inspection list______________.

8. Downstream Face of Dam: Condition: 1. Good X . 2. Minor Repairs___. 3. Major Repairs___ 4. Urgent Repairs___.

Comments:____.

9. Emergency Spillway: Condition: 1. Good____. 2. Minor Repairs_____. 3. Major Repairs___ 4. Urgent Repairs____.

Comments:____.

10. Water level @ time of inspection: 8 . ft. above____. below x .

top of dam________.

principal spillway x ________.

other____________________.

11. Summary of Deficiencies Noted:

Growth [Trees and Brush] on Embankment X .

Animal Burrows and Washouts____________________.

Damage to slopes or top of dam____________________.

Cracked or Damaged Masonry____________________.

Evidence of Seepage____________________.

Evidence of Piping____________________.

Erosion____________________.

Leaks____________________.

Trash and/or debris impeding flow____________________.

Clogged or blocked spillway____________________.

Other____________________.

L-103

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town HINSDALE. Dam No. 1-2-132-4.

Name of Dam Cleveland Reservoir. Inspected by: R D Jordan.

Date of Inspection 9-28-72.

2. Prev. Inspection X.

Owner/s: per: Assessors ______.

Reg. of Deeds ______. Pers. Contact ______.

	Name	St. & No.	City/Town	State	Tel. No.
1.	City of Pittsfield	City Hall	Pittsfield, MA		499-1100
2.					
3.					

3. Caretaker [if any] e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name	St. & No.	City/Town	State	Tel. No.
Louis Newbill	City Hall	Pittsfield, MA		499-1100

4. No. of Pictures taken 3.

5. Degree of Hazard: [if dam should fail completely]*

1. Minor ______. 2. Moderate ______.

3. Severe ______. 4. Disastrous X.

*This rating may change as land use changes [future development]

6. Outlet Control: Automatic ______. Manual X.

Operative X yes; ______ no.

Comments: ______

7. Upstream Face of Dam: Condition:

1. Good X. 2. Minor Repairs ______.

3. Major Repairs ______. 4. Urgent Repairs ______.

Comments: ______

Dam #11-4

INSPECTION OF DAMS

City or Town of Hinsdale Date June 11, 1971

Name of Dam Cleveland Reservoir Inspector R. Northrup & P. Fezzie

Owner City of Pittsfield Address City Hall, Pittsfield, Mass.

Caretaker City of Pittsfield Address City Hall, Pittsfield, Mass.

Location South of Frank Schnopps Road.

Type of Dimensions Earth fill 1600' long, 71' high. Road over top.

Spillway, type and size Concrete 80' long, 5' freeboard.

Outlets, type and size 30" supply, 30" feed.

Flashboards, type and height 24" wood.

Date Built 1949 Condition Good

When last repaired 1963 By whose orders Owners

Nature of Repairs Level raised 5' adding 350 MG to capacity.

Purpose of Dam Water supply.

Approximate storage of water 1.575 billion gallons.

Approximate area of water shed Small diversion area has 11 square miles.

Possible damage due to failure of dam Disastrous.

Remarks Water 8" below top of flashboards. Growth on toe of embankment. Small amount of seepage at isolated spots on toe of embankment. Unable to ascertain whether seepage or surface runoff causes these isolated wet spots.

Recommendations Check toe of embankment periodically for signs of serious seepage. Growth at toe is not serious and helps to prevent erosion.

COUNTY OF BERKSHIRE, MASS.
INSPECTION OF DAMS

City or Town of Hinddale Date 12, August 1966

Name of Dam Clevelend Inspector Louis J. Diamond

Owner City of Pittsfield Address 33 Pearl St. Tel
John Daniels Comm. P.W.
Caretaker Albert Goerlach Address Hinsdale, Mass. Tel

Location S.W. Cor. of Hinsdale.

Type and Dimensions Earth fill-1600' lg. 71' high. (66)

Spillway, type and size Conc. 80' lg- 5' freeboard.

Outlets, type and size 30" supply-30" feed.

Flashboards, type and height 24" wood.

Date Built 1948-49 Condition Good-Excellent

When last repaired 1963 By whose orders Owners

Nature of Repairs Raised level 5' - Added 350,000,000, gals to capacity.

Purpose of Dam Water supply-City of Pittsfield

Approximate storage of water 1,525,000,000 gals.

Approximate area of water shed Small-Diversion area has 11 sq. mi.

Possible damage due to failure of dam Disastrous

Remarks Water 12" belowlip of conc. spillway.

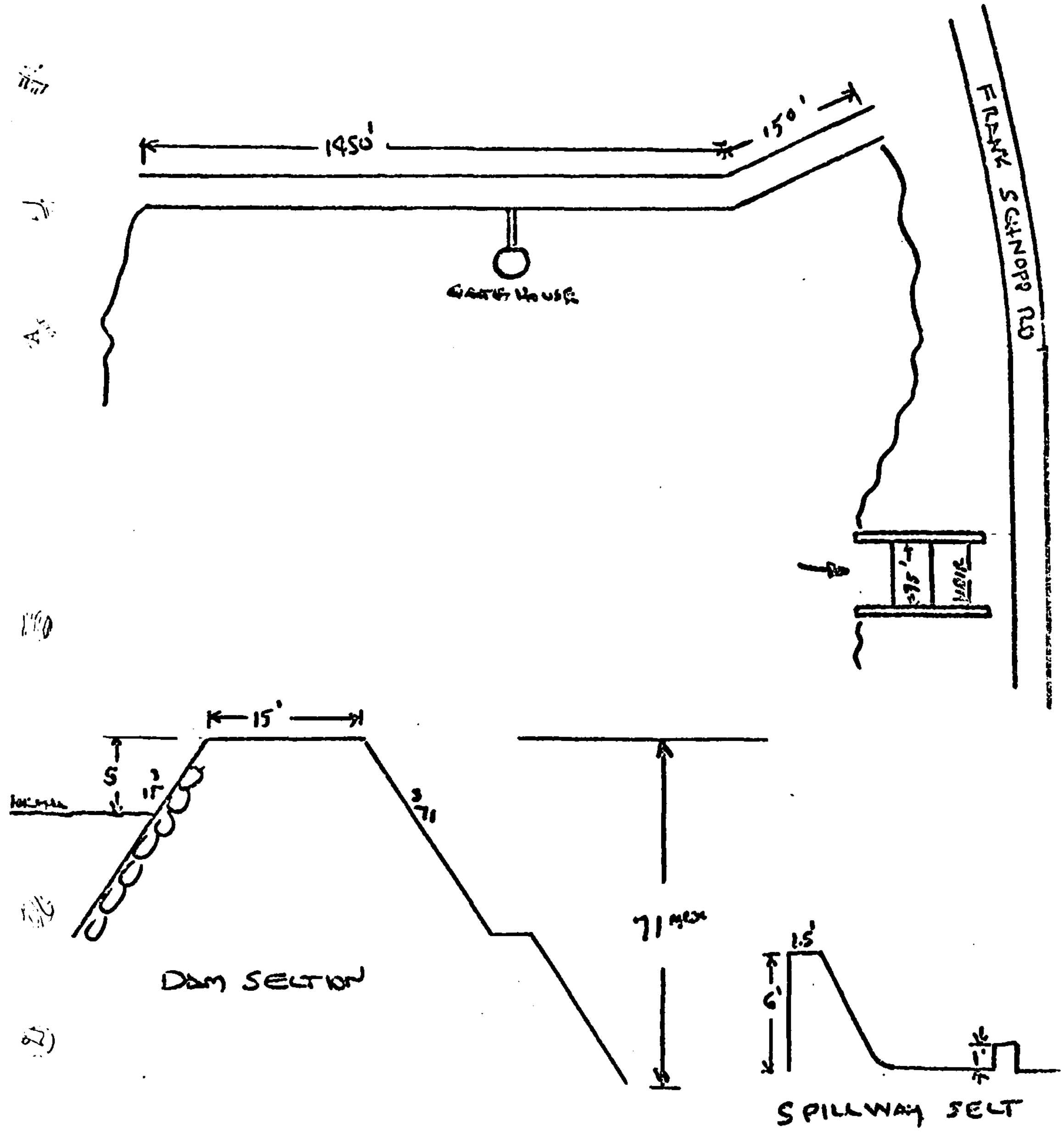
Recommendations Growth on top and slopes should be r oved.
R move growth developing in rip-rap near gatehouse.

APPENDIX B-6


Windsor
Reservoir
Cleveland
Brook
Reservoir
Camp
Taconic
Ashmere
Lake
Camp
Ashmere
Camp
Danbee
Camp
Lenore
SPILLWAY
ELEV 1578
Hinsdale
1393
1454

APPENDIX B-5

CLEVELAND RES.
1-2-132-4



APPENDIX B-4

L-169 A

DAM NO. 1-2-132-4.

10. Risk to life and property in event of complete failure.

No. of people 500+.

No. of homes 100±.

No. of Businesses 2.

No. of Industries 1. Type Papermaking.

No. of Utilities ______. Type ______.

Railroads ______.

Other dams Byron Weston.

Other Regional High School.

11. Attach Sketch of dam to this form showing section and plan on 8-1/2" x 11" sheet.

L-169

DESCRIPTION OF DAM

DISTRICT ONE

Submitted by R D Jordan

Dam No. 1-2-132-4

Date 7-28-72

City/Town HINSDALE

Name of Dam Cleveland Reservoir

1. Location: Topo Sheet No. 5-B

Provide 8-1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1949. Year/s of subsequent repairs 1963

3. Purpose of Dam: Water Supply X. Recreational ______.

Irrigation ______. Other ______.

4. Drainage Area: 11 sq. mi. ______ acres.

5. Normal Ponding Area: ______ Acres; Ave. Depth ______.

Impoundment: 1.575 Bill. gals; ______ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir - -

i.e. summer homes etc. ______

7. Dimensions of Dam: Length 1600'. Max. Height 71'.

Slopes: Upstream Face 3/1 earth, stone faced.

Downstream Face 3/1 earth.

Width across top 15'.

8. Classification of Dam by Material:

Earth X. Conc. Masonry ______. Stone Masonry ______.

Timber ______. Rockfill ______. Other ______.

9.
A. Description of present land usage downstream of dam: 50 %rural; 50 % urban.

B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure
Yes ______. No X.

APPENDIX B-2

LIST OF AVAILABLE DOCUMENTS
CLEVELAND BROOK RESERVOIR DAM

DOCUMENT	LOCATION
1. Original Cleveland Brook Reservoir Dam Construction Drawings (38 sheets) and Specifications, May 1948.	Metcalf & Eddy Engineers 50 Staniford Street, Boston, MA 02114 And City of Pittsfield, City Hall 70 Alden Street, Pittsfield, MA 01201
2. Drawings (5 sheets) for the Alterations to Cleveland Brook Reservoir Dam, January 1963	Metcalf & Eddy Engineers 50 Staniford Street, Boston, MA 02114 And City of Pittsfield, City Hall 70 Alden Street, Pittsfield, MA 01201
3. Report on Seepage at Cleveland Brook Reservoir Dam, December 1976	Metcalf & Eddy Engineers 50 Staniford Street, Boston, MA 02114 And City of Pittsfield, City Hall 70 Alden Street, Pittsfield, MA 01201

1973 REPORT ON SEEPAGE EXCERPTS

APPENDIX B

LIST OF AVAILABLE DOCUMENTS AND PRIOR INSPECTION REPORTS

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM DATE: 1 MAY 1979

SPECIAL STRUCTURE: DRAINAGE OUTLET STRUCTURE BY: R. WOOD

CHECK LIST	CONDITION
1. Outlet structure	1. a. Flap valve rusted and some debris present may prevent opening. b. Flow (slight) out of drain pipe in right wall. c. Flow along left toe of dam coming out from behind left wingwall. d. Flow coming out from behind right wing wall. e. Right wing wall has deteriorated top and exposed front face - much efflorescence. f. Moss at top of headwall. g. Left wall & energy disspaptors in good condition (concrete). h. Alge growth in channel between walls. i. Channel D/S overgrown with marsh grass with some young trees. Branch debris present.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM — DATE: 1 MAY 1979

CONTROL TOWER AND SERVICE BRIDGE: — BY: R. WOOD

CHECK LIST	CONDITION
1. Control Tower	1.
a. Seepage or Efflorescence	a. Slight on inside of brick.
b. Rust or Stains	b. None observed.
c. Cracks	c. None observed.
d. Condition of Joints	d. None observed.
e. Spalls, Voids or Erosion	e. None observed.
f. Visible Reinforcement	f. None observed.
g. General Struct. Condition	g. Roof excellent, walls & floor good Water to bot of operational floor; substructure not visible.
2. Service Bridge Superstructure	2.
a. Bearings and Anchor Bolts	a. Very good.
b. Longitudinal Members	b. Very good.
c. Transverse Members	c. Not observable.
d. Bracing	d. Not observable.
e. Underside of Deck	e. Not observable.
f. Deck	f. Not observable.
g. Expansion Joints	g.
h. Drainage System	h. None
i. Railings	i. Good.
j. Paint	j. Good.
3. Service Bridge Abut. & Piers	3.
a. Bridge Seat	a. Excellent.
b. Backwall	b. Excellent.
c. Abut. Alignment	c. Good.
d. Bridge Approach	d. Approach low.
e. General Struct. Condition	e. Excellent.
4. Equipment	4. Intake valve (3) are well maintained and operational. 1 outlet valve maintained and operational chain fall operational - Support beam in excellent condition. 2 lifting U bolts in good condition.

L-108

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: ~~City~~/Town HINSDALE . Dam No. 1-2-132-4 .

Name of Dam Cleveland Reservoir . Inspected by: RDJordan-PFFezzie.

Date of Inspection 1/29/74 .

2. Prev. Inspection X .

Owner/s: per: Assessors ________.

Reg. of Deeds ________. Pers. Contact ________.

	Name	St. & No.	City/Town	State	Tel. No.
1.	City of Pittsfield	City Hall	Pittsfield		499-1100
2.					
3.					

3. Caretaker [if any] e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name	St. & No.	City/Town	State	Tel. No.
Louis Newbill	City Hall	Pittsfield, MA		499-1100

4. No. of Pictures taken 4 .

5. Degree of Hazard: [if dam should fail completely]*

1. Minor ________. 2. Moderate ________.

3. Severe ________. 4. Disastrous X .

*This rating may change as land use changes [future development]

6. Outlet Control: Automatic ________. Manual x .

Operative x yes. ________ no.

Comments: ________

Upstream Face of Dam: Condition:

1. Good x . 2. Minor Repairs ____.

3. Major Repairs ____. 4. Urgent Repairs ____.

Comments: ________

APPENDIX B-11

8. Downstream Face of Dam: Condition: 1. Good X. 2. Minor Repairs___.
3. Major Repairs___ 4. Urgent Repairs___.

Comments:___

___

9. Emergency Spillway: Condition: 1. Good X. 2. Minor Repairs___.
3. Major Repairs___ 4. Urgent Repairs___.

Comments:___

___

___

10. Water level @ time of inspection: 7 ft. above___. below x.
top of dam___.
principal spillway x___.
other___.

11. Summary of Deficiencies Noted:

Growth [Trees and Brush] on Embankment x___.

Animal Burrows and Washouts___.

Damage to slopes or top of dam___.

Cracked or Damaged Masonry___.

Evidence of Seepage___.

Evidence of Piping___.

Erosion___.

Leaks___.

Trash and/or debris impeding flow___.

Clogged or blocked spillway___.

Other___.

12. Remarks & Recommendations: [Fully Explain]

This dam is well maintained and in very good condition. The concrete spillway is in good shape; no cracks or spalling was noted. The flashboards are in place, and appear to be sound.

There is some widely scattered brush growing through the upstream rock slope. It would be a very minor task to remove this growth. A fairly heavy growth of brush covers the lower downstream slope and toe. The Pittsfield Water Department has informed me that this will be removed during the summer of 1974. The toe of the dam is dry and stable. No wet or spongy areas were found.

In my opinion the dam is safe.

The description of this structure was submitted in 1972. There are no changes to be noted.

For location see Topo Sheet 5-B.

13. Overall Condition:

1. Safe_____ x _____.
2. Minor repairs needed__________
3. Conditionally safe - major repairs needed__________.
4. Unsafe__________.
5. Reservoir impoundment no longer exists [explain].
   Recommend removal from inspection list__________.

12. Remarks & Recommendations: (Fully Explain) Prev. Insp. date 1-29-74

SUPPLEMENTARY REPORT-CLEVELAND RESERVOIR DAM HINSDALE, MASS.

On Wednesday, November 5, 1975, I inspected the downstream slope of the dam to investigate reports of heavy seepage at the right abutment. Inspection of the abutment area verified the reports. Approximately five feet above the berm, an area of seepage exists that was observed in 1974. Free water (approx. 2 gpm) was flowing from the center of the spongy area. The flow was clear, no fines were being carried away, however, evidence of previous soil displacement was noted. Within a radius of three feet of the outfall the slope was very unstable. I could penetrate the slope 2' - 3' with a 1" sapling with very little effort.

Since the leak and seepage was not noted in the 1971, 72, and 74 Dept. inspection reports, I researched the County Engineer's records. No mention of this condition was contained in any report dating back to the construction of the dam.

The Pittsfield Water Dept. was notified and advised to take appropriate action. An engineering firm retained by the City, has been investigating the condition for several weeks.

Although the leak is probably nothing more than a spring originating at old ground adjacent to the abutment, the size and location of the structure warrant a full investigation.

I will forward to your office all future information I receive concerning this matter.

---

13. Overall Condition:

1. Safe________________________.
2. Minor repairs needed________________________.
3. Conditionally safe - major repairs needed____________.
4. Unsafe________________________.
5. Reservoir impoundment no longer exists (explain)

   Recommend removal from inspection list________________.

METCALF & EDDY
Engineers
Boston, Mass.

June 9, 1948
NC/d

Pittsfield, Mass.
Cleveland Brook Water Supply
Reservoir and Diversion Works
Design Data

Reservoir

Capacity	1500 million gallons
Surface Area	145 acres
Safe Yield	8 million gallons per day
Design Capacity of Supply Main from Reservoir	13.5 " " " "

Dam

Length	1600 feet
Maximum Height	66 "
" Width	530 "
Freeboard - Main Dam	7 "
Dike	6 ".
Water Surface	El. 1430
30" Drain Outlet	El. 1371
30" Supply Main Outlet	El. 1385

Spillway

Crest Length	80 feet
" Elevation	1430
Normal water level overflow	1429
Freeboard	5 feet
Design Depth	2.5 "
Design Flood Peak	2000 cubic feet per second

(equivalent to 980 cfs./sq.mi. plus 450 cfs. from diversion conduit)

Design Discharge Peak	900 cubic feet per second

Diversion Works

Conduit Capacity	430 cubic feet per second
Cady Brook Diversion	
Drainage Area	3.6 square miles
Overflow Spillway Length	60 feet
Capacity of Spillway	2100 cubic feet per second
	580 cfs./sq.mi.
East Branch Diversion	
Drainage Area	7.4 square miles
Overflow Spillway Length	70 feet
Capacity of Spillway	2800 cubic feet per second
	380 cfs./sq.mi.

FRANK A. MARSTON
JOHN P. WENTWORTH
HARRISON P. EDDY, JR.
ARTHUR L. SHAW
E. SHERMAN CHASE
FRANK L. FLOOD

ALMON L. FALES
CONSULTANT

METCALF & EDDY

ENGINEERS

STATLER BUILDING
BOSTON 16, MASS.

INVESTIGATIONS AND REPORTS
PLANS AND SPECIFICATIONS
SUPERVISION OF CONSTRUCTION
SUPERVISION OF OPERATION
MANAGEMENT VALUATIONS
LABORATORY FOR CHEMICAL
AND BIOLOGICAL ANALYSES

CABLE ADDRESS —"METEOD - BOSTON"

FILE

J-Pittsfield
Cleveland

February 10, 1949

Mr. Harry W. Heaphy
County Engineer
Berkshire County Court House
Pittsfield, Massachusetts

Dear Mr. Heaphy:

In order to keep you posted on the progress of the construction of Cleveland Brook dam in Hinsdale, there are two contemplated changes from the Contract Drawings which we believe you will be interested to know about.

A pervious formation of sand and gravel encountered under the upstream cutoff west of the brook has made it seem advisable to deepen the cutoff excavation to a depth of some 20 ft. below the brook level for a short distance west of the brook. It is expected that the work on this cutoff will proceed as soon as weather is favorable. In the west abutment, the Contractor has elected to use open cut excavation in lieu of the sheeted trench contemplated by the Contract drawings, and this will be carried somewhat deeper than originally planned to reach satisfactory impervious material.

It is anticipated that when weather conditions are favorable you will visit the job and our resident engineer will be glad to discuss all phases of the work with you.

Yours very truly,

METCALF & EDDY

By- Arthur L. Shaw
Arthur L. Shaw

NC/p

c/c to Mr. Whittlesey
Mr. Cannon

APPENDIX B-16

BOSTON • NEW YORK • PALO ALTO • PORT OF SPAIN

METCALF & EDDY

ENGINEERS

STATLER BUILDING
BOSTON 16 · MASSACHUSETTS

January 7, 1963

J - 5973

Mr. John Bradford
Chief Waterways Engineer
Division of Waterways
Mass. Dept. of Public Works
100 Nashua Street
Boston, Massachusetts

Dear Mr. Bradford:

We have been engaged by our client, the City of Pittsfield, Massachusetts, to prepare plans and specifications for raising the height of the City's Cleveland Brook water supply dam. The question is whether this project would require the approval of the Division of Waterways. We shall, of course, submit final plans and specifications to the Berkshire County Commissioners for approval.

The dam was constructed in 1949 on Cleveland Brook in the Town of Hinsdale about 2-1/2 miles north of Dalton. The dam consists of an earth embankment and one dike across Cleveland Brook. A low concrete spillway is located at a saddle in the easterly side of the reservoir basin about one-half mile southeasterly of the dam. The earth embankment has a maximum height of 66 ft. and a top width of 40 ft. The spillway is 1 ft. high and 80 ft. long with a depth of 5 ft. Stop logs 2 ft. high are on the crest of the spillway. The difference in elevation between the top of the dam and the crest of the spillway is 7 ft.

The dike has been designed as a fuse plug to permit overflow should water level in the reservoir approach within one foot of the top of the dam. The tributary drainage area of the dam is 1.5 square miles.

INVESTIGATIONS • REPORTS • DESIGNS • SUPERVISION OF CONSTRUCTION • SUPERVISION OF OPERATION
MANAGEMENT • VALUATIONS • LABORATORIES • RESEARCH

BOSTON • NEW YORK • PALO ALTO • PORT OF SPAIN

METCALF & EDDY

ENGINEERS

Mr. John Bradford
January 7, 19[illegible]

We plan to raise the top of the dam [illegible] ft. in height. A new spillway crest will be constructed 5 ft. [illegible] than the existing one. The new spillway section will be flanked by low earth dikes. One of these new dikes will be designed as an emergency overflow should the water in the reservoir approach within 2 ft. of the crest of the dam. The existing dike will be raised to the elevation of the new crest of the dam. The crest of the spillway will be provided with 2 ft. high flashboards. The center 30 ft. of these boards will be designed to collapse with water 0.5 ft. over the top of the boards.

Since we plan to advertise for bids in the very near future, it would be appreciated if the approval of the Division of Waterways of this project, if required, could be furnished us at the earliest possible date.

If you should require additional information, please contact us.

Very truly yours,

METCALF & EDDY

Walter [illegible]
Project Engineer

GET:mj

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MANAGEMENT • VALUATIONS • LABORATORIES • RESEARCH

METCALF & EDDY
ENGINEERS

STATLER BUILDING
BOSTON 16 · MASSACHUSETTS

January 14, 1963

PRINCIPAL DESIGN DATA
FOR
ALTERATIONS TO CLEVELAND BROOK DAM

Reservoir

Drainage area, sq. mi.	1.5
Area of water surface (Top of existing flashboards El. 1432) acres	137
Area of water surface (Top of new flashboards El 1437) acres	160
Capacity (Below top of existing flashboards) mil. gals	1451
Capacity (Below top of new flashboards) mil. gals	1704

Dam

El. top of dam (existing)	1437
El. top of dam (raised)	1442
Increased height of dam., ft.	1445
Top width of dam (existing), ft.	40
Top width of dam (raised), ft.	17.5
Max. height of dam (existing), ft.	66
Max. height of dam (raised), ft.	71
Existing freeboard above flashboards (El. 1432), ft.	5
New freeboard above flashboards (El. 1437), ft.	5

Spillway

Length of spillway, ft.	80
El. top spillway crest (existing)	1430
El. top spillway crest (new)	1435
El. top flashboards (existing)	1432
El. top flashboards (new)	1437
El. top existing abutments	1435
El. top raised abutments	1441
Freeboard at abutments above top of flashboards (existing), ft.	3
Freeboard at abutments above top of flashboards (new), ft.	4

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Spillway (Cont'd)

El. water surface at design flood (existing flash-boards in place)	1438.3
El. water surface at design flood (new flash boards with center 30 ft. collapsed and remainder in place)	1436.7
Freeboard at design flood (existing flashboards in place), ft.	0.7
Freeboard at design flood (new flashboards with center 30 ft. collapsed and remainder in place) ft.	2.3
Design peak discharge at spillway, c.f.s.	900
Design flood peak inflow to reservoir, c.f.s.	2800

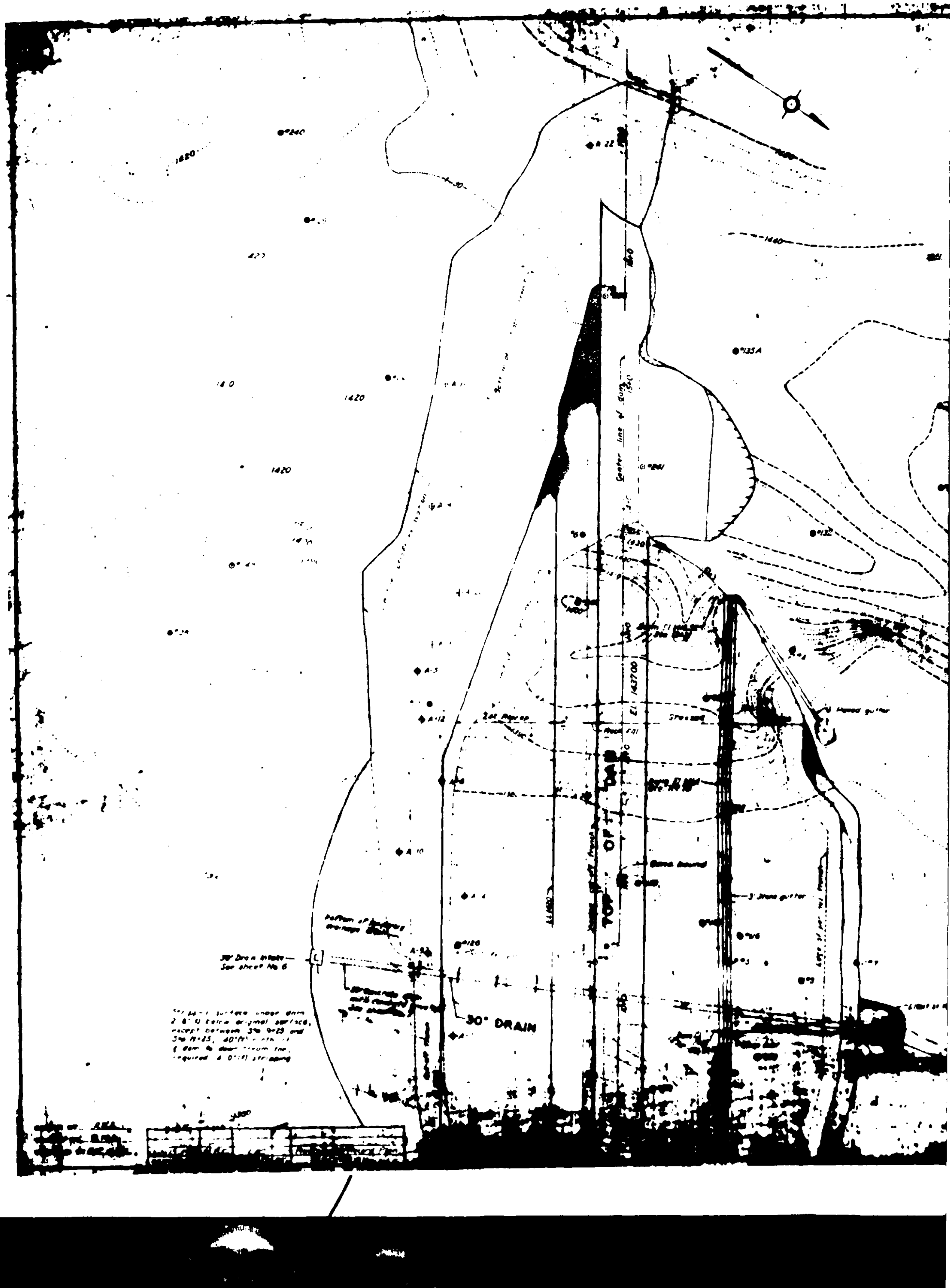
The design flood peak inflow to the reservoir is based on a run-off from the drainage area of 1800 c.f.s./sq. mi. or 1900 c.f.s. Added to this is the capacity of the diversion of approximately 900 c.f.s. from Cady and Windsor Brooks making a peak inflow to the reservoir of 2800 c.f.s.

