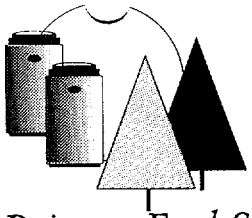
72-22



Private Fuel Storage, L.L.C.

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Phone 303-741-7009 Fax: 303-741-7806
John L. Donnell, P.E., Project Director

Mark Delligatti, Senior Project Manager
Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

March 31, 1999

SUBMITTAL OF COMMITMENT RESOLUTION INFORMATION
DOCKET NO. 72-22 / TAC NO. L22462
PRIVATE FUEL STORAGE FACILITY
PRIVATE FUEL STORAGE L.L.C.

Reference: 1. PFS Letter, Donnell to Delligatti, Commitment Resolution, dated March 17, 1999

2. PFS Letter, Parkyn to Director, Office of Material Safety and Safeguards, Submittal of Comment Resolution Information, dated March 24, 1999

Please find enclosed PFS response to NRC Commitment Resolution Comment (Reference 1). This information supplements that provided in Reference 2 concerning RAI's 2-1 and 2-2 (Geotechnical Program).

If you have any questions regarding this response, please contact me at 303-741-7009.

for John Donnell
Project Director

Copy to: John Parkyn
Sherwin Turk
Murray Wade
Denise Chancellor
John Paul Kennedy
Jay Silberg
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MF0611

ENCLOSURE

RAI's 2-1 & 2-2 (second round), Geotechnical Program

NRC Comment – The PFS field geotechnical investigation program is limited in the number of borings and tests provided. PFS should perform an evaluation of the Standard Penetration Test blow counts (N-values), individually, rather than averaged over 5-ft intervals, to demonstrate that the variability in N-values across the site is not significant. Atterberg Limits, shear strength, and compressibility should also be addressed.

PFS Resolution – PFS reviewed the variability of N-values across the site, evaluating the Standard Penetration Test (SPT) blow counts individually, rather than averaged over 5-ft intervals, and reported the findings on March 24, 1999. This response addresses the request for profiles of Atterberg limits and undrained shear strength. No additional compressibility testing has been performed since the teleconference of March 16, 1999.

A total of 63 natural water content tests, 63 Atterberg limits tests, and three consolidated - undrained triaxial tests were performed to develop data for responding to the request for profiles of Atterberg limits and shear strength across the emplacement area.

Table 1 presents these data in the form of a matrix of the Atterberg limits data vs depth, along with data for all samples that have been tested in the borings drilled in the proposed emplacement area. In this matrix, the data are arranged to correspond with the locations of the borings in the field, with north situated at the top of the sheet. For example, Boring A-1, which was drilled in the northwest corner of the proposed emplacement area, is located in the upper left corner of the matrix. Borings B-1, C-1, and D-1 were drilled in locations east of A-1, and these are arranged to the right of A-1 in the matrix. Boring A-2 was drilled at a location south of A-1, and it is arranged in the matrix in the row just below A-1. The remaining borings are located similarly with respect to their locations in the plan view. This results, therefore, in Borings A-4 through D-4 being located at the bottom of the matrix, with A-4 on the left (i.e., the southwestern corner of the proposed emplacement area) and D-4 on the far right (i.e., the southeastern corner of the proposed emplacement area).

These data are plotted in the attached figures, "Soil Properties vs Depth in Storage Pad Area," along with the SPT N-values and the results of the shear strength tests that have been performed to date. Note, two additional consolidated - undrained triaxial tests were performed on undisturbed samples that were obtained in the vicinity of the Canister Transfer Building, approximately 150 ft northeast of Boring D-4. These data also are included on the attached figures to present all of the available strength data vs depth that has been obtained near the pad emplacement area.

This matrix and these figures illustrate that the soils in the upper layer of the profile do not vary significantly across the site. Shear strength data are provided for samples obtained from depths of 5 to 7 ft and 10 to 12 ft. As can be seen on these figures, the

SPT N-values increase below this depth. As indicated in the response to SAR Question 2-2a of RAI No. 2:

> *"Since the strength of these soils is directly related to the blow count, testing soils whose blow count is less than the average provides a conservative estimate of the strength of the soil."*

Therefore, it is concluded that these data demonstrate that the soils in the upper layer are uniform across the site and there is not sufficient variability in the blow counts to justify requiring individual design parameters for each pad. In addition, the strength and compressibility testing that have been performed provide conservative estimates of the strength and compressibility of the deeper soils within the upper layer.

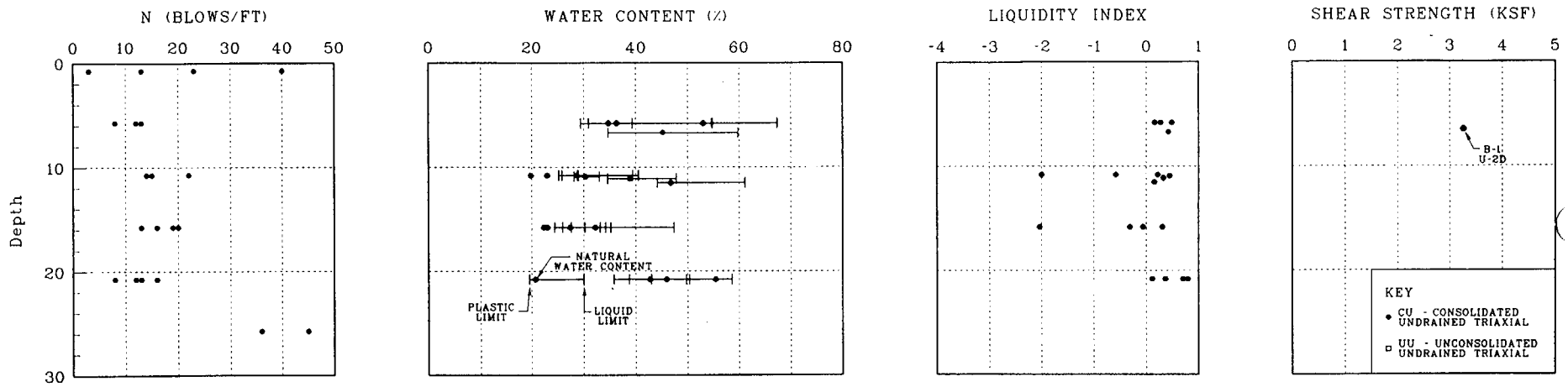
No additional consolidation tests were performed because suitable samples for performing these tests are not available at this time. In addition, compressibility of these soils is not considered to be a significant issue for the cask storage pads, since there is nothing connected to these pads that would be adversely affected by settlements. As indicated in the response to SAR Question 2-2(a) of RAI No. 2:

