APPENDIX 2A

ONSITE METEOROLOGICAL DATA SUMMARIES
NOVEMBER 1971-MARCH 1973

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

APPENDIX 2A

METEOROLOGICAL DATA SUMMARIES

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APPENDIX 2A

METEOROLOGICAL DATA SUMMARIES

2A.1 WIND DIRECTION AND SPEED JOINT FREQUENCY DISTRIBUTIONS BY STABILITY

Joint frequency distributions of the on-site wind data have been prepared for the ΔT stability categories presented in Regulatory Guide 1.23[1] and defined in Table 2A-1. Values of ΔT were obtained directly from the recorded values on the strip charts.

The seasonal and annual tables of joint frequency distributions of the 30 foot wind and ΔT stability data are as follows:

Tables	Season
2A-2 to 2A-9	Spring
2A-10 to 2A-17	Summer
2A-18 to 2A-25	Fall
2A-26 to 2A-33	Winter
2A-34 to 2A-41	Annual

2A.2 WIND DIRECTION PERSISTENCE

Seasonal and annual wind direction persistence for 22.5 degree and 45.0 degree sectors have been computed from the 30 foot on-site data. These summaries are presented in the following tables.

A. Wind Direction Persistence within 22.5 Degree Sectors

Table	Season
2A-42	Spring
2A-43	Summer
2A-44	Fall
2A-45	Winter
2A-46	Annual

B. Wind Direction Persistence within 45 Degree Sectors

Table	Season
2A-47 to 2A-49	Spring
2A-50 to 2A-52	Summer
2A-53 to 2A-55	Fall
2A-56	Winter

1 NRC Regulatory Guide 1.23, On-site Meteorological Programs, February 1972.

2A.3 MOISTURE DEFICIT JOINT FREQUENCY DISTRIBUTIONS

The on-site 30 foot dew point, ambient air temperature and wind direction have been used with the ΔT stability data to prepare joint frequency tables of moisture deficit by stability and wind direction. For these tables, moisture deficit is defined as the grams of water vapor per cubic meter of air that would be required for the air to reach saturation. Summaries for the period April 1, 1972, through March 31, 1973 are presented as follows:

Table	Season
2A-57 to 2A-64	Spring
2A-65 to 2A-72	Summer
2A-73 to 2A-80	Fall
2A-81 to 2A-88	Winter
2A-89 to 2A-96	Annual

TABLE 2A-1

Definitions of ΔT Stability Categories

Category	ΔT ($^{o}C/100$ m)
A	$\Delta T \leq -1.9$
B	$-1.9 < \Delta T \leq 1.7$
C	$-1.7 < \Delta T \leq -1.5$
D	$-1.5 < \Delta T \leq -0.5$
E	$-0.5 < \Delta T \leq 1.5$
F	$1.5 < \Delta T \leq 4.0$
G	$4.0 < \Delta T$

TABLE 2A-2

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0	0	1	0	3	0	11	1	0	0	1	2	1	1	2	0	1	24
(1)	0.0	1.1	0.0	3.3	0.0	12.1	1.1	0.0	0.0	1.1	2.2	1.1	1.1	2.2	0.0	1.1	26.4
(2)	0.0	0.0	0.0	0.1	0.0	0.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	1.1
4.1- 6.0	0	2	0	2	4	13	3	0	0	2	4	2	8	4	1	0	45
(1)	0.0	2.2	0.0	2.2	4.4	14.3	3.3	0.0	0.0	2.2	4.4	2.2	8.8	4.4	1.1	0.0	49.5
(2)	0.0	0.1	0.0	0.1	0.2	0.6	0.1	0.0	0.0	0.1	0.2	0.1	0.4	0.2	0.0	0.0	2.0
6.1- 8.0	0	0	4	1	0	0	0	0	0	1	0	0	7	1	1	0	15
(1)	0.0	0.0	4.4	1.1	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	7.7	1.1	1.1	0.0	16.5
(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.7
OVER 8.0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	1	0	6
(1)	0.0	2.2	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	6.6
(2)	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
ALL SPEEDS	0	5	7	6	4	24	4	0	0	4	6	3	16	7	4	1	91
(1)	0.0	5.5	7.7	6.6	4.4	26.4	4.4	0.0	0.0	4.4	6.6	3.3	17.6	7.7	4.4	1.1	100.0
(2)	0.0	0.2	0.3	0.3	0.2	1.1	0.2	0.0	0.0	0.2	0.3	0.1	0.7	0.3	0.2	0.0	4.1

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 91

TABLE 2A-3

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

	DIRECTION																
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0	1	0	1	1	4	4	5	0	0	1	5	2	3	6	1	1	35
(1)	1.3	0.0	1.3	1.3	5.3	5.3	6.6	0.0	0.0	1.3	6.6	2.6	3.9	7.9	1.3	1.3	46.1
(2)	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.2	0.1	0.1	0.3	0.0	0.0	1.6
4.1- 6.0	1	0	2	1	1	3	2	0	1	1	3	3	7	4	1	0	30
(1)	1.3	0.0	2.6	1.3	1.3	3.9	2.6	0.0	1.3	1.3	3.9	3.9	9.2	5.3	1.3	0.0	39.5
(2)	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.3	0.2	0.0	0.0	1.4
6.1- 8.0	0	2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	6
(1)	0.0	2.6	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	0.0	0.0	7.9
(2)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
OVER 8.0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	4
(1)	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	1.3	1.3	0.0	5.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
ALL SPEEDS	2	3	4	3	5	7	7	0	1	3	8	5	11	12	4	1	76
(1)	2.6	3.9	5.3	3.9	6.6	9.2	9.2	0.0	1.3	3.9	10.5	6.6	14.5	15.8	5.3	1.3	100.0
(2)	0.1	0.1	0.2	0.1	0.2	0.3	0.3	0.0	0.0	0.1	0.4	0.2	0.5	0.5	0.2	0.0	3.5

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 76

TABLE 2A-4

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0		1	0	1	2	3	10	5	1	0	2	4	4	5	3	2	0	43
	(1)	0.9	0.0	0.9	1.9	2.8	9.4	4.7	0.9	0.0	1.9	3.8	3.8	4.7	2.8	1.9	0.0	40.6
	(2)	0.0	0.0	0.0	0.1	0.1	0.5	0.2	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.0	2.0
4.1- 6.0		2	2	1	2	5	2	5	1	2	3	0	3	9	8	1	0	46
	(1)	1.9	1.9	0.9	1.9	4.7	1.9	4.7	0.9	1.9	2.8	0.0	2.8	8.5	7.5	0.9	0.0	43.4
	(2)	0.1	0.1	0.0	0.1	0.2	0.1	0.2	0.0	0.1	0.1	0.0	0.1	0.4	0.4	0.0	0.0	2.1
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	1	4	6	2	0	13
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	3.8	5.7	1.9	0.0	12.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.1	0.0	0.6
OVER 8.0		0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	4
	(1)	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	3.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2
ALL SPEEDS		3	3	2	4	8	12	10	2	2	5	4	8	18	20	5	0	106
	(1)	2.8	2.8	1.9	3.8	7.5	11.3	9.4	1.9	1.9	4.7	3.8	7.5	17.0	18.9	4.7	0.0	100.0
	(2)	0.1	0.1	0.1	0.2	0.4	0.5	0.5	0.1	0.1	0.2	0.2	0.4	0.8	0.9	0.2	0.0	4.8

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 106

TABLE 2A-5

SEABROOK

30 FT WIND DATA   DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS   SPRING (MAR 72 - MAY 72)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

	DIRECTION																
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	11	8	1	6	12	8	15	15	4	4	10	15	17	8	18	14	166
(1)	1.0	0.7	0.1	0.5	1.1	0.7	1.4	1.4	0.4	0.4	0.9	1.4	1.6	0.7	1.6	1.3	15.2
(2)	0.5	0.4	0.0	0.3	0.5	0.4	0.7	0.7	0.2	0.2	0.5	0.7	0.8	0.4	0.8	0.6	7.5
1.6- 4.0	15	74	44	29	34	42	48	35	26	23	22	34	46	60	37	36	605
(1)	1.4	6.8	4.0	2.7	3.1	3.8	4.4	3.2	2.4	2.1	2.0	3.1	4.2	5.5	3.4	3.3	55.4
(2)	0.7	3.4	2.0	1.3	1.5	1.9	2.2	1.6	1.2	1.0	1.0	1.5	2.1	2.7	1.7	1.6	27.5
4.1- 6.0	5	23	45	22	10	4	0	3	5	13	6	17	27	40	13	1	234
(1)	0.5	2.1	4.1	2.0	0.9	0.4	0.0	0.3	0.5	1.2	0.5	1.6	2.5	3.7	1.2	0.1	21.4
(2)	0.2	1.0	2.0	1.0	0.5	0.2	0.0	0.1	0.2	0.6	0.3	0.8	1.2	1.8	0.6	0.0	10.6
6.1- 8.0	0	5	20	4	2	1	0	0	0	2	1	0	5	24	5	1	70
(1)	0.0	0.5	1.8	0.4	0.2	0.1	0.0	0.0	0.0	0.2	0.1	0.0	0.5	2.2	0.5	0.1	6.4
(2)	0.0	0.2	0.9	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	1.1	0.2	0.0	3.2
OVER 8.0	0	5	7	2	0	0	0	0	0	0	0	0	0	3	0	0	17
(1)	0.0	0.5	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	1.6
(2)	0.0	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.8
ALL SPEEDS	31	115	117	63	58	55	63	53	35	42	39	66	95	135	73	52	1092
(1)	2.8	10.5	10.7	5.8	5.3	5.0	5.8	4.9	3.2	3.8	3.6	6.0	8.7	12.4	6.7	4.8	100.0
(2)	1.4	5.2	5.3	2.9	2.6	2.5	2.9	2.4	1.6	1.9	1.8	3.0	4.3	6.1	3.3	2.4	49.7

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 1092

TABLE 2A-6

SEABROOK

30 FT WIND DATA   DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS   SPRING (MAR 72 - MAY 72)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		10	7	2	3	3	9	9	11	8	10	16	21	27	12	10	10	168
	(1)	1.6	1.2	0.3	0.5	0.5	1.5	1.5	1.8	1.3	1.6	2.6	3.5	4.4	2.0	1.6	1.6	27.6
	(2)	0.5	0.3	0.1	0.1	0.1	0.4	0.4	0.5	0.4	0.5	0.7	1.0	1.2	0.5	0.5	0.5	7.6
1.6- 4.0		15	6	10	13	15	17	11	10	20	28	24	61	50	67	18	13	378
	(1)	2.5	1.0	1.6	2.1	2.5	2.8	1.8	1.6	3.3	4.6	3.9	10.0	8.2	11.0	3.0	2.1	62.2
	(2)	0.7	0.3	0.5	0.6	0.7	0.8	0.5	0.5	0.9	1.3	1.1	2.8	2.3	3.0	0.8	0.6	17.2
4.1- 6.0		0	1	1	0	0	1	1	0	7	5	6	4	9	12	1	1	49
	(1)	0.0	0.2	0.2	0.0	0.0	0.2	0.2	0.0	1.2	0.8	1.0	0.7	1.5	2.0	0.2	0.2	8.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.3	0.2	0.4	0.5	0.0	0.0	2.2
6.1- 8.0		0	0	2	0	1	0	0	0	1	1	0	0	1	2	0	0	8
	(1)	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.3	0.0	0.0	1.3
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4
OVER 8.0		0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	5
	(1)	0.0	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
	(2)	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
ALL SPEEDS		25	16	18	16	19	27	21	21	36	44	46	86	87	93	29	24	608
	(1)	4.1	2.6	3.0	2.6	3.1	4.4	3.5	3.5	5.9	7.2	7.6	14.1	14.3	15.3	4.8	3.9	100.0
	(2)	1.1	0.7	0.8	0.7	0.9	1.2	1.0	1.0	1.6	2.0	2.1	3.9	4.0	4.2	1.3	1.1	27.6

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 608

TABLE 2A-7

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX F - DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	3	0	2	2	4	5	4	0	2	6	8	10	12	8	7	1	74
(1)	2.8	0.0	1.9	1.9	3.7	4.6	3.7	0.0	1.9	5.6	7.4	9.3	11.1	7.4	6.5	0.9	68.5
(2)	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.0	0.1	0.3	0.4	0.5	0.5	0.4	0.3	0.0	3.4
1.6- 4.0	0	0	0	1	0	2	1	0	2	4	5	6	4	5	2	1	33
(1)	0.0	0.0	0.0	0.9	0.0	1.9	0.9	0.0	1.9	3.7	4.6	5.6	3.7	4.6	1.9	0.9	30.6
(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.2	0.3	0.2	0.2	0.1	0.0	1.5
4.1- 6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	3	1	2	3	4	7	5	0	4	10	13	16	16	13	9	2	108
(1)	2.8	0.9	1.9	2.8	3.7	6.5	4.6	0.0	3.7	9.3	12.0	14.8	14.8	12.0	8.3	1.9	100.0
(2)	0.1	0.0	0.1	0.1	0.2	0.3	0.2	0.0	0.2	0.5	0.6	0.7	0.7	0.6	0.4	0.1	4.9

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 108

TABLE 2A-8

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SPRING (MAR 72 - MAY 72)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

SPEED (MPS)	DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	1	2	1	0	2	6	2	5	4	5	9	12	42	16	6	3	116
(1)	0.8	1.7	0.8	0.0	1.7	5.1	1.7	4.2	3.4	4.2	7.6	10.2	35.6	13.6	5.1	2.5	98.3
(2)	0.0	0.1	0.0	0.0	0.1	0.3	0.1	0.2	0.2	0.2	0.4	0.5	1.9	0.7	0.3	0.1	5.3
1.6- 4.0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	1.7
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
4.1- 6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	1	2	1	0	2	6	2	5	4	5	9	12	42	18	6	3	118
(1)	0.8	1.7	0.8	0.0	1.7	5.1	1.7	4.2	3.4	4.2	7.6	10.2	35.6	15.3	5.1	2.5	100.0
(2)	0.0	0.1	0.0	0.0	0.1	0.3	0.1	0.2	0.2	0.2	0.4	0.5	1.9	0.8	0.3	0.1	5.4

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 118

TABLE 2A-9

SEABROOK

30 FT WIND DATA DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS SPRING (MAR 72 - MAY 72)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
		DIRECTION																
0.0- 1.5		25	17	6	11	21	28	30	31	18	25	43	58	98	44	43	28	526
	(1)	1.1	0.8	0.3	0.5	1.0	1.3	1.4	1.4	0.8	1.1	2.0	2.6	4.5	2.0	2.0	1.3	23.9
	(2)	1.1	0.8	0.3	0.5	1.0	1.3	1.4	1.4	0.8	1.1	2.0	2.6	4.5	2.0	2.0	1.3	23.9
1.6- 4.0		32	81	56	49	56	86	71	46	48	59	62	108	109	145	60	52	1120
	(1)	1.5	3.7	2.5	2.2	2.5	3.9	3.2	2.1	2.2	2.7	2.8	4.9	5.0	6.6	2.7	2.4	50.9
	(2)	1.5	3.7	2.5	2.2	2.5	3.9	3.2	2.1	2.2	2.7	2.8	4.9	5.0	6.6	2.7	2.4	50.9
4.1- 6.0		8	28	49	27	20	23	11	4	15	24	19	29	60	68	17	2	404
	(1)	0.4	1.3	2.2	1.2	0.9	1.0	0.5	0.2	0.7	1.1	0.9	1.3	2.7	3.1	0.8	0.1	18.4
	(2)	0.4	1.3	2.2	1.2	0.9	1.0	0.5	0.2	0.7	1.1	0.9	1.3	2.7	3.1	0.8	0.1	18.4
6.1- 8.0		0	7	27	6	3	1	0	0	1	4	1	1	18	34	8	1	112
	(1)	0.0	0.3	1.2	0.3	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.8	1.5	0.4	0.0	5.1
	(2)	0.0	0.3	1.2	0.3	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.8	1.5	0.4	0.0	5.1
OVER 8.0		0	12	13	2	0	0	0	0	0	1	0	0	0	7	2	0	37
	(1)	0.0	0.5	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	1.7
	(2)	0.0	0.5	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	1.7
ALL SPEEDS		65	145	151	95	100	138	112	81	82	113	125	196	285	298	130	83	2199
	(1)	3.0	6.6	6.9	4.3	4.5	6.3	5.1	3.7	3.7	5.1	5.7	8.9	13.0	13.6	5.9	3.8	100.0
	(2)	3.0	6.6	6.9	4.3	4.5	6.3	5.1	3.7	3.7	5.1	5.7	8.9	13.0	13.6	5.9	3.8	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 2199

DATA RECOVERY = 99.6 PERCENT

TABLE 2A-10

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	3
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.1	0.0	1.1	0.0	3.2
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0	0	0	2	4	6	7	5	0	1	1	6	5	8	5	2	0	52
(1)	0.0	0.0	2.1	4.3	6.4	7.4	5.3	0.0	1.1	1.1	6.4	5.3	8.5	5.3	2.1	0.0	55.3
(2)	0.0	0.0	0.1	0.2	0.3	0.3	0.2	0.0	0.0	0.0	0.3	0.2	0.4	0.2	0.1	0.0	2.4
4.1- 6.0	0	0	1	3	1	0	0	0	0	1	1	5	3	9	1	0	25
(1)	0.0	0.0	1.1	3.2	1.1	0.0	0.0	0.0	0.0	1.1	1.1	5.3	3.2	9.6	1.1	0.0	26.6
(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.4	0.0	0.0	1.2
6.1- 8.0	0	0	6	2	0	0	0	0	0	0	0	0	3	3	0	0	14
(1)	0.0	0.0	6.4	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	3.2	0.0	0.0	14.9
(2)	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.6
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	0	0	9	9	7	7	5	0	1	3	7	10	15	17	4	0	94
(1)	0.0	0.0	9.6	9.6	7.4	7.4	5.3	0.0	1.1	3.2	7.4	10.6	16.0	18.1	4.3	0.0	100.0
(2)	0.0	0.0	0.4	0.4	0.3	0.3	0.2	0.0	0.0	0.1	0.3	0.5	0.7	0.8	0.2	0.0	4.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 94

TABLE 2A-11

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	4
	(1)	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4	1.4	0.0	0.0	5.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1.6- 4.0		0	2	3	3	7	7	3	0	0	2	2	5	7	4	2	2	49
	(1)	0.0	2.8	4.2	4.2	9.9	9.9	4.2	0.0	0.0	2.8	2.8	7.0	9.9	5.6	2.8	2.8	69.0
	(2)	0.0	0.1	0.1	0.1	0.3	0.3	0.1	0.0	0.0	0.1	0.1	0.2	0.3	0.2	0.1	0.1	2.3
4.1- 6.0		0	1	0	0	1	1	1	0	0	1	2	0	3	4	1	0	15
	(1)	0.0	1.4	0.0	0.0	1.4	1.4	1.4	0.0	0.0	1.4	2.8	0.0	4.2	5.6	1.4	0.0	21.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.0	0.7
6.1- 8.0		0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2
	(1)	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	2.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	1.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		1	3	3	4	8	8	4	0	0	3	4	6	11	11	3	2	71
	(1)	1.4	4.2	4.2	5.6	11.3	11.3	5.6	0.0	0.0	4.2	5.6	8.5	15.5	15.5	4.2	2.8	100.0
	(2)	0.0	0.1	0.1	0.2	0.4	0.4	0.2	0.0	0.0	0.1	0.2	0.3	0.5	0.5	0.1	0.1	3.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 71

TABLE 2A-12

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	5
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.8	1.6	4.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
1.6- 4.0		2	1	0	4	15	11	5	0	0	4	13	7	7	5	4	1	79
	(1)	1.6	0.8	0.0	3.2	12.0	8.8	4.0	0.0	0.0	3.2	10.4	5.6	5.6	4.0	3.2	0.8	63.2
	(2)	0.1	0.0	0.0	0.2	0.7	0.5	0.2	0.0	0.0	0.2	0.6	0.3	0.3	0.2	0.2	0.0	3.7
4.1- 6.0		0	1	2	4	5	1	1	0	0	1	3	6	5	10	2	0	41
	(1)	0.0	0.8	1.6	3.2	4.0	0.8	0.8	0.0	0.0	0.8	2.4	4.8	4.0	8.0	1.6	0.0	32.8
	(2)	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.2	0.5	0.1	0.0	1.9
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		2	2	2	8	20	12	6	0	0	5	16	13	13	16	7	3	125
	(1)	1.6	1.6	1.6	6.4	16.0	9.6	4.8	0.0	0.0	4.0	12.8	10.4	10.4	12.8	5.6	2.4	100.0
	(2)	0.1	0.1	0.1	0.4	0.9	0.6	0.3	0.0	0.0	0.2	0.7	0.6	0.6	0.7	0.3	0.1	5.8

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 125

TABLE 2A-13

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		8	8	6	11	12	18	19	19	16	6	21	21	15	18	11	9	218
	(1)	1.0	1.0	0.7	1.3	1.4	2.1	2.3	2.3	1.9	0.7	2.5	2.5	1.8	2.1	1.3	1.1	26.0
	(2)	0.4	0.4	0.3	0.5	0.6	0.8	0.9	0.9	0.7	0.3	1.0	1.0	0.7	0.8	0.5	0.4	10.1
1.6- 4.0		5	9	26	29	81	73	38	9	25	60	68	27	26	25	10	9	520
	(1)	0.6	1.1	3.1	3.5	9.6	8.7	4.5	1.1	3.0	7.1	8.1	3.2	3.1	3.0	1.2	1.1	61.9
	(2)	0.2	0.4	1.2	1.3	3.7	3.4	1.8	0.4	1.2	2.8	3.1	1.2	1.2	1.2	0.5	0.4	24.0
4.1- 6.0		0	1	10	0	2	1	1	1	5	25	6	6	6	11	1	0	76
	(1)	0.0	0.1	1.2	0.0	0.2	0.1	0.1	0.1	0.6	3.0	0.7	0.7	0.7	1.3	0.1	0.0	9.0
	(2)	0.0	0.0	0.5	0.0	0.1	0.0	0.0	0.0	0.2	1.2	0.3	0.3	0.3	0.5	0.0	0.0	3.5
6.1- 8.0		0	0	11	1	0	1	0	0	0	1	2	0	0	3	0	0	19
	(1)	0.0	0.0	1.3	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.4	0.0	0.0	2.3
	(2)	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.9
OVER 8.0		0	0	5	0	1	0	0	0	0	0	0	0	0	1	0	0	7
	(1)	0.0	0.0	0.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.8
	(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
ALL SPEEDS		13	18	58	41	96	93	58	29	46	92	97	54	47	58	22	18	840
	(1)	1.5	2.1	6.9	4.9	11.4	11.1	6.9	3.5	5.5	11.0	11.5	6.4	5.6	6.9	2.6	2.1	100.0
	(2)	0.6	0.8	2.7	1.9	4.4	4.3	2.7	1.3	2.1	4.3	4.5	2.5	2.2	2.7	1.0	0.8	38.8

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 840

TABLE 2A-14

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	5	14	8	12	9	21	28	29	25	30	41	35	23	9	3	6	298
(1)	0.8	2.3	1.3	2.0	1.5	3.5	4.7	4.8	4.2	5.0	6.8	5.8	3.8	1.5	0.5	1.0	49.7
(2)	0.2	0.6	0.4	0.6	0.4	1.0	1.3	1.3	1.2	1.4	1.9	1.6	1.1	0.4	0.1	0.3	13.8
1.6- 4.0	1	3	10	7	12	13	18	6	21	49	54	44	27	12	6	1	284
(1)	0.2	0.5	1.7	1.2	2.0	2.2	3.0	1.0	3.5	8.2	9.0	7.3	4.5	2.0	1.0	0.2	47.4
(2)	0.0	0.1	0.5	0.3	0.6	0.6	0.8	0.3	1.0	2.3	2.5	2.0	1.2	0.6	0.3	0.0	13.1
4.1- 6.0	0	0	4	0	0	0	0	0	0	5	0	0	3	2	0	0	14
(1)	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.5	0.3	0.0	0.0	2.3
(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.6
6.1- 8.0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2
(1)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
OVER 8.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	6	17	23	20	21	34	46	35	46	84	96	79	53	23	9	7	599
(1)	1.0	2.8	3.8	3.3	3.5	5.7	7.7	5.8	7.7	14.0	16.0	13.2	8.8	3.8	1.5	1.2	100.0
(2)	0.3	0.8	1.1	0.9	1.0	1.6	2.1	1.6	2.1	3.9	4.4	3.7	2.4	1.1	0.4	0.3	27.7

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 599

TABLE 2A-15

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX F - DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		1	0	2	5	4	7	10	9	13	21	29	21	31	12	2	1	168
	(1)	0.4	0.0	0.9	2.2	1.7	3.1	4.4	3.9	5.7	9.2	12.7	9.2	13.5	5.2	0.9	0.4	73.4
	(2)	0.0	0.0	0.1	0.2	0.2	0.3	0.5	0.4	0.6	1.0	1.3	1.0	1.4	0.6	0.1	0.0	7.8
1.6- 4.0		0	0	1	3	0	3	0	1	0	5	10	12	14	11	0	0	60
	(1)	0.0	0.0	0.4	1.3	0.0	1.3	0.0	0.4	0.0	2.2	4.4	5.2	6.1	4.8	0.0	0.0	26.2
	(2)	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.5	0.6	0.6	0.5	0.0	0.0	2.8
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		1	0	3	8	4	10	10	10	13	26	39	34	45	23	2	1	229
	(1)	0.4	0.0	1.3	3.5	1.7	4.4	4.4	4.4	5.7	11.4	17.0	14.8	19.7	10.0	0.9	0.4	100.0
	(2)	0.0	0.0	0.1	0.4	0.2	0.5	0.5	0.5	0.6	1.2	1.8	1.6	2.1	1.1	0.1	0.0	10.6

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 229

TABLE 2A-16

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — SUMMER (JUN 72 - AUG 72)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
							DIRECTION										
0.0- 1.5	2	2	3	7	4	4	6	6	4	9	22	37	75	16	2	3	202
(1)	1.0	1.0	1.5	3.4	1.9	1.9	2.9	2.9	1.9	4.4	10.7	18.0	36.4	7.8	1.0	1.5	98.1
(2)	0.1	0.1	0.1	0.3	0.2	0.2	0.3	0.3	0.2	0.4	1.0	1.7	3.5	0.7	0.1	0.1	9.3
1.6- 4.0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	4
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.5	0.0	0.0	1.9
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
4.1- 6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	2	2	3	7	4	4	7	6	4	10	22	37	76	17	2	3	206
(1)	1.0	1.0	1.5	3.4	1.9	1.9	3.4	2.9	1.9	4.9	10.7	18.0	36.9	8.3	1.0	1.5	100.0
(2)	0.1	0.1	0.1	0.3	0.2	0.2	0.3	0.3	0.2	0.5	1.0	1.7	3.5	0.8	0.1	0.1	9.5

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 206

TABLE 2A-17

SEABROOK

30 FT WIND DATA | DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS | SUMMER (JUN 72 - AUG 72)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		17	24	19	35	29	50	63	63	58	67	113	115	147	57	20	21	898
	(1)	0.8	1.1	0.9	1.6	1.3	2.3	2.9	2.9	2.7	3.1	5.2	5.3	6.8	2.6	0.9	1.0	41.5
	(2)	0.8	1.1	0.9	1.6	1.3	2.3	2.9	2.9	2.7	3.1	5.2	5.3	6.8	2.6	0.9	1.0	41.5
1.6- 4.0		8	15	42	50	121	114	70	16	47	122	153	100	90	63	24	13	1048
	(1)	0.4	0.7	1.9	2.3	5.6	5.3	3.2	0.7	2.2	5.6	7.1	4.6	4.2	2.9	1.1	0.6	48.4
	(2)	0.4	0.7	1.9	2.3	5.6	5.3	3.2	0.7	2.2	5.6	7.1	4.6	4.2	2.9	1.1	0.6	48.4
4.1- 6.0		0	3	17	7	9	3	3	1	5	33	12	18	20	36	5	0	172
	(1)	0.0	0.1	0.8	0.3	0.4	0.1	0.1	0.0	0.2	1.5	0.6	0.8	0.9	1.7	0.2	0.0	7.9
	(2)	0.0	0.1	0.8	0.3	0.4	0.1	0.1	0.0	0.2	1.5	0.6	0.8	0.9	1.7	0.2	0.0	7.9
6.1- 8.0		0	0	18	4	0	1	0	0	0	1	3	0	3	7	0	0	37
	(1)	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.0	1.7
	(2)	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.0	1.7
OVER 8.0		0	0	5	1	1	0	0	0	0	0	0	0	0	2	0	0	9
	(1)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4
	(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4
ALL SPEEDS		25	42	101	97	160	168	136	80	110	223	281	233	260	165	49	34	2164
	(1)	1.2	1.9	4.7	4.5	7.4	7.8	6.3	3.7	5.1	10.3	13.0	10.8	12.0	7.6	2.3	1.6	100.0
	(2)	1.2	1.9	4.7	4.5	7.4	7.8	6.3	3.7	5.1	10.3	13.0	10.8	12.0	7.6	2.3	1.6	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 2164

DATA RECOVERY = 98.0 PERCENT

TABLE 2A-18

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

DIRECTION

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	1.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0		1	1	0	1	3	1	0	0	0	1	2	3	5	3	0	1	22
	(1)	1.8	1.8	0.0	1.8	5.3	1.8	0.0	0.0	0.0	1.8	3.5	5.3	8.8	5.3	0.0	1.8	38.6
	(2)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.0	1.1
4.1- 6.0		1	1	7	3	0	0	0	0	0	0	0	0	2	4	0	1	19
	(1)	1.8	1.8	12.3	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	7.0	0.0	1.8	33.3
	(2)	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.9
6.1- 8.0		0	0	5	0	0	0	0	0	0	0	0	0	2	4	2	0	13
	(1)	0.0	0.0	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	7.0	3.5	0.0	22.8
	(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.6
OVER 8.0		0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2
	(1)	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	3.5
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL SPEEDS		2	2	12	5	3	1	0	0	0	1	2	3	9	12	3	2	57
	(1)	3.5	3.5	21.1	8.8	5.3	1.8	0.0	0.0	0.0	1.8	3.5	5.3	15.8	21.1	5.3	3.5	100.0
	(2)	0.1	0.1	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.6	0.1	0.1	2.8

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 57

TABLE 2A-19

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
	(1)	1.6	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0		0	0	1	2	2	1	1	0	0	4	2	2	11	7	3	3	39
	(1)	0.0	0.0	1.6	3.1	3.1	1.6	1.6	0.0	0.0	6.3	3.1	3.1	17.2	10.9	4.7	4.7	60.9
	(2)	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.5	0.3	0.1	0.1	1.9
4.1- 6.0		0	1	6	0	0	1	0	0	0	0	0	2	3	1	2	1	17
	(1)	0.0	1.6	9.4	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	3.1	4.7	1.6	3.1	1.6	26.6
	(2)	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.8
6.1- 8.0		0	0	1	0	0	0	0	0	0	0	0	0	0	4	1	0	6
	(1)	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	1.6	0.0	9.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.3
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		1	1	8	2	2	2	2	0	0	4	2	4	14	12	6	4	64
	(1)	1.6	1.6	12.5	3.1	3.1	3.1	3.1	0.0	0.0	6.3	3.1	6.3	21.9	18.8	9.4	6.3	100.0
	(2)	0.0	0.0	0.4	0.1	0.1	0.1	0.1	0.0	0.0	0.2	0.1	0.2	0.7	0.6	0.3	0.2	3.2

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 64

TABLE 2A-20

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	1	0	0	0	0	0	2	0	0	1	0	4
	(1)	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	1.3	0.0	5.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2
1.6- 4.0		1	2	0	1	3	3	1	0	2	3	2	8	15	5	2	0	48
	(1)	1.3	2.5	0.0	1.3	3.8	3.8	1.3	0.0	2.5	3.8	2.5	10.1	19.0	6.3	2.5	0.0	60.8
	(2)	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.4	0.7	0.2	0.1	0.0	2.4
4.1- 6.0		0	0	4	1	0	0	0	0	0	1	0	1	3	5	3	1	19
	(1)	0.0	0.0	5.1	1.3	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.3	3.8	6.3	3.8	1.3	24.1
	(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.9
6.1- 8.0		0	0	0	2	0	0	0	0	0	0	0	0	1	3	0	0	6
	(1)	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	3.8	0.0	0.0	7.6
	(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3
OVER 8.0		0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2
	(1)	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	2.5
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL SPEEDS		1	2	4	5	3	4	1	0	2	4	2	11	19	13	7	1	79
	(1)	1.3	2.5	5.1	6.3	3.8	5.1	1.3	0.0	2.5	5.1	2.5	13.9	24.1	16.5	8.9	1.3	100.0
	(2)	0.0	0.1	0.2	0.2	0.1	0.2	0.0	0.0	0.1	0.2	0.1	0.5	0.9	0.6	0.3	0.0	3.9

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 79

TABLE 2A-21

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		11	12	7	7	3	8	8	3	5	6	6	8	7	12	13	14	130
	(1)	1.6	1.7	1.0	1.0	0.4	1.2	1.2	0.4	0.7	0.9	0.9	1.2	1.0	1.7	1.9	2.0	18.8
	(2)	0.5	0.6	0.3	0.3	0.1	0.4	0.4	0.1	0.2	0.3	0.3	0.4	0.3	0.6	0.6	0.7	6.4
1.6- 4.0		19	20	35	16	37	16	12	11	9	26	21	29	46	41	36	29	403
	(1)	2.7	2.9	5.1	2.3	5.3	2.3	1.7	1.6	1.3	3.8	3.0	4.2	6.6	5.9	5.2	4.2	58.2
	(2)	0.9	1.0	1.7	0.8	1.8	0.8	0.6	0.5	0.4	1.3	1.0	1.4	2.3	2.0	1.8	1.4	20.0
4.1- 6.0		4	11	11	1	0	0	0	0	3	10	6	6	18	30	5	5	110
	(1)	0.6	1.6	1.6	0.1	0.0	0.0	0.0	0.0	0.4	1.4	0.9	0.9	2.6	4.3	0.7	0.7	15.9
	(2)	0.2	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.3	0.3	0.9	1.5	0.2	0.2	5.4
6.1- 8.0		4	3	2	0	0	0	0	0	0	0	0	0	6	10	2	3	30
	(1)	0.6	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.4	0.3	0.4	4.3
	(2)	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.1	0.1	1.5
OVER 8.0		0	0	6	3	0	0	0	0	0	0	0	0	2	7	1	0	19
	(1)	0.0	0.0	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	0.1	0.0	2.7
	(2)	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.9
ALL SPEEDS		38	46	61	27	40	24	20	14	17	42	33	43	79	100	57	51	692
	(1)	5.5	6.6	8.8	3.9	5.8	3.5	2.9	2.0	2.5	6.1	4.8	6.2	11.4	14.5	8.2	7.4	100.0
	(2)	1.9	2.3	3.0	1.3	2.0	1.2	1.0	0.7	0.8	2.1	1.6	2.1	3.9	5.0	2.8	2.5	34.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 692

TABLE 2A-22

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

	DIRECTION																
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	8	4	2	7	7	5	9	19	22	16	25	24	33	30	15	11	237
(1)	1.2	0.6	0.3	1.0	1.0	0.7	1.3	2.8	3.3	2.4	3.7	3.6	4.9	4.5	2.2	1.6	35.2
(2)	0.4	0.2	0.1	0.3	0.3	0.2	0.4	0.9	1.1	0.8	1.2	1.2	1.6	1.5	0.7	0.5	11.7
1.6- 4.0	3	0	7	3	4	6	0	5	12	41	37	48	93	72	18	10	359
(1)	0.4	0.0	1.0	0.4	0.6	0.9	0.0	0.7	1.8	6.1	5.5	7.1	13.8	10.7	2.7	1.5	53.3
(2)	0.1	0.0	0.3	0.1	0.2	0.3	0.0	0.2	0.6	2.0	1.8	2.4	4.6	3.6	0.9	0.5	17.8
4.1- 6.0	1	1	2	11	3	1	0	0	1	0	0	1	5	21	0	2	49
(1)	0.1	0.1	0.3	1.6	0.4	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.7	3.1	0.0	0.3	7.3
(2)	0.0	0.0	0.1	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0	0.0	0.1	2.4
6.1- 8.0	0	0	3	5	0	0	0	0	0	0	0	0	2	9	3	1	23
(1)	0.0	0.0	0.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.3	0.4	0.1	3.4
(2)	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	1.1
OVER 8.0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	5
(1)	0.0	0.3	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
(2)	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
ALL SPEEDS	12	7	14	29	14	12	9	24	35	57	62	73	133	132	36	24	673
(1)	1.8	1.0	2.1	4.3	2.1	1.8	1.3	3.6	5.2	8.5	9.2	10.8	19.8	19.6	5.3	3.6	100.0
(2)	0.6	0.3	0.7	1.4	0.7	0.6	0.4	1.2	1.7	2.8	3.1	3.6	6.6	6.5	1.8	1.2	33.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 673

TABLE 2A-23

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX F — DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
							DIRECTION										
0.0- 1.5	3	1	2	1	2	0	4	3	10	11	25	10	39	24	4	2	141
(1)	1.5	0.5	1.0	0.5	1.0	0.0	2.1	1.5	5.2	5.7	12.9	5.2	20.1	12.4	2.1	1.0	72.7
(2)	0.1	0.0	0.1	0.0	0.1	0.0	0.2	0.1	0.5	0.5	1.2	0.5	1.9	1.2	0.2	0.1	7.0
1.6- 4.0	0	1	0	2	3	0	0	1	0	3	5	3	13	21	1	0	53
(1)	0.0	0.5	0.0	1.0	1.5	0.0	0.0	0.5	0.0	1.5	2.6	1.5	6.7	10.8	0.5	0.0	27.3
(2)	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.6	1.0	0.0	0.0	2.6
4.1- 6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	3	2	2	3	5	0	4	4	10	14	30	13	52	45	5	2	194
(1)	1.5	1.0	1.0	1.5	2.6	0.0	2.1	2.1	5.2	7.2	15.5	6.7	26.8	23.2	2.6	1.0	100.0
(2)	0.1	0.1	0.1	0.1	0.2	0.0	0.2	0.2	0.5	0.7	1.5	0.6	2.6	2.2	0.2	0.1	9.6

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 194

TABLE 2A-24

SEABROOK

30 FT WIND DATA   DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS   FALL (SEP, OCT 72 + NOV 71)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

		DIRECTION															
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	2	2	0	2	0	1	2	2	6	17	18	37	112	35	8	4	248
(1)	0.8	0.8	0.0	0.8	0.0	0.4	0.8	0.8	2.3	6.5	6.9	14.2	43.1	13.5	3.1	1.5	95.4
(2)	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.3	0.8	0.9	1.8	5.5	1.7	0.4	0.2	12.3
1.6- 4.0	0	0	0	0	0	0	0	0	0	1	0	2	4	5	0	0	12
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.8	1.5	1.9	0.0	0.0	4.6
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.6
4.1- 6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	2	2	0	2	0	1	2	2	6	18	18	39	116	40	8	4	260
(1)	0.8	0.8	0.0	0.8	0.0	0.4	0.8	0.8	2.3	6.9	6.9	15.0	44.6	15.4	3.1	1.5	100.0
(2)	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.3	0.9	0.9	1.9	5.7	2.0	0.4	0.2	12.9

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 260

TABLE 2A-25

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — FALL (SEP, OCT 72 + NOV 71)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		25	19	11	17	12	15	24	27	43	50	74	81	191	101	42	31	763
	(1)	1.2	0.9	0.5	0.8	0.6	0.7	1.2	1.3	2.1	2.5	3.7	4.0	9.5	5.0	2.1	1.5	37.8
	(2)	1.2	0.9	0.5	0.8	0.6	0.7	1.2	1.3	2.1	2.5	3.7	4.0	9.5	5.0	2.1	1.5	37.8
1.6- 4.0		24	24	43	25	52	27	14	17	23	79	69	95	187	154	60	43	936
	(1)	1.2	1.2	2.1	1.2	2.6	1.3	0.7	0.8	1.1	3.9	3.4	4.7	9.3	7.6	3.0	2.1	46.4
	(2)	1.2	1.2	2.1	1.2	2.6	1.3	0.7	0.8	1.1	3.9	3.4	4.7	9.3	7.6	3.0	2.1	46.4
4.1- 6.0		6	14	30	16	3	2	0	0	4	11	6	10	31	61	10	10	214
	(1)	0.3	0.7	1.5	0.8	0.1	0.1	0.0	0.0	0.2	0.5	0.3	0.5	1.5	3.0	0.5	0.5	10.6
	(2)	0.3	0.7	1.5	0.8	0.1	0.1	0.0	0.0	0.2	0.5	0.3	0.5	1.5	3.0	0.5	0.5	10.6
6.1- 8.0		4	3	11	7	0	0	0	0	0	0	0	0	11	30	8	4	78
	(1)	0.2	0.1	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	0.4	0.2	3.9
	(2)	0.2	0.1	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	0.4	0.2	3.9
OVER 8.0		0	2	6	8	0	0	0	0	0	0	0	0	2	8	2	0	28
	(1)	0.0	0.1	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	1.4
	(2)	0.0	0.1	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	1.4
ALL SPEEDS		59	62	101	73	67	44	38	44	70	140	149	186	422	354	122	88	2019
	(1)	2.9	3.1	5.0	3.6	3.3	2.2	1.9	2.2	3.5	6.9	7.4	9.2	20.9	17.5	6.0	4.4	100.0
	(2)	2.9	3.1	5.0	3.6	3.3	2.2	1.9	2.2	3.5	6.9	7.4	9.2	20.9	17.5	6.0	4.4	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 2019

DATA RECOVERY = 92.4 PERCENT

TABLE 2A-26

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0	0	0	0	0	0	0	0	0	0	0	1	3	1	1	0	0	6
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	21.4	7.1	7.1	0.0	0.0	42.9
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3
4.1- 6.0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	3
(1)	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	7.1	0.0	0.0	21.4
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
6.1- 8.0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	3
(1)	0.0	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	21.4
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	14.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
ALL SPEEDS	0	1	1	0	0	0	0	0	0	0	1	3	4	4	0	0	14
(1)	0.0	7.1	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	21.4	28.6	28.6	0.0	0.0	100.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.6

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 14

TABLE 2A-27

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

DIRECTION

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6- 4.0	0	0	0	0	0	0	0	0	0	1	3	4	0	2	0	0	10
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	9.1	12.1	0.0	6.1	0.0	0.0	30.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.0	0.0	0.5
4.1- 6.0	0	1	0	0	0	0	0	0	0	0	0	1	8	4	1	0	15
(1)	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	24.2	12.1	3.0	0.0	45.5
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.7
6.1- 8.0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	5
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	6.1	0.0	0.0	15.2
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	6.1	0.0	0.0	9.1
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
ALL SPEEDS	0	1	0	0	0	0	0	0	0	1	3	5	12	10	1	0	33
(1)	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	9.1	15.2	36.4	30.3	3.0	0.0	100.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	0.5	0.0	0.0	1.5

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 33

TABLE 2A-28

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
								DIRECTION									
0.0- 1.5	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
(1)	0.0	1.6	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0	0	0	0	0	0	0	0	0	0	1	10	6	2	5	0	1	25
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	15.6	9.4	3.1	7.8	0.0	1.6	39.1
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.1	0.2	0.0	0.0	1.2
4.1- 6.0	1	0	0	0	0	0	0	0	0	0	3	1	9	8	1	0	23
(1)	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	1.6	14.1	12.5	1.6	0.0	35.9
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.4	0.0	0.0	1.1
6.1- 8.0	0	0	2	0	0	0	0	0	0	0	0	2	3	4	0	0	11
(1)	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	4.7	6.3	0.0	0.0	17.2
(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.5
OVER 8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0	4.7
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
ALL SPEEDS	1	1	2	0	0	1	0	0	0	1	13	9	14	20	1	1	64
(1)	1.6	1.6	3.1	0.0	0.0	1.6	0.0	0.0	0.0	1.6	20.3	14.1	21.9	31.3	1.6	1.6	100.0
(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.4	0.6	0.9	0.0	0.0	3.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 64

TABLE 2A-29

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		6	3	1	2	1	1	4	3	7	6	8	15	13	14	12	10	106
	(1)	0.6	0.3	0.1	0.2	0.1	0.1	0.4	0.3	0.7	0.6	0.9	1.6	1.4	1.5	1.3	1.1	11.3
	(2)	0.3	0.1	0.0	0.1	0.0	0.0	0.2	0.1	0.3	0.3	0.4	0.7	0.6	0.6	0.6	0.5	4.9
1.6- 4.0		28	8	2	2	3	5	8	7	13	16	28	34	65	75	54	83	431
	(1)	3.0	0.9	0.2	0.2	0.3	0.5	0.9	0.7	1.4	1.7	3.0	3.6	6.9	8.0	5.8	8.9	46.0
	(2)	1.3	0.4	0.1	0.1	0.1	0.2	0.4	0.3	0.6	0.7	1.3	1.6	3.0	3.5	2.5	3.8	19.9
4.1- 6.0		6	8	10	7	1	0	0	2	1	4	9	15	48	58	13	18	200
	(1)	0.6	0.9	1.1	0.7	0.1	0.0	0.0	0.2	0.1	0.4	1.0	1.6	5.1	6.2	1.4	1.9	21.3
	(2)	0.3	0.4	0.5	0.3	0.0	0.0	0.0	0.1	0.0	0.2	0.4	0.7	2.2	2.7	0.6	0.8	9.2
6.1- 8.0		2	0	3	4	0	0	0	0	0	0	1	15	40	52	3	1	121
	(1)	0.2	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.6	4.3	5.5	0.3	0.1	12.9
	(2)	0.1	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.8	2.4	0.1	0.0	5.6
OVER 8.0		0	2	9	12	0	0	0	0	0	0	1	5	12	38	0	0	79
	(1)	0.0	0.2	1.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	1.3	4.1	0.0	0.0	8.4
	(2)	0.0	0.1	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	1.8	0.0	0.0	3.6
ALL SPEEDS		42	21	25	27	5	6	12	12	21	26	47	84	178	237	82	112	937
	(1)	4.5	2.2	2.7	2.9	0.5	0.6	1.3	1.3	2.2	2.8	5.0	9.0	19.0	25.3	8.8	12.0	100.0
	(2)	1.9	1.0	1.2	1.2	0.2	0.3	0.6	0.6	1.0	1.2	2.2	3.9	8.2	10.9	3.8	5.2	43.2

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 937

TABLE 2A-30

SEABROOK

30 FT WIND DATA   DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS   WINTER (DEC 71 - FEB 72)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

	DIRECTION																
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	5	3	0	3	2	7	8	18	24	12	22	34	37	23	9	4	211
(1)	0.6	0.3	0.0	0.3	0.2	0.8	0.9	2.1	2.7	1.4	2.5	3.9	4.2	2.6	1.0	0.5	24.2
(2)	0.2	0.1	0.0	0.1	0.1	0.3	0.4	0.8	1.1	0.6	1.0	1.6	1.7	1.1	0.4	0.2	9.7
1.6- 4.0	6	4	4	3	2	4	6	8	21	32	75	130	111	76	15	8	505
(1)	0.7	0.5	0.5	0.3	0.2	0.5	0.7	0.9	2.4	3.7	8.6	14.9	12.7	8.7	1.7	0.9	57.8
(2)	0.3	0.2	0.2	0.1	0.1	0.2	0.3	0.4	1.0	1.5	3.5	6.0	5.1	3.5	0.7	0.4	23.3
4.1- 6.0	0	0	3	7	5	0	0	2	5	26	6	19	26	11	1	1	112
(1)	0.0	0.0	0.3	0.8	0.6	0.0	0.0	0.2	0.6	3.0	0.7	2.2	3.0	1.3	0.1	0.1	12.8
(2)	0.0	0.0	0.1	0.3	0.2	0.0	0.0	0.1	0.2	1.2	0.3	0.9	1.2	0.5	0.0	0.0	5.2
6.1- 8.0	0	0	0	7	2	0	1	1	1	0	2	4	8	2	0	0	28
(1)	0.0	0.0	0.0	0.8	0.2	0.0	0.1	0.1	0.1	0.0	0.2	0.5	0.9	0.2	0.0	0.0	3.2
(2)	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.1	0.0	0.0	1.3
OVER 8.0	0	0	3	8	5	0	0	0	0	0	0	0	1	0	0	0	17
(1)	0.0	0.0	0.3	0.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.9
(2)	0.0	0.0	0.1	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
ALL SPEEDS	11	7	10	28	16	11	15	29	51	70	105	187	183	112	25	13	873
(1)	1.3	0.8	1.1	3.2	1.8	1.3	1.7	3.3	5.8	8.0	12.0	21.4	21.0	12.8	2.9	1.5	100.0
(2)	0.5	0.3	0.5	1.3	0.7	0.5	0.7	1.3	2.4	3.2	4.8	8.6	8.4	5.2	1.2	0.6	40.3

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 873

TABLE 2A-31

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

STABILITY INDEX F - DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		4	2	1	2	3	0	1	6	7	3	14	14	16	17	4	4	98
	(1)	2.9	1.4	0.7	1.4	2.2	0.0	0.7	4.3	5.1	2.2	10.1	10.1	11.6	12.3	2.9	2.9	71.0
	(2)	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.3	0.3	0.1	0.6	0.6	0.7	0.8	0.2	0.2	4.5
1.6- 4.0		0	0	0	1	0	0	1	0	0	3	9	5	11	8	1	0	39
	(1)	0.0	0.0	0.0	0.7	0.0	0.0	0.7	0.0	0.0	2.2	6.5	3.6	8.0	5.8	0.7	0.0	28.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.2	0.5	0.4	0.0	0.0	1.8
4.1- 6.0		0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	(1)	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		4	2	2	3	3	0	2	6	7	6	23	19	27	25	5	4	138
	(1)	2.9	1.4	1.4	2.2	2.2	0.0	1.4	4.3	5.1	4.3	16.7	13.8	19.6	18.1	3.6	2.9	100.0
	(2)	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.3	0.3	0.3	1.1	0.9	1.2	1.2	0.2	0.2	6.4

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 138

TABLE 2A-32

SEABROOK

30 FT WIND DATA　　DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS　　WINTER (DEC 71 - FEB 72)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		1	0	0	2	0	1	0	3	3	7	15	17	38	12	1	1	101
	(1)	0.9	0.0	0.0	1.9	0.0	0.9	0.0	2.8	2.8	6.5	13.9	15.7	35.2	11.1	0.9	0.9	93.5
	(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.3	0.7	0.8	1.8	0.6	0.0	0.0	4.7
1.6- 4.0		0	0	0	0	0	0	0	1	0	0	0	1	4	1	0	0	7
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.9	3.7	0.9	0.0	0.0	6.5
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		1	0	0	2	0	1	0	4	3	7	15	18	42	13	1	1	108
	(1)	0.9	0.0	0.0	1.9	0.0	0.9	0.0	3.7	2.8	6.5	13.9	16.7	38.9	12.0	0.9	0.9	100.0
	(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.3	0.7	0.8	1.9	0.6	0.0	0.0	5.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 108

TABLE 2A-33

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — WINTER (DEC 71 - FEB 72)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)	DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	16	9	2	9	6	10	13	30	41	28	59	80	104	66	26	19	518
(1)	0.7	0.4	0.1	0.4	0.3	0.5	0.6	1.4	1.9	1.3	2.7	3.7	4.8	3.0	1.2	0.9	23.9
(2)	0.7	0.4	0.1	0.4	0.3	0.5	0.6	1.4	1.9	1.3	2.7	3.7	4.8	3.0	1.2	0.9	23.9
1.6- 4.0	34	12	6	6	5	9	15	16	34	53	126	183	194	168	70	92	1023
(1)	1.6	0.6	0.3	0.3	0.2	0.4	0.7	0.7	1.6	2.4	5.8	8.4	9.0	7.8	3.2	4.2	47.2
(2)	1.6	0.6	0.3	0.3	0.2	0.4	0.7	0.7	1.6	2.4	5.8	8.4	9.0	7.8	3.2	4.2	47.2
4.1- 6.0	7	10	14	14	6	0	0	4	6	30	18	36	92	82	16	19	354
(1)	0.3	0.5	0.6	0.6	0.3	0.0	0.0	0.2	0.3	1.4	0.8	1.7	4.2	3.8	0.7	0.9	16.3
(2)	0.3	0.5	0.6	0.6	0.3	0.0	0.0	0.2	0.3	1.4	0.8	1.7	4.2	3.8	0.7	0.9	16.3
6.1- 8.0	2	0	6	11	2	0	1	1	1	0	3	21	54	62	3	1	168
(1)	0.1	0.0	0.3	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.1	1.0	2.5	2.9	0.1	0.0	7.8
(2)	0.1	0.0	0.3	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.1	1.0	2.5	2.9	0.1	0.0	7.8
OVER 8.0	0	2	12	20	5	0	0	0	0	0	1	5	16	43	0	0	104
(1)	0.0	0.1	0.6	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	2.0	0.0	0.0	4.8
(2)	0.0	0.1	0.6	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	2.0	0.0	0.0	4.8
ALL SPEEDS	59	33	40	60	24	19	29	51	82	111	207	325	460	421	115	131	2167
(1)	2.7	1.5	1.8	2.8	1.1	0.9	1.3	2.4	3.8	5.1	9.6	15.0	21.2	19.4	5.3	6.0	100.0
(2)	2.7	1.5	1.8	2.8	1.1	0.9	1.3	2.4	3.8	5.1	9.6	15.0	21.2	19.4	5.3	6.0	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 2167

DATA RECOVERY = 99.2 PERCENT

TABLE 2A-34

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX A - DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		0	0	0	0	0	0	0	0	0	1	0	0	1	0	3	0	5
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.0	1.2	0.0	2.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0		1	2	2	8	9	19	6	0	1	3	11	12	15	11	2	2	104
	(1)	0.4	0.8	0.8	3.1	3.5	7.4	2.3	0.0	0.4	1.2	4.3	4.7	5.9	4.3	0.8	0.8	40.6
	(2)	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.0	1.2
4.1- 6.0		1	4	8	8	5	13	3	0	0	3	5	7	14	18	2	1	92
	(1)	0.4	1.6	3.1	3.1	2.0	5.1	1.2	0.0	0.0	1.2	2.0	2.7	5.5	7.0	0.8	0.4	35.9
	(2)	0.0	0.0	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.0	0.0	1.1
6.1- 8.0		0	0	16	3	0	0	0	0	0	1	0	0	12	10	3	0	45
	(1)	0.0	0.0	6.3	1.2	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	4.7	3.9	1.2	0.0	17.6
	(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.5
OVER 8.0		0	2	3	1	0	0	0	0	0	0	0	0	2	1	1	0	10
	(1)	0.0	0.8	1.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.4	0.4	0.0	3.9
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL SPEEDS		2	8	29	20	14	32	9	0	1	8	16	19	44	40	11	3	256
	(1)	0.8	3.1	11.3	7.8	5.5	12.5	3.5	0.0	0.4	3.1	6.3	7.4	17.2	15.6	4.3	1.2	100.0
	(2)	0.0	0.1	0.3	0.2	0.2	0.4	0.1	0.0	0.0	0.1	0.2	0.2	0.5	0.5	0.1	0.0	3.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 256

TABLE 2A-35

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX B - DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

	DIRECTION																
SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	2	0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	7
(1)	0.8	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.0	2.9
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0	1	2	5	6	13	12	9	0	0	8	12	13	21	19	6	6	133
(1)	0.4	0.8	2.0	2.5	5.3	4.9	3.7	0.0	0.0	3.3	4.9	5.3	8.6	7.8	2.5	2.5	54.5
(2)	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.1	1.6
4.1- 6.0	1	3	8	1	2	5	3	0	1	2	5	6	21	13	5	1	77
(1)	0.4	1.2	3.3	0.4	0.8	2.0	1.2	0.0	0.4	0.8	2.0	2.5	8.6	5.3	2.0	0.4	31.6
(2)	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.0	0.9
6.1- 8.0	0	2	2	2	0	0	0	0	0	0	0	0	4	8	1	0	19
(1)	0.0	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	3.3	0.4	0.0	7.8
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2
OVER 8.0	0	1	0	0	0	0	0	0	0	1	0	0	1	4	1	0	8
(1)	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4	1.6	0.4	0.0	3.3
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL SPEEDS	4	8	15	9	15	17	13	0	1	11	17	20	48	45	14	7	244
(1)	1.6	3.3	6.1	3.7	6.1	7.0	5.3	0.0	0.4	4.5	7.0	8.2	19.7	18.4	5.7	2.9	100.0
(2)	0.0	0.1	0.2	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.2	0.2	0.6	0.5	0.2	0.1	2.9

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 244

TABLE 2A-36

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX C - DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	0	1	0	0	0	2	0	0	0	0	0	2	1	1	2	2	11
(1)	0.0	0.3	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.3	0.5	0.5	2.9
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.6- 4.0	4	3	1	7	21	24	11	1	2	10	29	25	29	18	8	2	195
(1)	1.1	0.8	0.3	1.9	5.6	6.4	2.9	0.3	0.5	2.7	7.8	6.7	7.8	4.8	2.1	0.5	52.1
(2)	0.0	0.0	0.0	0.1	0.2	0.3	0.1	0.0	0.0	0.1	0.3	0.3	0.3	0.2	0.1	0.0	2.3
4.1- 6.0	3	3	7	7	10	3	6	1	2	5	6	11	26	31	7	1	129
(1)	0.8	0.8	1.9	1.9	2.7	0.8	1.6	0.3	0.5	1.3	1.6	2.9	7.0	8.3	1.9	0.3	34.5
(2)	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.1	0.0	1.5
6.1- 8.0	0	0	2	2	0	0	0	0	0	0	0	3	8	13	2	0	30
(1)	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	2.1	3.5	0.5	0.0	8.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.4
OVER 8.0	0	1	0	1	0	0	0	0	0	0	0	0	0	6	1	0	9
(1)	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.3	0.0	2.4
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
ALL SPEEDS	7	8	10	17	31	29	17	2	4	15	35	41	64	69	20	5	374
(1)	1.9	2.1	2.7	4.5	8.3	7.8	4.5	0.5	1.1	4.0	9.4	11.0	17.1	18.4	5.3	1.3	100.0
(2)	0.1	0.1	0.1	0.2	0.4	0.3	0.2	0.0	0.0	0.2	0.4	0.5	0.7	0.8	0.2	0.1	4.4

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 374

TABLE 2A-37

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX D - DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

SPEED (MPS)	DIRECTION																
	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	36	31	15	26	28	35	46	40	32	22	45	59	52	52	54	47	620
(1)	1.0	0.9	0.4	0.7	0.8	1.0	1.3	1.1	0.9	0.6	1.3	1.7	1.5	1.5	1.5	1.3	17.4
(2)	0.4	0.4	0.2	0.3	0.3	0.4	0.5	0.5	0.4	0.3	0.5	0.7	0.6	0.6	0.6	0.5	7.3
1.6- 4.0	67	111	107	76	155	136	106	62	73	125	139	124	183	201	137	157	1959
(1)	1.9	3.1	3.0	2.1	4.4	3.8	3.0	1.7	2.0	3.5	3.9	3.5	5.1	5.6	3.8	4.4	55.0
(2)	0.8	1.3	1.3	0.9	1.8	1.6	1.2	0.7	0.9	1.5	1.6	1.5	2.1	2.4	1.6	1.8	22.9
4.1- 6.0	15	43	76	30	13	5	1	6	14	52	27	44	99	139	32	24	620
(1)	0.4	1.2	2.1	0.8	0.4	0.1	0.0	0.2	0.4	1.5	0.8	1.2	2.8	3.9	0.9	0.7	17.4
(2)	0.2	0.5	0.9	0.4	0.2	0.1	0.0	0.1	0.2	0.6	0.3	0.5	1.2	1.6	0.4	0.3	7.3
6.1- 8.0	6	8	36	9	2	2	0	0	0	3	4	15	51	89	10	5	240
(1)	0.2	0.2	1.0	0.3	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.4	1.4	2.5	0.3	0.1	6.7
(2)	0.1	0.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	1.0	0.1	0.1	2.8
OVER 8.0	0	7	27	17	1	0	0	0	0	0	1	5	14	49	1	0	122
(1)	0.0	0.2	0.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.4	0.0	0.0	3.4
(2)	0.0	0.1	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	0.0	0.0	1.4
ALL SPEEDS	124	200	261	158	199	178	153	108	119	202	216	247	399	530	234	233	3561
(1)	3.5	5.6	7.3	4.4	5.6	5.0	4.3	3.0	3.3	5.7	6.1	6.9	11.2	14.9	6.6	6.5	100.0
(2)	1.5	2.3	3.1	1.8	2.3	2.1	1.8	1.3	1.4	2.4	2.5	2.9	4.7	6.2	2.7	2.7	41.7

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 3561

TABLE 2A-38

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX E - DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

DIRECTION

SPEED (MPS)	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5	28	28	12	25	21	42	54	77	79	68	104	114	120	74	37	31	914
(1)	1.0	1.0	0.4	0.9	0.8	1.5	2.0	2.8	2.9	2.5	3.8	4.1	4.4	2.7	1.3	1.1	33.2
(2)	0.3	0.3	0.1	0.3	0.2	0.5	0.6	0.9	0.9	0.8	1.2	1.3	1.4	0.9	0.4	0.4	10.7
1.6- 4.0	25	13	31	26	33	40	35	29	74	150	190	283	281	227	57	32	1526
(1)	0.9	0.5	1.1	0.9	1.2	1.5	1.3	1.1	2.7	5.4	6.9	10.3	10.2	8.2	2.1	1.2	55.4
(2)	0.3	0.2	0.4	0.3	0.4	0.5	0.4	0.3	0.9	1.8	2.2	3.3	3.3	2.7	0.7	0.4	17.9
4.1- 6.0	1	2	10	18	8	2	1	2	13	36	12	24	43	46	2	4	224
(1)	0.0	0.1	0.4	0.7	0.3	0.1	0.0	0.1	0.5	1.3	0.4	0.9	1.6	1.7	0.1	0.1	8.1
(2)	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.2	0.4	0.1	0.3	0.5	0.5	0.0	0.0	2.6
6.1- 8.0	0	0	6	12	3	0	1	1	2	1	3	4	11	13	3	1	61
(1)	0.0	0.0	0.2	0.4	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.4	0.5	0.1	0.0	2.2
(2)	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.7
OVER 8.0	0	4	6	12	5	0	0	0	0	0	0	0	1	0	0	0	28
(1)	0.0	0.1	0.2	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
(2)	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
ALL SPEEDS	54	47	65	93	70	84	91	109	168	255	309	425	456	360	99	68	2753
(1)	2.0	1.7	2.4	3.4	2.5	3.1	3.3	4.0	6.1	9.3	11.2	15.4	16.6	13.1	3.6	2.5	100.0
(2)	0.6	0.5	0.8	1.1	0.8	1.0	1.1	1.3	2.0	3.0	3.6	5.0	5.3	4.2	1.2	0.8	32.2

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 2753

TABLE 2A-39

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX F - DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		11	3	7	10	13	12	19	18	32	41	76	55	98	61	17	8	481
	(1)	1.6	0.4	1.0	1.5	1.9	1.8	2.8	2.7	4.8	6.1	11.4	8.2	14.6	9.1	2.5	1.2	71.9
	(2)	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.4	0.5	0.9	0.6	1.1	0.7	0.2	0.1	5.6
1.6- 4.0		0	1	1	7	3	5	2	2	2	15	29	26	42	45	4	1	185
	(1)	0.0	0.1	0.1	1.0	0.4	0.7	0.3	0.3	0.3	2.2	4.3	3.9	6.3	6.7	0.6	0.1	27.7
	(2)	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.3	0.3	0.5	0.5	0.0	0.0	2.2
4.1- 6.0		0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	2
	(1)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	(1)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		11	5	9	17	16	17	21	20	34	56	105	82	140	106	21	9	669
	(1)	1.6	0.7	1.3	2.5	2.4	2.5	3.1	3.0	5.1	8.4	15.7	12.3	20.9	15.8	3.1	1.3	100.0
	(2)	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.4	0.7	1.2	1.0	1.6	1.2	0.2	0.1	7.8

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 669

TABLE 2A-40

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

STABILITY INDEX G - DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

SPEED (MPS)		DIRECTION NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		6	6	4	11	6	12	10	16	17	38	64	103	267	79	17	11	667
	(1)	0.9	0.9	0.6	1.6	0.9	1.7	1.4	2.3	2.5	5.5	9.2	14.9	38.6	11.4	2.5	1.6	96.4
	(2)	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.4	0.7	1.2	3.1	0.9	0.2	0.1	7.8
1.6- 4.0		0	0	0	0	0	0	1	1	0	2	0	3	9	9	0	0	25
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.3	0.0	0.4	1.3	1.3	0.0	0.0	3.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.3
4.1- 6.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1- 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER 8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS		6	6	4	11	6	12	11	17	17	40	64	106	276	88	17	11	692
	(1)	0.9	0.9	0.6	1.6	0.9	1.7	1.6	2.5	2.5	5.8	9.2	15.3	39.9	12.7	2.5	1.6	100.0
	(2)	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.5	0.7	1.2	3.2	1.0	0.2	0.1	8.1

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS FOR THIS PAGE = 692

TABLE 2A-41

SEABROOK

30 FT WIND DATA — DISTRIBUTION OF WIND DIRECTIONS AND SPEEDS — ANNUAL (NOV 71 - OCT 72)

TOTAL FOR ALL DELTA T STABILITIES

SPEED (MPS)		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	TOTAL
0.0- 1.5		83	69	38	72	68	103	130	151	160	170	289	334	540	268	131	99	2705
	(1)	1.0	0.8	0.4	0.8	0.8	1.2	1.5	1.8	1.9	2.0	3.4	3.9	6.3	3.1	1.5	1.2	31.6
	(2)	1.0	0.8	0.4	0.8	0.8	1.2	1.5	1.8	1.9	2.0	3.4	3.9	6.3	3.1	1.5	1.2	31.6
1.6- 4.0		98	132	147	130	234	236	170	95	152	313	410	486	580	530	214	200	4127
	(1)	1.1	1.5	1.7	1.5	2.7	2.8	2.0	1.1	1.8	3.7	4.8	5.7	6.8	6.2	2.5	2.3	48.3
	(2)	1.1	1.5	1.7	1.5	2.7	2.8	2.0	1.1	1.8	3.7	4.8	5.7	6.8	6.2	2.5	2.3	48.3
4.1- 6.0		21	55	110	64	38	28	14	9	30	98	55	93	203	247	48	31	1144
	(1)	0.2	0.6	1.3	0.7	0.4	0.3	0.2	0.1	0.4	1.1	0.6	1.1	2.4	2.9	0.6	0.4	13.4
	(2)	0.2	0.6	1.3	0.7	0.4	0.3	0.2	0.1	0.4	1.1	0.6	1.1	2.4	2.9	0.6	0.4	13.4
6.1- 8.0		6	10	62	28	5	2	1	1	2	5	7	22	86	133	19	6	395
	(1)	0.1	0.1	0.7	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.3	1.0	1.6	0.2	0.1	4.6
	(2)	0.1	0.1	0.7	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.3	1.0	1.6	0.2	0.1	4.6
OVER 8.0		0	16	36	31	6	0	0	0	0	1	1	5	18	60	4	0	178
	(1)	0.0	0.2	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.7	0.0	0.0	2.1
	(2)	0.0	0.2	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.7	0.0	0.0	2.1
ALL SPEEDS		208	282	393	325	351	369	315	256	344	587	762	940	1427	1238	416	336	8549
	(1)	2.4	3.3	4.6	3.8	4.1	4.3	3.7	3.0	4.0	6.9	8.9	11.0	16.7	14.5	4.9	3.9	100.0
	(2)	2.4	3.3	4.6	3.8	4.1	4.3	3.7	3.0	4.0	6.9	8.9	11.0	16.7	14.5	4.9	3.9	100.0

(1)=PERCENT OF ALL GOOD OBS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBS FOR THE SEASON

TOTAL OBS = 8549

DATA RECOVERY = 97.3 PERCENT

TABLE 2A-42

SEABROOK

30 FT LEVEL

SPRING (MAR 72 - MAY 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 22.5 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NNE	34	10	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	37	11	4	2	1	5	1	0	0	0	1	0	1	0	0	0	0	0	0	0
ENE	29	9	10	6	6	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
E	31	9	1	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
ESE	45	7	3	4	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	32	12	10	9	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	32	18	4	5	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
S	31	13	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
SSW	26	10	6	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	38	14	10	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	40	15	8	5	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	45	12	18	6	2	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0
WNW	64	44	14	7	4	4	0	0	1	1	0	0	0	0	0	0	0	0	0	0
NW	68	25	9	10	3	6	4	3	0	1	0	0	0	0	0	0	0	0	0	0
NNW	61	18	4	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
N	44	7	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ALL	657	234	106	66	28	22	12	4	2	3	2	0	2	0	0	1	0	0	0	0

2207 GOOD OBS USED 1 OBS MISSING 100.0 PERCENT DATA RECOVERY

TABLE 2A-43

SEABROOK

30 FT LEVEL SUMMER (JUN 72 - AUG 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 22.5 DEG SECTOR

WIND FROM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	HOURS OF PERSISTENCE																			
NNE	23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	26	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	24	13	3	1	1	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0
E	41	10	5	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	51	17	5	4	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0
SE	57	21	9	2	6	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	62	13	7	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S	59	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	68	9	4	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	70	18	8	6	6	2	0	1	0	1	0	0	1	0	0	0	0	0	0	0
WSW	94	30	16	8	3	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0
W	81	26	11	4	1	1	2	1	1	0	1	0	0	0	0	0	0	0	0	0
WNW	74	29	13	5	6	3	2	0	0	0	0	0	1	0	0	0	0	0	0	0
NW	52	26	4	3	2	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
NNW	31	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	28	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ALL	841	236	90	42	30	13	8	5	4	2	3	0	2	0	0	0	0	1	0	0

2208 GOOD OBS USED   0 OBS MISSING   100.0 PERCENT DATA RECOVERY

TABLE 2A-44

SEABROOK

30 FT LEVEL — FALL (SEP, OCT 72 + NOV 71)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 22.5 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NNE	29	6	6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	19	6	5	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
ENE	16	10	2	0	2	2	1	0	1	0	1	0	0	1	0	0	0	0	0	0
E	21	10	3	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
ESE	20	6	6	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	17	7	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	22	6	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	24	8	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	31	10	2	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
SW	44	16	7	5	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	63	16	6	3	1	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0
W	88	23	12	7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	109	44	27	16	8	5	3	0	0	0	1	0	0	0	0	0	1	0	0	0
NW	87	34	11	9	5	4	3	0	4	1	1	0	0	0	0	0	0	1	0	0
NNW	64	20	6	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	38	7	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ALL	692	229	103	54	29	17	10	0	8	1	3	1	0	1	1	0	1	1	0	0

2183 GOOD OBS USED   1 OBS MISSING   100.0 PERCENT DATA RECOVERY

TABLE 2A-45

SEABROOK

30 FT LEVEL — WINTER (DEC 71 - FEB 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 22.5 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NNE	30	11	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	16	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	13	1	1	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	16	6	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0
ESE	13	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	14	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	18	3	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	30	4	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	33	6	6	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	38	10	7	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
WSW	69	28	7	6	1	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0
W	83	32	11	6	4	3	6	1	2	0	0	0	0	0	0	0	0	1	0	0
WNW	104	41	20	17	6	5	3	1	3	1	0	0	0	0	0	0	0	0	0	1
NW	75	36	17	9	5	10	1	3	0	2	2	0	0	0	1	0	1	0	0	0
NNW	42	13	1	3	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0
N	32	13	4	4	2	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0
ALL	626	217	81	56	22	25	15	6	5	5	2	1	1	0	1	2	1	1	0	1

2184 GOOD OBS USED   0 OBS MISSING   100.0 PERCENT DATA RECOVERY

TABLE 2A-46

SEABROOK

30 FT LEVEL

ANNUAL (NOV 71 - OCT 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 22.5 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NNE	116	28	8	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	98	24	14	5	2	5	1	0	1	0	1	0	1	0	0	0	0	0	0	0
ENE	82	33	16	11	9	3	2	1	1	1	1	0	1	1	0	0	0	1	0	0
E	109	35	9	9	2	3	2	1	1	0	0	0	0	0	1	1	0	0	0	0
ESE	129	36	14	11	6	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0
SE	120	43	21	12	11	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	134	40	15	8	3	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
S	144	34	6	5	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
SSW	158	35	18	6	1	3	2	0	0	0	0	1	0	0	0	0	0	0	0	0
SW	190	58	32	13	8	4	4	1	0	1	0	0	1	0	0	1	0	0	0	0
WSW	266	89	37	22	6	7	1	1	3	0	1	0	1	0	0	0	0	0	0	0
W	297	93	52	23	10	6	8	2	3	0	2	0	0	0	0	1	0	1	0	0
WNW	351	158	74	45	24	17	9	1	4	2	1	0	1	0	0	0	1	0	0	1
NW	282	121	41	31	15	20	8	7	5	4	4	0	0	0	1	0	1	1	0	0
NNW	198	59	12	5	4	3	1	0	0	1	0	0	0	0	0	0	0	0	0	0
N	142	30	11	9	6	2	1	0	0	1	0	1	0	0	0	0	0	0	0	0
ALL	2816	916	380	218	109	77	45	15	19	11	10	2	5	1	2	3	2	3	0	1

8782 GOOD OBS USED 2 OBS MISSING 100.0 PERCENT DATA RECOVERY

TABLE 2A-47

SEABROOK

30 FT LEVEL

SPRING (MAR 72 - MAY 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NNE - NE	44	16	10	6	3	5	3	4	0	0	1	0	3	0	1	0	0	0	0	0
NE - ENE	31	10	9	3	7	4	1	2	0	1	2	0	1	0	1	0	0	2	0	1
ENE - E	43	5	2	2	5	4	3	3	0	2	1	1	0	0	3	0	1	0	0	0
E - ESE	51	11	14	6	5	2	2	1	3	2	1	2	2	0	0	0	0	1	0	0
ESE - SE	30	19	8	7	7	7	2	3	0	1	5	1	2	0	0	0	0	0	0	0
SE - SSE	25	10	13	5	5	4	11	4	3	2	1	0	0	0	1	0	0	0	0	0
SSE - S	28	17	5	4	7	1	6	4	5	1	2	3	0	0	0	1	0	0	0	0
S - SSW	30	16	9	6	6	4	4	3	0	1	0	0	1	0	1	0	0	0	0	0
SSW - SW	33	13	14	6	4	2	3	2	0	1	2	0	0	1	0	0	1	0	0	1
SW - WSW	36	15	9	4	7	3	3	3	0	1	0	1	0	0	0	1	0	1	0	0
WSW - W	47	13	18	6	8	3	4	2	1	1	3	1	1	2	1	0	0	1	0	1
W - WNW	51	33	16	8	5	7	6	2	1	1	3	2	2	2	1	2	0	1	0	0
WNW - NW	44	15	13	5	9	2	6	2	2	2	5	3	3	3	5	0	0	3	1	0
NW - NNW	39	29	10	7	11	6	3	1	3	2	4	1	1	3	0	2	1	0	2	0
NNW - N	62	28	7	15	6	4	3	3	4	3	0	1	2	3	0	1	0	0	0	0
N - NNE	63	19	12	5	3	6	0	1	1	2	3	0	0	0	0	0	0	0	0	0

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TABLE 2A-48

SEABROOK

30 FT LEVEL

SPRING (MAR 72 - MAY 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
	HOURS OF PERSISTENCE																			
NNE - NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE - ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
ENE - E	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
E - ESE	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE - SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE - SSE	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE - S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S - SSW	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW - SW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW - WSW	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
WSW - W	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W - WNW	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
WNW - NW	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
NW - NNW	0	0	0	0	0	1	2	0	0	1	0	0	0	1	0	0	0	0	0	0
NNW - N	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
N - NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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TABLE 2A-49

SEABROOK

30 FT LEVEL

SPRING (MAR 72 - MAY 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
NNE - NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE - ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE - E	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E - ESE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE - SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE - SSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE - S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S - SSW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW - SW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW - WSW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW - W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W - WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW - NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
NW - NNW	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
NNW - N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N - NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2207 GOOD OBS USED 1 OBS MISSING 100.0 PERCENT DATA RECOVERY

TABLE 2A-50

30 FT LEVEL

SEABROOK

SUMMER (JUN 72 - AUG 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NNE - NE	38	13	2	1	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
NE - ENE	46	15	2	3	1	2	0	1	0	1	1	0	1	0	0	0	0	1	0	0
ENE - E	44	13	10	7	3	1	1	0	1	0	1	1	0	0	0	0	0	1	0	1
E - ESE	52	20	9	3	2	3	3	3	1	2	0	0	1	2	0	1	0	0	1	0
ESE - SE	53	15	18	12	7	4	4	3	0	4	3	0	1	0	1	0	0	1	0	0
SE - SSE	58	14	10	7	6	6	6	9	4	1	3	0	0	2	2	0	0	1	0	0
SSE - S	63	29	7	10	11	6	8	3	0	1	1	1	0	1	0	0	0	0	0	0
S - SSW	80	25	16	10	2	9	2	1	1	1	0	0	0	0	1	0	0	0	0	0
SSW - SW	88	33	14	13	5	4	0	2	1	1	0	0	1	1	0	0	1	0	0	0
SW - WSW	79	33	15	13	6	4	4	4	3	1	1	2	0	1	1	2	1	0	1	1
WSW - W	75	22	11	11	6	9	7	5	4	1	2	2	1	0	1	0	1	0	2	1
W - WNW	83	35	18	10	11	6	10	6	3	3	3	1	4	0	1	2	1	0	0	0
WNW - NW	71	21	13	8	5	7	6	5	6	3	2	2	1	2	1	2	0	1	0	1
NW - NNW	54	22	18	2	7	5	3	2	1	0	3	1	3	1	1	1	0	0	0	0
NNW - N	55	23	14	5	6	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0
N - NNE	43	11	7	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0

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TABLE 2A-51

30 FT LEVEL SEABROOK SUMMER (JUN 72 - AUG 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
NNE - NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE - ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE - E	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E - ESE	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
ESE - SE	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE - SSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE - S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S - SSW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW - SW	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
SW - WSW	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW - W	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
W - WNW	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
WNW - NW	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
NW - NNW	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
NNW - N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N - NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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TABLE 2A-52

SEABROOK

30 FT LEVEL SUMMER (JUN 72 - AUG 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
NNE - NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE - ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE - E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E - ESE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE - SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE - SSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE - S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S - SSW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW - SW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW - WSW	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
WSW - W	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
W - WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW - NW	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW - NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW - N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N - NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(Column heading over hours 41–60: HOURS OF PERSISTENCE)

2208 GOOD OBS USED 0 OBS MISSING 100.0 PERCENT DATA RECOVERY

TABLE 2A-53

SEABROOK

30 FT LEVEL — FALL (SEP, OCT 72 + NOV 71)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	HOURS OF PERSISTENCE																			
NNE - NE	43	17	5	5	1	0	1	1	2	2	2	0	0	1	0	0	0	0	0	1
NE - ENE	26	9	9	4	2	2	1	0	0	1	2	0	1	1	0	0	0	0	0	0
ENE - E	21	14	4	5	2	2	0	1	2	0	1	1	2	1	0	0	0	0	0	0
E - ESE	16	9	8	3	4	3	2	0	2	1	4	1	0	2	0	0	0	1	0	0
ESE - SE	17	8	3	5	6	0	5	0	1	2	2	0	0	0	1	0	0	0	0	0
SE - SSE	22	13	5	4	1	3	2	0	0	1	2	0	0	1	0	0	0	0	0	0
SSE - S	23	4	10	4	4	5	1	0	0	0	0	1	0	0	0	0	0	0	0	0
S - SSW	34	7	6	8	1	2	0	2	0	0	0	0	2	0	0	0	0	1	0	0
SSW - SW	41	18	7	5	3	3	5	0	3	1	1	0	0	0	0	1	0	0	0	0
SW - WSW	59	17	10	4	0	9	1	1	1	1	0	1	0	0	1	0	1	1	1	0
WSW - W	84	26	14	8	10	1	1	3	2	1	2	0	1	1	0	0	1	1	1	1
W - WNW	72	30	16	16	7	7	9	2	1	3	1	1	5	3	3	0	4	0	0	1
WNW - NW	62	21	10	9	6	6	9	6	4	1	3	2	1	2	2	2	1	2	1	1
NW - NNW	60	32	16	13	6	7	6	4	5	5	6	2	5	3	4	1	1	2	2	0
NNW - N	63	34	20	12	11	5	1	3	5	3	0	0	0	1	0	1	2	0	0	0
N - NNE	54	22	18	5	4	2	3	4	2	0	0	0	0	0	1	0	0	0	0	0

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TABLE 2A-54

SEABROOK

30 FT LEVEL — FALL (SEP, OCT 72 + NOV 71)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
NNE - NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE - ENE	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
ENE - E	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
E - ESE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE - SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE - SSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE - S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S - SSW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW - SW	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW - WSW	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
WSW - W	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
W - WNW	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0
WNW - NW	2	1	2	2	2	2	1	0	0	0	0	0	1	0	1	0	0	0	0	0
NW - NNW	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
NNW - N	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
N - NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

------ CONTINUED ON NEXT PAGE ------

TABLE 2A-55

SEABROOK

30 FT LEVEL

FALL (SEP, OCT 72 + NOV 71)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
	HOURS OF PERSISTENCE																			
NNE - NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE - ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE - E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E - ESE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE - SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE - SSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE - S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S - SSW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW - SW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW - WSW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW - W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W - WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW - NW	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW - NNW	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW - N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N - NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2183 GOOD OBS USED 1 OBS MISSING 100.0 PERCENT DATA RECOVERY

TABLE 2A-56

SEABROOK

30 FT LEVEL — WINTER (DEC 71 - FEB 72)

OCCURRENCES OF WIND DIRECTION PERSISTENCE -- 45.0 DEG SECTOR

WIND FROM	HOURS OF PERSISTENCE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NNE - NE	22	12	9	2	2	1	1	0	0	1	0	0	0	0	0	0	3	2	0	0
NE - ENE	22	15	2	2	1	3	2	1	0	1	1	0	0	0	0	0	0	0	0	0
ENE - E	18	9	3	2	0	3	0	0	1	1	0	0	1	0	0	0	0	0	0	0
E - ESE	18	4	1	2	1	2	1	0	2	1	1	0	0	0	0	0	0	0	0	0
ESE - SE	24	6	4	1	0	1	2	1	0	1	0	0	0	0	0	1	0	0	0	0
SE - SSE	24	12	2	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE - S	30	9	2	4	2	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0
S - SSW	30	7	6	7	6	2	1	0	2	0	0	1	0	0	0	0	0	0	0	0
SSW - SW	39	16	8	6	2	2	3	2	0	0	0	1	0	0	1	1	0	0	0	0
SW - WSW	56	19	7	8	11	4	4	2	3	0	1	0	3	0	0	0	0	0	0	0
WSW - W	65	24	9	9	6	5	3	2	1	4	3	2	3	2	1	1	2	2	0	0
W - WNW	78	34	14	7	8	6	4	3	6	4	3	4	3	2	1	0	2	0	0	0
WNW - NW	51	21	17	5	3	6	7	6	3	4	4	0	1	2	1	3	3	5	0	1
NW - NNW	64	16	13	9	10	5	3	2	0	6	4	3	1	1	3	2	1	2	1	1
NNW - N	70	33	15	7	6	10	5	3	1	4	2	2	2	3	2	2	0	0	0	0
N - NNE	42	11	7	4	4	2	0	0	0	1	1	3	1	1	0	0	0	0	0	1

TABLE 2A-57

SEABROOK

30 FT DATA SPRING (APR - MAY 72 + MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX A -- DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

DEFICIT GTE - LT		WIND FROM NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
0.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1 - 0.5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5 - 1.0		0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	0	4
	(1)	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	3.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2
1.0 - 2.0		1	2	2	5	1	4	1	0	0	0	1	0	0	0	0	0	17
	(1)	0.9	1.9	1.9	4.7	0.9	3.8	0.9	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	16.0
	(2)	0.1	0.1	0.1	0.3	0.1	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.9
2.0 - 4.0		0	2	8	1	4	5	0	0	0	0	3	0	1	1	2	1	28
	(1)	0.0	1.9	7.5	0.9	3.8	4.7	0.0	0.0	0.0	0.0	2.8	0.0	0.9	0.9	1.9	0.9	26.4
	(2)	0.0	0.1	0.4	0.1	0.2	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.1	0.1	0.1	1.4
4.0 - 8.0		5	1	3	0	0	7	4	0	0	0	1	5	8	1	2	2	39
	(1)	4.7	0.9	2.8	0.0	0.0	6.6	3.8	0.0	0.0	0.0	0.9	4.7	7.5	0.9	1.9	1.9	36.8
	(2)	0.3	0.1	0.2	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.1	0.3	0.4	0.1	0.1	0.1	2.0
8.0		0	0	0	0	0	5	1	0	0	3	5	0	2	2	0	0	18
	(1)	0.0	0.0	0.0	0.0	0.0	4.7	0.9	0.0	0.0	2.8	4.7	0.0	1.9	1.9	0.0	0.0	17.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.2	0.3	0.0	0.1	0.1	0.0	0.0	0.9
ALL		6	5	13	6	5	24	6	0	0	3	10	5	11	4	5	3	106
	(1)	5.7	4.7	12.3	5.7	4.7	22.6	5.7	0.0	0.0	2.8	9.4	4.7	10.4	3.8	4.7	2.8	100.0
	(2)	0.3	0.3	0.7	0.3	0.3	1.2	0.3	0.0	0.0	0.2	0.5	0.3	0.6	0.2	0.3	0.2	5.4

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

106 GOOD OBS WITH STABILITY A 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-58

SEABROOK

30 FT DATA — SPRING (APR - MAY 72 + MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX B -- DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1 - 0.5		0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	2
	(1)	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	2.1
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
0.5 - 1.0		0	0	1	1	0	0	0	0	0	[illegible]	0	0	0	1	0	0	3
	(1)	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	3.2
	(2)	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2
1.0 - 2.0		0	2	8	0	1	2	1	0	0	0	0	0	0	0	0	1	15
	(1)	0.0	2.1	8.5	0.0	1.1	2.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	16.0
	(2)	0.0	0.1	0.4	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.8
2.0 - 4.0		2	0	4	3	4	5	0	0	1	0	0	2	3	4	1	0	29
	(1)	2.1	0.0	4.3	3.2	4.3	5.3	0.0	0.0	1.1	0.0	0.0	2.1	3.2	4.3	1.1	0.0	30.9
	(2)	0.1	0.0	0.2	0.2	0.2	0.3	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.2	0.1	0.0	1.5
4.0 - 8.0		1	1	0	0	2	2	2	0	1	2	2	2	5	3	2	0	25
	(1)	1.1	1.1	0.0	0.0	2.1	2.1	2.1	0.0	1.1	2.1	2.1	2.1	5.3	3.2	2.1	0.0	26.6
	(2)	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.3	0.2	0.1	0.0	1.3
8.0		1	0	0	0	0	0	3	0	0	3	5	1	2	3	1	0	20
	(1)	1.1	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	3.2	5.4	1.1	2.1	3.2	1.1	0.0	21.3
	(2)	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.3	0.1	0.1	0.2	0.1	0.0	1.0
ALL		4	3	14	[illegible]	7	9	[illegible]	0	2	5	8	5	10	12	4	1	94
	(1)	4.3	3.2	14.9	4.3	7.4	9.6	6.4	0.0	2.1	5.3	8.5	5.3	10.6	12.8	4.3	1.1	100.0
	(2)	0.2	0.2	0.7	0.2	0.4	0.5	0.3	0.0	0.1	0.3	0.4	0.3	0.5	0.6	0.2	0.1	4.7

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

94 GOOD OBS WITH STABILITY B — 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-59

SEABROOK

30 FT DATA — SPRING (APR - MAY 72 + MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX C -- DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5		0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
		(1)	0.0	0.0	0.9	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8
		(2)	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.5	1.0		0	0	1	4	1	2	0	0	0	0	0	0	0	1	0	0	9
		(1)	0.0	0.0	0.9	3.5	0.9	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	7.9
		(2)	0.0	0.0	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.5
1.0	2.0		1	1	2	0	2	7	1	0	0	0	0	0	1	0	2	0	17
		(1)	0.9	0.9	1.8	0.0	1.8	6.1	0.9	0.0	0.0	0.0	0.0	0.0	0.9	0.0	1.8	0.0	14.9
		(2)	0.1	0.1	0.1	0.0	0.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.9
2.0	4.0		1	0	0	1	3	3	1	0	1	[illegible]	2	2	5	3	1	1	26
		(1)	0.9	0.0	0.0	0.9	2.6	2.6	0.9	0.0	0.9	1.8	1.8	1.8	4.4	2.6	0.9	0.9	22.8
		(2)	0.1	0.0	0.0	0.1	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.1	0.3	0.2	0.1	0.1	1.3
4.0	8.0		1	1	0	0	1	3	4	0	1	3	1	2	10	10	3	0	40
		(1)	0.9	0.9	0.0	0.0	0.9	2.6	3.5	0.0	0.9	2.6	0.9	1.8	8.8	8.8	2.6	0.0	35.1
		(2)	0.1	0.1	0.0	0.0	0.1	0.2	0.2	0.0	0.1	0.2	0.1	0.1	0.5	0.5	0.2	0.0	2.0
8.0			0	0	0	0	0	1	4	2	1	1	2	4	[illegible]	3	0	0	20
		(1)	0.0	0.0	0.0	0.0	0.0	0.9	3.5	[illegible]	0.9	0.9	1.8	3.5	1.8	2.6	0.0	0.0	17.5
		(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.0	1.0
ALL			3	2	4	5	7	17	10	2	3	6	5	8	18	17	6	1	114
		(1)	2.6	1.8	3.5	4.4	6.1	14.9	8.8	1.8	2.6	5.3	4.4	7.0	15.8	14.9	5.3	0.9	100.0
		(2)	0.2	0.1	0.2	0.3	0.4	0.9	0.5	0.1	0.2	0.3	0.3	0.4	0.9	0.9	0.3	0.1	5.8

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

114 GOOD OBS WITH STABILITY C — 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-60

SEABROOK

30 FT DATA

SPRING (APR - MAY 72 + MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX D -- DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	2	0	0	0	0	0	0	0	0	0	1	2	2	1	3	11
	(1)	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.3	1.3
	(2)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.6
0.1	0.5	10	41	15	13	13	9	9	4	0	3	4	5	10	7	4	12	159
	(1)	1.1	4.7	1.7	1.5	1.5	1.0	1.0	0.5	0.0	0.3	0.5	0.6	1.1	0.8	0.5	1.4	18.2
	(2)	0.5	2.1	0.8	0.7	0.7	0.5	0.5	0.2	0.0	0.2	0.2	0.3	0.5	0.4	0.2	0.6	8.0
0.5	1.0	8	53	35	14	7	6	3	3	0	0	1	5	3	13	8	2	161
	(1)	0.9	6.1	4.0	1.6	0.8	0.7	0.3	0.3	0.0	0.0	0.1	0.6	0.3	1.5	0.9	0.2	18.4
	(2)	0.4	2.7	1.8	0.7	0.4	0.3	0.2	0.2	0.0	0.0	0.1	0.3	0.2	0.7	0.4	0.1	8.1
1.0	2.0	4	25	38	11	12	7	6	5	4	4	4	10	11	12	20	4	177
	(1)	0.5	2.9	4.4	1.3	1.4	0.8	0.7	0.6	0.5	0.5	0.5	1.1	1.3	1.4	2.3	0.5	20.3
	(2)	0.2	1.3	1.9	0.6	0.6	0.4	0.3	0.3	0.2	0.2	0.2	0.5	0.6	0.6	1.0	0.2	8.9
2.0	4.0	13	8	10	16	8	9	5	4	5	7	4	10	23	22	8	8	160
	(1)	1.5	0.9	1.1	1.8	0.9	1.0	0.6	0.5	0.6	0.8	0.5	1.1	2.6	2.5	0.9	0.9	18.3
	(2)	0.7	0.4	0.5	0.8	0.4	0.5	0.3	0.2	0.3	0.4	0.2	0.5	1.2	1.1	0.4	0.4	8.1
4.0	8.0	4	0	3	0	3	10	8	5	8	12	13	15	17	21	9	3	131
	(1)	0.5	0.0	0.3	0.0	0.3	1.1	0.9	0.6	0.9	1.4	1.5	1.7	1.9	2.4	1.0	0.3	15.0
	(2)	0.2	0.0	0.2	0.0	0.2	0.5	0.4	0.3	0.4	0.6	0.7	0.8	0.9	1.1	0.5	0.2	6.6
8.0		0	2	0	2	0	5	6	8	7	15	9	8	8	4	0	0	74
	(1)	0.0	0.2	0.0	0.2	0.0	0.6	0.7	0.9	0.8	1.7	1.0	0.9	0.9	0.5	0.0	0.0	8.5
	(2)	0.0	0.1	0.0	0.1	0.0	0.3	0.3	0.4	0.4	0.8	0.5	0.4	0.4	0.2	0.0	0.0	3.7
ALL		39	131	101	56	43	46	37	29	24	41	35	54	74	81	50	32	873
	(1)	4.5	15.0	11.6	6.4	4.9	5.3	4.2	3.3	2.7	4.7	4.0	6.2	8.5	9.3	5.7	3.7	100.0
	(2)	2.0	6.6	5.1	2.8	2.2	2.3	1.9	1.5	1.2	2.1	1.8	2.7	3.7	4.1	2.5	1.6	44.1

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

873 GOOD OBS WITH STABILITY D   161 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-61

SEABROOK

30 FT DATA — SPRING (APR - MAY 72 + MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX F -- DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

DEFICIT GTE LT		WIND FROM NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
0.1		0	1	0	1	1	1	0	0	1	0	0	2	2	0	0	0	9
	(1)	0.0	0.2	0.0	0.2	0.2	0.2	0.0	0.0	0.2	0.0	0.0	0.4	0.4	0.0	0.0	0.0	1.8
	(2)	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.5
0.1 - 0.5		1	2	4	4	4	1	1	0	0	0	4	5	15	14	5	4	64
	(1)	0.2	0.4	0.8	0.8	0.8	0.2	0.2	0.0	0.0	0.0	0.8	1.0	3.0	2.8	1.0	0.8	12.8
	(2)	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.2	0.3	0.8	0.7	0.3	0.2	3.2
0.5 - 1.0		4	7	4	1	2	4	5	1	1	2	3	4	10	7	4	3	62
	(1)	0.8	1.4	0.8	0.2	0.4	0.8	1.0	0.2	0.2	0.4	0.6	0.8	2.0	1.4	0.8	0.6	12.4
	(2)	0.2	0.4	0.2	0.1	0.1	0.2	0.3	0.1	0.1	0.1	0.2	0.2	0.5	0.4	0.2	0.2	3.1
1.0 - 2.0		5	12	5	0	1	6	2	0	2	1	7	21	17	30	6	4	119
	(1)	1.0	2.4	1.0	0.0	0.2	1.2	0.4	0.0	0.4	0.2	1.4	4.2	3.4	6.0	1.2	0.8	23.8
	(2)	0.3	0.6	0.3	0.0	0.1	0.3	0.1	0.0	0.1	0.1	0.4	1.1	0.9	1.5	0.3	0.2	6.0
2.0 - 4.0		8	1	4	0	2	2	3	5	6	18	14	22	28	20	2	1	136
	(1)	1.6	0.2	0.8	0.0	0.4	0.4	0.6	1.0	1.2	3.6	2.8	4.4	5.6	4.0	0.4	0.2	27.3
	(2)	0.4	0.1	0.2	0.0	0.1	0.1	0.2	0.3	0.3	0.9	0.7	1.1	1.4	1.0	0.1	0.1	6.9
4.0 - 8.0		5	2	2	0	1	0	2	4	8	14	19	9	3	10	0	1	80
	(1)	1.0	0.4	0.4	0.0	0.2	0.0	0.4	0.8	1.6	2.8	3.8	1.8	0.6	2.0	0.0	0.2	16.0
	(2)	0.3	0.1	0.1	0.0	0.1	0.0	0.1	0.2	0.4	0.7	1.0	0.5	0.2	0.5	0.0	0.1	4.0
8.0		0	0	0	0	0	1	0	3	6	6	3	3	1	4	2	0	29
	(1)	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.6	1.2	1.2	0.6	0.6	0.2	0.8	0.4	0.0	5.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.3	0.3	0.2	0.2	0.1	0.2	0.1	0.0	1.5
ALL		23	25	19	6	11	15	13	13	24	41	50	66	76	8[illegible]	19	13	499
	(1)	4.6	5.0	3.8	1.2	2.2	3.0	2.6	2.6	4.8	8.2	10.0	13.2	15.2	17.0	3.8	2.6	100.0
	(2)	1.2	1.3	1.0	0.3	0.6	0.8	0.7	0.7	1.2	2.1	2.5	3.3	3.8	4.3	1.0	0.7	25.2

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

499 GOOD OBS WITH STABILITY E — 46 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-62

SEABROOK

30 FT DATA — SPRING (APR - MAY 72 + MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX F -- DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	5
	(1)	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4	0.7	0.0	0.0	3.5
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.3
0.1	0.5	0	0	0	0	0	0	0	1	0	3	2	1	2	5	2	1	17
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	2.1	1.4	0.7	1.4	3.5	1.4	0.7	12.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.1	0.1	0.1	0.3	0.1	0.1	0.9
0.5	1.0	0	0	0	0	1	0	0	0	1	1	2	1	2	4	1	0	13
	(1)	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.7	0.7	1.4	0.7	1.4	2.8	0.7	0.0	9.2
	(2)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.7
1.0	2.0	1	1	1	2	1	3	2	0	1	[illegible]	1	6	9	9	7	2	48
	(1)	0.7	0.7	0.7	1.4	0.7	2.1	1.4	0.0	0.7	1.4	0.7	4.3	6.4	6.4	5.0	1.4	34.0
	(2)	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.1	0.1	0.1	0.3	0.5	0.5	0.4	0.1	2.4
2.0	4.0	1	1	0	0	0	1	0	0	0	2	3	5	10	7	2	0	32
	(1)	0.7	0.7	0.0	0.0	0.0	0.7	0.0	0.0	0.0	1.4	2.1	3.5	7.1	5.0	1.4	0.0	22.7
	(2)	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.3	0.5	0.4	0.1	0.0	1.6
4.0	8.0	1	0	0	0	0	0	2	0	2	4	2	2	6	3	2	1	25
	(1)	0.7	0.0	0.0	0.0	0.0	0.0	1.4	0.0	1.4	2.9	1.4	1.4	4.3	2.1	1.4	0.7	17.7
	(2)	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.1	0.3	0.2	0.1	0.1	1.3
8.0		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL		3	2	2	2	2	4	4	1	4	13	10	16	31	29	14	4	141
	(1)	2.1	1.4	1.4	1.4	1.4	2.8	2.8	0.7	2.8	9.2	7.1	11.3	22.0	20.6	9.9	2.8	100.0
	(2)	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.7	0.5	0.8	1.6	1.5	0.7	0.2	7.1

(WIND FROM)

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

141 GOOD OBS WITH STABILITY F — 8 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-63

SEABROOK

30 FT DATA

SPRING (APR - MAY 72 + MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX C -- DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

DEFICIT GTF	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	1	1	0	0	0	0	0	1	1	1	2	0	4	1	1	1	14
	(1)	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	1.3	0.0	2.6	0.6	0.6	0.6	9.1
	(2)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.7
0.1	0.5	1	0	0	0	0	0	0	1	0	0	0	6	18	3	0	0	29
	(1)	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	3.9	11.7	1.9	0.0	0.0	18.8
	(2)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.9	0.2	0.0	0.0	1.5
0.5	1.0	1	0	1	0	0	1	0	1	0	0	1	3	10	7	3	1	29
	(1)	0.6	0.0	0.6	0.0	0.0	0.6	0.0	0.6	0.0	0.0	0.6	1.9	6.5	4.5	1.9	0.6	18.8
	(2)	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.2	0.5	0.4	0.2	0.1	1.5
1.0	2.0	0	0	1	0	1	4	1	0	1	2	4	3	14	7	2	0	40
	(1)	0.0	0.0	0.6	0.0	0.6	2.6	0.6	0.0	0.6	1.3	2.6	1.9	9.1	4.5	1.3	0.0	26.0
	(2)	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.1	0.1	0.2	0.2	0.7	0.4	0.1	0.0	2.0
2.0	4.0	0	1	0	3	2	0	1	1	1	2	3	3	12	3	1	0	33
	(1)	0.0	0.6	0.0	1.9	1.3	0.0	0.6	0.6	0.6	1.3	1.9	1.9	7.8	1.9	0.6	0.0	21.4
	(2)	0.0	0.1	0.0	0.2	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.6	0.2	0.1	0.0	1.7
4.0	8.0	0	0	0	0	0	0	0	0	1	0	0	2	2	1	1	1	8
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	1.3	1.3	0.6	0.6	0.6	5.2
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.4
8.0		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL		3	2	2	3	3	5	2	5	4	5	10	17	60	22	8	3	154
	(1)	1.9	1.3	1.3	1.9	1.9	3.2	1.3	3.2	2.6	3.2	6.5	11.0	39.0	14.3	5.2	1.9	100.0
	(2)	0.2	0.1	0.1	0.2	0.2	0.3	0.1	0.3	0.2	0.3	0.5	0.9	3.0	1.1	0.4	0.2	7.8

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

154 GOOD OBS WITH STABILITY G   7 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-64

SEABROOK

30 FT DATA — SPRING (APR - MAY 72 + MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

TOTALS FOR ALL GOOD DELTA T STABILITIES

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		1	4	1	1	1	1	0	1	2	1	2	4	10	4	2	4	39
		(1)	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.5	0.2	0.1	0.2	2.0
		(2)	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.5	0.2	0.1	0.2	2.0
0.1	0.5		12	43	21	17	17	11	10	6	0	6	10	17	45	30	11	17	273
		(1)	0.6	2.2	1.1	0.9	0.9	0.6	0.5	0.3	0.0	0.3	0.5	0.9	2.3	1.5	0.6	0.9	13.8
		(2)	0.6	2.2	1.1	0.9	0.9	0.6	0.5	0.3	0.0	0.3	0.5	0.9	2.3	1.5	0.6	0.9	13.8
0.5	1.0		13	60	42	20	11	16	8	5	2	3	7	13	25	33	17	6	281
		(1)	0.7	3.0	2.1	1.0	0.6	0.8	0.4	0.3	0.1	0.2	0.4	0.7	1.3	1.7	0.9	0.3	14.2
		(2)	0.7	3.0	2.1	1.0	0.6	0.8	0.4	0.3	0.1	0.2	0.4	0.7	1.3	1.7	0.9	0.3	14.2
1.0	2.0		12	43	57	18	19	33	14	5	8	9	17	40	52	58	37	11	433
		(1)	0.6	2.2	2.9	0.9	1.0	1.7	0.7	0.3	0.4	0.5	0.9	2.0	2.6	2.9	1.9	0.6	21.9
		(2)	0.6	2.2	2.9	0.9	1.0	1.7	0.7	0.3	0.4	0.5	0.9	2.0	2.6	2.9	1.9	0.6	21.9
2.0	4.0		25	13	26	24	23	25	10	10	14	31	29	44	82	60	17	11	444
		(1)	1.3	0.7	1.3	1.2	1.2	1.3	0.5	0.5	0.7	1.6	1.5	2.2	4.1	3.0	0.9	0.6	22.4
		(2)	1.3	0.7	1.3	1.2	1.2	1.3	0.5	0.5	0.7	1.6	1.5	2.2	4.1	3.0	0.9	0.6	22.4
4.0	8.0		17	5	8	0	7	22	22	9	21	35	38	37	51	49	19	8	348
		(1)	0.9	0.3	0.4	0.0	0.4	1.1	1.1	0.5	1.1	1.8	1.9	1.9	2.6	2.5	1.0	0.4	17.6
		(2)	0.9	0.3	0.4	0.0	0.4	1.1	1.1	0.5	1.1	1.8	1.9	1.9	2.6	2.5	1.0	0.4	17.6
8.0			1	2	0	2	0	12	14	14	14	29	25	16	15	16	3	0	163
		(1)	0.1	0.1	0.0	0.1	0.0	0.6	0.7	0.7	0.7	1.5	1.3	0.8	0.8	0.8	0.2	0.0	8.2
		(2)	0.1	0.1	0.0	0.1	0.0	0.6	0.7	0.7	0.7	1.5	1.3	0.8	0.8	0.8	0.2	0.0	8.2
ALL			81	170	155	82	78	120	78	50	61	114	128	171	280	250	106	57	1981
		(1)	4.1	8.6	7.8	4.1	3.9	6.1	3.9	2.5	3.1	5.8	6.5	8.6	14.1	12.6	5.4	2.9	100.0
		(2)	4.1	8.6	7.8	4.1	3.9	6.1	3.9	2.5	3.1	5.8	6.5	8.6	14.1	12.6	5.4	2.9	100.0

(WIND FROM: NNE through N)

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

2208 OBS EXAMINED — 1981 GOOD OBS WERE FOUND AND USED (89.7 PCT)

TABLE 2A-65

SEABROOK

30 FT DATA

SUMMER (JUN 72 - AUG 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX A -- DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
		WIND FROM																
	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1 - 0.5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5 - 1.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0 - 2.0		0	0	2	1	1	0	0	0	0	0	0	0	0	0	1	0	5
	(1)	0.0	0.0	2.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	5.3
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
2.0 - 4.0		0	0	0	3	1	2	1	0	0	0	1	1	0	0	0	0	9
	(1)	0.0	0.0	0.0	3.2	1.1	2.1	1.1	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0	9.6
	(2)	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
4.0 - 8.0		0	0	5	5	4	4	2	0	1	2	5	3	6	7	1	0	45
	(1)	0.0	0.0	5.3	5.3	4.3	4.3	2.1	0.0	1.1	2.1	5.3	3.2	6.4	7.4	1.1	0.0	47.9
	(2)	0.0	0.0	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.1	0.2	0.1	0.3	0.3	0.0	0.0	2.1
8.0		0	0	2	0	1	1	2	0	0	1	1	6	9	10	1	0	34
	(1)	0.0	0.0	2.1	0.0	1.1	1.1	2.1	0.0	0.0	1.1	1.1	6.4	9.6	10.6	1.1	0.0	36.2
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.4	0.5	0.0	0.0	1.6
ALL		0	0	9	9	7	7	5	0	1	3	7	10	15	17	4	0	94
	(1)	0.0	0.0	9.6	9.6	7.4	7.4	5.3	0.0	1.1	3.2	7.4	10.6	16.0	18.1	4.3	0.0	100.0
	(2)	0.0	0.0	0.4	0.4	0.3	0.3	0.2	0.0	0.0	0.1	0.3	0.5	0.7	0.8	0.2	0.0	4.3

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

94 GOOD OBS WITH STABILITY A   0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-66

SEABROOK

30 FT DATA

SUMMER (JUN 72 - AUG 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX B -- DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4	0.0	2.8
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.5	1.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	2.0		0	0	3	1	0	2	0	0	0	0	0	0	0	0	0	0	6
		(1)	0.0	0.0	4.2	1.4	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5
		(2)	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
2.0	4.0		0	3	0	0	4	2	0	0	0	1	0	1	2	0	0	1	14
		(1)	0.0	4.2	0.0	0.0	5.6	2.8	0.0	0.0	0.0	1.4	0.0	1.4	2.8	0.0	0.0	1.4	19.7
		(2)	0.0	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.6
4.0	8.0		1	0	0	3	3	4	3	0	0	0	0	2	5	3	1	0	25
		(1)	1.4	0.0	0.0	4.2	4.2	5.6	4.2	0.0	0.0	0.0	0.0	2.8	7.0	4.2	1.4	0.0	35.2
		(2)	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0	1.2
8.0			0	0	0	0	1	0	1	0	0	2	4	3	4	7	1	0	23
		(1)	0.0	0.0	0.0	0.0	1.4	0.0	1.4	0.0	0.0	2.8	5.6	4.2	5.6	9.9	1.4	0.0	32.4
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.2	0.3	0.0	0.0	1.1
ALL			1	3	3	4	8	8	4	0	0	3	4	6	11	11	3	2	71
		(1)	1.4	4.2	4.2	5.6	11.3	11.3	5.6	0.0	0.0	4.2	5.6	8.5	15.5	15.5	4.2	2.8	100.0
		(2)	0.0	0.1	0.1	0.2	0.4	0.4	0.2	0.0	0.0	0.1	0.2	0.3	0.5	0.5	0.1	0.1	3.3

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

71 GOOD OBS WITH STABILITY B 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-67

SEABROOK

30 FT DATA

SUMMER (JUN 72 - AUG 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX C -- DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

DEFICIT GTF	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
	(1)	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.1	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	1.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	(1)	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	2.0	0	0	1	4	1	0	0	0	0	0	0	0	1	0	0	0	7
	(1)	0.0	0.0	0.8	3.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	5.6
	(2)	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
2.0	4.0	0	0	0	0	10	5	2	0	0	1	1	0	0	1	1	0	21
	(1)	0.0	0.0	0.0	0.0	8.0	4.0	1.6	0.0	0.0	0.8	0.8	0.0	0.0	0.8	0.8	0.0	16.8
	(2)	0.0	0.0	0.0	0.0	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
4.0	8.0	0	2	1	4	7	4	3	0	0	2	9	4	1	4	1	1	43
	(1)	0.0	1.6	0.8	3.2	5.6	3.2	2.4	0.0	0.0	1.6	7.2	3.2	0.8	3.2	0.8	0.8	34.4
	(2)	0.0	0.1	0.0	0.2	0.3	0.2	0.1	0.0	0.0	0.1	0.4	0.2	0.0	0.2	0.0	0.0	2.0
8.0		0	0	0	0	2	3	1	0	0	2	6	9	11	11	4	1	50
	(1)	0.0	0.0	0.0	0.0	1.6	2.4	0.8	0.0	0.0	1.6	4.8	7.2	8.8	8.8	3.2	0.8	40.0
	(2)	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.3	0.4	5	0.5	0.2	0.0	2.3
ALL		[illegible]	2	2	8	20	12	6	0	0	5	16	13	13	16	7	3	125
	(1)	1.6	1.6	1.6	6.4	16.0	9.6	4.8	0.0	0.0	4.0	12.8	10.4	10.4	12.8	5.6	2.4	100.0
	(2)	0.1	0.1	0.1	0.4	0.9	0.6	0.3	0.0	0.0	0.2	0.7	0.6	0.6	0.7	0.3	0.1	5.8

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

125 GOOD OBS WITH STABILITY C   0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-68

SEABROOK

30 FT DATA SUMMER (JUN 72 - AUG 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX D -- DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

DEFICIT GTE	DEFICIT LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5		1	2	0	1	1	1	0	1	1	0	0	0	0	0	1	1	10
		(1)	0.1	0.2	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	1.2
		(2)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
0.5	1.0		1	6	13	7	3	3	4	5	2	0	0	2	1	2	4	4	57
		(1)	0.1	0.7	1.5	0.8	0.4	0.4	0.5	0.6	0.2	0.0	0.0	0.2	0.1	0.2	0.5	0.5	6.8
		(2)	0.0	0.3	0.6	0.3	0.1	0.1	0.2	0.2	0.1	0.0	0.0	0.1	0.0	0.1	0.2	0.2	2.6
1.0	2.0		4	5	35	24	21	23	11	13	12	14	8	4	10	11	4	1	200
		(1)	0.5	0.6	4.2	2.9	2.5	2.7	1.3	1.5	1.4	1.7	1.0	0.5	1.2	1.3	0.5	0.1	23.8
		(2)	0.2	0.2	1.6	1.1	1.0	1.1	0.5	0.6	0.6	0.6	0.4	0.2	0.5	0.5	0.2	0.0	9.2
2.0	4.0		4	1	6	6	28	22	10	4	10	20	19	16	6	14	6	8	180
		(1)	0.5	0.1	0.7	0.7	3.3	2.6	1.2	0.5	1.2	2.4	2.3	1.9	0.7	1.7	0.7	1.0	21.4
		(2)	0.2	0.0	0.3	0.3	1.3	1.0	0.5	0.2	0.5	0.9	0.9	0.7	0.3	0.6	0.3	0.4	8.3
4.0	8.0		3	3	2	2	39	35	21	1	8	25	41	20	12	18	3	2	235
		(1)	0.4	0.4	0.2	0.2	4.6	4.2	2.5	0.1	1.0	3.0	4.9	2.4	1.4	2.1	0.4	0.2	28.0
		(2)	0.1	0.1	0.1	0.1	1.8	1.6	1.0	0.0	0.4	1.2	1.9	0.9	0.6	0.8	0.1	0.1	10.9
8.0			0	1	2	1	4	9	12	5	13	33	29	12	18	13	4	1	157
		(1)	0.0	0.1	0.2	0.1	0.5	1.1	1.4	0.6	1.5	3.9	3.5	1.4	2.1	1.5	0.5	0.1	18.7
		(2)	0.0	0.0	0.1	0.0	0.2	0.4	0.6	0.2	0.6	1.5	1.3	0.6	0.8	0.6	0.2	0.0	7.3
ALL			13	18	58	41	96	93	58	29	46	92	97	54	47	58	22	18	840
		(1)	1.5	2.1	6.9	4.9	11.4	11.1	6.9	3.5	5.5	11.0	11.5	6.4	5.6	6.9	2.6	2.1	100.0
		(2)	0.6	0.8	2.7	1.9	4.4	4.3	2.7	1.3	2.1	4.3	4.5	2.5	2.2	2.7	1.0	0.8	38.8

(WIND FROM: NNE through N)

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

840 GOOD OBS WITH STABILITY D 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-69

SEABROOK

30 FT DATA — SUMMER (JUN 72 - AUG 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX E -- DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	3
	(1)	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.5
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.1	0.5	0	1	1	0	2	1	0	1	1	1	0	1	0	0	0	2	11
	(1)	0.0	0.2	0.2	0.0	0.3	0.2	0.0	0.2	0.2	0.2	0.0	0.2	0.0	0.0	0.0	0.3	1.8
	(2)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5
0.5	1.0	3	7	9	12	5	7	4	3	8	6	9	10	7	2	3	2	97
	(1)	0.5	1.2	1.5	2.0	0.8	1.2	0.7	0.5	1.3	1.0	1.5	1.7	1.2	0.3	0.5	0.3	16.2
	(2)	0.1	0.3	0.4	0.6	0.2	0.3	0.2	0.1	0.4	0.3	0.4	0.5	0.3	0.1	0.1	0.1	4.5
1.0	2.0	2	0	8	5	5	10	8	10	9	24	29	21	20	5	1	1	158
	(1)	0.3	0.0	1.3	0.8	0.8	1.7	1.3	1.7	1.5	4.0	4.8	3.5	3.3	0.8	0.2	0.2	26.4
	(2)	0.1	0.0	0.4	0.2	0.2	0.5	0.4	0.5	0.4	1.1	1.3	1.0	0.9	0.2	0.0	0.0	7.3
2.0	4.0	0	5	4	1	7	7	10	10	12	24	27	27	17	9	0	2	162
	(1)	0.0	0.8	0.7	0.2	1.2	1.2	1.7	1.7	2.0	4.0	4.5	4.5	2.8	1.5	0.0	0.3	27.0
	(2)	0.0	0.2	0.2	0.0	0.3	0.3	0.5	0.5	0.6	1.1	1.2	1.2	0.8	0.4	0.0	0.1	7.5
4.0	8.0	1	4	1	1	2	8	20	10	12	27	26	12	4	4	2	0	134
	(1)	0.2	0.7	0.2	0.2	0.3	1.3	3.3	1.7	2.0	4.5	4.3	2.0	0.7	0.7	0.3	0.0	22.4
	(2)	0.0	0.2	0.0	0.0	0.1	0.4	0.9	0.5	0.6	1.2	1.2	0.6	0.2	0.2	0.1	0.0	6.2
8.0		0	0	0	0	0	1	4	1	4	2	5	8	5	2	2	0	34
	(1)	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.2	0.7	0.3	0.8	1.3	0.8	0.3	0.3	0.0	5.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.1	0.2	0.4	0.2	0.1	0.1	0.0	1.6
ALL		6	17	23	20	21	34	46	35	46	84	96	79	53	23	9	7	599
	(1)	1.0	2.8	3.8	3.3	3.5	5.7	7.7	5.8	7.7	14.0	16.0	13.2	8.8	3.8	1.5	1.2	100.0
	(2)	0.3	0.8	1.1	0.9	1.0	1.6	2.1	1.6	2.1	3.9	4.4	3.7	2.4	1.1	0.4	0.3	27.7

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

599 GOOD OBS WITH STABILITY E — 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-70

SEABROOK

30 FT DATA

SUMMER (JUN 72 - AUG 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX F -- DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5	0	0	0	2	0	0	0	0	0	0	3	0	2	2	0	0	9
	(1)	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.9	0.9	0.0	0.0	3.9
	(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.4
0.5	1.0	0	0	0	1	1	0	1	4	2	3	3	4	10	5	1	0	35
	(1)	0.0	0.0	0.0	0.4	0.4	0.0	0.4	1.7	0.9	1.3	1.3	1.7	4.4	2.2	0.4	0.0	15.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.2	0.5	0.2	0.0	0.0	1.6
1.0	2.0	1	0	1	2	2	4	2	0	1	4	11	14	18	7	1	0	68
	(1)	0.4	0.0	0.4	0.9	0.9	1.7	0.9	0.0	0.4	1.7	4.8	6.1	7.9	3.1	0.4	0.0	29.7
	(2)	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0	0.0	0.2	0.5	0.6	0.8	0.3	0.0	0.0	3.1
2.0	4.0	0	0	1	2	1	5	4	3	7	8	13	10	12	5	0	1	72
	(1)	0.0	0.0	0.4	0.9	0.4	2.2	1.7	1.3	3.1	3.5	5.7	4.4	5.2	2.2	0.0	0.4	31.4
	(2)	0.0	0.0	0.0	0.1	0.0	0.2	0.2	0.1	0.3	0.4	0.6	0.5	0.6	0.2	0.0	0.0	3.3
4.0	8.0	0	0	1	1	0	0	3	3	3	7	9	5	1	4	0	0	37
	(1)	0.0	0.0	0.4	0.4	0.0	0.0	1.3	1.3	1.3	3.1	3.9	2.2	0.4	1.7	0.0	0.0	16.2
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.2	0.0	0.2	0.0	0.0	1.7
8.0		0	0	0	0	0	1	0	0	0	4	0	1	2	0	0	0	8
	(1)	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	1.7	0.0	0.4	0.9	0.0	0.0	0.0	3.5
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.4
ALL		1	0	3	8	4	10	10	10	13	26	39	34	45	23	2	1	229
	(1)	0.4	0.0	1.3	3.5	1.7	4.4	4.4	4.4	5.7	11.4	17.0	14.8	19.7	10.0	0.9	0.4	100.0
	(2)	0.0	0.0	0.1	0.4	0.2	0.5	0.5	0.5	0.6	1.2	1.8	1.6	2.1	1.1	0.1	0.0	10.6

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

229 GOOD OBS WITH STABILITY F   0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-71

SEABROOK

30 FT DATA SUMMER (JUN 72 - AUG 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX G -- DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5	0	0	0	1	0	0	0	0	0	1	1	6	5	2	1	1	18
	(1)	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.5	2.9	2.4	1.0	0.5	0.5	8.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.1	0.0	0.0	0.8
0.5	1.0	1	1	0	2	0	1	2	1	0	2	2	8	26	5	1	0	52
	(1)	0.5	0.5	0.0	1.0	0.0	0.5	1.0	0.5	0.0	1.0	1.0	3.9	12.6	2.4	0.5	0.0	25.2
	(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.4	1.2	0.2	0.0	0.0	2.4
1.0	2.0	1	1	3	4	1	3	4	0	3	2	10	12	26	3	0	2	75
	(1)	0.5	0.5	1.5	1.9	0.5	1.5	1.9	0.0	1.5	1.0	4.9	5.8	12.6	1.5	0.0	1.0	36.4
	(2)	0.0	0.0	0.1	0.2	0.0	0.1	0.2	0.0	0.1	0.1	0.5	0.6	1.2	0.1	0.0	0.1	3.5
2.0	4.0	0	0	0	0	3	0	1	3	1	1	8	9	13	4	0	0	43
	(1)	0.0	0.0	0.0	0.0	1.5	0.0	0.5	1.5	0.5	0.5	3.9	4.4	6.3	1.9	0.0	0.0	20.9
	(2)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.4	0.4	0.6	0.2	0.0	0.0	2.0
4.0	8.0	0	0	0	0	0	0	0	2	0	3	1	2	5	3	0	0	16
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.5	0.5	1.0	2.4	1.5	0.0	0.0	7.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.0	0.7
8.0		0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	1.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL		2	2	3	7	4	4	7	6	4	10	22	37	76	17	2	3	206
	(1)	1.0	1.0	1.5	3.4	1.9	1.9	3.4	2.9	1.9	4.9	10.7	18.0	36.9	8.3	1.0	1.5	100.0
	(2)	0.1	0.1	0.1	0.3	0.2	0.2	0.3	0.3	0.2	0.5	1.0	1.7	3.5	0.8	0.1	0.1	9.5

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

206 GOOD OBS WITH STABILITY G 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-72

SEABROOK

30 FT DATA SUMMER (JUN 72 - AUG 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

TOTALS FOR ALL GOOD DELTA T STABILITIES

DEFICIT GTE LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
0.1		1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	2	6
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3
0.1 - 0.5		1	3	1	4	3	2	0	2	2	2	4	7	7	5	4	4	51
	(1)	0.0	0.1	0.0	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.2	0.2	0.2	2.4
	(2)	0.0	0.1	0.0	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.2	0.2	0.2	2.4
0.5 - 1.0		6	14	22	22	9	11	11	13	12	11	14	24	44	14	10	7	244
	(1)	0.3	0.6	1.0	1.0	0.4	0.5	0.5	0.6	0.6	0.5	0.6	1.1	2.0	0.6	0.5	0.3	11.3
	(2)	0.3	0.6	1.0	1.0	0.4	0.5	0.5	0.6	0.6	0.5	0.6	1.1	2.0	0.6	0.5	0.3	11.3
1.0 - 2.0		8	6	53	41	31	42	25	23	25	44	58	51	75	26	7	4	519
	(1)	0.4	0.3	2.4	1.9	1.4	1.9	1.2	1.1	1.2	2.0	2.7	2.4	3.5	1.2	0.3	0.2	24.0
	(2)	0.4	0.3	2.4	1.9	1.4	1.9	1.2	1.1	1.2	2.0	2.7	2.4	3.5	1.2	0.3	0.2	24.0
2.0 - 4.0		4	9	11	12	54	43	28	20	30	55	69	64	50	33	7	12	501
	(1)	0.2	0.4	0.5	0.6	2.5	2.0	1.3	0.9	1.4	2.5	3.2	3.0	2.3	1.5	0.3	0.6	23.2
	(2)	0.2	0.4	0.5	0.6	2.5	2.0	1.3	0.9	1.4	2.5	3.2	3.0	2.3	1.5	0.3	0.6	23.2
4.0 - 8.0		5	9	10	16	55	55	52	16	24	66	91	48	34	43	8	3	535
	(1)	0.2	0.4	0.5	0.7	2.5	2.5	2.4	0.7	1.1	3.0	4.2	2.2	1.6	2.0	0.4	0.1	24.7
	(2)	0.2	0.4	0.5	0.7	2.5	2.5	2.4	0.7	1.1	3.0	4.2	2.2	1.6	2.0	0.4	0.1	24.7
8.0		0	1	4	1	8	15	20	6	17	45	45	39	50	43	12	2	308
	(1)	0.0	0.0	0.2	0.0	0.4	0.7	0.9	0.3	0.8	2.1	2.1	1.8	2.3	2.0	0.6	0.1	14.2
	(2)	0.0	0.0	0.2	0.0	0.4	0.7	0.9	0.3	0.8	2.1	2.1	1.8	2.3	2.0	0.6	0.1	14.2
ALL		25	42	101	97	160	168	136	80	110	223	281	233	260	165	49	34	2164
	(1)	1.2	1.9	4.7	4.5	7.4	7.8	6.3	3.7	5.1	10.3	13.0	10.8	12.0	7.6	2.3	1.6	100.0
	(2)	1.2	1.9	4.7	4.5	7.4	7.8	6.3	3.7	5.1	10.3	13.0	10.8	12.0	7.6	2.3	1.6	100.0

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

2208 OBS EXAMINED 2164 GOOD OBS WERE FOUND AND USED (98.0 PCT)

SB 1 & 2 FSAR

TABLE 2A-73

SEABROOK

30 FT DATA — FALL (SEP 72 - NOV 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX A -- DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

DEFICIT GTE	LT		WIND FROM NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
		(1)	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
		(2)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.5	1.0		0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	2
		(1)	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	3.1
		(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
1.0	2.0		0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	4
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0	1.6	6.3
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.2
2.0	4.0		2	2	5	2	1	0	0	0	0	0	2	1	4	1	1	1	22
		(1)	3.1	3.1	7.8	3.1	1.6	0.0	0.0	0.0	0.0	0.0	3.1	1.6	6.3	1.6	1.6	1.6	34.4
		(2)	0.1	0.1	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.1	1.1
4.0	8.0		0	0	7	2	2	0	0	0	0	1	0	1	6	8	1	5	33
		(1)	0.0	0.0	10.9	3.1	3.1	0.0	0.0	0.0	0.0	1.6	0.0	1.6	9.4	12.5	1.6	7.8	51.6
		(2)	0.0	0.0	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.4	0.1	0.3	1.7
8.0			0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	1.6	0.0	3.1
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1
ALL			2	2	13	4	4	0	0	0	0	1	2	2	14	10	3	7	64
		(1)	3.1	3.1	20.3	6.3	6.3	0.0	0.0	0.0	0.0	1.6	3.1	3.1	21.9	15.6	4.7	10.9	100.0
		(2)	0.1	0.1	0.7	0.2	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.7	0.5	0.2	0.4	3.3

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

64 GOOD OBS WITH STABILITY A — 4 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-74

SEABROOK

30 FT DATA

FALL (SEP 72 - NOV 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX B -- DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

DEFICIT GTE LT		WIND FROM NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
0.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1 - 0.5		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	(1)	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
	(2)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.5 - 1.0		0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.9	0.0	0.0	4.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2
1.0 - 2.0		0	1	1	0	1	0	0	0	0	0	0	2	1	0	1	1	8
	(1)	0.0	1.5	1.5	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	2.9	1.5	0.0	1.5	1.5	11.8
	(2)	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.4
2.0 - 4.0		1	2	3	1	1	1	1	0	0	0	0	1	3	3	3	2	22
	(1)	1.5	2.9	4.4	1.5	1.5	1.5	1.5	0.0	0.0	0.0	0.0	1.5	4.4	4.4	4.4	2.9	32.4
	(2)	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	1.1
4.0 - 8.0		1	0	4	0	0	0	1	0	0	2	4	2	7	5	2	0	28
	(1)	1.5	0.0	5.9	0.0	0.0	0.0	1.5	0.0	0.0	2.9	5.9	2.9	10.3	7.4	2.9	0.0	41.2
	(2)	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.1	0.4	0.3	0.1	0.0	1.4
8.0		0	0	0	0	0	1	0	0	0	0	0	0	3	2	0	0	6
	(1)	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	4.4	2.9	0.0	0.0	8.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.3
ALL		2	4	8	1	2	2	2	0	0	2	4	5	15	12	6	3	68
	(1)	2.9	5.9	11.8	1.5	2.9	2.9	2.9	0.0	0.0	2.9	5.9	7.4	22.1	17.6	8.8	4.4	100.0
	(2)	0.1	0.2	0.4	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.3	0.8	0.6	0.3	0.2	3.5

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

68 GOOD OBS WITH STABILITY B   10 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-75

SEABROOK

30 FT DATA

FALL (SEP 72 - NOV 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX C -- DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
		(1)	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
		(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.1	0.5		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
		(1)	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
		(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.5	1.0		0	0	2	0	0	0	0	0	0	0	0	0	1	1	0	0	4
		(1)	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4	0.0	0.0	5.6
		(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2
1.0	2.0		1	0	2	2	0	0	0	0	0	0	0	0	1	3	0	1	10
		(1)	1.4	0.0	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	4.2	0.0	1.4	14.1
		(2)	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.5
2.0	4.0		2	0	1	0	0	0	0	0	0	1	1	0	3	2	1	0	11
		(1)	2.8	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4	0.0	4.2	2.8	1.4	0.0	15.5
		(2)	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.2	0.1	0.1	0.0	0.6
4.0	8.0		0	0	1	1	2	2	1	0	1	3	1	3	7	2	2	0	26
		(1)	0.0	0.0	1.4	1.4	2.8	2.8	1.4	0.0	1.4	4.2	1.4	4.2	9.9	2.8	2.8	0.0	36.6
		(2)	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.1	0.2	0.4	0.1	0.1	0.0	1.3
8.0			0	0	0	0	0	2	0	0	1	0	0	6	4	5	0	0	18
		(1)	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	1.4	0.0	0.0	8.5	5.6	7.0	0.0	0.0	25.4
		(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.3	0.2	0.3	0.0	0.0	0.9
ALL			3	0	6	5	2	4	1	0	2	4	2	9	16	13	3	1	71
		(1)	4.2	0.0	8.5	7.0	2.8	5.6	1.4	0.0	2.8	5.6	2.8	12.7	22.5	18.3	4.2	1.4	100.0
		(2)	0.2	0.0	0.3	0.3	0.1	0.2	0.1	0.0	0.1	0.2	0.1	0.5	0.8	0.7	0.2	0.1	3.6

(WIND FROM: NNE through N)

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

71 GOOD OBS WITH STABILITY C 4 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-76

SEABROOK

30 FT DATA

FALL (SEP 72 - NOV 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX D -- DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
	(1)	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
	(2)	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.1	0.5	10	5	6	0	1	0	1	0	2	0	1	2	2	9	6	16	61
	(1)	1.4	0.7	0.9	0.0	0.1	0.0	0.1	0.0	0.3	0.0	0.1	0.3	0.3	1.3	0.9	2.3	8.7
	(2)	0.5	0.3	0.3	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.5	0.3	0.8	3.1
0.5	1.0	6	4	17	1	0	2	1	2	0	0	2	4	8	15	8	29	99
	(1)	0.9	0.6	2.4	0.1	0.0	0.3	0.1	0.3	0.0	0.0	0.3	0.6	1.1	2.1	1.1	4.1	14.1
	(2)	0.3	0.2	0.9	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.4	0.8	0.4	1.5	5.1
1.0	2.0	27	32	28	11	3	9	4	1	6	7	10	8	10	16	17	22	211
	(1)	3.9	4.6	4.0	1.6	0.4	1.3	0.6	0.1	0.9	1.0	1.4	1.1	1.4	2.3	2.4	3.1	30.1
	(2)	1.4	1.6	1.4	0.6	0.2	0.5	0.2	0.1	0.3	0.4	0.5	0.4	0.5	0.8	0.9	1.1	10.8
2.0	4.0	6	6	3	10	20	11	9	9	5	10	9	13	19	23	8	2	163
	(1)	0.9	0.9	0.4	1.4	2.9	1.6	1.3	1.3	0.7	1.4	1.3	1.9	2.7	3.3	1.1	0.3	23.3
	(2)	0.3	0.3	0.2	0.5	1.0	0.6	0.5	0.5	0.3	0.5	0.5	0.7	1.0	1.2	0.4	0.1	8.4
4.0	8.0	0	1	2	2	21	5	3	4	2	25	18	9	20	11	3	4	130
	(1)	0.0	0.1	0.3	0.3	3.0	0.7	0.4	0.6	0.3	3.6	2.6	1.3	2.9	1.6	0.4	0.6	18.6
	(2)	0.0	0.1	0.1	0.1	1.1	0.3	0.2	0.2	0.1	1.3	0.9	0.5	1.0	0.6	0.2	0.2	6.7
8.0		0	0	0	0	1	0	0	1	1	1	9	7	9	5	0	0	34
	(1)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	1.3	1.0	1.3	0.7	0.0	0.0	4.9
	(2)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.5	0.4	0.5	0.3	0.0	0.0	1.7
ALL		49	48	56	26	46	27	18	17	16	43	49	43	68	79	42	73	700
	(1)	7.0	6.9	8.0	3.7	6.6	3.9	2.6	2.4	2.3	6.1	7.0	6.1	9.7	11.3	6.0	10.4	100.0
	(2)	2.5	2.5	2.9	1.3	2.4	1.4	0.9	0.9	0.8	2.2	2.5	2.2	3.5	4.1	2.2	3.7	36.0

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

700 GOOD OBS WITH STABILITY D 75 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-77

SEABROOK

30 FT DATA

FALL (SEP 72 - NOV 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX E -- DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	5
		(1)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.8
		(2)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.3
0.1	0.5		3	2	3	1	2	1	0	1	1	1	2	2	11	10	4	2	46
		(1)	0.5	0.3	0.5	0.2	0.3	0.2	0.0	0.2	0.2	0.2	0.3	0.3	1.7	1.6	0.6	0.3	7.1
		(2)	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.6	0.5	0.2	0.1	2.4
0.5	1.0		4	2	5	6	7	1	1	4	4	7	6	15	10	21	13	7	113
		(1)	0.6	0.3	0.8	0.9	1.1	0.2	0.2	0.6	0.6	1.1	0.9	2.3	1.6	3.3	2.0	1.1	17.5
		(2)	0.2	0.1	0.3	0.3	0.4	0.1	0.1	0.2	0.2	0.4	0.3	0.8	0.5	1.1	0.7	0.4	5.8
1.0	2.0		2	3	3	10	6	3	7	7	10	17	26	23	29	56	12	6	220
		(1)	0.3	0.5	0.5	1.6	0.9	0.5	1.1	1.1	1.6	2.6	4.0	3.6	4.5	8.7	1.9	0.9	34.2
		(2)	0.1	0.2	0.2	0.5	0.3	0.2	0.4	0.4	0.5	0.9	1.3	1.2	1.5	2.9	0.6	0.3	11.3
2.0	4.0		3	2	1	2	3	6	6	9	21	20	29	18	37	14	2	7	180
		(1)	0.5	0.3	0.2	0.3	0.5	0.9	0.9	1.4	3.3	3.1	4.5	2.8	5.7	2.2	0.3	1.1	28.0
		(2)	0.2	0.1	0.1	0.1	0.2	0.3	0.3	0.5	1.1	1.0	1.5	0.9	1.9	0.7	0.1	0.4	9.2
4.0	8.0		1	0	0	0	0	1	1	7	1	18	10	15	12	6	2	1	75
		(1)	0.2	0.0	0.0	0.0	0.0	0.2	0.2	1.1	0.2	2.8	1.6	2.3	1.9	0.9	0.3	0.2	11.6
		(2)	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.1	0.9	0.5	0.8	0.6	0.3	0.1	0.1	3.9
8.0			0	0	0	0	0	0	0	0	0	3	1	0	1	0	0	0	5
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.2	0.0	0.0	0.0	0.8
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.3
ALL			14	9	12	19	18	12	15	28	37	66	74	73	100	107	37	23	644
		(1)	2.2	1.4	1.9	3.0	2.8	1.9	2.3	4.3	5.7	10.2	11.5	11.3	15.5	16.6	5.7	3.6	100.0
		(2)	0.7	0.5	0.6	1.0	0.9	0.6	0.8	1.4	1.9	3.4	3.8	3.7	5.1	5.5	1.9	1.2	33.1

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

644 GOOD OBS WITH STABILITY E   46 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-78

SEABROOK

30 FT DATA — FALL (SEP 72 - NOV 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX F -- DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	1.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
0.1	0.5	0	1	0	0	0	0	1	0	1	0	0	2	12	9	3	0	29
	(1)	0.0	0.6	0.0	0.0	0.0	0.0	0.6	0.0	0.6	0.0	0.0	1.1	6.7	5.1	1.7	0.0	16.3
	(2)	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.6	0.5	0.2	0.0	1.5
0.5	1.0	2	0	0	1	0	0	0	1	2	1	4	3	13	6	2	1	36
	(1)	1.1	0.0	0.0	0.6	0.0	0.0	0.0	0.6	1.1	0.6	2.2	1.7	7.3	3.4	1.1	0.6	20.2
	(2)	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.7	0.3	0.1	0.1	1.8
1.0	2.0	1	0	2	0	2	0	2	1	4	6	10	8	13	12	3	1	65
	(1)	0.6	0.0	1.1	0.0	1.1	0.0	1.1	0.6	2.2	3.4	5.6	4.5	7.3	6.7	1.7	0.6	36.5
	(2)	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.2	0.3	0.5	0.4	0.7	0.6	0.2	0.1	3.3
2.0	4.0	0	0	1	2	4	0	1	1	4	5	7	0	4	4	0	1	34
	(1)	0.0	0.0	0.6	1.1	2.2	0.0	0.6	0.6	2.2	2.8	3.9	0.0	2.2	2.2	0.0	0.6	19.1
	(2)	0.0	0.0	0.1	0.1	0.2	0.0	0.1	0.1	0.2	0.3	0.4	0.0	0.2	0.2	0.0	0.1	1.7
4.0	8.0	0	0	0	0	0	0	0	0	0	0	5	2	2	2	1	0	12
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	1.1	1.1	1.1	0.6	0.0	6.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.1	0.1	0.0	0.6
8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL		3	1	3	3	6	0	4	4	11	12	26	15	44	33	10	3	178
	(1)	1.7	0.6	1.7	1.7	3.4	0.0	2.2	2.2	6.2	6.7	14.6	8.4	24.7	18.5	5.6	1.7	100.0
	(2)	0.2	0.1	0.2	0.2	0.3	0.0	0.2	0.2	0.6	0.6	1.3	0.8	2.3	1.7	0.5	0.2	9.1

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

178 GOOD OBS WITH STABILITY F — 16 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-79

SEABROOK

30 FT DATA — FALL (SEP 72 - NOV 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX G -- DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		0	0	0	0	0	1	0	1	0	0	0	3	7	2	1	0	15
		(1)	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	1.4	3.2	0.9	0.5	0.0	6.8
		(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.4	0.1	0.1	0.0	0.8
0.1	0.5		1	0	0	0	0	1	0	1	1	3	4	7	38	10	6	2	74
		(1)	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.5	1.4	1.8	3.2	17.1	4.5	2.7	0.9	33.3
		(2)	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.2	0.4	2.0	0.5	0.3	0.1	3.8
0.5	1.0		1	1	0	1	0	1	1	0	0	2	5	8	32	8	2	0	62
		(1)	0.5	0.5	0.0	0.5	0.0	0.5	0.5	0.0	0.0	0.9	2.3	3.6	14.4	3.6	0.9	0.0	27.9
		(2)	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.3	0.4	1.6	0.4	0.1	0.0	3.2
1.0	2.0		0	1	1	1	0	0	0	0	1	4	0	6	20	11	0	1	46
		(1)	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.5	1.8	0.0	2.7	9.0	5.0	0.0	0.5	20.7
		(2)	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.3	1.0	0.6	0.0	0.1	2.4
2.0	4.0		0	0	0	0	0	0	0	0	2	0	2	3	11	1	0	1	20
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.9	1.4	5.0	0.5	0.0	0.5	9.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.6	0.1	0.0	0.1	1.0
4.0	8.0		0	0	0	0	0	0	0	0	0	1	3	1	0	0	0	0	5
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.4	0.5	0.0	0.0	0.0	0.0	2.3
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.3
8.0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL			2	2	1	2	0	3	1	2	4	10	14	28	108	32	9	4	222
		(1)	0.9	0.9	0.5	0.9	0.0	1.4	0.5	0.9	1.8	4.5	6.3	12.6	48.6	14.4	4.1	1.8	100.0
		(2)	0.1	0.1	0.1	0.1	0.0	0.2	0.1	0.1	0.2	0.5	0.7	1.4	5.5	1.6	0.5	0.2	11.4

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

222 GOOD OBS WITH STABILITY G — 25 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-80

SEABROOK

30 FT DATA

FALL (SEP 72 - NOV 72)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

TOTALS FOR ALL GOOD DELTA T STABILITIES

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	1	0	0	3	0	1	0	2	0	0	0	3	7	2	6	0	25
	(1)	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.4	0.1	0.3	0.0	1.3
	(2)	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.4	0.1	0.3	0.0	1.3
0.1 -	0.5	14	9	9	2	4	2	2	2	5	4	7	13	63	38	19	20	213
		0.7	0.5	0.5	0.1	0.2	0.1	0.1	0.1	0.3	0.2	0.4	0.7	3.2	2.0	1.0	1.0	10.9
	(2)	0.7	0.5	0.5	0.1	0.2	0.1	0.1	0.1	0.3	0.2	0.4	0.7	3.2	2.0	1.0	1.0	10.9
0.5 -	1.0	13	7	25	9	7	4	3	7	6	10	17	30	65	54	25	37	319
	(1)	0.7	0.4	1.3	0.5	0.4	0.2	0.2	0.4	0.3	0.5	0.9	1.5	3.3	2.8	1.3	1.9	16.4
	(2)	0.7	0.4	1.3	0.5	0.4	0.2	0.2	0.4	0.3	0.5	0.9	1.5	3.3	2.8	1.3	1.9	16.4
1.0 -	2.0	31	37	37	24	12	12	13	9	21	34	46	47	77	98	33	33	564
	(1)	1.6	1.9	1.9	1.2	0.6	0.6	0.7	0.5	1.1	1.7	2.4	2.4	4.0	5.0	1.7	1.7	29.0
	(2)	1.6	1.9	1.9	1.2	0.6	0.6	0.7	0.5	1.1	1.7	2.4	2.4	4.0	5.0	1.7	1.7	29.0
2.0 -	4.0	14	12	14	17	29	18	17	19	32	36	50	[illegible]	81	48	15	14	452
	(1)	0.7	0.6	0.7	0.9	1.5	0.9	0.9	1.0	1.6	1.8	2.6	1.8	4.2	2.5	0.8	0.7	23.2
	(2)	0.7	0.6	0.7	0.9	1.5	0.9	0.9	1.0	1.6	1.8	2.6	1.8	4.2	2.5	0.8	0.7	23.2
4.0 -	8.0	2	1	14	5	25	8	6	11	4	50	41	33	54	34	11	10	309
	(1)	0.1	0.1	0.7	0.3	1.3	0.4	0.3	0.6	0.2	2.6	2.1	1.7	2.8	1.7	0.6	0.5	15.9
	(2)	0.1	0.1	0.7	0.3	1.3	0.4	0.3	0.6	0.2	2.6	2.1	1.7	2.8	1.7	0.6	0.5	15.9
8.0		0	0	0	0	1	3	0	1	2	4	10	13	18	12	1	0	65
	(1)	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.1	0.2	0.5	0.7	0.9	0.6	0.1	0.0	3.3
	(2)	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.1	0.2	0.5	0.7	0.9	0.6	0.1	0.0	3.3
ALL		75	66	99	60	78	48	41	51	70	138	171	175	365	286	110	114	1947
	(1)	3.9	3.4	5.1	3.1	4.0	2.5	2.1	2.6	3.6	7.1	8.8	9.0	18.7	14.7	5.6	5.9	100.0
	(2)	3.9	3.4	5.1	3.1	4.0	2.5	2.1	2.6	3.6	7.1	8.8	9.0	18.7	14.7	5.6	5.9	100.0

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

2184 OBS EXAMINED 1947 GOOD OBS WERE FOUND AND USED (89.1 PCT)

TABLE 2A-81

SEABROOK

30 FT DATA

WINTER (DEC 72 - FEB 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX A -- DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

DEFICIT GTE	LT	WIND FROM NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	2.4	0.0	0.0	4.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.5	1.0	0	0	3	0	0	0	0	0	0	0	0	1	2	1	3	2	12
	(1)	0.0	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	4.8	2.4	7.1	4.8	28.6
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.6
1.0	2.0	1	1	2	0	0	0	0	0	0	0	1	1	3	7	2	3	21
	(1)	2.4	2.4	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	2.4	7.1	16.7	4.8	7.1	50.0
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.1	0.1	1.0
2.0	4.0	0	0	0	0	0	0	0	0	0	1	2	2	1	0	0	0	6
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	4.8	4.8	2.4	0.0	0.0	0.0	14.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.3
4.0	8.0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	2.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL		1	1	5	0	0	0	0	0	0	1	3	6	6	9	5	5	42
	(1)	2.4	2.4	11.9	0.0	0.0	0.0	0.0	0.0	0.0	2.4	7.1	14.3	14.3	21.4	11.9	11.9	100.0
	(2)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.4	0.2	0.2	2.0

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

42 GOOD OBS WITH STABILITY A　　　　0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-82

SEABROOK

30 FT DATA

WINTER (DEC 72 - FEB 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX B -- DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	5
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	5.9	2.9	14.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.2
0.5	1.0	0	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	4
	(1)	0.0	2.9	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	11.8
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1.0	2.0	0	0	1	0	0	2	0	0		0	2	1	1	2	0	2	11
	(1)	0.0	0.0	2.9	0.0	0.0	5.9	0.0	0.0	0.0	0.0	5.9	2.9	2.9	5.9	0.0	5.9	32.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.5
2.0	4.0	0	0	0	0	0	0	0	0	0	0	3	0	6	3	1	0	13
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8	0.0	17.6	8.8	2.9	0.0	38.2
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.1	0.0	0.0	0.6
4.0	8.0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	2.9
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8.0		0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL		0	1	3	[illegible]	0	2	0	0	0	0	6	2	7	7	3	3	34
	(1)	0.0	2.9	8.8	0.0	0.0	5.9	0.0	0.0	0.0	0.0	17.6	5.9	20.6	20.6	8.8	8.8	100.0
	(2)	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.3	0.3	0.1	0.1	1.6

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

34 GOOD OBS WITH STABILITY B   0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-83

SEABROOK

30 FT DATA

WINTER (DEC 72 - FEB 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX C -- DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

DEFICIT GTE LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
0.1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1 - 0.5		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	1.8	3.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.5 - 1.0		1	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	6
	(1)	1.8	1.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.8	1.8	0.0	0.0	0.0	10.9
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
1.0 - 2.0		2	1	2	1	0	0	0	0	0	0	2	2	4	8	2	0	24
	(1)	3.6	1.8	3.6	1.8	0.0	0.0	0.0	0.0	0.0	0.0	3.6	3.6	7.3	14.5	3.6	0.0	43.6
	(2)	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.1	0.0	1.1
2.0 - 4.0		0	0	0	0	0	0	1	0	0	2	4	6	2	7	0	0	22
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	3.6	7.3	10.9	3.6	12.7	0.0	0.0	40.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.1	0.3	0.0	0.0	1.0
4.0 - 8.0		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	1.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL		3	2	3	1	0	0	1	0	0	2	7	9	8	16	2	1	55
	(1)	5.5	3.6	5.5	1.8	0.0	0.0	1.8	0.0	0.0	3.6	12.7	16.4	14.5	29.1	3.6	1.8	100.0
	(2)	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.4	0.7	0.1	0.0	2.6

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

55 GOOD OBS WITH STABILITY C 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-84

SEABROOK

30 FT DATA — WINTER (DEC 72 - FEB 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX D -- DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
		WIND FROM																
	0.1	4	1	4	0	0	0	1	0	1	0	0	0	5	10	11	10	47
	(1)	0.4	0.1	0.4	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.5	1.0	1.1	1.0	4.7
	(2)	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.5	0.5	2.2
0.1	0.5	24	6	5	12	1	0	2	1	4	2	3	1	12	37	30	64	204
	(1)	2.4	0.6	0.5	1.2	0.1	0.0	0.2	0.1	0.4	0.2	0.3	0.1	1.2	3.7	3.0	6.3	20.2
	(2)	1.1	0.3	0.2	0.6	0.0	0.0	0.1	0.0	0.2	0.1	0.1	0.0	0.6	1.7	1.4	3.0	9.5
0.5	1.0	36	23	4	3	6	5	1	4	2	4	10	10	53	74	19	47	301
	(1)	3.6	2.3	0.4	0.3	0.6	0.5	0.1	0.4	0.2	0.4	1.0	1.0	5.3	7.3	1.9	4.7	29.9
	(2)	1.7	1.1	0.2	0.1	0.3	0.2	0.0	0.2	0.1	0.2	0.5	0.5	2.5	3.5	0.9	2.2	14.1
1.0	2.0	24	13	3	5	1	5	2	1	2	15	16	15	67	68	16	23	276
	(1)	2.4	1.3	0.3	0.5	0.1	0.5	0.2	0.1	0.2	1.5	1.6	1.5	6.6	6.7	1.6	2.3	27.4
	(2)	1.1	0.6	0.1	0.2	0.0	0.2	0.1	0.0	0.1	0.7	0.7	0.7	3.1	3.2	0.7	1.1	12.9
2.0	4.0	1	0	0	1	0	0	1	0	1	5	13	32	33	52	8	7	154
	(1)	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.5	1.3	3.2	3.3	5.2	0.8	0.7	15.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	1.5	1.5	2.4	0.4	0.3	7.2
4.0	8.0	0	0	0	0	0	0	0	0	1	4	5	6	7	3	0	0	26
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.5	0.6	0.7	0.3	0.0	0.0	2.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.3	0.1	0.0	0.0	1.2
8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL		89	43	16	21	8	10	7	6	11	30	47	64	177	244	84	151	1008
	(1)	8.8	4.3	1.6	2.1	0.8	1.0	0.7	0.6	1.1	3.0	4.7	6.3	17.6	24.2	8.3	15.0	100.0
	(2)	4.2	2.0	0.7	1.0	0.4	0.5	0.3	0.3	0.5	1.4	2.2	3.0	8.3	11.4	3.9	7.0	47.1

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

1008 GOOD OBS WITH STABILITY D — 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-85

SEABROOK

30 FT DATA

WINTER (DEC 72 - FEB 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX E -- DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	2	1	0	2	0	0	1	0	0	0	1	0	1	1	1	3	13
	(1)	0.3	0.1	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.4	1.7
	(2)	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6
0.1	- 0.5	1	1	8	4	0	2	1	1	1	2	3	9	24	21	10	4	92
	(1)	0.1	0.1	1.0	0.5	0.0	0.3	0.1	0.1	0.1	0.3	0.4	1.2	3.1	2.7	1.3	0.5	11.9
	(2)	0.0	0.0	0.4	0.2	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.4	1.1	1.0	0.5	0.2	4.3
0.5	- 1.0	4	2	6	3	0	4	12	9	3	13	38	22	49	33	21	14	233
	(1)	0.5	0.3	0.8	0.4	0.0	0.5	1.5	1.2	0.4	1.7	4.9	2.8	6.3	4.3	2.7	1.8	30.0
	(2)	0.2	0.1	0.3	0.1	0.0	0.2	0.6	0.4	0.1	0.6	1.8	1.0	2.3	1.5	1.0	0.7	10.9
1.0	- 2.0	1	1	1	1	2	2	3	3	12	23	42	56	41	41	16	5	250
	(1)	0.1	0.1	0.1	0.1	0.3	0.3	0.4	0.4	1.5	3.0	5.4	7.2	5.3	5.3	2.1	0.6	32.2
	(2)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.6	1.1	2.0	2.6	1.9	1.9	0.7	0.2	11.7
2.0	- 4.0	0	0	0	0	0	0	1	4	2	17	41	28	35	33	7	1	169
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.3	2.2	5.3	3.6	4.5	4.3	0.9	0.1	21.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.8	1.9	1.3	1.6	1.5	0.3	0.0	7.9
4.0	- 8.0	0	0	0	0	0	0	0	1	2	8	4	1	2	1	0	0	19
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.0	0.5	0.1	0.3	0.1	0.0	0.0	2.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.2	0.0	0.1	0.0	0.0	0.0	0.9
8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL		8	5	15	10	2	8	18	18	20	63	129	116	152	130	55	27	776
	(1)	1.0	0.6	1.9	1.3	0.3	1.0	2.3	2.3	2.6	8.1	16.6	14.9	19.6	16.8	7.1	3.5	100.0
	(2)	0.4	0.2	0.7	0.5	0.1	0.4	0.8	0.8	0.9	2.9	6.0	5.4	7.1	6.1	2.6	1.3	36.2

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

776 GOOD OBS WITH STABILITY E   1 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-86

SEABROOK

.30 FT DATA

WINTER (DEC 72 - FEB 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX F -- DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

DEFICIT GTE LT		WIND FROM NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
0.1		0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.8	0.0	0.0	1.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.1 - 0.5		0	1	3	1	0	0	1	1	0	1	0	1	2	4	1	0	16
	(1)	0.0	0.8	2.4	0.8	0.0	0.0	0.8	0.8	0.0	0.8	0.0	0.8	1.6	3.1	0.8	0.0	12.6
	(2)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.7
0.5 - 1.0		0	0	2	2	1	2	2	3	1	3	6	4	4	3	7	0	40
	(1)	0.0	0.0	1.6	1.6	0.8	1.6	1.6	2.4	0.8	2.4	4.7	3.1	3.1	2.4	5.5	0.0	31.5
	(2)	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.3	0.2	0.2	0.1	0.3	0.0	1.9
1.0 - 2.0		0	0	0	0	0	1	1	2	5	1	7	14	2	4	4	0	41
	(1)	0.0	0.0	0.0	0.0	0.0	0.8	0.8	1.6	3.9	0.8	5.5	11.0	1.6	3.1	3.1	0.0	32.3
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.3	0.7	0.1	0.2	0.2	0.0	1.9
2.0 - 4.0		0	0	0	0	0	1	0	1	1	5	6	6	1	2	0	0	23
	(1)	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.8	0.8	3.9	4.7	4.7	0.8	1.6	0.0	0.0	18.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.0	0.1	0.0	0.0	1.1
4.0 - 8.0		0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	5
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	3.9
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2
8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL		0	1	5	3	1	4	4	7	7	10	25	25	9	14	12	0	127
	(1)	0.0	0.8	3.9	2.4	0.8	3.1	3.1	5.5	5.5	7.9	19.7	19.7	7.1	11.0	9.4	0.0	100.0
	(2)	0.0	0.0	0.2	0.1	0.0	0.2	0.2	0.3	0.3	0.5	1.2	1.2	0.4	0.7	0.6	0.0	5.9

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

127 GOOD OBS WITH STABILITY F 0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-87

SEABROOK

30 FT DATA — WINTER (DEC 72 - FEB 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX G -- DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		0	2	0	0	0	0	0	0	0	0	0	0	6	0	0	1	9
		(1)	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	1.0	9.0
		(2)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.4
0.1	0.5		0	0	0	0	0	0	0	2	0	1	5	1	17	2	1	0	29
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.0	5.0	1.0	17.0	2.0	1.0	0.0	29.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.8	0.1	0.0	0.0	1.4
0.5	1.0		0	1	0	0	0	0	0	0	0	2	3	3	15	2	1	1	28
		(1)	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	3.0	3.0	15.0	2.0	1.0	1.0	28.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.7	0.1	0.0	0.0	1.3
1.0	2.0		0	0	0	0	0	0	0	0	2	5	5	5	4	0	0	1	22
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	5.0	5.0	5.0	4.0	0.0	0.0	1.0	22.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.0	0.0	0.0	1.0
2.0	4.0		0	0	0	0	0	1	1	0	0	0	5	3	2	0	0	0	12
		(1)	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	5.0	3.0	2.0	0.0	0.0	0.0	12.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.6
4.0	8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8.0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL			0	3	0	0	0	1	1	2	2	8	18	12	44	4	2	3	100
		(1)	0.0	3.0	0.0	0.0	0.0	1.0	1.0	2.0	2.0	8.0	18.0	12.0	44.0	4.0	2.0	3.0	100.0
		(2)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.8	0.6	2.1	0.2	0.1	0.1	4.7

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

100 GOOD OBS WITH STABILITY G   0 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-88

SEABROOK

30 FT DATA WINTER (DEC 72 - FEB 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

TOTALS FOR ALL GOOD DELTA T STABILITIES

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		6	4	4	2	0	0	2	0	1	0	2	0	12	12	12	14	71
		(1)	0.3	0.2	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.6	0.6	0.6	0.7	3.3
		(2)	0.3	0.2	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.6	0.6	0.6	0.7	3.3
0.1	0.5		25	8	16	17	1	2	4	5	5	6	11	13	55	68	44	70	350
		(1)	1.2	0.4	0.7	0.8	0.0	0.1	0.2	0.2	0.2	0.3	0.5	0.6	2.6	3.2	2.1	3.3	16.3
		(2)	1.2	0.4	0.7	0.8	0.0	0.1	0.2	0.2	0.2	0.3	0.5	0.6	2.6	3.2	2.1	3.3	16.3
0.5	1.0		41	28	18	8	7	11	15	16	6	22	58	42	124	113	51	64	624
		(1)	1.9	1.3	0.8	0.4	0.3	0.5	0.7	0.7	0.3	1.0	2.7	2.0	5.8	5.3	2.4	3.0	29.1
		(2)	1.9	1.3	0.8	0.4	0.3	0.5	0.7	0.7	0.3	1.0	2.7	2.0	5.8	5.3	2.4	3.0	29.1
1.0	2.0		28	16	9	7	3	10	6	6	21	44	75	94	122	130	40	34	645
		(1)	1.3	0.7	0.4	0.3	0.1	0.5	0.3	0.3	1.0	2.1	3.5	4.4	5.7	6.1	1.9	1.6	30.1
		(2)	1.3	0.7	0.4	0.3	0.1	0.5	0.3	0.3	1.0	2.1	3.5	4.4	5.7	6.1	1.9	1.6	30.1
2.0	4.0		1	0	0	1	0	2	4	5	4	30	74	77	80	97	16	8	399
		(1)	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	1.4	3.5	3.6	3.7	4.5	0.7	0.4	18.6
		(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	1.4	3.5	3.6	3.7	4.5	0.7	0.4	18.6
4.0	8.0		0	0	0	0	0	0	0	1	3	12	15	8	10	4	0	0	53
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.7	0.4	0.5	0.2	0.0	0.0	2.5
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.7	0.4	0.5	0.2	0.0	0.0	2.5
8.0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL			101	56	47	35	11	25	31	33	40	114	235	234	403	424	163	190	2142
		(1)	4.7	2.6	2.2	1.6	0.5	1.2	1.4	1.5	1.9	5.3	11.0	10.9	18.8	19.8	7.6	8.9	100.0
		(2)	4.7	2.6	2.2	1.6	0.5	1.2	1.4	1.5	1.9	5.3	11.0	10.9	18.8	19.8	7.6	8.9	100.0

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

2160 OBS EXAMINED 2142 GOOD OBS WERE FOUND AND USED (99.2 PCT)

TABLE 2A-89

SEABROOK

30 FT DATA — ANNUAL (APR 72 - MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX A -- DELTA T LESS THAN OR EQUAL TO -1.9 DEGREES C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	3
	(1)	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	1.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	1.0	0	0	4	0	0	3	0	0	0	0	0	1	2	2	5	2	19
	(1)	0.0	0.0	1.3	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	0.7	1.6	0.7	6.2
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2
1.0	2.0	2	3	6	6	2	4	1	0	0	0	2	1	6	7	3	4	47
	(1)	0.7	1.0	2.0	2.0	0.7	1.3	0.3	0.0	0.0	0.0	0.7	0.3	2.0	2.3	1.0	1.3	15.4
	(2)	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.6
2.0	4.0	2	4	13	6	6	7	1	0	0	1	8	4	6	2	3	2	65
	(1)	0.7	1.3	4.2	2.0	2.0	2.3	0.3	0.0	0.0	0.3	2.6	1.3	2.0	0.7	1.0	0.7	21.2
	(2)	0.0	0.0	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.8
4.0	8.0	5	1	15	7	6	11	6	0	1	3	6	10	20	16	4	7	118
	(1)	1.6	0.3	4.9	2.3	2.0	3.6	2.0	0.0	0.3	1.0	2.0	3.3	6.5	5.2	1.3	2.3	38.6
	(2)	0.1	0.0	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.0	0.1	1.4
8.0		0	0	2	0	1	6	3	0	0	4	6	6	12	12	2	0	54
	(1)	0.0	0.0	0.7	0.0	0.3	2.0	1.0	0.0	0.0	1.3	2.0	2.0	3.9	3.9	0.7	0.0	17.6
	(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.7
ALL		9	8	40	19	16	31	11	0	1	8	22	23	46	40	17	15	306
	(1)	2.9	2.6	13.1	6.2	5.2	10.1	3.6	0.0	0.3	2.6	7.2	7.5	15.0	13.1	5.6	4.9	100.0
	(2)	0.1	0.1	0.5	0.2	0.2	0.4	0.1	0.0	0.0	0.1	0.3	0.3	0.6	0.5	0.2	0.2	3.7

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

306 GOOD OBS WITH STABILITY A   4 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-90

SEABROOK

30 FT DATA ANNUAL (APR 72 - MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX B -- DELTA T GREATER THAN -1.9 BUT LESS THAN OR EQUAL TO -1.7 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5	0	1	1	0	0	0	0	0	0	0	0	0	0	4	3	1	10
	(1)	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.1	0.4	3.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.5	1.0	0	1	3	1	0	0	0	0	0	0	0	1	1	3	0	1	11
	(1)	0.0	0.4	1.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	1.1	0.0	0.4	4.1
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.0	2.0	0	3	13	1	2	6	1	0	0	0	2	3	2	2	1	4	40
	(1)	0.0	1.1	4.9	0.4	0.7	2.2	0.4	0.0	0.0	0.0	0.7	1.1	0.7	0.7	0.4	1.5	15.0
	(2)	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
2.0	4.0	3	5	7	4	9	8	1	0	1	1	3	4	14	10	5	3	78
	(1)	1.1	1.9	2.6	1.5	3.4	3.0	0.4	0.0	0.4	0.4	1.1	1.5	5.2	3.7	1.9	1.1	29.2
	(2)	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.9
4.0	8.0	3	1	4	3	5	6	6	0	1	4	7	6	17	11	5	0	79
	(1)	1.1	0.4	1.5	1.1	1.9	2.2	2.2	0.0	0.4	1.5	2.6	2.2	6.4	4.1	1.9	0.0	29.6
	(2)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.0	1.0
8.0		1	0	0	0	1	1	4	0	0	5	10	4	9	12	2	0	49
	(1)	0.4	0.0	0.0	0.0	0.4	0.4	1.5	0.0	0.0	1.9	3.7	1.5	3.4	4.5	0.7	0.0	18.4
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.6
ALL		7	11	28	9	17	21	12	0	2	10	22	18	43	42	16	9	267
	(1)	2.6	4.1	10.5	3.4	6.4	7.9	4.5	0.0	0.7	3.7	8.2	6.7	16.1	15.7	6.0	3.4	100.0
	(2)	0.1	0.1	0.3	0.1	0.2	0.3	0.1	0.0	0.0	0.1	0.3	0.2	0.5	0.5	0.2	0.1	3.2

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

267 GOOD OBS WITH STABILITY B 10 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-91

SEABROOK

30 FT DATA | ANNUAL (APR 72 - MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX C -- DELTA T GREATER THAN -1.7 BUT LESS THAN OR EQUAL TO -1.5 DEG C PER 100 METERS

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	3
		(1)	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.8
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.5		0	0	1	1	0	1	0	0	0	0	0	0	0	1	1	1	6
		(1)	0.0	0.0	0.3	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	1.6
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.5	1.0		2	1	4	4	1	2	0	0	0	0	1	1	2	2	0	0	20
		(1)	0.5	0.3	1.1	1.1	0.3	0.5	0.0	0.0	0.0	0.0	0.3	0.3	0.5	0.5	0.0	0.0	5.5
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1.0	2.0		4	2	7	7	3	7	1	0	0	0	2	2	7	11	4	1	58
		(1)	1.1	0.5	1.9	1.9	0.8	1.9	0.3	0.0	0.0	0.0	0.5	0.5	1.9	3.0	1.1	0.3	15.9
		(2)	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.7
2.0	4.0		3	0	1	1	13	8	4	0	1	6	8	8	10	13	3	1	80
		(1)	0.8	0.0	0.3	0.3	3.6	2.2	1.1	0.0	0.3	1.6	2.2	2.2	2.7	3.6	0.8	0.3	21.9
		(2)	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.0	0.0	1.0
4.0	8.0		1	3	2	5	10	9	8	0	2	8	11	9	19	16	6	1	110
		(1)	0.3	0.8	0.5	1.4	2.7	2.5	2.2	0.0	0.5	2.2	3.0	2.5	5.2	4.4	1.6	0.3	30.1
		(2)	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.1	0.0	1.3
8.0			0	0	0	0	2	6	5	2	2	3	8	19	17	19	4	1	88
		(1)	0.0	0.0	0.0	0.0	0.5	1.6	1.4	0.5	0.5	0.8	2.2	5.2	4.7	5.2	1.1	0.3	24.1
		(2)	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.0	0.0	1.1
ALL			11	6	15	19	29	33	18	2	5	17	30	39	55	62	18	6	365
		(1)	3.0	1.6	4.1	5.2	7.9	9.0	4.9	0.5	1.4	4.7	8.2	10.7	15.1	17.0	4.9	1.6	100.0
		(2)	0.1	0.1	0.2	0.2	0.4	0.4	0.2	0.0	0.1	[illegible]	0.4	0.5	0.7	0.8	0.2	0.1	4.4

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

365 GOOD OBS WITH STABILITY C   4 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-92

SEABROOK

30 FT DATA ANNUAL (APR 72 - MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX D -- DELTA T GREATER THAN -1.5 BUT LESS THAN OR EQUAL TO -0.5 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	4	3	4	2	0	0	1	0	1	0	0	1	7	12	12	14	61
	(1)	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.4	0.4	1.8
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.7
0.1 -	0.5	45	54	26	26	16	10	12	6	7	5	8	8	24	53	41	93	434
	(1)	1.3	1.6	0.8	0.8	0.5	0.3	0.4	0.2	0.2	0.1	0.2	0.2	0.7	1.5	1.2	2.7	12.7
	(2)	0.5	0.7	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.6	0.5	1.1	5.3
0.5 -	1.0	51	86	69	25	16	16	9	14	4	4	13	21	65	104	39	82	618
	(1)	1.5	2.5	2.0	0.7	0.5	0.5	0.3	0.4	0.1	0.1	0.4	0.6	1.9	3.0	1.1	2.4	18.1
	(2)	0.6	1.0	0.8	0.3	0.2	0.2	0.1	0.2	0.0	0.0	0.2	0.3	0.8	1.3	0.5	1.0	7.5
1.0 -	2.0	59	75	104	51	37	44	23	20	24	40	38	37	98	107	57	50	864
	(1)	1.7	2.2	3.0	1.5	1.1	1.3	0.7	0.6	0.7	1.2	1.1	1.1	2.9	3.1	1.7	1.5	25.3
	(2)	0.7	0.9	1.3	0.6	0.4	0.5	0.3	0.2	0.3	0.5	0.5	0.4	1.2	1.3	0.7	0.6	10.5
2.0 -	4.0	24	15	19	33	56	42	25	17	21	42	45	71	81	111	30	25	657
	(1)	0.7	0.4	0.6	1.0	1.6	1.2	0.7	0.5	0.6	1.2	1.3	2.1	2.4	3.2	0.9	0.7	19.2
	(2)	0.3	0.2	0.2	0.4	0.7	0.5	0.3	0.2	0.3	0.5	0.5	0.9	1.0	1.3	0.4	0.3	8.0
4.0 -	8.0	7	4	7	4	63	50	32	10	19	66	77	50	56	53	15	9	522
	(1)	0.2	0.1	0.2	0.1	1.8	1.5	0.9	0.3	0.6	1.9	2.3	1.5	1.6	1.5	0.4	0.3	15.3
	(2)	0.1	0.0	0.1	0.0	0.8	0.6	0.4	0.1	0.2	0.8	0.9	0.6	0.7	0.6	0.2	0.1	6.3
8.0		0	3	2	3	5	14	18	14	21	49	47	27	35	22	4	1	265
	(1)	0.0	0.1	0.1	0.1	0.1	0.4	0.5	0.4	0.6	1.4	1.4	0.8	1.0	0.6	0.1	0.0	7.7
	(2)	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.3	0.6	0.6	0.3	0.4	0.3	0.0	0.0	3.2
ALL		190	240	231	144	193	176	120	81	97	206	228	215	366	462	198	274	3421
	(1)	5.6	7.0	6.8	4.2	5.6	5.1	3.5	2.4	2.8	6.0	6.7	6.3	10.7	13.5	5.8	8.0	100.0
	(2)	2.3	2.9	2.8	1.7	2.3	2.1	1.5	1.0	1.2	2.5	2.8	2.6	4.4	5.6	2.4	3.3	41.5

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

3421 GOOD OBS WITH STABILITY D 236 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-93

SEABROOK

30 FT DATA

ANNUAL (APR 72 - MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX E -- DELTA T GREATER THAN -0.5 BUT LESS THAN OR EQUAL TO +1.5 DEG C PER 100 METERS

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	3	2	0	4	1	1	1	0	1	0	1	2	3	2	6	3	30
	(1)	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	1.2
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4
0.1	0.5	5	6	16	9	8	5	2	3	3	4	9	17	50	45	19	12	213
	(1)	0.2	0.2	0.6	0.4	0.3	0.2	0.1	0.1	0.1	0.2	0.4	0.7	2.0	1.8	0.8	0.5	8.5
	(2)	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.6	0.5	0.2	0.1	2.6
0.5	1.0	15	18	24	22	14	16	22	17	16	28	56	51	76	63	41	26	505
	(1)	0.6	0.7	1.0	0.9	0.6	0.6	0.9	0.7	0.6	1.1	2.2	2.0	3.0	2.5	1.6	1.0	20.1
	(2)	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.7	0.6	0.9	0.8	0.5	0.3	6.1
1.0	2.0	10	16	17	16	14	21	20	20	33	65	104	121	107	132	35	16	747
	(1)	0.4	0.6	0.7	0.6	0.6	0.8	0.8	0.8	1.3	2.6	4.1	4.8	4.2	5.2	1.4	0.6	29.7
	(2)	0.1	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.4	0.8	1.3	1.5	1.3	1.6	0.4	0.2	9.1
2.0	4.0	11	8	9	3	14	15	20	28	41	79	111	95	117	76	11	11	647
	(1)	0.4	0.3	0.4	0.1	0.5	0.6	0.8	1.1	1.6	3.1	4.4	3.8	4.6	3.0	0.4	0.4	25.7
	(2)	0.1	0.1	0.1	0.0	0.1	0.2	0.2	0.3	0.5	1.0	1.3	1.2	1.4	0.9	0.1	0.1	7.9
4.0	8.0	7	6	3	1	3	9	23	22	23	67	59	37	21	21	4	2	308
	(1)	0.3	0.2	0.1	0.0	0.1	0.4	0.9	0.9	0.9	2.7	2.3	1.5	0.8	0.8	0.2	0.1	12.2
	(2)	0.1	0.1	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.8	0.7	0.4	0.3	0.3	0.0	0.0	3.7
8.0		0	0	0	0	0	2	4	4	10	11	9	11	7	6	4	0	68
	(1)	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.4	0.4	0.4	0.4	0.3	0.2	0.2	0.0	2.7
	(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.8
ALL		51	56	69	55	52	69	92	94	127	254	349	334	381	345	120	70	2518
	(1)	2.0	2.2	2.7	2.2	2.1	2.7	3.7	3.7	5.0	10.1	13.9	13.3	15.1	13.7	4.8	2.8	100.0
	(2)	0.6	0.7	0.8	0.7	0.6	0.8	1.1	1.1	1.5	3.1	4.2	4.1	4.6	4.2	1.5	0.9	30.6

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

2518 GOOD OBS WITH STABILITY E 93 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-94

SEABROOK

30 FT DATA

ANNUAL (APR 72 - MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX F -- DELTA T GREATER THAN +1.5 BUT LESS THAN OR EQUAL TO +4.0 DEG C PER 100 METERS

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		0	0	1	0	0	0	0	1	0	0	1	1	2	2	1	0	9
		(1)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.3	0.3	0.1	0.0	1.3
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.1	0.5		0	2	3	3	0	0	2	2	1	4	5	4	18	20	6	1	71
		(1)	0.0	0.3	0.4	0.4	0.0	0.0	0.3	0.3	0.1	0.6	0.7	0.6	2.7	3.0	0.9	0.1	10.5
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.2	0.1	0.0	0.9
0.5	1.0		2	0	2	4	3	2	3	8	6	8	15	12	29	18	11	1	124
		(1)	0.3	0.0	0.3	0.6	0.4	0.3	0.4	1.2	0.9	1.2	2.2	1.8	4.3	2.7	1.6	0.1	18.4
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.4	0.2	0.1	0.0	1.5
1.0	2.0		3	1	4	4	5	8	7	3	11	13	29	42	42	32	15	3	222
		(1)	0.4	0.1	0.6	0.6	0.7	1.2	1.0	0.4	1.6	1.9	4.3	6.2	6.2	4.7	2.2	0.4	32.9
		(2)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.2	0.4	0.5	0.5	0.4	0.2	0.0	2.7
2.0	4.0		1	1	2	4	5	7	5	5	12	20	29	21	27	18	2	2	161
		(1)	0.1	0.1	0.3	0.6	0.7	1.0	0.7	0.7	1.8	3.0	4.3	3.1	4.0	2.7	0.3	0.3	23.9
		(2)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.4	0.3	0.3	0.2	0.0	0.0	2.0
4.0	8.0		1	0	1	1	0	0	5	3	5	11	21	9	9	9	3	1	79
		(1)	0.1	0.0	0.1	0.1	0.0	0.0	0.7	0.4	0.7	1.6	3.1	1.3	1.3	1.3	0.4	0.1	11.7
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.3	0.1	0.1	0.1	0.0	0.0	1.0
8.0			0	0	0	0	0	1	0	0	0	5	0	1	2	0	0	0	9
		(1)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.7	0.0	0.1	0.3	0.0	0.0	0.0	1.3
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ALL			7	4	13	16	13	18	22	22	35	61	100	90	129	99	38	8	675
		(1)	1.0	0.6	1.9	2.4	1.9	2.7	3.3	3.3	5.2	9.0	14.8	13.3	19.1	14.7	5.6	1.2	100.0
		(2)	0.1	0.0	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.7	1.2	1.1	1.6	1.2	0.5	0.1	8.2

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

675 GOOD OBS WITH STABILITY F 24 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-95

SEABROOK

30 FT DATA — ANNUAL (APR 72 – MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

STABILITY INDEX G -- DELTA T GREATER THAN +4.0 DEGREES C PER 100 METERS

DEFICIT GTE	LT		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1		1	3	0	0	0	1	0	2	1	1	2	3	17	3	2	2	38
		(1)	0.1	0.4	0.0	0.0	0.0	0.1	0.0	0.3	0.1	0.1	0.3	0.4	2.5	0.4	0.3	0.3	5.6
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.5
0.1	0.5		2	0	0	1	0	1	0	4	1	5	10	20	78	17	8	3	150
		(1)	0.3	0.0	0.0	0.1	0.0	0.1	0.0	0.6	0.1	0.7	1.5	2.9	11.4	2.5	1.2	0.4	22.0
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.9	0.2	0.1	0.0	1.8
0.5	1.0		3	3	1	3	0	3	3	2	0	6	11	22	83	22	7	2	171
		(1)	0.4	0.4	0.1	0.4	0.0	0.4	0.4	0.3	0.0	0.9	1.6	3.2	12.2	3.2	1.0	0.3	25.1
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	1.0	0.3	0.1	0.0	2.1
1.0	2.0		1	2	5	5	2	7	5	0	7	13	19	26	64	21	2	4	183
		(1)	0.1	0.3	0.7	0.7	0.3	1.0	0.7	0.0	1.0	1.9	2.8	3.8	9.4	3.1	0.3	0.6	26.8
		(2)	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.2	0.2	0.3	0.8	0.3	0.0	0.0	2.2
2.0	4.0		0	1	0	3	5	1	3	4	4	3	18	18	38	8	1	1	108
		(1)	0.0	0.1	0.0	0.4	0.7	0.1	0.4	0.6	0.6	0.4	2.6	2.6	5.6	1.2	0.1	0.1	15.8
		(2)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.5	0.1	0.0	0.0	1.3
4.0	8.0		0	0	0	0	0	0	0	2	1	4	4	5	7	4	1	1	29
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.6	0.6	0.7	1.0	0.6	0.1	0.1	4.3
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.4
8.0			0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	3
		(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.4
		(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL			7	9	6	12	7	13	11	15	14	33	64	94	288	75	21	13	682
		(1)	1.0	1.3	0.9	1.8	1.0	1.9	1.6	2.2	2.1	4.8	9.4	13.8	42.2	11.0	3.1	1.9	100.0
		(2)	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.4	0.8	1.1	3.5	0.9	0.3	0.2	8.3

(WIND FROM: NNE … N)

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

682 GOOD OBS WITH STABILITY G — 32 MISSING WIND/TEMPS FOR THIS STABILITY

TABLE 2A-96

SEABROOK

- 30 FT DATA ANNUAL (APR 72 - MAR 73)

MOISTURE DEFICIT BY STABILITY AND WIND DIRECTION

TOTALS FOR ALL GOOD DELTA T STABILITIES

DEFICIT GTE	LT	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	ALL
	0.1	9	8	5	7	1	2	2	3	3	1	4	7	29	19	21	20	141
	(1)	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.2	0.3	0.2	1.7
	(2)	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.2	0.3	0.2	1.7
0.1 - 0.5		52	63	47	40	25	17	16	15	12	18	32	50	170	141	78	111	887
	(1)	0.6	0.8	0.6	0.5	0.3	0.2	0.2	0.2	0.1	0.2	0.4	0.6	2.1	1.7	0.9	1.3	10.8
	(2)	0.6	0.8	0.6	0.5	0.3	0.2	0.2	0.2	0.1	0.2	0.4	0.6	2.1	1.7	0.9	1.3	10.8
0.5 - 1.0		73	109	107	59	34	42	37	41	26	46	96	109	258	[illegible]	103	114	1468
	(1)	0.9	1.3	1.3	0.7	0.4	0.5	0.4	0.5	0.3	0.6	1.2	1.3	3.1	2.6	1.3	1.4	17.8
	(2)	0.9	1.3	1.3	0.7	0.4	0.5	0.4	0.5	0.3	0.6	1.2	1.3	3.1	2.6	1.3	1.4	17.8
1.0 - 2.0		79	102	156	90	65	97	58	43	75	131	196	232	326	312	117	82	2161
	(1)	1.0	1.2	1.9	1.1	0.8	1.2	0.7	0.5	0.9	1.6	2.4	2.8	4.0	3.8	1.4	1.0	26.2
	(2)	1.0	1.2	1.9	1.1	0.8	1.2	0.7	0.5	0.9	1.6	2.4	2.8	4.0	3.8	1.4	1.0	26.2
2.0 - 4.0		44	34	51	54	106	88	59	54	80	152	222	221	293	238	55	45	1796
	(1)	0.5	0.4	0.6	0.7	1.3	1.1	0.7	0.7	1.0	1.8	2.7	2.7	3.6	2.9	0.7	0.5	21.8
	(2)	0.5	0.4	0.6	0.7	1.3	1.1	0.7	0.7	1.0	1.8	2.7	2.7	3.6	2.9	0.7	0.5	21.8
4.0 - 8.0		24	15	32	21	87	85	80	37	52	163	185	126	149	130	38	21	1245
	(1)	0.3	0.2	0.4	0.3	1.1	1.0	1.0	0.4	0.6	2.0	2.2	1.5	1.8	1.6	0.5	0.3	15.1
	(2)	0.3	0.2	0.4	0.3	1.1	1.0	1.0	0.4	0.6	2.0	2.2	1.5	1.8	1.6	0.5	0.3	15.1
8.0		1	3	4	3	9	30	34	21	33	78	80	68	83	71	16	2	536
	(1)	0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.3	0.4	0.9	1.0	0.8	1.0	0.9	0.2	0.0	6.5
	(2)	0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.3	0.4	0.9	1.0	0.8	1.0	0.9	0.2	0.0	6.5
ALL		282	334	402	274	327	361	285	214	281	589	815	813	1308	1125	428	395	8234
	(1)	3.4	4.1	4.9	3.3	4.0	4.4	3.5	2.6	3.4	7.2	9.9	9.9	15.9	13.7	5.2	4.8	100.0
	(2)	3.4	4.1	4.9	3.3	4.0	4.4	3.5	2.6	3.4	7.2	9.9	9.9	15.9	13.7	5.2	4.8	100.0

(MOISTURE DEFICIT IS IN GRAMS PER CUBIC METER OF SATURATED AIR)

(1) = PCT OF ALL GOOD OBS OF THIS STABILITY
(2) = PCT OF ALL GOOD OBS

8760 OBS EXAMINED 8234 GOOD OBS WERE FOUND AND USED (94.0 PCT)

APPENDIX 2B

ONSITE METEOROLOGICAL DATA SUMMARIES APRIL 1979-MARCH 1980

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

APPENDIX 2B

ONSITE METEOROLOGICAL DATA SUMMARIES

APRIL 1979 - MARCH 1980

TABLES

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APPENDIX 2B

ONSITE METEOROLOGICAL DATA SUMMARIES

APRIL 1979 - MARCH 1980

FIGURES

TABLE 2B-1
(Sheet 1 of 8)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED, WIND DIRECTION,
AND PASQUILL STABILITY CLASS (43-FOOT LEVEL)

STABILITY CLASS A   CLASS FREQUENCY (PERCENT) = 6.52

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	1	0	1	4	1	0	0	2	1	1	3	3	2	1	0	0	20
(1)	0.00	.18	0.00	.18	.71	.18	0.00	0.00	.36	.18	.18	.54	.54	.36	.18	0.00	0.00	3.57
(2)	0.00	.01	0.00	.01	.05	.01	0.00	0.00	.02	.01	.01	.03	.03	.02	.01	0.00	0.00	.23
4-7	3	6	4	17	15	15	26	3	2	3	4	6	8	12	10	7	0	141
(1)	.54	1.07	.71	3.04	2.68	2.68	4.64	.54	.36	.54	.71	1.07	1.43	2.14	1.79	1.25	0.00	25.18
(2)	.03	.07	.05	.20	.17	.17	.30	.03	.02	.03	.05	.07	.09	.14	.12	.08	0.00	1.64
8-12	7	11	17	18	18	14	61	14	2	14	20	18	22	28	23	6	0	293
(1)	1.25	1.96	3.04	3.21	3.21	2.50	10.89	2.50	.36	2.50	3.57	3.21	3.93	5.00	4.11	1.07	0.00	52.32
(2)	.08	.13	.20	.21	.21	.16	.71	.16	.02	.16	.23	.21	.26	.33	.27	.07	0.00	3.41
13-18	0	0	15	1	0	3	2	0	1	8	4	5	8	31	10	1	0	89
(1)	0.00	0.00	2.68	.18	0.00	.54	.36	0.00	.18	1.43	.71	.89	1.43	5.54	1.79	.18	0.00	15.89
(2)	0.00	0.00	.17	.01	0.00	.03	.02	0.00	.01	.09	.05	.06	.09	.36	.12	.01	0.00	1.04
19-24	0	0	0	0	1	0	0	0	0	0	0	0	1	10	3	0	0	15
(1)	0.00	0.00	0.00	0.00	.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.18	1.79	.54	0.00	0.00	2.68
(2)	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.12	.03	0.00	0.00	.17
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.18	.18	0.00	0.00	0.00	.36
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	0.00	.02
ALL SPEEDS	10	18	36	37	38	33	89	17	7	26	29	32	43	84	47	14	0	560
(1)	1.79	3.21	6.43	6.61	6.79	5.89	15.89	3.04	1.25	4.64	5.18	5.71	7.68	15.00	8.39	2.50	0.00	100.00
(2)	.12	.21	.42	.43	.44	.38	1.04	.20	.08	.30	.34	.37	.50	.98	.55	.16	0.00	6.52

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-1
(Sheet 2 of 8)

STABILITY CLASS B   CLASS FREQUENCY (PERCENT) = 9.06

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	1	2	2	3	2	0	1	1	0	3	1	0	3	2	2	1	0	24
(1)	.13	.26	.26	.39	.26	0.00	.13	.13	0.00	.39	.13	0.00	.39	.26	.26	.13	0.00	3.08
(2)	.01	.02	.02	.03	.02	0.00	.01	.01	0.00	.03	.01	0.00	.03	.02	.02	.01	0.00	.28
4-7	12	8	4	19	20	25	32	8	0	5	13	9	18	18	27	9	0	227
(1)	1.54	1.03	.51	2.44	2.57	3.21	4.11	1.03	0.00	.64	1.67	1.16	2.31	2.31	3.47	1.16	0.00	29.18
(2)	.14	.09	.05	.22	.23	.29	.37	.09	0.00	.06	.15	.10	.21	.21	.31	.10	0.00	2.64
8-12	17	7	19	18	33	28	20	15	6	18	25	30	29	60	33	8	0	366
(1)	2.19	.90	2.44	2.31	4.24	3.60	2.57	1.93	.77	2.31	3.21	3.86	3.73	7.71	4.24	1.03	0.00	47.04
(2)	.20	.08	.22	.21	.38	.33	.23	.17	.07	.21	.29	.35	.34	.70	.38	.09	0.00	4.26
13-18	0	0	13	5	1	2	0	0	2	4	8	3	20	57	22	0	0	137
(1)	0.00	0.00	1.67	.64	.13	.26	0.00	0.00	.26	.51	1.03	.39	2.57	7.33	2.83	0.00	0.00	17.61
(2)	0.00	0.00	.15	.06	.01	.02	0.00	0.00	.02	.05	.09	.03	.23	.66	.26	0.00	0.00	1.60
19-24	0	0	1	0	0	0	0	0	0	0	0	0	3	17	2	0	0	23
(1)	0.00	0.00	.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.39	2.19	.26	0.00	0.00	2.96
(2)	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	.20	.02	0.00	0.00	.27
GT 24	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	0.00	0.00	.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.13
(2)	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01
ALL SPEEDS	30	17	40	45	56	55	53	24	8	30	47	42	73	154	86	18	0	778
(1)	3.86	2.19	5.14	5.78	7.20	7.07	6.81	3.08	1.03	3.86	6.04	5.40	9.38	19.79	11.05	2.31	0.00	100.00
(2)	.35	.20	.47	.52	.65	.64	.62	.28	.09	.35	.55	.49	.85	1.79	1.00	.21	0.00	9.06

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-1
(Sheet 3 of 8)

STABILITY CLASS C CLASS FREQUENCY (PERCENT) = 5.53

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	2	1	0	2	2	1	0	0	1	1	1	0	0	5	2	4	0	22
(1)	.42	.21	0.00	.42	.42	.21	0.00	0.00	.21	.21	.21	0.00	0.00	1.05	.42	.84	0.00	4.63
(2)	.02	.01	0.00	.02	.02	.01	0.00	0.00	.01	.01	.01	0.00	0.00	.06	.02	.05	0.00	.26
4-7	10	2	6	5	21	20	15	9	8	10	5	1	10	16	12	5	0	155
(1)	2.11	.42	1.26	1.05	4.42	4.21	3.16	1.89	1.68	2.11	1.05	.21	2.11	3.37	2.53	1.05	0.00	32.63
(2)	.12	.02	.07	.06	.24	.23	.17	.10	.09	.12	.06	.01	.12	.19	.14	.06	0.00	1.81
8-12	4	4	15	8	18	19	11	5	7	12	20	13	19	30	18	7	0	210
(1)	.84	.84	3.16	1.68	3.79	4.00	2.32	1.05	1.47	2.53	4.21	2.74	4.00	6.32	3.79	1.47	0.00	44.21
(2)	.05	.05	.17	.09	.21	.22	.13	.06	.08	.14	.23	.15	.22	.35	.21	.08	0.00	2.45
13-18	0	0	9	0	1	0	0	1	1	5	5	3	8	24	12	0	0	69
(1)	0.00	0.00	1.89	0.00	.21	0.00	0.00	.21	.21	1.05	1.05	.63	1.68	5.05	2.53	0.00	0.00	14.53
(2)	0.00	0.00	.10	0.00	.01	0.00	0.00	.01	.01	.06	.06	.03	.09	.28	.14	0.00	0.00	.80
19-24	0	0	0	0	0	0	0	1	1	0	0	1	2	10	3	0	0	18
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.21	.21	0.00	0.00	.21	.42	2.11	.63	0.00	0.00	3.79
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	.01	.02	.12	.03	0.00	0.00	.21
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.21	0.00	0.00	0.00	0.00	.21
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	.01
ALL SPEEDS	16	7	30	15	42	40	26	16	18	28	31	18	40	85	47	16	0	475
(1)	3.37	1.47	6.32	3.16	8.84	8.42	5.47	3.37	3.79	5.89	6.53	3.79	8.42	17.89	9.89	3.37	0.00	100.00
(2)	.19	.08	.35	.17	.49	.47	.30	.19	.21	.33	.36	.21	.47	.99	.55	.19	0.00	5.53

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-1
(Sheet 4 of 8)

STABILITY CLASS D CLASS FREQUENCY (PERCENT) = 41.54

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	27	22	17	33	23	25	13	27	24	13	11	14	26	36	30	33	0	374
(1)	.76	.62	.48	.93	.64	.70	.36	.76	.67	.36	.31	.39	.73	1.01	.84	.93	0.00	10.49
(2)	.31	.26	.20	.38	.27	.29	.15	.31	.28	.15	.13	.16	.30	.42	.35	.38	0.00	4.36
4-7	92	69	77	66	90	78	102	71	87	100	87	103	82	127	124	88	0	1443
(1)	2.58	1.93	2.16	1.85	2.52	2.19	2.86	1.99	2.44	2.80	2.44	2.89	2.30	3.56	3.48	2.47	0.00	40.47
(2)	1.07	.80	.90	.77	1.05	.91	1.19	.83	1.01	1.16	1.01	1.20	.96	1.48	1.44	1.03	0.00	16.81
8-12	67	33	71	34	54	65	34	45	65	101	144	75	92	232	119	41	0	1272
(1)	1.88	.93	1.99	.95	1.51	1.82	.95	1.26	1.82	2.83	4.04	2.10	2.58	6.51	3.34	1.15	0.00	35.67
(2)	.78	.38	.83	.40	.63	.76	.40	.52	.76	1.18	1.68	.87	1.07	2.70	1.39	.48	0.00	14.82
13-18	13	4	20	7	7	3	0	11	14	13	21	22	53	127	66	1	0	382
(1)	.36	.11	.56	.20	.20	.08	0.00	.31	.39	.36	.59	.62	1.49	3.56	1.85	.03	0.00	10.71
(2)	.15	.05	.23	.08	.08	.03	0.00	.13	.16	.15	.24	.26	.62	1.48	.77	.01	0.00	4.45
19-24	0	0	8	4	7	0	0	1	0	1	2	0	15	31	18	0	0	87
(1)	0.00	0.00	.22	.11	.20	0.00	0.00	.03	0.00	.03	.06	0.00	.42	.87	.50	0.00	0.00	2.44
(2)	0.00	0.00	.09	.05	.08	0.00	0.00	.01	0.00	.01	.02	0.00	.17	.36	.21	0.00	0.00	1.01
GT 24	0	0	2	5	0	0	0	0	0	0	0	0	0	0	1	0	0	8
(1)	0.00	0.00	.06	.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	0.00	0.00	.22
(2)	0.00	0.00	.02	.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	.09
ALL SPEEDS	199	128	195	149	181	171	149	155	190	228	265	214	268	553	358	163	0	3566
(1)	5.58	3.59	5.47	4.18	5.08	4.80	4.18	4.35	5.33	6.39	7.43	6.00	7.52	15.51	10.04	4.57	0.00	100.00
(2)	2.32	1.49	2.27	1.74	2.11	1.99	1.74	1.81	2.21	2.66	3.09	2.49	3.12	6.44	4.17	1.90	0.00	41.54

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-1
(Sheet 5 of 8)

STABILITY CLASS E   CLASS FREQUENCY (PERCENT) = 24.25

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	0.00	.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.05
(2)	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01
C-3	16	12	9	13	23	11	15	23	43	35	22	44	52	33	22	22	0	395
(1)	.77	.58	.43	.62	1.10	.53	.72	1.10	2.07	1.68	1.06	2.11	2.50	1.59	1.06	1.06	0.00	18.97
(2)	.19	.14	.10	.15	.27	.13	.17	.27	.50	.41	.26	.51	.61	.38	.26	.26	0.00	4.60
4-7	20	10	10	24	23	18	40	37	65	102	104	165	167	219	120	46	0	1170
(1)	.96	.48	.48	1.15	1.10	.86	1.92	1.78	3.12	4.90	5.00	7.93	8.02	10.52	5.76	2.21	0.00	56.20
(2)	.23	.12	.12	.28	.27	.21	.47	.43	.76	1.19	1.21	1.92	1.95	2.55	1.40	.54	0.00	13.63
8-12	10	6	1	2	4	8	5	14	13	24	86	94	66	87	21	5	0	446
(1)	.48	.29	.05	.10	.19	.38	.24	.67	.62	1.15	4.13	4.51	3.17	4.18	1.01	.24	0.00	21.42
(2)	.12	.07	.01	.02	.05	.09	.06	.16	.15	.28	1.00	1.10	.77	1.01	.24	.06	0.00	5.20
13-18	2	0	1	3	0	0	0	0	8	5	8	4	8	18	7	0	0	64
(1)	.10	0.00	.05	.14	0.00	0.00	0.00	0.00	.38	.24	.38	.19	.38	.86	.34	0.00	0.00	3.07
(2)	.02	0.00	.01	.03	0.00	0.00	0.00	0.00	.09	.06	.09	.05	.09	.21	.08	0.00	0.00	.75
19-24	0	0	0	0	1	0	0	0	1	0	0	0	0	4	0	0	0	6
(1)	0.00	0.00	0.00	0.00	.05	0.00	0.00	0.00	.05	0.00	0.00	0.00	0.00	.19	0.00	0.00	0.00	.29
(2)	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	.05	0.00	0.00	0.00	.07
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	48	29	21	42	51	37	60	74	130	166	220	307	293	361	170	73	0	2082
(1)	2.31	1.39	1.01	2.02	2.45	1.78	2.88	3.55	6.24	7.97	10.57	14.75	14.07	17.34	8.17	3.51	0.00	100.00
(2)	.56	.34	.24	.49	.59	.43	.70	.86	1.51	1.93	2.56	3.58	3.41	4.21	1.98	.85	0.00	24.25

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-1
(Sheet 6 of 8)

STABILITY CLASS F   CLASS FREQUENCY (PERCENT) = 6.94

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	13	6	12	16	3	10	10	8	14	21	28	25	46	41	26	16	0	295
(1)	2.18	1.01	2.01	2.68	.50	1.68	1.68	1.34	2.35	3.52	4.70	4.19	7.72	6.88	4.36	2.68	0.00	49.50
(2)	.15	.07	.14	.19	.03	.12	.12	.09	.16	.24	.33	.29	.54	.48	.30	.19	0.00	3.44
4-7	2	1	2	1	4	1	12	4	6	18	21	46	40	88	39	9	0	294
(1)	.34	.17	.34	.17	.67	.17	2.01	.67	1.01	3.02	3.52	7.72	6.71	14.77	6.54	1.51	0.00	49.33
(2)	.02	.01	.02	.01	.05	.01	.14	.05	.07	.21	.24	.54	.47	1.03	.45	.10	0.00	3.42
8-12	0	0	0	0	0	0	0	1	0	0	1	2	1	1	1	0	0	7
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.17	0.00	0.00	.17	.34	.17	.17	.17	0.00	0.00	1.17
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	.01	.02	.01	.01	.01	0.00	0.00	.08
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	15	7	14	17	7	11	22	13	20	39	50	73	87	130	66	25	0	596
(1)	2.52	1.17	2.35	2.85	1.17	1.85	3.69	2.18	3.36	6.54	8.39	12.25	14.60	21.81	11.07	4.19	0.00	100.00
(2)	.17	.08	.16	.20	.08	.13	.26	.15	.23	.45	.58	.85	1.01	1.51	.77	.29	0.00	6.94

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-1
(Sheet 7 of 8)

STABILITY CLASS G   CLASS FREQUENCY (PERCENT) = 6.14

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.19
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01
C-3	8	11	8	12	13	2	8	6	9	3	24	59	57	91	49	19	0	379
(1)	1.52	2.09	1.52	2.28	2.47	.38	1.52	1.14	1.71	.57	4.55	11.20	10.82	17.27	9.30	3.61	0.00	71.92
(2)	.09	.13	.09	.14	.15	.02	.09	.07	.10	.03	.28	.69	.66	1.06	.57	.22	0.00	4.42
4-7	2	1	1	1	0	1	4	3	2	1	1	16	21	63	27	3	0	147
(1)	.38	.19	.19	.19	0.00	.19	.76	.57	.38	.19	.19	3.04	3.98	11.95	5.12	.57	0.00	27.89
(2)	.02	.01	.01	.01	0.00	.01	.05	.03	.02	.01	.01	.19	.24	.73	.31	.03	0.00	1.71
8-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	10	12	9	13	13	3	12	9	11	5	25	75	78	154	76	22	0	527
(1)	1.90	2.28	1.71	2.47	2.47	.57	2.28	1.71	2.09	.95	4.74	14.23	14.80	29.22	14.42	4.17	0.00	100.00
(2)	.12	.14	.10	.15	.15	.03	.14	.10	.13	.06	.29	.87	.91	1.79	.89	.26	0.00	6.14

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-1
(Sheet 8 of 8)

STABILITY CLASS ALL   CLASS FREQUENCY (PERCENT) = 100.00

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
(1)	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02
(2)	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02
C-3	67	55	48	80	70	50	47	65	93	77	88	145	187	210	132	95	0	1509
(1)	.78	.64	.56	.93	.82	.58	.55	.76	1.08	.90	1.03	1.69	2.18	2.45	1.54	1.11	0.00	17.58
(2)	.78	.64	.56	.93	.82	.58	.55	.76	1.08	.90	1.03	1.69	2.18	2.45	1.54	1.11	0.00	17.58
4-7	141	97	104	133	173	158	231	135	170	239	235	346	346	543	359	167	0	3577
(1)	1.64	1.13	1.21	1.55	2.02	1.84	2.69	1.57	1.98	2.78	2.74	4.03	4.03	6.33	4.18	1.95	0.00	41.67
(2)	1.64	1.13	1.21	1.55	2.02	1.84	2.69	1.57	1.98	2.78	2.74	4.03	4.03	6.33	4.18	1.95	0.00	41.67
8-12	105	61	123	80	127	134	131	94	93	169	296	232	229	438	215	67	0	2594
(1)	1.22	.71	1.43	.93	1.48	1.56	1.53	1.10	1.08	1.97	3.45	2.70	2.67	5.10	2.50	.78	0.00	30.22
(2)	1.22	.71	1.43	.93	1.48	1.56	1.53	1.10	1.08	1.97	3.45	2.70	2.67	5.10	2.50	.78	0.00	30.22
13-18	15	4	58	16	9	8	2	12	26	35	46	37	97	257	117	2	0	741
(1)	.17	.05	.68	.19	.10	.09	.02	.14	.30	.41	.54	.43	1.13	2.99	1.36	.02	0.00	8.63
(2)	.17	.05	.68	.19	.10	.09	.02	.14	.30	.41	.54	.43	1.13	2.99	1.36	.02	0.00	8.63
19-24	0	0	9	4	9	0	0	2	2	1	2	1	21	72	26	0	0	149
(1)	0.00	0.00	.10	.05	.10	0.00	0.00	.02	.02	.01	.02	.01	.24	.84	.30	0.00	0.00	1.74
(2)	0.00	0.00	.10	.05	.10	0.00	0.00	.02	.02	.01	.02	.01	.24	.84	.30	0.00	0.00	1.74
GT 24	0	0	3	5	0	0	0	0	0	0	0	0	2	1	1	0	0	12
(1)	0.00	0.00	.03	.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02	.01	.01	0.00	0.00	.14
(2)	0.00	0.00	.03	.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02	.01	.01	0.00	0.00	.14
ALL SPEEDS	328	218	345	318	388	350	411	308	384	522	667	761	882	1521	850	331	0	8584
(1)	3.82	2.54	4.02	3.70	4.52	4.08	4.79	3.59	4.47	6.08	7.77	8.87	10.27	17.72	9.90	3.86	0.00	100.00
(2)	3.82	2.54	4.02	3.70	4.52	4.08	4.79	3.59	4.47	6.08	7.77	8.87	10.27	17.72	9.90	3.86	0.00	100.00

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-2
(Sheet 1 of 8)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED, WIND DIRECTION, AND PASQUILL STABILITY CLASS (209-FOOT LEVEL)

STABILITY CLASS A CLASS FREQUENCY (PERCENT) = 2.22

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	2
(1)	0.00	0.00	0.00	0.00	0.00	.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.52	0.00	0.00	0.00	1.04
(2)	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	.02
4-7	0	1	0	3	3	1	6	1	0	1	0	0	1	0	0	0	0	17
(1)	0.00	.52	0.00	1.56	1.56	.52	3.13	.52	0.00	.52	0.00	0.00	.52	0.00	0.00	0.00	0.00	8.85
(2)	0.00	.01	0.00	.03	.03	.01	.07	.01	0.00	.01	0.00	0.00	.01	0.00	0.00	0.00	0.00	.20
8-12	3	3	1	4	6	5	14	2	0	3	1	2	5	3	7	2	0	61
(1)	1.56	1.56	.52	2.08	3.13	2.60	7.29	1.04	0.00	1.56	.52	1.04	2.60	1.56	3.65	1.04	0.00	31.77
(2)	.03	.03	.01	.05	.07	.06	.16	.02	0.00	.03	.01	.02	.06	.03	.08	.02	0.00	.71
13-18	1	2	1	0	2	0	25	13	1	2	3	2	7	17	8	0	0	84
(1)	.52	1.04	.52	0.00	1.04	0.00	13.02	6.77	.52	1.04	1.56	1.04	3.65	8.85	4.17	0.00	0.00	43.75
(2)	.01	.02	.01	0.00	.02	0.00	.29	.15	.01	.02	.03	.02	.08	.20	.09	0.00	0.00	.97
19-24	0	0	0	0	0	0	0	2	0	0	1	0	1	9	2	0	0	15
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04	0.00	0.00	.52	0.00	.52	4.69	1.04	0.00	0.00	7.81
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.02	0.00	0.00	.01	0.00	.01	.10	.02	0.00	0.00	.17
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	1	12	0	0	0	13
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.52	6.25	0.00	0.00	0.00	6.77
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.14	0.00	0.00	0.00	.15
ALL SPEEDS	4	6	2	7	11	7	45	18	1	6	5	4	15	42	17	2	0	192
(1)	2.08	3.13	1.04	3.65	5.73	3.65	23.44	9.37	.52	3.13	2.60	2.08	7.81	21.88	8.85	1.04	0.00	100.00
(2)	.05	.07	.02	.08	.13	.08	.52	.21	.01	.07	.06	.05	.17	.49	.20	.02	0.00	2.22

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-2
(Sheet 2 of 8)

STABILITY CLASS B   CLASS FREQUENCY (PERCENT) = 3.37

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	3
(1)	0.00	0.00	0.00	0.00	0.00	0.00	.34	0.00	.34	0.00	0.00	.34	0.00	0.00	0.00	0.00	0.00	1.03
(2)	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	.01	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	.03
4-7	0	0	1	5	1	2	6	0	0	1	1	1	5	3	3	2	0	31
(1)	0.00	0.00	.34	1.72	.34	.69	2.06	0.00	0.00	.34	.34	.34	1.72	1.03	1.03	.69	0.00	10.65
(2)	0.00	0.00	.01	.06	.01	.02	.07	0.00	0.00	.01	.01	.01	.06	.03	.03	.02	0.00	.36
8-12	1	1	1	12	9	13	25	10	1	2	10	10	8	8	7	5	0	123
(1)	.34	.34	.34	4.12	3.09	4.47	8.59	3.44	.34	.69	3.44	3.44	2.75	2.75	2.41	1.72	0.00	42.27
(2)	.01	.01	.01	.14	.10	.15	.29	.12	.01	.02	.12	.12	.09	.09	.08	.06	0.00	1.43
13-18	1	4	4	2	0	1	6	12	2	7	10	10	13	19	15	2	0	108
(1)	.34	1.37	1.37	.69	0.00	.34	2.06	4.12	.69	2.41	3.44	3.44	4.47	6.53	5.15	.69	0.00	37.11
(2)	.01	.05	.05	.02	0.00	.01	.07	.14	.02	.08	.12	.12	.15	.22	.17	.02	0.00	1.25
19-24	0	0	0	0	0	0	2	0	0	0	2	3	2	10	2	0	0	21
(1)	0.00	0.00	0.00	0.00	0.00	0.00	.69	0.00	0.00	0.00	.69	1.03	.69	3.44	.69	0.00	0.00	7.22
(2)	0.00	0.00	0.00	0.00	0.00	0.00	.02	0.00	0.00	0.00	.02	.03	.02	.12	.02	0.00	0.00	.24
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	5
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	.69	0.00	0.00	1.72
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.03	.02	0.00	0.00	.06
ALL SPEEDS	2	5	6	19	10	16	40	22	4	10	23	25	28	43	29	9	0	291
(1)	.69	1.72	2.06	6.53	3.44	5.50	13.75	7.56	1.37	3.44	7.90	8.59	9.62	14.78	9.97	3.09	0.00	100.00
(2)	.02	.06	.07	.22	.12	.19	.46	.25	.05	.12	.27	.29	.32	.50	.34	.10	0.00	3.37

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-2
(Sheet 3 of 8)

STABILITY CLASS C   CLASS FREQUENCY (PERCENT) = 7.08

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	0	0	5	4	1	0	0	0	1	0	0	3	0	0	0	0	0	14
(1)	0.00	0.00	.82	.65	.16	0.00	0.00	0.00	.16	0.00	0.00	.49	0.00	0.00	0.00	0.00	0.00	2.29
(2)	0.00	0.00	.06	.05	.01	0.00	0.00	0.00	.01	0.00	0.00	.03	0.00	0.00	0.00	0.00	0.00	.16
4-7	3	2	2	5	6	20	10	5	4	1	5	1	10	7	18	8	0	107
(1)	.49	.33	.33	.82	.98	3.27	1.64	.82	.65	.16	.82	.16	1.64	1.15	2.95	1.31	0.00	17.51
(2)	.03	.02	.02	.06	.07	.23	.12	.06	.05	.01	.06	.01	.12	.08	.21	.09	0.00	1.24
8-12	10	4	3	8	16	26	28	15	3	13	14	15	18	19	23	8	0	223
(1)	1.64	.65	.49	1.31	2.62	4.26	4.58	2.45	.49	2.13	2.29	2.45	2.95	3.11	3.76	1.31	0.00	36.50
(2)	.12	.05	.03	.09	.19	.30	.32	.17	.03	.15	.16	.17	.21	.22	.27	.09	0.00	2.58
13-18	4	1	6	5	3	1	2	13	1	5	19	14	29	48	33	0	0	184
(1)	.65	.16	.98	.82	.49	.16	.33	2.13	.16	.82	3.11	2.29	4.75	7.86	5.40	0.00	0.00	30.11
(2)	.05	.01	.07	.06	.03	.01	.02	.15	.01	.06	.22	.16	.34	.56	.38	0.00	0.00	2.13
19-24	0	1	4	0	0	0	0	0	1	1	1	3	5	30	12	0	0	58
(1)	0.00	.16	.65	0.00	0.00	0.00	0.00	0.00	.16	.16	.16	.49	.82	4.91	1.96	0.00	0.00	9.49
(2)	0.00	.01	.05	0.00	0.00	0.00	0.00	0.00	.01	.01	.01	.03	.06	.35	.14	0.00	0.00	.67
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	5	17	3	0	0	25
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.82	2.78	.49	0.00	0.00	4.09
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.06	.20	.03	0.00	0.00	.29
ALL SPEEDS	17	8	20	22	26	47	40	33	10	20	39	36	67	121	89	16	0	611
(1)	2.78	1.31	3.27	3.60	4.26	7.69	6.55	5.40	1.64	3.27	6.38	5.89	10.97	19.80	14.57	2.62	0.00	100.00
(2)	.20	.09	.23	.25	.30	.54	.46	.38	.12	.23	.45	.42	.78	1.40	1.03	.19	0.00	7.08

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-2
(Sheet 4 of 8)

STABILITY CLASS D   CLASS FREQUENCY (PERCENT) = 43.31

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-3	5	8	7	10	13	10	5	4	10	14	6	5	6	5	7	10	0	125
(1)	.13	.21	.19	.27	.35	.27	.13	.11	.27	.37	.16	.13	.16	.13	.19	.27	0.00	3.34
(2)	.06	.09	.08	.12	.15	.12	.06	.05	.12	.16	.07	.06	.07	.06	.08	.12	0.00	1.45
4-7	53	56	35	47	47	48	54	40	26	22	35	26	37	47	48	49	0	670
(1)	1.42	1.50	.94	1.26	1.26	1.28	1.44	1.07	.70	.59	.94	.70	.99	1.26	1.28	1.31	0.00	17.92
(2)	.61	.65	.41	.54	.54	.56	.63	.46	.30	.25	.41	.30	.43	.54	.56	.57	0.00	7.76
8-12	101	82	68	53	46	83	59	73	86	107	139	78	78	121	128	70	0	1372
(1)	2.70	2.19	1.82	1.42	1.23	2.22	1.58	1.95	2.30	2.86	3.72	2.09	2.09	3.24	3.42	1.87	0.00	36.70
(2)	1.17	.95	.79	.61	.53	.96	.68	.85	1.00	1.24	1.61	.90	.90	1.40	1.48	.81	0.00	15.90
13-18	52	46	66	14	15	16	10	37	33	76	120	75	99	251	121	18	0	1049
(1)	1.39	1.23	1.77	.37	.40	.43	.27	.99	.88	2.03	3.21	2.01	2.65	6.71	3.24	.48	0.00	28.06
(2)	.60	.53	.76	.16	.17	.19	.12	.43	.38	.88	1.39	.87	1.15	2.91	1.40	.21	0.00	12.15
19-24	23	19	24	5	9	4	5	13	11	10	15	18	54	113	56	0	0	379
(1)	.62	.51	.64	.13	.24	.11	.13	.35	.29	.27	.40	.48	1.44	3.02	1.50	0.00	0.00	10.14
(2)	.27	.22	.28	.06	.10	.05	.06	.15	.13	.12	.17	.21	.63	1.31	.65	0.00	0.00	4.39
GT 24	0	3	9	7	6	0	1	5	3	3	5	3	27	44	27	0	0	143
(1)	0.00	.08	.24	.19	.16	0.00	.03	.13	.08	.08	.13	.08	.72	1.18	.72	0.00	0.00	3.83
(2)	0.00	.03	.10	.08	.07	0.00	.01	.06	.03	.03	.06	.03	.31	.51	.31	0.00	0.00	1.66
ALL SPEEDS	234	214	209	136	136	161	134	172	169	232	320	205	301	581	387	147	0	3738
(1)	6.26	5.72	5.59	3.64	3.64	4.31	3.58	4.60	4.52	6.21	8.56	5.48	8.05	15.54	10.35	3.93	0.00	100.00
(2)	2.71	2.48	2.42	1.58	1.58	1.87	1.55	1.99	1.96	2.69	3.71	2.38	3.49	6.73	4.48	1.70	0.00	43.31

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD   C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-2
(Sheet 5 of 8)

STABILITY CLASS E   CLASS FREQUENCY (PERCENT) = 30.38

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	3
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.04	.04	0.00	0.00	0.00	0.00	0.00	0.00	.04	0.00	.11
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	.03
C-3	5	6	9	9	9	10	12	6	8	5	7	6	4	6	9	6	0	117
(1)	.19	.23	.34	.34	.34	.38	.46	.23	.31	.19	.27	.23	.15	.23	.34	.23	0.00	4.46
(2)	.06	.07	.10	.10	.10	.12	.14	.07	.09	.06	.08	.07	.05	.07	.10	.07	0.00	1.36
4-7	25	24	22	26	30	33	29	29	33	42	32	16	22	31	31	15	0	440
(1)	.95	.92	.84	.99	1.14	1.26	1.11	1.11	1.26	1.60	1.22	.61	.84	1.18	1.18	.57	0.00	16.78
(2)	.29	.28	.25	.30	.35	.38	.34	.34	.38	.49	.37	.19	.25	.36	.36	.17	0.00	5.10
8-12	40	41	32	18	24	16	31	64	83	115	137	114	104	145	141	57	0	1162
(1)	1.53	1.56	1.22	.69	.92	.61	1.18	2.44	3.17	4.39	5.23	4.35	3.97	5.53	5.38	2.17	0.00	44.32
(2)	.46	.48	.37	.21	.28	.19	.36	.74	.96	1.33	1.59	1.32	1.20	1.68	1.63	.66	0.00	13.46
13-18	26	23	8	3	2	8	17	32	40	37	112	141	116	140	76	13	0	794
(1)	.99	.88	.31	.11	.08	.31	.65	1.22	1.53	1.41	4.27	5.38	4.42	5.34	2.90	.50	0.00	30.28
(2)	.30	.27	.09	.03	.02	.09	.20	.37	.46	.43	1.30	1.63	1.34	1.62	.88	.15	0.00	9.20
19-24	2	2	2	3	0	0	5	19	6	6	6	8	8	19	7	0	0	93
(1)	.08	.08	.08	.11	0.00	0.00	.19	.72	.23	.23	.23	.31	.31	.72	.27	0.00	0.00	3.55
(2)	.02	.02	.02	.03	0.00	0.00	.06	.22	.07	.07	.07	.09	.09	.22	.08	0.00	0.00	1.08
GT 24	0	0	2	1	0	0	0	1	0	0	0	0	3	4	2	0	0	13
(1)	0.00	0.00	.08	.04	0.00	0.00	0.00	.04	0.00	0.00	0.00	0.00	.11	.15	.08	0.00	0.00	.50
(2)	0.00	0.00	.02	.01	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	.03	.05	.02	0.00	0.00	.15
ALL SPEEDS	98	96	75	60	65	67	94	152	171	205	294	285	257	345	266	92	0	2622
(1)	3.74	3.66	2.86	2.29	2.48	2.56	3.59	5.80	6.52	7.82	11.21	10.87	9.80	13.16	10.14	3.51	0.00	100.00
(2)	1.14	1.11	.87	.70	.75	.78	1.09	1.76	1.98	2.38	3.41	3.30	2.98	4.00	3.08	1.07	0.00	30.38

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-2
(Sheet 6 of 8)

STABILITY CLASS F CLASS FREQUENCY (PERCENT) = 7.76

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.15	0.00	0.00	0.00	0.00	0.00	.15
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	.01
C-3	5	2	6	6	5	3	6	4	3	2	8	4	2	2	1	0	0	59
(1)	.75	.30	.90	.90	.75	.45	.90	.60	.45	.30	1.19	.60	.30	.30	.15	0.00	0.00	8.81
(2)	.06	.02	.07	.07	.06	.03	.07	.05	.03	.02	.09	.05	.02	.02	.01	0.00	0.00	.68
4-7	11	11	8	8	3	5	5	13	26	17	14	11	8	13	10	11	0	174
(1)	1.64	1.64	1.19	1.19	.45	.75	.75	1.94	3.88	2.54	2.09	1.64	1.19	1.94	1.49	1.64	0.00	25.97
(2)	.13	.13	.09	.09	.03	.06	.06	.15	.30	.20	.16	.13	.09	.15	.12	.13	0.00	2.02
8-12	13	5	6	4	0	0	1	10	32	33	27	23	30	42	37	21	0	284
(1)	1.94	.75	.90	.60	0.00	0.00	.15	1.49	4.78	4.93	4.03	3.43	4.48	6.27	5.52	3.13	0.00	42.39
(2)	.15	.06	.07	.05	0.00	0.00	.01	.12	.37	.38	.31	.27	.35	.49	.43	.24	0.00	3.29
13-18	3	3	0	0	0	0	0	2	8	12	15	22	18	23	39	7	0	152
(1)	.45	.45	0.00	0.00	0.00	0.00	0.00	.30	1.19	1.79	2.24	3.28	2.69	3.43	5.82	1.04	0.00	22.69
(2)	.03	.03	0.00	0.00	0.00	0.00	0.00	.02	.09	.14	.17	.25	.21	.27	.45	.08	0.00	1.76
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	32	21	20	18	8	8	12	29	69	64	64	61	58	80	87	39	0	670
(1)	4.78	3.13	2.99	2.69	1.19	1.19	1.79	4.33	10.30	9.55	9.55	9.10	8.66	11.94	12.99	5.82	0.00	100.00
(2)	.37	.24	.23	.21	.09	.09	.14	.34	.80	.74	.74	.71	.67	.93	1.01	.45	0.00	7.76

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-2
(Sheet 7 of 8)

STABILITY CLASS G CLASS FREQUENCY (PERCENT) = 5.87

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.20	0.00	.20
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	0.00	.01
C-3	3	7	4	3	2	2	4	2	3	3	5	7	3	4	4	6	0	62
(1)	.59	1.38	.79	.59	.39	.39	.79	.39	.59	.59	.99	1.38	.59	.79	.79	1.18	0.00	12.23
(2)	.03	.08	.05	.03	.02	.02	.05	.02	.03	.03	.06	.08	.03	.05	.05	.07	0.00	.72
4-7	12	7	10	7	5	0	1	8	14	19	13	21	12	12	11	7	0	159
(1)	2.37	1.38	1.97	1.38	.99	0.00	.20	1.58	2.76	3.75	2.56	4.14	2.37	2.37	2.17	1.38	0.00	31.36
(2)	.14	.08	.12	.08	.06	0.00	.01	.09	.16	.22	.15	.24	.14	.14	.13	.08	0.00	1.84
8-12	18	6	9	0	1	0	1	3	17	18	28	14	19	30	29	17	0	210
(1)	3.55	1.18	1.78	0.00	.20	0.00	.20	.59	3.35	3.55	5.52	2.76	3.75	5.92	5.72	3.35	0.00	41.42
(2)	.21	.07	.10	0.00	.01	0.00	.01	.03	.20	.21	.32	.16	.22	.35	.34	.20	0.00	2.43
13-18	2	3	0	0	0	0	0	2	2	2	9	5	4	21	18	7	0	75
(1)	.39	.59	0.00	0.00	0.00	0.00	0.00	.39	.39	.39	1.78	.99	.79	4.14	3.55	1.38	0.00	14.79
(2)	.02	.03	0.00	0.00	0.00	0.00	0.00	.02	.02	.02	.10	.06	.05	.24	.21	.08	0.00	.87
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALL SPEEDS	35	23	23	10	8	2	6	15	36	42	55	47	38	67	62	38	0	507
(1)	6.90	4.54	4.54	1.97	1.58	.39	1.18	2.96	7.10	8.28	10.85	9.27	7.50	13.21	12.23	7.50	0.00	100.00
(2)	.41	.27	.27	.12	.09	.02	.07	.17	.42	.49	.64	.54	.44	.78	.72	.44	0.00	5.87

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-2
(Sheet 8 of 8)

STABILITY CLASS ALL   CLASS FREQUENCY (PERCENT) = 100.00

WIND DIRECTION FROM

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	2	0	5
(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	.01	0.00	0.00	0.00	.02	0.00	.06
(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.01	.01	0.00	0.00	.01	0.00	0.00	0.00	.02	0.00	.06
C-3	18	23	31	32	30	26	28	16	26	24	26	26	15	18	21	22	0	382
(1)	.21	.27	.36	.37	.35	.30	.32	.19	.30	.28	.30	.30	.17	.21	.24	.25	0.00	4.43
(2)	.21	.27	.36	.37	.35	.30	.32	.19	.30	.28	.30	.30	.17	.21	.24	.25	0.00	4.43
4-7	104	101	78	101	95	109	111	96	103	103	100	76	95	113	121	92	0	1598
(1)	1.20	1.17	.90	1.17	1.10	1.26	1.29	1.11	1.19	1.19	1.16	.88	1.10	1.31	1.40	1.07	0.00	18.51
(2)	1.20	1.17	.90	1.17	1.10	1.26	1.29	1.11	1.19	1.19	1.16	.88	1.10	1.31	1.40	1.07	0.00	18.51
8-12	186	142	120	99	102	143	159	177	222	291	356	256	262	368	372	180	0	3435
(1)	2.16	1.65	1.39	1.15	1.18	1.66	1.84	2.05	2.57	3.37	4.12	2.97	3.04	4.26	4.31	2.09	0.00	39.80
(2)	2.16	1.65	1.39	1.15	1.18	1.66	1.84	2.05	2.57	3.37	4.12	2.97	3.04	4.26	4.31	2.09	0.00	39.80
13-18	89	82	85	24	22	26	60	111	87	141	288	269	286	519	310	47	0	2446
(1)	1.03	.95	.98	.28	.25	.30	.70	1.29	1.01	1.63	3.34	3.12	3.31	6.01	3.59	.54	0.00	28.34
(2)	1.03	.95	.98	.28	.25	.30	.70	1.29	1.01	1.63	3.34	3.12	3.31	6.01	3.59	.54	0.00	28.34
19-24	25	22	30	8	9	4	12	34	18	17	25	32	70	181	79	0	0	566
(1)	.29	.25	.35	.09	.10	.05	.14	.39	.21	.20	.29	.37	.81	2.10	.92	0.00	0.00	6.56
(2)	.29	.25	.35	.09	.10	.05	.14	.39	.21	.20	.29	.37	.81	2.10	.92	0.00	0.00	6.56
GT 24	0	3	11	8	6	0	1	6	3	3	5	3	36	80	34	0	0	199
(1)	0.00	.03	.13	.09	.07	0.00	.01	.07	.03	.03	.06	.03	.42	.93	.39	0.00	0.00	2.31
(2)	0.00	.03	.13	.09	.07	0.00	.01	.07	.03	.03	.06	.03	.42	.93	.39	0.00	0.00	2.31
ALL SPEEDS	422	373	355	272	264	308	371	441	460	579	800	663	764	1279	937	343	0	8631
(1)	4.89	4.32	4.11	3.15	3.06	3.57	4.30	5.11	5.33	6.71	9.27	7.68	8.85	14.82	10.86	3.97	0.00	100.00
(2)	4.89	4.32	4.11	3.15	3.06	3.57	4.30	5.11	5.33	6.71	9.27	7.68	8.85	14.82	10.86	3.97	0.00	100.00

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD

C= CALM (WIND SPEED LESS THAN OR EQUAL TO .58 MPH)

TABLE 2B-3

WIND DIRECTION PERSISTENCE SUMMARY (43-FOOT LEVEL)

43.0 FT WIND DATA

WIND DIRECTION PERSISTENCE SUMMARY - NUMBER OF OBSERVATIONS AND PERCENT PROBABILITY

DIRECTION PERSISTENCE (HOURS)

DIRECTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	GT.24	TOTAL
N	115	35	7	8	3	2	1	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	175
	66	86	90	94	96	97	98	98	98	98	99	99	99	99	99	99	99	99	99	100	0	0	0	0	0	
NNE	118	22	10	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157
	75	89	96	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NE	89	17	10	9	4	5	2	3	2	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	145
	61	73	80	86	89	92	94	96	97	98	99	99	99	99	99	99	99	99	100	0	0	0	0	0	0	
ENE	100	37	16	8	5	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	171
	58	80	89	94	97	98	98	99	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
E	114	37	22	9	8	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	199
	57	76	87	91	95	97	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ESE	141	44	14	4	3	3	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	213
	66	87	93	95	97	98	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SE	155	60	14	8	8	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249
	62	86	92	95	98	99	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SSE	157	39	10	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	214
	73	92	96	97	98	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
S	161	46	15	10	5	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	240
	67	86	92	97	99	99	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SSW	174	55	22	15	5	6	1	3	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	283
	61	81	89	94	96	98	98	99	99	99	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	
SW	175	60	29	20	12	6	3	0	3	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	313
	56	75	84	91	95	96	97	97	98	99	99	99	100	100	100	100	100	100	0	0	0	0	0	0	0	
WSW	215	75	33	18	12	4	4	2	4	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	373
	58	78	87	91	95	96	97	97	98	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	
W	308	88	41	21	14	8	5	2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	490
	63	81	89	93	96	98	99	99	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	
WNW	322	127	57	35	24	13	11	8	9	4	3	2	0	3	1	2	1	0	0	0	0	1	0	0	0	623
	52	72	81	87	91	93	95	96	97	98	98	99	99	99	99	100	100	100	100	100	100	100	0	0	0	
NW	274	100	45	22	12	6	3	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	467
	59	80	90	94	97	98	99	99	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NNW	158	33	16	9	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	219
	72	87	95	59	99	99	99	99	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	2776	875	361	204	119	63	41	22	27	12	8	5	5	4	1	2	1	2	1	1	0	1	0	0	0	4531

TABLE 2B-4

WIND PERSISTENCE SUMMARY (209-FOOT LEVEL)

NUMBER OF OBSERVATIONS AND PERCENT PROBABILITY

DIRECTION PERSISTENCE (HOURS)

DIRECTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	GT.24	TOTAL
N	133	25	24	11	5	0	5	1	2	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	209
	64	76	87	92	95	95	97	98	99	99	99	99	99	99	99	100	100	0	0	0	0	0	0	0	0	
NNE	137	37	17	8	7	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	213
	64	82	90	93	97	98	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NE	95	28	15	10	7	7	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	167
	57	70	83	89	93	97	98	98	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ENE	84	31	10	11	6	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	144
	58	80	87	94	99	99	99	99	99	99	99	99	99	99	99	100	0	0	0	0	0	0	0	0	0	
E	93	36	10	6	1	2	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	152
	61	85	91	95	96	97	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ESE	103	33	15	7	4	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168
	61	81	90	94	96	98	99	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SE	93	50	25	12	5	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	190
	49	75	88	95	97	98	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SSE	116	49	28	9	8	1	2	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	218
	53	76	89	93	96	97	98	99	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	
S	131	52	29	11	1	4	2	1	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	235
	56	78	90	95	95	97	98	98	98	99	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
SSW	170	66	30	14	11	8	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	303
	56	78	88	92	96	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SW	154	64	41	18	13	8	5	2	4	2	4	1	0	0	0	0	0	0	1	0	0	0	0	0	1 *	318
	48	69	81	87	91	94	95	96	97	98	99	99	99	99	99	99	99	99	100	100	100	100	100	100	100	
WSW	166	49	36	20	13	3	1	6	3	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	301
	55	71	83	90	94	95	96	98	99	99	99	99	99	100	0	0	0	0	0	0	0	0	0	0	0	
W	174	70	42	28	11	10	5	3	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	346
	50	71	83	91	94	97	98	99	99	99	99	99	99	100	100	100	100	0	0	0	0	0	0	0	0	
WNW	207	104	33	30	12	14	12	7	10	4	4	1	2	1	2	4	0	0	1	0	0	0	0	1	0	449
	46	69	77	83	86	89	92	93	96	96	97	98	98	98	99	100	100	100	100	100	100	100	100	100	0	
NW	189	79	48	30	14	9	9	5	4	3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	393
	48	68	80	88	92	94	96	97	98	99	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	
NNW	118	48	22	7	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	202
	58	82	93	97	98	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	2163	821	425	232	121	76	53	33	30	14	14	4	3	4	3	6	2	0	2	0	0	0	0	1	1	4008

* THIS OCCURANCE LASTED 29 HOURS

TABLE 2B-5

INVERSION PERSISTENCE SUMMARY
(43-150 FOOT DELTA-T)

DURATION (HOURS)	NUMBER OF OBSERVATIONS	PERCENT PROBABILITY
1	143	32.72
2	66	47.83
3	30	54.69
4	23	59.95
5	23	65.22
6	20	69.79
7	18	73.91
8	14	77.12
9	22	82.15
10	15	85.58
11	22	90.62
12	9	92.68
13	14	95.88
14	3	96.57
15	8	98.40
16	4	99.31
17	3	100.00

THE LONGEST INVERSION LASTED 17 HOURS

OF THE LONGEST INVERSIONS
NUMBER 1 STARTED 16 HOURS INTO DAY 234
NUMBER 2 STARTED 16 HOURS INTO DAY 267
NUMBER 3 STARTED 16 HOURS INTO DAY 275

THIRD COLUMN DEFINES THE PERCENT PROBABILITY
THAT IF AN INVERSION OCCURS, ITS DURATION
WILL BE LESS THAN THE NUMBER OF HOURS SPECIFIED

TABLE 2B-6

INVERSION PERSISTENCE SUMMARY
(43-209 FOOT DELTA-T)

DURATION (HOURS)	NUMBER OF OBSERVATIONS	PERCENT PROBABILITY
1	163	33.20
2	61	45.62
3	40	53.77
4	29	59.67
5	30	65.78
6	17	69.25
7	25	74.34
8	10	76.37
9	22	80.86
10	19	84.73
11	27	90.22
12	13	92.87
13	15	95.93
14	9	97.76
15	4	98.57
16	5	99.59
17	2	100.00

THE LONGEST INVERSION LASTED 17 HOURS

OF THE LONGEST INVERSIONS
NUMBER 1 STARTED 17 HOURS INTU DAY 199
NUMBER 2 STARTED 16 HOURS INTO DAY 234

THIRD COLUMN DEFINES THE PERCENT PROBABILITY
THAT IF AN INVERSION OCCURS, ITS DURATION
WILL BE LESS THAN THE NUMBER OF HOURS SPECIFIED

TABLE 2B-7

TEMPERATURE AVERAGES AND EXTREMES

(Values in °F)

Month	Average	Maximum	Minimum
Apr 1979	43.4	70.0	28.6
May	56.6	92.1	39.6
Jun	63.7	89.6	43.6
Jul	69.5	89.1	47.2
Aug	66.3	87.6	47.7
Sep	60.1	83.0	34.7
Oct	50.0	82.1	29.9
Nov	46.0	70.3	26.5
Dec	33.3	64.3	0.0
Jan 1980	26.9	57.8	6.4
Feb	24.2	48.2	5.6
Mar	34.2	58.7	1.9
Apr 1979 - Mar 1980	47.8	92.1	0.0

TABLE 2B-8

DEW POINT AVERAGES AND EXTREMES

(Values in °F)

Month	Average	Maximum	Minimum
Apr 1979	(a)	(a)	(a)
May	50.5	64.1	28.5
Jun	53.2	68.1	31.6
Jul	57.5	67.7	38.0
Aug	64.3	73.0	44.1
Sep	55.2	70.6	39.4
Oct	38.8	62.5	21.1
Nov	37.6	63.3	7.1
Dec	24.7	49.7	-5.6
Jan 1980	15.1	55.5	-11.0
Feb	12.4	34.3	-8.7
Mar	24.3	52.6	-7.5
Apr 1979 - Mar 1980	35.4	73.0	-11.0

(a) Collection of onsite dew point data did not begin until May 1979.

TABLE 2B-9

PRECIPITATION TOTALS

(Values in Inches of Water)

Month	Total Precipitation
Apr 1979	2.69
May	3.47
Jun	0.71
Jul	2.87
Aug	3.87
Sep	3.75
Oct	4.75
Nov	3.33
Dec	1.59
Jan 1980	0.38
Feb	0.69
Mar	4.30
12-Month Average	32.40

45

TABLE 2B-10

METEOROLOGICAL DATA RECOVERY RATES

Parameter	Possible Hours	Usable Hours	Recovery Rate
43 Foot Wind Speed	8784	8683	98.8%
209 Foot Wind Speed	8784	8663	98.6%
43 Foot Wind Direction	8784	8654	98.5%
209 Foot Wind Direction	8784	8677	98.8%
43 Foot Temperature	8784	8679	98.8%
43-150 Foot Delta Temp	8784	8619	98.1%
43-209 Foot Delta Temp	8784	8661	98.6%
43 Foot Dew Point	7920[a]	5573	79.2%[b]
Precipitation	8784	8513	96.9%
Solar Radiation	8784	8689	98.9%
Composite (43' WS, 43' WD, 43-150' DT)	8784	8584	97.7%
Composite (209' WS, 209' WD, 43-209' DT)	8784	8631	98.3%

[a] Collection of Dew Point data began on May 7, 1979.

[b] This figure includes the time period May 7, 1979 through March 31, 1980.

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TABLE 2B-11
(Sheet 1 of 2)

STABILITY PERSISTENCE SUMMARY
APRIL 1979-MARCH 1980

a. 43-150 Foot Delta-Temperature

STABILITY PERSISTENCE SUMMARY - NUMBER OF OBSERVATIONS AND PERCENT PROBABILITY

STABILITY PERSISTENCE (HOURS)

STABILITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	GT.24	TOTAL
A	111	51	31	12	13	3	7	2	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	236
	47	69	82	87	92	94	97	97	99	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B	297	100	47	22	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	476
	62	83	93	98	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C	319	55	10	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	388
	82	96	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D	333	180	136	70	36	34	32	13	14	15	8	16	9	8	3	5	5	5	2	2	2	1	3	0	5[(a)]	937
	36	55	69	77	81	84	88	89	91	92	93	95	96	96	97	97	98	98	99	99	99	99	99	99	100	
E	322	133	73	46	32	20	17	13	19	9	9	0	8	3	2	0	2	1	0	0	0	0	0	0	0	709
	45	64	74	81	85	88	91	93	95	96	98	98	99	99	100	100	100	100	0	0	0	0	0	0	0	
F	210	76	24	11	13	1	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	341
	62	84	91	94	98	98	99	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
G	61	33	12	12	6	11	9	4	3	3	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	160
	38	59	66	74	78	84	90	93	94	96	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	1653	628	333	177	108	71	67	35	40	29	22	18	17	11	5	5	7	6	2	2	2	1	3	0	5	3247

(a) Of these 5 occurences of D stability which persisted over 24 hours:

- o one lasted 28 hours
- o one lasted 32 hours
- o one lasted 33 hours
- o one lasted 40 hours
- o one lasted 44 hours

TABLE 2B-11
(Sheet 2 of 2)

b. 43-209 Foot Delta-Temperature

STABILITY PERSISTENCE SUMMARY - NUMBER OF OBSERVATIONS AND PERCENT PROBABILITY

STABILITY PERSISTENCE (HOURS)

STABILITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	GT.24	TOTAL
A	59	22	2	5	2	2	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97
	61	84	86	91	93	95	96	98	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B	141	42	15	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	203
	69	90	98	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C	233	90	34	19	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	380
	61	85	94	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D	265	165	123	75	44	38	25	17	17	8	13	14	5	6	7	5	3	2	5	2	3	1	0	1	12[a]	856
	31	50	65	73	79	83	86	88	90	91	92	94	95	95	96	97	97	97	98	98	98	98	98	99	100	
E	276	157	68	58	50	35	15	18	19	18	9	3	5	9	5	1	1	1	0	1	2	1	0	0	0	752
	37	58	67	74	81	86	88	90	93	95	96	97	97	98	99	99	99	99	99	100	100	100	0	0	0	
F	185	88	38	18	10	6	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	350
	53	78	89	94	97	99	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
G	44	19	15	9	7	11	10	3	4	0	7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	132
	33	48	59	66	71	80	87	89	92	92	98	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	1203	583	295	188	118	92	55	40	43	26	29	20	10	15	12	6	4	3	5	3	5	2	0	1	12	2770

[a] Of these 12 occurences of D stability which persisted over 24 hours:

- two lasted 25 hours
- two lasted 26 hours
- one lasted 27 hours
- one lasted 28 hours
- two lasted 32 hours
- one lasted 36 hours
- two lasted 44 hours
- one lasted 46 hours

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TABLE 2B-12
(Sheet 1 of 2)

STABILITY PERSISTENCE SUMMARY
JUNE 1980-MAY 1981

a. 43-150 Foot Delta-Temperature

STABILITY PERSISTENCE SUMMARY - NUMBER OF OBSERVATIONS AND PERCENT PROBABILITY

STABILITY PERSISTENCE (HOURS)

STABILITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	GT.24	TOTAL
A	99	49	36	23	26	16	19	14	6	5	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	300
	33	49	61	69	78	83	89	94	96	98	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
B	311	105	32	16	5	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	474
	66	88	95	98	99	99	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C	251	56	19	6	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	337
	74	91	97	99	99	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D	324	154	79	51	46	27	21	17	15	14	17	9	10	14	7	6	6	2	1	8	2	0	2	1	8 [a]	841
	39	57	66	72	78	81	83	85	87	89	91	92	93	95	96	96	97	97	98	98	99	99	99	99	100	
E	313	120	63	41	32	24	10	3	4	4	5	0	1	0	0	1	0	0	0	0	0	0	0	0	0	621
	50	70	80	86	92	95	97	98	98	99	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0	
F	210	75	31	17	5	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	343
	61	83	92	97	99	99	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
G	69	27	14	14	10	12	6	3	8	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	168
	41	57	65	74	80	87	90	92	97	98	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	1577	586	274	168	127	83	62	39	33	25	29	11	12	14	7	7	6	2	1	8	2	0	2	1	8	3084

[a] Of these 8 occurences of D stability which persisted over 24 hours:

- one lasted 25 hours
- one lasted 27 hours
- one lasted 28 hours
- one lasted 30 hours
- one lasted 35 hours
- one lasted 36 hours
- one lasted 41 hours
- one lasted 50 hours

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TABLE 2B-12
(Sheet 2 of 2)

b. 43-209 Foot Delta-Temperature

STABILITY PERSISTENCE SUMMARY - NUMBER OF OBSERVATIONS AND PERCENT PROBABILITY

STABILITY PERSISTENCE (HOURS)

STABILITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	GT.24	TOTAL
A	70	33	14	9	11	5	5	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	156
	45	66	75	81	88	91	94	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
B	195	67	26	11	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	302
	65	87	95	99	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C	281	78	23	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	389
	72	92	98	99	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D	259	140	101	57	35	22	21	23	21	12	12	10	12	6	8	10	4	6	4	4	1	1	3	1	15[a]	788
	33	51	63	71	75	78	81	84	86	88	89	90	92	93	94	95	96	96	97	97	97	98	98	98	100	
E	302	142	79	55	39	24	18	8	12	10	5	1	8	5	0	1	0	0	0	0	1	0	0	0	0	710
	43	63	74	81	87	90	93	94	96	97	98	98	99	100	100	100	100	100	100	100	100	0	0	0	0	
F	205	82	42	23	11	3	5	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	374
	55	77	88	94	97	98	99	99	99	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
G	49	21	25	10	9	11	5	2	10	5	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	150
	33	47	63	70	76	83	87	88	95	98	99	99	100	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	1361	563	310	169	110	66	54	41	45	28	19	12	21	11	8	11	4	6	4	4	2	1	3	1	15	2869

[a] Of these 15 occurences of D stability which persisted over 24 hours:

- three lasted 25 hours
- three lasted 27 hours
- one lasted 28 hours
- one lasted 29 hours
- one lasted 31 hours
- one lasted 33 hours
- one lasted 36 hours
- one lasted 42 hours
- one lasted 45 hours
- one lasted 46 hours
- one lasted 50 hours

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APPENDIX 2C

GEOLOGIC INVESTIGATIONS OF THE SCOTLAND ROAD FAULT (CLINTON - NEWBURY FAULT), NEWBURY, MASSACHUSETTS, AND PORTSMOUTH FAULT INVESTIGATIONS

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

SCOTLAND ROAD FAULT INVESTIGATIONS

CONTENTS

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK STATION

SCOTLAND ROAD FAULT INVESTIGATIONS

Investigations have been conducted over a portion of the Scotland Road fault in Newbury, Massachusetts, to determine the presence, location, orientation and physical characteristics of the fault, and to examine the nature and structure of the unconsolidated Pleistocene deposits which overlie the fault trace. The investigations have indicated that the fault structure is of Permian age, and that Pleistocene deposits overlying the fault zone show no evidence of movement on the fault subsequent to their deposition.

I. LOCATION OF FAULT INVESTIGATIONS

The Scotland Road fault was inferred by A. F. Shride of the U. S. Geological Survey (Shride; 1971) to trend easterly through the towns of West Newbury, Newbury and Newburyport, Massachusetts, about 7 miles to the south of the proposed Seabrook Station (see Figure 1). Shride has interpreted the Scotland Road fault to represent the eastern portion of the Clinton-Newbury fault, which is inferred to trend northeasterly for about 60 miles from the area of Worcester, Massachusetts, to project offshore at Plum Island, Newbury.

Detailed investigations to locate and examine the fault and its overlying Pleistocene deposits have been carried out just to the north of Scotland Road near the north corner of Newbury, Massachusetts, in an open field owned by the Marion H. Marshall Estate (see Figure 2). In this area, the fault forms the boundary between Newburyport granodiorite of presumed Devonian age on the north, and an unnamed complex of diorite and schist of unknown geologic age on the south. Diabase dikes of probable Triassic age intrude both the Newburyport and the unnamed diorite/schist on both sides of the fault.

II. INVESTIGATION PROCEDURES

A. Preliminary - General Area

As preliminary investigation of the Scotland Road fault zone, J. R. Rand walked portions of the fault trace, and inquired of A. F. Shride by telephone as to his studies of the fault zone in the area. R. J. Holt of Weston Geophysical Research, Inc., and J. R. Rand together viewed the inferred trace of the fault zone between Plum Island and Groveland, Massachusetts, by helicopter flying at various altitudes. Diorite ridges aligned parallel to, and about 1000 feet to the south of the trace of the Scotland Road fault in West Newbury are readily seen from the air, but no anomalous physiographic features were noted along the trace of the fault itself. Backhoe trenching investigations over the inferred trace of the fault were attempted on the farm of Miss Alice Elwell, adjacent to Holman Lane,

West Newbury. This exploration, ultimately involving a 232-foot trench excavation in boulder till, sand-cobble till and clay till, was terminated because these glacial materials did not appear suitable for demonstrating the presence or absence of tectonic fault deformation.

B. Final - Property of Marion H. Marshall Estate

As geographic control for all investigations at the final study area on property owned by the Marion H. Marshall Estate in Newbury, a stadia survey of the area and a base map showing all pertinent features were provided by McKenna Associates, Engineers, Portsmouth, New Hampshire (see Plate 1). Technical investigations in the study area have included a seismic refraction survey; the excavation of four backhoe trenches; and the drilling of nine core borings. Laboratory investigations conducted on drill core samples from the study area have included petrographic examinations and radiometric age dating.

III. TECHNICAL INVESTIGATIONS

A. Seismic Refraction Survey

A seismic refraction survey was conducted across the study area during the period November 5-19, 1973, by Weston Geophysical Engineers, Inc., Weston, Massachusetts, to determine thicknesses of unconsolidated overburden and weathered rock materials, as well as velocities of the various geologic materials in the study area. Technical details of this survey are presented in a report by Weston Geophysical Engineers, Inc., attached herewith.

This seismic survey report concludes:

"The bedrock surface, as interpreted from seismic data, does not have any sharp breaks indicating faulting. The seismic velocities of the bedrock do not change sufficiently along the 1000-foot line of investigation to indicate the presence of any significant bedrock anomaly. The fault zone does not exhibit significant velocity differences from adjacent bedrock."

B. Borings Investigations

During the period December 4, 1973, to February 13, 1974, nine borings were put down along the centerline of the seismic refraction survey (Seismic Line "A") to locate, define and sample the Scotland Road fault zone (see Plates 2 and 3). These borings, designated SRF-1 through SRF-9, were drilled by American Drilling and Boring Co., Inc., East Providence, Rhode Island, under the supervision of Geotechnical Engineers, Inc., Winchester, Massachusetts. Geotechnical Engineers' personnel logged the unconsolidated soils materials in these borings, and J. R. Rand logged the bedrock cores. Detailed logs of these borings are attached herewith.

1. Soils

The unconsolidated soils materials encountered in 7 of the study area borings include a blanket of silty clay ranging to 40 feet in thickness,

overlying sandy deposits of varying grain sizes which range to 55 feet in thickness. Locally, a basal section of boulders of a few feet in thickness underlies the sand deposits immediately upon the bedrock surface. Soils materials were not sampled in the two angle borings, SRF-5 and SRF-7.

Plates 3 and 4 describe J. R. Rand's interpretation of the stratigraphy of the soils materials along the line of borings. The geologic interpretation is that of a blanket of glacial-marine clay of late Pleistocene age overlying glacial outwash and marine sands, all underlain by a smooth bedrock surface on which were deposited discontinuous thin sheets of glacial till or ground moraine. The sands in borings SRF-1 and SRF-4, on the southeastern end of the line of borings, are largely yellow-brown, medium- to coarse-grained, and resemble glacial outwash. The sands in SRF-6, SRF-9, SRF-2, SRF-8 and SRF-3 are commonly finer-grained and gray in color, and contain occasional thin interbeds of gray clay. These sands underlying the northern part of the line of borings are interpreted as having been derived from erosion of the outwash, with redeposition in the near-shore marine environment prior to, but historically essentially contemporaneously with deposition of the marine clays. The boundary between the two types of sandy deposits is in the area of SRF-6, where the elevation of the top of the sandy material is low, and the overlying clay blanket is thick.

2. Bedrock

The bedrock in the study area has been defined by outcrops of Newburyport granodiorite at the north end of Seismic Line "S", and by the nine borings which extend intermittently from the outcrop area on the north to Scotland Road on the south. The Newburyport outcrops at the north end of the line consist of massive, mottled pink and green, medium-grained granodiorite which exhibits saussurite alteration of feldspars and chloritization of biotite. The rock does not show evidence of shearing on the outcrop surfaces.

Proceeding southeasterly along the line of borings, the bedrock is seen in cores from SRF-5, SRF-7 and SRF-3 to become progressively more altered chemically and more deformed mechanically, becoming light tannish-green in color, and medium-fine grained and foliated in texture and fabric. With continued distance to the southeast, the bedrock in the hangingwall of the fault is seen in SRF-7, -8, -2, -9 and -6 to be an intensely deformed, light yellow-green welded breccia or cataclastic rock. All of the rock in the fault zone is compact and well consolidated, and no zones of clay gouge or other unconsolidated crushed or sheared materials were encountered in borings in the study area.

Borings SRF-7, SRF-8 and SRF-9 all progressed through the intensely deformed portion of the Scotland Road fault zone into unaltered, dark gray diorite and schist of the unnamed complex which lies to the south of the fault.

In each of these borings, a thin (1" to 2"), tan aphanitic rock layer was cored about 5 feet stratigraphically above the horizon where alteration and cataclastic deformation ceased, and this thin marker has been termed "mylonite" on Plates 3 and 4. Borings SRF-4 and SRF-2 drilled only unaltered bedrock of the diorite/schist complex.

