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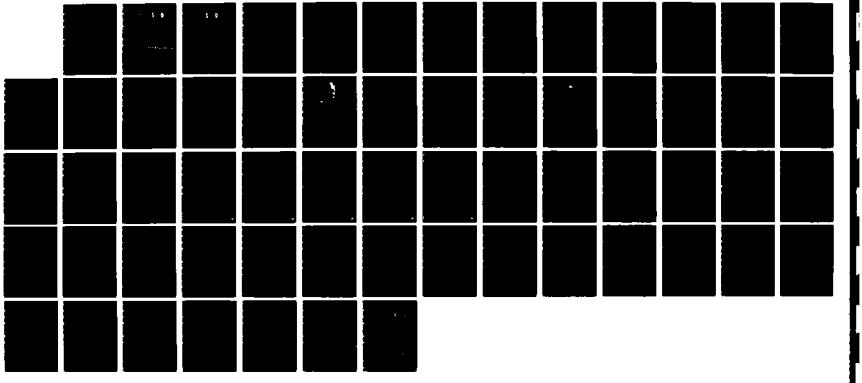

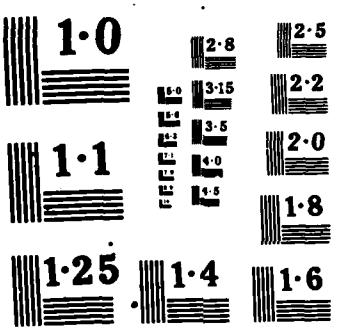

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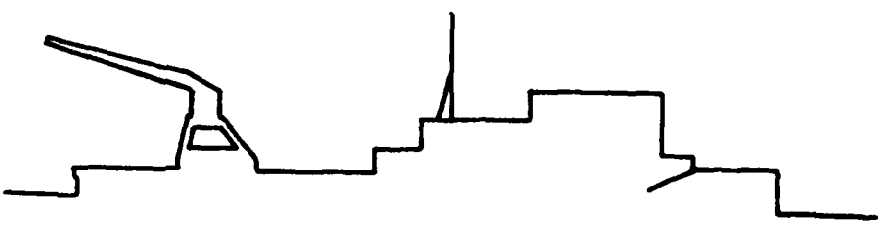
FPO-1-85(9) February 1985



Ocean Engineering

CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON NAVY YARD
WASHINGTON, DC 20374

SITE SURVEY
OF
THE NAVAL STATION NORFOLK
PROPOSED DEGAUSSING RANGE
AND
DEPERMING SLIPS

FPO-1-85(9) February 1985

by

Sandra C. Vickstrom

David A. Raecke, Director
Construction Division

Ocean Engineering and Construction Project Office
Chesapeake Division, Naval Facilities Engineering Command
Washington, DC 20374-2121

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19. ABSTRACT (Continue on reverse if necessary & identify by block number)
This report describes the purpose, execution, and findings of the geotechnical and geophysical survey performed by the Ocean Engineering and Construction Project Office of Chesapeake Division, Naval Facilities Engineering Command, (CHESNAVFACENGCOM) in the Entrance Reach and Lambert Bend waterways of (Con't)

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Norfolk Harbor. The Entrance Reach Channel of Norfolk Harbor has been selected as the site for a future degaussing range to be operated by the Naval Station Norfolk Magnetic Silencing Facility (MSF). The purpose of the survey was to provide geotechnical information for the design of the degaussing range and the associated platform. Additionally, a probe of the cable route from the platform location to the shore ranging facility was required. The platform location to the shore ranging facility was required. The survey also included a bottom probe of the MSF Deperming Garden which is located on the southwest bank of the Norfolk Harbor Lambert Bend Channel. This information was requested for the purpose of planning the installation of new hardware and cables in the deperming slips.

ACKNOWLEDGEMENTS

CHESNAVFACENGCOM commends the efforts of all organizations involved with the Norfolk Harbor Survey. Our appreciation goes to Mr. C. Stewart, Director of MSF, Norfolk Naval Station and his colleagues for their assistance to CHESDIV while on site. We thank Mr. Hank Lingg of NCEL for operating the vibracorer and for his assistance in working with UCT-1 during the coring phase of the survey. Also, we extend our thanks to Chief J. Aylsworth and the detachment from UCT-1 for their support and their professionalism which aided in the efficient execution of this survey.

SECTION I

INTRODUCTION

1.1 Objective

This report describes the purpose, execution, and findings of the geotechnical and geophysical survey performed by The Ocean Engineering and Construction Project Office of Chesapeake Division, Naval Facilities Engineering Command, (CHESNAVFACENGCOM) in the Entrance Reach and Lambert Bend waterways of Norfolk Harbor. The Entrance Reach Channel of Norfolk Harbor has been selected as the site for a future degaussing range to be operated by the Naval Station Norfolk Magnetic Silencing Facility (MSF). The purpose of the survey was to provide geotechnical information for the design of the degaussing range and the associated platform. Additionally, a probe of the cable route from the platform location to the shore ranging facility was required. The survey also included a bottom probe of the MSF Deperming Garden which is located on the southwest bank of the Norfolk Harbor Lambert Bend Channel. This information was requested for the purpose of planning the installation of new hardware and cables in the deperming slips.

1.2 Project Background

The Ocean Engineering and Construction Project Office of CHESNAVFACENGEOM has program responsibilities to design and install the in-water facilities for all Magnetic Silencing Facilities. This survey represents the initial investigation of the environmental conditions which the degaussing range facility design must accommodate.

The existing degaussing facility is located west of Sewells Point in the northern most section of the Norfolk Harbor Reach Channel. The degaussing range is being relocated to deeper water and in a straight channel to overcome the problem of servicing large naval vessels in an area of limited maneuverability and negligible clearance. The selection of a new facility location required a site survey to determine the design requirements imposed by the immediate environment such as bottom soil density/composition and typical channel currents. Given the existing program schedule, budget, etc., the deperming garden was included in the survey to provide information to support future hardware replacement.

1.3 Tasking

Naval Sea Systems Command (NAVSEA) Code 56Z14 tasked CHESNAVFACENGCOM to provide engineering and management services necessary to design and install facilities for new and updated degaussing equipment. CHESNAVFACENGCOM tasked the following organizations to provide the specified assistance:

Naval Civil Engineering Laboratory (NCEL) - Provided vibracorer with expendables and operator.

CHESNAVFACENGCOM Ocean Construction Equipment Inventory (OCEI) - Provided equipment as required from available inventory at St. Juliens Creek, Portsmouth, Va.

Underwater Construction Team One (UCT-1) - Provided diving support; equipment operation and deck force, and served as liaison with the US Coast Guard and NAVSTA Norfolk, Va.

Value Service Engineering (VSE) - Provided support by contracting Law Engineering Testing Company (LETC) to perform the required soils analysis. LETC provided transportation and analysis of four core samples, documentation and report of findings.

1.4 Cost Data

1. VSE (Law Engineering included)		$ 23,786
2. NCEL (Vibracorer and Operator)		$ 3,979
3. LCU-2 fuel		$ 2,500
4. UCT-1		N/C
5. FPO-1 Travel		$ 3,992
FPO-1 Labor		$ 3,075
	Total	$ 37,332

1.5 Project Requirements

1.5.1 The Project Execution Plan FPO-1-84(12) specified the Norfolk Harbor Survey to include four forty-foot core samples from the selected range site in the Entrance Reach Channel. The core sites were to be aligned perpendicular to the channel in the general

area where the Sewells Point Spit rises to a 5-foot water depth on the southeast bank of the channel. The channel was redefined to account for future deepening which may occur prior to the installation of this range (see Appendix A). Cores one and two were to be distributed across the modified channel which is the proposed location for the deep water range. Core number three was to be located on the proposed location for the shallow water or minesweep range . The fourth core was to be placed near the five foot water depth on Sewell's Spit which approximates the proposed platform location (see figure 1).

If a forty-foot core was not obtained at each of the four sites due to the corer's inability to vibrate into the sediment (or sediment refusal), the corer was to be fitted for a water jetting capability. The site was to be jetted to determine if penetration to forty feet could be accomplished.

1.5.2 Upon completion of the coring phase of the survey, the core samples were to be transported to LETC testing facilities. All four cores were to be subjected to the following tests:

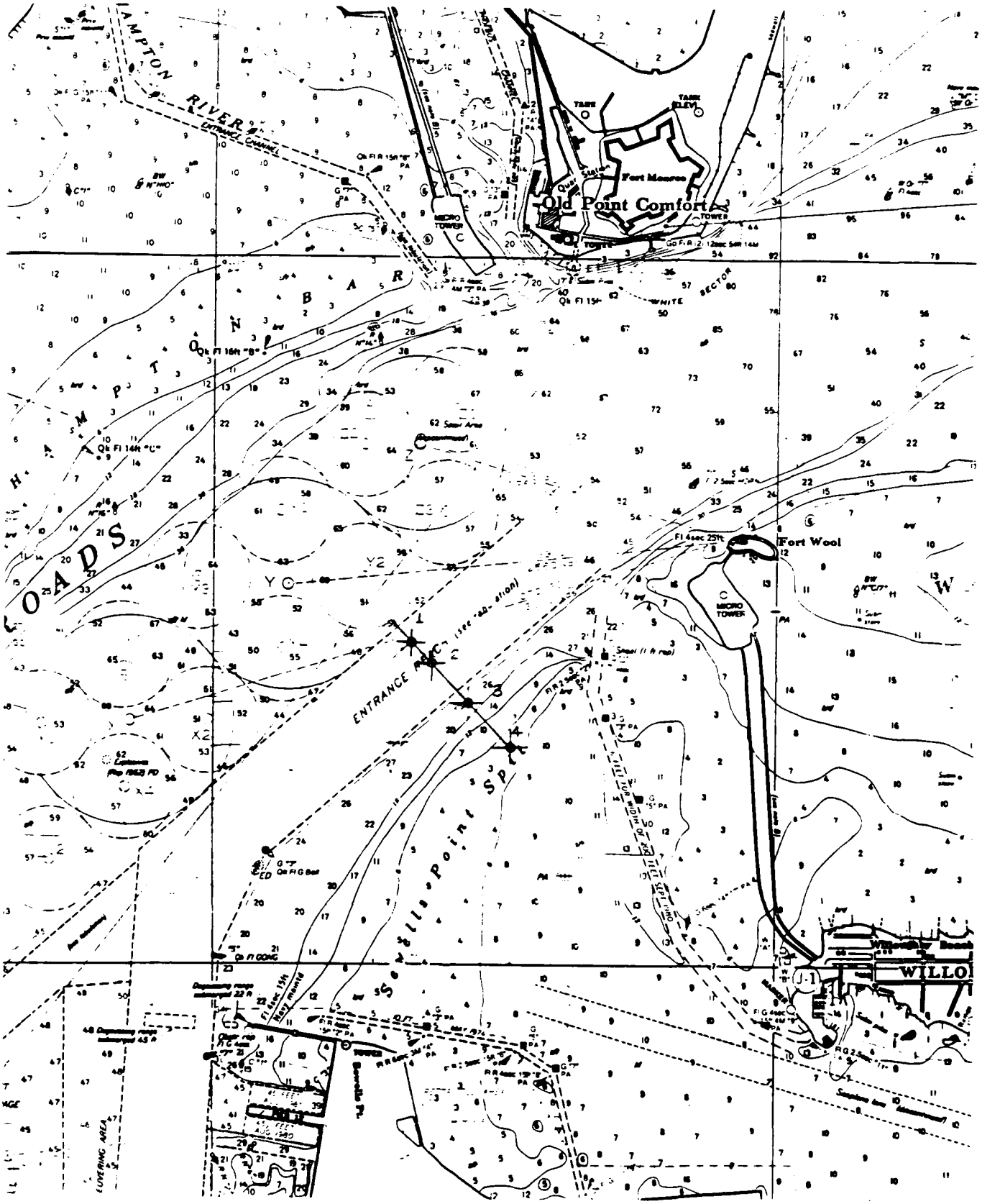
Soil Identification - per core
Sieve Analysis - (ASTM-D422) 4 locations max.
Atterberg Limits - (ASTM-D23 and D424) 2 locations max.

In addition, the core obtained from the proposed platform location was to undergo consolidated, undrained triaxial testing every 10 feet or where the layer changes (5 locations max.).

1.5.3 Divers were to perform manual probes in twelve locations equally spaced along the proposed cable path from an instrumentation platform to the ranging station on shore Sewell's Point (see Figure A1). The first probe was to be taken at the proposed instrumentation platform site . The remaining eleven probes to be taken along the proposed path would be used to determine the bottom strata's suitability for cable burial to a depth of six feet.

1.5.4 Also, current meter readings were to be taken at mid-channel for three water column depths at peak ebb and flood tides. Surface environmental information was to be obtained as available such as the existence of prominent prevailing winds or other environmental criteria which would impose specific requirements for the design of the facility.

1.5.5 The inclusion of the MSF Deperming Garden extended the survey requirements to encompass a manual bottom probe of the three slips in that facility. The objective was to determine the relative depth of silt deposited in the slips. The number of probes were designated



U.S. Naval Oceanographic Chart 12245 Showing Site Location

Figure 1.

as follows: 3 soundings in slips numbers one and three and 2 soundings in slip number two. Additionally, depth measurements were to be taken in the slips to further assist in determining the amount of material which would have to be dredged in order to replace magnetometers and cables.

1.6 Deviation From Requirements

Several items defined in section 1.5 were altered due to on site circumstances. The deviations from the execution plan are presented in the following text.

1.6.1 Core Samples -Degaussing Range

Core sample number three met refusal after an elapsed core time of three minutes and forty-eight seconds and achieved a penetration of approximately thirty feet at refusal. The corer was then fitted with a jetting attachment and the core site was jetted to a depth of forty feet.

Core sample number four was thirty feet in length at the time the liner was removed from the corer. This, however, did not indicate a refusal situation. The strip chart recorder which was attached to the device indicated that 38 to 40 feet of penetration was attained. When the liner was removed from the corer, the "fingers" of the retaining cup were inverted, indicating that part of the sample had fallen out of the core tube due to the inability of the retaining cup to support the sample weight. A second attempt to core near the fourth location was not possible due to the absence of spare core liners.

1.6.2 Current Meter Readings

The current information was not obtained because the current meter failed to operate properly. It was initially tested at the onset of the survey and found functional; however, simultaneous operation with the vibracorer was not possible due to manpower constraints. Survey personnel went back to take the measurements but the current meter was not functioning nor did it work for the remainder of the survey. When the current meter is again operational, it can be deployed to obtain the current readings.

1.6.3. Deperming Slips - Bottom Probe

The bottom survey of the deperming slips was altered from eight probes to a total of 35 probes distributed among the three slips. This decision was based on discussions with the facility director who explained that during recent operations the magnetometer cables had been damaged due to insufficient clearance between vessel and slip bottom. Thus, a greater number of probes was required to accurately define the extent of silting around the three slips. The revised number of probes were distributed as follows: 12 in slip 3, 13 in slip 2, and 10 in slip 1. An additional four probes were taken in the turning basin area located southeast of the deperming garden. This information was requested by the facility personnel for future planning purposes. The average depth of silt found in this area was 2.5 feet.

SECTION II

PROJECT EXECUTION

2.1 Project Staging

All NCEL, OCEI, and UCT-1 equipment was staged out of Naval Amphibious Base (NAB), Little Creek, Norfolk, Va., by the UCT-1 Detachment assigned to this survey project. The Landing Craft Utility Vessel (LCU) and the small work boat were also acquired from the NAB.

2.2 Project Execution Schedule

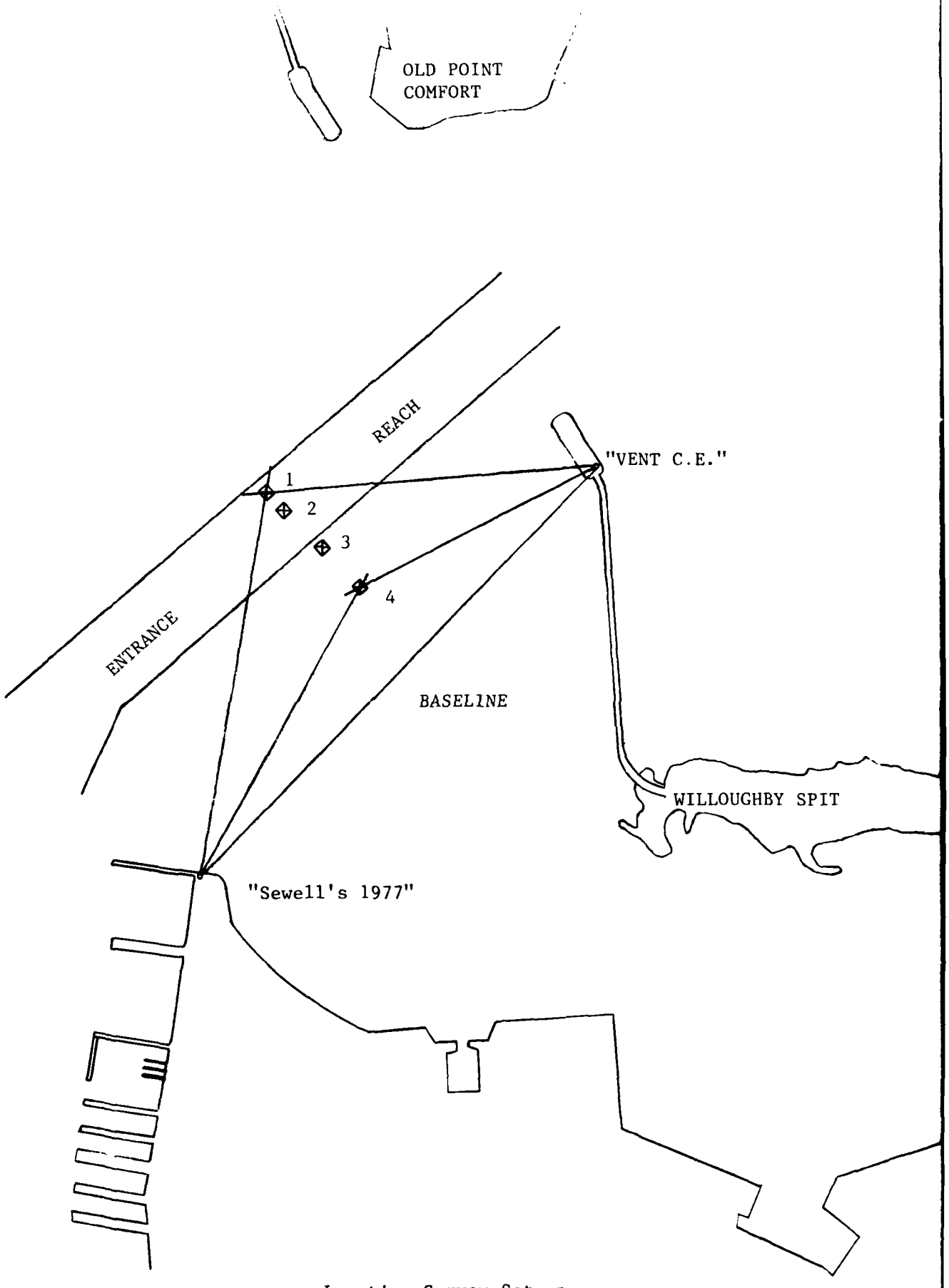
July 7 - 8	LCU mobilization at NAB Little Creek, Va.
July 9 - 10	Set up transits, position LCU, and conducted coring operations
July 11	Demobilization of LCU at NAB Little Creek, Va.
July 12 - 13	Conducted Probe at Deperming Facility
July 14	Final Demobilization of LCU, work boat, and coring gear.

2.3 Preliminary Set-Up

Transits were set-up on "Sewell's 1977" bench mark on the ranging facility grounds and on "Vent C.E." bench mark on the south island of the Hampton Roads Tunnel (see Figure 2). The horizontal control points are of second and third order respectively as documented by the Norfolk District, Corps of Engineers. The Lambert Grid State Plane (South Virginia) coordinates in feet for these two bench marks are given below.