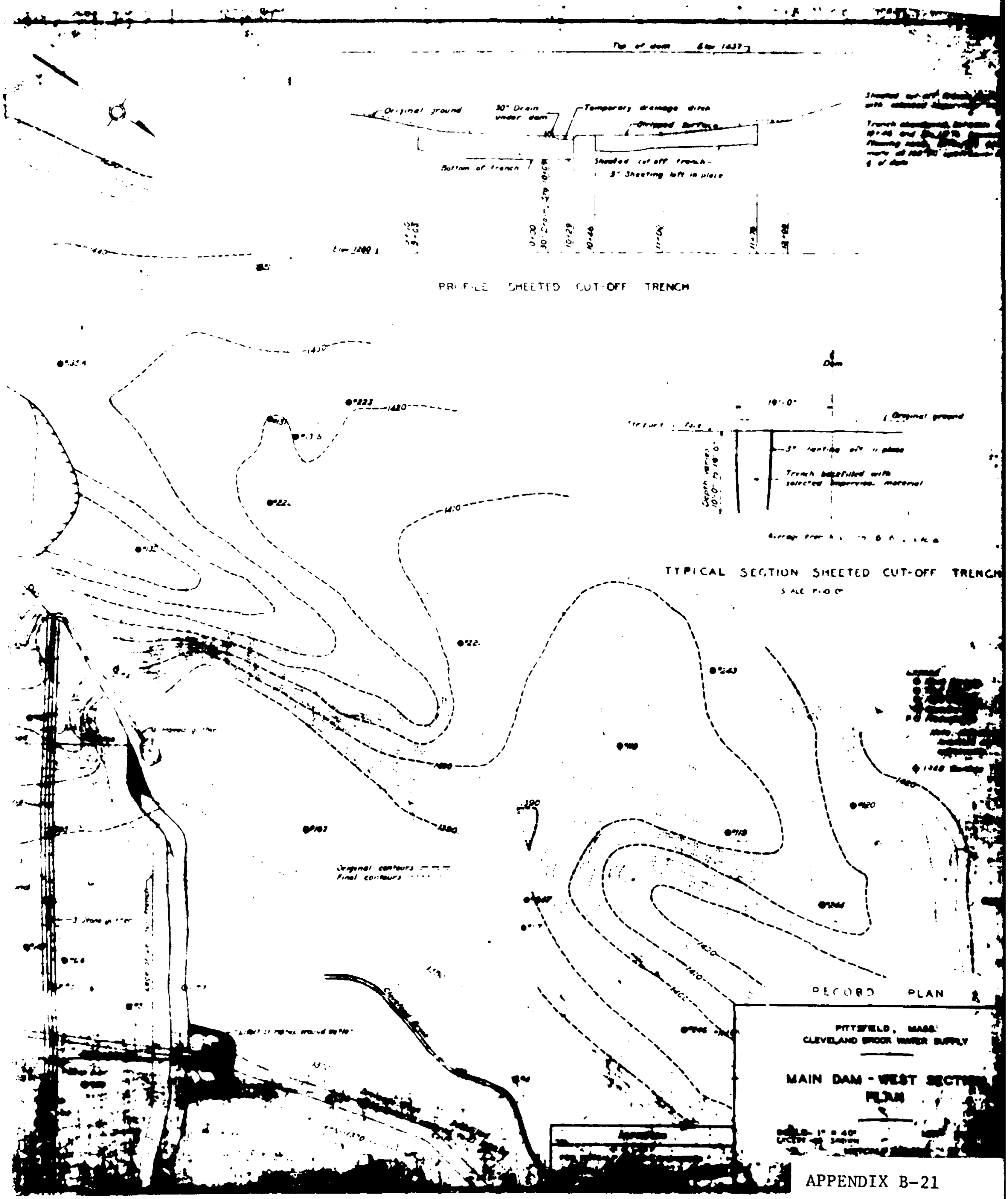
The design peak discharge at the spillway of 900 c.f.s. is a result of the peak inflow to the reservoir being modified by the storage capacity of the reservoir above the top of the flashboards.

Discharge over the spillway was determined by the following formula:

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

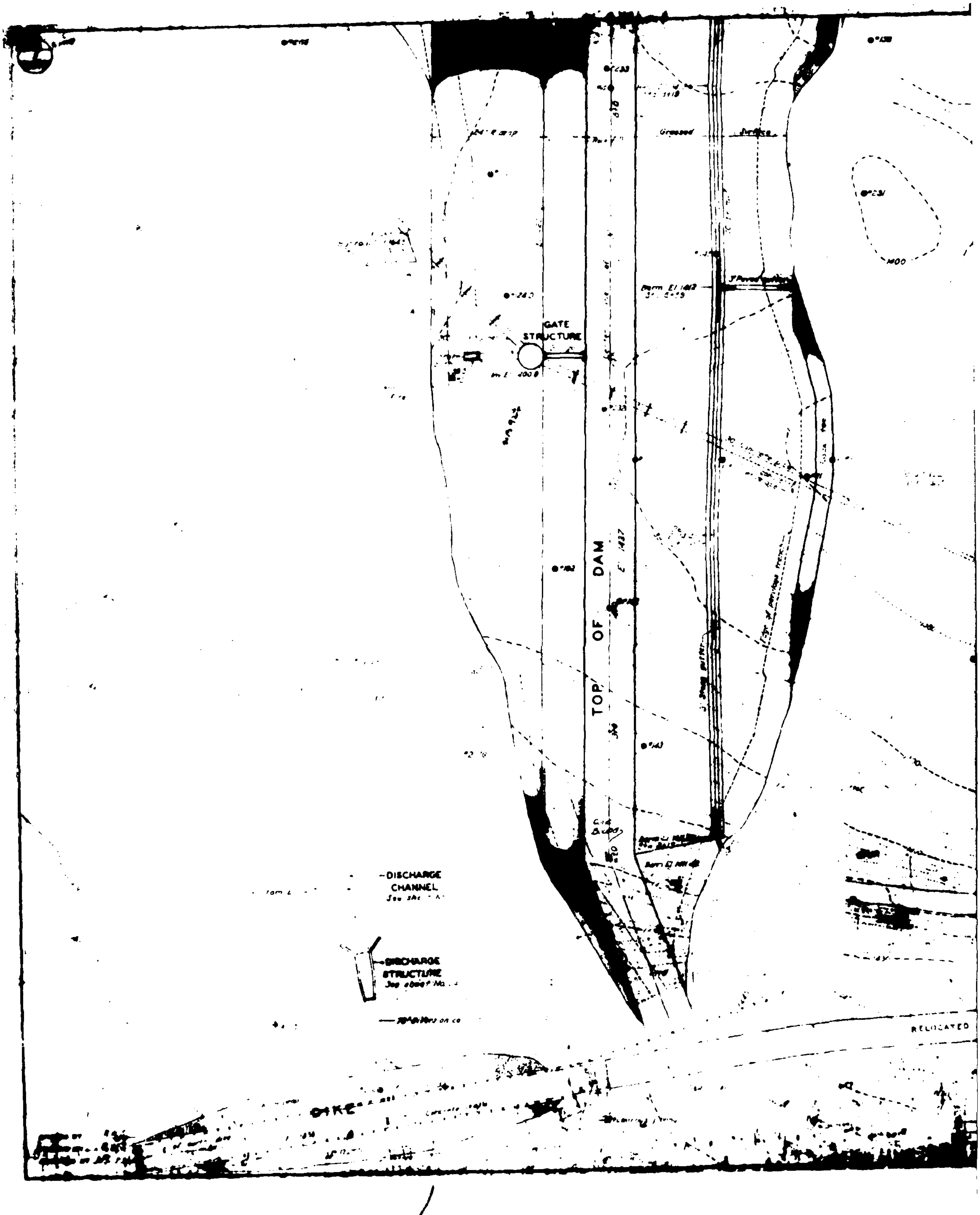
Where Q = Discharge over spillway, c.f.s.
C = Coefficient, 3.3 for flashboards vertical, 2.7 for flashboards horizontal
L = Length of weir section in feet
H = Head on weir in feet

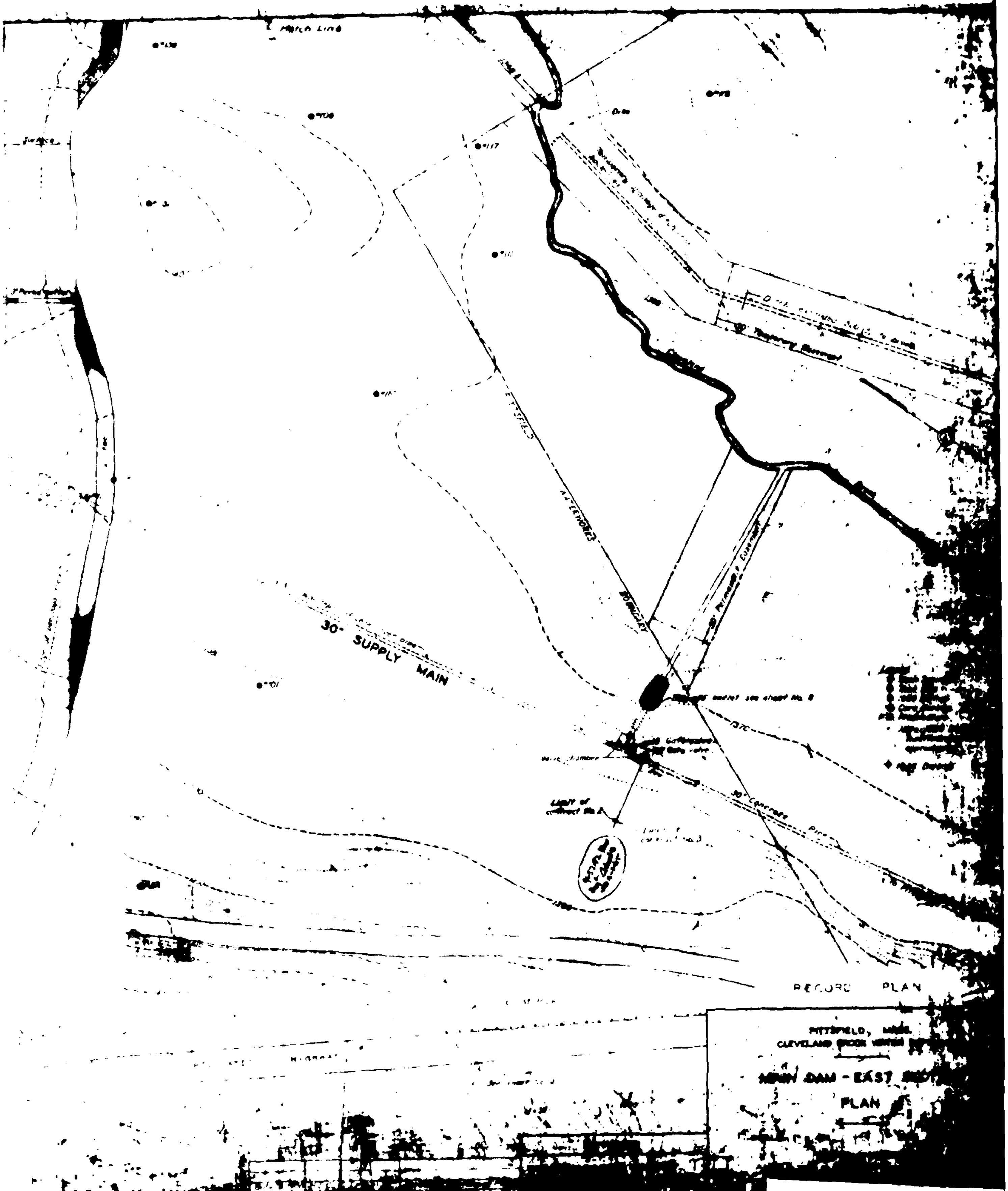

1420
1420
1460
Center line of dam
TOP OF DAM
30" DRAIN



APPENDIX B-21

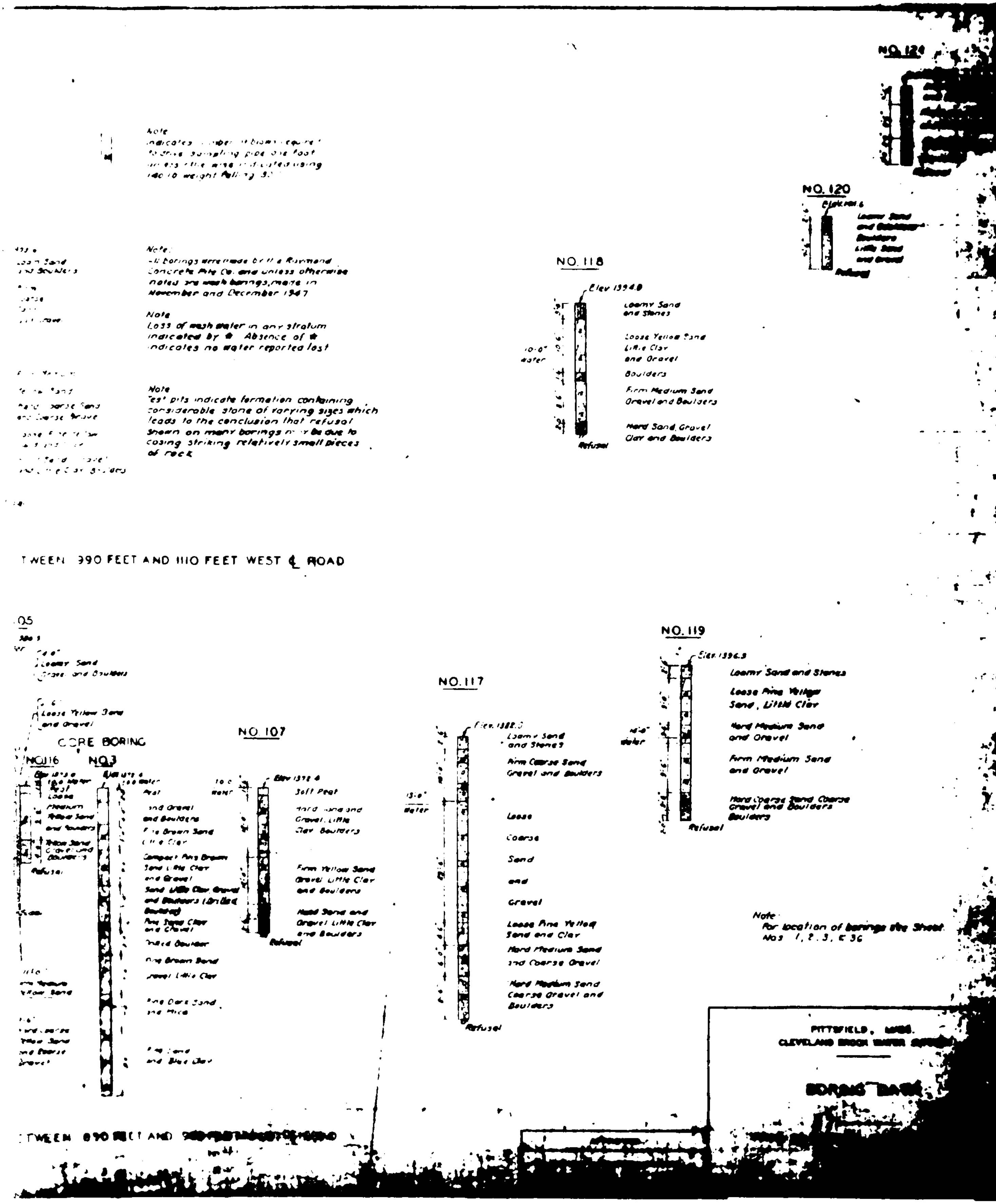
2


GATE
STRUCTURE
TOP OF DAM
DISCHARGE
CHANNEL
DISCHARGE
STRUCTURE
DIKE
RELOCATED

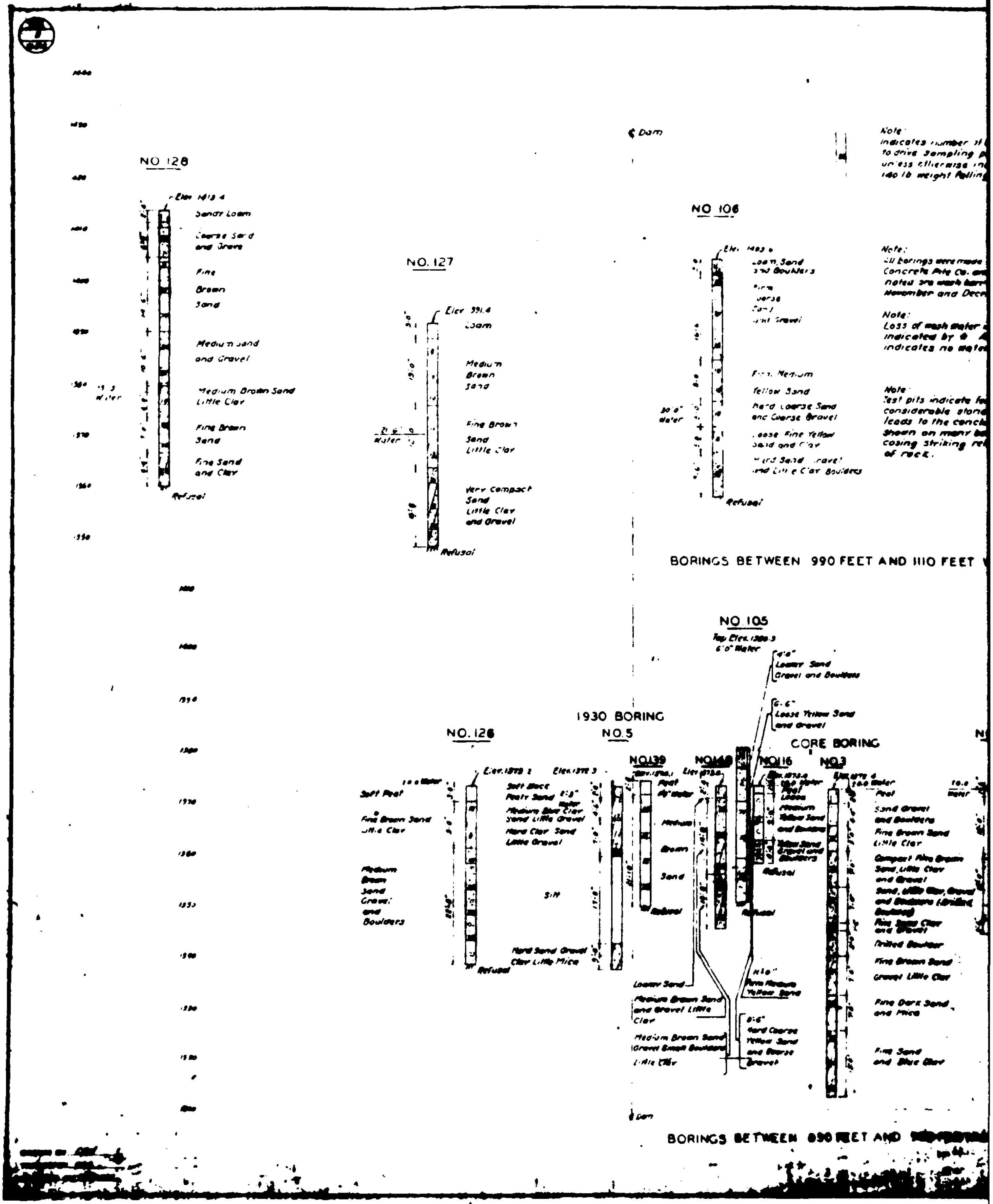


APPENDIX B-22

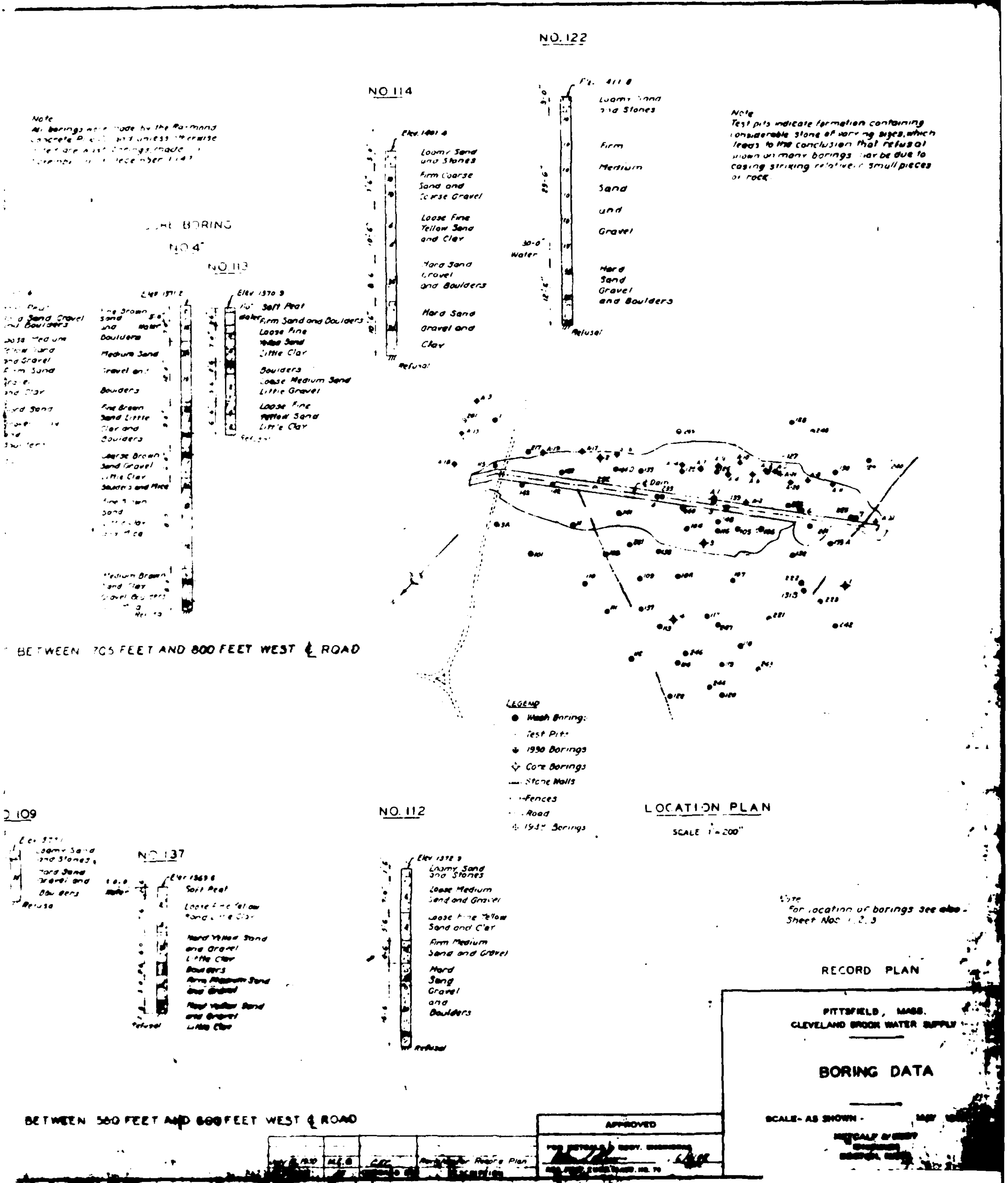
2


NO. 120
Loamy Sand
Boulders
Little Sand
and Gravel
Refusal
NO. 118
Elev 1394.8
Loamy Sand and Stones
Loose Yellow Sand Little Clay and Gravel
Boulders
Firm Medium Sand Gravel and Boulders
Hard Sand, Gravel Clay and Boulders
Refusal
10'-0" water
Note
All borings were made by the Raymond Concrete Pile Co. and unless otherwise noted are wash borings, made in November and December 1947
Note
Loss of wash water in any stratum indicated by ✱. Absence of ✱ indicates no water reported lost
Note
Test pits indicate formation containing considerable stone of varying sizes which leads to the conclusion that refusal shown on many borings may be due to casing striking relatively small pieces of rock
TWEEN 990 FEET AND 1110 FEET WEST ℄ ROAD
NO. 119
Elev 1396.3
Loamy Sand and Stones
Loose Fine Yellow Sand, Little Clay
Hard Medium Sand and Gravel
Firm Medium Sand and Gravel
Hard Coarse Sand Coarse Gravel and Boulders
Refusal
NO. 117
Elev 1388.0
Loamy Sand and Stones
Firm Coarse Sand Gravel and Boulders
Loose
Coarse
Sand
and
Gravel
Loose Fine Yellow Sand and Clay
Hard Medium Sand and Coarse Gravel
Hard Medium Sand Coarse Gravel and Boulders
Refusal
NO 107
Elev 1392.4
Soft Peat
Hard Sand and Gravel, Little Clay, Boulders
Firm Yellow Sand Gravel Little Clay and Boulders
Hard Sand and Gravel Little Clay and Boulders
Refusal
CORE BORING
NO.116
NO.3
Peat
Loose
Medium
Yellow Sand
and Boulders
Yellow Sand Gravel and Boulders
Refusal
Sand and Gravel
and Boulders
Fine Brown Sand Little Clay
Compact Fine Brown Sand Little Clay and Gravel
Sand Little Clay Gravel and Boulders
Fine Sand Clay and Gravel
Hard Boulder
Fine Brown Sand
Gravel Little Clay
Fine Dark Sand and Mica
Fine Sand and Blue Clay
Loose Yellow Sand
Loamy Sand
Gravel and Boulders
Loose Yellow Sand and Gravel
Note
For location of borings see Sheet Nos 1, 2, 3, & 36
PITTSFIELD, MASS.
CLEVELAND BROOK WATER SUPPLY
BORING DATA
TWEEN 890 FEET AND

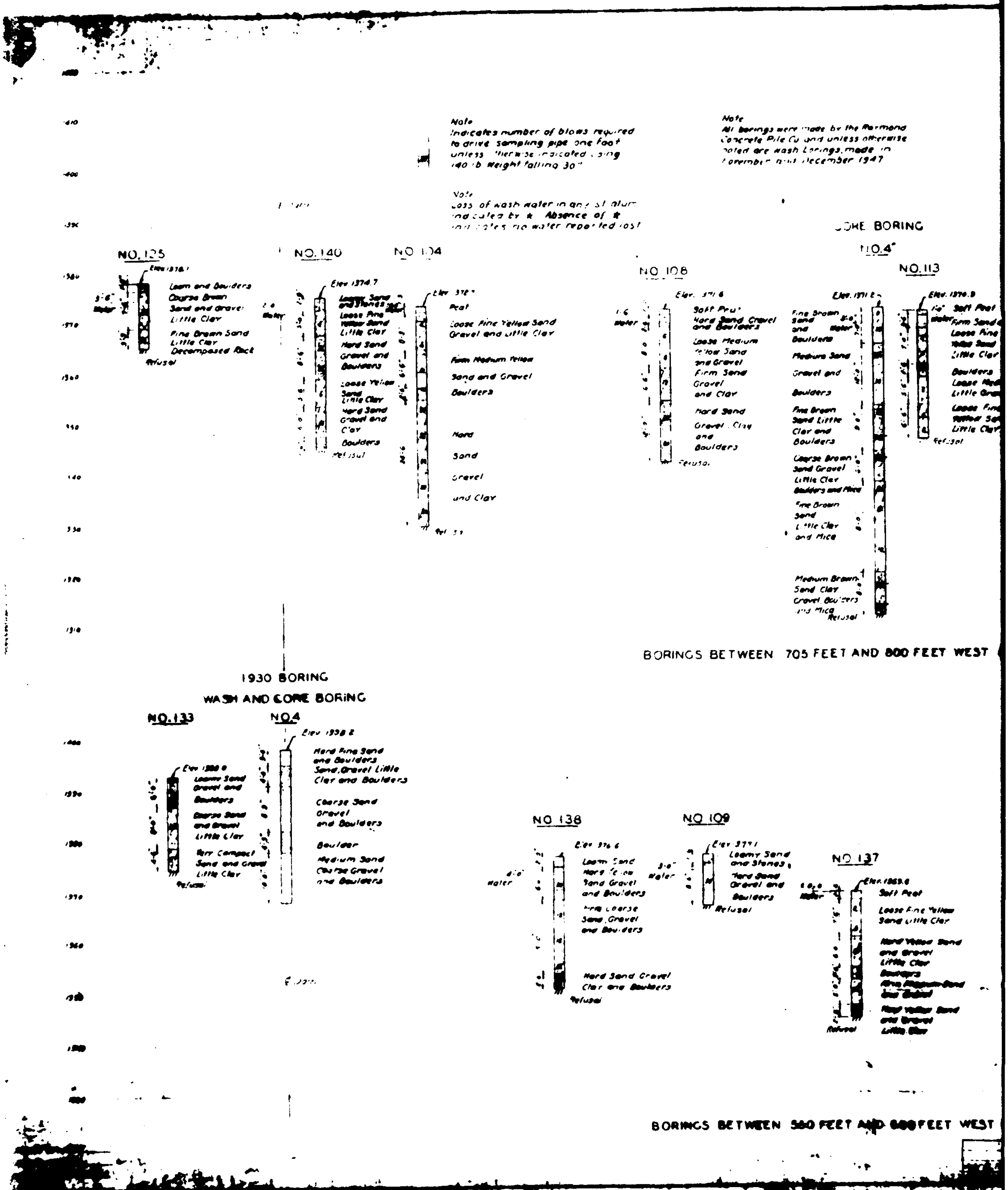
2

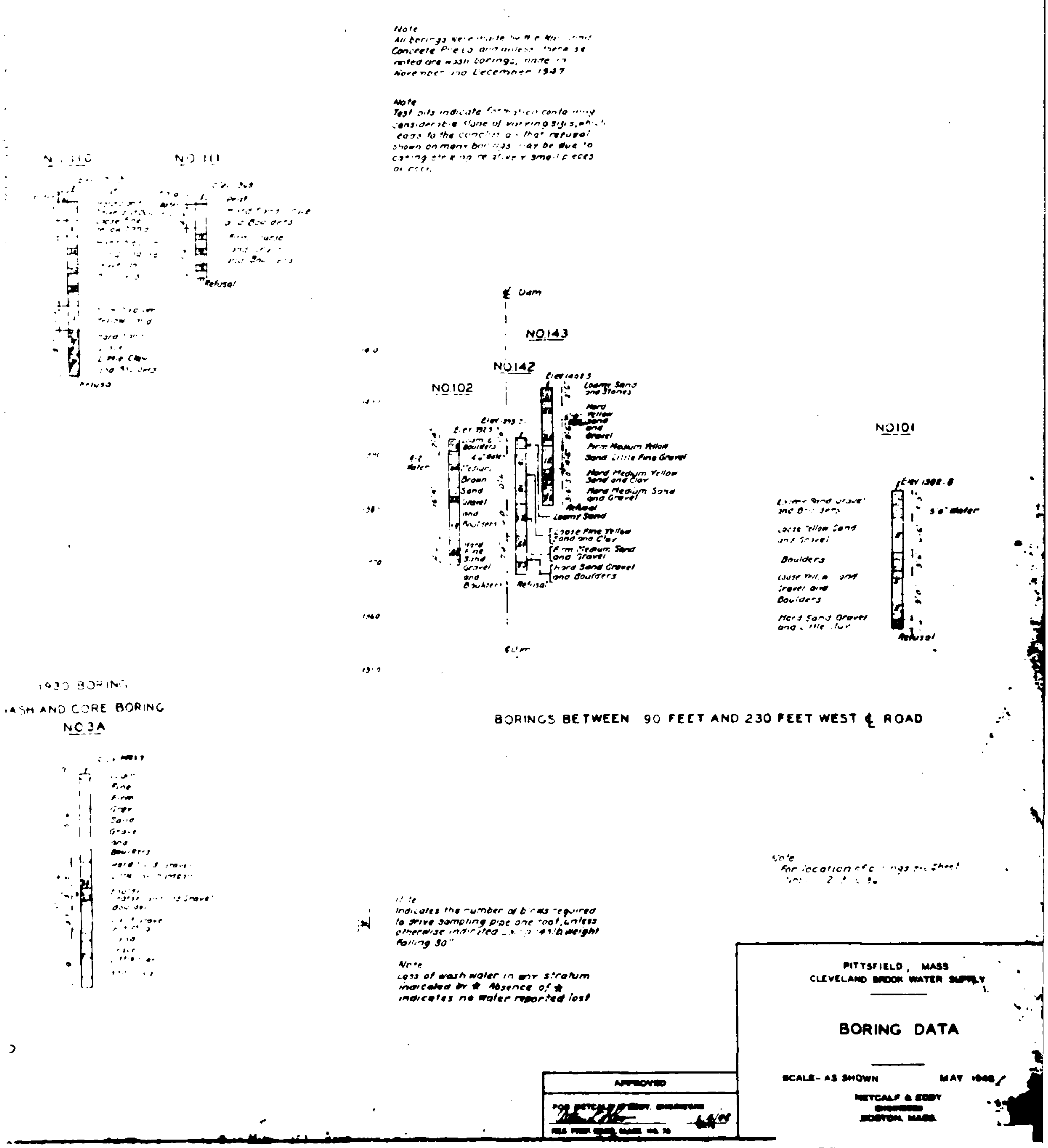


NO. 128
Sandy Loam
Coarse Sand and Gravel
Fine Brown Sand
Medium Sand and Gravel
Medium Brown Sand Little Clay
Fine Brown Sand
Fine Sand and Clay
Refusal
NO. 127
Loam
Medium Brown Sand
Fine Brown Sand Little Clay
Very Compact Sand Little Clay and Gravel
Refusal
℄ Dam
NO. 106
Loam Sand and Boulders
Firm Medium Yellow Sand
Hard Coarse Sand and Coarse Gravel
Loose Fine Yellow Sand and Clay
Refusal
Note:
Note:
Note:
Note:
BORINGS BETWEEN 990 FEET AND 1110 FEET
NO. 105
Loamy Sand Gravel and Boulders
Loose Yellow Sand and Gravel
1930 BORING
NO. 5
NO. 126
CORE BORING
NO. 139
NO. 116
NO. 3
Soft Peat
Fine Brown Sand Little Clay
Medium Brown Sand Gravel and Boulders
Refusal
Soft Black Peaty Sand
Hard Clay Sand Little Gravel
Silt
Hard Sand Gravel Clay Little Mica
Medium Brown Sand
Refusal
Loamy Sand
Medium Brown Sand and Gravel Little Clay
Firm Medium Yellow Sand
Hard Coarse Yellow Sand and Coarse Gravel
Peat
Sand Gravel and Boulders
Fine Brown Sand Little Clay
Drilled Boulder
Fine Brown Sand
Gravel Little Clay
Fine Dark Sand and Mica
Fine Sand and Blue Clay
BORINGS BETWEEN 890 FEET AND