- *the samples that were tested for compressibility were obtained from testing specimens from the upper 25 to 30 feet where the Standard Penetration Test (SPT) blow count was less than or equal to the average value of all samples obtained in this layer, and*
- *the SPT blow count is inversely related to compressibility of soils.*

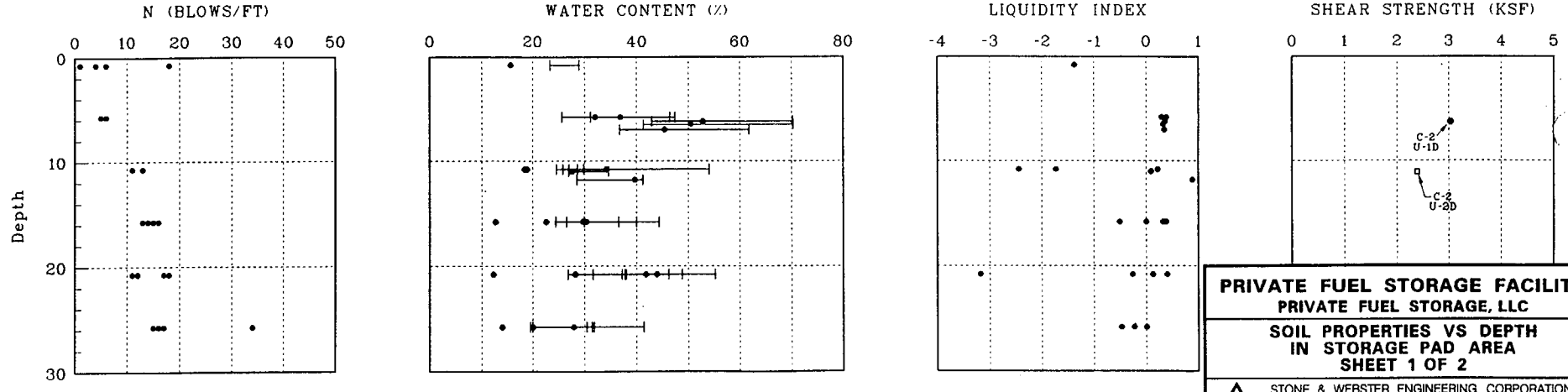
Therefore, as the blow count increases, the compressibility (and, hence, settlement) decreases. If additional laboratory tests were performed on samples of the soils from deeper within the profile than those that were tested (from depths of about 10 to 11 ft), it is expected that their compressibilities would be lower than those determined by testing these specimens, because their SPT blow counts are higher.

NORTHERN HALF OF EMPLACEMENT AREA

BORINGS A-1 THOUGH D-1



BORINGS A-2 THOUGH D-2



PRIVATE FUEL STORAGE FACILITY
PRIVATE FUEL STORAGE, LLC

SOIL PROPERTIES VS DEPTH IN STORAGE PAD AREA
SHEET 1 OF 2

STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASSACHUSETTS
05996-GSK-B-35A-0

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Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
A-1	S 1	0.8					
A-1	S 2	5.8	34.7	54.8	30.9	23.9	15.9
A-1	S 3	10.8	19.8	28.8	25.8	3.0	-200.0
A-1	S 4	15.8	22.3	30.2	27.6	2.6	-203.8
A-1	S 5	20.8	55.4	58.6	43.0	15.6	79.5
A-1	S 6	25.8					
B-1	S 1	0.8					
B-1	U 2D	6.7	45.2	59.8	34.7	25.1	41.8
B-1	S 3	10.8	23.0	39.4	29.0	10.4	-57.7
B-1	S 4	15.8	23.0	35.2	25.9	9.3	-31.2
B-1	S 5	20.8	45.9	50.3	35.8	14.5	69.7
B-1	S 6	25.8					
C-1	S 1	0.8					
C-1	S 2	5.8	53.0	67.4	39.3	28.1	48.8
C-1	U 3B	10.9	30.3	33.0	28.1	4.9	44.9
C-1	U 3C	11.1	38.9	47.8	34.6	13.2	32.6
C-1	U 3D	11.5	46.7	61.1	44.1	17.0	15.3
C-1	S 4	15.8	27.4	34.2	24.4	9.8	30.6
C-1	S 5	20.8	42.7	49.7	38.7	11.0	36.4
C-1	S 6	25.8					
D-1	S 1	0.8					
D-1	S 2	5.8	36.3	54.6	29.4	25.2	27.4
D-1	S 3	10.8	28.6	40.5	25.2	15.3	22.2
D-1	S 4	15.8	32.2	47.3	33.1	14.2	-6.3
D-1	S 5	20.8	20.7	30.0	19.5	10.5	11.4