Sewell's 1977	Vent C.E.
236638.663 N	244100.850 N
2635144.571 E	2642153.130 E

The design core site coordinates were presented in the FPO-1-84(12) Execution Plan and are restated in Appendix A. The transit operators obtained a zero reference by backsighting off the opposing bench mark. The angles calculated to locate the core locations are the following:



Location Survey Set-up

Figure 2

Core #	"Sewell's 1977"	"Vent C.E."
1	34° 6' 23.5"	41° 21' 14.34"
2	30° 40' 28.21"	37° 23' 10.94"
3	23° 33' 12.59"	28° 55' 23.83"
4	14° 10' 13.78"	17° 26' 22.5"

Given the limitations of the transits available, the angles were located to the nearest third of a minute. The actual angles turned from each transit to locate the core positons are given below:

Core #	"Sewell's 1977"	"Vent C.E."
1	34° 6' 20"	41° 21' 20"
2	30° 40' 20"	37° 23' 20"
3	23° 33' 20"	28° 55' 20"
4	14° 10' 20"	17° 26' 20"

The transit operators utilized radio communications to direct the small workboat to the appropriate locations at which time a marker buoy was released to mark each core site.

2.4 Coring Procedure

The vibracorer was deployed and retrieved using the 35 ton Grove crane which was operated by a UCT-1 equipment operator. Preparation of the vibracorer was executed as defined in the FPO-1-84(12) Execution Plan. The penetration recording system was tested and in working order. The vibracorer was lifted off the deck of the LCU, swung out over the side, and lowered to the channel floor. The recorder was turned on and the 2 $^{1}/_{2}$" air valve was opened to start the vibrator. Upon indication of approximately 40 feet of penetration, the air valve was shut off and the corer was retrieved. The assembly was lowered to the deck, the kick leg was collapsed, and the corer was laid horizontally on the deck. At this point, the liner containing the core was removed from the corer and was cut into 5' sections which were capped, sealed, and labelled. The core sections were placed in a stand to minimize sediment disturbance.

This procedure was repeated without incident for cores number two and number four. Core number three met refusal at thirty feet and required jetting to forty feet. Also, approximately ten feet of core number four was lost during retrieval; however, the specified penetration had been attained.

2.5 LCU Demobilization

Upon completion of coring operations the LCU returned to the NAB Little Creek, Norfolk, Va., where all project equipment was offloaded for UCT-1 to effect shipment to the respective

points of origin. The core sample segments were taken to UCT-1 base. Law Engineering Testing Company arranged for the transportation of the core samples to their testing facilities. Section 3 presents the LETC test results.

2.6 Cable Path Manual Probe

UCT-1 personnel executed the manual probe from the proposed platform location on Sewell's Spit to the ranging station perimeter. They utilized a length of #6 rebar to probe the proposed cable path. The work boat was positioned on the proposed platform location. The probe was held vertically and lowered to determine the relative water depth at the given location. The probe was then forced manually into the sediment from the deck of the work boat and the penetration was recorded. This procedure was repeated for a total of 13 probes along the cable path (see Figure A1). The results from this probe are presented in Table 1. In noting the range of depths obtained, the manual probe alone was not sufficient to determine if a cable burial of six feet can be achieved. Further investigation such as a sub-bottom profile and coring should be conducted in this area to better define the sediment composition. Test results from the cores and profiles can provide a basis for the selection of a cost effective method of cable burial.

2.7 Deperming Slip Probe

The deperming slip survey consisted of 35 probes. The hand-held device used is shown in Figure 3. It was constructed from #6 rebar with 3" rebar segments welded to the rod every foot to simplify measurements in a zero visibility environment. The rebar rod had a perforated steel plate welded to one end. The steel plate served to prevent the rebar from merely piercing the channel bottom sediment which in turn assisted in the determination of the extent of the silt layer. The probe locations are shown in Figure 4. The average depth of silt in slips 1 through 3 was 5.5', 3.4', and 4.3' respectively.

TABLE 1
Sewell's Spit Cable Path Probe Data

PROJECT: Norfolk Survey
LOCATION: Entrance Reach to Sewell's Point
DATE: 12 July 1984
TIDAL RANGE: 3.0'
HIGH TIDE: 0830
LOW TIDE: 1433

SITE	WATER DEPTH	PENETRATION	TIME	COMMENTS
1*	8'	6"	1030	Sand
2	8'	4"	1032	Sand
3	8.5'	6"	1035	Sand
4	9'	4"	1037	Sand
5	9'	4"	1039	Sand
6	9.5'	4"	1041	Sand
7	9.5'	4"	1043	Sand
8	9.5'	7"	1046	Sand
9	9.5'	4"	1048	Sand
10	9'	4"	1050	Sand
11	8.5'	4"	1054	Sand
12	8'	4"	1056	Sand
13	10'	18"	1059	Mud

* Proposed platform location

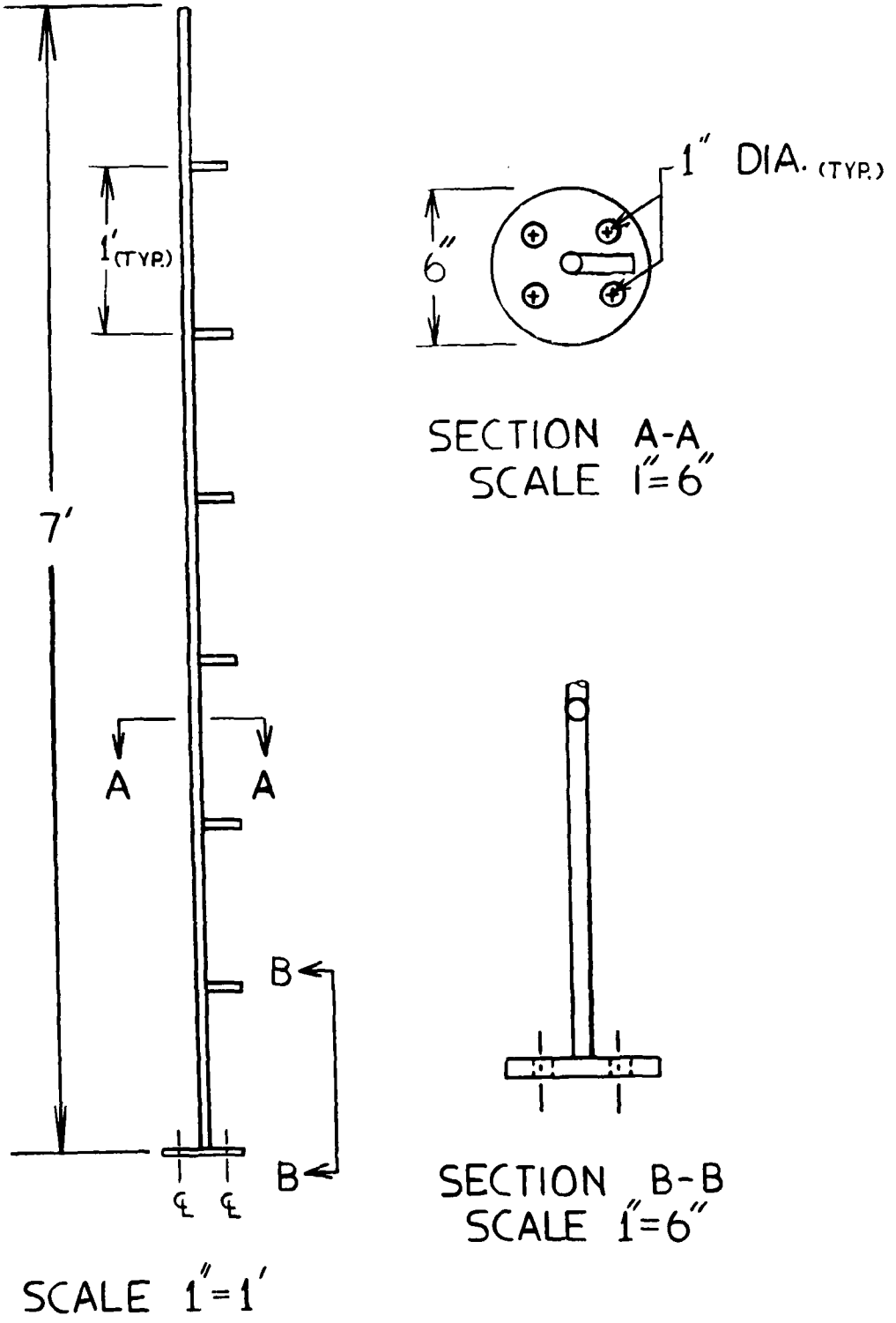
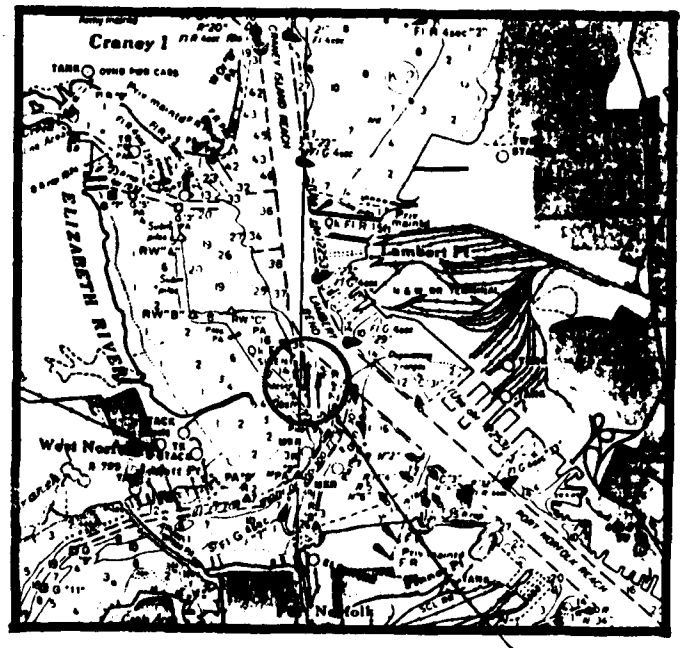
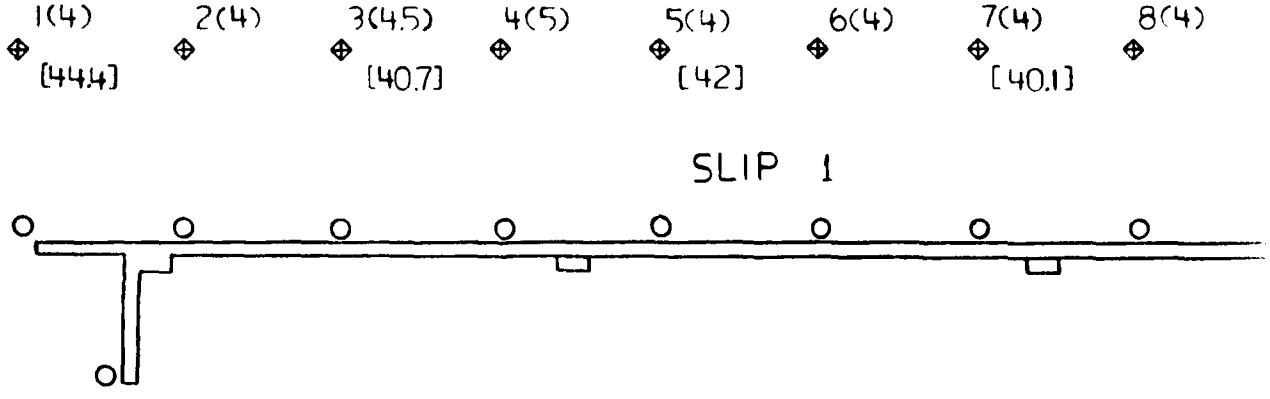
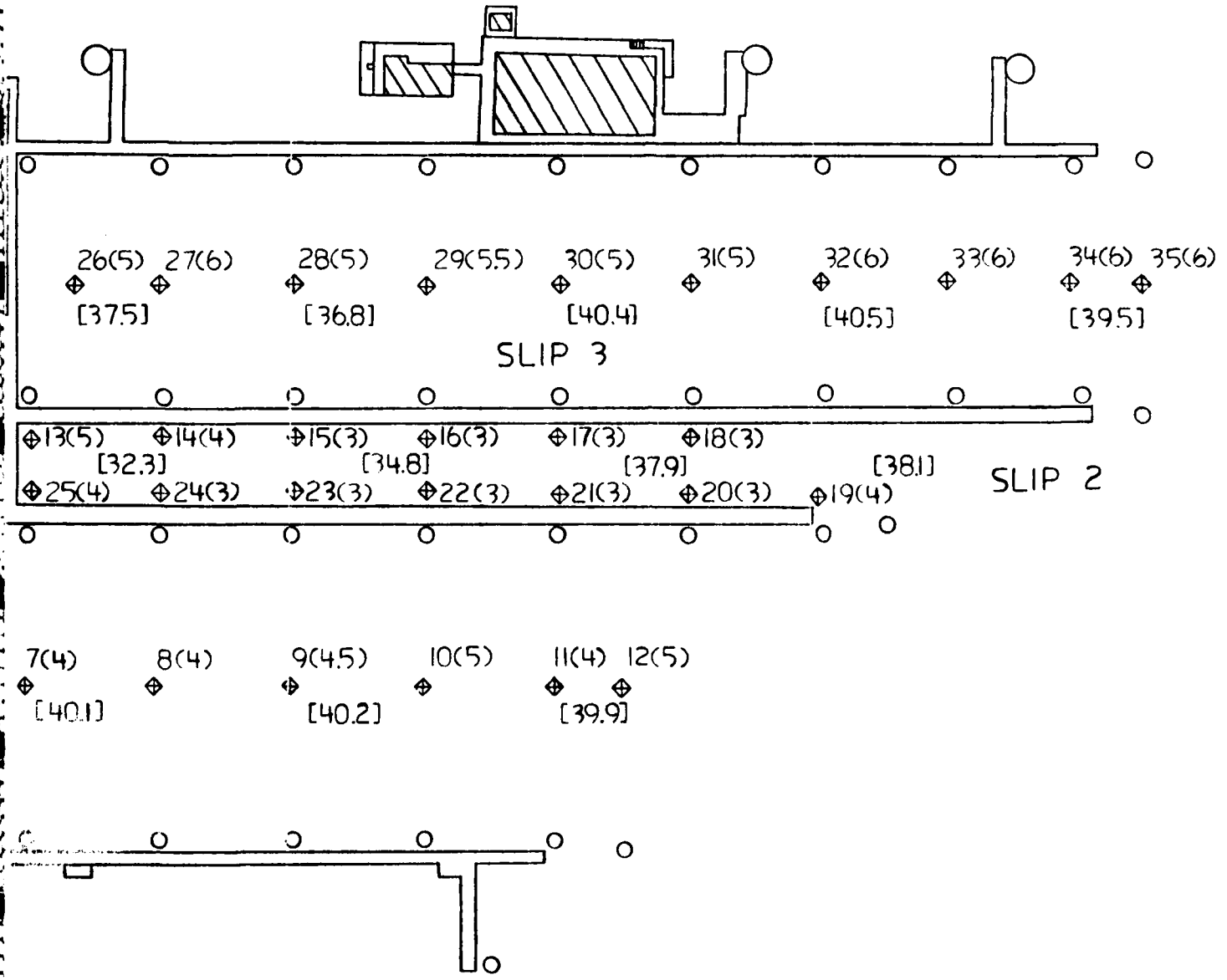


Figure 3. - Device Used For Manual Probe





DEPERMING
NAVAL STATI



KEY:

- ⊕ PROBE SITE
- # PROBE NUMBER
- (#) DEPTH OF SILT LAYER IN FEET
- [#] SOUNDING REFERENCED TO MLW IN FEET

DEPERMING GARDEN
NAVAL STATION, NORFOLK

Deperming Slips - Probe Locations

Figure 4

SECTION III

RECOMMENDATIONS FOR FUTURE SITE SURVEYS

3.1 The following items are presented as recommendations for future site surveys as noted from experiences gained from the Norfolk Harbor survey.

* All aspects of the project should be defined beyond question in an execution plan.

*For any items not explicitly defined, the execution plan should contain a stipulation that the tasked organization must submit a return "Plan of Execution" such that an approved plan exists before arriving on site.

* The project engineer should be consulted on any changes to the execution plan due to on site circumstances.

* Spare parts and or maintenance kits should accompany all equipment (as appropriate) that is involved in an at-sea operation. Plan on a worst case situation.

* When shipping equipment or other items necessary for an operation, all shipments should allow for ample time to arrive prior to the project start date. Also, all shipments must be tracked (in process) by the originator to ensure arrival. Request check-in (to the originator) of equipment at each transfer level.

SECTION IV

CORE SAMPLE TEST RESULTS

A. Consolidated Undrained Test Results

LAW ENGINEERING TESTING COMPANY
7913 WESTPARK DRIVE
P.O. DRAWER QQ•McLEAN, VIRGINIA 22101-0700
(703) 790-5700

September 13, 1984

VSE Corporation
2550 Huntington Avenue
Alexandria, Virginia 22303

ATTENTION: Bill Walker

SUBJECT: Results of CU Triaxial Tests
Degaussing Range Norfolk
Navy Contract N00600-82-D002
LETCO Project No. W4-4519

Dear Bill,

The requested laboratory testing on Core 4 has been completed. The results of five consolidated-undrained triaxial compression tests with pore pressure measurements are attached. The clayey to silty sands exhibited an average effective stress friction angle of about 32 degrees. The undrained shear strengths (defined at maximum deviator stress) are summarized as follows:

Core	Depth* (Ft)	Confining Stress (ksf)**	C_u (ksf)	C_u/P_o'
4E	5.5	0.43	1.12	2.60
4D	13.5	0.79	0.79	1.00
4C	18.5	1.01	0.35	0.35
4B	24.5	1.44	0.56	0.39
4A	27.5	1.73	1.03	0.59

* below mud line
** estimated overburden (P_o')

Also enclosed are the visual classifications on all four cores as requested by Mr. Allan Hubler.

