SECTION 1

FINAL REPORT OF SUBSURFACE EXPLORATION

WINNIPESAUKEE RIVER BASIN

EXTENDING FROM LAKEPORT TO TILTON, N.H.

CONTRACT DACW-33-85-D-0011
CONTRACTING OFFICER:
Edward D. Hammond, LTC, CE
28 June 1985

DELIVERY ORDER NO. 0020
17 DEC 1986

PREPARED FOR: U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254-9149

PREPARED BY: Paul M. Fisher, P.E.
Atlantic Testing Laboratories, Limited
P. O. Box 356
Cicero, New York 13039

April 13, 1987

ATL Report No. CD021-1A-4-87

SECTION 2

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SECTION 3

SCOPE OF INVESTIGATION

a. Delivery Order No. 0020

CHECKED BOX APPLIES: [X] ORDER FOR SUPPLIES OR SERVICES [ ] REQUEST FOR QUOTATIONS NO.

RETURN COPY(IES) OF THIS QUOTE BY

(THIS IS NOT AN ORDER. See DD Form 1155r)

5. CERTIFIED FOR NATIONAL DEFENSE UNDER DMS REG 1 DO

1. CONTRACT/PURCHASE ORDER NO: DACW33-85-D-0011

2. DELIVERY ORDER NO: 0020

3. DATE OF ORDER: 86 DEC 17

4. REQUISITION/PURCH REQUEST NO: GEB 87-24

6. ISSUED BY: Dept. of the Army CODE
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149
Buyer/Symbol: Hebert/NEDCL-C Phone: AC 617-647-8207

7. ADMINISTERED BY (If other than 6) CODE

8. DELIVERY FOB: [X] DEST [ ] OTHER (See Schedule if other)

9. CONTRACTOR/QUOTER CODE FACILITY CODE

NAME AND ADDRESS:
Atlantic Testing Laboratories, Ltd.
P.O. Box 29
Canton, NY 13617

10. DELIVER TO FOB POINT BY: in accordance with Paragraph 7 of Attachment 1

11. CHECK IF BUSINESS IS: [X] SMALL [ ] SMALL DISADVANTAGED [ ] WOMEN-OWNED

12. DISCOUNT TERMS: NET

13. MAIL INVOICES TO: Finance & Accounting Officer at issuing office

14. Services for: CODE
U.S. Army Engineer Division, N.E.
ATTN: Geotechnical Engineering Branch
424 Trapelo Road
Waltham, MA 02254-9149

15. PAYMENT WILL BE MADE BY: CODE
Finance & Accounting Officer at issuing office

MARK ALL PACKAGES AND PAPERS WITH CONTRACT OR ORDER NUMBER

16. TYPE OF ORDER: DELIVERY [X] PURCHASE [ ]

This delivery order is subject to instructions contained on this side of form only and is issued pursuant to the authority cited herein and in accordance with and subject to terms and conditions of above numbered contract.

Reference your furnish the following on terms specified herein, including, for U.S. purchases, General Provisions of Purchase Order on DD Form 1155r (EXCEPT CLAUSE NO 12 APPLIES ONLY IF THIS BOX [ ] IS CHECKED, AND NO. 14 IF THIS BOX [ ] IS CHECKED): special provisions ; and delivery as indicated. This purchase is negotiated under authority of 10 USC 2304(a)(3) or as specified in the schedule if within the U.S., its possessions or Puerto Rico, if otherwise under 2304(a)(6).

[ ] If checked, Additional General Provisions apply; Supplier shall sign "Acceptance" on DD Form 1155r and return copies.

SBSA
STATUS
GEB
AE/PS Coord
SO
JJH/ckh

17. ACCOUNTING AND APPROPRIATION DATA/LOCAL USE
96X3122 Construction General
BE831304X0PA000 (MD)
Contract

Susan Cotchkarsky Jan 10/12

18. ITEM NO (Line)	19. SCHEDULE OF SUPPLIES/SERVICES (12/17/86)	20. QUANTITY ORDERED/ ACCEPTED*	21. UNIT	22. UNIT PRICE	23. AMOUNT
	Furnish necessary services, equipment and Personnel for execution of Thirty-Two (32) Test Borings at Various Locations along Winnipesaukee River, New Hampshire, in accordance with attachment No. 1.	APPROX.			ESTIMATED
1.1	Geologist	120	Hr	$40.00	$4,800.00
1.3	Per Diem - Overnight Stay	15	Day	45.00	675.00
1.4	Mileage from Waltham, MA and Return	510	Mi	.35	178.50

*If quantity accepted by the Government is same as quantity ordered, indicate by √ mark. If different, enter actual quantity accepted below quantity ordered and encircle.

24. UNITED STATES OF AMERICA
BY: THOMAS A RHEN, Colonel, CE
Division Engineer
CONTRACTING/ORDERING OFFICER

25. TOTAL: $45,228.20

29. DIFFERENCES

26. QUANTITY IN COLUMN 20 HAS BEEN: [ ] INSPECTED [ ] RECEIVED [ ] ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED

DATE SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

27. SHIP. NO. [ ] PARTIAL [ ] FINAL

28. D.O. VOUCHER NO.

30. INITIALS

32. PAID BY

33. AMOUNT VERIFIED CORRECT FOR

31. PAYMENT [ ] COMPLETE [ ] PARTIAL [ ] FINAL

34. CHECK NUMBER

36. I certify this account is correct and proper for payment.

DATE SIGNATURE AND TITLE OF CERTIFYING OFFICER

35. BILL OF LADING NO.

37. RECEIVED AT 38. RECEIVED BY 39. DATE RECEIVED 40. TOTAL CONTAINERS 41. S/R ACCOUNT NUMBER 42. S/R VOUCHER NO

STANDARD FORM 36 JULY 1966
GENERAL SERVICES ADMINISTRATION
FED PROC REG (41 CFR) 1-16.101

CONTINUATION SHEET

REF NO OF DOC BEING CONT'D
Delivery Order No. 0020
to DACW33-85-D-0011

NAME OF OFFEROR OR CONTRACTOR
ATLANTIC TESTING LABORATORIES, LTD.

Contract Line Item No.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		APPROX.			ESTIMATED
2.1	Geotechnical Report (Price expressed as a percentage of Line Item 1.1 or 1.2)	1	Job	60% of 1.1	2,880.00
3.1	Mobilization and Demobilization	1	Job	180.00	180.00
3.2	Mileage from/to Waltham, MA	170	Mi	.35	59.50
3.4	Survey Crew and Equipment	1	Day	440.00	440.00
3.5	Overnight Per Diem for Survey Crew	1	Day	90.00	90.00
3.6	Data Reduction and Plotting (Price expressed as a percentage of Line Item 3.4)	1	Job	100% of 3.4	440.00
6.1	Mobilization and Demobilization	2	Job	700.00	1,400.00
6.3	Mileage from/to Contracotr's main equipment Storage Site, Site Located in Manchester, NH and Canton, NY	148	Mi	1.15	170.20
6.5	Standby time/on site moves	95	Hr	75.00	7,125.00
10.2	16 ft. Boat	15	Day	60.00	900.00
10.6	320 Square foot float	2	Job	800.00	1,600.00
10.7	Mobilization and Demobilization for 320 square foot float	2	Job	950.00	1,900.00
13.1	0 - 30 ft. depth	70	Ea	13.00	910.00
14.1	0 - 50 ft. depth	190	Lf	22.00	4,180.00
18.1	BX, NX Size	130	Lf	18.00	2,340.00
18.2	HX, and 6 inch Size	150	Lf	28.00	4,200.00
22.3	NWX Size and/or NWM	40	Lf	45.00	1,800.00
32.0	Crane and Operator	10	Day	896.00	8,960.00

ATTACHMENT 1

CONTRACT NO. DACW33-85-D-0011

DELIVERY ORDER NO. 0020

SCOPE OF INVESTIGATIONS

PROJECT: Winnipesaukee River Basin Local Flood Protection

SITES: Franklin, Northfield, Tilton, The Plains, Lochmere, Laconia, and Lakeport, NH

PURPOSE: Borings are required to study subsurface conditions for the proposed channel improvement and dam.

1. SCOPE OF INVESTIGATIONS

a. Locate 32 continuous Standard Penetration Test (SPT) sample borings (FD-87-A to FD-87-Z and FD-87AA to FD-87-FF) by taping the distances from existing features indicated on Plates 1 to 8. A level survey shall be performed to determine the elevations of borings FD-87-I to FD-87-N. The elevation of the remaining borings shall be interpolated from profile data shown on Plates 1 to 7.

b. The continuous SPT sample borings shall be driven to the following depths,: A-6′, B-6′, C-6′, D-6′, E-6′, F-6′, G-6′, H-6′, I-20′, J-25′, K-20′, L-20′, M-25′, N-20′, O-10′, P-6′, Q-6′,, R-6′, S-6′, T-6′, U-6′, V-6′, W-6′, X-6′, Y-6′, Z-6′, AA-10′, BB-10′, CC-10′, DD-10′, EE-10′, and FF-20′. The sampling work shall be performed in accordance with ASTM specification D1586-84. Refusal is defined as 50 blows with no penetration when attempting to drive a splitspoon sampler. Where refusal is encountered in boreholes FD-87-I to FD-87-N and FD-87-FF before the required depth is attained, the boring shall be continued using vertical diamond core drilling. If the material causing refusal is not penetrated within five feet of the original refusal elevation, the boring shall be terminated. If refusal is encountered in the remaining holes before one-half the required depth is attained, the hole shall be moved 10 feet upstream and one attempt should be made to reach the specified depth. Resampling of the depth previously penetrated will not be required.

c. A solid barrel sampler type with ball check head (2 1/2" inside diameter) shall be used in boreholes FD-87-A to FD-87-H, FD-87-O to FD-87-Z, and FD-87-AA to FD-87-EE. Samples taken in these holes with the solid barrel sampler shall be taken in 2-foot increments and stored at 40 degrees F. Entire samples shall be saved.

d. Permeability tests shall be performed in boreholes FD-87-I, FD-87-N, FD-87-R, FD-87-L, FD-87-M, and FD-87-N, according to the directions given in Attachment 2. Splitspoon samples shall not be taken in zones where permeability tests are to be executed.

e. A geotechnical inspector shall act as field inspector while performing the borings. The inspector shall provide telephone reports to Mr. Yuri Yatsevitch, Corps of Engineers at tel. (617) 647-8387 at least once each working day. The alternate point of contact is Mr. Paul Schimelfenyg, Corps of Engineers tel. (617) 647-8394.

d. All samples shall be delivered to the Corps of Engineers Headquarters in Waltham, Massachusetts. Sample delivery shall be coordinated with the Director, NED Materials and Water Quality Laboratory at tel. 617-647-8367/8392.

2. SITE CONDITIONS.

The proposed explorations are in the Winnipesaukee River Channel in New Hampshire. As much as 10 feet of water is expected to be flowing in the river bed. Gravel, cobbles and boulders are on the surface of the riverbed. The underlying soils are expected to be sand and gravel materials. A profile of subsurface conditions near the proposed bottom hinged gate structure site is shown on Plate 8. The contractor shall be prepared to core if bedrock or boulders are encountered in borings FD-87-K and FD-87-P. Sediment samples collected and tested by the Corps of Engineers in July 1983 contained moderately high levels of lead and zinc at one location, but these did not exceed levels found in other unpolluted New England streams.

3. RIGHTS-OF-ENTRY.

Rights-of-entry and utility locations are the responsibilities of the contractor. People to contact regarding rights of entry and utility locations are indicated on Attachment No. 3.

4. COORDINATION.

Yuri Yatsevitch, Corps of Engineers, (617) 647-8387, shall be contacted five days prior to start of work and at least once a day by the geotechnical inspector to report on how work is progressing and what types of materials are being encountered.

5. EXPLORATION NUMBERS.

The exploration locations are shown on Plates 1 to 7 and shall be designated FD-87 1 through 32 in order of their completion. The numbers shall be indicated on the boring logs and shown on a plan of explorations.

6. GOVERNMENT REVIEW .

The Government will review the draft submittal of the geotechnical report. Subsequent to such review, the Contractor shall accomplish any corrections which may be directed as the result of the Government review.

7. COMPLETION SCHEDULE

Services under this delivery order shall start within fifteen days after the receipt of the delivery order. Duration of the drilling effort is estimated to be twenty-five calendar days. The geotechnical report shall be submitted in draft form for review, to the Government, postmarked no later than seven calendar days after completion of the field work.

Government review will take approximately ten calendar days from receipt of draft report. The final geotechnical report shall be submitted postmarked no later than seven calendar days after receipt of draft report with Government comments.

8. QUALITY CONTROL

You will be held responsible for the quality of the maps submitted and for all damages caused the Government as a result of your negligence in the performance of any services furnished under the contract.

Although submissions required by your contract are technically reviewed by the Government, it is emphasized that your work must be prosecuted using proper internal controls and review procedures. The letter of transmittal for each submission which you make shall include a certification that the submission has been subjected to your own review and coordination procedures to ensure (a) completeness for each discipline commensurate with the level effort required for that submission, (b) elimination of conflicts, errors, and omissions, and (c) the overall professional and technical accuracy of the submission. Documents which are signficantly deficient in any of these areas will be returned to you for correction and/or upgrading prior to our completing our review.

ATTACHMENT NO. 2

FIELD TEST PROCEDURE

FIELD PERMEABILITY TESTS

1. Use. Field permeability tests shall, in general, be used for determining the permeability of cohesionless strata penetrated by borings. Useful results can be obtained on cohesionless soils having a permeability less than 10^{-3} centimeters per second, if reasonable care is exercised.

2. Apparatus. The following equipment is necessary to run the tests:

a. Drill rig or other means of driving, pulling, and cleaning casing (pipe).

b. Casing (pipe)

c. Filter material (ottawa sand, coarse sand, and gravel)

d. Pump

e. Timing device (watch or clock with second hand)

f. Water level reader

g. Scale

3. Water. The water to be used for the field permeability tests shall be clean. Small amounts of suspended matter in the water could cause grossly misleading test results. A settling tank, filter or other appropriate method should be used to assure only clear water is added during the test. It is also desirable for the temperature of the added water to be higher than groundwater temperature to prevent the creation of air bubbles in the ground which may greatly reduce the acceptance of water.

4. Procedure. The procedure shall consist of the following steps:

a. General.

(1) Drive casing to the bottom elevation of the proposed test. Permeability tests shall be executed in each borehole at 5-7 feet, 10-12 feet and 15-17 feet of depth unless rock is encountered. Permeability will not be required where rock is cored.

(2) Clean inside of casing with water without disturbing the soil below the bottom elevation of the casing.

(3) Bump back casing 1.5 to 2.0 feet. Fill uncased portion of hole with a filter material which is coarser than the material that was removed as casing is being bumped. Filter material can be omitted if uncased portion of hole will remain open without the filter material.

(4) Remove all drill rods and equipment.

b. Falling Head Test

(5) Fill casing with water

(6) Record water elevation versus elapsed time

(7) Repeat steps (5) and (6) until test results are consistent.

(8) Add 5 feet of casing

(9) Repeat steps (5), (6, and (7).

c. Rising Head Test

(10) Pump water out of casing until water level in casing is at least 5 feet below river level.

(11) Record water elevation versus elapsed time. A water level reader may be required.

(12) Repeat steps (10), (11) until test results are consistent.

5. Presentation of Results. Test data should be recorded on copies of attached form. Test locations (depths) should be noted on the boring logs.

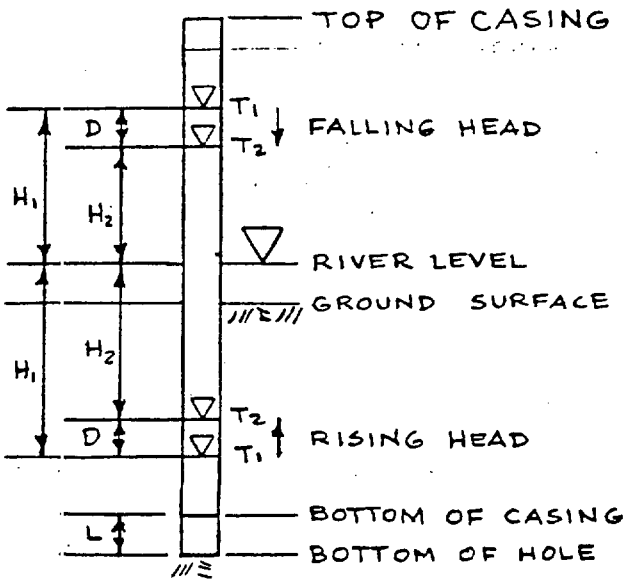
FIELD PERMEABILITY TEST RESULTS

DATE:	BORING NO:	DEPTH:	INSPECTOR:	
D_o =	D_i =	L=	H_1 =	m= 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME $(t_2 - t_1)$	D $(H_2 - H_1)$	H_2 $(H_1 - D)$	K_H	ELAPSED TIME $(t_2 - t_1)$	D $(H_2 - H_1)$	H_2 $(H_1 - D)$	K_H

NOTES:

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$k_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

Winnipesaukee River Numbers

KCOT06

1. River Elevations
   - Don Rapoza
     Nit Water Resource Board
     Concord, NH
     603/271-3406
2. Utilities
   - David Gloddy
     Town of Franklin
     603/934-4103
   - David Wadleigh
     Town of Tilton
     603/286-4721
   - Frank DeNormandie
     City Engineer
     Laconia, NH
     603/524-7520
3. Railroad Bridges
   - Vinay Mudholkar
     Chief Engineer
     Gilford Rail System
     Ironhorse Park
     North Billerica, MA 01862
     617/663-6957
4. Highway Bridges
   - Andrew Lane or John Moore
   - State of New Hampshire
   - Department of Public Works and Highways
     603/271-2731

Attach 3

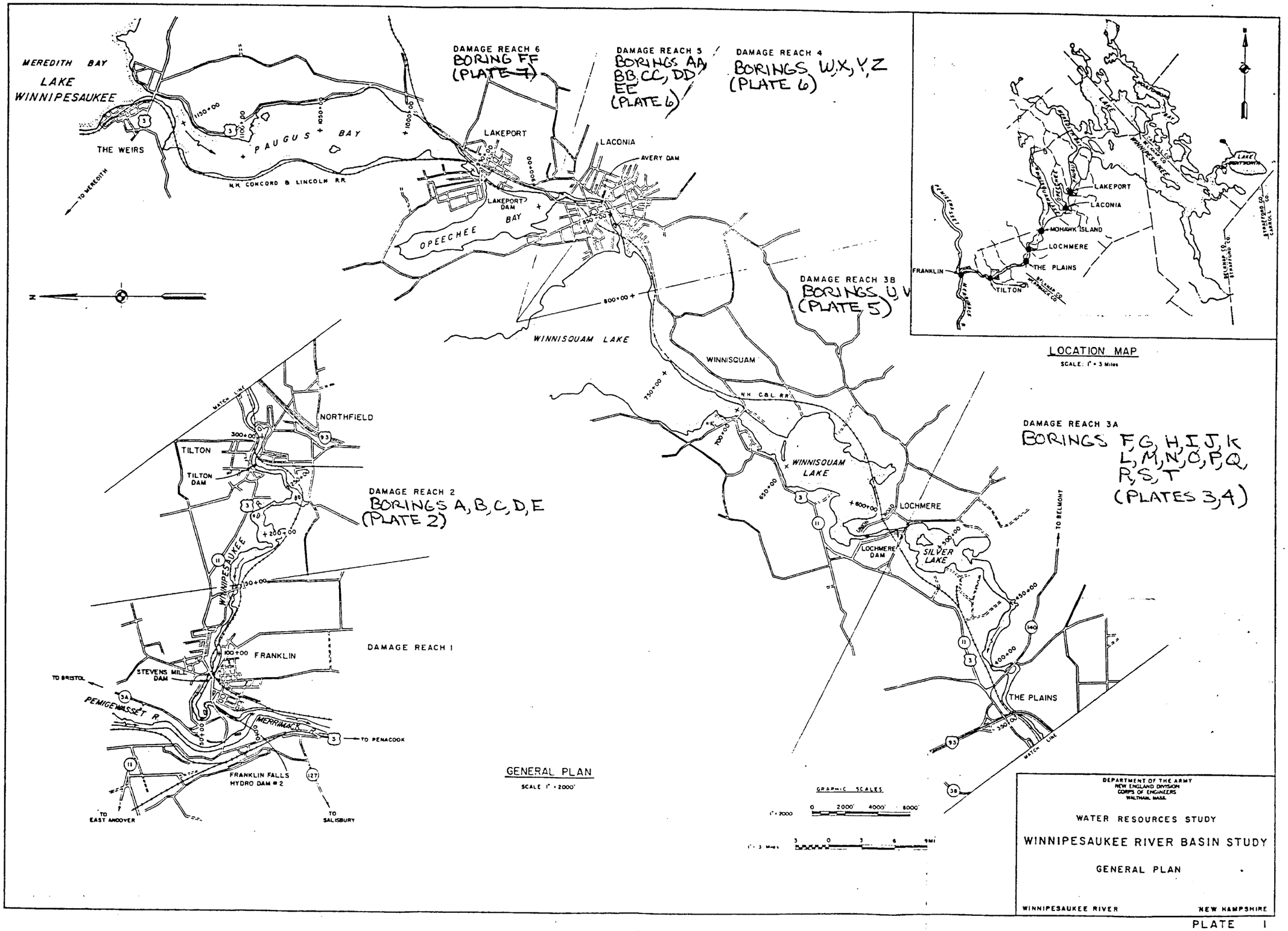
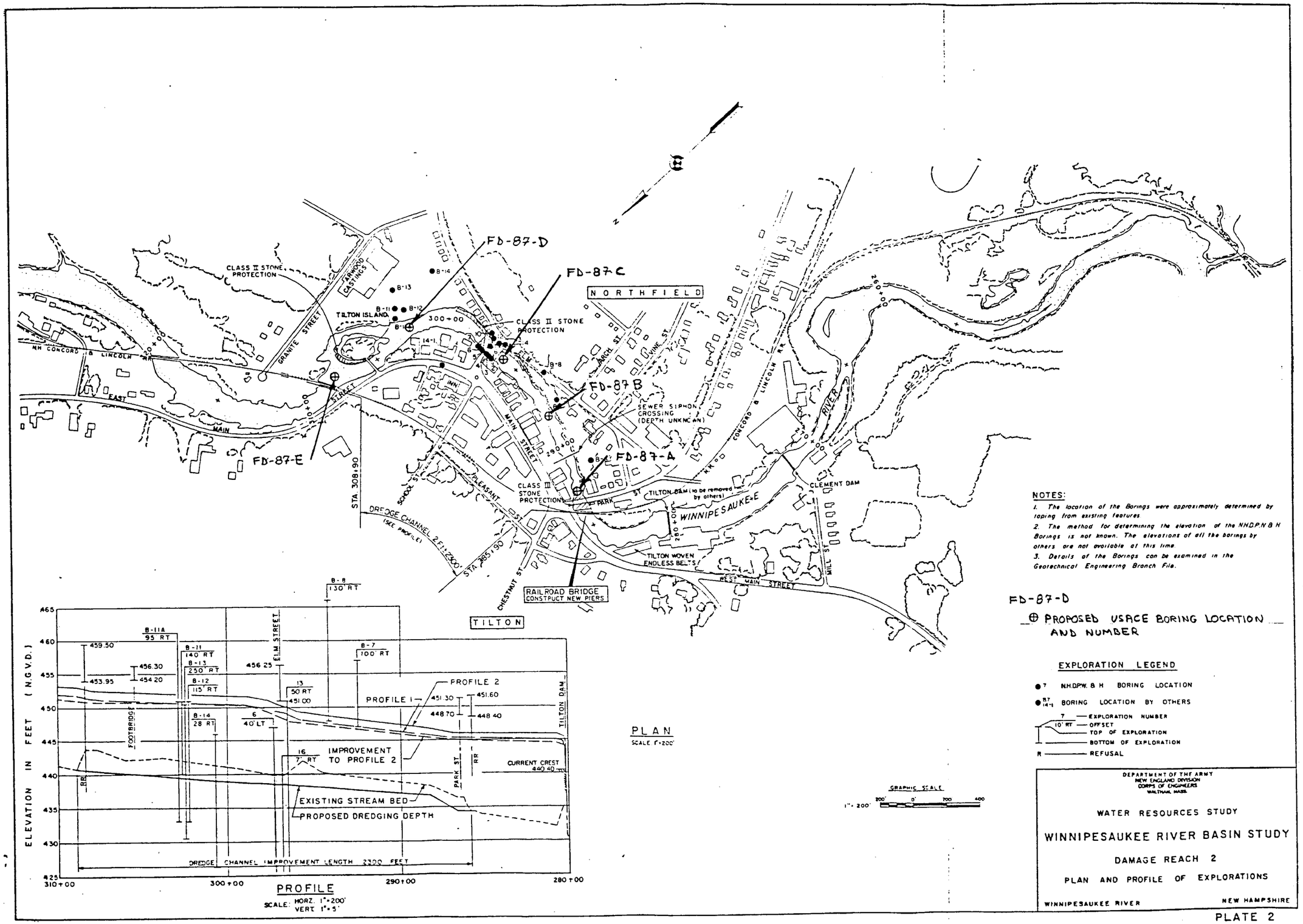

MEREDITH BAY
LAKE WINNIPESAUKEE
THE WEIRS
TO MEREDITH
PAUGUS BAY
N.H. CONCORD & LINCOLN R.R.
DAMAGE REACH 6
BORING FF (PLATE 7)
DAMAGE REACH 5
BORINGS AA, BB, CC, DD, EE (PLATE 6)
DAMAGE REACH 4
BORINGS W, X, Y, Z (PLATE 6)
LAKEPORT
LACONIA
AVERY DAM
LAKEPORT DAM
OPEECHEE BAY
WINNISQUAM LAKE
WINNISQUAM
N.H. C&L RR
DAMAGE REACH 3B
BORINGS U, V (PLATE 5)
WINNISQUAM LAKE
LOCHMERE
LOCHMERE DAM
SILVER LAKE
TO BELMONT
DAMAGE REACH 3A
BORINGS F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T (PLATES 3, 4)
THE PLAINS
MATCH LINE
NORTHFIELD
TILTON
TILTON DAM
DAMAGE REACH 2
BORINGS A, B, C, D, E (PLATE 2)
WINNIPESAUKEE
DAMAGE REACH 1
FRANKLIN
STEVENS MILL DAM
TO BRISTOL
PEMIGEWASSET R.
MERRIMACK
TO PENACOOK
FRANKLIN FALLS HYDRO DAM # 2
TO EAST ANDOVER
TO SALISBURY
LOCATION MAP
SCALE: 1" = 3 Miles
LAKEPORT
LACONIA
MOHAWK ISLAND
LOCHMERE
THE PLAINS
FRANKLIN
TILTON
GENERAL PLAN
SCALE 1" = 2000'
GRAPHIC SCALES
0 2000' 4000' 8000'
1" = 2000
3 0 3 6 9 MI
1" = 3 Miles
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
WATER RESOURCES STUDY
WINNIPESAUKEE RIVER BASIN STUDY
GENERAL PLAN
WINNIPESAUKEE RIVER
NEW HAMPSHIRE

PLATE 1



NOTES:

1. The location of the Borings were approximately determined by taping from existing features.
2. The method for determining the elevation of the NHDPW&H Borings is not known. The elevations of all the borings by others are not available at this time.
3. Details of the Borings can be examined in the Geotechnical Engineering Branch File.

FD-87-D

⊕ PROPOSED USACE BORING LOCATION AND NUMBER

EXPLORATION LEGEND

- ●7 N.H.DPW. & H BORING LOCATION
- ●B7/14-1 BORING LOCATION BY OTHERS
- 7 — EXPLORATION NUMBER
- 10' RT — OFFSET
- TOP OF EXPLORATION
- BOTTOM OF EXPLORATION
- R — REFUSAL

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

WATER RESOURCES STUDY

WINNIPESAUKEE RIVER BASIN STUDY

DAMAGE REACH 2

PLAN AND PROFILE OF EXPLORATIONS

WINNIPESAUKEE RIVER — NEW HAMPSHIRE

PLATE 2

NOTES:

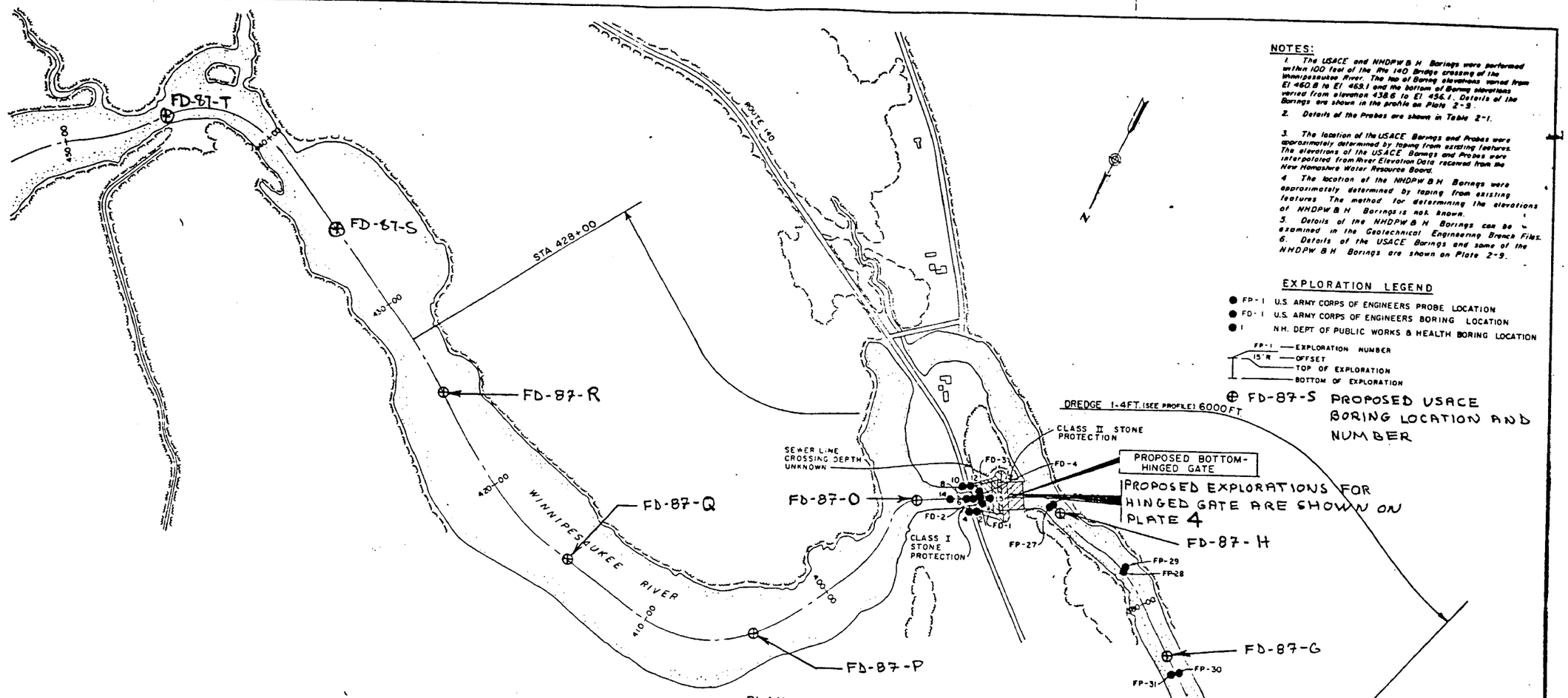
1. The USACE and NHDPW & H Borings were performed within 100 feet of the Rte 140 Bridge crossing of the Winnipesaukee River. The top of Boring elevations varied from El 460.8 to El 469.1 and the bottom of Boring elevations varied from elevation 438.6 to El 456.1. Details of the Borings are shown in the profile on Plate 2-9.
2. Details of the Probes are shown in Table 2-1.
3. The location of the USACE Borings and Probes were approximately determined by taping from existing features. The elevations of the USACE Borings and Probes were interpolated from River Elevation Data received from the New Hampshire Water Resource Board.
4. The location of the NHDPW & H Borings were approximately determined by taping from existing features. The method for determining the elevations of NHDPW & H Borings is not known.
5. Details of the NHDPW & H Borings can be examined in the Geotechnical Engineering Branch Files.
6. Details of the USACE Borings and some of the NHDPW & H Borings are shown on Plate 2-9.

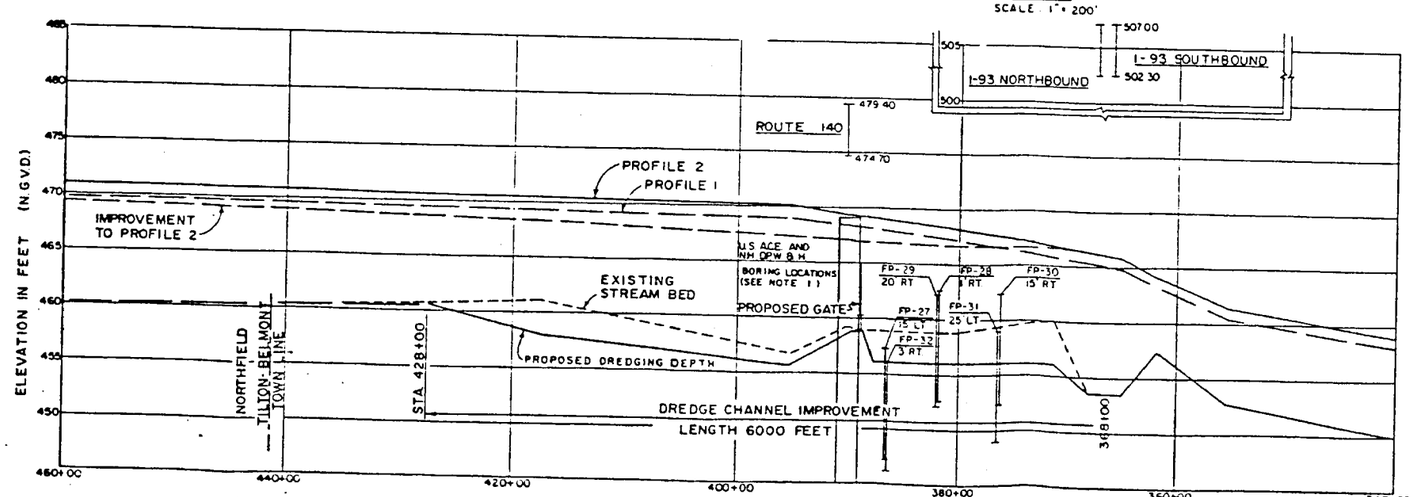
EXPLORATION LEGEND

- FP-1 U.S. ARMY CORPS OF ENGINEERS PROBE LOCATION
- FD-1 U.S. ARMY CORPS OF ENGINEERS BORING LOCATION
- 1 N.H. DEPT OF PUBLIC WORKS & HEALTH BORING LOCATION

FP-1 — EXPLORATION NUMBER
15' R — OFFSET
TOP OF EXPLORATION
BOTTOM OF EXPLORATION

⊕ FD-87-S PROPOSED USACE BORING LOCATION AND NUMBER





GRAPHIC SCALE
1" = 200' 200' 0 200' 400'

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

WATER RESOURCES STUDY

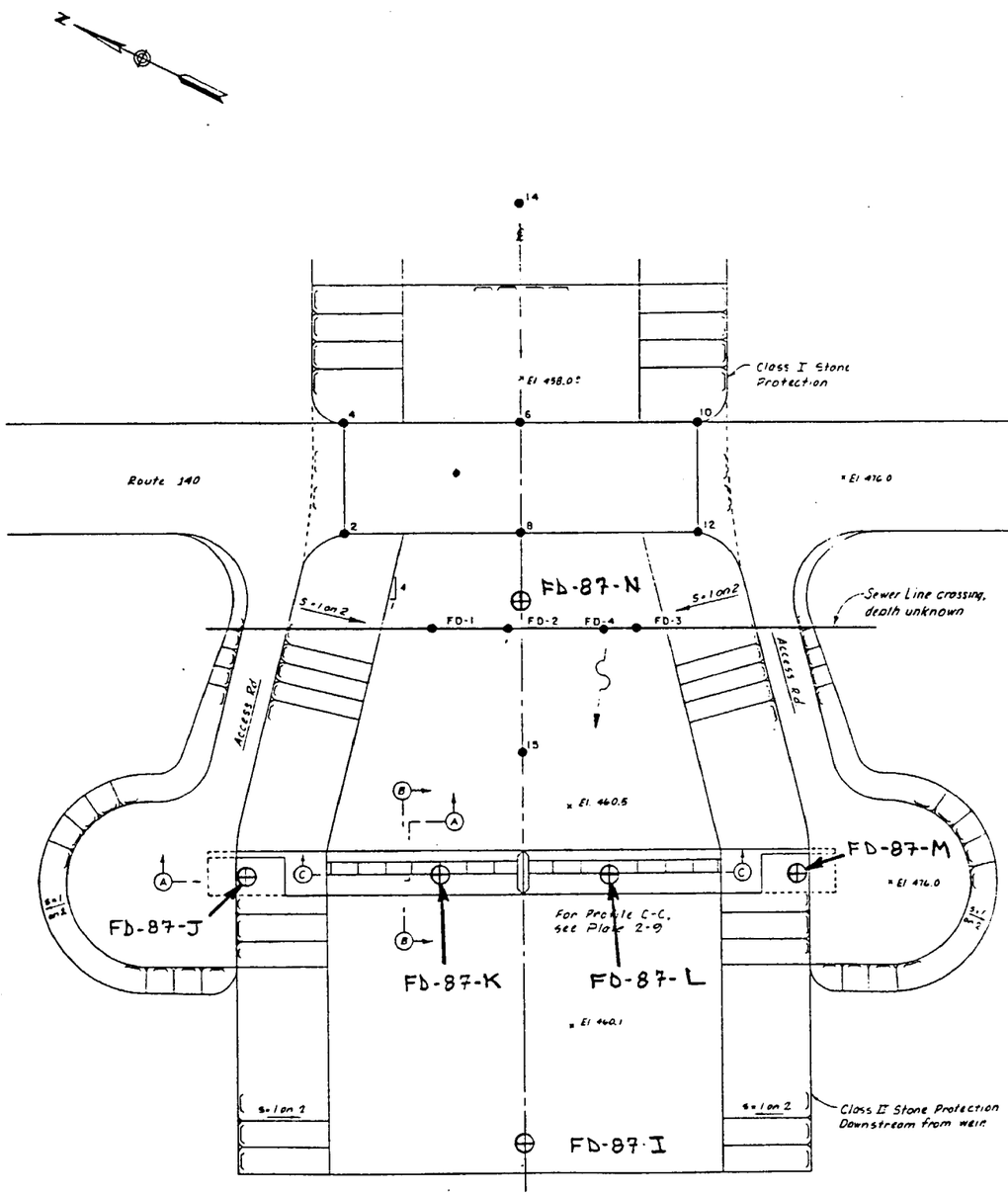
WINNIPESAUKEE RIVER BASIN STUDY

DAMAGE REACH 3A

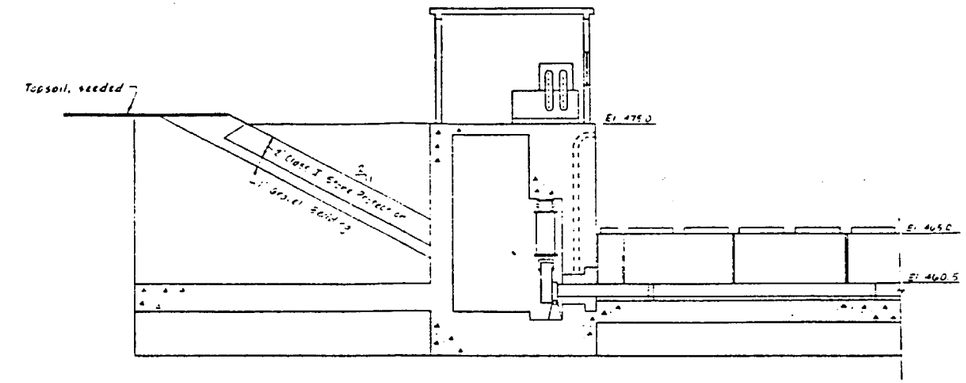
PLAN AND PROFILE OF EXPLORATIONS

WINNIPESAUKEE RIVER — NEW HAMPSHIRE

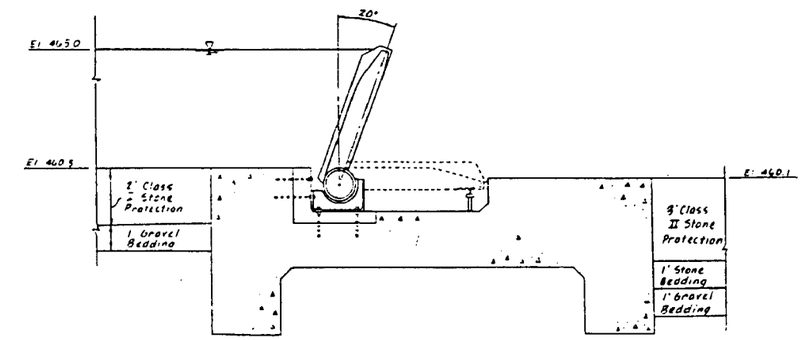
PLATE 3



PLAN
SCALE 1" = 20'



SECTION A-A
SCALE 1" = 5'



SECTION B-B
SCALE 1" = 2'

EXPLORATION LEGEND

- ● FD-1 U.S. ARMY CORPS OF ENGINEERS BORING LOCATION
- ● 12 N.H. DEPT OF PUBLIC WORKS & HEALTH BORING LOCATION

⊕ FD-87-N PROPOSED USACE BORING LOCATION AND NUMBER

NOTES

1. The location of the U.S.A.C.E. and N.H.D.P.W. & H. borings were approximately determined by taping from existing features.

