ATLANTIC TESTING LABORATORIES, LIMITED
Sustaining Member—N.Y.S. Society of Professional Engineers

Box 29
Canton, N.Y. 13617
(315) 386-4578

Box 356
Cicero, N.Y. 13039
(315) 699-5281

October 8, 1987

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

Attn: Chief, Engineering Division, NEDED

Re: Piezometer Installation and Survey Program
Townshend Dam, Townshend, VT
North Springfield Dam, North Springfield, VT
Delivery Order No. 0023
ATL Report No. CD025-026-1-8-87

Gentlemen:

In accordance with Delivery Order No. 0023, dated June 23, 1987, attached is one final copy of our Engineering Report for the subsurface investigation performed at Townshend Dam, Townshend, Vermont, and North Springfield Dam, North Springfield, Vermont.

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

If you have any questions or comments, please feel free to contact me.

Respectfully submitted,

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

SFT/GRH/smf

2 cc: Chief, Geotechnical Engineering Branch

atts.

SECTION 1
SURVEY, INSPECTION, EXPLORATION
AND
PIEZOMETER INSTALLATION

TOWNSHEND AND NORTH SPRINGFIELD DAMS, VERMONT

CONTRACT DACW 33-85-D-0011
CONTRACTING OFFICER:
THOMAS A. RHEN, COLONEL, CE
DIVISION ENGINEER
23 JUNE 1987

DELIVERY ORDER NO. 0023

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

PREPARED BY: Gregory R. Hargrave
Atlantic Testing Laboratories, Limited
P.O. Box 29
Canton, NY 13617

Report No. CD025-026-1-8-87

August 31, 1987

SECTION 2

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SECTION 1 Title Page

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SECTION 3 Scope of Investigation
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- b. Project Site
- c. Purpose
- d. Scope of Work

SECTION 4 Quality Control
- a. General Certification Statement
- b. Records Taken
- c. Equipment Used
- d. Procedures

SECTION 5 Summary of Activities and Telephone Log
- Table I Summary of Activities
- Table II Telephone Log

SECTION 6 Chain of Custody Logs

SECTION 7 Safety Reports

SECTION 8 Field Inspector's Logs
- a. Figure 1 - General Project Map
- b. Figure 2 - Site Location Map
- c. Figure 3 - Boring Location Plan
- d. Boring Logs

SECTION 9 Other Records Taken
- a. Control Point Sketch

SECTION 3

SCOPE OF INVESTIGATION

a. DELIVERY ORDER NO. 0023

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/PURCH ORDER NO.: DACW33-85-D-0011
2. DELIVERY ORDER NO.: 0023
3. DATE OF ORDER: 87 JUN 23
4. REQUISITION/PURCH REQUEST NO.: GEB-87-78

6. ISSUED BY: Dept. of the Army CODE
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149
Buyer/Symbol: Apidianakis/CENED-CT-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, New York 13617

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

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

12. DISCOUNT TERMS
NET

13. MAIL INVOICES TO:
SEE BLOCK 15

14. ~~SHIP TO~~: Services For: CODE
U.S. Army Engineer Division, New England
ATTN: Geotechnical Engineering Branch
424 Trapelo Road
Waltham, Massachusetts 02254-9149

15. PAYMENT WILL BE MADE BY: CODE
Finance and Accounting Officer at Issuing Office

MARK ALL PACKAGES AND PAPERS WITH CONTRACT OR ORDER NUMBER

16. TYPE OF ORDER

DELIVERY	X	This delivery order is subject to instructions contained on this side of form only and is issued [redacted] in accordance with and subject to terms and conditions of above numbered contract.
PURCHASE		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 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 COOR
EJA/ejh

17. ACCOUNTING AND APPROPRIATION DATA/LOCAL USE
96X3123 Operations & Maintenance CE Civil
CC119074000K000 $15,425.10
CC123074000K000 $35,991.90

18. ~~ITEM NO.~~ Contract Line	19. SCHEDULE OF SUPPLIES/SERVICES	20. QUANTITY ORDERED/ ACCEPTED *	21. UNIT	22. UNIT PRICE	23. AMOUNT
	Furnish necessary services and equipment for piezometer installation and survey at Townshend and North Springfield Dams, Vermont	APPROX.			ESTIMATED
1.2	Geotechnical Inspector	240	hr	$40.00	$9,600.00
1.3	Per Diem - Overnight Stay	40	day	45.00	1,800.00
1.4	Mileage from Waltham, MA and Return	220	mi	.35	77.00
2.1	Geotechnical Report	1	job	60% of Line Item 1.2	5,760.00
					ESTIMATED

* *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 ~~$51,417.00~~
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
Exception Approved March 1977

CONTINUATION SHEET

REF NO OF DOC BEING CONTD
Delivery Order No. 0023 to DACW33-85-D-0011

NAME OF OFFEROR OR CONTRACTOR

ATLANTIC TESTING LABORATORIES, LTD.

Contract Line ITEM NO	SUPPLIES/SERVICES	QUANTITY APPROX.	UNIT	UNIT PRICE	AMOUNT ESTIMATED
3.1	Mobilization & Demobilization	1	job	$180.00	$180.00
3.3	Mileage from/to Contractor's equipment storage site (Manchester, NH or Canton, NY)	150	mi	.35	52.50
3.4	Survey Crew & Equipment	3	day	440.00	1,320.00
3.5	Overnight Per Diem for Survey Crew	2	day	90.00	180.00
3.6	Data Reduction & Plotting	1	job	100% of Line Item 3.4	1,320.00
6.1	Mobilization & Demobilization	2	job	700.00	1,400.00
6.3	Mileage from/to Contractor's Main Equipment Storage Site (Manchester, NH or Canton, NY)	150	mi	1.15	172.50
6.5	Standby time/on site moves	64	hr	75.00	4,800.00
9.1	Bulldozer (150 HP) with Operator	24	hr	70.00	1,680.00
13.1	0-30 ft. depth	10	ea	13.00	130.00
13.2	31-50 ft. depth	4	ea	16.00	64.00
13.3	51-100 ft. depth	6	ea	20.00	120.00
18.1	BX, NX Size	60	lf	18.00	1,080.00
18.2	HX and 6 Inch Size	205	lf	28.00	5,740.00
19.1	NX Size Casing	40	lf	15.00	600.00
19.5	HX Size Casing	78	lf	18.00	1,404.00
20.1	NX Casing	110	lf	20.00	2,200.00
20.3	HX Casing	78	lf	25.00	1,950.00
22.2	BWX Size and/or BWM	30	lf	40.00	1,200.00
22.3	NWX Size and/or NWM	15	lf	45.00	675.00
22.4	4" x 5½" Size Double Tube Barrel	10	lf	70.00	700.00
24.1	Casagrande type/or Equal 0-50 ft. Depth	244	lf	15.00	3,660.00
24.2	Casagrande type/or Equal, over 50 ft. Depth	136	lf	17.00	2,312.00
30.1	Light Lumber for Shoring Excavation	2	MBF	620.00	1,240.00

ATTACHMENT NO 1

GEB REQUISITION NO. 87-78 DACW33-85-D-0011

DELIVERY ORDER NO 0023

EXPLORATION, PIEZOMETER INSTALLATION,

PIEZOMETER REHABILITATION AND SURVEY INSTRUCTIONS

PROJECT: Piezometer Installation

SITES: Townshend Dam, Townshend, VT and No. Springfield Dam, No. Springfield, VT

PURPOSE: Install piezometers to determine phreatic surface, pore pressures and average permeabilities of the foundation at both sites. Survey the top elevation of all piezometers (new and existing) at both sites. Survey final locations (station and offset) of all new piezometers.

1. SCOPE OF INVESTIGATION

a. General. Townshend Dam is located on the West River in Townshend, Vermont. The dam is a rolled earth and rockfill embankment which is 1700 feet long and has a maximum height of 133 feet. It has an impervious core with adjacent pervious fill zones and rockfill outer shells. The project at this site consists of installing four piezometers in four new bore holes and surveying the locations of these new piezometers as well as the top elevations of all piezometers on site.

North Springfield Dam is located on the Black River in North Springfield, Vermont. The dam is a random earth and rockfill dam which is 2940 feet long with a maximum height of 120 feet. The project at this site includes installing one piezometer in each of two new bore holes and surveying the locations of these new piezometers as well as the top elevation of all piezometers on site.

b. Townshend Dam borings.

(1) Three wash borings shall be performed within a 5 foot radius of existing piezometers PZ-1, PZ-2, and PZ-3 on the upstream slope as shown on Attachment 2. These existing piezometers are pneumatic type and are no longer operational. If the contractor chooses he may remove the existing piezometer casing and drill the new boring in the old hole. Cross sections of these existing piezometers have been sent separately. One boring shall be performed at the PZ-5 location on the crest of the dam. The borehole for PZ-5 (FD-85-8) was started in 1985 and stopped at a depth of 95.5 feet because of continuous loss of drilling fluid in the rockfill zone. (The boring log has been sent separately.) Four inch diameter casing was left in the borehole to a depth of about 71 feet inside of 6-inch diameter casing that extends to an unknown depth. The boring for installation of piezometer PZ-5 will be continued into the foundation of the dam below the rockfill using a smaller diameter casing. The boring elevation and depths are listed in Table 1 sent separately.

(2) Soil sampling shall be accomplished by the SPT method. Sampling of replacement borings for PZ-1, PZ-2, and PZ-3 will consist of continuous sampling from 5 feet above the tip elevation to the end of the borings. Sampling of PZ-5 boring will be at 5 foot intervals once the rockfill zone is cleared.

(3) Holes shall be advanced by upward discharge fishtail bit or roller bit except through the impervious zone where only a roller bit will be allowed.

(4) In case of major lost circulation while drilling through coarse materials, an organic self-destructing biodegradable guar-based drilling fluid (revert or equivalent) may be used. No other type of drilling fluid will be permitted.

(5) When refusal is encountered prior to reaching the required piezometer depth a rock bit or core barrel shall be used until break through.

(6) Casing shall be used to completely pass through all rockfill zones continuous with the surface. Holes will have 3 feet of casing above and immediately below the surface. The casing shall be HX size.

(7) A drilling platform shall be required on all embankment slope holes.

(8) To accomplish this work one drill rig and crew will be mobilized.

(9) The sites shall be returned to its pre-work condition upon completion. Also, the project manager must approve the site condition prior to demobilization.

c. <u>North Springfield Borings.</u>

(1) Two drive sample borings shall be performed along the downstream toe filter just upstream from the seepage pond as shown in Attachment 3 as PZ-13 and PZ-14.

(2) Soil sampling shall be accomplished by the SPT method at intervals of five feet once the rockfill zone is cleared. The depth of this top rockfill layer is unknown. The boring depths and elevations are shown on detail sections sent separately.

(3) Holes shall be advanced by upward discharge fishtail bit or roller bit except through the impervious zone where only a roller bit will be allowed.

(4) In case of major lost circulation while drilling through coarse materials, an organic self-destructing biodegradable guar-based drilling fluid (revert or equivalent) may be used. No other type of drilling fluid will be permitted.

(5) When refusal is encountered prior to reaching the required piezometer depth a rock bit or core barrel shall be used until break through.

(6) Casing shall be used to completely pass through all rockfill zones continuous with the surface. Holes will have 3 feet of casing above and immediately below the surface. The casing shall be HX size.

(7) To accomplish this work one drill rig and crew will be mobilized.

(8) The sites shall be returned to its pre-work condition upon completion. Also, The project manager must approve the site condition prior to demobilization.

d. Piezometers. A total of six new piezometers will be installed for this project. Casagrande open-type piezometers or other approved type shall be in accordance with paragraph 24, page C-26 of the Contract. In all holes the casing shall remain in place through the rock-fill zones. Stickup for replacement piezometers PZ-1, PZ-2, and PZ-3 at Townshend shall be between 12 and 18 inches. All other stickups shall be 3 feet. The location of tip elevations and depth are listed in Tables 1 and 2 provided separately.

e. Inspection.

(1) One geotechnical inspector shall act as a field inspector while performing the borings and installing piezometers. The inspector shall provide telephone reports to Mr. L'Heureux, Corps of Engineers, at 617-647-8597 every working day or completion of each boring (prior to piezometer installation).

(2) All samples shall be delivered to the Corps of Engineers Headquarters in Waltham, MA by the field inspector. Sample delivery shall be coordinated with the Director, NED Materials and Water Quality Laboratory at 617-647-8367/8392.

f. Survey. After completion of all other work, an elevation survey shall be performed at both sites to determine the top elevation of all piezometer riser (PVC) pipes at both sites. Note riser pipes for PZ-2 thru PZ-4 are 1 1/4" steel riser pipes. Elevations should be referenced to the staff gage on the side of each control tower. The zero stage for each gage is 457.0' NGVD and 452.0' for Townshend Dam and No. Springfield Dam, respectively. Approximate top elevations of existing piezometers are listed on Tables 3 and 4 provided separately.

2. SITE CONDITIONS

a. The sites are Townshend Dam in Townshend, Vermont and North Springfield Dam in Springfield, Vermont owned by the U.S. Government and operated by the Corps of Engineers.

b. At Townshend Dam, drilling operations shall be on the dam crest and the upstream slope (1V on 2.5H). Locations of the borings are shown in Attachment 2.

c. At North Springfield Dam, drilling operations shall be on a downstream berm area. Locations of the borings are shown in Attachment 3.

3. RIGHTS OF ENTRY

The geotechnical inspector shall notify the Project Manager, Mr. Ray Ballentine at the Townshend Dam at 802-365-7703 and Mr. Tom Coen at North Springfield Dam at 802-886-2775 prior to commencement of work.

4. COORDINATION

Mr. L'Heureux, Corps of Engineers 617-647-8597, shall be contacted five days prior to start of work and each work day to report on the progress of the work. The geotechnical inspector shall report on how work is progressing and what types of material are being encountered

5. EXPLORATIONS

The drive sampling borings designated PZ-1, PZ-2, PZ-3, PZ-5, PZ-13, and PZ-14 located on Attachments 2 and 3 shall be numbered FD-87-1 through FD-87-6 in order of their completion. The new numbers shall be indicated on the exploration logs and shown on a plan of explorations. Piezometers shall be numbered as listed.

6. GOVERNMENT REVIEW

The Government will review the draft geotechnical report submittal as well as the completed report. Subsequent to such review, the Contractor shall accomplish any corrections which may be directed as the result of the Government review. Duration of review is approximately ten days.

7. COMPLETION SCHEDULE

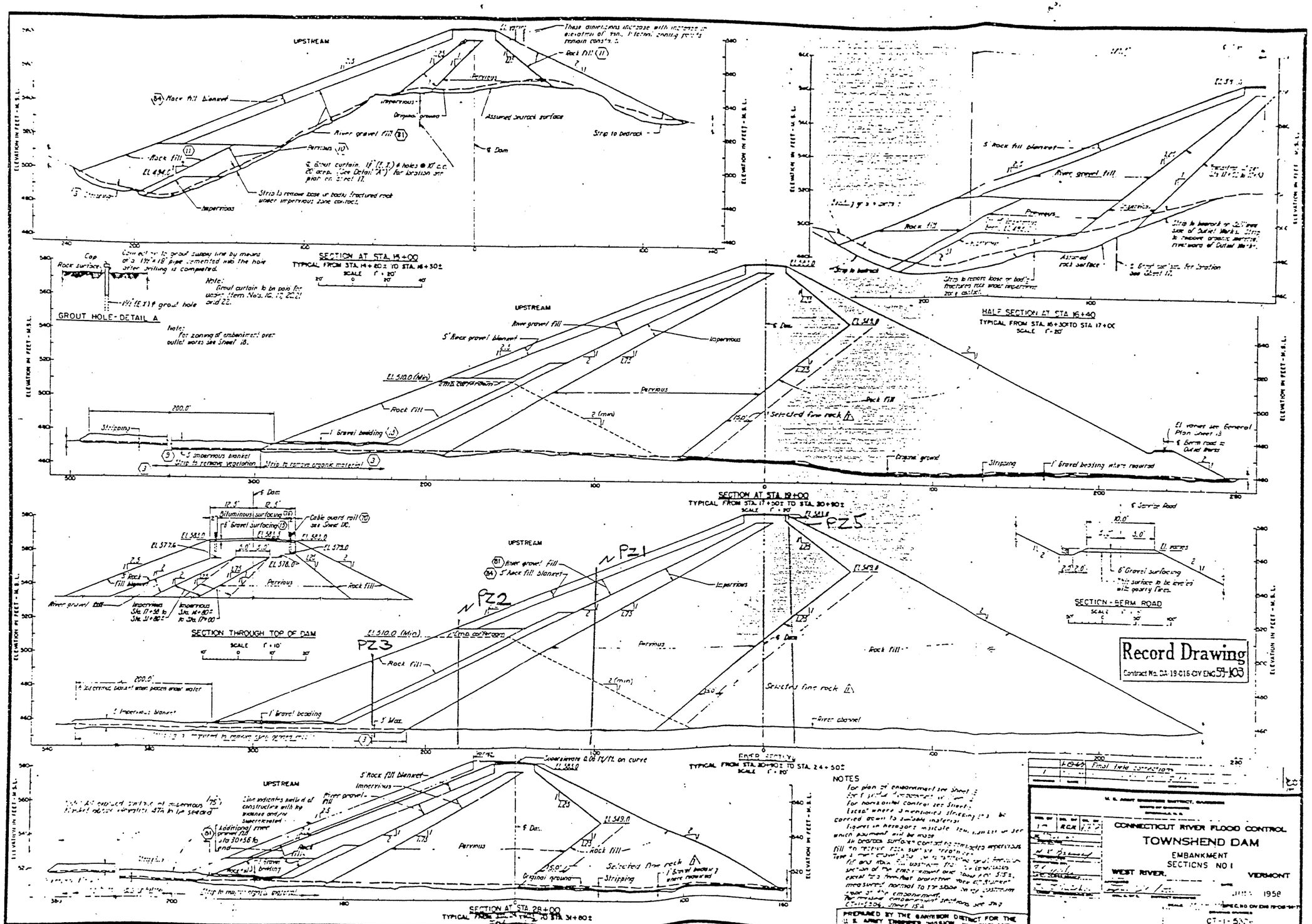
Services under this contract start within fourteen calendar days after receipt of delivery order. Duration of field work is estimated to be 42 calendar days. The geotechnical report shall be submitted in draft format for review by the Government no later than fourteen calendar days after completion of the drill portion of the field work. The final geotechnical report shall be submitted no later than seven calendar days after receipt of draft report including the action taken on possible comments.

The data from the survey portion of this delivery order shall be included on the piezometer logs and submitted with the draft report.

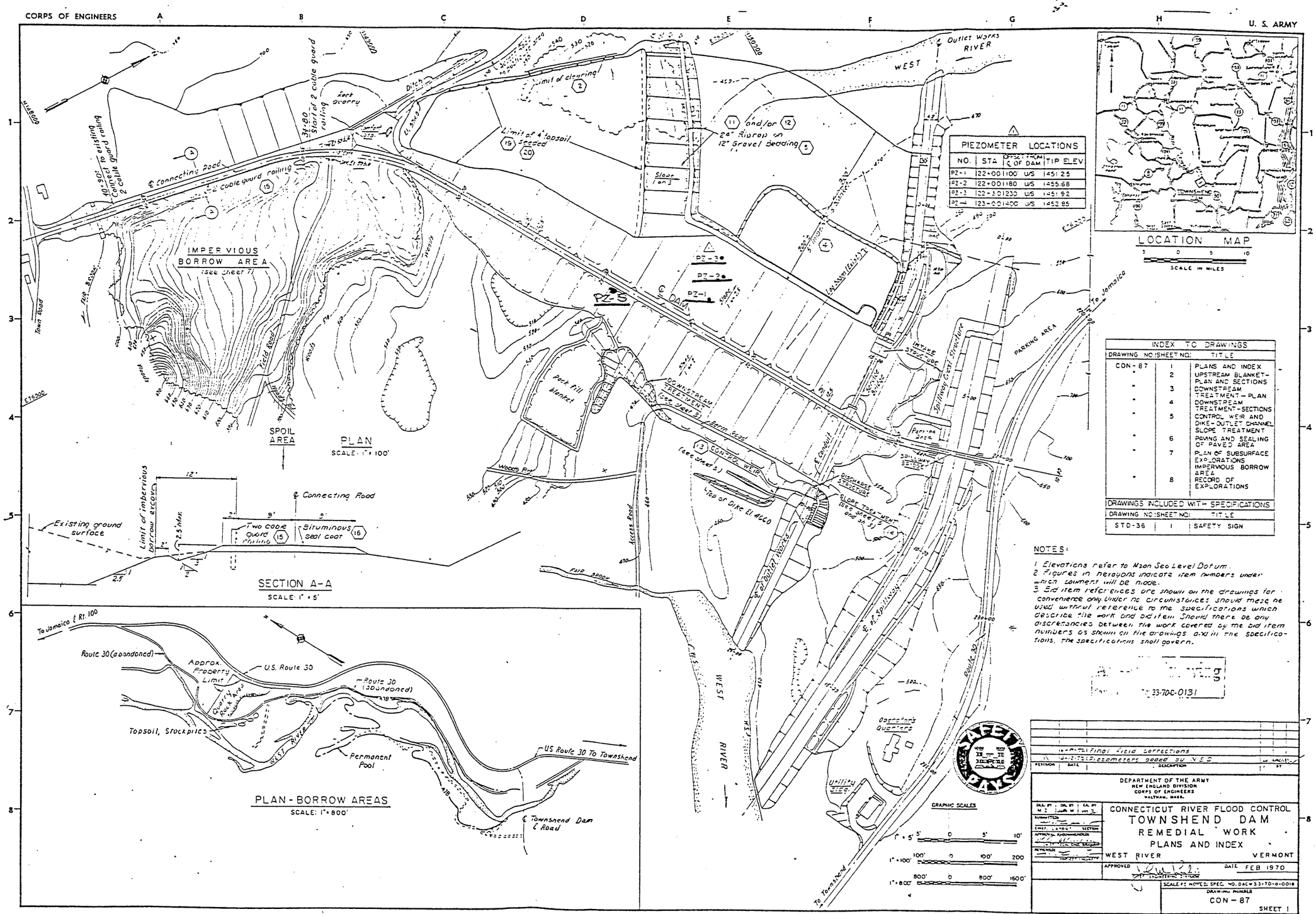
8. QUALITY CONTROL

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 insure (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 significantly deficient in any of these areas will be returned to you for correction and/or upgrading prior to our completing our review. Contract submission dates will not be extended if a resubmission of draft material is required for this reason.



ATTACHMENT 1 PLATE 10



PIEZOMETER LOCATIONS				
NO.	STA	OFFSET FROM ℄ OF DAM		TIP ELEV
PZ-1	122+00	1100'	U/S	1451.25
PZ-2	122+00	1180	U/S	1455.68
PZ-3	122+30	1230	U/S	1451.92
PZ-4	123+00	1400	U/S	1452.85

INDEX TO DRAWINGS		
DRAWING NO.	SHEET NO.	TITLE
CON-87	1	PLANS AND INDEX
"	2	UPSTREAM BLANKET-PLAN AND SECTIONS
"	3	DOWNSTREAM TREATMENT-PLAN
"	4	DOWNSTREAM TREATMENT-SECTIONS
"	5	CONTROL WEIR AND DIKE-OUTLET CHANNEL SLOPE TREATMENT
"	6	PAVING AND SEALING OF PAVED AREA
"	7	PLAN OF SUBSURFACE EXPLORATIONS IMPERVIOUS BORROW AREA
"	8	RECORD OF EXPLORATIONS

DRAWINGS INCLUDED WITH SPECIFICATIONS		
DRAWING NO.	SHEET NO.	TITLE
STD-36	1	SAFETY SIGN

NOTES:

1. Elevations refer to Mean Sea Level Datum.
2. Figures in hexagons indicate item numbers under which payment will be made.
3. Bid item references are shown on the drawings for convenience only. Under no circumstances should these be used without reference to the specifications which describe the work and bid item. Should there be any discrepancies between the work covered by the bid item numbers as shown on the drawings and in the specifications, the specifications shall govern.

33-70-C-0131

REVISION	DATE	DESCRIPTION	BY
		Final field corrections	
		Piezometers added by N.E.D.	

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

CONNECTICUT RIVER FLOOD CONTROL
TOWNSHEND DAM
REMEDIAL WORK
PLANS AND INDEX
WEST RIVER VERMONT

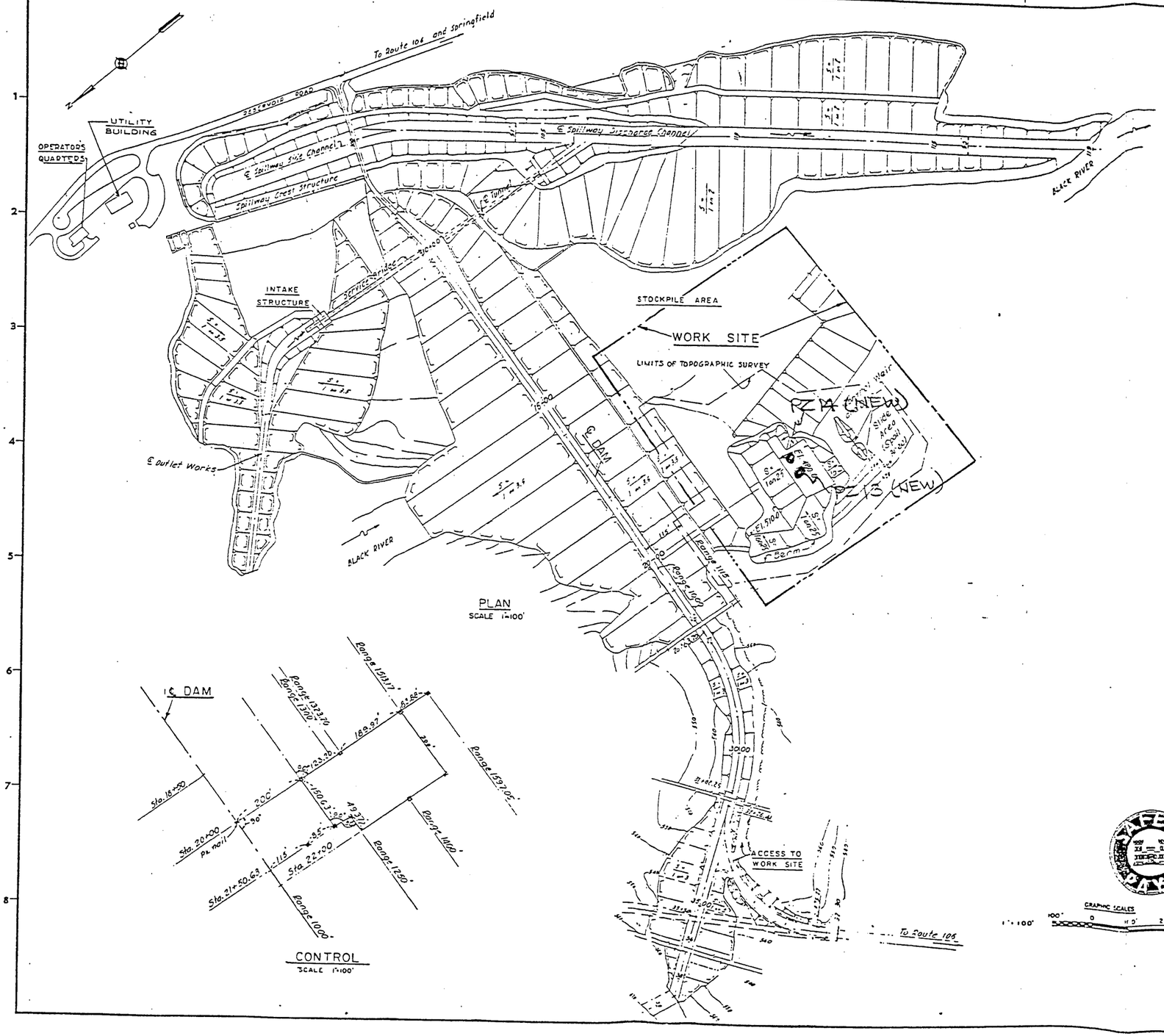
APPROVED DATE FEB 1970

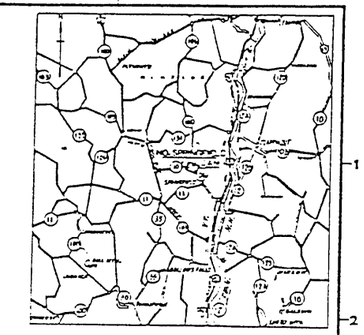
SCALE AS NOTED. SPEC. NO. DACW33-70-B-0018

DRAWING NUMBER
CON-87
SHEET 1

ATTACHMENT 2 PLATE 29

CORPS OF ENGINEERS — U. S. ARMY





LOCATION MAP

INDEX TO DRAWINGS		
DRAWING NO. (SHEET NO.)		TITLE
CON-88	1	REMEDIAL WORK – PLAN AND INDEX
"	2	" " TOPOGRAPHIC SURVEY AND EXCAVATION PLAN
"	3	" " GRADING PLAN - CONTROL WEIR DETAILS
"	4	" " SECTIONS
DRAWINGS INCLUDED WITH SPECIFICATIONS		
DRAWING NO. (SHEET NO.)		TITLE
STD-36	1	SAFETY SIGN
DRAWINGS ISSUED FOR INFORMATION		
DRAWING NO. (SHEET NO.)		TITLE
CT-1-5065	30	OUTLET WORKS – PLAN AND PROFILE
CT-1-5066	31	" " INTAKE STRUCTURE
CT-1-5057	32	" "
CT-1-5116	78	" " MECHANICAL EQUIP.
CT-1-5117	79	" "
CT-1-5118	80	" "
CT-1-5124	84	" " BULKHEAD
CT-1-5126	85	" " GATES & HOISTS ASSEMBLY
CT-1-5133	92	" " GATES & HOISTS ASSEMBLY
CT-1-5142	99	" " INTAKE STRUCTURE
CT-1-5143	100	" " "

NOTES:

1. Elevations refer to Mean Sea Level Datum.
2. Figures in hexagons indicate item numbers under which payment will be made.
3. Bid item references are shown on the drawings for convenience only. Under no circumstances should these be used without reference to the specifications which describe the work and bid item. Should there be any discrepancies between the work covered by the bid item numbers as shown on the drawings and in the specifications, the specifications shall govern.

Ranges are distances from center line of Dam (Range 1000')

Record Drawing

Contract No. DACW 33-70-C-0131

REVISION	DATE	DESCRIPTION	BY

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

CONNECTICUT RIVER FLOOD CONTROL
NORTH SPRINGFIELD DAM
REMEDIAL WORK
PLAN AND INDEX

BLACK RIVER — VERMONT

APPROVED — CHIEF, ENGINEERING DIVISION — DATE FEB. 1970

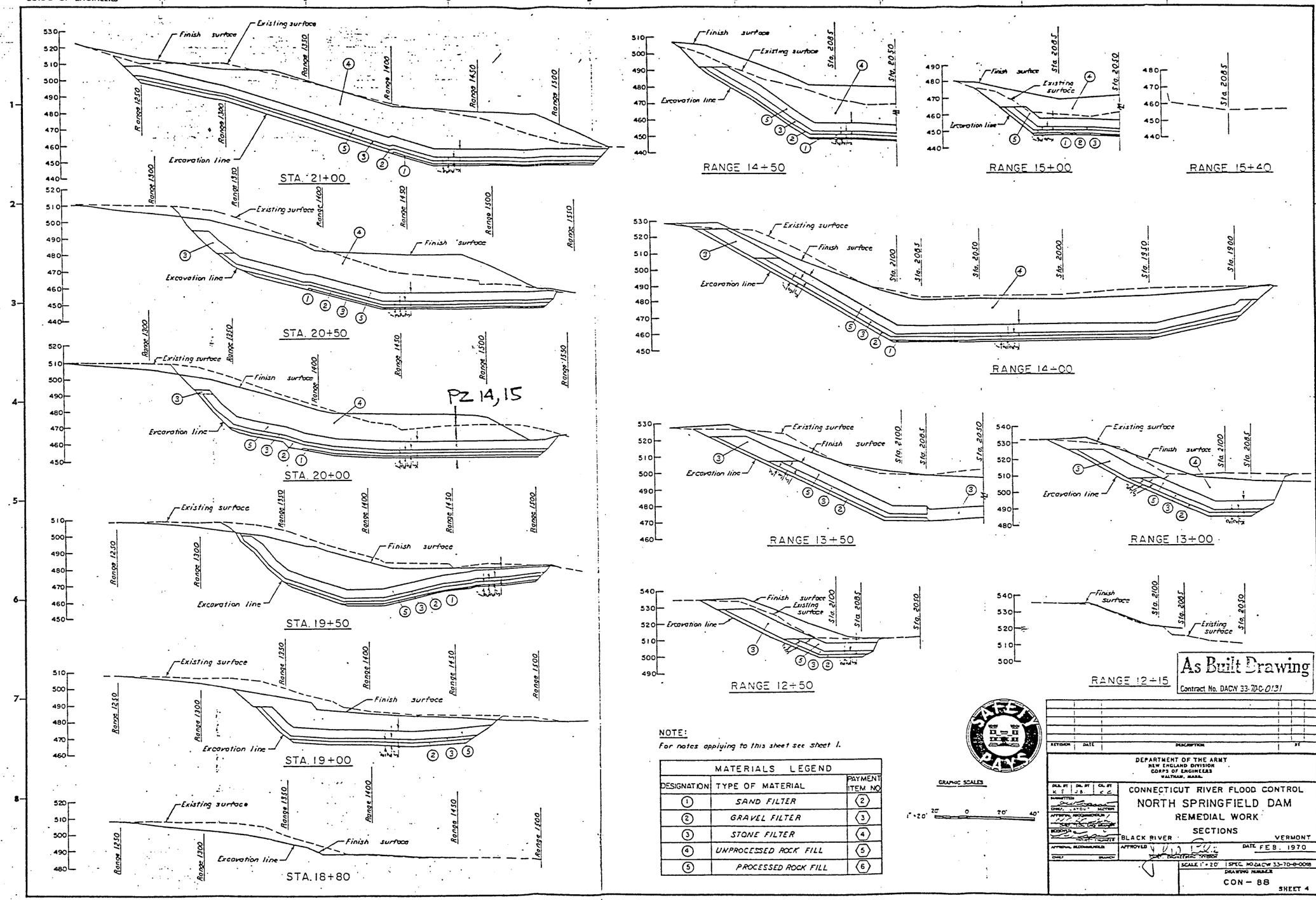
SCALE: AS SHOWN — SPEC. NO. DACW 33-70-B-0048

DRAWING NUMBER CON-88 — SHEET 1

ATTACHMENT 3

PLATE 30

CORPS OF ENGINEERS U. S ARMY



NOTE:
For notes applying to this sheet see sheet 1.