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
A-2	S 1	0.8	15.6	28.9	23.3	5.6	-137.5
A-2	U 2C	6.2	52.8	70.2	42.9	27.3	36.3
A-2	U 2E	7.0	45.4	61.8	36.7	25.1	34.7
A-2	S 3	10.8	18.4	27.0	24.5	2.5	-244.0
A-2	S 4	15.8	29.7	36.5	26.5	10.0	32.0
A-2	S 5	20.8	28.2	38.0	26.8	11.2	12.5
A-2	S 6	25.8	27.9	41.4	30.4	11.0	-22.7
B-2	S 1	0.8					
B-2	S 2	5.8	32.0	47.4	25.6	21.8	29.4
B-2	U 1	9.0					
B-2	S 3	10.8	18.9	29.8	25.8	4.0	-172.5
B-2	S 4	15.8	12.6	Nonplastic			
B-2	S 5	20.8	43.9	55.1	46.2	8.9	-25.8
B-2	S 6	25.8	20.1	31.8	20.0	11.8	0.8
C-2	S 1	0.8					
C-2	U 1D	6.5	50.5	70.3	41.3	29.0	31.7
C-2	U 2C	11.0	27.6	34.6	26.9	7.7	9.1
C-2	U 2E	11.8	39.7	41.2	28.5	12.7	88.2
C-2	S 2	15.8	30.3	40.0	24.4	15.6	37.8
C-2	S 3	20.8	41.8	48.8	37.2	11.6	39.7
C-2	S 4	25.8					
C-2	S 5	30.8					
D-2	S 1	0.8					
D-2	S 2	5.8	36.9	46.4	31.1	15.3	37.9
D-2	S 3	10.8	34.2	54.0	28.6	25.4	22.0
D-2	S 4	15.8	22.6	44.3	29.9	14.4	-50.7
D-2	S 5	20.8	12.2	37.7	31.6	6.1	-318.0
D-2	S 6	25.8	13.9	31.4	19.5	11.9	-47.1

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
A-3	S 1	0.8					
A-3	S 2	5.8	36.0	49.8	23.3	26.5	47.9
A-3	S 3	10.8	43.3	60.1	35.1	25.0	32.8
A-3	S 4	15.8	25.9	35.8	27.7	8.1	-22.2
A-3	S 5	20.8					
A-3	S 6	25.8					
B-3	S 1	0.8	8.9	26.6	19.7	6.9	-156.5
B-3	U 1B	5.5	33.5	52.4	25.2	27.2	30.5
B-3	U 2	11.0					
B-3	S 2	15.8					
B-3	S 3	20.8	44.6	54.3	41.6	12.7	23.6
B-3	S 4	25.8					
B-3	S 5	30.8					
C-3	S 1	0.8					
C-3	S 2	5.8	26.8	43.1	22.4	20.7	21.3
C-3	S 3	10.8	32.6	48.8	29.4	19.4	16.5
C-3	S 4	15.8	27.9	32.9	23.1	9.8	49.0
C-3	S 5	20.8	39.5	50.8	35.8	15.0	24.7
C-3	S 6	25.8	18.1	26.2	19.5	6.7	-20.9
D-3	S 1	0.8					
D-3	S 2	5.8	23.5	43.4	27.3	16.1	-23.6
D-3	S 3	10.8	25.0	Nonplastic			
D-3	S 4	15.8	36.8	40.6	28.0	12.6	69.8
D-3	S 5	20.8	42.0	47.7	34.2	13.5	57.8
D-3	S 6	25.8					

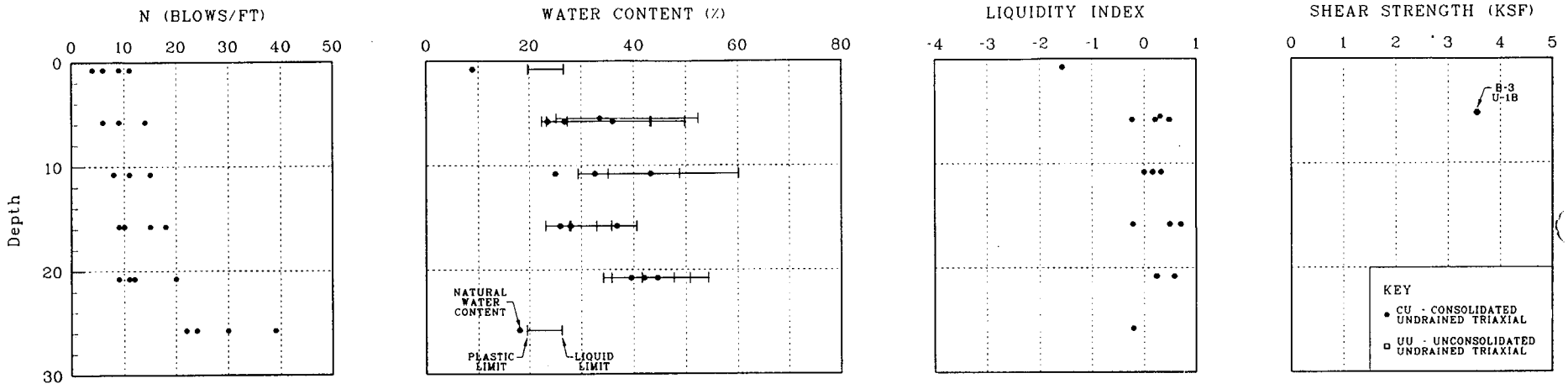
Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
A-4	S 1	0.8					
A-4	S 2	5.8	44.2	69.0	42.4	26.6	6.8
A-4	S 3	10.8	10.8	Nonplastic			
A-4	S 4	15.8	19.3	29.9	22.4	7.5	-41.3
A-4	S 5	20.8	37.8	56.5	41.6	14.9	-25.5
A-4	S 6	25.8	15.2	29.1	19.8	9.3	-49.5
B-4	S 1	0.8					
B-4	S 2	5.8	48.4	56.5	27.8	28.7	71.8
B-4	U 3D	10.7	42.6	42.5	24.7	17.8	100.6
B-4	S 4	15.8	19.9	30.7	24.6	6.1	-77.0
B-4	S 5	20.8	24.2	35.4	29.9	5.5	-103.6
B-4	S 6	25.8	24.5	32.6	24.3	8.3	2.4
C-4	S 1	0.8					
C-4	S 2A	5.2	28.6	46.1	22.9	23.2	24.6
C-4	S 2B	6.0	50.6	69.5	44.2	25.3	25.3
C-4	S 3	10.8	18.2	26.5	26.0	0.5	-1560.0
C-4	S 4	15.8	26.5	36.6	26.9	9.7	-4.1
C-4	S 5	20.8	40.7	52.5	41.5	11.0	-7.3
C-4	S 6	25.8	18.7	29.2	20.1	9.1	-15.4
D-4	S 1	0.8					
D-4	S 2	5.8	38.0	49.3	27.7	21.6	
D-4	S 3A	10.3	16.8	24.7	23.3	1.4	-464.3
D-4	S 4A	15.4	8.3	Nonplastic			
D-4	S 4B	16.2	32.8	42.8	25.7	17.1	41.5
D-4	S 5	20.8	43.4	56.8	41.2	15.6	14.1
D-4	S 6	25.8	18.0	27.0	21.6	5.4	-66.7