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

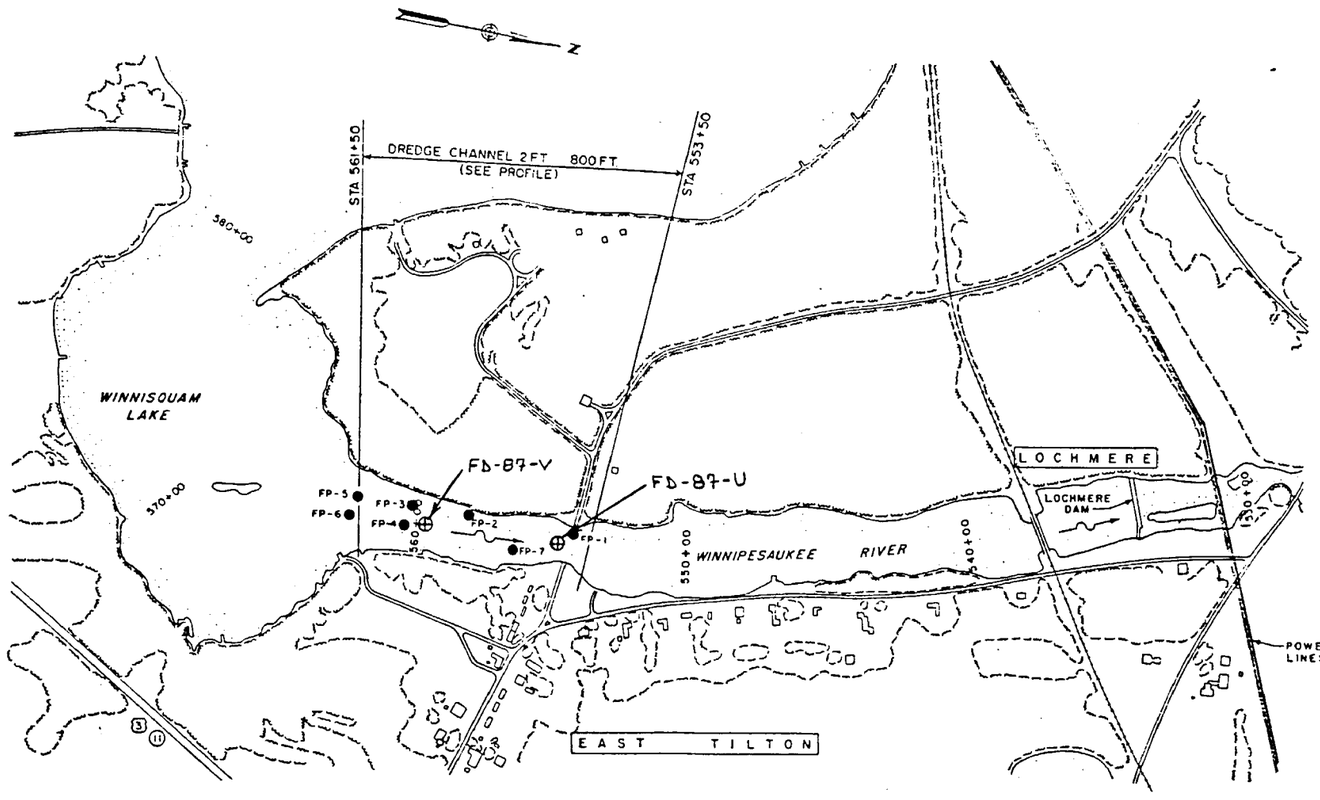
WATER RESOURCES STUDY

WINNIPESAUKEE RIVER BASIN STUDY

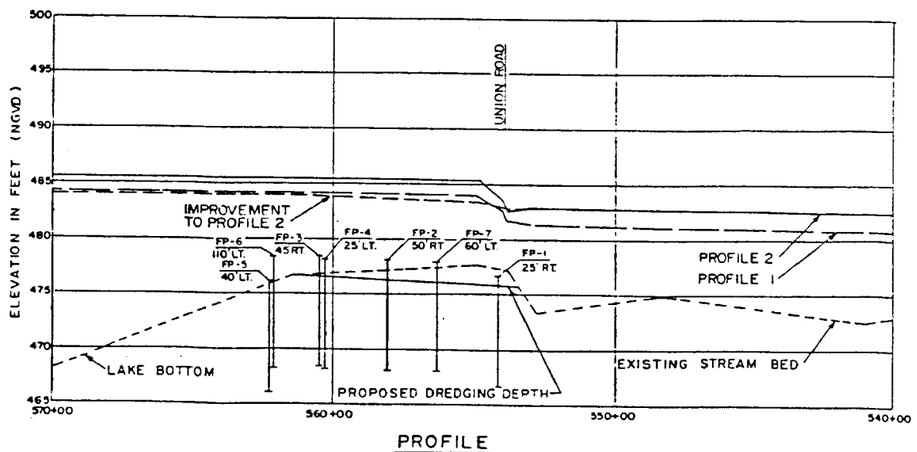
BOTTOM-HINGED GATE
EXPLORATION LOCATIONS

WINNIPESAUKEE RIVER — NEW HAMPSHIRE

PLATE 4



⊕ FD-87-V PROPOSED USACE BORING LOCATION AND NUMBER



PROFILE
SCALE HOR. 1" = 200 VER. 1" = 5'

PLAN
SCALE 1" = 200'

GRAPHIC SCALE
1" = 200'
200' 0 200' 400'

NOTES:

1. The location of the Probes were approximately determined by taping from existing features. The elevations of the Probes were interpolated from River Elevation Data received from the New Hampshire Water Resource Board.
2. Details of the Probes are shown in Table 2-1.

EXPLORATION LEGEND

● FP-1 U S ARMY CORPS OF ENGINEERS PROBE LOCATION

FP-1 — EXPLORATION NUMBER
15' LT. — OFFSET
— TOP OF EXPLORATION
— BOTTOM OF EXPLORATION

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

WATER RESOURCES STUDY

WINNIPESAUKEE RIVER BASIN STUDY

DAMAGE REACH 3B

PLAN AND PROFILE OF EXPLORATIONS

WINNIPESAUKEE RIVER NEW HAMPSHIRE

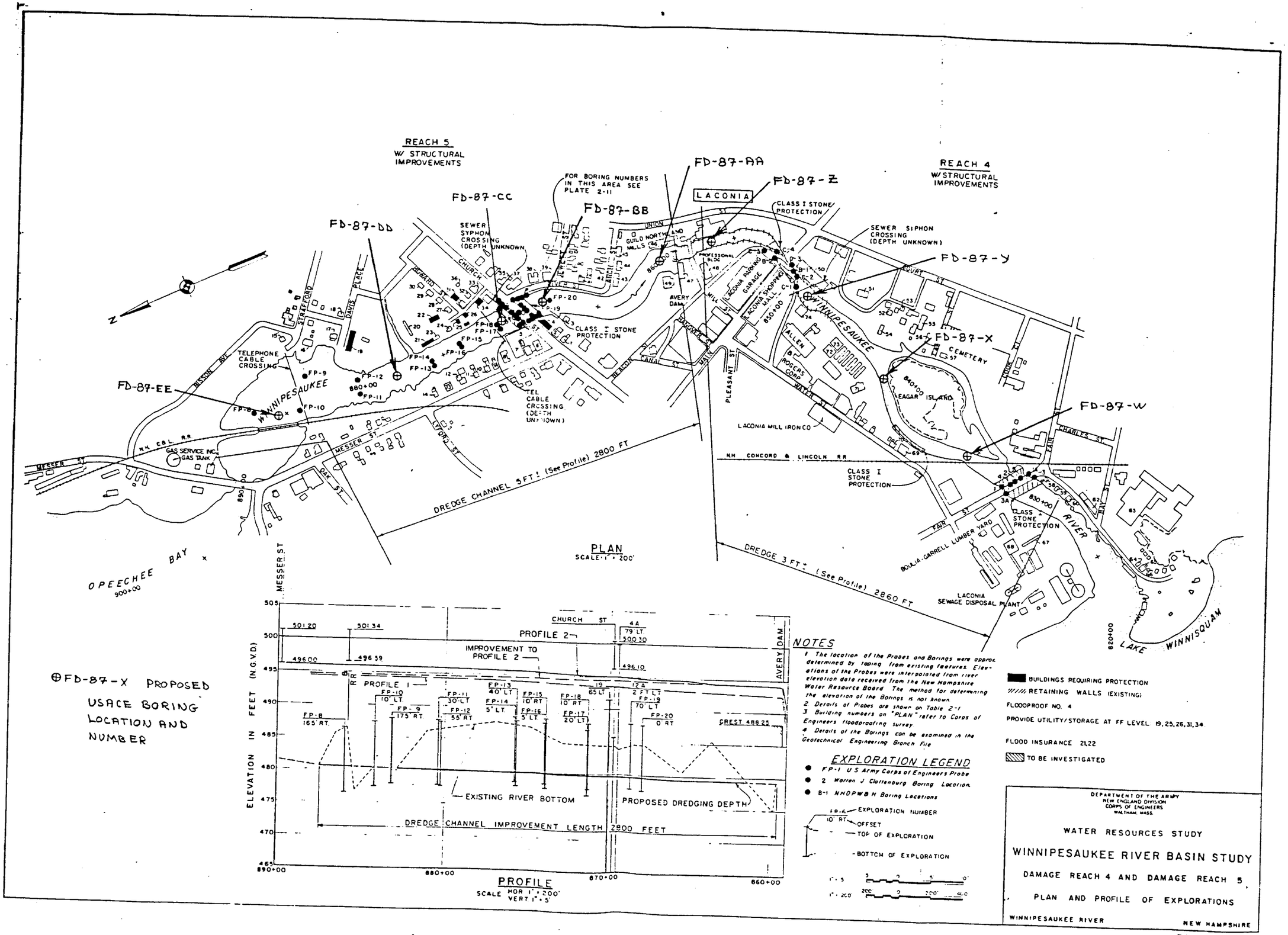
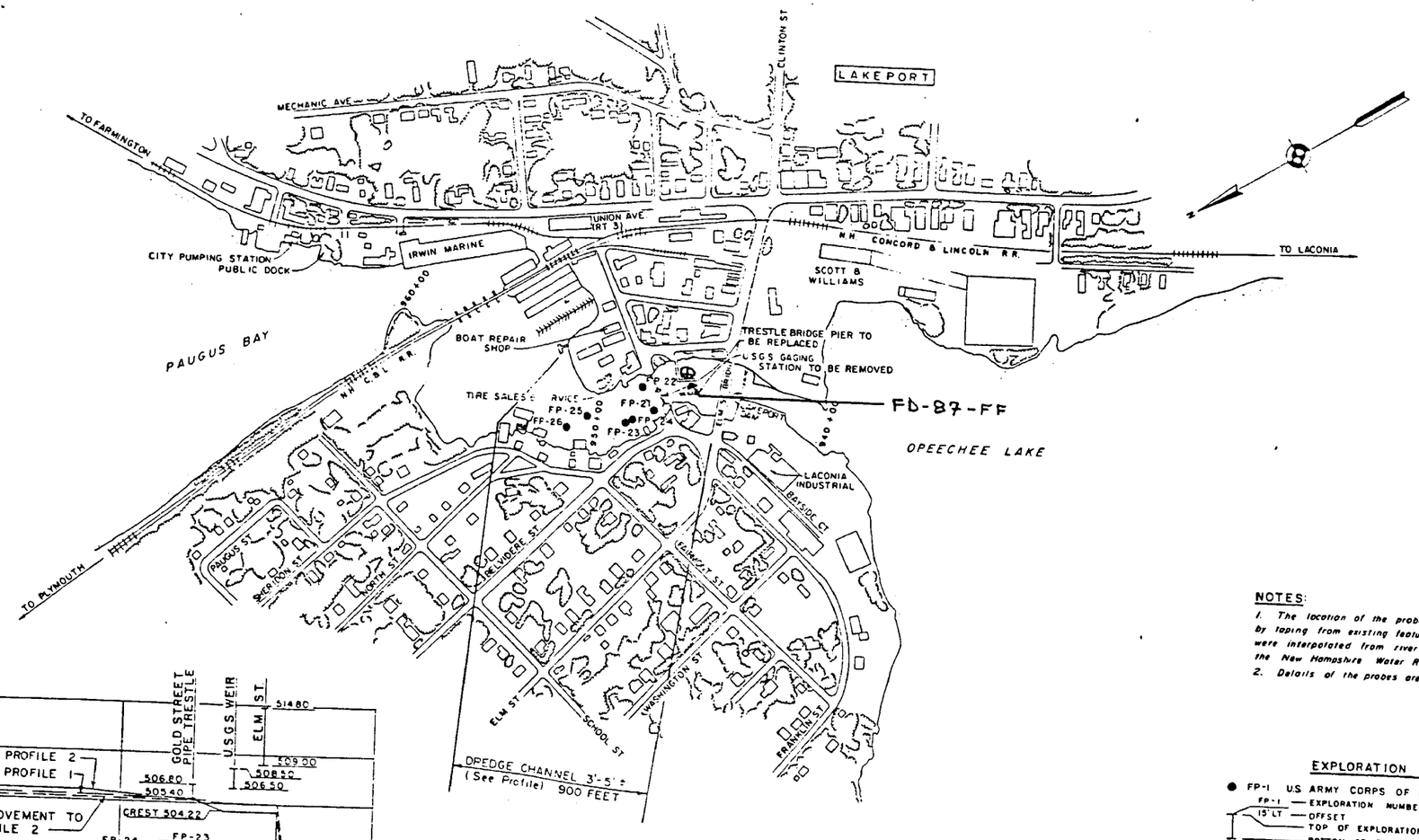
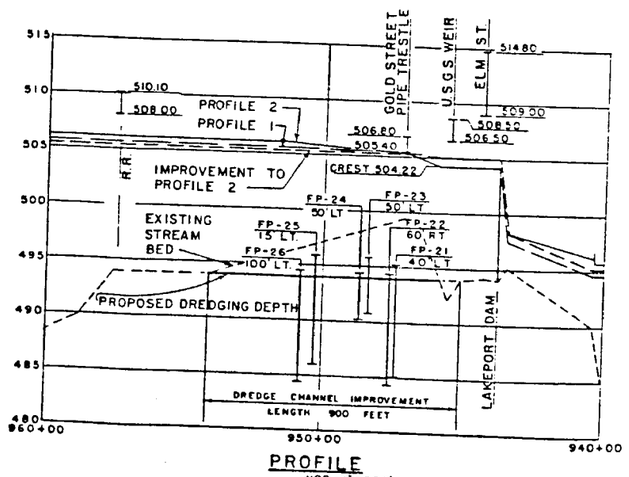

REACH 5
W/ STRUCTURAL IMPROVEMENTS
REACH 4
W/ STRUCTURAL IMPROVEMENTS
FOR BORING NUMBERS IN THIS AREA SEE PLATE 2-11
FD-87-AA
FD-87-Z
FD-87-CC
FD-87-BB
FD-87-DD
FD-87-Y
FD-87-X
FD-87-EE
FD-87-W
LACONIA
CLASS I STONE PROTECTION
SEWER SIPHON CROSSING (DEPTH UNKNOWN)
TELEPHONE CABLE CROSSING
TEL CABLE CROSSING (DEPTH UNKNOWN)
WINNIPESAUKEE
GAS SERVICE INC. GAS TANK
N.H. C&L RR
N.H. CONCORD & LINCOLN RR
DREDGE CHANNEL 5FT± (See Profile) 2800 FT
DREDGE 3 FT± (See Profile) 2860 FT
LACONIA MILL IRON CO
BOULA-GARRELL LUMBER YARD
LACONIA SEWAGE DISPOSAL PLANT
LAKE WINNISQUAM
OPEECHEE BAY
AVERY DAM
GEAGAR ISLAND
CEMETERY
PLAN
SCALE 1" = 200'
PROFILE 2
IMPROVEMENT TO PROFILE 2
PROFILE 1
EXISTING RIVER BOTTOM
PROPOSED DREDGING DEPTH
DREDGE CHANNEL IMPROVEMENT LENGTH 2800 FEET
ELEVATION IN FEET (N.G.V.D.)
PROFILE
SCALE HOR 1" = 200' VERT 1" = 5'
⊕FD-87-X PROPOSED USACE BORING LOCATION AND NUMBER
NOTES
1 The location of the Probes and Borings were approx. determined by taping from existing features. Elevations of the Probes were interpolated from river elevation data received from the New Hampshire Water Resource Board. The method for determining the elevation of the Borings is not known.
2 Details of Probes are shown on Table 2-1
3 Building numbers on "PLAN" refer to Corps of Engineers floodproofing survey.
4 Details of the Borings can be examined in the Geotechnical Engineering Branch File
EXPLORATION LEGEND
FP-1 U.S. Army Corps of Engineers Probe
2 Warren J. Clattenburg Boring Location
B-1 NHDPWBH Boring Locations
EXPLORATION NUMBER
OFFSET
TOP OF EXPLORATION
BOTTOM OF EXPLORATION
BUILDINGS REQUIRING PROTECTION
RETAINING WALLS (EXISTING)
FLOODPROOF NO. 4
PROVIDE UTILITY/STORAGE AT FF LEVEL 19, 25, 26, 31, 34
FLOOD INSURANCE 2L22
TO BE INVESTIGATED
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
WATER RESOURCES STUDY
WINNIPESAUKEE RIVER BASIN STUDY
DAMAGE REACH 4 AND DAMAGE REACH 5
PLAN AND PROFILE OF EXPLORATIONS
WINNIPESAUKEE RIVER
NEW HAMPSHIRE

PLATE 6



PLAN
SCALE: 1" = 200'



PROFILE
SCALE: HOR - 1" = 200'
VERT - 1" = 5'

NOTES:

1. The location of the probes were approximately determined by taping from existing features. Elevations of the probes were interpolated from river elevation data received from the New Hampshire Water Resources Board.
2. Details of the probes are shown in Table 2-1.

EXPLORATION LEGEND

- ● FP-1 U.S. ARMY CORPS OF ENGINEERS PROBE LOCATION
- FP-1 — EXPLORATION NUMBER
- 15' LT — OFFSET
- TOP OF EXPLORATION
- BOTTOM OF EXPLORATION

⊕ FD-87-FF PROPOSED USACE BORING LOCATION AND NUMBER

GRAPHIC SCALE
1" = 200' 200' 0 200 400'

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

WATER RESOURCES STUDY

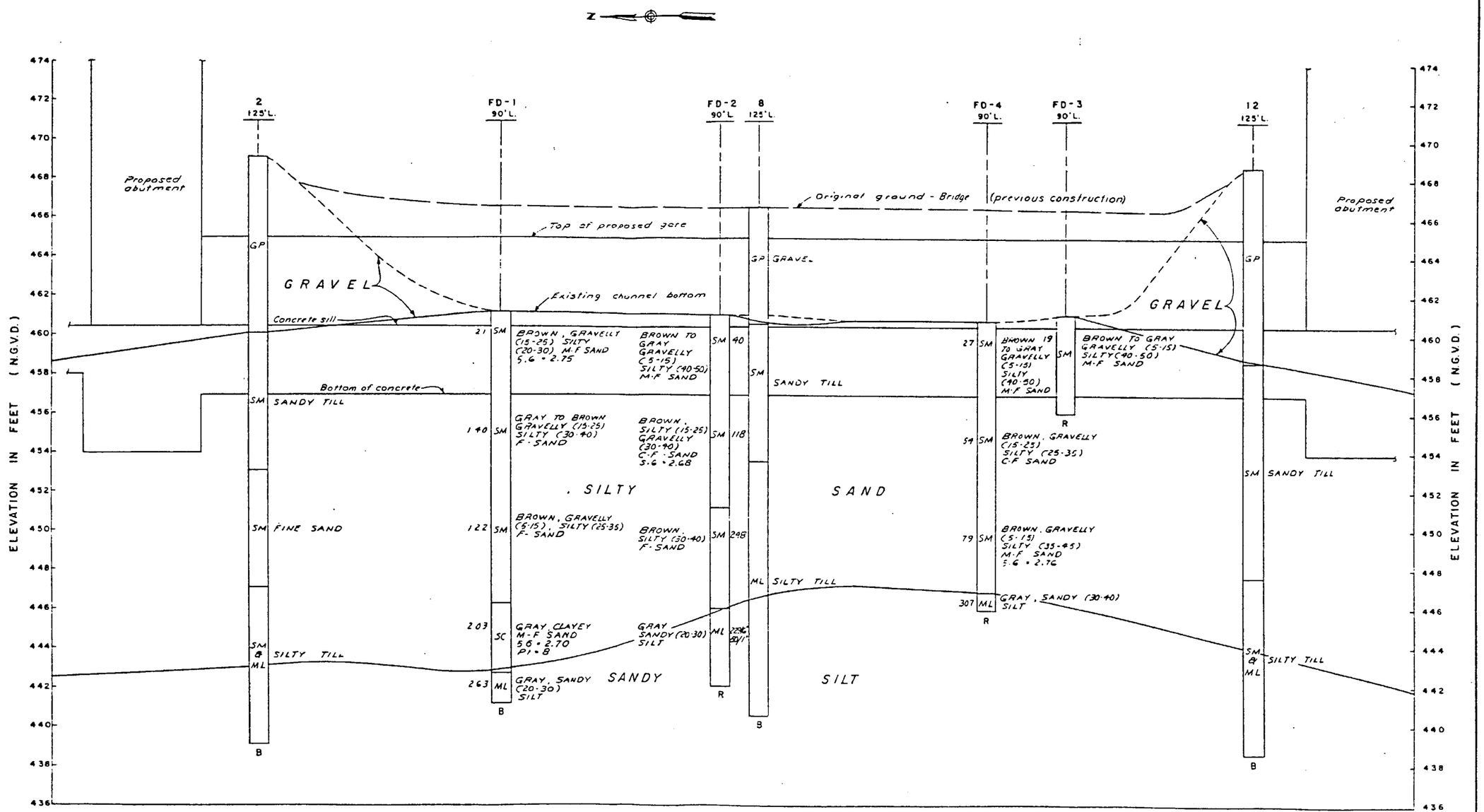
WINNIPESAUKEE RIVER BASIN STUDY

DAMAGE REACH 6

PLAN AND PROFILE OF EXPLORATIONS

WINNIPESAUKEE RIVER — NEW HAMPSHIRE

PLATE



EXPLORATION LEGEND

FD-1 — U.S.A.C.E. BORING NUMBER
2 — N.H.D.P.W.&H BORING NUMBER
10'L — OFFSET FROM ℄ OF PROPOSED WEIR

TOP OF BORING

SM — UNIFIED SOIL CLASSIFICATION

10 — STANDARD PENETRATION VALUE NUMBER. BLOWS REQUIRED TO DRIVE A 2⅛" O.D. SPLIT SPOON SAMPLER WITH A 140 POUND HAMMER AND 30 INCH DROP. (ASTERISK INDICATES SAMPLER DRIVEN WITH A 300 POUND HAMMER AND A 30 INCH DROP.)

BOTTOM OF HOLE

B
R — REFUSAL LESS THAN ONE INCH PENETRATION OF A 2⅛" O.D. SPLIT SPOON SAMPLER WITH 100 BLOWS OF A 300 POUND HAMMER AND A 30 INCH DROP

NOTES:

1. The location of the Borings was determined by taping from existing features.
2. The Elevations of the USACE Borings were interpolated from River Elevation Data received from the New Hampshire Water Resource Board. The method for determining the Elevations of NHDPHW Probes is unknown.

GRAPHIC SCALES

HOR. 1" = 5' — 5' 0 5' 10'

VERT. 1" = 2' — 2' 0 2' 4'

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

WATER RESOURCES STUDY

WINNIPESAUKEE RIVER BASIN STUDY

ENGINEERING LOG PROFILE C-C AT BOTTOM HINGED GATE

WINNIPESAUKEE RIVER — NEW HAMPSHIRE

PLATE 8

b. Project Site

The subsurface investigation was generally performed in the Winnipesaukee River between the towns of Tilton and Lakeport, N.H. This extends from the Corps of Engineers' designated river stationing 289+00 to 946+00. Borings FD-87-J, FD-87-M and FD-87-FF were the exceptions being performed on the banks of the river. A Boring Location Sketch is provided with each field log in Section 8.

Borings FD-87-I through FD-87-M were performed in the area of the proposed bottom hinge gate dam. The gate is planned to be constructed just downstream (west) of Route 140 Bridge.

River bottom conditions for those borings conducted in or on the water were generally sandy or covered with cobbles and boulders. River depths ranged from 2 to 9 feet in the areas of exploration. Excessive river flows and winter weather created dangerous site conditions in some locations. Additional set-up time and equipment were employed to assure crew safety. These procedures are noted later.

c. Purpose

Channel improvements are proposed for certain sections of the Winnipesaukee River. A hinge gate dam is also planned to assist in local flood protection. Borings were required to study the subsurface conditions with regards to soil quality and consistancy. In-place permeabilities were performed during the exploration for the proposed dam.

d. Scope of Work

Thirty-two (32) borings were to be performed in accordance with Delivery Order 0020. These were designated as FD-87-A through FD-87-Z and FD-87-AA through FD-87-FF. Ultimately, two borings were deleted, FD-87-D and FD-87-E, in the Tilton, N.H. area. Samples were to be retrieved using either 1-3/8 or 2-1/2 inch I.D. driven split spoon, as directed, with final depths ranging from 6 to 25 feet. Standard Penetration Test (SPT), ASTM D-1586, which uses the 1-3/8" I.D. sampler, was required on Borings FD-87-I though CD-87-N and FD-87-FF. The remainder of the borings were to be sampled using the 2-1/2" I.D. split spoon, which was in lieu of a solid barrel sampler.

Borings performed for the proposed dam, FD-87-I through FD-87-N, were to be located by survey. These six borings also required permeability tests during the exploration.

General inspection, exploration and permeability test instruction were provided by the Army Corps of Engineers, New England Division, through the contracted "Specifications for Services and Equipment Necessary for Conducting Geotechnical Exploratory Work, Various Locations in New England, and New York" and through Delivery Order No. 0020, which is included in Section 3a. Specific instructions and changes during the course of work were given verbally during on-site and phone conversations through a Corps of Engineer representative. Pertinent instructions and changes can be found listed in Table I and Table II of Section 5, herewith.

SECTION 4

QUALITY CONTROL

a. General Certification Statement

I hereby certify that the above mentioned records, equipment and procedures mentioned below were used to perform the subsurface exploration described herein. I also certify that the work was performed in a professional manner and meets the requirements set forth in the delivery order. This report has been subject to my review and is both complete and technically accurate.

CERTIFIED, Arpil 13, 1987

Spencer Thew

Spencer F. Thew, P.E./L.S.

b. Records Taken

An Atlantic Testing Laboratories, Limited, 2-man drill crew, accompanied by a Geotechnical Engineer, were generally at the referenced site from January 5, 1987 to February 21, 1987. Occasionally a second crew was mobilized to the site. The engineer collected the drilling data and samples. A surveyor was on-site January 7, 1987 to locate and elevate the six borings for the proposed dam. Pertinent survey data, drilling procedures, sampling operations, soil classifications, and testing data were noted on the following forms provided for use by the Corps of Engineers:

NED 121 (Field Log of Test Boring, Summary)
NED 58 (Field Log of Test Borings, Log Construction Page)
NED 58A (Continuation of NED 58)
NED 59 (Subsurface Water Observations and Boring Location Sketch)
NED (Field Permeability Test Results)

A completed series of logs for each of the thirty (30) borings are included in Section 8, Field Inspector's Logs. The original boring designations were changed to a numerical designations upon the start of each boring exploration, i.e. FD-87-H is FD-87-1, FD-87-G is FD-87-2, FD-87-F is FD-87-3, etc. These changes are noted in the Boring Summary and the Field Log of Test Borings in Section 8.

A Corps of Engineers label (ENG form 1742) was completed and affixed to each jar sample taken. The soil samples were transferred to Corps of Engineers' representative Joseph A. Calucci in Waltham, Mass. Samples were delivered in marked boxes on February 2, 5 and 23, 1987, totaling 15 boxes.

Summary of daily activities and telephone conversations can be found in Tables I and II of Section 5. Also documented during the project operations were three chain of custody logs and six safety meeting reports, located in Sections 6 and 7, respectively. Note that exposure time for ATL, Corps and subcontracted personnel were included on the safety meeting reports.

c. Equipment Used

All personnel, equipment and supplies were provided by Atlantic Testing Laboratories, Limited, with exception to that provided by the subcontractors. A listing of pertinent equipment follows:

1. Survey Equipment

   - Wild Heerburg, T-1A, 20-second theodolite (erect image)
   - Wild Heerburg, NAK2, automatic level
   - 25 feet, extendable, fiberglass, stadia rod
   - 200 feet survey chain
   - David White hand level
   - Survey stakes and ribbon
   - fluorescent paint

2. Drilling Equipment

   - Tractor-trailer
   - Truck-mounted CME 45 drill rig
   - 320 sq. ft. float
   - Acker HB drill rig mounted on skids
   - 10 HP Cathead and tripod
   - 140 lb. and 300 lb. hammers
   - AW and NW taper threaded drill rod, in 5 feet and 10 feet lengths; used for sampling and turning 3-1/8-inch roller bit
   - Auger, 3-1/8-inch ID, 7 inch OD, slot fit, hollow stem augers in 5 feet lengths with carbide tip teeth
   - Three 1-1/2-inch centrifical pumps
   - Service boat with 10 HP outboard motor
   - A 2-inch OD by 6 foot diamond bit core barrel
   - Split spoon samplers, 2-1/2-inch ID by 2 feet in length, 1-3/8-inch ID by 2 feet in length
   - 16 and 32 oz. sample jars
   - 4-inch threaded thin wall casing with drive shoe

3. Permeability Test Equipment

   - 100-foot electronic water level indicator
   - Standard watch
   - 6-foot folding ruler marked in 100th of a foot

4. Subcontracted Equipment

   - Truck crane, 110-foot boom, 5-ton capacity, with operator
   - Tractor-trailer for equipment moves

d. Procedures

A total of thirty (30) borings were performed at the referenced site. This involved coordination, gaining right-of-entry, locating borings, accessing the boring sites, drilling, sampling and performing permeability tests.

1. Coordination

The on-site ATL Geotechnical Engineer gave a verbal project update, generally on a daily basis, to a Corps of Engineer representative. An account of these conversations and project activities are summarized in Section 5. Changes to the delivery order have been noted in this section.

2. Right-of-entry

Land owners and utility companies were contacted by the on-site engineer prior to the start of work. New Hampshire Water Resource Board was also made aware of the exploration in the Winnipesaukee River. Work performed on the bridges was cleared through the Highway, Police and Fire Departments.

3. Survey Procedures

A location and elevation survey was not required for twenty-four (24) of the borings. As instructed, this information was interpolated from drawings provided in the delivery order and recorded on the logs.

The dam borings, FD-87-I through FD-87-N, were set by tying into the adjacent Route 140 Bridge. The bridge was bisected in both directions, setting the bridge centerlines. The elevation of these borings were figured using 479.44 feet as the top of the north bridge abutment.

4. Boring Access Procedures

The borings were performed using one of four methods: track-mounted drill rig; skid drill rig mounted on float; tripod mounted on float; and tripod with platform. The three land borings were easily accessible, over the snow, by the track rig.

The float was used in sections of the river which were deep enough to draft and where the flow rate was not excessive. The 16 by 20 float generally requires disassembly and assembly for each land move. The assembled float was moved on the trailer around Avery Dam in Laconia, N. H. This was a short move, less than 1/4 mile, and required assistance by the local police.

The float or float components were moved from the trailer to the water, and vice versa, with the use of a truck-mounted crane. The tripod or skid drill rig, as well as the drilling appurtenence, was also set with the crane.

A service boat, with a 10 HP outboard motor was generally used to move

the float in the water. Occasionally, an additional 10 HP outboard motor was attached to the float to assist the service boat. In sections of the river where the water was moving too fast to use the outboard motors, an anchor on the drill rig winch line was set. The winch was then used to pull the float upstream. A safety line was tied from the float to each shore, generally to a tree. An attempt was made to set the float in upstream of the boring locations. The float could then be moved downstream using just the two aforementioned safety lines.

In areas where the water was too shallow and/or swift for the float, particularly in Tilton, N.H., a tripod was used. The tripod, with elevated platform, was completely erected first on land. A truck crane was used to set the tripod, equipment and drill crew on the boring location in the river.

5. Drilling Procedure

Accessing the boring locations generally regulated the equipment used. The thirty (30) borings were performed using one of four different equipment configurations. The drilling equipment used was a track mounted drill rig, skid drill rig mounted on a float, tripod mounted on a float and tripod with a platform. The Inspection Field Logs, Section 8, contain the equipment and drilling methods used for each of the borings.

Samples were retrieved using a 1-3/8" or 2-1/2" split spoon, driven with a 140-pound hammer, falling 18 inches. The blow counts for each half-foot were recorded on the logs. Refusal was defined as 50 blows with no penetration. The 1-3/8" I.D. sampler was used for seven borings, FD-87-I through FD-87-N and FD-87-FF, in accordance with ASTM Specification D-1586-84. The sampling schedule was provided in the delivery order.

Hollow stem auger or thin wall casing was used to hold the hole open, if required. The hole was cleaned out using river water through a tri-cone roller bit. Rock coring was not necessary for any of the thirty borings.

Samples were classified in the field or in a heated room (so as not to allow the samples to freeze) in accordance with ASTM D-2488, without qualifying laboratory tests. Sample recovery was noted as poor in the gravelly materials and fair in the sandy materials. Representative samples were taken from each soil sampling run and placed into 16-ounce or 32-ounce jars with hermetically sealed lids. Jars were labeled with the sticker (ENG Form 1742) provided to us by the Corps. A chain of custody log was maintained documenting custody of the samples between Atlantic Testing Laboratories, Limited, and the Corps of Engineers.

6. Permeability Test Procedures

Three falling head and three rising head tests were conducted on Borings FD-87-I through FD-87-N. These borings are in the area of the proposed dam. A vertical zone of soil was tested by setting the driven thin wall casing two feet above the bottom of the hole. Water was then pumped down the casing, filling the casing. Once filled, the water surface in the casing was monitored using an electronic water level indicator. The rising head test was performed similarly to the aforementioned falling head test, except water was pumped from the cased hole. Specific testing instructions were provided by the Corps and are noted in the delivery order. The test results are contained in the Inspection Field Logs, Section 8.

SECTION 5

SUMMARY OF ACTIVITIES

AND

CONVERSATION LOGS

TABLE I

SUMMARY OF ACTIVITIES

DATE	ACTIVITY
Monday, January 5, 1987	- Mobilize Geotechnical Engineer (Paul Fisher) to site. - Mobilize Acker Model HB skid rig, 10 HP Tripod rig, Float and 2 drillers (Paul Davis and Jim Boyer) to site. - Geotechnical Engineer on-site (1400 - 1700).
Tuesday, January 6, 1987	- Safety meeting (0800 - 0830). - Driller placed boat in at Route 140 crossing of the Winnipesaukee River; unloaded and prepared equipment and float (0830 - 1700). - Geotechnical Engineer on-site (0730 - 1800).
Wednesday, January 7, 1987	- Drillers set up float and Acker drill rig in water off Rt. 140 bridge (0700 - 1200); water move (1200 - 1430); advanced FD-87-1 (H) from 0' to 4' (1430 - 1700). - Subcontracted truck crane on-site (0830 - 1130). - Atlantic Testing Laboratories, Limited, surveyor, Marvin Montgomery, on site (0700 - 1200) to locate and elevate Borings FD-87-I through N. - Geotechnical Engineer on-site (0700 - 1800).
Thursday, January 8, 1987	- Drillers advanced FD-87-1 (H) from 4' to 6' (0700 - 1130); moved to FD-87-2 (G) (1130 - 1530); sampled FD-87-2 (1430 - 1530); moved to FD-87-3 (F) (1530 - 1700). - Geotechnical Engineer on-site (0730 - 1830).
Friday, January 9, 1987	- Drillers sampled FD-87-3 (F) (0700 - 0830); moved float and rig upstream with use of winch and two safety lines (0830 - 1230) - Geotechnical Engineer on-site (0700 - 1400).

TABLE I
SUMMARY OF ACTIVITIES (cont'd)

Monday, January 12, 1987	- Safety meeting (1130 - 1200). - Equipment maintenance (1200 - 1330). - Drillers finished moving float upstream, using winch and two safety lines, towards Route 140 bridge (1330 - 1730). - Geotechnical Engineer on-site (1100 - 1800).
Tuesday, January 13, 1987	- Drillers moved float upstream using winch and onto FD-87-4 (N) (0700 - 1130); advanced from 0' to 7' (1130 - 1430); permeability test (1430 - 1630); advanced from 7' to 8' (1630 - 1700). - Geotechnical Engineer on-site (0700 - 1830).
Wednesday, January 14, 1987	- Float drillers continued advancing FD-87-4 from 8' to 12' (0700 - 1030); permeability test (1030 - 1130); advanced from 12' to 17' (1130 - 1330); permeability test (1330 - 1400); advanced from 17' to 20' (1400 - 1530); moved to FD-87-5 (K) (1530 - 1700). - Mobilized track-mounted CME 45 and drillers (Gary Cambridge and Fred Murdock) to site; moved onto FD-87-6 (M) (1600 - 1700). - Geotechnical Engineer on-site (0700 - 1800).
Thursday, January 15, 1987	- Float drillers advanced FD-87-5 (K) from 0' to 7' (0700 - 0830); permeability test (0830 - 0930); advanced from 7' to 12' (0930 - 1100); permeability test (1100 - 1200); advanced from 12' to 17' (1200 - 1300); permeability test (1300 - 1400); advanced from 17' to 20' (1400 - 1500); moved to FD-87-7 (L) (1500 - 1630); advanced FD-87-7 from 0' - 5' (1630 - 1700). - Track CME 45 Drillers advanced FD-87-6 (M) from 0' to 7' (0700 - 0900); permeability test (0900 - 1000); advanced from 7' to 12' (1000 - 1100); permeability test (1100 - 1200); advanced from 12' to 17' (1200 - 1300); permeability test (1300 - 1400); advanced from 17' to 20' (1400 - 1530); moved to FD-87-J (1530 - 1630). - Geotechnical Engineer on-site (0700 - 1930).

TABLE I
SUMMARY OF ACTIVITIES (cont'd)

Friday, January 16, 1987	- Float rig continued advancing FD-87-7 (L) from 5' to 7' (0700 - 0800); permeability test (0800 - 0900); advanced from 7' to 12' (0900 - 1000); permeability test (1000 - 1030); advanced from 12' to 17' (1030 - 1230); permeability test (1230 - 1300). - Track rig crew moved hauler and four trailers to new storage site (Pike); serviced equipment. - Geotechnical Engineer on-site (0700 - 1300).
Monday, January 19, 1987	- Track-mounted drill rig demobilization from job site. - Float rig (Davis and Boyer) continued advancing FD-87-7 from 17' to 20' (0930 - 1130); moved float to FD-87-8 (I) (1130 - 1500); advanced boring from 0' to 7' (1500 - 1630). - Safety meeting (1630 - 1700). - Geotechnical Engineer on-site (1500 - 1830).
Tuesday, January 20, 1987	- Float rig continued on FD-87-8; permeability test (0700 - 0800); questioned permeability test results due to loose casing; moved boring location and advanced hole from 0' to 7' (0800 - 0900); permeability test (0900 - 1000); advanced from 7' to 12' (1000 - 1200); advanced from 12' to 17' (1200 - 1300); permeability test (1300 - 1330); advanced from 17' to 20' and out (1330 - 1400); moved float upstream ready to move to other side of Rt. 140 bridge (1400 - 1700). - Geotechnical Engineer on-site (0700 - 1830).
Wednesday, January 21, 1987	- Float was moved upstream underneath Rt. 140 bridge after lifting the Acker HB drill rig off. The rig was then reset on the float on the other side of the bridge (0700 - 1000). - Subcontracted truck crane on-site (0830 - 0930).

TABLE I
SUMMARY OF ACTIVITIES (cont'd)

	- The float was moved upstream using two, 10-HP outboard motors to FD-87-9 (T) (1000 - 1130); sampled FD-87-9 (1130 - 1230); moved to FD-87-10-(S); sampled FD-87-10 (1230 - 1300); moved to FD-87-11 (R) (1300 - 1330); sampled FD-87-11 (1330 - 1400); moved to FD-87-12 (Q) (1400 - 1430); sampled FD-87-12 (1430 - 1500); moved to FD-87-13 (P) (1500 - 1530); sampled FD-87-13 (1530 - 1600); moved to FD-87-14 (O) (1600 - 1630); sampled FD-87-14 (1630 - 1700). - Geotechnical Engineer on-site (0700 - 1930).
Thursday, January 22, 1987	- Float drillers move equipment downstream to Rt. 140 bridge (0700 - 1000); disassembled, moved and reassembled float in snow storm for FD-87-U and V (1000 - 1730). - Mobilized drillers, Randy Todd and John Saarinen, to site; assisted move of float (1230 - 1600). - Subcontracted truck crane on-site (1230 - 1400). - Geotechnical Engineer on-site (0700 - 1830).
Friday, January 23, 1987	- Drillers, Randy Todd and John Saarinen, service equipment (0700 - 1030); demobilized. - Float drillers, Paul Davis and Jim Boyer, service equipment (0700 - 1030). - Geotechnical Engineer on-site (0700 - 1000).
Monday, January 26, 1987	- Float drillers on-site (1100 - 1700) start frozen motors, snow removal, free float which was frozen into the ice due to the storm and freezing temperatures. - Geotechnical Engineer on-site (1600 - 1900).
Tuesday, January 27, 1987	- Safety meeting (0700 - 0730). - Float drillers erected tripod and moved to FD-87-15 (V) (0730 - 0930); sampled FD-87-15 (0930 - 1030); moved to FD-87-16 (U) (1030 - 1100); sampled FD-87-16 (1100 - 1200); disassembled float, moved to Laconia, New Hampshire; and reassembled float on water (1200 - 1730).