MATERIALS LEGEND		
DESIGNATION	TYPE OF MATERIAL	PAYMENT ITEM NO.
1	SAND FILTER	2
2	GRAVEL FILTER	3
3	STONE FILTER	4
4	UNPROCESSED ROCK FILL	5
5	PROCESSED ROCK FILL	6

GRAPHIC SCALES
1" = 20' 20' 0 20' 40'

REVISION	DATE	DESCRIPTION	BY

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

CONNECTICUT RIVER FLOOD CONTROL
NORTH SPRINGFIELD DAM
REMEDIAL WORK
SECTIONS
BLACK RIVER VERMONT

DATE FEB. 1970
SCALE 1" = 20' | SPEC. NO. DACW 33-70-B-0098
DRAWING NUMBER
CON - 88
SHEET 4

ATTACHMENT 3 PLATE 33

b. Project Site

1. TOWNSHEND DAM is located in Townshend, Vermont, on the West River. The investigations were on the crest as well as the upstream side of the dam. Boulder-sized rip rap on the 2.5:1 slopes covered the work area on the upstream side.

2. NORTH SPRINGFIELD DAM is located in North Springfield, Vermont, on the Black River. The investigations were on the downstream side of the dam. The work area was on a level surface covered by gravel.

General Project Maps, Site Location Plans, and Boring Location Plans are included in Section 8. General plans of this dam facility, provided to us in the Delivery Order, are in part (a) of this section.

c. Purpose

The purpose of the exploration was to recover soil for classification and install piezometers to determine phreatic surface, pore pressures and average permeabilities of the foundations at both sites. The top elevation of all piezometers at both sites are to be surveyed to determine the elevations of the new piezometers. The final location (station and offset) for the new piezometers are also to be determined.

d. Scope of Work

Survey, inspection, exploration and piezometer installation instructions, which were provided by the Army corps of Engineers, New England Division, in Delivery Order No. 0023, are included in Section 3a. General inspection, exploration, and piezometer installation instructions were provided by the Army Corps of Engineers, New England Division, through the contracted "Specification for Services and Equipment Necessary for Conducting Geotechnical Exploratory Work, Various Locations in New England and New York. Specific instructions and changes during the course of the work were given verbally during on-site and telephone conversations through a Corps of Engineers representative. All new instructions and changes can be found listed in Table II of Section 5.

Drilling, sampling and piezometer installation was performed by Atlantic Testing Laboratories' personnel using Atlantic Testing Laboratories' equipment. The test borings were advanced and sampled as indicated on Attachment No. 1 of the Delivery Order (Section 3a) and as outlined in the contract specifications and as amended in the conversations outlined in Table II, Section 5. Overburden sampling was performed using a 140 lb hammer, driving a 2 ft split spoon sampler (1-3/8" I.D.) at 5 ft intervals for FD-87-1, FD-87-2 and FD-87-4. No soil samples were taken during the installation of FD-87-3, FD-87-5, and FD-87-6.

SECTION 4

QUALITY CONTROL

a. General Certification Statement

I hereby certify that the 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 August 31, 1987

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

b. Records Taken

Pertinent drilling procedures, sampling operations, and soil classifications were noted on the following forms provided for use by the Corps of Engineers:

NED 121 - Field Log of Test Boring, Summary
NED 58 and 58a - Field Log of Test Boring
NED 74 - Field Log of Undisturbed Sampling in Drill Holes
NED 59 - Subsurface Water Observations and Boring Location Sketch

Information outlining the installed piezometer characteristics were noted on the Piezometer Installation Report and the Monitoring Well Installation Detail. A completed series of logs for each of the borings is included in Section 8 along with location maps.

Sample containers and rock core were labeled using ENG Form 1742 and were delivered to the USACE NED Materials and Water Quality Laboratory on August 18 and August 29, 1987.

A summary of daily activities and a telephone log are Tables I and II of Section 5, respectively. A chain of custody log is in Section 6. The Safety Meeting Reports, NED Form 251, including exposure time for Atlantic Testing Laboratories' personnel, are located in Section 7.

c. Equipment Used

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

1. <u>Drilling Equipment</u>

- CME 75 truck mounted drill rig
- skid-mounted CME45 drill rig on trailer
- 4" and 3-3/8" O.D. casing with drive shoes
- drill rod, NX taper threaded in 2 feet, 5 feet, and 10 feet lengths used for sampling and turning 3-7/8", 3-1/2" and 2-15/16" roller bits
- auger, 3-1/4" I.D., 8" O.D., slot fit, hollow stem augers in 2 feet and 5 feet lengths with carbide tip teeth
- one 1/2" centrifical pump with 500 ft of fire house
- 5" O.D. by 3 ft diamond bit core barrel; 2.98" O.D. by 5 ft diamong bit core barrel
- split spoon samplers, 1-3/8" I.D. by 2 ft in length
- drilling platform, approximately 8 ft by 12 ft, was constructed of 2" by 10" rough cut timber planks placed on a frame of 4" by 4" and 6" by 8" timber beams; 2" by 4" timbers were used for bracing
- three 100 gallon stock tanks
- two 3" centrifical pumps

<u>Piezometer Supplies</u>

- Casagrande piezometer 1" I.D. by 2 ft in length
- threaded 3/4" I.D. schedule 80 PVC riser pipe in 2 ft, 5 ft and 10 ft lengths
- filter sand, #4, in 100 pound bags
- Bentonite well seal, 3/8" diameter peltonite

- backfill material was #4 filter sand
- well protector, 3" diameter by 10 ft long black iron pipe threaded to accept a vented pipe cap and NW casing
- oxygen-acetylene cutting torch to remove old piezometer protective casing
- mobile welder

Well Test Equipment

- 200 ft electronic water level indicator (Roctest Model CPR4)
- standard watch with stopwatch function

Subcontracted Equipment

- two two trucks, 1/2" cables, with operators

2. Survey Equipment

- Wild T1000 Theodolite with DI 1000 Distance Meter
- Wild T-1, 6-minute Theodolite
- wild NARI, automatic level
- 25 ft expandable fiberglass stadia rod

d. Procedures

1. Survey Procedures

Spencer F. Thew, P.E./L.S. surveyors were on-site at Townshend Dam and North Springfield Dam on August 6, 1987 to locate the piezometers to be surveyed. The dam crest monuments were used for horizontal and vertical control.

2. Sampling and Drilling Procedures

Four piezometers were installed in the Townshend Dam, one on the crest and three on the upstream 2.5:1 rock slope. This involved surveying piezometer elevations, building platforms and placing equipment on them, drilling and sampling through the dam embankment, followed by piezometer installation and testing.

Two piezometers were installed in the North Springfield Dam, both were on the downsteam side of the dam. This involved drilling and sampling through the dam embankment, followed by observation piezometer installation and testing.

Sampling techniques, as described in the contract and in the delivery order, and as modified during the work period, involved retrieving material using the Standard Penetration Test. A 2" O.D. by 1-3/8" I.D. by 2-foot long split spoon sampler was driven 1.5 or 2.0 feet, and the blow counts for a 140 lb hammer falling 18 inches were recorded for every 0.5 feet advancement. Refusal was defined as 100 blows with no penetration or bouncing refusal. The sampling interval was every 5 feet once the rock filled zone was cleared.

Samples were classified in the field in accordance with ASTM D-2488. Representative samples were taken from each soil sampling run (5 ft sampling interval) and placed in 16 oz jars with hermetically sealed lids. Sample jars were labeled using ENG Form 1742 and were delivered to the USACE NED Materials and Water Quality Laboratory on August 18, 1987. A chain of custory log was maintained to document custody of the samples between Atlantic Testing Laboratories and the Corps of Engineers.

3. Access Procedures

On the Townshend Dam one piezometer was installed at the edge of the dam crest. This was accessed by disconnecting the guard rail wire, and backing the truck mounted CME 75 into place.

The remainder of the wells at Townshend Dam required construction of a platform on which to set and operate the CME 45 skid drill rig. The platform material was hand carried down the slope. The founding 6 inches by 8 inches timbers were placed directly on the boulder rip rap. Timbers (6 inches by 8 inches and 4 inches by 4 inches) were crossed horizontally to provide a level frame. Planking (2 inches by 10 inches) were tightly nailed producing a level work area. Bracing was added using 2 inches by 4 inches timbers.
The CME 45 skid rig's winch was used to move the rig down the slope. Winch lines from the subcontracted wreckers were used as a safety line during down slope movement. The wrecker, located on the dam crest, was implemented to move the rig up slope and to retrieve drilling appurtenances and platform materials at completion. The wrecker located to the side of the rig was used to move the rig laterally. On the North Springfield Dam, the CME 75 was used exclusively.

Both the CME 75 and CME 45 skid rig were equippped to handle several different methods of drilling. Different techniques of advancing each hole, in conjunction with sampling, were employed to best suit the situation. These systems and their effectiveness are generally described as follows:

CME 75:

- 4" diamond core bit used to advance through coarse granular material, boulders and cobbles

- 3-7/8" roller bit used to advance through granular material, cobbles, gravel and sand

- 5" diamond core bit used to advance through coarse granular material, boulders and cobbles

- 4" casing used in granular material to prevent hole from caving

- 3" driven casing used as protective casing for piezometer

CME 45 Skid Rig:

- 3-7/8" roller bit used to advance through "old" in-place casing
- 2-7/8" roller bit used with water to advance through cobbles and boulders
- 2-7/8" roller bit used with "Clear Mud" drilling fluid to advance through granular material such as sand, gravel and cobbles
- NW casing advanced with 300 lb hammer was used in granular material and as protective casing for piezometers.

Specific procedures for each well have been recorded on the boring logs contained in Section 8d.

4. Well Installation Procedures

After the boring had been advanced to the required depth, the Clear Mud if used, was deactivated using Clorox and the drill rods removed. No. 4 filter sand was added to the specified piezometer tip depth. The 2 ft long casagrande piezometer and 3/4" PVC riser pipe were connected and lowered to the determined depth as specified by the Corps of Engineers. No. 4 filter sand was added, followed by a bentonite seal (3/8" peltonite). The remainder of the open hole was filled with No. 4 sand or bentonite/cement grout as specified by the Corps of Engineers. Either a 3" or 4" protective casing was placed around the 3/4" riser pipe. A lockable pipe cap was placed on the top of the well and secured with a padlock.

5. Well Testing Procedures

A falling head test, as described in the contract, was performed on each well shortly after installation. This required pouring water down the riser pipe until it completely fills and measuring the water level drop against time. The depth was measured using an electronic water level indicator at 1, 5, and 10 minute increments. All well piezometers displayed good results, signifying an accurate monitor of the water table.

SECTION 5

SUMMARY OF ACTIVITIES
AND
TELEPHONE LOG

TABLE I

Summary of Activities

NOTE: On-site hours reflect inspector's on-site time at Townshend Dam.

Date	Activity
13 July	Monday: - mobilize geotechnical inspector, trainee, CME 75 and drill crew to site - inspector, trainee on-site 6:00-8:30 pm - meet Park Ranger Julie Casey and explained traffic considerations; obtained emergency numbers, etc. She will inform Deputy Sheriff Claude Weyant about the presence of our equipment on-site and request this his office maintain security checks. Met with Bob McCarthy, State Police, and requested the same from his office. - Locate Grace Cottage, the Townshend Emergency Room/Hospital and Brattleboro Hospital.
14 July	Tuesday: - on-site 7:00 am - 4:30 pm - Meet with Larry McLaughlin, project manager, regarding place to store equipment, access to upstream toe of dam, post removal, traffic problems. Mr. McLaughlin contacted town office officials regarding requirements for traffic control. He later contacted North Springfield Corporation office regarding traffic cones; inspector picked up cones and purchased topographic maps in Chester, Vt. - Located 3" fire hose in Keene, NH. - dropped off equipment at Corp office in Townshend, drillers went to Keene to pick up materials. - Conducted safety meeting. - Build platform. - Placed CME 75 over PZ-5. - Set up water system, need additional pump to bring water up. - John Saarinen on-site 3 pm. - Delivered additional steel to storage area. - Drillers picked up additional pump and tub.
15 July	Wednesday: - on-site 7:00 am - 6:00 pm - Set up water system, required different pump. - Started drilling using 3-7/8" roller bit on PZ-5 through open uncased hole, at 71 ft encountered granular material; advanced to approximately 90 ft at which point there was a loss of drilling fluid. - Tried to locate source of 3" casing, unsuccessfully. - Load steel at storage area. - Picked up 3" pump and suction hose. - Set up pump system, work for approximately 3 minutes, pump blew hole in its casing. - Tried to get water system going using pumps, would not work. Hauled water in equipment truck utilizing 3 one hundred gallon stock tanks. - Advanced hole to 99.5 ft before grouting hole with 300 gallons of bentonite/cement grout.

16 July — Thursday:
- on-site 6:00am - 11:00 am
- Bentonite/cement grout at 74.4 ft.
- Note missing traffic cone.
- Grout hole to 15 ft with bentonite/cement.
- Returned pumps to Brattleboro and Keene.

20 July — Monday:
- on-site 12:30 pm - 8:00 pm
- Advance PZ-5 to 105 ft using 3-7/8" O.D. roller bit; rock fill zone is at approximately 100 ft.
- Picked up casing in Billerica, MA.

21 July — Tuesday:
- on-site 6:30 am - 8:00 pm
- Picked up pizometer materials.
- PZ-5 advanced to 134 ft using 3-7/8" O.D. roller bit; piezometer tip depth of 133.3 ft.

22 July — Wednesday:
- on-site 6:30 am - 7:00 pm
- PZ-5 completed with exception of falling head test.
- Subcontractor on-site to place CME 45 on platform.
- Drillers working at PZ-5; mobilize to North Springfield with CME 75.

23 July — Thursday:
- on-site 6:30 am - 5:00 pm
- Set up water system for PZ-1, FD87-3; required another pump.
- Drill rig engine not working properly; attempted to locate a mechanic.
- Paul L'Heureux, Army Corps of Engineers, on-site to check job progress.

24 July — Friday:
- on-site 7:00 am - 11:00 am
- CME 45 still not running properly.
- Paul L'Heureux, Army Corps of Engineers, on-site answering questions concerning stand-by time and method of installing piezometers. Stand-by time can be charged for time spent on difficult mobilization. In North springfield, 4" casing will be used to keep hole open while (1) piezometer is placed in hole; (2) sand pack is put in place; (3) seal is put in place; (4) 3" protective casing is put in place around PVC rister and tap casing to seal but not into sand pack. After this is done, the 4" casing will be pulled. Mr. L'Heureux noted that ATL is to place locks on the wells when they are completed.
- Returned pump to Keene.

27 July — Monday:
- on-site 12:00 - 6:00 pm
- Mechanic worked on CME 45.
- Took water reading on FD87-1.

28 July — Tuesday:
- on-site 6:30 am - 5:30 pm
- Took water reading on FD87-1.
- Mechanic on-site, wrong parts but did get drill running.
- Water system started, drilling commenced.
- Advanced to 25 ft on PZ-1 using 3-1/2" roller bit, encountered difficult drilling due to caving.
- Grouted hole.
- Delivered materials to Paul Fisher, the inspector in North Springfield, and discussed sequence of events for installing well.
- Held safety meeting.

29 July — Wednesday:
- on-site 6:30 am - 6:30 pm
- Started drilling at 17 ft.
- At 25 ft depth, started driving NW casing.
- Advanced hole to 30 ft using 3-1/2" O.D. roller bit.
- Advanced hole to 55 ft using 2-15/16" roller bit.
- Advanced NW casing to 30 ft using 300 lb hammer.
- Received equipment and samples from FD87-2 and FD87-4 at North Springfield.

30 July — Thursday:
- on-site 6:30 am - 9:00 pm
- Took water readings from FD87-1.
- Drill not running properly.
- Advanced hole FD87-3 to 76 ft using 2-15/16" roller bit.
- Advanced NW casing to 63 ft using 300 lb hammer.

31 July — Friday:
- on-site 6:30 am - 11:30 am
- Advanced hole FD87-3 to 89 ft using 2-15/16" roller bit.
- Mechanic worked on CME 45.

3 August — Monday:
- on-site 12:00 - 5:00 pm
- Continued drilling on FD87-3, advanced hole to 90.5 ft using 2-15/16" roller bit.

4 August — Tuesday:
- on-site 6:30 am - 6:30 pm
- Placed piezometer on FD87-3 at 90 ft; left in-place 16.4 ft of NW casing with 1.4 ft of stick-up.
- Move to PZ-2; disassemble drilling platform.

5 August — Wednesday:
- on-site 6:30 am - 7:00 pm
- Completed disassembling platform at FD87-3.
- Move equipment with aid of wrecker; old casing from PZ-2 got in way of rig; drillers out of oxygen.

6 August — Thursday:
- on-site 6:30 am - 4:00 pm
- Subcontractor cut old casing stick up and helped move rig onto platform.
- Started drilling on PZ-2; had to pull old casing.
- Survey crew of Spencer T. Thew, P.E./L.S., was on-site to set control for horizontal and vertical survey.

10 August Monday:
- Rain halted work today due to slippery site conditions.

11 August Tuesday:
- on-site 6:00 am - 7:30 pm
- Exploration continued on FD87-5 using 3" casing and 2-15/16" roller bit.
- Advanced casing to approximately 30 ft using 300 lb hammer; roller bit to 57 ft.

12 August Wednesday:
- on-site 6:00 am - 7:30 pm
- Advanced FD87-5 from 57 to 61 ft using roller bit, mud.
- Installed piezometer, tip depth at 59.5 ft; 31.2 ft of NW casing with 1.2 ft stick-up left in place.
- Performed falling head test on FD87-5.
- Disassembled platform.
- Reassembled platform at FD87-6 (PZ-3).

13 August Thursday:
- on-site 6:30 am - 7:00 pm
- Completed assembling platform at FD87-6.
- Moved all equipment other than that being used on FD87-6 to top or bottom of dam.
- Started drilling FD87-6 using 3-1/8" roller bit to 17 ft, then advanced hole to 34 ft with 2-15/16" roller bit.
- Advanced NW casing to 30 ft using 300 lb hammer.

14 August Friday:
- on-site 6:30 am - 11:30 am
- NW casing advanced to 39 ft using 300 lb hammer, advanced 2-15/16" roller bit to 45 ft, completed drilling FD87-6.
- Installed piezometer, tip set at 43.5 ft; 40.33 ft of NW casing with 1.33 ft stick-up left in place.
- Performed falling head test.
- Cleaned up site, demobilized to Canton.

17 August Monday:
- on-site 12:30 pm - 4:30 pm
- Mobilize to site.
- Put guard rails and guy wires back up.

18 August Tuesday:
- on-site 7:00 am - 12:30 pm
- Cleaned up job site; disassembled platform; moved rig with aid of wrecker.
- Inspector talked to dam tender who related that ATL was not responsible for removal of old piezometer material, pipe and concrete piers.
- Put casing tops and caps on wells.
- Measure stick up of casing and piezometer risers.
- Locked wells at Townshend Dam which were installed by ATL with 2207 series lock.
- Dam tender was satisfied with site clean up.
- Inspector left for North Springfield to take water reading then on to Waltham, MA to deliver soil samples

3 September Thursday:

- on-site 9:00 am - 12:00 noon
- Survey crew of Spencer F. Thew, P.E./L.S., was on-site to sruvey elevations and final locations of piezometers.

Summary of Activities

NOTE: On-site hours reflect inspector's on-site time at North Springfield.

Date	Activity
23 July	Thursday: - on-site 8:00 am - 3:30 pm - Advanced FD87-2 to 24.5 ft using 3" I.D. core barrel; experienced caving of material or loss of core. Drive 4" casing to 21 ft; advance roller bit to 24.8 ft with difficulty; roller bit stripped by rocks. - Held safety meeting. - Obtain info regarding safety from Pauline Barton, Basin Managers Office; Project Supervisor Tom Coen not in; return 3 of 4 traffic cones, 4th was stolen. - Paul L'Heureux, Army Corps of Engineers, on-site 11:00 am - 1:30 pm, must use 3" casing or black pipe to protect riser through the rock fill zone as the shifting rocks may cause the tubing to kink at the bottom. Note - surveyors will need a large wrench to crack the screw caps on some of the piezometers. - Important to secure snuggly bottom of casing in the foundation materials and to grout the top so that it is as stable as possible. - Regarding stand-by - granted for on-site moves, including water set-up, inclement weather and not for any rig repairs unless caused by vandalist. - Casing in Townshend PZ-1-2-3. The existing casing should extend below the rock fill zone on PZ-1. - In PZ-2-3 if boulders are encountered while drilling through the exisitng casing, the hole will have to be moved and redrilled to properly determine and case the rock fill zone.
27 July	Monday: - on-site 1:00 pm to 5:00 pm - Conducted safety meeting. - Advanced FD87-2 from 24.8 ft to 32 ft using 3" I.D. core barrel.
28 July	Tuesday: - on-site 6:30 pm to 9:00 pm - Advanced FD87-2 from 32 ft to 38 ft using 3" roller bit. - Set well and backfilled, leaving 30 ft of 3" casing with 4 ft stick-up in place. - Move equipment to FD87-4. - Started coring rip rap to 21 ft using 4" diamond core barrel.
29 July	Wednesday: - on-site 7:00 am - 5:00 pm - Filled water truck. - Advanced FD87-4 to 37 ft using 4" diamond core barrel to 29 ft then advanced 3" casing using 300 lb hammer to 29 ft, finally, using 3" roller bit advanced hole to 37 ft; leaving 29.5 ft NW casing with 2.8 ft stick-up in-place. - Set well and backfilled.

6 August Thursday:

- Survey crew of Spencer F. Thew, P.E./L.S., on-site to set control for horizontal and vertical survey.

3 September Thursday:

- on-site 1:00 pm - 5:00 pm
- Survey crew of Spencer F. Thew, P.E./L.S., on-site to survey elevations and final locations of piezometers.

TABLE II

Telephone Log

Date	Conversation
7 July	Tony Firicano (from T. Beddoe, ATL) - Mobilization to North Springfield 7/13 and drilling on 7/14. - Will be training new inspector. Tom Coen, Project Manager at North Springfield Dam - Mobilization on Monday, 7/13 and start up 7/14 - left message on machine.
13 July	Tony Firicano - Mobilization today. Larry McLaughlin - Traffic could not be stopped from crossing the dam; arranged meeting at 7 am Tuesday at the dam.
15 July	Paul L'Heureux, Army Corps of Engineers - Project update. - Theresa Beddoe resigning, training Gregory Hargrave who will be on-site Monday.
16 July	Paul L'Heureux, Army Corps of Engineers - Use of "Clear Mud" drilling fluid if either 4" or 6" casing need to be pulled from PZ-5; drilling and inspection schedule for next week; North Springfield borings are urgent; project update.
17 July	Paul L'Heureux, Army Corps of Engineers - Differing schedules will not allow us to meet on-site, therefore, John Hart is phone contact.
20 July	Sharon Flint, ATL - Regarding drilling materials required and time of departure to drillers.
21 July	Sharon Flint, ATL - Regarding piezometers in transit to job site. John Hart, Army Corps of Engineers - Job progress, location of seal, etc. Want seal for FD87-1 at interface between rock zone and dam foundation, 99 to 103 ft. No problem with sampling with SPS on NW rod; casing is to be left around piezometer riser pipe in rock zone; PZ-1,2,3 cannot have 3" casing telescoped through present casing because they want good sand pack around piezometer tip.

22 July	John Hart, Army Corps of Engineers - Job progress; setting of piezometer for FD87-1; requested clarification of need for casing the full length of riser through rock zone. As Townshen Dam is a rock fill as opposed to an earthen fill, there are large voids in the dam which generally preclude grouting the holes. The rocks over a period of 20 - 50 years will shift, especially during period of high water, and may impinge upon and break the riser pipe. As FD87-1 is on top of the dam near the centerline and will experience smaller lateral stresses and as it is already cased to 71 ft, and has been successfully grouted through the entire depth of the rock fill, it was agreed that the boring should backfilled with bentonite/cement grout.
29 July	Paul L'Heureux, Army Corps of Engineers - Job progress, location of bentonite seal on FD87-3; want seal in same location as previous seal.
30 July	Paul L'Heureux, Army Corps of Engineers - Daily progress; soil sampling on FD87-3; location of bentonite seal and backfill material to be used - no soil samples are to be taken on FD87-3; seal is to be located at same elevation as bottom seal shown in Attachment #4 (PZ-1); need a 5 ft seal; backfill material can be any material; samples from Townshend Dam and North Springfield are to be delivered together.
3 August	Paul L'Heureux, Army Corps of Engineers - Daily progress and modifications to delivery order; slow progress due to boulders; call if drilling does not speed up; no soil samples are to be taken on PZ-1, 2, 3. Terry Wong, Army Corps of Engineers - Slow progress on FD87-3, 1-1/2 ft in 3 hours due to boulders.
4 August	Paul L'Heureux, Army Corps of Engineers - Slow progress on FD87-3; well is deep enough; put in piezometer; decrease amound of sand beneath the piezometer tip from 1 ft to 0.5 ft.
6 August	Paul L'Heureux, Army Corps of Engineers - Had to pull old casing after it became hung on tools; use 3" casing through rock filled zone; one set of water level readings at North Springfield are sufficient. Jim Thew, ATL Surveyor - Directions to Townshend Dam to make site inspection.
11 August	Terry Wong, Army Corps of Engineers - Daily progress.
13 August	Terry Wong, Army Corps of Engineers - Daily progress and stick up length of riser pipes which should be between 12- 18 ft on PZ-1, 2, 3 (FD87-3, 5, 6).

14 August	Yuri Yatsevitch, Army Corps of Engineers - Use of monuments on dam crest for survey purposes; have to call back on Monday and talk to Terry Wong.
17 August	Tony Firicano - Use of dam crest monuments for survey purposes okay; received elevations for Townshend and North Springfield.
18 August	Terry Wong, Army Corps of Engineers - Need one more water reading from North Springfield; deliver all soil samples to Waltham, MA.
28 July	Terry Wong, Army Corps of Engineers - Job update from Paul Fisher.
	Paul L'Heureux, Army Corps of Engineers - From Paul Fisher - core 5 ft into bedrock if in question.

SECTION 6

CHAIN OF CUSTODY LOGS

ATLANTIC TESTING LABORATORIES, Limited

CHAIN OF CUSTODY LOG

PROJECT: Townshend Dam, VT

ITEMS:

Tubes: None

Bottles: None

Jar Samples: 4

Core Boxes: None

Sampling Logs:

Date & Time Received	Date & Time Transferred	Comments	Custodian
As Sampled	8/18/87 17:00	Greg Howard (ATL)	G All John Re 8/18/8

ATLANTIC TESTING LABORATORIES, Limited

CHAIN OF CUSTODY LOG

PROJECT: NORTH SPRINGFIELD DAM

ITEMS:

Tubes: NONE

Bottles: NONE

Jar Samples: 7 JARS (1 BOX)

Core Boxes: NONE

Sampling Logs: NONE

Date & Time Received	Date & Time Transferred	Comments	Custodian
AS SAMPLED	7/29/87 1700	P. FISHER (ATL)	[signature] John Re 8/18/
7/29/87		G. HARGROVE (ATL)	GAH

SECTION 7

SAFETY REPORTS

WEEKLY SAFETY MEETING

NEDSO

Date held 7-14-87

THRU: Area Engineer, New England Area

Time 1:10

TO: Safety Office, NED

Report No. 00025

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

Contract No. /D.O.No. 0003

Contractor Atlantic Testing Laboratories, Ltd.

Conducted By T. Roddoo

All personnel present (Contr) 4
(Sub) 0
(Govt) 0

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

✓ Accident Prevention Plan

✓ Individual Protective Equipment - hard hats, gloves, steel-toed shoes

✓ Prevention of Falls - watch footing on scree slope

✓ Back Injury, Safe Lifting Techniques - use hg ...

✓ Fire Prevention - extinguishers full + available - have two

✓ Sanitation, First Aid, Waste Disposal - 1st aid kits - have two

✓ Tripping Hazards - trash, hose, nails in lumber - keep gear neat

✓ Staging, Ladders, Concrete Forms, Safety Nets - wood platforms - be certain are stable

Hand Tools, Portable Power Tools, Woodworking Machinery -

✓ Equipment Inspection & Maintenance (Zero Defects) - gin rope + cables

✓ Hoisting Equipment - use hg instead of back

✓ Ropes, Hooks, Chains and Slings - keep in good shape

Electrical Grounding, Temporary Wiring, GFCI -

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

✓ Welding, Cutting - prep. of lumber for platforms

Excavations -

✓ Loose Rock and Steep Slopes -

Explosives -

Water Safety -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other - communicated hospital locations + emergency nos. posted listing in hg's glove box.

Prepared by T. Roddoo Title Geo

2. Forwarded.

Signature Theresa A. Roddoo
Resident Engineer

CF: EXPOSURE HOURS:
Work Date: 7/14, 7/15, 7/16, 7/17, 7/18
Non-work Date: 7/13, 7/19

Man Hours:
Contr: 121.5 hrs
Subcontr: -0-
Govt: -0-
TOTAL: 121.5

NED FL APR 82 251

WEEKLY SAFETY MEETING

NEDSO

Date held 7-2-87

THRU: Area Engineer, New England Area

Time 7:30 pm

TO: Safety Office, NED

Report No. CD 025

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

Contract No. /D.O.No. 0023 Contractor Atlantic Testing Laboratories, Ltd.

Conducted By G. Hargrove All personnel present (Contr) 6
(Sub) 0
(Govt) 0

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

✓Accident Prevention Plan

✓Individual Protective Equipment - hard hats, gloves, steel-toed shoes

✓Prevention of Falls - watch footing on steep slope

✓Back Injury, Safe Lifting Techniques - use rig

✓Fire Prevention - extinguishers full + available, have two

✓Sanitation, First Aid, Waste Disposal - 1st AID KITS - have two

✓Tripping Hazards - trash, hose, nails in lumber - keep site neat

✓Staging, Ladders, Concrete Forms, Safety Nets - wood platforms - be certain of stability

Hand Tools, Portable Power Tools, Woodworking Machinery -

✓Equipment Inspection & Maintenance (Zero Defects) - gin ropes + cables

✓Hoisting Equipment - use rig instead of back

✓Ropes, Hooks, Chains and Slings - keep in good shape

Electrical Grounding, Temporary Wiring, GFCI -

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

✓Welding, Cutting - prep of lumber for platforms

Excavations -

Loose Rock and Steep Slopes -

Explosives -

Water Safety -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by G. Hargrove Title Geol.

2. Forwarded. posted listing in rig's glove box

Signature [illegible]
Resident Engineer

CF: EXPOSURE HOURS:
Work Date: 7/20, 7/21, 7/22, 7/23, 7/24
Non-work Date: 7/19, 7/25

Man Hours:
Contr: 251
Subcontr: 3
Govt: 1.5
TOTAL: 255.5

NED FL APR 82 251

WEEKLY SAFETY MEETING

NEDSO

Date held 7/23/87

THRU: Area Engineer, New England Area

Time 9:00

TO: Safety Office, NED

Report No. CD026

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

Contract No. /D.O.No. 0023 Contractor Atlantic Testing Laboratories, Ltd.