TABLE 1

MATRIX OF ATTERBERG LIMITS IN PROPOSED EMPLACEMENT AREA PFSF SAFETY ANALYSIS REPORT

SOUTHERN HALF OF EMPLACEMENT AREA

BORINGS A-3 THOUGH D-3



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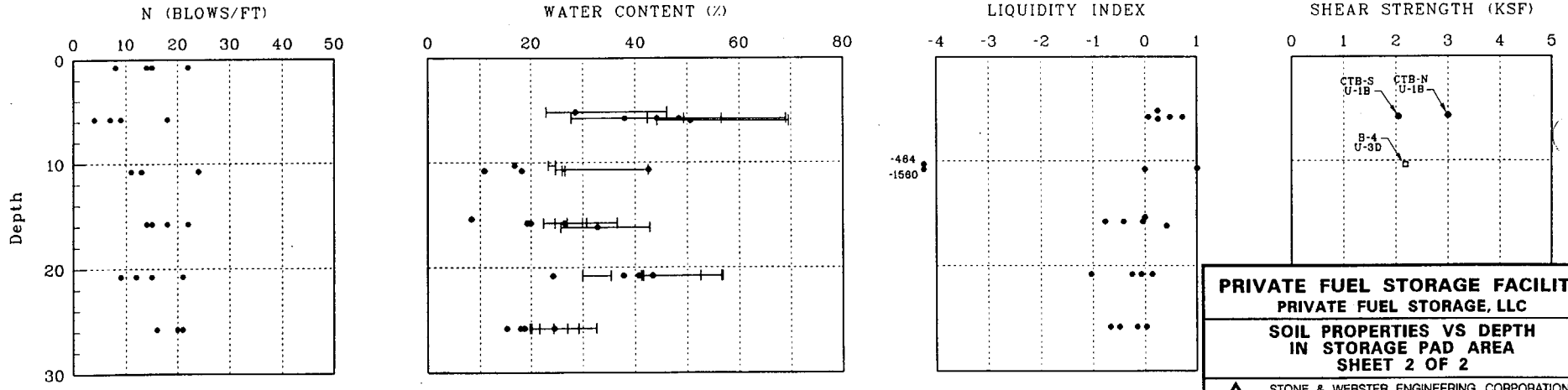

PRIVATE FUEL STORAGE FACILITY
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SOIL PROPERTIES VS DEPTH IN STORAGE PAD AREA SHEET 2 OF 2

STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASSACHUSETTS
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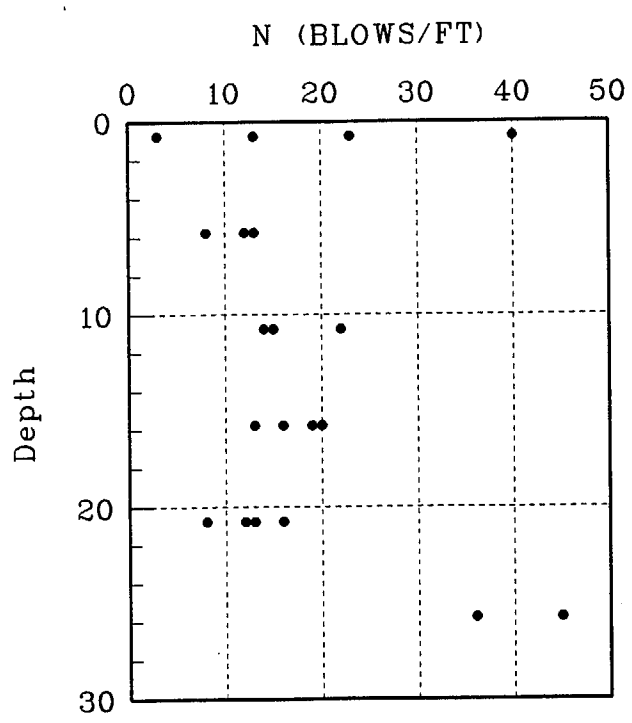
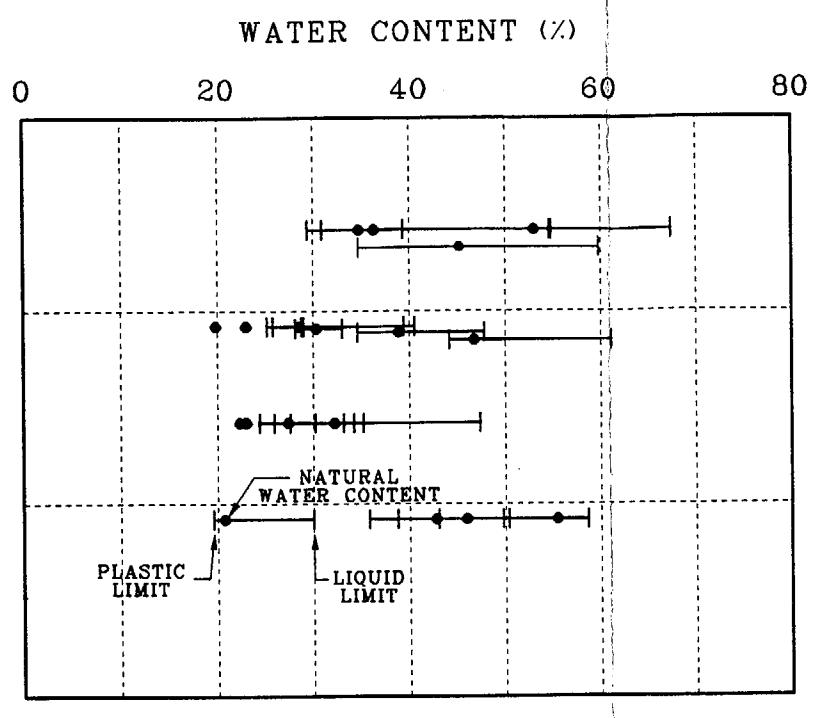
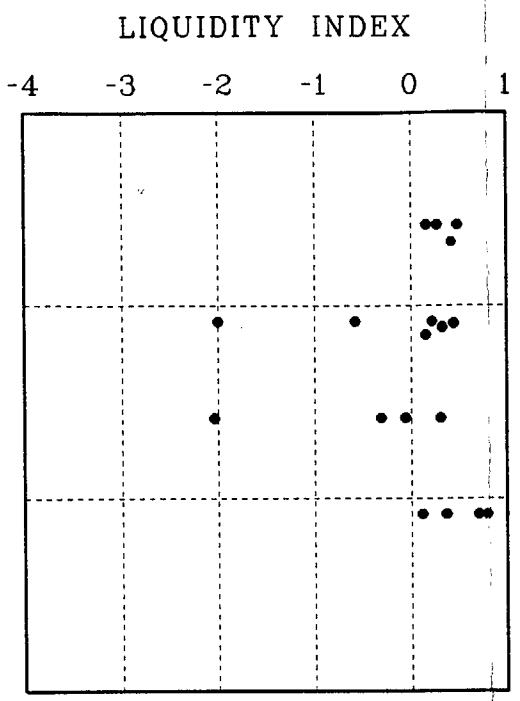
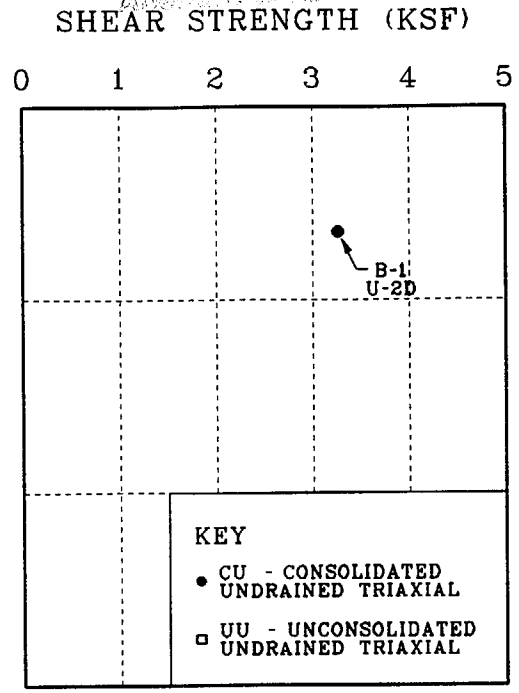
NORTHERN HALF OF EMPLACEMENT AREA