Core in borings SRF-2, -3, -7, -8 and -9 was taken with an orienting barrel. Orientation measurements made by Geotechnical Engineers consistently show schistosity or foliation fabric of cores of the fault zone in these borings to dip in the range 35° to 60° toward the north or N10°W. On Plate 2, the subcrop of the footwall of the fault is interpreted to strike N80°E and to dip to the north at an average of about 44°. The trace of the footwall lies within only about 150 feet of the location inferred by A. F. Shride from his regional mapping studies. The true thickness of the rock section subject to mechanical deformation in the fault zone approaches 300 feet, indicating that the Scotland Road fault is a regional tectonic feature of major geologic significance.

C. Trenching Investigations

At various times during the period November 20, 1973, to March 4, 1974, four backhoe trenches were excavated in the study area to expose and examine the glacial-marine clay which overlies the Scotland Road fault zone (see Plate 2). In all trenches, the organic topsoil zone was about 6 inches to 8 inches thick overlying weathered clay, and was continuous and lay parallel with the nearly planar surface of the study area field.

1. Trench 1

Trench 1, near the north edge of the fault zone, was excavated on November 20, 1973, in massive olive-gray clay to a depth of about 12 feet at the north end of the trench, and was carried for about 150 feet toward the southeast with a depth of 4 feet to 5 feet. A 2-inch to 3-inch layer of fine laminated silty sand occurred in the clay at a depth of 3 feet to 3½ feet below ground surface, sloping gradually to the south. This laminated sand-silt layer was continuous and not disrupted in the southern 100 feet of the trench. At the northern end of the trench, the sand-silt layer merged upward into the weathered portion of the soil zone and became unidentifiable.

2. Trench 2

Trench 2, to the south of the fault trace, was excavated on December 12, 1973, to a depth of 7 feet to 8 feet in clay, and was carried northwesterly for about 50 feet until collapse of the trench walls terminated the work. This trench exposed a thin, flat-lying laminated sand-silt layer in the clay at a depth of about 6 feet. This sand-silt layer generally resembled that found in Trench 1, although the layer was saturated in Trench 2, and small springs issued from it locally when cut by the backhoe bucket.

3. Trench 3

Trench 3 was excavated across the fault zone from south to north on February 26-27, 1974, for a total length of 435 feet and to an average depth of about 7 feet. The trench was cut in olive-gray clay which was internally

massive, but which had a thick-bedded characteristic which permitted measuring the gentle undulating layering structure in the clay. Strike-and-dip plots of these layering features are shown in plan on Plate 2, and the projected layering of the clay is shown schematically in profile on Plate 4.

In addition to gross layering structure seen in the clay throughout the length of the trench, a 2-inch to 4-inch laminated fine sand and silt layer was identified within the clay overlying the footwall trace of the underlying fault zone. This sand-silt marker layer dipped northerly out of the weathered soil zone at about 100 feet north of the south end of the trench, and sloped northerly into a synclinal sag at 135 feet north of the south end of the trench, to rise back into the weathered soil zone and be lost about 170 feet north of the south end of the trench.

The structure of layering in the clay throughout Trench 2 forms gently undulating, open folds which appear generally to parallel the upper surface of the underlying outwash and marine sand deposits. No tight or abrupt folds were seen to disrupt the continuity of layering in the clay, and close examination throughout the length of the trench failed to detect any drag folding within the clay beds. The clay is jointed throughout the trench area, with joints tending to change orientations to conform to changing attitudes of the broad undulations in clay layering. No slickensides or other evidence of displacement were detected on any joints in the trench. No

sand dikes cutting across clay layering or filling joints were found. No offsets were found in the thin, sagged sand-silt marker horizon which was interbedded in the clay between Stations 100 and 170 in Trench 3.

Between 55 feet to 65 feet north of the south end of Trench 3, the backhoe excavated a pocket into the floor of the trench to a depth of about 14 feet, to determine whether there were any stratigraphic changes to that depth which might be useful to examine while proceeding northerly with the excavation across the fault zone. To the 14-foot depth tested, no sand layers were seen in the clay, and the pocket was backfilled to restore the trench floor to the normal 7-foot depth. Within a few moments of completing and tamping the backfill, several springs erupted from the trench floor within the backfill area, with artesian flows rising 1 inch to 2 inches above the floor of the trench. Fine gray sand suspended in the flowing waters of the several springs rapidly built sand cones several inches thick around the springs. A dam was built across the trench to the north of the springs, to protect the proposed excavation to the north from flooding, and thereafter the southern 80 feet of the trench filled to within 2 feet of ground surface, with the highly mobile fine gray sand continuing to be deposited from the springs onto the floor of the flooding trench.

4. Trench 4

Trench 4 was excavated on March 4, 1974, in an attempt to locate the westerly projection of the laminated sand-silt marker horizon found between

Stations 100 and 170 in Trench 3. A similar layer was found in Trench 4, taking the form of an open synclinal sag which plunged gently to the northeast toward Trench 3. Spoon sampling of the soils in Boring SRF-6, between the two trenches, also had detected a sand-silt layer in the clay at an elevation corresponding with that which projected between the two trenches.

Various points on the sand-silt horizon in each of the two trenches were then surveyed in by McKenna Associates in order to provide locations and elevations with which to define the structure of the horizon as it passed over the footwall and portions of the intensely deformed base of the Scotland Road fault. These surveyed points are designated points "A" through "J" on Plate 2. The structure of the horizon is defined in plan in an insert on Plate 2, and in profiles showing the east wall of Trench 3 and the east and west walls of Trench 4 on Plate 4.

As shown on Plate 2, the structure of the sand-silt marker horizon takes the form of an open, doubly-plunging syncline which strikes southwesterly across the footwall of the fault. No offsets of the sand-silt layer were detected in either trench, and no abrupt folding or drag folds were detected in this layer or in the clay beds in either trench. The sand-silt layer in both trenches does not apparently thicken or show increased grain sizes toward the trough of the syncline. No sand dikes were found in Trench 4, nor were joints slickensided.

No evidence was found to suggest that the synclinal structure of the sand-silt layer crossing the fault in the area of Trenches 3 and 4 was formed by other than passive deformation due to differential settlement of the underlying clay. The relatively non-compressible outwash and marine sands underlying the clay in the study area are at a low elevation beneath the area of this synclinal sag, and the relatively compressible clay section is thick. Conversely, the sand elevation is high and the clay is thin as seen in borings put down to the north and south of the sag. With the gradual post-depositional compaction of the clay materials through time, the thicker clay sections settled more deeply than the thin clay sections, passively producing sags in the originally horizontal layering of the fine-grained clay deposits.

There is no detectable sag in the topsoil zone which overlies the synclinal sag in the sand-silt marker horizon in Trenches 3 and 4, and there is no noticeable variation in thickness of the topsoil zone in these trenches. Since the sand-silt layer does not thicken or show coarser grain sizes toward the trough of the synclinal sag, the sand-silt layer appears to have been deposited on an originally horizontal surface which lay stratigraphically above the present ground surface. Differential settlement and sagging of the sand-silt horizon must have been completed prior to the last erosional beveling of the present ground surface, presumably upon retreat of the last post-glacial marine transgression, since the topsoil zone built

upon this beveled horizon shows no evidence of having sagged over the sand-silt sag or over any other of the gently undulations seen in the clay layering throughout the length of Trench 3. There is no evidence of disruption of any of the sedimentary layers overlying the fault zone in any of the trenches, to suggest movement on the Scotland Road fault subsequent to deposition of the overlying Pleistocene deposits.

D. Age of Pleistocene Deposits

No shells or other organic materials were found in the clay in the study area with which to establish an age of deposition of the clay. The clay deposit is, however, considered correlative with similar glacial-marine clays which blanket portions of the seaboard lowland throughout eastern New England.

Borns (1973) reports that "a major amelioration of climate began prior to 14,200 years ago which resulted in a rapid dissipation of the ice sheet in New England at least by 12,500 years ago". The recession of the ice sheet was accompanied by a marine invasion of the seaboard lowland, with deposition of glacial-marine clay sediments. Borns brackets the time of deposition of the glacial-marine clay in the region between 13,500 and 12,500 years ago.

Schafer and Hartshorn (1965) report that radiocarbon dates of shells from glacial-marine sediments on the seaboard lowland in Maine range from 11,800 to 12,800 years old. Kaye and Barghoorn (1964) have constructed

a curve of sea-level fluctuations for the Boston, Massachusetts, area which describes the last marine submergence as having ended about 12,500 years ago in that area.

It appears, therefore, that the glacial-marine clays of the Newbury study area are at least older than 11,800 years, and are probably in the range of 12,500 to 13,500 years old.

E. Petrographic Examinations

The petrography of eight samples of drill core from borings in and adjacent to the Scotland Road fault has been described by Professor Gene Simmons and Dorothy Richter of Massachusetts Institute of Technology.

Sample	Boring	Depth (feet)	Description
SRF-1A	SRF-1	74.0 to 74.4	Amphibolite breccia
SRF-2A	SRF-2	60.0 to 60.4	Mylonized quartz-muscovite schist
SRF-2B	SRF-2	72.9 to 73.4	Brecciated quartz-muscovite schist
SRF-3A	SRF-3	67.0 to 67.5	Muscovite mylonite
SRF-4A	SRF-4	92.9 to 93.3	Chlorite augen gneiss
SRF-5A	SRF-5	42.1 to 42.6	Sheared granodiortie
SRF-5B	SRF-5	175.1 to 175.6	Altered olivine basalt
SRF-7A	SRF-7	115.9 to 116.4	Ultramylonite

Simmons and Richter conclude from their studies that "the samples (with the exception of sample SRF-5B) all show evidence of dynamic deformation; that is, cataclasis, brecciation and intense crushing--all probably due to motion along the fault. The deformation clearly took place after the regional metamorphism of the rocks (which was probably associated with the Devonian Acadian orogeny). The microcracks produced in the deformational

events appear in thin section to have either annealed, or have been filled by secondary minerals. There is no firm petrographic evidence of recent deformation of these samples". The complete text of the Simmons and Richter report is attached herewith.

A further indication of the old age of deformation of the fault zone is evidenced by sample SRF-5B, from a diabase dike which is enclosed within deformed rocks of the fault zone. Petrographically the dike is seen to be completely undeformed. The dike has been dated radiometrically (K-Ar) at 199±9 million years.

F. Radiometric Age Dating

K-Ar age determination have been obtained on six samples of drill core from borings in and adjacent to the Scotland Road fault by Geochron Laboratories, Division of Krueger Enterprises, Inc., Cambridge, Massachusetts.

Sample	Boring	Depth (feet)	Material	Age
SRF-5A	SRF-5	42.1 to 42.6	whole rock	272 10 M.Y.
SRF-3A	SRF-3	67.0 to 67.5	whole rock	269 10 M.Y.
SRF-2A	SRF-2	60.0 to 60.4	whole rock	256 10 M.Y.
SRF-8A	SRF-8	155.6 to 156.0	sericite/ feldspar	248 9 M.Y.
SRF-1A	SRF-1	74.0 to 74.4	amphibole	324 14 M.Y.
SRF-5B	SRF-5	175.1 to 175.6	whole rock	199 9 M.Y.

Samples SRF-5A, -3A, -2A, and -8A are from within the fault zone; SRF-1A is from the diorite/schist complex which lies to the south of the fault zone; SRF-5B is from an undeformed diabase dike which is enclosed within deformed rocks of the fault zone (see Plate 3). Of apparent geologic

interest is the fact that radiometric ages increase progressively with distance from the footwall of the fault zone. SRF-8A is from about 5 feet above the mylonite band near the footwall of the fault, whole SRF-5A is in relatively undeformed granodiorite about 250 feet stratigraphically above the footwall. Radiometric dating of rocks within the Scotland Road fault zone indicates that the fault is of Permian age, and suggests that deformation in the zone may have been active through a period of as much as 20 million years. The dike (SRF-5B) which intruded the fault zone is completely undeformed, indicating that movement on the fault had ceased by Triassic time.

IV. CONCLUSIONS

The Scotland Road fault has been located within 150 feet of the location inferred by A. F. Shride on the basis of his regional field studies. Nine core borings have defined the fault zone as being about 300 feet thick and dipping at about 44° to the north adjacent to Scotland Road in Newbury, Massachusetts. Chemical alteration and mechanical deformation in the fault zone increases progressively from north to south across the fault zone, and alteration effects of faulting terminate abruptly at the footwall of the fault zone, about 5 feet stratigraphically below a thin mylonite band. The fault is a feature of major geological significance in the region.

The fault is geologically very old, of early to middle Permian age, and the altered and deformed bedrock materials in the fault zone are annealed and compact. No unconsolidated gouge, shear zones or polished joint surfaces

were detected in cores from borings drilled across the width of the fault zone. The bedrock surface overlying the fault zone slopes gradually up to undeformed bedrock outcrops at the north edge of the fault zone, and appears from refraction seismic surveys and borings data to be smooth and sub-planar, with no detectable topographic anomalies.

Surficial materials overlying the fault zone include glacial till, glacial outwash and marine sands, and glacial-marine clays, all of Pleistocene age. The youngest of these Pleistocene deposits are the glacial-marine clays, estimated from regional studies to be older than 11,800 years. A thin, essentially horizontal layer of post-Pleistocene topsoil covers the glacial-marine clay in the area.

Examination of the glacial-marine clay in four trenches excavated over the area of the fault zone failed to detect any evidence of tectonic fault displacement in the clay and its interbedded sand-silt layers. Bedding in the clay displayed no abrupt monoclinal or drag folds. Joints were not slickensided. The thin laminated sand-silt horizons interbedded in the clay were not offset. No sand dikes were found in the clay, which directly overlies deposits of highly mobile fine sand.

All evidence observed in the current investigations indicate that Pleistocene deposits overlying the Scotland Road fault have not been subjected to disruption by tectonic faulting.

John R. Rand
Consulting Geologist

References:

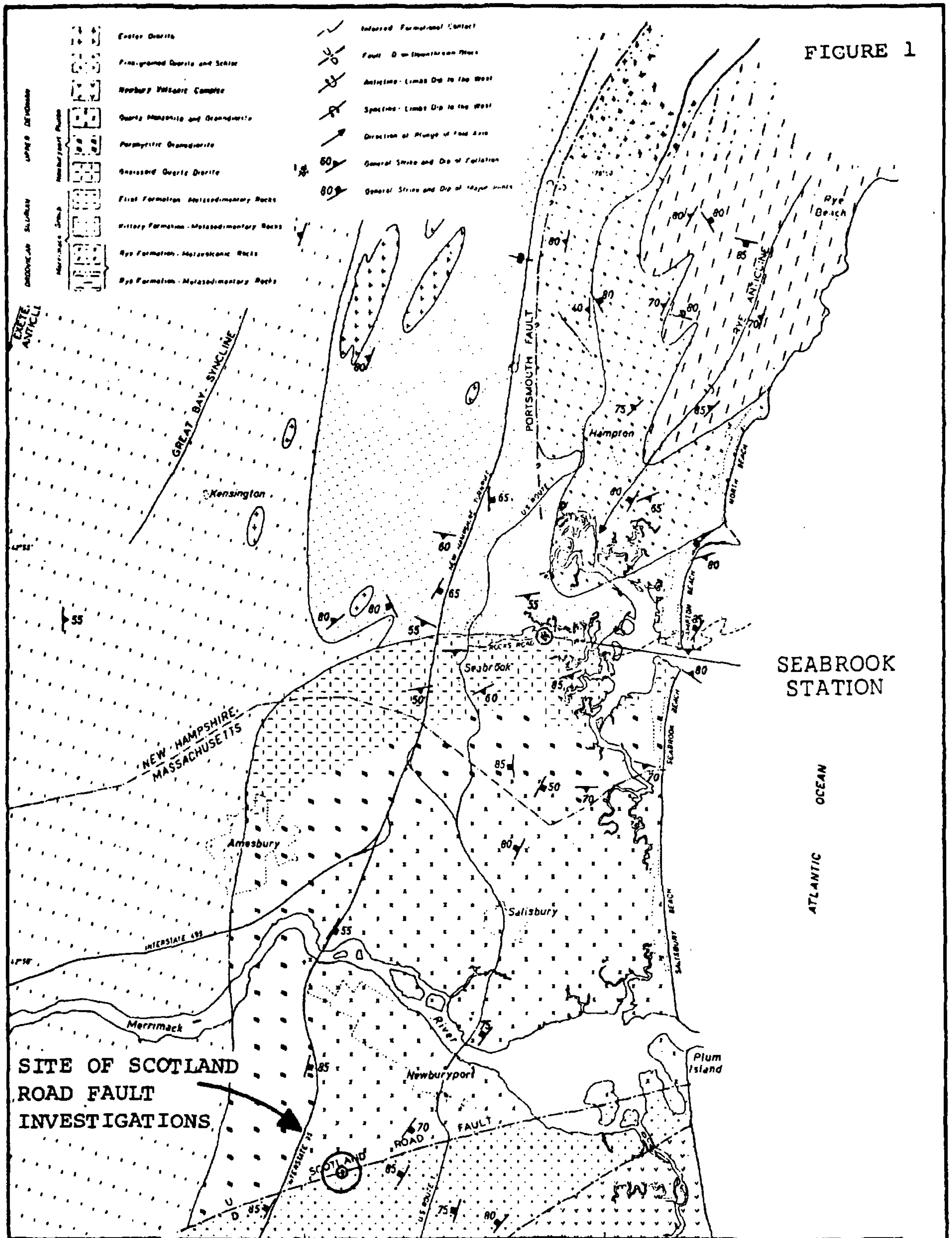
Borns, H. W., Jr. (1973) Late Wisconsin Fluctuations of the Laurentide Ice Sheet in Southern and Eastern New England. in The Wisconsinan Stage; Geological Society of America, Memoir 136; Boulder, Colorado.

Kaye, C. A. and E. S. Barghoorn (1964) Late Quarternary Sea-Level Change and Crustal Rise at Boston, Massachusetts, with Notes on the Autocompaction of Peat. Geological Society of America, Bulletin Vol. 75, 63-80.

Schafer, J. P. and J. H. Hartshorn (1965) The Quaternary of New England. in The Quaternary of the United States; Princeton University Press; Princeton, New Jersey.

Shride, A. F. (1971) Igneous Rocks of the Seabrook, New Hampshire-Newbury, Massachusetts, Area. in Guidebook for Field Trips in Central New Hampshire and Contiguous Areas. New England Intercollegiate Geological Conference - 1971.

NOTE: The study area was visited on March 13, 1974, by M. H. Pease, Jr. and P. J. Barosh, U. S. Geological Survey, Boston. Trenches 3 and 4 were inspected. The trenches were thereupon filled in.



BEDROCK GEOLOGY OF THE SEABROOK REGION, NEW HAMPSHIRE - MASSACHUSETTS

0 1 2 3 4
SCALE OF MILES

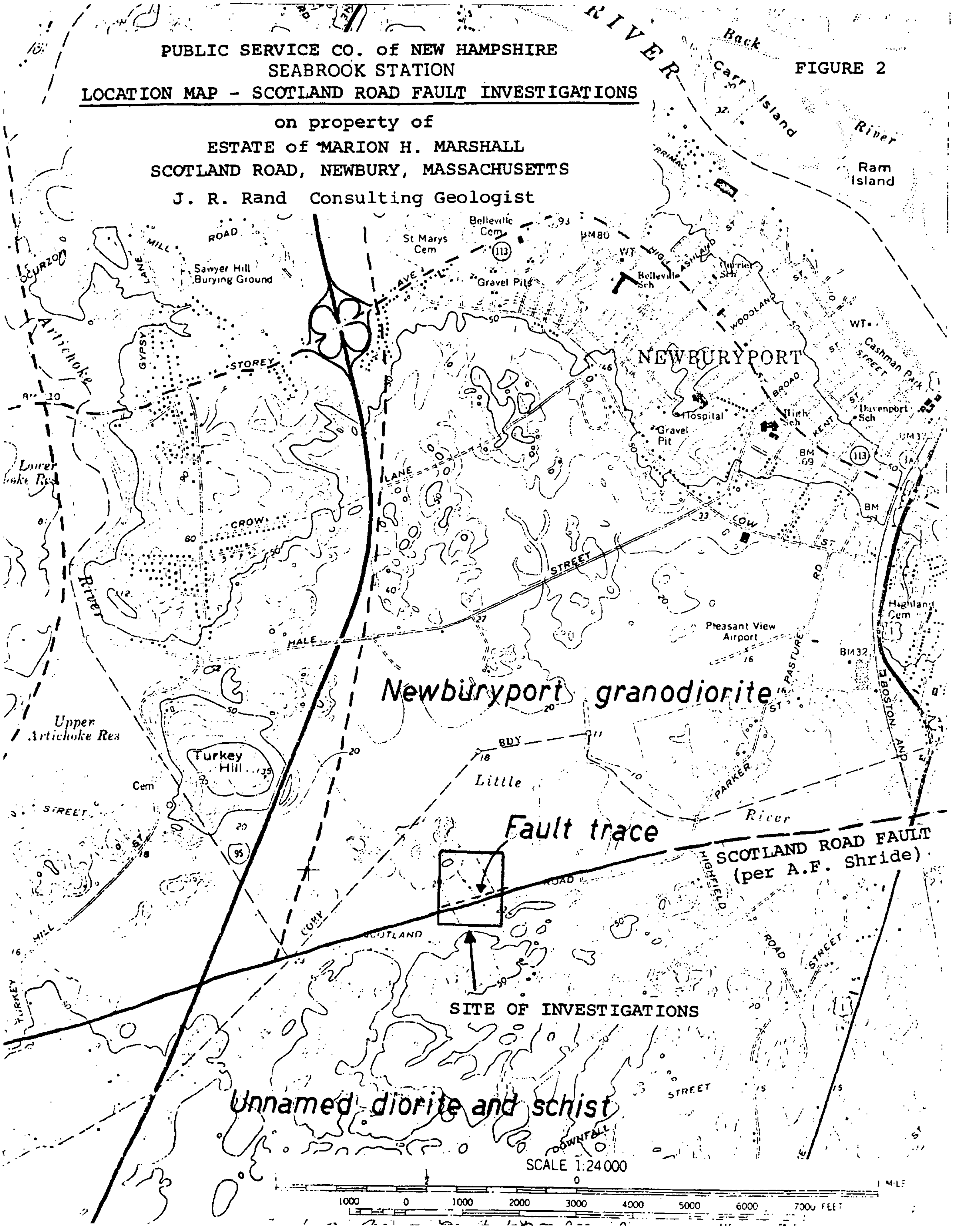
LOCATION MAP
REGIONAL FAULT INVESTIGATIONS
PUBLIC SERVICE CO. of NEW HAMPSHIRE
SEABROOK STATION
J. R. Rand, Consulting Geologist

PUBLIC SERVICE CO. of NEW HAMPSHIRE
SEABROOK STATION

FIGURE 2

LOCATION MAP - SCOTLAND ROAD FAULT INVESTIGATIONS

on property of
ESTATE of MARION H. MARSHALL
SCOTLAND ROAD, NEWBURY, MASSACHUSETTS
J. R. Rand Consulting Geologist



ATTACHMENT No. 1

SEISMIC REFRACTION SURVEY
SCOTLAND ROAD FAULT ZONE
NEWBURY, MASSACHUSETTS

WESTON GEOPHYSICAL ENGINEERS, INC.
for
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEISMIC REFRACTION SURVEY

SCOTLAND ROAD FAULT ZONE

NEWBURY, MASSACHUSETTS

for

PUBLIC SERVICE COMPANY

OF NEW HAMPSHIRE

WESTON GEOPHYSICAL ENGINEERS, INC.
WESTON, MASSACHUSETTS

SEISMIC REFRACTION SURVEY

SCOTLAND ROAD FAULT ZONE

NEWBURY, MASSACHUSETTS

INTRODUCTION

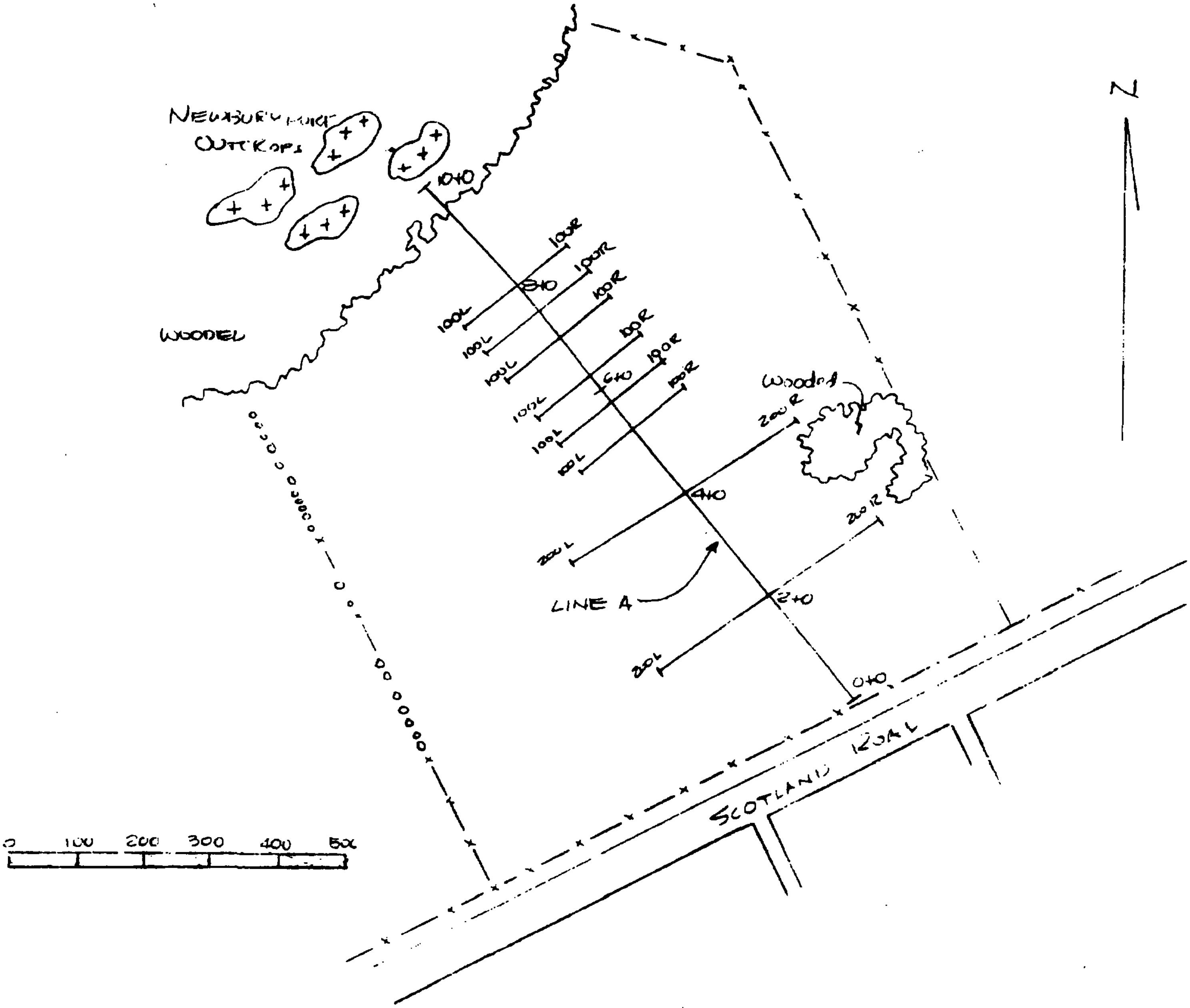
A seismic refraction survey was conducted across the mapped location of the Scotland Road fault, as originally mapped by A. F. Shride (1971) and shown on Figure 1 and Plate 2 of the report. Seismic field work took place during the period of November 5 through 19, 1973. The location of this survey is shown on Figure 1 of this attachment.

The general purpose of this work was to determine thicknesses of overburden and weathered rock materials as well as the velocities of the verious geologic materials existing at this location.

RESULTS

The results of this refraction survey are shown on a profile of the bedrock surface (Figure 2). Also shown on this profile are overburden and bedrock seismic velocities, boring locations, and bedrock depths as found from borings as well as the fault zone, as indicated by J. R. Rand.

The bedrock surface, as interpreted from seismic data, does not have any sharp breaks indicating faulting. The seismic velocities of the bedrock do not change sufficiently along the 1,000-foot line of investigation to indicate the presence of any significant bedrock anomaly. The fault zone does not exhibit significant velocity differences from the adjacent bedrock.



SEISMIC LINE LOCATIONS

SCOTLAND ROAD FAULT

PUBLIC SERVICE CO. of NEW HAMPSHIRE

SEABROOK NUCLEAR STATION

Figure 1

ATTACHMENT No. 2

GEOLOGIC AND SOILS LOGS OF BORINGS
SRF-1 THROUGH SRF-9

BORING LOCATION See Scotland Rd. site plan INCLINATION Vertical BEARING ____ DATE START/FINISH Dec. 4, 1973 / Dec. 6, 1973

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 69.0 ft DRILLED BY American Drilling & Boring Co.; W. Manco

GROUND EL (MSL) 18.1 ft DEPTH TO WATER/DATE 0.5 ft / Dec. 28, 1973 LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	SAMPLE Type and No.	SAMPLE N or Rec.	RATE OF ADV. min/ft	WATER CONTENT %	or RQD Graphic (0–100)	PRESSURE TEST gpm psi	PRESSURE TEST Computed k 10^{-4} cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)
18.1		S1	7		33.5						Mottled gray, olive-gray, and brown silty clay. Low plasticity; w > P. L.; s_u (tor) = 50 tsf
		S2	7		29.4			TOP	OF CLAY		Slightly mottled gray & olive brown silty clay. Low to med. plasticity. s_u (tor) > 1.0 tsf
		S3	21		32.3						Olive-brown silty clay. Low to medium plasticity; w > P. L. s_u (tor) > 1.0 tsf 1)
		S4	29		31.9						Similar to Sample S3. s_u (tor) > 1.0 tsf
		S5	30		32.4						Similar to S3, but somewhat softer; contains few gray spots to 8 mm. s_u (tor) = 0.95 tsf
		S6	31		34.8						Similar to S3, but softer; some gray spots. s_u (tor) = 0.65 tsf
	10	S7	5		37.8			TOP	OF SAND		Similar to Sample S3, but medium stiff; contains a gray silt layer < 0.5 mm thick; color varies slightly olive-brown to olive-gray. s_u (tor) = 0.34 tsf
	13.0										
0		S8	0								Gray layered silty clay and clayey fine sand. Silty clay is soft; medium to high plasticity; slightly sticky; very soft when remolded. Layers vary 0.5-10 mm. s_u (tor) = 0.22 tsf
	20	S9	9								Gray silty fine sand. Uniform; fines are nonplastic; very fast reaction to shaking test.
		S10	10								Similar to Sample S9, but also contains a few gray clay layers 1-2 mm thick.
	30	S11	9/6"								Similar to Sample S9, but also contains some gray clay layers.
		S11A	19								Brown silty fine sand. Uniform; fines are nonplastic; contains a few rusty-brown fine sand layers.
		S12	24								Brown slightly silty fine to medium sand. Uniform; fines are nonplastic; contains a layer of gray clayey gravelly sand with subrounded gravel up to 20 mm in size.
-20	40	S13	26								Brown very slightly silty uniform fine to medium sand.
		S14	31								Light brown silty fine sand. Uniform; fines are nonplastic; contains a few subrounded coarse sand grains and some rusty-brown medium sand layers.
	50	S15	17								Similar to Sample S14.
	56.0	S16A	59					TOP	OF TILL		Similar to Sample S14.
-40		S16B	15/6"								Gray-brown silty sandy gravel. Widely graded; angular grains; contains gravel pieces up to 30 mm in size; fines are nonplastic.
	60	S17A	79								Light gray fine to medium sand. Uniform; angular to subrounded grains; clean.
		S17B	28/6"								Light gray silty sandy gravel. Angular grains; appears to decomposed rock and rock fragments up to 30 mm in size.
		S18	92/6"								Gray silty gravelly fine sand. Uniform; fines are nonplastic; contains angular gravel pieces up to 15 mm in size.
		NX-1	41								
	69.0	NX-2	100	3.0				TOP	OF ROCK		Cored boulders.
	70	NX-3	93	4.2	43						75° Joint Clean — Fresh and hard. Drills well. Only very slight surface wx effects on joints and partings. — Diorite. Dark gray with large (?)hornblend crystals (1/2") in fine-grained quartz diorite matrix.
-60	79.0	NX-4	98	3.6	83						75° Joint Minor wx — 76.3' Gradational contact - fused. — Diorite. Massive, fine-grained, dk. gra
								BOTTOM	OF BORING		

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break
wx - Weathered, weathering
k - Coefficient of permeability
Groundwater

NOTES

1) - s_u (tor) = Shear strength measured with Torvane.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: January 10, 1974 Project 7286

PAGE 1 of 1 LOG OF BORING SRF-1

BORING LOCATION See Scotland Rd. site plan INCLINATION Vertical BEARING ____ DATE START/FINISH Dec. 7, 1973 / Dec. 10, 1973

CASING ID 3 in. CORE SIZE 2-1/8 to 1-5/8 TOTAL DEPTH 77.5 ft DRILLED BY American Drill. & Boring Co.;W. Mann, R. Lamoureux

GROUND EL (MSL) 17.6 ft DEPTH TO WATER/DATE 0.0 ft / Dec. 31, 1973 LOGGED BY Soil - K. Polk; Rock J. R. Rand

EL. MSL ft	SAMPLE Depth ft	SAMPLE Type and No.	SAMPLE N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0–100)	PRESSURE TEST gpm psi	PRESSURE TEST Computed k 10^{-4} cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)
17.6	1	S1A S1B	2 4/6"		3)			TOP	OF CLAY	S1A - Dark brown soft fibrous peat. S1B - Mottled gray and olive-brown silty clay.
		S2	16		29.0					Similar to Sample S1B, contains some rusty brown layers to 3 mm thick. s_u(tor) > 1.0 tsf
		S3	26		30.1					Olive brown silty clay. Low to medium plasticity; w > P. L.; s_u(tor) >1.0 tsf 2)
		S4	24		33.8					Similar to Sample S3, but fewer brown spots; gray streaks to 5 mm. s_u(tor) > 1.0 tsf
		S5	13		35.6					Similar to S3, but fewer brown spots; more gray streaks; somewhat softer. s_u(tor) = .90 tsf
		S6	5		35.5					Olive-brown silty clay. Low to medium plasticity. s_u(tor) = 0.50 tsf
	10	S7	5		48.5					Similar to S6, but no dark brown spots; soft to medium stiff; slightly sticky. s_u(tor) = 0.23-0.30 tsf
0		S8	2		52.5					Gray to olive-gray silty clay. Very soft to soft; medium to high plasticity; slightly sticky. s_u(tor) = 0.15 tsf
	20	S9	0		37.8					Similar to Sample S8. s_u(tor) = 0.18 tsf
	24.0							TOP	OF SAND	
		S10	7							Gray very silty fine sand. Uniform; fines are generally nonplastic, but contains a few gray clay pockets up to 8 mm in size.
	30	S11	10							Similar to Sample S10.
-20		S12	13							Gray-brown fine to medium sand. Uniform; subrounded grains; clean.
	40	S13	4							Light gray fine sand. Uniform; clean; contains one 8 mm size subrounded piece gravel.
		S14	8							Similar to Sample S13.
	50	NX-1	93		1) 22			TOP	OF ROCK	
	50.5			4)					52°	No slickensides. Not notably wx. Altered by metamorphic process to light yellow green color. Not slickensided.
		NX-2	100		32				49° 53°	Cataclastic rock. Mottled light yellowish green, fine-grained matrix. Foliated with rounded pebble-like breccia, and swirled feldspathic and chloritic foliations. Thin feldspathic stringers and irregular veinlets dip 35° to 40° opposite to dip of foliation. Cross-stringers.
-40	60	NX-3	100		23				45° 55°	
		BX-4	100	4.7	67				46°	50° Joint. Minor rusty. Fresh. Drills well. Partings and some high-angle joints show crusty surface wx effects. No slickensides or other recent movements.
	70	BX-5	100	2.6	55				47° 40°	85° Joint. Irregular. 60° Joint, striated. Cross-stringers
		BX-6	100	2.0	100				42°	Not slickensided. Clean joints
-60	77.5							BOTTOM	OF BORING	

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample   ⊻ Groundwater
U - Undisturbed samples
S - Shelby tube   N - Denison
F - Fixed piston   P - Pitcher
O - Osterberg   G - GEI
D - Drilling break   k - Coefficient of permeability
wx - Weathered, weathering

NOTES
1) Cored two boulders from 47.5 ft to 50.5 ft.
2) s_u (tor) = Shear strength measured with Torvane
3) S1A = 146.2, S1B = 31.7
4) Rate of advance not available for NX-1 through 3.

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YANKEE ATOMIC ELECTRIC COMPANY
united engineers

Date: January 10, 1974   Project 7286

PAGE 1 of 1   LOG OF BORING SRF 2

BORING LOCATION: See Scotland Rd. site plan INCLINATION: Vertical BEARING: ______ DATE START/FINISH: Dec. 11, 1973 / Dec. 19, 1973

CASING ID: 3 in. CORE SIZE: 2-1/8 to 1-7/8 in. TOTAL DEPTH: 95.0 ft DRILLED BY: American Drilling & Boring Co.; Manco

GROUND EL (MSL): 17.9 ft DEPTH TO WATER/DATE: 0.0 ft / Dec. 31, 1973 LOGGED BY: Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	SAMPLE Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	PRESSURE TEST	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	SOIL AND ROCK DESCRIPTIONS
17.9		S1	4		40.0			Slightly mottled brown and gray peaty silty clay. Low plasticity. s_u (tor) = 0.60 tsf 1)
		S2	19		29.1			Mottled olive-gray and rusty brown silty clay. Low plasticity; w > P. L. s_u (tor) = 0.90 tsf
		S3	33		27.8			Similar to Sample S2. s_u (tor) > 1.0 tsf
		S4	9		36.3			Olive-brown silty clay. Medium plasticity; w > P. L.; s_u (tor) = 0.80 tsf
		S5	7		37.7			Similar to Sample S4, but contains several silt laters < 0.5mm thick. s_u (tor) = 0.48 tsf
		S6	4		45.0			Similar to S4, but medium stiff; contains several very thin silt layers. s_u (tor) = 0.45 tsf
		S7	2		43.5			Olive-brown to gray silty clay. Slightly sticky; s_u (tor) = 0.12-0.17 tsf
	10	S7A	2/6"		51.9			Gray silty clay. Very soft to soft; medium plasticity; sticky. s_u (tor) = 0.10 tsf
0		S8	2		55.4			Similar to Sample S7A. s_u (tor) = 0.12 tsf.
	20	S9	3		50.9			Similar to Sample S7A. s_u (tor) = 0.15-0.19 tsf
		S10	2		36.3			Similar to Sample S7A, but also contains a few silt layers < 0.5 mm thick; color varies slightly lighter and darker. s_u (tor) = 0.18 tsf
	30					TOP	OF SAND	
		S11	16					Gray layered soft silty clay and silty fine sand. Layers are 1-5 mm thick.
		S12	8					Gray silty fine sand. Uniform; fines are nonplastic; very fast reaction to shaking test; contains a few gray clay layers up to 5 mm thick.
-20	38.0					TOP	OF TILL	
	40	S13	57					Gray-green silty angular rock fragments up to 30 mm in size.
		S14	75/6" *			TOP	OF ROCK	Similar to Sample S13, but larger pieces. Appears to be decomposed rock.
	42	NX-1	97	3.0	43			
	50	NX-2	97	3.2	47			
		NX-3	100	4.0	77			
-40	60	NX-4	100	3.8	87			
		NX-5	100	4.2	75			
	70	NX-6	100	4.0	82		2) N50E, 38NW F	
		NQ-7	100		68		N83W, 46NE J; N89E, 51NW F	
-60	80	NQ-8	100	3)	52			
		NQ-9	95		67		N56W, 27SW F; N80W, 64NE J	
		NQ-10	100		72		N69E, 39NW F; N65W, 46NE J	
	90	NQ-11	100		63		N52W, 58NE S; N56W, 27NE J; N 9W, 24NE J; N86W, 52NE F	
	95					BOTTOM	OF BORING	

Rock descriptions (Weathering, defects, etc. / Type, texture, mineralogy, color, hardness, etc.):

- 45° joint-rusty; 50° joint minor wx; Vuggy; 40° joint — Fairly fresh (as for wx) but is altered, presumably hydrothermally, to a light gray-green to tan green color. Joints show slight rusty wx effects. — Tan diabase — Altered diorite (?). Fine-grained, light gray-green matrix with medium-grained feldspar phenocrysts. Sense of vague foliation throughout.
- Fresh, but altered hydrothermally to light greenish (epidote) gray. Joints and partings are not slickensided, not polished. — Quartz-Pink feldspar 61.5'; Epidote; Claystone; Gouge; Epidote — Fault block (?) Fused, tight contacts-notable epidotization strong foliation. Fine-grained to very fine-grained, locally feldspathized light gray to light green.
- Rough; Driller ground; 61° joint; Rough surface — Fresh, but altered hydrothermally. Quartz/pyrite mineralization conforms to foliation. Joints are not slickensided. — Pyrite — Altered diorite (?). Moderately foliated, saussuritized feldspar phenocrysts in fine-grained matrix. Appears to be moderately foliated Newburyport Diorite.
- Fairly fresh, but altered. Joints not slickensided or polished.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample; ∇ Groundwater
- U - Undisturbed samples
  - S - Shelby tube; N - Denison
  - F - Fixed piston; P - Pitcher
  - O - Osterberg; G - GEI
- D - Drilling break; k - Coefficient of permeability
- wx - Weathered, weathering

NOTES

1) s_u (tor) = Shear strength measured with Torvane.
2) This is only a partial list of dip and strike data.
3) Rate of advance not available for NQ-8 through NQ-11.

* Used 300 lb hammer.

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers

Date: February 13, 1974 Project 7286

PAGE 1 of 1 LOG OF BORING SRF 3

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION: See Scotland Rd. site plan | INCLINATION: Vertical | BEARING: ____ | DATE START/FINISH: Dec. 20, 1973 / Jan. 3, 1974

CASING ID: 3 in. | CORE SIZE: 2-1/8 to 1-7/8 in. | TOTAL DEPTH: 96.0 ft | DRILLED BY: American Drilling & Boring Co., W. Manco

GROUND EL (MSL): 17.6 ft | DEPTH TO WATER/DATE: 0.0 ft / Jan. 2, 1974 | LOGGED BY: Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	Depth ft	Sample Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content or RQD %	Pressure Test	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	Soil and Rock Descriptions
17.6		S1, S1A	1, 6		27.5			S1-Dark brown peaty topsoil. S1A-Mottled brown, olive-brown, and gray silty clay. Med. stiff to stiff; low plasticity; contains roots < 0.5mm in dia.; w above PL. s_u (tor) = 0.75 tsf. S2-Similar to S1A, but very stiff; somewhat blocky, some layering; w slightly above PL. s_u (tor) > 1.0 tsf S3-Olive-brown silty clay. Very stiff; low to medium plasticity; somewhat blocky. s_u (tor) > 1.0 tsf S4-Similar to Sample S3, with some dark brown spots up to 1 mm thick. s_u (tor) > 1.0 tsf S5-Olive-brown silty clay. Medium stiff to stiff; medium plasticity; contains several dark brown spots. s_u (tor) = 0.62 tsf S6-Similar to Sample S5. s_u (tor) = 0.45 tsf S7-Similar to Sample S5. s_u (tor) = 0.35 tsf
		S2	19		28.0			
		S3	17		30.7			
		S4	31		33.7			
		S5	6		40.8			
		S6	9		38.5			
	10	S7	11		41.3			
		S8	13		33.0	TOP	OF SAND	Gray silty clay. Medium stiff; medium to high plasticity; contains some silty fine sand layers up to 20 mm thick near bottom. s_u (tor) = 0.30 tsf
0	16.6							
	20	S9	10					Light gray silty fine sand. Uniform; fines are nonplastic; very fast reaction to shaking test; contains a few clay layers up to 1 mm thick.
		S10	30					Similar to Sample S9, but contains clay layers up to 5 mm thick.
	30	S11	34					Brown medium to coarse sand. Uniform; subrounded grains; contains a few olive-brown clay layers up to 8 mm thick and a few gravel pieces up to 15 mm in size.
	34.0					TOP	OF TILL	
-20		S12	25					Gray-brown silty gravelly sand. Widely graded; subangular to subrounded grains; fines are nonplastic; contains a few gravel pieces up to 20 mm in size.
	40	S13	17					Brown gravelly silty sand. Widely graded; subrounded grains; fines are nonplastic; contains a few gravel pieces up to 20 mm in size.
		S14	18					Similar to Sample S13, but also contains subangular grains.
	50	S15	9					Similar to Sample S13, but clean.
-40		S16	15*					Brown medium sand. Uniform; subrounded grains; clean.
	60					TOP	OF ROCK	
		NX-1	100	3.6	0			
		NX-2	77	5.7	0			
	70	NX-3	100	3.1	14			
		NX-4	83	4.0	0			
-60		NX-5	100	3.0	0			
	80	NX-6	100	2.8	33			
		xNQ-7	100	2)	7			
	90	xNQ-8	95		45		N20W, 44NW J; N 2E, 44SE J	
	96	xNQ-9	100		0		N80W, 60NE J; N66W, 55NE J	
						BOTTOM	OF BORING	

Rock descriptions (Weathering, defects, etc.):

- Rusty
- Soft-fissile — Fresh internally. Locally is subject to severe wx, softening. Parts on foliation. Not slickensided.
- Striated Chlorite
- Fault-narrow — Fresh. Closely broken on high-angle joints or on partings on high-angle foliation. Fresh, not wx.
- 82.5 Faulted 85.0
- Feldspar veining apparent faulted zone 82.5-85'

Rock descriptions (Type, texture, mineralogy, color, hardness, etc.):

Schist. Feldspathic, fine-grained medium dark gray foliation matrix with disseminated medium-grained feldspars. Not altered. May be foliated diorite.

Apparent narrow fault zones or shears at 77', 82.5-85' and 88.5' Have feldspar stringers, and micaceous "gouge".

Sense of drag-folding at 90.6 ft is up.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample — Groundwater
- U - Undisturbed samples
  - S - Shelby tube, N - Denison
  - F - Fixed piston, P - Pitcher
  - O - Osterberg, G - Gel
- D - Drilling break, k - Coefficient of permeability
- wx - Weathered, weathering

NOTES

1) s_u (tor) = Shear strength measured with Torvane
2) Rate of advance not available for NQ-7 to 9.
* - Used 300 lb hammer
x - Oriented core

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: January 10, 1974 | Project 7286

PAGE 1 of 1 | LOG OF BORING SRE 4

GEOTECHNICAL ENGINEERS INC

BORING LOCATION: See Scotland Road site plan | INCLINATION: 45 - 46° | BEARING: S30E | DATE START/FINISH: December 26, 1973 / January 8, 1974

CASING ID: 3 in. | CORE SIZE: 1-7/8 in. | TOTAL DEPTH: 197.7 [1] ft | DRILLED BY: American Drilling & Boring Co., T. Canning.

GROUND EL (MSL): 17.6 ft | DEPTH TO WATER/DATE: 0.0 ft / Dec. 26, 1973 | LOGGED BY: Soil - K. Polk; Rock - J. R. Rand

Column headings: EL. MSL ft; SAMPLE (Depth ft; Type and No.; N or Rec.); RATE OF ADV. min/ft; WATER CONTENT or RQD (%; Graphic 0–100); PRESSURE TEST (gpm/psi; Computed k 10^{-1} cm/sec); STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside); CORE BREAKS; SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

EL. 17.6 at ground surface; 0 at depth ≈ 24; −20 at ≈ 53; −40 at ≈ 82; −60 at ≈ 110; −80 at ≈ 139.

0 – 34.0 ft: Water content 3) None; 2) (no samples). TOP OF ROCK at 34.0 ft. Rate of advance note 4) at start of coring.

Sample	N or Rec.	Rate of Adv. min/ft	RQD %	Strike, Dip
NQ-1	88	1.6	71	40°
NQ-2	100	1.5	58	
NQ-3	92	1.6	62	
NQ-4	100	1.7	50	
NQ-5	88	1.9	70	
NQ-6	95	2.0	77	30°
NQ-7	75	2.0	75	40°
NQ-8	100	2.5	52	35°
NQ-9	93	2.5	48	
NQ-10	95	2.8	28	40°
NQ-11	98	3.5	27	
NQ-12	97	3.8	0	40°
NQ-13	97	4.8	35	30°
NQ-14	100	1.7	35	35°
NQ-15	100	1.6	72	
NQ-16	100	1.6	72	23°
NQ-17	98	1.7	85	
NQ-18	102	1.7	67	47°
NQ-19	100	1.7	68	50°
NQ-20	100	1.8	78	
NQ-21	100	1.9	12	
NQ-22	100	2.0	32	
NQ-23	98	2.2	63	

Soil and Rock Descriptions

Weathering, defects (in order of depth): Most partings are joints; Chlorite; Rusty joint - Strikes ± NW; Rusty joint; Minor rusty; Minor rusty; Minor rusty; Minor rusty; Minor rusty; Minor rusty; Minor rusty, Bleached; Bleached; Joints striated, Rough not slickensided; Minor wx; Minor bleached.

Fresh with minor powdery wx effects on joint surfaces. Joint surfaces are not slickensided.

Granodiorite. Typical Newburyport, medium-grained, medium gray, with greenish gray hue, and pink feldspar spotting. Generally massive. Locally shows foliated zones. Cut by fused feldspar quartz stringers. Biotite speckling. Becomes medium-fine grained at 56', foliation develops locally vague. First mechanical effects of fault zone apparently at around 56-58'.

Med. Grained / Finer Grained / Pyrrhotite

Fresh. Drills well. Joint and partings show minor surface wx effects. Not slickensided.

Fused fault material

Fresh. Partings locally show minor wx effects, but not slickensided.

Diorite. Medium-fine grained. Medium greenish gray. Locally foliated. Foliation is sometimes drag-folded. Rock is mechanically deformed, approaching fault-carbonate veinlets.

Cherty Vein

Fresh. Not wx, but is altered hydrothermally to light greenish gray color. Partings are not slickensided.

Fine-grained rock, with chlorite (?) speckling. Locally foliated, cut throughout by feldspar veinlets.

103': Contact (joint) dips 43°

Granodiorite. Medium grained, medium greenish gray, massive, chlorite specks. (not fully altered)

109': Contact dips 20°

110': Fine-grained rock fused contact dips 50°

Fresh and hard. Drills well. Relatively minor hydrothermal alteration.

Granodiorite. Medium-grained. Locally shows tendency to foliation. Medium greenish gray.

Foliated-fused Cataclastic

Fresh and hard. Local minor bleaching. Partings show minor wx effects, but are not slickensided.

Granodiorite. Medium-grained, medium greenish gray. Fairly massive. Dark chlorite speckling. (Chlorites not altered appreciably)

Fine Inclusion

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample
- U - Undisturbed samples
  - S - Shelby tube; N - Denison
  - F - Fixed piston; P - Pitcher
  - O - Osterberg; G - GEI
- ∇ Groundwater
- D - Drilling break
- k - Coefficient of permeability
- wx - Weathered, weathering

NOTES

1) Depths noted were measured "along the boring", not vertically
2) Washed through clay to 34.0' - no samples taken
* - Roller bitted to 36.0'
3) No clays present; therefore no water contents were determined.
4) Roller bitted to 52.0 ft.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers & constructors inc

Date: January 11, 1974 | Project 7286

PAGE 1 of 2 | LOG OF BORING SBF 5

GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Scotland Road site plan INCLINATION 45 - 46° BEARING ______ DATE START/FINISH December 26, 1973 / January 8, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 197.7 ft DRILLED BY American Drilling & Boring Co., T. Canning.

GROUND EL (MSL) 17.6 ft DEPTH TO WATER/DATE 0.0 ft / Dec. 26, 1973 LOGGED BY Soil - K. Polk; Rock - J. R. Rand

CONTINUED FROM PREVIOUS PAGE

EL. MSL ft	Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)
	148							
	150	NQ-24	97	2.5	70			
		NQ-25	100	2.7	60			
	160	NQ-26	97	3.1	68			
-100		NQ-27	98	3.4	47			27°
	170	NQ-28	102	3.2	47			
		NQ-29	92	3.5	35			30°
	180	NQ-30	93	3.1	57			
		NQ-31	97	3.1	62			40°
	190	NQ-32	100	3.2	63			30°
-120		NQ-33	100	2.5	55			30°
	197.7							

BOTTOM OF BORING

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.)

- Fresh and hard. Partings are not slickensided.
- Slight wx
- Fresh and hard. Partings are not slickensided.
- Slight wx
- Note: At 171.2' Fresh diabase butts against light green fine-grained cataclasite (calcite) stringer in diabase does not extend across into cataclasite.

(Type, texture, mineralogy, color, hardness, etc.)

- Chlorites are still dark green.
- Becomes vaguely foliated. Apparently cataclastic. Light greenish gray.
- 174.2 Open contact dips 0°
- Diabase. Dark gray, not altered.
- 176.4 Open contact dips 56. Not slickensided. Cataclastic. Lt. greenish gray, fine-grained, foliated.
- 181.7 Fused, brecciated contact. Diabase, dark gray, unaltered.
- Note: At 181.7', contact of diabase is brecciated, and re-cemented by calcite. Diabase is not appreciably altered.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ⊻ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers & constructors inc.

Date: January 11, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING SRF 5

GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Scotland Rd. site plan INCLINATION Vertical BEARING ______ DATE START/FINISH Jan. 4, 1974 / Jan. 8, 1974

CASING ID 3 in. CORE SIZE 1-5/8 in. BX TOTAL DEPTH 58.0 ft DRILLED BY American Drilling & Boring; Manco

GROUND EL (MSL) 17.8 ft DEPTH TO WATER/DATE 0.0 ft / Jan. 30, 1974 LOGGED BY Soil - K. L. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	SAMPLE Type and No.	SAMPLE N or Rec.	RATE OF ADV. min/ft	WATER CONTENT %	or RQD Graphic (0–100)	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)
17.8		S1, S1A	1/6", 3								S1-Brown organic silt. S1A - Mottled gray and brown silty clay; low plasticity.
		S2	15								Olive-brown silty clay. Stiff to very stiff; low plasticity; somewhat blocky structure.
		S3	15								Similar to Sample S2, but fewer brown spots. s_u(tor) > 1.0 tsf
		S4	18								*Olive-brown silty clay. V. stiff; low to med. plasticity; w above PL; somewhat blocky.*
		S5	13								Similar to Sample S4. s_u(tor) > 1.0 tsf
		S6	8								Similar to Sample S4, but also contains some gray streaks up to 3 mm thick.
	10	S7	5								Similar to Sample S4, but medium stiff. s_u(tor) = 0.45 tsf.
		S8	3								Gray silty clay. Soft; medium plasticity; slightly sticky. s_u(tor) = 0.26 tsf
0	20	S9	4								Similar to Sample S8, but more sticky. s_u(tor) = 0.15 tsf
		S10	5								Similar to Sample S8, but more sticky. s_u(tor) = 0.14 tsf
	30	S11	5								Similar to Sample S8, but more sticky. s_u(tor) = 0.20 tsf
		S12	5								Similar to Sample S8. s_u(tor) = 0.25-0.30 tsf
-20	40	S13	4					TOP	OF SAND		Similar to Sample S8, few silty fine sand layers to 1 mm thick. s_u(tor) = 0.30 tsf
	41.0	S14	13/6"								Layered gray silty clay and silty fine sand. Clay is soft; low to medium plasticity; in layers up to 30 mm thick. Sand is uniform; in layers up to 10 mm thick.
		S15, S16	12, 9/6"					TOP	OF TILL		
	46.5, 50	S17, S18	70, 65/6"					TOP	OF ROCK		Gray-brown silty medium to coarse sand. Widely graded; fines are nonplastic; subangular to subrounded grains; contains a few gravel pieces up to 8 mm in size.
	53	BX-1	92	3.0	57						*Minor rusty Minor rusty Not wx. Altered by hydrothermal bleaching.* Cataclastic, foliated. Fused breccia, medium-light greenish gray.
-40	58							BOTTOM	OF BORING		

Note: Casing bent at ± 14 ft while driving and hole could not accept N-barrel for 5 ft only. Could not risk a second run due to caving potential at base of casing.

Note: Rock is medium-fine grained, groundmass contains subrounded fragments and micro-faulted piece. All fused. Joints show minor rusty surface wx effects. Not slickensided.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) S_u(tor) = Shear strength measured with Torvane

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: March 9, 1974 Project 7286

PAGE 1 of 1 LOG OF BORING SRF 6

GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Scotland Road site plan INCLINATION 45° BEARING S44E or 136° T DATE START/FINISH Jan. 8, 1974 / Jan. 18, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 255.0 ft DRILLED BY American Drilling & Boring; T. Canning,

GROUND EL (MSL) 17.5 ft DEPTH TO WATER/DATE 0.3 ft / Jan. 18, 1974 LOGGED BY Soil - K. Polk, Rock - L. R. Rand

EL. MSL ft	Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	PRESSURE TEST gpm psi	Computed k $10^{-?}$ cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S - Slickenside)
17.5		2)			1) None			
	65.5					TOP	OF ROCK	
		NQ-1 3)	92	1.5	42			
	70	NQ-2	83	1.3	47			
		NQ-3	100	1.3	13			
-40	80	NQ-4	77	1.3	23			
		NQ-5	100	1.4	6			
	90	NQ-6	100	1.4	0			
		NQ-7	93	2.0	25			
	100	NQ-8	100	2.1	55			
		NQ-9	97	1.9	47			
-60	110	NQ-10	85	2.1	12			
		NQ-11	80	2.1	7			
	120	NQ-12	100	2.2	55			5) N18E, 83NW J; N68W, 38NE J
		NQ-13	98	2.1	73			N46E, 38NW J
	130	NQ-14	93	1.6	43			N44E, 68NW J; N16E, 81SE J; N20W, 58NE F
		NQ-15	97	2.6	63			
-80	140	NQ-16	83	2.3	33			
	148	NQ-17	92	2.0	23			

Depth scale: 10, 20, 30, 40, 50, 60, 70 … 148 ft; EL. scale: 17.5, 0, -20, -40, -60, -80.

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

Minor rusty
Minor rusty
1' core lost
Minor rusty

Fairly fresh and hard throughout but altered by bleaching. Partings are not slickensided.

Cataclastic. Foliated, saussuritized, deformed diorite. Fine to medium grained, light greenish to tannish gray.

Aphanitic- yellow-green

Driller broken at close intervals

Not wx. Core broken throughout into 1' to 4' pieces by poor drilling.

Cataclastic. Fairly fine-grained, light greenish gray. Foliated. Apparent dark (chlorite ?) minerals scattered locally.

Discontinuous vertical joint strikes NW

95.2 Fused intrusive contact, NE strike
Diabase. Dark gray fine grained. Younger than alteration in country rock. Calcite veinlets.
Calcite vein
99.2

Striated

Not wx. Bleached by hydrothermal alteration to greenish-gray.

Cataclastic. Medium grained foliated diorite to 103'. Fine-grained, foliated with small quartz eyes below. Becomes very fine-grained.

2' core lost
Soft, some talc

112' to 114' core lost in soft zone. Minor rough slickensides.

114.9
Greenish tan (?)Diabase (?)-Bleached to greenish tan, aphanitic. May be mylonitic. Hairline foliation.

Slickensided- minor polish
Internal slickensides parallel to foliation
Fused

Not wx. Hydrothermally altered throughout. Fairly hard. Drills well. Partings tend to parallel foliation.

Welded breccia
Welded breccia

Cataclastic. Fine-grained, medium light greenish gray. Does not resemble diabase. Irreg. veining (feldspar) throughout.

Light greenish tan
133'

Diorite-granodiorite. Medium grained, light greenish gray. Locally foliated.

Mismatch
1' core lost
Somewhat softened by alteration

Not wx. Hydrothermally altered. Light tan bleach. Joints and partings are not slickensided.

Granodiorite. Light tannish gray (extensive bleaching), foliated, medium grained.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
Groundwater
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break
wx - Weathered, weathering
k - Coefficient of permeability

NOTES

1) Angle hole
2) Washed through soil from 0-65.5' - no sample taken.
3) Roller bitted to 66.0'
4) No clays present; therefore, no water contents were determined.
5) This is only a partial list of dip and strike data.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: February 13, 1974 Project 7286

PAGE 1 of 2 LOG OF BORING SB-7

GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Scotland Road site plan INCLINATION 45° BEARING S44E or 136° DATE START/FINISH Jan. 8, 1971 / Jan. 18, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 255.0 ft DRILLED BY American Drilling & Boring; T. Canning,

GROUND EL (MSL) 17.5 ft DEPTH TO WATER/DATE 0.3 ft / Jan. 18, 1971 LOGGED BY Soil - K. L. Polk, Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0–100)	PRESSURE TEST gpm/psi	Computed k 10^{-1} cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)
	150	NQ-18	92	2.0	35				
		NQ-19	100	2.4	48				
	160	NQ-20	100	2.2	32				
-100		NQ-21	100	1.9	45				
	170	NQ-22	97	1.9	28				
		NQ-23	100	2.0	51				
	180	NQ-24	100	2.1	55				
		NQ-25	100	1.7	28				
	190	NQ-26	100	1.6	72				
-120		NQ-27	100	1.7	25				
		NQ-28	100	1.9	40				N53E, 24NW J
	200	NQ-29	100	1.9	87				N78E, 38NW J; N70E, 82NW J; N80E, 43SE F
		NQ-30	100	1.7	80				N86W, 42NE F; N84W, 90 J; N80E, 70NE S
	210	NQ-31	100	1.9	52				N66E, 17NW S; Horizontal F
		NQ-32	100	2.3	55				N80E, 73NW J; N75E, 39NW S
	220	NQ-33	100	2.1	53				
-140		NQ-34	100	2.1	90				N59E, 52NW S; N52E, 78NW J; N76E, 80NW S; N61E, 77SE J
	230	NQ-35	100	2.5	54				
		NQ-36	100	2.6	65				N67W, 81NE S; N81E, 44NW S; N35W, 33SW S
	240	NQ-37	100	2.3	60				N35W, 72NE J; N60W, 50NE J; N64W, 43NE J; N72E, 58NW J
		NQ-38	100	2.6	43				N61E, 60NW J; N30E, 16NW S
-160	250	NQ-39	100	2.6	46				N70E, 61NW J; N85E, 69NW F; N72E, 56NW S
		NQ-40	64	2.5	18				N52E, 44NW J
	255						BOTTOM	OF BORING	

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

CONTINUED FROM PREVIOUS PAGE

Weathering, defects		Remarks	Type, texture, mineralogy, color, hardness
		149.7	Broken contact. No visible attitude
Breccia-fused Driller ground	Not wx. Minor surface wx effects on partings. Partings generally parallel to foliation. Not so bleached as above. Not slickensided.	Less bleached Epidote	Cataclastic. Fine-grained, medium gray fused breccia. Hairline veinlets. Medium dark green (epidote) beginning 155'
		Offset veinlets Fused	Cataclastic. Fine-grained, locally foliated and brecciated (fused). Medium-dark greenish gray. Epidotized.
Slight wx Not extensively bleached, moderate alteration only	Not wx. Some minor wx effects locally on joints. Tends to part parallel to foliation. Not slickensided. Competent fairly hard. Drills fairly well.	Fused breccia throughout	Cataclastic. Fine-grained becoming prominently foliated, brecciated. Not cut by cross-cutting veinlets. Hard, breccia is fused (annealed). Not fissile or slickensided. Medium greenish gray.
Moderate bleaching alteration	Not wx. Minor surface wx effects on joints and partings. Not slickensided.	mylonite	Cataclastic. Fine-grained matrix, epidote banding. Extensive fused breccia fabric. Light yellow-green mylonite (aphanitic) at 210.6-211.6'. Fused throughout. Not slickensided.
Smooth. Moderate wx, minor striated Slickensided on foliation Pyrite xtals Smooth, soft Moderate wx Smooth, chlorite	Not wx internally. Joints and partings not polished. Some slickensides. Some slickensides and softened rock at 222.4'.	213.7 Clinton-Newbury fault. Contact fused,	Moderate wx at 213.2' Diorite. Slight alteration and foliation to about 218'. Medium grained, medium gray. Veined below 218'.
	Fresh and hard. Drills well. Joints and partings show minor surface wx. Not slickensided.		Diorite. Medium grained, medium dark to dark gray. Not altered hydrothermally. Irregularly calcite-veined throughout. Fused.
Hematite Moderate wx Minor slickensided Moderate wx	Fresh and hard. Local zones of slight to moderate wx. Not hydrothermally altered.		Diorite. Mixed medium-grained dark gray diorite enclosing fine-grained, dark gray diorite inclusions. Extensively irregularly veined.
9' left in hole			

LEGEND
N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES
x - Oriented core

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers & constructors inc.

Date: April 18, 1971 Project 7286

PAGE 2 of 2 LOG OF BORING SRF 7

GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Scotland Rd. site plan INCLINATION Vertical BEARING ______ DATE START/FINISH Jan. 25, 1974 / Feb. 19, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 172.0 ft DRILLED BY American Drilling & Boring; T. Canning

GROUND EL (MSL) 17.6 ft DEPTH TO WATER/DATE Tidal ft / - LOGGED BY Soil - K. L. Polk; Rock - J. R. Rand

EL. MSL ft	Depth ft	Sample Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content or RQD %	Pressure Test gpm psi	Computed k 10^{-4} cm/sec	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickensides)	Soil and Rock Descriptions
17.6		S1,S1A	0,5		31				
		S2	24		29.4				Similar to Sample S1A, but very stiff. s_u (tor) > 1.0 tsf [2]
		S3	29		27.4				Similar to Sample S1A, but very stiff. s_u (tor) > 1.0 tsf
		S4	14		33.8				
		S5	7		40.4				Similar to Sample S4, but fewer brown spots; softer. s_u (tor) = 0.58 tsf
		S6	4		41.9				Similar
	10	S7	2/18"		48.9				Gray silty clay. Soft; medium plasticity; slightly sticky; contains one brown spot 10 mm in size. s_u (tor) = 0.15 tsf
0		S8	0		51.1				Similar to Sample S7, but contains some slightly darker and lighter colored layering. s_u (tor) = 0.15 tsf
	20	S9	3		33.1				Similar to Sample S7, but contains some darker and lighter colored layers dipping ~10°. s_u (tor) = 0.18 tsf
		S10	8		43.3				Similar to Sample S7, but contains a silty fine sand layer; sticky (very disturbed).
	30	S11	2		44.3				Similar to Sample S7, but very soft and sticky (very disturbed).
	33.0						TOP	OF SAND	
-20		S12	5						Gray-brown slightly silty fine to medium sand. Uniform; fines are nonplastic.
	40	S13	0						Similar to Sample S12, but contains a clay layer and few gravel pieces up to 5 mm in size.
		S14	39						Similar to Sample S12, but contains a clay layer and a few gravel pieces up to 15 mm in size.
	48.0						TOP	OF ROCK	
	50	1)							
		NQ-1	52	1.5	0				
-40		NQ-2	95	1.3	25				
	60	NQ-3	98	1.4	83				
		NQ-4	100	1.4	74			3)	
	70	NQ-5	93	1.5	82			N78W, 57NE F	
		NQ-6	100	1.0	95			N86E, 60NW F	
-60	80	NQ-7	100	1.0	86			N81E, 36NW J; N36W, 40NE F; N49W, 27NE J	
		NQ-8	100	1.0	63			N10E, 25SE S; N79W, 54NE J; N36W, 29NE J	
	90	NQ-9	100	1.1	82				
		NQ-10	100	1.1	87			N87W, 75NE J	
-80		NQ-11	100	1.2	31			N50W, 27NE S; N35W, 36NE J; N87E, 64NW B	
	100	NQ-12	83	1.2	75			N 7E, 35SE J	
		NQ-13	100	1.2	78			N72E, 47NW F; N57W, 29NE J; N54W, 47NE F	
		NQ-14	98	1.2	93			N82E, 37NW J; N70E, 36NW J; N58E, 54NW F	
	110	NQ-15	100	1.0	80			N71W, 76NE J; N40W, 12NE J	
-100		NQ-16	92	1.0	23				
	120	NQ-17	100	1.0	83				
		NQ-18	100	0.8	58				
		NQ-19	100	1.0	100				
	130	NQ-20	100	1.1	82				
-120		NQ-21	100	1.1	70				
	140	NQ-22	100	1.0	62				
	145								

Rock descriptions (Weathering, defects, etc. / Type, texture, mineralogy, color, hardness, etc.):

- Slight wx; Slight wx on partings; D; Slight wx. Generally not wx internally. Breaks on foliation with slight powdery wx effects on partings surfaces. *Medium* greenish-gray hydrothermal alteration. — Cataclastic. Fine-grained, bleached to light tan-green gray.
- Slight wx; D. Not wx. Minor wx effects on some partings as well as some striated but not polished surfaces. — Highly deformed welded breccia. Welded breccia throughout. Less bleached. Fused contact, deformed dips 60°.
- 80.0' Cataclastic. Medium dark greenish gray. Deformed veins. 83.6'
- Foliation; Soft-striated; Powdery surface; Chips. Not wx. Drills well. Light green-gray hydrothermal alteration. Soft, powdery zone at 96 ft probably wx associated with joint. Local striated joints or partings usually parts on foliation. — Fused breccia. Epidote. Diorite. Cataclastic. Fine-grained, medium greenish gray. Foliated. Local fused breccia zones.
- Not wx. Joints show minor slippery chlorite-talc coatings. Not polished. Subject to hydrothermal alteration, epidotization. — Welded breccia. Welded breccia throughout. Cataclastic. Fine-grained, medium greenish gray. Zones of welded breccia, hairline epidote stringers.
- Chips. Not wx. Minor surface wx effects on partings. Partings also show some striated, not polished surfaces. — Light tan. Cataclastic. Fine-grained, medium light greenish-gray. Local welded breccias. Fairly well foliated.
- Minor rusty; Chlorite. Not wx. Medium-gray green bleaching due to hydrothermal alteration. Minor surface wx effects on partings. Some partings striated. — Medium grained. Cataclastic. Fine-grained, fused breccia throughout. Medium greenish-gray.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample; ▼ Groundwater
- U - Undisturbed samples
  - S - Shelby tube; N - Denison
  - F - Fixed piston; P - Pitcher
  - O - Osterberg; G - GEI
- D - Drilling break; k - Coefficient of permeability
- wx - Weathered, weathering
- x - Oriented core

NOTES

1) Roller bitted to 53 ft.
2) s_u (tor) = Shear strength measured with Torvane
3) This is only a partial list of dip and strike data.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: March 9, 1974 Project 7286

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GEOTECHNICAL ENGINEERS INC.

BORING LOCATION See Scotland Rd. site plan INCLINATION Vertical BEARING ______ DATE START/FINISH Jan. 25, 1974 / Feb. 19, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 172.0 ft DRILLED BY American Drilling & Boring; T. Canning

GROUND EL (MSL) 17.6 ft DEPTH TO WATER/DATE Tidal ft / - LOGGED BY Soil - K. L. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0–100)	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
											CONTINUED FROM PREVIOUS PAGE	
	146	NQ-23	100	1.1	57				N72E, 68NW J,F N85W, 81SW J N85W, 20NE S		Not polished.	Intensely deformed, re-welded. Not cut by cross-cutting veinlets. No observable calcite.
	150	NQ-24	100	1.2	78				N86W, 60NE F N82E, 28NW J			
-140		NQ-25	100	1.2	77				N59W, 40SW J N85E, 56NW F N34W, 19NE J N75E, 51NW F		Chips Not wx. hydrothermally altered to 163.6'. Fresh, essentially unaltered below partings generally parallel foliation. A few striated surfaces, not polished.	Cataclastic. Fine-grained fused breccia, hairline epidote. Medium greenish gray-tan at 159-160.6 ft 160.2' to 160.4' Mylonite
	160	NQ-26	98	1.2	47						Chips Not slickensided	Fault zone-transitional-not slick.
		NQ-27	98	1.5	57				N63W, 56NE F N21W, 34SW S N27E, 70NW F		Smooth joint	Diorite. Slight alteration and foliated to about 168 ft. Medium-fine grained, medium gray.
	170	NQ-28	100	1.2	71				N89E, 46NW F			
	172							BOTTOM	OF BORING			

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: March 9, 1974 Project 7286

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GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Scotland Rd. site plan INCLINATION Vertical BEARING ______ DATE START/FINISH Dec. 20, 1973 / Jan. 3, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 118.3 ft DRILLED BY American Drilling & Boring; T. Canning, T. Paquette

GROUND EL (MSL) 17.8 ft DEPTH TO WATER/DATE 0.2 ft / Dec. 20, 1973 LOGGED BY Soil - K. L. Polk; Rock J. R. Rand

Column headings: EL. MSL ft | SAMPLE: Depth ft, Type and No., N or Rec. | RATE OF ADV. min/ft | WATER CONTENT % or RQD, Graphic (0–100) | PRESSURE TEST: gpm psi, Computed k 10^{-4} cm/sec | STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside) | CORE BREAKS | SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

EL. MSL ft	Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content % or RQD
17.8		S1, S1A			*
		S2			27.4
		S3			28.2
		S4			33.0
		S5			37.9
		S6			40.3
	10	S7			40.0
0		S8	0		45.8
	20	S9	3		41.9
		S10	3		44.1
	30	S11	8		29.5
-20	37.0	S12	9		29.6
	40	S13	11		
		S14	0		
	50	S15	24		
	55.0				
-40	57.0	NQ-1	90		
	60	NQ-2	100	1.0	33
		NQ-3	100	1.2	26
	70	NQ-4	100	1.2	7
-60		NQ-5	97	1.2	43
	80	NQ-6	100	1.5	28
		NQ-7	100	1.9	53
	90	NQ-8	96	2.0	65
-80		NQ-9	98	2.0	98
	100	NQ-10	100	2.0	100
		NQ-11	64	1.9	7
		NQ-12	100	1.8	48
	110	NQ-13	100	2.0	83
-100	118.3	NQ-14	100	2.0	62

Soil descriptions

Dark brown clayey topsoil; some small roots; organic odor. S1A-Mottled gray, brown, and rusty-brown silty clay. Low plasticity. s_u(tor) > 1.0 tsf. S2-Similar to Sample S1A, with blocky structure. s_u(tor) > 1.0 tsf. S3-Olive-brown silty clay. Low to medium plasticity; w above PL; nonsticky; somewhat blocky structure. s_u(tor) > 1.0 tsf. S4-Similar to Sample S3. s_u(tor) > 1.0 tsf. S5-Similar to Sample S3, but stiff; spots. s_u(tor) = 0.5-0.6 tsf. S6-Olive-brown to olive-gray silty clay. Medium plasticity; nonsticky; contains a few silt layers < 0.5 mm thick. s_u(tor) = 0.36-0.42 tsf. S7-Similar to Sample S6, but slightly sticky. s_u(tor) = 0.32 tsf.

Gray silty clay. Soft; medium to high plasticity; sticky. s_u(tor) = 0.15 tsf

Similar to Sample S8, but has a blocky structure; appears disturbed. s_u(tor) = 0.23 tsf

Similar to Sample S8, but has a blocky structure; appears very disturbed. s_u(tor) = 0.10 tsf

Similar to Sample S8, but medium stiff; blocky structure; appears very disturbed. s_u(tor) = 0.43 tsf

Similar to Sample S8, but has a blocky structure; contains layers of silty fine sand up to 20 mm thick.

TOP OF SAND (37.0 ft)

Gray fine sand. Uniform; clean; very fast reaction to shaking test.

Similar to Sample S13, but also contains a layer of coarse sand.

Light gray fine to coarse sand. Widely graded; very slightly silty; subangular grains; contains a few gravel pieces up to 15 mm in size.

TOP OF TILL (55.0 ft)

TOP OF ROCK (57.0 ft)

Rock descriptions

Core breaks notes	Weathering, defects, etc.	Type	Type, texture, mineralogy, color, hardness, etc.
Chips; Chips 72.5'; Ground chips 74.5'; Chlorite	*Not wx internally, but is bleached by hydrothermal alteration.* Minor wx effects on partings. Parts on foliation. No polished slickensides. Some partings striated. Moderate wx 72.5' to 74.5'.	Welded breccia throughout	*Cataclastic. Generally* fine-grained, medium greenish gray (epidotized). Predominantly welded breccia throughout *quartz veinlets x-cut* foliation.
Chips; Chips-slight wx	Not wx internal. Joints and partings are not polished. Some striated surfaces.	Tan mylonite	Light yellow-green alteration 80' to 81.7'.
Chlorite-striated			Diorite. Medium-grained, medium gray. Unaltered rock - feldspar veinlets. Foliated to about 89' depth.
D Driller mislatch	Fresh and hard. Drills well. Joints and partings not slickensided. Not affected by hydrothermal alteration or mechanical deformation.		Diorite - amphibolite. Medium-grained, dark gray, irregular feldspathic veinlets.
Slight wx	Fresh and hard. Not deformed or altered by faulting effects.	Pink quartzite (?)	Diorite - amphibolite. Medium-grained, dark gray, not foliated.

Strike, dip

N81E, 58NW F
N42E, 34NW F
N83E, 59NW J
N74E, 13NW F
N74W, 55NE J
N38W, 46SW F
N76E, 48NW F
N15E, 51SE J
North, 78E J
N75W, 30NE J
East, 55N F
N34W, 56NE F

BOTTOM OF BORING (118.3 ft)

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample; Groundwater
U - Undisturbed samples
S - Shelby tube; N - Denison
F - Fixed piston; P - Pitcher
O - Osterberg; G - GEI
D - Drilling break; k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) s_u(tor) = Shear strength measured with Torvane.

* 1 - 103.4, 1A - 30.6

x - Oriented core

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: May 8, 1974 Project 7286

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GEOTECHNICAL ENGINEERS INC.

ATTACHMENT No. 3

PETROLOGY AND PRELIMINARY INTERPRETATION OF EIGHT SAMPLES OF DRILL CORE FROM THE SCOTLANT ROAD FAULT NEWBURY, MASSACHUSETTS

GENE SIMMONS
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PETROGRAPHY AND PRELIMINARY INTERPRETATION
OF EIGHT SAMPLES OF DRILL CORE
FROM THE SCOTLAND ROAD FAULT,
NEWBURYPORT, MASSACHUSETTS

Weston Geophysical Research, Inc.
Post Office Box 306
Weston, Massachusetts 02193

Gene Simmons
Dorothy Richter
15 June 1974

SUMMARY

The petrography of eight samples of drill core from the vicinity of the Scotland Road fault, Newburyport, Massachusetts is described in this report. The samples (with the important exception of sample SRF-5B) all show evidence of dynamic deformation; That is, cataclasis, brecciation, and intense crushing--all probably due to motion along the fault. The deformation clearly took place after the regional metamorphism of the rocks (which was probably associated with the Devonian Acadian orogeny). The microcracks produced in the deformational events appear in thin section to have either annealed, or have been filled by secondary minerals. There is no firm petrographic evidence of recent deformation of these samples.

Sample SRF-5B may be a very important clue to the history of movement on the Scotland Road Fault. It is an altered olivine basalt that seems to be completely free of deformation. If the thin section is representative of a significant volume of this rock, then it may show that no deformation has occurred on the Scotland Road Fault since this rock last cooled below about 500°C. An even stronger statement can be made with respect to movement on the fault after the alteration of the rock was completed: Because the strength of diabase decreases with alteration and because of the absence of deformational features in Sample SRF-5B, we are quite sure that no movement occurred on the fault after the alteration was completed.

Table 1 is a summary of the rock types in the Scotland Road fault suite. Detailed petrographic descriptions and photomicrographs of textural features are given on the following pages.

Table 1. Summary of Samples

Sample #	Rock Type
SRF-1A	Amphibolite breccia
SRF-2A	Mylonized quartz-muscovite schist
SRF-2B	Brecciated quartz-muscovite schist
SRF-3A 67'	Muscovite mylonite
SRF-4A 43'	Chlorite augen gneiss
SRF-5A 42'	Sheared granodiorite
SRF-5B 175'	Altered olivine basalt
SRF-7A 116'	Ultramylonite
SRF-8A 155'	Brecciated quartz-muscovite schist
SRF-8B 146.5'	Brecciated quartz-muscovite schist
SRF-9A 80'	Brecciated quartz-muscovite schist

PETROGRAPHY OF SAMPLE SRF-1A

Name: Amphibolite breccia

Macroscopic Description

This sample is a coarse-grained dark green breccia. Large (to 1.5cm) angular fragments of dark green amphibole appear set in a finer matrix of crushed amphibole and finer-grained white minerals. Zones of continuous mylonized and sheared materials cut across the sample.

Microscopic Description

Texture

The texture of the thin section is very complex. Large single crystals can be seen to be split, sheared, rotated, and crushed. The original foliation of the schist is totally disrupted and the crystals are now randomly oriented. Multiple sets of fine parallel cracks and/or inclusion trains can be traced from an amphibole crystal into an adjacent feldspar grain. Coherent fragments of crystals can be "fitted" back together by eye, but they are separated by fibrous chlorite. Large cystals have cataclastic material along grain edges. Calcite viens which crosscut the breccia are themselves deformed, and crosscut by thin veins of undeformed plagioclase.

Mineralogy

Hornblende is the dominant constituent of the rock. It is optically negative with a large axial angle, and pleochroic from pale green to dark greenish brown.

Crystal fragments range in size from 0.01mm- 1.5cm. The crystals contain abundant inclusion trains and cataclastic material occurs within crystals and bevels grain boundaries. The hornblende appears to be unaltered except for a few overgrowths of blue-green amphibole.

Plagioclase is the second most abundant mineral in the rock. It occurs as untwinned crystals which were probably a part of the original amphibolite schist. Plagioclase forms large (0.5 - 1.0mm) crystals which are completely covered with linear sets of dusty inclusions. Most crystals appear strained and broken; healed fractures are marked by strings of quartz, calcite, and fresh plagioclase.

Chlorite forms pale green, fibrous, slightly pleochroic aggregates. All crystals display a consistent anomalous "tiger eye" brown interference color. Some of the chlorite seems to be post-brecciation recrystallized mylonitic material which appears to be stretched between cystals. A lesser amount of chlorite appears to be retrograded biotite which is recognized by small amounts of relict biotite and remnant pleochroic haloes.

Calcite appears in veins and fills interstices in the matrix of the rock. Most of the calcite in the veins

is highly distorted and elongated; but there are also minor amounts of undistorted calcite in thin younger veins.

Sphene occurs in accessory amounts as small nodular crystals associated with fuzzy aggregates of leucoxene.

Opaque minerals form stringy aggregates in the mica flakes and more rarely occur as roundish single crystals in the matrix of the rock.

Apatite and Cordierite occur as small euhedral crystals in the matrix of the sample.

Estimated modal composition

amphibole	45%
plagioclase	30%
calcite	15%
opaque	5%
accessories	5%

PETROGRAPHY OF SAMPLE SRF-2A

Name: Mylonized quartz muscovite schist

Macroscopic Description

Sample SRF-2A is a light greenish-grey rock. It appears in hand specimen to be a brecciated cataclasite; in other words, it has a very complex texture which may be the result of multiple deformations. The sample can be separated into different domains of fragments of coarser and finer grained material. The fragments are separated by fine-grained, lighter colored material.

Microscopic Description

Texture

The domains mentioned above appear in thin section as very fine mosaics of granular quartz grains and scaly muscovite. The average grain size is about 0.0mm.

The coherent fragments are separated by shear zones of chlorite, calcite, sphene and ultrafine material which is unresolvable with high magnification.

Mineralogy

Quartz is abundant in the rock fragments and occurs as small (0.2mm) roundish grains. Many grains appear to be crushed and granulated. Most grains have undulose extinction. The quartz crystals are almost always separated from each other by a film of minute mica flakes, except in the coarser grained fragments where they are in direct contact along sutured grain boundaries.

Muscovite occurs as small scaly clusters of crystals. Muscovite is a major constituent of the rock and has three modes of occurrence -- 1) as minute aggregates completely replacing what was probably feldspar, 2) as thin films around individual quartz crystals, and 3) as part of the shear zones between the rock fragments.

Calcite forms small aggregates in the shear zones and small veins which cut the rock.

Chlorite occurs in the shear zones between the fragments as irregular stringers.

Estimated modal composition

quartz	40%
muscovite	35%
calcite	15%
chlorite	5%
unresolvable material	5%

PETROGRAPHY OF SAMPLE SRF-2B

Name: Brecciated quartz-muscovite schist

Macroscopic Description

This sample is a medium greyish green brecciated rock which is very similar to sample SRF-2A in hand specimen. It is slightly coarser grained than the latter sample but is has a similar texture of sheared and brecciated metamorphic rock fragments up to 2cm in size.

Microscopic Description

Texture

The thin section shows a complex texture of brecciated quartz-muscovite rock. The fragments are of various sizes but have an internal uniform grain size of 0.1mm or less. The fragments are separated by zones of unresolvably fine minerals mixed with calcite.

Mineralogy

Quartz is one of the most abundant minerals in this rock. It occurs as irregular but generally ovoid grains which appear to be highly strained and are 0.1mm in size. Most of the quartz grains are not in contact with other quartz grains, and contain relatively few inclusions and bubble trains.

Muscovite forms small scaly masses which thinly separate quartz grains. The muscovite contains many small inclusions of opaques. Muscovite is a common mineral in the shear zones where it has a weblike pattern.

Chlorite is not very abundant in the main body of the rock but it is quite common in the sheared zones between the rock fragments. It is generally very pale green, only slightly pleochroic, and very weakly birefringent.

Biotite occurs as a few relict grains associated with some of the chlorite.

Calcite, clouded with fluid inclusions, fills the shear zones and younger veins. It is also present in the matrix of the fragments as small subhedral crystals.

Opaque grains are widely dispersed throughout the thin sections as minute single crystals and aggregates.

Garnet crystals are present in the sample but are very rare. Crystals <0.1mm in size appear brownish at the core because of tiny opaque inclusions.

Estimated Modal Composition

quartz	35%
muscovite	40%
calcite	15%
chlorite	5%
opaques & accessories	5%

PETROGRAPHY OF SAMPLE SRF-3A 67'

Name: Muscovite Mylonite

Macroscopic Description

This sample is a massive rock, mottled light and dark grey, and almost gneissic in texture. Most grains are too fine-grained to be recognized although enough larger quartz grains are visible to give the sample its banded appearance.

Microscopic Description

Texture

The sample is very fine-grained (~0.01mm) and vaguely schistose in thin section. Very faint outlines of lenticular shapes seem to mark former brecciated fragments. These fragments are obscured by a fine network of stringy mica which have a preferred orientation in another direction. The complex texture of this sample suggests multiple periods of deformation.

Mineralogy

Muscovite is abundant in this sample as ultrafine crystals which are often optically aligned to give a weblike appearance of the mineral. Muscovite is very finely mixed with quartz in the matrix of the rock. It is the major mineral in the sample, although one cannot see it in hand specimen.

Quartz occurs as isolated fragmental crystals in the sample. It generally has indistinct grain boundaries.

Quartz also appears to be mixed with the muscovite at a very fine scale.

Calcite occurs commonly as 0.5mm roundish crystals in the matrix and as thin aggregates following the schistosity.

Opaque grains occur in small knots with streamlined outlines, and small crystals following schistosity.

<u>Estimated Modal Composition</u>

muscovite	70%
quartz	15%
calcite	10%
opaques	5%

Note: Another thin section from this core exhibits similar textures but contains small domains which are calcite rich.

PETROGRAPHY OF SAMPLE SRF-4A 43'

Name: Chlorite augen gneiss

Macroscopic Description

This sample is a fine-grained augen gneiss. It has a dark green matrix of indistinguishable minerals and 0.5mm "eyes" of white crystals. The sample shows strong directional foliation which is crosscut by younger veins of light colored minerals.

Microscopic Description

Texture

In thin section, the sample shows a complex, almost chaotic texture. It is basically a mosaic of fragmental quartz and feldspar crystals and aggregates with lenticular shapes sandwiched by shear zones of chlorite, calcite, and opaques. Thin veins of calcite cut the foliation.

Mineralogy

Chlorite is the most abundant mineral in the rock. It is pale green, pleochroic, and exhibits anomalous brown interference colors. Very fine, scaly aggregates of chlorite are commonly finely mixed with quartz and opaque grains. Larger crystals of chlorite show small amounts of relict biotite.

Plagioclase occurs as intensely sericitized, poorly twinned, fragmented crystals in the augen.

Quartz has three modes of occurrence in this sample: 1) large broken crystals in the augen, 2) very finely

mixed in the matrix, and 3) fresh crystals in thin veinlets.

Calcite is a very common mineral in the matrix, shear zones, and in veins. It commonly has deformed twin planes.

Orthoclase occurs in accessory amounts as anomalously fresh appearing fragmental crystals in the augen.

Opaque grains are widely dispersed throughout the thin section as minute crystals.

Estimated Modal Composition

chlorite	35%
plagioclase	20%
quartz	15%
calcite	20%
orthoclase	5%
opaque	5%

Note -- the bulk mineral composition of this sample suggests that its protolith was a mafic igneous rock.

PETROGRAPHY OF SAMPLE SRF-5A 42'

Name: Sheared granodiorite

Macroscopic Description

This sample appears in hand specimen to be a massive, coarse-grained igneous rock with no evidence of deformation. The average grain size is approximately 1mm. Visible in hand specimen are pink feldspar, white quartz, and an unknown green mineral.

Microscopic Description

Texture

The thin section has the hypidiomorphic granular texture typical of plutonic rocks. Equidimensional crystals showing varying degrees of alteration are crosscut by thin veinlets. The major deformational features in the thin section are: healed cracks, undulose extinction of the minerals, and a narrow shear zone.

Mineralogy

"Plagioclase", once a major component of this sample, has been completely kaolinized with only a few rare traces of the original twinning or textures left. The kaoinization reaction produces excess SiO_2 which can be seen in the thin section as a thin rim around each kaolinized grain. These peculiar rims are optically uniform around each crystal. The rims only occur along feldspar-feldspar contacts but do not occur along feldspar-quartz contacts.

Quartz occurs as 1 mm blocky crystals with undulose extinction and numerous inclusion trains. Quartz-feldspar boundaries are generally smooth whereas quartz-quartz boundaries are sutured, a sign of partial recrystallization. Quartz also occurs in the rims around kaolinized feldspar grains as mentioned above.

Microcline occurs as slightly altered crystals with a microperthitic texture.

Chlorite forms pseudomorphs after biotite and amphibole. It is medium green, weakly pleochroic, and contains abundant needles of opaques.

Calcite occurs as small clusters of crystals finely mixed with kaolinite alteration products, as thin veinlets, and as aggregates in the matrix. Calcite also fills the one shear zone in the thin section.

Accessory minerals in this rock are opaques, apatite, and sphene.

Estimated Modal Composition

"plagioclase"	40%
microcline	20%
quartz	25%
chlorite	12%
opaque & accessories	3%

PETROGRAPHY OF SAMPLE SRF-5B 175'

Name: Altered olivine basalt

Macroscopic Description

This is a massive, dark greenish grey aphanitic rock. Small dark phenocrysts (0.5 - 1.0mm) and 0.5mm white amygdules are visible in the black groundmass. There are no signs of deformation such as shear zones or even veins.

Microscopic Description

Texture

The sample has a very fine-grained (<0.1mm) intersertal texture. The matrix texture is somewhat obscured by partial alteration of the minerals. The vesicles are rimmed with fibrous minerals. The phenocrysts are completely replaced by alteration minerals.

Mineralogy

Plagioclase occurs as small (0.1mm or less) laths in the matrix of the rock. It does not form any phenocrysts. The plagioclase is generally poorly twinned and partially altered to a sericitic product.

Pyroxene crystals occur as small roundish grains with small scale intergrowths with opaque rods. It is pinkish brown in color and is probably augite.

Serpentine completely replaces roundish 1.0mm phenocrysts of olivine. Serpentine also occurs as fibers in the matrix of the rock, and as the lining of the amygdules.

Calcite forms twinned single crystals in the amygdules and is otherwise rare in the matrix.

Estimated Modal Composition

plagioclase	35%
pyroxene	35%
serpentine	10%
calcite	10%
sericitic alteration	10%

Note -- This sample is probably from a dike which post-dates movement along the Scotland Road fault since it is completely undeformed.

PETROGRAPHY OF SAMPLE SRF-7A 116'

Name: Ultramylonite

Macroscopic Description

This is a compact, extremely fine-grained, mustard colored rock. A few small whitish augen (0.5 - 1.0mm) are visible in the hand specimen. The matrix is buff colored, highly sheared looking material.

Microscopic Description

Texture

This is an ultrafine-grained crush breccia. The original texture of the rock is totally obliterated. The apparent mineral layering is due to 'smearing' of the grain in local shear zones.

Mineralogy

The rock is so fine-grained that individual crystals are difficult to discriminate, except in the few augen of quartz, calcite, and opaque minerals. The matrix is extremely finely-ground quartz, mica, calcite, sphene, apatite, and opaque minerals. Calcite occurs in small nodules which show some signs of recrystallization.

Note -- the fine-grained nature of this rock precludes any further discussion of its mineralogy or texture.

PETROGRAPHY OF SAMPLE SRF-8A 155'

Name: Brecciated quartz-muscovite schist

Macroscopic Description

This sample is a dark greenish grey rock. On a fresh surface it appears to be a fine grained quartzite cut by narrow black shear zones and mottled tan zones. The wet sawed surface shows the texture of a breccia with distinct fragments ranging in size from 1mm to 1cm. The fragments are separated by the tan material; both are cut by the black shear zone.

Microscopic Description

Texture

The texture in thin section is similar to other samples in the suite. Lenticular fragments of various sizes of quartz muscovite rock are separated by ultrafine-grained shear zones. Average grain size is 0.1mm. The relative proportions of quartz and muscovite varies from fragment to fragment.

Mineralogy

Quartz occurs as roundish grains which are almost always isolated from each other by varying amounts of muscovite. Some of the crystals appear to be broken.

Muscovite forms scaly masses which are vaguely schistose. Muscovite is a major component of the rock, filling interstices, between quartz grains, shear zones. It forms the bulk of several lithic fragments.

Chlorite is a major constituent of the sheared zones between lithic fragments although it is not abundant in the fragments themselves. It is pale green, slightly pleochoic, and exhibits anomalous blue interference colors.

Opaque grains, finely mixed with leucoxene, form intricate integrowths pseudomorphous after tabular biotite plates and occur as euhedral crystals in the lithic fragments.

Calcite is common in the shear zones as elongate crystals. It also occurs as minute single crystals in the lithic fragments, and in a few thin, undeformed veins.

Sphene forms fine granular aggregates in the matrix of the fragments and occurs as stringers in the shear zones.

<u>Estimated modal composition</u>

Quartz	45%
Muscovite	30%
Chlorite	10%
Opaque	5%
Calcite	5%
Sphene	5%

PETROGRAPHY OF SAMPLE SRF-8B 146.5'

Name: Brecciated quartz-muscovite schist

Macroscopic Description

This sample is strikingly similar to SRF-8A in hand specimen. It is dark greenish-grey in color. On a fresh broken surface, it appears fine grained and structureless. On the sawed surface, one can see lenticular fragments of various sizes, thinly outlined by lighter colored material. The core is broken along a major fracture surface.

Microscopic Description

Texture

The texture of the sample is variable and complex. The rock fragments consist of roundish quartz grains and scaly mica; the grain size and composition of the fragments vary. The lithic fragments are separated by mylonite which consists of ground quartz, mica, chlorite, and calcite.

Mineralogy

Quartz is the most abundant and most coarsely grained mineral in the rock. It occurs as roundish grains which vary in size (0.1-0.3mm) and abundance (60%-40%) in the different lithic fragments. The crystals commonly contain inclusions. Quartz crystals are rare in contact with each other. A minor amount of quartz occurs in thin veins which cut the rock and probably post-date the brecciation.

Muscovite occurs as scaly aggregates whose crystals are

much less than 0.1mm in size. The aggregates form most of the matrix of the lithic fragments. Submicroscopic muscovite appears to occur in the mylonized zones.

Chlorite forms pale green 0.1mm crystals in the shear zones. Chlorite less commonly occurs in the matrix of the lithic fragments.

Opaque grains occur in the shear zones, in the matrix and in a few rare veins.

Carbonate forms irregular clusters of crystals in the shear zones but does not occur in the lithic fragments.

Sphene occurs in minor amounts as grainy aggregates in the matrix of fragments and in the mylonized zones.

Estimated modal composition

Quartz	40%
Muscovite	40%
Chlorite	10%
Calcite	5%
Opaques	5%

PETROGRAPHY OF SAMPLE SRF-9A 80'

Name: Brecciated quartz-muscovite schist

Macroscopic Description

The texture of this sample is similar to that of samples 8A and 8B, although the rock is light tannish-grey in color. Lenticular and irregularly shaped fragments 0.1-1cm in size are recognizable in a highly sheared matrix. Individual minerals are too fine-grained to recognize in hand specimen. Thin veins of light-colored minerals and, more rarely, opaques are present.

Microscopic Description

Texture

The thin section exhibits the chaotic texture of the rock. Lenticular quartz-muscovite lithic fragments are elongate parallel to foliation. Mylonized zones appear to be structureless. Irregular semi-parallel veinlets cut the foliation.

Mineralogy

Quartz occurs as roundish grains in the lithic fragments. The grains appear to be highly strained and in places broken. They commonly contain linear arrays of inclusions. Very finely ground quartz is apparently a constituent in the mylonite zones. Several thin veins of quartz cut the rock. The margins of the veins are commonly sutured and show signs of recrystallization; in some places the vein quartz is optically continuous with quartz grains which it cuts.

Muscovite forms scaly masses between quartz grains in the lithic fragments. The individual crystals are minute but seem to show a general preferred orientation parallel to the foliation. Muscovite appears to be relatively more abundant in the finer-grained lithic fragments than in the coarser-grained fragments.

Calcite is prominant in the mylonized zones and in a few veins. It occurs less commonly in the matrix of the rock fragments.

Sphene aggregates are also common in the shear zones but sparsely distributed in the rest of the rock.

Opaques seem to be concentrated in the shear zones between lithic fragments in clusters of 0.1mm crystals. They also occur in a few veins and as euhedral crystals in the fragments.

Estimated modal composition

Quartz	35%
Muscovite	30%
Calcite	20%
Sphene	5%
Opaques	10%

Note: The light color of this sample is apparently due to the virtual absence of chlorite in the shear-zones coupled with the relative abundance of calcite.

1

2

Photo 1. Sample SRF-1A. Amphibolite breccia. Plane polarized light. Width of field 1.5mm. This photomicrograph shows a typical field of view of this sample. Note that the large darkish hornblende crystals are sheared. The lighter grey crystals are plagioclase. See also Photo 2.

Photo 2. Sample SRF-1A. Amphibolite breccia. Crossed polarized light. Width of field 1.5mm. This photomicrograph shows a major shear zone in the rock. The elongate crystals are deformed calcite. See also Photo 1.

3

4

Photo 3. Sample SRF-2A. Mylonized quartz-muscovite schist. Cross polarized light. Width of field 1.5mm. This photomicrograph shows one large lithic fragment covering 3/4 of the photograph and consisting of roundish quartz grains and fuzzy muscovite. The dark zones around the fragment are shear zones of chlorite and other unresolvable minerals. See Photo 4 for an enlargement of the lithic fragment.

Photo 4. Sample SRF-2A. Mylonized quartz-muscovite schist. Plane polarized light. Width of field 0.5mm. This photo is an enlargement of the large lithic fragment shown in Photo 3. The roundish grains are quartz, and the matrix is scaly muscovite, opaques, sphene, and tiny euhedral crystals of calcite as in the left center of the photo.

Photo 5. Sample SRF-2B. Brecciated quartz-muscovite schist. Plane polarized light. Width of field 1.5mm. This photomicrograph shows the chaotic texture typical of this rock. Note the lenticular fragments of varying grain sizes. The round white crystals are quartz; the darker minerals are scaly muscovite, sphene, calcite and opaques. See also Photo 6, an enlargement of a part of this field magnified. Note the similarity of this sample with SRF-2A.

Photo 6. An enlargement of a portion of Photo 5. Sample SRF-2B. Brecciated quartz-muscovite schist. Plane polarized light. Width of field 0.5mm. This photomicrograph shows the chaotic texture typical of this rock. The round white crystals are quartz; the darker minerals are scaly muscovite, sphene, calcite and opaques. Note the similarity of this sample with SRF-2A.

Photo 7. Sample SRF-3A 67'. Muscovite mylonite. Crossed polarized light. Width of field 1.5mm. This photomicrograph shows the typical texture of this very fine-grained sample. The few larger grains are fragmented quartz crystals. They are set in a finely ground matrix of quartz, muscovite and lesser amounts of calcite, sphene, and opaques.

Photo 8. Sample SRF-4A 43'. Chlorite augen gneiss. Plane polarized light. Width of field 1.5mm. This photomicrograph shows a polycrystalline 'eye' (lower half of photo) in a crushed and sheared matrix. The light grains in the photo are mostly plagioclase and quartz. The large darker grey crystals are chlorite. Note the concentration of opaques in the shear zone in the upper right corner.

Photo 9. Sample SRF-5A 42'. Sheared granodiorite. Crossed polarized light. This photomicrograph shows a typical field of view of this sample. Note the large fuzzy grains. They are kaolinized plagioclase crystals which have narrow rims of optically continuous quartz. These rims were probably produced as a result of the kaolinization. Note that the rims do not continue along a quartz-plagioclase grain boundary at the left. The medium grey grains are microperthite, and the light grey grains are quartz.

Photo 10. Sample SRF-5B 175'. Altered olivine basalt. Plane polarized light. Width of field 1.5mm. This photomicrograph is a good example of the texture of this sample. In the upper left is an amygdule filled with twinned calcite and lined with fibrous serpentine. At the right is a phenocryst of olivine which has been completely replaced by serpentine. The matrix consists of laths of plagioclase (white) and darker crystals of pyroxene and black opaques. See also photo 11, an enlargement of the matrix.

11

12

Photo 11, an enlargement of a portion of photo 10. Sample SRF-5B 175'. Altered olivine basalt. Plane polarized light. Width of field 0.5mm. This photomicrograph is an enlargement of the matrix.

Photo 12. Sample SRF-7A 116'. Ultramylonite. Plane polarized light. Width of field 1.5mm. This photomicrograph shows typical texture of this rock. Dark shear zones can be distinguished against the background of highly crushed minerals. See also photo 13.

13

14

Photo 13. an enlargement of a portion of photo 12. Sample SRF-7A 116'. Ultramylonite. Plane polarized light. Width of field 0.5mm. The rock is so pulverized that only a few grains can be identified with certainty--some dark nodular sphene, a few quartz grains and a few aggregates of calcite.

Photo 14. Sample SRF-8A 155'. Brecciated quartz-muscovite schist. Plane polarized light. Width of field 1.5mm. This photomicrograph shows a typical field of view. Two large lithic fragments are separated by a dark grey shear zone consisting of chlorite, calcite, and finely ground quartz and muscovite. The white grains in the rock fragments are quartz which are surrounded by darker muscovite, calcite, sphene, and opaque grains.

Photo 15. Sample SRF-8B 146.5'. Brecciated quartz muscovite schist. Cross polarized light. Width of field 1.5mm. This photomicrograph shows parts of three lithic fragments. Two of the fragments are coarser-grained than the fragment in the lower right. The larger roundish grains are quartz and the fuzzy material is fine grained masses of muscovite. A thin black line of chlorite and opaques separate the three fragments. Note the similarity of this sample to SRF-8A.

Photo 16. Sample SRF-9A 80'. Brecciated quartz-muscovite schist. Cross polarized light. Width of field 1.5mm. The left hand side of the photomicrograph shows a lithic fragment of roundish quartz grains surrounded by scaly masses of muscovite. At the right is a stringy mylonite zone consisting of pulverized quartz and muscovite with carbonate and opaques. This sample is similar to samples SRF-8A and 8B except for the absence of chlorite.

ATTACHMENT No. 4

K-Ar AGE DETERMINATIONS OF SIX SAMPLES FROM THE SCOTLAND ROAD FAULT ZONE

GEOCHRON LABORATORIES DIVISION,
KRUEGER ENTERPRISES, INC.
CAMBRIDGE, MASSACHUSETTS 02139
for
WESTON GEOPHYSICAL RESEARCH, INC.
WESTBORO, MASSACHUSETTS 01581

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MASSACHUSETTS 02139 • (617) 876-3691

16 May 1974

Richard J. Holt
Weston Geophysical
P.O. Box 364
Weston, MA 02193

Dear Mr. Holt:

Enclosed are the analytical reports of the K-Ar age determinations on two (2) of the six (6) samples sent to us by Gene Simmons at M.I.T. I have already given these results to you by telephone.

We analyzed sample 5B as a whole rock and obtained an age of about 199 m.y., and we analyzed a sericite concentrate from 8A and obtained an age of about 248 m.y. This latter concentrate contained a significant amount of feldspar, but with a sample of this sort it is often not possible to obtain a high quality mica concentrate. The measured age of sample 8A should be a reasonably good metamorphic age for the rock.

If you have any questions, please do not hesitate to contact me. In the meantime, I am enclosing our invoice for this work. I will contact you as soon as the remaining samples have been analyzed.

Sincerely,

Richard H. Reesman

Richard H. Reesman
General Manager

RHR/dm
encl: 2 reports & invoice #4401

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MA 02139 • (617)-876-3691

POTASSIUM-ARGON AGE DETERMINATION | **REPORT OF ANALYTICAL WORK**

Our Sample No. R-2813 | **Date Received:** 22 April 1974

Your Reference: SRF 5B (175.1') | **Date Reported:** 14 May 1974

Submitted by:
Richard Holt
Weston Geophysical Res. Inc.
P.O. Box 364
Weston, MA 02193

Sample Description & Locality: Dark basalt drill core, SRF 5B (175.1')

Material Analyzed: Whole rock, crushed to -40/+100 mesh.

Ar^{40*}/K^{40} = .01230 | AGE = 199 ± 9 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.01647	.686	.01638
.01628	.645	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
1.095	1.091	1.331
1.087		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION | **REPORT OF ANALYTICAL WORK**

Our Sample No. M-2820

Date Received: 26 April 1974

Your Reference: SRF 8A

Date Reported: 15 May 1974

Submitted by: Richard J. Holt
Weston Geophysical
P.O. Box 364
Weston, MA 02193

Sample Description & Locality: Sericitized meta-sediment, drill core #SRF 8A.

Material Analyzed: Sericite concentrate with substantial feldspar remaining.

Ar^{40*}/K^{40} = .01550

AGE = 248 ± 9 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.09410	.891	.09629
.09848	.791	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
5.086	5.092	6.212
5.099		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln \left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1 \right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MASSACHUSETTS 02139 • (617) 876-3691

31 May 1974

Richard Holt
Weston Geophysical Research Inc.
P.O. Box 364
Weston, MA 02193

Dear Mr. Holt:

Enclosed are the analytical reports of the K-Ar age determinations on the remaining four (4) samples of the six (6) we received from Gene Simmions last month.

The amphibole in SRF 1A gave an age of 324 m.y. Samples SRF 2A, SRF 3A, and SRF 5A 42' were analyzed as whole rocks and gave indistinguishable ages of 256 m.y., 269 m.y., and 272 m.y. respectively.

Judging from past analyses we have done for you I suspect these numbers are about what you expected.

If you have any questions, please do not hesitate to contact me. In the meantime, I am enclosing our invoice for this work. We look forward to serving you again in the near future.

Sincerely,

Richard H. Reesman
General Manager

RHR/dm
encl: 4 reports & invoice # 4414

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MA. 02139 • (617)-876-3691

POTASSIUM–ARGON AGE DETERMINATION **REPORT OF ANALYTICAL WORK**

Our Sample No. A-2814 **Date Received:** 22 April 1974

Your Reference: SRF 1A up **Date Reported:** 31 May 1974

Submitted by:

Richard Holt
Weston Geophysical Res. Inc.
P.O. Box 364
Weston, MA 02193

Sample Description & Locality: Coarse-grained amphibolite

Material Analyzed: Amphibole concentrate, -40/+100 mesh.

Ar^{40*}/K^{40} = .02069 AGE = 324 ± 14 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.01967	.679	.01974
.01981	.704	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.786	.782	.954
.778		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION **REPORT OF ANALYTICAL WORK**

Our Sample No. R-2817 **Date Received:** 26 April 1974

Your Reference: SRF 2A **Date Reported:** 31 May 1974

Submitted by: Richard J. Holt
Weston Geophysical
P.O. Box 364
Weston, MA 02193

Sample Description & Locality: Sericite schist

Material Analyzed: Whole rock, crushed to -60/+100 mesh.

Ar^{40*}/K^{40} = .01604 AGE = 256 ± 10 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.03235	.676	.03307
.03378	.807	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
1.699	1.689	2.061
1.680		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln \left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1 \right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION **REPORT OF ANALYTICAL WORK**

Our Sample No.	R-2818	**Date Received:**	26 April 1974
Your Reference:	SRF 3A	**Date Reported:**	31 May 1974

Submitted by: Richard J. Holt
Weston Geophysical
P.O. Box 364
Weston, MA 02193

Sample Description & Locality: Sericite schist

Material Analyzed: Whole rock, crushed to -60/+100 mesh.

Ar^{40*}/K^{40} = .01690 AGE = 269 ± 10 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.07748	.913	.07756
.07763	.787	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
3.782	3.761	4.589
3.741		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM–ARGON AGE DETERMINATION — **REPORT OF ANALYTICAL WORK**

Our Sample No. R-2819 — **Date Received:** 26 April 1974

Your Reference: SRF 5A 42' — **Date Reported:** 31 May 1974

Submitted by: Richard J. Holt
Weston Geophysical
P.O. Box 364
Weston, MA 02193

Sample Description & Locality: Altered granodiorite

Material Analyzed: Whole rock, crushed to -60/+100 mesh.

Ar^{40*}/K^{40} = .01710 — AGE = 272 ± 10 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.06782	.879	.06893
.07003	.872	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
3.341	3.304	4.030
3.267		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

GEOLOGICAL INVESTIGATIONS

of the

PORTSMOUTH FAULT
(Novotny - 1963)

PORTSMOUTH-HAMPTON, NEW HAMPSHIRE

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK STATION

SEPTEMBER 1974

PORTSMOUTH FAULT INVESTIGATIONS

CONTENTS

CONTENTS (CON'T.)

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK STATION

PORTSMOUTH FAULT INVESTIGATIONS

Investigations have been conducted along the general path of the inferred Portsmouth fault between Portsmouth and Hampton, New Hampshire, in an attempt to locate and define the inferred feature, and to examine the nature and structure of unconsolidated Pleistocene deposits which overlie bedrock in the area. (Figure 1)

All investigations have failed to locate or to suggest the existence of the Portsmouth fault. Well-stratified outwash sand deposits of Pleistocene age, as exposed in the walls of a number of gravel pits at scattered localities along the general trend of the inferred fault, show no evidence of tectonic faulting subsequent to their deposition.

Consideration of all available facts leads to the conclusion that the Portsmouth fault does not exist.

I. DEFINITION OF THE PORTSMOUTH FAULT

The Portsmouth fault was originally postulated by R. F. Novotny to trend southerly in an arcuate path for a total length of 12½ miles from Pierce's Island, Portsmouth, to the Taylor River, Hampton, New Hampshire (Novotny; 1963). Novotny's bases for postulating the fault include: 1) brecciated and faulted rocks in the Kittery formation in an exposure on Route 1 By-pass, Portsmouth; 2) brecciated and partly silicified Kittery formation rocks exposed on the southeastern shore of Goat Island, New Castle; 3) brecciated and partly silicified Kittery formation rocks exposed near the east end of Brumley Hill, North Hampton; 4) the presence of granitic intrusives in the Rye formation near the Kittery contact; 5) an apparently unconformable stratigraphic relationship between the Rye and Kittery formations along the trend of their contact zone.

Novotny further interpreted the Portsmouth fault to form the steeply west-dipping contact between the Rye and Kittery formations. Displacement was inferred to be down on the west, suggesting a normal fault. Outcrops were reported to be too few and too poor to attempt calculation of fault displacement.

II. INVESTIGATION PROCEDURES

A. Preliminary - General Area

As a preliminary investigation of the Portsmouth fault, J. R. Rand walked portions of the fault trace as it was defined by Novotny, and examined gravel pits and highway road cuts and construction excavations in a strip about 2 miles wide overlapping the postulated trace of the fault from Portsmouth to Hampton. Each specific outcrop cited by Novotny as proof of faulting was also examined. R. J. Holt of Weston Geophysical Research, Inc. and J. R. Rand together viewed by helicopter the inferred trace of the fault between the Seabrook site and Gerrish Island, Maine. J. R. Rand also studied commercial aerial photographs covering the zone from the site to North Hampton, and his own color photographs taken along the path of the zone during the helicopter inspection. Backhoe trenching and ground magnetometer surveys have also been conducted in Greenland, New Hampshire, 8 to 9 miles north of the Seabrook site, in an effort to locate the fault (Point "A" on Figures 1 and 2). Several bedrock samples were taken along the zone for radiometric age dating.

B. Detailed - Breakfast Hill Road, Greenland

Just to the northeast of the intersection of the New Hampshire Turnpike and Breakfast Hill Road, Greenland, a wide area of outwash sands, ice-contact gravels and cobble till deposits was excavated for Turnpike construction subsequent to Novotny's field studies in the area (Point "A" on Figures 1 and 2; Figure 3; Figure 4). Within this large area, numerous low, glacially striated surfaces of Rye formation bedrock are now exposed in the floor of the reclaimed borrow area, in contradiction to Novotny's interpretation of Kittery formation terrane in this area. Survey control for investigations was provided by McKenna Associates, Portsmouth (map attached).

1. *Coakley Sand Pit*

As shown on Figure 3, backhoe trenching in an operating sand pit at the northwest corner of the area exposed additional outcrop of the Rye formation bedrock. Boring PF-1 was drilled on a N50W (True) bearing at an inclination of about 43° to a depth of 276', taking oriented core samples, in a search for a possible Rye/Kittery contact in an apparent folded structure which underlay well-stratified and undisturbed outwash sands exposed in the north wall of the pit.

Boring PF-1 encountered only interbedded gneiss, fine-grained schist and thin interbedded quartzites of the Rye formation, and was terminated as it passed to the west of the edge of the sand pit. The structure of the Rye formation in the boring, as indicated by orientation measurements of bedrock foliation, is that of a tight syncline which dips steeply to the west. Five zones of welded breccia were encountered in the boring, the thickest of which included 7.5' of welded quartzite breccia at 249.5' to 257' depths in the hole. The brecciated rock in PF-1 was fresh, compact, thoroughly welded or annealed, and did not show polished or slickensided surfaces on partings.

No mineralization, hydrothermal alteration, shear zones, or other evidence of major faulting was encountered in the boring. The welded brecciation is of the type found frequently in borings in metamorphic rocks in the region, and is interpreted to be associated with strains developed at the time of folding and metamorphism of the region during the Acadian orogeny. Two diabase dikes encountered in the boring were fresh, unaltered, and showed normal intrusive contacts.

2. Loch-Coombs Reclaimed Borrow Area

As shown on Figure 4, three core borings (PF-2, PF-3, PF-3A) were drilled across the property line between lands of Anthony Loch and Richard Coombs, at the north edge of a reclaimed borrow area to the north of Breakfast Hill Road, to investigate the western boundary of a local magnetic anomaly.

a. Ground Magnetometer Survey

Because the bedrock exposed throughout the Breakfast Hill study area is represented only by Rye formation metavolcanic rocks for as much as one-half mile to the west of Novotny's fault trace, and comprises no outcrops of Kittery formation quartzites as had been interpreted by Novotny, the presence of a fault contact between these two formations in this area cannot, by definition, exist. Having no formational contact to investigate for these current studies, Weston Geophysical Engineers, Inc. undertook a ground magnetometer survey to determine whether any anomalous magnetic features might occur which could suggest faulting within the Rye formation itself. Technical details of this survey are presented in a report by Weston Geophysical Engineers, Inc., attached herewith.

The magnetometer surveys show no anomalous magnetic intensities in the zone of Novotny's fault trace in five profiles which were conducted across the inferred trace at intervals influencing a zone of almost 4,000' along the trace from north to south. In the area of Coombs Pond (Figure 4), a local magnetic anomaly high was detected on 3 survey lines (Lines 6, 2NR and 2R). The apparent alignment of this anomaly is about N10E, parallel to the strike of bedrock foliation in the area. Novotny's inferred fault trace in the same general area strikes about N40E, transverse to foliation.

b. Borings Investigations

Two borings, PF-2 and PF-3A, were drilled at approximately 40° inclination to the southeast to investigate bedrock conditions at the western boundary of the local magnetic anomaly. A third boring, PF-3, was drilled vertically to determine bedrock depth prior to drilling PF-3A. The results of these borings are generalized in cross section on Figure 4, on which also is projected the magnetic profile of Mag. Line 6.

Overburden, which was not specifically sampled in these three borings, is comprised of outwash sands overlying a sandy boulder till. Boring PF-2 was drilled to a depth of 271' (about 201' in bedrock), in light gray banded gneiss and dark green amphibolite, intruded locally by weakly magnetic diabase dikes. PF-3 was drilled to a depth of 50' (10' in bedrock) in gray and greenish gneiss. PF-3A was drilled to a depth of 204.3' (124' in bedrock) in gray banded gneiss, dark green amphibolite and, at the bottom 5' of the boring, notably magnetic, salmon-feldspar gneiss, with a single diabase dike. The location of the basal magnetic gneiss in PF-3A conforms reasonably with the downward projection on the local bedrock structure of the magnetic anomaly found by surface surveys. The weakly magnetic dikes in the borings conform with a slight increase in magnetic intensity found by surface surveys.

The condition of bedrock in PF-2, PF-3 and PF-3A was weakened by weathering effects on moderately closely-spaced jointing to about -70' Elevation. In no boring, however, were there slickensided or polished joint surfaces, gouge zones, hydrothermal alteration or any other visible evidence of bedrock faulting.

C. Petrographic Examinations

The petrography of three samples of drill core from Boring PF-2 has been described by Professor Gene Simmons and Dorothy A. Richter of Massachusetts Institute of Technology.

Sample	Depth	Field Description	Petrographic Description
PF-2A	99.5 - 99.9'	Gneiss	Felsic Metatuff
PF-2B	136.0 - 136.5'	Diabase	Metabasalt
PF-2C	262.0 - 262.4'	Amphibolite	Fine Grained Amphibolite

Simmons and Richter conclude from their studies that "Evidence for dynamic structural deformation, either recent or ancient, is entirely absent. In summary, we find no petrographic evidence that these three samples are associated with a fault. If a fault does exist in the region from which these samples were obtained, then either its deformation was not so pervasive as to effect these three samples, or else the deformation occurred before metamorphism and all petrographic evidence has been erased by the last metamorphic event".

The full report by Simmons and Richter is attached herewith.

III. RESULTS OF INVESTIGATIONS ALONG THE INFERRED FAULT

None of the current investigations along the path of the inferred Portsmouth fault has detected or suggested the presence of a through-going fault structure along the zone of the Rye/Kittery contact between Portsmouth and Hampton. No exposure of Pleistocene deposits seen along this zone has shown internal structures suggestive of tectonic fault displacement.

A. Novotny's "Faulted" Outcrop Exposures

1. Route 1 By-pass, Portsmouth (Point "B" on Figures 1 and 2)

Novotny cites a road cut on the north side of the Route 1 By-pass in Portsmouth as suggesting the presence of the Portsmouth fault nearby, but not within, the road cut exposure. This exposure shows two steeply west-dipping zones of weathered and rusty rock material interlayered in gneiss and quartzite. In one of these weathered zones, an open drag fold was interpreted by Novotny to represent differential movement, down on the west. This folding could also represent simple folding of the beds, signifying an anticline to the west.

The rock materials within these two weathered zones are not slickensided or mineralized, and the rock adjacent to the weathered zones shows no hydrothermal alteration. Very similar open folding can be seen in an unweathered exposure of quartzitic rock near the Rye/Kittery contact, 3.54 miles S52W of this locality, on the west right-of-way of the New Hampshire Turnpike, where there is no evidence of fracturing. Fold structures of the type

seen at the Route 1 By-pass and on the New Hampshire Turnpike right-of-way are most logically explained as simple small-scale drag folding formed during the regional folding of the Rye anticline. The exposure on the Route 1 By-pass is suggestive of faulting only because it is weathered. Rye formation rocks occur on both sides of the weathered zone at the Route 1 exposure.

2. <u>Goat Island, New Castle</u> (Point "C" on Figures 1 and 2)

Bedrock structure on the southeast shore of Goat Island is a complex jumble of brecciated Rye formation metavolcanics and quartzite. The breccia is welded, and is intruded by diabase dikes. No "trend" of faulting is apparent at this locality to suggest a through-going fault plane which might connect this exposure with the exposure cited on the Route 1 By-pass, 2.1 miles to the southwest. The apparently random distribution of metavolcanics and quartzite breccia blocks suggests that fault structure in this area may represent explosion breccia, which Hussey (1962) has also found as discontinuous masses 3 miles to the east on Gerrish Island, Maine. Hussey suggests that the breccia at Gerrish Island may relate to volcanic activity associated with the Cape Neddick and Tatnic volcanic complexes, southwestern Maine.

3. <u>Brumley Hill, North Hampton</u> (Point "F" on Figure 1)

The brecciated quartzite cited by Novotny for the east end of Brumley Hill showed some healed fracturing and rusty staining in a dark, fine-grained quartzite. Billings (1956) interpreted this area to lie in a broad fold zone in the Rye formation. No through-going shears were apparent in the exposure to suggest the presence of faulting. The exposure no longer exists, having been removed during construction of a new north-bound lane of the New Hampshire Tunrpike.

B. <u>Granite in the Rye Formation</u>

Novotny states (1963; p. 147): "Although metamorphic zones are apparently not displaced because of the fault, the presence of concordant foliated and granulated Breakfast Hill granite only in the Rye formation and near the Kittery formation contact supports the hypothesis of a fault developed during the Acadian period of orogeny, along which deeply buried and intruded portions of the Rye formation were elevated". (Point "D" on Figures 1 and 2)

Foliated granite, seen in a number of places in the Rye formation, appears to be a primary metamorphic constituent of that formation, having formed by recrystallization ("granitization") of the inherently feldspathic Rye formation rocks. These granitic masses appear genetically related to a process of metamorphism within the Rye, rather than to plutonic intrusions from a separate deep-seated source. Because of the fundamental lack of feldspar in the Kittery formation, furthermore, no comparable granitization of the Kittery could have occurred at the time the Rye was being recrystallized and granitized.

Whereas the granites of the Rye formation to the east of the Rye/Kittery contact do not in themselves offer any proof that the Rye has been elevated relative to the Kittery, plutonic intrusives of the Exeter diorite are found in the Kittery formation to the west of the Rye/Kittery contact, tending to negate an hypothesis of fault displacement based on the presence or absence of igneous rocks in the metamorphic terrane. (Point "E" on Figures 1 and 2)

C. Unconformable Rye/Kittery Stratigraphy

Whereas Novotny interpreted an unconformable stratigraphic relationship between the Rye and Kittery formations in the area between Portsmouth and Hampton, outcrops of the two formations are widely scattered, and the contact between these formations is nowhere exposed along the 12½ mile path of the inferred Portsmouth fault. On Gerrish Island, Maine, about 5 miles east of Portsmouth, Hussey (1962) interprets the Rye/Kittery contact to be conformable, grading upward through progressively less feldspathic gneisses of the Rye formation into biotite quartzites typical of the Kittery.

Novotny, Hussey and Billings (1956) all define the Rye formation as metavolcanic and the Kittery as metasedimentary, predominantly quartzite. Novotny interprets the contact between these two formations to be defined by a major fault structure, while Hussey and Billings do not. Novotny, furthermore, defines the geographic location of the Rye/Kittery contact as much as three-quarters of a mile to the east of the contact trace defined by Hussey and Billings. Figure 1 shows by a dotted line the contact between the Rye metavolcanic member and the Kittery formation as defined by Billings to the southwest and by Hussey to the northeast.

Current investigations have indicated that Novotny's contact trace trends from Portsmouth to North Hampton through a terrane characterized only by bedrock exposures of the Rye formation metavolcanic member. Since the metavolcanic member of the Rye is made up of an original sequence of different types of volcanic rocks and interbedded sedimentary units, unconformable stratigraphic relationships might be expected in the zone where Novotny has defined the Rye/Kittery contact. Such relationships would not, however, signify the presence of a major fault zone. Furthermore, foliation structure symbols shown on Figure 1 (after Novotny and Hussey; and J. R. Rand reconnaissance) indicate a reasonable parallelism of bedrock structure along Novotny's inferred fault trace in this area, with no suggestion of the alledged formational unconformity.

D. Radiometric Age Dating

Four outcrop samples (PF-S1, -S2, -S3, -S4) were taken at intervals along the path of the inferred fault for radiometric age dating (K-Ar). The locations and K-Ar ages of these samples, along with three other samples taken from Borings B2, B4 and B9 at the site area in 1969, are defined on Figure 1. Age determinations were obtained by Geochron Laboratories, Division of Krueger Enterprises, Inc., Cambridge, Massachusetts.

Sample	Location	Rock Type	Material	K-Ar Age
PF-S1	Towle Road, Hampton	Quartzite	Biotite	268±10 M.Y.
PF-S2	Rte. 151, North Hampton	Quartzite	Amphibole	308±14 M.Y.
PF-S3	Rte. 1, Portsmouth	Gneiss	Muscovite	294±10 M.Y.
PF-S4	Rte. 1, Portsmouth	Quartzite	Mica-Quartz	262±11 M.Y.
B2	129.5' - Boring B2	Qtz. Diorite	Biotite	294± 9 M.Y.
B4	93.0' - Boring B4	Schist	Biotite	254± 9 M.Y.
B9	12.3' - Boring B9	Bio. Diorite	Biotite	284± 9 M.Y.

No anomalously young ages were found in this dating program. All ages found conform to previously reported regional data which indicates a Permian thermal event for the area (Zartman et al, 1970). The lower ages obtained in this investigation (PF-S1, PF-S4 and B4) are mineral dependent, with argon loss associated with the fine-grained materials analyzed.

IV. CONCLUSIONS

Field investigations have shown that

1. The graphic trace of the alleged Portsmouth fault bears no meaningful spatial relationship to the contact between the Rye and Kittery formations, along which the fault was postulated by Novotny to trend.

2. There is no evidence of the alleged unconformable relationship between the Rye and Kittery formations.

3. There is no evidence of anomalous magnetic intensities on the inferred fault trace in Greenland, New Hampshire.

4. Examination of drill cores in the area of the alleged fault trace in Greenland, complimented by petrographic studies of core samples, indicate no evidence of faulting in that area.

5. There is no evidence of a through-going fault structure associated with the specific bedrock exposures cited by Novotny as indicating the presence of the Portsmouth fault.

6. There is no justification for ascribing the presence of granitic rocks at ground surface in the Rye formation terrane to the differential uplift of these rocks along a nearby fault.

7. There are no meaningful variations in radiometric ages of rocks along the alleged fault trace.

8. Ground and aerial examinations have failed to detect any anomalous landforms or stream patterns along the trace of the alleged fault.

9. Pleistocene deposits exposed in road cuts and gravel pits along the alleged fault trace show no features which might imply tectonic faulting in the area.

The current investigations have concluded that the Portsmouth fault does not exist.

John R. Rand
Consulting Geologist

September 1974

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Hussey, A. J. II (1962) The Geology of Southern York County, Maine. Special Geologic Studies, No. 4, Maine Geological Survey; Augusta, Maine.

Novotny, R. F. (1963) Bedrock Geology of the Dover-Exeter-Portsmouth Region, New Hampshire. Doctral Thesis, Department of Geology, The Ohio State University; Columbus, Ohio.

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Zartman, R. E., P. M. Hurley, H. W. Krueger and B. J. Gilletti (1970) A Permian Disturbance of K-Ar Radiometric Ages in New England: Its Occurrence and Cause, Geological Society of America Bulletin, Vol. 81, 3359-3374.

ATTACHMENT NO. 1

GROUND MAGNETOMETER SURVEY

BREAKFAST HILL ROAD AREA

GREENLAND, NEW HAMPSHIRE

WESTON GEOPHYSICAL RESEARCH, INC.

WESTBORO, MASSACHUSETTS

GROUND MAGNETOMETER SURVEY

BREAKFAST HILL ROAD AREA

GREENLAND, NEW HAMPSHIRE

SUMMARY

This report details a ground magnetometer survey conducted by Weston Geophysical Research, Inc. in the vicinity of Breakfast Hill Road, Greenland, New Hampshire. This study was completed in conjunction with a general geologic investigation of the inferred Portsmouth fault, as proposed by Novotny (1963).

Five separate magnetic lines were run across the trace of the inferred fault. No magnetic evidence for faulting was found on any of the profiles.

INSTRUMENTATION

The survey was begun with a vertical field, torsion magnetometer (Askania, Model Gfz), which is tripod mounted and must be leveled prior to each reading. Because this procedure is difficult in soft or swampy ground, which is extensive in the investigation area, the vertical field magnetometer was replaced with a total field, proton precession magnetometer (Geometrics, Model G-816), which requires neither tripod nor leveling.

METHOD

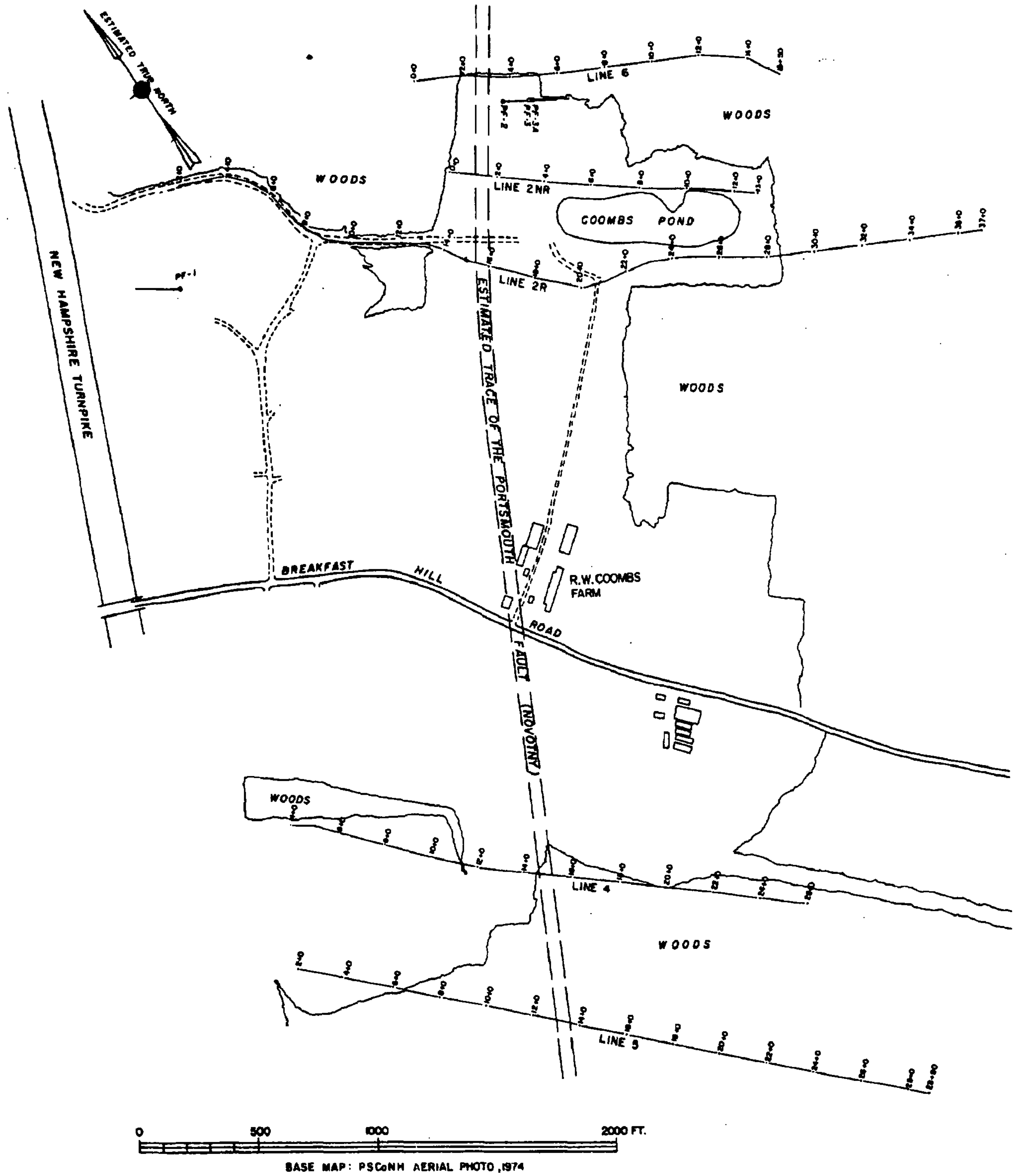
The survey method consisted of making total magnetic field intensity measurements at paced intervals along a predetermined line. The interval used varied from 50 to 100 feet. The magnetic sensor was oriented north (magnetic) for each reading, and readings were repeated to insure precision. A base station was established, and base station readings were taken regularly to determine the diurnal variation of the earth's magnetic field during a given portion of the survey. The diurnal variation has been removed from the final profiles. Careful notes were taken during the survey so that the presence of magnetic interference sources (i. e., power lines, buried metal, houses, parked vehicles, etc.) could be considered in the final analysis.

RESULTS

Total field intensity magnetic profiles were made from data for five traverses in the area of investigation. As shown in Figure A1a, Profiles 2R, 2NR and 6 are located at distances extending up to approximately 2,500 feet northeast of Breakfast Hill Road, near Coombs Pond. Profiles 4 and 5 are located at distances extending up to approximately 1,500 feet southwest of Breakfast Hill Road. All five magnetic profiles crossed Novotny's inferred fault trace at nearly perpendicular angles. Any magnetic expression of Novotny's inferred fault (within the Rye formation) should, therefore, have been readily apparent.

Figure A1a locates the inferred fault trace relative to magnetic profiles reported in Figure A1b at or near the following profile points: 3+0 on Line 6, 1+5 on Line 2NR, 16+0 on Line 2R, 15+0 on Line 4, and 13+0 on Line 5.

No evidence of the postulated fault was found. Further examination of the profiles indicates that localized anomalies, probably due to local variations in magnetic mineral concentrations known to be present in the Rye formation, appear on each of the traverses near Coombs Pond. Profiles 6, 2NR and 2R show such an anomalous condition, which appears to trend N10E in the vicinity of the three lines. It should be noted that this strike is parallel to the bedrock foliation of the area.



AREA LOCATION

FIGURE A1a

ATTACHMENT NO. 2

GEOLOGIC BORINGS LOGS

BORINGS PF-1, PF-2, PF-3, PF-3A

BORING LOCATION See Breakfast Hill Rd. site plan INCLINATION 48.5° BEARING N 50 W DATE START/FINISH Feb. 19, 1974 / March 21, 1974

CASING ID 3 in. CORE SIZE 2-1/8 to 1-7/8 in. TOTAL DEPTH 276.0 ft DRILLED BY American Drilling & Boring Co.; K. Allen

GROUND EL (MSL) 79.1 ft DEPTH TO WATER/DATE 13.7 ft / - LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft: 79.1 (top), +60, +40, +20, 0, -20

Depth ft: 0.5 (top of rock), 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140

Sample Type and No.	N or Rec.	Rate of Adv. min/ft	WATER CONTENT or RQD %
NX-1	100	4.0	0
NX-2	100	4.7	21
NX-3	100	6.4	25
NX-4	100	4.1	74
NX-5	100	6.8	60
NX-6	100	9.0	56
NX-7	100	5.0	89
NX-8	100	2.7	35
NX-9	100	5.1	62
NX-10	96	5.6	62
NX-11	100	5.5	12
NX-12	100	5.0	0
NX-13	100	4.0	43
NX-14	92	15.5	42
NX-15	96	13.1	22
NX-16	100	7.3	64
NX-17	94	6.8	70
NX-18	100	7.9	95
NX-19	100	10.0	100
NX-20	100	6.0	100
NX-21	100	11.2	92
NX-22	100	12.8	88
NX-23	97	18.4	73
NX-24	100	8.0	65
NX-25	100	6.6	83
NX-26	96	17.4	86
NX-27	100	7.2	73
NX-28	100	5.6	95
NX-29	100	7.4	93
NX-30	100	24.4	75
NX-31	99	5.6	92
NX-32	97	4.0	95
NX-33	100	6.2	90
NX-34	100	5.6	100
NX-35	100	12.8	58

PRESSURE TEST (gpm epsi; Computed k 10^{-4} cm/sec): TOP OF ROCK

STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside):

N37E, 74NW F
N60E, 32SE S
N45W, 42NE J
N33E, 28SE J
N50W, 4NE J
N75E, 8NW J
N33W, 18NE J
N52E, 78NW F
Horizontal S
N45E, 9SE J
N83E, 32SE J
N 6W, 10NE J
N43E, 62SE J
N40E, 67SE J
N15E, 73NW F
N20E, 62NW F
N10W, 77SW F
N41W, 66NE S
N66E, 83NW F
N66E, 74NW F
N33E, 69NW
N47E, 35SE J

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.)

Minor rusty
Slight wx on foliation and joints
Slight wx
D
Minor rust
Slight wx
Moderate wx
Moderate wx
D
D
Minor rusty
Slight wx
Minor rusty
Moderate wx
85° joint
Calcite coating
D
Moderate wx
Rusty stain
Vuggy
D
Minor chlorite
Pyrite coated
D
On foliation
Minor vuggy

Fresh and hard. Local minor rusty and surface wx effects on joints and some partings. Partings not slickensided.

Fresh and hard. Minor rusty, vuggy zones associated with joints and partings not slickensided.

Fresh and hard. Local zones of slight to moderate wx on joint surfaces. Not slickensided.

Fresh and hard. Joints and partings are clean, not slickensided. Hard, dense.

Fresh and hard. Joints and partings are clean except in narrow rusty-stained zone at 80.5-80.8'. Not slickensided.

Fresh and hard. Some thin calcite coatings on joints. Joints and partings not slickensided.

Fresh and hard throughout. Joints and partings are generally clean. Not wx. Surfaces are not slickensided.

Fresh and hard throughout. Joints and partings are clean. Not slickensided. Has only very minor tendency to part on foliation.

(Type, texture, mineralogy, color, hardness, etc.)

Drag folds - sense of movement west side up to the east - syncline to west

Welded breccia
Welded diabase

Rye formation. Fine to very fine-grained, medium dark gray. Thinly and evenly foliated, metavolcanic. Fine feldspathic quartzite. Brecciated fractures welded with calcite.

Gneiss
Gneiss
Gneiss
Gneiss
Gneiss

Fine-very fine feldspathic quartzite with interbeds of light gray feldspathic gneiss. Medium-grained

Gneiss

40.5' Broken contact-minor rusty

Diabase. Fine, dark gray.

43.7' Fused transitional contact

Sense of drag folds suggests syncline to west.

Quartzite
Quartzite
Quartzite
Quartzite
Medium grained

Rye metavolcanics. Fine, evenly laminated feldspathic quartzite. Discrete fairly pure quartzite beds.

Gneiss
Quartz-feldspar gneiss
Garnets (?)
Dark fine feldspathic hornfels

Rye formation. Predominantly fine-grained, dark gray hornfelsic schist. Very dense texture. Interlayered with zones of quartzose. Feldspathic gneiss, medium to coarse grained, light gray. All contacts are tight, fused. Somewhat transitional.

Quartzite
Gneiss

Interlayered fine-grained feldspathic gneiss. Light gray, and fine-grained, dark gray hornfelsic schist.

Welded micro-fault

Sense of some open drag folding suggests that syncline is to the west. Rock fabric offset locally by welded micro faults.

Fold sense Syncline to west

Micro fault-welded
Quartzite
Quartzite
Lime silicate
Quartzite

Rye formation. Predominantly fine-grained, dark gray (hornfelsic) feldspathic schist. Very hard. Almost massive texture. Interbedded locally as shown with fairly pure white quartzite beds.

Quartzite

Rye formation, as above. Fairly evenly, thinly laminated throughout, although laminae locally are wavy, some complex folding.

Welded breccia gneiss

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▼ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) No clays present; therefore no water contents were determined.

x - Oriented core

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
United Engineers

Date: May 14, 1974 Project 7286

PAGE 1 of 2 LOG OF BORING PF 1

GEOTECHNICAL ENGINEERS INC

BORING LOCATION See Breakfast Hill Rd. site plan INCLINATION 48.5° BEARING N 50 W DATE START/FINISH Feb. 19, 1974 / March 21, 1974

CASING ID 3 in. CORE SIZE 2-1/8 to 1-7/8 in. TOTAL DEPTH 276.0 ft DRILLED BY American Drilling & Boring Co.; K. Allen

GROUND EL (MSL) 79.1 ft DEPTH TO WATER/DATE 13.7 ft / - LOGGED BY Soil - K. Polk; Rock - J. R. Rand

CONTINUED FROM PREVIOUS PAGE

EL. MSL ft	Depth ft	Sample Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content or RQD %	Pressure Test gpm / psi	Computed k 10^{-} cm/sec	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	Core Breaks / Weathering, defects, etc.
	144.0								
-20		NQ-36	100	9.2	100				Mislatch
	150	NQ-37	100	4.8	89			N23E, 78NW F; N82W, 42SW J; N32W, 28NE J	D, D
		NQ-38	100	5.0	87			N32E, 62SE J; N18E, 60SE J	
	160	NQ-39	100	5.2	100			N45W, 10NE J	D, D
		NQ-40	96	5.4	96			N18W, 23NE J; N65W, 61SW J	
	170	NQ-41	98	6.6	71			N40E, 61SE J	Minor rusty
		NQ-42	100	5.6	95			N35E, 16SE J	
-40	180	NQ-43	100	4.0	50			N88E, 34SE J; N80E, 57SE J	D
		NQ-44	93	9.8	93				D
	190	NQ-45	100	6.0	58				
		NQ-46	92	7.8	0			N62E, 60NW J; N73W, 35SW J; N82W, 59SW J	
	200	NQ-47	100	18.0	52				Chips-slight wx effects
		NQ-48	100	6.6	100				
-60	210	NQ-49	100	3.6	100				
		NQ-50	100	4.2	100				Slight wx
	220	NQ-51	100	6.6	65				
		NQ-52	100	8.0	100				D
	230	NQ-53	100	14.6	100			N15E, 85SE F; N80E, 11SE S; N66W, 65SW J	D; Pyrite xtals
		NQ-54	100	5.0	40				Chips-fresh
-80	240	NQ-55	100	4.0	98			N 5E, 86SE F; N60E, 16SE S	Slight wx
		NQ-56	98	5.0	97			N15E, 87SE F; N31E, 70SE S; N30W, 15NE S	Pyrite; Slight wx
	250	NQ-57	100	7.0	45			N24E, 38SE S	Not wx
		NQ-58	100	8.0	33			N20E, 75SE J	Vuggy
	260	NQ-59	100	6.6	43			N13E, Horiz. F	
		NQ-60	100	6.0	33			N75W, 6NE J; N25E, Vert F	Chips-slight surface wx
-100	270	NQ-61	100	6.0	68			N10E, 75SE F; N42W, 50NE S	
		NQ-62	100	6.8	100				
	276					BOTTOM	OF BORING		

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.)	Log notes	(Type, texture, mineralogy, color, hardness, etc.)
Fresh and hard. Some minor powdery wx effects on some joints and partings. No polishing.	Gneiss; Gneiss	Predominantly quartzite. Very fine-grained, medium gray. Fairly massive. Local interbeds of feldspathic gneiss. Fused fault plane at 155.3'.
Fresh and hard. Joints and partings show only local minor wx effects. Partings are not polished.	Calcitic veining	Rye formation. Fine-grained dark gray feldspathic quartzite. Fairly evenly, but vaguely foliated.
Fresh and hard. Joints and partings show only local minor wx effects. Not slickensided or polished.	Quartzite; Gneiss; Medium coarse Diabase	Rye formation, as above with local zones of feldspathized quartzite and feldspathic gneiss.
	Welded breccia at contact; 199.8' Fused contact dips 60°	
Fresh and hard. Excellent drilling. Partings in diabase break across core. Not jointed. Not wx or slickensided.	Chill	Diabase. Medium-grained dark gray with white phenocryst spotting. Notably calcitic. Diabase, as above.
	218.7' Fused contact	
Fresh and hard. Only minor surface wx effects on joints and partings. Not slickensided.		Rye formation. Fine-grained, medium to dark gray. Feldspathic, evenly foliated throughout.
Fresh and hard. Only minor surface wx effects on joints and partings. Not slickensided.		Rye formation. Fine-grained, dark gray. Evenly foliated feldspathic quartzite. Quartzite. Fine, medium gray.
	249.5' Fused contact	Welded breccia. Quartzite fragments, angular with some veining. Annealed rock throughout.
Fresh and hard. Only minor surface wx effects.	257.0' Quartzite; Diabase; Diabase, Fused	Rye formation. Predominantly fine-grained, dark gray feldspathic quartzite.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample
- U - Undisturbed samples
  - S - Shelby tube
  - F - Fixed piston
  - O - Osterberg
  - N - Denison
  - P - Pitcher
  - G - GEI
- Groundwater
- D - Drilling break
- wx - Weathered, weathering
- k - Coefficient of permeability

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: May 14, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING PE 1

GEOTECHNICAL ENGINEERS INC

BORING LOCATION: Breakfast Hill Road, Greenland, New Hampshire | INCLINATION: 40° | BEARING: S50E | DATE START/FINISH: July 9, 1974 / July 24, 1974

CASING ID: 3 in. | CORE SIZE: 2-1/8 in. | TOTAL DEPTH: 271.0 ft | DRILLED BY: American Drilling & Boring Co.; K. Allen

GROUND EL (MSL): +62.0 ft | DEPTH TO WATER/DATE: -2.1 ft / July 19, 1974 | LOGGED BY: Soil - K. L. Polk; Rock - J. R. Rand

Strike, dip: F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside

EL. MSL (ft): +62.0, +50, +30, +10, 0, -20, -40, -60

Depth (ft): 10, 20, 30, 40, 50, 60, 65 – TOP OF ROCK

Sample Type and No.	N or Rec.	Rate of Adv. min/ft	RQD %
NX-1	30	2.7	10
NX-2	95	3.0	0
NX-3	98	3.0	0
NX-4	100	3.0	0
NX-5	100	3.7	8
NX-6	100	3.4	32
NX-7	98	4.0	31
NX-8	100	3.9	63
NX-9	100	4.4	52
NX-10	100	5.7	40
NX-11	98	5.3	9
NX-12	97	5.1	30

Strike, dip: 57°, 22°, 15°, 14°

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.)

Sand seam. Moderate wx. Slight to moderate wx throughout. Minor vuggs.

Subject to slight wx throughout and parts readily on foliation. Core characterized by disks 1/2" to 2" in length. Minor rusty staining on joints. Not slickensided or polished.

Slight wx. Vuggs. Moderate wx. Slight wx.

Small pervasive vugs throughout. Subject to slight wx throughout on foliation. Characterized by pervasive small vugs. Parts on foliation at 1/2" to 1" intervals.

Core contains numerous small vugs. Fresh pyrite xtals.

Fresh internally, but subject to vug development throughout. (May be wx calcite?) Joints and partings are not slickensided or polished.

Severe wx. Vuggs. Pyrite. Epidote. Minor vuggs. Epidote.

Fresh and hard. Only minor local solution effects. Closely jointed. Joints are not slickensided or polished.

Slight wx. Chlos

(Type, texture, mineralogy, color, hardness, etc.)

Diabase and gneiss boulders (?)

70' Top of rock (?)

Drag folding. Gneiss. Banded light and medium gray. Fine-grained, thinly laminated. Fused diabase inclusion at 79'.

80.3' Contact broken. Not slickensided.

Diabase. Fine, dark.

81.5' Contact broken. Not slickensided.

Quartz. Quartz.

Gneiss. Banded to thinly laminated light and medium gray. Fine to very fine grained, feldspathic with local quartzitic or cherty banding. Definitely not Kittery Quartzite. Probably metamorphosed acid volcanics.

PF-2A

Becomes more feldspathic at 110.5'.

119.7' Broken contact. Not slickensided.

Diabase. Fine-medium grained, dark gray. Diabase. Medium-grained, dark gray. Massive. Some local porphyritic texture, small phenocrysts.

PF-2B Becomes finer-grained. Chill zone

135

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample; Groundwater
U - Undisturbed samples
S - Shelby tube; N - Denison
F - Fixed piston; P - Pitcher
O - Osterberg; G - GEI
D - Drilling break; k - Coefficient of permeability
wx - Weathered, weathering

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

United Engineers

Date: August 15, 1974 | Project 7286

PAGE 1 of 2 | LOG OF BORING PF-2

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION Breakfast Hill Road, Greenland, New Hampshire INCLINATION 40° BEARING S50E DATE START/FINISH July 8, 1974 / July 24, 1974

CASING ID 3 in. CORE SIZE 2-1/8 in. TOTAL DEPTH 271.0 ft DRILLED BY American Drilling & Boring Co.; K. Allen

GROUND EL (MSL) 162.0 ft DEPTH TO WATER/DATE -2.1 ft / July 10, 1974 LOGGED BY Soil - K. L. Polk; Rock - J. R. Rand

EL MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0–100%)	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	CORE BREAKS
	139.5	NX-13	90	4.8	0					
	140	NX-14	93	4.4	0					
		NX-15	100	5.0	31					
	150	NX-16	100	6.4	41					
	160	NX-17	62	7.5	28					
	170	NX-18	96	7.5	51				20°	
		NX-19	34	6.0	12					
	180	NX-20	100	3.6	24					
		NX-21	99	2.6	13				20°	
	190	NX-22	100	9.0	0				10°	
	200	NX-23	100	9.5	0					
		NX-24	100	5.0	32				30°	
	210	NX-25	100	2.0	46				20°	
		NX-26	100	2.6	32				15°	
	220	NX-27	95	2.1	65					
	230	NX-28	100	2.0	77					
	240	NX-29		2.5						
		NX-30	100	4.9	91					
	250	NX-31	98	6.9	90					
	260	NX-32	100	4.7	93				15°	
	270 / 271.0						BOTTOM OF BORING		60°	

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.) / (Type, texture, mineralogy, color, hardness, etc.)

CONTINUED FROM PREVIOUS PAGE

Chips. Slightly wx throughout. Not slickensided. — About 139.5' contact broken

Chips. Vuggy. Generally fresh internally. — Quartzitic. Gneiss, feldspathic, locally quartzitic. Light to medium gray, irregular gneissosile. Locally schistose.

Drilling better. Less wx. Some local minor vug development. Joints and partings are not slickensided. — Quartzitic. Medium grained.

Chips. Fairly fresh internally. Some minor local vug development. Not slickensided. — Quartzose. Becomes darker gray, finer grained irregularly. Foliated schist, feldspathic.

Chips. Vuggy. Striated joint. Not polished. Rods dropped. Wx zone 1'. Pyrite. Slight wx. Slight wx. Slight wx. Chlorite. Steep joint. Rough surface. Vuggy. Fairly fresh internally. Some minor vuggy textures, and powdery wx effects on joints and partings. Joints are not polished. — Drag Folds. Schist, gneissic-feldspathic as above.

Approximately 177.5' presume wx contact. Not slickensided.

Diabase. Dark gray, medium grained, gravelly to fine grained. (Chill) at top and bottom. Not calcitic.

190.1' Fused contact. Dips parallel to foliation.

Chips. Minor vuggy. Quite fresh internally. Some minor local vug textures. Minor surface wx on joints. Joints not polished or slickensided. Minor vuggy. — Drag Folds. Metaquartzite to meta-silt, feldspathic, fine-grained, cherty, medium gray. Locally gneissic. Banded texture of fine-medium light gray feldspathic quartzite with dark gray, very fine grained cherty rock. Banding is commonly even to slightly wavy.

Chips. Vuggy. Chlorite. Fresh and hard. Some minor local vug development. Minor surface wx effects on joints. No polishing or slickensides on joints. — Drag Folds. Becomes somewhat schistose, greenish tinge (lime silicates?)

Slight wx. — 221.9 Contact broken. Not slickensided.

Chill. Diabase, calcitic, medium grained, dark gray, scattered phenocrysts.

Fresh and hard; drills very well. Only minor powdery wx effects on joints. No evidence of movement. — Diabase, calcitic, medium grained, dark gray, massive with occasional carbonate veinlets. Chill.

239.9 Fused contact. Dips ± 58°

Fresh and hard; drills well. Only very minor powdery surface wx effects on some joints and partings. Not slickensided. — Feldspathic. Quartzite, fine, medium gray, somewhat feldspathic.

245.5 Gradational fused contact amphibolite(?), fine grained, dark green color. Light green hairline laminate are very irregular in texture. Some calcite veining. Hard rock. — Feldspathic.

Fresh and hard; drills well. Not slickensided on joints. — PF-2C Quartzite. Breaks across grain. Local zones of fine grained, medium dark gray quartzite.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
Groundwater

S - Shelby tube, N - Denison
F - Fixed piston, P - Pitcher
O - Osterberg, G - GEI

D - Drilling break
wx - Weathered, weathering
k - Coefficient of permeability

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers & constructors inc

Date: August 15, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING PF-2

GEOTECHNICAL ENGINEERS INC

BORING LOCATION: Breakfast Hill Road, Greenland, New Hampshire | INCLINATION: Vertical | BEARING: | DATE START/FINISH: July 29, 1974 / July 30, 1974

CASING ID: 3 in. | CORE SIZE: 2-1/8 in. | TOTAL DEPTH: 50.0 ft | DRILLED BY: American Drilling & Boring Co.; K. Allen

GROUND EL (MSL): +61.8 ft | DEPTH TO WATER/DATE: -2.4 ft - July 29, 1974 | LOGGED BY: Soil - K. L. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	SAMPLE Type and No.	SAMPLE N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic (0–100)	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
+61.8		1)										
	10											
+40	20											
	30											
+20	40						TOP	OF ROCK				
		NX-1	93	1.0	30				67°		Rusty. Slight wx. Minor rust. Slight wx. — Fairly fresh internally. Joints and partings have minor rust and powder wx effects.	Contact: Gneiss, medium light gray, medium coarse grained. Broken: Gneiss or quartzite, medium dark green, fine-grained.
		NX-2	100	1.1	0				70°			
	50						BOTTOM	OF BORING			Note: Joints and partings not slickensided or polished.	Not magnetic.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample
- U - Undisturbed samples
  - S - Shelby tube
  - F - Fixed piston
  - O - Osterberg
  - N - Denison
  - P - Pitcher
  - G - GEI
- Groundwater (symbol)
- D - Drilling break
- wx - Weathered, weathering
- k - Coefficient of permeability

NOTES

1) Washed through soil 0-40 ft. No samples taken.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

United Engineers

Date: August 11, 1974 | Project 7286

PAGE 1 of 1 | LOG OF BORING [illegible]

Geotechnical Engineers Inc.

BORING LOCATION: Breakfast Hill Road, Greenland, New Hampshire — INCLINATION: 41° — BEARING: S50E — DATE START/FINISH: July 30, 1974 / August 8, 1974

CASING ID: 3 in. — CORE SIZE: 2-1/8 in. — TOTAL DEPTH: 204.3 ft — DRILLED BY: American Drilling and Boring Co.; K. Allen

GROUND EL (MSL): +61.8 ft — DEPTH TO WATER/DATE: -2.5 ft / July 30, 1974 — LOGGED BY: Soil - K. L. Polk; Rock - J. R. Rand

EL. MSL ft	Sample Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	Water content % or RQD	Pressure test	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)
+61.8	0	1)					
-20	80	NX-1	99	2)	11	TOP	OF ROCK
		NX-2	80		10		
		NX-3	69		0		
		NX-4	100		0		
		NX-5	100		0		
	90	NX-6	100		0		
		NX-7	100		26		
-40	100	NX-8	48		31		
		NX-9	100		0		
		NX-10	97		0		
	110	NX-11	100	5.6	26		
		NX-12	100	4.3	16		
-60	120	NX-13	100	3.2	63		
		NX-14	100	3.0	20		
	130	NX-15	100	7.0	0		
		NX-16	100	5.5	0		
		NX-17	100	9.0	0		
-79.8	140	NX-18	100	9.0	0		

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

Weathering	Defects	Type	Description
Slight wx; Chips; Moderate wx; Minor vuggy; Chips; Slightly vuggy	Generally fresh internally, subject to slight wx on closely-spaced joints. Joints and partings are not slickensided or polished. Core breaks at close intervals.	Diabase; Pegmatite; Diabase; Dark gray quartzite	Gneiss, quartzite. Somewhat mottled light to medium gray, fine-grained rock. Locally greenish tinge (lime silicates).
Slight wx; Slight wx	Generally fresh. Slight powdery wx effects on joints and partings. No slickensides or polished joints.		Gneiss, [illegible], locally banded. Becomes somewhat schistose at base.
		106' Fused contact. Chill zone	Diabase, dark gray, fine to medium grained. Phenocrysts wx, vuggy, rock is not calcitic. Rock is magnetic.
Slight wx; Chlorite; Slight wx; Slight wx	Fresh, with slight wx effects locally on joints. Some small vugs in diabase where phenocrysts dissolved. Not slickensided or polished.	116.3' Fused contact. Chill zone.	Diabase (Gabbro?). Dark gray, medium-coarse grained, mottled texture. Magnetic, non-calcitic.
Vuggy; Chips; Vuggy; Chips to 135'; Slight wx; Vuggy	Fresh and hard internally. Parts easily on foliation, making for "0" RQD. Partings and joints are not slickensided or polished.	128.7' Fused contact. Chill zone. Thin quartz banding	Quartzite gneiss, thinly banded, greenish tinge (calc-silicate rock). Fine-grained. Banding normal to hole - 50° dip to N57W. Locally somewhat vuggy.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
(water level symbol) Groundwater
S - Shelby tube; N - Denison
F - Fixed piston; P - Pitcher
O - Osterberg; G - GEI
D - Drilling break
k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) Washed through soil 0-80 ft, no samples taken.
2) No drill times available.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: August 15, 1974 — Project 7286

PAGE 1 of 2 — LOG OF BORING PL-3A

GEOTECHNICAL ENGINEERS INC

BORING LOCATION Breakfast Hill Road, Greenland, New Hampshire INCLINATION 11° BEARING S50E DATE START/FINISH July 30, 1974 / August 8, 1974

CASING ID 3 in. CORE SIZE 2-1/8 in. TOTAL DEPTH 201.3 ft DRILLED BY American Drilling and Boring Co.; K. Allen

GROUND EL (MSL) 161.8 ft DEPTH TO WATER/DATE -2.5 ft / July 30, 1974 LOGGED BY Soil - K. L. Polk; Rock - J. R. Rand

CONTINUED FROM PREVIOUS PAGE

EL. MSL ft	Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	RQD %
80		NX-19	100	8.4	0
		NX-20	100	5.8	20
	150	NX-21	100	16.0	0
		NX-22	100	3.0	0
		NX-23	100	13.0	0
100	160				
		NX-24	100	4.8	29
		NX-25	97	7.8	43
	170	NX-26	100	5.4	22
		NX-27	97	6.2	36
120	180	NX-28	100	3.9	32
		NX-29	100	6.0	0
	190	NX-30	100	4.9	49
140	200	NX-31	100	10.9	62
	201.3				

RQD Graphic: 0 – 100

STRIKE, DIP: F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside

PRESSURE TEST: gpm / psi; Computed k 10^{-4} cm/sec

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

Contact broken

Slight wx effects

Moderate wx

Moderate wx. Pyrite crystals

Fairly fresh internally but subject locally to slight to moderate wx, vug development. Joints and partings not slickensided.

Feldspathic / Feldspathic / Feldspathic / Feldspathic

Amphibolite (?). Dark green, similar to 245.5' in PF-2. Fine-grained, locally foliated or sanded rock. Local feldspathic gneiss. Bands are transitional with amphibolite. Rock is not magnetic.

Slight wx effects

Fairly fresh, subject to slight wx effects. Joints and partings are not slickensided or polished.

Quartzitic

Amphibolite, dark green, fine-grained. Locally fine light green veinlets or seams. Local zones of gray feldspathic or quartzitic gneiss.

Chips. Vuggy. Crystal growths

Fresh and hard. Local minor wx effects. Joints are planar and are not slickensided or polished.

Dark green quartzitic / Dark green

Gneiss, alternating layers of greenish quartzitic gneiss and gray evenly layered quartzitic gneiss. Gradational contacts. Dark green rock, looks like amphibolite. Not magnetic.

Minor vuggy

Shows some internal folding.

Dark green. Evenly foliated gneiss / Amphibolite / quartzite

Feldspathic gneiss, pink feldspars. Strongly magnetic.

Minor vuggy

Fresh. Joints and partings are not slickensided or polished.

0.1' welded breccia

BOTTOM OF BORING

Note: Contains magnetite concentrations 200.0' to 201.3'. Strongly magnetic, coarse feldspathic gneiss.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
Groundwater
D - Drilling break
wx - Weathered, weathering
k - Coefficient of permeability

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date August 15, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING PF-3A

GEOTECHNICAL ENGINEERS INC

ATTACHMENT NO. 3

PETROGRAPHY AND PRELIMINARY INTERPRETATION OF THREE SAMPLES OF DRILL CORE FROM THE PORTSMOUTH FAULT GREENLAND, NEW HAMPSHIRE

Gene Simmons
Dorothy A. Richter

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CAMBRIDGE, MASSACHUSETTS

for

WESTON GEOPHYSICAL RESEARCH, INC.

WESTBORO, MASSACHUSETTS

PETROGRAPHY AND PRELIMINARY INTERPRETATION OF THREE SAMPLES OF DRILL CORE FROM THE PORTSMOUTH FAULT, GREENLAND, NEW HAMPSHIRE

Weston Geophysical Research, Inc.
Post Office Box 306
Weston, Massachusetts 02193

Gene Simmons
Dorothy Richter
26 August 1974

SUMMARY

In this report we describe three samples of drill core from the vicinity of the alleged Portsmouth fault near Greenland, New Hampshire. The three samples are metamorphic rocks. The pronounced laminations in sample PF-2A appear to be of primary depositional origin rather than of tectonic origin. The peculiar arcuate structures common to both samples PF-2A and PF-2C are reminiscent of glass shards, which suggests that the rocks are totally recrystallized meta-tuffs or reworked volcanic detritus of different compositions. Sample PF-2B is a partially recrystallized basalt which is probably younger than the other two samples. All three samples lack substantial preferred orientation of their minerals. Evidence for dynamic structural deformation, either recent or ancient, is entirely absent. In summary, we find no petrographic evidence that these three samples are associated with a fault. If a fault does exist in the region from which these samples were obtained, then either its deformation was not so pervasive as to affect these three samples, or else the deformation occurred before metamorphism and all petrographic evidence has been erased by the last metamorphic event.

PETROGRAPHY OF SAMPLE PF-2A 99.5-99.9'

Name: Felsic metatuff

Macroscopic Description

This sample is a finely laminated schist. It is light grey in color and fine grained. Layers of alternating light and dark colors are probably due to segregation of mineral phases. Euhedral crystals of pyrite (~ 1/2 mm) are abundant. The texture is punctuated by light colored augen and irregular 0.5 mm pores. This 5 inch core shows no veins, folds, and only a few large cracks.

Microscopic Description

Texture

The average grain size is less than 0.05 mm. Laminations are the product of the effect of variations in grain size, in the proportions of quartz to mica, and the abundance of opaques. Micas tend to show a preferred orientation of flakes at an angle of about 60° to the laminae. Most of the veinlet-like seams of quartz follow the foliation; although a few seams crosscut the foliation they are not common and their margins have recrystallized to blend with the rest of the rock. The augen are pods of fine grained quartz. Some of the pores have minor amounts of weathering products around the rims.

A few large microcracks that are now completely healed were observed in the thin section. They are marked by

chlorite, quartz, and trains of discrete grains of opaques (probably pyrite). However, there is no other textural evidence of penetrative deformation. The thin laminations and indications of flow structures imply that this sample is a recrystallized silicious tuff or reworked volcanic detritus.

Mineralogy

Quartz is the most abundant mineral in the thin section. It occurs in very fine (0.01-0.1 mm) anhedral aggregates. The individual crystals appear strained and have sutured grain boundaries. Coarser grained quartz occurs in thin seams and pods which are generally parallel to the layering.

Muscovite occurs as small flakes between quartz grains. It commonly shows a preferred orientation at about 60° to the layering. Muscovite rarely occurs in multigranular aggregates.

Chlorite occurs scattered through the matrix, in minor amounts in thin seams both with and without quartz, and in a few of the darker laminae in the sample. It is pale green, fibrous, and exhibits blue and brown interference colors.

Opaque grains occur in thin, discontinuous layers in the sample. Some seem to be dendrites parallel to the layers, and others are small nodules. Many crystals can be seen in hand specimens to occur as well formed

cubes.

Calcite and sphene occur in accessory amounts in some of the layers.

Estimated Modal Composition

quartz	60%
muscovite	15%
chlorite	15%
others	10%
	100%

PETROGRAPHY OF SAMPLE PF-2B 136-136.5'

Name: Metabasalt

Macroscopic Description

This massive dark grey sample has a fine grained, uniform, phaneritic texture. Felty plagioclase crystals (1-2 mm size) set in a dark groundmass are easily recognized with a hand lens. The plagioclase (Hardness 6) is evidently quite altered since it is readily pulverized by probing with a knife point (Hardness 5.5). In the black groundmass biotite flakes are large enough to be seen. Pyrite is present as widely dispersed anhedral grains. There are no veins or major cracks visible in the core. A few open pores are present.

Microscopic Description

Texture

The thin section displays a primary intersertal texture which is partially masked by secondary minerals. Plagioclase laths (0.5 mm) form a mat with ferromagnesian and secondary minerals filling the interstices. Cleavage cracks are not abundant. There is no evidence of healed cracks, no veinlets, and no other signs of structural disruption. Even the larger feldspar crystals are remarkably free of all types of microcracks.

The absence of deformation structures in this rock indicates that no significant non-hydrostatic stress has

existed after the last metamorphic event. Hence, if a fault is present in the vicinity of this rock, stresses, if any, have been small since the time of last metamorphism of the rock.

Mineralogy

Plagioclase originally composed about 40% of the rock. It is now very highly altered to sericitic products. Most of the lath-like crystals have a turbid appearance, and are uniform 0.5 mm. There are a very few larger crystals which are now sericitized.

Clinopyroxene (probably augite) occurs as abundant roundish grains 0.1 - 0.3 mm in diameter. The crystals have poor cleavage and weak zonation. The clinopyroxene is interpreted to be relict in this biotite grade metamorphic assemblage.

Opaque grains are relatively abundant in thin section. They commonly have square outlines, and occur in clumps with pyroxene and biotite.

Biotite occurs as subhedral crystals in the matrix. Basal sections are reddish brown while other orientations are pleochroic from yellowish brown to dark brown. The biotite is probably metamorphic in origin.

Chlorite is a common mineral in the matrix of this rock. It is pale green and fibrous. There are a few ovoid mats of chlorite about 1 mm in diameter which may represent replaced olivine crystals.

Apatite is an accessory mineral in this sample. Euhedral crystals are minute but common.

Actinolite needles are dispersed through the section. Incipient blue green actinolite also seems to be present in some chlorite mats.

Minor amounts of sphene and hematite are also present in the rock.

Estimated Modal Composition

plagioclase (plagioclase + sericite)	40%
clinopyroxene	15%
opaque	10%
biotite	15%
chlorite	15%
apatite and accessories	5%
	100%

PETROGRAPHY OF SAMPLE PF-2C 262.0-262.4'

Name: Fine Grained Amphibolite

Macroscopic Description

This specimen is a very fine grained dark green rock. The individual minerals are too small to identify with a hand lens. The rock is massive and non-foliated. It is cut by a weblike network of calcite and quartz veinlets. Small clots of pyrite are visible.

Microscopic Description

Texture

The sample displays a complex texture in thin section. The average grain size is about 50 microns. There is no preferred orientation or systematic foliation although the constituent minerals are metamorphic. There is a vague layering to the rock marked by arcuate clumps and thin layers of epidote and calcite. Calcite-quartz veins which randomly crosscut the rock are partially recrystallized.

Mineralogy

Amphibole (probably hornblende) and chlorite, in about equal proportions, are in the sample. The amphibole occurs as brownish green stubby, poorly formed crystals finely mixed with chlorite. The crystals are pleochroic from pale green to brownish green. There is no apparent preferred orientation of the grains.

Chlorite is also a major phase in the rock. It is generally

pale bluish green and forms both platy mats and stringy aggregates.

Epidote occurs as minute granular crystals clustered in veins, in arcuate clumps, and scattered through the matrix.

Quartz forms spongy crystals in the matrix barely resolvable at high magnification, and clear 0.1 mm crystals in veins.

Sphene is widely distributed as nodular aggregates and a few 0.1 mm subhedral crystals.

Apatite is present as accessory crystals.

Calcite is common in fine grained veins and in lesser amounts in the matrix.

Opaque grains are usually associated with veins and are not common in the matrix.

Estimated Modal Composition

amphibole	25%
chlorite	25%
epidote	20%
quartz	20%
calcite	5%
opaque, sphene & apatite	5%
	100%

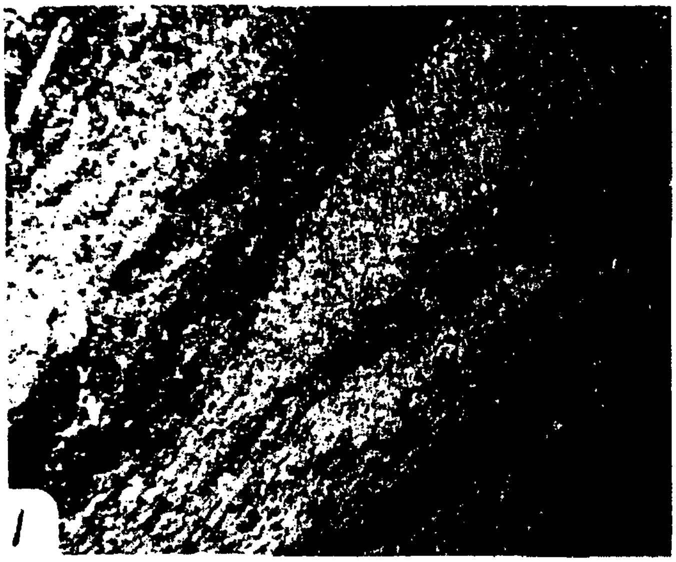


Photo 1. Sample PF-2A 99.5-99.9'. Felsic metatuff. Plane polarized light. Width of field 1.5 mm. The photomicrograph shows the fine grained nature of the sample. Roundish white spots are quartz which are obscured by muscovite and chlorite. The thin discontinuous laminae are composed of sphene, calcite, iron oxides, and chlorite. (The black circles are bubbles in the epoxy.)

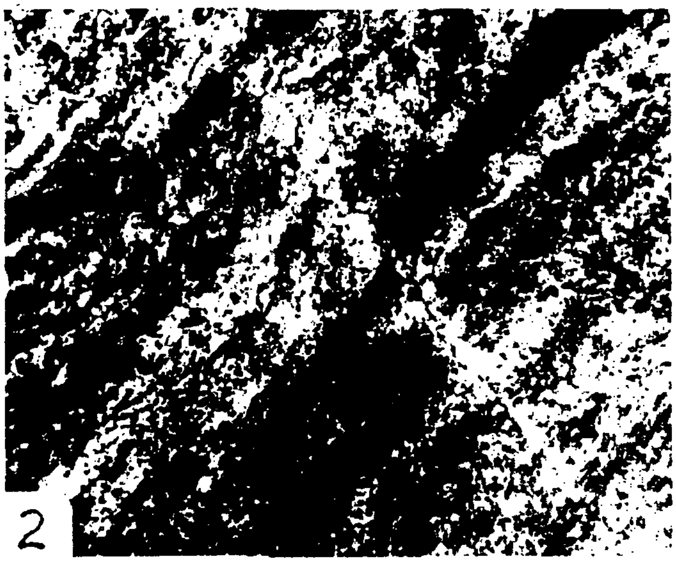


Photo 2. Sample PF-2A 99.5-99.9'. Felsic metatuff. Plane polarized light. Width of field 0.5 mm. This photomicrograph is an enlarged view of the matrix and shows one of the few quartz veinlets which crosscuts the laminae. The thin, discontinuous laminae are composed of sphene, calcite, iron oxides, and chlorite. In this view, the dark laminae are almost opaque because the individual grains are only about 1-2μ.

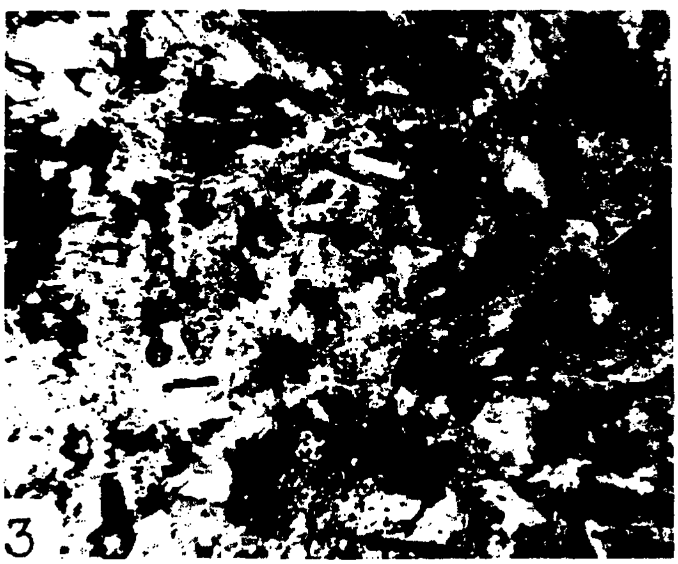


Photo 3. Sample PF-2B 136-136.5'. Metabasalt. Plane polarized light. Width of field 1.5 mm. This photomicrograph shows the typical textures observed in this sample. The light grey dusty looking background is altered plagioclase. Ovoid darker grains are relict clinopyroxene. Note the abundance of black grains; they are both opaque minerals and iron-rich biotite. See photo 4 for the details of the fabric.

Photo 4. Sample PF-2B 136-136.5'. Metabasalt. Plane polarized light. Width of field 0.5 mm. This photomicrograph shows the typical details of the fabric. Note how pervasively altered the plagioclase is. Note also the hexagonal biotite plates; the euhedral form implies that the biotite is metamorphic.

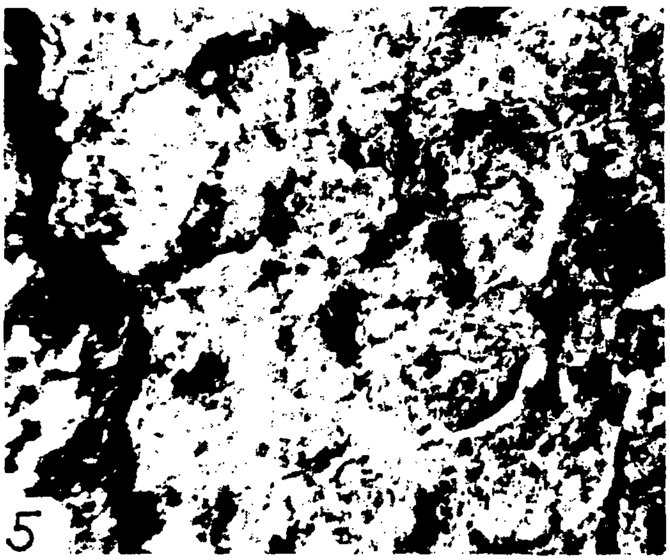


Photo 5. Sample PF-2C 262-262.4'. Fine grained amphibolite. Plane polarized light. Width of field 1.5 mm. This photomicrograph shows a typical view of this sample. The fine light and medium grey crystals are intergrown amphibole and chlorite; the white grains are quartz; and the darkest aggregates are clusters of epidote-calcite-sphene. Note the abundant arcuate quartz and epidote shapes; these are all polygranular.

Photo 6. Sample PF-2C 262-262.4'. Fine grained amphibolite. Plane polarized light. Width of field 0.5 mm. This photomicrograph shows the intimate amphibole-chlorite intergrowths, and a granular epidote-sphene seam which arches across the field of view.

ATTACHMENT NO. 4

K-Ar AGE DETERMINATIONS OF SEVEN SAMPLES RELATED TO THE INFERRED PORTSMOUTH FAULT

GEOCHRON LABORATORIES DIVISION

KRUEGER ENTERPRISES, INC.

CAMBRIDGE, MASSACHUSETTS

for

WESTON GEOPHYSICAL RESEARCH, INC.

WESTBORO, MASSACHUSETTS

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE, MASSACHUSETTS 02139 • (617) 876-3691

20 August 1974

Richard J. Holt
Weston Geophysical Res. Inc.
P.O. Box 550
Westboro, MA 01581

Dear Mr. Holt:

Enclosed are the analytical reports Mr. Rand requested. They are B-1236, B-1237 and B-1238 which were submitted for analyses on 20 January 1969.

Please forward these reports to Mr. Rand and if we can be of any further assistance, please do not hesitate to contact us.

Sincerely,

Derreth McStowe
Office Manager

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
24 BLACKSTONE STREET • CAMBRIDGE MA 02139 • (617) 876-3691

POTASSIUM-ARGON AGE DETERMINATION — **REPORT OF ANALYTICAL WORK**

Our Sample No. B-1236

Your Reference: B2 129.5

Date Received: 20 January 1969

Date Reported: 31 January 1969

Submitted by:
Ed Levine
Weston Geophysical Research Inc.
P.O. Box 364
Weston, MA

Sample Description & Locality:

Newburyport quartz diorite, biotite-bearing phase, drill core B2, Seabrook, N.H.

Material Analyzed:
Biotite concentrate, -20/+100 mesh

Ar^{40*}/K^{40} = 0.0186

AGE = 294 ($\pm$ 9) x 10^6 yrs.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
0.1431	0.950	0.1432
0.1432	0.953	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
6.295	6.306	7.693
6.316		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_\beta + \lambda_e} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

Geochron Laboratories, Inc.

24 Blackstone Street, Cambridge, Mass. 02139
Telephone TRowbridge 6-8691

REPORT OF ANALYTICAL WORK

POTASSIUM-ARGON AGE DETERMINATION

Our Sample No. B-1237

Date Received: 28 January 1969

Your Reference: NH #4 93'

Date Reported: 31 January 1969

Submitted by:

Mr. M. Levine
Weston Geophysical Research, Inc.
P. O. Box 364
Weston, Mass.

Sample Description & Locality:

Biotite-rich metasediment of the Merrimack Group,
Drill Core NH #4, 93', Seabrook, N. H.

Material Analyzed:

Biotite concentrate, -60/+200 mesh. The biotite was too fine grained to be completely free grains, therefore, a concentrate of the most biotite-rich grains was used. Estimated 70-80% biotite.

Ar^{40*}/K^{40} = 0.0159

AGE = 254 (±9) x 10^6 years.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
0.0483	0.892	0.0483
0.0483	0.897	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
2.430	2.486	3.033
2.542		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}

Geochron Laboratories, Inc.

24 Blackstone Street, Cambridge, Mass. 02139
Telephone TRowbridge 6-3691

REPORT OF ANALYTICAL WORK

POTASSIUM-ARGON AGE DETERMINATION

Our Sample No. B-1238

Your Reference: B9 12.3'

Submitted by:
Mr. M. Levine
Weston Geophysical Res., Lab.
P. O. Box [illegible]
Weston, Mass.

Date Received: 20 January 1969

Date Reported: 31 January 1969

Sample Description & Locality: Biotite phase of Newburyport Quartz diorite, Drill core B9, Seabrook, N.H. Coarse-grained diorite in igneous contact with dark, fine-grained rock.

Material Analyzed: Biotite concentrate. -40/+100 mesh, from coarse igneous phase. Fresh biotite, 75%, Chlorite, 15%; Amphibole, 10%.

Ar^{40*}/K^{40} = 0.0179

AGE = 284 (±9) x 10^6 years.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
0.0854	0.935	
0.0904*	0.917	0.0857
0.0860		

(*Poor gas sample - not used in age calculation).

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
3.998		
	3.933	4.798
3.868		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln \left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1 \right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION

24 BLACKSTONE STREET • CAMBRIDGE, MASSACHUSETTS 02139 • (617) 876-3691

19 August 1974

Richard J. Holt
Weston Geophysical Res. Inc.
P.O. Box 550
Westboro, MA 01581

Dear Mr. Holt:

Enclosed are the analytical reports of the K-Ar age determinations on the seven (7) rock samples described in John Rand's letter of 18 July 1974.

These samples were a little difficult to work with because of the type of materials, however we did the best we could with them. The measured K-Ar ages are about what I would expect for these rocks.

I will be away for a few days, but Hal Krueger will be here. I have discussed these results with him, and he is quite familiar with the geology of the area in question and with the work we did for you in this area several years ago. He will be happy to discuss these results with you in greater detail if you care to give him a call.

In the meantime, I am enclosing our invoice for this work. We look forward to serving you again in the near future.

Sincerely,

Richard H. Reesman

Richard H. Reesman
General Manager D.M.

RHR/dm
nelc: 7 reports & invoice #4473
cc: J.R. Rand (letter)

KRUEGER ENTERPRISES, INC.
GEOCHRON LABORATORIES DIVISION
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POTASSIUM-ARGON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. B-2882 — Date Received: 22 July 1974

Your Reference: PF - S1 — Date Reported: 16 August 1974

Submitted by: Richard J. Holt
Weston Geophysical Res., Inc.
P.O. Box 550
Westboro, MA 01581

Sample Description & Locality: Kittery quartzite
Towle Road, Hampton-Exeter Expressway
Hampton, New Hampshire

Material Analyzed: Chloritized biotite concentrate, -80/+200 mesh.

Ar^{40*}/K^{40} = .01687 — AGE = 268 ± 10 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.06717	.834	.06653
.06588	.862	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
3.224	3.233	3.944
3.242		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION — **REPORT OF ANALYTICAL WORK**

Our Sample No. A-2883

Date Received: 22 July 1974

Your Reference: PF - S2

Date Reported: 16 August 1974

Submitted by: Richard J. Holt
Weston Geophysical Res., Inc.
P.O. Box 550
Westboro, MA 01581

Sample Description & Locality: Rye fm. feldspathic quartzite
Winnicut Road, Route 151
North Hampton, New Hampshire

Material Analyzed: Amphibole concentrate, -80/+200 mesh. Estimated composition: 95% gray-black amphibole, 5% adhering groundmass.

Ar^{40*}/K^{40} = .01960

AGE = 308 ± 14 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.01794	.674	.01773
.01752	.668	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.752	.741	.904
.731		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln \left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1 \right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION | **REPORT OF ANALYTICAL WORK**

Our Sample No. M-2884

Date Received: 22 July 1974

Your Reference: PF - S3

Date Reported: 16 August 1974

Submitted by: Richard J. Holt
Weston Geophysical Research Inc.
P.O. Box 550
Westboro, MA 01581

Sample Description & Locality: Rye fm. feldspathic gneiss
Route 1 Bypass, Lafayette Road
Portsmouth, New Hampshire

Material Analyzed: Muscovite concentrate, -80/+200 mesh. Estimated composition: 90% msucovite, 5% biotite, 5% quartz and feldspar.

Ar^{40*}/K^{40} = .01864 AGE = 294 ± 10 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.1522	.852	.1500
.1478	.782	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
6.563	6.597	8.048
6.631		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION **REPORT OF ANALYTICAL WORK**

Our Sample No. M-2885

Date Received: 22 July 1974

Your Reference: PF - S4

Date Reported: 16 August 1974

Submitted by: Richard J. Holt
Weston Geophysical Res., Inc.
P.O. Box 550
Westboro, MA 01581

Sample Description & Locality: Rye fm. feldspathic quartzite
Route 1 Bypass, Greenleaf Road
Portsmouth, New Hampshire

Material Analyzed: Concentrate of fine-grained mica-quartz aggregates, -80/+200 mesh.

Ar^{40*}/K^{40} = .01645

AGE = 262 ± 11 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.02042	.625	.02046
.02049	.645	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
1.015	1.019	1.243
1.023		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION — **REPORT OF ANALYTICAL WORK**

Our Sample No. A-2886 — Date Received: 22 July 1974

Your Reference: SRF - S1 — Date Reported: 16 August 1974

Submitted by: Richard J. Holt
Weston Geophysical Res., Inc.
P.O. Box 550
Westboro, MA 01581

Sample Description & Locality: Diorite
Scotland Road, Interstate 95
Newbury, Massachusetts

Material Analyzed: Amphibole concentrate, -80/+200 mesh. Estimated composition: 85% amphibole, 10% biotite, 5% chlorite.

Ar^{40*}/K^{40} = .02764 — AGE = 422 ± 17 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.03714	.807	.03892
.04070	.389	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
1.154	1.154	1.407
1.154		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION — **REPORT OF ANALYTICAL WORK**

Our Sample No. A-2887

Date Received: 22 July 1974

Your Reference: SRF - S2

Date Reported: 16 August 1974

Submitted by: Richard J. Holt
Weston Geophysical Res., Inc.
P.O. Box 550
Westboro, MA 01581

Sample Description & Locality: Schist
Highfield Road, Abandoned RR grade
Newbury, Massachusetts

Material Analyzed: Chlorite - amphibole concentrate, -80/+200 mesh. Estimated composition: 40% amphibole, 60% chlorite.

Ar^{40*}/K^{40} = .01932

AGE = 304 ± 15 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.01162	.381	.01149
.01136	.548	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.492	.487	.594
.483		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln \left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1 \right]$$

Note: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

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POTASSIUM-ARGON AGE DETERMINATION — **REPORT OF ANALYTICAL WORK**

Our Sample No. B-2888

Date Received: 22 July 1974

Your Reference: SRF - S3

Date Reported: 16 August 1974

Submitted by: Richard J. Holt
Weston Geophysical Res., Inc.
P.O. Box 550
Westboro, MA 01581

Sample Description & Locality: Newburyport granodiorite
Parker Street, Little River area
Newburyport, Massachusetts

Material Analyzed: Chlorite-biotite concentrate, -80/+200 mesh. Estimated composition: 70% chloritized biotite, 30% quartz.

Ar^{40*}/K^{40} = .01860

AGE = 294 ± 20 M.Y.

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/ Total Ar^{40}	Ave. Ar^{40*}, ppm.
.005765	.325	.005548
.005330	.370	

Potassium Analyses:

% K	Ave. %K	K^{40}, ppm
.245	.244	.298
.244		

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/ year

$\lambda_e = 0.585 \times 10^{-10}$/ year

$K^{40}/K = 1.22 \times 10^{-4}$ g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right]$$

Note: Ar^{40*} *refers to radiogenic* Ar^{40}.
M.Y. refers to millions of years.

APPENDIX 2D

GEOLOGIC BEDROCK LOGS OF BORING IN THE SITE AREA

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

APPENDIX 2D

LIST OF BORINGS DONE FOR SEABROOK STATION

(Reference Section 2.5.1.2. and Figures 2.5.9) and 2.5.14)

A number of boring programs have been done for various purposes at and near the **Seabrook** Station site. The list in this appendix is meant to serve as an index for these borings.

Some of the logs of these borings are included in this appendix. Other logs can be found in one of three locations:

1. Miscellaneous Site Area Borings, **Seabrook** Station: PSNH Site Document Control Center, Seabrook, N.H.

2. **Seabrook** Station Geotechnical Report - Circulating Water Tunnels, Vols. 1 and 2: Geotechnical Engineers, Inc., Winchester, Mass., June, 1974

3. **Seabrook** Station Geotechnical Reports - Intake Tunnel Extension: Geotechnical Engineers, Inc., Winchester, Mass., September,1975

An entry in this table for each boring, notes the location of its log.

LIST OF BORINGS DONE FOR
SEABROOK STATION

Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
A-1	Old Cooling System Design	Hampton Beach State Park	Beach	49'	49'	9 Nov '68	1	Auger Boring
A-2	Old Cooling System Design	Hampton Beach State Park	Beach	48.5'	48.5'	9 Nov '68	1	Auger Boring
A-3	Old cooling System Design	Hampton Beach State Park	Beach	53'	53'	11 Nov '68	1	Auger Boring
A-4	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	11 Nov '68	1	Auger Boring
A-5	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	9 Nov '68	1	Auger Boring
A-6	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	14 Nov '68	1	Auger Boring
A-7	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	14 Nov '68	1	Auger Boring
A-8	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	15 Nov '68	1	Auger Boring
A-9	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	25 Nov '68	1	Auger Boring
A-10	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	15 Nov '68	1	Auger Boring
A-11	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	15 Nov '68	1'	Auger Boring
A-12	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	15 Nov '68	1	Auger Boring
A-14	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	15 Nov '68	1	Auger Boring
A-15	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	15 Nov '68	1	Auger Boring

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
A-16	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	11 Nov '68	1	Auger Boring
A-17	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	11 Nov '68	1	Auger Boring
A-18	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	11 Nov '68	1	Auger Boring
A-19	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	14 Nov '68	1	Auger Boring
A-20	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	14 Nov '68	1	Auger Boring
A-21	Old Cooling System Design	Hampton Beach State Park	Beach	56'	56'	14 Nov '68	1	Auger Boring
AIT-1	Intake Tunnel	20546N 80140E	+11.4	17.0	315.0	7 Sept '73	2	
AIT-2	Alternate Tunnel Alignment	20211N 81372E	+ 5.1	8.5	300.0	19 Oct '73		
AIT-3	Alternate Tunnel Alignment	19848N 82720E	- 0.2	32.5	292.0	23 Oct '73		
AIT-4	Alternate Tunnel Alignment	19556N 83798E	+ 5.2	64.0	290.0	14 Nov '73		
AIT-5	Alternate Tunnel Alignment	19327N 84663E	- 2.2	95.0	279.0	9 Nov '73	2	
AIT-6	Alternate Tunnel Alignment	19117N 85438E	+ 2.8	148.5	291.0	29 Oct '73	2	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
AIT-7	Alternate Tunnel Alignment	18908N 86222~	- 2.4	132.0	270.0	04 Sept '73	2	
AIT-8	Alternate Tunnel Alignment	18663N 87143E	-15.0	83.0	268.0	14 Sept '73	2	
AIT-11	Alternate Tunnel Alignment	18221N 88746E	+ 9.0	6.0	6.0	08 Nov '73	2	Boring Abandoned
AIT-12	Alternate Tunnel Alignment	18144N 89012E	+13.5	138.5	272.8	24 Oct '73		
AIT-13	Alternate Tunnel Alignment	17981N 89610E	+10.3	125.0	275.0	03 Oct '73		
AIT-15	Alternate Tunnel Alignment	17730N 90526E	- 8.6	71.5	238.0	01 Oct '73	2	
AIT-16	Alternate Tunnel Alignment	17537N 91267E	-14.1	62.5	231.5	11 Oct '73	2	
AIT-17	Intake Tunnel	17366~ 91907E	-24.1	42.5	216.3	06 Oct '73	2	
AIT-18	Alternate Tunnel Alignment	17182N 92577E	-26.2	45.0	272.0	13 Sept '73	2	
AIT-20	Alternate Tunnel Alignment	17158N 92663E	-36.3	49.5	81.0	14 Sept '73	2	
AIT-22	Alternate Tunnel Alignment	171958 92527E	-32.1	36.5	204.5	22 Sept '73	2	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
AIT-24	Alternate Tunnel Align-ment	17105N 91945E	-35.6	65.0	65.0	17 Oct '73	2	
AIT-24A	Alternate Tunnel Align-ment	17084N 92927E	-35.6	99.0	198.8	22 Oct '73	2	
AIT-25	Alternate Tunnel Align-ment	16996N 93261E	-37.1	24.0	199.3	25 Oct '73	2	
AIT-26	Intake Tunnel	17146N 89283E	+10.6	67.0	347.8	15 Apr '74	2	Boring Inclined 40°
AIT-27	Alternate Tunnel Align-ment	17223N 90217E	- 7.7	80.0	245.3	01 Mar '74	2	
AIT-28	Alternate Tunnel Align-ment	17254N 90887E	-12.8	80.5	233.0	16 Feb '74	2	
AIT-29	Alternate Tunnel Align-ment	17318N 91383E	-18.2	20.0	230.0	19 Feb '74	2	
AIT-30	Alternate Tunnel Align-ment	17394N 92288E	-29.9	46.0	57/9	22 Feb '74	2	Boring Inclined 38°
AIT-30A	Alternate Tunnel Align-ment	17394N 922888	-29.5	46.5	221.3	26 Feb '74	2	
AIT-31	Alternate Tunnel Align-ment	17054N 89238E	i-10.7	69.0	346.0	29 Apr '74	2	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
AIT-32	Alternate Tunnel Alignment	16918N 90562E	-12.4	59.0	240.0	15 Mar '74	2	
AIT-33	Alternate Tunnel Alignment	16840N 91054E	-14.4	80.0	162.0	05 Mar '74	2	
AIT-33A	Alternate Tunnel Alignment	16839N 91054E	-14.4	80.0	241.0	12 Mar '74		
AXT-34	Alternate Tunnel Alignment	16780N 91515E	-19.6	59.0	230.0	05 Mar '74	2	
AIT-35	Alternate Tunnel Alignment	16770N 925783	-33.5	30.0	45.5	28 Mar '74	2	
ATT-36	Alternate Tunnel Alignment	16912N 93045E	-39.1	55.4	69.5	27 Mar '74	2	
AIT-37	Alternate Tunnel Alignment	16766N 930423	-34.3	17.5	30.5	26 Mar '74	2	
AIT-38	Intake Tunnel Extension	17491N 93300E	-41.2	43.0	212.0	24 June '75	3	
AIT-39	Intake Tunnel Extension	17552N 93840E	-42.1	51.0	195.0	16 June '75	FSAR Appendix 2D	
AIT-39A	Intake Tunnel Extension	17566N 93938E	-39.3	57.0	220.0	29 July '75	3	
AIT-40	Intake Tunnel Extension	17575N 94040E	-40.5	78.0	234.0	14 June '75	3	
AIT-41	Intake Tunnel Extension	17597N 94240E	-37.3	75.0	202.0	19 June '75	3	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
AIT-41A	Intake Tunnel Extension	17500N 94234E	-38.9	62.0	219.0	19 July '75	3	
AIT-42	Intake Tunnel Extension	17909N 97006E	-40.8	52.0	214.0	26 June '75		
AIT-43	Intake Tunnel Extension	17762N 95707E	-48.9	51.0	218.0	16 July '75	3	
AIT-44	Intake Tunnel Extension	17816N 96156E	-51.3	49.0	219.0	12 Aug '75	3	
AIT-45	Intake Tunnel Extension	17901N 969003	-62.8	36.0	191.0	09 July '75	3	
AIT-45A	Intake Tunnel Extension	17893N 96810E	-58.3	38.0	186.0	23 July '75	3	
AIT-45B	Intake Tunnel Extension	17880N 96696E	-54.5	37.0	193.0	24 July '75		
AIT-45C	Intake Tunnel Extension	17865N 966011	-58.3	38.0	194.0	08 Aug '75	3	
AAIT-19	Alternate Tunnel Alignment	17179N 92412E	-31.8	46.0	210.0	25 Jan '74	2	
AAIT-20	Intake Tunnel	17446N 92908E	-38.7	44.0	210.8	12 Feb '74	2	
AAIT-23	Intake Tunnel	17405N 9270713	-33.8	46.5	210.0	23 Jan '74	2	
AAIT-24	Alternate Tunnel Alignment	16663N 922213	-27.6	23.0	53.5	01 Feb '74	2	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
AAIT-26	Alternate Tunnel Alignment	16834N 92976E	-38.8	50.0	210.1	14 Feb '74	2	
ADT-1	Discharge Tunnel	20436N 80175E	+12.1	9.5	300.0	07 Sept '73	2	
ADT-2	Discharge Tunnel and Intake Tunnel	201668 80848~	+07.2	15.0	300.0	05 Oct '73	2	
ADT-3	Intake Tunnel	19853N 81686E	+05.4	31.5	300.0	27 Nou '73	2	
ADT-4	Intake Tunnel	195398 82461E	- 0.7	43.5	271.0	09 Oct '73	2	
ADT-5	Intake Tunnel	19279N 83172E	+ 4.2	54.0	271.0	15 Oct '73	2	
ADT-5A	Intake Tunnel	19129N 83560E	+ 5.2	90.5	292.5	19 Dec '73	2	
ADT-6	Alternate Tunnel Alignment	19052N 842423	- 0.8	100.0	342.0	30 Aug '73	2	
ADT-7	Intake Tunnel	19002N 83901E	- 4.1	108.0	297.0	11 Oct '73	2	
ADT-7A	Intake Tunnel	18853N 84280E	- 3.7	99.0	287.0	14 Jan '74	2	
ADT-8	Intake Tunnel	18717N 84599E	+ 1.1	101.0	256.0	24 Sept '73	2	
ADT-9	Alternate Tunnel Alignment	18313N 86427~	- 1.5	110.0	323.0	20 Aug '73	2	
ADT-10	Intake Tunnel	18410N 85422~	- 0.3	105.0	280.0	28 Nov '73	2	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
ADT-10A	Intake Tunnel	182698 85784E	+ 0.1	121.5	275.0	04 Feb '74	2	
ADT-11	Intake Tunnel	18128N 86125E	- 0.5	93.0	298.7	02 Oct '73	2	
ADT-11A	Intake Tunnel	17951N 86601E	- 1.8	64.3	270.0	16 Jan '74	2	
ADT-12	Intake Tunnel	17781N 87059E	-10.3	103.5	240.3	18 Sept '73	2	
ADT-12A	Intake Tunnel	176628 87344E	-13.5	41.0	260.0	26 Dec '73	2	
ADT-13	Intake Tunnel	17458N 87897E	- 8.5	18.8	228.0	29 Sept '73	2	
ADT-14	Discharge Tunnel and Intake Tunnel	17161N 88821E	+13.2	25.5	288.0	29 Nov '73	2	Boring Inclined 17°
ADT-15	Discharge Tunnel	16941N 89285E	+ 7.7	47.0	240.0	04 Nov '73	2	
ADT-16	Discharge Tunnel	16553~ 90235E	- 9.1	38.0	243.6	14 Nov '73	FSAR Appendix 2D	
ADT-16A	Discharge Tunnel and Fault investigation	16571N 90280E	- 4.0	33.5	240.3	07 Jan '74	FSAR Appendix 2D	
ADT-16B	Discharge Tunnel and Fault investigation	16545N 90185E	- 8.3	36.3	240.0	14 Jan '74	FSAR Appendix 2D	
ADT-16C	Discharge Tunnel and Fault investigation	16493N 90257E	- 5.5	23.0	238.5	17 Jan '74	FSAR Appendix 2D	
ADT-16D	Discharge Tunnel and Fault investigation	16660N 902198	- 7.8	38.0	241.4	14 Nov '74	FSAR Appendix 2D	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
ADT-17	Discharge Tunnel	16213N 91109E	-14.8	102.3	260.8	06 Oct '73	2	
ADT-17A	Discharge Tunnel	16110N 91380E	-17.7	88.0	225.0	12 Dec '73	2	
ADT-18	Discharge Tunnel	15967N 91745E	-24.0	45.5	225.0	10 Nov '73	2	
ADT-19	Discharge Tunnel	15718N 92402E	-23.5	6.5	197.2	05 Nov '73	2	
ADT-20	Discharge Tunnel	15462~ 93063E	-40.6	10.0	175.1	07 Nov '73	2	
ADT-21	Discharge Tunnel	15208N 93723E	-51.6	43.0	190.3	04 Dec '73	2	
ADT-22	Discharge Tunnel	19904N 94492E	-55.4	54.0	179.9	28 Nov '73	2	
ADT-23	Discharge Tunnel	14879N 94561E	-58.6	41.0	72.5	01 Dec '73	2	
ADT-25	Discharge Tunnel	14931N 94418E	-54.5	59.0	92.0	30 Nov '73	2	
ADT-27	Discharge Tunnel	14637~ 947523	-59.0	10.0	170.0	12 Apr '74	2	
ADT-28	Discharge Tunnel	14526N 94809E	-65.4	12.0	165.0	11 Apr '74	2	
ADT-29	Discharge Tunnel	14374N 949151	-47.0	0.0	180.7	11 Apr '74	2	
ADT-30	Discharge Tunnel	14144N 95021E	-63.8	23.0	164.3	05 Apr '74	2	
ADT-31	Discharge Tunnel	13891~ 95151E	-53.6	0.5	91.2	21 Mar '74	2	
ADT-31A	Discharge Tunnel	13926N 95150E	-57.3	0.0	167.8	25 Mar '74	2	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
ADT-32	Discharge Tunnel	14862N 94622E	-58.8	27.0	169.8	07 Dec '73	2	
ADT-33	Discharge Tunnel and Intake Tunnel	20175N 80459E	+ 9.4	16.6	368.5	79 Mar '74	2	Boring Inclined 33°
ADT-34	Discharge Tunnel	19977N 81201E	+ 5.3	19.0	368.0	20 Mar '74	2	Boring Inclined 34°
ADT-35	Discharge Tunnel	19608N 81992B	- 3.0	40.5	40.5	26 Feb '74	2	
ADT-35A	Discharge Tunnel	19631N 81974E	- 2.3	37.5	300.0	07 Mar '74	2	
ADT-36	Discharge Tunnel	19364N 82706E	- 3.1	4.0	289.7	20 Mar '74	2	
ADT-37	Discharge Tunnel and Intake Tunnel	18947N 83394E	+ 5.3	84.0	354.0	22 Apr '74	2	Boring Inclined 33°
ADT-37A	Discharge Tunnel	18969N 83729E	+ 5.1	----	-----	15 Mar '74	2	Boring Abandoned
ADT-37B	Discharge Tunnel	18963N 83740E	+ 4.0	118.0	350.0	12 Apr '74	2	Boring Inclined 31°
ADT-38	Discharge Tunnel	18962N 84445E	- 1.0	78.0	198.0	23 Apr '74	2	
ADT-39	Discharge Tunnel	18470N 85030E	- 1.5	102.0	280.5	19 Feb '74	2	
ADT-40	Discharge Tunnel and Intake Tunnel	17384N 88389E	+12.4	52.0	360.0	26 Apr '74	2	Boring Inclined 37°
ADT-41	Discharge Tunnel	17974N 86307E	- 1.3	60.0	275.0	21 Feb '74	2	
ADT-42	Discharge Tunnel	17616N 87273E	-13.5	40.0	260.0	29 Jan '74	2	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
ADT-43	Discharge Tunnel	18275N 85525E	+ 0.3	106.0	276.0	08 Mar '74	2	
B-1	W of Turbine Bldg. II	20440N 78830E	+19.2	22.5	99.3	15 Oct '68	1	
B-2	SW Trench, S of' Containment I	20180N 79650E	+14.1	3.9	155.0	29 Oct '68	1	
B-3	∿ 200' N of Turbine Bldg. I	21020N 793503	+ 5.5	32.5	100.0	06 Nov '68	1	
B-4	N of Site	22100N 78900E	+ 4.4	40.0	140.0	27 Nov '68	1	
B-5	S of Cooling Tower - Marsh	19900N 79300E	+12.7	13.0	33.0	02 Dec '68	1	
B-6	S of Site in Marsh (?)	19800N 79600E	+ 4.4	32.5	54.9	14 Dec '68	1	
B-J	W side Waste Process Bldg.	20200N 79400E	+12.2	14.0	34.5	18 Dec '68	1	
B-8	N of EFP Bldg. I	20520N 796208	+30.9	04.2	25.3	21 Dec '68	1	
B-9	E of Turbine Bldg. I	20700N 79670E	+20.9	04.0	28.0	31 Dec '68	1	
B-10	Approximately 100' NE of Turbine Bldg. I	20980N 797603	+ 6.7	31.0	51.3	08 Jan '69	1	
B-11	Approximately 250' E of Turbine Bldg. I	21010N 80120E	+ 5.4	35.8	59.6	18 Jan '69	1	
B-12	N of Pumphouse	20750N 79960E	+12.8	----	-----	---------	1	No Log
B-13	N of EFP Bldg. II	20380N 79180E	+15.4	11.0	31.0	20 Mar '69	1	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
B-14	SE Corner Admin. Bldg.	20500N 79330E	+18.1	8.0	28.0	19 Mar '69	1	
B-15	Heater Bay I	20740N 79480E	+18.0	11.0	31.0	13 Mar '69	1	
B-16	Fire Protection Water Tanks	20780N 78440E	+17.6	52.5	72.2	20 Feb '69	1	
B-17	N end of Site	21400N 78900E	+16.2	60.0	160.0	12 Mar '69	1	
B-18	∿ 325' W of Turbine Bldg. II	20460N 78330E	+20.7	22.5	42.5	14 Feb '69	1	
B-19	N end of Site	21350N 78900E	+15.9	47.0	67.0	26 Mar '69	1	
B-20	N end of Site	21325N 78900E	+ 6.4	34.0	100.0	28 Mar '69	1	
B-21	N end of Site	21800N 78900E	+ 9.4	50.0	150.u	31 Jan '69	1	
B-22	NW of Turbine Bldg. II	20630N 78900E	+11.4	2.5	68.5	08 Apr '69	1	
B-23	N end of Site	21600N 78900E	+10.2	76.0	176.0	18 Feb '69	1	
B-24	N end of Site	21200N 78920E	+12.4	21.0	121.0	24 Feb '69	1	
B-25	SW Trench S of Containment I	20200N 79770E	+18.5	9.0	20.0	24 Jan '69	1	
B-26	Just SW of SW Pumphouse	203208 79920E	+24.1	3.0	23.0	23 Jan '69	1	
B-27	Shaft Transition Area	20570N 80070E	+15.6	6.0	26.0	20 Jan '69	1	

Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
B-28	Center Turbine Bldg. II	20580N 79070E	**+19.0**	4.0	23.8	11 Feb '69		
B-29	Approximately 250' E of Turbine Bldg, I	20830N 80240E	+ 5.8	42.6	62.5	24 Jan '69		
B-30	W side Control Bldg. **II**	20270N 78970E	**+18.5**	7.0	27.0	10 Mar '69		
B-31	Containment I NE quadrant	**20440N** 79720E	**+29.9**	3.0	23.0	13 Mar '69		
B-32	NW of Turbine Bldg. II	**20680N** 78750E	**+19.0**	9.3	29.8	24 Feb '69		
B-33	Approximately 50' N of Rubine Bldg. I	**20920N** 79470E	**+10.0**	18.0	37.8	29 Jan '69		
B-34	Approximately 200' N of Admin. Bldg.	**21010N** 79210E	**+06.3**	49.6	69.8	05 Feb '69		
B-35	Approximately Center Turbine Bldg. I	20650N 79540E	**+21.5**	2.5	41.5	12 Mar '69		
B-36	SE Corner of Turbine Bldg. I	**20540N** 79575E	**+27.4**	2.0	67.5	02 Apr '69		
B-37	Containment I NW quadrant	20420N 79625E	**+24.4**	6.0	46.5	19 Mar '69		
B-38	NE of Containment I CW Trench	**20550N** 79750E	**+32.6**	2.3	150.0	13 Mar '69		
B-39	E of Containment I	20455N 797803	**+31.9**	1.5	70.5	28 Mar '69		
B-40	E of Turbine Bldg. I	20680N 79700E	**+26.2**	2.5	66.5	24 Mar '69		

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
B-41	NE of Containment I CW Trench	20580N 79825E	+27.6	6.8	67.6	18 Mar '69	1	
B-42	N end of Site	21300N 78900E	+14.3	44.0	164.0	20 Mar '69	1	
B-43	N end of Site	21300N 78550E	+26.2	39.0	59.0	17 Mar '69	1	
B-44	N end of Site	21450N 78380E	+23.2	77.0	100.0	01 Mar '69	1	
B-45	N end of Site	21500N 78500E	+21.1	94.5	114.5	08 Apr '69	1	
B-46	N end of Site	21630N 78500E	+13.3	77.0	99.3	23 Apr '69	1	
B-47	N end of Site	20840N 79740E	+12.2	8.5	28.5	24 July '69	1	
B-48	NE quadrant Turbine Bldg. I	20800N 79600E	+13.2	5.5	26.0	25 July '69	1	
C-1	Old Cooling System Design	21060N 80350E	+ 4.9	22.0	22.0	27 Jan '69	1	
c-2	Old Cooling System Design	21050N 80850E	+ 4.2	50.0	50.0	30 Jan '69	1	
c-3	Old Cooling System Design	21830N 81000E	+ 4.7	50.0	50.0	28 Jan '69	1	
c-4	Old Cooling System Design	21020N 81350E	+ 4.0	50.0	50.0	31 Jan '69	1	
c-5	Old Cooling System Design	22570N 81620E	+ 4.5	33.0	33.0	28 Jan '69	1	
C-6	Old Cooling System Design	20990N 81850B	+ 4.8	50.0	50.0	03 Feb '69	1	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
c-7	Old Cooling System Design	22300N 82557E	+ 4.9	50.0	50.0	14 Feb '69	1	
C-8	Old Cooling System Design	20990N 82330E	+ 4.8	50.0	50.0	04 Feb '69	1	
c-9	Old Cooling System Design	21900N 83450E	+ 4.5	50.0	50.0	13 Feb '67	1	
C-10	Old Cooling System Design	20850N 82835E	+ 4.3	50.0	50.0	05 Feb '69	1	
c-11	Old Cooling System Design	21200N 84150E	+ 4.5	50.0	50.0	13 Feb '69	1	
c-12	Old Cooling System Design	20675N 83230E	+ 4.0	50.0	50.0	15 Feb '69	1	
c-13	Old Cooling System Design	20500N 84870E	+ 4.5	50.0	50.0	12 Feb '69	1	
c-14	Old Cooling System Design	20450N 83275~	+ 4.0	50.0	50.0	12 Feb '69	1	
c-15	Old Cooling System Design	19800N 85580E	+ 0.4	50.0	50.0	18 Feb '69	1	
C-16	Old Cooling System Design	19930N 85860E	+ 2.1	----	----	---------	1	No Log
c-17	Old Cooling System Design	19540N 86050E	+ 2.6	50.0	50.0	20 Feb '69	1	
C-18	Old Cooling System Design	19200N 86450E	-----	50.0	50.0	19 Mar '69	1	
c-19	Old Cooling System Design	18890N 86840E	-----	50.0	50.0	19 Mar '69	1	
c-20	Old Cooling System Design	18590N 87230E	0.0	50.0	50.0	20 Mar '69	1	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
c-21	Old Cooling System Design	18250N 87600E		50.0	50.0	17 Mar '69		
c-22	Old Cooling System Design	18000N 880403	+16.2	50.0	50.0	13 Feb '69	1	
C-23	Old Cooling System Design	17800N 88500E	+14.0	50.0	50.0	17 Feb '69	1	
c-24	Old Cooling System Design	17600N 88950E	+14.0	50.0	50.0	18 Feb '69	1	
C-25	Old Cooling System Design	17410N 89400E	+10.0	50.0	50.0	03 Apr '69	1	
C-26	Old Cooling System Design	17750N 87760E	0.0	50.0	50.0	20 Mar '69	1	
c-27	Old Cooling System Design	20178N 841708	+ 4.0	50.0	50.0	08 Feb '69		
C-28	Old Cooling System Design	20020N 84560E	+ 3.9	50.0	50.0	06 Feb '69	1	
C-29	Old Cooling System Design	19745N 85000E	+ 4.0	50.0	50.0	07 Feb '69	1	
c-30	Old Cooling System Design	19520N 85520E	+ 2.9	50.0	50.0	17 Feb '69	1	
c-31	Old Cooling System Design	19290N 85950E	+ 2.3	50.0	50.0	21 Feb '69	1	
C-32	Old Cooling System Design	20970N 80470E	+ 5.1	30.5	43.0	06 Mar '69	1	
c-33	Old Cooling System Design	20850N 807808	+ 3.6	30.5	30.5	24 Mar '69	1	
c-34	Old Cooling System Design	20750N 81000E		44.0	44.0	24 Mar '69	1	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
c-35	old Cooling System Design	20640N 81305E	+ 4.3	38.0	38.0	11 Mar '69	1	
C-36	Old Cooling System Design	20800N 80500E	+ 4.5	10.0	15.0	09 Mar '69	1	
c-37	Old Cooling System Design	20710N 80740E	+ 4.3	2.0	07.0	10 Mar '69	1	
C-38	Old Cooling System Design	20540N 80930E	t 5.2	16.5	18.5	10 Mar '69	1	
c-39	Old Cooling System Design	20530N 81200E	+ 4.0	30.0	30.0	11 Mar '69	1	
c-40	Old Cooling System Design	20480N 81700E	+ 4.8	44.4	44.4	03 Apr '69	1	
c-41	Old Cooling System Design	20350N 816503	+ 4.7	35.0	35.0	03 Apr '69	1	
C-42	Old Cooling System Design	20290N 81160E	+ 4.6	30.0	30.0	04 Apr '69	1	
c-43	Old Cooling System Design	20110N 82620E	+ 4.5	30.0	30.0	04 Apr '69	1	
c-44	Old Cooling System Design	20050N 83000E	+ 3.8	32.0	32.0	28 Mar '69	1	
c-45	Old Cooling System Design	19920N 83095E	+ 2.1	34.0	34.0	28 Mar '69	1	
C-46	Old Cooling System Design	19830N 83320E	+ 4.0	33.3	33.3	31 Mar '69	1	
c-47	Old cooling System Design	19740N 83550E	+ 4.0	43.0	43.0	31 Mar '69	1	
c-40	Old Cooling System Design	19650N 83800E	+ 4.1	50.0	50.0	01 Apr '69	1	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
c-49	Old Cooling System Design	19550N 84020E	+ 4.0	50.0	50.0	02 Apr '69	1	
c-50	Old Cooling System Design	20290N 828853	+ 3.9	31.0	31.0	02 Apr '69	1	
c-51	Old Cooling System Design	20050N 83150E	+ 3.7	15.0	20.0	Apr '69	1	
c-52	Old Cooling System Design	19960N 83380E	+ 4.0	21.0	21.0	26 Mar, '69	1	
c-53	Old Cooling System Design	19860N 83600E	+ 4.0	36.6	36.6	26 Mar '69	1	
c-54	Old Cooling System Design	19780N 83820E	+ 4.0	50.0	50.0	01 Apr '69	1	
c-55	Old Cooling System Design	19780N 83050E	+ 3.8	40.0	40.0	27 Mar '69	1	
C-56	Old Cooling System Design	19690N 83260E	+ 4.1	38.0	38.0	27 Mar '69	1	
c-57	Old Cooling System Design	19350N 844853	+ 0.5	50.0	50.0	27 Mar '69	1	
C-58	Old Cooling System Design	19180N 84950E	+ 0.1	50.0	50.0	27 Mar '69	1	
c-59	Old Cooling System Design	19000N 85420E	+ 0.5	50.0	50.0	26 Mar '69	1	
C-60	Old Cooling System Design	18820N 85860E	+ 3.8	50.0	50.0	25 Mar '69	1	
C-61	Old Cooling System Design	18510N 86290E	-----	50.0	50.0	25 Mar '69	1	
C-62	Old Cooling System Design	18350N 86800E	0.0	50.0	50.0	24 Mar '69	1	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
c-63	Old Cooling System Design	18200N 87280E	0.0	50.0	50.0	24 Mar '69		
C-64	Old Cooling System Design	17900N 88270E	+17.8	50.0	50.0	31 Mar '69		
C-65	Old Cooling System Design	17700N 88730E	+13.7	50.0	50.0	01 Apr '69	1	
C-66	Old Cooling System Design	17500N 89180E	+13.3	38.0	38.8	01 Apr '69	1	
C-67	Old Cooling System Design	19845N 82000E	+ 4.5	31.0	31.0	11 Apr '69	1	
C-68	Old Cooling System Design	19650N 82440E	+ 3.9	39.6	32.6	11 Apr '69		
C-69	Old Cooling System Design	19345N 83130E	+ 4.1	39.9	39.9	09 Apr '69		
c-70	Old Cooling System Design	19125N 835953	+ 4.0	50.0	50.0	09 Apr '69		
c-71	Old Cooling System Design	19780N 81370E	+ 4.7	40.5	40.5	22 July '69	1	
C-72	Old Cooling System Design	19550N 81890E	+ 3.6	52.0	52.0	18 July '69		
c-73	Old Cooling System Design	19480N 82310E	+ 4.8	52.0	52.0	21 July '69	1	
c-74	Old Cooling System Design	19140N 82640E	- 4.4	42.8	42.8	16 July '69	1	
c-75	Old Cooling System Design	18620N 82810E	- 3.0	52.0	52.0	15 July '69	1	
C-76	Old Cooling System Design	18460N 83240E	- 1.0	52.0	52.0	15 July '69		

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
C-77	Old Cooling System Design	18690N 83650E	- 1.0	52.5	52.5	14 July '69	1	
C-78	Old Cooling System Design	18910N 840503	- 1.0	52.0	52.0	11 July '69	1	
Dl-1	SW Trench, between Units I & II	79373E 20093N	+ 9.8	16.5	124.U	04 Dec '72	FSAR Appendices 2D and 2J	
Dl-3	SW of Containment II	793103 20218N	+14.0	11.0	65.50	04 Dec '72	" "	
Dl-4	(E of) Fuel Storage Bldg. II	79278E 20122N	t11.4	15.5	170.00	27 Nov '72	" "	
Dl-5	SW Trench N of Cooling Tower	792503 20027N	t16.6	15.3	65.4	24 Nov '72	" "	
Dl-6	S of Primary Auxiliary Bldg. II	79156E 20054N	+19.2	11.5	33.u	27 Nov '72	" "	
D 1 - 7	Fuel Storage Bldg. II, center	79110E 20192N	i-14.3	14.5	118.7	11 Nov '72	" "	
Dl-8	Center of Containment II	79213E 20245~	+15.9	9.0	29.5	05 Dec '72	" "	
Dl-9	Primary Auxiliary Bldg. II	79060E 20083N	+20.8	1.5	24.5	28 Nov '72	" "	
D1-10	Primary Auxiliary Bldg. II	79088E 20189N	+19.2	8.0	112.00	06 Dec '72	" "	
Dl-11	WSFPC II, N end	791163 20276N	+13.8	11.5	65.0	07 Dec '72	" "	
D1-12	Tank Farm II	78963E 20111N	+23.9	6.5	29.5	29 Nov '72	" "	
D2-1	DG Bldg. II	78896E 20234N	t21.2	6.0	31:o	06 Dec '72	" "	
D2-3	N of DG Bldg II	78829E 20360 N	+19.4	25.2	60.0	26 Nov '72	" "	

Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
D2-4	Just W of Unit II	78800E 20264N	+16.7	19.0	171.u	24 Nov '72	FSAR Appendices 2D and 2J	
D2-5	Just W of Unit II	78775E 20167N	+16.5	6.5	65.0	01 Dec '72	" " "	
D2-7	Just W of Unit 11	78730E 20283N	+16.7	24.5	125.U	28 Dec '72	" " "	
E1-1	Containment I, Center	79677~ 20398N	+28.9	0.0	150.1	26 Dec '72	" " "	
E1-2	Control Bldg. I, Center	79500E 20450 N	+21.4	6.5	27.2	12 Dec '72	" " "	
E1-3	W aide DG Bldg. I	7935UE 20400 N	+15.2	16.5	42.0	13 Dec '72	" " "	
E1-4	Fuel Storage Bldg. I, Center	79698 E 20297 N	+20.2	1.5	105.0	19 Dec '72	" " "	
E1-5	Center of Primary Auxiliary Bldg.	79551 E 20296 N	+16.0	6.5	108.0	19 Dec '72	" " "	
E1-6	N end of Waste Process Bldg.	79400 E 20300 N	+14.3	1.5	24.0	19 Dec '72	" " "	
E2-1	Containment II, Center	79201E 20247 N	+15.9	6.5	159.2	13 Dec '72	" " "	
E2-2	NE of Containment II	79272E 20355 N	+13.7	11.5	32.5	14 Dec '72	" " "	
E2-3	W side of Turbine Bldg. II	79002 E 20409 N	+19	35.0	52.0	04 Dec '73	1	
E2-4	E side of Turbine Bldg. II	79170 E 20508 N	+18	5.0	26.0	05 Dec '73	1	
E2-5	NE quad Containment II	79212 E 20277 N	+18	8.0	97.8	29 Apr '74	1	
E2-6	SW corner of PAB I	79551E 20203 N	+12	16.9	42.5	06 May '74	1	
E2-7	N end of PAB I	795523 20374N	+17	13.5	115.2	13 May '74	1	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
E2-8	SE corner of Cooling Tower	**79370E** 19997N	**+10**	7.0	70.0	08 May '74	1	
E2-9	S of Unit I	**79568E** **20115N**	**+9**	15.0	70.0	01 May '74	1	
E2-10	S of Unit I	79580E 20060N	**+8**	7.0	70.0	03 May ' 14	1	
E2-11	Containment I Perimeter	**20435E** 796118	**+25.0**	17.7	168.0	27 June '74	FSAR Appendix 2F	Boring **Inclined** About 40°
E2-12	Containment I Perimeter	20334E 79642 **N**	**+21.5**	1.0	165.5	18 June '74	" "	**Boring Inclined** About 40°
E2-13	Containment I Perimeter	20365E 79745N	**+30.5**	0.0	169.0	03 July '74	" "	Boring Inclined About **40°**
E2-14	Containment I Perimeter	20467E 79713N	**+29.9**	3.0	166.0	19 June '74	" "	Boring **Inclined** About 40°
E2-15	Containment II Perimeter	20321E 79179 **N**	**+13.9**	11.5	165.0	05 June '74	" "	Boring **Inclined** About 40°
E2-16	Containment 11 Perimeter	20227N 79130E	**+16.8**	9.5	165.2	29 May '74	FSAR Appendix **2F**	Boring Inclined About **40°**
E2-17	Containment II Perimeter	20117N 79224E	**+13.3**	19.0	165.0	05 June '74	FSAR Appendix 2F	Boring Inclined About **40°**
E2-18	Containment II Perimeter	20270N 79272E	**+14.9**	14.0	168.0	28 **May** '74	**FSAR** Appendix 2F	Boring **Inclined** About 40°
E2-27	N side of Cooling Tower	79158 **E** 19990 **N**	**+19**	2.5	79.8	15 May '74	**1**	
E2-28	S side of Cooling Tower	**79180E** **19930N**	**+18**	1.0	101.8	16 May '74	1	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Referenced	Remarks
F-1'	Alternate Tunnel Alignment	17600N 86700E	- 3.0	9.5	9.0	17 Apr '73	2	
F-1A	Alternate Tunnel Alignment	17600N 86694E	- 3.0	15.0	143.8	25 Apr '73	2	
F-2	Alternate Tunnel Alignment	19189N 86875E	- 1.4	13.8	264.4	15 May '73	2	
F-3	Alternate Tunnel Alignment	19374N 88446E	+ 9.4	87.5	298.8	07 June '73	2	
F-4	Alternate Tunnel Alignment	18311N 88393E	+16.8	135.3	329.6	02 July '73	FSAR Appendix 2D	
F-5	Alternate Tunnel Alignment	18332N 884303	+15.7	121.3	319.5	31 July '73	2	
F-6	Alternate Tunnel Alignment	18450N 87945E	- 1.5	124.2	339.0	09 Aug '73	2	
G-1	Fuel Oil Storage Tank	29690N 78370E	+17.3	16.5	16.5	30 Sept '74	FSAR Appendix 21	
G-2	Settling Basin Inlet	21380N 78900E	+15.9	14.5	14.5	01 Oct '74	FSAR Appendix 2I	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
G-3	Settling Basin **Outlet**	21717N 78949E	+ 9.4	34.8	34.8	01 Oct '74	FSAR Appendix 21	
G-4	Settling Basin	215718 78992E	+ 9.6	22.5	22.5	03 Oct '74	" " "	
G-5	Site Retaining Wall	20969N 79525E	+ 7.8	9.7	09.7	03 Oct '74	" " "	
G-6	Site Retaining Wall	20949N 79349E	+ 8.2	19.5	19.5	03 Oct '74	" " "	
G-7	Site Retaining Wall	20932N 79175E	+ 8.6	23.2	23.2	03 Oct '74	" " "	
G-8	Site Retaining Wall	21006N 79107E	+ 7.3	19.0	19.0	07 Oct '74	" " "	
G-9	Concrete **Seawall**	20123N 79720E	+ 9.5	10.5	25.5	09 Oct '74	" " "	
G-10	Concrete **Seawall**	20083N 78587E	+ 7.9	6.5	22.0	08 Oct '74	" " "	
G-11	Concrete **Seawall**	20042N 79455E	+ 6.8	15.9	31.0	10 Oct '74	" " "	
G-12	Revetment **Seawall**	19898N 78500E	+ 7.2	11.0	11.0	10 Oct '74	" " "	
G1	Falling Head Permeability	21882N 782913	+16.4	----	----	---------	FSAR Appendix 21	No Log
G2	Falling Head Permeability	21412N 77959E	+25.4	74.0	84.0	27 Jan '69	" " "	
G3	Falling Head Permeability	20436N 77489E	+35.4	11.0	21.0	19 Feb '69	" " "	
G4	Falling Head Permeability	19989N 77116E	+30.1	5.0	15.0	20 Feb '69	" " "	
G5	Falling Head Permeability	19200N 76420E	+40.4	65.0	78.0	04 Mar '69	" " "	

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
OC1A	Containment I	20413N 79671E	+28.0	0.2	46.6	03 July '73	FSAR Appendix 2H	Overcore Hole
P1	Old Cooling System Design	Offshore	- 2.0	42.0	42.0	28 May '69	1	
P2	Old Cooling System Design	Offshore	- 9.0	37.5	36.5	11 June '69	1	
P3	Old Cooling System Design	Offshore	-12.0	74.5	74.5	14 June '69	1	
P4	Old Cooling System Design	Offshore	-15.0	14.1	14.1	04 June '69	1	
P5	Old Cooling System Design	Offshore	-23.0	24.8	24.8	10 June '69	1	
P6	Old Cooling System Design	Offshore	-31.5	48.0	48.0	10 June '69	1	
P7	Old Cooling System Design	Offshore	-38.5	25.0	25.0	15 June '69	1	
P8	Old Cooling System Design	Offshore	-44.0	46.0	46.0	10 June '69	1	
P9	Old Cooling System Design	Offshore	-40.0	17.0	17.0	11 June '69	1	
P10	Old Cooling System Design	Offshore	-40.0	21.0	21.0	15 June '69	1	
P11	Old Cooling System Design	Offshore	-19.0	18.5	18.5	14 June '69	1	
PF-1	Portsmouth Fault Investigation	Greenland, NH	+79.1	0.5	267.0	21 Mar '74	FSAR Appendix 2C	Boring Inclined 48°
PF-2	Portsmouth Fault Investigation	Greenland, NH	+62.0	65.0	271.0	24 July '74	FSAR Appendix 2C	Boring Inclined 40°

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Boring No.	Purpose	Location/ Coordinates	Ground Elevation	Soil Bored (Ft)	Total Depth (Ft)	Date Completed	Reference	Remarks
PF-3	Portsmouth Fault Investigation	Greenland, NH	+61.8	40.0	50.0	30 July '74	FSAR Appendix 2C	
PF-3A	Portsmouth Fault Investigation	Greenland, NH	+61.8	80.0	204.3	08 Aug '74	" " "	
SRF-1	Scotland Rd Fault Investigation	Newhury, MA	+18.1	13.0	79.0	06 Dec '73	" " "	
SRF-2	Scotland Rd Fault Investigation	Newhury, MA	+17.6	50.5	77.5	10 Dec '73	" " "	
SRF-3	Scotland Rd Fault Investigation	Newbury, MA	+17.9	42.0	95.0	19 Dec '73	" " "	
SRF-4	Scotland Rd Fault Investigation	Newhury, MA	+17.6	60.0	96.0	03 Jan '74	" " "	
SRF-5	Scotland Rd Fault Investigation	Newbury, MA	+17.6	34.0	197.7	08 Jan '74	" " "	Boring Inclined 45°
SRF-6	Scotland Rd Fault Investigation	Newbury, MA	+17.8	53.0	58.0	08 Jan '74	" " "	
SRF-7	Scotland Rd Fault Investigation	Newhury, MA	+17.5	65.5	255.0	18 Jan '74	" " "	Boring inclined 45°
SRF-8	Scotland Rd Fault Investigation	Newhury, MA	+17.6	49.0	172.0	19 Feh '74	" " "	
SRF-9	Scotland Rd Fault Investigation	Newhury, MA	+17.8	57.0	118.3	03 Jan '74	" " "	

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PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 99.2'

Logged By: J. R. Rand 7/10/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'				
10'				
20'				X'LDER - FOLIATED GRANITE 22.5' top of Rock
22.5'–30'	Breaks in Chips to 1' pieces	Rock is fresh minor rusty staining locally on joints	+ +	Diabase - Dark-grey, fine-grained with dark green phenocrysts
30'	CHIPS		+ +	
34'–40'	Breaks in [illegible] 1.5' [illegible] / PITTED	Ditto Fresh Rock	+ +	
40'–50'	VERY MINOR RUST	All joints @ Low angle	+ +	Rock becomes a little coarser grained - dark-grey to black
50'–63'	Breaks @ .2' to 1' pieces	Ditto Fresh Rock HIGH ANGLE (65°) JOINTS AT 1' to 2' INTERVALS	+ +	
63'–79'	Breaks @ .2' to 1.5' pieces	Rock Fresh as above Rust is rare. but some joints are stained	+ +	
80'				

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PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION

BEARING

INCLINATION

DEPTH 99.2'

Logged By: J. R. Rand 7/10/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
60'				
70'				
80'	Breaks @.1' to 1.5' pieces; Rusty; Rusty	Rock is fresh. Good drilling. locally is minor rust. Stained on joints	+ + + + + + + +	Diabase - Dark-grey, fine-grained with small dark green phenoclyst speckling
90'	Breaks @ chips to .8' pieces; Rusty; Rusty; Rusty	Rock is fairly fresh to fresh. local rust on joints	+ + + + + + +	Diabase - Dark-grey, fine grained with small dark-green phenocryst speckling
100'				99.2' Bottom of Hole
110'				

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PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 34.3'

Logged By: J. R. Rand 7/12/72

Depth	CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'					
10'					13' Top of Rock
	Breaks @ Chips to 1.4' pieces	CHIPS, CHIPS, CHIPS — Rock moderately weathered. Rusty Stained. Minerals discolored. Rock is fairly fresh, showing rusty staining only on partings.	80°	x x x x x	Diorite – coarse grained, light grey Porphyritic
20'					Mica Schist. very fine grained Grey. wavy foliation. Steep dip to foliation. (80°) Locally fine quartzitic rock.
30'	Breaks @.1' to 1' pieces	Rock is fresh with only minor rusty staining on some joints			Schist - fine grained grey mica Schist - sub-vertical foliation
					34.3' Bottom of Hole
40'					

DDH B-8 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 25.4'

Logged By: J. R. Rand 7/11/72

Depth	CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'					4.2' Top of Rock
10'	Breaks @Chips to .8' pieces	CHIPS / CHIPS	Rock is fresh with only minor rusty staining, slight mineral discoloration on some joints	COARSE	Diorite, fine-grained, Dark-grey, massive, with local intermix of coarse-grained light grey porphyritic diorite.
20'	CHIPS TO .6' pieces	CHIPS / CHIPS	Slight to moderate weathering, Rust, DISCOLORED	COARSE / COARSE	At base fine diorite is discolored to dull brown. (mod. weathering)
30'					25.4' Bottom of Hole
40'					

DDH B-13 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 31.0'

Logged By: J. R. Rand 7/11/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'				
10'				11' Top of Rock
11'–20'	Breaks @.1' to 2' pieces	Rock is fresh, Only minor rusty Staining locally on joints.	x x x	Diorite, intermixed dark grey, fine grained rock and coarser grained, porphyritic light grey rock.
20'	Rusty	Joints @ 30° and 60° dips	x x x	COARSE
	Rusty	Rock is fresh	x x x	COARSE Predominantly a fine-grained rock type.
30'	.2' to .6' pcs.	Minor Rust Stains	x x x	MEDIUM DARK GREY FINE-GRAIN DIORITE
31'				31' Bottom of HOLE
40'				

DDH B-14 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 28.0'

Logged By: J. R. Rand 7/11/72

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG	DESCRIPTIVE NOTES
0'					
8'					8' Top of Rock
10'	Breaks @Chips to 1/2' pieces	RUSTY CHIPS	Rock is fairly fresh, with only Slight weathering on veinlets, and minor rusty stains on joints		Diorite, Dark-grey, Fine-grained type predominates
		CHIPS		COARSE	Diorite, mixed dark grey,
20'		CHIPS		COARSE	Fine-grained in light grey, Coarse-grained porphyritic
	.1' to .8' pieces		Rock is fresh	COARSE	
				COARSE	
28'					28' Bottom of Hole.
30'					
40'					

DDH B-15 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 31.0'

Logged By: J. R. Rand 7/10/72

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG	DESCRIPTIVE NOTES
0					Top of Rock 4' (?)
	CHIPS ONLY (may be boulder zone)		May be boulder zone, rock is moderately weathered with dark brown rusty staining		Porphyritic Diorite (boulder?)
10'					Diabase Dike (?) or Diabase boulder (?).
	Chips to .2'				POSSIBLE TRUE TOP OF ROCK: 13'
	.5' to 1.5' pieces	70° joint 60° joint Rusty	Rock is fresh, No rust, joints not slickensided		Bedrock: porphyritic diorite with local zones of medium grey, fine grained diorite.
20'	Breaks @ .1' to 1' intervals	Rusty pitted	Rock is fresh minor rust as shown		80° Min. Silicified zone
30'					31' Bottom of Hole
40'					

PROJECT: SEABROOK STATION:

HOLE LOCATION: ELEVATION:

BEARING: INCLINATION: DEPTH: 160.0'

Logged By: J. R. Rand

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
30'				
40'				
50'				
60'	Core beaks in chips to .3' pieces throughout	Rock is slightly to moderately weathered, Local decom-position, some rusty staining on partings		60' Top of Rock Metasediment – feldspathic schist, locally quartzitic light grey fine grained rock – evenly foliated.
70'		35°		
80'		45°		
90'				

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PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 160.0'

Logged By: J. R. Rand

Depth	CONDITION OF CORE		DIP		DESCRIPTIVE NOTES
80'–90'					
90'–110'	Breaks @ chips to .2' pieces throughout		40°, 45°	Rock is moderately weathered throughout, somewhat softened, bleached, with dull iron staining on joints, tan bleaching in micas. Poor coring rock	Metasediment - fine-grained feldspathic schist, locally light grey quartzitic
110'–135'	Breaks @ chips to .4' pieces throughout	Chips through-out	45°, 50°, 45°	Moderately weathered rock, somewhat bleached, Vuggy along foliation planes, Some light rusty staining Not a strong rock inherently	Fine-grained, light grey feldspathic schist - Fairly evenly foliated rock
135'–155'	Breaks @ chips to .8' pieces	CHIPS	50°, 50°	Moderately to slightly weathered rock. Rock become fairly fresh	Feldspathic schist - locally interlayered with 1/4" quartzite beds
155'–160'	Chips to .6' pieces	CHIPS	55°	Rock is fairly fresh, minor rust on partings	Feldspathic schist, light grey, fine grained.
160'					160' Bottom of Hole

PROJECT SEABROOK STATION

DDH B-19 PAGE 1 of 1

HOLE LOCATION

ELEVATION

BEARING

INCLINATION

DEPTH 67.0'

Logged By: J. R. Rand 7/10/72

CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
		Foliation Dip		47' Top of Rock
Rock Broken @ Chips to .3' pieces	OCCA-SIONALLY VUGGY	Rock is slightly weathered, dis-colored through-out, minor staining on joints and partings		Metasedimentary Rock Feldspathic (quartzitic?) schist. Foliation wavy, variable. Light-grey, fine-grained — Rock breaks both on foliation and across core.
				67' Bottom of Hole

0' 10' 20' 30' 40' 50' 60' 70'

PROJECT SEABROOK STATION

DDH B-20 PAGE 1 of 1

HOLE LOCATION

ELEVATION

BEARING

INCLINATION

DEPTH 100 ft

Logged By: J. R. Rand 7/11/72

Depth	CONDITION OF CORE		DIP	DESCRIPTIVE NOTES
20'–34'				34' Top of Rock
34'–53'	CHIPS TO .4' pieces throughout	Rock is moderately to severely weathered throughout, bleached to light tannish grey. soft, crumbly. No appreciable rusty staining	50°	Predominantly metasediment. Quartzitic to feldspathic Schist, fine-grained (bleached due to weathering), locally interlayered with bleached decomposed coarse-grained diorite(?). Welded fault in quartz
53'–67'		Rock has little strength	50°	TRANSITIONAL (INTRUSIVE) CONTACT. Diorite, coarse-grained porphyritic Bleached to light tannish grey, locally layered,
67'–89'	Breaks @ Chips to .5' pieces throughout	CHIPS Rock is moderately weathered, breaks on and across foliation. No rust, but dull powdery stain on joints. CHIPS CHIPS	45°, 50°	Gradational into feldspathic, quartzitic schist, light-grey fine to medium fine grained
89'–100'	Breaks @chips to .6' pieces	CHIPS CHIPS Rock appears slightly weathered. Some bleaching of feldspars. very minor rust on parting	50°, 50°	Metasediment - feldspathic schist, fairly fine-grained, evenly foliated. light to medium grey micas locally discolored to tan brown
100'				100' Bottom of Hole

DDH 3-21 PAGE 1 of 2

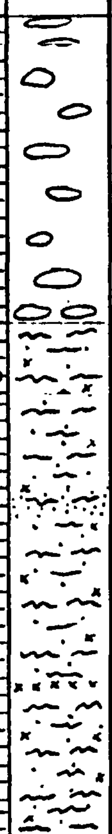
PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 150.0'

Logged By: J. R. Rand 7/11/72 7/12/72

Depth	CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0					
10'					
20'					
30'				32'	
30'–50'	Note: Smooth or polished surfaces seen on occasional joint planes. Not characteristic of whole rock.				Boulder zone: mixed diorite, granite and dark-grey massive quartzite boulders
50'					50' Base of Boulders - Top of Rock
50'–65'	Breaks @ Chips to .5' pieces	CHIPS; HIPS; SLICKENSIDES; HIPS. Rock is slightly weathered, some rusty staining on joints and partings, minor solution effects	40°; 50°	Quartzitic	Schist - feldspathic, locally quartzitic. Light-grey, fine-grained evenly foliated rock
65'–80'	Chips to 1' pieces	CHIPS; CHIPS; CHIPS. Rock is fairly fresh throughout minor powdery stains on partings. Minor slickensides on joints	50°	Feldspathic	Schist - quartzitic Fine-grained, light grey evenly foliated.
80'					



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PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 150.0'

Logged By: J. R. Rand 7/12/72

Depth	CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
70'					
80'–90'	Breaks @ chips to .2' pieces throughout	CHIPS; CHIPS; CHIPS. Rock is fairly fresh but poor drilling — Parts on both joints and partings. Local minor rust staining	55°; 45°		Schist, feldspathic as below
100'–110'	Breaks @ chips to .6' pieces throughout	CHIPS; CHIPS; CHIPS; CHIPS. Rock is fairly fresh throughout locally subject to Rosty staining on joints and partings	55°; 50°		Schist, feldspathic, may be quartzitic locally. Fine-grained, light grey Evenly Foliated
120'–130'	Breaks @ Chips to .8' pieces	CHIPS; CHIPS; STAINED SLICKENSIDES; CHIPS. Rock is fairly fresh throughout, subject to light staining on joints and partings. Some joints show slickensides covered with powder coating	45°; 50°	feldspathic; feldspathic	Schist, feldspathic, light grey, fine grained. Local feldspar stringers. Rock is evenly foliated. Quartzitic/Feldspathic
140'	Breaks @ Chips to .6' pieces	CHIPS. Rock is fresh, minor staining on joints, breaks on both joints and partings	50°		Feldspathic schist, light-medium-grey, fine grained, Evenly Foliated rock
150'	Chips to .8' pieces	CHIPS. Rock is fairly fresh through out.	45°		
150'		Note: some minor polishing on joints — not characteristically fault slickensides			150' Bottom of Hole

DDH B-23 PAGE 1 of 2

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 176.0'

Logged By: J.R.Rand 7/12/72

CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
40'				
50'				50.2' Boulder zone: mixed diorite, diabase and grey massive quartzite boulders. Not much weathering
60'				
70'				67'
				76' Top of Rock
80' Breaks @ chips to .5' pieces	CHIPS; MODERATE WEATHERING; CHIPS; CHIPS; VUGS; CHIPS	Rock is slightly weathered, minor discoloration, local rusty staining and solution effects on joints and partings; 50°; 45°		Schist, feldspathic and quartzitic. Light-grey fine-grained, evenly foliated
90'				
100' Chips to .8' pieces	CHIPS	Rock is fairly fresh. Minor staining and minor local feldspar discoloration; 57°	FELDSPATHIC; FELDSPATHIC	Schist, feldspathic and quartzitic. Light-grey, fine-grained, evenly foliated
Chips to .7' pieces	4 CHIPS; CHIPS			
110'		55°		
120'				

PROJECT SEABROOK STATION

DDH B-23 PAGE 2 of 2

HOLE LOCATION

ELEVATION

BEARING

INCLINATION

DEPTH 176.0'

Logged By: J. R. Rand

Depth	CONDITION OF CORE		DIP	DESCRIPTIVE NOTES
100'–~115'				
~115'–135' (120', 130')	CHIPS, to .5' pieces; CHIPS; CHIPS; CHIPS; CHIPS, VUGGY; CHIPS	Rock is slightly weathered locally. Stain on joints. Occasional solution effects	55°; 58°	ELDSPATHIC; ELDSPATHIC; Schist - feldspathic, Quartzitic, light-grey, fine-grained, evenly foliated. (NO MOVEMENT ON DIABASE CONTACTS) 2. INTRUSIVE CONTACT. NO DISPLACEMENT EVIDENCE
135'–150' (140', 150')	Breaks @ Chips to .5' pieces; CHIPS, BLEACHED	Rock fairly fresh to slightly weathered. Rusty staining on some joints		Diabase - fine grained, Sub-black, phenocryst speckling. OCK IS BLEACHED (CHILLED ZONE ?) TO TAN. CONTACT DIPS 55° NORMAL TO SCHISTOCITY
150'–156'	CHIPS'	Slightly weathered in metasediment		NO DISPLACEMENT EVIDENCE ON CONTACT
156'–170' (160', 170')	Breaks @ Chips to .4' pieces; CHIPS; CHIPS; CHIPS	Rock is fairly fresh to slightly weathered. Some powdery staining on joints and partings. Some rust stains locally	50°; 45°	EGMATITE VEINLET; Schist - Quartzitic, Somewhat feldspathic, fine-grained, medium light-grey. Evenly foliated
170'–176'	.1' to .6' pieces	Rock is fresh		Diabase - fine grained dark-grey to black. Speckled phenocrysts.
176'				176' Bottom of Hole
180'				

DDH B-24 PAGE 1 of 2

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 121.0'

Logged By: J. R. Rand 1/7/1 2/7/1

Depth	Condition of Core	Dip	Graphic Log	Descriptive Notes
0–21'				21' Top of Rock
21'–41'	Breaks @ Chips to 1.4' pieces	SOFT, RUSTY, HIGHLY WEATHERED; RUST; CHIPS. Rock is moderately weathered throughout, locally severe weathering on joints: Rock fairly compact internally. High angle joints @ 1' to 4' intervals		Diorite, intermixed fine-grained, dark-grey massive and coorse-grained light grey. INE; REDOMINANTLY FINE GRAINED
41'–61'	Breaks @ Chips to 1.2' pieces	RUSTY; CHIPS, BLEACHED; CHIPS; SEVERE WEATHERING, RUST; RUSTY JOINT. Rock is moderately weathered throughout. Some feldspars bleached, discolored to tannish. Local Highly weathered rusty zones		Diorite, porphyritic, medium coarse-grained, medium dark-grey. Subject to narrow veining @ 6" to 1' intervals. Veins dip 55°-60°. All veins discolored tan by weathering. Rock is fairly compact, weathering not withstanding
61'–80'	Breaks @ Chips to 2' pieces	CHIPS, SOFT; CHIPS; SOFT, RUSTY. Rock is moderately weathered throughout. Feldspar veinlets discolored to tan. Some Solution effects. Vugs		Ditto as above. WELDED BRECCIA-TIGHT STRUCTURE WITH SURFACE WEATHERED EFFECTS

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 121.0'

Logged By: J. R. Rand 7/11/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
70'				
80'–97'	Breaks @ .3' to 1.5' pieces; RUSTY, WEATHERING	Rock is slightly to moderately weathered. Minor pitting; veinlets discolored to tan. Local rusty zones on joints		Intermixed fine-grained Dark-grey Diorite and light grey coarse-grained Diorite. Fine-grained rock type predominates. Rock discolored a little by weathering.
97'–110'	Breaks @ Chips to 1.5' pieces; CHIPS; CHIPS	Rock is slightly to moderately weathered. Minor pitting. Feldspar veinlets are discolored to tan. Rock not notably weak.	FINE; FINE; FINE	
110'–121'	Chips to 1.5' pieces; MODERATE WEATHERING, RUST; MODERATE WEATHERING, RUST	Rock is slightly to moderately weathered throughout. Feldspars discolored in veinlets. Local rusty zones on joints	FINE; FINE	Intermixed fine-and coarse-grained Diorite. High angles veining at 6" to 1' intervals. Rock is discolored by weathering. (SLIGHT TO MODERATE WEATHERING – COMPACT)

121' Bottom of Hole

130'

DDH B-26 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 23.0'

Logged By: J. R. Rand 7/11/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'				
3'				3' Top of Rock
	Breaks @ Chips to 2.5' pieces; CHIPS, RUSTY; CHIPS, RUSTY; CHIPS, RUSTY; CHIPS, RUSTY	Rock is fresh subject to local rusty staining on joints. High angle joints @ 5' intervals	FINE; FINE; FINE; FINE; FINE; FINE	Diorite - Fine-grained, dark-grey, intermixed with light-grey, coarse-grained granitic rock (Diorite?)
10'				
20'				
23'				23' Bottom of Hole
30'				

DDH B-28 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 23.7'

Logged By: J. R. Rand 7/12/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'			4' Top of Rock
Breaks @ Chips to .8' pieces; SANDSEAM; CHIPS, SOFT; SAND SEAM; CHIPS; CHIPS	Rock is slightly to moderately weathered throughout. Some rock De-composition, and heavy rust on high angle joints.	FINE ... FINE	DIABASE-(BOULDER?) Diorite - intermixed dark-grey, fine-grained and coarse grained, light grey. Rock is predominantly coarse-grained type.
10'			
20'			23.7' Bottom of Hole
30'	Note: Rock weathering and rust appears due to surface weathering. Between weathered zones rock is fairly fresh internally.		