Conducted By T. Boddoe 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 - use hig when need you can

Fire Prevention -

✓ Sanitation, First Aid, Waste Disposal - location of rest rooms

✓ Tripping Hazards - trash, hose, nails in lumber - rocks, keep equipment in order

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery -

Equipment Inspection & Maintenance (Zero Defects) -

Hoisting Equipment -

✓ Ropes, Hooks, Chains and Slings - zero defects!

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 -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other - emergency numbers for Springfield area given to drivers, directions to hospital.

Prepared by T. Boddoe Title Geo.

2. Forwarded.

Signature Thomas L. Boddoe
Resident Engineer

CF: EXPOSURE HOURS:
Work Date: 7/23, 7/24
Non-work Date: 7/18, 7/19, 7/21, 7/22, 7/25

Man Hours:
Contr: 30 1/2
Subcontr: —
Govt: 2 1/2
TOTAL: 31.5

NED FL APR 82 251

North Springfield, VT

WEEKLY SAFETY MEETING

NEDSO

Date held 7-28-87

THRU: Area Engineer, New England Area

Time 4:00 pm

TO: Safety Office, NED

Report No. CD 0025

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

Contract No. /D.O.No. 0023 Contractor Atlantic Testing Laboratories, Ltd.

Conducted By Greg Hargrave All personnel present (Contr) 3
(Sub)
(Govt)

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 -

Sanitation, First Aid, Waste Disposal -

✓ Tripping Hazards - trash, hose, nails in lumber - rocks, keep equipment in order

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery -

✓ Equipment Inspection & Maintenance (Zero Defects) -

Hoisting Equipment -

✓ Ropes, Hooks, Chains and Slings - Zero Defects

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 -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by Greg Hargrave Title Geologist

2. Forwarded.

Signature Gleason R. Hargrave
Resident Engineer

CF: EXPOSURE HOURS:
Work Date: 7/27 → 7/31
Non-work Date: 7/26, 8/1

Man Hours:
Contr: 117
Subcontr: 2
Govt: 0
TOTAL: 119

NED APR 82 251

WEEKLY SAFETY MEETING

NEDSO

Date held 7-27-87

THRU: Area Engineer, NEW ENGLAND Area

Time 1300-1330

TO: Safety Office, NED

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

Contract No. DO 023 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 REVIEWED TELEPHONE No. + LOCATIONS OF

Individual Protective Equipment - HARD HAT + GLOVES

Prevention of Falls - FROM RIG AND ROCKS

✓ Back Injury, Safe Lifting Techniques -

Fire Prevention - FUELS + STORAGE

✓ Sanitation, First Aid, Waste Disposal -

Tripping Hazards - trash, hose, nails in lumber - GENERAL LAY DOWN EQUIP.

Staging, Ladders, Concrete Forms, Safety Nets -

Hand Tools, Portable Power Tools, Woodworking Machinery - DRILL RIG

Equipment Inspection & Maintenance (Zero Defects) -

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 - NONE

✓ Welding, Cutting -

Excavations -

Loose Rock and Steep Slopes - ROCK SLOPES

Explosives -

Water Safety -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by P. FISHER Title ENGINEER

2. Forwarded.

Signature [signature]
Resident Engineer

CF:

NED FL 251

WEEKLY SAFETY MEETING

NEDSO

Date held 8-5-87

THRU: Area Engineer, New England Area

Time 12:00

TO: Safety Office, NED

Report No. CD 025

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

Contract No. /D.O.No. 0023 Contractor Atlantic Testing Laboratories, Ltd.

Conducted By G. Hargrove All personnel present (Contr) 3
(Sub)
(Govt)

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

✓ Accident Prevention Plan

✓ Individual Protective Equipment - hard hat, gloves, steel toed shoes

✓ Prevention of Falls -

✓ Back Injury, Safe Lifting Techniques - use rig when possible

✓ Fire Prevention - fire extinguishers, proper storage of gasoline

✓ Sanitation, First Aid, Waste Disposal -

✓ Tripping Hazards - trash, hose, nails in lumber - keep gear neat

✓ Staging, Ladders, Concrete Forms, Safety Nets - platforms properly built

✓ Hand Tools, Portable Power Tools, Woodworking Machinery -

✓ Equipment Inspection & Maintenance (Zero Defects) - gin line, steel cables

Hoisting Equipment -

Ropes, Hooks, Chains and Slings -

Electrical Grounding, Temporary Wiring, GFCI -

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

✓ Welding, Cutting - wear gloves

Excavations -

✓ Loose Rock and Steep Slopes -

Explosives -

Water Safety -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by G. Hargrove Title Geologist

2. Forwarded.

Signature George P. Hargrove
Resident Engineer

CF: EXPOSURE HOURS:
Work Date: 8/3, 8/4, 8/5, 8/6
Non-work Date: 8/2, 8/7, 8/8

Man Hours:
Contr: 120.5 hrs
Subcontr: 6 hrs
Govt: -0-
TOTAL: 126.5

NED FL APP PZ 251

WEEKLY SAFETY MEETING

NEDSO

Date held 8-11-87

THRU: Area Engineer, New England Area

Time 12:15 pm

TO: Safety Office, NED

Report No. CD 025

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

Contract No. /D.O.No. 0023 Contractor Atlantic Testing Laboratories, Ltd.

Conducted By Greg Harrison

All personnel present (Contr) 3
(Sub)
(Govt)

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

✓ Accident Prevention Plan

✓ Individual Protective Equipment - hard hat, steel toed shoes, gloves

✓ Prevention of Falls - watch footing

✓ Back Injury, Safe Lifting Techniques - use rig when possible -

✓ Fire Prevention - fire extinguisher

✓ Sanitation, First Aid, Waste Disposal -

✓ Tripping Hazards - trash, hose, nails in lumber - keep site neat

✓ Staging, Ladders, Concrete Forms, Safety Nets -

✓ Hand Tools, Portable Power Tools, Woodworking Machinery -

✓ Equipment Inspection & Maintenance (Zero Defects) - *Zero defects

✓ Hoisting Equipment - air line, etc

✓ Ropes, Hooks, Chains and Slings -

Electrical Grounding, Temporary Wiring, GFCI -

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

✓ Welding, Cutting - wear proper equipment

Excavations -

✓ Loose Rock and Steep Slopes -

Explosives -

Water Safety -

Toxic materials - hazards, MSDS, respiratory, ventilation -

Other -

Prepared by Greg Harrison Title Geologist

2. Forwarded.

Signature Gregory P. Harrison
Resident Engineer

CF: EXPOSURE HOURS:
Work Date: 8/10, 8/11, 8/12, 8/13, 8/14
Non-work Date: 8/10, 8/15

Man Hours:
Contr: 138.5
Subcontr: 9
Govt: 0
TOTAL: 147.5

NED FL APR 82 251

SECTION 8

BORING LOGS

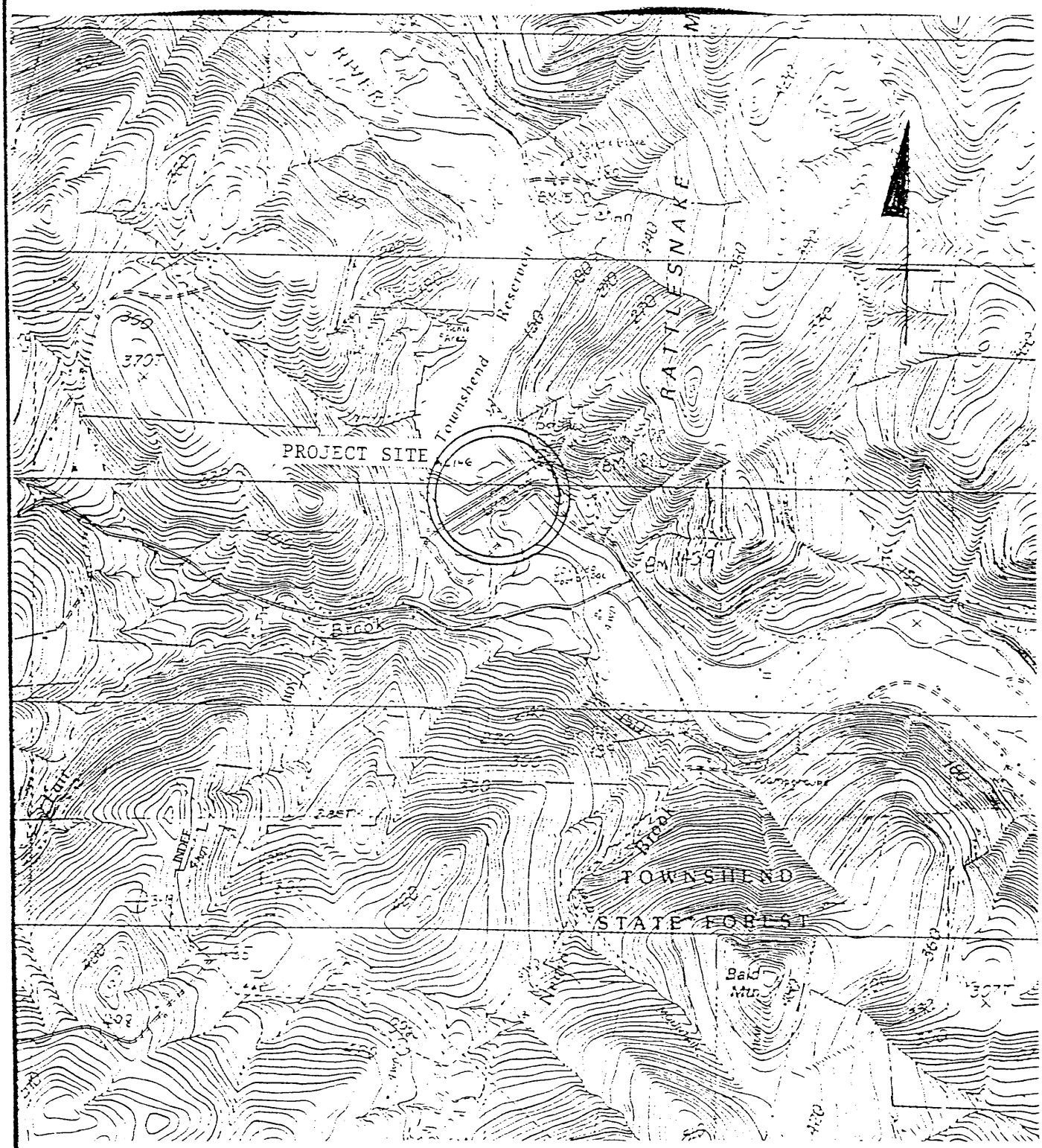
a. Figure 1 - General Project Map

GENERAL PROJECT MAP

PROJECT No	CD 025 026	SCALE: 1:316800	NORTH SPRINGFIELD AND TOWNSHEND, VERMONT

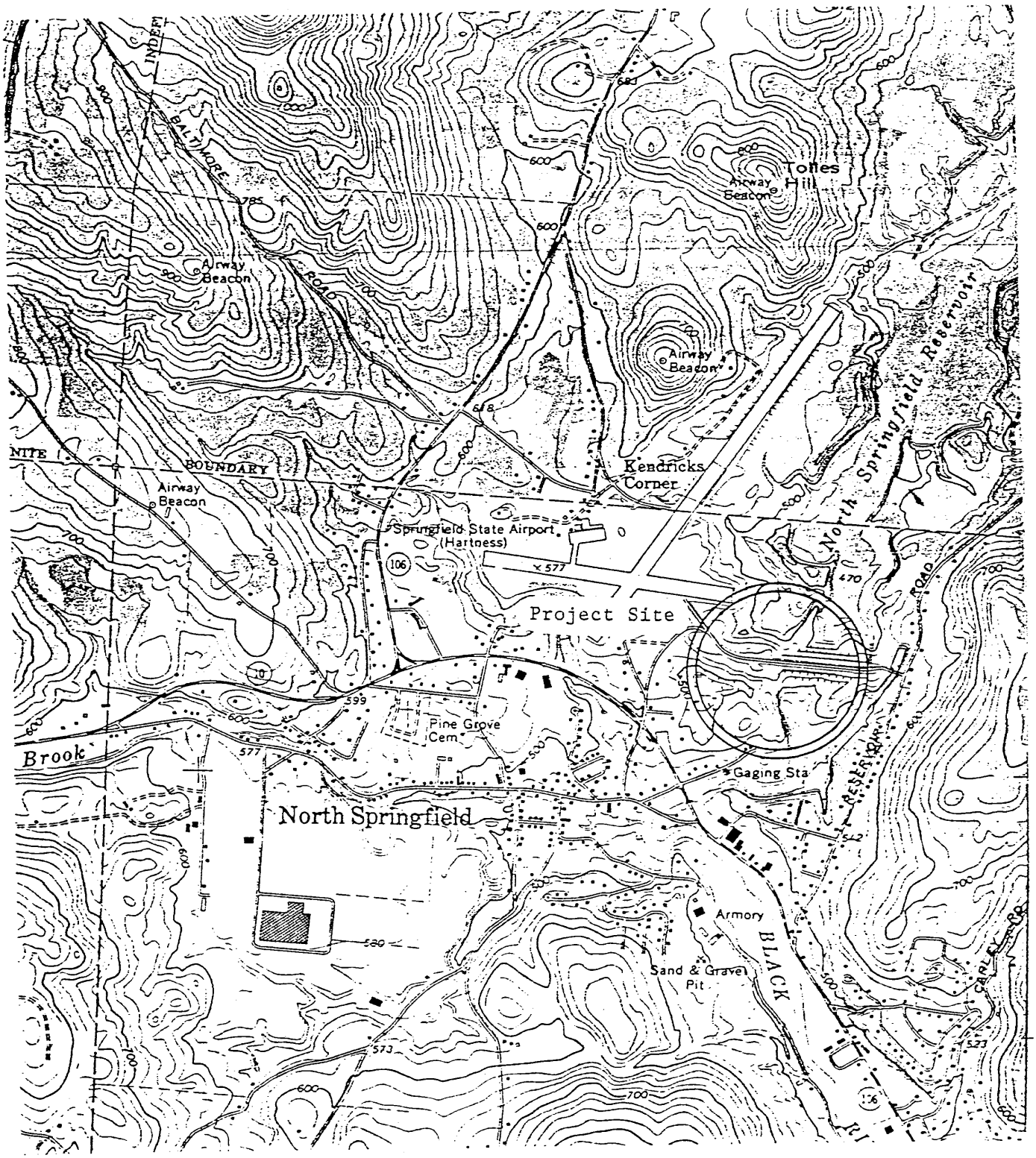
b. Figure 2 - Site Location Map

SITE LOCATION MAP

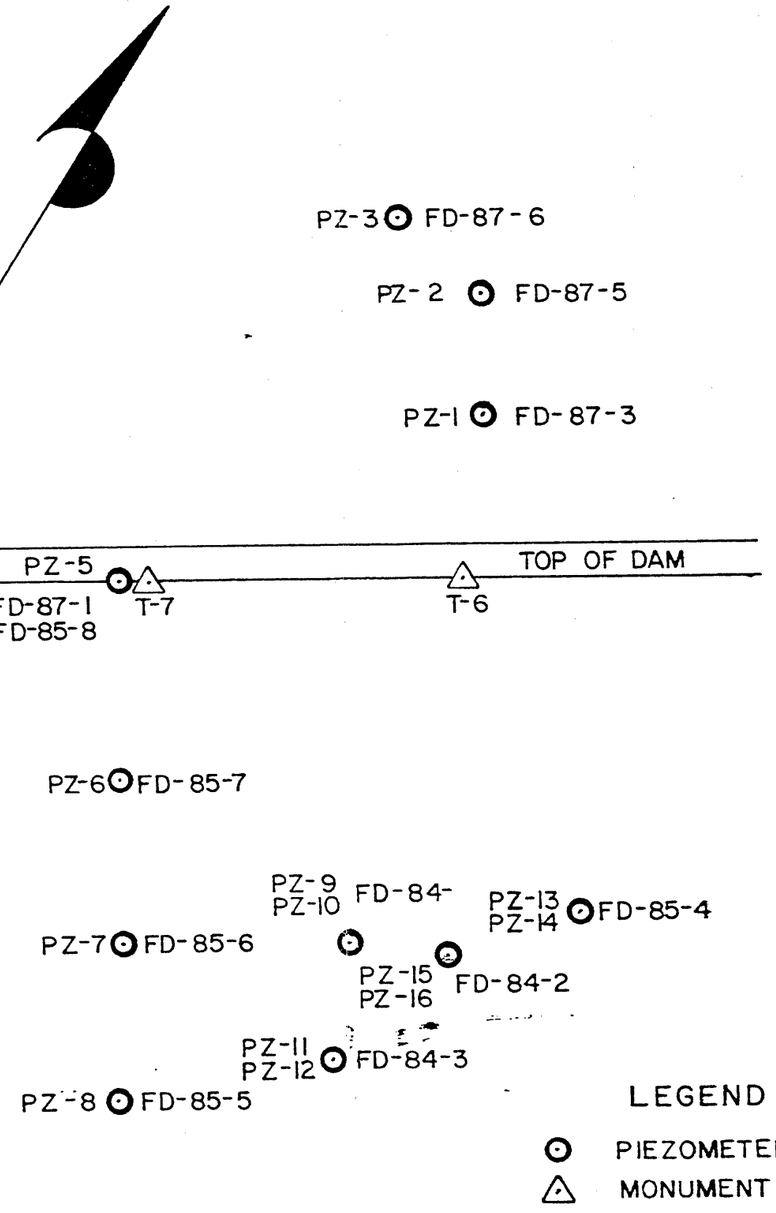


PROJECT No. CD 025	SCALE: 1:25000	U.S.G.S. QUADRANT: TOWNSHEND VERMONT

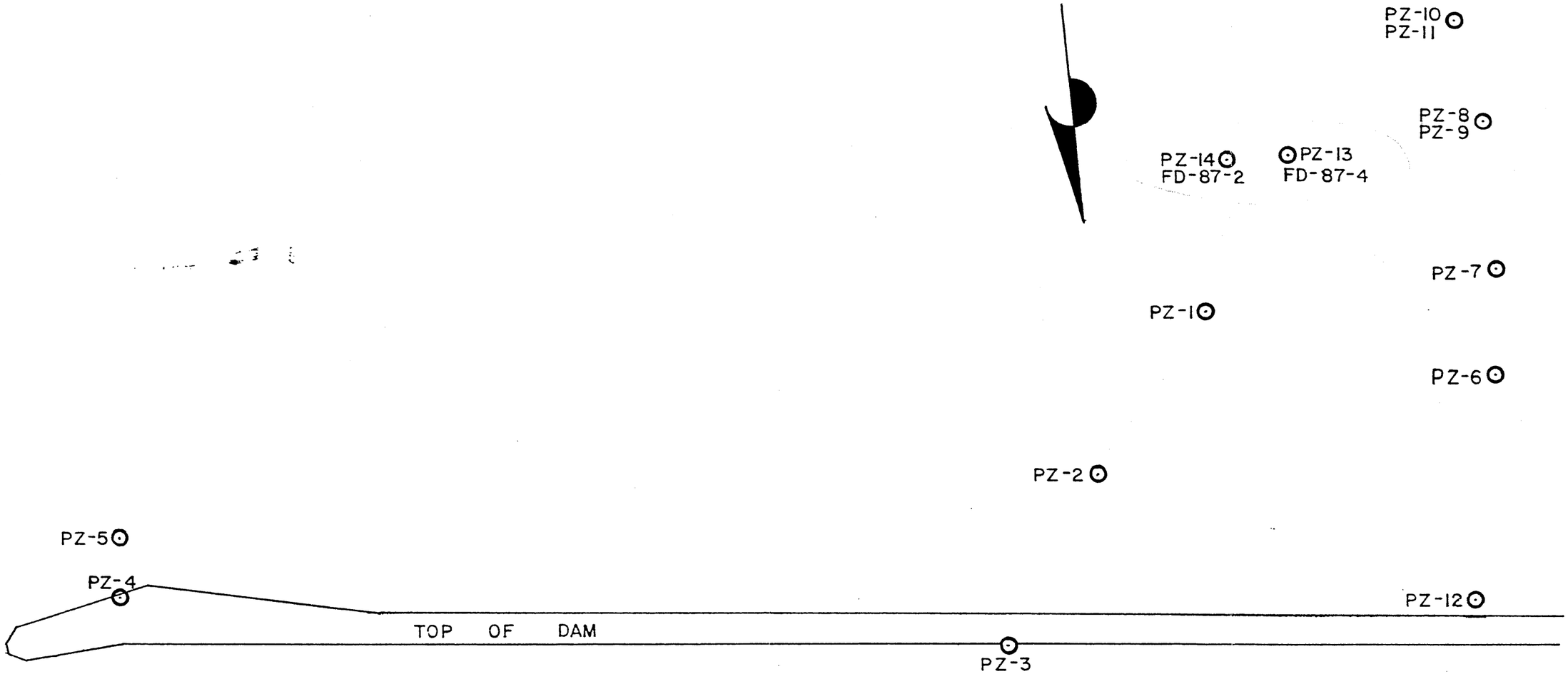
SITE LOCATION MAP



PROJECT No CD 026	SCALE: 1: 24000	U.S.G.S. QUAD: Chester, Vt



PIEZOMETER LOCATION TOWNSHEND DAM WEST RIVER, VERMONT	DATE 9/10/87	ATLANTIC TESTING LABORATORIES, Limited P.O. BOX 29, CANTON, NEW YORK (315) 386-4578
PROJECT NUMBER CD 025	SCALE 1" = 100'	CICERO, N.Y. ENDICOTT, N.Y. BURLINGTON, VT. MANCHESTER, N.H.



LEGEND

⊙ PIEZOMETER LOCATION

PIEZOMETER LOCATION NORTH SPINGFIELD DAM BLACK RIVER, VERMONT	DATE 9/10/87	ATLANTIC TESTING LABORATORIES, Limited P.O. BOX 29, CANTON, NEW YORK (315) 386-4578 CICERO, N.Y. ENDICOTT, N.Y. BURLINGTON, VT. MANCHESTER, N.H.
PROJECT NUMBER CD026	SCALE 1" = 100'	

d. Boring Logs

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

FIELD LOG OF TEST BORING

PROJECT NO. D.O. No. 0023

Site Townshend Dam Vt — Page 1 of 13 Pages

Hole No. FD87-1 Diam. (Casing) 3" I.D. — Boring Started 7-15-87

Co-ordinates: N sta 24+58 E off 18 D/S — Boring Completed 7-21-87

Drilled by Hawkins + Fox — Report Submitted

Purpose of Exploration install piezometers to determine hydrologic characteristics of foundation

Elevation Top of Hole 582.6 M.S.L.
Total Overburden Drilled 134.0 Feet
Elevation Top of Rock — M.S.L.
Elevation Bottom of Hole 448.6 M.S.L.
Total Rock Drilled — Feet
Total Depth of Hole 134.0 Feet
Core Recovered 0 %
Core Recovered 0 Ft.; — Diam. — In.
Soil Samples 1 3/8 In. Diam. 4 No.
Soil Samples — In. Diam. — No.

Casing Left in Place 73.7 Feet

Note - 2.7' stick up

Water Table Depth 114.9'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0.0	71.0	4" cased open hole left by previous drill crew
71.0	134.0	3 7/8" roller bit with "Clear Mud" drilling fluid

INDEX

Ground Water — ~~Back of~~ Page 12
Boring Location Sketch — ~~Back of~~ Page 12
Overburden Record — Page 2-
Rock Drilling — Page —
Piezometer Installion Report — Page 11
Monitoring Well Installation Detail — Page 13
Page —

Prepared by T. A. Beddoe / G. Hargrave — Field Data — Lab. Data

Submitted by Atlantic Testing Lab, 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 Townshend Dam Vt — Page 2 of 13 Pages

Boring No. FD87-1 Desig. PZ-5 Diam. (Casing) 3" ID

Co-ordinates: N Sta 24 + 58 E off 18 D/S

Elevation Top of Boring 582.6 M.S.L. — Hammer Wt. 140# — Boring Started 7/15/87

Total Overburden Drilled 134.0 Feet — Hammer Drop 30" — Boring Completed 7/21/87

Elevation Top of Rock — M.S.L. — Casing Left 71'

Total Rock Drilled 0 Feet — Subsurface Water Data — Page 12

Elevation Bottom of Boring 448.6 M.S.L. — Obs. Well 3/4"

Total Depth of Boring 134.0 Feet — Drilled By Hawkin + Fox

Core Recovered 0 % No. Boxes 0 — Mfg. Des. Drill CME 75

Core Recovered 0 Ft: 0 Diam. 0 In. — Inspected By: Beddoe / Hargrave

Soil Samples 1 3/8 In. Diam. 4 No. — Classification By: Hargrave

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

DEPTH 1"=2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER 6" / CORE RECOVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
			REC		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole

GENERAL REMARKS:

Site Townshend Dam VT	Boring No. FD 87-1	Page 3 of 13

DEPTH	1"=2'	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	BLOWS PER FT ~~CORE REC'VY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10'				DEC		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
11'							
12'							
13'							
14'							
15'							
16'							
17'							
18'							
19'							
20'							
27'							

Site Townshend Dam, VT	Boring No. ED-87-1	Page 4 of 13

DEPTH	1" = 2'	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	~~BLOWS PER FT CORE RECVY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
27'				REC		3 7/8" O.D roller bit advanced through open cased hole to 71.0'	Open cased hole
30'							
40'							
44'							

:.3A(Test)

Boring No ED 87-1

Site	Boring No.	Page 5 of 13
Townshend Dam, VT	FD 87-1	

DEPTH		CORE/SAMPLE			BLOWS PER FT	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	1"	NO.	SIZE	~~DEPTH RANGE~~	~~CORE RECOVY~~		
44'				Rec		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
50'							
60'							
61'							

Site	Boring No.	Page 6 of 13
Townshend Dam, VT	FD 87-1	

DEPTH	1" = 2'	CORE/SAMPLE NO.	SIZE	~~DEPTH~~	~~BLOWS PER FT~~ ~~CORE RECVY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
61'				Rec		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
70'							
71.0'						advanced 3 7/8" O.D. roller bit to 85.0' using "Clear Mud" drilling fluid. Note: easy drilling to 85.0'	granular material, no sample retained (Rock Fill Core of Dam - bit advanced through material caved into hole drilled in August 1985.)
78'							

Site	Boring No.	Page 7 of 13
Townshend Dam, VT	FD 87-1	

DEPTH	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	~~BLOWS PER FT~~ ~~CORE REC'VY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
78			REC		Advanced 3 7/8" O.D. roller bit to 91.0' using "Clear Mud" drilling fluid Note: easy drilling	granular material - no sample retained (Rock Fill Core of Dam - bit advanced through material caved into hole drilled in August 1985.)
80						
90						
91'					Advanced 3 7/8" O.D. roller bit to 99.5' using "Clear Mud" drilling fluid Note: drilling difficult due to cobbles, loss of drilling fluid at 91.0!	granular material Note: cobbles No sample retained (Rock Fill Core of Dam)
95						

Site	Boring No.	Page 8 of 13
Townshend Dam, UT	FD 87-1	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER 6" / CORE RECOVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
95			REC		Advanced 3 7/8" O.D. roller bit to 99.5' using "clear Mud" drilling fluid Note: drilling difficult due to cobbles, loss of drilling fluid @ 91.0'. Hole was grouted with bentonite cement to 52'. Three (3) hundred gallons of grout were used. Exploration Terminated 7/15/87	Granular cobbly material Note: Rock fill zone of Dam No sample retained
99.5'					Exploration Continued 7/16/87 Hole was grouted with bentonite cement to 15'. Exploration Terminated 7/16/87	
100					Exploration continued 7/20/87 Advanced roller bit to 105.0' Cleared rock fill zone of Dam @ 100', continued boring to 105' to verify Dam foundation Note: difficulty pulling NW rods Exploration terminated 7/20/87	Granular material - foundation of Dam No sample Retained until foundation verified.
105'	S-1	1 3/8"	25%	32 52 61 64	Exploration Continued 7/21/87 Sampled using 2" O.D. split spoon sampler, advanced on NW rods using a 140 lbs hammer	Light Brown mf SAND; trace SILT; (wet, nonplastic), very dense SP
107'					Advanced roller bit 120'. At 110.0' cobbles were encountered to 111.5'; Gravelly Sand layer 111.5' to 113.0'	Note: pieces of gin line wicking were detected in sample
110'						Cobbly material, no sample retained
112'						Gravelly Sand layer from 111.5 to 113.0'

Site	Boring No.	Page
Townshend Dam UT	FD 87-1	9 of 13

DEPTH	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	~~BLOWS PER 6"~~ ~~CORE RECVY~~	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
112			Rec		Advanced 3 7/8" O.D. roller bit to 120' using "Clear Mud" Drilling fluid boulders encountered to 119.0'; from 119.0' to 120.0' gravelly material encountered	Gravelly Sand layer from 111.5' to 113.0'
						Granular material with boulders from 113.0' to 119.0' no sample retained
115						
						Granular Material, gravelly 119.0' to 120.0' no sample retained
120'	S-2	1 3/8"	50%	62 67 57 97	Sampled using 2" O.D. split spoon sampler, advanced on NW rod using 140 lbs hammer	Light Brown cf GRAVEL; some cmf SAND; little SILT (wet, non-plastic) very dense; GW-GM
122'					Advanced roller bit to 125.0' Note: encountered difficult drilling in gravel seams. @ 120.0' to 122.0' and several other thin seams.	Note pieces of gin line wicking were detected in sample
125'	S-3	1 3/8"	15%	48 25 100	Sample using 2" OD. split spoon sampler, advanced on NW rod using 140 lbs hammer	Light Brown cmf SAND; little fGRAVEL; trace SILT (wet, non-plastic) very dense; SP
127'					Advanced roller bit to 131.0' encountered difficult drilling in several thin gravel seams.	
129						

Site	Boring No.	Page 10 of 13
Townshend Dam UT	FD 87-1	

DEPTH 1" = 2'	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	BLOWS PER 6" ~~CORE RECOVERY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
129'			REC		Advanced 3 7/8 O.D. roller bit to 131.0' using "Clear Mud" drilling fluid Encountered difficult drilling in several thin gravel seams.	
130'						
131'	S-4	1 3/8"	75%	44 44 43 44	Sampled using 2" O.D. split spoon sampler, advanced on NW rod using 140 lbs. hammer	Soil Similer to Sample #3; trace f GRAVEL; (wet, non-plastic) SP
133					Advanced roller bit to 134' using "Clear Mud" drilling fluid, easy drilling;	Note: trace gin line wicking
134'					Boring terminated @ 134.0' on 7-21-87 Note: Piezometer was installed with tip depth of 133.3' on 7-21-87	
135'						
140'						
145						

BA(Test)

Boring No FD 87-1

PIEZOMETER INSTALLATION REPORT

PROJECT: Townshend Dam | DATE. 7/21/87

LOCATION (STA): 24 + 58 | OFFSET FROM CENTER LINE: 18 D/s | PIEZ NO.: PZ-5

PIEZ TYPE: Casagrande | DEPTH OF PIEZ: 133.3' | RISER PIPE DIAM: 3/4" Sch. 80 pvc

PIEZ TIP SET IN (SOIL TYPE): SP | SOIL SAMPLE NO.: #4 | BORING DIAM: 4"

METHOD OF INSTALLATION: 3 7/8" O.D. roller bit thru all material

TYPE OF PROTECTION FOR PIEZ: 73.7' of 4" steel casing; Note 2.7' stickup VENT: locking cap installed

GROUND ELEV.: 582.6' | ELEV. TOP OF RISER: 585.2' | ELEV PIEZ TIP: 449.3'

FILTER: #4 filter sand FROM ELEV: 479.6' TO ELEV: 448.6

SEAL: Bentonite Pellets FROM ELEV: 485.6' TO ELEV: 479.6'

INSTALLED BY: Hawkins and Fox | CONTRACT NO.: DO-0023 | FOREMAN: Greg Hargrave

DATE OF INSTALLATION: 7/21/87 | DATE OF OBSERVATIONS:

METHOD OF TESTING PIEZ.: Falling Head Test

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET *	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
	1	64.7						
	1:30	82.4						
	3:00	99.7						
	5:00	—						
	10:00	—						

REMARKS: At begining of test elapsed time equals "0" minutes and depth to water equals "0" feet

* depth to water from top of pvc riser pipe

Gregory R. Hargrave
INSPECTOR

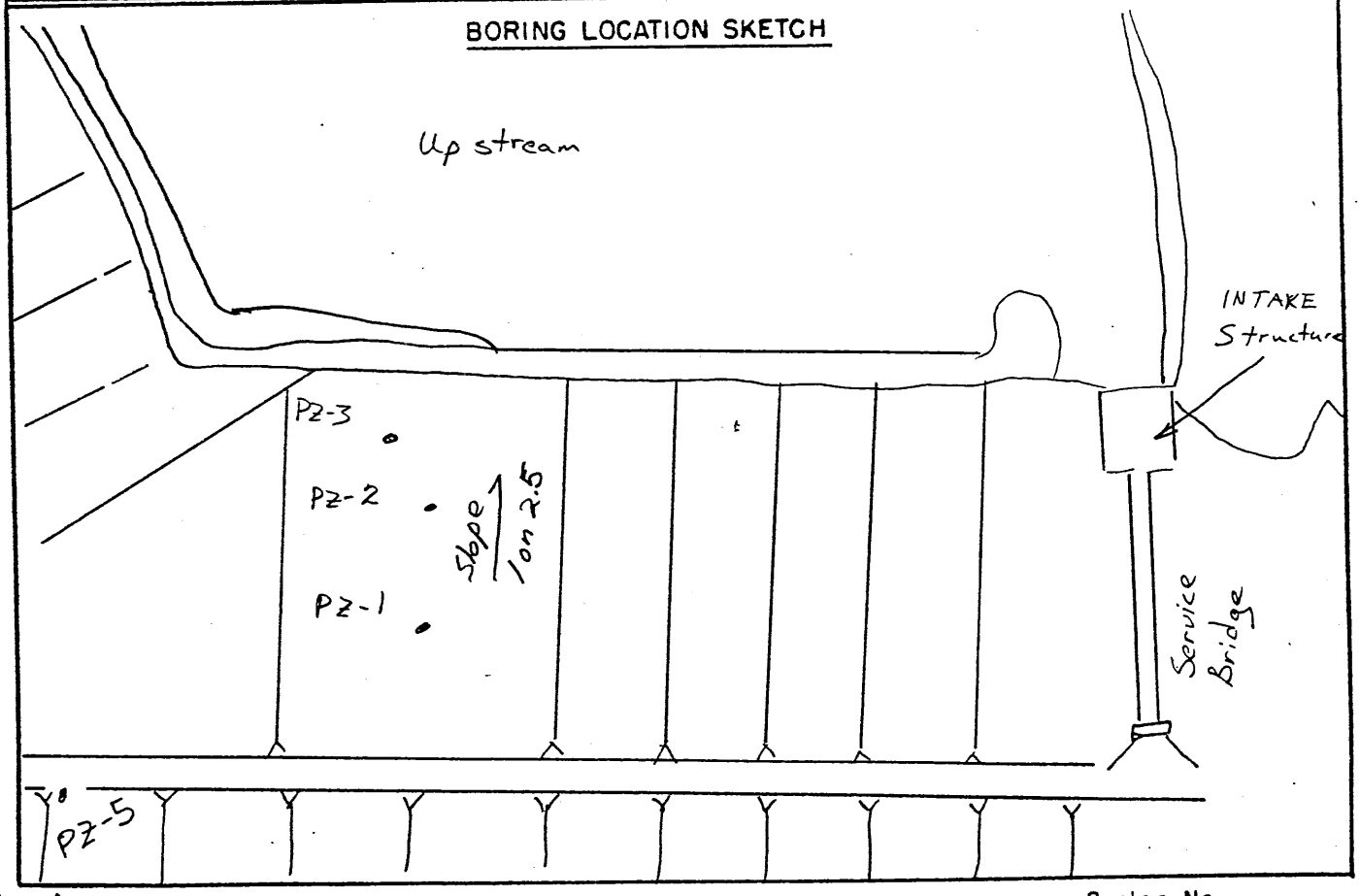
Site: Townshend Dam, Ut
Boring No: FD 87-1

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
7/14/87	10:00	71'	71'	dry	—	
7/21/87	7:00	71'	105'	61.7'	520.9	Boring advanced using "Clear mud"
7/27/87	2:15	71'	134'	114.8	467.8	Water depth inside piezometer riser pipe
7/28/87	7:00	71'	134	114.7	467.8	
7/29/87	7:00	71'	134	114.7	467.8	
7/30/87	8:00	71'	134	114.7	467.8	
7/31/87	7:00	71'	134	114.7	467.8	
8/3/87	12:00	71'	134	114.8	467.8	
8/4/87	7:00	71'	134	114.8	467.8	
8/18/87	9:00	71'	134	114.9	467.7	

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



FORM 59 (Test)

Boring No.