BORINGS A-1 THOUGH D-1

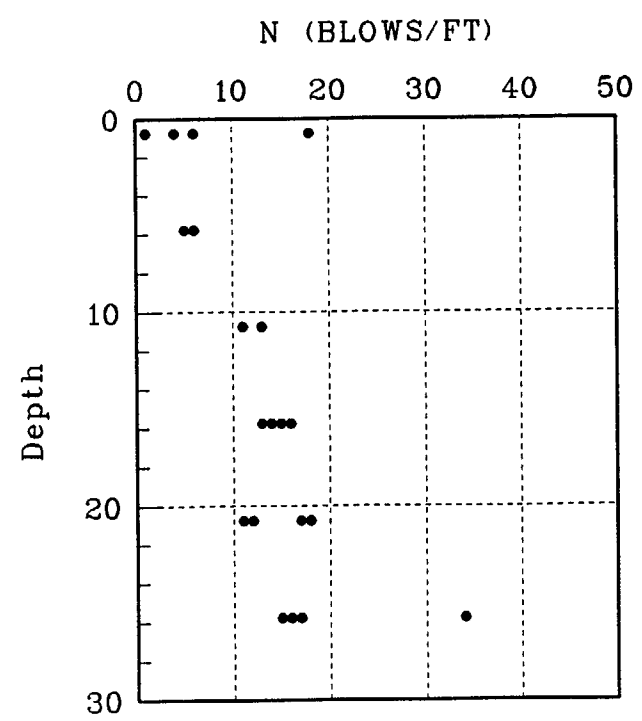


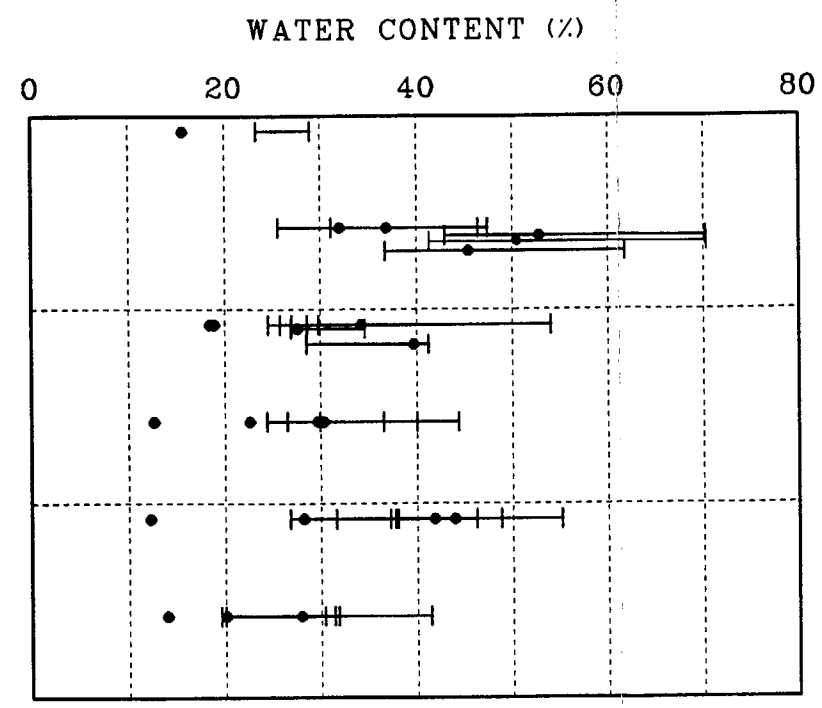


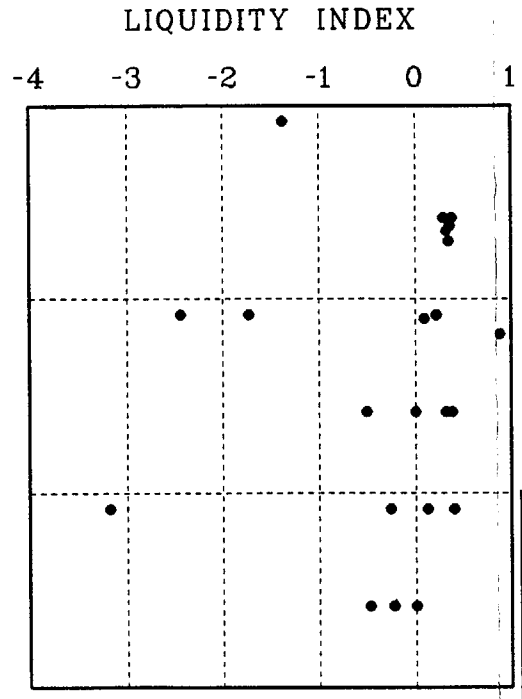


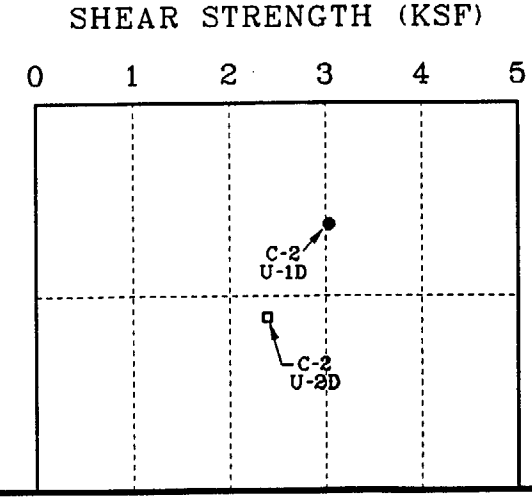


BORINGS A-2 THOUGH D-2









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PRIVATE FUEL STORAGE FACILITY
PRIVATE FUEL STORAGE, LLC

SOIL PROPERTIES VS DEPTH IN STORAGE PAD AREA
SHEET 1 OF 2

STONE & WEBSTER ENGINEERING CORPORATION
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05996-GSK-B-35A-0

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Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
A-1	S 1	0.8					
A-1	S 2	5.8	34.7	54.8	30.9	23.9	15.9
A-1	S 3	10.8	19.8	28.8	25.8	3.0	-200.0
A-1	S 4	15.8	22.3	30.2	27.6	2.6	-203.8
A-1	S 5	20.8	55.4	58.6	43.0	15.6	79.5
A-1	S 6	25.8					

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
B-1	S 1	0.8					
B-1	U 2D	6.7	45.2	59.8	34.7	25.1	41.8
B-1	S 3	10.8	23.0	39.4	29.0	10.4	-57.7
B-1	S 4	15.8	23.0	35.2	25.9	9.3	-31.2
B-1	S 5	20.8	45.9	50.3	35.8	14.5	69.7
B-1	S 6	25.8					

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
C-1	S 1	0.8					
C-1	S 2	5.8	53.0	67.4	39.3	28.1	48.8
C-1	U 3B	10.9	30.3	33.0	28.1	4.9	44.9
C-1	U 3C	11.1	38.9	47.8	34.6	13.2	32.6
C-1	U 3D	11.5	46.7	61.1	44.1	17.0	15.3
C-1	S 4	15.8	27.4	34.2	24.4	9.8	30.6
C-1	S 5	20.8	42.7	49.7	38.7	11.0	36.4
C-1	S 6	25.8					

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
D-1	S 1	0.8					
D-1	S 2	5.8	36.3	54.6	29.4	25.2	27.4
D-1	S 3	10.8	28.6	40.5	25.2	15.3	22.2
D-1	S 4	15.8	32.2	47.3	33.1	14.2	-6.3
D-1	S 5	20.8	20.7	30.0	19.5	10.5	11.4

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
A-2	S 1	0.8	15.6	28.9	23.3	5.6	-137.5
A-2	U 2C	6.2	52.8	70.2	42.9	27.3	36.3
A-2	U 2E	7.0	45.4	61.8	36.7	25.1	34.7
A-2	S 3	10.8	18.4	27.0	24.5	2.5	-244.0
A-2	S 4	15.8	29.7	36.5	26.5	10.0	32.0
A-2	S 5	20.8	28.2	38.0	26.8	11.2	12.5
A-2	S 6	25.8	27.9	41.4	30.4	11.0	-22.7

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
B-2	S 1	0.8					
B-2	S 2	5.8	32.0	47.4	25.6	21.8	29.4
B-2	U 1	9.0					
B-2	S 3	10.8	18.9	29.8	25.8	4.0	-172.5
B-2	S 4	15.8	12.6	Nonplastic			
B-2	S 5	20.8	43.9	55.1	46.2	8.9	-25.8
B-2	S 6	25.8	20.1	31.8	20.0	11.8	0.8