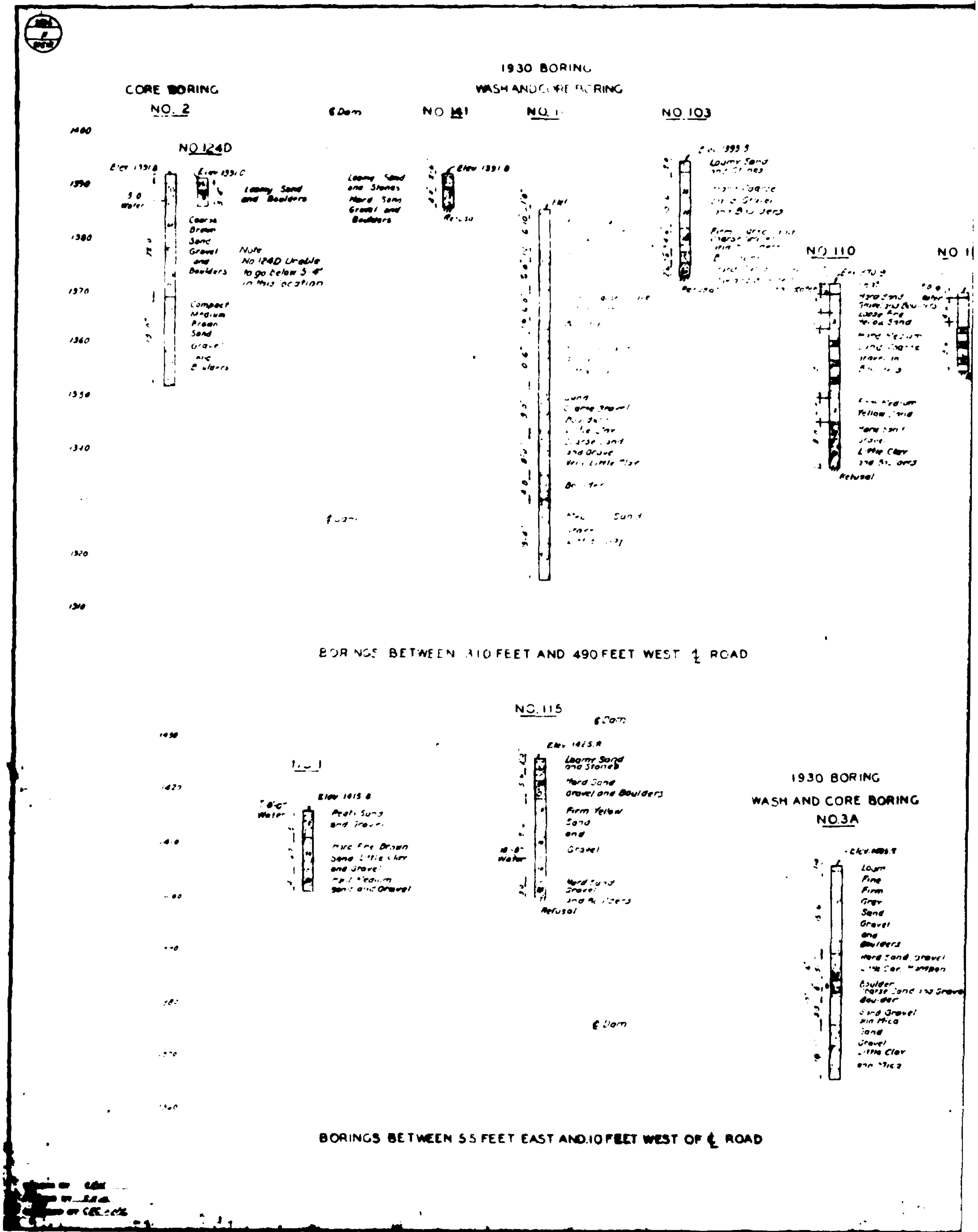

NO. 122
NO 114
Note
Test pits indicate formation containing considerable stone of varying sizes, which leads to the conclusion that refusal shown on many borings may be due to casing striking relatively small pieces of rock.
Loamy Sand and Stones
Firm Coarse Sand and Coarse Gravel
Loose Fine Yellow Sand and Clay
Hard Sand Gravel and Boulders
Hard Sand Gravel and Clay
Refusal
Firm
Medium
Sand
and
Gravel
Hard Sand Gravel and Boulders
Water
NO 113
Soft Peat
Firm Sand and Boulders
Loose Fine Yellow Sand Little Clay
Boulders
Loose Medium Sand Little Gravel
Loose Fine Yellow Sand Little Clay
BETWEEN 705 FEET AND 800 FEET WEST ℄ ROAD
LEGEND
Wash Borings
Test Pits
1930 Borings
Core Borings
Stone Walls
Fences
Road
1947 Borings
LOCATION PLAN
SCALE 1" = 200'
NO. 112
NO. 137
Loamy Sand and Stones
Loose Medium Sand and Gravel
Loose Fine Yellow Sand and Clay
Firm Medium Sand and Gravel
Hard Sand Gravel and Boulders
Refusal
Soft Peat
Loose Fine Yellow Sand Little Clay
Hard Yellow Sand and Gravel Little Clay
Boulders
Firm Medium Sand and Gravel
Hard Yellow Sand and Gravel Little Clay
Note
For location of borings see also Sheet Nos. 1, 2, 3
RECORD PLAN
BETWEEN 560 FEET AND 600 FEET WEST ℄ ROAD
APPROVED
PITTSFIELD, MASS.
CLEVELAND BROOK WATER SUPPLY
BORING DATA
SCALE - AS SHOWN

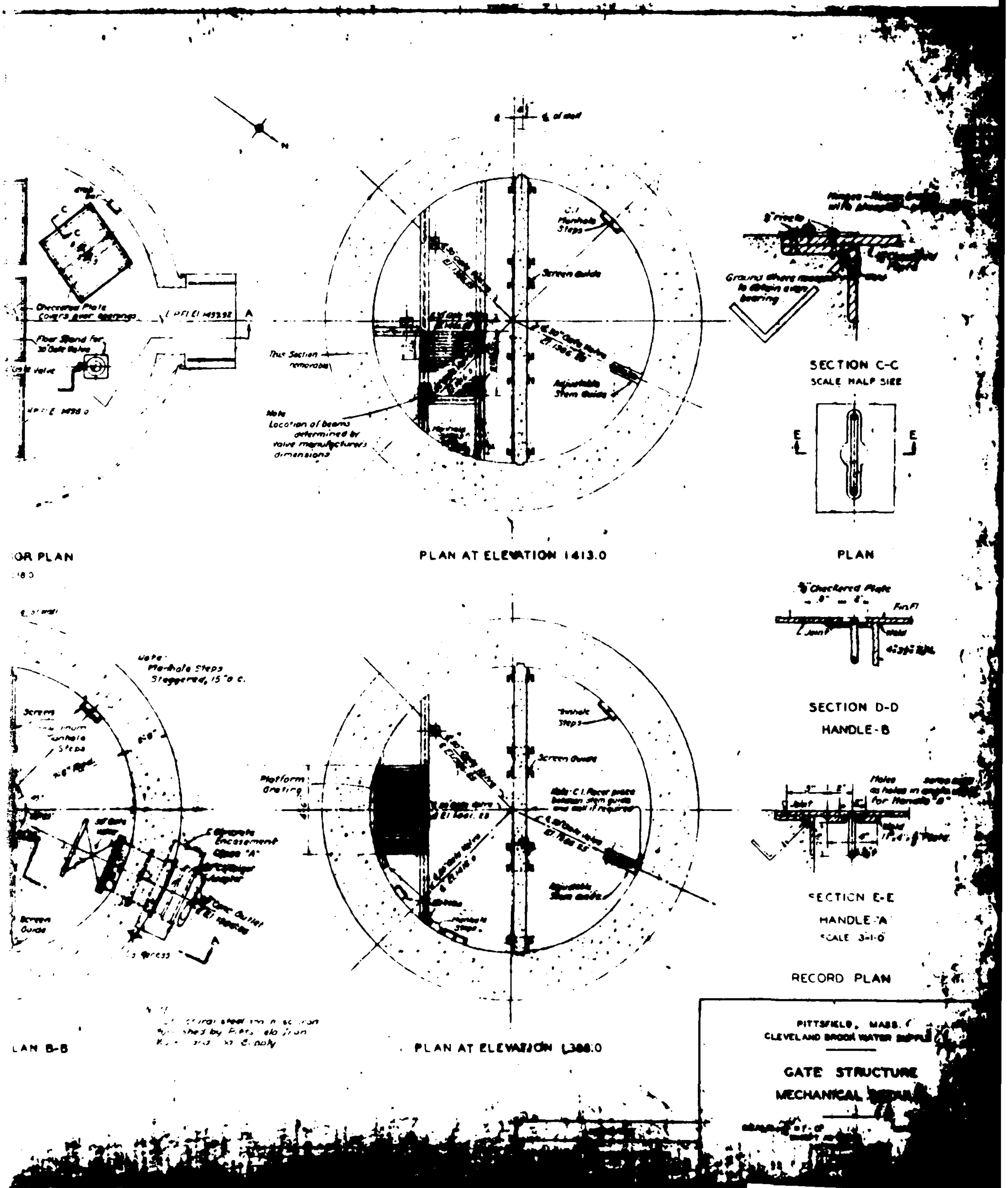
2


Note
Indicates number of blows required to drive sampling pipe one foot unless otherwise indicated using 140 lb weight falling 30"
Note
Loss of wash water in any stratum indicated by ★. Absence of ★ indicates no water reported lost
Note
All borings were made by the Raymond Concrete Pile Co and unless otherwise noted are wash borings made in November and December 1947
CORE BORING
NO. 125
NO. 140
NO. 104
NO. 108
NO. 4
NO. 113
Loam and Boulders
Coarse Brown Sand and Gravel Little Clay
Fine Brown Sand Little Clay Decomposed Rock
Refusal
Elev 1374.7
Peat
Loose Fine Yellow Sand Gravel and Little Clay
Firm Medium Yellow Sand and Gravel Boulders
Hard Sand Gravel and Clay
Soft Peat
Hard Sand Gravel and Boulders
Loose Medium Yellow Sand and Gravel
Firm Sand Gravel and Clay
Hard Sand Gravel, Clay and Boulders
Refusal
BORINGS BETWEEN 705 FEET AND 800 FEET WEST
1930 BORING
WASH AND CORE BORING
NO. 133
NO. 4
Hard Fine Sand and Boulders Sand, Gravel Little Clay and Boulders
Coarse Sand Gravel and Boulders
Boulder
Medium Sand Coarse Gravel and Boulders
Loamy Sand Gravel and Boulders
Coarse Sand and Gravel Little Clay
Very Compact Sand and Gravel Little Clay
Refusal
NO 138
NO 109
NO 137
Loam Sand
Hard Yellow Sand Gravel and Boulders
Firm Coarse Sand, Gravel and Boulders
Hard Sand Gravel Clay and Boulders
Loamy Sand and Stones
Hard Sand Gravel and Boulders
Soft Peat
Loose Fine Yellow Sand Little Clay
Hard Yellow Sand and Gravel Little Clay Boulders
Refusal
BORINGS BETWEEN 580 FEET AND 600 FEET WEST

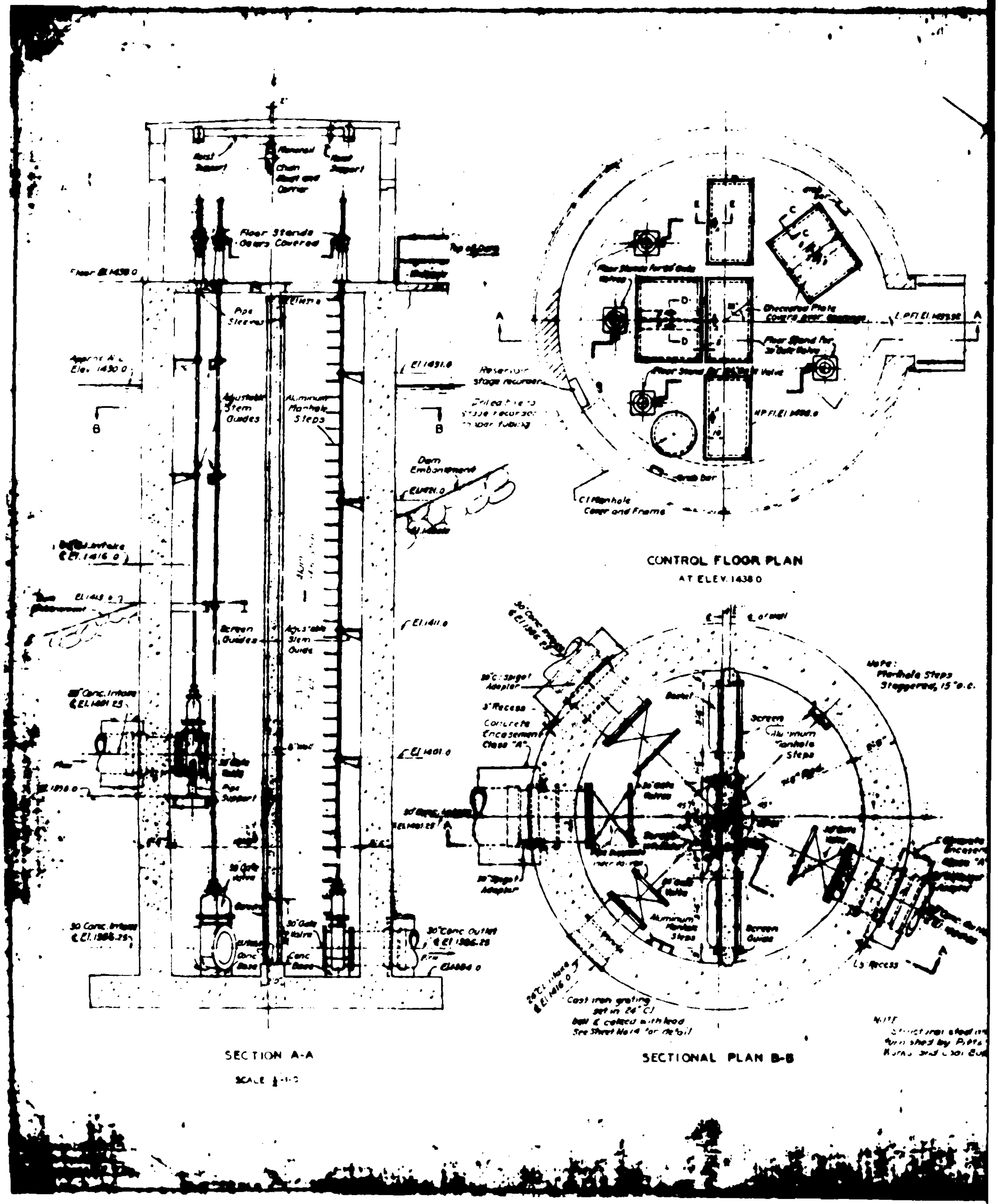

Note
All borings were made by the Raymond Concrete Pile Co. and unless otherwise noted are wash borings, made in November and December 1947
Note
Test pits indicate formation containing considerable stone of varying sizes, which leads to the conclusion that refusal shown on many borings may be due to casing striking relatively small pieces of rock.
NO 111
Refusal
NO 143
NO 142
NO 102
Loamy Sand and Stones
Firm Medium Yellow Sand Little Fine Gravel
Hard Medium Yellow Sand and Clay
Hard Medium Sand and Gravel
Refusal
Loamy Sand
Loose Fine Yellow Sand and Clay
Firm Medium Sand and Gravel
Hard Sand Gravel and Boulders
Refusal
Brown Sand Gravel and Boulders
NO 101
5.0' Water
Loose Yellow Sand and Gravel
Boulders
Hard Sand Gravel and Little Clay
Refusal
1930 BORING
WASH AND CORE BORING
NO 3A
BORINGS BETWEEN 90 FEET AND 230 FEET WEST ℄ ROAD
Indicates the number of blows required to drive sampling pipe one foot, unless otherwise indicated, using 140 lb. weight falling 30"
Note
Loss of wash water in any stratum indicated by ★. Absence of ★ indicates no water reported lost
PITTSFIELD, MASS.
CLEVELAND BROOK WATER SUPPLY
BORING DATA
SCALE - AS SHOWN
MAY 1948
METCALF & EDDY
ENGINEERS
BOSTON, MASS.
APPROVED

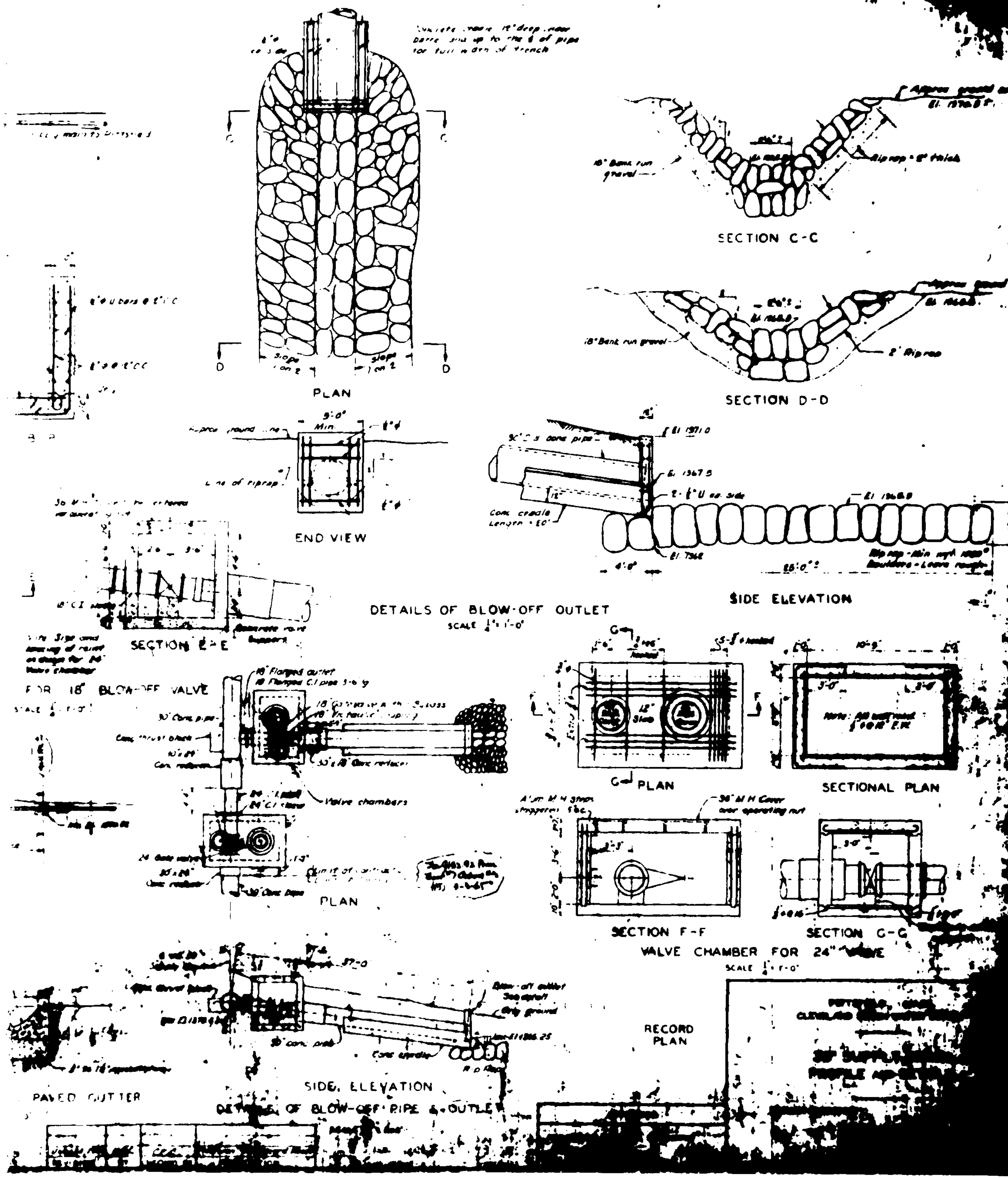
2


1930 BORING
WASH AND CORE BORING
CORE BORING
NO. 2
NO 124D
NO 103
NO 110
Elev 1391.8
5.0 Water
Loamy Sand and Boulders
Coarse Brown Sand Gravel and Boulders
Note
No 124D Unable to go below 5'-4" in this location
Compact Medium Brown Sand Gravel and Boulders
Loamy Sand and Stones
Hard Sand Gravel and Boulders
Refusal
Loamy Sand and Stones
Firm Medium Yellow Sand
Hard Sand Gravel Little Clay and Boulders
BORINGS BETWEEN 310 FEET AND 490 FEET WEST ℄ ROAD
NO. 115
Elev 1415.8
Peat, Sand and Gravel
Elev 1425.8
Loamy Sand and Stones
Hard Sand Gravel and Boulders
Firm Yellow Sand and Gravel
Hard Sand Gravel and Boulders
Refusal
1930 BORING
WASH AND CORE BORING
NO.3A
Loam Fine Firm Grey Sand Gravel and Boulders
Sand Gravel
BORINGS BETWEEN 55 FEET EAST AND 10 FEET WEST OF ℄ ROAD

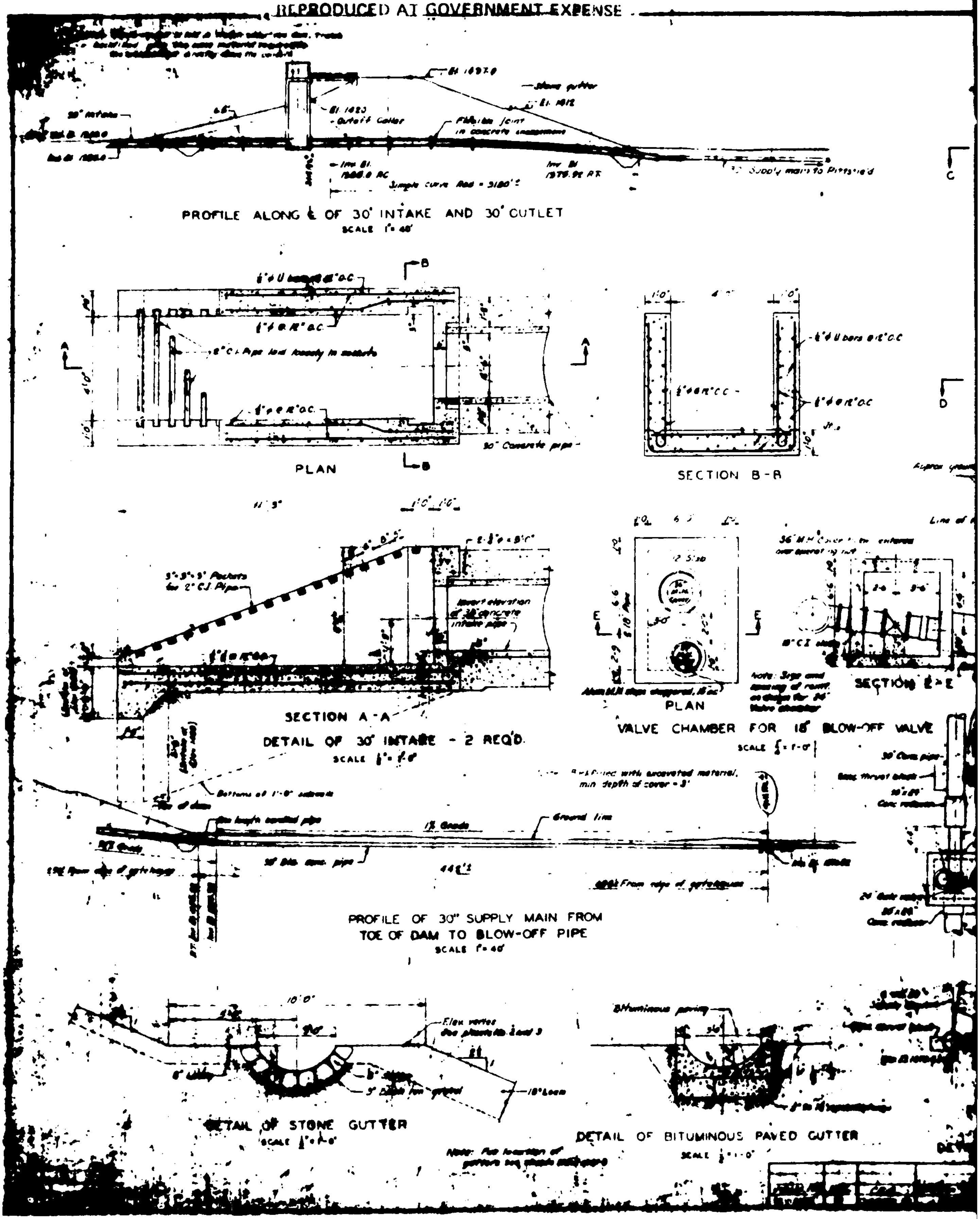

OR PLAN
PLAN AT ELEVATION 1413.0
SECTION C-C
SCALE HALF SIZE
PLAN
SECTION D-D
HANDLE-B
SECTION E-E
HANDLE-A
SCALE 3=1-0
RECORD PLAN
LAN B-B
PLAN AT ELEVATION 1388.0
PITTSFIELD, MASS.
CLEVELAND BROOK WATER SUPPLY
GATE STRUCTURE
MECHANICAL