DDH B-30 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 27.0'

Logged By: J. R. Rand 7/10/72

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG	DESCRIPTIVE NOTES
0'			FOLIATION ↓		7' Top of Rock
10'	Breaks @ .1' to 2' pieces	50° joint 30° joint	Rock is fresh, only local rusty staining on joints. Mostly 60° Low angle (30°) joints	x x x	Diorite, medium grey, medium coarse-grained, locally with foliated grey granite zones.
20'	1' to 1.5' pieces	30° joint	Rock is fresh. Biotite may be slightly weathered	x x x	Porphyritic Diorite, Biotite Spotting
30'					27' Bottom of Hole

DDH ʊ-31 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION

BEARING

INCLINATION

DEPTH 23.0'

Logged By: J. R. Rand 7/10/72

CONDITION OF CORE		DIP	GRAPHIC LOG		DESCRIPTIVE NOTES
0'					3' Top of Rock
Breaks @Chips to 1' pieces (10')	CHIPS / CHIPS / CHIPS	Rock is slightly weathered, subject to brown iron staining on joints @6" to 1' intervals		COARSE / COARSE / COARSE / COARSE	Diorite - intermixed dark-grey fine-grained and light-grey coarse-grained types. Coarser-grained rock tends to weather more than Fine-grained
.1' to .8' pieces (20')	RUSTY VERTICAL JOINT			FINE-GRAINED DIORITE	Porphyritic Diorite
(30')		Rock is fresh but rusty staining on joints to bottom. Biotite is slightly weathered to show rusty brown streak. No slickensides			23' Bottom OF Rock

DDH 6-35 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 41.6'

Logged By: J. R. Rand 7/10/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'				2.5' Top of Rock
10'	Rock Broken @ chips to 1' pieces	CHIPS, CHIPS, CHIPS, CHIPS	Rock is fresh internally. Iron and manganese staining on closely spaced joints	Diorite - fine-grained, medium-dark grey. Occasional small white phenocrysts
20'–30'	Breaks @ .2' to 1' intervals	25° joint, 50° joint, 60° joint (minor pyrite), MINOR RUST	Rock is fresh. Minor rusty staining locally on joints. Joints not slickensided	Generally fine-grained, medium-light grey Diorite with local zones of porphyritic Diorite
40'	.2' to 1.2' intervals			DRUSY QUARTZ AND CALCITE LINED VUG
				41.6' Bottom of Hole
50'				

DDH 8-37 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION

BEARING

INCLINATION

DEPTH 44.0'

Logged By: J. R. Rand 7/10/72

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG	DESCRIPTIVE NOTES
0'					
6'					6' Top of Rock
10'	Breaks @ chips to 1' pieces	CHIPS 70° joint	Rock is fresh Some slight weathering and iron staining on joints. Joints @30° dip @1'-4' intervals	COARSE	Diorite - medium fine-grained medium dark-grey, massive
20'	Breaks @ Chips to 1' pieces	CHIPS MODERATE WEATHERING WITH RUSTY JOINTS 65° joint	Rock is generally fresh with thin rusty staining on joints.	PEGMATITE	Medium fine grained medium grey massive Diorite
30'		MINOR RUST 65° joint	Rock is fresh. No rust except as shown. No Slickenside		High angle joints @ about 1' intervals
40'	Breaks @ Chips to 1' pieces	CHIPS	Rock is fresh Not rusty on joints	PEGMATITE WITH GARNET, TOURMALINE(?) AND FINE SULPHIDE STRINGERS	
44'					44' Bottom of Hole
50'					

DDH 8-38 PAGE 1 of 2

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 152.5'

Logged By: J. R. Rand 7/10/72

Depth	CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'					2.3' Top of Rock
	Chips to .6' pieces	CHIPS	Rock is mostly fresh, with local moderately weathered zones adjacent to joints		Fine Grained medium grey diorite
10'	2' pieces	SLIGHT WEATHERING		FINE	Coarse grained Diorite, light grey with rare patches of fine-grained grey diorite
		SLIGHT WEATHERING	Rock is fresh except as noted		
20'	Broken in Chips to 3' pieces	CHIPS	Minor local rust on joints	FINE / FINE	Coarse grained rock appears a little later than the fine-grained rock
30'		CHIPS, RUSTY			
40'	Rock Breaks @.1' to 1.5' intervals		Rock is fresh Minor rust locally on joints	CONTACT 65°	DIABASE CUTS DIORITE o N INTRUSIVE CONTACT •
				CHILLED	Diabase, Dark grey, fine-grained with dark green phenocryst speckling and occasional patches of epidote
50'				DIORITE / CHILLED	
	Breaks @Chips to 1.2' pieces		Rock is fresh Very little staining on joints	CONTACT 60°-70°	Diorite - mixed coarse and fine grained rock
60'		CHIPS		CONTACT 60°	Diabase Dike
				CONTACT 65°	Diorite, Mixed coarse and fine grained rocks
70'					
80'					

DDM B-38 PAGE 2 of 2

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 152.5'

Logged By: J. R. Rand 7/10/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
70'–72.5'				
72.5'–90'	Breaks @.3' to 2' intervals. Rock is fresh. Only very minor slight staining on joints	50°	15' VEIN; RELICT BANDING AFTER META-SEDIMENTS; EGMATITE	Diorite, fine-grained, medium light grey, with local zones of Coarser-grained feldspathic rock
90'–105.2'	Breaks @.3' to 2' intervals. Rock is fresh. Minor locally rusty on some joints. RUSTY STAIN 105.2'			Medium-coarse grained Diorite
105.2'–125.2'	Breaks @.5' to 1.5' intervals. Rock is fresh throughout. Only occasional minor Staining on joints. 60° joint. Rock not closely jointed. No slickensides. RUSTED, PITTED, WEATHERED 125.2'			Diorite, massive dark grey medium-Fine grained with local zone of coarser-grained light grey porphylitic Diorite. Occasional feldspathic veining
125.2'–145.2'	Breaks @ Chips to 2' pieces. CHIPS, MINOR RUST. Rock is fresh. Minor rusty Staining on some joint surfaces.		COARSE; COARSE; COARSE	Diorite, dark grey, fine-grained, with occasional coarse grained light grey zones
145.2'–152.5'	Breaks @.4' to 2' pieces. Rock is fresh		COARSE	Predominantly fine-grained Diorite

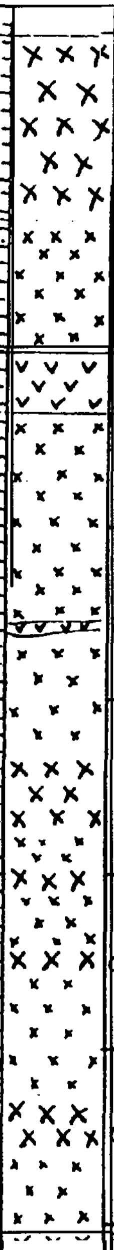
152.5' Bottom Of Hole

Depth scale: 70', 80', 90', 100', 110', 120', 130', 140', 150'

PROJECT SEABROOK	STATION	DDH B-39	PAGE 1 of 1
HOLE LOCATION		ELEVATION	
BEARING	INCLINATION	DEPTH 72′	
		Logged By: J. R. Rand 7/11/72	

Depth	CONDITION OF CORE	DIP	DESCRIPTIVE NOTES
0–1.5′			1.5′ Top of Rock -
1.5′–21′	Breaks @ chips to .8′ pieces; Chips; Chips; Chips; chips. Rock is slightly weathered, pitted with weak rust staining on joints. 60° to 70° joints @ 2′ intervals		Diorite - light grey coarse grained (to ~12′); Diorite - medium dark grey, fine grained, massive
21′–24′	Chips in Veg Rusty		pegmatite, quartz, feldspar with bull quartz in center
24′–40′	Breaks @ chips to 1.5′ pieces. Rock is fresh - only occasional very minor rust staining on joints		Diorite dark grey fine grained, as above; pegmatite veinlet
40′–54′	Breaks @ .1′ to 2′ pieces. Rock is fresh minor staining on joints		Diorite, Dark grey, fine grained, with occasional coarse-grained zones; coarse; coarse
54′–72′	Breaks @ chips to 3.5′ pieces; Chips; Slight weathering; Chips. Rock is fresh only minor rusty staining locally on joints slight weathering @ 64′ ~~as shown~~		Diorite dark grey, fine-grained, with occasional zones of intermixed light grey, coarse grained diorite; coarse; coarse
72′			~~coarse~~ Bottom of Hole

GRAPHIC LOG



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PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 66.5'

Logged By: J. R. Rand 7/11-12/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
			2.5' Top of Rock
Breaks @ chips to .8' pieces (chips; chips; chips)	Rock is slightly weathered, with local rusty staining on joints		Diorite - intermixed fine-grained, dark grey and coarse-grained light grey. fine-grained rock predominates
Breaks @ .1' to 3' pieces	Rock is fresh, not stained. Rock is fresh, locally weathered on joints(?) as		Diorite - mixed dark-grey fine-grained and light-grey coarse grained.
Breaks @ chips to .5' (Chips)	shown (Rusty		
SAND (SOFT SAND SEAM)	and some vug		
Breaks @ chips to 2.5' pieces (Chips/vuggy)	development adjacent to joints). Rock is fresh, minor staining on joints only		
Breaks @ .1' to 4' pieces (Driller breaks?)	Rock is fresh only very minor light rusty stains on some joints		Diorite (granitic) coarse grained, light grey speckled, massive
			Fine-grained Diorite
			Diorite, medium fine grained, light grey foliated
			66.5' Bottom of Hole

Depth scale: 10', 20', 30', 40', 50', 60', 70'

PROJECT SEABROOK STATION

DDH B-41 PAGE 1 OF 1

HOLE LOCATION

ELEVATION

BEARING

INCLINATION

DEPTH 67.5'

Logged By: J. R. Rand 7/11-12/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
			DIORITE BOULDERS
			6.9' Top of Rock
Breaks @ Chips to 2' pieces	Chips. Rock is fairly fresh, subject to rusty staining, some weakening on joints. Chips	FINE; fine	Diorite, mixed fine-grained dark-grey and coarse-grained light-grey. Coarse grained predominates
Breaks @ Chips to .8' pieces	vuggy, decomposed on 55° joints, severely weathered. Rock is fairly fresh internally, except as shown. Chips, rusty. joints (50°-70°) @ 1' to 4' intervals. Rusty	fine; fine; fine; Diorite; Fine	Diorite, mixed fine-grained dark-grey and coarse-grained light-grey types as shown
Breaks @ .1' to 1.5' pieces	Rock is fresh, only very minor rusty stains locally on joints. Chips. joints @ 30°-40°	Coarse; fine; Coarse; fine; Coarse	Diorite, mixed fine-grained dark-grey massive and coarse grained light grey
Breaks @ .3' to 1.8' pieces	Rock is fresh, No rust on joints	fine; fine	Mixed fine and coarse diorite
			67.5' Bottom of Hole

Depth scale: 0', 10', 20', 30', 40', 50', 60', 70'

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 164.4'

Logged By: J. R. Rand 7/10/72

Depth	CONDITION OF CORE		DIP	GRAPHIC LOG		DESCRIPTIVE NOTES
0'						
10'						
20'						
30'						
40'					Top of Rock 44'	
44'–55' (50')	Chips to .3' pieces		Moderately weathered bleached brecciated rock, Small bright green Specks. Appeas to be same rock as below		Breccia	Apparently a weathered Diorite(?) Locally shows fine angular (cemented) breccia texture
55'–70' (60')	Breaks @ .1' to .8' intervals	minor rusty stains on joints	Rock is fresh, with local minor weathering of feldspar phenocrysts. Joints show minor rusty staining. Jointing @ 1' intervals		Veining	Fine grained, massive, medium-grey, locally speckled diorite, with prominent feldspar quartz veining at high angles. Diabasic(?)
68'– (70')						Rock becomes diabasic, Dark-grey, fine-grained with dark green phenocrysts
80'						

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PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 164.4'

Logged By: J. R. Rand 7/10-11/72

Depth	CONDITION OF CORE		DIP	DESCRIPTIVE NOTES
60'				
70'	Chips to .4' pieces	Rock is minor weathered. Pock-marks where phenocrysts have weathered out		Diabase Dike (?)
		Chips		Chill zone (?) aphantic
80'		Chips	65° contact	Diorite (?) light grey (bleached)
		Rock is slightly to moderately weathered bleached, not slickensided on joints	70°	Shear zone - welded, high angle with micro displacements. Rock is compact, breaks across core and not notably on high angle shear planes.
				Shear
90'	Chips to .7' pieces	Chips. Slight to moderate weathering, bleaching, some feldspars to tan. Fairly compact rock.	55°	Rock locally foliated (Relict schistosity) maybe feldspathized meta sediment.
		Chips		
100'	Rock breaks @.4' to .8' pieces	Rock is bleached to medium-brown, phenocrysts weathered to light tan		Chill zone. Diabase, fine-grained, dark grey, with dark green phenocryst (small). Only very minor veining
110'		No High Angle Joints. Rock becomes fresh, and phenocrysts return to normal dark-green color. Minor rusty stains on some joints		Diabase
120'	Rock breaks @.4' to .6' pieces	Rock is fairly fresh		
130'		BLEACHED CHILL ZONE, SILICIFICATION		Chill zone. Welded breccia in Diabase chill
		Chips	70°	Silicified contact
		Rock appears fairly fresh. Minor stains on joints	40°	Metasedimentary rock, Quartzitic schist, minor feldspathization
		Chips	50°	
140'		139.3'		

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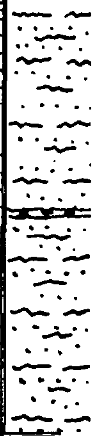
PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 164.4′

Logged BY: J. R. Rand

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
130′			
139.3′			
140′ .1′ to .8′ pieces	Rock slightly weathered 55°		
Broken @ Chips to .4′ pieces (150′)	Rock is slightly weathered through-out minor bleaching, rusty staining or powdering on joints. Diabase bleached to brown		Impure quartzite schist, feldspathization (minor)
			Diabase, aphanitic
			Fine grained, light grey rock
160′ .5′ to 1.3′ pieces	No slickensides; pyrite on joint 55°		
			164.4′ Bottom of Hole
170′			



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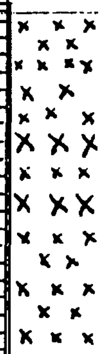
PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 28.5'

Logged By: J. R. Rand 7/11/72

CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
Rock breaks @ .1' to 2' pieces	minor rusty; 75° joint; Chips	Rock is fresh. Very minor (calcite?) coating on some joints. Mostly not rusty.		3.5' Top of Rock. Diorite, mixed fine-grained, dark-grey and coarse-grained light-grey. Rock is predominantly fine-grained diorite. 28.5' Bottom of Hole

0

10'

20'

30'

DDH DI-1 PAGE 1 of 2

PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION

BEARING

INCLINATION

DEPTH 124'

Logged By: J. R. Rand 12/11/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0 – 10'			
			TOP OF ROCK 18'
20' CHIPS	most joints low angle at 20°-30°; 60° Jt.; 50° Jt. - minor slicks - chlorite	Rock is fairly fresh throughout - locally minor softened on joint surfaces	Diorite, fine-grained Dark grey, massive - closely joined at 3" to 1' intervals joints have slickenside-like smearing with chlorite development = slippery
CHIPS			
30' CHIPS	80°-90° Jt. with slicks, chlorite dev't. high angle curved joints - chlorite dev't. throughout on joints		
CHIPS		Rock is fairly fresh but locally shows vug development on joints and in [illegible]	Diorite, fine-grained. Dark grey as above massive
40'	(Driller) vugs		
50'	(Driller) vugs		
	Core Breaks at 6" to 2' intervals on lowangle joints @ 20°-30° dips	ROCK IS FRESH	Diorite, fine-grained, Dark grey, massive - locally speckled with whitish, rounded pheno crysts
60' – 70'			
			DIABASE DIKE
80'			

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 124'

Logged By: J. R. Rand 12/11/72

DEPTH	CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
70'	Low Angle joints form core breaks	Rock is fresh		+ + +	Diabase dike
80'			80°		77.4' 80° intrusive, chilled tight contact
				x x x	Quartz diorite, fine grained, medium grey
		Chlorite development	55°	x x Δ Δ	May be a faulted contact (?)
		70° vein, filled		x x	Rock becomes medium-coarse grained
90'		Joints are low angle; 65° joint. Rock is fresh, except at 97.6' to 98.8' where softened on fault zone.		x x	Quartz diorite, intermixed coarse- and fine rock types.
100'		Chips; 45° joint; 60° joints. Zone is soft but not apparently open.	45°	Δ Δ Δ	97.6' Apparent fault zone, softened by weathering but not rusty or slickensided. 45° dip
110'	Core breaks on wide-spaced joints	Rock is fresh. Driller breaks. Breaks on low angle joints as shown. No rust. Joints are low angle at 20° average dip. Joints show minor pyrite smear.		x x	Quartz diorite, massive texture, medium coarse grained, not foliated, medium grey.
120'		Driller breaks		x x	
					124' Bottom of Hole
130'					

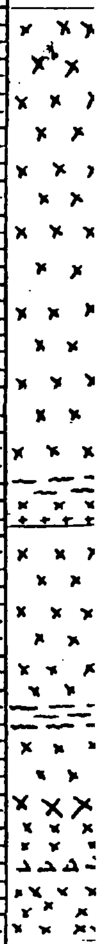
DDH DI-3 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 65.5'

Logged By: J. R. Rand 12/11/72

Depth	CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'					
10'					11' Top of Rock
11'–30'		Most joints are 20°-30° dips. Chips. Chips, 85° joint. Rock is fresh. Minor rusty stains locally on joints			Quartz diorite, fine grained dark grey. Locally with irregular foliation.
30'–42'	Breaks @ Chips to .8' pieces	85°-90° joint. 70° joint, flat, not smooth. 85°-90° joint, pyrite. Chips. Rock is fresh, No rust on joints. Joints show frequent pyrite coatings. Rock chips in area of high biotite or chlorite content.			Quartz diorite, as above. [h]igh chlorite content. [Ve]ry fine-grained, possible diabase dike
42'–65.5'	Break @ .4' to 1' pieces	Vuggy vein, not open. 65° joint on foliation. Joints are 20°-30° dips @ 1'-2' intervals. 70° joint, smooth. 70°-90° joint with chlorite. 65° joint. Rock is fresh, not rusty on joints. Rock is fresh, joints locally slippery due to chlorite, not slickensided.	50°, 75°		Quartz diorite, predominantly fine-grained, medium grey. Foliated. Foliation varies in dip and strike. [B]iotite knots. [C]oarser grained. [W]elded breccia, tight, 75° foliation
65.5'					65.5' Bottom of Hole
70'					

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PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 169'

Logged By: J. R. Rand 11/24/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'–16.5'				16.5' Top of Rock
16.5'–30'	Breaks @ .1' to 1' pieces on low angle joints	65° joint; vuggy; most joints dip 35°-45° of various strikes. Some joints show slickenside effect. Rock is fresh, not rusty on joints. Minor Vuggy @ 23'-24'	Coarse; Fine	Quartz diorite, predominantly fine-grained, medium-dark-grey, massive texture
30'–47'	Core Broken on joints @ chips to .6' pieces	chips; Chips; Most joints @ 30°-40° dips @ close intervals from .1' to .6' apart. Rock is fresh; Very minor dusty coatings on joints, but not rusty. Joints frequently show slickensides or smeared chlorite	Intrusion breccia-welded	Quartz diorite, fine grained, medium dark grey, fairly massive but locally shows vague foliation texture. Narrow Veinlets sometimes show minor vuggy solution effects
47'–63'	Core is extensively broken into sliver-like chips. incipient slickensides?	65° joint shear attitude. Higher chlorite content. Rock is fairly fresh, but is softened by close-spaced shearing? Some minor vuggy openings, No rust	Becomes Coarser-grained	Quartz diorite, medium-coarse-grained. Rock is extensively broken in possible shear zone. Rock is inherently slippery due to chlorite. Minor stains but not Rusty.
63'–73'	Core Broken @ .1' to .3' pieces. Minor light rust stains locally	Chips. Rock is fresh, Minor vuggy on high-angle joints. Most such joints are not open - welded. 73' Base of vugs in Rock		Diorite, fine-grained dark grey locally with medium coarse grained quartz-diorite
73'–80'		Rock is fresh, not vuggy		

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 169'

Logged By: J. R. Rand 11/24/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
70'				
80' – 90'	Core broken as shown	chips; 65° joint set, minor chlorite; 70° joint, minor crusting, no rust; some pyrite smear; 70° joint; irregular 70° joint	Rock is fresh throughout. No rust or weather stains. 50° contact	Medium coarse quartz diorite. Diorite, fine grained, dark grey. Local coarser grained zones
100' – 110'	Core broken as shown predominantly high angle joints	60° joint, minor coating, smooth; sub-vertical joint; 70° joint smooth, clean; 65° joint	Rock is fresh, minor manganese and pyrite smearing on some joints	Diorite, predominantly fine-grained, dark grey. Some minor local coarser-grained patches. Rock is fresh throughout
120' – 130'	Core broken as shown	70° joint, smooth, clean; 75° joint, smooth, clean; 70° joint	Rock is fresh, Core is broken closely on 30° joints and occasional 70°-75°. Some manganese and pyrite on joints. Sharp angular breaks. 65° foliation	Diorite, fine-grained, dark-grey. Quite massive texture with local foliation ghosts. Rock is fresh, closely jointed at .2' to 1' intervals at varying attitudes and bearings of dip
140' – 150'	Core broken as shown	45° joint, minor stains; 75° joint, clean	55° foliation. Rock is fresh throughout. 30° dippin joints are characteristic. Some manganese and pyrite staining on joints.	Diorite, fine grained, dark grey, locally vaguely foliated. Rock is fresh, not weathered throughout.

DDH D1-4 PAGE 3 of 3

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 169'

Logged By: J. R. Rand 11/24/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
140'				
150'	Core Broken as shown. Breaks @ .1' to .8' intervals. thin pyrite smears; 60° joint, clean; Chips on some joints. Rock is fresh. Locally joint surfaces are slippery with chlorite development. Most breaks in core on 25° to 30° low angle joints. No Rust or weather staining	55°	x x x	Quartz diorite, medium grey, medium coarse grained.
160'			x x x	Fine grained, dark grey, massive diorite
167.3'				INTRUSIVE CONTACT
			x x x	Quartz diorite, medium coarse grained
170'				- 169' Bottom

DDH DI-5 PAGE 1 oi

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH- 65.3'

Logged By: J. R. Rand 12/13/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'				
10'				Boulder- Quartz diorite, micaceous, foliated
				15.3' Top of Rock
20'	Core is broken @ chips to 1' pieces on low-and high-angle joints	Rusty; 70° joint, rusty. Rock is fresh Minor rusty staining on joints. 50°	× × ×	Predominantly fine-grained: Quartz diorite, mixture of coarse and fine grained rock types
		70° joint, rusty, vuggy. At 25'-27' rock is subjected to vuggy solution effects.	X X X	Predominantly coarse-grained
30'	Core breaks @ chips to .3' pieces on low- and high-angle joints	75° joint; 70° joint; 65° joints. Rock is fresh, Prominent rust formation on joints. Joints occur at .1' to .3' intervals	+ +	High angle (70°-75°) intrusive contact, welded. Diabase dike, dark grey to sub-black, fine grained, massive with pyrite specks and knots. Rock closely jointed at various strikes and dips. Low angle (10°-30°) joints predominate.
40'		80°-90° joint, chlorite smeared; moderate weathering, heavy rust; 70° joint, rusty	+ +	
50'	Core breaks @ .1' to 2' pieces on 20°-30° low angle joints	rusty; 75° joint, rust coated. Rock is fresh. Rusty coatings on low angle and high angle joints at widespread intervals as shown.	+ +	Diabase dike, as above, massive, sub-black, fine grained rock.
60'		75° joint, rust coated	+ +	
				65.3' Bottom of Hole
70'				

DDH DI-6 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING ' INCLINATION DEPTH 33.0'

Logged By: J. R. Rand 12/13/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'			
10'			3.0' Top of Rock
Core Breaks on 30° joints @6" to 2' intervals; Rusty; Rusty	Rock is fresh, Joints normally are clean, but locally have rusty coating as shown. Joints dip 30° to 40°. No high angle joints.	x x x	Quartz diorite, medium grained, medium-dark greenish grey, speckled texture, massive.
20'			
30'; Rusty		x x x	Transitional Contact; Quartz diorite, coarse grained light grey
			3.0' Bottom of Hole
40'			

DDH D1-7 PAGE 1 of 2

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 118.7'

Logged By: J. R. Rand 12/12/72

CONDITION	I OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'–15.4'				15.4' Top of Rock
Broken @.1' to 2' pieces	Most joints @20°-30° dips; 80° joint, clean; 70° joint; 80°-90° curved joint; 60° joint	Rock is fresh, no rust on joints. Low angle (20°-30°) joints @ 1' to 2' intervals. High angle joints @ 1' to 4' intervals @ Various orientations	medium Coarse / Fine ↓	Quartz diorite, predominantly fine grained, medium grey, locally, with high angle (70°-85°) foliation texture.
Breaks @.1' to 2' pieces	curved joint 70°-90°, Pyrite; 60°-70° joints on foliation	Rock is fresh. Joints tend to lie on foliation planes, but also cross-cut foliation planes. Pyrite on joints		Quartz diorite, fine-grained, foliated. Jointing frequently follows biotite concentrations along foliation planes. Also cross-cuts foliation at 30°-40° dips.
Breaks @.2' to 2' pieces	80° joint; 60° joints; joints @ 50°-60° dips	Rock is fresh. Joints follow both high-angle foliation and 30°-40° low angle variable joint patterns. No rust. Pyrite on some joints.		Quartz diorite, as above. Fine-grained foliated at 60°-80° dips

Depth scale: 0', 10', 20', 30', 40', 50', 60', 70', 80'

DDH DI-7 PAGE 2 of 2

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 118.7′

Logged By: J. R. Rand 12/12/72

Depth	CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
70′–90′	Breaks @.2′ to 2′ pieces	80° joint; 65° joint	45°. Rock is fresh. Joints @ 6″ to 2′ intervals @ 30°-40° dips. Occasional high-angle joints		Quartz diorite, fine-grained, medium-grey, foliated. Foliation @ 45° to 70° dips. Rock parts on biotite foliations and across foliation at various attitudes
90′–110′		80° joint; 85° joint; Chips, not rusty	Rock is fresh. Joints @ 10°-30° plus high angle. At 105′-106.5′ Rock is weakened on joint/foliation. Not rusty, but may be moderately weathered		Quartz diorite, fine-grained, locally foliated, medium-grey
110′–118.7′	Breaks @ 1′ to 2′ pieces	55° joint	Rock is fresh, breaks on 30°-40° joints @ 1′ to 3′ intervals		Fine-grained, only weakly foliated to massive texture
118.7′					118.7′ Bottom Of Hole

DDH D1-8 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 29.5

Logged By: J. R. Rand 12/11/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'			
			9' Top of Rock
10' Core Broken into Chips; CHIPS →; 20' CHIPS →	30° dipping joints @ 3"-6" intervals, slightly rusty; 70° joints, rusty; Joints not rusty, pyrite smeared. Rock is fairly fresh, rather highly jointed, which causes considerable chipping of core. Rock locally rusty on joints as shown	x x x	Quartz diorite, predominantly medium-fine-grained, locally foliated. Medium-grey color. Some minor vug development to about 20' depth. Foliation is very steep to vertical.
30'			29.5' Bottom of Hole

DDH D1-4 PAGE 1 OF 1

PROJECT SEABROOK STATION

HOLE LOCATJON

ELEVATION

BEARING INCLINATION DEPTH

Logged By: J. R. Rand 12/13/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'				1.5' Top of Rock
10'	Breaks @ .1' to 2' pieces on 30°-40° joints	70° joint, rusty; Rusty	Rock is fresh. Breaks on 30°-40° dipping joints @ .3' to 1' intervals	Quartz diorite. Mixed fine-grained dark-grey micaceous rock in coarse-grained lighter grey matrix. Rock is foliated. Layering @ 60° dip anitic texture, foliated
20'	.3' to 1.6' pieces	Rusty	Rock is fresh. Locally rusty staining on some joints.	Porphyritic quartz diorite, as at bottom of hole D2-4
				4.5' Bottom of Hole
30'				

DDH DI-10 | PAGE 1 of 2

PROJECT SEABROOK | STATION

HOLE LOCATION | ELEVATION

BEARING | INCLINATION | DEPTH

Logged By: J. R. Rand 12/12/72

Depth	CONDITION OF CORE	DIP		DESCRIPTIVE NOTES
0'–12'				Boulders
12'				12' Top of Rock
12'–28'	Broken @ Chips to 1' pieces	65° joint; 60°-70° joints; Chips; 80° joint	Rock is fresh. Rusty staining on some joints, not on all joints. Rock breaks normally on 30°-40° dipping joints @ 1' intervals	Quartz diorite, medium-coarse grained, light medium grey. Locally foliated @ High angle (60°-70°) dips.
~28'–30'				VERY FINE GRAINED ROCK — Relict quartzite layer, partially recrystallized by diorite (?)
30'–48'	Breaks @ .3' to 2' intervals on 30°-40° joints	Rusty joint; 60°-90° joint with pyrite	Rock is fresh. No rust on joints. High angle joints infrequent. Most breaks on 30°-40° joints	Quartz diorite, medium-coarse grained, medium light grey. Locally some foliation @ steep dips. Finer grained near top of section.
48'–67'	Breaks @ .2' to 1.5' intervals	70°-90° joint with pyrite; Smooth 60° joint with pyrite	Rock is fresh. Not rusty on joints. Most joints are @ 30° dips, not smooth. Some pyrite coatings on high angle joints	Finer grained
67'–83'	Breaks @ .3' to 3' intervals	65° joint	Rock is fresh, not rusty on joints. Most breaks on low-angle 20°-30° joints.	Finer grained; Quartz diorite, fine-grained medium grey, foliated. Foliation is steep, 60°-90° and wavy

DDH DI-10 PAGE 2 of 2

PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION

BEARING

INCLINATION

DEPTH 112′

Logged By: J. R. Rand 12/12/72

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG	DESCRIPTIVE NOTES	
80′						
	Breaks @ Chips to 1′ pieces; chips ↗	Broken on smooth 85°-90° joint	Rock is fresh. Breaks on low angle (10°-30°) joints		very fine-grained rock, massive, welded	Quartz diorite, fine-grained, medium-grey, foliated
90′			High angle (85°-90°) joint set @ 90′ depth has pyrite coating			
100′						Becomes coarse-grained rock
	Breaks @ .1′ to .6′ pieces throughout	70°-90° rough joint	High angle joints are curved, have chlorite or biotite smooth surfaces with pyrite			
110′					112′ Bottom of Hole	
120′						

PROJECT SEABROOK	STATION	DDH D1-11	PAGE 1 of 1
HOLE LOCATION		ELEVATION	
BEARING	INCLINATION	DEPTH 65.5′	
		Logged By: J. R. Rand 12/12/72	

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG	DESCRIPTIVE NOTES
0′–12.5′				12.5′ Top of Rock	
12.5′–33′	Broken @ Chips to .6′ pieces throughout	85° joint; Joints are mostly low-angle @ 10°-30° dips	Rock is slightly weathered to 15′. Rock is fresh, with minor rusty stains on joints locally to 18.7′. Pyrite coatings on joints below 18.7′	Coarser grained; Finer ↓	Quartz diorite. Predominantly fine-medium grained, medium-grey with local foliation textures. Foliation @ 80° or steeper
33′–53′	Breaks @ .2′ to 1.5′ pieces	85° joint; 85° joint; 70° joint	Rock is fresh. Breaks mostly on 10°-30° Low angle joints @ 1′-2′ intervals	Coarser dark-greenish diorite	
53′–65.5′	Breaks @ .3′ to 2′ pieces		Rock is fresh. Joints @ 30°-40° dips @ 1′ to 2′ intervals	Coarser dark-greenish	Quartz diorite, predominantly fine-grained, not notably foliated. Local zones of coarser grained, dark greenish diorite.
65.5′				65.5′ Bottom of Hole	

Depth scale: 0′, 10′, 20′, 30′, 40′, 50′, 60′, 70′

DDH D1-12 PAGE 1 of 1

PROTECT SEABRCOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 29.5'

Logged By: J R. Rand 2/13/72

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG	DESCRIPTIVE NOTES
0'					
10'	Rock **Breaks** @.3' to 1' pieces	Joints @ 30°-40° dips throughout	Rock is fresh. Minor rusty staining on some joints		1.5' Top of Rock icaceous: Quartz diorite, fine grained, quite micaceous (biotite) in zones and knots, enclosed in coarse-grained quartz diorite matrix.
20'	Breaks @.1' pieces	Rusty, slight weathering on joints	Rock is fresh, subject to minor weathering and rusty staining on joints.		icaceous rock: Micaceous rock type is not apparently metasedimentary. Has rather massive texture
	.5' to 1.3' pieces	65° joint	Rock is Fresh, Not Rusty		
30'					29.5' Bottom of Hole

DDH D2-1 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 31.0'

Logged By: J. R. Rand 12/12/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'				
				Boulders - quartz diorite
10'				11' Top of Rock
	Rock Breaks @.1' to 1.5' pieces on low angle (30°) joints	85° joint Rock is moderately weathered, rusty, vuggy		Quartz diorite, predominantly fine-grained medium grey, with occasional zones of coarser-grained, light-medium-grey matrix.
20'		Rock is fresh, minor rusty staining on some joints		
		.2' severe weathering, soft		Rock becomes a little Coarser grained
30'	.1' to 1.4' pcs.	MINOR RUST ON ONE JOINT		
				31' Bottom of Hole
40'				

DDH D2-3 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 60.0'

Logged By: J. R. Rand

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVC NOTES
0'–25.2'				25.2' Top of Rock
25.2'–39.5'	Core breaks on joints @ Chips to .5' pieces; CHIPS	Chips, minor rust; 65° joint, rusty; Rusty 60° joint; RUSTY. Rock is slightly weathered to about 31'. Fresh below 31'. Joints show local rust coatings and some slight rock weathering.		[D]IABASE DIKE, WELDED CONTACTS DIP 60°. Quartz diorite, fairly coarse-grained, medium-grey micaceous. 5° intrusive contact, welded
39.5'–41.5'	Core Breaks @ Chips to 1' pieces	Chips, minor rust. Most joints @30°-40° dips. 65° joint. Rock is fairly fresh to fresh. Some dusty coating on joints. Feldspars a little discolored		Diabase dike, sub-black, fine-grained. 5° intrusive contact, welded
41.5'–51.5'				Quartz diorite, predominantly coarse-grained. [Q]UARTZITE INCLUSION(?). 5° intrusive contact, welded
51.5'–60.0'	Chips to 3.3' piece	Chips, minor rust. Rock is fresh. 60° joint, powder coating		Diabase dike, sub-black, fine grained, crystalline. [M]edium-[f]ine-grained. [C]hill zone at base - Near a contact (?)
60.0'				[6]0.0' Bottom of Hole

DDH D-2-4 PAGE 1 of 3

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 171.0'

Logged By: J. R. Rand 11/24/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'				
10'				
20'				· 21.5' Top of Rock
21.5'–35'	Core is Broken @ places Shown in "Condition" Column	Rock is fresh, not weathered. 30° joint, smooth, clean, no rust. 65° foliation. 30° joint, no rust. 30° joint, clean. Rock parts on 30° dip. Very thin veinlets. No slickensides		Fine grained. Quartz diorite, medium-grey, medium-coarse-grained, with local fine-grained dark grey diorite zones as shown. Rock is predominantly finer-grained diorite. Fresh, crystalline
30'				
35'–54'	Breaks in Core as Shown	Slight bleaching. Rock is strong. 60° foliation		Mixed coarse and fine diorite. Fine-grained
40'				
50'		30° dip on veinlets in Breccia zone		52.1' to 53.5' is welded, healed, solid breccia zone
54'–72'		Rock is fresh, as above. Core breaks are characteristically @ 30° dip attitudes		Diorite, as above, mixed coarse-grained light grey quartz diorite matrix, enclosing fine-grained, dark grey diorite inclusions.
60'				
70'				
72'–90'	Breaks in Core as Shown	Driller break. Rock is fresh, as above. Tends to part on 30° dipping joints, or very thin 30° veinlets		Fine. Rock becomes predominantly coarse-grained, with relatively small zones of fine-grained diorite.
80'				

DDH D2-4 PAGE 2 of 3

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH

Logged By: J. R. Rand 11/24/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
80'				
88.2' – 90'	Breaks in Core as Shown	Driller breaks; 60° joint, clean	Rock is fresh, as above. No rust or staining. Drills well throughout.	Quartz diorite, as above, predominantly coarse-grained medium grey, with occasional patches of fine-grained, dark grey diorite.
100'			ine / ine	
110'	Breaks in Core as shown	Driller break; 30° joints; 65° joint, clean	No slickensides on joints. 60° foliation	ine
120'	Breaks in Core as Shown	Driller break; Driller break; 45° joint	Breaks in core as shown are commonly on 30° dipping joints. 60° foliation. Joints are clean, not slickensided, and do not dip uniformly in one direction.	- Fine; ine. Quartz diorite, as above, predominantly coarse-grained.
130'				
140'			Rock is fresh, as above.	Fine-grained diorite. Fine-grained diorite
150'				60° veinlets, welded microfault, tight; Coarse
153.0'				INTRUSIVE CONTACT, IRREGULAR AT 65° DIP
		Driller break		Porphyritic quartz diorite, Coarse grained, massive texture, medium grey with slight greenish tings.
160'				

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 171'

Logged By: J. R. Rand 11/24/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
150'				
160'–170'	Core Broken as shown	Rock is fresh, not weathered	x x x x x x x x x x x x	Porphyritic quartz-diorite, massive, coarse-grained, medium-grey.
171'				Bottom Of Hole
180'				

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 65.0'

Logged By: J. R. Rand 12/11/72

Depth	CONDITION OF CORE		DIP	DESCRIPTIVE NOTES
10'–19'				Boulder zone in overburden. fine-grained diorite
19.0'				19.0' Top of Rock
20'–31'	Rock Breaks @.3' to 2' intervals on low angle joints	Joints are low-angle @20°-30° Rock is fresh immediately below bedrock Surface.	65°, 60°	Quartz diorite, intermixed coarse- and fine-grained rock types. Locally foliated at high angle dips as shown.
31'–50'	Rock Breaks @.3' to 2' intervals on low-angle joints	Joints are predominantly low angle @20°-30° Rock is fresh throughout.	60°	ine; uartz vein; Fine
50'–65'	Rock Breaks @1' to 3' intervals	Rock is fresh. Slight weathering @57.0'; ← slight rust on open foliation plane	60°	Fine-grained quartz diorite, medium grey, massive, pepper-salt texture; oarse
65'				65' Bottom of Hole

DDH D2-7 PAGE 1 of 2

PROJECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 125'

Logged By: J. R. Rand 12/11/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES

0'

10'

20'

25' Top

Diabase dike, very fine-grained, very dark grey to sub black

Rock is fresh, only minor staining locally on joints

70° joint

30'

30° contact, intrusive, welded

CHIPS

JOINTS AT 20° TO 40° DIPS AT 3" TO 1' INTERVALS

Quartz diorite, medium coarse-grained with fine-grained diorite inclusions

40'

10° contact, welded, intrusive

CHIPS

ROCK IS MODERATELY WEATHERED, SOFTENED ON JOINTS

Diabase dike, very fine-grained sub black green olivine speckled

Core is broken to chips through-out

Rock does not appear highly weathered, but is apparently weakened somewhat, drills very poorly

50'

IABASE DIKE

Quartz diorite, medium-coarse grained with local bands of finer grained diorite giving a broad foliated effect.

INER GRAINED

Steeply dipping foliation as shown.

60'

Core is broken on low angle 20° to 30° joints

Rock is fresh

← MINOR VUGS ON JOINTS

70° JOINT MINOR RUST

70'

65° intrusive contact

Diabase dike, very fine-grained sub black with local white speckling

80'

DDH D2- 7 PAGE 2 of 2

PROTECT SEABROOK STATION

HOLE LOCATION ELEVATION

BEARING INCLINATION DEPTH 125.0'

Logged By: J. R. Rand 12/11/72

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG / DESCRIPTIVE NOTES
70'–80'				
~77'–92'	Breaks @.1' to 1.5' pieces on low-angle joints	MOST JOINTS @ 20° TO 50° DIPS, @.3' TO 1' INTERVALS; 85° TO 90° JOINT	Rock is fresh. Not rusty on joints. Some pyrite coatings on joints	DARK MICACEOUS ROCK NOT METASEDIMENTARY. Quartz diorite, predominantly micaceous (chloritic) fine-grained, dark-greenish grey
~92'–109'	Broken on low angle joints @.5' to 1' intervals	JOINTS ARE CLEAN, LOW ANGLE @ 20° TO 30°; 85° JOINT CALCITE FILLED NO SLICKENSIDES	Rock is fresh through-out	Quartz diorite, medium-coarse-grained, medium grey. locally intermixed with fine-grained diorite near top of section.
~109'–125'	Good drilling Breaks @ wide intervals	CLEAN LOW ANGLE JOINTS; DRILLER	Rock is fresh through-out	Quartz diorite, intermixed coarse and fine grained rock types
125'				125' Bottom of Hole,

Depth scale: 70', 80', 90', 100', 110', 120', 130'

DDH E1-1 PAGE 1 of 2

PROJECT SEABROOK STATION

HOLE LOCATION Center of Unit #1 ELEVATION 23.9'

BEARING INCLINATION DEPTH 150.1'

Logged By: J. R. Rand 12/26/72

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG	DESCRIPTIVE NOTES
					NO OVERBURDEN
0'					0.0' Top of Rock
0'–22'	Core Breaks on low angle (30°) joints @ Chips to 1' intervals	Rusty; 70° joint even; Chips-Rusty; 70° joint CHIPS, RUSTY MODERATE WEATHERING MINOR VUGGY; CHIPS, RUSTY	Rock is fresh. Locally affected by slight to moderate weathering on joints as shown. Most joints dip about 30° at .3' to 1' intervals	x x x	Quartz diorite, medium fine grained, medium grey. Massive texture (not notably foliated). Locally intruded by pegmatite veinlets as shown. PEGMATITE VEINLET, 65° DIP; PEGMATITE VEINLET, 75° DIP; PEGMATITE VEINLET
22'–41'	Breaks on low angle joints @ .5' to 1.5' intervals	60° joint minor rust; 65° joint slight weathering; 65° joint clean minor rust	Rock is fresh. Slight weathering to minor rusty coatings on some joints. Joints are normally clean. Not Rusty	x x x	Quartz diorite, as above, Massive, medium fine grained, medium grey.
41'–61'	Breaks @ .5' to 2' pieces	70° joint, minor rust; 70° joint, rough; slight weathering; ½' moderately weathered	Rock is fresh. Low angle joints @ 30° to 35° dips. Joints not rusty except as shown	x x x	Quartz diorite as above. Massive medium fine grained, medium grey, low angle (30° to 35°) joints @ .5' to 2' intervals
61'–80'	Breaks @ .3' to 3' pieces	Slight weathering; Slightly weathered, rusty; 70° joint, rusty moderately weathered on joint plane; 60° joint slightly weathered, rusty	Rock is fresh. Slight to moderate weathering, rust on occasional joints as shown	x x x / X X	Rock becomes coarse-grained Quartz diorite @ 72.6' depth. 50° dip on intrusive, welded contact. COARSE GRAINED. Low angle joints dip 30° to 40° @ .5' to 3' intervals

Depth scale: 0', 10', 20', 30', 40', 50', 60', 70'

DDH E-1-1 PAGE 2 of 2

PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION 28.9'

BEARING INCLINATION DEPTH 150.1'

Logged By: J. R. Rand 12/26/72

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG	DESCRIPTIVE NOTES
70'					
80'	Breaks @ wide spaces @ .5' to 3' pieces	60° joint set minor rust; slightly weathered	Rock is fresh. Low angle joints @ wide intervals, up to 3' apart. Minor rust and slight to moderate weathering localized on high angle joints.	FINE GRAINED	Quartz diorite, mixed fine grained dark grey patches in coarse grained lighter grey matrix. Become fine grained below 87.5'
90'	Breaks @ .5' to 3' pieces	60° joint, minor rust; .1' Heavy rust, severely weathered 50° dip	Rock is fresh, joints are clean, 0.1' of soft severely weathered zone @ 95.0' to 95.4' depth	COARSE GRAINED; FINE GRAINED	Low angle joints @ 30° to 40° dips @ .5' to 3' intervals. 50° Foliation
100'				70° Contact TIGHT WELDED WITH CHILL ZONE	Diabase Dike, very fine grained, sub-black, dark olivine speckling
110'	Breaks @ chips to .8' pieces	vertical joint clean; 65° joints rusty	Rock is fresh, locally rusty on joints. 119.7' to 120.8' is severely weathered zone. Soft, rusty, Rock in place but decomposed zone dips 45°	65° CONTACT, TIGHT, WELDED, WITH CHILL ZONE	Quartz diorite, medium-fine-grained medium grey. Fairly massive texture
120'	WEATHERED →	Severe weathering on foliation for 1.1' of core; minor rust vuggy; 60° joint			
130'	Breaks @ .1' to 3.5' pieces	70° joint clean	Low angle joints @ about 30° dips. Rock is fresh, not rusty on joints. Joints @ 30°		
140'	Breaks @ .3' to 1.6' pieces	55° joint clean	Rock is fresh, No rust on joints.	COARSE	Low angle joints @ 1' to 2' intervals. Rock Drills well
150'					150.1' Bottom of Hole

DDH E1-2 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION 20.450 N 79.500 E ELEVATION 21.4'

BEARING INCLINATION DEPTH

Logged **By:** J. R. Rand 12/27/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
			7.2' Top of Rock
Breaks @.1' to 2.2' pieces	Rusty 70° Jts, minor **rust**	Rock is fresh - minor rusty stains on joints to 14' depth - Low angle joints dip about 30° throughout	Quartz diorite, mixed fine-grained, dark grey and coarse-grained light grey matrix rock - por phy ritic toward base
			Porphyritic
			27.2' Bottom of Hole

0

10'

20'

30'

40'

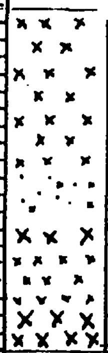
DDH Et - 3 PAGE I of I

PROJECT SEABROOK STATION

HOLE LOCATION Site #2 - 79,350 E 20,400 N ELEVATION 15.2'

BEARING INCLINATION DEPTH

Logged By: J. R. Rand 12/27/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
			22' Top of Rock
Breaks @ Chips to .5' pieces throughout; 60° Joint clean; 55° Joint clean	Rock is Fresh Low angle joints (30° Dip) @ .2'-.5' intervals joints are clean, not rusty		Quartz diorite, predom. fine grained Dark greenish grey, with coarse grained porphyritic texture near base - bleached zone 31.5'-34.5' is not soft. Contacts trasitional. Bleached light tannish grey
			42' Bottom of Hole

Depth scale: 0, 10', 20', 30', 40', 50

PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION 20.2′

BEARING

INCLINATION

DEPTH

Logged By: J. R. Rand 12/27/72

Depth	CONDITION OF CORE		DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0					
5′				Boulders	5′ Top of rock
5′–25′	CHIPS Breaks @.2′ to 2.5′ pieces	CHIPS RUSTY 70°-90° ROUGH Jt. 50° Jt., Clean	Rock is fresh below 7′ depth - Some minor rust on some joints - low angle joints dip @ 30°-45° at various orientations		Quartz Diorite, mixed fine-grained dark grey and coarse grained light grey matrix - locally foliated at 55°-60° Dips
25′–47′	Breaks @.3′ to 2.2′ pieces	minor rust 70° Jt., on foliation - slight weathered, rusty minor rust on Jt.	Rock is fresh - minor rusty staining on some joints, as noted Low angle joints dip 30° @ .5′ to 2′ intervals	Pegmatite veinlet Finer grained	Quartz Diorite, mixed fine- and coarse-grained types foliated - foliation dips 30°-50° variable

Depth scale: 0, 10′, 20′, 30′, 40′, 50′, 60′

DDI-I E1-4 PAGE 2 of 3

PROJECT SEABROOK STATION

HOLE LOCATION 20.300 N 79.700 E ELEVATION 20.2'

BEARING INCLINATION DEPTH

Logged By: J. R. Rand 12/26/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
Breaks at Chips to 1' pieces; Rock bleached Slight weathered; minor rust; CHIPS 65° Jt. - clean; 80° Jt. - rough, rusty; 65° Jt.	Rock is fresh - most low angle joints are clean - occasional minor rust as shown; 60°	x x x - FINE GRAINED; FOLIATION 60°	Quartz diorite - mixed fine-grained, dark grey rock in medium-coarse grained, light grey matrix - locally foliated

0
10'
20'
30'
40'
50'
60'
70'

DDH E 1-4 PAGE 3 of 3

PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION 20 2'

BEARING INCLINATION DEPTH

Logged By: J. R. Rand 12/26/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
60'				
70'	Breaks @ .5' to 2' pieces	Low-angle jts. @ 35°-40° DIP	Rock is fresh-good drilling-No high angle joints-35°-40° joints @ 1'-2' intervals-joints are not rusty	Quartz diorite, foliated, mixed fine grained dark-grey and medium-coarse lighter grey matrix - foliation 50°-60° dip
80'			Fine grained	
90'	Breaks @ .3' to 1.5' pieces		Rock is fresh-not rusty on joints-low angle joints dip 10° 30°	Quartz diorite, fine-grained to 98'. Predominantl Coarse-grained below.
100'		Rough uneven 65° Jt.		
				05' Bottom o f Hole
110'				

DDH E1-5 PAGE 1 of 2

PROJECT SEABROOK STATION

HOLE LOCATION 20.300 N 79.550 E ELEVATION 16.0'

BEARING INCLINATION DEPTH

Logged By: J. R. Rand 12/26/72

Depth	CONDITION OF CORE	DIP	DESCRIPTIVE NOTES
0'–8'			8' Top of Rock
8'–26'	CHIPS; Break @ chips to 1' pieces	60°-70° Joints rusty; CHIPS; 70° Joint rusty; 55° Joint Clean; Rusty Chips. Rock is fairly fresh internally - rusty coatings on joint planes - rock moderately weathered to 1.5' - most joints Dip 50° or steeper	Quartz diorite — mixed fine grained, dark grey and lighter grey as shown
26'–46'	Rock breaks in Rusty Chips to 35.8'; Rock breaks in .1' to 1.5' pieces	MOD. WEATHERED; 35.8'; 60° joint clean. Rock is fairly Fresh internally - high angle joints are rust coated - locally moderate weathering of rock in joint zones. Rock is frech - low angle joints @ 35°-40° @ various oreintations	Quartz diorite, mixed fine grained, dark grey and coarse grained. Lighter grey matrix - 35°-40° low angle joints @ .5' to 1' intervals
46'–65'	Breaks @ .1' to 2' pieces	60° Joint set rusty; 75° smooth Clean joint. Rock is fresh - joints are clean - low angle joints (15°-35° Dips) are @ 1' to 4' intervals	Quartz diorite, mixed fine grained, dark grey and coarse-grained lighter grey rock types. Rock is only vaguely foliated - predominantly coaser grained matrix rock

GRAPHIC LOG

10' 20' 30' 40' 50' 60' 70' 80'

DDH E1-5 PAGE 2 of 2

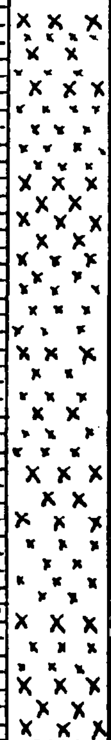
PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION 16.0'

BEARING INCLINATION DEPTH

Logged By: J. R. Rand 12/26/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
50' – 60'				
~65' – 82'	Breaks @.3' to 1.5' pieces; 70° rough joint clean	Rock is fresh low angle joints @25° to 40° @ .5' to 2' intervals		Quartz diorite - mixed fine grained, dark grey and coarse grained lighter grey matrix.
~82' – 98'	Breaks @.1' to 1.2' pieces; 50° joint on foliation; 60° joint; 65° joint	Rock is fresh low angle joints @5°-30°, most 5°-10° dips		Quartz diorite, mixed fine-and coarse-grained rock types
~98' – 108'	Breaks @.3' to 4' pieces	Rock is fresh low angle joints clean, dip 5°-30° (average 5°-10°) No Rust		Quartz diorite, mixed fine-grained and coarse grained as shown
108'				108' Bottom of hole
110' – 120'				

DDH E1-6 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION 20.300 N 79.400 E ELEVATION

BEARING INCLINATION DEPTH

Loggea By: J. R. Rand 12/27/72

CONDITION OF CORE		DIP		GRAPHIC LOG	DESCRIPTIVE NOTES
					4'-Top of Rock
Core breaks @ chips to .8' pieces		70° joint Chips Rusty Chips 70° joint Chips slight weathering Rusty 55° joint Rusty	Rock is essentially fresh - locally slightly weathered on joints, minor rust - low angle joints dip 30° occur @ .2' to 1' intervals		Quartz diorite, mixed fine-grained, dark grey and coarse-grained light grey matrix
					pegmatite veinlet
					24' bottom of hole

Depth scale: 0, 10', 20', 30', 40'

PROJECT SEABROOK STATION DDH E2-1 PAGE 1 of 2

HOLE LOCATION ELEVATION 15.9′

BEARING INCLINATION **DEPTH** 159.2′

Logged By: J. R. Rand 12/12/72

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0′–10′				9′ top of Rock
10′–30′	60° joint; 85° joint minor rust; 80° joint minor rust; 70° joint clean	Rock is fresh throughout – minor rusty staining on joint surfaces to about 18′ depth	x x x	Quartz Diorite – medium-fine grained, medium grey. Vague foliation @ high angle (80°± DIP)
30′–50′	60° joint; 65° joint; 65° joint; 70° joint	Rock is fresh breaks on 30°-40° joints with a few 60°-70° joints. Not rusty on joints	x x x	Quartz Diorite, as above – foliation more prominant @ 50°-70° Dips but variable in direction. Finer grained medium-dark grey diorite patches enclosed in medium fine-grained matrix
50′–67′	70° joint pyrite smear; DRILLER; 70° joint pyrite smear	Rock is fresh, no rust. Rock breaks on 30°-40° joints @ 6″ to 12″ intervals good drilling	x x x	Quartz diorite, as above. Becoming a little coarser-grained with depth. Less obviously foliated, more massive texture.
67′–85′	70°-75° joint; 65° joint; 65° joint; 65° joint smooth	Rock is fresh. High angle jointing becoming more closely spaced @ 2′-4′ intervals in hole – joints are wavy but smooth. Pyrite coatings	x x x	Quartz diorite, as above, becomes finer grained, foliated – some tendacy to break along smooth foliation planes.

DDH E2-1 PAGE 2 of 2

PROJECT SEABROOK STATION

HOLE LOCATION

ELEVATION 15.9'

BEARING INCLINATION DEPTH 159.2'

Logged By: J. R. Rand

Depth	CONDITION OF CORE	DIP		GRAPHIC LOG		DESCRIPTIVE NOTES
80'						
90'	Most breaks in core @ 30°-40° dips; SOFT	70° jt.; Core ground in soft zone; Slickenside	Rock is fresh – high angle smooth wavy jointing is closely spaced – frequently on foliation planes but cross-cutting foliation also – pyrite coating on joint planes – Some joints are slickenside	x x x		Quartz diorite medium-fine grained, medium grey, foliated
				△ △ △	HIGH ANGLE FABRIC 70°-90° DIPS	WELDED FAULT ZONE – PRESENCE OF BIOTITE ON ZONE MAKES IT WEAK, DIFFICULT TO DRILL – NO RUST OR GOUGE – PYRITE ON SLIP PLANE
				△ △ △	Breccia-welded	
100'		70°-90° smooth jt.		x x x		
110'	Most breaks @ 30° dips	70° jt. smooth; CHIPS – soft Coreground; 65° jt. Smooth	Rock is fresh – tends to break up on drilling in zones where Biotite rich – local slickenside striations on joints – joints run @ various orientations	△ △ △ //////	Breccia Welded	Quartz diorite as above. Rock is generally foliated and high angle joints with smooth surfaces tend to occur along foliation
120'	High angle joints on weak zone; CHIPS; CHIPS	Apparent fault zone polished slickenside in Biotite – rock soft not rusty, no gouge; Slickenside		//////	FAULT-WELDED	Quartz diorite, fine grained, medium grey, locally with foliation @ 45°-60°, usually steep foliation – in apparent fault zone @ 122'-123.5', rock is polished with slickenside @ various angles
130'	Most breaks @ 30°-45° dips	85°-90° jt.	Slickenside zone does not appear open or subject to groundwater movement	x x x		
140'	Breaks on low angle (45°) joints @ 6" to 2' intervals		Rock is fresh – some joints show smearing or slickensides – joints commonly @ 45° dip on foliation planes	x x x		Quartz diorite, fine grained, medium-dark grey – resembles "granitized" meta-quartzite – well foliated throughout @ 40°-60° dips. Rock parts (joints) on foliation were somewhat micaceous
150'				x x x		
	.3' to 1' intervals		Rock is Fresh	60° △ △ △ / 50° x x x	welded breccia	Quartz diotite – coarser grained – foliated @ 50°
160'						159.2' Bottom of hole

DDH E2-2 PAGE 1 of 1

PROJECT SEABROOK STATION

HOLE LOCATION 20.355 N 79.275 E ELEVATION

BEARING INCLINATION DEPTH

Logged By: J. R. Rand 12/26/72

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'			
10'			12.5' Top of Rock
Breaks in core @.1' to 1' pieces; LOST; 20' 85° joint	Rock is fresh, not rusty on joints. Some minor powdery coating on some joints. Low angle joints @ 20°-30° dips	x x x	Quartz diorite, medium-fine grained, medium-grey, massive texture — locally minor porphyritic, 20°-30° low angle joints @ .2'-.5' intervals
30' CHIPS; 65° joint		x x x	
			32.5' Bottom of Hole
40'			

DDH F-IA PAGE 1 of 2

PROJECT SEABROOK NUCLEAR STATION

HOLE LOCATION Hampton Harbor ELEVATION

BEARING vertical INCLINATION DEPTH 143 10

Wx = weathered, wrathering Logged By: J.R. Rand 5 '16 '73

CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
0'			UNCONSOLIDATED OVERBURDEN
10' INDIVIDUAL BREAKS IN CORE SHOWN BY CROSS LINES			
			15' TOP OF ROCK
BOX 1 15'-36'	Rusty joint-70°; Slightly weathered; Rusty slight to moderate weathering on joints; 75° rough joint, clean; Rusty joint; slight ... weathering, rust on 10° joint	ROCK IS ESSENTIALLY FRESH, WITH MINOR RUSTY COATINGS ON PARTINGS, AND LOCALLY SLIGHT TO MODERATE WEATHERING ADJACENT TO JOINTS	Fine / Fine	QUARTZ DIORITE, INTERMIXED FINE-GRAINED DARK GREY DIORITE ENCLOSED IN MATRIX OF MEDIUM-COARSE GRAINED LIGHT GREY QUARTZ DIORITE. LOCALLY FOLIATED. FOLIATION AT ABOUT 45° DIP NEAR TOP, GOING TO 50° AS SHOWN
BOX 2 36'-54'	Minor rusty; Minor rusty; 7 ' d continuous core broken by driller for storage; Minor rusty; Minor rusty	ROCK IS FRESH - MINOR RUSTY SEAMS ON PARTINGS AS SHOWN	Fine / Fine / Fine	WELDED OR FUSED CONTACTS THROUGHOUT
BOX 3 54'-74'	30° joints - minor rusty; 60° Rough joint - Minor rusty	ROCK IS FRESH - MINOR RUSTY STAINING LOCALLY AS SHOWN ON JOINT SURFACES	Garnets / Garnets	AMPHIBOLITIC - MASSIVE, MEDIUM - COARSE, DARK GREENISH GREY CRYSTALLINE. QUARTZ DIORITE, DARK GREY FINE-GRAINED DIORITE IN MEDIUM COARSE LIGHT GREY QUARTZ DIORITE MATRIX
80'			

Depth scale: 0', 10', 20', 30', 40', 50', 60', 70', 80'

JUNE 1973

PROJECT SEABROOK NUCLEAR STATION

HOLE LOCATION ______ ELEVATION ______

BEARING ______ INCLINATION ______ DEPTH ______

Logged By : J.R.Rand 5/16/73

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
70′				
80′	BOX 4 74′-94′; Minor rust; Slight rock weathering; ROCK IS FRESH, WITH SOME MINOR RUSTY STAINING AS SHOWN; Minor rust stain			QUARTZ DIORITE AS ABOVE, GRADING TO MEDIUM GRAINED SUB-MASSIVE QUARTZ-DIORITE WITH SCATTERED FELDSPAR SPECKLING LOCALLY IS SLIGHTLY FOLIATED
90′				
100′	Box 5 94′-114′; Rough 70° joint; Minor rust; ROCK IS FRESH			COARSE GRAINED SUB-MASSIVE QUARTZ DIORITE, FELDSPAR SPECKLING BECOMES PROMINENT
110′	Driller break; Minor rust; 112′ Smooth Rusty Chips-rusty; SLIGHT ROCK WEATHERING. MINOR VUGGY TEXTURE			QUARTZ DIORITE, INTERMIXED FINE DIORITE IN MEDIUM-COARSE QUARTZ DIORITE MATRIX
120′	Box 6 114′-133′10″; Chips; ROCK IS NOTABLY VUGGY: BREAKS ON CHLORITE-RICH HIGH ANGLE PARTINGS; ① 124.5′		Pegmatite	ROCK APPEARS CHLORITE-RICH, AND IS WEAKENED BY JOINTING AND MODERATE WEATHERING
130′	Minor rusty; ROCK IS FRESH; 60° joint		Fine	QUARTZ DIORITE, INTERMIXED FINE DIORITE AND MEDIUM-COARSE QUARTZ DIORITE MATRIX
140′	Box 7 133′10″ 143′10″; Minor rusty stain; Slight vug development on joint			TENDS TO MEDIUM-FINE GRAINED ROCK TOWARDS BASE
			143′10″	BOTTOM OF HOLE
150′	① SAMPLES FOR PHYSICAL TESTING: GEOTECHNICAL ENGINEERS INC. 5/23/73			

JUNE 1973

PROJECT SEABROOK NUCLEAR STATION

HOLE LOCATION Hampton Harbor ELEVATION

BEARING Vertical INCLINATION DEPTH 264 5

Logged By: J.R. Rand 5/14/73

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
130'	NOTE: CROSS-HATCH MARKS IN "CONDITION" COLUMN EQUAL MEASURED BREAKS, JOINTS OR PARTINGS IN CORE			UNCONSOLIDATED OVERBURDEN
				138' TOP OF ROCK
140'	Box 1 138'-158'	ROCK ESSENTIALLY FRESH FROM TOP DOWN. HIGH ANGLE JOINTS AND LOW ANGLE PARTINGS SHOW MINOR RUSTY STAINING. GENERALLY SHOW STRIATED SURFACES BUT ARE NOT POLISHED. PYRITE COATINGS ON STRIATED SURFACES ARE NOT POLISHED		SCHIST, FELDSPATHIC, WITH DISSEMINATED BIOTITE VAGUELY FOLIATED SOMEWHAT MASSIVE MEDIUM-GRAINED TEXTURE. MEDIUM DARK GREY COLOR. MINERALS ARE NOT SUBJECT TO WEATHERING EFFECTS. FOLIATION SENSE IS AROUND 40° DIP
150'	at 50° to 75° Chips at 6"			ROCK BREAKS ACROSS FOLIATION. FOLIATION DIPS ABOUT 60°, BUT IS NOT PROMINENT EXCEPT LOCALLY.
160'	Box 2 158'-178.5'	ROCK IS ESSENTIALLY FRESH. MINOR LIGHT GREENISH-GREY POWDER COATING ON JOINTS AND PARTINGS. PARTINGS DIP ROUGHLY 30°, WHILE JOINTS DIP AT VARIOUS ORIENTATIONS AT 55° TO 70°		
170'	Chips; 35° Joint wavy			
180'	Box 3 178.5'-198.8'	ROCK IS ESSENTIALLY FRESH. TENDS TO PART FAIRLY EASILY ALONG STRIATED CHLORITE-COATED JOINTS. STRIATED SURFACES ARE RE-MINERALIZED AND DO NOT SUGGEST RECENT MOVEMENT. MINOR RUSTY COATINGS ON SOME PARTINGS		Garnets locally SCHIST, FELDSPATHIC, MEDIUM-GRAINED, SUB-MASSIVE TEXTURE, WITH LOCAL ZONES OF PROMINENT HIGH-ANGLE FOLIATION. STRIATED CHLORITE RICH JOINT SURFACES ARE COMMON AND ARE MODERATELY SLIPPERY.
190'	Chips-minor; Veggy			
200'				

JUNE 1374

DDH F-2

PROJECT SEABROOK NUCLEAR STATION

HOLE LOCATION ____ ELEVATION ____

BEARING ____ INCLINATION ____ DEPTH ____

Logged By: J.R. Rand 5/14/73

Depth	CONDITION OF CORE	DIP	GRAPHIC LOG	DESCRIPTIVE NOTES
190'				
200'	BOX 4 198.8'-216'	ROCK IS ESSENTIALLY FRESH. JOINTS HAVE MINOR STAINING AND PYRITE CRUSTS. JOINTS ARE STRIATED, WITH CHLORITE. PARTINGS DIP 30°-40°, ACROSS FOLIATION. JOINTS ARE NOT NOTABLY RUST-STAINED		SCHIST FELDSPATHIC, AS ABOVE. POSSIBLY A LITTLE COARSER-GRAINED THAN ABOVE.
210'				BECOMING MOTTLED WITH BIOTITE KNOTS AND MASSES ENCLOSED IN FELDSPATHIC MATRIX. CONTORTED FOLIATION. (META-VOLCANIC UNIT?)
220'	BOX 5 216'-236'	Chips ROCK IS FRESH. CHLORITE-RICH PARTINGS ARE SLIPPERY, BUT ARE COATED WITH PYRITE AND/OR POWDER AND DO NOT SHOW RECENT SLIPPAGE.		SCHIST, AS ABOVE, BECOMING MORE MORE BIOTITE-RICH, FINER-GRAINED BELOW 227.' HIGHLY CONTORTED FOLIATION, BUT RESISTANT TO BREAKING.
230'				
240'	BOX 6 236'-255'3"	Slickensides ROCK IS FRESH. JOINTS AND PARTINGS ARE LOCALLY QUITE SLIPPERY, STRIATED.	Pegmatite veinlet	SCHIST, FELDSPATHIC, BIOTITE-RICH, HIGHLY CONTORTED FOLIATION. MEDIUM-TO MEDIUM-FINE GRAINED, MEDIUM-DARK GREY. CHLORITE AND PYRITE ON JOINTS.
250'		Polished-pyrite smeared		
260'	BOX 7 255'3"-264'5"	Polished ROCK IS FRESH. PARTINGS ARE SLIPPERY.		
				264'5" BOTTOM OF HOLE
270'		① SAMPLES FOR PHYSICAL TESTING - GEOTECHNICAL ENGINEERS INC. 5/23/73		

JUNE 1973

BORING LOCATION N1831 INCLINATION Vertical BEARING ______ DATE START/FINISH June 8, 1973 / July 2, 1973

CASING ID 5 in. to 4 in. to 3 in. CORE SIZE 2-1/8 in. TOTAL DEPTH 339.6 ft DRILLED BY American Drilling and Boring, T. Paquette

GROUND EL (MSL) 16.9 ft DEPTH TO WATER/DATE 15.2 ft / July 2, 1973 LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL MSL ft	Depth ft	Sample No.	Type N and/or Rec.	Rate of Adv. min/ft	Water Content %	RQD Graphic	Pressure Test (gpm, psi, Computed k 10^{-4} cm/sec)	Strike, Dip (F = Foliation, J = Joint, C = contact, B = Bedding, S = Slickenside)	Core Breaks	Soil and Rock Descriptions (Weathering, defects, etc.; Type, texture, mineralogy, color, hardness, etc.)
16.9		A1								Brown fine to medium sand with gravel pieces up to 4" in size (Fill).
		A2								Light brown medium sand. Clean; uniform; subrounded grains
	10	S3	6							Similar to Sample A2, but brown.
0		S4	41							Light brown fine to medium sand. Clean; uniform.
	20	S5	69							Similar to Sample S4.
		S6	34							Light brown medium sand. Clean; uniform; subrounded grains; contains a trace of coarse sand and fine gravel.
	30	S7	52							Similar to Sample S6.
-20		S8	54							Similar to Sample S6.
	40	S9	57							Similar to Sample S6.
		S10	60							Gray fine to medium sand. Clean; uniform; subrounded grains with a trace of coarse sand.
	50	S11	74							Gray fine sand. Clean; uniform; contains one 10 mm size grave, and a feu black Silty sand layers 4 mm thick.
-40		S12	80							Similar to Sample S10, but contains a 15 mm thick layer of gray-brown silty sand having a slight organic odor.
	60	S13	58							Similar to Sample S10.
		S14	29							Similar to Sample S10, but gray-brown.
		S14A	15				TOP	OF CLAY		Gray fine to medium sand. Clean; uniform.
	70	S15	11		43.3					Gray silty clay. Soft; medium plasticity and sensitivity; contains several silt and silty fine sand layers up to 75 mm thick and one 20 mm thick black organic silt layer. Silt and fine sands layers give a very fast reaction to shaking test. s_u(tor) = 0.13-0.15 tsf 1)
-60		S16	1		48.2					Gray silty clay. Very soft to soft; medium to high plasticity; medium sensitivity; contains a few fine sand lenses up to 8 mm thick. s_u(tor) 0.10-0.13 tsf
	80	S17	0		41.9					Similar to Sample S16. s_u(tor) = 0.11 tsf
		S18	0		44.6					Similar to Sample S16. s_u(tor) = 0.16-0.18 tsf
	90	S19	0		36.8					Similar to Sample S16. s_u(tor) = 0.18 tsf
-80		S20	0		36.7					Similar to Sample S16. s_u(tor) = 0.19-0.21 tsf
	100	S21	0		34.3					Similar to Sample S16. s_u(tor) = 0.20 tsf
		S22	0		34.2					Similar to Sample S16. s_u(tor) = 0.17-0.19 tsf
	110	S23	0		28.8					Similar to Sample S16. s_u(tor) = 0.33-0.30 tsf
-100		S24	0		34.8					Similar to Sample S16. s_u(tor) = 0.19 tsf
	120	S25	0		30.9		TOP	OF TILL		Similar to Sample S16. s_u(tor) = 0.16-0.18 tsf. (Lost 20 cu. ft mud @ 125 ft)
		S26	102							Gray silty gravelly fine to medium sand. Widely graded; contains angular gravel pieces up to 35 mm in size. Possible till material. 128'10" May be top of rock.
	130	NX-1	100		0					Chips - moderate wx. May be boulder in till. 129'6" Roller bit, no recovery
							TOP	OF ROCK		135'4" Top of good rock.
-120		NX-2	97	4.1	67				D; Minor rust stain	Fairly fresh. Slight wx tendency in feldspars, and locally powdery on joints. Schist, gneissic. Medium to medium coarse grained, medium gray. Not prominently foliated. Feldspathic.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample; ▼ Groundwater
U - Undisturbed samples
S - Shelby tube; N - Denison
F - Fixed piston; P - Pitcher
O - Osterberg; G - GEI
D - Drilling break; k - Coefficient of permeability
wx - Weathered, weathering

NOTES

A - Auger sample

1) s_u(tor) = Shear strength measured with Torvane.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

United Engineers & Constructors Inc.

Date: October 4, 1973 Project 7286

PAGE 1 of 3 LOG OF BORING F4

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N18311, E88393; **INCLINATION** Vertical **BEARING** **DATE START/FINISH** June 8 1973 / July 2 1973

CASING ID 5 in. to 4 in. to 3 in. CORE SIZE 2-1/8 in. TOTAL DEPTH 329.6 ft DRILLED BY American Drilling and Boring, T. Paquette

GROUND EL (MSL) 16.8 ft DEPTH TO WATER/DATE 15.2 ft / July 2, 1973 LOGGED BY Soil - K. Polk; Rock - J. R. Rand

CONTINUED FROM PREVIOUS PAGE

Sample Type and NO.	N or Rec.	Rate of Adv. min/ft	Water content or RQD %
NX-3	106	2.6	64
NX-4	99	2.7	55
NX-5	100	2.4	43
NX-6	[illegible]	[illegible]	[illegible]
NX-7	93	5.4	25
NX-8	82	2.5	0
NX-9	110	4.5	0
NX-10	61	8.9	3
NX-11	63	5.8	0
NX-12	95	5.7	10
NX-13	102	3.4	42
NX-14	35	4.9	0
NX-15	74	5.5	0
NX-16	67	9.3	0
NX-17	50	8.0	0
NX-18	11	12.0	0
NX-19	7	12.0	0
NX-20	45	12.0	0
NX-21	70	10.7	9
NX-22	93	9.0	0
NX-23	100	7.3	0
NX-24	100	8.3	57
NX-25	42	7.0	0
NX-26	95	7.2	62
NX-27	96	8.3	17
NX-28	87	7.0	0
NX-29	67	6.0	0
NX-30	100	8.0	0
NX-31	87	9.0	16
NX-32	165	8.0	0
NX-33	100	5.2	30
NX-34	60	8.2	0
NX-35	59	7.7	14
NX-36	100	12.0	0
NX-37	67	12.0	0
NX-38	71	19.0	0

Depth scale (ft): 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 284. Elevation scale (ft, MSL): 140, 160, 180, 200, 220, 240, 260, 267.2.

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.)

Chips — No rusty staining. Most partings cut across foliation-dip 20°-35°. Many low-angle partings are smooth.

Chips-angular — Fairly fresh. May be slight wx of feldspars. Partings are powdery, but not rusty.

Dips NE?

Angular chips-zone of intersecting smooth even joints — Even joints intersect at about 90°

Rock slightly vuggy. — Becomes moderately weathered, vuggy.

170.6'

Chips; Extreme wx-sandy; Moderate-severe wx; Chips; Extreme wx; Chips-moderate to severe wx; Chips; Extreme wx-crumbles; Chips; Extreme wx-crumbly, earthy material, black; Earthy; Chips; Chips; Chips — Weathered, moderate to extreme wx at discontinuous intervals as shown. Not rusty. Extreme wx-decomposed to soft granular, unconsolidated. Rock crumbles at extreme wx; is sectile, soft at severe wx. Weathered throughout, moderate to extreme, but predominately severe to extreme, soft rock chips to crumbly decomposed earthy material.

Slightly to moderately wx.

Chips; Chips; about 5' of core lost; Extreme wx, soft, earthy material — Moderately to extremely wx-locally occurs as crumbly, earthy material, discontinuously separated by chips of moderately wx rock.

Extreme wx earthy; Chips-slightly to moderately wx; 1.5' core lost; Core lost-probably extreme wx; Extreme wx; Chips — Becomes less wx-slight to moderate wx. Some rusty stain on joints. Locally fresh internally, but subject to moderate wx on joints.

Extreme wx; Extreme wx; Chips; 10" core lost; Chips — Locally fresh internal, but subject to moderate to moderately severe wx on joints.

Chips-fairly fresh; Chips-moderately wx; Chips-internally slickensided; Severe wx; Chips-fairly fresh — Fairly fresh to slightly wx. Conchoidal slickensided surfaces locally. Chlorite concentrations(?)

Chips-internally slickensided on conchoidal surfaces — Fairly fresh internally, except locally goes to moderate to extreme wx.

(Type, texture, mineralogy, color, hardness, etc.)

As above gneissic schist. Medium grained, weakly foliated.

173' Approx contact depth-dip 45°. Extreme wx of diabase just below contact

Diabase. Dark gray, fine grained, with scattered dark green olivine specking. Olivine wx to tan speckling. Massive texture. Note Rock appears to be closely jointed, but does not show evidence of shearing. Joints frequently at 80°, suggesting 80° dip on dike

Quartz-feldspar veining

203'8" Fused contact, appears to be sub-vertical. Schist, gneissic, feldspathic medium to medium-coarse grained, medium gray, not sheared.

212.5' Quartz feldspar in contact zone (Actual contact not seen-may be a foot or two lower.)

Diabase. Dark gray to sub-black. Fine-grained. Apparently cut by closely-spaced high-angle joints. Not apparently broken by shearing

Diabase, as above. Fairly fresh. Olivines not discolored except locally.

Diabase. Locally has angular feldspathic inclusions.

Diabase. Dark gray, fine-grained. Olivine crystals fairly prominent.

STRIKE, DIP: F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample; Groundwater
U - Undisturbed samples
S - Shelby tube; N - Denison
F - Fixed piston; P - Pitcher
O - Osterberg; G - GEI
D - Drilling break; k - Coefficient of permeability
wx - Weathered, weathering

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers & constructors inc.

Date: October 4, 1973 **Project 7281**

PAGE 2 of 3 **LOG OF BORING F4**

BORING LOCATION N18311, E88393; INCLINATION Vertical BEARING ______ DATE START/FINISH June 8, 1973 / July 2, 1973

CASING ID 5 in. to 4 in. to 3 in. CORE SIZE 2-1/8 in. TOTAL DEPTH 329.6 ft DRILLED BY American Drilling and Boring T. Paquette

GROUND EL (MSL) 16.8 ft DEPTH TO WATER/DATE 11.2 ft / July 2, 1973 LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	PRESSURE TEST gpm psi	Computed 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
									CONTINUED FROM PREVIOUS PAGE	
87.2	284									
		NX-39	73	9.0	16				Extreme wx	Diabase, Dark gray, fine-grained, with small scattered dark green phenocrysts and scattered small white feldspathic phenocryst speckling.
	290	NX-40	76	6.7	42				Fairly fresh. Drills fairly well.	
280		NX-41	102	5.0	56					
	300	NX-42	90	5.4	73				Most breaks across core	
		NX-43	107	6.7	78				80° -polished slickensides. Fresh. Some minor powdering of feldspar phenocrysts. Minor powdering on joints.	
	310								60°-Chlorite coated-striated	
300		NX-44	100	4.7	94					
	320								Curved joint-highly chloritic, slickensided. Fresh. Drills well. Parts on chlorite-smeared, striated, slippery joints.	
		NX-45	98	5.0	97				75° Joint-chlorite smeared	
312.5	329.6									
						BOTTOM	OF BORING			

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
WX - Weathered, weathering

NOTES

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers & constructors inc
a subsidiary of Raytheon Company

Date: October 4 1973 Project 7299

PAGE 3 of 3 LOG OF BORING F4

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N16553, E90235: Offshore INCLINATION Vertical BEARING ______ DATE START/FINISH Nov. 10, 1973 / Nov. 14, 1973

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 243.6 ft DRILLED BY Warren George, Inc. P. Schaeble, J. Harris

GROUND EL (MSL) -9.1 ft DEPTH TO WATER/DATE Tidal ft / - LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	SAMPLE Type and No.	SAMPLE N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	PRESSURE TEST gpm / psi	Computed k 10^{-4} cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = contact, B = Bedding, S = Slickenside)
-9.1		S1	33		2) None			
		S2	51					
-20	10	S3	145					
		S4	67					
	20	S5	69					
		S6	65					
-38.0	28.0					TOP	OF TILL	
-40	30	S7	88/6"					
		S7A	87					
		S8	123					
-41.7	38.0					TOP	OF ROCK	
	40	NQ-1	83	0.0	1) 29			
		NQ-2	97	6.0	50			
-60	50	NQ-3	94	5.0	49			
		NQ-4	102	5.0	55			
	60	NQ-5	100	4.0	85			
-80	70	NQ-6	99	6.0	97			
	80	NQ-7	100	8.0	81			
		NQ-8	100	6.0	96			
-100	90	NQ-9	100	1.0	90			
	100	NQ-10	100	5.0	70			
-120	110	NQ-11	100	5.0	50			
		NQ-12	98	5.0	97			
	120	NQ-13	100	1.0	65			N63E, 62SE F; N32W, 40SW J; N70W, 38SW F
		NQ-14	100	5.0	83			N15W, 76NE S; N16W, 58NE J
-140	130	NQ-15	100	5.0	85	0.0 / 129.3	0.0	N21E, 35SE S
	x	NQ-16	100	5.0	100			
		NQ-17	75	5.0	0			
		NQ-18	98	6.0	88			N20W, 22NE J; N41W, 19NE J
	140	NQ-19	98	5.1	83			N20E, 28NW S
-152.9	143.8							

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

S1: Light gray fine sand. Uniform; clean.

S2: Gray medium to coarse sand. Uniform; clean; subangular to subrounded grains.

S3: Gray-brown gravelly sand. Widely graded; slightly silty; subangular to subrounded grains; contains several gravel pieces up to 25 mm in size.

S4: Similar to S3, but sand is mostly fine to medium grained.

S5: Light gray fine to medium sand. Uniform; clean.

S6: Similar to Sample S5.

S7: Brown silty sandy gravel. Widely graded; fines are nonplastic; angular to subangular grains; contains gravel pieces up to 30 mm in size.

S7A: Light gray gravelly very silty fine sand. Uniform; fines nonplastic; contains several angular gravel pieces up to 15 mm in size.

S8: Similar to Sample S7A, but contains gravel pieces up to 35 mm in size.

Rock:

- Minor wx; Talc; Pyrite — Hard, but is affected throughout by slight to moderate bleaching (presume hydrothermal). Joints show minor wx effects. Bleaching does not seem to degrade rock strength.
  - Diorite. Fine-grained.
  - 42.1' Fused contact dips 55°
  - Diabase. Greenish tan, bleached.
  - 45.8' Diorite. Fine-grained medium tannish-gray. Moderately bleached. Quartz diorite.
- 66.0' Fused intrusive contact
- D; Slight wx; D; D; Minor chlorite — Fresh and hard. Drills well. Only local and minor bleaching effects
  - Bleached Diabase. Bleached at top. Dark gray below.
  - 71.9' Fused contact dips about 68°
  - Diorite. Fine-grained, medium tannish gray. Some minor bleaching.
- Minor wx; Minor wx; Pyrite; Graphite(?)-dips 63°; Polished slickensides — Fresh and hard. Drills well. Minor surface wx effects on some partings.
  - Diorite (?) or feldspathized quartzite (?). Fine-grained, quartzose, prominent foliation showing high, but quite variable dips.
- Polished slickensides; D; Pyrite; Slickensided 35° joint - talc — Fresh and hard. Drills well. Some minor wx effects on joint surfaces.
  - Diorite. Quartzose and locally foliated. Fine-grained, medium gray. Local minor bleaching.
- 111.4' Contact dips about 25°
- D — Top 2.5' of diabase is bleached, hard.
  - Bleached Diabase. Fine-grained, grades to dark gray below bleached zone.
- 117.8'
- Minor wx; Slickensides; Conchoidal; Pyrite-slickensides — Fresh and hard. Drills well. Slickensides do not appear recent, are commonly on irregular, interlocking surfaces.
  - Diorite. Fine-grained, medium dark gray. Irregularly foliated throughout.
- Polished slickensides — Fresh and hard. Drills well. Joints and partings are locally slickensided - 144.5' slickensides. High polish.
  - Fused, welded breccia

LEGEND

- I" - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample
- U - Undisturbed samples
- Groundwater
- S - Shelby tube
- F - Fixed piston
- O - Osterberg
- N - Denison
- P - Pitcher
- G - GEI
- D - Drilling break
- wx - Weathered, weathering
- k - Coefficient of permeability

NOTES

1) - Roller bitted to 40.5 ft
2) - No clays present; therefore no water contents were determined.
3) - This is only partial list of dip and strike data.
- 300 lb. hammer used.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

United Engineers & Constructors Inc.

Date November 23, 1973 Project 7186

PAGE 2 1 of LOG OF BORING ADT 16

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N16553, E90235, Offshore INCLINATION Vertical BEARING ______ DATE START/FINISH Nov. 10, 1973 / Nov. 14, 1973

CASING ID 3 in. I-T/S in. ft TOTAL DEPTH 243.6 ft DRILLED BY warren George, Inc. ; P. Schaeble, J. Harris

GROUND EL (MSL) ft -9.1 DEPTH TO WATER/DATE Tidal ft / LOGGED BY Soil - K. Polk; Rock - J. E. Rand

CONTINUED FROM PREVIOUS PAGE

EL. MSL ft	Sample Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	RQD %	Pressure gpm / psi	Computed k 10^{-4} cm/sec	Strike / Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	Core Breaks
-152.9	143.8	NQ-		5.1	70			N81E, 35SE J	
-160	150	NQ-		4.1	97	0.0 / 149.3	0.0	N42W, 30NE J; N 5W, 76NE S; N 0E, 44NE J	
		NQ-	100	6.1	88				
	160	NQ-		5.1	94			N78W, 60SW; N26E, 71NW F	Pyrite
		NQ-		5.1	100			N80W, 78NE F; N15W, 52SW J	
-180	170	NQ-		5.1	69			N73W, 68SW S; N20E, 70SE C	
		NQ-	100	5.1	100	0.6 / 168.3	0.04	N30W, 40NE J	
	180	NQ-		6.1	87			N82W, 48NE F; N73W, 30NE J; N21W, 49NE	
		NQ-		4.1	61			N55E, 50NW C	Slickensides - Apparently welded; Slickensides
-200	190	NQ-		5.1	60	.45 / 139.0	0.03	N88E, 34NW S	Pyrite slickensides
		NQ-3	99	5.1	90			N15E, 72SE S; N20E, 35SE J; N20E, 64NW J	
	200	NQ-3	100	6.0	66			N58E, 46NW J; N75E, 27SE J; N88E, 44NW S	Pyrite; Bleached; Moderate wx
		NQ-3	97	5.0	60			N12E, 55NW J; N57E, 12NW S	Moderate wx
-220	210	NQ-3	100	5.0	67	.30 / 215.6	0.02	N75E, J; N64W, 64NE S	Highly polished smooth slickensides, dip 66
		NQ-3	100	5.0	82			N10E, J; N16E,	Highly polished slickensides
	220	NQ-3	100	5.1	67			N32E, 32SE S; N41W, 35NE J	Slight wx; D
		NQ-3	100	5.8	93			N57E, 86NW J	D
-240	230	NQ-3	100	5.6	52	.15 / 217.8	0.01	N44W, 74SW S; N90E, 35S J	Slight wx; Talc
		NQ-3	96	5.0	91			N45E, 42NW J	
	240	NQ-3	100	5.0	100			N23E, 76SE C	
-252.7	243.6								

BOTTOM OF BORING

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

- Fresh and hard. Drills well. Only very minor wx effects on joints and Partings. — **Diorite.** Fine-grained, medium dark gray. Irregularly foliated throughout. Diabase.
- 166.8' Diabase. Unbleached. 168.9' Intrusive contact dips 50°. 170.3' Diabase. Bleached tan. Fine-grained. Hard. Diorite 173.8' Fused contact dips 80°. — Fresh and hard. Drills well. Diabase is tan-bleached, but adjacent diorite is not bleached. Shart contacts.
- **Diorite.** Fine-grained, medium gray.
- 183.5' Irregular fused intrusive contact. Fine / Coarse. Diabase. Tan (bleached throughout). — Moderately to severely wx. Softened Locally. weak.
- X High angle, fused fault (?) Contact.
- Fused breccia. Quartzite (?) Thinly foliated, variable dips. Fine-grained, medium gray. — Fresh and hard. Local slickensided zones appear to be old. Related to folding.
- Quartzite, as above. Well foliated.
- 202.0' Fused feldspathized contact. Tan aphanitic rock-quartz eyes. Quartzite. Bleached (hydrothermal?). — Fresh and hard. Locally subject to slight to moderate wx effects on joint surfaces. Highly polished slickensides . Also at 117.6'.
- Gray Local Bleached. **Diorite.** Mixed medium fine quartz diorite. Coarse grained quartz diorite and quartzitic.
- 212.6' **Diorite.** Bleached throughout to light greenish tan. Fine-grained quartzose. — Hard, but bleached throughout to light greenish tan. Presume hydrothermal bleach.
- 226.0' Fused contact dips about 60°. **Diabase.** Bleached to light greenish tan. Fine-grained with darker green mineral speckling. — Hard, but bleached throughout. Drills well. Minor surface wx effects on joints. Joints are not slickensided.
- 238.6' Fused contact. Irregular dip. **Diorite.** Bleached. Fine-grained, greenish tan.

X Note: High-polish "joint" at Strike N45W, Dip 61° NE

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

X - Oriented core.

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
ATOMIC ELECTRIC COMPANY
united engineers & constructors inc

Date: November 23, 1973 Project 7266

PAGE 2 of LOG OF BORING ADT 16

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N16571 BEARING: Offshore INCLINATION Vertical DATE START/FINISH Jan. 4, 1974 / Jan. 7, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 240.3 ft DRILLED BY Warren George, Inc. P. Schaeble, J. Harris

GROUND EL (MSL) ft -4.0 DEPTH TO WATER/DATE Tidal ft / LOGGED BY

Column headings: EL. MSL ft | SAMPLE: Depth ft, Type and No., N or Rec. | RATE OF ADV. min/ft | WATER CONTENT or RQD: %, Graphic (0–100) | PRESSURE TEST: gpm, psi, Computed k 10^{-4} cm/sec | STRIKE, DIP: F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside | CORE BREAKS | SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

EL. -4.0 ft: 3) None (water content)

1) (washed through soil, 0 – 33.5 ft)

33.5 ft: TOP OF ROCK

2)

Type and No.	Rec. %	Rate of Adv. min/ft	RQD %
NQ-1	100	5.0	53
NQ-2	100	5.2	68
NQ-3	100	5.3	71
NQ-4	100	4)	83
NQ-5	100		100
NQ-6	100		100
NQ-7	100		63
NQ-8	100		100
NQ-9	100		80
NQ-10	100		80
NQ-11	100		78
NQ-12	100		75
NQ-13	100		98
NQ-14	100	5)	82
NQ-15	100		98
NQ-16	100		87

Strike, dip 6):
N62W, 61NE J
N79W, 25NE J
N85W, 62SW J
N79E, 78SE J
N11W, 63SW C
N76W, 39NE J
N 7W, 42SW J
N73W, 23NE J

Soil and rock descriptions:

Pyrite. Fresh and hard. Drills well. Minor surface wx effects on joints and partings. — Diorite. Fine-grained, medium dark gray. Generally massive texture.

Slight wx. D. Fresh and hard. Drills we... Local slight wx on partings. Partings dip 10° to 20°. Few high angle joints.

Slight wx.
56.9 Open contact dips 30°
Diabase. Fine, dark gray
59.0
62.6 Open contact dips 25°
Diabase. Fine, feldspar spots.
67.7 Open contact dips 30°

Slight wx. D. Fresh and hard. Drills we... Joints and partings are not wx. Not slickensided. — Slight bleaching effect. Diorite. Fine-grained, medium dark gray. Irregularly foliated throughout. some very vague bleaching effects, 84-85'.

D

Welded breccia. Minor bleaching.

Polished slickensides. Fresh and hard. Drills very well. Polished slickensides at 98.6' on 60' foliation plane. Apparent minor hydrothermal bleaching at 92'. Joints are clean. — Diorite. Fine-grained, medium dark gray. Locally foliated.

102.7 Open contact dips 38°
Chill zone-brown. Diabase. Dark gray, fine-grained.
Diorite. Fused diorite inclusion at 109.6 - 110.0'

D. Subvertical joint. Fresh and hard. Drills well. Joints and partings show only very minor surface wx effects. — Diabase is fine-grained, dark gray, sub-black throughout. Brownish at chilled contacts.

D. Prominent feldspar spotting.

Minor vuggy. Graphite striated. Polished graphite. Fresh and hard. Drills well. Graphitic partings 135' to 138', appear polished, but are not on planar surfaces.
132.6 Fused contact dips 71° Chilled
Diorite. Quartzose. Fine-grained, dark gray with irregular contorted foliation throughout. No meaningful dip direction.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample; Groundwater
U - Undisturbed samples
S - Shelby tube; N - Denison
F - Fixed piston; P - Pitcher
O - Osterberg; G - GEI
D - Drilling break; k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) Washed through soil to 33.5 ft. No sample taken.
2) Roller bitted to 34.8 ft.
3) No clays present, therefore, no water contents were determined.
4) Drilling rates for NQ-4 through NQ-13 are 5 to 7 minutes per ft.
5) Drilling rates for NQ-14 through NQ-37 are 5 to 10 minutes per ft.

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
United Engineers

Date: January 14, 1974 Project 7286

PAGE 1 of 2 LOG OF BORING ADT 16A

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N16571, E90280; Offshore INCLINATION Vertical BEARING ______ DATE START/FINISH Jan. 4. 1974 / Jan. 7, 1974

CMWG ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 240.3 ft DRILLED BY Warren George. Inc.; P. Schaeble, J. Harris

GROUND EL (MSL) -4.0 ft DEPTH TO WATER/DATE Tidal ft / LOGGED BY Soil - K. Polk; Rock - J. R. Rand

CONTINUED FROM PREVIOUS PAGE

S = Slickensided

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec
	143.1	NQ-17	100		94		
	150	NQ-18	100		100		
-160		NQ-19	100		100		
	160	NQ-20	62		92		
		NQ-21	85		65		
	170	NQ-22	98		94		
		NQ-23	100		100		
-180		NQ-24	100		97		
	180	NQ-25	100		100		
		NQ-26	100		100		
	190	NQ-27	88		66		
-200		NQ-28	102		63		
	200	NQ-29	100		90		
		NQ-30	100		97		
	210	NQ-31	98		98		
-220		NQ-32	100		100		
	220	NQ-33	93		98		
		NQ-34	98		78		
	230	NQ-35	92		100		
-240		NQ-36	100		100		
	240	NQ-37	83		12		
	240.3					BOTTOM	OF BORING

STRIKE, DIP (F = Foliation, J = Joint, c = Contact, B-Bedding, S = Slickensided):

N26W, 22SW J; N10E, 50SE F; N45W, 27SW J; N60W, 25SW J; N25W, 56NE J; N61W, 35SW J; N84E, 67SE F; N11W, 18SW S; N23E, 50SE F; N47E, 76SE F; N25E, 76SE J; N 5E, 34NW J; N50W, 26NE J; N74W, 60NE J; N11E, 11NW J; N 6W, 24NE J; N21E, 20NW J; N71W, 37NE J; N36W, Vert. J; N 9W, 63NE; N19E, 53SE F; N48E, 53NW F; N33E, 82NW J; N36W, 60NE F; N28W, 52SW S; N 1W, 51SW F; N49W, 29SW J; N35E, 24NW J; N86E, 27SE J; N58W, 58NE C; N32W, 36SW J; N 5E, 66SE J; N55E, 73NW J; N57E, 30SE J; N24E, 40SW C; N76E, 62SE J; N72E, 65SE J

CORE BREAKS: Foliation; On foliation; Grout talc; Fresh

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) / (Type, texture, mineralogy, color, hardness, etc.)

Weathering, defects, etc.	Notes	Type, texture, mineralogy, color, hardness, etc.
Fresh and hard. Drills very well. Joints and partings are fresh, not slickensided.	Orient	Diorite. Fine-grained, dark gray quartzose. Irregularly foliated throughout.
Fresh and hard. Drills well. Joints and partings clean. Tends locally to part on high-angle foliation.		Diorite. Fine-grained, dark gray. Irregularly foliated throughout.
Shows minor greenish hydrothermal bleaching. Hard.	Minor Bleach	Diorite. Coarse-grained, light greenish gray granodiorite. Some minor hydrothermal alteration
	Coarse	Diorite(?) Fine-grained, medium dark gray. May be quartzite (?)
Fresh and hard. Bleached locally hydrothermally. Joints and partings are not slickensided.	190.1	Veined contact dips 60°
	Bleach	Diabase. Fine grained, bleached tannish gray. Bleaching digs out at about 166.3'
	Becomes dark gray	Diabase. Fine-med. dark gray. Fused contact dips 60°
Not wx. Subject to hydrothermal alteration. Bleaching. Joints and partings not slickensided.	198.8 Bleach; Possible fault-tight; Bleach; Fused fault (?)	Granodiorite. Medium coarse-grained, light tannish gray.
Fresh and hard. Drills well.	Quartzite; Quartz-feldspar peg.	(?)Diorite. Fine-grained light brownish gray.
Locally bleached (hydrothermal alteration) but is not materially softened.	Bleached; Bleached; Pegmatite	Diorite-granodiorite. Medium to medium-fine grained, light tannish gray (due to hydrothermal alteration). Locally unbleached.
	Bleached diabase	Fused contact dips 3?°
Fresh and hard.	230.7 Bleached	Diabase. Fine-grained, light tannish gray.
	Not Bleached	Diabase. Dark gray.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample
- U - Undisturbed samples
  - S - Shelby tube
  - F - Fixed piston
  - O - Osterberg
  - N - Denison
  - P - Pitcher
  - G - GEI
- Groundwater
- D - Drilling break
- wx - Weathered, weathering
- k - Coefficient of permeability

NOTES

(6) This is only a partial list of dip and strike data.

X - Oriented core.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers & constructors inc.

Date: January 14, 1974 Project 7281

PAGE 2 of 2 LOG OF BORING ADT16A

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N16545, E90185; Offshore INCLINATION Vertical BEARING ____ DATE START/FINISH Jan. 8, 1974 / Jan. 14, 1974

CASING ID 3 in CORE SIZE 1-7/8 in. TOTAL DEPTH 240.0 ft DRILLED BY Warren George, Inc.; P. Schaeble, J. Harris

GROUND EL (MSL) ft -5.3 DEPTH TO WATER/DATE Tidal ft / LOGGED BY Soil - K. Polk; Rock - J. R. Band

EL MSL ft	Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content % or RQD	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)
-8.3					3) None	
-20	10	1)				
-40	36.3	2)		4)		TOP OF ROCK
	40	NQ-1	98		93	
-60	50	NQ-2	100		90	
	60	NQ-3	100		79	
-80	70	NQ-4	98		94	
	80	NQ-5	100		100	
-100	90	NQ-6	100		100	
	100	NQ-7	100		93	
-120	110	NQ-8	98		97	N79E,31NW J; N45E,66SE J
	120	NQ-9	94		93	N42E,58SE S
		NQ-10	97		93	N29W,30NE S; N59W,41NE J; N50E,78SE C
-140	130	NQ-11	98		87	N79W,68NE J; N34E,69NW C
		NQ-12	100		100	N25E,34NW C; N31W,67SW S
	140	NQ-13	100		90	N68E,29SW J; N36W,58NE S
	142.4					

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

- Pyrite; Manganese — Fresh and hard. Drills very well. Very minor surface wx effects on joints and partings. No slickensides. — Diorite. Mixed fine-grained foliated dark gray diorite in medium-coarse-grained, medium gray granodiorite. Foliation in fine-grained diorite is wavy, irregular.
- Fresh and hard. Drills very well. Minor surface wx effects on joints and partings. Not slickensided. — Diorite. Fine-grained, dark gray. Internally complex folding.
- D; Foliation — Transitional Fused Contact. Very fine-grained, thinly laminated, wavy, drag-folded laminae. Pinkish brown and dark gray foliation. Chert (?) or metasiltstone.
- 75.9 — Chert, as above. Contact dips 65°
- 78.7 — Diabase. Fine-grained, dark gray. No bleaching
- Fresh and hard. Drills very well. Very minor surface wx effects on joints and partings. No slickensides.
- 86.1 — Fused contact dips 55°. Diorite. Fine-grained, medium dark gray. Locally vaguely foliated. Pyrite disseminated locally.
- Polished slickensides on 20° partings; Pyrite — Fresh and hard. Drills very well. Small polished slickensides at 96.6-99.7' on low-angle partings. Not bleached. — Diorite. Fine-grained, medium dark gray. Fairly massive.
- 111.6' — Open contact dips 20°. Diabase. Fine-grained, dark gray. Not bleached.
- D; Slight polish — Fresh. Not bleached. Hard. Drills well. Joints are fresh to very minor surface wx effects. Not slickensided.
- 122.2' — Fused contact dips 50°. Diorite. Fine-grained, medium dark gray. Contorted foliation.
- 128.4' — Irregular intrusive contact dips 70°. Diabase. Dark gray, fine-grained. Not bleached.
- D
- 137.1' — Jagged intrusive contact-fused. Diorite. Fine-grained medium dark gray. Wavy irregular foliation. Quartz diorite.
- Chlorite-striated — Fresh and hard. Drills well. Minor chlorite on some joints and partings. Not polished. Not wx. Not bleached.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in and longer/length cored, %
- S - Split spoon sample; Groundwater
- U - Undisturbed sample
- S - Shelby tube; N - Denison
- F - Fixed piston; P - Pitcher
- O - Osterberg; G - GE
- D - Drilling break; k - Coefficient of permeability
- wx - Weathered, weathering

NOTES

1) No samples taken.
2) Roller bitted to 38.0 ft.
3) NC clays present; therefore no water contents were determined.
4) Drill time for entire boring from 8 to 15 minutes per foot.

* - Oriented core

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers

Date: April 11, 1974 Project 7286

PAGE __ of 2 LOG OF BORING ADT-16B

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N16546, E90165; Offshore INCLINATION Vertical BEARING ______ DATE START/FINISH Jan. 8, 1974 / Jan. 14, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 240 ft DRILLED BY Warren George, Inc.; P. Schaeble, J. Harris

GROUND EL (MSL) -8.3 ft DEPTH TO WATER/DATE Tidal ft / • LOGGED BY Soil • K. Polk; Rock • J. R. Rand

CONTINUED FROM PREVIOUS PAGE

EL. MSL ft	Sample Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content or RQD %	Pressure Test gpm psi	Computed k 10^{-4} cm/sec	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)
	142.4							
		NQ-14	100		100			N36W, 58NE S; N35W, 34SW C
-160	150	NQ-15	100		100			N13W, 38SW J; N26E, 53NW J
		NQ-16	100		100			N72W, 51SW F
	160	NQ-17	100		88			N36W, 41NE S; N26W, 51NE S; N82E, 52NW S
		NQ-18	100		93			N78E, 68SE J; N 6W, 21NE S; N82W, 76SW F
-180	170	NQ-19	100		73			N31E, 34NW S; N 6W, 41NE F; N29W, 32SW S
		NQ-20	100		100			N80W, 52NE J; N59E, 76SE F
	180	NQ-21	97		97			N41E, 43NW J; N 0E, 58NE F
		NQ-22	100		97			N63W, 50SW J
-200	190	NQ-23	100		100			N72W, 71NE J; N86W, 35SW F; N89E, 80NE S; N89E, 51SW F
		NQ-24	100		68			N46E, 60SE J
	200	NQ-25	100		95			N85W, 78NE S; N64E, 59SE F; N25W, 42SW J
		NQ-26	100		100			N32E, 57SE J
-220	210	NQ-27	100		90			N79W, 47SW J; N75E, 49NW F; N22E, 31NW J
		NQ-28	100		98			N52W, 33NE J
	220	NQ-29	100		56			N32E, 41SE S; N52E, 52SE J
		NQ-30	92		90			
-240	230	NQ-31	100		97			N41E, 36SE F; N80E, 71NW J
		NQ-32	100		100			N31E, 33SE J; N52E, 57NW S
		NQ-33	100		94			
	240					BOTTOM	OF BORING	

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

147.5 Open contact dips 22°

Diabase. Dark gray.

150.4 Open contact dips 35°

Fresh. Hard. Drills well. Joints and partings are not slickensided.

Diorite. Quartzose. Fine-grained, medium dark gray. Wavy, foliated. Steep dips.

Graphite-polished

Minor polish / Graphite / Graphite

Fresh and hard. Drills well. Joints and partings show only very minor surface wx effects. Minor bleaching at 169-170'.

Fused, welded breccia / Bleach / Bleach

Diorite. Fine-grained dark gray. Irregular wavy foliation. Slightly bleached. medium-grained at 168' and 169'. Fused contacts.

D

Fresh and hard. Drills very well. Not slickensided.

Diorite. Fine-grained, medium dark gray quartz diorite. Vaguely to widely foliated throughout.

D

Minor slickensides / Pyrite

Fresh and hard. Not slickensided. Drills well. Only very minor surface wx effects on joints and partings.

Diorite. Mixed fine-grained dark gray quartz diorite and medium-coarse medium gray granodiorite. Locally foliated.

Fine-grained, dark gray.

Minor wx / Surface powder

225.9 Fused contact dips about 60°

D

Fresh, but bleached by hydrothermal alteration. Not wx. Not slickensided

Bleached throughout

Quartz diorite. Granodiorite. Medium coarse-grained, medium light greenish-gray. Feldspar veining is tight.

Fresh. Bleached. High-angle veinlets.

Striated-slickensides / Not polished

Bleached

LEGEND

N - Standard penetration resistance, blows/ft
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
Groundwater
D - Drilling break
wx - Weathered, weathering
k - Coefficient of permeability

NOTES

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers & constructors inc

Date: April 11, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING ADT 16B

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N16493. E90257; Offshore INCLINATION Vertical BEARING ______ DATE START/FINISH Jan. 14, 1974 . Jan. 17, 1974 .

CASING m 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 238.5 ft DRILLED BY Warren George, Inc.: P. Schaeble, J. Harris

GROUND EL (MSL) -9.5 ft DEPTH TO WATER/DATE ~~Tidal~~ ft / ______ LOGGED BY Soil - K. Polk; Rock - J. R. Rand

Columns: EL. MSL ft | SAMPLE (Depth ft; Type and No.; N or Rec.) | RATE OF ADV. min/ft | WATER CONTENT % or RQD (Graphic, 0–100) | PRESSURE TEST (gpm; psi; Computed k 10^{-4} cm/sec) | STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside) | CORE BREAKS | SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

EL. 5.5 at top. 2) None. 1) Washed through soil. TOP OF ROCK at 33'.

Sample	Rec. %	Rate min/ft	RQD %	Strike, Dip
NQ-1	100	8.0	40	
NQ-2	100	8.0	33	
NQ-3	100	8.8	0	
NQ-4	100	10.0	0	
NQ-5	100	9.3	33	
NQ-6	83	10.0	61	
NQ-7	100	8.5	67	
NQ-8	100	1.2	0	
NQ-9	96	10.7	59	
NQ-10	100	10.0	43	N34E, 47SE S; N61W, 34NE S
NQ-11	100	8.0	85	N43W, 72SW S; N57W, 27NE S
NQ-12	100	10.6	83	N45W, 28NE J; N18E, 61NW J; N74E, 55SE S
NQ-13	100	9.4	62	N84W, 53SW J; N 6W, 42NE S; N80E, 54NW S; N54W, 51SW F
NQ-14	100	10.0	80	N64W, 67NE S
NQ-15	100	11.0	8	
NQ-16	100	7.0	75	N16E, 22SE J
NQ-17	100	8.4	53	N 7E, 75NW S; N30W, 46NE S; N80W, 27NE J
NQ-18	100	11.6	50	N22W, 54SW J
NQ-19	100	9.8	62	N82E, 31NW J; N 4W, 38NE F; N61W, 33NE J
NQ-20	100	10.2	47	N78W, 36NE J
NQ-21	100	9.6	16	N13W, 66NE J; N 3E, 41SE F; N44W, 67NE F
NQ-22	100	9.4	50	N21W, 52NE J; N20E, 44SE F
NQ-23	97	8.2	43	N27W, 51NE S; N40W, 48NE J; N77W, 35NE J; N76E, 14NW S
NQ-24	97	10.6	78	N80W, 66SW J
NQ-25	100	11.4	85	N62E, 14NW J; N50W, 18NE J; N76W, 60SW S; N36W, 54NE S
NQ-26	100	6.6	29	N 6W, 38NE J; N27W, 47NE J
NQ-27	100	8.0	53	N52W, 46NE F; N 5E, 70SE J; N88W, 67NW S
NQ-28	100	8.4	27	N15E, 40NW S

Soil and rock descriptions:

Striated; rusty; Minor rusty. Fresh and hard. Subject to minor surface wx effects on joints and partings. — Diorite. Medium coarse-grained, medium gray.

30.3' – 31.4' Diabase. Tan, bleached. Contact veined, dips 65°.

Note: Bleached diabase. At 31.4' is fused fault surface.

36.5' Diorite. Mostly fine-grained, gray. Diabase. Dark gray. Fine. Open rusty contact dips 35°. 40.9'

Calcite vein; Minor rusty; Manganese; Minor rusty. Fresh and hard. Minor rusty wx effects on some joint and parting surfaces. — Diorite. Fine-grained, dark gray. Vague wavy foliation.

Minor rusty; Pyrite. — Diorite. Fine, medium dark gray.

Fresh and hard. Minor surface wx effects on joints and partings. Not slickensided. — Diorite. Fine-grained, dark gray. Fairly massive.

66.4' Fused contact dips 20°. Diabase. Fine, dark gray. 69.2' Rough open contact dips 40°.

Manganese. — Diorite. Fine-grained, medium dark gray.

Striated. Fresh and hard. Drills well. Joints and partings show only minor surface wx effects. Partings are not slickensided. No bleaching. — Diorite. Fine-grained, medium dark gray. Locally shows vague wavy foliation.

D

Pyrite. Fresh and hard. Some minor chlorite on joints and partings. — Diorite. Fine-grained, dark gray. Vague wavy foliation.

Minor chlorite; Minor chlorite; Minor chlorite; Pyrite; Pyrite. Fresh and hard. Joints and partings not slickensided. Show minor surface wx effects. — Diorite. Quartzose. Fine-grained, medium dark gray. Locally vague foliation textures.

Fresh and hard. Drills well. Some joints show minor surface wx effects. No bleaching. — Diorite. Fine-grained, medium dark to dark gray. Quartzose. Vague wavy foliation fabric throughout.

Fresh and hard. Drills very well. — Open contact dips 37°

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon • OD ▽ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
WX - Weathered, weathering

NOTES

1) Washed through soil 0-33'. No samples taken.

2) No clays present; therefore no water contents were determined.

x - Oriented core.

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers & constructors inc.

Date: April 17, 1974 Project 7286

PAGE 1 of 2 LOG OF BORING ADT 16C

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N16493, E90257; Offshore INCLINATION Vertical BEARING ____ DATE START/FINISH Jan. 14, 1974 , Jan. 17, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 238.5 ft DRILLED BY Warren George, Inc.; P. Schaeble, J. Harris

GROUND EL (MSL) -5.5 ft DEPTH TO WATER/DATE Tidal ft / LOGGED BY Soil - K. Polk; Rock - J. R. Rand

CONTINUED FROM PREVIOUS PAGE

EL. MSL ft	Sample Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content or RQD %	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	Soil and Rock Descriptions (Weathering, defects, etc.)
	143.6						
		x NQ-29	100	10.0	92	N82E, 22SE S; N20E, 56SE J	
	150	x NQ-30	98	8.8	95	N59W, 52NE J; N69E, 33SE J	
-160		x NQ-31	100	9.4	37	N50W, 43NE J; N66W, 69NE F	
	160	NQ-32	100	9.0	73		
		NQ-33	100	8.2	82		Striated
	170	NQ-34	100	9.0	65		Striated
-180		NQ-35	100	7.2	87	N53E, 29SE J; N39W, 57NE S	
	180	x NQ-36	100	8.5	79	N26E, 66NW J; N26E, 64NW J	Open joint; Calcite coated
		x NQ-37	100	9.6	98		
	190	x NQ-38	100	8.2	80	N54W, 62NE S	
-200		x NQ-39	100	9.5	47	N58W, 44NE J; N83W, 69SW J; N71E, 74NW J	Chlorite; Chlorite Slippery
	200	x NQ-40	100	9.7	50	N 4W, 18NE J; N41E, 35NW J	Chlorite
		x NQ-41	100	8.9	23	N44W, 84NE J; N63W, 55SW F; N45E, 73NW J	Rough irregular joints
	210	x NQ-42	100	8.0	45	N32E, 34SE J; N16E, 39SE J; N63E, 35SW J; N62W, 43SW J	Calcite, pyrite on foliation
-220		x NQ-43	100	9.1	58	N58E, 18NW C	
	220	x NQ-44	98	9.7	90	N83W, 10NW J	Striated chlorite-slickensided
		x NQ-45	100	8.6	82	N78E, 65SE J; N17E, 41SE S	
	230	x NQ-46	100	9.5	90	N53W, 70NE J; N46E, 45SE J	Calcite lined
-240		x NQ-47	93	9.1	93	N 1E, 34NE J	Quartz-feldspar veinlet-no calcite
	238.5						

BOTTOM OF BORING

Soil and Rock Descriptions (Type, texture, mineralogy, color, hardness, etc.):

143.6'–166.9': Joints and partings not slickensided. Feldspar specs throughout. Diabase. Fine-grained, dark gray. Grades to medium-grained at 145'. Becomes white feldspar speckled at 151'. Fresh and hard. Drills well. Joints and partings locally show striations, minor slickensides. Diabase. Fine-grained, dark gray.

166.9' Open contact dips 38°

166.9'–177.0': Diorite. Fine-grained, medium gray. Quartzose-diabase inclusion is irregular, fused. Diabase, fused. Fresh and hard. Drills very well. Joints and partings fresh.

177.0' 6" granodiorite at base. Fused contact dips 70°

177.0'–194.5': Diabase. Fine-grained, dark gray with calcite phenocrysts 183' to 186'. Calcite speckling. Fresh and hard. Drills well. Some striated chlorite on joints and partings. Diabase, as above.

194.5' Open contact dips 14°

194.5'–217.4': Diorite. Fine-grained, medium dark gray quartzose. Fairly well foliated throughout. Pegmatite. Pyrite. Breccia-fused with calcite. Prominent pyrite mineralization with calcite. Fused breccia at 208.8–210.4'. Fresh and hard throughout. Joints and partings show only minor surface wx effects. Fresh and hard. Minor surface wx effects on partings.

217.4' Fused contact dips 5°

217.4'–238.5': Brown chill zone. Not bleached. Diabase. Fine at top. Diabase. Medium-fine grained, dark gray with hair-line calcite veinlets. Fresh and hard. Drills very well. At 235.5' becomes bleached gradually.

235.5' Rock gradually becomes bleached, transitional contact over .5' core bleach

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
S - Shelby tube
F - Fixed piston
O - Osterberg
N - Denison
P - Pitcher
G - GEI
D - Drilling break
wx - Weathered, weathering
k - Coefficient of permeability
Groundwater

NOTES

X - Oriented core.

x - Oriented core.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

United Engineers

Date: April 17, 1974 Project 7266

PAGE 2 of 2 LOG OF BORING ADT 16C

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N16600, E90219; Offshore INCLINATION Vertical BEARING ______ DATE START/FINISH Nov. 10, 1974 / Nov. 14, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 341.4 ft DRILLED BY Warren George, Inc.; P. Schaeble, J. Harris

GROUND EL (MSL) -7.8 ft DEPTH TO WATER/DATE Tidal ft / - LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft -7.8

Depth ft	Sample Type and No.	N or Rec.	Rate of Adv. min/ft	RQD %	Pressure Test	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	Soil and Rock Descriptions
0–38.0	1)			2) None			
38.0					TOP	OF ROCK	
40	NQ-…	00	7.0	19			Minor polish
	NQ-…	00	7.0	46			Minor polish
	NQ-…	00	5.0	52			Vertical joint
50	NQ-…	00	6.0	48			
	NQ-…	82	5.0	53			
60	NQ-…	99	7.0	35			
	NQ-…	00	6.0	76			Polished slickensides at 70.1'
70	NQ-…	99	6.0	79			
80	NQ-…	00	6.0	74			
90	NQ-…	00	6.0	79			Smooth
100	NQ-…	.00	6.0	79			Pyrite-minor polish
	NQ-…	97	7.0	67			Smooth joints
110	NQ-…	96	8.0	62			55° joints-high polish-smooth
120	NQ-…	100	8.0	88			65° joints-smooth; 65° joints-smooth; Vertical joint
	NQ-…	100	1.0	33			Chlorite
130	NQ-…	100	8.0	80			Calcite filling
	NQ-…	100	8.0	72			Minor polish
140	NQ-…	100	8.0	27			
144.5							

Soil and Rock Descriptions (Weathering, defects, etc. / Type, texture, mineralogy, color, hardness, etc.)

- 38.0–53.8': Fresh and hard. Closely spaced high-angle joints. Joints are polished at 42.3' and 44.5'. — Diorite. Fine-grained, dark gray. Vaguely foliated throughout.
- 53.8'–54.6': Diabase inclusion. Chilled, fused, undulating contact.
- 54.6'–70.5': Fresh and hard. Drills well. Polished surface shiny at 70.1'. — Diorite. Fine-grained, dark gray. Quartzose with steep, undulating foliation throughout.
- 70.5': Fused contact dips 52°. Chill zone
- 70.5'–86.8': Fresh and hard. Drills well. High-angle joints are smooth, planar. Not polished. Minor surface wx effects. — Diabase. Dark gray, fine-grained. Calcite phenocrysts. Generally finely calcitic throughout.
- 86.8': Contact dips 48°
- 86.8'–131.8': Fresh and hard. Drills very well. Some joints are fairly smooth, some pyrite coatings on joints. — Diorite. Fine-grained dark gray. Quartzose. Diorite. Fine-grained, dark gray with vague foliation. (May be an impure quartzite ? ?)
  - Fresh and hard. Not bleached. Joints are characteristically planar. Smooth locally show high polish. — Diorite. Medium-fine grained, medium dark gray. Local zones of fine-grained, dark gray foliated quartz diorite.
  - Thin chlorite coating on non-polished joints.
- 131.8': Open contact dips 40°
- 131.8'–138.0': Fresh, hard. Not bleached. Some smooth joints. Not highly polished. — Diabase. Dark gray, fine-grained.
- 138.0': Fused, wavy contact dips 70°
- 138.0'–141.4': Diorite. Fine-grained.
- 141.4'

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample; ▽ Groundwater
U - Undisturbed samples
S - Shelby tube; N - Denison
F - Fixed piston; P - Pitcher
O - Osterberg; G-GE.
D - Drilling break; k - Coefficient of permeability
WX - Weathered, weathering

NOTES

1) - Washed through soil O-38'. No samples taken.

2) - No clays present; therefore no water contents were determined.

x - Oriented core.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

United Engineers & Constructors Inc. — a subsidiary of Raytheon Company

Date: April 16, 1974 Project 7286

BORING LOCATION N16600, E90219; Offshore INCLINATION Vertical BEARING DATE START/FINISH Nov. 10, 1974 / Nov. 14, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 241.4 ft DRILLED BY Warren George, Inc.; P. Schaeble, J. Harris

GROUND EL (MSL) -7.8 ft DEPTH TO WATER/DATE Tidal ft / LOGGED BY Soil K. Pout; Rock - J. R. Rand

CONTINUED FROM PREVIOUS PAGE

EL. MSL ft	Sample Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content or RQD %	Pressure Test gpm psi	Computed k 10^{-4} cm/sec	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)	Core Breaks
	144.5								
		NQ-19	100	7.0	63			N76W, 67NE S; N64W, 52NE J; N38W, 24SW J	
60	150	NQ-20	100	9.0	65			N89E, 32SE J	
		NQ-21	100	9.0	66			N48E, 13NW J; N66E, 13NW J; N55E, 24NW J	
	160	NQ-22	100	9.0	93			N 6W, 23NE J	
		NQ-23	98	9.0	72			N47E, 19SE J; N 8W, 30NE J	
80	170	NQ-24	100	9.0	92			N62E, 22SE J; N34W, 72SW J; N48E, 69NW C	Calcite coating
		NQ-25	100	9.0	57			N34E, 37SE F; N33E, 40SE S; N90E, 23S J	
	180	NQ-26	100	10.0	62			N15E, 16NW J; N52E, 57NW S	Calcite filling
		NQ-27	100	10.0	48			N87W, 49NE J; N70E, 14NW J; N55W, 18NE J	
100	190	NQ-28	100	12.0	22			N24E, 75NW C; N66W, 60NE F; N65W, 63NE S	
		NQ-29	98	11.0	72			N15E, 45SE F	
	200	NQ-30	100	10.0	66			N38W, 6SW J; N 5W, 41NE S; N71W, 43NE J; N80W, 70NE J	
		NQ-31	98	13.0	78				D Calcite-filled
120	210	NQ-32	100	13.0	87			N34E, 56NW J; N56W, 52NE J	
		NQ-33	9.	13.0	85			N62W, 58SW F; N18E, 50SE J	Minor striated
	220	NQ-34	100	15.0	54			N21E, 46SE J; N69W, 72NE J; N33E, 46SE F; N56E, POSE J	
		NQ-35	100	14.0	49			N57E, 71SE J	
140	230	NQ-36	100	13.0	41			N18E, 57NW J; N21E, 52SE F	
		NQ-37	100	13.0	46			N56W, 50NE J; N11W, 66NE J	
	240 / 241.4	NQ-38	100	13.0	17			N35E, 69NW J	

BOTTOM OF BORING

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

Fresh and hard. Drills very well. Joints and partings are clean. Local minor calcite coating on joints. Not smooth or slickensided.

146.6 Fused contact dips 56°

Diabase. Fine-grained, dark gray with fine calcite specks scattered throughout.

Fresh and hard. Drills very well. Joints and partings are not smooth or slickensided. No bleaching.

Diabase. Fine-grained dark gray with prominent white calcite phenocrysts.

175.0 Fused, chilled contact dips 60°

Diorite. Medium grained.

Open contact dips 25-30° - Calcite

Diabase. Fine-grained, near black. Diorite inclusion at base.

Fresh and hard. Drills well. Joints and partings are fairly fresh. Calcite fillings in some joints.

185.0 Fused contact-80-85° dip-calcite

Brown chill zone

Diabase. Fine-grained, dark gray.

193.1 Fused, undulating contact

50° Vein-fused fault

Diorite. Medium-coarse grained; medium grained quartzose.

Fresh and hard. Drills well. Only very minor local surface wx effects on joints and partings. Not slickensided.

Fine

Diorite. Predominantly medium coarse grained, notably quartzose medium gray. Local zones of fine-grained quartzose diorite. Granodiorite, locally porphyritic.

Fine

Fresh and hard. Drills very well. Joints and partings show only very minor surface wx effects.

Diorite. Predominantly medium-coarse grained, with white feldspathic spotting locally.

Welded breccia

Medium gray. Not bleached.

Fresh and hard. Drills well. Minor surface wx effects on joints and partings.

Pink feldspar

Diorite. Fine-grained, dark gray.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample; ▽ Groundwater
- U - Undisturbed samples
  - S - Shelby tube; N - Denison
  - F - Fixed piston; P - Pitcher
  - o - Osterberg; G - GEI
- D - Drilling break; k - Coefficient of permeability
- WX - Weathered, weathering

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers & constructors inc.

Date: April 18, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING ADT 16D

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION Offshore N17552, E93840 INCLINATION Vertical BEARING ______ DATE START/FINISH June 15, 1975 / June 16, 1975

CASING ID 3-6 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 195.3 ft DRILLED BY Warren George Inc.; J. Johnston, P. Scheeble

GROUND EL -42.4 ft DEPTH TO WATER/DATE Tidal ft / LOGGED BY Soil/Rock - F. X. Bellini

EL. ft	Depth ft	Sample Type and No.	N or Rec.	Soil and Rock Descriptions
-42.4		S1A / S1B	28	Light brown, uniform, clean fine sand. Dark gray sandy, slightly silty gravel. Widely graded. Fines are non-plastic. Contains angular to subangular medium to coarse sand and gravel pieces up to 30mm long, and few shell fragments.
		S2	63	Light gray, fine to medium grained sand, clean and uniform. Rounded to subrounded grains.
	14.5	S3	81	Similar to Sample 2.
				TOP OF CLAY
-60	20	S4	2	Layered gray fine grained silty sand and gray silty clay (small recovery).
		S5	0	Gray silty clay. Medium plasticity, very slow reaction to shaking test, medium to high dry strength. Contains a few pockets of fine sand up to 5mm thick.
		S6	0	Similar to Sample 5, but with 10-30mm light and dark gray layers and a 4mm fine sand layer.
		S7	0	Similar to Sample 6.
-80	39.5	S8A	8	Similar to Sample 6.
		S8B		Layered gray clay, silt and silty fine sand, 2-15mm thick, silt shows fast reaction to shaking test.
	40	S8C	46	TOP OF TILL. Gray gravelly silty sand to sandy silt, widely graded. Fines are non-plastic. Contains angular to subrounded gravel up to 15mm long.
		S9	102	Similar to Sample 8C, but with gravel up to 30mm long.
		S10	39	Similar to Sample 8C, but with gravel up to 35mm long.
	L.0			TOP OF ROCK

1)

EL. ft	Depth ft	Type and No.	Rec.	Rate of Adv. min/ft	RQD %	Pressure Test gpm / psi	Computed 10^{-4} cm/sec	Strike, Dip
-100	60	NQ-1	100	2-1/2, 2-1/2, 2-1/2, 2-1/2	70			57° F; 60° J
		NQ-2	100	2-1/2, 2-1/2, 2-1/2, 3-1/2	73			
		NQ-3	100	3-1/2, 3, 4, 3, 4	82			70° J
-120	80	NQ-4	100	3-1/2, 3, 3, 4	64	0.0	0	
		NQ-5	98	4, 3, 3, 4, 3	79			80° J
-140	100	NQ-6	100	3, 3, 3, 3, 4	94	1.1 / 1.2	0.01	
		NQ-7	91	4-1	74			70° J
60	12	NQ-8	00		78	5 / 1.4	0.11	
		NQ-9	90		1.1			70° J
80	14	NQ-10	00		13	0 / 10.0	0	73° J; 60° F
17.6	145							

Rock descriptions (weathering, defects, etc.):

- Sl wx — Fresh, hard, drills well. Localized zones of very broken rock. R=39 (broke). Minor fault with displacement evident at 59'. Sl wx of feldspathic jt coatings. Some healed jts evident. R=45
- Chips; Sl wx; Pyrite
- Irregular surface; Chlorite — R=43
- Chips; Wx, slicked surfaces — Moderately to severely wx zone 74.5 - 75.5 ft. R=35-39 (broke)
- D; Sl wx — Fresh, hard, drills very well. Joint surfaces clean to slightly wx. R=44 (broke)
- Irreg. jts — Fresh, hard. Does not tend to break along fabric. R=40 (broke)
- Sl wx — R=44 (broke)
- Clean — R=46
- Clean — Fresh, hard, drills very well
- Sl wx — R=0 (broke)
- Clean to sl wx — R=51 (broke)
- Pyrite
- Sl wx — Fresh, hard, drills very well. R=35 (broke)
- Epidote?
- D — R=44. Fresh, hard, drills very well. Jts. clean to sl wx. R=44 (broke)
- Clean — Minor fault, healed, at 142.5 ft. R=39 (broke)
- Sl wx — R=48 (broke)

Rock descriptions (type, texture, mineralogy, color, hardness, etc.):

- Quartz vein; Healed fault; Schistose; Bleached; Quartz vein; Bleached — Quartzite, dark gray, fine grained, uniform. Weak gneissic texture, bleached tan to green gray in some places. Quartz feldspar muscovite and biotite visible. Some small quartz and calcite present. Many thin altered feldspathic veins throughout.
- Bleached — Quartzite, dark gray fine gr., uniform. Weakly schistose and locally bleached. Fabric locally well developed. Locally garnetiferous
- Quartz vein; Bleached — 89.5
- Bleached — Cataclasite, bleached tan, fine to med. grained with well developed fabric. 92.3
- Quartzite, as above
- Quartz vein
- Quartzite, as above.
- Quartz vein; Minor bleaching; Bleaching; Quartz veins; Minor bleaching — Quartzite, dark gray, fine gr., uniform. General weak gneissocity, locally well developed. Some localized bleaching, and weak gneissic texture. Garentiferous
- Minor bleaching; Healed fault

N = Standard penetration resistance, blows/ft
Rec = Length recovered/length cored, %
RQD = Length of sound core 4 in. and longer/length cored, %
S = Split spoon sample; Groundwater
U = Undisturbed samples; R = Schmidt Hammer Hardness
S = Shelby tube; N = Denison
F = Fixed piston; P = Pitcher
O = Osterberg; G = GEI
D = Drilling break; k = Coefficient of permeability
wx = Weathered, weathering

NOTES

1) Roller Bitted Rock 5X.0-56.0 ft.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: August 6, 1975 Project 7286

PAGE 1 of 2 LOG OF BORING m-39

GEOTECHNICAL ENGINEERS INC

BORING LOCATION Offshore N17552, E93840 INCLINATION Vertical BEARING DATE START/FINISH June 15, 1975 / June 16, 1975

CASING ID 3-6 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 195.3 ft DRILLED BY Warren George Inc.; J. Johnston, P. Scheable

GROUND EL -42.4 ft DEPTH TO WATER/DATE Tidal ft / LOGGED BY Soil/Rock - F. X. Bellini

CONTINUED FROM PREVIOUS PAGE

EL. ft	Sample Depth ft	Type and No.	N or Rec.	Water Content or RQD %	Pressure Test gpm / psi	Computed k 10^{-4} cm/sec
-187.6	145.2					
		NQ-11	98	93		
-200	160	NQ-12	100	82	6.8 / 172.4	0.45
		NQ-13	100	0		
		NQ-14	92	55		
-220	180	NQ-15	100	20		
		NQ-16	99	75	11.6 / 131.6	1.01
		NQ-17	100	89		
-237.6	195.3					

Rate of advance (min/ft), top to bottom: 4, 4, 4, 4, 5, 5, 5, 6, 5, 6, 10, 6, 5, 6, 5, 6, 6, 6, 5, 4, 4, 5, 5, 6, 5, 5

Strike, dip (F = Foliation, J = Joint, C = Contact, S = Slickensides): 80° J; 48° F; 40° F; 52° F; 35° F; 60° J; 90° J; 80° J; 60° J; 65° J; 60° J; 90° J; 65° J; 63° J; 70° J; 80° J; 40° C; 53° J

Soil and Rock Descriptions

(Weathering, defects, etc.)

Clean to sl wx. D. No slicks. R=35 (broke). R=34 (broke). Fresh, hard, drills very well. Minor, healed faults at 150.0, 151.5, 152.0 and 154.5 ft.

Chips. Core lost. R=53. Fresh, hard, jts. generally sl wx to clean, some localized zones of very broken rock. R=53

Sl wx

Sl wx. R=49

No slicks. R=0 (broke). Fresh, hard, drills well, jts. clean to sl wx

Chips, core lost? D

(Type, texture, mineralogy, color, hardness, etc.)

Bleaching. Bleaching. Weak gneissosity. Sheared? Bleaching. Quartzite, as above, but showing ~~general minor~~ bleaching, heavy where indicated.

165.0

Bleaching. Bleaching. Internal contact. Diabase, very dark gray to black, fine grained near contacts, fine to med. grained near center. Internal contacts suggest composite origin. Locally bleached to light brown or tan.

Fused, internal contact. Schistose lens. Schistose lens. Diabase, as above, with occasional dark gray schistose lenses.

BOTTOM OF BORING

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample
- U - Undisturbed samples
  - S - Shelby tube; N - Denison
  - F - Fixed piston; P - Pitcher
  - O - Osterberg; G - GEI
- Groundwater
- R - Schmidt Hammer Hardness
- D - Drilling break
- wx - Weathered, weathering
- k - Coefficient of permeability

NOTES

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers & constructors inc.

Date: August 6, 1975 Project 7286

PAGE 2 of 2 LOG OF BORING AIT-39

GEOTECHNICAL ENGINEERS INC

APPENDIX 2E

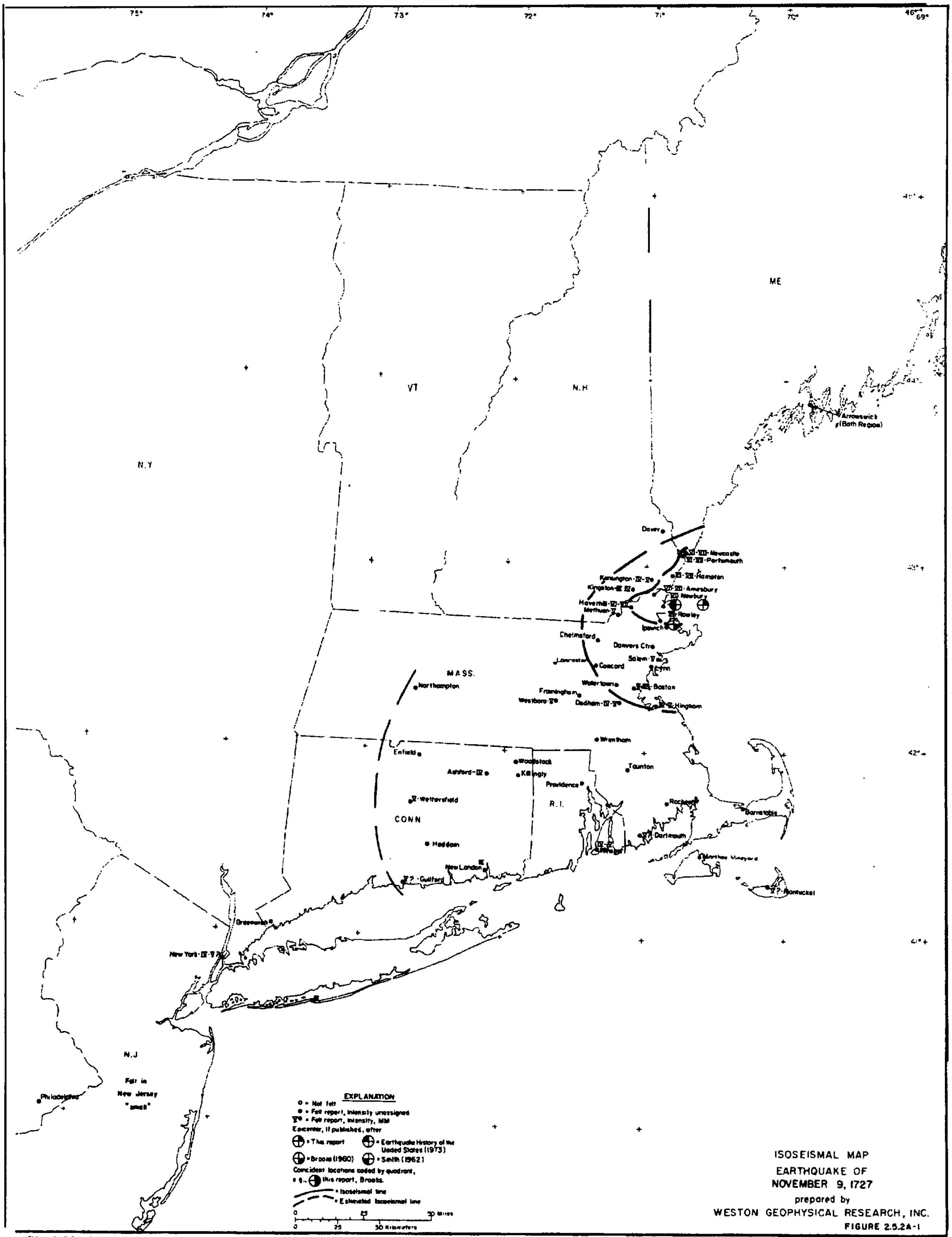
HISTORICAL EARTHQUAKES IN THE SITE VICINITY

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

APPENDIX 2.5.2A

PART I

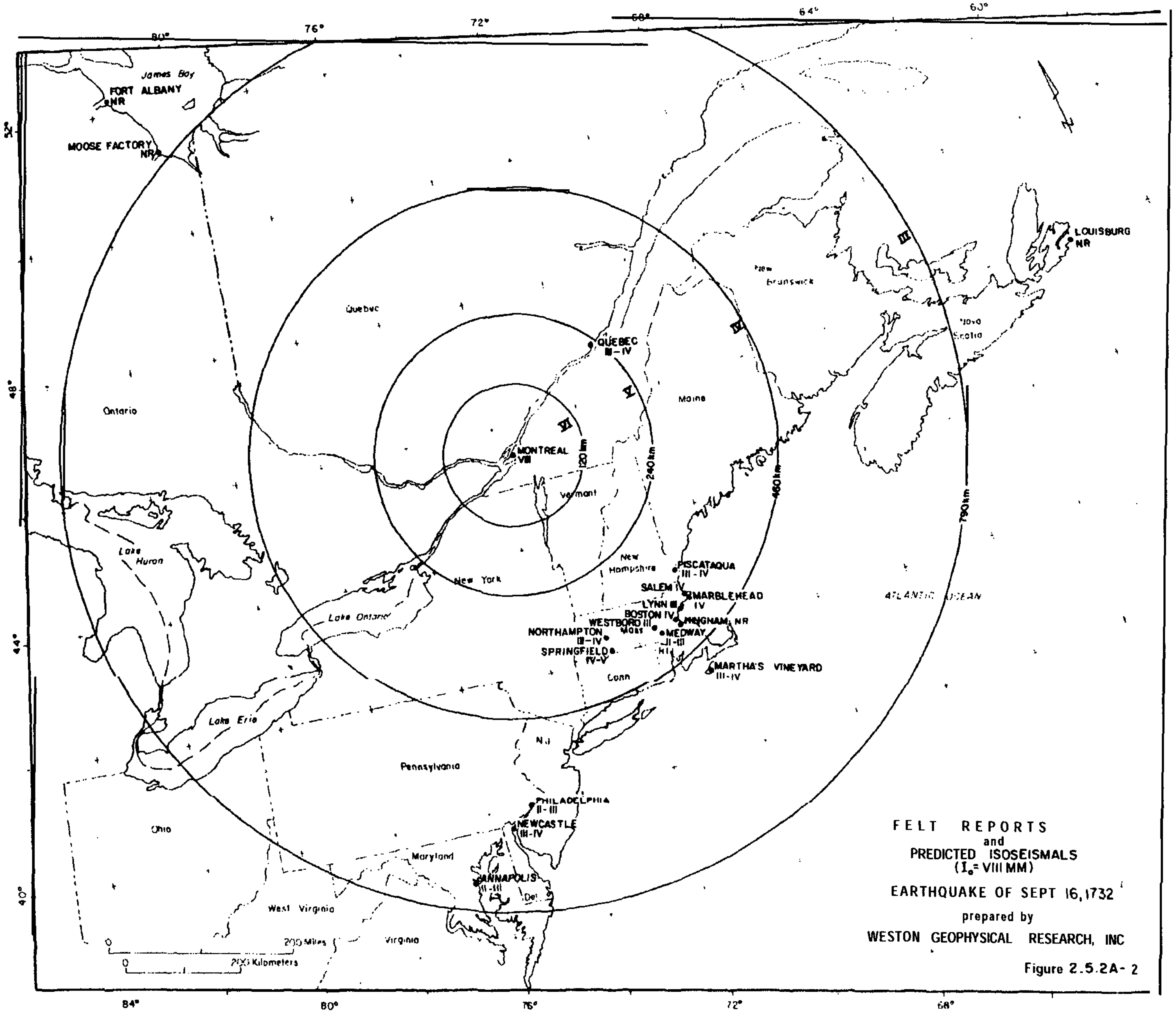
LIST OF ISOSEISMAL MAPS



ISOSEISMAL MAP
EARTHQUAKE OF
NOVEMBER 9, 1727
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-1

a: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2, Docket No. 50-471

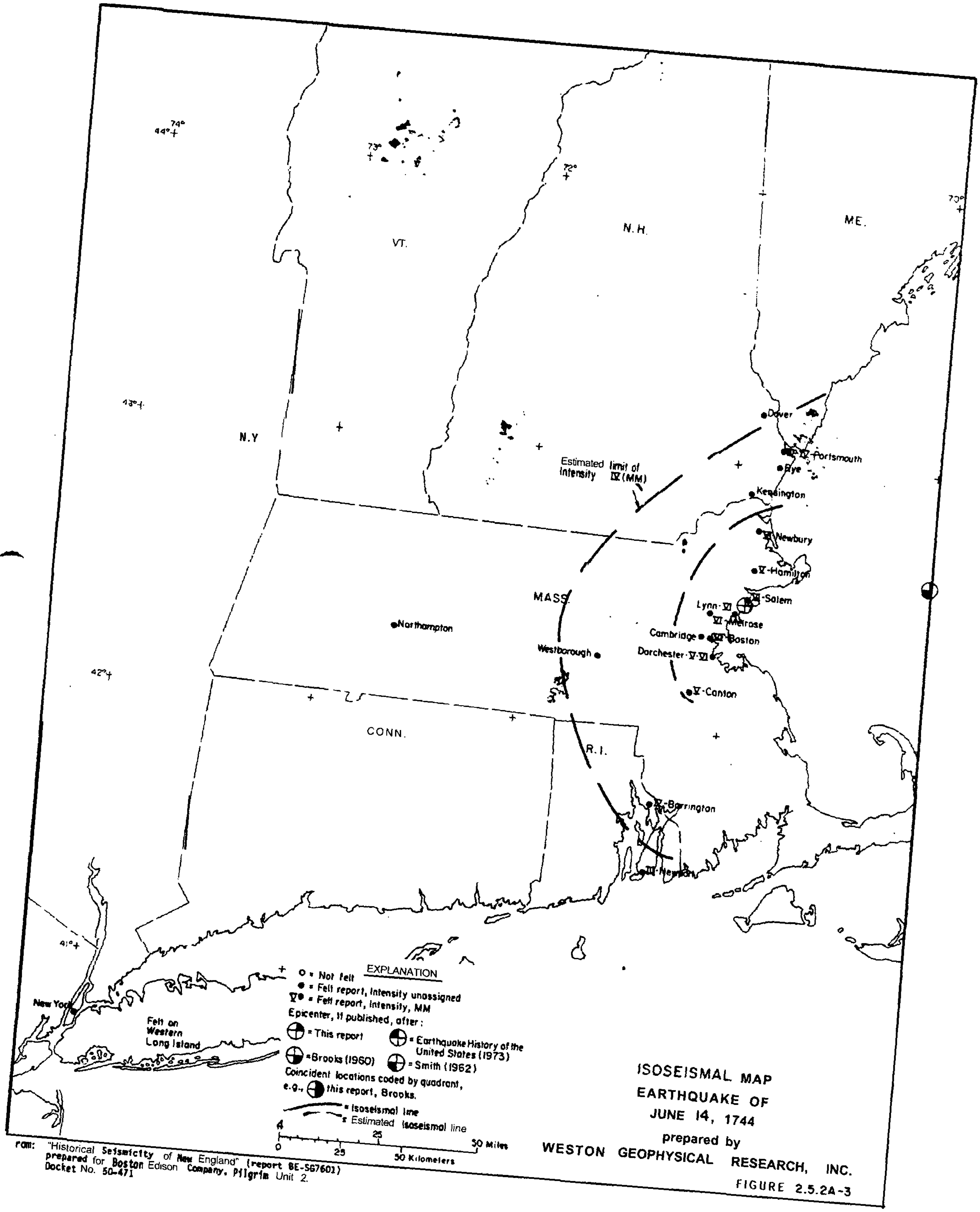


FELT REPORTS and PREDICTED ISOSEISMALS (I_o = VIII MM)

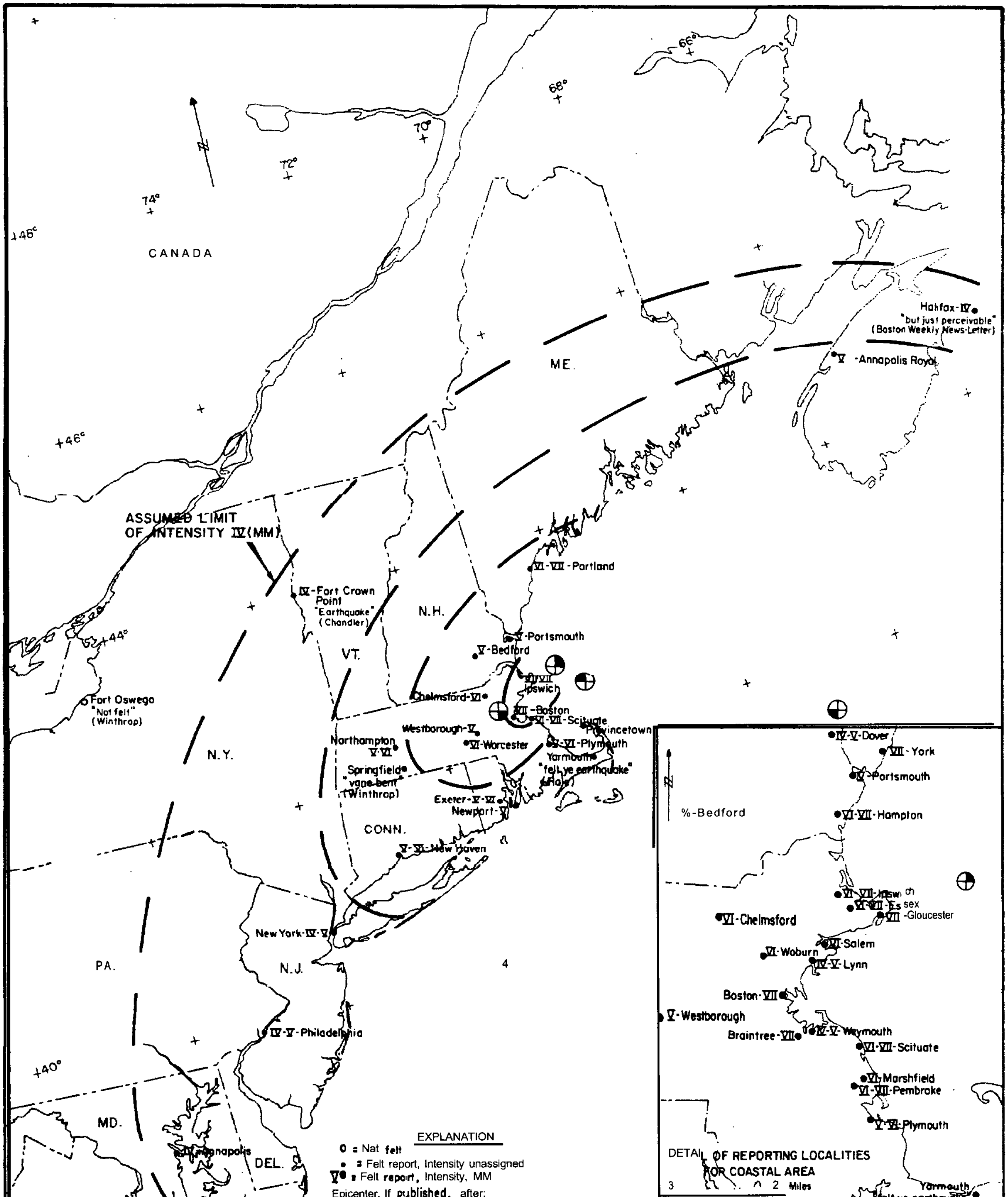
EARTHQUAKE OF SEPT 16, 1732

prepared by WESTON GEOPHYSICAL RESEARCH, INC

Figure 2.5.2A-2



From: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2. Docket No. 50-471



ISOSEISMAL MAP
EARTHQUAKE OF
NOVEMBER 18, 1755
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-4

From: "Historical Seismicity of New England" (report BE-SG7601)
prepared for Boston Edison Company. Pilgrim Unit 2.
Docket No. 50-471

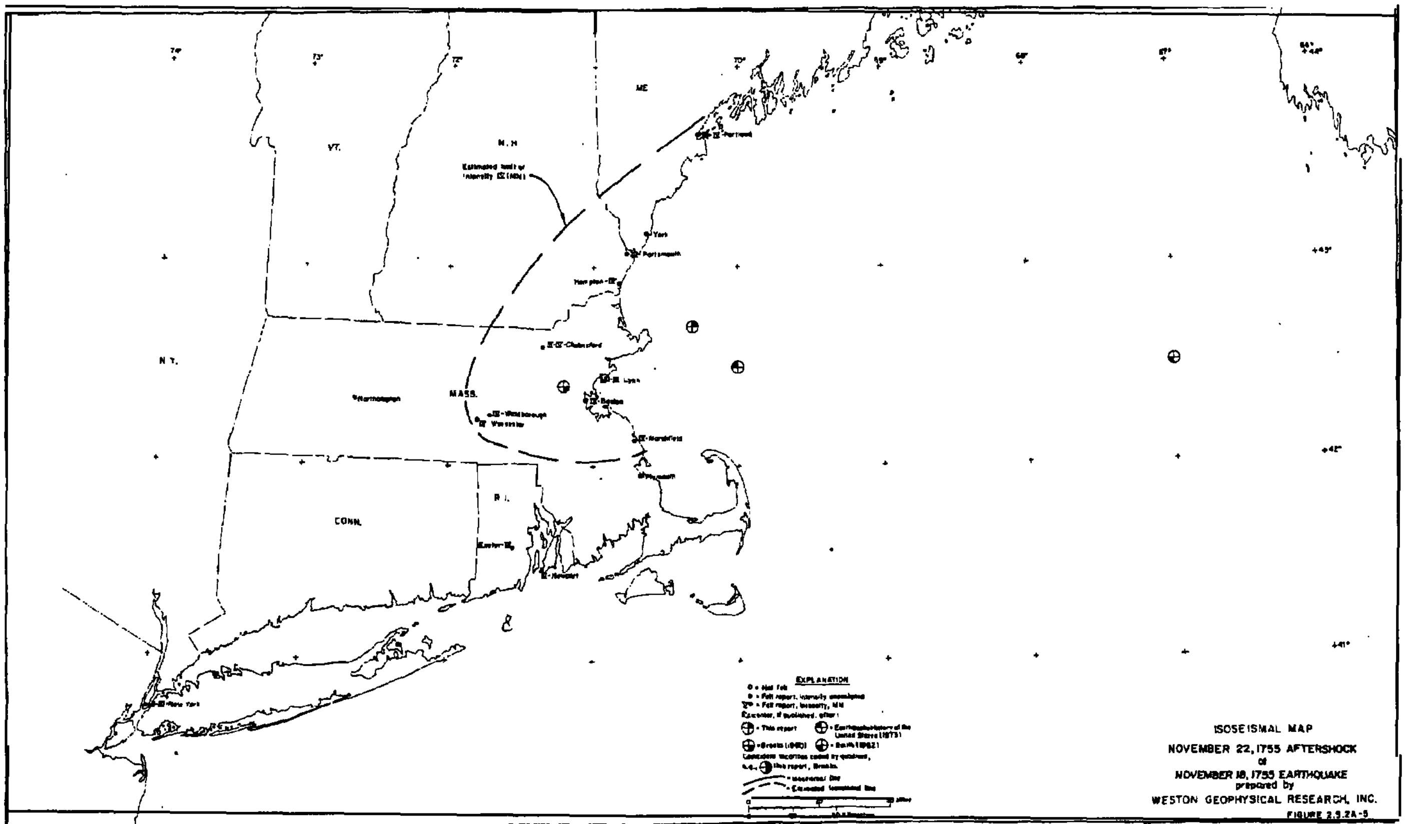
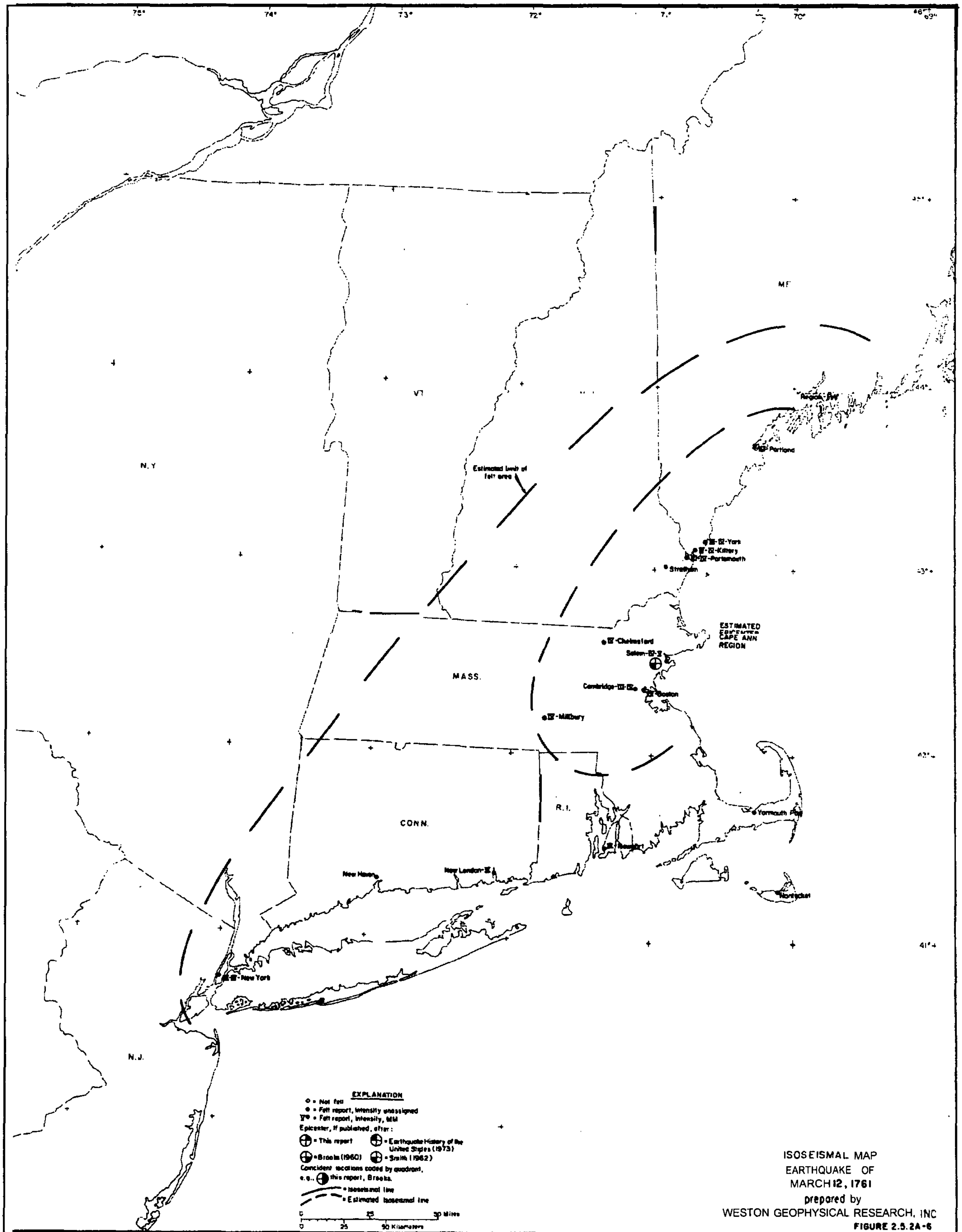


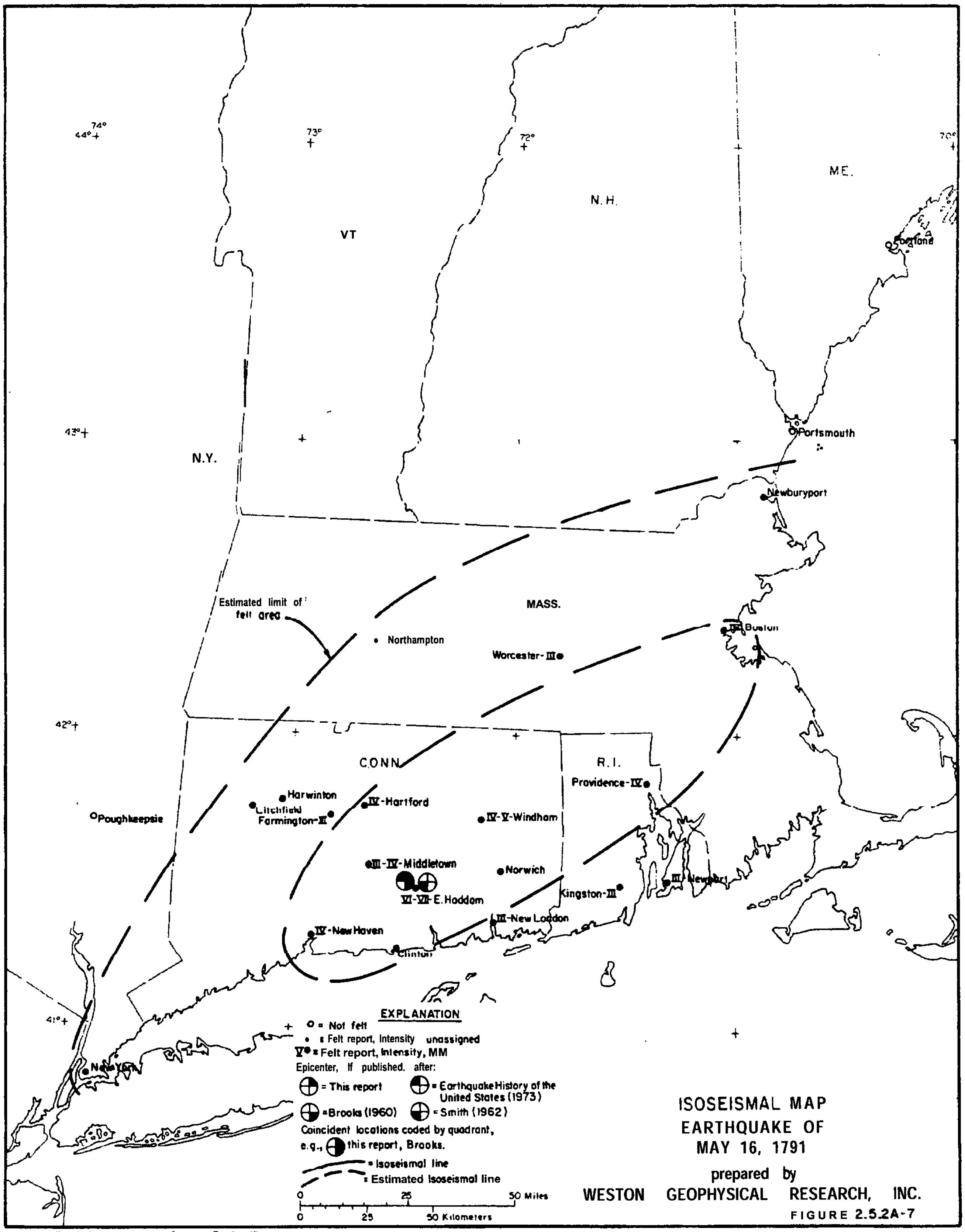
FIGURE 2.5.2A-5



ISOSEISMAL MAP
EARTHQUAKE OF
MARCH 12, 1761
prepared by
WESTON GEOPHYSICAL RESEARCH, INC

FIGURE 2.5.2A-6

"Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2, Docket No. 50-471)

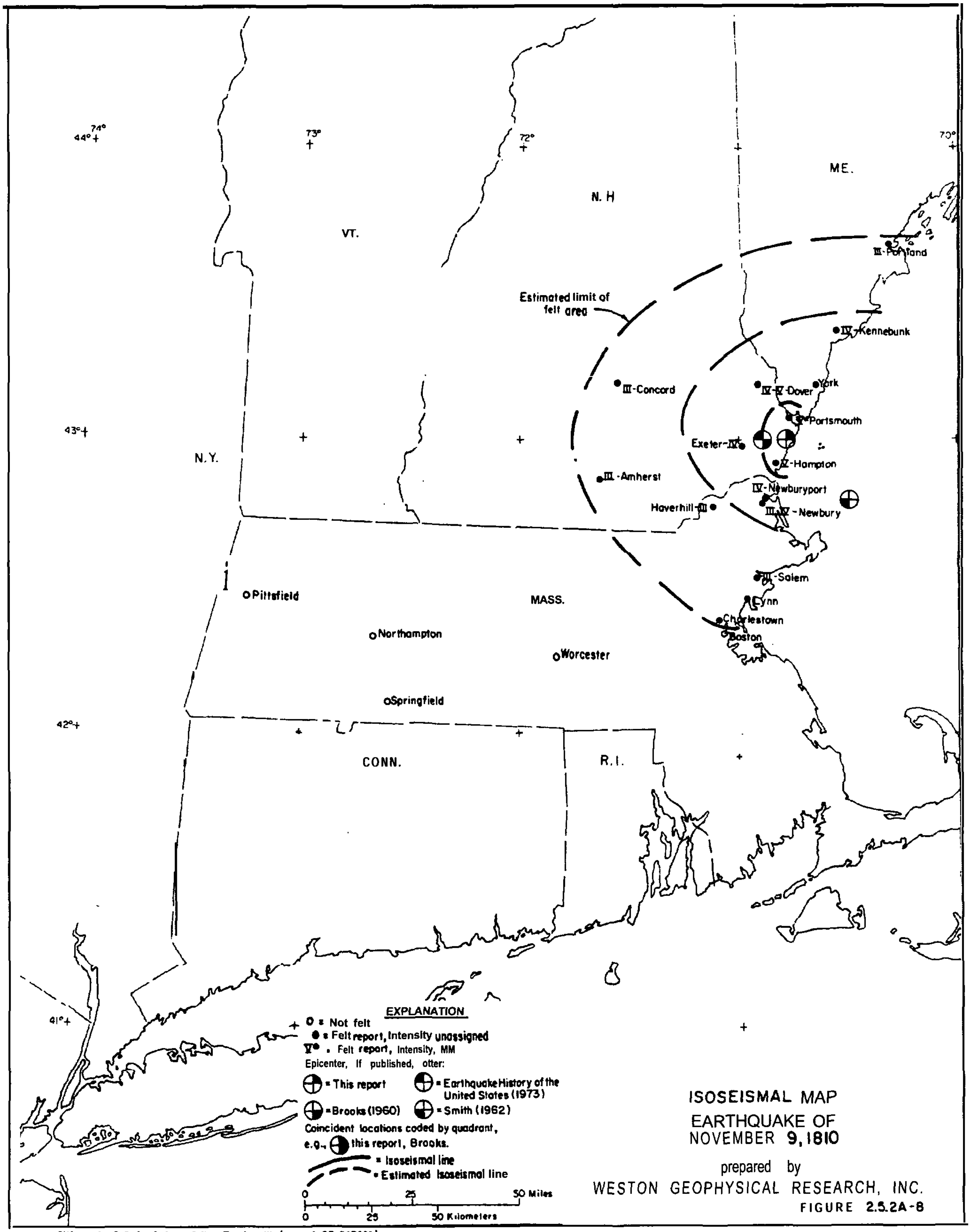


ISOSEISMAL MAP
EARTHQUAKE OF
MAY 16, 1791

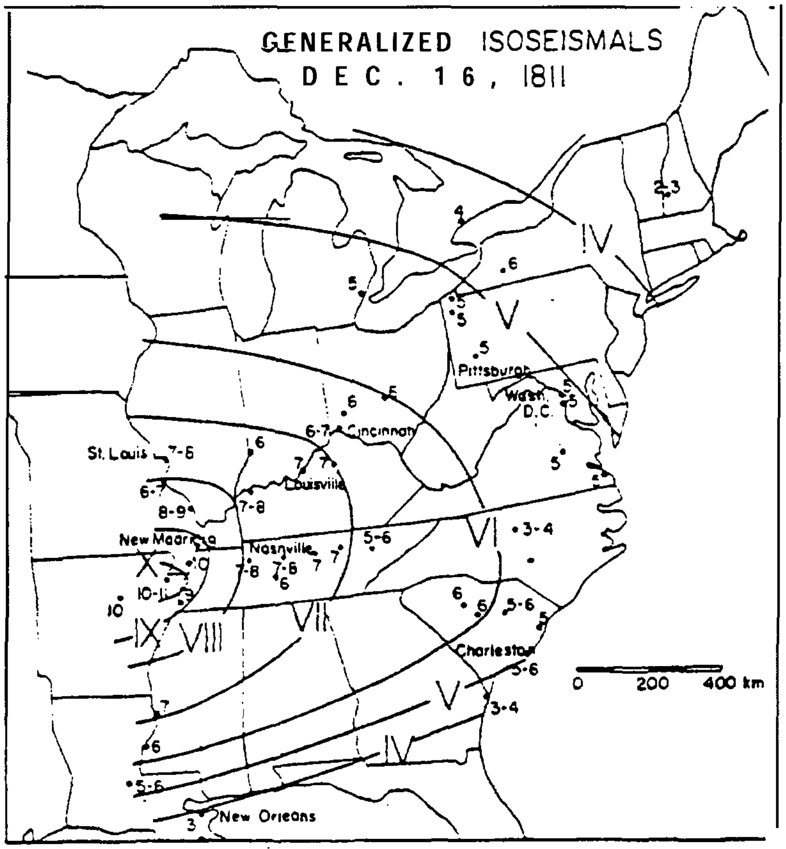
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-7

From: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2, Docket No. 50-471



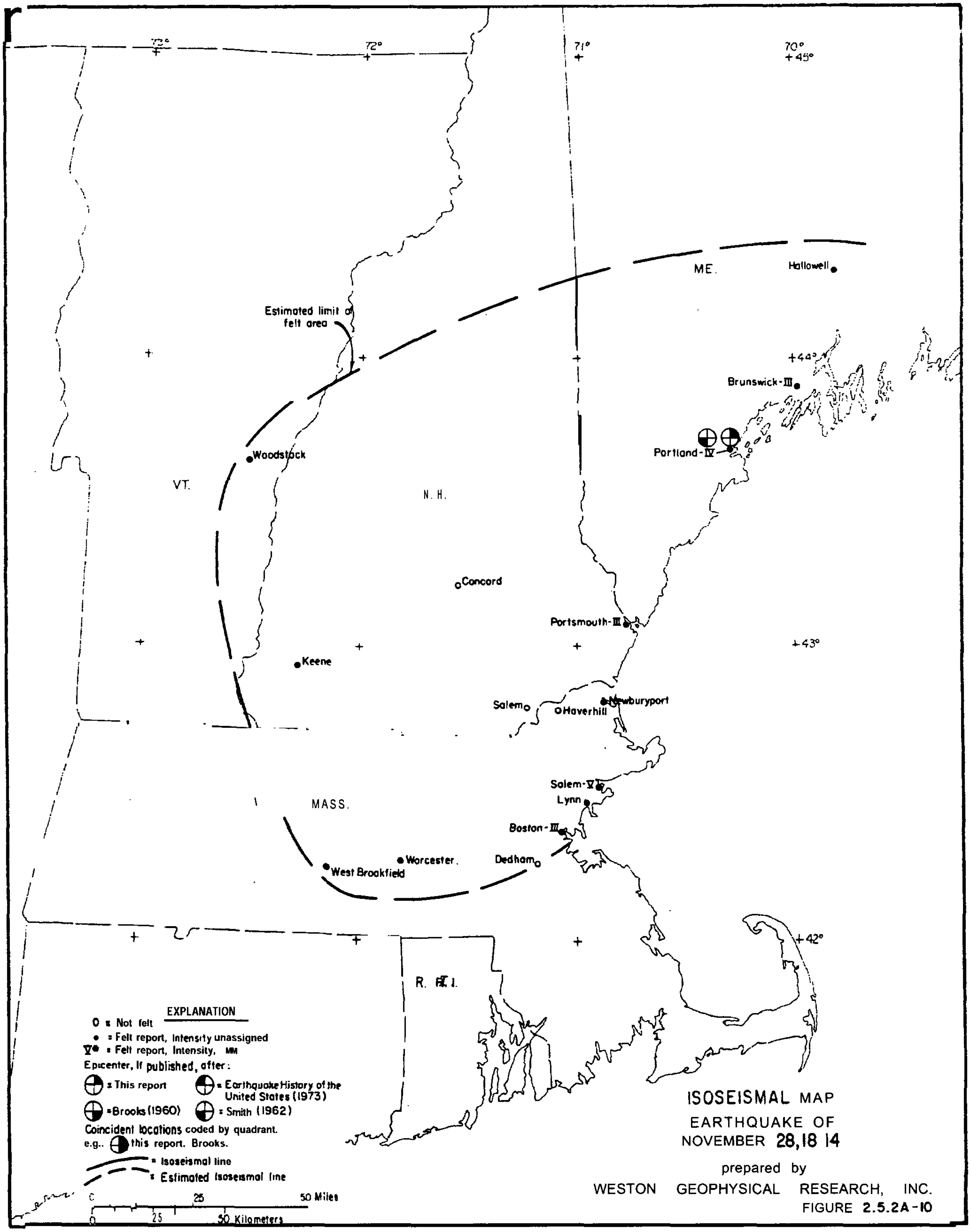
rom: "Historical Seismicity of New England" (report BE-SG7601)
prepared for Boston Edison Company, Pilgrim Unit 2.
Docket No. 50-471



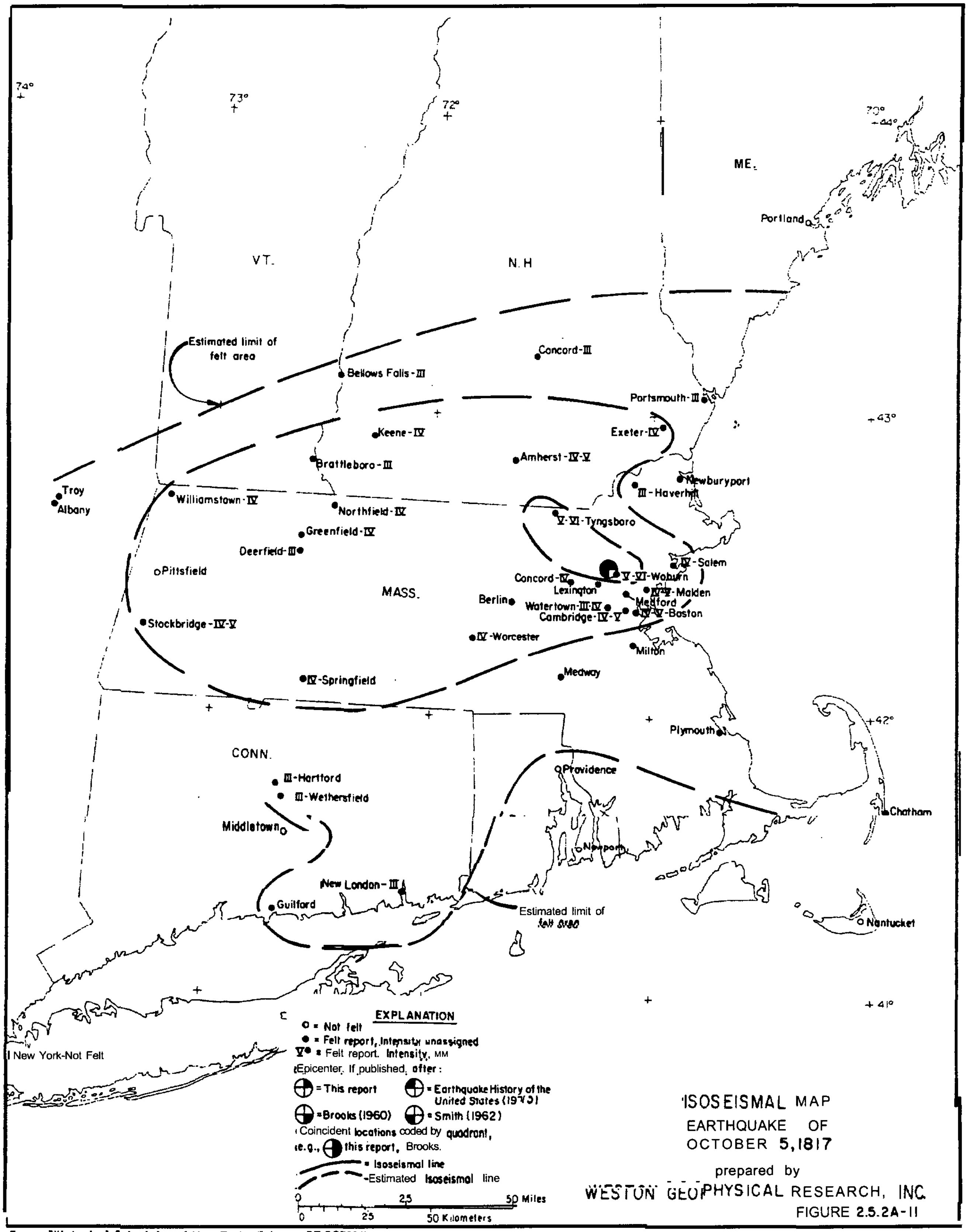
Generalized isoseismal map of the earthquake of December 16, 1811 at 08h15m GMT. MM intensity values at individual points are given in Arabic numerals (see Table 1 for sources of information). The isoseisms, labeled with Roman numerals, indicate the outer bound of the region of specified intensity.

Nuttli, Otto W., 1973, The Mississippi Valley Earthquakes of 1811 and 1812: Intensities, Ground Motion and Magnitudes, B.S.S.A., Vol. 63, No. 1, pp. 227-248.

Figure 2.5.2A-9



an: "Historical Seismicity of New England" (report BE-SG7601)
prepared for Boston Edison Company, Pilgrim Unit 2.
Docket No. 50-471

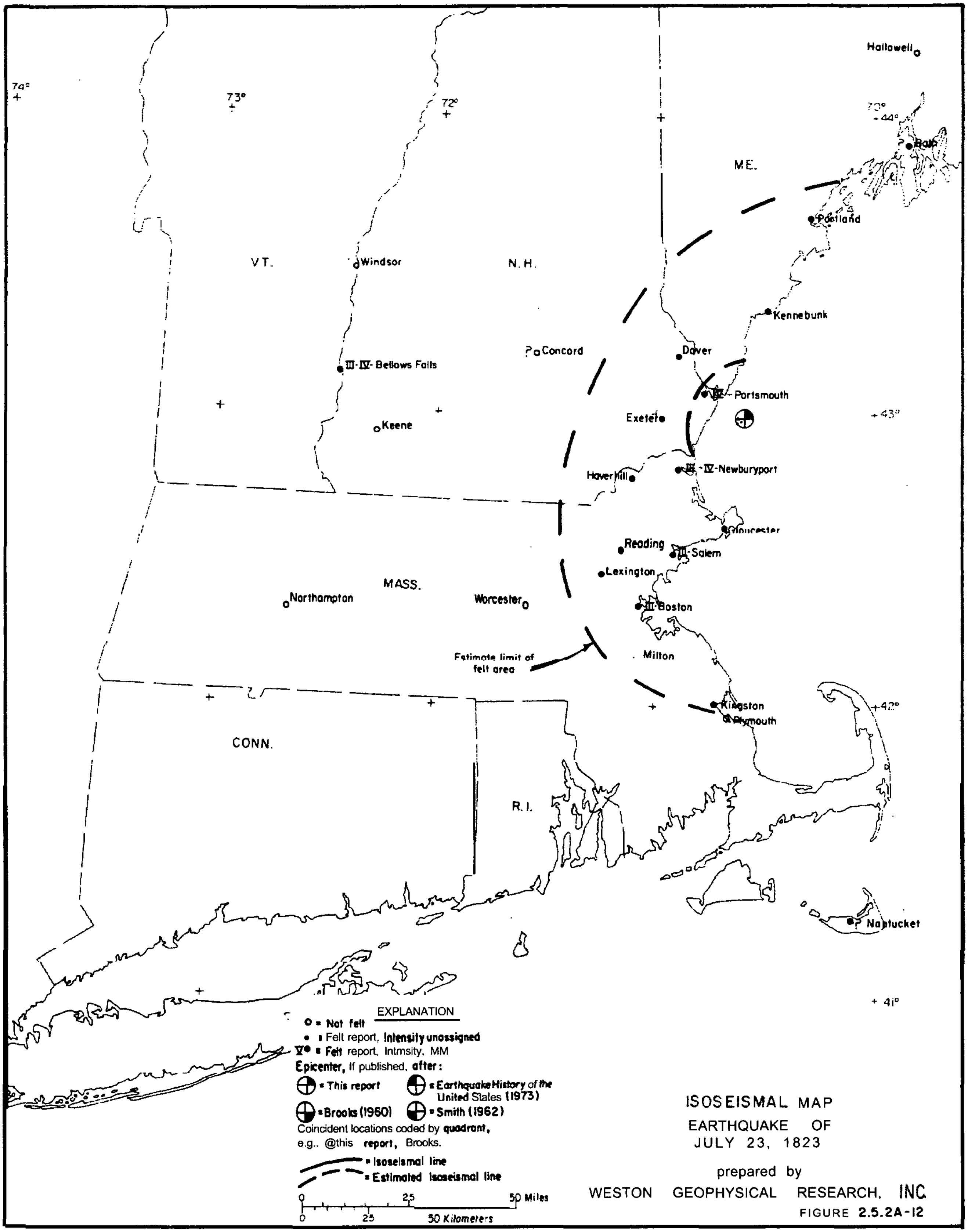


ISOSEISMAL MAP
EARTHQUAKE OF
OCTOBER 5, 1817

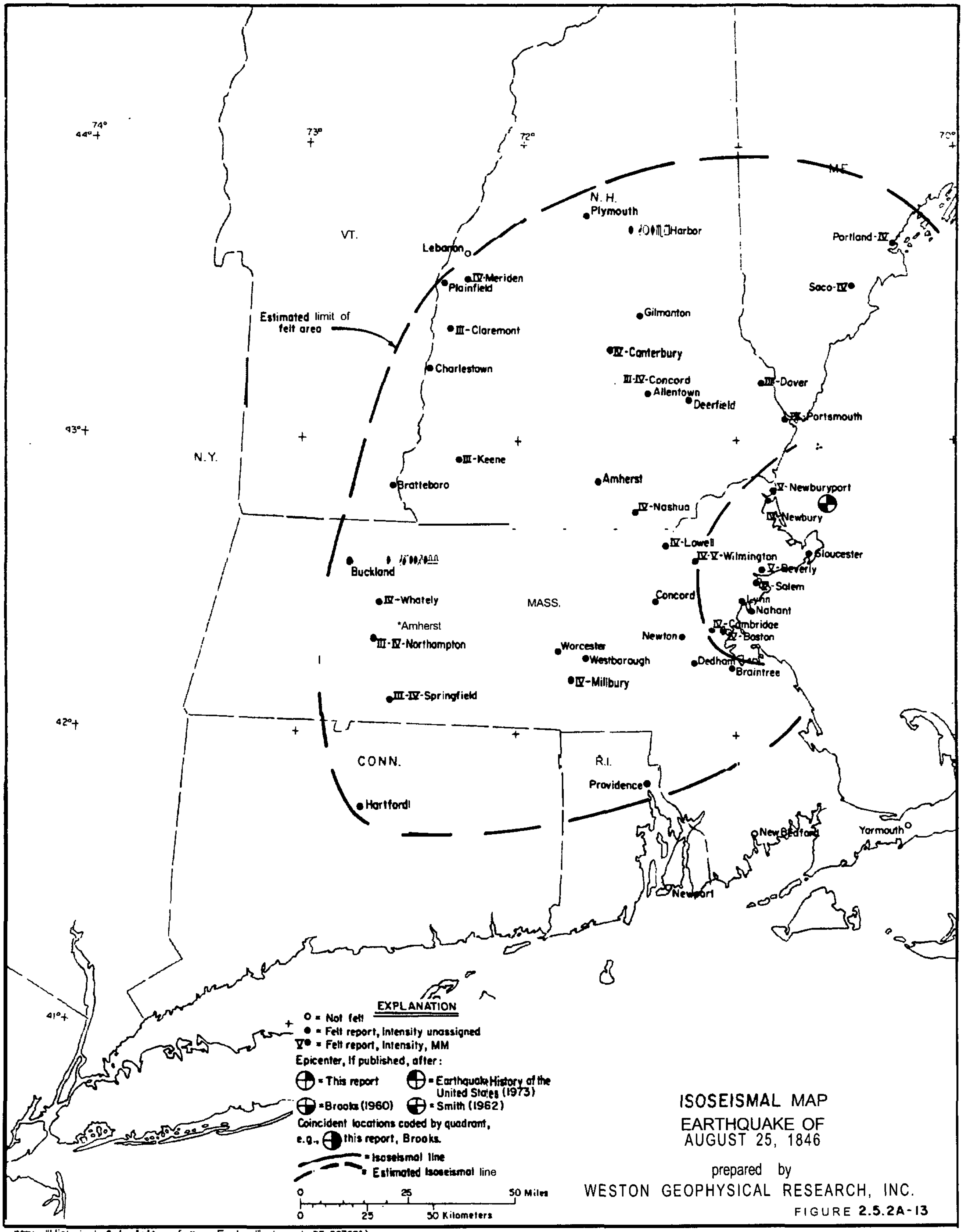
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-11

Frm: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2. Docket No. 50-471



ON: "Historical Seismicity of New England" (report BE-SG7601)
prepared for Boston Edison Company. Pilgrim Unit 2,
Docket No. 50-471

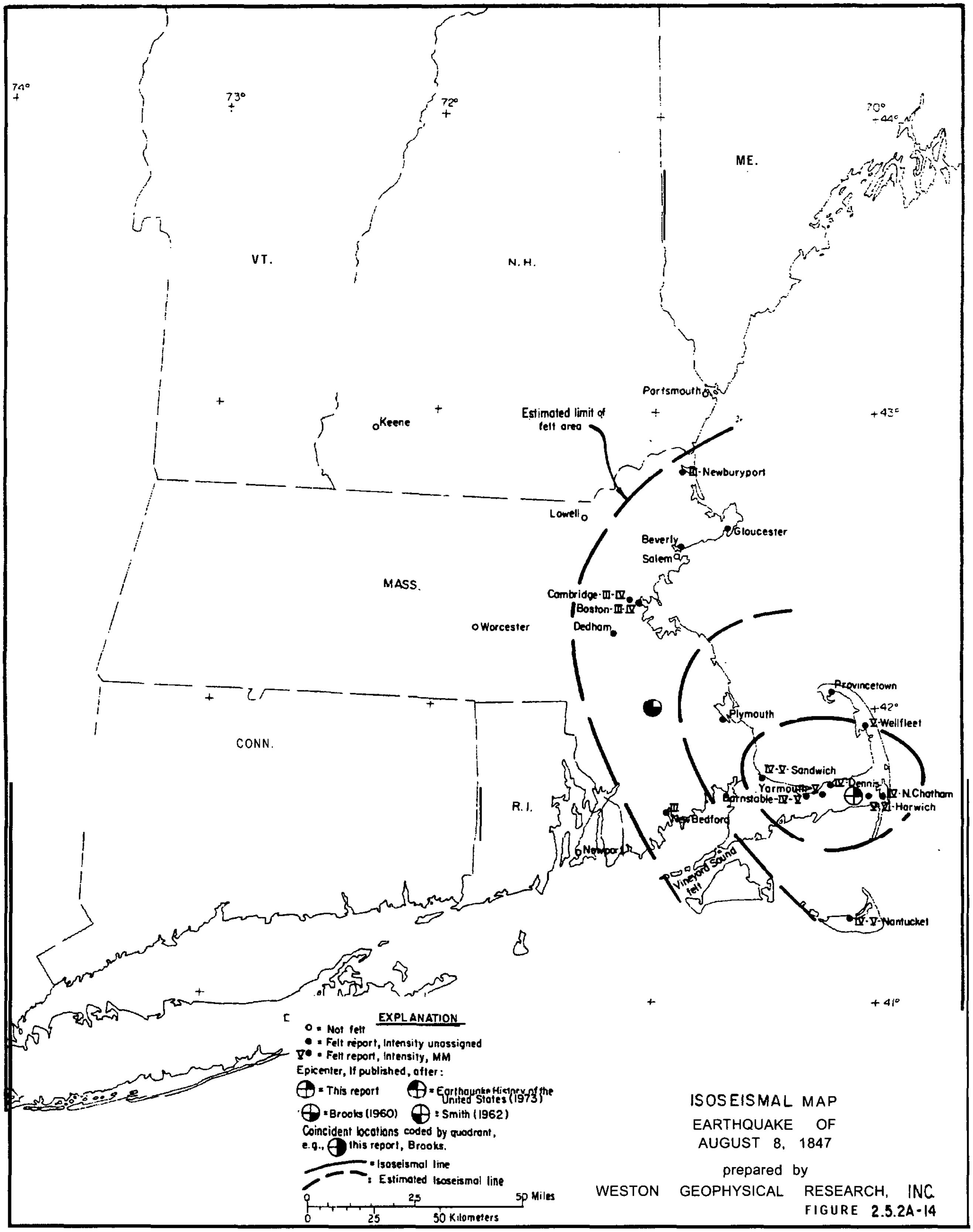


ISOSEISMAL MAP
EARTHQUAKE OF
AUGUST 25, 1846

prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-13

From: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company. Pilgrim Unit 2. Docket No. 50-471

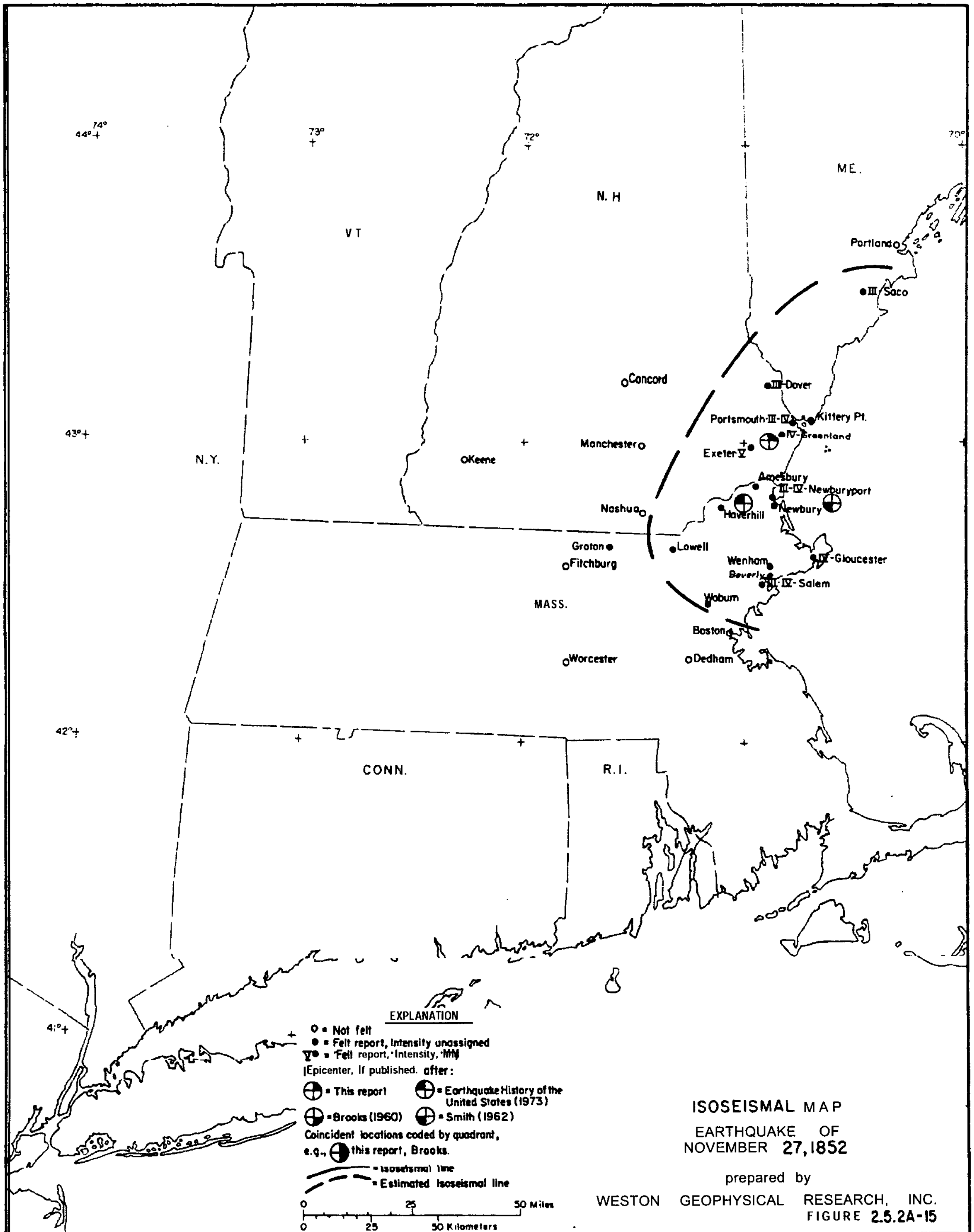


ISOSEISMAL MAP
EARTHQUAKE OF
AUGUST 8, 1847

prepared by
WESTON GEOPHYSICAL RESEARCH, INC

FIGURE 2.5.2A-14

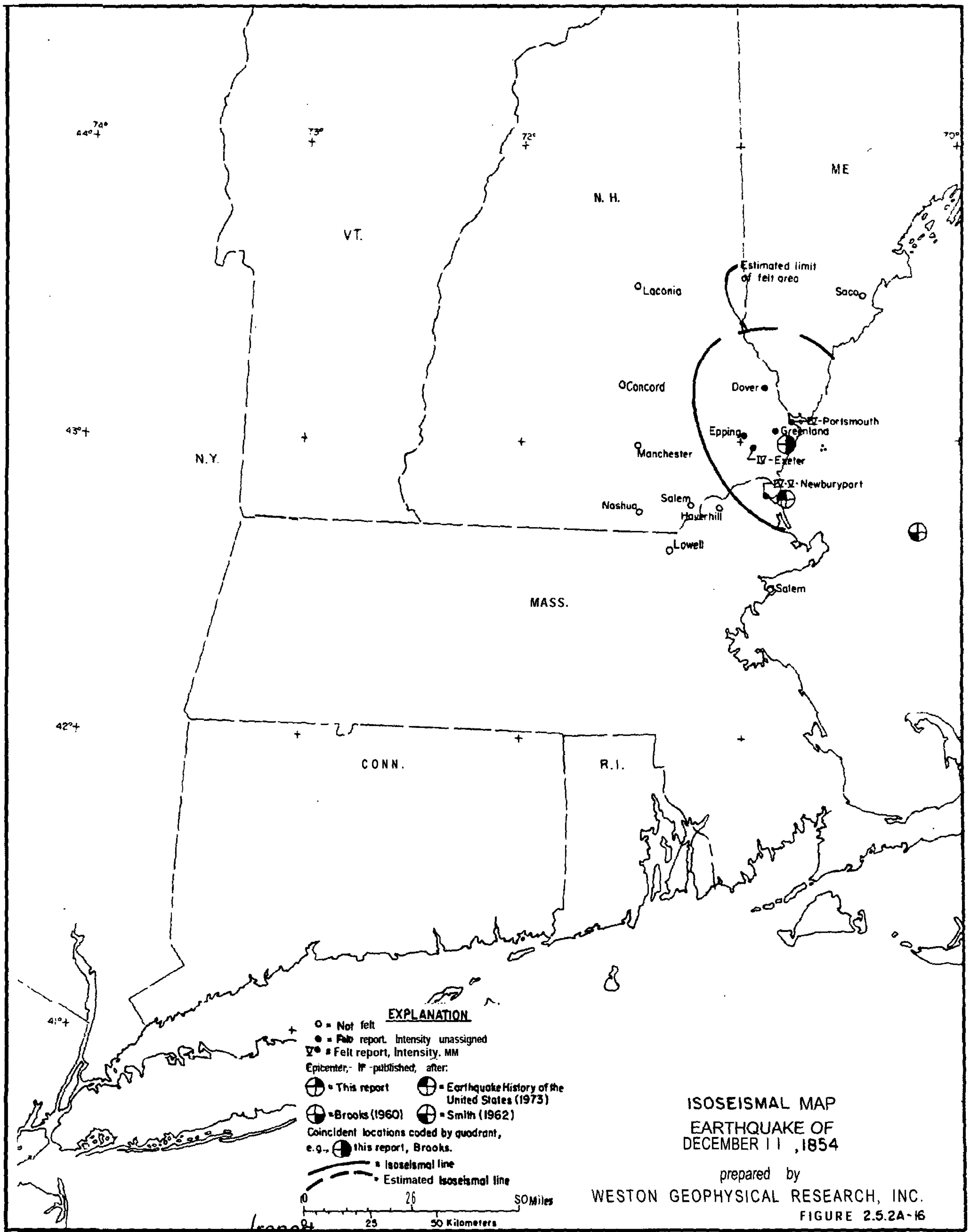
'OM: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2, Docket No. 50-471



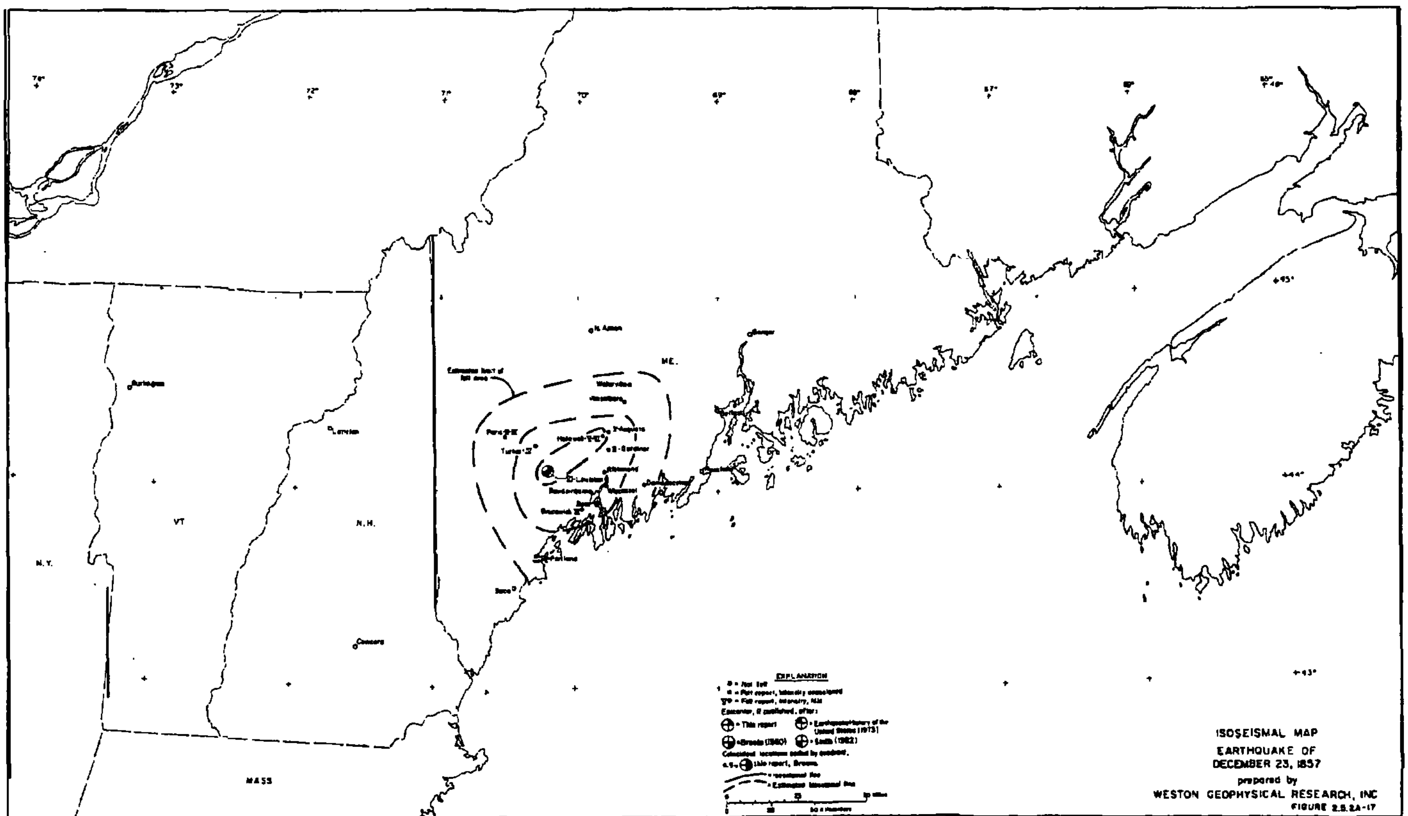
ISOSEISMAL MAP
EARTHQUAKE OF
NOVEMBER 27, 1852
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-15

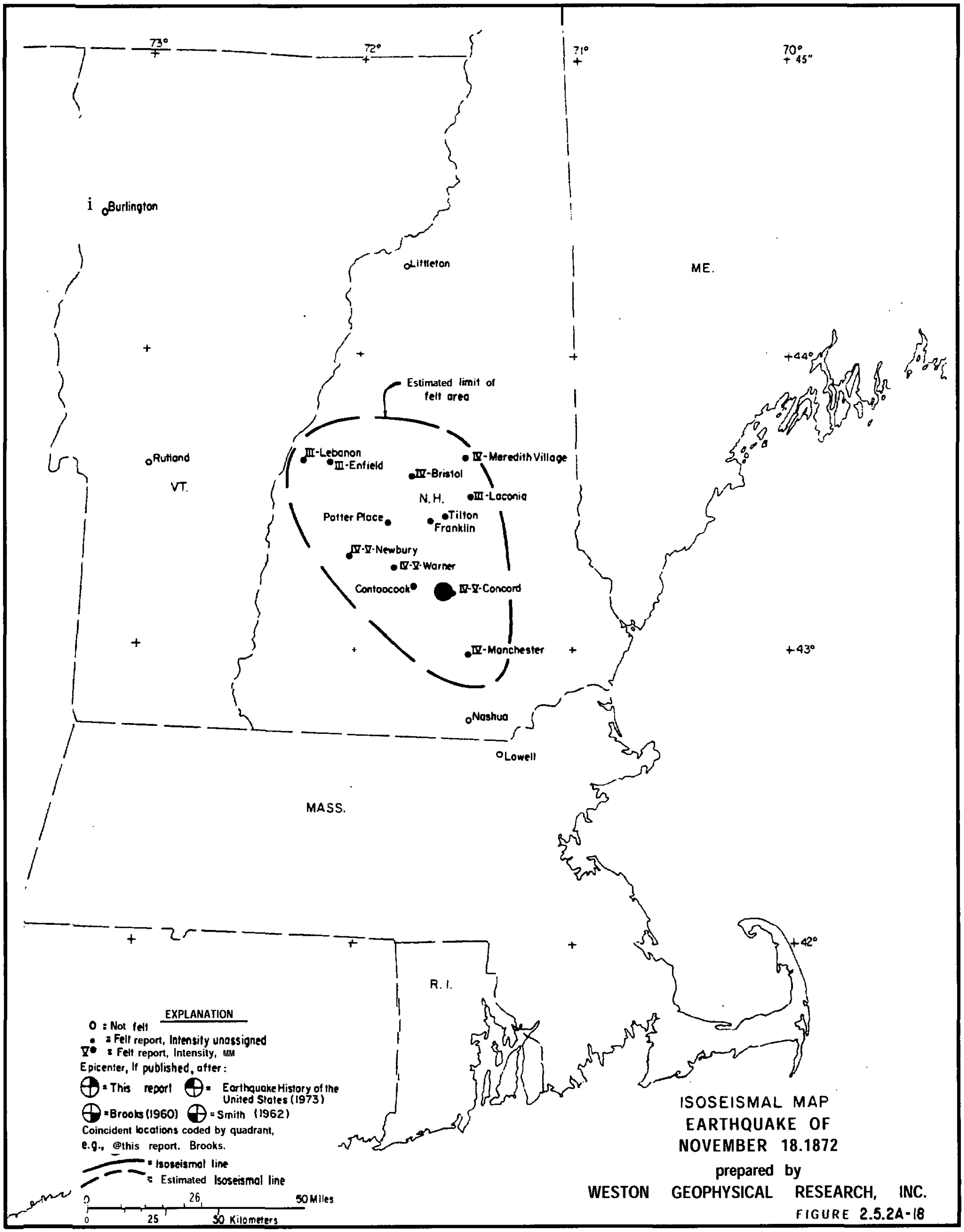
From: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2. Docket No. 50-471



From: "Historical Seismicity of New England" (report BE-SG7601)
prepared for Boston Edison Company, Pilgrim Unit 2,
Docket No. 50-471

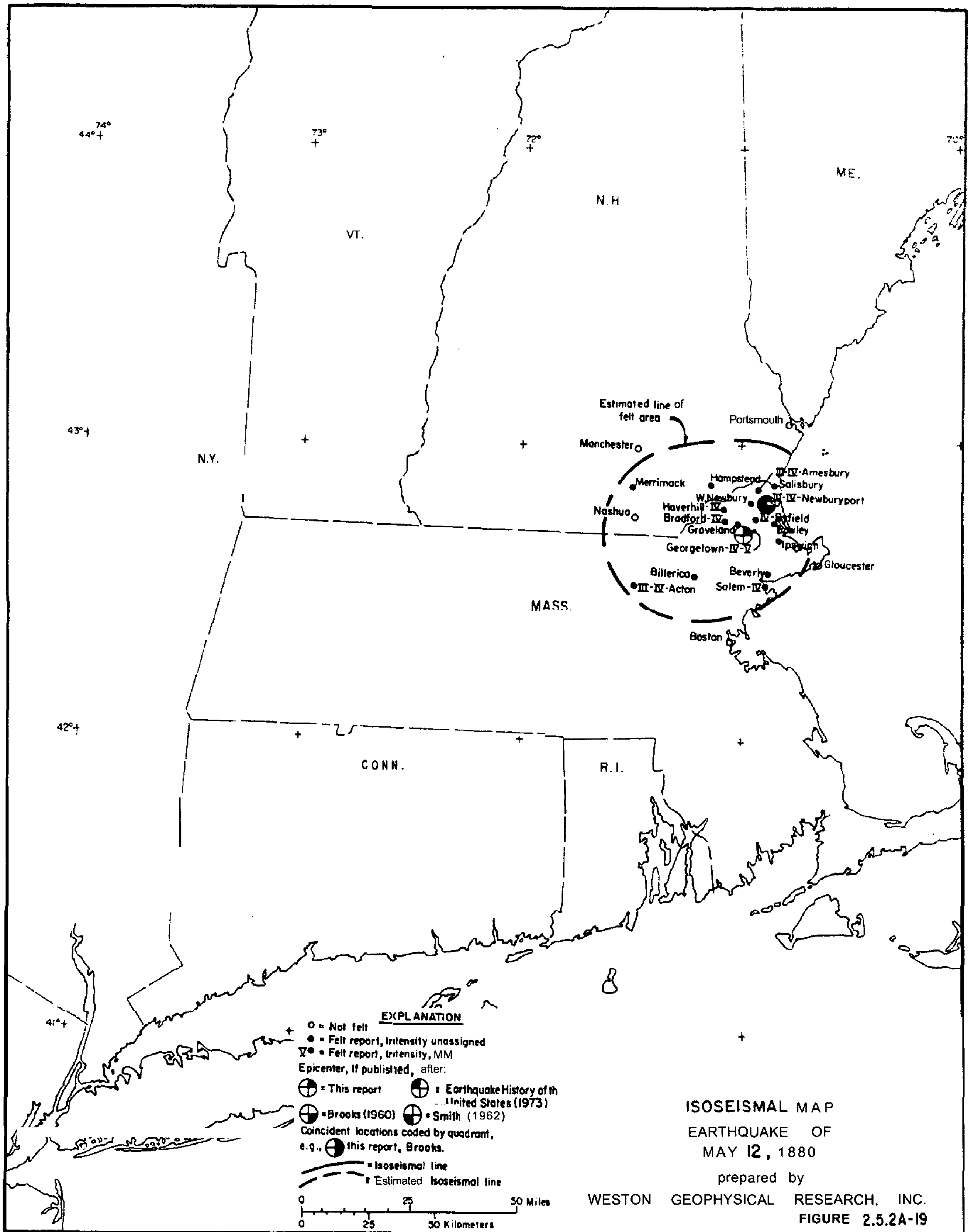


ISOSEISMAL MAP
EARTHQUAKE OF
DECEMBER 23, 1857
prepared by
WESTON GEOPHYSICAL RESEARCH, INC
FIGURE 2.5.2A-17



ISOSEISMAL MAP
EARTHQUAKE OF
NOVEMBER 18.1872
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.
FIGURE 2.5.2A-18

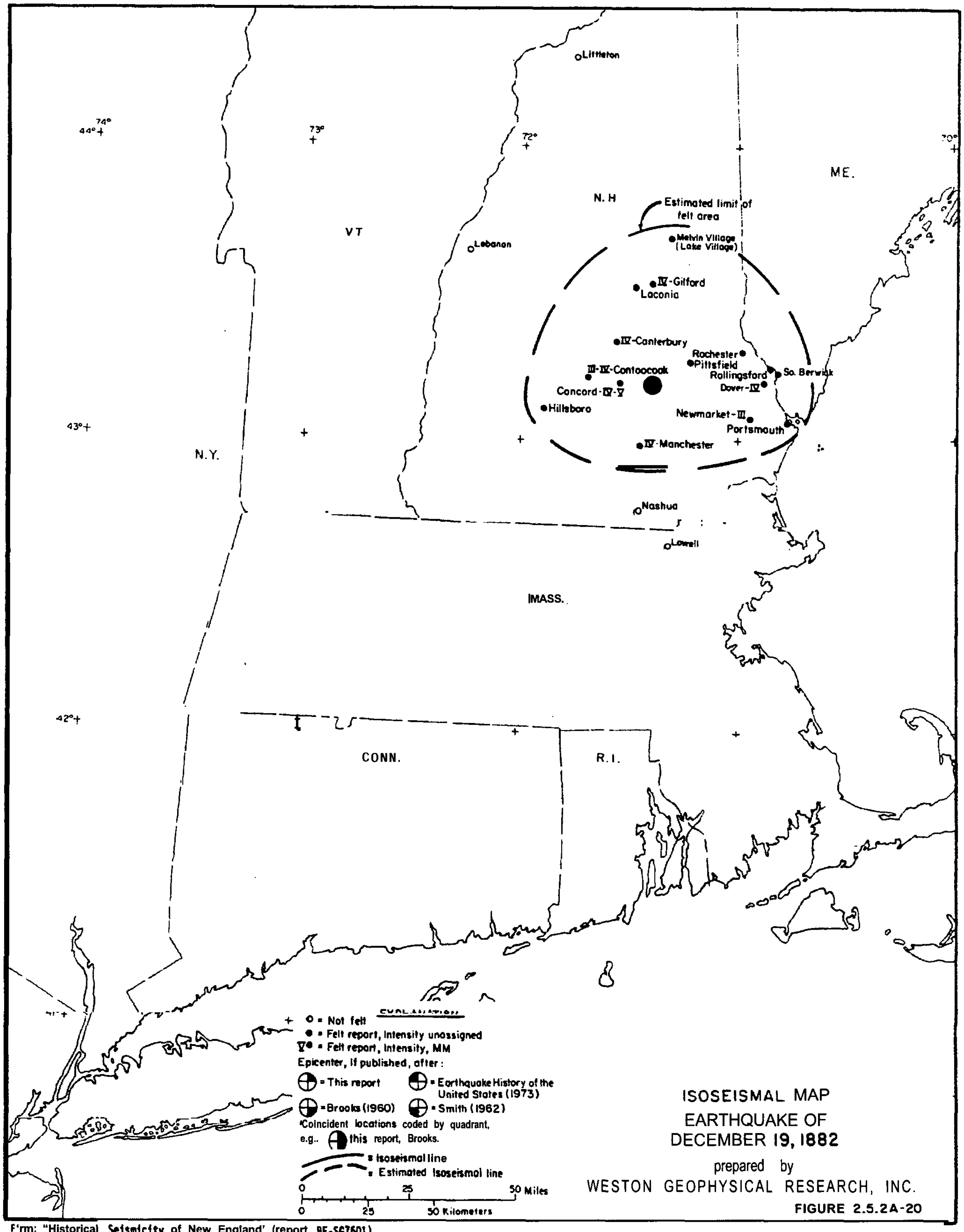
xx: "Historical Seismicity Of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2, Docket No. 50-471



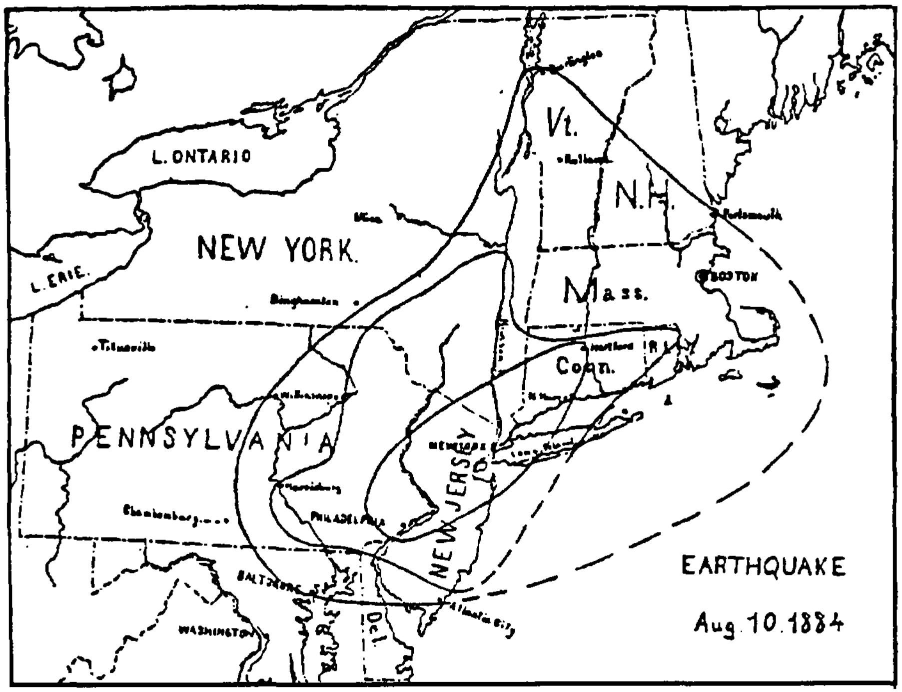
ISOSEISMAL MAP
EARTHQUAKE OF
MAY 12, 1880
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-19

From: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company. Pilgrim Unit 2, Docket No. 50-471

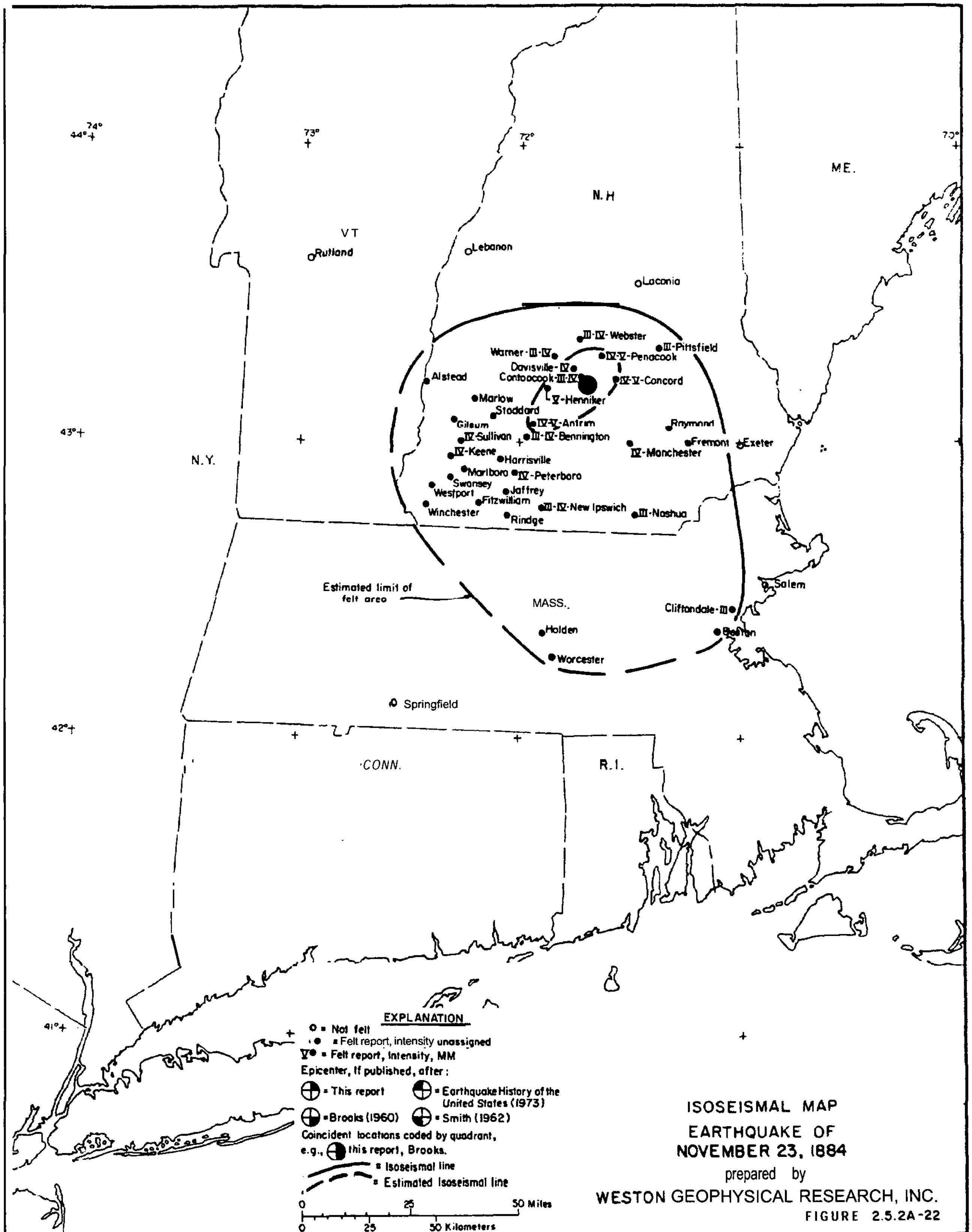


From: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2. Docket No. 50-471



Rockwood, C. G., Jr., "Notices of Recent **American** Earthquakes", Amer. Jour. Sci., V. 29, pp. 425-437.

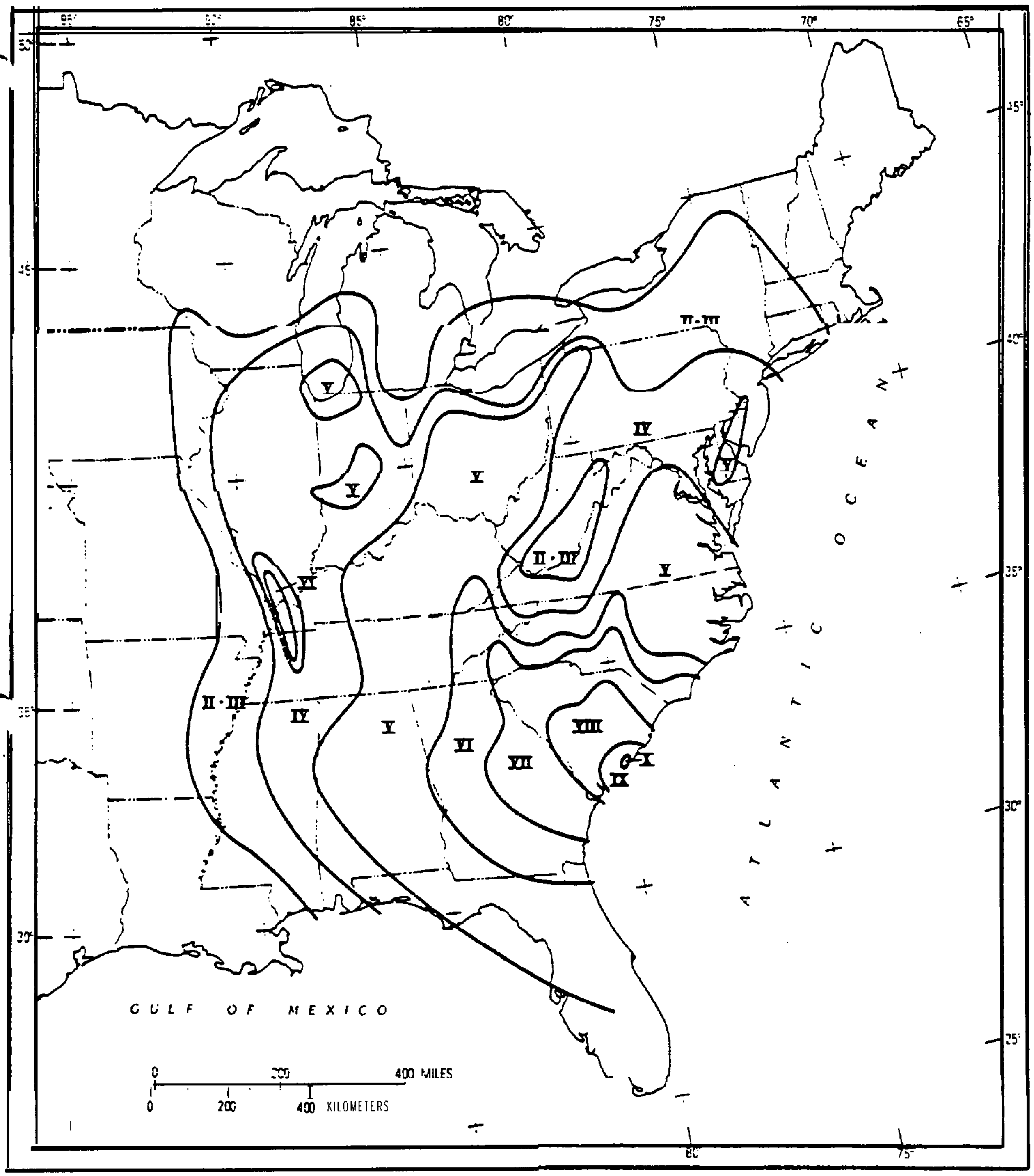
Figure 2.5.2A-21



ISOSEISMAL MAP
EARTHQUAKE OF
NOVEMBER 23, 1884
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-22

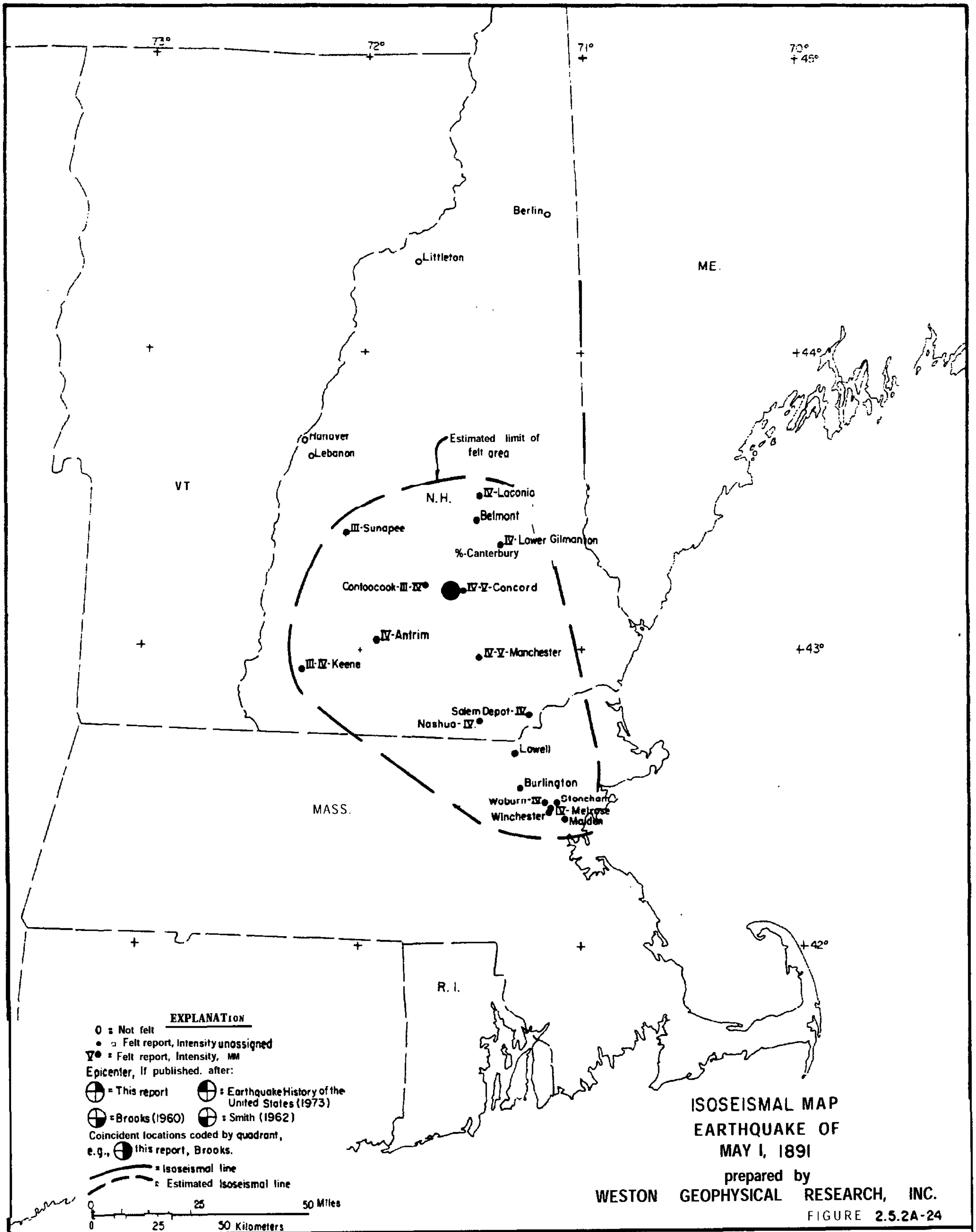
From: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2. Docket No. 50-471



.—**Isoseismal** map of the **Eastern** United States contoured to show the broad **regional** patterns of the reported **intensities for** the 1886 Charleston earthquake. **Contoured intensity levels are shown in Roman numerals.**

"Studies Related to the Charleston, South Carolina, Earthquake of 1886-A Preliminary Report". Geological Survey Professional Paper 1028, U.S.G.S., Washington, D.C., 1977.

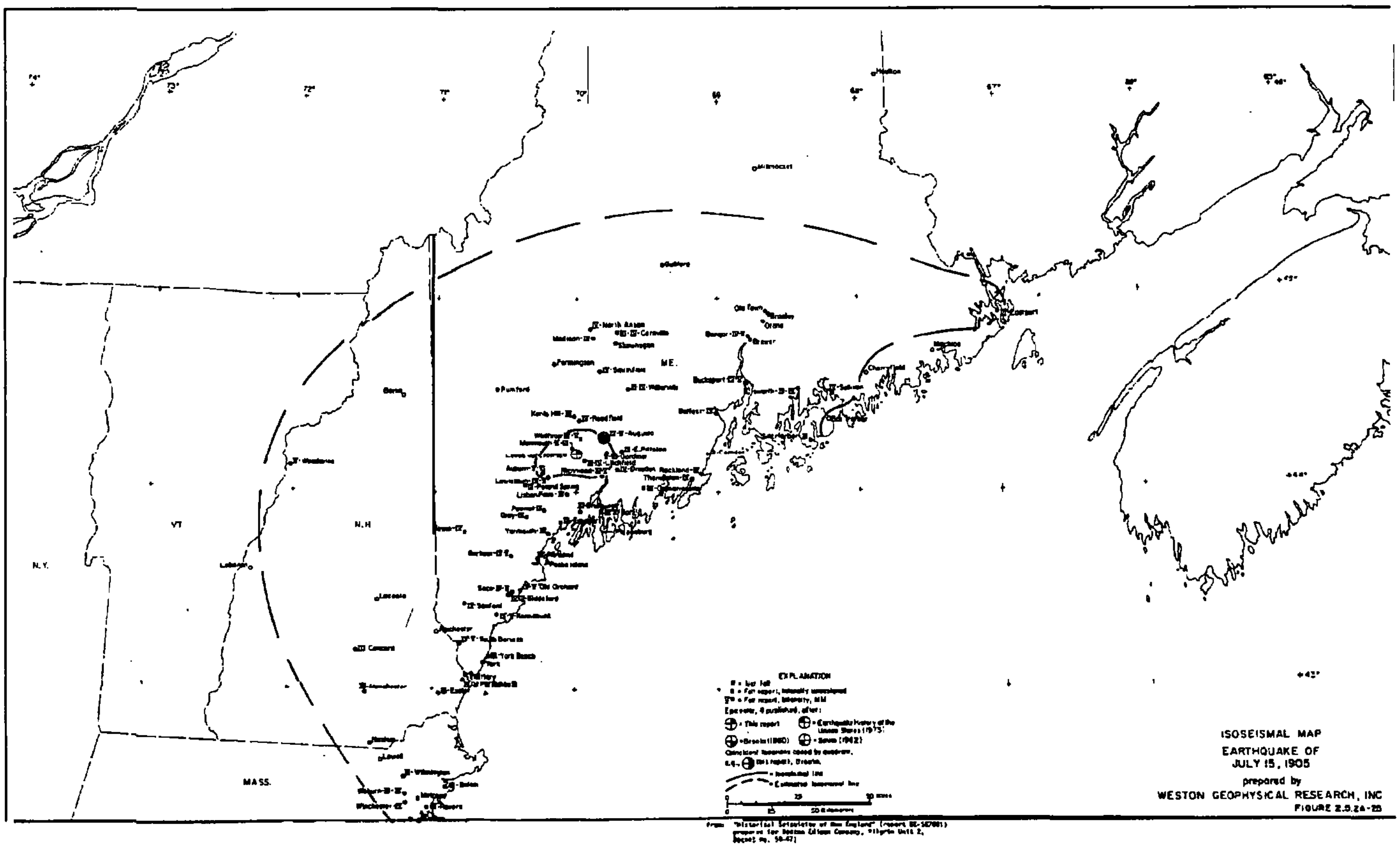
Figure 2.5.2A-23



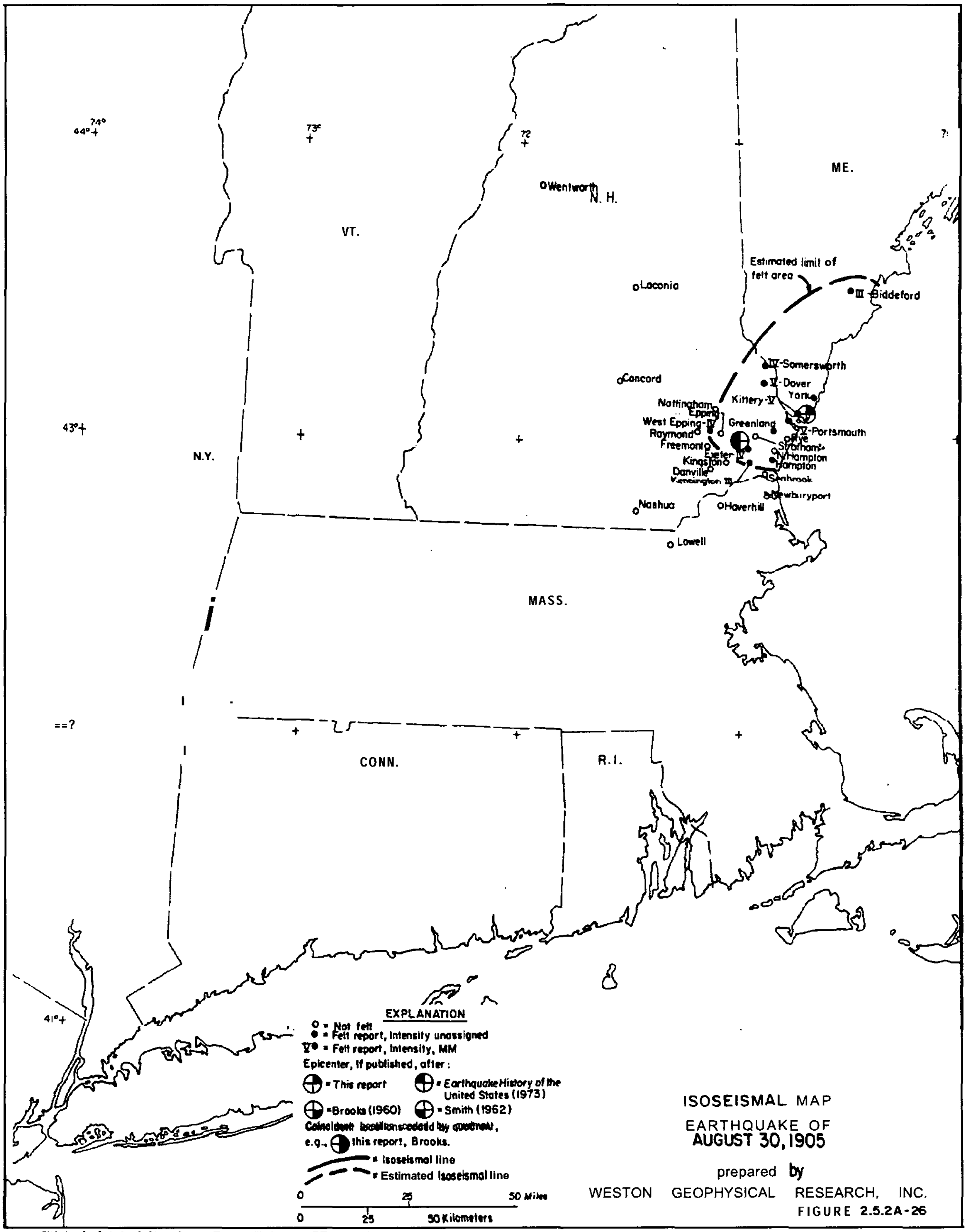
ISOSEISMAL MAP
EARTHQUAKE OF
MAY 1, 1891
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-24

RI: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company. Pilgrim Unit 2, Docket No. 50-471



ME.
N.H.
VT
N.Y.
MASS.
EXPLANATION
ISOSEISMAL MAP
EARTHQUAKE OF
JULY 15, 1905
prepared by
WESTON GEOPHYSICAL RESEARCH, INC

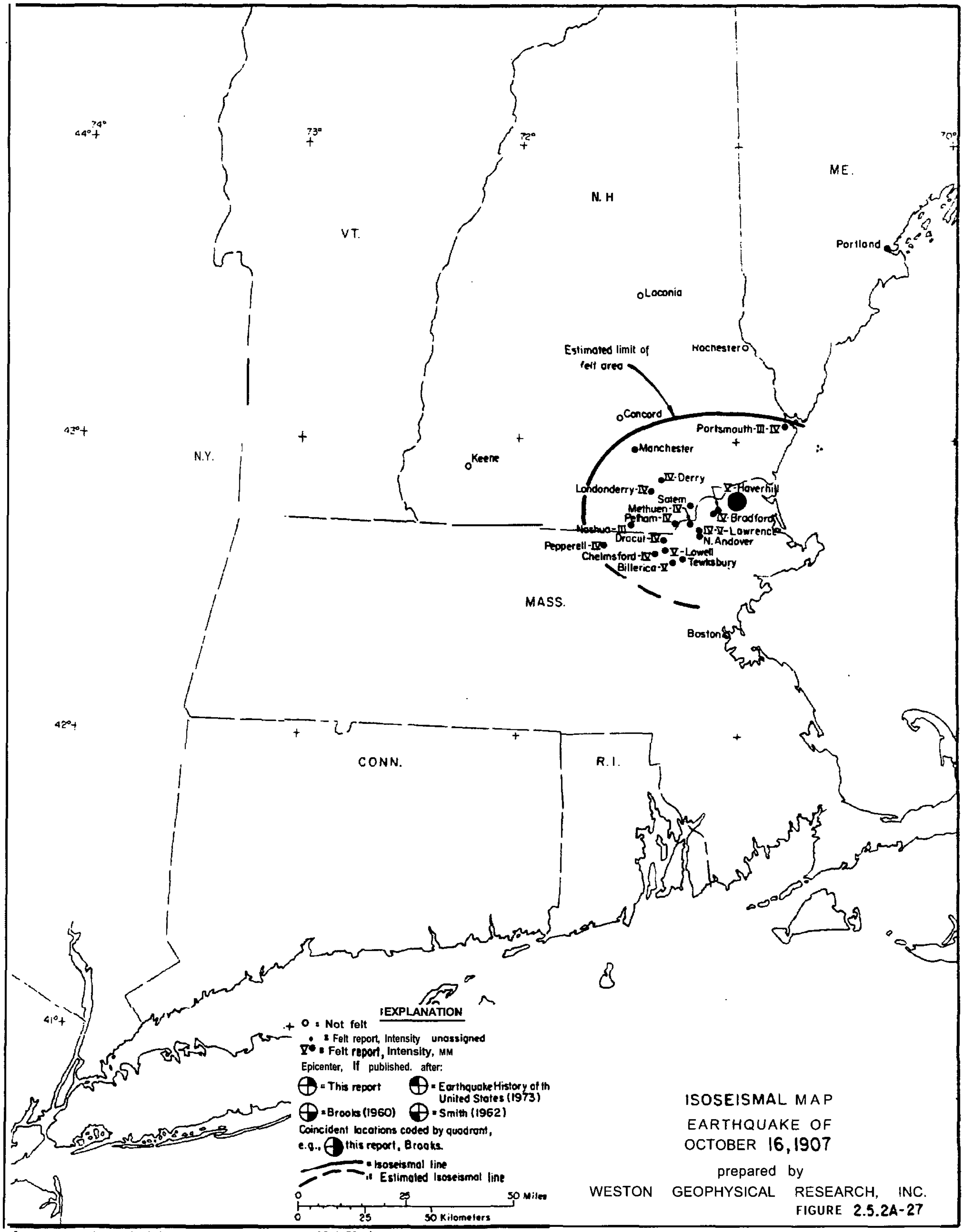


ISOSEISMAL MAP
EARTHQUAKE OF
AUGUST 30, 1905

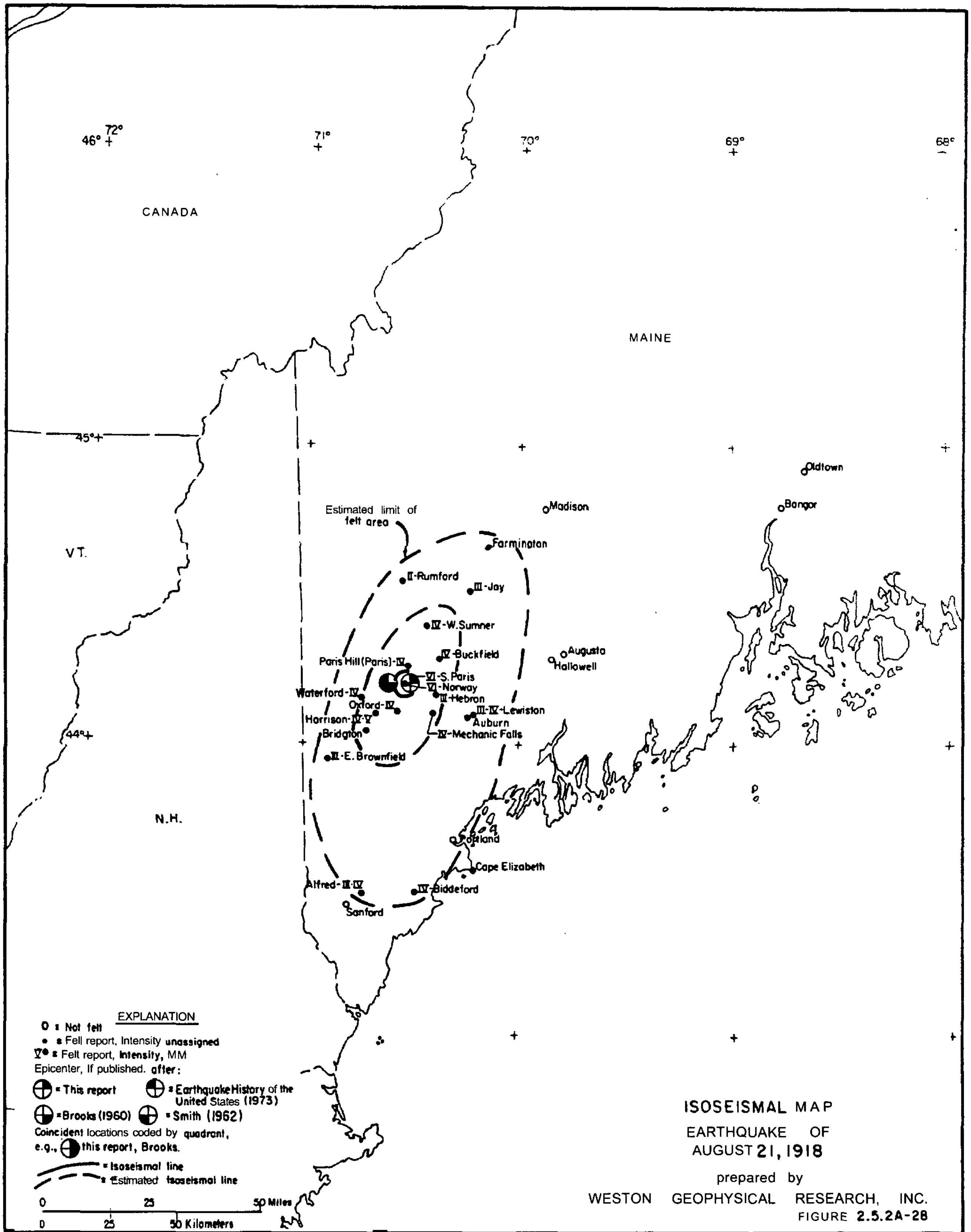
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-26

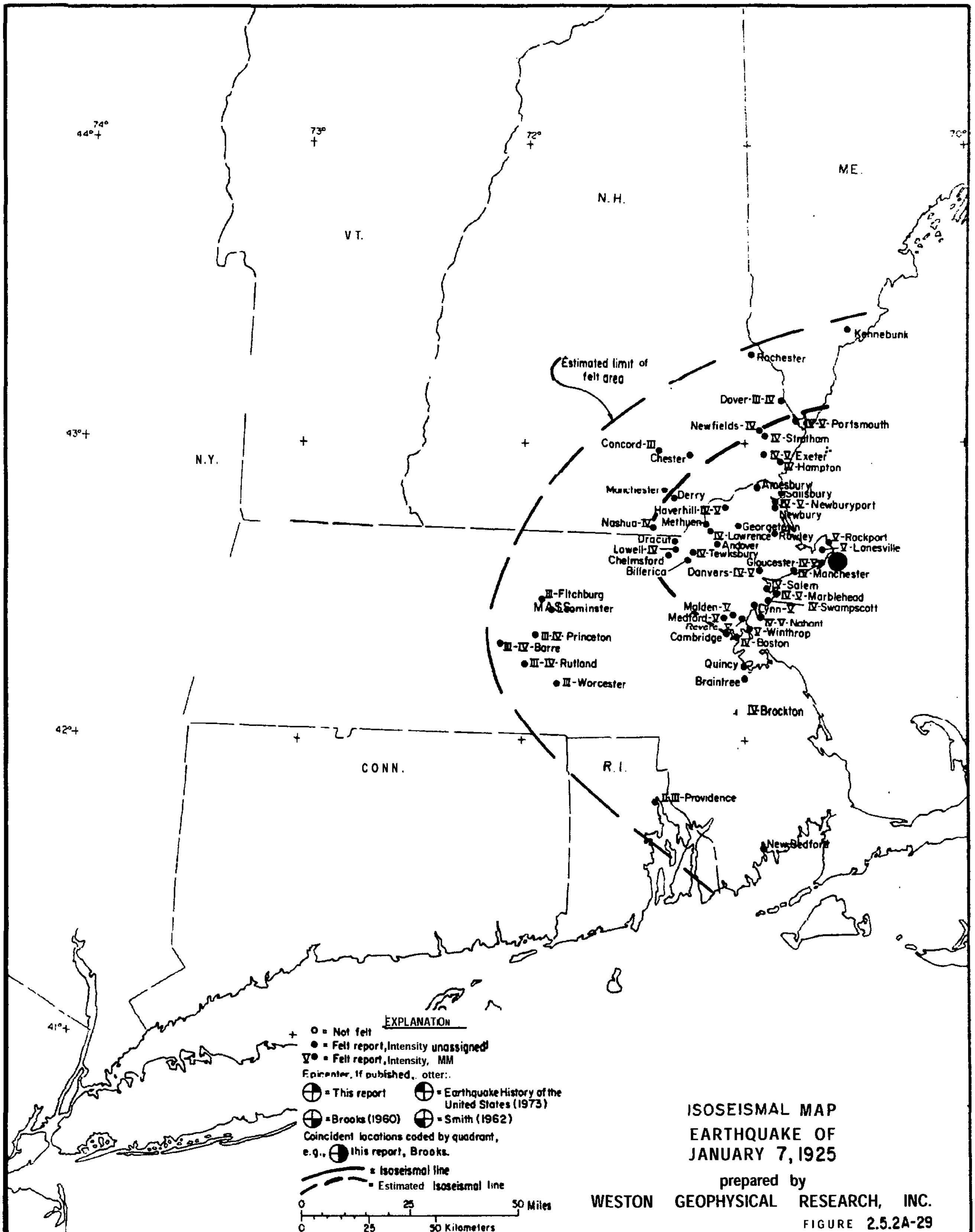
From: "Historical Seismicity of New England" (report BE-567501)
prepared for Boston Edison Company, Pilgrim Unit 2.
Docket No. 50-471



From: "Historical Seismicity of Nw England" (report BE-SG7601)
prepared for Boston Edison Company, Pilgrim Unit 2.
Docket No. 50-471



From: "Historical Seismicity of New England" (report BE-567601) prepared for Boston Edison Company, Pilgrim Unit 2. Docket No. 50-471



ISOSEISMAL MAP
EARTHQUAKE OF
JANUARY 7, 1925
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.
FIGURE 2.5.2A-29

From: "Historical Seismicity of New England' (report 8E-S67601) prepared for Boston Edison Company. Pilgrim Unit 2. Docket No. 50-471

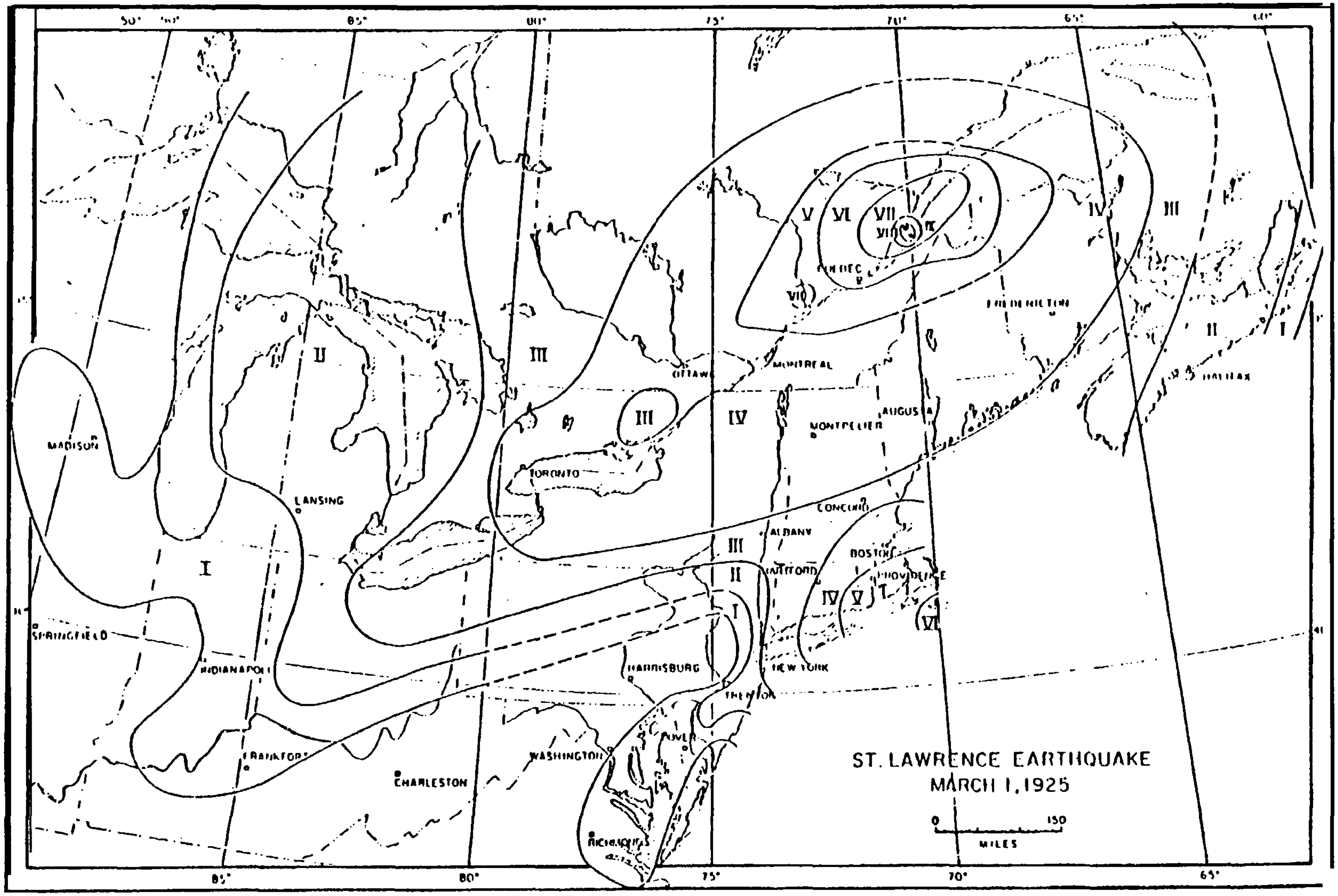
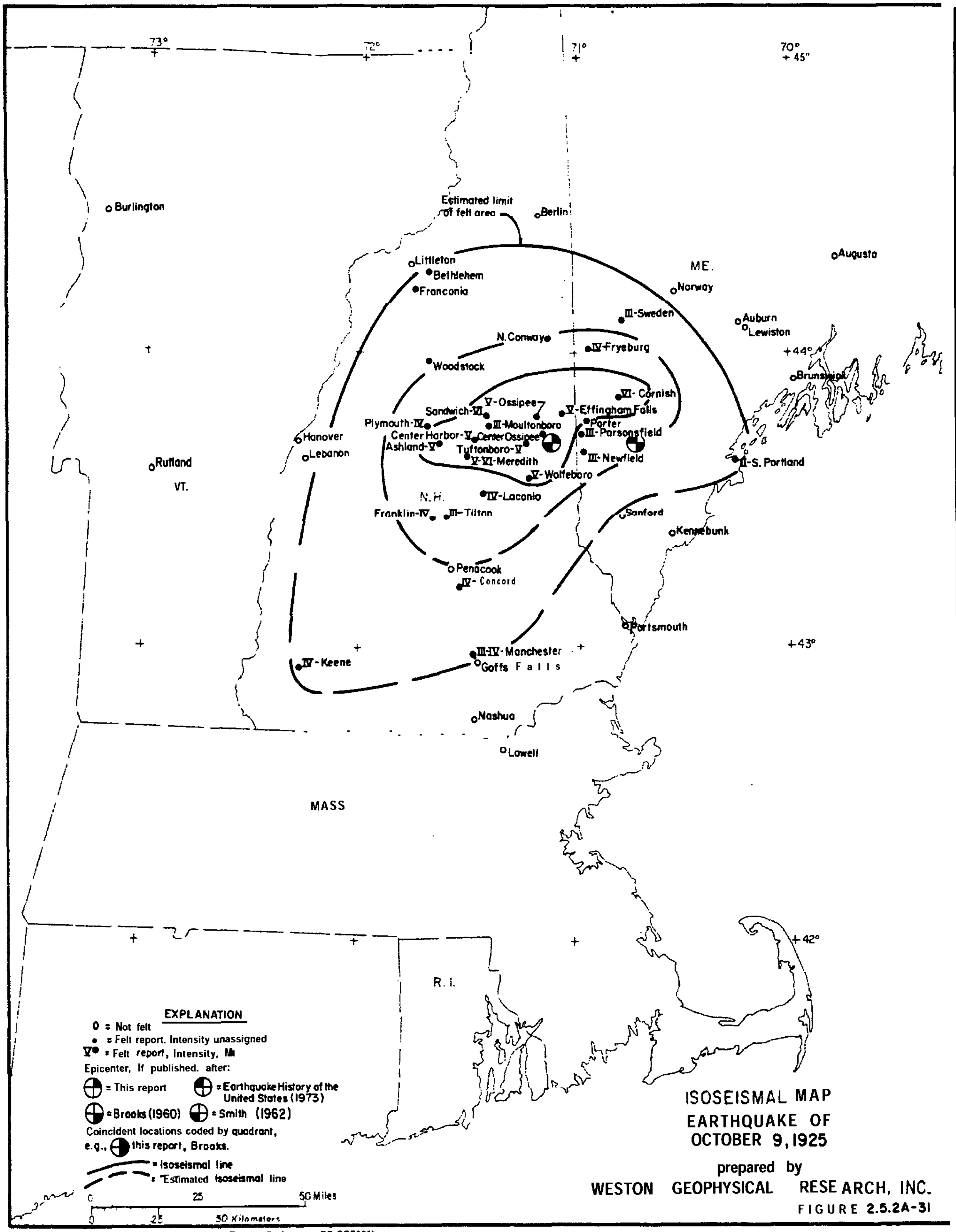
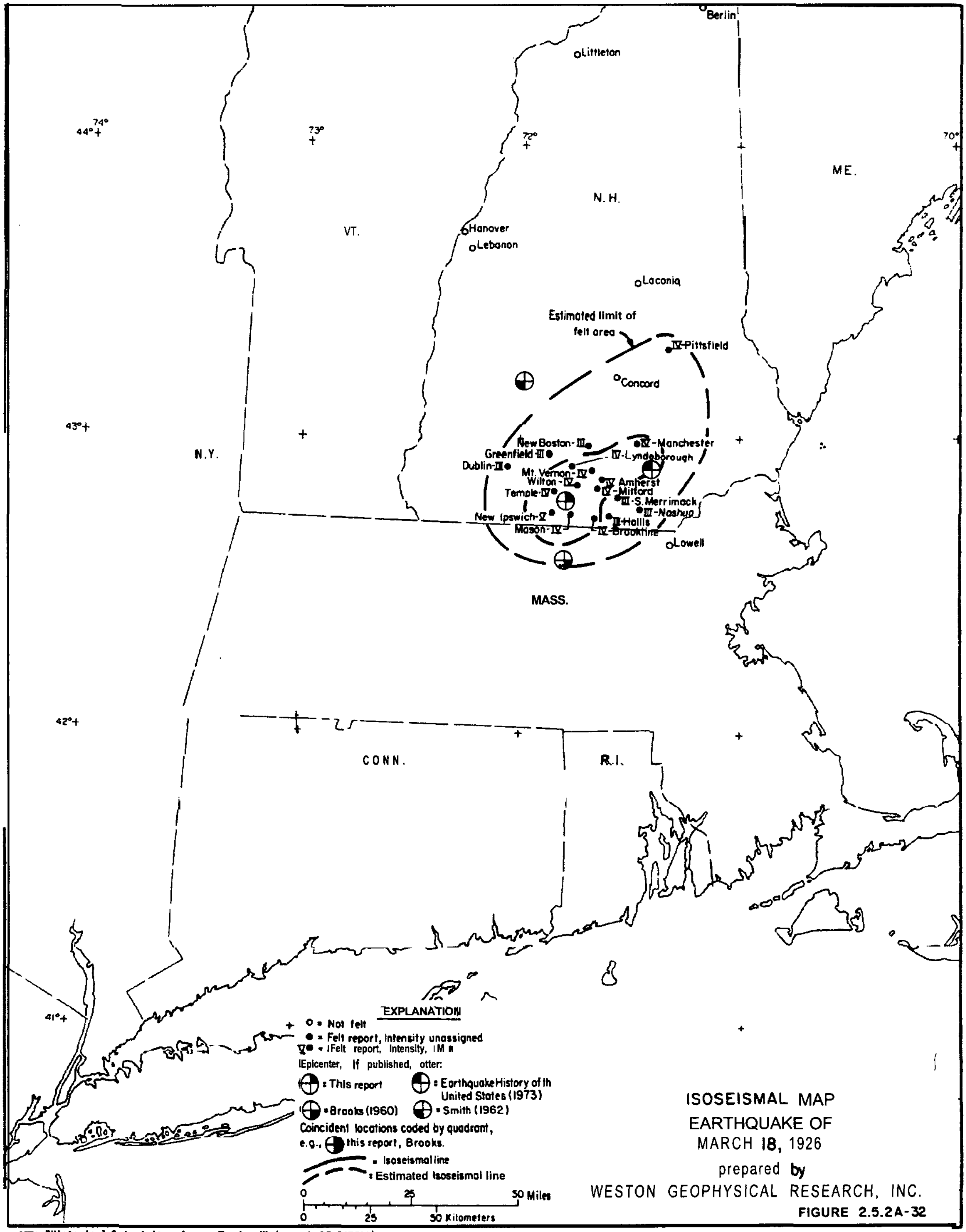


Figure 2.5.2A-30

Smith, W. E. T., Earthquakes of Eastern Canada And Adjacent Areas, 1928-1959, Publications of the Dominion Observatory, Department of Mines and Technical Surveys, Ottawa, Canada, 1966, p. 119, Vol. 32, No. 3.