TABLE I
SUMMARY OF ACTIVITIES (cont'd)

	- Subcontracted truck crane on-site (1400 - 1730).
	- Geotechnical Engineer on-site (0700 - 1930).
Wednesday, January 28, 1987	- Float moved to FD-87-17 (EE) (0700 - 0900); sampled FD-87-17 (0900 - 1100); moved to FD-87-18 (DD) (1100 - 1130); sampled FD-87-18 (1130 - 1230); moved to FD-87-19 (CC) (1230 - 1300); sampled FD-87-19 (1300 - 1330); moved to FD-87-20 (BB) (1330 - 1430); sampled FD-87-20 (1430 - 1530); moved to FD-87-21 (AA) (1530 - 1600); sampled FD-87-21 (1600 - 1700); moved float to shore for land move (1700 - 1800).
	- Geotechnical Engineer on-site (0700 - 1830).
Thursday, January 29, 1987	- Moved float, without dissembling, on trailer assisted by police escort (0600 - 0830); positioned float over FD-87-22 (Z) (0830 - 0900); sampled FD-87-22 (0900 - 1030); moved under Main Street Bridge in swift water to FD-87-Y (1030 - 1400); set up tripod (1400 - 1500).
	- Subcontracted truck crane on-site (0630 - 0730).
	- Geotechnical Engineer on-site (0600 - 1830).
Friday, January 30, 1987	- Vandals cut the float loose last night. Moved float upstream to FD-87-23 (Y) (0700 - 0830); sampled FD-87-23 (0830 - 0900); moved to FD-87-24 (X) (0900 - 0930); sampled FD-87-24 (0930 - 1000); moved to FD-87-25 (W) (1000 - 1030); sampled FD-87-25 (1030 - 1100); moved float to shore and dismantled tripod (1100 - 1200).
	- Drillers Gary Cambridge and Todd Burnham on-site at 0930; demobilized Acher HB drill rig.
	- Geotechnical Engineer (0800 - 1400).
Monday, February 2, 1987	- Safety meeting (1100 - 1130).
	- Drillers, Paul Davis and Jim Boyer, disassembled float and loaded equipment (1130 - 1330); maintenance on trailer (1330 - 1430); moved tripod to Tilton, New Hampshire and reassembled tripod on land (1430 - 1730).
	- Geotechnical Engineer on-site (1100 - 1830).

TABLE I
SUMMARY OF ACTIVITIES (cont'd)

Tuesday, February 3, 1987	- Drillers set tripod in river over FD-87-26 (B) using crane (0700 - 0830); sampled FD-87-26 (0830 - 0900); moved assembled tripod to FD-87-27 (A) (0900 - 0930); sampled FD-87-27 (0930 - 1000); moved to FD-87-28 (C) using crane from bridge (1000 - 1100); sampled FD-87-28 (1100 - 1130); disassembled tripod and load equipment (1130 - 1500); equipment maintenance (1500 - 1700). - Subcontracted truck crane on-site (0730 - 1300). - Geotechnical Engineer on-site (0700 - 1830).
Wednesday, February 4, 1987	- Demobilized float, drillers and engineer. - Geotechnical Engineer on-site (0700 - 1530).
Thursday, February 19, 1987	- Mobilized track-mounted CME 45, two drillers and Geotechnical Engineer to Lakeport, New Hamphsire.
Friday, February 20, 1987	- Safety meeting (0700 - 0730). - Disassembled fence and moved drill rig to FD-87-29 (FF) (0730 - 0900); advanced boring from 0' to 25'; this boring was advanced an extra 5' due to excessive amount of fill encountered (0900 - 1400); moved drill rig and equipment to FD-87-30 (J) (1400 - 1700). - Geotechnical Engineer on-site (0700 - 1830).
Saturday, February 21, 1987	- Drillers advanced FD-87-30 (J) from 0' to 7' (0700 - 0800); permeability test (0800 - 0830); advanced boring from 7' to 12' (0830 - 1000); permeability test (1000 - 1100); advanced boring from 12' to 17' (1100 - 1230); permeability test (1200 - 1230); advanced boring from 17' to 25' (1230 - 1830); equipment maintenance (1830 - 2000). - Geotechnical Engineer on-site (0700 - 1430) then demobilize.
Sunday, February 22, 1987	- Demobilized drill rig and drillers.

TABLE II

CONVERSATION LOGS

DATE	CONVERSATION
Monday, January 5, 1987	- Telecom with Yuri Yatsevitch, a representative of the Corps of Engineers, regarding: scale drawings for boring locations; only survey FD-87-I, J, K, L, M and N; 2-1/2" I.D. split spoon will be used in place of a solid barrel sampler.
Tuesday, January 6, 1987	- Telecom with Ron DeFillipo, a representative of the Corps of Engineers, regarding: use either 1.5' or 2' split spoon; received survey information for locating the six borings for the proposed gate structure; use 140-pound hammer on the 2-1/2" I.D. split spoon. - Telecom with John Moore, a representative of the Department of Public Works and Highways, regarding working off on the Rt. 140 bridge. - Met with Mr. Fauteux, land owner southwest of Rt. 140 bridge, regarding boring FD-87-M on his property.
Wednesday, January 7, 1987	- Telecom with Scott Davis, Assistant District Engineer, New Hampshire Highway Department (524-6667), regarding clearance to block one lane of traffic on Rt. 140 bridge. - Telecom with Mr. Yatsevitch regarding project update. - Telecom with Dig Safe (1-800-225-4977) utility clearance at Rt. 140 bridge - No. 87021551, Tilton area - No. 87021593, and Laconia area - 87021608. - Met with Jeff Yates, a representative of Gas Service, Inc., landowner northwest of Rt. 140 bridge, regarding Boring FD-87-J on property and gas line location.
Thursday, January 8, 1987	- Telecom with Mr. Yatsevitch regarding: project update; may mobilize track drill rig for borings on land.

TABLE II
CONVERSATION LOGS (cont'd)

Friday, January 9, 1987	- Telecom with Mr. DeFillipo regarding project update.
Monday, January 12, 1987	- Telecom with Mr. DeFillipo and Mr. Yatsevitch regarding project update.
Tuesday, January 13, 1987	- Telecom with Mr. Yatsevitch. Advised him of the substantial time required to move upstream to FD-87-4 (N) due to the fast running current and irregular bottom. - Telecom with Mr. Paul Schimelfenyg, a representative of the Corps of Engineers, regarding requirements for permeability test. Atlantic Testing Laboratoried, Limited, is not required to calculate Kn.
Wednesday, January 14, 1987	- Met with Mr. Yatsevitch and Mr. Schimelfenyg on-site (1000 - 1500); reviewed the proposed boring location; observed permeability test; noted the difficult proposed boring location in Tilton, New Hampshire; allowed to move boring locations upstream or downstream 50' and left or right of river centerline 25'; was made aware of the track rig coming on-site today for land holes; was made aware of excessive standby time required for moves; noted difficulties in holding sample temperature at 40° F; given permission to move FD-87-A upstream 100' - 200'.
Thursday, January 15, 1987	- Telecom with Vern Knowlton, a representative of the New Hampshire Water Resource (603-271-3406) regarding: altering river flow in Tilton, New Hampshire area; requires two-day notice. - Telecom with Mr. Yatsevitch regarding project update and track rig on-site.
Tuesday, January 20, 1987	- Telecom with Mr. Yatsevitch regarding project update.
Wednesday, January 21, 1987	- Telecom with Mr. Yatsevitch regarding project update.

TABLE II
CONVERSATION LOGS (cont'd)

Thursday, January 22, 1987	- Telecom with Mr. Yatsevitch regarding: project update; approved using extra drill crew to assist in move of float; FD-87-0 is 6' in depth not 10'. - Telecom with Ken Kyle, New Hampshire District Engineer, Department of Transportation (524-6667), regarding reduction of traffic to one lane on Rt. 140 bridge.
Tuesday, January 27, 1987	- Telecom with Mr. Yatsevitch. Atlantic Testing Laboratories, Limited, will use 32-ounce jars as well as 16-ounce jars for soil samples; noted the substantial amount of time required to move equipment from location to location; FD-87-D and E are cancelled. - Telecom with Ken Boehnier, a representative of Laconia, New Hampshire Department of Public Works, to clear drilling locations.
Wednesday, January 28, 1987	- Met with Richard Richardson, a representative of Laconia, New Hampshire Department of Public Works, regarding sewer line location. - Met with L. F. Pond, of the Laconia Police Department, regarding moving float over the road as an oversized load. - Telecom with Dig Safe regarding utility clearance. - Telecom with New England Telephone regarding underground line location. - Telecom with Mr. Yatsevitch regarding: project update; do not sample FD-87-GG; must move FD-87-AA upstream of safety rope at Avery Dam.
Thursday, January 29, 1987	- Telecom with Mr. Yatsevitch regarding: project update; project schedule; received permission for a second sample delivery to Waltham.

TABLE II
CONVERSATION LOGS (cont'd)

Friday, January 30, 1987	- Telecom with Mr. Yatsevitch regarding project update and extra float move, due to vandalism. - Telecom with New Hampshire Water Resource Board (271-3406) regarding lowering water level in Tilton, New Hampshire next week.
Monday, February 2, 1987	- Telecom with Dan Raposa, a representative of Water Resource, regarding lower water level for tommorrow in Tilton. - Telecom with Tilton and Northfield, New Hampshire Police and Fire Departments regarding blocking one lane of traffic on Canon Bridge tommorrow. - Telecom with Mr. Yatsevitch regarding: project update; nine boxes of samples turned into the Corps Lab today.
Tuesday, February 3, 1987	- Telecom with Mr. Yatsevitch regarding: project update; ground elevation below Avery Dam for FD-87 W (478), X (476), Y (478) and Z (479).
Wednesday, February 4, 1987	- Telecom with Mr. Yatsevitch regarding demobilization float, drillers and engineer until track rig is mobilized to site.
Thursday, February 19, 1987	- Telecom with Mr. DeFillipo regarding the return of the drill rig and crew to the project site.
Friday, February 20, 1987	- Telecom with Mr. Yatsevitch regarding project update and the possibility of FD-87-29 going over 20'.

SECTION 6

CHAIN OF CUSTODY LOGS

ATLANTIC TESTING LABORATORIES, Limited

CHAIN OF CUSTODY LOG

PROJECT: WINNIPESAUKEE RIVER, NH, DACW33-85-D-0011, D.O. #020

ITEMS:

Tubes: NONE

Bottles: NONE

Jar Samples: ALL SAMPLE FOR FO-87-1 → 14 + 17 → 20 (9 BOXES)

Core Boxes: NONE

Sampling Logs: NONE

Date & Time Received	Date & Time Transferred	Comments	Custodian
AS SAMPLED	2/2/87 1100	PAUL FISHER (ATL)	[illegible]
2/2/87, 1100	2/2/87 1230	GREG CRAIG (ATL)	[illegible]
	2/2/87 230	Joseph G. Gluck (CORPS)	[illegible]

NOTE: KEEP SAMPLES AT 40° F.

ATLANTIC TESTING LABORATORIES, Limited

CHAIN OF CUSTODY LOG

PROJECT: WINNIPESAUKEE RIVER, NH
DACW 33-85-D-0011, D.O. #020

ITEMS:

Tubes: NONE

Bottles: NONE

Jar Samples: ALL SAMPLE FOR FD-87-15, 16, 21 THRU 28 (3 BOXES)

Core Boxes: NONE

Sampling Logs: NONE

Date & Time Received	Date & Time Transferred	Comments	Custodian
AS SAMPLED	2/4/86 1700HRS	PAUL FISHER (ATL)	[illegible]
2/4/86, 1700HRS	2/4/88 1700hrs	GREG CRAIG (ATL)	GC
	2/5/87 1600	Joseph C. Colucci (CORPS)	JC

NOTE: KEEP SAMPLES AT 40° F

ATLANTIC TESTING LABORATORIES, Limited

CHAIN OF CUSTODY LOG

PROJECT: WINNIPESAUKEE RIVER BASIN, NH
DACW 33-85-D-0011, D.O. #0020

ITEMS:

Tubes: NONE

Bottles: NONE

Jar Samples: FD-87-29 + FD-87-30 (3 BOXES)

Core Boxes: NONE

Sampling Logs: NONE

Date & Time Received	Date & Time Transferred	Comments	Custodian
AS SAMPLER	2/21/87 1200	PAUL FISHER	[illegible]
2/21/87 1200	2/21/87 12:00	Gregory P. Craig	GPC
	2/23/87 1030	JOSEPH [illegible]	JC

SECTION 7

SAFETY REPORTS

TILTON NH
FIRE + AMBULANCE 524-1545
POLICE 286-4442

WEEKLY SAFETY MEETING

NEDSO

Date held 1/6/87

THRU: Area Engineer, NEW ENGLAND Area

Time 0800

TO: Safety Office, NED

1. Weekly safety meeting was held this date for the following personnel:

Contract No. DACW33-85-D-0011 D.O. 020 Contractor ATLANTIC TESTING LAB

Conducted By PAUL FISHER All personnel present (Contr) 3
(Sub) 0
(Govt) 0

Subjects discussed (Note, delete, or add):
EM 385-1-1, Section: _____

Accident Prevention Plan

— Individual Protective Equipment -

Prevention of Falls -

Back Injury, Safe Lifting Techniques -

— Fire Prevention - FIRE EXTINGUISER ON BOAT

Sanitation, First Aid, Waste Disposal -

— Tripping Hazards - trash, hose, nails in lumber - ANCHOR LINES

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery -

— Equipment Inspection & Maintenance (Zero Defects) - DRILL RIG, BOAT, FLOAT, TRUCK

— Hoisting Equipment - DRILL RIG

— Ropes, Hooks, Chains and Slings - CABLES

Electrical Grounding, Temporary Wiring, GFCI -

— Lockouts for safe clearance procedures - electrical, pressure, moving parts - UTILITY CLEARANCE

Welding, Cutting -

Excavations -

— Loose Rock and Steep Slopes - SNOW COVERED AREA

Explosives -

— Water Safety - BOAT AND MOTOR

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other - WATER SAFTY

Prepared by PAUL FISHER Title ENG

2. Forwarded.

Signature [signature]
Resident Engineer

CF: EXPOSURE TIME 1/5 TO 1/9
ATL 104 HRS
SUBCONTRACTOR 7 HRS

NED FL 251

LACONIA, N.H.
FIRE + AMBULANCE 524 1545
POLICE 524 5252

WEEKLY SAFETY MEETING

NEDSO

Date held 1/12/87

THRU: Area Engineer, NEW ENGLAND Area

Time 1130

TO: Safety Office, NED

1. Weekly safety meeting was held this date for the following personnel:

Contract No. DACW33-85-D-0011 Contractor ATLANTIC TESTING LAB

Conducted By PAUL FISHER All personnel present (Contr) 3
(Sub) 0
(Govt) 2

Subjects discussed (Note, delete, or add):
EM 385-1-1, Section: _____

Accident Prevention Plan

— Individual Protective Equipment - COLD WEATHER GEAR

— Prevention of Falls - INTO COLD WATER

— Back Injury, Safe Lifting Techniques - DURING DRILLING OPERATION

— Fire Prevention - GAS CANS

— Sanitation, First Aid, Waste Disposal - NOTE TELEPHONE NO. ABOVE

— Tripping Hazards - trash, hose, nails in lumber - ANCHOR LINES AND EQUIPMENT ON DECK

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery -

— Equipment Inspection & Maintenance (Zero Defects) - DRILL RIG + BOAT

— Hoisting Equipment - WINCH ON DRILL RIG

— Ropes, Hooks, Chains and Slings - CABLES

Electrical Grounding, Temporary Wiring, GFCI -

— Lockouts for safe clearance procedures - electrical, pressure, moving parts - HAVE OK FROM DIG SAFE

Welding, Cutting -

Excavations -

Loose Rock and Steep Slopes -

Explosives -

— Water Safety - HEAVY CURRENT

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by PAUL FISHER Title ENG

2. Forwarded.

EXPOSURE TIME 1/12 - 1/16
ATL 148 HRS
CORPS 10 HRS

CF:

Signature [signature]
Resident Engineer

NED FL 251

WEEKLY SAFETY MEETING

NED:SO

Date held 1-19-87

THRU: Area Engineer, NEW ENGLAND Area

Time 1630

TO: Safety Office, NED

1. Weekly safety meeting was held this date for the following personnel:

Contract No. DACW33-85-D-0011 Contractor ATLANTIC TESTING LAB

Conducted By PAUL FISHER All personnel present (Contr) 3
(Sub) 0
(Govt) 0

Subjects discussed (Note, delete, or add):
EM 385-1-1, Section: _____

Accident Prevention Plan

— Individual Protective Equipment - HARD HAT

Prevention of Falls -

Back Injury, Safe Lifting Techniques -

— Fire Prevention - EXTINGUISHER IN BOAT

— Sanitation, First Aid, Waste Disposal -

— Tripping Hazards - trash, hose, nails in lumber - INSTALLED GANG BOX ON BOARD FLOAT

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery -

— Equipment Inspection & Maintenance (Zero Defects) -

— Hoisting Equipment - DRILL RIG

— Ropes, Hooks, Chains and Slings -

Electrical Grounding, Temporary Wiring, GFCI -

Lockouts for safe clearance procedures - electrical, pressure, moving parts -

Welding, Cutting -

Excavations -

Loose Rock and Steep Slopes -

Explosives -

— Water Safety - LIFE JACKETS IN BOAT AND ON FLOAT

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by P FISHER Title ENG

2. Forwarded. EXPOSURE TIME 1/19-1/20

CF: ATL 145.5 HRS
SUB 10 HRS

Signature _____
Resident Engineer

NED FL 251

WEEKLY SAFETY MEETING

NEDSO

Date held 1-27-87

THRU: Area Engineer, New England Area

Time 0700

TO: Safety Office, NED

1. Weekly safety meeting was held this date for the following personnel:

Contract No. DACW33-85-D-0011 D.O. 020 Contractor Atlantic Testing Lab

Conducted By P Fisher All personnel present (Contr) 3
(Sub) 0
(Govt) 0

Subjects discussed (Note, delete, or add):
EM 385-1-1, Section: _____

Accident Prevention Plan

— Individual Protective Equipment - Cold Weather Gear

— Prevention of Falls - Into Icey River

— Back Injury, Safe Lifting Techniques -

Fire Prevention -

Sanitation, First Aid, Waste Disposal -

— Tripping Hazards - trash, hose, nails in lumber - Equipment On Float

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery -

— Equipment Inspection & Maintenance (Zero Defects) -

Hoisting Equipment - Tri-Pod Rig

— Ropes, Hooks, Chains and Slings - Anchor Lines

Electrical Grounding, Temporary Wiring, GFCI -

— Lockouts for safe clearance procedures - electrical, pressure, moving parts -

Welding, Cutting -

Excavations -

Loose Rock and Steep Slopes -

Explosives -

— Water Safety - Falling Into River

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

2. Forwarded. Exposure Time 1/26-1/30 Prepared by P Fisher Title Eng

ATL 126 HRS

CF: Sub 4½ Signature [signature]
Resident Engineer

NED FL 251

WEEKLY SAFETY MEETING

NEDSO

Date held 2/2/87

THRU: Area Engineer, New England Area

Time 1100

TO: Safety Office, NED

1. Weekly safety meeting was held this date for the following personnel:

Contract No. DACW33-85-D-0011 D.O. #020 Contractor Atlantic Testing Lab

Conducted By D. Fisher All personnel present (Contr) 3
(Sub) 0
(Govt) 0

Subjects discussed (Note, delete, or add):
EM 385-1-1, Section: _____

Accident Prevention Plan

— Individual Protective Equipment -

— Prevention of Falls - Into Fast Running Water in Tilton NH

Back Injury, Safe Lifting Techniques - Working with Tri-Pod

Fire Prevention -

Sanitation, First Aid, Waste Disposal -

— Tripping Hazards - trash, hose, nails in lumber -

Staging, Ladders, Concrete Forms, Safety Nets -

— Hand Tools, Portable Power Tools, Woodworking Machinery - 10 HP Cat Head

— Equipment Inspection & Maintenance (Zero Defects) -

— Hoisting Equipment - Tri-Pod

— Ropes, Hooks, Chains and Slings -

Electrical Grounding, Temporary Wiring, GFCI -

Lockouts for safe clearance procedures - electrical, pressure, moving parts -

Welding, Cutting -

Excavations -

— Loose Rock and Steep Slopes - Snow + Ice

Explosives -

— Water Safety -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by D. Fisher Title Eng

2. Forwarded.

Exposure Time 3/2 - 1/4

CF:

ATL 57 hrs

Sub 11 hrs

Signature [signature]
Resident Engineer

NED APP FL 251

WEEKLY SAFETY MEETING

NEDSO

Date held 2/20/87

THRU: Area Engineer, New England Area

Time 0700-0730

TO: Safety Office, NED

1. Weekly safety meeting was held this date for the following personnel:

Contract No. DO. 0020 Contractor Atlantic Testing Lab

Conducted By Paul Fisher All personnel present (Contr) 3
(Sub) 0
(Govt) 0

Subjects discussed (Note, delete, or add):
EM 385-1-1, Section: _____

✓ Accident Prevention Plan New Site

✓ Individual Protective Equipment -

Prevention of Falls -

Back Injury, Safe Lifting Techniques -

✓ Fire Prevention - Gas Cans

Sanitation, First Aid, Waste Disposal -

Tripping Hazards - trash, hose, nails in lumber -

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery -

✓ Equipment ~~Inspection & Maintenance~~ (Zero Defects) - Of Drill Rig

✓ Hoisting Equipment - Drill Rig

✓ Ropes, Hooks, Chains and Slings - Drill Rig

Electrical Grounding, Temporary Wiring, GFCI -

Lockouts for safe clearance procedures - electrical, pressure, moving parts -

Welding, Cutting -

Excavations -

Loose Rock and Steep Slopes -

Explosives -

✓ Water Safety - Working Next To River

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by P Fisher Title Eng

2. Forwarded.

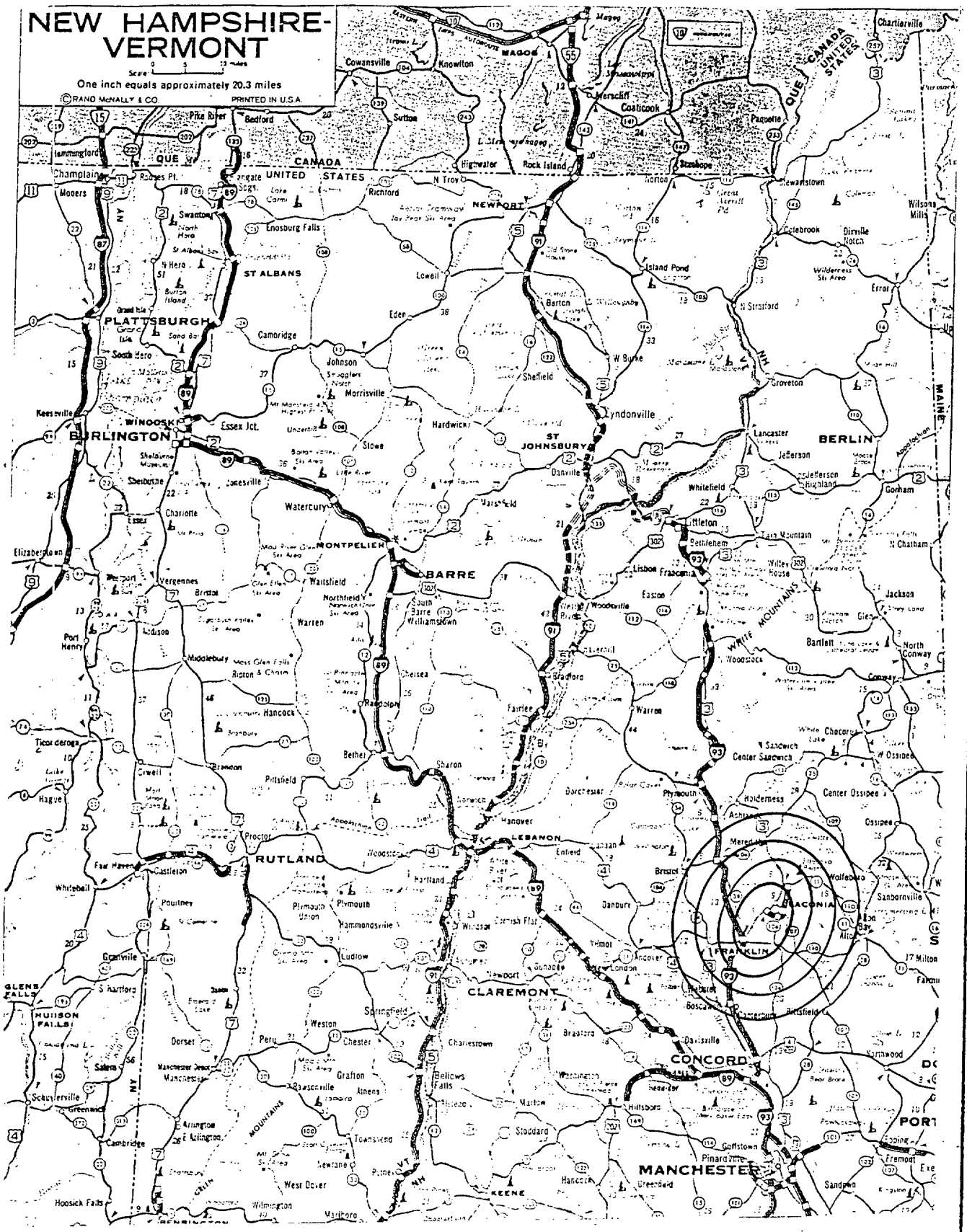
CF: Exposure Time 2/19 - 2/21 Signature [signature]
Resident Engineer

ATL 64.5

NED FL 251

SECTION 8

FIELD INSPECTOR'S LOGS



GENERAL PROJECT LOCATION MAP	SCALE AS ABOVE	PROJECT No. CD021	DATE 4-10-87
WINNIPESAUKEE RIVER BASIN EXTENDING FROM LAKEPORT TO TILTON, NH	ATLANTIC TESTING LABORATORIES, Limited BOX 28 CANTON, NY. 13617	BOX 356 CICERO, NY 13039	

ATLANTIC TESTING LABORATORIES, Limited

Reply To: ( ) CANTON
( ) CICERO
( ) UTICA

April 13, 1987

U.S. Army Corps of Engineers
New England Division
424 Trapela Road
Waltham, MA 02254-9149

Attn: Mr. Richard D. Reardon

Re: Subsurface Exploration Final Report
Winnipesaukee River Basin
Extending from Lakeport to Tilton, N.H.
Contract DACW33-85-D-0011
Delivery Order No. 0020
ATL Report No. CD021-1A-4-87

Gentlemen:

In accordance with Delivery Order No. 0020, dated December 17, 1986, attached is one copy of our final report detailing the subsurface investigation at Tilton, New Hampshire as referenced above.

By copy of this letter, we are also transmitting two copies of this report to the Chief of the Geotechnical Branch.

If you have any questions or comments, please do not hesitate to contact our office.

Respectfully submitted,

Paul M. Fisher, P.E.
Geotechnical Engineer

PMF/sg

Enclosures

2cc: A. F. Mancini - Chief of the Geotechnical Branch

RECEIVED
APR 20 1987
GEOTECHNICAL ENGINEERING BRANCH

ROUTING SLIP (AR 340-15)	NEVER USE FOR APPROVALS, DISAPPROVALS, CONCURRENCES, OR SIMILAR ACTIONS.

	TO	INITIALS	DATE
	DIVISION ENGINEER		
	DEPUTY DIV ENGR		
	ASST DIV ENGR		
	TECHNICAL ASSISTANT		
	EO EMPL OPP OFFICER		
	SEC & LAW ENF OFCR		
	VALUE ENGR OFCR		
	AUDIT OFFICE		
	ADP CENTER		
	COMPTROLLER		
	FIN & ACCTG BR		
	MGT ANAL BR		
	BUDGET BR		
	CONSTRUCTION DIV		
/	ENGINEERING DIV		
	DESIGN BR		
2	GEOTECHNICAL BR		
	PROJ MGT BR		
	NED MAT & WATER QUAL	LAB	
	WATER CONTROL BR		
	OFC OF ADMIN SVCS		
	REPROGRAPHICS BR		
	GRAPHIC ARTS		
	MOTOR TRANSPORT SEC		
	TECHNICAL LIBRARY		
	WORD PROCESSING CTR		
	MAIL & RECORDS		
	OFFICE OF COUNSEL		
	OPERATIONS DIV		
	REGULATORY BR		
	EMERG OPNS BR		
	PERSONNEL OFFICE		
	PLANNING DIV		
	BASIN MGT BR		
	COASTAL DEV BR		
	IMPACT ANALYSIS BR		
	PLAN FORMULATION BR		
	PROC & SUP DIV/SM BUS		
	WAREHOUSE		
	PROGRAMS OFFICE		
	PUBLIC AFFAIRS OFFICE		
	REAL ESTATE DIV		
	RIVERS & HARBORS		
	SAFETY OFFICE		

CHECK ACTION DESIRED

	INFORMATION		SIGNATURE		NOTE AND RETURN		
	CIRCULATE		NECESSARY ACTION		SEE ME		

FROM	TELEPHONE	DATE

ORGANIZATION

DA FORM 1 NOV. 54, 1222

2/86

ATLANTIC TESTING LABORATORIES, Limited

Reply To: ( ) CANTON
( ) CICERO
( ) UTICA

April 13, 1987

U.S. Army Corps of Engineers
New England Division
424 Trapela Road
Waltham, MA 02254-9149

Attn: Mr. Richard D. Reardon

Re: Subsurface Exploration Final Report
Winnipesaukee River Basin
Extending from Lakeport to Tilton, N.H.
Contract DACW33-85-D-0011
Delivery Order No. 0020
ATL Report No. CD021-1A-4-87

Gentlemen:

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By copy of this letter, we are also transmitting two copies of this report to the Chief of the Geotechnical Branch.

If you have any questions or comments, please do not hesitate to contact our office.

Respectfully submitted,

Paul M. Fisher, P.E.
Geotechnical Engineer

PMF/sg

Enclosures

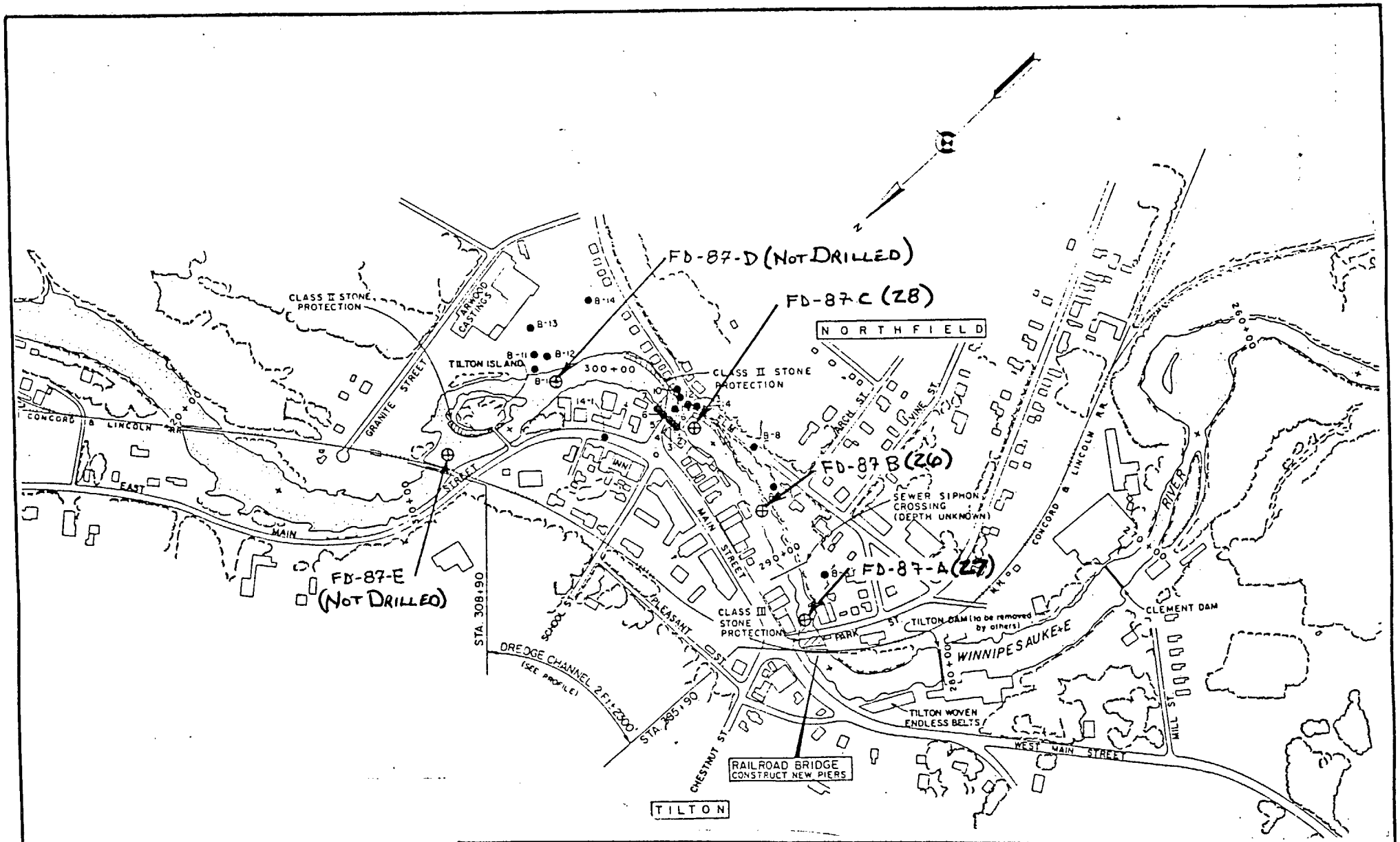
2cc: A. F. Mancini - Chief of the Geotechnical Branch

RECEIVED
APR 27 1987
GEOTECHNICAL
ENGINEERING BRANCH

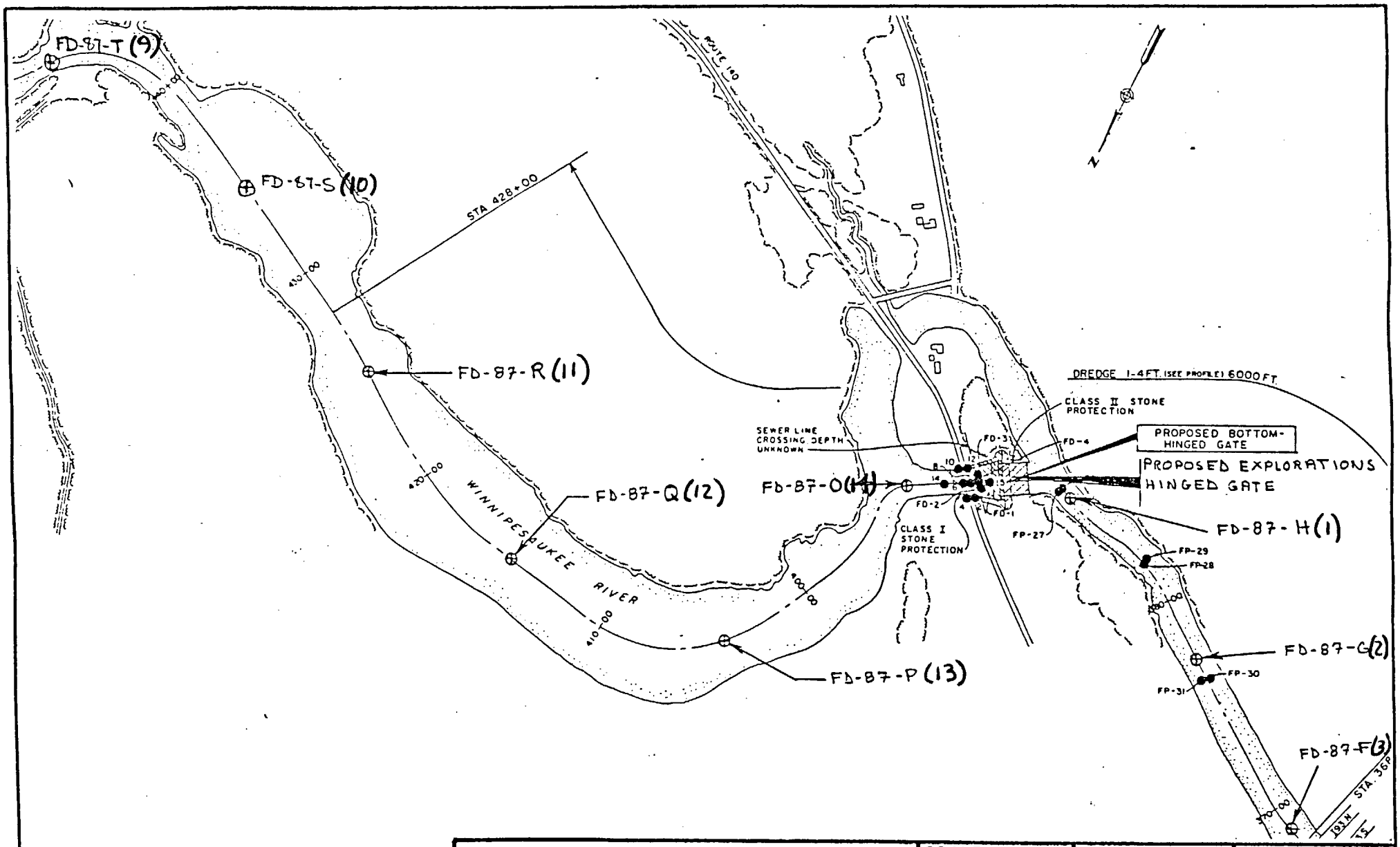
BOX 29
CANTON, N. Y. 13617
315/386-4578

698 STEVENS STREET
UTICA, N. Y. 13502
315/735-3309

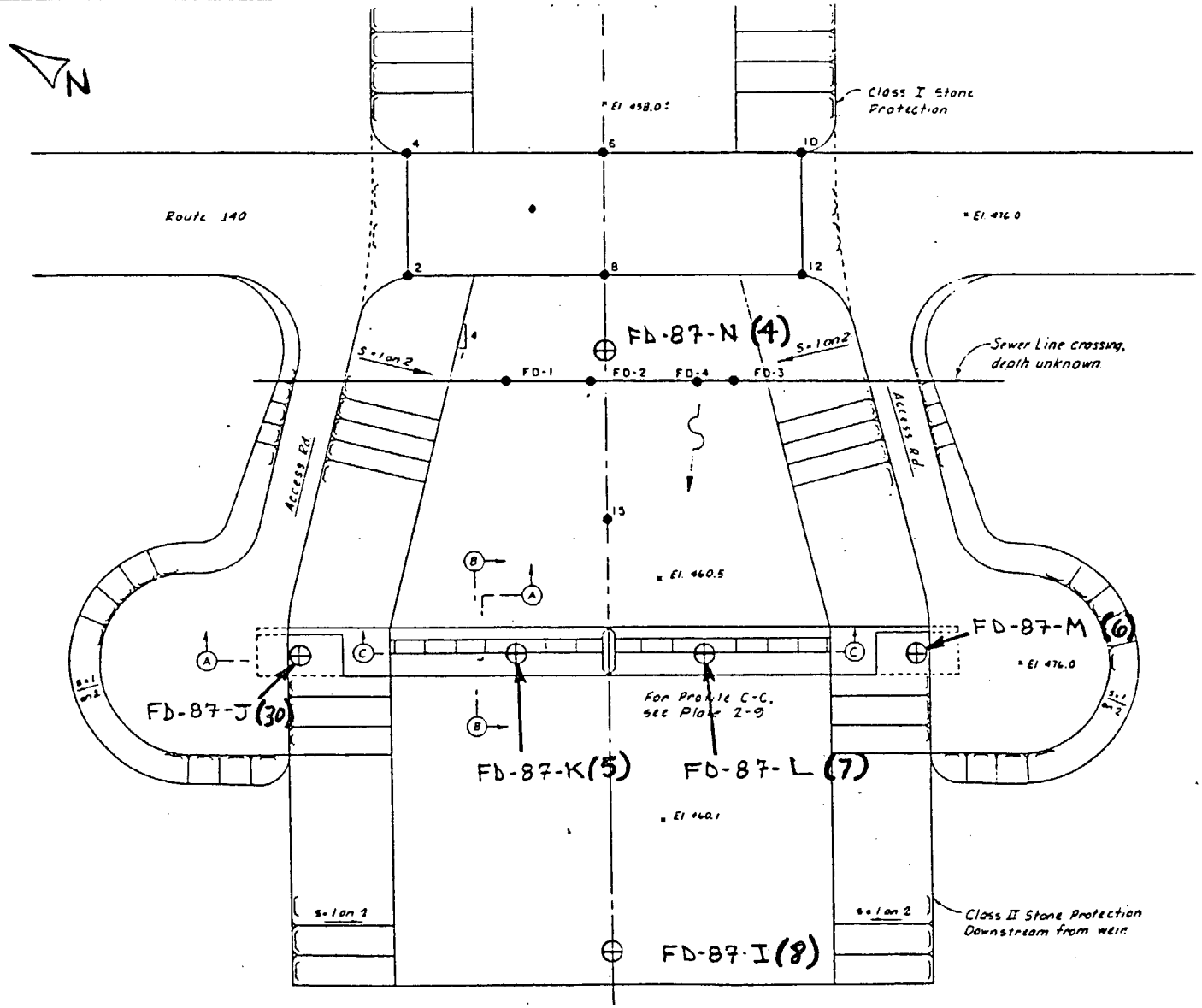
BOX 356
CICERO, N. Y. 13039
315/699-5281