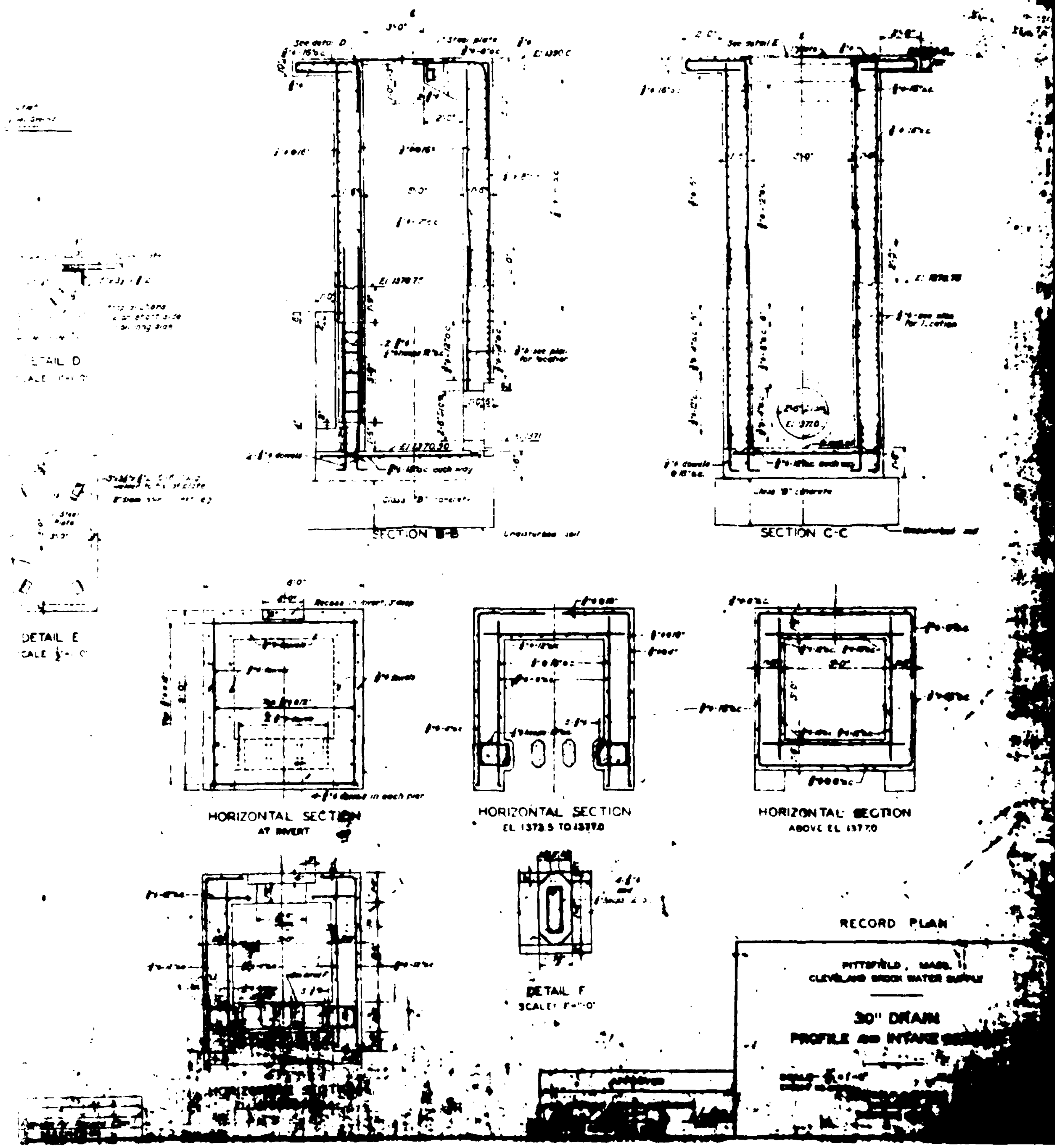
2


SECTION A-A
SCALE
CONTROL FLOOR PLAN
AT ELEV. 1438.0
SECTIONAL PLAN B-B
Floor Stands Gears Covered
Aluminum Manhole Steps
Adjustable Stem Guides
Screen Guides
Dam Embankment
Note: Manhole Steps Staggered, 15" o.c.
Cast iron grating set in 24" CI bell & calked with lead See Sheet No.14 for detail

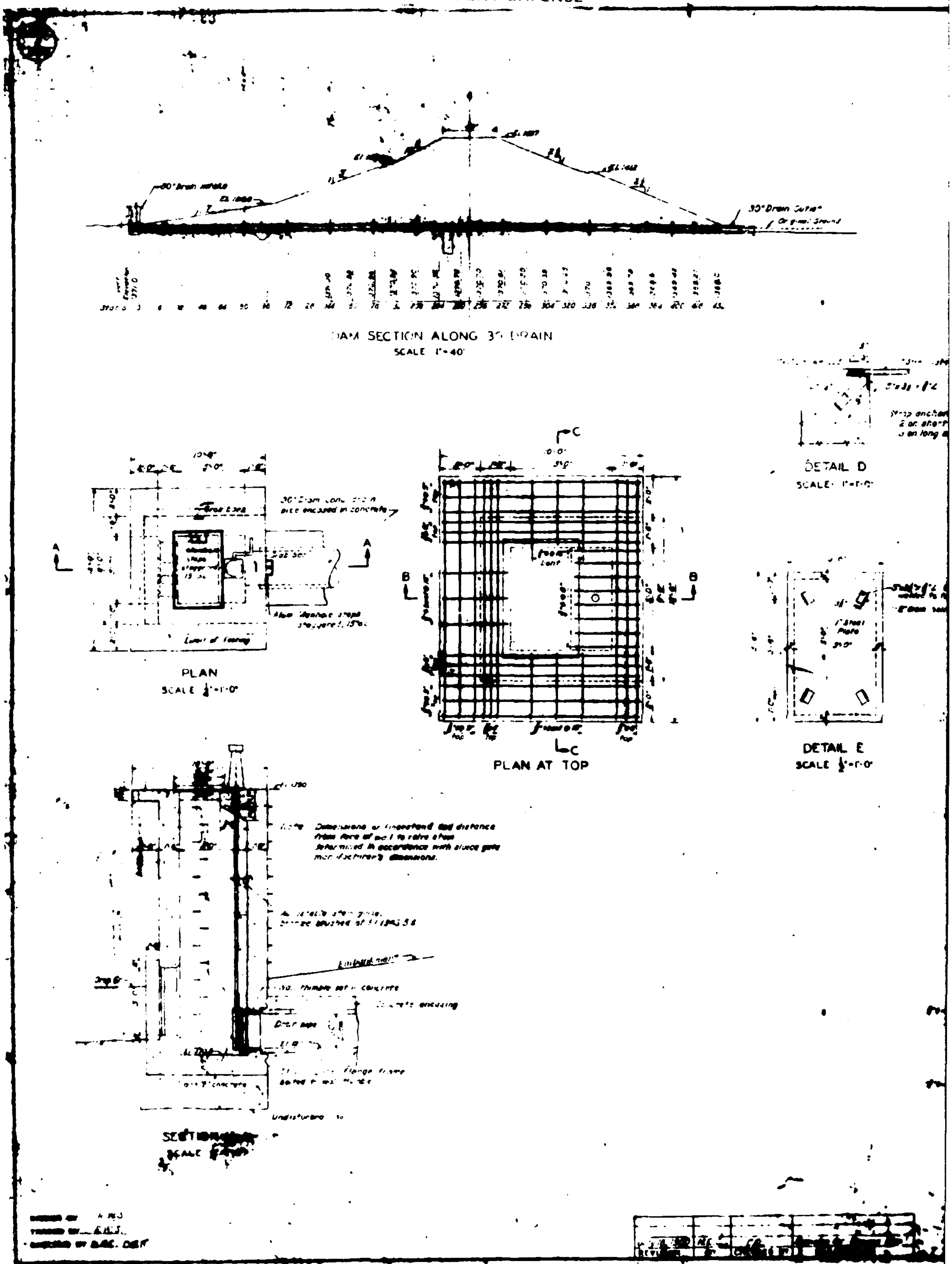

PLAN
SECTION C-C
SECTION D-D
Riprap - 8" thick
18" Bank run gravel
2' Riprap
9'-0" Min.
END VIEW
Line of riprap
Conc. cradle
SIDE ELEVATION
DETAILS OF BLOW-OFF OUTLET
SECTION E-E
FOR 18" BLOW-OFF VALVE
18" Flanged outlet
Valve chambers
PLAN
SECTIONAL PLAN
SECTION F-F
SECTION G-G
VALVE CHAMBER FOR 24" VALVE
RECORD PLAN
PAVED GUTTER
SIDE ELEVATION
Blow-off outlet
Orig. ground
Rip Rap

2

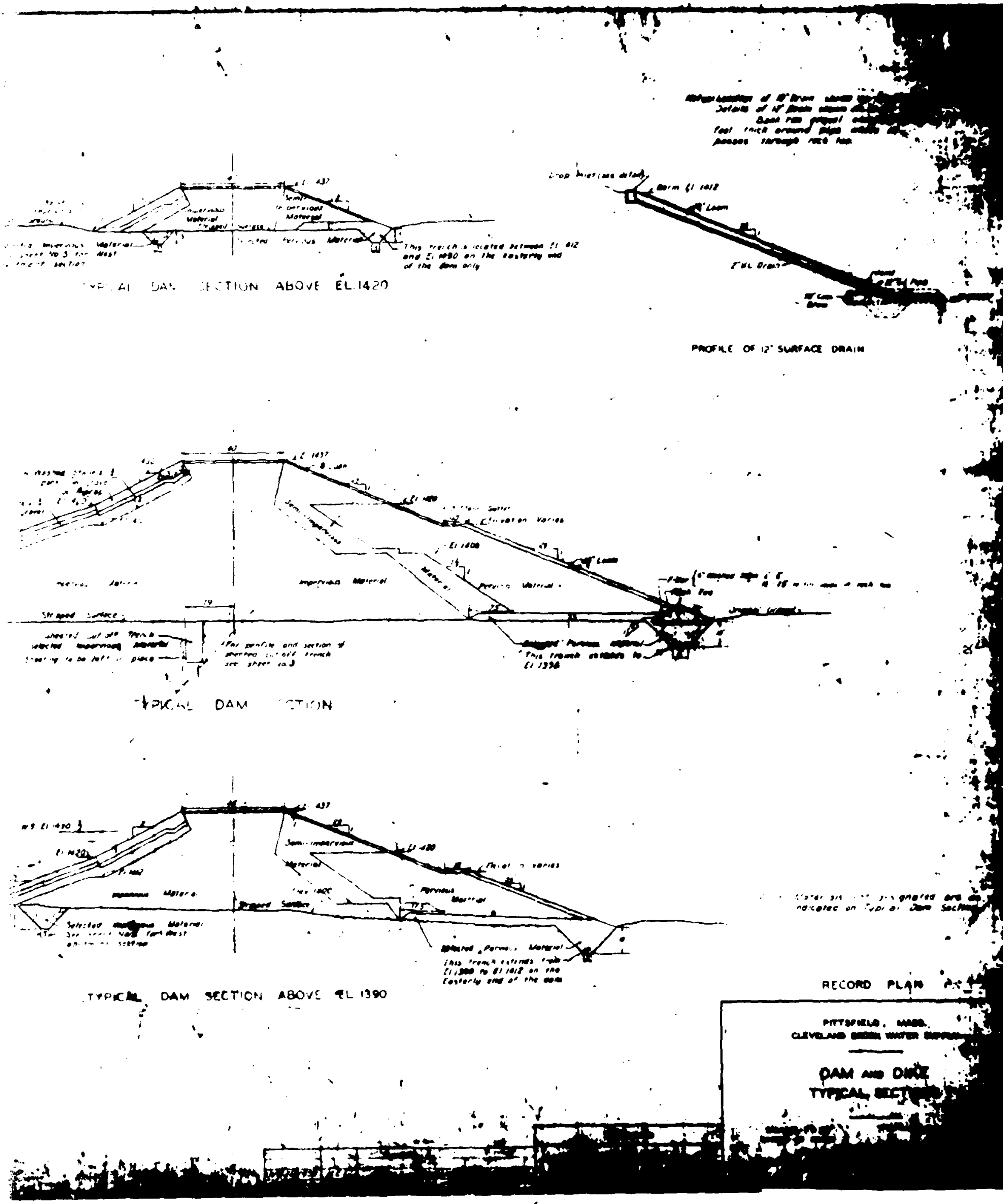

PROFILE ALONG ℄ OF 30" INTAKE AND 30" OUTLET
SCALE 1"=40'
Simple curve Rad = 3180'±
Supply main to Pittsfield
PLAN
SECTION B-B
30" Concrete pipe
SECTION A-A
DETAIL OF 30" INTAKE - 2 REQ'D.
Bottom of 1'-0" subgrade
PLAN
VALVE CHAMBER FOR 18" BLOW-OFF VALVE
SECTION E-E
min. depth of cover = 3'
Ground line
30" Conc. pipe
PROFILE OF 30" SUPPLY MAIN FROM
TOE OF DAM TO BLOW-OFF PIPE
SCALE 1"=40'
Bituminous paving
DETAIL OF STONE GUTTER
DETAIL OF BITUMINOUS PAVED GUTTER

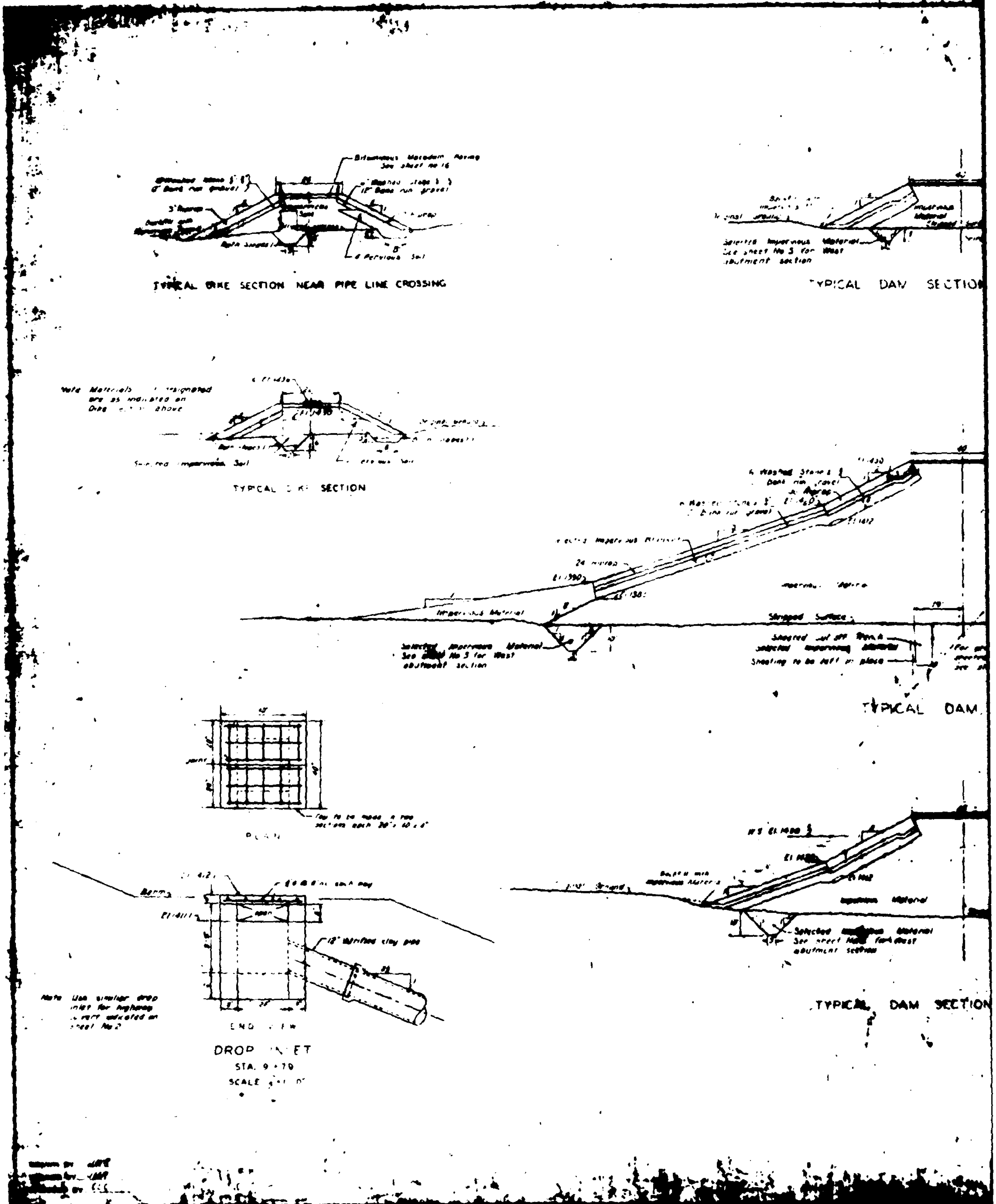

SECTION B-B
SECTION C-C
DETAIL D
DETAIL E
HORIZONTAL SECTION
AT INVERT
HORIZONTAL SECTION
EL 1373.5 TO 1377.0
HORIZONTAL SECTION
ABOVE EL 1377.0
DETAIL F
RECORD PLAN
PITTSFIELD, MASS.
CLEVELAND BROOK WATER SUPPLY
30" DRAIN
PROFILE and INTAKE

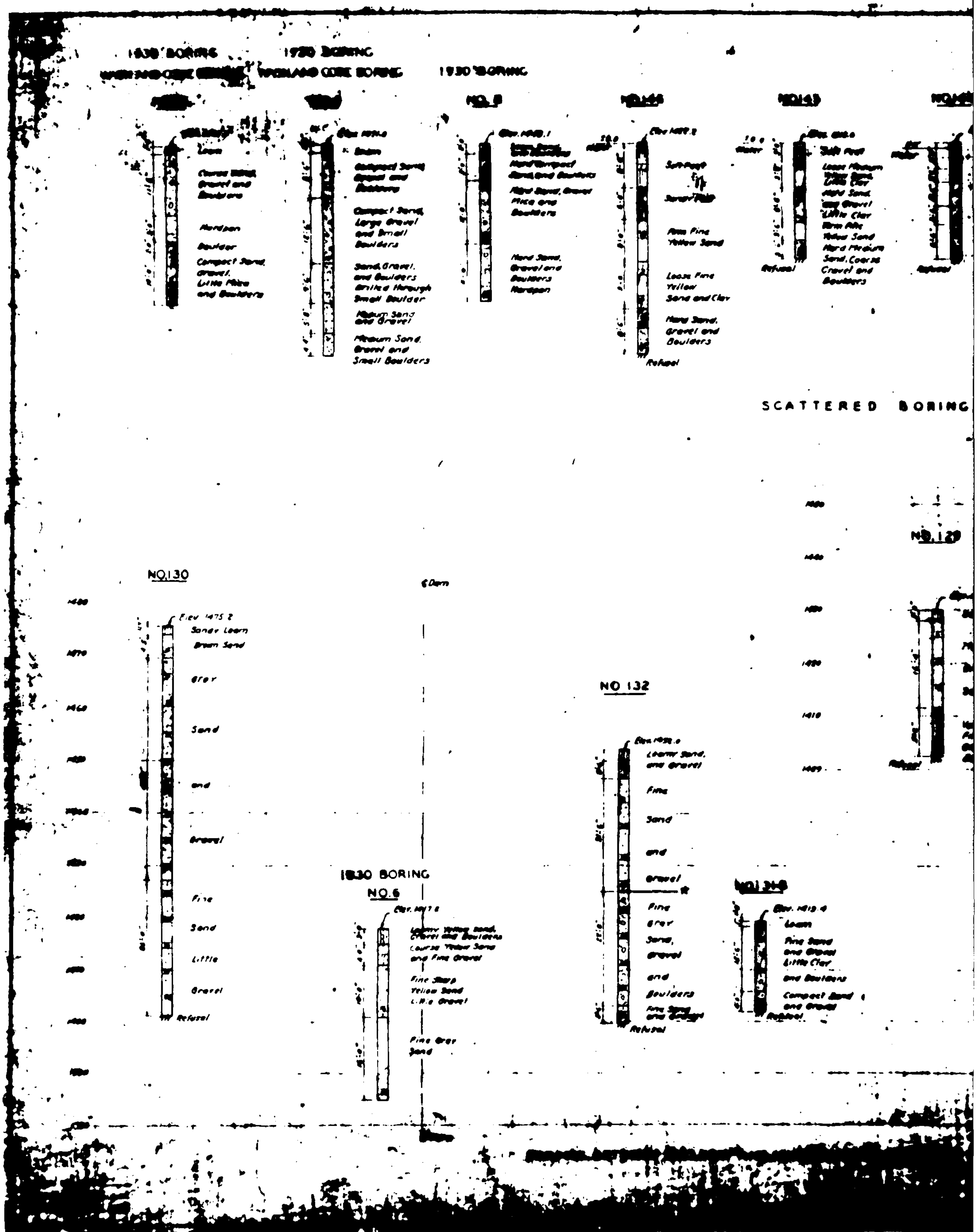
2

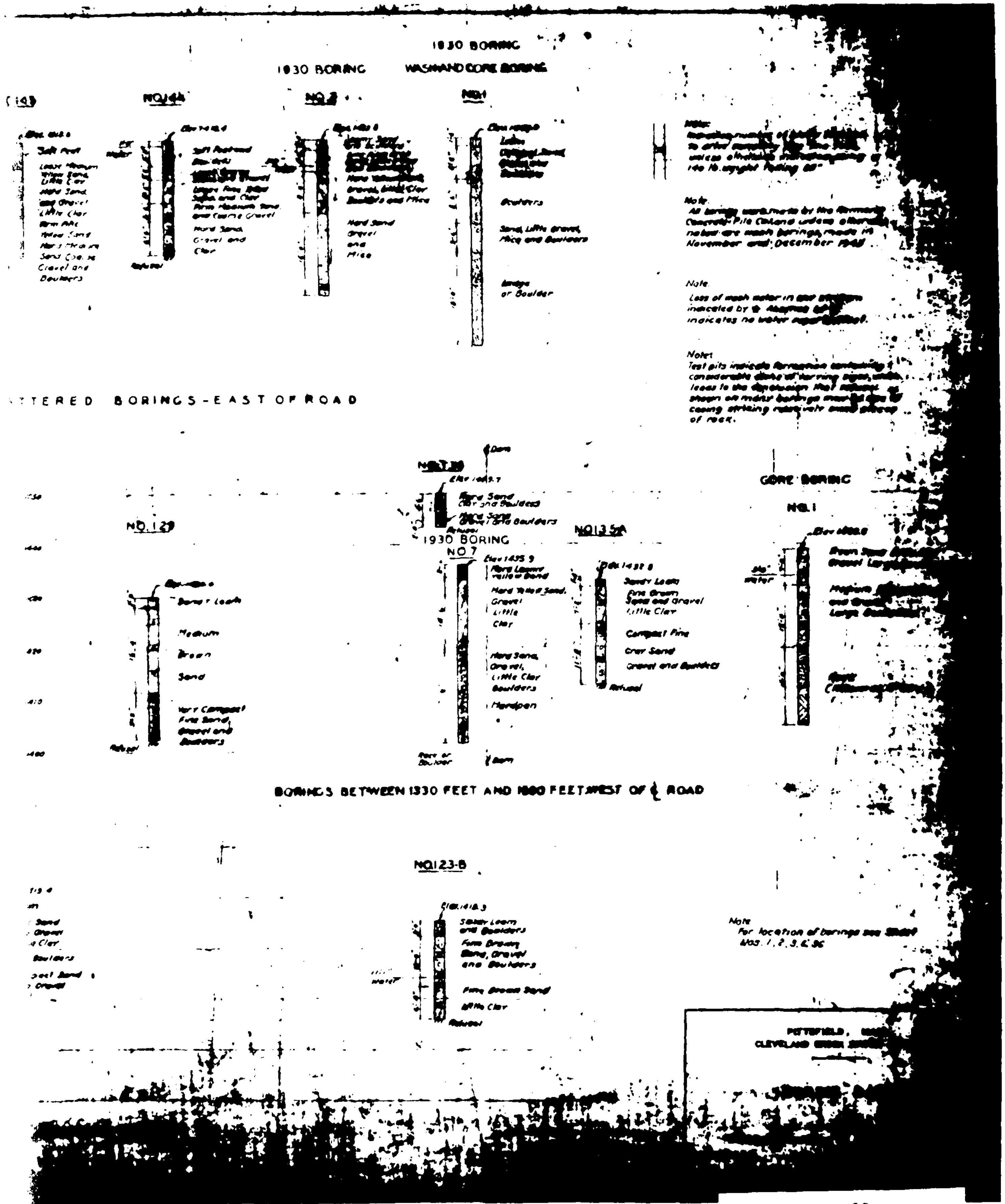


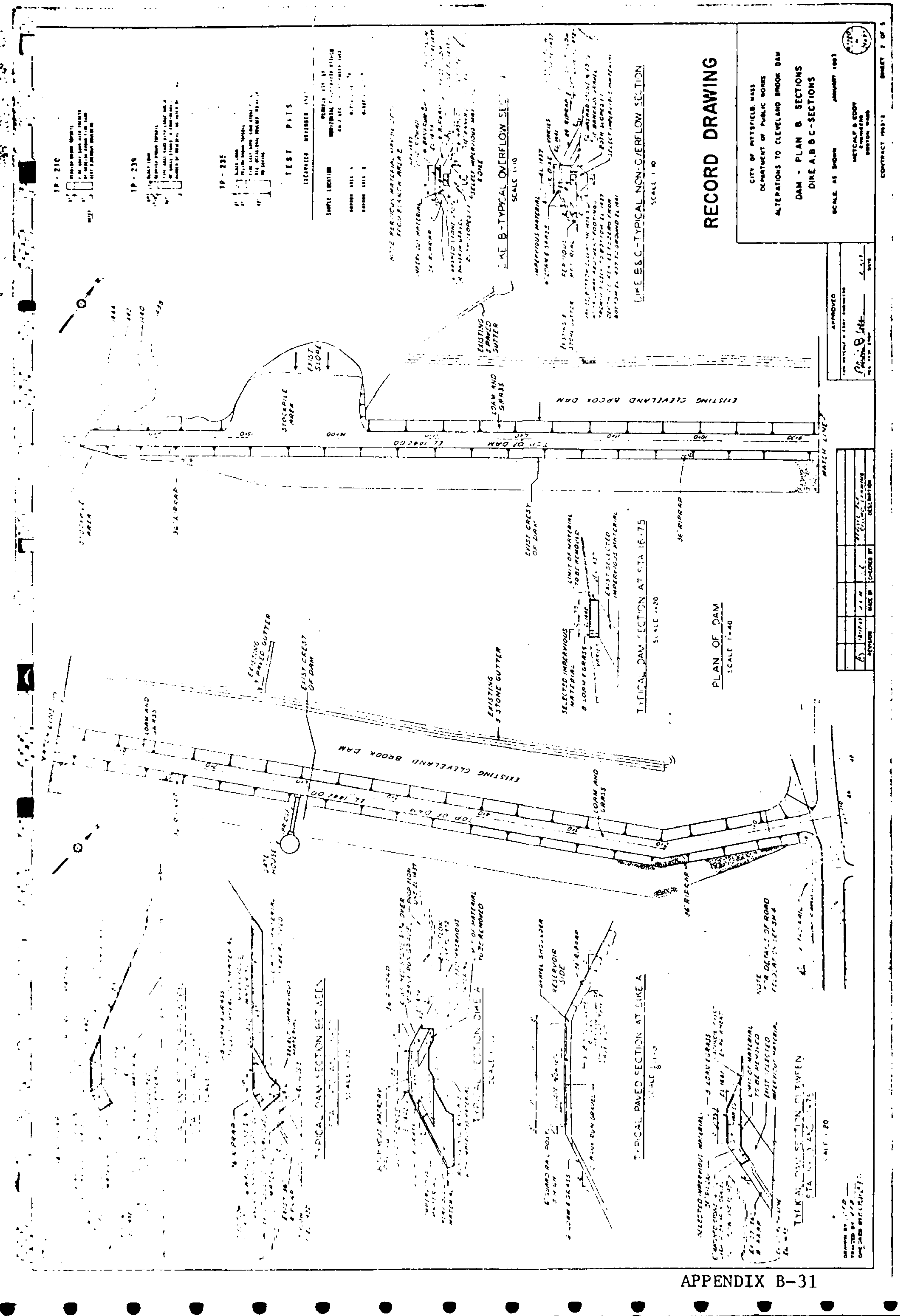
DAM SECTION ALONG 30" DRAIN
SCALE 1"=40'
30" Drain Outlet
Original Ground
PLAN
PLAN AT TOP
DETAIL D
DETAIL E
Limit of footing
Embankment
Concrete encasing
Drain pipe
Undisturbed


PROFILE OF 12" SURFACE DRAIN
Drop Inlet (see detail)
Berm El 1412
TYPICAL DAM SECTION
Striped Surface
TYPICAL DAM SECTION ABOVE EL. 1390
RECORD PLAN
PITTSFIELD, MASS.
DAM AND DIKE
TYPICAL SECTIONS

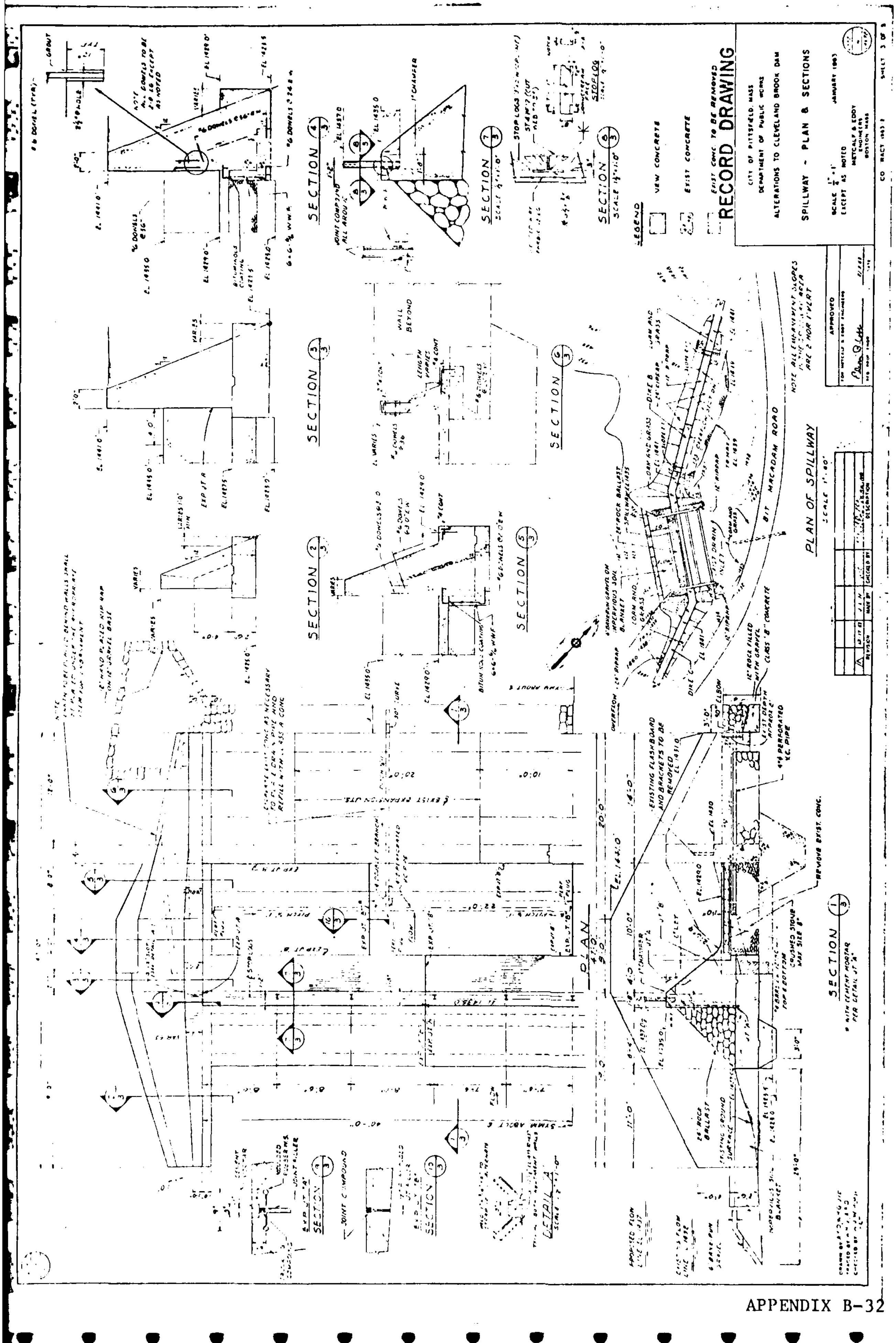

TYPICAL DIKE SECTION NEAR PIPE LINE CROSSING
TYPICAL DAM SECTION
TYPICAL DIKE SECTION
Impervious Material
Stripped Surface
TYPICAL DAM
PLAN
12" Vitrified clay pipe
TYPICAL DAM SECTION
END VIEW
DROP INLET
STA. 9+70