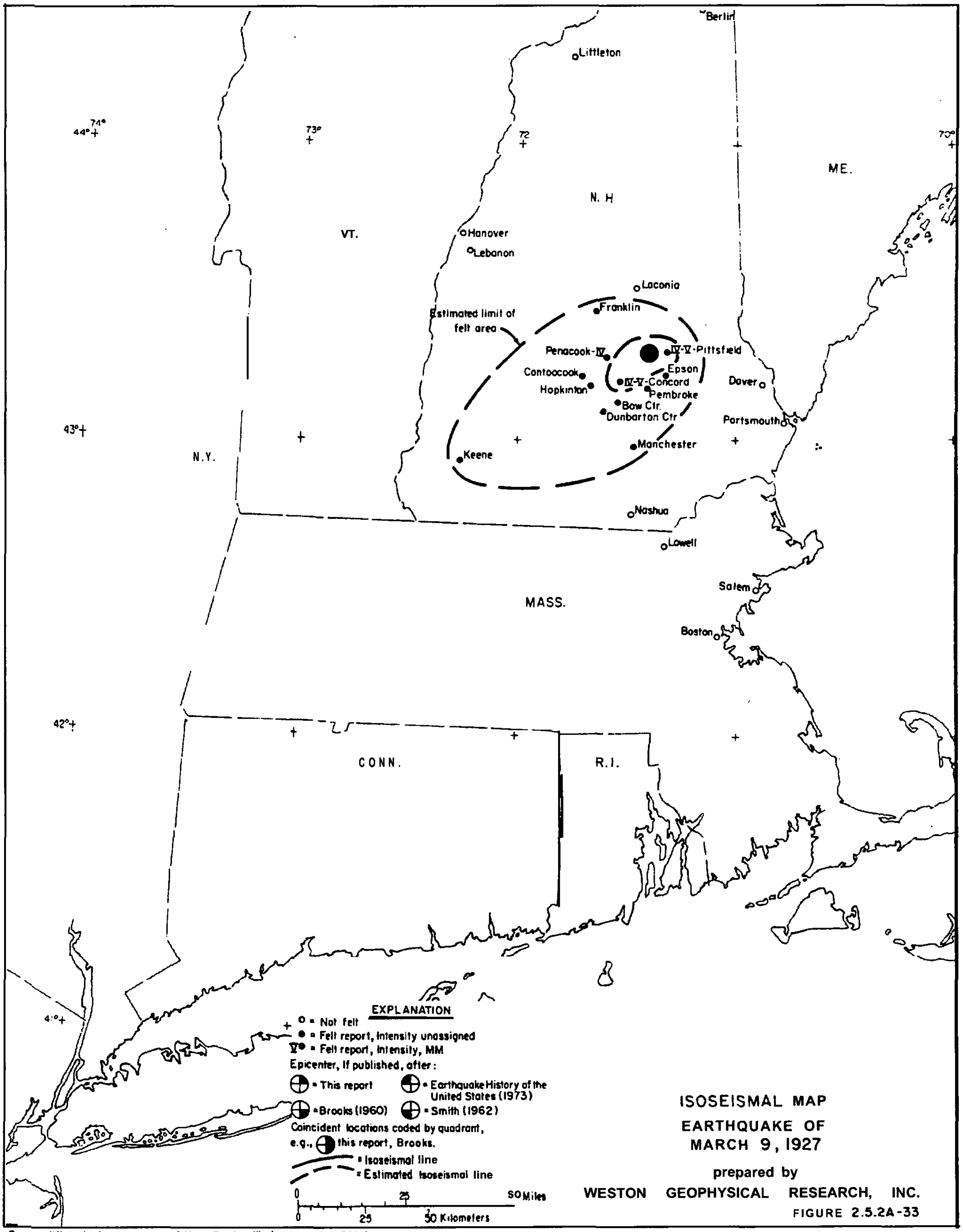
From: "Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company. Pilgrim Unit 2, Docket No. 50-471



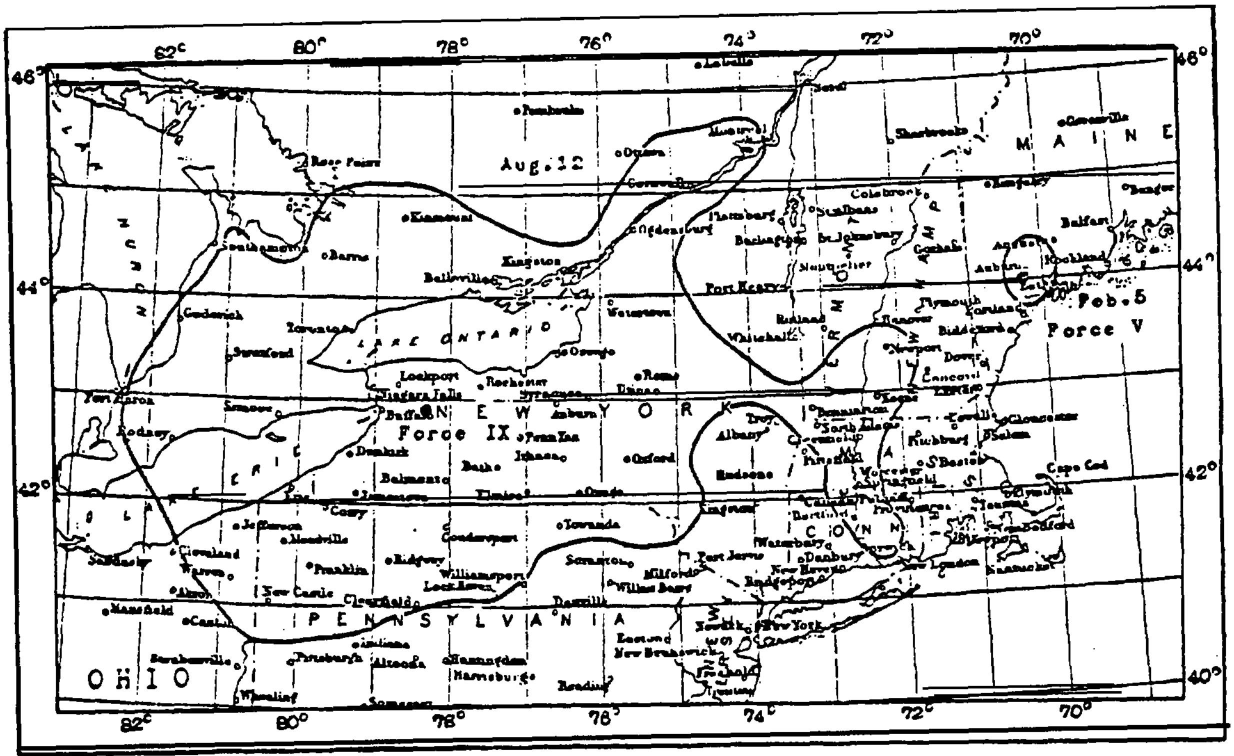
ISOSEISMAL MAP
EARTHQUAKE OF
MARCH 18, 1926
prepared by
WESTON GEOPHYSICAL RESEARCH, INC.

FIGURE 2.5.2A-32

*OR: "Historical Seismicity of New England" (report BE-SG7601)
prepared for Boston Edison Company, Pilgrim Unit 2,
Docket No. 50-471

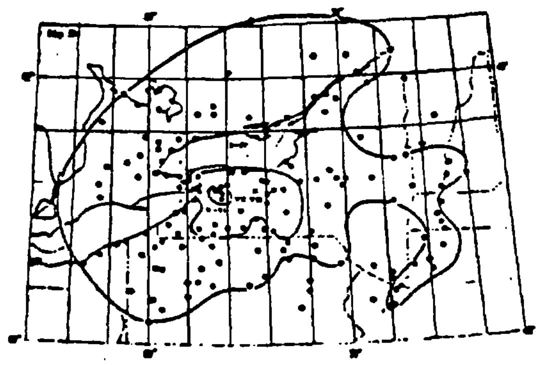


From: 'Historical Seismicity of New England" (report BE-SG7601) prepared for Boston Edison Company, Pilgrim Unit 2. Docket No. SO-471



Areas affected by shocks of February 5 and August 12

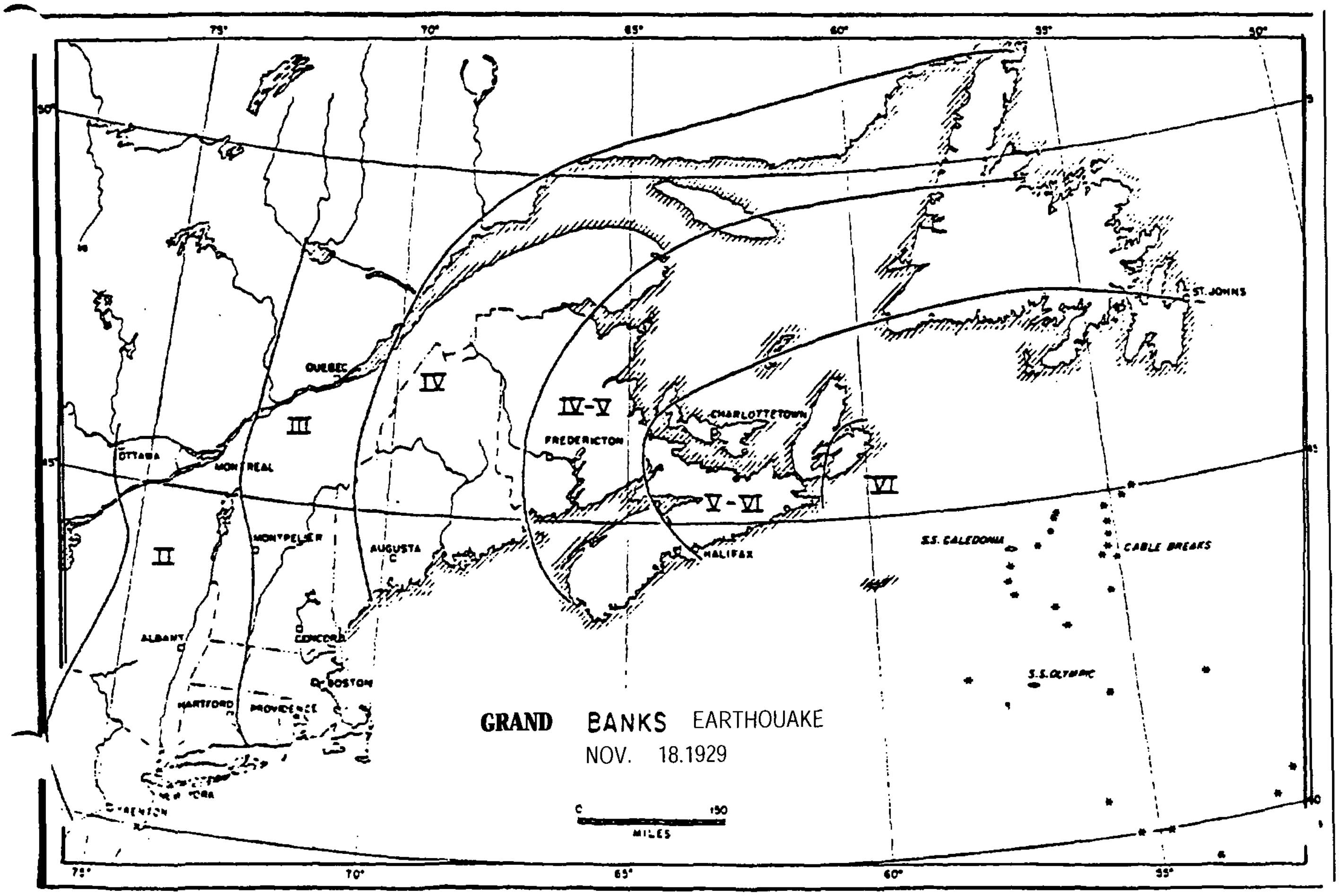
Heck, N. H. and R. R. Bodle, 1931, United States Earthquakes, 1929, United States Department of Commerce, Coast and Geodetic Survey, Washington, D.C., p. 7.



The Attica, New York, Earthquake of August 12, 1929. A modification of Heck and Bodle (1931, fig. 3): 125,000 sq. mi.

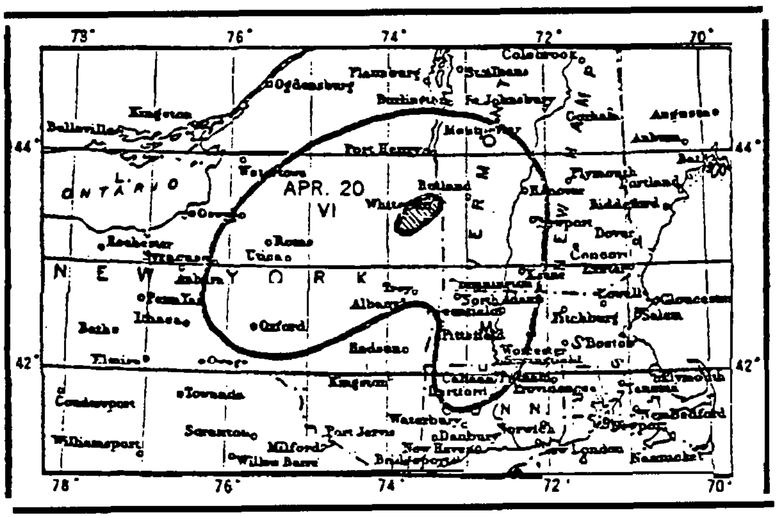
Docekal, J., 1971, Earthquakes of the Stable Interior with Emphasis on the Midcontinent, Department of Geology, University of Nebraska, Lincoln, Nebraska, p. 134.

Figure 2.5.2A-34



Smith, W.E.T., Earthquakes of Eastern Canada and Adjacent Areas, 1928-1959, Publications of the Dominion Observatory, V. 32, NO. 3, Ottawa, Canada, 1966.

Figure 2.5.2A-35

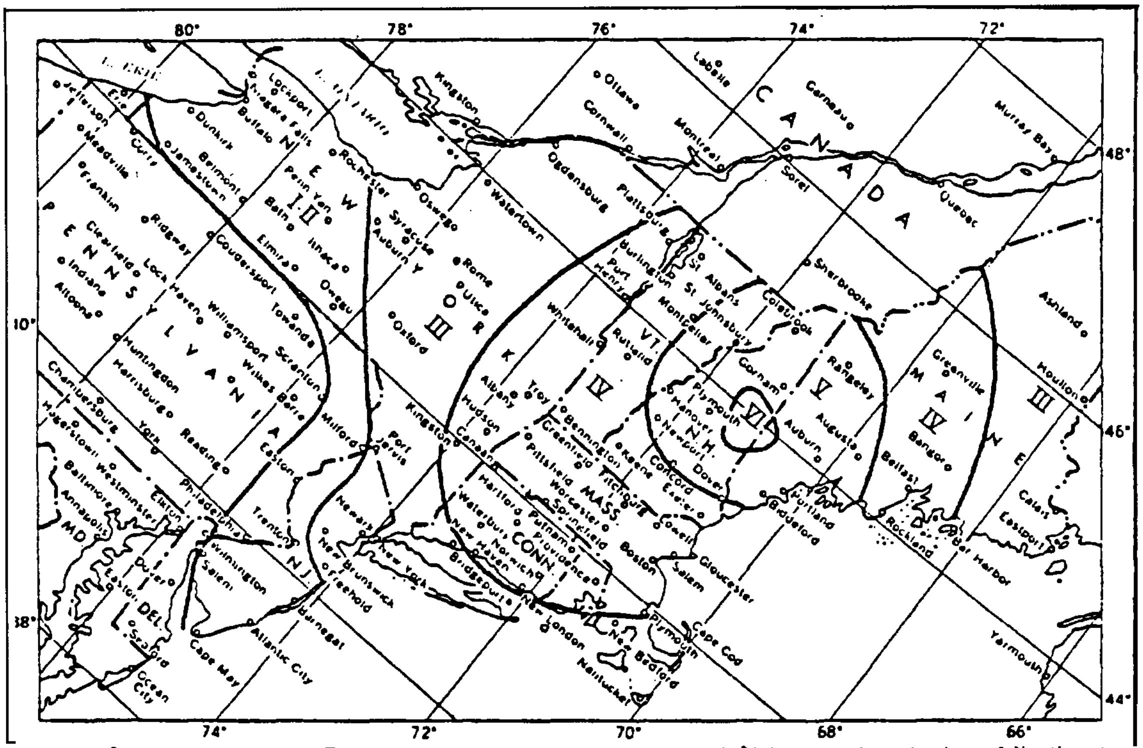


Area affected by Lake George shock of April 20

Neumann, Frank, United States Earthquakes, 1931, U.S. Dept. of Commerce, Coast and Geodetic Survey, Washington, D.C., 1932

April 20, 1931

Figure 2.5.2A-36



·Isoseismals of the New Hampshire earthquakes of December 20 and 24, based on investigations of Northeastern Seismological Association.

Neumann, Frank, <u>United States Earthquakes, 1940,</u> U.S. Dept. of Commerce, Coast and Geodetic Survey, Washington, D.C., **1942.**

Dec. 20, 24, **1940**

Figure 2.5.2A-37

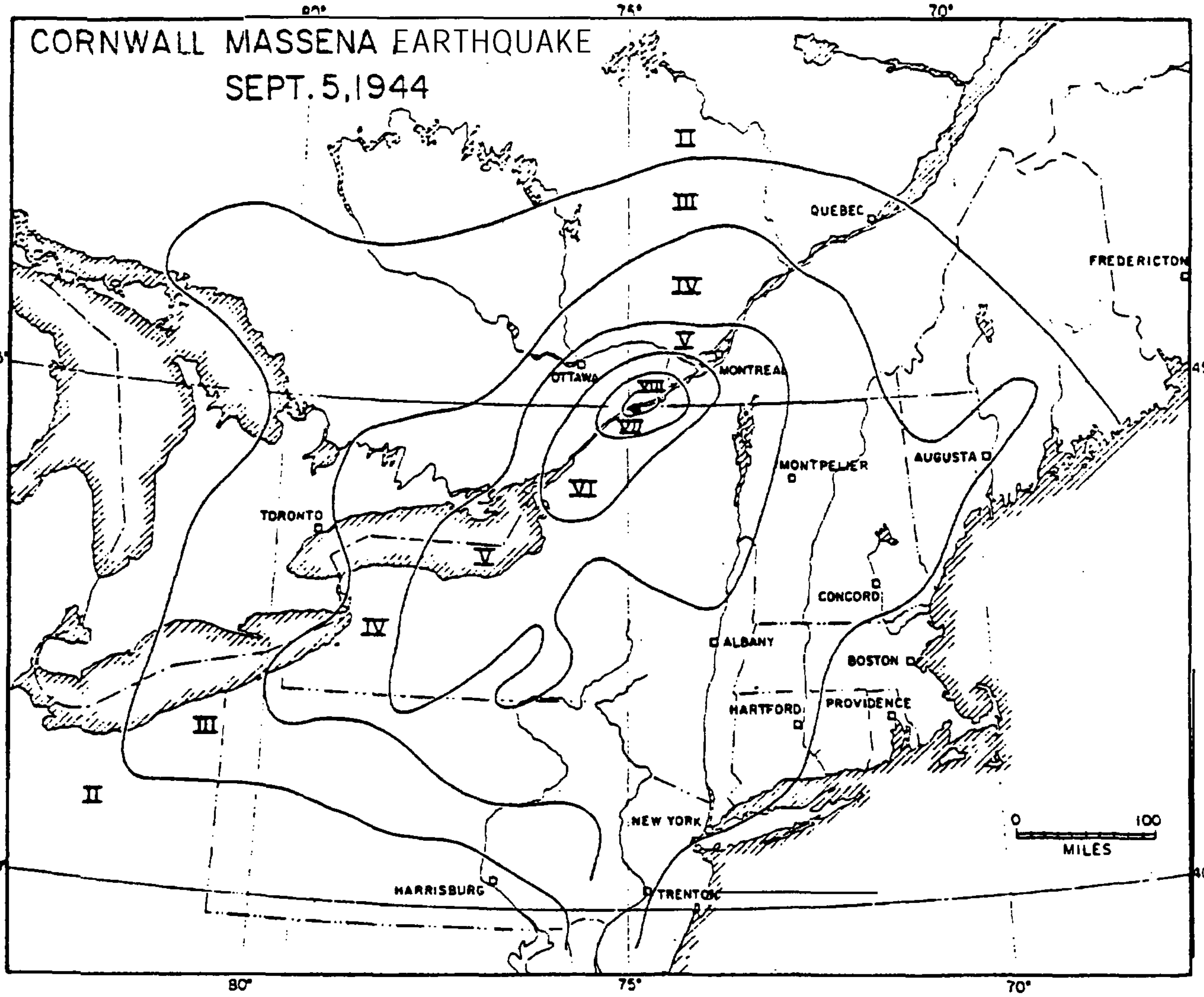
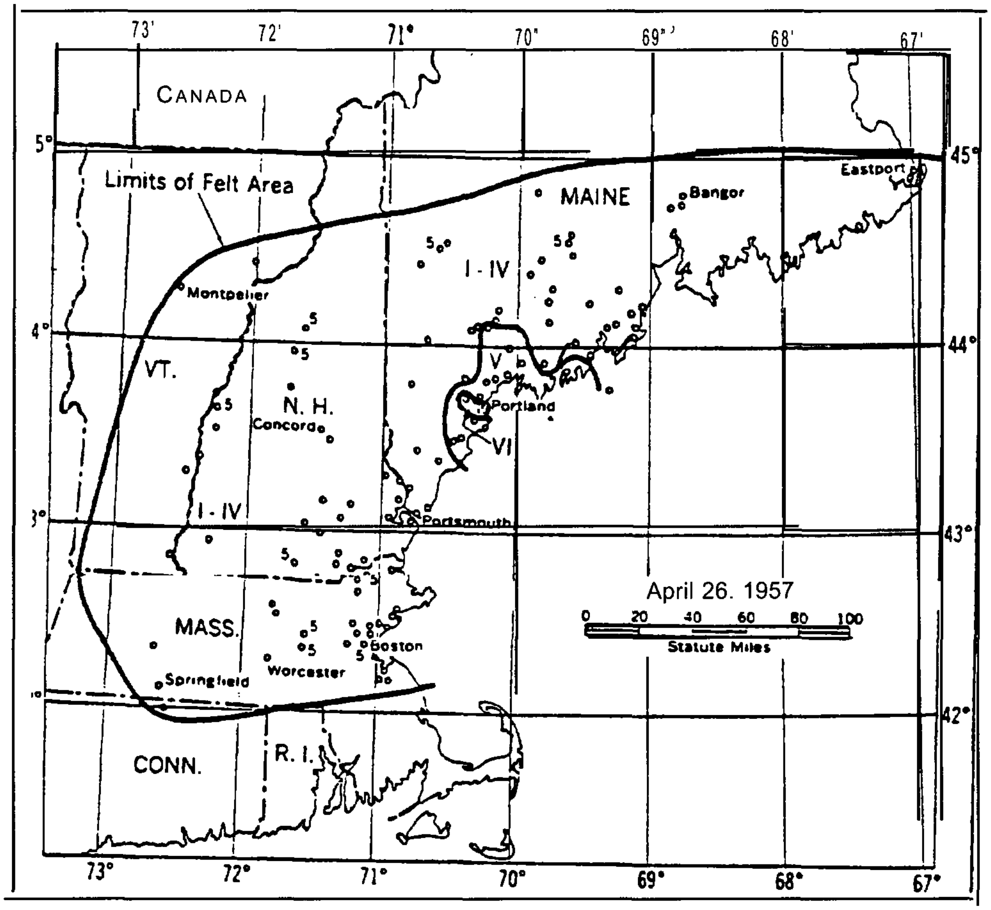


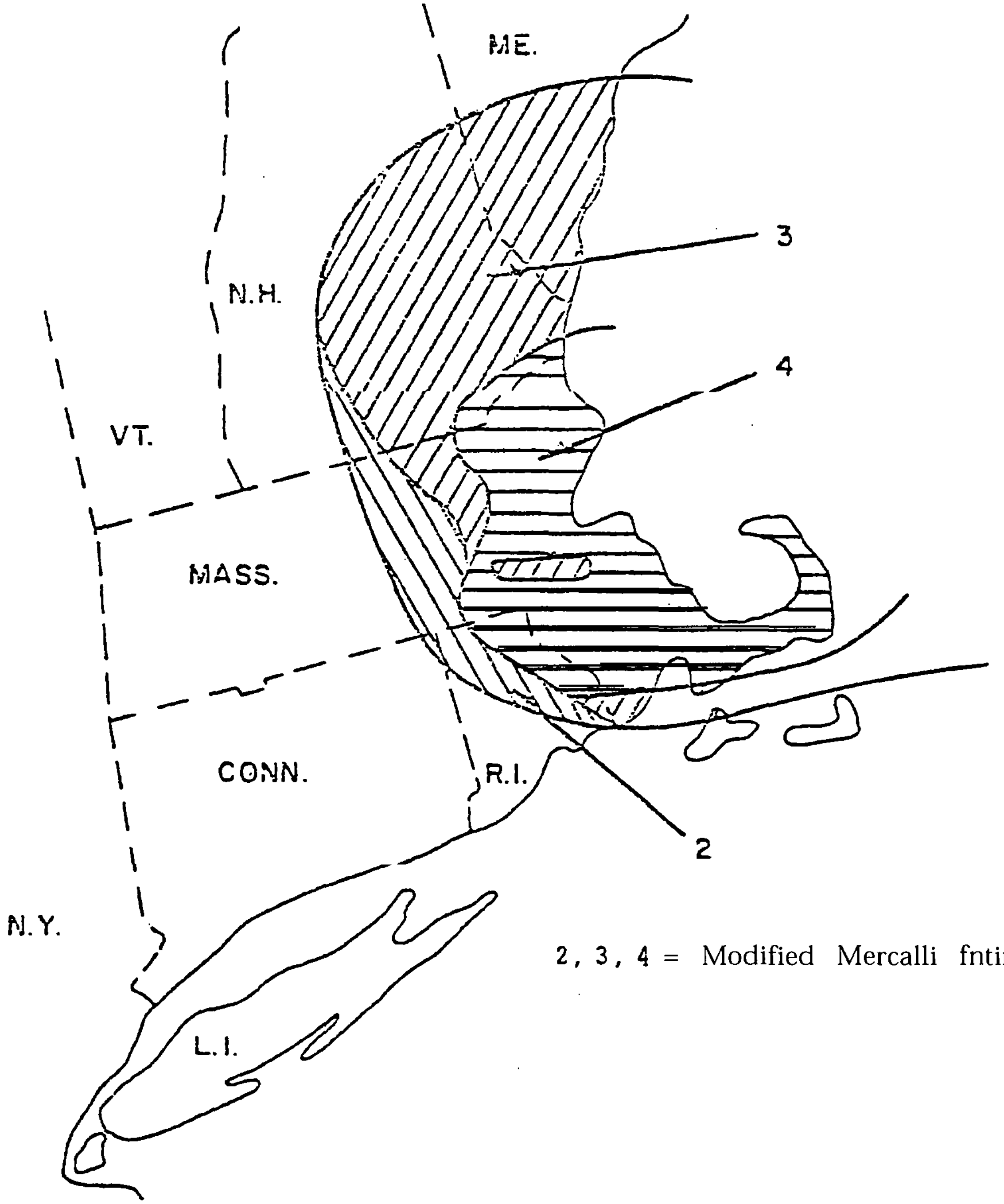
FIGURE 6. Adapted from Milne (M14).

Smith, W.E.T., 1966, Earthquakes of Eastern Canada and Adjacent Areas, 1928-1959, Publications of the Dominion Observatory, Ottawa, Canada, Vol. 32, No. 3.



Brazee, R. J. and W. K. Cloud, United States Earthquakes, 1957, U.S. Dept. of Commerce, Coast and Geodetic Survey, Washington, D.C., 1959.

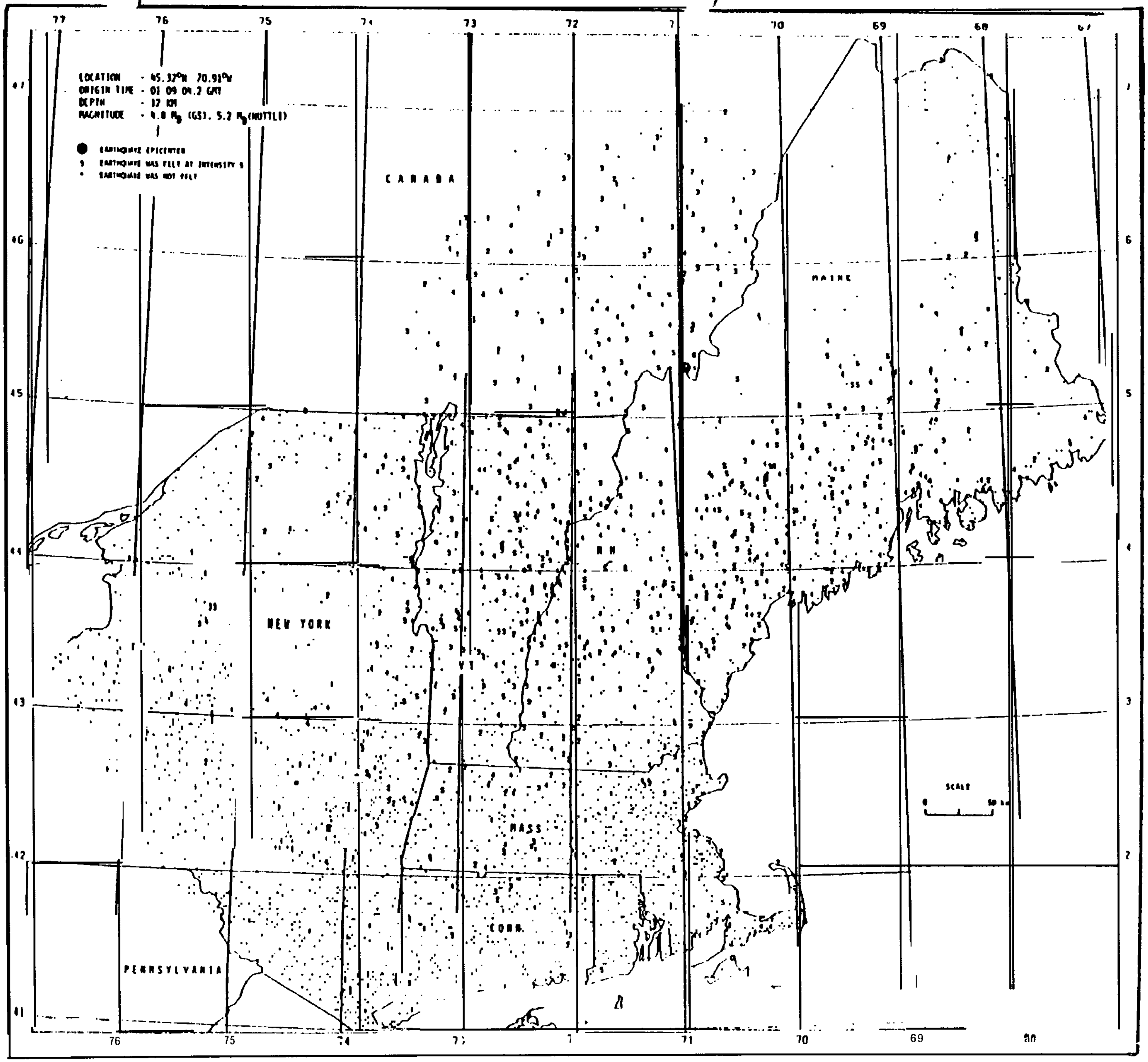
Figure 2.5.2A-39



2, 3, 4 = Modified Mercalli fntinsities

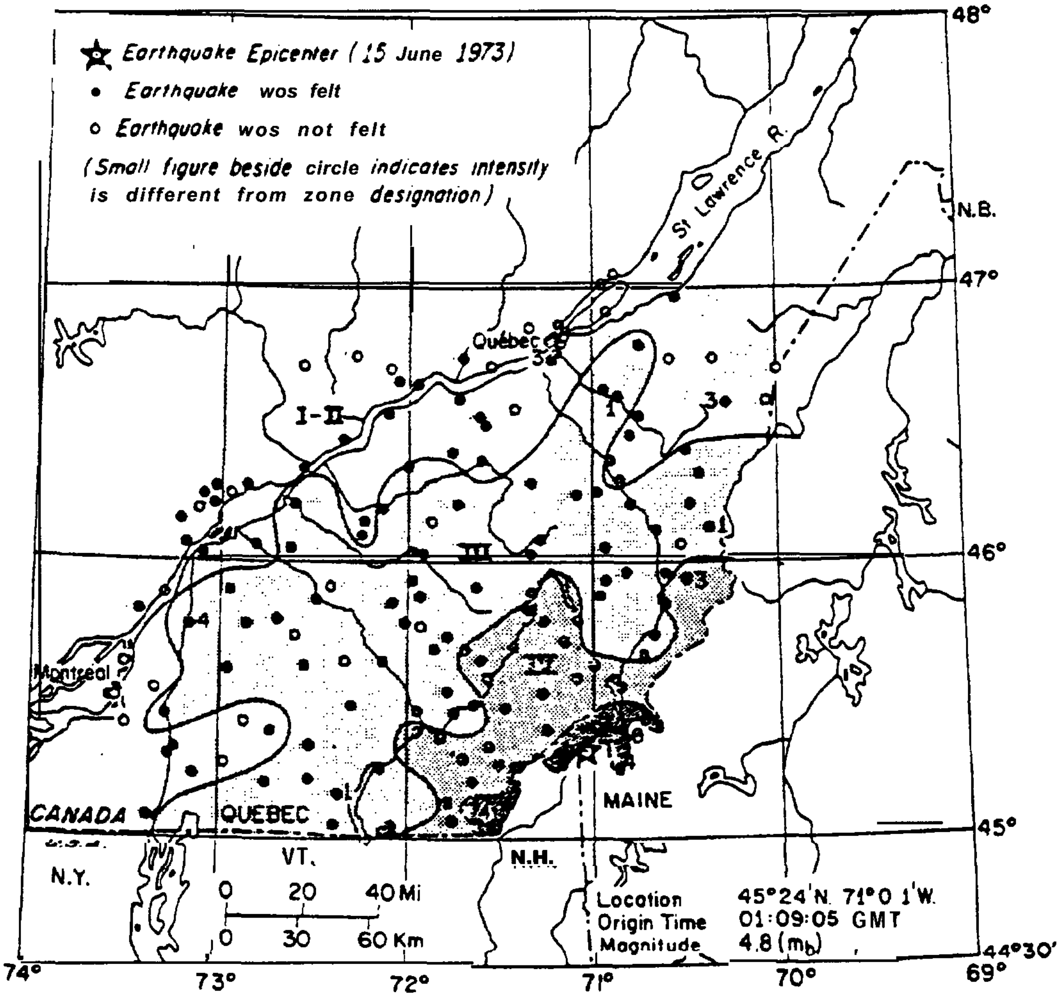
*after Breitling, W., "Crustal Structure and Attenuation Derived from the Boston Earthquake of October 1 6, 1963, " Unpublished Master's Thesis, Boston College, Chestnut Hill, Massachusetts, 1965, page 2.

Figure 2.5.2A-40



Wetmiller, R. J., "The Quebec-Maine Border Earthquake, 15 June, **1973",** Canadian Jour. of Earth Sci., **V.** 12, No. 11, 1975.

Figure 2.5.2A-41a



Wetmiller, R. J., "The Quebec-Maine Border Earthquake, 15 June, 1973", Canadian Jour. of Earth Sci., V. 12, NO. 11, 1975.

Figure 2.5.2A-41b

APPENDIX 2.5.2A

PART II

LIST OF TABLES

INTRODUCTION

This section presents a brief discussion of those historical events that are of special interest to the site, either because of their proximity or their site intensity. Most of the events included in this discussion have a predicted site intensity equal to or greater than IV(MM).

The historical documentation on felt reports near the site, or at nearby localities is also presented whenever available. Information on felt reports near the epicenters has been included only for those few events that are related to the maximum earthquake potential. A more complete documentation for most of the selected events can be found in Historical Seismicity of New England, prepared in 1976 for the Pilgrim Unit II Docket by Weston Geophysical.

EARTHQUAKE OF 1534 (DATE UNCERTAIN)

EPICENTRAL INTENSITY: IX-X(MM)

LOCATION: 47.6N, 70.1W

EVALUATION:

This event is included in the present catalog for sake of completeness. Smith (1962) is the first cataloger of this event. It is omitted in the later edition of the Earthquake History of the United States (Coffman and von Hake, 1973). The time, location, and intensity are quite vague, and the supporting evidence quoted by Smith comes from Thwaites, editor of the Jesuit Relations. Reference is made to the fact that *"the Savages have preserved the tradition of a great earthquake which had happened in former times, but that they did not know either the time or the cause of the disturbance."* Thwaites also quotes from a Topographical Dictionary under the heading "Les Eboulements," where reference is made to the local tradition of an earthquake which happened near this locality between the two voyages of Jacques Cartier (1534-1535).

Clearly, assigning an Intensity IX-X to characterize such a wording is not a rigorous application of the Mercalli scale, but a subjective attempt to imply the occurrence of a severe shock. Once accepted that the event occurred near Les Eboulements, Quebec and had such a large intensity, it is logical to assume that it could have been felt at the site at the Intensity V level.

EARTHQUAKE OF JUNE 11, 1638
(JUNE 1, 1638, JULIAN CALENDAR)

CA: 20:00 (GMT)

EPICENTRAL INTENSITY: IX(MM)

LOCATION: 47.65N, 70.17W

EVALUATION:

The location of this event has been subjected to multiple revisions by various catalogers. Unfortunately, the sparsity of information is the main reason for this variety of interpretations. Because the historical documentation has remained minimal, the presently assumed location must still be considered uncertain. For sake of clarification, it is helpful to recall that Heck and Eppley (1958) in their Earthquake History of the United States listed the event *"In New England,"* with no intensity assigned. Mather and Godfrey (1927) had estimated the potential location *"off Cape Ann"* and the intensity as VIII(RF). Smith (1962), giving high importance to a felt report from Three Rivers (Quebec), decided to give the *"St. Lawrence Valley"* as the probable source region, and used the Three Rivers' coordinates. He also upgraded the Intensity VIII (Rossi-Forel) to IX(MM) without stating his reasons. In 1965, Eppley, in his revised catalog, changed his own 1958 position and accepted Smith's suggested location and intensity. In the meantime, Smith (1966) considered that he should not have diverged from Mather and Godfrey, and in a note placed at the end of the introduction to the second part of his catalog, reversed his position and placed the event back *"off Cape Ann,"* leaving untouched his own upgraded intensity. When Coffman and von Hake (1973), published their revised Earthquake History of the United States, they apparently did not notice Smith's (1966) revision and left the event near Three Rivers, Quebec. Stevens (1974) in a brief note in the Bulletin of the Geological Society of America signaled, in an answer to Sbar and Sykes (1973), that Smith had removed the event from the Three Rivers' location.

In 1976 further research by Weston Geophysical indicated that some similarity between the 1925 isoseismals and the 1638 and 1663 felt report distributions existed, suggesting that all three events could have the same regional location. Smith (1962) had also pointed out that a *"fairly severe shock in the St. Lawrence Valley could have produced the observed results"* in New England. In 1976, the Earth Physics Branch accepted the suggestion that the La Malbaie area was a likely location for the event, although other regions should not be excluded. Basham et al. (1979) consider the event too uncertain to use it in their risk assessment, keeping 1663 as a starting time. They concede that an event (magnitude 6) could be accommodated in the La Malbaie region on the basis of the recurrence curve.

The eyewitness reports from the coastal region of Massachusetts, for the earthquake of June 1, 1638, are not inconsistent with those from the earthquake of March 1, 1925 (GMT). Data from Boston, Plymouth, and Newbury, Massachusetts, Providence, Rhode Island, and the region about Three Rivers, Quebec compare well with the isoseismals of the 1925

event. The absence of reports of damage to dwellings or chimneys in early documents precludes consideration of the Cape Ann region as an epicentral location for the event. Samuel Williams (1785) of Harvard, in one of the earliest published systematic catalogs of New England earthquakes, considers that the 1638 earthquake, like that of the 1663 earthquake, was centered in Canada. An earthquake of epicentral Intensity IX(MM), centered in the La Malbaie region of Quebec, can account for the intensity observations of the historical record for the June 1, 1638 earthquake; it is accepted here as the more probable.

PERTINENT ACCOUNTS:

Anonymous, Town Records Entry, Newbury, Massachusetts

"Being this day assembled to treat or consult about the well ordering of the affairs of the towne about one of the clock in the afternoone, the sunn shining faire, it pleased God suddenly to raise a vehement earthquake coming with a shrill clap of thunder issuing as is supposed out of the east, which shook the earth and the foundations of the house in a very violent manner to our great amazement and wonder, wherefore taking notice of so great and strange a hand of God's providence, we were desirous of leaving it on record to the view of after ages to the intent that all might take notice of Almighty God and fear his name.'" (Cited in Currier 1902, p. 250.)

Bradford, Plymouth Plantation, Massachusetts

"This year, about the first or second of June, was a great and fearful earthquake. It was in this place heard before it was felt. It came with a rumbling noise or low murmur, like unto remote thunder. It came from the northward and passed southward; as the noise approached nearer, the earth began to shake and cause like things as stood upon shelves, to clatter and fall down. Yea, persons were afraid of the houses themselves. It so fell out that at the same time divers of the chief of this town were met together at one house, conferring with some of their friends that were upon their removal from the place, as if the Lord would hereby show the signs of His displeasure, in their shaking a-pieces and removals one from another. However, it was very terrible for the time, and as the men were set talking in the house, some women and others were without the doors, and the earth shook with that violence as they could not stand without catching hold of the posts and pales that stood next them. But the violence lasted not long. And about half an hour, or less came another noise and shaking, but neither so loud nor strong as the former, but quickly passed over and so it ceased. It was not only on the seacoast, but the Indians felt it within land, and some ships that were upon the coast were shaken by it. So powerful is the mighty hand of the Lord, as to make both the earth and sea to shake, and the mountains to tremble before Him, when He pleases. And who can stay His hand?" (Cited in Morrison, 1952, pp. 302-303.)

Hull, Diary Entry, Written While At Boston, Massachusetts

"The 1st of the 4th month, about noon, was a very great and general earthquake. The vessels upon the river, and the goods that were in the said ships, moved much. Many upon the land could scarcely stand upright."

Johnson, 1654

"This yeare, the first day of the Fourth-Month, about two of the clock in the after-noone, the Lord caused a great and terrible Earth-quake, which was general throughout all the English Plantations; the motion of the Earth was such, that it caused diverse men (that had never knowne an Earthquake before) being at worke in the Fields, to cast down their workins-tooles, and run with gastly terrified lookes, to the next company they could meet withall; it came from the Westerne and uninhabited parts of this Wildernesse, and went the direct course this brood of Travellers came."

Josselyn

"June the second, a great and terrible earthquake throughout the country.

"...at 4 of the clock we descryed two sail bound for New-found-land, and so far the Streights, they told us of a general Earth-quake in New-England...and now we are two leagues off Cape Ann."

Note: These are notes made upon a voyage from England in 1638. There is no mention of an earthquake felt while at sea.

Le Jeune, Rev. Paul, 1638, Written at Three Rivers, Quebec

"On St. Barnabas' day, we had an earthquake in some places; and it was so perceptible that the savages were greatly surprised to see their bark plates collide with each other, and the water spill out of their kettles. This drew from them a loud cry of astonishment."

Note: This account was written at Three Rivers, Quebec on August 25, 1638. St. Barnabas day is June 11. Catholic countries were already on the Gregorian calendar. Corresponding dates in New England would be 10 days earlier or June 1, Old Style.

Williams, Roger, 1638, Written At Providence, Rhode Island

"2 things at present for information.

"First, in the affaires of the Most High; his late dreadfull voice and hand: that audible and sensible voice, the Earthquake.

"All these parts felt it, (whether beyond the Nanhiggonsick I yet learne not), for my selfe I scarce perceaued ought but a kind of thunder & a gentle mooving & the natiues apprehensions, & but one sudden short motion.

"The younger natives are ignorant of the like; but the elder informe me that this is the 5th within these 4 score yeare in the land: the first about 3 score & 10 yeare since: the second some 3 score & 4 yeare since: the third some 54 yeare since, the 4th some 46 since..."

Winthrop, John, 1638, Journal Entry Written At Boston, Massachusetts

"Between 3 and 4 in the afternoon...there was a great earthquake. It came with a noise like a continued thunder or a rattling of coaches in London, but was presently gone. It was at Connecticut, at Naragansett, at Pascataquack, and all the parts about. It shook the ships, which rode in the harbor, and all the islands, etc. The noise and the shakings continued about four minutes. The earth was unquiet twenty-days after by times."

Hutchinson (1765), Later History published 127 years after the 1638 event

"The year 1638 was memorable for a very great earth-quake through New-England. The shake, by the printed accounts of it, and from manuscript letters, appears to have been equal to that of 1727, the pewter in many places being thrown off the shelves, and the tops of chimneys in some places shook down, but the noise, though great, not so surprising as that of the last mentioned. The course of it was west to east."

Note: The account of the later history by Hutchinson contrasts with the eyewitness descriptions provided insofar as it reports chimneys damaged. No eyewitness document reports any damage to dwellings or chimneys.

EARTHQUAKE OF FEBRUARY 5, 1663
(JANUARY 27, 1663, JULIAN CALENDAR)

CA. 17:30 (GMT)

EPICENTRAL INTENSITY: X(MM)

LOCATION: 47.6N, 70.1W

EVALUATION

The above coordinates place the epicenter near La Malbaie, Quebec. They correspond to the March 1, 1925 event. It should be pointed out that such a location has been continuously proposed by E. A. Hodgson (1928), (1950), and Smith (1962). On the other hand, American catalogs show a change of view in this matter. Heck and Eppley (1958) carry the coordinates of Three Rivers, Quebec; Eppley (1965) and later, Coffman and von Hake (1973), probably following Smith, adopted the La Malbaie location. The confusion is understandable in view of importance given to the description of landslides near Three Rivers, dramatically formulated in some of the principal sources, these of Father Lalemant and Mother Marie de l'Incarnation cited by Smith (1962).

The Intensity X(MM), the highest assigned to the La Malbaie event, is again an attempt to reflect the relative seriousness of the shock more than a strict application of the Mercalli scale. E. A. Hodgson (1950) ventured to say that this earthquake *"may have been worse than any of the others, or may be that the accounts were exaggerated..."*.

PERTINENT ACCOUNTS:

Hull, John, Diary Entry, Boston, Massachusetts

"26th of 11th. In the evening, about six o'clock, was an earthquake, that shook much for near one-quarter of an hour;---there was shaking in several parts of the town, and other towns, two or three times the same week; but the former was general."

Mather, Cotton, Written at Boston, Massachusetts

"Earthquakes: six or seven shocks in January '1663'. (Authors Note: of this Increase Mather, in his Illustrious Providences, says: 'In the year 1662, on the 26, 27, and 28 of January, the Earth was shaken at least six times in the space of three dayes. I remember that upon the first approach of the earthquake, the things on the Shelves in the House began to move. Many People ran out of their Houses with fear and amazement; but no House fell, nor was any damage sustained.')"

Sewall, Samuel, Recollection in letter dated November 14, 1727

"I remember the Earthquake of 1662/3 and my being shaken by it, as I sat in my father's house at Newbury in the jâm of the chimny."

EARTHQUAKE OF NOVEMBER 9, 1727
(OCTOBER 29, 1727, JULIAN CALENDAR)

CA: 22:40 (L)

EPICENTRAL INTENSITY: VII(MM)

LOCATION: 42.8N, 70.6W

EVALUATION:

This is the second largest historical event after that of November 18, 1755 that has occurred off the coast of northeastern Massachusetts. Its approximate location is based on felt report distribution (Figure 2.5.2A-1). The epicentral distance to the site is about 14 miles; the event has been considered related to the Cape Ann pluton and the structure of the northeastern Massachusetts Thrust Fault Complex. It was felt widely over an area of 296,000 square kilometers, from the Kennebunk River, Maine to the Delaware River, south of Philadelphia. Maximum damage was observed near the mouth of the Merrimack River (Intensity VI-VII). Cracked chimneys were reported from as far north as Portsmouth, New Hampshire, and as far south as Boston. Historians seem unanimous in that the earthquake was strongest in Newbury, Massachusetts. The complete listing of all reported accounts have been presented in the Boston Edison Company, Pilgrim Unit II Docket No. 50-471, BE-SG 7601. Only the most pertinent accounts are included here.

This shock had a long sequence of aftershocks which historical records have preserved. A discussion of this sequence follows the accounts.

PERTINENT ACCOUNTS:

Allen, J., Boston, Massachusetts (Undated period entry as remark in church record)

"It began as I conceive in the South-East, about half an Hour after Ten in the Lord's Day Evening after the 29th of October, 1727. All of a sudden our Houses shook as if they were falling to pieces, and this was attended with a great Noise, which lasted about one Minute, and then took its course Northward. In a very short time it return's upon us, tho' with far less Strength, and the Shocks were repeated seven Times in my hearing that Night; but there were many more at Salem, Ipswich, etc. Distant Rumbles were heard by us many times until the next Friday-Evening. Since that we don't know that we have heard it; but it has been heard at Newbury every Day since, and for more than three Weeks."

SB-E561 (U)

Blunt, John, New Castle, New Hampshire (Letter dated January 23, 1728)

"...on the night between the 29 & 30 of October about 9 of the clock I retired to bed. (being my usual hour) but being that night otherwise different than commonly I took a book and read of it for about the...of an hour and then composed my bed for sleep but long had I not been asleep before I awoke, Awoke! Did I lay...: I Dreamt, oh Dream! Do I lay, no, no Dream neither, But to then that I lay I believe a mean between both, but never in such a strong...confirmation in all my Life: for as soon as I raised my head from my pillow and my Intellect again began to exert its operative faculty, Perceiving the Bed to Work like a boat & the house trembled as though it would immediately fall to pieces and the Terrible noise which was began compared to the strongest that I remember now...to...Rev. Landon to inqure what the matter was (who himself had just got out of his bed) replied, its a Terrible Earthquake with that I ran & got my clothes, then we ran out at the Door, but by the trembling of the Earth and the Dreadful noise accompanying it seemed as the foundations of the Earth now moved and the Powers of heaven shaken the...land to come from the NW & pass along toward the SE (this from my own observation... (manuscript unclear)*...one of our neighbors they plainly perceived the shaking of the earth about half a minute before they heard the noise...I cannot now give you a particular account to affects it had on the place & people, I cannot give, the chimneys of many houses have broken and the tops broken off to the roof of the houses and som Cellar walls tumbled in. It seems it was a gread Deal more Terrible in the towns on Merrimack, espeically Haverhill, Amesbury, Saybrury and Newbury..."*

Boston Gazette, The, Boston, Massachusetts (Period newspaper account dated November 6, 1727)

"Boston, Nov. 6.

"On the 29th past about 30 Minutes past 10 at Night, which was very Calm & Serene, and the Sky full of Stars, the Town was of a sudden exceedingly surprised with the most violent shock of an Earthquake that ever was known. It began with a loud Noise like Thunder, the very Earth reel'd and trembled to such a prodigious degree, that the Houses rock'd and shook insomuch, that every Body expected they should be Buried in the Ruins. Abundance of the Inhabitants were wakened out of their Sleep with the utmost Astonishment, and others so sensibly affrighted, that they run into the Streets thinking themselves were safe there; but thro' the Infinite Goodness and Mercy of GOD, the Shock continued but about ten Minutes, and tho' some small damage was done in a few Houses, yet by God's great Blessing, we dont hear that any Body received any hurt thereby. There were several times till the next Morning heard some (manuscript unclear). *Rumblings of it, but since then, the Earth has been quiet, tho' the Minds of the People have still a great and just Terror and Dread upon them.'"*

Clark, Peter, Salem Village, Massachusetts (Period diary entry)

"Being Lord's day, at night, between 10 & 11 o'clock there happened a very great earthquake, accompanied with a terribel noise and shaking, which was greatly suprising to ye whole land, y^e^ rumbling in y^e^ bowels of the earth, with some lesser trepidation of the earth, has been repeated at certain times, for divers weeks after."

Jaques, Stephen, Newbury, Massachusetts (Probable period account, date unknown)

"On the twenty-ninth day of October, between ten and eleven, it being sabath day night, there was a terabel earthquake. The like was never known in this land. It came with a dreadful roreing as if it was thunder, and then a pounce like grate guns two or three times close one after another. It shook down bricks from y^e^ tops of abundance of chimnies, some almost all the heads...All that was about y^e^ houses trembled, beds shook, some cellar walls fell partly down. Benjamins Plumer's stone without his dore fell into his cellar. Stone walls fell in a hundred plasis. Most peopel gat up in a moment. It came very often all y^e^ night after, and it was heard two or three times some days and nights, and on the sabath day night on y^e^ twenty-fourth of December following, between ten and eleven, it was very loud, as any time except y^e^ first, and twice that night after but not so loud. The first night it broke out in more than ten places in y^e^ town in y^e^ clay low land, blowing up y^e^ sand, sum more, sum less. In one place near Spring Island it blew out, as was judged twenty loads, and when it was cast on coals in y^e^ night, it burnt like brimstone."

Jeffrey, James, Salem, Massachusetts (Period "diary" entry in almanac)

"...about half an hour after ten oclock there was the most terrible Earthquake every known in New England -Continued about two minutes of first shock & had several small ones afterwards, & some night y^e^ continued at times all y^e^ weeks afterwards all y^e^ People in Town sat up most part of y^e^ night."

Kelley, Richard, Amesbury, Massachusetts (Period diary entry)

"In y^e^ yeare 1727, October 29, about ten of y^e^ clock, it being Sabath day night, was a Grate earthquake which was extrodenery loud and hard as awaked many out of sleep, the housen did shake & windows ratel and puter and dishes clater on y^e^ shelves & y^e^ tops of many chimneys fell of & maney ware so shatered as that people ware fain to take them down and new build them again."

Plant, Rev. Matthias, Newbury, Massachusetts (Period account, primary source is original Minister's Record Book; later variants noted in references)

"Oct. 29. 1727. being the Lord's-Day, about 40 Minutes past Ten the same Evening, there came a great rumbling Noise; but before the Noise was heard, or Shock perceived, our Bricks upon the Hearth rose up about three quarters of a Foot, and seem'd to fall down and loll the other way, which was in half a Minute attended with the Noise or Burst. The Tops of our Chimneys, Stone-fences, were thrown down; and in some Places (in the lower Grounds, about three Miles from my House; where I dwell) the Earth opened, and threw out some Hundred loads of Earth, of a different Colour from that near the Surface, something darker than your white Marl in England; and in many Places, opened dry Land into good Springs, which remain to this Day; and dried up Springs, which never came again. It continued roaring, bursting, and shocking our Houses all that Night. Though the first was much the loudest and most terrible, yet eight more, that came that Night, were loud, and roared like a Cannon at a Distance...

"Postscript.

"I forgot to tell you, Sir, that (except the first Shock) these frequent Repetitions of the Roaring and Shocks of the Earthquake were upon Merrimack River, and seldom extended above seven or eight Miles Distance from, or 20 or 30 up the said River; those Instances only excepted, which I have mention'd in the Relation; and the first Shock of it was greater with us than anywhere else in New-England; and the Tops of Chimneys, and Stone-fences, were thrown down only in these Parts."

Prince, Thomas, Boston, Massachusetts (Notes appended to a sermon in 1727)

"The Preface.

"Giving a Summary Account of the OCCASION of the following Sermons.

"On the Night after the Lord's Day Octob. 29. about 40 Minutes past X, in a calm & serene Hour, the Town of Boston was on a sudden extreamly surpriz'd with the most violent Shock of an Earthquake that has been known among us. It came on with a loud hollow Noise like the Roaring of a Great fired Chimney, but incomparably more fierce & terrible. In about half a Minute the Earth began to heave and tremble: The Shock increasing, rose to the Hight in about a Minute more, when the Moveables, Doors, Windows, Walls, especially in the upper Chambers, made a very fearful Clattering, and the Houses rock'd & crackl'd, as if they were all dissolving and falling to pieces. The People asleep were awakened with the greatest astonishment: many others affrighted run into the Streets for Safety. But the Shaking quickly abated, and in another half Minute intirely ceased.

"The Noise & Shakes seem'd to come from the Northwestward, and to go off Southeasterly; and so the Houses seemed to reel. Some Damage was done to the more brittle sort of Moveables, and some Bricks on the Tops of some Chimneys fell; but not an House was broken, nor a Creature hurt. At several times till Day-light, were heard some distant Rumblings, and some fainter Shocks were felt: But since, the Earth has been quiet in Town, tho' the minds of many continue very greatly & justly affected."

Sargeant, (Rev.) Christopher, Methuen, Massachusetts (Period entry in notebook)

"Observations on the Year 1727.

"This year October the 29th we had the most terrible Earthquake. It began on Sabbath Day Night between ten & eleven of the clock wh puts people into the utmost consternation & fright many possessed with fear y^t It was the Great Day of the Son of man appearing...It began like a most violent clap of thunder. Some say preceeded by a trembling of the Earth. But it was accompanied with most dreadful Shock of the Earth. It Continued a Minute & half at least falling & then returning with violence three times in the s^d Term..."

Sewall, Henry, Newbury, Massachusetts (Letter dated November 21, 1727)

"Honored sir:

"Thro' God's goodness to us we are all well, and have been preserved at the time of the late great and terrible earthquake. We were sitting by the fire and about half after ten at night our house shook and trembled as if it would have fallen to pieces. Being affrighted we ran out of doors, when we found the ground did tremble, and we were in great fear of being swallowed up alive; but God preserved us, and did not suffer it to break out, till it got forty or fifty rods from the house, where it brake the ground in the common near a place called Spring island, and there is from sixteen to twenty loads of fine sand thrown out where the ground broke, and several days after the water boiled out like a spring, but is now dry, and the ground closed up again. I have sent some of the sand that you may see it. Our house kept shaking about three minutes."

Waldeigh, George, Dover, New Hampshire

"An earthquake occurred of which it is recorded that - the shock was very loud, and was attended with a terrible noise, something like thunder. The houses trembled as if they were following: divers chimney were cracked and some had their tops broken off."

Note: It is uncertain whether this is a generic description, or whether it described the actual effects at Dover. (Later history published 1913)

Waldron, Richard, Portsmouth, New Hampshire (Letter dated January 12, 1728)

"...the Earthquake still continues in these parts; but it is most frequent and loud near the Merrimack River. On Saturday night last it was heard several times in our neighborhood. And a Man who lives about a mile distant from us, in the skirts of a wood, immediately after the first Rumbling and little Shock, heard a fine musical sound, like the sound of a Trumpet at a distance...the Musick continued till after the Second Rumbling, which succeeded the former in about ten minutes. The man's wife heard what he did..."

Weekly News-Letter, The, Boston, Massachusetts (Period newspaper, November 16, 1727)

"Hampton in New-Hampshire, Novemb. 13th. 1727.

"'The first shock of the Earthquake on the 29th past was here much as it was in Boston, or perhaps a little stronger. Divers People in this & some Neighbouring Parishes observed just as the Earthquake began, A flash of Light at the Windows: A Young Man of this Town being then standing abroad near his Fathers House, at first heard a small Rumbling Noise; immediately upon which he sew a Flash of Light run along upon the Ground 'till it came to the House, and then began the Shake. It appears that what he said of the flash of Light was not a meer Fancy, by this, That a Dog which was then lying on its Course as the Light came to him gave a sudden yelp and leap, and thereby slow'd that he perceiv'd it.

"'Another thing among us which seems worth or Notice is, A Spring of Water which (as the Owner says) has run freely there Fourscore Years is now, upon the Earthquake very considerably Sunk, so that they were oblig'd to dig it out, and tho' the digging has rais'd the Water something, yet not to its former height. But what is, it may be, yet more remarkable is, That this Spring which was never known to Freeze before, now Freezes like any standing Water.

"'It seems nothing has been perceiv'd at Boston since the first Night, but it has been otherwise here; not a Day since but that the sound has been heard, and oftentimes it has been so as to give some Jarr to our Houses.

"'in the time of the first shock the Brute Creatures (as was observ'd by some who were then abroad) Ran Roaring about the fields in the greatest distress: and the Reasonable Inhabitants of the Earth were no less frighted. So was Isreal when GOD came down upon Sinai, and the whole Mount quaked greatly: Then they spoke well, and made promises of Obedience: And GOD says upon it, Deut. 5:29 Oh that there were such an HEART in them, that they would Fear Me, and keep my Commands always, that it might be well with them, and with their Children for ever.

AFTERSHOCK SEQUENCE OF THE NOVEMBER 9, 1727 EVENT

DISCUSSION:

The earthquake of November 9, 1727, is characterized by a very long sequence of aftershocks, particularly dense during the following three months. None of the aftershocks exceeded Intensity V(MM); most were only locally felt in the Cape Ann, Massachusetts region. Several second order aftershocks followed by swarm-type activity are noted. These are the earthquakes of November 14, 1727, Intensity IV-V(MM) and a series of small shocks during the period November 19 through 22 and January 4, 1728, Intensity IV-V(MM) followed by a series of small shocks on January 18 and 19. A late large aftershock occurred on February 10, 1728, Intensity V(MM).

Numerous aftershocks were noted by Rev. Matthias Plant at Newbury, Massachusetts who maintained a record of earthquakes felt from 1727 through 1748 in his Minister's Record. A detailed aftershock record also exists at Marblehead, Massachusetts. Rev. Ebeneezer Parkman of Westboro, Massachusetts has included in his diary references to some of the aftershocks.

Through research into historical documents, especially diaries and journals, it is possible to reconstruct a very detailed list of the aftershocks. Table 1 gives the date, local time, and estimated intensity of each aftershock; in general, the Plant's chronology has been accepted as the preferable one.

In Table 2, a comparative listing of the Newbury and Marblehead accounts is presented for the first week after the main shock.

Three aftershocks with an intensity greater than IV(MM) are presented below:

EARTHQUAKE OF NOVEMBER 14, 1727
CA. 17:00 (L)
Epicentral Intensity: IV-V(MM)
Location: 42.8N, 70.6W

The epicentral location is assumed similar to that of the main shock, approximately 14 miles east-southeast of the Seabrook site. No damage is reported from any locality, including Newbury where Rev. Matthias recorded "...very loud claps." It was felt in Essex and Middlesex counties in Massachusetts, as well as Boston and Westborough to the west-southwest.

PERTINENT ACCOUNTS:

Note: Dated accounts are the Julian Calendar, an addition of 11 days is required for conversion to the Gregorian Calendar.

Dexter, (Rev.) Samuel, Dedham, Massachusetts (Period diary entry)

"very sensible...as I sat in my study, to y[t] *Degree y*[t] *it jarr'd the windows. People were put in a very great surprise by it, both in Boston & in y*[e] *Country."*

Douglass, William (letter dated November 20, 1727)

"Essex and Middlesex counties:

"(at 4[h] *p.m.) 'a small shock was felt all over the countys of Essex and Middlesex.'"*

New England Weekly Journal, Boston, Massachusetts, November 13, 1727 (letter dated November 8, 1727 written from Marblehead with dated entries)

"Marblehead, Mass.:...and a very considerable one that made our windows jar at 4[h]*."*

Parkman, Ebeneezer (Rev.), Westborough, Massachusetts (Period diary entry)

"My wife and the young People of the house asserted that between 4 and 5 p.m. they heard the Like again...And this was confirmed by many other persons."

Plant, (Rev.) Matthias, Newbury, Massachusetts (Period entry, published in 1742-1743)

"Evening; very loud claps"

Sargeant, (Rev.) Christopher, Methuen, Massachusetts (Period diary entry)

"a very considerable return of it."

EARTHQUAKE OF JANUARY 4, 1728
CA. 23:00 (L)
Epicentral Intensity: IV-V(MM)
Location: 42.8N, 70.6W

No damage was reported from any locality. It was felt from Casco Bay, Maine, south to the Charles River region in Massachusetts. It was not reported as felt in Boston, Massachusetts.

PERTINENT ACCOUNTS:

Note: Dated accounts are in the Julian Calendar, an addition of 11 days is required for conversion to the Gregorian Calendar.

Gookin, (Rev.) Nathaniel, Hampton, New Hampshire (Appendix to sermon published 1727)

"there were two Shocks; the first of which was very loud, and jarred the Houses. This Shock, I am informed, extended from Charles River to Casco-Bay."

Plant, (Rev.) Matthias, Newbury, Massachusetts (Period account in minister's record)

"it was very Loud, as any time except y^e first, and twice that night after but not so loud."

Note: Casco-Bay is the old name of the settlement corresponding to Falmouth, Maine.

EARTHQUAKE OF FEBRUARY 10, 1728
CA. 15:30 (L)
Epicentral Intensity: V(MM)
Location: 42.8N, 70.6W

The earthquake of February 10, 1728 is considered to be an aftershock of the earthquake of November 9, 1727. The epicentral intensity, based on reports from Newbury and Ipswich, Massachusetts, is V(MM). The felt area is estimated at 8,500 square kilometers. No damage is reported for this event.

PERTINENT ACCOUNTS:

Note: Dated accounts are in the Julian Calendar, an addition of 11 days is required for conversion to the Gregorian Calendar.

Boston Gazette, Boston, Massachusetts, February 12, 1728
(Letter from Marblehead dated January 31, 1728)

"Marblehead, Massachusetts: 'a terrible shock of an Earthquake, which began with a rumbling noise like the rolling of a log over an hollow floor & increased until it seemed like the discharging of several cannon at a distance; at which time the earth trembled so as to jar the pewter on the shelves in many houses; the whole shock lasted about 50 seconds. It's thought that had this Shock been in the Night in still weather it would have appeared the greatest since the Great Shock on the 29th of October. This is the 3d shock we have had within these Six Day last past; and about the 30th since the 30th of October last.'"

Boston Gazette, Boston, Massachusetts, February 5, 1728
(Period newspaper account)

"we had here the severest Shock that has ever been heard since this 30 of Oct. last. It making the very houses shake and the people to run out into the Streets in the utmost consternation.

"And the same was felt about the same time in divers other Places. And more particularly at Ipswich, where it had done considerable damage in some houses."

Boston Weekly News Letter, Boston, Massachusetts, February 1, 1728
(Period newspaper account)

"we had here in Boston the greatest Shock that has been observ'd since the Night after Octob. 29. It made the Houses Shake and the Moveable jarred. It was perceived mostly by those indoors; and many ran out into the streets in great Consternation. The same was felt in the same manner in diverse other Places."

Bucknam, Nathan, Medway, Massachusetts (Period diary entry)

"there was an Earthquake y 2 of y Clock y^t^ jarred y house"

New England Weekly Journal, Boston, Massachusetts, February 5, 1728
(Period newspaper account)

"there was felt in this Town a considerable Shock of an Earthquake, and we learn that the same was heard and felt about the same time in divers other Towns even as far as Piscataqua."

New England Weekly Journal, Boston, Massachusetts, February 12, 1728
(Period newspaper account)

"about a quarter before 2 of the Clock p.m. one of the most observable since the first Earthquake, but not equal to that, the roaring or rumbling heard very generally in the Towns round about, and in many places a Shaking or Trembling of the Earth and Houses, the Glass ratling, and the Pewter on some Shelves, ceasing in about a Minute."

Parkman, Ebenezer, Westborough, Massachusetts (Period diary entry)

"It was heard and felt by most persons. The Sound was great, and, with many a shake was distinctly perceiv'd...almost all people heard it and many felt it shake the houses."

Plant, (Rev.) Matthias, Newbury, Massachusetts (Period acount in minister's record)

"there was a very loud clap equall to any but y^e first for Terror, shaking y^e houses so as that many people were afraid of their falling down Pewter: was shaked of dressers considerable distance."

Plant, (Rev.) Matthias, (Philosophical Transactions published 1742-43)

"there was a very great Roaring, equal to any but the first, for Terror: It shook our Houses so, that many People were afraid of their falling down; Pewter etc. was shook off our Dressers; the People that were in the Church for Evening Service, ran out; the lead Windows rattled to such a Degree, as that I thought they would all be broke."

Sargeant, (Rev.), Christopher, Methuen, Massachusetts (Period diary entry)

"returned w considerable force"

EARTHQUAKE OF SEPTEMBER 16, 1732
(SEPTEMBER 5, 1732, JULIAN CALENDAR)

CA. 16:00 (GMT)

EPICENTRAL INTENSITY: VIII(MM)(R)

LOCATION: 45.5N, 73.6W

EVALUATION:

Because this earthquake is one of the largest in the Western Quebec Seismic Zone and its location and epicentral intensity have often been questioned in recent years, both in Canada and United States, it was the object of an intensive study during the preparation of New York State Electric & Gas Corporation's (NYSE&G) I and II, PSAR (1978). The main reason for these uncertainties lies in the sparsity of the basic documentation available to the earlier catalog authors; in addition, some of the original information remains confusing because the contemporaneous style is often metaphoric.

A brief review of the historical cataloging of this event is necessary to understand the justification of the revised intensity. Mather and Godfrey (1927) were the first to estimate the intensity of the event. They associated an Intensity IX (Rossi-Forel) with an epicenter somewhere *"in Quebec"*; they also estimated an Intensity III(RF) for the Boston area. They gave only two references: Brigham (1871) and Lewis and Newhall (1865). The second catalog to appear was that of Heck and Eppley (1958), which placed the epicenter northwest of Montreal (46N, 74W), with an Intensity VIII(MM). Brigham was the only reference given. Brigham had leaned heavily on Rev. Matthias Plant's diary for his summary (See below). Brooks (1959), in his catalog, retained the same parameters as Heck and Eppley. Smith (1962) moved the epicenter to Montreal (45.5N, 73.6W), and raised the intensity to IX(MM), with no further explanation than *"chimneys fell and walls were cracked. Three hundred houses were damaged. One girl was killed."* In support, he quoted from a letter by Mother Duplessis, religious superior of the hospital in Quebec to a female friend in France. He also gave a dozen references which will be discussed below. Eppley (1965) and Coffman and von Hake (1973) repeated the new location and intensity, and simply gave Brigham and Smith as their only references.

Smith's choice needs to be critically evaluated, in view of the fact that limited evidence is presented in support of the upgraded intensity that makes this event the largest one within the Western Quebec Seismic Zone. Besides referring to all antecedent catalogs, Smith listed several other sources, but these sources referred to the 1732 earthquake only in a superficial way, except for two of them, Laflamme and E. Hodgson, which quoted part of the same letter of Mother Duplessis. It becomes apparent after reading the references used by the various catalog authors,

that they had no first-hand reports from Montreal itself, and that the letter from Mother Duplessis, written in Quebec, was the key description of the main earthquake, its effects and aftershocks.

From 1976 to 1978, investigations were carried out by Weston Geophysical, both in Montreal, Quebec, and at the Canadian Archives in Ottawa, to uncover additional information which could directly or indirectly help in ascertaining both the epicentral location and intensity of the event. Also included was a search for felt reports at more remote locations.

The major findings consist of a brief history of the religious community which was in charge of the Hotel-Dieu Hospital in Montreal, written in Montreal, by Sister Cuillerier, for the years 1725-1747, and of some correspondence related to compensatory funds for the repairs of local damages. It is considered that from their nature, i.e., historical notes and business letters, these primary sources are more objective and direct than second-hand reports, even if the contemporaneous style remains ornate at times.

The earthquake description found in Cuillerier's pages leaves no doubt that the main shock was severe, and that a long sequence of aftershocks occurred. Chimney damage was considerable; walls were cracked; wells were disturbed; fear made people run outside; and the frequent aftershocks compelled some to stay out. Damage to the hospital walls were relatively bad, but this structural damage is explicitly attributed to two previous fires that had weakened the masonry. In a letter of Mr. Chaussegros de Lery to the Marine Council, it is stated that the damage to the stone walls around the city was minor: *"few stones were displaced"*; similarly for the damage to parapets. It is also explicit, from Sister Cuillerier's and Mother Duplessis' texts, that fear was kindled by the clergy, as if the earthquake occurrences were related to some divine punishment for sinful activity. There is no doubt that the style of both writers is colored by this view; thus, many of the metaphors used should not be accepted literally.

One important point to be made is that all felt reports and damages observed in Montreal can be objectively included in an Intensity VIII(MM). The poor quality of masonry, the construction practices in the early 1700's, and the soil conditions of Lower Montreal (glacial deposits resulting from the Champlain submergence, Clark, 1972) constitute many factors that can explain the extensive chimney damages, without requiring a large magnitude event.

It should be noted that such an Intensity VIII(MM) appears to accommodate conservatively all other felt reports obtained at remote locations, in particular, those in New England and at Quebec City. In Figure 2.5.2A-2, isoseismals calculated with the intensity-distance relationship of Gupta and Nuttli (1976) have been superimposed on the felt report map.

From other studies where more abundant data points exist, such relationship has been observed to be conservative. Intensities reported in eastern Massachusetts, New Hampshire and Connecticut are in good agreement with the predicted values. Similarly, the single report from Quebec City, by the Intendant, Mr. Hocquart, that the earthquake *"amounted to not much"*, constitutes at the most an Intensity IV, and possibly III-IV; this level is quite acceptable with respect to the predicted V level, but would be anomalously low in comparison with a predicted VI-VII level that would result for Quebec if an Intensity IX is postulated for Montreal. Other reports in Philadelphia, New Castle, Annapolis, are in good agreement with the predicted isoseismals associated with an Intensity VIII(MM) for I_o. The fact that more distant localities, such as Louisburg, N.S. and Southern James Bay did not report any tremor, also suggests that I_o=VIII(MM) is a more likely characterization of the event.

In view of the fact that reports on earthquake effects in Montreal and felt reports from other distant locations support an epicentral intensity VIII(MM), it is concluded that the Intensity IX(MM) proposed by Smith (1962) should be revised. An Intensity VIII(MM) appears to be a more objective characterization.

Concerning the location of the epicenter, it is proposed that the Smith's coordinates be retained as the most probable, and given an uncertainty of 30 miles. The main reason for this position is the fact that the distribution of settlements near Montreal, particularly along the St. Lawrence, was such that an epicenter substantially outside Montreal would have been recognized as such. A 1739 census, as given by Sulte (1882), certainly indicates a good coverage around Montreal, with the exception of the northwest. Yet, the hypothesis of an epicenter in this direction, e.g. near Mont-Tremblant, is rejected, as it would imply a larger epicentral intensity in order to explain a site intensity VIII in Montreal, but would become irreconcilable with the Quebec and James Bay observations. The continuous spread of settlements from Montreal to Quebec illustrated by Sulte militates against E. Hodgson's *"suggested possibility that the event could have been further down the river"*.

It is thus concluded that the 1732 event should be considered as having occurred most probably in Montreal, with an epicentral intensity VIII(MM). It is further suggested that a magnitude $m_{bLg}=6.0\pm\frac{1}{4}$ would be a better characterization of the event, taking into account the entire set of felt reports and the possibility of local amplification at the Montreal site.

PERTINENT ACCOUNTS:

American Weekly Mercury, The, Philadelphia, Pennsylvania, September 7 to September 14, 1732

"New-Castle, Sept. 6. Yesterday about Noon we had a pretty Considerable shock of an Earthquake in and about this Town, most people in Town being sensibly affected with it, and several that were employed in making and stacking of Hay in our Meadows were greatly surprised. It lasted about a Minute, and everybody that felt it found at the same time a disorder in their Stomach, Head and Sight."

Extrait des ANNALES DE L'HOTEL-DIEU DE SAINT-JOSEPH DE MONTREAL, "Fin des Annales de Soeur Morin, Relation de Soeur Cuillerier: 1725-1747," Archives des Religieuses Hospitalières de Saint-Joseph, 251, Avenue des Pins ouest, Montréal.

"Nous avons entré dans nos dortoirs en 1728 et 29 une party de la dote de Ma soeur Gassien a étée consomée à cet ouvrage 1730 se sont passée tranquillement et sans auquun évenement particulier Mais en trinte-deux nous avons eue une picotte sy universelle qu'il a passée dans nos salles plus de 500 Malades qui nous ont donné une fatigue incroyable. Cette picotte fut précédée d'un tremblement de terre si terible que l'on doute qu'il y en eu de plus violent dans les endroits même qui ont ettée renversé et qui ont abimée. Ce fut le 16 septembre à onzes heur trois card que la première secousse se fit entandre et santir elle abaty dabor 567 cheminée fandy presque tous les Mures des Maisons la nôtre fut très en daumagée aussi bien que nos métérie des quelles tous les puis furent comblée de ce premier mouvement qui dura bien un car d'heure sans sarêtez Nous courument toutes dans le jardin pour naitre pas ecrasez sous notre bâtiment étant plus en danger de tomber qu'un autre nos murailles ayant souffert deux incendy rien de plus terrible Mes chères soeurs que de voir les cloché et les Maisons fléchire come des rausau et branler ausy fort que sy ils avoit étez de Carte après cette première secousse il en vint plus de 50 dans vint-catre heures Ce qui obligea tout le monde de Couchez dans les campagne et dans les jardins dans la crainte dêtre abimée par quel quune Mais les prieres publique fléchirent la miséricorde du seigneur qui cest contanté de tenir tout son peuple en alarmes pendans plus de neuf mois les brouissement sestant toujours fait entandre pandans ce longes-pace de temps les dames firent voeux de laisser les panier et les vanité Mais il y en eu quelqunue qui suivan le légerreté naturelle aux sexe nentandans plus que de petits tremblement se crurent en suretéz et reprirent leurs adjustment dieu sanvangea et en fit entandre un semblable au prêmier. la nuit du 25 doctobre au 26 ce qui fit redoubler les voeux et les priere."

Anonymous, manuscript in possession of Bibliothèque de Montréal, Montreal, Canada.

"Tremblement de terre.

"1732. Secousses: Montreal 300 maisons endommagées, une fille tuée, plusieurs personnes blessées,...on couche dans les jardins."

Letter of M. Hocquart, Intendant, to the Governor-General, including the Letter from Sister Levasseur to the Secretary of State, Correspondance Générale in possession of the Public Archives of Canada, Ottawa, Canada.

"Mrs de Beauharnois

Monseigneur

"...avec les autres demandes les religieuses hospitalieres de Montreal nous ont adressé un placet que nous avons l'honneur de vous envoyer, par lequel elles vous supplient Monseigneur, d'avoir égard à la situations où elles se trouvent et au dommage que le tremblement de terre leur a causé nous ne scavons pas précisément en quoy ce dommage consiste: mais nous sommes informés que leur maison en vue de celles qui ont le plus souffert de cet accident, les soins et les attentions que ces religieuses ont pour les malades, méritent que vous ayés des bontés pour elles.

"Nous sommes avec un très profond respect
Monseigneur
Vos très humbles et très obéissants serviteurs.
Hocquart
A Quebec le 27 octobre 1732."

"A Monseigneur de Maurepas ministre et secretaire d'Etat.

Monseigneur

"La bonté avec la quelle Votre Grandeur toujours attentive aux besoins de cette colonie y donne sans cesse des marques de l'honneur de sa protection me faite esperer que mes tres humbles representations pourront interesser cette bonté secourable en faveur d'une communauté nécessiteuse sur laquelle Votre Grandeur a déjà plusieurs fois repandue ses bienfaits, c'est dans cette confiance Monseigneur qu'après avoir adressé mes voeux au ciel pour la conservation de Votre Grandeur je prends la liberté de lui remonter avec un profond respect que le rétablissement de notre monastère nous ayant endetté de plus de vingt mil livres malgré les graces que nous avons receus da Sa Majesté, nous sommes encore aujourd'huy par notre situation l'objet auquel elles peuvent être plus justement appliqués puisque le Seigneur vient de nous donner un nouvel accident en ruinant presque entièrement notre monastère par un tremblement de terre effreyant qui a fait d'autant plus d'impression à nos murailles quelles ont déjà soufferts deux incendies, nous avons meme tout lieu d'apprehender Monseigneur que les grandes gelées de l'hiver ne le fassent tomber absolument, etant toutes fondues a jour la charpente sortie d'un demi-pied, toutes nos cheminées renversées, ce qui nous fait craindre d'etre ecrasez sous notre bâtiment, qu'il plaise à Votre Grandeur Monseigneur d'avoir pitié de cette communauté desolée, et d'écouter la très humble prière que je prends la liberté d'adresser à Votre Grandeur au nom des religieuses hospitalières de Montreal de ville Marie de leur accorder une gratification suffisante pour mettre leur monastere en surêté, et aider à payer leur deptes afin qu'elles continuent leurs soins aux soldats, sauvages et habitans malades. J'ay l'honneur d'être avec un profond respect

Monseigneur
De Votre Grandeur la très humble et très obéissante servante.
Soeur le Vasseur supérieure des religieuses hospitalières de St. Joseph."

Boston Gazette, The, Boston, Massachusetts, September 4, 1732

"On Tuesday last about Noon we were very much surprised here by the Shock of an Earthquake, it was attended with hardly any Noise, the Shake continued near half a Minute, and some Houses were perceived to tremble very much, so that several things were shaken down from their Places."

Boston Weekly News-Letter, The, Boston, Massachusetts, September 14, 1732

"By a letter from Marthas Vineyard, dated the 11th Instant, we have Advice, that they had the Shock of an Earthquake in that Place the Tuesday before, a little after Noon, as was evident to many on the Island, which was near the Time when it was perceiv'd here. They could not learn that the Shake was attended with any Rumbling as is usual. So that hereby we are assured the said Shake was very extensive."

Boston Weekly News-Letter, The, Boston, Massachusetts, November 30, 1732

"On Saturday last Mr. Lydius came hither by land from Albany, and informs us, that before he left that place, he received a Letter from a Relation of his at Montreal in Canada, who gave him an account that on the 5th of September last about noon an amazing Shock of an Earthquake was felt there, (the same day and hour it was last perceived here) which was so violent that about 165 Houses suffer'd more or less damage thereby, and the Walls fortifying the Place in part thrown down. Three Persons were killed, and Six wounded; that the Shake was repeated nine or ten Nights following (and only in the Nights) in all which time the People were afraid to lodge in their Houses. Mr. Lydius had the above Account confirm'd to him by an English Gentleman arrived at Albany from Montreal."

Brigham, William T., Memoirs of the Boston Society of Natural History (1871); I. Volcanic Manifestations in New England Being an enumeration of the principal earthquakes from 1638 to 1869

"September 15, 1732. A violent earthquake was felt in Canada, which did considerable damage at Montreal, as stated in the preceding list. It came at eleven o'clock A.M., and was attended with a rumbling noise. A clock was stopped at Annapolis, Maryland, although the shock was slightly felt at Boston. In June, of the next year, on the fourteenth, according to some authorities, it is said a shock was felt at Annapolis, but there is no certainty that it took place."

Buckman, Nathan, "Diaries: 1722-1767"; written at Medway, Massachusetts, in possession of the American Antiquarian Society, Worcester, Massachusetts

"An Earthquake perceived by some."

Couanier de Launay, M.E.-L., Histoire des Religieuses Hospitalières De Saint-Joseph (France Et Canada), Paris, 1887, p. 119.

"Trois ans après (1732), un affreux tremblement de terre qui se fit sentir surtout à Montréal, endommagea gravement les bâtiments. Les réparations ne purent être terminées que l'année d'après, au moyen de la dot d'une des soeurs."

Faillon, Etienne M., Vie de Mlle Mance Et Histoire De l'Hotel-Dieu de Villemarie, Dans l'Île de Montreal, en Canada, Tome II, 1854.

"Au milieu des embarras qu'elles éprouvaient dans l'état de dénûment où elles se voyaient réduites, elles eurent encore à essuyer, l'année 1732, les effets d'un violent tremblement de terre, qui mit leur vie en péril et endommagea leur nouveau bâtiment. La première secousse, qui eut lieu le 16 du mois de septembre, à onze heures trois quarts, se fit sentir plus ou moins dans toute la colonie, mais nulle part elle ne fut si violente que dans l'île de Montréal. Cette secousse abattit tout d'abord plus de trois cents cheminées, écrivaient les hospitalières de Villemarie à leurs soeurs de France, et fendit presque tous les murs des maisons; la nôtre fut très-endommagée, aussi bien que nos métairies, dont tous les puits furent comblés par ce premier tremblement, qui dura bien un quart d'heure sans s'arrêter. Nous courûmes toutes dans le jardin pour n'être pas écrasées sous notre bâtiment, qui était plus en danger de tomber qu'aucun autre, nos murailles ayant souffert deux incendies. Rien de plus terrible, mes chères soeurs, que de voir les clochers et les maisons fléchir comme des roseaux, et branler aussi fort que s'ils eussent été de cartes. Après cette première secousse, il en vint plus de trente en vingtquatre heures, ce qui obligea tout le monde de coucher dans la campagne et dans les jardins, crainte d'être écrasé par les maisons. Les dames firent alors voeu de renoncer à l'usage de porter des paniers sous leurs robes et à d'autres semblables vanités; mais il y en eut quelques-unes qui, n'entendant plus que de petits tremblements, se crurent en sûreté, et, suivant leur légèreté naturelle, reprirent leurs adjustements. DIEU, pour les rappeler à leur devoir, fit entendre un nouveau tremblement semblable au premier, la nuit du 25 au 26; ce qui fit redoubler les voeux et les dévotions. Enfin, les prières publiques ont touché la miséricorde du SEIGNEUR, qui s'est contenté de tenir tout son peuple en alarmes pendant plus de neuf mois, les bruissements s'étant toujours fait entendre pendant ce long espace de temps. M. Chaussegros de Léry, ingénieur, écrivait que si la première secousse eût duré quelques minutes de plus, une grande partie des maisons de Villemarie auraient été renversées. Il ajoutait qu'elle s'était fait sentir à Québec, mais très-légèrement.

"Après ce désastre, la mère Levasseur, supérieure des filles de Saint-Joseph, s'empressa d'écrire de nouveau à M. de Maurepas, afin d'obtenir de lui quelques secours, tant pour payer leurs dettes, qui s'élevaient alors à 20,000 livres, que pour réparer les dégâts faits à leur bâtiment."

Note: Inserted here is a quotation of Sister Levasseur's letter. See Letter of M. Hocquart in this appendix.

"M. de Beauharnois et M. Hocquart accompagnèrent la supplique des religieuses au ministre d'une lettre de recommandation, en date du 27 octobre 1732. Ils faisaient remarquer qu'ils ne savaient pas en quoi consistant le dommage que le tremblement de terre leur avait causé, mais que leur maison était une de celles qui avaient le plus souffert de cet accident. Enfin, ils terminaient en assurant le ministre que les soins et les attentions de ces religieuses pour les malades méritaient qu'il vint à leur aide dans cette occasion. Le 6 mai 1733, le ministre invita le gouverneur et l'intendant à faire l'estimation de ce dommage, que M. de Léry porta à la somme de 640 livres. Nous vous supplions, Monseigneur, écrivaient au ministre le gouverneur et l'intendant, de vouloir bien accorder cette somme à cette communauté; elle mérite vos bontés pour les soins assidus que les religieuses apportent au soulagement des pauvres malades, et qu'elles ont redoublés à l'occasion de la petite vérole, ayant continuellement eu, pendant quatre mois, près de cent soldats à soigner. Cette maladie épidémique fut si ufut si universelle à Montréal, que les hospitalières recurent dans leurs salles plus de cinq cents malades; ce qui leur occasionna beaucoup de dépenses et un surcroit de fatigues excessives. Ce fut l'année même où arriva cette contagion, en 1733, qu'elles parvinrent enfin à achever leur bàtiment, en employant pour cet usage la dot d'une de leurs soeurs. Mais comme la croix devait être le plus ferme appui de cette maison, à peine les bâtiments étaient achevés, et avant même qu'on eût recu la somme de 640 livres accordée pour réparer les dégâts faits par le tremblement de terre, tous ces bâtiments furent de nouveau réduits en cendres, comme nous le raconterons au chapitre suivant."

Hobart, Nehemiah, "Journal of Nehemiah Hobart, written at Hingham, Massachusetts: 1721-1746", in possession of the Massachusetts Historical Society, Boston, Massachusetts

"A shock of an earthquake att (sic) Boston, Ma: Vinyard about noon, yet no rumbling heard."

Hocquart, M., "Lettre d'Hocquart au Ministère," Manuscript in possession of the Public Archives, Ottawa, Canada.

"M. Hocquart 30 Octobre 1732

"Monseigneur

"...J'ay recu aujourdhuy une lettre de Montréal par laquelle on me marque que la nuit du 24 au 25, il s'est fait sentir un tremblement de terre à peu près semblable à celuy du 16 7bre moins violent, mais plus long accompagné d'un bruissement dans la montagne qui a duré longtemps.

L'on ne m'écrit pas d'autres circonstances, ni que ce tremblement aüt causé de nouveaux dommages.

"Je suis avec un très profond respect
"Monseigneur
"Votre très humble et très obéissant serviteur.
"Hocquart
"à Québec le 30 octobre 1732."

Hodgson, E. A., 1950. The Saint Lawrence earthquake, March 1, 1925: Dom. Obs. Pub., Ottawa, v. 7, No. 10, Appendix B, p. 430, "Earthquake September 5, 1732."

"In the second of the four lists published by Sir. Wm. Dawson, he states: "1732, September 5, Canada, New England, and as far as Maryland, buildings injured..."

Note: After referring to abstracts of Mgr. Laflamme, Sister Duplessis, and other correspondence, Hodgson concludes:

"It is desirable that further references to this earthquake be sought, in order that it may be established whether an earthquake of such intensity centred near Montreal or, if not, the position of its epicentre.

"The fact that the first tremors lasted 'only two or three minutes,' would indicate that Montreal was not the centre of this earthquake. It is just possible that later references. may establish an epicentre much farther down the Saint Lawrence."

Holyoke Diaries, The, annotated by George Francis Dow, the Essex Institute, Salem, Massachusetts, 1911, p. 4

Note: At Marblehead.

"Large shock of an earthquake."

Hunt, Ebeneezer, "Journal", Judd Manuscripts in possession of the Forbes Library, Northampton, Massachusetts, Vol. I, p. 23

"...about 12 o'clock in the day which shook the houses considerably. Some thought it was as powerful as that of Oct. 29, 1727."

LaFlamme, Mgr. J.-C. K., "Les tremblements de terre de la région de Québec," Memoires de la Societé Royale du Canada, 1907, Sec. 4, p. 160-161

"1732.--Le séisme de 1732 n'ayant affecté que la région de Montréal (M) ne rentre pas rigoureusement dans le cadre de ce travail. Nous en dirons quelques mots cependant pour faire voir que, si les séismes montréalais ont, en général, moins d'intensité que ceux de la région inférieure de la province, ils peuvent cependant atteindre un certain degré de violence.

"La Mère Duplessis de Ste Hélène, supérieure de l'Hôtel-Dieu de Québec, après avoir parlé, dans une lettre du 20 octobre 1732, de l'incendie de Montréal qui avait détruit 190 'corps de logis,' ajoute: 'Depuis un mois c'est un tremblement de terre qui y jette une consternation qu'on ne peut exprimer. De la première secousse qui ne dura que deux ou trois minutes, plus de trois cents maisons ont été endomagées, quantité de cheminées tombées des murailles fendues, des personnes blessées, une fille tuée, des grêles de pierres qui se répandaient partout et qui semblaient être jetées par des mains invisibles, enfin un effroi si universel que les maisons sont désertes, on couche dans les jardins, les bêtes même privées de raison jetaient des cris capables de redoubler la frayeur des hommes. On fait des confessions générales de tous les côtés; les dames ont quitté leurs paniers, les prêtres leur ont fait signer une promesse. Plusieurs ont fui et sont venus à Québec peur d'être enseveli sous les ruines de cette pauvre ville. Le fâcheux est que tout cela n'est pas fini. Il n'est point de jour qu'il ne se fasse sentir; il y a des puits qui ont été extrêmement taris, des chemins bouleversés.'

"D'autre part, l'ingénieur de Léry écrit au ministre pour lui annoncer qu'il y a eu un tremblement de terre à Montréal. Le 3 octobre 1732, l'intendant Hocquart apprend au Ministre la nouvelle de ce tremblement de terre, et, le 12 avril 1735, le Président du Conseil de Marine écrit á l'intendant Hocquart qu'il ne peut accorder aux Récollets la somme qu'ils demandent pour les pertes subies par eux dans le tremblement de terre.[1]"

[1]*Renseignements fournis par M. J.-E. Roy*

Lewis, Richard, Philosophical Transactions, Number 429, 1733

A letter from Mr. Richard Lewis, at Annapolis in Maryland, to Mr. Collinson, F.R.S. containing the Account of a remarkable Geneneration of Insects: of an Earthquake; and of an Explosion in the Air.

"On Tuesday the 5th of September last, about Eleven in the Morning, an Earthquake was felt in diverse Places in Maryland; the most particular Account I have heard of it was from Mr. Chew. It shook his House for some time, and stopp'd the Pendulum of his Clock; during its Continuance, a rumbling Noise was heard in the Air, and many People who did not feel the Shaking, as well as those who did, complained of a Dizziness in their Heads, and Sickness at their Stomachs: At the same time, I have been credibly informed, it was felt in Pennsylvania, and New-England; but I have not heard whether it extended to North or South Carolina."

Des Miettes d'histoire par S.S.-Eulalie de Barcelone, 1925, Archives de la Congregation de Notre-Dame, Montréal, Quebec, 200.100, 1, p. 32.

"1732-Inondation, petite vérole. Plus de trente secousses de tremblement de terre en vingt-quatre heures, et abattent plus de trois cents cheminées. Ces secousses se renouvellent plus ou moins fréquentes pendant neuf mois."

Lewis, Alonzo and James R. Newhall, History of Lynn, Essex County Massachusetts: including Lynnfield, Saugus, Swampscot, and Nahant, Boston, 1865

"1732. On the 5th of September, there was an earthquake without noise."

New-England Weekly Journal, The, Boston, Massachusetts, September 11, 1732

"Boston"

"On Tuesday last a few Minutes after Twelve at Noon was felt here a surprizing Shock of an Earthquake, attended with little or no Noise, the Shake continued near half a Minute, and some Houses were perceived to shake very much, so that several small things were shook down from their Places. The same was very sensibly felt in most of the Neighbouring Towns, and to the Eastward as far as Piscataqua."

New-England Weekly Journal, The, Boston, Massachusetts, September 25, 1732

"Boston.

"We are inform'd, that the Earthquake felt here on Tuesday, the 5th Instant, was perceived near the same time at Philadelphia; and from Springfield we hear it was very surprizing there, shook down several things from off the Shelves at the House of Capt. William Pynchon; and a Man in a Orchard there perceiv'd that several Apples were shook off the Trees thereby."

Nova francia, Vol. III, No. 2, 24 décembre 1927, "Lettre de Mère Marie-Andrée Duplessis de Sainte-Hélène, supérieure des Hospitalières de l'Hôtel-Dieu de Québec," avec des notes de A.-Léo Leymarie.

"Madame et tres chere amie,...

"Il est temps de vous parler des fleaux dont Dieu afflige le canada, il y a quelques années que je vo mandé un incendie presque general qui avoit consumé plus de 190 corps de logis à Montreal ce printemps, la même ville a été inondée et fort incommodée de leau qui a monté si haut que les caves étoient pleines tout y flottoit, les planchers se soulevoient, les rues étoient impraticables et plusieurs marchands ont beaucoup perdu, depuis un mois c'est un tremblemt de terre qui y jette une consternation qu'on ne peut exprimer des la p[ere] secousse qui ne dura que 2 a 3 minutes plus de 300 maisons ont été endomagées, quantité de cheminées tombées, des murailles fenduës, des personnes blessées, une fille tuée, des grêles de pierres qui se repandoient partout et qui sembloient être jettées par des mains invisibles, enfin un effroy si universel que les maisons sont désertes on couche dans les jardins, les bêtes mêmes privées de raison jettoient des cris capables de redoubler la frayeur des hommes, on fait des confessions generales

de tous cotés, les Dames ont quitté leurs paniers, les prêtres leur ont fait signer une promesse, plusieurs ont fuĩ et sont venues a Quebec peur d'etre ensevelies sous les ruĩnes de cette pauvre ville, le facheux est que cela n'est pas fini, il n'est point de jour qu'il ne se fasse sentir, il y a des puys qui ont entierement tari, des chemins bouleversés...."

Parkman, Ebenezer, September, 1732, The Diary of Ebenezer Parkman, First Part 1719-1755, ed. Francis G. Walett, American Antiquarian Society, 1974

"September 5. N.B. An Earthquake just about (or a little after) Noon."

Note: Rev. Parkman lived in Westboro, Massachusetts.

Pennsylvania Gazette, The, Philadelphia, Pennsylvania, September 12 to September 18, 1732

"Philadelphia, Sept. 18

"On Tuesday the 5th Instant, a small Shock of an Earthquake was felt in this City, about Noon. It was also felt at New-Castle."

Plant, (Rev.) Matthias, Philosophical Transactions of Royal Society, London (1742-43), No. 462, Vol. XLII, p. 33.

"September 5, 1732. About noon we had a severe shock, which was perceived at Boston and Piscataqua, but attended with little or no noise. The same earthquake was heard at Montreal, in Canada, at the same time and about the same hour of the day, and did damage to one hundred and eighty-five houses, killed seven persons, and hurt five others; and it was heard there several times afterwards, only in the night, as the newspapers give us this account."

Roy, Pierre George, Inventaire des Papiers de Lery Conservés aux Archives de la Province de Quebec, Volume I, Quebec, 1939, Letter of M. Chaussegros de Lery to the President of the Marine Council.

" 20 octobre 1732"

"Monseigneur.

"Neuf jours apres mon départ de Montreal qui étoit le 16, du mois passé il y a eu un tremblement de terre assez violent qui a fait tomber une bonne partie des cheminées, en a fait fendre dautres et plusieurs mur des maisons se sont ouverts les personnes qui en viennent mont asseuré que sil avoit continué encore deux minutes une grande partie des maisons auroient été renversée jay apris depuis que la terre avoit tremblé pendant plusieurs jours mais les secouses nont pas eté si violentes le premier tremblement s'est fait sentir presque dans toute la colonie je lay senty a Quebec mais cetoit peu de chose.

"Les Entrepreneurs qui sont descendus mon dit avoir visité les murs de L'anceinte ils disent qu'a la porte de St. Laurent il y a en quelques pierres de dérangées qu'ils ont accomodé et mont demandé 10 livres pour cela dans la maconnerie il y a eu quelques desus de parapets de dérangés et quelques pierres du desus des Embrazures de tombées ils offrent de retablir le tout pour 50 livres dans le bastion du nord il setoit fait une fente ils m'ont asseuré que dans les dernieres secouses elle s'etoit fermée ils mon dit aussi que les allignements des murs et les taluds n'avoient pas changés, Mr. le Général et Mr. L'Itendant on receut plusieurs lettres de Montreal je suis persuadé Monseigneur qu'ils vous informeront mieux que moy du degat qu'a causé ce tremblement en ayant receu le détail....

"Je suis avec un profound respect,
Monseigneur,
Votre tres humble et tres obéissant serviteur.

CHAUSSEGROS DE LERY

"A Quebec le 20 octobre 1732.

"Soeur Sainte-Henriette, Cahier 6e." Archives de la Congrégation de Notre-Dame, Montréal, Quebec, p. 420.

"Petite vérole. Tremblements de 1732-1733.

"A la même époque, il y eut des tremblements de terre qui se firent sentir particulièrement à Montréal. La première secousse, qui eut lieu le 16 septembre 1732, abattit plus de trois cents cheminées; il y en eut plus de trente en vingtquatre heures et elles se renouveleront à divers intervalles pendant plus de neuf mois."

<u>Weekly Rehearsal, The</u>, Boston, Massachusetts, September 11, 1732

"Boston, Sept. 11. About 12 o'Clock on Tuesday last, we felt a considerable Shock of an Earthquake, which lasted the space of half a Minute; and several Persons affirm that they observed the Houses at some Distance to move; but we cannot learn that this shaking was attended with any such Noise as usual. We hear the Shock was felt in several of the adjacent Towns, particularly at Salem, where the shaking was very violent and lasted near a Minute. From Portsmouth, a Gentleman writes, 'That the Shock was very little inferiour (sic) *to the great Earthquake in 1729* (sic), *and lasted near a Minute, but was not accompanied with the usual Rumbling.' It was felt in all the Places from whence we have yet heard, at the same Instant we observed it here."*

Williams, Samuel, "Observations and Conjectures on the Earthquakes of New England," Memoirs of the American Academy of Arts and Sciences, Boston, 1785

"Observations and Conjectures on the Earthquakes of New England.

"In 1732, there was an earthquake, which, though small, was of considerable extent. It came on September 5, o.s. at about 11^h A.M. being attended with a rumbling noise; and was of such violence as to occasion a considerable jarring of the houses. The duration of it, was not more than ten or fifteen seconds. This earthquake was much more evident at Montreal in Canada, than it was in any part of New-England; being attended with considerable damage there. As this was the chief feat of it, it seems to have come from thence, in a north-westerly course, to New-England. Its extent, from south-west to north-east, was equal to that of most of the earthquakes that have been in the country; being felt from Maryland to the northeasterly parts of New-England: and from north-west to south-east, it reached from Montreal, and probably from many miles beyond it, to the seacoast."

EARTHQUAKE OF JUNE 14, 1744
(JUNE 3, 1744, JULIAN CALENDAR)

CA. 10:15 (L)

EPICENTRAL INTENSITY: VI(MM)

LOCATION: 42.5N, 70.9W

EVALUATION:

This earthquake is estimated to be centered in the Southern Cape Ann region, near Salem, Massachusetts (Figure 2.5.2A-3). Reports of an Intensity VI(MM) level are found for Newburyport, Salem, Lynn, Melrose, and Boston. The epicentral location cannot easily be determined, as attested by early catalogs which referred only to "eastern Massachusetts." Smith's location, further to the east, (42.6N, 60.0W) is an attempt to take into account the undetermined location "off Cape Ann" given by Mather and Godfrey (1927), and to accommodate the observed coastal distributions of felt reports. The higher intensity to be associated with an epicenter at sea was logical, but remains an extrapolation.

The current location near Salem is preferably chosen in view of the distribution of similar Intensity VI(MM) levels, from Newburyport to Dorchester, and the fact that the report of the main aftershocks and some secondary ones appear to be primarily associated with the Salem vicinity.

In some of the reports, a reference is made to the similarity of this shock with that of 1727. At first, one might consider the possibility of a similar epicenter and intensity. On closer examination, one finds that such a position is not accurate; in Dorchester, it is explicitly reported that the 1744 earthquake was not as strong as that of 1727. The felt reports for the 1727 earthquake were predominantly stronger north of Cape Ann, in contrast with the 1744 earthquake.

There is no doubt that a large uncertainty ±15 miles can be associated with the event.

PERTINENT ACCOUNTS:

Boston Weekly News-Letter, The, Boston, Massachusetts, June 5, 1744
(Period newspaper account)

"Last Lord's Day between 10 and 11 o'Clock in the Forenoon we were surprized with a violent Shock of an Earthquake attended with a loud rumbling Noise whereby People were put into a very great Consternation, and many who were attending the Divine Worship ran out into the streets fearing the Houses would fall upon them: A great many Bricks were shook off from several Chimneys in this and other Towns, and much of the Stone Fences in several Places in the Country was tumbled down by it. It was perceived to continue longer and be more severe in some Places than at

others; and 'tis tho't by some to be felt near equal to that which we had in the Year 1727. How extensive it was we cannot yet learn, but by Information at present we are assured that it reach'd above 100 Miles. Another shock was felt at Salem, and others reach'd above 100 Miles. Another shock was felt at Salem, and others adjacent: Towns, about five o'Clock in the Afternoon of the same Day, which was considerable and again surprised the People very much. Three or Four smaller Shocks were perceived in the Night and Morning Succeeding.

"We hear from Hopkinton, that the Monday before the Earthquake, the Mud arose from the Bottom of two large fishing Ponds in that Town so as thicken the Water and prevent their fishing in them. It continued so for two or three Days and then setled and grew clear again. T'is remarkable that the same happened to these Ponds a few Days before the great Earthquake in the Year 1727."

Fuess, Salem, Massachusetts (Later history, published 1835)

"The Earthquake of 1744 - In 1744 there was another terrific earthquake, which was thought by some to have been nearly equal in severity to that of 1727. In May there had been two slight shocks, occurring in both instances in the morning. At a quarter past ten on Sunday morning, June 3, just after church services had begun, the severest shock came. It reached only about a hundred miles and was ushered by a loud rumbling, which threw the people into consternation as they remembered the experience of seventeen years before.

"People ran out of their houses, fearing they would fall upon them; and the rector and many of the congregation ran out of the Episcopal Church at Newbury (in that part now Newburyport). In the Hamlet parish in Ipswich (now the town of Hamilton), the shock came when the pastor, Rev. Mr. Wigglesworth, was preaching. The congregation was greatly alarmed; but he endeavored to calm them, remarking that 'there can be no better place for us to die in than the house of God.'

"Bricks were shaken from chimneys and stone walls were thrown down. At about five o'clock in the afternoon another and lesser shock was felt at Salem and adjacent towns, and people screamed and ran out of doors. Three or more lesser shocks were perceived that night and the next morning."

Boston Gazette or Weekly Journal, The, Boston, Massachusetts, June 12, 1744 (Period newspaper account)

"Portsmouth, N.H., June 9

"Last Lord's Day, a little after 10 o'clock. the People thro' out this Province and the County of York, were very sensible of a severe shock of an Earthquake, attended with a loud rumbling Noise, which greatly surpris'd them; but we can't learn of any damage being done: Those that were upon the Water near the Coast and Rivers, were as sensible of the convulsion as those on the Land."

Wadleigh, George, Dover, New Hampshire (Later History, published 1913)

"A great Earth Quake Sabbath Day June 3, 1744."

Sawyer, (Rev.) Roland D., Kensington, New Hampshire (Later History, published 1974)

"The only earthquake ever felt in Kensington of sufficient severity to be recorded were those of October 29, 1727 and June 3, 1744."

Parson, Langdon, Rye, New Hampshire (Later History, published 1905)

Note: June 3, 1744 - smart shock of earthquake.

EARTHQUAKE OF NOVEMBER 18, 1755

CA. 04:12 (L)

EPICENTRAL INTENSITY: VIII(MM)

LOCATION: 42.7N, 70.3W

EVALUATION:

This is the largest historical event within the site region. It is also the most significant one because of its close epicentral distance to the site (30 miles). The approximate location can only be estimated on the basis of the felt report distribution from which isoseismals are attempted (Figure 2.5.2A-4). An uncertainty of ±15 miles seems to be a reasonable compromise.

The event has been thoroughly discussed in the Pilgrim Unit II Docket Boston Edison Company, 1976. Its tectonic origin and location have been related to the Cape Ann pluton and the Northeastern Massachusetts thrust fault complex. All documentary evidence of felt reports have been published in the Historical Seismicity of New England (BE-SG 7601, Boston Edison Company, 1976), prepared by Weston Geophysical.

The event was felt over a wide area of approximately one million square kilometers, extending from Halifax, Nova Scotia to Annapolis, Maryland. The damage was limited to coastal New England locations, from Portland, Maine to New Haven, Connecticut. The worst chimney and fence damages, definitely of an Intensity VII(MM) level were observed in the Cape Ann region and in Boston proper. Because much of the damage in Boston was confined to landfilled areas near the shores, it is considered to be partly attributed to soil amplification. For this reason, the Intensity VII(MM) reports of the Cape Ann region, even though less dramatic in style and fewer in number, are considered to be more indicative of the epicentral location.

PERTINENT ACCOUNTS:

Adams, N., Portsmouth, New Hampshire (citation in later History 1825)

"The most severe and tremendous earthquake, which was ever felt in this country, took place on the night of the 18th of November, after midnight. The weather was remarkably serene, the sky clear the moon shone bright, and a solemn stillness prevailed all nature, at the time it commenced."

Boston Weekly News Letter, November 20, 1755 (Effects in Boston)

"the tops of many Chimnies, and some of them quite down to the Roofs, were thron down, and several of the Roofs upon which they fell were beat in: Many Chimnies also, for 6, 7, and 8 Feet below the Top, were loosened and turned several Inches on the main Body; and others, with the Brick Walls of some Houses were disjointed, burst out and shatter'd: the wooden Post that supported the Spindle and Vane of Faneuil Hall Market was by the Shake broke off, and they fell to the Ground on the North Side....And in the inside of many Houses, the Pewter, Earthen, Glass, China, and other Ware, were thrown off the Shelves, and other Places whereon they stood, and many Things were broke to Pieces."

Dow, J., Hampton, New Hampshire (Citation in Later History, 1893)

"The shaking of the earth was so great that several chimineys in this town were thrown down.

"The earthquake occurring at an hour when the mass of the people were asleep, many of them being suddenly awakened were very much terrified, not imediately perceiving the cause of the commotion. The older people, however, had not forgotten the earthquake of 1727, and now, as on the occasion, they recognized the hand of God in the occurrence."

Quincy, E., Portsmouth, New Hampshire (Letter dated November 22, 1755)

"...it was very shocking in thes Town and the Towns round about us....My wife awoke in the midst of the shaking...." (Letter 22 Nov. 1755)

Winthrop, John (1757) Description of Effects in Boston

"the principle effect of the earthquake for which I can find sufficient vouchers, for many strange things have been related which upon examination, appear to be without foundation. Besides the throwing down of glass, pewter and other movables, in the houses, many chimneys were levelled with the roofs of the houses, and many shattered and thrown down in part. Some were broken off several feet below the top, and, by the suddeness and violence of the jerks, canted horizontally an inch or two over, so to stand very dangerously. Some others were twisted or turned around in part. The roofs of some houses were quite broken in by the fall of chimneys; and the gable ends of some brick buildings thrown down, and many were craked. The vane upon the public market house was thrown down; the wooden spindle which supports it, about five inches in diameter and which had stood the most violent gusts of wind, being snapped off. A new vane upon one of the churches was bent at its spindle, two or three points of the compass; and another at Springfield was bent to a right angle. A distiller's cistern made of plank, almost new, and very strong put together, was burnt to pieces by the agitation of liquor in it; which was thrown out with such force as

to break down one whole side of the shed that defended the cistern from the weather....About 100 chimneys were in a manner levelled with the roofs and about 1,500 shattered or thrown down in part."

Note: Much of the damage in Boston probably occurred in areas where poor foundation materials were present. An account of the earthquake quoted by Brigham (1871) says *"that in some places, especially on the low, loose ground made by encroachments on the harbor, the streets are almost covered with the bricks that have fallen."*

AFTERSHOCKS OF THE EARTHQUAKE OF NOVEMBER 18, 1755

EVALUATION:

Data regarding the aftershocks of the earthquake of November 18, 1755 have been compiled. These data are summarized in Table 3. Aftershocks are reported from the period of November 18, 1755 to March 15, 1756.

A widely felt, though lesser shock of the main tremor at 4:30 a.m., is reported for eastern New England at 5:29 a.m. on November 18, 1755. At 4:00 p.m. on November 18, a tremor is also reported at Kittery, Maine. On November 19 and 20, 1755, three are reported from northeastern Massachusetts at Chelmsford, Ipswich (10:00 p.m.), and York, Maine (time not given), respectively. The largest aftershock, that of November 22, 1755, is widely reported. The aftershock of December 19, 1755, at 10:00 p.m., was reported felt from Marshfield, Massachusetts to Portland, Maine. On March 11, 1756, earthquakes are reported as felt in the towns east of Boston, Massachusetts (between 3:00 and 4:00 p.m.), and on March 15, 1756, along the coast from Salem, Massachusetts to Wells, Maine (time not given). Neither event was reported as felt in Boston.

A number of contemporary observers within the scientific community at Boston, Massachusetts recorded detailed observations on the aftershocks as well as the effects of the main shock. Only three aftershocks were reported in Boston; November 18 (5:29 a.m.), November 22 (8:27 p.m.), and December 19, 1755 (10:00 p.m.). However, reports of numerous shocks from locations north and east of Boston are reported in period citations.

The principal data summarizing observations through 1755 are given in Chauncy (1755), Mayhew (1755), and Winthrop (1757) (Table 4). The aftershocks on March 11 and 15, 1756, were not felt in Boston, according to newspaper reports. Later publications by Winthrop (1757) and Williams (1785) do not indicate that any aftershocks were reported in Boston after December 19. During the period November 18 (from the 5:29 a.m. event) up to November 22, reports from Portland and York, Maine, Hampton, New Hampshire, and Essex County, Massachusetts indicate that slight shocks were reported almost daily. The reports are not sufficiently descriptive to define the earthquakes; for example, a journal entry by Rev. Thomas Smith for November 22, 1755, written at Portland, Maine, merely notes the events as *"Besides several earthquakes we have had this week..."*

The available reports indicate that a large number of aftershocks were reported from localities east and north of Boston, Massachusetts and support a Cape Ann epicenter region.

EARTHQUAKE OF MARCH 12, 1761

CA. 02:15 (GMT)

EPICENTRAL INTENSITY: V (MM)

LOCATION: CAPE ANN REGION

EVALUATION:

This earthquake is estimated to be centered in the Cape Ann region based on reports from coastal localities (Figure 2.5.2A-6). No damage is attributed to this tremor; however, it was widely felt extending over an estimated 127,000 square kilometer region. It appears to have been most strongly felt near Salem, Massachusetts. This was the basis for some early epicentral estimates; the event is included in Table 2.5.2-2 because of the uncertainty of the location.

PERTINENT ACCOUNTS:

Boston Gazette and Country Journal, The, Boston, Massachusetts, March 16, 1761 (Period Newspaper Account)

"Portsmouth (New Hampshire) March 13

"Yesterday Morning, between the hours of two and three o'Clock, a smart Shock of an Earthquake was felt in this and the neighboring Towns, attended with a loud rumbling Noise, which was soon followed by another, but hapily did no Damage.

Lane, Samuel, Stratham, New Hampshire (Diary entry)

"Earthquakes in the years following...Mar 12, 1761."

EARTHQUAKE OF NOVEMBER 9, 1810

CA. 21:15 (L)

EPICENTRAL INTENSITY: V(MM)

LOCATION: 43.0N, 70.8W

EVALUATION:

The earthquake of November 9, 1810 is centered in the vicinity of Portsmouth, New Hampshire, Figure 2.5.2A-8. This location is consistent with the epicentral location of the original PSAR. It was felt over an area of 21,500 square kilometers. The maximum effects were reported from Portsmouth, New Hampshire; the principal damage was broken glass. At Hampton, New Hampshire, no damage was reported, but *"it was severe enough to stop clocks."* (Newburyport Herald, November 13, 1810).

PERTINENT ACCOUNTS:

Columbian Centinel, Boston, Massachusetts, November 14, 1810

"Earthquake. A severe agitation of the earth was felt in Portsmouth, N.H. Friday evening last, about three minutes past 9 o'clock. - Its progress appeared to be from N.W. to S.E. and was accompanied by a heavy explosion. - Its duration from one to two minutes -Some window glass was broken by the shock, which a vessel coming into the harbor felt as severely as if she had run aground. The Kennebunk paper mentions it as having been violently felt there; that it lasted about 20 seconds, was attended with a loud rumbling, and that the houses and contents were very much agitated. The Portland Gazette states its being but slightly felt there, about half past 9 o'clock, and that from a calm the wind for a few moments blew very fresh before the shock. It was sensibly felt at Salem, Newburyport, York, Exeter, Dover, Haverhill, and many of the interior towns, and at Charlestown, in this vicinity, but we have not heard of its being experienced in this town."

New Hampshire Gazette, The, Portsmouth, New Hampshire, November 13, 1810

"On Friday evening last, at a few minutes past 9 o'clock, a shock of an earthquake was felt in this town, the most severe it is said since 1755. It was felt also at Portland and at Newburyport. Its apparent course from west to east."

Newburyport Herald, Newburyport, Massachusetts, November 16, 1810

"Dover, New Hampshire - Inhabitants of this town were considerably alarmed by a severe shock of an earthquake--lasted one minute more severe than any of last fifty years.

<u>Newburyport Herald</u>, Newburyport, Massachusetts, November 13, 1810

"Earthquake - On Friday evening last a severe shock of an earthquake was felt in this town, which lasted about 20 seconds. It appeared to pass from the southward to the northward,--the noise like a carriage moderately passing a bridge, till there succeeded a kind of roaming (sic) like distant thunder. A vessel was at that time coming up the river, which felt the shock, so as to induce the people to think she struck a rock.

"At Haverhill it was sensibly felt, and at Hampton it was so severe as to stop clocks.

"In Portsmouth, (says the Oracle) it was felt a minute past nine, its duration nearly two minutes; being more severe than has been felt there for many years. Some window glass was broken by the shock."

EARTHQUAKE OF OCTOBER 5, 1817

CA: 11:45 (L)

EPICENTRAL INTENSITY: V-VI(MM)

LOCATION: 42.5N, 71.2W

EVALUATION:

The earthquake of October 5, 1817, is listed in numerous earthquake compilations as an event of epicentral Intensity VII-VIII(MM), based upon the observation of Brigham (1871) (as reported by Felt, 1899) that *"walls were thrown down at Woburn."*

Contemporary accounts, mainly from newspapers, indicate that the intensity did not exceed V-VI. The *"walls"* referred to by Brigham are probably wall fences characteristic of rural New England pasture land rather than house walls (Berkshire Star, October 16, 1817). These walls are constructed by removing glacial boulders from pasture land and piling them loosely on top of each other to make a *"stone fence."* Intensity IV-V(MM) effects are characterized almost exclusively by indirect descriptions such as *"severe"* and isolated cases of excitement. There are no reports of any damage identified to buildings or their contents.

The density of felt reports is insufficient to adequately define the epicenter of the earthquake. The region between Tyngsboro and Woburn defines the meizoseismal area. The convention of listing the epicenter as published in existing lists, then Woburn, is retained. The maximum epicentral intensity does not exceed V-VI(MM). The perceptible area is about 55,000 square kilometers (Figure 2.5.2A-11).

PERTINENT ACCOUNTS:

Berkshire Star, Stockbridge, Massachusetts, October 16, 1817

*"The Earthquake mentioned in our last, was more severely felt in some towns, to the north and east, than in this place -We have accounts of it from towns in New York, Vermont, New Hampshire, and from many towns in this State, as far east as Newburyport - In many places it caused great alarm. - At Cambridgeport *the meeting house was so severely shaken as to cause the whole congregation to desert it instantaneously - and in some places the wall fences were thrown down.*

Boston Commercial Gazette, Boston, Massachusetts, October 6, 1817

"Yesterday about 20 minutes before 11 o'clock, a smart shock of an Earthquake was felt in this town. The vibration continued about one second in this place. In Broad-street, we are told, the shock was so severe as to occasion several of the inhabitants residing therein to leave their houses.

"We have since learnt, that the shock was severely felt in the neighboring towns, particularly at Cambridgeport, where the meetinghouse was shook in so tremulous a manner, as to cause an immediate desertion of the whole congregation; - at Woburn, many of the walls were thrown down, and some houses represented as rocking like a cradle."

Essex Register, Salem, Massachusetts, October 7, 1817

"Last Sunday, at 47 minutes past eleven, A.M. we had a shock of an Earthquake. It came from the Northwest, and continued about 10 seconds. The noise was considerable, and the shock great enough to bring a whole congregation from their seats.

"A small distance was observed between the first report and the shock, the undulation was quick, but without the least injury."

Portsmouth Oracle, The, Portsmouth, New Hampshire, October 11, 1817

"An Earthquake was felt in this town on Sunday night last at 5 minutes before 12 o'clock and was said by some persons to be repeated by a violent one a few moments afterwards. The shock was considered as sensible as any observed for many years.

"Exeter Oct 7 One of the severest shocks of an earthquake ever known in this town was experienced on the last Sabbath about a quarter before twelve o'clock, A.M. It was attended by a sound similar to the rapid passage of a heavy wagon, and continued about thirty seconds. Buildings were sensibly shaken and this effort continued some seconds after the cessation of the noise.

Salem Gazette, Salem, Massachusetts, October 7, 1817

"On Sunday last, at 47 minutes before 12 o'clock, apparent time, a shock of an earthquake, of 1 or 2 seconds continuance, was experienced in this town and vicinity; the jar and trembling, though so considerable as in many instances to cause persons involuntarily to flee from their seats, were by others not perceived at all."

EARTHQUAKE OF JULY 23, 1823

CA: 06:55 (L)

EPICENTRAL INTENSITY: IV-V(MM)

LOCATION: 42.9N, 70.6W

EVALUATION:

The earthquake of July 23, 1823 was originally identified as a local felt report from Sanford, Maine, by Mather and Godfrey (1927). However, the event was unreported in the Sanford area newspapers. Dispatches in area newspapers indicated that the event was in fact, widely felt. Reports from Bath, Maine, and Nantucket, Massachusetts, were not confirmed in the local newspapers. It was felt from at least Kingston, Massachusetts, to Portland, Maine. Except for a report from Bellows Falls, Vermont, there are no local felt reports from localities outside of the line shown on the isoseismal map as the estimated limit of felt area (Figure 2.5.2A-12). The epicenter is estimated as southeast of Portsmouth, New Hampshire. The epicentral intensity is estimated at IV-V(MM), based on attenuation. The perceptible area is 29,000 square kilometers.

PERTINENT ACCOUNTS:

Columbian Centinel, Boston, Massachusetts, July 26, 1823

"Earthquake. - A shock of earthquake was very sensibly felt in this city about 7 o'clock on Wednesday morning, for four or five seconds. It was also experienced in Dorchester, Milton, Salem, Gloucester, Reading, Lexington and other places heard from. - A gentlemen in Kingston, after noticing the shock, remarks that it was more violent than the four felt on the 12th inst. Remote papers mention other slight shocks felt on the 12th. It may be remarked that similar shocks have been observed for many years after a fall of heavy rain has succeeded dry spells."

Portsmouth Journal of Literature and Politics, Portsmouth, New Hampshire, July 26, 1823

"The Earthquake of Wednesday morning was felt in this town with unusual violence, and its extent must have been great. It was felt, as we are informed in Bath, Portland, Kennebunk, Dover, Exeter, Newbury-port, Salem, Boston, Reading, Gloucester, Lexington, Kingston M, etc. It is said that some stone walls were thrown down in the neighborhood of this town. Piscataqua Bridge was violently shaken. It appeared in some houses like the report of a distant heavy cannon. The Salem Register says the Earthquake was at 5 minutes after 7- in this town it was at 5 minutes before 7."

Newburyport Herald, Newburyport, Massachusetts, July 25, 1823

"A smart shock of an Earthquake was felt in this town Wednesday morning at four minutes before 7 o'clock. Its duration was 8 or 10 seconds."

New Hampshire Gazette, Portsmouth, New Hampshire, July 29, 1823

"Earthquake. - A smart shock of an Earthquake was felt in this and the neighboring towns on Wednesday morning last about 7 o'clock. It was also felt in Kennebunk, Newburyport, Salem, Boston, &c."

EARTHQUAKE OF AUGUST 25, 1846

CA: 04:45 (L)

EPICENTRAL INTENSITY: V(MM)

LOCATION: 42.5N, 70.8W

EVALUATION:

The earthquake of August 25, 1846 is centered off the coast of eastern Massachusetts in the Cape Ann region (Figure 2.5.2A-13). This epicentral estimate is consistent with other previous estimates. The epicentral intensity is considered as V(MM), with V(MM) effects reported from Newburyport, Beverly, and Salem, Massachusetts. Although newspaper dispatches from other localities mention that a chimney was damaged in Jamaica Plain, near Boston, this is not corraborated by any dispatch from a Boston newspaper. The earthquake was felt over an area of 51,800 square kilometers. At Newburyport, Massachusetts *"houses were shaken, windows and doors rattled, bells were rung, and the slumbering were waked up."* (The Herald, Newburyport, Massachusetts, August 26, 1840).

PERTINENT ACCOUNTS:

Herald, The, Newburyport, Massachusetts, August 26, 1846

"'An earthquake of very considerable violence was experienced in this city' (at approximately 4:57 a.m.) 'houses were shaken, windows and doors rattled, bells were rung, and the slumbering were waked up.'"

"Felt at Cambridge, Lynn, Nahant, Salem, Beverly, Westboro, Worcester; sensibly felt at Worcester. At Beverly, - felt in every part of town. At Wilmington, 'in some instances crockery ware was thrown from shelves.' Felt also at Braintree, Dedham, Concord, and Jamaica Plains, Massachusetts."

Lewis, Lord John, Diary of Newbury, August 1846

"--a smart shock of an earthquake was felt in this place on the 25th in the morning at 5 o'clock, it was sufficient to shake the houses, and the beds in which people were. It was felt all round, the northern part of New England, in Maine, New Hampshire and other places. In Salem, Beverly, and other places, it opened doors, shook the crockery from the shelves, etc. it lasted from 10 to 15 seconds."

New Hampshire Patriot, Concord, New Hampshire, August 27, 1846

"The Earthquake in this city was felt 2½ minutes before 5 o'clock on Tuesday morning, Aug. 25, but, timekeepers vary, we had better call it 5 o'clock. It began at that hour at Newburyport, where it lasted 8 minutes. The shock was felt in all the towns of the commonwealth from

which we have heard, and houses were shaken, bells rung, and people roused from their beds in this city. Not being awake at the moment, we cannot, of course, have a very distinct idea of vibrations. - Boston Post, Wednesday."

Salem Advertiser, Salem, Massachusetts, August 26, 1846

"A smart shock of an earthquake was experienced in this city, with effects causing, doors to be thrown open, and even crockery in some instances to be tumbled from the shelves."

Salem Gazette, The, Salem, Massachusetts, August 28, 1846

"An Earthquake.

"Quite a smart shock of an Earthquake was experienced in this city, and its vicinity, at a few minutes past five o'clock, on Tuesday morning. - The accounts are so uniform, and come from so many concurring sources, in our city and out of it, that we are not at liberty to doubt that our city has been visited by this uncommon and extraordinary phenomenon of Nature. It was very sensibly felt throughout our city-and our advices, so far as we received them yesterday, lead to the belief that the concussion was very extensive....

"The Traveller says: - We have heard from Cambridge, Newton, Lynn, Nahant, Salem, Beverly, Westboro, and Worcester, and in these places the houses were shaken, windows and doors rattled, bells were rung, and the slumbering were waked up. The vibrations do not appear to have been preceded or attended by that rumbling sound which usually accompanies earthquakes. The sound, as it appeared to us, was more like that produced by the sudden and violent motions of a person in an adjoining room, or in the chamber overhead. Some say there were two or three successive shocks; but, to us, it rather appeared like one continued jar, or shock, of considerable violence....

"A correspondent of the Journal, at Beverly, writes as follows: -

"Mr. Sleeper: -We had a heavy earthquake, this morning, at Beverly, about 5 o'clock. It was felt in every part of the town. My bed shook, and it sounded as though a dozen railroad trains were passing over the roof of my house.

"Was it an Earthquake? -At five minutes before 5, this morning, a heavy noise and shaking was heard and felt by a number of our citizens. It was of longer duration than could have been produced by a cannon, or an explosion of powdermill. -Springfield Republican, 25th.

"The Earthquake.

"We have placed on our first page an account of the earthquake, as it appeared in some other places. In this city, the clocks struck five immediately after its termination. The duration of the shock is differently estimated, according to the imagination of the observer, from one second to several minutes. The noise was so great, and the motion so decided, that great numbers of persons were awakened from their sleep. It does not appear to have extended west or south of Massachusetts...."

Salem Register, Salem, Massachusetts, August 27, 1846

"By the concussion houses were shaken, windows rattled, doors unlatched, door bells were rung, furniture as well as china and other wares were much disturbed and many slumberers were aroused. At Jamaica Plain a chimney was shaken down."

EARTHQUAKE OF NOVEMBER 27, 1852

CA: 23:45 (L)

EPICENTRAL INTENSITY: V(MM)

LOCATION: 43.0N, 70.9W

EVALUATION:

The earthquake of November 27, 1852 is centered near Exeter, New Hampshire (Figure 2.5.2A-15). It was felt over a 9,900 square kilometer region from the Cape Ann region north to Saco, Maine. The maximum effects, Intensity V(MM), were observed near Exeter, New Hampshire.

PERTINENT ACCOUNTS:

Daily Morning Chronicle, Portsmouth, New Hampshire, November 30, 1852

"The Earthquake, on Saturday night, was likened by some persons in this city, who happened to be up and doing, to the roaring of a chimney on fire-others supposed it to be the heavy rumbling of a loaded wagon over a paved street.

"It was supposed by some gentlemen at Kittery Point to be a steamboat in the harbor letting off steam.

"The Salem Register calls it a 'smart shock,' and says, 'The rumbling noise and the jarring of the windows and doors were very perceptible for the space, some say, of half a minute. Some faithless ones attribute the shock to the explosion of a power-mill somewhere.'

"A lady in Greenland says the earthquake shook her house and those of her neighbors very sensibly.

"The Boston Journal says it was felt at Exeter where it shook the doors and windows violently, and in one instance jarred down some of the plastering of a dwelling house. It does not seem to have been felt at Boston.

"A very heavy explosion startled our citizens at 25 minutes before 12 o'clock, Saturday night. It came from a northerly direction and was probably from the Exeter Power Mills, though no former explosion of these mills ever produced here half so severe a concussion, or anything like the loud report and reverberation. After the shock, a roar like that of a foul chimney burning, was distinctly perceptible, in doors, for two minutes. The night was still and clear with a light air from NW-ground wet and soft.

"If this was not the effect of a great explosion it must have been one of those earthquakes and the most severe of them all, which at irregular intervals from time immemorial have visited the valley of the Merrimack. -Newburyport Herald."

Maine Democrat, Saco, Maine, December 7, 1852

"The Earthquake. -The shock of an earthquake was felt here on Saturday evening last, at thirty-five minutes after eleven o'clock. The shock here was not severe. We were standing near a stove at the time, and did not perceive any jar, but only heard the noise rumbling off in the distance in a westerly direction, and no apparent cause visible. The night was clear, the moon bright, and the air still.

"The force of the earthquake was evidently to the west of Portsmouth. At Exeter, it was felt with much violence. In Newburyport the Herald notes the minute the same as at Portsmouth. There it was thought it lasted nearly two minutes, and was much more severe than at Exeter. In Salem, it was also noticed, but it was less violent. No mention is made of it south of Salem."

EARTHQUAKE OF DECEMBER 11, 1854

CA: 00:30 (L)

EPICENTRAL INTENSITY: IV-V(MM)

LOCATION: 43.0N, 70.8W

EVALUATION:

The earthquake of December 11, 1854 is centered in southeastern New Hampshire (Figure 2.5.2A-16). The maximum observed intensity is at Newburyport, where there were unconfirmed reports of articles shaken from shelves in some cases. The distribution of intensities within the isoseismal region indicate an epicenter within the area about Exeter, New Hampshire. The earthquake was felt over an area of 4,100 square kilometers.

PERTINENT ACCOUNTS:

Exeter News Letter, The, Exeter, New Hampshire, December 11, 1854

"Earthquake -- This Monday morning at seven minutes before one o'clock, a smart shock of an earthquake was experienced in this town. The motion of the earth was quite perceptible, and its acting upon furniture and loose windows and doors, was anything but agreeable to weak nerves. The noise attending, was like that of the swift approach of a heavy carriage on frozen ground, hit when the shock appeared (sic) *to be immediately beneath, it was much heavier."*

Journal, The, Portsmouth, New Hampshire, December 16, 1854

"The Earthquake

"On Saturday (sic) *night last, at half past 12 o'clock, a shock of an earthquake was sensibly felt in this city and vicinity. The watchmen* (sic) *at the Navy Yard thought they saw lightning at the time and regarded the noise as thunder. Some of our city watchmen who were at the time in Market Street, heard the commencement and passing away of the sound. It seemed to them like two distinct explosions. --probably from the sound coming through* (sic) *different avenues between high buildings. It rattled the door shutters near them.*

"The Newburyport Herald says it was sensibly felt there at the same hour. The houses were shaken and the crockery ware in some houses was thrown down from the shelves.

"It was not felt in Salem. The Saco papers make no mention of it. Nor do those of Manchester and Concord."

"Quotes Exeter New Letter

"The direction of the sound in Portsmouth and Epping was apparently from the southeast to the northwest.

"In Greenland and in Epping it was as severely felt. As has usually been the case, rain fell the next day."

EARTHQUAKE OF OCTOBER 17, 1860

CA. 11:15 (GMT)

EPICENTRAL INTENSITY: VIII-IX(MM)

LOCATION: 47.5N, 70.1W

EVALUATION:

The earthquake of October 17, 1860 is centered in the St. Lawrence River Valley, northeast of Quebec city, near La Malbaie, about 510 kilometers from the site. The earthquake was felt over a 1,700,000 square kilometer region. It was felt throughout much of New England. Based upon intensity attenuation characteristics (Table 2.5.2-7), the intensity at the site is estimated at IV-V(MM).

EARTHQUAKE OF OCTOBER 20, 1870

CA: 16:30 (GMT)

EPICENTRAL INTENSITY: IX(MM)

LOCATION: 47.4N, 70.5W

EVALUATION:

The earthquake of October 20, 1870 is centered in the Baie St. Paul region, northeast of Quebec city about 500 kilometers north of the site. It was felt over a 2,500,000 square kilometer region including all of New England. Based on intensity attenuation characteristics (Table 2.5.2-7), the intensity at the site is estimated at V(MM).

PERTINENT ACCOUNTS:

Daily Free Press and Times, The, Burlington, Vermont, October 21, 1870 (Dispatch from Newburyport, Massachusetts)

"At twenty minutes to twelve, a slight jar was felt in this city, which was almost immediately followed by a rumbling, which lasted half a minute, jarring buildings, ringing doorbells, and shaking globes from chandeliers. In many instances the occupants ran into the streets from dwellings. It seemed to pass in a south-westerly direction."

Salem Register, Salem, Massachusetts, October 24, 1870

"At Salem, Massachusetts, 'solid and most substantial buildings felt the shock, heavy tables and dishes were sensibly shaken, horse's bells were rung, clocks were stopped in several instances, and hanging implements vibrated materially.'"

EARTHQUAKE OF MAY 12, 1880

CA: 07:45 (L)

EPICENTRAL INTENSITY: IV-V(MM)

LOCATION: 42.7N, 71.0W

EVALUATION:

The earthquake of May 12, 1880 is centered in northeastern Massachusetts (Figure 2.5.2A-19). The maximum effects are noted at Groveland, Massachusetts. The epicentral intensity is IV-V(MM). The felt area is 4,600 square kilometers.

PERTINENT ACCOUNTS:

Monthly Weather Review, May, 1880

"Newburyport, Mass., 12th, 7:45 a.m., a violent shock, houses shook in many parts of the city, the accompanying noise resembling that of a heavy barrel rolling over a chamber floor. Shocks were felt at the same time in Haverhill, Groveland and surrounding towns. Billerica, Mass., 12th, slight shock at 7:30 a.m."

Newburyport Herald, Newburyport, Massachusetts, May 13, 1880

Note: At 7:45 A.M., May 12, 1880 an earthquake was felt at some places and not at others. People had difficulty recognizing it as an earthquake, it being more noise than motion.

It was felt at Byfield, West Newbury, Haverhill, Groveland; at Amesbury the earthquake was strong enough to rattle crockery in several houses.

New York Times, New York, New York, May 16, 1880

"The Salem (Mass.) Gazette gives some further information concerning the earthquake shock which visited Eastern Massachusetts about 7:45 o'clock on Wednesday morning. It says: 'We hear reports of it in all the towns between Salem and Newburyport. In Salem, the shock was felt in all parts of the city. The accompanying sound was by some thought to be thunder; by others, an explosion as of rockblasting; and more generally as the rumbling of a wagon. In Newburyport, the shock was felt in the shaking of crockery and furniture, and in some houses sounding like persons moving in adjoining rooms. From Merrimac and Amesbury, from Georgetown and Rowley we have similar reports. At Haverhill an explosion was heard, the air vibrated, the earth trembled, people were swayed to and fro, crockery was shaken, and other signs of subterranean disturbance were noticed. At Acton, in Middlesex County, the shaking was lateral, and resembled the sensation caused by a heavily-loaded team passing over a stony street.'"

EARTHQUAKE OF AUGUST 30, 1905

CA: 10:40 (L)

EPICENTRAL INTENSITY: V(MM)

LOCATION: 43.1N, 70.7W

EVALUATION:

The earthquake of August 30, 1905 is centered in the vicinity of Portsmouth, New Hampshire and Kittery, Maine (Figure 2.5.2A-26). It was not reported felt in Massachusetts. The epicentral intensity is V(MM). The felt area is 3,600 square kilometers. Newspaper reports from the Portsmouth Herald (August 31, 1905) that *"it is rumored that chimnies were shaken down in North Hampton and Greenland"* are not confirmed by The Exeter News Letter (August 31, 1905) which indicated that the earthquake was not reported from North Hampton, Greenland, Seabrook as well as other localities.

Even though The Exeter News Letter states explicitly that the event was not reported from Seabrook, it is probably more realistic in view of the relatively short epicentral distance to assume that the event was felt mildly, i.e. with an Intensity III.

PERTINENT ACCOUNTS:

Exeter New Letter, The, Exeter, New Hampshire, September 1, 1905

"West Epping - September 4 -- 'At exactly 5:39 p.m. Cambridge time, on Wednesday of last week a distinct earthquake shock was felt here. Windows and dishes rattle violently, while the report was deep, low pitched, weird and long. It must have lasted fully eight or ten seconds, time enough for me to walk from a rear room in a large house out through the front door and on to the lawn. I was on the lawn before the rumbling ceased. We have had a dozen seismic tremors in southern New Hampshire since forty years; this however if memory serves me, was the most pronounced of any.

"Earthquake not reported from:

"Stratham, Rye, Freemont, Raymond, Nottingham, Kingston, Greenland, North Hampton, Hampton, Seabrook, Danville, Epping."

Haverhill Evening Gazette, Haverhill, Massachusetts, August 31, 1905

"Earth Quivers

"Portsmouth, New Hampshire, August 31 -- A series of earthquakes, the most severe ever experienced in this section, which, at about 5:35 to 5:40 o'clock yesterday afternoon were felt from the vicinity of Exeter to beyond Biddeford, Maine had their center of disturbance in this city, and were so severe that people, fearing the shaking houses and stores would collapse, ran in terror out of doors. The scene in the

shopping district was exciting for a number of minutes. For several seconds a tremor ran through the city, and windows, dishes, pictures, and other articles rattled. The experience of other places on the coast line and for a few miles inward was only in a less degree. The shock seemed to travel from west to east. No damage is reported.

"The shock here came at 5:35 and it was accompanied by a loud report as of thunder, followed by a rumbling. There were three distinct shocks, wach with its own rumble -- 'At Hampton the shock was very plain, but it was greater toward this city, for Greenland was more affected. On the other side of the city by Kittery and down to York it was plainly heard, but at Wentworth at Newcastle the shock was not heard at all.

Portsmouth Herald, The, Portsmouth, New Hampshire, August 31, 1905

"Three (3) Earthquake Shocks

"Citizens of Portsmouth, New Hampshire, Kittery and Biddeford, Maine get a scare.

"A series of earthquake shocks, the most severe ever experienced in this section were felt here late yesterday afternoon. Buildings trembled perceptibly, dishes were shaken from shelves, and in many cases people rushed in terror from their houses into the street.

"There were three distinct shocks. In each instance the tremor was accompanied by a sound which might be caused by a distant explosion. --

"The first shock was felt a little before 5:40 p.m. and the other shocks followed soon after. In the business section of the city, the shoppers and store employees rushed out into the street, believing that the buildings were about to collapse. Each of the three shocks continued for several seconds.

"Kittery, Maine

"Three shocks felt - accompanied by heavy rumbling.

"First shock 5:38 p.m., other two in rapid succession.

"As the doors and windows were rattled by the vibrations of the earth and the lighter bric-a-brac came tumbling down from walls and mantlepieces, people ran out of doors in considerable alarm.

"Biddeford, Maine

"A slight shock felt. Dinstinctly felt in overlying districts. Accompanied by a sound like the rumbling of distant thunder.

"An Earth Tremor

"The earthquake shock was the most startling, being so violent as to shake pictures from the walls of houses in the South End. It is rumored that chimnies were shaken down in North Hampton and Greenland.'

"Sounded like heavy object falling and rolling or like explosion. Eclipse of sun in A.M. before quake, thunder storm and lightning after quake."

EARTHQUAKE OF OCTOBER 16, 1907

CA: 00:10 (L)

EPICENTRAL INTENSITY: V(MM)

LOCATION: 42.8N, 71.0W

EVALUATION:

The earthquake of October 16, 1907 is centered in northeastern Massachusetts (Figure 2.5.2A-27). The epicentral intensity is V(MM). The felt area is 5,600 square kilometers. Even though no explicit felt report can be found for Seabrook, it is assumed in view of the estimated epicenter in the vicinity of Haverhill, that the earthquake must have been felt at Seabrook (Intensity III-IV).

PERTINENT ACCOUNTS:

Portsmouth Daily Herald, Portsmouth, New Hampshire, October 16, 1907

"Quake shock felt

"Tuesday Evening's Jar Was of Several Seconds' Duration

"Residents of this city claim they felt the earthquake shock shortly after seven o'clock on Tuesday evening, which was reported in dispatches from Derry, this county, and Lowell, Lawrence and Haverhill, Mass.

"The shock lasted for several seconds, seemingly, and the heavy rumbling ended in an apparent explosion.

"At Derry dishes were rattled on shelves and table, but no special damage was reported."

EARTHQUAKE OF JANUARY 7, 1925

CA: 13:07 (GMT)

EPICENTRAL INTENSITY: V(MM)

LOCATION 42.6N, 70.6W

EVALUATION:

The earthquake of January 7, 1925 is located in the vicinity of Cape Ann, Massachusetts. The epicentral location and intensity were determined by Porter (1924). The isoseismal map (Figure 2.5.2A-29) is constructed from data after Porter and additional newspaper investigations. The earthquake was felt over an estimated area of 29,000 square kilometers. The maximum intensity is V(MM) at Cape Ann and vicinity. At Hampton, New Hampshire, a news item in the Manchester Union of January 8, 1925, describes the effects as follows:

> *"Reports from Hampton and Stratham state that the shock was distinctly felt there, causing dishes and other contents of the house to rattle, and many of the houses were shaken."*

PERTINENT ACCOUNTS:

Porter, William W. II (1924)

"Intensity

"The region known to be affected by the earthquake of January 7, 1925, consists of a roughly semicircular area limited on the east by the Atlantic Ocean, and on the south, west, and north by a circular curve passing from a short distance south of Providence, Rhode Island, north-northwest to Worcester, Massachusetts, to Fitchburg, to Manchester and Rochester, New Hampshire, and to the seacoast near Kennebunk, Maine, about thirty-eight miles south of Portland. The position of the inner isoseismic line is very poorly defined, as the entire disturbance was of such small magnitude that an accurate quantitative determination of its effects is impossible. However, reports by C. W. Brown of Brown University, Associated Press dispatches, communications from various newspapers and from individuals, and a personal canvass of the northern area indicate that in general, the shock was of greater intensity within the area enclosed by the inner line: a chimney collapsed in Lynn; dishes and other articles were displaced from shelves; pictures fell from walls; and various reports indicate greater intensity in the inner area. The expression on the map of this difference in intensity is the inner isoseismic line, which merely traverses an indefinable zone of gradation between the two areas.

"Greatest Intensity: Barely V, Rossi-Forel Scale. The region of greatest intensity appears to have been Cape Ann. Plaster fell from the ceiling of Redmen's Hall, Rockport; near Lanesville a clock stopped at ten minutes past eight, and bottles 'danced a regular jig' on the drug store shelves; houses were sharply jarred; and the shock was noted by a large percentage of the population. This is the only area where the shock was reported to have been felt by pedestrians out of doors. W. F. Eldrege of Rockport stated that an undulatory wave seemed to stop him abruptly while walking.

"Almost universally the shock was compared to the vibrations produced by a motor truck being driven over rough pavement. In approaching Cape Ann, the size of the truck alluded to increased, and on the Cape, the consensus of opinion was that the vibrations were much too severe to have been produced by a truck.

"At one point on the Cape coal was being unloaded from a truck at the time of the earthquake, and a verbal report stated that a concussion was produced which felt as though the truck had crashed into the house. In Haverhill a contrasting report stated that the disturbance sounded as though a truck had bumped into the house, but that the jar was insufficient.

"Intermediate Intensity: IV +, Rossi-Forel Scale. Next to Cape Ann, the most severely affected regions were Merrimack Valley in northeastern Massachusetts, and the shore district north of Boston, including Lynn, Malden, Salem, Beverly, Marblehead, Nahant, and Ipswich. The inner isoseismic line incloses this region, the general effects of which have been listed above. One feature, however, recieved undue emphasis in press reports. The crack a mile long in Groveland Street, Haverhill, proved to be a series of short breaks in the asphalt with a total length of about fifty yards. Similar cracks are of common occurrence at this time of year due to frost action, and it is probable that tension existed, and that the actual fracture was induced by the seismic vibrations.

"The direction of movement of the disturbance is in most cases very vaguely defined. The one outstanding indication of direction occurred in Haverhill, where sixteen rolls of congoleum rugs were overturned from the east-southeast. These rolls, measuring nine feet in length, and with a diameter of about a foot, were free to fall in any direction except toward the south. The three men who were present at the time of the earthquake were positive that the direction of fall of all the rolls was from the east-southeast. So far as is known, no fixed objects were displaced in this area. The report of a broken water main in Haverhill due to the earthquake is unfounded.

EARTHQUAKE OF MARCH 1, 1925

CA: 02:19:20 (L)

EPICENTRAL INTENSITY: IX(MM)

LOCATION: 47.6N, 70.1W

EVALUATION:

The earthquake of March 1, 1925 is centered in the La Malbaie region, northeast of Quebec city, 525 kilometers north of the site. It was felt over nearly 5,000,000 square kilometers. The major damage occurred in the St. Lawrence River Valley, particularly on soft alluvial soils. Isoseismals (Figure 2.5.2A-30) indicate that the intensity at the site was about IV(MM).

PERTINENT ACCOUNTS:

The Union, March 2, 1925, Manchester, New Hampshire

"All sections of Hampton Beach were in the path of the earthquake, Saturday evening around 9:20. No damage was reported. At the Coast Guard station on the North beach, the shock was only slightly felt. The captain of the guard said the ocean was undisturbed during the earth's tremor.

"At (sic) *Hampton Beach, people living in a cottage reported that dishes shook in the cupboards and a pan under the sink fell to the floor. They were not aware that it was an earthquake until a little later when informed over the radio."*

EARTHQUAKE OF OCTOBER 9, 1925

CA: 13:55 (L)

EPICENTRAL INTENSITY: VI(MM)

LOCATION: 43.7N, 71.1W

EVALUATION:

The earthquake of October 9, 1925 has its epicenter in central New Hampshire (Figure 2.5.2A-31). The epicenter is poorly defined and the published location of Smith (1962) is retained. The epicentral intensity is VI(MM). The felt area is 17,700 square kilometers. The earthquake was not felt at localities such as Sanford and Kennebunk, Maine, and Portsmouth, New Hampshire, and is inferred from the isoseismal map (Figure 2.5.2A-31) to have not affected the site.

PERTINENT ACCOUNTS:

Concord Daily Monitor, Concord, New Hampshire, October 9, 1925

"An earthquake, slight in intensity, but generally felt throughout the Merrimack Valley, the Winnipesaukee Lake region and in the northeastern part of the state along the Maine border, was felt today in Concord by several persons. No damage beyond the breaking of window glass in Ossipee, the tumbling of chimneys in two or three towns, and the dumping of canned goods from shelves in Ossipee and Effingham Falls stores, was reported.

EARTHQUAKE OF MARCH 18, 1926

CA: 21:09 (L)

EPICENTRAL INTENSITY: V(MM)

LOCATION: 42.8N, 72.8W

EVALUATION:

The earthquake of March 18, 1926 is centered in southern New Hampshire, near the town of New Ipswich (Figure 2.5.2A-32). The epicentral intensity is V(MM). The felt area is 4,800 square kilometers. Published research by Neumann (1925-1927) indicates that the felt reports were mainly in south-central New Hampshire and adjacent Massachusetts. There is no indication that coastal localities in southern Maine, New Hampshire, or northeastern Massachusetts reported the shock.

PERTINENT ACCOUNTS:

Manchester Union, The, Manchester, New Hampshire, March 19, 1926

"Southern N.H. Shaken By Slight Earthquake

"Slight earthquakes are reported to have occurred in four sections of southern New Hampshire yesterday afternoon.

"Towns and cities dffected by the tremblor are Manchester, Nashua, Milford, Amherst, Wilton, Mont Vernon and Greenfield, according to dispatches received last night.

"All the shocks were felt at 3 o'clock, or shortly after. Wilton, Milford, Amherst and Mont Vernon are grouped in a semicircle about 12 miles from Nashua, while Greenfield is 25 miles from the Gate City.

"Reports indicate that the 'quake did not last the same length of time in each of the cities and towns. In Milford it lasted for 15 minutes. (sic) *Manchester 20 seconds and other places felt it for fully half a minute.*

"Manchester and Nashua felt only brief shocks, while Milford and surrounding towns experienced the temblor for at least 15 seconds.

EARTHQUAKE OF DECEMBER 20 AND 24, 1940

CA: 07:27:26 (GMT) (DECEMBER 20)

CA: 13:43:44 (GMT) (DECEMBER 24)

EPICENTRAL INTENSITY: VII(MM)

LOCATION: 43.8N, 71.3W

EVALUATION:

Both earthquakes are centered near Ossipee, New Hampshire. The isoseismal map (Figure 2.5-2A-37) shows that the Intensity VII(MM) effects occurred at Tamsworth and Wonalancet, New Hampshire. Damage of Intensity VI(MM) was noted in numerous localities in central New Hampshire and western Maine. The shocks were felt over an estimated area of more than 786,000 square kilometers including all of New England, New York, and New Jersey.

The intensity at the site, as shown by the isoseismal map, Figure 2.5.2A-37, is IV(MM). In the vicinity of the site, at such places as Portsmouth and Durham, New Hampshire, and Amesbury, Newburyport, Salem, and Gloucester, Massachusetts, the earthquakes were felt by many people, and were well accompanied by the creaking of buildings and the rattling of dishes, windows, and doors.

EARTHQUAKE OF JULY 29, 1954

CA. 19:57:06 (GMT)

EPICENTRAL INTENSITY: V(MM)

LOCATION: 42.7N, 70.7W

EVALUATION:

The epicenter of the earthquake was located off the coast of northeastern Massachusetts, about 15 miles south-southeast of the site. The epicentral location was determined from seismograms recorded at Weston Observatory, Weston, Massachusetts, and at the Harvard Seismograph Station, Harvard, Massachusetts. The earthquake was felt from Lynn, Massachusetts, on the south to Kittery, Maine, on the north, and up to 20 miles inland over a 4,100 square kilometer area.

The quake was most strongly felt along the Massachusetts coast from Gloucester to Salisbury. In this area there were a few reports of small objects overturned, dishes and glassware knocked over, and clocks stopped (Newburyport Daily News, July 30, 1954; Gloucester Daily Times, July 30, 1954). Outside of this area, the earthquakes's effects consisted mostly of dishes, windows, and doors rattling.

Based upon press descriptions and reports collected by Weston Observatory through a canvass card survey, the intensity of this earthquake in the vicinity of the site was III-IV(MM).

EARTHQUAKE OF APRIL 26, 1957

CA. 11:40:06 (GMT)

EPICENTRAL INTENSITY: VI(MM)

LOCATION: 43.6N, 69.8W

EVALUATION:

The epicenter for this event was located off the coast of Maine, about 71 miles northeast of the site. Slight damage of Intensity V to VI(MM) occurred in the Portland area (Figure 2.5-2A-39). The quake was felt over 82,500 square kilometers including most of Massachusetts, Vermont, New Hampshire, and southern central Maine. The isoseismal map prepared by the United States Coast and Geodetic Survey (see Figure 2-5.2A-39) shows that the intensity at the site was no higher than IV(MM).

EARTHQUAKE OF OCTOBER 16, 1963

15:31:01.8 (GMT)

EPICENTRAL INTENSITY: V(MM)

LOCATION: 42.5N, 70.8W

EVALUATION:

The epicenter for this earthquake was located in Massachusetts Bay, southeast of Cape Ann about 27 miles southeast of the site.

The earthquake was felt over approximately 17,800 square kilometers of northeastern Rhode Island, eastern Massachusetts, southeastern New Hampshire, and extreme southwestern Maine.

von Hake and Cloud (1965) list this earthquake as Intensity VI(MM). They report damages at Somerville (fallen plaster - Intensity VI(MM)) and at Winthrop (cracked windows - Intensity V(MM)), but these reports "were not substantiated" by Breitling (1965). The one instance of damage in Somerville apparently occurred in a building which was either poorly constructed or had undergone settlement prior to the earthquake. The Coast and Geodetic Survey report states that "cracks in the foundation and pantry became large" which indicates that the cracks were present prior to the earthquake.

Breitling's isoseismal map (Figure 2.5-2A-40) shows a maximum intensity of IV(MM) on land. Analysis of press reports and of a canvass card survey conducted by Weston Observatory show that the maximum effects at many towns in eastern Massachusetts consisted of houses rocked, windows and dishes rattled, and knicknacks thrown from the shelves (Amesbury and Methuen).

Based on Breitling's investigations and reports collected by Weston Observatory through a canvass card survey, the intensity of this earthquake in the vicinity of the site was IV(MM).

EARTHQUAKE OF OCTOBER 30, 1963

17:36:57.9 (GMT)

EPICENTRAL INTENSITY: IV-V(MM)

LOCATION: 42.7N, 70.8W

EVALUATION:

The epicenter for this earthquake was located in northeastern Massachusetts, about 13 miles south of the site. The epicentral location was determined from seismograms recorded at four stations of Weston Observatory's New England Seismic Network (stations are located at Weston, Massachusetts; Berlin, New Hampshire; Milo and Machias, Maine). The earthquake was felt in northeastern Massachusetts from north Boston, and in adjacent portions of southeastern New Hampshire over a 5,900 square kilometer area.

A questionnaire canvass conducted by the Weston Observatory indicated that the intensity of the earthquake was IV(MM). However, the press report for a few instances of craked plaster and other minor damage in the Ipswich-Rowley area (Salem Evening News, October 31, 1963) indicate that the intensity may have been as high as V(MM) near the epicenter. *"The intensity of the tremor was felt particularly in Ipswich and in Rowley. Householders in Rowley reported that dishes rattled and lamp fixtures swayed"* (Salem Evening News, October 31, 1963).

Based on the press descriptions and questionnaire survey conducted by Weston Observatory, the estimated intensity of this earthquake at the site was IV(MM).

EARTHQUAKE OF OCTOBER 21, 1971

00:54:46.2 (GMT)

EPICENTRAL INTENSITY: V(MM)

LOCATION: 42.7N, 71.15W

EVALUATION:

The earthquake of October 21, 1971 was reported by Coffman and von Hake (1971) as felt in several Merrimack Valley communities at Intensity V(MM). It was not reported felt in any coastal New Hampshire area.

PERTINENT ACCOUNTS:

Coffman and von Hake (1973)

"Northeastern Massachusetts. The shock shifted objects and shook buildings at a few towns in northeastern Massachusetts. Int. V at Andover, Billerica, Methuen, Newburyport, and Tewksbury. Int. IV at Georgetown, Gloucester, Groveland, Ipswich, Lawrence, Merrimac, Middleton, North Andover, Reading, and Wakefield, Mass., and Salem, N.H. Int. II at Lowell and Wilmington, Mass."

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TABLE 1

AFTERSHOCKS OF THE EARTHQUAKE OF NOVEMBER 9, 1727
FROM THE MINISTER'S RECORD (1727-1748)
OF THE REV. MATTHIAS PLANT

DATE YR	MO	DA	TIME (LOCAL)	INTENSITY* EVALUATION (MM)
1727	11	09	2300	F
1727	11	09	2335	IV
1727	11	09	2354	F
1727	11	10	0215	F
1727	11	10	0410	F
1727	11	10	0545	IV
1727	11	10	1530	F
1727	11	10	1700	F
1727	11	11		F
1727	11	11	1010	F
1727	11	11	1435	F
1727	11	11	1933	F
1727	11	11	2042	F
1727	11	12		F
1727	11	13		F
1727	11	14	1700	IV-V
1727	11	14	2400	F
1727	11	15	0410	F
1727	11	15		F
1727	11	16	1630	F
1727	11	16	2300	F
1727	11	17	1000	F
1727	11	18	1120	IV
1727	11	19		F
1727	11	23	1630	F
1727	11	24	0400	F
1727	11	26	1430	F
1727	11	30	2200	F
1727	12	01		F
1727	12	01		IV
1727	12	10		F
1727	12	12		F
1727	12	16		IV
1727	12	19	1000	IV
1727	12	28	2230	IV
1727	12	29	0400	F
1728	01	04	2300	IV-V
1728	01	09		F
1728	01	12	1400	F
1728	01	14	2100	F
1728	01	17	1800	F
1728	02	04	2130	IV
1728	02	04	2130	IV
1728	02	04	2130	IV
1728	02	05	1300	F
1728	02	08	0630	IV
1728	02	08	1000	F

DATE YR MO DA	TIME (LOCAL)	INTENSITY* EVALUATION (MM)
1728 02 09	0100	F
1728 02 09		F
1728 02 10	1350	V
1728 02 10	1530	F
1728 03 04	0030	F
1728 03 11	1315	F
1728 03 17	2345	F
1728 03 23		F
1728 03 28	0300	F
1728 03 30	1340	F
1728 03 30	2100	F
1728 05 03		F
1728 05 09	1700	F
1728 05 16		IV
1728 05 23	0940	F
1728 05 28	2000	F
1728 06 02		F
1728 06 02	1000	F
1728 06 04	2300	F
1728 06 17	0300	F
1728 06 19	0300	F
1728 06 22	0900	F
1728 07 14	0200	F
1728 07 30	1000	IV
1728 08 02	0315	IV
1728 08 05		F
1728 09 28	0400	F
1728 11 20	0400	F
1729 01 29	2000	F
1729 02 02	2400	F
1729 03 30	1400	IV
1729 08 06		IV
1729 09 19	1530	F
1729 10 08	1630	F
1729 11 09	2240	F
1729 11 25	0800	IV
1729 12 08	2000	IV
1730 02 19	2000	F
1730 02 19	2400	F
1730 03 09	0145	IV
1730 03 30		F
1730 04 23	2000	IV
1730 08 08	0900	F
1730 08 26	0800	F
1730 11 25	0900	F
1730 11 25	0900	F
1730 12 05	2020	F
1730 12 17	2245	F
1730 12 22	1845	F

DATE YR MO DA	TIME (LOCAL)	INTENSITY* EVALUATION (MM)
1731 01 12	1900	IV
1731 01 22	2400	IV
1731 03 18	1700	F
1731 06 08	0900	F
1731 07 16		F
1731 09 01	2100	F
1731 10 12	2300	IV
1732 02 18	1900	F
1733 01 10		F
1733 03 12		F
1733 10 30	2400	F
1734 01 27	2200	F
1734 07 10	0315	F
1734 10 20	1020	F
1734 11 27	0600	F
1735 02 13	1745	F
1735 04 01	1030	F
1736 02 13	1745	F
1736 07 24	0915	F
1736 10 12	0130	F
1736 11 23	0200	IV
1736 11 23	0600	F
1737 02 17	1615	F
1737 09 20	1020	IV
1740 12 25	0635	F
1741 01 29	0400	F
1741 02 05	1550	F
1742 04 08	0645	F
1742 09 24	1730	F
1743 08 21	1700	F
1744 05 24		F
1744 05 27	1115	F
1746 08 13		F
1747 01 17	2400	F
1747 12 14	0430	F
1747 12 17	1600	F
1748 03 22	0645	F

*F indicates unassigned intensity, inferred to be ≤III(MM).

TABLE 2

RECORD OF AFTERSHOCKS OF THE 1727 EARTHQUAKE
AT NEWBURY AND MARBLEHEAD, MASSACHUSETTS

DATE (O.S.)	TIME (LOCAL)	EXCERPTS TAKEN FROM ORIGINAL MINISTER'S RECORD BOOKS KEPT BY REV. MATTHIAS PLANT AT NEWBURY, MASSACHUSETTS	RECORD OF AFTERSHOCKS AT MARBLEHEAD, MASSACHUSETTS
October 29	--	"...and Eight more immediately followed louder than the rest that followed and lasted al y^{e} week sometimes breaking with loud clasps 6 times or oftener in a day and as oftern in y^{e} night..."	"...There were about 7 or 8 small rumblings, after this, heard before one of the clock;..."
October 30	2:15 a.m.		"...there were two others, one only heard the other felt."
	4:10 a.m.		"...we heard another."
	5:45 a.m.		"...another,"
	3:30 p.m.		"...we heard it again,..."
	5:00 p.m.		"...the same afternoon;..."
	-- p.m.		"...and I am told by some that were up in the following Night, that they heard the rumbling twice or thrice;..."

TABLE 2 (Cont'd.)

DATE (O.S.)	TIME (LOCAL)	EXCERPTS TAKEN FROM ORIGINAL MINISTER'S RECORD BOOKS KEPT BY REV. MATTHIAS PLANT AT NEWBURY, MASSACHUSETTS	RECORD OF AFTERSHOCKS AT MARBLEHEAD, MASSACHUSETTS
October 31	10:00 a.m.		"...there was a pretty strong one."
	6:35 p.m.		"...an other;..."
	7:33 p.m.		"...an other;..."
	8:42 p.m.		"...and a Fourth Time...and I am told was heard several times in the Night after."
November 2	Night	"...somewhat abated..."	"...the Earthquake heard twice last night."
November 3	-- p.m.	"...3 very loud claps..." (i.e. referring to the three reported November 3-4; also at Marblehead, time given as evening and about midnight)	"...it was heard again last night;..."
November 4	4.00 a.m.	"...about y[e] Brake of day..."	"...and a very considerable one that made our windows jar."
November 4	10:00 p.m.	"...we also had it upon Saturday..." (no time given).	"...some say they heard it about 4..." (original illegible, Weston Geophysical).

TABLE 2 (Cont'd.)

DATE (O.S.)	TIME (LOCAL)	EXCERPTS TAKEN FROM ORIGINAL MINISTER'S RECORD BOOKS KEPT BY REV. MATTHIAS PLANT AT NEWBURY, MASSACHUSETTS	RECORD OF AFTERSHOCKS AT MARBLEHEAD, MASSACHUSETTS
November 5	4:30 --	"...we also had it...Sabbath..." (no time given).	"It was distinctly heard about 4^h 30^m just after we came from meeting."
November 5	11:00 p.m.		"...and I am told about 11 at night they heard it again."
November 6	10:00 a.m.	"...much abated in y^e noise and terror."	
November 7	11:00 a.m.	Not reported by Plant	"...it was plainly heard..." "...so that it has been heard about 30 times in the compass of the 9 or 10 days past."
		Weston Geophysical Note: significant textural differences in the original Minister's Record and the account in the Philosophical transactions published years later. Descriptions are taken from the original record.	Weston Geophysical Note: the record ends on November 7, 1727. The letter, written at Marblehead, Massachusetts is dated November 8, 1727.

TABLE 3

AFTERSHOCKS OF THE 1755 EARTHQUAKE

DATE	TIME	REPORTING LOCALITIES
Nov. 18, 1755	5:29 a.m.	Massachusetts: Amesbury[†], Boston, Chelmsford, Essex County, Marshfield, Northampton, Salem, Westborough, Worcester; Maine: York; New Hampshire: Bedford; Rhode Island: Exeter.
Nov. 18, 1755	4:00 p.m.	Kittery, Maine.
Nov. 19, 1755	10:00 p.m.	Massachusetts: Chelmsford, Ipswich; Maine: York.
Nov. 20, 1755	Not Given	York, Maine.
Nov. 22, 1755	8:27 p.m.	Massachusetts: Amesbury[†], Boston, Chelmsford, Essex County, Lynn, Marshfield, Northampton, Plymouth, Worcester, Westborough; Maine: Portland, York; New Hampshire: Hampton, Portsmouth; Rhode Island: Exeter, Newport; New York: New York.
Dec. 19, 1755	10:00 p.m.	Massachusetts: Boston, Essex County, Marshfield; Maine: Portland.
Mar. 11, 1756	3:00-4:00 p.m.	Reported in "towns east of Boston."
Mar. 15, 1756	Not Given	Reported along the coast from Salem, Massachusetts to Wells, Maine.

[†]Amesbury reports are uncertain and are not used in consideration of aftershocks.

TABLE 4

SUMMARY OF OBSERVATIONS[†] ON AFTERSHOCKS

Chauncy (1755):

> *"...These are all the shocks we have had in this town, tho' elsewhere they have been more numerous. In some places they have felt 5 or 6; in others 10 or 11; & in others still, at least 20."*

Mayhew (1755):

> *"...Many other shocks have been felt since the first and the greatest, to the eastward and northward of Boston; at 20, 30, 40, and 50 miles distance, if not farther."*

Winthrop (1755):

> *"...Since the reading of this lecture, there has been another small shock, viz. on Friday the 19th of December in the evening, exactly at 10 o'clock; the sky being then perfectly clear, and a very gentle gale at S.W. It was preceded by the peculiar noise of an Earthquake about 3 or 4 seconds, and the jarring lasted near as long; causing the window-shutters and door of the chamber, in which I then was, to clatter. Those of my family, who were in a lower room, perceived nothing of the shake, though they heard the noise. These are the only shocks that I have been sensible of; though it is said, that many others have been felt in the Province of New-Hampshire, since the first great one."*

Winthrop (1757):

> *"...These four are the only shocks, that I have been sensible of from the 18th of November last to this date; tho' more are said to have been felt in other parts of the country to the northward of us....*
>
> *"The center of our former earthquakes, as well as of this, seems to have been near the river Merrimac, about the latitude of 43° north, and 40 miles north from hence; many shocks having been felt in that neighbourhood, which did not extend to this place."*

Williams (1785):

> *"...Many others, but very small, were felt in different parts of the Massachusetts and New-Hampshire, for several months after."*

[†]Account arranged chronologically in order of publication.

APPENDIX 2F

GEOTECHNICAL REPORT - REACTOR BORINGS. JULY 1974

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

GEOTECHNICAL REPORT

REACTOR BORINGS

SEABROOK STATION, NEW HAMPSHIRE

Submitted to

YANKEE ATOMIC ELECTRIC CO.

GEOTECHNICAL ENGINEERS INC.
1017 Main Street
Winchester, Massachusetts 01890

July 31, 1974

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LIST OF FIGURES

1.0 INTRODUCTION

1.1 Purpose

An excavation approximately 150 feet in diameter and 70 feet deep will be required for each of the two proposed reactors at Seabrook Station.

To design the side slopes of the excavation and to estimate the quantity of excavation, it is necessary to determine the frequency and orientation of fractures in the rock. For this purpose inclined borings were made around the perimeter of each of the two proposed excavations. The core was oriented and the orientation of joints, slickensided surfaces, and foliation was determined.

1.2 Scope

Four inclined borings were made around the perimeter of each proposed reactor excavation. The borings ranged in length from 165 to 169 feet, and in inclination from 39° to 41.5°, measured from vertical. (The bottom of a 165-foot-long boring inclined at 40° is at a vertical difference in elevation of 126 feet below the ground surface.)

2.4 Orientation Data

Core was oriented from near the rock surface to the bottom of the hole, with three exceptions: Boring E2-11 in which orientation starts at 63 ft (inclined length) below the rock surface; Boring E2-17 in which orientation terminates at 65 ft (inclined length) in a borehole that was 165 ft long; and Boring E2-15 in which orientation terminates at 42 ft (inclined length) in a borehole that was 165 ft long.

Appendix II is a summary of all the orientation data, and Appendix III contains polar equal area stereo net projections for the features oriente(in each borehole.

Fig. 1 is a plot of generalized dip and strike data for joints in each of the borings.

Fig. 2 is a plot of generalized dip and strike data for foliation. As shown on the individual boring logs in Appendix I, the rock at the two reactor sites does not exhibit much foliation.

Fig. 3 is a plot of generalized dip and strike data for slickensided surfaces.

Fig. 4 is a contoured plot of the projections of poles for 230 joints measured in the core from borings at Reactor 1; Fig. 5 is a contoured plot of the projections of poles for 93 joints in Reactor 2; and Fig. 6 is a contoured plot of the projections of poles for 114 slickensided surfaces in Reactor 2.

Fig. 4 shows that there are two dominant sets of fracture surfaces at Reactor No. 1 with strikes and dips roughly as follows (listed in order of decreasing frequency of occurrence):

N30E, 40NW
N40E, 60SE

Figs. 5 and 6 show that there are three dominant sets of fracture surfaces at Reactor No. 2, with strikes and dips roughly as follows (listed in order of decreasing frequency of occurrence):

N30E, 30 NW
N45E, 55SE
N15W, 60 SW

TABLES

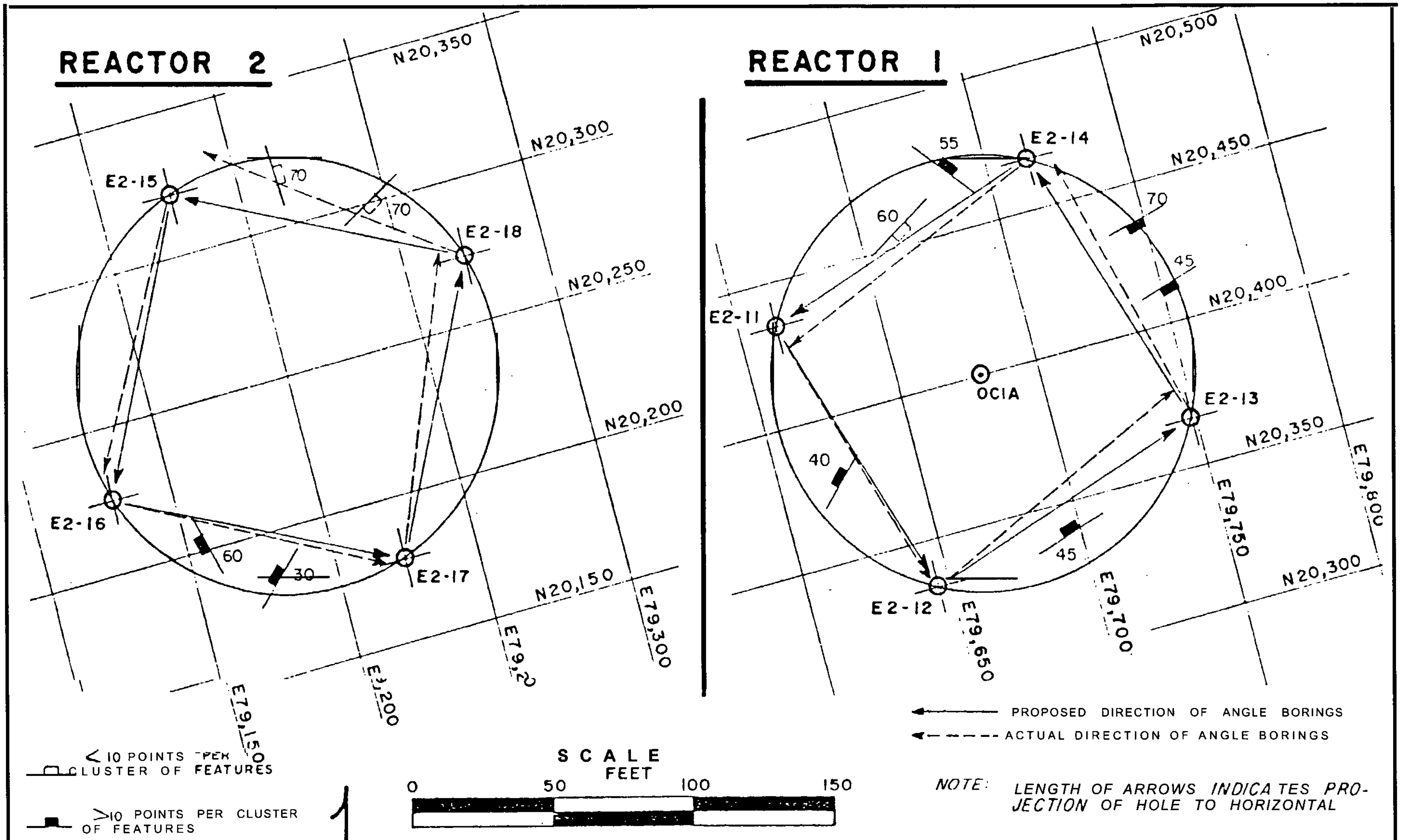
TABLE 1

ZONES ORIENTED IN REACTOR BORINGS

Reactor No.	Boring No.	Length of Boring* (feet)	Inclination of Boring Measured From Vertical	Length Oriented* (feet)	Vertical Depth to Top of Rock (feet)
1	E2-11	168.0	40°	63-168	13.5
1	E2-12	165.7	41°	13.8-165.7	0.7
1	E2-13	169.0	41°	22-169	0.0
1	E2-14	166.0	41.5°	11-166	2.2
2	E2-15	165.0	41.5°	13.5-42	8.6
2	E2-16	165.1	41°	18-165	7.1
2	E2-17	165.0	41°	22-65	14.3
2	E2-18	168.0	39°	15.5-168	10.8

*Measured along inclined axis of borehole.

FIGURES



PROPOSED DIRECTION OF ANGLE BORINGS

ACTUAL DIRECTION OF ANGLE BORINGS

< 10 POINTS PER CLUSTER OF FEATURES

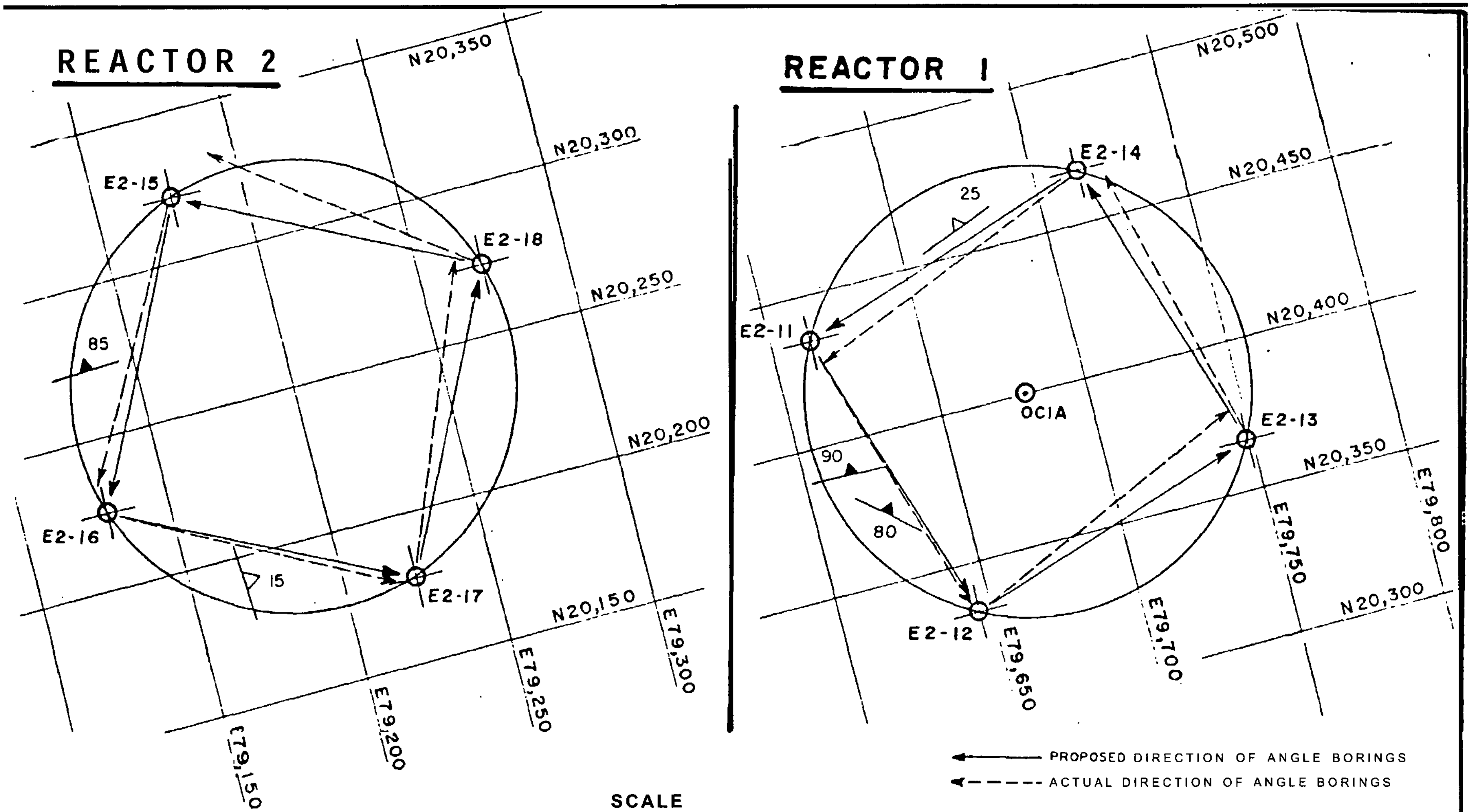
>10 POINTS PER CLUSTER OF FEATURES

OVERCORE BORING

ANGLE BORING

NOTE: LENGTH OF ARROWS *INDICATES* PROJECTION OF HOLE TO HORIZONTAL

YANKEE ATOMIC	SEABROOK STATION	PLAN OF REACTOR SITES SHOWING GENERALIZED DIP & STRIKE OF *JOINTS*
GEOTECHNICAL ENGINEERS, INC. WINCHESTER, MASSACHUSETTS	PROJECT 7206	JULY 1974 FIG. I



PROPOSED DIRECTION OF ANGLE BORINGS
ACTUAL DIRECTION OF ANGLE BORINGS

△ < 2 POINTS PER CLUSTER OF FEATURES

▲ >2 POINTS PER CLUSTER OF FEATURES

OVERCORE BORING

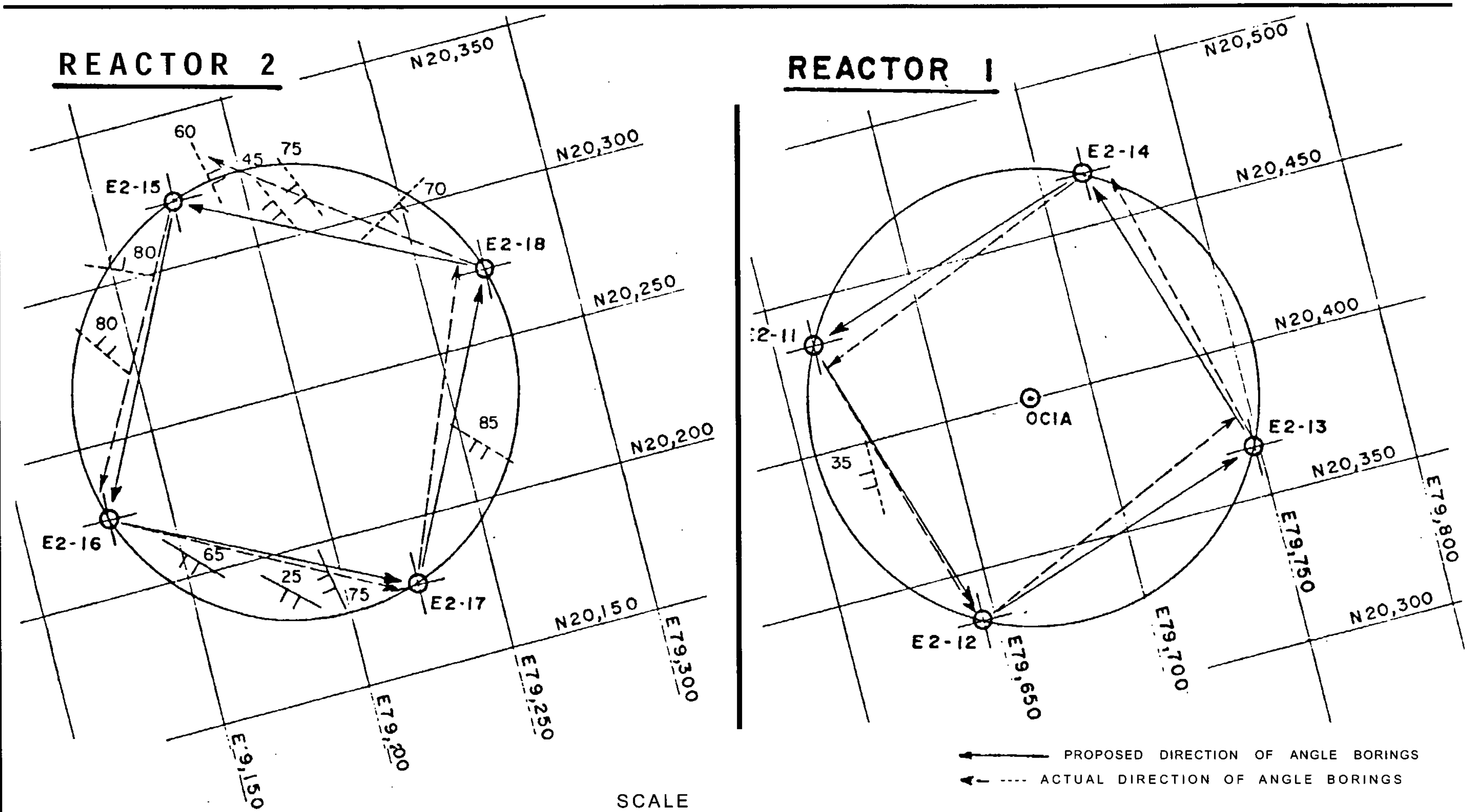
ANGLE BORING

N

SCALE
FEET
0 50 100 150

NOTE: *LENGTH OF ARROWS INDICATES PROJECTION OF HOLE TO HORIZONTAL.*

YANKEE ATOMIC	SEABROOK STATION	PLAN OF REACTOR SITES SHOWING GENERALIZED DIP & STRIKE OF FOLIATIONS
GEOTECHNICAL ENGINEERS, INC. WINCHESTER, MASSACHUSETTS	PROJECT 7286	JULY 1974 FIG. 2



>8 POINTS PER CLUSTER OF FEATURES

OVERCORE BORING

ANGLE BORING

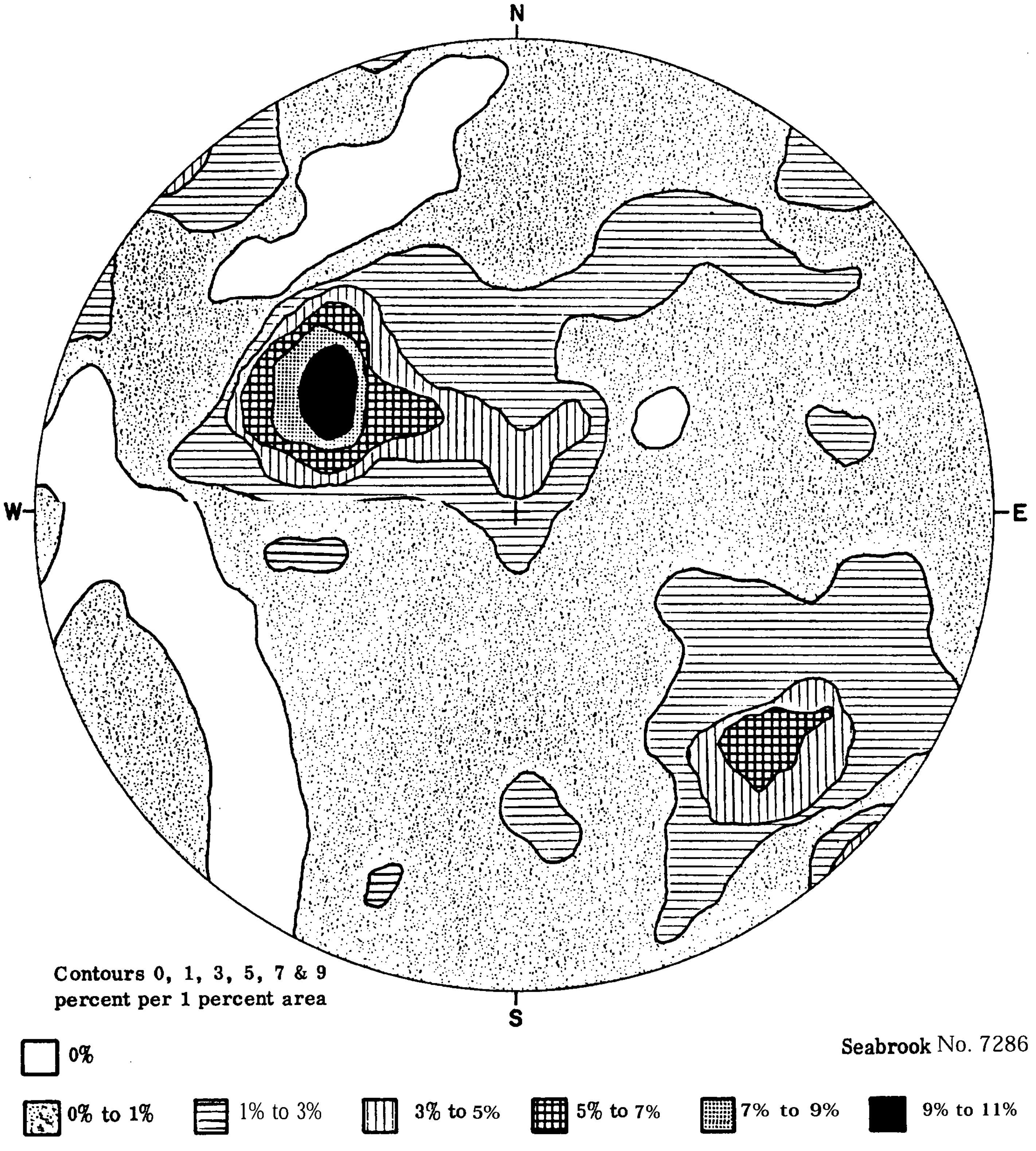
N

SCALE FEET

0 50 100 150

NOTE: LENGTH OF ARROWS INDICATES PROJECTION OF HOLE TO HORIZONTAL.

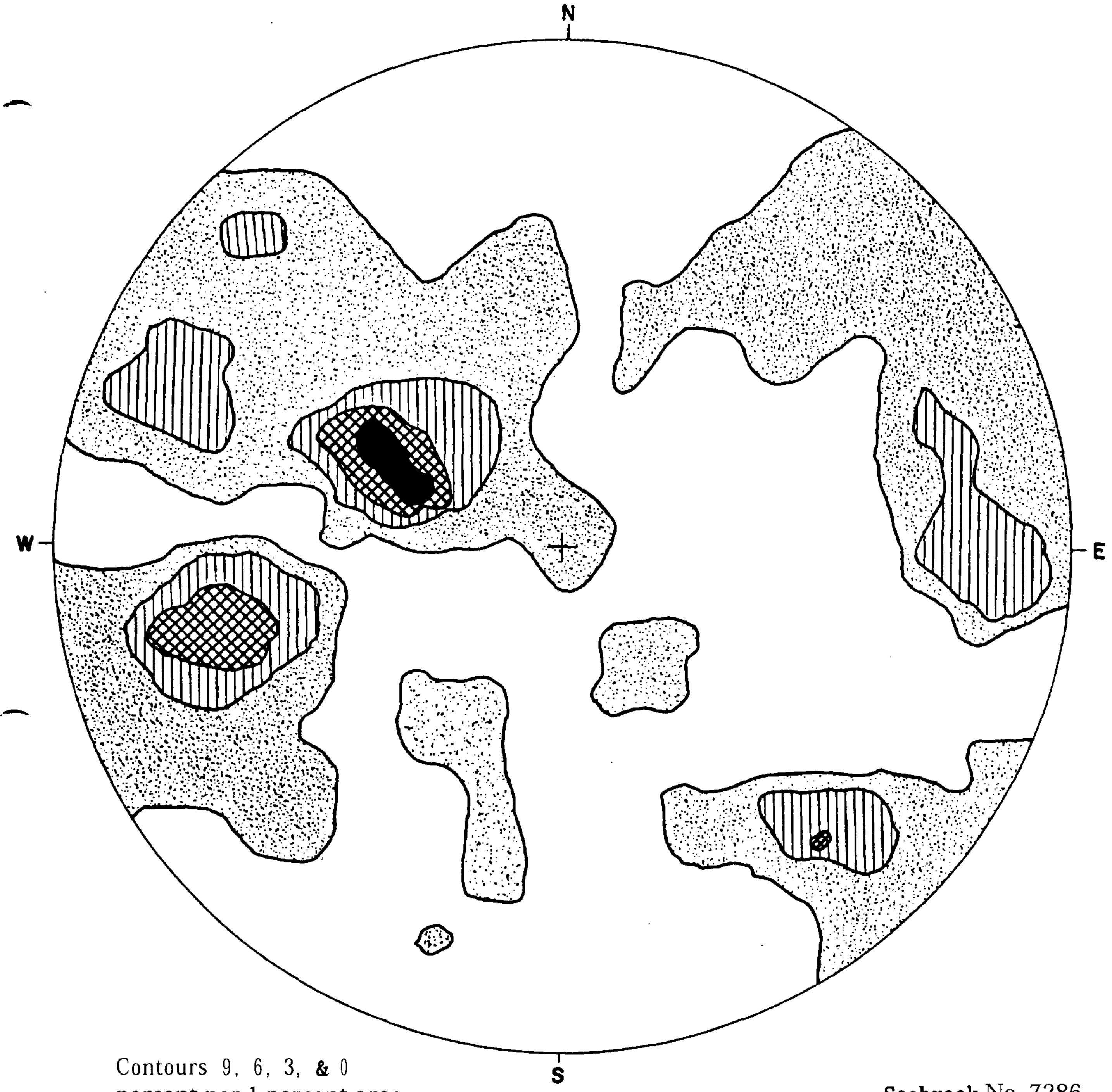
YANKEE ATOMIC	SEABROOK STATION	PLAN OF REACTOR SITES SHOWING GENERALIZED DIP & STRIKE OF SLICKENSIDED SURFACES
GEOTECHNICAL ENGINEERS, INC WINCHESTER. MASSACHUSETTS	PROJECT 7266	JULY 1974 FIG. 3



Seabrook No. 7286

Contoured Equal Area Upper Hemisphere Polar Projection of Poles to 230 Joints In Reactor 1; Borings E2-11, 12, 13 & 14

Fig. 4



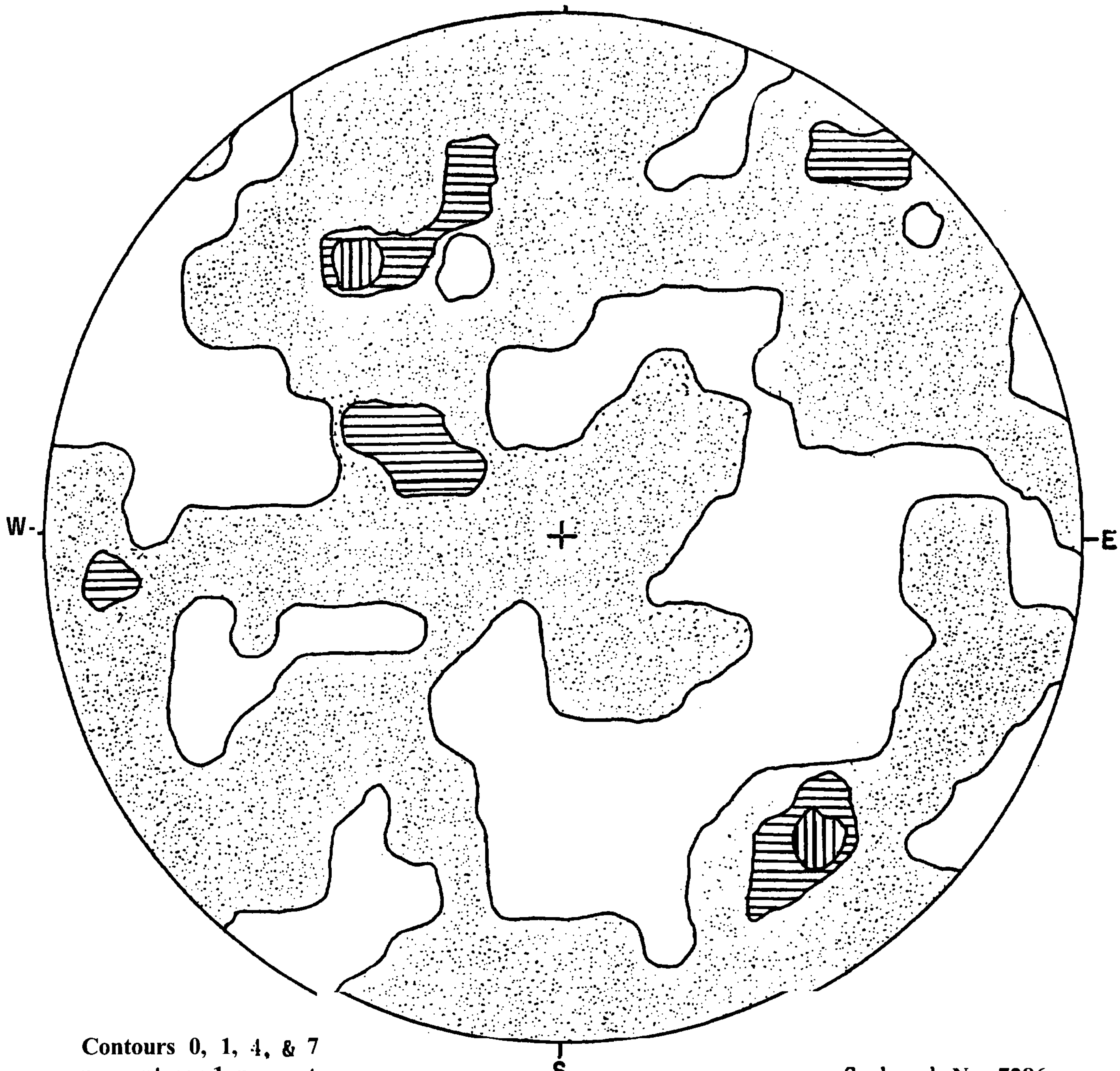
Contours 9, 6, 3, & 0 percent per 1 percent area

Seabrook No. 7286

0% | 0% to 3% | 3% to 6% | 6% to 9% | 9% to 11%

Contoured **Equal** Area **Upoer** Hemisphere Polar Projection of Poles to 93 Joints **In** Reactor 2; Borings **E2-15**, 16, **17, 18.**

Fig. 5



Contours 0, 1, 4, & 7
percent per 1 percent area

Seabrook No. 7286

Contoured Equal Area Upper Hemisphere Polar Projection of Poles to 114 Slickensided Surfaces in Reactor 2; Borings E2-15, 16, 17, & 18.

Fig. 6

APPENDIX I

APPENDIX I

Boring Logs

Note: All holes are angle holes. Depths are measured along core axis. Inclinations of holes are measured from vertical.

BORING LOCATION N20135, E29611, Plot S9 INCLINATION 16° BEARING S31E DATE START/FINISH June 20, 1971 / June 22, 1971

CASING ID 3 in. CORE SIZE 2 1/8 - 1 7/8 in. TOTAL DEPTH 168.0 ft DRILLED BY American Drilling & Boring Co. - L. Lanning

GROUND EL (MSL) 25.0 ft DEPTH TO WATER DATE 9.7 ft June 21, 1971 LOGGED BY Soil - [illegible] Fall, Rock - J. B. Head

EL. MSL ft	Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content %	Pressure Test	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickensid)	Core Breaks
25.0					2)			
				1)		TOP	OF TILL	
	6.5	SS-1	100					
		SS-2	99					
	10	NQ-3	16					
		NQ-4	31					
	17.7	NQ-5	57			TOP	OF ROCK	
	20	NQ-6	76		51			1.5' core lost
0	30	NQ-7	100		83			
	40	NQ-8	100		81			
	50	NQ-9	100		91			
-20	60	NQ-10	100		74			
		NQ-11	100		99		N21E, 13NW J	
	70	NQ-12	100		97		N15E, 69NW J	
		NQ-13	100		76		N13E, 54NW J	
		NQ-14	100		00		N12W, 50SW S	
	80						N96E, 69NW J	
		NQ-15	100		00		N15W, 62SW S	
-40							N17W, 19SW S	
		NQ-16	100		73		N14W, 40SW J	
	90	NQ-17	100		98		N65W, 55NE J	
		NQ-18	100		00			
		NQ-19	100		00			
	100	NQ-20	100		85		N15E, 72SE C	
							N55E, 76NW C	
		NQ-21	100		00		N52E, 69NW J	
-60	110	NQ-22	100		82		N38E, 13NW J	
							N27W, 72NE J	
							N65W, 55SW J	
		NQ-23	100		87			
	120	NQ-24	100		00		N25E, 90NW J	
		NQ-25	100		00		N75E, 82NW S	
	130	NQ-26	100		00		N31E, 19NW J	
							N33E, 36NW J	
-80		NQ-27	100		17		N10E, 11NW J	
	140	NQ-28	10		0		N74W, 61NE S	
		NQ-29	98		95		N41E, 16NW J	
	146						N31E, 22NW J	

SOIL AND ROCK DESCRIPTIONS

Weathering, defects, etc.		Type, texture, mineralogy, color, hardness, etc.
1.5' core lost; Rusty stain; Rusty stain	Fresh internally. Some minor rusty staining on joints and partings. Not chloritic.	Diorite. Medium fine grained, medium dark gray. Massive texture.
Minor rusty		
Minor rusty	Fresh and hard. Drills well. Most joints and partings are clean. Not chloritic.	Pegmatite. Diorite. Predominantly medium-fine grained, medium dark gray with occasional medium coarse quartz diorite.
Solid core	Fresh and hard. Drills core well. Joints and partings clean. Not chloritic. Most partings break across core.	Diorite. Fine to medium fine grained, medium dark gray. Massive texture.
		Diorite. Medium-fine grained, medium gray. Massive.
Minor chlorite; Slight rusty	Fresh and hard. Joints and partings generally clean. Some minor chlorite on joints and partings in diabase.	74.8' Fused intrusive contact. Diabase. Fine to medium-grained, dark greenish gray. Locally calcitic.
		83.1' Fused contact
Pyrite	Fresh and hard. Joints and partings generally clean. Diabase broken on calcite veining.	Diorite. Medium-fine grained, medium gray. Massive.
		Diorite. Medium-fine, massive. Becoming gneissoid foliated toward base.
		Fused. Diabase, fine calcitic - calcite veining. Fused.
	Fresh and hard. Joints and partings clean. Not chloritic.	Diorite. Mixed fine-grained dark gray and medium-coarse grained medium gray. Gneissoid. Predominantly fine-grained.
	Fresh and hard. Drills well.	Foliated texture. Diorite. Predominantly fine grained, medium dark gray. Gneissoid at top of section.
Vuggy-slight wx; Minor chlorite; Core lost	Locally vuggy. Slightly wx. 2' core lost 38 [illegible]. Chips look OK. [illegible]	Welded breccia

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
Groundwater

S - Shelby tube
F - Fixed piston
O - Osterberg
N - Denison
P - Pitcher
G - GEI

D - Drilling break
wx - Weathered, weathering
k - Coefficient of permeability
x - Oriented core

NOTES

1) - Washed through soil 0 - 6.5 ft. No samples taken.

2) - No clays present; therefore no water contents determined.

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers

Date: July 11, 1971 Project 7286

PAGE 1 of 2 LOG OF BORING [illegible]

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N20135, E29611, Plant Site INCLINATION 10° BEARING S31E DATE START/FINISH June 20, 1974 / June 27, 1974

CASING ID 3 in. CORE SIZE 2-1/8 - 1-7/8 in. TOTAL DEPTH 168.0 ft DRILLED BY American Drilling & Boring Co.; J. Canning

GROUND EL (MSL) 25.6 ft DEPTH TO WATER DATE 9.7 ft June 21, 1974 LOGGED BY Soil - K. Polk; Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	SAMPLE Type and No.	SAMPLE N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)		(Type, texture, mineralogy, color, hardness, etc.)
											CONTINUED FROM PREVIOUS PAGE		
	146	NQ-30	100		100				N27E, 32NW J		Slight wx	Fresh and hard. Drills well. Partings are clean.	Diorite. Mixed fine and medium coarse grained textures. Locally gneissoid.
	150	NQ-31	100		100				N26E, 28NW J		Slight wx Solid core		
		NQ-32	100		100				N63W, 25NE F		Solid core		
									N18W, 71NE J			Fresh and hard. Drills well. Joints and partings are clean.	Diorite. Predominantly fine, medium dark with patches of coarse quartz diorite.
100	160	NQ-33	100		100				N30E, 75NW J				
		NQ-34	97		93				N50W, 13NE F				
	168						BOTTOM		OF BORING				

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break
wx - Weathered, weathering
k - Coefficient of permeability
Groundwater

NOTES

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers

Date July 11, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING 12-11

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N20334, E79612; Plant Site   INCLINATION 0   BEARING N66E   DATE START/FINISH June 10, 1971 / June 18, 1971

CASING ID 3 in.   CORE SIZE 2-1/8 - 1-7/8 in.   TOTAL DEPTH 165.5 ft   DRILLED BY American Drilling & Boring Co., A. Whitaker

GROUND EL (MSL) + 21.5 ft   DEPTH TO WATER/DATE - 7.1 ft June 19, 1971   LOGGED BY Soil E. Pell, Rev. J. B. Rand

EL. MSL ft	Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	Water content or RQD %
21.5					
		NX-1	100	2	16
		NX-2	85	3	0
	10	NX-3	100	3	46
		NX-4	100	3	25
		NQ-5	81	3	43
	20	NQ-6	100	4	82
		NQ-7	98	4	44
0	30	NQ-8	100	5	68
		NQ-9	100	4	97
	40	NQ-10	100	4	98
		NQ-11	100	5	89
	50	NQ-12	100	5	92
20		NQ-13	100	6	90
	60	NQ-14	98	16	89
		NQ-15	100	20	100
	70	NQ-16	100	15	92
		NQ-17	100	6	85
10	80	NQ-18	100	8	92
		NQ-19	100	8	83
	90	NQ-20	100	6	64
		NQ-21	100	5	89
	100	NQ-22	100	6	25
80		NQ-23	100	6	90
	110	NQ-24	100	8	100
		NQ-25	97	5	91
	120	NQ-26	100	4	90
		NQ-27	97	5	75
	130	NQ-28	100	6	95
		NQ-29	100	6	100
	140	NQ-30	94	6	91
		NQ-31	95	6	75
	165.5				

PRESSURE TEST: gpm / psi; Computed k 10^{-4} cm/sec — TOP OF ROCK

STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside) [2]:

N18E, 13NW J; North, 21W J; N17E, 17NW J; N77W, 15NE J; N41W, 67NE J; N23E, 47NW J; N73W, 82SW J; N63W, 37SW J; N12E, 67NW J; N63E, 15NW J; N10E, 16NW J; N18E, 52NW J; N31E, 13NW J; N51E, 37NW J; N26W, 86NE J; N75W, 55SW J; N19W, 81SW J; N81E, 55SE J; N26E, 65NW; N35E, 45NW C; N28W, 43SW; N26E, 37NW J; N65W, 67SW J; N36E, 45NW J; N35E, 34NW J; N15E, 12NW J; N15E, 12NE J; N35E, 42NW J; N75E, 73SE J

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.)		(Type, texture, mineralogy, color, hardness, etc.)
Rusty; Rusty; Rusty; Rusty; Rusty; Rusty; Rusty; Rusty	Fresh to slightly wx internally. Joints and partings have rusty coatings. Not chloritic.	Diorite. Predominantly medium coarse grained, medium gray with occasional local fine-grained patches.
Slight wx; Minor rusty; Slight wx; D; Slight wx; Minor rusty; Extreme wx-crumbly	Fresh and hard. Partings show powdery or rusty staining. Not slickensided.	Diorite. Predominantly fine grained, medium dark gray. Locally coarse-grained and locally foliated.
D; D; D	Fresh and hard. Drills well. Joints and partings are clean. Not chloritic.	Diorite. Predominantly fine-grained, medium dark gray with occasional patches of coarse quartz diorite.
Slight wx; Minor rusty; 5' solid piece	Fresh and hard. Drills very well. Some local minor rusty stains on partings. Not slickensided.	Diorite. Mixed fine-grained medium dark gray diorite and coarse-grained light gray quartz diorite.
Vuggy-Slight wx; Rusty stain; Rusty stain	Fresh and hard. Drills well. Some slight rusty staining on some partings. Not slickensided.	Diorite. Predominantly fine-grained, medium dark gray with local zones of medium coarse quartz diorite.
Rusty; Severe wx	Generally fresh. Local wx and rusty staining (93 to 101' core may be mixed up - box knocked over in field). Fused veinlets; Diabase; Diabase; Slightly bleached	
Rusty; Rusty; Moderate wx		Diorite. Predominantly fine-grained, dark to medium gray. Some saussuritization of feldspars.
D; D	Fresh and hard. Drills very well. Partings not slickensided. Show only very minor wx effects. Fused veinlets	Diorite. Fine-grained, medium dark gray. Small white phenocryst speckling.
D; Rusty	Fresh and hard. Drills well. Joints and partings are clean. Not chloritic.	Diorite. Mixed fine grained dark gray in medium coarse medium gray quartz diorite. Predominantly fine-grained.
D; D	Fresh and hard. Joints and partings clean. Not chloritic.	Diorite. Predominantly fine-grained, medium dark gray.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample   ▽ Groundwater
U - Undisturbed samples
S - Shelby tube   N - Denison
F - Fixed piston   P - Pitcher
O - Osterberg   G - GEI
D - Drilling break   k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) - Washed through soil 0-1 ft. No samples taken.

2) - This is only a partial list of dip and strike data.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: July 11, 1971   Project 7286

PAGE 1 of 2   LOG OF BORING

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N20311, E70632, Plant Site INCLINATION 0° BEARING N66E DATE START/FINISH June 10, 1974 / June 1[illegible], 1974

CASING ID 3 in. CORE SIZE 2-1/8 - 3-7/8 in. TOTAL DEPTH 165.5 ft DRILLED BY American Drilling & Boring Co., A. [illegible]

GROUND EL (MSL) [illegible] ft DEPTH TO WATER DATE 7.[illegible] ft June 12, 1974 LOGGED BY [illegible]

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST Gage psi	Computed k 10^{-5} cm/sec	STRIKE, DIP F - Foliation J - Joint C - Contact B - Bedding S - Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
											CONTINUED FROM PREVIOUS PAGE	
	147.5											
	150	NQ-32	100	6	52				N25E, 37NW J		Driller mislatched	
-100		NQ-33	100	6	100				N25E, 26NW J		Fresh and hard. Drills very well. Joints and partings are clean. Not chloritic.	Diorite. Fine grained, medium dark gray. Massive texture.
	160	NQ-34	93	6	93						Solid core	
	165.5	NQ-35	100	1	100						Solid core	
								BOTTOM	OF BORING			

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ∇ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
x - Weathered, weathering

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: July 11, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING [illegible]

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N20375, E79715; Plant Site **INCLINATION** 0° **BEARING** N10W **DATE START/FINISH** June 20, 1971 / July 1, 1971

CASING ID 3 in. **CORE SIZE** 1-7/8 - 2-1/8 in. **TOTAL DEPTH** 160.0 ft **DRILLED BY** American Drilling & Boring Co. A. Whitaker

GROUND EL (MSL) +30.5 ft **DEPTH TO WATER/DATE** 13.0 ft June 21, 1971 **LOGGED BY** Soil - K. Polk; Rock - J. R. Rand

EL. MSL 10.5 — Top of rock (S = Slickenside)

Depth (ft)	Sample Type and No.	N or Rec.	Rate of Adv. (min/ft)	RQD %
	NX-1	88	3.0	17
	NX-2	72	1.0	0
	NX-3	100	5.0	13
-10	NX-4	100	5.0	96
	NX-5	100	4.0	85
-20	NX-6	100	4.0	100
	NQ-7	75	5.0	46
	NQ-8	93	7.0	13
-30	NQ-9	100	9.0	82
	NQ-10	100	12.0	80
-40	NQ-11	100	11.0	100
	NQ-12	100	15.0	83
	NQ-13	100	16.0	100
-50	NQ-14	97	18.0	93
	NQ-15	100	4.0	93
-60	NQ-16	100	5.0	98
	NQ-17	100	6.0	92
-70	NQ-18	97	9.0	88
	NQ-19	98	2.0	97
-80	NQ-20	97	5.0	83
	NQ-21	100	20.0	97
-90	NQ-22	100	4.0	80
	NQ-23	98	6.0	98
-100	NQ-24	100	8.0	93
	NQ-25	100	9.0	88
-110	NQ-26	100	0.0	100
	NQ-27	100	5.0	67
	NQ-28	100	10.0	75
-120	NQ-29	97	4.0	63
	NQ-30	100	5.0	83
-130	NQ-31	100	6.0	54
	NQ-32	98	6.0	55
-140	NQ-33	98	6.0	50

Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding) [2)]:
N43E, 29NW J; N10E, 58SE J; N15E, 75SE J; Horiz. J; N30E, 83SE J; N32E, 67SE J; N65E, 27NW J; N25E, 67SE J; N55E, 85SE J; N55E, 11SE J; N28E, 25NW J; N25E, 61SE J; N35E, 66SE J; N09W, 30NW J; N35W, 63NE J; N55E, 7NW J; N53E, 84SE J; N16E, 86NW J; N50E, 30SE J; N83E, 52SE J; N15E, 21NW J; N16E, 58SE J; N15E, 87NW J; N15W, 57NE J; N21E, 88NE J; N35E, 84SE J; North, 36W J; N19E, 86SE C; N67W, 83SW J; N15W, 17NE J; N70E, 23NW J; N50W, 30NE J; N16W, 41NE J; N68W, 54NE J; N56E, 83NW S; N15E, 35SE J; East, 5NE J; N50E, 18NW J; N31E, 12SE J; N28E, 30SE J

Soil and Rock Descriptions (Weathering, defects, etc.)

- Rusty staining; Slight wx; Rusty staining; Moderate wx — Slightly wx to about 8' and fresh and hard below. Not chloritic.
- Rusty; Slight rusty; Slight rusty; Slight rusty — Fresh and hard. Slight rusty staining on joints. Not chloritic or slickensided.
- Slight rusty; Slight rusty; Moderate wx; 1' core lost — 1' zone of moderate wx. Core lost.
- Slight wx; Slight wx; Slight wx; D; Slight wx — Fresh and hard. Some joints and partings show minor powdery to rusty surface wx effects. Not chloritic.
- Slight wx; Slight wx; Slight rusty; D; Slight wx; Slight wx; Slight wx — Fresh and hard. Some joints and partings show very minor powdery surface wx effects. Not chloritic.
- Moderate wx; Minor vuggy; Severe wx; Moderate wx — Fresh and hard. Local thin zones of moderate to severe wx on closely spaced joints. Not chloritic.
- Slight wx; Moderate wx; Slight wx — Fresh and hard. Drills well. Some thin wx zones on joints or partings as shown. Not chloritic.
- Rusty stain; Minor rusty; Slight wx — Fresh and hard. Some minor local rusty staining on some joints. Not chloritic.
- Minor rusty — Fresh and hard. Some minor wx and rusty staining.
- Minor rusty; Slight wx; Moderate wx — Fresh and hard. Local slight to severe wx ... joints.

(Type, texture, mineralogy, color, hardness, etc.)

- Diorite. Mixed fine-grained, medium dark gray diorite with patches of medium to medium-coarse quartz diorite.
- Diorite. Mixed fine-grained dark gray diorite in medium coarse, medium gray quartz diorite.
- Diorite. Mixed fine-grained, dark gray diorite in medium to medium-coarse, medium gray quartz diorite.
- Diorite. Mixed fine-grained, dark gray diorite in medium to coarse, medium gray quartz diorite. Predominantly fine-grained.
- Diorite. Mixed fine-grained, dark gray diorite in medium-coarse, medium gray quartz diorite. Medium coarse textures predominate.
- Quartz diorite. Medium-coarse grained, medium gray with occasional patches of included fine-grained diorite.
- Diorite. Mixed fine-grained, dark gray in medium coarse, medium gray quartz diorite. Quartz diorite.
- Diabase inclusion; Diabase
- Diorite. Medium-grained medium gray.
- Fused contact (broken)
- Diabase. Dark gray.
- Fused contact
- Diorite. Medium-coarse grained, medium gray. Somewhat porphyritic.

LEGEND
N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ⊻ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES
1) No clay samples present; therefore no water contents were determined.
2) This is only a partial list of dip and strike data.

x - Oriented core

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United Engineers

Date July 10, 1971 Project 7286

PAGE 1 of 2 LOG OF BORING L2-13

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N20165, E79715, [illegible] INCLINATION 0° BEARING N30W DATE START/FINISH June 20, 1974 / July 3, 1974

CASING ID 3 in. CORE SIZE 1-7/8 - 2-1/8 in. TOTAL DEPTH 169.0 ft DRILLED BY American Drilling & Boring Co.; A. Whitaker

GROUND EL (MSL) [illegible] ft DEPTH TO WATER/DATE [illegible] ft [illegible] LOGGED BY Soil - [illegible]; Rock - [illegible]

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP (F - Foliation, J - Joint, C - Contact, B - Bedding, S - Slickenside)	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
											CONTINUED FROM PREVIOUS PAGE	
	144	NQ-3	95	3.0	25				N22E, 45SE J; N46F, 69SE J		Slight wx; Rusty; Fresh and hard. Some minor wx effects and rusty staining on joints.	Diorite. Medium-grained medium gray. Somewhat porphyritic.
	150	NQ-35	100	4.0	33				N56E, 79NW J; N30E, 81SE J; N35E, 46SE J		Severe wx; Rusty stain; Rusty stain; Vuggy	Veining
		NQ-36	100	6.0	85				N89E, 86SE J; N19E, 66SE J		Minor rusty; Slight wx	
	160	NQ-37	100	7.0	83				N55E, 63SE J			
		NQ-38	93	[illegible]	87				N67E, 76SE J		Slight wx	
	169						BOTTOM		OF BORING			

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ▽ Groundwater
U - Undisturbed samples

S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI

D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: July 11, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING E2-11

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N20467, E79713; Plant Site INCLINATION 11.5 BEARING S55W DATE START/FINISH June 6, 1971 / June 19, 1971

CASING ID 3 in. CORE SIZE 2-1/8 - 1.775 TOTAL DEPTH 166.0 ft DRILLED BY American Drilling & Boring Co.; J. Canning

GROUND EL (MSL) [illegible] ft DEPTH TO WATER/DATE [illegible] ft June 11, 1971 LOGGED BY Soil - K. L. Poll; Rock - J. R. Rand

EL. MSL ft	Sample Depth ft	Type and No.	N or Rec. %	Rate of Adv. min/ft	Water Content % or RQD %	Strike, Dip (F - Foliation, J - Joint, C - Contact, B - Bedding, S - Slickensided)
29.9	3.0	3)			2)	TOP OF ROCK
		NX-1	100	3.8	21	
	10	NX-2	100	4.1	33	
+20		NQ-3	90	2.1	23	N65E, 13NW J; N58W, 88NE J; N11E, 69SE J; N73W, 72NE J
		NQ-4	93	1.8	27	
	20	NQ-5	90	2.4	30	
		NQ-6	79	2.9	17	
		NQ-7	68	2.7	11	N28E, 67SE J
	30	NQ-8	100	4.5	11	
		NQ-9	83	4.1	0	
		NQ-10	38	2.5	0	
0	40	NQ-11	97	1.1	60	
		NQ-12	100	1.4	90	N22E, 53SE J; N60W, 69NE J; N13E, 40NW J
	50	NQ-13	100	5.2	92	N 3W, 67NE J
		NQ-14	100	6.2	87	N57W, 41NE J
	60	NQ-15	98	5.5	92	N40E, 35NW J
-20		NQ-16	100	5.6	77	N65W, 14NE J; N50E, 12SE J; N30E, 30NW J
	70	NQ-17	100	6.4	93	N15E, 85NW C
		NQ-18	100	6.3	65	N 5E, 19SE J; N60E, 55SE J
	80	NQ-19	100	3.6	32	East, 77S J; N15W, 42SW J
		NQ-20	100	4.8	71	
		NQ-21	100	5.5	89	N16W, 87NE J
	90	NQ-22	97	1.8	62	N 6E, 61SE J; N11E, 77SE J
-40		NQ-23	89	2.7	0	
		NQ-24	100	5.0	11	N10E, 68SE S
		NQ-25	95	5.3	81	
	100	NQ-26	100	4.8	67	N79E, 40SE J; N75E, 19NW J
		NQ-27	99	5.0	75	N73E, 16NW J; N26E, 38NW J; N50E, 62SE J
	110	NQ-28	100	5.4	82	N20W, 67NE J; N22W, 58W J
-60		NQ-29	98	5.7	85	
	120	NQ-30	100	6.0	81	
		NQ-31	100	5.4	100	
		NQ-32	98	6.7	98	
	130	NQ-33	100	4.6	53	N10E, 22NW J; N55E, 69SE J; N63E, 72SE J
		NQ-34	78	5.7	98	
	140					

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.) / (Type, texture, mineralogy, color, hardness, etc.)

Weathering notes	Defects	Type, texture, mineralogy
Rusty staining; Vuggy; Minor rusty staining	Generally fresh and hard internally. Joints and partings have thin minor rusty staining. Closely spaced joints and partings.	Diorite. Mixed fine-grained, dark gray diorite and medium to coarse quartz diorite.
Rusty staining	Subject to slight to moderate wx although generally hard between joints and partings. Rusty staining on joints. Not slickensided.	Diorite. Mixed coarse and fine.
Vuggy		Pegmatite. Quartz-feldspar. Light tannish and gray-white.
Slight wx	Fresh and hard. Partings clean.	Diorite. Mixed fine, dark gray and coarse quartz diorite.
Slight rusty	Fresh and hard. Drills well. Partings generally clean. Not slickensided.	Diorite. Mixed fine-grained, dark gray diorite in coarse-grained quartz diorite.
Moderate wx; Moderate wx; Minor rusty; Minor rusty; Rusty stain-; moderate wx	Fresh and hard with thin local rusty stained areas and some local moderate wx. Not slickensided.	Diorite. Predominantly medium grained, spotted (dark matrix) quartz diorite with some local fine grained, medium dark gray diorite.
Slight wx; Rusty stain; Slight wx; Rusty stain	Fresh and hard. Partings subject to rusty stains. Not slickensided.	Diorite. Fine-grained, medium dark gray with small phenocrest spotting. Some thin fused veinlets.
Minor rusty; Minor rusty; Minor rusty; Minor rusty; Minor rusty; Minor rusty; Slight wx; Pyrite	Fresh and hard. Some minor wx effects on partings. No chlorite. Not slickensided.	Diorite. Fine-grained, dark gray with small phenocrysts spotting. Contains pyrrhotite. Diabase intrusion
	Fresh and hard. Drills well. Joints and partings are clean.	Diorite. Predominantly fine-grained medium dark gray with patches of medium coarse quartz diorite.
	Fresh and hard. Joints and partings are clean. Not chloritic.	Diorite. Mixed fine grained, medium dark gray diorite with occasional patches of medium coarse quartz diorite.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) - This is only a partial list of dip and strike data.
2) - No clays present, therefore no water contents were determined.
3) - Washed through soil 0-3 ft. No samples taken.

x - Oriented core

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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Date: July 2, 1971 Project 7286

PAGE 1 of 2 LOG OF BORING [illegible]

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N201.7, [illegible] Plant Site INCLINATION 11.5° BEARING S55W DATE START/FINISH June 6, 1971 / June 15, 1971

CASING ID 3 in. CORE SIZE 2 1/8 to 1 7/8 in. TOTAL DEPTH 166.0 ft. DRILLED BY American Drilling & Boring Co., [illegible], Canning

GROUND EL (MSL) [illegible] DEPTH TO WATER/DATE 11.0 ft June 11, 1971 LOGGED BY [illegible]

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)	(Type, texture, mineralogy, color, hardness, etc.)
											CONTINUED FROM PREVIOUS PAGE	
	139 / 140	NQ-35	100	10.5	92				N71W, 25NE J		D	
-80		NQ-36	98	2.0	98						D	
									N63W, 60NE J		D	
	150	NQ-37	100	2.0	93				N19E, 62SE J; N11E, 70SE J		Slight wx. Fresh and hard. Joints and partings clean. Not chloritic.	Diorite. Predominantly fine-grained medium dark gray with patches of medium coarse quartz diorite.
		NQ-38	99	3.1	98				N61W, 54NE J		D	
									N65E, 19NW S; N55E, 29NE J			
	160	NQ-39	100	3.3	93							
	166	NQ-40	98	3.2	95				N25W, 20SW J			

BOTTOM OF BORING

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ☿ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: July [illegible], 1971 Project: [illegible]

PAGE 2 of 2 LOG OF BORING [illegible]

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N26321, E70179, Plant Site INCLINATION 41.5° BEARING S10 W DATE START/FINISH June 3, 1971 / June 5, 1971

CASING ID 3 in. CORE SIZE 2-1/8 - 1-7/8 in. TOTAL DEPTH 165.0 ft DRILLED BY American Drilling & Boring; A. Whitaker

GROUND EL (MSL) 13.9 ft DEPTH TO WATER DATE ft June 1, 1971 LOGGED BY Soil K. Cole; Rock J. R. Rand

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm psi	Computed k 10^{-1} cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)
13.9		1)							
	10 / 11.5							TOP	OF ROCK
									21
		NQ-2	91	5.0	0				N85W, 80NE S
0		NQ-3	100	6.0	37				N74W, 35NE J
	20								N58E, 19NW S
		NQ-4	100	6.0	8				
		NQ-5	100	6.0	42				N75E, 82NW J; N63E, 83NW J
	30	NQ-6	100	3.0	19				N88E, 82NW S
		NQ-7	100	3.0	99				N80E, 3SE J; N83E, 39NW S
	40	NQ-8	100	3.0	57				N50W, 85NE S
-20		NQ-9	100	3.0	73				
	50	NQ-10	100	3.0	67				
	60	NQ-11	100	4.0	67				
-40	70	NQ-12	98	4.0	73				
	80	NQ-13	100	4.0	73				
-60	90	NQ-14	100	5.0	49				
	100	NQ-15	98	5.0	73				
	110	NQ-16	91	5.0	65				
-80	120	NQ-17	100	4.0	80				
	130	NQ-18	102	5.0	80				
	140								

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

Rusty / Rusty / Rusty / Minor chlorite / Minor chlorite — Generally fresh and hard internally. Some minor chlorite on joints and partings. — Foliated quartzite — Diorite. Mixed fine-grained foliated diorite (?) or quartzitic schist and medium coarse quartz diorite.

Severe wx — tionable. — Foliated quartzite(?)

Minor chlorite / Chips / D — Fresh and hard. Joints and partings clean. Some minor chlorite. — Diorite. Fine-grained dark gray locally resembles quartzite with zones of medium coarse quartz diorite.

Minor chlorite

Slight wx — Fresh and hard. Joints or partings not chloritic. — Diorite (?) to dioritized quartzitic schist (?). Fine to medium grained, medium dark gray feldspathic rock.

Diorite. Medium, medium gray.

Moderate wx — Fresh and hard. Joints and partings not notably chloritic.

Metaquartzite (?). Fine grained, medium dark gray, fairly weak foliated.

Minor chlorite / Pyrite — Fresh and hard. Some joints or partings show minor chlorite. — Pyrite / Welded breccia — Metaquartzite (?). Schist. Fine-grained medium dark gray. Locally well foliated.

Chlorite / Polished-conchoidal

2.7' — Fused contact

Minor chlorite — Fresh and hard. Some joints or partings have minor chlorite surface ... chlorite development. — Diorite. Predominantly granodiorite, saussuritized feldspars. Medium-coarse grained. Local patches of fine-grained diorite (?) or quartzite(?). Locally foliated.

Minor chlorite / Slight wx / Minor chlorite

1' core unaccounted for — Fresh and hard. Joints and partings locally show minor chloritic surfaces. — Metaquartzite (?) or diorite (?). Fine-grained, medium dark gray. Generally foliated rock.

Minor chlorite / Minor chlorite / Minor chlorite

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
∇ Groundwater
D - Drilling break
k - Coefficient of permeability
wx - Weathered, weathering

LEGEND

NOTES

1) - Washed through soil 0 - 11.5 ft. No soil samples taken.

2) - This is only a partial list of dip and strike data. Orientation discontinued at 42 ft.

x - Oriented core

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

United Engineers & Constructors Inc.

Date: July 2, 1971 Project 7268

PAGE 1 of 2 LOG OF BORING 12-15

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N26121, E79179, Plant Site INCLINATION 11.5° BEARING S10°W DATE START/FINISH June 3, 1974 / June 5, 1974

CASING ID 3 in. CORE SIZE 2-1/8 - 1-7/8 in. TOTAL DEPTH 165.0 ft DRILLED BY American Drilling & Boring; A. Whitaker

GROUND EL (MSL) +17.9 ft DEPTH TO WATER DATE ___ ft June 1, 1974 LOGGED BY Soil - K. Fok Rock - J. R. Rand

EL. MSL ft	SAMPLE Depth ft	SAMPLE Type and No.	SAMPLE N or Rec.	RATE OF ADV min./ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm psi	PRESSURE TEST Computed k 10^{-1} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)			(Type, texture, mineralogy, color, hardness, etc.)
											CONTINUED FROM PREVIOUS PAGE			
	140										Minor chlorite	Fresh and hard. Drills well. Some minor smooth chlorite development on some joints or partings.		Metaquartzite (?). Fine-grained medium dark gray, locally feldspathized. Local vague banding or foliation.
-100		Q-1	95	5.0	81						Minor chlorite			
	150													
		Q-2	104	5.0	76						Chlorite	Fresh and hard. Some thin chlorite on joints as shown.		Metaquartzite (?). Fine-grained, medium dark gray vaguely foliated.
	160													
		Q-2	101	3.0	75						Chlorite			
	165													
							BOTTOM OF BORING							

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ⊻ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
ws - Weathered, weathering

NOTES

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers

Date: July 2, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING E2-15

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N20227, E79130, Plant Site INCLINATION 0° BEARING S78°E DATE START/FINISH May 20, 1971 / May 29, 1971

CASING ID 3 in. CORE SIZE 2-1/8 - 1-7/8 in. TOTAL DEPTH 165.2 ft DRILLED BY American Drilling & Boring Co.; A. Whitaker

GROUND EL (MSL) 17.5 ft DEPTH TO WATER/DATE 2.5 ft May 29, 1971 LOGGED BY Soil - S. L. Poll; Rock - L. R. Bond

EL. MSL ft	Sample Depth ft	Type and No.	N or Rec.	Rate of Adv. min/ft	Water Content % or RQD	Strike, Dip (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)
17.5		1)			2)	
+10	0.5	NX-1	12/60"			TOP OF ROCK
	10	NX-2	83	4.0	60	3)
0		NX-3	59	1.0	15	N36E, 28NW J
	20	NQ-4	88	1.0	12	N 5W, 55SW S
						N18W, 58SW J
		NQ-5	100	3.0	41	N15W, 64SW J
	30	NQ-6	96	3.0	0	N15W, 61SW J
						N21W, 68SW J
-20		NQ-7	100	2.0	69	N 8W, 17SW J
						N46W, 30NE F
		NQ-8	100	3.0	60	
	40					N11W, 83SW J
		NQ-9	100	1.0	68	N57E, 38NW J
						N10E, 69NW J
		NQ-10	100	3.0	40	N11E, 61NW S
	50					N70E, 16NW J
						N16E, 81NW J
		NQ-11	98	3.0	45	N15E, 78SE S
-40		NQ-12	100	3.0	80	N27E, 77NW J
	60					N51E, 47NW S
		NQ-13	100	1.0	45	
		NQ-14	100	4.0	83	
	70	NQ-15	100	1.0	70	
-60		NQ-16	100	1.0	83	N31E, 28NW J
						N20E, 73NW J
	80					N19E, 37NW J
						N26E, 38NW J
		NQ-17	98	6.0	88	
		NQ-18	98	6.0	60	N22E, 31NW J
	90					N55W, 82NE J
		NQ-19	69	6.0	52	
-80						N20E, 33NW S
		NQ-20	100	4.0	89	
	100					N53E, 69NW J
						N12E, 28SE J
		NQ-21	100	4.0	92	N 5W, 60SW S
						N11W, 85SW S
		NQ-22	100	4.0	75	
	110					N25W, 81SW S
		NQ-23	98	1.0	59	N36E, 50NW S
						N23E, 32NW J
-100		NQ-24	100	4.0	65	N29E, 72NW J
	120					N25E, 35NW J
		NQ-25	100	5.0	48	N35E, 22NW S
						N30E, 21NW C
		NQ-26	100	1.0	73	N61E, 56SW S
	130					N35W, 77SW J
		NQ-27	100	3.0	57	N23W, 76SW S
						N35E, 35NW S
-120		NQ-28	100	2.0	0	
	140					N21E, 30NW S
		NQ-29	100	1.0	50	N51E, 15NW S
						N58E, 67NW S
	145.2					

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.) / (Type, texture, mineralogy, color, hardness, etc.)

Cored fill and boulders.

Minor rusty. Slight wx. 1' core lost. Minor rusty. D. Minor rusty.
Fresh and hard. Local slight surface wx effects. Rust on joints and partings.
Diorite. Mixed fine-grained medium dark gray and medium-coarse grained medium gray. Moderate saussuritization of feldspars. Fine-grained rock is magnetic.

Slight wx.
Fresh and hard. Only minor surface powdery wx effects on joint and parting surfaces. Magnetic.
Welded breccia.
Diorite. Fine grained, medium dark gray. Generally massive texture. Magnetic (apparently disseminated pyrrhotite).

Vuggy.
Fresh and hard. Only minor powdery wx effects on joints and partings. Magnetic. Appears to be finely disseminated. Pyrrhotite.
Diorite. Fine-grained, medium dark gray. Magnetic. Locally well foliated.

Slippery-on foliation.
Fresh and hard. Drills very well. Joints and partings show only minor surface wx effects. Magnetic.
Diorite (?). Fine-grained, medium dark gray. Somewhat resembles impure quartzite. Pyrrhotite disseminated.

Medium-grained, greenish gray diorite. Moderate saussuritization.

Fresh and hard. Drills well. Joints and partings are generally clean. Minor surface wx effects.
Chips. Mismatch. D.
Bleached.
Diorite. Fine to medium fine-grained, medium dark gray. Magnetic feldspars moderately saussuritized.

Slight wx.
Fresh and hard. Drills fairly well. Local slight surface wx effects on some joints.
Slight wx. Minor vuggy.
Diorite. Fine to medium fine grained, medium dark gray. Locally quartzose. Magnetic.

Bleach.
Slight wx.
Fresh and hard. Slight wx effects on joints. Moderate wx 136.7 to 137.1'.
Diorite. Fine to medium fine grained, medium dark gray. Massive. Disseminated pyrrhotite. Magnetic.

Minor chlorite. Slight wx. Slight wx. Moderate wx. Severe wx. Pyrite. Vuggy.
Fresh and hard, except soft, severe wx at 138-138.7'. Minor chlorite on some joints.
Diorite. Fine grained medium dark gray. Generally massive. Locally foliated. Magnetic.

LEGEND
- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample
- U - Undisturbed samples
  - S - Shelby tube
  - F - Fixed piston
  - O - Osterberg
  - N - Denison
  - P - Pitcher
  - G - GEI
- ▽ Groundwater
- D - Drilling break
- k - Coefficient of permeability
- wx - Weathered, weathering
- x - Oriented core

NOTES
1) - Washed through soil 0-5 ft. No sample taken.
2) - No clays sampled; therefore no water contents were determined.
3) - This is only a partial list of dip and strike data.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: June 28, 1971 Project 7286

PAGE 1 of 2 LOG OF BORING 12-16

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N202227, E79130; Plant Site   INCLINATION 0°   BEARING S78 E   DATE START/FINISH May 20, 1971 / May 29, 1971

CASING ID 3 in.   CORE SIZE 2-1/8 x 1-7/8 in.   TOTAL DEPTH 165.2 ft   DRILLED BY American Drilling & Boring Co. - A. Whitaker

GROUND EL (MSL) 16 ft   DEPTH TO WATER/DATE 2.5 ft May 29, 1971   LOGGED BY Soil G. L. Poll, Rock A. B. Bond

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm psi	Computed k 10⁻⁴ cm/sec	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding)	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)		(Type, texture, mineralogy, color, hardness, etc.)
	145.2	NQ-30	100	1.0	32				N10E, 68NW S; N82E, 77NW S		Minor chlorite; D		Foliated
	150	NQ-31	100	1.0	82				N37W, 90SW S; N31W, 56NE S; N59W, 53NE S		Pyrrhotite	Fresh and hard. Excellent drilling.	
-120		NQ-32	100	4.0	92						D		
	160	NQ-33	100	1.0	100				N10W, 72SW S		Bleached		Welded breccia. Diorite. Medium-fine grained, medium dark gray. Massive. Magnetic.
	165.2							BOTTOM	OF BORING				

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample   ∇ Groundwater
U - Undisturbed samples
S - Shelby tube   N - Denison
F - Fixed piston   P - Pitcher
O - Osterberg   G - GEI
D - Drilling break   k - Coefficient of permeability
WX - Weathered, weathering

NOTES

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: June 28, 1971   Project 7286

PAGE 2 of 2   LOG OF BORING E2-16

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N20117, E79224, Plant Site INCLINATION 0° BEARING N6.5E DATE START/FINISH May 30, 1974 / June 5, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 165.0 ft DRILLED BY American Drilling & Boring; T. Canning

GROUND EL. (MSL) 13.3 ft DEPTH TO WATER/DATE ft June 5, 1974 LOGGED BY Soil - K. Polk Rock - J. R. Rand

EL. MSL ft	Depth ft	Sample Type and No.	N or Rec.	Rate of Adv. min/ft	Water content or RQD %	Strike, Dip
13.3		1)				
	19.6					TOP OF ROCK 3)
	20	2)				
		NQ-1	100	*	0	
		NQ-2	80	*	0	
		NQ-3	82	1.8	0	N37E, 34NW J
	30	NQ-4	100	2.0	21	N87W, 87SW J
		NQ-5	95	2.0	96	N17W, 77NE J
		NQ-6	80	1.8	0	
	40	NQ-7	100	2.1	73	N50W, 78NE S; N61E, 52NE J
-20		NQ-8	100	1.9	28	N51E, 21NE J
		NQ-9	100	2.0	61	
	50	NQ-10	100	2.0	29	
		NQ-11	100	2.1	53	N55W, 80NE J
		NQ-12	100	2.8	60	N68E, 80NF S
	60	NQ-13	100	3.1	48	N71W, 89NE S
		NQ-14	100	2.8	38	
-40	70	NQ-15	97	2.0	33	
		NQ-16	100	2.0	21	
	80	NQ-17	100	2.1	60	
		NQ-18	90	2.9	0	
	90	NQ-19	90	2.0	32	
-60		NQ-20	100	2.0	22	
	100	NQ-21	100	2.1	49	
	110	NQ-22	100	2.1	64	
		NQ-23	100	1.5	100	
-80	120	NQ-24	88	2.3	95	
	130	NQ-25	100	2.1	94	
	135					

Strike, Dip: F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside

SOIL AND ROCK DESCRIPTIONS

(Weathering, defects, etc.) / (Type, texture, mineralogy, color, hardness, etc.)

- Core is closely broken by rusty and wx joints and partings. — Diorite. Medium grained quartz diorite.
- Slight wx on coatings. Fresh and hard. Joints or partings show slight wx effects. Does not core well. Close breaks. — Grades into well-foliated quartzitic schist. Schist is locally feldspathic. (Diorite)
- Slight wx effects. — Quartzitic schist. Fine to medium-fine grained medium gray. Well foliated. (Welded breccia)
- Chips, Chlorite, Chlorite polishing, Chlorite polishing, Chlorite polishing. Fresh and hard. Conchoidal jointing shows polished surfaces (of other #2 holes). — Quartzite (?) to quartzitic schist. Fine-grained, medium gray. Well foliated. (Welded breccia)
- Slight to mod. wx, Minor chlorite, Minor chlorite, Chlorite polish, Polish-chips. Fresh and hard. Local chlorite and conchoidal polish on some joint surfaces. — Metaquartzite (?). Fine-grained, medium dark gray. Massive to vaguely banded rock. Somewhat feldspathic.
- Slight wx. Closely-spaced jointing. Attitude not known. — Metaquartzite (?). Fine-grained, medium dark gray. Quite massive texture.
- Polished-slight wx, Polished, Polished. Generally fresh. Locally subject to slight to moderate wx.
- Moderate wx. Fresh and hard. Drills well. Some very minor chlorite locally on some joints or partings. — Quartzite (?). Fine-grained, medium dark gray, vaguely banded or foliated. Locally feldspathic. "Metaquartzite"
- Chlorite, Chlorite, Chlorite-polish. Fresh and hard. Generally drills well. Polished conchoidal surfaces locally on joint — Metaquartzite (?). Fine-grained, medium dark gray. Vaguely banded.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample
- ∇ Groundwater
- U - Undisturbed samples
  - S - Shelby tube
  - N - Denison
  - F - Fixed piston
  - P - Pitcher
  - O - Osterberg
  - G - GEI
- D - Drilling break
- k - Coefficient of permeability
- wx - Weathered, weathering

NOTES

1) - Washed through soil 0-19 ft. No samples taken.
2) - Roller bitted from 19 to 22 ft.
3) - This is only a partial list of dip and strike data. Orientation discontinued @ 65 ft.

* Not available.

x - Oriented core.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

United Engineers

Date: July 3, 1974 Project 7286

PAGE 1 of 2 LOG OF BORING F2-12

GEOTECHNICAL ENGINEERS INC.