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
C-2	S 1	0.8					
C-2	U 1D	6.5	50.5	70.3	41.3	29.0	31.7
C-2	U 2C	11.0	27.6	34.6	26.9	7.7	9.1
C-2	U 2E	11.8	39.7	41.2	28.5	12.7	88.2
C-2	S 2	15.8	30.3	40.0	24.4	15.6	37.8
C-2	S 3	20.8	41.8	48.8	37.2	11.6	39.7
C-2	S 4	25.8					
C-2	S 5	30.8					

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
D-2	S 1	0.8					
D-2	S 2	5.8	36.9	46.4	31.1	15.3	37.9
D-2	S 3	10.8	34.2	54.0	28.6	25.4	22.0
D-2	S 4	15.8	22.6	44.3	29.9	14.4	-50.7
D-2	S 5	20.8	12.2	37.7	31.6	6.1	-318.0
D-2	S 6	25.8	13.9	31.4	19.5	11.9	-47.1

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
A-3	S 1	0.8					
A-3	S 2	5.8	36.0	49.8	23.3	26.5	47.9
A-3	S 3	10.8	43.3	60.1	35.1	25.0	32.8
A-3	S 4	15.8	25.9	35.8	27.7	8.1	-22.2
A-3	S 5	20.8					
A-3	S 6	25.8					

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
B-3	S 1	0.8	8.9	26.6	19.7	6.9	-156.5
B-3	U 1B	5.5	33.5	52.4	25.2	27.2	30.5
B-3	U 2	11.0					
B-3	S 2	15.8					
B-3	S 3	20.8	44.6	54.3	41.6	12.7	23.6
B-3	S 4	25.8					
B-3	S 5	30.8					

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
C-3	S 1	0.8					
C-3	S 2	5.8	26.8	43.1	22.4	20.7	21.3
C-3	S 3	10.8	32.6	48.8	29.4	19.4	16.5
C-3	S 4	15.8	27.9	32.9	23.1	9.8	49.0
C-3	S 5	20.8	39.5	50.8	35.8	15.0	24.7
C-3	S 6	25.8	18.1	26.2	19.5	6.7	-20.9

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
D-3	S 1	0.8					
D-3	S 2	5.8	23.5	43.4	27.3	16.1	-23.6
D-3	S 3	10.8	25.0	Nonplastic			
D-3	S 4	15.8	36.8	40.6	28.0	12.6	69.8
D-3	S 5	20.8	42.0	47.7	34.2	13.5	57.8
D-3	S 6	25.8					

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
A-4	S 1	0.8					
A-4	S 2	5.8	44.2	69.0	42.4	26.6	6.8
A-4	S 3	10.8	10.8	Nonplastic			
A-4	S 4	15.8	19.3	29.9	22.4	7.5	-41.3
A-4	S 5	20.8	37.8	56.5	41.6	14.9	-25.5
A-4	S 6	25.8	15.2	29.1	19.8	9.3	-49.5

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
B-4	S 1	0.8					
B-4	S 2	5.8	48.4	56.5	27.8	28.7	71.8
B-4	U 3D	10.7	42.6	42.5	24.7	17.8	100.6
B-4	S 4	15.8	19.9	30.7	24.6	6.1	-77.0
B-4	S 5	20.8	24.2	35.4	29.9	5.5	-103.6
B-4	S 6	25.8	24.5	32.6	24.3	8.3	2.4

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
C-4	S 1	0.8					
C-4	S 2A	5.2	28.6	46.1	22.9	23.2	24.6
C-4	S 2B	6.0	50.6	69.5	44.2	25.3	25.3
C-4	S 3	10.8	18.2	26.5	26.0	0.5	-1560.0
C-4	S 4	15.8	26.5	36.6	26.9	9.7	-4.1
C-4	S 5	20.8	40.7	52.5	41.5	11.0	-7.3
C-4	S 6	25.8	18.7	29.2	20.1	9.1	-15.4

Boring No.	Sample	z_{avg}	Natural Water Content	Liquid Limit	Plastic Limit	Plastic Index	Liquidity Index
D-4	S 1	0.8					
D-4	S 2	5.8	38.0	49.3	27.7	21.6	47.7
D-4	S 3A	10.3	16.8	24.7	23.3	1.4	-464.3
D-4	S 4A	15.4	8.3	Nonplastic			
D-4	S 4B	16.2	32.8	42.8	25.7	17.1	41.5
D-4	S 5	20.8	43.4	56.8	41.2	15.6	14.1
D-4	S 6	25.8	18.0	27.0	21.6	5.4	-66.7

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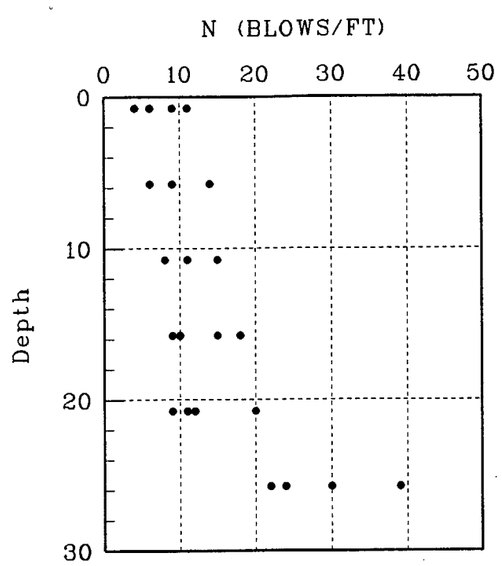
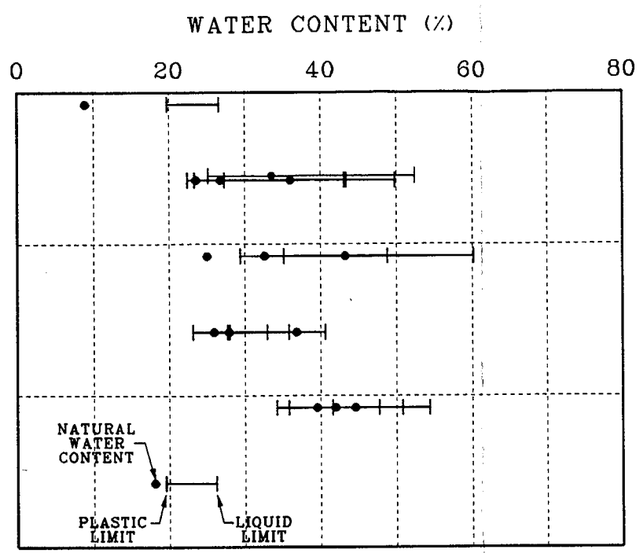
TABLE 1