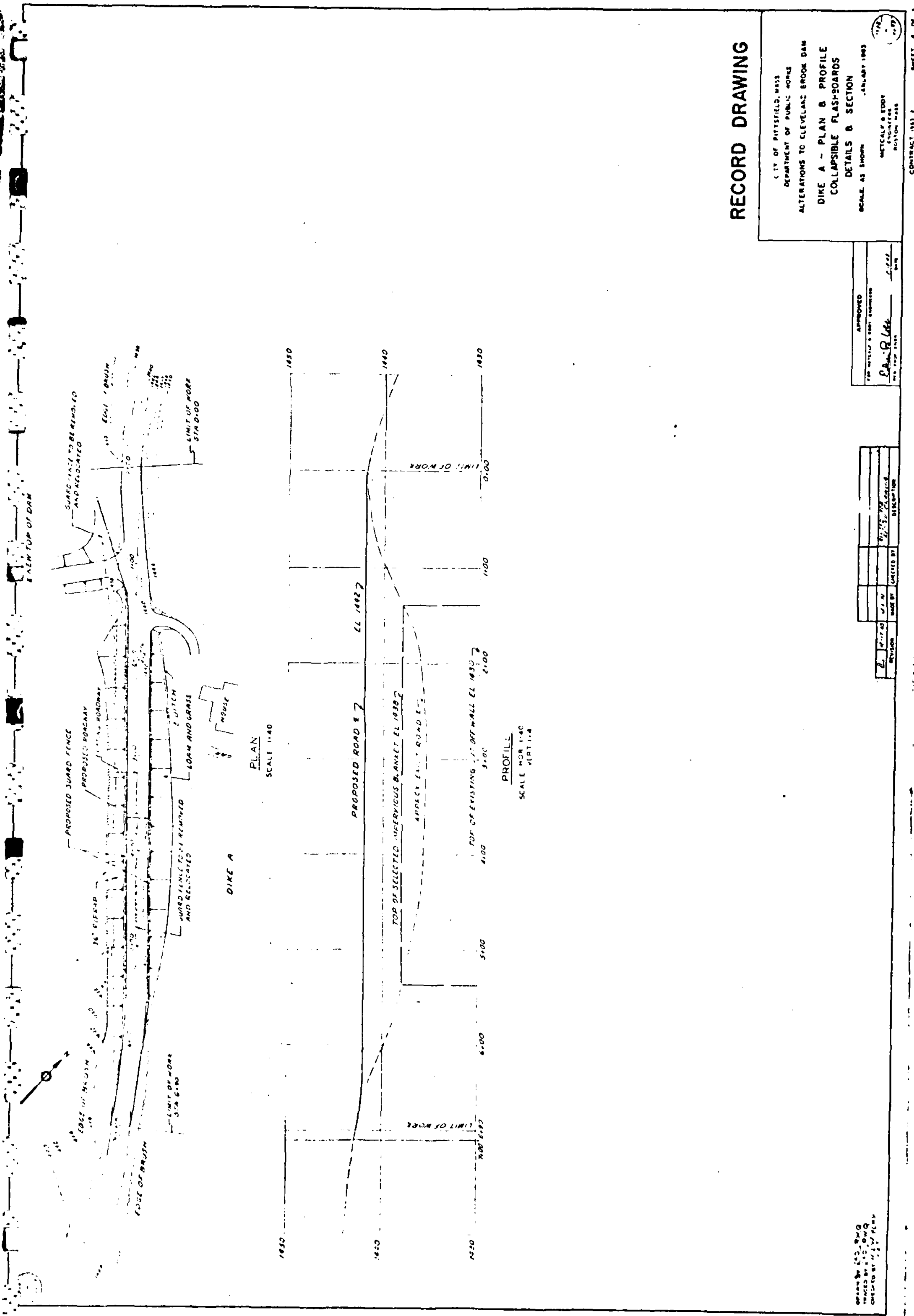

1930 BORING
1930 BORING
1930 BORING
NO. 8
SCATTERED BORING
NO.130
Elev. 1475.2
Sandy Loam
Brown Sand
Gray
Sand
and
Gravel
Fine
Sand
Little
Gravel
Refusal
NO 132
Loamy Sand and Gravel
Fine
Sand
and
Gravel
Fine
Gray
Sand,
Gravel
and
Boulders
Refusal
1930 BORING
NO.6
Fine Sharp
Yellow Sand
Little Gravel
Fine Gray
Sand
Compact Sand,
Large Gravel
and Small
Boulders
Sand, Gravel,
and Boulders
Drilled through
Small Boulder
Medium Sand
and Gravel
Medium Sand,
Gravel and
Small Boulders
Hard Sand,
Gravel and
Boulders
Hardpan
Loose Fine
Yellow
Sand and Clay
Hard Sand,
Gravel and
Boulders
Refusal
Compact Sand,
Gravel,
Little Mica
and Boulders
Hardpan
Boulder
Loam
Fine Sand
and Gravel
Little Clay
and Boulders
Compact Sand
and Gravel
Refusal


1930 BORING
1930 BORING
WASH AND CORE BORING
NO.14A
NO.2
NO.1
Boulders
Ledge or Boulder
BORINGS - EAST OF ROAD
1930 BORING
NO.7
Hardpan
NO.129
Medium
Brown
Sand
NO.135A
Compact Fine
Gray Sand
Gravel and Boulders
Refusal
CORE BORING
NO.1
BORINGS BETWEEN 1330 FEET AND 1800 FEET WEST OF ℄ ROAD
NO.123-B
Sandy Loam and Boulders
Fine Brown Sand
Little Clay
Refusal
PITTSFIELD
CLEVELAND



APPENDIX B-31


RECORD DRAWING
CITY OF PITTSFIELD, MASS
DEPARTMENT OF PUBLIC WORKS
ALTERATIONS TO CLEVELAND BROOK DAM
SPILLWAY - PLAN & SECTIONS
JANUARY 1963
METCALF & EDDY
ENGINEERS
BOSTON, MASS
LEGEND
NEW CONCRETE
EXIST CONCRETE
EXIST CONC TO BE REMOVED
APPROVED
PLAN OF SPILLWAY
BIT MACADAM ROAD
NOTE: ALL EMBANKMENT SLOPES IN THE SPILLWAY AREA ARE 2 HOR 1 VERT
SECTION 1
SECTION 2
SECTION 3
SECTION 4
SECTION 5
SECTION 6
SECTION 7
SECTION 8
PLAN
DETAIL A
EXISTING FLASHBOARD AND BRACKETS TO BE REMOVED
REMOVE EXIST. CONC.
JOINT COMPOUND
STOP LOGS


RECORD DRAWING
CITY OF PITTSFIELD, MASS
DEPARTMENT OF PUBLIC WORKS
ALTERATIONS TO CLEVELAND BROOK DAM
DIKE A - PLAN & PROFILE
COLLAPSIBLE FLASHBOARDS
DETAILS & SECTION
SCALE AS SHOWN
JANUARY 1963
METCALF & EDDY
ENGINEERS
BOSTON MASS
CONTRACT 1963 2
APPROVED
REVISION
MADE BY
CHECKED BY
DESCRIPTION
PLAN
SCALE 1:40
PROFILE
DIKE A
HOUSE
LOAM AND GRASS
PROPOSED GUARD FENCE
PROPOSED ROADWAY
LIMIT OF WORK
PROPOSED ROAD
EL 1882
TOP OF SELECTED IMPERVIOUS BLANKET EL 1830
1850
1840
1830

July 28, 1976

Subject WATERWAYS-District One
Hinsdale Cleveland Reservoir
Dam No. 1-2-132-4

Mr. John Bartels, Chairman
Board of Selectmen
Dalton, MA 01226

Dear Sir

In answer to your letter of July 20, 1976 requesting information concerning the condition of the subject dam, we enclose a copy of the inspection report submitted to Boston Waterways in November, 1975. Please note that this report is of an advisory nature, and does not indicate an emergency situation.

The Pittsfield Water Department and District One personnel monitored the flow throughout the winter and spring of 1975-1976. No increase in flow was noted. Dye tests performed by consulting engineers were negative. This strengthened our belief that the flow is a spring and not a leak.

However, as we originally stated in the report, the size and location of this structure warrants an in depth investigation of the condition. Not until an investigation is completed can anyone absolutely determine the true nature of this matter.

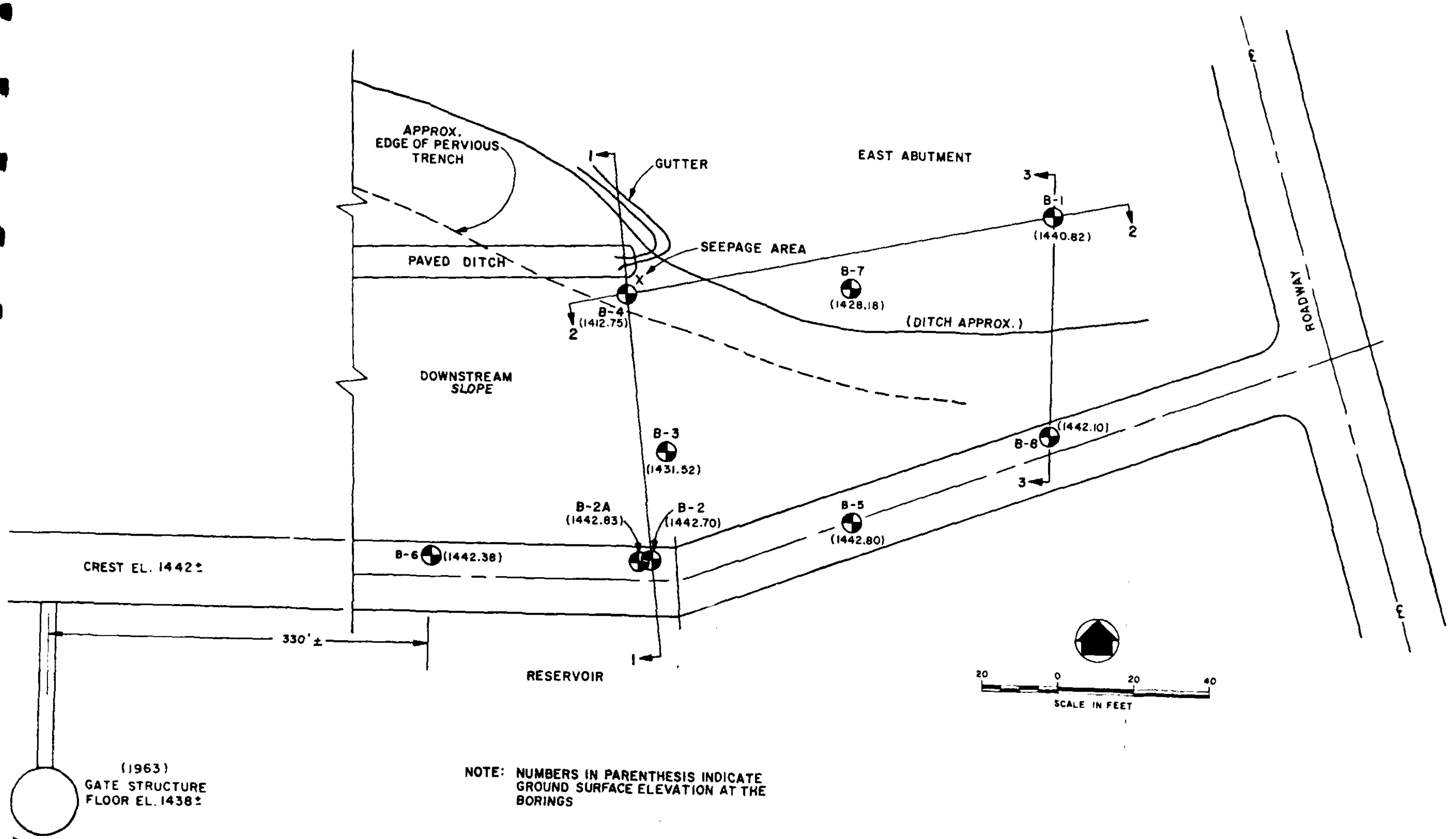
If we can be of further assistance, please contact the District One office.

Very truly yours

Dean P. Amidon

Dean P. Amidon, P. E.
District Highway Engineer

RDJmif
Enclosure
cc J. J. Hannon
Chief Engineer, DEQE
SurvLen



NOTE: NUMBERS IN PARENTHESIS INDICATE GROUND SURFACE ELEVATION AT THE BORINGS

FIG. E-1 PLAN OF BORING LOCATIONS

METCALF & EDDY

TABLE 1. RESULTS OF INSITU FALLING HEAD PERMEABILITY TESTS

Perm No.	Boring	Depth	Elevation (ft.)	Permeability coefficient k cm/sec Initial	Final	Assumed	Unified soil classification(1)	Blows/6" interval	Comments
1	B-1	37.5	1,403.30	$6x10^{-4}$	$5x10^{-4}$	$5x10^{-4}$	SM	22-36-69-78	Foundation soil (abutment)
2	B-2	24.0	1,418.70	$4x10^{-4}$	$1x10^{-4}$	$1x10^{-4}$	SM	29-64-46-32	Embankment soil (core)
3	B-2	30.0	1,412.82	$2x10^{-3}$	$2x10^{-3}$	$2x10^{-3}$	SM	22-34-40-118	Embankment soil (near contact surface)
4	B-3	16.0	1,415.44	$3x10^{-4}$	$2x10^{-4}$	$2x10^{-4}$	SP-SM	19-16-37-29	Embankment soil (semi-impervious zone)
5	B-3	20.0	1,411.44	$6x10^{-4}$	$4x10^{-4}$	$4x10^{-4}$	SM	1-4-20-24	Foundation soil (near contact surface)
6	B-4	6.0	1,406.75	$2x10^{-2}$	$5x10^{-3}$	$2x10^{-2}$	SP-SM	3-3-4-3	Within pervious toe
7	B-4	8.0	1,404.75	$2x10^{-2}$	$9x10^{-3}$	$2x10^{-2}$	SM	3-3-3-40	Apparent contact (toe and foundation soil)
8	B-4	18.0	1,394.75	$1x10^{-2}$	$1x10^{-2}$	$1x10^{-2}$	SM	7-9-14-20	Foundation soil
9	B-5	24.0	1,418.80	$3x10^{-3}$	$1x10^{-3}$	$3x10^{-3}$	SP-SM	34-29-28-32	Foundation soil
10	B-5	28.0	1,414.80	$3x10^{-3}$	$2x10^{-3}$	$2x10^{-3}$	SP-SM	22-12-12-17	Foundation soil
11	B-6	22.0	1,420.38	-	-	$1x10^{-3}$	SM	13-14-17-28	Embankment soil (core)
12	B-6	30.0	1,412.38	$2x10^{-3}$	$3x10^{-4}$	$3x10^{-4}$	GP-GM	37-51-63-79	Embankment soil (core)
13	B-7	20.0	1,408.18	$2x10^{-3}$	$1x10^{-3}$	$1x10^{-3}$	SP-SM	9-12-15-17	Foundation soil
14	B-7	25.0	1,403.18	$1x10^{-3}$	-	$1x10^{-3}$	SP-SM	27-31	Foundation soil
15	B-8	15.0	1,427.25	$2x10^{-4}$	$1x10^{-4}$	$1x10^{-4}$	SM	29-46-52-35	Foundation soil
16	B-8	21.0	1,421.25	$2x10^{-3}$	$1x10^{-3}$	$1x10^{-3}$	SM	12-11-11-10	Foundation soil
17	B-8	27.0	1,415.25	$6x10^{-3}$	$3x10^{-3}$	$6x10^{-3}$	No sample	14-11-10-9	Foundation soil
18	B-8	35.0	1,407.25	$1x10^{-3}$	-	$1x10^{-3}$	SM	19-20-56-33	Foundation soil

1. SM - silty sand.
SF-SM - Poorly graded silty sand.
GP-GM - Poorly graded silty gravel.

TABLE 2. PIEZOMETERS - LOCATIONS AND WATER LEVEL MEASUREMENTS

Boring	Piez. No.	Date Installed	Tip El. (ft.)	Water elevations in piezometers						
				Date - 9/16/76	9/17/76	9/20/76	9/21/76	9/27/76	10/4/76	10/22/76
				Res. El. - 1,429.27	1,429.15	1,425.85	1,428.75	1,428.[illegible]	1,427.90	1,429.50
3	P-1	9/10/76	1,401.94	1,421.12	1,424.07	1,421.62	1,421.1[illegible]	1,42[illegible].02	1,420.02	1,420.22
3	P-2	9/10/76	1,411.94	1,421.22	1,423.72	1,420.82	1,421.42	1,420.32	1,420.07	1,420.47
3	P-3	9/13/76	1,421.44	1,422.00	1,422.02	Dry	1,421.72	Dry	Dry	Dry
4	P-4	9/14/76	1,397.75	-	1,409.35	1,406.95	1,405.90	1,408.75	1,408.35	1,408.35
4	P-5	9/14/76	1,405.75	-	1,411.70	1,409.35	1,411.60	1,411.45	1,411.12	1,410.75
2A	P-6	9/16/76	1,402.02	-	1,420.76	1,420.45	1,420.75	1,419.95	1,419.80	1,420.25
2A	P-7	9/16/76	1,407.32	-	1,422.71	1,422.95	1,422.75	1,421.95	1,422.95	1,421.95
2	P-8	9/16/76	1,411.90	-	1,423.48	1,423.48	1,423.56	1,421.18	1,422.68	1,422.38
2	P-9	9/16/76	1,421.40	-	1,423.48	1,423.58	1,422.38	1,422.08	1,421.78	1,422.28
7	P-10	9/16/76	1,410.18	-	1,421.15	1,420.48	1,420.78	1,416.38	1,422.38	1,420.08
8	P-11	9/20/76	1,410.10	-	-	-	Plugged	Plugged	Plugged	Plugged
8	P-12	9/20/76	1,420.74	-	-	-	1,423.49	1,421.19	1,421.94	1,422.19
8	P-13	9/20/76	1,427.10	-	-	-	Dry	Dry	Dry	Dry
1	P-14	9/21/76	1,411.25	-	-	-	-	1,418.45	1,419.75	1,419.45
1	P-15	9/21/76	1,422.12	-	-	-	-	Dry	Dry	Dry

CLIENT: Metcalf & Eddy, Inc.	**General Borings, Inc.** P. O. BOX 7135 PROSPECT, CONN. 06712	SHEET 1 OF 2	HOLE NO. B-1
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam	LINE	
FOREMAN-DRILLER D.T. E.P.	LOCATION Hinsdale, Massachusetts	STATION	
INSPECTOR R.W.		OFFSET	

GROUND WATER OBSERVATIONS
AT 18.75 FT. AFTER 0 HOURS
AT 19.25 FT. AFTER 16 HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW	SS	NX
SIZE I.D.	4"	3"	2 1/8"
HAMMER WT.		300 LBS.	BIT
HAMMER FALL		18"	

DATE Start 9/7 Finish 9/9/76
SURFACE ELEV.
GROUND WATER ELEV.

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.
		1	ss	18"	14"	1.5'	2	4	7		dry medium	1.0'
		2	ss	18"	14"	3.0'	8	10	9		"	
5		3	ss	18"	8"	4.5'	6	6	7		"	6.0'
		4	ss	18"	10"	6.0'	4	6	5		"	
		5	ss	18"	9"	7.5'	16	29	31	dry very	dense	
10		6	ss	18"	14"	9.0'	32	56	59		"	
		7	ss	18"	18"	10.5'	36	74	110	moist	very dense	
		8	ss	9"	6"	11.25'	64	150/3"			"	
		9	ss	18"	10"	14.5'	14	16	13		moist	med.
15		10	ss	18"	12"	16.0'	11	31	16		moist	dense
		11	ss	18"	14"	17.5'	12	22	24		"	
		12	ss	24"	4"	19.5'	13	14	14	16	"	
20		13	ss	24"	5"	21.5'	16	13	26	14	"	
		14	ss	24"	14"	23.5'	31	46	14	32	"	
25		1	C	36"	27"	26.5'	CORED					
		15	ss	12"	6"	28.5'	21	75			moist	
										very	dense	
30		16	ss	24"	16"	31.0'	21	26	31	37	"	
		17	ss	24"	18"	33.0'	31	42	46	53	"	
35		18	ss	[illegible]	[illegible]	[illegible]	[illegible]	52	51	64	"	
		19	ss	[illegible]	10"	[illegible]	[illegible]	36	61	78	"	
		20	ss	[illegible]	8"	37.75'	62	100/3"			"	
40		21	ss	12"	7"	40.5'	56	150			"	

FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.

1) Topsoil - brown fine-medium sand, trace coarse gravel.
2) Brown fine-medium sand, trace silt, trace fine gravel.
3) Same as sample #2.
4) Same as sample #2.
5) Brown-orange-gray fine-medium sand, trace coarse sand, trace fine gravel, trace silt, trace fractured rock.
6) Brown-gray fine-medium sand, trace silt, little rock fract[illegible], trace coarse gravel.
7) Same as sample #6.
8) Gray coarse-fine sand, some coarse-fine gravel. (Refusal on spoon at 11.25') Cored 6" [illegible], cored 11.25'-13.0'.
9) Gray-brown fine sand, little silt, some fine-medium gravel.
10) Same as sample #9.
11) Same as sample #9, some coarse sand.
12) Same as sample #11, coarse gravel in spoon tip.
13) Gray-brown fine-medium [illegible] little silt, some fine-medium gravel.
14) Brown coarse-fine sand [illegible] medium-fine gravel, trace [illegible].
NOTE: Refusal at 23.5' cor[illegible] boulder 23.5'-26.5', [illegible] 2.25'.
15) Brown fine sand, little [illegible], trace fine gravel.
NOTE: Drilled cobble [illegible].
16) Same as sample #15.
17) Same as sample #15, [illegible] coarse gravel.

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ________ FT.
ROCK CORING ________ FT.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

CLIENT: Metcalf & Eddy, Inc.		SHEET 2 OF 2
		HOLE NO. B-1
CONTRACTOR: GBI #723	PROJECT NAME: Cleveland Brook Reservoir Dam	LINE
FOREMAN-DRILLER: D.T. E.P.	LOCATION: Hinsdale, Massachusetts	STATION
INSPECTOR: R.W.		OFFSET

GROUND WATER OBSERVATIONS

AT 18.75 FT. AFTER 0 HOURS

AT 19.25 FT. AFTER 16 HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW	SS	NX
SIZE I.D.	4"	3"	2 1/8"
HAMMER WT.		300 LBS.	BIT
HAMMER FALL		18"	

DATE Start 9/7 Finish 9/9/76

SURFACE ELEV.

GROUND WATER ELEV.

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
		22	ss	18"	9"	41.5'	26	79	150		moist	cored	18) Same as sample #17.
										very	dense	cobbles	19) Same as sample #17.
			ss	0"		42.0'	50/0"						20) Same as sample #17, refusal
45'		23	ss	12"	6"	45.0'	81	100			"		at 37.75' cored cobbles.
5													21) Same as sample #20.
													22) Same as sample #20.
		24	ss	6"	3"	46.5'	150				"		23) Same as sample #20.
													24) Same as sample #20, drilled
50'		25	ss	9"	6"	48.75'	37	100/3"			"	48.75'	with tri-cone to 48.0'.
10												EOB	25) Same as sample #24.
													END OF BORING 48.75'
													45.75' Soil
15													3.0' Rock
20													
25													
30													
35													
40													

TYPE OF SAMPLES
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT.
ROCK CORING ______ FT.

CLIENT: Metcalf & Eddy, Inc.	**General Borings, Inc.** P. O. BOX 7135 PROSPECT, CONN. 06712		SHEET Redrilled OF HOLE NO. B-1
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam		LINE
FOREMAN-DRILLER F.C. B.C.	LOCATION Hinsdale, Massachusetts		STATION
INSPECTOR			OFFSET

GROUND WATER OBSERVATIONS

AT ______ FT. AFTER ______ HOURS

AT ______ FT. AFTER ______ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW		
SIZE I.D.	4"		
HAMMER WT.		LBS.	BIT
HAMMER FALL			

DATE Start 9/21/76 Finish

SURFACE ELEV.

GROUND WATER ELEV.

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
													Ran casing to 31.5' to install Piezometers.
5													1st 30.6'
10													2nd 18.7'
15													
20													
25													
30													
35													
40													

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT.
ROCK CORING ______ FT.

CLIENT	General Borings, Inc.	SHEET 1 OF 1
Metcalf & Eddy, Inc.	P. O. BOX 7135 PROSPECT, CONN. 06712	HOLE NO. B-2
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam	LINE
FOREMAN-DRILLER D.T. E.P.	LOCATION Hinsdale, Massachusetts	STATION
INSPECTOR R.W.		OFFSET

GROUND WATER OBSERVATIONS
AT ______ FT. AFTER ______ HOURS
AT ______ FT. AFTER ______ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW	SS	NX
SIZE I.D.	4"	3"	2 1/8"
HAMMER WT.		300 LBS.	BIT
HAMMER FALL		18"	Carb.&Diam.

DATE Start 9/10 Finish 9/10/76
SURFACE ELEV. ______
GROUND WATER ELEV. ______

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.
												.5'
		1	ss	24"	18"	[illegible]	[illegible]	4	9	6	dry medium	
		[illegible]	ss	[illegible]	[illegible]	[illegible]	[illegible]	6	7	6	"	5.0'
5		[illegible]	ss	24"	14"	[illegible]	8	11	18	18	dry dense	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	9	11	dry medium	8.5'
10		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26	[illegible]	[illegible]	dry very dense	
		[illegible]	ss	[illegible]	[illegible]	[illegible]	7	27	23	31	moist very dense	12.0'
		7	ss	[illegible]	14"	[illegible]	[illegible]	[illegible]	39	46	"	
15		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15	22	26	29	"	
		[illegible]	ss	24"	[illegible]	[illegible]	51	21	14	11	moist medium	
20		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16	17	15	18	moist dense	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	19	23	19	"	
25		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	64	46	32	moist very dense	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37	52	76	"	
		[illegible]	ss	[illegible]	[illegible]	[illegible]	[illegible]	59	27	32	"	
30		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	118	"	30.0' EOB
35												
40												

FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.

1) Topsoil & brown fine-medium sand, little fine gravel, trace silt.
2) Light brown fine-medium sand, trace fine gravel, trace silt.
3) Gray-brown fine sand, little silt, little medium-fine gravel.
4) Same as sample #4, trace fractured rock.
5) Brown-gray fine-medium sand, trace silt, little fine-coarse gravel.
6) Gray-brown coarse-fine sand, some fine gravel, trace silt.
7) Brown fine sand, trace fine gravel, trace silt.
8) Brown-gray fine sand, trace silt, trace coarse sand, trace fine gravel.
9) Same as sample #8, trace coarse gravel.
10) Same as sample #9.
11) Same as sample #9
12) Brown-gray fine-medium sand, trace silt, little coarse-fine gravel.
13) Same as sample #12.
14) Same as sample #12.
15) Same as sample #12.

NOTE: Cored 15" boulder. Broke casing at 30.0' moved boring 4.0' South.

END OF BORING 30.0' [illegible]

TYPE OF SAMPLE: D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
TP=TEST PIT UT=UNDISTURBED THINWALL V=VANE TEST
PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT
ROCK CORING ______ FT

CLIENT: Metcalf & Eddy, Inc.	General Borings, Inc. P. O. BOX 7135 PROSPECT, CONN. 06712	SHEET - OF 1 HOLE NO. B-2-A
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam	LINE
FOREMAN-DRILLER D.T. E.P.	LOCATION Hinsdale, Massachusetts	STATION
INSPECTOR J.B.		OFFSET 4.0' South of B-2

GROUND WATER OBSERVATIONS
AT ____ FT. AFTER ____ HOURS
AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW	SS	
SIZE I.D.	4"	3"	
HAMMER WT.		300 LBS.	BIT
HAMMER FALL		18"	

DATE Start 9/15 Finish 9/15/76
SURFACE ELEV. ____
GROUND WATER ELEV. ____

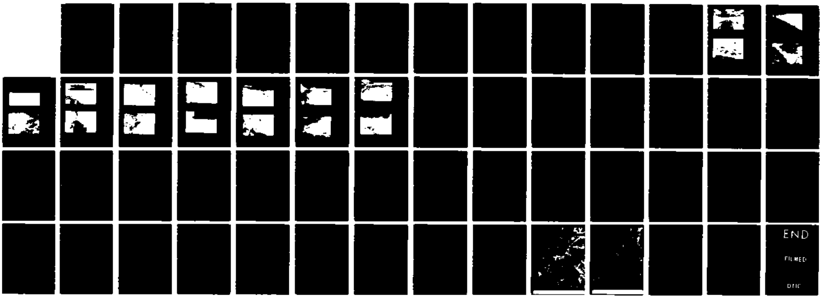
DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
													Drilled casing 0.0'-30.0'. No samples, refusal on casing at 30.0', cored 12" boulder.
35'		1	ss	18"	14"	33.5'	25	46	118		moist		1) Gray-brown fine-medium sand, little silt, trace fine-medium
			ss	24"	0"	36.0'	29	56	24	42	very dense	36.0' EOB	gravel. NOTE: Spoon separated in hole, lost half, moved hole 4.0' south of B-2-A.
40'													END OF BORING 36.0' Soil
													Installed two piezometers: 1 at 30.75' 1 at 21.33'

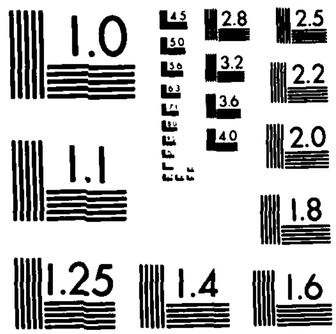
TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE 0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ____ FT.
ROCK CORING ____ FT.