ATLANTIC TESTING LABORATORIES, LIMITED

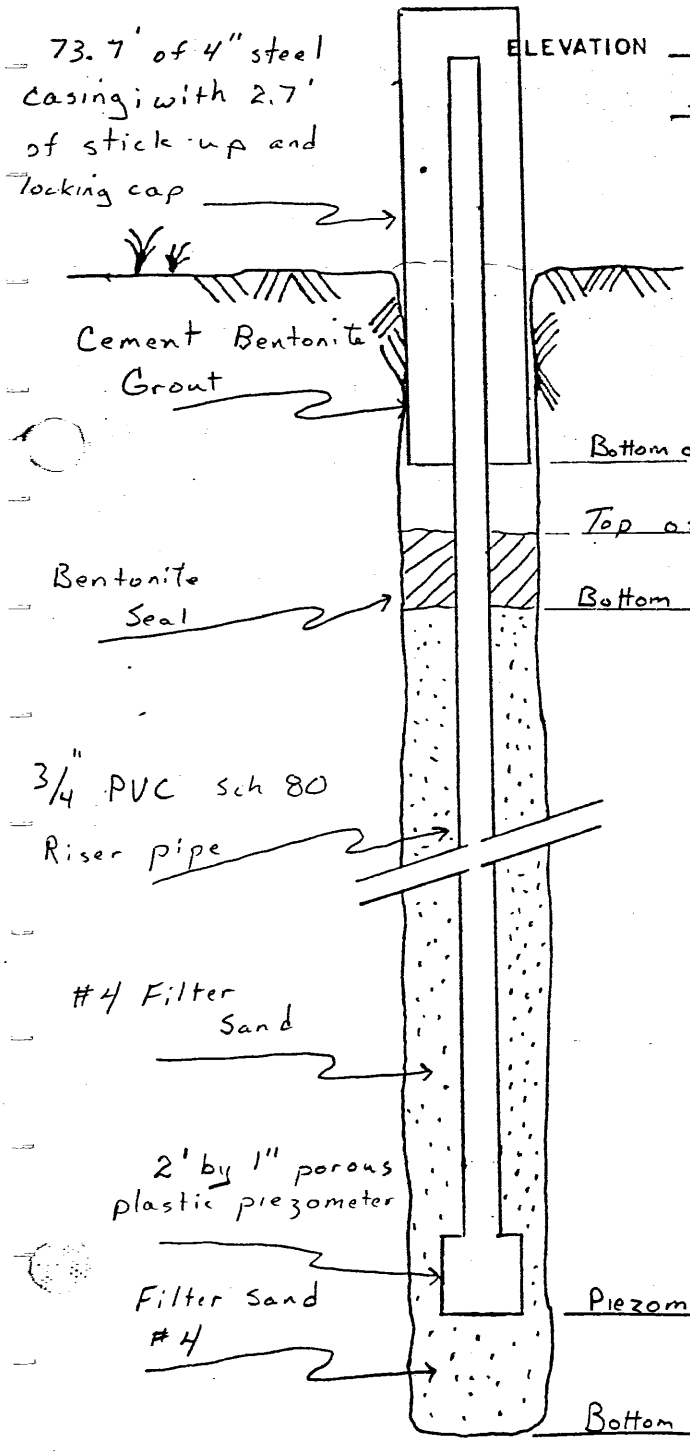
MONITORING WELL INSTALLATION DETAIL

PROJECT: Townshend Dam, Vt D. O. # 0023

PROJECT NO. CD-025

CLIENT: USACE, NED

WELL NO. FD 87-1



ELEVATION 585.3 Top of pipe (2.7' of stick up)

585.2' Top of PVC (2.6 of stick up)

SURFACE ELEVATION 582.6'

	DEPTH	SOIL STRATA
		Boulder, cobbles, and sand predominatly GW-GM, SP Note: Rock Fill Zone of Dam
Bottom of casing	71.0'	
Top of seal	97'	
	100'	
Bottom of seal	103'	Predominatly Sand, but some Gravel, SP and GW-GM Note: Dam Foundation
Piezometer tip	133.3'	
Bottom of Boring	134.0'	

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

FIELD LOG OF TEST BORING

PROJECT NO. D.O. # 0023

Site North Springfield, VT

Page 1 of 8 Pages

Hole No. FD87-2 Diam. (Casing) 30' of 3"

Boring Started 7-23-87

Co-ordinates: X STA A+55 X OFF 440 D/S

Boring Completed 7-28-87

Drilled by Hawkins + Fox

Report Submitted

Purpose of Exploration install piezometers to determine hydrologic characteristics of foundation

Elevation Top of Hole 480.9' M.S.L.

Total Overburden Drilled 38 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole 442.9 M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 38 Feet

Core Recovered RIP RAP %

Core Recovered ____ Ft.; ____ Diam. ____ in.

Soil Samples 1 3/8 in. Diam. 2 No.

Soil Samples ____ in. Diam. ____ No.

Casing Left in Place 3" ϕ 30' Feet
4' STICK UP

Note: elevations taken from table 2, attachment 3

Water Table Depth 20.4'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	21	4" DRIVEN CASING
0	32	5" CORE BARREL
0	32	3" DRIVEN CASING
0	38	3" ROLLER BIT

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Overburden Record — Page 2-4
Rock Drilling — Page 5
Piezometer Installation Report — Page 7
Monitoring Well Installation Detail — Page 8
— Page

Prepared by T. BEDDOE + P. FISHER (Field Data) NONE (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 North Springfield, VT Page 2 of 8 Pages

Boring No. FD87-2 Desig. DZ-14 Diam. (Casing) 4"

Co-ordinates: N STA 19+55 (22+00) E OFF 440 D/S (100')

Elevation Top of Boring 480.9' M.S.L.
Total Overburden Drilled 38' Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring 442.9 M.S.L.
Total Depth of Boring 38' Feet
Core Recovered ____ % No. Boxes ____
Core Recovered ____ Ft. ____ Diam. ____ In.
Soil Samples 1 3/8" In. Diam. 2 No.
Soil Samples ____ In. Diam. ____ No.

Hammer Wt. 140# Boring Started 7/23/87
Hammer Drop 30"
Casing Left 30' Boring Completed 7/28/87
Subsurface Water Data ____ Page 6
Obs. Well 3/4" To 37'
Drilled By Hawkins + Fox
Mfg. Des. Drill CME 75
Inspected By: Beddoe + Hargrave
Classification By: FISHER
Classification By: ____

DEPTH (0.0, 1" = 2')	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
					5" ID diamond core barrel advanced to 2.0' rapidly using water.	coarse granular material with boulders. Rock fill zone of dam. No sample retained.
					Lost drilling water at 2.0', advance slowed by boulders.	
					R-1 to 10.0'	R-1 Varying metamorphic lithologies. 4 pieces 7 chips and fragments 5.0' Recovery = 50% RQD = 40% Note voids in between boulders. Core not retained
	R-1	3"	0.0 to 10.0	50%		
10.0						

GENERAL REMARKS:
Elevations are taken from Table 2, Attachment 3 of the Delivery Order.

RM 58 (Test)

Boring No. FD87-2

Site	Boring No.	Page 3 of 8
North Springfield Dam, VT	FD87-2	

DEPTH		CORE/SAMPLE NO.	SIZE	DEPTH RANGE	CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10.0	1" 2'					5" ID diamond core barrel advanced to 19.0' slowly due to boulders. No water return. R-2 to 19.0'	Boulders with interstitial voids. Rock fill zone of dam. Samples not retained.
		R-2	3"	10.0' to 19.0'	42%		R-2 Varying metamorphic lithologies Rec = 3.8' = 42% 5 pieces, 1 water 5 chips and fragments RQD = 41% Note: some of core remained in hole
19.0						Continue coring from 19.0' to 24.5'.	R-3 Varying metamorphic lithologies
		R-3	3"	19.0' to 24.5'	73%	Advance 4" ID casing to 21.0' using Rig's hydraulic system. Advance 3 7/8" O.D. roller bit using water to 24.8'. Note no water return.	Rec = 4.0' = 73% 4 pieces 20+ chips + fragments RQD = 64% Note: hole caved and/or core remained in hole to 21.5'
24.5						Exploration Terminated 7/23/87	
24.8						STARTED 7/27/87	
		R-4	3"	24.8 To 32		CONTINUED CORING FROM 24.8 TO 32'	
27.0							

Site	Boring No.	Page 4 of 8
N. SPRINGFIELD DAM	FD-87-2	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RANGE	BLOWS PER 6" / CORE REC'VY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
27							
		R-4	3"	24.8 To 32'	5% REC 0 RQD	CONTINUED CORING TO 32'	OUT OF BOULDERS @ 27'
	32					END DRILLING 7/27/87 SET 3" DRIVEN CASING ON 7/28/87	
		S-1	1 3/8 50% REC	32' To 34'	71 65 76 51	2" OD SPLIT SPOON DRIVEN BY 140# HAMMER	GREY + BROWN cmf SAND + mf GRAVEL (SP-GP)
	34						
							14" BOULDER @ 34.8'
	36						
		S-2	1 3/8 60% REC	36' To 38'	17 23 34 26	2" O.D. SPLIT SPOON DRIVEN BY 140# HAMMER WASHED HOLE WITH ROLLER BIT AND CLEAR MUD (32' TO 38')	DARK BROWN cmf SAND, LITTLE mf GRAVEL, LITTLE DECOMPOSED MICA ROCK (SP-GP)
	38						
						EXPLORATION TERMINATED @ 38' (7/28/87)	

FIELD LOG OF TEST BORING IN ROCK

SITE North Springfield VT HOLE NO. FD87-2 PAGE 5 of 8

DATE	DEPTH FT. FROM	DEPTH FT. TO	RUN FT.	RUN REC'V'Y FT.	REC'V'Y %	DRILLING BEHAVIOR: FEED	DRILLING BEHAVIOR: WATER	DRILLING BEHAVIOR: REASON FOR PULL	ACTUAL DRILLING TIME	BIT NO. SIZE AND TYPE	ADDITIONAL REMARKS
7/23/87	0.0	10.0	10.0	5.0	50%	400 lbs 4th gear	water return first 2' no water return 2'-10'	core barrel full	24 min	5" ID diamond	first 2' - coarse granular material - surface fill 2'-10' - boulders of rock fill zone with interstitial voids
7/23/87	10.0	19.0	9.0	3.8	42	200-400 lbs, 4th gear	no water return	core barrel full	36 min	5" ID diamond	Boulders of rock fill zone
7/23/87	19.0	24.5	5.5	4.0	73	200-400 lbs, 4th gear	no water return	core barrel full	45 min	5" ID diamond	Boulders of rock fill zone note caving + loss of core down hole after barrel pulled

TOTAL BED ROCK DRILLED 0.0 FEET

TOTAL BED-ROCK RECOVERED 0.0 FEET

BED ROCK RECOVERY 0.0 PERCENT

Note: cores of boulders not saved.

DRILLER Hawkins + Fox

INSPECTOR Beddoe

NED FORM DEC 130

REPLACES EDITION OF APR 63 WHICH MAY BE USED UNTIL EXHAUSTED

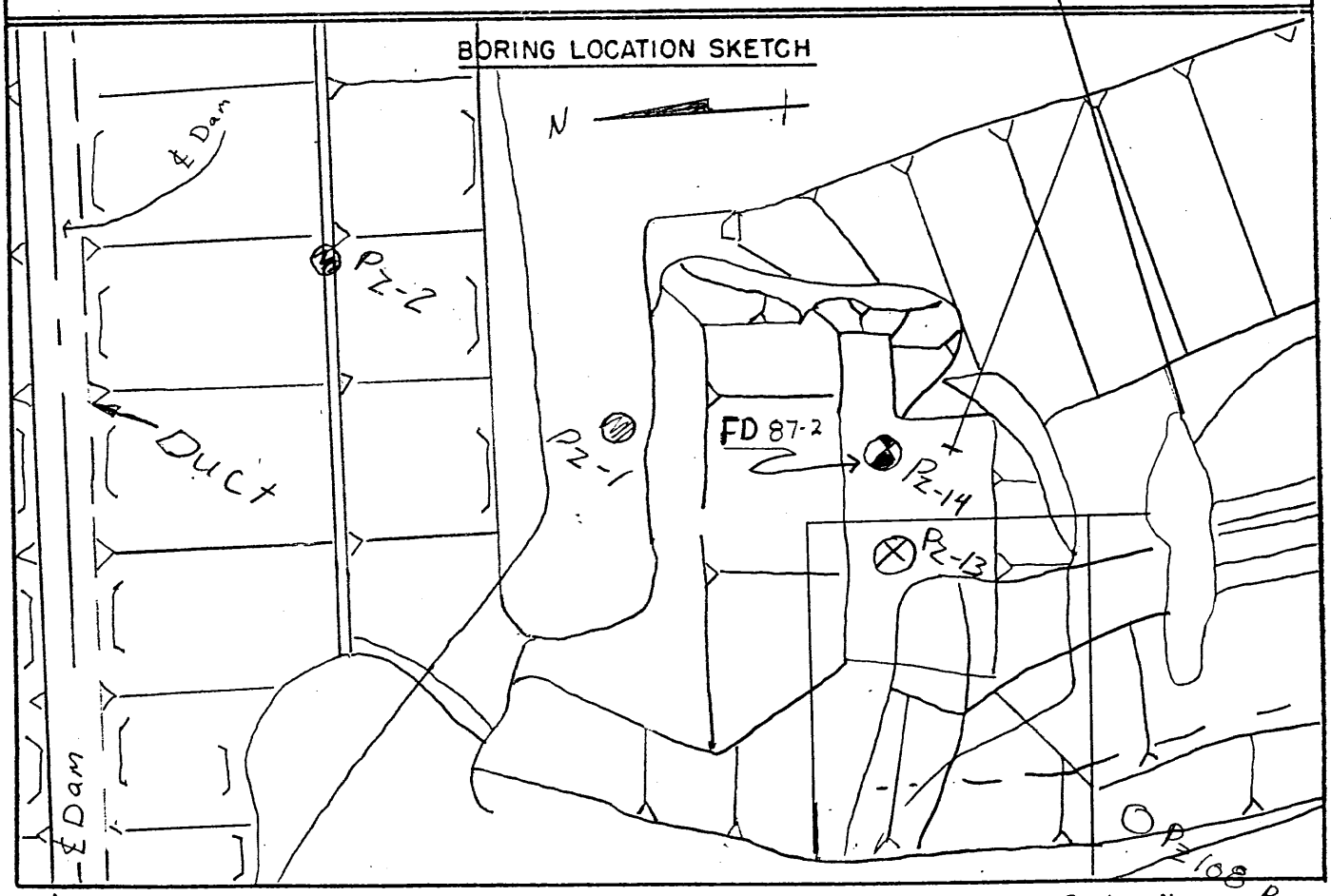
Site: North Springfield
Boring No: FD 87-2

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
7/28/87	1300	37' PVC	38'	—	—	installed well taken from
7/29/87	1400	37'	38'	24.5'	456.4'	top of casing
8/18/87	12:30		38'	21.0'	459.9'	

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



Boring No. B
FD 87-2

PIEZOMETER INSTALLATION REPORT

PROJECT: NORTH SPRINGFIELD DAM | DATE: 7-28-87

LOCATION (STA): 19+55 | OFFSET FROM CENTER LINE: 440' D/S | PIEZ NO.: FD-87-2

PIEZ TYPE: POUROUS (2' LONG) | DEPTH OF PIEZ: 37' | RISER PIPE DIAM: 3/4" ID

PIEZ TIP SET IN (SOIL TYPE): SP-GP | SOIL SAMPLE NO.: S-2 | BORING DIAM: 4" (3" @ PZ)

METHOD OF INSTALLATION: ROTARY DRILL W/4"+3" CASING

TYPE OF PROTECTION FOR PIEZ: 3" ϕ WELDED PIPE | VENT: LOCK CAP

GROUND ELEV.: 480.9' | ELEV. TOP OF RISER: 484.8' | ELEV PIEZ TIP: 443.9'

FILTER: #4 SAND | FROM ELEV: 442.9' | TO ELEV: 450.9'

SEAL: 3/8" PELTONITE | FROM ELEV: 450.9 | TO ELEV: 454.9

INSTALLED BY: HAWKINS + FOX | CONTRACT NO.: D.O. 023 | FOREMAN: FISHER

DATE OF INSTALLATION: 7-28-87 | DATE OF OBSERVATIONS: 7-29-87

METHOD OF TESTING PIEZ.: FALLING HEAD TEST

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
1500	~~0~~	24.3						
1502	0	0	← GENERALLY TOOK WATER AS FAST AS					
1503	1	24.2					I COULD POUR	
1505	3	24.3						

REMARKS: USED FLUIDRIL CLEAR MUD, ACTIVATED W/CLOROX

PAUL FISHER
INSPECTOR

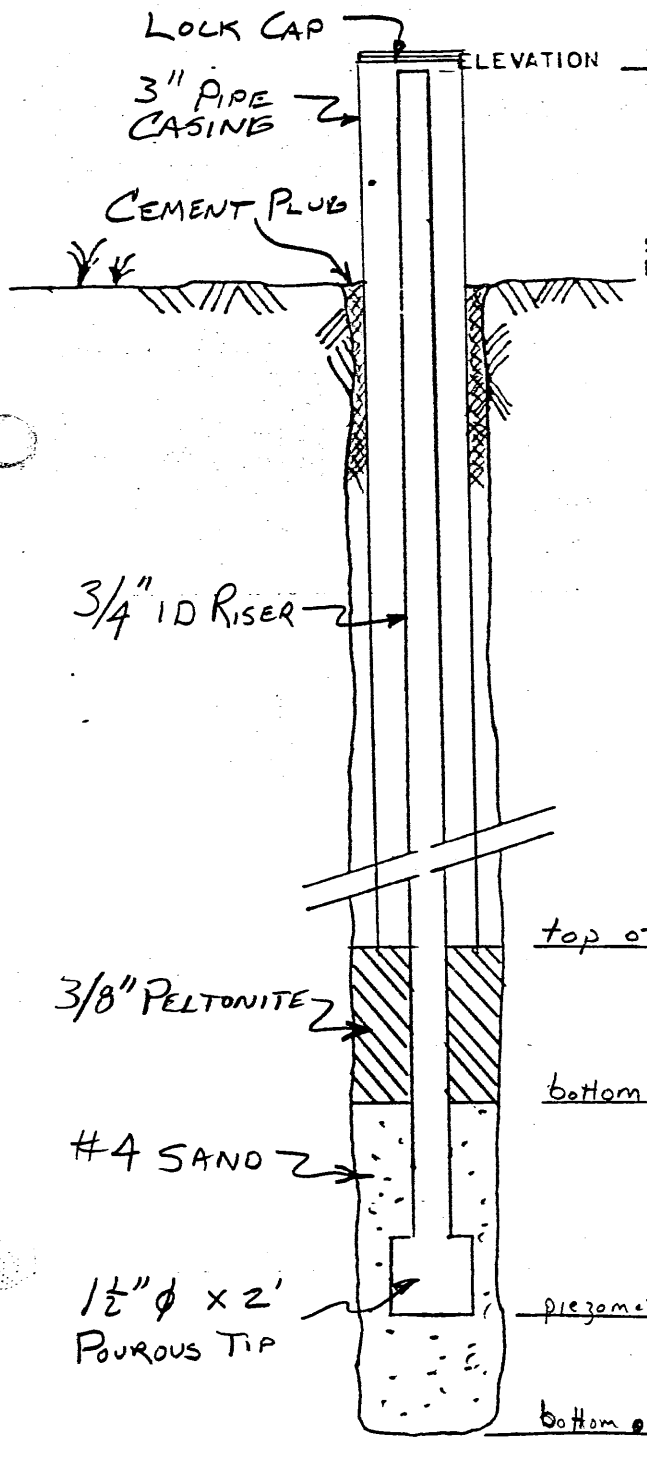
ATLANTIC TESTING LABORATORIES, LIMITED

MONITORING WELL INSTALLATION DETAIL

PROJECT: North Springfield Dam Vt **PROJECT NO.** D.O. 023

CLIENT: Corps Of Engineers **WELL NO.** FD-87-2

N.T.S.



ELEVATION 484.8 pvc riser pipe

SURFACE ELEVATION 480.9'

	DEPTH	SOIL STRATA
		Rip Rap Fill (Boulders)
top of seal	26'	
	27'	Gravelly Sand
bottom of seal	30'	
piezometer tip	37'	
bottom of boring	38'	

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NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. D.O. 0023

Site Townshend Dam, VT — Page 1 of 10 Pages

Hole No. FD-87-3 Diam. (Casing) _____ — Boring Started 7-27-87

Co-ordinates: ~~X~~ sta 21+95 ~~Y~~ offset 100 u/s — Boring Completed 8-3-87

Drilled by Chambers + Saarinen — Report Submitted _____

Purpose of Exploration install piezometers and determine hydrologic characteristics of the foundation

Elevation Top of Hole 546.7' M.S.L.
Total Overburden Drilled 90.5' Feet
Elevation Top of Rock — M.S.L.
Elevation Bottom of Hole 456.4' M.S.L.
Total Rock Drilled 0.0' Feet
Total Depth of Hole 90.5' Feet
Core Recovered 0.0 %
Core Recovered — Ft.; — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Casing Left in Place 16.4 Feet with 1.4' stickup

Water Table Depth 81.6'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	21'	3½" O.D. roller bit
21'	25'	3½" O.D. roller bit with "Clear Mud"
		drilling fluid
30'	90.5'	2 15/16" O.D. roller bit with
		"Clear Mud" drilling fluid
0	50'	NW driven casing

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Prepared by Greg Hargrave — Field Data — Lab. Data

Submitted by Atlantic Testing Laboratories, Limited

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 Townshend Dam, Vt — Page 2 of 10 Pages

Boring No. FD87-3 Desig. PZ-1 Diam. (Casing) _____

Co-ordinates: N _____ E _____

Elevation Top of Boring 546.7' M.S.L.
Total Overburden Drilled 90.5' Feet
Elevation Top of Rock 0.0' M.S.L.
Total Rock Drilled 0.0' Feet
Elevation Bottom of Boring 456.2 M.S.L.
Total Depth of Boring 90.5' Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft: — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140# Boring Started 7/28/87
Hammer Drop 30" Boring Completed 8/3/87
Casing Left 16.4
Subsurface Water Data _____ Page _____
Obs. Well _____
Drilled By Chambers + Sacrinen
Mfg. Des. Drill CME 45
Inspected By: Greg Hargrave
Classification By: Greg Hargrave
Classification By: _____

DEPTH 0.0	DEPTH 1"=2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
				Rec.		3½" O.D. roller bit advanced through open cased hole to 12'	Open cased hole
10'							

GENERAL REMARKS:

RM 58(Test)

Boring No. FD-87-3

Site	Boring No.	Page 3 of 10
Townshend Dam Vt	FD-87-3	

DEPTH		CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	BLOWS PER FT ~~CORE REC VT~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10'				REC		3½" O.D. roller bit, advanced thru open cased hole to 12' Note: easy drilling	Open cased hole
12'						Advanced 3½" O.D. roller bit to 25' Note: easy drilling	granular material Note: possible mortor SAND No Sample retained
20'						Note: drilling became more difficult as drillers encountered gravel and possible cobbles @ 20' Advanced 3½" O.D. roller bit from 21' to 25' using "Clear Mud" drilling fluid because hole was caving, Hole was grouted using 25 gallons of cement to 17' Exploration Terminated 7/28/87	granular material gravel and possible cobbles No Sample Retained
25'						Exploration Continued 7/29/87 Advance 3½" O.D. roller bit to 50' Encounted gravel and possible cobbles	granular material gravel and possible cobbles No Sample Retained
27'							

Site	Boring No.	Page 4 of 10
Townshend Dam Vt	FD 87-3	

DEPTH		CORE/SAMPLE NO.	SIZE	DEPTH/RANGE	BLOWS PER FOOT / CORE RECVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
27'				REC		3½" O.D. roller bit advanced to 30' gravel and possible cobbles encountered, predominatly easy drilling. Note: Drilling fluid changed color from 26' to 30', alternating from Brown to white then back to Brown in color	granular material gravel and possible cobbles. No sample Retained
30'						-Advance NW casing using 300lbs hammer to 30'	
						Advanced 2 15/16" O.D. roller bit to 50'. gravel and possible cobbles encountered to 35'	
35							granular material, SAND, no gravel encountered. No sample Retained
44							

Site	Boring No.	Page 5 of 10
Townshend Dam Vt	FD 87-3	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH	BLOWS PER FT / CORE RECVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
44				REC		2 15/16" O.D. roller bit Advanced to 50' easy drilling	granular material SAND No sample Retained
47							granular material Gravel and possible cobbles No Sample Retained
50'						Advanced 2 15/16" roller bit using "Clear Mud" drilling fluid to 55' Note: easy drilling - NW casing pulled and inspected, drive shoe tightened then advanced to 30'	
55'						Exploration Terminated 7/29/87	
						Exploration Continued 7/30/87 NW Casing Advanced to 50'	granular material Gravel and possible cobbles No sample retained
						Advanced 2 15/16" roller bit to 65' Note: drilling fluid was white in color from 48' to 50', drilling fluid was light brown after 50'	
61'							

Site	Boring No.	Page 6 of 10
Townshend Dam Vt.	FD 87-3	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RANGE	BLOWS PER FT / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
62'						Advanced 2 15/16" roller bit to 65' Note: predominatly easy drilling	granular material GRAVEL, POSSIBLE COBBLES NO SAMPLE RETAINED
63'						Advanced NW casing using 300lbs hammer to 63', Note: could not advance NW casing past 63' due to cobble	granular material, cobble ?; NO SAMPLE RETAINED
						Advanced 2 15/16" roller bit to 75' encountered cobbles, drilling difficult	granular material COBBLES and GRAVEL No Sample Retained
70'						Advanced 2 15/16" roller bit to 76' using "Clear Mud" drilling fluid encountered cobbles drilling difficult	
75'							granular material boulder No SAMPLE RETAINED
76'						Exploration TERMINATED 7/30/87 Exploration Continued 7/31/87 Advanced 2 15/16" roller bit to 89' using "Clear Mud" drilling fluid drilling difficult	granular material cobbles, gravel No Sample Retained
	79						

Site	Boring No.	Page 7 of 10
Townshend Dam Vt	FD 87-3	

DEPTH	CORE/SAMPLE NO	SIZE	DEPTH RANGE	BLOWS PER FT / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
79'					Advanced 2 15/16" roller bit to 89' using "Clear Mud" drilling fluid drilling difficult, boulders and cobbles	granular material cobbles and gravel No sample retained
80'						
85'					Note: from 85' to 88' easy drilling, gravel and possible cobbles	granular material gravel and possible cobbles No sample retained
88'					Note: from 88' to 89' drilling difficult	granular material cobbles
89'					Exploration Terminated @ 89' 7/31/87	No Sample Retained.
					Exploration continued 8/3/87 Advanced 2 15/16" roller bit to 90.5' using "Clear Mud" drilling fluid, drilling difficult	granular material cobbles and gravel Note: No sample retained
90'					Boring Terminated @ 90.5' 8/3/87	
96						

PIEZOMETER INSTALLATION REPORT

PROJECT: Townshend Dam, Vt | DATE: 8/4/87

LOCATION (STA): 21+95 | OFFSET FROM CENTER LINE: 100' u/s | PIEZ NO.: FD 87-3

PIEZ TYPE: Casagrande | DEPTH OF PIEZ: 90.0' | RISER PIPE DIAM: 3/4" schedule 80 PVC

PIEZ TIP SET IN (SOIL TYPE): | SOIL SAMPLE NO.: — | BORING DIAM: 2 15/16"

METHOD OF INSTALLATION: 2 15/16" roller bit thru all material

TYPE OF PROTECTION FOR PIEZ: 16.4' of casing; NW casing telescopes up, ~~out of 4" ID casing to have a stick up of 1.4'~~ VENT: locking cap installed

GROUND ELEV.: 546.7' | ELEV. TOP OF RISER: 548.1' | ELEV PIEZ TIP: 456.7'

FILTER: #4 SAND | FROM ELEV: 456.7' | TO ELEV: 460.6'

SEAL: Bentonite Pellets | FROM ELEV: 460.6' | TO ELEV: 472.7'

INSTALLED BY: Randy Todd; John Searing | CONTRACT NO.: D.O. 0025 | FOREMAN: Greg Hargrave

DATE OF INSTALLATION: 8/4/87 | DATE OF OBSERVATIONS: 8/4/87

METHOD OF TESTING PIEZ.: Falling Head Test Method

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
	0	0						
	1	14.4						
	3	44.4						
	5	49.6						
	10	53.5						

REMARKS:

Gregory R. Hargrave
INSPECTOR

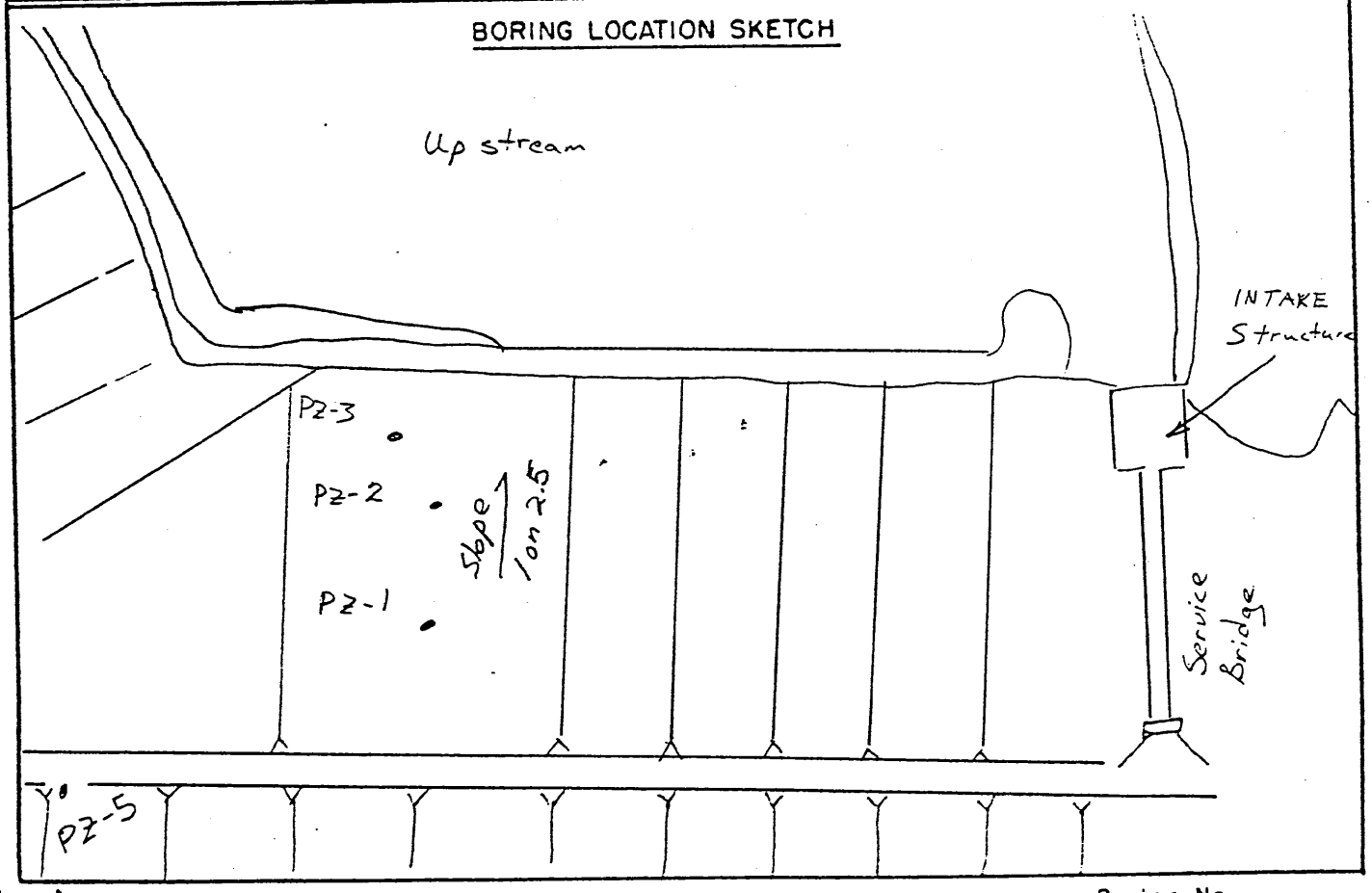
Site: Townshend Dam Vt
Boring No: FD 87-3

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
8-4-87	3:00	15'	90.5	53.5'	493.2'	
8-18-87	10:30	15'	90.5	81.6'	465.1'	

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



FORM 59 (Test)

Boring No.