Very truly yours,
LAW ENGINEERING TESTING COMPANY

Paul W. Mayne, P.E.
Senior Geotechnical Engineer

Enclosures
PWM/ab

LAW ENGINEERING TESTING COMPANY

SOIL DATA SUMMARY

BORING NO.	SAMPLE DEPTH (FT.)	SAMPLE TYPE	SOIL CLASSIFICATION	UNIT WEIGHT PCF		% FINER NO. 200 SIEVE	SPECIFIC GRAVITY	VOID RATIO	NATURAL MOISTURE %	ATTERBERG LIMITS			ADDITIONAL TESTS CONDUCTED
				Wet	Dry					L.L.	P.L.	P.I.	
1-H	0-5	UD	(CH or MH)			94.5							
1-G	5-10	UD	(CL)			>50				42	20	22	
1-F	10-15	UD	(CH or MH)			79.8							
1-E	15-20	UD	CH			98.2			88.0	91	35	56	
1-D	20-25	UD	(CH or MH)			97.5							
1-C	25-30	UD	(CH)			>50				79	31	48	
1-B	30-35	UD	(CH or MH)			99.1							
2-H	0-5	UD	(CH or MH)			64.8							
2-G	5-10	UD	(CH)			>50				74	26	48	
2-F	10-15	UD	(CH or MH)			93.1							
2-E	15-20	UD	CH			99.0			74.5	77	32	45	
2-D	20-25	UD	(CH or MH)			98.7							
2-C	25-30	UD	(CH)			>50				94	36	58	
2-B	30-35	UD	(SC or SM)			8.8							

NOTES: 1. Soil tests in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System

( ) - Symbol represents visual classification

PROJECT NAME Degaussing Range

PROJECT NUMBER W4-4519

PROJECT LOCATION Norfolk, Virginia

LAW ENGINEERING TESTING COMPANY

SOIL DATA SUMMARY

BORING NO.	SAMPLE DEPTH (FT.)	SAMPLE TYPE	SOIL CLASSIFICATION	UNIT WEIGHT PCF		% FINER NO. 200 SIEVE	SPECIFIC GRAVITY	VOID RATIO	NATURAL MOISTURE %	ATTERBERG LIMITS			ADDITIONAL TESTS CONDUCTED
				Wet	Dry					L.L.	P.L.	P.I.	
3-F	0-5	UD	(CH or MH)			77.0							
3-E	5-10	UD	(CL)			> 50				32	22	10	
3-D	10-15	UD	(CH or MH)			57.5							
3-C	15-20	UD	CL			78.5			47.0	43	18	25	
3-B	20-25	UD	(CH or MH)			91.4							
3-A	25-30	UD	CH			99.5				74	29	45	
4-F	0-5	UD	(SC or SM)	127.8	104.9	13.7	2.66	.582	21.9				UU Triaxial
4-E	5-10	UD	(SM)	122.1	96.9	< 50	2.68	.726	26.0	15	NP	-	UU Triaxial
4-D	10-15	UD	(SC or SM)			34.4							
4-C	15-20	UD	SC	118.6	92.7	39.6	2.69	.81	27.9	28	19	9	UU Triaxial
4-B	20-25	UD	(SC or SM)	115.8	85.9	23.2	2.68	.947	34.8				UU Triaxial
4-A	25-30	UD	SM	126.9	104.1	15.7	2.68	.607	22.0	14	NP	-	UU Triaxial

NOTES: 1. Soil tests in accordance with applicable ASTM Standards
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( ) - Symbol represents visual classification

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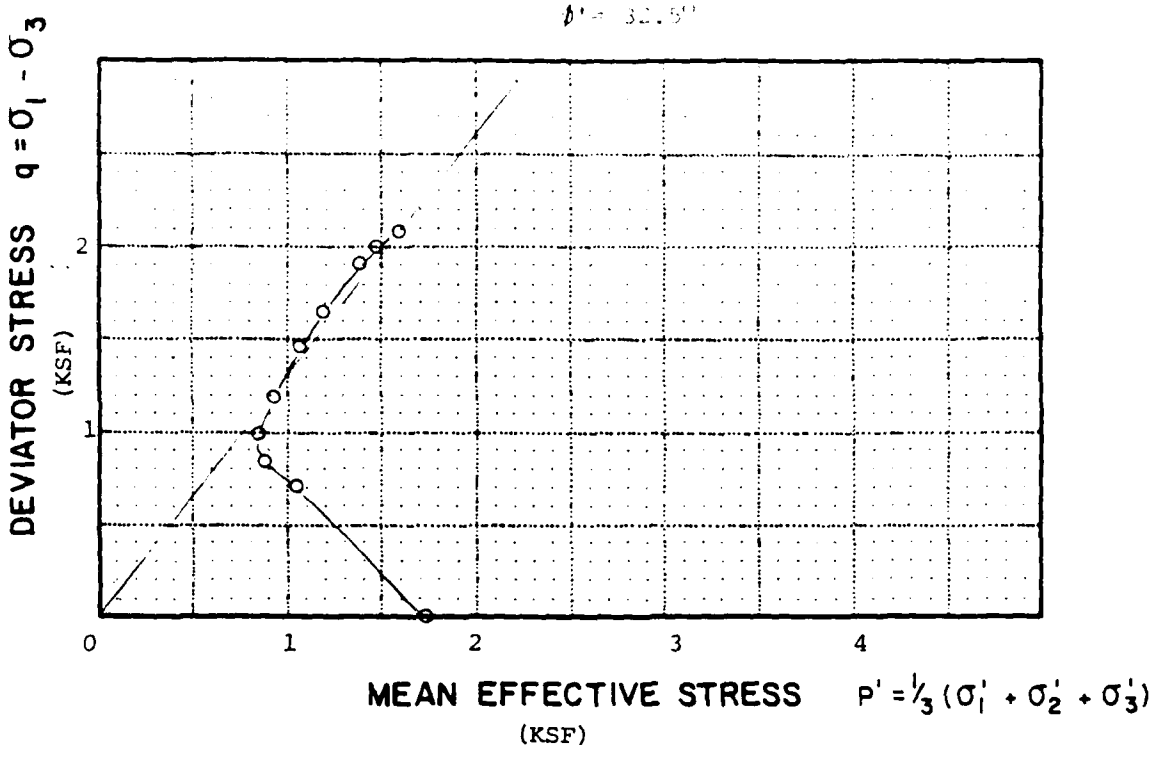
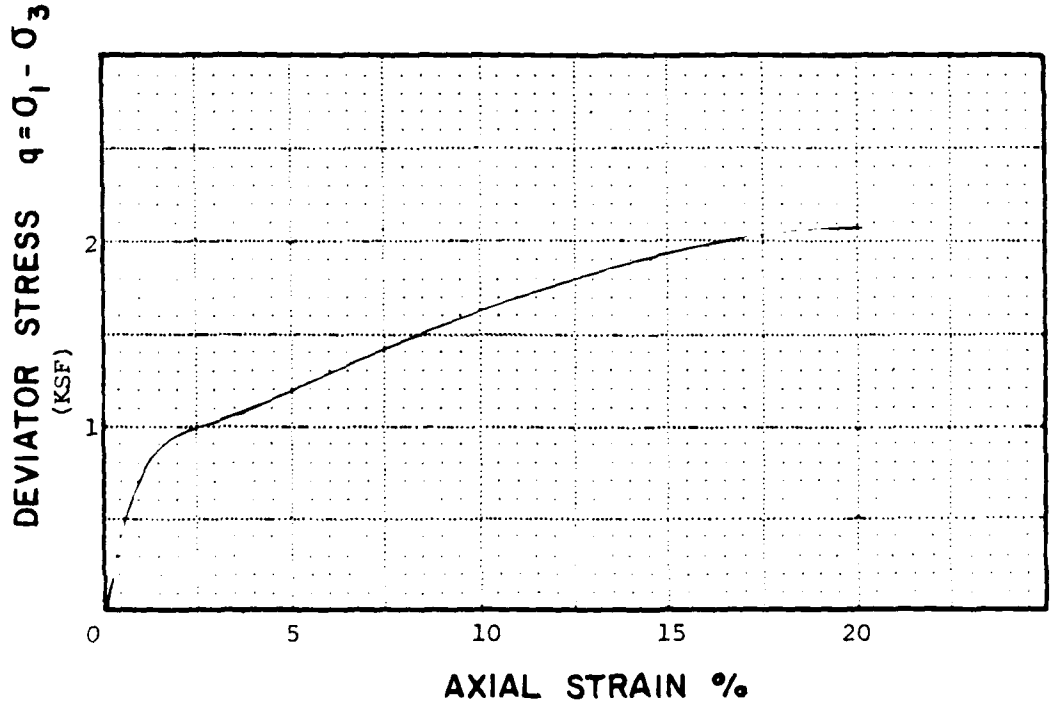
PROJECT NUMBER W4-4519

PROJECT LOCATION Norfolk, Virginia





SAMPLE NUMBER	1	2	3
Initial: Water Content(%)	22.8		
Wet Density(pcf)	125.4		
Dry Density(pcf)	102.1		
Consolidation Pressure (ksf)	1.73		

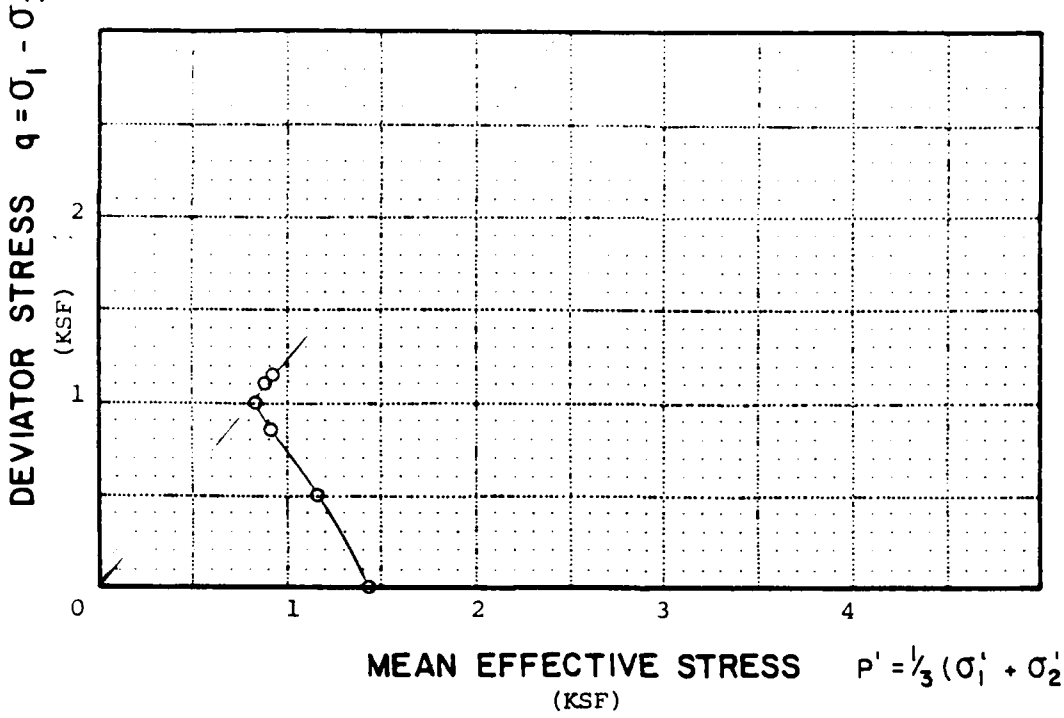
NOTES: Firm Gray Clayey Sand
4A @ 27.5 ft.

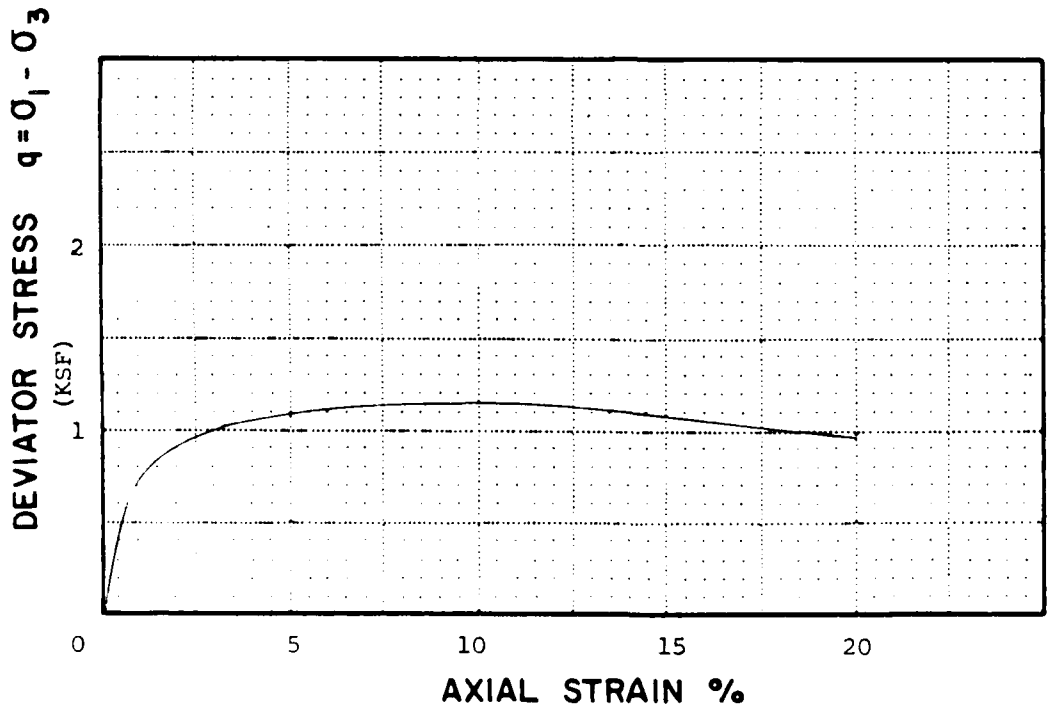
Drawn RGH
Checked PWM
Date 9-10-84

TRIAXIAL TEST RESULTS

4A @ 27.5 ft.

W4-4519
DEGAUSSING RANGE





SAMPLE NUMBER	1	2	3
Initial: Water Content(%)	26.2		
Wet Density (pcf)	121.3		
Dry Density (pcf)	96.5		
Consolidation Pressure (ksf)	1.44		

NOTES: Firm Gray Clayey Sand
4B @ 24.5 ft.

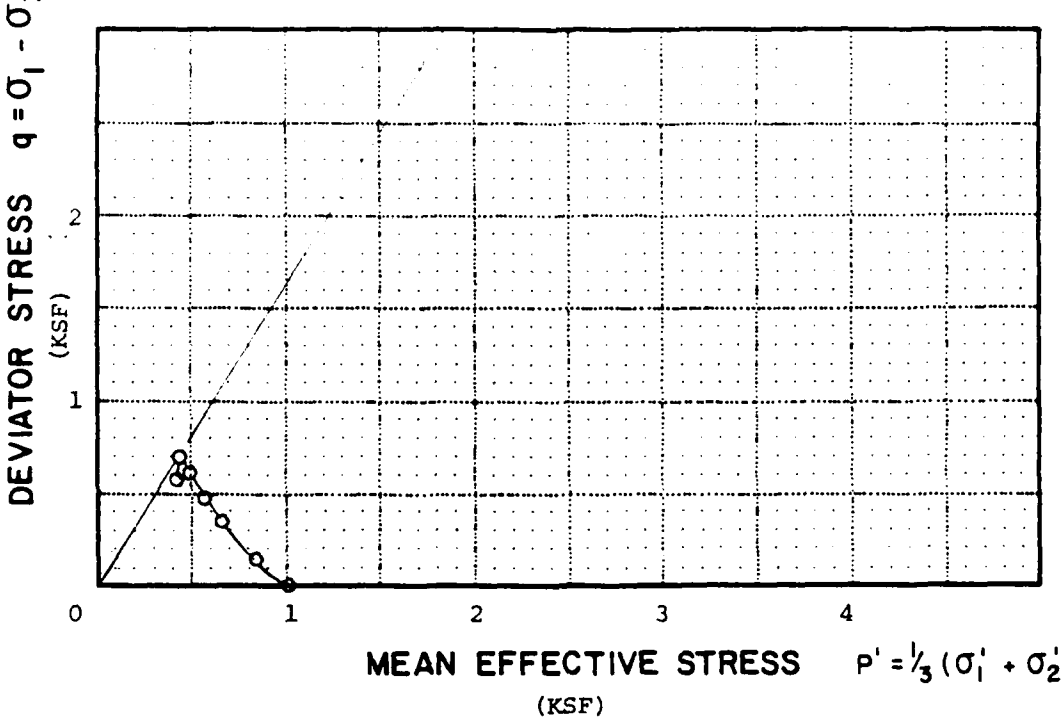
Drawn: RGH
Checked: PWM
Date: 9-10-84

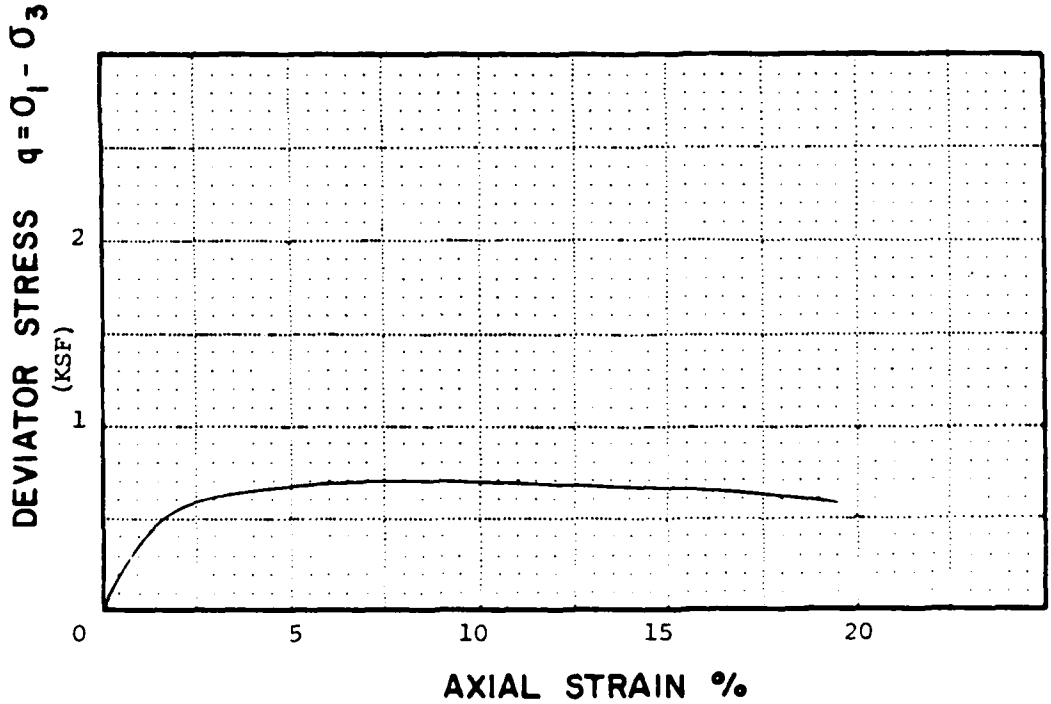
TRIAXIAL TEST RESULTS

4B @ 24.5 ft.

W4-4519
DEGAUSSING RANGE

$\phi' = 38.5^{\circ}$





SAMPLE NUMBER	1	2	3
Initial: Water Content(%)	44.8		
Wet Density (pcf)	110.8		
Dry Density (pcf)	76.3		
Consolidation Pressure (ksf)	1.01		

NOTES: Soft Gray Clayey Sand
4C @ 18.5 ft.

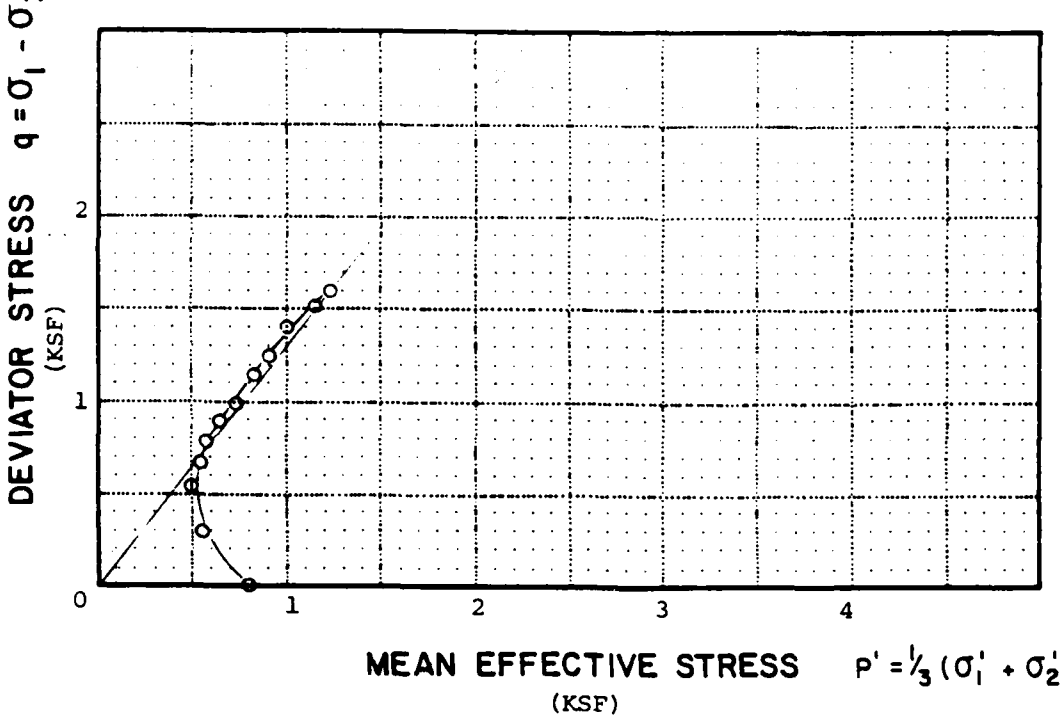
Drawn: RGH
Checked: PWM
Date: 9-10-84

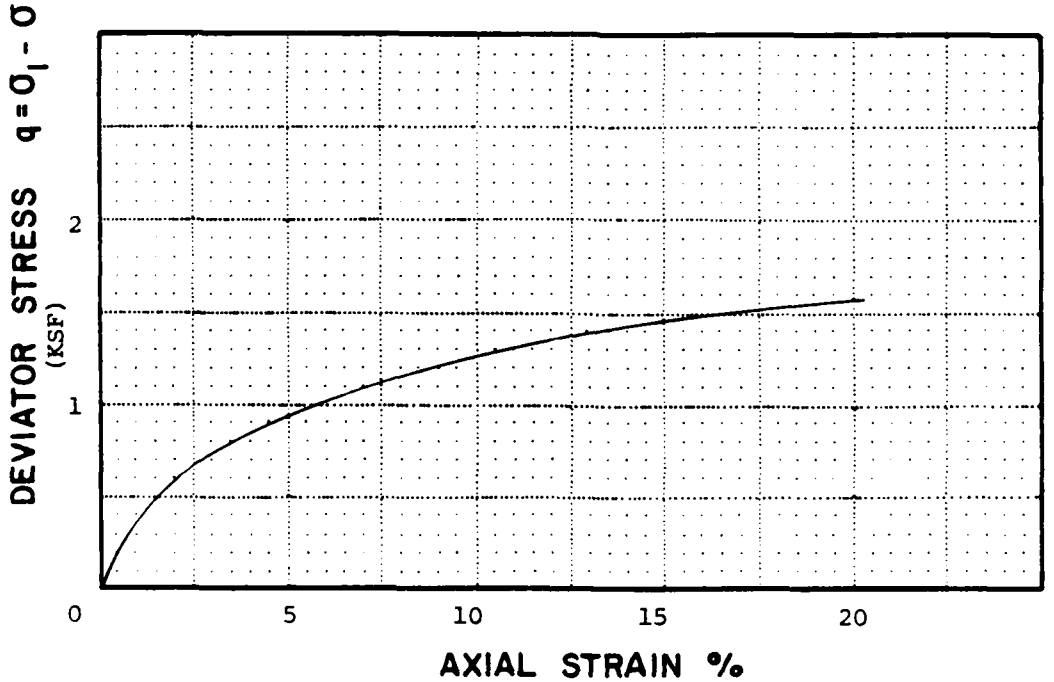
TRIAXIAL TEST RESULTS

4C @ 18.5 ft.