BORING LOCATION N20117, E70221; Plant Site INCLINATION 0° BEARING N6.5E DATE START/FINISH May 30, 1971 / June 5, 1971

CASING ID 3 in. CORE SIZE 1 7/8 in. TOTAL DEPTH 165.0 ft DRILLED BY American Drilling & Boring, T. Canning

GROUND EL (MSL) [illegible] ft DEPTH TO WATER/DATE 2.2 ft, June 5, 1971 LOGGED BY [illegible] J. H. Reed

EL. MSL ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm/psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)		(Type, texture, mineralogy, color, hardness, etc.)
											CONTINUED FROM PREVIOUS PAGE		
	135												
-100		NQ-26	98	2.5	81								
	140										Minor chlorite		
	150	NQ-27	100	2.9	75						Slight wx Polish Polish Pyrite	Fresh and hard. Conchoidal and fused polished surfaces on some joints as shown.	Metaquartzite (?). Feldspathic. Fine to medium grained, medium gray. Only vague local foliation.
	160	NQ-28	89	2.5	25								
-120	165	NQ-29	100	3.0	55								

BOTTOM OF BORING

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ☿ Groundwater
U - Undisturbed samples
S - Shelby tube D - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers

Date July 3, 1971 Project 7286

PAGE 2 of 2 NO. OF BORING E2-17

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N20270, E79272 (Plant Site) INCLINATION 30° BEARING N68.5W DATE START/FINISH May 22, 1971 / May 25, 1971

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 168.0 ft DRILLED BY American Drilling & Boring Co. T. Canning

GROUND EL (MSL) 14.9 ft DEPTH TO WATER DATE 29 in. ft May 24, 1971 LOGGED BY Soil - L. Poll, Rock - J. R. Rand

EL. MSL. ft	SAMPLE Depth ft	Type and No.	N or Rec.	RATE OF ADV min/ft	WATER CONTENT or RQD %	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding, S = Slickenside)
+14.9		3)			2)	
	14.0	TOP OF ROCK				
		NQ-1	100	1.7	23	
		NQ-2	100	2.0	0	
0	20	NQ-3	100	1.9	14	
		NQ-4	100	2.1	10	N28W, 50SW S
		NQ-5	100	2.2	0	
	30	NQ-6	100	1.5	0	
		NQ-7	100	3.8	17	
		NQ-8	100	3.9	53	N53E, 25SE J
		NQ-9	100	1.3	0	
	40	NQ-10	95	1.5	36	N 5E, 73SE J; N55E, 25SE J
-20		NQ-11	100	1.1	39	
		NQ-12	100	2.7	67	N30W, 72NE J
	50	NQ-13	100	2.3	67	N87E, 86SE S; N25E, 81SE J; N18W, 44SW S
		NQ-14	98	2.6	67	N 8W, 69SW S
	60	NQ-15	100	3.5	93	N50W, 87NE S
		NQ-16	100	2.9	82	N63W, 71NE S; N64E, 80SW J; N45E, 85NW J
	70	NQ-17	100	3.4	65	
-40		NQ-18	100	3.5	69	N55W, 61NE J; N14W, 68NE J
		NQ-19	92	3.5	71	N20W, 66NE S
	80	NQ-20	50	3.1	0	
		NQ-21	46	3.0	9	
	90	NQ-22	78	3.4	0	
		NQ-23	100	*	0	
		NQ-24	100	3.3	12	
		NQ-25	100	3.2	26	
-60	100	NQ-26	100	3.0	31	
		NQ-27	100	3.5	12	
		NQ-28	92	3.0	31	
	110	NQ-29	100	3.0	72	
		NQ-30	100	3.2	80	
	120	NQ-31	100	3.7	68	
-80		NQ-32	100	4.0	67	N37W, 44SW S; N 1E, 76SE J
	130	NQ-33	100	3.6	85	N11W, 67NE J; N61E, 1NW S
		NQ-34	100	5.9	90	N77W, 50NE S; N54E, 68SE J
		NQ-35	87	1.9	12	
	140	NQ-36	100	6.0	50	
		NQ-37	100	1.[illegible]	67	N32W, 50NE S; N19E, 63SE S; N15E, 25NW
	148					

SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.) (Type, texture, mineralogy, color, hardness, etc.)

- Slight wx. Slight wx. Rock broken on close chlorite coated joints. Minor to moderate chlorite on joints. — Fresh. Some slight wx on closely-spaced joints. Joints have minor chlorite coatings. — Diorite (?). Fine-grained medium dark gray. Looks somewhat like quartzite. Magnetic.
- Powdery wx. Slight to moderate wx - stained. Slight wx. Chips - moderate wx. — Fresh, intermittent slight to moderate wx on joint zones. Some minor bleaching. Minor rust. Magnetic. — Mixed fine quartzose diorite. Medium dark gray. May be metaquartzite (?). Rock is magnetic. Apparently disseminated pyrrhotite.
- Slight wx. Minor chlorite. Slight rusty. D — Fresh and hard. Not affected by wx. Joints and partings are not slickensided. Minor powdery wx effects only on joints. — (?)Quartzite. Fine-grained medium gray, locally feldspathized to medium coarse-grained, medium light gray quartz diorite(?). Feldspathized. Feldspar porphyroblasts.
- Minor chlorite. Slight wx. Slight wx. Chips-moderate wx. Slight chlorite. — Fresh and hard internally. Some local slight to moderate wx. No rust. — Diorite. Mixed fine-grained medium-dark gray diorite and medium to medium coarse grained diorite. Feldspars show saussuritization. Magnetic.
- Chips - 2.2' core lost - rock looks Ok. No chlorite. 2' core lost. Chips-chlorite. Chlorite. Chips. — Rock which was recovered is fresh and hard. Fresh internally. Cut by closely-spaced chlorite coated joints. (See Boring E2-1.) — Diorite. Fine-grained, medium dark gray. Locally medium-coarse grained, saussuritized. Magnetic.
- Chlorite-Slight-mod. wx. Chips-chlorite coated joints. Pyrite. — Fresh and hard. Chlorite-coated joints 102.6' to 105.6'. Joints and partings generally fresh. — Diorite. Fine to medium-fine grained medium dark gray. Magnetic. Slight greenish tinge.
- Fresh and hard. Drills well. No chlorite on joints. Joints and partings show only minor surface wx effects. — Diorite. Mixed fine-grained medium gray diorite and medium coarse grained gray quartz diorite. Magnetic disseminated pyrrhotite, local 1-2" feldspar porphyroblasts.
- Vertical joint. Slight wx. — Fresh and hard. Most joints are clean. Local minor chlorite partings. — Diorite. Fine-grained, medium dark gray. Massive. Magnetic. Disseminated pyrrhotite. Feldspathized.

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample ∇ Groundwater
U - Undisturbed samples
S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI
D - Drilling break k - Coefficient of permeability
wx - Weathered, weathering

NOTES

1) - Roller bitted from 14.0 ft to 15.5 ft.
2) - No clays sampled; therefore no water contents were determined.
3) - Washed through soil 0-14 ft. No samples taken.

* - Not available.
x - Oriented core

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
United Engineers & Constructors Inc.

Date July 1, 1971 Project 7266

PAGE 1 of 2 LOG OF BORING [illegible]

GEOTECHNICAL ENGINEERS INC

BORING LOCATION N20270, E79272 ; [illegible] INCLINATION 39 BEARING N68.5W DATE START/FINISH May 22, 1974 / May 29, 1974

CASING ID 3 in. CORE SIZE 1-7/8 in. TOTAL DEPTH 168.0 ft DRILLED BY American Drilling & Boring Co., [illegible] Canning

GROUND EL (MSL) [illegible] ft DEPTH TO WATER/DATE 29.0 ft May 24, 1974 LOGGED BY [illegible]

EL. MSL ft	SAMPLE Depth ft	SAMPLE Type and No.	SAMPLE N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	Graphic	PRESSURE TEST gpm psi	Computed k 10^{-4} cm/sec	STRIKE, DIP F = Foliation J = Joint C = Contact B = Bedding S = Slickenside	CORE BREAKS	SOIL AND ROCK DESCRIPTIONS (Weathering, defects, etc.)		(Type, texture, mineralogy, color, hardness, etc.)
-100	148												
	150	NQ-38	100	5	87				30E, 28NW J		Minor chlorite		
									13W, 66NE J		Minor chlorite		
									19W, 86NE S		Pyrite		
		NQ-39	100	.0	25				52E, 66SE S		Chlorite		
									35E, 72SE S				
	160	NQ-40	97	8	80				36W, 53SW S		Pyrite	Fresh and hard. Some chlorite and pyrite on joints.	Diorite. Fine-grained, medium dark gray. Massive. Magnetic.
									50E, 67SE J				
		NQ-41	99	0	100				77W, 52SW J		Pyrite		
	168										Pyrite		
								BOTTOM	OF BORING				

LEGEND

N - Standard penetration resistance, blows/ft
Rec - Length recovered/length cored, %
RQD - Length of sound core 4 in. and longer/length cored, %
S - Split spoon sample
U - Undisturbed samples
Groundwater

S - Shelby tube N - Denison
F - Fixed piston P - Pitcher
O - Osterberg G - GEI

D - Drilling break
wx - Weathered, weathering
k - Coefficient of permeability

SEABROOK STATION
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
YANKEE ATOMIC ELECTRIC COMPANY
united engineers

Date Jul. 1, 1974 Project 7286

PAGE 2 of 2 LOG OF BORING [illegible]

GEOTECHNICAL ENGINEERS INC

APPENDIX I I

Project Seabrook
Project No. 7286

Boring No. E2-11

Ground Elevation (MSL) = + 25.0

Type of Feature

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
66.1	N21E	43MW	X				
70.2	N15E	64NW	X				
74.0	N13E	53NW	X				
75.9	N67W	45NE	X				
76.0	N12W	50SW			X		
76.1	N80 w	70NE			X		
77.0	N30W	69SW			X		
78.5	N86E	67NW	X				
81.1	N15W	62NW			X		
a2.9	N39E	15NW			X		
83.0	N45E	84NW			X		
84.0	N17W	49sw			X		
85.1	N50E	7SE	X			X	Diabase over Diorite
87.0	N14W	4osw	X				
87.4	N65E	80NW	X				
88.5	N65W	55NE	X				
99.3	N45E	72SE				X	Diorite over Diabase
99.9	N30E	75NW			X		
100.6	N55E	76NW				X	Diabase over Diorite
103.1	N50W	25SW	X				
105.5	N52E	68NW	X				
108.1	N35E	45NW	X				
108.9	N85E	86NW		X			
110.9	N38E	48NW	X				
110.9	N10E	85SE	X				
111.0	N50E	81NW	X				
111.1	N50E	81NW	X				
111.2	N50E	81NW	X				
112.0	N27W	72NE	X				
113.1	N65E	90NW	X				
113.4	N50E	53NW	X				
113.5	N15W	55NE	X				
114.0	N65W	55SW		X			
121.5	N75E	90NW		X			
123.5	N75E	39NW		X			
124.8	N75E	82NW					
129.3	N34E	19NW	X				
129.8	N29E	40NW	X				
129.9	N82E	37NW	X				
131.1	N33E	36NW	X				
133.1	N15E	50NW	X				
133.1	N15E	50NW					
133.2	N30W	75NE					
133.5	N25E	37NW	X				
134.5	N40E	41NW	X				
135.2	N43E	80NW	X				

Project Seabrook
Project No. 7286

Boring No. E2-11

Ground Elevation (MSL) = + 25.0

Type of Feature

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
137.5	N74W	61NE			X		
142.8	N44E	40NW	X				
143.3	N25E	40NW	X				
143.6	N47E	46NW	X				
143.8	N30E	45NW	X				
144.2	N25E	36NW	X				
144.8	N30E	45NW	X				
144.9	N20E	45NW	X				
145.4	N70W	80NE		X			
146.0	N31E	22NW	X				
147.4	N27E	32NW	X				
148.5	N70E	90NW		X			
149.6	N70W	71NE		X			
152.0	N26E	28NW	X				
154.4	N85E	70NW		X			
155.3	N63W	25NE		X			
158.2	N35E	41NW	X				
159.0	N18W	70NE	X				
161.0	N85W	16NE	X				
162.0	N30E	75NW	X				
163.1	N25E	45NW	X				
163.9	N70W	15NE	X				
164.8	N50W	43NE					

Boring No. E2-12

Project Seabrook
Project No. 7286

Ground Elevation (MSL) = ± 21.5

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
19.2	N18E	43NW	x				
19.8	N17E	46NW	X				
20.2	Horizontal		X				
21.2	North	21w	X				
21.9	N35E	25SE		X			
23.0	N23W	39SW	X				
24.0	N17E	47NW	X				
24.4	N50E	61SE	X				
25.1	Horizontal		X				
25.8	N38W	73NE	X				
27.1	N73W	15NE	X				
29.0	N41W	67NE	X				
35.1	N23E	47NW	X				
40.0	N73W	82SW		X			
44.3	N63W	37SW	X				
48.9	N12E	67NW	X				
50.4	N63E	45NW	X				
53.3	N40E	46NW	X				
57.3	N38E	52NW	X				
59.4	N34E	43NW	X				
60.0	N8W	79NE	X				
61.5	N51E	37NW	X				
75.0	N26W	86NE	X				
77.0	N75W	55SW	X				
77.5	N9E	48NW	X				
77.6	N9E	48NW	X				
82.0	N19W	81 SW	X				
82.4	N41E	40NW	X				
83.0	N81E	55SE	X				
85.7	N26E	65NW	X				
89.0	N35E	45NW				X	Diabase Dikelet
89.1	N35E	45NW	X			X	Diabase Dikelet
103.9	N28W	43sw	X				
108.0	N26E	37NW	X				
111.9	N65W	67SW	X				
114.3	N36E	45NW	x				
119.5	N35E	44NW	X				
119.6	N35E	44NW	X				
119.7	N60E	22NW	X				
132.1	N15E	12NW	X				
133.0	N40E	43NW	X				
136.0	N45E	12NE	X				
143.1	N35E	42NW	X				
143.9	N55E	50SE		X			
144.9	N75E	73SE		X			
153.7	N25E	37NW	X				
156.8	N25E	26NW	X				

Project Seabrook
Project No. 7286

Boring No. E2-13

Ground Elevation (MSL) = + 30.5

Type of Feature

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
23.6	N83E	28NW	X				
25.3	N40E	58SE	X				
28.7	N15E	75SE	X				
34.0	Horizontal		X				
34.5	N25E	12SE	X				
35.1	N30E	83SE	X				
35.7	N35E	22sw	X				
38.3	N32E	67SE	X				
39.2	N5W	31NE	X				
44.2	N65E	27NW	X				
49.5	N25E	67SE	X				
50.8	N34E	30SE	X				
50.9	N29E	51SE	X				
51.8	N55E	85SE					
52.5	N55E	11SE	X				
55.9	N28E	25NW	X				
62.8	N28E	64SE	X				
63.0	N32E	60SE	X				
64.3	N35E	66SE	X				
67.0	N79W	39sw	X				
70.5	N35W	63NE	X				
70.8	N40W	54NE	X				
76.8	N55E	7NW	X				
77.0	N50E	4NW	x				
77.3	N52E	22NW	X				
78.7	N53E	84SE	X				
81.2	N46E	86NW	X				
82.0	N67E	75SE	X				
83.8	N80E	30SE	X				
89.5	N83E	52SE	X				
90.3	East	58S	X				
98.8	N45E	21NW	X				
99.3	N51E	65SE	X				
100.6	N46E	58SE	X				
101.7	N23E	39sw	x				
102.8	N45E	87NW	X				
105.0	N15W	57NE.	X				
108.4	N21E	88SE	x				
110.4	N35E	88SE	X				
112.5	North	36W	X				
115.3	N19E	86SE				X	Diabase over Diorite
117.3	N67W	83SW	X				
117.8	Horizontal		X				
118.2	N40E	N40E				X	Diorite over Diabase
118.3	N45W	N40E				X	Diabase over Diorite
120.1	N30E	N45W	X				

Project Seabrook
Project No. 7286

Boring No. E2-13

Ground Elevation (MSL) = + 30.5

Type of Feature

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
121.8	N30E	38SE	X				
123.0	N70E	23NW		X			
123.7	N80W	37NE	X				
125.0	N50W	30NE	X				
125.4	N44E	57SE	X				
128.0	N16W	44NE	X				
129.3	N68W	54NE	X				
131.3	N56E	83NW				X	Diorite over Diabase
131.6	N15W	19%	X				
131.7	N45E	76SE	X			X	Diabase over Diorite
132.8	N60E	44SE	X				
134.1	N45E	35SE	X				
135.0	N42E	37SE	X				
13G.3	East	8NE	X				
136.8	N38E	73SE	X				
138.0	N50E	18NW	X				
139.3	N35E	43SE	X				
140.5	N31E	42SE	X				
142.4	N28E	30SE	X				
142.5	N40E	46NW	X				
145.0	N22E	45SE	X				
145.2	N22E	45SE	X				
149.7	N46E	63SE	X				
150.0	N34E	34SE	X				
150.5	N21E	73SE	X				
151.3	N56E	79NW	X				
151.7	N26E	48SE	X				
153.0	N30E	81SE	X				
154.7	N26E	78SE	X				
154.9	N38E	46SE	X				
157.4	N89E	86SE	X				
158.0	N75W	72SW	X				
159.9	N49E	66SE	X				
162.3	N55E	63SE	X				
163.7	N60E	70SE	X				
165.5	N67E	76SE	X				

Project Seabrook
Project NO. 7286

Boring No. E2-14

Ground Elevation (MSL) = + 29.9

Type of Feature

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
11.8	N65E	43NW	X				
12.0	N65W	77SW	X				
13.6	N83W	83NE	X				
13.8	N70W	42NE	X				
13.9	N70W	42NE	X				
14.5	N44E	69SE	X				
15.8	N37E	67SE	x				
16.5	N73W	72NE	X				
28.9	N28E	67SE	X				
29.0	N85E	26NW	X				
42.2	N22E	53SE	X				
43.2	N87E	37Nw	X				
44.0	N60W	69NE	X				
46.0	N43E	40NW	X				
50.8	N3W	67NE	X				
51.8	N57W	71NE	X				
53.2	N57W	41NE	X				
58.9	N30E	35NW	X				
62.5	N65W	14NE	X				
63.8	N71W	52NE	X				
65.3	N50E	42St	X				
65.4	N75E	38SE	X				
66.7	N42W	50NE	X				
67.0	N30E	30NW	X				
70.0	N45E	85NW				X	Diorite over Diabas
70.8	N30W	21NE	X				
72.9	N5E	49SE	X				
73.5	N43W	63NE	X				
74.6	N60E	55SE	X				
78.2	East	77s	X				
80.0	N15W	42SW	X				
80.2	N70E	12NW	X				
80.4	N49E	33NW	X				
iM.2	N46W	87NE	X				
85.0	N34W	82SW	X				
87.5	N6E	64SE	X				
87.8	N48W	14NE	X				
88.2	N3W	39NE	X				
89.3	N11E	77SE	X				
89.6	N65E	86SE	X				
94.3	N10E	68SE					
94.6	N59E	59SE					
99.3	N78E	40SE	X				

Project Seabrook
Project No. 7286

Boring No. E2-14

Ground Elevation (MSL) = + 29.9

Type of Feature

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
101.3	N75E	18NW	X				
103.8	N73E	46NW	X				
104.0	N77E	46NW	X				
105.0	N26E	38NW	X				
107.5	N50E	62SE	X				
108.0	N46E	63SE	X				
108.3	N21E	62SE	X				
109.8	N20W	61NE	X				
110.1	N45E	81SE	X				
110.4	N45E	81SE	X				
112.3	N22W	5SW	X				
112.4	N65E	38NW	X				
129.3	N40E	22NW		X			
129.5	N60E	33NW		X			
131.5	N55E	69SE	X				
131.9	N84W	75NE	X				
132.2	N50W	64NE	X				
133.5	N63E	72SE	X				
141.9	N71W	25NE	X				
142.5	N73W	20NE	x				
146.8	N63W	60NE	X				
148.9	N49E	62SE	X				
149.2	N75W	53NE	X				
150.0	N34E	70SE	X				
153.2	N61W	54NE	X				
154.6	N70W	39NE	X				
155.9	N65E	43NW					
158.0	N55E	29NE	X				
164.8	N25W	20SW		X			

Boring No. E2-15

Project Seabrook
Project No. 7286

Ground Elevation (MSL) = + 13.9

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
			Type of Feature				
17.0	N85W	80NE			X		
17.6	N85E	89NW		X			
18.G	N73W	70NE		X			
18.7	N45E	36NW	X				
19.4	N74W	35NE	X				
20.9	N69E	65NW			X		
21.7	N58E	49NW			X		
16.5	N82E	88NW			X		
24.9	Horizontal		X				
26.G	N75E	82NW		X			
27.G	N69E	83NW		X			
28.1	N77W	78NE			X		
30.0	N50W	78NE			X		
29.3	N63E	86SE			X		
31.0	N88E	82NW			X		
31.5	N86E	80NW			X		
32.0	N49W	73NE			X		
35.5	N80E	3SE		X			
37.5	N83E	39NW			X		
40.3	N50W	85NE			X		
41.5	N55W	86NE			X		
39.7	N60W	60NE			X		

Boring No. E2-16

Ground Elevation (MSL) = + 16.0

Project Seabro
Project No. 7286

Type of Feature

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
17.3	N36E	28NW	X				
18.3	N10W	56SW	X				
20.0	N5W	85SW			X		
20.6	N20W	70SW	X				
23.0	N18W	58SW	X				
23.5	N25E	15NW	X				
23.9	N25W	50SW	X				
24.3	N25W	53SW	X				
25.3	N45W	64SW	X				
25.9	N5E	86SE	X				
29.9	N15W	64SW	X				
30.0	N15W	64SW	X				
32.0	N21W	68SW	X				
33.9	N10W	68SW	X				
34.3	N8W	47SW	X				
35.0	N46W	30NE		X			
41.2	N11W	83SW	X				
41.7	N10W	55SW	X				
43.7	N57E	38NW	X				
44.5	N50E	30NW			X		
44.6	N52W	61NE			X		
45.1	N43E	69NW	X				
45.6	N19E	71NW	X				
46.1	N25E	89NW	X				
47.5	N44E	61NW			X		
48.0	N39W	67SW	X				
49.0	N70E	46NW	X				
50.0	N84W	68NE			X		
50.4	N42E	77NW	X				
52.4	N16E	84NW	X				
52.5	N16E	84NW	X				
53.0	Horizontal		X				
54.6	N15E	78SE			X		
56.9	N21E	69NW	X				
57.7	N27E	77NW	X				
58.2	N51E	47NW			X		
58.3	N86W	59NE			X		
58.13	N7E	62NW	X				
75.4	N31E	28NW	X				
77.4	N20E	73NW	X				
78.4	N43E	40NW	X				
79.7	N19E	37NW	X				
81.5	North	26W			X		
81.6	N26E	27NW			X		
82.3	N26E	38NW	X				
82.7	N15E	28NW	X				

Boring No. E2-16

Project Seabrook
Project No. 7286

Ground Elevation (MSL) = + 16.8

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
			Type of Feature				
83.8	N15E	25NW	X				
86.8	N22E	34NW	X				
87.5	N5E	76SE	X				
88.0	N55W	82NE	X				
89.0	N12W	74SW			X		
96.5	N20E	33NW			X		Trend=N35W Plunge=27
100.8	N53E	68NW	X				
102.5	N12E	28SE		X			
104.9	N5W	60SW			X		Trend=N71W Plunge=54
106.2	N41W	85SW			X		Trend=S34W Plunge=87
107.0	N50E	5NW			X		Trend=N66W Plunge=19
107.5	N30W	11NE		X			
101.9	N25W	81SW			X		Trend=S16E Plunge=18
109.1	N21W	45SW	X				
109.3	N41E	25NW	X				
110.9	N5W	84SW			X		Trend=S20W Plunge=70
111.1	Horizontal		X				
112.1	N36E	50NW			X		Trend=N71W Plunge=45
112.3	N15E	15NW			x		Trend=S60E Plunge=16
113.0	N5E	85NW			X		Trend=S55W Plunge=70
115.3	N23E	32NW	X				
115.4	N15E	20NW	X				
115.9	N20E	30NW	X				
116.9	N26E	32NW	X				
118.9	N29E	72NW	X				
121.3	N25E	35NW	X				
121.11	N70E	17SE			X		
121.8	N70W	74NE		X			
122.0	N30E	30NW	X				
123.1	N35E	22NW			X		Trend=N35W Plunge=22
124.3	N15W	81SW			X		
125.G	N30E	21NW	X				
126.7	N28W	84SW	X				
127.6	N61E	56SW			X		Trend=N60W Plunge=33
128.8	N48W	76 SW		X			
129.3	N35W	77SW			X		
130.1	N40W	24NE			X		
131.0	N15W	14NE		X			
131.2	N64W	51NE			X		
132.4	N23W	76 SW			X		
133.0	N5W	74SW			X		
133.0	N70E	30NW	X				
133.3	N40E	83SE	X				
133.5	N10W	11NE			X		
134.0	N35E	35NW			X		
134.3	N45W	45NE	X				

Boring No. E2-16

Ground Elevation (MSL) = + 16.8

Project Seabroo'
Project No. 7286

Feature Depth	Strike	Dip	Joint	Foliation	Slickcnsided Surface	Contact	Remarks
140.5	N21E	30NW			X		
142.2	N53E	45NW			X		Trend=N35E Pl unge=10
142.3	N41E	10NW			X		
143.1	N50E	65NW			X		
143.2	N71E	69NW			X		Trend=N40E Plunge=33
143.9	N81E	55NW			X		Trend=N35E Plunge=35
144.1	N72E	65NW			X		
144.1	N17E	54NW	X				
146.1	N59E	80NW			X		Trend= N5W Plunge=73
146.5	N37E	63NW			X		Trend=N20E Plunge=17
147.2	N40E	68NW			X		
147.5	N8W	48SW			X		
140.1	N59E	80NW			X		
148.2	N68E	62NW			X		
148.3	N82E	77NW			X		
149.5	N53E	65NW			X		
151.2	N27W	90SW			X		
151.8	Horizontal		X				
152.0	N81W	56NE			x		
154.0	N35E	29NW			X		
155.7	N59W	53NE			X		
162.0	N10W	72 SW			X		

Project Seabrook
Project No. 7286

Boring No. E2-17

Ground Elevation (MSL) = t 13.3

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
			Type of Feature				
28.0	N37E	34NW	X				
29.5	N55E	59sc	X				
33.3	N87W	87SW		X			
34.3	N47W	23NE			X		
35.9	N17W	77NE	X				
42.G	N50W	78NE			X		
43.4	N49E	23NE			X		
44.1	N61E	52NE	X				
45.0	N24W	10NE			X		
45.1	N49E	60NE			X		
45.3	N73E	84NE			X		
45.9	N51E	24NE	X				
54.7	N55W	80NE		X			
55.5	N78W	86NE			X		
56.0	N68E	80NE			X		
5G.2	N76W	86NE			X		
5G.3	N44E	64NE			X		
56.4	N44E	64NE			X		
60.5	N71W	89NE			X		

Boring No. E2-18

Ground Elevation (MSL) = + 14.9

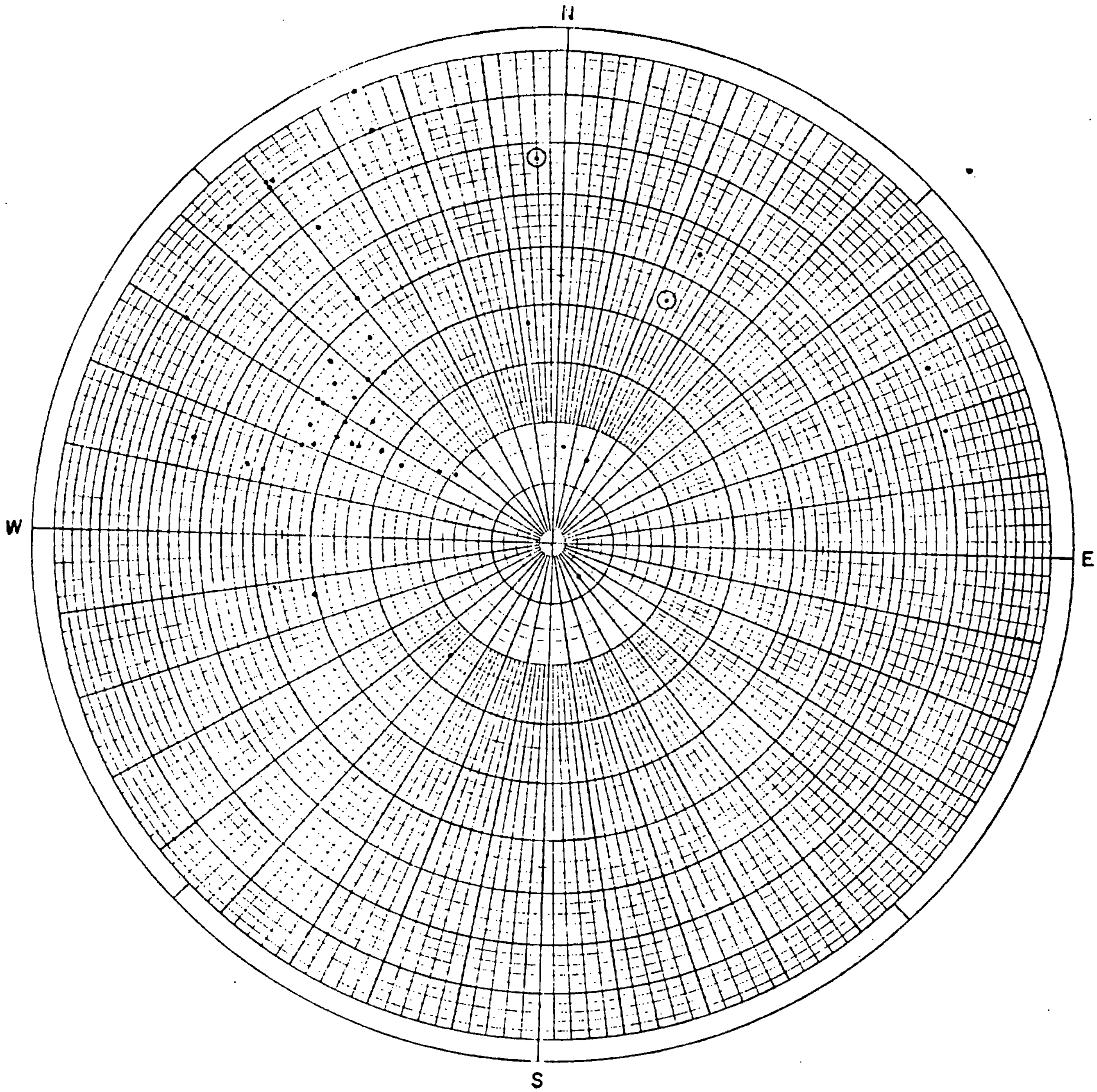
Project Seabrook
Project No. 7286

Feature Depth	Strike	Dip	Joint	Foliation	Slickensided Surface	Contact	Remarks
22.8	N28W	50SW			X		
36.0	N53E	25SE	X				
42.0	N5E	73SE	X				
42.6	N42E	64SE	X				
43.1	N55E	25SE	X				
44.0	N8W	45SW	X				
46.6	N30W	72NE	X				
57.0	N45W	75SW			X		
47.5	N40W	81SW			X		
49.1	N87E	86SE			X		
50.2	N87E	73SE			X		
50.3	N60W	36SW	X				
51.3	N25E	81SE	X				
53.0	N48W	44SW			X		
54.0	N8W	34SW			X		
54.1	N76W	56SW	X				
54.2	N73W	73SW			X		
54.3	N21E	70SE			X		
56.0	N8W	69SW			X		
57.11	North	East	X				
61.7	N50W	87NE			X		
64.6	N63W	74NE			X		
66.6	N64E	80SW	X				
67.3	N5W	52SW			X		Trend=N79W Plunge=18
67.9	N55E	89SE	X				
68.0	N45E	85NW	X				
68.3	N45E	85NW	X				
68.5	N23E	45NW	X				
72.2	N55W	61NE	X				
73.6	N45E	62SE	X				
74.8	N14W	68NE	X				
75.0	N42E	71SE	X				
76.0	N20W	66NE			X		
123.8	N37W	44SW			X		
125.0	N4E	76SE	X				
126.0	N21W	63NE			X		Trend=S62E Plunge=52
176.1	N6E	64SE			X		
126.3	N17W	64NE			X		
128.0	N14W	67NE	X				
129.6	N70E	53NW	X				
131.1	N64E	1NW			X		
132.5	N15W	68NE	X				
135.6	N77W	50NE			X		
137.1	N54E	68SE			X		
137.4	N42W	62NE			X		
143.9	N32W	50NE			X		Trend=S25E Plunge=38

APPENDIX I I I

APPENDIX III

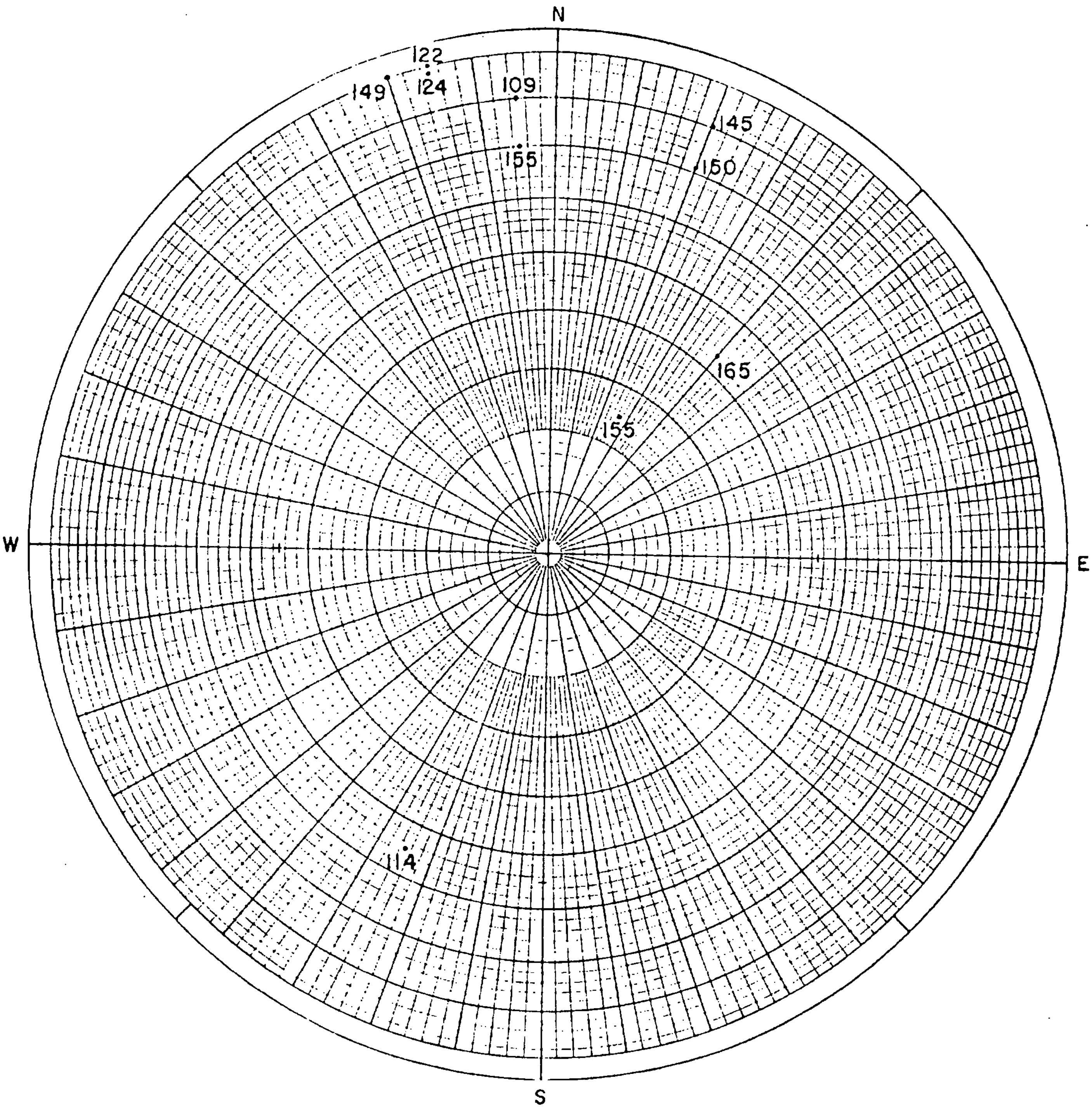
Polar Equal Area Stereo Net Projections



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-11
Ground Elevation (MSL) +25.5 ft
Joints in:

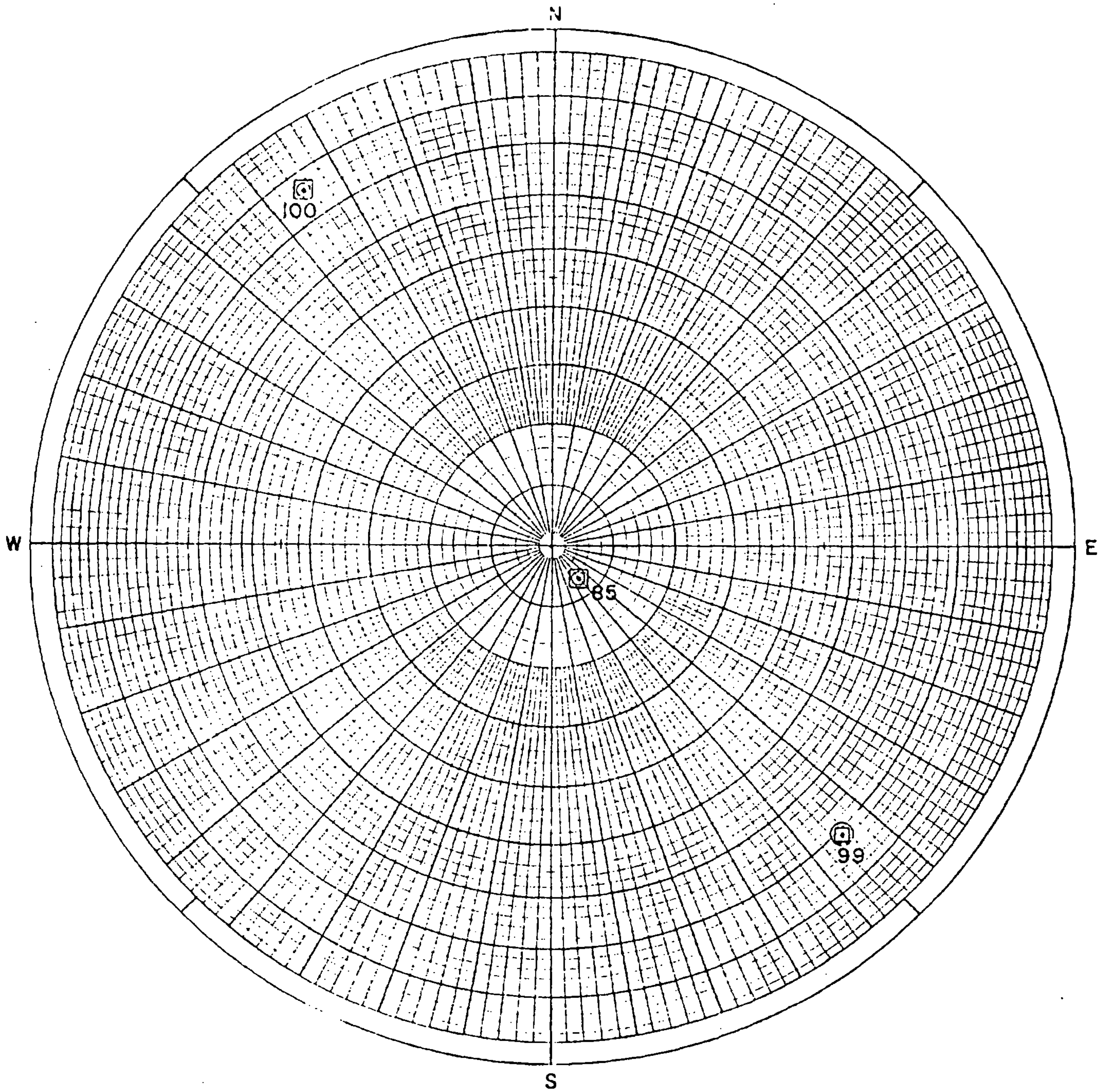
. Diorite
⊙ Diabase



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2 -11
Ground Elevation (MSL) +25.0 ft
Foliation in:

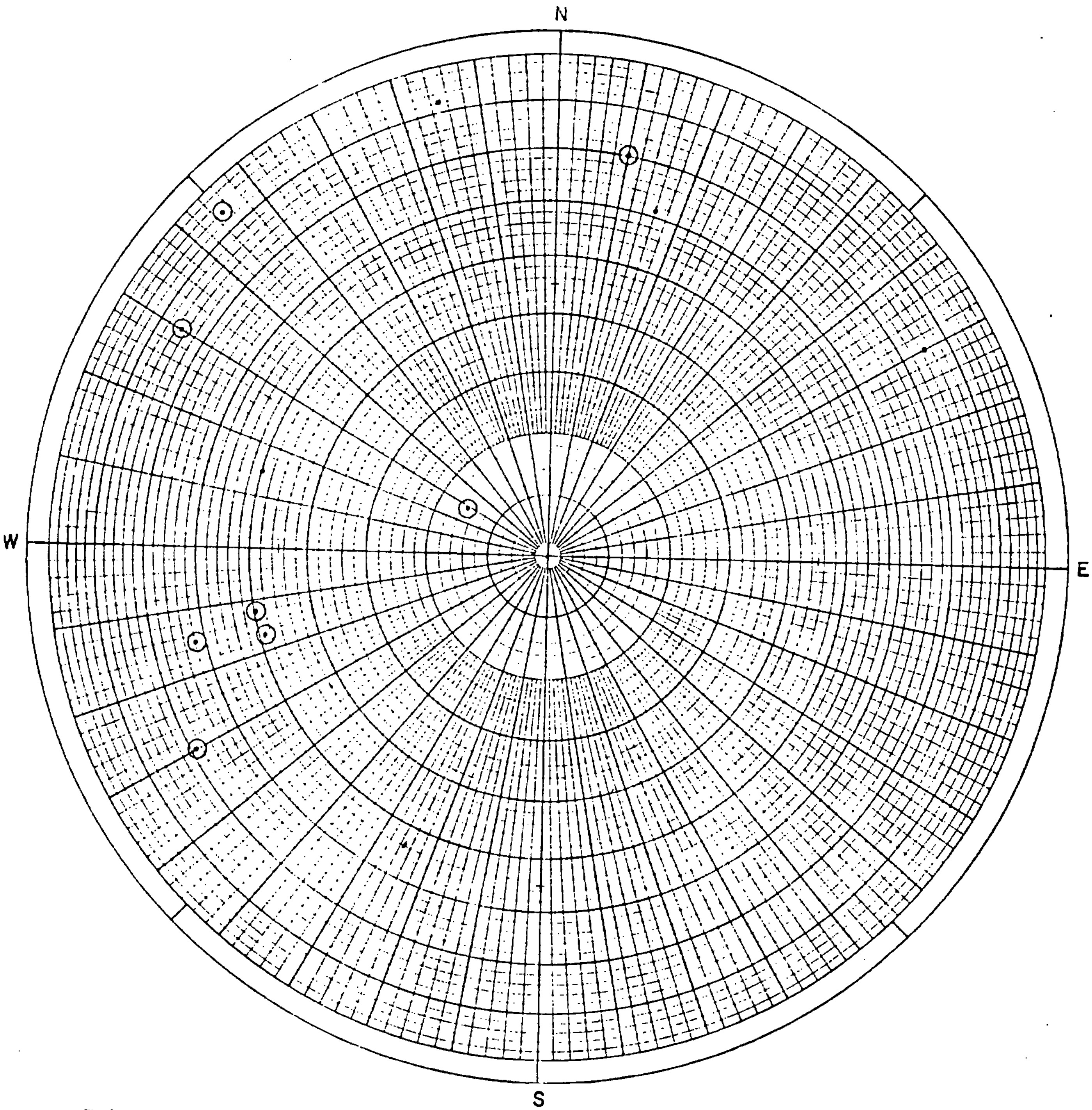
. Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-11
Ground Elevation (MSL) +25.0 ft
Contacts and Depth :

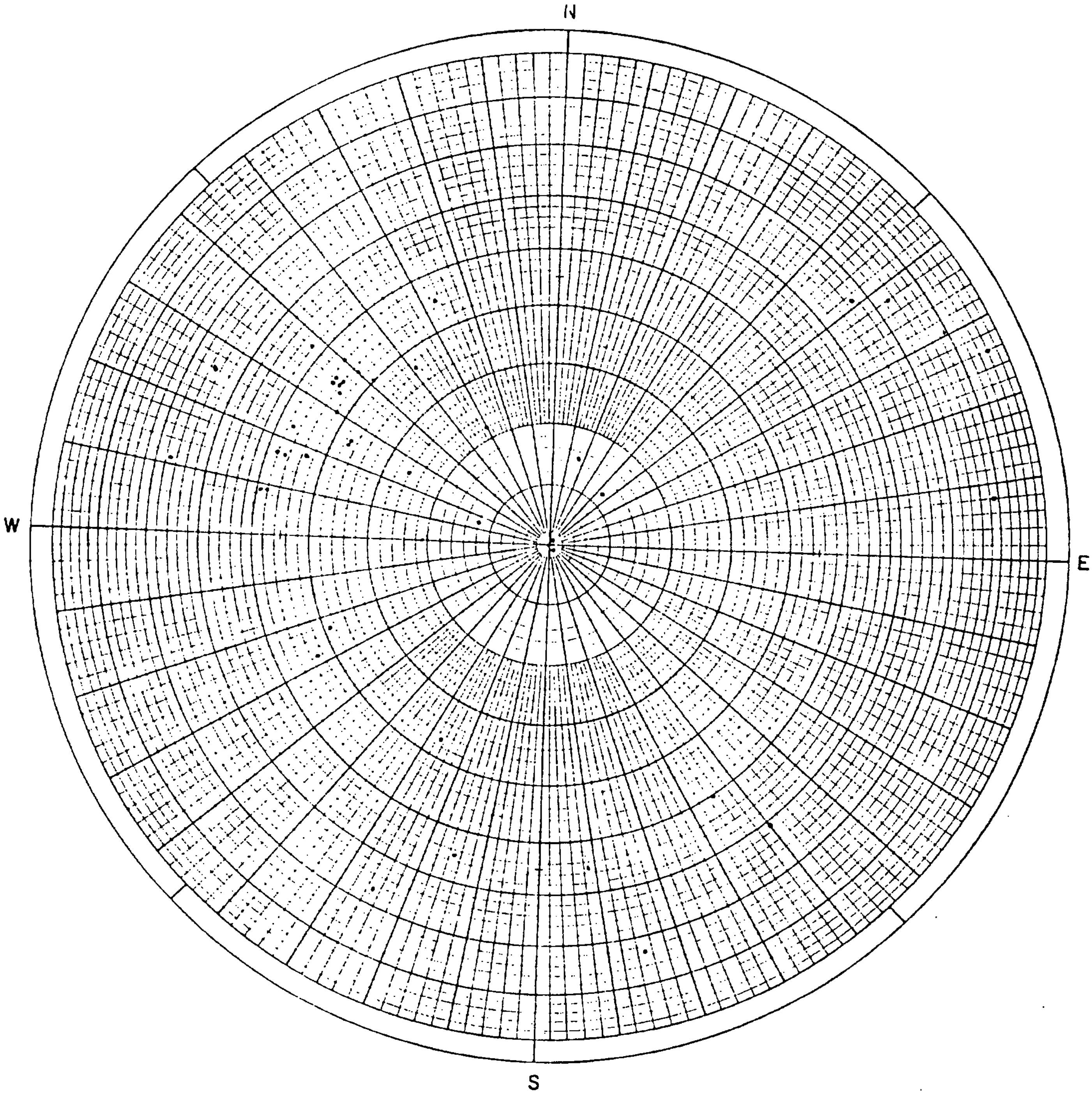
- Diorite over Diabase
- Diabase over Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-11
Ground Elevation (MSL) +25.0 ft
Slickensided Surfaces in:

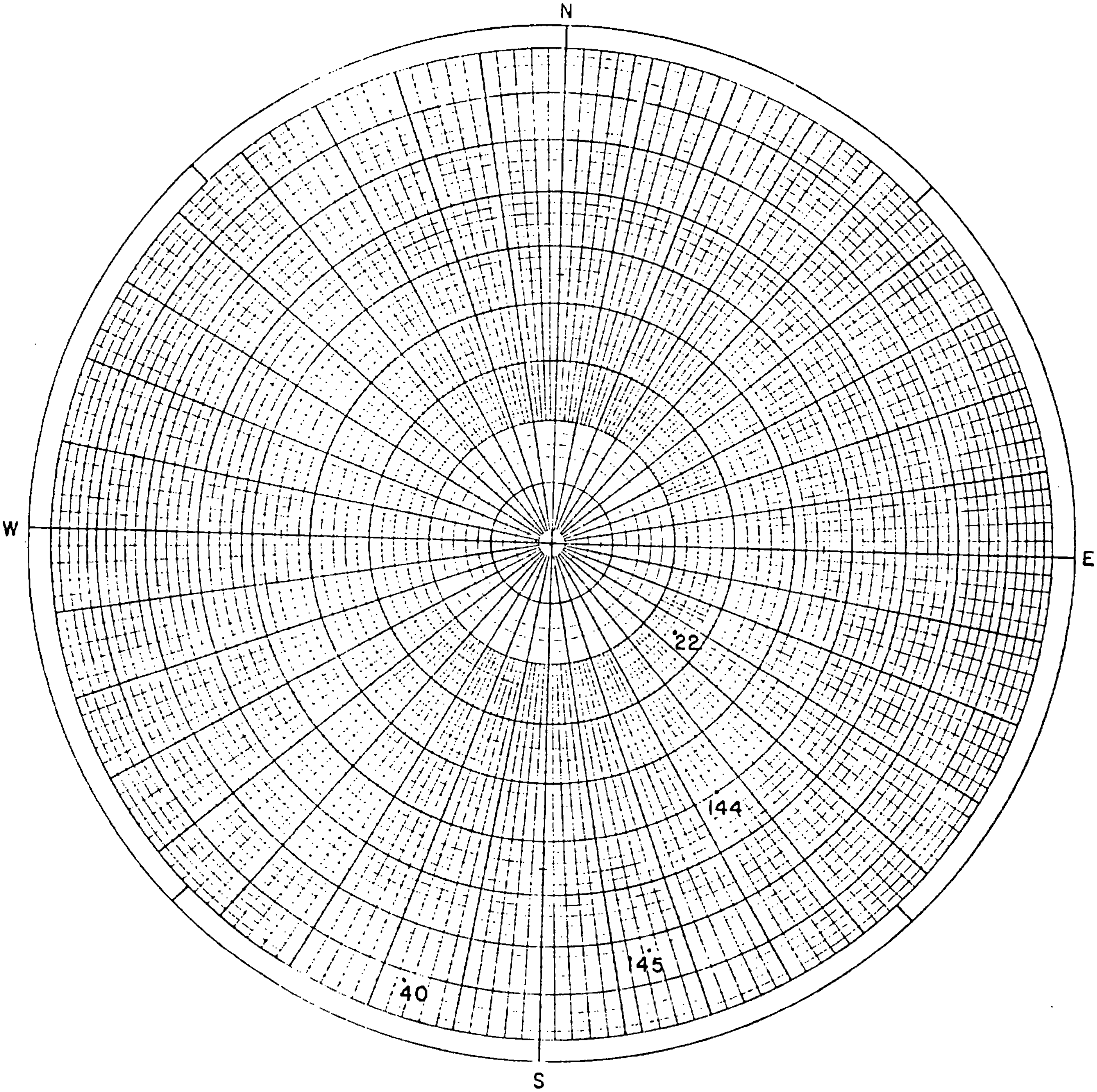
. Diorite
⊙ Diabase



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-12
Ground Elevation (MSL) +21.5 ft
Joints in

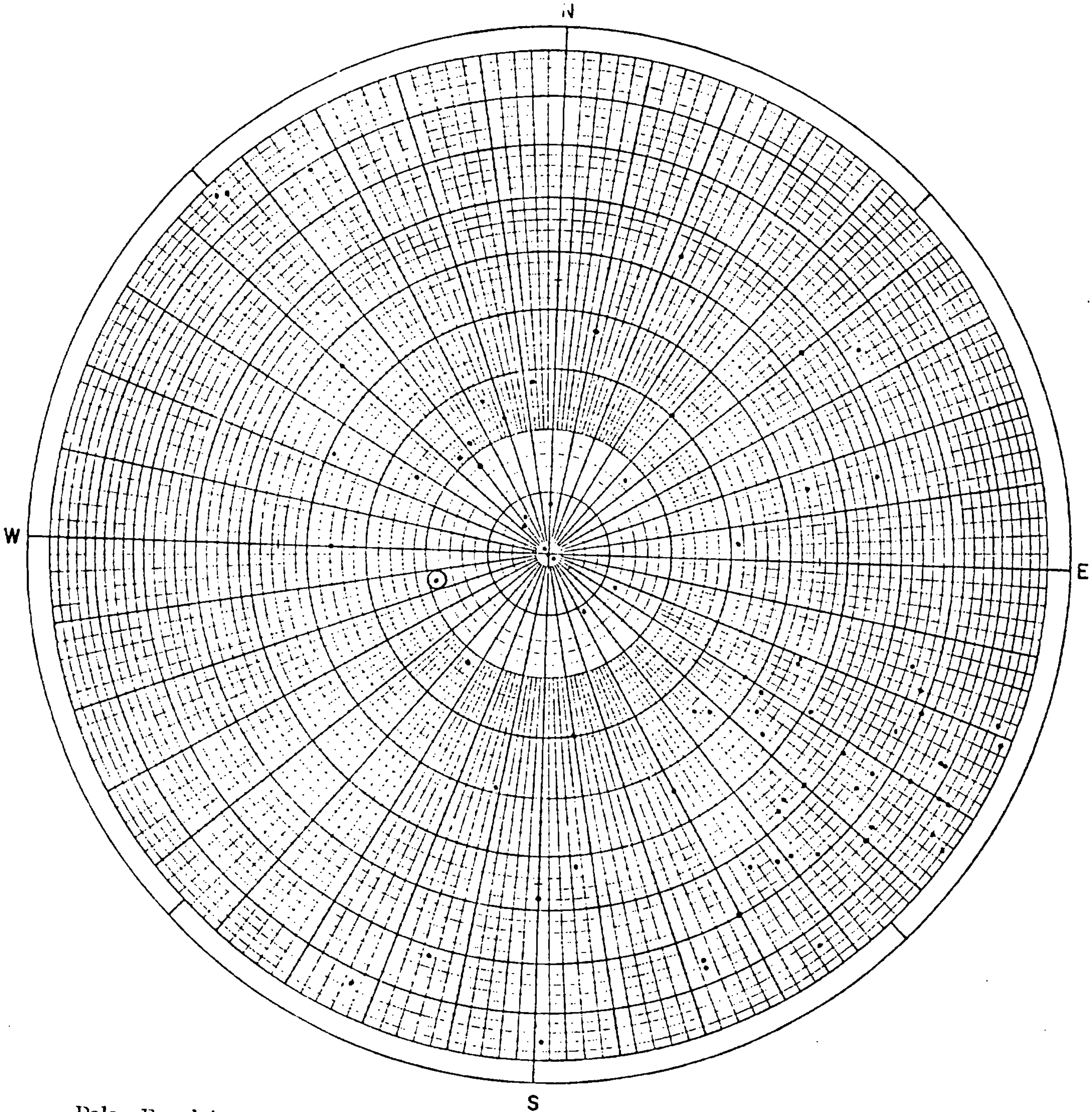
· Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-12
Ground Elevation (MSL) +21.5
Foliation and Depth in:

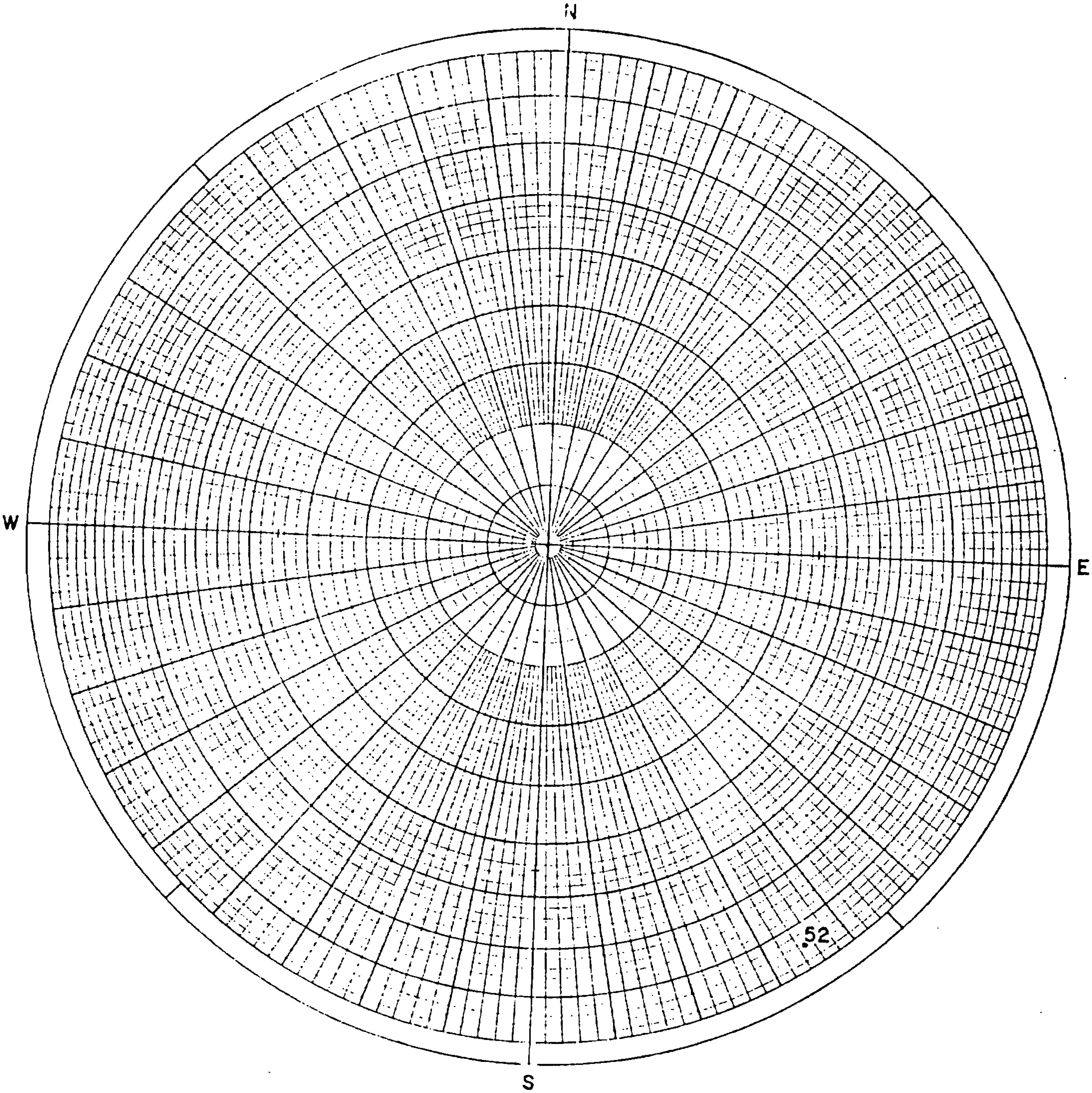
• Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-13
Ground Elevation (MS L) +30. 5 ft
Joints in:

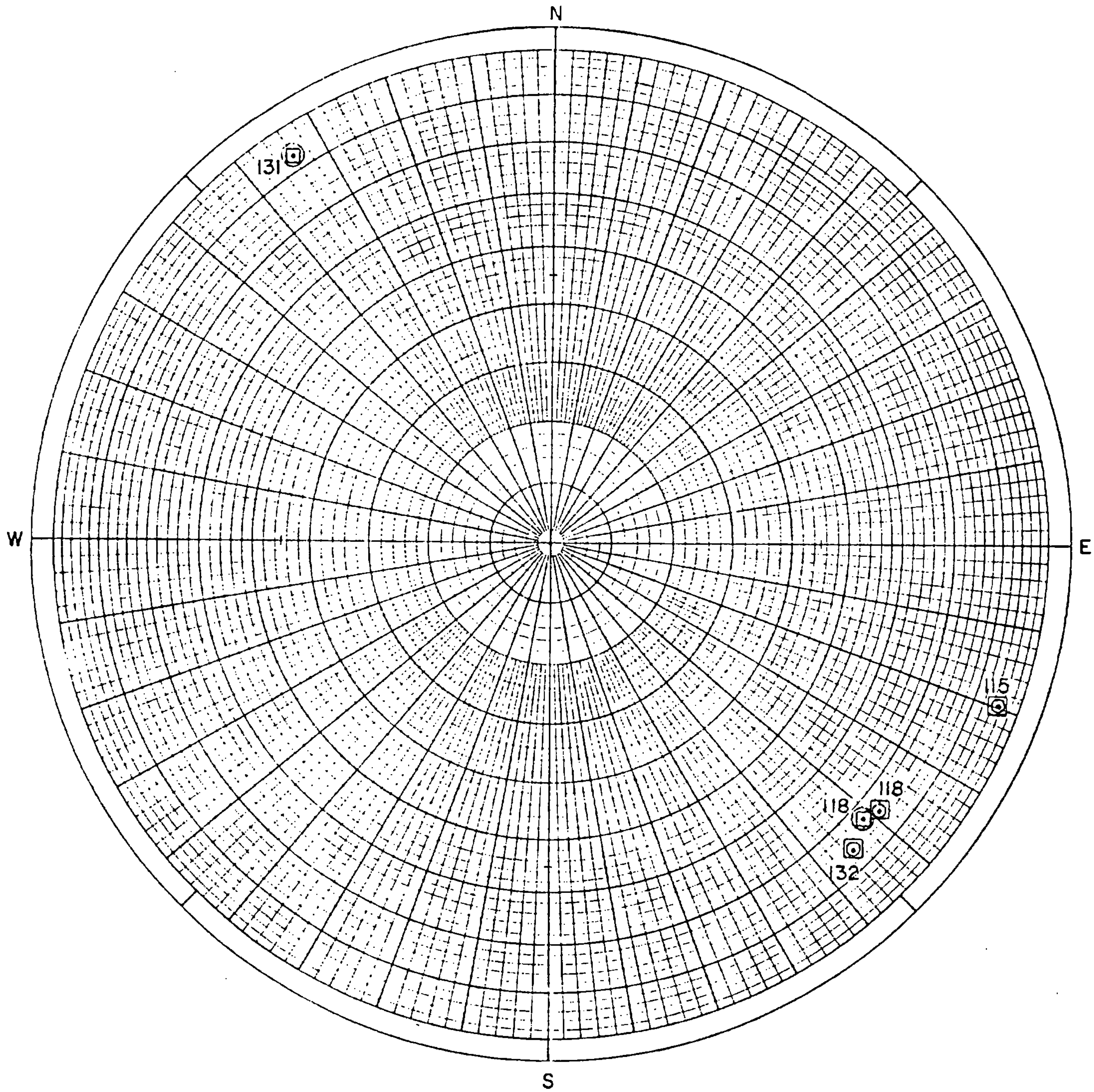
. Diorite
⊙ Diabase



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-13
Ground Elevation (MSL) +30.5 ft
Foliation and Depth in:

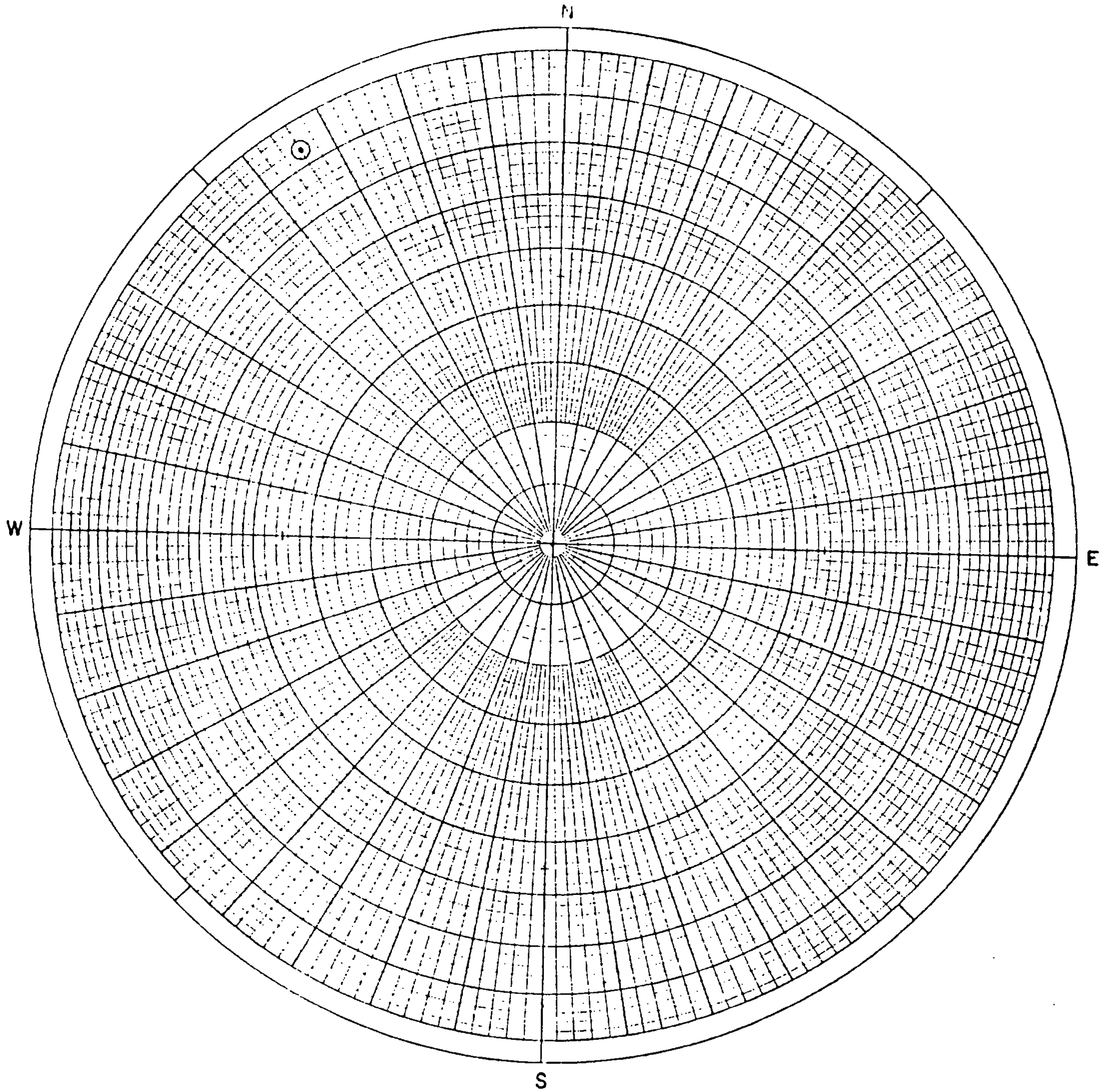
. Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-13
Ground Elevation (MSL) -130.5 ft
Contacts and Depth:

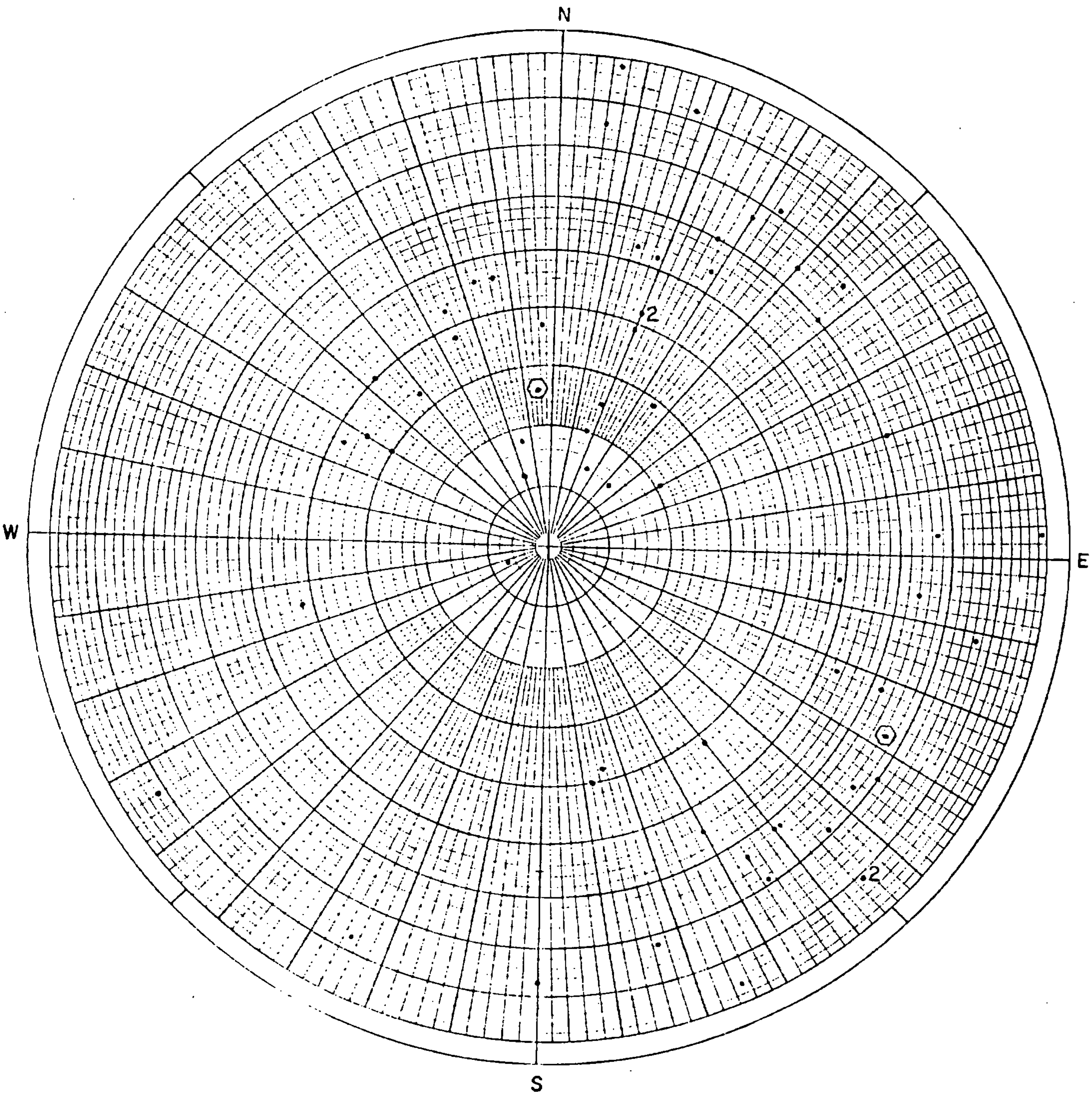
Diorite over Diabase
Diabase over Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Scabrook Station
June 1974

Boring E2-13
Ground Elevation (MSL) +30.5 ft
Slickensided Surfaces in:

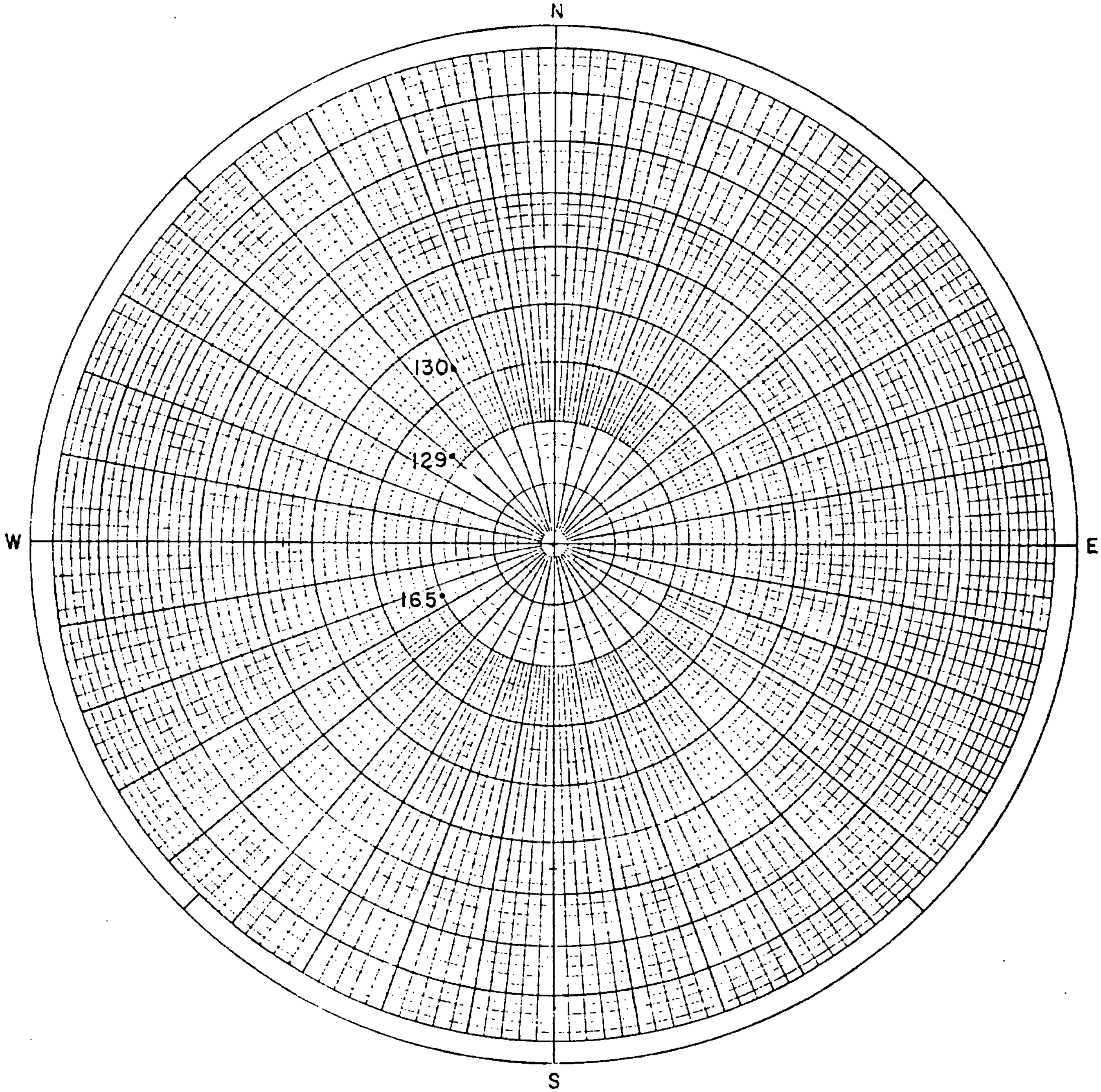
⊙ Diabase



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2 -14
Ground **Elevation** (MSL) +29.9 ft
Joints in:

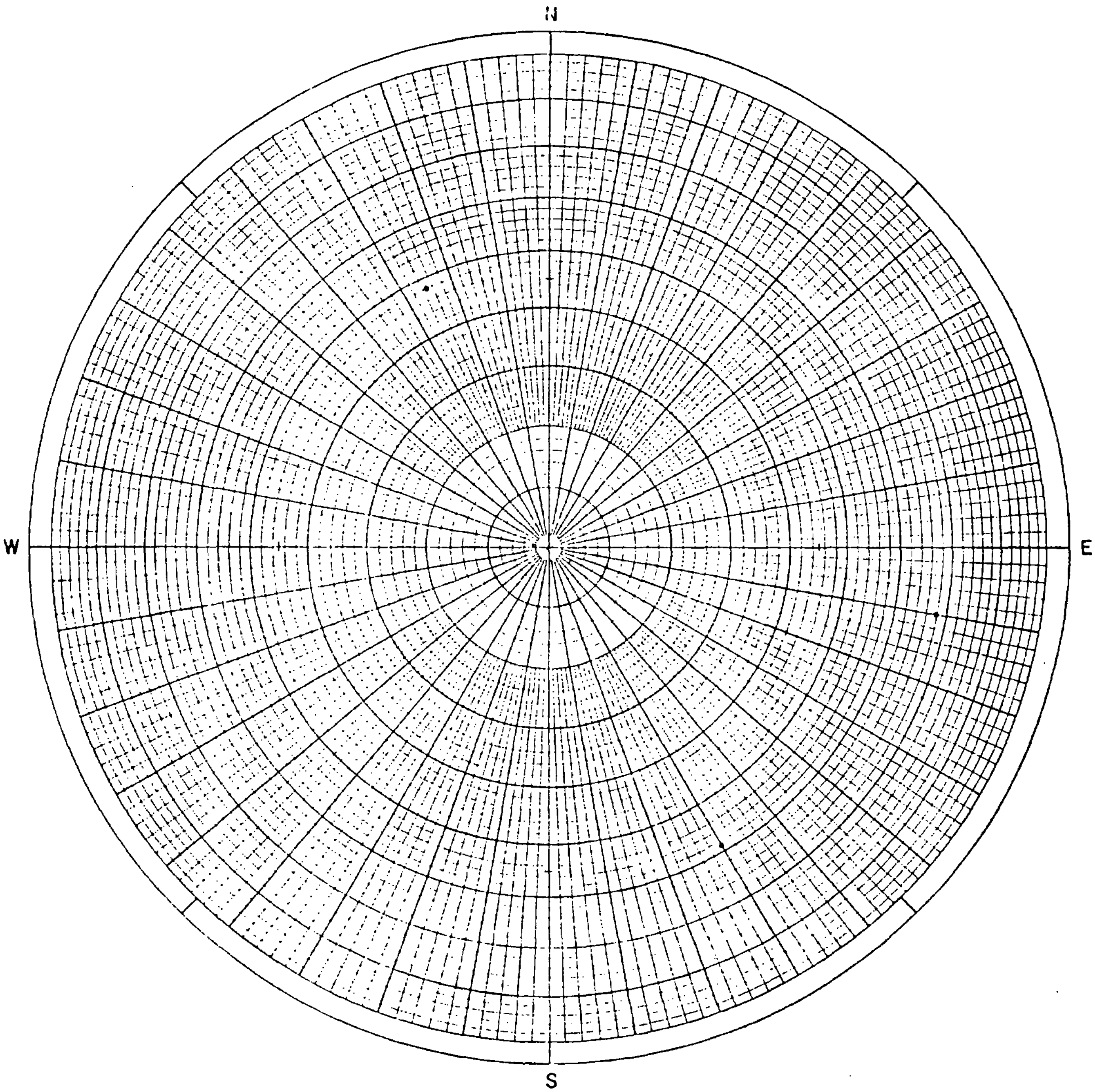
· Diorite
⊙ Pegmatite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-14
Ground Elevation (MSL) + 29.9 ft
Foliation and Depth in:

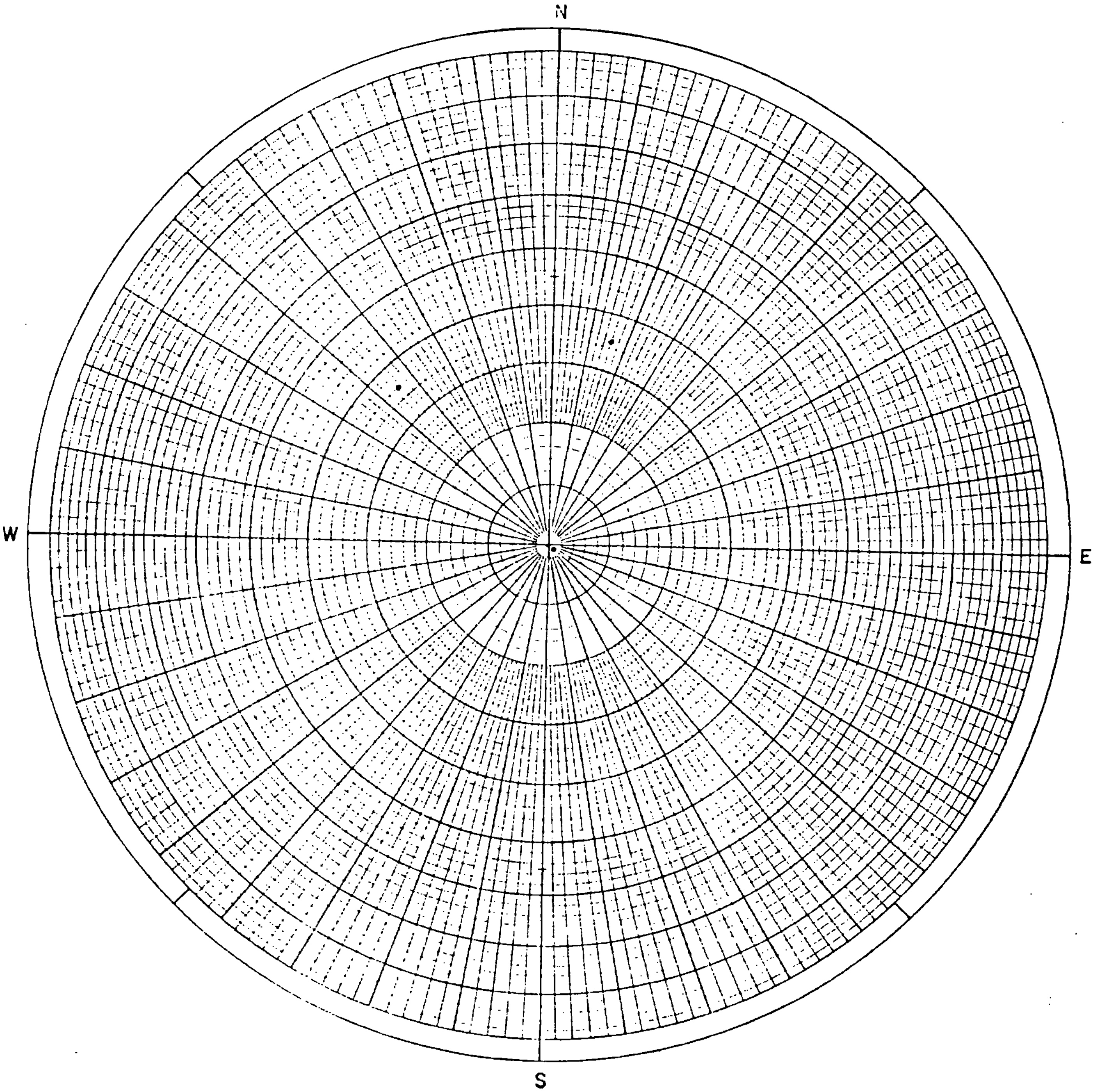
• Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-14
Ground Elevation (MSL) +29.9 ft
Slickensided Surfaces in:

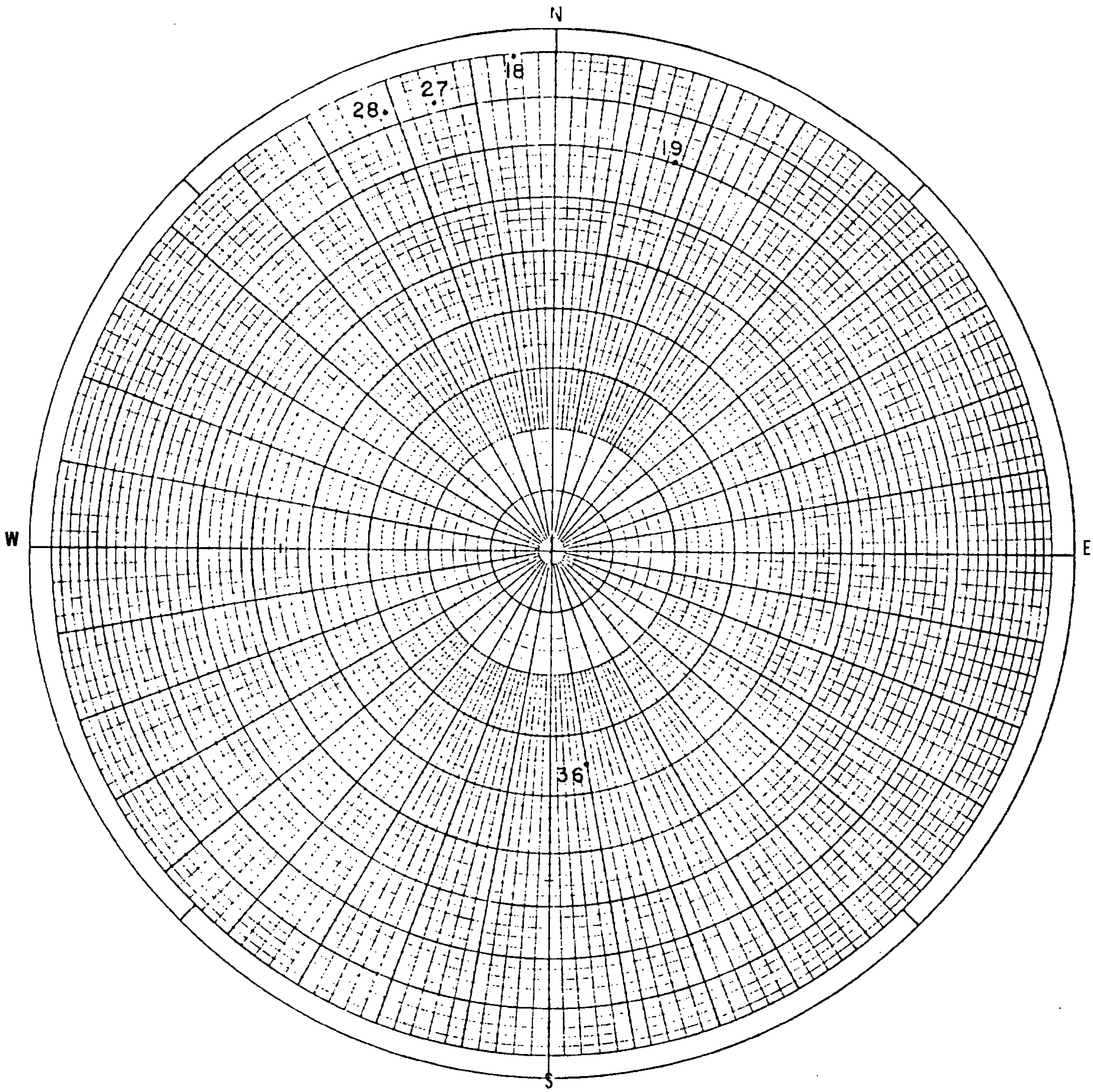
. Diorite



Polar Equal Area Slcrco Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-15
Ground Elevation (MSL) + 13.9 ft
Joints in:

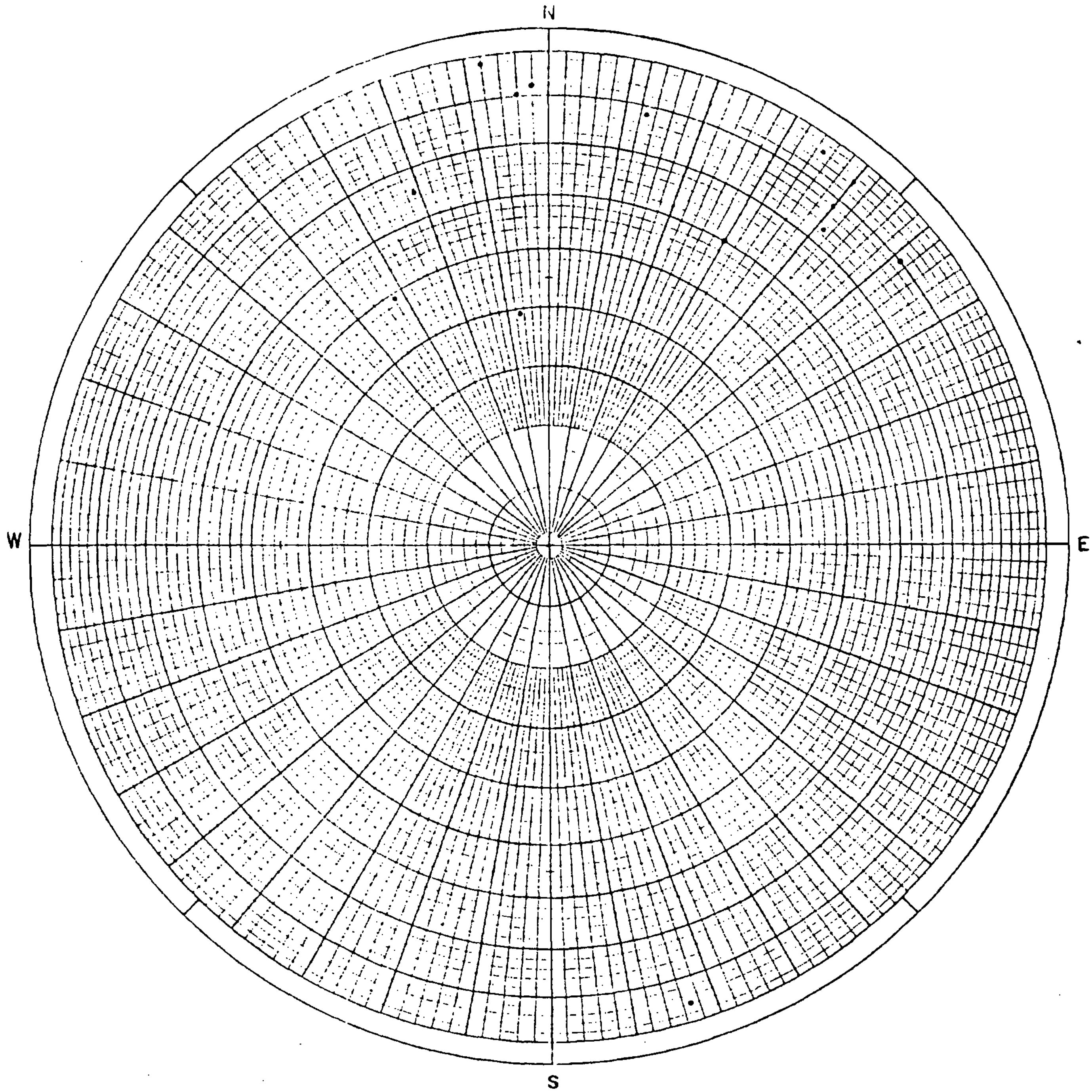
. Dioritc



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-15
Ground Elevation (MSL) +13.9 ft
Foliation in:

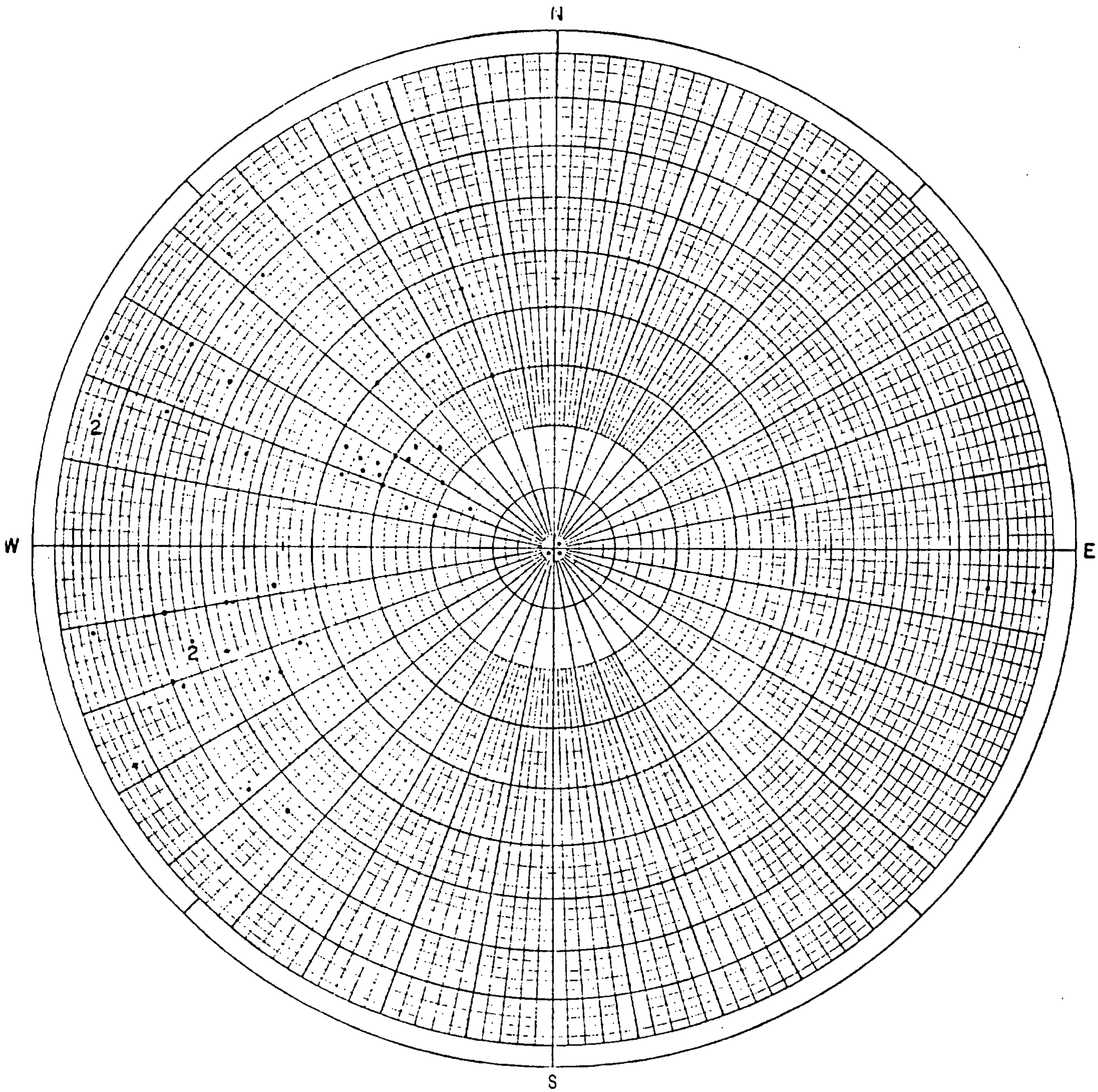
. Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-15
Ground Elevation (MSL) t-13.9 ft
Slickensided Surfaces in:

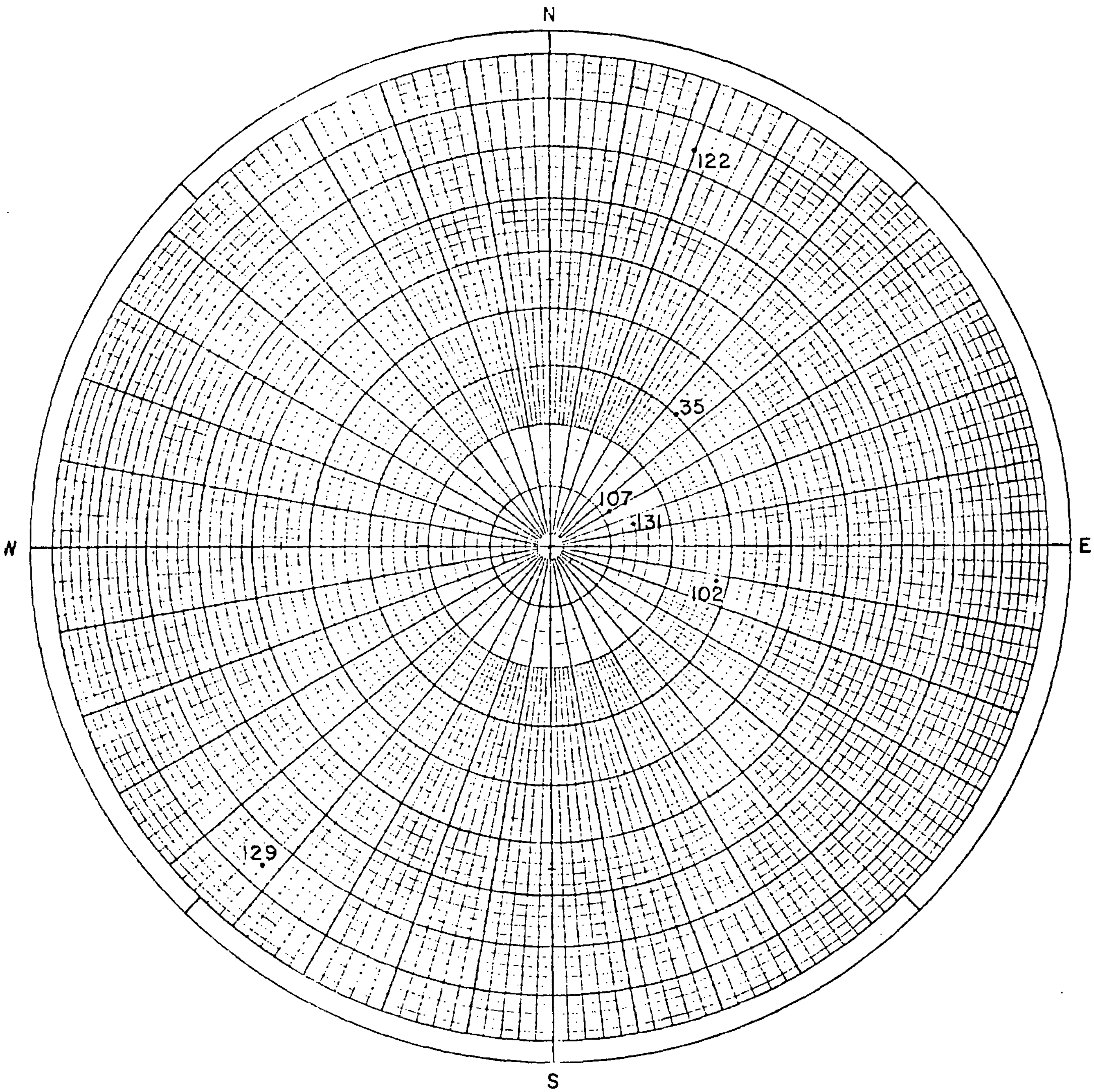
. Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1374

Boring E2-16
Ground Elevation (MSL) +16. 8 ft
Joints in:

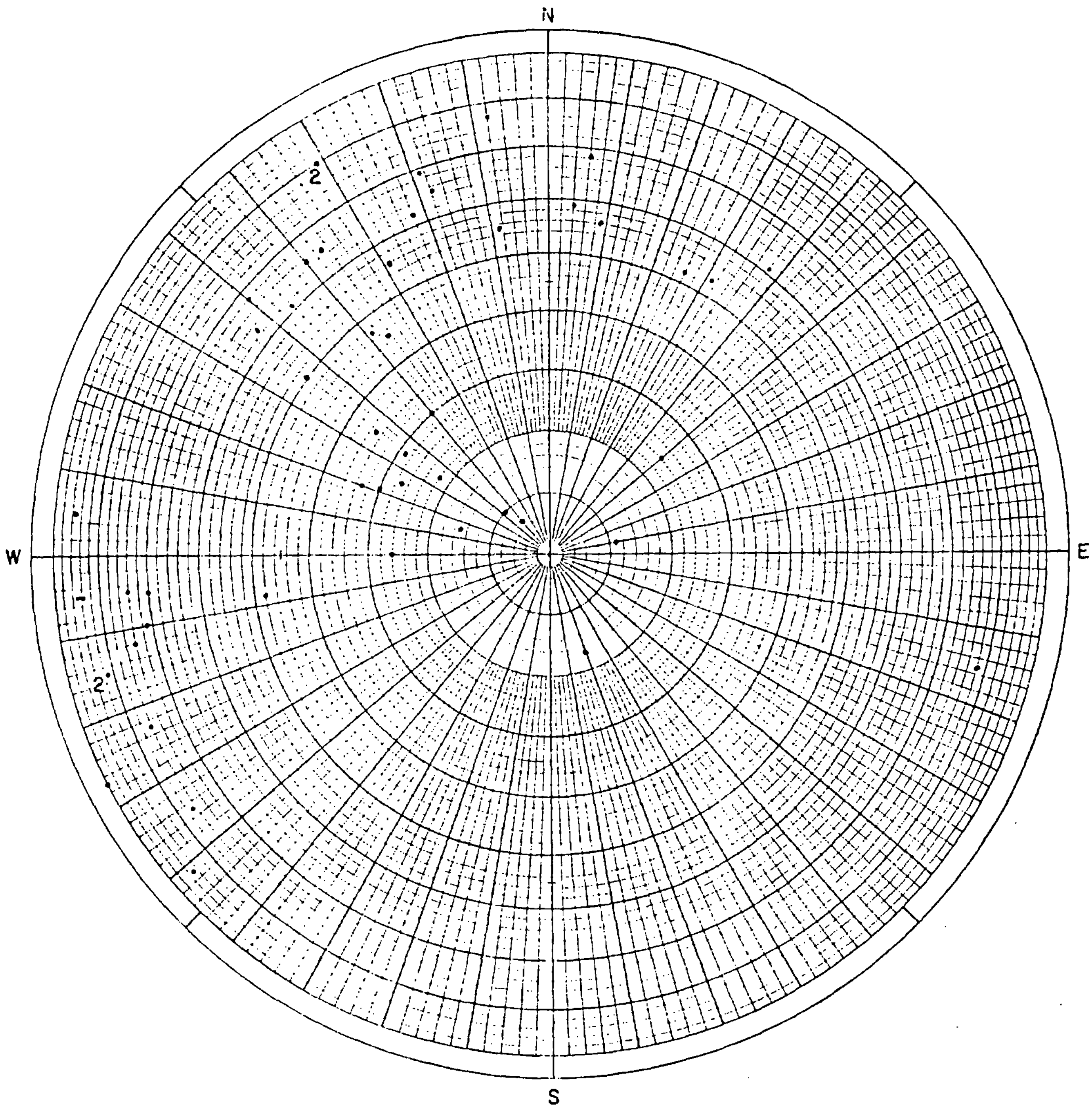
. Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-16
Ground Elevation (MSL) +16.8 ft
Foliaiton and Depth in:

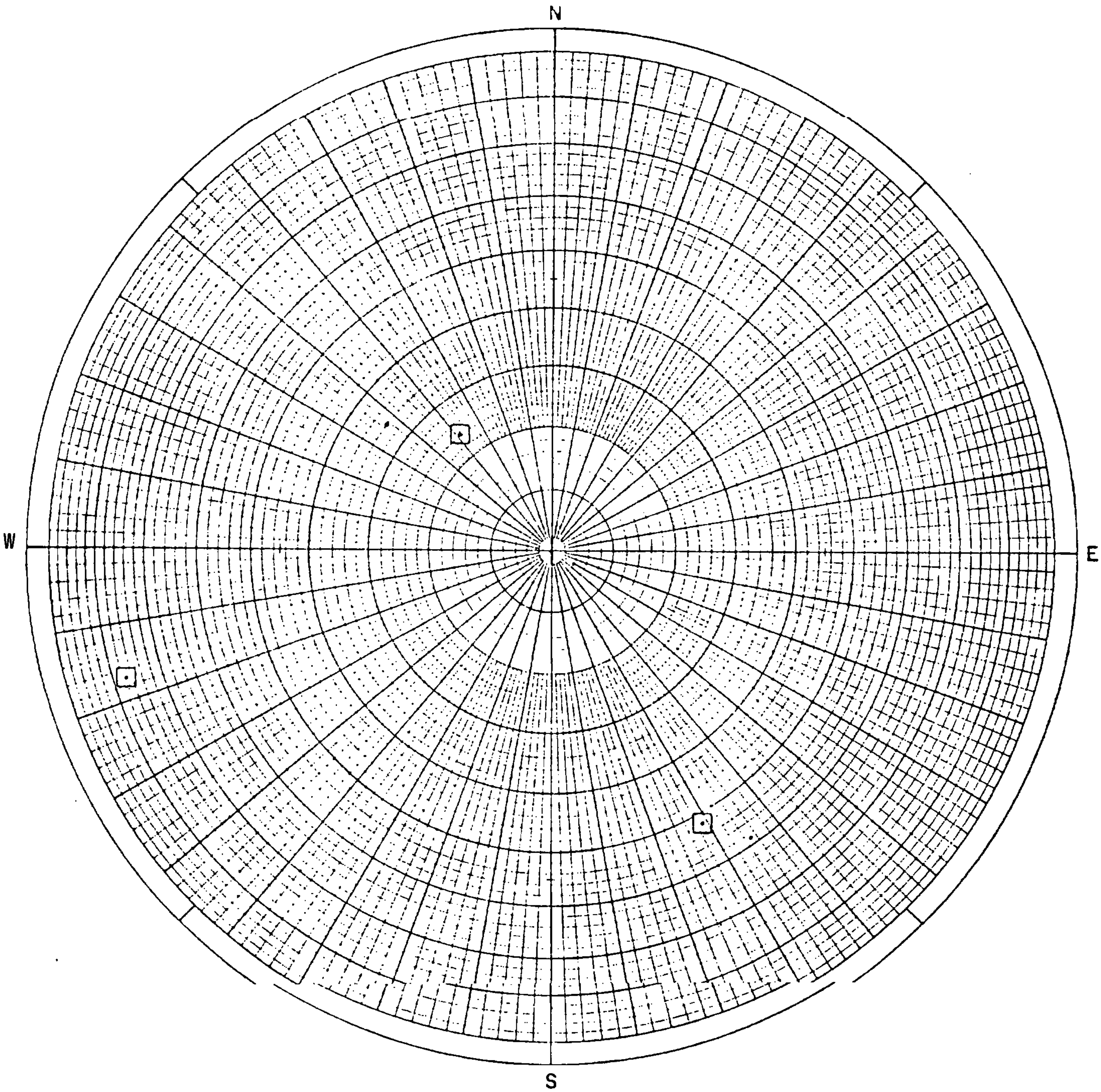
. Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2 - 16
Ground Elevation (MSL) +16. 8 ft
Slickensided Surfaces in:

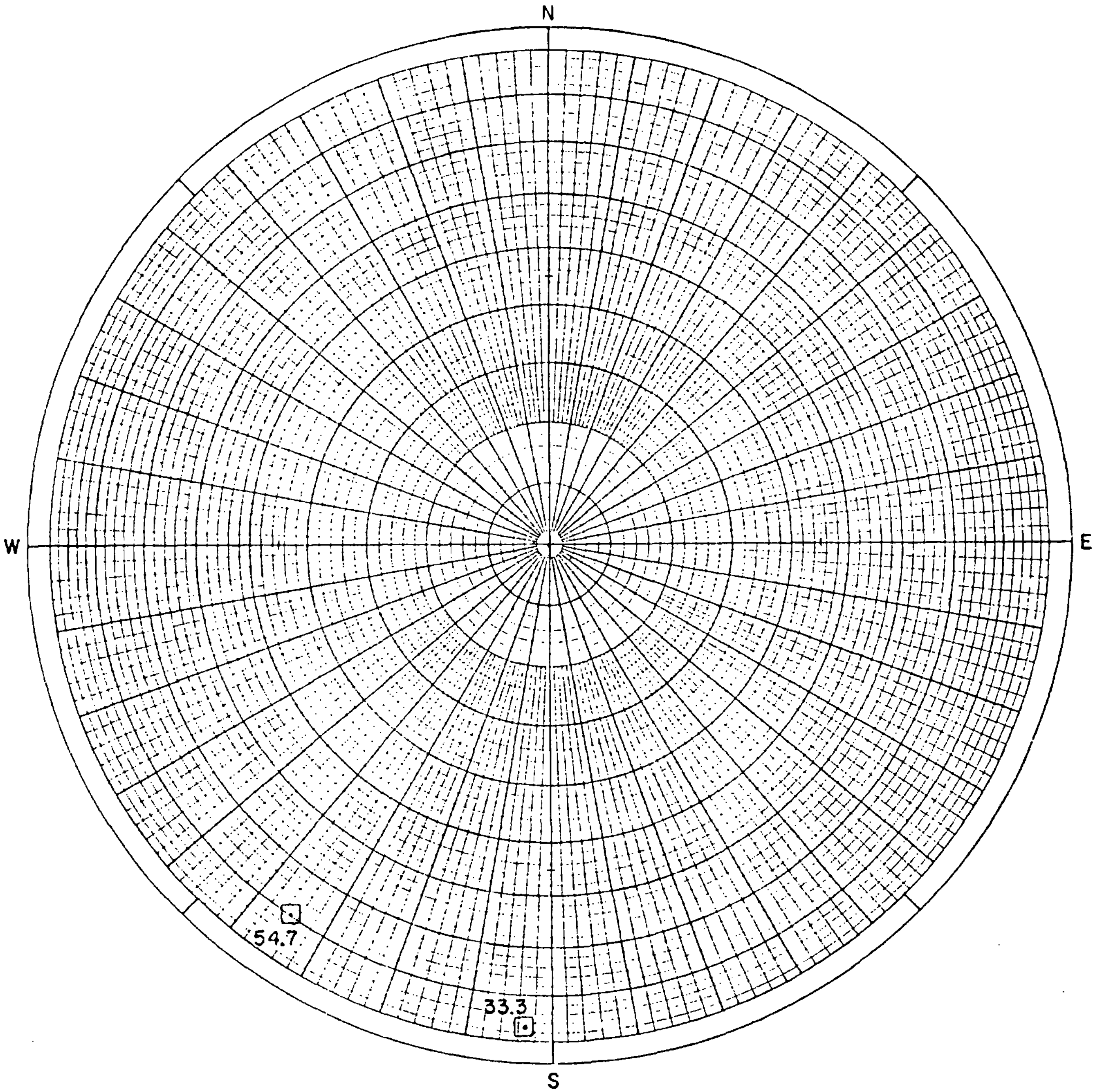
- Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-17
Ground Elevation (MS L) +13.3
Joints in:

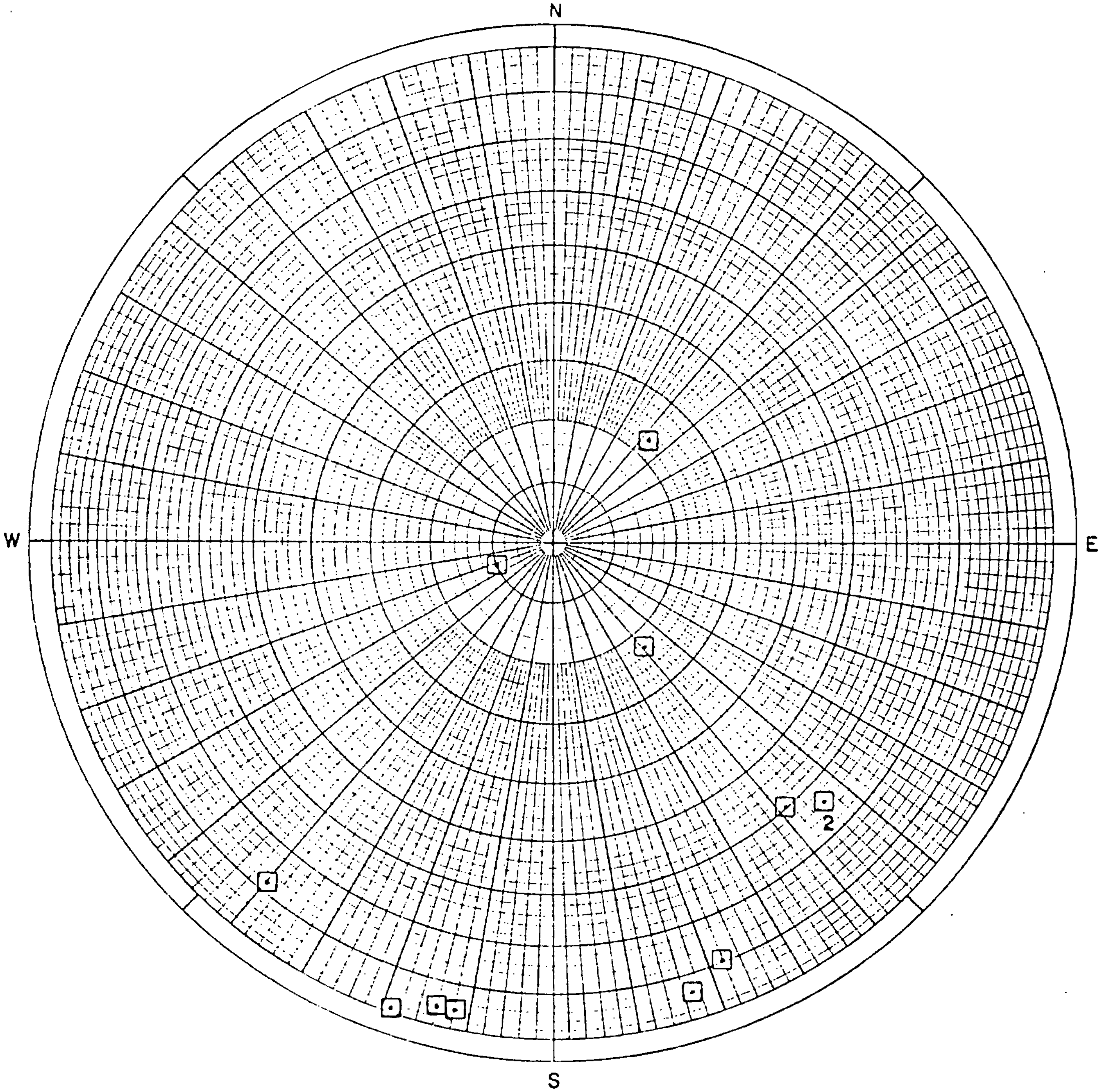
- Diorite
- ⊡ Schist



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-17
Ground Elevation (MSL) + 13.3 ft
Foliation and Depth in:

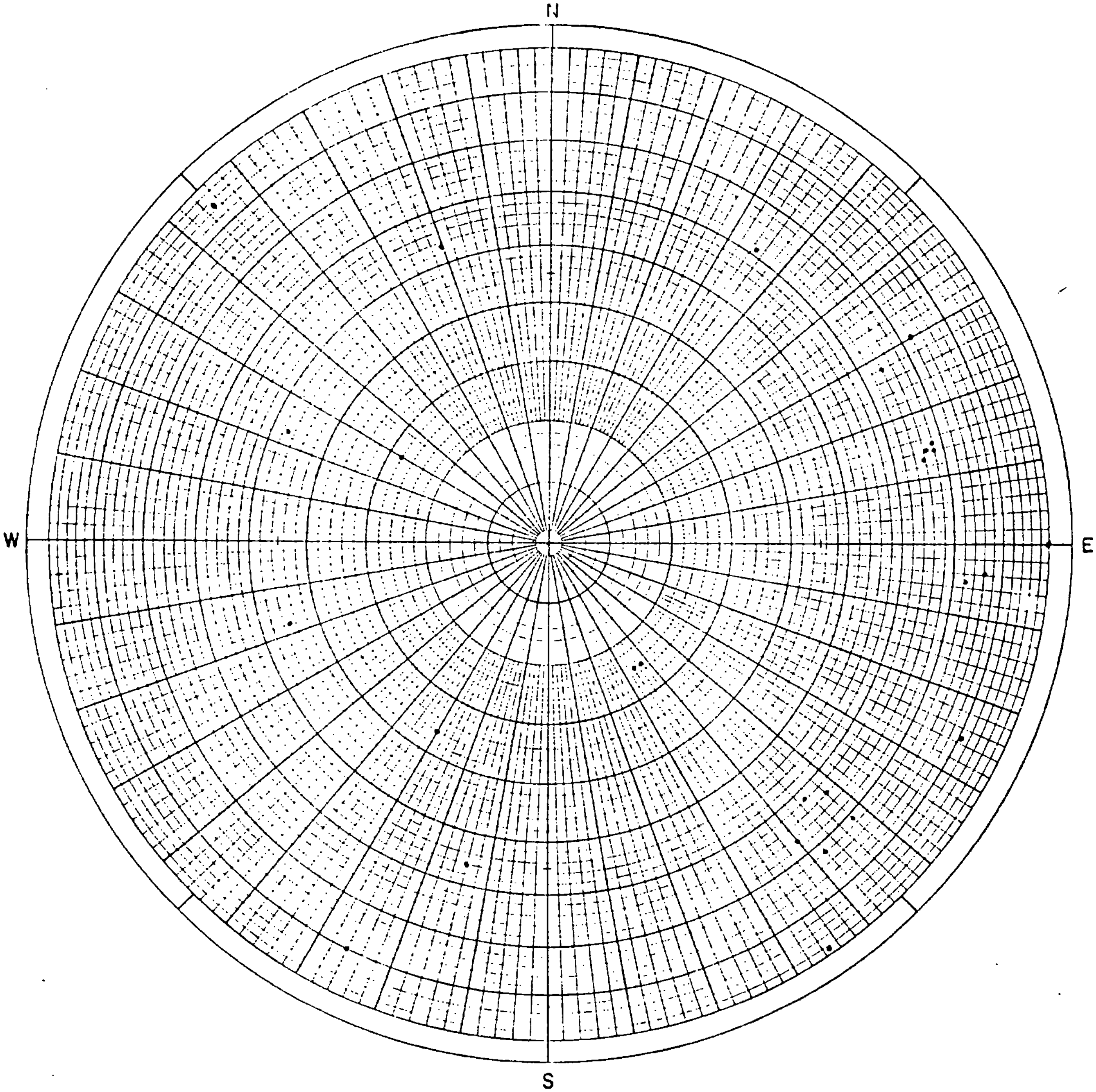
⊡ Schist



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-17
Ground Elevation (MSL) + 13.3 ft
Slickensided Surfaces in:

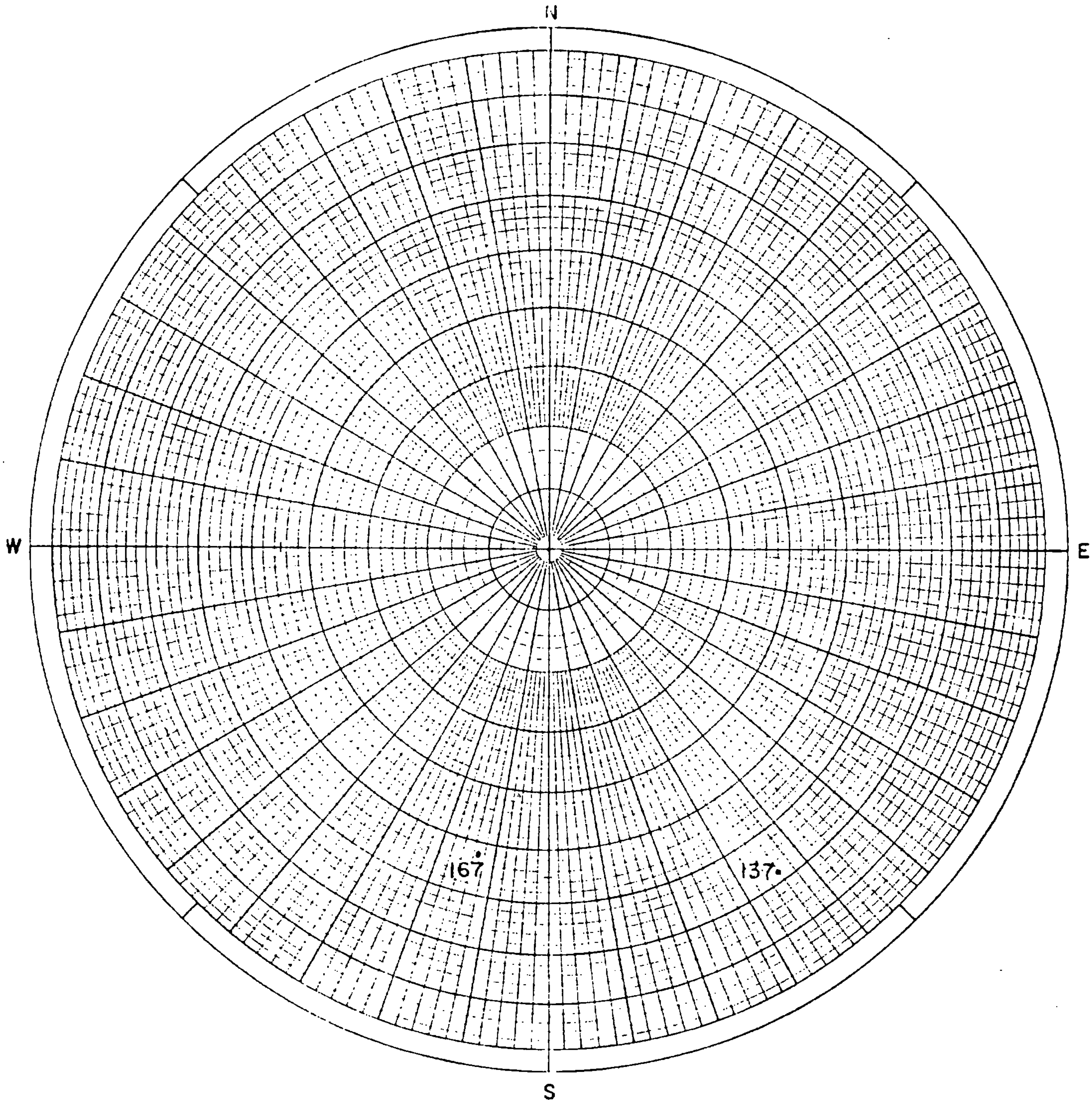
⊡ Schist



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-18
Ground Elevation (MSL) +14.9 ft
Joints in:

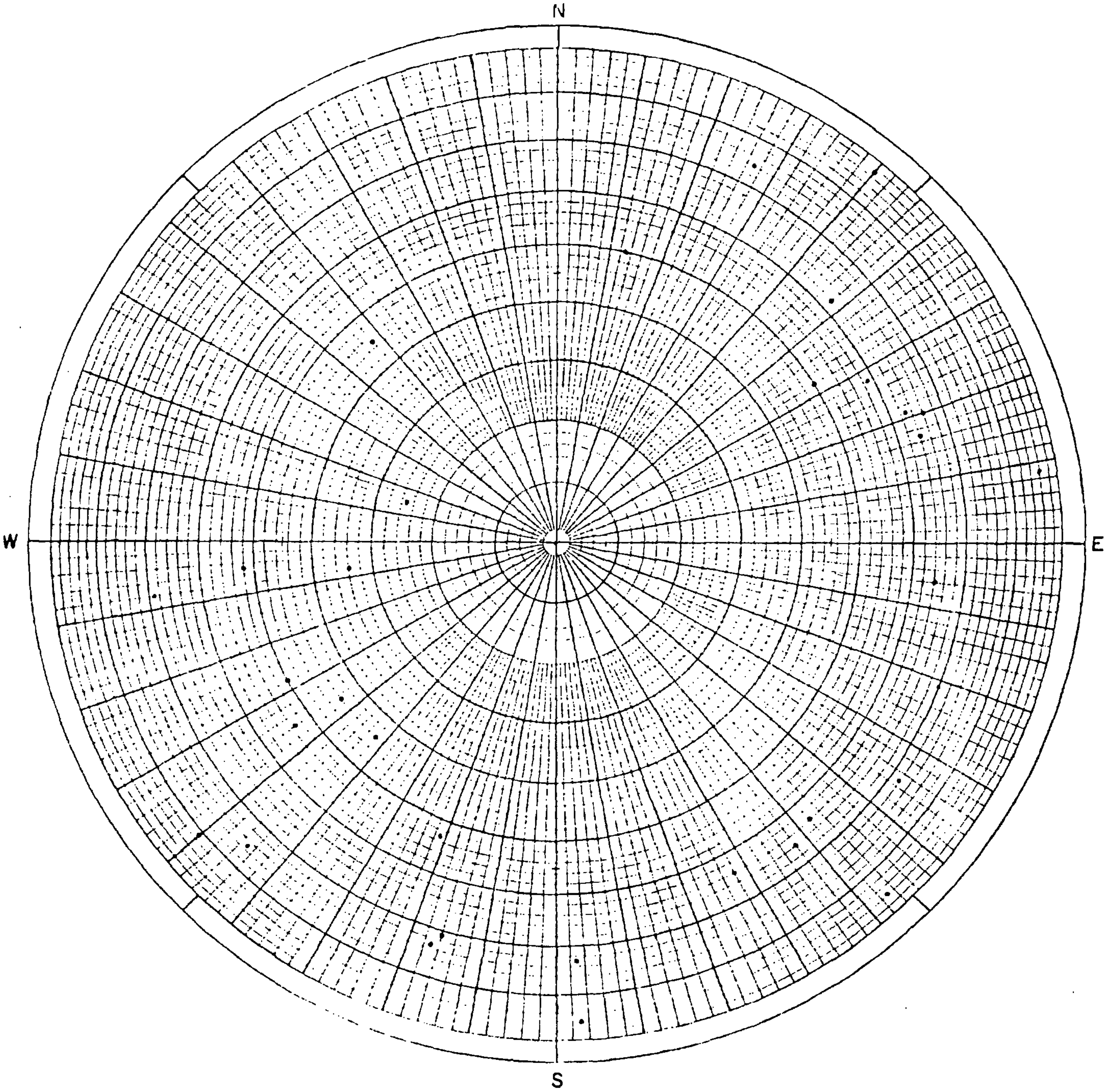
. Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-18
Ground Elevation (MSL) +14. 9 ft
Foliation and Depth in:

. Diorite



Polar Equal Area Stereo Net
Geotechnical Engineers, Inc.
Seabrook Station
June 1974

Boring E2-18
Ground Elevation (MSL) +14.9 ft
Slickensided Surfaces in:

• Diorite

APPENDIX IV

APPENDIX IV

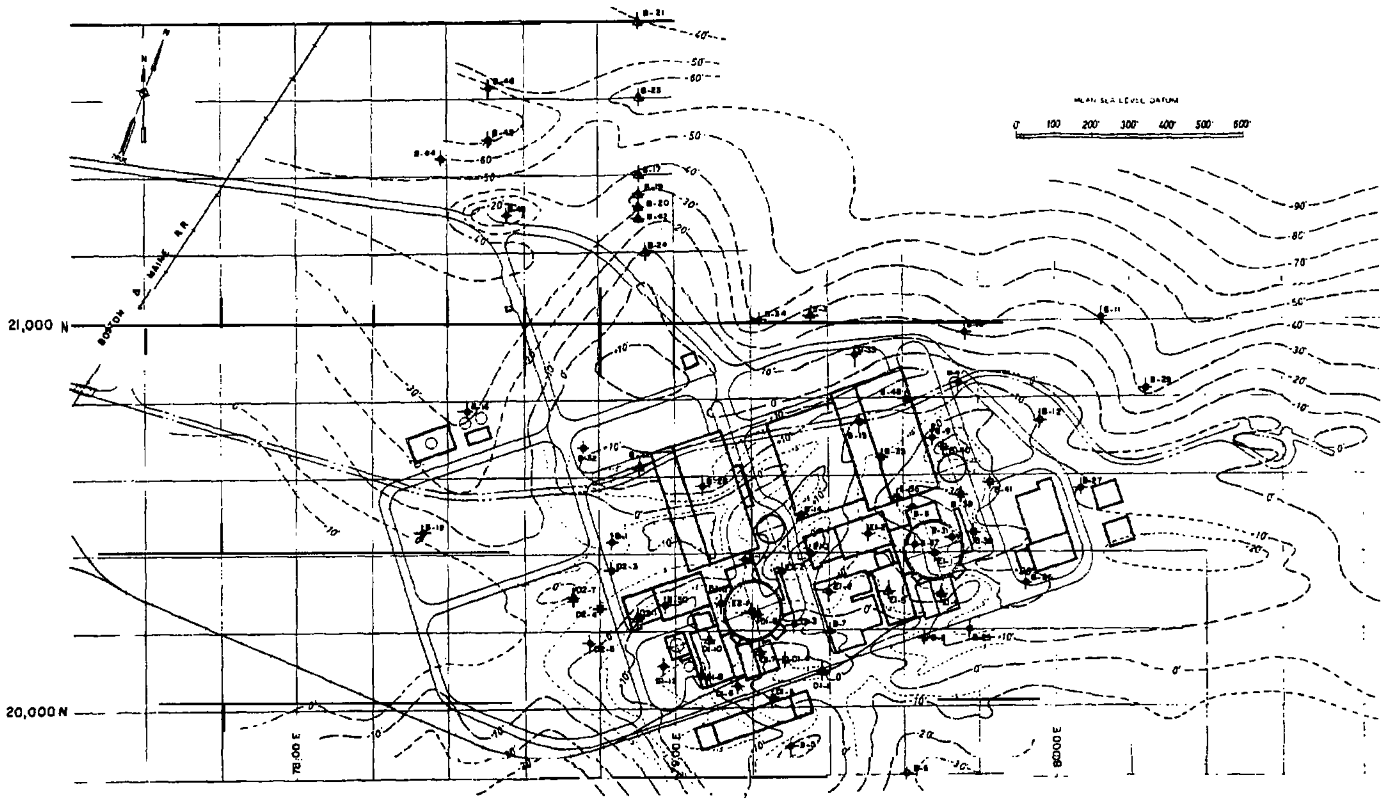
Overburden Descriptions

Note: The boring layout and soil descriptions are taken from the PSAR.

CONTENTS OF APPENDIX IV

1. Fig. 2.5-9 from PSAR
2. Boring Logs from Appendix 2D of PSAR:

    D1-11
    D1-8
    E2-1
    E1-1



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION *Preliminary Safety Analysis Report*	ESTIMATED TOPOGRAPHY OF THE BEDROCK SURFACE FIG. 2.5-9

SOIL DESCRIPTIONS

Ground Elevation: 13.8 ft
Depth to Water Level: 1.2 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o-2	1-1-4-7	Top is dark brown peat with many roots up to 1 mm diameter. Bottom is brown sand. Fine grained; uniform; contains few black organic pieces < 1 mm In size; < 5% silt.
2	5- 6.5	7-10-12	Light gray silty sand. Fine grained; uniform; very fast reaction to shaking test; contains ~ 30-40% nonplastic fines; part of sample is silty gravelly sand containing gravel up to 28 mm in size; angular grains
3	10-11.5	27-30-44	Gray silty sand. Widely graded; angular to subrounded grains; contains ~ 25-30% nonplastic fines; few gravel pieces up to 8 mm in size. w.= 7.5.g

BORING NO. D1-8
SOIL DESCRIPTIONS

Ground Elevation: 15.9 ft
Depth to Water Level: 1.9 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o- 1.5	1-1-12	Top is dark brown fine-sandy organic silt containing several roots < 1 mm diameter. Bottom is brown and rusty-brown sandy silt containing many dark brown organic pieces < 0.5 mm in size.
2	5- 6 . 5	31-40-72	Brown slightly gravelly silty sand. Widely graded; angular to subrounded grains; contains ~ 30-40% nonplastic fines and ~ 10-15% gravel up to 35 mm in size; fast reaction to shaking test.
3	8.5- 9	127	Gray-brown silty gravelly sand. Widely graded; angular grains; contains ~ 30-40% gravel up to 25 mn in size and ~ 20-30% nonplastic fines.

BORING NO. E2-1
SOIL DESCRIPTIONS

Ground Elevation: 15.9 ft
Depth to Water Level: 6.0 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o- 2	1-1-7-19	Top is brown sandy organic silt containing roots up to 12 mm diameter. Bottom is light brown to gray-brown gravelly silty sand. Widely graded; generally angular grains; contains ~ 20-30% nonplastic fines and ~ 10-20% gravel up to 18 mm in size; several rusty-brown spots up to 10 mm in size.
2	5- G.6	31-60-74	Similar to bottom portion of Sample No. 1, but slightly less silty and fewer rusty-brown spots.

BORING NO. E1-1
SOIL DESCRIPTIONS

Ground Elevation: 28.9 ft
Depth to Water Level:

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
			No soil samples taken. (Bedrock at ground surface.)

APPENDIX 2G

STATIC DYNAMIC ROCK PROPERTIES

The information contained in this appendix was not revised, but has been extracted from the original **FSAR** and is provided for historical information.

APPENDIX 2G

STATIC AND DYNAMIC ROCK PROPERTIES

TABLES

45

TABLE 2G-1

UNCONFINED COMPRESSION TESTS

Test No.	Location	Hole No.	Depth (ft)	Rock Type	Unconfined Compressive Strength q_u (psi)	Axial Strain@ Failure %	Initial Tangent Modulus (psi)	Secant Modulus @ 50% q_u (psi)	Poisson's Ratio Initial Load	Poisson's Ratio Secant Value @ 50% qu
E1A	Reactor 1	E1-1	31.4- 31.8	Diorite	22,400	.21	12 x 106	12 x 106	.29	.25
E1D			78.3- 78.7	Diorite	19,520					
E1F			79.1- 79.5	Diorite	19,820	.21	9.3 x 10^6	9.3 x 106	.25	.25
E1G			79.5- 79.9	Diorite	19,400	.20	13 x 106	11 x 106	---	---
E2A	Reactor 2	E2-1	49.6- 50.0	Diorite	18,020	.20	12 x 106	10 x 106	.36	.28
E2B			50.0- 50.4	Diorite	Failed by splitting. Do not report.					
E2C			50.4- 50.8	Diorite	15,530	.17	12 x 106	9.9 x 106	.18	.20
E2G			138.7-139.1	Diorite	5,970					
E2J			139.4-139.8	Diorite	11,610	.21	12 x 106	9.7 x 106	.21	.23
E2M			141.9-142.3	Diorite	18,610	.20	10 x 106	10 x 10^6	.23	.25
B7B	Near Reactors	B7	27.8- 28.2	Schist	17,940	.20	11 x 106	10 x 106	.17	.19
B42D	Contact	B42	123.5-123.9	Diabase	27,600	.27	11 x 106	10 x 106	.21	.26
B42F			141.3-141.7	Schist	16,500	.21	9.1 x 106	8.0 x 106	.18	.21
B42H			142.7-143.1	Schist	11,970	.18	10 x 106	7.4 x 106	---	---
F1A	Tunnel	F1A	127.5-127.9	Diorite	16,130	.19	11 x 10^6	9.9 x 106	.33	.28
F1B			127.9-128.3	Diorite	13,950					
F2A	Tunnel	F2	246.3-246.7	Schist	6,060					
F2C			247.2-247.6	Schist	6,000					
F2F			260.3-260.7	Schist	6,330					

NOTE: In tests for which values of axial strain at failure, modulus, and Poisson's ratio are omitted, the strain-gage readings appear to be unreliable, No stress-strain curves are plotted for these tests.

TABLE 2G-2

LABORATORY COMPRESSION WAVE VELOCITY MEASUREMENTS

Test No.	Location	Hole No.	Depth (Feet)	Rock Type	Density (gm/cm^3)	Laboratory Compression Wave Velocity @ 0 psi	@ 3000 psi
E 1 H	Reactor 1	E 1 - 1	79.9 - 80.3	Diorite	2.81	19,460	19,880
E 2 E	Reactor 2	E 2 - 1	51.2 - 51.6	Diorite	2.83	18,860	19,090
E 2 H	Reactor 2	E 2 - 1	139.1 - 139.4	Diorite	2.77	20,050	20,300
B 42 B	Contact	B 42	122.5 - 123.0	Diabase	2.84	18,600	18,800
B 42 G	Contact	B 42	141.8 - 142.3	Schist	2.77	16,960	17,320
F 1 D	Tunnel	F 1 A	128.7 - 129.2	Diorite	2.79	20,050	20,340
F 2 D	Tunnel	F 2	259.0 - 259.4	Schist	2.86	18,110	18,370

TABLE 2G-3

STRENGTH, VELOCITY, AND HARDNESS DATA
SAMPLES FROM TUNNEL ALIGNMENTS
SERIES 1

Boring No.	Depth, ft.	Rock Mechanics Laboratory Number	Unit Weight Dry gm/cc	Sonic Velocity, fps (Dry) Axial Load psi				Ultimate Unconfined Compressive Strength psi	L/D Ratio	Modulus of Elasticity psi x 10^6		Rock Hardness					Rock Description	Remarks
				0	100	500	1000			E_i	$E_{t_{50}}$	H_R	H_S	H_A	H_T	A_R		
M - I	167.0.267.1	73-49	2.93	17,564	17.606	17.404	17.691	33,954	3.72	0.24	1.29	52	ID	6.U	132	16.7	Diorite - fine grained; some quartz, feldspar, mafics, and iron sulfides	Failed along iron stained joint
ADT-2	266.6-267.6	73-50	2.66	16.992	16.492	16.193	16,501	22,587	2.76	0.94	4.m.	49	01	6.06	120	I8.9	Diorite - coarse grained; primarily feldspar and biotite; slight foliation developed	
ADT-2	267.0-267.7	73-51	2.m	16.271	16.312	16.437	16.479	15,580	3.26	1.46	6.32	36	68	4.01	m	16.0	Quartz diorite - very fine grained; quartz, feldspars, lcrr. and mafics; med. gray	
ADT-4	250.0-250.8	73-52	2.73	16.370	15,434	16.496	16.631	19.306	4.03	0.80	6.01'	32	62	3.61	61'	9.9	Diorite - medium to fine grained; highly micaceous; cuartz, feldspar. mica, mafics; lite gray; some foliation developed.	
M - I	255.4-256.0	73-53	2.11	16.410	16.616	15,570	15,57(	20,895	2.26	0.91	4.84	33	71	6.00	7Y	6.9	Diorite - medium grained; quartz, feldspar, ical. mafics; medium gray; somewhat slickersided.	Failed along pre-existing but healed fracture
ADT-11	222.9-223.6	73-64	---	14.996	16.014	15.014	16.071	10,060	2.61	0.39	2.88	34	69	5.00	76'	12.1	Schistose diorite - fine grained; high biotite content; foliation developed tc fair degree	
ADT-13	213.0-213.7	73-66	2.71	17.063	16,996	17.336	17.611		2.71			47	88	6.94	125'	9.1	Diorite - med. to coarse grained; quartz, feldspar, biotite, mafics; and iron sulfides	
M-17	109.0-109.8	73-w	3.01	17,007	17.007	17,079	17.07.	7.026	4.04	0.62	5.40	60	I2	4.66	108	16.4	Diabase - fine grained; feldspar, pyrite and mafics; dark gray	Failed along calcite filled joint
AIT-1	250.0-250.9	73-57	2.89	16.343	16.423	16.747	16,62	21,290	3.42	1.44	6.10	61	Is	4.66	108'	8.(	Quartz diorite - coarse grained; high quartz-feldspar content, also lcu; rd. to lite gray	Failed along pn- ᵉrist.n# but healed fracture
AIT-7	198.5-199.8	73-I)		14,682	14,682	14,789	14,84;	6.910	2.61	0.31	1.U)	46	67	4.76	99	10.:	Biotite schist - med. to fine grained; quartz, feldspar, and mafics; fine foliation nll developed	Failed along iron stained joint
AIT-8	195.0-196.2	73-59	2.83	17,686	17,686	17.624	17.911	19.163	2.72	1.43	2.611	37	58	6.13	83	11.	Biotite schist - rd. grained; well developed fine foliation with quartz-rich layers; med. gray	
F-6	196.3-196.9	73-60	2.11	16.662	16.640	16,604	16.771	22,312	3.16	1.36	6.11	46	73	4.88	101'	16.:	Schistose quartz diorite - fine to med. grained; quartz, feldspar biotite; foliation fair; med. to dk. gr	
F-5	205.3-205.9	73-61	2.70	15,989	15,989	16.066	16.111	24,796	3.41	1.22	4.87	45	70	3.33	84'	11.	Diabase - very fine grained; primarily feldspar and mafics; dark gray	Failed along pre-existing but healed fracture
AIT-18	141.2-142.3	73-62	2.82	16,493.	16.627	16.627	16.621	19,036	4.01	1.07	6.36	39	71	3.23	71'	7.:	Quartzitic Schist - rd. grained; mostly quartz, feldspar, and biotite with iron sulfides; foliation only fairly developed; med. gray	

E_i - Initial tangent modulus

E_{t50} - tangent modulus at 50% of the ultimate unconfined strength.

H_R - Schmidt (L-type) Rebound Hardness

H_S - Shore Scleroscope (C-2 type) Hardness

H_A - Modified Taber Abrasion Hardness

H_T - $H_R\sqrt{H_A}$

A_R - Rock Abrasiveness

APPENDIX 2G

STATIC AND DYNAMIC ROCK PROPERTIES

FIGURES

NOTE: The stress-strain curves shown in Figures **2G-1** through **2G-11** are terminated at the last strain reading before sudden, brittle failure. The maximum compressive load at failure was recorded by the testing machine and was used to calculate the compressive strengths contained in Table **2G-1.**

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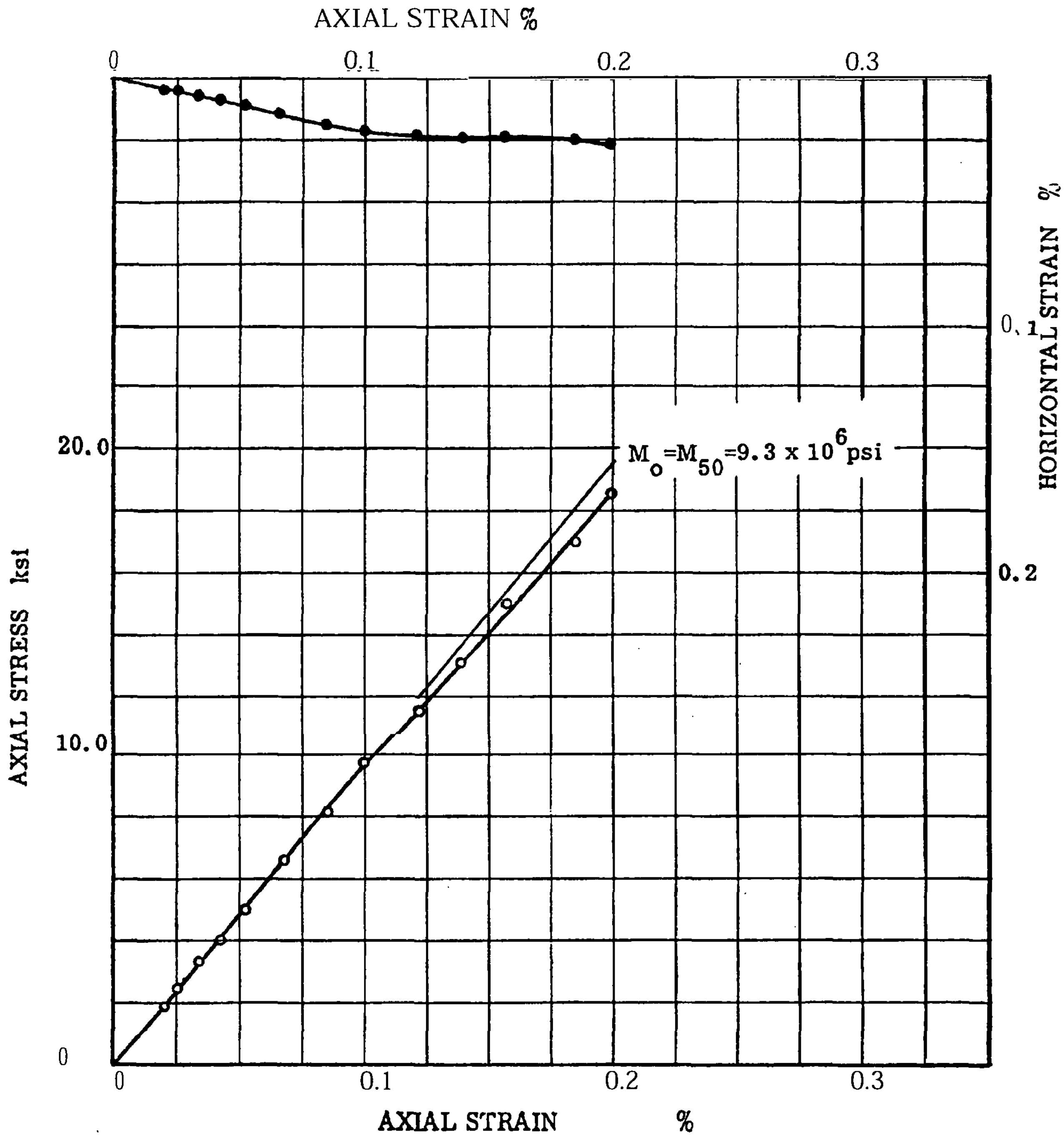
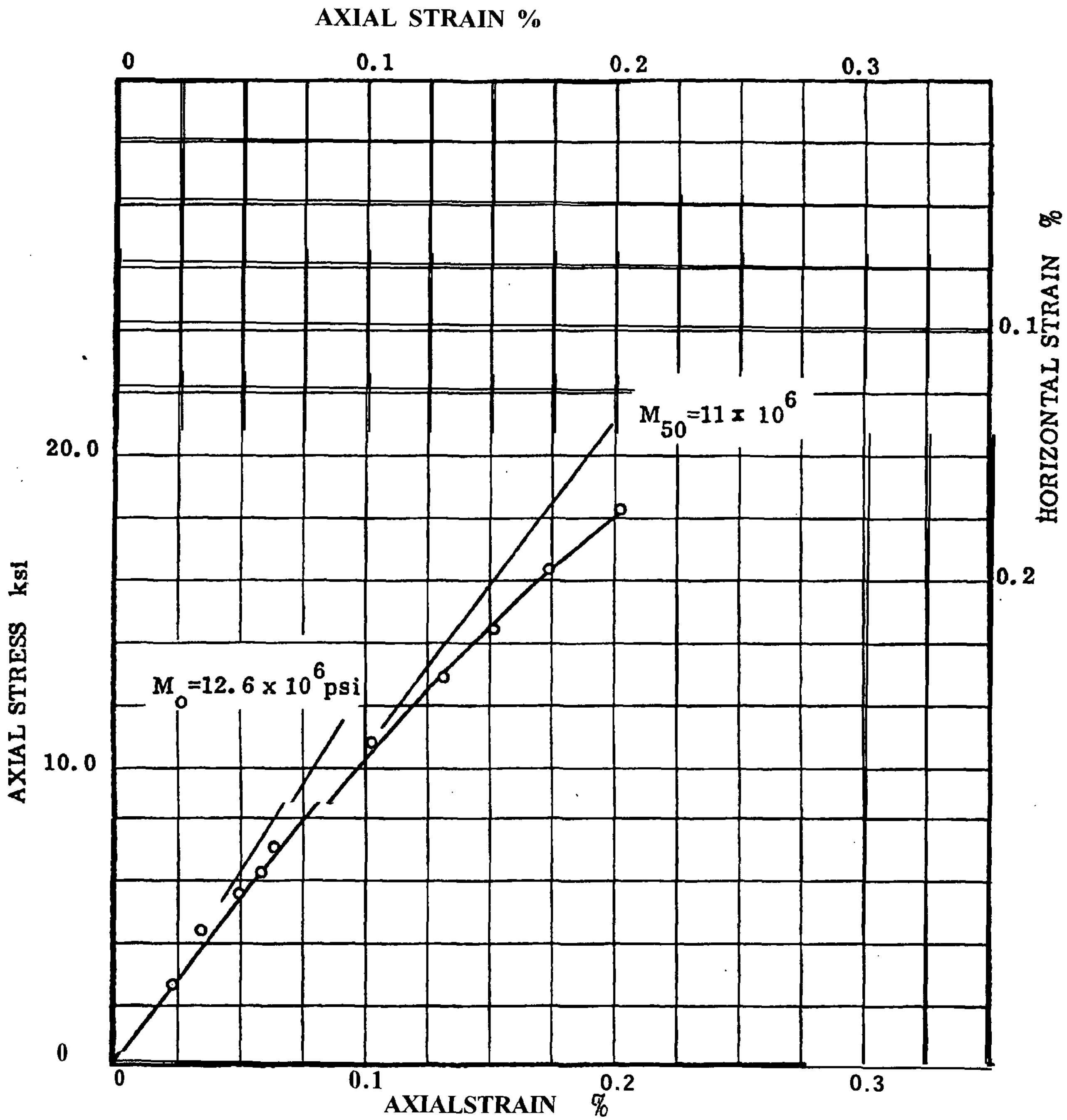


M = Modulus of Deformation

Diorite
Borehole El-1 Depth 79.1 to 79.5 **ft**

UNCONFINED TEST E 1 F STRESS -STRAIN CURVE

FIGURE 2G-1



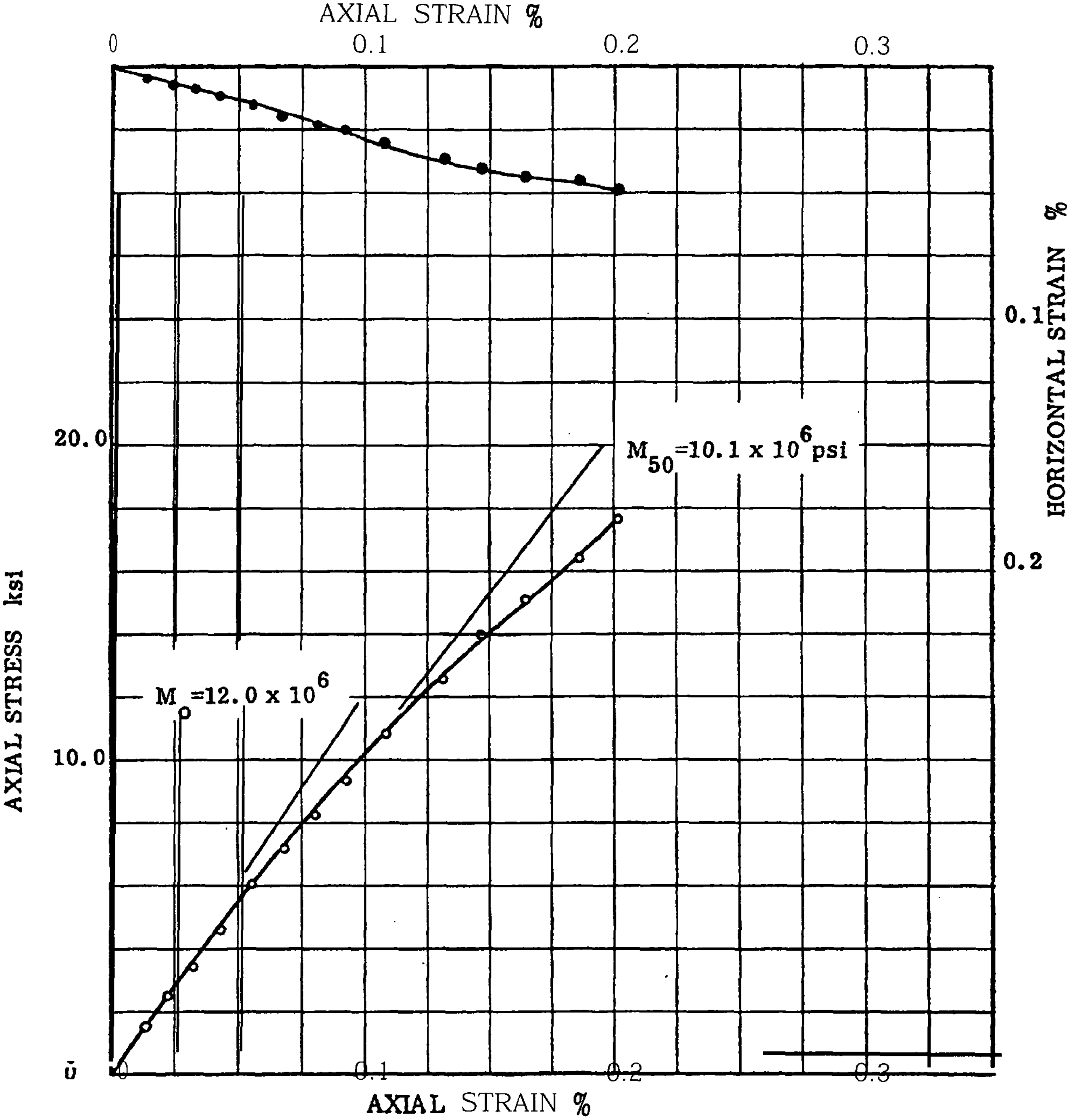
M = Modulus of Deformation

Diorite

Borehole E1-1 Depth 79.5 to 79.3 ft

UNCONFINED TEST E1G STRESS-STRAIN CURVE

FIGURE 2G-2

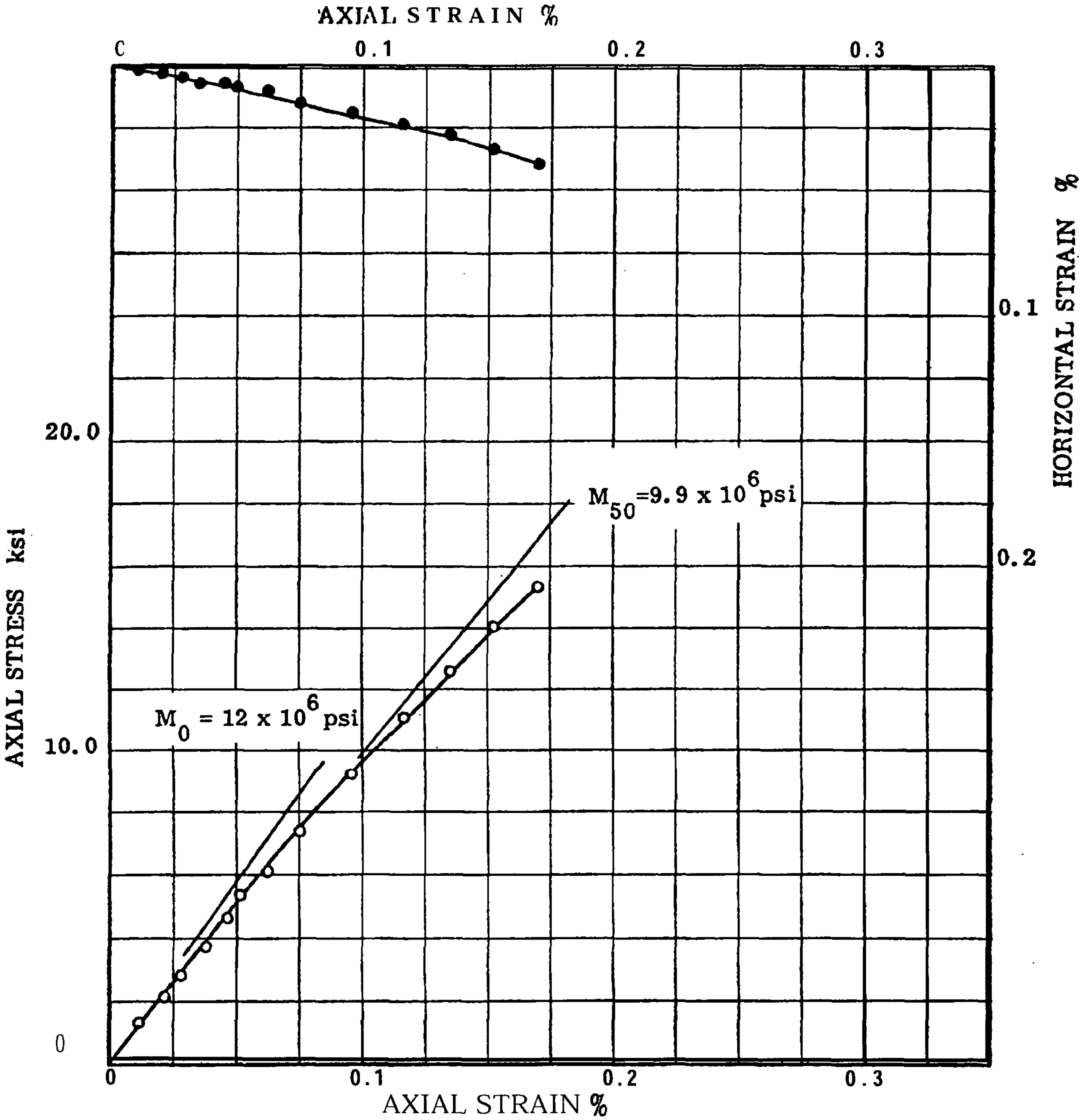


M= Modulus of Deformation

Diorite
Borehole E2-2 Depth 49. 6 to 50. 0ft

UNCONFINED TEST E2A STRESS-STRAIN CURVE

FIGURE 2G-3



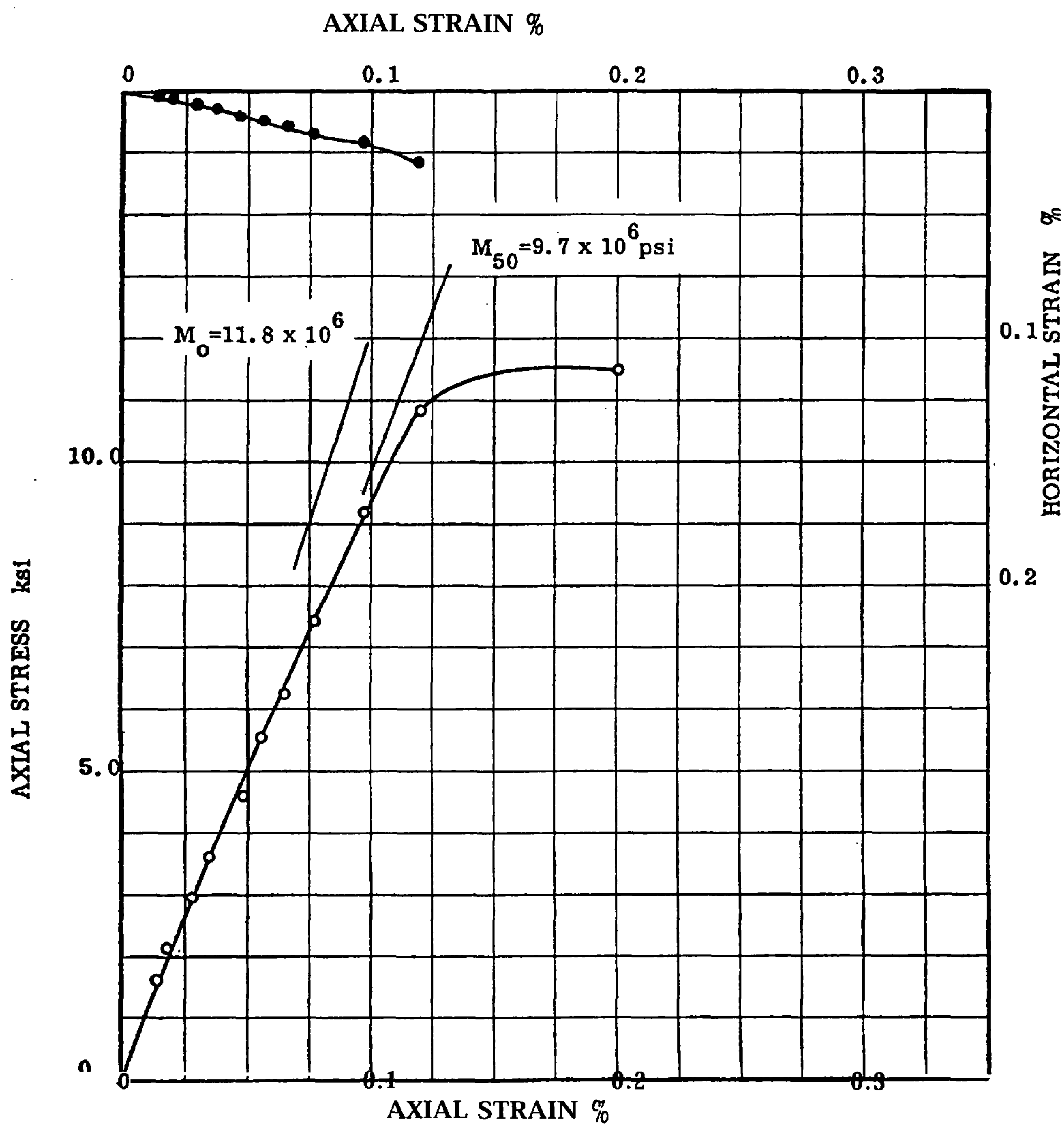
Diorite

M = **Modulus** of Deformation

Borehole E2-2 Depth 50.4 to 50.8 ft

UNCONFINEDTEST E2C STRESS-STRAIN CURVE

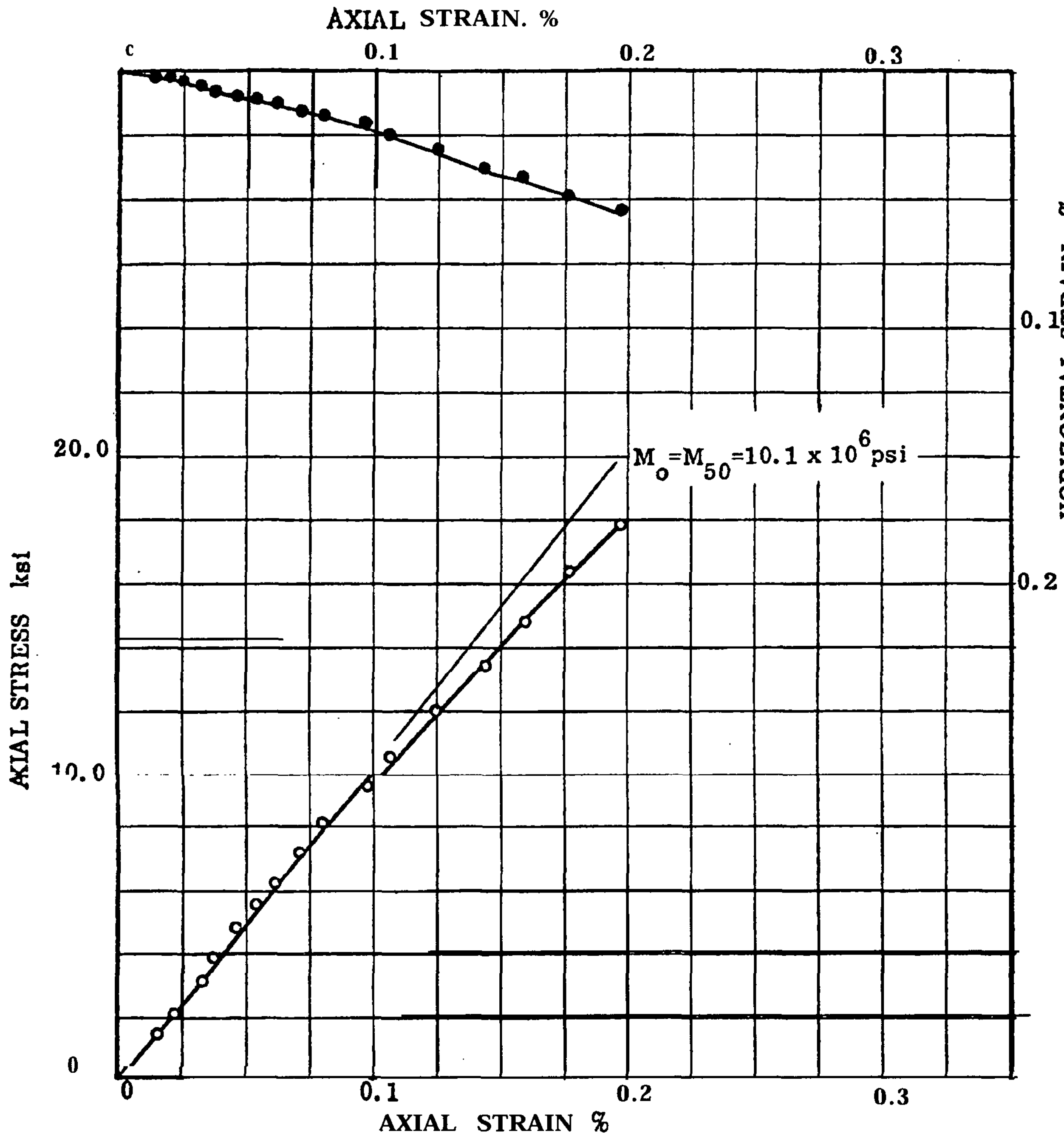
FIGURE 2G-4



M = Modulus of Deformation

Schist
Borehole E2-2 Depth 139.4 to 139.8

UNCONFINED TEST E2 J STRESS-STRAIN CURVE
FIGURE 2G-5



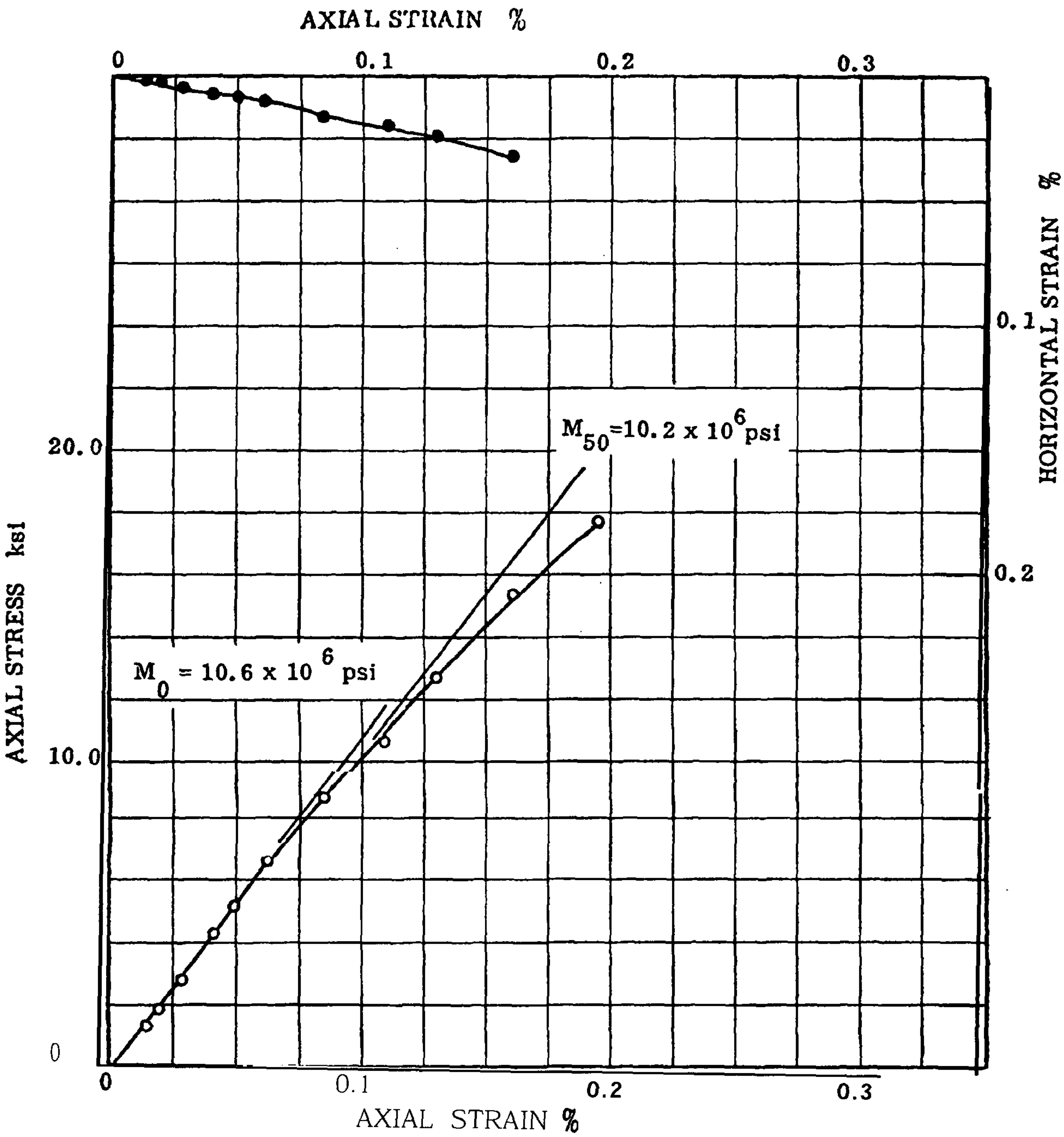
Schist

M = Modulus of Deformation

Borehole E2-2 Depth 141.9 to 142.3 ft

UNCONFINED TEST E2M STRESS -STRAIN CURVE

FIGURE 2G-6

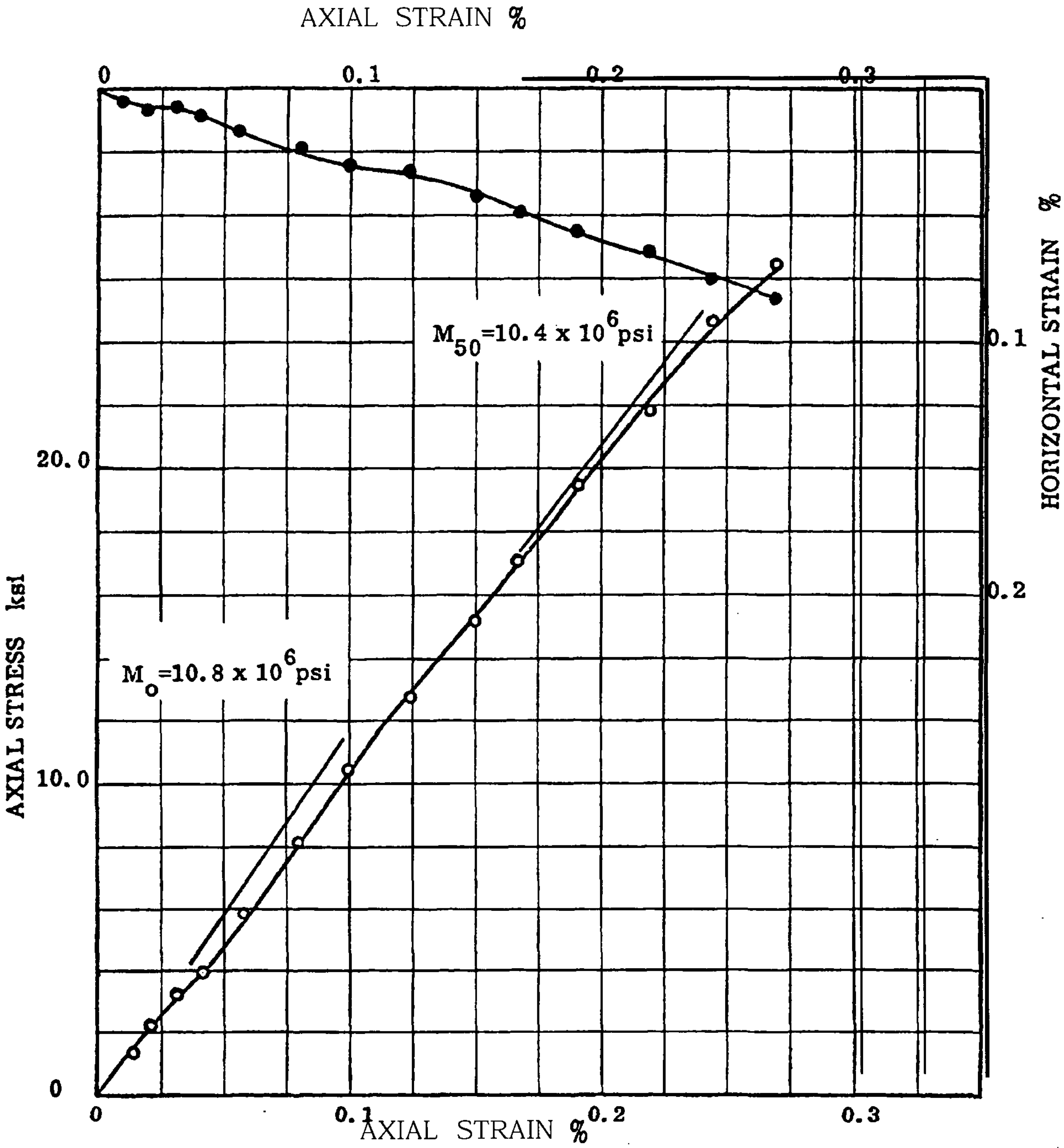


M = **Modulus of** Deformation

Borehole B7 Schist Depth 27.8 to 28.2 **ft**

UNCONFINED TEST B7B STRESS-STRAIN CURVE

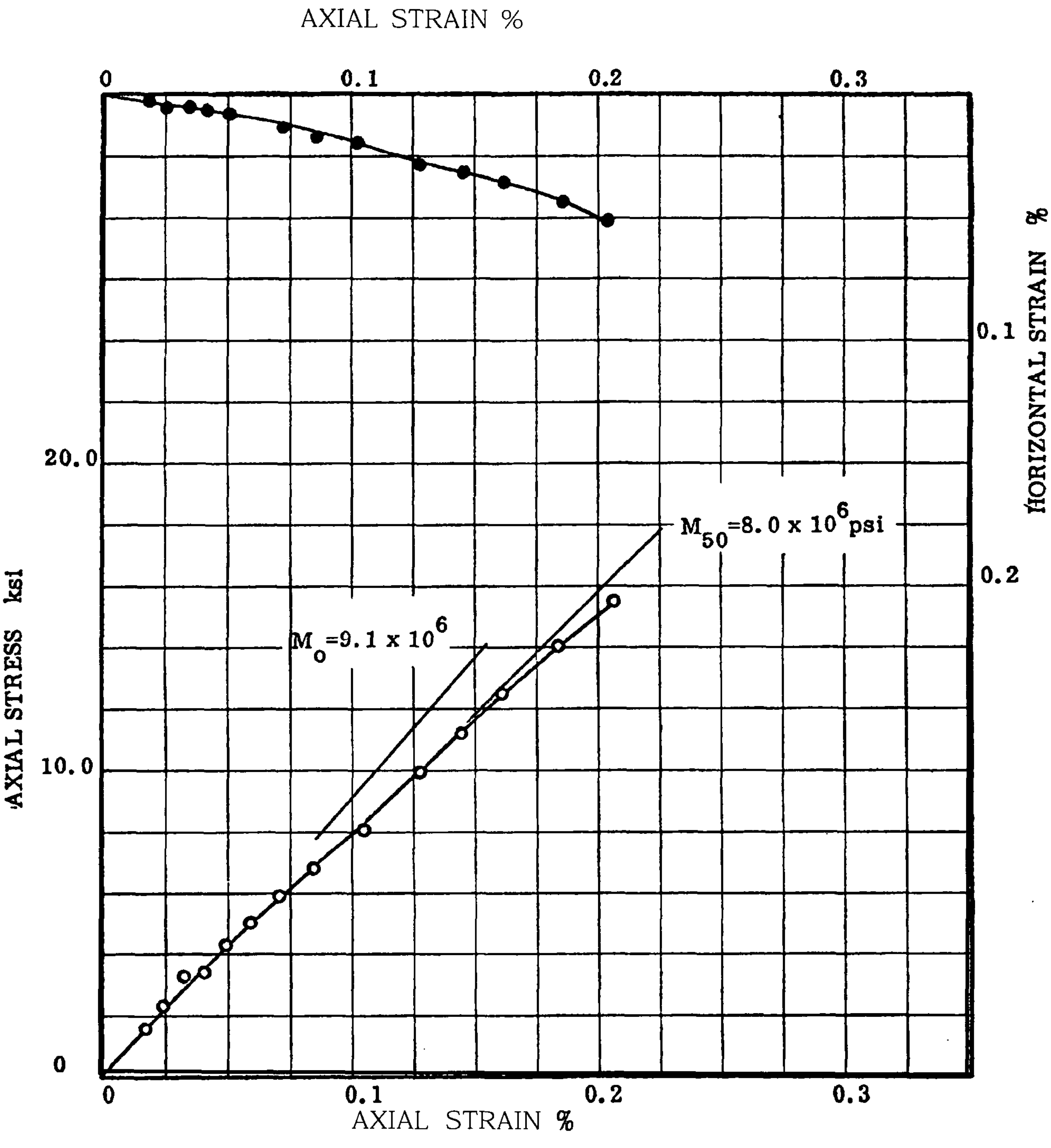
FIGURE 2G- 7



M = **Modulus** of Deformation

Diabase
Borehole B-12 Depth 123.5 to **12[illegible].9 ft**

UNCONFINED TEST B42D STRESS-STRAIN CURVE
FIGURE 2G-8



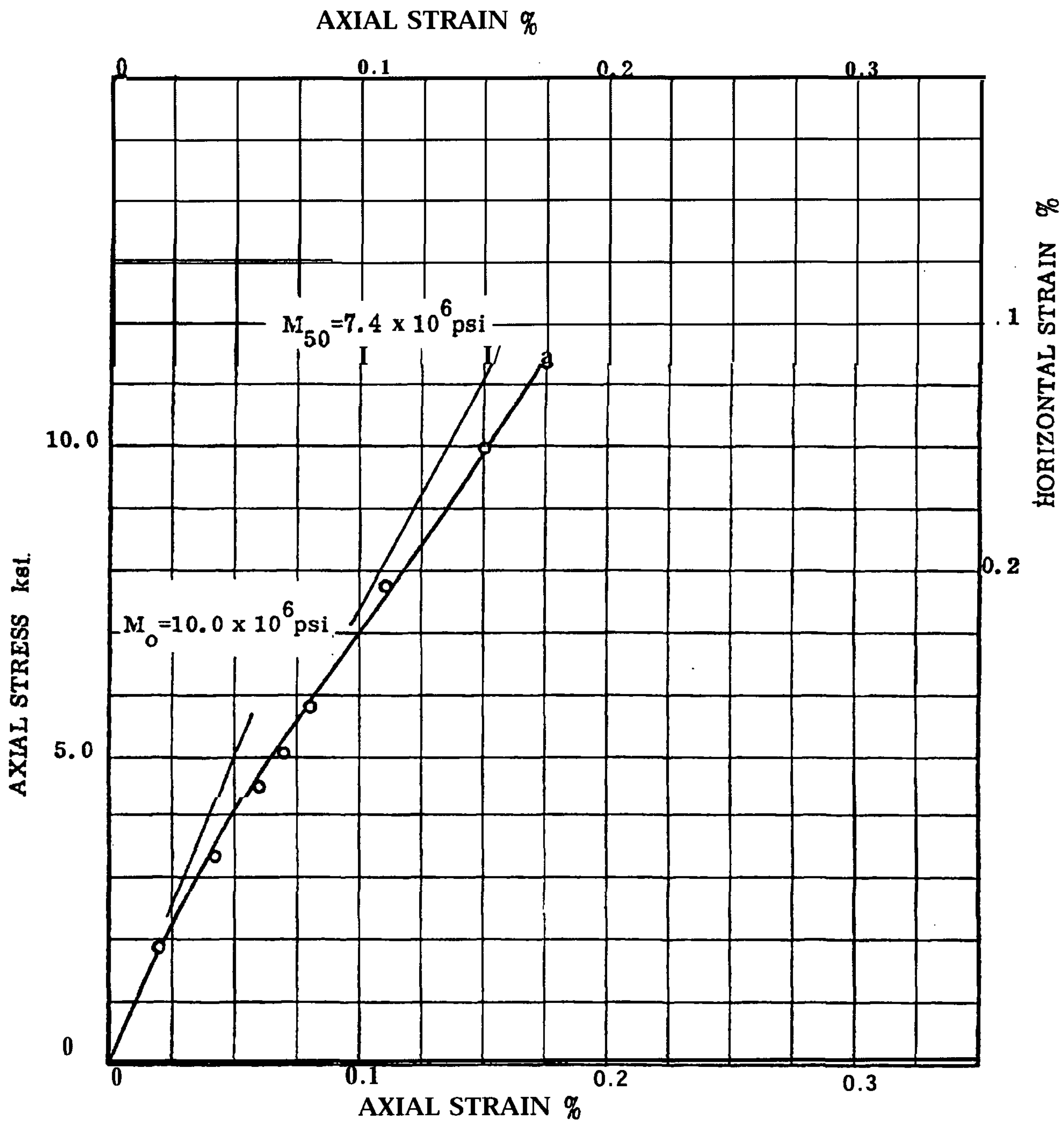
M = Modulus of Deformation

Schist

Borehole B42 Depth 141.3 to 141. **7 ft**

UNCONFINED TEST B42F STRESS-STRAIN CURVE

FIGURE 2G-9

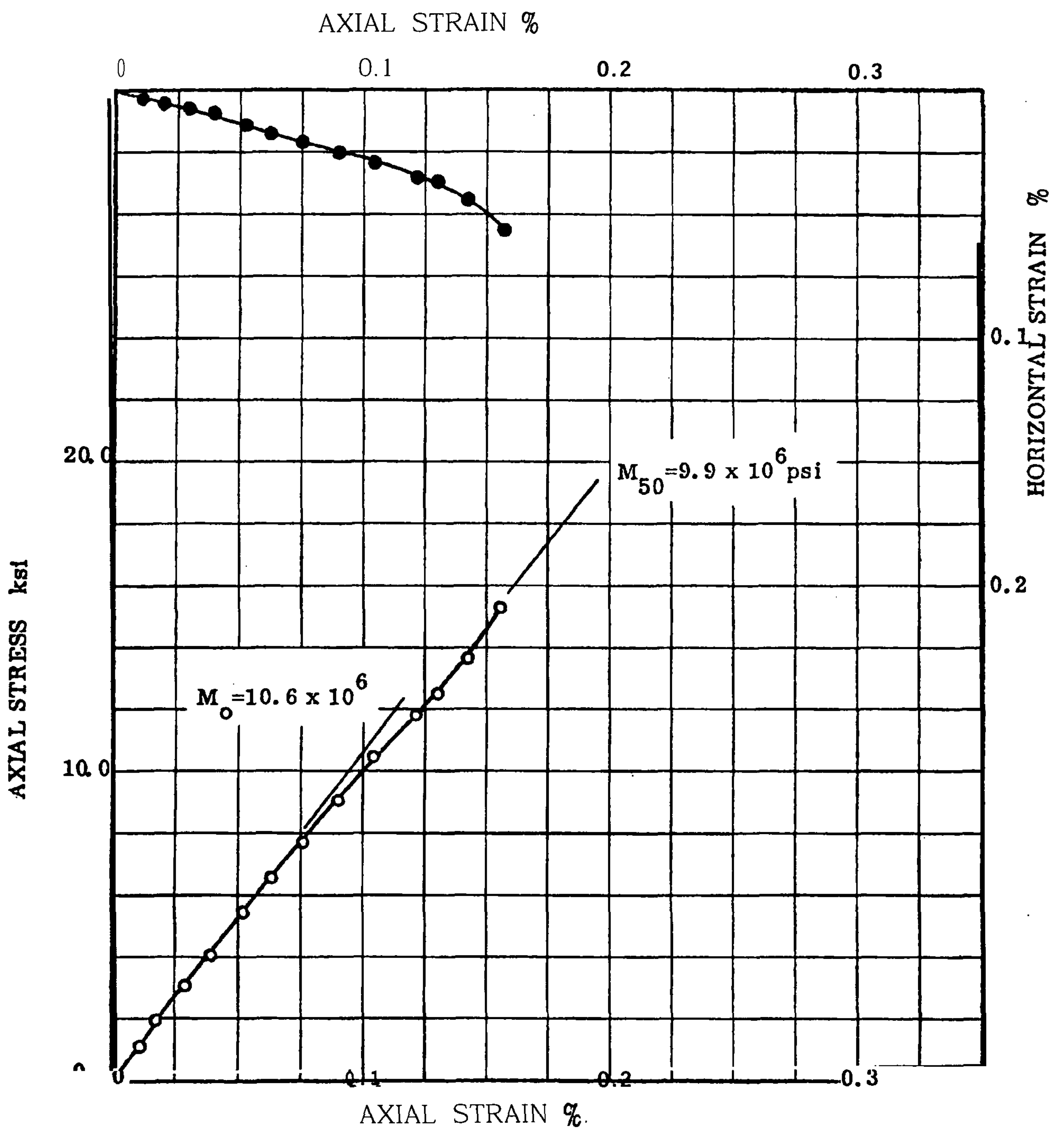


M = Modulus of Deformation

Borehole B42 Schist Depth 142.7 to 143.1 ft

UNCONFINED TEST B42H STRESS-STRAIN CURVE

FIGURE 2G-10



M = **Modulus** of Deformation

Diorite

Borehole F1A Depth 127.5 to 127.?ft

UNCONFINED TEST F IA STRESS-STRAIN CURVE

FIGURE 2G-11

APPENDIX 2H

ROCK STRESS MEASUREMENTS IN BORING OC1A

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

SEABROOK STATION

ROCK STRESS MEASUREMENTS
IN BORING OC1A

for

Yankee Atomic Electric Company
and
Public Service Company of New Hampshire

September 1973

by

Geotechnical Engineers, Inc.
934 Main Street
Winchester, Massachusetts 01890

SEABROOK STATION

ROCK STRESS MEASUREMENTS IN BORING OC1A

CONTENTS

LIST OF TABLES

LIST OF FIGURES

SUMMARY

Rock stress measurements were made in June and July 19'73 at depths of 33 ft to 42 ft in vertical Boring OC1A, which is about 34 ft from the center of proposed Reactor No. 1 of Seabrook Station.

The results of five measurements of compressive stresses in the horizontal plane were:

Largest stress: 1240 psi (150 to 2150 psi)
Smallest stress: 860 psi (50 to 1570 psi)

The vertical stress can be assumed equal to the overburden stress of about 50 psi. The average direction of the largest stress in the horizontal plane was N 40 E ($\pm$ 36°). These results compare well with other stress measurements in New England. (Fig. 18).

The rock at this location consists of a medium-grained, massive, quartz-diorite that contains pegmatitie dikes ranging in thickness from inches to two feet. See Figs. 2 and 3 for logs of Boring OC1A and El-1. The latter hole is NX-size and is located at the center of proposed Reactor No. 1.

The stress measurements were made by inserting a **6-arm borehole** gage in a 1.5 in. diameter hole and overcoring with a bit that cuts a 4.31 in. diameter core around the inner hole. The rock modulus was measured by testing the annular core in a cell constructed to apply stress to the exterior of the **annulus** while making deformation measurements in the inner hole with the **borehole** gage.

SEA BROOK STATION

ROCK STRESS MEASUREMENTS
IN BORING OC1A

for

Yankee Atomic Electric Company

and

Public Service Company of New Hampshire

Geotechnical Engineers, Inc. September 10, 1973

1. INTRODUCTION

1.1 Background

Measurements of seismic velocities in the bedrock at the plant site at Seabrook Station were made in the spring of 1969 by Weston Geophysical Research. These measurements indicated that the velocity in the Newburyport granodiorite ranged from 16500 fps to 18500 fps, whereas in the Kittery Schist the velocity was about 13000 fps. The velocities in the granodiorite were slightly on the high side, although not unusual in the area, and could be taken as a possible indication of in-situ stresses in the bedrock. Therefore, a modest program of stress measurement was undertaken in the zone where high velocities were measured at the location of one of the two proposed reactors. The measurements were made during June and July 1973.

1.2 Purpose

The purpose of this report is to present the results of measurements of in-situ stresses in the Newburyport granodiorite in vertical Boring OC1A at a depth of 31 to 43 ft using the overcoring technique. The coordinates of this hole are N20413, E796'71.

1.3 Scope

One hole was drilled near the center of proposed Reactor #1 at Seabrook Station for the purpose of measuring in-situ stresses. Eleven measurements

were made using the overcoring technique. Each measurement consisted of three deformation readings in the horizontal plane on axes oriented 120° apart. Of the eleven attempts, the data from five of the measurements, at depths of 33 ft 9 in. to 41 ft 5 in., were deemed suitable for analysis and are reported herein. The other measurements gave poor or marginal information because of rock fracture and /or equipment breakdown during overcoring.

Moduli of elasticity of the rock were measured (a) on two annular cylinders of rock removed after overcoring, and (b) intact specimens oriented such that the load was' applied in the direction of the axis that was horizontal in-situ. These moduli were used with the measured deformations and published formulae to compute the magnitude and direction of the largest and smallest normal stresses in the horizontal plane. The vertical stress was assumed to be *equal* to the overburden *pressure.*

The test procedures used are described in detail in Appendix A and B.

The tests were carried out in the field by Pierre Le Francois under the direction of Geotechnical Engineers Inc. The drilling was performed by the American Drilling and Boring Company.

2. METHOD OF MEASUREMENT

2.1 General

The overcoring technique consists of three phases:

1. Measurement of borehole expansion during overcoring.

2. Determination of the modulus of elasticity of the rock, for rebound to zero stress, preferably at the point of measurement, and

3. Computation of stresses using the theory of linear elasticity and the measured deformations and moduli.

Each of the above steps are described briefly in subsequent subsections.

2.2 The Overcoring Technique

Fig. 1 is a sketch of the appearance of the hole during overcoring. A PX hole, 5. O-in. diameter, was first drilled with a single-tube core barrel to the desired depth. In this case, this depth was the shallowest at which the rock was continuous enough to be tested, which turned out to be 31 to 43 ft below ground surface. Logs of Boring OC1A and Boring El-1 (NX-size), which are about 14 ft apart, are shown in Figs. 2 and 3, respectively.

An EX single-tube core barrel, 1.5 in, 0. D. , was then carefully centered in the bottom of the PX hole and drilled to a depth of about 2 ft. The recovered EX core was examined to determine whether the rock was sufficiently continuous to attempt a measurement. If the core was unbroken, or only jointed once or twice, then an attempt was made.

The borehole gage, which is described in Subsection 2.3, was then lowered into the hole using orientation rods. These rods were used to preserve the orientation of the measuring points and for measuring depths accurately when the borehole gage was lowered into the hole. The measuring points on the borehole gage were at least 3.5 in. below the bottom of the PX core barrel (Fig. 1) so that a minimum depth of overcoring would be needed for a measurement, and to allow two measurements for each EX run if the rock did not break.

Overcoring with the PX single-tube core barrel was then carried out. Readings of deformation on three axes 120° apart in the horizontal plane were taken continuously until the PX core barrel was about 5 in. below the measuring points, or until the readings stopped changing rapidly.

The procedure for carrying out each measurement is described in detail in Appendix A.

2.3 The Borehole Gage

A photograph of the instrument, the hose, the readout, and the pressure application system is shown in Fig. 4. The instrument, without its vinyl sheath, is shown in Fig. 5. The deformation is measured by bending of the cantilevers that are seen at the left in Fig. 5. The readout. of thc strain gages on the cantilever arms is proportional to the movement of the tips of the cantilevers. In this instrument three pairs of cantilevers were installed 120° apart. In principle only three cantilevers are needed, but a fourth is necessary to be able to compute body movement of the instrument within the hole. To eliminate this computation, the cantilevers were installed in pairs such that body movements cause zero output on the readout device. The instrument was designed and constructed by Pierre Le Francois.

The tips of the cantilevers are attached to the vinyl sheath, Fig. 4, such that when air pressure (or bottlednitrogen pressure) is applied inside, the cantilevers are forced against the side of the hole. Hence the hose serves the dual purpose of protecting the strain gage leads and passing air to the instrument. The readout is made on a conventional strain gage indicator.

2.4 Measurement of Modulus of Rock

To obtain the best value of the modulus of elasticity of the rock in the zone tested, it is necessary to remove the overcored annular cylinder of rock from the hole and test it in a rock modulus cell. In Fig. 6 an annular core is shown in the cell with the borehole gage in the central hole of the core. To determine the modulus one applies pressure to the outside of the core, up to about 3000 psi, and then removes it in increments, measuring the deformation of the central hole for each pressure decrement. In this way one reproduces reasonably well in the core the stresses that it underwent during overcoring. The details of the measurement procedure are given in Appendix B.

In the present case the rock in Boring OC1A, at the measuring points, was so broken up that only two satisfactory annular cores of sufficient length (16 in.) were recovered. They both contained slightly healed joints that broke during testing, although satisfactory results were obtained from both.

'To supplement the measurement of modulus on the annular cores, intact specimens of rock from Boring OC1A, from depths where stress measurements were made, were tested in unconfined compression. The specimens were loaded in the direction of the axis that was horizontal in-situ so that the load was in the same direction as in situ. The rebound modulus of these specimens was measured with the aid of strain gages glued on the sides of the specimens.

2.5 Computation of Stresses

The major and minor stresses in the horizontal plane were computed from the measurements using the following formulae from Obert (1 966):

$$p = \frac{Ek}{6d} (R_1 + R_2 + R_3) \qquad (1)$$

$$q = \frac{\sqrt{2}\, Ek}{12d} \sqrt{(R_1 - R_2)^2 + (R_2 - R_3)^2 + (R_3 - R_1)^2} \qquad (2)$$

where:

p = Stress at center of Mohr circles of stress, psi
q = Radius of Mohr circle of stress , psi
E= Modulus of elasticity measured for same stress changes as occurred in situ, psi
d = Diameter of central hole in which instrument is placed, in.
kR = Horizontal expansion of the diameter of the borehole during overcoring. The subscripts refer to axes that are 120° apart in the plane perpendicular to the axis of the borehole gage - in this case horizontal. R is the reading in microinches/inch ($\mu\epsilon$) and k is the instrument calibration in in. /$\mu\epsilon$

From the values p and q one can compute the largest and smallest stresses in the plane perpendicular to the axis of the borehole gage from:

$$\sigma_I = p + q \qquad (3)$$

$$PI = p - q \qquad (4)$$

The direction of stress σ_I is obtained from the formula: 1):

$$\alpha = 1/2 \tan^{-1} \frac{\sqrt{3}\,(R_2 - R_3)}{2R_1 - (R_2 + R_3)} \qquad (5)$$

where: α = angle measured from the direction of R_1 to the direction of σ_I in the counterclockwise direction.

Reference (1) Obert, Leonard (1966) "Determination of the Stress in Rock - A State of the Art Report," Presented at the 69th Annual Meeting of the ASTM, Atlantic City.

1) Eq. (5) contains $\sqrt{3}$ in the argument rather than 3, which was shown in the Reference (1) by error, but was correct in an earlier reference.

Equation (5) is subject to the following restrictions:

If $R_2 > R_3$ and $R_2 + R_3 < 2R_1$, then $0 < \alpha < 45^\circ$
and $R_2 + R_3 > 2R_1$, then $45^\circ < \alpha < 90^\circ$
If $R_2 < R_3$ and $R_2 + R_3 > 2R_1$, then $90^\circ < \alpha < 135^\circ$
and $R_2 + R_3 < 2R_1$, then $135^\circ < \alpha < 180^\circ$

All but Eq. (5) above are based on the assumption that a plane stress condition exists at the measuring point in situ, i.e. that the vertical stress is zero. Since the vertical stress is very close to the overburden stress of about. 50 psi, which is small compared to the magnitude of horizontal stresses of interest, the plane stress assumption is appropriate in this case. Hence the computed stresses are dependent only on the modulus of elasticity and not on Poisson's ratio of the rock.

3. TEST DATA AND RESULTS

3.1 Calibrations

The results of calibrations of the instrument and measurements of rock modulus are shown in Table 1. Direct calibration of Instrument, No, 2 with a micrometer yielded $k = 10\ \mu$ in. $/\mu\epsilon$. Since $5\mu\epsilon$ can be read, the instrument can be used to discern movements in the borehole as small as 5×10^{-5}in. Instrument, No. 1 was not calibrated directly, but it is capable of discerning movements of 2×10^{-5}in. in the borehole.

The borehole gages were calibrated under conditions similar to in-situ conditions by using an annular aluminum cylinder of known modulus (10×10^6 psi) as a standard. Table 1 shows that Instrument No. 2 yielded $k = 8.6\ \mu$ in.$/\mu\epsilon$, as compared with $10\ \mu$ in.$/\mu\epsilon$ for the direct calibration above. Since the calibration in the rock modulus cell models very closely the in-situ testing conditions and since the modulus of aluminum is well known, the value of $k = 8.6\ \mu$ in. $/\mu\epsilon$ for Instrument No. 2 is the better value and was used herein. * Similarly $k = 4.4\ \mu$ in.$/\mu\epsilon$ was used for Instrument No. 1.

Two annular cores of granodiorite were retrieved that could be tested in the rock modulus cell. The second of these, near tests OC1A-8/9, broke and had to be glued with epoxy to complete the test, The results in Table 1 show that the moduli of the two cores were 4.1 and 3.0 $\times 10^6$ psi. The modulus for the pegmatite (Test OC1A-2) was assumed to be 4.1×10^6 psi also since it was harder but seemed to contain a greater number of healed joints than the granodiorite.

As a check on the modulus values obtained for the annular cores of granodiorite, additional tests were made by cutting 1.2 in. cube samples from some of the broken cores, gluing on strain gages, and loading them horizontally. The moduli were:

---

*The direct calibration was made without the vinyl sheath in place. The cantilevers were therefore unstressed. When the gage is in the borehole, the cantilevers are stressed to half their elastic limit. Hence, the direct calibration is not as appropriate as the calibration which makes use of a standard annular cylinder.

From Test	Rock*	Rebound Modulus 10^6 psi
OC1A-2	Granodiorite	12
OC1A-2	Pegmatite	12
OC1A-3	Granodiorite	5
OC1A-7	Granodiorite	11

* Specimens were cubes 1.2 in. on a side.

The range of possible moduli of the granodiorite is from about 3 to 12 x 10^6 psi. The larger values were measured on small intact specimens using strain gages, whereas the smaller values were measured on the annular cores using a loading sys tern and measuring device which were identical for practical purposes to in situ conditions. Hence the moduli used in the computations were those measured on the annular cores. The fact that one intact specimen of granodiorite had a modulus of only 5 x10^6 psi gives some confidence in the use of a still lower modulus for the large annular cores, because they can be expected to contain more defects than the smaller specimens.

3.2 In Situ Stresses and Directions

Table 2 shows the test conditions and the computed calibrations and moduli. Table 3 shows the readings selected from the data in Figs. 7 to 11 together with the stresses and directions computed from Eys. (3), (4), and (5). The dimensions of the overcored hole for each test are shown in Figs. 12-16, and photographs of the annular cores recovered, including the ones for which moduli were measured, are shown in Fig. 17.

Fig. 18 shows to scale the computed stresses and directions for the best estimated values. Table 3 shows the numerical values for these best estimates as well as other possible values for Tests OC1A-2, 7, and 9. These additional values arise from alternate selections of the changes in reading from Figs. 7, 10, and 11.

The largest normal stress in the horizontal plane (σ_I) is compressive, ranges from 150 to 2150 psi, and averages 1240 psi. The smallest normal stress in the horizontal plane (σ_{II}) is also compressive, ranges from 50 to 1570 psi, and averages 860 psi. The direction of σ_I is N 40 E $\pm$, 36°. In giving this direction, the direction for Test OC1A-5 is neglected because the stress was so small in that test that the computed direction is not meaningful.

4. DISCUSSION OF RESULTS

The stresses and directions in Fig. 18 show that the direction of the major stress in the horizontal plane is generally NE-SW. The magnitude of this stress is best taken as the average of the five satisfactory measurements, since inherent variations in the stress and direction can occur within any given block of rock in situ, particularly near surface. This average is 1240 psi (87 bars) for the major stress and 860 psi (61 bars) for the minor stress in the horizontal plane. The vertical stress is assumed equal to the overburden pressure of about. 50 psi,

At the bottom of Fig. 18 is a tabulation of some known previous stress measurements in New England (Sbar and Sykes, 1973). The general agreement. between the stresses at Seabrook and those elsewhere in New England is clear. The direction of the major stress is also in reasonable agreement. The range of error in the computed direction, simply due to alternate selections of the changes that occurred during overcoring, is such as to place all of the earlier values essentially within the possible total range for the present case.

It should be noted that the technique used herein for modulus measurement is really nothingmore than a method for reapplying the in-situ stresses under laboratory conditions. Hence the computed stresses are in fact independent of the absolute values of the modulus and the instrument calibration constant. If the researchers who made the previous measurements did not use a similar approach, then the agreement of all the data may be fortuitous.

By measuring the deformation of an annular specimen of rock in the laboratory one eliminates many potential sources of error. However, the damage done to the core during drilling is not taken into account. If the rock in-situ contains microfractures, they may be opened during drilling of the EX and the PX holes. When this annulus is brought to the laboratory, its modulus is likely to be lower than in situ. Previous work by Obert (1962) indicates that until the stress levels reach about 50% of the crushing strength of the intact rock, the effect of stress relief is likely to be low. The effect in the present case is probably low because the crushing strength is more than four times the highest stress that was measured.

Reference (2) Sbar, M. L. and Sykes, L. R. (1973) "Contemporary Compressive Stress and Seismicity in Eastern North America: An Example of Intra-Plate Tectonics," Geological Society of America Bulletin, Volume 84, No. 6, p. 1871.

Reference (3) Obert, Leonard (1962) "Effects of Stress Relief and Other Changes in Stress on the Physical Properties of Rock," Bureau of Mines, RI 6053.

TABLES

TABLE 1 CALIBRATIONS

A. DIRECT CALIBRATION WITH MICROMETER

Inst No.	Change in Reading per 10^{-3} in. for each Channel, $\mu\epsilon$				Instrument Calibration k μ in./$\mu\epsilon$
	R_1	R_2	R_3	Avg	
2	100	100	103	101	10

B. CALIBRATIONS USING ANNULAR CORES IN ROCK MODULUS CELL

Inst No.	Change in Reading per 10^3 psi for each Channel, $\mu\epsilon$				k	E	Medium
	R_1	R_2	R_3	R_{Avg}	μ in./$\mu\epsilon$	10^6 psi	--
1	76	78	76	77	4.4	10	Al
2	40	41	39	40	8.6	10	Al
	41	39	39	40	8.6	10	Al
1	200	173	192	188	4.4	4.1	OC1A-4 diorite
2	135	140	130	135	8.6	3.0	OC1A-8/9 diorite

Underlined values computed using equation for thick-walled cylinder under external pressure for OD = 4.31 in, ID = 1.50 in.: $kR = 3.43\frac{p}{E}$. The quantity kR is equal to the diametral deformation. Al = Aluminum.

TABLE 2 TEST CONDITIONS FOR STRESS MEASUREMENTS

Test No.	Depth ft-in.	Inst. No.	Inst. Calib. k μ in. /$\mu\epsilon$	Modulus E 10^6 psi	True Azimuth Channel #1 deg.	Rock Type
OC1A-2	33 - 9½	2	8.6	4.1	285	Pegmatite
OC1A-5	36 - 9	1	4.4	4.1	165	Granodiorite
OC1A-6	38 - 3	2	8.6	4.1	285	Granodiorite
OC1A-7	39 - 3	2	8.6	3.0	255	Granodiorite
OC1A-9	41 - 5	2	8.6	3.0	240	Granodiorite

μ in. = microinches

$\mu\epsilon$ = micros train

k = instrument calibration

E = modulus of elasticity used for computation of stresses (see Table 3)

All tests performed in vertical Boring OC1A. Coordinates 20413N; 79671E. Ground El. 28.0. Hole diameter = 5.0 in. Core O.D. = 4.3 in. Hole 0. D. in which instrument placed = 1.5 in. Of eleven attempts made to measure stresses, five were successful.

TABLE 3 DATA AND RESULTS OF STRESS MEASUREMENTS

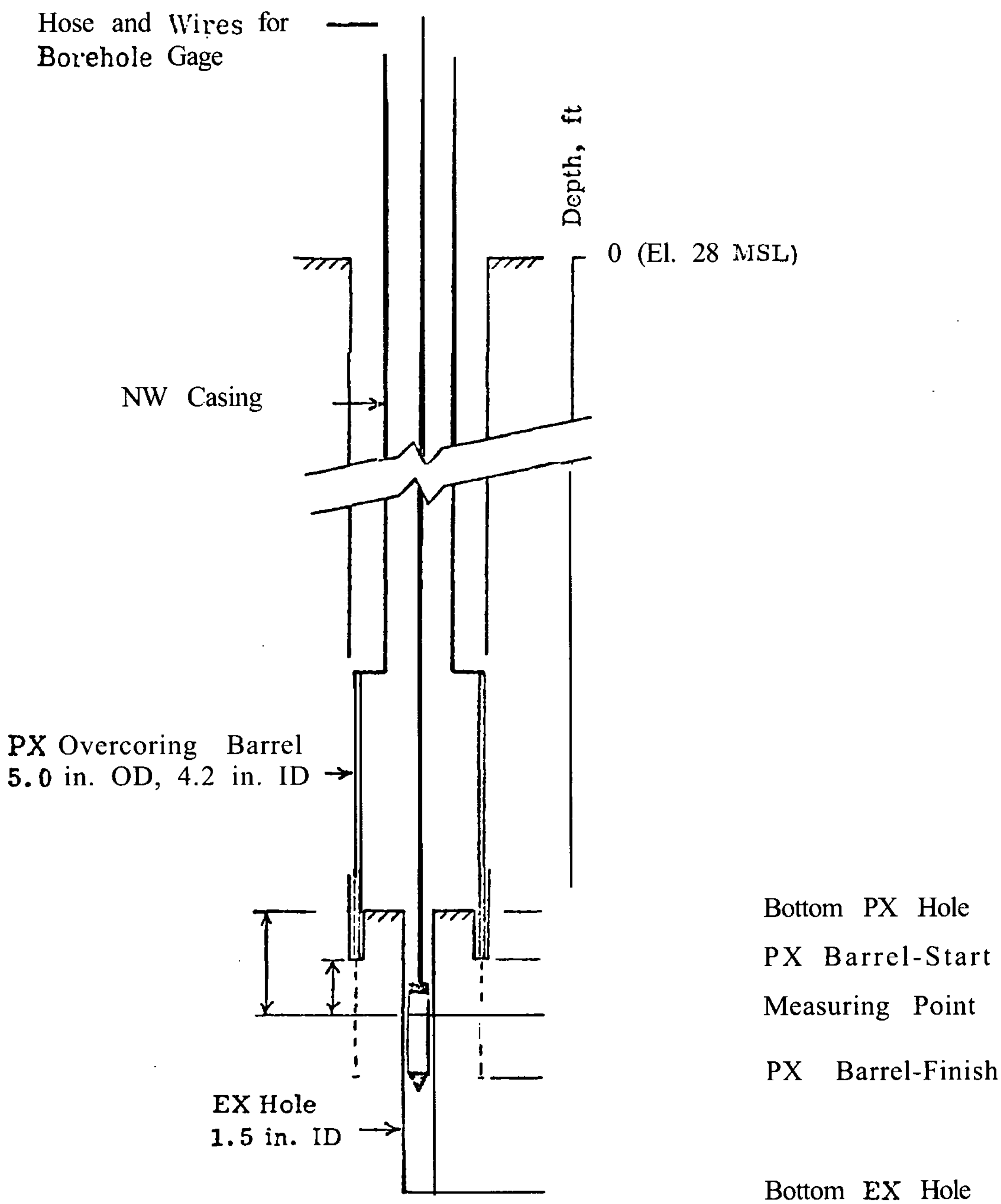
Test No.	Depth	Reading Change during Overcoring 1) 3)			Compressive Stress in Horizontal Plane 2)		True Bearing of σ_I
		R_1	R_2	R_3	σ_I	σ_{II}	
	ft-in.	$\mu\epsilon$	$\mu\epsilon$	$\mu\epsilon$	psi	psi	
OC1A-2	33 - 9½	80	95	125	1335	1025	N 38 E
		80	95	(90)	(1090)	(990)	(N 5 E)
OC1A-5	36 - 9	20	30	0	150	50	N 55 W
OC1A-6	38 - 3	60	110	90	1190	850	N 3 E
OC1A-7	39 - 3	250	150	250	2150	1570	N 45 E
		250	(200)	(200)	(2010)	(1710)	(N 75 E)
		250	150	(200)	(1970)	(1470)	(N 60 E)
OC1A-9	41 - 5	90	195	100	1400	800	N 48 E
		(130)	195	100	(1470)	(970)	(N 36 E)

1) Readings are shown for data from Channels 1, 2, and 3 on instrument. For all tests except OC1A-5, the numbering of the channels, each 120° apart, was counterclockwise. For OC1A-5 it was clockwise. In the equations for computation of the angle between the σ_I and the Channel 1 directions, the numbering is assumed to be clockwise. Hence for all but Test OC1A-5, R_2 and R_3 should be exchanged when computing this angle. See text for equations used for computations.

2) The vertical stress is assumed to be equal to the overburden, i.e. about 50 psi. Hence the stresses shown for the horizontal plane are close to the major and the intermediate principal stresses at each point tested.

3) Numbers in parentheses are alternate possible selections of reading changes during each test from the plots in Figs. 7, 10, and 11. These alternates are not considered quite as probable as the ones without parentheses, but they are included, together with the resulting stresses and stress directions to provide insight into the significance and dependability of the results as they are affected by this one source of error.

FIGURES



Yankee Atomic Electric Company	SEABROOK STATION	SKETCH OF HOLE DURING OVERCORING
Geotechnical Engineers, Inc. Winchester, Massachusetts	Project 7286	Sept. 10. 1973 FIG. 1

SEABROOK STATION
LOG OF BORING OC1A

Coordinates: N 20413; E 79671 | Logged by I'. LeFrancois

Top El. (MSL): 28.0 | Date Logged August 1973

Depth (ft)	BREAKS	DIP	CONDITION OF CORE	GRAPHIC LOG	DESCRIPTIVE NOTES
30	Multiple drilling breaks		60° Joint rusty 30° Joint slightly rusty	①	Pegmatite dike, coarse grained.
					Contact: 60° dip
32			Joint set intersecting at. 30°		Quartz diorite. Dark gray, medium grain, massive texture. Quartz ~ 15%, Feldspar- 35%, Ferromagnesium ~ 40%, Biotite ~ 10%
34			Multiple joints, with pieces from 1/4" to 3" long. Dip from 20 to 70°	② ③	Pegmatite dike, coarse grained. Contact 45° dip
					Quartz diorite as above.
36			55° Tight joint broken by drilling	④ ⑤	
	Drilling break		35°		
38			70° Tight joint 40° Rusted joint 40° Two tight joints, rusty	⑥ ⑦	Pegmatite dike, 2" wide, at about 40° dip.
					Quartz diorite as above.
40			60° Rusty joint 20° Rusty joint 40° Two tight joints	⑧	
	Drilling break		0°	⑨	
42			6 0° Tight joint		
			60° Tight joint		
44	Drilling breaks			⑩ ⑪	

REMARKS - Log is shown, to a large scale, only for range of depth where stress measurements were attempted. Photographs of cores from tested depths are shown in Fig. 17. Log of Boring El-l, 14 ft away, shown in Fig. 3. Depth of stress measurements are shown above by: ①= OC1A-1.

FIG. 2

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SEABROOK STATION
LOG OF BORING EI-1

Coordinates: N 20400; E 79675 Logged by J. R. Rand
Top El. (MSL): 25.9 Date Logged Dec. 26, 1972

Depth (ft)	BREAKS	DIP	CONDITION OF CORE	GRAPHIC LOG	DESCRIPTIVE NOTES
0–20	Core Breaks on low angle (3 0°) joints @ Chips to 1' intervals	Rusty 70° joint even Chips-Rusty 70° joint Chips, rusty moderate weathering minor vugging	Rock is fresh. Locally affected by slight to moderate weathering on joints as shown. Most joints dip about 30° at .3' to 1' intervals.		Quartz diorite, medium fine grained medium grey. Massive texture (not notably foliated. Locally intruded by pegmatite veinlets as shown. Pegmatite Veinlet, 65° Dip Pegmatite Veinlet, 75° Dip
20–30	Breaks on low angle joints @ .5' to 1.5' intervals	Chips, rusty 60° joint minor rust 65° joint slight weathering	Rock is fresh. Slight weathering to minor rusty coatings on some joints.		Pegmatite Veinlet Quartz diorite, as above, Massive, medium fine grained, medium grey.
30–40		65° joint clean, minor rust	Joints are normally clean. Not rusty.		
40–60	Breaks @ .5' to 2' pieces	70° joint minor rust 70° joint rough slight weathering moderately weathered slight weathering	Rock is fresh. Low angle joints @ 30° to 35° dips. Joints not rusty except as shown.		Quartz diorite as above. Mostly medium fine grained medium grey low angle (30° to 35") joints @ .5' to 2 ' intervals.
60–70	Breaks @ .3' to 3' pieces	slightly weathered rusty	Rock is fresh. Slight to moderate weathering, rust on occasional joints as shown.		Rock becomes coarse-grained Quartz diorite @ 72.6' depth. 50° dip on intrusive, welded contact. Reactor excavation

REMARKS - The total depth of this boring is 150 ft, as shown in the log submitted by J. R. Rand for the PSAR for Seabrook Station. This partial log is taken from the original and is included to cover the rock above and immediately below the zone where stres measurements were made, i.e. from 33 - 44 ft.

FIG. 3

Φ GEOTECHNICAL ENGINEERS INC

Geotechnical Engineers Inc.

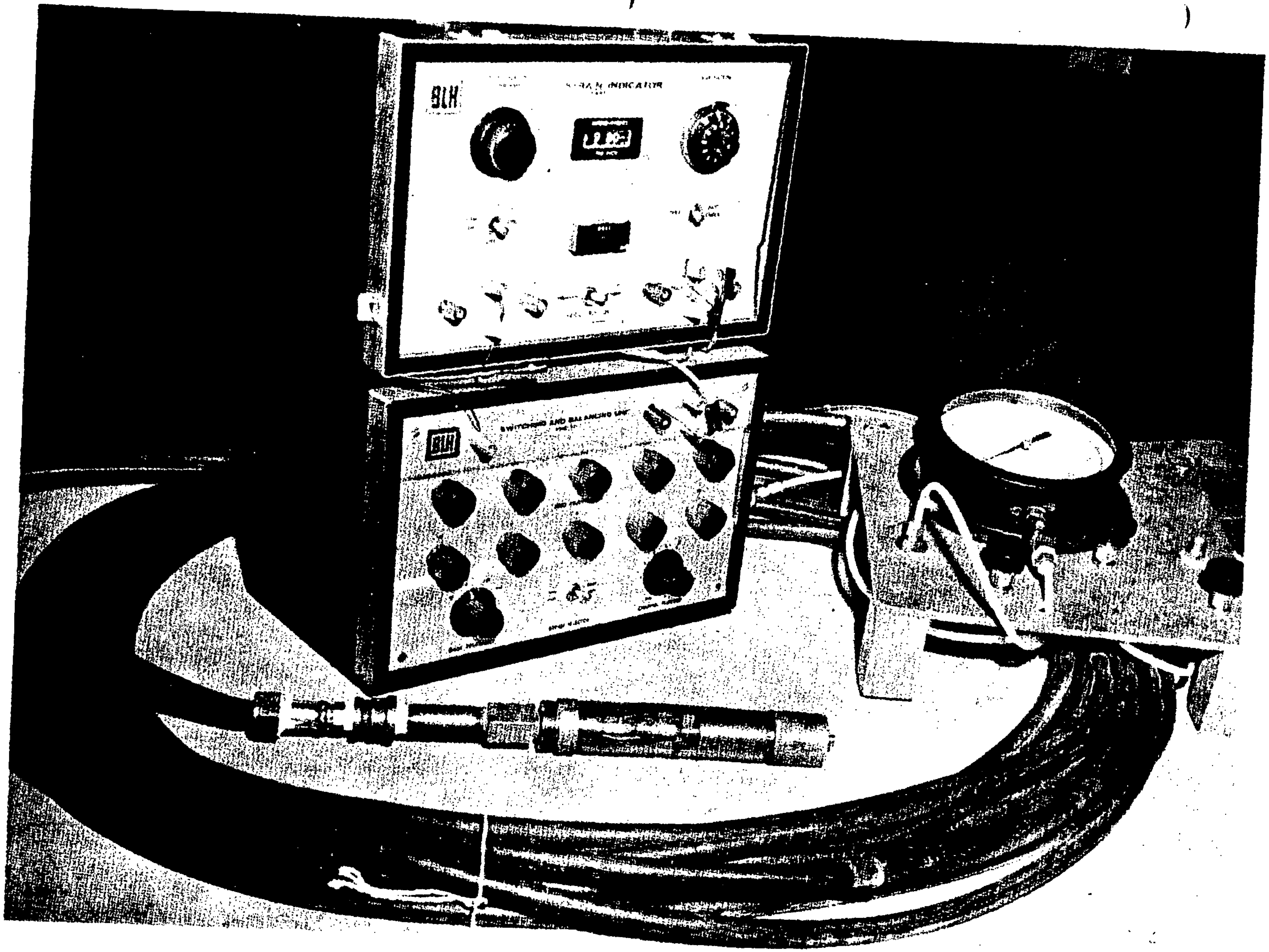
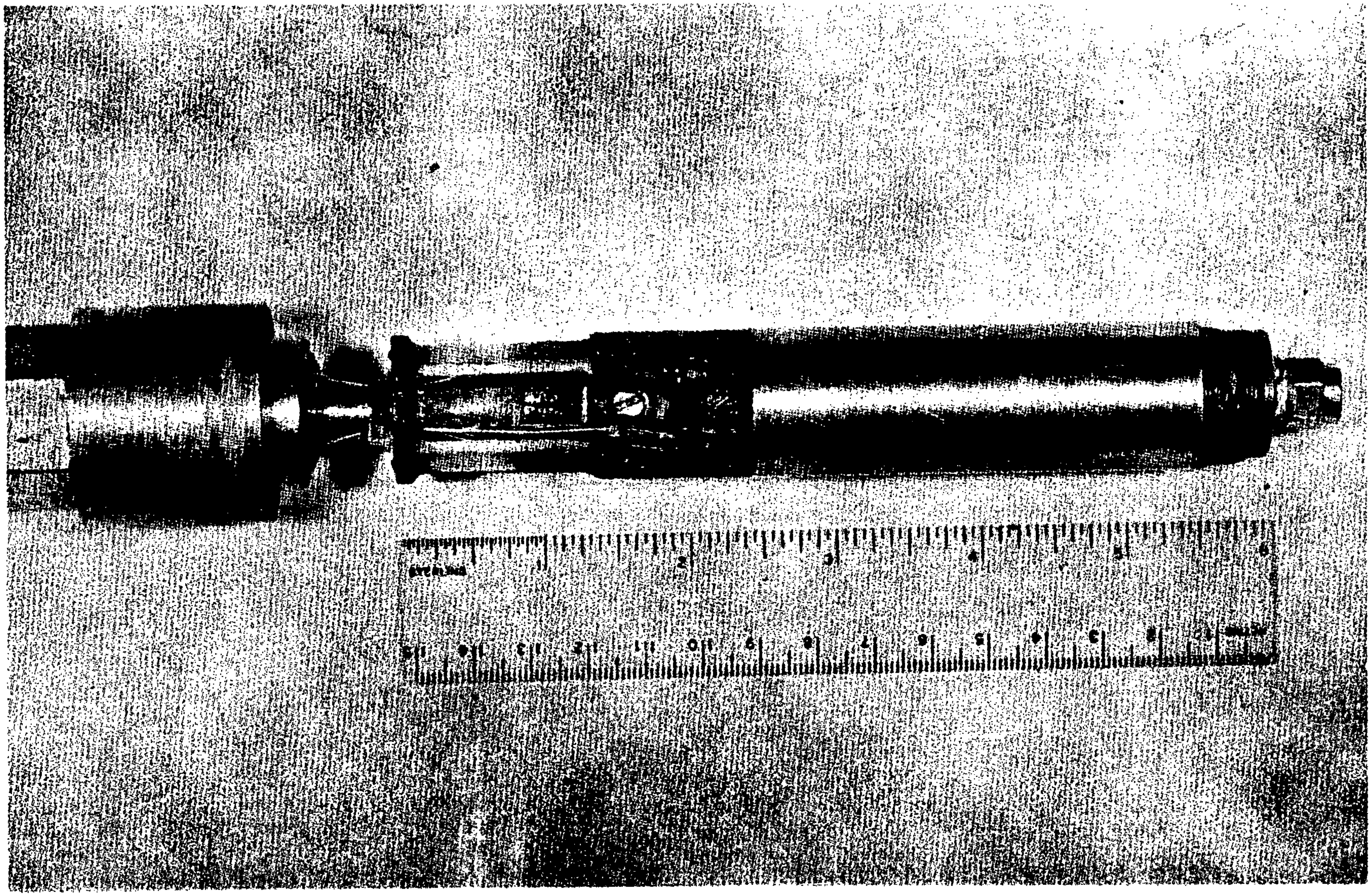


FIG. 4

BOREHOLE GAGE SYSTEM

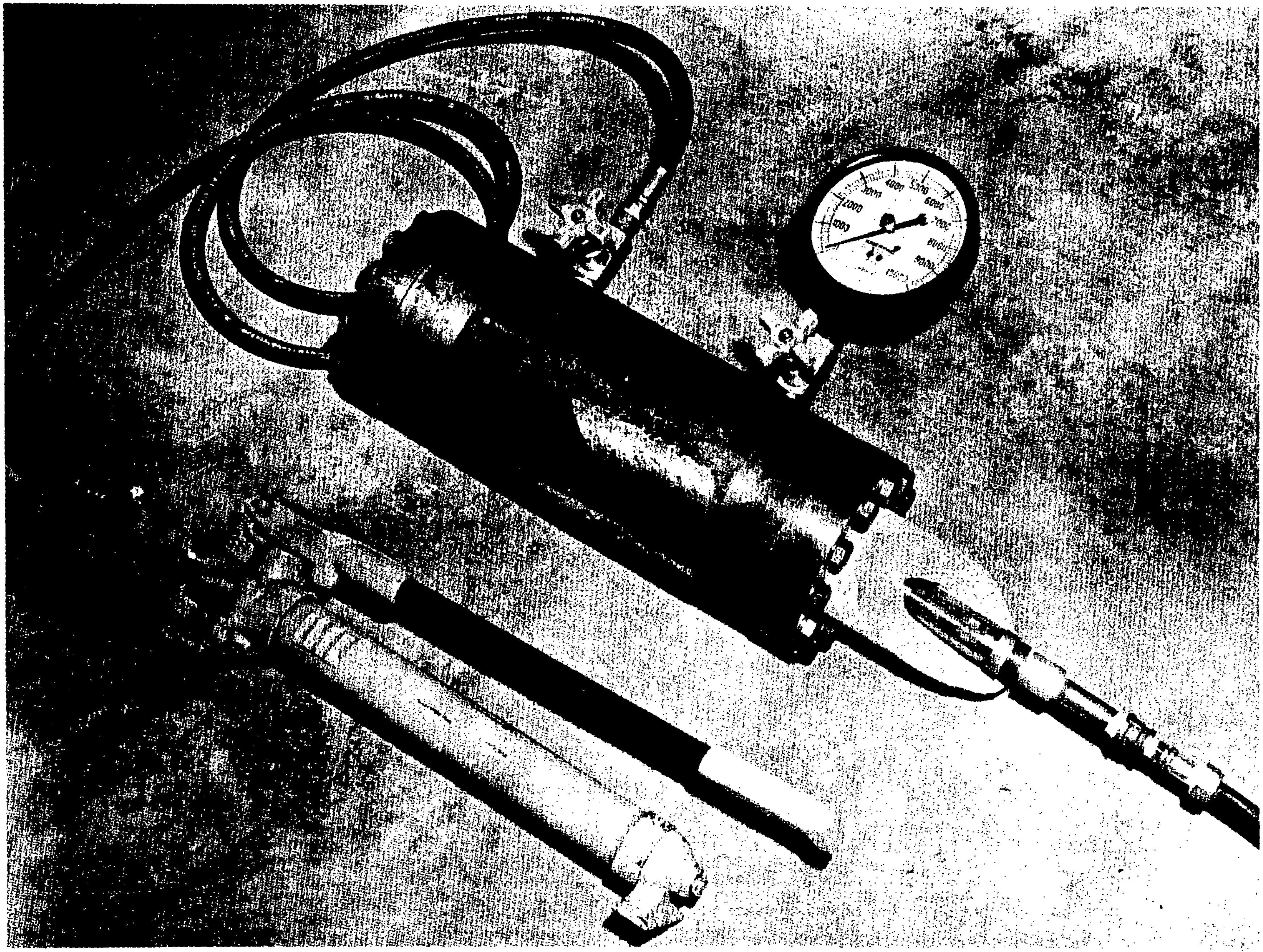
FIG. 5



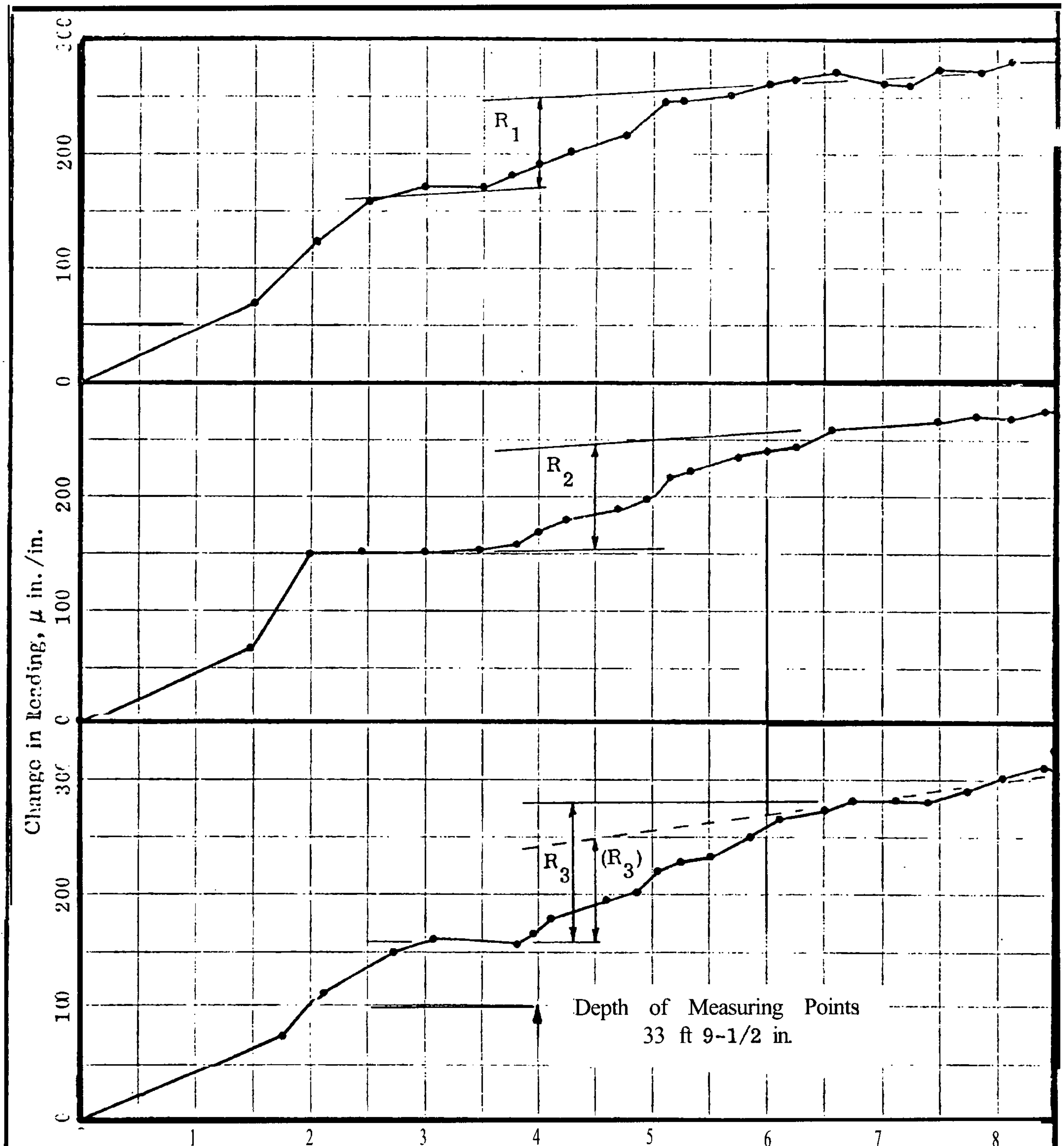
BOREHOLEGAGE
(vinyl sheath removed)

Geotechnical Engineers Inc.

FIG. 6



ROCK MODULUS CELL

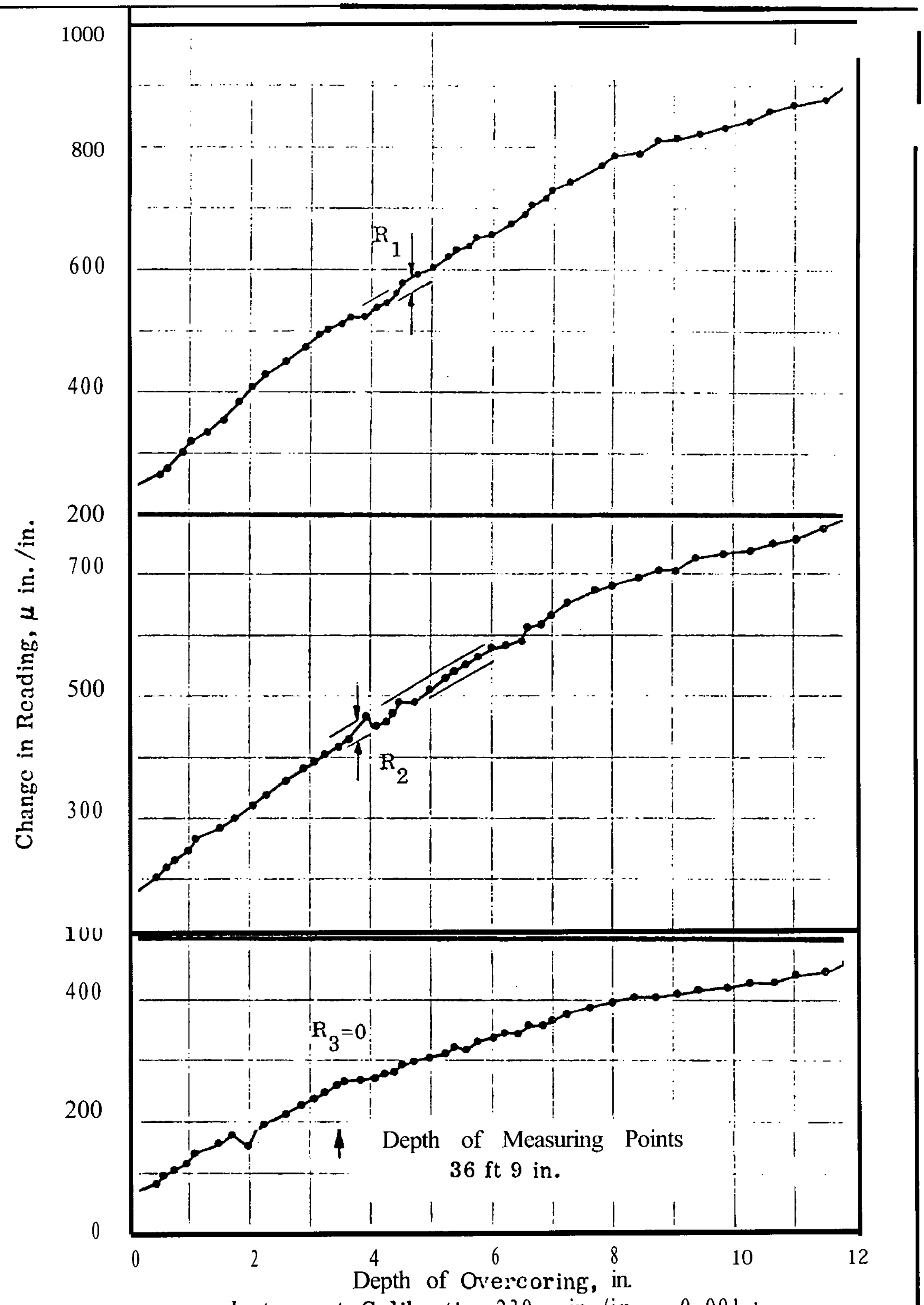


Depth of Overcoring, in.
Instrument Calibration 116 μ in. /in. = 0.001 in.

Note: Hole I.D. = 1.495 in.
O. D. = 4.31 in.

Yankee Atomic Electric Company	SEABROOK STATION	DATA FROM STRESS MEASUREMENTS TEST OC1A-2
Geotechnical Engineers, Inc. Winchester, Massachusetts	Project 7286	Aug. 8, 1973 FIG. 7

GEOTECHNICAL ENGINEERS INC

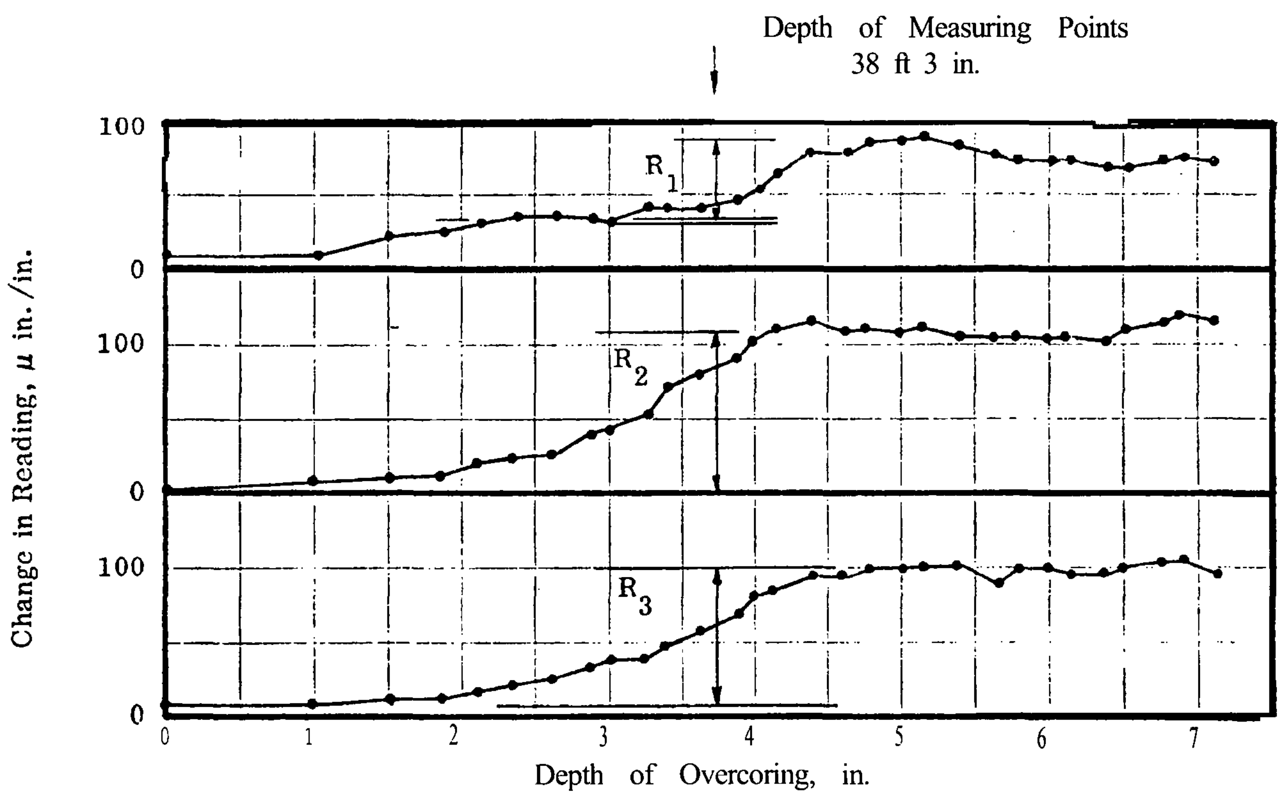


Instrument Calibration 230 μ in./in. = 0.001 in.

Note: Hole I.D. = 1.495 in O.D. -4.31 in.

Yankee Atomic Electric Company Geotechnical Engineers, Inc. Winchester, Massachusetts	SEABROOK STATION Project 7286	DATA FROM STRESS MEASUREMENTS TEST OC1A-5 Aug. s, 1973 FIG. 8

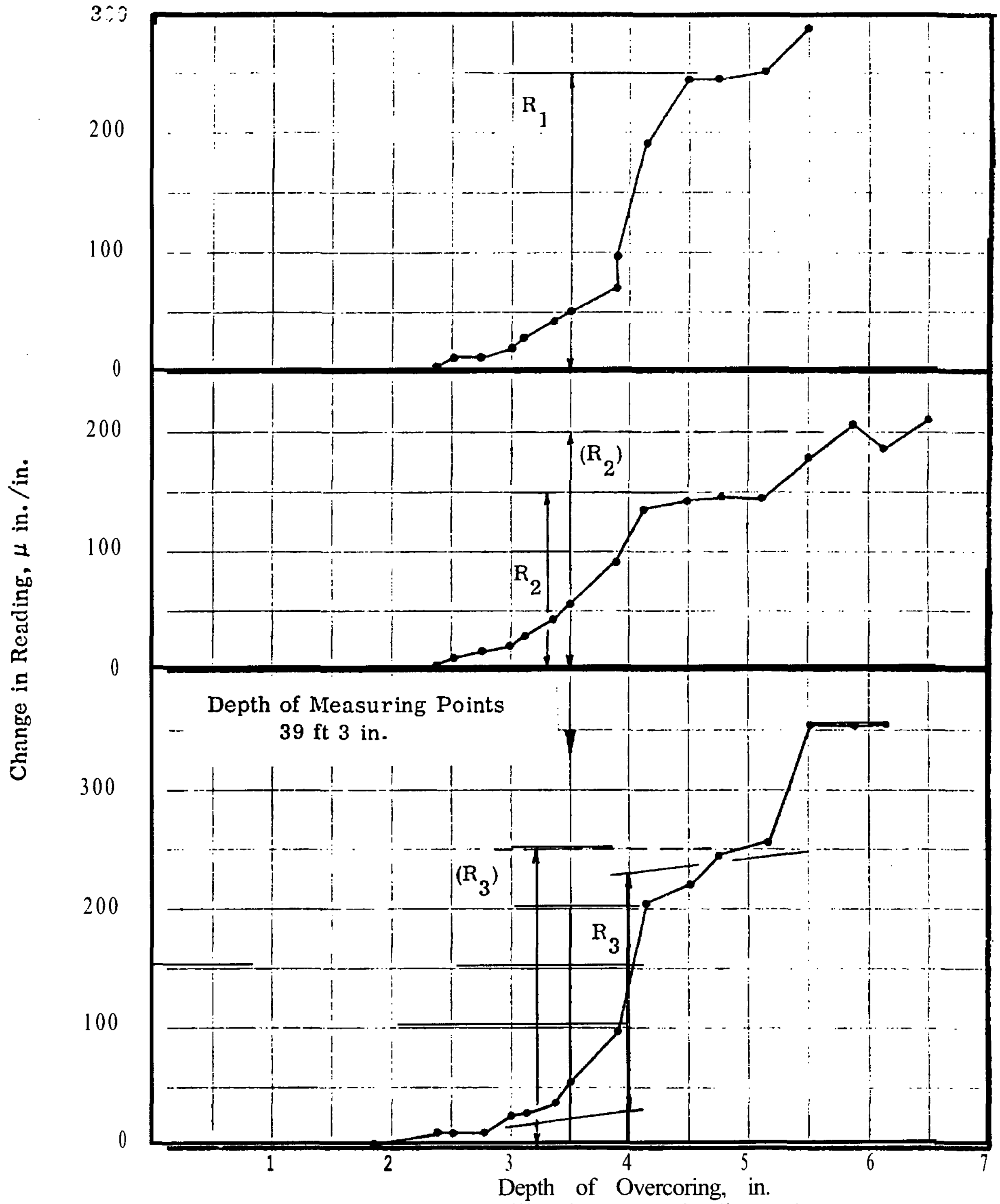
GEOTECHNICAL ENGINEERS INC



Instrument Calibration 116 μ in. /in. = 0.001 in.

Note: Hole I.D. = 1.495 in.
O.D. = 4.31 in.

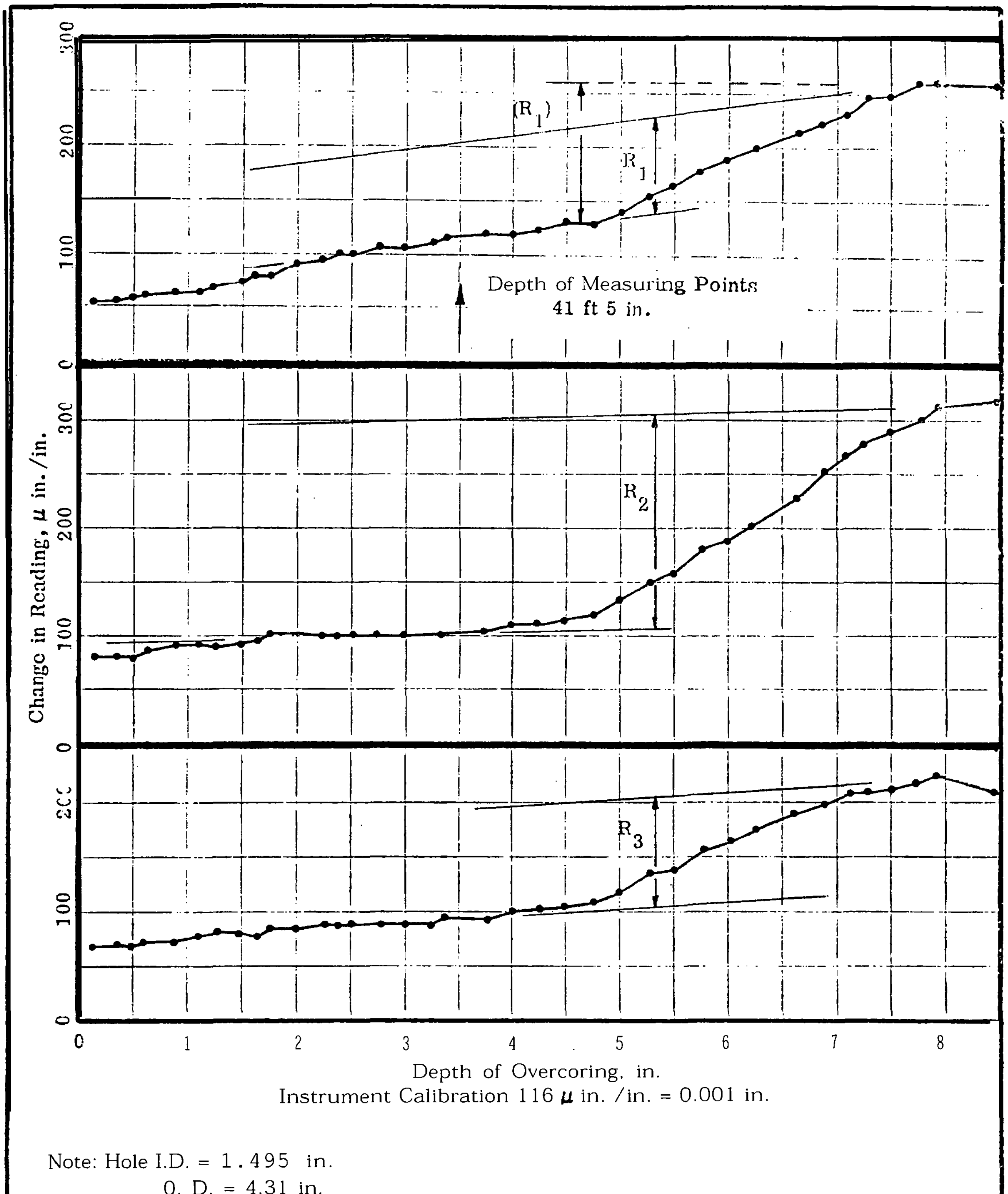
Yankee Atomic Electric Company	SEABROOK STATION	DATA FROM STRESS MEASUREMENTS TEST OC1A-6
Geotechnical Engineers, Inc. Winchester, Massachusetts	Project 7256	Aug. 8, 1973 FIG. 9



Instrument Calibration 116 μ in. /in. = 0. 001 in.

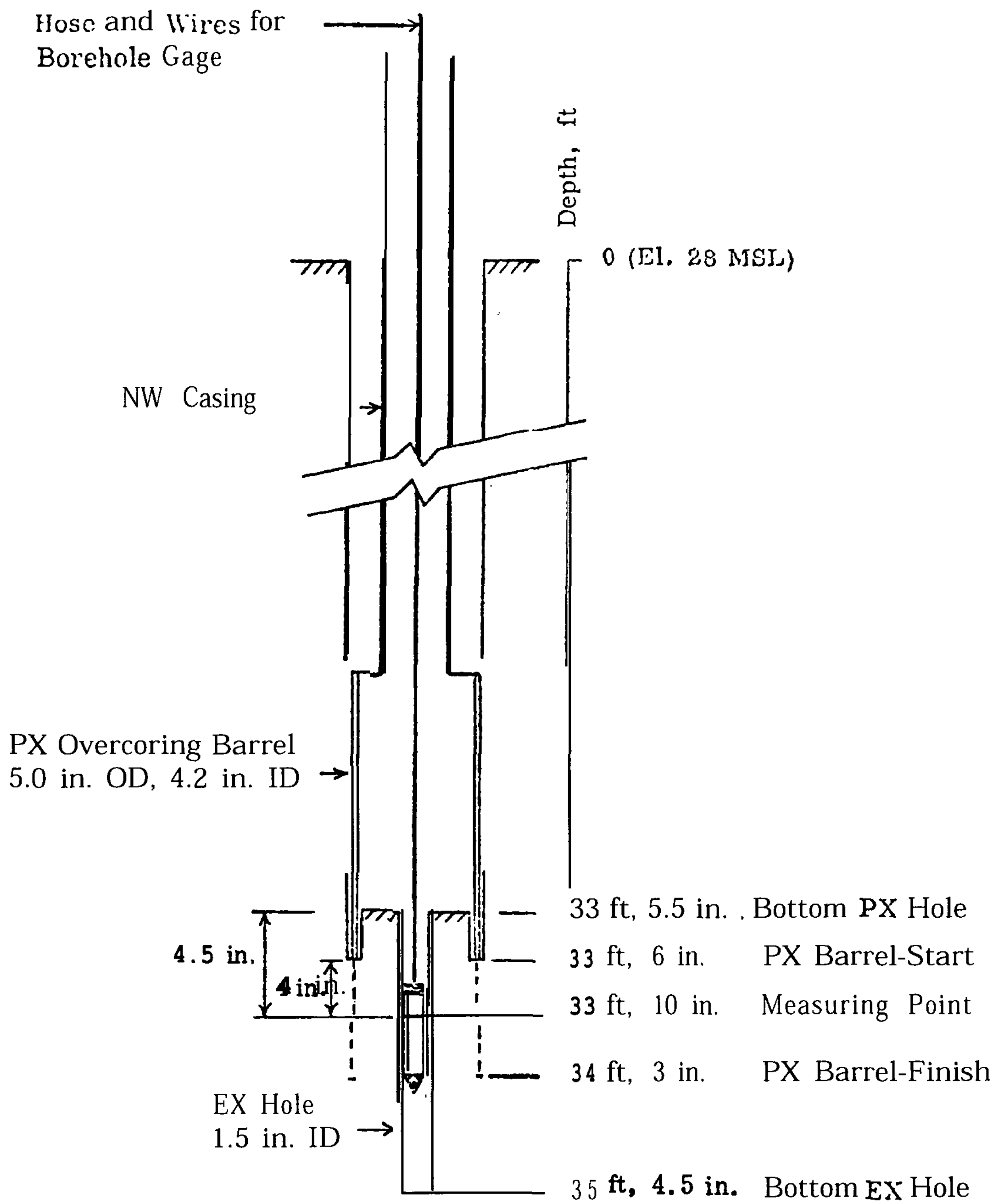
Note: Hole I.D. = 1.495 in.
0. D. = 4.31 in.