ATLANTIC TESTING LABORATORIES, LIMITED

MONITORING WELL INSTALLATION DETAIL

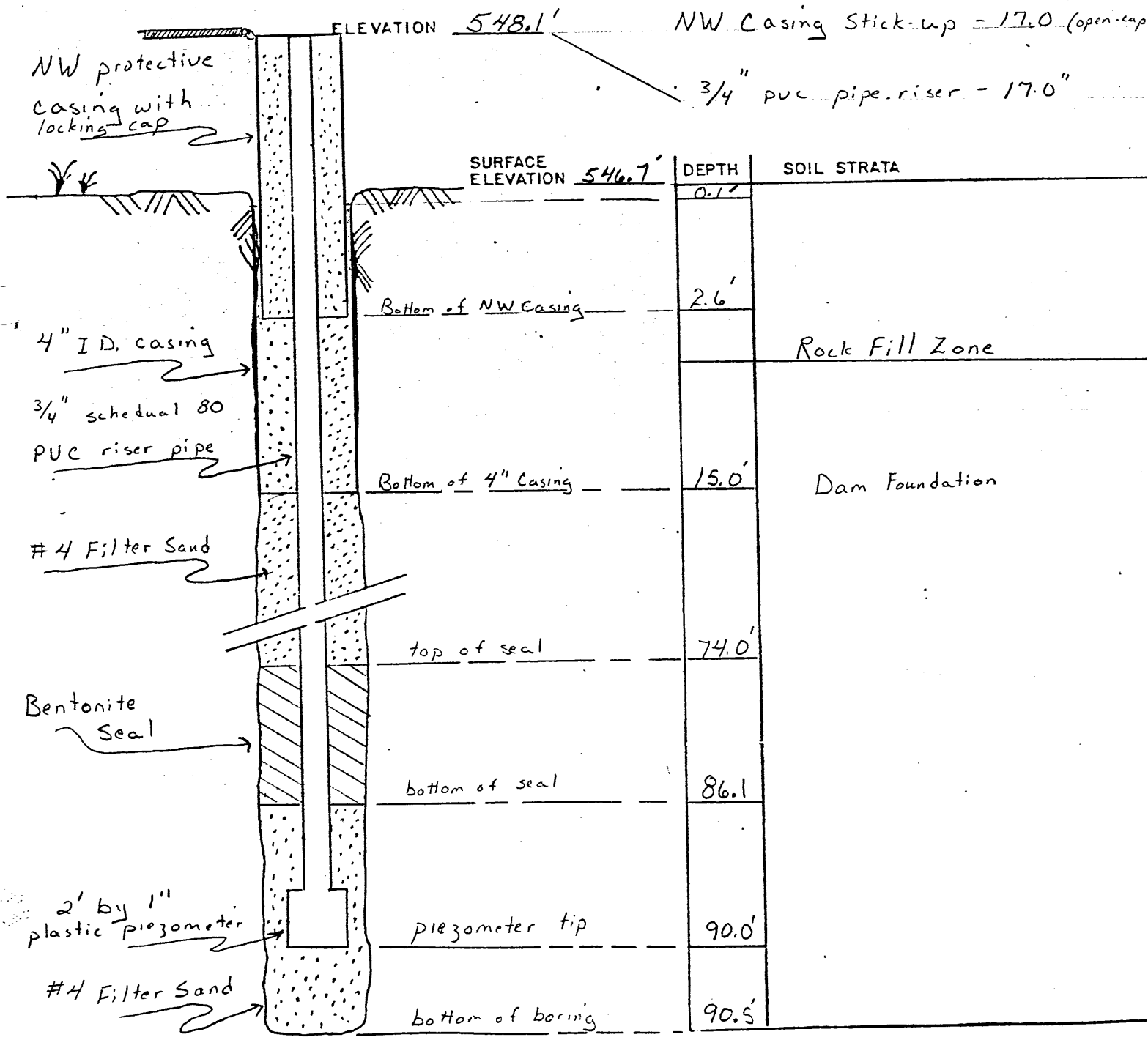
PROJECT: Townshend Dam, Vt

PROJECT NO. CD-025

CLIENT: USACE, NED

WELL NO. FD-87-3

N.T.S.



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NEW ENGLAND DIVISION
FOUNDATION AND MATERIALS BRANCH

FIELD LOG OF TEST BORING

PROJECT NO. D.O. #0023

Site: North Springfield Dam — Page 1 of 7 Pages

Hole No. FO-87A — Diam. (Casing) 3" — Boring Started 7-28-87

Co-ordinates: STA 20+13 OFF 445' D/S — Boring Completed 7-29-87

Drilled by Hawkins + Fox — Report Submitted

Purpose of Exploration: To Set Observation Well

Elevation Top of Hole 482.8 N.S.L.
Total Overburden Drilled 37 Feet
Elevation Top of Rock —— N.S.L.
Elevation Bottom of Hole 445.8 N.S.L.
Total Rock Drilled 0 Feet
Total Depth of Hole 37 Feet
Core Recovered —— %
Core Recovered — Ft.: — Diam. — in.
Soil Samples 1 3/4" in. Diam. 2 No.
Soil Samples —— in. Diam. —— No.

Casing Left in Place 3" @ 29½ Feet
2.8' Stickup

Water Table Depth 23.8

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	29	4" Diamond Bit Core Barrel
0	29	3" Casing
29	37	3" Roller Bit And Clear Mud

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Monitoring Well Installation Detail	Page 7.
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Prepared by Paul Fisher (Field Data) — None (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 N. SPRINGFIELD DAM Page 2 of 7 Pages

Boring No. FD-87-4 Desig. PZ-13 Diam. (Casing) 3"

Co-ordinates: STA 20+13 OFFS 445'0/S

Elevation Top of Boring 482.8 M.S.L. Hammer Wt. 140 Boring Started 7-28-87

Total Overburden Drilled 37 Feet Hammer Drop 30 Boring Completed 7-29-87

Elevation Top of Rock — M.S.L. Casing Left 3"

Total Rock Drilled 0 Feet Subsurface Water Data ____ Page ____

Elevation Bottom of Boring 445.8 M.S.L. Obs. Well 3/4"

Total Depth of Boring 37 Feet Drilled By HAWKINS & FOX

Core Recovered ____ % No. Boxes ____ Mfg. Des. Drill CME 75

Core Recovered ____ Ft: ____ Diam. ____ In. Inspected By: FISHER

Soil Samples 1 5/8 In. Diam. 2 No. Classification By: FISHER

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

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER 6" / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
	R-1	4"	0 To 12.5	0.3'	4" DIAMOND BIT CORE BARREL WITH WATER (DID NOT RETAIN ALL SAMPLE IN BARREL)	BROWN + GREY cmf SAND AND cmf GRAVEL, LITTLE BOULDERS (FILL)
2						BOULDER RIP RAP FILL
10						

GENERAL REMARKS: NO WATER RETURN AFTER 2'

RH 71 58 (Test)

Boring No. FD-87-4

Site	Boring No.	Page 3 of 7
N. SPRINGFIELD DAM	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						
	R-1 CONT	4"	0 TO 12.5	0.3' REC	4" DIAMOND BIT CORE BARREL W/WATER	BOULDER RIP RAP FILL MANY VOIDS
12.5						
	R-2	4"	12.5 TO 15	4.5 REC	PICKED UP SAMPLE LEFT FROM R-1	
15						
	R-3	4"	15 TO 21	4.5' REC		
21					END 7/28/87	
					START 7/29/87	
					CONT. 4" CORE BARREL	
	R-4	4"	21' TO 29'	4.2' REC		
26						BOULDER FILL END

Site	Boring No.	Page 4 of 7
N SPRINGFIELD DAM	FD-87-4	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
	R-4 CONT	4"	21' To 29'		-4" DIAMOND BIT CORE BARREL W/WATER TO 29'. -DROVE 3" CASING TO 29' AFTER REMOVING BARREL. -CLEANED HOLE FROM 29' TO 37' WITH 3" ROLLER BIT USING CLEAR MUD -SAMPLING PERFORMED WITH 2"OD x 2' SPLIT SPOON	
29						
	S-1	1 3/8 40% REC	29' To 30.9	20 38 49 100/.4		GREEN cmf - SAND (SP)
35						
	S-2	1 3/8 60% REC	35' To 37'	28 29 19 17		TAN TO OR BROWN cmf+ SAND, LITTLE mf GRAVEL, TRACE SILT (SP-GP)
37						
					EXPLORATION TERMINATED @ 37'	

PIEZOMETER INSTALLATION REPORT

PROJECT: North Springfield Dam, VT | DATE: 7-29-87

LOCATION (STA): 20+13 | OFFSET FROM CENTER LINE: 445' | PIEZ NO.: FD-87-4

PIEZ TYPE: 2' Pourous | DEPTH OF PIEZ: 37' | RISER PIPE DIAM: 3/4"

PIEZ TIP SET IN (SOIL TYPE): SP-GP | SOIL SAMPLE NO.: S-2 | BORING DIAM: 3"

METHOD OF INSTALLATION: Rotary Drill

TYPE OF PROTECTION FOR PIEZ: 3" ϕ Welded Pipe Casing | VENT: Lock Cap

GROUND ELEV.: ? 482.8 | ELEV. TOP OF RISER: 485.6' | ELEV PIEZ TIP: 36' 446.8

FILTER: #4 Sand | FROM ELEV: 445.8 | TO ELEV: 453.8

SEAL: 3/8" Peltonite | FROM ELEV: 453.8' | TO ELEV: 457.6'

INSTALLED BY: Hawkins + Fox | CONTRACT NO.: D.O. 023 | FOREMAN: Fisher

DATE OF INSTALLATION: 7-29-87 | DATE OF OBSERVATIONS: 7-29-87

METHOD OF TESTING PIEZ.: Falling Head Test

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
1445	Finished Installation							
1512	—	23.8						
1519	0	0	1524	5	23.1			
1520	1	12.75	1529	10	23.75			
1522	3	21.8						

REMARKS: Used Fluidril Clear Mud, Activated w/ Clorox

P. Fisher
INSPECTOR

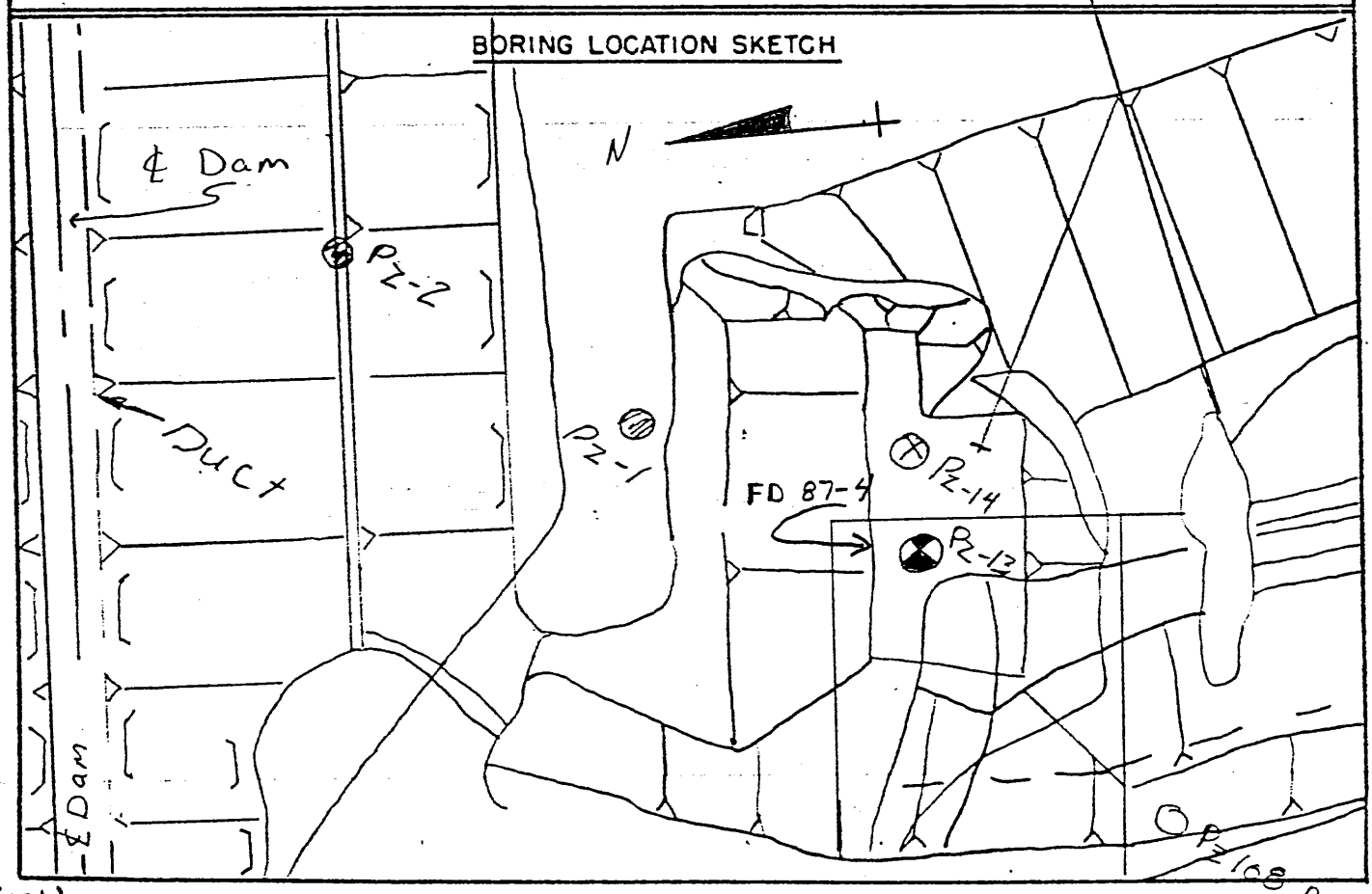
Site: North Springfield
Boring No: FD 87-4

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
8/18/87	12:30	29'	37'	20.6'	462.2	

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



Boring No. B

ATLANTIC TESTING LABORATORIES, LIMITED

MONITORING WELL INSTALLATION DETAIL

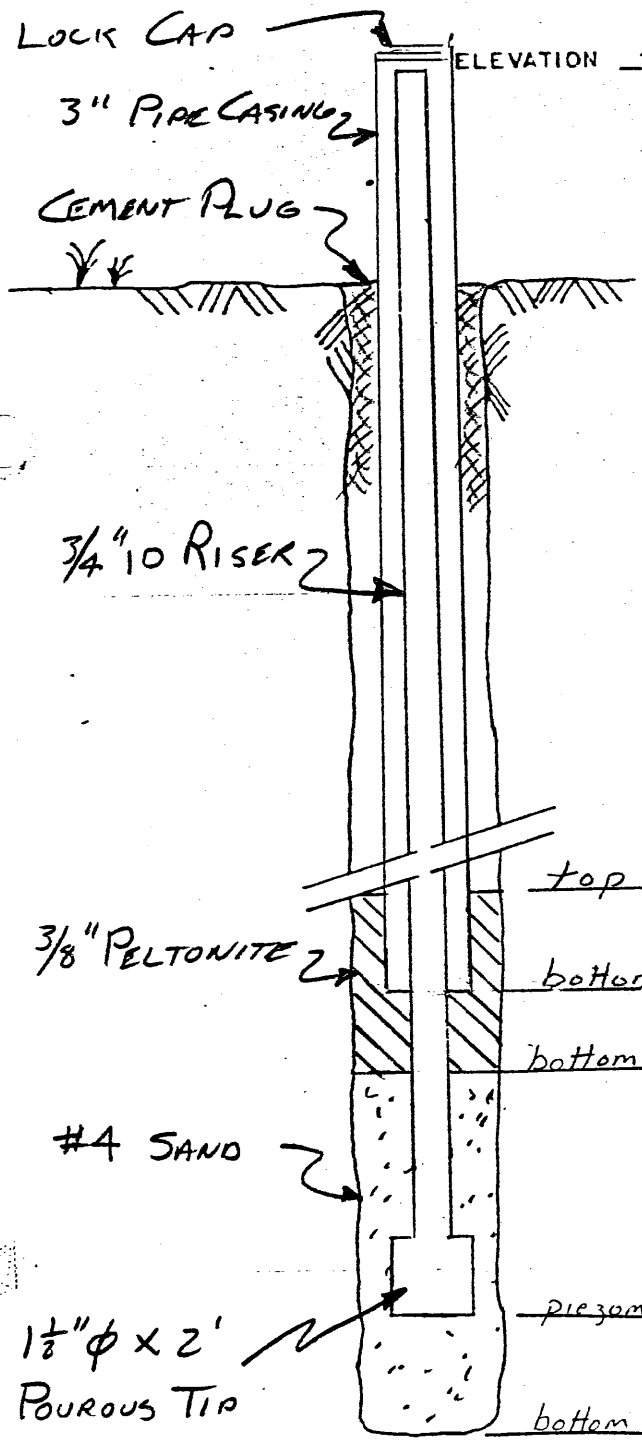
PROJECT: N. SPRINGFIELD DAM VT

PROJECT NO. CO-023

CLIENT: CORPS OF ENG.

WELL NO. FD-87-4

N.T.S.



ELEVATION 485.6' top of pvc riser pipe

SURFACE ELEVATION 482.8

DEPTH	SOIL STRATA
	BOULDER RIP RAP
top of seal 25.2'	
26'	
bottom of casing 26.7'	SP-GP
bottom of seal 29'	
piezometer tip 36'	
bottom of boring 37'	

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

FIELD LOG OF TEST BORING

PROJECT NO. D.O. 0023

Site Townshend Dam, Vt — Page 1 of 8 Pages

Hole No. FD87-5 Diam. (Casing) 3 — Boring Started 8-6-87

Co-ordinates: X (Sta) 21+95 Y (offset) 180' u/s — Boring Completed 8-12-87

Drilled by Todd & Saarinean — Report Submitted

Purpose of Exploration install piezometer and determine the hydrologic characteristics of the foundation

Elevation Top of Hole 514.8 M.S.L.
Total Overburden Drilled 61 Feet
Elevation Top of Rock —
Elevation Bottom of Hole 453.8 M.S.L.
Total Rock Drilled — Feet
Total Depth of Hole 61 Feet
Core Recovered — %
Core Recovered — Ft.; — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Casing Left in Place 31.2 Feet with 1.16' stick up

Water Table Depth 61.'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0.0	10.0	Advanced 3 7/8" roller bit thru open cased hole
0.0	30.0	Advanced NW casing using 300 lbs hammer
15.0	27.0	Advanced 2 3/16" roller bit
27.0	61.0	Advanced 2 5/16" roller bit using "clear Mud" drilling fluid

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— Page —

Prepared by Greg Hargrave — Field Data — Lab. Data

Submitted by Atlantic Testing Laboratories 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 Townshend Dam, Vt — Page 2 of 8 Pages

Boring No. FD87-5 Desig. P2-2 Diam. (Casing) 3

Co-ordinates: Sta 21+95 Offset 180' u/s

Elevation Top of Boring 514.8 M.S.L.
Total Overburden Drilled 61 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled — Feet
Elevation Bottom of Boring 453.8 M.S.L.
Total Depth of Boring 61 Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Hammer Wt. — Boring Started 8-6-87
Hammer Drop —
Casing Left 31.2' Boring Completed 8-12-87
Subsurface Water Data — Page 6
Obs. Well —
Drilled By Randy Todd, John Saarinen
Mfg. Des. Drill CME 45
Inspected By: Greg Hargrove
Classification By: —
Classification By: —

DEPTH	1" = 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0.0'						Advanced 3 7/8" roller bit from 0.0' to 10.0' through open cased hole Note: easy drilling, @ 10' roller bit became "nub-hung", drillers pulled old casing to free roller bit	Open cased hole
5'							
10'						Exploration Terminated 8/6/87	

GENERAL REMARKS:

Site	Boring No	Page 3 of 8
Townshend Dam Vt	FD 87-5	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RANGE	BLOWS PER FT / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10'						Exploration continued 8/11/87 Advanced NW casing to 16.5' using 300 lbs hammer	Grout Mix Material No Sample Retained
15'						Advanced 2 15/16" roller bit from 15' to 18' with water Note: when drillers pulled old casing they excavated hole to 15' - easy drilling Advanced NW casing to 18' using 300 lbs hammer Advanced 2 15/16" roller bit to 25' using water - easy drilling Advanced NW casing to 25' with 300 lbs hammer	Granular Material sand, gravel, grout mix material, possible cobbles No Sample Retained
20'							Granular Material Grout Mix Material, gravel, sand No Sample Retained
25'						Advanced 2 15/16" roller bit to 27' with water	
27							

Site	Boring No	Page 4 of 8
Townshend Dam Vt	FD 87-5	

DEPTH	1" = 2'	CORE/SAMPLE NO	SIZE	DEPTH RUN	CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
27'						Advanced 2 15/16" roller bit to 30' using "Clear Mud" drilling fluid Advanced NW casing to 30' using 300 lbs hammer	Granular Material Grout mix material, sand Gravel, possible cobbles No sample Retained
30'						Advanced 2 15/16" roller bit using "clear mud" drilling fluid to 32.5'	
		R-1	3"	32.5 to 32.7	0% Rec	2.98" ID Diamond bit core barrel Note: difficult drilling Advanced 2 15/16" roller bit thru boulder with water (32.7 to 34.0) Note: difficult drilling	Granular Material Boulder No Sample Retained
35'						Advanced 2 15/16" roller bit to 57' using "Clear Mud" drilling fluid Note: Drilling difficult from 34 to 36' — Drilling easy from 36' to 57' — cave-in from 36' to 37'	Granular Material cobbles and gravel No sample Retained Granular Material Sand, gravel, grout mix material No Sample Retained
40'							Granular Material Gravel and cobbles No sample Retained
44'							

Site	Boring No	Page 5 of 8
Townshend Dam Vt	FD 87-5	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RUN	BLOWS PER FT / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
44'						Advanced 2 15/16" roller bit to 57' using "clear mud" drilling fluid	Granular Material Gravel and cobbles
45'						Note: easy drilling	No Sample Retained
50'						Note: difficult drilling from 51.5' to 57'	
							Granular Material Cobbles No Sample Retained
55'						Exploration Terminated 8-11-87	
						Exploration continued 8-12-87 Advanced 2 15/16" roller bit to 58' using water Note: difficult drilling	Granular Material boulder No Sample Retained
						Advanced 2 15/16" roller bit using "clear mud" drilling fluid to 61' Note: difficult drilling	Granular Material gravel and cobbles No Sample Retained
60'							
61'						Boring Terminated @ 61.0' on 8-12-87	

Piezometer installed, tip depth @ 59.5'

5-A(Test)

Boring No FD-87-5

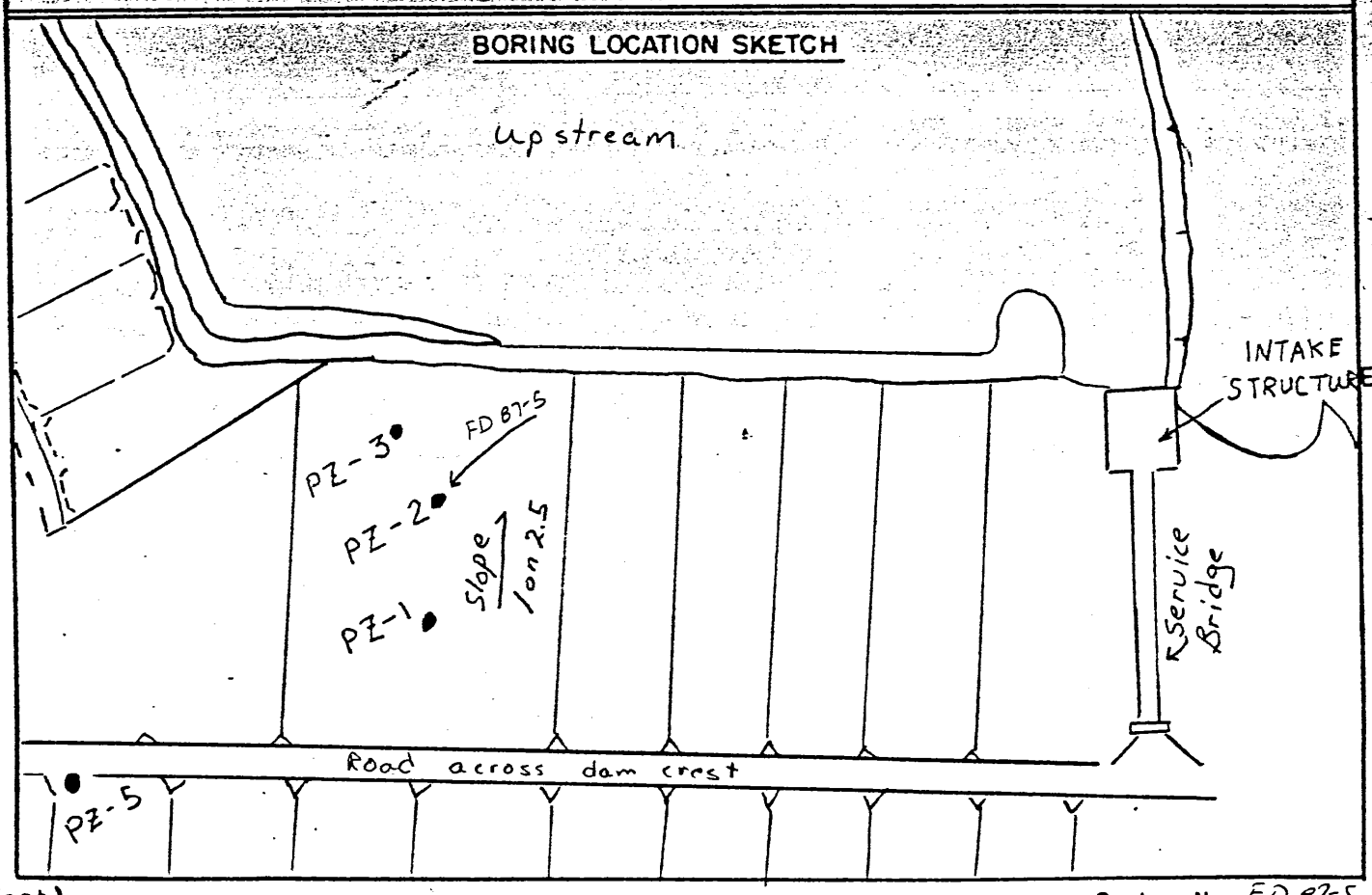
Site: Townshend Dam, Vt
Boring No: FD 87-5

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
8-12-87	4:15	30.0'	61.0	25.0'	489.8	water level reading taken 10 min after falling head test
8/18/87	11:00	30.0'	61.0	45.3'	469.5	

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



PIEZOMETER INSTALLATION REPORT

PROJECT: Townshend Dam Vt | DATE: 8-12-87

LOCATION (STA): 21+95 | OFFSET FROM CENTER LINE: 180' u/s | PIEZ NO.: FD 87-5

PIEZ TYPE: Casagrande | DEPTH OF PIEZ: 59.5' | RISER PIPE DIAM: 3/4" PVC schedual 80

PIEZ TIP SET IN (SOIL TYPE): | SOIL SAMPLE NO.: — | BORING DIAM: 2 15/16"

METHOD OF INSTALLATION: 2 15/16" roller thru all material

TYPE OF PROTECTION FOR PIEZ: 31.6 NW casing with 1.7' stick up | VENT: locking cap

GROUND ELEV.: 514.8 | ELEV. TOP OF RISER: 516.0' | ELEV PIEZ TIP: 455.3'

FILTER: #4 Sand | FROM ELEV: 460.3' | TO ELEV: 460.3

SEAL: Bentonite Pellets | FROM ELEV: 465.8' | TO ELEV: 460.3'

INSTALLED BY: Randy Todd + John Searing | CONTRACT NO.: D.O. 0023 | FOREMAN: Greg Hargrave

DATE OF INSTALLATION: 8-12-87 | DATE OF OBSERVATIONS: 8-12-87

METHOD OF TESTING PIEZ.: Falling Head Test Method

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
	0	0						
	1	10.9						
	3	20.1						
	5	20.3						
	10	24.6						

REMARKS: * Ground elevation taken off table 1 attachment #3 D.O. 0023

Gregory R. Hargrave
INSPECTOR

ATLANTIC TESTING LABORATORIES, LIMITED

MONITORING WELL INSTALLATION DETAIL

PROJECT: Townshend Dam, Vt

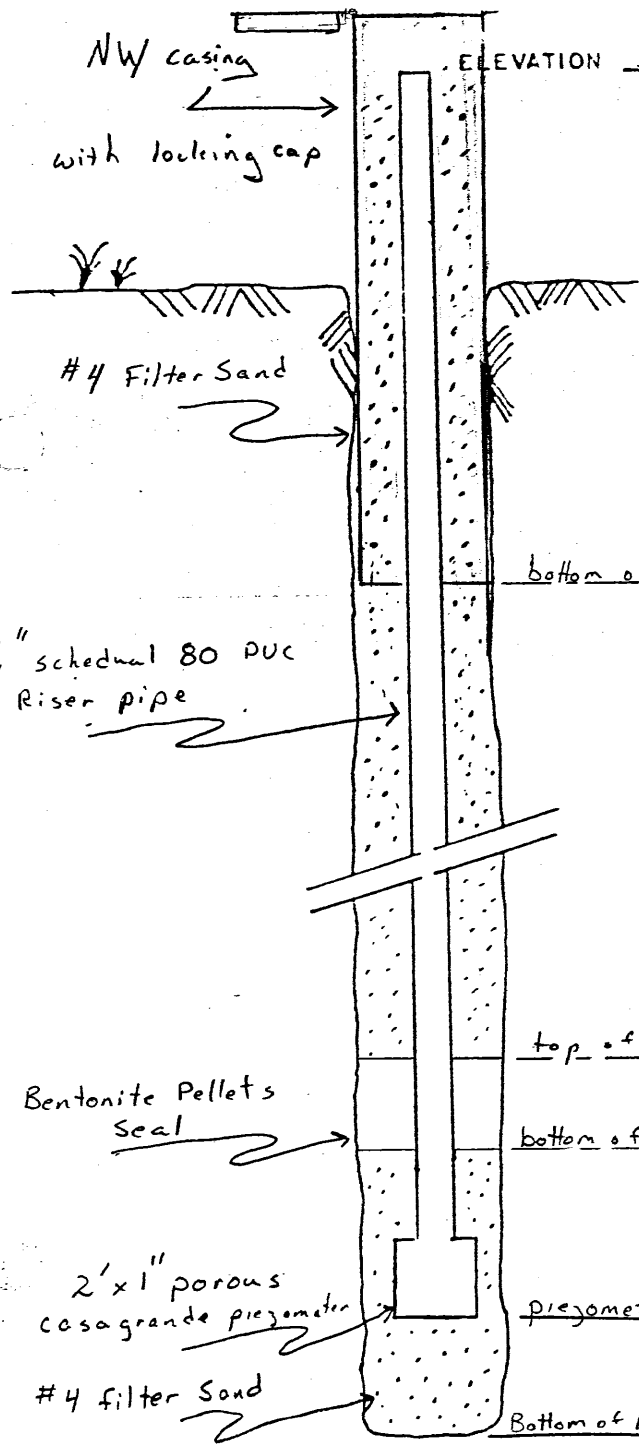
PROJECT NO. CD 025

CLIENT: US ACE, New England Division

WELL NO. FD 87-5

516 NW casing stickup - 14.5" (open cap)

ELEVATION 516 PVC riser stick up - 14.0"



SURFACE ELEVATION	514.8	DEPTH	SOIL STRATA
		23'	Rock Fill Zone
bottom of casing		30'	
			Dam Foundation
top of seal		49.0'	
bottom of seal		54.5'	
piezometer tip		59.5'	
Bottom of Boring		61.0'	

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FIELD LOG OF TEST BORING

PROJECT NO. DO. 023

Site Townshend Dam, VT — Page 1 of 8 Pages

Hole No. FD 87-6 Diam. (Casing) 3" ID — Boring Started 8-13-87

Co-ordinates: Sta 22+39 Offset 230 u/s — Boring Completed 8-18-87

Drilled by RANDY TODD + John Saarinean — Report Submitted

Purpose of Exploration install piezometer to determine hydrologic characteristics of foundation

Elevation Top of Hole 494.7 M.S.L.
Total Overburden Drilled 45' Feet
Elevation Top of Rock — M.S.L.
Elevation Bottom of Hole 449.7 M.S.L.
Total Rock Drilled 0 Feet
Total Depth of Hole 45' Feet
Core Recovered — %
Core Recovered — Ft.; — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Casing Left in Place 40.33 Feet
with 1.33' stick-up

* elevation taken from attachem 3; table 1

Water Table Depth 27.3'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	17	3 1/8" roller bit with water
17'	42'	2 15/16" roller bit with water
42'	45'	2 15/16" roller with "Clear Mud" drilling fluid
0	39'	Advanced NW casing with 300lbs hammer

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Prepared by Greg Hargrave — Field Data — Lab. Data

Submitted by Atlantic Testing Laboratories, Ltd

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FIELD LOG OF TEST BORING

Site Townshend Dam Vt — Page 1 of 8 Pages

Boring No. FD 87-6 Desig. P2-3 Diam. (Casing) 3" I.D.