W4-4519
DEGAUSSING RANGE

M = 1.30
ϕ' = 32.3°





SAMPLE NUMBER	1	2	3
Initial: Water Content(%)	31.3		
Wet Density (pcf)	119.2		
Dry Density (pcf)	90.8		
Consolidation Pressure (ksf)	.79		

NOTES: Soft Gray Silty Sand
4D @ 13.5 ft.

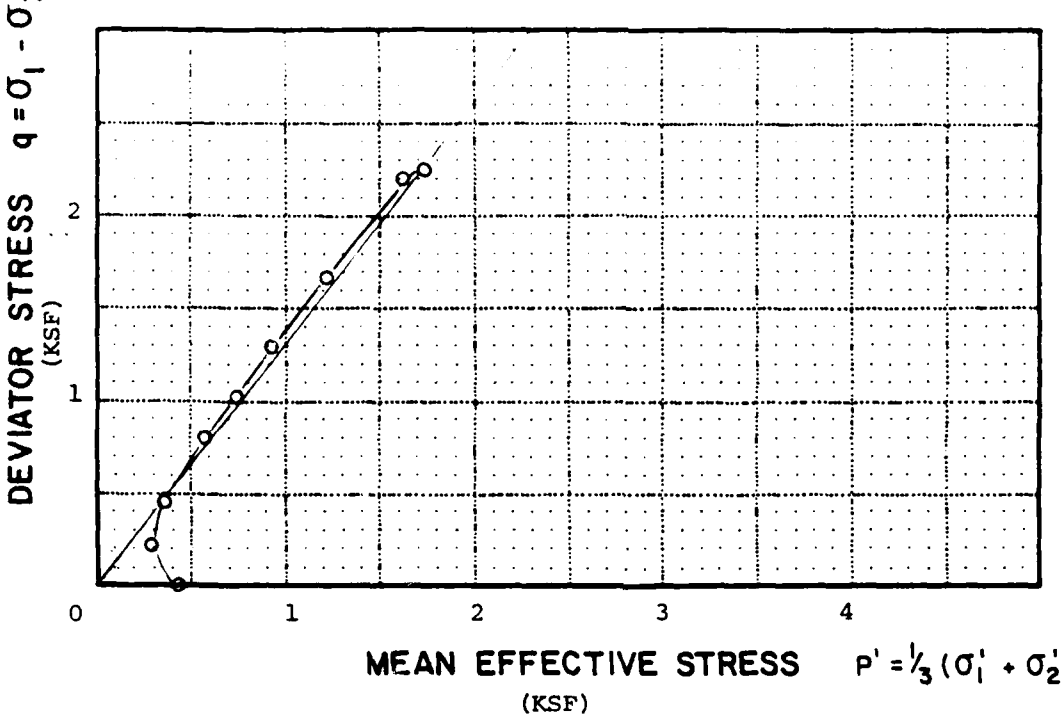
Drawn: RGH
Checked: PWM
Date: 9-10-84

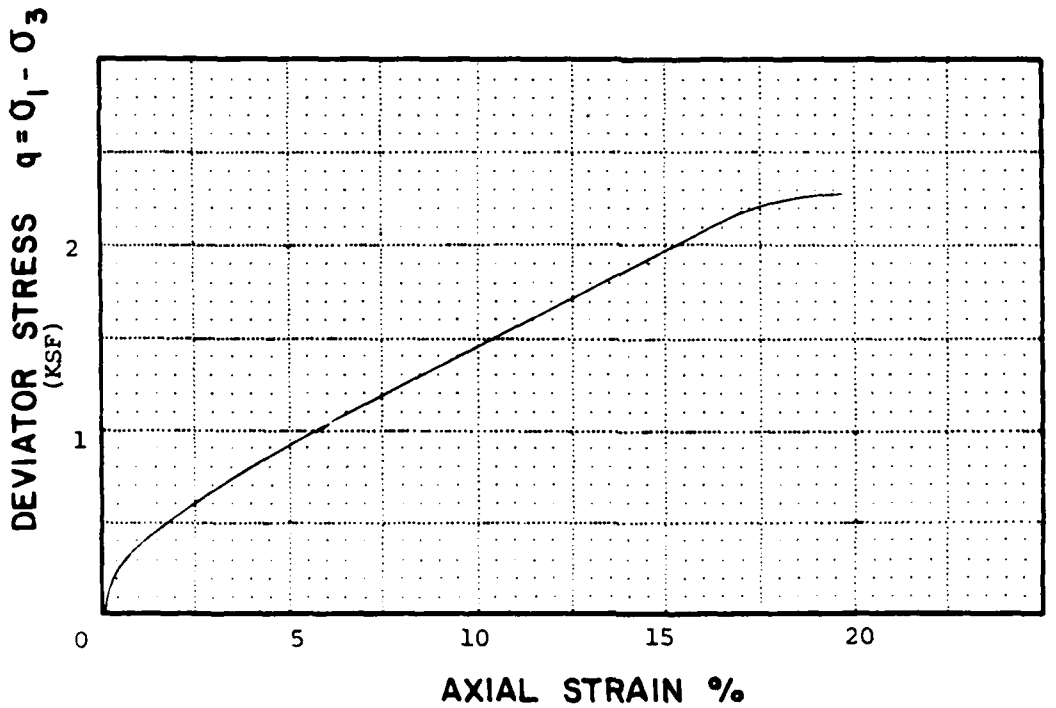
TRIAXIAL TEST RESULTS

4D @ 13.5 ft.

W4-4519
DEGAUSSING RANGE

M = 1.29
ϕ' = 32.1°





SAMPLE NUMBER	1	2	3
Initial: Water Content(%)	25.1		
Wet Density(pcf)	122.1		
Dry Density(pcf)	97.6		
Consolidation Pressure (ksf)	0.43		

NOTES: Soft Gray Slightly Clayey Sand
4E @ 5.5 ft.

Drawn: RGH
Checked: PWM
Date: 9-10-84

TRIAXIAL TEST RESULTS

4E @ 5.5 ft.

W4-4519
DEGAUSSING RANGE

[illegible] MEANZ
[illegible]

[illegible] AND [illegible] DEPTH RANGE
[illegible] @ [illegible] FT
SAMPLE [illegible] N TO FIRM GRAY CLAYEY SAND

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

PROVING RING .433 CALIBRATED 3 1984

P R O P E R T I E S

SPECIFIC GRAVITY	=	2 70	
LIQUID LIMIT	=	0	
PLASTIC LIMIT	=	0	
MEASURED VOLUME CHANGE	=	- 433	IN3
CELL PRESSURE	=	4 61	KSF
CONSOLIDATION PRESSURE	=	1 73	KSF

PROPERTY		INITIAL	CONSOLIDATED	
HEIGHT	=	4 233	4 186	INCHES
VOID RATIO	=	650	597	
AREA	=	3 225	3 157	SQ IN
PERCENT MOISTURE	=	22 81	22 13	PERCENT
WET DENSITY	=	125 41	128 81	PCF
DRY DENSITY	=	102 12	105 47	PCF
PERCENT SATURATION	=	94 77	100 00	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	000000	000000	0000	597	000
2	008360	008360	0000	597	1 299
3	014810	014810	0000	597	1 346
4	028186	028186	0000	597	1 237
5	034636	034636	0000	597	1 177
6	047773	047773	0000	597	1 022
7	061150	061150	0000	597	915
8	080976	080976	0000	597	783
9	100802	100802	0000	597	657
10	120867	120867	0000	597	580
11	140932	140932	0000	597	514
12	160519	160519	0000	597	464
13	180106	180106	0000	597	435
14	202560	202560	0000	597	406

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF)	Q/P PARAMETERS
1	1 73	00	1 73	1 73	1 00	1 00	00	1 73	00
2	2 44	92	1 51	81	1 41	1 88	71	1 04	68
3	2 56	1 13	1 44	60	1 48	2 39	84	88	95
4	2 73	1 24	1 49	49	1 58	3 03	1 00	83	1 21
5	2 78	1 24	1 54	48	1 61	3 18	1 06	84	1 26
6	2 92	1 22	1 70	51	1 69	3 34	1 19	91	1 31
7	3 05	1 21	1 84	52	1 76	3 55	1 32	96	1 38
8	3 21	1 16	2 05	57	1 85	3 59	1 48	1 06	1 39
9	3 37	1 08	2 29	65	1 95	3 55	1 65	1 19	1 38
10	3 49	1 03	2 47	70	2 02	3 51	1 77	1 29	1 37
11	3 63	98	2 65	75	2 10	3 53	1 90	1 38	1 37
12	3 73	93	2 80	80	2 16	3 51	2 01	1 47	1 37
13	3 74	88	2 87	85	2 17	3 36	2 01	1 52	1 32
14	3 79	84	2 96	89	2 20	3 32	2 07	1 58	1 31

LAW ENGINEERING TESTING COMPANY
TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DEGAUSSING RANGE
BORING NUMBER IS CORE 48 UD @ 24 FT
SAMPLE IDENTIFICATION IS FIRM GRAY SILTY SAND

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

PROVING RING 1433 CALIBRATED 3 / 1984

P R O P E R T I E S

SPECIFIC GRAVITY	=	2 71
LIQUID LIMIT	=	0
PLASTIC LIMIT	=	0
MEASURED VOLUME CHANGE	=	- 750 IN3
CELL PRESSURE	=	4 32 KSF
CONSOLIDATION PRESSURE	=	1 44 KSF

PROPERTY		INITIAL	CONSOLIDATED	
HEIGHT	=	4 371	4 290	INCHES
VOID RATIO	=	753	660	
AREA	=	3 257	3 143	SQ IN
PERCENT MOISTURE	=	26 18	24 36	PERCENT
WET DENSITY	=	121 75	126 67	PCF
DRY DENSITY	=	96 49	101 86	PCF
PERCENT SATURATION	=	94 28	100 00	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	000000	000000	0000	660	000
2	006293	006293	0000	660	859
3	016083	016083	0000	660	973
4	031933	031933	0000	660	952
5	044986	044986	0000	660	948
6	057805	057805	0000	660	906
7	077152	077152	0000	660	841
8	096265	096265	0000	660	796
9	122370	122370	0000	660	788
10	148243	148243	0000	660	811
11	173883	173883	0000	660	862
12	199522	199522	0000	660	937

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF)	Q/P PARAMETERS
1	1 44	00	1 44	1 44	1 00	1 00	00	1 44	00
2	1 95	43	1 51	1 01	1 35	1 50	51	1 17	43
3	2 29	83	1 46	61	1 59	2 38	85	90	95
4	2 45	96	1 49	48	1 70	3 09	1 01	82	1 23
5	2 45	96	1 49	48	1 70	3 12	1 01	82	1 24
6	2 48	94	1 54	50	1 72	3 10	1 04	84	1 24
7	2 54	93	1 61	51	1 77	3 15	1 10	88	1 25
8	2 58	91	1 67	53	1 79	3 14	1 14	91	1 25
9	2 57	89	1 68	55	1 78	3 04	1 13	93	1 21
10	2 53	89	1 65	55	1 76	2 98	1 09	92	1 19
11	2 48	90	1 58	54	1 72	2 92	1 04	89	1 17
12	2 41	91	1 50	53	1 68	2 85	97	85	1 14

[illegible]
TRIAXIAL SHEAR TEST

[illegible] AREA [illegible] ARE 24-401Y DEVAUSSING RANGE
[illegible] NUMBER IS 46 00 @ 18 5 FT
SAMPLE IDENTIFICATION IS SOFT GRAY CLAYEY SAND

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

PROVING RING 1435 CALIBRATED 3 / 1984

P R O P E R T I E S

SPECIFIC GRAVITY	=	2 72	
LIQUID LIMIT	=	0	
PLASTIC LIMIT	=	0	
MEASURED VOLUME CHANGE	=	- 872	IN3
CELL PRESSURE	=	3 89	KSF
CONSOLIDATION PRESSURE	=	1 01	KSF

PROPERTY		INITIAL	CONSOLIDATED	
HEIGHT	=	4 385	4 287	INCHES
VOID RATIO	=	1 225	1 086	
AREA	=	3 180	3 049	SQ IN
PERCENT MOISTURE	=	44 76	39 91	PERCENT
WET DENSITY	=	110 44	113 86	PCF
DRY DENSITY	=	76 29	81 38	PCF
PERCENT SATURATION	=	99 40	100 00	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	000000	000000	0000	1 085	000
2	003732	003732	0000	1 085	1 627
3	010496	010496	0000	1 085	1 384
4	016793	016793	0000	1 085	1 209
5	029621	029621	0000	1 085	1 150
6	043382	043382	0000	1 085	1 062
7	061808	061808	0000	1 085	1 091
8	074870	074870	0000	1 085	1 132
9	093995	093995	0000	1 085	1 138
10	113354	113354	0000	1 085	1 134
11	132946	132946	0000	1 085	1 243
12	152072	152072	0000	1 085	1 194
13	173996	173996	0000	1 085	1 272
14	193588	193588	0000	1 085	1 326

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF)	Q/P PARAMETERS
1	1 01	00	1 01	1 01	1 00	1 00	00	1 01	00
2	1 14	22	92	79	1 13	1 17	14	83	16
3	1 34	47	88	54	1 33	1 62	34	65	51
4	1 50	59	90	41	1 49	2 18	49	58	85
5	1 62	71	91	30	1 61	3 05	62	50	1 22
6	1 70	74	96	27	1 69	3 56	69	50	1 38
7	1 71	77	94	24	1 70	3 90	70	48	1 47
8	1 70	78	92	22	1 69	4 08	69	46	1 52
9	1 71	79	91	21	1 69	4 27	70	45	1 57
10	1 71	80	91	21	1 70	4 34	70	44	1 58
11	1 66	81	85	20	1 64	4 21	65	42	1 55
12	1 68	80	88	20	1 67	4 29	67	43	1 57
13	1 63	79	84	22	1 61	3 78	62	43	1 44
14	1 57	75	82	26	1 56	3 21	57	44	1 27

LAW ENGINEERING TESTING COMPANY
TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DEGAUSSING RANGE
BORING NUMBER IS 4-D UD @ 13 5 FT
SAMPLE IDENTIFICATION IS SOFT GRAY SILTY SAND

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

PROVING RING 1433 CALIBRATED 3 / 1984

P R O P E R T I E S

SPECIFIC GRAVITY	=	2 70
LIQUID LIMIT	=	0
PLASTIC LIMIT	=	0
MEASURED VOLUME CHANGE	=	- 415 IN3
CELL PRESSURE	=	3 67 KSF
CONSOLIDATION PRESSURE	=	79 KSF

PROPERTY		INITIAL	CONSOLIDATED	
HEIGHT	=	4 286	4 241	INCHES
VOID RATIO	=	856	800	
AREA	=	3 179	3 115	SQ IN
PERCENT MOISTURE	=	31 32	29 62	PERCENT
WET DENSITY	=	119 19	121 34	PCF
DRY DENSITY	=	90 76	93 61	PCF
PERCENT SATURATION	=	98 76	100 00	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	000000	000000	0000	799	000
2	003301	003301	0000	799	1 174
3	012731	012731	0000	799	859
4	019097	019097	0000	799	747
5	025463	025463	0000	799	629
6	038666	038666	0000	799	496
7	058470	058470	0000	799	393
8	077803	077803	0000	799	306
9	097372	097372	0000	799	247
10	123778	123778	0000	799	184
11	149712	149712	0000	799	136
12	169281	169281	0000	799	093
13	188850	188850	0000	799	067
14	202524	202524	0000	799	060

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF)	Q/P PARAMETERS
1	79	-2 88	3 67	3 67	1 00	1 00	00	3 67	00
2	1 09	35	74	45	1 37	1 66	29	54	54
3	1 35	48	87	31	1 71	2 80	56	50	1 12
4	1 46	50	96	29	1 84	3 27	67	52	1 29
5	1 56	49	1 08	31	1 98	3 53	77	56	1 37
6	1 68	44	1 24	35	2 13	3 56	89	65	1 38
7	1 79	39	1 40	40	2 27	3 52	1 00	73	1 37
8	1 94	35	1 59	44	2 45	3 61	1 15	82	1 39
9	2 04	31	1 73	48	2 57	3 58	1 25	90	1 39
10	2 18	26	1 92	54	2 75	3 59	1 39	1 00	1 39
11	2 26	20	2 06	59	2 85	3 47	1 46	1 08	1 35
12	2 32	14	2 17	65	2 92	3 34	1 52	1 16	1 31
13	2 37	11	2 27	69	2 99	3 30	1 58	1 21	1 30
14	2 38	10	2 29	70	3 01	3 28	1 59	1 23	1 30

LAW ENGINEERING TESTING COMPANY
TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DEGAUSSING RANGE
BORING NUMBER IS 4E UD @ 5 5 FT
SAMPLE IDENTIFICATION IS SOFT GRAY SLIGHTLY CLAYEY SAND

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

PROVING RING 1433 CALIBRATED 3 / 1984

P R O P E R T I E S

SPECIFIC GRAVITY	=	2 71
LIQUID LIMIT	=	0
PLASTIC LIMIT	=	0
MEASURED VOLUME CHANGE	=	- 092 IN3
CELL PRESSURE	=	3 31 KSF
CONSOLIDATION PRESSURE	=	43 KSF

PROPERTY		INITIAL	CONSOLIDATED	
HEIGHT	=	4 260	4 251	INCHES
VOID RATIO	=	733	721	
AREA	=	3 190	3 176	SQ IN
PERCENT MOISTURE	=	25 12	26 61	PERCENT
WET DENSITY	=	122 11	124 40	PCF
DRY DENSITY	=	97 59	98 26	PCF
PERCENT SATURATION	=	92 89	100 00	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T D A T A

READING NUMBER	STRAIN (IN/IN)	SHEAR STRAIN	VOLUME STRAIN (CC/CC)	VOID RATIO	A FACTOR
1	000000	000000	0000	721	000
2	003294	003294	0000	721	1 020
3	009645	009645	0000	721	699
4	016233	016233	0000	721	493
5	029172	029172	0000	721	314
6	042346	042346	0000	721	155
7	061637	061637	0000	721	039
8	081163	081163	0000	721	- 049
9	100689	100689	0000	721	- 097
10	119745	119745	0000	721	- 136
11	146093	146093	0000	721	- 176
12	172207	172207	0000	721	- 205
13	198791	198791	0000	721	- 250