AD-A154 494 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS CLEVELAND BROOK RESER..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV JUN 79 2/2

UNCLASSIFIED F/G 13/13 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

CLIENT Metcalf & Eddy, Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 1 OF 1
HOLE NO. B-2-B

CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam	LINE
FOREMAN-DRILLER D.T. E.P.	LOCATION Hinsdale, Massachusetts	STATION
INSPECTOR J.B.		OFFSET 3.0' South of B-2-A

GROUND WATER OBSERVATIONS
AT 19 FT. AFTER ______ HOURS
AT ______ FT. AFTER ______ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	BW	SS	
SIZE I.D.	2½"	1 3/8"	
HAMMER WT.		140 LBS.	BIT
HAMMER FALL		30"	

DATE Start 9/16 Finish 9/16, 7[illegible]
SURFACE ELEV. ______
GROUND WATER ELEV. ______

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
											Drilled with BW casing		Drilled to 30.0', no samples taken. Permeability Test at 30.0'.
35' 5			ss	24"	0"	36.0'	21	14	12	10	moist		No recovery at 34.0'-36.0'.
		1	ss	24"	16"	38.0'	11	10	11	16	moist medium		1) Brown fine-medium sand, little silt, trace fine-medium gravel.
40' 10		2	ss	24"	12"	40.0'	14	17	14	19	moist dense		2) Same as sample #1, trace silt.
		3	ss	24"	9"	42.0'	11	16	21	19	"		3) Same as sample #2. 4) Same as sample #1, little silt. 5) Same as sample #4.
		4	ss	24"	12"	44.0'	9	10	10	12	moist medium		Refusal at 45.5' cored 1.0' boulder and cobbles to 46.0'.
15		5	ss	18"	10"	45.5'	12	19	27	50/0"	moist very dense		6) Gray-brown fine-medium sand, little silt, little fine-medium gravel.
50' 20		6	ss	24"	12"	50.0'	11	21	16	15	moist dense		7) Same as sample #6, trace fractured rock.
		7	ss	24"	14"	52.0'	16	22	27	48	moist very dense		8) Brown-gray fine-medium sand, trace silt, trace fine-medium gravel.
55'		8	ss	24"	18"	54.0'	33	52	41	39	"	54.0' EOB	
25													END OF BORING 54.0' [illegible]
													Installed two Piezometers 1 at 40.75' 1 at 35.0'
30													
35													
40													

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT.
ROCK CORING ______ FT

CLIENT: Metcalf & Eddy, Inc.	**General Borings, Inc.** P. O. BOX 7135 PROSPECT, CONN. 06712	SHEET 1 OF 1 HOLE NO. B-3
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam	LINE
FOREMAN-DRILLER F.C. B.C.	LOCATION Hinsdale, Massachusetts	STATION
INSPECTOR J.B.		OFFSET

GROUND WATER OBSERVATIONS
AT 9.5 FT. AFTER ____ HOURS
AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW	SS	
SIZE I.D.	4"	3"	
HAMMER WT.		300 LBS.	BIT
HAMMER FALL		18"	

DATE Start 9/8 Finish 9/8/76
SURFACE ELEV. ____
GROUND WATER ELEV. ____

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.
		1	ss	24"	10"	2.0'	2	5	4	5	dry loose	
		2	ss	24"	12"	4.0'	8	10	15	21	dry dense	
5		3	ss	24"	10"	6.0'	21	29	47	54	dry very dense	
		4	ss	24"	5"	8.0'	27	24	30	37	wet very dense	
10		5	ss	24"	12"	10.0'	10	16	17	14	wet dense	
		6	ss	24"	13"	12.0'	47	62	73	98	wet very dense	
		7	C	24"		14.0'						
15		8	ss	24"	15"	16.0'	19	16	37	29	"	
		9	ss	24"	12"	18.0'	14	20	9	8	wet medium	19.0'
20		10	ss	24"	18"	20.0'	1	4	20	24	wet dense	
		11	ss	24"	14"	22.0'	29	34	37	62	wet very dense	
		12	ss	24"	16"	24.0'	19	18	18	17	wet dense	
25		13	ss	24"	10"	26.0'	18	17	17	16	"	
		14	ss	24"	20"	28.0'	21	19	29	37	wet very dense	
30		15	ss	24"	16"	30.0'	16	16	17	19	wet dense	30.0' EOB
35												
40												

FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.

0.0'-19.0' cobbles and coarse gravel.
1) Brown fine sand & coarse gravel, trace silt.
2) Brown fine sand & medium gravel, trace silt.
3) Brown fine-coarse sand, trace fine gravel, trace silt.
4) Brown medium-coarse sand, trace silt and coarse gravel.
5) Brown fine-medium sand, trace silt & coarse gravel.
6) Brown medium-fine sand, little silt, trace coarse-medium gravel.
7) Cored 12.0'-14.0', boulder 12.0'-13.0'.
8) Brown fine-medium sand, little silt & coarse gravel.
9) Brown medium-coarse sand & medium-coarse gravel, trace silt.
10) 1st 12"-layer wood fibers, trace peat and loose, brown fine sand, [tr] coarse gravel. Last 12" brown fine sand, little silt, tr. medium-coarse gravel.
11) Brown fine-medium sand & medium-coarse gravel.
12) Brown fine sand, trace silt, little medium-fine gravel.
13) Brown fine sand, trace silt, trace fine-coarse gravel.
14) Brown fine sand.
15) Brown fine sand, little silt, little medium-coarse gravel.

END OF BORING 30.0' Soil
Installed three Piezometers:
1st - 30.0' 2nd - 19.5'
3rd - 10.0'

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ____ FT.
ROCK CORING ____ FT.

CLIENT: Metcalf & Eddy, Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 1 OF 1

HOLE NO. B-4

CONTRACTOR GBI #723

PROJECT NAME Cleveland Brook Reservoir Dam

LINE

FOREMAN-DRILLER F.C. B.C.

LOCATION Hinsdale, Massachusetts

STATION

INSPECTOR J.B.

OFFSET

GROUND WATER OBSERVATIONS

AT 1 FT. AFTER 0 HOURS

AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW	SS	
SIZE I.D.	4"	3"	
HAMMER WT.		300 LBS.	BIT
HAMMER FALL		18"	

DATE Start 9/13 Finish 9/13/76

SURFACE ELEV.

GROUND WATER ELEV.

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.
		1	ss	24"	10"	2.0'	1	3	4	4	wet loose	loose
		2	ss	24"	11"	4.0'	2	3	4	3	"	
5		3	ss	24"	9"	6.0'	3	3	4	3	"	7.5'
		4	ss	24"	11"	8.0'	3	3	3	40	wet dense	
10		5	ss	24"	10"	10.0'	15	20	15	23	"	
		6	ss	24"	15"	12.0'	9	20	14	16	wet medium	
		7	ss	24"	13"	14.0'	10	14	16	15	wet dense	
15		8	ss	24"	14"	16.0'	9	10	9	11	wet medium	
		9	ss	24"	24"	18.0'	7	9	14	20	wet dense	
20		10	ss	24"	12"	20.0'	10	11	9	10	wet medium	21.5'
		11	ss	24"	23"	22.0'	7	10	29	73	wet very dense	
25												25.0' EOB
30												
35												
40												

FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.

1) Brown fine-medium sand, little silt, trace fine-coarse gravel.
2) Brown fine-medium sand, little silt and medium-fine gravel.
3) Brown fine-medium sand, little silt, trace medium-coarse gravel.
4) Brown fine-medium sand, little silt, trace medium-coarse gravel.
5) Brown fine sand and medium-coarse gravel, little silt.
6) Brown fine sand, little silt, little medium-fine gravel.
7) Brown medium-fine sand, little silt, trace medium-fine gravel.
8) Brown medium-fine sand, little fine gravel.
9) Brown fine sand, little silt and medium-fine gravel.
10) Brown fine-medium sand, little silt, trace fine-medium gravel.
11) Brown fine sand, trace medium-coarse gravel, little silt, little mica-schist mixed.

NOTE: Ran core barrel 22.0'-25.0', boulder on boulder.

END OF BORING 25.0' Soil

Installed two Piezometers 1st - 15.0' 2nd - 7.5'

TYPE OF SAMPLES D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE

EARTH BORING ____ FT.

ROCK CORING ____ FT.

CLIENT: Metcalf & Eddy, Inc.	General Borings, Inc. P. O. BOX 7135 PROSPECT, CONN. 06712	SHEET 1 OF 1 HOLE NO. B-4-A
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam	LINE
FOREMAN-DRILLER F.C. B.C.	LOCATION Hinsdale, Massachusetts	STATION
INSPECTOR J.B.		OFFSET

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	
AT .5 FT. AFTER ___ HOURS	TYPE	HW	SS		DATE Start 9/15 Finish 9/15/76
AT ___ FT. AFTER ___ HOURS	SIZE I.D.	4"	3"		SURFACE ELEV.
	HAMMER WT.		300 LBS.	BIT	GROUND WATER ELEV.
	HAMMER FALL		18"		

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC
													Ran Casing 3.0' and took Permeability Test for 3 minutes.
5													
10													
15													
20													
25													
30													
35													
40													

TYPE OF SAMPLES
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT.
ROCK CORING ______ FT.

CLIENT: Metcalf & Eddy, Inc.	**General Borings, Inc.** P. O. BOX 7135 PROSPECT, CONN. 06712	SHEET 1 OF 1 HOLE NO. B-5
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam	LINE
FOREMAN-DRILLER D.T. E.P.	LOCATION Hindsdale, Massachusetts	STATION
INSPECTOR J.B.		OFFSET

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.		Start	Finish
AT 18.25 FT. AFTER 0 HOURS	TYPE	HW	SS		DATE	9/20	9/21/76
AT ____ FT. AFTER ____ HOURS	SIZE I.D.	4"	3"		SURFACE ELEV.		
	HAMMER WT.		300 LBS.	BIT	GROUND WATER ELEV.		
	HAMMER FALL		18"				

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. / MOIST	STRATA CHANGE DEPTH / ELEV.
												.5'
		1	ss	24"	9"	2.0'	9	17	16	17	dry dense	
		2	ss	24"	12"	4.0'	8	21	16	29	"	
5												
		3	ss	24"	20"	6.0'	16	27	39	38	moist very dense	
		4	ss	24"	10"	8.0'	21	20	32	26	"	
10		5	ss	24"	12"	10.0'	28	36	32	26	"	
		6	ss	24"	10"	12.0'	20	30	35	55	"	12.83'
		7	ss	4"	4"	12.83'	75/4"				"	
			ss	0"	0"	14.0'	50/0"					
15												16.0'
		8	ss	24"	5"	18.0'	29	56	42	55	"	
20		9	ss	24"	7"	20.0'	27	39	26	35	"	
		10	ss	24"	6"	22.0'	29	56	54	61	"	
		11	ss	24"	12"	24.0'	34	29	28	32	"	
25			ss	24"	0"	26.0'	11	14	17	18		
		12	ss	24"	14"	28.0'	22	12	12	17	moist medium	
30		13	ss	24"	3"	30.0'	21	17	20	16	moist dense	
		14	ss	24"	10"	32.0'	16	14	15	17	"	
		15	ss	24"	12"	34.0'	16	19	17	21	"	
35		16	ss	24"	14"	36.0'	15	15	16	19	"	36.0'
												EOB

FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.

1) Topsoil & brown coarse-fine sand, little fine gravel.

2) Same as sample #1, no topsoil, trace coarse gravel.

3) Brown fine-medium sand, little silt, little fine-medium gravel.

4) Same as sample #3.

5) Same as sample #3.

6) Same as sample #3, little fine gravel.

Pressed tube 6"-recovered 6" 12.0'-12.5'.

7) Same as sample #6, some fine-coarse gravel.

Cored cobbles & boulders 12.83'-14.0'. Refusal at 14.0' cored cobbles to 16.0'.

8) Gray-brown fine-coarse sand, trace silt, trace fine gravel.

9) Coarse-fine gravel (appears to be washed).

10) Gray-brown fine-coarse sand, some coarse-fine gravel, little silt.

11) Gray-brown coarse-fine sand, some fine-medium gravel, trace silt.

No recovery 24.0'-26.0'.

12) Same as sample #11, some coarse gravel.

13) Coarse gravel in spoon tip.

14) Gray-brown fine-medium sand, little silt, little fine-medium gravel.

15) Same as sample #14.

16) Same as sample #14.

END OF BORING 36.0' Soil

TYPE OF SAMPLES: D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ____ FT.
ROCK CORING ____ FT.

CLIENT: Metcalf & Eddy, Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 1 OF 1

HOLE NO. B-6

CONTRACTOR: GBI #723	PROJECT NAME: Cleveland Brook Reservoir Dam
FOREMAN-DRILLER: F.C. B.C.	LOCATION: Hinsdale, Massachusetts
INSPECTOR: J.B.	

LINE

STATION

OFFSET

GROUND WATER OBSERVATIONS

AT 17.5' FT. AFTER ____ HOURS

AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW	SS	
SIZE I.D.	4"	3"	
HAMMER WT.		300 LBS.	BIT
HAMMER FALL		18"	

DATE Start 9/16 Finish 9/16/76

SURFACE ELEV. ____

GROUND WATER ELEV. ____

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.
		1	ss	24"	13"	2.0'	4	7	10	10	dry medium	
		2	ss	24"	16"	4.0'	10	11	27	40	dry very dense	
5		3	ss	24"	13"	6.0'	23	21	24	30	"	
		4	ss	24"	14"	8.0'	19	28	32	41	"	
10		5	ss	24"	13"	10.0'	23	39	47	62	wet very dense	
		6	ss	24"	5"	12.0'	37	49	67	74	"	
		7	ss	24"	11"	14.0'	31	23	27	38	"	
15		8	ss	24"	12"	16.0'	10	23	27	30	"	
		9	ss	24"	13"	18.0'	19	18	27	26	"	
20												
		10	ss	24"	8"	22.0'	13	14	17	28	wet dense	
		11	ss	24"	10"	24.0'	16	17	23	26	"	
25		12	ss	24"	17"	26.0'	26	34	39	41	wet very dense	
		13	ss	24"	14"	28.0'	31	47	56	59	"	
30		14	ss	24"	11"	30.0'	37	51	63	79	"	30.0' EOB
35												
40												

FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.

1) Brown fine sand, little silt, little medium-fine gravel.
2) Brown fine sand, little silt and coarse gravel.
3) Brown fine sand, little silt, trace medium-coarse gravel.
4) Brown fine sand, little silt, trace fine-medium gravel.
5) Brown medium-coarse sand, little silt, trace medium-coarse gravel.
6) Brown fine-medium sand, trace coarse gravel.
7) Brown fine-medium sand, trace fine-medium gravel.
8) Brown medium-fine sand, little silt, trace fine-medium gravel.
9) Brown-gray fine-medium sand, little silt, trace medium-fine gravel.
NOTE: Cored 18.0'-19.5', ran into boulder, ran casing to 20.0', recovered 1.5'.
10) Brown fine-medium sand, little silt, trace fine-medium gravel.
11) Brown fine sand, little silt, trace medium-coarse gravel.
12) Brown fine sand, little silt, trace medium-fine gravel.
13) Brown fine-medium sand, little silt, trace medium-coarse gravel.
14) Brown-gray fine-medium sand, little silt, trace medium-coarse gravel.

END OF BORING 30.0' [illegible]

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

TOTAL FOOTAGE
EARTH BORING ____ FT.
ROCK CORING ____ FT.

CLIENT: Metcalf & Eddy, Inc.	**General Borings, Inc.** P. O. BOX 7135 PROSPECT, CONN. 06712	SHEET 1 OF 1 HOLE NO. B-7
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam	LINE
FOREMAN-DRILLER F.C. B.C.	LOCATION Hinsdale, Massachusetts	STATION
INSPECTOR J.B.		OFFSET

GROUND WATER OBSERVATIONS
AT 6.25 FT. AFTER 0 HOURS
AT ______ FT. AFTER ______ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW	SS	
SIZE I.D.	4"	3"	
HAMMER WT.		300 LBS.	BIT
HAMMER FALL		18"	

	Start	Finish
DATE	9/15	9/15/76

SURFACE ELEV. ______
GROUND WATER ELEV. ______

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.
		1	ss	24"	14"	2.0'	3	2	3	2	dry loose	
		2	ss	24"	11"	4.0'	3	2	3	9	dry medium	4.5'
5		3	ss	24"	15"	6.0'	9	17	17	31	moist dense	
		4	ss	24"	13"	8.0'	28	27	31	35	moist very dense	
10		5	ss	24"	16"	10.0'	10	17	16	11	moist medium	
		6	ss	24"	13"	12.0'	10	13	12	14	wet medium	
		7	ss	24"	14"	14.0'	13	14	13	14	"	
15		8	ss	24"	16"	16.0'	11	10	13	20	wet dense	
		9	ss	24"	16"	18.0'	11	15	10	14	wet medium	
20		10	ss	24"	14"	20.0'	9	12	15	17	wet dense	20.5'
		11	ss	24"	16"	22.0'	15	27	34	41	wet very dense	
		12	ss	24"	11"	24.0'	27	34	49	61	"	
25		13	ss	12"	6"	25.0'	27	31			"	25.0' EOB
30												
35												

FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.

1) Brown fine sand, little silt, little fine gravel and tree roots.
2) Brown fine sand, little silt, trace fine gravel.
3) Brown fine sand, little silt, trace fine-coarse gravel, tree roots mixed.
4) Brown medium-coarse sand, trace fine-medium gravel.
5) Brown fine sand, little silt, trace fine-medium gravel.
6) Brown fine sand, little silt, trace fine-coarse gravel.
7) Brown fine sand, little silt, little fine-coarse gravel.
8) Brown fine sand, little silt, little medium-coarse gravel.
9) Brown fine-medium sand, little silt, trace medium-coarse gravel.
10) Brown fine-medium sand, little silt, little fine-coarse gravel.
11) Gray-brown fine-medium sand, little silt, trace fine-coarse gravel.
12) Gray-brown medium-coarse sand, trace fine-medium gravel, little silt.
13) Gray-brown medium-coarse sand, trace medium-coarse gravel.

END OF BORING 25.0' [illegible]

Installed one Piezometer at 18.0'

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT.
ROCK CORING ______ FT.

CLIENT: Metcalf & Eddy, Inc.	**General Borings, Inc.** P. O. BOX 7135 PROSPECT, CONN. 06712	SHEET 1 OF 1 HOLE NO. B-8
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam	LINE
FOREMAN-DRILLER D.T. E.P.	LOCATION Hinsdale, Massachusetts	STATION
INSPECTOR J.B.		OFFSET

GROUND WATER OBSERVATIONS
AT 14 FT. AFTER 24 HOURS
AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HW	SS	
SIZE I.D.	4"	3"	
HAMMER WT.		300 LBS.	BIT
HAMMER FALL		18"	

	Start	Finish
DATE	9/16	9/20/76

SURFACE ELEV. ____
GROUND WATER ELEV. ____

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. / MOIST	STRATA CHANGE DEPTH / ELEV.
												.5'
		1	ss	24"	19"	2.0'	9	11	10	13	dry medium	
		2	ss	24"	20"	4.0'	13	15	21	32	dry very dense	
5		3	ss	24"	20"	6.0'	16	29	56	39	"	
		4	ss	24"	18"	8.0'	14	30	33	45	"	
10		5	ss	24"	14"	10.0'	19	24	32	53	"	
		6	ss	12"	8"	11.0'	36	100			moist very dense	
15		7	ss	24"	16"	15.0'	29	46	52	35	"	
		8	ss	24"	18"	17.0'	27	36	39	40	"	
		9	ss	24"	19"	19.0'	19	20	16	12	moist medium	
20		10	ss	24"	9"	21.0'	12	11	11	10	"	
		11	ss	24"	6"	23.0'	6	8	5	5	"	
25			ss	24"	0"	25.0'	8	8	7	8		
		12	ss	24"	3"	27.0'	14	11	10	9	wet medium	
		13	ss	24"	9"	29.0'	7	8	7	9	"	
30		14	ss	24"	3"	31.0'	8	29	21	19	wet dense	
		15	ss	24"	16"	33.0'	12	16	15	17	"	
35		16	ss	24"	12"	35.0'	19	20	56	33	wet very dense	35.0' EOB
40												

FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.

1) Topsoil and light brown fine-medium sand, trace silt, trace fine gravel.
2) Same as sample #1, trace medium gravel.
3) Gray-brown fine-medium sand, trace silt, trace fine-medium gravel, trace coarse gravel.
4) Same as sample #3, no coarse gravel.
5) Same as sample #4.
6) Brown-gray fine-medium sand, trace coarse sand, trace silt, some fine-coarse gravel.
NOTE: Refusal at 11.0', cored cobbles to 13.0'
7) Brown fine-medium sand, trace silt, some fine-medium gravel.
8) Brown-gray fine sand, some silt, some fine-medium gravel.
9) Brown fine-medium sand, trace silt, little fine-medium gravel.
10) Brown fine-medium sand, little silt, little fine gravel, trace fractured rock.
11) Brown fine-medium sand, little silt, little fine-medium gravel.
Note: No recovery at 25.0'.
12) Brown fine-medium sand, little fine-medium gravel, trace silt.
13) Same as sample #12.
14) Same as sample #12.
15) Same as sample #12.
16) Same as sample #12, some coarse gravel.
END OF BORING 35.0' Soil

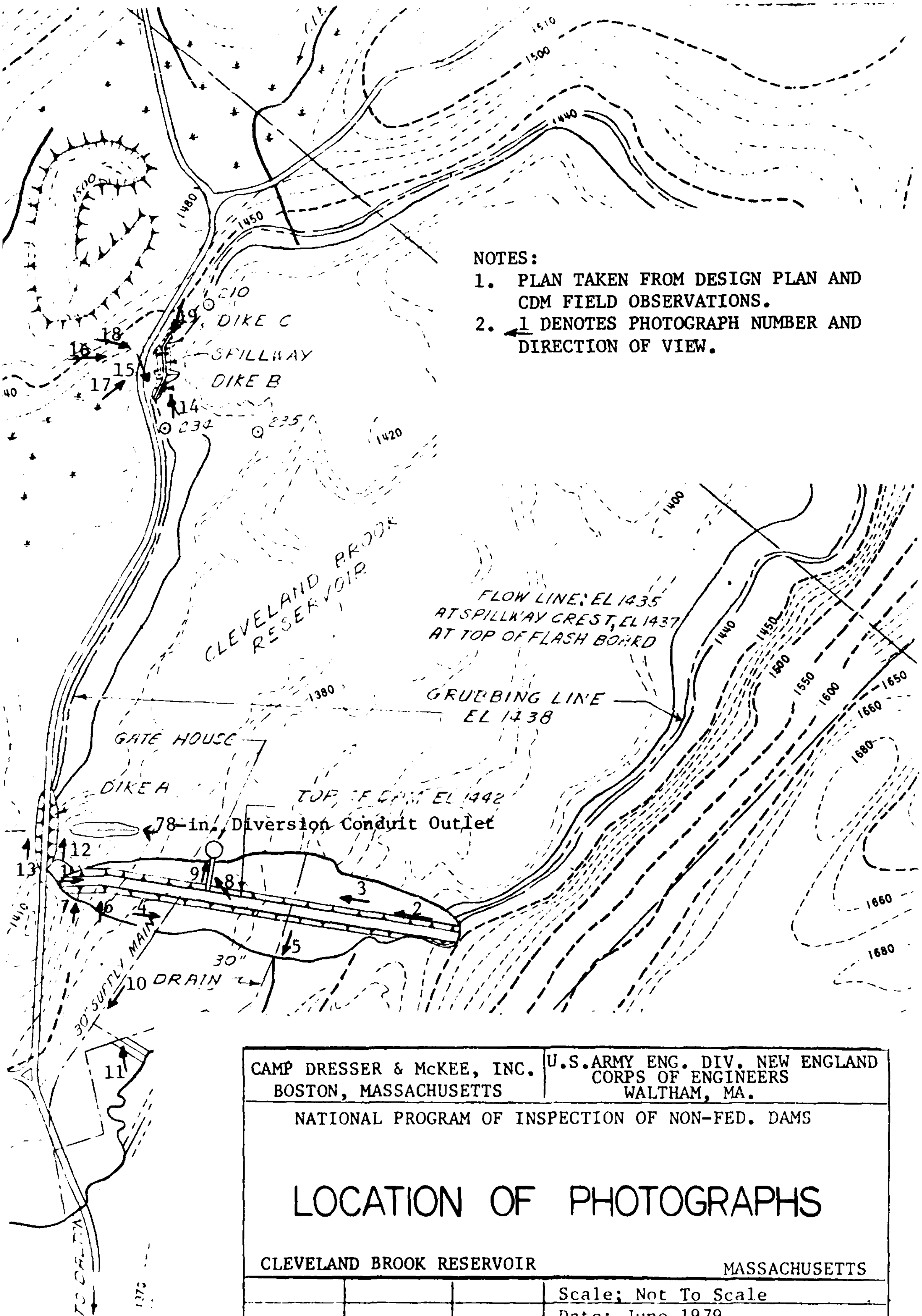
Installed three Piezometers
1st 32.0' 2nd 20.0'
3rd 15.0'

TYPE OF SAMPLES
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ____ FT
ROCK CORING ____ FT

APPENDIX C

SELECTED PHOTOGRAPHS OF PROJECT



CAMP DRESSER & McKEE, INC.
BOSTON, MASSACHUSETTS

U.S.ARMY ENG. DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION OF PHOTOGRAPHS

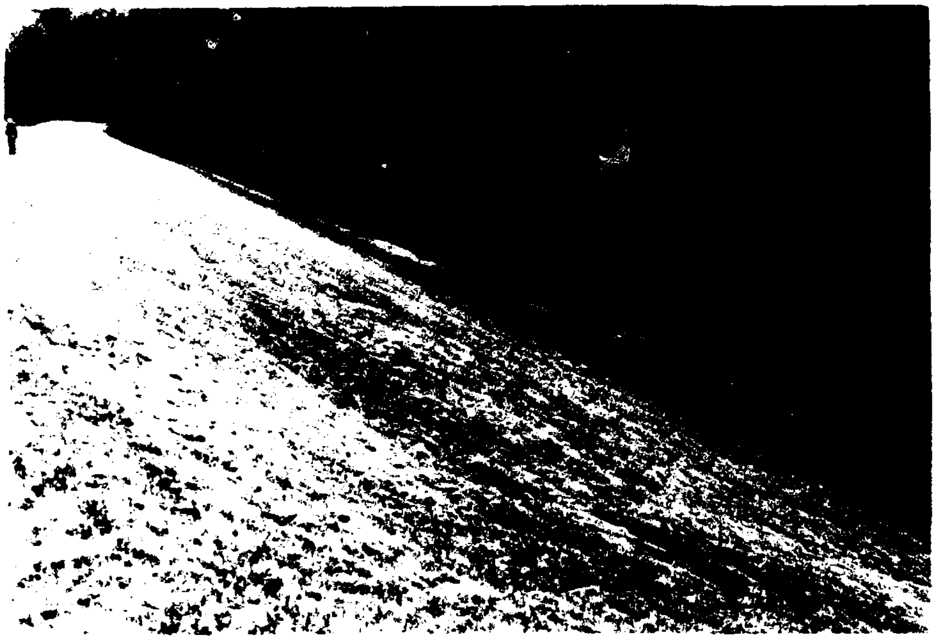
CLEVELAND BROOK RESERVOIR — MASSACHUSETTS

Scale; Not To Scale

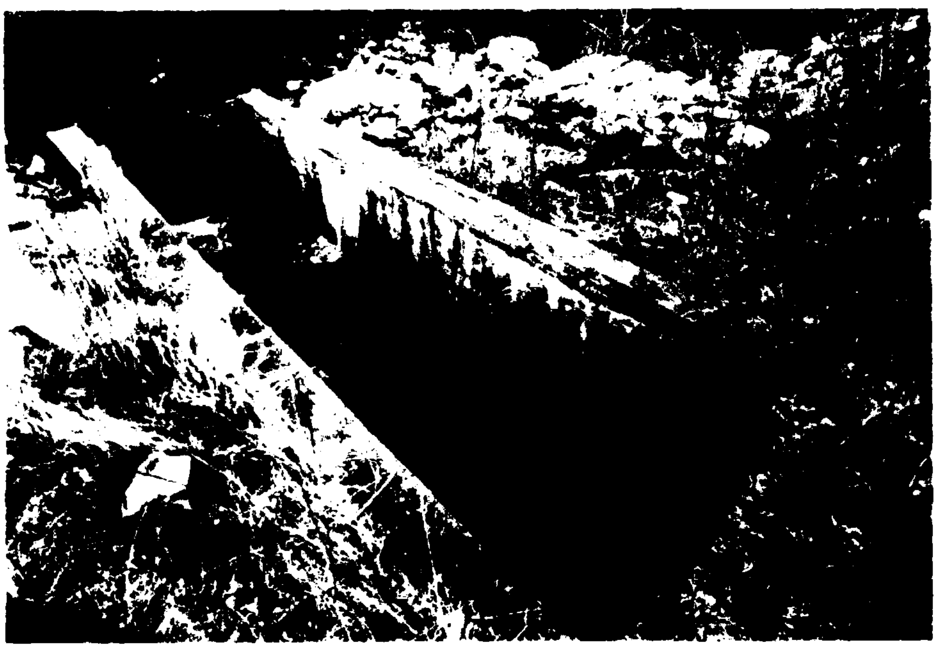
Date; June 1979

2. CREST OF DAM FROM LEFT OF DAM.

3. RIPRAP AT UPSTREAM FACE OF DAM.



4. DOWNSTREAM FACE OF DAM VIEWED FROM RIGHT SIDE.



5. RESERVOIR DRAIN AND DRAINAGE PIPE OUTLET AT TOE OF DAM.

CAMP DRESSER & McKEE INC.