Co-ordinates: N (sta) 22+39 E (offset) 230 u/s

Elevation Top of Boring 494.7 M.S.L.
Total Overburden Drilled 45' Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled — Feet
Elevation Bottom of Boring 449.7 M.S.L.
Total Depth of Boring 45' Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft: — Diam. — In.
Soil Samples — In. Diam. — No.
Soil Samples — In. Diam. — No.

Hammer Wt. —
Hammer Drop —
Casing Left 40.33'
~~Subsurface Water Data~~ Page 6
Obs. Well 3/4"
Drilled By Randy Todd + John Sacrinean
Mfg. Des. Drill CME 45
Inspected By: Greg Hargrave
Classification By: —
Classification By: —

Boring Started 8-13-87
Boring Completed 8-18-87

DEPTH 1"=2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0					Advanced 3 1/8" roller bit thru open cased hole. Note: easy drilling	open cased hole
5'						
10'						

GENERAL REMARKS:

ORM 58 (Test)

Boring No. FD 87-6

Site	Boring No.	Page 3 of 8
Townshend Dam Vt	FD 87-6	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10'					Advanced 3 1/8" roller bit thru open cased hole Note: easy drilling	open cased hole
15'					Advanced 3 1/8" roller bit to 17' Note: easy drilling	Granular material Sand No Sample Retained
17'					Note: Advanced NW casing to 20'; then started to advance 2 15/16" roller bit from 17' Note: easy drilling	Granular material Grout Mix and Sand No Sample Retained
20'					Note: lost water @ 20.5 regained water @ 22'	Granular Material Sand and Gravel No Sample Retained
25'					Advanced NW casing to 25'; then advanced 2 15/16" roller bit from 22' to 28 1/2	
27'						

Site	Boring No	Page 4 of 8
Townshend Dam Vt	FD 87-6	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RANGE	BLOWS PER FT / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
27'						Advanced 2 15/16" roller bit to 28.5' with water Note: easy drilling	Granular material Sand, grout mix material No sample retained
						Advanced NW casing to 30' Advanced 2 15/16" roller bit from 28.5 to 33'	Granular Material Sand, Gravel, cobbles
30'						Advanced NW casing to 35'	No sample retained.
						Advanced 2 15/16" roller bit from 33' to 34' Exploration Terminated 8-13-87	
34'						Exploration Continued 8-14-87 Advanced 2 15/16" roller bit to 39' using water	Granular material Sand
35'						Advanced NW casing to 39'	No Sample Retained Granular material Sand and grout mix material No sample Retained
40'						Advanced 2 15/16" roller bit to 42' using water	Granular Material Gravel and possible cobbles
						Advanced 2 15/16 roller-bit to 45' using "Clear Mud" drilling fluid	No Sample Retained
44							

Site	Boring No	Page 5 of 8
Townshend Dam, Vt	FD 87-6	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RANGE	BLOWS PER FT / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
44'						Advanced 2 15/16" roller bit to 45' using "Clear Mud" Drilling Fluid	Granular Material
45						Boring Terminated 8-14-87 @ 45'	Sand, Gravel
						Piezometer set with tip depth of 43.5'	No sample Retained

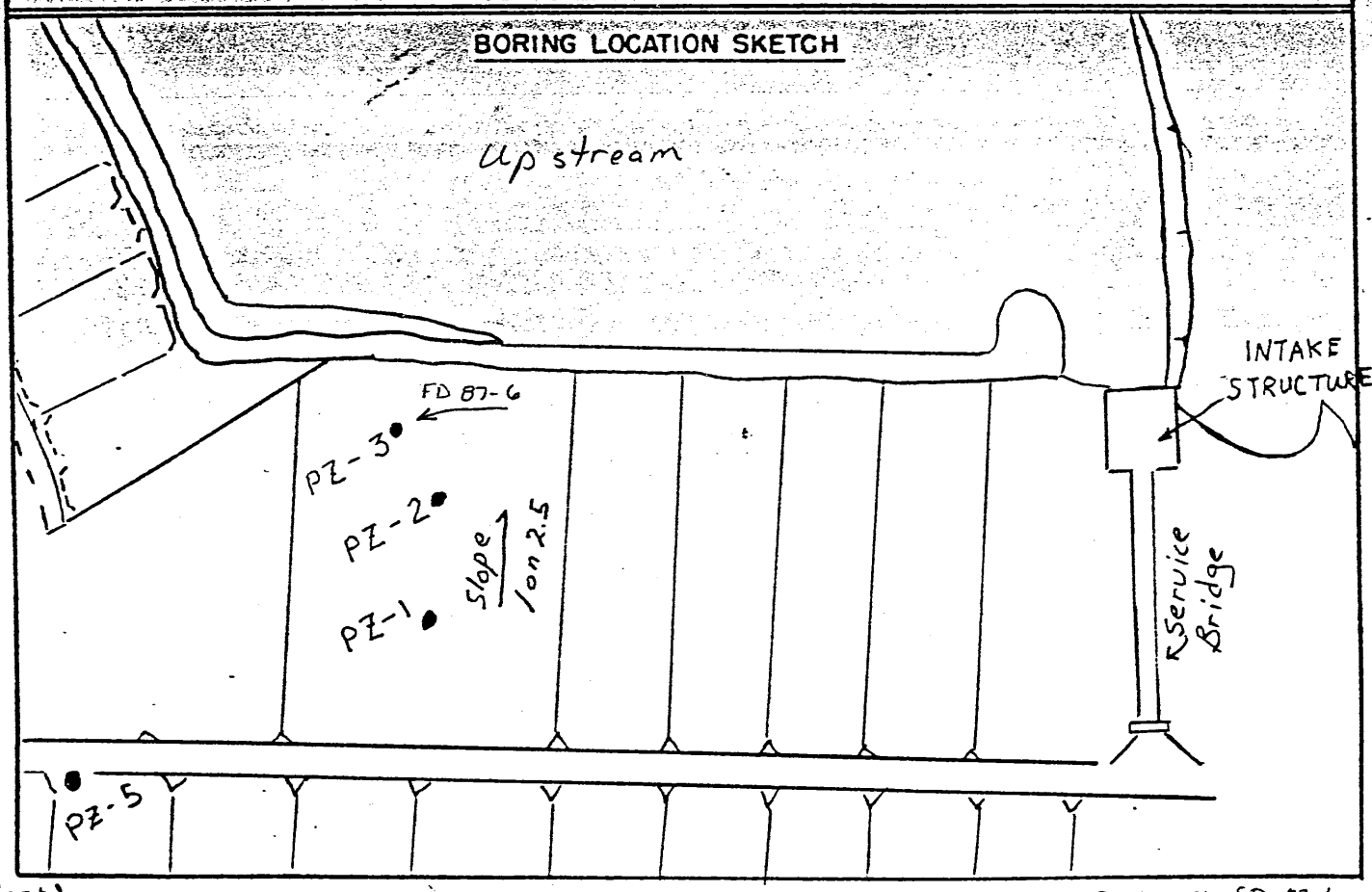
Site: Townshend Dam Vt
Boring No: FD 87-6

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
8-14-87	11:00	39'	45'	27.1'	467.6	Reading taken 10 minutes after falling head test
8/18/87	11:15	39'	45'	27.3'	467.4	

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



PIEZOMETER INSTALLATION REPORT

PROJECT: Townshend Dam Vt | DATE: 8-14-87

LOCATION (STA): 22+39 | OFFSET FROM CENTER LINE: 230' u/s | PIEZ NO.: FD 87-6

PIEZ TYPE: Casagrande | DEPTH OF PIEZ: 43.5 | RISER PIPE DIAM: 3/4" ID

PIEZ TIP SET IN (SOIL TYPE): | SOIL SAMPLE NO.: NA | BORING DIAM: 2 15/16"

METHOD OF INSTALLATION: 2 15/16" roller bit

TYPE OF PROTECTION FOR PIEZ: NW casing | VENT: locking cap installed

GROUND ELEV.: 494.7' | ELEV. TOP OF RISER: 496.0' | ELEV PIEZ TIP: 451.2'

FILTER: #4 SAND | FROM ELEV: 449.7' | TO ELEV: 454.4'

SEAL: Bentonite Pellets | FROM ELEV: 454.4' | TO ELEV: 459.2'

INSTALLED BY: Todd, Saarinean | CONTRACT NO.: D.O. 0023 | FOREMAN: Hargrave

DATE OF INSTALLATION: 8-14-87 | DATE OF OBSERVATIONS: 8-14-87

METHOD OF TESTING PIEZ.: Falling Head Test Method

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
	0	0						
	1	26.9						
	3	27.1						
	5	27.1						
	10	27.1						

REMARKS:

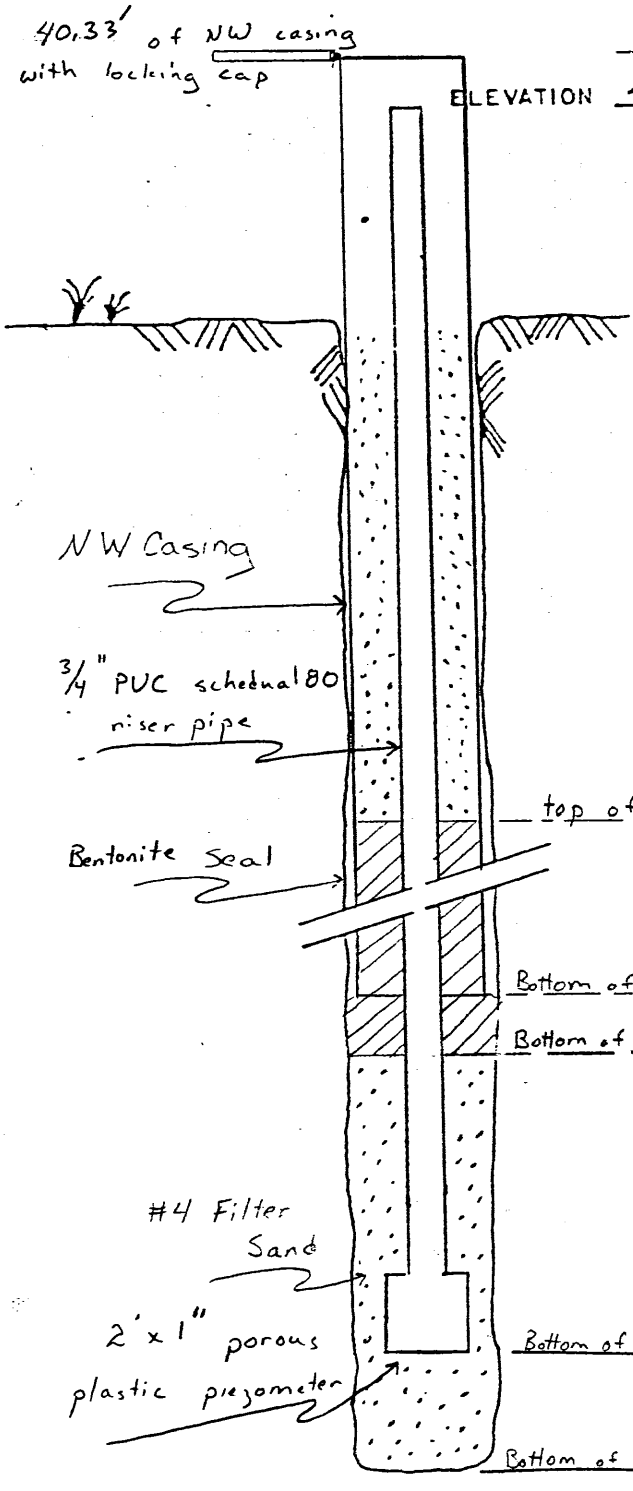
Gregory R. Hargrave
INSPECTOR

ATLANTIC TESTING LABORATORIES, LIMITED

MONITORING WELL INSTALLATION DETAIL

PROJECT: Townshend Dam Vt **PROJECT NO.** D.O. 023

CLIENT: USACE, NED **WELL NO.** FD 87-6



496	NW casing (stick-up - 1.33')	
ELEVATION 496	PVC riser pipe (stick-up - 1.27')	
SURFACE ELEVATION 494.7	DEPTH	SOIL STRATA
top of seal	35.5'	
	38'	Rock Fill Zone
Bottom of casing	39'	
Bottom of seal	40.3'	Dam Foundation
Bottom of piezometer	43.5'	
Bottom of Boring	45'	

SECTION 9

OTHER RECORDS TAKEN

a. Survey Notes

SUMMARY OF PIEZOMETER LOCATIONS & ELEVATIONS

North Springfield Dam

Piezometer Identification	Elevation of Ground	Elevation of Riser	Elevation of Meter	Coordinates North	Coordinates East
PZ-1	485.07	488.24	No PVC	51,641.07	50,425.77
PZ-2	532.70	536.43	No PVC	51,871.11	50,518.87
PZ-3	569.27	572.09	No PVC	52,024.28	50,605.98
PZ-4	569.52	572.97	No PVC	51,958.38	51,394.08
PZ-5	556.87	557.54		51,868.46	51,373.22
PZ-6	538.37	542.94	542.82	51,800.01	50,156.23
PZ-7	536.39	539.46	539.34	51,702.19	50,146.49
PZ-8	505.84	510.01	509.12	51,571.34	50,141.25
PZ-9					
PZ-10	512.11	515.41	514.66	51,470.53	50,147.44
PZ-11					
PZ-12	570.05	573.21		52,030.87	50,200.13
FD-87-4	482.75	485.39	485.35	51,634.50	50,254.22
FD-87-2	480.91	484.81	484.76	51,622.35	50,319.37

SUMMARY OF PIEZOMETER LOCATIONS & ELEVATIONS

Townshed Dam

Piezometer Identification	Elevation of Ground	Elevation of Riser	Elevation of Meter	Coordinates North	Coordinates East
FD-87-3	546.66	550.13	550.43	201,314.42	445,402.46
FD-87-5	514.75	517.36	517.26	201,348.14	445,36.567
FD-87-6	494.67	497.27	497.16	201,401.58	445,292.93
FD-87-1	582.64	585.72	585.56	201,099.99	445,256.15
PZ-6	529.05	530.79	530.80	200,984.18	445,321.34
PZ-7	514.86	516.93	516.93	200,890.00	445,378.82
PZ-8	501.46	506.16	506.06	200.799.23	445,425.78
PZ-9 PZ-10	477.30	479.57	479.57	200,965.22	445,502.24
PZ-11 PZ-12	476.05	478.96	478.76	200,890.79	445,425.78
PZ-13	471.55	474.40	473.62	200,990.82	445,564.24
PZ-15 PZ-16	472.52	474.52	474.42	201,054.34	445,617.78

ATLANTIC TESTING LABORATORIES, Limited

CHAIN OF CUSTODY LOG

PROJECT: NORTH SPRINGFIELD DAM

ITEMS:

Tubes: NONE

Bottles: NONE

Jar Samples: 7 JARS (1 BOX)

Core Boxes: NONE

Sampling Logs: NONE

Date & Time Received	Date & Time Transferred	Comments	Custodian
AS SAMPLED	7/29/87 1700	P. FISHER (ATL)	[signature] John Reis 8/18/87
7/29/87		G. HOLGROVE (ATL)	[signature]

ATLANTIC TESTING LABORATORIES, Limited

CHAIN OF CUSTODY LOG

PROJECT: Townshend Dam, Vt

ITEMS:

Tubes: None

Bottles: None

Jar Samples: 4

Core Boxes: None

Sampling Logs:

Date & Time Received	Date & Time Transferred	Comments	Custodian
As Sampled	8/18/87 1700	[illegible]	[illegible] John Reis 8/18/87

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

FIELD LOG OF TEST BORING

PROJECT NO. D.O. #0023

Site: NORTH SPRINGFIELD DAM — Page 1 of 7 Pages

Hole No. FO-87A Diam. (Casing) 3" — Boring Started 7-28-87

Co-ordinates: STA 20+13 OFF 445' D/S — Boring Completed 7-29-87

Drilled by HAWKINS + FOX — Report Submitted

Purpose of Exploration: TO SET OBSERVATION WELL

Elevation Top of Hole ____ M.S.L.
Total Overburden Drilled 37 Feet
Elevation Top of Rock ____ M.S.L.
Elevation Bottom of Hole ____ M.S.L.
Total Rock Drilled 0 Feet
Total Depth of Hole 37 Feet
Core Recovered ____ %
Core Recovered ____ Ft.: ____ Diam. ____ in.
Soil Samples ____ in. Diam. ____ No.
Soil Samples ____ in. Diam. ____ No.

Casing Left in Place 3" @ 29½ Feet
2.8' STICKUP

Water Table Depth 23.8

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	29	4" DIAMOND BIT CORE BARREL
0	29	3" CASING
29	37	3" ROLLER BIT AND CLEAR MUD

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Ground Water	Back of Page 7
Boring Location Sketch	Back of Page 7
Overburden Record	Page 2-4
Rock Drilling	Page 2-4
Piezometer Installation Report	Page 5
Monitoring Well Installation Detail	Page 7
	Page

Prepared by PAUL FISHER (Field Data) — NONE (Lab. Data)

Submitted by ATLANTIC TESTING LAB

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

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

FIELD LOG OF TEST BORING

PROJECT NO. D.O. #0023

Site: North Springfield Dam — Page 1 of 7 Pages

Hole No. FO-87A Diam. (Casing) 3" — Boring Started 7-28-87

Co-ordinates: STA 20+13 OFF 445' D/S — Boring Completed 7-29-87

Drilled by Hawkins + Fox — Report Submitted

Purpose of Exploration: To Set Observation Well

Elevation Top of Hole ____ M.S.L.
Total Overburden Drilled 37 Feet
Elevation Top of Rock ____ M.S.L.
Elevation Bottom of Hole ____ M.S.L.
Total Rock Drilled 0 Feet
Total Depth of Hole 37 Feet
Core Recovered ____ %
Core Recovered ____ Ft.: ____ Diam. ____ in.
Soil Samples ____ in. Diam. ____ No.
Soil Samples ____ in. Diam. ____ No.

Casing Left in Place 3" @ 29½ Feet
2.8' Stickup

Water Table Depth 23.8

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	29	4" Diamond Bit Core Barrel
0	29	3" Casing
29	37	3" Roller Bit And Clear Mud

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Rock Drilling	Page 2-4
Piezometer Installation Report	Page 5
Monitoring Well Installation Detail	Page 7
	Page

Prepared by Paul Fisher (Field Data) — None (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 N. SPRINGFIELD DAM Page 2 of 7 Pages

Boring No. FD-87-4 Desig. PZ-13 Diam. (Casing) 3"

Co-ordinates: STA 20+13 OFFS 445' O/S

Elevation Top of Boring _____ M.S.L.
Total Overburden Drilled 37 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring _____ M.S.L.
Total Depth of Boring 37 Feet
Core Recovered _____ % No. Boxes _____
Core Recovered _____ Ft. _____ Diam. _____ in.
Soil Samples 1 5/8 in. Diam. 2 No.
Soil Samples _____ in. Diam. _____ No.

Hammer Wt. 140 Boring Started 7-28-87
Hammer Drop 30 Boring Completed 7-29-87
Casing Left 3"
Subsurface Water Data _____ Page _____
Obs. Well 3/4"
Drilled By HAWKINS & FOX
Mfg. Des. Drill CME 75
Inspected By: FISHER
Classification By: FISHER
Classification By: _____

DEPTH 1" = 2	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER 6" / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	R-1	4"	0 To 12.5	0.3'	4" DIAMOND BIT CORE BARREL WITH WATER (DID NOT RETAIN ALL SAMPLE IN BARREL)	BROWN + GREY cmf SAND AND cmf GRAVEL, LITTLE BOULDERS (FILL)
2						BOULDER RIP RAP FILL
10						

GENERAL REMARKS: NO WATER RETURN AFTER 2'

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site N. SPRINGFIELD DAM Page 2 of 7 Pages

Boring No. FD-87-4 Desig. PZ-13 Diam. (Casing) 3"

Co-ordinates: STA 20+13 OFFS 445' O/S

Elevation Top of Boring _____ M.S.L.
Total Overburden Drilled 37 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring _____ M.S.L.
Total Depth of Boring 37 Feet
Core Recovered _____ % No. Boxes _____
Core Recovered _____ Ft. _____ Diam. _____ In.
Soil Samples 1 3/8 In. Diam. 2 No.
Soil Samples _____ In. Diam. _____ No.

Hammer Wt. 140 Boring Started 7-28-87
Hammer Drop 30
Casing Left 3" Boring Completed 7-29-87
Subsurface Water Data _____ Page _____
Obs. Well 3/4"
Drilled By HAWKINS & FOX
Mfg. Des. Drill CME 75
Inspected By: FISHER
Classification By: FISHER
Classification By: _____

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER 6" / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2	R-1	4"	0 To 12.5	0.3'	4" DIAMOND BIT CORE BARREL WITH WATER (DID NOT RETAIN ALL SAMPLE IN BARREL)	BROWN + GREY cmf SAND AND cmf GRAVEL, LITTLE BOULDERS (FILL)
2						BOULDER RIP RAP FILL
10						

GENERAL REMARKS: NO WATER RETURN AFTER 2'

Site	Boring No.	Page 3 of 7
N. SPRINGFIELD DAM	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						
	R-1 CONT	4"	0 TO 12.5	0.3' REC	4" DIAMOND BIT CORE BARREL W/ WATER	BOULDER RIP RAP FILL MANY VOIDS
12.5						
	R-2	4"	12.5 TO 15	4.5 REC	PICKED UP SAMPLE LEFT FROM R-1	
15						
	R-3	4"	15 TO 21	4.5' REC		
21					END 7/28/87	
					START 7/29/87	
					CONT. 4" CORE BARREL	
	R-4	4"	21' TO 29'	4.2' REC		
26						BOULDER FILL END

Site	Boring No.	Page 3 of 7
N. SPRINGFIELD DAM	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						
	R-1 CONT	4"	0 TO 12.5	0.3' REC	4" DIAMOND BIT CORE BARREL W/ WATER	BOULDER RIP RAP FILL MANY VOIDS
12.5						
	R-2	4"	12.5 TO 15	4.5 REC	PICKED UP SAMPLE LEFT FROM R-1	
15						
	R-3	4"	15 TO 21	4.5' REC		
21					END 7/28/87	
					START 7/29/87	
					CONT. 4" CORE BARREL	
	R-4	4"	21' TO 29'	4.2' REC		
26						BOULDER FILL END

Site	Boring No.	Page 4 of 7
N SPRINGFIELD DAM	FD-87-4	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2 27						
29	R-4 CONT	4"	21' TO 29'		-4" DIAMOND BIT CORE BARREL W/WATER TO 29'. -DROVE 3" CASING TO 29' AFTER REMOVING BARREL. -CLEANED HOLE FROM 29' TO 37' WITH 3" ROLLER BIT USIND CLEAR MUD -SAMPLING PERFORMED WITH 2" OD x 2' SPLIT SPOON	
	S-1	1 3/8 40% REC	29' TO 30.9	20 38 49 100/.4		GREEN cmf + SAND (SP)
35						
37	S-2	1 3/8 60% REC	35' TO 37'	28 29 19 17		TAN TO DK BROWN cmf + SAND, LITTLE mf GRAVEL, TRACE SILT (SP-GP)
					EXPLORATION TERMINATED @ 37'	

Site	Boring No.	Page 4 of 7
N SPRINGFIELD DAM	FD-87-4	

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
29	R-4 CONT	4"	21' To 29'		-4" DIAMOND BIT CORE BARREL W/WATER TO 29'. -DROVE 3" CASING TO 29' AFTER REMOVING BARREL. -CLEANED HOLE FROM 29' TO 37' WITH 3" ROLLER BIT USING CLEAR MUD -SAMPLING PERFORMED WITH 2"OD x 2' SPLIT SPOON	
	S-1	1 3/8 40% REC	29' To 30.9	20 38 49 100%		GREEN cmf + SAND (SP)
35	S-2	1 3/8 60% REC	35' To 37'	28 29 19 17		TAN TO OR BROWN cmf + SAND, LITTLE mf GRAVEL, TRACE SILT (SP-GP)
37					EXPLORATION TERMINATED @ 37'	

PIEZOMETER INSTALLATION REPORT

PROJECT: North Springfield Dam, VT | DATE: 7-29-87

LOCATION (STA): 20+13 | OFFSET FROM CENTER LINE: 445' | PIEZ NO.: FD-87-4

PIEZ TYPE: 2' Pourous | DEPTH OF PIEZ: 37' | RISER PIPE DIAM: 3/4"

PIEZ TIP SET IN (SOIL TYPE): SP-GP | SOIL SAMPLE NO.: S-2 | BORING DIAM: 3"

METHOD OF INSTALLATION: Rotary Drill

TYPE OF PROTECTION FOR PIEZ: 3" ϕ Welded Pipe Casing | VENT: Lock Cap

GROUND ELEV.: ? | ELEV. TOP OF RISER: | ELEV PIEZ TIP: 36'

FILTER: #4 Sand | FROM ELEV: 37' | TO ELEV: 29'

SEAL: 3/8" Peltonite | FROM ELEV: 29' | TO ELEV:

INSTALLED BY: Hawkins + Fox | CONTRACT NO.: D.O. 023 | FOREMAN: Fisher

DATE OF INSTALLATION: 7-29-87 | DATE OF OBSERVATIONS: 7-29-87

METHOD OF TESTING PIEZ.: Falling Head Test

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
1445	Finished Installation							
1512	—	23.8						
1519	0	0	1524	5	23.1			
1520	1	12.75	1529	10	23.75			
1522	3	21.8						

REMARKS: Used Fluidril Clear Mud, Activated w/ Clorox

P. Fisher
INSPECTOR

PIEZOMETER INSTALLATION REPORT

PROJECT: North Springfield Dam, Vt | DATE: 7-29-87

LOCATION (STA): 20+13 | OFFSET FROM CENTER LINE: 445' | PIEZ NO.: FD-87-4

PIEZ TYPE: 2' Pourous | DEPTH OF PIEZ: 37' | RISER PIPE DIAM: 3/4"

PIEZ TIP SET IN (SOIL TYPE): SP-GP | SOIL SAMPLE NO.: S-2 | BORING DIAM: 3"

METHOD OF INSTALLATION: Rotary Drill

TYPE OF PROTECTION FOR PIEZ: 3" ϕ Welded Pipe Casing | VENT: Lock Cap

GROUND ELEV.: ? | ELEV. TOP OF RISER: | ELEV PIEZ TIP: 36'

FILTER: #4 Sand | FROM ELEV: 37' | TO ELEV: 29'

SEAL: 3/8" Peltonite | FROM ELEV: 29' | TO ELEV:

INSTALLED BY: Hawkins + Fox | CONTRACT NO.: D.O. 023 | FOREMAN: Fisher

DATE OF INSTALLATION: 7-29-87 | DATE OF OBSERVATIONS: 7-29-87

METHOD OF TESTING PIEZ.: Falling Head Test

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
1445	Finished Installation							
1512	—	23.8						
1519	0	0	1524	5	23.1			
1520	1	12.75	1529	10	23.75			
1522	3	21.8						

REMARKS: Used Fluidril Clear Mud, Activated w/ Clorox

P. Fisher
INSPECTOR

Site: _____
Boring No: _____

SUBSURFACE WATER OBSERVATIONS

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

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

Site: _____
Boring No: _____

SUBSURFACE WATER OBSERVATIONS

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

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

ATLANTIC TESTING LABORATORIES, LIMITED

MONITORING WELL INSTALLATION DETAIL

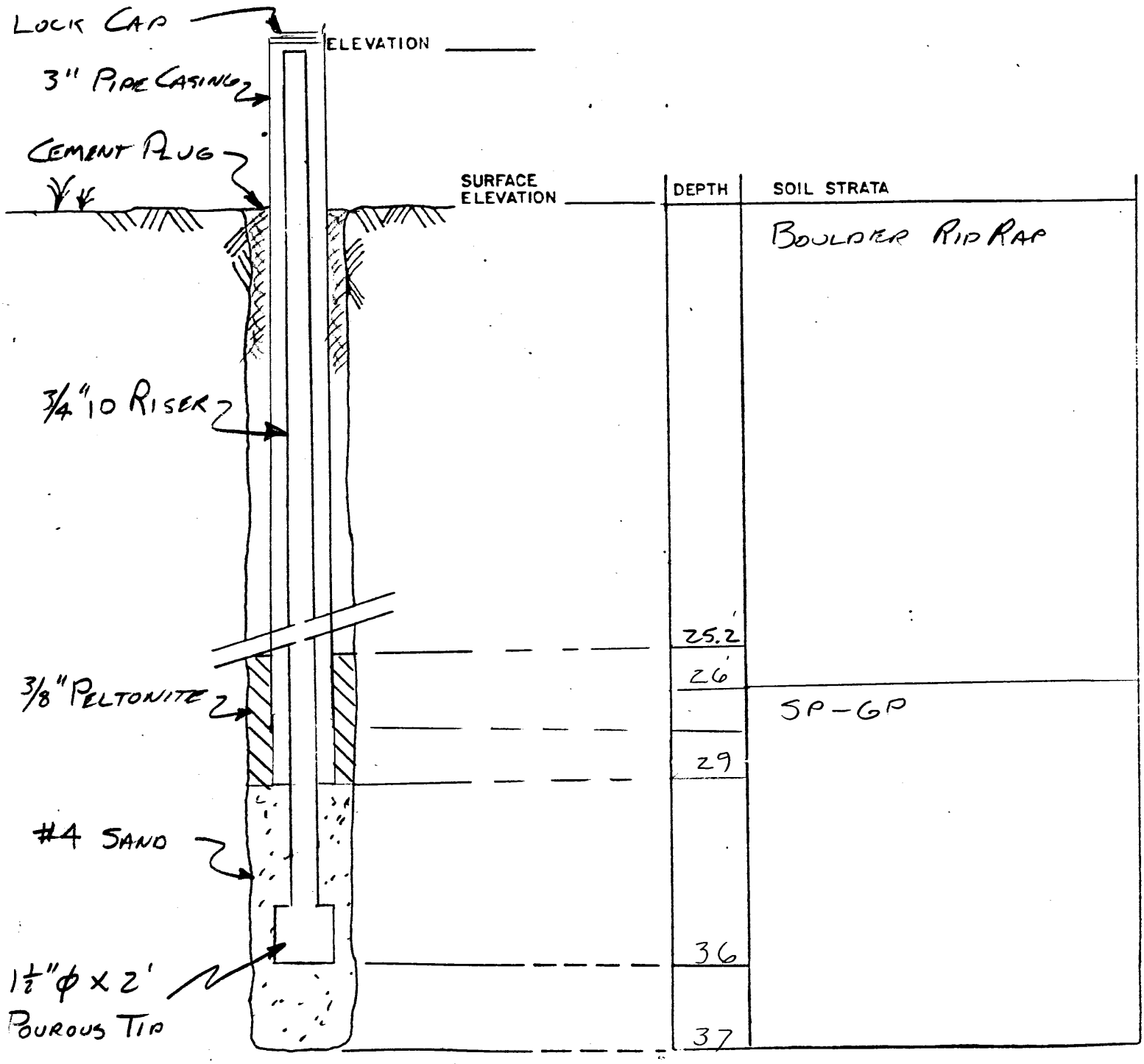
PROJECT: N. SPRINGFIELD DAM VT

PROJECT NO. CO-023

CLIENT: CORPS OF ENG.