READING NUMBER	SIG1 (KSF)	PWP (KSF)	EFF SIG1 (KSF)	EFF SIG3 (KSF)	TOTAL STRESS RATIO	EFF STRESS RATIO	Q (KSF) CAMBRIDGE	P (KSF) PARAMETERS	Q/P
1	43	00	43	43	1 00	1 00	00	43	00
2	66	23	43	20	1 52	2 12	22	28	81
3	79	25	54	18	1 83	2 97	36	30	1 19
4	90	23	67	20	2 08	3 31	47	36	1 31
5	1 05	19	85	24	2 42	3 57	61	44	1 38
6	1 23	12	1 11	31	2 85	3 60	80	57	1 39
7	1 47	04	1 43	39	3 40	3 65	1 04	74	1 41
8	1 72	- 06	1 78	50	3 98	3 60	1 29	92	1 39
9	1 91	- 14	2 06	58	4 43	3 57	1 48	1 07	1 38
10	2 10	- 23	2 33	66	4 86	3 53	1 67	1 22	1 37
11	2 36	- 34	2 70	77	5 46	3 50	1 93	1 41	1 36
12	2 64	- 45	3 09	88	6 10	3 49	2 20	1 62	1 36
13	2 67	- 56	3 24	99	6 19	3 26	2 24	1 74	1 29

B. Unconsolidated Undrained and Other Specified Tests Results

LAW ENGINEERING TESTING COMPANY

SOIL DATA SUMMARY

BORING NO.	SAMPLE DEPTH (FT.)	SAMPLE TYPE	SOIL CLASSIFICATION	UNIT WEIGHT PCF		% FINER NO. 200 SIEVE	SPECIFIC GRAVITY	VOID RATIO	NATURAL MOISTURE %	ATTERBERG LIMITS			ADDITIONAL TESTS CONDUCTED
				Wet	Dry					L.L.	P.L.	P.I.	
1-H	0-5	UD				94.5							
1-G	5-10	UD								42	20	22	
1-F	10-15	UD				79.8							
1-E	15-20	UD	CH			98.2			88.0	91	35	56	
1-D	20-25	UD				97.5							
1-C	25-30	UD								79	31	48	
1-B	30-35	UD				99.1							
2-H	0-5	UD				64.8							
2-G	5-10	UD								74	26	48	
2-F	10-15	UD				93.1							
2-E	15-20	UD	CH			99.0			74.5	77	32	45	
2-D	20-25	UD				98.7							
2-C	25-30	UD								94	36	58	
2-B	30-35	UD				8.8							

NOTES: 1. Soil tests in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System

PROJECT NAME Degaussing Range

PROJECT NUMBER W4-4519

PROJECT LOCATION Norfolk, Virginia

LAW ENGINEERING TESTING COMPANY

SOIL DATA SUMMARY

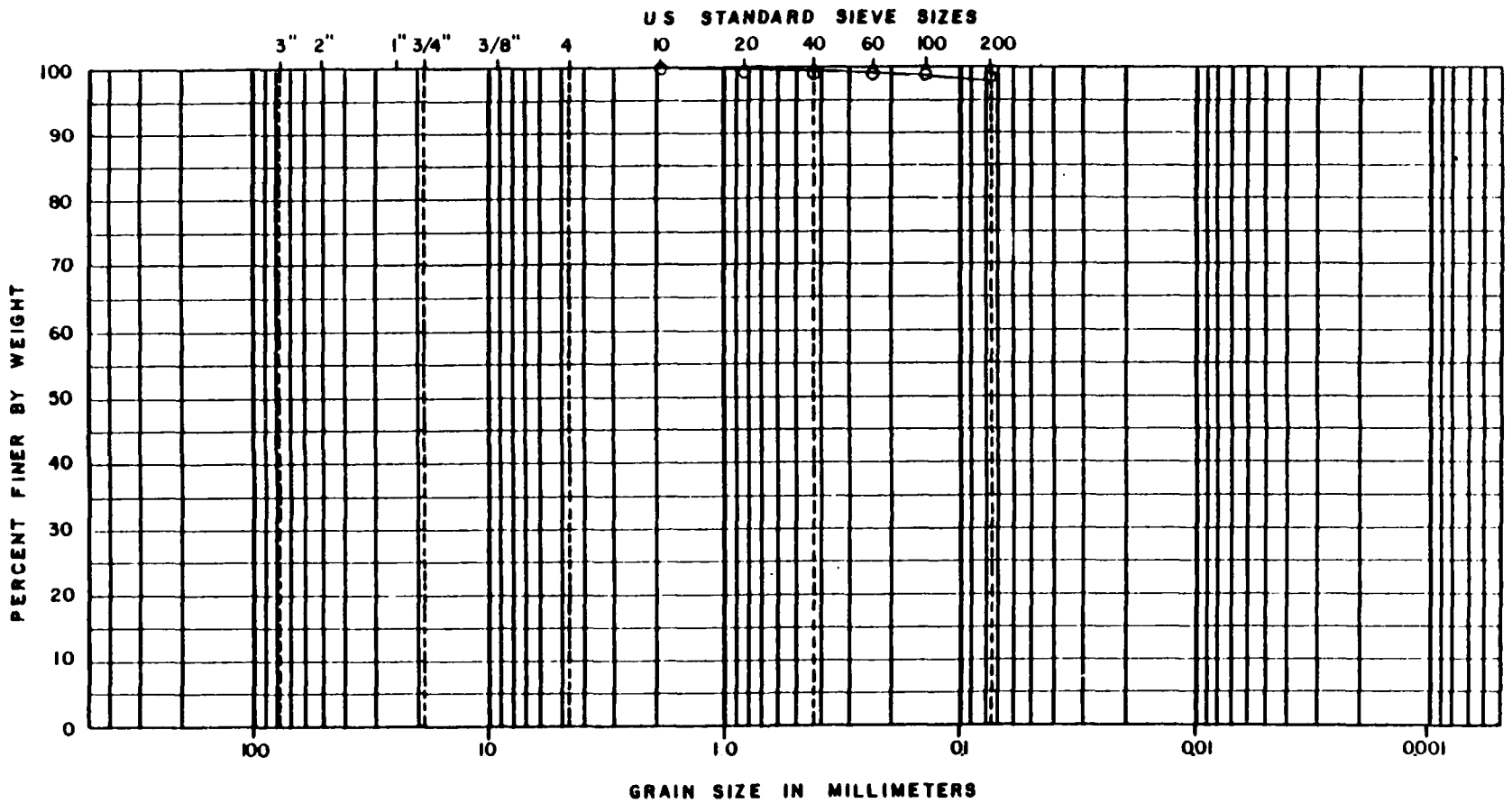
BORING NO.	SAMPLE DEPTH (FT.)	SAMPLE TYPE	SOIL CLASSIFICATION	UNIT WEIGHT PCF		% FINER NO. 200 SIEVE	SPECIFIC GRAVITY	VOID RATIO	NATURAL MOISTURE %	ATTERBERG LIMITS			ADDITIONAL TESTS CONDUCTED
				Wet	Dry					L.L.	P.L.	P.I.	
3-F	0-5	UD				77.0							
3-E	5-10	UD								32	22	10	
3-D	10-15	UD				57.5							
3-C	15-20	UD	CL			78.5			47.0	43	18	25	
3-B	20-25	UD				91.4							
3-A	25-30	UD	CH			99.5				74	29	45	
4-F	0-5	UD		127.8	104.9	13.7	2.66	.582	21.9				UU Triaxial
4-E	5-10	UD		122.1	96.9		2.68	.726	26.0	15	NP	-	UU Triaxial
4-D	10-15	UD				34.4							
4-C	15-20	UD	SC	118.6	92.7	39.6	2.69	.81	27.9	28	19	9	UU Triaxial
4-B	20-25	UD		115.8	85.9	23.2	2.68	.947	34.8				UU Triaxial
4-A	25-30	UD	SM	126.9	104.1	15.7	2.68	.607	22.0	14	NP	-	UU Triaxial

NOTES: 1. Soil tests in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System

PROJECT NAME Degaussing Range

PROJECT NUMBER W4-4519

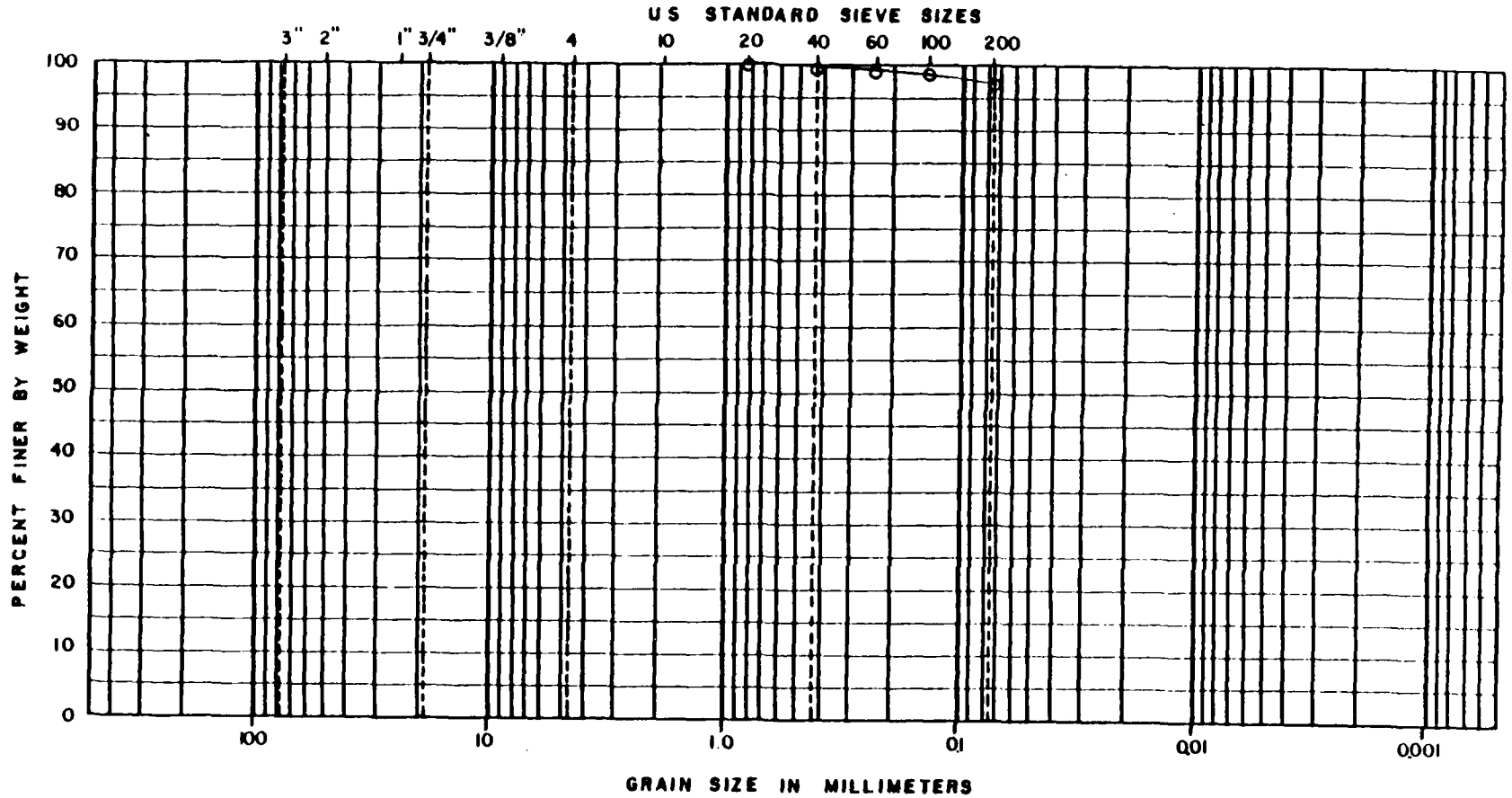
PROJECT LOCATION Norfolk, Virginia



BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
1-B	30-35 Ft.					
JOB NO. W4-4519						

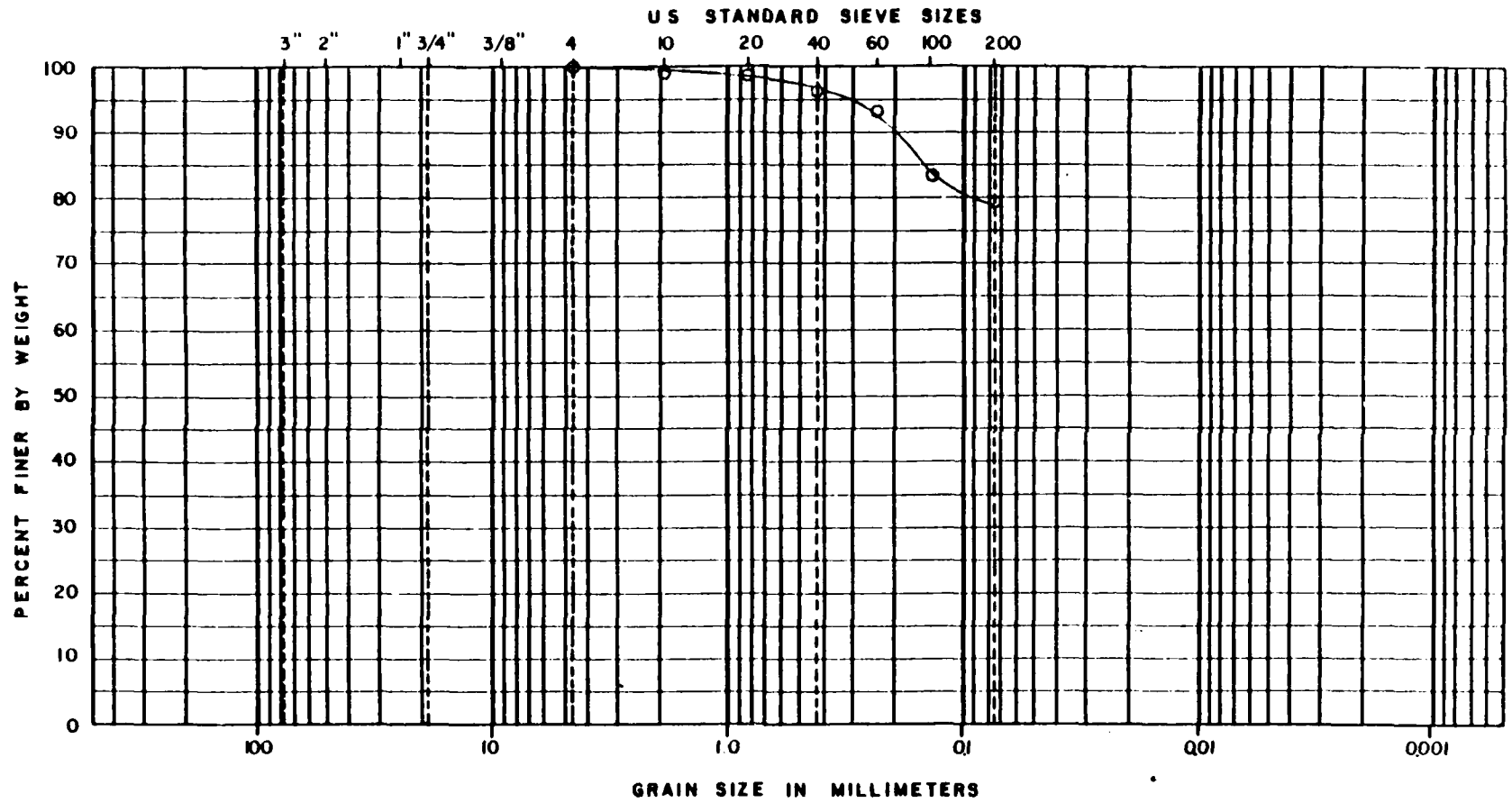
GRAIN SIZE DISTRIBUTION

BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES



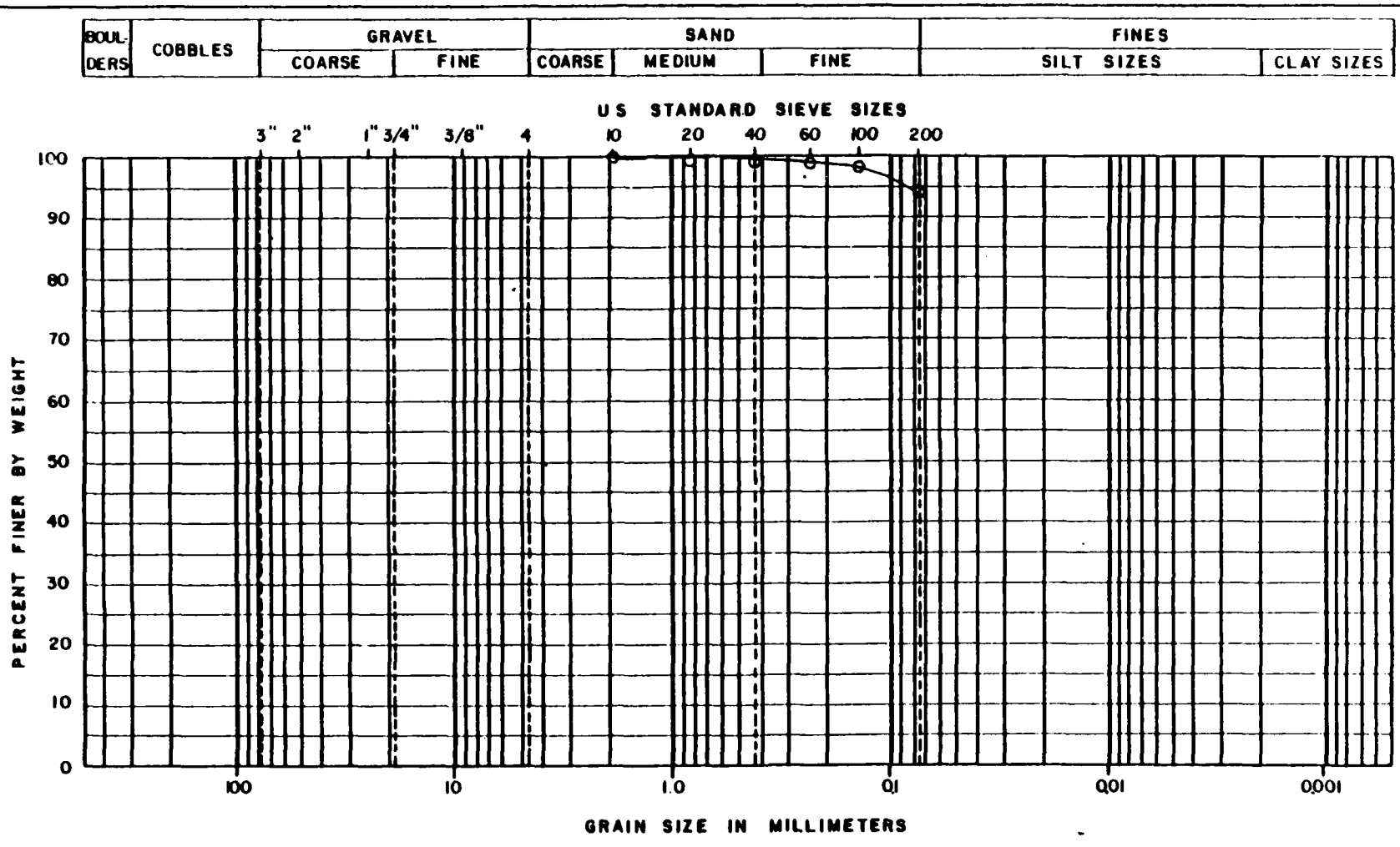
BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
1-D	20-25 Ft.					
JOB NO. W4-4519						