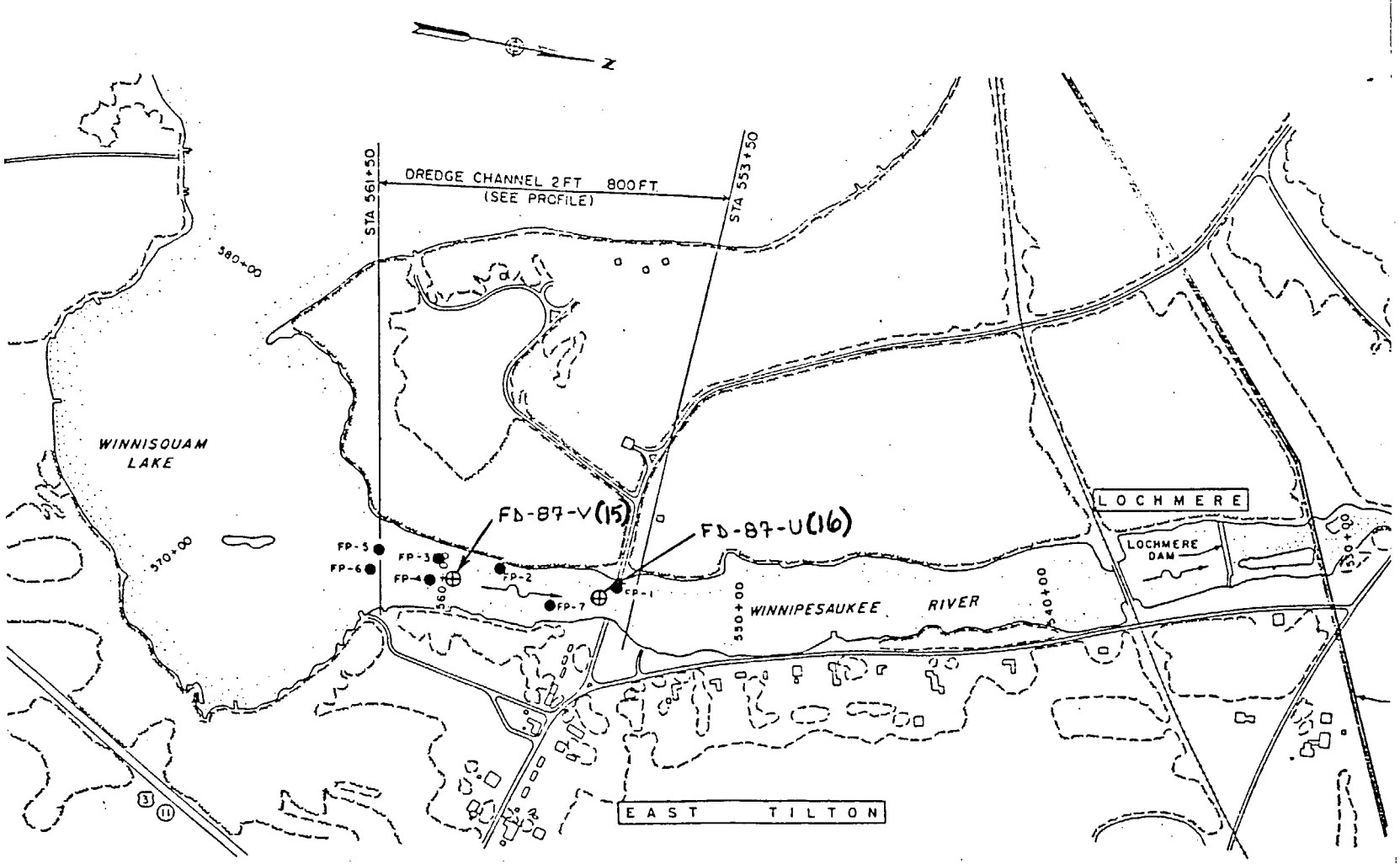
BORING LOCATION PLAN	SCALE NTS	PROJECT No. CD021	DATE 4-10-87
WINNESPESAUKEE RIVER BASIN DELIVERY ORDER NO. 020	ATLANTIC TESTING LABORATORIES, Limited BOX 28 CANTON, NY. 13617 BOX 356 CICERO, NY. 13039		



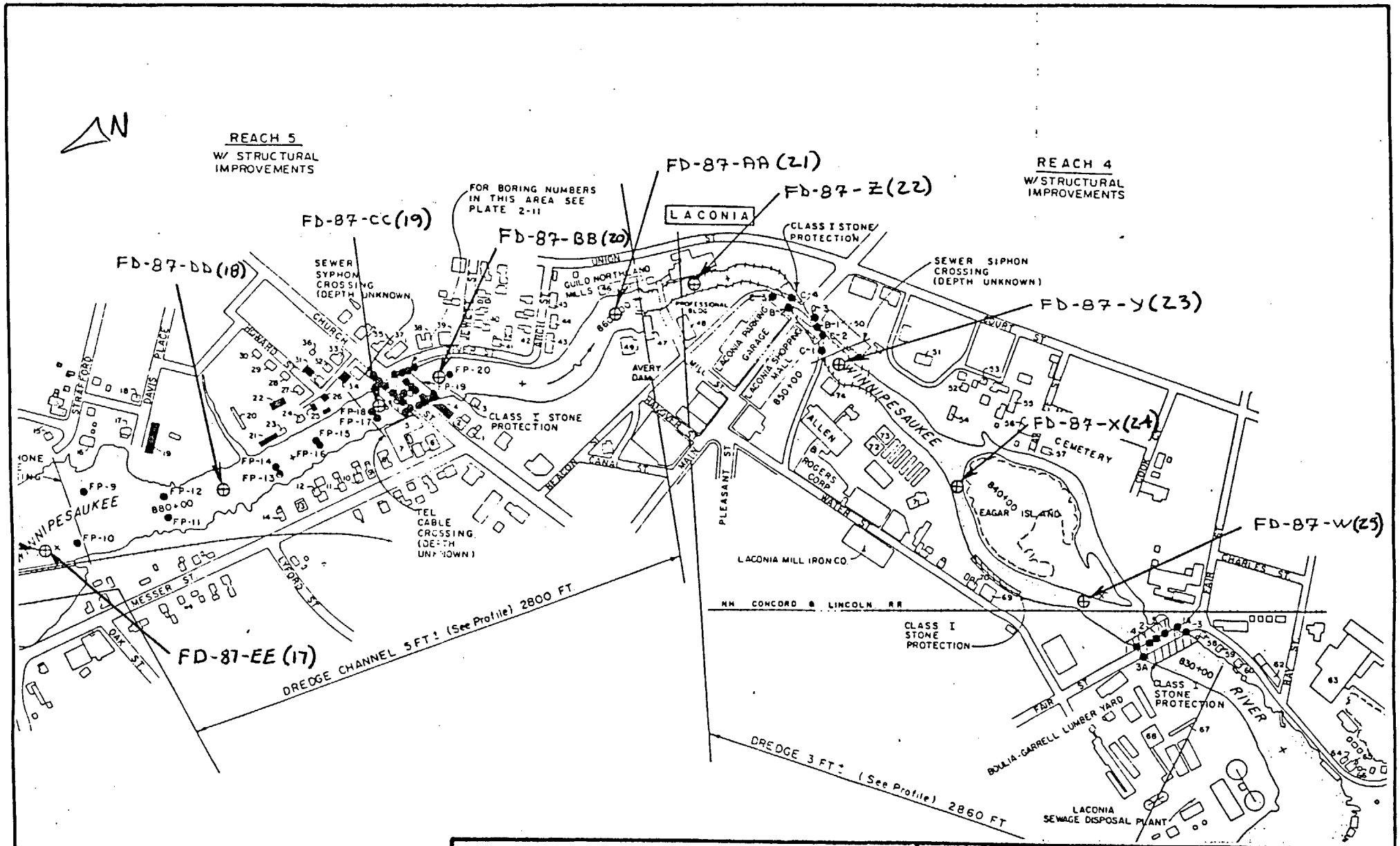
BORING LOCATION PLAN	SCALE NTS	PROJECT No. CD021	DATE 4-10-87
WINNEPESAUKEE RIVER BASIN DELIVERY ORDER NO. 020	ATLANTIC TESTING LABORATORIES, Limited BOX 28 CANTON, NY. 13617	BOX 356 CICERO, NY. 13039	



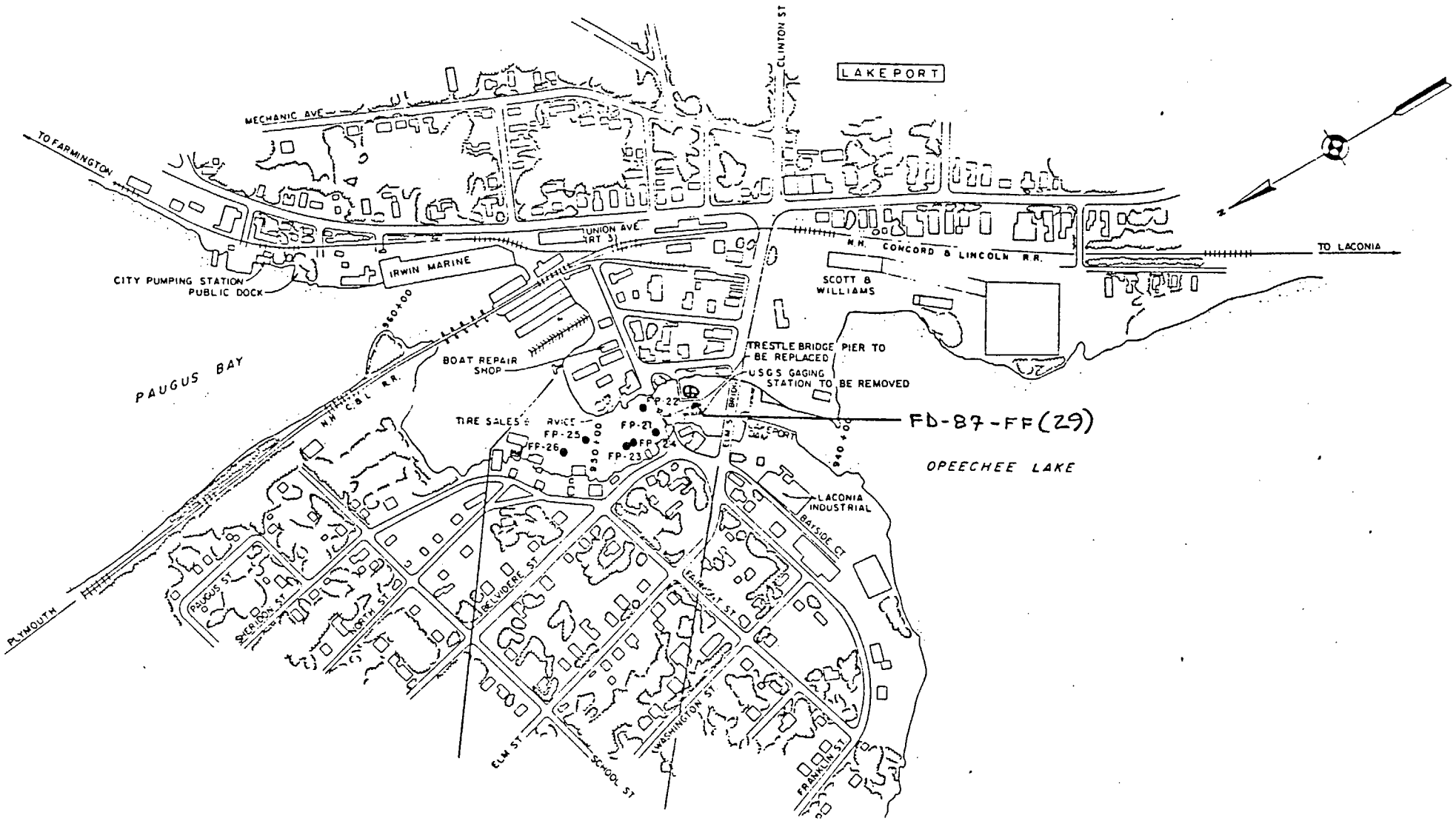
BORING LOCATION PLAN	SCALE NTS	PROJECT No. CD021	DATE 4-10-87
WINNIPESAUKEE RIVER BASIN DELIVERY ORDER NO. 020	ATLANTIC TESTING LABORATORIES, Limited BOX 28 CANTON, NY. 13617 BOX 356 CICERO, NY. 13039		



BORING LOCATION PLAN	SCALE NTS	PROJECT No. CD021	DATE 4-10-87
WINNIPESAUKEE RIVER BASIN DELIVERY ORDER NO. 020	ATLANTIC TESTING LABORATORIES, Limited BOX 28 CANTON, NY. 13617 BOX 356 CICERO, NY. 13039		



BORING LOCATION PLAN	SCALE NTS	PROJECT No. CD021	DATE 4-10-87
WINNIPESAUKEE RIVER BASIN DELIVERY ORDER NO. 020	ATLANTIC TESTING LABORATORIES, Limited BOX 28 CANTON, NY 13617	BOX 356 CICERO, NY 13039	



BORING LOCATION PLAN	SCALE NTS	PROJECT No. CD021	DATE 4-10-87
WINNIPESAUKEE RIVER BASIN DELIVERY ORDER NO. 020	ATLANTIC TESTING LABORATORIES, Limited BOX 28 CANTON, NY. 13617 BOX 356 CICERO, NY. 13039		

BORING SUMMARY

WINNIPESAUKEE RIVER, NEW HAMPSHIRE

DELIVERY ORDER NO. 0020

BORING IDENTIFICATION FD-87-	STATION	OFFSET	START	FINISH	ACTUAL DEPTH FT.	SAMPLE SIZE	PERM. TEST	DRILLING TECHNIQUES
1 (H)	387 + 00	C.L.	1/7	1/8	6	2-1/2	No	Acker HB on float
2 (G)	377 + 00	C.L.	1/8	1/8	6	2-1/2	No	Acker HB on float
3 (F)	369 + 00	C.L.	1/9	1/9	6	2-1/2	No	Acker HB on float
4 (N)	389 + 55	C.L.	1/13	1/14	20	1-3/8	Yes	Acker HB on float
5 (K)	388 + 55	Lt. 30'	1/15	1/15	20	1-3/8	Yes	Acker HB on float
6 (M)	388 + 51	Rt. 108'	1/15	1/15	26	1-3/8	Yes	Track rig on land
7 (L)	388 + 55	Rt. 30'	1/16	1/19	20	1-3/8	Yes	Acker HB on float
8 (I)	392 + 50	C.L.	1/19	1/20	20	1-3/8	Yes	Acker HB on float
9 (T)	455 + 00	C.L.	1/21	1/21	6	2-1/2	No	Acker HB on float
10 (S)	435 + 00	C.L.	1/21	1/21	6	2-1/2	No	Acker HB on float
11 (R)	425 + 00	C.L.	1/21	1/21	6	2-1/2	No	Acker HB on float
12 (Q)	415 + 00	C.L.	1/21	1/21	6	2-1/2	No	Acker HB on float
13 (P)	405 + 00	C.L.	1/21	1/21	6	2-1/2	No	Acker HB on float
14 (O)	394 + 00	C.L.	1/21	1/21	6	2-1/2	No	Acker HB on float
15 (V)	560 + 00	C.L.	1/27	1/27	6	2-1/2	No	Tripod on float
16 (U)	555 + 00	C.L.	1/27	1/27	6	2-1/2	No	Tripod on float
17 (EE)	885 + 00	C.L.	1/28	1/28	10	2-1/2	No	Tripod on float
18 (DD)	878 + 00	C.L.	1/28	1/28	10	2-1/2	No	Tripod on float
19 (CC)	870 + 00	C.L.	1/28	1/28	10	2-1/2	No	Tripod on float
20 (BB)	868 + 00	C.L.	1/28	1/28	10	2-1/2	No	Tripod on float
21 (AA)	856 + 00	C.L.	1/28	1/28	10	2-1/2	No	Tripod on float
22 (Z)	856 + 00	C.L.	1/30	1/30	6	2-1/2	No	Tripod on float
23 (Y)	849 + 00	C.L.	1/30	1/30	6	2-1/2	No	Tripod on float
24 (X)	842 + 00	C.L.	1/30	1/30	6	2-1/2	No	Tripod on float
25 (W)	834 + 00	C.L.	1/30	1/30	6	2-1/2	No	Tripod on float
26 (B)	292 + 00	C.L.	2/3	2/3	6	2-1/2	No	Tripod in water
27 (A)	289 + 00	C.L.	2/3	2/3	6	2-1/2	No	Tripod in water
28 (C)	296 + 00	C.L.	2/3	2/3	6	2-1/2	No	Tripod in water
29 (FF)	946 + 00	Rt. 35'	2/20	1/20	25	1-3/8	No	Track rig on land
30 (J)	388 + 58	Lt. 92'	2/21	1/21	25	1-3/8	Yes	Track rig on land
- (D)	302 + 50	C.L.	-	-	-	-	No	Deleted on 1/27
- (E)	306 + 50	C.L.	-	-	-	-	No	Deleted on 1/27

FD-87-1

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, D.O. 020

Site: WINNIPESAUKEE RIVER

Page 1 of 3 Pages

Hole No.: FD-87 1 (H) Diam. (Casing): 4"

Boring Started: 1-7-87

Co-ordinates: STA # 387+00 B ℄

Boring Completed: 1-8-87

Drilled by: DAVIS + BOVER, ATL

Report Submitted:

Purpose of Exploration: STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole: 459' M.S.L.

Casing Left in Place: NONE Feet

Total Overburden Drilled: 6' Feet

Elevation Top of Rock: — M.S.L.

Elevation Bottom of Hole: 453' M.S.L.

Total Rock Drilled: 0 Feet

Total Depth of Hole: 6' Feet

Core Recovered: — %

Core Recovered: — Ft.: — Diam. — In.

Soil Samples: 2½ In. Diam. 3 No.

Soil Samples: — In. Diam. — No.

RIVER Water ~~[illegible]~~ Depth: 6.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	2'	3" O.D. DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 3½" ROLLER BIT

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Prepared by: PAUL FISHER
Field Data

Lab. Data

Submitted by: ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site: WINNIPESAUKEE R. Page 2 of 3 Pages

Boring No. FD-87-1 Desig. H Diam. (Casing) 4"

Co-ordinates: ~~N~~ STA 387+00 ~~E~~ ℄ ⊥

Elevation Top of Boring 459 M.S.L. Hammer Wt. 140LB Boring Started 1-7-87

Total Overburden Drilled 6 Feet Hammer Drop 30" Boring Completed 1-8-87

Elevation Top of Rock — M.S.L. Casing Left 0

Total Rock Drilled 0 Feet Subsurface Water Data — Page —

Elevation Bottom of Boring 453 M.S.L. Obs. Well —

Total Depth of Boring 6 Feet Drilled By DAVIS + ROWER ATL

Core Recovered — % No. Boxes — Mfg. Des. Drill ACKER HS

Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FLAHER

Soil Samples 2½ In. Diam. 3 No. Classification By: PAUL FLAHER

Soil Samples — In. Diam. — No. Classification By: —

DEPTH 1" = 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S1	2½	0-2	5, 9, 12, 21	3" O.D. DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3½" ROLLER BIT	BROWN GRAVELLY SAND TRACE SILT (SW) (MED. DENSE)
2	S2	2½	2-4	56, 50, 52, 55		AS ABOVE (VER. DENSE)
4	S3	2½	4-6	61, 59, 49, 53		AS ABOVE (VERY DENSE)
6					EXPLORATION TERMINATED	@ 6'

GENERAL REMARKS:
RIVER BOTTOM COVERED WITH SAND AND COBBLES

Site: WINNIPESAUKEE R
Boring No: FD-87-1 (H)

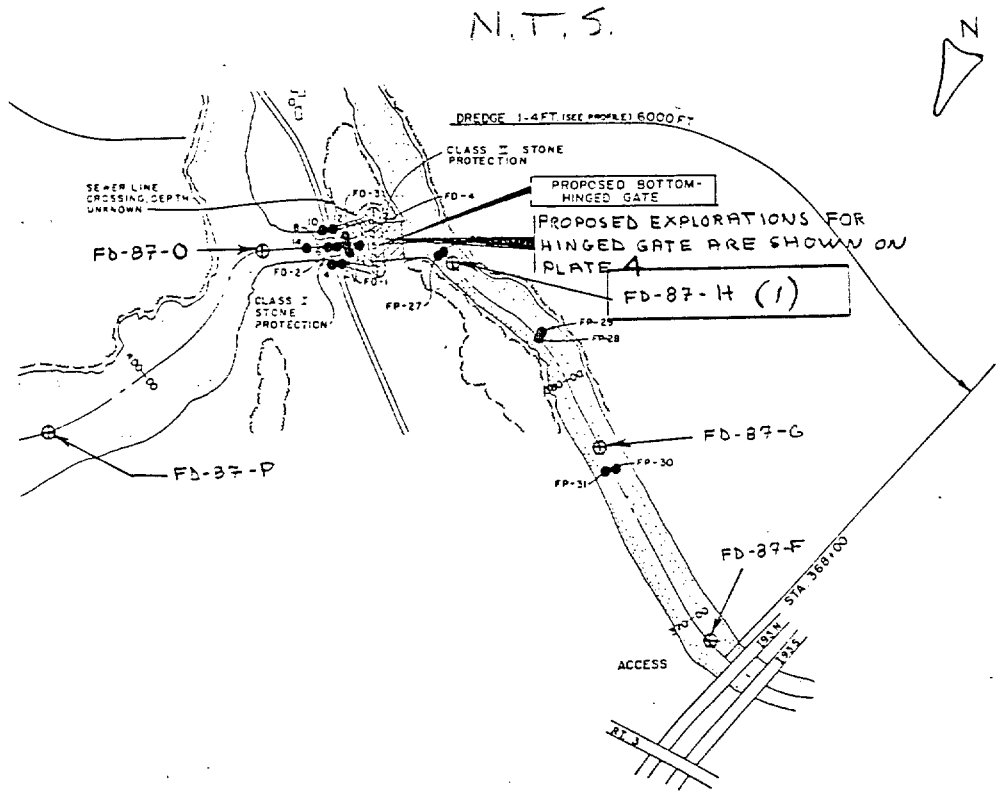
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



NED FORM 59 (Test)
MAR 71

Boring No. 1

FD-87-2

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, DO-020

Site WINNIPESAUKEE R

Page 1 of 3 Pages

Hole No. FD-87 2 (G) Diam. (Casing) 4"

Boring Started 1-8-87

Co-ordinates: STA 377+00 ~~E~~ ℄

Boring Completed 1-8-87

Drilled by DAVIS + BOYER

Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 459' M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 6' Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 453' M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6' Feet

Core Recovered — %

Core Recovered — Ft.: ___ Diam. ___ In.

Soil Samples 2½ In. Diam. 3 No.

Soil Samples — In. Diam. — No.

RIVER Water ~~Table~~ Depth 3.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 2½" ROLLER BIT

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Prepared by PAUL FISHER
Field Data

Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 3 Pages
FD-87
Boring No. 2 Desig. G Diam. (Casing) 4"
Co-ordinates: N STA 377+00 E ℄

Elevation Top of Boring 459 M.S.L. Hammer Wt. 140 LB Boring Started 1-8-87
Total Overburden Drilled 6 Feet Hammer Drop 30" Boring Completed 1-8-87
Elevation Top of Rock — M.S.L. Casing Left —
Total Rock Drilled 0 Feet Subsurface Water Data — Page —
Elevation Bottom of Boring 453 M.S.L. Obs. Well —
Total Depth of Boring 6 Feet Drilled By DAVIS + BOVER
Core Recovered — % No. Boxes — Mfg. Des. Drill ACKER HB
Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FISHER
Soil Samples 2½ In. Diam. 3 No. Classification By: PAUL FISHER
Soil Samples — In. Diam. — No. Classification By: —

DEPTH 1" = 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	20 21 49 53	3" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3½ ROLLER BIT	BROWN GRAVELLY SAND TRACE SILT (SW) (VERY DENSE)
2	S-2	2½	2-4	26 41 53 40		AS ABOVE
4	S-3	2½	4-6	90 110 92 100		BROWN, SAND AND GRAVEL (SP/GP) (VERY DENSE)
6					EXPLORATION TERMINATED	@ 6'

GENERAL REMARKS:
RIVER BOTTOM COVERED WITH BOULDERS AND COBBLES

Site: WINNIPESAUKEE R.
Boring No: FD-87-2 (G)

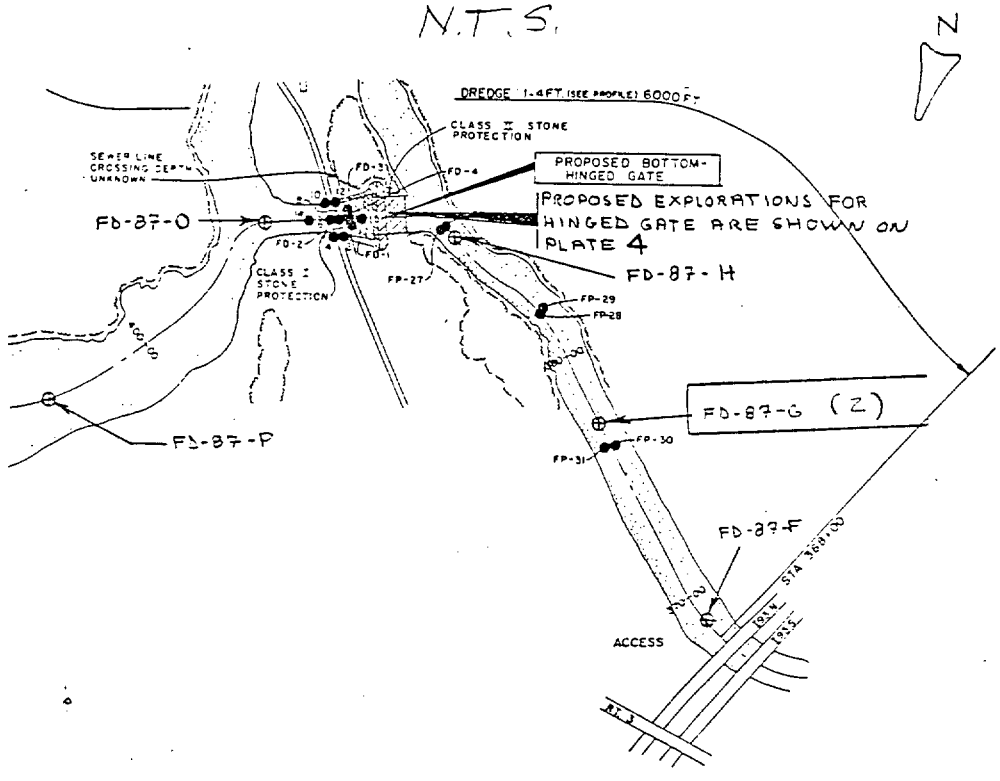
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 2

FD-87-3

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, DO 020

Site WINNIPESAUKEE RIVER — Page 1 of 3 Pages

Hole No. FD-87 3 (F) Diam. (Casing) 4" — Boring Started 1-9-87

Co-ordinates: STA 369+00 ℄ — Boring Completed 1-9-87

Drilled by DAVIS + BOYER — Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 454 M.S.L. — Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 448 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½ In. Diam. 3 No.

Soil Samples — In. Diam. — No. — RIVER Water Table Depth 2.5'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD DRIVEN SPLIT
		SPOON FOLLOWED BY 4"
		DRIVEN CASING AND 3½"
		ROLLER BIT

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Prepared by PAUL FISHER — Field Data — Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R. Page 2 of 3 Pages
Boring No. FO-87 3 Desig. F Diam. (Casing) 4"
Co-ordinates: N STA 369+00 E ℄

Elevation Top of Boring 454' M.S.L.
Total Overburden Drilled 6 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 448' M.S.L.
Total Depth of Boring 6 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 2½ In. Diam. 3 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140 LB Boring Started 1-9-87
Hammer Drop 30"
Boring Completed 1-9-87
Casing Left —
Subsurface Water Date — Page —
Obs. Well —
Drilled By DAVIS + BOYER
Mfg. Des. Drill ACKER HR
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

DEPTH (1" = 2')	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	23, 31, 45, 47	3" O.D. DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3½" ROLLER BIT	BROWN GRAVEL AND SAND (GP/SP) (VERY DENSE)
2	S-2	2½	2-4	61, 53, 71, 73		BROWN GRAVELLY SAND, TRACE SILT (SW) (VERY DENSE)
4	S-3	2½	4-6	73, 68, 67, 100		AS ABOVE
6					EXPLORATION TERMINATED	@ 6'

GENERAL REMARKS:
RIVER BOTTOM COVERED WITH BOULDERS AND COBBLES

Site: WINNIPESAUKEE R.
Boring No: FD-87-3 (F)

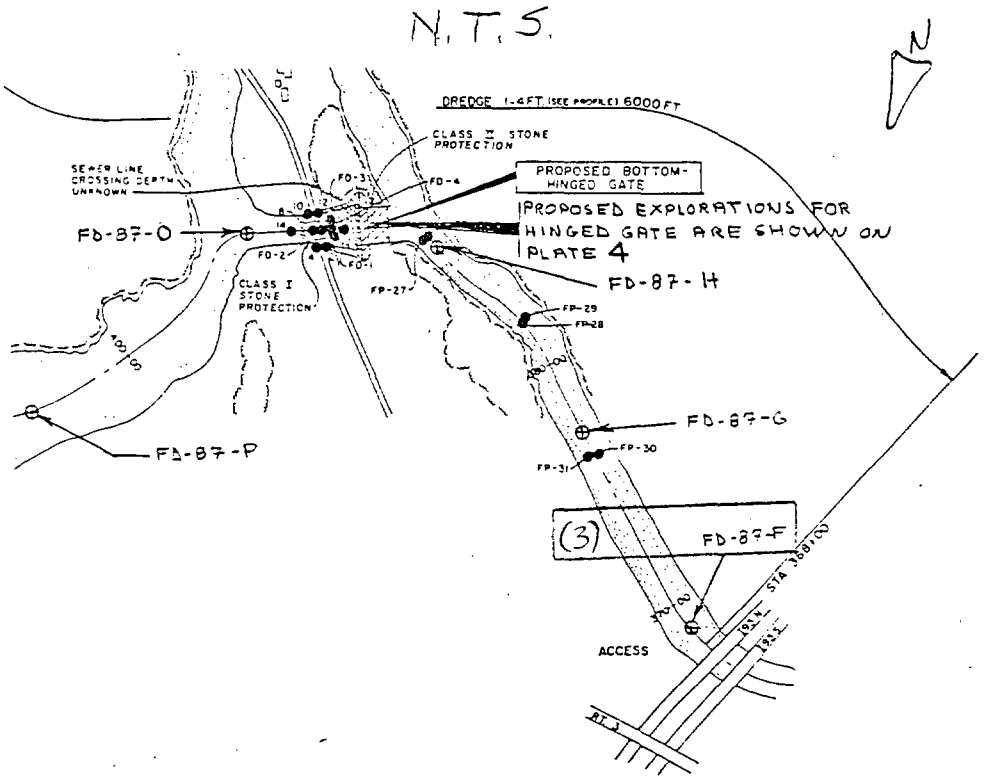
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



FD-87-4

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO 020

Site: WINNIPESAUKEE R

Page 1 of 7 Pages

Hole No. FD-87 4 (N) Diam. (Casing) 4"

Boring Started 1-13-87

Co-ordinates: 45' W. OF RT. 140 ℄ @ RIVER ℄

Boring Completed 1-14-87

Drilled by DAVIS + BOYER

Report Submitted

Purpose of Exploration PROPOSED GATE STRUCTURE

Elevation Top of Hole 459.4 M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 20 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 439.4 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 20 Feet

Core Recovered — %

Core Recovered — Ft.: ____ Diam. ____ in.

Soil Samples 1 3/8 in. Diam. 6 No.

Soil Samples — in. Diam. — No.

RIVER Water Depth 6.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	20	2" OD DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 3 1/2" ROLLER BIT

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Prepared by PAUL FIELDED
Field Data

Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site: WINNIPESAUKEE R — Page 2 of 7 Pages

Boring No. FD-87 4 — Desig. N — Diam. (Casing) 4"

Co-ordinates: N _____ E _____ — 45' W. OF RT. 140 ℄ @ RIVER ℄

Elevation Top of Boring: 459.4 M.S.L.
Total Overburden Drilled: 20 Feet
Elevation Top of Rock: — M.S.L.
Total Rock Drilled: 0 Feet
Elevation Bottom of Boring: 439.4 M.S.L.
Total Depth of Boring: 20 Feet
Core Recovered: — % No. Boxes: —
Core Recovered: — Ft: — Diam. — In.
Soil Samples: 1 3/8 In. Diam. 6 No.
Soil Samples: — In. Diam. — No.

Hammer Wt.: 140 LB
Hammer Drop: 30"
Casing Left: —
Subsurface Water Data: — Page: —
Obs. Well: —
Drilled By: DAVIS + BOYER
Mfg. Des. Drill: ACKER HB
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

Boring Started: 1-13-87
Boring Completed: 1-14-87

DEPTH (1" = 2)	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	1 3/8	0-2	19, 27, 34, 40	2" O.D. DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3 1/2" ROLLER BIT	BROWN SAND, SOME SILT, TRACE GRAVEL (SP) (VERY DENSE)
2	S-2	1 3/8	2-4	41, 37, 32, 35		GREY SILTY SAND TRACE GRAVEL (SM) (VERY DENSE)
4			4-5		NO SAMPLE, ROLLER BIT REQUIRED DUE TO COBBLES	
6			5-7		PERMEABILITY TEST (OPEN HOLE)	
	S-3	1 3/8	7-8	11, 100		AS ABOVE
8			8-10		NO SAMPLE, ROLLER BIT REQUIRED DUE TO COBBLES	
10						

GENERAL REMARKS:
SANDY RIVER BOTTOM

Site	Boring No.	Page 3 of 7
WINNIPESAUKEE R.	FD-87-4	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2						
			10-12		PERMEABILITY TEST	GREY SILTY SAND TRACE GRAVEL (SM) (VERY DENSE
12						
	S-4	1 3/8	12'-13.5'	39 46 52		AS ABOVE
14	S-5	1 3/8	13.5'-15'	46 57 73		AS ABOVE
16			15-17		PERMEABILITY TEST	GREY SANDY SILT TRACE GRAVEL (ML-SM) (VERY DENSE)
18	—	1 3/8	17'-18.5'	77 92 84	NO RECOVERY, COBBLE	AS ABOVE
	S-6	1 3/8	18.5'-20'	67 73 79		AS ABOVE
20					EXPLORATION TERMINATION @ 20'	

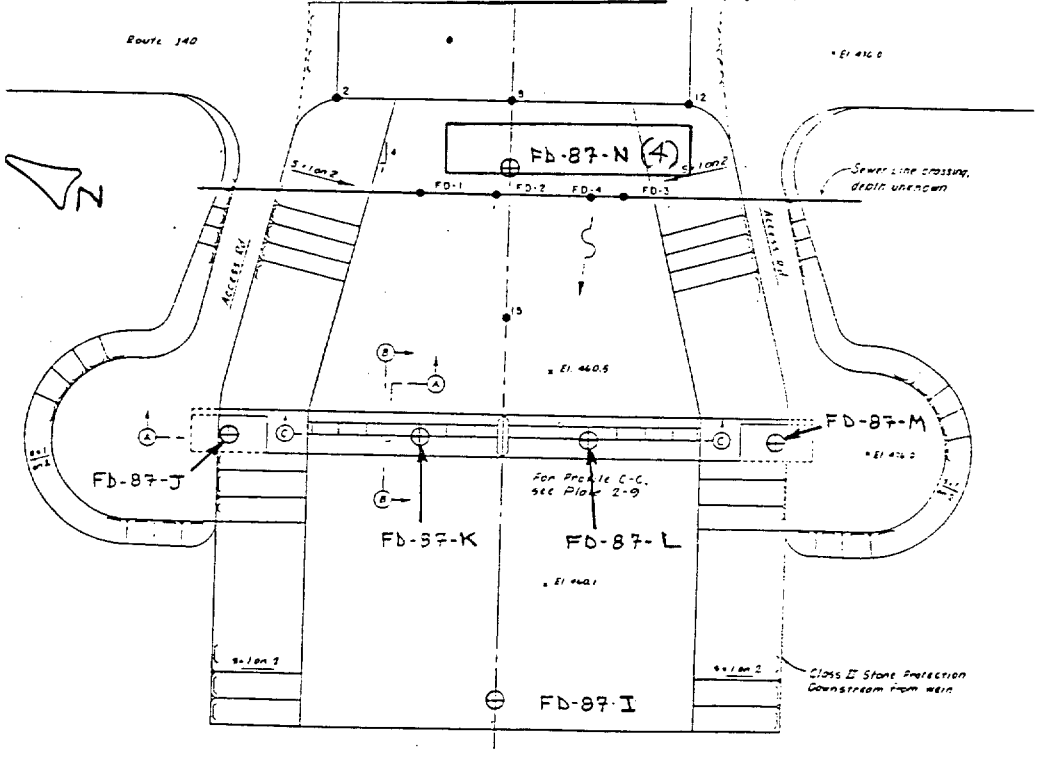
Site: WINNIPESAUKEE R.
Boring No: FD-87-4 (N)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						SEE PERM TESTS

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



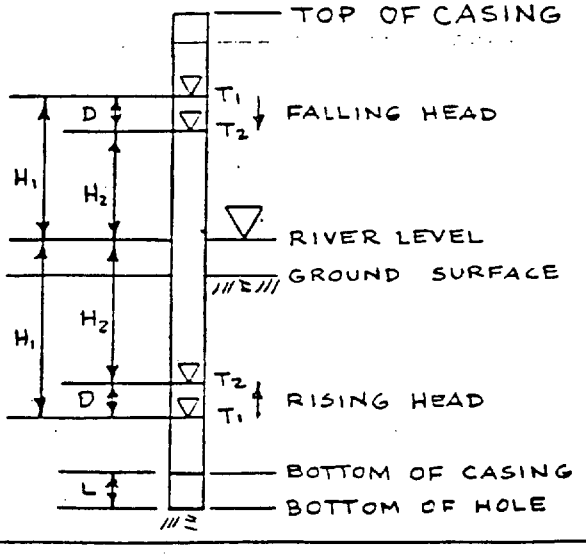
FIELD PERMEABILITY TEST RESULTS

DATE: 1-13-87	BORING No: FR-87-4	DEPTH: 5'-7'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2'	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0 MIN	*			0	0	H_1 = 9.40	
1/2				1	0.55	8.85	
1				2	1.12	8.28	
2				4	1.23	8.17	
4				8	5.00	4.40	
8				16	7.27	2.13	

NOTES: * COULD NOT FILL CASING TO TOP USING 25gpm PUMP

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1+\left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

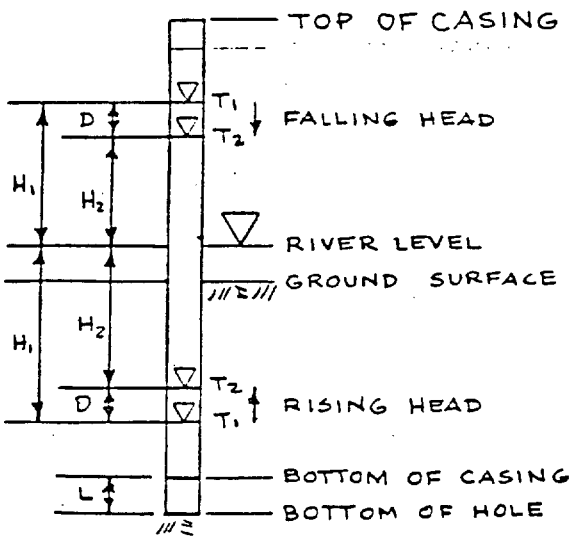
FIELD PERMEABILITY TEST RESULTS

DATE: 1-14-87	BORING NO: FP-87-4	DEPTH: 10'-12'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2'	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 5.20'		0	0	H_1 = 9.02	
1/2 min	.08	5.12		1/2 min	.05	8.97	
1	.18	5.02		1	.11	8.91	
2	.24	4.96		2	.19	8.83	
4	.44	4.76		4	.23	8.79	
8	.79	4.41		6	.46	8.56	
				8	.60	8.42	
0	0	H_1 = 5.20'					
1/2 min	.04	5.16					
1	.11	5.09					
2	.16	5.04					
4	.32	4.88					
8	.63	4.57					

NOTES:

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

FIELD PERMEABILITY TEST RESULTS

T: 1-14-97	BORING NO: EP-97-4	DEPTH: 15'-17'	INSPECTOR: PAUL FISHER
= 4.5"	Di = 4.0"	L = 2'	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME (t_2-t_1)	D (H_2-H_1)	H_2 (H_1-D)	K_H	ELAPSED TIME (t_2-t_1)	D (H_2-H_1)	H_2 (H_1-D)	K_H
0	0	H_1 = 5.00		0	0	H_1 = 4.92	
1/2 MIN	.08'	4.92		1/2 MIN	.01	4.91	
	.17	4.83		1	.03	4.89	
2	.29	4.71		2	.07	4.85	
	.60	4.40		3	.25	4.67	
8	1.13	3.87		4	.31	4.61	
				6	.63	4.24	
				8	.94	3.98	

T[illegible]:

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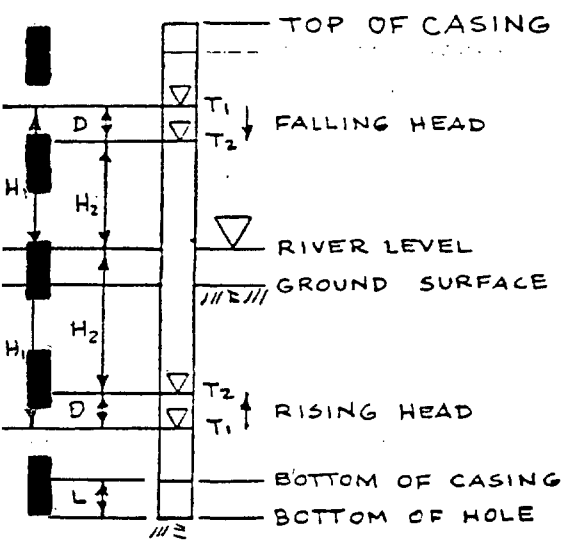


SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1+\left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

FD-87-5

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO. 020

Site: WINNIPESAUKEE R

Page 1 of 7 Pages

Hole No. FD-87-5 (K) Diam. (Casing) 4"

Boring Started 1-15-87

Co-ordinates: N _____ E _____ 145' W OF RT. 140 ℄ + 30' N OF RIVER ℄

Boring Completed 1-15-87

Drilled by DAVIS & BOYER

Report Submitted _____

Purpose of Exploration PROPOSED GATE STRUCTURE

Elevation Top of Hole 459.0 M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 20 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 439.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 20 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — in.