WELL NO. FD-87-4

N.T.S.



ATLANTIC TESTING LABORATORIES, LIMITED

MONITORING WELL INSTALLATION DETAIL

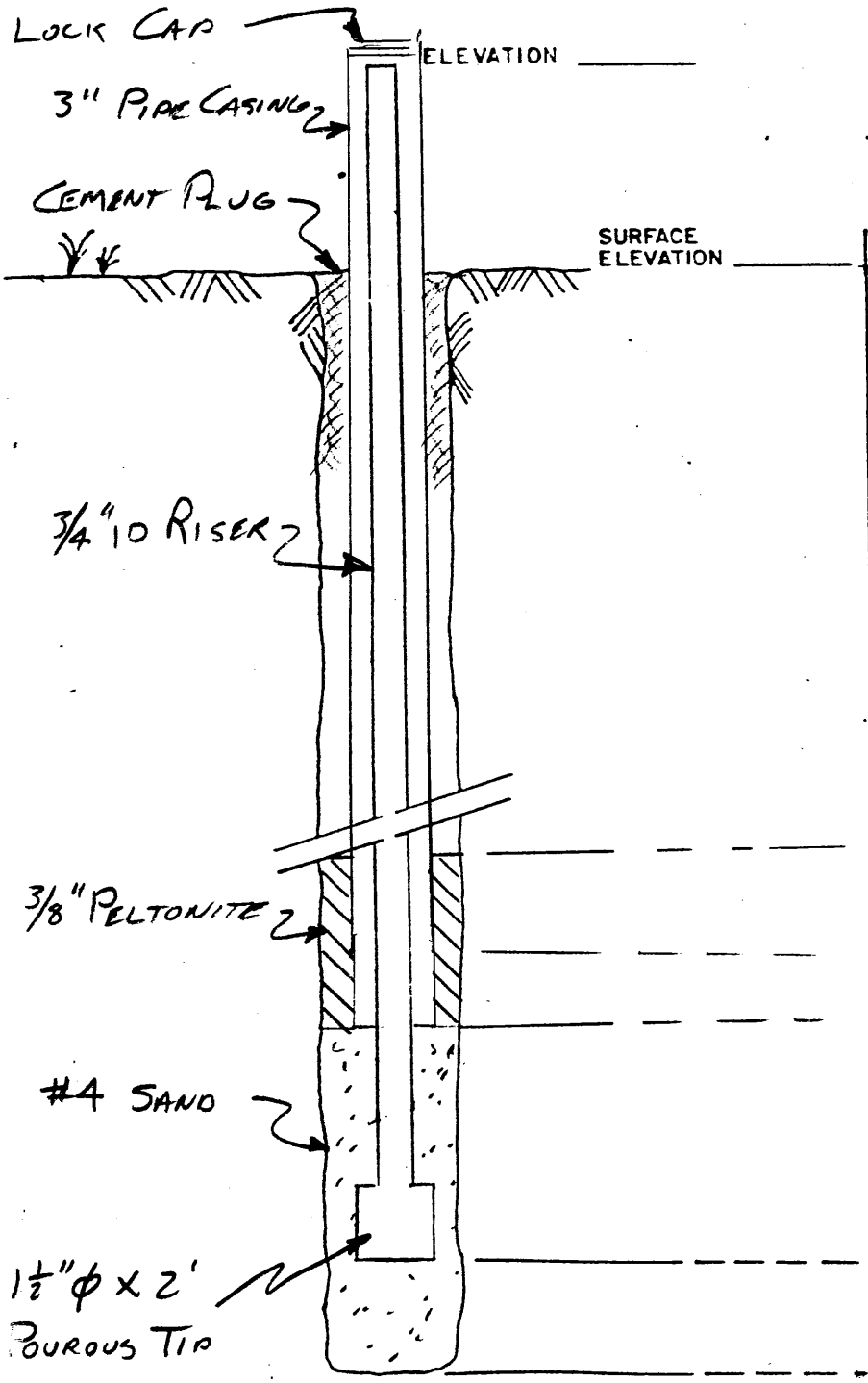
PROJECT: N. SPRINGFIELD DAM VT

PROJECT NO. CO-023

CLIENT: CORPS OF ENG.

WELL NO. FD-87-4

N.T.S.



DEPTH	SOIL STRATA
	BOULDER RIP RAP
25.2	
26	SP-GP
29	
36	
37	

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

FIELD LOG OF TEST BORING

PROJECT NO. D.O. # 0023

Site North Springfield, VT — Page 1 of 8 Pages

Hole No. FD87-2 Diam. (Casing) 30' of 3" — Boring Started 7-23-87

Co-ordinates: X STA A+55 X OFF 440 D/S — Boring Completed 7-28-87

Drilled by Hawkins + Fox — Report Submitted

Purpose of Exploration install piezometers to determine hydrologic characteristics of foundation

Elevation Top of Hole ≈480.0 M.S.L.
Total Overburden Drilled 38 Feet
Elevation Top of Rock — M.S.L.
Elevation Bottom of Hole M.S.L.
Total Rock Drilled 0 Feet
Total Depth of Hole 38 Feet
Core Recovered RIP RAP %
Core Recovered Ft.: Diam. In.
Soil Samples 1 3/8 In. Diam. 2 No.
Soil Samples In. Diam. No.

Casing Left in Place 3" ϕ 30' Feet
4' STICK UP

Water Table Depth 20.4'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	21	4" DRIVEN CASING
0	32	5" CORE BARREL
0	32	3" DRIVEN CASING
0	38	3" ROLLER BIT

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Ground Water — Back of Page 6
Boring Location Sketch — Back of Page 6
Overburden Record — Page 2-4
Rock Drilling — Page 5
Piezometer Installation Report — Page 7
Monitoring Well Installation Detail — Page 8
— Page

Prepared by T BEDDOE + P. FISHER (Field Data) — NONE (Lab. Data)

Submitted by ATLANTIC TESTING LAB

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

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

FIELD LOG OF TEST BORING

PROJECT NO. D.O. # 0023

Site North Springfield, VT

Page 1 of 8 Pages

Hole No. FD87-2 Diam. (Casing) 30' of 3"

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Boring Completed 7-28-87

Drilled by Hawkins + Fox

Report Submitted

Purpose of Exploration install piezometers to determine hydrologic characteristics of foundation

Elevation Top of Hole ≈480.0 M.S.L.

Total Overburden Drilled 38 Feet

Elevation Top of Rock — M.S.L.

Elevation Bottom of Hole M.S.L.

Total Rock Drilled 0 Feet

Total Depth of Hole 38 Feet

Core Recovered RIP RAP %

Core Recovered Ft.; Diam. in.

Soil Samples 1 3/8 in. Diam. 2 No.

Soil Samples in. Diam. No.

Casing Left in Place 3" ϕ 30' Feet
4' STICK UP

Water Table Depth 20.4'

Depth From	Depth To	Method of Drilling and Type of Bit Used
0	21	4" DRIVEN CASING
0	32	5" CORE BARREL
0	32	3" DRIVEN CASING
0	38	3" ROLLER BIT

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— Page

Prepared by J. BEDDOE + P. FISHER (Field Data) NONE (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 North Springfield, VT Page 2 of 8 Pages

Boring No. FD87-2 Desig. DZ-14 Diam. (Casing) 4"

Co-ordinates: N STA 19+55 E OFF 440 D/S

Elevation Top of Boring ≈480.0' M.S.L. Hammer Wt. 140# Boring Started 7/23/87

Total Overburden Drilled 38' Feet Hammer Drop 30" Boring Completed 7/28/87

Elevation Top of Rock ____ M.S.L. Casing Left 30'

Total Rock Drilled 0 Feet Subsurface Water Data ____ Page ____

Elevation Bottom of Boring ____ M.S.L. Obs. Well 3/4" To 37'

Total Depth of Boring 38' Feet Drilled By Hawkins + Fox

Core Recovered ____ % No. Boxes ____ Mfg. Des. Drill CME 75

Core Recovered ____ Ft: ____ Diam. ____ In. Inspected By: Beddoe + Hargrave

Soil Samples 1 3/8" In. Diam. 2 No. Classification By: 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
0.0	1" = 2'					5" ID diamond core barrel advanced to 2.0' rapidly using water.	coarse granular material with boulders. Rock fill zone of dam. No sample retained.
						Lost drilling water at 2.0', advance slowed by boulders.	
						R-1 to 10.0'	R-1 Varying metamorphic lithologies. 4 pieces 7 chips and fragments 5.0' Recovery = 50% RQD = 40% Note voids inbetween boulders. Core not retained
		R-1	3"	0.0 to 10.0	50%		
10.0							

GENERAL REMARKS:
Elevations are taken from Table 2, Attachment 3 of the Delivery Order.

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site North Springfield, VT — Page 2 of 8 Pages

Boring No. ED87-2 Desig. DZ-14 Diam. (Casing) 4"

Co-ordinates: N STA 19+55 E OFF 440 D/S

Elevation Top of Boring ≈480.0' M.S.L.
Total Overburden Drilled 38' Feet
Elevation Top of Rock ____ M.S.L.
Total Rock Drilled 0 Feet
Elevation Bottom of Boring ____ M.S.L.
Total Depth of Boring 38' Feet
Core Recovered ____ % No. Boxes ____
Core Recovered ____ Ft: ____ Diam. ____ In.
Soil Samples 1 3/8" In. Diam. 2 No.
Soil Samples ____ In. Diam. ____ No.

Hammer Wt. 140# Boring Started 7/23/87
Hammer Drop 30"
Casing Left 30' Boring Completed 7/28/87
Subsurface Water Data ____ Page ____
Obs. Well 3/4" To 37'
Drilled By Hawkins + Fox
Mfg. Des. Drill CME 75
Inspected By: Beddoe + Hargrave
Classification By: FISHER
Classification By: ____

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS/FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0.0 1" = 2'					5" ID diamond core barrel advanced to 2.0' rapidly using water. Lost drilling water at 2.0', advance slowed by boulders. R-1 to 10.0'	Coarse granular material with boulders. Rock fill zone of dam. No sample retained.
	R-1	3"	0.0 to 10.0	50%		R-1 Varying metamorphic lithologies. 4 pieces 7 chips and fragments 5.0' Recovery = 50% RQD = 40% Note voids in between boulders. Core not retained
10.0						

GENERAL REMARKS:
Elevations are taken from Table 2, Attachment 3 of the Delivery Order.

Site	Boring No.	Page 3 of 8
North Springfield Dam, VT	FD87-2	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RANGE	CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10.0	1' 2'					5" ID diamond core barrel advanced to 19.0' slowly due to boulders. No water return. R-2 to 19.0'	Boulders with interstitial voids. Rock fill zone of dam. Samples not retained.
		R-2	3"	10.0' to 19.0'	42%		R-2 Varying metamorphic lithologies. Rec = 3.8' = 42%. 5 pieces, 1 water. 5 chips and fragments. RQD = 41%. Note: some of core remained in hole
19.0						Continue coring from 19.0' to 24.5'.	
		R-3	3"	19.0' to 24.5'	73%	Advance 4" ID casing to 21.0' using Rig's hydraulic system. Advance 3 7/8" O.D. roller bit using water to 24.8'. Note no water return.	R-3 Varying metamorphic lithologies. Rec = 4.0' = 73%. 4 pieces. 20+ chips + fragments. RQD = 64%. Note: hole caved and/or core remained in hole to 21.5'.
24.5						Exploration Terminated 7/23/87	
24.8						STARTED 7/27/87	
		R-4	3"	24.8 To 32		CONTINUED CORING FROM 24.8 TO 32'	
27.0							

Site	Boring No.	Page 3 of 8
North Springfield Dam, VT	FD87-2	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RANGE	CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10.0	1" 2'					5" ID diamond core barrel advanced to 19.0' slowly due to boulders. No water return. R-2 to 19.0'	Boulders with interstitial voids. Rock fill zone of dam. Samples not retained.
		R-2	3"	10.0' to 19.0'	42%		R-2 Varying metamorphic lithologies Rec = 3.8' = 42% 8 pieces, 1 water 5 chips and fragments RQD = 41% Note: some of core remained in hole
19.0						Continue coring from 19.0' to 24.5'.	
		R-3	3"	19.0' to 24.5'	73%	Advance 4" ID casing to 21.0' using Rig's hydraulic system. Advance 3 7/8" O.D. roller bit using water to 24.8'. Note no water return.	R-3 Varying metamorphic lithologies Rec = 4.0' = 73% 4 pieces 20+ chips + fragments RQD = 64% Note: hole caved and/or core remained in hole to 21.5'
24.5						Exploration Terminated 7/23/87	
24.8						STARTED 7/27/87 CONTINUED CORING FROM 24.8 TO 32'	
		R-4	3"	24.8 To 32			
27.0							

Site	Boring No.	Page 4 of 8
N. SPRINGFIELD DAM	FD-87-2	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RANGE	BLOWS PER 6" / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
27	1 2	R-4	3"	24.8 To 32'	5% REC 0 RQD	CONTINUED CORING TO 32'	OUT OF BOULDERS @ 27'
	32					END DRILLING 7/27/87 SET 3" DRIVEN CASING ON 7/28/87	
		S-1	1 3/8 50% REC	32' To 34'	71 65 76 51	2" OD SPLIT SPOON DRIVEN BY 140# HAMMER	GREY + BROWN cmf SAND + mf GRAVEL (SP-GP)
	34						
	36						14" BOULDER @ 34.8'
		S-2	1 3/8 60% REC	36' To 38'	17 23 34 26	2" OD SPLIT SPOON DRIVEN BY 140# HAMMER WASHED HOLE WITH ROLLER BIT AND CLEAR MUD (32' TO 38')	DARK BROWN cmf SAND, LITTLE mf GRAVEL, LITTLE DECOMPOSED MICA ROCK (SP-GP)
	38						
						EXPLORATION TERMINATED @ 38' (7/28/87)	

Site	Boring No.	Page 4 of 8
N. SPRINGFIELD DAM	FD-87-2	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH RANGE	BLOWS PER 6" / CORE REC'VY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
27		R-4	3"	24.8 To 32'	5% REC 0 RQD	CONTINUED CORING TO 32'	OUT OF BOULDERS @ 27'
	32					END DRILLING 7/27/87 SET 3" DRIVEN CASING ON 7/28/87	
		S-1	1 3/8 50% REC	32' To 34'	71 65 76 51	2" OD SPLIT SPOON DRIVEN BY 140# HAMMER	GREY + BROWN cmf SAND + mf GRAVEL (SP-GP)
	34						
							14" BOULDER @ 34.8'
	36						
		S-2	1 3/8 60% REC	36' To 38'	17 23 34 26	2" O.D. SPLIT SPOON DRIVEN BY 140# HAMMER WASHED HOLE WITH ROLLER BIT AND CLEAR MUD (32' TO 38')	DARK BROWN cmf SAND, LITTLE mf GRAVEL, LITTLE DECOMPOSED MICA ROCK (SP-GP)
	38						
						EXPLORATION TERMINATED @ 38' (7/28/87)	

FIELD LOG OF TEST BORING IN ROCK

SITE North Springfield VT HOLE NO. FD87-2 PAGE 5 of 8

DATE	DEPTH PT. FROM	DEPTH PT. TO	RUN PT.	RUN REC'V'Y PT.	REC'V'Y %	DRILLING BEHAVIOR: FEED	DRILLING BEHAVIOR: WATER	DRILLING BEHAVIOR: REASON FOR PULL	ACTUAL DRILLING TIME	BIT NO. SIZE AND TYPE	ADDITIONAL REMARKS
7/23/87	0.0	10.0	10.0	5.0	50%	400 lbs 4th gear	water return first 2' no water return 2'-10'	core barrel full	2.4 min	5" ID diamond	first 2' - coarse granular material - surface fill 2'-10' - boulders of rock fill zone with interstitial voids
7/23/87	10.0	19.0	9.0	3.8	42	200-400 lbs, 4th gear	no water return	core barrel full	36 min	5" ID diamond	Boulders of rock fill zone
7/23/87	19.0	24.5	5.5	4.0	73	200-400 lbs, 4th gear	no water return	core barrel full	45 min	5" ID diamond	Boulders of rock fill zone note caving + loss of core down hole after barrel pulled

TOTAL BED ROCK DRILLED 0.0 FEET

TOTAL BED-ROCK RECOVERED 0.0 FEET

BED ROCK RECOVERY 0.0 PERCENT

Note: cores of boulders not saved.

DRILLER Hawkins + Fox

INSPECTOR Beddoe

NED FORM DEC 130

REPLACES EDITION OF APR 63 WHICH MAY BE USED UNTIL EXHAUSTED

FIELD LOG OF TEST BORING IN ROCK

SITE North Springfield VT HOLE NO. FD87-2 PAGE 5 of 8

DATE	DEPTH PT. FROM	DEPTH PT. TO	RUN PT.	RUN REC'V'Y PT.	REC'V'Y %	DRILLING BEHAVIOR: FEED	DRILLING BEHAVIOR: WATER	DRILLING BEHAVIOR: REASON FOR PULL	ACTUAL DRILLING TIME	BIT NO. SIZE AND TYPE	ADDITIONAL REMARKS
7/23/87	0.0	10.0	10.0	5.0	50%	400 lbs 4th gear	water return first 2' no water return 2'-10'	core barrel full	24 min	5" ID diamond	first 2' - coarse granular material - surface fill 2'-10' - boulders of rock fill zone with interstitial voids
7/23/87	10.0	19.0	9.0	3.8	42	200-400 lbs, 4th gear	no water return	core barrel full	36 min	5" ID diamond	Boulders of rock fill zone
7/23/87	19.0	24.5	5.5	4.0	73	200-400 lbs, 4th gear	no water return	core barrel full	45 min	5" ID diamond	Boulders of rock fill zone note caving + loss of core down hole after barrel pulled

TOTAL BED ROCK DRILLED 0.0 FEET

TOTAL BED-ROCK RECOVERED 0.0 FEET

BED ROCK RECOVERY 0.0 PERCENT

Note: cores of boulders not saved.

DRILLER Hawkins + Fox

INSPECTOR Beddoe

NED FORM DEC 130

REPLACES EDITION OF APR 63 WHICH MAY BE USED UNTIL EXHAUSTED

Site: North Springfield, VT
Boring No: FD87-2

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
7/28	1300	37' PVC	38'	—		INSTALLED WELL
7/29	1400			24.45		TAKEN FROM TOP OF CASING

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

Boring No. FD87-2

Site: North Springfield, UT
Boring No: FD87-2

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
7/28	1300	37' PVC	38'	—		INSTALLED WELL
7/29	1400			24.45		TAKEN FROM TOP OF CASING

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

PIEZOMETER INSTALLATION REPORT

PROJECT: North Springfield Dam | DATE: 7-28-87

LOCATION (STA): 19+55 | OFFSET FROM CENTER LINE: 440' D/S | PIEZ NO.: FD-87-2

PIEZ TYPE: Pourous (2' Long) | DEPTH OF PIEZ: 37' | RISER PIPE DIAM: 3/4" ID

PIEZ TIP SET IN (SOIL TYPE): SP-GP | SOIL SAMPLE NO.: S-2 | BORING DIAM: 4" (3" @ PZ)

METHOD OF INSTALLATION: Rotary Drill w/4" + 3" Casing

TYPE OF PROTECTION FOR PIEZ: 3" ϕ Welded Pipe | VENT: Lock Cap

GROUND ELEV.: ? | ELEV. TOP OF RISER: ≈ +4' | ELEV PIEZ TIP: 37'

FILTER: #4 Sand | FROM ELEV: 38' | TO ELEV: 30

SEAL: 3/8" Peltonite | FROM ELEV: 30' | TO ELEV: 26'

INSTALLED BY: Hawkins + Fox | CONTRACT NO.: D.O. 023 | FOREMAN: Fisher

DATE OF INSTALLATION: 7-28-87 | DATE OF OBSERVATIONS: 7-29-87

METHOD OF TESTING PIEZ.: Falling Head Test

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
1500	~~0~~	24.3						
1502	0	0	← Generally Took Water As Fast As					
1503	1	24.2					I Could Pour	
1505	3	24.3						

REMARKS: Used Fluidril Clear Mud, Activated w/Clorox

Paul Fisher
INSPECTOR

PIEZOMETER INSTALLATION REPORT

PROJECT: NORTH SPRINGFIELD DAM | DATE: 7-28-87

LOCATION (STA): 19+55 | OFFSET FROM CENTER LINE: 440' O/S | PIEZ NO.: FD-87-2

PIEZ TYPE: POUROUS (2' LONG) | DEPTH OF PIEZ: 37' | RISER PIPE DIAM: 3/4" ID

PIEZ TIP SET IN (SOIL TYPE): SP-GP | SOIL SAMPLE NO.: S-2 | BORING DIAM: 4" (3" @ PZ)

METHOD OF INSTALLATION: ROTARY DRILL W/4"+3" CASING

TYPE OF PROTECTION FOR PIEZ: 3" ϕ WELDED PIPE | VENT: LOCK CAP

GROUND ELEV.: ? | ELEV. TOP OF RISER: ≈ +4' | ELEV PIEZ TIP: 37'

FILTER: #4 SAND | FROM ELEV: 38' | TO ELEV: 30

SEAL: 3/8" PELTONITE | FROM ELEV: 30' | TO ELEV: 28'

INSTALLED BY: HAWKINS + FOX | CONTRACT NO.: D.O. 023 | FOREMAN: FISHER

DATE OF INSTALLATION: 7-28-87 | DATE OF OBSERVATIONS: 7-29-87

METHOD OF TESTING PIEZ.: FALLING HEAD TEST

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
1500	~~0~~	24.3						
1502	0	0	← GENERALLY TOOK WATER AS FAST AS					
1503	1	24.2					I COULD POUR	
1505	3	24.3						

REMARKS: USED FLUIDRIL CLEAR MUD, ACTIVATED W/CLOROX

PAUL FISHER
INSPECTOR

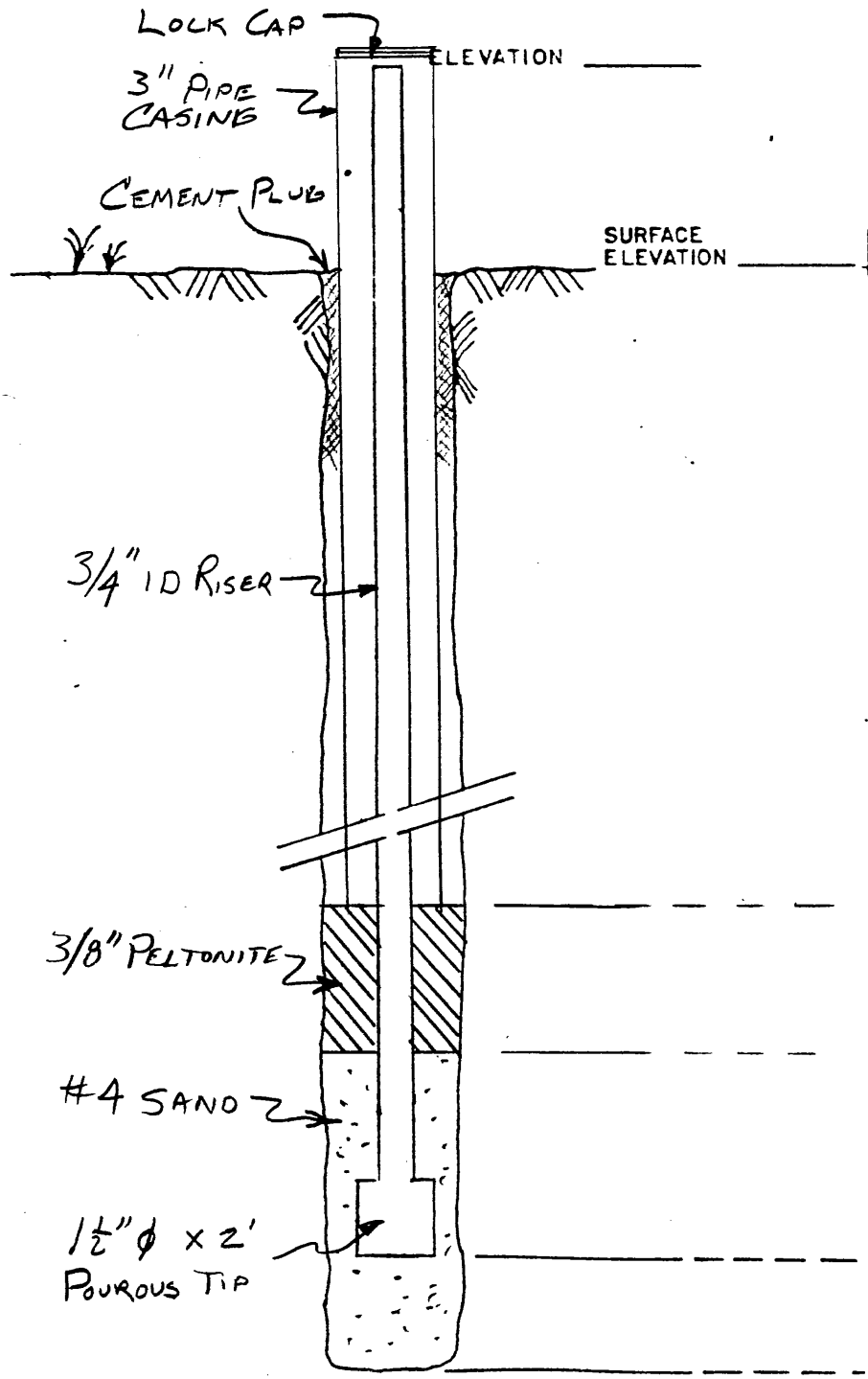
ATLANTIC TESTING LABORATORIES, LIMITED

MONITORING WELL INSTALLATION DETAIL

PROJECT: North Springfield Dam Vt **PROJECT NO.** D.O. 023

CLIENT: Corps Of Engineers **WELL NO.** FD-87-2

N.T.S.



DEPTH	SOIL STRATA
	Rip Rap Fill (Boulders)
26'	
27'	Gravelly Sand
30'	
37'	
38'	

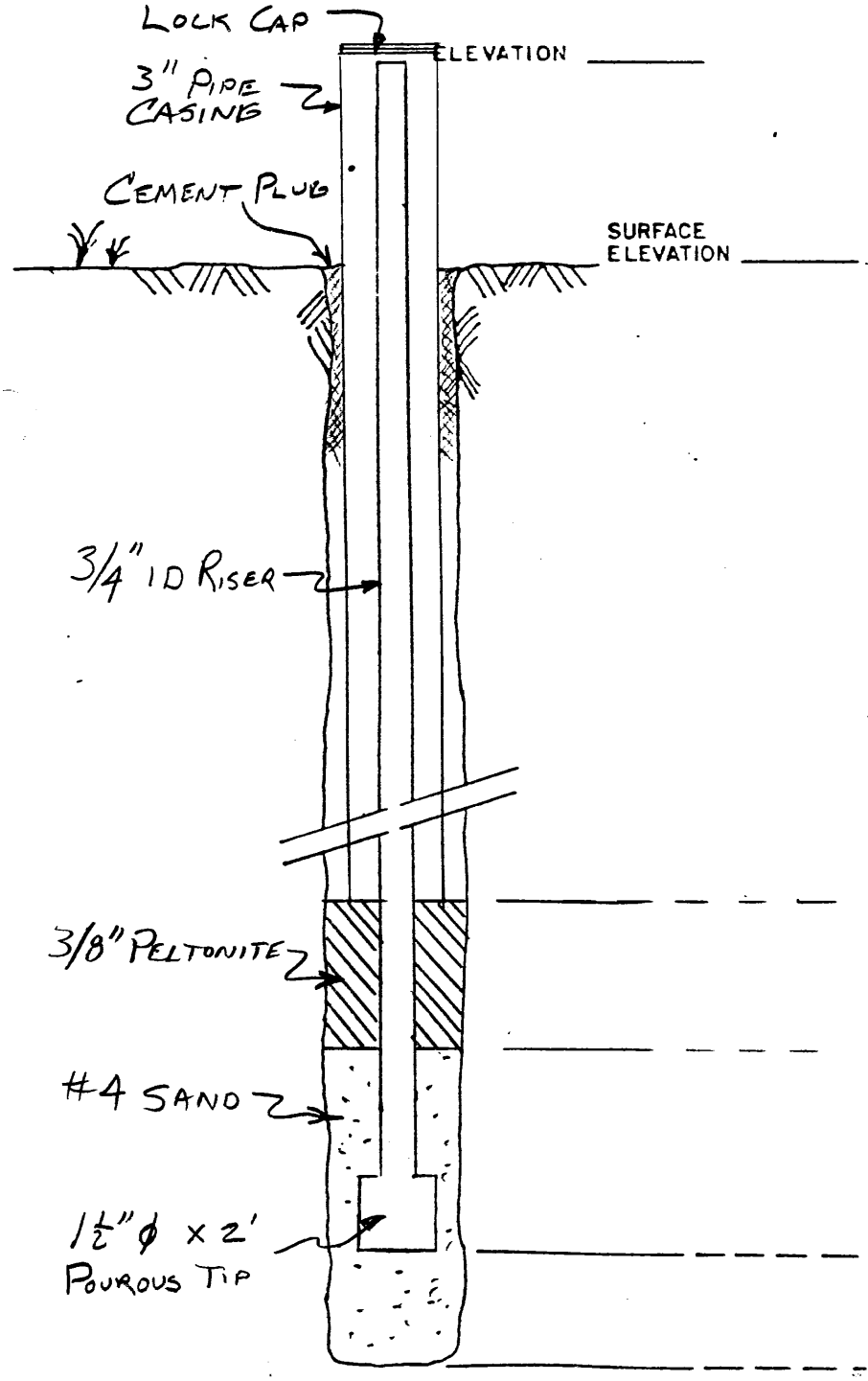
ATLANTIC TESTING LABORATORIES, LIMITED

MONITORING WELL INSTALLATION DETAIL

PROJECT: North Springfield Dam Vt **PROJECT NO.** D.O. 023

CLIENT: Corps Of Engineers **WELL NO.** FD-87-2

N.T.S.