GRAIN SIZE DISTRIBUTION



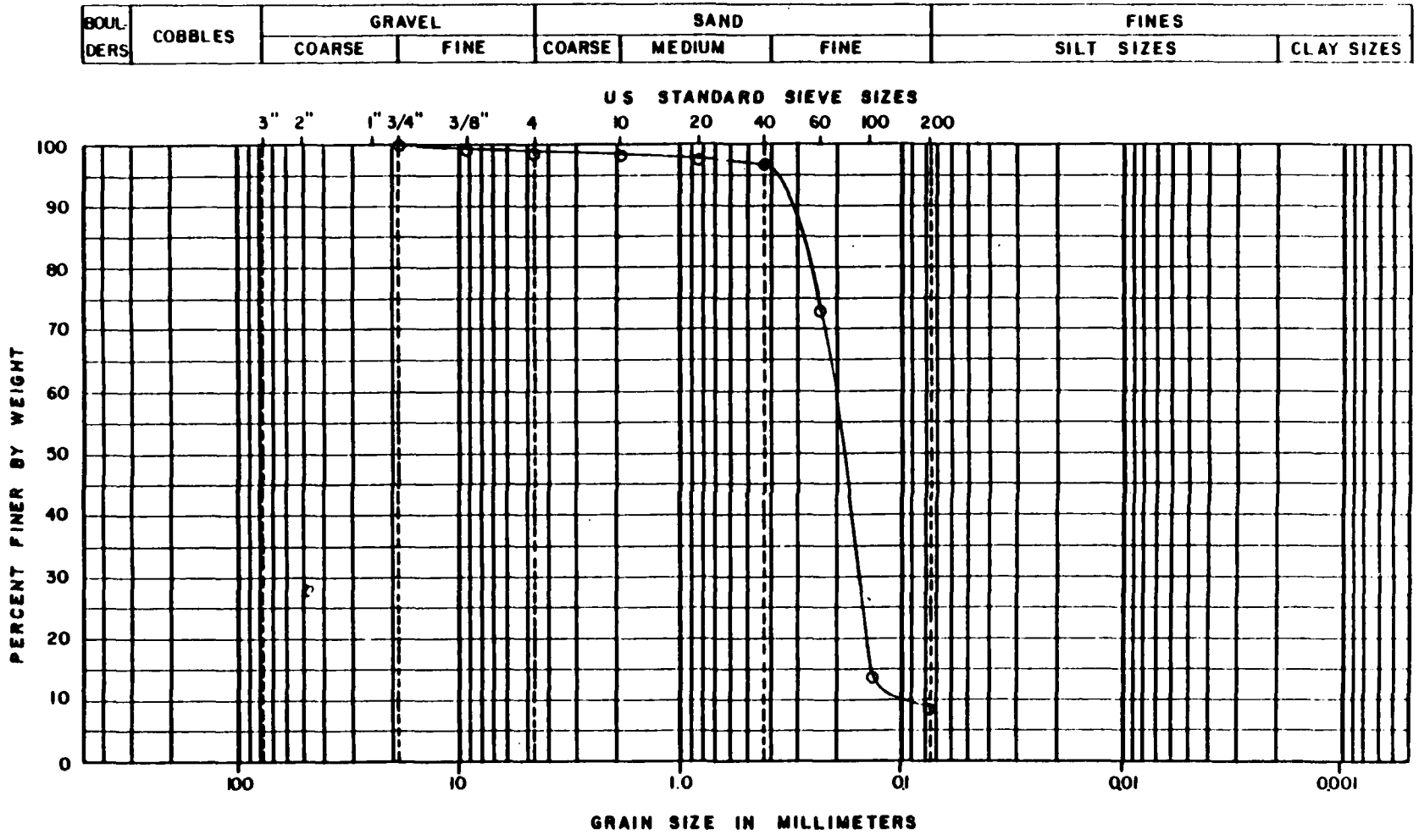
BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
1-F	10-15 Ft.					
JOB NO. W4-4519						

GRAIN SIZE DISTRIBUTION



BORING NO	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
1-H	0-5 Ft.					
JOB NO. W4-4519						

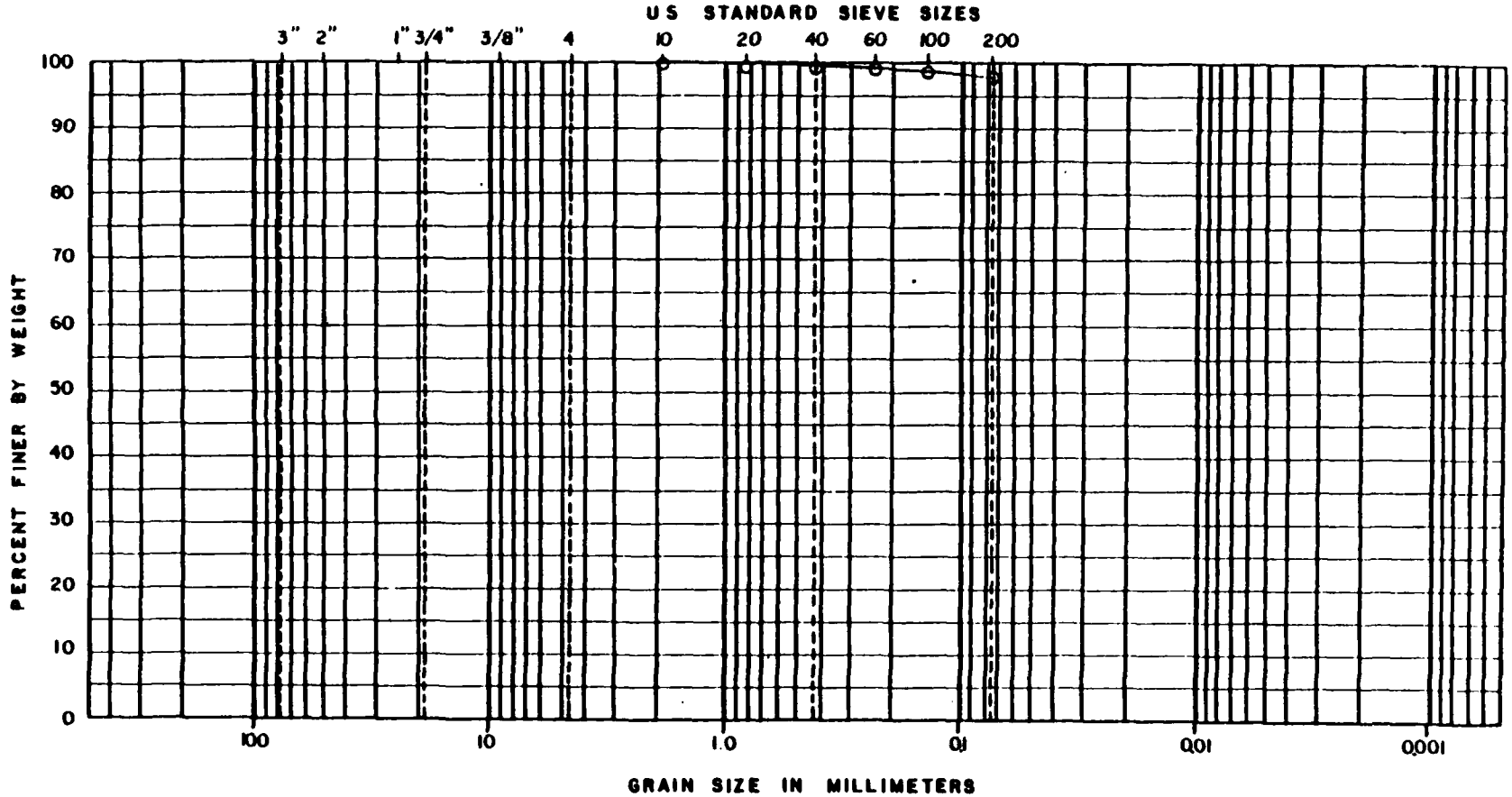
GRAIN SIZE DISTRIBUTION



BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
2-B	30-35 Ft.					
JOB NO. W4-4519						

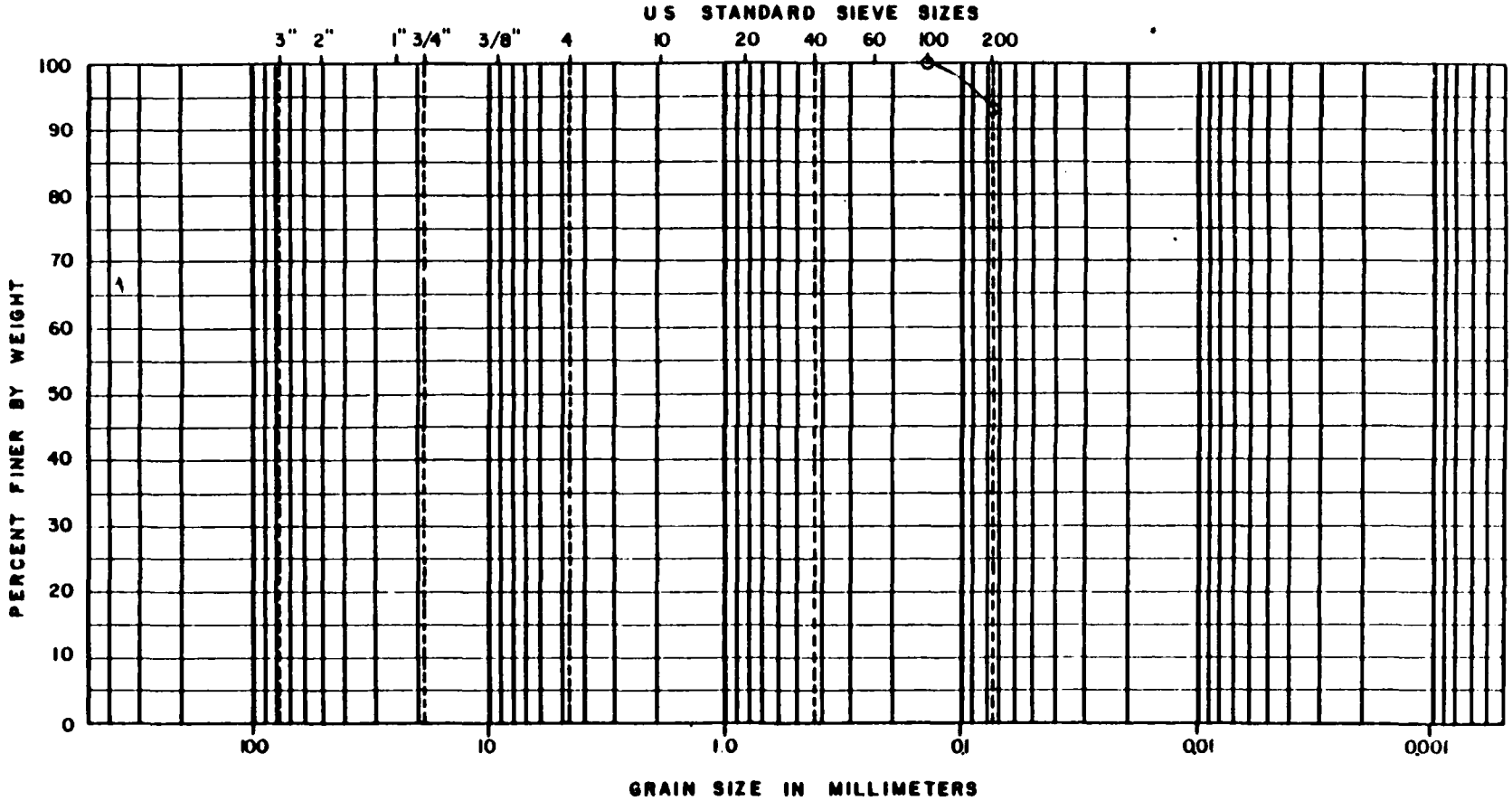
GRAIN SIZE DISTRIBUTION

BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES



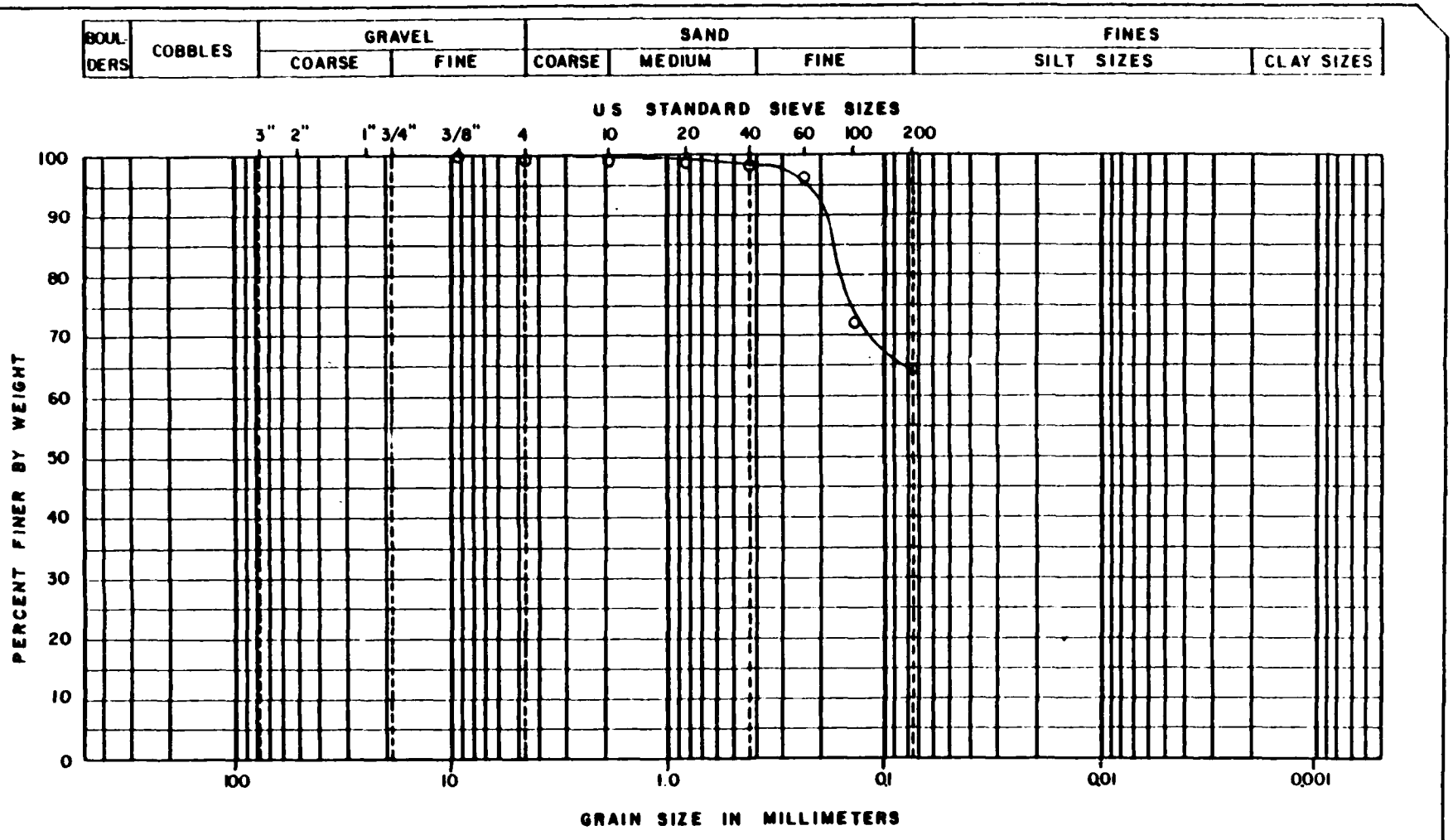
BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
2-D	20-25 Ft.					
JOB NO. W4-4519						

GRAIN SIZE DISTRIBUTION



BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
2-F	10-15 Ft.					
JOB NO. W4-4519						

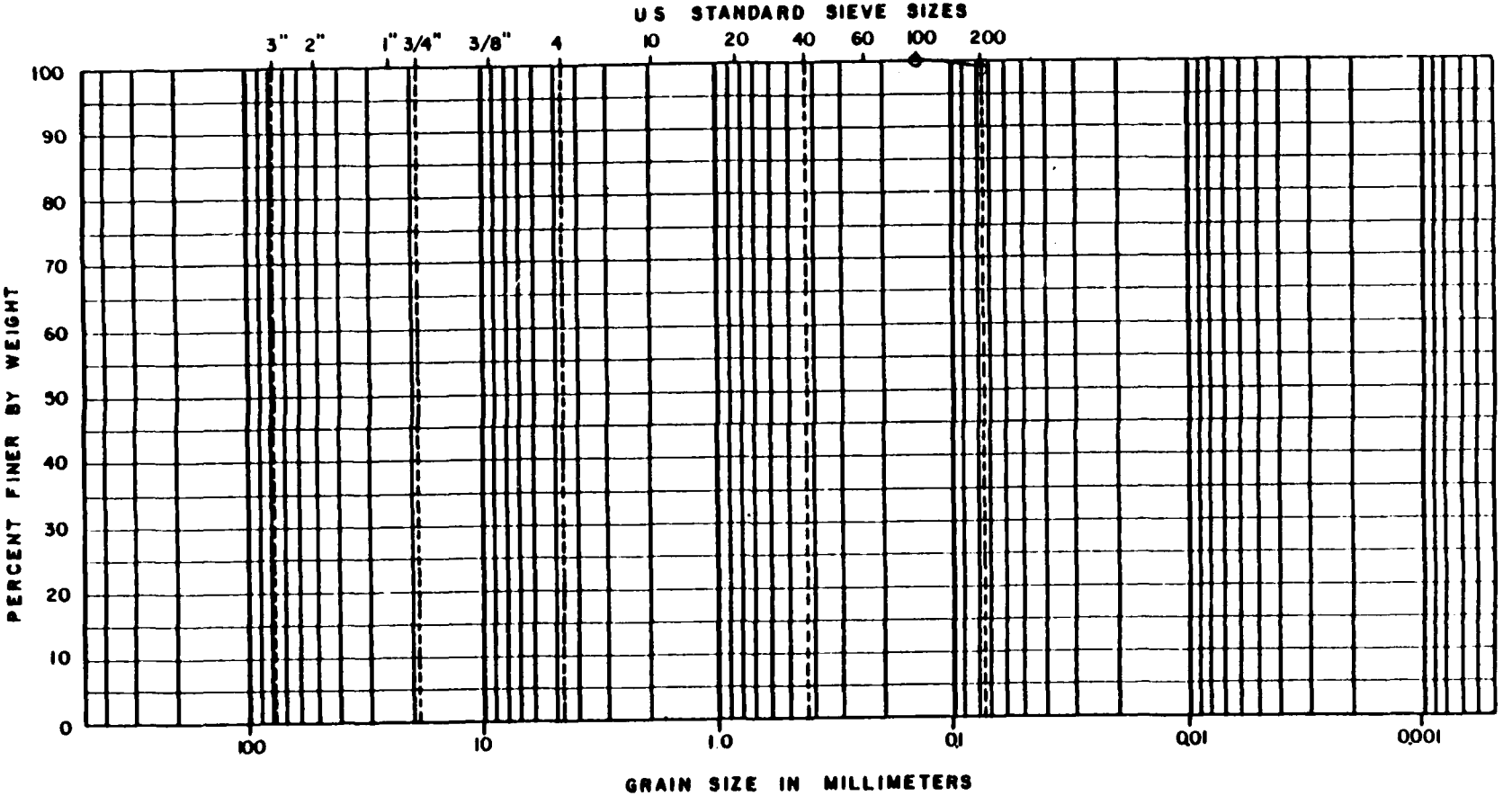
GRAIN SIZE DISTRIBUTION



BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
2-H	0-5 Ft.					
JOB NO. W4-4519						