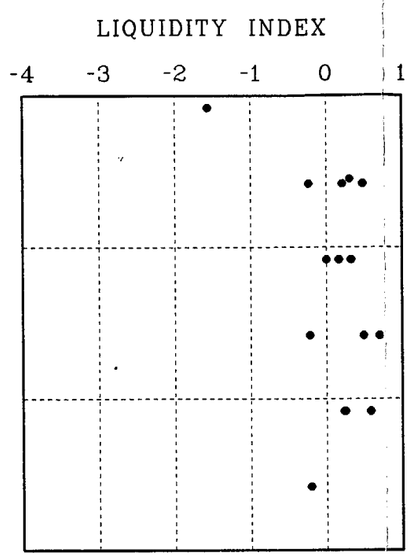
MATRIX OF ATTERBERG LIMITS IN PROPOSED EMPLACEMENT AREA PFSF SAFETY ANALYSIS REPORT

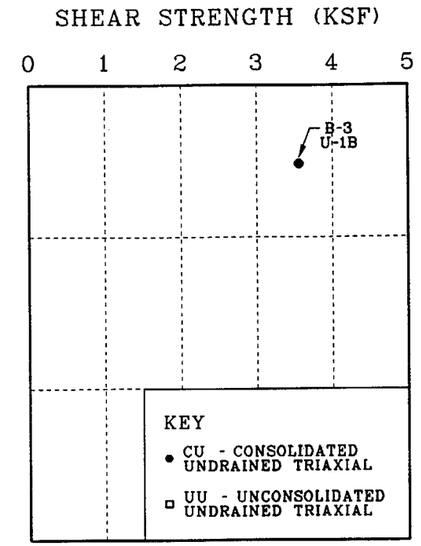
SOUTHERN HALF OF EMPLACEMENT AREA

BORINGS A-3 THOUGH D-3

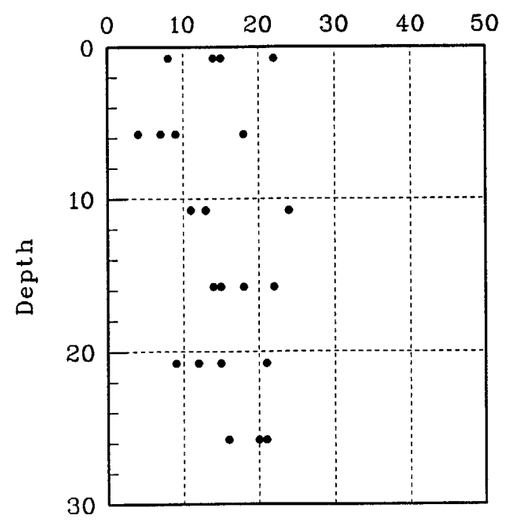


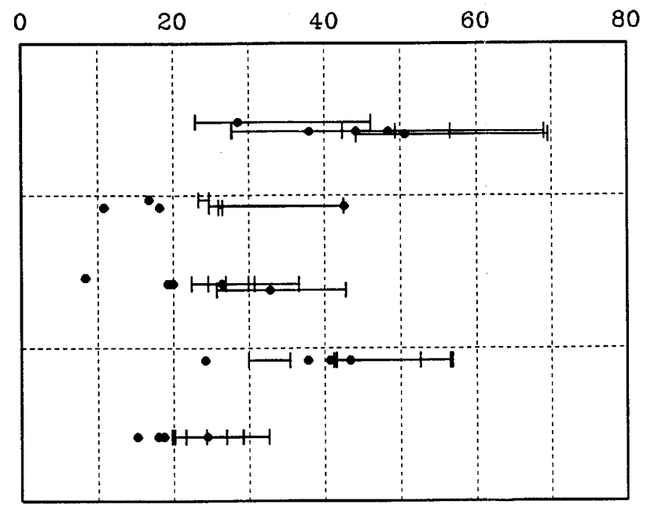


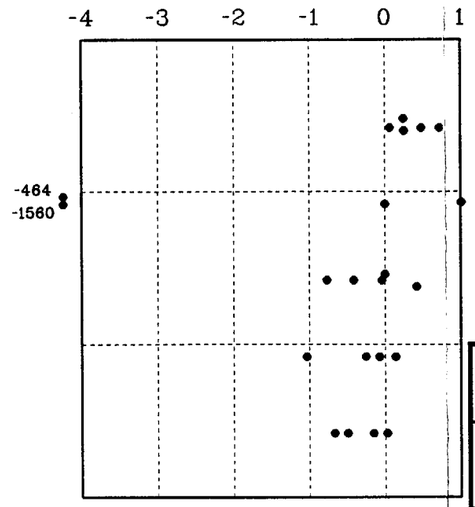


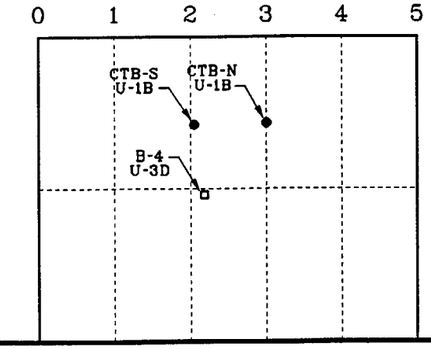


BORINGS A-4 THOUGH D-4









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SOIL PROPERTIES VS DEPTH IN STORAGE PAD AREA SHEET 2 OF 2

STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASSACHUSETTS
05996-GSK-B-35B-0

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