CLIENT COE JOB NO 380-6-RT-10 PAGE 5

PROJECT Dam Insp. DATE CHECKED 7/20/79 DATE 7-18-79

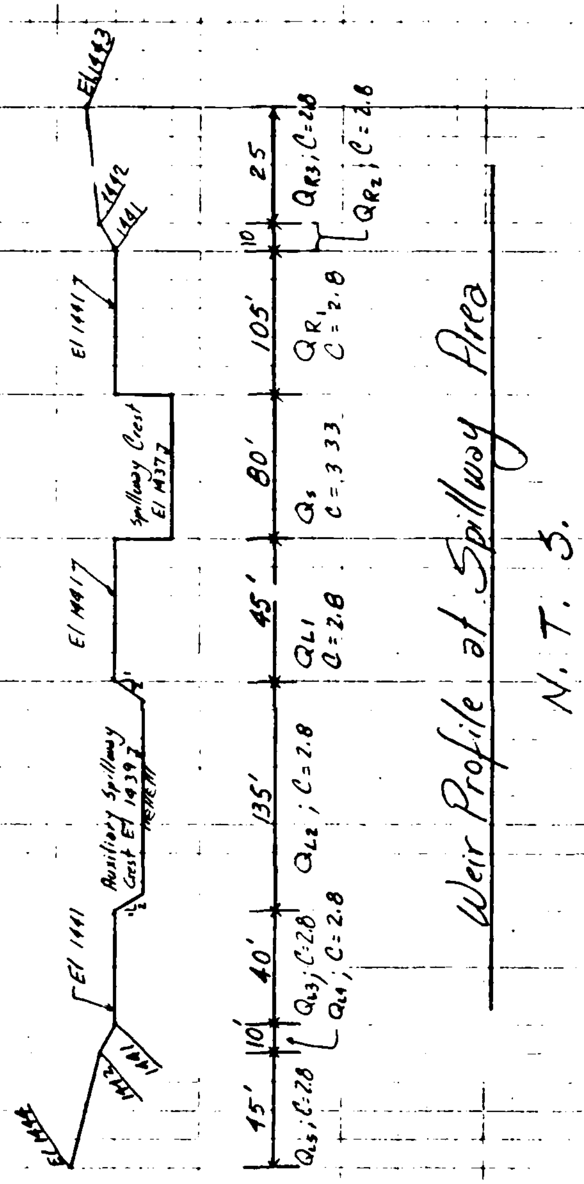
DETAIL Cleveland Boat Rec CHECKED BY JED COMPUTED BY Joe H.

Stage - Discharge Relationship

Upstream W.S. El.	Spillway Q_S	Right Embankment Q_{R1}	Q_{R2}	Q_{R3}	Left Embankment Q_{L1}	Q_{L2}	Q_{L3}	Q_{L4}	Q_{L5}	Main Dam	Dike A	Total
1437	—	—	—	—	—	—	—	—	—	—	—	ZERO
1438	266	—	—	—	—	—	—	—	—	—	—	266
1439	750	—	—	—	—	—	—	—	—	—	—	750
1440	1375	—	—	—	—	375	—	—	—	—	—	1750
1441	2110	—	—	—	—	1028	—	—	—	—	—	3138
1442	2941	294	10	—	126	1911	112	10	—	—	—	5404

CAMP DRESSER & McKEE INC

CLIENT COE JOB NO 380-6-RT-10 PAGE 4
PROJECT Dam Insp. DATE CHECKED 7/20/79 DATE 7-18-79
DETAIL Cleveland Brook Reservoir CHECKED BY JED COMPUTED BY Joe A.



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PROJECT DAM INSP. DATE CHECKED 7/20/79 DATE 7-18-79
DETAIL Cleveland Boat Reservoir CHECKED BY JED COMPUTED BY Joe A.

TEST FLOOD DETERMINATION

The dam is classified as being of intermediate size and high hazard,

∴ Test Flood is PMF

The terrain in the drainage area is rolling with a small area which is flat. Base the PMF determination on a point on the curve labelled "Rolling" terrain. The curve is taken from the N. E. D. Corps of Engineer's "Preliminary Guidance for Estimating PMF in Phase I Dam Safety Investigations", March, 1978.

$$\therefore PMF = 2200 \text{ cfs/mi.sq.} \times 1.52 \text{ mi.sq} = 3,344 \text{ cfs}$$

say 3,350 cfs

STAGE-DISCHARGE RELATIONSHIPS

Assume conditions as they were during field investigation

i.e. flashboards in-place; spillway crest el 1437.0

Compute Stage-Discharge Relationship (see weir profile next page)

Flow over the spillway is:

$$Q\,(cfs) = 3.33\,(B - 0.1\,nH)\,H^{3/2}$$

Flow Over the Embankments, Main Dam and Dike A is:

$$Q\,(cfs) = 2.8\,BH^{3/2}$$

where B = Length of weir, ft

H = Upstream Head measured above the crest. Use avg. Head where the weir is sloped

n = number of contraction

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DETAIL Cleveland Bk. Resv. CHECKED BY JED COMPUTED BY Joe H.

ELEVATIONS

Spillway crest w/ and w/o flashboards	1437.0 ; 1435.0
Toe of Main Dam	1371.0
Crest of Main Dam & Dike A	1442.0
Right Spillway Embankment (Dike C)	1441.0
Left Spillway Embankment (Dike B)	1439.0

Elevations based on 1963 Construction Alteration Dwgs. Datum is the 1927 National Vertical Geodetic Datum.

SURFACE AREAS

@ el 1429.0 ; 144.6 acres ≅ 0.226 mi. sq. (Pond Surface Area)
1440.0 ; 156.6 acres ≅ 0.245 mi. sq "
1450.0 ; 183.2 acres ≅ 0.286 mi. sq. "

Drainage area = 972.8 acres = 1.52 mi. sq.

STORAGE VOLUMES

From 1963 Metcalf & Eddy report (latest alterations), reservoir storage with two feet of flashboards in-place (El. 1437.0) is 5,230 acre-feet. At elevation 1435.0, storage is 4,928 ac-ft.

@ el 1440.0 = 5,230 ac-ft + (150.6 ac) 3 ft = 5,682 ac-ft

@ el 1445.0 = $5{,}682 + \left(\frac{183.2+156.6}{2}\right)5 = 6{,}532$ ac-ft

SIZE CLASSIFICATION

Hydraulic Height = 70-feet ∴ intermediate
The hydraulic height is based on a W.S. El. of 1441 at dam failure

Storage at Top of Dam (El 1442) = 6,022 ac-ft ∴ intermediate

HAZARD CLASSIFICATION

The dam failure analysis (pages 9 - 28) indicates severe damage to property and a high potential for loss of life.

∴ Hazard is HIGH

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DATE 4/79
COMPUTED BY CPM

Scale of Mapping 1" = 2000' sq in × 91.83 = # Acres (A)
A ÷ 640 = # mi²

DRAINAGE AREA

1. 8.02 } 8.01 ave = 8.01 in² = 736 A = 1.150 mi² ✓
2. 8.00 plus 0.37 sq. mile area east of Schnopps Road diverted to the reservoir by a culvert as stated in original design computations of 1948 by M&E

WATER SURFACES

EL. 1429

1. 1.56 } 1.575 ave = 1.575 in² = 144.6 A = 0.226 mi² ✓
2. 1.59

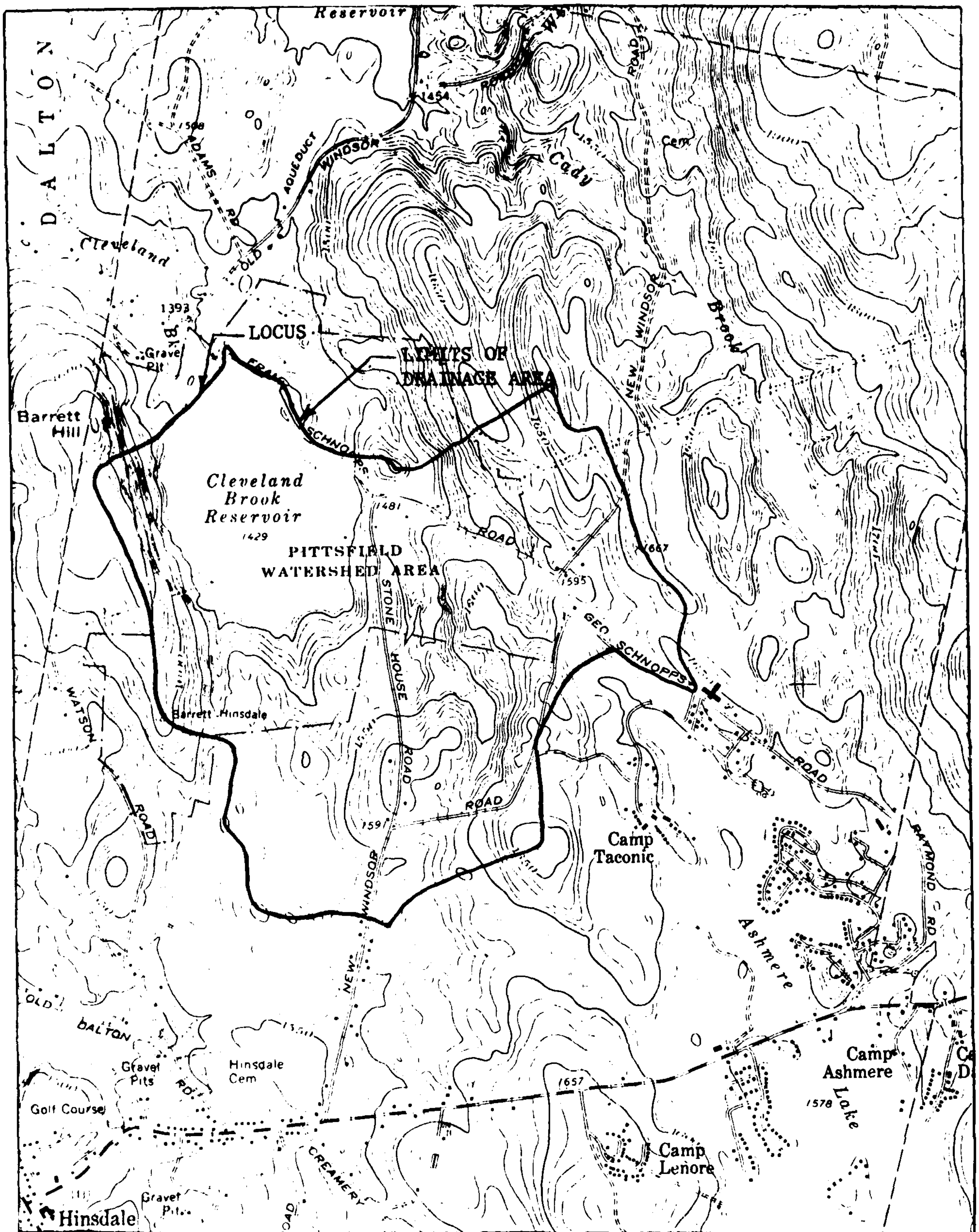
EL 1440

1. 1.70 } 1.705 ave = 1.705 in² = 156.6 A = 0.245 mi² ✓
2. 1.71

El 1450

1. 1.99 } 1.995 in² = 183.2 Acres = 0.286 mi. sq.
2. 2.00

Elevations Based on National Vertical Geodetic Datum



DAM CLEVELAND BROOK RESERVOIR

IDENTIFICATION NO. MA 00225

DRAINAGE AREA MAP
USGS QUADRANGLE

PERU, MASS

APPROX. SCALE: 1" = 2000'

APPENDIX D-1

APPENDIX D

MAPS AND HYDRAULIC/HYDROLOGIC COMPUTATIONS

18. VIEW TOWARDS SPILLWAY FROM DOWNSTREAM. LOW FLOW PIPE BENEATH ROAD OUTLETS IN FOREGROUND. DIKE C AT LEFT SIDE OF PICTURE AND DIKE B ON RIGHT SIDE OF PICTURE.

19. OVERVIEW OF DIKE C FROM EAST END. SPILLWAY AND DIKE B IN BACKGROUND.

16. SPILLWAY WEIR FROM DOWNSTREAM OF DIKE B.

17. SEEPAGE DOWNSTREAM OF SPILLWAY DISCHARGE APRON. DROP INLET FOR LOW FLOW PIPE BENEATH ROADWAY IN UPPER LEFT CORNER OF THE PICTURE.

14. OVERVIEW OF DIKE B AND OVERFLOW SPILLWAY FROM WEST END.

15. RIPRAP PROTECTION OF OVERFLOW SPILLWAY INVERT.

12. UPSTREAM FACE OF DIKE A FROM DAM RIGHT ABUTMENT.

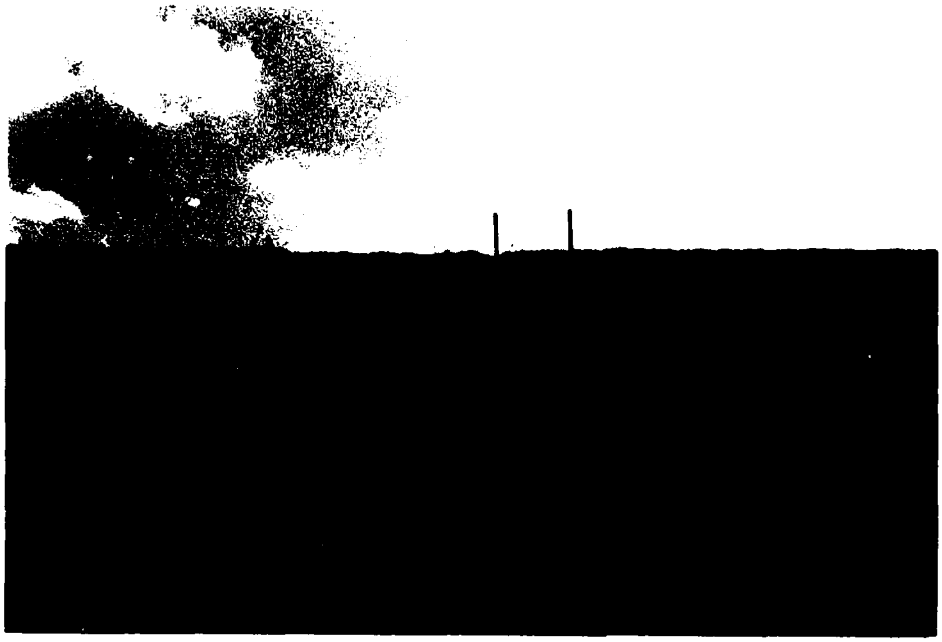
13. CREST AND DOWNSTREAM FACE OF DIKE A FROM WEST END.


10. VALVE CHAMBER ON WATER TRANSMISSION MAIN DOWNSTREAM OF DAM.


11. HEADWALL FOR BLOW-OFF FROM TRANSMISSION MAIN VALVE CHAMBER.

8. INTAKE GATEHOUSE (CONTROL TOWER) FOR WATER TRANSMISSION MAIN.

9. INTERIOR OF GATEHOUSE.



6. OBSERVATION WELLS ON DOWNSTREAM FACE OF DAM NEAR RIGHT ABUTMENT.

7. SEEPAGE AND FLOW MEASURING PIPE ON DOWNSTREAM FACE OF DAM NEAR RIGHT ABUTMENT.

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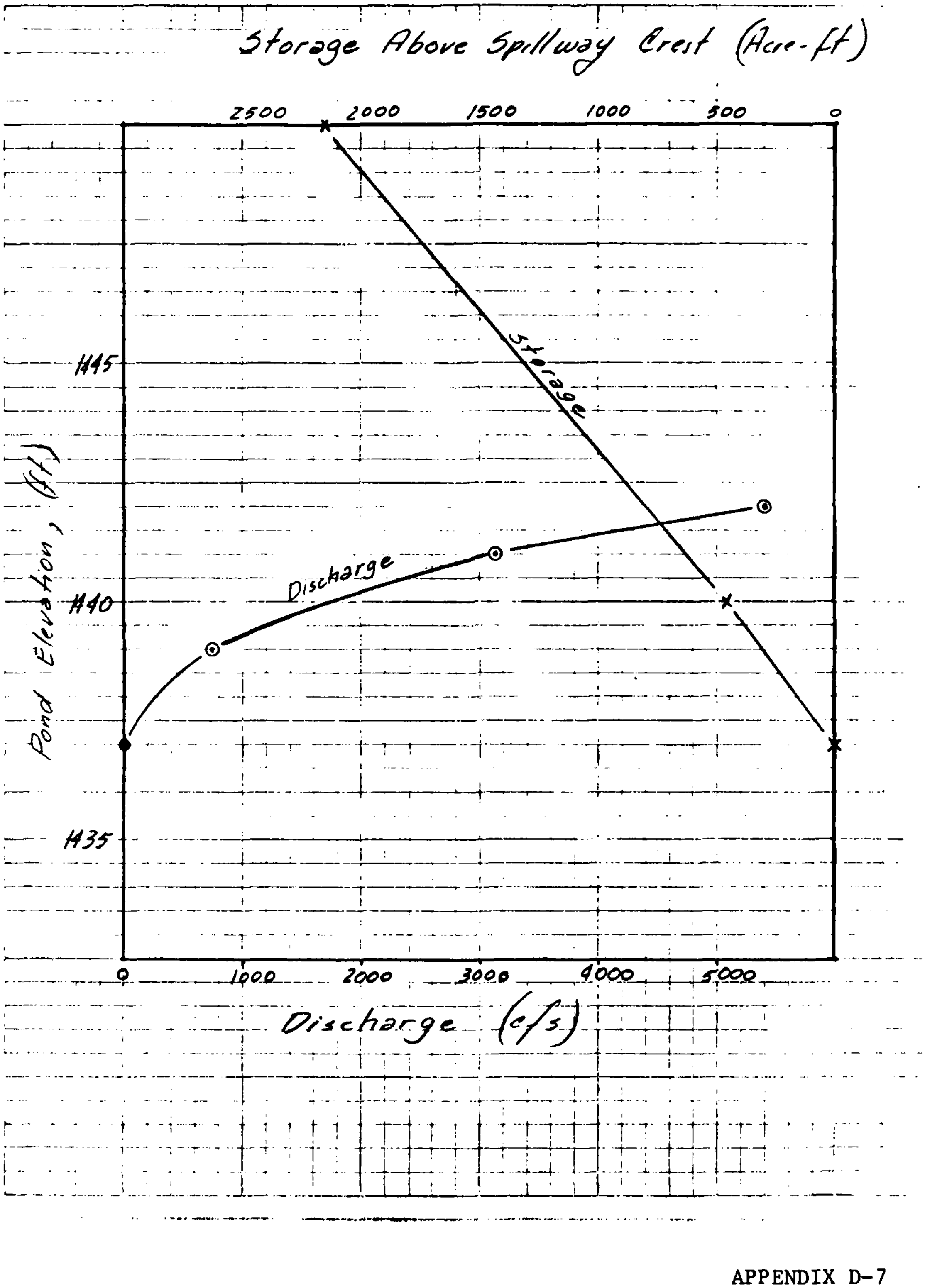

SURCHARGE STORAGE ROUTING

Q_{P_1} = 3,350 cfs (see page 3 ; TEST FLOOD)

Surcharge Height to Pass Q_{P_1} is 1441.1 ft

$$STOR_1 = \frac{\text{Surcharge Storage}}{\text{Drainage Area}} = \frac{639 \text{ Ac-ft} \times 12''/\text{ft}}{973 \text{ Ac}} = 7.881''$$

Probable Max. Flood Runoff:

$$Q_{P_2} = Q_{P_1} \times \left(1 - \frac{STOR_1}{19}\right) = 3{,}350 \times \left(1 - \frac{7.881}{19}\right) = 1{,}960 \text{ cfs}$$

Surcharge Height to Pass Q_{P_2} is 1440.15

$$STOR_2 = \frac{478 \times 12}{973} = 5.895''$$

$$STOR_{AVG} = \frac{7.881 + 5.895}{2} = 6.888 \text{ inches}$$

$$Q_{P_3} = Q_{P_1} \times \left(1 - \frac{STOR_{AVG}}{19}\right) = 3{,}350 \times \left(1 - \frac{6.888}{19}\right) = 2{,}136 \text{ cfs}$$

Surcharge Height To Pass Q_{P_3} is 1440.28 ft.

$$\text{Related } STOR = \underbrace{\frac{500 \times 12}{973}}_{= STOR_3} = 6.170 \text{ in} < STOR_{AVG}$$

then compute Q_{P_4}:

$$\text{New } STOR_{AVG} = \frac{6.888 + 6.170}{2} = 6.529 \text{ inches}$$

$$Q_{P_4} = 3{,}350 \times \left(1 - \frac{6.529}{19}\right) = 2{,}199 \text{ cfs, say } 2{,}200 \text{ cfs}$$

Surcharge Height To Pass Q_{P_4} is 1440.35 ft

Flow through spillway at test flood elevation (1440.35')

$$Q_s = 3.33(80)(3.35)^{1.5} = 1{,}633 \text{ cfs, say } 1{,}630 \text{ cfs}$$

Flow through Emergency spillway @ el 1440.35'

$$Q_{L2} = 2.8(54')(0.675')^{1.5} + 2.8(127')(1.35')^{1.5} = 566 \text{ cfs}$$

say 570 cfs

TAILWATER ANALYSIS:

determine the capacity of the natural channel immediately D/S of the main spillway @ D/S WSEl = Spillway Crest El.:

$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$ where $n \approx 0.095$

$A^* = 100 \times 7 = 700$ sq ft

$R = \frac{A}{P} = \frac{700}{110} = 6.36$

$S \approx 0.015$

$\therefore Q = \frac{1.49}{0.095} 700 (6.36)^{0.667} (0.015)^{1/2}$

$= 9{,}750$ cfs >>> 1,633 cfs which discharges through the main spillway as a result of the Test Flood.

determine the capacity of the natural channel immediately downstream of the auxiliary spillway @ D/S WSEl = Spillway Crest El.:

again $Q = \frac{1.49}{n} R^{2/3} S^{1/2}$

where $n \approx 0.05$

$A^* = 180 \times 1 = 180$

$R = \frac{180}{180} = 1$

$S \approx 0.015$

$\therefore Q = \frac{1.49}{0.05} 180 (1)^{0.6667} (0.015)^{1/2}$

$= 660$ cfs > 566 cfs discharging at Test Flood

In addition to the capacity of the channel immediately D/S of the auxiliary spillway, discharge from the auxiliary spillway can freely flow to the channel immediately D/S of the main spillway thus eliminating the possibility of tailwater effects.

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DAM FAILURE ANALYSIS:

determine Q_p

$$Q_p = 8/27\, (W_b)(g)^{1/2}\, (Y_o)^{3/2}$$

where: W_b = 40% of the dam width measured at the mid-height of the dam
= 1085 × 0.4 = 434 ft.

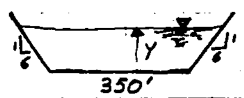
g = 32.2 ft/sec²

Y_o = Hydraulic height at time of dam failure. Assume pond level at top of spillway dam.
= 1441 − 1371
= 70 ft

$$Q_p = 8/27\,(434)(32.2)^{0.5}(70)^{1.5}$$
= 427,350 cfs

REACH 1: Dam to first crossing of Old Windsor Rd. and Cleveland Brook. Cleveland Brook crosses Old Windsor Rd. through a 6'ϕ steel culvert. A V-notch weir is welded onto the d/s side of the 6'ϕ steel culvert.

Assume a trapezoidal X-section and compute depth of flow.



$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

where n = Manning's coeff assumed @ 0.045
A = area, ft²
R = A/P, ft (hydraulic radius)
S = slope, ft/ft = 0.015
Y = depth of flow, ft

Y ft	Area ft²	Q cfs
25	12,500	362,300
30	15,900	509,900

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Reach 1 (cont.)

depth of flow to carry 427,350 cfs is 27.2 ft.

compute storage in reach 1 and route flow:

$$V_1 = \left[12{,}500 + \frac{(15{,}900 - 12{,}500)}{10} 2.7\right] \times 1280 ft \times \frac{1 Ac}{43560 ft^2}$$

$$= 395 \text{ ac-ft}$$

then, $Q_{p_2}(\text{trial}) = Q_{p_1}\left(1 - \frac{V_1}{S}\right)$

$$= 427{,}350\left(1 - \frac{395}{2954}\right)$$

$$= 370{,}200 \text{ cfs}$$

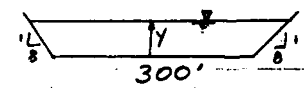
$Q_{p_1} = 427{,}350$ cfs
$V_1 = 395$ ac-ft
S = storage @ time of dam failure = 2954 ac-ft based on a prismoidal appr.

based on Q_p trial $V_2 = 350$ ac-ft : $V_{avg} = 373$ ac-ft.

$$Q_{p_2} = 427{,}350\left(1 - \frac{373}{2954}\right) = 373{,}400 \text{ cfs} \quad : Y = 25.4'$$

REACH 2: First to second crossing of Old Windsor Rd and Cleveland Brook. The brook culvert is a 6'ø corrugated metal pipe, which is of little significance relative to the magnitude of the dam failure outflow.

Assume a trapezoidal X-section and determine depth of flow:



Slope for reach = 0.025
n = 0.045

$$Q = \frac{1.49}{0.045}\left[(300+8Y)Y\right]\left(\frac{(300+8Y)Y}{300+2Y\sqrt{65}}\right)^{0.6667}(0.025)^{0.5}$$

Y (ft)	Area (ft²)	Q (cfs)
15	6300	169,250
20	9200	290,100
25	12,500	445,750

$Y_1 = 22.7'$; $V_1 = \frac{800' \times 22.5' \times 1300'}{43560} = 537$ ac-ft (800' = average width for storage determination)

Reach 2 (cont.)

$$Q_{p_2}(\text{trial}) = 373{,}400\left(1 - \frac{537}{2954}\right) = 305{,}450 \text{ cfs}$$

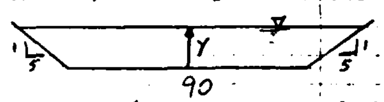
based on Q_{p_2}(trial), $V_2 = \frac{20.5 \text{ ft deep}}{22.5 \text{ ft deep}}\ 537 \text{ ac-ft} = 489$ ac-ft.

$V_{avg} = 513$ ac-ft.

$$Q_{p_2} = 373{,}400\left(1 - \frac{513}{2954}\right) = 308{,}550 \text{ cfs}$$

$Y = 20.6'$

REACH 3: Second to third crossing of Old Windsor Road and Cleveland Brook. The brook crosses under the road through bridge opening 11 ft by 11 ft. The bridge is of small hydraulical significance when dealing with a flow of about 300,000 cfs. Determine depth of flow in the reach based on a trapezoidal X-section.



Slope for reach = 0.05
n = 0.045

$$Q = \frac{1.49}{0.045}(90+5Y)Y\left(\frac{(90+5Y)Y}{90+2Y\sqrt{26}}\right)^{0.6667}(0.05)^{0.5}$$

Y ft	A ft²	Q cfs
25	5,375	298,250
30	7,200	368,650

@ Q = 308,550 c/s Y = 27.5 ft.

Given the steep slope, storage for the reach is negligible.

Assume Qout = 305,000 c/s

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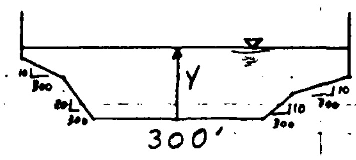
REACH 4: Third crossing of Cleveland Brook and Old Windsor Road to confluence of Cleveland Brook and the East Branch of the Housatonic River. A section of this reach just downstream of the Old Windsor Rd can be assumed to have similar characteristics as reach 3. Assume depth of water in this reach to be about 27.5 ft. Beyond this section, the topography changes radically. The slope flattens out and the overbank storage becomes very significant. Assume the following X-section to calculate depth of flow.



Slope = 0.01
$n = 0.095$

$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$

Y ft	A ft^2	P ft	Q cfs
20	17,000	1,600	272,100
25	29,250	1,755	462,350

Storage

Y, ft	El. @ pt. of Confluence	Area, acres	Storage, ac-ft
10	1150	8.3	8.3 × 5 = 42
20	1160	35	42 + 21.7 × 10 = 259
30	1170	78	259 + 56.5 × 10 = 824

depth of water to pass 305,000 cfs is 20.9 ft.

$V_1 = 310$ ac-ft. $Q_{p_2}(\text{trial}) = 305{,}000\left(1 - \frac{310}{2954}\right) = 273{,}000$ cfs

based on $Q_{p_2}(\text{trial})$, $V_2 = 260$ ac-ft. ; $V_{avg} = 267$ ac-ft.

$$Q_{p_2} = 305{,}000\left(1 - \frac{267}{2954}\right) = 277{,}450 \text{ cfs}$$

$Y = 20.2$ ft

WS El @ confluence of Cleveland Bk and the East Branch of the Housatonic River ≈ 1160.2

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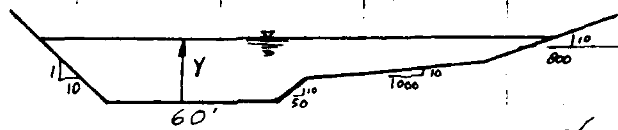
REACH 5 Confluence of Cleveland Brook and the East Branch of the Housatonic River to street just upstream of Center Pond. The importance of the bridge relative to the flow is minor. Assume the road to blend into the surrounding topo, and base the depth of water on a trapezoidal X-section.



slope ≈ 0.0036 } assumed
n ≈ 0.095 }

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Y, ft	Area, ft²	Perimeter, ft	Q, cfs
25	17,625	1,760	162,700
30	26,550	2,210	276,700
20	8,950	1,310	64,000

Storage

Y, ft	WSEl @ Bridge, ft	Area (acres)	Storage, ac-ft
10	1150	27	27 × 6.5 = 176
20	1160	48	176 + 37.5×10 = 551
30	1170	128	551 + 88×10 = 1431
40	1180	222	1431 + 175×10 = 3181

WSEl to pass 277,450 cfs is 1170

$V_1 = 1431$ ac-ft $\quad Q_{P_2}(\text{trial}) = 277,450\left(1 - \frac{1431}{2954}\right)$

$= 143,050$ cfs $\quad Y = 24.1'$

based on Q_{P_2} (trial) $V_2 = 912$ ac-ft

$V_{avg} = 1172$

$$Q_{P_2} = 277,450\left(1 - \frac{1172}{2954}\right) = 167,370 \text{ cfs}$$

Q_{P_2} corresponds to a depth of 25.2' = El 1165.2'

Reach 5 (cont.)

Note that the WSEl at the bridge is 5-feet higher than at the confluence point, upstream. Reroute the flow through reach 4 assuming a WSEl at the confluence of Cleveland Brook and East Branch of Housatonic River of 1166.0.