GRAIN SIZE DISTRIBUTION

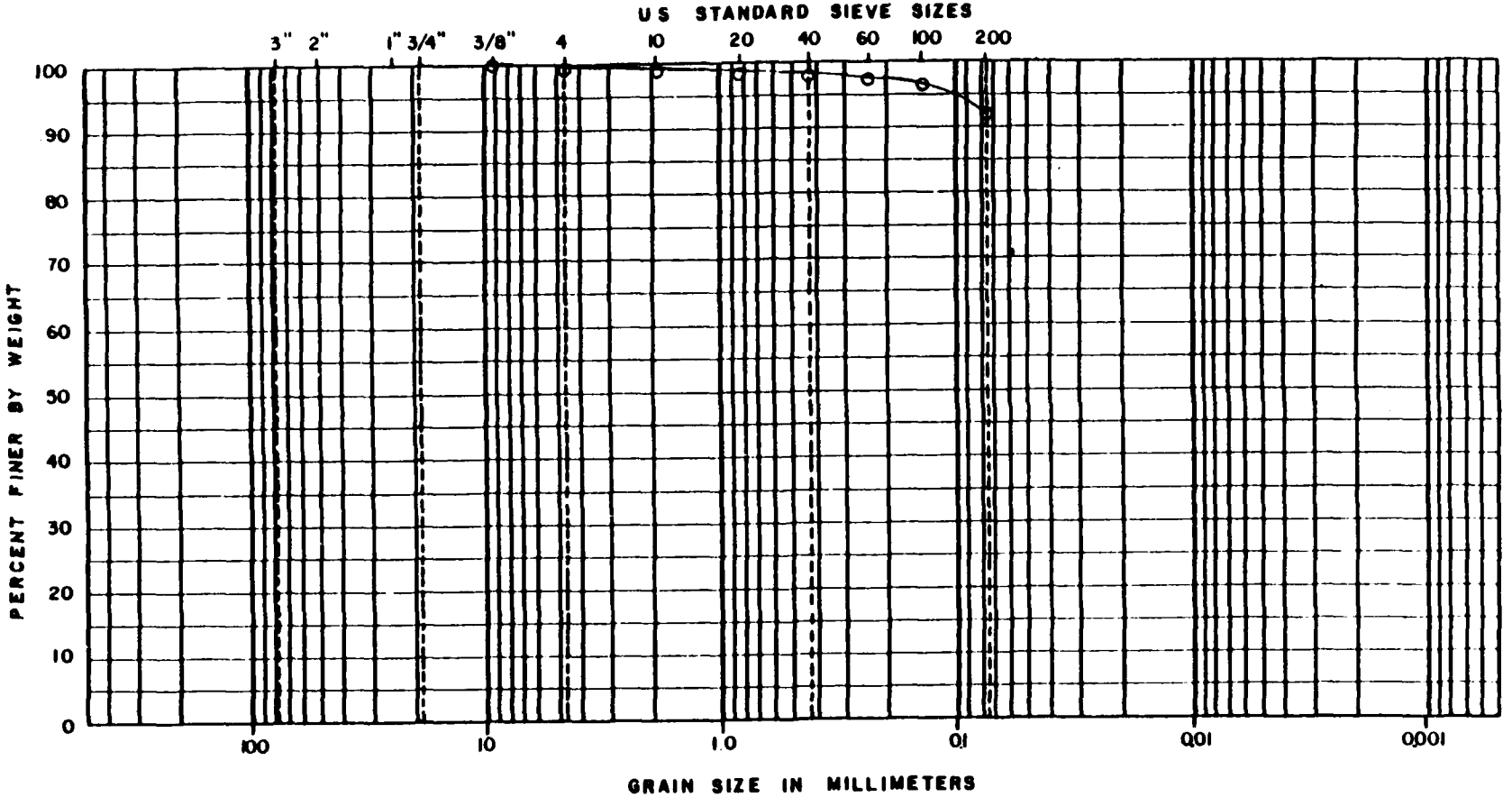
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES



BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
3-A	25-30 Ft.		74	29	45	CH
JOB NO. W4-4519						

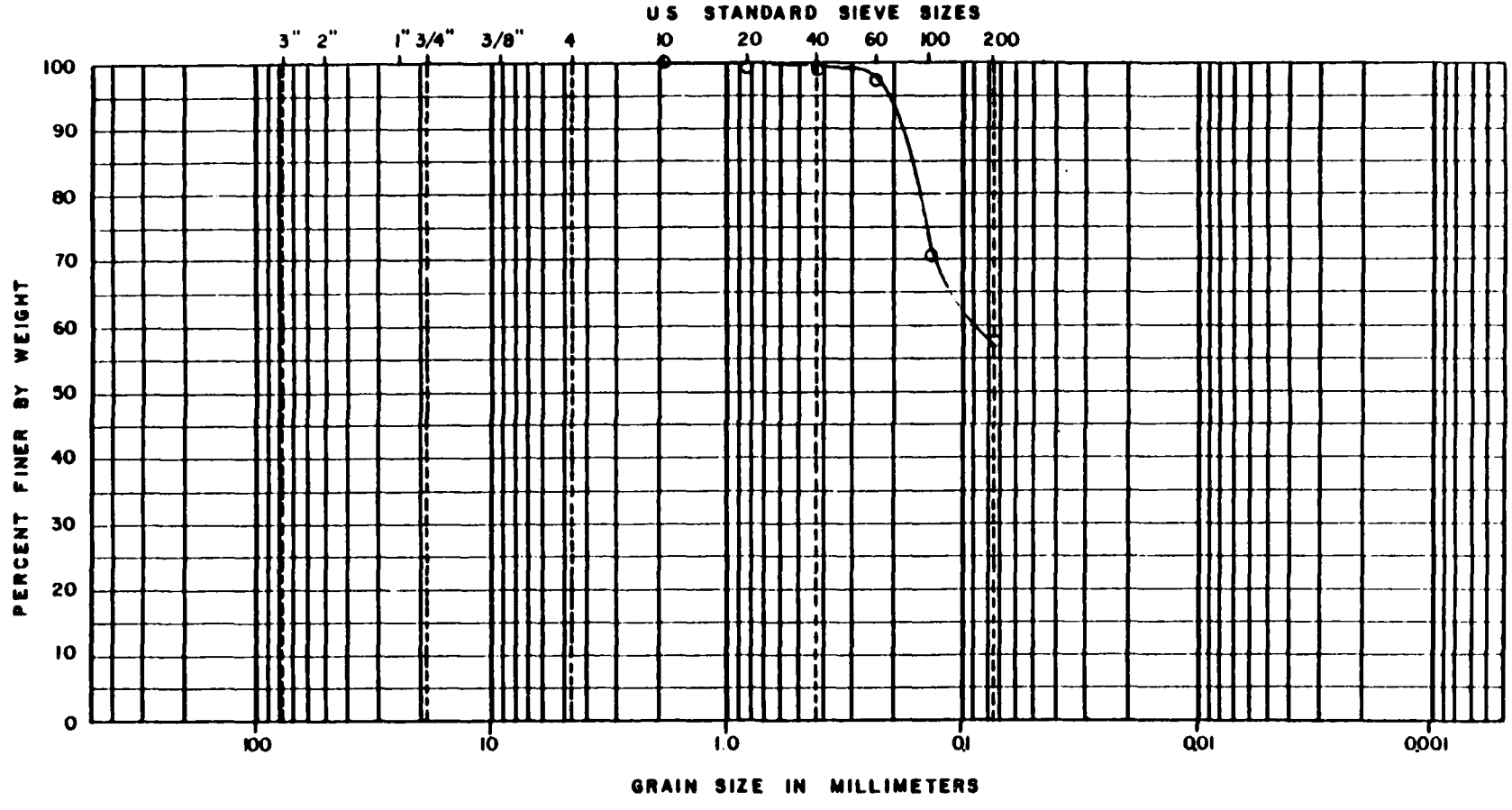
GRAIN SIZE DISTRIBUTION

BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES



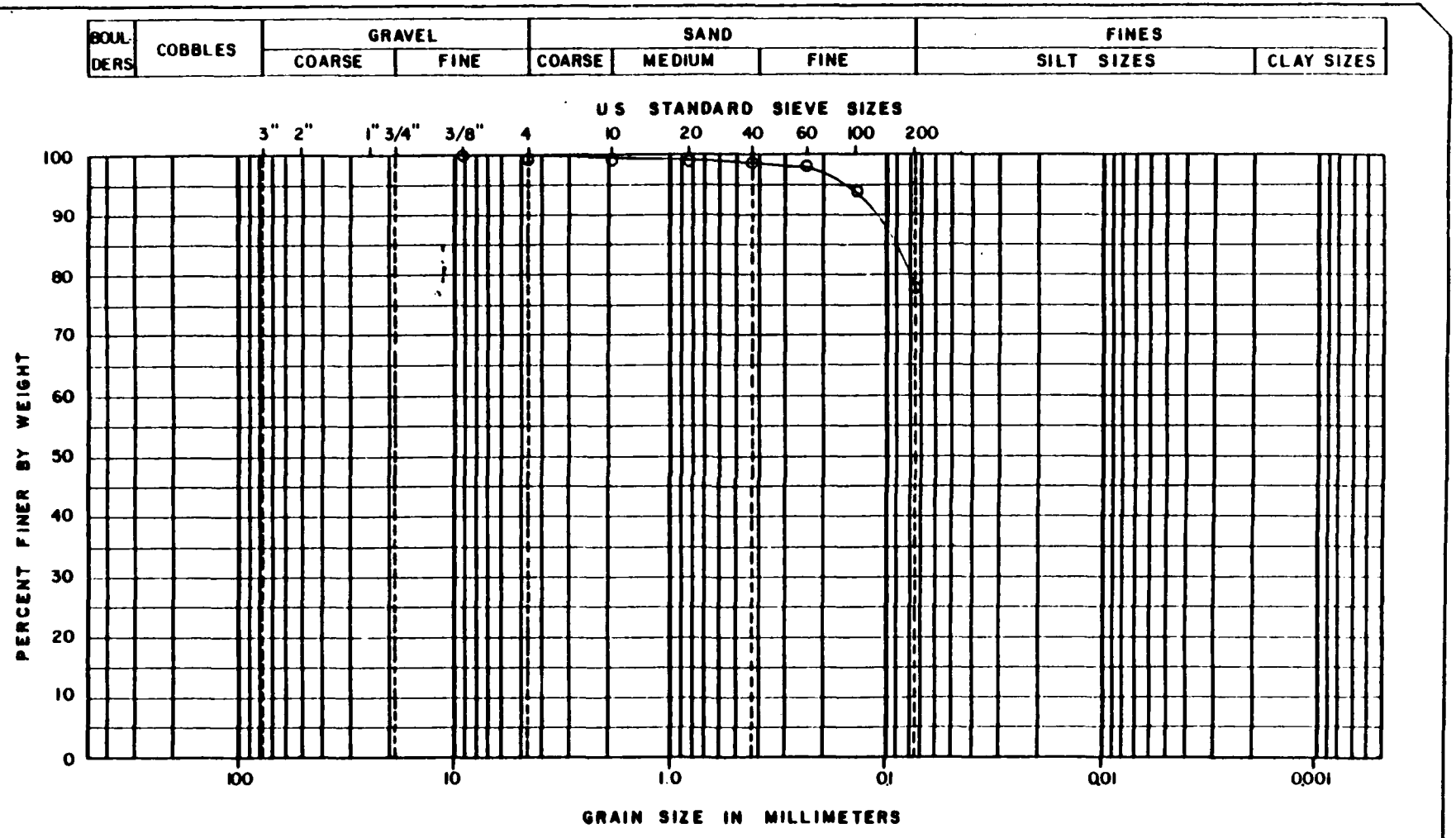
BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
3-B	20-25 Ft.					
JOB NO. W4-4519						

GRAIN SIZE DISTRIBUTION



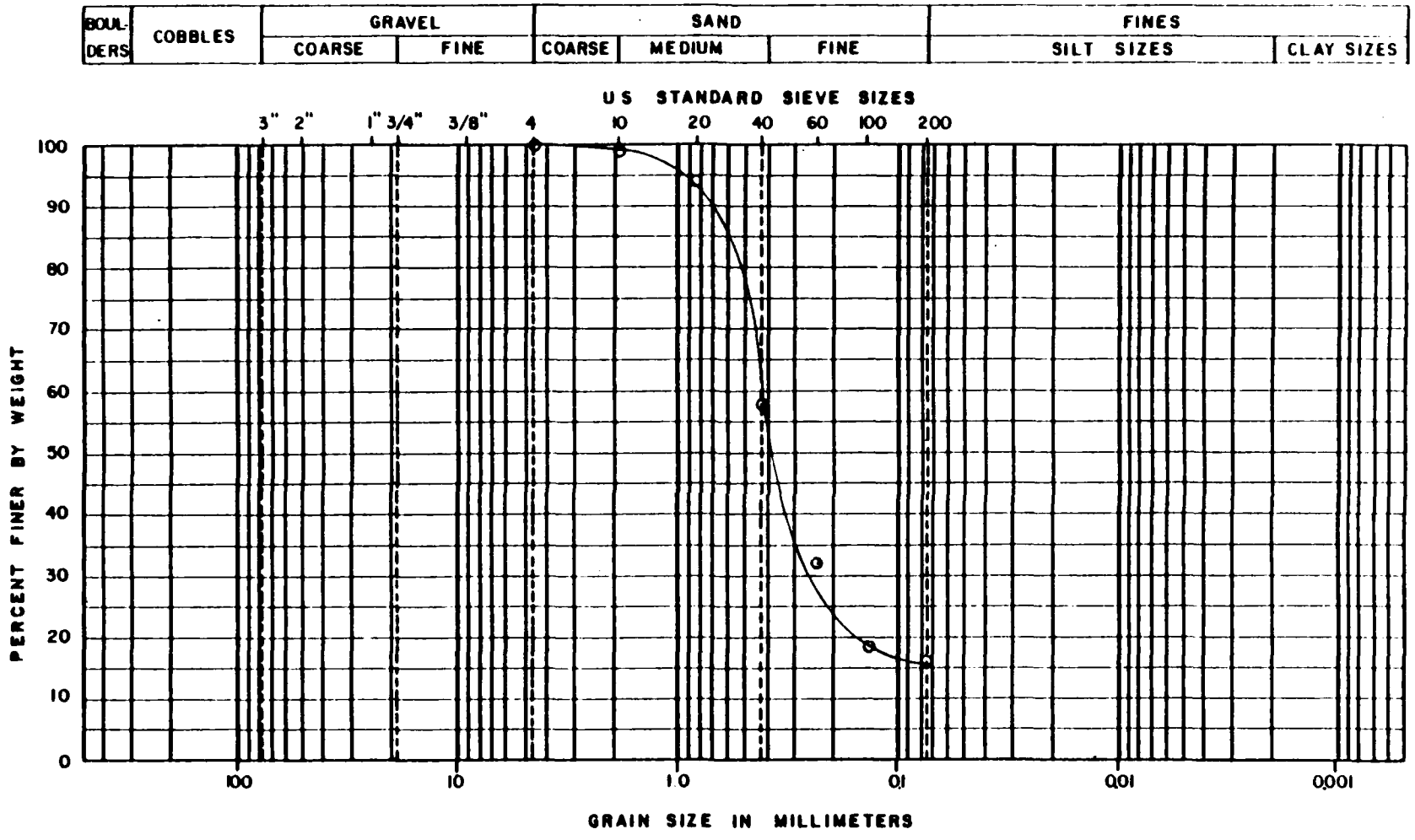
BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
3-D	10-15 Ft.					
JOB NO. W4-4519						

GRAIN SIZE DISTRIBUTION



BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
3-F	0-5 Ft.					
JOB NO. W4-4519						