Yankee Atomic Electric Company	SEABROOK STATION	DATA FROM **STRESS MEASUREMENTS** TEST OC1A-7
Geotechnical Engineers, Inc. Winchester, Massachusetts	Project 7286	Aug. 8, 1973 FIG. 10



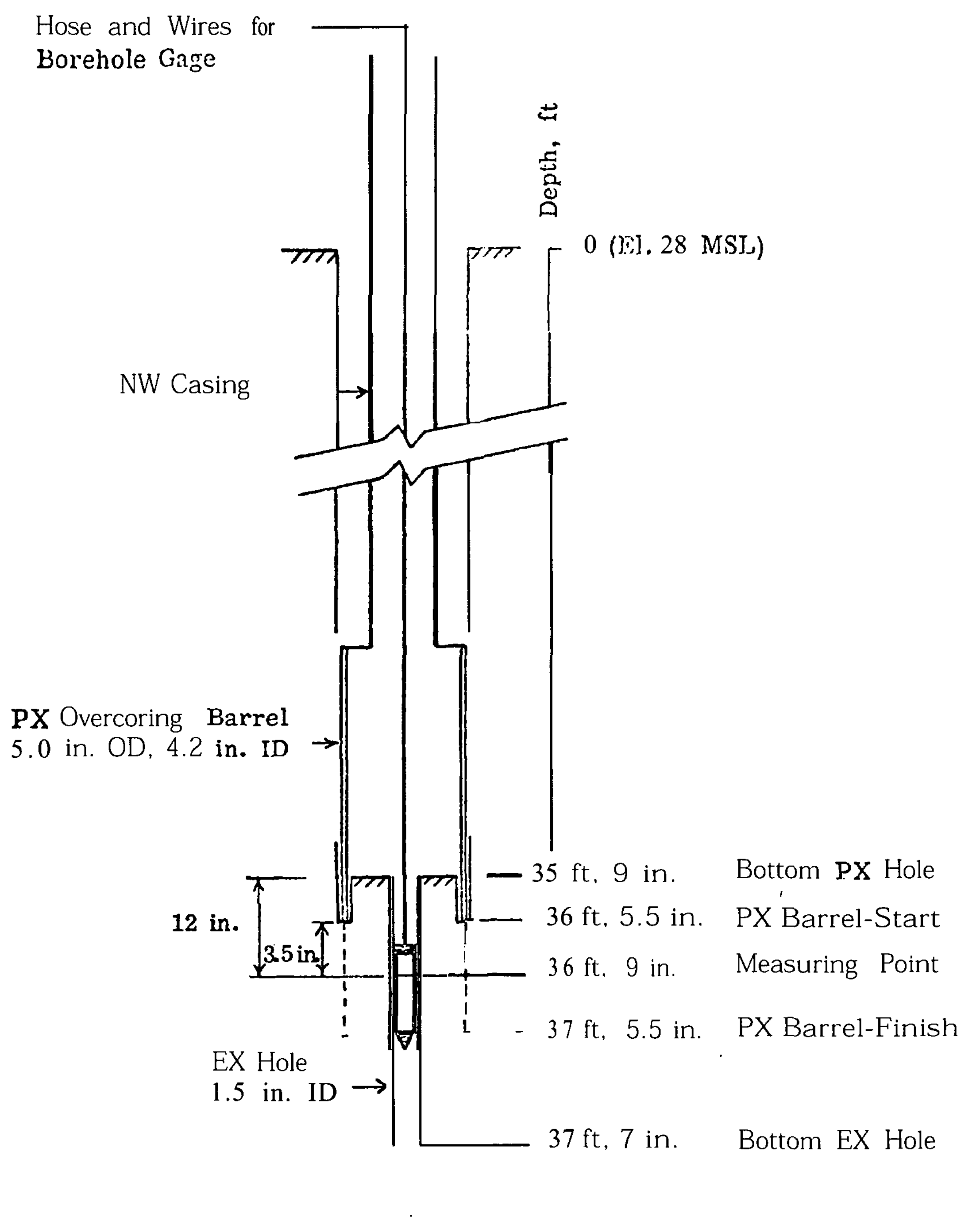
Yankee Atomic Electric Company	**SEABROOK** STATION	DATA FROM STRESS MEASUREMENTS TEST **OC1A-9**
Geotechnical Engineers, Inc. **Winchester,** Massachusetts	Project 7286	Aug. 8, 1973 FIG. 11

GEOTECHNICAL ENGINEERS INC



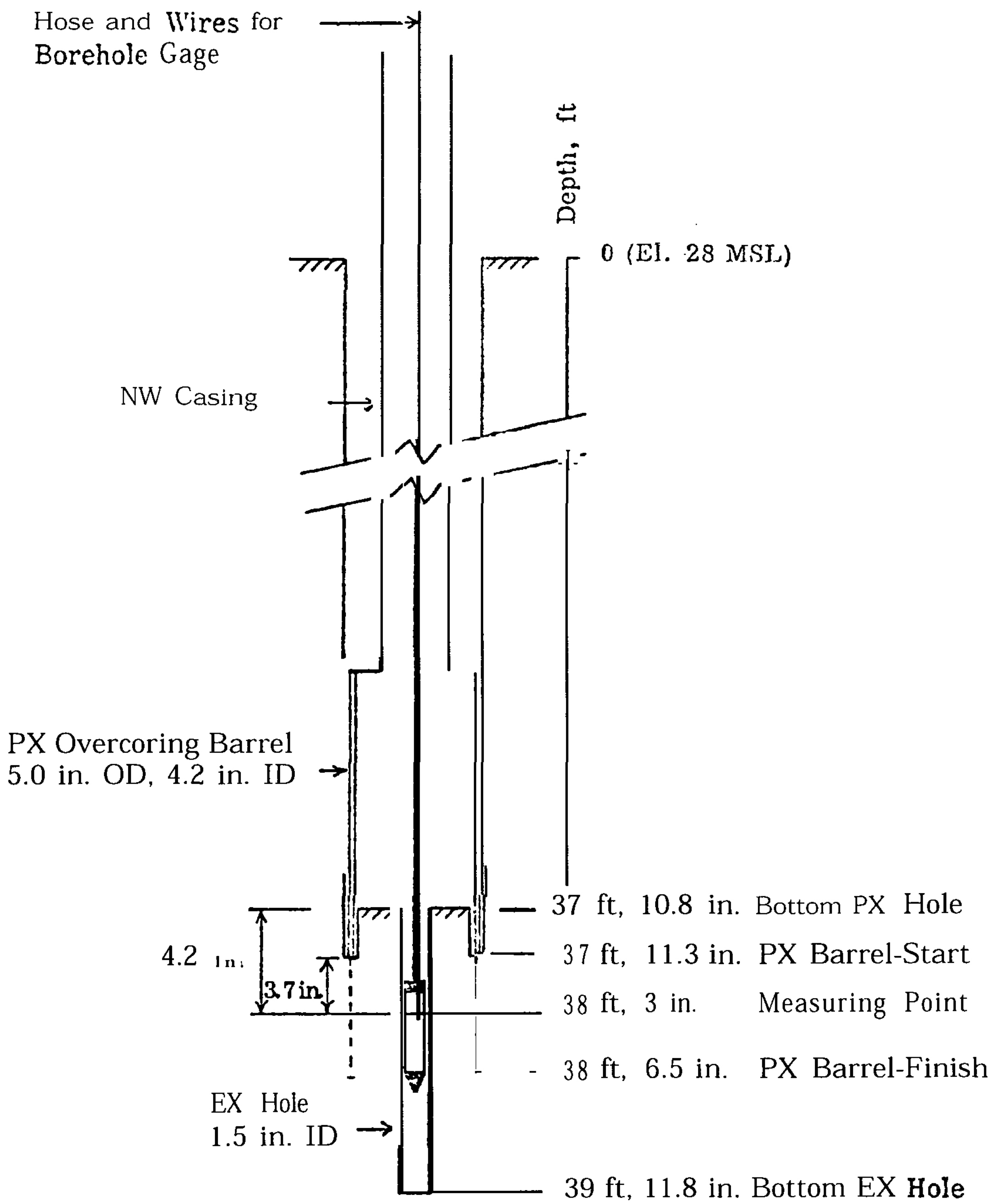
Yankee Atomic Electric Company	SEABROOK STATION	TEST OC1A-2 HOLE DIMENSIONS
Gcotechnical Engineers, Inc. Winchester, Massachusetts	Project 7236	June 20, 1973 FIG. 12

GEO'TECHNICAL ENGINEERS, INC



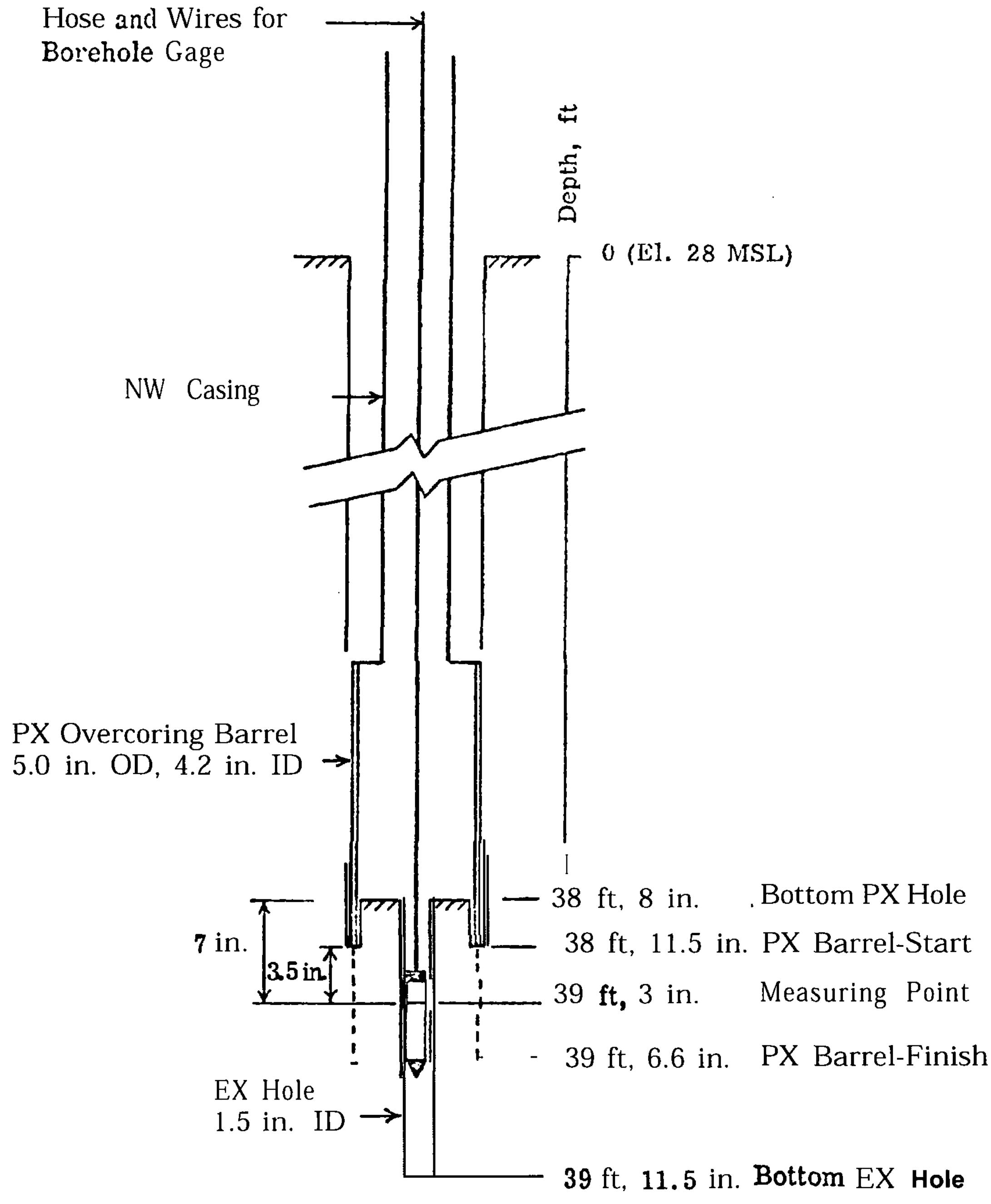
Yankee Atomic Electric Company	SEABROOK STATION	TEST OC1A-5 HOLE DIMENSIONS
Geotechnicsl Engineers, Inc. Winchester, Massachusetts	Project 7286	June 27, 1973 FIG. 13

GEOTECHNICAL ENGINEERS INC.



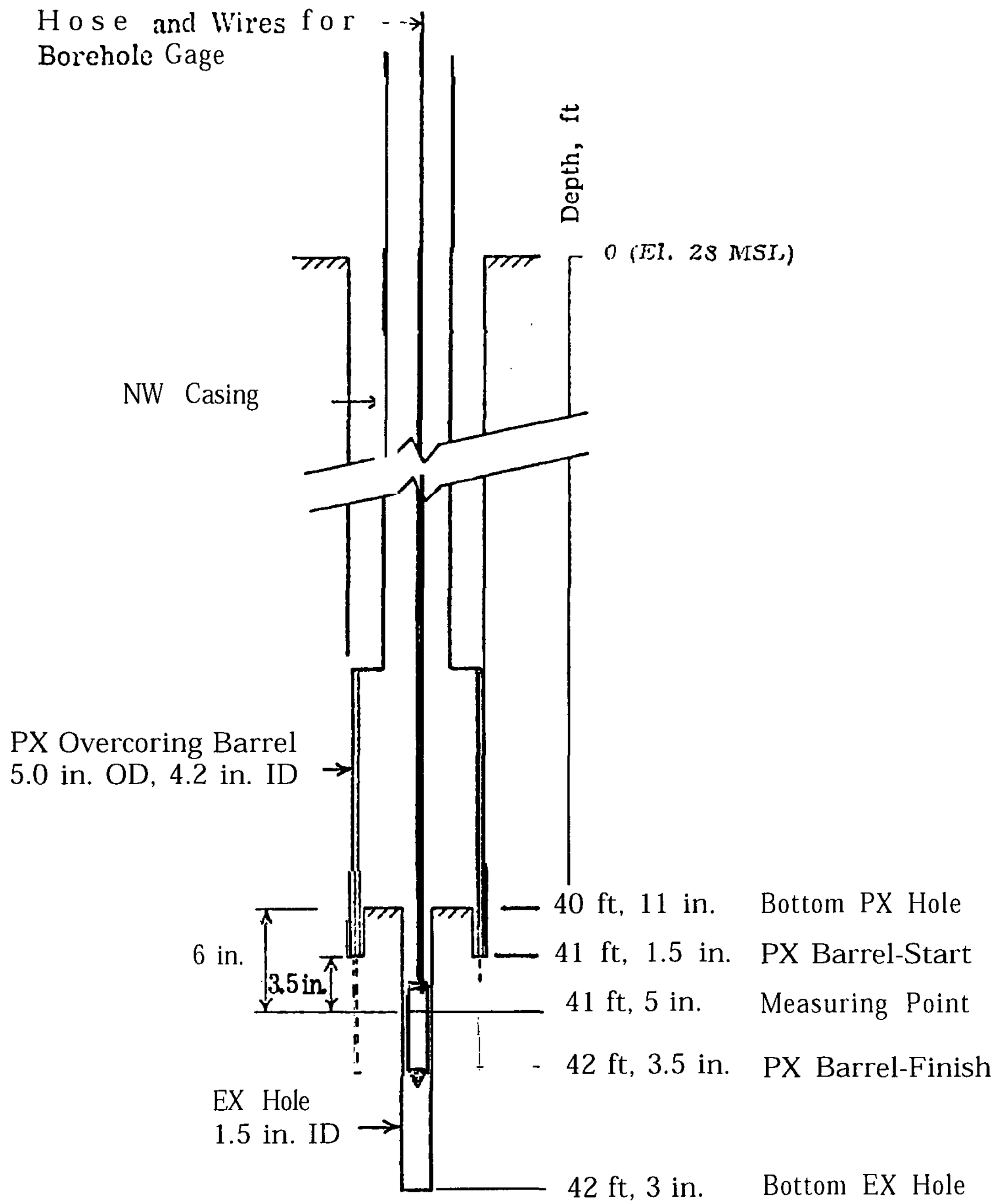
Yankee Atomic Electric Company	SEABROOK STATION	TEST OCIA-6 HOLE DIMENSIONS
Geotechnical Engineers, Inc. Winchester, Massachusetts	Project 7286	June 28, 1973 FIG. 14

GEOTECHNICAL ENGINEERS INC.



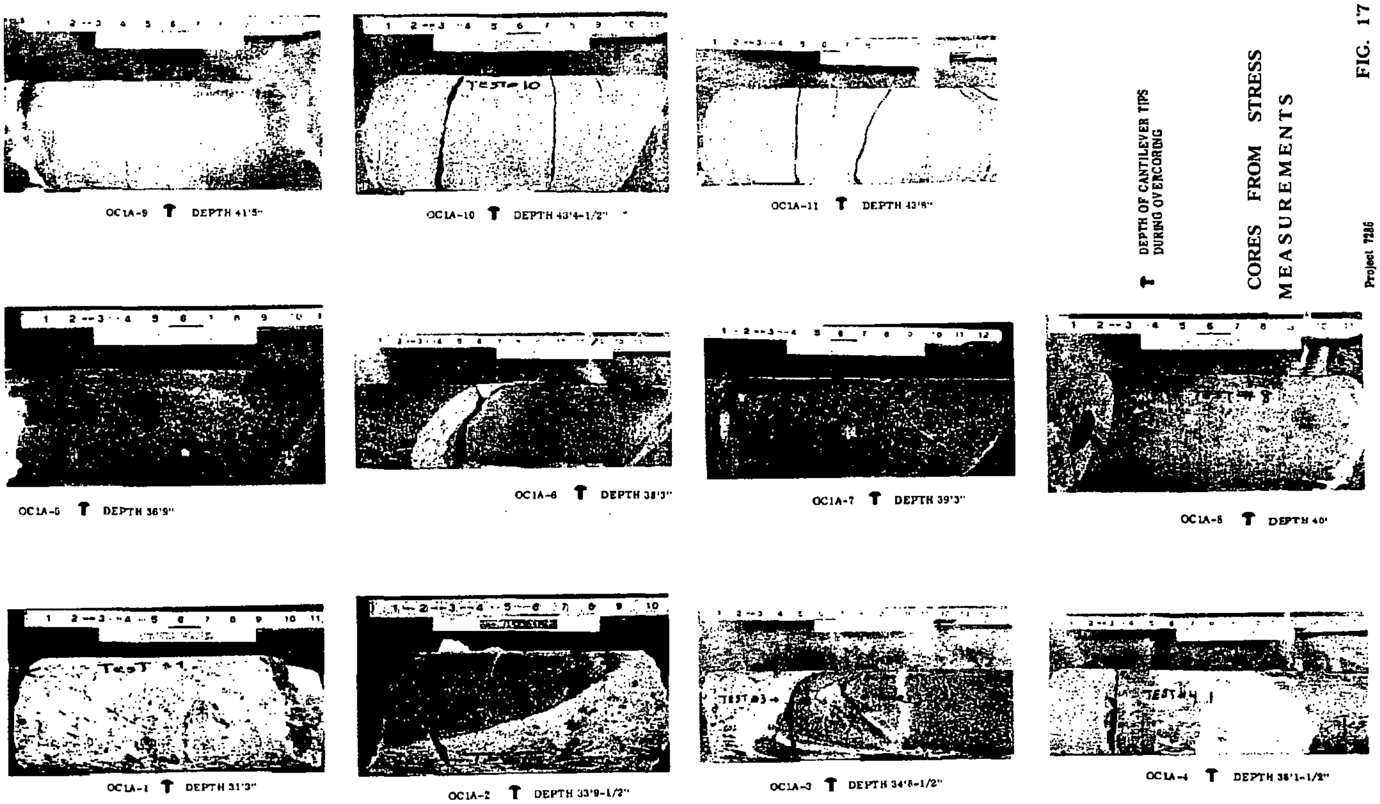
Yankee Atomic Electric Company	SEABROOK STATION	TEST OC 1A-7 HOLE DIMENSIONS
Geotechnical Engineers, Inc. U-inches ter, Massachusetts	Project 7286	June 28, 1973 FIG. 15

GEOTECHNICAL ENGINEERS INC.



Yankee Atomic Electric Company	SEABROOK STATION	TEST OC1A-9 HOLE DIMENSIONS
Geotechnical Engineers, Inc. Winchester, Massachusetts	Project 7256	June 29, 1973 FIG. 16

GEOTECHNICAL ENGINEERS INC.

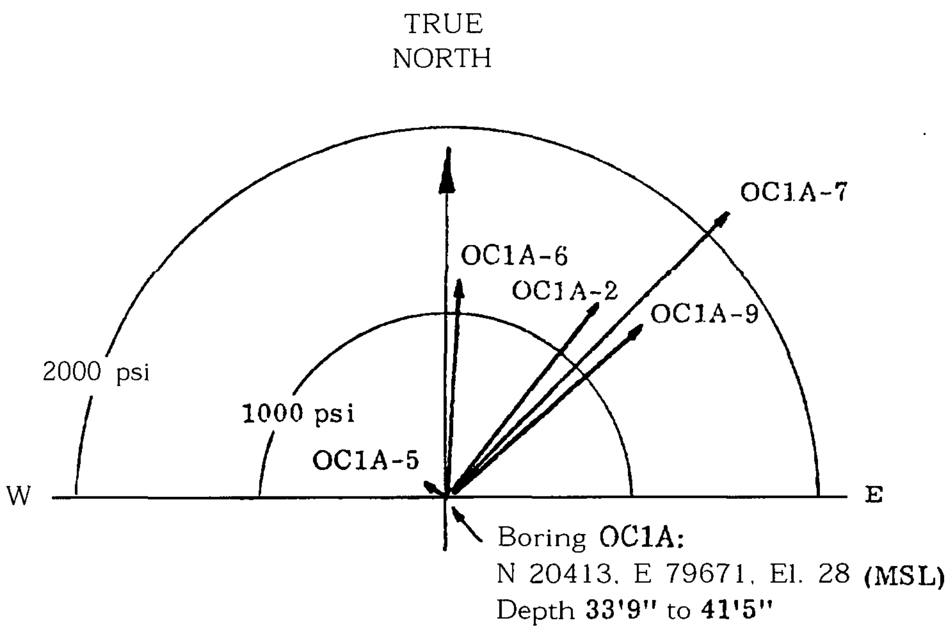


T DEPTH OF CANTILEVER TIPS DURING OVERCORING

CORES FROM STRESS MEASUREMENTS

Project 7286

FIG. 17



MAXIMUM IN-SITU COMPRESSIVE STRESSES ON HORIZONTAL PLANE
Seabrook Nuclear Station, New Hampshire
June - July, 1973

PREVIOUS STRESS MEASUREMENTS IN NEW ENGLAND *

Location	σ_I bars	σ_{II} bars	Bearing	Rock Type
Barre, Vt.	118	54	N 14 E	Granite
Proctor, Vt.	90	35	N 4 W	Dolomite
Tewksbury, Mass.	81	45	N 2 W	Paragneiss
W. Chelmsford, Mass.	145	76	N 56 E	Granite
Seabrook, N. H.	85	59	N 40 E	Granodiorite
Range	(8 - 145)	(3 - 106)	(± 36°)	

All stresses measured at depths less than 50 m (160 ft)
Stresses are compressive
One bar is 14.5 psi

*Sbar, M. L. and Sykes, L. R. (1973) "Contomporary Compressive Stress and Seismicity in Eastern North America: An Example of Intra-Plate Tectonics," Geological Society of America Bulletin, Volume 84, No. 6, p. 1871.

Yankee Atomic Electric Company	SEABROOK STATION	SUMMARY OF STRESS MEASUREMENTS
Geotechnical Engineers, Inc. Winchester, Massachusetts	Project 7286	Sept. 7, 1973 Fig. 18

GEOTECHNICAL ENGINEERS INC.

APPENDIX A

APPENDIX A

Test Procedure For

MEASUREMENT OF STRESSES IN ROCK BY OVERCORING TECHNIQUE IN VERTICAL HOLE

Geotechnical Engineers, Inc. September 1973

NOTE: HANDLE THE INSTRUMENT, HOSE, ORIENTATION RODS AND ALL ASSOCIATED EQUIPMENT VERY CAREFULLY TO PREVENT KINKING HOSE, LEAKS, AND INSTRUMENT DAMAGE.

1. Drill a pilot NX hole to examine the type and quality of rock. Make measurements only in zones where NX cores are primarily longer than 10 in.

2. In a hole about 5-10 ft from pilot hole, drill through poor zones with large diameter double-tube core barrel to reach measuring zone as quickly as possible. Then continue with PX overcore barrel to desired depth in three to five foot runs, each time examining the core to determine whether the rock is suitable for a measurement.

3. If the last run of PX core was suitable to try a measurement, attach the EX core barrel to the rods at the bottom end of the PX barrel with an adapter specially designed for that purpose. The adapter ensures that the EX core barrel is centered in the PX hole.

4. Drill the EX hole about 2 ft beneath the bottom of the previous bottom elevation of the PX bit and then withdraw the EX core.

5. Examine the EX core carefully to determine whether the rock is good enough for a stress measurement. The core pieces preferably should contain only drilling breaks and no natural fractures. If a natural fracture is more than 10 in. below the top, then a measurement near the top of the hole can be attempted.

6. Return the PX overcore bit to the bottom of the hole.

7. Wash through the BW casing rods and out the bottom of the PX bit for 15 minutes to remove all cuttings.

8. Measure accurately (to 1/8 in.) the depth from the surface reference point to the top of the rock at the bottom of the PX (not EX) hole. Enter the measurement on a sketch of the hole.

9. Measure and mark the required length on the orientation rods, so that measuring points will be at the proper depth.

10. Thread the instrument hose through the swivel at the top of the drive rod, attach gasket and reducing coupling, then attach to swivel. Do not over-tighten as this action may damage the instrument hose.

11. Attachinstrument leads to readout device and check readout to ensure that the strain gages can be read, that nothing is wrong with the instrument, and record the direction of reading change that corresponds to expansion of hole. Record instrument number. Record arrangement of leads on readout device.

12. Select desired orientation of measuring points on instrument. If possible, orient one axis in direction of anticipated major stress. Record orientation.

13. Lower the instrument in the hole after attaching it to the orientation rod with the special fitting for the instrument. The orientation of the cantilevers in the instrument relative to the orientation line on the rods must be recorded on the data sheet. Lower the instrument slowly and carefully, pulling up with slight pressure on the instrument hose so that the instrument is held in the orientation device. When the instrument goes below water, apply pressure inside the vinyl sheath to ensure that no water can enter. Use 2 psi pressure per foot of depth (or 1 kg/cm^2 per 30 ft of depth) as a minimum, but do not apply so much that the instrument will be over inflated and cannot be inserted into the EX hole.

14. Insert the instrument into the EX hole very carefully and without banging it on the lip of the EX hole. It helps to use a tapered point on the lower end of the instrument so that the EX hole can be found easily. Lower to the desired elevation and make sure that this elevation is accurate. Record the depth to the measurement point on the instrument from the surface reference point to the nearest 1/8 in.

15. Before inflating, make sure that the orientation of the measuring points relative to the line on the orientation rods and relative to a fixed azimuth reference is correct and record the orientation.

16. Inflate the instrument to a pressure of about 4 kg/cm^2 greater than the water pressure at that depth, but not greater than about 6 kg/cm^2 above the water pressure.

17. Remove the orientation rods carefully, making sure that the orientation fitting at the bottom does not catch on the hose on the way up. The rods should be unhooked carefully so that the connectors will not be broken.

18. Screw the drive rod (to which the swivel is attached) to the top of the drill rods using the special adapter. During this process the instrument hose has to be pulled up slightly through the swivel until the hose is straight in the drill rods.

19. Pull the PX barrel off the bottom of the hole slightly and start the drilling fluid running through the system.

20. Take readings continuously on the instrument readout device until the readings have stabilized with the water running and the PX barrel turning without any downward pressure.

DO NOT START OVERCORING UNTIL THE READINGS HAVE STABILJZED

21. When a plot shows that the readings are stable, which may take about 20 minutes, then set the readout to a convenient starting point so that the subsequent readings can be taken easily.

22. Apply slight downward pressure on the PX bit to start the overcoring. Drill at a rate of about 1/2 in. per minute (24 min. per foot), A slightly faster rate could be used if the rock is particularly good. The core catcher should be in place during this operation to ensure that the annular core will be recovered later. The core catcher may cause some extraneous vibrations.

23. Take readings during overcoring in the following sequence:

TIME DEPTH GAGE 1 GAGE 2 GAGE 3

Take readings continuously during overcoring, so that as good a graph as possible can be prepared. The driller should call out the overcoring depth to the nearest 1/8 in. when requested by the recorder. Then the person making the strain gage readings should provide his readings. A third person records all readings given to him and the time to the nearest ten seconds.

BE READY TO STOP THE DRILL DURING OVERCORING ANYTTME THAT THE READINGS START TO FLUCTUATE RAPIDLY-HAVE A SIGNAL PREARRANGED. ROTATION OF INSTRUMENT IN HOLE MAY DAMAGE IT.

24. When the readings stop changing during overcoring, stop the downward pressure and rotation but continue water flow. Continue the recording until the readings have again stabilized. During this wait, plot the readings taken in Step 23.

25. Lower the orientation rods into the hole and attach to instrument after detaching the drive rod from the drill rod at the top. When lowering the orientation rods, be sure that the hose is not cut or damaged.

26. Release the pressure in the instrument to that required to keep the water out. Wait until the pressure down at the instrument is at this level.

27. At this stage the instrument may be lowered to make a second stress measurement (to Step 14) or the instrument may be removed. The orientation rods are desirable for removal because if they are not used the top of the instrument can get caught on the lower lip of the drill rods at the top of the PX barrel. Remove from hole carefully and slowly, reducing internal pressure gradually if necessary.

28. Loosen the reducing coupling at the swivel, detach instrument from readout device, unthread the instrument hose from the swivel carefully, and put the instrument in a safe place. Examine the instrument and the hose for damage. Recheck instrument readout.

29. Attach the drive rod to the drill rod.

30. Remove the annular core.

31. With a crayon mark the location where the measuring points were on the annular core.

32. Carefully and in detail describe the core, particularly within 3 in., on each side of the measurement point. Photograph the core wet and dry, making sure that the crayon mark shows up.

33. *To* determine the modulus of the rock for computation of stresses, it is necessary to have a core with a length of 12 in. or more. Save such a piece from the measurement elevation so that it may be tested in the laboratory or field.

CHECK THE DATA SHEET, SKETCHES AND DESCRIPTIONS TO ENSURE THAT ALL DATA NEEDED FOR UNDERSTANDING THE TEST HAVE BEEN RECORDED. LIST THE NAMES OF ALL PERSONNEL AT THE SITE.

APPARATUS

1. Borehole gage for EX hole (1.5-m. dia.) including hose containing lead wires and air tube.

2. Portable strain gage readout system, including strain indicator and switching and balancing unit for three strain gages.

3. Dry nitrogen supply system, pressure gage, and pressure regulator. Pressure required is 100 psi plus hydrostatic pressure at greatest depth below water level at which instrument will be used.

4. Drilling system for overcoring, including hydraulic drill rig, SW casing for seating to rock, NW casing for use as drill rod for overcoring bit, 5 in. by 4-3/16 in. (PX) overcoring bit 5 ft long, 2 and 5-ft-long EX core barrel (1.5 in. O. D.) adaptor to attach EX core barrel to bottom of overcoring bit. Swivel to allow passage of instrument hose so that it will not twist during test but drill water will not leak appreciably.

5. Data sheets, form attached.

6. Orientation rods for setting the borehole gage elevation and for maintaining orientation of borehole gage.

7. Compass for determining orientation of borehole gage.

APPENDIX A

OVERCORING READINGS - SEABROOK II, NEW HAMPSHIRE

Hole No. ______ Depths ______ Project No. ______ Date ______ Test ______

Hole Location ______ Bot. 5-in. Hole ______ Driller ______

Rot. EX Hole ______ Engineer ______

El. Top of Hole ______ Pins on Gage ______ Weather ______

El. Datum ______ Dimensions in ______ Page ______

Orientation of Gage ______

	Time	Elapsed Time	Overcore Depth	Strain Gage Readings								
				1	2	3	4	5	6	7	8	9
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												

Remarks ______

Geotechnical Engineers, Inc

GEOTECHNICAL ENGINEERS INC

APPENDIX B

APPENDIX B

MEASUREMENT OF MODULUS OF ANNULAR ROCK CORE

Geotechnical Engineers Inc. September 1973

1. Prepare rock modulus cell by inserting membrane, filling with hydraulic fluid (trapping as little air as possible) and securing end plates.

2. Break rock annulus that was removed from hole in field into sections not less than 12 in. long and such that points within EX hole at which borehole gage measurements were made in field can be close to center of rock modulus cell if possible.

3. Insert core in cell.

4. Insert borehole gage in cell, preferably at same location as in field.

5. Apply 100 psi nitrogen pressure to interior of gage to secure it in proper location. Preferably use same pressure as was used in-situ during overcoring (after subtracting in-situ water pressure).

6. Connect leads from borehole gage to strain gage readout device, using same wires, lengths, and hook-up as in-situ.

7. Take initial gage readings until readings are stable.

8. Apply pressure to exterior of rock annulus in increments of 500 psi until the compression of the diameters is equal to theirextension during overcoring but do not exceed 3000 psi unless an axial load is put on the core. Record all strain gage readings each time an increment is applied. Allow for equilibrium to be reached before adding each new increment.

9. Release the pressure in decrements of 500 psi, taking readings as before.

10. Reapply the maximum stress in 1000 psi increments. Repeat the loading and unloading until results are consistent.

11. Using the diameter changes measured in the field and in the laboratory, together with the stresses applied in the laboratory, compute the rock modulus and the stress in situ. For the rock modulus cell:

$$u = kR = \frac{2\,db^2}{(b^2 - d^2)} \quad \frac{P}{E}$$

where:

u = diametral deformation
k = instrument calibration
R = instrument reading
d = I.D. of core
b = O. D. of core
P = external pressure
E = rock modulus

APPENDIX 21

GEOTECHNICAL REPORT ADDITIONAL PLANT SITE BORINGS

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

GEOTECHNICAL REPORT
ADDITIONAL PLANT-SITE BORINGS FOR WATER AND OIL STORAGE TANKS, SETTLING BASIN, RETAINING WALL, SEAWALL, AND RIP-RAP STRUCTURES G-SERIES BORINGS

SEABROOK STATION, NEW HAMPSHIRE

Submitted to
YANKEE ATOMIC ELECTRIC COMPANY

GEOTECHNICAL ENGINEERS INC.
1017 Main Street
Winchester, Massachusetts 01890

Project 7286
October 21, 1974

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Purpose

The purpose of the geotechnical investigation was to provide soil and bedrock descriptions pertinent to the design and construction of several proposed structures which will be located at the plant site, including water and oil storage tanks, settling basin, retaining wall, seawall, and rip-rap structures.

1.2 Scope

A subsurface investigation, consisting of a total of 12 borings and 1 test pit was made for the following areas:

a. Water and Oil Tanks At Fire Pump House - One boring was made at the center of the fuel oil storage tank, using standard split-spoon sampling techniques to refusal for the purpose of investigating deposits that may cause settlement problems. Because no unsuitable deposits were encountered at the site for the proposed oil storage tank and based on the general knowledge of site geology, supplementary borings for the proposed water tanks were not done.

b. Settling Basin - A series of three borings was made in the area of a proposed settling basin using standard split-spoon sampling techniques to refusal for the purpose of investigating soil conditions at the proposed inlet and outlet structures for the basin, and also to examine the in-situ soil for possible use as construction materials for the dikes. In addition, a test pit bag sample was taken near the center of the settling basin, tested for grain size distribution, and examined as a possible dike material.

c. Retaining Wall - A series of four borings was made for a proposed retaining wall for the purpose of locating and sampling the dense glacial till. These borings were advanced by first "washing" to establish the top of the till layer, then sampling this layer by split-spoon techniques, and finally advancing the borehole to refusal using a roller bit. Based on the results of geophysical surveys and other borings drilled into bedrock in the vicinity, it is believed that refusal does correspond to the bedrock surface in these holes.

2.0 BORING AND TEST PIT DATA

2.1 Table and Figures

Table I is a summary of the boring data including boring location, "as-bored" coordinates, ground elevation, depth to glacial till, and depth to top of bedrock.

The locations of the borings and one exploratory test pit are included in Fig. 1. Fig. 2 shows the grain size curve from a sieve analysis which was performed on a sample from the test pit.

2.2 Boring and Test Pit Logs

Logs of the borings and one exploratory test pit are included in Appendix I. Driller's boring logs are included in Appendix II.

TABLES

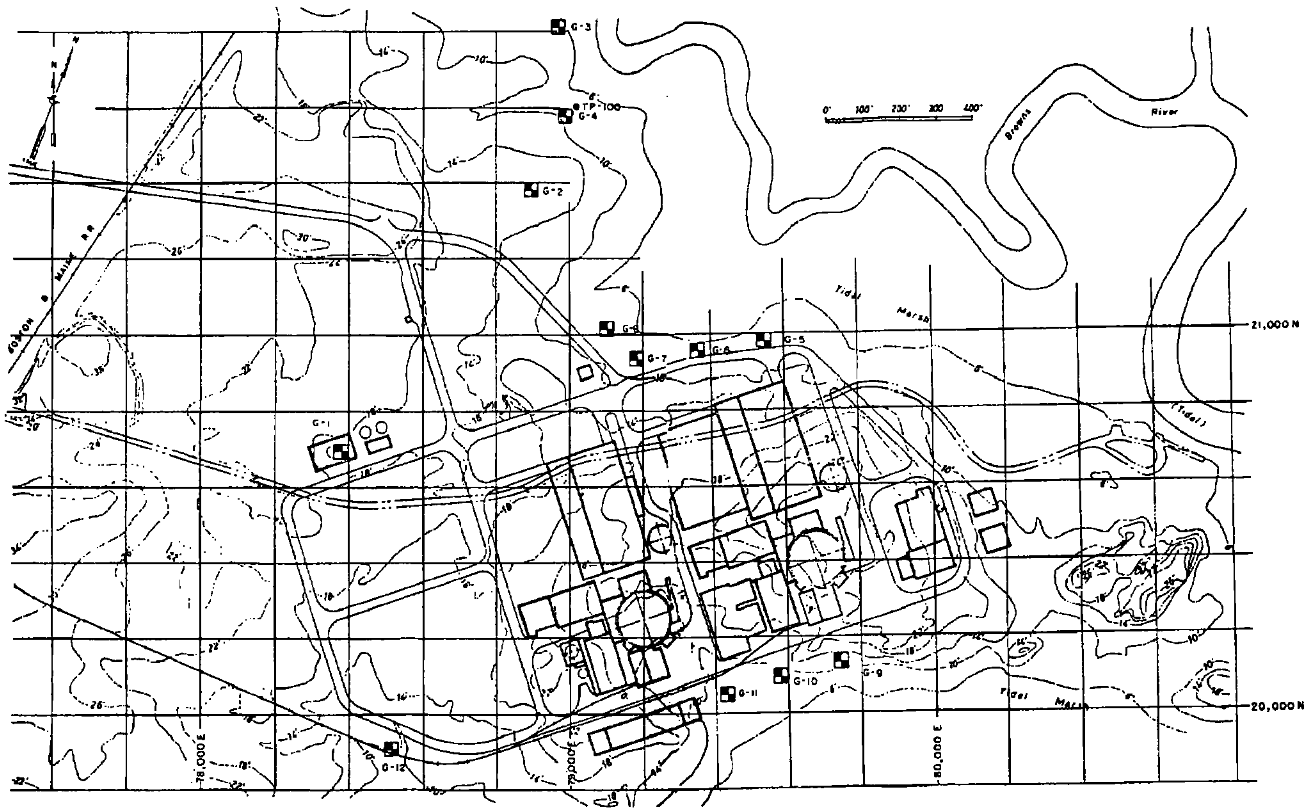
TABLE I

SURIRIARY OF BORING DATA

Boring No.	Boring Location	As-bored Coord.	Ground Elev ft	Depth to Top of Till ft	Depth to Top of Bedrock ft
G-1	Oil Storage Tank	29,690N 78,370E	17.3	8.0	--
G-2	Settling Basin (Inlet)	21,380N 78,900E	15.9	5.0	--
G-3	Settling Basin (Outlet)	21,717N 78,949E	9.4	28.0	--
G-4	Settling Basin (additional)	21,571N 78,992E	9.6	19.0	--
G-5	Retaining Wall	20,969N 79,525E	7.8	9.0	9.7”
G-6	Retaining Wall	20,949N 79,349E	8.2	10.8	19.5*
G-7	Retaining Wall	20,932N 79,175E	8.6	11.5	23.2”
G-8	Retaining Wall	21,006N 79,107E	7.3	10.5	19.0”
G-9	Seawall	20,123N 79,720E	9.5	--	10.5
G-10	Seawall	20,083N 78,587E	7.9	--	6.8
G-11	Seawall	20,042N 79,455E	6.8	--	15.9
G-12	Rip-Rap	19,898N 78,500E	7.2	--	11. o*

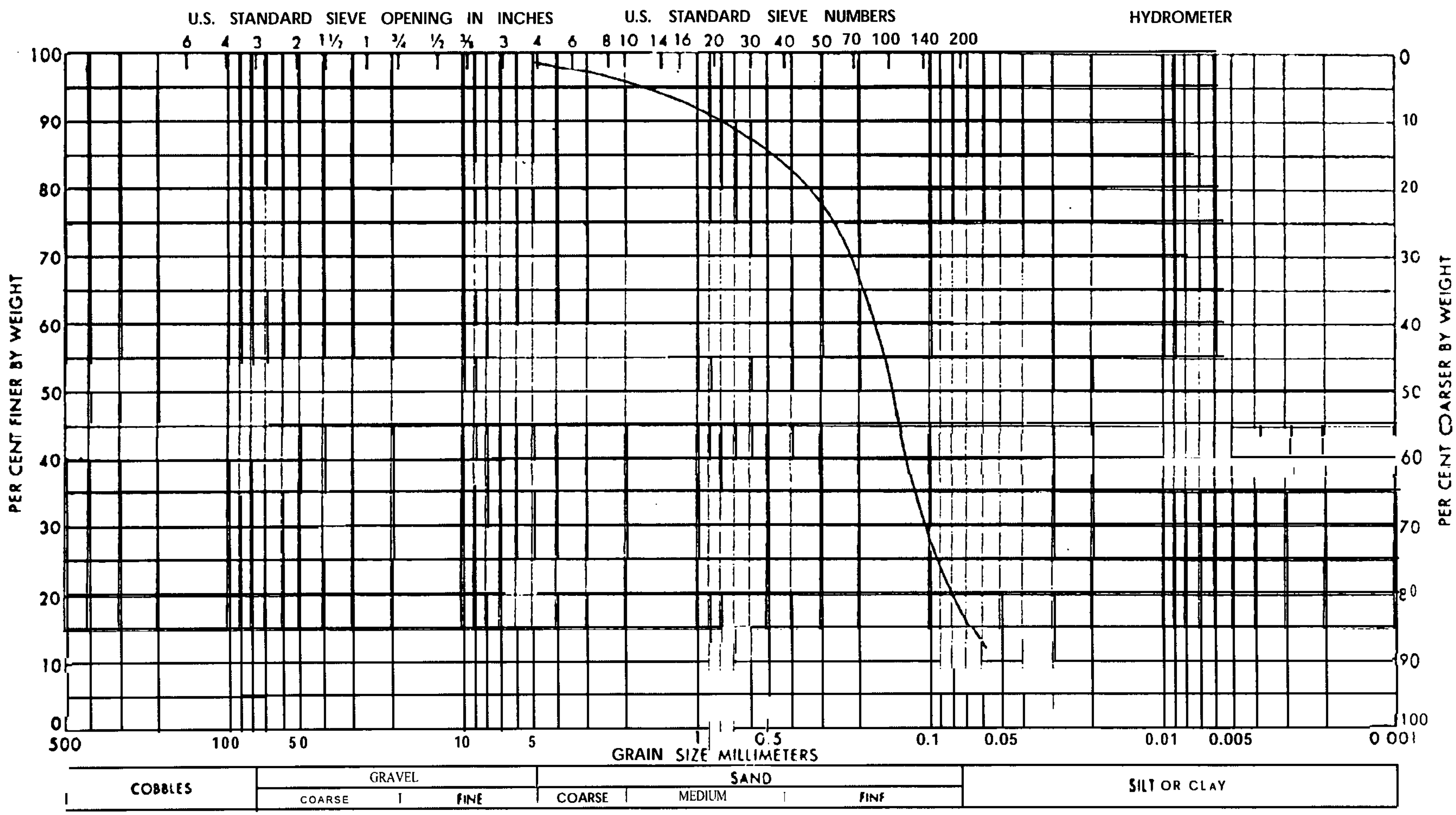
*In these holes the boring was made to refusal and no rock was cored. However, based on the results of geophysical surveys and other borings drilled into bedrock in the vicinity, it is believed that refusal does correspond to the bedrock surface.

FIGURES



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION	SEABROOK STATION SITE TOPOGRAPHY AND PLOT PLAN PLAN OF BORING LOCATIONS
UNITED ENGINEERS & CONSTRUCTORS GEOTECHNICAL ENGINEERS, INC.	OCT. 17, 1974 FIG. 1 G-SERIES BORINGS

Lab. 4-3, rev. 0 28 May 74



Yankee Atomic Electric Co.	Seabrook Station	GRAIN SIZE CURVE TEST PIT #100 TP - SAMPLE
Geotechnical Engineers, Inc. Winchester, Massachusetts	Project 7286	Oct. 1974 Fig. 2

APPENDIX I

BORING N O. G-1

pg. 1 of 1

Proj. No. : 7286

Date: Sent. 30. 1974

Described by: W. Pitt

Ground Elevation +17.3 ft

Depth to Water Level: depth at ground elev. 0700; 10/1/74

Sample NO.	Depth ft	Number of Blows per 6"	Description
S-1	0.0-1.0	1-2	Black, soft PEAT and organic SILT; highly decomposed
S-1A	1.0-2.0	6-14	Gray-brown, gravelly, sandy, slightly organic SILT, contains subangular gravel up to 35 mm in size.
s-2	3.0-5.0	11-16 32-23	Rust brown and brown slightly mottled gravelly, sandy SILT, trace clay. Contains gravel up to 13 mm in size. Moderate reaction to shaking test. Low plasticity.
s-3	5.0-6.5	27-39 57	Similar to S-2. Contains gravel up to 35 mm in size.
			color change
s-4	10.0-11.5	100/4"	140# hammer gray, very dense, sandy, gravelly SILT trace clay.
		5/2" 28-22	300# hammer contains broken pieces of gravel up to 35 mm
s - 5	15.0-16.5	5 4 100/4"	140# hammer Similar to S-4
		12/2" 40	300# hammer
			Casing refusal at 16.5 Bottom of Borehole
			End of Exploration

GEOTECHNICAL ENGINEERS INC.

BORING NO. G - 2

pg. 1 of 1

Proj. No. : 7286

Date: Oct. 1, 1974

Described by: W. Pitt

Ground Elevation +15.9 ft

Depth to Water Level: -5.1' measured at 0715, 10/2/74

Sample No.	Depth ft	Number of Blows per 6"	Description
S-1	0. 0-1.0	2-5	Light brown, silty fine SAND. Contains root fibers and decomposed organic matter.
S-1A	1.0-2.0	3-2	Dark brown/rust brown/gray mottled; fine sandy SILT, trace fine gravel
s-2	3. o-4.5	17-50/0" (140# hammer) 22-42 (300# hammer)	Light brown, gravelly, sandy SILT. Contains gravel from various litho-logies up to 35 mm in size.
s-3	5.0-7.0	15 23 23 33	Light brown silty, gravelly, fine to coarse SAND widely graded,' resembles glacial till
s-4	LO. 0-11.5	57-100 (140# hammer) 33 (300# hammer)	Gray brown /rust brown slightly mottled dense, silty, gravelly SAND (similar to S-3) Contains broken pieces of gravel up to 35 mm in size. Casing refusal met at 13.8' Roller bit refusal at 14.5' Bottom of Borehole
			End of Exploration

BORING NO. G-3

Proj. No. : 7286

Date: Oct. 1, 1974'

Described by: W. Pitt

Ground Elevation +9.4 ft

Depth to Water Level: -2.1 measured at 0730, 10/2/74

Sample No.	Depth ft	Number of Blows per 6"	Description
S-1	0.0-2.0	1/1.5' 2/.5'	Brown grading to buff, soft, homogeneous SILT, trace clay. Upper 1-2" contains grass and shallow root zone.
s-2	3. O-5.0	10-20 21-20	Similar to S-l, buff/rust brown mottled, contains black spots - decomposed organic matter? ?; trace roots and mica particles
s-3	6.0-7.0	14-16	Light brown, loose, silty fine SAND, trace clay
S-3A	7.0-8.0	22-32	Rust brown/buff medium dense, mottled SILT, little to trace clay. Low plasticity.
s-4	10.0-12.0	2-4 4-5	Gray, medium stiff homogeneous CLAY; high plasticity
s-5	15.0-17.0	2-3 3-4	Similar to S-4
S-6	19.5-20.0	32	Gray-brown silty, sandy, GRAVEL; trace clay. Contains angular pieces of gravel up to 25 mm. Well-graded.
S-6A	20. o-21.5	20-12	Light brown, gravelly, sandy CLAY. Contains gravel pieces up to 25 mm in size
S-7	25-25.5	100/3" 50/2"	140# hammer Similar to S-6, very dense 300# hammer (Resembles glacial till)
			continued)

21.5'

GEOTECHNICAL ENGINEERS INC

BORING NO. G-3

(Concluded)

Proj. No. : 7286

Date: Oct. 1, 1974

Described by: W. Pitt

Ground Elevation +9.4 ft

Depth to Water Level: -2.1 measured at 0730, 10/2/74

Sample NO.	Depth ft	Number of Blows per 6"	Description
S-8	30.0-31.5	25 25 58	Gray, very dense, silty fine SAND, some gravel up to 30 mm in size
s-9	34'10"→	100/0" 20/0"	140# hammer 300# hammer No recovery Casing refusal at 34'10" Bottom of Borehole
			End of Exploration

BORING NO. G-4

pg. 1 of 1

Proj. No. : 7286

Date: Oct. 2, 1974

Described by: W. Pitt

Ground Elevation +9.6 ft

Depth to Water Level: Not taken

Sample No.	Depth ft	Number of Blows per 6"	Description
S-1	0.0-0.5	1	Dark brown, fibrous PEAT and organic SILT
S-1A	0.5-2.0	1-1-2	Light brown, fine sandy SILT or silty fine SAND
s-2	3.0-5.0	6-10 22-42	Light brown/dark brown/rusty brown slightly mottled, medium dense, silty, gravelly fine SAND. Contains gravel up to 35 mm in size.
s-3	6-7.5	100/5" 3/1" 35-60	140# hammer 300# hammer Similar to S-Z, medium dense to dense
	8.0		Large cobble
s-4	10.0-11.5	25-50 57	Similar to S-3, coarse to fine SAND Widely graded
s-5	15.0-16.2	100'0" 42 60 75 '3"	140# hammer Similar to S-4 300# hammer (Increase in sand and gravel sizes)
19			
S-6	20-21	76-76	Gray, very dense, gravelly, silty coarse to fine SAND; little to trace clay. (Till) Roller bit refusal at 22.5 Bottom of Borehole
22.5			
			End of Exploration

GEOTECHNICAL ENGINEERS INC.

BORING NO. G-5

Proj. No. : 7286

Date: Oct. 3, 1974

Described by: W. Pitt

Ground Elevation +7.8 ft

Depth to Water Level: Not taken

Sample No.	Depth ft	Number of Blows per 6"	Description
			Drove casing to 9.0', where encountered strata change - casing refusal Split-spoon at 9.0 - 9.7
S-1	9.0-9.7	58-100/2" 5/0"	140# hammer 300# hammer gray/brown slightly mottled, very dense silty, gravelly, SAND; little to to trace clay, (Till) Roller bit refusal at 9. 7' Bedrock ? Bottom of Borehole
			End of Exploration

BORING NO. G-G

pg. 1 of 1

Proj. No.: 7286

Date: Oct. 3, 1974

Described by: W. Pitt

Ground Elevation +8.2 ft

Depth to Water Level: Not taken

Sample No.	Depth ft	Number of Blows per 6"	Description
			Drove casing to refusal - 9.0' Roller bitted to 10.8' - strata change Split-spoon attempt at 10. 8'
S-1	10.8-12.3	57 100/4" 8/2" 30	140# hammer gray, very dense, sandy, gravelly SILT, trace to little clay. (Till) 300# hammer Roller bit refusal at 19.5' Bottom of Borehole
			End of Exploration

BORING NO. G-7

pg. 1 of 1

Proj. No. : 7286

Date: Oct. 3. 1974

Described by: W. Pitt

Ground Elevation +8.6 ft

Depth to Water Level: Not taken

	Sample No.	Depth ft	Number of Blows per 6"	Description
				Drove casing to 10' Roller bitted to 11.5' - strata change
11.5	S-1	11.5-13.0	24 92 22	140# hammer gray, very dense gravelly, silty SAND trace to little clay. (Till) 300# hammer Roller bitted to refusal at 23.2 Bottom of Borehole
23.2				End of Exploration

GEOTECHNICAL ENGINEERS INC

BORING NO. G-8

pg. 1 of 1

Proj. No. : 7286

Date: October 7, 1974

Ground Elevation +7.3

Depth to Water Level: Not Taken

Described by: W. Pitt

	Sample No.	Depth it	Number of Blows per 6"	Description
		10.1 →		Cobble. Drove casing to refusal at 10.5. Strata change.
10.5	S-1	10.5-12.0	18-16-24	Gray, medium dense clayey silty, SAND, little to trace. Gravel contains subround gravel up to 15 mm in size. Medium plasticity, well graded. Moderate reaction to shaking test.
19.0				Bottom of borehole, roller bit refusal at 19.0'.

GEOTECHNICAL ENGINEERS INC.

BORING NO. G-9

pg. 1 of 1

Proj. No. : 7286

Date: October 9, 1974

Described by: W. Pitt

Ground Elevation +9.5 ft

Depth to Water Level: Not Taken

	Run No.	Depth ft.	Recovery and RQD %	Description
				No Samples -- Washed through overburden
10.5'				TOP OF ROCK
	NX-1'	10.5-15.5	REC = 100% RQD = 96%	Gray/white mixed fine and medium grained DIORITE. Minor jointing. Fresh and hard throughout. Minor slickensiding on joint surfaces.
	NX-2	15.5-20.5	REC = 100% RQD = 76%	Similar to NX-1; minor to moderately jointed. Joints rusty; vuggy. Moderate weathering on joint surfaces.
	NX-3	20.5-25.5	REC = 100% RQD = 80%	Similar to NX-2; high angle jointing with calcite infilling.
25.5'				Bottom of boring @ El. -35.0 ft

BORING NO. G-10

Proj. No. : 7286

Date: October 8, 1974

Described by: W. Pitt

Ground Elevation +7.9 ft

Depth to Water Level: Not Taken

	Run No	Depth ft.	Recovery and RQD %	Description
				No Samples -- Washed through overburden TOP OF ROCK
6.5,				Roller bitted to 7.0 ft
	NX-1	**7.0-12.0**	REC = 98% **RQD** = 65%	Gray, mixed fine and medium g-rained DIORITE. Moderately jointed. Generally fresh and hard **through**-out. Moderately weathered; rusty on joint surfaces.
	NX-2	**12.0-**17.0	REC = 100% **RQD** = 62%	Similar to NX-1; intact rock generally fresh and hard. Moderate to severe weathering on joint surfaces.
	NX-3	**17.0-**22.0	REC = 100% **RQD** = 75%	Similar to NX-2; generally fresh and hard throughout. Moderate we'athering on joint surfaces.
22.0'				Bottom of boring @ El. -29.9 ft.

BORING NO. G-11

pg. 1 of 1

Proj. No. : 7286

Date: October 8. 1974

Ground Elevation +6.8 ft
Depth to Waler Level: Not Taken

Described by: W. Pitt

	Run No	Depth ft.	Recovery and RQD %	Description
				No Samples -- Washed through overburden
15.9'				TOP OF ROCK
				Roller bitted to 16.0 ft
	NX-1	16.0- -21.0	REC = 92% RQD = 55%	Gray, mixed fine and medium grained DIORITE; semi-schistose in texture. Moderately jointed with several high angle joints. Generally hard and fresh throughout with minor clay infilling on slicked joint surfaces.
	NX-2	21.0- 26.0	REC = 100% RQD = 67%	Similar to NX-1, moderately hard; vuggy in places with several weathered, high angle joints.
	NX-3	26.0- 31.0	REC = 96% RQD = 68%	Similar to NX-2; moderate to severe weathering on joint surfaces.
31.0'				Bottom of boring @ El. -37.8 ft.

GEOTECHNICAL ENGINEERS INC

BORING NO. G-12

pg. 1 of 1

Proj. No. : 7286

Date: October 10, 1974

Described by: W. Pitt

Ground Elevation. +7.2 ft
Depth to Water Level: Not Taken.

	Sample No.	Depth ft	Number of Blows per 6"	Description
	S-1	0.0-1.0	1-4	Brown-black soft PEAT and organic SILT, highly decomposed, root mass throughout.
1.	S-1A	1.0-2.0	6-6	Gray-dark brown mottled, loose fine to medium SAND, little to trace silt. - - - - - - - - COLOR CHANGE - - - - - - - - -
5.	s-2	5.0-6.5	-12-21-28	Gray, slightly micaceous, similar to S-1A.
9.0	s-3	10.0-10.9	5-100/5" 10/0"	140# hammer. Gray, homogeneous CLAY 300# Hammer. High plasticity
11.				Bottom of hole Roller bitted 1" - refusal. Bedrock or large boulder. End of exploration.

DESCRIPTION OF EXPLORATORY TEST PITS

Test Pit #100 | Ground Elev. : +9.6

Location: tp adjacent to DH-G-4, Coord. 21, 572N - 78,993E | Depth to Water: Not encountered

Date: October 3, 1974 | Project 7286

Depth ft	Soil Description
1.0' O-1.0	Black-brown fibrous PEAT and organic SILT
1.0 →	TP Sample - light brown-yellow brown, loose, silty fine SAND, cobbles >3" found. throughout. Test pit was hand dug to a depth of approximately 2 ft

APPENDIX 2

American Drilling **& Boring** Co., Inc.
100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. G-1
LINE & STA.
OFFSET
SURF. ELEV.

TO Yankee Atomic Electric Co. ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Specification PROJ NO 7236
SAMPLES SENT TO Delivered to Geotech at Site OUR JOB NO. 4025

GROUND WATER OBSERVATIONS
At 2" after 14 Hours
At ____ after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	S/S	
Size I.D.	3"	1-3/8"	
Hammer Wt	300#	140#	BIT
Hammer Fall	24"	30"	

	Date	Time
START	9/30/74	
COMPLETE	"	
TOTAL HRS.		

BORING FOREMAN K. Allen
INSPECTOR [illegible]
SOILS ENGR.

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE N	o	
	3	0'-1'	D	1	2		w/loose	1'	Leaves, root matter, sandy	1	24"	
	6	1'-2'	D	5	14		moist		Silt (muddy)	1a		
	14						m/dense					
	16	3'-5'	D	11	16	32	moist		Brown fine SAND, some silt	2	24"	10
	37					23	very		trace coarse sand & fine			
	7	5'-6.5'	D	37	39	57	dense		to coarse gravel	3	18"	12
	45											
	55											
	100							9'				
	1[illegible]			4"	2"							
		10'-11.5'	D	100	33	22	moist			4	18"	12
				(140)	(300)		hard		Gray clayey SILT, little fine			
									to medium sand & fine to			
									coarse gravel (TILL)			
					4"	8"						
		15'-16.5'	D	124	100	82	"	16.5'		5	18	1"
					(140)	(300)						
									Bottom of Boring - 16.5'			

GROUND SURFACE TO 16' USED NW CASING: THEN sampled to 16.5'

Sample Type:
O-Dry C=Cored W-washed
UP: Undisturbed Piston
TP= Test Pit A=Auger V=Vane Test
UT= Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fa on 2" O.D. Sampler

Cohesionless Density	
0-10	Loose
10-30	Med. Dense
30-50	Dense
50 +	Very Dense

Cohesive Consistency	
0-4	Soft
4-8	M/Stiff
8-15	Stiff
15-30	V-Stiff
30 +	Hard

SUMMARY:
Earth Boring 16.5'
Rock Coring
Samples 5

HOLE NO G-1

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. G-2
LINE & STA.
OFFSET
SURF. ELEV.

TO Yankee Atomic Electric Co. | ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System | LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Specificat[illegible] | PROJ. NO. 7286
SAMPLES SENT TO Delivered to Geotech at Site | OUR JOB NO. 4-85

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
@ 4' after 1/2 Hours	Type	NW	S/S	
@ ___ after ___ Hours	Size I.D.	3"	1-3/8"	
	Hammer Wt.	300"	140#	BIT Roller
	Hammer Fall	24"	30"	

	Date	Time
START	10/1/74	
COMPLETE	"	
TOTAL HRS.		
BORING FOREMAN	K. Tien	
INSPECTOR	[illegible]	
SOILS ENGR.		

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No.	Pen	Rec
	4	0'-2'	D	2	5	3	moist	1'	Sandy SILT (Tonsoil)	1	24	[illegible]
	17					2	loose		Brown fine SAND, trace fine			
	20	2'-3.5'	D	17	50/0'	22	dry		gravel, trace of	2	18	1'
	80			(100)		42	very	4'	Boulders			
	115					(300)	dense					
	2	5'-7'	D	15	23	23	wet			3	24	1[illegible]
	5					33	very		Brown fine silty SAND, some			
	2						dense		coarse sand & fine-coarse			
	45								gravel, trace Boulders			
	90											
	65	10'-11.5'	D	57	100	33	"			4	18	1[illegible]
	160			(140)		(300)			(Refusal cas.-12'6"-drilled			
	123/6"								w/roller bit to 14'6")			
								14.5				
									Bottom of Boring - 14.5'			

GROUND SURFACE TO 12'6" USED NW CASING: THEN Roller bit to 14.5'

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler		SUMMARY:
D=Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 14.5'
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP= Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples 4
UT= Undisturbed Thinwall	and 35 to 50%	30-50 Dense	8-15 Stiff	HOLE NO. G-2
		50 + Very Dense	15-30 V-Stiff	

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R I

TO Yankee Atomic Electric Co. ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Speci[illegible] PROJ NO 7286
SAMPLES SENT TO Delivered to Geotech at Site OUR JOB NO 4-85

SHEET 1 OF 1
DATE
HOLE NO. G-3
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ____ after ____ Hours	Type	NW	S/S	
	Size O.	3"	1-3/8"	
At ____ after ____ Hours	Hammer Wt	300#	140#	BIT
	Hammer Fall	24"	30"	

	Date	Time
START	10/1/74	
COMPLETE	10/2/74	
TOTAL HRS.		
BORING FOREMAN	K. Allen	
INSPECTOR	[illegible]	
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From- To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
	1	0'-2'	D	P 1	s H		wet			1	24"	24'
	3						soft					
	4								Brown SILT			
	7	3'-5'	D	10	20	21	wet			2	24"	18
	14					20	hard					
	10						wet	6'				
	18	6'-7'	D	14	16		dense	7'	Brn. fine silty SAND Lens)	3	12"	12'
	30	7'-8'	D	22	32		wet		Brown silty CLAY			
	32						hard	9'				
	[illegible]											
	24	10'-12'	D	2	4	4	wet			4	24'	24'
	28					5	stiff					
	30								Gray CLAY			
	20											
	30						wet					
	25	15'-17'	D	2	3	3	medium			5	24"	24'
	25					4	stiff					
	25											
	25						wet	19'				
	45	19.5'-20'	D	32			dense	20'	Gray GRAVEL (fractures)	6	6"	6'
	44	20'-21.5'	D	20	12	17	wet	21.5'	Brown sandy CLAY	6a	18'	12
	9						very					
	17						stiff		Brown silty sandy GRAVEL			
	40											
	[illegible]											
	45	25'-25.5'	D	100	50		wet			7	6"	6'
	30			(140)	(300)		very					
	45						dense	28'				
	65											
	75								Gray silty fine SAND, little			
	44	30'-31.5'	D	25	25	58	"		fine-medium gravel	8	18'	14'
	40											
	45											
	90											
	175	@ 34'10"	D	100/0"	20/0"		"	34'10"				
	(10")			(1[illegible])	([illegible]00)							
									Bottom of Boring - 34'10"			
									Refusal			

GROUND SURFACE TO 34'10" USED [illegible] CASING: THEN Acrusa

Sample Type	Proportions Used		140 lb Wt. x 30" fall on 2" O.D. Sampler Cohesionless Density		Cohesive Consistency		SUMMARY:
D=Dry C=Cored W=Washed	trace	0 to 10%	0-10	Loose	0-4 Soft	30 + Hard	Earth Boring 34'10
UP: Undisturbed Piston	little	10 to 20%	10-30	Med. Dense	4-8 M/Stiff		Rock Coring
TP= Test Pit A-Auger V-Vane Test	some	20 to 35%	30-50	Dense	8-15 Stiff		Samples 8
UT= Undisturbed Thinwall	and	35 to 50%	50 +	Very Dense	15-30 V-Stiff		HOLE NO G-3

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. G-4
LINE & STA.
OFFSET
SURF. ELEV.

TO Yankee Atomic Electric Co. ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Speci[illegible] PROJ. NO. 7286
SAMPLES SENT TO Delivered to Geotech at Site OUR JOB NO. 4-85

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR		Date	Time
At 1'6" after 23 Hours	Type	NW	S/S	-	START	10/2/74	
At ___ after ___ Hours	Size I.D.	3"	1-3/8"		COMPLETE	"	
	Hammer Wt.	300#	140#	BIT	TOTAL HRS.		
	Hammer Fall	24"	30"		BORING FOREMAN	K. Allen	
					INSPECTOR	[illegible]	
					SOILS ENGR.		

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No.	Pen	Rec
1	0'-2'	D	1	1	1	wet	1'	(Topsoil) Brown SILT	1	24"	6"
1					2	soft					
17						wet		Brown fine sandy SILT			
10	3'-5'	D	6	10	22	very	4'		2	24"	18"
26					42	dense					
10			6"	6"							
7	6'-7.5'	D	100	38	60	"		Brown fine SAND, some coarse sand & fine-coarse gravel trace of silt	3	18"	18"
100			(140)	(300)							
[illegible]											
[illegible]											
[illegible]	10'-11.5'	D	25	50	57	"			4	18"	18"
90											
60											
125											
175											
20	15'-16.2'	D	50(	[illegible]	42 60	"			5	15"	15"
21			75/3"	(300)							
26											
75							19'				
16								Gray silty SAND, some fine to coarse gravel			
	20'-21'	D	76	76		"			6	12"	12"
							22.5'				
								Bottom of Boring - 22.5' Refusal - Roller Bit			

GROUND SURFACE TO 20' USED NW CASING: THEN Roller bit to refusal

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	
50 +	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 22.5'
Rock Coring
Samples 6

HOLE NO. G-4

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF
DATE
HOLE NO. G-5
LINE & STA.
OFFSET
SURF. ELEV.

TO Yankee Atomic Electric Co. ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per specif. cat. PROJ. NO. 7206
SAMPLES SENT TO Delivered to Geotech. at Site OUR JOB NO. 6-25

GROUND WATER OBSERVATIONS
At - after Hours
At after Hours

	CASING	SAMPLER	CORE	BAR
Type	NW	S/S		
Size I.D.	3"	1-3/8"		
Hammer Wt	300#	140#	BIT	
Hammer Fall	24"	30"		

	Date	Time
START	10/4/74	a.m. p.m.
COMPLETE	"	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	K. Allen	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From- To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No.	Pen	Rec
	1											
	7											
	17								Casing Refusal @ 9'			
	21								Top of TILL 9' . sampled			
	28											
	100+											
	42											
	30											
	75				2"	0"	wet	9'				
		9'-9'8"	D	52	100	50	very		Gray fine silty SAND, some	1	8"	6
					(140	(300)	dense	9'8"	fine-coarse gravel			
									Bottom of Boring - 9'8"			
									Refusal w/roller bit			

GROUND SURFACE TO 9' USED NW CASING: THEN Refusal w/roller bit

Sample Type
D=Dry C=Cored W=Washed
UP: Undisturbed Piston
TP= Test Pit A=Auger V=Vane Test
UT-Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	
50 +	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 9'8"
Rock Coring
Samples 1

HOLE NO. G-5

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. G-6
LINE & STA.
OFFSET
SURF. ELEV.

TO Yankee Atomic Electric Co. ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Specificat[illegible] PROJ. NO. 7286
SAMPLES SENT TO Delivered to Geotech.at S[illegible] OUR JOB NO. 4-85

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	S IS	
Size I.D.	3"	1-3/8"	
Hammer Wt.	300#	140#	BIT
Hammer Fall	24"	30"	

	Date	Time
START	10/4/74	
COMPLETE	"	
TOTAL HRS.		

BORING FOREMAN K. Allen
INSPECTOR [illegible]
SOILS ENGR.

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From- To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No.	Pen	Rec
	4								Casing Refusal @ 9' Strata change @ 9'9" (TILL)			
	14											
	30											
	70											
	42											
	100+											
	70											
	120											
	110							9'				
					7"	8"	wet					
		10'9"-12'	D	57	100	38	very		Gray fine SAND, some fine to coarse gravel, little silt	1	18	14
					(140)	(300)	dense					
								19'6"				
									Bottom of Boring - 19'6" Refusal w/roller bit			

GROUND SURFACE TO 9' USED NW CASING: THEN Roller bit to refusal (rock?)

Sample Type	Proportions Used	140lb Wt. x 30" fall on 2" O.D. Sampler		SUMMARY:
D: Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 19'6"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP=Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples 1
UT=Undisturbed Thinwall	and 35 to 50%	30-50 Dense; 50 + Very Dense	8-15 Stiff; 15-30 V-Stiff	HOLE NO. G-6

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R I

SHEET	1 OF 1
DATE	
HOLE NO.	G-7
LINE & STA.	
OFFSET	
SURF. ELEV.	

TO Yankee Atomic Electric — ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System — LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Specification — PROJ. NO. 723
SAMPLES SENT TO Delivered to Geotech.at Site — OUR JOB NO. 4-25

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At - ___ after ___ Hours	Type	NW	S/S	
	Size I.D.	3"	1-3/8"	
At ___ after - - Hours	Hammer Wt.	300	140	BIT
	Hammer Fall	24	30"	

	Date	Time
START	10/4/74	a.m. p.m.
COMPLETE	"	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	[illegible]	
INSPECTOR	Staff	
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No.	Pen	Rec
	1											
	17											
	24								Casing Refusal @ 10'			
	45								Strata Change (TILL) @ 11'6			
	51											
	42											
	30											
	40											
	42											
		11'6"-13'	D	24	92	22	wet very dense	11'6"	Gray fine SAND, some fine to coarse gravel, little silt	1	18"	1"
								23'2"	Bottom of Boring - 23'2" Roller Bit Refusal			

GROUND SURFACE TO 10' USED NW CASING: THEN Used Roller Bit to 23'2"

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler		SUMMARY:
D-Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 23'2"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft	30 + Hard. Rock Coring
TP= Test Pit A-Auger V=Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples 1
UT= [illegible]		30-50 Dense	8-15 Stiff	

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. C-8
LINE & STA.
OFFSET
SURF. ELEV.

TO Yankee Atomic Electric ADDRESS Westboro, Mass.
PROJECT NAME Circ. Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Specific... PROJ. NO. 7286
SAMPLES SENT TO Delivered to Geotech... OUR JOB NO. 4-85

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type	NW	S/S	- - - -
Size I.D.	3"	1 3/8"	
Hammer Wt.	300	140	BIT
Hammer Fall	24"	30"	

	Date	Time
START	10/7/74	a.m. p.m.
COMPLETE	"	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
	1											
	5											
	6								Casing Refusal @ 10'6"			
	13											
	16											
	17											
	13											
	15											
	21											
								10'6"				
		10'6"-12'	3	17	13	24	wet dense		Gray fine SAND, some fine to coarse gravel, little silt:	1	18	14
								19'				
									Bottom of Boring - 13' Roller Bit Refusal			

GROUND SURFACE TO 10'6" USED NW" CASING: THEN Roller bit refusal

Sample Type	Proportions Used		140lb Wt. x 30" fall on 2" O.D. Sampler				SUMMARY:
D= Dry C=Cored W=Washed	trace	0 to 10%	Cohesionless Density		Cohesive consistency		Earth Boring 19'
UP= Undisturbed Piston	little	10 to 20%	0-10	Loose	0-4 Soft	30 + Hard	Rock Coring
TP= Test Pit A=Auger V=Vane Test	some	20 to 35%	10-30	Med. Dense	4-8 M/Stiff		Samples 1
UT= Undisturbed Thinwall	and	35 to 50%	30-50	Dense	8-15 Stiff		

HOLE NO. C-8

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R I.

SHEET 1 OF 1
DATE
HOLE NO. C-9
LINE & STA.
OFFSET
SURF. ELEV.

TO Yankee Atomic Electric ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Specification PROJ. NO. 7780
SAMPLES SENT TO Delivered to Geotech. at Site OUR JOB NO. 4-85

GROUND WATER OBSERVATIONS
At 2' after 1/4 Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW		NWD
Size I D	3"		
Hammer Wt.	300#		BIT
Hammer Fall	24"		

	Date	Time
START	10/7/74	a.m. p.m.
COMPLETE	"	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN [illegible]
INSPECTOR [illegible]
SOILS ENGR.

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
									OVERBURDEN			
								10'6'				
		10'6"-15'6"	C	3 MIN/FT						C1	60	60"
									Gray QUARTZ DIORITE			
		15'6"-20'6"	C	6 MIN/FT						C2	60	61"
		20'6"-25'6"	C	5 MIN/FT						C3	60	59"
								25'6'				
									Bottom of Boring • 25'6" cored 15'			

GROUND SURFACE TO 10'6" USED NW "CASING: THEN Cored

Sample Type
D=Dry C=Cored W=Washed
UP- Undisturbed Piston
TP=Test Pit A-Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fall on 2" O.D. Sampler
Cohesionless Density
30-50 Dense
10-30 Med. Dense

Cohesive Consistency
8-15 Stiff 30 + Hard
4 - 8 M/Stiff

SUMMARY:
Earth Boring 10'6
Rock Coring 15'
Samples ---

HOLE NO.

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. C-10
LINE & STA.
OFFSET
SURF. ELEV.

TO Yankee Atomic Electric ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Specificati PROJ. NO 7286'
SAMPLES SENT TO Delivered to Geotech.at Site OUR JOB NO. 4-85

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ____ after ____ Hours	Type	NW	-	NXD3
	Size I.D.	3"		
At ____ after ____ Hours	Hammer Wt.	300#		BIT
	Hammer Fall	24"		dia

	Date	Time
START	10/7/74	a.m. p.m.
COMPLETE	10/8/74	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN K. Allen
INSPECTOR W. Rice
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No.	Pen	Rec
									OVERBURDEN			
								7'				
		7'-12'	C	3-5	Min/Ft					C1	60'	60"
		12'-17'	C	3-5	Min/Ft				Gray DIORITE	C2	60'	60"
		17'-22'	C	4	Min/Ft					C3	60'	60"
								22'				
									Bottan ofboring- 22'			

GROUND SURFACE TO 7' USED ... CASING: THEN Cored to 22'

Sample Type
D-Dry C=Cored W=Washed
UP: Undisturbed Piston
TP= Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	
50 +	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 7'
Rock Coring 15'
Samples ---

HOLE NO. C-10

SHEET 1 OF 1
DATE
HOLE NO. C-11
LINE & STA.
OFFSET
SURF ELEV.

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R I.

TO Yankee Atomic Electric Co. ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distrubution as per Specification PROJ. NO 7236
SAMPLES SENT TO Delivered to Geotech.at Site OUR JOB NO. 4-85

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	-	NXD2
Size I.D.	3"	-	-
Hammer Wt	300#	-	BIT
Hammer Fall	24"	-	Dia

	Date	Time
START	10/8/74	a.m. p.m.
COMPLETE	"	a.m. p.m.

TOTAL HRS.
BORING FOREMAN K. Allen
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From- To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
									OVERBURDEN			
								16'				
		16'-21'	C	4	Min/Ft					C1	60	55'
		21'-26'	C	4	Min/Ft				Gray DIORITE	C2	60	60'
		26'-31'	C	7	Min/Ft					C3	60	60'
								31'				
									Bottom of Boring - 31'			

GROUND SURFACE TO 16' USED NW CASING: THEN Cored to 31'

Sample Type
D=Dry C=Cored W=Washed
UP= Undisturbed Piston
TP= Test Pit A=Auger V-Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY:
Earth Boring 16'
Rock Coring 15'
Samples --
HOLE NO.

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF
DATE
HOLE NO. G-12
LINE & STA.
OFFSET
SURF. ELEV.

TO Yankee Atomic Electric ADDRESS Westboro, Mass.
PROJECT NAME Circulating Water System LOCATION Seabrook, N.H.
REPORT SENT TO Distribution as per Specification PROJ NO 7285
SAMPLES SENT TO Delivered to Geotech. at Site OUR JOB NO. 4-25

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
Top of Ground
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	S/S	
Size I.D.	3"	1-3/8"	2-15/16"
Hammer Wt.	300#	140#	BIT
Hammer Fall	24"	30"	Roller

	Date	Time
START	10/10/74	
COMPLETE	"	
TOTAL HRS.		
BORING FOREMAN	K. Allen	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
	1	0'-1'	D	1	4		w/m/s	1'	Brown PEAT	1	12"	6"
	7	1'-2'	D	6	6		wet			1a	12"	3
	14						medium					
	15						dense		Gray fine silty SAND			
	71											
	33	5'-6'6"	D	12	21	28	wet			2	18"	12
	35						dense					
	37							9'				
	32								Gray CLAY			
		10'-10'11"	D	5	3/5"	100/0"	wet	10'11"		3	11"	11
				(140)	(140)		stiff	11'	~~Roller Bit Refusal @ 11'~~			
									Bottom of Boring- 11' Refusal			

GROUND SURFACE TO 10' USED NW CASING: THEN Sampled to 11'

Sample Type
D=Dry C=Cored W=Washed
UP: Undisturbed Piston
TP= Test Pit A=Auger V=Vane Test
UT- Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense
30-50 Dense
50+ Very Dense

Cohesive Consistency
0-4 Soft 30+ Hard
4-8 M/Stiff
8-15 Stiff
15-30 V-Stiff

SUMMARY:
Earth Boring 11'
Rock Coring ---
Samples 3

HOLE NO. G-12

APPENDIX 2J

SAMPLE DESCRIPTIONS FOR BORINGS MADE IN NOVEMBER-DECEMBER 1972

(REFERENCE FSAR FIGURE 2.5-46)

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

SAMPLE DESCRIPTIONS
FOR
BORINGS MADE NOVEMBER-DECEMBER, 1972

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

Submitted

to

YANKEE ATOMIC ELECTRIC

Project 7286

GEOTECHNICAL ENGINEERS, INC.
934 Main Street
Winchester, Massachusetts 01890

January 1973

NOTATION

w	water content of split-spoon sample received in the laboratory
PL	plastic limit
q_u(rec)	equivalent unconfined compressive strength based on penetrometer resistance measured in the laboratory on the split-spoon sample

NOTES

1. There are no borings corresponding to the following numbers: D1-2, **D2-2, D2-6.**
2. Logs of the rock cores are shown on separate sheets.
3. All samples taken with **2-inch** split-spoon sampler.

BORING NO. DI-1

SOIL DESCRIPTIONS

Ground Elevation: **9.8 ft**

Depth to Water Level: [illegible] ft　　　　Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o- 0.5	1	Dark brown leaves and root material.
1A	0.5- 2	2-2-3	Gray-brown slightly organic silty uniform fine to medium sand.
2	5- 6.5	40-17-39	Brown and red-brown silty gravelly sand. Widely graded; contains some fine-sandy silt pockets; grave up to ~ 25 mm in size.
3	10-11	16-20	Brown silty gravelly sand. Widely graded; angular to subrounded grains; contains ~ 20-30% gravel up to 28 mm in size and ~ 10-20% nonplastic fines; few gray lenses ~ 5 mm thick and several rusty-brown spots.
4	15-16.5	10-12-20	Light gray slightly silty and gravelly sand. Fine to coarse grained with a few gravel pieces up to 35 mm in size; angular to subrounded grains; ~ 5-10% silt.

BORING NO. D1-3
SOIL DESCRIPTIONS

Ground Elevation: 14.0 ft
Depth to Water Level: 2.0 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 0.5	1	Dark brown **fine-sandy organic** silt. Nonplastic; contains some roots up to 0.5 mm diameter.
1A	0.5-1.5	3-4	Light brown sand. Fine to medium **grained;** uniform contains few black organic pieces < 0.5 mm in size; < 5% nonplastic fines.
2	5- 6.5	8-15-2:	Brown to rusty-brown sandy silty gravel. Widely graded; angular to subangular grains; contains ~ **30-40%** nonplastic fines and ~ **20-30%** sand; grave pieces up to 25 mm in size. w = 11.2%
3	10-11	43-150	Gray silty gravelly sand. Widely graded; angular grains; contains ~ **30-40% gravel** up to 30 mm in **size** and ~ **20-30%** slightly cohesvie fines.

BORING NO. DI-4
SOIL DESCRIPTIONS

Ground Elevation: 11.4 ft
Depth to Water Level: 2.0 ft bove ground surface Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 0.5	1	Dark brown decomposed leaves.
1A	0.5-1.	3-3'	Light brown slightly gravelly silty sand. Widely graded; subangular grains; slightly plastic fines; gravel pieces up to ~ 20 mm in size.
2	5- 6.5	13-8-1!	Yellow-brown silty clay. Stiff; orange streaks throughout sample; occasional pockets of orange fine sand; some discoloration on freshly broken surface. w = 19.9%
3	8- 9.5	12-25-5	Brown slightly clayey gravelly fine sand. Subangular grains; red-brown fine sand at top of sample; contain gravel up to ~ 30 mm in size.
4	13-13.9	64-87/5'	Gray gravelly silty sand. Widely graded; contains subangular gravel pieces up to ~ 25 mm in size; slightly plastic fines.
5	5.4-15.	25/1"- 25/0"	No recovery.

BORING NO. D1-5
SOIL DESCRIPTIONS

Ground Elevation: 16.6 ft
Depth to Water Level: 2.8 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 1.5	1-1-2	Top is dark brown leaves and decomposed root materials. Bottom is brown silty sand. Sand is mostly fine-grained with a trace of medium and coarse grains.
2	1.5- 3	1-2-10	Light brown slightly silty fine sand. Contains few medium sand grains and gravel pieces up to ~ 20 mm in size.
3	5- 6.5	31-33-46	Brown slightly gravelly silty sand. Widely graded; subangular to subrounded grains; contains a pocket of weathered quartz; orange-brown staining on freshly broken gravel surfaces.
4	10-11.5	23-52-122	Brown gravelly silty sand. Widely graded; gravel is subangular to subrounded; iron oxide staining on freshly broken surfaces of gravel; gravel pieces range in size up to ~ 20 mm.
5	14-15.3	20-29-100/4"	Top is orange-brown silty fine to medium sand with a trace of coarse sand. Bottom is gray stratified sand: clayey silt and Clay. Layers are < 2 mm thick; contains some coarse sand and a few gravel pieces up to ~ 25 mm in size. w = 23.6%

BORING NO. D1 -6
SOIL DESCRIPTIONS

Ground Elevation: 19.2 ft
Depth to Water Level: 3 ft   Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 1	1 - 1	Brown organic silty fine sand with small roots and leaves.
1A	1- 1.5	4	Light brown silty fine sand. Uniform; contains a few gravel pieces up to ~ 15 mm in size.
2	5- 6.1	24-124-46/1"	Light brown and red-brown gravelly silty sand. Widely graded; some iron staining on weathered gravel pieces up to ~ 20 mm in size.
3	10-11.5	4-56-11	Red-brown silty fine to coarse sand. Generally angular grains; has appearance of weathered rock.

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BORING NO. D1-7
SOIL DESCRIPTIONS

Ground Elevation: 14.3 ft
Depth to Water Level: 1.2 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o- 1.5	1-2-3	Brown sandy organic silt. Contains leaves and roots up to 8 mm diameter; some lighter brown silty sand pockets.
2	1.5- 3	2-3-4	Mottled brown, gray, and rusty-brown clayey silt. Very ***stiff;*** low plasticity and *toughness;* w slightly above PL; contains brown and rnsty-brown silty fine sand layers up to 40 mm thick; a few roots up to 2 mm diameter. q_u**(rec)** = 2.5 tsf w = 19.0%
3	5- 6.5	20-26-29	Most of sample is gray angular rock fragments up to 35 mm in size. One layer ~ 30 mm thick is brown to rusty-brown gravelly silty sand. Widely graded; angular grains; contains ~ **20-30%** slightly cohesive fines and gravel up to 10 mm in size.
4	10-11	55-90	Brown and rusty-brown silty sandy gravel. Widely graded; angular grains; contains ~ **30-40%** fine to coarse sand and ~ **10-20%** nonplastic fines; gravel pieces up to 35 mm in size.
5	13-14.5	15-30-55	Gray sandy silty gravel, Widely graded; angular grains; contains ~ **20-25%** slightly cohesvie fines and ~ 10% fine to coarse sand; gravel pieces up to 30 mm in size.

BORING NO. D1-8
SOIL DESCRIPTIONS

Ground Elevation: 15.9 ft
Depth to Water Level: 1.9 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 1.5	1-1-12	Top is dark brown fine-sandy organic silt containing *several* roots < 1 mm diameter; Bottom is brown and rusty-brown sandy silt containing many dark brown organic pieces < 0.5 mm in size.
2	5- 6.5	31-40-72	Brown slightly gravelly silty sand. Widely graded; angular to subrounded grains; contains ~ 30-40% nonplastic fines and ~ 10-15% gravel up to 35 mm in size; fast reaction to shaking test.
3	8.5- 9	127	Gray-brown silty gravelly sand. Widely graded; angular grains; contains ~ 30-40% gravel up to 25 mm in size and ~ 20-30% nonplastic fines.

BORING NO, D1-9
SOIL DESCRIPTIONS

Ground Elevation: 20.8 ft
Depth to Water 1/ I: 2.2 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o- 1.5	2-2-2	Light brown silty fine sand.

BORING NO. DI-10
SOIL DESCRIPTIONS

Ground Elevation: 19.2 ft
Depth to Water Level: 5.5 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 1.5	2-2-3	Brown slightly organic sandy silt. Nonplastic; contains ~ 40-50% fine to medium sand and several root up to 1 mm diameter, many decomposed vegetation pieces < 1 mm in size; fast reaction to shaking test.
2	1.5- 3	3-4-5	Brown gravelly silty sand. Widely graded; grains ax angular to subangular; contains ~ 20-30% nonplastic fines and ~ 10-20% gravel up to 30 mm in size; fast reaction to shaking test.
3	7.5- 8	120	Similar to Sample No. 2, but more silty; some gray pockets or layers ~ 30 mm thick; contains several gray angular rock fragments at bottom.

BORING NO, DI-11
SOIL DESCRIPTIONS

Ground Elevation: 13.8 ft
Depth to Water Level: 1.2 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o-2	1-1-4-7	Top is dark brown peat with many roots up to 1 mm diameter. Bottom is brown sand. Fine grained; uniform; contains few black organic pieces < 1 mm in size; < 5% silt.
2	5- 6.5	7-10-12	Light gray silty sand. Fine grained; uniform; very fast reaction to shaking test; contains ~30-40% nonplastic fines; part of sample is silty gravelly sand containing gravel up to 28 mm in size; angular grains
3	10-11.5	27-30-44	Gray silty sand. Widely graded; angular to subrounded grains ; contains ~ 25-30% nonplastic fines; few gravel pieces up to 8 mm in size. w.= 7.5%

BORING NO. DI-12
SOIL DESCRIPTIONS

Ground Elevation: 23.9 ft
Depth to Water Level: 3.5 ft

Project No. 7268

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o- 1.5	1-1-3	Brown and dark brown slightly organic silty **gravelly** sand. Fine to medium **grained;** contains many pockets of dark brown organic sandy silt, and several roots up to 6 mm diameter; fines are nonplastic; contains several gravel pieces **10-27** mm in size.
2	**5- 6.5**	17-32-57	Brown gravelly silty sand.. Widely graded; angular to subangular grains; contains ~ **30-35%** nonplastic fine; and ~ **20-30% gravei** up to 30 mm **in** size; very fast reaction to shaking test.

BORING NO. D2-1
SOIL DESCRIPTIONS

Ground Elevation: 21.2 ft
Depth to Water Level: 0.3 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 1.5	2-2-5	Brown slightly organic silty sand. 'Fine to medium grained; uniform; contains ~ 20-30% nonplastic fines and roots up to 1 mm diameter; some black organic pieces < 0.5 mm in size.
2	5- 6	17-120	Mottled gray, brown, and rusty-brown gravelly silty sand. Widely graded; subangular to subrounded grains; contains ~ 25-35% nonplastic fines and ~ 15-25% gravel up to 20 mm in size. w = 10.5%

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BORING NO. D2-3
SOIL DESCRIPTIONS

Ground Elevation: 19.4 ft
Depth to Water Level: 2. 0 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Dcecription
1	o- 0.5	1	Brown organic silty fine sand. Contains some leaves at top and few small roots.
IA	0.5- 2	3-4-4	Light brown silty fine to medium sand. Contains a few gravel piece6 up to ~ 20 mm in size; fines are nonplastic.
2	5.5-7.5	13-30-29-23	Light brown slightly gravelly very silty sand; sand is fine to coarse; few coarse gravel pieces are gray; contains some iron staining at bottom.
3	10-11.5	21-28-26	Stratified light brown and red-brown and gray silty sand. Contains a few gravel pieces up to ~ 20 mm in size.
4	15-16.5	38-32-31	Gray slightly gravelly very silty sand. Widely graded; few gravel pieces up to ~ 35 mm in size.
5	20-21.5	14-22-31	Similar to Sample No. 4, but fines are very slightly plastic.
6	25-25.2	35/3"	Similar to Sample No. 4, but fines are slightly plasti

BORING NO. D2-4
SOIL DESCRIPTIONS

Ground Elevation: 16.7 ft
Depth to Water Level: 0.0

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 1.5	1-1-3	Top is dark brown decomposed roots and leaves. Bottom is red-brown slightly silty fine sand containing numerous mica flakes.
2	1.5- 3	3-6-11	Light brown slightly silty gravelly fine sand. Gravel pieces are subangular and range in size up to ~ 20 m contains numerous mica flakes.
3	5- 6.5	24-35-3:	Brown slightly gravelly silty fine sand. Contains some medium and coarse sand and few fine gravel pieces; one 25 mm size piece of subrounded quartz at top; occasional pockets of red-brown fine sand.
4	10-10.6	25-100/1	Gray slightly clayey gravelly sand. Widely graded; gravel pieces are subangular to subrounded. w = 9.1%
5	13-14.5	18-22-2	Similar to Sample No. 4; 50 mm size piece of gravel at bottom.
6	15-16.5	20-16-2	Gray moderately clayey gravelly sand. Widely graded; gravel fragments are subangular and range in size up to ~ 25 mm.
7	20-21.5	9-27-2'	Similar to Sample No. 6.

BORING NO. D2-5
SOIL DESCRIPTIONS

Ground Elevation: 16.5 ft
Depth to Water Level: 5.8 ft

Project No. 7268

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0 - 1.5	2-2-4	Rusty-brown silty sand. Fine grained; uniform; contains ~ 10-20% nonplastic fines; trace of black organic specks < 0.5 mm in size; some black organic sandy silt and roots at top.
2	5- 6.5	7-7-5	Brown sandy clayey silt. Very stiff; low plasticity; slow reaction to shaking test; friable @ PL; w slightly above PL; contains ~ 10-15% fine to coarse subangular sand; several rusty-brown weathered gravel pieces up to 8 mm in size. q_u(rec) = 3.5 tsf w = 17.4%

BORING NO. **D2-7**
SOIL DESCRIPTIONS

Ground Elevation: 16.7 ft
Depth to Water Level: 1.5 ft

Project No. 7268

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o- 1.5	1/12"-2	Brown leaves and root material; changes to **gray-**brown organic silty fine sand with layers of brown organic silt.
2	**1.5-** 2	3	Brown organic silty fine sand.
2A	**2-** 3	13-12	Light brown silty fine sand; changing to gravelly silt: fine to coarse sand at bottom.
3	**5-** 6.5	13-16-21	Light brown and red-brown very **silty** fine sand. Contains a trace of coarse sand and a few gravel pieces up to ~ 35 mm in size; some iron staining.
4	10-11.5	**40-81-200**	Gray gravelly silty sand. Contains angular gravel fragments up to ~ 30 mm in size; bottom of sample is rock fragments.
5	15-16.5	18-52-47	Mottled gray and brown gravelly **sandy** clay. Contains some' coarse sand and gravel fragments up to ~ 35 mm in size. **w = 29.6%**
6	19-19.6	**100-100/1"**	Similar to Sample No. 5, but less clayey. w = 11.5%
7	**24-24.5**	250	Similar to Sample No. 5, **but more gravelly.** w = 12.4%

BORING NO. EI-1
SOIL DESCRIPTIONS

Ground Elevation: 28.9 ft
Depth to Water Level:

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
			No soil samples taken. (Bedrock at ground surface.)

BORING NO. E1-2
SOIL DESCRIPTIONS

Ground Elevation: 21.4 ft
Depth to Water Level: 3.8 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Dcecription
1	o- 1.5	3-14-6	Brown and dark brown slightly organic silty sand. Fine to medium grained; contains ~ 30 mm thick layer of sandy organic silt containing many small roots up to 3 mm diameter; contains a few angular gravel pieces up to 22 mm in size.
2	5- 6.5	19-31-54	Light brown silty sand. Fine to coarse grained; subangular; contains ~ 20-25% nonplastic fines; very fast reaction to shaking test; contains a few gravel up to 35 mm in size; some darker brown spots.

BORING NO. E1-3
SOIL DESCRIPTIONS

Ground Elevation: 15. 2 ft
Depth to Water Level: 0.3 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Dcecription
1	o- 1.5	1-1-1	Brown slightly organic silty sand. Fine to medium **grained;** contains ~**10-20%** nonplastic fines; contains a few small roots up to 1 mm diameter and a trace of black decomposed vegetation fibers; one ~ 50 mm thick layer at top is black sandy organic silt with small roots.
2	5- 6.5	8-8-7	Light brown sand. Fine to medium **grained;** uniform; < 5% silt; contains a few black organic specks < 0.5 mm in size.
3	10-11.5	12-12-15	Gray gravelly silty sand. Widely graded; grains are subangular to subrounded; contains ~ **30-40%** slightly cohesive fines **and ~ 10-15%** gravel up to 30 mm in size; moderately fast reaction to shaking test. w = 9.8%
4	15-16.5	17-23-21	Similar to Sample No. 3. w = 11.4%

BORING NO. EI -4
SOIL DESCRIPTIONS

Ground Elevation: 20.2 ft
Depth to Water Level: 3.0 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 1.5	1-1-1	No Recovery.

BORING NO. E1-5
SOIL **DESCRIPTIONS**

Ground Elevation: 16.0 ft
Depth to Water Level: 4.2 ft

Project No. 7296

Sample No.	Depth ft	Number of Blows per 6"	Dcecription
1	0 - 1	2-3	Brown fine-sandy organic silt with leaves, several roots up to 3 mm diameter.
2	1- 2.5	5-7-10	Brown sand. Fine grained; uniform; contains severa black organic pieces < 1 mm in size; < 5% nonplastic fines; contains one 20 mm size gravel piece.
3	5- 6.5	23-55-78	Brown and gray silty gravel. Widely graded; angulai grains; contains ~ 3C -40% slightly sandy brown silt between the gray gravel and rock fragments ranging in size up to 28 mm; the brown silt is nonplastic; ver fast reaction to shaking test.

BORING NO. EI-6
SOIL DESCRIPTIONS

Ground Elevation: 14.3 ft
Depth to Water Level: 1.3 ft
Project No. 7280

Sample No.	Depth ft	Number of Blows per 6"	Description
1	o- 1.5	1-2-5	No Recovery. (Pushed gravel.)

BORING NO. E2-1
SOIL DESCRIPTIONS

Ground Elevation: 15.9 ft
Depth to Water Level: 6.0 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	Description
1	0- 2	1-1-7-19	Top is brown sandy organic silt containing roots up to 12 mm diameter. Bottom is light brown to gray-brown gravelly silty sand. Widely graded; generally angular grains; contains ~20-30% nonplastic fines and ~10-20% gravel up to 18 mm in size; several rusty-brown spots up to 10 mm in size.
2	5- 6.6	31-60-74	Similar to bottom portion of Sample No. 1, but slightly less silty and fewer rusty-brown spots.

BORING NO. **E2-2**
SOIL DESCRIPTIONS

Ground Elevation: **13.7 ft**
Depth to Water Level: 0.1 ft

Project No. 7286

Sample No.	Depth ft	Number of Blows per 6"	**Description**
1	0- 1.5	1-2-2	Top is dark brown peat. Highly decomposed; contain! several roots up to 0.5 mm diameter. Bottom is brown **sand.** Fine **grained;** uniform; contains **< 5%** nonplastic fines.
2	**5-** 6.5	6-7-9	Similar to bottom portion of Sample No. 1.
3	10-11.5	18-21-39	Gray silty gravelly sand. Widely graded; angular to subangular grains; contains **~ 30-40%** gravel up to 34 mm in size and **~15-20%** nonplastic fines.

APPENDIX 2K

SEISMIC SURVEY

(THIS APPENDIX HAS BEEN EXTRACTED IN ITS ENTIRETY FROM THE SEABROOK STATION PSAR, WHERE IT IS REFERRED TO AS APPENDIX 2E)

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

APPENDIX 2E

SEISMIC SURVEYS

Seismic refraction surveys wer e conducted in the following areas: the plant site; tidal marsh; Hampton Harbor; Hampton State Park-State Beach; and offshore (to the east of Hampton State Beach). The purpose of these reconnaissance, seismic surveys was to determine depths to bedrock and depths of major seismic overburden discontinuities. The results of these surveys are summarized as follows:

1. Plant Site Area

The plan of the seismic lines of investigation, in the plant site area is shown on Figure 2E-1. In addition to the previously stated purpose, Line 20,000N was extended west to.provide supplimentary data for the groundwater hydrology study. Other lines were extended north for the purpose of exploring the contact zone between the Newburyport quartz diorite in the site area and the Merrimack Formation to the north of the site.

The results of refraction surveys in the plant site area are shown on Figure 2E-2 (Sheets 1, 2, and 3). In 'general, the seismic survey showed that hard rock was shallow in the vicinity of the selected plant location, with dense till along the north side of the site and less dense till and possible other overburden materials west of the plant location. There is good correlation between seismic and boring data.

The bedrock velocities measured by surface refraction techniques ranged between 13,000 and 16,000 ft/sec; this is indicative of sound bedrock conditions.

Overburden materials can be tentatively identified by their respective seismic velocities. Velocities for the overburden materials ranged from 2,000 ft/sec for loose, unconsolidated overburden materials to 6,500 to 6,800 ft/sec for dense glacial till. In general, overburden materials with velocities in excess of 5,500 ft/sec and in excess of 3,000 ft/sec for unsaturated materials are indicative of glacial till. Velocities below 5,500 ft/sec for saturated overburden usually indicate a fluvial or marine deposition.

The extension of Line 20,000N west to 76,900E indicates bedrock in the order of 200 feet deep and the absence of any potentially important aquifers.

A number of lines were extended northward to investigate a contact zone; however, Line 78,750E was the only one over which a velocity change from 15,000 ft/sec (Newburyport) to 13,000 ft/sec (Merrimack) was noted. This change was noted near Station 21,400N. The velocity change was subsequently confirmed by crosslines, and the contact location confirmed by borings. Line 80,500E had a velocity change between 20,900N and 21,100N, but it was not as evident as Line 78,750E. Other lines were either not extended sufficiently to the north or overburden velocity or depth variations were such that any

velocity change could not be definitely ascribed to the bedrock type.

2. Tidal Marsh Area

The plan map of the seismic lines in the tidal marsh area is shown on Figure 2E-3. The basic program of investigation consisted of Line A and Lines 2A, 2B, and 2C across the tidal marsh area with a number of crosslines between. The location and orientation of the crosslines were determined by depths to bedrock and the numerous small streams and man-made canals which crisscrossed the area. Detailed investigations were made along Browns River (600 series of seismic lines) and then westward to the site passing north of Hunts Island (Line NS-2 and the 700 and 800 series). A detailed plan map of the seismic lines in this area is shown on Figure 2E-3. The 600 series of seismic lines were operated as a marine refraction survey. Elevations of the bottom of Browns River were provided by McKenna Associates.

The results of the seismic survey in the tidal marsh area are shown on Figure 2E-4 (Sheets 1 through 10). In general, the bedrock surface in the tidal marsh is more than 50 feet below ground surface although a few sharp rises in the bedrock surface were noted in the vicinity of Browns River, where some outcrops were noted. Although Boring C-68 encountered refusal at an elevation of -28 feet, the bedrock surface rises to an

elevation of -10 feet along Lines 805 and NS-24, about SO to 70 feet northeast of the boring. Another example of the sharp changes in bedrock depths occurs in the vicinity of Line A where Boring C-52, 25 feet right of Line A, encountered refusal at the elevation of -33 feet, while the seismic data along Lines A and NS-6 indicate that a ridge of shallow rock (approximately Elevation -18 feet) occurs along or just to the north of Line A.

The borings showed that the glacial till found along the north of the site extends into the tidal marsh south of Line A and as far east as Line A-12. The till is only a few feet in thickness and, therefore, could not be detected seismically.

Boring data subsequently showed that in some areas the depths to bedrock were too shallow by as much as S feet. This was due'to a surface layer of organic material (peat) of about the same thickness. Organic materials, because of air entrapped and the overall nature of the material, are not conducive to good generation or transmission of seismic energy. In a few areas of the tidal marsh, organic materials were so thick as to prevent the generation of a recordable seismic signal.

3. Hampton Harbor Area

The results of the fathometer survey which took place during March and April 1973 are shown in the form of a bottom contour

map (Figure 2E-5). The results of the seismic investigations are shown in the form of a bedrock contour map (Figure 2E-6). The contours are based on seismic reflection and seismic refraction surveys conducted during March and April 1973 and augmented by the data obtained from a seismic refraction survey conducted in the fall of 1968. The 1968 data were obtained in the northern half of the area shown on Figure 2E-6 and mainly consisted of information on the minimum depths to a bedrock with only a few computed bedrock depths. The track maps for the 1973 reflection and refraction surveys are shown on Figures 2E-7 and 2E-8, respectively.

In the southern half of the area the bedrock was found to be generally shallow and somewhat irregular. The bedrock contour map in this area was based principally on seismic reflection data, the interpretation of which was confirmed by Boring F1A. Organic materials which prevented the generation of a good seismic signal were noted in a few small areas and at the southern edge of the area of investigation.

The bedrock contour map in the northern half of the area of investigation is based on a combination of seismic reflection and refraction data. Glacial till was detected against the north side of the shallow rock area by the seismic reflection.

The till appeared to thin towards the north so that the till and bedrock could not be distinguished on the seismic reflection records. Based on Boring F-2 which encountered 14 feet of till above bedrock, the seismic reflection data were reevaluated and the contours, as shown on Figure 2E-6, were constructed from the reevaluated reflection data and the seismic refraction data.

4. State Park - State Beach Area

The location plan of the seismic lines in this area is shown on Figure 2E-9 and the seismic results are shown on Figure 2E-10 (Sheets 1, 2, and 3). Two relatively shallow areas in the bedrock surface were detected in the State Park: one in the vicinity of Lines SPS and SPB, just north of Boring C-56; the second, in the vicinity of Lines SP3, SP4, and SPE, just north of Boring C-66. Boring C-24 confirmed the fact that a depression in the bedrock surface exists between the two high areas of rock.

In the State' Beach area, a thin layer of glacial till was encountered by Boring P-1, but was not detected seismically. The seismic overburden velocity of 5,500 ft/sec, as detected on the more easterly lines of the State Beach area, may be indicative of a dense sand.

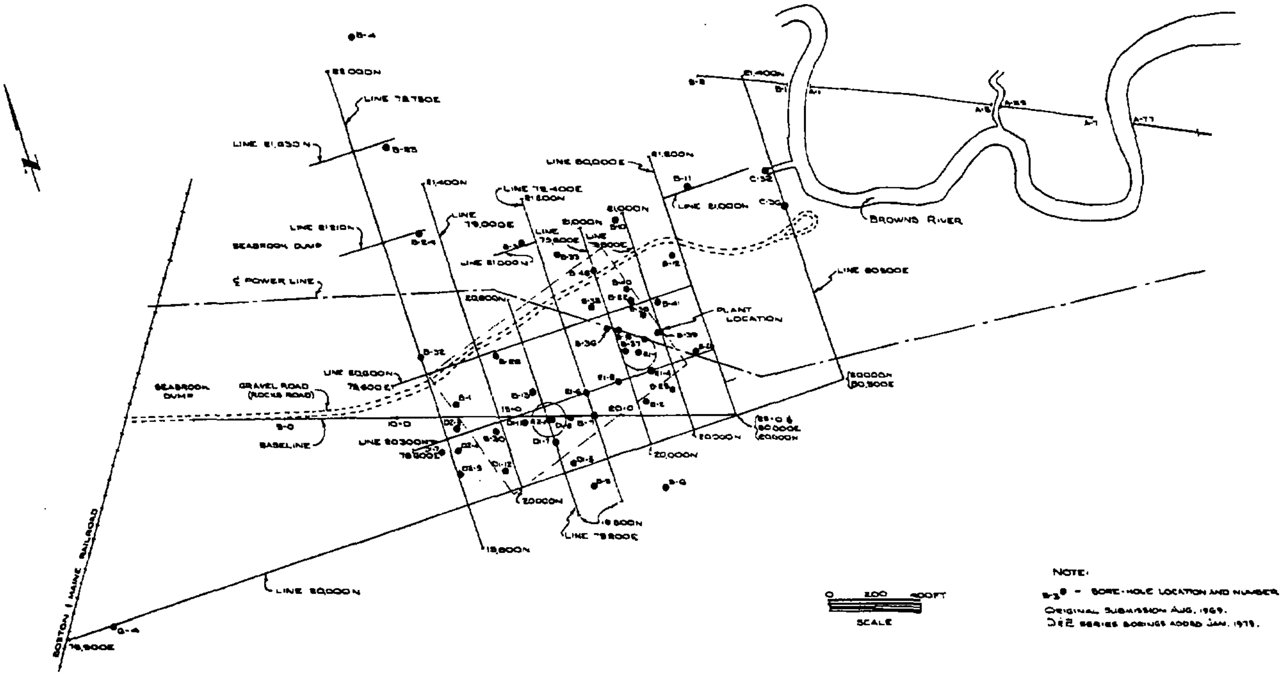
5. Offshore Area

The results of the fathometer survey which took place in March and April 1973 are shown on Figure 2E-11. The bedrock contour map, Figure 2E-12, was constructed from seismic reflection and refraction data obtained in March and April 1973, and from a seismic refraction survey conducted during the fall of 1968. The track map for the 1973 reflection and refraction surveys is shown on Figure 2E-13. The 1968 seismic refraction survey was conducted in an area extending in an east-northeasterly direction for a distance of about a mile from the Hampton State Beach.

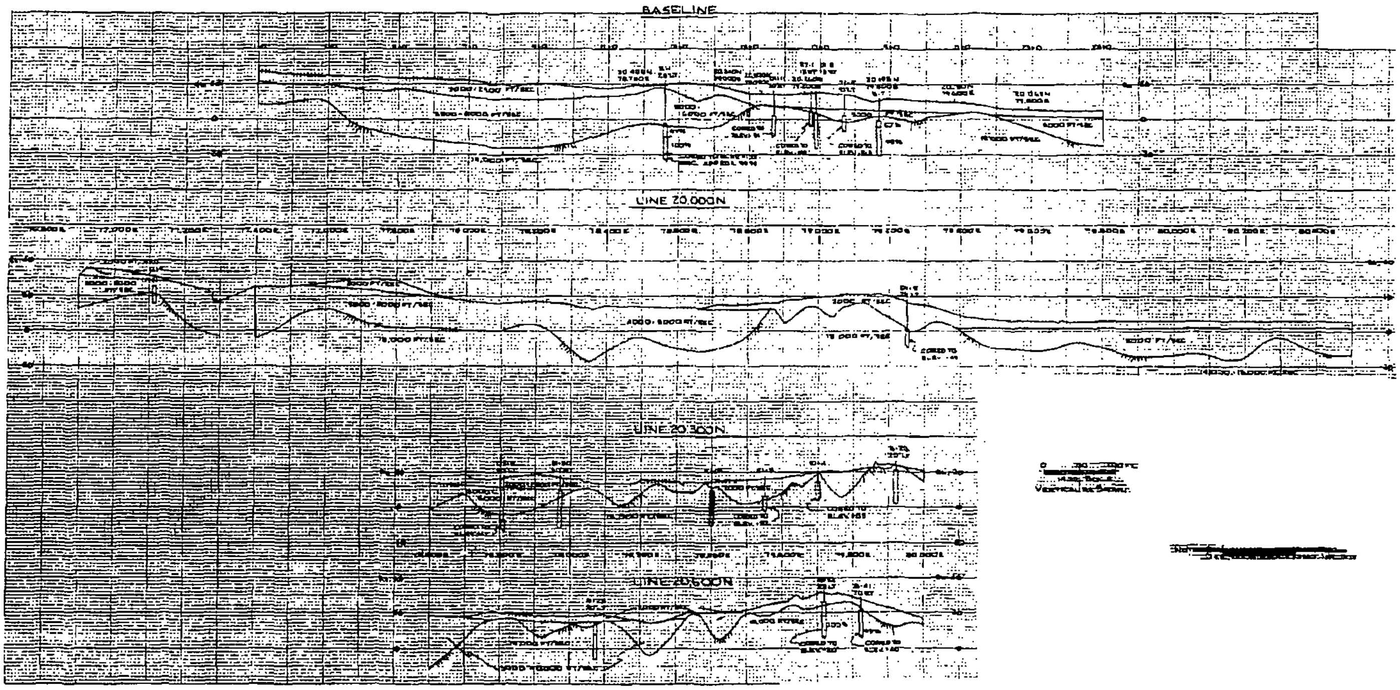
The contour maps show that much of the ocean bottom offshore consists of highly irregular bedrock outcrops. A denser material, possibly glacial till as indicated by the seismic refraction velocities, was found along the northern and western sides of the ledge outcrops. Refraction velocities in the 5,500 to 5,700 ft/sec range were found in this area, while away from the area, velocities generally ranged between 5,100 and 5,400 ft/sec. The seismic reflection data showed both glacial till and bedrock, although in some areas, reflections were only obtained from the till. In these latter cases, the refraction data provided the basis for the bedrock contours. Borings P-2 through P-10 conformed to the general picture shown by the seismic data.

SECTION **2E.1**

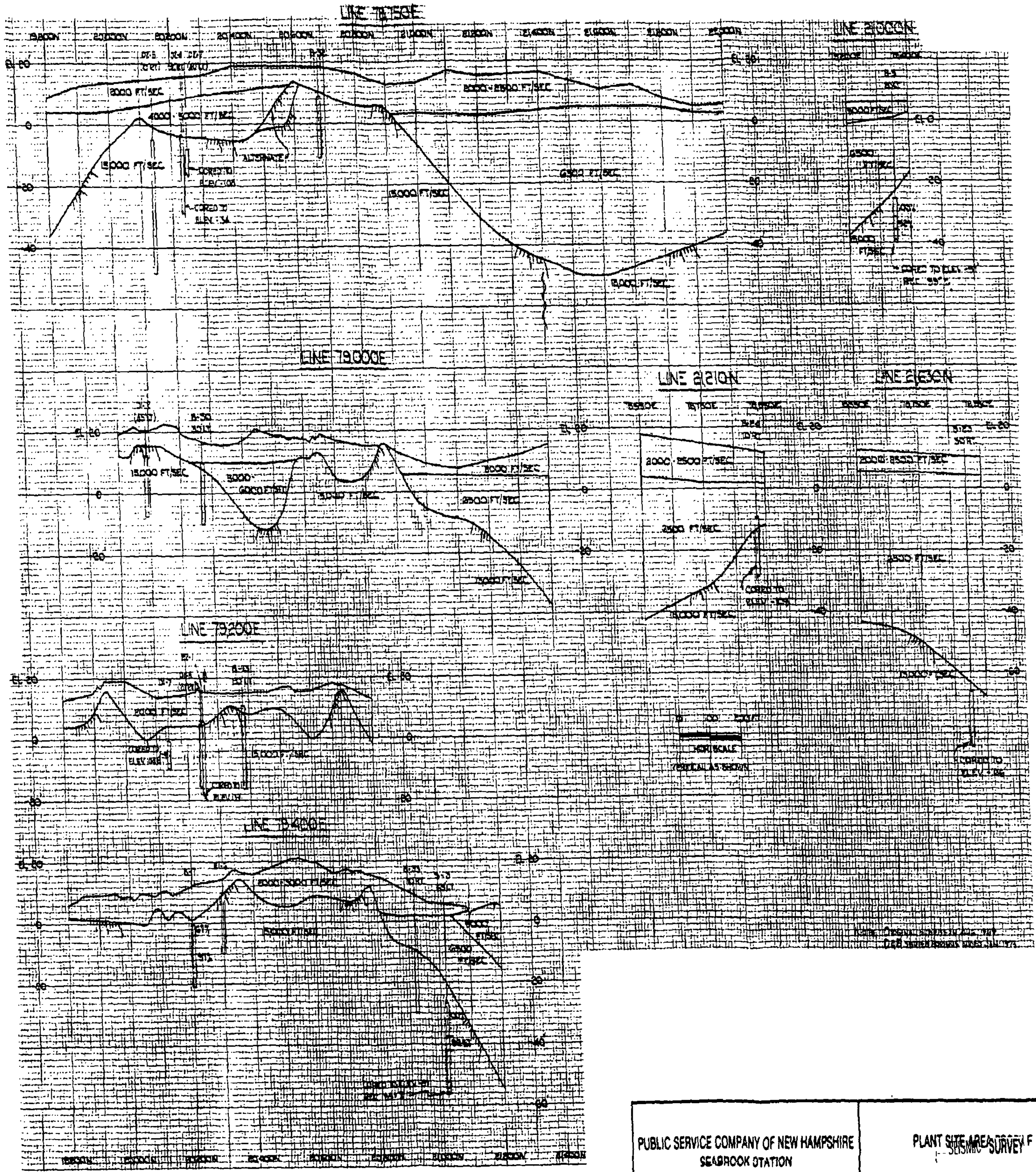
PLANT SITE AREA FIGURES



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	PLANT SITE AREA PLAN MAP SEISMIC SURVEY
	FIG. 2E-1 SB 1 & 2



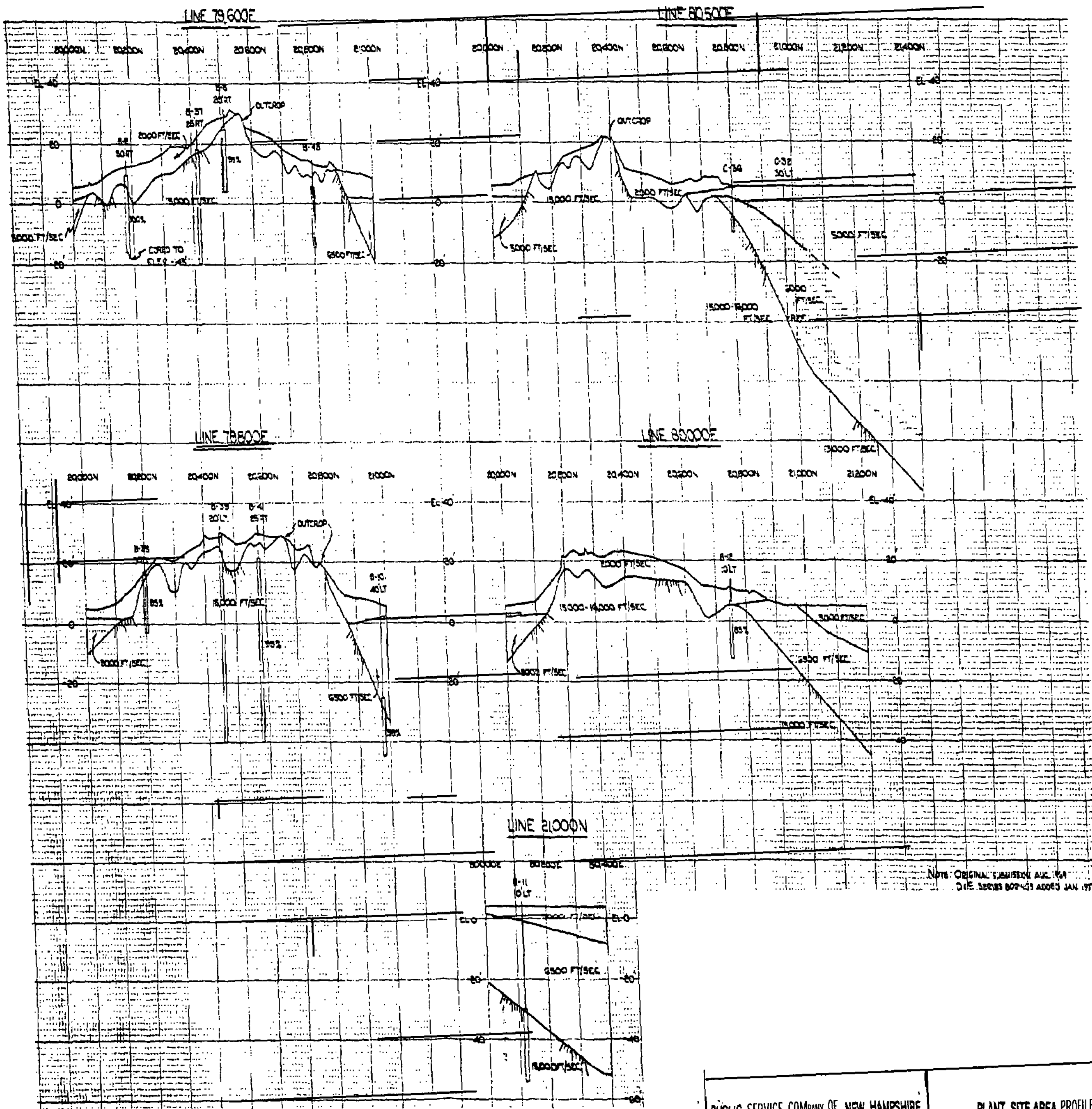
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	PLANT SITE AREA PROFILE SEISMIC SURVEY
	FIG. 2E-2 SH.1 SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

PLANT SITE AREA SEISMIC SURVEY

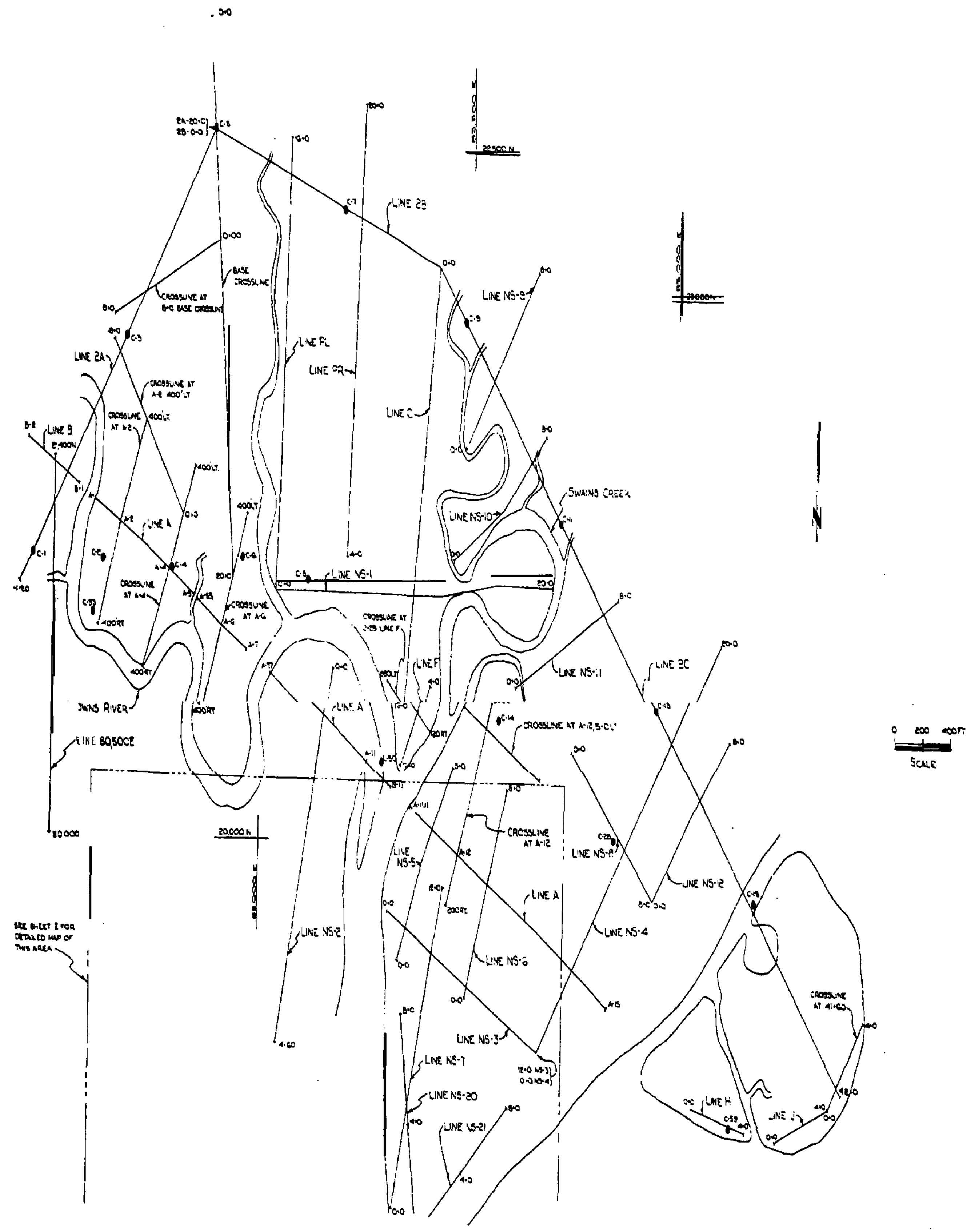
FIG. 2E-2 SH.2 SF162



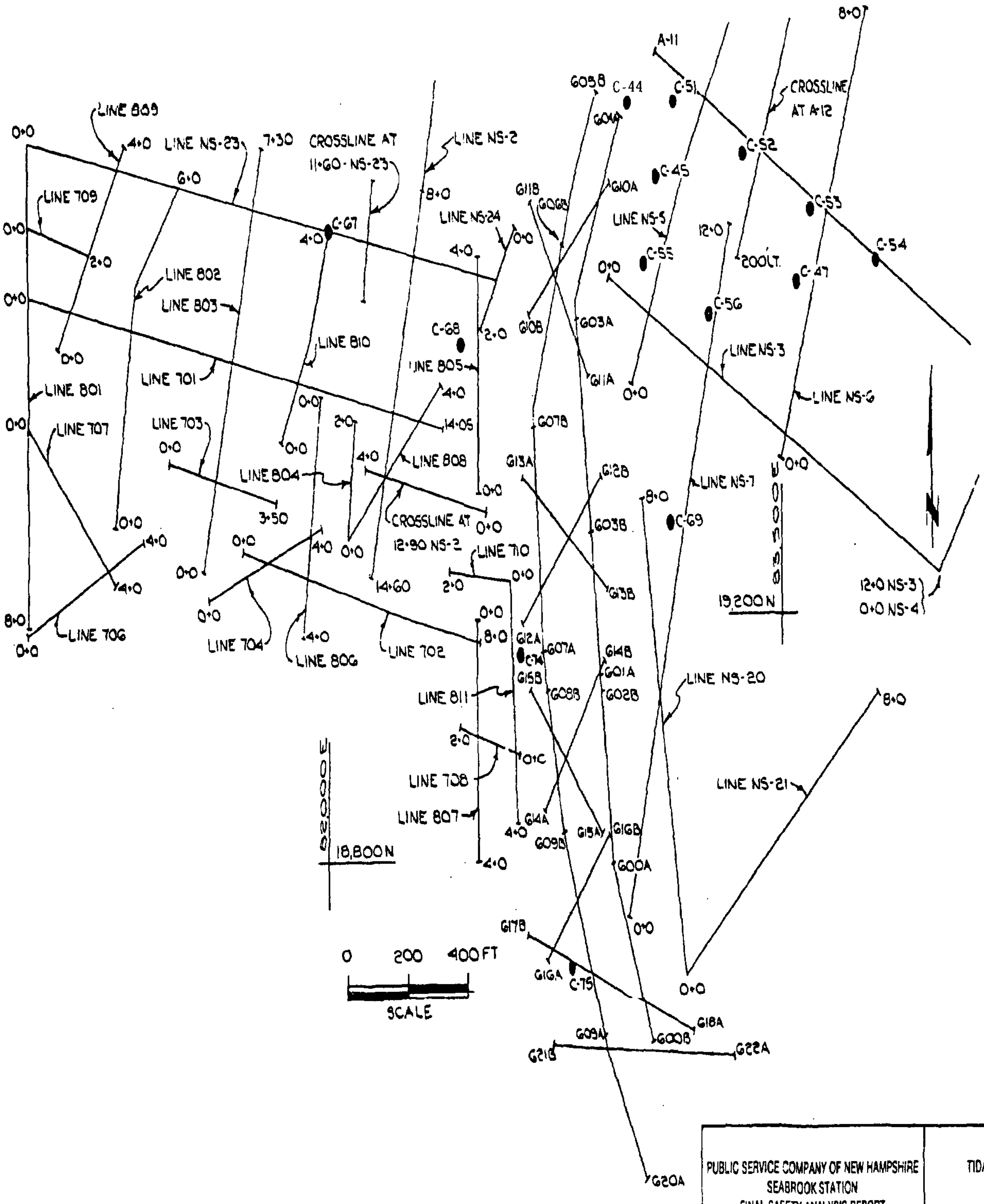
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

PLANT SITE AREA PROFILE
SEISMIC SURVEY

FIG. 2E-2	SH.3	SB 1 & 2



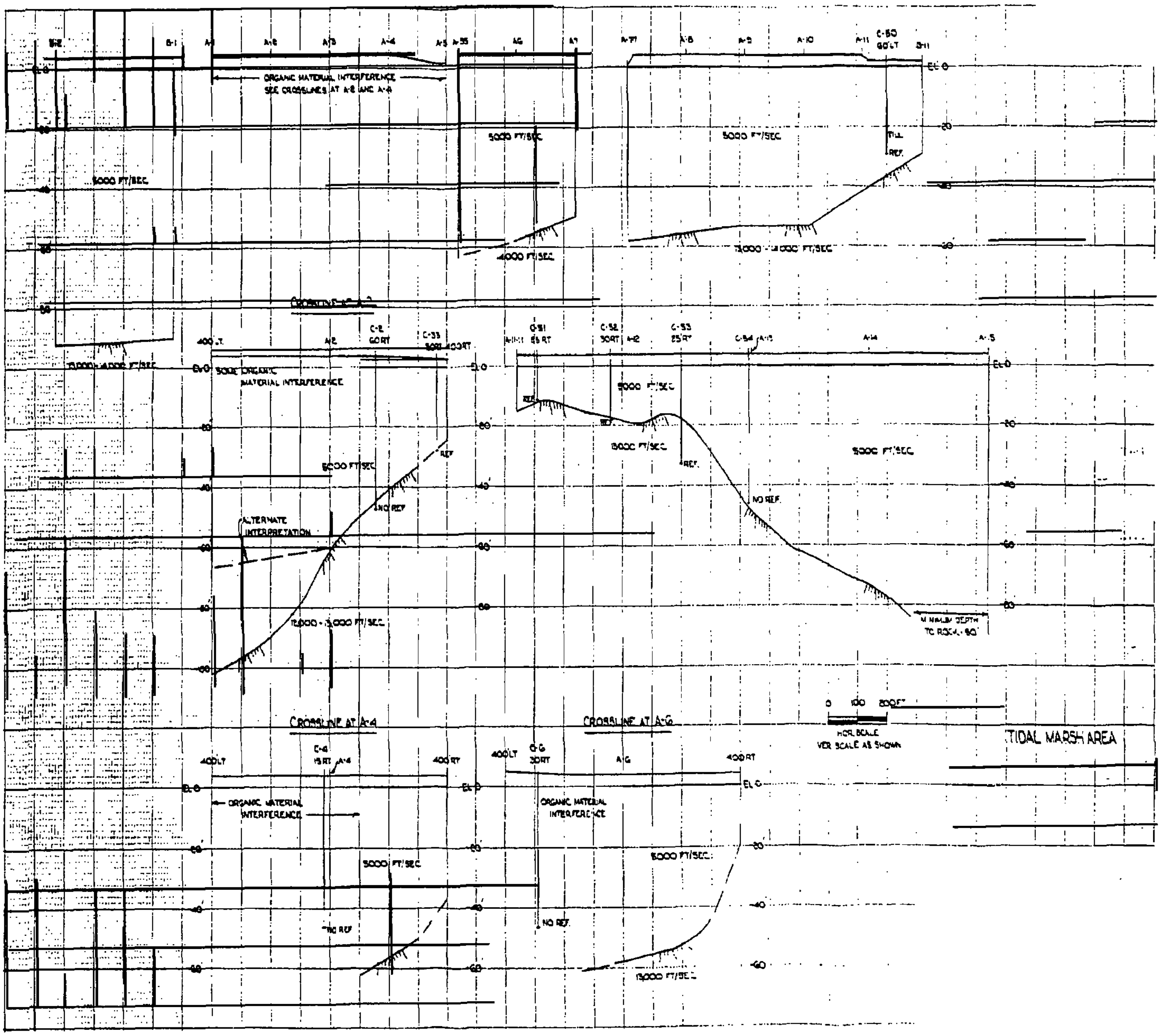
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE **SEABROOK** STATION FINAL SAFETY ANALYSIS **REPORT**	**TIDAL** MARSH AREA PLAN MAP SEISMIC SURVEY
	FIG. 2E-3 SH.1 SB 1 & 2



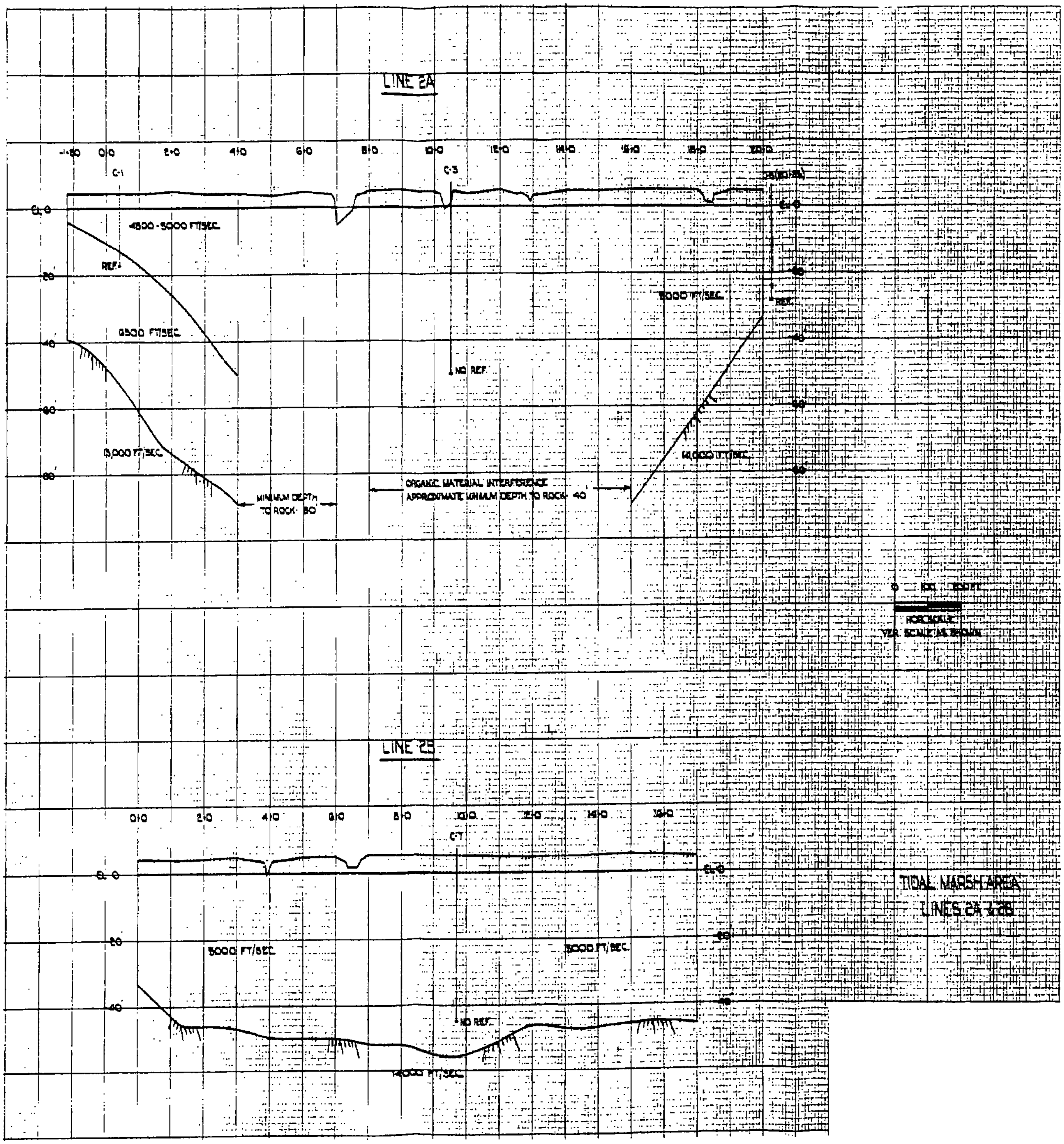
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

TIDAL MARSH AREA PLAN MAP
SEISMIC SURVEY

FIG. 2E-3 SH.2 SB 1 & 2



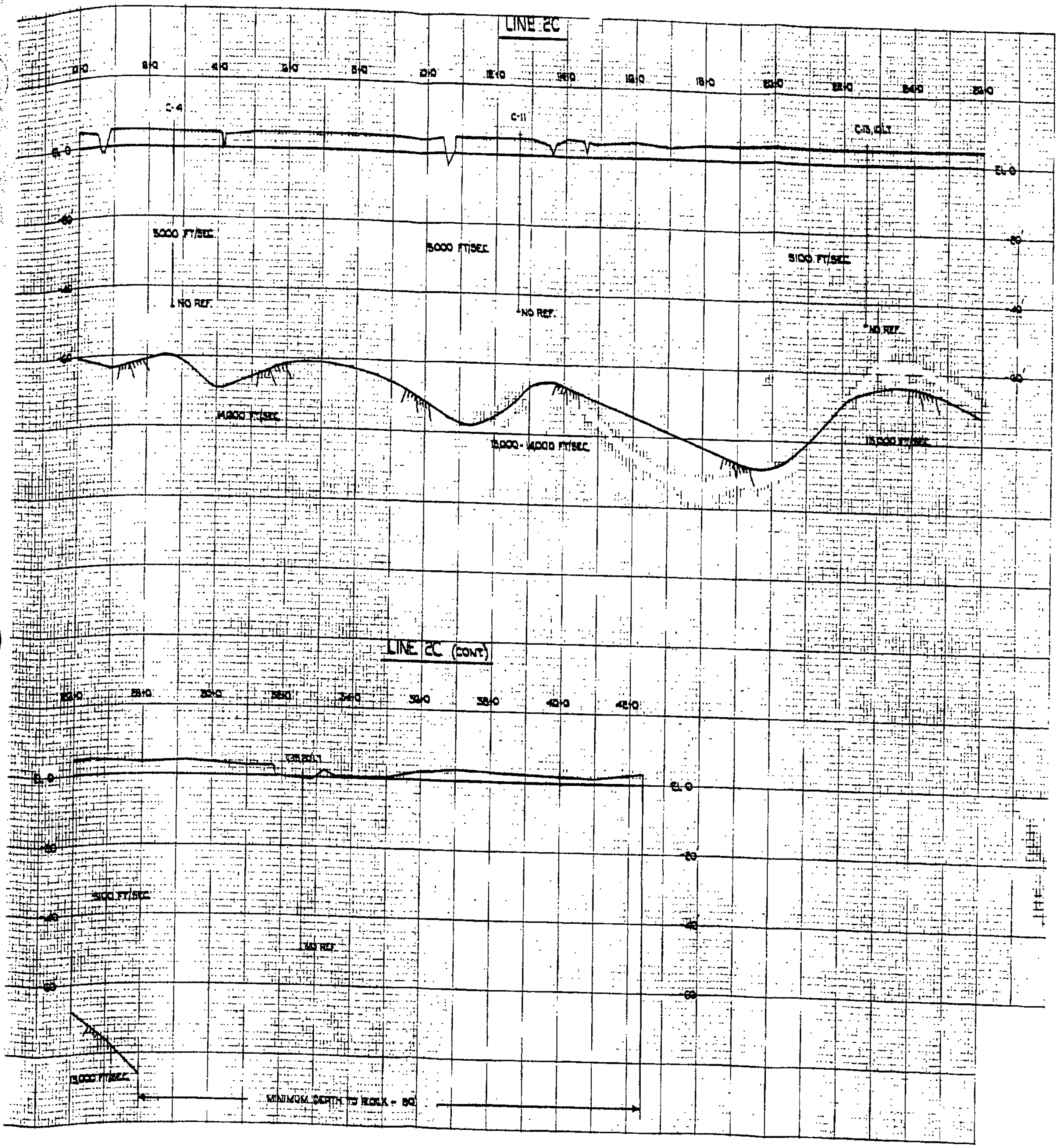
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	TIDAL MARSH AREA PROFILE SEISMIC SURVEY	
	FIG. 2E-4	SH 1
		SB 1 & 2

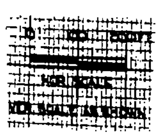


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

TIDAL MARSH AREA PROFILE
SEISMIC SURVEY

FIG. 2E-4	SH.2	SB 1 & 2

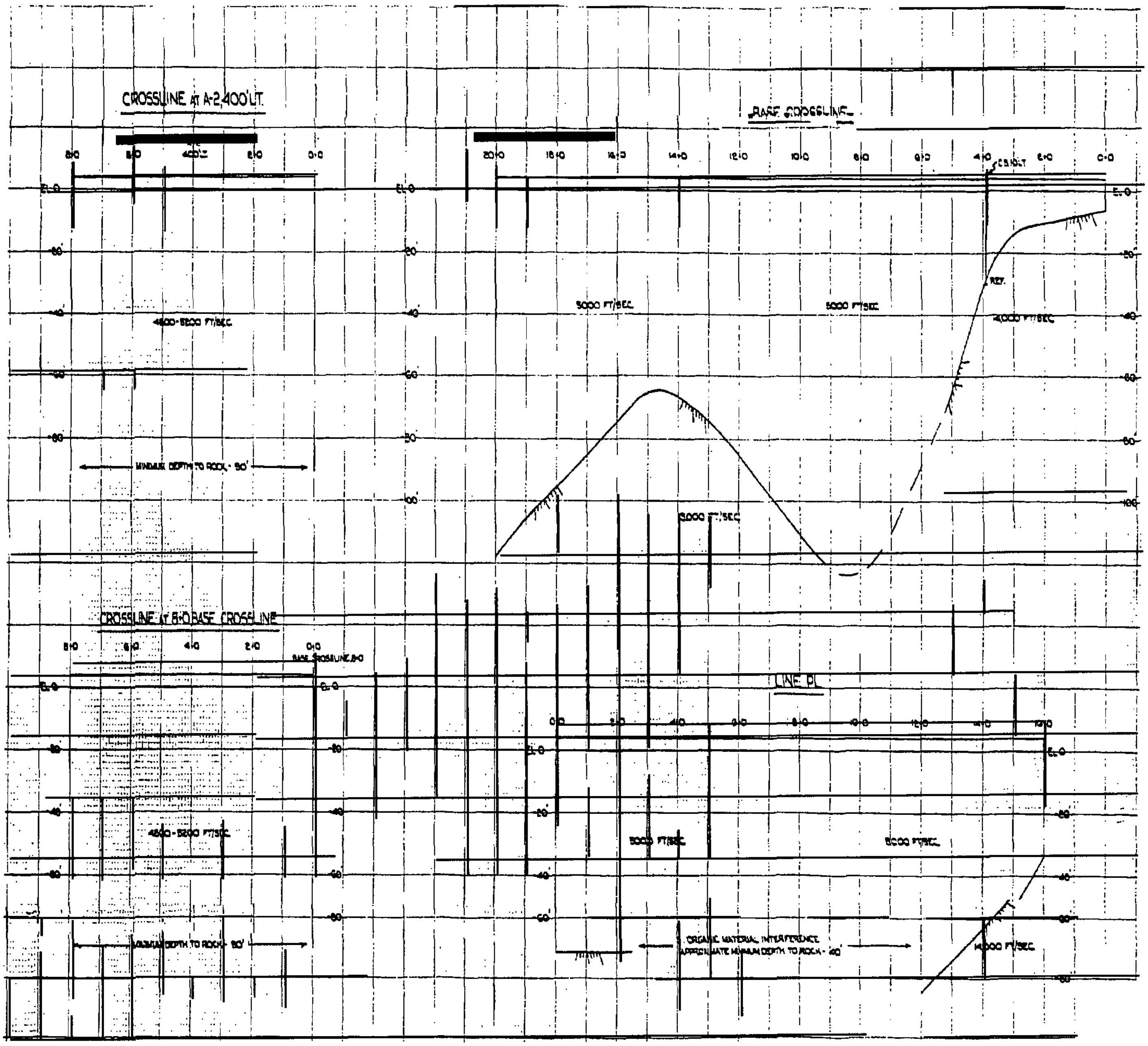


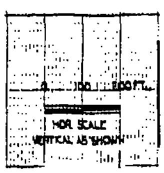


PUBLIC SERVICE COMPANY OF NEW HAMPS
SEABROOK STATION
FINAL SAFETY

PROFILE
SEISMIC SURVEY

FIG. 2E-4	SH.3	SB 1 & 2

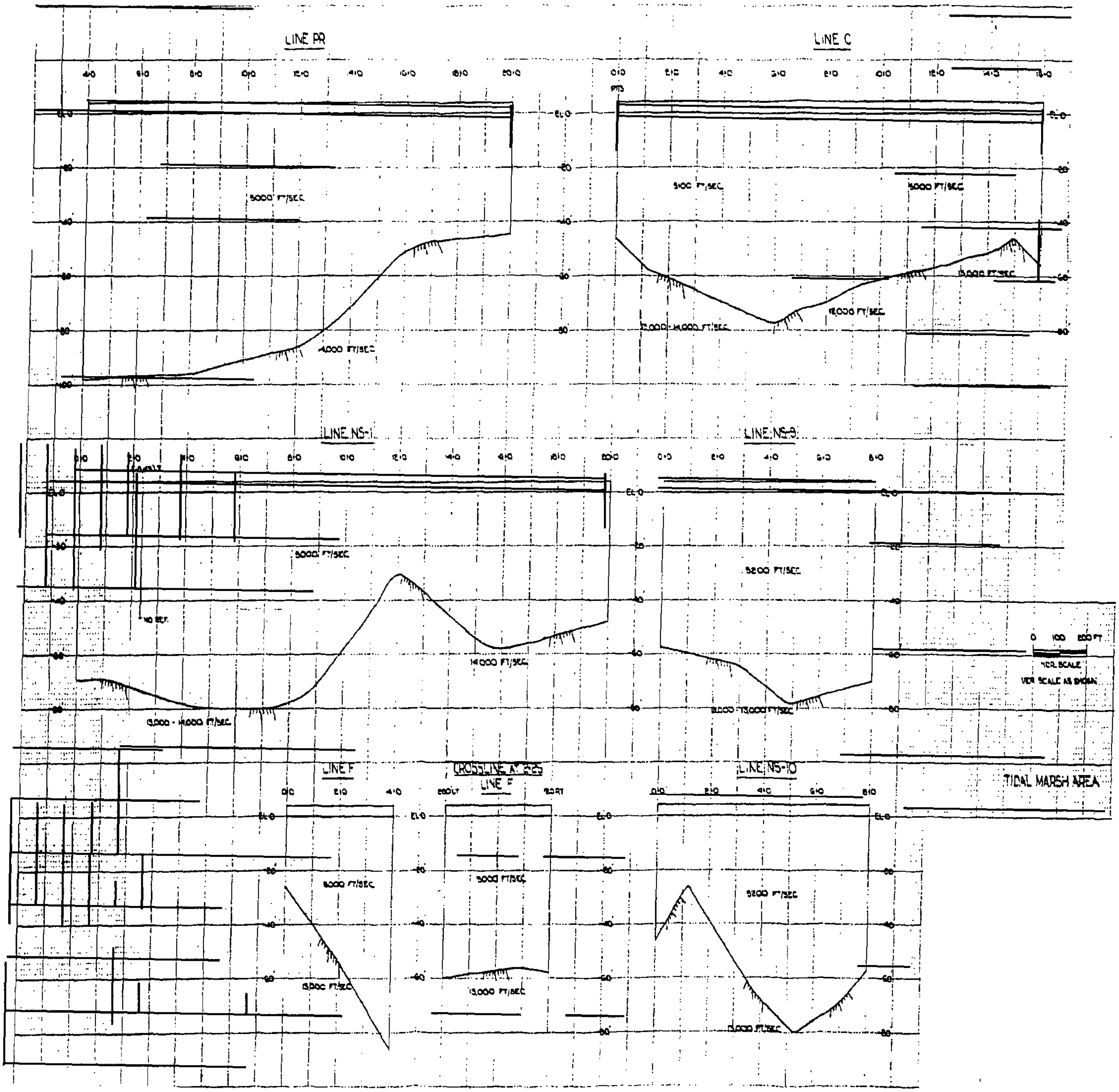




PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

TIDAL MARSH AREA PROFILE
SEISMIC SURVEY

FIG. 2E-4 | SH.4 | SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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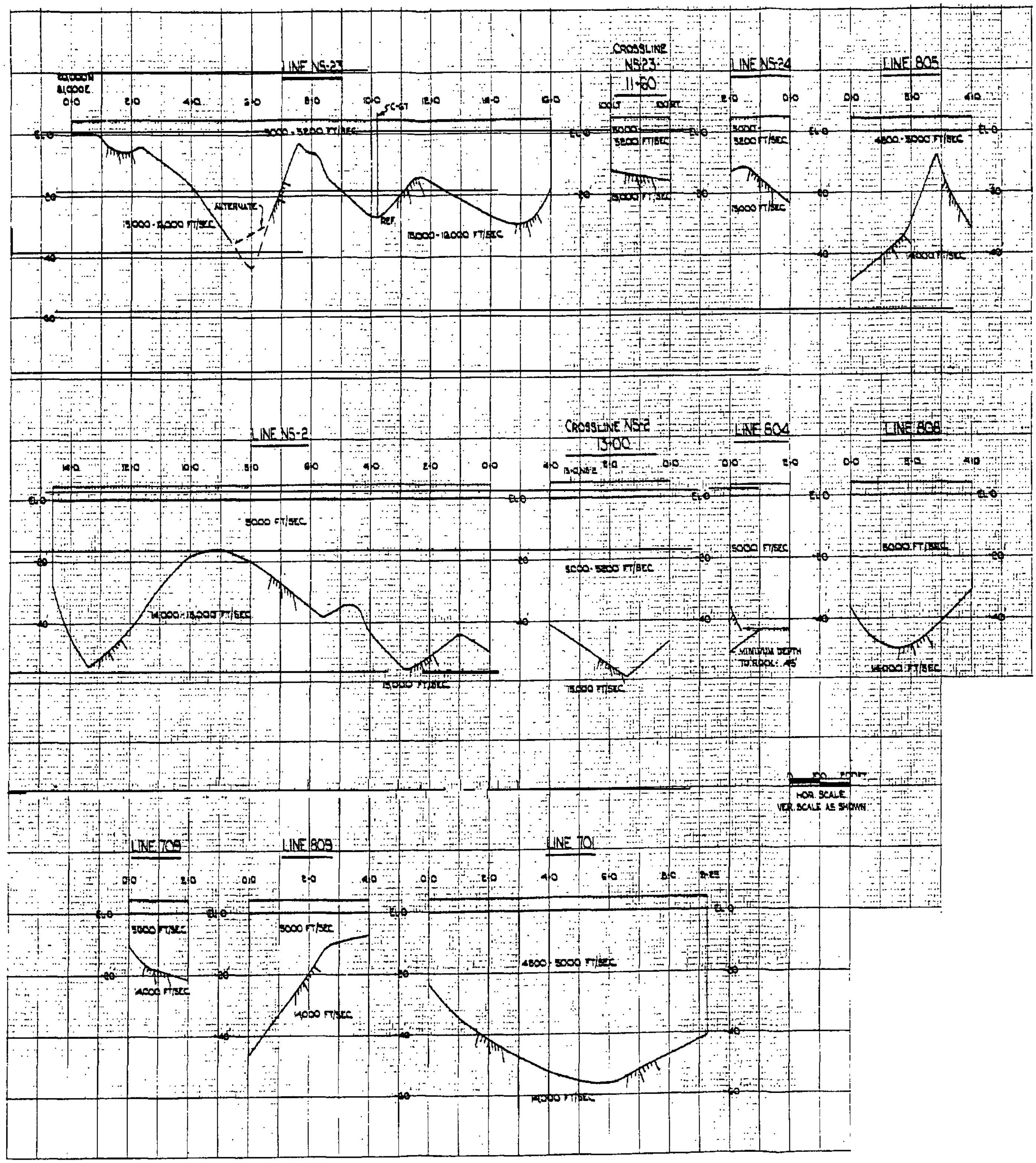
FINAL SAFETY ANALYSIS REPORT

TIDAL MARSH AREA PROFILE
SEISMIC SURVEY

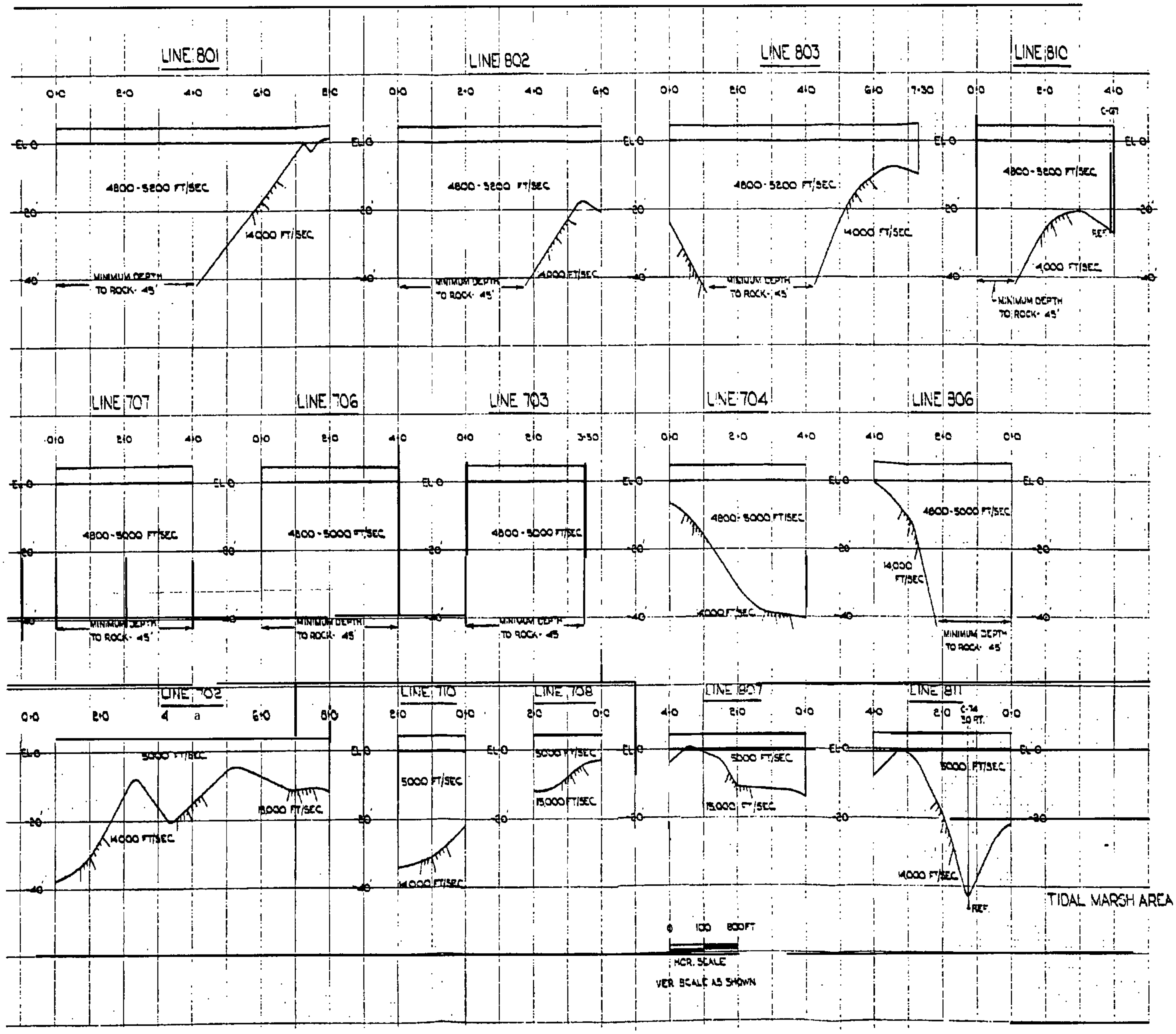
FIG 2E-4 | SH. 5 | SB 1 & 2



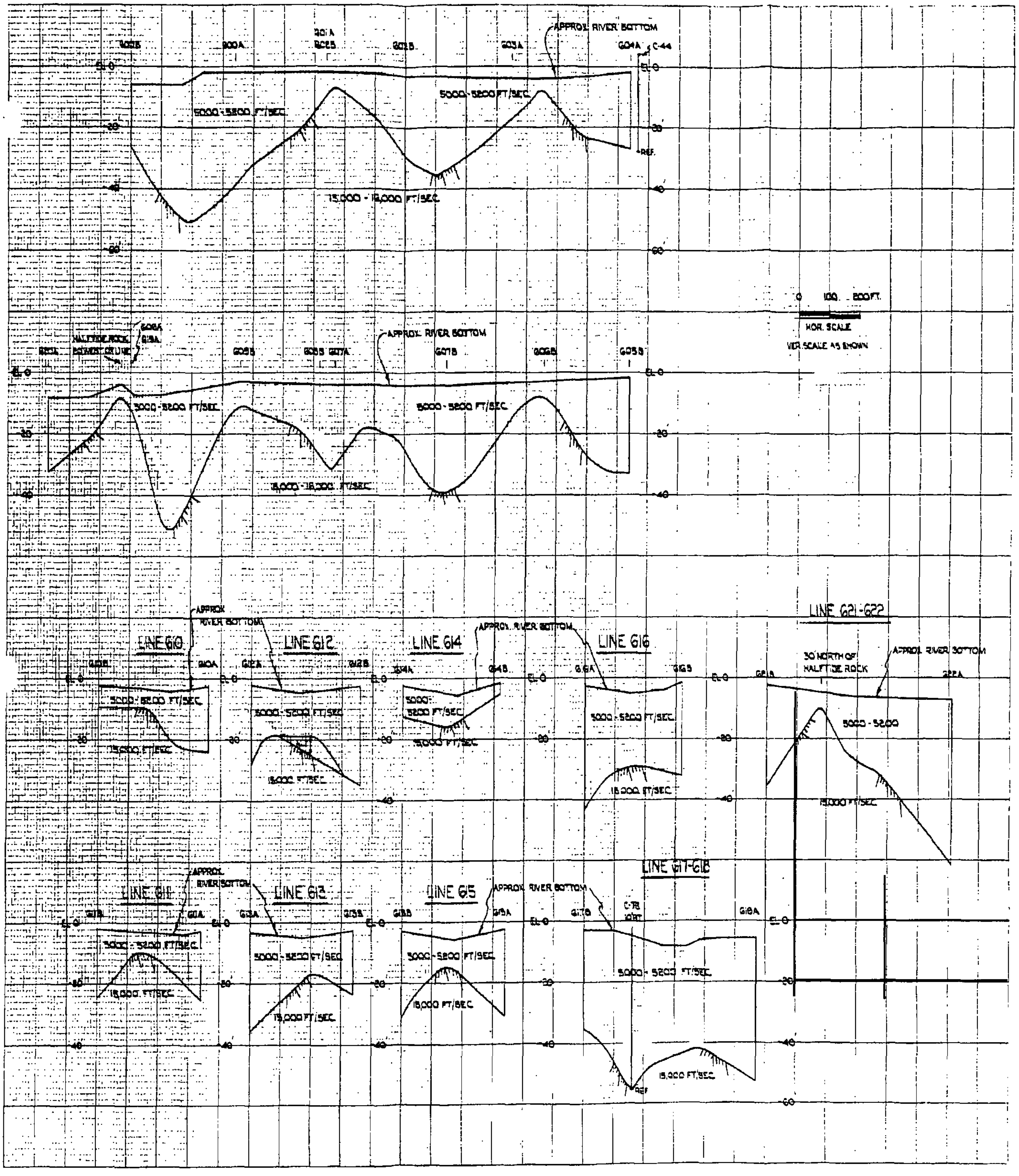
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

TIDAL MARSH AREA PROFILE
SEISMIC SURVEY

FIG. 2E-4 SH.6 | SB 1 & 2



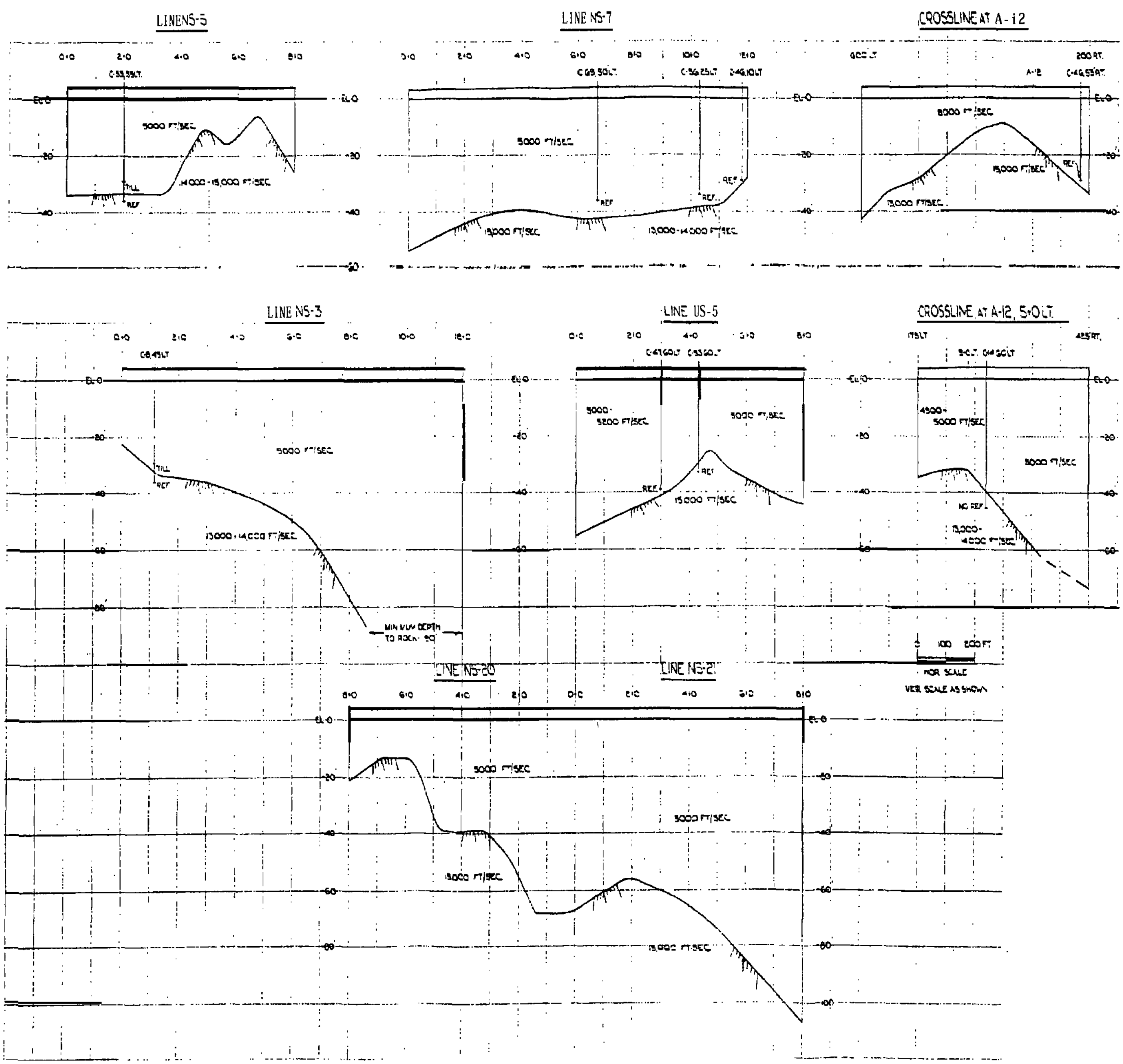
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	TIDAL MARSH AREA PROFILE SEISMIC SURVEY
	FIG. 2E-4 SH 7 SB 1 & 2



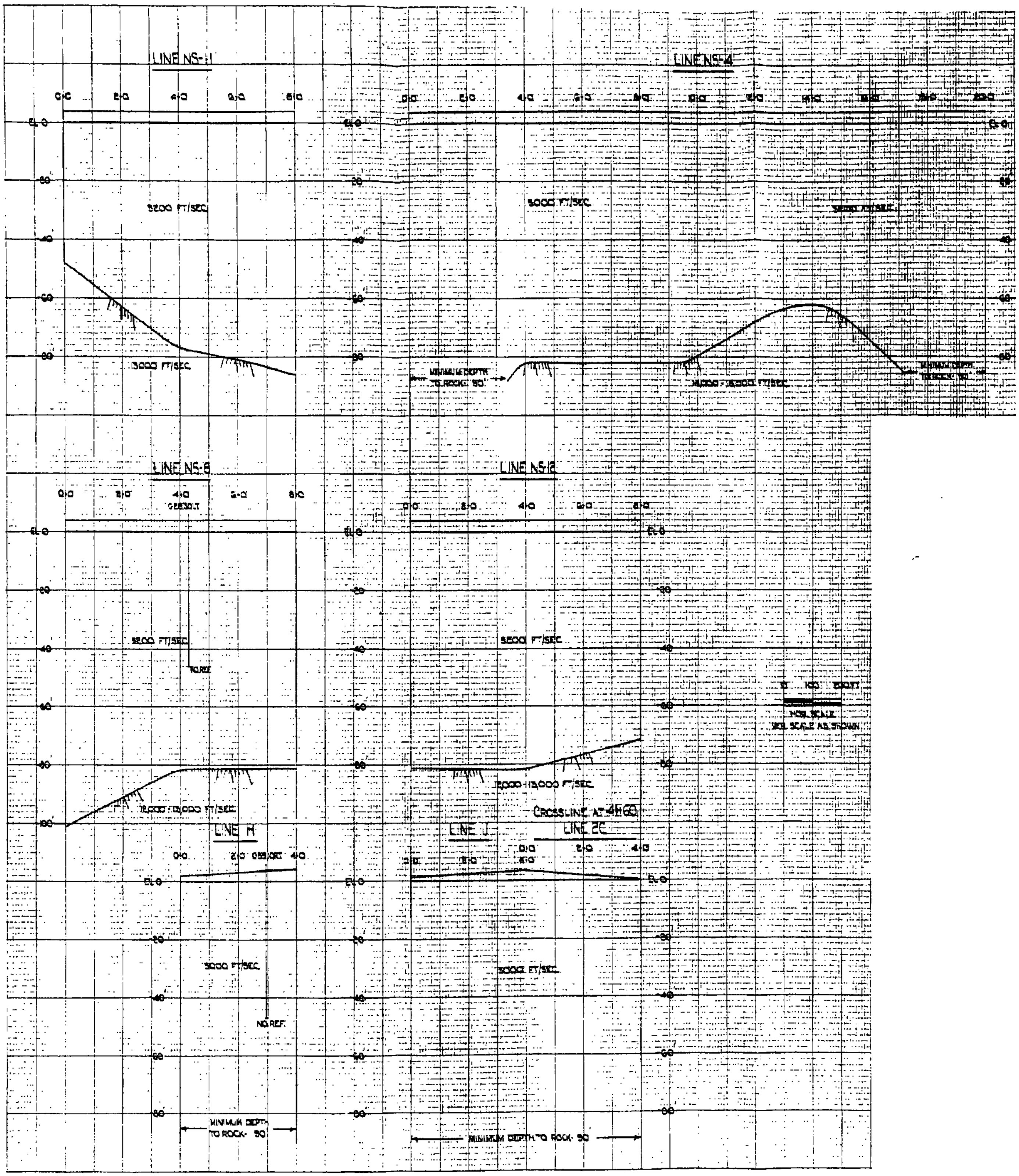
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

TIDAL MARSH AREA PROFILE
SEISMIC SURVEY

FIG. 2E-4 SH.8 SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	TIDAL MARSH AREA PROFILE SEISMIC SURVEY		
	FIG. 2E-4	SH.9	SB 1 & 2



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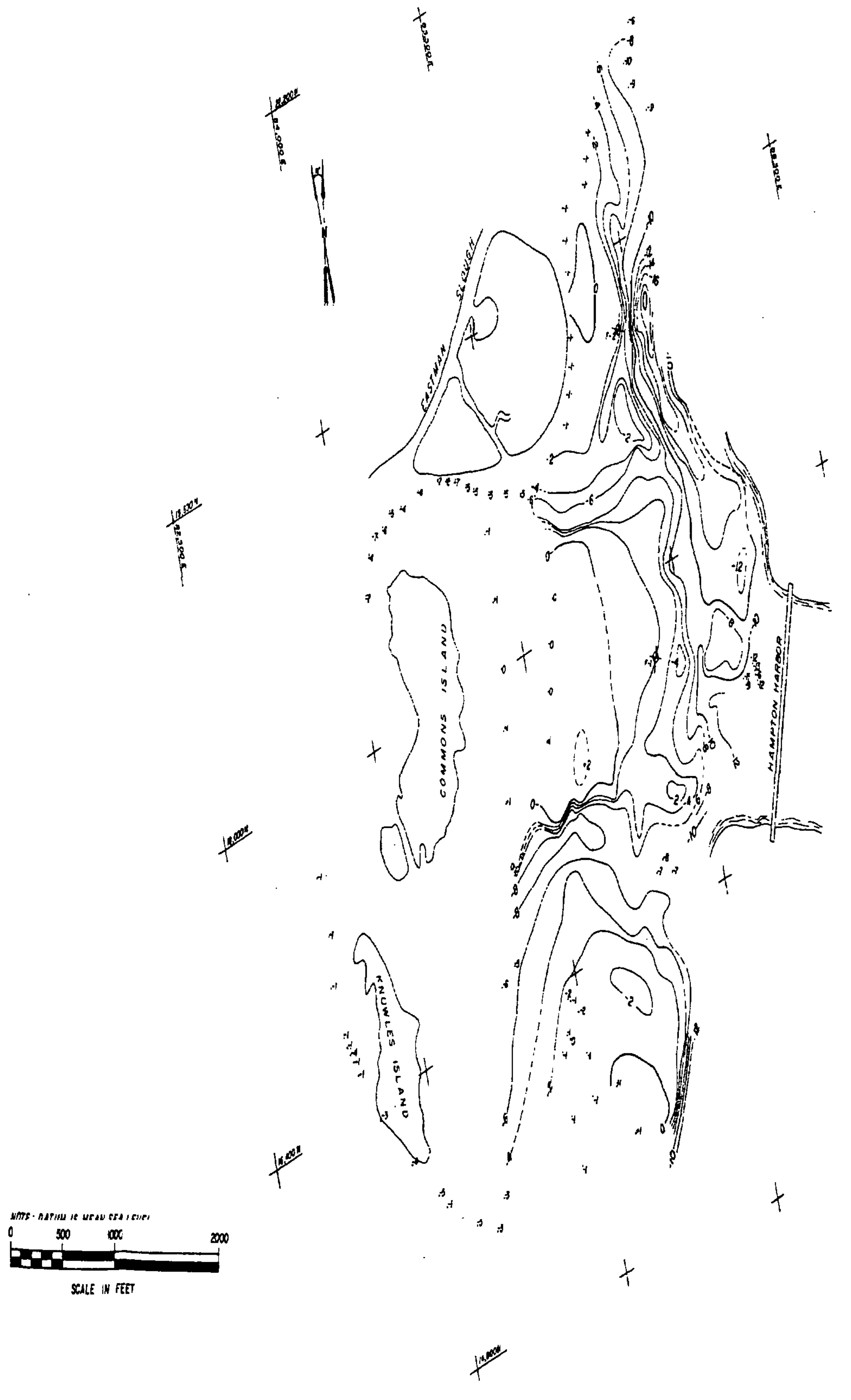
FINAL SAFETY ANALYSIS REPORT

TIDAL MARSH AREA PROFILE
SEISMIC SURVEY

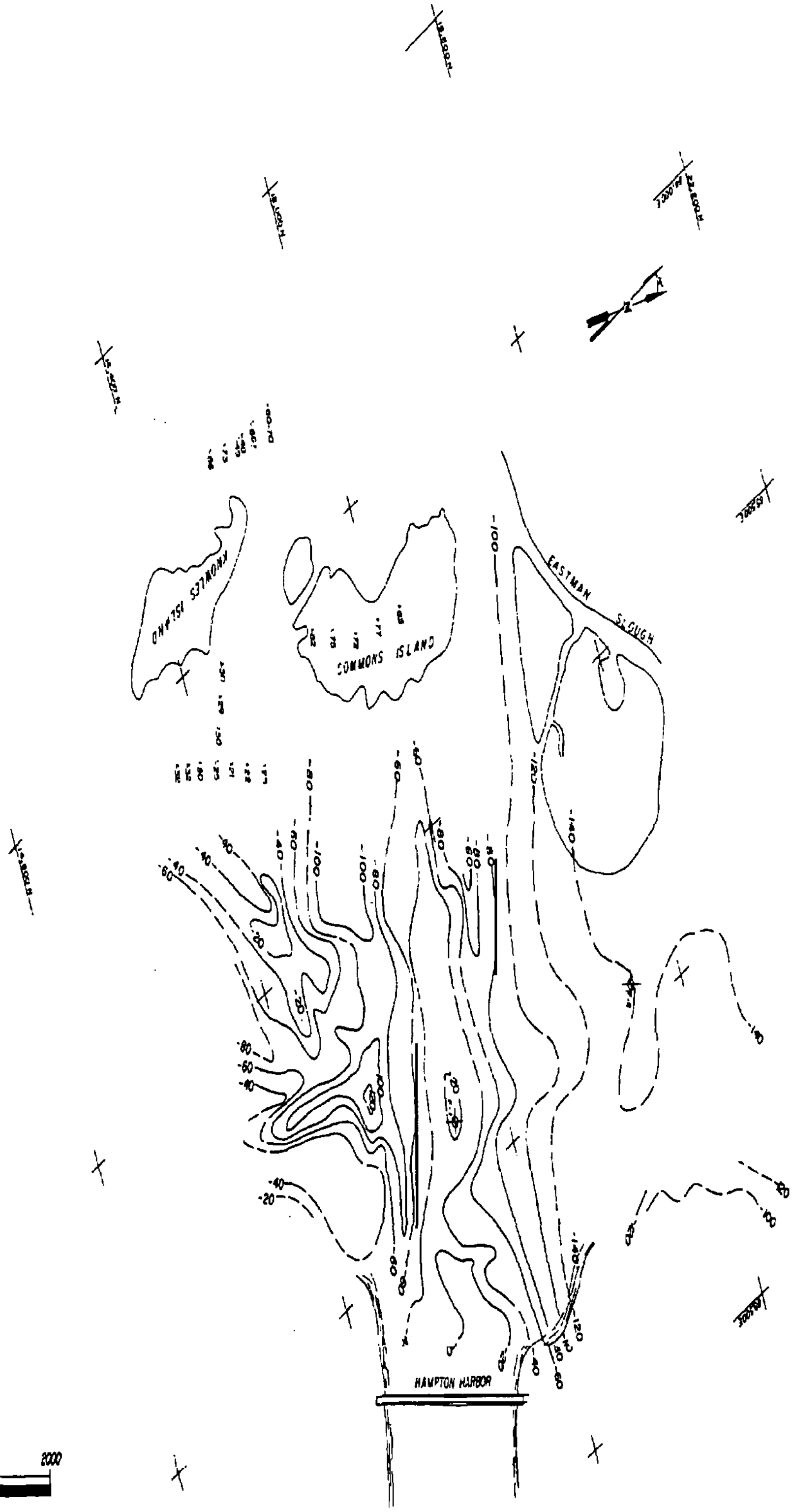
FIG. 2E-4 | **SH.10** | **SB 1 & 2**



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

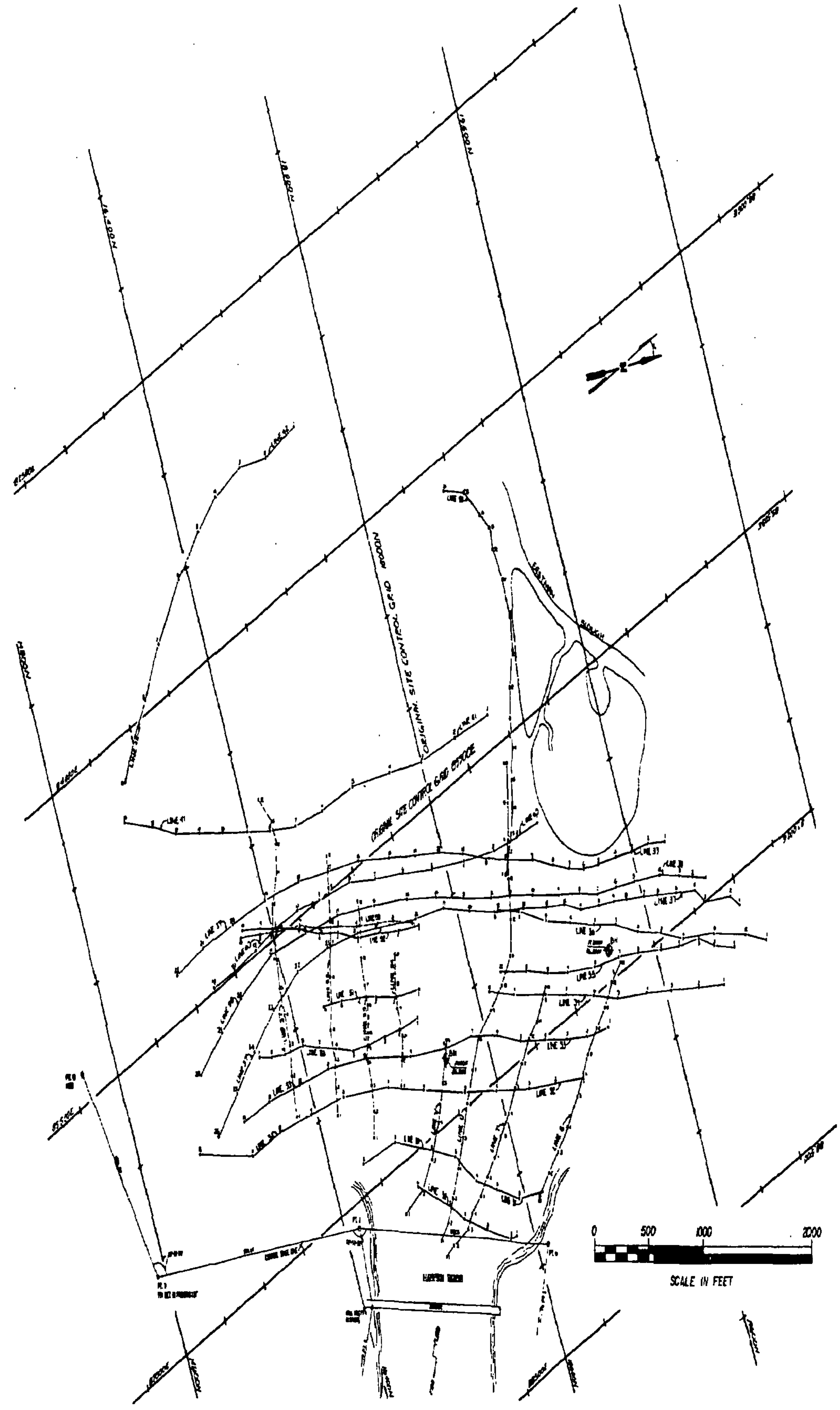
HAMPTON HARBOR AREA
BOTTOM CONTOUR MAP
SEISMIC SURVEY

FIG. 2E-5	SB 1 & 2

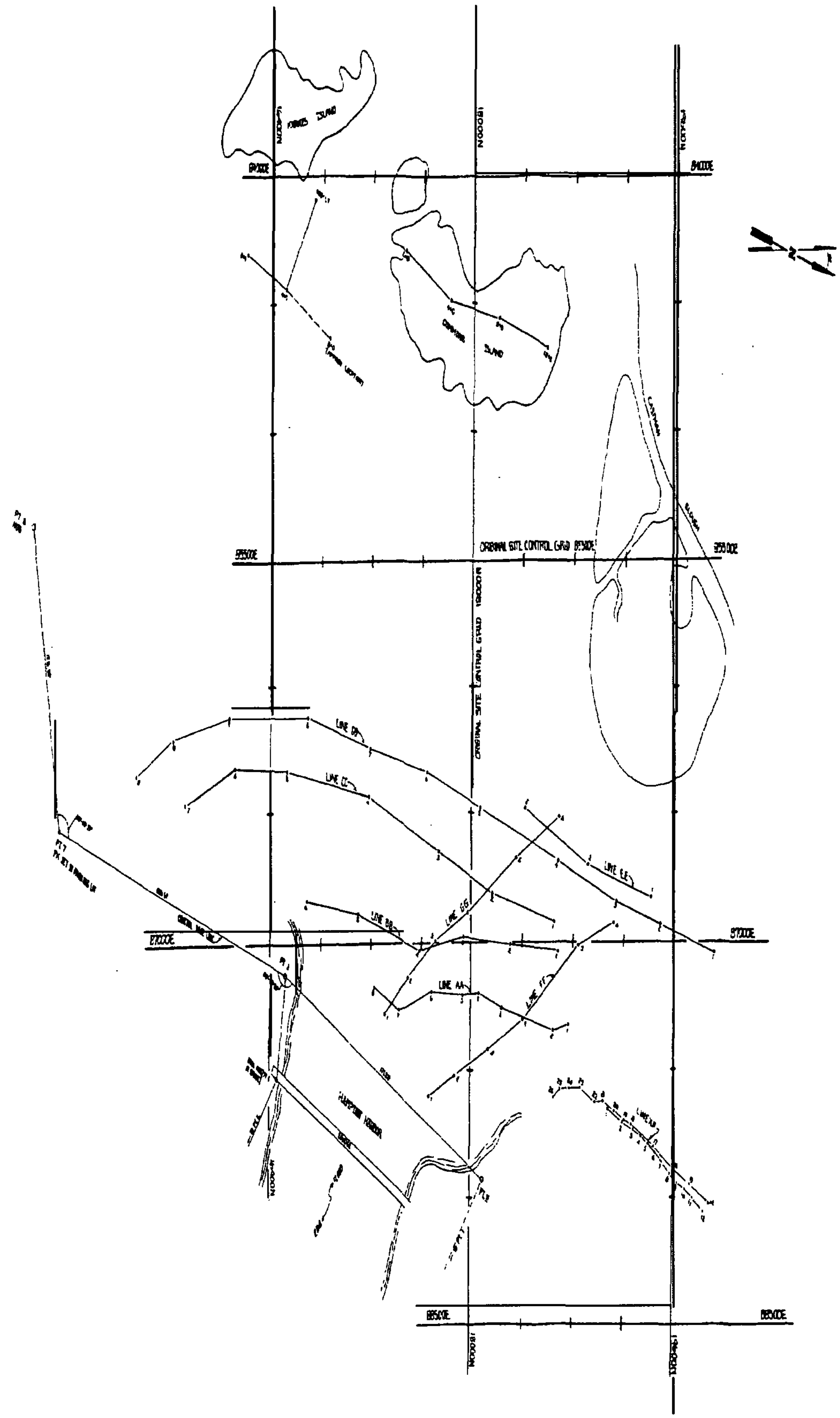


NOTE: DATUM IS MEAN SEA LEVEL.

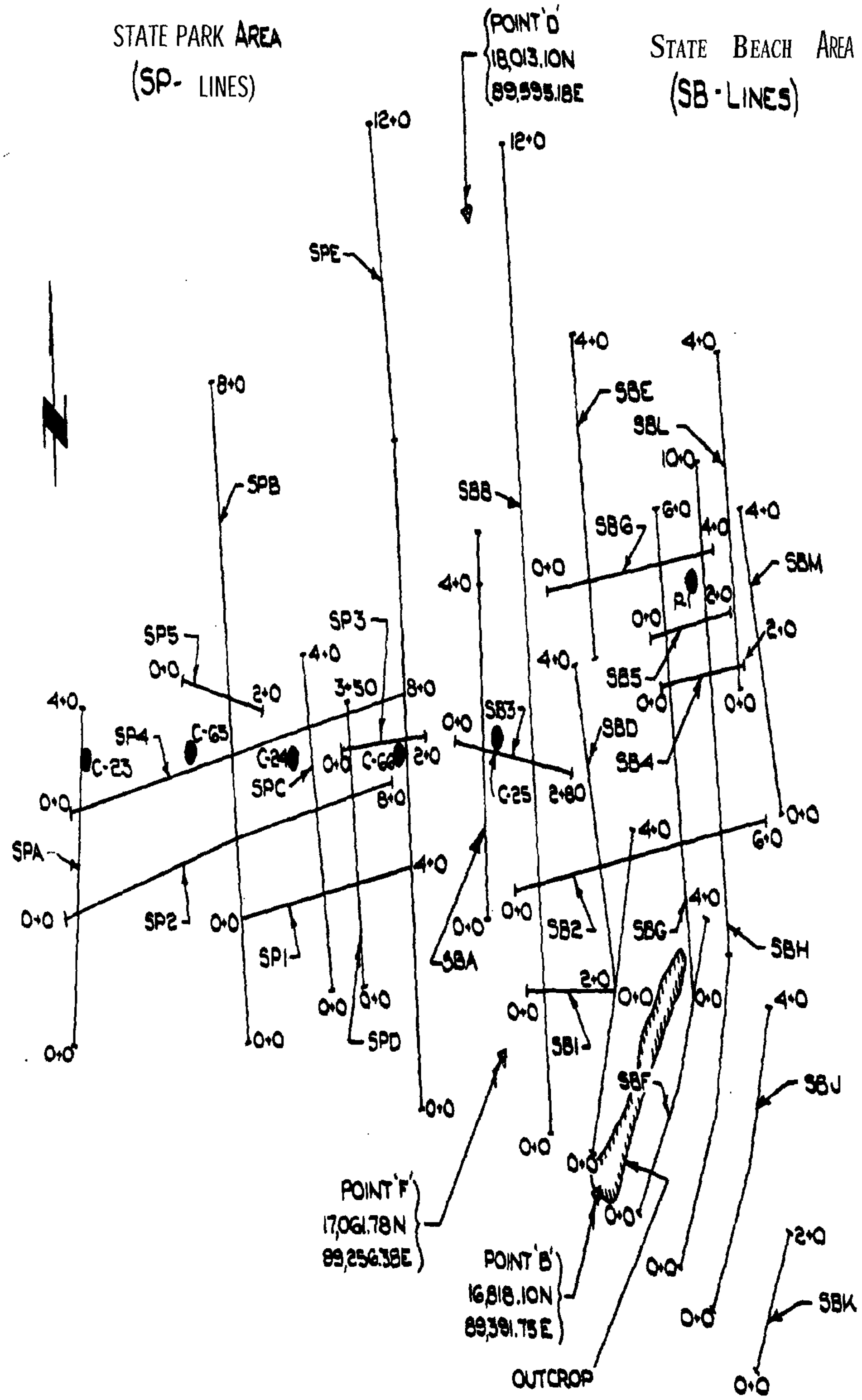
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE **SEABROOK** STATION FINAL SAFETY ANALYSIS REPORT	**HAMPTON HARBOR AREA BEDROCK CONTOUR MAP SEISMIC SURVEY**
	FIG. 2E-6 | SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	HAMPTON HARBOR AREA TRACK MAP - REFLECTION SEISMIC SURVEY	
	FIG. 2E-7	SB 1 & 2



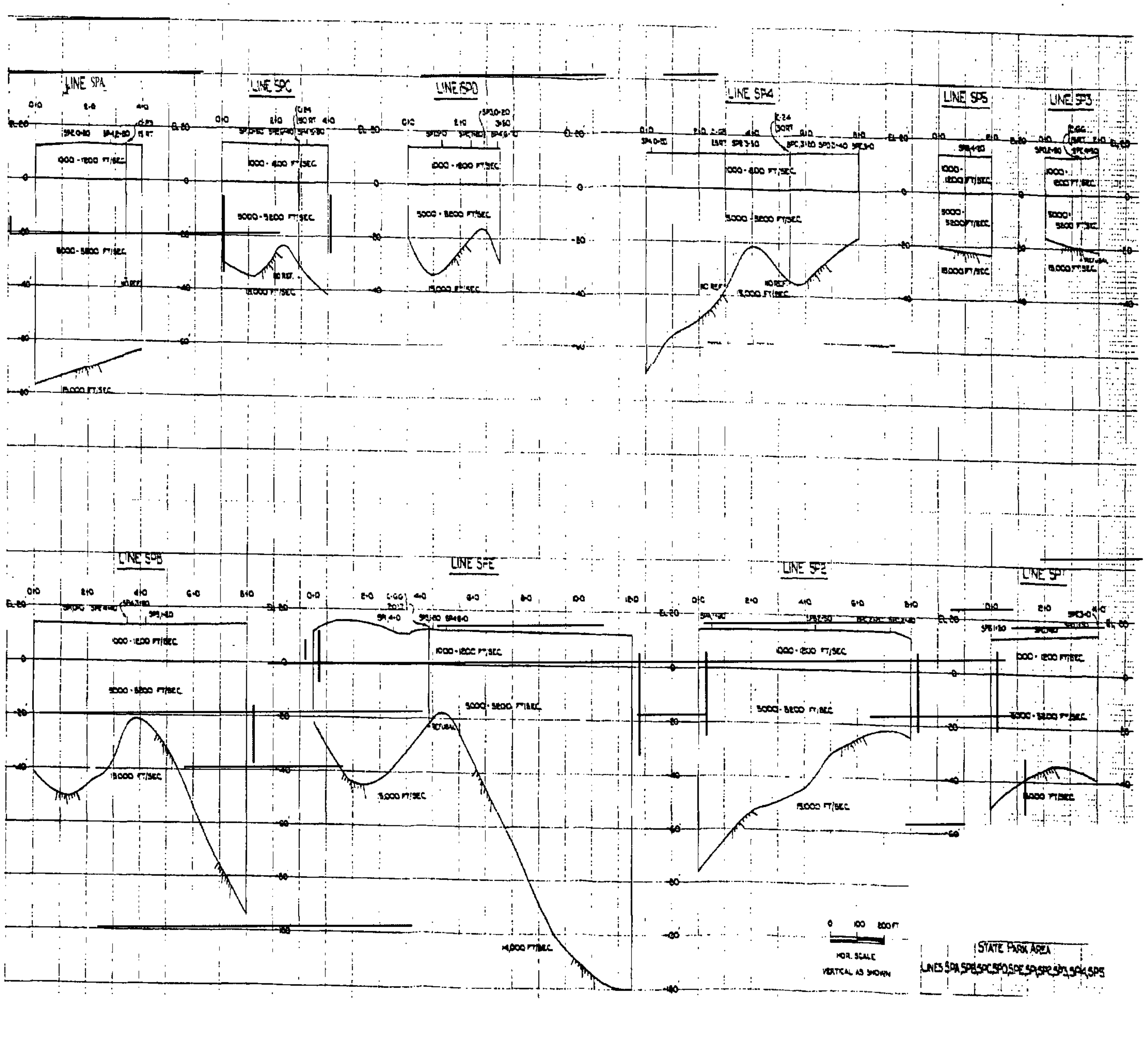
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	HAMPTON HARBOR AREA TRACK MAP - REFRACTION SEISMIC SURVEY
	FIG. 2E-8 | SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

STATE PARK
STATE BEACH AREA PLAN MAP
SEISMIC SURVEY

FIG. 2E-9 | SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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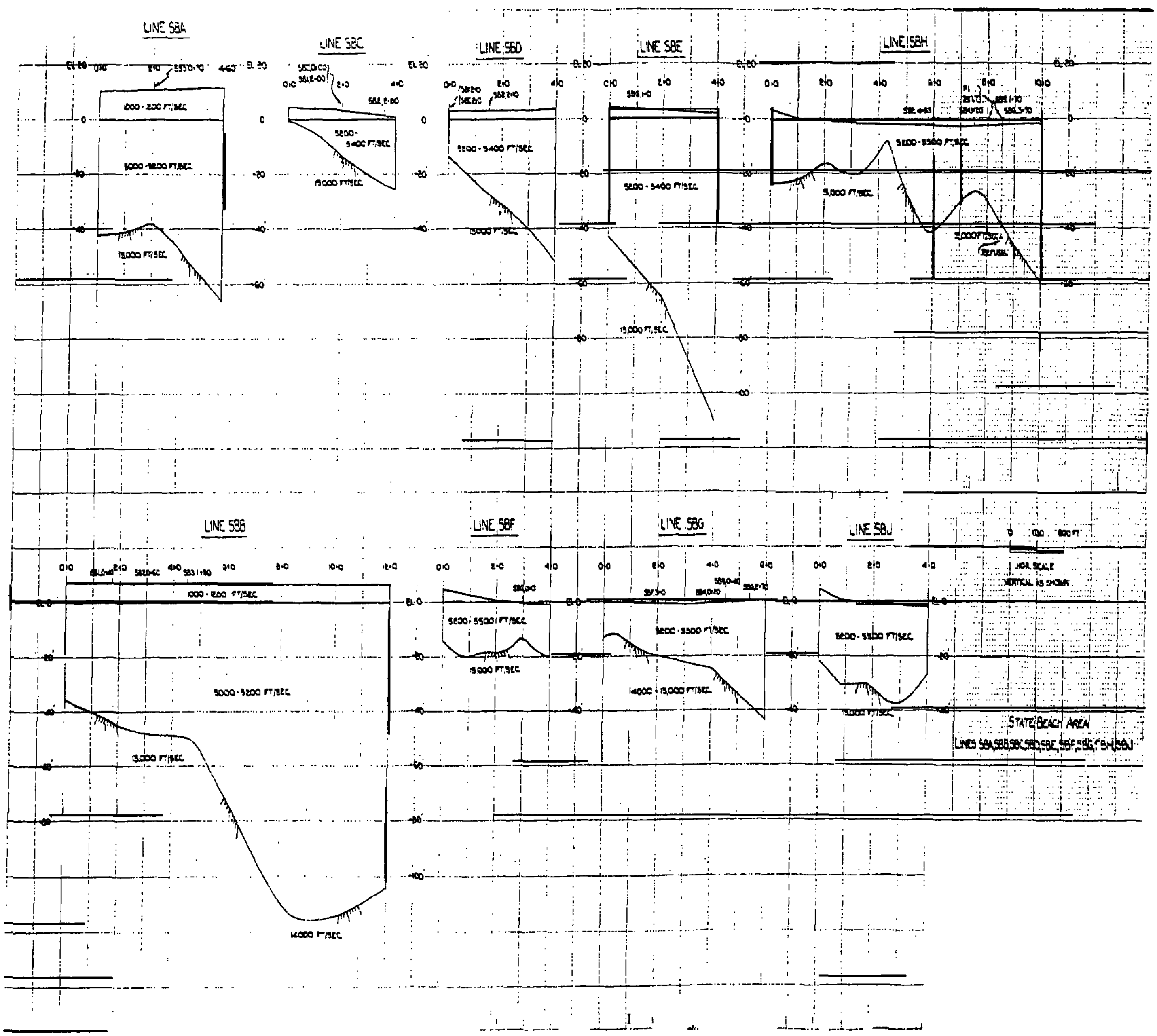
FINAL SAFETY ANALYSIS REPORT

STATE PARK
STATE BEACH AREA PROFILE
SEISMIC SURVEY

FIG. 2E-10 SH.1 SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
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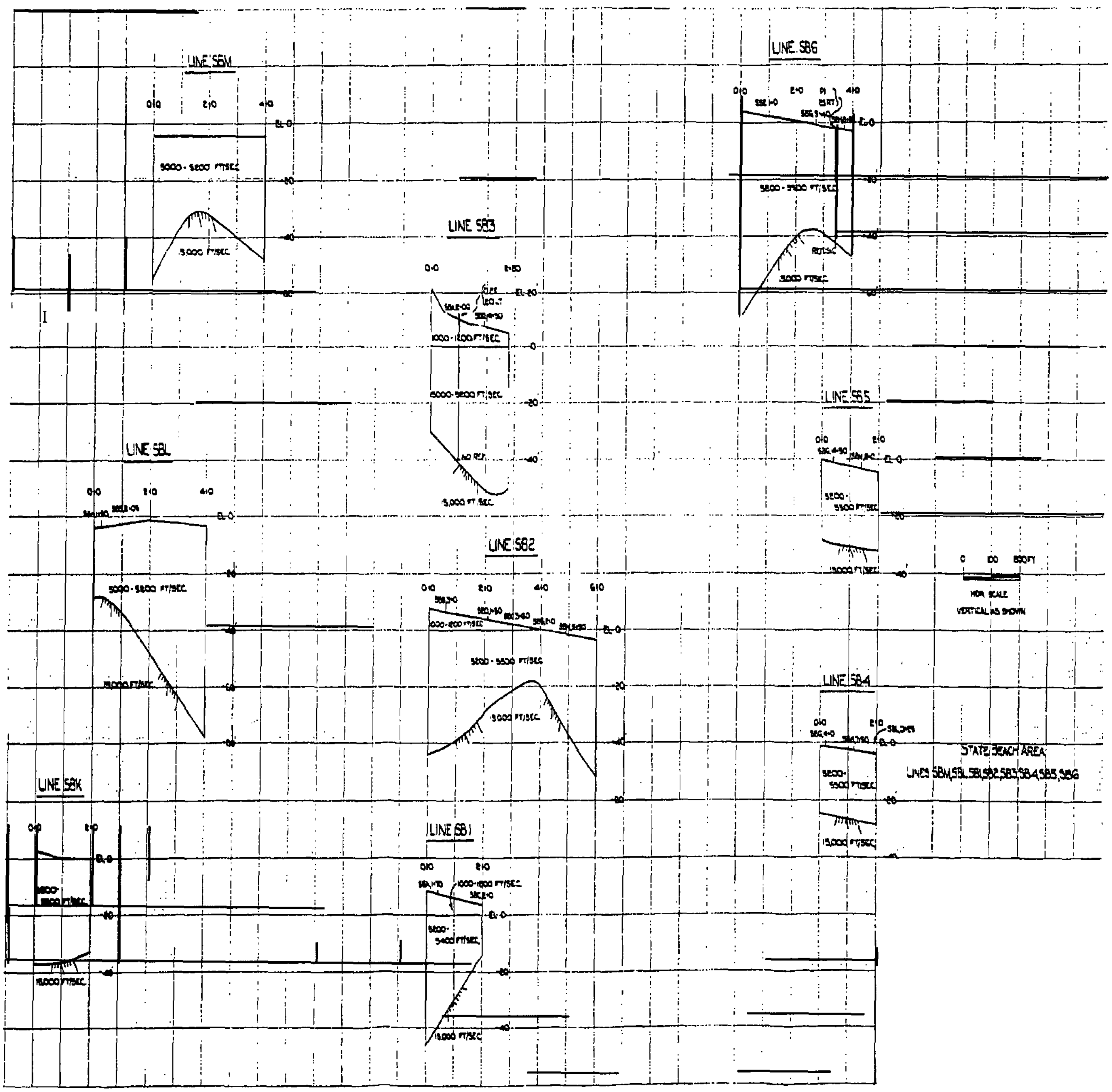
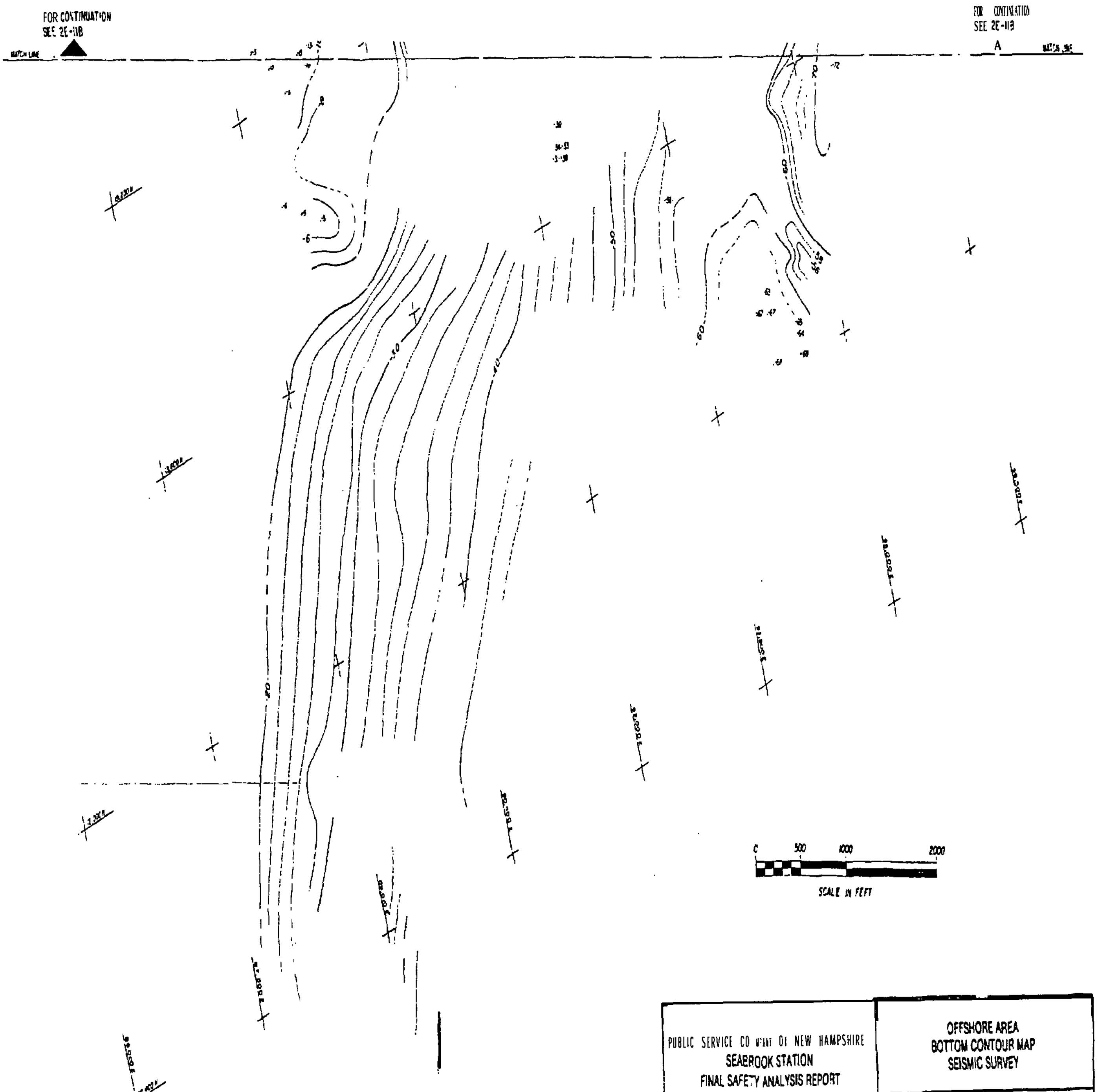
FINAL SAFETY ANALYSIS REPORT

STATE PARK
STATE BEACH AREA PROFILE
SEISMIC SURVEY

FIG. 2E-10 | SH.2 | S9 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	STATE PARK STATE BEACH AREA PROFILE SEISMIC SURVEY		
	FIG. 2E-10	SH.3	SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

OFFSHORE AREA
BOTTOM CONTOUR MAP
SEISMIC SURVEY

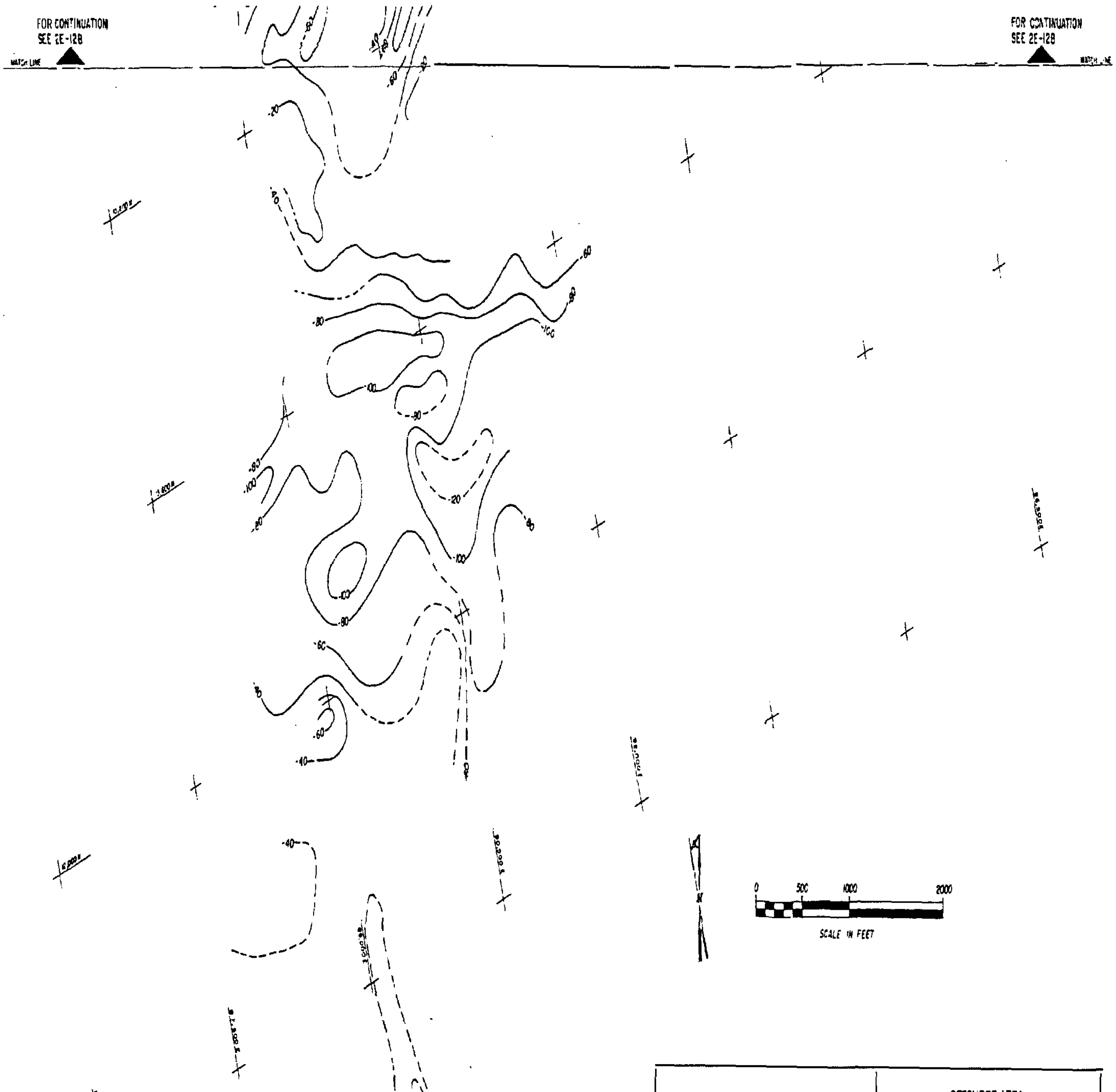
FIG. 2E-11A | SB 1 & 2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

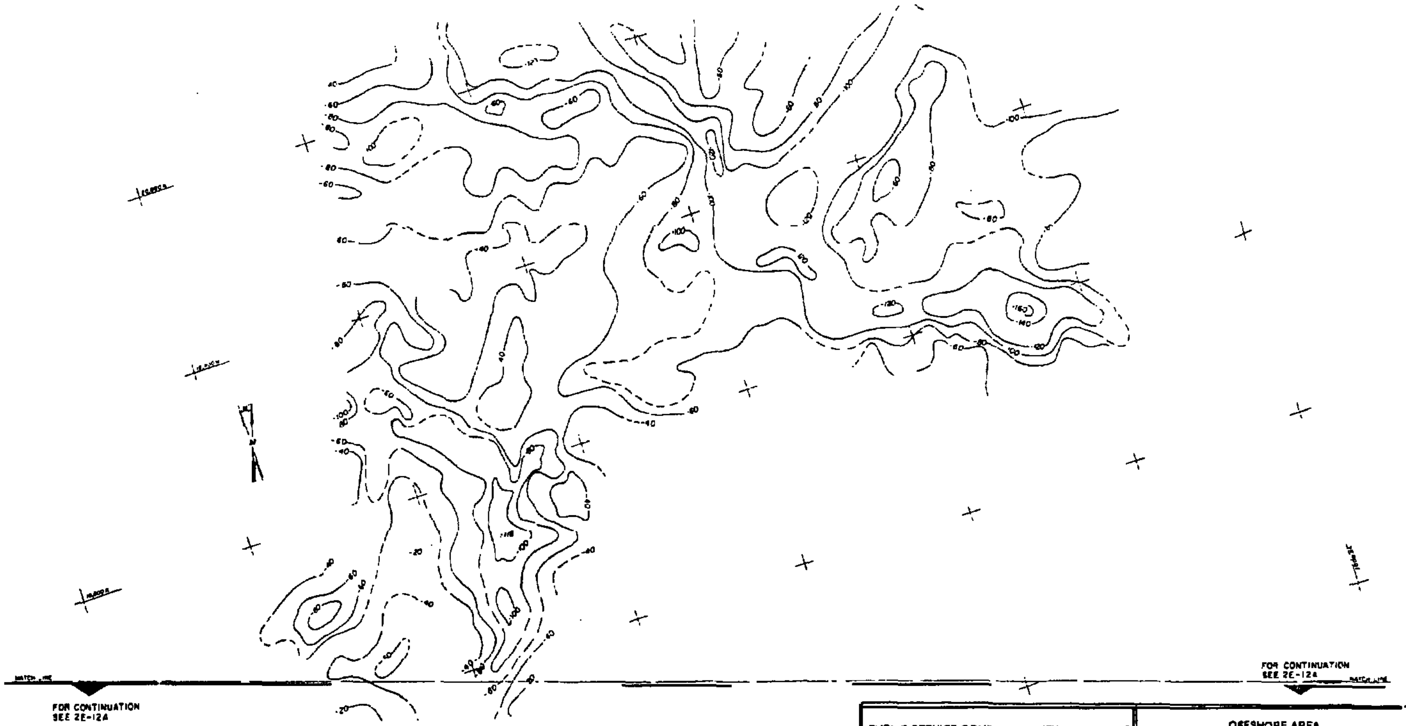
OFFSHORE AREA
BOTTOM CONTOUR MAP
SEISMIC SURVEY

FIG 2E-11B

SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	OFFSHORE AREA BEDROCK CONTOUR MAP SEISMIC SURVEY
	FIG 2E-12A



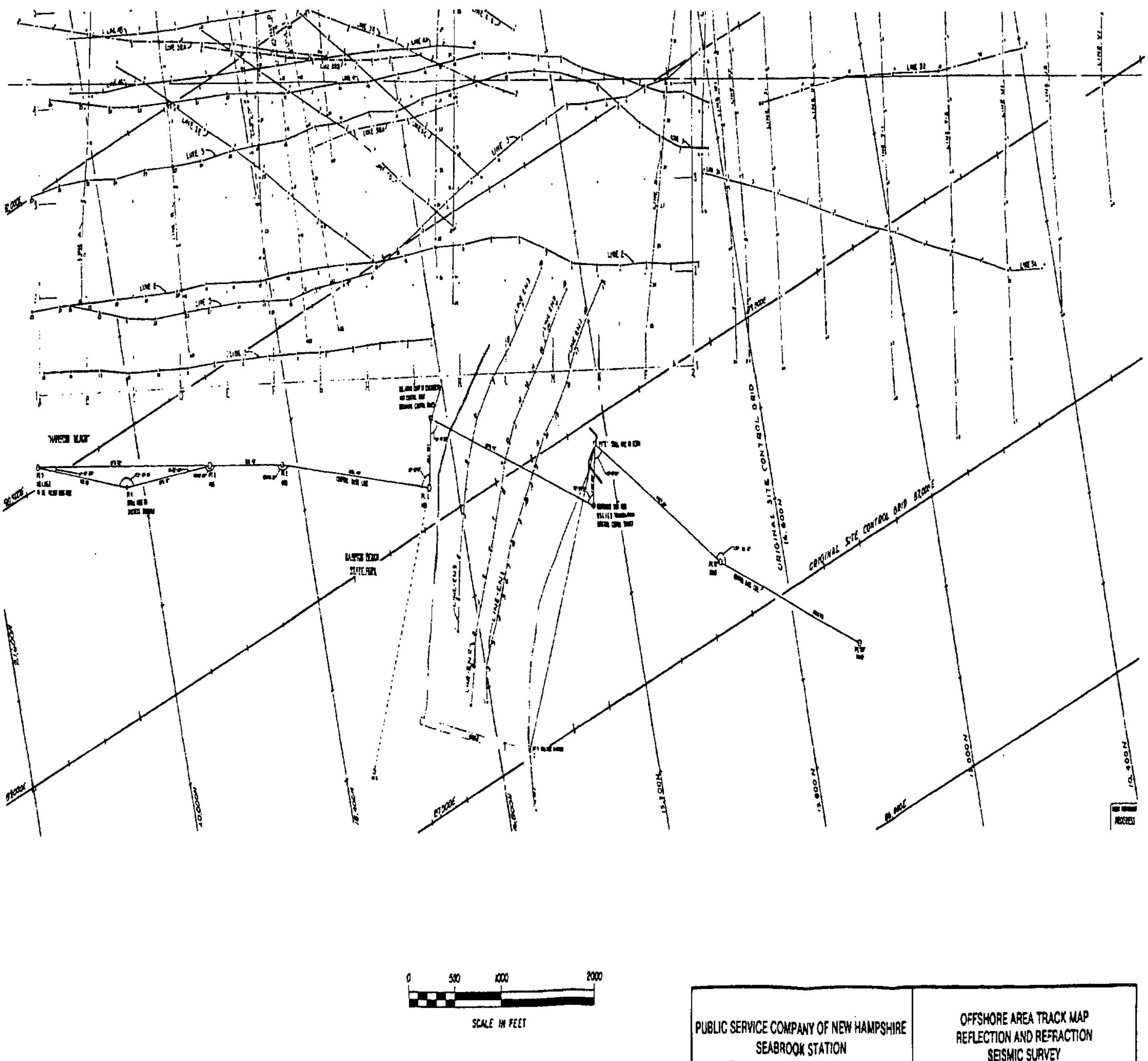
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	OFFSHORE AREA BEDROCK CONTOUR MAP SEISMIC SURVEY	
	FIG. 2E-12B	SB 1 & 2

FOR CONTINUATION
SEE 2E-13B

A

FOR CONTINUATION
SEE 2E-13B

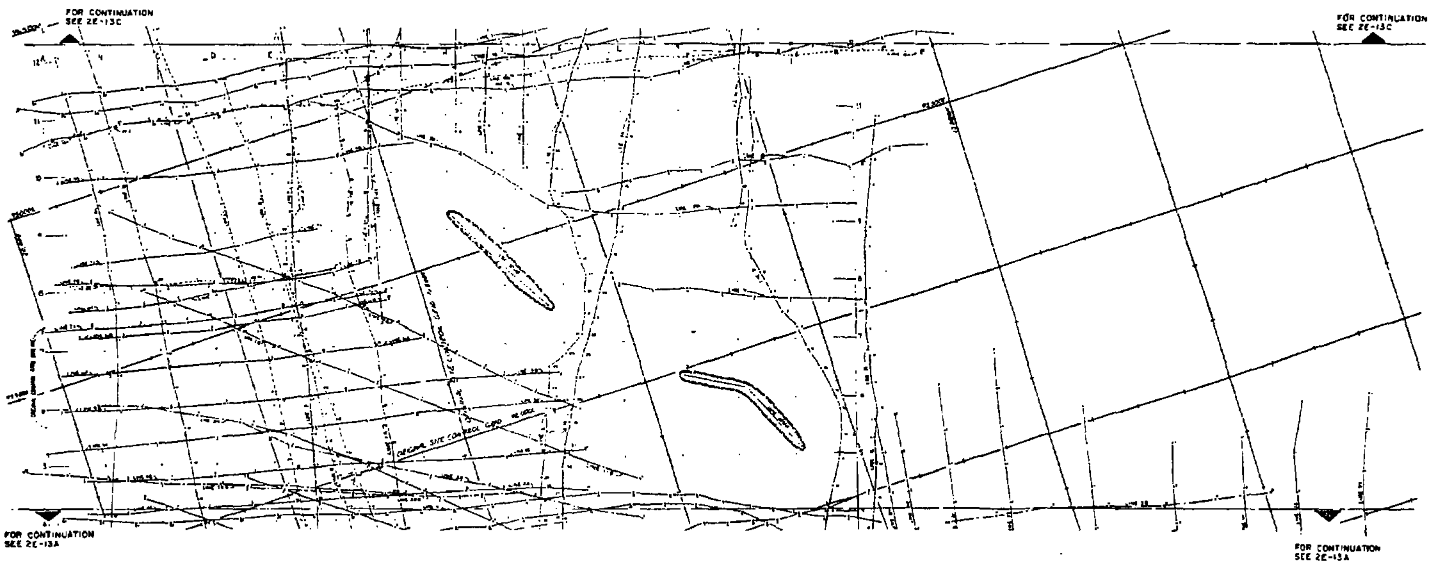
A



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
FINAL SAFETY ANALYSIS REPORT

OFFSHORE AREA TRACK MAP
REFLECTION AND REFRACTION
SEISMIC SURVEY

FIG. 2E-13A | SB 1 & 2



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE SEABROOK STATION FINAL SAFETY ANALYSIS REPORT	OFFSHORE AREA TRACK MAP REFLECTION AND REFRACTION SEISMIC SURVEY	
	FIG. 2E-13B	SB 1 & 2

APPENDIX 2L

GEOLOGIC INVESTIGATION OF SOILS AND THE BEDROCK SURFACE AT UNIT 2 CONTAINMENT SITE. **SEABROOK** STATION

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

GEOLOGIC INVESTIGATIONS

of

SOILS AND THE BEDROCK SURFACE

at

UNIT 2 CONTAINMENT SITE

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK, NEW HAMPSHIRE

October 24, 1974

CONTENTS

Geological Investigations
of
Soils and the Bedrock Surface
Unit 2 Containment Site
Seabrook Station
Seabrook, New Hampshire

During August and early September, 1974, four trenches 200' in length were excavated to bedrock on an "x" configuration across the area of the Unit 2 containment site at the Seabrook Station, New Hampshire.

The bedrock in the floor of these trenches is gneissoid quartz diorite of the Newburyport pluton, which is commonly fractured at less than 3' intervals in this area by an intersecting pattern of high-angle and low-angle joints. The most prominent and continuous joint se; within the containment area appears to be one which strikes N80-90E, dips steeply to the north, and is characterized by smooth chlorite-coated joint surfaces.

Unconsolidated overburden in the containment area ranges to a maximum of about 16' in thickness, and is characterized by a basal deposit of sand-silt-cobble till locally overlain by a blanket of medium-fine outwash sand. Glacial-marine clay lies between the till and outwash to the east of the containment. Where covered by outwash sand, the upper surface of the till is beveled to a gently undulating, sub-planar erosion surface upon which rest isolated eratic boulders ranging to 3' in diameter.

No evidence of Recent fault displacement was observed on the bedrock surface in the Unit 2 trenches. The sub-planar till/outwash contact horizon, which occurs in three of the four trenches, shows no evidence in these areas of static or dynamic deformation.

1. Purpose of Investigations

Bedrock at the site of the proposed Unit 2 containment is largely obscured by glacial till, glacial-marine clay and outwash sand. Boring E2-1, drilled in December 1972 to a depth of 159.2' on the vertical centerline of Unit 2, encountered thin zones of structural weakness in the diorite bedrock at intervals between elevations -75' and -110'.

These zones are characterized by smooth chlorite-rich surfaces on high-angle joints, and by closely-jointed zones in chlorite-rich portions of the bedrock. High-angle joints in Boring E2-1 dip from 60° to 85°, and most commonly dip 65-70°

Trenching investigations over the Unit 2 site were conducted in August-September 1974 for precautionary purposes, to ascertain the structure of the glacial deposits in the urea and to examine the nature of jointing in the underlying bedrock surface.

2. Borings Investigations Subsequent to Boring E2-1

During April 1974, Eoring E2-5 was drilled to a depth of 97.8' at a iocatior, 33' N13E (True) of the centerline of Unit 2 (see Appendix I for boring log) . This boring encountered joints with minor chlorite coatings at various elevations, with a zone of smooth chlorite-coated joints between -64 to -79' elevations. These joints dip 55° to 75°, and frequently show pyrite crystal growths over the chlorite surfaces.

During May-June 1974, four inclined borings, E2-15, E2-16, E2-17 and E2- 18, were put down around the periphery of the Unit 2 containment site to develop information relative to engineering of the containment excavation . Logs and orientation data for these borings are presented in a July 31, 1974 report prepared by Geotechnical Engineers, Inc., Winchester, Massachusetts (see Appendix II) .

Borings E2-15 and E2-16, along the west and south edges of the containment, respectively, encountered very few chlorite-coated joints. A polished joint at 88' depth in E2-15 appears likely to represent the projection to depth of a prominent chlorite-coated high-angle joint which is observed on the bedrock surface to trend east-west through the centerline of Unit 2. There are no anomalously polished joints in Boring E2-16.

Boring E2-17, drilled northerly across the east edge of the containment site, encountered polished chlorite-coated joints intermittently at depths of 62-67', 82', 87', 98-103', 137' and 152-156'. Some of these joints appear to correlate with the prominent east-west joint which trends through the centerline of Unit 2. This prominent joint appears to split into a number of high-angle branches as it passes east into the zone of influence of Boring E2-17.

Boring E2-18 encountered numerous individual joints which have minor chlorite coatings. No anomalously polished or chlorite-rich joints were found, however, in the 168' inclined depth drilled.

When examined in conjunction with joint mapping of the bedrock surface (Figure 2), Borings E2-15, E2-16, E2-17 and E2-18 do not indicate the presence of a through-going fault structure in the area of Unit 2. These borings do appear, however, to suggest that the most prominent or continuous high-angle chlorite-coated joint system in the containment area trends approximately east-west (True) through the central part of the containment, and dips 70-80^{o} to the north.

3. Trench Excavations

During August 1974, four trenches were excavated with a backhoe to bedrock across the 'Unit 2 site, to form an "x" whose legs are each approximately 203' long and intersect at right angles at the vertical centerline of the Unit. The legs trend approximately True North, East , South and West (see Figure 1) .

Ground surface elevations in the area of the trenches range from about +10' to +20' . The elevation of the bedrock surface in the floor of the trenches ranges from about -3' at Station 1+80 in the East trench, to +14' at Station 1+85 in the South trench. Profiles of the bedrock surface along the centerlines of the trenches, as surveyed by Public Service Company 'of New Hampshire personnel, are shown on Figures 1 and 3.

4. Bedrock Exposed in the Trenches

Figure 2 shows by half-tone shading the areas of bedrock mapped by J. R. Rand in the several trenches. Although the trenches were excavated to bedrock, throughout, the bedrock in the low elevation areas was too obscured by water and mud to permit the observation of joints or other pertinent structural features. Although much of the bedrock surface is rough and irregular due to glacial plucking or breaking by the backhoe, wide areas of the bedrock are locally smooth and show glacial striations.

Throughout the area exposed by the trenches the bedrock consists predominantly of gneissoid, sometimes quartzitic, quartz diorite which ranges in grain size from fine- to medium-grained. Coarse

hornblende diorite occurs locally in the West and South trenches. Gneissoid banding commonly strikes about N80W and dips very steeply to the north. No diabase dikes were observed in the trenches or in the several borings in the area. The bedrock is commonly fresh and hard in the containment area, with weathering effects limited to surface staining on joints.

A. Faulting

No evidence of offset of the 'bedrock surface or the overlying glacial sediments was observed in the trenches. Welded breccia fabric, which is seen locally in drill core both in the Unit 2 area and elsewhere throughout the site area, can be seen exposed on a smooth glacially-scoured bedrock surface approximately 5' to the southwest of Boring E2-1 in the trench excavation. This breccia is 1-2" wide, strikes approximately east-west, dips steeply, is annealed and compact, and shows no offset of the glaciated bedrock surface.

B. Jointing

As shown on Figure 2, jointing in the bedrock is closely spaced throughout the Unit 2 containment area, occurring at intervals which rarely exceed 5' and commonly occurring at less than 3' intervals.

High-angle joints (greater than 50° dips) occur in three prominent orientations:

Strike N65-70W	Dip 65-80N
Strike N05-20W	Dip 65-85W
Strike N80-90E	Dip 65-90N

At the centerline of Unit 2, the most continuous joint trend is N80-90E with steep dips to the north. This set is seen commonly to have chlorite-coated surfaces. The N65-70W joints appear to converge and terminate against the N80-90E set, while the N05-20W joints are characteristically short and discontinuous. Slickenside striations which occur on many of the joints exhibit widely divergent directions of movement.

Low-angle joints (less than 50° clips) appear to be somewhat more common than high-angle joints, and occur generally in three prominent orientations:

Strike N25-40E	Dip $35-40^{\circ}$ NW and SE
Strike N 15-30W	Dip $35-40^{\circ}$ NE and SW
Strike N80-90E	Dip $35-45^{\circ}$ North

Low-angle joint surfaces are commonly planar and occasionally show slickenside striations, with no consistent striation orientation from joint to joint.

From about Station 1+15 to 1+50 in the East trench, the bedrock is subject to closely-spaced jointing, and the upper 1-3' of the bedrock was sufficiently fractured to permit excavation by the backhoe. Joints in this area are chlorite-coated and smooth, and show some polishing on conchoidal surfaces. Thin gray clay fillings occur locally in discontinuous patches between some joints. Slickensides show no preferred orientation, and no strike direction could be determined for this zone.

5. Unconsolidated Glacial Deposits

As shown on trench profiles on Figure 3, brown sand-silt-cobble till directly overlies the bedrock surface throughout the area exposed by the four trenches. Till rises to ground surface throughout the length of the South trench, and rises locally to ground surface in the North trench and in the area of the Unit 2 centerline. Where the till does not rise to ground surface in the trenches, the upper surface of the till is a gently undulating, sub-planar erosion surface on which was deposited a layer of medium-fine outwash sand. At the east end of the East trench, a sequence of interbedded, evenly-layered marine clays and sands lies between the till and the overlying outwash sand layer. At scattered intervals in the West, North and East trenches, isolated boulders ranging to 3' in diameter lie enclosed in outwash sand and rest on the upper surface of the till.

Subsequent to backhoe excavation of the trenches, the contact horizon between the till and overlying outwash sand was exposed and cleaned by hand throughout the length of its exposure in the West, North and East trenches. The contact was inspected and photographed by J. R. Rand throughout its exposed length in these trenches, and its elevation determined by transit leveling along both walls of each of these trenches. The extent of the outwash sand deposits in the trench walls and the elevations of the till/outwash contact from place to place are shown on Figure 2.

No features were observed along this till/outwash contact in any of the trenches to suggest either static or dynamic deformation subsequent to deposition of the sand on the beveled till surface. Throughout the zone of close and slippery bedrock jointing between Stations 1+15 and 1+50 in the East trench, the overlying till/outwash contact horizon is sub-planar and continuous.

Glacial materials overlying the bedrock surface throughout the South trcrich are limited to unsorted, non-layered sand-silt-cobble till. These materials locally show a crude stratification, and nowhere exhibit structures suggestive of post-depositional deformation.

6. Conclusions

Examination of the overburden, bedrock surface and bedrock joints in the Unit 2 trench excavations has revealed several distinctive features which are indicative of the tectonic stability of the bedrock at the site:

A. Intermittent crudely-stratified horizons in the glacial till are not displaced over joints in the underlying bedrock.

B. The undulating, sub-planar erosion surface at the top of the till is through-going and not subject to structural offsets or other deformations suggestive of faulting,

C. Local exposures of glacially-scoured bedrock surfaces are smooth across joints in the bedrock.

D. Slickenside striations on closely-spaced bedrock joints exhibit widely divergent orientations, with no preferred attitude or orientation.

John R. Rand
Consulting Geologist

FIGURES

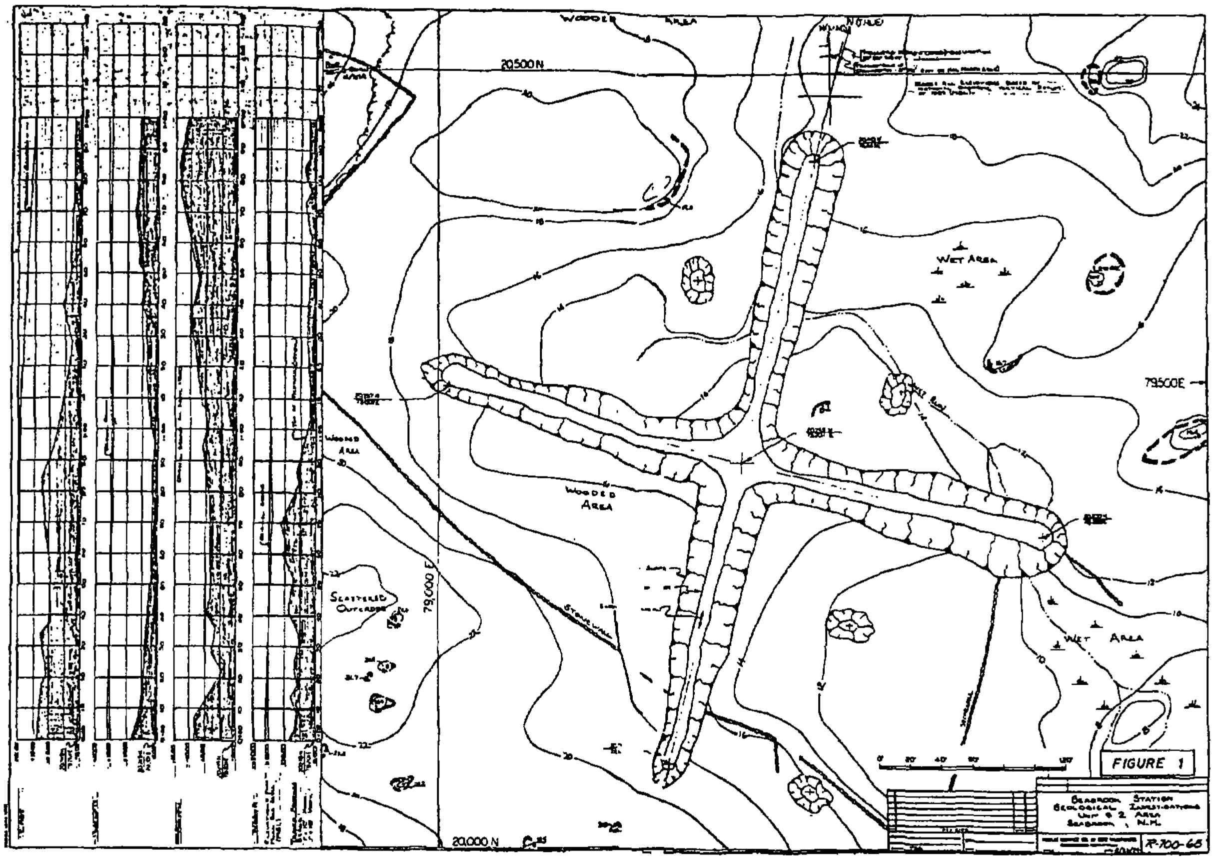
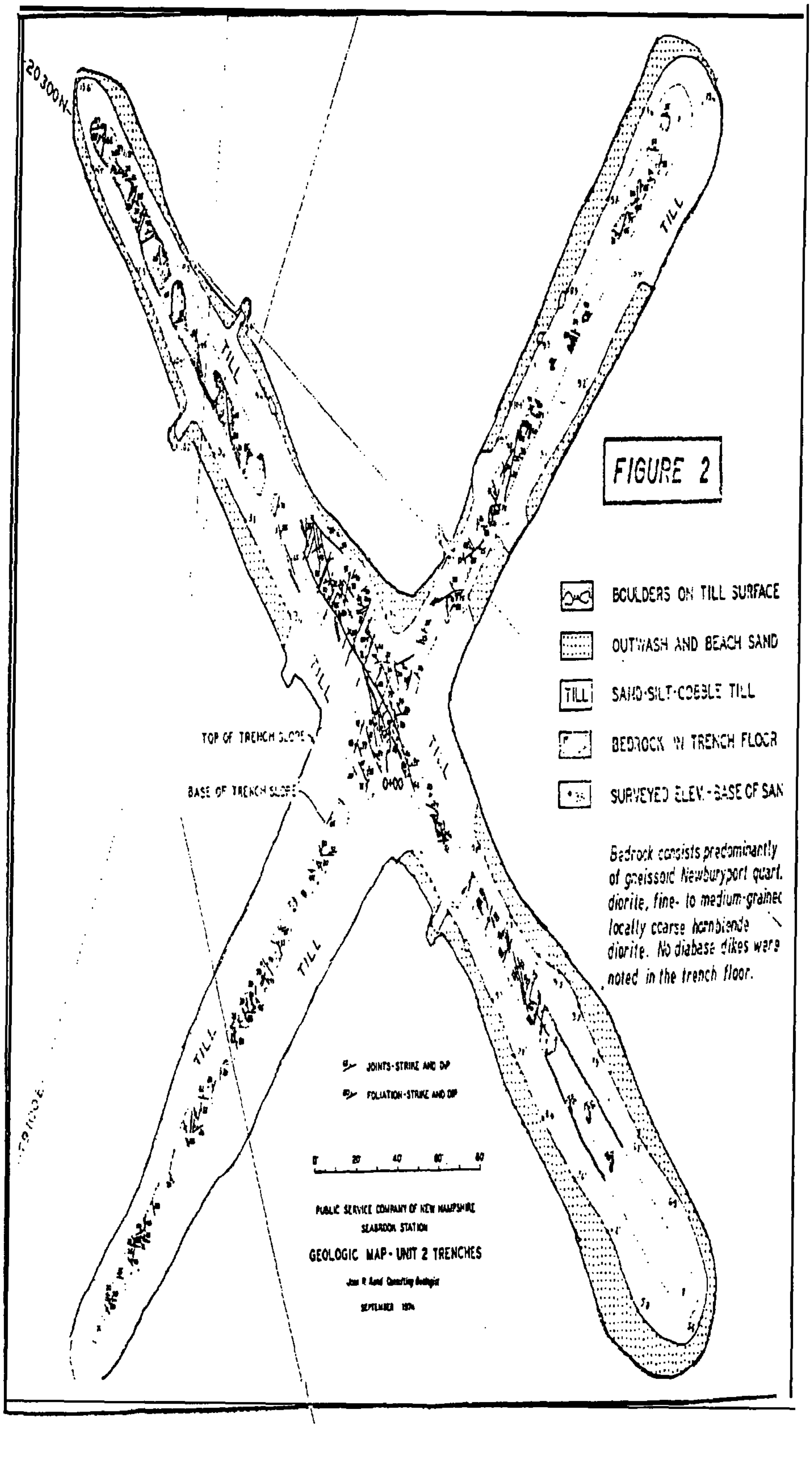
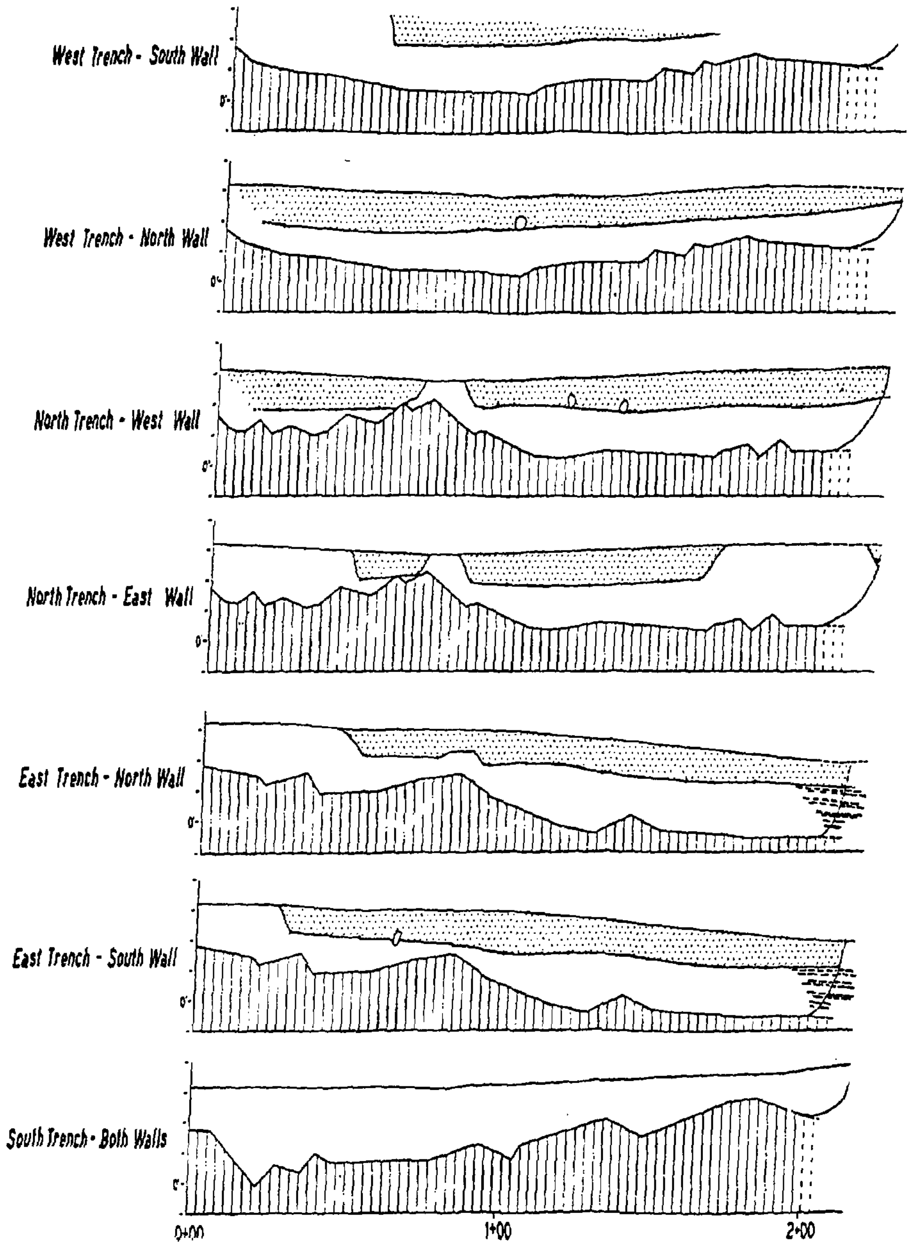

20500N
WET AREA
79500E
WOODED AREA
SCATTERED OUTCROPS
79,000 E
WET AREA
20,000 N

FIGURE 1


20300N
FIGURE 2
BOULDERS ON TILL SURFACE
OUTWASH AND BEACH SAND
SAND-SILT-COBBLE TILL
BEDROCK IN TRENCH FLOOR
TILL
TOP OF TRENCH SLOPE
BASE OF TRENCH SLOPE
0+00
Bedrock consists predominantly of gneissoid Newburyport quartz diorite, fine- to medium-grained locally coarse hornblende diorite. No diabase dikes were noted in the trench floor.
JOINTS-STRIKE AND DIP
FOLIATION-STRIKE AND DIP
0' 20' 40' 60' 80'
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK STATION
GEOLOGIC MAP - UNIT 2 TRENCHES
SEPTEMBER 1974



GLACIAL OUTWASH AND BEACH SANDS

GLACIAL-MARINE CLAY-SILT

GLACIAL SAND-SILT-COBBLE TILL

BEDROCK - PROFILE ALONG TRENCH CENTERLINE

SURVEYED ELEVATION - BASE OF SAND

BOULDERS LYING ON SURFACE OF TILL

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK STATION

SOILS PROFILES - UNIT 2 TRENCHES

John R. Rand, Consulting Geologist

SEPTEMBER 1974

FIGURE 3

APPENDIX I
Boring Log - Boring E2-5

BORING LOCATION N20277, E29215, Plant Site INCLINATION Vertical BEARING ______ DATE START/FINISH April 25, 1974 / April 29, 1974

CASING ID 3 in. CORE SIZE 2-1/8 in. TOTAL DEPTH 97.7 ft DRILLED BY American Drilling & Boring, A. Whitaker

GROUND EL (MSL) +16.5 ft DEPTH TO WATER DATE +1.5 ft April 30, 1974 LOGGED BY Soil - K. J. Pol; Rock - J. R. Rand

EL. MSL ft	Depth ft	Type and No.	N or Rec.	RATE OF ADV. min/ft	WATER CONTENT or RQD %	PRESSURE TEST	STRIKE, DIP (F = Foliation, J = Joint, C = Contact, B = Bedding)	SOIL AND ROCK DESCRIPTIONS
16.5	0	S1	2					Dark brown topsoil with roots.
		S2	3				TOP OF SAND	Similar to Sample S1.
		S2A	4					Lt. brown and rusty brown silty fine sand. Uniform; fines are nonplastic.
	3.0	S3	24				TOP OF TILL	Light rusty brown very slightly silty uniform fine sand.
		S3A						Light brown fine to medium gravelly sand. Fines are nonplastic; widely graded.
		S4	86					Similar to Sample S3A, but less gravelly.
		S5	37					Rusty brown silty fine sand. Uniform, fines are nonplastic; gray-brown gravelly pocket.
		S6	47					Similar to Sample S3A, contains gray silty fine sand layer 10 mm thick.
	9.0	S7	100/0				TOP OF ROCK	Refusal - No sample.
	10	NX-1	100	3)	40			
0	20	NX-2	100		43			
	30	NX-3	100		38			
-20	40	NX-4	100		42			
		NX-5	96		70			
	50	NX-6	99		65			
-40	60	NX-7	100		73			
	70	NX-8	100		50			
-60	80	NX-9	94		35			
	90	NX-10	100		0			
-80	97.7	NX-11	92		31		BOTTOM OF BORING	

Rock descriptions (weathering, defects, etc.):

Slight wx; Rusty; Vertical joint; Slight wx; Slight wx; Moderate wx; Slight wx; Vuggy — Fresh and hard. Local high angle joints show surface wx effects. Partings dip 10 to 20°. — Diorite (?). Medium-fine to medium grained medium gray. Contains magnetic disseminated through rock. Fine quartzite is not magnetic. (Fine quartzite)

Minor chlorite; 68° No chlorite, Slight wx; Minor chlorite; Pyrite; Minor chlorite — Fresh and hard. Joints and partings show minor surface wx effects. Some minor chlorite coatings. — Magnetic. Diorite (?) or feldspathic metaquartzite (?). Medium fine grained, medium gray. Locally foliated, variable orientations. Magnetic.

68 Minor chlorite; Minor chlorite; 63 Chlorite — Fresh and hard. High-angle joint sets widely spaced. Slight surface wx effects on joints. — Magnetic. Diorite (?) or feldspathic metaquartzite (?). Medium fine grained, medium gray. Locally medium-grained, feldspathized rock attracts magnet.

58° Chlorite; Partings at 15°; 58 Minor chlorite; Vertical joint; Slight wx — Fresh and hard. High-angle joints not closely-only slight surface wx effects on joints. Most partings dip 30 to 45°. — Magnetic. Diorite (?) or feldspathic metaquartzite (?). Medium fine grained, medium gray. Local wavy foliation. Notably magnetic.

67 Chlorite; Chlorite; Chlorite-slippery; 65° joints; Chlorite; Chips; 70 chlorite; Chlorite-pyrite xtals; 67 joints; Chlorite — Fresh and hard. Subject to closely-spaced high-angle jointing with chlorite coatings. Pyrite xtals overgrowths on chlorite. — Magnetic. Diorite. Medium-fine grained, medium gray. Locally foliated, generally massive. Attracts magnet quite noticeably. Chlorite coatings on joints are locally overgrown with pyrite.

LEGEND

- N - Standard penetration resistance, blows/ft
- Rec - Length recovered/length cored, %
- RQD - Length of sound core 4 in. and longer/length cored, %
- S - Split spoon sample; ▽ Groundwater
- U - Undisturbed samples
  - S - Shelby tube; N - Denison
  - F - Fixed piston; P - Pitcher
  - O - Osterberg; G - GEI
- D - Drilling break; k - Coefficient of permeability
- wx - Weathered, weathering

NOTES

1) - Scale of soil log doubled to accommodate descriptions.

2) - No clays present; therefore no water contents were determined.

3) - Rate of advance not available.

SEABROOK STATION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

YANKEE ATOMIC ELECTRIC COMPANY

united engineers

Date: July 5, 1974 Project 7286

PAGE 1 of 1 LOG OF BORING E2-5

GEOTECHNICAL ENGINEERS INC

APPENDIX 2M

GEOTECHNICAL REPORT - PRELIMINARY REPORT. COMPRESSION TESTS ON STRUCTURAL BACKFILL AND SAND CEMENT, SEABROOK STATION

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

PRELIMINARY REPORT
'COMPRESSION TESTS ON
STRUCTURAL BACKFILL AND SAND-CEMENT
SEABROOK STATION

January 24, 1978

Prepared for

PUBLIC SERVICE CO. OF NEW HAMPSHIRE
and
UNITED ENGINEERS AND CONSTRUCTORS, INC.

by

Geotechnical Engineers Inc.
1017 Main Street
Winchester, Massachusetts 01890

Project 77386

TABLE OF CONTENTS

LIST OF TABLES

*To be added when tests are complete.

LIST OF FIGURES

1. INTRODUCTION

1.1 Purpose

The purpose of the laboratory testing program described herein was to determine the engineering properties of a sand used as structural backfill and a sand-cement mixture, using 5% cement, which is planned as a possible substitute for structural **backfill at Seabrook** Station.

1.2 Scope

Two bag samples of soil obtained from Beard Pit No. 5, Dover, NH were received by Geotechnical Engineers Inc. from Pittsburgh Testing Laboratories personnel. The following tests were performed by GEI:

Structural Backfill

1 Specific Gravity Test
2 Sieve Analyses
1 Moisture-Density Relation Test
6 Consolidated-Drained Triaxial, $\bar{S}$, Tests
7 Consolidated-Undrained Triaxial, $\bar{R}$, Tests

Sand-Cement

9 Unconfined Compression Tests on 2-in. Cube Samples at 7, 28 and 90 Days
3 Unconfined Compression Tests on 2.8-in.-dia. Cylindrical Samples at 28 Days
6 Confined Compression Tests on 2.8-in.-dia. Cylindrical Samples at 28 Days

1.3 Schedule

The schedule of tests is given in Table 1.

2. DESCRIPTION OF STRUCTURAL BACKFILL AND RESULTS OF INDEX TESTS

2.1 Description

Beard Pit No. 5 soil is a yellowish-brown gravelly sand containing about two percent fines.

2.2 Grain-Size Distribution Tests

Two sieve analyses were performed. The grain-size distribution of Beard Pit No. 5 soil as received was first determined. The entire sample was subsequently sieved on a No. 4 (4.75 mm) mesh and a grain-size distribution of soil passing the No. 4 mesh was determined. The minus No. 4 material was used for triaxial testing.

2.2.1 Procedure

To determine the grain-size distribution of the original soil, a representative sample was selected, weighed and air-dried. The sample was sieved on a 3/8-in. mesh and aggregates retained were removed, weighed and separately sieved. A representative sample of aggregates passing the 3/8-in. mesh was weighed, oven-dried and washed on a No. 200 (.074 mm) sieve. The soil retained on the No. 200 sieve was oven-dried, weighed and mechanically sieved.

The entire quantity of soil was then sieved on a No. 4 (4.75 mm) mesh and aggregates retained were removed. A representative sample of soil passing the No. 4 mesh was oven-dried and washed on a No. 200 (.074 mm) sieve. Soil retained on the No. 200 sieve was subsequently oven-dried, weighed and mechanically sieved to determine the grain-size distribution of the soil to be used for compaction and triaxial testing.

2.2.2 Results

The grain-size distribution curve of Beard Pit No. 5 soil is presented in Fig. 1.

The grain-size distribution curve of the soil passing the No. 4 (4.75 mm) sieve is presented in Fig. 2.

2.3 Specific Gravity Test

One specific gravity test was performed on Beard Pit No. 5 soil.

2.3.1 Procedure

The test was performed in accordance with ASTM Designation D854 with the following exceptions:

a. Temperatures were measured to $0.1^{o}C$.

b. The pycnometer was calibrated by actual measurements over a range of temperatures, rather than at one temperature.

c. The oven-dried sample was not soaked in water prior to testing, rather it was soaked only during removal of entrapped air under a partial vacuum.

2.3:2 Results

The specific gravity of the solids was 2.67.