Soil Samples 1 3/8 in. Diam. 8 No.

Soil Samples — in. Diam. — No.

RIVER Water Table Depth 6.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	20	2" OD DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 3 1/8" ROLLER BIT

INDEX

Ground Water	Back of Page	—
Boring Location Sketch	Back of Page	4
Overburden Record	Page	2-3
Rock Drilling	Page	—
PERMEABILITY TEST	Page	5-7
	Page	
	Page	

Prepared by PAUL FISHER
Field Data Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R Page 2 of 7 Pages

Boring No. FD-87-5 Desig. K Diam. (Casing) 4"

Co-ordinates: N _____ E _____ 145' W OF RT 140 ℄ + 30' N OF RIVER ℄

Elevation Top of Boring 459.0 M.S.L.
Total Overburden Drilled 20 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 439.0 M.S.L.
Total Depth of Boring 20 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 1 3/8 In. Diam. 8 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140 LB
Hammer Drop 30"
Casing Left —
Subsurface Water Data — Page —
Obs. Well —
Drilled By DAVIS & BOYER
Mfg. Des. Drill ACKER HB
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

Boring Started 1-15-87
Boring Completed 1-15-87

DEPTH (ft.)	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	1 3/8	0-2	7 12 14 10	2" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3½" ROLLER BIT	BROWN SAND SOME SILT TRACE GRAVEL (SP) (MED. DENSE)
2	S-2	1 3/8	2-3.5	4 8 12		AS ABOVE
4	S-3	1 3/8	3.5-5	10 10 15		GREY SILTY SAND TRACE GRAVEL (SM) (MED DENSE)
6			5-7		PERMEABILITY TEST	
8	S-4	1 3/8	7-8.5	23 64 50		AS ABOVE (VERY DENSE)
10	S-5	1 3/8	8.5-10	49 58 62		AS ABOVE

GENERAL REMARKS: SANDY RIVER BOTTOM

Site	Boring No.	Page 3 of 7
WINNIPESAUKEE R.	FD-87-5	

DEPTH 1" = 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
			10-12		PERMEABILITY TEST	GREY SILTY SAND TRACE GRAVEL (SM) (VERY DENSE)
12			12-13.5		NO SAMPLE, ROLLER BIT REQUIRED DUE TO COBBLE	
14	S-6	1 3/8	13.5-15	61 73 89		AS ABOVE
16			15-17		PERMEABILITY TEST	
18	S-7	1 3/8	17-18.5	73 92 100		AS ABOVE
	S-8	1 3/8	18.5-20	89 100 110		DARK GREY SANDY SILT (ML/SM) (VERY DENSE)
20					EXPLORATION TERMINATED	≈ 20'

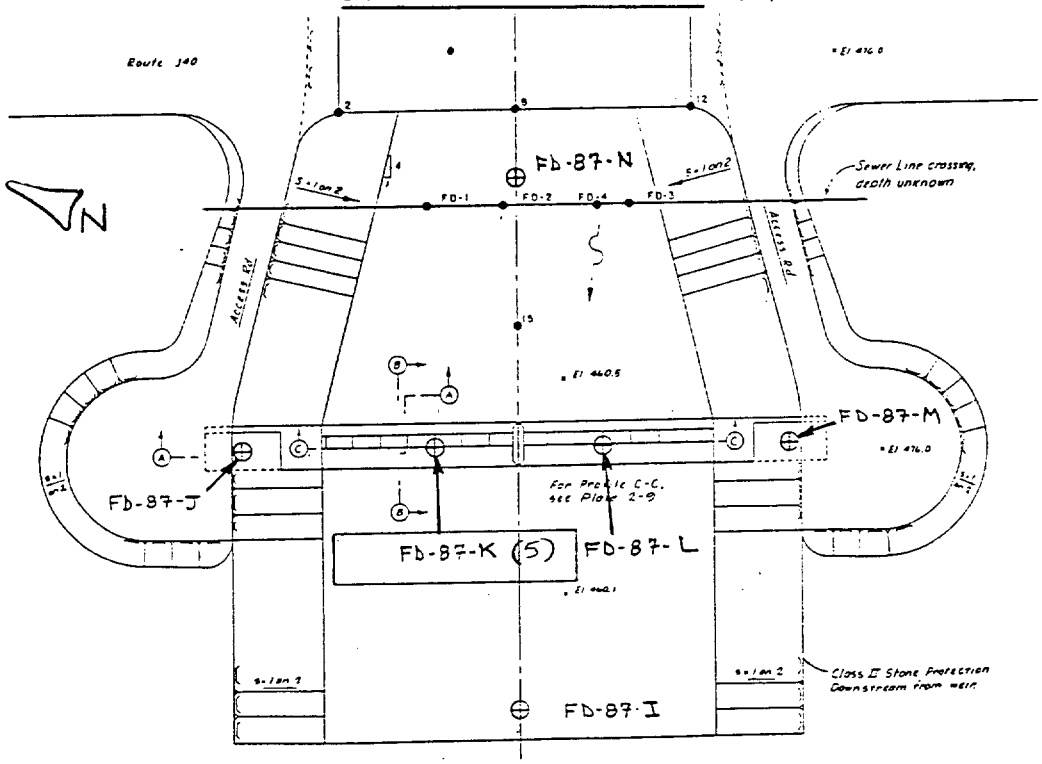
Site: WINNIPESAUKEE R.
Boring No: FD-87-5 (K)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						SEE PERM TESTS

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 5

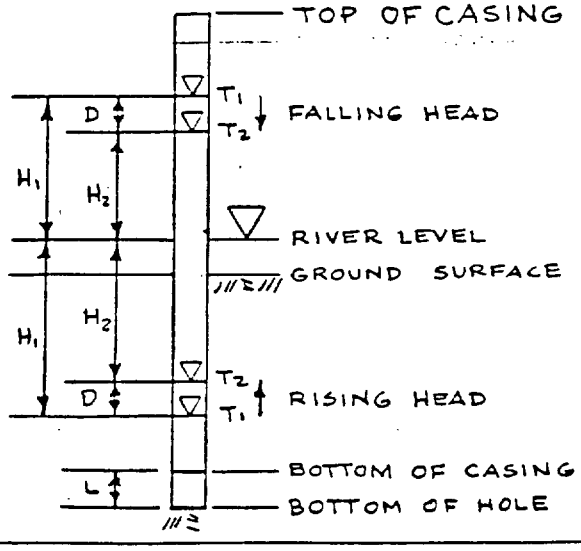
FIELD PERMEABILITY TEST RESULTS

DATE: 1-15-87	BORING NO: FD-87-5	DEPTH: 5'-7'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2'	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 1.5'		0	0	H_1 = 6.72	
1/2 MIN	.02	1.48		1/2 MIN	.25	6.47	
1	.04	1.46		1	.47	6.25	
2	.09	1.41		2	.87	5.85	
4	.19	1.31		4	1.63	5.09	
6	.25	1.25		6	2.48	4.24	
8	.33	1.17		8	3.15	3.57	

NOTES:

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$k_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1+\left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

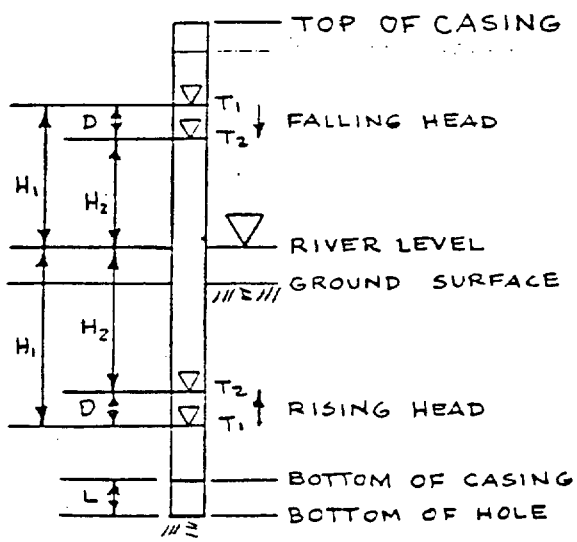
FIELD PERMEABILITY TEST RESULTS

DATE: 1-15-87	BORING NO: FD-87-5	DEPTH: 10'-12'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2'	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 2.50'		0	0	H_1 = 6.53	
1/2 MIN	1.52'	.98		1/2 MIN	.25	6.28	
1	1.88	.62		1	.52	6.01	
2	2.13	.37		2	.96	5.57	
4	2.28	.22		4	1.64	4.89	
6	2.33	.17		6	2.36	4.17	
8	2.40	.10		8	2.79	3.74	

NOTES:

SCHEMATIC



SYMBOLS

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D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

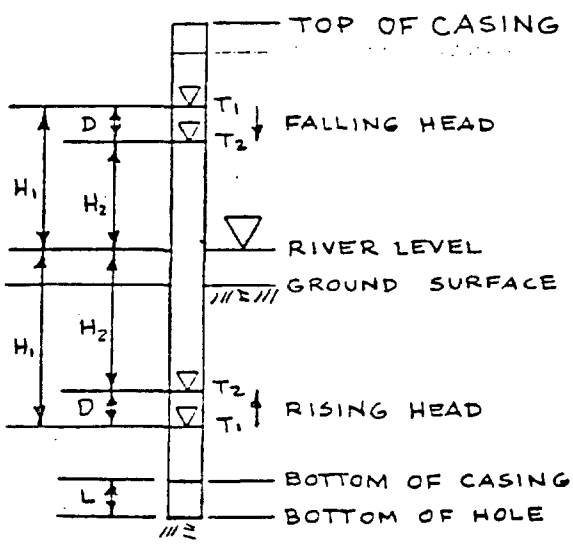
FIELD PERMEABILITY TEST RESULTS

DATE: 1-15-87	BORING NO: FP-87 5	DEPTH: 15'-17'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2	H_1 = SEE BELOW	m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 1.50'		0	0	H_1 = 9.21	
1/2 MIN	.01	1.49		1/2 MIN	.08	9.13	
1	.03	1.47		1	.14	9.07	
2	.06	1.44		2	.30	8.91	
4	.11	1.39		4	.76	8.45	
6	.16	1.34		6	1.32	7.89	
8	.20	1.30		8	1.78	7.43	

NOTES:

SCHEMATIC



SYMBOLS

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D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

FD-87-6

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, DO. 020

Site: WINNIPESAUKEE R

Page 1 of 7 Pages

Hole No. FD-87-6 (M) Diam. (Casing) 4"

Boring Started: 1-15-87

Co-ordinates: N _____ E _____ 149' W. OF RT 140 ℄ + 108' S. OF RIVER ℄

Boring Completed: 1-15-87

Drilled by: CAMBRIDGE + MURDOCK

Report Submitted: _____

Purpose of Exploration: PROPOSED GATE STRUCTURE

Elevation Top of Hole: 470.1 M.S.L.

Total Overburden Drilled: 26 Feet

Elevation Top of Rock: — M.S.L.

Elevation Bottom of Hole: 444.1 M.S.L.

Total Rock Drilled: 0 Feet

Total Depth of Hole: 26 Feet

Core Recovered: — %

Core Recovered — Ft.: — Diam. — in.

Soil Samples: 1 3/8 in. Diam. 10 No.

Soil Samples: — in. Diam. — No.

Casing Left in Place: NONE Feet

Water Table Depth: ≈5.3'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	26	2" OD. DRIVEN SPLIT SPOON
		FOLLOWED BY DRIVEN
		CASING AND 3 1/2" ROLLER BIT

INDEX

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Boring Location Sketch	Back of Page 4
Overburden Record	Page 2-3
Rock Drilling	Page —
PERMEABILITY TEST	Page 5-7
	Page
	Page

Prepared by: PAUL FASSEN
Field Data — Lab Data

Submitted by: ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R Page 2 of 7 Pages
Boring No. FD-87-6 Desig. M Diam. (Casing) 4"
Co-ordinates: N 149' W. OF RT 140 ℄ + 108' S. OF RIVER ℄ E

Elevation Top of Boring 470.1 M.S.L.
Total Overburden Drilled 26 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 444.1 M.S.L.
Total Depth of Boring 26 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 1 3/8 In. Diam. 10 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140 LB
Hammer Drop 30"
Casing Left —
Subsurface Water Data — Page —
Obs. Well —
Drilled By CAMBRIDGE + MURDOCK
Mfg. Des. Drill TRACK MOUNTED CME 45
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

Boring Started 1-15-87
Boring Completed 1-15-87

DEPTH (1" = 2)	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	1 3/8	0-2	15, 15, 27, 73	2" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3 1/2" ROLLER BIT	DARK BROWN SANDY SILT LITTLE GRAVEL TRACE ORGANICS (ML) (MED DENSE)
2						BROWN GRAVELLY, SILTY SAND (SM) (VERY DENSE)
	S-2	1 3/8	2-4	21, 36, 85, 75		AS ABOVE
4	S-3	1 3/8	4-5	34, 41		AS ABOVE
6			5-7		PERMEABITITY TEST	
8	S-4	1 3/8	7-9	12, 36, 39, 47		AS ABOVE
10	S-5	1 3/8	9-10	26, 34		AS ABOVE

GENERAL REMARKS: BORING PERFORMED ON LAND

Site	Boring No.	Page 3 of 7
WINNIPESAUKEE R	FD-87-6	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2						
			10-12		PERMEABILITY TEST	
12						
	S-6	1 3/8	12-14	13 12 16 23		GREY SILTY SAND (SM) (MED DENSE)
14	S-7	1 3/8	14-15	18 23		AS ABOVE (DENSE)
			15-17		PERMEABILITY TEST	
16						
	S-8	1 3/8	17-17.8	112 100/.3'		GREY SANDY SILT TRACE GRAVEL (ML/SM) (VERY DENSE)
18						
					NO SAMPLE, ROLLER BIT REQUIRED	
20						
	S-9	1 3/8	20-21	178 181		AS ABOVE
24					NO SAMPLE, ROLLER BIT REQUIRED	
	S-10	1 3/8	25-26	95 140		AS ABOVE
26						

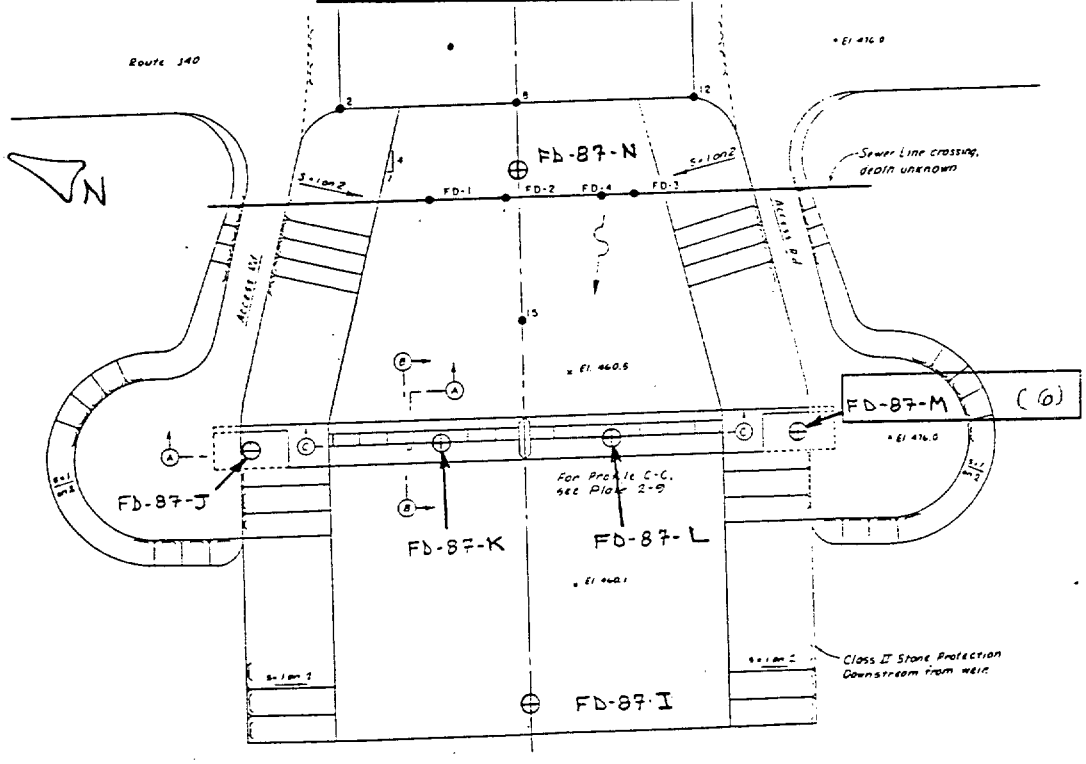
Site: WINNIPESAUKEE R.
Boring No: FD-87-6 (M)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
1/15/87		5		NOT STABLE		ASSUME WATER
						LEVEL AT 5.3'
						(SEE PERM TESTS)

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 6

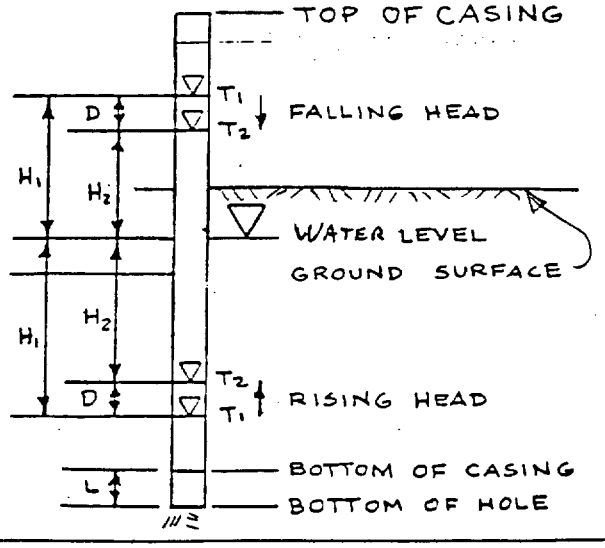
FIELD PERMEABILITY TEST RESULTS

DATE: 1-15-87	BORING No: FP-87 6	DEPTH: 5'-7'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2'	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME $(t_2 - t_1)$	D $(H_2 - H_1)$	H_2 $(H_1 - D)$	K_H	ELAPSED TIME $(t_2 - t_1)$	D $(H_2 - H_1)$	H_2 $(H_1 - D)$	K_H
0 MIN	0	H_1 = 5.60		0 MIN	0	H_1 = 1.75	
½	0	5.60		½	0	1.75	
1	0	5.60		1	0	1.75	
2	0	5.60		2	0	1.75	
4	0	5.60		4	0	1.75	
8	0	5.60		8	0	1.75	

NOTES: BORING PERFORED ON LAND

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

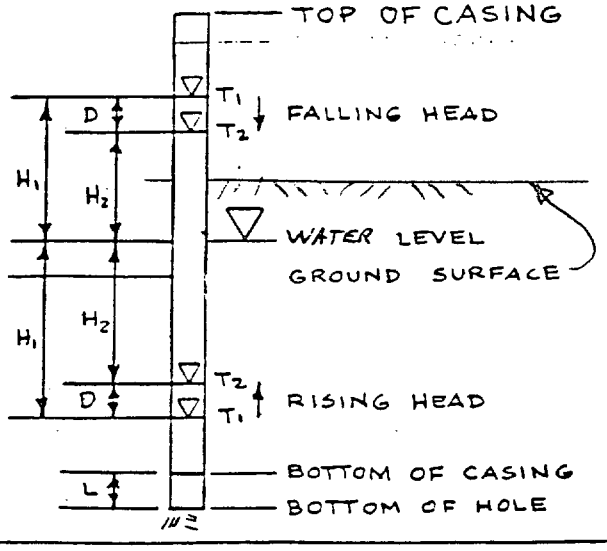
FIELD PERMEABILITY TEST RESULTS

DATE: 1-15-87	BORING NO: FP-87 6	DEPTH: 10'-12'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2'	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0 MIN	0	H_1 = 5.60'		0	0	H_1 = 6.40'	
½	.15'	5.45		½	.50'	5.90	
1	.35	5.25		1	1.58	4.82	
2	.90	4.70		2	2.61	3.79	
4	1.61	3.99		4	3.58	2.82	
8	2.80	2.80		8	4.25	2.15	
				12	5.42	.98	
				16	5.92	.48	

NOTES: BORING PERFORMED ON LAND

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$k_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

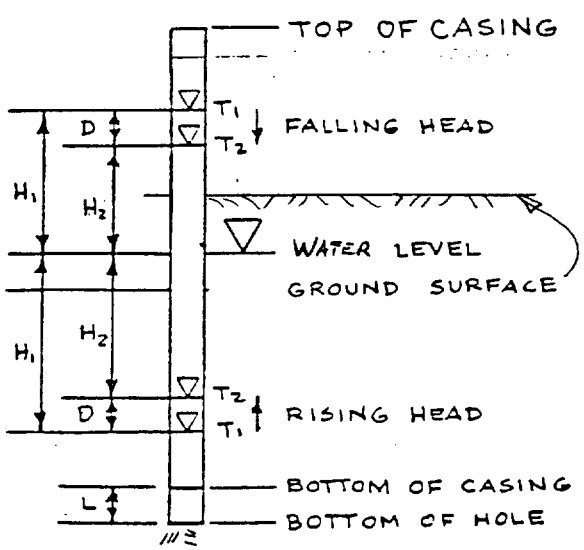
FIELD PERMEABILITY TEST RESULTS

DATE: 1-15-87	BORING NO: FO-87 6	DEPTH: 15'-17'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2'	H_1 = SEE BELOW m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 5.75'		0	0'	H_1 = 11.25'	
½ MIN	0	5.75		½ MIN	0	11.25	
1	.02	5.73		1	0	11.25	
2	.04	5.71		2	0	11.25	
4	.08	5.67		4	0	11.25	
8	.17	5.58		8	0	11.25	

NOTES: BORING PERFORMED ON LAND

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1+\left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

FD-87-7

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, D.O. 020

Site: WINNIPESAUKEE R

Page 1 of 7 Pages

Hole No. FD-87-7 (L) Diam. (Casing) 4"

Boring Started: 1-16-87

Co-ordinates: N 145' W. OF RT. 140 ℄ +30' S. OF RIVER ℄ E

Boring Completed: 1-19-87

Drilled by: DAVIS + BOYER

Report Submitted:

Purpose of Exploration: PROPOSED GATE STRUCTURE

Elevation Top of Hole: 458.4 M.S.L.

Casing Left in Place: NONE Feet

Total Overburden Drilled: 20 Feet

Elevation Top of Rock: — M.S.L.

Elevation Bottom of Hole: 438.4 M.S.L.

Total Rock Drilled: 0 Feet

Total Depth of Hole: 20 Feet

Core Recovered: — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples: 1 3/8 In. Diam. 9 No.

Soil Samples: — In. Diam. — No.

RIVER Water ~~Table~~ Depth: 5.2'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	20	2" OD DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 3 1/4 ROLLER BIT

INDEX

Ground Water	Back of Page	—
Boring Location Sketch	Back of Page	4
Overburden Record	Page	2-3
Rock Drilling	Page	—
PERMEABILITY TEST	Page	5-7
	Page	
	Page	

Prepared by: PAUL FISHER
Field Data — Lab. Data

Submitted by: ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R Page 2 of 7 Pages

Boring No. FD-87-7 Desig. L Diam. (Casing) 4"

Co-ordinates: 145' W. OF RT 140 ℄ + 30' S. OF RIVER ℄

Elevation Top of Boring 458.4 M.S.L. Hammer Wt. 140 LB Boring Started 1-16-87

Total Overburden Drilled 20 Feet Hammer Drop 30" Boring Completed 1-19-87

Elevation Top of Rock — M.S.L. Casing Left —

Total Rock Drilled 0 Feet Subsurface Water Data — Page —

Elevation Bottom of Boring 438.4 M.S.L. Obs. Well —

Total Depth of Boring 20 Feet Drilled By DAVIS & BOWER

Core Recovered — % No. Boxes — Mfg. Des. Drill ACKER HB

Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FISHER

Soil Samples 1 3/8 In. Diam. 9 No. Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. Classification By: —

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	1 3/8	0-2	7 9 6 10	2" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3 1/2" ROLLER BIT	BROWN SILTY SAND TRACE GRAVEL (SM) (MED DENSE)
2	S-2	1 3/8	2-3.5	12 18 20		GREY SILTY SAND TRACE GRAVEL (SM) (DENSE)
4	S-3	1 3/8	3.5-5	22 16 26		AS ABOVE
6			5-7		PERMEABILITY TEST	
8	S-4	1 3/8	7-8.5	43 61 65		AS ABOVE (VERY DENSE)
10	S-5	1 3/8	8.5-10	59 67 73		AS ABOVE

GENERAL REMARKS: SAND - RIVER BOTTOM

Site	Boring No.	Page 3 of 7
WINNIPESAUKEE R	FD-87-7	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
			10-12		PERMEABILITY TEST	GREY SILTY SAND TRACE GRAVEL (SM) (VERY DENSE)
12	S-6	1 3/8	12-13.5	52 61 73		AS ABOVE
14	S-7	1 3/8	13.5-15	62 60 72		AS ABOVE
16			15-17		PERMEABILITY TEST	GREY SANDY SILTY TRACE GRAVEL (ML/SM) (VERY DENSE)
18	S-8	1 3/8	17-18.5	56 73 41		
	S-9	1 3/8	18.5-20	61 93 110		AS ABOVE
20					EXPLORATION TERMINATED	@ 20'

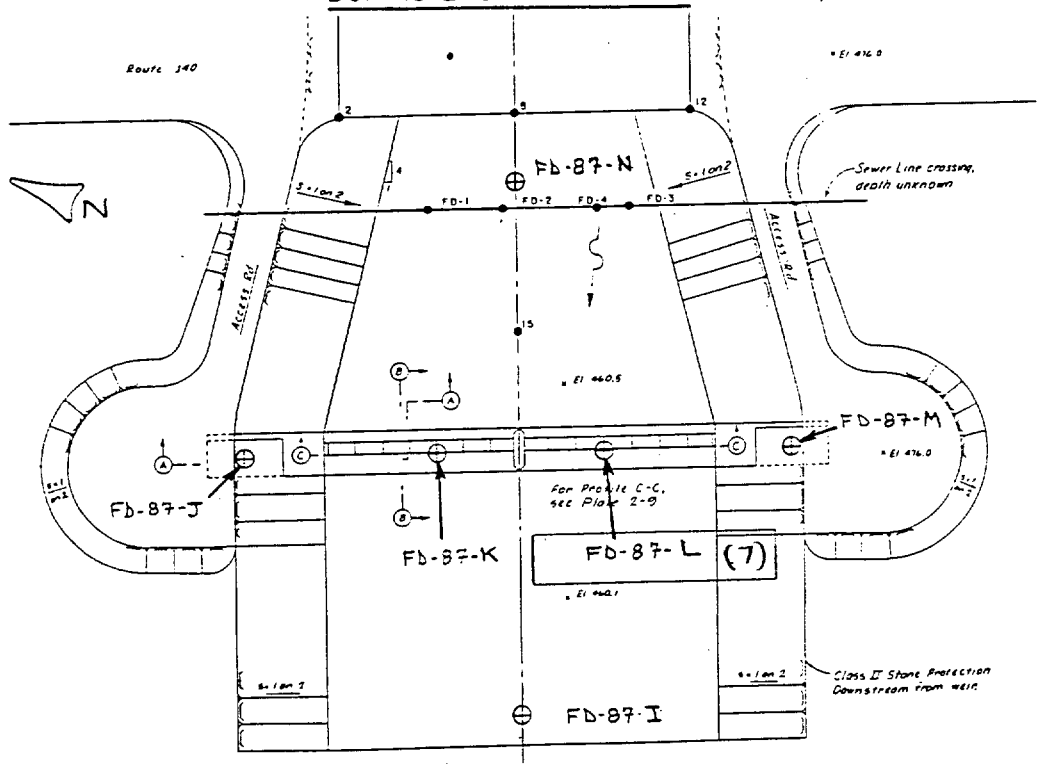
Site: WINNIPESAUKEE R
Boring No: FD-87-7 (L)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						SEE PERM TEST

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S



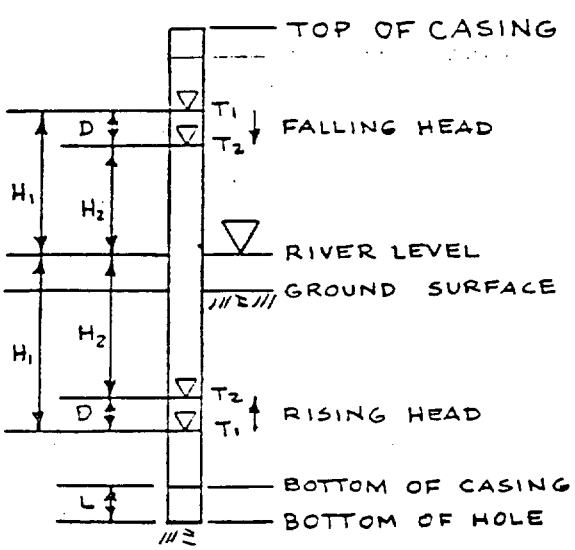
FIELD PERMEABILITY TEST RESULTS

DATE: 1-16-87	BORING NO: EU-87-7	DEPTH: 5'-7'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2	H_1 = SEE BELOW, m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 2.70		0	0	H_1 = 5.80	
1/2 MIN	1.08	1.62		1/2 MIN	.06	5.74	
1	1.68	1.02		1	.13	5.67	
2	2.04	.66		2	.20	5.60	
4	2.35	.35		4	.38	5.42	
6	2.47	.23		6	.50	5.30	
8	2.59	.11		8	.68	5.12	

NOTES:

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1+\left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

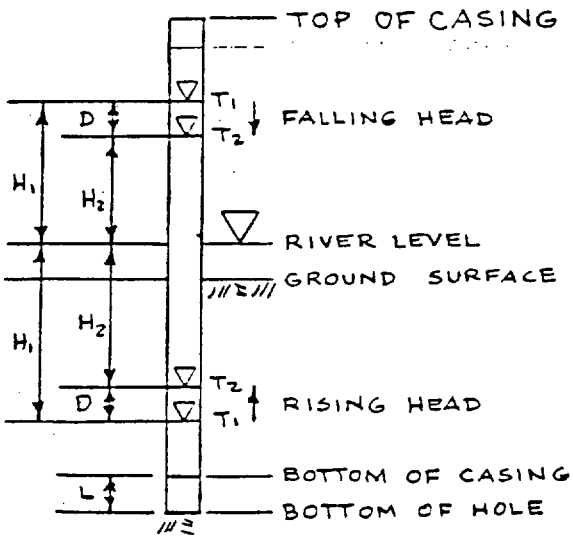
FIELD PERMEABILITY TEST RESULTS

DATE: 1-16-87	BORING NO: 7 (FP-87)	DEPTH: 10'-12'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 1.6'		0	0	H_1 = 6.77	
1/2 MIN	0	1.6		1/2 MIN	.01	6.76	
1	0	1.6		1	.03	6.74	
2	0	1.6		2	.04	6.73	
4	0	1.6		4	.12	6.65	
6	0	1.6		6	.15	6.62	
8	0	1.6		8	.21	6.56	

NOTES:

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$k_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

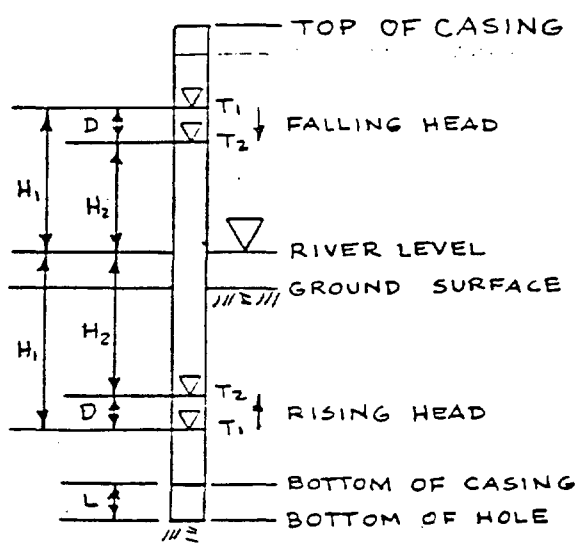
FIELD PERMEABILITY TEST RESULTS

DATE: 1-16-87	BORING NO: FD-87 7	DEPTH: 15'-17'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 2.1		0	0	H_1 = 6.84	
1/2 MIN	0	2.1		1/2 M	.02	6.82	
1	0	2.1		1	.05	6.79	
2	0	2.1		2	.07	6.77	
4	0	2.1		4	.11	6.73	
6	0	2.1		6	.16	6.68	
8	0	2.1		8	.20	6.64	

NOTES:

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$k_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

FD-87-8

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO 020

Site: WINNIPESAUKEE R.

Page 1 of 7 Pages

Hole No. FD-87-8 (I) Diam. (Casing) 4

Boring Started: 1-19-87

Co-ordinates: N _____ E _____ (250' W. OF RT. 140 ℄ @ RIVER ℄)

Boring Completed: 1-20-87

Drilled by: DAVIS + BOYER

Report Submitted: _____

Purpose of Exploration: PROPOSED GATE STRUCTURE

Elevation Top of Hole: 455.1 M.S.L.

Casing Left in Place: NONE Feet

Total Overburden Drilled: 20 Feet

Elevation Top of Rock: — M.S.L.

Elevation Bottom of Hole: 435.1 M.S.L.

Total Rock Drilled: 0 Feet

Total Depth of Hole: 20 Feet

Core Recovered: — %

Core Recovered: — Ft.: — Diam. — In.

Soil Samples: 1 3/8 In. Diam. 9 No.

Soil Samples: — In. Diam. — No.

RIVER Water Table Depth: 8.5'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	20	2" OD DRIVEN SPLIT SPOON
		FOLLOW BY 4" DRIVEN
		CASING AND 3 1/8" ROLLER BIT

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Rock Drilling	Page —
PERMEABILITY TEST	Page 5-7
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	Page

Prepared by: PAUL FISHER
Field Data — Lab. Data

Submitted by: ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 7 Pages

Boring No. FD-87-8 Desig. I Diam. (Casing) 4"

Co-ordinates: 250' W OF RT 140 ℄ & @ RIVER ℄

Elevation Top of Boring 455.1 M.S.L.
Total Overburden Drilled 20 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 435.1 M.S.L.
Total Depth of Boring 20 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 1 3/8 In. Diam. 9 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140 LB Boring Started 1-19-87
Hammer Drop 30"
Casing Left — Boring Completed 1-20-87
Subsurface Water Data — Page —
Obs. Well —
Drilled By DAVIS & BOYER
Mfg. Des. Drill ACKER HB
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	1 3/8	0-2	1 1 2 2	2" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3 1/2 ROLLER BIT	BLACK SILTY SAND TRACE MICA, TRACE ORGANICS (DELITARIOUS MATERIAL) (SM) (VERY LOOSE)
2	S-2	1 3/8	2-3.5	3 3 4		AS ABOVE (LOOSE)
4	S-3	1 3/8	3.5-5	6 9 10		AS ABOVE (MED DENSE)
6			5-7		PERMEABILITY TEST	BROWN SAND SOME SILT (SP) (MED-DENSE)
8	S-4	1 3/8	7-8.5	12 14 14		
10	S-5	1 3/8	8.5-10	9 24 27		AS ABOVE (VERY DENSE)

GENERAL REMARKS:
MOVED BORING LOCATION 5' WEST AFTER DRILLING 7' IN DEPTH.
SANDY RIVER BOTTOM

Site	Boring No.	Page 3 of 7
WINNIPESAUKEE R	FD-87-8	

DEPTH (Ft.)	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
			10-12		PERMEABILITY TEST	BROWN SAND SOME SILT (SP)(DENSE)
12	S-6	1 3/8	12-13.5	16 18 19		
14	S-7	1 3/8	13.5-15	15 23 28		AS ABOVE (VERY DENSE
16			15-17		PERMEABILITY TEST	GREY SANDY SILT TRACE GRAVEL (ML/SM.)(VERY DENSE)
18	S-8	1 3/8	17-18.5	40 44 57		
	S-9	1 3/8	18.5-20	54 55 55		AS ABOVE
20					EXPLORATION TERMINATION @ 20'	

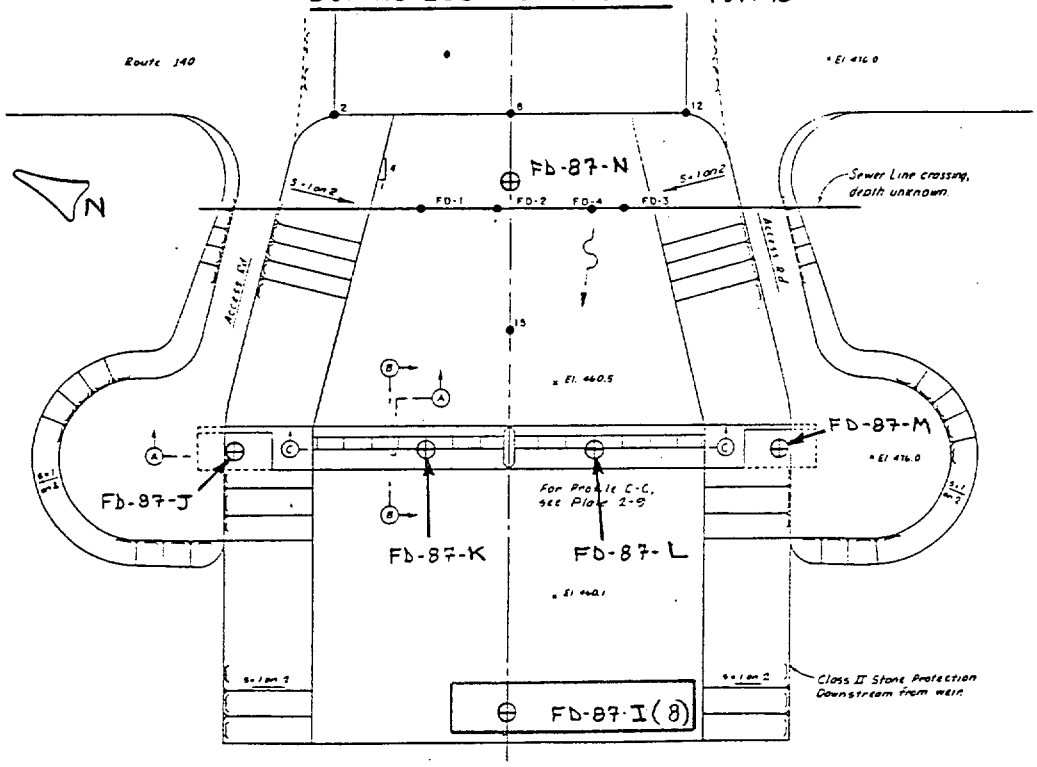
Site: WINNIPESAUKEE R
Boring No: FD-87-8 (I)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						SEE PERM TEST

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



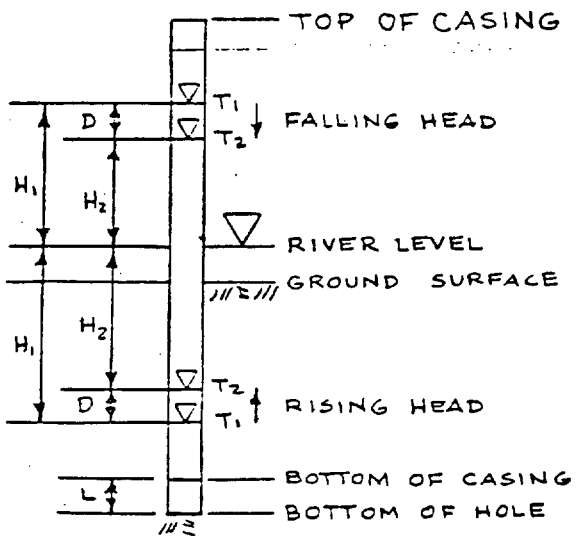
FIELD PERMEABILITY TEST RESULTS

DATE: 1-20-87	BORING No: FD-87-8	DEPTH: 5'-7'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 1.8'		0	0	H_1 = 7.2'	
1/2 MIN	0	1.8		1/2 MIN	0	7.2	
1	0	1.8		1	0	7.2	
2	0	1.8		2	0	7.2	
4	0	1.8		4	0	7.2	
8	0	1.8		8	0	7.2	
* 0	0	H_1 = 1.9'		0	0	H_1 = 7.6'	
1/2 MIN	0	1.9		1/2 MIN	0	7.6'	
1	0	1.9		1	0	7.6'	
2	0	1.9		2	0	7.6	
4	0	1.9		4	0	7.6	
8	0	1.9		8	0	7.6	

NOTES: * MOVED BORING LOCATION, REDRILLED AND RETESTED. RELOCATED WEST 5'

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1+\left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

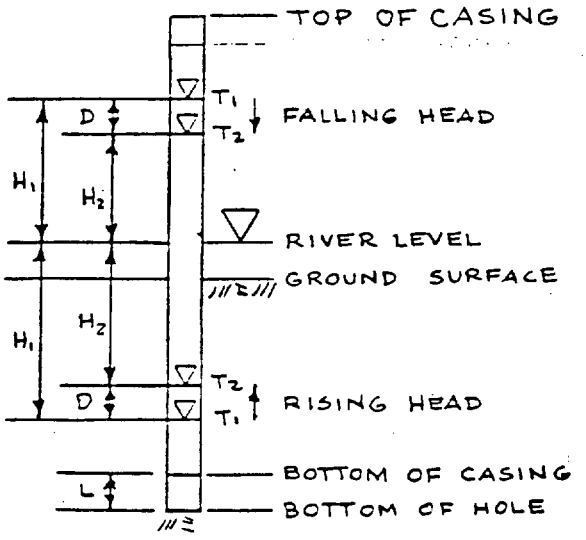
FIELD PERMEABILITY TEST RESULTS

DATE: 1-20-87	BORING NO: EP-87-8	DEPTH: 10'-12'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 1.80		0	0	H_1 = 8.32'	
1/2 MIN	.14	1.66		1/2 MIN	.43	7.89	
1	.29	1.51		1	1.01	7.31	
2	.53	1.27		2	1.14	7.18	
4	.87	.93		4	1.94	6.38	
6	1.10	.70		6	2.03	6.29	
8	1.25	.55		8	2.12	6.20	

NOTES:

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1+\left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

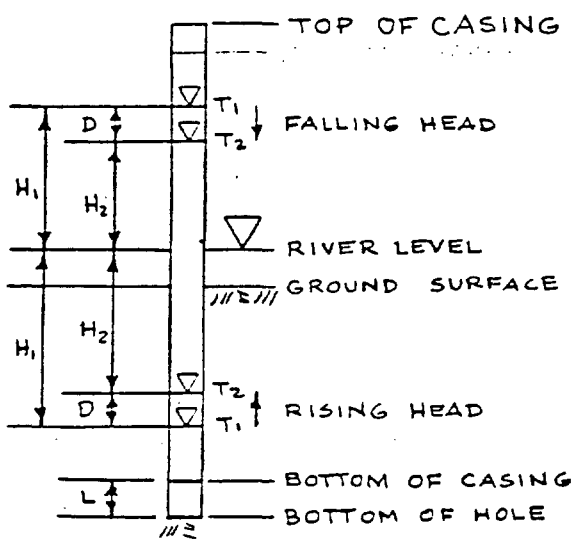
FIELD PERMEABILITY TEST RESULTS

DATE: 1-20-87	BORING NO: FD-87-8	DEPTH: 15'-17'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 2.00'		0	0	H_1 = 8.20'	
1/2 MIN	.06	1.94		1/2 MIN	.20	8.00	
1	.16	1.84		1	.33	7.87	
2	.37	1.63		2	.57	7.63	
4	.50	1.50		4	1.06	7.14	
6	.68	1.32		6	1.56	6.64	
8	.88	1.12		8	1.89	6.31	

NOTES:

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$k_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

FD-87-9

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, D.O. 020

Site: WINNIPESAUKEE R — Page 1 of 3 Pages

Hole No. FD-87-9 (T) Diam. (Casing) 4" — Boring Started 1-21-87

Co-ordinates: STA. 445+00 @ ℄ — Boring Completed 1-21-87

Drilled by DAVIS + BOYER — Report Submitted

Purpose of Exploration: STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 460.2 M.S.L. — Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 454.2 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½ In. Diam. 3 No.