DEPTH	SOIL STRATA
	Rip Rap Fill (Boulders)
26'	
27'	
	Gravelly Sand
30'	
37'	
38'	

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

Note: Depths are in feet below original ground

BORING LOCATION SKETCH

Site: Townshend Dam, VT
Boring No: FD87-1

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
7/14/87	10:00	71.00	71.00	dry	—	
7/21/87	7:00	71.00	105.00	61.7'	521.30'	boring being advanced
						using Clear Mud
7/27/87	2:15	71.00	134.00	114.8'	468.2'	water depth inside
7/28/87	7:00	71.00	134.00	114.65'	468.35'	piezometer riser pipe
7/29/87	7:00	71.00	134.00	114.65'	468.35'	
7/30/87	7:00	71.00	134.00	114.65'	468.35'	
7/31/87	7:00	71.00	134.00	114.65'	468.35'	
[illegible]/4/87	4:00	71.00	134.00	114.8	468.2'	
[illegible]/87	7:00	71.00	134.00	114.8	468.2'	
[illegible]	[illegible]	71.00	134.00	114.9	468.1'	

Note: Depths are in feet below original ground / Ground elevation is 583.00'

BORING LOCATION SKETCH

Site: Townshend Dam, VT
Boring No: FD87-1

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
7/14/87	10:00	71.00	71.00	dry	—	
7/21/87	7:00	71.00	106.00	61.7'	521.30'	boring being advanced
						using Clear Mud
7/27/87	2:15	71.00	134.00	114.8'	468.2'	water depth inside
7/28/87	7:00	71.00	134.00	114.65'	468.35'	piezometer riser pipe
7/29/87	7:00	71.00	134.00	114.65'	468.35'	
7/30/87	7:00	71.00	134.00	114.65'	468.35'	
7/31/87	7:00	71.00	134.00	114.65'	468.35'	
[illegible]/4/87	4:00	71.00	134.00	114.8	468.2'	
[illegible]/87	7:00	71.00	134.00	114.8	468.2'	
[illegible]	[illegible]	71.00	134.00	114.9	468.1'	

Note: Depths are in feet below original ground / Ground elevation is 583.00'

BORING LOCATION SKETCH

2.7½

PIEZOMETER INSTALLATION REPORT

PROJECT: Townshend Dam | DATE: 7/21/87

LOCATION (STA): 24+58 | OFFSET FROM CENTER LINE: 18 D/S | PIEZ NO.: PZ-5

PIEZ TYPE: Casagrande | DEPTH OF PIEZ: 133.3' | RISER PIPE DIAM: 3/4" sch. 80

PIEZ TIP SET IN (SOIL TYPE): SP | SOIL SAMPLE NO.: #4 | BORING DIAM: 4"

METHOD OF INSTALLATION: 3 7/8" O.D. roller [illegible] all material

TYPE OF PROTECTION FOR PIEZ: 73.7' of 4" steel casing; note 2.7' of stick up | VENT: locking cap installed

GROUND ELEV.: 583' | ELEV. TOP OF RISER: | ELEV PIEZ TIP: 449.7

FILTER: #4 filter sand | FROM ELEV: 449.0 | TO ELEV: 480

SEAL: Bentonite Pellets | FROM ELEV: 480.0 | TO ELEV: 486.0'

INSTALLED BY: Hawkins and Fox | CONTRACT NO.: 0023 | FOREMAN: Greg Hargrave

DATE OF INSTALLATION: 7/21/87 | DATE OF OBSERVATIONS: 7/23/87

METHOD OF TESTING PIEZ.: Falling Head Test

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET *	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
	1	64.7						
	1:30	82.4						
	3:00	99.7						
	5:00	—						
	10:00	—						

REMARKS: At begining of test elapsed time equals "0" minutes and depth to water equals "0" feet

* depth to water from top of pvc riser pipe

INSPECTOR

2.7 1/2

PIEZOMETER INSTALLATION REPORT

PROJECT: Townsend Dam | DATE: 7/21/87

LOCATION (STA): 21+58 | OFFSET FROM CENTER LINE: 18 U/S | PIEZ NO.: PZ-5

PIEZ TYPE: Casagrande | DEPTH OF PIEZ: 133.3' | RISER PIPE DIAM: 3/4" sch. 80

PIEZ TIP SET IN (SOIL TYPE): SP | SOIL SAMPLE NO.: #4 | BORING DIAM: 4"

METHOD OF INSTALLATION: 3 7/8" OD, rotary [illegible] all material

TYPE OF PROTECTION FOR PIEZ: 73.7' of 4" steel casing; note 2.7' of stick up | VENT: locking cap installed

GROUND ELEV.: 583' | ELEV. TOP OF RISER: | ELEV PIEZ TIP: 449.7

FILTER: #4 filter sand | FROM ELEV: 449.0 | TO ELEV: 480

SEAL: Bentonite Pellets | FROM ELEV: 480.0 | TO ELEV: 486.0'

INSTALLED BY: Hawkins and Fox | CONTRACT NO.: 0023 | FOREMAN: Greg Hargrave

DATE OF INSTALLATION: 7/21/87 | DATE OF OBSERVATIONS: 7/23/87

METHOD OF TESTING PIEZ.: Falling Head Test

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET *	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER FEET
	1	64.7						
	1:30	82.4						
	3:00	99.7						
	5:00	—						
	10:00	—						

REMARKS: At begining of test elapsed time equals "0" minutes and depth to water equals "0" feet

* depth to water from top of pvc riser pipe

INSPECTOR

Site	Boring No.	Page 10 of 13
Townshend Dam VT	FD 87-1	

DEPTH 1" = 2'	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	BLOWS PER 6" ~~CORE RECVY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
129'			REC		Advanced 3 7/8 O.D. roller bit to 131.0' using "Clear Mud" drilling fluid Encountered difficult drilling in several thin gravel seams.	
130'						
131'	S-4	1 3/8"	75%	44 44 43 44	Sampled using 2" O.D. split spoon sampler, advanced on NW rod using 140 lbs. hammer	Soil similar to Sample #3; trace f GRAVEL; (wet, non-plastic) SP
133					Advanced roller bit to 134' using "Clear Mud" drilling fluid, easy drilling;	Note: trace gin line wicking
134'					Boring terminated @ 134.0' on 7-21-87 Note: Piezometer was installed with tip depth of 133.3' on 7-21-87	
135'						
140'						
145						

Site	Boring No.	Page 10 of 13
Townshend Dam UT	FD 87-1	

DEPTH	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	BLOWS PER 6" ~~CORE REC'VY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
129'			REC		Advanced 3 7/8 O.D. roller bit to 131.0' using "Clear Mud" drilling fluid Encountered difficult drilling in several thin gravel seams.	
130'						
131'	S-4	1 3/8"	75%	44 44 43 44	Sampled using 2" O.D. split spoon sampler, advanced on NW rod using 140 lbs. hammer	Soil similar to Sample #3; trace f GRAVEL; (wet, non-plastic) SP
133					Advanced roller bit to 134' using "Clear Mud" drilling fluid, easy drilling;	Note: trace gin line wicking
134'					Boring terminated @ 134.0' on 7-21-87 Note: Piezometer was installed with tip depth of 133.3' on 7-21-87	
135'						
140'						
145						

Site	Boring No.	Page 9 of 13
Townshend Dam UT	FD 87-1	

DEPTH	CORE/SAMPLE NO	SIZE	DEPTH RANGE	BLOWS PER 6" / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
112			Rec		Advanced 3 7/8" O.D. roller bit to 120' using "Clear Mud" Drilling fluid boulders encountered to 119.0'; from 119.0' to 120.0' gravelly material encountered	Gravelly Sand layer from 111.5' to 113.0'
						Granular material with boulders from 113.0' to 119.0' no sample retained
115						
						Granular material, gravelly 119.0' to 120.0' no sample retained
120'	S-2	1 3/8"	50%	62 67 57 97	Sampled using 2" O.D. split spoon sampler, advanced on NW rod using 140 lbs hammer	Light Brown cf GRAVEL; some cmf SAND; little SILT (wet, non-plastic) very dense; GW-GM
122'					Advanced roller bit to 125.0' Note: encountered difficult drilling in gravel seams. @ 120.0' to 122.0' and several other thin seams.	Note pieces of gin line wicking were detected in sample
125'	S-3	1 3/8"	15%	48 25 100	Sample using 2" O.D. split spoon sampler, advanced on NW rod using 140 lbs hammer	Light Brown cmf SAND; little fGRAVEL; trace SILT (wet, non-plastic) very dense; SP
127'					Advanced roller bit to 131.0' encountered difficult drilling in several thin gravel seams.	
129						

Site	Boring No.	Page 9 of 13
Townshend Dam UT	FD 87-1	

DEPTH	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	~~BLOWS PER 6" CORE RECVY~~	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
112			Rec		Advanced 3 7/8" O.D. roller bit to 120' using "Clear Mud" Drilling fluid boulders encountered to 119.0'; from 119.0' to 120.0' gravelly material encountered	Gravelly Sand layer from 111.5' to 113.0'
						Granular material with boulders from 113.0' to 119.0' no sample retained
115						
						Granular material, gravelly 119.0' to 120.0' no sample retained
120'	S-2	1 3/8"	50%	62 67 57 97	Sampled using 2" O.D. split spoon sampler, advanced on NW rod using 140 lbs hammer	Light Brown Cf GRAVEL; some cmf SAND; little SILT (wet, non-plastic) very dense; GW-GM
122'					Advanced roller bit to 125.0' Note: encountered difficult drilling in gravel seams @ 120.0' to 122.0' and several other thin seams.	Note pieces of gin line wicking were detected in sample
125'	S-3	1 3/8"	15%	48 25 100	Sample using 2" O.D. split spoon sampler, advanced on NW rod using 140 lbs hammer	Light Brown cmf SAND; little fGRAVEL; trace SILT (wet, non-plastic) very dense; SP
127'					Advanced roller bit to 131.0' encountered difficult drilling in several thin gravel seams.	
129						

Site	Boring No.	Page 8 of 13
Townshend Dam, UT	FD 87-1	

DEPTH	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	BLOWS PER 6" ~~CORE RECVY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
95			REC		Advanced 3 7/8" O.D. roller bit to 99.5' using "clear Mud" drilling fluid Note: drilling difficult due to cobbles, loss of drilling fluid @ 91.0'. Hole was grouted with bentonite cement to 52'. Three (3) hundred gallons of grout were used. Exploration Terminated 7/15/87	Granular cobbly material Note: Rock fill zone of Dam No sample retained
99.5'					Exploration Continued 7/16/87 Hole was grouted with bentonite cement to 15'. Exploration Terminated 7/16/87	
100					Exploration continued 7/20/87 Advanced roller bit to 105.0' Cleared rock fill zone of Dam @ 100', continued boring to 105' to verify Dam foundation Note: difficulty pulling NW rods Exploration terminated 7/20/87	Granular material - foundation of Dam No sample Retained until foundation verified.
105'	S-1	1 3/8"	25%	32 52 61 64	Exploration Continued 7/21/87 Sampled using 2" O.D. split spoon sampler, advanced on NW rods using a 140 lbs hammer	Light Brown mf SAND; trace SILT; (wet, nonplastic); very dense SP
107'					Advanced roller bit 120'. At 110.0' cobbles were encountered to 111.5'; Gravelly Sand layer 111.5' to 113.0'	Note: pieces of gin line wicking were detected in sample
110'						Cobbly material, no sample retained
112'						Gravelly Sand layer from 111.5 to 113.0'

Site	Boring No.	Page 8 of 13
Townshend Dam, UT	FD 87-1	

DEPTH	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	BLOWS PER 6" ~~CORE RECOVY~~	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
95			REC		Advanced 3 7/8" O.D. roller bit to 99.5' using "clear Mud" drilling fluid Note: drilling difficult due to cobbles, loss of drilling fluid @ 91.0'. Hole was grouted with bentonite cement to 52'. Three (3) hundred gallons of grout were used. Exploration Terminated 7/15/87	Granular cobbly material Note: Rock fill zone of Dam No sample retained
99.5'					Exploration Continued 7/16/87 Hole was grouted with bentonite cement to 15'. Exploration Terminated 7/16/87	
100					Exploration continued 7/20/87 Advanced roller bit to 105.0' Cleared rock fill zone of Dam @ 100', continued boring to 105' to verify Dam foundation Note: difficulty pulling NW rods Exploration terminated 7/20/87	Granular material - foundation of Dam No sample Retained until foundation verified.
105'	S-1	1 3/8"	25%	32 52 61 64	Exploration Continued 7/21/87 Sampled using 2" O.D. split spoon sampler, advanced on NW rods using a 140 lbs hammer	Light Brown mf SAND; trace SILT; (wet, nonplastic), very dense SP
107'					Advanced roller bit 120'. At 110.0' cobbles were encountered to 111.5'; Gravelly Sand layer 111.5' to 113.0'	Note: pieces of gin line wicking were detected in sample
110'						Cobbly material, no sample retained
112'						Gravelly Sand layer from 111.5 to 113.0'

Site	Boring No.	Page 7 of 13
Townshend Dam, VT	FD 87-1	

DEPTH	CORE/SAMPLE NO.	SIZE	~~DEPTH~~ ~~RUN~~	~~BLOWS PER FT~~ ~~CORE REC'VY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
78			REC		Advanced 3 7/8" O.D. roller bit to 91.0' using "Clear Mud" drilling fluid Note: easy drilling	granular material - no sample retained (Rock Fill Core of Dam - bit advanced through material caved into hole drilled in August 1985.)
80						
90						
91'					Advanced 3 7/8" O.D. roller bit to 99.5' using "Clear Mud" drilling fluid Note: drilling difficult due to cobbles, loss of drilling fluid at 91.0!	granular material Note: cobbles No sample retained (Rock Fill Core of Dam
95						

Site	Boring No.	Page 7 of 13
Townshend Dam, VT	FD 87-1	

DEPTH	CORE/SAMPLE NO.	SIZE	~~DEPTH~~	~~BLOWS PER FT~~ CORE REC'VY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
78			REC		Advanced 3 7/8" O.D. roller bit to 91.0' using "Clear Mud" drilling fluid Note: easy drilling	granular material - no sample retained (Rock Fill Core of Dam - bit advanced through material caved into hole drilled in August 1985.)
80						
90						
91'					Advanced 3 7/8" O.D. roller bit to 99.5' using "Clear Mud" drilling fluid Note: drilling difficult due to cobbles, loss of drilling fluid at 91.0!	granular material Note: cobbles No sample retained (Rock Fill Core of Dam
95						

Site	Boring No.	Page 6 of 13
Townshend Dam, VT	FD 87-1	

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH	BLOWS PER 6" / CORE RECOVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
61'				Rec		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
70'							
71.0						advanced 3 7/8" O.D. roller bit to 85.0' using "Clear Mud" drilling fluid. Note: easy drilling to 85.0'	granular material, no sample retained (Rock Fill Core of Dam - bit advanced through material caved into hole drilled in August 1985.)
78'							

Site	Boring No.	Page 6 of 13
Townshend Dam, VT	FD 87-1	

DEPTH	1" = 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT / CORE RECVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
61'				Rec		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
70'							
71.0'						advanced 3 7/8" O.D. roller bit to 85.0' using "Clear Mud" drilling fluid. Note: easy drilling to 85.0'	granular material, no sample retained (Rock Fill Core of Dam - bit advanced through material caved into hole drilled in August 1985.)
78'							

Site	Boring No.	Page 5 of 13
Townshend Dam, VT	FD 87-1	

DEPTH		CORE/SAMPLE			BLOWS PER FT	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	1"	NO.	SIZE	~~DEPTH RANGE~~	~~CORE REC'VT~~		
44'				Rec		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
50'							
60'							
61'							

Site	Boring No.	Page 5 of 13
Townshend Dam, VT	FD 87-1	

DEPTH		CORE/SAMPLE			BLOWS PER FT	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	1"	NO.	SIZE	DEPTH RANGE	CORE REC'VY		
44'				Rec		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
50'							
60'							
61'							

58A(Test)

Boring No FD 87-1

Site Townshend Dam, VT	Boring No. FD-87-1	Page 4 of 13

DEPTH	1" = 2'	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	~~BLOWS PER FT~~ ~~CORE RECVY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
27'				REC		3 7/8" O.D roller bit advanced through open cased hole to 71.0'	Open cased hole
30'							
40'							
44'							

58A(Test)

Boring No FD 87-1

Site Townshend Dam, VT	Boring No. FD-87-1	Page 4 of 13

DEPTH	1" = 2'	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	~~BLOWS PER FT~~ ~~CORE RECVY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
27'				REC		3 7/8" O.D roller bit advanced through open cased hole to 71.0'	Open cased hole
30'							
40'							
44'							

58A(Test)

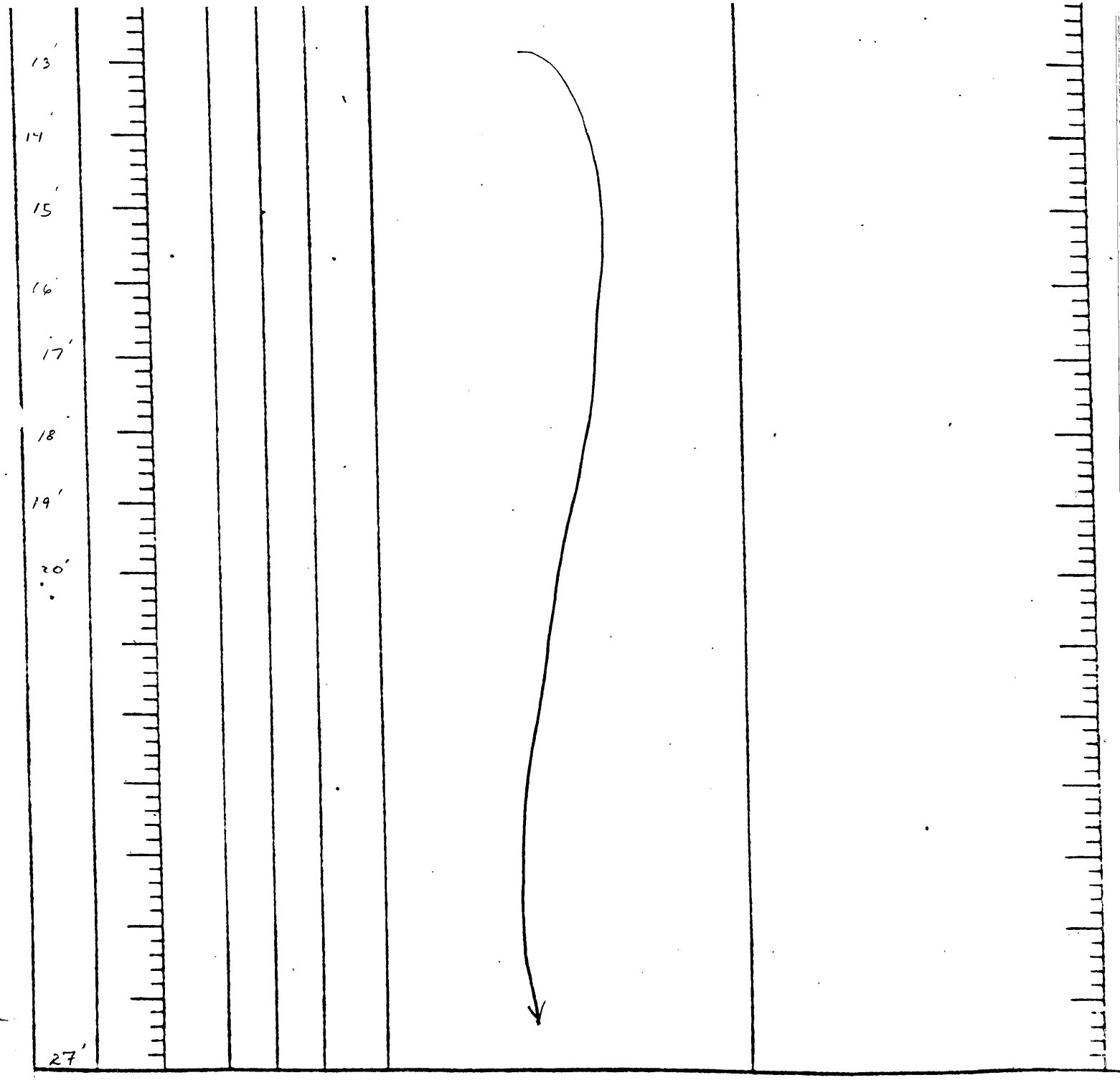
Boring No FD 87-1

Site Townshend Dam VT.	Boring No. FD 87-1	Page 3 of 13

DEPTH		CORE/SAMPLE NO	SIZE	DEPTH	BLOWS PER 6" / CORE REC'VY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10'	1'=2'			REC		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
11							
12							
13							
14							
15							
16							
17'							
18							
19'							
20'							
27'							

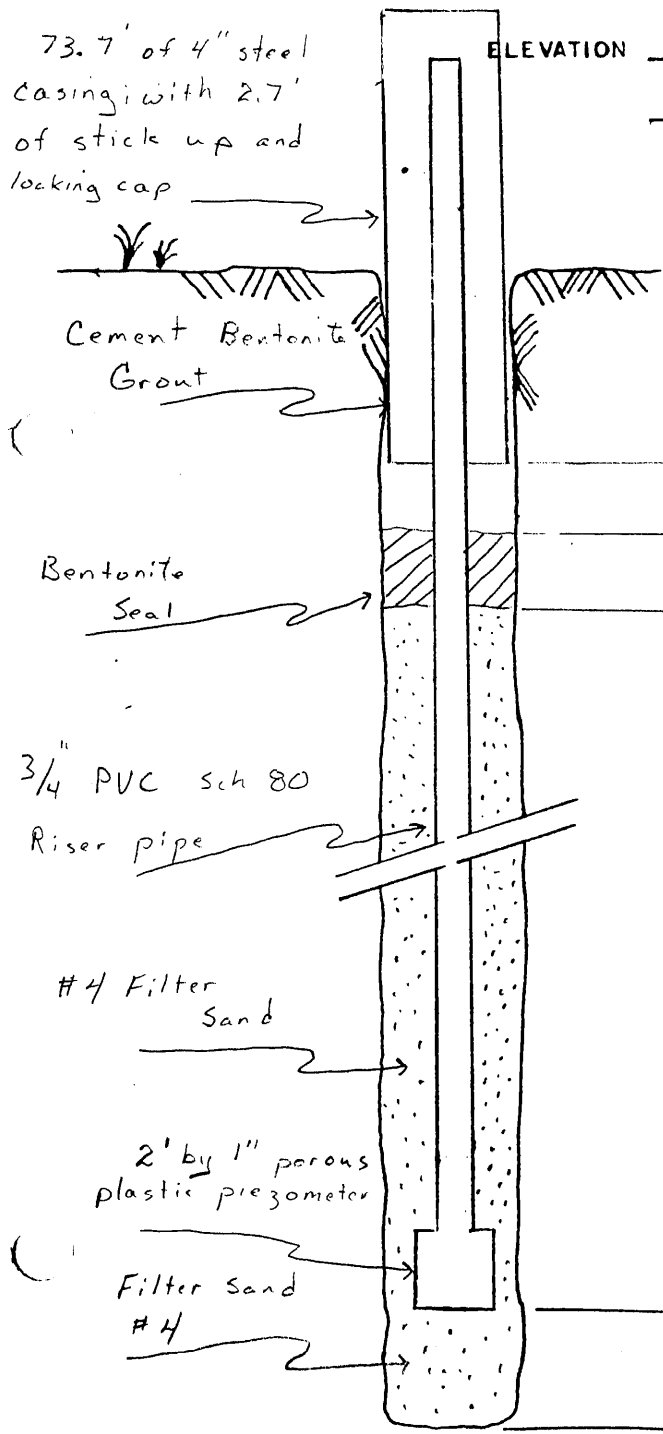
Site Townshend Dam VT	Boring No. FD 87-1	Page 3 of 13

DEPTH	1"=2'	CORE/SAMPLE NO.	SIZE	~~DEPTH RANGE~~	BLOWS PER FT ~~CORE REC'VY~~	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
10'				DEC		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
11							
12							
13							
14'							
15'							
16'							
17'							
18'							
19'							
20'							
27'							



:58A(Test)

Boring No FD 87-1



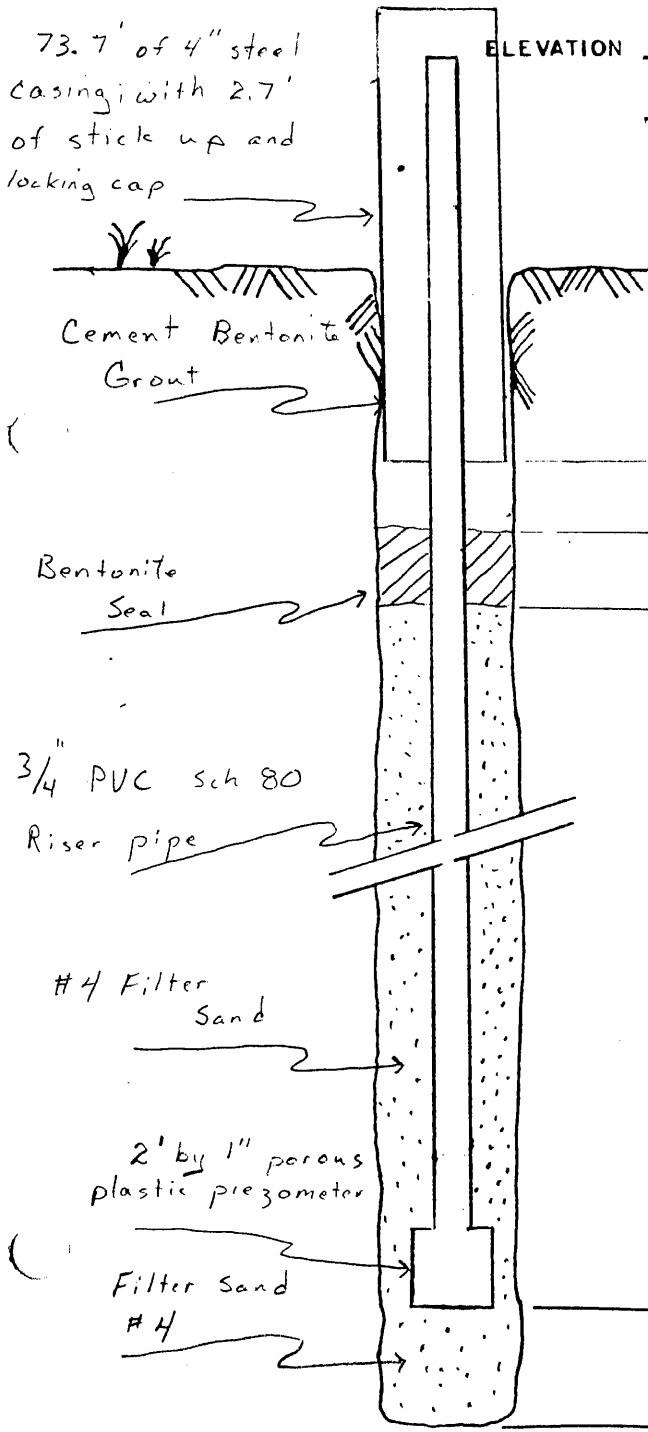
ELEVATION

Top of pipe (2.7' of stick up)

Top of PVC (2.6 of stick up)

SURFACE ELEVATION - 583.0'

DEPTH	SOIL STRATA
	Boulder, cobbles, and sand predominatly GW-GM, SP Note: Rock Fill Zone of Dam
71.0'	
97'	
100'	
103'	Predominatly Sand, but some Gravel, SP and GW-GM Note: Dam Foundation
133.3'	
134.0'	



ELEVATION _____ Top of pipe (2.7' of stick up)

_____ Top of PUC (2.6 of stick up)

SURFACE ELEVATION - 583.0'

DEPTH	SOIL STRATA
71.0'	Boulder, cobbles, and Sand predominatly GW-GM, SP Note: Rock Fill Zone of Dam
97'	
100'	
103'	Predominatly Sand, but some Gravel, SP and GW-GM Note: Dam Foundation
133.3'	
134.0'	

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site Townshend Dam VT Page 2 of 13 Pages

Boring No. FD87-1 Desig. DZ-5 Diam. (Casing) 3" I.D.

Co-ordinates: N sta 24+58 E off 18 D/S

Elevation Top of Boring 583.0 M.S.L.
Total Overburden Drilled 134.0 Feet
Elevation Top of Rock — M.S.L.
Total Rock Drilled 0.0 Feet
Elevation Bottom of Boring 449.0 M.S.L.
Total Depth of Boring 134.0 Feet
Core Recovered 0 % No. Boxes 0
Core Recovered 0 Ft: — Diam. — In.
Soil Samples 1 3/8 In. Diam. 4 No.
Soil Samples — In. Diam. — No.

Hammer Wt. 140# Boring Started 7/15/87
Hammer Drop 30"
Casing Left 71' Boring Completed 7/21/87
Subsurface Water Data — Page 12
Obs. Well 3/4"
Drilled By Hawkins + Fox
Mfg. Des. Drill CME 75
Inspected By: Beddoe / Hargrave
Classification By: Hargrave
Classification By: —

DEPTH 1" = 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0.0			REC		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
10'						

GENERAL REMARKS:
Elevations are taken from Table 2, Attachment 3 of the delivery order
Piezometer tip set at 133.3'

U. S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION **FIELD LOG OF TEST BORING**	Site Townshend Dam VT Page 2 of 13 Pages Boring No. FD87-1 Desig. DZ-5 Diam. (Casing) 3" I.D. Co-ordinates: N sta 24+58 E off 18 D/S

Elevation Top of Boring 583.0 M.S.L.	Hammer Wt. 140#	Boring Started 7/15/87	
Total Overburden Drilled 134.0 Feet	Hammer Drop 30"	Boring Completed 7/21/87	
Elevation Top of Rock — M.S.L.	Casing Left 71'		
Total Rock Drilled 0.0 Feet	Subsurface Water Date	Page 12	
Elevation Bottom of Boring 449.0 M.S.L.	Obs. Well 3/4"		
Total Depth of Boring 134.0 Feet	Drilled By Hawkins + Fox		
Core Recovered 0 % No. Boxes 0	Mfg. Des. Drill CME 75		
Core Recovered 0 Ft: Diam. — In.	Inspected By: Beddoe / Hargrave		
Soil Samples 1 3/8 In. Diam. 4 No.	Classification By: Hargrave		
Soil Samples — In. Diam. — No.	Classification By: —		

DEPTH		CORE/SAMPLE			BLOWS PER FT.	6" SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0.0	1" = 2'	NO.	SIZE	DEPTH RANGE	CORE RECVY		
				REC		3 7/8" O.D. roller bit advanced through open cased hole to 71.0'	Open cased hole
10'							

GENERAL REMARKS:
Elevations are taken from Table 2, Attachment 3 of the delivery order
Piezometer tip set at 133.3'

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

FIELD LOG OF TEST BORING

PROJECT NO. D.O. No. 0023

Site Townshend Dam, VT — Page 1 of 13 Pages

Hole No. FD87-1 Diam. (Casing) 3" I.D. — Boring Started 7-15-87

Co-ordinates: sta 24+58 off 18 D/S — Boring Completed 7-21-87

Drilled by Hawkins + Fox — Report Submitted

Purpose of Exploration install piezometers to determine hydrologic characteristics of foundation

Elevation Top of Hole 583.0 M.S.L.
Total Overburden Drilled 134.0 Feet
Elevation Top of Rock — M.S.L.
Elevation Bottom of Hole 449.0 M.S.L.
Total Rock Drilled 0.0 Feet
Total Depth of Hole 134.0 Feet
Core Recovered 0.0 %
Core Recovered 0.0 Ft.; — Diam. — in.
Soil Samples 1 3/8 in. Diam. 4 No.
Soil Samples — in. Diam. — No.

Casing Left in Place 73.7 Feet
Note: 2.7 Feet of stickup

Water Table Depth

Depth From	Depth To	Method of Drilling and Type of Bit Used
0.0	71.0	4" cased open hole left by previous drill crew
71.0	134.0	3 7/8" roller bit with "Clear Mud" drilling fluid

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Ground Water — ~~Back of~~ Page 12
Boring Location Sketch — ~~Back of~~ Page 12
Overburden Record — Page 2-10
~~Rock Drilling~~ — Page —
Piezometer Installation Report — Page 11
Monitoring Well Installation Detail — Page 13
— Page —

Prepared by T.A. Beddoe / G. Hargrave
Field Data — Lab. Data

Submitted by Atlantic Testing Labs, Ltd.

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

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

FIELD LOG OF TEST BORING

PROJECT NO. D.O. No. 0023

Site Townshend Dam, VT — Page 1 of 13 Pages

Hole No. FD87-1 Diam. (Casing) 3" I.D. — Boring Started 7-15-87

Co-ordinates: ~~X~~ sta 24+58 ~~Y~~ off 18 D/S — Boring Completed 7-21-87

Drilled by Hawkins + Fox — Report Submitted

Purpose of Exploration install piezometers to determine hydrologic characteristics of foundation

Elevation Top of Hole 583.0 M.S.L.
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