3. MOISTURE-DENSITY RELATION TEST

3.1 Procedure

A moisture-density relation test was performed on Beard Pit No. 5 soil in accordance with ASTM Designation D1557, Method A. Soil passing a No. 4 (4.75 mm) sieve was compacted in a 4-in.-diameter mold using the Modified AASHO compaction effort. Twenty-five blows of a 10-lb hammer having a 2-in.-diameter ram face were uniformly distributed over each of 5 equal layers. The compaction was performed using a Soil Test Mechanical Compactor, Model CN-4230.

3.2 Results

Results of the moisture-density test are plotted in Fig. 3.

Determinations performed on soil initially adjusted to a water content greater than 13% were observed to have excess water bleed from the bottom of the mold as the compaction progressed.

The computed dry unit weight using both the as-molded water content and the water content immediately after compaction, when the wet weight was measured, are shown in Fig. 3. The true maximum dry unit weight achieved was 112.0 pcf.

However, in Fig. 3 is is seen that the maximum dry unit weight would appear to be only 110.3 pcf if the as-molded water content had been used.

4. CONSOLIDATED-DRAINED, S, TRIAXIAL TESTS

Six S tests were performed on compacted specimens of Beard Pit No. 5 soil. Only soil passing a No. 4 sieve was used. Specimens were compacted to 90% and 95% of the maximum dry unit weight as determined by ASTM Designation D1557, Method A (Section 3). Tests were performed at effective consolidation pressures of 0.5, 2.0 and 6.0 ksc (7.1, 28.4, 85.3 psi). Test specimens typically had a diameter of **2.9-in.** and a height of 6.6-in.

4.1 Procedure

A predetermined quantity of air-dried soil was thoroughly mixed with distilled water to a water content of 14%. The mixture was divided in seven portions of equal weight and placed in covered containers.

The compaction was performed in seven layers within a split mold. The mold was lined with a rubber membrane which was held tightly to the inside of the mold by a small vacuum. The first soil layer was placed in the mold and leveled off. A 1-psi surcharge was lowered onto the soil and vibrated vertically using an Ingersoll-Rand pneumatic hammer. The hammer provided low frequency-high amplitude vibrations. The layer was compacted to a predetermined height to achieve the desired unit weight. The surcharge was removed and the soil surface scarified. Subsequent layers were added and compacted in the same manner to form a test specimen of the desired size and unit weight.

The mold and specimen assembly was then mounted on the bottom platen of a triaxial cell. A vacuum of approximately **15-in.** of Hg was applied to the specimen to provide support to the specimen. The mold was removed and the diameter and height of the specimen were measured. A second membrane was placed around the specimen and O-rings attached to seal the membranes to the top and bottom platens.

The triaxial cell was subsequently assembled and flooded with water. A chamber pressure of 0.5 ksc was applied and the vacuum released to distilled water at atmospheric pressure. When the vacuum had dissipated, distilled water was permeated through the specimen to improve saturation by displacing air voids. A back pressure of approximately 10 ksc was utilized to complete saturation. B-values of 0.90 or higher were measured.

The specimen was then consolidated to the desired effective consolidation pressure. Volume changes during consolidation were measured by monitoring the flow of pore water through the drainage system.

The test specimen was subsequently loaded axially at a constant rate of strain of approximately 0.4%/min. During shear the specimen was allowed to drain through both ends. Volume changes were measured by monitoring the flow of pore water. Axial loads were measured with a proving ring and deformations were monitored with an axial dial. The test was terminated at 20% axial strain. The specimen was then removed and oven-dried to determine the weight of solids.

4.2 Stress-Strain Curves For S Tests

Results of the consolidated-drained triaxial, S, tests are plotted in terms of

a. normalized shear stress on the 45° plane, $q/\bar{\sigma}_{3c}$, vs. axial strain, and

b. volumetric strain, $\Delta V/V$, vs. axial strain.

The results of individual S tests are presented in Appendix A and Table 2 contains the details of each S test performed.

A summary of S tests performed on specimens initially compacted to a specific 90% compaction are plotted in Fig. 4, and 95% compaction in Fig. 5.

4.3 Moduli and Poisson's Ratios For S Tests

Figs. 6 and 7 are plots of secant modulus and Poisson's ratio, respectively, as a function of axial strain from the triaxial S tests.

Fig. 8 (top) is a plot of the initial tangent modulus and the secant modulus at 50% of the compressive strength versus the effective consolidation pressure, $\bar{\sigma}_{3c}$. At the bottom in Fig. 8 is a similar plot for the values of Poisson's ratios.

5. CONSOLIDATED-UNDRAINED, $\bar{R}$, TRIAXIAL TESTS

Seven $\bar{R}$ tests were performed on compacted specimens of Beard Pit No. 5 soil. Only soil passing a No. 4 sieve was used. Specimens were compacted to 90% and 95% of the maximum dry unit weight as determined by ASTM Designation D1557, Method A (Section 3). Tests were performed at effective consolidation pressures of 0.5, 2.0 and 6.0 ksc (7.1, 28.4, and 85.3 psi). Specimens were typically 2.9-in. in diameter and 6.6-in. high.

5.1 Procedure

Each test specimen was compacted, saturated and consolidated in the same manner as described for S tests, Section 4.1.

When consolidation was complete, the specimen was axially loaded at a constant rate of strain of approximately 0.4%/min. No drainage was permitted. Axial loads were measured with a proving ring. Excess pore water pressures incurred during shear were monitored with a Tyco pressure transducer attached to the pore water system.' The transducer calibration was checked prior to each test. Deformations were monitored with an axial dial. Tests were typically terminated at 20% axial strain.

5.2 Stress-Strain Curves For $\bar{R}$ Tests

The results of individual consolidated-undrained triaxial, $\bar{R}$, tests are presented in Appendix B in terms of

a. normalized shear stress on the 45° plane, $q/\bar{\sigma}_{3c}$, vs. axial strain,

b. normalized effective minor principal stress, $\bar{\sigma}_3/\bar{\sigma}_{3c}$, vs. axial strain, and

c. normalized shear stress on the 45° plane, $q/\bar{\sigma}_{3c}$, vs. the normalized effective normal stress on the 45° plane, $\bar{p}/\bar{\sigma}_{3c}$.

The details of each $\bar{R}$ test are given in Table 3. A summary of the $\bar{R}$ tests is given in Fig. 9 for 90% compaction and in Fig. 10 for 95% compaction.

5.3 Moduli and Poisson's Ratio For $\bar{R}$ Tests

The secant moduli from $\bar{R}$ tests are plotted as a function of strain in Fig. 11. In Fig. 12 the initial tangent moduli and the secant moduli at 50% of the compressive strength are plotted as a function of effective consolidation pressure.

The Poisson's ratio for undrained shear may be taken as 0.50. In the event that such a value causes singular points in computer programs used to calculate stresses, then a value of Poisson's ratio of 0.49 or 0.495 may be used.

6. TESTS ON SAND-CEMENT

We herewith forward results of tests on 2-in. cube specimens of sand-cement, so that the results will be available early in this preliminary form.

In Fig. 13 are plotted the stress-strain curves for unconfined tests on three replicate specimens cured for 7 days, and in Fig. 14 are the stress-strain curves for unconfined tests on three replicate specimens cured for 28 days. Details of these tests are given in Table 4.

The sand-cement specimens were prepared using the same sand and cement that were used at the Seabrook site for test batches. The mixtures are shown in Figs. 13'and 14.

It may be seen that the strength increased rapidly with cure time. A strength increase that is logarithmic with time would lead to the predition of an average strength of 180 psi for the specimens cured 90 days. Similarly, the average modulus would increase to 33,800 psi.

7. COEFFICIENT OF SUBGRADE REACTION

7.1 Structural Backfill

To determine reasonable values for the coefficient of **subgrade** reaction of buried pipes, the following procedure may be used:

1. Determine whether the loading condition is "drained" or "undrained." That is, will volume changes take place during loading (drained), or will volume changes not occur during loading (undrained).

2. Establish the allowable diametral strain of the pipe. That is, select a diameter-strain that the pipe can withstand with an adequate factor of safety. That strain may be as low as 0.1% for stiff, brittle pipes,to 3% or 4% for flexible pipes.

3. Compute the vertical effective stress in the ground at the level of the middle (springline) of the pipe.

4. Choose whether the expected degree of compaction of the structural backfill is 90% Modified or 95% Modified.

5. Given the above data, enter the appropriate table below, and interpolate to obtain a value of k_sD, i.e., the coefficient of **subgrade reaction** times the pipe diameter (in psi).

6. Divide k_sD by the pipe diameter to obtain the value of k_s in pci (pounds/cubic inch).

k_sD-VALUES FOR DRAINED LOADING

Tabulated values are in psi

Effective Vertical Stress at Springline psi	Allowable Diameter Strain, %			
	0.1	0.5	1.0	2.0
	90% MODIFIED COMPACTION			
7.1	31,800	11,800	5,900	2,800
28.4	107,500	40,400	22,500	11,000
85.3	263,000	93,700	55,500	29,700
	95% MODIFIED COMPACTION			
7.1	50,900	15,900	8,000	3,500
28.4	131,400	51,800	28,200	13,700
85.3	281,600	114,800	68,800	35,800

k_sD-VALUES FOR UNDRAINED LOADING

Tabulated values are in psi

Effective Vertical Stress at Springline psi	Allowable Diameter Strain, %			
	0.1	0.5	1.0	2.0
	90% MODIFIED COMPACTION			
7.1	32,700	16,200	13,100	9,100
28.4	97,500	34,100	22,200	13,500
85.3	267,500	79,500	45,200	24,700
	95% MODIFIED COMPACTION			
7.1	54,300	34,000	30,300	23,600
28.4	127,100	51,800	38,700	27,800
85.3	307,200	101,200	65,100	41,300

NOTATIONS

B	Skempton's B-value. Ratio of pore pressure increase
D_i	Inside diameter
D_o	Outside diameter
E_o	Initial tangent modulus, $\Delta(\sigma_1 - \sigma_3)/\Delta\varepsilon$
E_{sd}	Secant modulus from drained triaxial tests
E_{su}	Secant modulus from undrained triaxial tests
E_{50}	Secant modulus at 50% compression strength
kg/cm^2) ksc)	Kilograms/cm^2 multiply by 14.22 to obtain psi
k_s	Modulus of subgrade reaction
P	Percent compaction. Dry unit weight of specimen divided by maximum dry unit weight from compaction curve
$\bar{p}$	Average principal effective stress, $(\bar{\sigma}_1 + \bar{\sigma}_3)/2$
pcf	Pounds/cubic foot
pci	Pounds/cubic inch
psi	Pounds/square inch
q	Shear stress on 45^o plane, or maximum shear stress in specimen, $(a_1 - \sigma_3)/2$
V_c	Volume upon completion of consolidation
w	Water content
γ_d	Dry unit weight
ε_a	Axial strain
ε_v	Volume strain (volumetric strain) = $\Delta V/V_c$

ν_0	Poisson's ratio, initial tangent value
ν_{sd}	Poisson's ratio, secant value from drained tests
ν_{50}	Poisson's ratio, secant value at 50% compressive strength
σ_1	Major principal total stress
$\bar{\sigma}_1$	Major principal effective stress
σ_3	Minor principal total stress
$\bar{\sigma}_3$	Minor principal effective. stress
$\sigma_1 - \sigma_3$	Principal stress difference ("deviator stress") $\equiv (\bar{\sigma}_1 - \bar{\sigma}_3)$
σ_{3c}	Minor principal effective stress upon completion of consolidation

TABLES

TABLE . SCHEDULE OF TESTS ON SAND-CEMENT
SEABROOK STATION

Month	Activity
NOV 1977	Prepare 9 - 2 in. cube samples
DEC 1977	Test 3 - 2 in. cube samples : 7-day cure
DEC 1977	Test 3 - 2 in. cube samples : 28-day cure
JAN 1978	Prepare 9 - 2.8 in. dia. cylinders
FEB 1978	Test 9 - 2.8 in. dia. cylinders : 28-day cure (3 unconfined; 3 at confining pressure of 7.1 psi; 3 at' confining pressure of 28.4 psi)
FEB 1978	Test 3 - 2 in, cube samples : 90-day cure
MAR 1978	

TABLE 2 - CONSOLIDATED-DRAINED (S) TRIAXIAL TESTS
STRUCTURAL BACKFILL - BEARD PIT 5 SAND
SEABROOK STATION

Test No.	Initial Water Content	Dry Unit Weights: In Compaction Mold	Dry Unit Weights: In Triaxial Cell, Initial	Dry Unit Weights: In Triaxial Cell, After Consolidation	Percent Compaction, P, ASTM D1557, A: In Compaction Mold	Percent Compaction: In Triaxial Cell, Initial	Percent Compaction: In Triaxial Cell, After Consolidation	Effective Consolidation Stress $\bar{\sigma}_{3c}$	B Value	At Max. Compressive Stress: Deviator Stress $(\sigma_1 - \sigma_3)$	At Max. Compressive Stress: Axial Strain ε_a	At Max. Compressive Stress: Volume Strain ε_v	Moduli: Initial E_o	Moduli: At 50% Max. Stress E_{50}	Poisson's Ratio: Initial ν_o	Poisson's Ratio: At 50% Max. Stress ν_{50}
	%	pcf	pcf	pcf				ksc		ksc	%	%	psi	psi		
S1	13.8	100.7	100.8	100.8	89.9	90.0	90.0	0.50	0.97	1.64	1.31	0.41	6,260	4,050	0.31	0.43
S2	13.8	100.9	101.0	101.5	90.1	90.2	90.6	2.00	0.95	5.88	2.38	0.08	14,220	11,090	0.17	0.23
S3	13.8	101.0	101.3	102.3	90.2	90.4	91.4	6.00	0.95	15.05	7.28	-0.66	23,750	18,770	0.22	0.23
S4	13.8	106.4	106.4	106.4	95.0	95.0	95.0	0.50	0.95	2.34	1.31	0.92	13,510	9,600	0.33	0.35
S5	13.5	106.3	106.4	106.8	94.9	95.0	95.3	2.00	0.97	7.96	2.62	0.92	21,330	16,140	0.17	0.27
S6	13.7	106.3	106.4	107.3	94.9	95.0	95.8	6.00	0.95	19.35	4.00	0.34	29,150	24,740	0.20	0.27

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TABLE 3 - CONSOLIDATED-UNDRAINED ($\bar{R}$) TRIAXIAL TESTS
STRUCTURAL BACKFILL - BEARD PIT 5 SAND
SEABROOK STATION

Test No.	Initial Water Content	Dry Unit Weights: In Compaction Mold	Dry Unit Weights: In Triaxial Cell, Initial	Dry Unit Weights: In Triaxial Cell, After Consolidation	Percent Compaction, P, ASTM D1557, A: In Compaction Mold	Percent Compaction, P, ASTM D1557, A: In Triaxial Cell, Initial	Percent Compaction, P, ASTM D1557, A: In Triaxial Cell, Consolidation	Effective Consolidation Stress σ_{3c}	B Value	At Maximum Compressive Stress: Deviator Stress $(\sigma_1 - \sigma_3)$	At Maximum Compressive Stress: Axial Strain ε_a	At Maximum Compressive Stress: Effective Minor Principal Stress $\bar{\sigma}_3$	Moduli: Initial E_o	Moduli: At 50% Maximum Stress E_{50}
	%	p pcf	c	f pcf				ksc		ksc	%	ksc	psi	psi
$\bar{R}1$	13.7	101.0	101.2	101.2	90.2	90.4	90.4	0.50	0.96	6.86	9.53	2.63	5,830	3,130
$\bar{R}2$	13.5	100.6	100.6	100.9	89.8	89.8	90.1	2.00	0.90	7.94	8.33	3.11	12,730	5,760
ii3	13.8	100.8	101.1	102.2	90.0	90.3	91.2	6.00	0.99	11.32	6.69	4.46	38,110	18,630
$\bar{R}7$	13.6	101.0	101.2	102.3	90.2	90.4	91.3	6.00	0.95	12.24	5.73	4.77	24.460	19,050
$\bar{R}4$	13.8	106.3	106.5	106.5	94.9	95.1	95.1	0.50	0.95	19.91	13.83	7.23	11,870	7,180
ii5	13.6	106.3	106.3	106.6	94.9	94.9	95.2	2.00	0.95	21.87	14.53	7.93	19,770	8,390
$\bar{R}6$	13.5	106.3	106.4	107.2	94.9	95.0	95.7	6.00	0.96	27.88	11.58	io.35	44,010	14,220

TABLE 4 - UNCONFINED TESTS ON 2-IN. CUBE SAMPLES OF SAND-CEMENT, 5% CEMENT SEABROOK STATION

Cure Time days	Test No.	Unit Weight Wet pcf	Unconfined Strength psi	Strain At Peak %	Modulus of Elasticity* psi
7	7-1	124.0	66.7	0.80	10,600
	7-2	123.9	72.5	0.92	10,110
	7-3	126.2	85.3	0.83	13,650
			Avg 74.8		Avg 11,450
28	28-1	127.4	141.6	0.67	33,330
	28-2	126.2	133.8	0.77	19,130
	28-3	126.8	130.0	0.87	22,760
			Avg 135.0		Avg 25,070
90	90-1				
	90-2				
	90-3				

*Modulus computed for the straight line portion of the stress-strain curve, neglecting any curvature at origin, which may be affected by initial seating strains.

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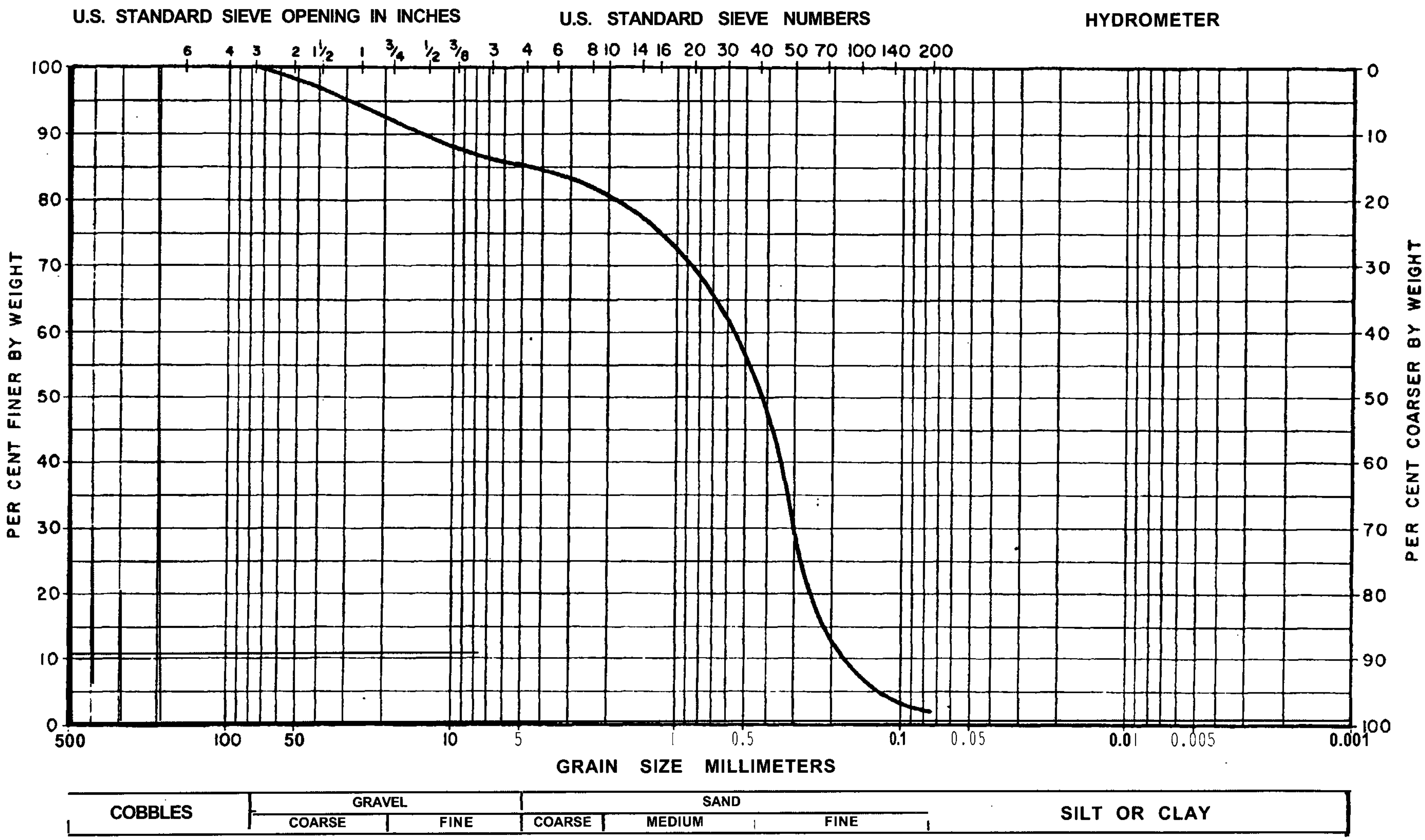
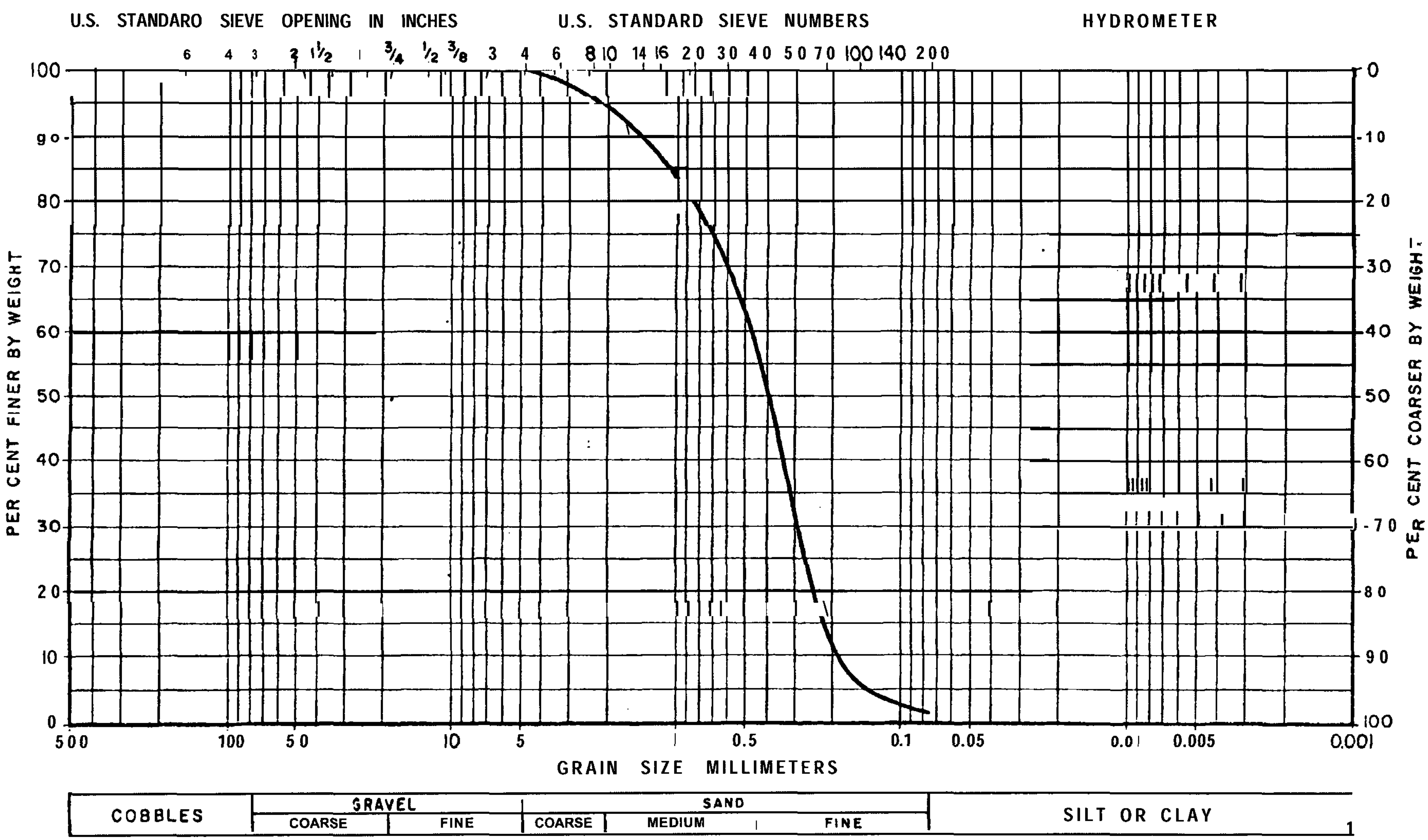
FIGURES

Lab. 4-3 rev. 0 28 May 74

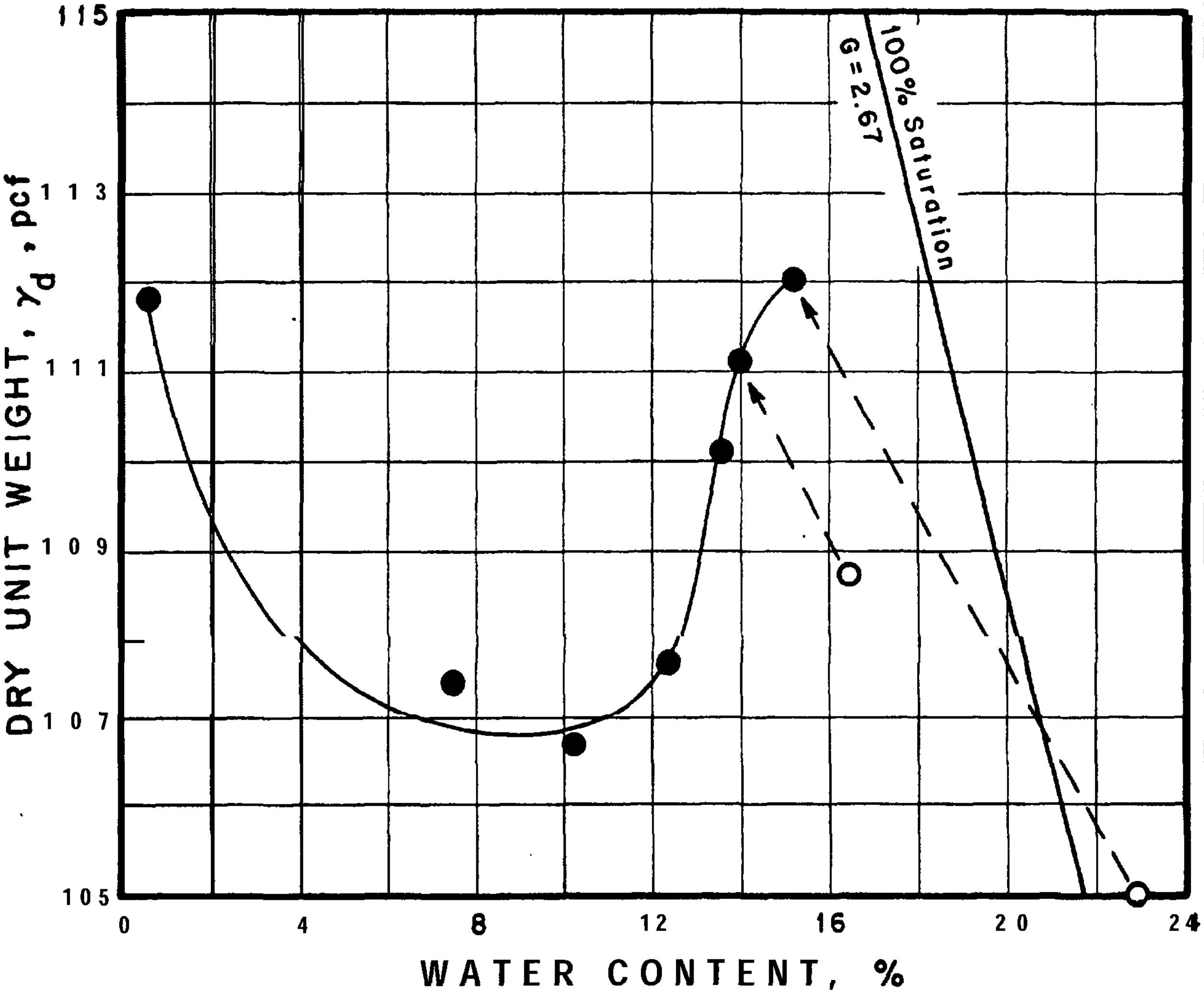


Public Service Company of New Hampshire	Triaxial Tests Structural Backfill	GRAIN-SIZE DISTRIBUTION BEARD PIT NO. 5 SOIL
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	Jan. 23, 1978 Fig. 1

Lab. 4-3 rev. 0 28 May 74



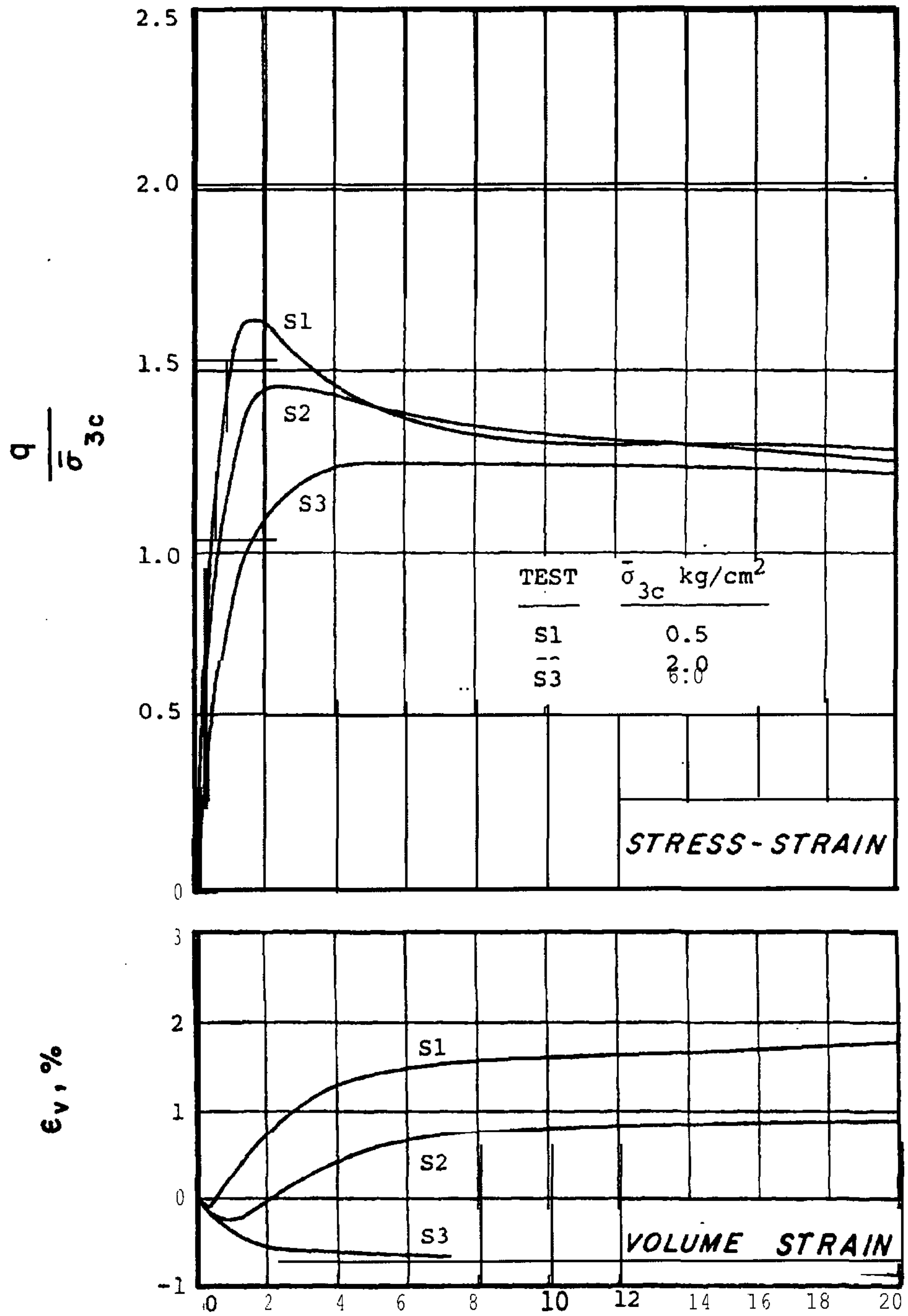
Public Service Company of New Hampshire	Triaxial Tests Structural Backfill	GRAIN-SIZE DISTRIBUTION BEARD PIT NO. 5 SAND - NO. 4 MATERIAL
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77306	Jan. 23, 1978 Fig. 2



● As mixed before compaction

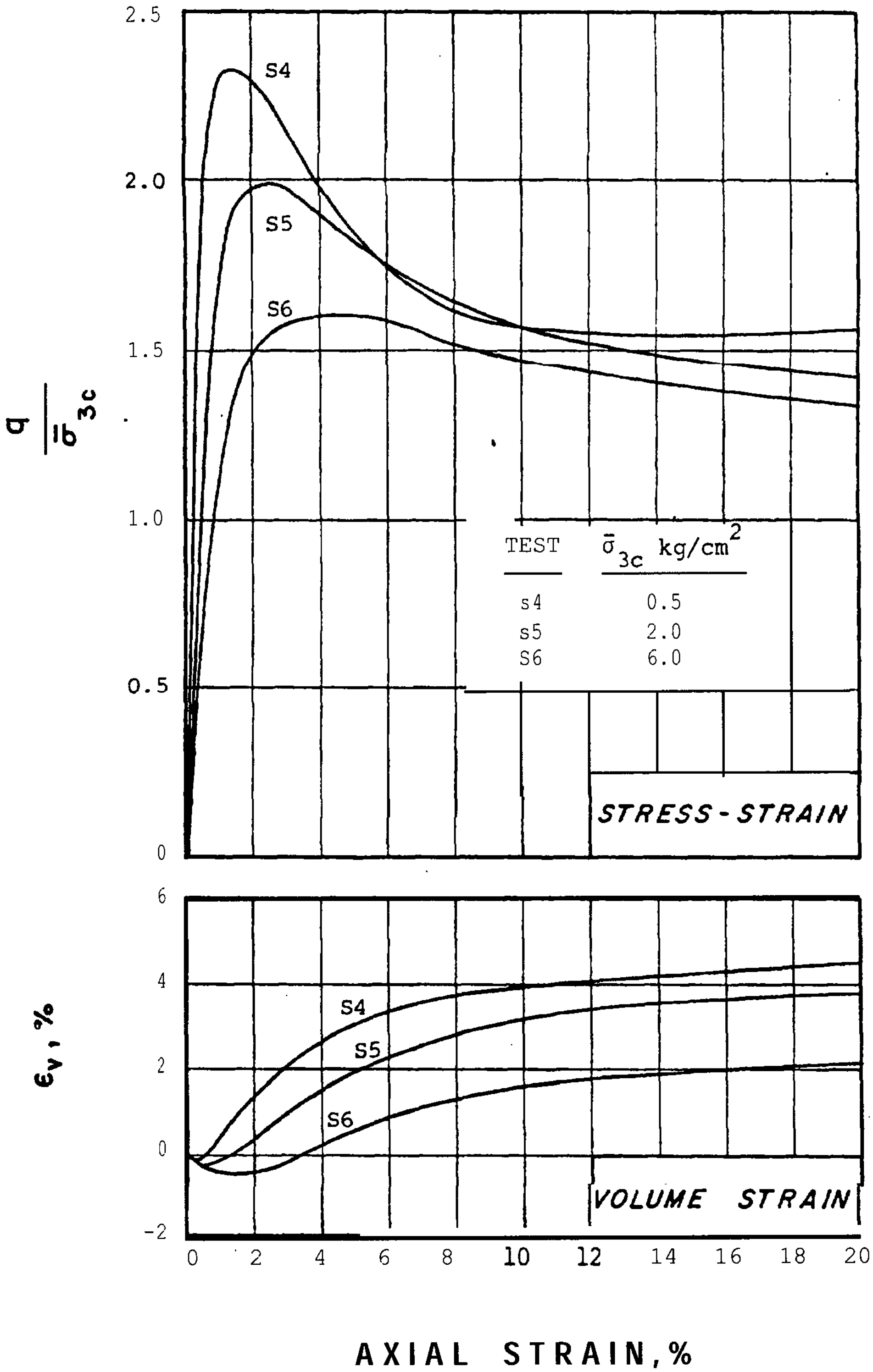
O After compaction

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	MOISTURE - DENSITY RELATION TEST BEARD PIT No.5 SOIL
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	January 23, 1978 Fig. 3

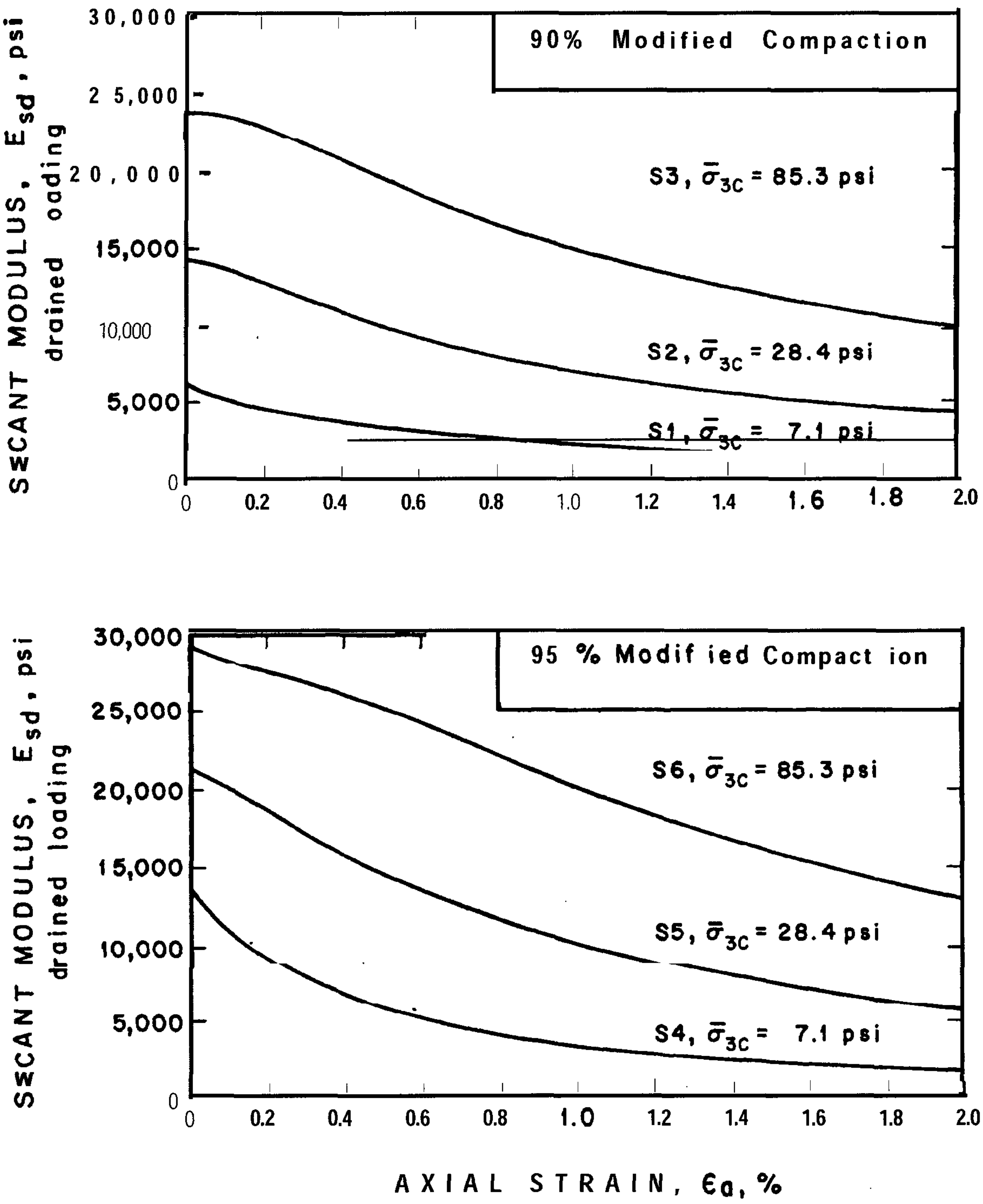


AXIAL STRAIN, %

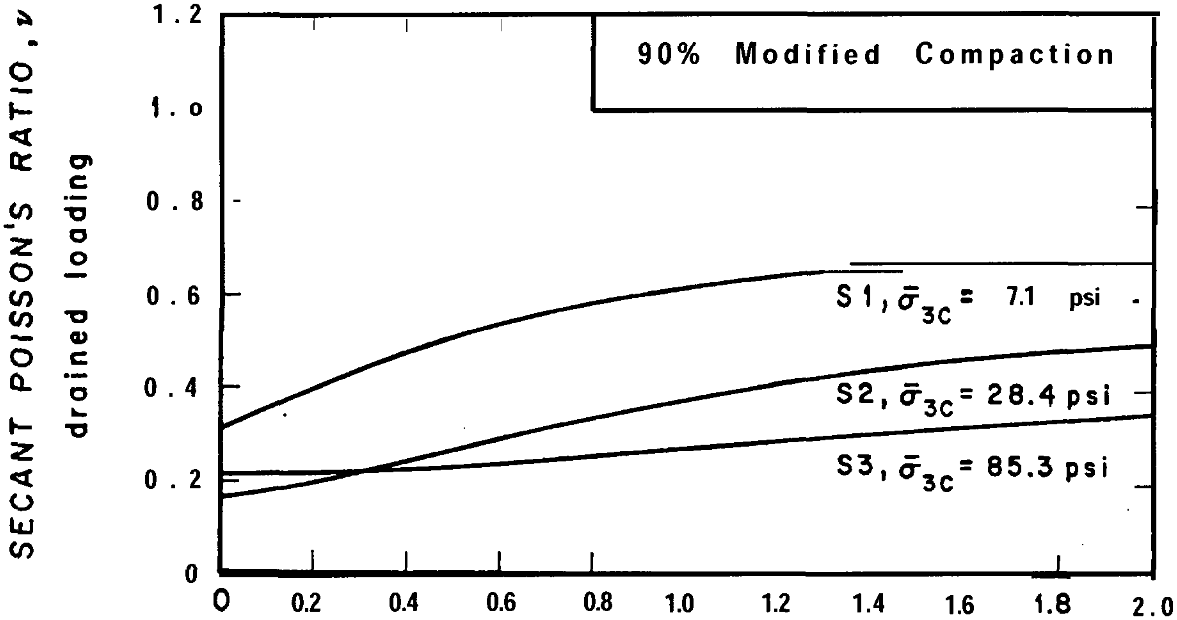
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	SUMMARY OF CONSOLIDATED-DRAINED TRIAXIAL TESTS 90% COMPACTION
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77366	DECEMBER, 1977 FIG. 4

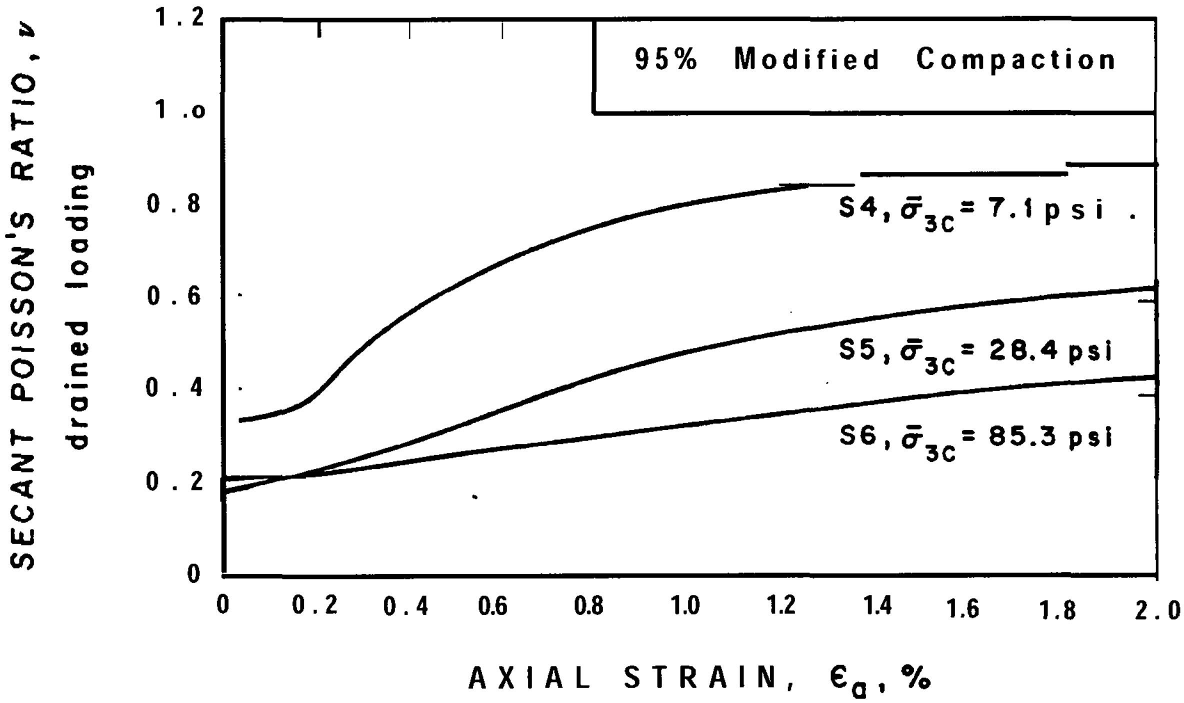


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	SUMMARY OF CONSOLIDATED-DRAINED TRIAXIAL TESTS 95% COMPACTION
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. 5

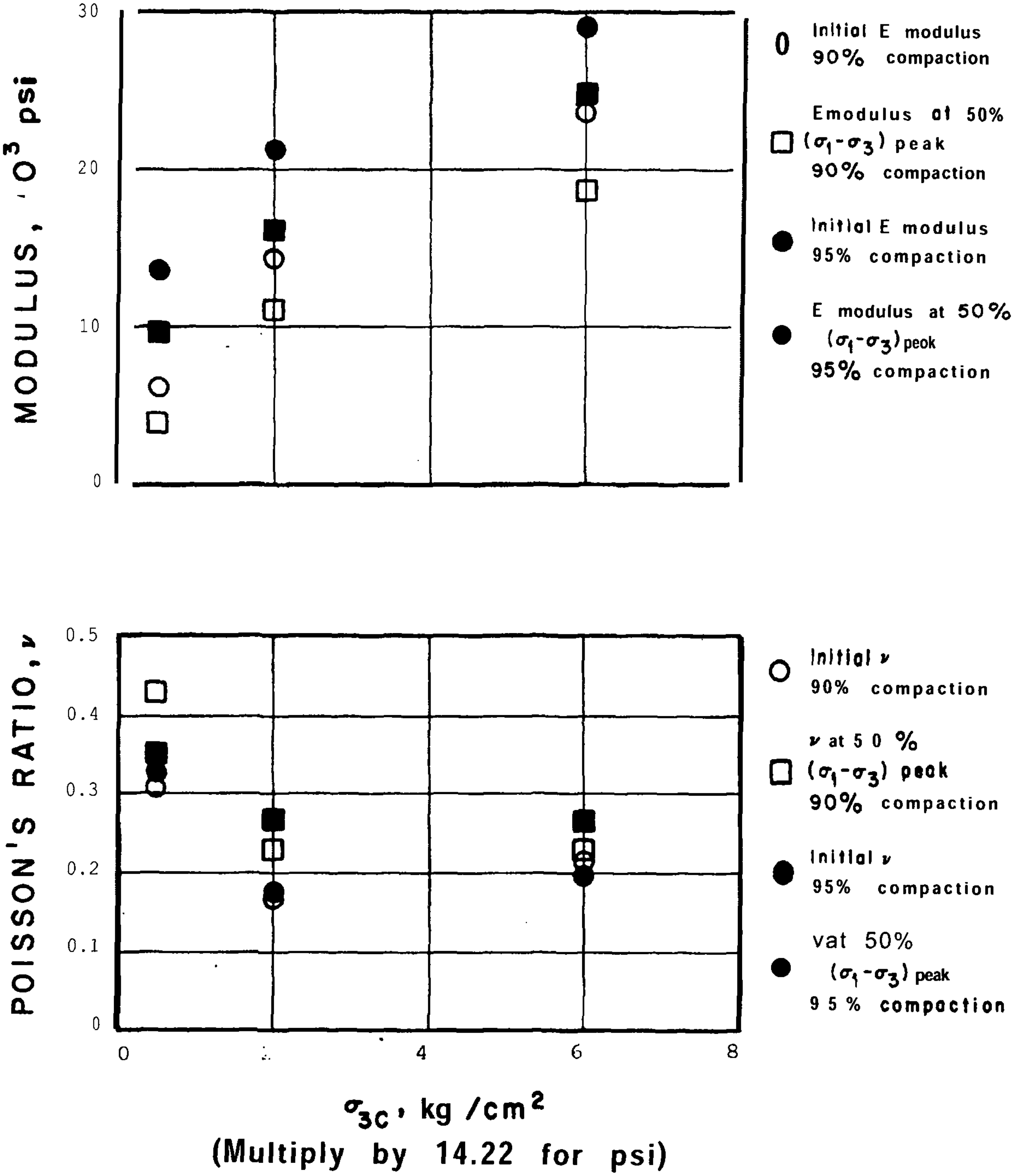


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	MODULI FOR DRAINED LOADING
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	JANUARY 23, 1978 Fig.6

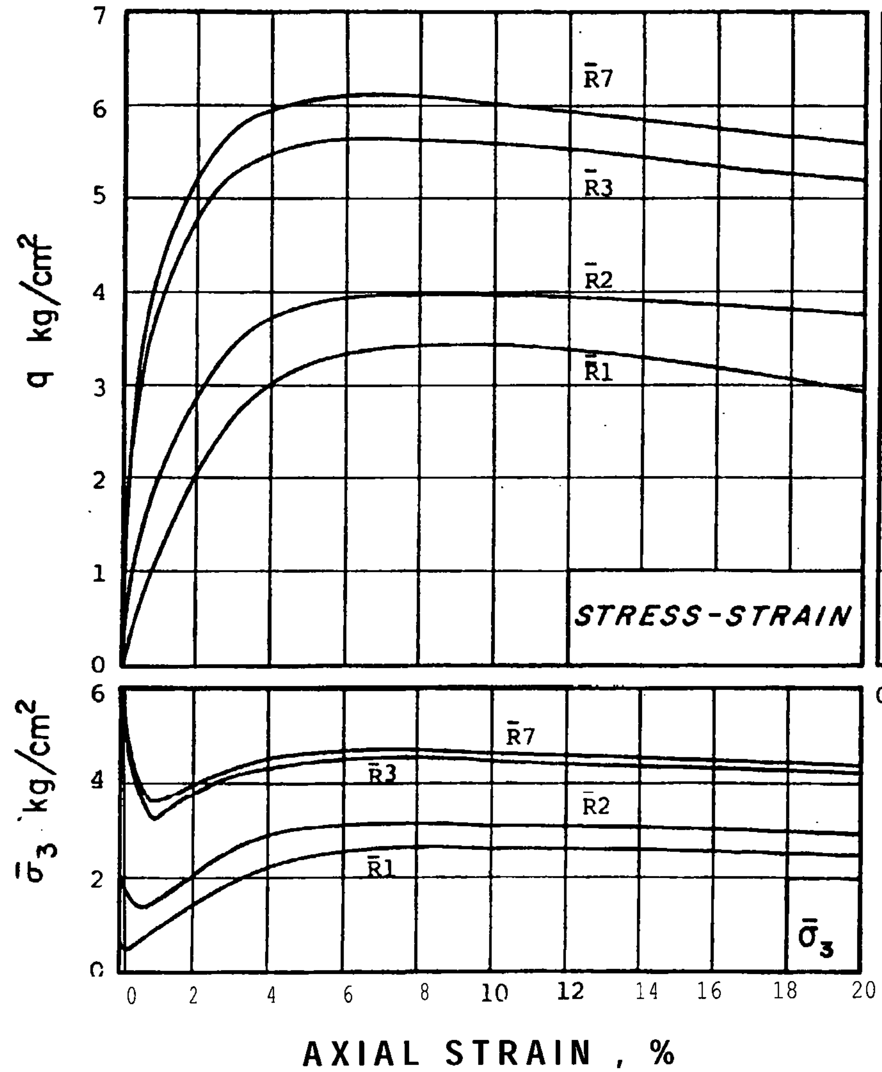


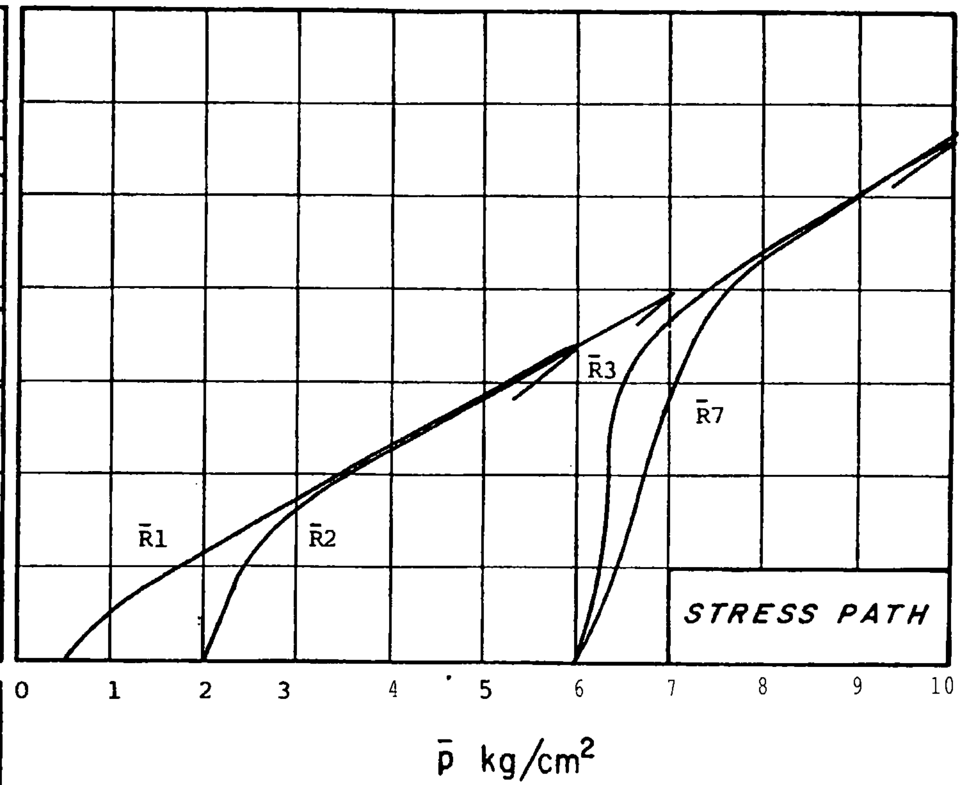


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	POISSON'S RATIOS FOR DRAINED LOADING
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	JANUARY 23,1978 Fig. 7



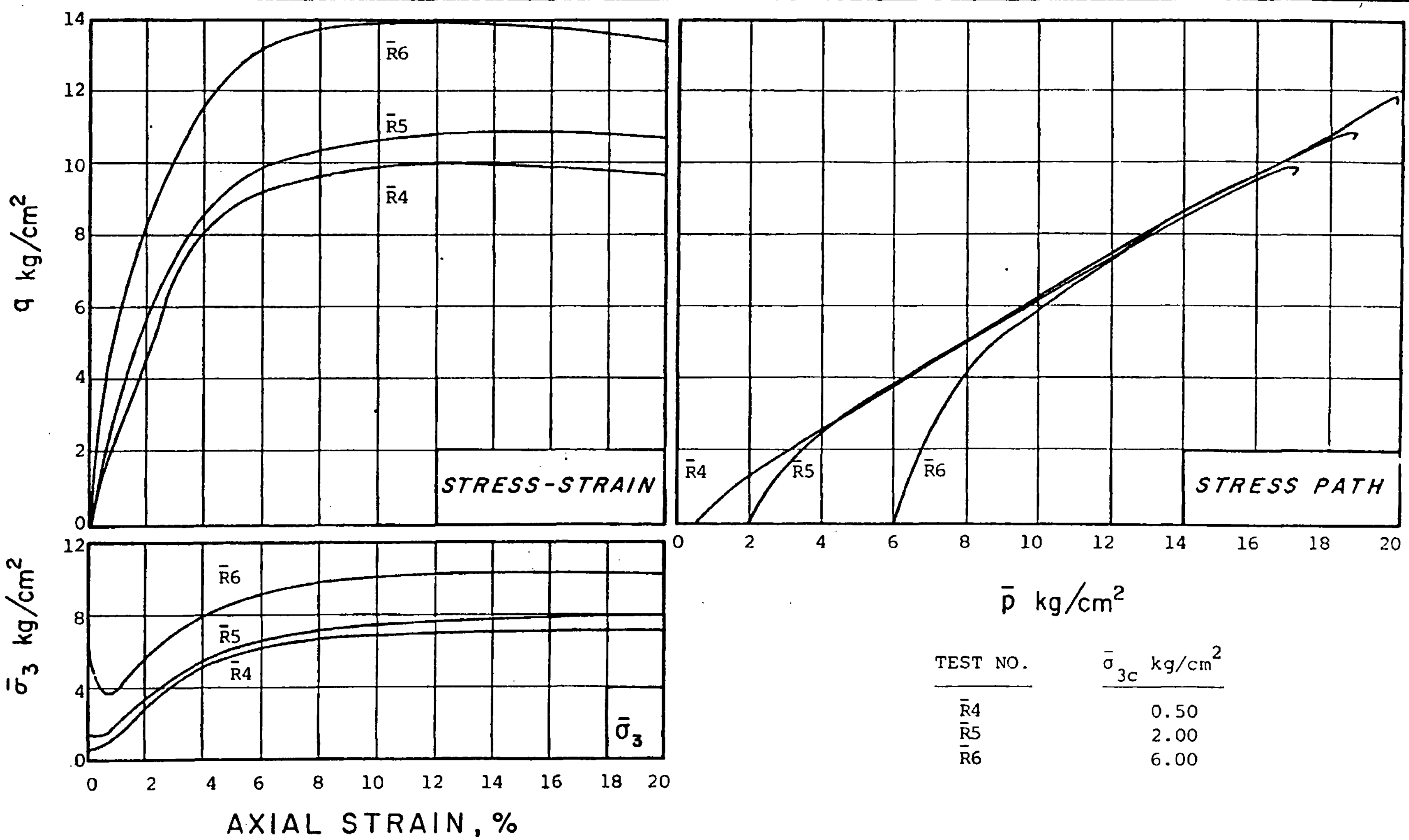
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL L L	SUMMARY OF CONSOLIDATED-DRAINED TRIAXIAL TESTS
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER,1977 FIG. 8





TEST NO.	σ_{3c} kg/cm^2
R̄1	0.50
R̄2	2.00
R̄3	6.00
R̄7	6.00

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	SUMMARY OF CONSOLIDATED-UNDRAINED TRIAXIAL TESTS 90% COMPACTION
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. 9



TEST NO.	$\bar{\sigma}_{3c}$ kg/cm^2
$\bar{R}4$	0.50
$\bar{R}5$	2.00
$\bar{R}6$	6.00

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

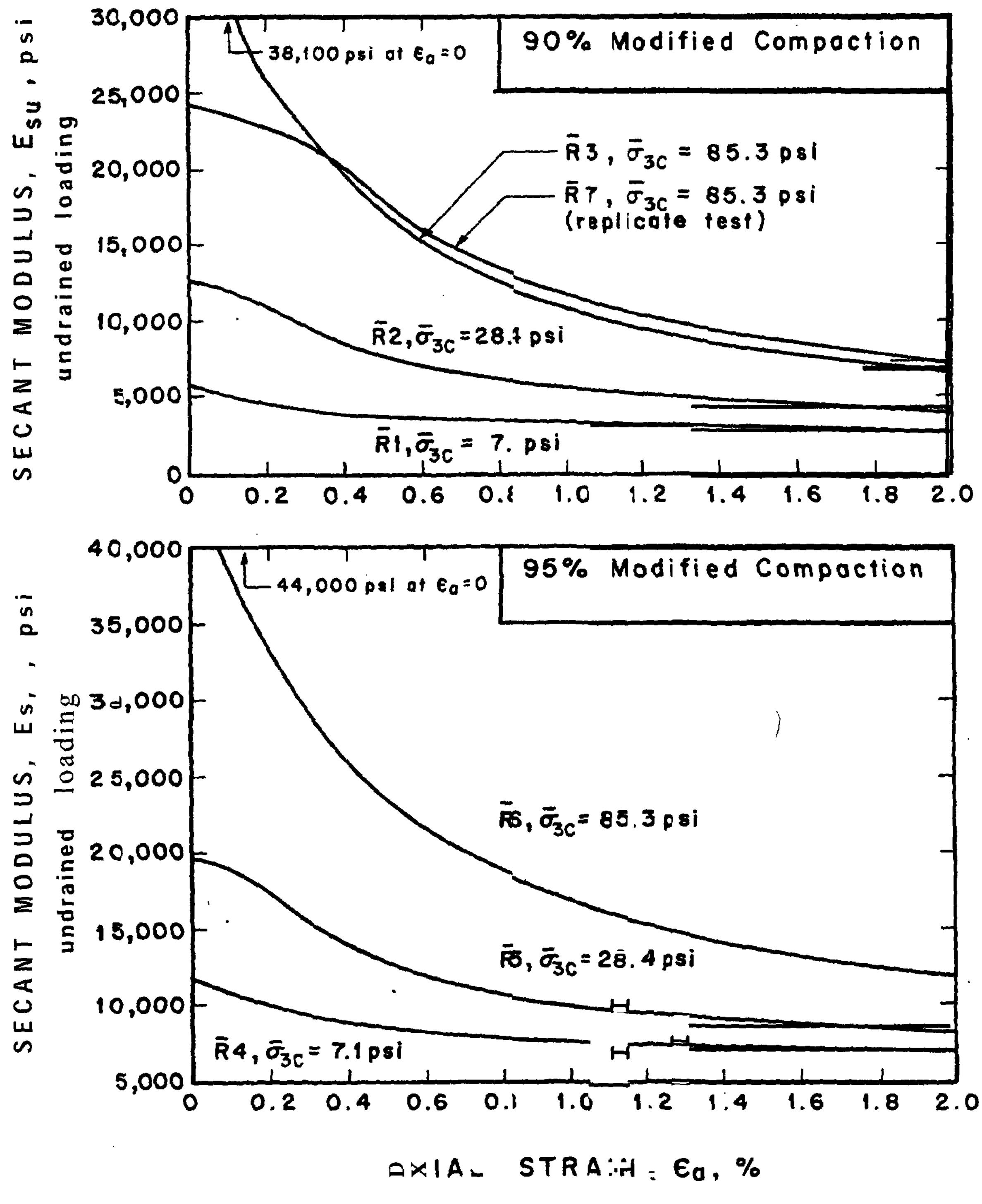
GEOTECHNICAL ENGINEERS INC.
WINCHESTER, MASSACHUSETTS

TRIAXIAL TESTS
STRUCTURAL BACKFILL

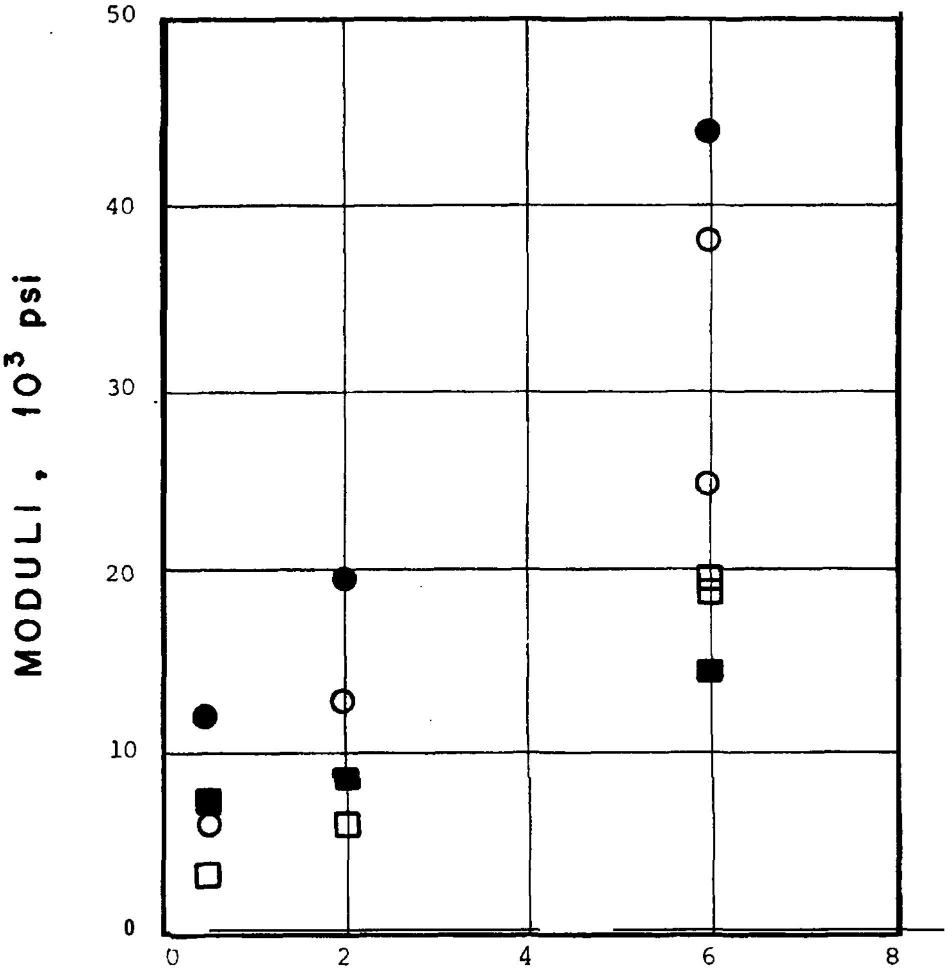
PROJECT 77386

SUMMARY OF CONSOLIDATED-UNDRAINED TRIAXIAL TESTS
95% COMPACTION

DECEMBER, 1977 FIG. 10



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	MODULI FOR UNDRAINED LOADING
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	JANUARY 23, 1978 Fig. 11



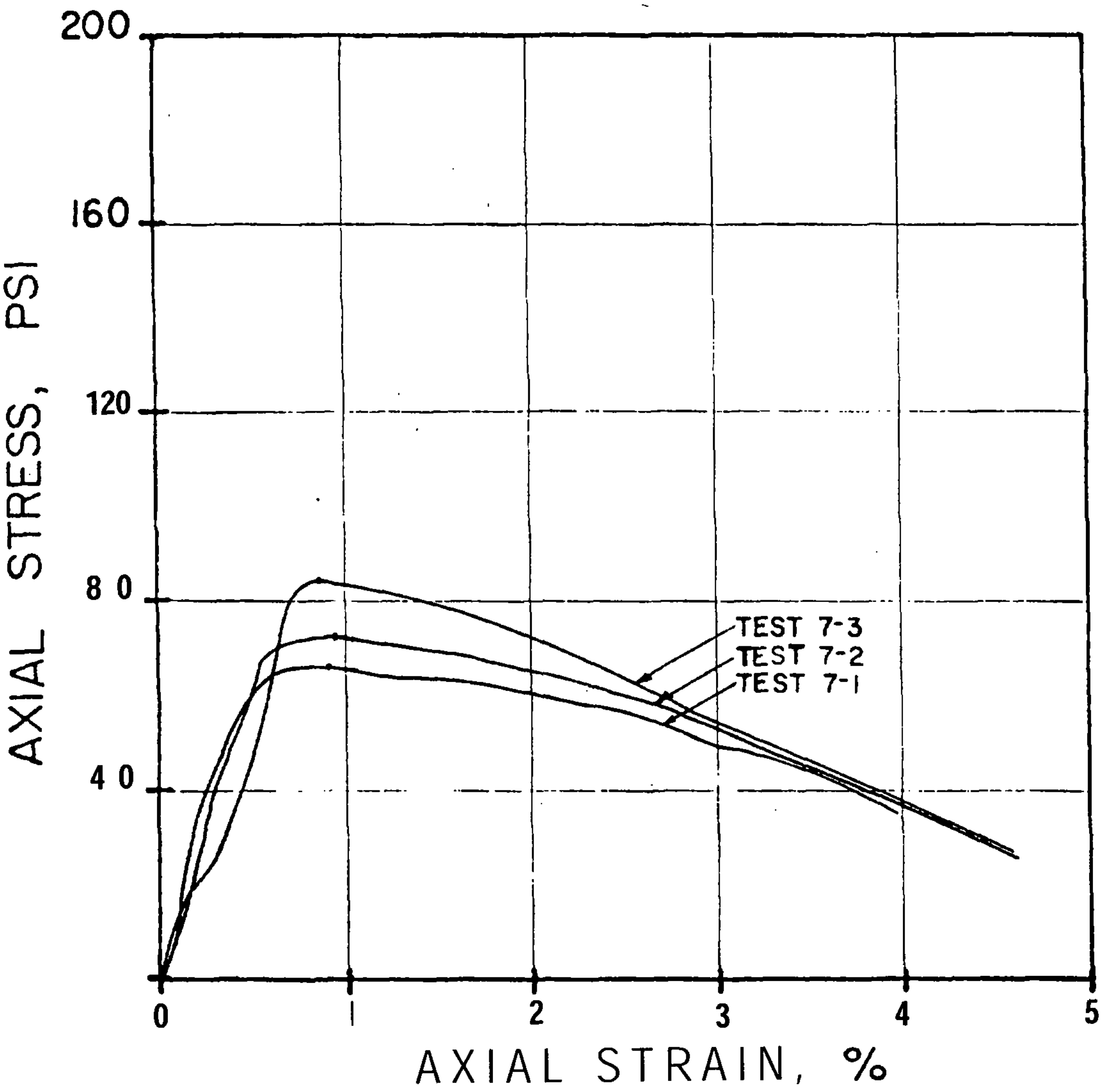
$\bar{\sigma}_{3C}$, ksc

(Multiply by 14.22 for psi)

0'	E_0	90% Compaction
□	E_{50}	90% Compaction
●	E_0	95% Compaction
●	E_{50}	95% Compaction

NOTE POISSON'S RATIO FOR UNDRAINED TESTS MAY BE TAKEN AS 0.49 TO 0.50

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	SUMMARY OF MODULI FOR CONSOLIDATED-UNDRAINED TESTS
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. 12



Sand-Cement Mixture (by weight):

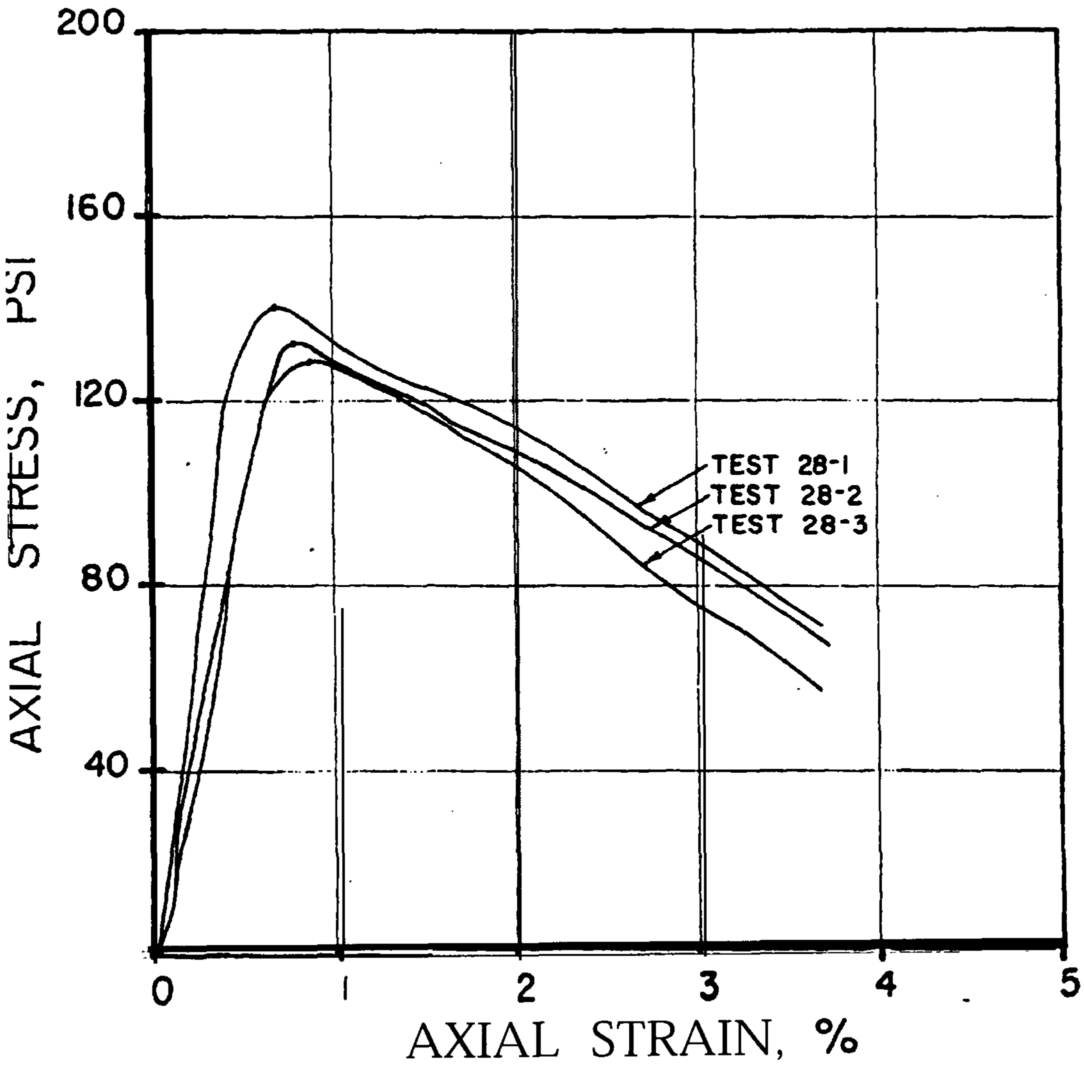
1 part cement
16.18 parts sand (oven-dry)
2.79 parts water

Prepared as per ASTM C305

Specimens Tested:

2 in. cube specimens
Cured 7 days
Unit weight after cure (pcf)
7-1 124.0
7-2 123.9
7-3 126.2
Strain control. loading at 1.5 mm/min

Public Service Company of New Hampshire	Triaxial Tests Sand-Cement Backfill Seabrook Station	COMPRESSION TESTS 7-DAY CURE 5% CEMENT
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	January 1978 Fig. 13



Sand-Cement Mixture (by weight):

1 part cement
16.18 parts sand (oven-dry)
2.79 parts water

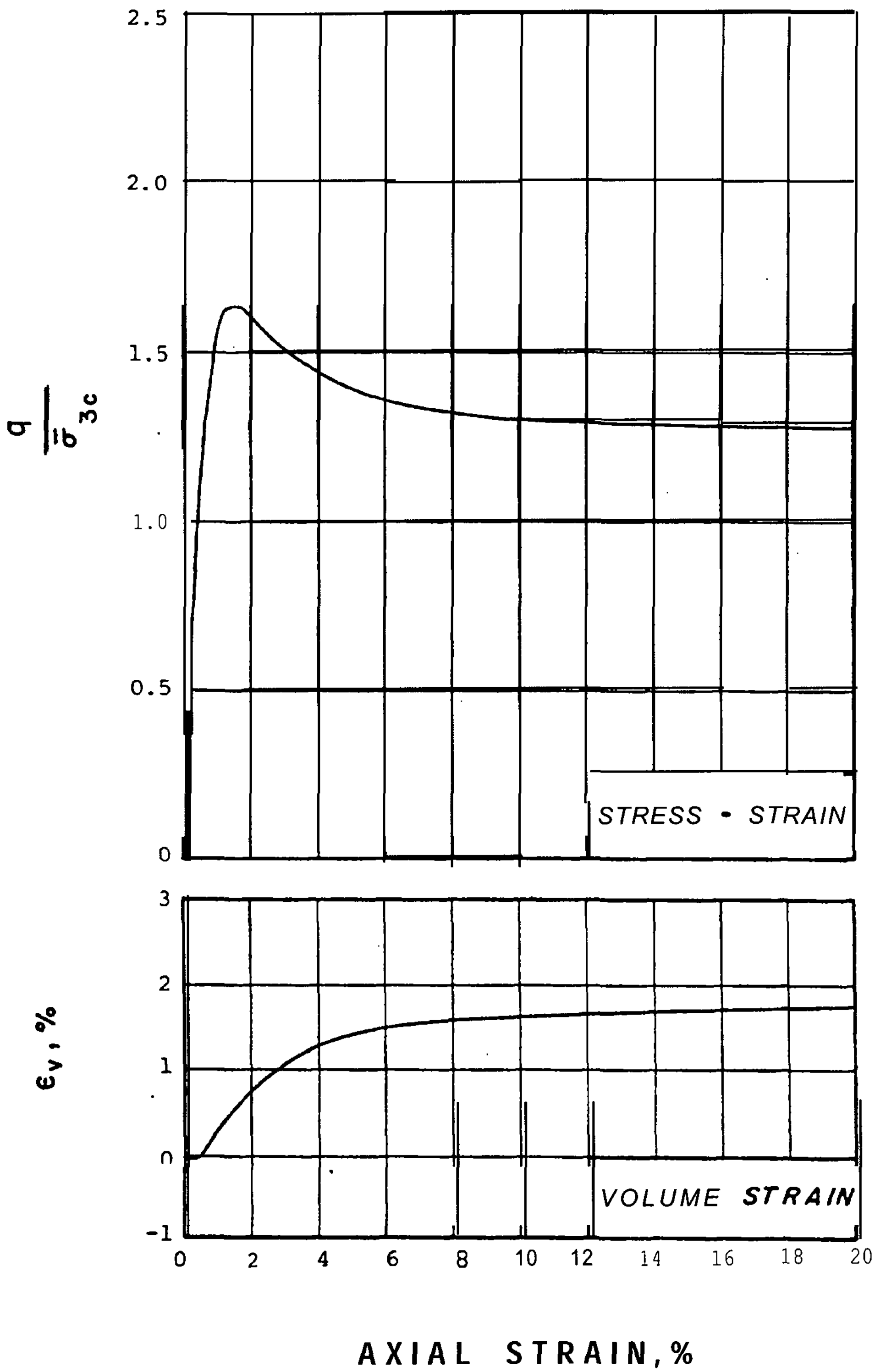
Prepared as per ASTM C305

Specimens Tested:

2 in. cube specimens
Cured 28 days
Unit weight after cure (pcf)
28-1 127.4
28-2 126.2
28-3 126.8
Strain control loading at 1.5 mm/min

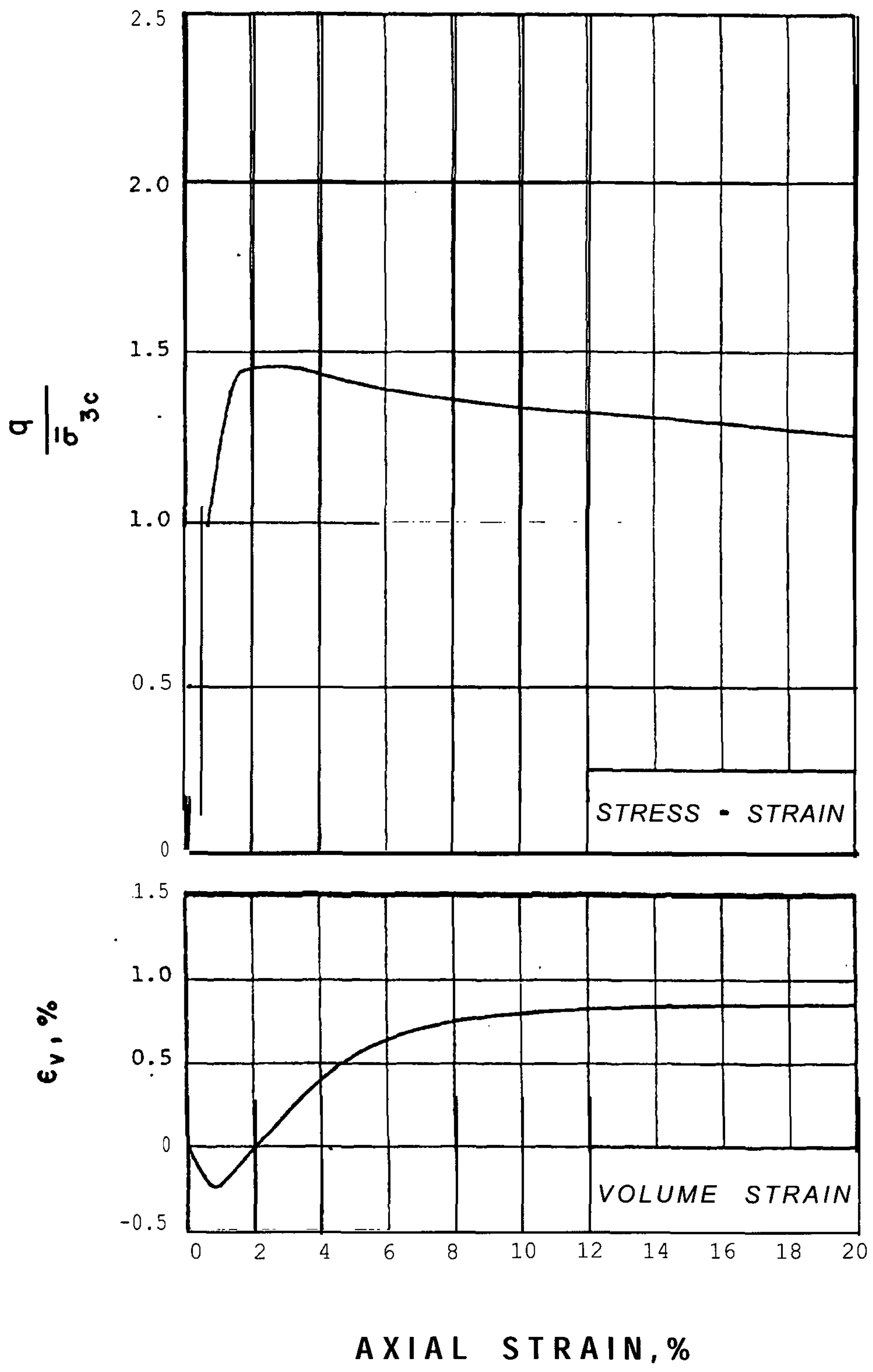
Public Service Company of New Hampshire	Triaxial Tests Sand-Cement Backfill Seabrook Station	COMPRESSION TESTS 28-DAY CURB 5% CEMENT
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	January 1978 Fig.14

APPENDIX A



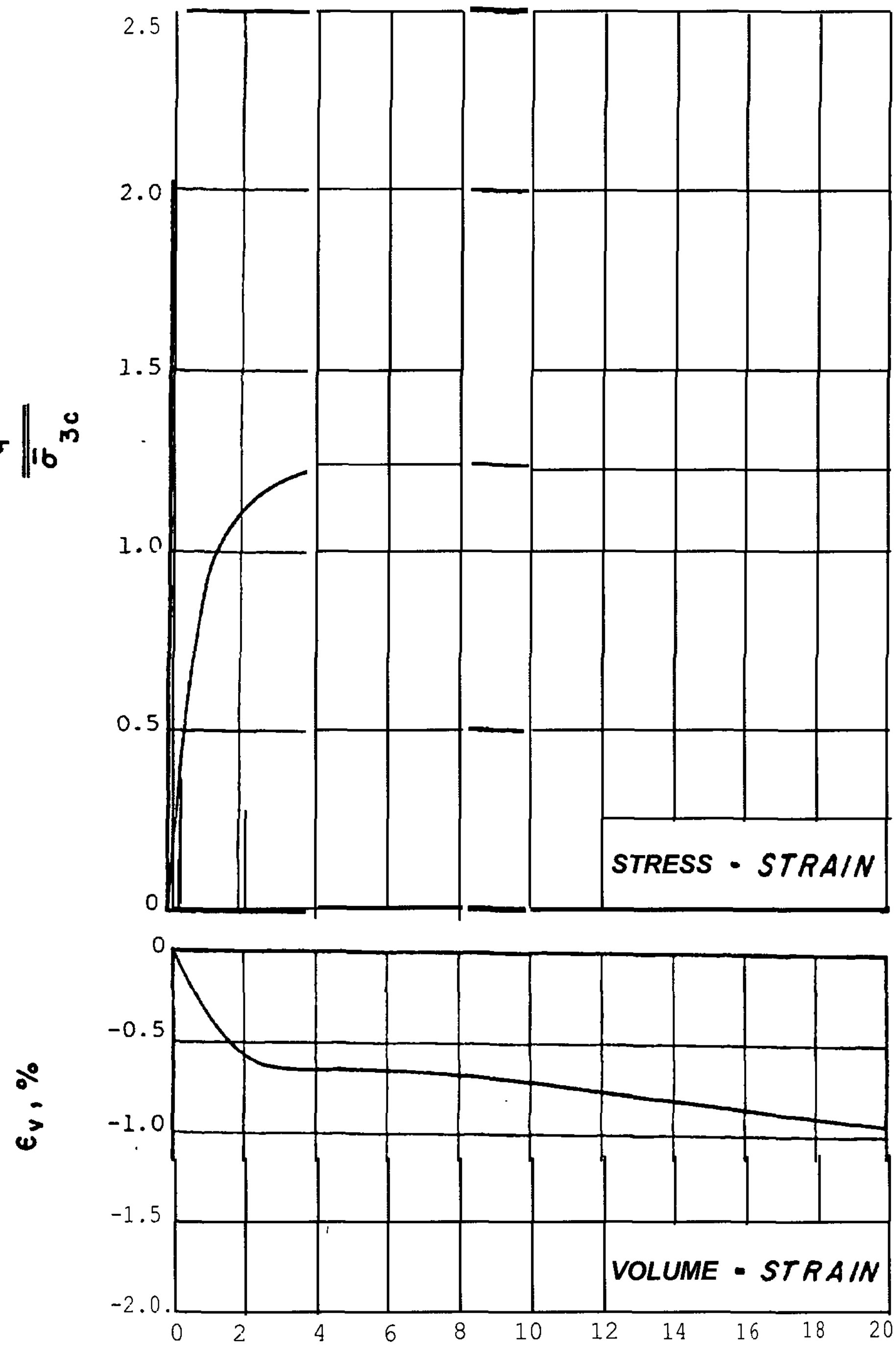
TEST S1 90% Compaction $\bar{\sigma}_{3c}$ = 0.5 kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACK FILL	CONSOLIDATED-DRAINED TRIAXIAL TEST S1
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A



TEST S2 **90% Compaction** $\bar{\sigma}_{3c}$ = 2.0 kg/cm^2

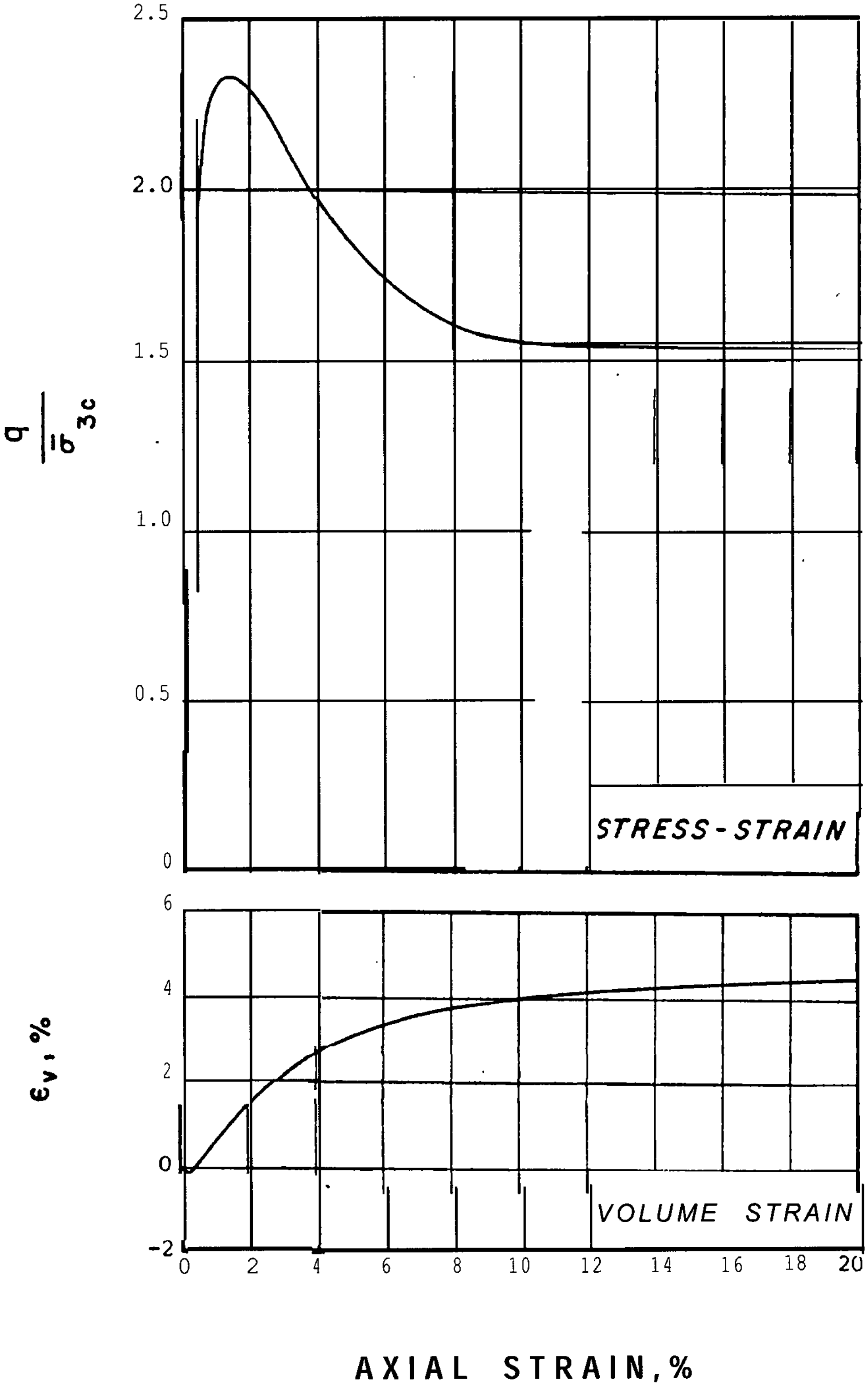
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	**CONSOLIDATED-DRAINED TRIAXIAL TEST S2**
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. **A2**



AXIAL STRAIN, %

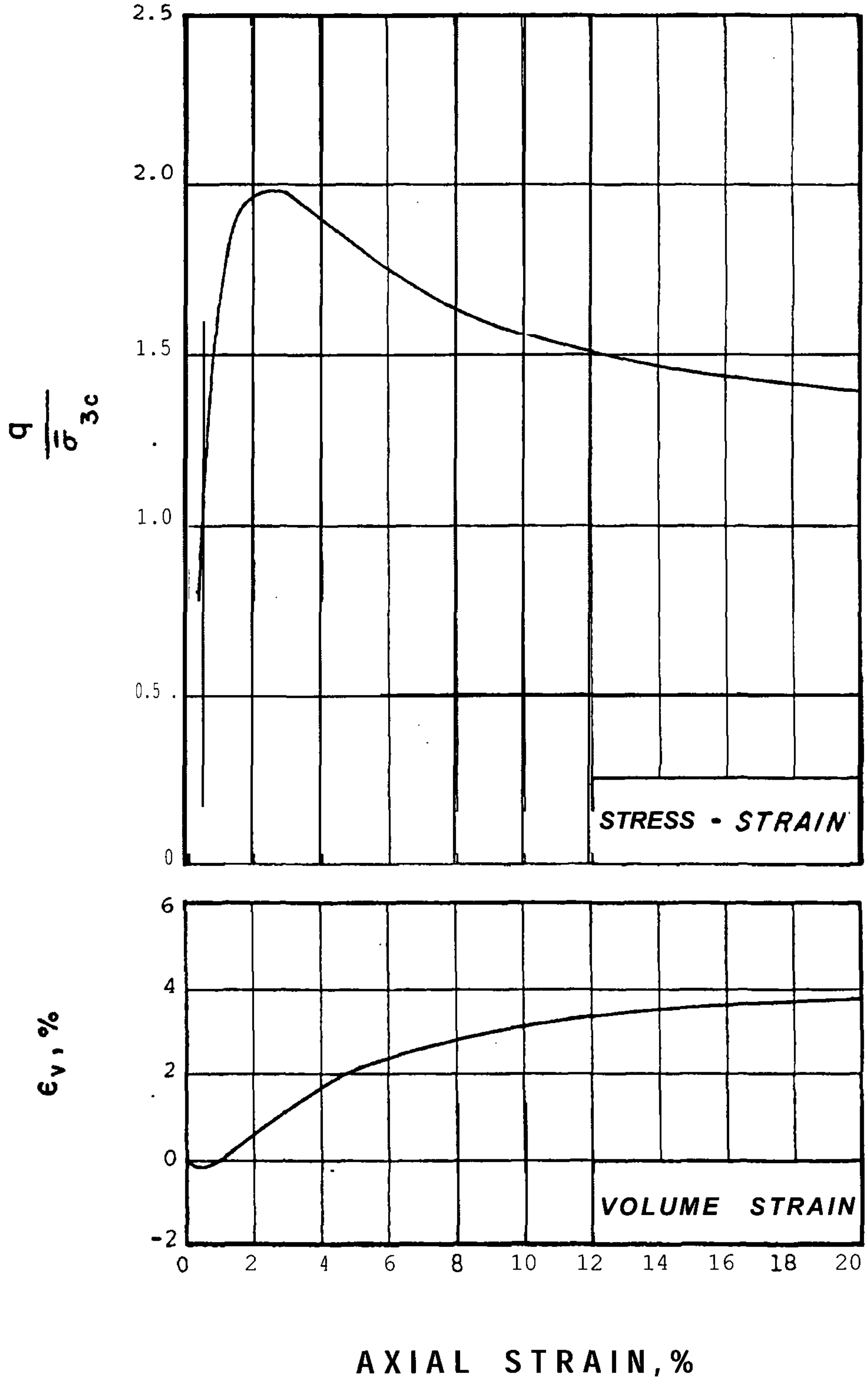
TEST S3 90% Compaction $\bar{\sigma}_{3c}$ = 6.0 kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-DRAINED TRIAXIAL TEST S3
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A3



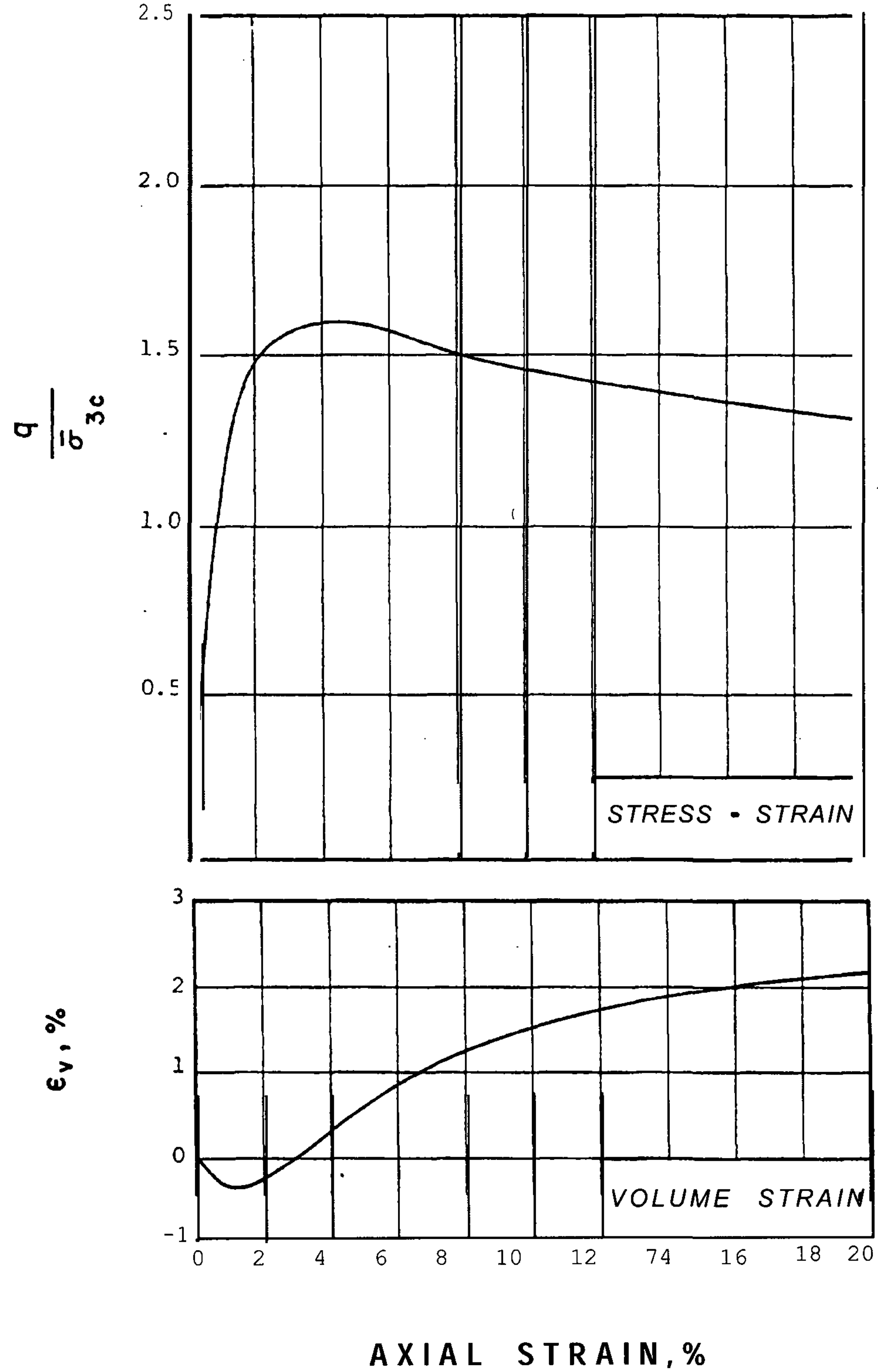
TEST S4 95% Compaction $\bar{\sigma}_{3c}$ = 0.5 kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-DRAINED TRIAXIAL TEST S4
GEOTECHNICAL ENGINEERS INC WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A4



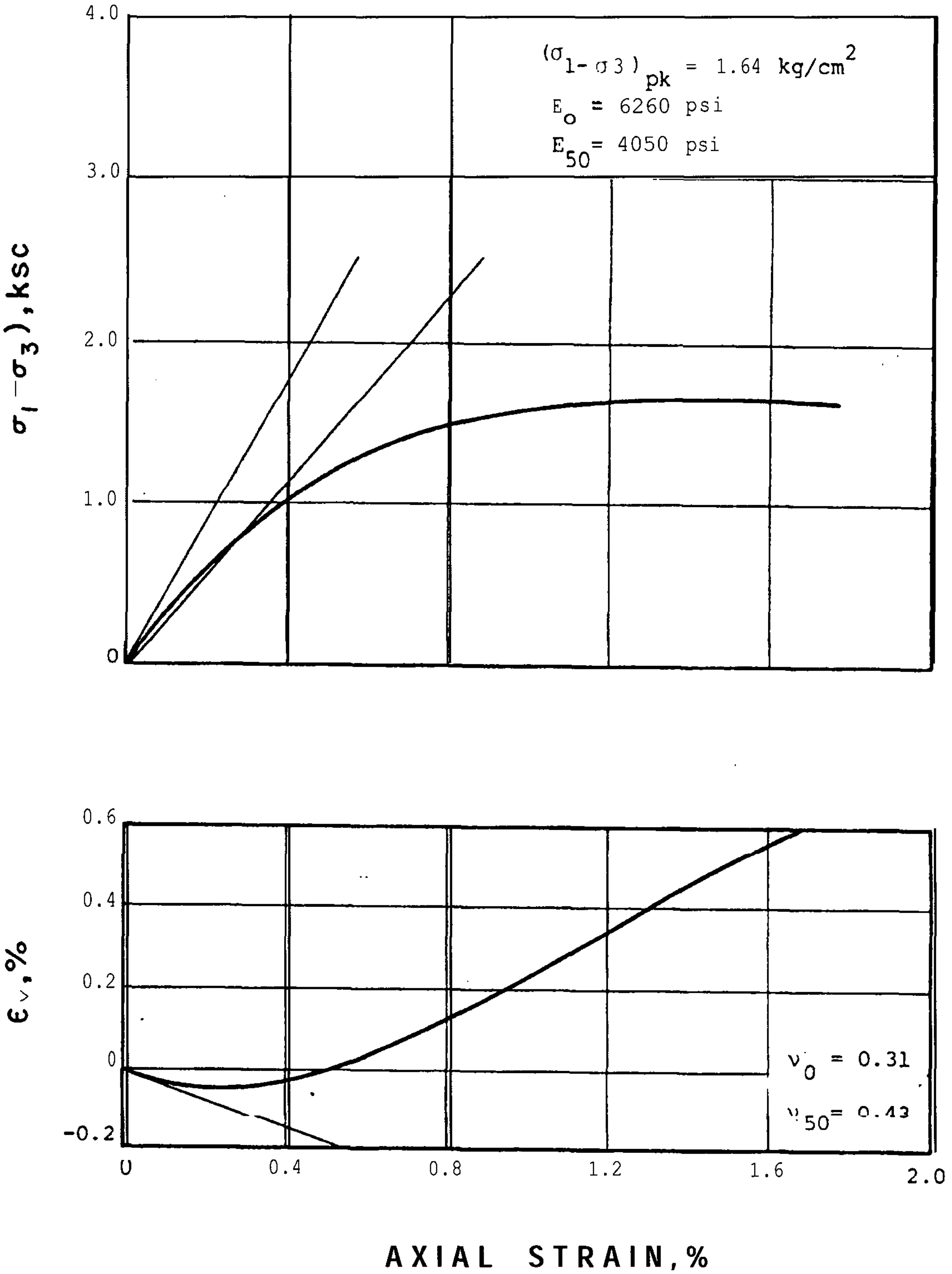
TEST S5 95% Compaction $\bar{\sigma}_{3c}$ = 2.0 kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-DRAINED TRIAXIAL TEST S5
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A5



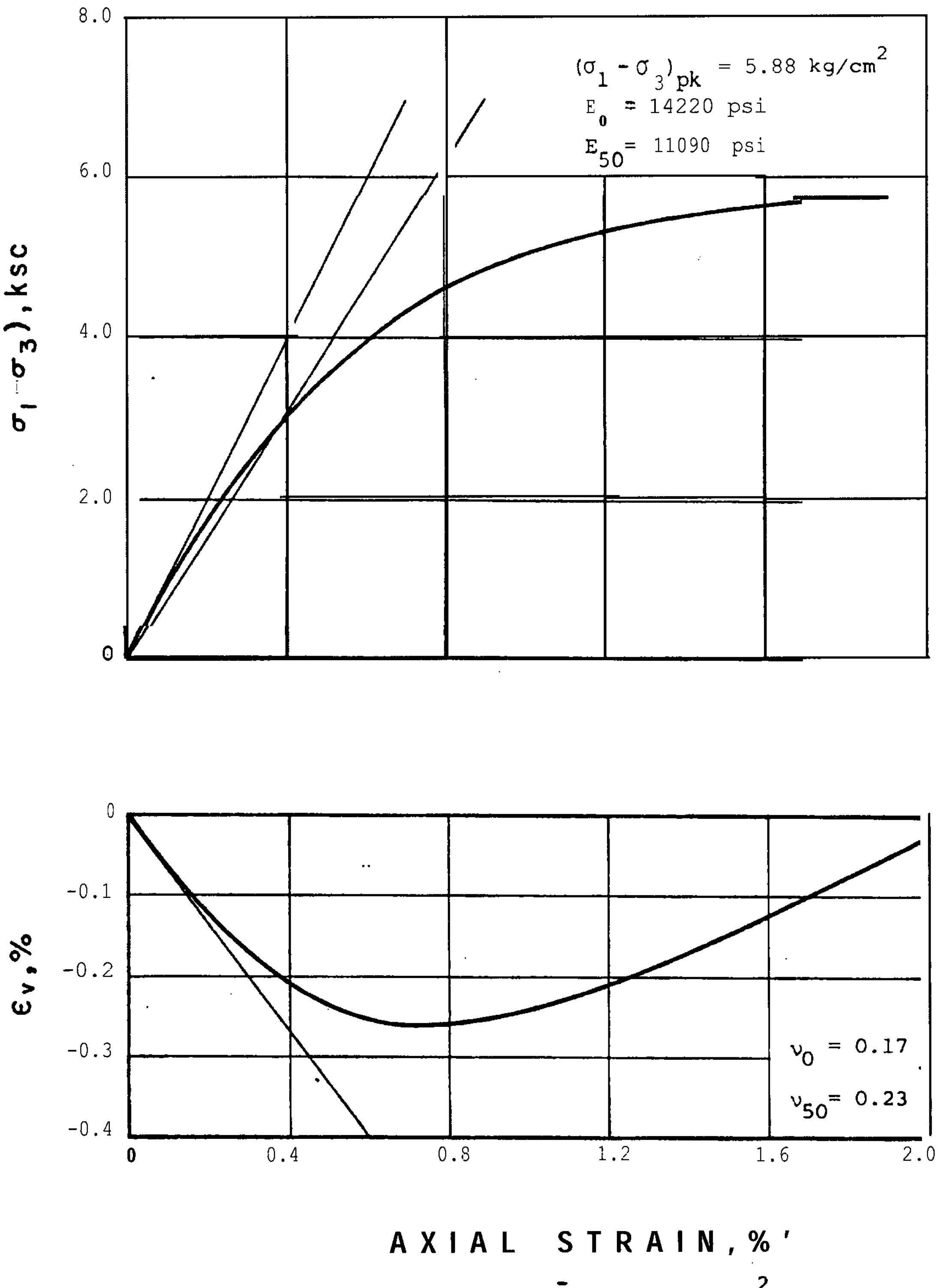
TEST S6 95% Compaction $\bar{\sigma}_{3c} = 6.0$ kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STR UCTURAL BACK FI LL	CONSOLIDATED-DRAINED TRIAXIAL TEST S6
SEOTECHNICAL ENGINEERS INC. VINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A6



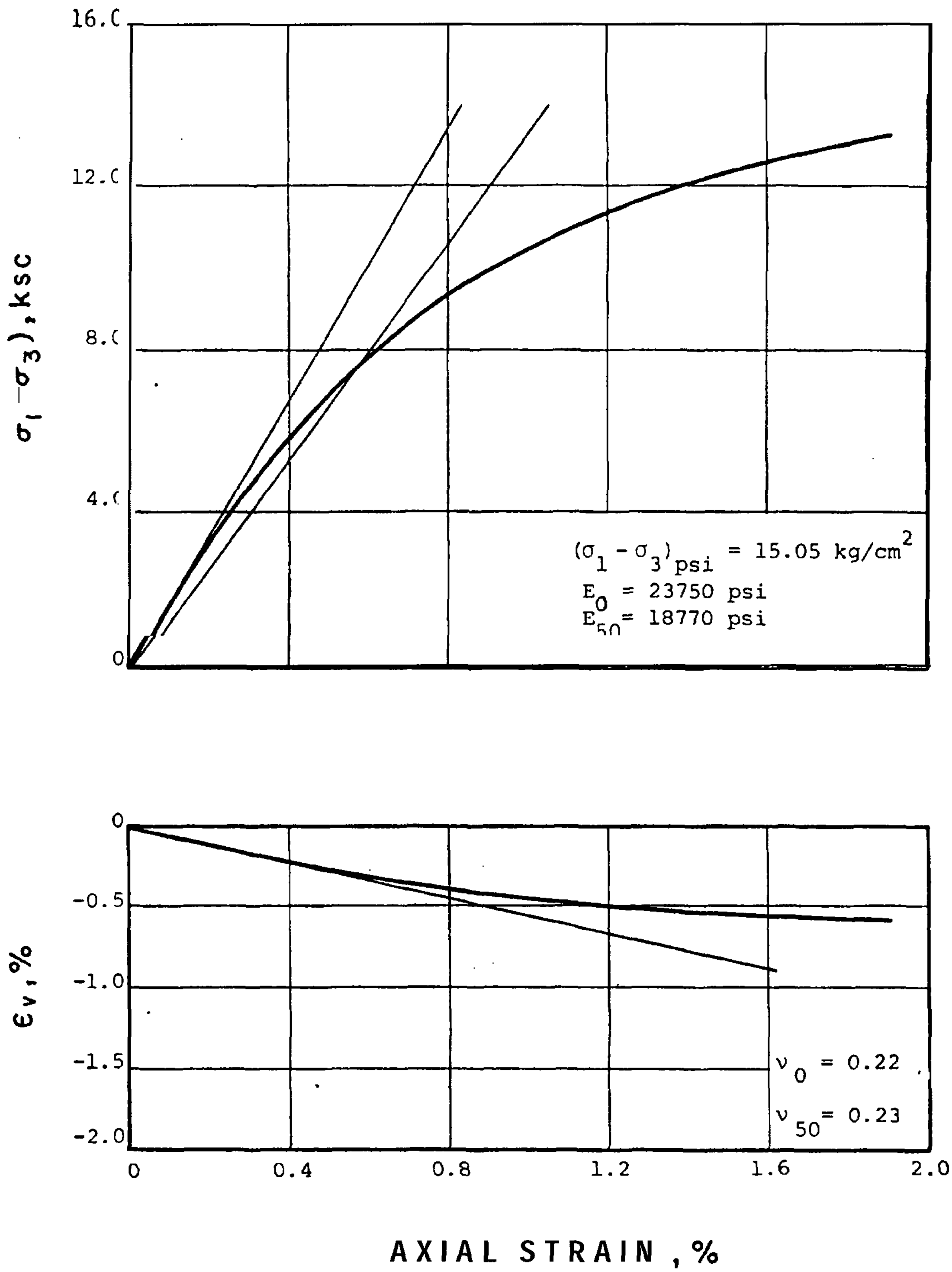
TEST S1 90% Compaction $\bar{\sigma}_{3c}$ = 0.5 kg/cm²

'UBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-DRAINED TRIAXIAL TEST S1 Expanded Scales
;EOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A7



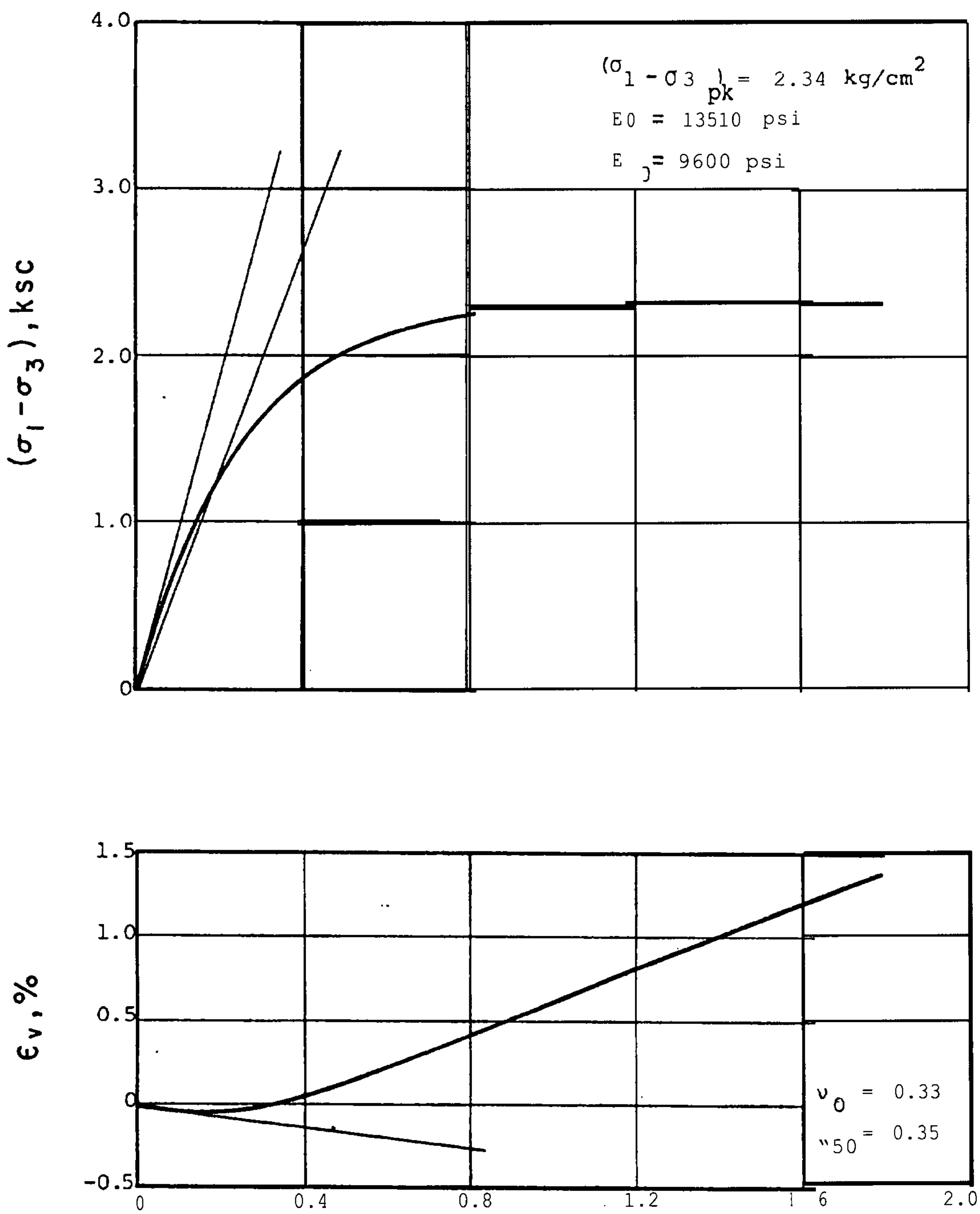
TEST S2 90% Compaction $\bar{\sigma}_{3c}$ = 2.0 kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-DRAINED TRIAXIAL TEST S2 Expanded Scales
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A8



TEST S3 90% Compaction $\bar{\sigma}_{3c}$ = 6.0 kg/cm^2

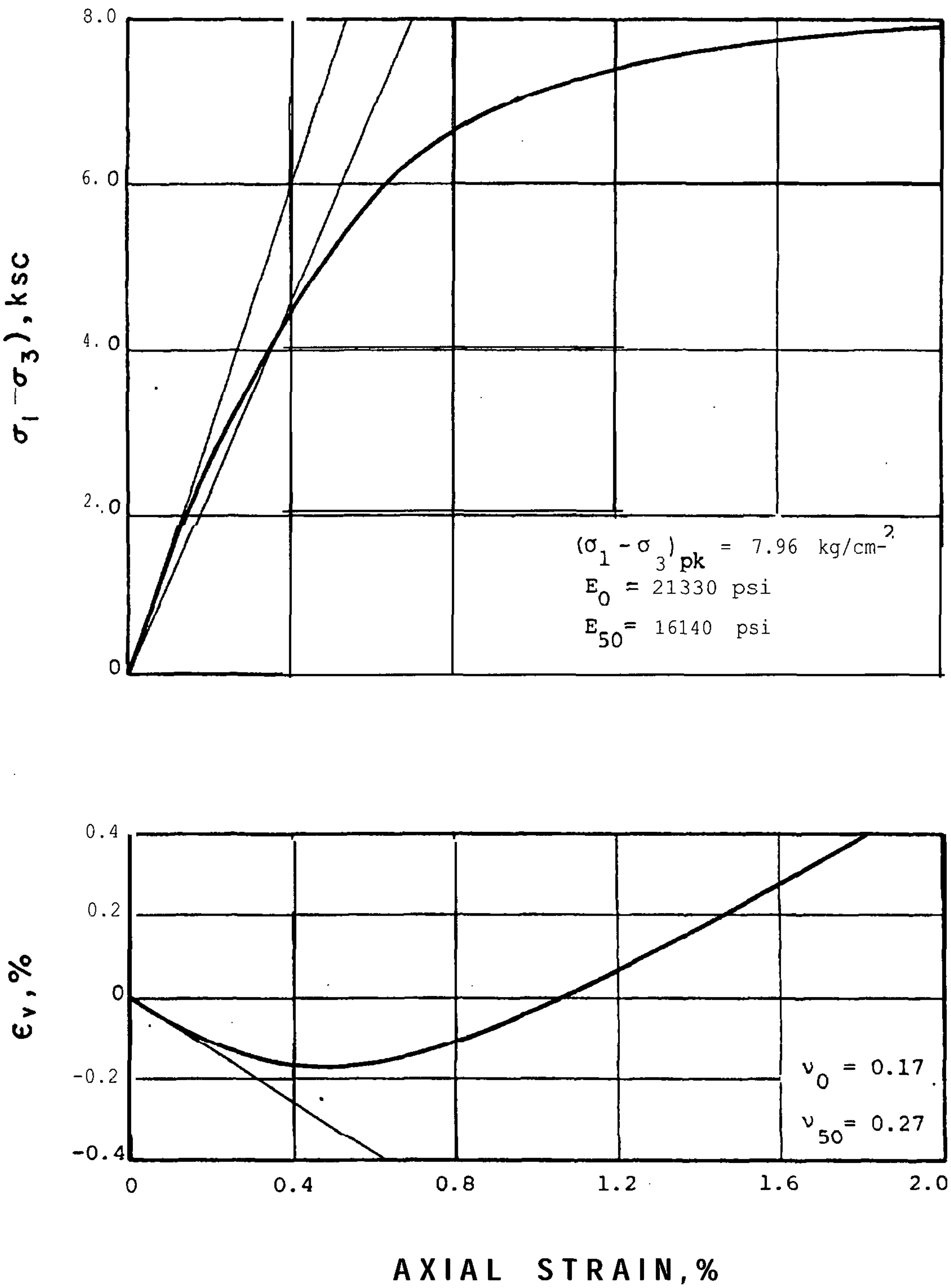
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-DRAINED TRIAXIAL TEST S3 Expanded Scales
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A9



AXIAL STRAIN, %

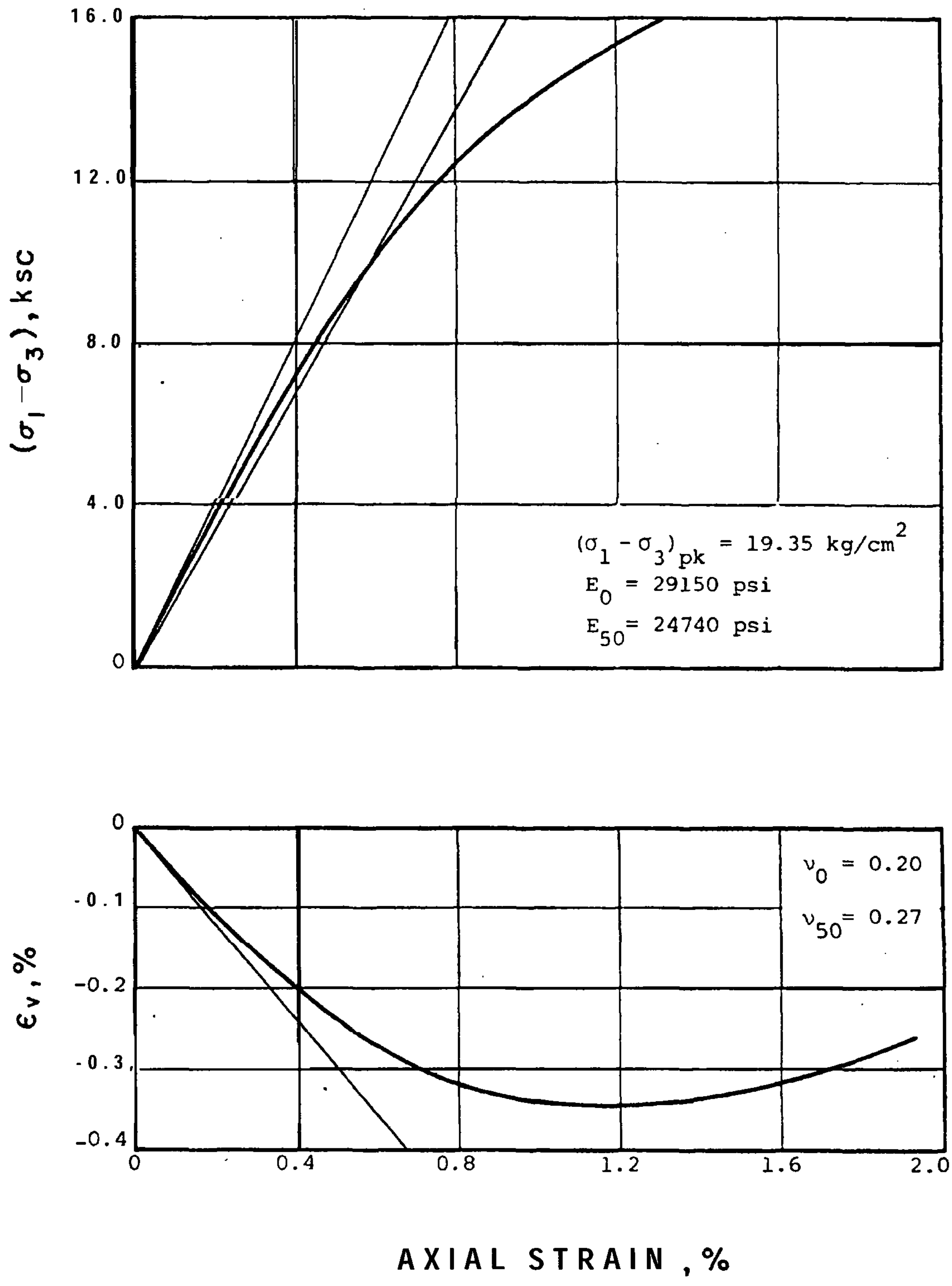
TEST S4 95% Compaction $\bar{\sigma}_{3c}$ = 0.5 kg/cm²

ᑭUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-DRAINED TRIAXIAL TEST S4 Expanded Scales
;EOTECHNICAL ENGINEERS INC. VINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A10



TEST S5 95% Compaction $\bar{\sigma}_{3c}$ = 2.0 kg/cm^2

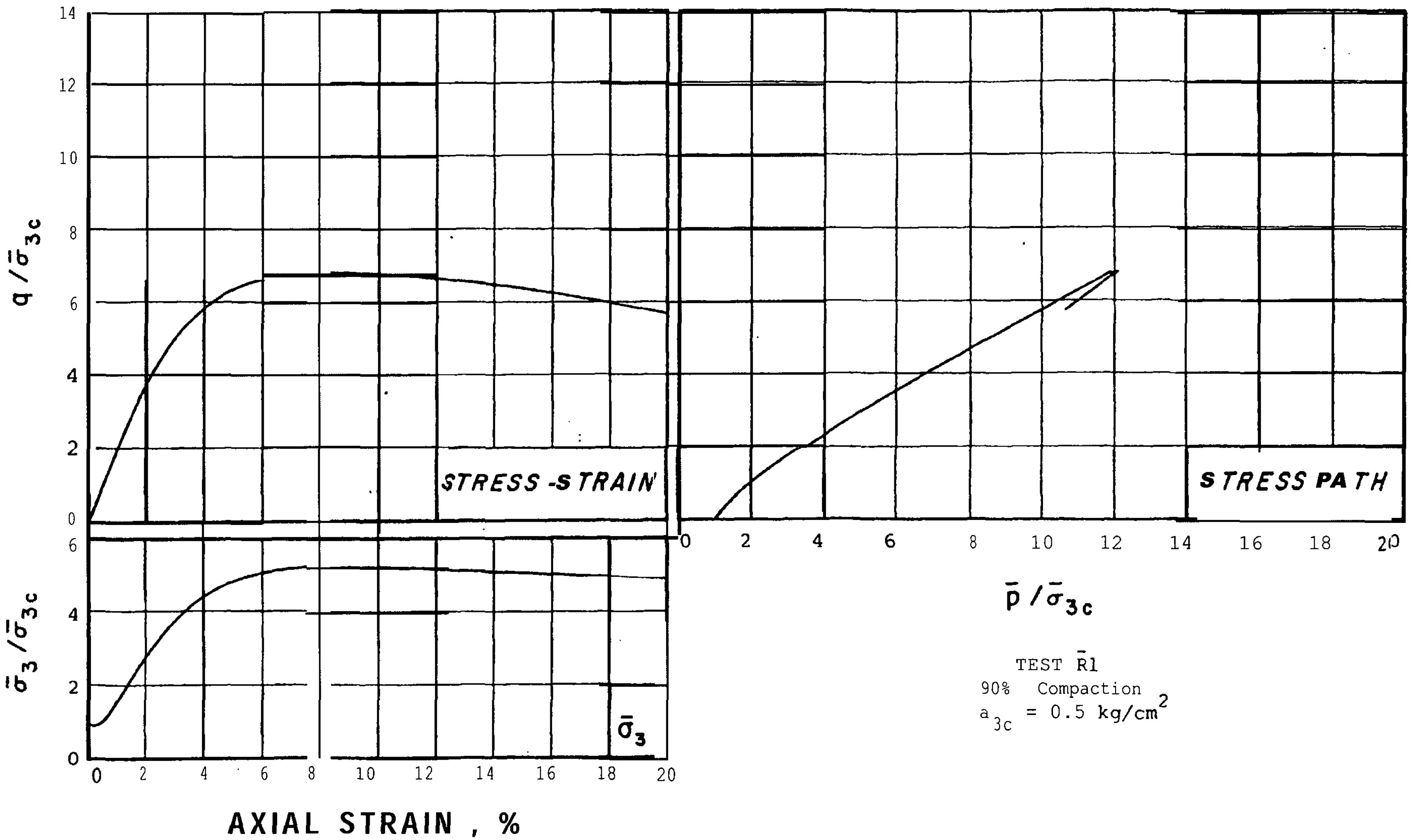
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL	CONSOLIDATED-DRAINED TRIAXIAL TEST S5 Expanded Scales
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A1



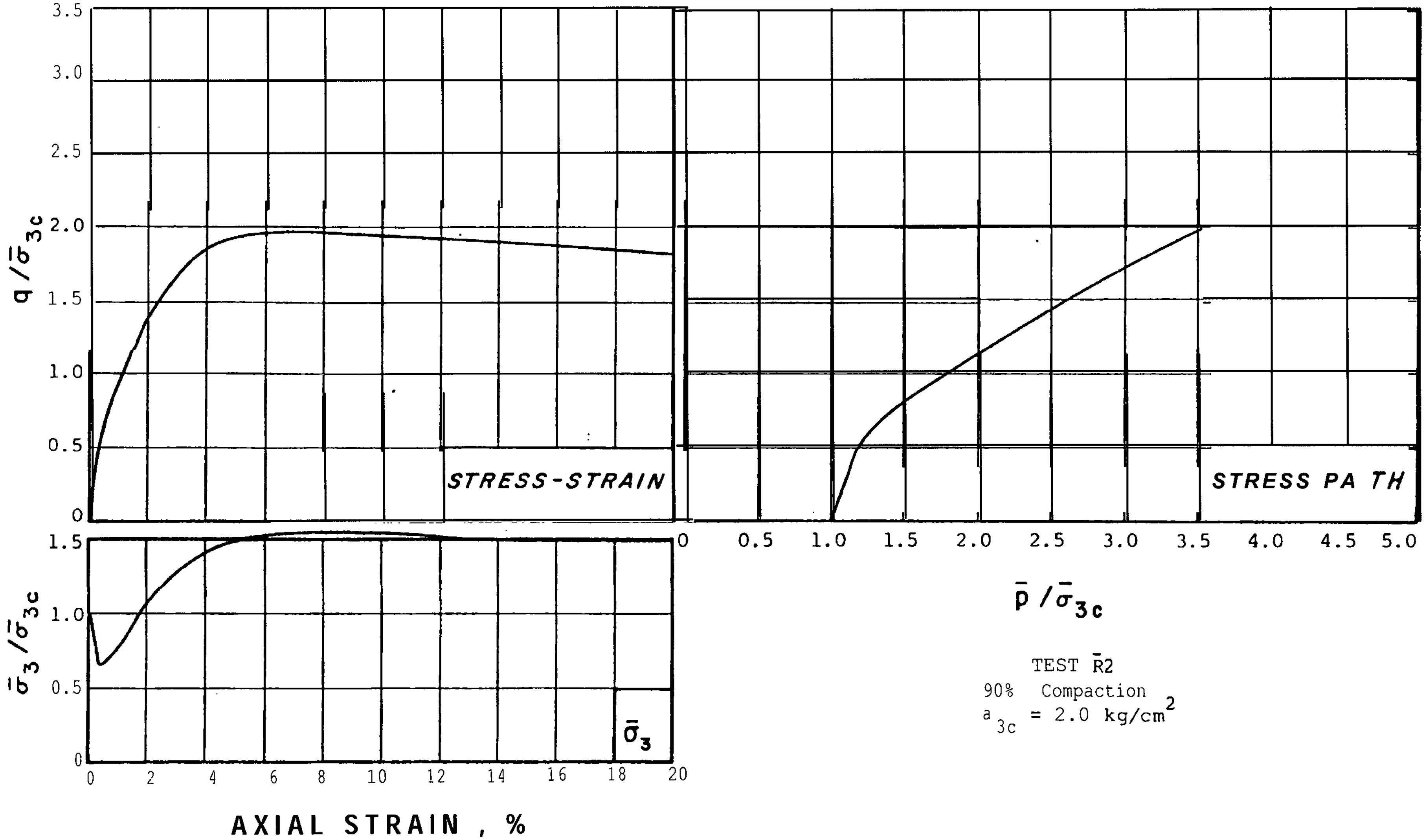
TEST S6 95% Compaction $\bar{\sigma}_{3c}$ = 6.0 kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-DRAINED TRIAXIAL TEST S6 Expanded Scales
GEOTECHNICAL ENGINEERS INC. NINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. A1

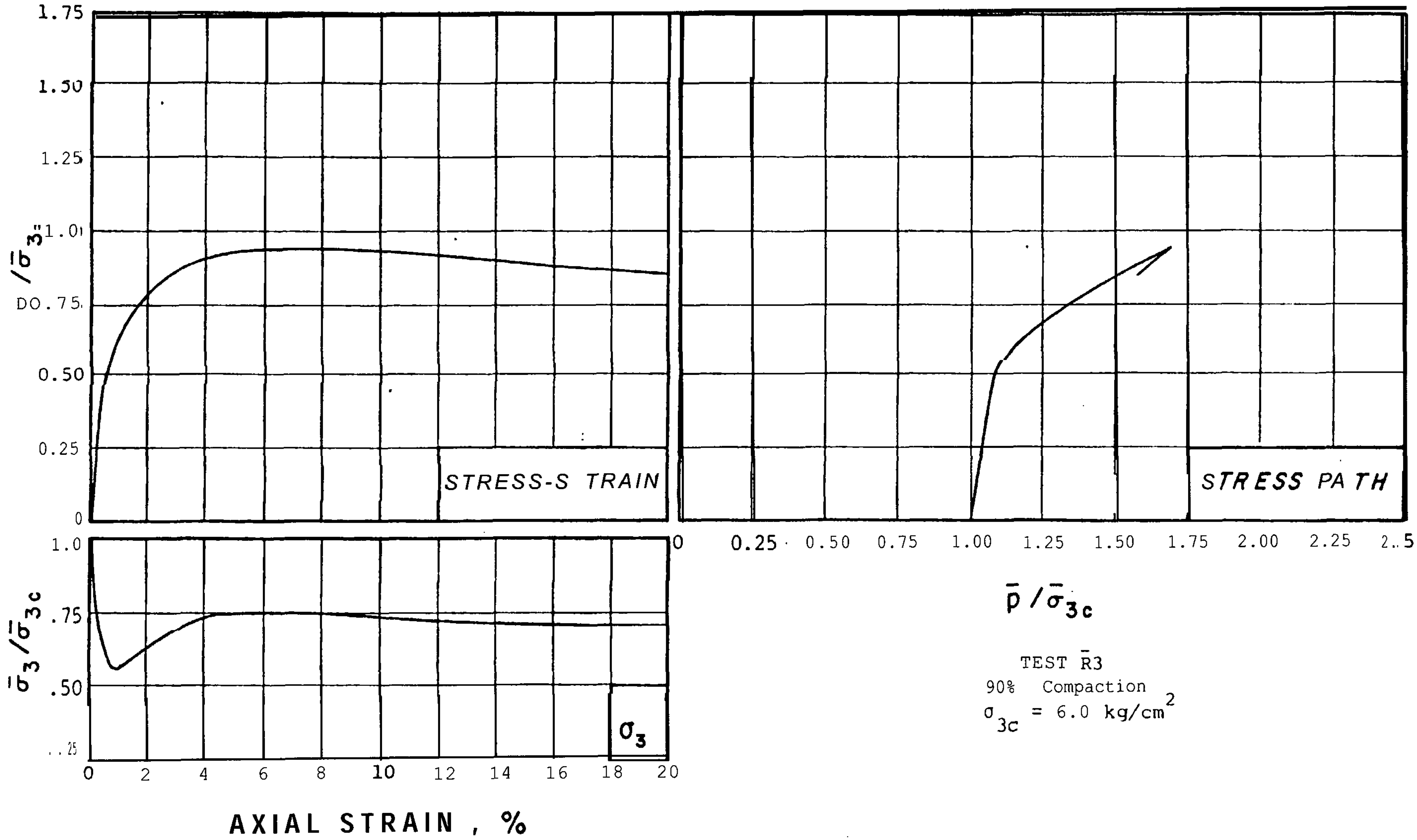
APPENDIX B



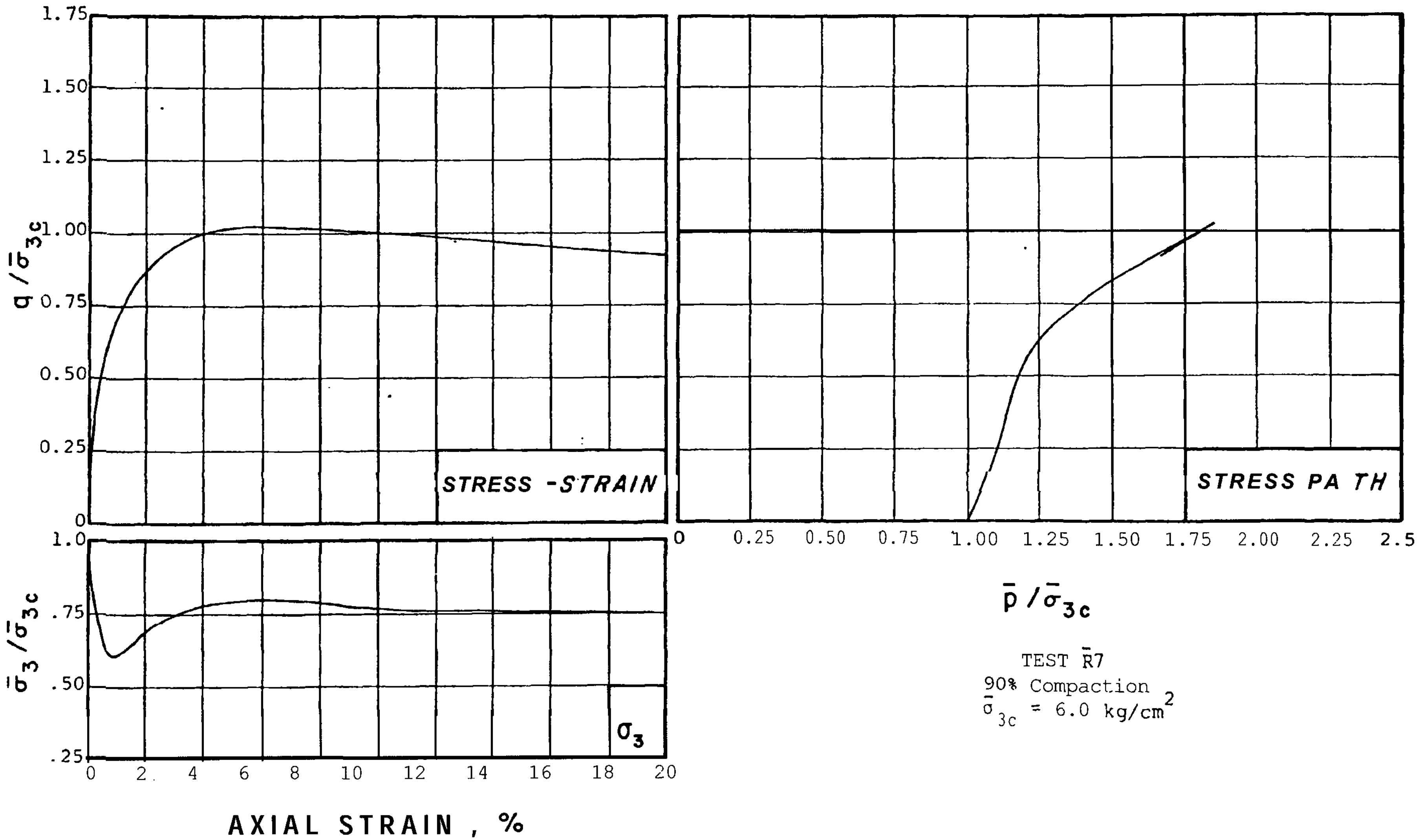
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}1$
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B.



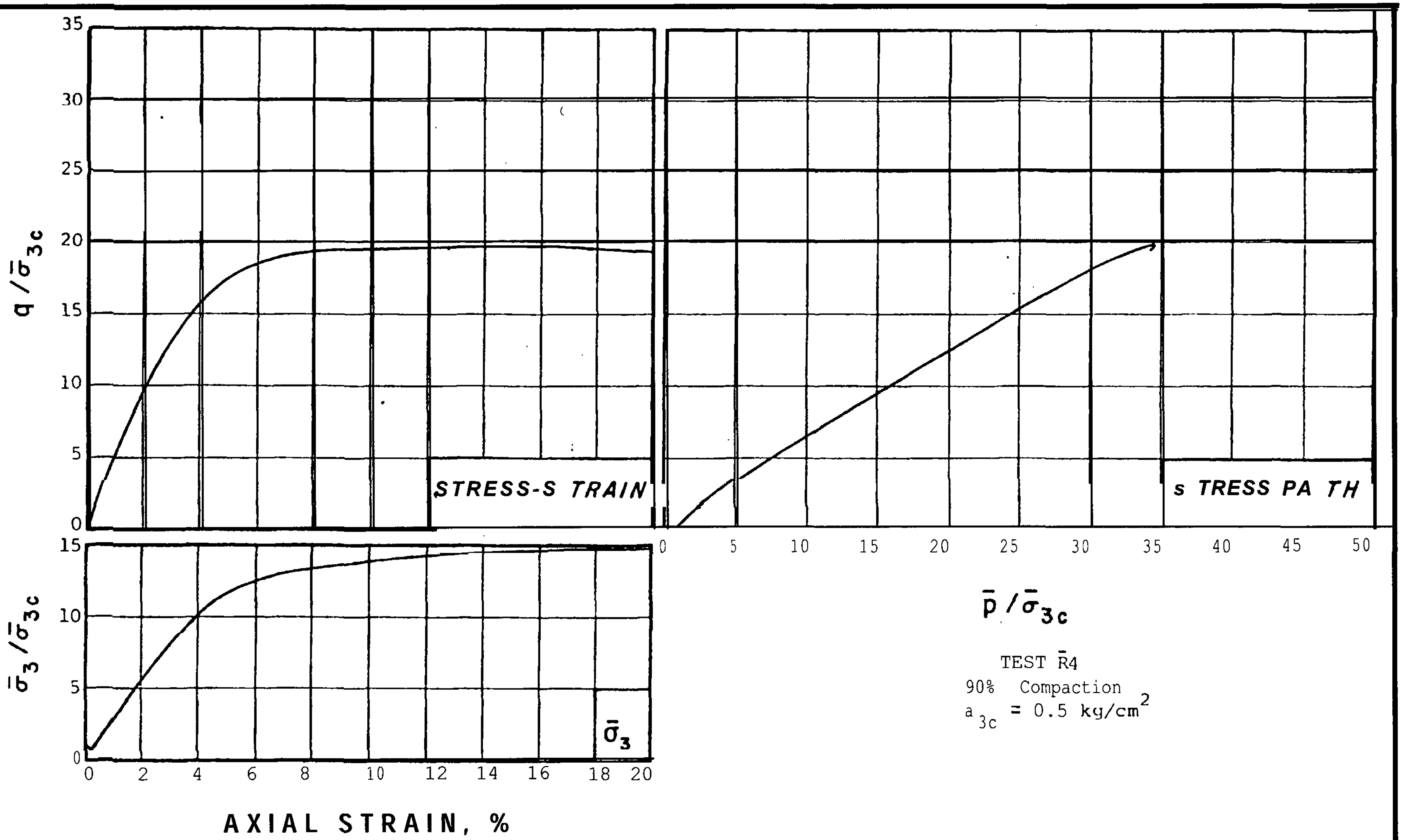
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}2$
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B2



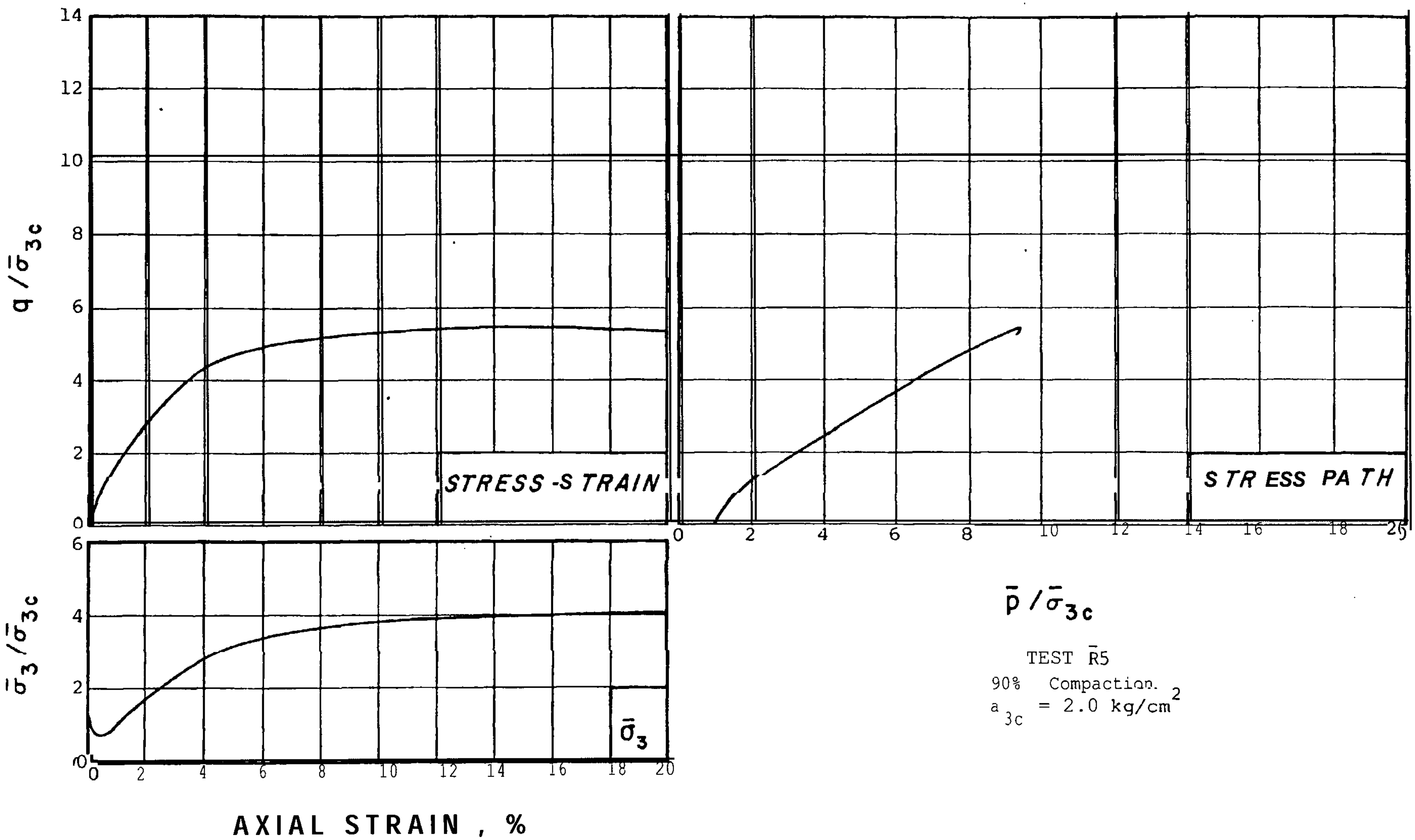
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}3$
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B3



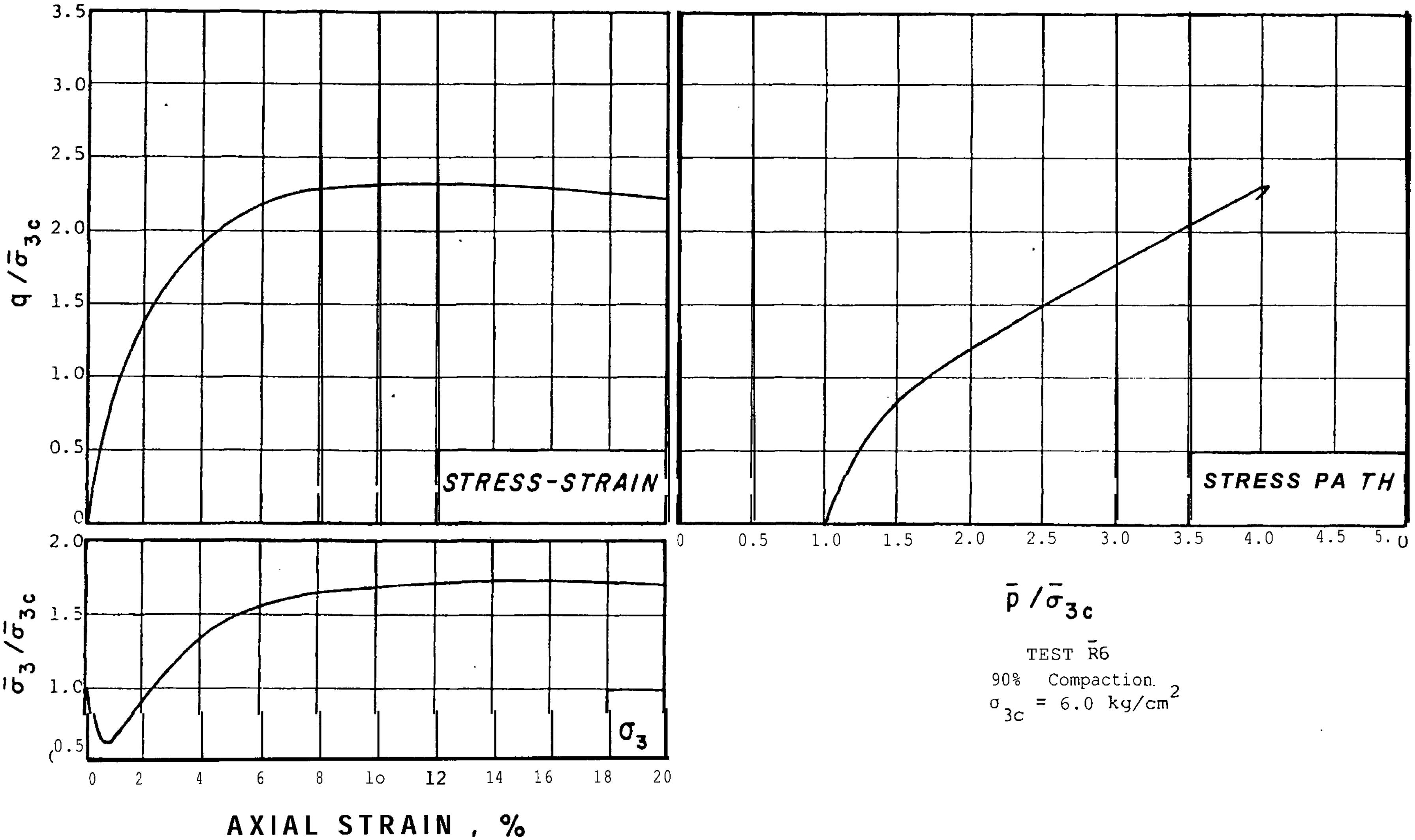
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}7$
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B4



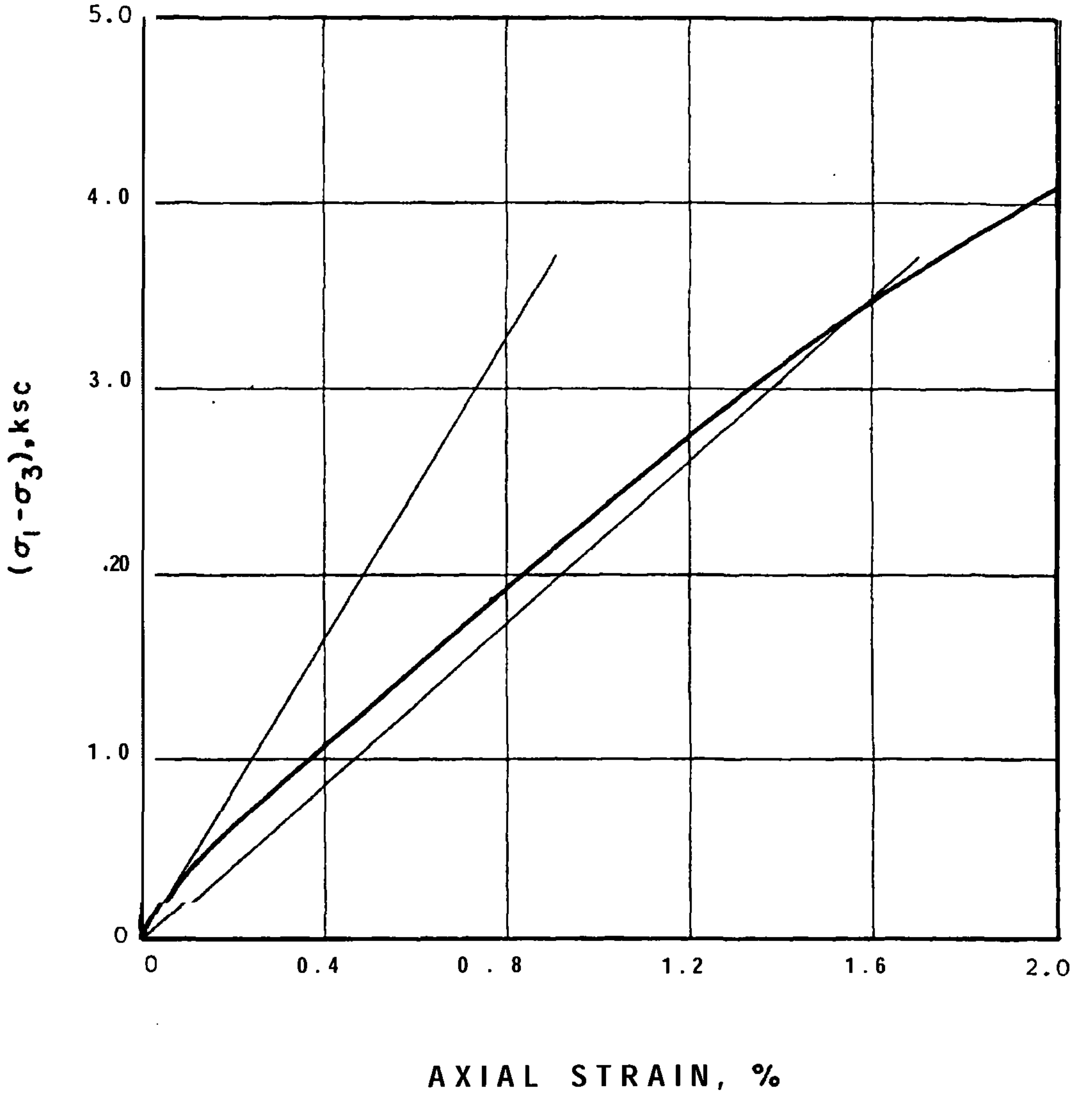
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST R̄4
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B5



PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}5$
STRUCTURAL	BACKFILL	
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B

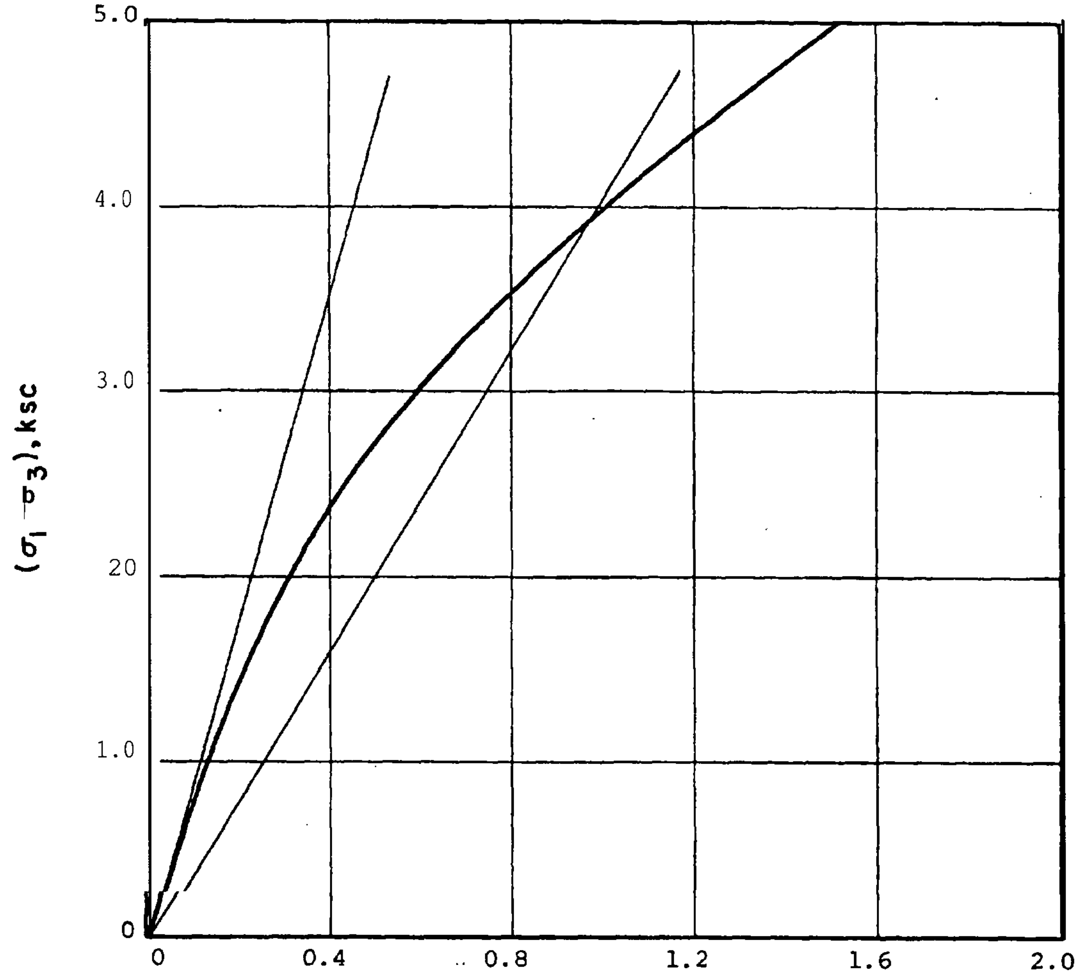


PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}6$
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B7



TEST $\bar{R}1$
90% Compaction
$\bar{\sigma}_{3c} = 0.5\ kg/cm^2$

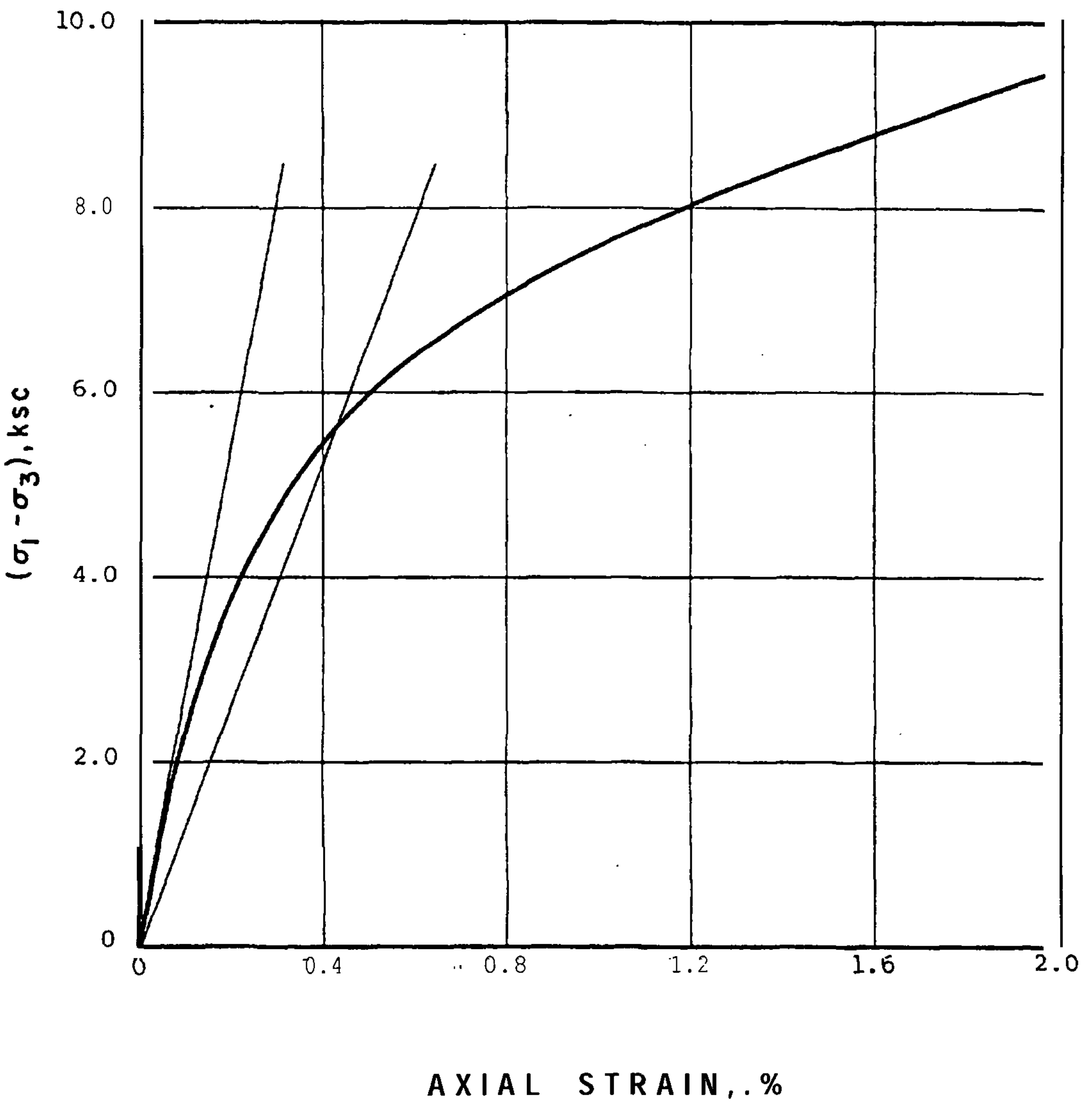
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}1$ EXPANDED SCALES
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B8



AXIAL STRAIN, %

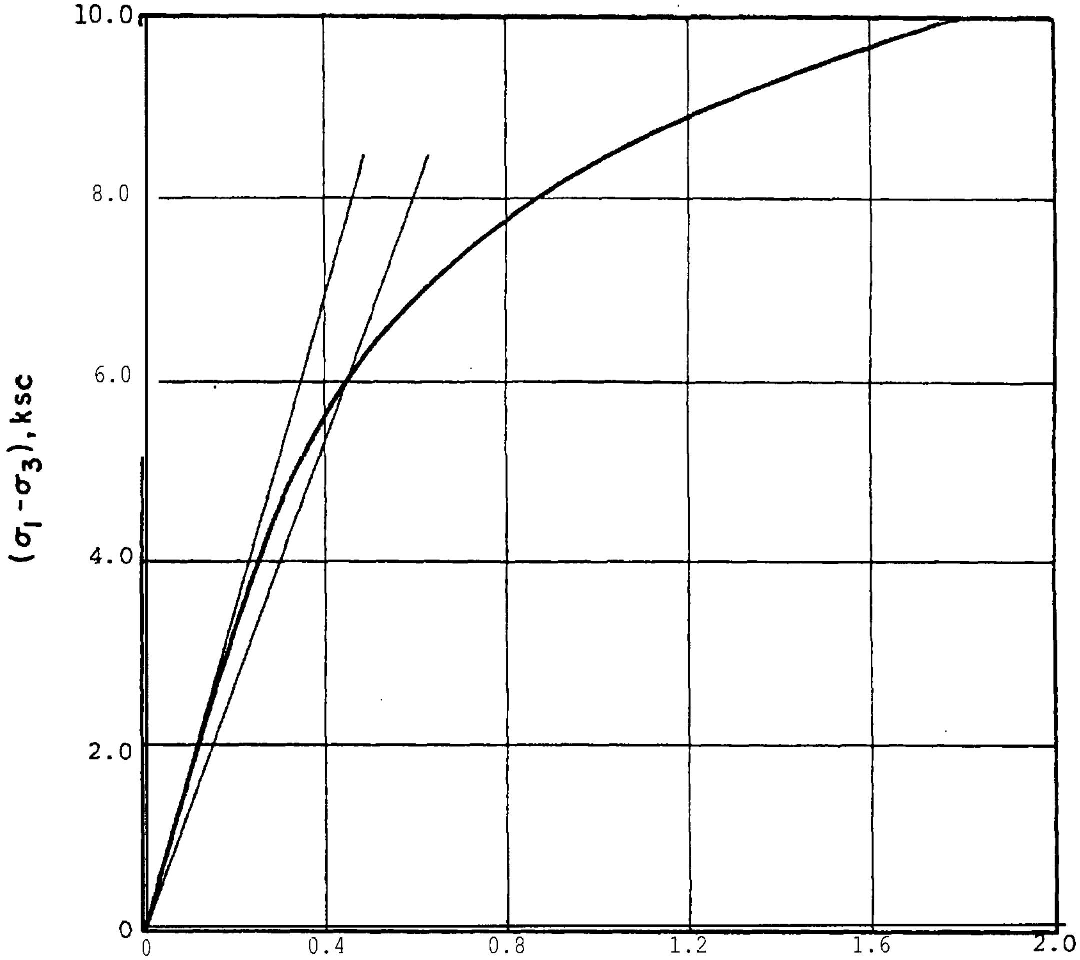
TEST $\bar{R}2$
90% Compaction
$\sigma_{3c} = 2.0$ kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}2$ EXPANDED SCALES
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B9



TEST $\bar{R}3$
90% Compaction
σ_{3c} = 6.0 kg/cm²

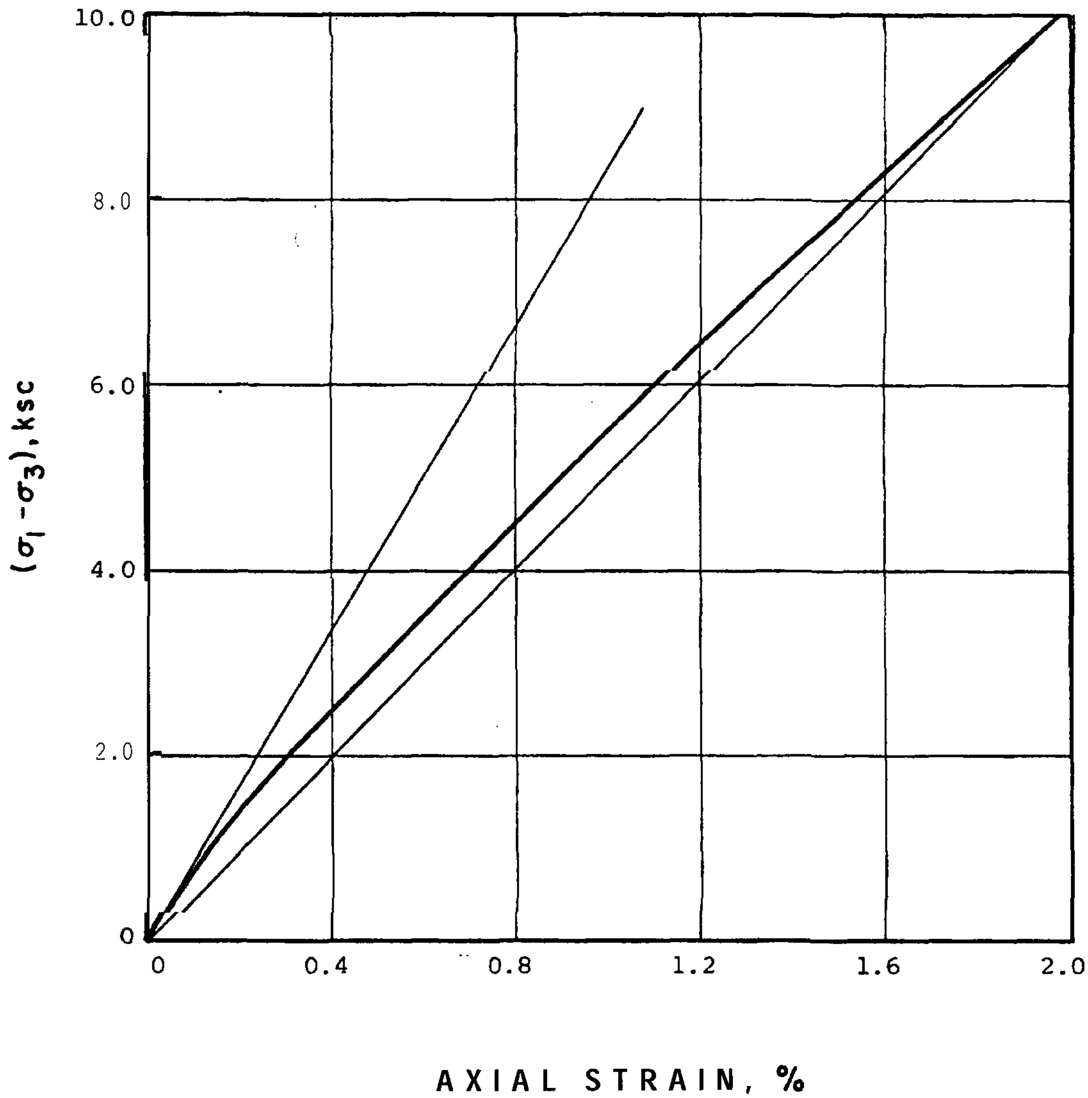
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}3$ EXPANDED SCALES
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B10



AXIAL STRAIN, %

TEST $\bar{R}7$
90% Compaction
$\bar{\sigma}_{3c} = 6.0\ kg/cm^2$

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}7$ EXPANDED SCALES
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG B1

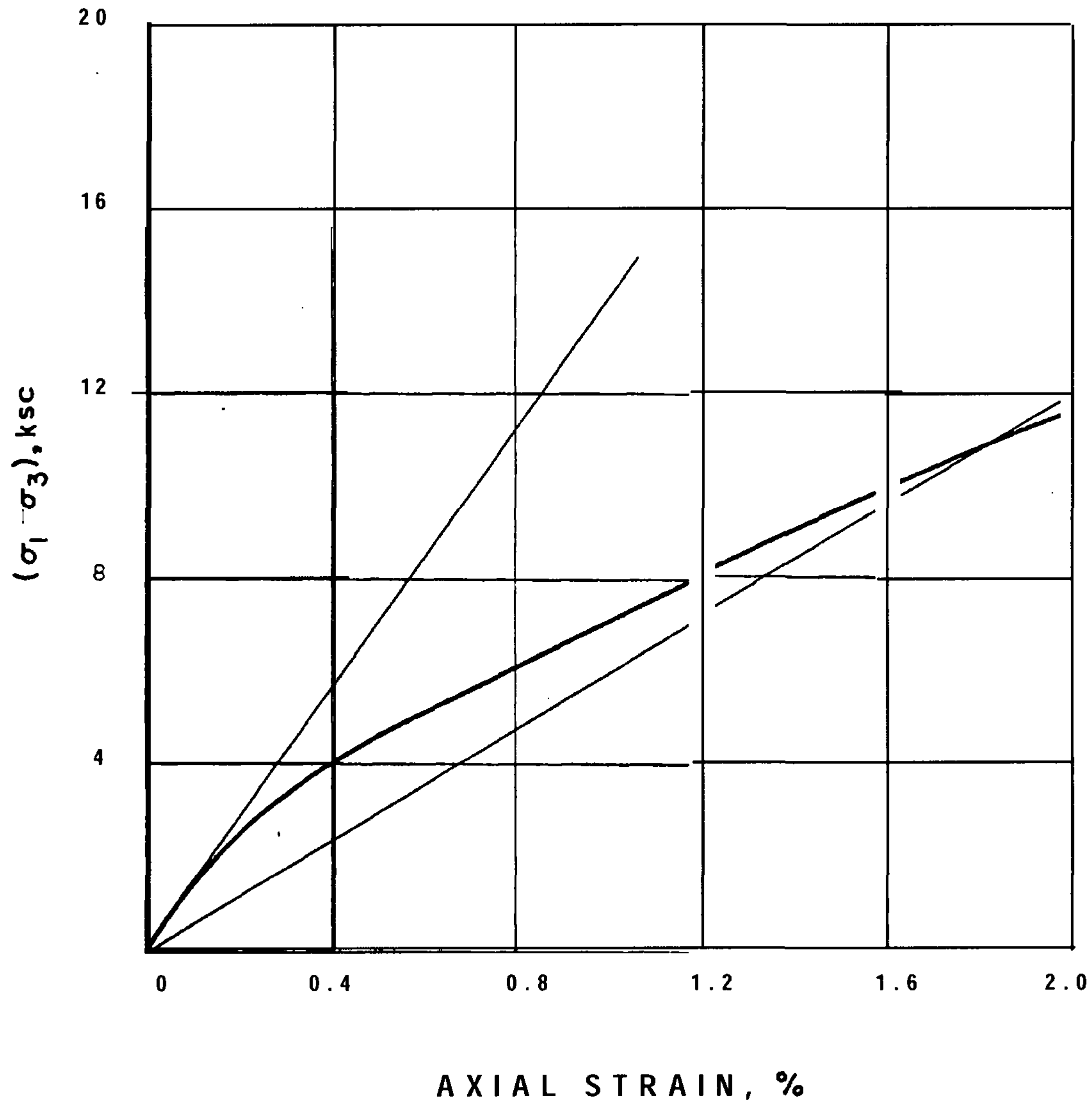


TEST $\bar{R}4$

90% Compaction

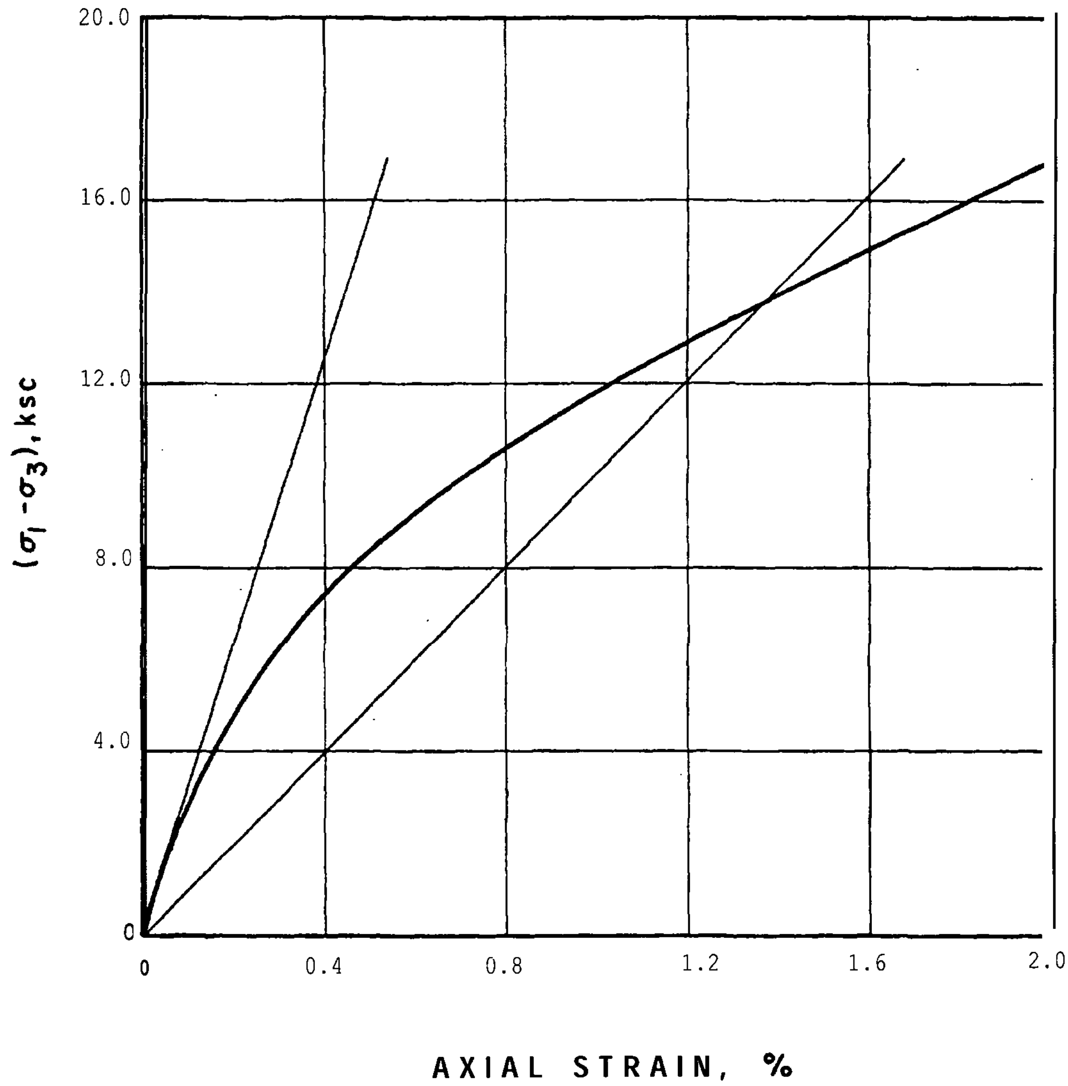
$\bar{\sigma}_{3c} = 0.5\ kg/cm^2$

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}4$ EXPANDED SCALES
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG B12



TEST $\bar{R}5$
90% Compaction
$\bar{\sigma}_{3c}$ = 2.0 kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}5$ EXPANDED SCALES
GEOTECHNICAL ENGINEERS INC WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B1:



TEST $\bar{R}6$
90% Compaction
$\bar{\sigma}_{3c} = 6.0$ kg/cm^2

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE	TRIAXIAL TESTS STRUCTURAL BACKFILL	CONSOLIDATED-UNDRAINED TRIAXIAL TEST $\bar{R}6$ EXPANDED SCALES
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	PROJECT 77386	DECEMBER, 1977 FIG. B1

GEOTECHNICAL ENGINEERS INC.
1017 MAIN STREET · WINCHESTER · MASSACHUSETTS 01890 (617) 729-1625

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February 14, 1978
Project 77386
File No. 2.0

Mr. John Herrin
Public Service Co. of New Hampshire
1000 Elm Street - 11th Floor
Manchester, NH 03105

Subject: Interim Test Results on Sand-Cement Backfill
Seabrook Station

Reference: Preliminary Report, Compression Tests on
Structural Backfill and Sand-Cement
Seabrook Station, GEI, January 24, 1978

Dear Mr. Herrin:

The purpose of this letter is to present data on moduli determined on sand-cement backfill at the request of United Engineers and Constructors Inc. The data herein supplements the data in the reference and will be incorporated in the completed version of that report. The subgrade modulus values were submitted to Mr. Patel of UE&C by telephone on February 13, 1978.

The stress strain curves for three unconfined compression tests on cylindrical specimens are shown in the enclosed Fig. 15 and the test data are summarized in the enclosed Table 5.

The following values of the coefficient of subgrade reaction were computed for the cube and cylindrical specimens cured for 28 days.

k_sD-VALUES FOR SAND-CEMENT BACKFILL 28-DAY CURE

Tabulated values are in psi

Effective Vertical Stress at Springline psi	Allowable Diameter Strain, %			
	0.02	0.1	0.3	0.5
CUBE SPECIMENS				
0			100,000	
CYLINDRICAL SPECIMENS				
0	200,000	89,000	60,000	36,000

The stress strain curves for the cylindrical specimens show an initial straight line portion with **a very** high modulus of elasticity. At axial strains of about 0.03% there is a break in the curves and a second straight line is followed up to near the peak strength. The tangent modulus of this second straight line portion of the curves is about one-third of the initial modulus. Fig. 16 shows the variation of the secant modulus with axial strain for the unconfined tests on cylindrical specimens.

Seating problems occurred in the tests on the cube specimens, as seen in Figs. 13 and 14 of the above reference, and thus the high initial modulus observed for the cylindrical samples was not observed for the cubes. However, the second straight line slope for the cylindrical specimens in Fig. 15 is in good agreement with the straight line portion of the curves for the cube specimens. The compressive strength of the cube specimens is somewhat higher than that of the cylindrical specimens, probably as a result of the more significant end restraint of the cube specimens. For these two reasons we feel that the results of tests on cubes and cylinders are consistent with each other, but that the results for tests on cylinders are more reliable and should be used to establish moduli of **subgrade** reaction.

We have also provided by telephone various friction coefficients and estimates of shear wave velocities in the compacted soil. These data will be confirmed in writing at a later date.

Sincerely yours,

GEOTECHNICAL ENGINEERS INC.

Steve J. Poulos

Steve J. Poulos
Principal

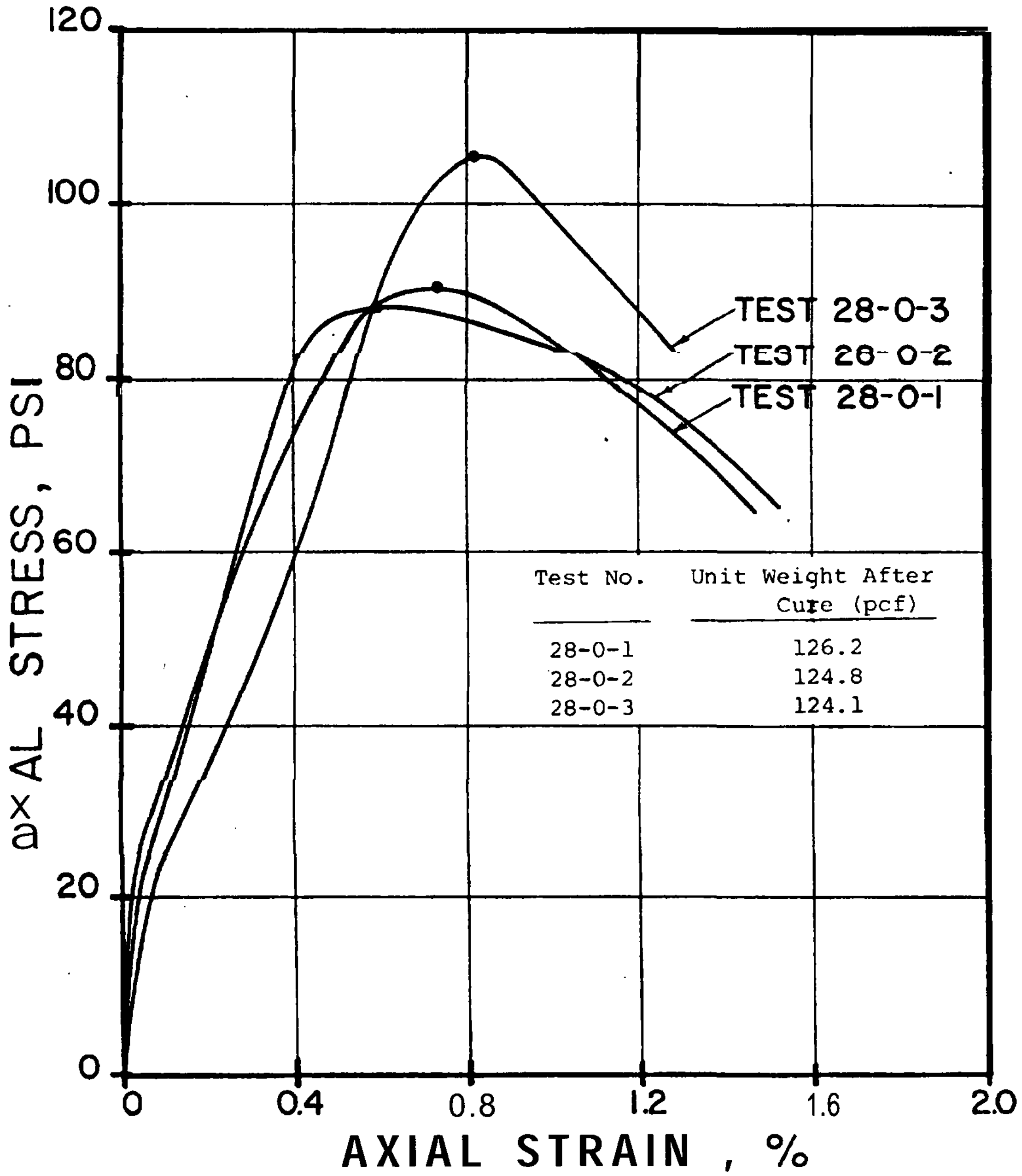
SJP:ms
Encl.
cc: R. Pizzuti, YAEC w/1 encl.
D. Rhoads, UE&C w/1 encl.
A. Desai, UE&C w/1 encl.
D. Patel, UE&C, 7 U O, w/1 encl.

TABLE 5 - COMPRESSION TESTS ON 2.8-IN.-DIAMETER SAND-CEMENT SPECIMENS, 5% CEMENT SEABROOK STATION

Cure Time days	Test No.	Unit Weight Wet pcf	Confining Stress ksc	Compressive Strength psi	Strain At Peak %	Initial Modulus of Elasticity psi
28	28-0-1	126.2	0.00	91.0	0.65	75,000
28	28-0-2	124.8	0.00	88.8	0.58	52,200
28	28-0-3	124.1	0.00	106.1	0.80	34,300
				Avg 95.3		Avg 50,500

Geotechnical Engineers Inc.

Project 77386
February 7, 1978



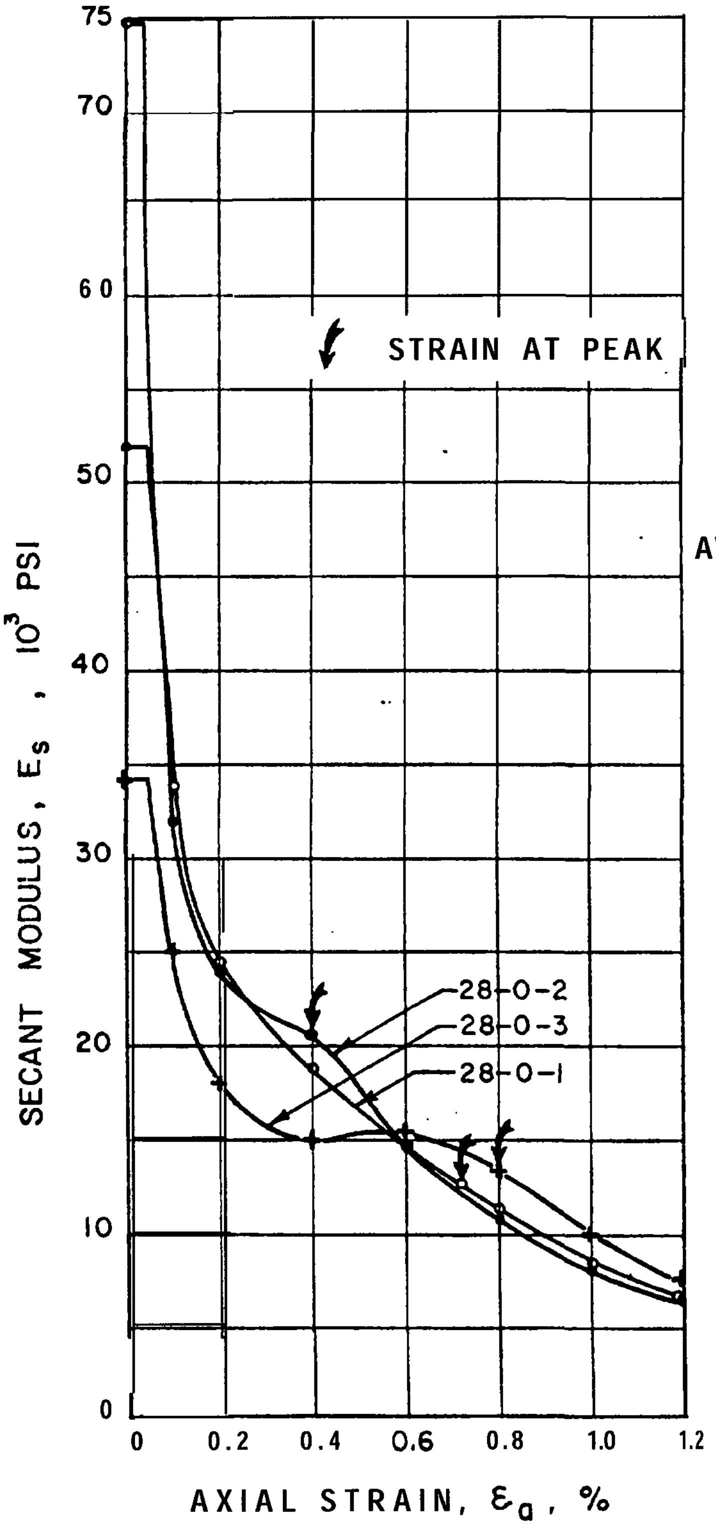
Sand-Cement Mixture:

1 part cement
16.18 parts sand (oven-dry)
2.79 parts water

Specimens Tested:

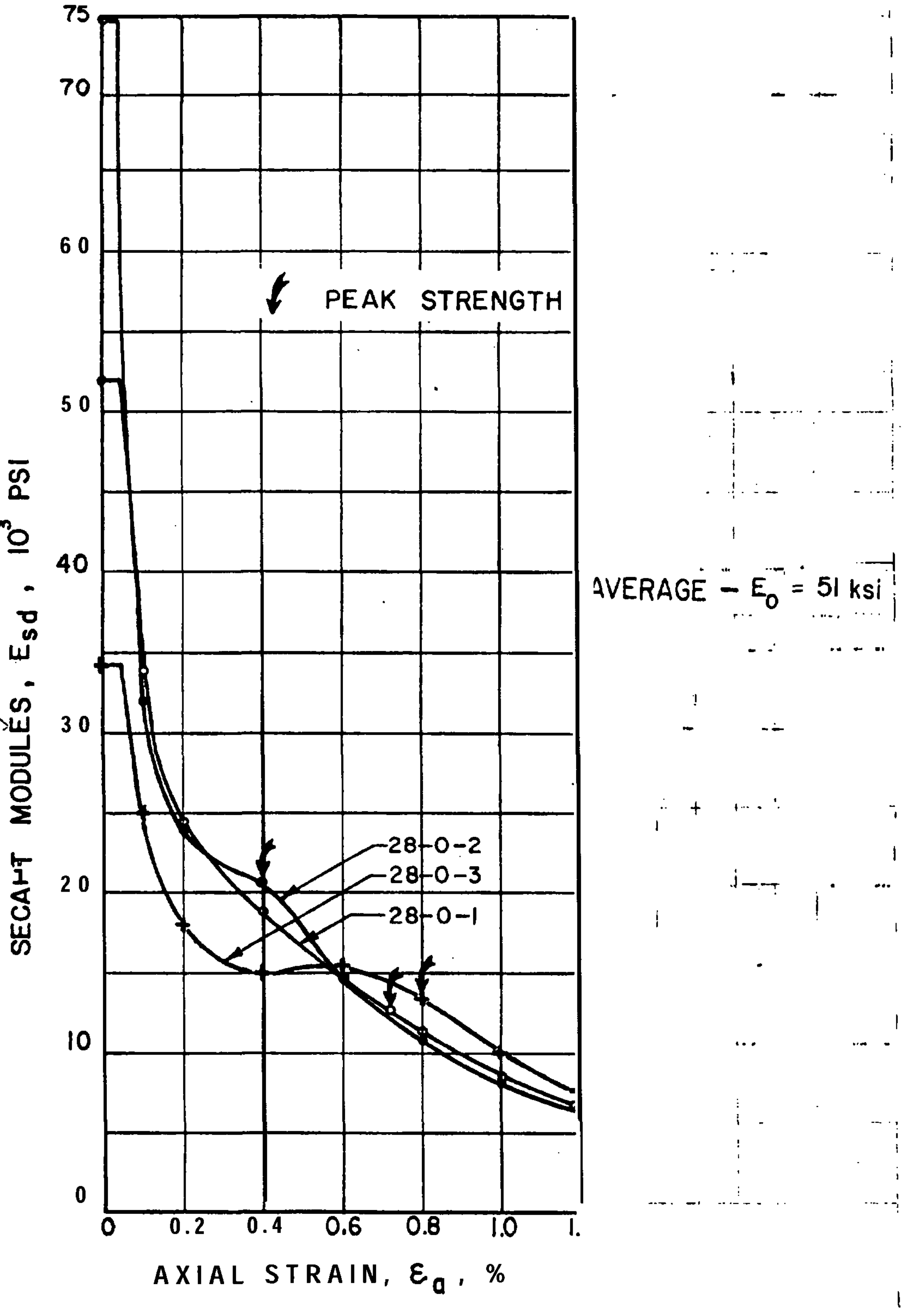
2.8-in.-diameter specimens
28-day cure
Unconfined tests
Strain control loading at
1.1 mm/min.

Public Service Company of New Hampshire	Triaxial Tests Sand-Cement Backfill Seabrook Station	COMPRESSION TESTS 2.8-IN.-DIAMETER SPECIMEN 5% CEMENT, 28-DAY CURE
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	February 1978 Fig. 15



AVERAGE E_0 = 51 ks

Public Service Company of New Hampshire	Triaxial Tests Sand-Cement Backfill **Seabrook** Station	SECANT MODULUS VS STRAIN **2.8-IN.-DIA.** SPECIMENS 5% CEMENT, **28-DAY** CURE
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	February 1978 **Fig.** 16



PEAK STRENGTH
AVERAGE – E_o = 51 ksi
28-0-2
28-0-3
28-0-1
SECANT MODULES, E_{sd}, 10^3 PSI
AXIAL STRAIN, ε_a, %
75
70
60
50
40
30
20
10
0
0
0.2
0.4
0.6
0.8
1.0
1.

Φ GEOTECHNICAL ENGINEERS INC.

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February 27, 1978
Project 77386
File No. 2.0

Mr. John Herrin
Public Service Co. of New Hampshire
1000 Elm Street-11th floor
Manchester, NH 03105

Subject: Interim Test Results on Sand-Cement'Backfill
Seabrook Station

Reference: Preliminary Report, Compression Tests On
Structural Backfill and Sand-Cement
Seabrook Station, GEI, January 24, 1978

Bear Mr. Herrin:

The purpose of this letter is to present additional data on moduli determined on sand-cement backfill. These data supplement the data in the reference and in our letter of February 14.

These triaxial tests were performed on cylindrical specimens of sand-cement. The specimens were cured for 33 days instead of the intended 28 days because of the February 6, 1978 blizzard here in Boston. The test data are summarized in a revised Table 5 and the stress strain curves are presented in Fig. 17.

The modulus and strength data were estimated for 28-day curing on the basis of the rate of change of modulus and strength with time as measured using the cube specimens (see referenced report). The estimated values of strength and modulus for 28-day cure also are shown in Table 5.

The values of the coefficient of subgrade reaction were computed for several strain levels in the same manner as those shown in the preliminary report of January 24 and the letter of February 14. The following table lists all values obtained to date for the sand-cement specimens.

k_sD-VALUES FOR SAND-CEMENT BACKFILL
28-DAY CURE, 5% CEMENT

Tabulated values are in psi

Effective Vertical Stress at Springline psi	Allowable Diameter Strain, %			
	0.02	0.1	0.3	0.5
CUBE SPECIMENS				
0			100,000	
CYLINDRICAL SPECIMENS				
0	200,000	89,000	60,000	36,000
42.7		138,000	163,000	129,600

Sincerely yours,

GEOTECHNICAL ENGINEERS INC.

Steve J. Poulos
Principal

GC:ms
Encl.

cc: R. Pizzuti, YAEC w/1 encl.
D. Rhoads, UE&C w/1 encl.
A. Desai, UE&C w/1 encl.
D.. Patel, UE&C, 7UO, w/1 encl.

TABLE 5 - COMPRESSION TESTS ON 2.8-IN.-DIAMETER SAND-CEMENT SPECIMENS, 5% CEMENT[1)]
SEABROOK STATION

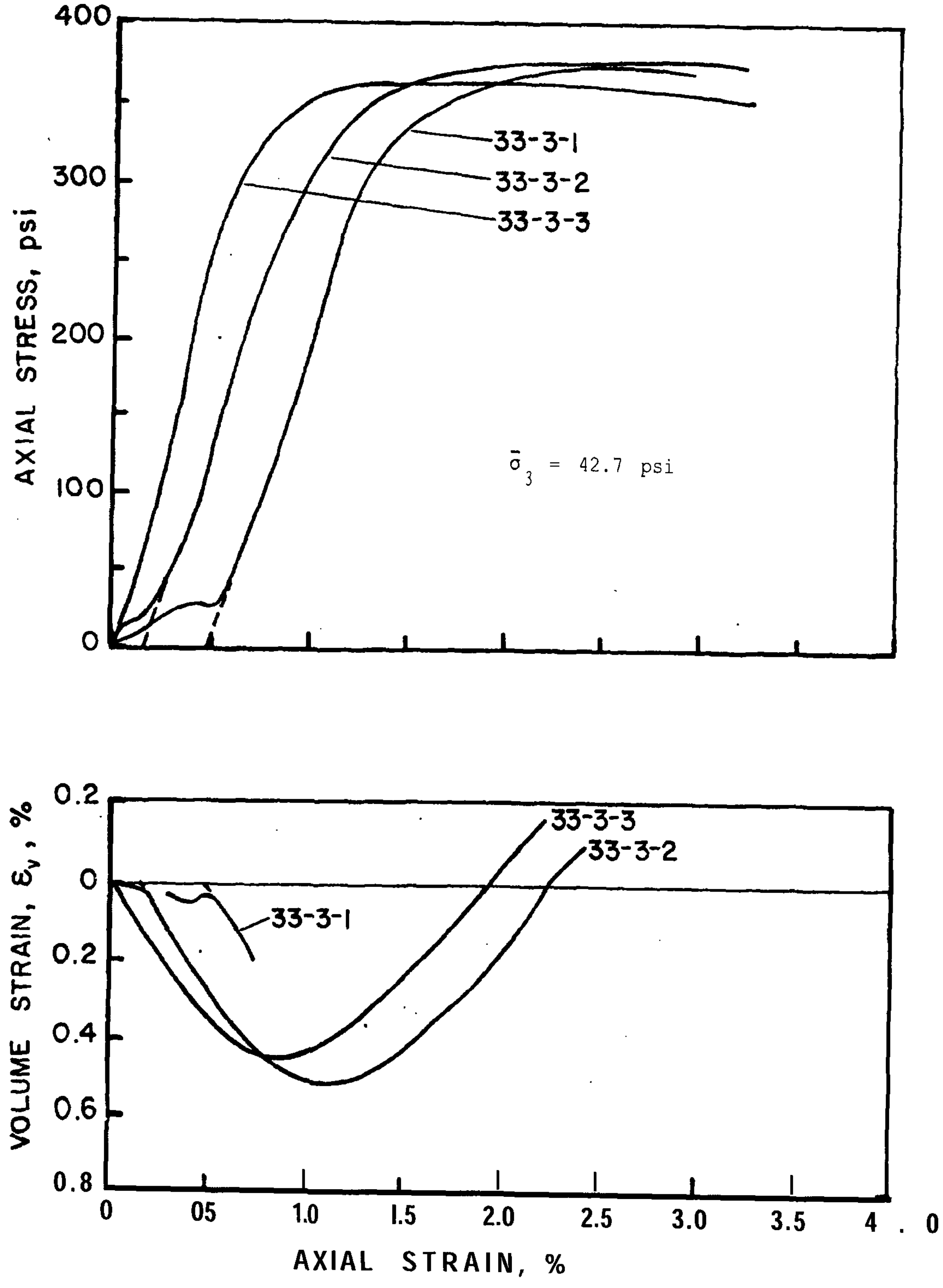
Cure Time days	Test No.	Unit Weight Wet pcf	Confining Stress ksc	Compressive Strength psi	Strain at Peak %	Initial Modulus of Elasticity psi
28	28-O-1	126.2	0.00	91	0.65	75,000
28	28-O-2	124.8	0.00	89	0.58	52,200
28	28-O-3	124.1	0.00	106	0.80	34,300
33	33-3-1	124.4	42.7	372	2.10	35,000
28	Estimated[2)]			365		33,600
33	33-3-2	124.1	42.7	376	2.40	33,300
28	Estimated[2)]			369		31,700
33	33-3-3	124.8	42.7	364	1.40	40,000
28	Estimated[2)]			357		38,400

NOTE: 1) The percentage of cement is computed as the ratio of the weight of cement to the total weight of sand, cement, and water, and then multiplying that ratio by 100.

2) The strengths and moduli for 28-day cure was estimated based on the rates of change measured for the cube specimens.

Geotechnical Engineers Inc.

Project 77386
February 7, 1978
Revised February 24, 1978



Public Service Company of New Hampshire	Triaxial Tests Structural Backfill	SAND-CEMENT SPECIMENS 2.8-IN.-DIA., 5% CEMENT 33-DAY CURE, $\bar{\sigma}_3$ = 42.7p
Geotechnical Engineers **Inc.** Winchester, Massachusetts	Project 77386	Feb. 23, 1978 Fig. 17

GEOTECHNICAL ENGINEERS INC.

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March 10, 1978
Project 77386
File No. 2.0

Mr. John Herrin
Public Service Co. of New Hampshire
1000 Elm Street - 11th Floor
Manchester, NH 03105

Subject: **Interim** Test Results on Sand-Cement Backfill Seabrook Station

Reference: Preliminary Report, Compression Tests On Structural Backfill and Sand-Cement Seabrook Station, GEI, January 24, 1978

Dear Mr. Herrin:

The purpose of this letter is to present additional data on moduli determined on sand-cement backfill. These data supplement the data in the reference and in our letters of February 14 and 27.

Three triaxial tests were performed on cylindrical specimens of sand-cement. The specimens were cured for 28 days and were tested under a confining stress of 7.1 psi. The test data are summarized in a revised Table 5.

The values of the coefficient of subgrade reaction were computed for several strain levels in the same manner as those shown in the preliminary report of January 24 and the letters of February 14 and 27. The following table lists all values obtained to date for the sand-cement specimens:

k_sD-VALUES FOR SAND-CEMENT BACKFILL
28-DAY CURE, 5% CEMENT

Tabulated values are in psi

Effective Vertical Stress at Springline psi	Allowable Diameter Strain, %			
	0.02	0.1	0.3	0.5
CUBE SPECIMENS				
0			100,000	
CYLINDRICAL SPECIMENS				
0	200,000	89,000	60,000	36,000*
7.1	115,000	106,000	79,600	50,600*
42.7		138,000	163,000	129,600

*Modulus value determined at strains greater than the strain at peak compressive strength.

Geotechnical Engineers Inc.

Project 77386
Revised March 6, 1978

Three unconfined tests were performed on cube specimens of sand-cement cured for 90 days. The test data are summarized in a revised Table 4.

The stress-strain curves for the additional tests will be transmitted as soon as they have been drafted.

Sincerely yours,

GEOTECHNICAL ENGINEERS INC.

Steve J. Poulos
Principal

GC/SJP:ms
Encl.
cc: R. Pizzuti, YAEC
D. Rhoads, UE&C
A. Desai, UE&C
D. Patel, UE&C 7UO

TABLE 4 - UNCONFINED TESTS ON 2-IN. CUBE SAMPLES OF SAND-CEMENT, 5% CEMENT SEABROOK STATION

Cure Time days	Test No.	Unit Weight Wet pcf	Unconfined Strength psi	Strain At Peak %	Modulus of Elasticity* psi
7	7-1	124.0	66.7	0.80	10,600
	7-2	123.9	72.5	0.92	10,110
	7-3	126.2	85.3	0.83	13,650
			Avg 74.8		Avg 11,450
28	28-1	127.4	141.6	0.67	33,330
	28-2	126.2	133.8	0.77	19,130
	28-3	126.8	130.0	0.87	22,760
			Avg 135.0		Avg 25,070
90	90-1	124.4	117.9	0.95	26,320
	90-2	124.5	139.4	1.08	27,030
	90-3	125.0	133.7	0.84	31,250
			Avg 130.3		Avg 28,200

*Modulus computed for the straight line portion of the stress-strain curve, neglecting any curvature at origin, which may be affected by initial seating strains.

Geotechnical Engineers Inc.

Project 77386
January 23, 1978
Revised March 6, 1978

TABLE 5 - COMPRESSION TESTS ON 2.6-IN.-DIAMETER SAND-CEMENT SPECIMENS, 5% CEMENT[1)]
SEABROOK STATION

Cure Time days	Test No.	Unit Weight Wet pcf	Confining Stress ksc	Compressive Strength psi	Strain at Peak %	Initial Modulus of Elasticity psi
28	28-0-1	126.2	0.0	91	0.65	75,000
28	28-0-2	124.8	0.0	89	0.58	52,200
28	28-0-3	124.1	0.0	106	0.80	34,300
33	33-3-1	124.4	42.7	372	2.10	35,000
28	Estimated[2)]			372		34,600
33	33-3-2	124.1	42.7	376	2.40	33,300
28	Estimated[2)]			376		32,900
33	33-3-3	124.8	42.7	364	1.40	40,000
28	Estimated[2)]			364		39,600
28	28-.5-1	124.6	7.1	119	0.60	32,600
28	28-.5-2	123.9	7.1	134	0.90	22,900
28	28-.5-3	124.3	7.1	122	0.97	17,400

NOTE: 1) The percentage of cement is computed as the ratio of the weight of cement to the total weight of sand, cement, and water, and then multiplying that ratio by 100.

2) The strengths and moduli for 28-day cure was estimated based on the rates of change measured for the cube specimens.

Geotechnical Engineers Inc.

Project 77386
February 7, 1978
Revised-February 24, 1978
Revised March 6, 1978

APPENDIX 2N

GEOTECHNICAL REPORT TEST FILL STUDY OF QUARTZITE MOLE CUTTINGS

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

TEST FILL STUDY
OF
QUARTZITE MOLECUTTINGS

Submitted to

Public Service Company of New Hampshire

Submitted by

Geotechnical Engineers Inc.
1017 Main Street
Winchester, Massachusetts 01890

July 13, 1979
Project 76301

William R. Fisher
Senior Engineer

Steve J. Poulos
Principal

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 Purpose

The intake and discharge tunnels at Seabrook Station are being excavated using a tunnel boring machine, more commonly termed a mole. The excavated material from the mole is a widely-graded crushed stone commonly termed tunnel muck, which, for this report, shall be termed "molecuttings."

The purpose of the test fill study was to determine if the quartzite molecuttings obtained from-the tunnel excavations could be used for Safety and Nonsafety-Related Structural Fill. Construction of the test fills provided the opportunity to observe the behavior of the molecuttings during placement and obtain data necessary to develop procedures to control the compaction of the molecuttings during placement.

1.2 Background

The molecuttings from the quartzite bedrock in the tunnels are widely-graded crushed stone containing up to 13% passing the No. 200 sieve. The grain size curve of the molecuttings plots below the lower limit of the Safety and Nonsafety-Related Structural Backfill specification. The resistivity of the molecuttings is generally below the specified minimum value of 10,000 $ohms\text{-}cm^3$. Thus, although the molecuttings appeared superior to the gravelly sand structural fill as a backfill material, it was rejected because the gradation and resistivity requirements did not comply with the specifications. Use of the molecuttings for Safety and Nonsafety-Related Structural Fill required that selected tests be performed which would demonstrate that the molecuttings were as good or better than the presently used gravelly sand when both materials were placed at the same percent compaction. Investigation of the resistivity problem was addressed by UE&C.

The Safety and Nonsafety-Related Structural Fill is used for backfill around pipes and conduits, under floor slabs, roads, etc. For these applications the deformation characteristics of the backfill will control the soil support of the pipes and settlements of structures. One method of determining the deformation properties of a soil is by determining the soil modulus by the use of a plate load test. Plate load tests were performed on carefully constructed test fills consisting of (a) gravelly sand, (b) molecuttings, and (c) a test fill of essentially alternating layers of gravelly sand and molecuttings which herein will be referred to as the stratified gravelly sand and molecuttings test fill

The modulus from each test fill was used as a means of comparing the desirability of the molecuttings versus the gravelly sand for use as Safety and Nonsafety-Related Backfill.

The molecuttings are widely graded and contain high percentages of stone retained on the 3/4-in. sieve. In many cases the percent retained on the 3/4-in. sieve exceeds the allowable limits for the Modified AASHO compaction test (D1557). Thus, it was necessary to determine by means of field and laboratory tests performed during construction of the test fill how construction control of the placement of the molecuttings should be handled.

1.3 Summary

The results of the plate load tests indicate that the molecuttings will provide superior support for pipes and structures than the gravelly sand currently accepted for Safety and Nonsafety-Related Structural Fill when both materials are placed at the same percent compaction. The molecuttings and gravelly sand will provide about equivalent deformation properties when the percent compaction of the molecuttings is as much as 2 to 3% lower than the gravelly sand. Therefore, the use of molecuttings for Safety and Nonsafety-Related Structural Fill is recommended. Further, it is recommended that the percent compaction of the molecuttings for Safety and Nonsafety-Related Structural Fill be 95% and 93%, respectively.

The molecuttings used in constructing these test fills were widely graded crushed stone with up to 7% passing the No. 200 sieve. The water content of the material varied from 3 to 4% up to 10% during placement. Because of the grain-size distribution compaction of the molecuttings was sensitive to fluctuations in the water content of the material. Based on data obtained from tests performed during construction of the test fills, limitations on the grain-size distribution and water content of the molecuttings during placement have been recommended in Section 5.

Construction of the test fills indicated that placement of the molecuttings can be controlled by modifying standard testing procedures. The in-place dry density can be measured using the nuclear density meter and the laboratory reference dry density determined by modifying the currently specified compaction tests.

Details of the construction of the test fills, performance and results of the plate load tests, and procedures for control of placement and compaction of molecuttings are presented in the following sections.

2. CONSTRUCTION OF TEST FILLS

Four test fills were constructed for this study. The orientation of the test fills is shown in Fig. 1. The soils and details of placement for each test fill is presented below.

2.1 Gravelly Sand

Gravelly sand satisfying the requirements for Safety and Nonsafety-Related Structural Fill Specifications 9763-8-5 and 9763-8-4 was placed in 8-in. -thick loose lifts and compacted to a minimum of 95% of the maximum dry density as determined by ASTM D1557, Method D. Satisfactory compaction was generally achieved by applying water to the surface of the loose lift and compacting with six coverages with the Mikasa double drum roller. Eight lifts of gravelly sand were placed and compacted, resulting in a total height of about 4 ft.

2.2 Molecuttings (Controlled Placement)

The construction of this test fill was controlled to achieve the compaction requirements of Safety and Nonsafety-Related Structural Fill (i.e., 95% of the maximum dry density as determined by ASTM D1557).

Molecuttings were placed in 8-in. loose lifts and compacted to 95% compaction. To achieve 95% compaction, control of the water content to within a few percent of the optimum water content, and numerous coverages with the Mikasa double drum roller was required. Attempts at controlling the water content included mixing of wet and dry molecuttings and adding water to molecuttings with water contents 2 to 3% below optimum. Molecuttings placed at water contents several percent higher than optimum could not achieve 95% compaction until sufficient drainage had reduced the water content to near the optimum value. Eight lifts of molecuttings were placed and compacted resulting in a total height of about 4 ft.

2.3 Molecuttings (No Special Controls)

Construction of this test fill involved the placement of the molecuttings with limited control of water content and a specified compactive effort. The molecuttings were generally placed in G-in. loose lifts and compacted by six coverages with the Mikasa double drum roller. In some instances, water content control was limited to permitting drainage of a compacted layer overnight before placement of the succeeding layer. Eight lifts of molecuttings were placed and compacted.

2.4 Stratified Molecuttings and Gravelly Sand

The first three lifts of this test fill were constructed the same way as the test fill of Molecuttings (No Special Controls). The water content of the molecuttings placed for the third lift was about 3% higher than optimum. The surface of the third lift was saturated and became severely rutted during compaction. Sandwiching layers of gravelly sand between layers of molecuttings was done to determine (1) if the gravelly sand provided drainage of sandwiched layers of molecuttings and (2) the feasibility of constructing a backfill of stratified gravelly sand and molecuttings (which may be required in the zone of frost penetration). Therefore, lifts 4 and 6 were constructed using gravelly sand. Lift 4 was compacted with six coverages of the Mikasa double drum roller and lift 6 was compacted to at least 95% compaction. Molecuttings for lifts 5, 7 and 8 were generally placed in 8-in. loose lifts with limited water content control and compacted with six coverages of the Mikasa double drum roller.

3. PERCENT COMPACTION OF TEST FILLS

3.1 Gravelly Sand

The percent compaction of each lift was determined by performing in-place density tests and laboratory compaction tests. The average percent compaction of the gravelly sand test fill was 97.4%.

The in-place density for each lift, after compaction, was determined by performing two 6-in. -diameter Sand Cone (SC) tests and three Nuclear Density Meter (NDM) tests. The in-place density determined by the NDM was generally performed at probe depths of 4 in. and 8 in. The two SC tests were performed adjacent to two of the NDM tests to provide a comparison of the water content and dry density measured by each 'method. The SC and NDM tests were generally performed within a 5-ft radius of the plate load test location. .

One-point compaction samples were obtained adjacent to the SC and NDM test locations. The one-point samples were compacted in accordance with ASTM D1557, Method D. The maximum dry density for the one-point sample was determined by plotting the one-point dry density on a family of curves for the gravelly sand and interpolating the maximum dry density. The percent compaction was computed by dividing the in-place dry density by the corresponding one-point compaction determined maximum dry density. Table 1 presents the summary of the percent compaction achieved in the test fill. A profile of the test fill and the average percent compaction for each lift is shown on Fig. 2.

Three compaction tests were performed in accordance with ASTM D1557, Method D, on bag samples of gravelly sand obtained from material placed in lifts 2, 4 and 7. The compaction curves and related grain-size curves performed by Pittsburgh Testing Labs are shown on Figs. 4 and 5, respectively.

3.2 Molecuttings (Controlled Placement)

The average percent compaction achieved for this test fill was 96.7%. The in-place density of each lift after compaction was determined by performing several NDM tests and, when the soil conditions were acceptable, one 12-in.-diameter SC test. The SC test was performed adjacent to a NDM test to provide a comparison of the water content and dry density measured by each method. Observations in the field and data from tests indicated that the hole excavated for the SC test tended to squeeze in or reduce in volume when the molecuttings were placed and compacted

at water contents above or near optimum. Results from the SC tests when these conditions existed gave unreasonably high dry densities, and, as a result, SC tests were considered valid only when they were performed in areas where the water content of the molecuttings was less than 5%. A more complete discussion of this problem is presented in Section 5. The SC and NDM tests were generally performed within about a 5-ft radius of the plate load test.

Generally, several NDM tests were required before a lift of the molecuttings was compacted to a dry density that was estimated to provide 95% compaction. One-point compaction samples were obtained adjacent to the series of NDM and SC tests that indicated about 95% compaction had been achieved. The one-point samples were compacted in accordance with ASTM D1557, Method C, except the minus 1½-in. material was included for compaction. The maximum dry density for the one-point sample was determined by plotting the one-point dry density on a family of compaction curves for molecuttings and interpolating the maximum dry density.

Correction of the in-place dry density to account for the plus 1½-in. material, which was removed for the laboratory test, was necessary in order to determine the percent compaction. Details of the correction procedure are presented in Appendix A. The percent compaction was computed by dividing the corrected in-place dry density by the corresponding maximum dry density determined by the one-point compaction technique. Table 2 presents the summary of the percent compaction achieved in the test fill. A profile of the test fill and the average percent compaction for each lift is presented in Fig. 2.

Two compaction tests were performed in accordance with ASTM D1557, Method C, except the minus 1½-in. material was included and there was no limit on the percent retained on 1&-in. sieve on bag samples of molecuttings from lifts 4 and 6. The compaction curves and related grain-size curves are shown on Figs. 6 and 7, respectively.

3.3 Molecuttings (No Special Controls)

The average percent compaction of this test fill was 93.0%. The water content of the molecuttings during placement was generally above optimum and was not controlled during compaction. Sand Cone tests to determine the in-place dry density were not performed because of the inaccuracy in performing the test in molecuttings compacted at water contents near or above optimum. The in-place dry density was determined by performing at least

two and most usually three to five NDM tests at probe depths of 4 and 8 in. The NDM tests were generally performed within a 5-ft radius of the plate load test location.

One-point compaction samples were obtained adjacent'to the series of NDM tests that indicated the next lift of molecuttings could be placed. In some cases after a lift had been compacted, NDM tests performed, and one-point samples obtained, the lift was permitted to drain overnight and additional NDM tests taken in the morning. One-point compaction samples generally were not obtained for the NDM tests performed after drainage. The procedure to compute the percent compaction for each in-place density test was the same as described in the previous section.

Table 3 presents the summary of the percent compaction achieved in the test fill. A profile of the test fill and the average percent compaction for each lift is presented in Fig. 3.

Two compaction tests were performed in accordance with ASTM D1557, Method C, except the minus 1½-in. material was included and there was no limit on the percent retained on the 1½-in. sieve on bag samples obtained from lifts 2A and 7A. The compaction curves and the grain-size curve for lift 2A are shown on Figs. 6 and 7, respectively.

3.4 Stratified Molecuttings and Gravelly Sand

The average percent compaction of the gravelly sand and molecuttings test fill was 92.8%. Molecuttings were used **for** lifts 1, 2, 3, 5, 7, and 8 for this test fill. The in-place dry density and percent compaction of the molecuttings was determined in accordance with the procedure described in the previous section. Lifts 4 and 6 of the test fill were constructed using gravelly sand. The in-place density for lift 4 was determined by four NDM tests. One SC test and 3 NDM tests were performed in lift 6. The maximum dry density and computation of the percent compaction at each in-place density test location was as described in the section for gravelly sand. Table 4 presents the summary of the percent compaction in the test fill. A profile of the test fill and the average percent compaction of each lift is presented in Fig. 3.

4. PLATE LOAD TESTS

Five plate load tests were performed on the four test fills. The plate load test number, test fill and date of the test is presented below.

Plate Load Test No.	Test Fill	Date of Test
1	Gravelly Sand	June 7, 1979
2	Molecuttings (No Special Control) .	June 14, 1979
3	Stratified Mole-cuttings and Gravelly Sand	June 15, 1979
4	Molecuttings (Controlled Placement)	June 18, 1979
5	Molecuttings (No Special Control)	June 27, 1979

The locations of the tests are indicated on Fig. 1 and details of the procedure are presented in Appendix B. In brief the procedure was as follows: an 18-in.-diameter steel plate was generally placed 12 in. below the surface of the test fill and loaded to produce contact stresses to 4 tsf and then to 12 tsf. Deflections of the plate were measured and recorded.

The results of the plate load tests are presented in Figs. B2 through B6. Values of Young's Modulus, E, were calculated from the results of the plate load tests using elastic theory. A description of the analysis is presented in Appendix B. A summary of the modulus calculated for each test is presented in Table 5. The percent compaction indicated in Table 5 represents the average percent compaction of lifts within the zone of significant stress increase due to the load on the plate. For an 18-in. -diameter plate this zone is about 18- to 36-in.-thick.

The soil modulus determined by the plate load test vs percent compaction is plotted on Fig. 8. The results indicate that the molecuttingshave a much higher modulus than the gravelly sand when both materials are compacted to the same percent compaction. In fact, the modulus of the molecuttings compacted to 93% compaction is approximately equivalent to the modulus of the gravelly sand placed at 97% compaction. Plate Load Test No. 5 (PLT-5) was performed 13 days after and about 4 ft away from Plate Load Test No. 2 (PLT-2). The soil modulus for PLT-5 was about two times

the modulus for PLT-2. The increase in modulus may have been caused by densification of the molecuttings as a result of drainage over the 13 day period between the performance of the two tests. Assuming that the molecuttings were saturated after PLT-2 and the water content reduced by 1% during a period of 13 days, the in-place dry density would have increased by 2 to 3 pcf or about a 1 to 2% increase in the percent compaction. The modulus for PLT-5, as a result of the densification, nearly plots on the line from PLT-2 to PLT-4.

Test PLT-3 was performed on the stratified molecuttings and gravelly sand test fill. The average percent compaction of the molecuttings and gravelly sand was 92.5 and 96.1%, respectively. Plate load tests, PLT-2 and PLT-1, were performed on separate test fills of molecuttings and gravelly sands compacted to about the same percent compaction and the moduli were 7,300 psi and 10,100 psi, respectively. The moduli determined for the stratified test fill, however, was 17,000 psi. Based on the results of PLT-1 and PLT-2 the anticipated modulus determined by FLT-3 was between 8 and 10,000 psi. The high modulus measured by PLT-3 may have been caused by one or more of the following factors:

1. Distribution of the load may have been more rapid for the layered fill than in a homogeneous fill, and

2. Drainage of the molecuttings and related increases in dry density and modulus may have accelerated faster in the stratified test fill than in the homogeneous molecuttings (No Special Controls) test fill due to drainage through the gravelly sand layers.

5. PLACEMENT AND FIELD CONTROL OF MOLECUTTINGS

The purpose of this section is to present recommendations for the placement and field control of molecuttings based on field and laboratory data obtained during construction of the test fills.

Review of the data obtained provided the information necessary to make recommendations on the limits for grain size, lift thickness, determination of in-place density and percent compaction, and control of water contents of the molecuttings. A discussion of each of the items is presented below.

5.1 Grain-Size Limits

Grain-size analyses were performed on thre'e samples of the molecuttings used for the test fills. The grain-size curves are presented on Fig. 7. The molecuttings were generally widely graded with uniformity coefficients of 45 to 100. The maximum particle size was generally less than 3-in.-diameter and the percent by weight passing the No. 200 sieve was from 5 to 7%. Based on these and other grain-size analyses recommendations for gradation requirements were developed and are presented in Appendix A.

5.2 Lift Thickness

The molecuttings were placed in 8-in.-thick loose lifts during construction of the test fills. Observations made during placement of the molecuttings indicated that the ability to achieve a specific percent compaction was mostly affected by the water content of the material rather than the thickness of the lift. When the molecuttings were placed at water contents above optimum, a specific degree of compaction generally **was** not achieved until the water content was reduced to'or below the optimum water content as a result of drainage. The time required for drainage is a function of the lift thickness and, therefore, where 95% and 93% compaction is required, lift thicknesses of 8-in. and 12-in. are recommended. The 12-in.-thick loose lift in areas where 93% compaction is required was recommended based on the fact that the average percent compaction of 93.0% was achieved for the molecuttings (No Special Controls) test fill without the benefit of extensive compactive efforts.

5.3 Determination of In-Place Dry Density

The nuclear density meter (NDM) provides a much faster determination of the field in-place dry density and water content than the sand cone (SC). The accuracy of the NDM tests performed in the gravelly sand and molecuttings was verified by comparing the results of adjacent NDM and SC tests.

5.3.1 Gravelly Sand

Generally, two SC tests were performed adjacent to two NDM tests on each lift of the test fill to compare the in-place dry density and water content measured by each method.. The in-place water content determined by the sand cone versus nuclear density meter is plotted on Fig. 9. The data indicate that both methods measure essentially the same water content at values less than 8% and, as the water content increases, the NDM measures a lower value than the SC. As a result, a correction was applied to the water content measured by the NDM to compute the in-place dry density... A plot of sand cone versus nuclear density meter determined in-place dry density is shown on Fig. 10. The correlation of the densities determined by each method was considered to be poor. The correlation may have been improved if more frequent moisture checks had been performed during construction of the test fill.

5.3.2 Molecuttings

Twelve-inch-diameter sand cone tests were performed in the molecuttings to reduce the effects that the maximum particle size and percentage of material larger than the 1½-in. sieve would have on in-place dry density determination. The in-place dry density and water content determined by the SC test was compared to the results from adjacent 8-in.-deep NDM tests. Comparison of the results indicated the water content determined by the NDM averaged 1.7% higher than that determined by the sand cone. The 1.7% difference in water contents was confirmed by performing water content checks at random NDM test locations. A 1.7% bias correction was applied to the water contents determined by the NDM. A plot of sand cone determined water content versus nuclear density meter water content (with a 1.7% bias correction) is presented on Fig. 11.

The plot shows there is a good correlation between the sand cone and nuclear density meter (after bias correction) water content determinations. A second water content check was made on molecuttings.after the test fill was completed which indicated that the bias had increased to 2.5%. Because the water content bias changed significantly within a period of two weeks periodic checks of the bias are recommended.

The in-place dry density determined by the sand cone test and the 8-in. NDM test after correction for the water content bias is plotted on Fig. 12. The solid dots and dashed circles represent in-place dry density measurements at water contents less than 5% and greater than 5%, respectively. The data indicate that there is good correlation of dry densities determined by both methods at water contents less than 5% and that the SC measured higher dry densities than the NDM at water contents above 5%. For this test fill the SC tests performed in molecuttings compacted at water contents above 5% are not considered valid for the reasons presented in the following discussion.

When the molecuttings were placed at water contents above about 5%, the compacted surface would exhibit a spongy behavior when one walked across the surface. The degree of sponginess increased as the moisture increased above the optimum water content. The sponginess is believed to be caused by water and air pore pressures. The net effect was that as the sand cone hole was excavated the pore pressures at the walls of the hole were relieved by the walls moving laterally into the hole until an equilibrium of the pore pressure at the walls of the hole was reached. Thus, by the time the volume of the hole was measured a significant decrease in the volume of the hole had occurred but the quantity of soil excavated was from the original volume. The result was that the dry soil excavated was divided by a reduced.volume which resulted in an inaccurately high computed dry density.

The SC and NDM test results indicate that the NDM can be used to determine the in-place dry density and water content of molecuttings. The water content bias should be checked periodically to account for changes that occur in the molecuttings. Details of a recommended placement procedure arepresented in Appendix A.

5.4 Determination of Percent Compaction

The field and laboratory data indicated the nuclear density meter could be used to determine the in-place dry density after the appropriate water content bias had been determined for the molecuttings being tested.

The preferred field procedure for determing the percent compaction of compacted soil is as follows:

1. Gbtain a one-point sample of the soil before compaction.

2. Perform the' one-point compaction test in the lab and determine the maximum dry density from a family of curves.

3. Perform the in-place dry density of the compacted lift using the nuclear density meter at or near the location of where the one-point sample was taken.

This procedure can be used for the molecuttings if at least three nuclear density meter determinations of the in-place dry density are made. The average of the three tests should be used to represent the in-place density for computation of the percent compaction. The above procedure will reduce the effect that minor variations in the character of the molecuttings will have on the in-place dry density determination.

The use of a standard laboratory compaction test or one which was slightly modified was considered the best method of determining the maximum dry density of the molecuttings. The Modified AASHG Compaction Test, ASTM D1557, permits the use of minus 3/4-in. material to be compacted in 6-in. molds. Grain-size analyses performed on molecuttings indicate that nearly 50% of the sample is retained on the 3/4-in. sieve, and, as a result, the material passing the 3/4-in. sieve would behave much differently than the total sample during compaction. A sample of the molecuttings that would represent the compaction behavior of the material was considered possible if the amount of coarse material removed was limited to about 20% by weight of the total sample. This could generally be achieved by removing material retained on the 1½-in. sieve. For the test fill the laboratory compaction used was ASTM D1557, Method C, except the plus 1½-in. material was removed. Because this compaction test, as modified above, was used for the test fill and gave reasonable results its use is recommended for performing laboratory compaction tests on the molecuttings.

5.5 Water Content Control

The laboratory compaction curves for compaction tests performed on samples of molecuttings show a sharp peak in dry density at the optimum water content, Fig. 6. The dry density drops as the water increases or decreases from the optimum value. The laboratory data show that small variations in water content significantly affect the degree of compaction that can be achieved in the molecuttings. This behavior was also observed during placement and compaction of the molecuttings in the test fills. In the test fill where placement of the molecuttings was controlled, the required percent compaction generally could only be achieved by controlling the water content, by either wetting or drying, of the molecuttings. The most efficient compaction of the molecuttings was when the water content was from about 4 to 6%. Therefore, the water content of the molecuttings should not differ from optimum by more than $\pm$ 1%, for most efficient compaction.

TABLES

TABLE 1 - SUMMARY OF FIELD DENSITY TESTS
GRAVELLY SAND TEST FILL
QUARTZITE MOLECUTTINGS STUDY
SEABROOK STATION

Lift No.	Sample No.	One-Point Compaction: Percent +3/4-in. Material %	One-Point Compaction: Water Content %	One-Point Compaction: Dry Density γ_d, pcf	Laboratory Maximum Dry Density γ_d, pcf	In-Place Dry Density, pcf: Total Sample	In-Place Dry Density, pcf: Corrected For +3/4-in. Material	Percent Compaction %
1	ND-1	One-point samples not obtained			122.1 (1)	120.9	This column does not apply for compaction test performed using ASTM D1557, Method D	99.0 (3)
	ND-2					123.7		101.3 (3)
	ND-3					121.1		99.2 (3)
	SC-1					118.1		96.7 (3)
2	SC-1	11.1	9.7	120.9	123.0	115.0		93.5
	ND-2	4.8	10.0	116.8	120.5	117.1		97.2
	SC-3	9.4	9.0	120.1	123.0	120.3		97.8
	ND-4 (1)	8.1	9.2	117.9	122.0	119.5		97.2 (3)
	ND-5 (1)	N.A.	13.0	122.3	122.3	119.2		97.4 (3)
3	ND-1	One-point samples not obtained				123.0		100.6 (3)
	SC-2					126.0		103.2 (3)
	ND-3					121.4		99.4 (3)
	SC-4 (1)					122.5		100.3 (3)
	ND-5 (1)	N.A.	5.2	115.5	122.1	121.5		99.4 (3)
4	ND-1 (2)	8.5	4.9	117.8	125.5	119.1		94.9
	SC-2 (2)	8.5	4.9	117.8	125.5	120.5		96.0
	ND-3 (2)	5.0	7.4	119.1	124.0	124.1		100.0
	SC-4 (2)	5.0.	7.4	119.1	124.0	118.8		95.8
	ND-5	5.8	7.0	121.5	126.0	119.0		94.4

NOTES:
(1) One-point compaction sample performed by Pittsburgh Testing Labs.
(2) One one-point compaction sample obtained for sand cone and nuclear density test performed adjacent to each other.
(3) Percent compaction computed using maximum dry density determined by Pittsburgh Testing Lab.

Geotechnical Engineers Inc.

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TABLE 1 - SUMMARY OF FIELD DENSITY TESTS
GRAVELLY SAND TEST FILL
QUARTZITE MOLECUTTINGS STUDY
SEABROOK STATION

Lift NO.	Sample No.	One-Point Compaction: Percent +3/4-in. Material %	One-Point Compaction: Water Content %	One-Point Compaction: Dry Density γ_d, pcf	Laboratory Maximum Dry Density γ_d, pcf	In-Place Dry Density, pcf: Total Sample	In-Place Dry Density, pcf: Corrected For +3/4-in. Material	Percent Compaction %
5	ND-1 (2)	4.8	9.7	124.5	125.0	125.5		100.4
	SC-2 (2)	4.8	9.7	124.5	125.0	123.8		99.0
	ND-3	5.8	10.3	123.1	124.0	120.9		97.5
	SC-4 (2)	13.0	9.3	126.4	127.0	124.9		98.0
	ND-5 (2)	13.0	9.3	126.4	127.0	121.3		95.5
6	ND-1	3.9	10.0	122.3	123.2	117.8		95.6
	ND-2 (2)	13.2	8.4	126.0	127.0	118.7		93.5
	SC-3 (2)	13.2	8.4	126.0	127.0	125.7		99.0
	SC-4 (2)	9.1	7.6	123.3	126.5	123.0		97.2
	ND-5 (2)	9.1	7.6	123.3	126.5	126.6		99.7
7	ND-1 (2)	5.9	6.8	120.5	126.5	122.5		96.8
	SC-2 (2)	5.9	6.8	120.5	126.5	123.8		97.9
	ND-3 (2)	10.7	7.8	121.0	124.8	121.6		97.4
	SC-4 (2)	10.7	7.8	121.0	124.8	123.2		98.7
	ND-5	11.3	7.6	121.5	125.8	121.9		96.9
8	ND-1	One-point samples not obtained				119.6		98.9 (3)
	SC-2					118.9		98.3 (3)
	ND-3					120.2		99.4 (3)
	SC-4					118.8		98.3 (3)
	ND-5 (1)	N.A.	13.8	117.9	120.9	116.2		96.1 (3)

NOTES: (1) One-point compaction sample performed by Fittsburgh Testing Lab.
(2) One one-point compaction, sample obtained for sand cone and nuclear density test performed adjacent to each other.
(3) Percent compaction computed using maximum dry density determined by Pittsburgh Testing Lab.

TABLE 2 - SUMMARY OF FIELD DENSITY TESTS
MOLECUTTINGS (CONTROLLED PLACEMENT) TEST FILL
QUARTZITE MOLECUTTINGS STUDY
SEABROOK STATION

Lift No.	Sample No.	One-Point Compaction: Percent +1½-in. Material %	One-Point Compaction: Water Content %	One-Point Compaction: Dry Density γ_d, pcf	Laboratory Maximum Dry Density γ_d, pcf	In-Place Dry Density, pcf: Total Sample	In-Place Dry Density, pcf: Corrected For +1½-in. Material	Percent Compaction %
1	ND-12	One-point samples not obtained			N.A.	145.5	N.A.	N.A.
	ND-13				N.A.	144.0	N.A.	N.A.
	ND-14				N.A.	142.6	N.A.	N.A.
	ND-15				N.A.	146.9	144.5	N.A.
2	ND-8	10.8	5.1	145.4	151.0	150.0	146.9	97.3
	ND-9	24.9	5.1	146.0	151.5	149.5	140.9	93.0
	ND-10 (1) SC-11	(1) 7.(2)	3.7	143.3 (2) 143.3	153.0 (2) 153.[illegible]	161.5 152.4	150.5 158.4	98.(3)
3	ND-10	11.4	4.6	145.9	152.0	143.1	139.0	91.4
	ND-12 (1) SC-12	10. 4.4 (2)	4.1 4.4	144 144.9 144.9 (2)	152.0 (2) 152.5	[illegible]	[illegible]	[illegible]
4	ND-1	7.3	5.0	151.2	154.0	149.4	147.4	95.7
	ND-2	8.2	4.6	148.3	154.0	148.3	145.9	94.7
	ND-3 (1)	6.8	4.3	147.5 (2)	154.0 (2)	144.9	142.7	92.6
	SC-4 (1)	(2)		147.5	154.0	149.7	149.7	97.2

NOTES: (1) One one-point compaction sample obtained for sand cone and nuclear density test performed adjacent to each other.
(2) Laboratory one-point compaction test results and interpolated maximum dry density are from adjacent nuclear density meter one-point compaction samples and test results.
(3) In-place dry density measured is in error for reasons discussed in the text.

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TABLE 2 - SUMMARY OF FIELD DENSITY TESTS
MOLECUTTINGS (CONTROLLED PLACEMENT) TEST FILL
QUARTZITE MOLECUTTINGS STUDY
SEABROOK STATION

Lift No.	Sample No.	One-Point Compaction: Percent +1½-in. Material %	One-Point Compaction: Water Content %	One-Point Compaction: Dry Density γ_d, pcf	Laboratory Maximum Dry Density γ_d, pcf	In-Place Dry Density, pcf: Total Sample	In-Place Dry Density, pcf: Corrected For +1½-in. Material	Percent Compaction %
5	ND-8	5.6	4.9	148.7	155.0	150.6	149.1	96.2
	ND-9 (1)	7.7	4.1	146.5	155.0	148.0	145.7	94.0
	ND-10 (1)	14.5	4.7	146.0	153.0	149.4	145.0	94.8
	SC-11	(2)		146.0 (2)	153.0 (2)	162.3	160.6	(3)
6	ND-4	16.9	4.0	146.0	155.0	152.6	146.0	95.5
	ND-5 (1)	7.8	4.5	147.9	153.0	150.2	148.1	96.8
	ND-6 (1)	7.5	4.2	148.3	154.0	152.3	150.4	97.7
	SC-7	(2)		148.3	154.0			
7	ND-4	12.5	4.9	145.2	151.0	147.1	143.1	94.8
	ND-5	12.2	5.0	147.5	152.0	149.5	145.9	96.0
	ND-6	10.4	4.6	146.3	152.0	147.6	144.4	95.0
8	ND-1	One-point samples not obtained				146.0	N.A.	N.A.
	ND-2					146.5	N.A.	N.A.
	ND-3					146.1	N.A.	N.A.

NOTES: (1) One one-point compaction sample obtained for sand cone and nuclear density test performed adjacent to each other.
(2) Laboratory one-point compaction test results and interpolated maximum dry density are from adjacent nuclear density meter one-point compaction samples and test results.
(3) In-place dry density measured is in error for reasons discussed in the text.

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TABLE 3 - SUMMARY OF FIELD DENSITY TESTS
MOLECUTTINGS (NO SPECIAL CONTROLS) TEST FILL
QUARTZITE MOLECUTTINGS STUDY
SEABROOK STATION

Lift No.	Sample No.	One-Point Compaction: Percent +1½-in. Material %	One-Point Compaction: Water Content %	One-Point Compaction: Dry Density γ_d, pcf	Laboratory Maximum Dry Density γ_d, pcf	In-Place Dry Density, pcf: Total Sample	In-Place Dry Density, pcf: Corrected For + 1½-in. Material	Percent Compaction %
1	ND-4	One-point samples not obtained				146.3		N.A.
	ND-5					142.4		N.A.
	ND-6					145.5		N.A.
	ND-7					149.1	149.1	N.A.
2	ND-4	12.3	4.6	147.7	155.0	149.4	145.7	94.0
	ND-5	10.6	5.8	149.0	152.0	145.8	144.5	95.1
	ND-6	14.5	5.5	149.6	152.0	145.8	142.3	93.6
	SC-7	12.3	4.6	147.7	155.0	157.8	154.5	91.0
3	ND-5	6.0	6.7	147.0	151.0	143.7	141.7	93.8
	ND-6	9.2	6.2	147.8	151.0	141.9	138.5	91.7
4	ND-1	10.6	6.5	148.8	151.1	144.7	141.1	93.3
	ND-2	15.5	6.6	146.0	151.0	143.0	137.1	90.8
5	ND-1	12.3	4.9	148.9	153.0	150.9	147.5	96.4
	ND-2	12.3	5.0	148.1	152.0	152.2	149.0	98.0
	ND-3	24.8	4.7	147.7	153.0	140.5	129.0	84.3
6	ND-5	23.5	4.3	153.3	156.0	154.2	147.7	94.7
	ND-6	8.5	3.6	145.1	153.0	145.1	142.3	93.0
	ND-7	9.4	5.6	153.6	155.0	143.3	140.0	90.3

TABLE 3 - SUMMARY OF FIELD DENSITY TESTS
MOLECUTTINGS (NO SPECIAL CONTROLS) TEST FILL
QUARTZITE MOLECUTTINGS STUDY
SEABROOK STATION

Lift No.	Sample No.	One-Point Compaction: Percent +1½-in. Material	One-Point Compaction: Water Content %	One-Point Compaction: Dry Density γ_d, pcf	Laboratory Maximum Dry Density γ_d, pcf	In-Place Dry Density, pcf: Total Sample	In-Place Dry Density, pcf: Corrected For +1½-in. Material	Percent Compaction %
7	ND-7	5.1	3.1	141.2	149.0	140.0	138.1	92.7
	ND-8	4.0	3.4	140.1	148.0	139.2	137.7	93.0
	ND-9	7.5	3.9	143.6	151.0	148.8	146.6	97.1
8	ND-1	One-point samples not obtained				144.4	N.A.	N.A.
	ND-2					125.0	N.A.	N.A.
	ND-3					144.3	N.A.	N.A.

TABLE 4 - SUMMARY OF FIELD DENSITY TESTS
STRATIFIED MOLECUTTINGS AND GRAVELLY SAND TEST FILL
QUARTZITE MOLECUTTINGS STUDY
SEABROOK STATION

Lift No.	Sample No.	One-Point Compaction			Laboratory Maximum Dry Density γ_d, pcf	In-Place Dry Density, pcf		Percent Compaction
		Percent + 1½-in. Material %	Water Content %	Dry Density γ_d, pcf		Total Sample	Corrected For +1½-in. Material	%
3	ND-7	15.0	5.7	149.3	153.0	148.8	144.1	94.2
	ND-8	12.2	6.0	148.8	152.0	145.9	141.8	93.3
4 (1)	ND-3	11.3 (2)	5.6	118.3	125.0	114.3	N.A.	91.4
	ND-4	11.5 (2)	2.7	122.2	124.0	108.1	N.A.	87.2
	ND-5	3.3 (2)	3.0	115.1	123.0	108.2	N.A.	88.0
	ND-6	7.4 (2)	4.9	116.9	124.5	110.6	N.A.	88.8
5	ND-4	10.4	4.3	145.7	151.0	151.3	148.5	98.4 (3)
	ND-5	16.3	3.8	144.8	153.0	138.1	130.8	85.5
6 (1)	SC-1 (4)	N.A.	N.A.	123.3	127.5	123.8	N.A.	97.1
	ND-2 (4)	14.1 (2)	7.2	123.3	127.5	121.1	N.A.	95.0
	ND-3	2.7 (2)	6.8	118.8	124.5	119.3	N.A.	95.8
	ND-4	12.4 (2)	8.3	120.3	124.0	119.6	N.A.	96.5
7	ND-10	4.8	2.7	137.5	148.0	140.2	138.4	93.5
8	ND-4	One point samples not obtained				147.3	N.A.	N.A.
	ND-5					140.8	N.A.	N.A.

NOTES:
(1) Gravelly sand used for the construction of Lift.
(2) Values represent percent +3/4-in. material.
(3) Nuclear density probe may have penetrated gravelly sand layer below.
(4) One one-point compaction sample obtained for SC-1 and ND-2.

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TABLE 5 - SUMMARY OF PLATE LOAD TESTS RESULTS
QUARTZITE MOLECUTTINGS STUDY
SEABROOK STATION

Plate Load Test No.	Soil At Test Location	Soil Modulus, psi		Average Percent Compaction	Remarks
		Virgin	Reload		
1	Gravelly Sand	10,100-10,500	20,000-29,700	97.1	
2	Mole Cuttings (No Special Control)	7,300-7,700	25,200-40,300	92.6	
3	Stratified Mole Cuttings and Gravelly Sand	17,000-26,100	41,200-45,300	M.C.=92.5 G.S.=96.1	Ave. Percent Compaction 93.7
4	Mole Cuttings (Controlled Placement)	28,300-35,900	54,300-66,600	95.3	
5	Mole Cuttings (No Special Control)	13,200-21,200	43,100-49,200		Performed 13 days after PLT-2

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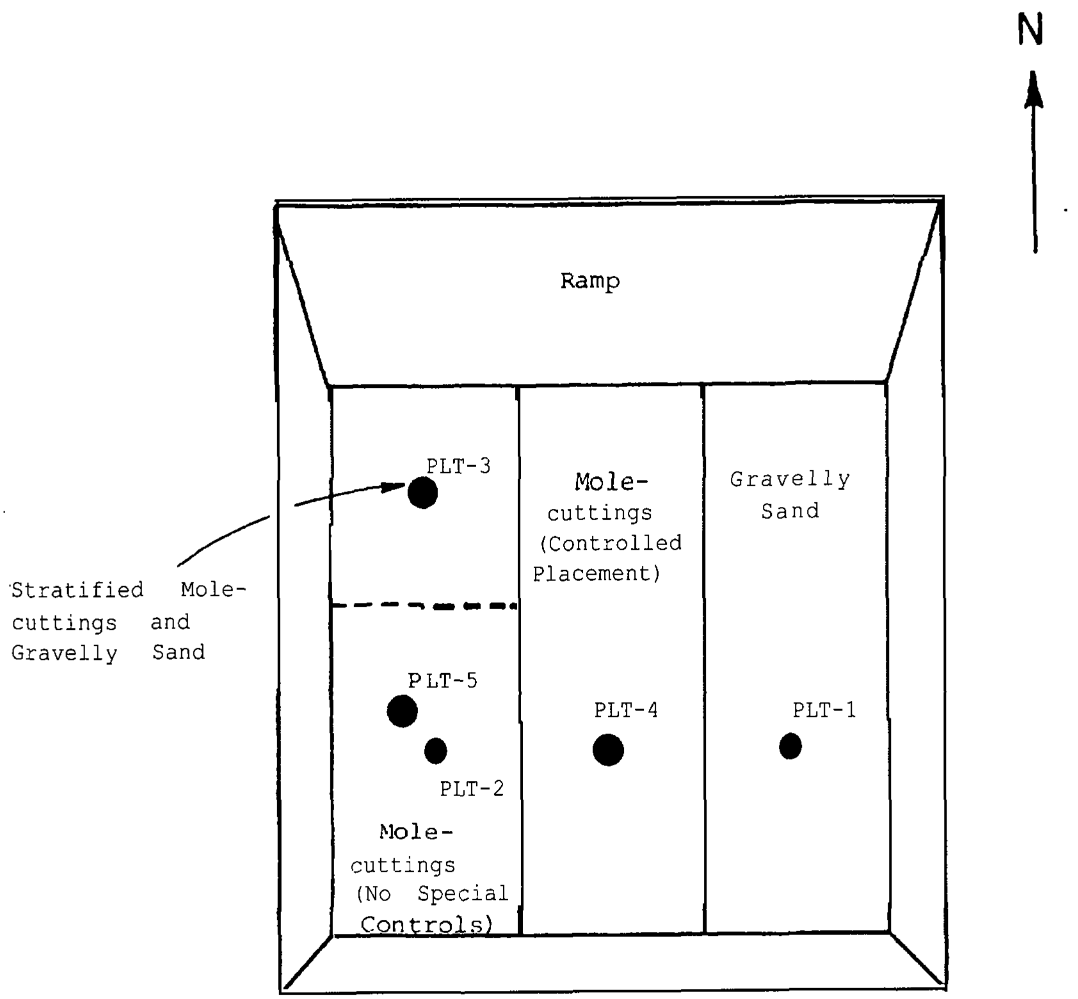
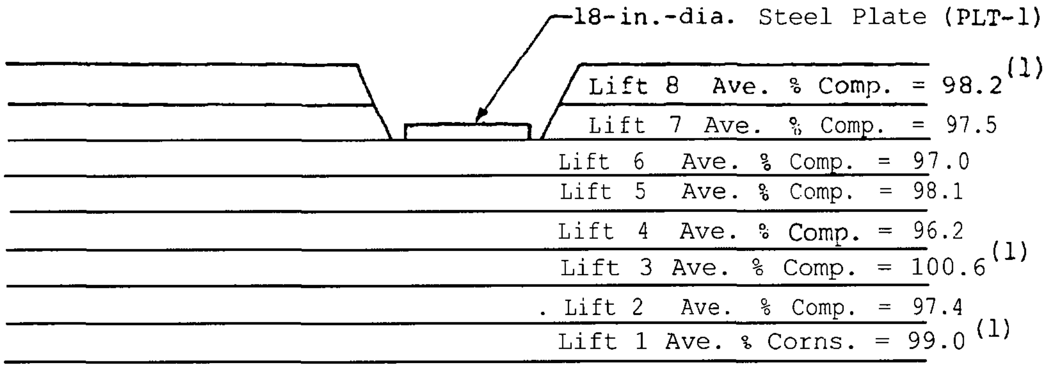
FIGURES



Not To Scale

Public Service Company of New Hampshire	Quartzite Molecuttings Study	PLAN VIEW OF TEST FILLS
GEOTECHNICAL ENGINEERS INC WINCHESTER, MASSACHUSETTS	Project 76301	July 11, 197[illegible] Fig. 1

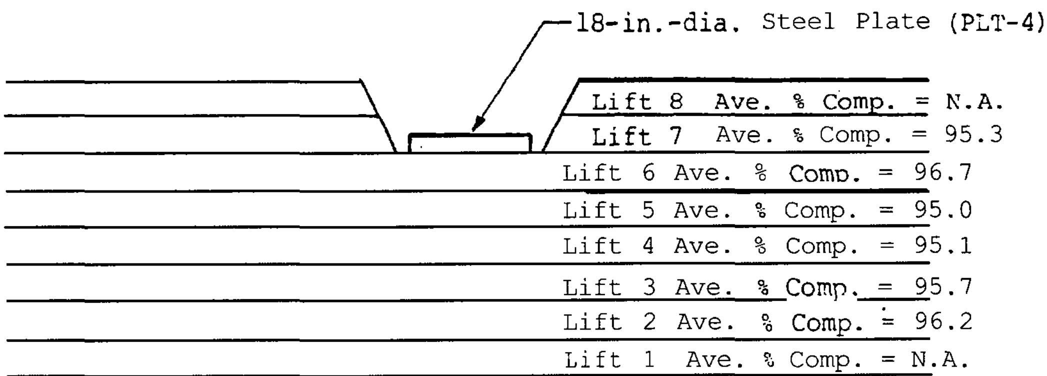
PROFILE OF GRAVELLY SAND TEST FILL



Scale: 1" = 2.5'

1. One-point compaction samples not obtained. Average percent compaction is based on maximum dry density provided by PTL.