Storage in reach 4 = 598 ac-ft

$$Q_{p_2} = 305{,}000\left(1 - \frac{598}{2954}\right) = 243{,}250 \text{ cfs}$$

Reroute reach 5

@ Q = 243,250 Stage = 1168.5 ft or Y = 28.5'

V_1 = 1299 ac-ft $Q_{p_2}(\text{trial}) = 243{,}250\left(1 - \frac{1299}{2954}\right) = 136{,}300$

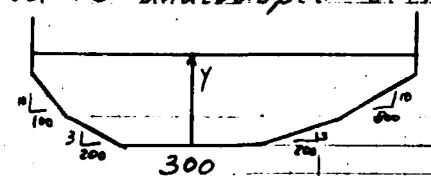
based on $Q_{p_2}(\text{trial})$ Y = 23.8 V_2 = 885 ac-ft

V_{avg} = 1092 ac-ft

$$Q_{p_2} = 243{,}250\left(1 - \frac{1092}{2954}\right) = 153{,}300 \text{ cfs} \rightarrow Y = 24.5$$

WSEl = 1169.5'

REACH 6 Street upstream of Center Pond to section at mid-Center Pond.
Base WSEl on a trapezoidal X-section. Assume that flow is restricted to undeveloped overbank areas only.



Y, ft	Area, ft²	Wetted Perimeter, ft	Q, cfs
23	29,000	1625	207,400
21	25,800	1620	171,300

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Reach 6, (cont.)

Storage

WSEl, ft	Area, acres	Storage, ac-ft	Y, ft
1140	17.5	17.5 × 3 = 53	3
1150	71	53 + 44 × 10 = 493	13
1160	128.6	493 + 100 × 10 = 1493	23

Route flow through reach 6

Q = 153,300 cfs ; Y = 20.0 ; Storage = 1193 Ac-ft.

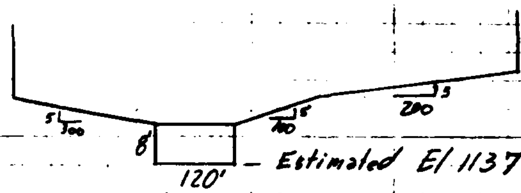
Q_{P_2}(trial) = $153{,}300\left(1 - \frac{1193}{2954}\right) = 91{,}400$ cfs

based on Q_{P_2} trial Y = 16.6 ; Storage = 853 ; Sto_{AVG} = 1023 ac-ft

$Q_{P2} = 153{,}300\left(1 - \frac{1023}{2954}\right) = 100{,}200$ cfs : WSEl 1154.1 ft.

REACH 7: Mid of Center Pond to Main Street.

Assume section at Main street to determine WSEl.



– Estimated El 1137'

Rating Curve:

WSEl	Pressure Flow C = 0.75	Weir Flow C = 2.8	Total Flow, cfs
1150	12,900	8,100	21,000
1160	22,400	80,500	102,900

Reach 7 (cont.)

Storage

WSEl	Area, acres	Storage, acre-ft
1140	34	34 x 3 = 102
1150	56	102 + 45 x 10 = 552
1160	105	552 + 80.5 x 10 = 1357

Reach 7 routing

Q = 100,200 cfs ; WSEl = 1159.7 ; Storage = 1333 ac-ft.

Q_{P_2} (trial) $= 100,200\left(1 - \frac{1333}{2954}\right) = 55,000$ cfs

based on Q_{P_2} (trial) WSEl = 1154.2 ; Storage = 890 for Sto_{AVG} = 1112 a-ft

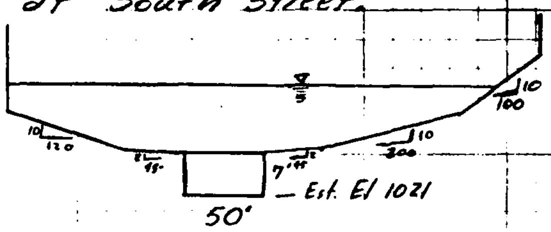
$Q_{P_2} = 100,200\left(1 - \frac{1112}{2954}\right) = 62,500$ cfs ; WSEl 1155.1 ft

Note that WSEl @ reach 7 is higher than @ reach 6. Assume WSEl of 1155.5 ft @ reach 6 and reroute through reach 7.

@ WSEl 1155.5 @ reach 6, the Storage = 1043 ac-ft. This is approximately equal to the computed average storage for reach 6. Therefore the computed Q_{P_2} for reach 6 is O.K. and the reach 7 routing is also good as computed above.

REACH 8: Main Street to South Street

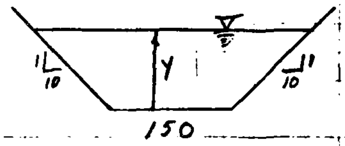
Estimate a cross-section @ South Street and determine the WSEl at South Street.



WSEl	Pressure Flow C=0.7	Weir Flow C=2.8	Total Flow, cfs
1040	6800	25,000	31,800
1045	8100	50,700	58,800
1050	9200	93,900	103,100

∴ WSEl to pass 62,500 cfs is 1045.4

Determine depth of flow at mid-reach. Assume a trapezoidal X-section



Avg. Slope ≈ 0.0075
n = 0.095
Length of reach ≈ 7,000'

Y, ft	Area, ft²	Q, cfs
10	2,500	26,600
15	4,500	59,900
20	7,000	109,400

∴ Average depth in the reach is 15.3 ft. The x-sectional area ≈ 5,200 ft².

Reach 8 (cont.)

The slope in the reach is reasonably flat; some storage will accumulate in the reach.

@ $Area_{AVG} = 5{,}200 ft^2$, Storage $= \frac{5200 \times 7000}{43560} = 836$ ac-ft.

$Q_{P_2}(trial) = 62{,}500\left(1 - \frac{836}{2954}\right) = 49{,}800$ cfs.

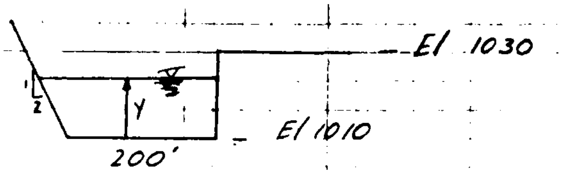
based on $Q_{P_2}(trial)$, $Y = 12.7'$; storage $= \frac{3600 \times 7000}{43560} = 579$ ac-ft

Avg Storage = 708 ac-ft.

$Q_{P_2} = 62{,}500\left(1 - \frac{708}{2954}\right) = 47{,}500$ cfs. WSEl @ South St Est. @ 1042.9

REACH 9: South Street to Dam just downstream of Sewage Disposal Facilities.

Assumed Dam Profile:



WSEl.	Dam Weir Flow (cfs); C = 3.3	Overbank Weir Flow (cfs); C = 2.8	Total Flow (cfs)
1010			0
1020	20,850	650	21,500
1025	38,350	1750	40,100
1030	59,050	3550	62,600

Storage

WSEl	Area, acres	Storage, ac-ft
1020	37	37 × 5 = 185
1030	43	185 + 40 × 10 = 585

Reach 9 (cont.)

route flow through reach 9:

to pass 47,500 cfs, WSEl @ Dam is 1026.6; Est. Storage = 4..

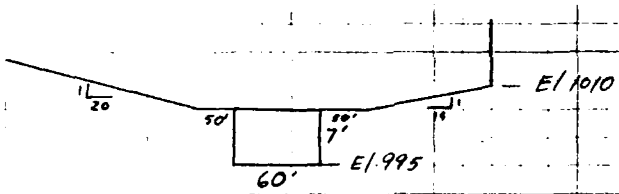
$$Q_{P_2}(\text{trial}) = 47,500\left(1 - \frac{449}{2954}\right) = 40,300 \text{ cfs}$$

based on Q_{P_2}(trial), WSEl = 1025 and Storage = 385; $Sto_{AVG} = 417$ a.f.

$$Q_{P_2} = 47,500\left(1 - \frac{417}{2954}\right) = 40,800 \text{ cfs} \text{ ; WSEl } 1025$$

REACH 10: Dam to Hubbard Avenue. Length of reach is small, and storage for the reach is negligible. The reason for taking a section at Hubbard Avenue is to determine if the u/s dam is flooded and by how much.

Estimated X-Section at Hubbard Avenue:



WSEl	Pressure Flow $C = 0.7$	Weir Flow $C = 2.8$	Total Flow (cfs)
1010	6700	16,200	22,900
1015	8,500	39,700	48,200

∴ backwater elev. @ U/S Dam ≈ 1013.5' ; WSEl @ Dam ≈ 1025

$$\text{if } Q/Q_1 = \left(1 - \left(\frac{H_2}{H_1}\right)^{1.5}\right)^{0.385}$$

where: Q = free discharge
Q_1 = reduced discharge
H_2 = backwater height
H_1 = Water height @ Dam

$$Q/Q_1 = \left(1 - \left(\frac{3.5}{15.2}\right)^{1.5}\right)^{0.385} = 0.96$$

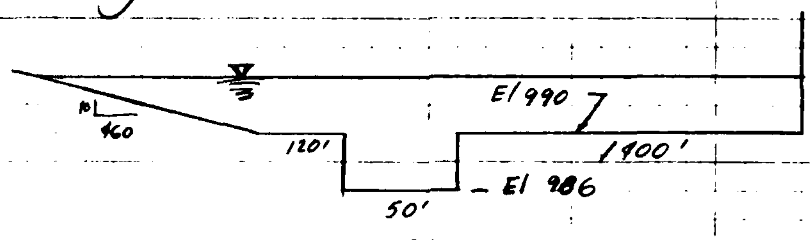
= percent of free discharge due to flooding of dam by backwater

reach 10 (cont.)

It appears that flooding of the dam reduces its effeciency by about 4 percent which can be neglected.

REACH 11: Hubbard Avenue to road embankment upstream of railroad bridge.

Compute WSEl based on a section through the roadway embankment.



$n = 0.095$
$S = 0.002$

Because most of the flow will be overbank flow, where the roadway blends with the surrounding topography, compute rating curve for the section based on open channel flow, rather than flow over a weir.

WSEl (ft)	X-Section Area (ft^2)	Wetted Perimiter (ft)	Flow (cfs)
995	8625	1813	36,100
997	12,317	1907	63,250

WSEl at road embankment is approx 995.4'

There is considerable storage in reach 11. A lot of this storage is along a tributary brook called Unkamet Brook.

Storage

WSEl	Area, acres	Storage, ac-ft
990	46.5	46.5 × 1.5 = 70
1000	393.5	70 + 220 × 10 = 2270

Reach 11 (cont.)

route flow through reach 11:

@ WSEl 995.4, Storage = 1258 ac-ft

$Q_{p_2}(\text{trial}) = 40,800\left(1 - \frac{1258}{2954}\right) = 23,400$ cfs.

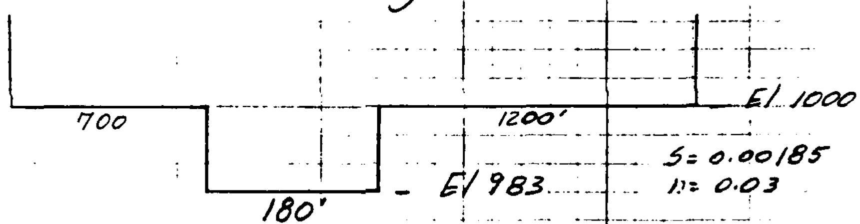
based on Q_{p_2}(trial), WSEl = 994.1' ; Storage = 972 ac-ft

$\text{Storage}_{\text{AVG}} = 1115$ ac-ft.

$Q_{p_2} = 40,800\left(1 - \frac{1115}{2954}\right) = 25,400$ cfs ; WSEl = 994.2'

REACH 12: Road embankment to railroad bridge

Estimated X-section through R.R. embankment.



WSEl. (ft)	Area (ft²)	Wetted Perimeter (ft)	Flow (cfs)
990	1260	194	9,350
1000	3060	214	38,500

Storage	WSEl	Area, acres	Storage, ac-ft
	990	80	80 x 1.5 = 120
	1000	208	120 + 144 x 10 = 1560

reach 12 (cont.)

route flow through reach 12:

@ Q = 25,400 cfs, WSEl = 995.5 ft., Storage ≈ 912 ac.ft.

$Q_{P_2}(\text{trial}) = 25{,}400\left(1 - \frac{912}{2954}\right) = 17{,}550$ cfs

based on Q_{P_2}(trial), WSEl ≈ 992.8 ft; Sto ≈ 523 for $Sto_{AVG} = 718$

$Q_{P_2} = 25{,}400\left(1 - \frac{718}{2954}\right) = 19{,}250$ cfs ; $WSEl_{@\,Bridge} = 993.4'$

Determine WS El just upstream of the bridge:

contraction loss:

$$h_L = 0.5\left(\frac{V_1^2}{2g} - \frac{V_2^2}{2g}\right)$$ for sharp cornered entrance

Velocity upstream, $V_2 \cong \frac{Q}{700 \times 10.5} = \frac{Q}{7350\ ft^2} = 2.6$ fps

Vel downstream, $V_1 = 19{,}250/1875 \approx 10.3$ fps

$$h_L = 0.5\left(\frac{10.3^2}{64.4} - \frac{2.6^2}{64.4}\right) \approx 0.8\ ft$$

∴ WSEl just upstream of the bridge ≈ 994.2 ft.

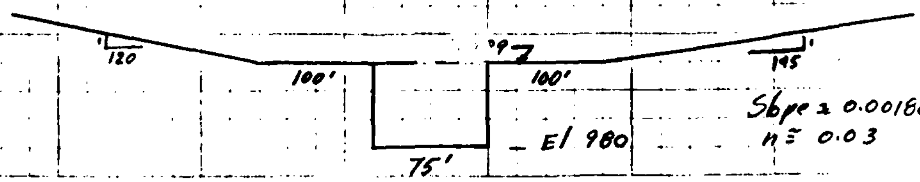
and storage for the reach ≈ 725 ac-ft

∴ corrected outflow = $25{,}400\left(1 - \frac{\frac{725+718}{2}}{2954}\right) = 19{,}200$ cfs

REACH 13: Railroad Bridge to bridge at East Street

Assume a control section at the East Street bridge.

Estimated X-Section:



Slope ≈ 0.00188
n = 0.03

reach 13 (cont.)

WSEl (ft)	Orifice Flow, cfs C=0.7	Weir Flow, cfs C=2.8	Total Flow
989	5,450	—	5,450
993	10,400	10,100	20,500

Storage:

WSEl	Area, acres	Storage, ac-ft
990	14	14×1.5 = 21
1000	32	21 + 23×10 = 251

Route flow through reach 13:

@ Q = 19,200 cfs ; WSEl ≈ 992.7 and Storage ≈ 83 ac.ft

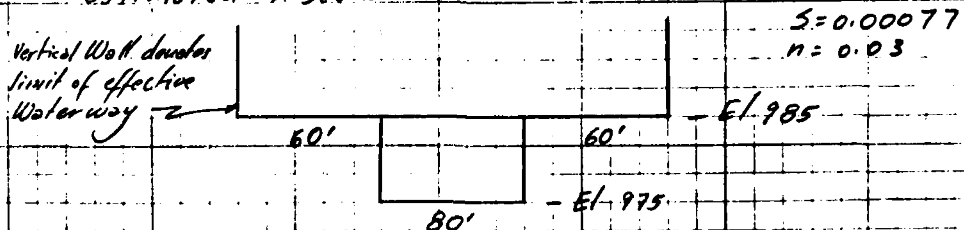
since storage is small, no iterations are required.

$$Q_{p_2} = 19,200\left(1 - \frac{83}{2954}\right) = 18,650 \text{ cfs} ; \text{ WSEl } 992.5$$

REACH 14: East Street to Newell Street

Assume the Newell St. Bridge to be the control section:

Estimated X-Section:



WSEl	Orifice Flow, cfs C = 0.7	Weir Flow, cfs C = 2.8	Total Flow, cfs
985	4,400	—	4,400
900	11,900	6,250	18,150

reach 14 (cont.)

Storage:

WSEl	Area, acres	Storage, ac-ft
980	31	31 x 2.5 = 78
990	660	78 + 345.5 x 10 = 3533

reach 14 provides considerable storage. Instead of taking a section at mid-reach to maintain the storage for the reach below 50% of the reservoir storage, use the following approach.

Assume a flow @ Newell Street of 7000 cfs.

$\therefore$ WSEl @ Newell St. ≈ 986.0 ft; assume a WSEl of 986.5 @ mid-reach.

Average Storage for the total reach ≈ 2324 ac-ft
At mid-reach, the storage ≈ 1162 ac-ft

Q_{P_2} @ mid reach = $18,650 \left(1 - \frac{1162}{2954}\right) = 11,300$ cfs

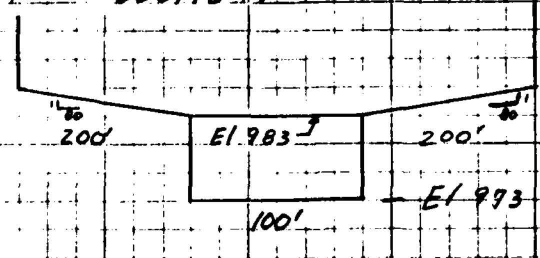
Q_{P_2} @ Newell St = $11,330 \left(1 - \frac{1162}{2954}\right) = 6,850$ cfs

resulting WSEl @ the bridge ≈ 985.9 ft ≈ 986.0' $\therefore$ O.K.

REACH 15: Newell Street to bridge at unnamed downstream street between East & Newell Street.

Assume that the bridge at the unnamed street controls.

Estimated X-section.



n = 0.03

S = 0.00077

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Environmental Engineers
Boston, Mass.

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PROJECT: Dam Insp.
DETAIL: Cleveland Brook Res.
JOB NO: 380-6-RT-10
DATE CHECKED: 7/10/79
CHECKED BY: JED
PAGE: 25
DATE: 6-14-79
COMPUTED BY: Joe A.

WSEl	Orifice Flow, cfs $C=0.7$	Weir Flow, cfs $C=2.8$	Total Flow, cfs
983	5,650	—	5,650
988	12,550	11,250	23,800

Storage:

WSEl	Area, acres	Storage, acre-ft
980	16	16x6=96
985	42	96+29x10=386

@ Q= 6,850 cfs, WSEl ≈ 983.3' and Storage = 192 ac-ft.

$$Q_{P_2}(\text{trial}) = 6,850\left(1-\frac{192}{2954}\right) = 6,400 \text{ cfs}$$

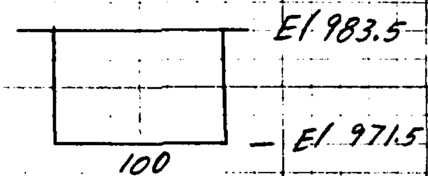
based on Q_{P_2}(trial), Storage ≈ 189 for an avg. of 191 ac-ft.

$$Q_{P_2} = 6,850\left(1-\frac{191}{2954}\right) = 6400 \text{ cfs} \text{ ; WSEl } 982.2'$$

REACH 16: Unnamed Street to Elm Street.

Assume X-Section of Elm Street bridge to be the control section

Estimated X-Section:



$n = 0.03$
$S = 0.00077$

WSEl	Flow, cfs (based on Manning's Open Channel Eq.)
981.5	5650
983.5	7500

reach 16 (cont.)

Storage:

WSEl	Area, acres	Storage, ac-ft
180	18	18×8 = 144
185	39	144 + 28.5×10 = 429

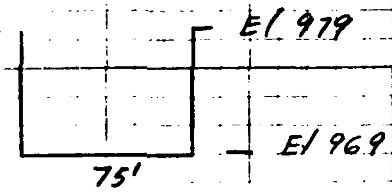
@ Q = 6,400 cfs, WSEl ≈ 982.3'; Storage ≈ 210 ac-ft.

since storage is minor, no itterations are necessary.

$Q_{P_2} = 6{,}400\left(1 - \frac{210}{2954}\right) = 5{,}950$ cfs.; WSEl 981.8'

REACH 17: Elm Street to Dawes Avenue

Estimated X-Section at Dawes Avenue:



S = 0.0037
n = 0.03

There is no material storage in reach 17.

WSEl	Flow
977	6350
979	9000

@ Q = 5,950 cfs WSEl ≈ 976.7 ft. @ Dawes Av.

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REACH 18: Dawes Ave. to Pomeroy Avenue crossing with the East Branch of the Housitonic River.

Assume a cross section at Pomeroy Avenue similar to that at Dawes Avenue.

therefore, if bottom channel elevation ≈ 963 ft, the WSEl at Pomeroy Ave ≈ 970.7

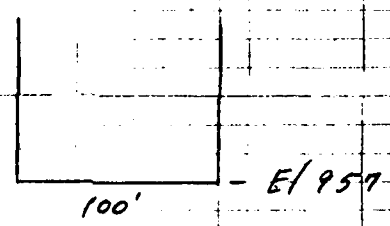
at this WSEl, Storage is approx. $\frac{400 ft \times 1400 ft \times 4 ft}{43560} = 52$ ac-ft

$$Q_{P_2} = 5950\left(1 - \frac{52}{2954}\right) = 5,850 \text{ cfs.}$$; WSEl 970.4'

REACH 19: Pomeroy Ave @ East Br. of Housitonic to Pomeroy Ave. @ Housitonic River.

Estimated X-Section:

S = 0.00059
n = 0.03



WSEl	Flow, cfs
967	4950
970	7450

Storage:

WSEl	Area, acres	Storage, ac-ft
960	28	28x1.5 = 42
970		42 + 90x10 = 942

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reach 19 (cont.)

@ Q= 5,850 cfs, WSEl= 968.1 ; Storage = 771 ac-ft

$$Q_{P_2}(\text{trial}) = 5850\left(1-\frac{771}{2959}\right) = 4,323 \text{ cfs}$$

based on Q_{P_2} trial, WSEl= 966.2 ; Sto = 600 ac-ft

$Sto_{AVG} = 686$ ac-ft

$$Q_{P_2} = 5850\left(1-\frac{686}{2959}\right) = 4,500 \text{ cfs.}$$

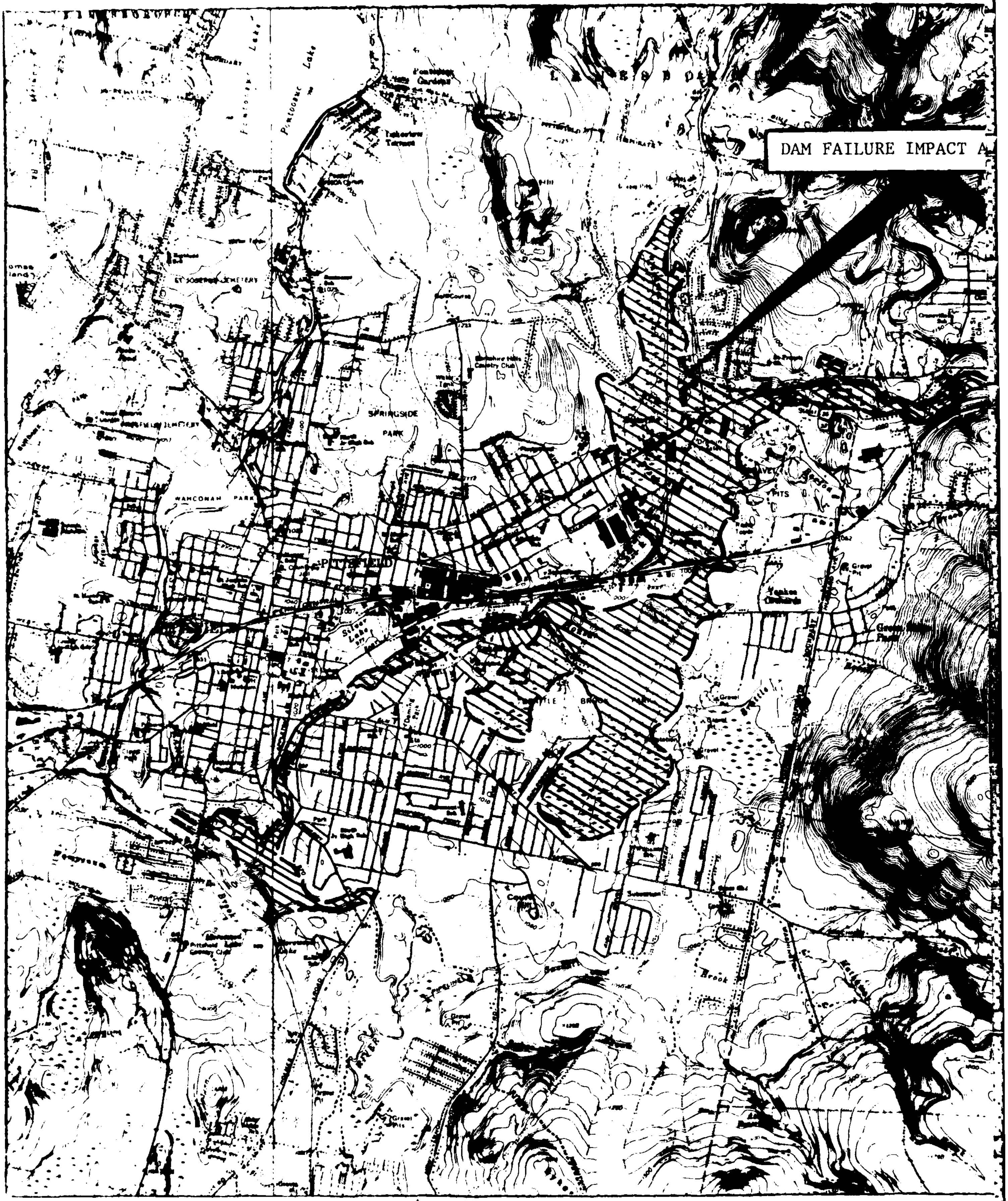
WSEl ≈ 966.5 ft

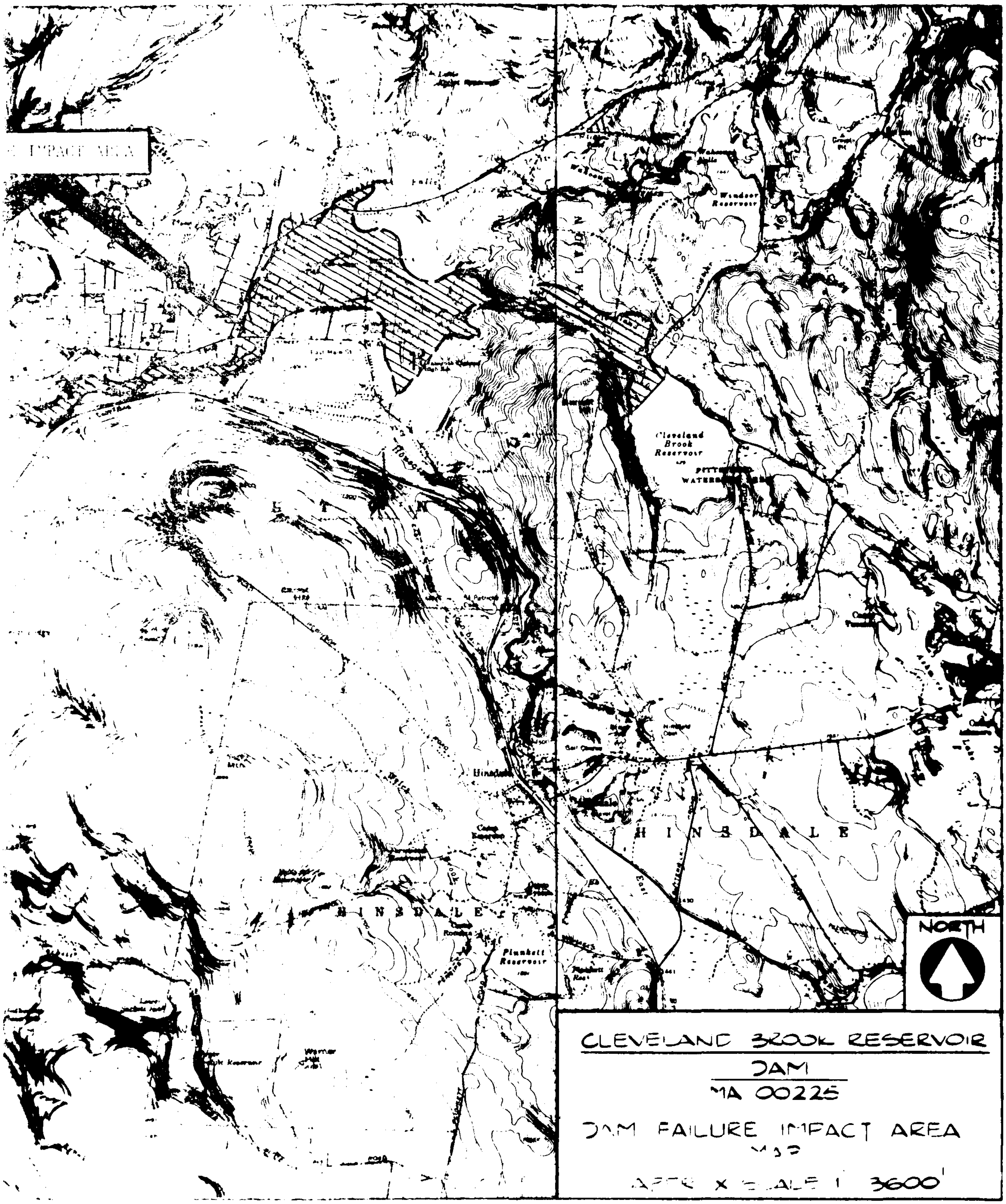
REACH 20: Pomeroy Ave. at Housitonic River to Holmes Road.

Assume the bridge at Holmes Road to have a capacity similar to that at Pomeroy Ave. The channel invert at Holmes Road is about the same elevation as at Pomeroy Ave. Therefore the WSEl @ Holmes Road ≈ 966.5

Beyond Holmes Road the overbank storage is extensive the remaining flow will be attenuated and no further potential for loss of life or property is expected.

From the Cleveland Reservoir up to Holmes Road the potential for loss of life and property is HIGH


DAM FAILURE IMPACT A
Pontoosuc Lake
SPRINGSIDE
PARK
WAHCONAH PARK
PITTSFIELD


IMPACT AREA
Windsor Reservoir
Cleveland Brook Reservoir
HINSDALE
HINSDALE
Plunkett Reservoir
NORTH
CLEVELAND BROOK RESERVOIR
DAM
MA 00225
DAM FAILURE IMPACT AREA
MAP

2

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	225	NED	MA	003	01				CLEVELAND BROOK RESERVOIR DAM	4228.2	7306.9	31MAY79

POPULAR NAME	NAME OF IMPOUNDMENT
	CLEVELAND BROOK RESERVOIR

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	07	CLEVELAND BROOK	DALTON	0	7500

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
REPG	1948	S	71	70	6022	4928	NED	N	N	N	N	

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	1650	U	80	4850												

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF PITTSFIELD	METCALF + EDDY ENGINEERS	

REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
CAMP DRESSER + MCKEE INC	01MAY79	PUBLIC LAW 92-367

REMARKS