Soil Samples — In. Diam. — No. — RIVER Water Table Depth 4.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 3⅞" ROLLER BIT

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Prepared by PAUL FISHER — Field Data — Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121 — REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 3 Pages

Boring No. FD-87-9 Desig. T Diam. (Casing) 4"

Co-ordinates: STA 445+00 B 4

Elevation Top of Boring 460.2 M.S.L.
Total Overburden Drilled 6 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 454.2 M.S.L.
Total Depth of Boring 6 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft : — Diam. — In.
Soil Samples 2½ In. Diam. 3 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140 LB
Hammer Drop 30"
Casing Left —
Subsurface Water Data — Page —
Obs. Well —
Drilled By DAVIS & BOYER
Mfg. Des. Drill ACKER HB
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

Boring Started 1-21-87
Boring Completed 1-21-87

DEPTH (Ft. Z)	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	9, 11, 13, 14	3" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3½" ROLLER BIT	BROWN SAND (SW) (MED DENSE)
2	S-2	2½	2-4	19, 16, 20, 17		AS ABOVE (DENSE)
4	S-3	2½	4-6	19, 18, 18, 17		AS ABOVE
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: SANDY RIVER BOTTOM

Site: WINNIPESAUKEE R
Boring No: FD-87-9 (T)

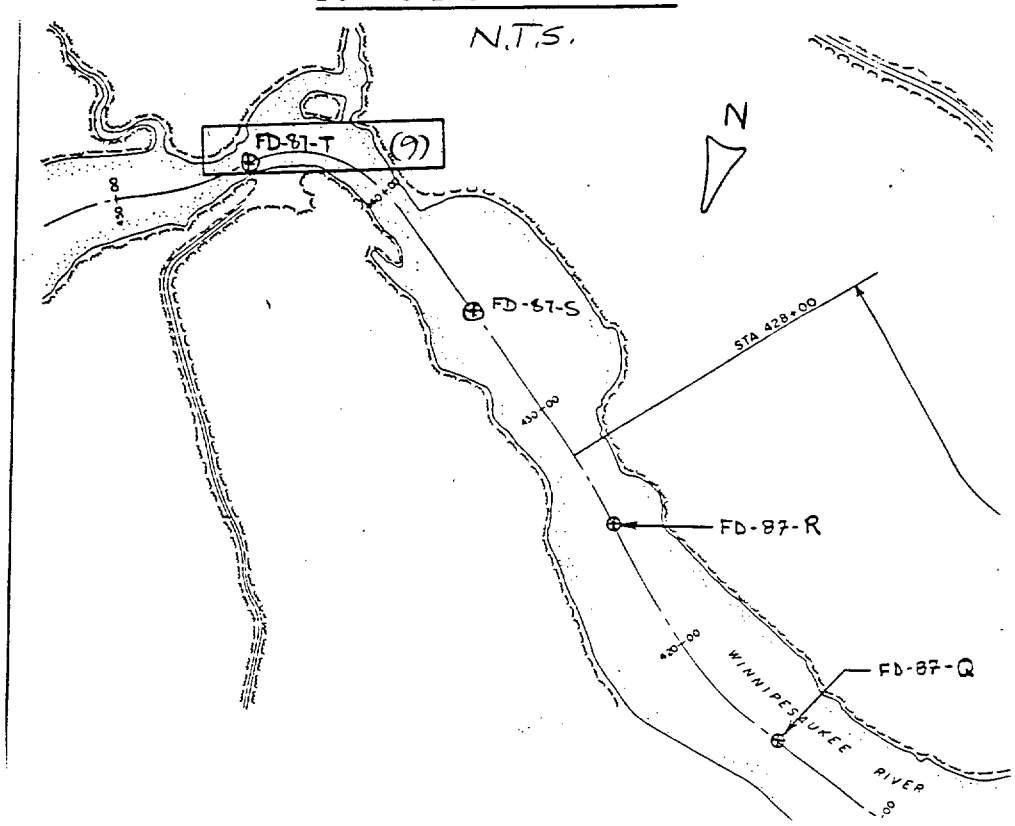
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



NED FORM 59 (Test)
MAR 71

Boring No. 9

FD-87-10

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, D.O. 02

Site: WINNIPESAUKEE R.
Page 1 of 3 Pages

Hole No. FD-87-10 (S) Diam. (Casing): 4"
Boring Started: 1-21-87

Co-ordinates: STA 435+00 ℄
Boring Completed: 1-21-87

Drilled by: DAVIS + BOYER
Report Submitted:

Purpose of Exploration: STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole: 460.5 M.S.L.
Casing Left in Place: NONE Feet
Total Overburden Drilled: 6 Feet
Elevation Top of Rock: — M.S.L.
Elevation Bottom of Hole: 454.5 M.S.L.
Total Rock Drilled: 0 Feet
Total Depth of Hole: 6 Feet
Core Recovered: — %
Core Recovered: — Ft.: — Diam. — In.
Soil Samples: 3.4 In. Diam. 3 No.
Soil Samples: — In. Diam. — No.
Water Table Depth: 6.5'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD DRIVEN SOIL
		CASING FOLLOWED BY 4"
		DRIVEN CASING AND 3 7/8"
		ROLLER BIT

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Prepared by: CARL FISHER
Field Data
Lab. Data

Submitted by: ATLANTIC TESTING LAB

WED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R Page 2 of 3 Pages

Boring No. FD-87-10 Desig. S Diam. (Casing) 4"

Co-ordinates: STA 435+00 ℄ ℄

Elevation Top of Boring 460.5 M.S.L. Hammer Wt. 140 LB Boring Started 1-21-87

Total Overburden Drilled 6 Feet Hammer Drop 30" Boring Completed 1-21-87

Elevation Top of Rock — M.S.L. Casing Left —

Total Rock Drilled 0 Feet Subsurface Water Data — Page —

Elevation Bottom of Boring 454.5 M.S.L. Obs. Well —

Total Depth of Boring 6 Feet Drilled By DAVIS + BOYER

Core Recovered — % No. Boxes — Mfg. Des. Drill ACKER HR

Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FISHER

Soil Samples 2 ½ In. Diam. 3 No. Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. Classification By: —

DEPTH 1" = 2	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	9, 11, 5, 7	3" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3½" ROLLER BIT	DARK BROWN SAND TRACE GRAVEL TRACE SILT (SW) (MED DENSE).
2	S-2	2½	2-4	11, 11, 13, 14		BROWN SAND TRACE GRAVEL (SW) (MED DENSE)
4	S-3	2½	4-6	13, 14, 12, 20		AS ABOVE
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: SANDY RIVER BOTTOM

FORM 58 (Test) Boring No. _____

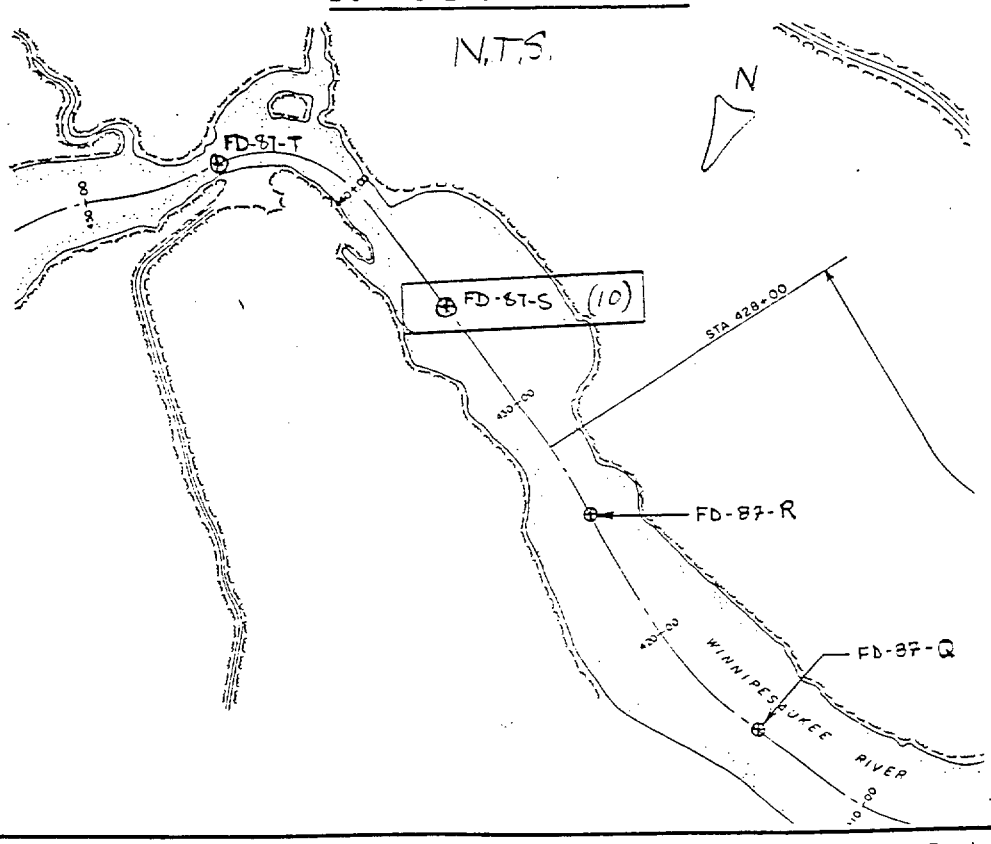
Site: WINNIPESAUKEE R.
Boring No: FD-87-10 (5)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



NED FORM 59 (Test) MAR 71

Boring No. 10

FD-87-11

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, DO 030

Site WINNIPESAUKEE R

Page 1 of 3 Pages

Hole No. FD-87-11 (A) Diam. (Casing) 4"

Boring Started 1-21-87

Co-ordinates: STA 425+00 ℄

Boring Completed 1-21-87

Drilled by DAVIS + BOWER

Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS ON RIVER BOTTOM

Elevation Top of Hole 461.0 M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 455.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½ In. Diam. 3 No.

Soil Samples — In. Diam. — No.

RIVER Water Table Depth 4.5'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD DRIVEN SOIL-SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 3½" ROLLER BIT

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Prepared by PAUL C. SHEEN
Field Data

Lab. Data

Submitted by FOUNDATION TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U.S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site W/INNIPESAUKEE R — Page 2 of 3 Pages

Boring No. FD-87-11 Desig. R Diam. (Casing) 4"

Co-ordinates: STA 425+00 ℄

Elevation Top of Boring 461.0 M.S.L. — Hammer Wt. 140 LB — Boring Started 1-21-87

Total Overburden Drilled 6 Feet — Hammer Drop 30" — Boring Completed 1-21-87

Elevation Top of Rock — M.S.L. — Casing Left —

Total Rock Drilled 0 Feet — Subsurface Water Date — Page —

Elevation Bottom of Boring 455.0 M.S.L. — Obs. Well —

Total Depth of Boring — Feet — Drilled By DAVIS + BOWER

Core Recovered — % No. Boxes — — Mfg. Des. Drill ALLEN HR

Core Recovered — Ft. — Diam. — In. — Inspected By: PAUL FISHER

Soil Samples 2½ In. Diam. 3 No. — Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. — Classification By: —

DEPTH (1" = 2')	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	7, 8, 9, 11	3" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3½" ROLLER BIT	BROWN SAND (SW)
2	S-2	2½	2-4	18, 19, 19, 17		BROWN SAND TRACE SILT (SP)
4	S-3	2½	4-6	18, 21, 22, 20		
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: SAND @ BOTTOM

FORM 58 (Test)

Boring No. FD-87-1

Site: WINNIPESAUKEE R.
Boring No: FD-87-11 (R)

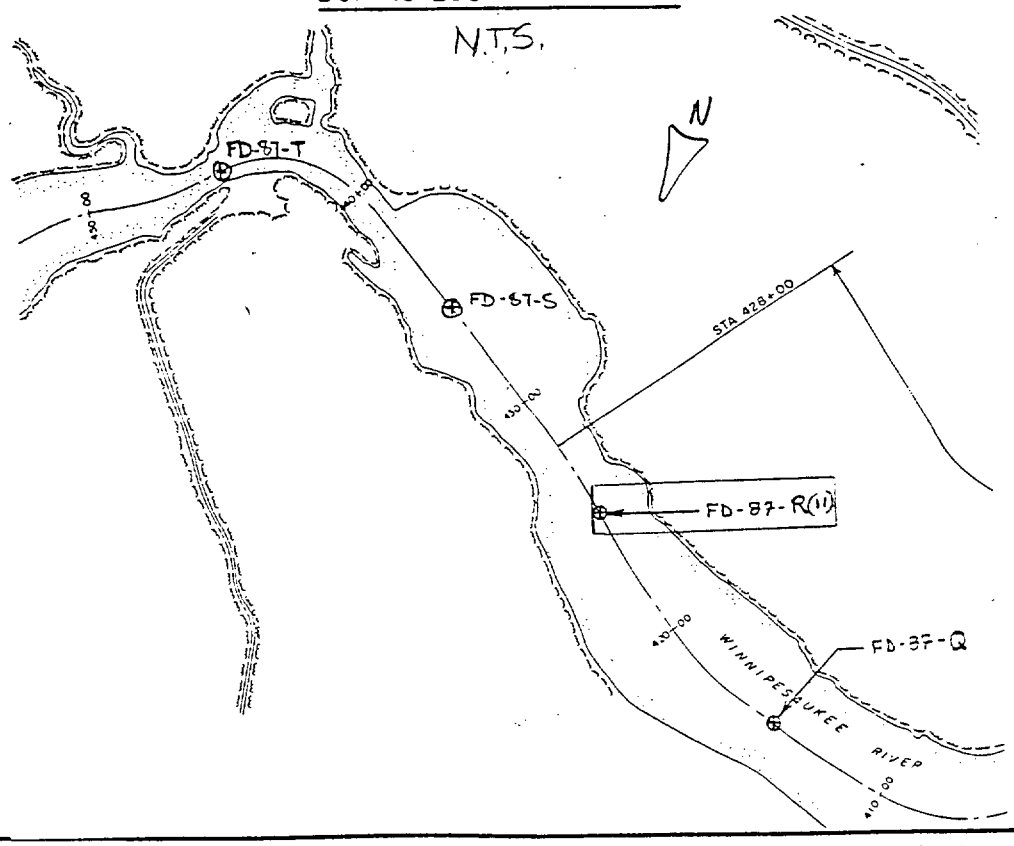
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 11

FD-87-12

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, D.O. 020

Site WINNIPESAUKEE RIVER — Page 1 of 3 Pages

Hole No. FD-87-12 (Q) Diam. (Casing) 4" — Boring Started 1-21-87

Co-ordinates: STA 415+00 @ ℄ — Boring Completed 1-21-87

Drilled by DAVIS + BOYER — Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 460.0 M.S.L. — Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 454.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — in.

Soil Samples 2½ in. Diam. 3 No.

Soil Samples — in. Diam. — No. — RIVER Water Table Depth 6.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD. DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 3¼" ROLLER BIT

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Prepared by PAUL FISHER — Field Data — Lab. Data

Submitted by ATLANTIC TESTING LAB

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U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R. Page 2 of 3 Pages

Boring No. FD-87-12 Desig. Q Diam. (Casing) 4"

Co-ordinates: STA N 415+00 E ℄

Elevation Top of Boring 460.0 M.S.L.
Total Overburden Drilled 6 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 454.0 M.S.L.
Total Depth of Boring 6 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 2½ In. Diam. 3 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140 LB
Hammer Drop 30"
Casing Left —
Subsurface Water Data — Page —
Obs. Well —
Drilled By DAVIS & BOWER
Mfg. Des. Drill ACKER HB
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

Boring Started 1-21-87
Boring Completed 1-21-87

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	4, 3, 7, 10	3" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3½" ROLLER BIT	BROWN SAND (SW) (MED DENSE)
2	S-2	2½	2-4	13, 7, 7, 9		AS ABOVE
4	S-3	2½	4-6	14, 8, 7, 8		AS ABOVE
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: SANDY RIVER BOTTOM

RM 58 (Test)

Boring No. FD-87-12

Site: WINNIPESAUKEE R.
Boring No: FD-87-12 (R)

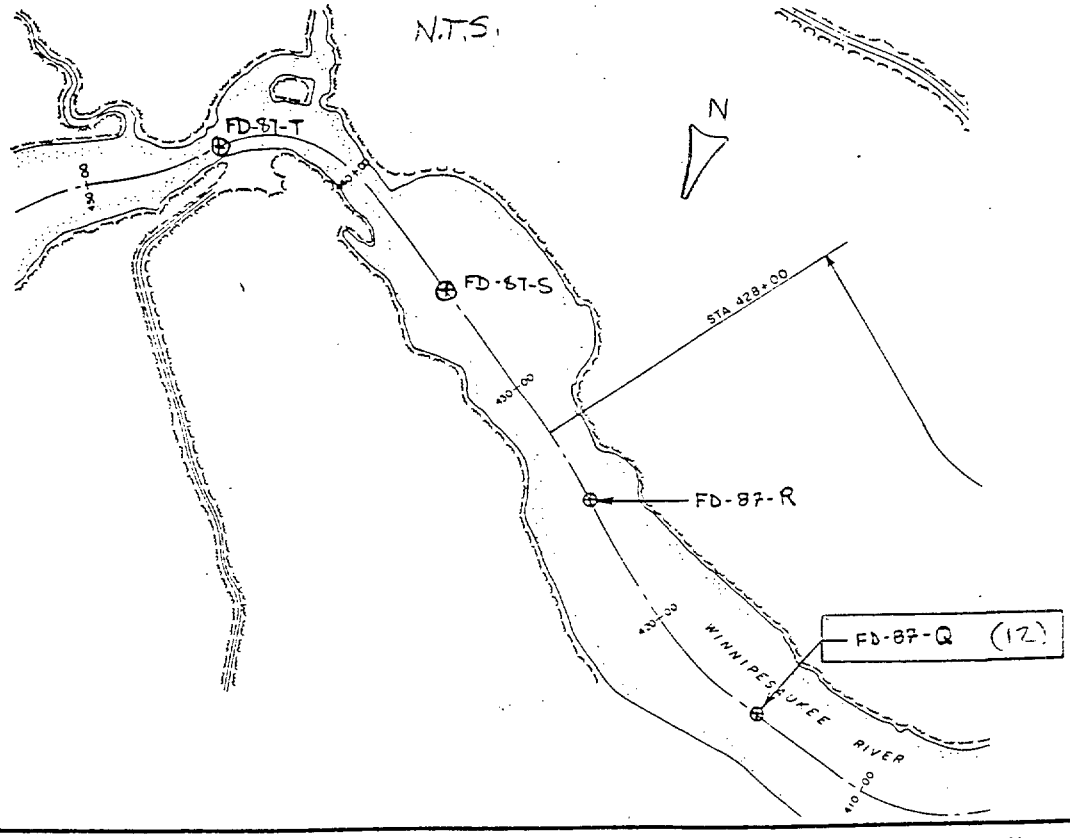
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 12

FD-87-13

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, D.O. 020

Site WINNIPESAUKEE RIVER — Page 1 of 3 Pages

Hole No. FD-87-13 (A) Diam. (Casing) 4" — Boring Started 1-21-87

Co-ordinates: STA 40E+00 ℄ — Boring Completed 1-21-87

Drilled by DAVIS + BOVER — Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 458.5 M.S.L. — Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 452.5 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½ In. Diam. 3 No.

Soil Samples — In. Diam. — No. — RIVER Water ~~Table~~ Depth 4.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	2" OD DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 3½" ROLLER BIT

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Prepared by PAUL [illegible] — Field Data — Lab. Data

Submitted by [illegible]

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R Page 2 of 3 Pages

Boring No. FD-87 13 Desig. P Diam. (Casing) 4"

Co-ordinates: STA N 405+00 E ℄

Elevation Top of Boring 458.5 M.S.L. Hammer Wt. 140LB Boring Started 1-21-87

Total Overburden Drilled 6 Feet Hammer Drop 30" Boring Completed 1-21-87

Elevation Top of Rock — M.S.L. Casing Left —

Total Rock Drilled 0 Feet Subsurface Water Data — Page —

Elevation Bottom of Boring 452.5 M.S.L. Obs. Well —

Total Depth of Boring 6 Feet Drilled By DAVIS + BOYER

Core Recovered — % No. Boxes — Mfg. Des. Drill ACKER HB

Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FISHER

Soil Samples 2½ In. Diam. 3 No. Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. Classification By: —

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1'=2	S-1	2½	0-2	1 1 1 1	3" O.D. DRIVEN SPLIT SPOON FOLLOW 3x4" DRIVEN CASING AND 3½" ROLLER BIT	DARK GREY SAND TRACE SILT (SP) (VERY LOOSE)
2	S-2	2½	2-4	1 1 1 1		AS ABOVE
4	S-3	2½	4-6	1 1 1 1		AS ABOVE
6					EXPLORATION TERMINATED	@ 6'

GENERAL REMARKS: SANDY RIVER BOTTOM

FORM 58(Test)

Boring No. FD-87-13

Site: WINNIPESAUKEE R.
Boring No: FD-87-13 (P)

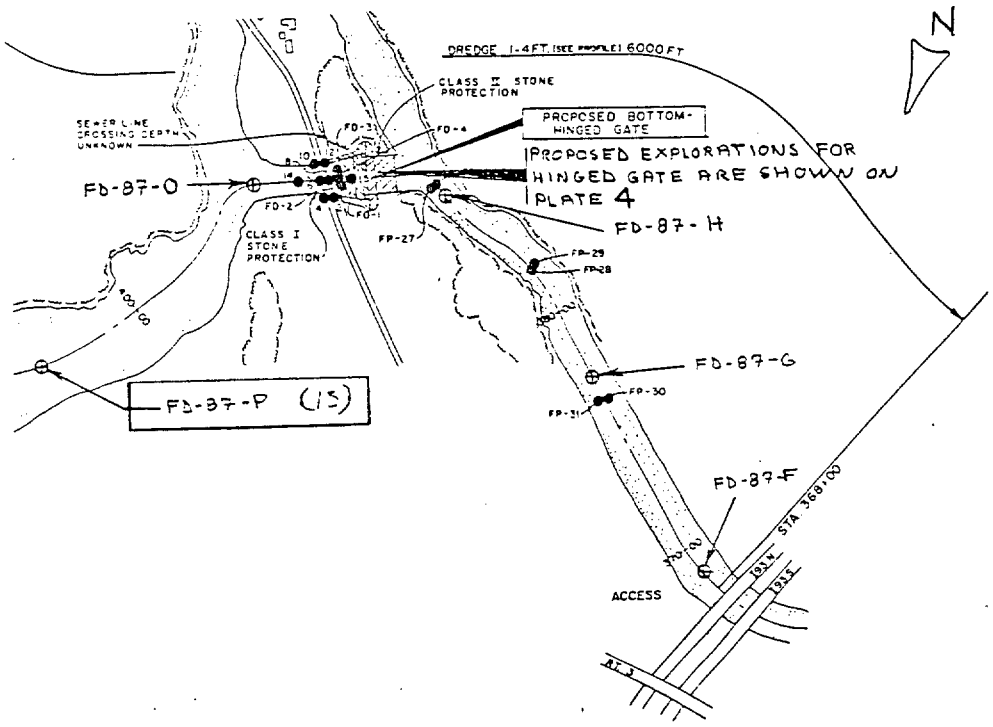
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



NED FORM 59 (Test)
MAR 71

Boring No. 13

FD-87-14

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, D.O. 020

Site WINNIPESAUKEE RIVER

Page 1 of 3 Pages

Hole No. FD-87-14 (0) Diam. (Casing) 4"

Boring Started 1-21-87

Co-ordinates: STA 394+00 ℄

Boring Completed 1-21-87

Drilled by DAVIS + BOYER

Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 457.0 M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 451.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2± In. Diam. 3 No.

Soil Samples — In. Diam. — No.

River Water Table Depth 60'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN
		CASING AND 3 7/8" ROLLER BIT

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Prepared by PAUL FISHER
Field Data

Lab. Data

Submitted by ATLANTIC TESTING LAB

FORM NED DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R. Page 1 of 3 Pages
Boring No. FD-87-14 Desig. O Diam. (Casing) 4"
Co-ordinates: A STA 394+00 B ℄

Elevation Top of Boring 457.0 M.S.L.
Total Overburden Drilled 6 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 451.0 M.S.L.
Total Depth of Boring 6 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 2½ In. Diam. 3 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140 lb Boring Started 1-21-87
Hammer Drop 30"
Boring Completed 1-21-87
Casing Left —
Subsurface Water Data — Page —
Obs. Well —
Drilled By DAVIS + BOYER
Mfg. Des. Drill ACKER 1-B
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

DEPTH (ft.)	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	20 19 17 16	3" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3½" ROLLER BIT	BROWN GRAVELLY SAND, TRACE SILT TRACE ORGANICS (SW) (DENSE)
2	S-2	2½	2-4	17 18 17 19		AS ABOVE
4	S-3	2½	4-6	24 40 32 31		AS ABOVE (VERY DENSE)
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: SANDY RIVER BOTTOM

Site: WINNIPESAUKEE R.
Boring No: FD-87-14 (O)

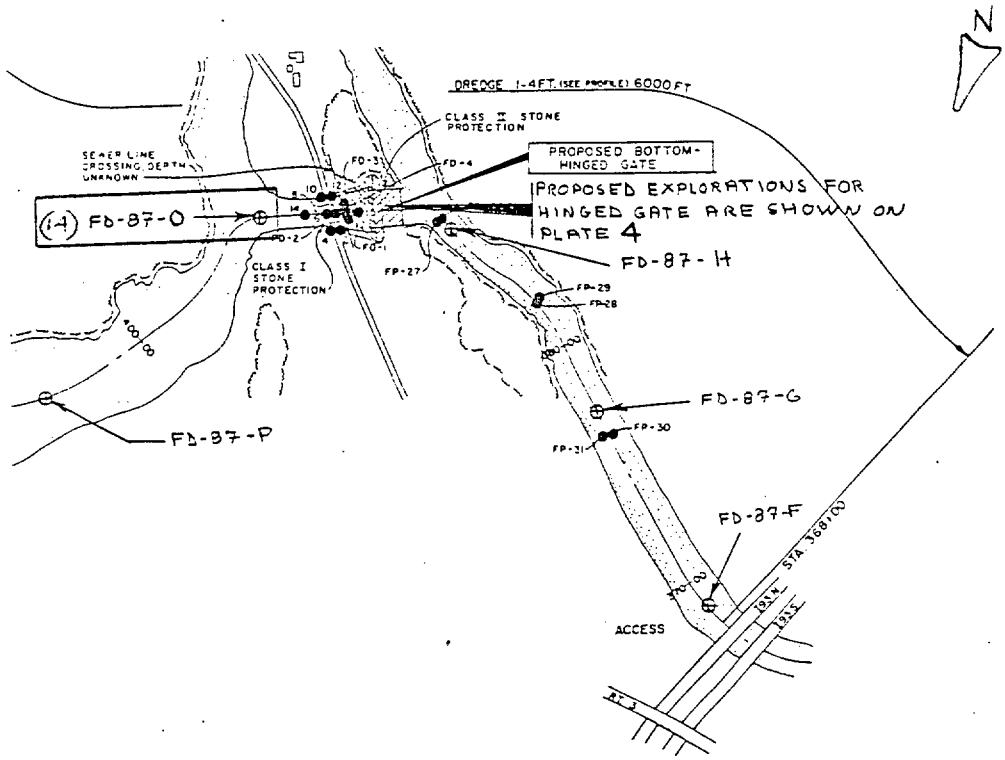
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



FD-87-15

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO #020

Site Housatonic River — Page 1 of 3 Pages

Hole No. FD-87-15 (V) Diam. (Casing) 4" — Boring Started 1-27-87

Co-ordinates: STA 560+00 ℄ — Boring Completed 1-27-87

Drilled by Davis & Boyer — Report Submitted

Purpose of Exploration Study Subsurface Conditions Of River Channel

Elevation Top of Hole 477.0 M.S.L. — Casing Left in Place None Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 471.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½" In. Diam. 3 No.

Soil Samples — In. Diam. — No. — River Water ~~Table~~ Depth 3.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD Driven Split Spoon

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Prepared by Dave Fagen — Field Data — Lab. Data

Submitted by Atlantic Testing Lab

MED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNEPAUKEE R — Page 2 of 3 Pages

Boring No. FD-87-15 Desig. V Diam. (Casing) 4"

Co-ordinates: STA 560+00 ℄

Elevation Top of Boring 477.0 M.S.L.
Total Overburden Drilled 6 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 471.0 M.S.L.
Total Depth of Boring 6 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 2½ In. Diam. 3 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140 LB
Hammer Drop 30"
Casing Left —
Subsurface Water Data — Page —
Obs. Well —
Drilled By DAVIS + BOVER
Mfg. Des. Drill 10 HP CAT-HEAD + TRI-PO
Inspected By: PAUL ESHER
Classification By: PAUL ESHER
Classification By: —

Boring Started 1-27-87
Boring Completed 1-27-87

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	27 42 39 38	3" OD DRIVEN SPLIT SPOON	BROWN GRAVELLY SAND (SW)
2	S-2	2½	2-4	39 41 40 33		
4	S-3	2½	4-6	48 53 62 53		
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: RIVER BOTTOM COVERED WITH BOULDERS + COBBLES

Site: WINNIPESAUKEE R.
Boring No: FD-87-15 (V)

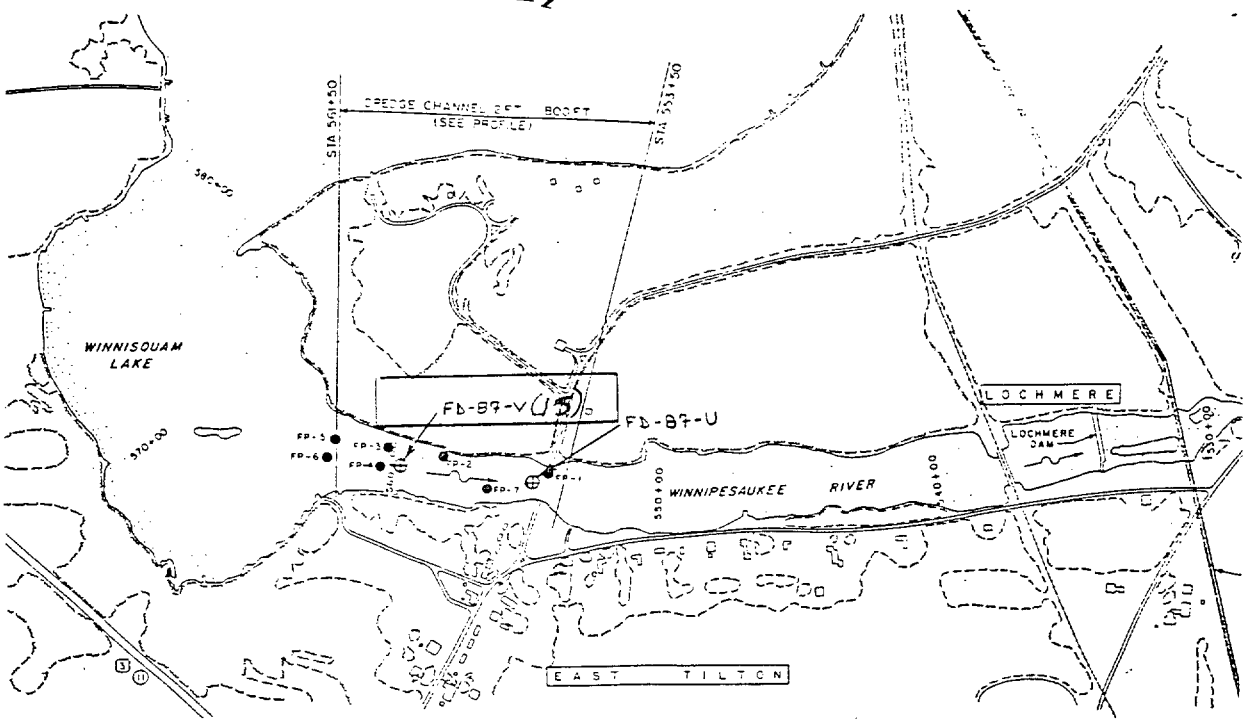
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



FD-87-16

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, DO#020

Site WINNIPESAUKEE RIVER — Page 1 of 3 Pages

Hole No. FD-87-16 (U) Diam. (Casing) 4" — Boring Started 1-27-87

Co-ordinates: STA 555+00 ℄ — Boring Completed 1-27-87

Drilled by DAVIS + BOWER — Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 477.5 M.S.L. — Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 471.5 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½ In. Diam. 2 No.

Soil Samples — In. Diam. — No. — RIVER Water ~~Table~~ Depth 2.3'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" DRIVEN SAND SAMPLER

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Prepared by PAUL SAWYER — Field Data — Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121 — REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 3 Pages

Boring No. FO-87-16 Desig. U Diam. (Casing) 4"

Co-ordinates: STA 555+00 ℄

Elevation Top of Boring 477.5 M.S.L. — Hammer Wt. 140 LB — Boring Started 1-27-87

Total Overburden Drilled 6 Feet — Hammer Drop 30"

Elevation Top of Rock — M.S.L. — Casing Left — — Boring Completed 1-27-87

Total Rock Drilled 0 Feet — Subsurface Water Date — Page —

Elevation Bottom of Boring 471.5 M.S.L. — Obs. Well —

Total Depth of Boring 6 Feet — Drilled By DAVIS + BOWER

Core Recovered — % No. Boxes — — Mfg. Des. Drill 10 HP CAT HEAD TRI-PO

Core Recovered — Ft. — Diam. — In. — Inspected By: PAUL FISHER

Soil Samples 2½ In. Diam. 2 No. — Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. — Classification By: —

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½"	0-2	20, 49, 53, 61	3" OD DRIVEN SPLIT SPOON	BROWN GRAVELLY SAND (SW) (VERY DENSE)
2	—	2½"	2-4	40, 27, 32, 34	NO RECOVERY	AS ABOVE
4	S-2	2½"	4-6	30, 29, 28, 31		AS ABOVE
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: RIVER BOTTOM COVERED WITH BOULDERS + COBBLES

Site: WINNIPESAUKEE R.
Boring No: FD-87-16 (U)

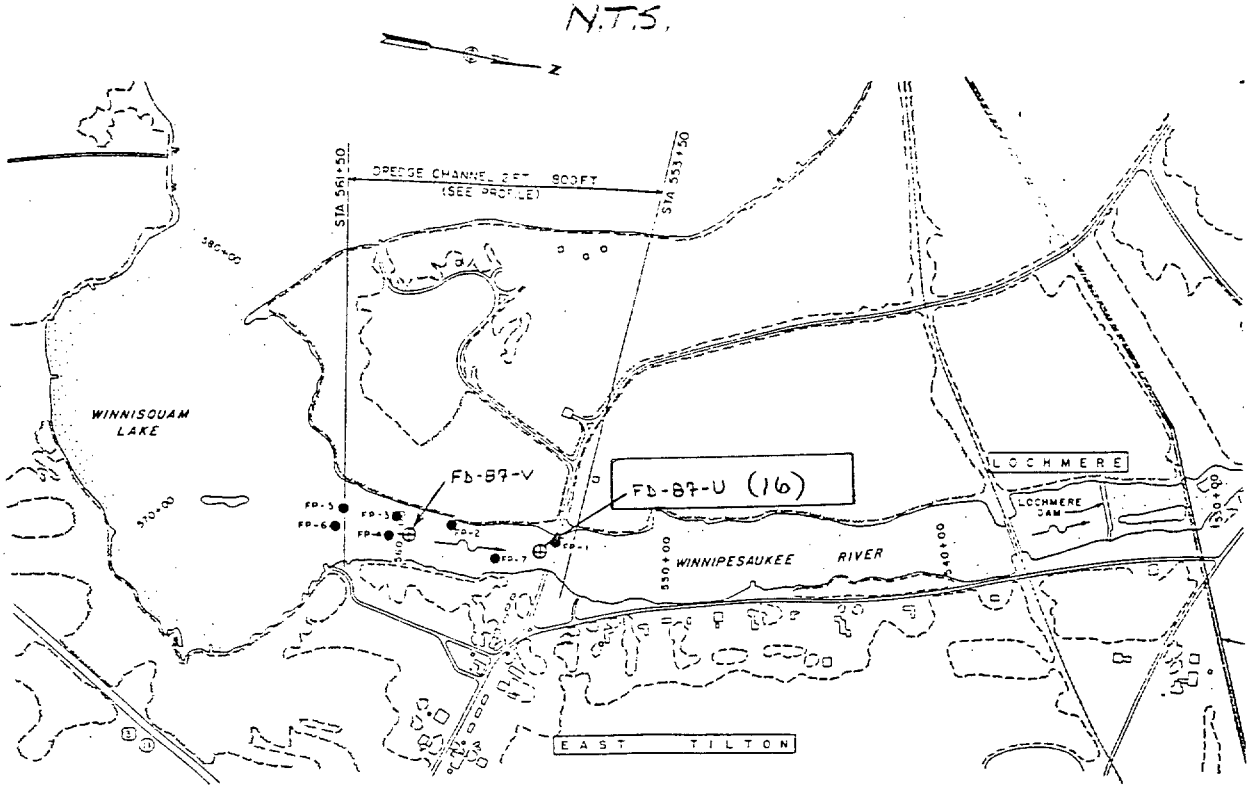
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 16

FD-87-17

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO. #020

Site WINNIPESAUKEE RIVER — Page 1 of 3 Pages

Hole No. FD-87-17 (EE) Diam. (Casing) 4" — Boring Started 1-28-87

Co-ordinates: STA 885+00 ℄ ℄ — Boring Completed 1-28-87

Drilled by DAVIS + BOYER — Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 480.0 M.S.L. — Casing Left in Place NONE Feet

Total Overburden Drilled 10 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 470.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 10 Feet

Core Recovered — %

Core Recovered — Ft.; — Diam. — in.

Soil Samples 2½ in. Diam. 5 No.