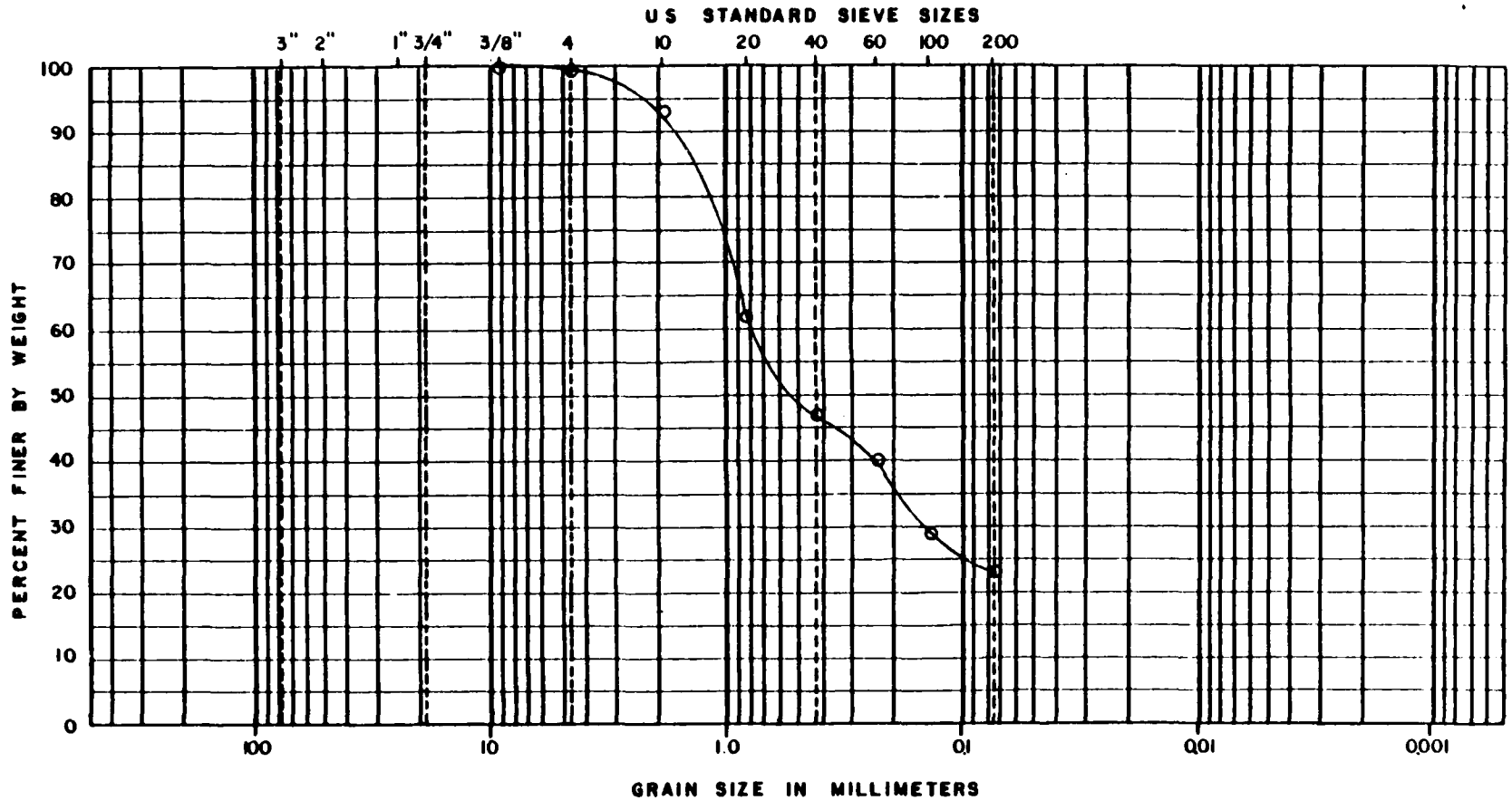
GRAIN SIZE DISTRIBUTION



BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
4-A	25-30 Ft.		14	NP	-	SM

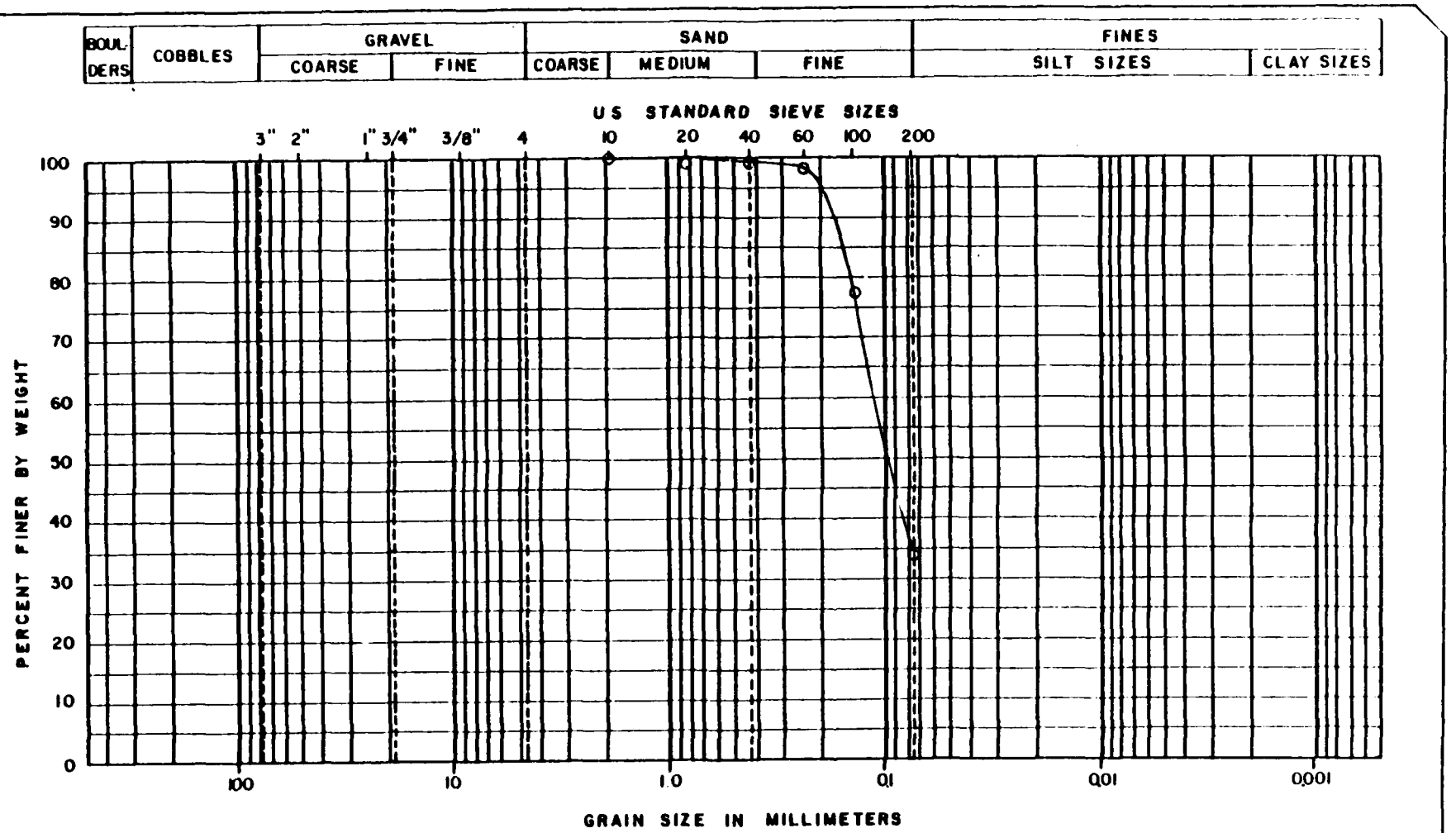
JOB NO. W4-4519

GRAIN SIZE DISTRIBUTION



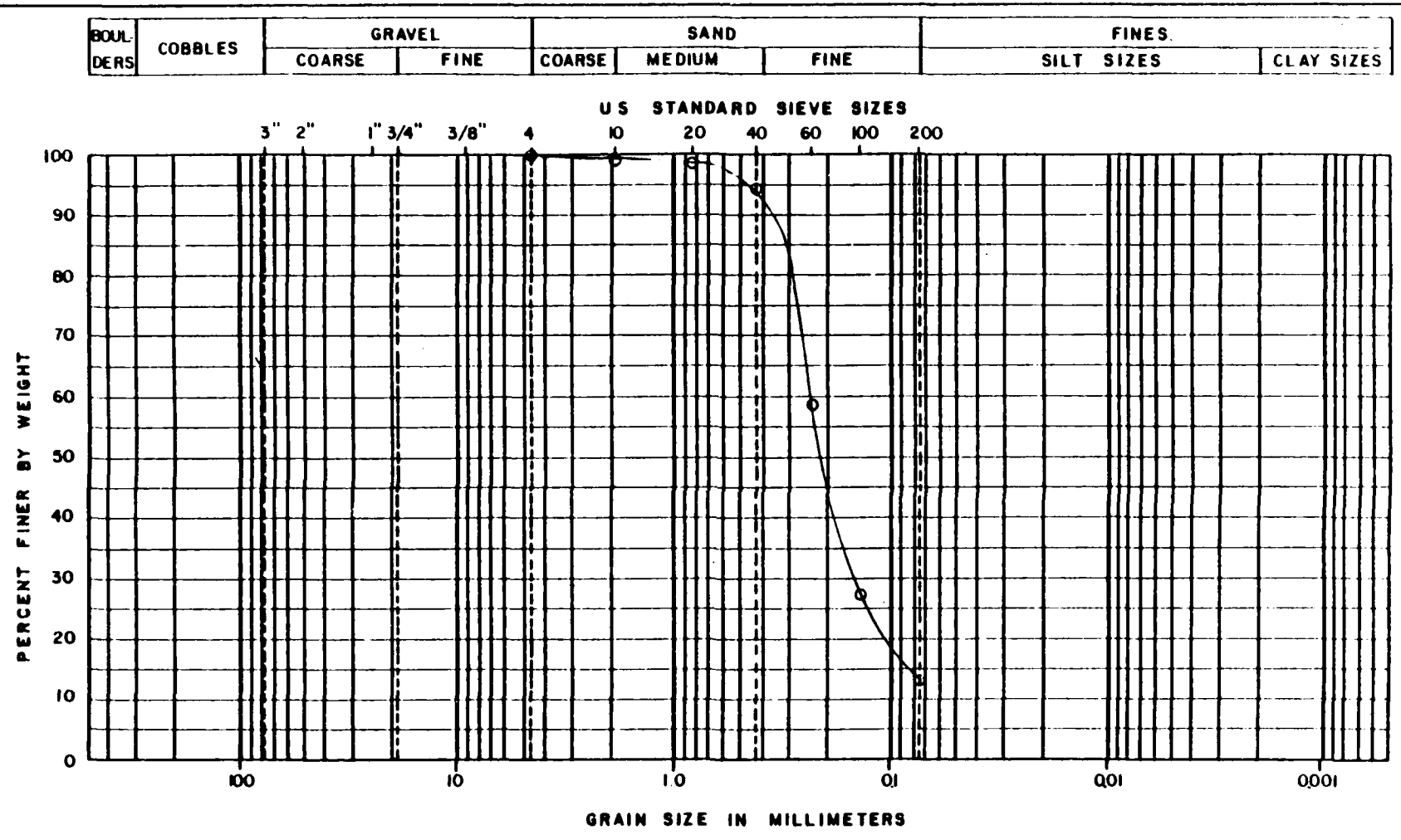
BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
4-B	20-25 Ft.					
JOB NO. W4-4519						

GRAIN SIZE DISTRIBUTION



BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
4-D	10-15 Ft.					
JOB NO. W4-4519						

GRAIN SIZE DISTRIBUTION



BORING NO.	DEPTH	NAT WC	LL	PL	PI	DESCRIPTION OR CLASSIFICATION
4-F	0-5 Ft.					
JOB NO. W4-4519						

GRAIN SIZE DISTRIBUTION

LAW ENGINEERING TESTING COMPANY
TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DEGAUSSING RANGE
BORING NUMBER IS 4F UD @ 4 FT
SAMPLE IDENTIFICATION IS FIRM GRAY FINE-MEDIUM SAND, LITTLE FINES

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 10763 CALIBRATED 3 / 1984

P R O P E R T I E S			
SPECIFIC GRAVITY	=	2.66	
LIQUID LIMIT	=	0	
PLASTIC LIMIT	=	0	
INITIAL LENGTH	=	3.93	INCHES
VOID RATIO	=	.582	
INITIAL AREA	=	3.464	SQ. IN.
MOISTURE CONTENT	=	21.90	PERCENT
WET DENSITY	=	127.87	PCF
DRY DENSITY	=	104.90	PCF
PERCENT SATURATION	=	100.03	PERCENT
CELL PRESSURE	=	.23	KSF

I N P U T D A T A		O U T P U T D A T A		
DEF	RING	STRAIN	V. STRESS	T. STRESS
INCHES	DIV	IN/IN	KSF	KSF
.700000	1.0	.000000	000	.230
.710000	5.0	.002545	.158	.388
.720000	6.5	.005089	.216	.447
.730000	8.0	.007634	.275	.505
.740000	9.0	.010178	.313	.543
.760000	11.0	.015267	.389	.620
.780000	13.0	.020356	.465	.695
.800000	14.5	.025445	.520	.751
.850000	20.5	.038168	.742	.972
.900000	25.5	.050891	.919	1.150
.980000	34.0	.071247	1.212	1.442
1.030000	38.0	.083969	1.340	1.570
1.100000	43.5	.101781	1.509	1.740
1.150000	46.0	.114504	1.575	1.806
1.240000	50.0	.137405	1.671	1.902
1.330000	53.0	.160305	1.726	1.957
1.420000	55.0	.183206	1.744	1.974
1.500000	55.5	.203562	1.716	1.947

LAW ENGINEERING TESTING COMPANY
TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DEGAUSSING RANGE
BORING NUMBER IS 4E UD @ 9 FT.
SAMPLE IDENTIFICATION IS FIRM TO LOOSE SILTY FINE-MEDIUM SAND

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 10763. CALIBRATED 3 / 1984

PROPERTIES		
SPECIFIC GRAVITY	= 2.68	
LIQUID LIMIT	= 0	
PLASTIC LIMIT	= 0	
INITIAL LENGTH	= 3.99	INCHES
VOID RATIO	= .726	
INITIAL AREA	= 3.398	SQ. IN.
MOISTURE CONTENT	= 26.04	PERCENT
WET DENSITY	= 122.14	PCF
DRY DENSITY	= 96.91	PCF
PERCENT SATURATION	= 96.18	PERCENT
CELL PRESSURE	= .52	KSF

INPUT DATA		OUTPUT DATA		
DEF	RING	STRAIN	V. STRESS	T. STRESS
INCHES	DIV	IN/IN	KSF	KSF
.000000	2.0	.000000	.000	.518
.010000	5.0	.002506	.121	.639
.020000	6.0	.005013	.160	.679
.040000	7.0	.010025	.199	.718
.060000	8.0	.015038	.238	.757
.100000	10.0	.025063	.314	.833
.150000	12.0	.037594	.388	.906
.200000	13.5	.050125	.440	.959
.260000	15.0	.065163	.490	1.008
.320000	16.5	.080201	.538	1.056
.400000	18.5	.100251	.598	1.117
.520000	21.0	.130326	.666	1.184
.600000	22.0	.150376	.685	1.203
.700000	23.0	.175439	.698	1.216
.800000	23.5	.200501	.693	1.211

LAW ENGINEERING TESTING COMPANY
TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DEGAUSSING RANGE
BORING NUMBER IS 4C UD @ 16 FT
SAMPLE IDENTIFICATION IS LOOSE-VERY LOOSE GRAY FI-MED SAND, LITTLE FINES

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 1433 CALIBRATED 3 / 1984

P R O P E R T I E S			
SPECIFIC GRAVITY	=	2.69	
LIQUID LIMIT	=	0	
PLASTIC LIMIT	=	0	
INITIAL LENGTH	=	3.92	INCHES
VOID RATIO	=	.810	
INITIAL AREA	=	3.194	SQ. IN.
MOISTURE CONTENT	=	27.88	PERCENT
WET DENSITY	=	118.60	PCF
DRY DENSITY	=	92.74	PCF
PERCENT SATURATION	=	92.60	PERCENT
CELL PRESSURE	=	.92	KSF

I N P U T D A T A		O U T P U T D A T A		
DEF	RING	STRAIN	V. STRESS	T. STRESS
INCHES	DIV	IN/IN	KSF	KSF
-.239000	4.0	.000000	.000	.922
-.230000	6.5	.002295	.112	1.034
-.209000	7.5	.007649	.157	1.078
-.171000	9.0	.017338	.222	1.143
-.055000	10.5	.046915	.279	1.201
.075000	11.5	.080061	.311	1.233
.200000	14.0	.111933	.400	1.322
.330000	17.0	.145079	.501	1.423
.450000	18.5	.175676	.539	1.460
.540000	19.0	.198623	.542	1.464
.610000	19.0	.216471	.530	1.451

LAW ENGINEERING TESTING COMPANY
TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DEGAUSSING RANGE
BORING NUMBER IS 48 UD @ 21 FT
SAMPLE IDENTIFICATION IS LOOSE GRAY FINE SAND, LITTLE SILT & CLAY

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 1433 CALIBRATED 3 / 1984

PROPERTIES			
SPECIFIC GRAVITY	=	2.68	
LIQUID LIMIT	=	0	
PLASTIC LIMIT	=	0	
INITIAL LENGTH	=	4.18	INCHES
VOID RATIO	=	.947	
INITIAL AREA	=	3.115	SQ. IN.
MOISTURE CONTENT	=	34.79	PERCENT
WET DENSITY	=	115.78	PCF
DRY DENSITY	=	85.89	PCF
PERCENT SATURATION	=	98.47	PERCENT
CELL PRESSURE	=	1.21	KSF

INPUT DATA		OUTPUT DATA		
DEF	RING	STRAIN	V.STRESS	T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
-.542000	6.0	.000000	.000	1.210
-.529000	7.0	.003114	.046	1.256
-.480000	8.5	.014850	.114	1.323
-.406000	10.0	.032575	.179	1.388
-.297000	11.5	.058683	.239	1.449
-.234000	12.0	.073772	.257	1.466
-.163000	13.5	.090778	.315	1.525
-.088000	14.5	.108743	.350	1.560
.128000	15.0	.160479	.349	1.559
.253000	15.5	.190419	.355	1.565
.332000	16.0	.209341	.365	1.575
.471000	17.0	.242635	.385	1.595

LAW ENGINEERING TESTING COMPANY
TRIAXIAL SHEAR TEST

PROJECT NAME & NO. ARE W4-4519 DEGAUSSING RANGE
BORING NUMBER IS 4A UD @ 27 FT
SAMPLE IDENTIFICATION IS LOOSE GRAY FI-MED SAND, SOME SILT & CLAY

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 1433 CALIBRATED 3 / 1984

PROPERTIES			
SPECIFIC GRAVITY	=	2.68	
LIQUID LIMIT	=	0	
PLASTIC LIMIT	=	0	
INITIAL LENGTH	=	4.21	INCHES
VOID RATIO	=	.607	
INITIAL AREA	=	3.211	SQ. IN.
MOISTURE CONTENT	=	21.98	PERCENT
WET DENSITY	=	126.93	PCF
DRY DENSITY	=	104.06	PCF
PERCENT SATURATION	=	97.04	PERCENT
CELL PRESSURE	=	1.56	KSF

INPUT DATA		OUTPUT DATA		
DEF	RING	STRAIN	V. STRESS	T. STRESS
INCHES	DIV	IN/IN	KSF	KSF
-.593000	8.0	.000000	.000	1.555
-.516000	10.5	.018307	.110	1.665
-.450000	15.5	.033999	.325	1.880
-.410000	18.0	.043509	.429	1.984
-.350000	22.0	.057775	.592	2.147
-.300000	25.5	.069662	.730	2.285
-.200000	33.0	.093438	1.016	2.572
-.050000	40.5	.129101	1.269	2.824
.200000	41.0	.188540	1.201	2.756
.300000	41.5	.212316	1.183	2.739
.400000	41.0	.236091	1.130	2.686

APPENDIX A

ENTRANCE REACH CHANNEL MODIFICATION

Part of the planned future maintenance of the Norfolk Harbor areas includes the deepening of several major channels. The Corps of Engineers, Norfolk District, plans to modify the Entrance Reach Channel by an approximate two degree rotation to the north. Thus, it was necessary to incorporate planned modifications to the channel into this survey. The Corps of Engineers provided CHESDIV with coordinates for two points which define the altered northwest channel boundary. The geodetic positions in Latitude and Longitude and the Lambert Grid State Plane (South Virginia) coordinates in feet are given below.

Lat	36° 59'25.76" N	246665 Northing
Long	76° 18'41.77" E	2639100 Easting
Lat	36° 58'17.87" N	239630 Northing
Long	76° 20'12.72" E	2631880 Easting

The Corps also plans to reduce the width of the channel to 1000 feet from the existing 1500 foot wide waterway. Figure A1 shows the existing channel as marked on USGS chart 12245 as well as the modified channel as defined by the given coordinates.

The core location coordinates were derived from the given channel boundary coordinates. The bearing of the new channel was found to be 45° 44' 36.73". A line from the Sewell's Spit proposed platform location was drawn perpendicular to the channel centerline. The 1st and 2nd core sites were located on this line 250' on either side of the channel centerline. The 3rd core was located approximately 925' from the centerline along the coring line toward Sewell's Spit. The 4th core site was located at the 5' water mark on Sewell's Spit. The geodetic positions in Latitude and Longitude and the Lambert Grid State Plane (South Virginia) coordinates in feet are given below:

CORE #	Design Coordinates			Located
1	Lat 36° 58' 55.51"	243538.47	Northing	243539
	Long 76° 19' 17.78"	2636249.49	Easting	2636250
2	Lat 36° 58' 51.89"	243180.36	Northing	243181
	Long 76° 19' 13.59"	2636598.42	Easting	2636600
3	Lat 36° 58' 45.19"	242517.86	Northing	242518
	Long 76° 19' 05.82"	2637243.96	Easting	2637240
4	Lat 36° 58' 37.50"	241756.76	Northing	241757
	Long 76° 18' 56.90"	2637985.55	Easting	2637990

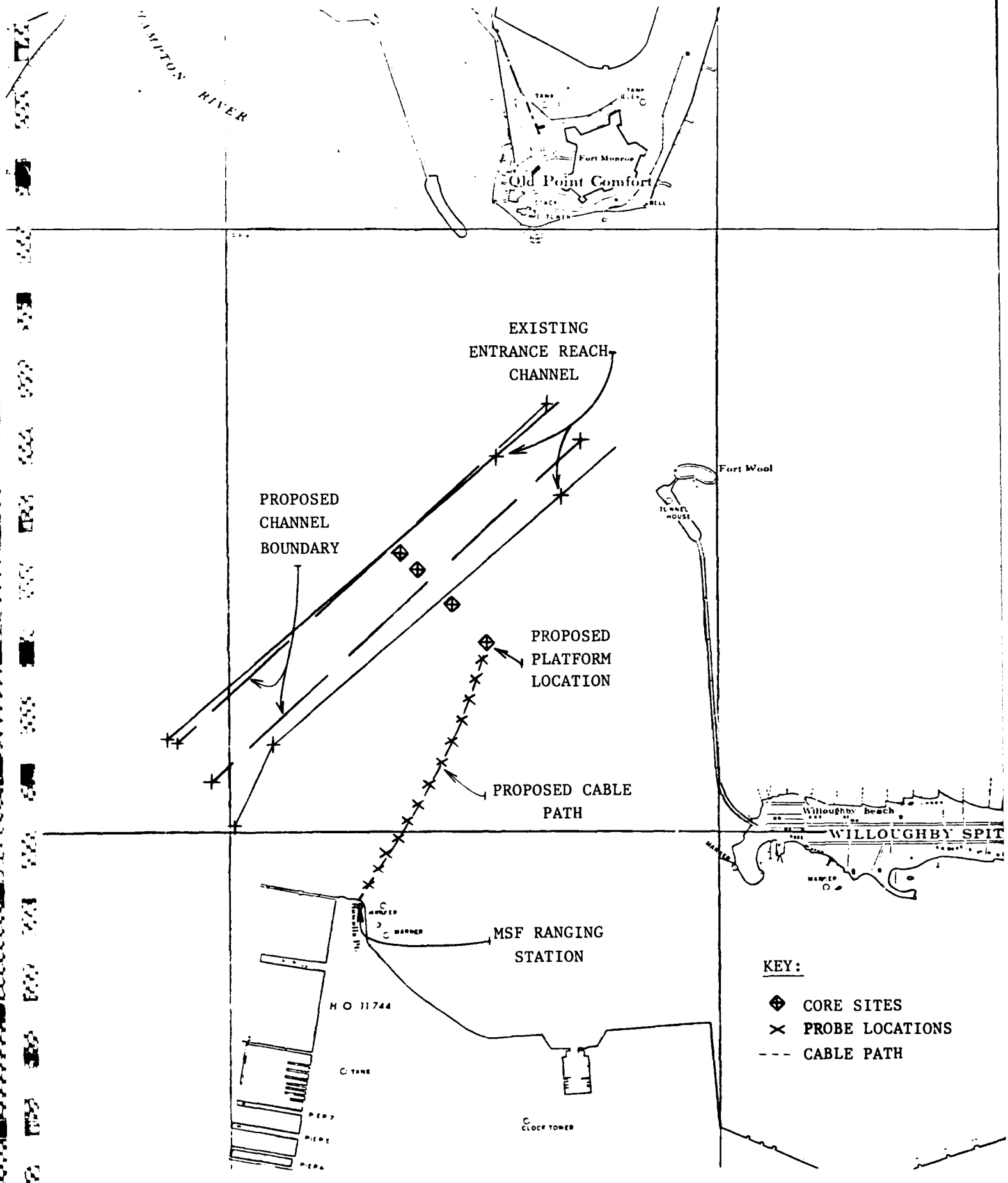


Figure A1 - Entrance Reach Channel Modification

END

DTIC

7-86