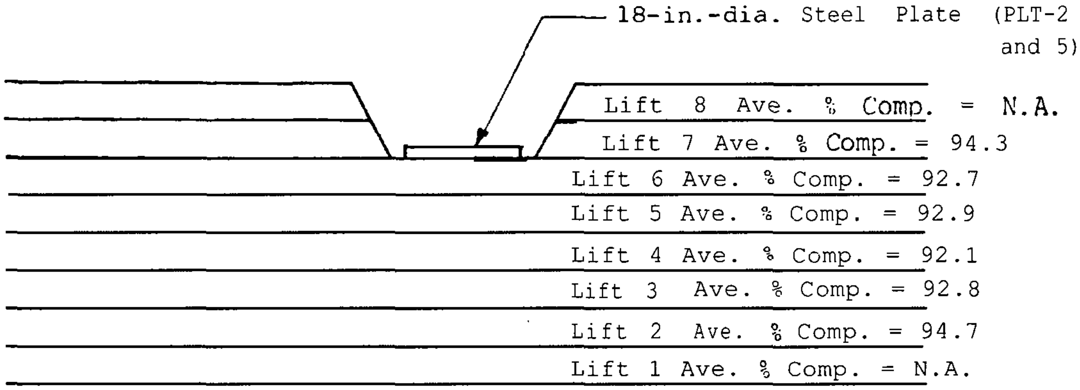
PROFILE OF MOLECUTTINGS (CONTROLLED PLACEMENT) TEST FILL



Scale: 1" = 2.5'

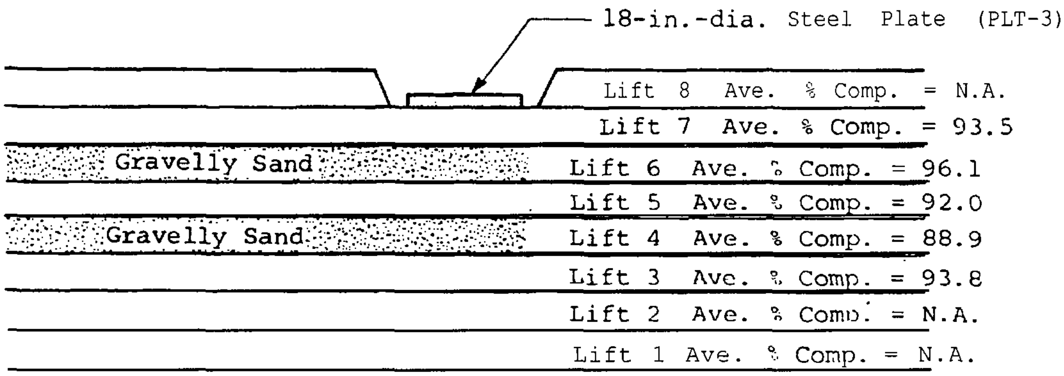
Public Service Company of New Hampshire	Quartzite Molecuttings Study	PROFILE OF TEST FILLS
GEOTECHNICAL ENGINEERS INC WINCHESTER, MASSACHUSETTS	Project 76301	July 11, 197[illegible] Fig. 2

PROFILE OF MOLECUTTINGS
(NO SPECIAL CONTROLS) TEST FILL



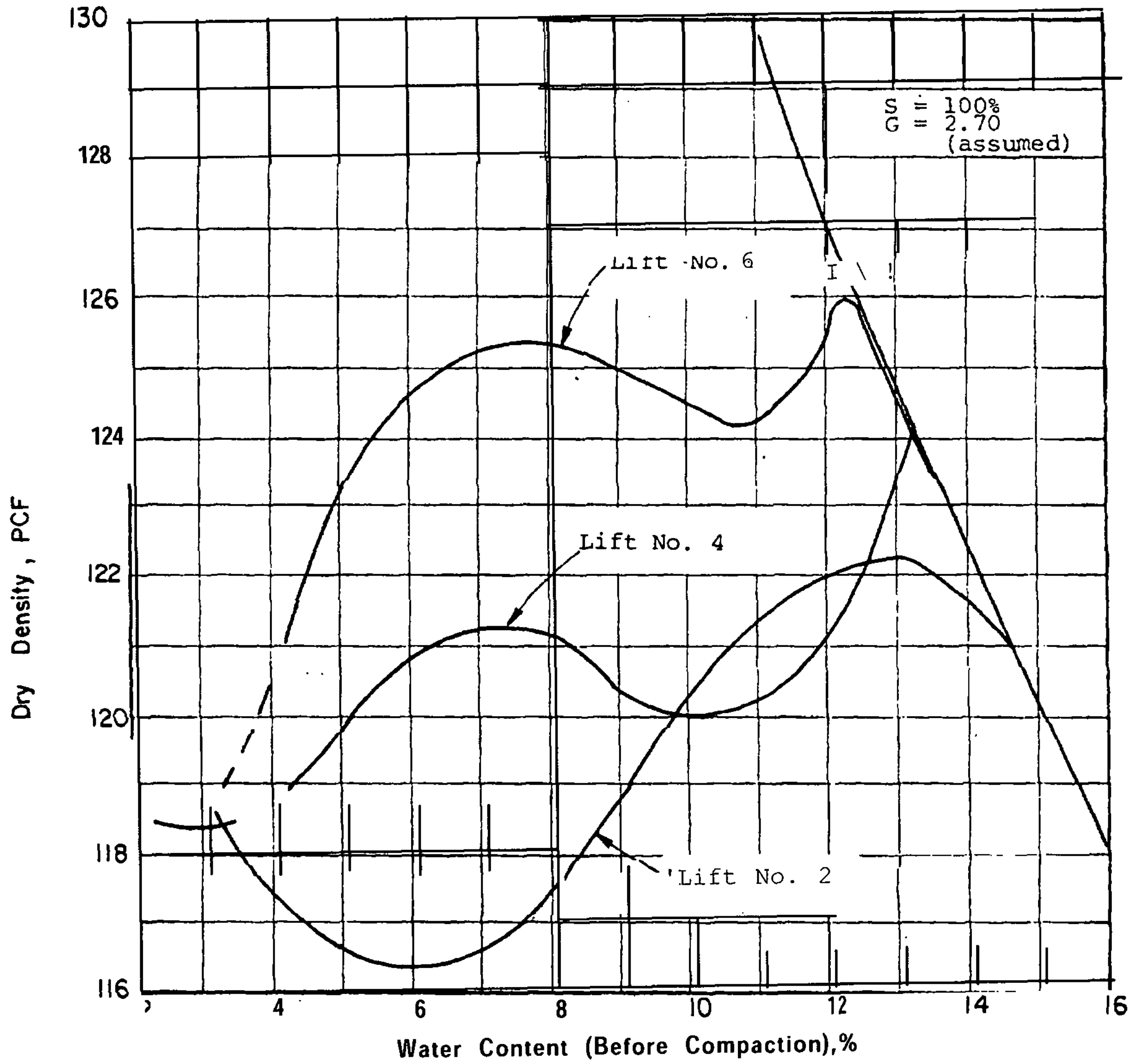
Scale: 1" = 2.5'

PROFILE OF STRATIFIED MOLECUTTINGS
AND GRAVELLY SAND TEST FILL



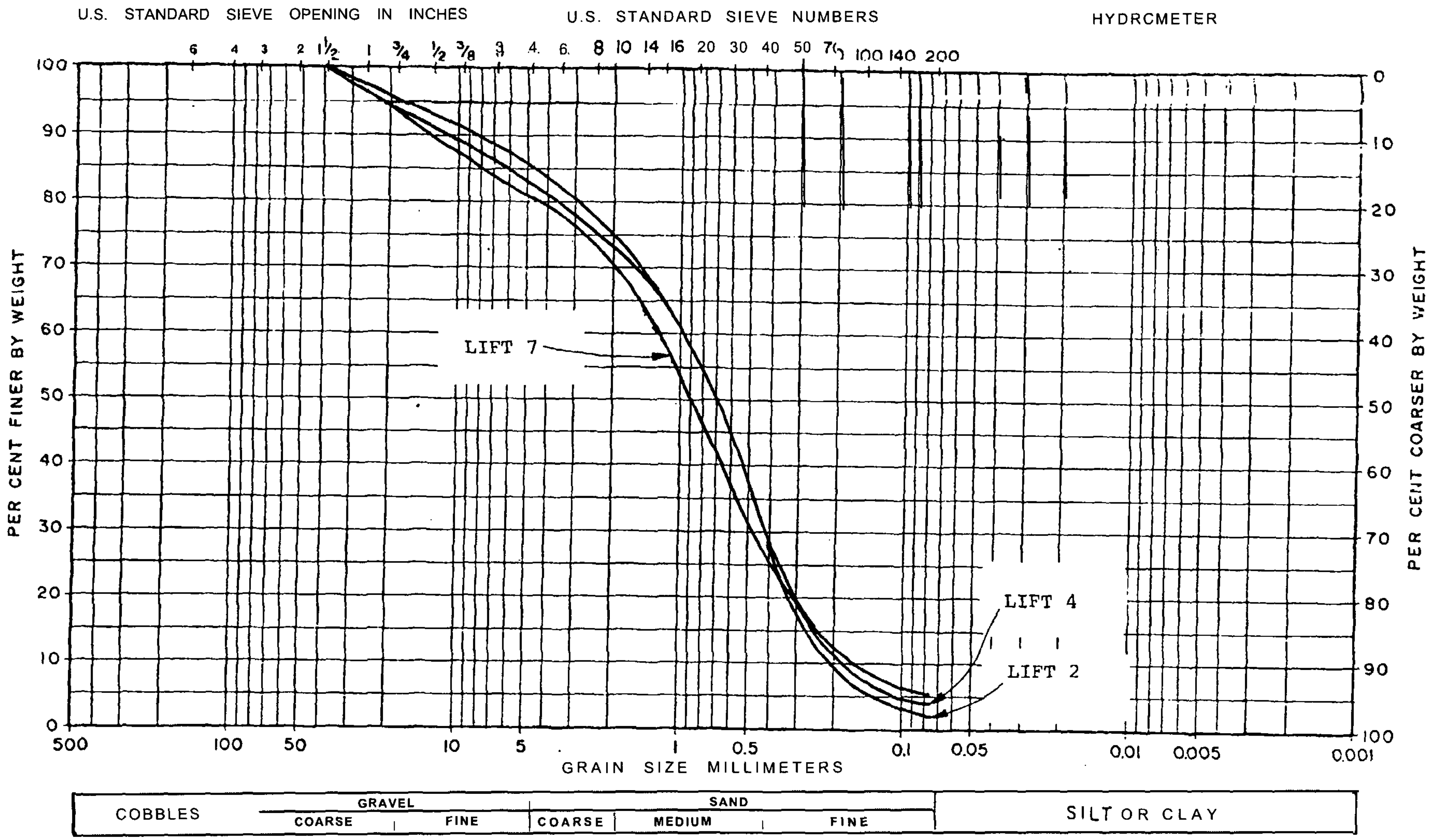
Scale: 1" = 2.5'

Public Service Company of New Hampshire	Quartzite Molecuttings Study	PROFILE OF TEST FILLS
GEOTECHNICAL ENGINEERS INC WINCHESTER • MASSACHUSETTS	Project 76301	July 11, 1979 Fig. 3



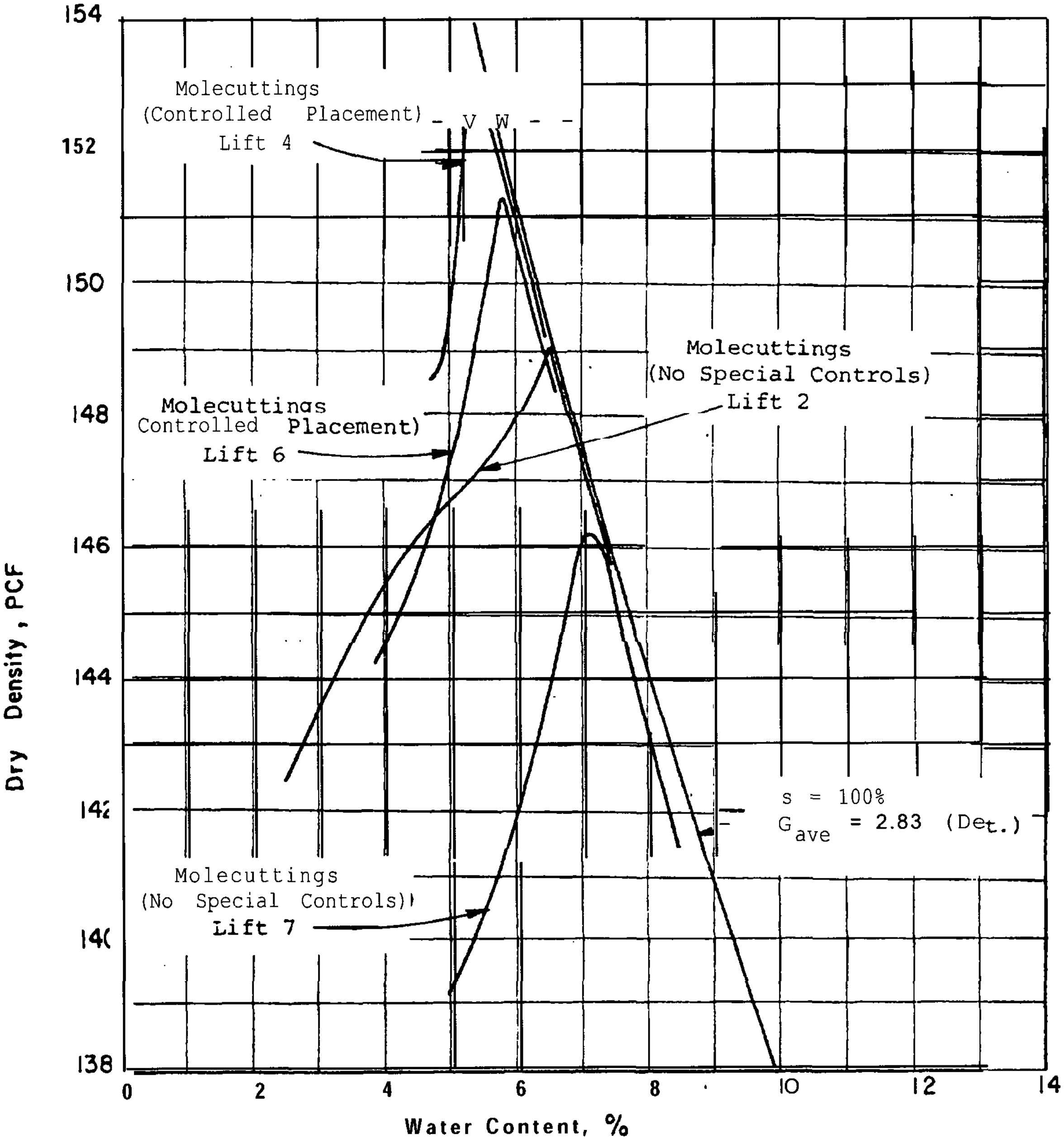
NOTE: Compaction test performed in accordance with ASTM D1557, Method D, by Pittsburgh Testing Labs.

Public Service Company of New Hampshire	Quartzite Molecuttings Study	COMPACTION CURVES GRAVELLY SAND TEST FILL
GEOTECHNICAL ENGINEERS INC. WINCHESTER, MASSACHUSETTS	Project 76301	July 12, 1979 Fig. 4



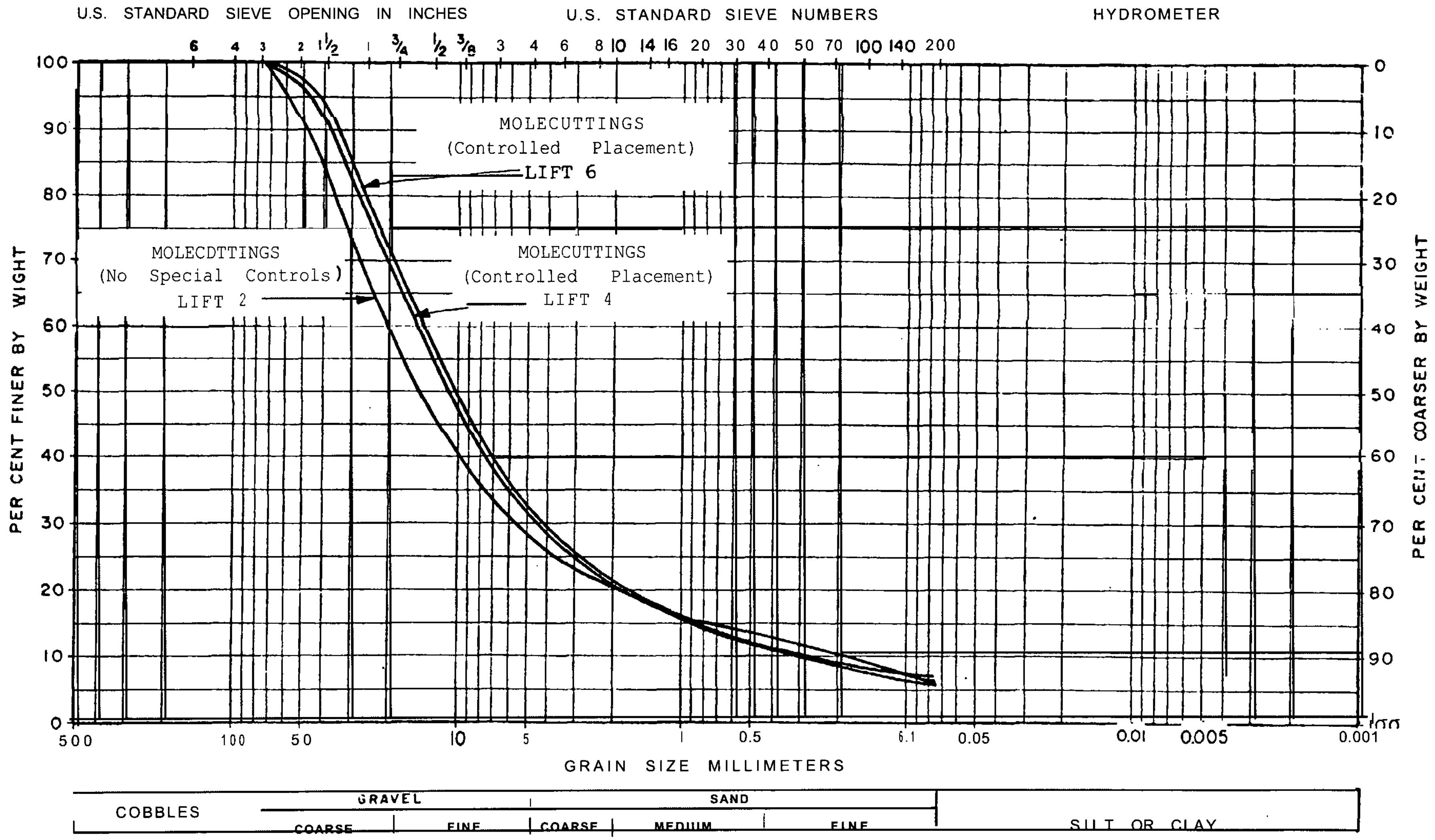
Grain-size analyses performed by Pittsburgh Testing Labs.

Public Service Company of New Hampshire	Quartzite Molecuttings Study	GRAIN SIZE CURVES GRAVELLY SAND TEST FILL
GEOTECHNICAL ENGINEERS INC WINCHESTER • MASSACHUSETTS	Project 76301	July 11, 1979 Fig. 5



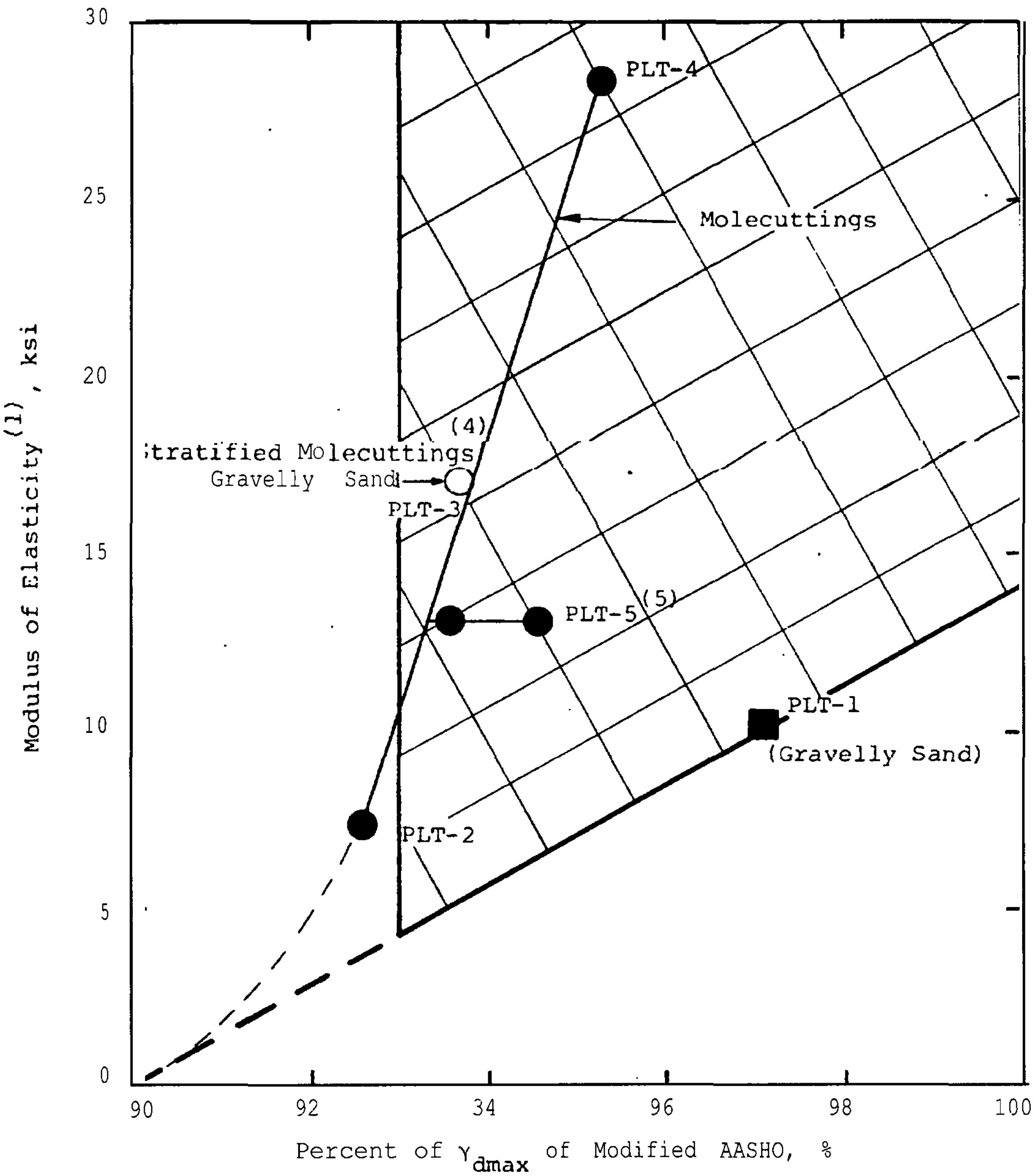
NOTE: 1. Compaction test performed in accordance with ASTM D1557, Method C, except the plus 1½-in. material was discarded and no limitation placed on the percent retained on the 1½-in. sieve.

Public Service Company of New Hampshire GEOTECHNICAL ENGINEERS INC WINCHESTER · MASSACHUSETTS	Quartzite Molecuttings Study Project 76301	COMPACTION CURVES Molecuttings July 12, 1979 Fig. 6



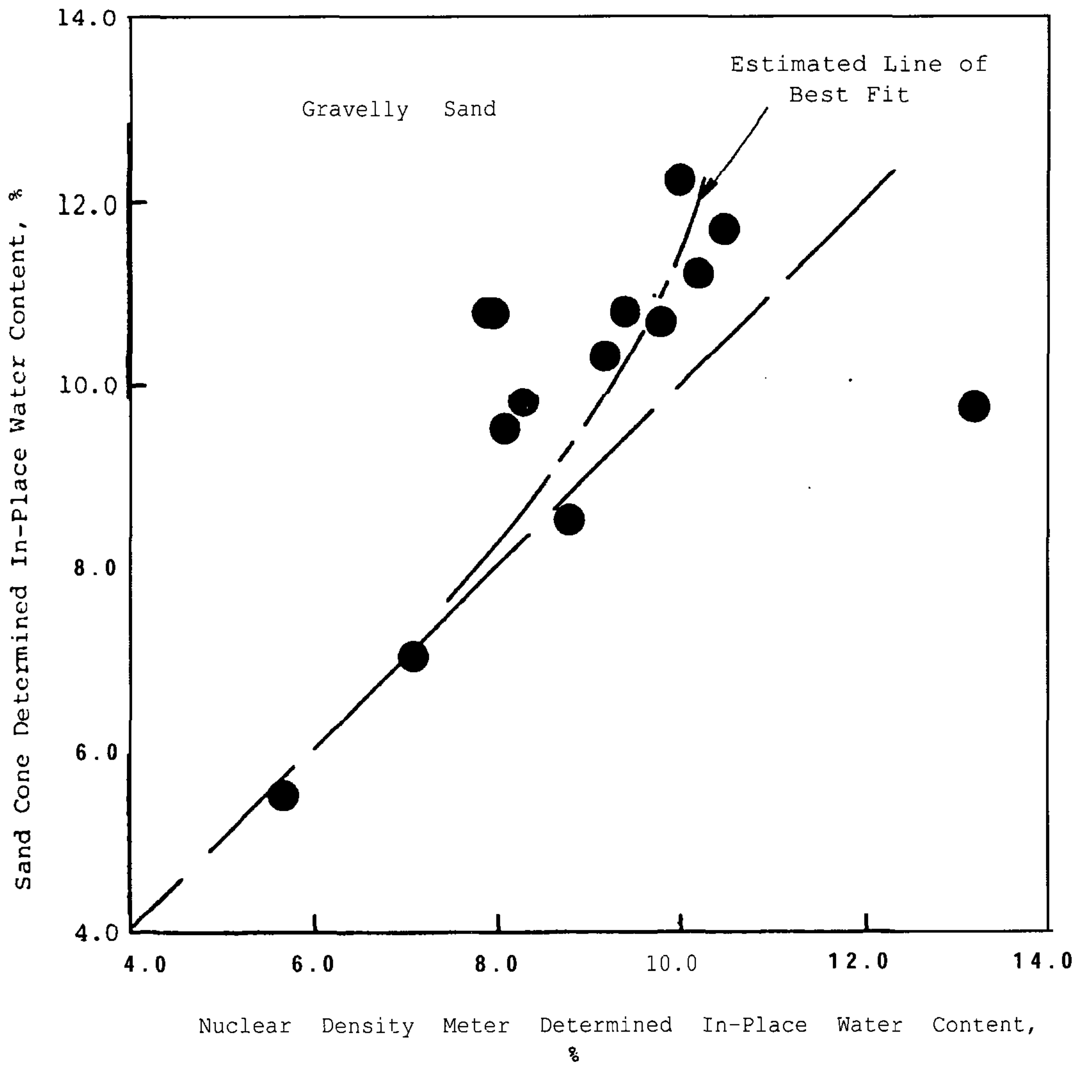
Grain-size analyses performed using successive elutriation.

Public Service Company of New Hampshire	Quartzite Molecuttings study	GRAIN SIZE CURVES SAMPLES OF MOLECUTTINGS
GEOTECHNICAL ENGINEERS INC WINCHESTER . MASSACHUSETTS	Project 76301	July 11, 1979 Fig. 7

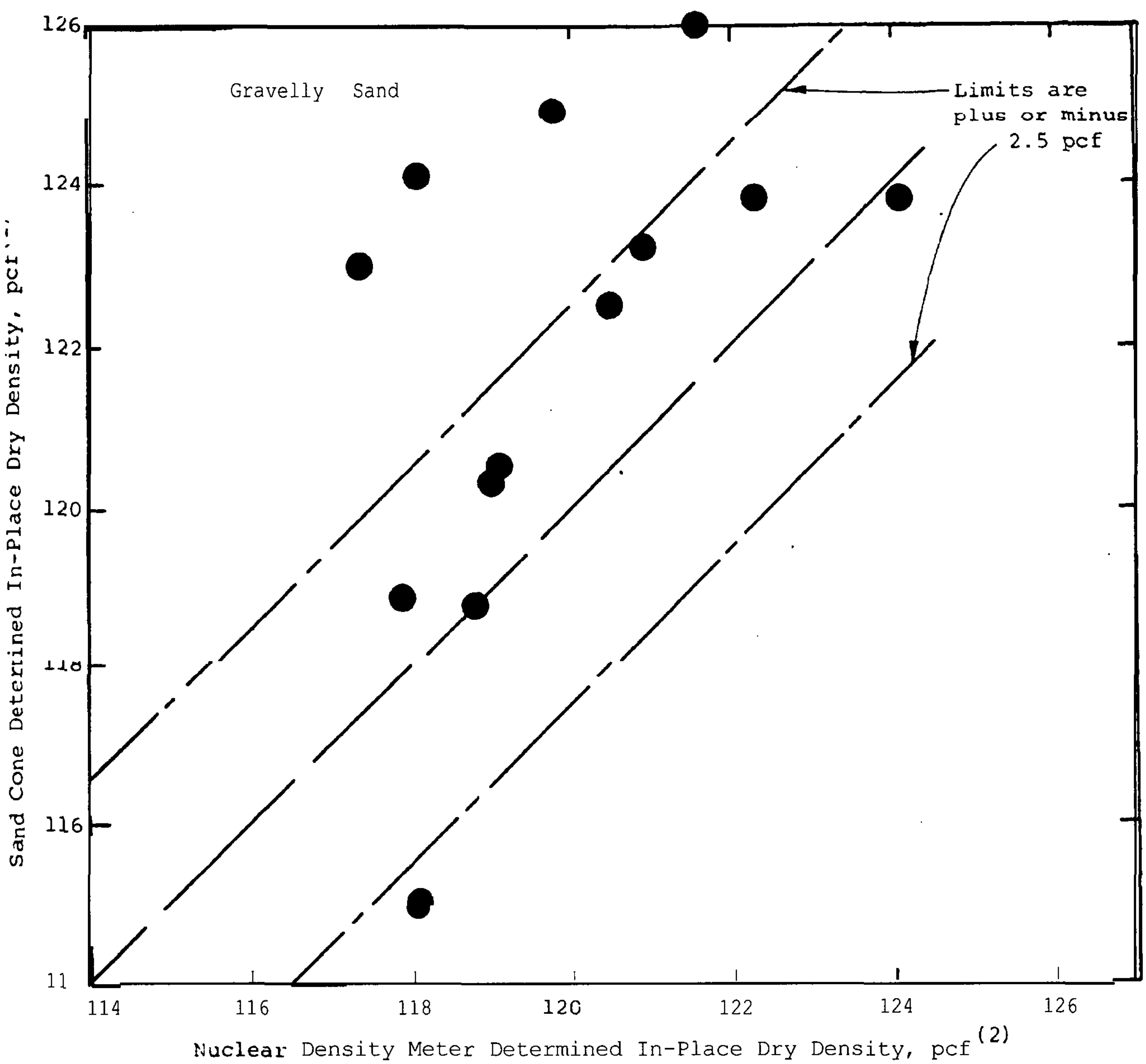


NOTES:
1. Modulus of elasticity computed using theory of elasticity for semi-infinite, isotropic soil.
2. Modulus of elasticity value plotted is minimum value from virgin loading curve.
3. Percent compaction is the average percent compaction of the first three layers of soil under the plate.
4. Percent compaction the average percent compaction of two layers of molecuttings and one layer of gravelly sand.
5. Range in percent compaction is estimated. See discussion in text.

Public Service Company of New Hampshire	Quartzite Molecuttings Study	MODULUS OF ELASTICITY VERSUS PERCENT COMPACTION MOLECUTTINGS-GRAVELLY SAND
GEOTECHNICAL ENGINEERS INC WINCHESTER • MASSACHUSETTS	Project 76301	July 11, 1979 Fig. 8

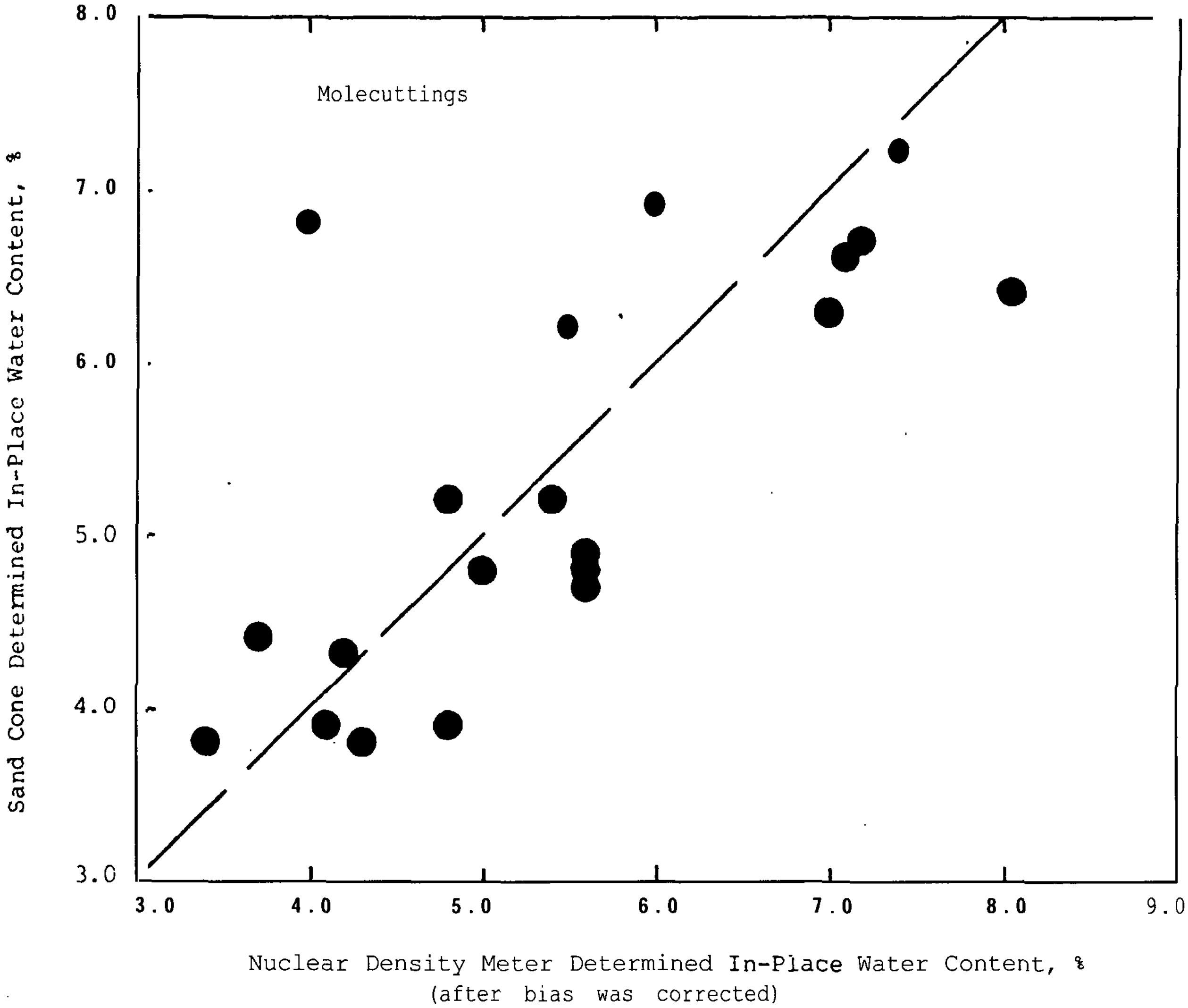


Public Service Company of New Hampshire	Quartzite Molecuttings Study	WATER CONTENT SAND CONE VS NUCLEAR DENSITY METER GRAVELLY SAND
GEOTECHNICAL ENGINEERS INC WINCHESTER • MASSACHUSETTS	Project 76301	July 11, 1979 Fig. 9



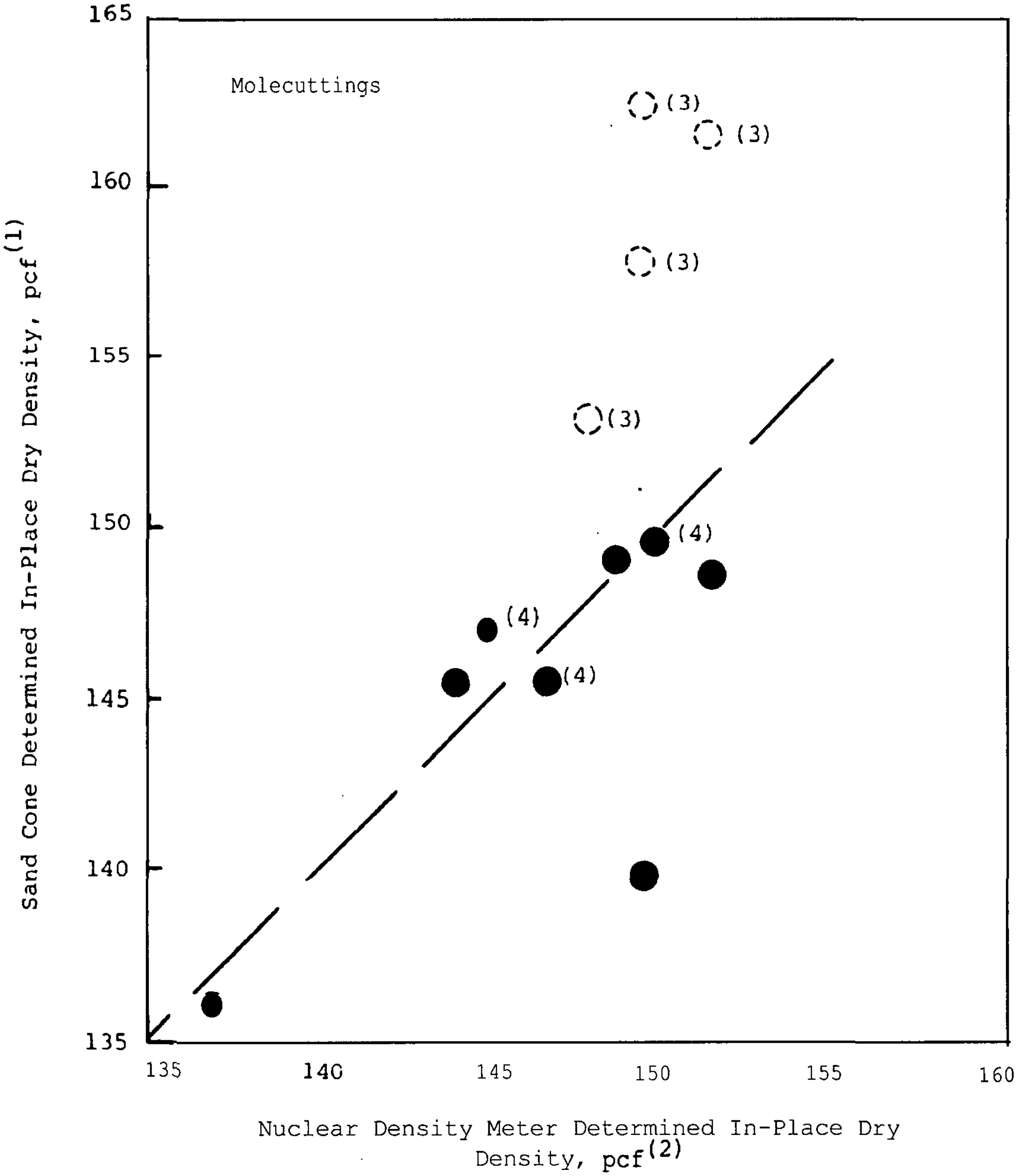
NOTES:
1. In-place dry density includes plus 3/4-in. material.
2. In-place dry density based on 8-in. deep nuclear test. Densities have been corrected for water content bias according to plot of "W" sand cone versus "W" nuclear device for gravelly sand:
3. Sand Cone and Nuclear Density Meter determinations were performed adjacent to each other (about 6-12 in. apart).

Public Service Company of Elcw Hampsh i L-C	Quartzite Molecuttings study	SAND CONE VS NUCLEAR DENSITY METER DET. IN-PLACE DRY DENSITY GRAVELLY SAND
GEOTECHNICAL ENGINEERS INC WINCHESTER - MASSACHUSETTS	Project 76301	July 11, 197? Fig. 10



NOTES: 1. In-place water content is based on 8-in. deep nuclear test.

Public Service Company of New Hampshire	Quartzite Molecuttings Study	WATER CONTENT SAND CONE VS NUCLEAR DENSITY METER MOLECUTTINGS
GEOTECHNICAL ENGINEERS INC WINCHESTER • MASSACHUSETTS	Project 76301	July 11, 1979 Fig. 11



NOTES:
1. In-place dry density is uncorrected for the plus 1½-in. material.
2. In-place dry density is based on the 8-in. deep nuclear test, except where noted.
3. Water content of Sand Cone was greater than 5.0%.
4. In-place density is based on 4-in. deep nuclear test.

Public Service Company of New Hampshire	Quartzite Molccuttings Study	SAND CONE VS NUCLEAR DENSITY METER DET. IN-PLACE DRY DENSITY MOLECUTTINGS
GEOTECHNICAL ENGINEERS INC WINCHESTER, MASSACHUSETTS	Project 76301	July 11, 1979 Fig. 12

APPENDIX A

APPENDIX A

SAFETY-RELATED STRUCTURAL FILL

A. MATERIAL

1. Gradation for molecuttings should meet the following criteria:

3 in.	100
1½ in.	100-70
3/4 in.	100-35
3/8 in.	100-17
No. 4	75-10
No. 20	32-0
No. 40	22-o
No. 200	10-0

2. The uniformity coefficient, D_{60}/D_{10}, should be not less than 5.

B. PLACEMENT

1. Molecuttings should be placed in 8-in.-thick loose lifts and compacted to 95% of maximum dry density as determined by ASTM D1557 with exceptions for testing noted in Section C.2.

2. The water content of the molecuttings should be at optimum ± 1% during placement. The water content during placement of quartzite molecuttings should be stockpiled or otherwise treated to reduce the water content to less than 6%. If the water content is less than 4%, the addition of water during compaction will be necessary if satisfactory compaction is to be achieved.

3. Molecuttings should not be placed in direct contact with pipes, culverts, or other structures sensitive to abrasion and/or high point loads.

4. The pore fluid of the molecuttings is brackish and, as a result, the resistivity of the muck is likely to be below the minimum limit of 10,000 ohms-cm^3. United Engineers is to develop recommendations for placement of the molecuttings in areas when high resistivity of backfill material is required.

C. TESTING AND FIELD CONTROL

1. Due to anticipated variations in rock type the mole-cuttings should be monitored daily by determining the grain-size distribution, water content, and rock type for at least one typical sample. The grain-size analysis should be performed by using a wet sieving technique and every tenth test should be performed by using the elutriation method, without pre-drying of the sample. The frequency of testing may be reduced in time after those testing become familiar with the material and thus capable of judging when the material is or is not acceptable.

   a. If the percent passing the #200 sieve material is greater than 10%, the material should not be used.

   b. If the water content is greater than 1% above optimum, the molecuttings should be stockpiled or treated to reduce the water content to optimum.

2. A family of at least three compaction curves should bc developed using ASTM D1557, Method C, except that the minus 1½-inch material shall be used. Each compaction curve should be accompanied by a grain-size analysis. Additional compaction curves should be performed once every 7,500 yards or earlier if visual changes in the molecuttings grain size is observed.

3. A bag sample of the molecuttings should be obtained after the loose lift has been placed and before compaction begins. The sample should be large enough to perform a laboratory one-point compaction test and to measure the percent material retained on the l&inch sieve.

4. Separate the plus 1½-in. material and calculate its percentage by weight of the entire sample.

5. A one-point compaction test should be'performed on the bag sample of molecuttings in accordance with ASTM D1557, Method C, except that the minus 1½-in. sieve material shall be used. The maximum dry density for

this sample, γ_{dx}, is determined by plotting the one-point dry density on the family of curves and interpolating the maximum dry density for the minus 1½-in. material.

6. The in-place dry density should be determined by performing at least three nuclear density meter tests. The average dry density should be used to compute the percent compaction. This method should reduce the effects of sharp variations in the molecuttings on the in-place dry density determinations.

   a. The water content bias for the nuclear density meter should be corrected for use in molecuttings. The water content bias should be checked weekly.

7. The percent compaction is determined by dividing the corrected in-place dry density by the laboratory maximum dry density as determined in 6. above. A formula to compute the corrected in-place dry density, to correct for the quantity of plus 1½-in. material, is presented below.

$$\gamma_{dc} = \frac{\gamma_{ND} - RG\gamma_w}{1-R}$$

where γ_{dc} = corrected in-place dry density for the minus 1½-in. sieve material

γ_{ND} = average in-place dry density determined by using nuclear density meter

γ_w = unit weight of water

G = specific gravity of molecuttings

R = percent, by weight of the total sample retained on the 1½-in. sieve

The percent compaction is computed as follows:

$$\text{Percent Compaction } P(\%) = \frac{\gamma_{dc}}{\gamma_{dx}} \times 100$$

γ_{dx} = Maximum dry density of minus 1½-in. material determined in Step 5. from the family of curves and the one-point compaction.

NONSAFETY-RELATED STRUCTURAL FILL

A. MATERIAL

1. Gradation for molecuttings should meet the following criteria:

3 in.	100
1½ in.	100-70
3/4 in.	100-35
3/8 in.	100-17
No. 4	75-10
No. 20	32-0
No. 40	22-o
No. 200	10-0

2. The uniformity coefficient (D_{60}/D_{10}) should not be less than 5.

B. PLACEMENT

1. Molecuttings should be placed in 12-in.-thick loose lifts and compacted to 93% of maximum dry density as determined by ASTM D1557 with exceptions noted in Section C.2 for Safety-Related Structural Fill.

2. Molecuttings can be sandwiched between presently accepted gravelly sand structural fill. When molecuttings and gravelly sand are alternated in the backfill, the following limits are recommended.

   a. Molecuttings should be placed in 8-in.-thick loose lifts and compacted to 93% of maximum dry density as determined by ASTM D1557.

   b. Gravelly sand should be placed in accordance with the present specification for structural fill (i.e., 8-in. loose lifts compacted to 95% of ASTM D1557).

3. The water content of the molecuttings should be at optimum + 1% during placement if no gravelly sand layers are present. When the molecuttings and gravelly sand are placed in alternating layers, the water content of the molecuttings may be permitted to be as high as 2% above optimum. If the water content of the molecuttings exceeds the suggested limits of water content, the molecuttings should be stockpiled or otherwise treated to alter the water content. If the water content is low, say 2 to 4%, the addition of water during compaction may be necessary to achieve satisfactory compaction.

4. Molecuttings should not be placed in direct contact with pipes, culverts, or other structures sensitive to abrasion and high point loads.

5. The pore fluid of the molecuttings is brackish and, as a result, the resistivity is likely to be below the minimum limit of 10,000 ohms-cm^3. United Engineers is to develop recommendations for placement of the molecuttings in areas when high resistivity of backfill material is required.

C. <u>TESTING AND FIELD CONTROL</u>

Testing and field control for use of molecuttings in non-safety-related areas is the same as for safety-related areas except for Section C.1.b, which should read as follows:

b. When the water content of the molecuttings is outside of the range of optimum ± 1%, the material should be stockpiled or treated to reduce the water content to within the suggested limit before placement.

RANDOM FILL

A. MATERIAL

The molecuttings to be used as Randon Fill should comply with the present specification as described in Specification No. 9763-8-4, Section 3.2.2 dated September 27, 1974.

B. PLACEMENT

1. Molecuttings should be placed in 12-in.-thick loose lifts and compacted to 90% of maximum dry density as determined by ASTM D1557 with exceptions noted in Section C.2 for Safety-Related Structural Fill.

2. Although limits on the water content of the molecuttings are not necessary, the most efficient compaction will occur at optimum water content ± 1%.

C. TESTING AND FIELD CONTROL

Testing and field control for use of molecuttings as Random Fill should be the same as outlined for Safety-Related areas with the following exceptions:

C.1.a The gradation of the molecuttings should comply with present specifications for Random Fill.

C.1.b No limit on the water content of the molecuttings is recommended. The maximum permissible water content in the field will be dictated by the ability to achieve the required percent compaction.

APPENDIX B

APPENDIX B

PLATE LOAD TEST

B-1 Purpose

The plate load tests were performed to determine the deformation characteristics of gravelly sand and molecuttings. The results of the plate load tests provided the basis for comparison of the two materials and to determine the effect that percent compaction has on their deformation characteristics.

B-2 Procedure

For each test a 24-in. -diameter hole was excavated to a depth of 12 in., except for test PLT-3 which was 6 in. deep. An 18-in.-diameter, 1-in.-thick steel plate was placed on a thin layer of liquid hydrous stone which was placed directly on the bottom surface of the test hole. Additional 1-in.-thick steel plates 14-in. and 10-in. in diameter were placed in a pyramid arrangement on top of the 18-in. plate.

After the hydrous stone and plates were in place, the plate was loaded by a hydraulic jack reacting against the underside of a loaded, flat-bed trailer, as illustrated in Fig. B-1.

The loads were measured using a calibrate pressure gage.

Deformations of the plate were measured using three dial indicators attached to a reference beam as illustrated in Fig. B-1. The dial indicators were graduated to .001 mm. The reference beam supports were separated from the center of the plate by about 72 in., which was a sufficient distance for deflections under the supports to be negligible during loading of the plate.

The loading sequence for each test was as follows:

1. Applied load to develop contact stress of 4 tons per square foot (tsf) in four equal increments.

2. Unload to zero load in two equal increments.

3. Repeat load-unload cycle to 4 tsf.

4. Load to develop contact stress of 12 tsf in six equal increments.

5. Unload to zero load in three equal increments.

6. Repeat load-unload cycle to 12 tsf two more times.

Each loading or unloading increment was held constant until the rate of deformation of the plate was less than .001 mm/min.

The air temperature when the plate load tests were performed was about 80^{o} F.

B-3 Results

The load versus displacement curves for the five plate load tests are illustrated in Figs. B-2 through B-6. The slope of the virgin load curve was generally straight except for test PLT-2 and PLT-3 where slight curvature was observed. The slope of the reload curves were much flatter than the virgin curve and the slopes of the repeated reload-unload cycles were parallel as would be expected.

Values of Young's Modulus, E, were calculated from the results of the plate load tests using elastic theory. The solution for the settlement of a loaded, rigid circular plate on an elastic half space is as follows:

$$s = \frac{qD(1-\nu^2)I}{E} \quad \text{(From Poulos and Davis, p. 166)}$$

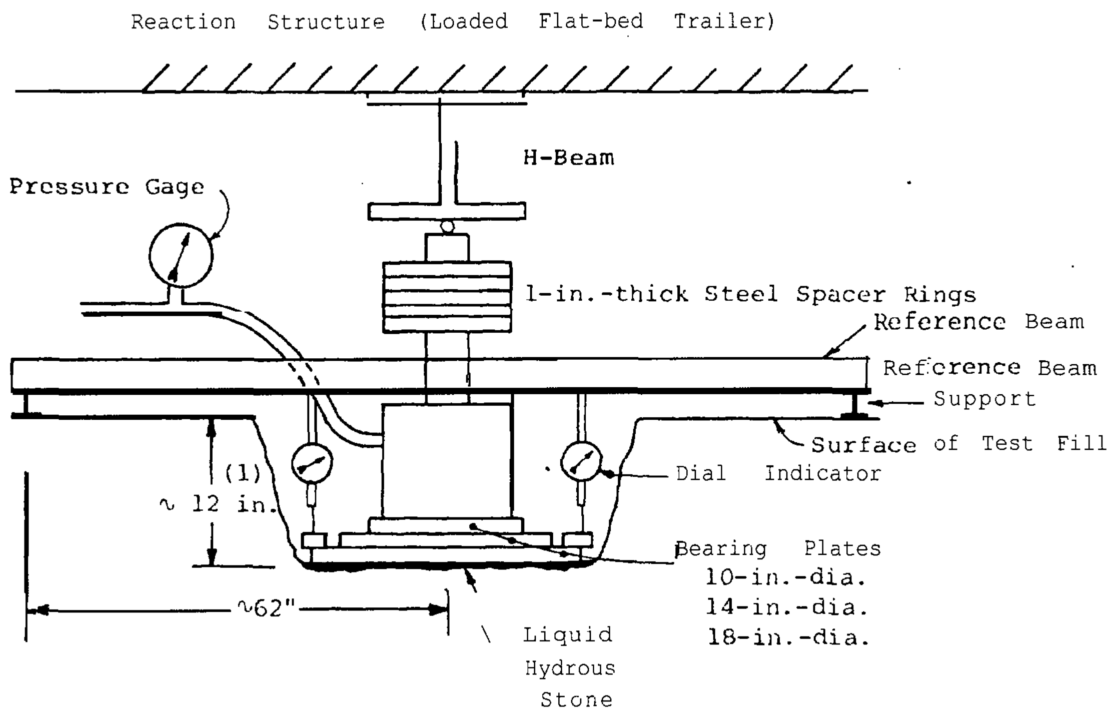
where s = settlement
q = average stress on the plate = $\frac{4P}{\pi D^2}$
P = load on the plate
D = diameter of the plate
ν = Poisson's ratio
I = influence factor = $\pi/4$
E = Young's Modulus

Assuming a value v = 0.3 and rearranging to compute E, yields:

$$E = \frac{0.91P}{DS}$$

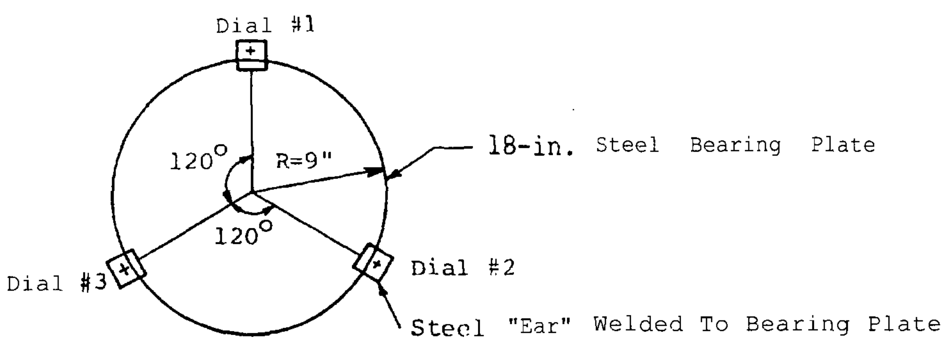
The modulus calculated is the average modulus within the zone of significant stress which for an 18-in. plate would extend between 18 to 36 inches beneath the plate.

The moduli calculated using this method are presented in Table B1. For each test tangent moduli were calculated using the straight segments of the load and reload curves.



NOTE: 1. Depth for PLT-3 was about 6-in.

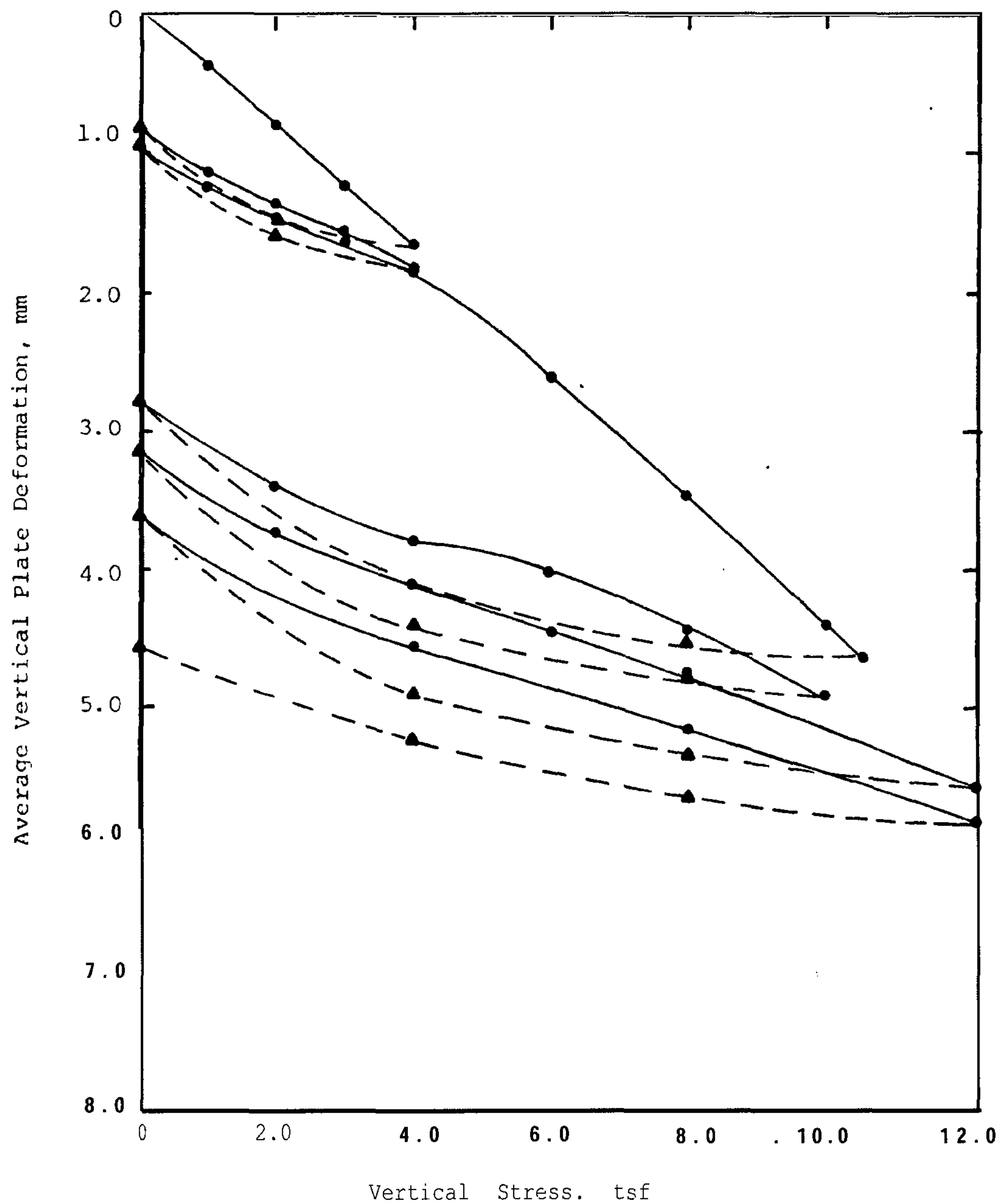
Schematic Illustration of Plate Load Test Equipment
(Not To Scale)



Dial indicators #1, #2, and #3 monitored displacement of "ears" attached to circumference of bearing plate.

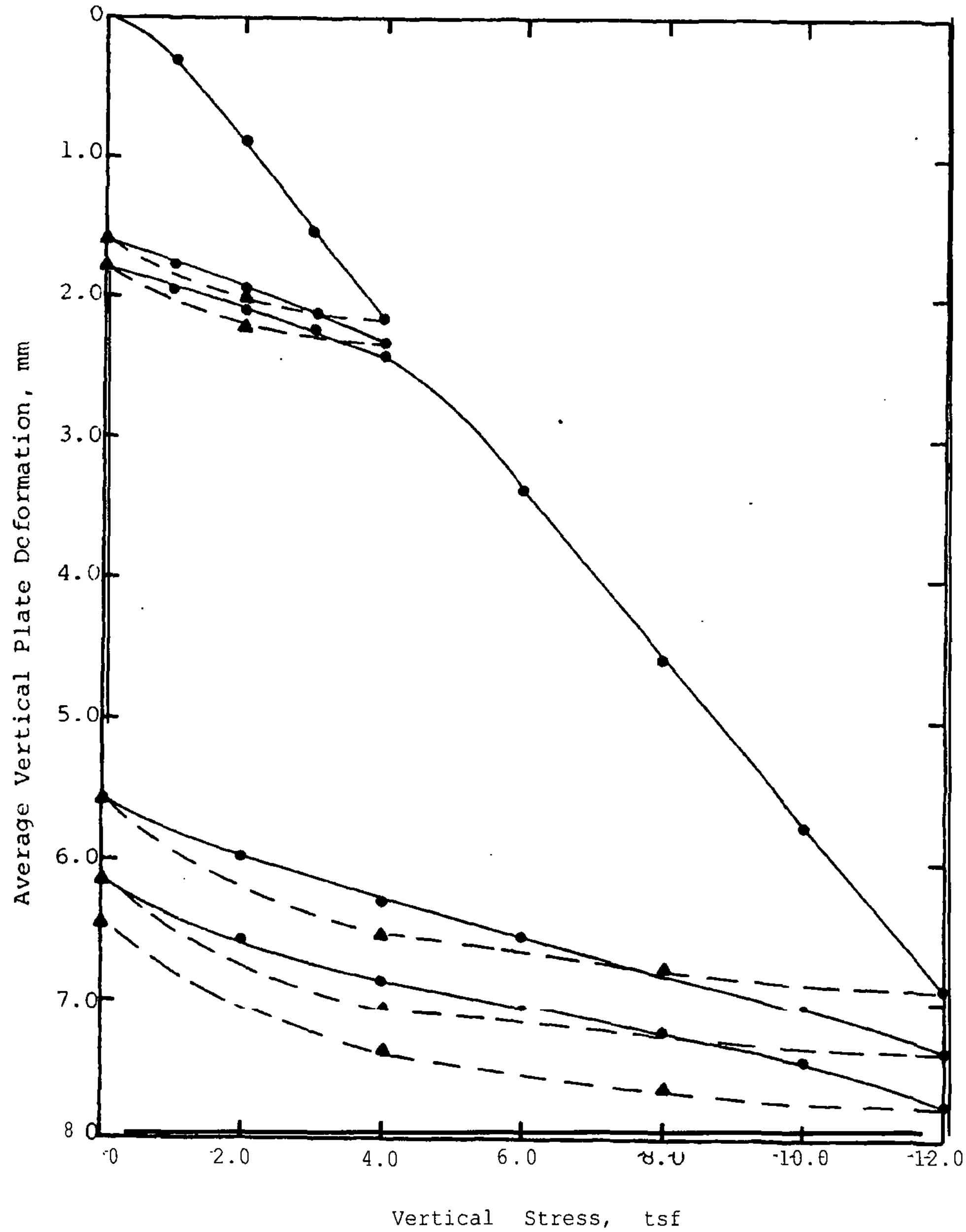
Plan Showing Locations of Dial Indicators
(Not To Scale)

Public Service Company of New Hampshire	Quartzite Molecuttings Study	PLATE BEARING TEST EQUIPMENT
GEOTECHNICAL ENGINEERS INC WINCHESTER . MASSACHUSETTS	Project 76301	July 12, 1979 Fig.B1



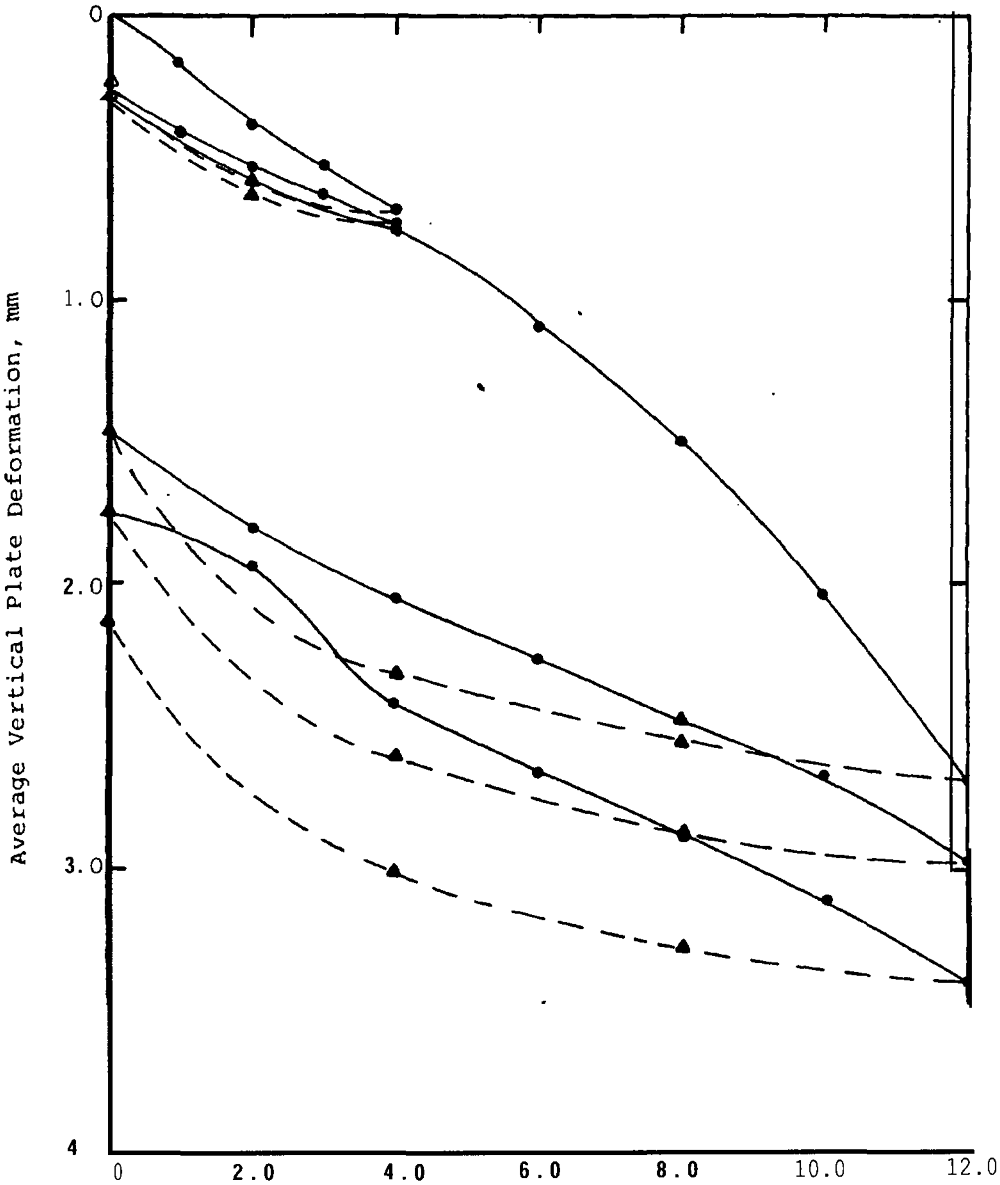
Date Performed: June 7, 1979
By: W. Fisher/R. Gardner
Plate Diameter: 18-in.

Public Service Company of New Hampshire	Quartzite Molecuttings Study	VERTICAL STRESS VS DEFORMATION PLATE LOAD TEST - PLT-1 GRAVELLY SAND
GEOTECHNICAL ENGINEERS INC WINCHESTER • MASSACHUSETTS	Project 76301	July 11 1979 Fig. B2



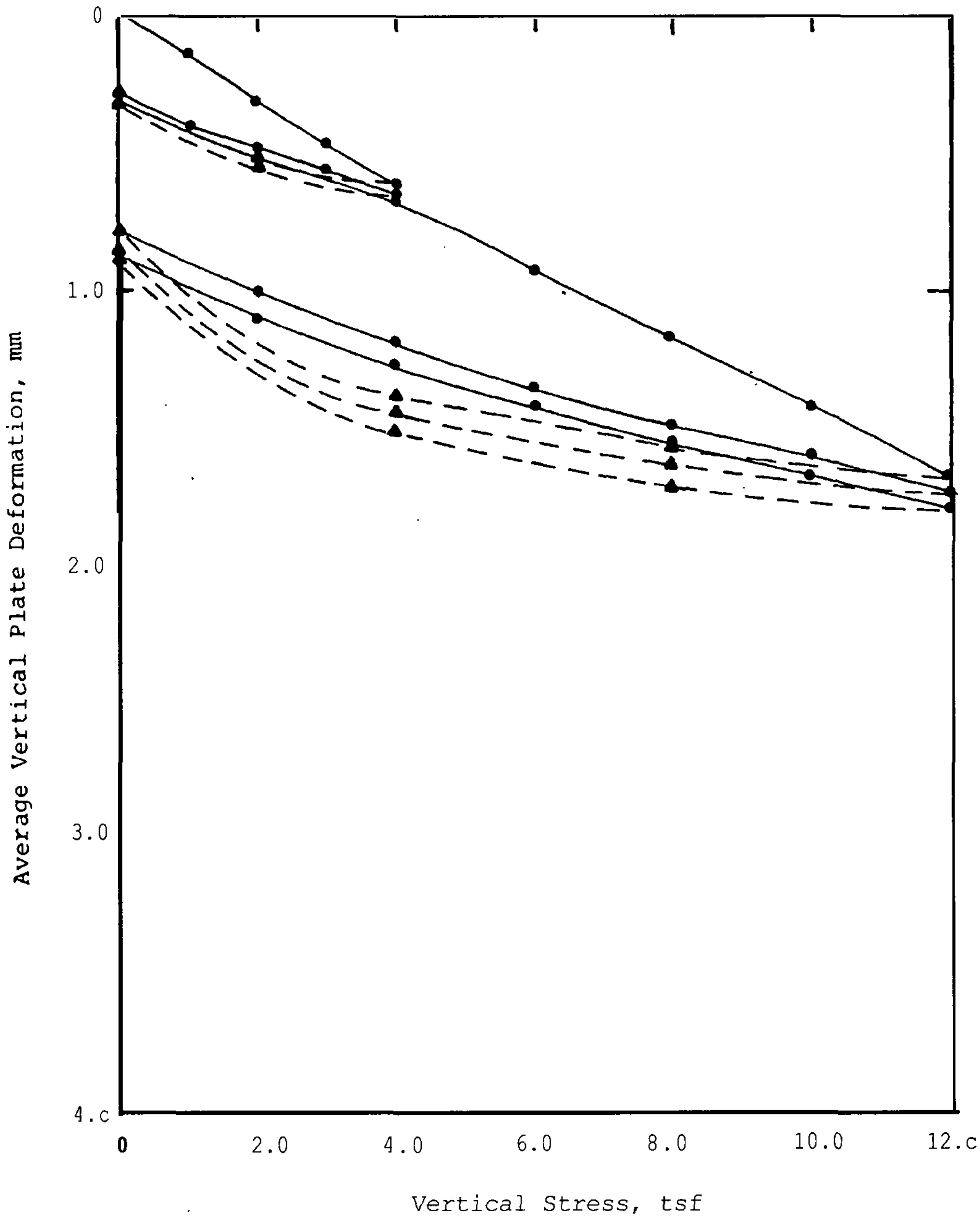
Date Performed: June 14, 1979
By: W. Fisher/R. Gardner
Plate Diameter: 18-in.

Public Service Company of New Hampshire	Quartzite Molecuttings Study	VERTICAL STRESS VS DEFORMATION PLATE LOAD TEST - PLT-2 MOLECUTTINGS (NO SP. CON.)
GEOTECHNICAL ENGINEERS INC WINCHESTER, MASSACHUSETTS	Project 76301	July 11. 1979 Fig. B3



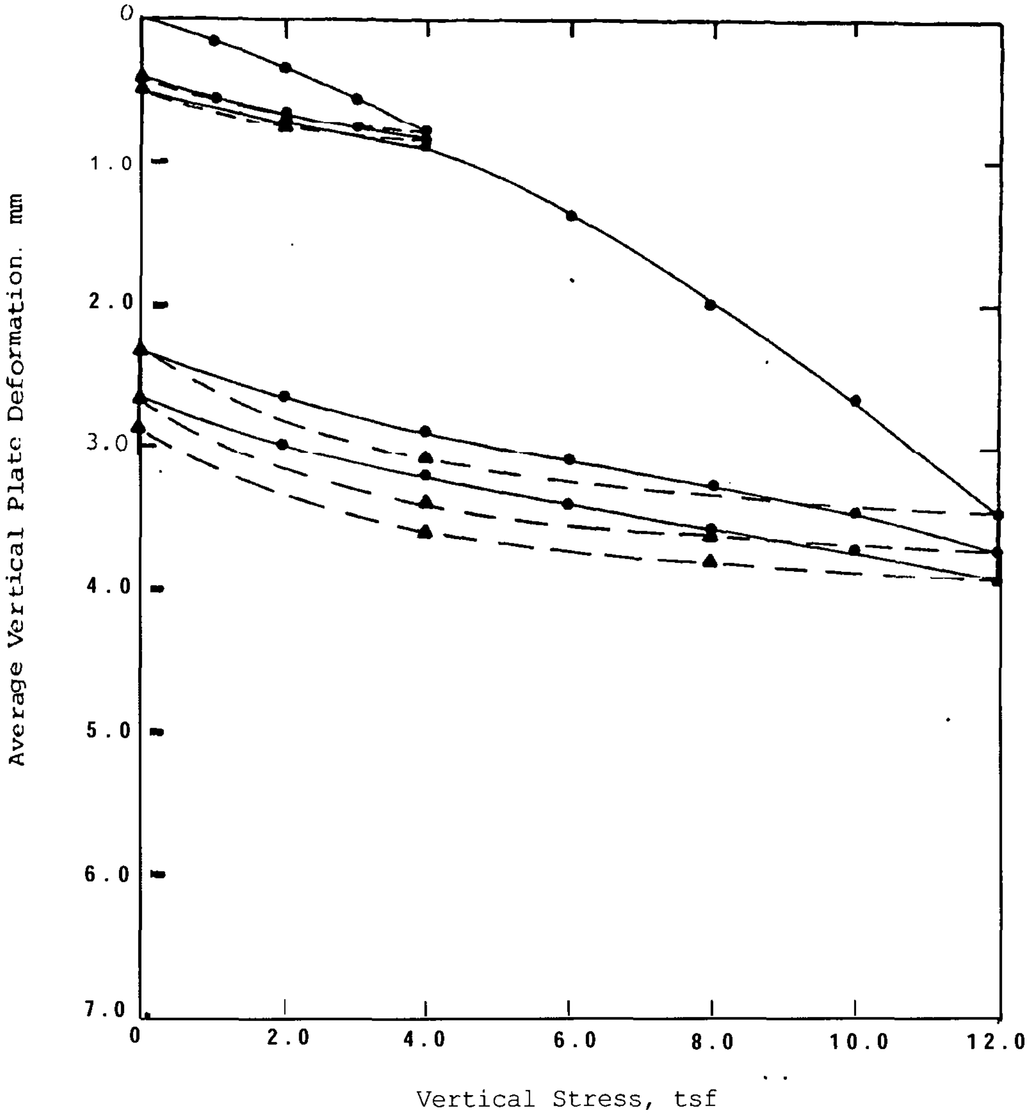
Date Performed: June 15, 1979
By: W. Fisher/R. Gardner
Plate Diameter: 18-in.

Public Service Company of New Hampshire	Quartzite Molecuttings Study	VERTICAL STRESS VS DEFORMATION PLATE LOAD TEST - PLT-3 ST. MOLECUTTINGS & GR. SI
GEOTECHNICAL ENGINEERS INC WINCHESTER • MASSACHUSETTS	Project 76301	July 11, 1979 Fig. B4



Date Performed: June 18, 1979
By: W. Fisher/R. Gardner
Plate Diameter: 18-in.

Public Service Company of New Hampshire	Quartzite Molecuttings Study	VERTICAL STRESS VS DEFORMATION PLATE LOAD TEST - PLT-4 MOLECUTTINGS (CON. PLACE.
GEOTECHNICAL ENGINEERS INC WINCHESTER • MASSACHUSETTS	Project 76301	July 11, 1979 Fig. B5



Date Performed: June 27, 1979
By: W. Fisher
Plate Diameter: 18-in.

Public Service Company of New Hampshire	Quartzite Molecuttings Study	VERTICAL STRESS VS DEFORMATION PLATE LOAD TEST - PLT-5 MOLECUTTINGS (NO SP. CON.
GEOTECHNICAL ENGINEERS INC WINCHESTER, MASSACHUSETTS	Project 76301	July 11, 1979 Fig. B6

TABLE - SUMMARY OF FIELD DENSITY TESTS

Page

Lift No.	Sample No.	One-Point Compaction			Laboratory Maximum Dry Density	In-Place Dry Density, pcf		Percent Compaction
		Percent +3/4-in. Material	Water Content	Dry Density		Total Sample	Corrected For +3/4-in. Material	
		%	%	γ_d, pcf	γ_d, pcf			%

APPENDIX 20

GEOTECHNICAL REPORT • DISCUSSION OF DERIVATION OF COEFFICIENTS OF **SUBGRADE** REACTION

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

Φ GEOTECHNICAL ENGINEERS INC.
1017 MAIN STREET. WINCHESTER. MASSACHUSETTS 01890 (617) 729-1625

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March 22, 1978
Project 77386
File No. 2.0

Mr. John Herrin
Public Service Co. of New Hampshire
1000 Elm Street - 11th Floor
Manchester, NH 03105

Subject: Discussion of Derivation of Coefficients of Subgrade Reaction

Dear Mr. Herrin:

In the following we describe some techniques that we have developed to convert the moduli obtained from triaxial tests to moduli of subgrade reaction for various loading conditions. We present this information to complement various telephone conversations with D. Patel of UE&C.

Computation of Coefficients of Subgrade Reaction

The coefficient of subgrade reaction, k_s, represents soil deformation, due to pressure acting along a boundary surface, as if the soil were composed of independent springs, each representing a unit of area with a spring constant k_s. The spring constant is defined as a pressure divided by a displacement. Such a representation is convenient for analytical purposes but neglects the influence of adjacent loaded surface areas on the displacement of any given point on the boundary surface. Thus, the coefficient of subgrade reaction is not a unique number for an elastic material but is a function of the size of the loaded area, the pressure distribution, and the geometry of the material. For a soil, the modulus of subgrade reaction is also dependent on the method or sequence of loading, i.e., the stress path.

On the basis of the theory of elasticity, we have computed coefficients of subgrade reaction for the structural backfill and the sand cement for three geometries of loading using the modulus of elasticity and Poisson's ratio data obtained in the triaxial test results. The geometries of loading studied are illustrated in Figs. 1 through 9 and are as follows:

1. Circular or square footing subjected to vertical load.

2. Pressure inside a cylindrical cavity in the soil mass assuming a plane strain condition. This is representative, for example, for the loading produced by thermal expansion of the cross section of a buried pipe.

3. Pressure inside a cylindrical cavity with simultaneous application of a vertical surcharge, p, and a horizontal pressure, $k_o p$. This loading is an approximate representation of the placement of fill over a buried pipe, which deforms to produce an increased lateral stress around the pipe. A plane strain condition was assumed.

The modulus of elasticity and Poisson's ratio used in the computations are strain dependent and were selected for the average strain in the region of the soil mass that contributes most to the displacements, namely, within a distance of one diameter from the pipe and one footing width below the footing base. These strains were correlated with the displacements which, in turn, were expressed in terms of footing settlement divided by footing width, 6/B, or in terms of the diameter strain of the pipe, ε_d. In Figs. 1 through 9, the values of the coefficient of subgrade reaction are plotted as a function of (T/B or ε_d and confining pressure. Confining pressure is to be taken as the effective overburden pressure computed at the elevations shown in the figures. An exception to the above procedure is that for the surcharge type loading, a constant Poisson's ratio of 0.3 was used.

The elastic modulus E and Poisson's ratio v used as a basis for the coefficient of subgrade reaction computations were obtained from triaxial compression tests in which the minor principal stresses were kept constant and the major principal stress was increased monotonically until the specimen failed. Such a stress path would be sufficient to determine E and v for an elastic material. However, soil is not elastic and E and v are dependent on the stress path or stress history. In particular, higher values of E would be obtained for repeated or cyclic loading. For the static load conditions, we feel that the values of subgrade reaction presented are reasonable estimates for the in-situ loading conditions. As shown in the next section, the values compare well with values given in published literature. We recommend, however, that when these values are used, sensitivity analyses should be made to assure that the designs are safe for a range 25% above and below the given values.

Comparison With Published Coefficients of Subgrade Reaction

The coefficients of subgrade reaction obtained from the GEI tests were compared with data presented by K. Terzaghi in the paper entitled

"Evaluation of Coefficients of Subgrade Reaction ," *Geotechnique*, vol. 5, 1955, pp. 297-326.

For shallow footings the vertical coefficient of subgrade reaction for a one square foot plate, k_{s1}, is estimated by Terzaghi to range between 300 and 1,000 ton/cu ft for dense sands, i.e., a range for k_{s1} x B of 4,000 to 14,000 psi. These values are intended for shallow footings, e.g., a typical depth of embedment, D_f, of 4 ft, and for a width, B, of one foot. Thus, they are representative of confining pressures equivalent to a depth of 4.5 ft or about 4 psi.

The coefficient of horizontal subgrade reaction is given by Terzaghi for a 1 sq ft vertical area at a given depth, and it is assumed to be proportional to the effective stress at that depth. For example, for dense sands at a confining pressure of 10 psi, a range of k_sD of 7,000 to 14,000 psi is indicated.

The GEI data for structural backfill, for strains of about 1%, Figs. 1, 2, 4 and 5, agree with Terzaghi's data. No specific information on strain level is given by Terzaghi for his data, but he indicates that the data are applicable to a factor of safety against bearing capacity failure that is larger than two. It is also implicit that the factor of safety would not be much more than 2. Perhaps it lies in the range of 2 to 4. For such factors of safety, the results of plate load tests on sands (1 sq ft plate) would indicate typical settlements of 0.1 in. to 0.3 in., which would be equivalent to a vertical strain on the order of 1% in the soil adjacent to the plate. Thus, the data for the structural backfill obtained from the triaxial tests correspond to coefficients of subgrade reaction within the range given by Terzaghi.

Sincerely yours,

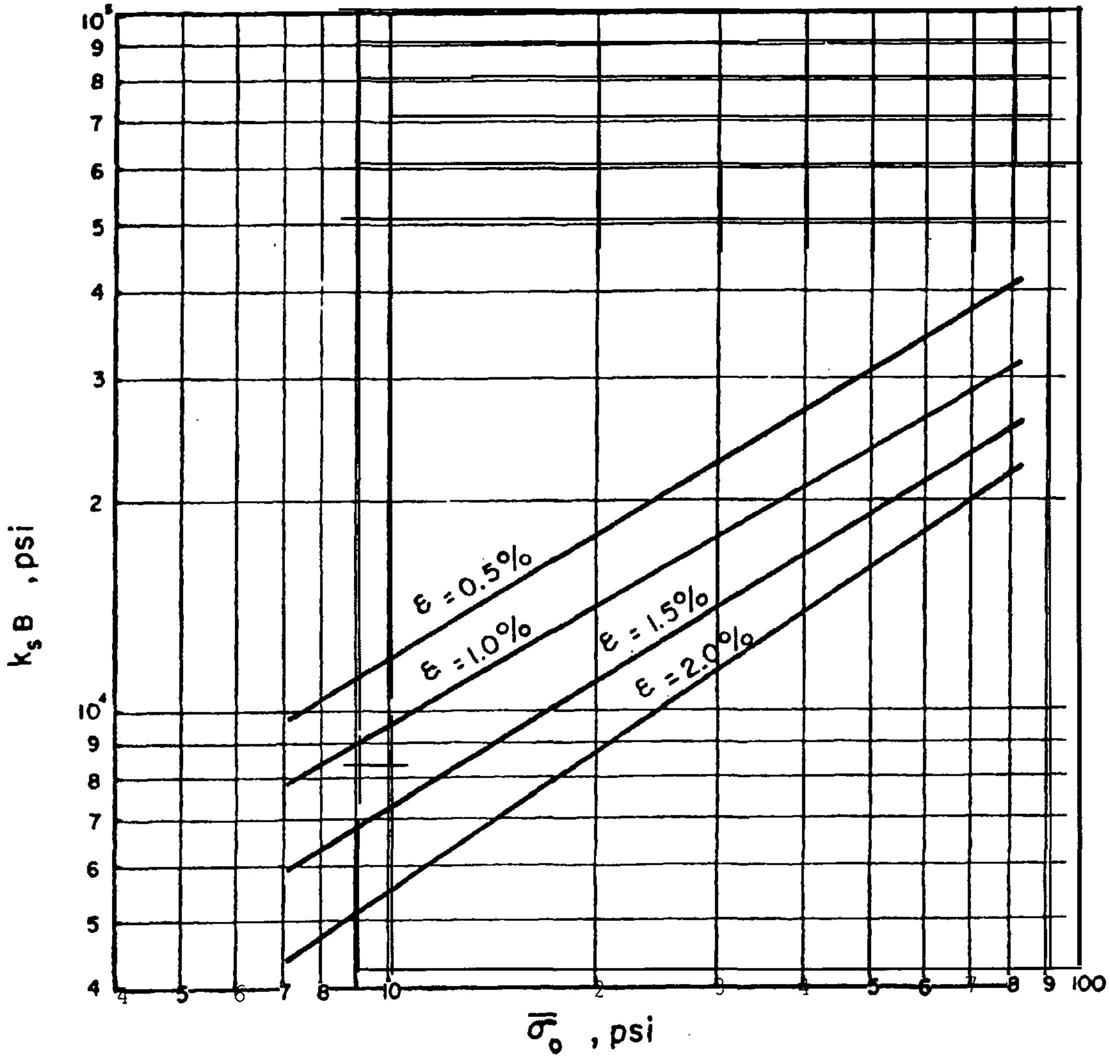
GEOTECHNICAL ENGINEERS INC.

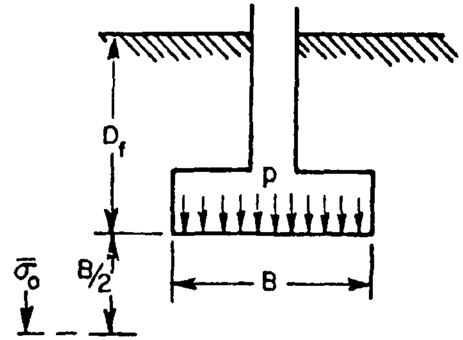
Gonzalo Castro
Principal

Steve J. Poulos
Principal

GC/SJP:ms
Encl.
cc w/encl.: R. Pizzuti, YAEC
D. Rhoads, UE&C
A. Desai, UE&C
D. Patel, UE&C

FIGURES





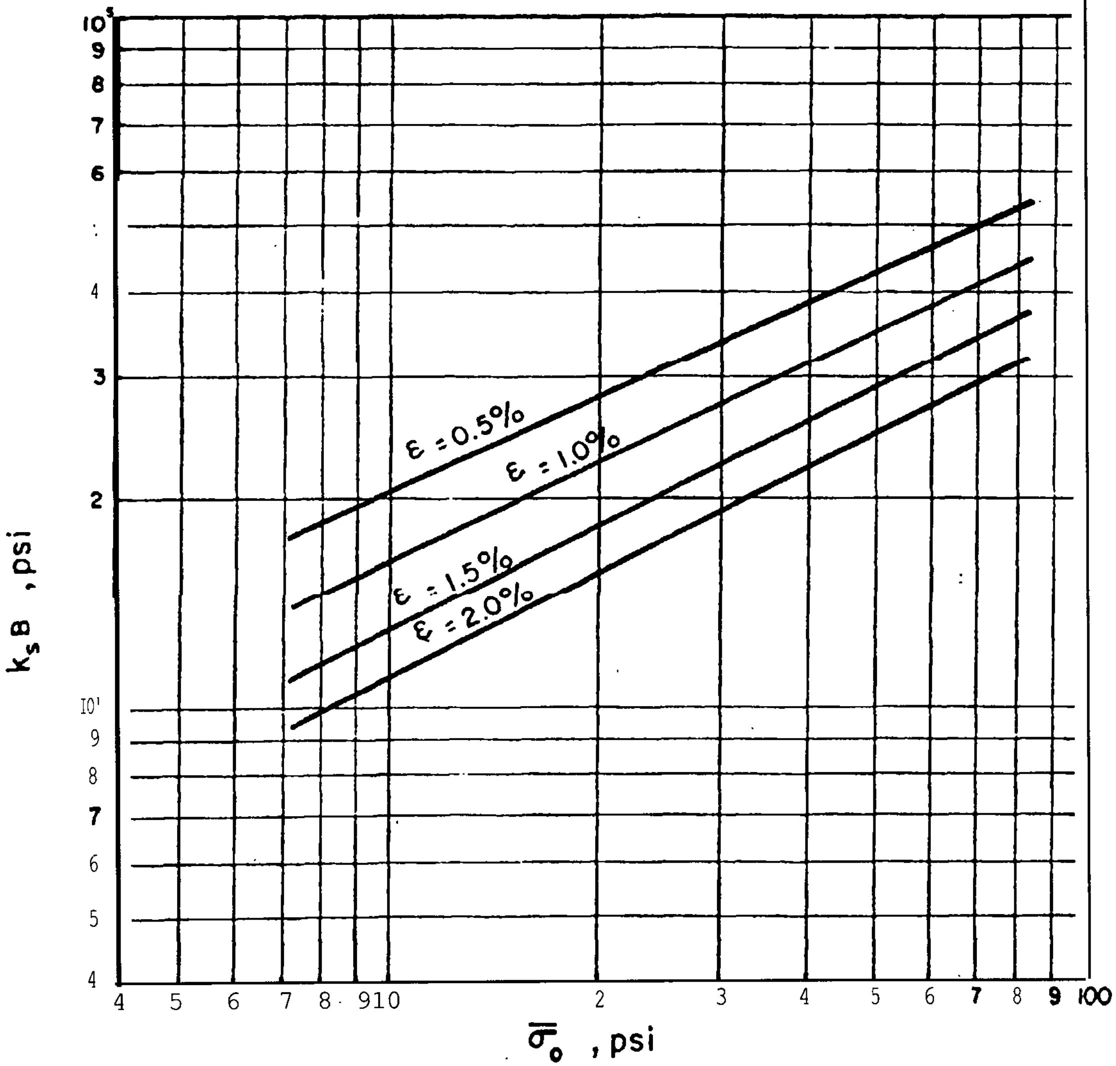
δ = SETTLEMENT

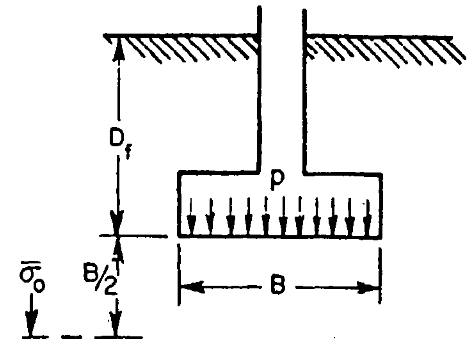
$k = \frac{p}{\delta}$

$\varepsilon = \frac{\delta}{B}$

$\bar{\sigma}_o$ = EFFECTIVE VERTICAL STRESS AT DEPTH (D_f t B/2)

Public Service Company of New Hampshire	Subgrade Reaction Sand and Sand-Cement Backfill	FOOTING PRESSURE ON STRUCTURAL BACKFILL 90% COMPACTION
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	March 13, 3.978 Fig. 1





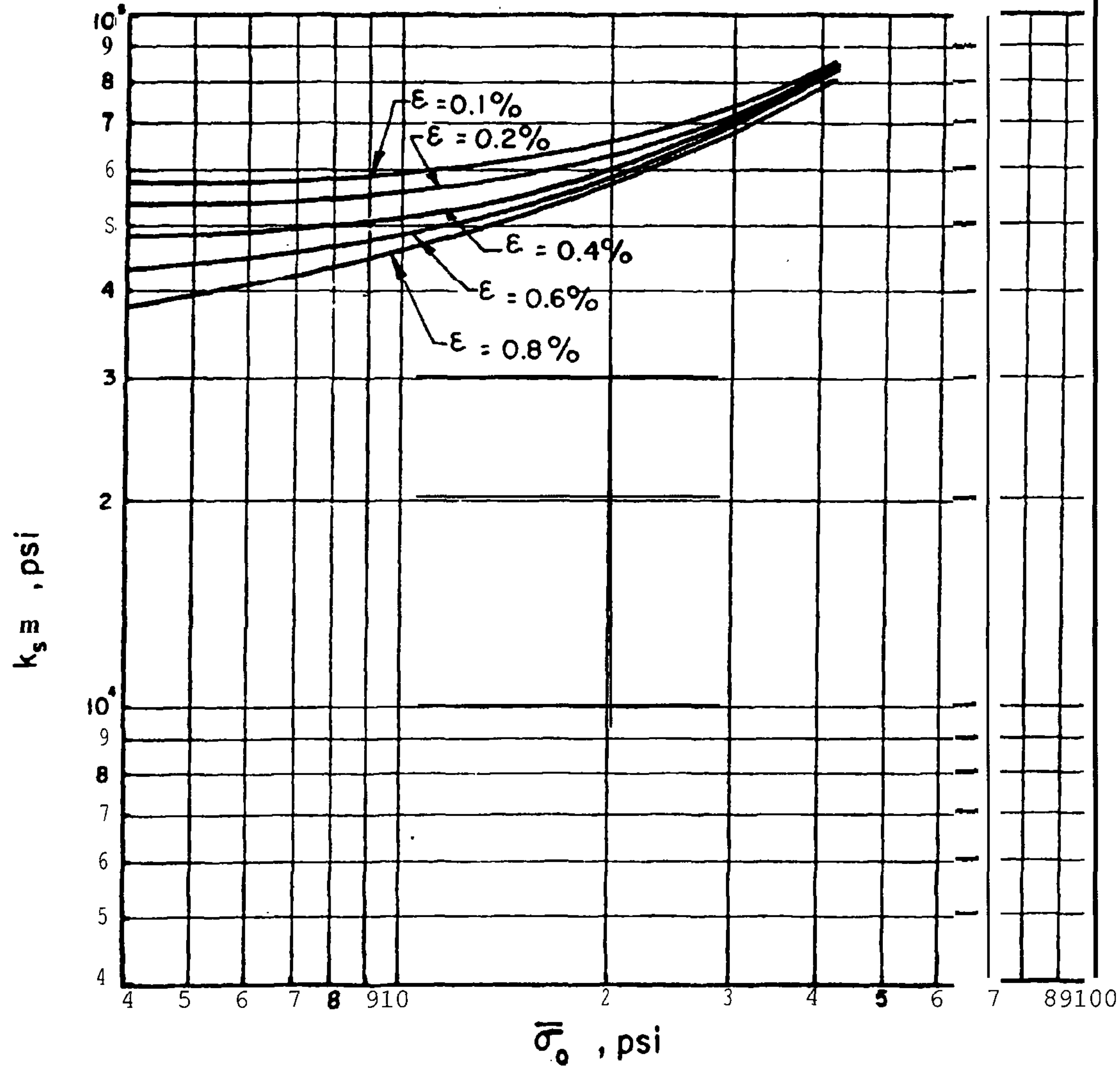
δ = SETTLEMENT

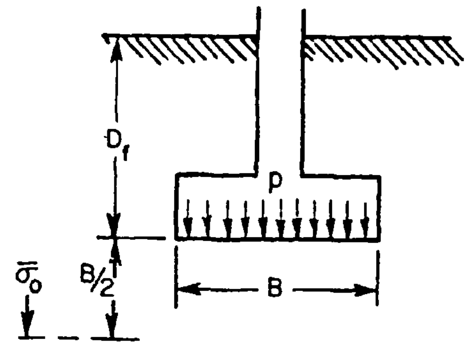
$k = \frac{p}{\delta}$

$\varepsilon = \frac{\delta}{B}$

$\bar{\sigma}_o$ = EFFECTIVE VERTICAL STRESS AT DEPTH (D_f t B/2)

Public Service Company of New Hampshire	**Subgrade** Reaction Sand and Sand-Cement Backfill	FOOTING PRESSURE ON STRUCTURAL BACKFILL 95% COMPACTION
Geotechnical **Engineers** Inc. Winchester, Massachusetts	Project,.77386	March 13, 1978 Fig. 2





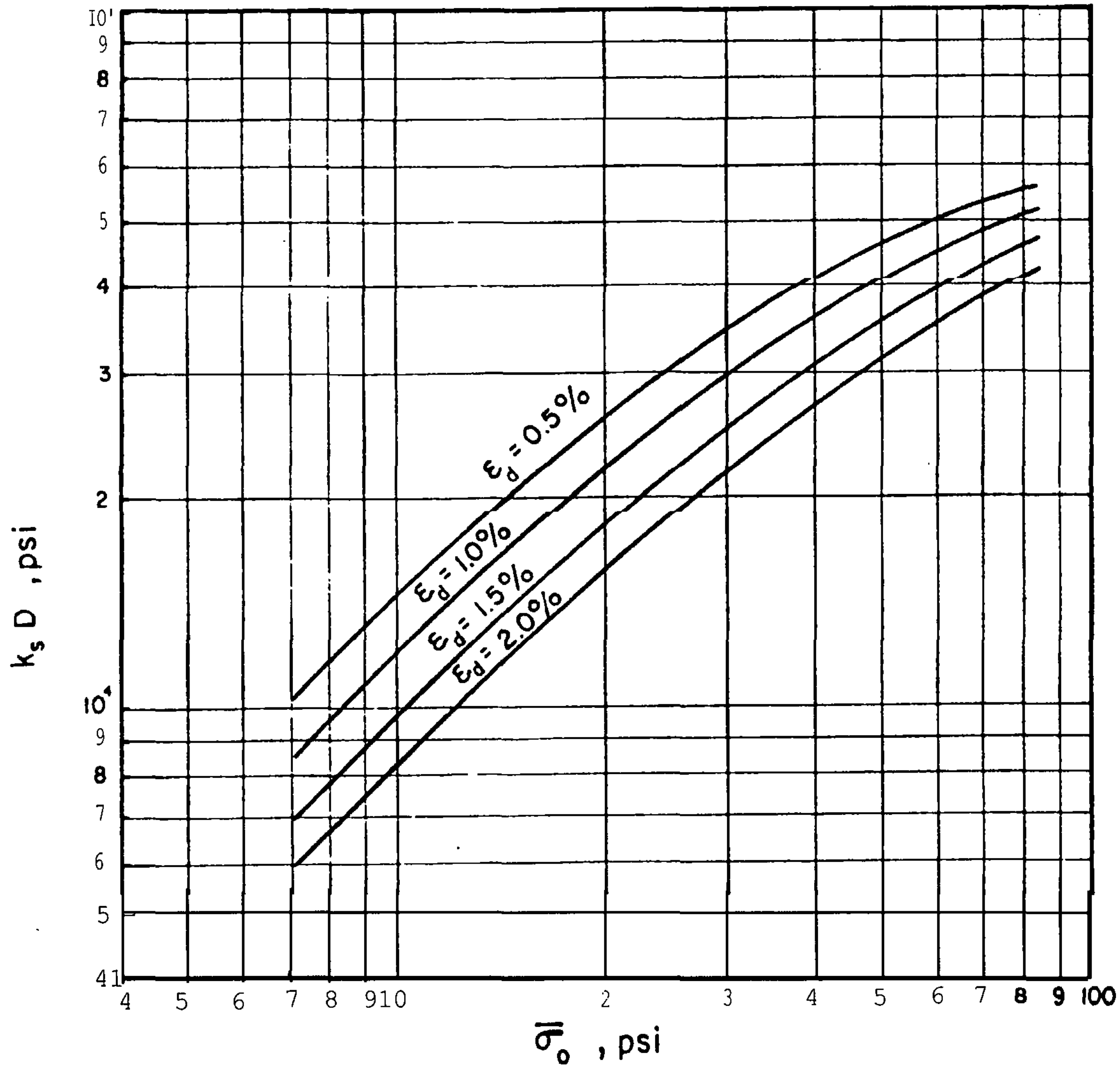
δ = SETTLEMENT

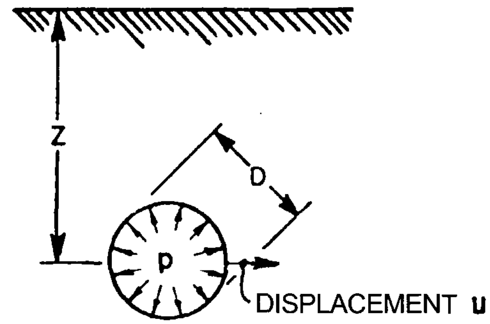
$k = \frac{p}{\delta}$

$\varepsilon = \frac{\delta}{B}$

$\bar{\sigma}_o$ = EFFECTIVE VERTICAL STRESS AT DEPTH (D_f + B/2)

Public Service Company of New Hampshire	**Subgrade** Reaction Sand and Sand-Cement Backfill	FOOTING PRESSURE ON SAND-CEMENT BACKFILL
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	March 13, 1978 Fig.3



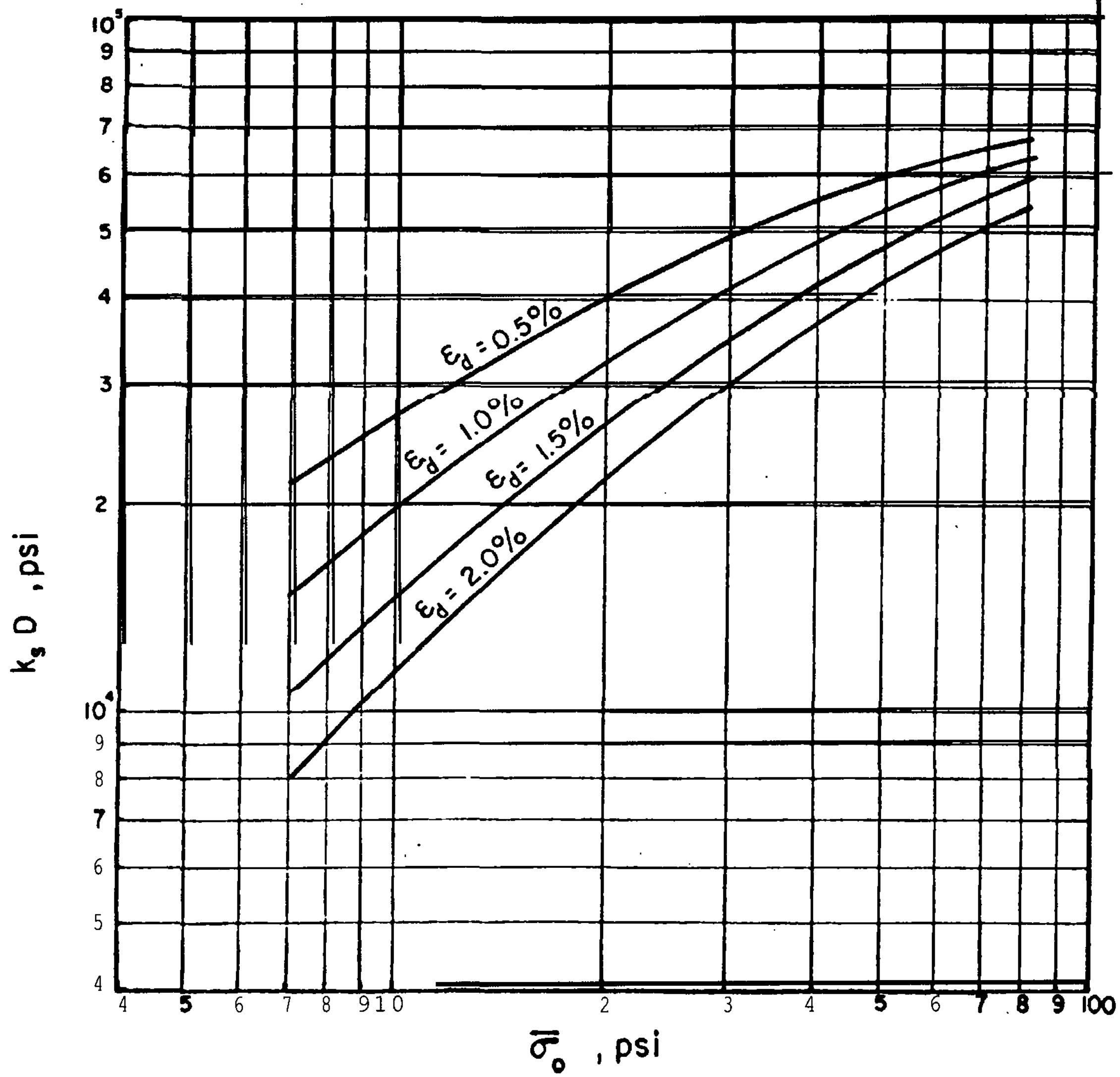


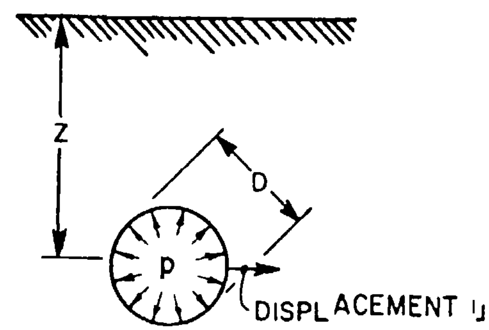
$k_s = \frac{p}{u}$

$\bar{\sigma}_o$ = EFFECTIVE VERTICAL STRESS AT DEPTH Z

$\varepsilon_d = \frac{2u}{D}$

Public Service Company of New Hampshire	**Subgrade** Reaction Sand and Sand-Cement Backfill	INTERNAL PRESSURE PIPE BURIED IN STRUCTURAL BACKFILL 90% COMPACTION
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	March 13, 1978 Fig. 4



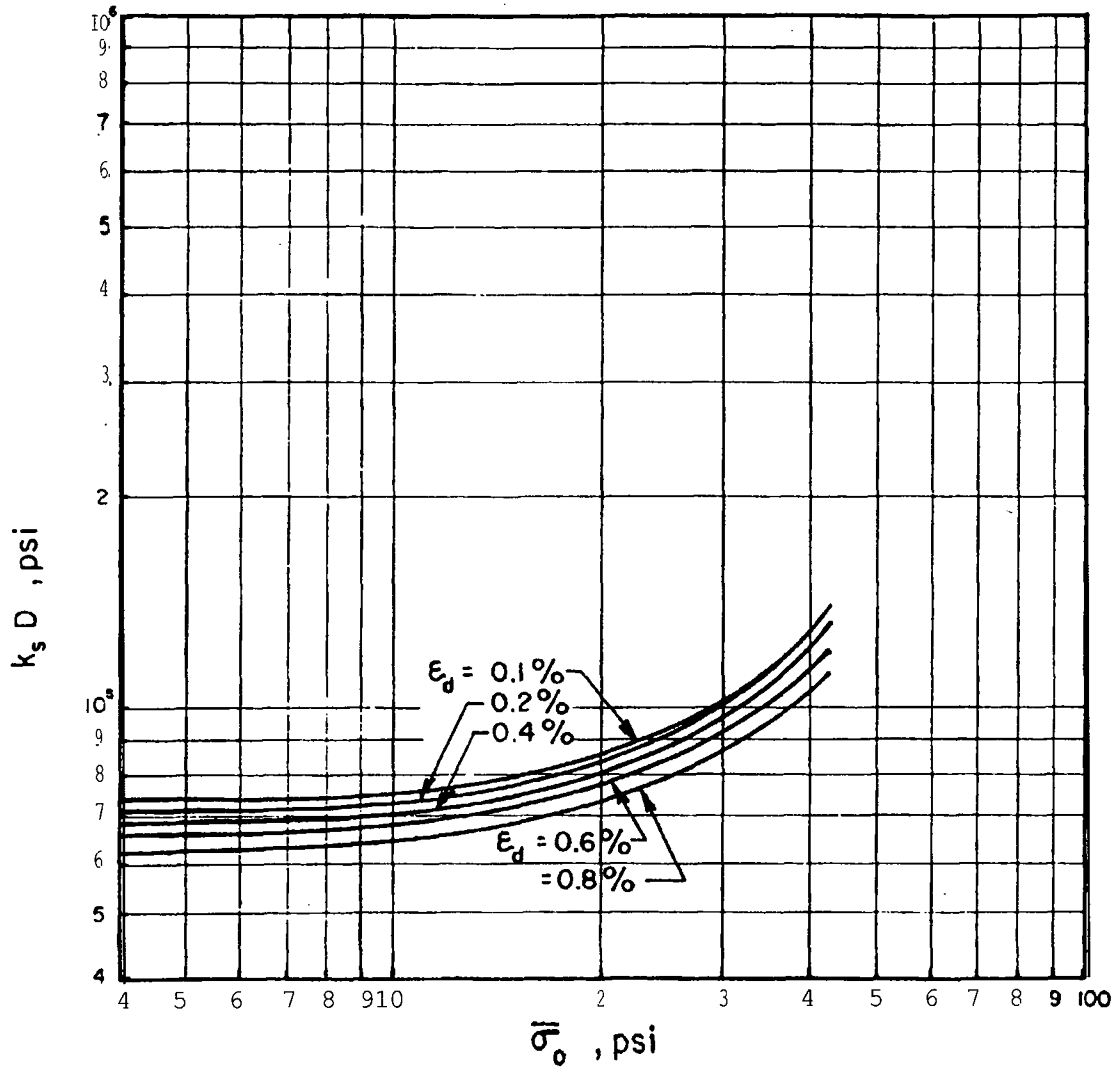


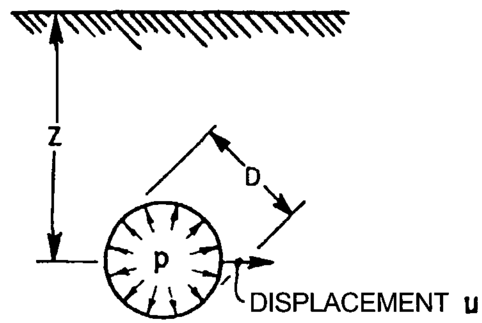
$k_s = \frac{p}{u}$

$\overline{\sigma}_o$ = EFFECTIVE VERTICAL STRESS AT DEPTH Z

$\varepsilon_d = \frac{2u}{D}$

Public Servide Company of New Hampshire	Subgrade Reaction Sand and Sand-Cement Backfill	INTERNAL PRESSURE PIPE BURIED IN STRUCTURAL BACKFILL 95% COMPACTION
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	March 13, 1978 Fia. 5



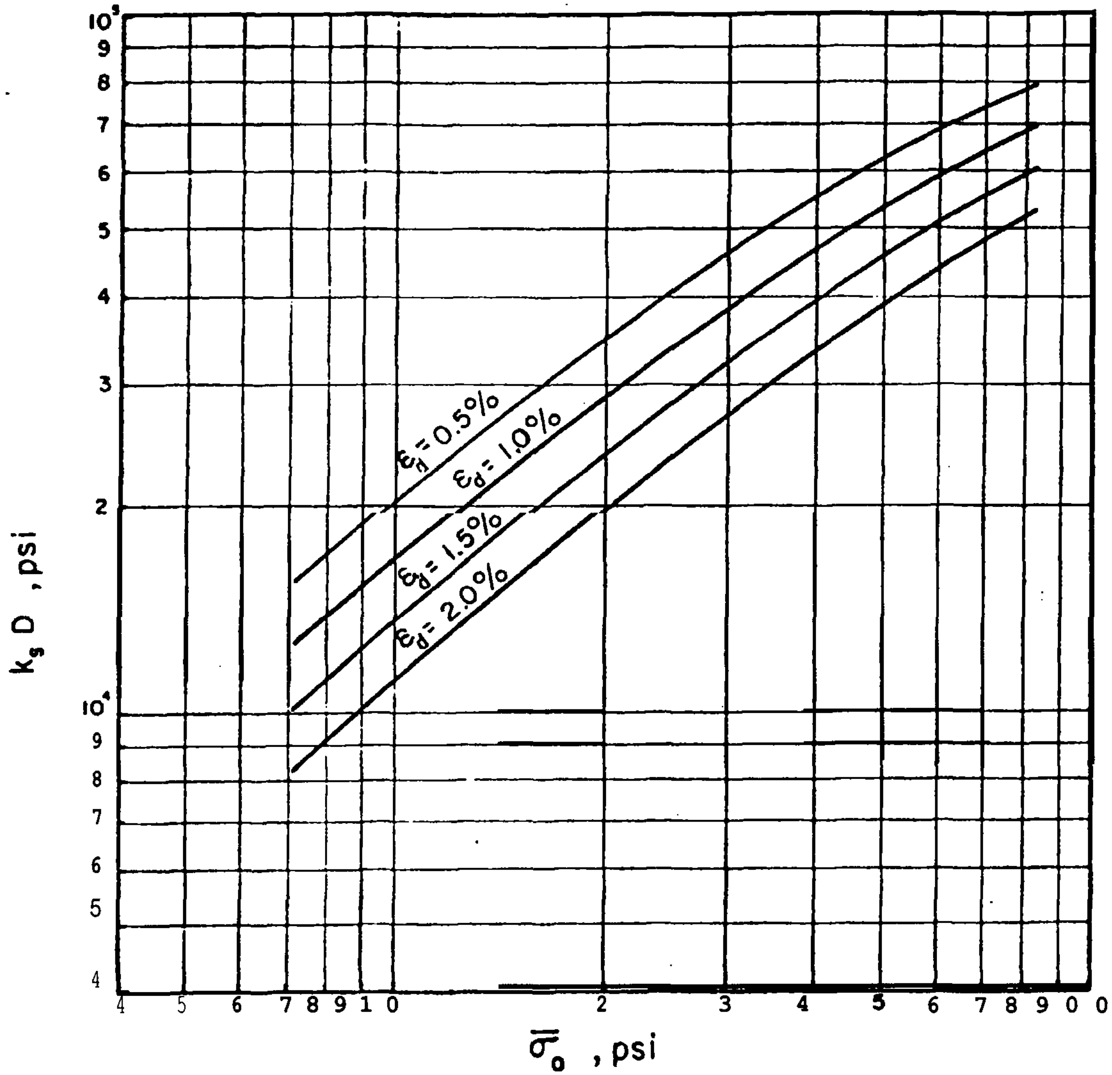


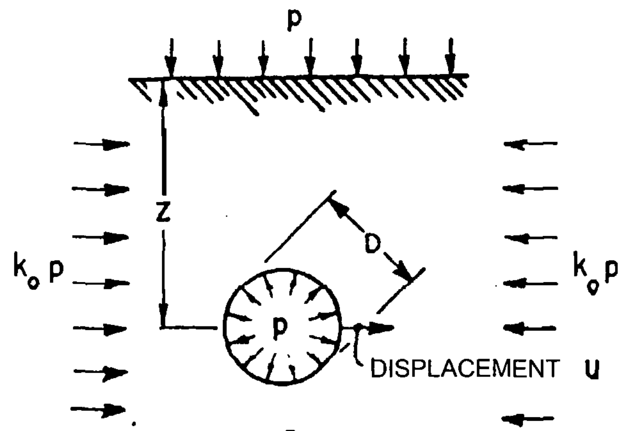
$k_s = \frac{p}{u}$

$\bar{\sigma}_o$ = EFFECTIVE VERTICAL STRESS AT DEPTH Z

$\varepsilon_d = \frac{2u}{D}$

Public Service Company of New **Hampshire**	**Subgrade** Reaction Sand and Sand-Cement Backfill	INTERNAL PRESSURE PIPE BURIED IN SAND-CEMENT BACKFILL
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	March 13, 1978 Fig. 6



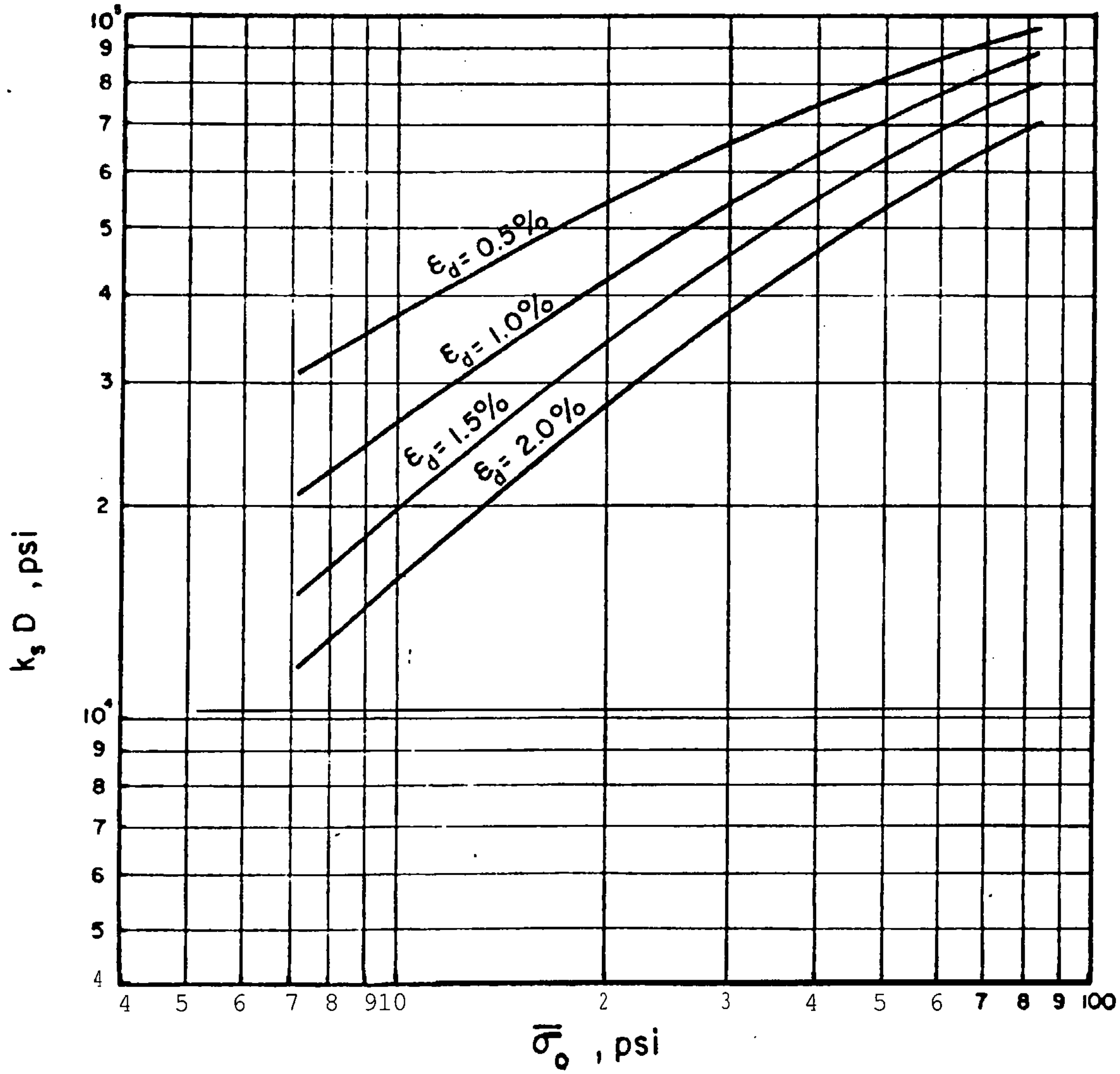


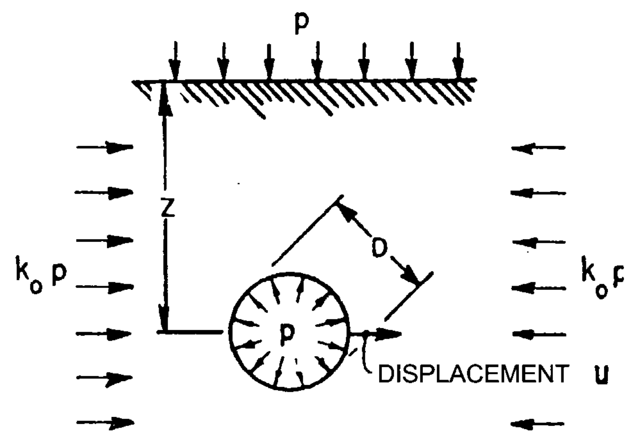
$$k_s = \frac{p}{u}$$

$$\varepsilon_d = \frac{2u}{D}$$

$\bar{\sigma}_o$ = EFFECTIVE VERTICAL STRESS AT DEPTH Z

Public Service Company of New Hampshire	Subgrade Reaction Sand and Sand-Cement Backfill	SURCHARGE PRESSURE ON PIPE IN STRUCTURAL BACKFILL 90% COMPACTION
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	March 13, 1978 Fig. 7



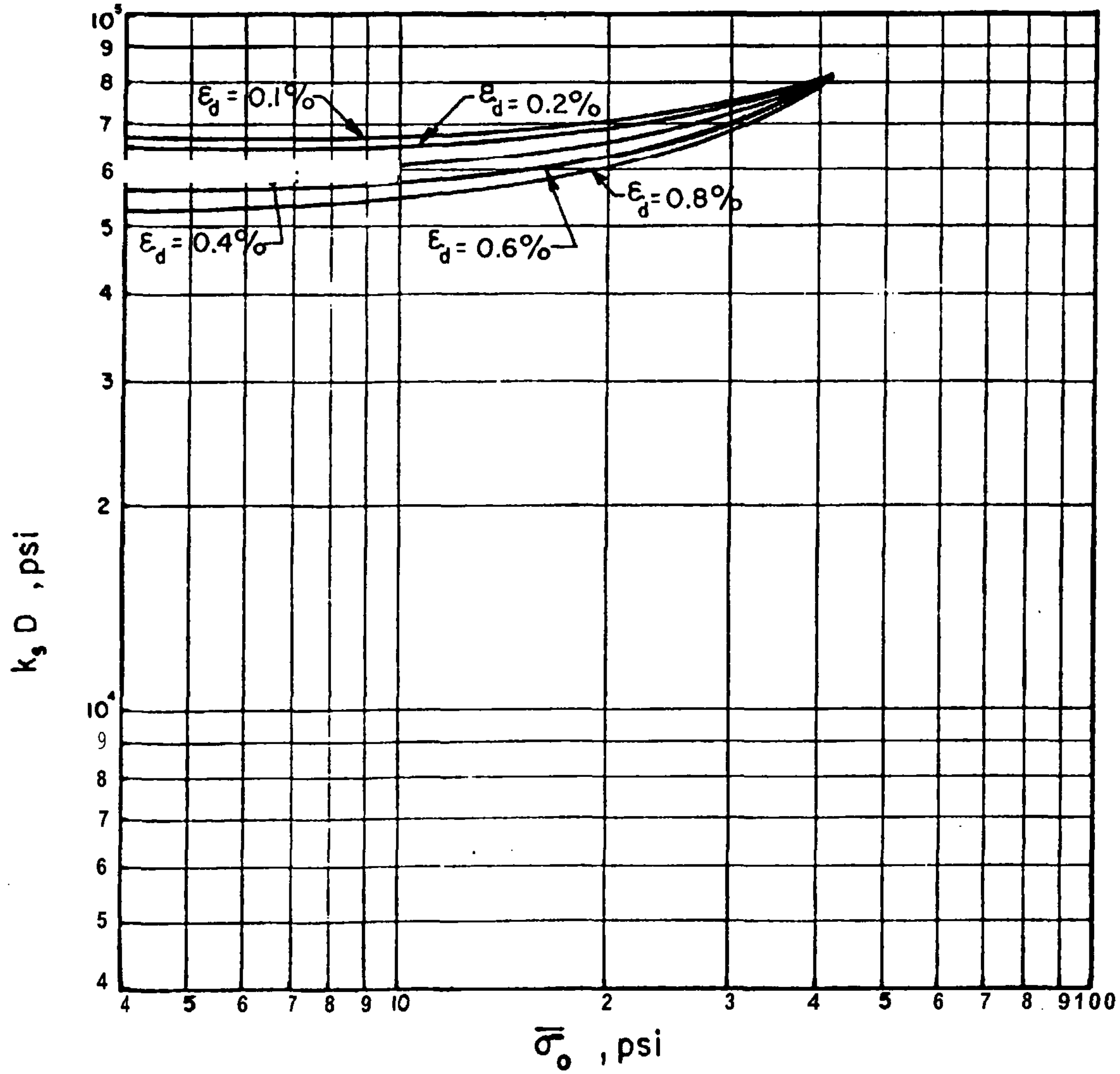


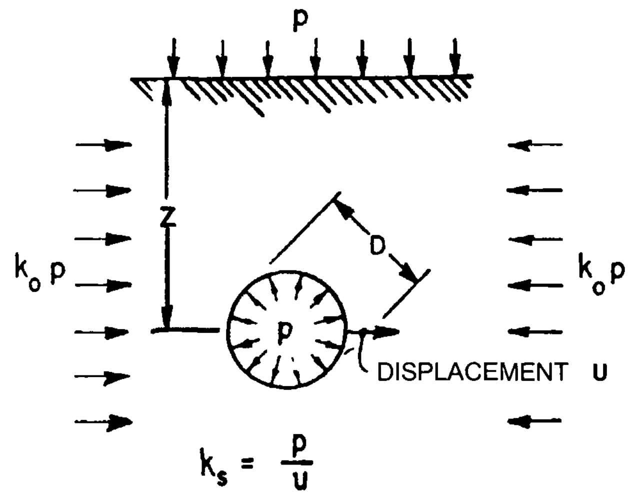
$$k_s = \frac{p}{u}$$

$$\varepsilon_d = \frac{2u}{D}$$

$\bar{\sigma}_o$ = EFFECTIVE VERTICAL STRESS AT DEPTH Z

Public Service Company of New Hampshire	Subgrade Reaction Sand and Sand-Cement Backfill	SURCHARGE PRESSURE ON PIPE IN STRUCTURAL BACKFILL '95% COMPACTION
Geotechnical Engineers Inc. Winchester, Massachusetts	Project 77386	March 13, 1978 Fig. 8





$$k_s = \frac{p}{u}$$

$$\varepsilon_d = \frac{2u}{D}$$

$\bar{\sigma}_o$ = EFFECTIVE VERTICAL STRESS AT DEPTH Z

Public Service Company of New Hampshire	Subgrade Reaction Sand and Sand-Cement Backfill	SURCHARGE PRESSURE ON PIPE IN SAND-CEMENT BACKFILL
Geotechnical Engineers Inc.. Winchester, Massachusetts	Project 77386	March 13, 1978 Fig. 9

APPENDIX 2P

SEABROOK STATION CONTAINMENT AIRCRAFT IMPACT ANALYSIS

The information contained in this appendix was not revised, but has been extracted from the original FSAR and is provided for historical information.

APPENDIX 2P

SEABROOK STATION CONTAINMENT

AIRCRAFT IMPACT ANALYSIS

Prepared by

UNITED ENGINEERS
& CONSTRUCTORS INC.

OCTOBER 1975

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
SEABROOK, NEWHAMPSHIRE

CONTENTS

ABSTRACT

Results are presented which verify the adequacy of the Seabrook containment to resist the impact of an FB-111 type aircraft. Included is a description of the dynamic forcing function, the elastic-dynamic analysis, the elastic-plastic analysis, an estimate of reinforcement and liner strain and a verification of the punching shear capability of the containment.

It is shown that there exists no credible mechanism by which spilled fuel from the impacting aircraft can access the annulus. The ensuing fire is, therefore, postulated to start in the immediate vicinity external to the enclosure and it is demonstrated that these external fires do not, in any way, inhibit or handicap the safe shutdown capability of the plant following the postulated crash.

It is concluded, that under the aircraft impact, the containment structure is able to withstand postulated impact and that the consequences of the aforementioned fire hazard is mitigated by the inherent design features of Seabrook Station.

1.0 STRUCTURAL ANALYSIS OF SEABROOK STATION CONTAINMENT FOR AIRCRAFT IMPACT

1.1 Introduction

The Seabrook Station containment has been analyzed for the effects of a-postulated impact by an FB-111 type aircraft with a speed at impact of 200 mph. Based on the analyses performed;-the adeauacy of the containment to withstand the postulated impact is verified. The Seabrook Station containment and enclosure building is described in Section 3.8.1 of the Seabrook PSAR. The FB-111 aircraft, the missile in the postulated impact,is 73.5 feet long, has a wingspan (sDread oosition) of 70.0 feet and weighs 81.800 Dounds (See Reference 1).

In order to perform the analyses, a force-time relationship is developed from the mechanical properties of the impacting aircraft. An elastic dynamic analysis indicates that an elastic-plastic dynamic analysis is required to predict the flexural response of the structure. From this analysis of the structure, an estimate is made of the strains experienced by the reinforcing bars and liner. Subsequently, an analysis is performed to verify the adequacy of the containment against punching shear and penetration.

1.2 FORCING FUNCTION FOR IMPACTING AIRCRAFT

The time variation of the load on a rigid surface due to an impacting aircraft may be developed using the momentum principle. The governing equations which are used to determine the time variation of the force experienced by the target are (Reference 2):

$$-P_c(\xi_n(t)) = \frac{d^2\xi_n}{dt^2}\int_{\xi_n(t)}^{L} \omega(x,t)\,dx$$

$$R(t) = P_c(\xi_n(t)) + \left(\frac{d\xi_n}{dt}\right)^2 \omega(\xi_n,t)$$

where

R(t) is the force acting on the target (positive for compression),

$\xi_n(t)$ is the extent of crushing at any time t as measured from the leading edge of nose of the missile,

$P_c(\xi_n)$ is the load required to crush the cross section of the missile at any distance ξ_n from the nose, (positive for compression)

$\omega(\xi_n)$ is the mass density per unit length of the missile as a function of the distance from the nose.

These equations are used to determine the two unknowns, the crushing length, $\xi_n(t)$, and the reaction, R(t), as functions of time. The information required to determine these variables consists of the initial impact velocity, weight or mass distribution and crushing load distribution of the aircraft.

The first equation is integrated numerically to obtain the velocity time history. The reaction force is then determined from the second equation.

Figure 1 shows three views of the FB-111 aircraft. Figure 2a ahows the one dimensional idealized model of the same aircraft. Figure 2b describes the weight distribution for an FB-111 with a total weight of 81,800 pounds. The sketch and the weight distribution are obtained from Reference 1. The particular configuration used is essentially the same as that summarized on P. 1.3.3 of Reference 1 with the wing stores and wing useful load removed.

This configuration is consistent with the normal operation (90% of the time) of the FB-111 at Pease AFB. The value of 81,800 pounds is the

weight before the airplane has warmed up and taken off. **In normal** flights the aircraft would fly a mission and return to Pease AFB with approximately 10,000 pounds of fuel. On this basis, the landing weight would be approximately 59,000 pounds. For those missions when the aircraft is flown with wing tanks the maximum take-off weight is **100,000** pounds. The FB-111is not allowed to land with fuel in these wing tanks; therefore in all cases the maximum landing weight is 81,800 pounds.

Thus, the 81,800 lbs weight of the FB-111 used in the impact analysis was the fully loaded FB-111 without wing tanks. This weight is conservatively large for any configuration of the aircraft flying out of Pease AFB, but it was used because it represented a maximum upper bound on the weight of the FB-111 in the landing pattern.

The exact crushing load distribution for an PB-111 is not available. The crushing load distribution shown on **Figure 2c** is arrived at by scaling the known values for a **Boeing-720(Ref.2).It** is demonstrated in this report that the peak value of the reaction is relatively insensitive to reasonable variations of the crushing load.

Figure **3 shows** the reaction-time relationship for the FB-111 striking a rigid wall at **an** impact velocity of **200** mph. The peak value of the reaction is 8.2 x 10^6 pounds. This peak value occurs when the wing structure is in the process of collapsing. This peak reflects the

concentration of mass in the wing structure and the fuel that is stored in the fuselage in the vicinity of the wing location. It is noted that the cross-sectional area over which the peak occurs will be considerably larger than the area of fuselage cross-section. The secondary peak of 4.2 x 10^6 pounds (at 0.21 sec.) occurs when the airplane is crushing in the vicinity of the engines.

The determination of the sensitivity of the reaction to the magnitude of the crushing load is investigated by determining the reaction for values of one-fifth and five times this crushing load. These results are shown in Figure 4. From Figure 4, the peak values of the reactions are:

Pc/5	8.5 x 10^6 pounds
PC	8.2 x 10^6 pounds
5xP_c	7.1 x 10^6 pounds

The peak value of the reaction is relativelv insensitive to variations in' the magnitude of the crushing load, and the scaled value of Pc is judged to give accurate results.

1.3 Flexural Behavior of Containment

1.3.1 Elastic Dynamic Analysis

For the elastic dynamic analysis, the finite element method was chosen as the analytical method, and a computer program for axisymmetric structures subjected to arbitrary static and dynamic loads was used. (See Reference 3 for the basis of the mechanics of the program.) Damping was not considered. Thus, the predicted structural response is slightly larger than that which does occur.

To accomplish the analysis, several assumptions were made. They are as follows:

i) The **containment** is fixed at the base of the cylinder.

ii) Impact loads are uniformly distributed over the loading zones.

iii) In the axisymmetric analysis (impact at apex of dome), the loading zone is a circle with a radius of 52.77 inches and an area of 8748.3 square inches.

iv) In the asymmetric analysis (impact at springline), the loading zone is a square, 93.53 inches on a side and 8748.3 square inches in area.

v) The stiffness of the reinforcing steel is neglected; only the gross concrete volume is considered. The modulus of elasticity was taken as 3.0 x 10^6 **lbs/sq.** in., Poisson's ratio was taken as 0.15, and the weight density was taken as 150 pcf.

vi) The effect of the enclosure building is neglected. It can be shown that the enclosure absorbs approximately 4% of the energy of the impacting aircraft.

The containment structure is modeled with axisymmetric conical shell elements, a plot of this model is shown in Figure 5.

Two impact positions, the apex of the dome and the springline, are considered. The impact at the dome is uniformly distributed over the first seven (7) elements, and the impact at the springline is uniformly distributed over the six (6) elements nearest to the springline. By means of a half-range cosine series, the load at the springline is confined to a

6.18' arc. Thirty (30) terms were used to represent this Fourier series which is shown, normalized to 1.0, in Figure 6. Experience with loadings similar to the loadings here, has demonstrated that twenty (20) terms of the series were found to be too few and ninety (90) terms were found to yield results very close to those generated by thirty (30) terms.

Selected maximum results for the axisymmetric and asymmetric analyses are given in Tables 1-1 and 1-2, respectively. These moments will cause cracking of the concrete and yielding of the rebar. Therefore, an elastic-plastic dynamic analysis is required.

1.3.2' Elastic-Plastic Dynamic Analysis

The procedure followed for the elastic-plastic analysis of the response of the containment under aircraft impact follows that of Biggs (Reference 4). In this procedure, knowing the load-time relationship, the first natural frequency of that part of the structure participating in the energy absorption, and the allowable ductility ratio (defined as the ratio of the maximum deflection to the deflection at yield), the ratio (F/Rm) of the maximum value of the load-time relationship to the maximum value of the resistance function can be determined. This

can then be compared with the actual estimated maximum values of the load-time relationship and resistance function.

The force-time relationship, given in Figure 3 is approximated by a triangular load-time curve with the same total impulse and peak force. This ideal and the actual force-time relationships are compared in Figure 7 . It is assumed that a circular region of radius "a" will participate in the energy absorption. The natural frequency, associated with this participating region, is estimated on the basis of the first natural frequency of a flat circular plate of radius "a" clamped at the edges. The assumption of clamped edges, in that it gives a smaller period for the first natural frequency than in the actual case, is a conservative simplification. This follows because, in general the value of the maximum allowable forcing function decreases as the first natural period decreases (Ref. 4, p. 78, Figure 2.26). Conversely, ignoring the curvature is non-conservative in that it gives an estimate of the period which is larger than the actual case. For small values of the radius "a", the curvature effect is minimal.

All calculations are based upon the 3'-6" dome section configuration. The first natural frequency of a flat circular plate, clamped at the edge is:

$$P = \sqrt{\frac{D}{M}} \; \frac{1}{a^2} \; X.17$$

where D is the **flexural** rigidity and M is the mass density per unit surface area (See, for example, Ref. 5).

For the 3'-6" thick concrete plate with a Young's modulus of 3×10^6 psi and a unit weight of 150 pounds per cubic foot, the period is:

uncracked section: $$T = \frac{a^2}{15.94 \times 10^3}$$ "a" in feet; cracked section: $$T = \frac{a^2}{12.86 \times 10^3}$$

Using Fig, 2.26 of Reference 4 (p. 78), the ratio F/Rm, as a function of the radius of the participating material of the containment, can be determined for various values of ductility ratio.

For the purpose of this investigation, two (2) ductility ratios, 3 and 10 are used. For plates and shells, the lower value is conservative, the larger value reasonable. The results of the calculations are shown in Table 1-3 and Figure 8. Although the range of Fig. 2.26 of Reference 4 is limited to a td/T of 20, it can be observed that for a ductility ratio greater than two and td/T of 20, F/Rm is greater than unity. Therefore, the allowable peak force, F, can be larger than the maximum value of the resistance, Rm.

1.3.3 Resistance Function

In the vicinity of the impact region, the response of the structure is assumed to have the characteristics shown in Figure 9a.

For values of the force less than Rm, the displacements are limited in magnitude even though the response may be inelastic. As the load reaches the value Rm, the deformations are able

to become arbitrarily large, i.e., the collapse load has been reached. The collapse load for a concentrated load on a curved shell is not readily accessible. As a conservative estimate, the collapse load for a flat plate with reinforcement the same as the dome is used to estimate the collapse load for the shell..

Expecting the yield line formation shown in Figure 9b observation suggests that the clamped boundary condition case should be used. The value of the collapse load, Rm, is then (Reference 6)

$$R_M = 2\pi(M_u^+ + M_u^-)$$

where M_u is the ultimate moment capacity and the notation + and - refers to the outside and inside reinforcement respectively.

The ultimate moment capacities and collapse loads of the containment are:

dome M^+ = 643 k-ft./ft.
M^- = 651 k-ft./ft.
Rm = 8,131k

springline M^+ = 1,235 k-ft./ft
M- = 643 k-ft./ft
Rm = 11,800k

At the dome, the collapse load and peak load are approximately equal. However, from Figure 8 , the dynamic effect allows the structure to withstand loads in excess of the capacity. From Figure 8 the allowable load is 10% larger than the resistance or collapse load. Therefore, the apex will not

collapse. Since the maximum load, **8,200k is** less than the capacity of the dome in the springline, **11,800k,** collapse will not occur at the springline.

The dome will not collapse, under the applied load.

1.3.4 Estimation of Rebar and Liner Strains

While plastic analysis techniques are useful for finding collapse loads, they cannot be directly used to find the strains and displacements corresponding to collapse loads.

However, a procedure making use of the ductility ratio can be used to approximate the maximum strains in the structure subject to dynamic loading when nonlinear material behavior is encountered. This procedure is described below.

A typical load-displacement curve for reinforced concrete section is shown in Figure 10. This curve is linear up to the load causing cracking (P_{cr}) after which a straight line of somewhat flatter slope is obtained until the load (P_y) is reached which causes yielding of the steel.

Any increase in load beyond (P_y) causes the displacement to increase disproportionately. Further increase in load causes extensive displacements to occur, resulting in eventual collapse. This actual behavior of the structure was idealized as shown in Figure **9a,** and was used for the elastic-plastic dynamic analysis previously discussed. This **idealized** curve represents **the** resistance function of the structure.

The ductility ratio, μ, referred to in the elastic-plastic dynamic analysis represents the ratio of the maximum displacement of the structure to the deflection established as yield (Y_{el}) for the structure.

While it is recognized that the ductility ratio is not an exact measure of the maximum strain at a particular point of the structure, it can be used as an approximation because the strain at yield in the actual structure is very nearly the strain corresponding to yield for the idealized structure.

The procedure used herein is based on the peak of the actual forcing function resulting from the-aircraft impact, the duration of loading, the idealized resistance function for the structure and the first natural period of the responding part of the structure. By using the above known quantities, the corresponding ductility ratio for the structure may be determined.

For a peak in the forcing function of 8,200k and a maximum force in the resistance function of 8,130 k, the maximum ductility ratio for all ratios of t_d/T is approximately 1.5 (See Fig. 2-26, Ref. 2). Thus, regardless of the natural period of the responding part of the structure, the largest displacement that will occur under the aircraft impact loading is the same as that corresponding to yield for the idealized structure.

The yield strain for the reinforcing steel is

$$\varepsilon_Y = \frac{60}{30 \times 10^3} = 0.002 \text{ in/in}$$

If it is assumed that the strain corresponding to yield (Y_{el}) for the idealized structure is 50% larger than this (actually is much less than this),, then an upper bound for the strain in the reinforcing steel will be:

$$\varepsilon = 1.5 \times 1.5 \times 0.002 \text{ in/in} = 0.0045 \text{ in/in}$$

Since the liner and the tension reinforcing steel are only several inches apart in a 42" thick containment dome, they will be strained to nearly the same values. Hence, there will be no possibility of impairing the leak tight integrity of the liner.

1.4 Response of the Enclosure Building

During the early stages of the impact process, the enclosure building will deform until it comes into contact with the containment. The enclosure building must deflect five feet in order to come into contact with the containment dome. Such a deformation will involve an inelastic response. This inelastic response will involve both flexure and shear.

The 15" thick enclosure building is reinforced with #10's @ 12", both ways and both faces. The collapse load is 635k.

The allowable shear load will depend upon the shear area over which the transverse shear stress acts. This shear area is determined by multiplying the average shear periphery by the effective depth of the shell. The average shear periphery is determined by a contour which is at a distance of one-half the effective depth away from the contour of the contact area (Figure 11). Figures 12 to 21 show the impact area and shear periphery associated with various locations

along the aircraft and for the effective depths of the enclosure building (9") and containment (37").

The reaction as a function of the cross section being crushed is determined from the reaction-time and crushing distance relationship and is shown in Figure 22.

From this information, it is possible to examine the effect of the aircraft impact on the enclosure building as a function of the distance being crushed. Figure 23 shows the average shear stress on the enclosure as a function of distance being crushed. For example, using a shear strength of 4.25 $\sqrt{f'_c}$, the enclosure building will fail by shear when the aircraft is crushing at 7.25 feet. Also shown on Figure 23 is the reaction as a function of the distance being crushed. For a collapse load of 635k, the enclosure building will collapse when the aircraft is crushing at 9.75 feet. It would appear that, using $4.25\sqrt{f'_c}$ as a shear strength, the enclosure building would fail by shear before collapse, however, the two events would occur at a time difference of 0.0086 sec. Any increase in actual shear strength above $4.25\sqrt{f'_c}$ would increase the possibility of punch through and collapse happening simultaneously. As will be domonstrated in Section 1.5, the actual shear strength can vary considerably above a value of $4.25\sqrt{f'_c}$. No clear conclusion can be drawn as to whether punch through or collapse occurs first. Based on the above discussion, the failure of the enclosure building will involve both extensive shear and flexure damage and it will deform until it comes into contact with the containment.

1.5 Shear Capability of the Containment

The enclosure building will deform until it comes into contact with the containment dome. The dome will then resist the impact force and experience transverse shear stress in the vicinity of the impact area. The maximum average shear stress is determined by defining a shear perimeter and thickness over which the impact force is acting. Figure 24 describes the procedure by which the shear perimeter for the maximum average shear stress acting on the containment dome is determined. The shear perimeter for the containment is at a distance

$$\text{(effective depth of enclosure)} + \left(\frac{\text{effective depth of containment}}{2}\right)$$

away from the perimeter of the impact area.

The values of the shear perimeter for various cross sections of the aircraft are given in Table 1-4. Also shown are the shear area, impact force and average shear stress for the containment building. The values of average shear stress as a function of the cross section being crushed is shown in Figure 25. The shear stress is given in terms of psi and $\sqrt{f'_c}$. The maximum value of the average shear stress occurs when the aircraft is crushing at a distance of 35 feet from the nose. The value of this maximum average shear stress is 229 psi or $4.18\sqrt{f'_c}$.

Various shear strengths have been proposed. A tabulation of these shear strengths, for parameters similar to the aircraft and structure under discussion is shown in Table 1-5. It is seen that the maximum nominal shear stress of $4.18\sqrt{f'_c}$ is less than all the other proposed values except the conservative value of $4\sqrt{f'_c}$ as proposed by the

XI-Committee 326. Hence, it is concluded the the containment will not fail by punch through.

1.6 Requirements to Prevent Perforation

The velocity of the engines as they impact on the enclosure building and containment is 250 fps.

The FB-111 has two Pratt & Whitney **JTF10A-270** (Military designation **TF30-P-7)** jet turbo fan engines with an outside diameter of 50.22 inches. Each engine has a dry weight of 4,121 pounds (Ref. 1). The thickness of the dome required for no performation was determined using procedures reported in Reference 7.

The pertinent nomenclature is :

- **x** penetration thickness for infinitely thick slab (inches)
- **e** perforation thickness for reinforced concrete (inches)
- **dm** diameter of missile (inches)
- **V** velocity of impact (feet per second)
- **W** weight of missile
- **K** $\frac{180}{\sqrt{f'_c}}$
- f'_c ultimate compression strength of concrete (psi)

$$G = K(.72)(.50)\frac{W}{dm^3}\, dm^{0.2}\left(\frac{V}{1000}\right)^{1.8}$$

$$\frac{x}{dm} = 2\sqrt{G}, \quad G < 1.0$$

$$\frac{e}{dm} = 2.57\left(\frac{x}{dm}\right) - 0.454\left(\frac{x}{dm}\right)^2, \quad 0 \le \frac{e}{dm} \le 3$$

Since a jet engine is not completely solid (thin shells for torque transmission, blades for fan, compressor and turbine, burner cans for combustion) the engine was assumed to behave similarly to a hollow pipe missile.

For a fan-jet, the outside diameter is slightly larger than the gas generator. Two values of dm (the diameter of the gas generator) were used, SO.23 inches and 40 inches. The results are:

dm (inches)	e(inches)
50.22	*21.8*
40.00	*22.8*

These values can be compared with the dome thickness of 42 inches. From these calculations, **it** can be concluded that there will be no perforation.

1.7 Conclusions

From the above results of the analysis of the **Seabrook** Station Containment, the following conclusions can be made:

1. The enclosure building will fail and will come into contact with the containment building. The mode of failure will not be by shear or flexure alone, but will involve both types of damage.
2. The containment building will not fail. The **flexural** strength will prevent collapse. The shear strength will prevent.punch **through.** There will be permanent damage ***to*** the structure, but *the* extent of this damage will not be sufficient to cause loss of the integrity of the building.

3. The liner strains, although inelastic, will be sufficiently small so that tearing of the liner will not occur.

4. The engines will not perforate the containment.

These conclusions can be made even though the above analysis was performed with considerable conservatisms. The conservative aspects of the analysis are:

1. The reaction-time relationship was determined for impact on a rigid target. A realistic, flexible target would reduce the peak value of the reaction.

2. Normal impact was assumed. Any impact angle other than 90° reduces the impact force and increase the area over which the impact force acts.

3. The arcing effect of the doubly-curved dome was ignored. Arching increases the collapse and punching load capacities.

4. The shear stresses can be computed more accurately using the effective force occuring during the time necessary for the structure to respond rather than the peak instantaneous force. The peak instantaneous force will give larger shear stresses than the effective force.

5. The actual concrete compression strength will be larger than the specified strength of 3,000 psi. This would result in a larger value for the shear strength.

6. A conservative estimate of the shear periphery used to calculate shear areas and shear strengths was chosen. The

failure cone was assumed to be through the containment only and not through the combined thicknesses of the containment and enclosure building. The latter would be more accurate.

The integrity of the containment building will not be impaired in the occurrence of the postulated aircraft impact.

1.8 REFERENCES FOR SECTION 1.0

1. "FB-111 Unit Inertia Data, "General Dynamics, Fort Worth Division, Report FZS-12-6010, Revision "A", January, 1968.

2. Riera, J.O., "On the Stress Analysis of Structures Subjected to Aircraft Impact Forces" Nuclear Engineering and Design, North Holland Publishing Company, Amsterdam, Holland, 8 **(1968)**, p. 415-426.

3. Ghosh, S., and Wilson, E., "Dynamic Stress Analysis of Axisymmetric Structures Under Arbitrary Loading", University of California, Berkeley, CA., Revised Sept., 1975.

4. Biggs, J. M., Introduction to Structural Dynamics, McGraw-Hill, Inc., 1964, pps. 69-84.

5. Meiorovitch, Analytical Methods in Vibrations, The Macmillan Company, 1967, p. 183.

6. Save and Massonnet, Plastic Analysis and Design of Plates, Shells and Disks, North Holland, 1972, p. 245.

7. Kennedy, Effects of an Aircraft Crash Into a Concrete Reactor Containment Building. Holmes & Narver, Inc., July, 1966.

TABLE 1-1

MAXIMUM RESPONSE

AXISYMMETRIC ANALYSIS

(IMPACT AT DOME)

Moments	Meridional	-1006 Ft-K/Ft
	Circumferential	-1005 FT-K/FT
Forces	Meridional	-478 K/Ft
	Circumferential	-478 F/Ft

TABLE 1-2

MAXIMUM RESPONSE

ASYMMETRIC ANALYSIS

(IMPACT AT SPRINGLINE)

ELEMENT 36*	Moments	Meridional	-1139 Ft-K/Ft
		Circumferential	-1309 Ft-K/Ft
	Forces	Meridional	383 K/Ft
		Circumferential	442 K/Ft
ELEMENT 37*	Moments	Meridional	-1148. Ft-K/Ft
		Circumferential	1350 Ft-K/Ft
	Forces	Meridional*	378 K/Ft
		Circumferential	431 K/Ft

* Element 36 is element **immediately** above springline.

Element 37 is element immediately below springline.

TABLE 1-3

ALLOWABLE MAXIMUM FORCE, MAXIM?? RESISTANCE RATIO FOR VARIOUS DUCTILITY RATIOS AND PARTICIPATING TARGET MATERIAL RADII

A* (ft)	T (sec)	td/T	μ	F/Rm
		Uncracked Section		
4	1.00×10^{-3}	170.0		**
a	4.01×10^{-3}	42.4		1
12	9.03×10^{-3}	18.8		
16	1.61×10^{-2}	10.6		
20	2.51×10^{-2}	6.8	3	1.12
			10	1.23
24	3.61×10^{-2}	4.8	3	1.15
			10	1.12
28	4.92×10^{-2}	3.5	3	1.20
			10	1.33
32	6.42×10^{-2}	2.6	3	1.25
			10	1.47
		Cracked Section		
4	1.24×10^{-3}	137.1		
a	4.92×10^{-3}	34.2		1
12	1.12×10^{-2}	15.2		
16	1.99×10^{-2}	a.5	3	1.10
			10	1.20
20	3.11×10^{-2}	5.4	3	1.10
			10	1.30
24	4.48×10^{-2}	3.8	3	1.17
			10	1.36
28	6.09×10^{-2}	2.8	3	1.23
			10	1.47
32	7.96×10^{-2}	2.1	3	1.25
			10	1.70

* Participating Radius; since this is not well defined, a range of values is included.

** By observation, Pigure 2.26, "Introduction to Structural Dynamics" Riggs

TABLE 1-4

AVERAGE SHEAR STRESS - CONTAINMENT

Location ft.	Shear Perimeter ft.	Shear Area in^2	Reaction pounds	Average Shear Stress psi
15	32.6	14,474	1,284,000	89
19	37.0	16,428	1,625,000	99
27	41.8	18,559	3,298,000	178
35	50.2	22,288	5,105,000	229
41	99.8	44,311	8,200,000	185*
50	45.5	20,202	2,765,000	137
58	49.2	21,844	4,200,000	191**,+
65	49.2	21,844	686,000	32

*If the wings were assumed to have sheared-off at the time that the aircraft were crushing at this location the shear perimeter and reaction would-be reduced to 64.6 ft. and 6,070k respectively. The average shear stress then becomes 198 psi.

**If the horizontal and vertical stabilizers were assumed to have sheared-off at the time that the aircraft were crushing at this location the shear perimeter and reaction would be reduced to 42.1 ft. and 3,900k respectively. The average shear stress then becomes 209 psi.

+The average shear stress for the case were the crushing strength is reduced by 5 is 245 psi.

TABLE 1-5

COMPARISON OF ULTIMATE SHEAR STRENGTH CAPACITY*

Ultimate Shear Strength psi	Ultimate Shear Strength $\sqrt{f'c}$	Comment
717	13.1	equation 5-2, $\phi_o = .5$
655	11.9	equation 5-1, $\phi_o = .5$
607	11.08	equation S-10, $\phi_o = .5$
527	9.62	equation 5-5, $\phi_o = .5$
525	9.58	equation 5-2, $\phi_o = 1$
523	9.55	equation 5-3, $\phi_o = .5$
445	8.1	equation 5-1, $\phi_o = 1$
391	7.14	equation S-10, $\phi_o = 1$
383	6.99	equation 5-5, $\phi_o = 1$
363	6.62	equation 5-12**
351	6.41	equation 5-4a
292	5.33	equation 5-6
219	4.00	equation 5-9, Committee 326 shear stress at distance d/2 from periphery $\phi = 1$

*"The Shear Strength of Reinforced Concrete Member-Slabs", Joint ASCE-ACI Task Committee 426, Journal of the Structural Division, ASCE, Aug., 1974.

c = 93" $\sqrt{f'c}$ = 3,000 psi p = 0.0099

d = 37" f_Y = 60,000 psi

**Adjusted for circular region, evaluated at d/2 away from periphery.

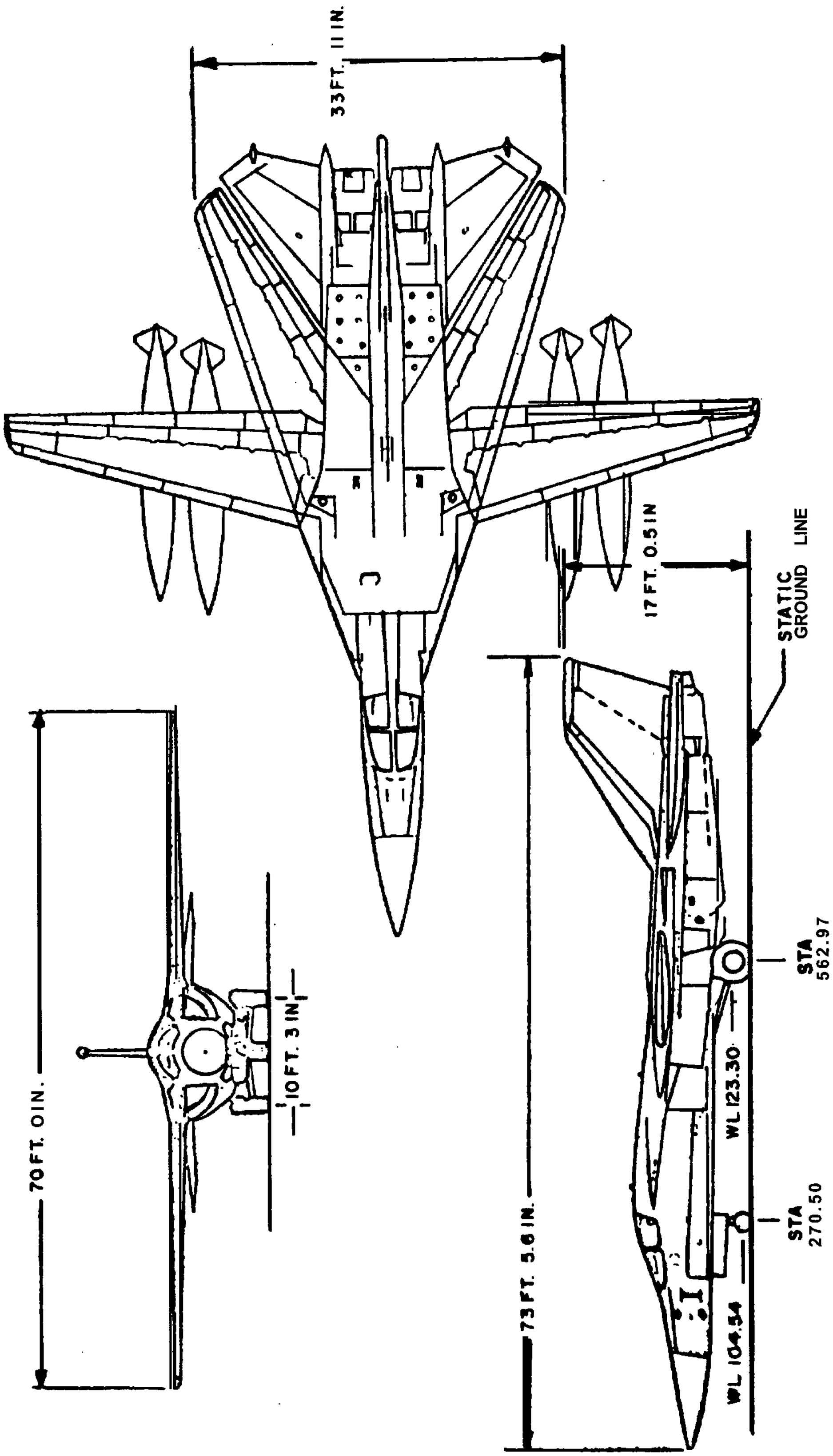


FIGURE 1

FB-111 CONFIGURATION (FROM REFERENCE 2)

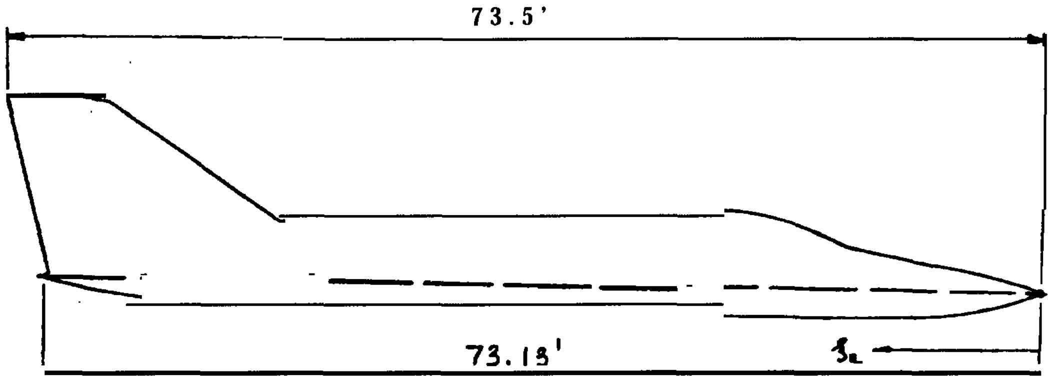


Figure 2A FB111 • CONFIGURATION

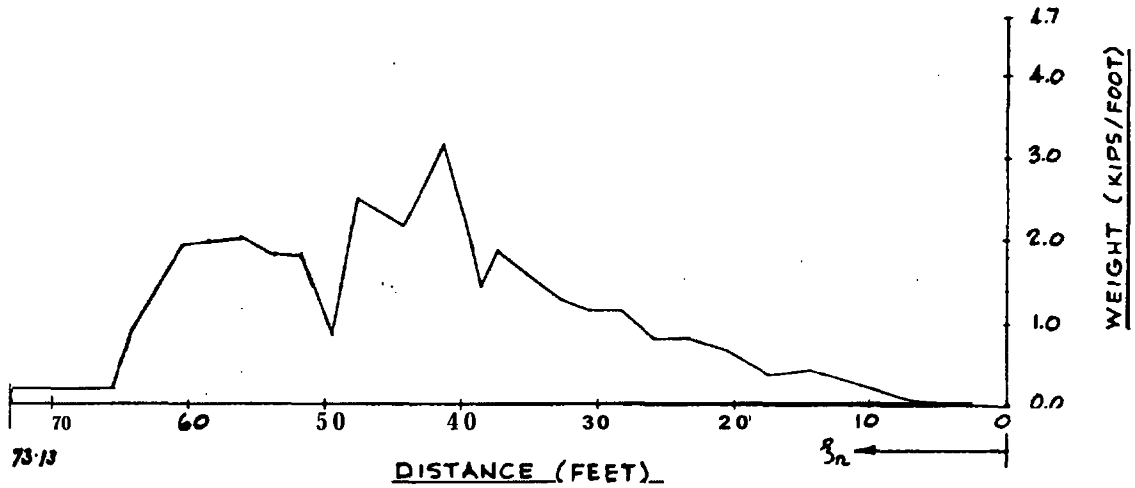


Figure 2B WEIGHT DISTRIBUTION

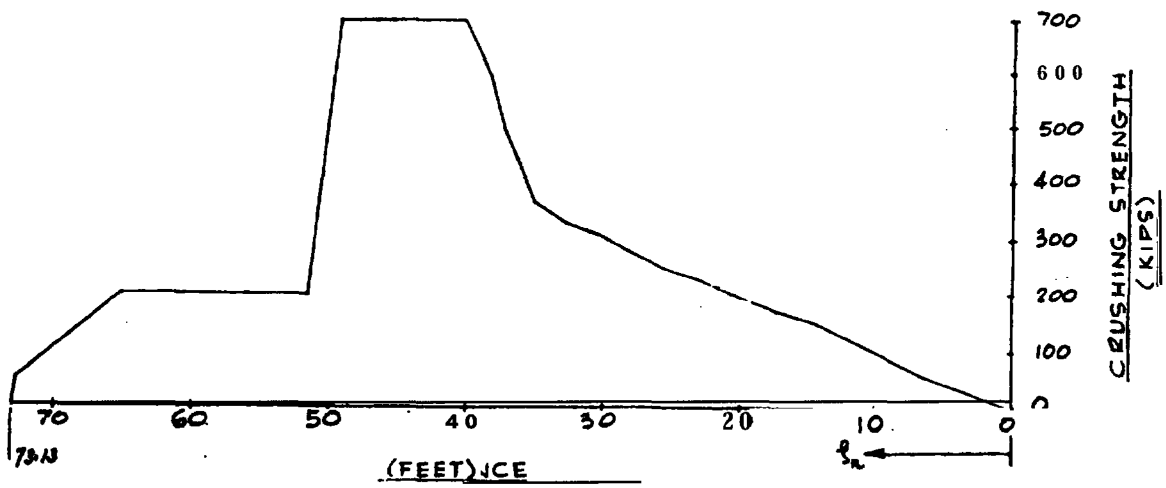
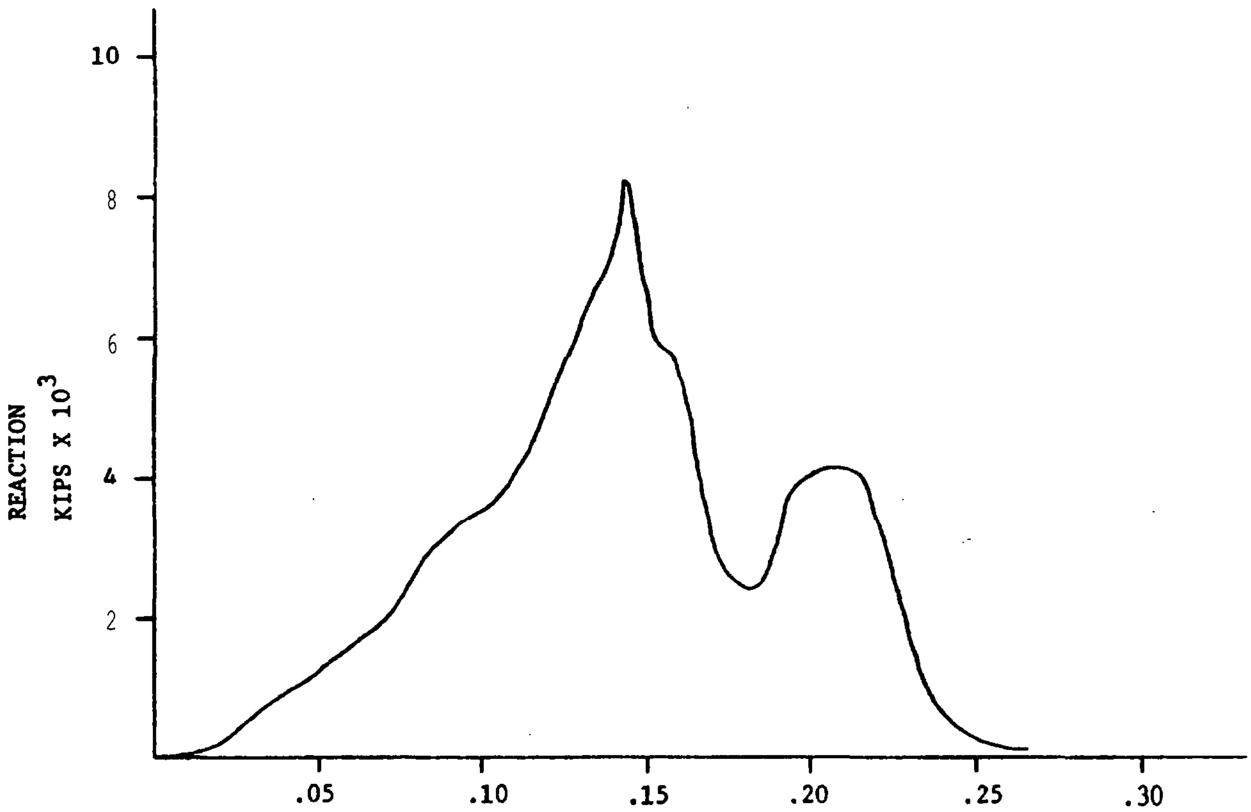


Figure 2C CRUSHING STRENGTH DISTRIBUTION



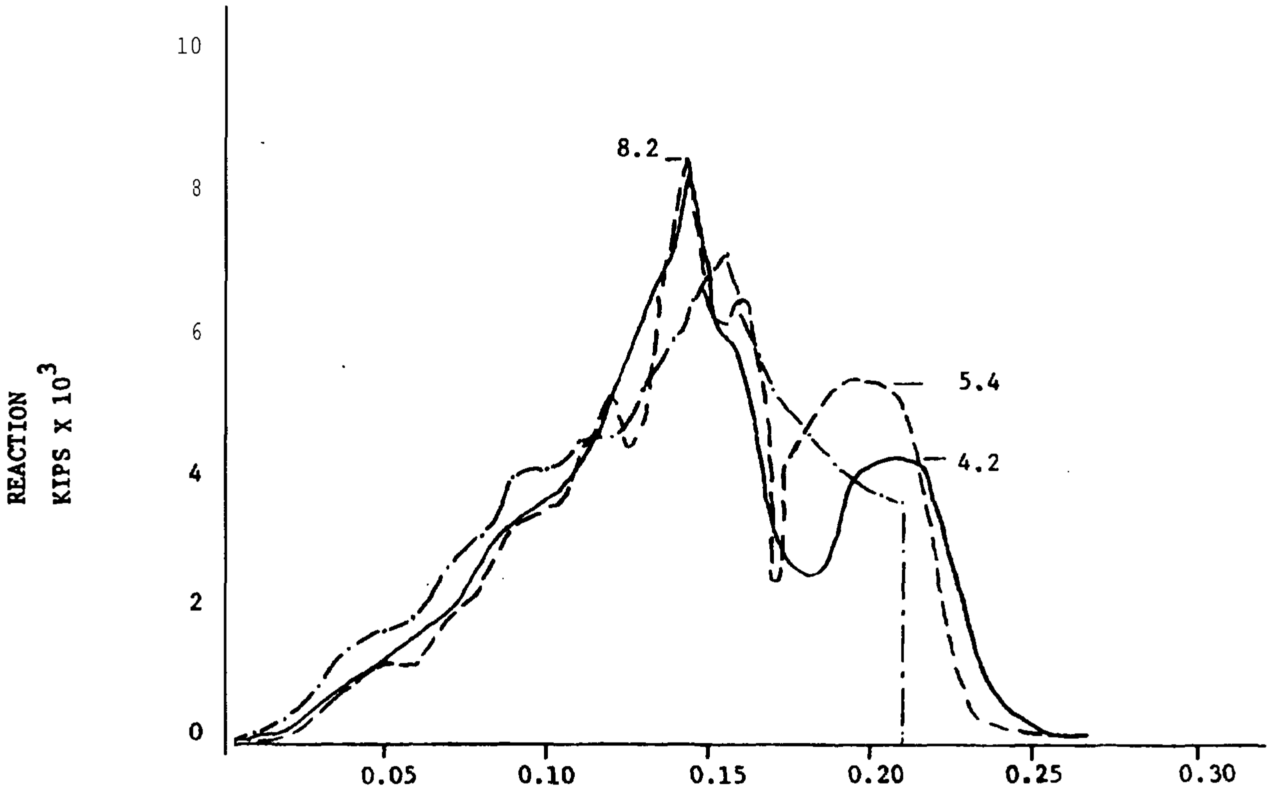
TIME
SECONDS
FIGURE 3

REACTION-TIME RELATIONSHIP

$P_c/5$ — — — —

$5P_c$ —·—·—·—·—

P_c denotes the scale crushing load used in the calculation.
$P_c/5$ and P_c x 5 denotes that one-fifth and five time the crushing load were used, 'respectively.



TIME
SECONDS
FIGURE 4

Reaction-Time Relationship for FB-111 with impact velocities of 200 mph.

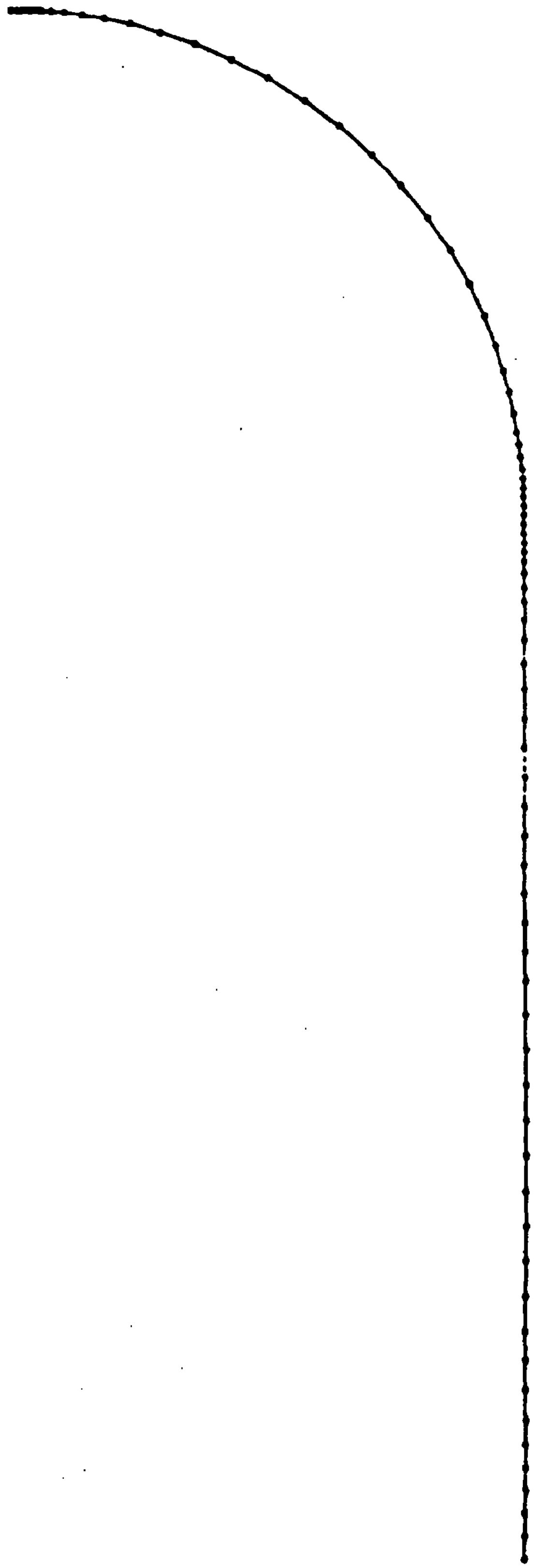


FIGURE 5
FINITE ELEMENT MODEL

PSNH SEABROOK S T A T I O N CONTAINMENT MISSILE IMPACT 6.1911 DEGREE IMPULSE

NO. OF COEFFS. 30.

MAXIMUM 3.8909

MINIMUM -0.1382

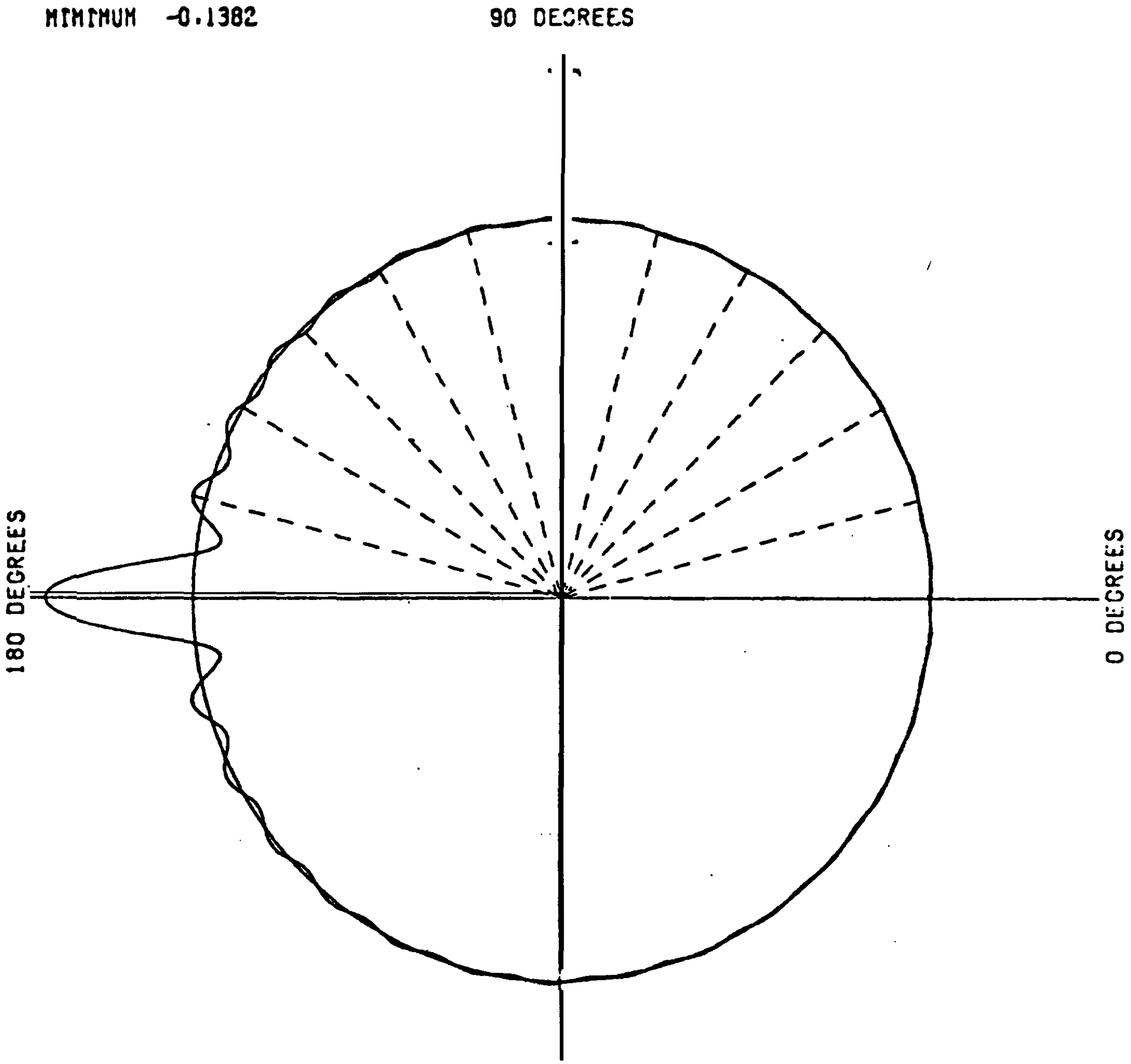


FIGURE.6
FOURIER SERIES REPRESENTATION OF SPRINGLINE LOADING

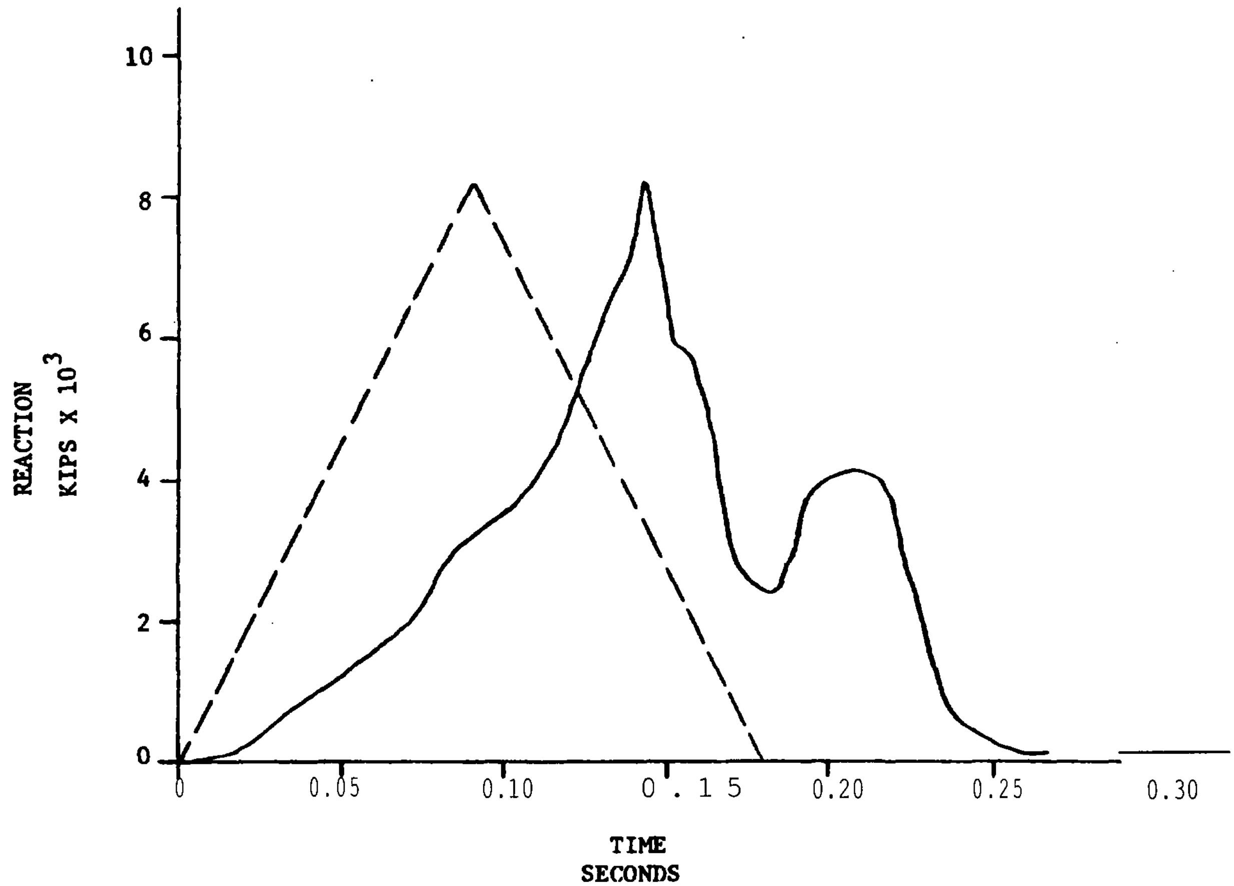


FIGURE 7 ACTUAL AND IDEAL REACTION TIME RELATIONSHIP

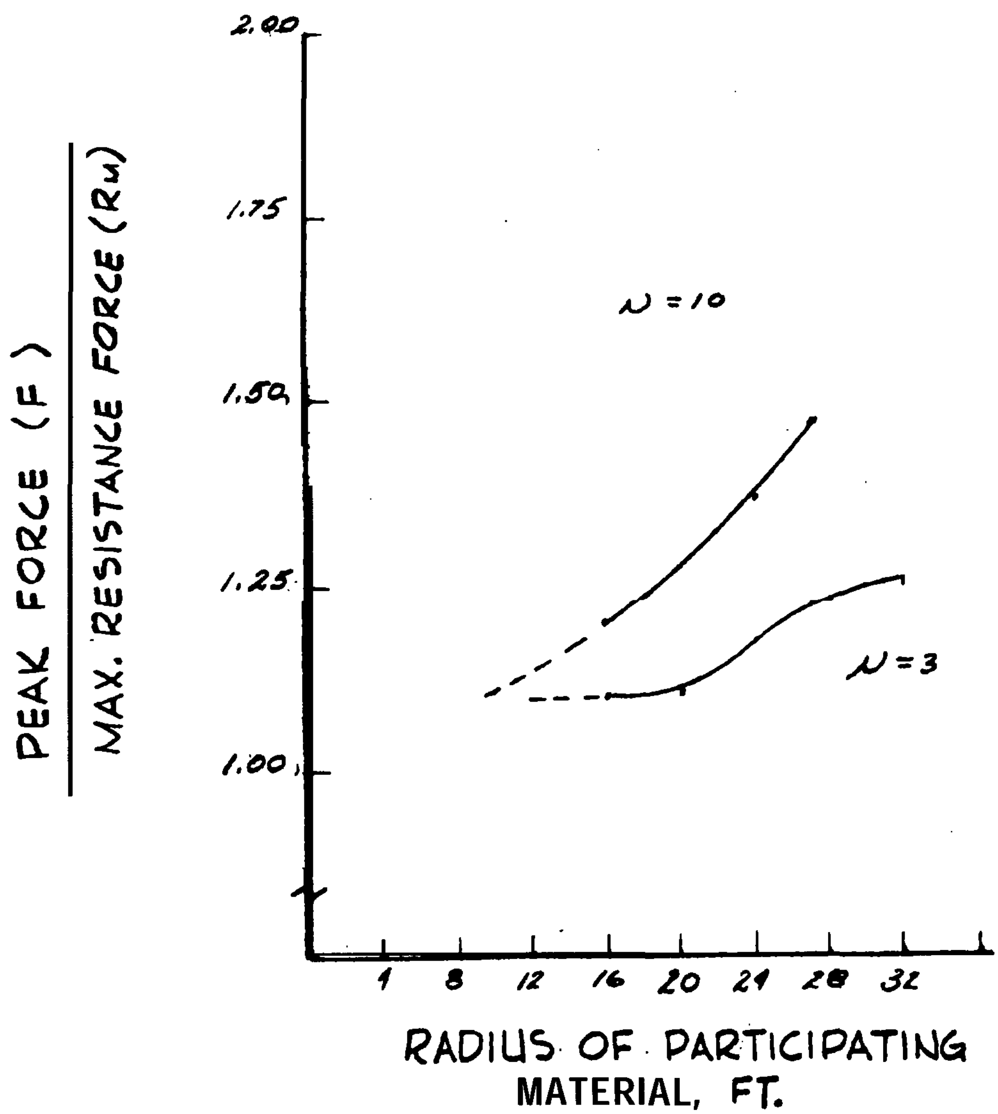


FIGURE 8
ALLOWABLE MAXIMUM FORCE, MAXIMUM RESISTANCE RATIO FOR VARIOUS DUCTILITY RATIOS AND PARTICIPATION TARGET MATERIAL RADII

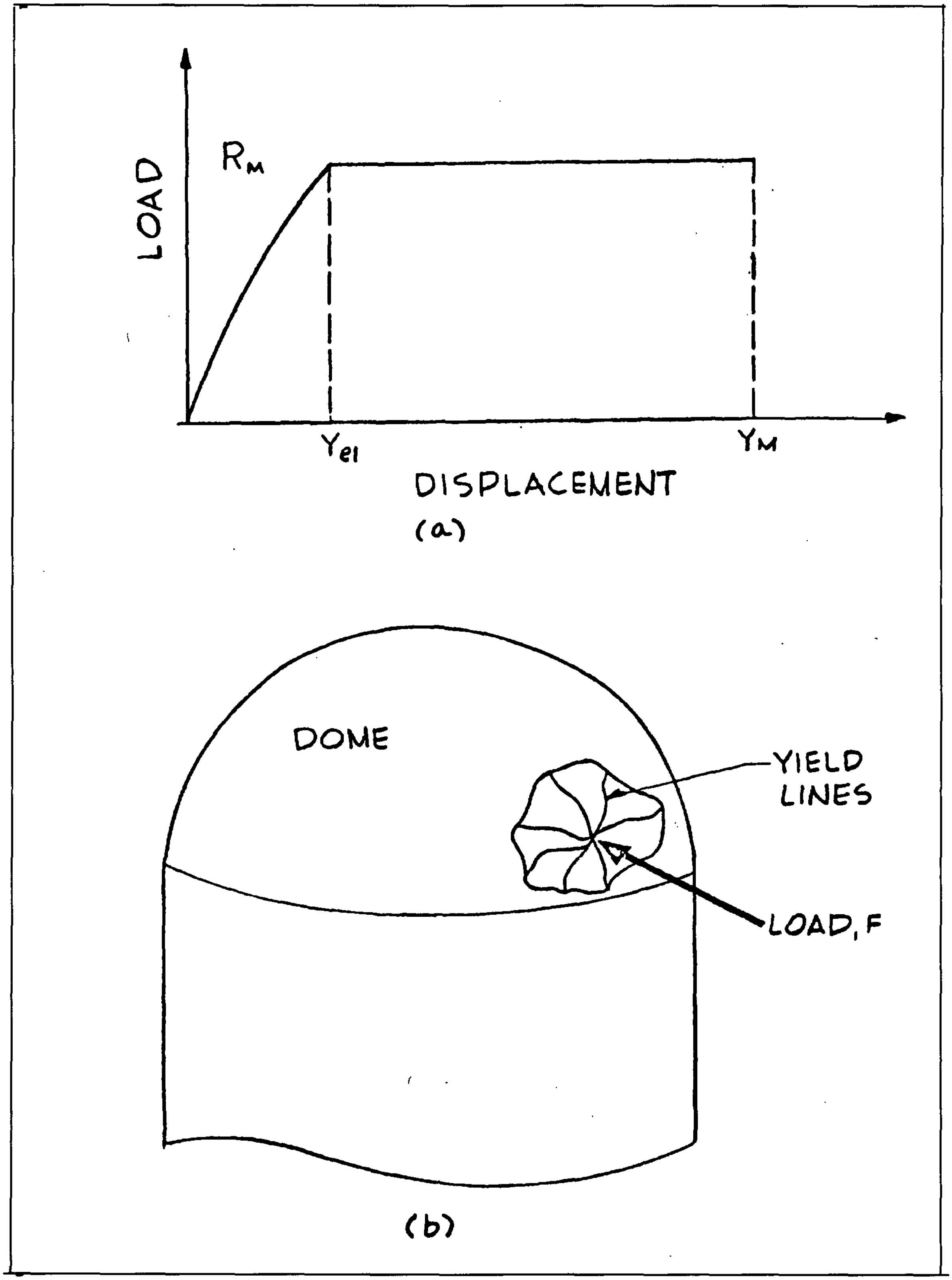


FIGURE 9

LOAD, DISPLACEMENT BEHAVIOR AND **POSTULATED YEILD** LINE CONFIGURATION

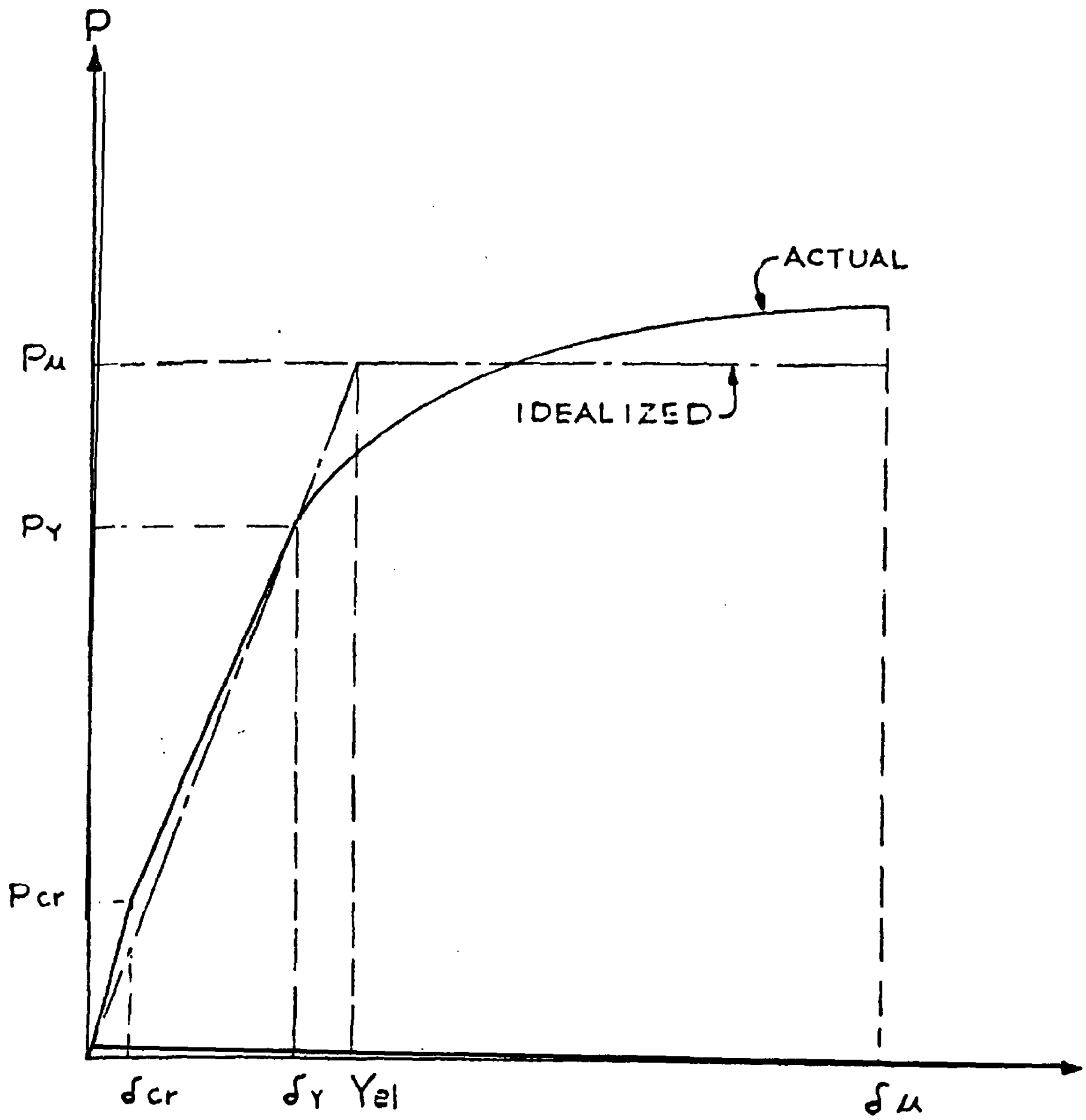


FIGURE 10.
LOAD-DISPLACEMENT CURVE FOR REINFORCED CONCRETE

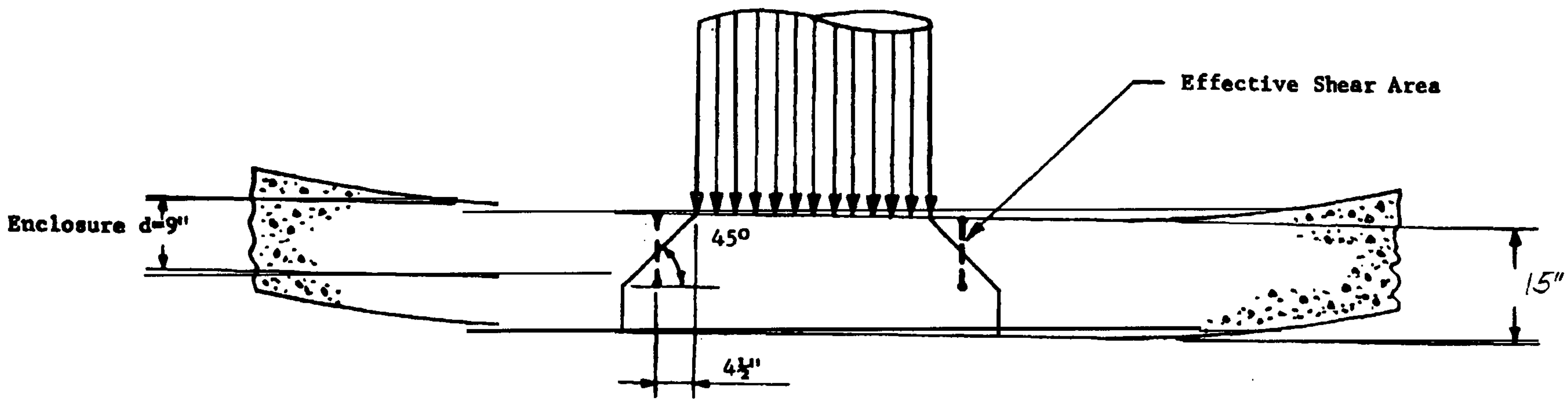


Figure 11, SCHEMATIC FOR EFFECTIVE SHEAR AREA - ENCLOSURE

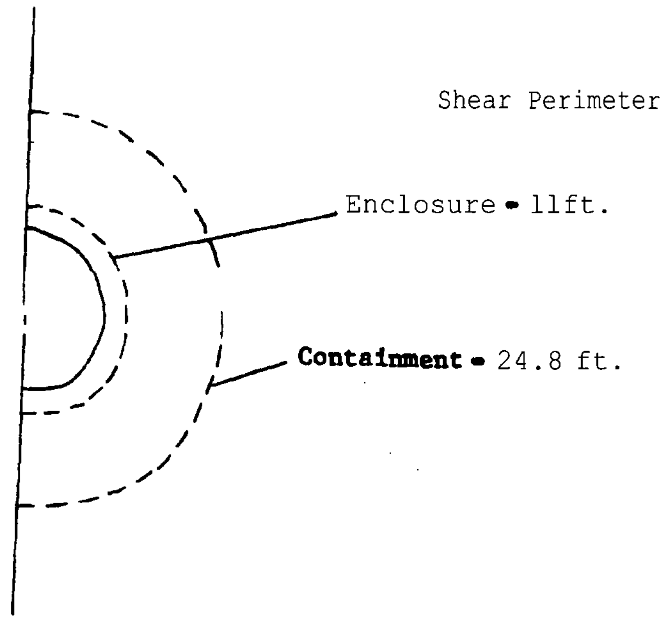


Figure **12** Impact **Area and** Shear Perimeter at 5 Feet From Nose

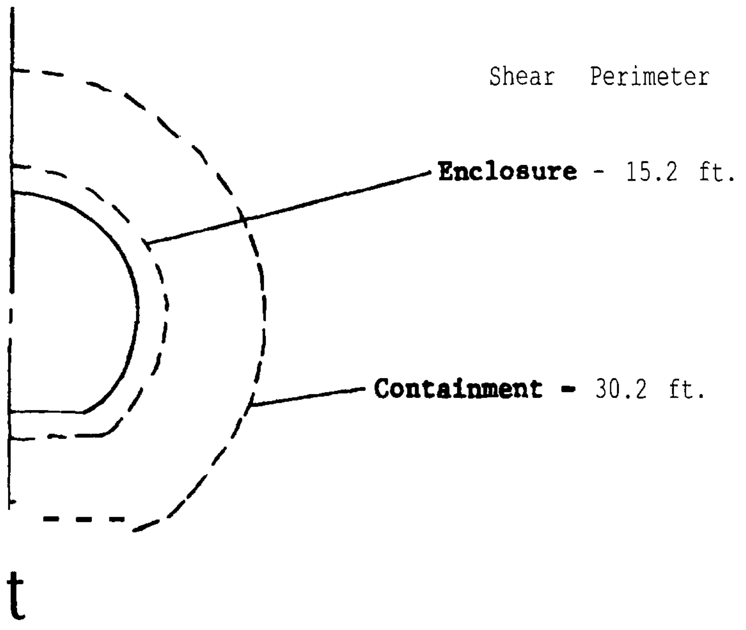


Figure 13, Impact Area and Shear Perimeter at 8.5 Feet From Nose

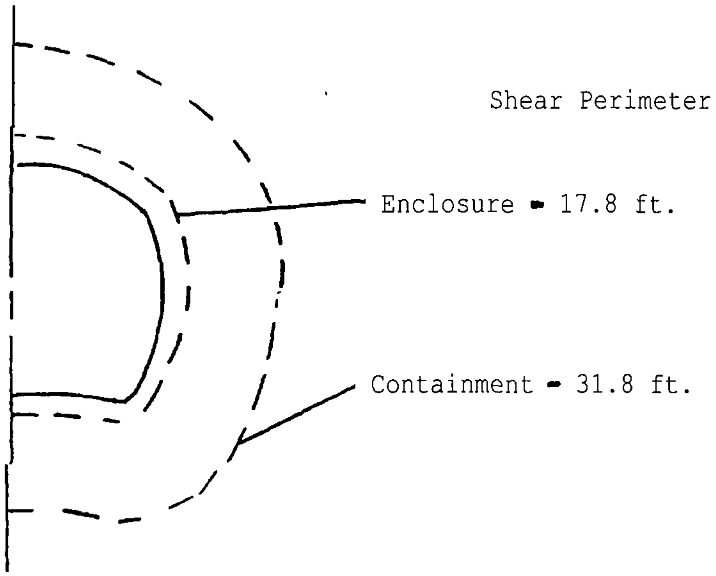


Figure **14**, Impact Area and Shear Perimeter at 9.9 feet From Nose

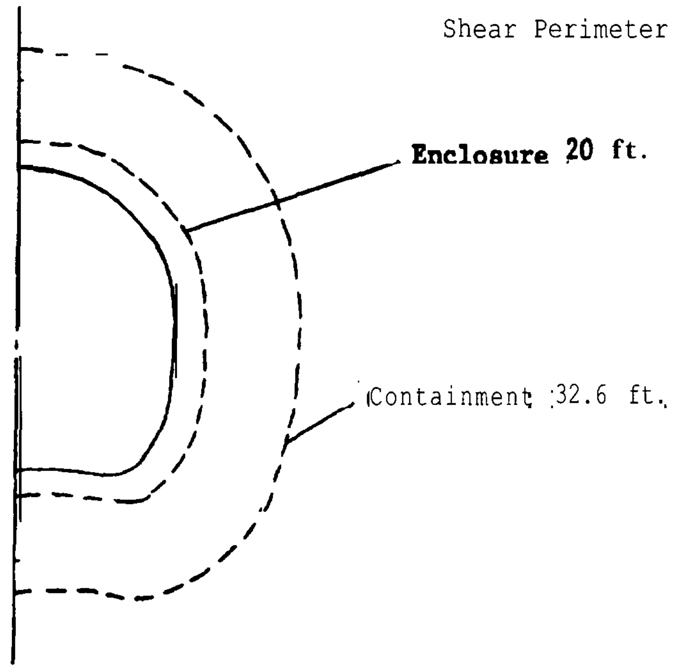


Figure 15 Impact Area and Shear Perimeter at 15 Feet From Nose

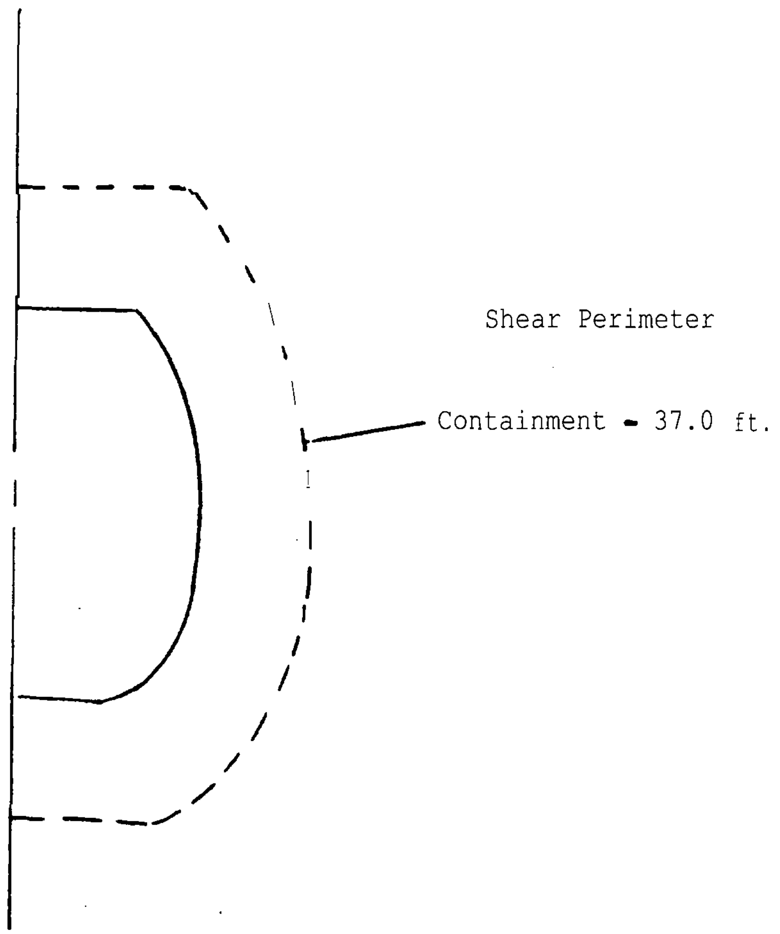


Figure 16, Impact Area and Shear Perimeter at 19.0 Feet From Nose

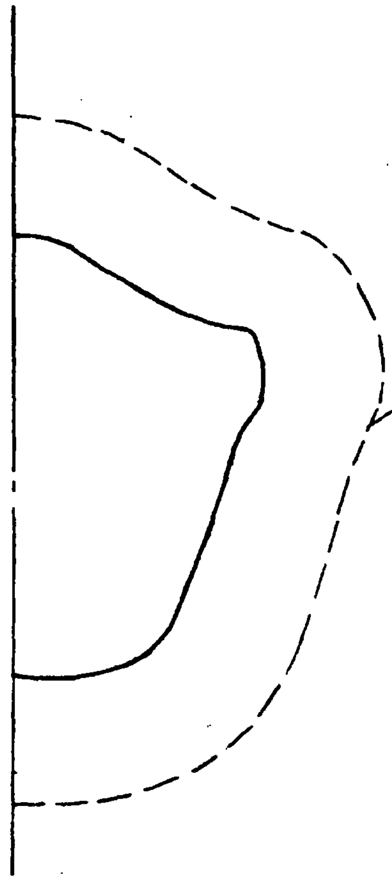


Figure 17, Impact Area and Shear Perimeter at 27 Feet From Nose

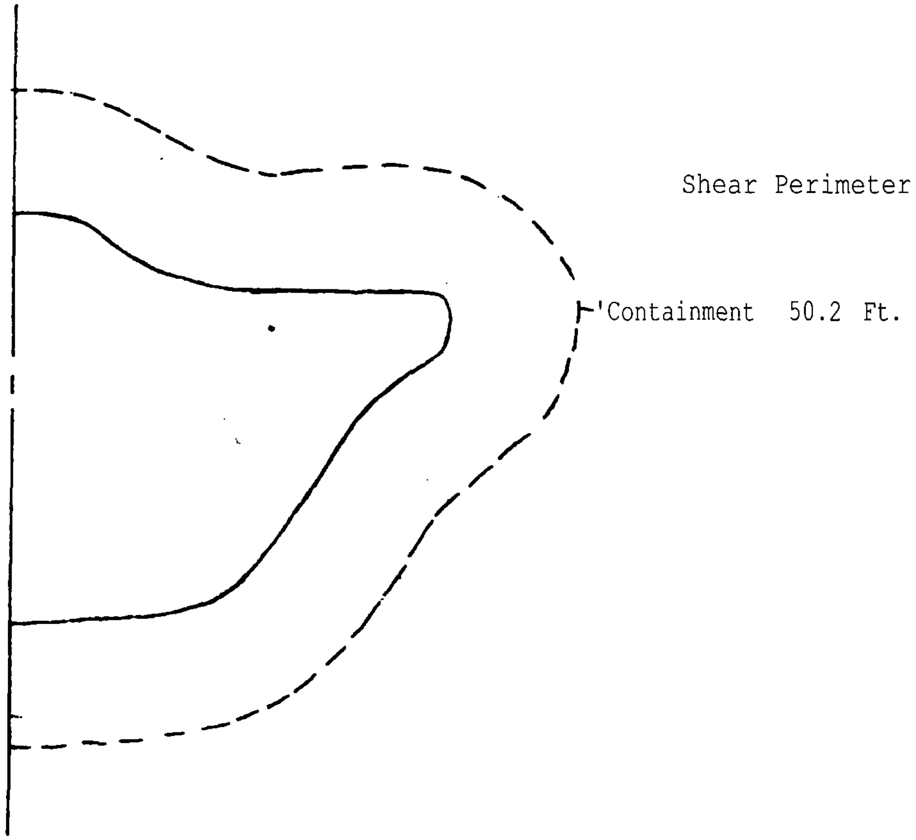


Figure 18. Impact Area and Shear Perimeter at 35 Feet from Nose

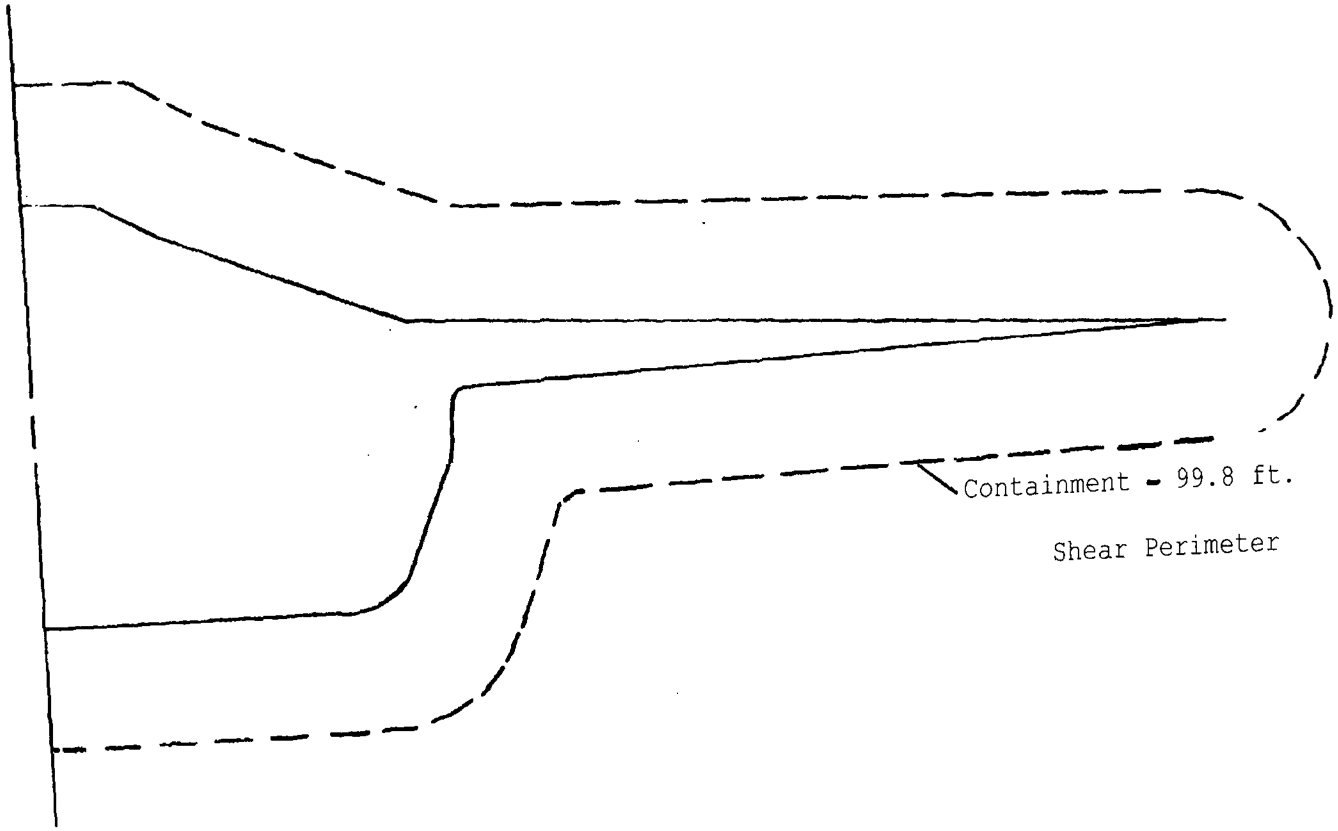


Figure 19, Impact Area and Shear Perimeter at 41.0 Feet From Nose

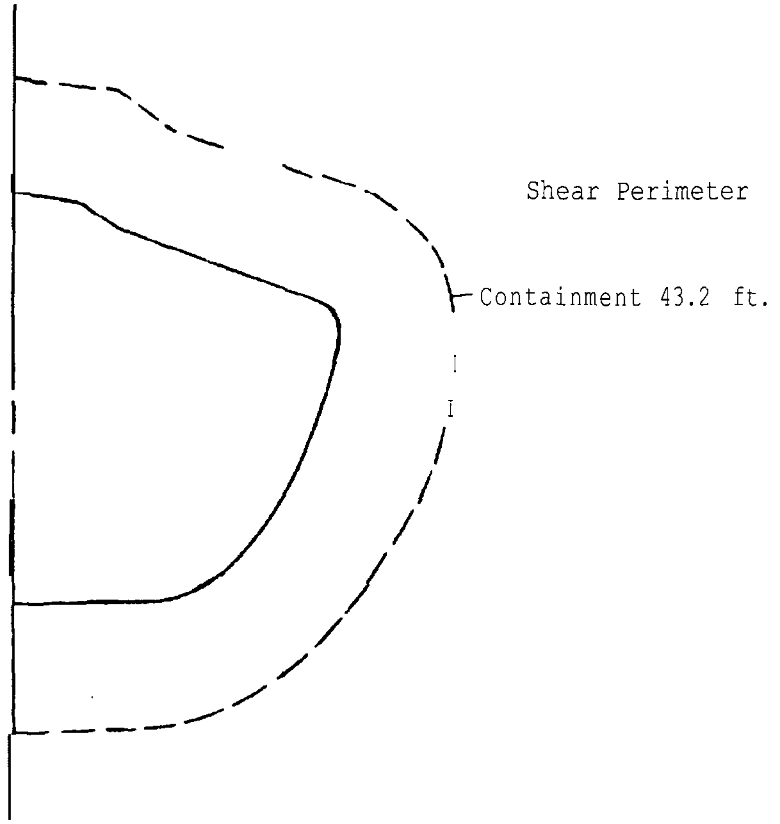


Figure 20, Impact Area and Shear Perimeter at 50.0 Feet From Nose

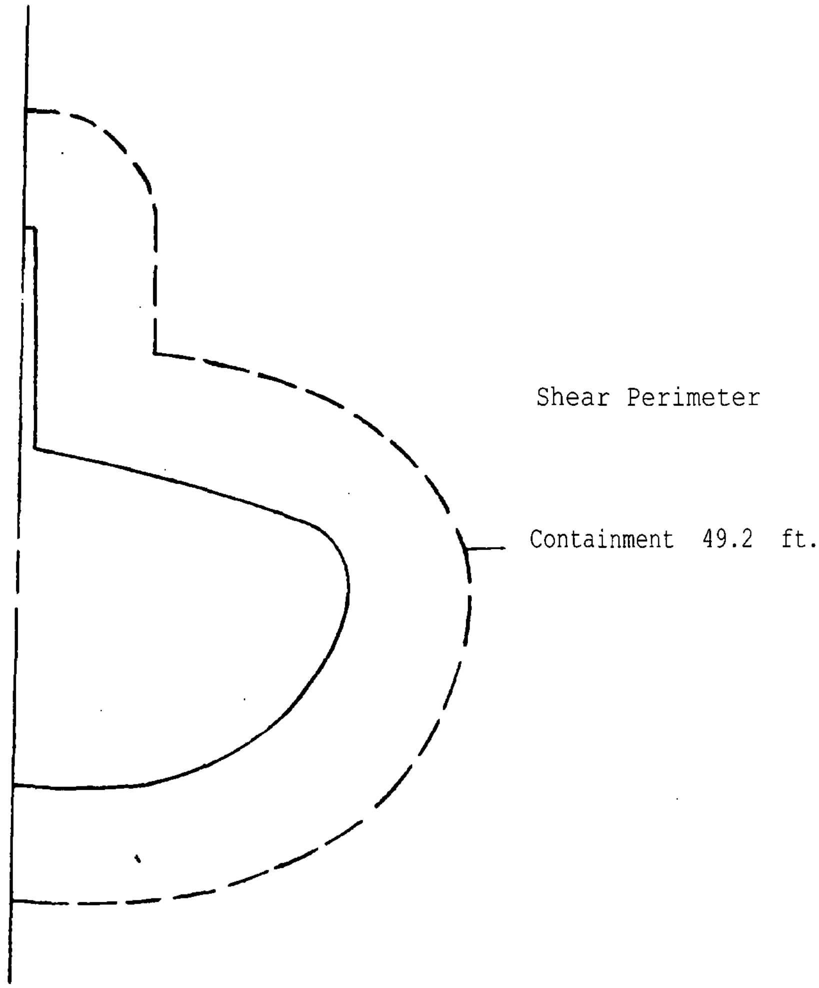


Figure 21 Impact Area and Shear Perimeter at 58.0 Feet From Nose

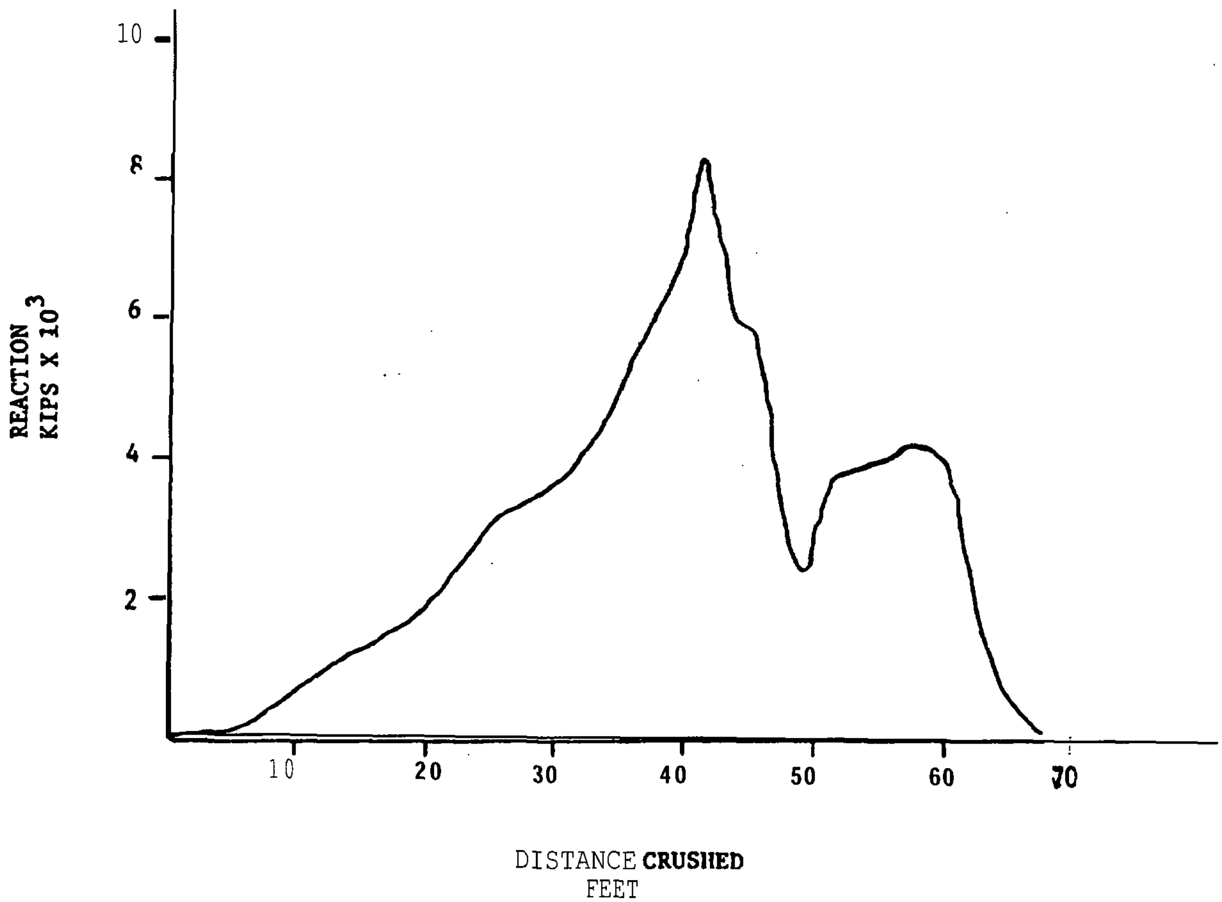
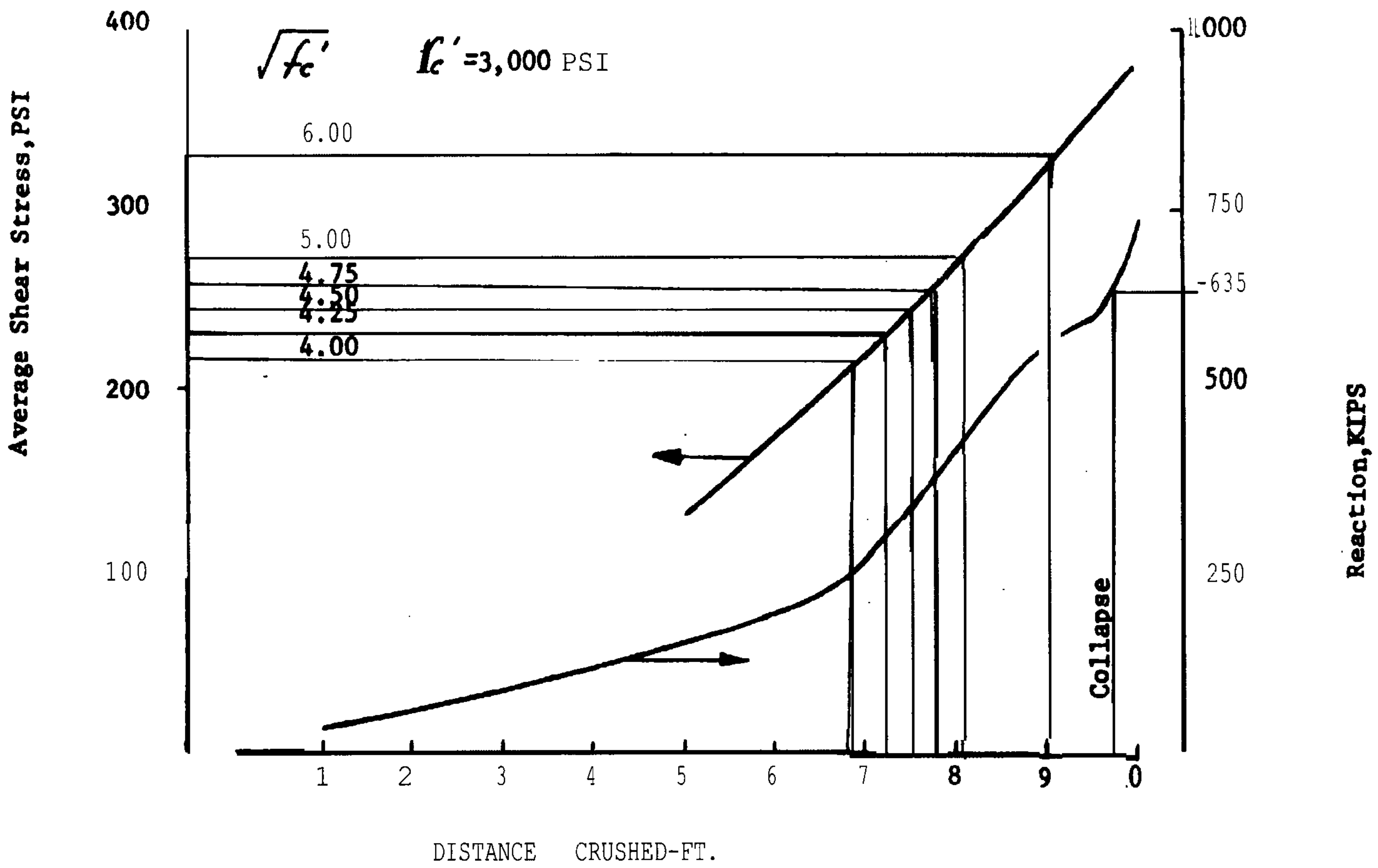


FIGURE 22, REACTION-CRUSHING LOCATION RELATIONSHIP



SB 1 & 2
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Figure 23 Average Shear Stress-Distance Crushed and Reaction Distance Crushed Relationship for the Enclosure Building.

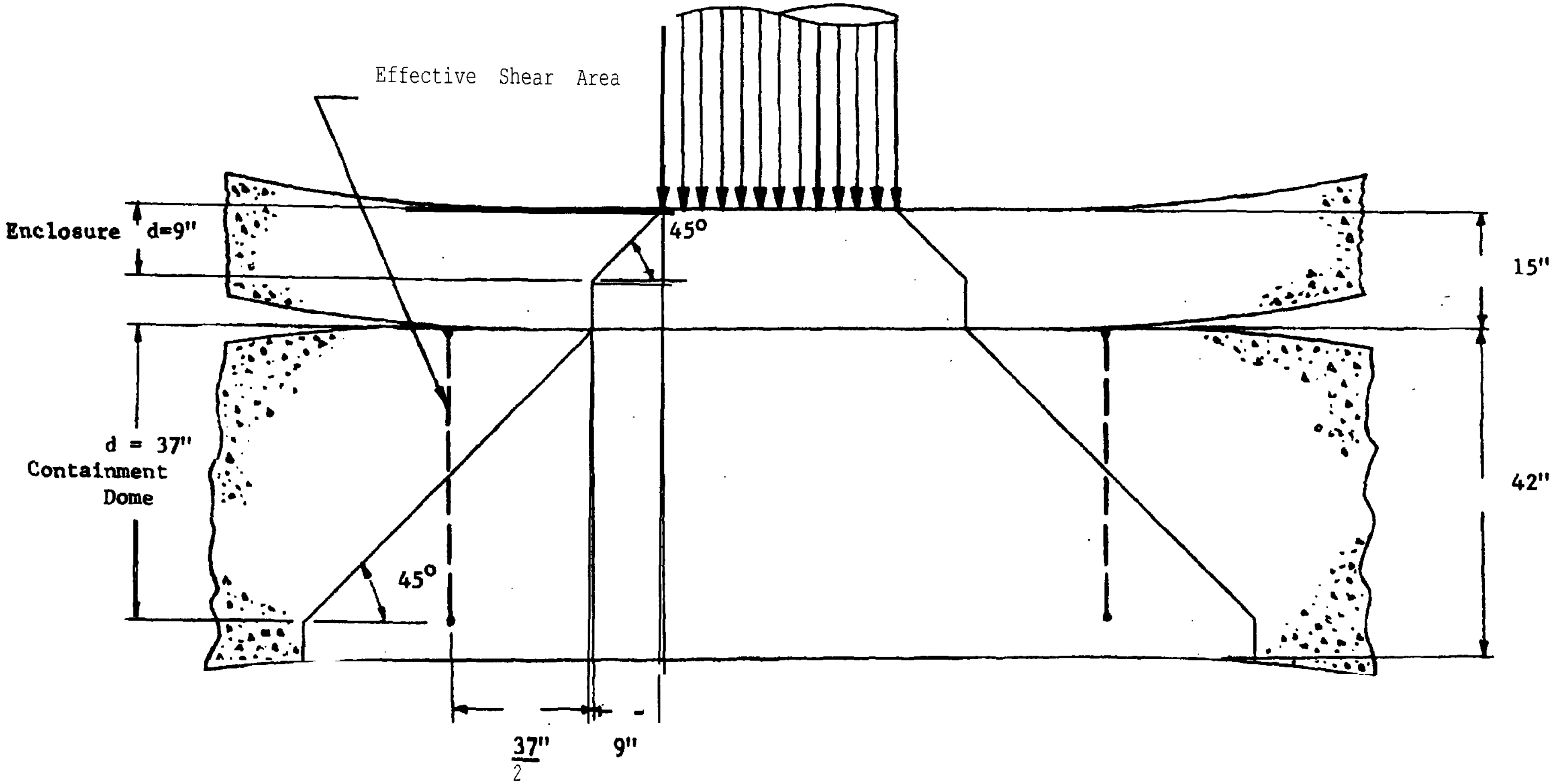

FIGURE 24 SCHEMATIC FOR EFFECTIVE SHEAR AREA - CONTAINMENT

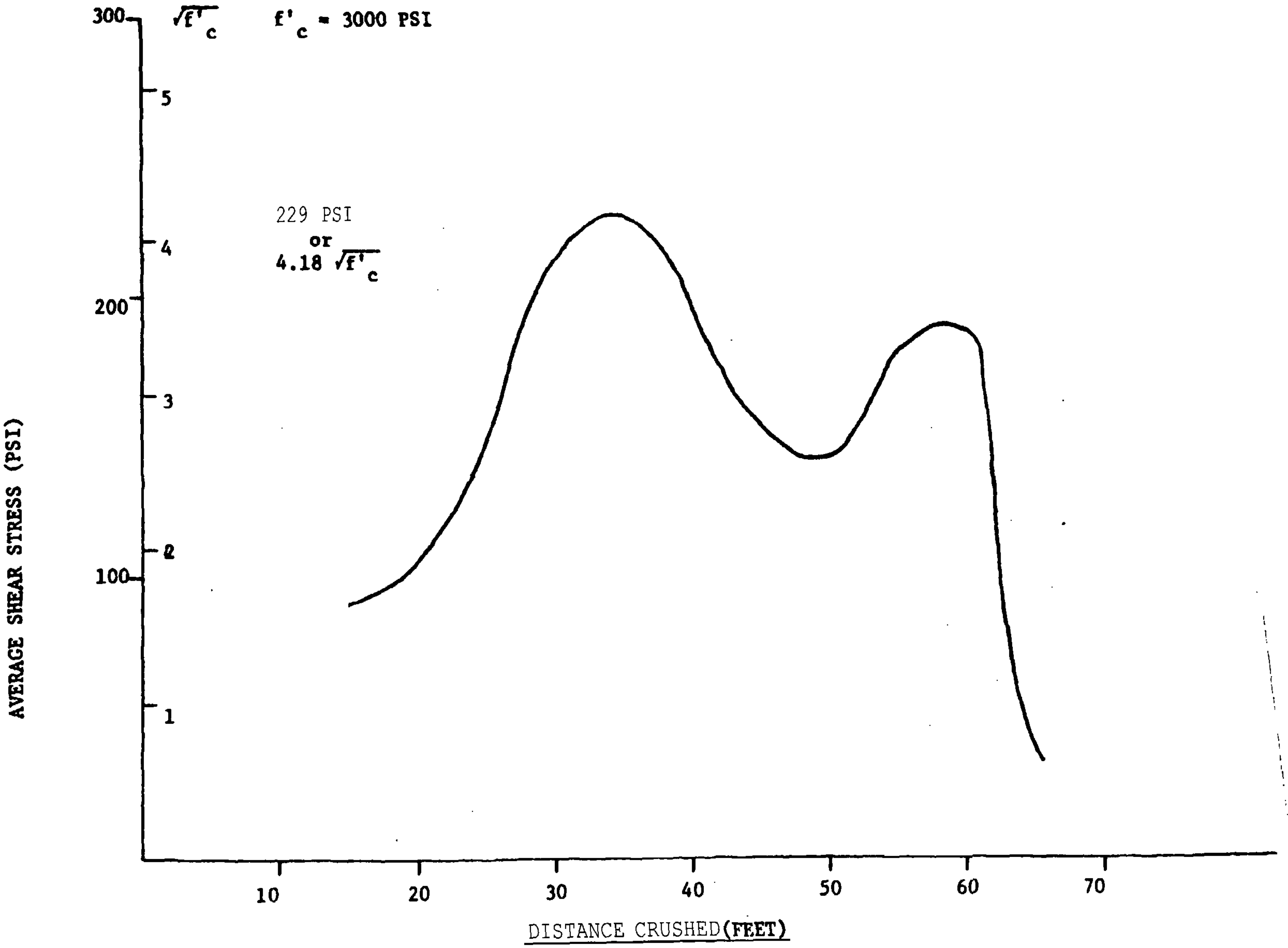

Figure 25 **AVERAGE SHEAR** STRESS-DISTANCE CRUSHED RELATIONSHIP FOR CONTAINMENT

2.0 FIRE HAZARD ANALYSIS OF SEABROOK STATION CONTAINMENT FOR AIRCRAFT IMPACT

A highly unlikely chain of adverse events is postulated in the following manner:

An FB-111 with a weight of 81,800 lbs and initial speed of 200 mph impacts on one of the two double containment complexes of the Seabrook plant. The enclosure building deforms locally under the initial impact,and the local deformation continues with little to no perforation until the enclosure building comes into contact with the containment building. This fact, plus the fact that if any penetration should occur it would be only the nose of the aircraft, will preclude the spilling of significant amounts of fuel into the annulus space. The annulus space contains no equipment,and all penetrations both mechanical and electrical are isolated from missiles and fuel by reinforced concrete slabs, The enclosure building acts as a barrier and directs the spilled fuel to the exterior area near the enclosure building. The following effects were then studied:

(1) Possible production of combustible vapor, its prompt ignition and the ensuing pressure pulse, and the possibility that the combustible vapor may be sucked into the plant areas and be cause for delayed ignition or toxic atmosphere in habitability systems.

(2) The fuel spilled and its transport to various areas of the plant. An ignition is then postulated, and the effect of the ensuing fire studied in order to evaluate

the safe shutdown capability of the plant.

(3) The effect of smoke and/or toxic gases as may be generated by the fire, with particular reference to control room habitability.

(4) The effects as detailed in (1) and (3) for all smaller aircraft.

2.1 COMBUSTIBLE VAPOR PRODUCTION

The FB-111 carries approximately 32,000 lbs of type JP-4 fuel. As indicated in Reference 1, the process of combustible vapor production is as follows: the crashing aircraft drags along the ground in a relatively slow deceleration (0.4 g) which lasts for a 'long' time (20 **secs),** and the fuel issuing from the wing after some postulated leakage mechanism is atomized to mist by the air as a result of its velocity relative to air. For the direct impact considered here, the decelerations are very high (peak value of 29 g) and of very 'short' duration (0.3 sec.). The atomizing process under these conditions is not significant. It is, therefore, concluded that the combustible vapor production and the associated hazards can be considered to be mitigated.

2.2 FIRE ANALYSIS

Various spill mechanisms are postulated either on the roofs or on the ground adjacent to the containment structure:

(a) The various roof areas adjacent to the containment enclosure with their elevation approximate areas, etc., are detailed in Table 2-1. As stated in PSAR Section 2.4, most of these roofs have parapets, and the roof drainage systems are designed to drain at least 3 inches per hour rain. It is

noted further that 1 inch of fuel takes 10 minutes to burn.[2] Using the minimum area in Table 2-1, and a catastrophic instantaneous mode of fuel release, the maximum expected duration of the fire is 17.9 minutes.

(b) For ground areas adjacent to the containment, there is approximately 1.5 acres of land, the total drainage of which is approximately 6 cfs. The spreading of the fuel over this area and the adequate drainage would result in a film fire with width comparable to the roughness of the pavement, e.g., 1/16 inch. The resulting fire would last only for 1 minute at the most.

(c) The mechanism of fire propagation was examined. No flammable material is normally expected to be present next to the containment which can serve as the propagator of the fire. The range of the fire has very conservatively estimated to be 200 ft. from its point of origin.

(d) Smoke is postulated to be traveling from this centre fire location carried by the wind. Its effect on the habitability systems was then studied.

(e) The possible hazard of fuel getting into the PAB Building through the vent stack is considered remote due to the following reasons:

a) The mechanism is improbable.

b) The entering fuel will be drained off at the base of the vertical stack, just as rainwater would be.

(f) The possible hazard of fuel getting into the main steam line tunnels through the side vent openings is considered not probable since the vent openings are above grade.

2.3 EVALUATION OF VARIOUS SAFETY RELATED AREAS

The various intake points to the safety related areas and their description8 are detailed in Table 2-2, including the missile shields when applicable, under the accident conditions detailed in Subsection 2.3. All buildings other than the control room and the PAB residual heat removal area are either not needed for safe shutdown or are redundant. However, the conservative analysis below includes the reaction of these areas to the postulated fire.

(a) Control Room

There is no mechanism for the fire to endanger the habitability of the control room, since the split intake vents are at a distance of at least 300 ft. from the containment; therefore, it is beyond the reach of the direct fire. However, in the remote event that the fire finds its way into the intake structure, the temperature and smoke sensors will sense it and the intake opening will be closed. Under these conditions, the other intake will be used for ventilating the control rooms.

(b) Primary Auxiliary Building (PAB)

The air intake is located on the east wall of the primary auxiliary building at an elevation of 56'-0". The area in front of the intake has the containment enclosure roof elevation of 53'-0" and the east wall of the PAB faces the containment and the fuel storage building. There may be a small fire lasting 12.5 minutes at most on the roof of the containment enclosure area, a part of which may be injected into the PAB air intake, as its height is 3 ft. above the

roof of containment enclosure area. The inside of the PAB has roll-type filters after the intake and heating coil panels after the filter. Therefore, the flame and the hot gases would have to penetrate the filter and the coils before reaching the fans.

As indicated in Subsection 2.2, the roof surface of the containment enclosure area will be finished smooth and with proper drainage to drain off the spilled fuel quickly. Smoke and heat sensors will be located at the air inlet so that on a signal from them the operator can stop the fans.

(c) Diesel Generator Building

The diesel generator building intakes are on opposite sides of the building and are located at least 180 ft. from the containment structures. It is considered improbable that the spilled fuel will find its way underneath one of these intakes. Furthermore, the intakes are 28.5' above grade level, and it is unlikely that the fire will rise to that height. In addition, one of the intakes is shielded by the diesel generator building and it is thus not considered credible that the fire could reach that intake. Although it may be postulated that the hot gas from the direct intake point may cause momentary oxygen starvation of one diesel generator, the shielded intake will ensure the integrity of other diesel generator and of one train.

(d) Service Water Building

The intake for the service water building is approximately 280 ft. from the containment'and should be out of reach of the postulated fire. Furthermore, the air intake is located

in the east wall of the building. Consequently, the building serves as a shield for the spilled fuel flow. Additionally, there is a missile shield in front of the structure, which should inhibit any possible fuel flow and subsequent fire. The fire effects are, therefore, considered minimal. However, a minute amount of hot gas may enter the facility, but since the pumps are located at the west end of the building, it will not critically threaten their operation due to rise of temperature.

(e) Vent Stack

The vent stack is not a safety related item and, as indicated in Subsection 2.2, it does not furnish a significant pathway for the fuel to get into the primary auxiliary building. This mechanism of fire propagation is, therefore, considered incredible.

(f) Cable Spreading, Battery Room, Switch Gear Room and Cable Tunnel

The air intake for cable spreading, battery room, switch gear room and cable tunnel areas is through the mechanical equipment room of the diesel generator building, and the various safety aspects discussed for the diesel generator room hold for this case.

2.4 HAZARDS FROM SMALLER AIRCRAFT

The smaller plane crashes were examined for the various areas, as detailed in Subsections 2.2 and 2.3. The fuel in general may be JP-1, kerosene and JP-4. Since the fuel carrying capacity for all these planes is smaller than that of FB-111, and their burning temperatures are of the same order of magnitude, it was concluded that the effect would be enveloped by those in the case of FB-111.

2.5 CONCLUSIONS

In view of the results in Subsections 2.2 and 2.3, it was concluded that the hazard to Seabrook Station from direct fire after the postulated crash of an FB-111 or smaller aircrafts on the containment represents only very minimal potential hazard to the plant. The present design of the plant has inherent safety features so that the consequence of this minimal hazard is mitigated.

2.6 REFERENCES FOR SECTION 2

1. Appraisal of Fire Effects From Aircraft Crash at Zion Power Reactor Facility, I. Irving Pinkel, Consultant, Atomic Energy Commission, July 17, 1972.
2. Flammability Characteristics of Combustible Gases and Vapors, Bulletin 627, U. S. Bureau of Mines, 1965, Michael Zabetakis.

TABLE 2-1
ROOF DESCRIPTIONS

BUILDINGS	ROOF AREA (SQ. FT.)	ELEVATION	REMARKS
CONTAINMENT ENCLOSURE AREA	4,100	53' - 0"	WITH PARAPET
EMERGENCY FEED WATER PUMP BLDG.	3,000	47' - 0"	WITH PARAPET
FUEL STORAGE BUILDING	9,200	84' - 0"	WITH PARAPET
PRIMARY AUXILIARY BUILDING	8,144	81' - 0"	WITH PARAPET
PAB Filter Room	2,856	108' - 0"	WITH PARAPET

NOTE: GRADE ELEVATION 20' - 0"

TABLE 2-2

VENTILATION SYSTEM DESCRIPTIONS OF THE BUILDING SURROUNDING THE CONTAINMENT

SHEET 1 OF 2

BUILDING	BUILDING SURFACE FACING THE CONT.	LOCATIONS OF THE INTAKES			TYPE OF SHIELDING	REMARKS
		SURFACE	PATHWAY FROM CONT. WALL	ELEVATION		
Diesel Gen.	South wall	South Wall	200 ft.	28.5 ft. above gr.	Other Bldg. at 40' dist.	Ventilation & Combustion air; not necessary for safe shutdown.
		North Wall	240 ft. (thru roof)	28.5 ft. above gr.	Other Bldg. at 40' dist.	
PAB	East wall	East Wall	20 ft.	3 ft. above adjacent roof.	Shielded by the Cont. & F. Stg. Bldg.	Normal ventilation air; only RHR pump area safe shutdown related.
		North Wall	95 ft. (thru roof)	29 ft. above gr.	2' thick conc. missile shield.	Ventilation air to safety related primary component cooling water pump area and Boron injection pump area.
Emergency Feedwater Pump Bldg.	South Wall	North Wall	30 ft. (thru roof)	18 ft. above gr.	2' thick concrete missile shield	Ventilation air to the emergency feedwater pump area.

TABLE 2-2 (CONT.)
SHEET 1 OF 2

BUILDING	BUILDING SURFACE FACING THE CONT.	LOCATION OF THE INTAKES			TYPE OF SHIELDING	REMARKS
		SURFACE	PATHWAY FROM CONT. WALL	ELEVATION		
Service Water Pump House	West Wall	East Wall	290 ft. (thru roof)	45 ft. above gr.	2' thick conc. missile shield.	Ventilation air to the service water pump house.
		West Wall	180 ft.	13.5 ft. above gr.	2' thick conc. missile shield.	Air intake to the electrical areas.
Control Room & Computer Room	South 6 East Walls	Remote Intake Ports	300 ft. (at least)	At gr. level	Covered with grating.	Ventilation air to the habitable areas of the control and computer room.

APPENDIX 2Q EAB AND LPZ SHORT TERM ACCIDENT DIFFUSION ESTIMATES FOR AST

2Q.1 OBJECTIVE

Conservative values of atmospheric diffusion at the site boundary (EAB) and the low population zone (LPZ) were calculated for appropriate time periods using meteorological data collected onsite during the time period 1998 through 2002.

2Q.2 METHODOLOGY

The methodology used for this calculation is consistent with Regulatory Guide 1.145 as implemented by the PAVAN computer code (Reference 2). Using joint frequency distributions of wind direction and wind speed by atmospheric stability, the PAVAN computer code provides relative air concentration (CHI/Q) values as functions of direction for various time periods at the site boundary and LPZ. Three procedures for calculation of CHI/Qs are utilized for the site boundary and LPZ; a direction-dependent approach, a direction-independent approach, and an overall site CHI/Q approach. The CHI/Q calculations are based on the theory that material released to the atmosphere will be normally distributed (Gaussian) about the plume centerline. A straight-line trajectory is assumed between the point of release and all distances for which CHI/Q values are calculated.

The theory and implementing equations employed by the PAVAN computer code are documented in Reference 2.

2Q.3 CALCULATIONS/PAVAN COMPUTER CODE INPUT DATA

The boundary distance used in each of the 16 downwind directions from the site was set to 914 m. The LPZ boundary distance was set to 2,011 m.

All of the releases were considered ground level releases because the highest possible release elevation is from the plant stack at 185 ft above plant grade. From Section 1.3.2 to Reference 1, a release is only considered a stack release if the release point is at a level higher than two and one-half times the height of adjacent solid structures. For the Seabrook plant, the elevation of the top of the containment is 199.25 ft. Therefore, the highest possible release point is not 2.5 times higher than the adjacent containment buildings, and thus all releases were considered ground level releases. As such, the release height was set equal to 10.0 meters as required by Table 3.1 of Reference 2. The building area used for the building wake term was 2,416 m^2.

The tower height at which the wind speeds were measured is 10.05 m above plant grade. The windspeed units are given in miles per hour, therefore the PAVAN variable UCOR was set equal to 101 to convert the windspeeds to meters per second as described in Table 3.1 of Reference 2. The maximum windspeed in each windspeed category was chosen to match the raw joint frequency distribution data, which conforms to the windspeed bins in Table 1 of Reference 3.

2Q.4 RESULTS

PAVAN computer runs for the EAB and LPZ boundary distances were performed using the data discussed previously. Per Section 4 of Reference 1, the maximum CHI/Q for each distance was determined and compared to the 5% overall site value for the boundary under consideration. For dose calculations, the most limiting 2 hour CHI/Qs were combined with the worst 2 hour EAB doses to maximize calculated EAB doses (conservative approach).

The maximum EAB and LPZ CHI/Qs that resulted from this comparison are provided in the table below:

Offsite Boundary χ/Q Factors for Analysis Events		
Time Period	EAB χ/Q (sec/m^3)	LPZ χ/Q (sec/m^3)
0-2 hours	3.17E-04	1.54E-04
0-8 hours	2.08E-04	8.63E-05
8-24 hours	1.68E-04	6.46E-05
1-4 days	1.06E-04	3.45E-05
4-30 days	5.51E-05	1.40E-05

2Q.5 REFERENCES

1. USNRC Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1, November 1982, (Reissued February 1983 to correct page 1.145-7).

2. NUREG/CR-2858, "PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations," November 1982.

3. Safety Guide 23, "Onside Meteorological Programs," February 17, 1972.

APPENDIX 2R SHORT-TERM (ACCIDENT) DIFFUSION FOR THE CONTROL ROOM

2R.1 OBJECTIVE

Conservative values of atmospheric diffusion to the Control Room were calculated for appropriate time periods using meteorological data collected onsite during the time period 1998 through 2002.

2R.2 METHODOLOGY

The ARCON96 computer code is used by the USNRC staff to review licensee submittals relating to control room habitability (Reference 1). Therefore, the ARCON96 computer code was used to determine the relative concentrations (CHI/Qs) for the control room air intakes and inleakage locations.

The ARCON96 computer code uses hourly meteorological data for estimating dispersion in the vicinity of buildings to calculate relative concentrations at control room air intakes that would be exceeded no more than five percent of the time. These concentrations are calculated for averaging periods ranging from one hour to 30 days in duration.

The theory and implementing equations employed by the ARCON96 computer code are documented in Reference 1.

2R.3 CALCULATIONS/ARCON COMPUTER CODE INPUT DATA

Five years of meteorological data (1998-2002) were used for the ARCON96 computer code runs. The percentage of valid data over this time period was 98.8% which exceeds the minimum value of 90% data recovery specified in Reference 2.

A number of various release-receptor combinations were considered for the control room CHI/Qs. These different cases were considered to determine the limiting release-receptor combinations for the various events. The case matrix for these combinations is provided in Table 2R-2.

The distance and direction inputs for the ARCON96 runs may be found in Table 2R-1. The distances were converted from feet to meters with a factor of 0.3048 m/ft. The distances in meters were then rounded down to the nearest tenth for conservatism. The elevation difference term was set equal to zero for each case since all elevation points are taken with respect to the same datum.

The lower and upper measurement heights for the meteorological data were entered as 10.05 m and 60.66 m, respectively, for each case. The mph option was selected for the windspeed units.

A ground level release was chosen for each scenario since none of the release points are 2.5 times taller than the closest solid structure as called out in Section 3.2.2 of Reference 3 for stack releases. The top of the containment structure is at an elevation of 199.25 ft. The highest release point is from the top of the plant stack at an elevation of 185 ft., which is not 2.5 times higher than the nearby containment structure. The vertical velocity, stack flow, and stack radius terms were all set equal to zero since each case is a ground level release. The vent release option was not selected for any of the scenarios.

The actual release height was used in the cases. No credit was taken for effective release height due to plume rise; therefore, for the releases from the stacks, the release elevations were set equal to the stack top elevation. The release heights were taken as the release elevations less the plant grade elevation of 19 ft.

The only cases in this analysis that take credit for the building wake effect are the scenarios where the release is from the containment building, the tank farm, or the waste processing building. Some of the other scenarios have buildings between the release and receptor points, but for these cases the building wake was not credited for the sake of conservatism. Not crediting wakes was accomplished by setting the building area term equal to 0.01 m^2 as stated in Table A-2 of Reference 3. The first building area used is a conservatively determined containment cross sectional area. The area is calculated as the sum of the cross sectional areas created by the cylindrical portion of the containment structure above the highest nearby roof and the hemispherical area of the dome. The width used is equal to the diameter of the containment structure. The height of the cylindrical portion is taken as the distance between the top of the cylinder portion of the containment structure (represented by the spring line elevation) and the primary auxiliary building roof elevation. The radius of the hemispherical dome is taken as one half of the calculated diameter. The containment area was determined to be 1,506 m^2. The second building area is calculated as the product of the minimum roof height of the waste processing building and tank farm and one half the width of the waste processing building and tank farm. The minimum roof height and one half of the width are used for conservatism. This building area was determined to be 337 m^2.

All of the default values in the ARCON96 code were unchanged from the code default values with the following exceptions. Table A-2 of Reference 3 suggests use of a value of 0.2 for the Surface Roughness Length, and use of a value of 4.3 for the Averaging Sector Width Constant. These two changes were made for each case. The minimum wind speed was left at 0.5 m/s per the guidance instruction in Table A-2 of Reference 3.

2R.4 RESULTS

ARCON96 computer runs for the various release points and control room intake locations were performed using the data discussed previously. Per Reference 3, the 95th percentile CHI/Q values were determined. The resulting CHI/Qs are listed in Table 2R-2.

2R.5 REFERENCES

1. NUREG/CR-6331 PNL-10521, "Atmospheric Relative Concentrations in Building Wakes," May 1995, with Errata dated July 1997.

2. Safety Guide 23, "Onside Meteorological Programs," February 17, 1972.

3. USNRC Regulatory Guide 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," June 2003.