Soil Samples — in. Diam. — No. — RIVER Water ~~Table~~ Depth 20'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	10	3" OD DRIVEN SOLID SPOON
		AND 4" DRIVEN CASING

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Prepared by PAUL FISHER — Field Data — Lab. Data

Submitted by ATLANTIC TESTING LTD

NED FORM DEC 63 121 — REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R. Page 2 of 3 Pages
Boring No. FO-87-17 Desig. EE Diam. (Casing) 4"
Co-ordinates: STA 885+00 ℄

Elevation Top of Boring 480.0 M.S.L.
Total Overburden Drilled 10 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 470.0 M.S.L.
Total Depth of Boring 10 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 2½ In. Diam. 5 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140# Boring Started 1-28-87
Hammer Drop 30"
Casing Left — Boring Completed 1-28-87
Subsurface Water Data — Page —
Obs. Well —
Drilled By DAVIS & BOWER
Mfg. Des. Drill 10 HP CATHEAD & TRI-POD
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

DEPTH (1" = 2)	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	10 13 5 7	3" OD DRIVEN SPLIT SPOON AND 4" DRIVEN CASING	GREY SAND (SP) (MED DENSE)
2	S-2	2½	2-4	7 8 8 5		AS ABOVE
4	S-3	2½	4-6	7 6 6 5		AS ABOVE
6	S-4	2½	6-8	11 10 8 8		AS ABOVE
8	S-5	2½	8-10	14 11 11 12		AS ABOVE
10						

GENERAL REMARKS: SANDY RIVER BOTTOM

EXPLORATION TERMINATED @ 10'

Site: WINNIPESAUKEE R
Boring No: FD-87-17 (EE)

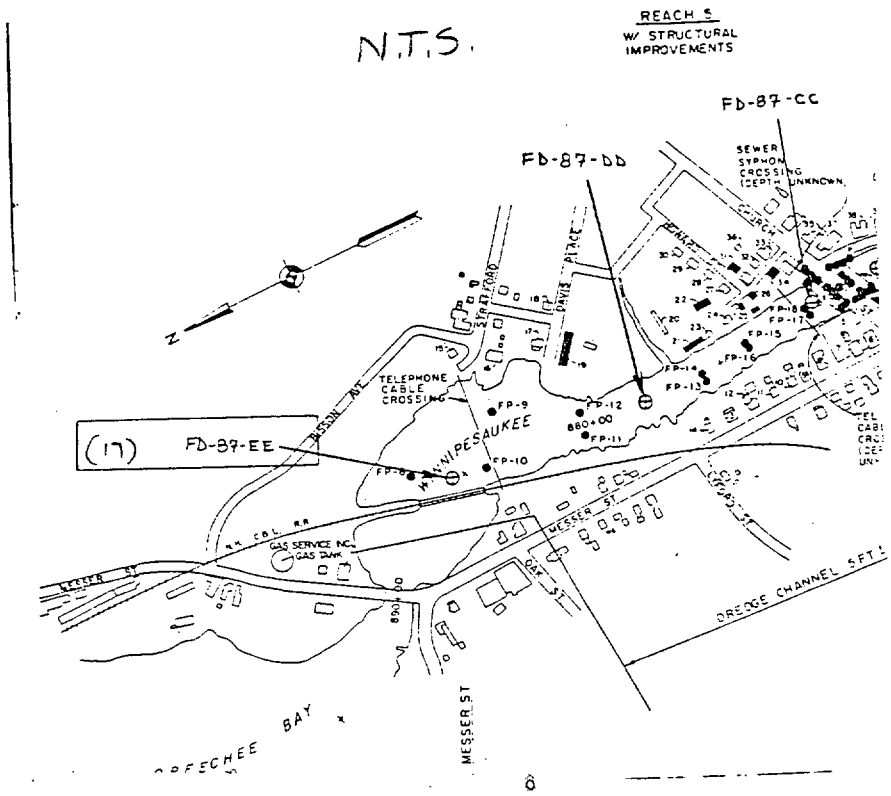
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 17

FD-87-18

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, D.O. #020

Site WINNIPESAUKEE RIVER

Page 1 of 3 Pages

Hole No. FD-87-18 (OD) Diam. (Casing) 4"

Boring Started 1-28-87

Co-ordinates: STA 878+00 ℄

Boring Completed 1-28-87

Drilled by DAVIS + BOWER

Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 487.5 M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 10 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 477.5 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 10 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½ In. Diam. 5 No.

Soil Samples — In. Diam. — No.

RIVER Water ~~Table~~ Depth 7.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	10	3" OD DRIVEN SPLIT-SPOON
		AND 4" DRIVEN CASING

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Prepared by PAUL FISHER
Field Data

Submitted by ATLANTIC TESTING LAB
Lab. Data

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 3 Pages

Boring No. FD-87-18 Desig. DD Diam. (Casing) 4"

Co-ordinates: STA 878+00 @ ℄

Elevation Top of Boring 487.5 M.S.L. — Hammer Wt. 140 # — Boring Started 1-28-87

Total Overburden Drilled 10 Feet — Hammer Drop 30" — Boring Completed 1-28-87

Elevation Top of Rock — M.S.L. — Casing Left —

Total Rock Drilled 0 Feet — Subsurface Water Data — Page —

Elevation Bottom of Boring 477.5 M.S.L. — Obs. Well —

Total Depth of Boring 10 Feet — Drilled By DAVIS & BOYER

Core Recovered — % — No. Boxes — — Mfg. Des. Drill 10 HP CATHEAD TRI-POD

Core Recovered — Ft — Diam. — in. — Inspected By: PAUL FISHER

Soil Samples 2½ in. Diam. 5 No. — Classification By: PAUL FISHER

Soil Samples — in. Diam. — No. — Classification By: —

DEPTH 1" = 2	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	11 13 11 10	3" OD DRIVEN SPLIT SPOON AND 4" DRIVEN CASING	BROWN SAND TRACE SILT (SP-SM) (MED. DENSE).
2	S-2	2½	2-4	13 14 15 14		AS ABOVE
4	S-3	2½	4-6	15 15 15 14		AS ABOVE
6	S-4	2½	6-8	8 8 12 16		AS ABOVE
8	S-5	2½	8-10	12 10 10 13		AS ABOVE
10						

GENERAL REMARKS: SANDY RIVER BOTTOM

EXPLORATION TERMINATED @ 10'

Site: WINNIPESAUKEE R
Boring No: FD-87-18 (DD)

SUBSURFACE WATER OBSERVATIONS

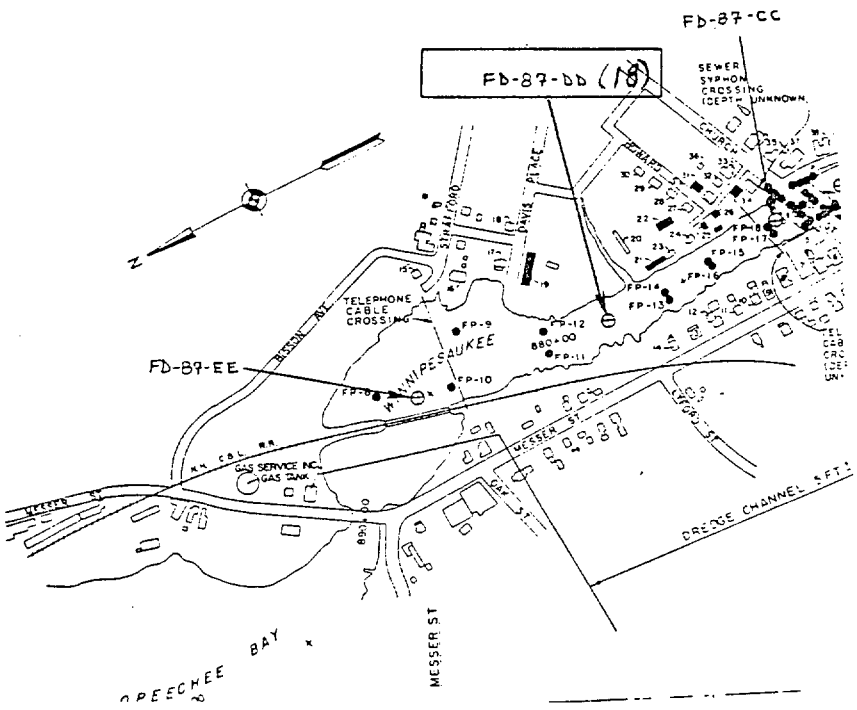
DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.

REACH 5
W/ STRUCTURAL IMPROVEMENTS



NED FORM 59 (Test)
MAR 71

Boring No. 18

FD-87-19

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO #020

Site WINNIPESAUKEE RIVER — Page 1 of 3 Pages

Hole No. FD-87-19 (CL) Diam. (Casing) 4" — Boring Started 1-28-87

Co-ordinates: STA 870+00 E ℄ — Boring Completed 1-28-87

Drilled by DAVIS & BOYER — Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 484.0 M.S.L. — Casing Left in Place NONE Feet

Total Overburden Drilled 10 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 474.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 10 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2" In. Diam. 5 No.

Soil Samples — In. Diam. — No. — RIVER Water ~~Table~~ Depth 8.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	10	3" OD DRIVEN SPLIT SPOON
		AND 4" DRIVEN CASING

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Prepared by CARL FISHER — Field Data — Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R Page 2 of 3 Pages

Boring No. FD-87-19 Desig. CC Diam. (Casing) 4"

Co-ordinates: STA 870+00 ℄

Elevation Top of Boring 484.0 M.S.L. Hammer Wt. 140# Boring Started 1-28-87

Total Overburden Drilled 10 Feet Hammer Drop 30"

Elevation Top of Rock — M.S.L. Casing Left — Boring Completed 1-28-87

Total Rock Drilled 0 Feet Subsurface Water Data — Page —

Elevation Bottom of Boring 484.0 M.S.L. Obs. Well —

Total Depth of Boring 10 Feet Drilled By DAVIS & BOYER

Core Recovered — % No. Boxes — Mfg. Des. Drill 10 HP CATHEAD + TRI-POD

Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FISHER

Soil Samples 2 K In. Diam. 5 No. Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. Classification By: —

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	4, 5, 12, 14	3" OD DRIVEN SPLIT SPOON AND 4" DRIVEN CASING	BROWN SAND, LITTLE GRAVEL (SW) (MED DENSE)
2						
	S-2	2½	2-4	16, 12, 12, 17		AS ABOVE
4						
	S-3	2½	4-6	12, 14, 15, 15		AS ABOVE
6						
	S-4	2½	6-8	14, 14, 16, 16		AS ABOVE
8						
	S-5	2½	8-10	9, 14, 20, 24		GREY SAND (SP) (DENSE)
10						

GENERAL REMARKS: SANDY RIVER BOTTOM

EXPLORATION TERMINATED @ 10'

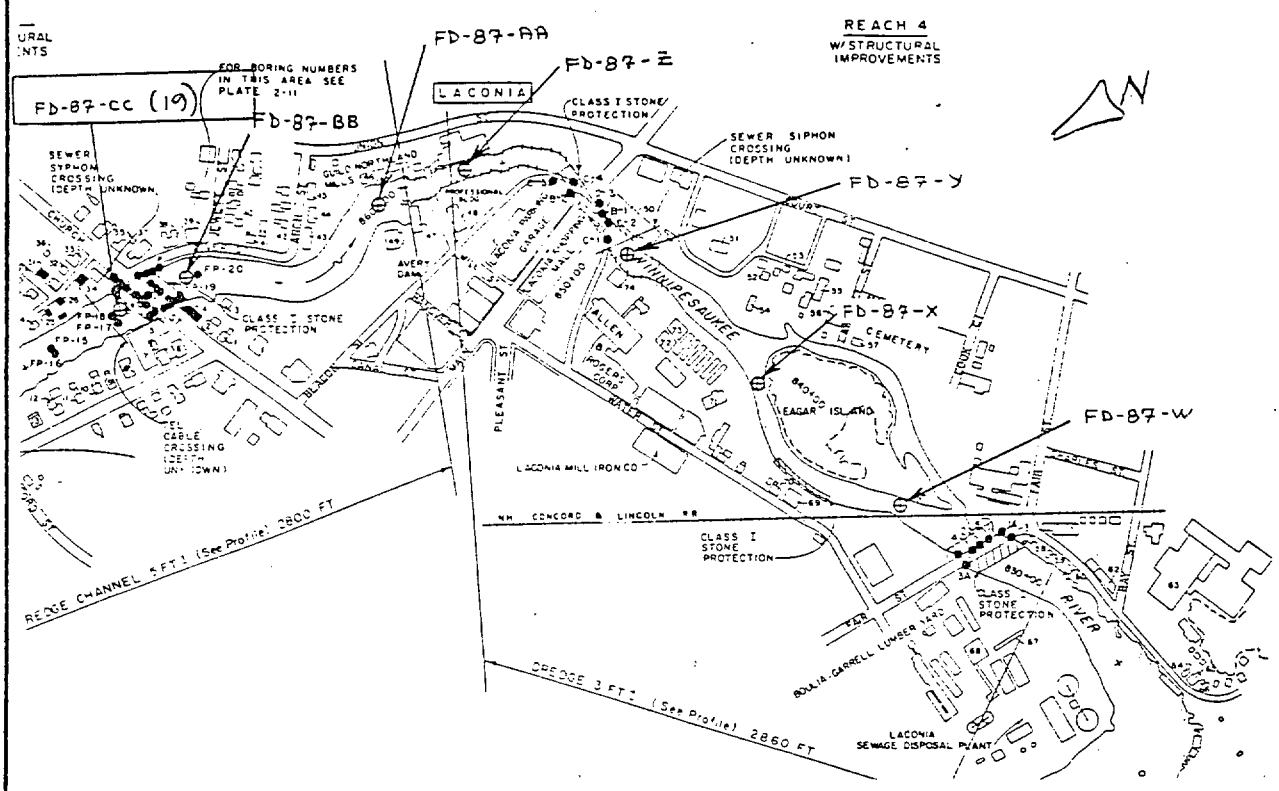
Site: WINNIPESAUKEE R.
Boring No: FD-87-19 (CC)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



NFD FORM 59 (Test) MAR 71

Boring No. 19

FD-87-20

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO #020

Site WINNIPESAUKEE RIVER

Page 1 of 3 Pages

Hole No. FD-87-20 (38) Diam. (Casing) 4"

Boring Started 1-28-87

Co-ordinates: STA 863+00 E ℄

Boring Completed 1-28-87

Drilled by DAVIS + BOYER

Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 484.0 M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 10 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 474.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 10 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½ In. Diam. 5 No.

Soil Samples — In. Diam. — No.

RIVER Water Table Depth 7.5'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	10	3" ID DRIVEN SPLIT SPOON
		AND 4" DRIVEN CASING

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Prepared by DAVE FISHER
Field Data Lab. Data

Submitted by ATLANTIC TEST-LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 3 Pages

Boring No. FD-87-20 Desig. BB Diam. (Casing) 4"

Co-ordinates: N STA 868+00 E ℄

Elevation Top of Boring 484.0 M.S.L.
Total Overburden Drilled 10 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 474.0 M.S.L.
Total Depth of Boring 10 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 2½ In. Diam. 5 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140# Boring Started 1-28-87
Hammer Drop 30"
Casing Left — Boring Completed 1-28-87
Subsurface Water Data — Page —
Obs. Well —
Drilled By DAVIS + BOWER
Mfg. Des. Drill 10HP CATHEAD + TRI-POD
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

DEPTH 1" = 2	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	8 4 4 5	3" OD DRIVEN SPLIT SPOON AND 4" DRIVEN CASING	BROWN WITH RED LAYER SAND SOME SILT; LESS SILTY WITH DEPTH (SP-SM) (LOOSE)
2	S-2	2½	2-4	4 6 9 9		AS ABOVE (MED DENSE)
4	S-3	2½	4-6	6 6 7 9		AS ABOVE
6	S-4	2½	6-8	7 9 9 12		AS ABOVE
8	S-5	2½	8-10	12 12 16 24		AS ABOVE
10						

GENERAL REMARKS: SILTY SAND RIVER BOTTOM

EXPLORATION TERMINATED @ 10'

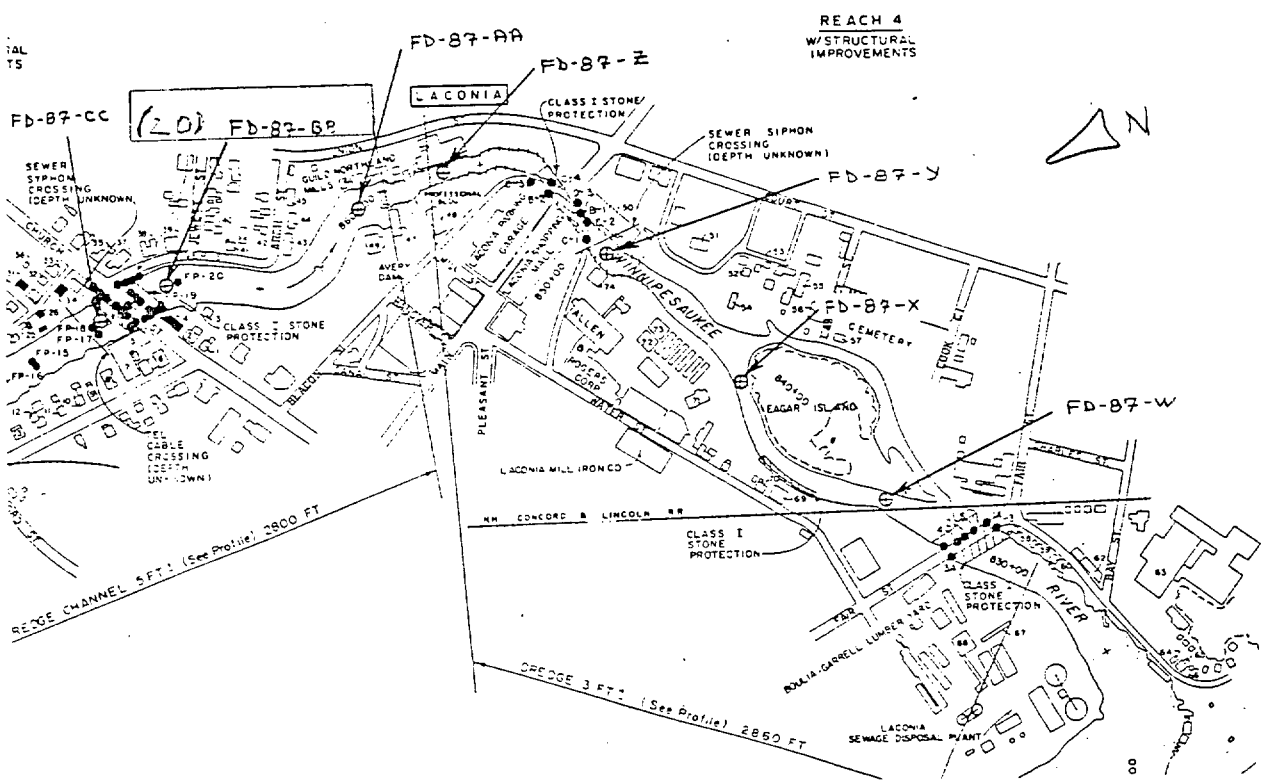
Site: WINNIPESAUKEE R.
Boring No: FD-87-20 (BB)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 20

FD-87-21

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO #020

Site Winnicesauke River

Page 1 of 3 Pages

Hole No. FD-87-21 (AW) Diam. (Casing) 4"

Boring Started 1-28-87

Co-ordinates: ~~N~~ 860+00 ~~E~~

Boring Completed 1-28-87

Drilled by Davis & Boyen

Report Submitted

Purpose of Exploration Study Subsurface Conditions Of Ringe Channel

Elevation Top of Hole 480.0 M.S.L.

Casing Left in Place None Feet

Total Overburden Drilled 10 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 470.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 10 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — in.

Soil Samples — in. Diam. 4 No.

Soil Samples — in. Diam. — No.

River Water Table Depth 7.5'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	10	3" OD Driven Split Spoon
		4" 4" Driven Casing

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Prepared by Paul Fisher
Field Data

Lab. Data

Submitted by Atlantic Testing Lab

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 3 Pages

Boring No. FD-87-21 Desig. AA Diam. (Casing) 4"

Co-ordinates: STA 860+00 ℄

Elevation Top of Boring 480.0 M.S.L. — Hammer Wt. 140# — Boring Started 1-28-87

Total Overburden Drilled 10 Feet — Hammer Drop 30"

Elevation Top of Rock — M.S.L. — Casing Left — — Boring Completed 1-28-87

Total Rock Drilled 0 Feet — Subsurface Water Data — Page —

Elevation Bottom of Boring 470.0 M.S.L. — Obs. Well —

Total Depth of Boring 10 Feet — Drilled By DAVIS + BOYER

Core Recovered — % No. Boxes — — Mfg. Des. Drill 10 HP CATHEAD + TRI-POD

Core Recovered — Ft. — Diam. — In. — Inspected By: PAUL FISHER

Soil Samples 2½ In. Diam. 4 No. — Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. — Classification By: —

DEPTH (1" = 2)	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0–2	S-1	2½	0-2	47, 69, 32, 24	3" OD DRIVEN SPLIT SPOON AND 4" DRIVEN CASING	BROWN GRAVELLY SAND (SW) (VERY DENSE)
2–4	S-2	2½	2-4	33, 44, 45, 36		AS ABOVE
4–6	—	2½	4-6	32, 43, 40, 45	NO RECOVERY	AS ABOVE
6–8	S-3	2½	6-8	24, 24, 30, 32		AS ABOVE
8–10	S-4	2½	8-10	36, 26, 32, 30		GREY SAND LITTLE SILT (SP-SM) (VERY DENSE)

GENERAL REMARKS: RIVER BOTTOM COVERED WITH COBBLES AND BOULDERS

FORM 58 (Test)

Boring No. FD-87-21

Site: WINNIPESAUKEE R

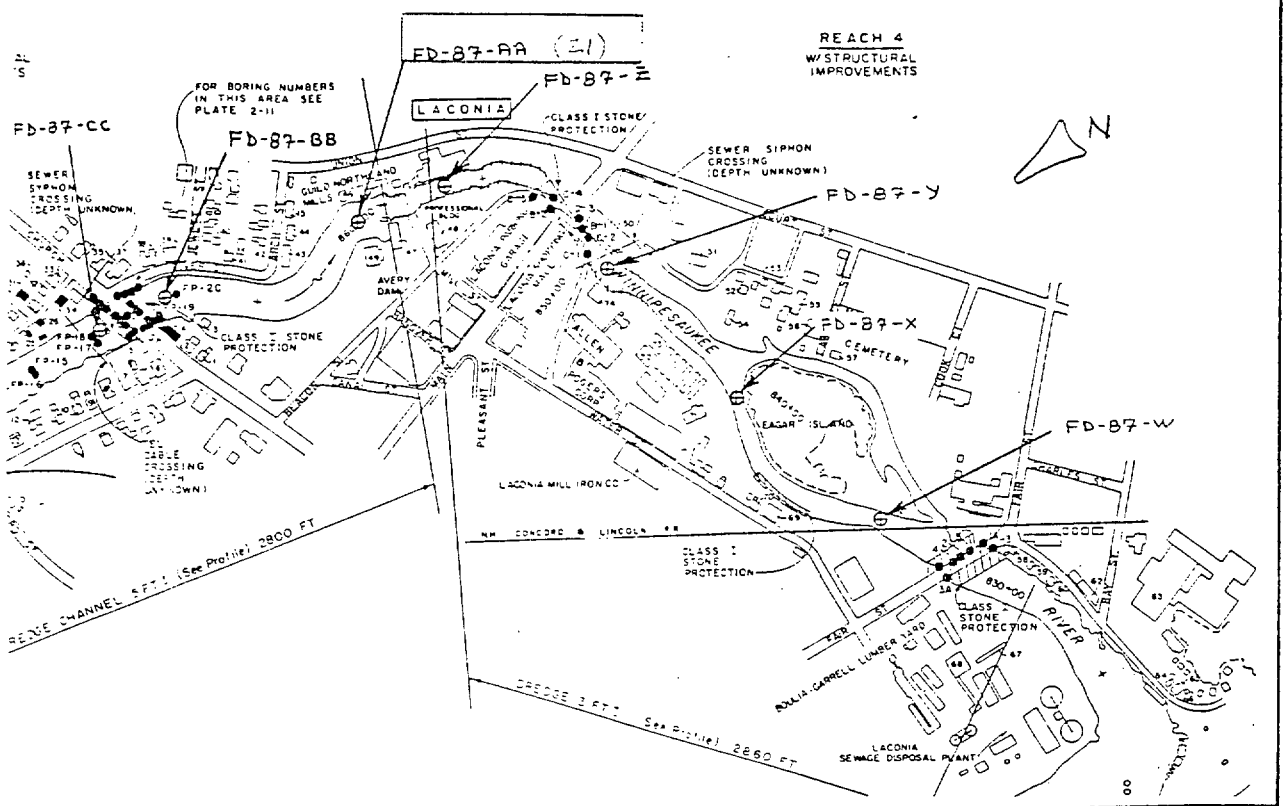
Boring No: FD-87-21 (AA)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



FD-87-22

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO #020

Site Winnipesaukee River

Page 1 of 3 Pages

Hole No. FD-87-22 (Z) Diam. (Casing) 4"

Boring Started 1-29-87

Co-ordinates: N 856+00 E ℄

Boring Completed 1-29-87

Drilled by Davis & Rouse

Report Submitted

Purpose of Exploration Subsurface Conditions of River Channel

Elevation Top of Hole 479.0 M.S.L.

Casing Left in Place None Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 473.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — in.

Soil Samples 2½ in. Diam. 3 No.

Soil Samples — in. Diam. — No.

River Water Table Depth 4.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD Driven Split Spoon

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Prepared by Paul Fisher
Field Data

Submitted by Alamo Testing Lab

Lab. Data

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 3 Pages

FD-87-
Boring No. 22 Desig. Z Diam. (Casing) 4"

Co-ordinates: N STA 456+00 E ℄

Elevation Top of Boring 479.0 M.S.L.
Total Overburden Drilled 6 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 473.0 M.S.L.
Total Depth of Boring 6 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 24 In. Diam. 3 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140# Boring Started 1-29-87
Hammer Drop 30"
Casing Left —
Boring Completed 1-29-87
Subsurface Water Data — Page —
Obs. Well —
Drilled By DAVIS + BOYER
Mfg. Des. Drill 1040 CAT-HEAD + TRI-CONE
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

DEPTH (1" = 2')	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	6, 22, 43, 44	3" OD DRIVEN SPLIT SPOON IN OPEN HOLE (VERY LITTLE CAVE-IN)	BROWN SAND SOME GRAVEL (SW) (VERY DENSE)
2	S-2	2½	2-4	12, 14, 15, 15		AS ABOVE (MED DENSE)
4	S-3	2½	4-6	20, 20, 24, 23		AS ABOVE (DENSE)
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: RIVER BOTTOM COVERED WITH COBBLE AND SOME BOULDERS

FORM 58 (Test)

Boring No. FD-87-22

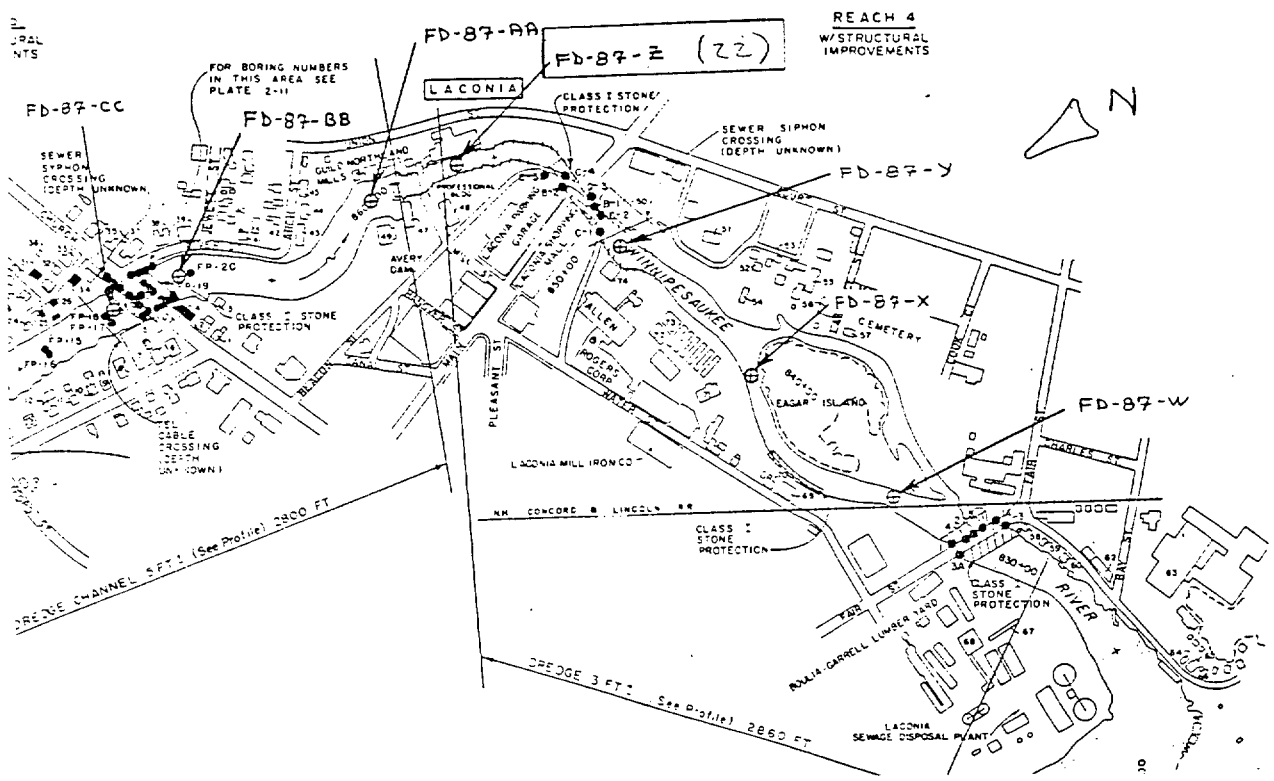
Site: WINNIPESAUKEE R
Boring No: FD-87-22(Z)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



NED FORM 59 (Test)
MAR 71

Boring No. 22

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW 33-85-D-0011, DO #020

Site: WINNIPESAUKEE RIVER

Page 1 of 3 Pages

Hole No. FD-87-23 (Y) Diam. (Casing): 4"

Boring Started: 1-30-87

Co-ordinates: STA 849+00 ℄

Boring Completed: 1-30-87

Drilled by: DAVIS & BOYER

Report Submitted:

Purpose of Exploration: STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole: 478.0 M.S.L.

Casing Left in Place: None Feet

Total Overburden Drilled: 6 Feet

Elevation Top of Rock: — M.S.L.

Elevation Bottom of Hole: 472.0 M.S.L.

Total Rock Drilled: 0 Feet

Total Depth of Hole: 2 Feet

Core Recovered: — %

Core Recovered: — Ft.: — Diam. — in.

Soil Samples: 2" in. Diam. 2 No.

Soil Samples: — in. Diam. — No.

RIVER Water ~~Table~~ Depth: 3.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	2	3" OD DRIVEN SPLIT SPOON

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Prepared by: PAUL FISHER
Field Data

Lab. Data

Submitted by: ATLANTIC TESTING LTD

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R Page 1 of 2 Pages

Boring No. FD-87-23 Desig. Y Diam. (Casing) 4"

Co-ordinates: ⊕ STA 849+00 ⊕ ℄

Elevation Top of Boring 478.0 M.S.L. Hammer Wt. 140# Boring Started 1-30-87

Total Overburden Drilled 6 Feet Hammer Drop 30" Boring Completed 1-30-87

Elevation Top of Rock — M.S.L. Casing Left —

Total Rock Drilled 0 Feet Subsurface Water Data — Page —

Elevation Bottom of Boring 472.0 M.S.L. Obs. Well —

Total Depth of Boring 6 Feet Drilled By DAVIS + BOYER

Core Recovered — % No. Boxes — Mfg. Des. Drill 10HP CATHEAD + TRI-POD

Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FISHER

Soil Samples 2 In. Diam. 2 No. Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. Classification By: —

DEPTH 1" = 2	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	6, 14, 14, 18	3" OD DRIVEN SPLIT SPOON IN OPEN HOLE (SOME CAVE-IN)	BROWN GRAVELLY SAND (SW) (MED. DENSE)
2	—	2½	2-4	20, 23, 29, 21	NO RECOVERY, POSSIBLE COBBLE	ASSUMED CHANGE GRAY SAND (SP) (DENSE)
4	S-2	2½	4-6	22, 18, 19, 23		
6					EXPLORATION TERMINATED	≈6'

GENERAL REMARKS: SANDY RIVER BOTTOM

FORM 58(Test) Boring No.

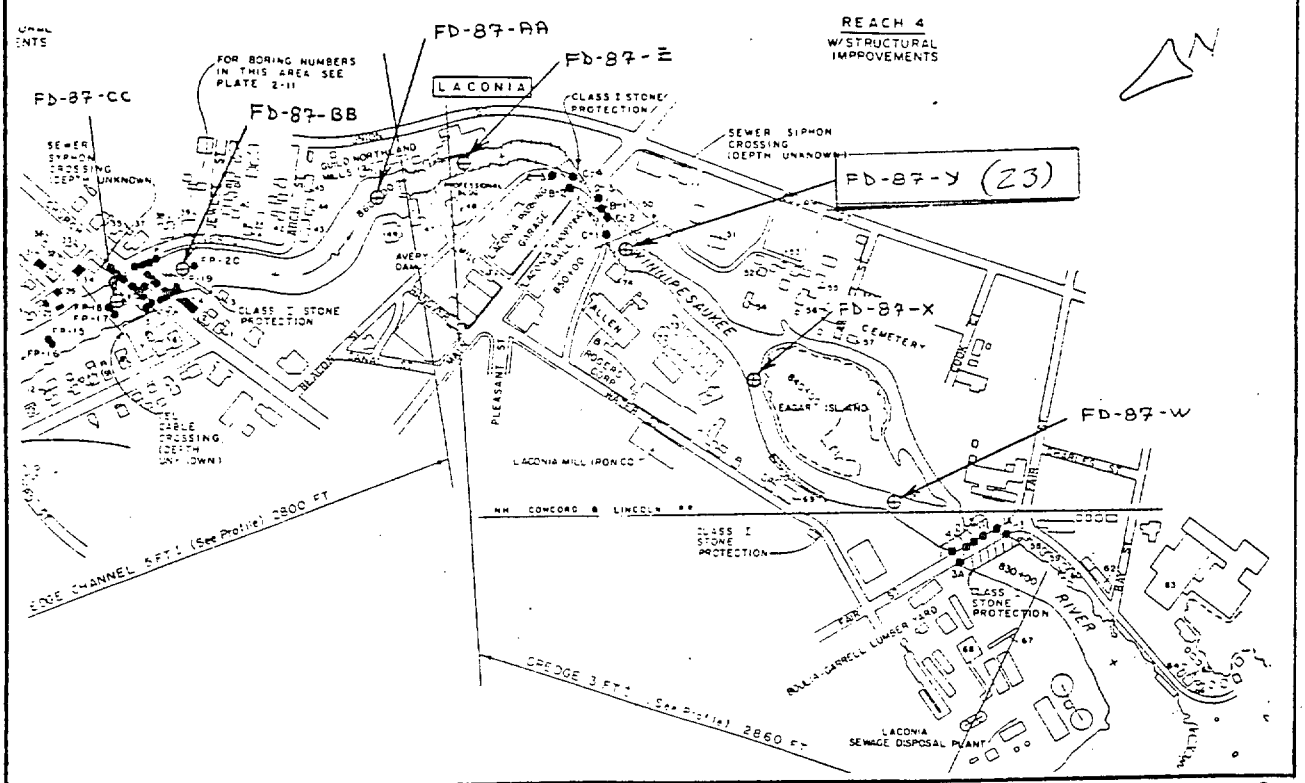
Site: WINNIPESAUKEE R
Boring No: FD-87-23 (Y)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH NTS



NED FORM 59 (Test) MAR 71

Boring No. 23

FD-87-24

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO #020

Site WINNIPESAUKEE RIVER

Page 1 of 3 Pages

Hole No. FD-87-24(X) Diam. (Casing) 4"

Boring Started 1-30-87

Co-ordinates: STA # 842+00 ℄

Boring Completed 1-30-87

Drilled by DAVIS + BOYER

Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 476.0 M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 470.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½ In. Diam. 3 No.

Soil Samples — In. Diam. — No.

River Water Table Depth 3.5'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	2½ O.D. SOLID SPLIT SPOON

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Prepared by PAUL FISHER
Field Data Lab. Data

Submitted by ATLANTIC TESTING LAB

MED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R. Page 1 of 3 Pages

Boring No. FD-87-24 Desig. X Diam. (Casing) 4"

Co-ordinates: N STA 842+00 E ℄

Elevation Top of Boring 476.0 M.S.L. Hammer Wt. 140# Boring Started 1-30-87

Total Overburden Drilled 6 Feet Hammer Drop 30" Boring Completed 1-30-87

Elevation Top of Rock — M.S.L. Casing Left —

Total Rock Drilled 0 Feet Subsurface Water Data — Page —

Elevation Bottom of Boring 470.0 M.S.L. Obs. Well —

Total Depth of Boring 6 Feet Drilled By DAVIS + BOYER

Core Recovered — % No. Boxes — Mfg. Des. Drill 10 HP CATHEAD + TRI 900

Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FISHER

Soil Samples 2½ In. Diam. 3 No. Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. Classification By: —

DEPTH 1" = 2	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
2	S-1	2½	0-2	6 7 7 9	3" OD DRIVEN SPLIT SPOON IN OPEN HOLE (VERY LITTLE CAVE-IN)	GREY SAND SOME SILT (SP-SM) (MED. DENSE)
4	S-2	2½	2-4	4 4 9 10		GREY SAND (SP) (MED. DENSE)
6	S-3	2½	4-6	9 10 10 11		AS ABOVE
					EXPLORATION TERMINATED	≈ 6'

GENERAL REMARKS: SANDY RIVER BOTTOM

FORM 58 (Test)

Boring No. FD-87-24

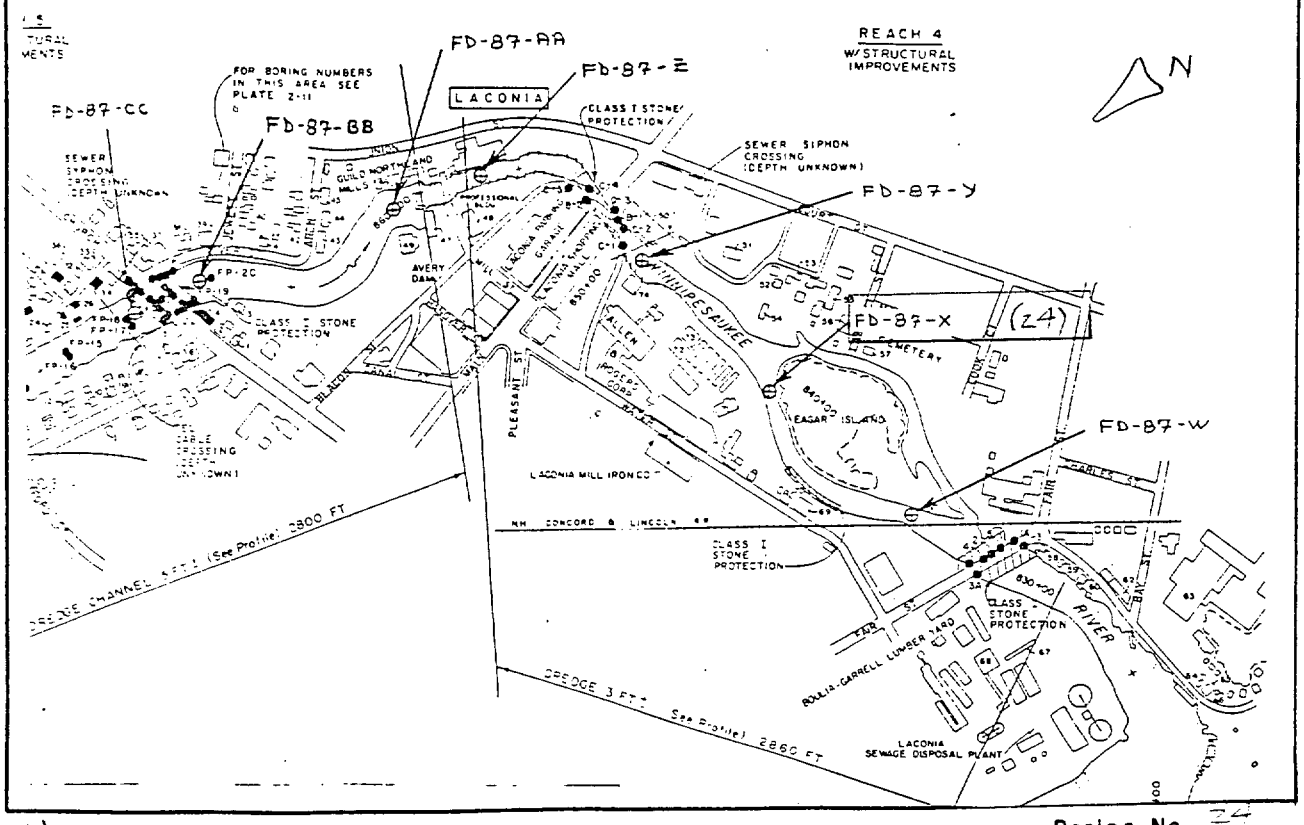
Site: WINNIPESAUKEE R
Boring No: FD-87-24 (X)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 24

FD-87-25

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, D.O. #020

Site: WINNIPESAUKEE RIVER — Page 1 of 3 Pages

Hole No. FD-87-25(W) — Diam. (Casing) 4" — Boring Started 1-30-87

Co-ordinates: STA N 824+00 B ℄ — Boring Completed 1-30-87

Drilled by DAVIS + BOYER — Report Submitted

Purpose of Exploration: STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 478.0 M.S.L. — Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 472.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 2½ In. Diam. 3 No.

Soil Samples — In. Diam. — No. — RIVER Water Table Depth 6.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" OD DRIVEN SPLIT SPOON

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Prepared by PAUL FISHER — Field Data — Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121 — REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R Page 2 of 3 Pages
Boring No. 25 Desig. W Diam. (Casing) 4"
Co-ordinates: N STA 834 + 00 E ℄

Elevation Top of Boring 478.0 M.S.L. Hammer Wt. 140 # Boring Started 1-30-87
Total Overburden Drilled 6 Feet Hammer Drop 30"
Elevation Top of Rock — M.S.L. Casing Left — Boring Completed 1-30-87
Total Rock Drilled 0 Feet Subsurface Water Data — Page —
Elevation Bottom of Boring 472.0 M.S.L. Obs. Well —
Total Depth of Boring 6 Feet Drilled By DAVIS & BOYER
Core Recovered — % No. Boxes — Mfg. Des. Drill 10 HP CATHEAD + TRIPOD
Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FISHER
Soil Samples 2 1/2 In. Diam. 3 No. Classification By: PAUL FISHER
Soil Samples — In. Diam. — No. Classification By: —

DEPTH 1" = 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2 1/2	0-2	6 6 7 9	3" D.O. DRIVEN SPLIT SPOON IN OPEN HOLE (VERY LITTLE CAVE-IN	BROWN SAND (SW) (MED. DENSE)
2	S-2	2 1/2	2-4	9 9 10 14		AS ABOVE
4	S-3	2 1/2	4-6	12 12 16 21		AS ABOVE
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: SANDY RIVER BOTTOM

RM 58 (Test)

Boring No. ED-87-25

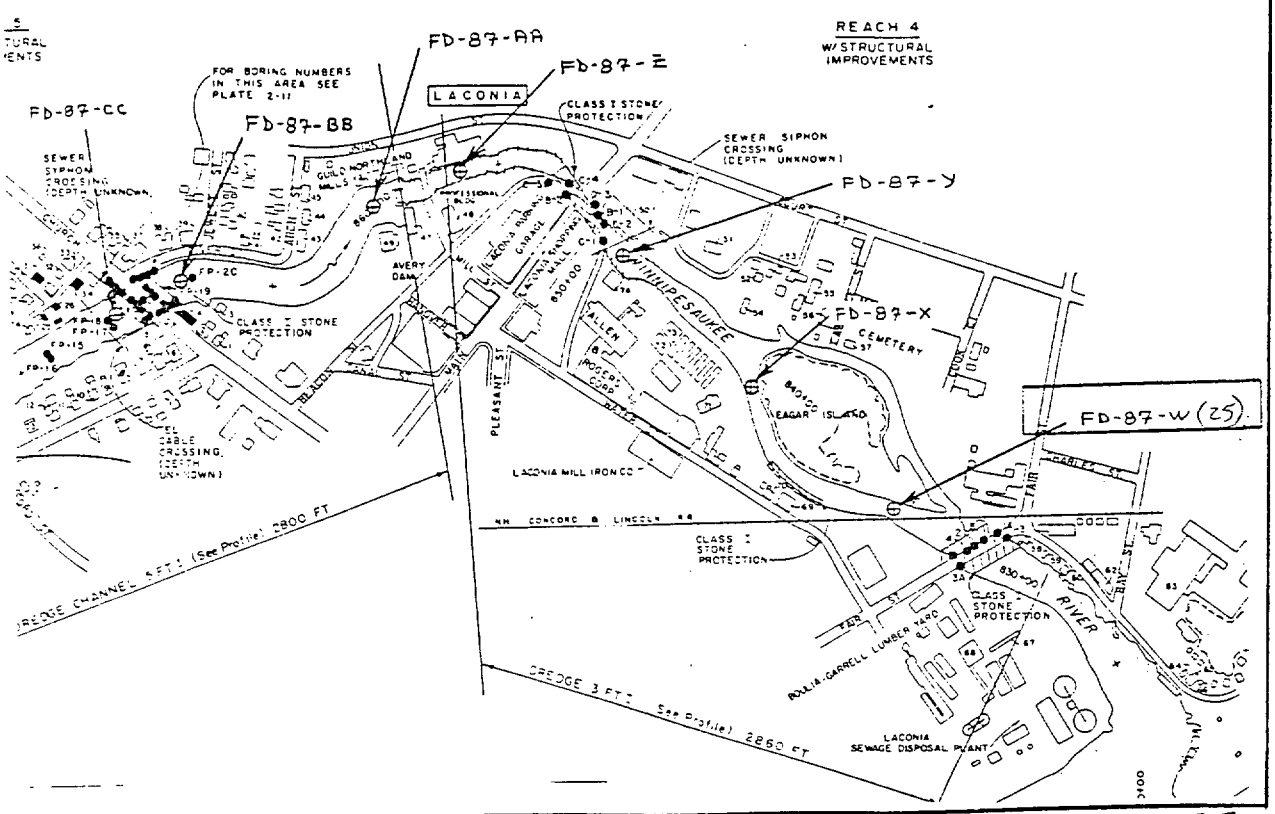
Site: WINNIPESAUKEE R
Boring No: FD-87-25 (W)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



NED FORM 59 (Test) MAR 71

Boring No. 25

FD-87-26

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, D.O. #020

Site: WINNIPESAUKEE RIVER

Page 1 of 3 Pages

Hole No. FD-87-26 (3) Diam. (Casing) 4"

Boring Started 2-3-87

Co-ordinates: STA 292+00 ℄

Boring Completed 2-3-87

Drilled by DAVIS & BOWER

Report Submitted

Purpose of Exploration: STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 439.0 M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 433.0 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — in.

Soil Samples 2 1/4 in. Diam. — No.

Soil Samples — in. Diam. — No.

RIVER WAS LOWERED ≈ 1.3'

RIVER Water Table Depth 3.5'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3 PORTLAND SOLID CROWN

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Prepared by DAVE FISHER
Field Data

Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 3 Pages

Boring No. FD-87-26 Desig. B Diam. (Casing) 4"

Co-ordinates: STA 292+00 ℄

Elevation Top of Boring 439.0 M.S.L. — Hammer Wt. 140# — Boring Started 2-3-87

Total Overburden Drilled 6 Feet — Hammer Drop 30" — Boring Completed 2-3-87

Elevation Top of Rock — M.S.L. — Casing Left —

Total Rock Drilled 0 Feet — Subsurface Water Date — Page —

Elevation Bottom of Boring 433.0 M.S.L. — Obs. Well —

Total Depth of Boring 6 Feet — Drilled By DAVIS & BOYER

Core Recovered —% No. Boxes — — Mfg. Des. Drill 10 HP CATHEAD & TRIPOD

Core Recovered — Ft : — Diam. — In. — Inspected By: PAUL FISHER

Soil Samples 2½ In. Diam. 3 No. — Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. — Classification By: —

DEPTH (1" = 2')	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	8, 10, 10, 14	3" OD DRIVEN SPLIT SPOON IN OPEN HOLE (VERY LITTLE CAVE-IN)	BROWN GRAVELLY SAND TRACE SILT (SW) (MED DENSE)
2	S-2	2½	2-4	10, 10, 12, 16		AS ABOVE
4	S-3	2½	4-6	64, 34, 30, 32		AS ABOVE (VERY DENSE)
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: RIVER BOTTOM COVER WITH GRAVEL AND COBBLES

Site: WINNIPESAUKEE R.
Boring No: FD-87-26 (B)

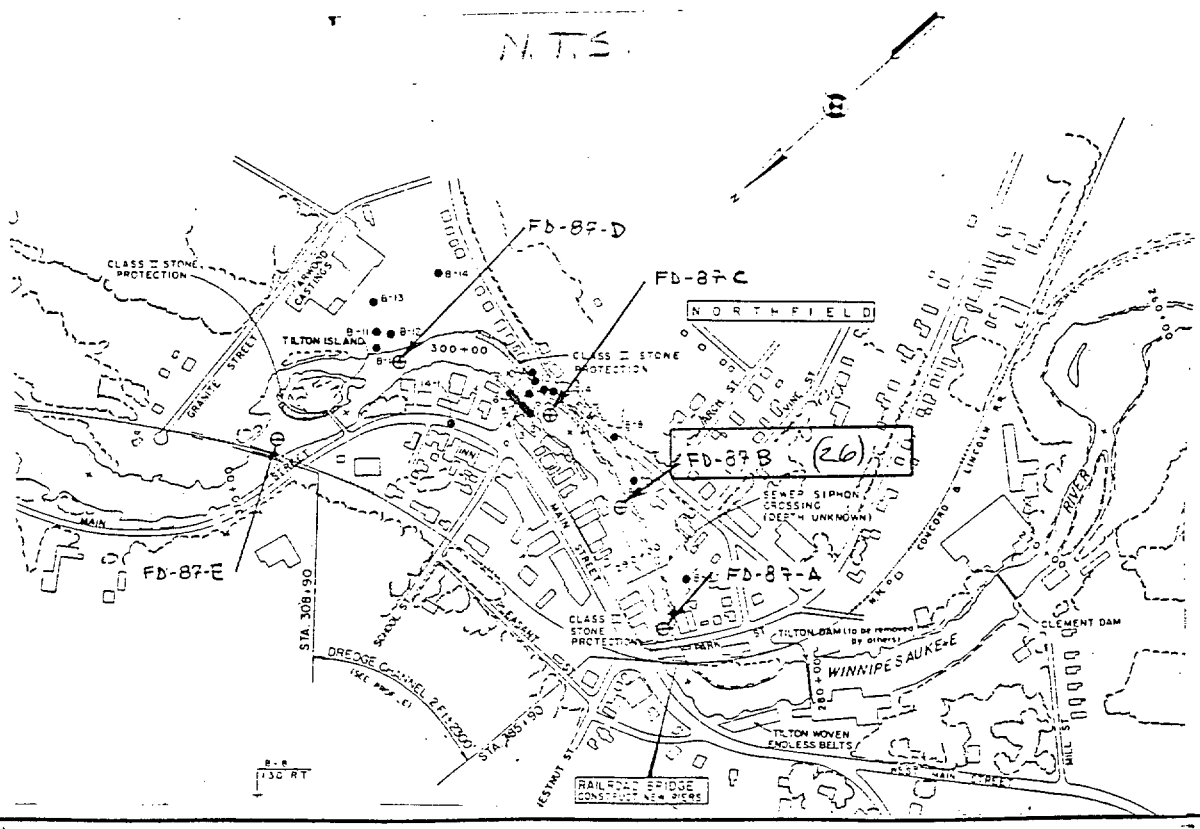
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



FD-87-27

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO #020

Site: WINNIPESAUKEE RIVER — Page 1 of 3 Pages

Hole No. FD-87 27 (A) Diam. (Casing) 4" — Boring Started 2-3-87

Co-ordinates: STA 289+00 @ ℄ — Boring Completed 2-3-87

Drilled by DAVIS & BOYER — Report Submitted

Purpose of Exploration: STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 438.0 M.S.L.
Total Overburden Drilled 6 Feet
Elevation Top of Rock —
Elevation Bottom of Hole 432.0 M.S.L.
Total Rock Drilled 0 Feet
Total Depth of Hole 6 Feet
Core Recovered — %
Core Recovered — Ft.: — Diam. — In.
Soil Samples 2½ In. Diam. 3 No.
Soil Samples — In. Diam. — No.

Casing Left in Place NONE Feet

RIVER WAS LOWERED TO 1.5'

RIVER Water Table Depth 2.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	3" O.D. DRIVEN SPLIT SPOON

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Prepared by PAUL FISHER — Field Data — Lab. Data

Submitted by SOIL TESTING LAB

NED FORM DEC 63 121 — REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 1 of 3 Pages

Boring No. FO-87-27 Desig. A Diam. (Casing) 4"

Co-ordinates: STA 289+00 ℄

Elevation Top of Boring 438.0 M.S.L. — Hammer Wt. 140 # — Boring Started 2-3-87

Total Overburden Drilled 6 Feet — Hammer Drop 30" — Boring Completed 2-3-87

Elevation Top of Rock — M.S.L. — Casing Left —

Total Rock Drilled 0 Feet — Subsurface Water Date — Page —

Elevation Bottom of Boring 432.0 M.S.L. — Obs. Well —

Total Depth of Boring 6 Feet — Drilled By DAVIS + BOYER

Core Recovered — % No. Boxes — — Mfg. Des. Drill 10 HP CATHEAD + TRIPOD

Core Recovered — Ft : — Diam. — In. — Inspected By: PAUL FISHER

Soil Samples 2½ In. Diam. 3 No. — Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. — Classification By: —

DEPTH 1' 2	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-1	2½	0-2	17 15 18 20	3" OD DRIVEN SPLIT SPOON IN OPEN HOLE (VERY LITTLE CAVE-IN)	GREY GRAVELLY SAND SOME SILT (SW-SM) (DENSE)
2	S-2	2½	2-4	10 12 11 14		AS ABOVE (MED DENSE)
4	S-3	2½	4-6	20 21 20 20		GREY SANDY SILT TRACE GRAVEL (ML-SM) (DENSE)
6					EXPLORATION TERMINATED	2.5'

GENERAL REMARKS: RIVER BOTTOM COVERED WITH COBBLES AND BOULDERS

Site: WINNIPESAUKEE R.
Boring No: FD-87-27 (A)

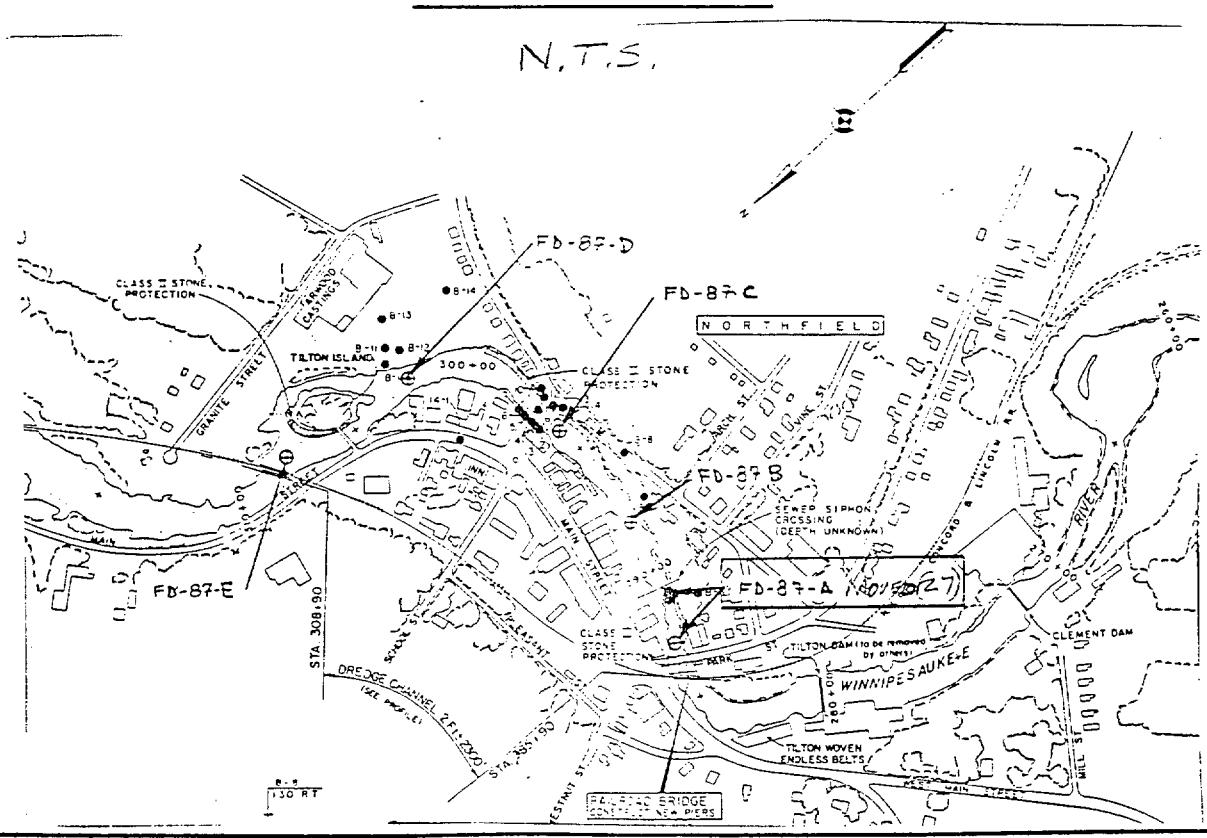
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



NFD FORM 59 (Test)
MAR 71

Boring No. 27

FD-87-28

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, DO #020

Site WINNIPESAUKEE RIVER

Page 1 of 3 Pages

Hole No. FO-87-23 (C) Diam. (Casing) 4"

Boring Started 2-3-87

Co-ordinates: STA N 296+00 E ℄

Boring Completed 2-3-87

Drilled by DAVIS + BOYER

Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS OF RIVER CHANNEL

Elevation Top of Hole 441.5 M.S.L.

Casing Left in Place NONE Feet

Total Overburden Drilled 6 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 435.5 M.S.L.

Total Rock Drilled 0 Feet

RIVER WAS LOWERED @ 1.3'

Total Depth of Hole 6 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — in.

Soil Samples 2½ in. Diam. — No.

Soil Samples — in. Diam. — No.

RIVER Water Table Depth 2.0'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	6	2" OD DRIVEN SOIL-SPOON

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Prepared by PAUL FISHER
Field Data Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIDESAUKEE R — Page 2 of 3 Pages

Boring No. FD-87-28 Desig. C Diam. (Casing) 4"

Co-ordinates: STA 296+00 ℄

Elevation Top of Boring 441.5 M.S.L.
Total Overburden Drilled 6 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 435.5 M.S.L.
Total Depth of Boring 6 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 2½ In. Diam. — No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140# Boring Started 2-3-87
Hammer Drop 30"
Casing Left — Boring Completed 2-3-87
Subsurface Water Data — Page —
Obs. Well —
Drilled By
Mfg. Des. Drill 10 HP CATHEAD + TRIPOD
Inspected By: PAUL FISHER
Classification By: PAUL FISHER
Classification By: —

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	—	2½	0-2	19, 21, 22, 22	3" OD DRIVEN SPLIT SPOON IN OPEN HOLE; NO RECOVERY	BROWN GRAVELLY SAND, TRACE SILT (SW) (DENSE)
2	S-1	2½	2-4	18, 26, 27, 30		AS ABOVE (VERY DENSE)
4	S-2	2½	4-6	37, 34, 33, 33		AS ABOVE
6					EXPLORATION TERMINATED @ 6'	

GENERAL REMARKS: RIVER BOTTOM COVERED WITH GRAVEL AND COBBLES

Site: WINNIPESAUKEE R.
Boring No: FD-87-28 (C)

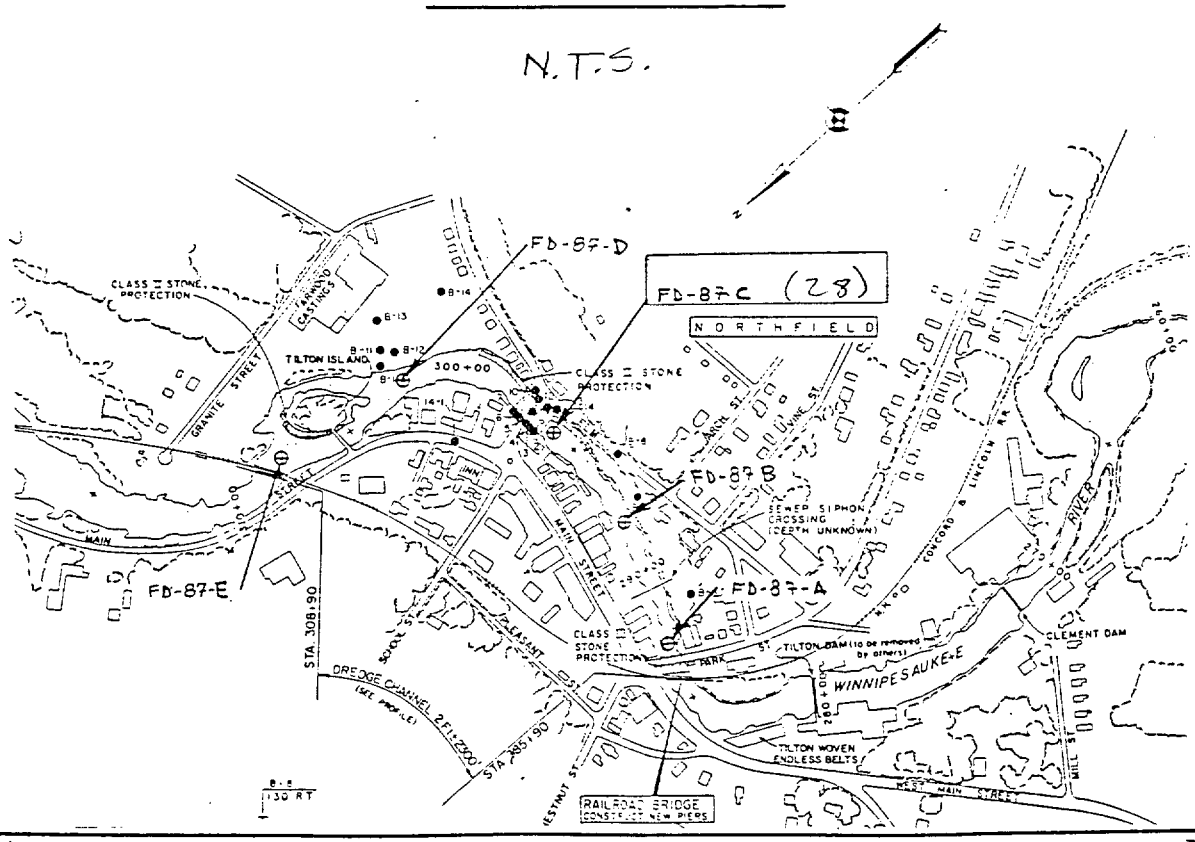
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
						N/A

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

N.T.S.



FD-87-29

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW33-85-D-0011, 00 0020

Site WINNIPESAUKEE RIVER

Page 1 of 4 Pages

Hole No. FD-87-29 (FA) Diam. (Casing) 3 1/8

Boring Started 2/20/87

Co-ordinates: STA 946+00 E 35' RT OF ℄

Boring Completed 2/20/87

Drilled by CAMBRIDGE + BURNHAM

Report Submitted

Purpose of Exploration STUDY SUBSURFACE CONDITIONS AT THE USGS GAGING STATION

Elevation Top of Hole 504.9 M.S.L.

Total Overburden Drilled 25 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 479.9 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 25 Feet

Core Recovered — %

Core Recovered — Ft.: — Diam. — In.

Soil Samples 1 3/8 In. Diam. 9 No.

Soil Samples — In. Diam. — No.

Casing Left in Place None Feet

Water Table Depth 2.3'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	5	SET 3 1/8" ID HOLLOW STEM AUGER
5	25	2" OD DRIVEN SPLIT SPOON
		FOLLOWED BY 3 1/8" ROLLER
		BIT

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Prepared by PAUL FISHER
Field Data

Lab. Data

Submitted by ATLANTIC TESTING LAB

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R Page 2 of 4 Pages

Boring No. FD-87-29 Desig. FF Diam. (Casing) 3 1/8

Co-ordinates: STA 946+00 RT 35' OF ℄

Elevation Top of Boring 504.9 M.S.L. Hammer Wt. 140# Boring Started 2/20/87

Total Overburden Drilled 25 Feet Hammer Drop 12" Boring Completed 2/20/87

Elevation Top of Rock — M.S.L. Casing Left —

Total Rock Drilled 0 Feet Subsurface Water Date — Page —

Elevation Bottom of Boring 479.9 M.S.L. Obs. Well —

Total Depth of Boring 25 Feet Drilled By CAMBRIDGE + BURNHAM

Core Recovered — % No. Boxes — Mfg. Des. Drill CME 45 ON TRACKS

Core Recovered — Ft. — Diam. — In. Inspected By: PAUL FISHER

Soil Samples 1 3/8 In. Diam. 9 No. Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. Classification By: —

DEPTH		CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	2					3 1/8" ID HOLLOW STEM AUGER SET TO 5'	WEIR ACCESS ROAD BROWN, GRAVELLY SAND, LITTLE SILT (FILL) (SP-GP)
	4						
5.0							
	6	S-1	1 3/8	5-7	4 5 6 12	2" OD x 2' DRIVEN SPLIT SPOON IN OPEN HOLE FOLLOWED BY 3 1/8 ROLLER BIT	BROWN GRAVELLY SAND, LITTLE SILT (FILL) (SP-GP) (MED. DENSE)
7.0							
	8	S-2	1 3/8	7-9	4 21 8 5		AS ABOVE
9.0							
	10	S-3	1 3/8	9-11	2 12		AS ABOVE (DENSE)

GENERAL REMARKS:
BORING PERFORM ON USGS GAGING STATION ACCESS ROAD

Site	Boring No.	Page 3 of 4
WINNIPESAUKEE R.	FD-87-29	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
11.0	S-3 CONT.	1 3/8	9-11	26 30	2" OD x 2' DRIVEN SPLIT SPOON FOLLOWED BY 3 1/8" HOLLOW-STEM AUGER	BROWN GRAVELLY SAND, LITTLE SILT (FILL) (SP-GP)(DENSE)
13.0	S-4	1 3/8	11-13	4 6 4 13	WOOD @ 13'	AS ABOVE (MED DENSE)
15.0	S-5	1 3/8	13-15	18 5 15 23		BROWN SAND, SOME GRAVEL, TRACE SILT (SW) (MED DENSE)
17.0	S-6	1 3/8	15-17	35 35 25 20		AS ABOVE (VERY DENSE)
19.0	S-7		17-19	30 34 37 42		BROWN FINE SAND SOME GRAVEL, LITTLE SILT (SP) (VERY DENSE)
21.0	—	—	19-21	—	UNABLE TO SAMPLE DUE TO COBBLES	
23.0	S-8	1 3/8	21-23	25 42 41 38		AS ABOVE
25.0	S-9	1 3/8	23-25	30 42 40 25		AS ABOVE
					EXPLORATION TERMINATED @ 25'	

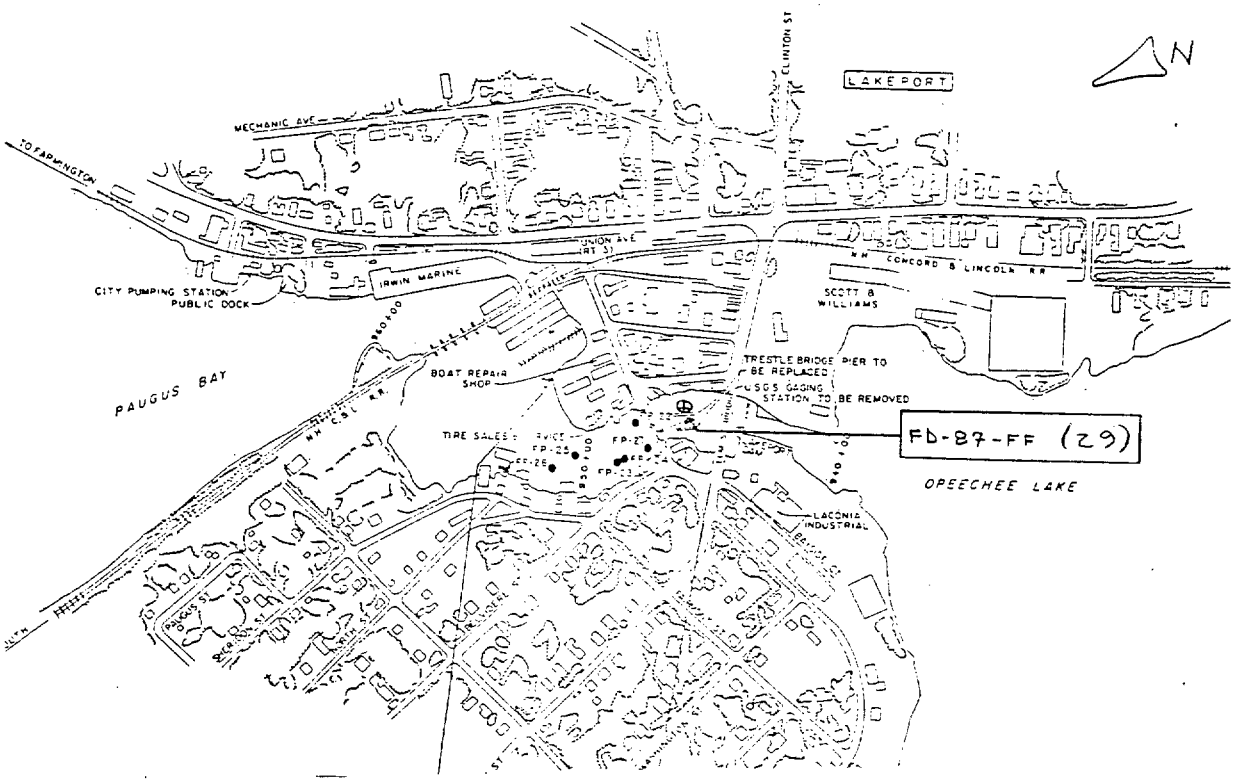
Site: WINNIPESAUKEE R.
Boring No: FD-87-29 (FF)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
2/20	1000	5.0	5.0	2.3		LEVEL NOTED
						DURING DRILLING
						OPERATION 15 MIN
						STABILIZATION TIME

Note: Depths are in feet below original ground

BORING LOCATION SKETCH N.T.S.



FD-87-30

CORPS OF ENGINEERS, U. S. ARMY
NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. DACW-33-85-D-0011

Site: WINNIPESAUKEE RIVER

Page 1 of 7 Pages

Hole No. FD-87-30(J) Diam. (Casing) 4"

Boring Started 2/21/87

Co-ordinates: N _____ E _____ 142' W. OF RT 140 & 92' N OF RIVER ℄

Boring Completed 2/21/87

Drilled by CAMBRIDGE & CRAIG

Report Submitted _____

Purpose of Exploration: PROPOSED GATE STRUCTURE

Elevation Top of Hole 469.1 M.S.L.

Total Overburden Drilled 25 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 444.1 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 25 Feet

Core Recovered _____ %

Core Recovered — Ft.: — Diam. — in.

Soil Samples 1 3/8 in. Diam. 10 No.

Soil Samples — in. Diam. — No.

Casing Left in Place NONE Feet

Water Table Depth 5.0

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	25	2"OD DRIVEN SPLIT SPOON
		FOLLOWED BY 4" DRIVEN CASING.
		AND 3 1/2" ROLLER BIT

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Prepared by PAUL FISHER
Field Data

Submitted by ATLANTIC TESTING LAB
Lab. Data

NED FORM DEC 63 121

REPLACES EDITION OF JUN 51 WHICH MAY BE USED UNTIL EXHAUSTED

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site WINNIPESAUKEE R — Page 2 of 7 Pages

Boring No. FD-87-30 Desig. J Diam. (Casing) 4"

Co-ordinates: STA 142' W of Rt. 140 ℄, 92' N. of River ℄

Elevation Top of Boring 469.1 M.S.L. — Hammer Wt. 140# — Boring Started 2/21/87

Total Overburden Drilled 25 Feet — Hammer Drop 18" — Boring Completed 2/21/87

Elevation Top of Rock — M.S.L. — Casing Left —

Total Rock Drilled 0 Feet — Subsurface Water Date — Page —

Elevation Bottom of Boring 444.1 M.S.L. — Obs. Well —

Total Depth of Boring 25 Feet — Drilled By CAMBRIDGE + CRAIG

Core Recovered — % No. Boxes — — Mfg. Des. Drill CME 45 ON TRACK

Core Recovered — Ft. — Diam. — In. — Inspected By: CAMBRIDGE + CRAIG

Soil Samples 1 3/8 In. Diam. 10 No. — Classification By: PAUL FISHER

Soil Samples — In. Diam. — No. — Classification By: —

DEPTH 1" = 2	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
2	S-1	1 3/8	0-2	2 4 5 4	2" OD DRIVEN SPLIT SPOON FOLLOWED BY 4" DRIVEN CASING AND 3 1/2" ROLLER BIT	BLACK, ORGANIC SILT LITTLE CLAY, TRACE SAND (OL) (STIFF)
4	S-2	1 3/8	2-4	16 79 73 75		BROWN SAND SOME GRAVEL, TRACE SILT (SP) (VERY DENSE)
5	S-3	1 3/8	4-5	30 43		GREY FINE SAND SOME SILT, TRACE GRAVEL (SC-SM) (VERY DENSE)
7	—	—	5-7	—	PERMEABILITY TEST	
9	S-4		7-9	34 43 52 49		AS ABOVE
10	S-5		9-10	50 55		AS ABOVE

GENERAL REMARKS:

Site	Boring No.	Page 3 of 7
WINNIPESAUKEE R.	FD-87-30	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10			10-12		PERMEABILITY TEST	
12	S-6	1 3/8	12-12.8	30 100/.2	END 4" CASING PENETRATION	GREY FINE SAND, LITTLE SILT, LITTLE GRAVEL, NUMEROUS COBBLES INCOUNTERED (SP) (VERY DENSE)
12.8			12.8-15		ROLLER BIT THROUGH ≈2' BOULDER, NO SAMPLE	
15			15-17		PERMEABILITY TEST	
17	S-7	1 3/8	17-18.4	54 89 100/.4		AS ABOVE
18.4					COBBLES, ROLLER BIT	
19	S-8	1 3/8	19-20	64 86		AS ABOVE
20	S-9	1 3/8	20-22	64 69 75 80		AS ABOVE
22	S-10	1 3/8	22-23.5	62 80 100/1.5		AS ABOVE
23.5			23.5-25		ROLLER BIT DUE TO COBBLES, NO SAMPLE	
25					EXPLORATION TERMINATED @ 25'	

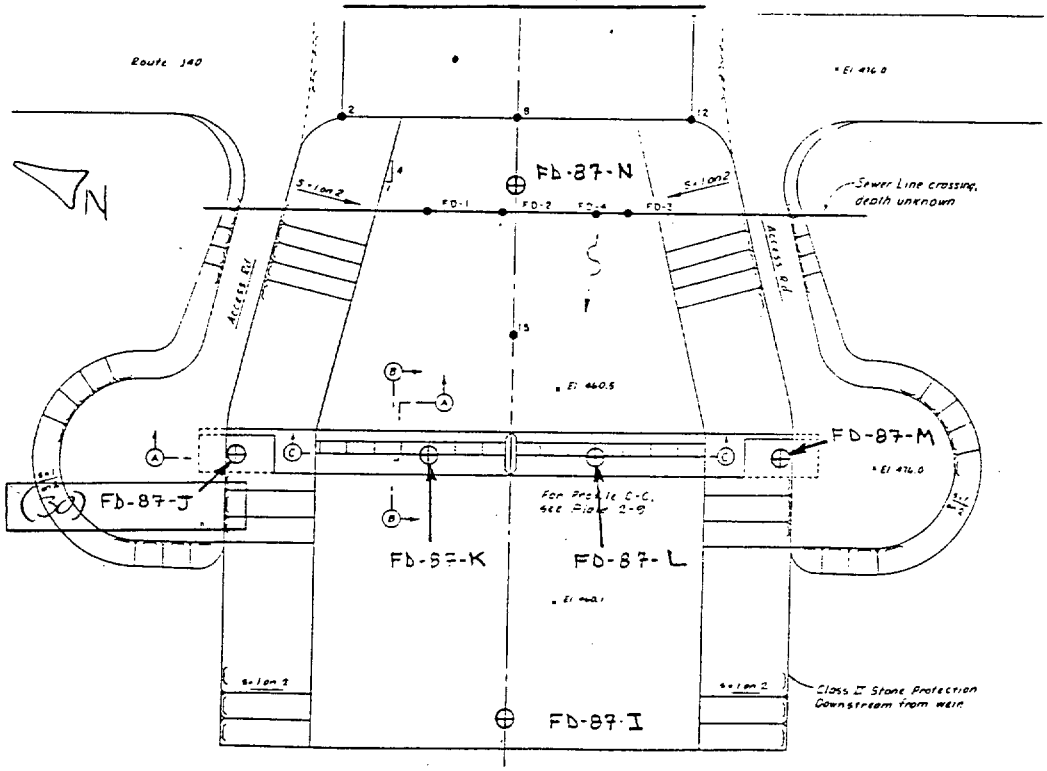
Site: WINNIPESAUKEE R
Boring No: FD-87-30(J)

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
2/21/87	0730	4	5	≈5		NOTED WATER
						LEVEL FROM
						MOISTURE CHANGE
						IN SAMPLE, WATER
						LEVEL DID NOT
						STABILIZE (SEE
						PERM TESTS)

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



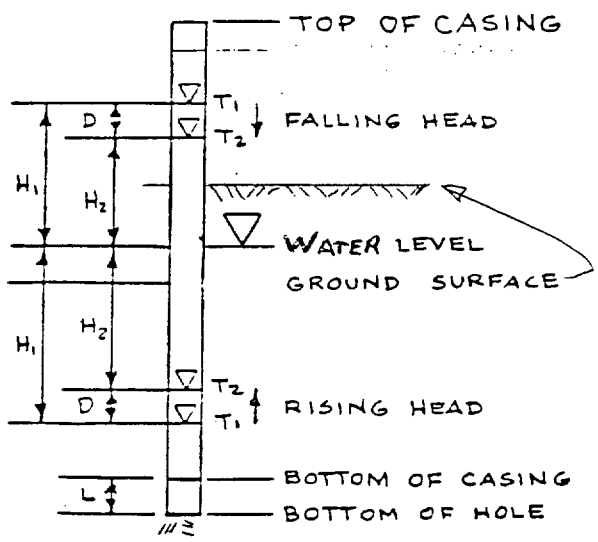
FIELD PERMEABILITY TEST RESULTS

DATE: 2/21/87	BORING No: FB-87-30	DEPTH: 5'-7'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2'	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 5.50		0	0	H_1 = .85	
1	.07	5.42		1	0	.85	
2	.12	5.38		2	0	.85	
3	.25	5.25		4	0	.85	
4	.33	5.17		6	0	.85	
5	.45	5.05		8	0	.85	
6	.57	4.93		10	0	.85	
7	.72	4.78					
8	.82	4.68					
10	.90	4.60					

NOTES: BORING PERFORMED ON LAND

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1+\left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

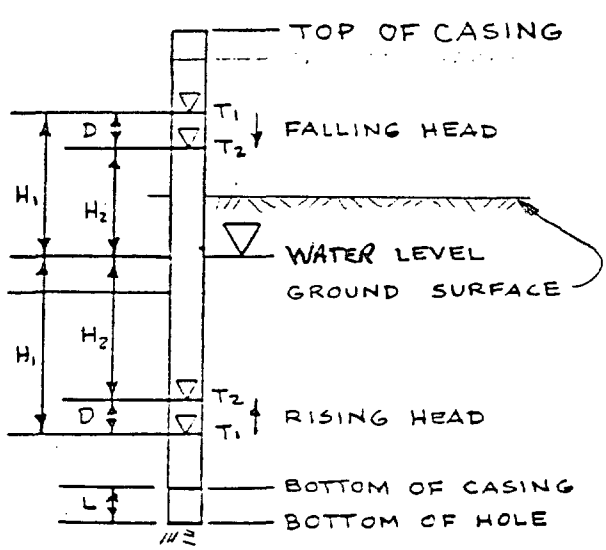
FIELD PERMEABILITY TEST RESULTS

DATE: 2/21/87	BORING No: FD-87-30	DEPTH: 10'-12'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 2'	H_1 = SEE BELOW, m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 5.60'		0	0	H_1 = 6.20	
1	.08	5.52		1	.06	6.14	
2	.13	5.47		2	.14	6.06	
3	.19	5.41		3	.22	5.98	
4	.25	5.35		4	.30	5.90	
7	.42	5.18		6	.43	5.77	
12	.52	5.08		8	.57	5.63	
				10	.60	5.60	

NOTES: BORING PERFORMED ON LAND

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1+\left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$

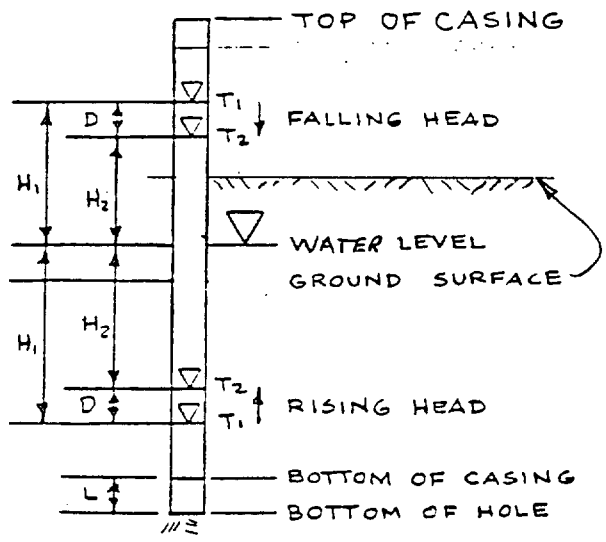
FIELD PERMEABILITY TEST RESULTS

DATE: 2/21/87	BORING NO: 30 (FD-87)	DEPTH: 15'-17'	INSPECTOR: PAUL FISHER
D_o = 4.5"	D_i = 4.0"	L = 42' (SEE NOTE)	H_1 = SEE BELOW; m = 3

FALLING HEAD				RISING HEAD			
ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H	ELAPSED TIME ($t_2 - t_1$)	D ($H_2 - H_1$)	H_2 ($H_1 - D$)	K_H
0	0	H_1 = 8.50		0	0	H_1 = 9.20	
1	.54	7.96		1	.43	8.72	
2	1.00	7.50		2	.93	8.27	
3	1.46	7.04		3	1.43	7.77	
4	1.75	6.75		4	1.90	7.30	
5	2.04	6.46		6	2.69	6.51	
6	2.35	6.15		8	3.45	5.75	
7	2.58	5.92		10	4.23	4.97	
8	2.81	5.69					
9	2.92	5.58					
10	3.19	5.31					
11	3.50	5.00					
12	3.58	4.92					
14	3.92	4.58					

NOTES: THE 4" CASING COULD ONLY BE DRIVEN TO 12.8' DUE TO OBSTRUCTIONS (SEE LOG). A 3 1/8" ROLLER BIT WAS ADVANCED TO 17'. THE PERM TEST WAS THEN PERFORMED.

SCHEMATIC



SYMBOLS

D_o = OUTSIDE DIAMETER OF CASING (CM)
D_i = INSIDE DIAMETER OF CASING (CM)
L = LENGTH OF SAMPLE (CM)
m = TRANSFORMATION RATIO
H = PIEZOMETRIC HEAD
T = TIME (SEC.)
k_h = HORIZONTAL PERMEABILITY (CM/SEC)
D = CHANGE IN H

$$K_h = \frac{D_i^2 \ln\left[\frac{mL}{D_o} + \sqrt{1 + \left(\frac{mL}{D_o}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$K_h = \frac{D_i^2 \cdot \ln\left(\frac{2mL}{D_o}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad \text{for } \frac{mL}{D_o} > 4$$