APPENDIX D

IN-SITU MOISTURE CONTENTS
COARSE TAILINGS, SOIL COVER, AND FINE TAILINGS

COARSE TAILINGS AND SOIL COVER IN-SITU MOISTURE CONTENTS

Canonie Environmental

D-2

By [illegible] Date 2/16/91 Subject UNC SOIL COVER Sheet No. 1 of ___

Chkd. By SWM Date 3-1-91 LONG TERM MOISTURE Proj. No. 86-060-2.1

1/4" X 1/4"

PURPOSE: TO DETERMINE THE LONG-TERM MOISTURE CONTENT OF THE RADON BARRIER AT THE UNITED NUCLEAR SITE USING IN-SITU SOIL MOISTURES AS DISCUSSED WITH NRC PERSONNEL ON 2/13/91

METHOD: USE EXISTING IN-SITU MOISTURE DATA FOR SAMPLES WHERE GRADATION ANALYSES WERE PERFORMED AND FALL WITHIN THE ACCEPTABLE SOIL COVER ENVELOPE FOR THE SITE AND WHERE THE SAMPLES WERE OBTAINED FROM A REPRESENTATIVE BORROW SOURCE AND FROM A DEPTH OF 120 cm TO 500 cm (4 ft - 16.5 ft). THIS METHOD WAS DEEMED AN ACCEPTABLE METHOD FOR DETERMINATION OF THE LONG-TERM MOISTURE CONTENT FOR THE RADON BARRIER AT A 2/13/91 MEETING BETWEEN DAWN JACOBY OF NRC AND CANONIE.

RESULTS: THE AVERAGE IN-SITU MOISTURE OF 47 TESTS MEETING BOTH DEPTH AND GRADATION CRITERIA IS 12.9 %

CALCULATION: ACCEPTABLE GRADATION

SEIVE SIZE	% PASSING
200 mm	> 40 & < 85
100 mm	> 50
40 mm	> 65
10 mm	> 85
4 mm	> 90
3/4 in.	> 95
3 in.	> 100

Canonie Environmental

D-3

By mjj Date 2/15/91 Subject UNC SOIL COVER Sheet No. ____ of ____

Chkd. By SMM Date 3-1-91 LONG-TERM MOISTURE Proj. No. 86-060-24

1/4" X 1/4"

LOCATION	DEPTH (ft)	-200 FRACTION (%)	% MOISTURE
78-1041-3	13	59	10
-10	11	71	12
-11	5	60	12
-15	10	75	14
-22	9	55	21
-24	16	83	24
-19	10	50	10
			Σ = 103

N = 7

$\bar{x}$ = 14.7

Canonie Environmental

D-4

By mjg Date 2/13/91 Subject UNC Soil Cover Sheet No. ____ of ____

Chkd. By [illegible] Date [illegible] LONG-TERM MOISTURE Proj. No. 96060-21

1/4" X 1/4"

LOCATION	DEPTH (ft)	-200 FRACTION (%)	% MOISTURE
78-1096-2	9.0	53	7
-3	14.5	48	5
-4	4.5	79	8
-5	4.5	76	7
-5	14.5	62	8
-7	9.5	44	5
-18	4.5	52	4
~~-18~~	~~14.5~~	~~92~~	~~38~~
-31	9.5	52	5
			Σ = 49

N = 8

$\bar{x}$ = 6.1 %

Canonie Environmental

D-5

By mjj Date 2/15/91 Subject LLRC SOIL COVER Sheet No. ____ of ____

Chkd. By [illegible] Date [illegible] LONG-TERM MOISTURE Proj. No. 86-1160-24

1/4" X 1/4"

LOCATION	DEPTH (FT)	-200 FRACTION (%)	% MOISTURE
79-1096-A1-2	10.5	57	16
A2-6	9.0	54	15
A2-8	9.0	58	17
A3-1	12.0	77	14
A3-2	7.0	54	16
A6-1	11.5	79	21
C1-8	6.0	49	21
C1-11	9.0	45	18
C1-16	14.0	56	17
C1-20	10.0	61	18
C1-21	11.0	62	12
C2-4	7.0	54	8
C2-8	5.0	52	16
C3-5	4.5	58	12
C4-5	9.0	56	20
C4-16	8.2	54	15
C4-26	8.5	50	9
D1-2	7.0	63	12
D1-3	8.0	55	10
D1-4	10.0	45	8
D1-7	16.0	58	10
D2-3	4.0	50	10
D2-5	6.0	59	10
D2-8	11.0	63	11
D2-10	15.0	56	11
E1-5	6.5	44	17
E1-7	8.5	50	20
E1-12	13.5	46	13
E1-15	15.0	46	20
			Σ = 417

N = 29 $\bar{X}$ = 14.4

Canonie Environmental

D-6

By mm Date 2/5/91 Subject LINC SOIL COVER Sheet No. ____ of ____

Chkd. By SAM Date 2-1-91 LONG TERM MOISTURE Proj. No. [illegible]

1/4 X 1/4

LOCATION	DEPTH	-200 FRACTION (%)	% MOISTURE
~~86-RP-P2~~	~~10~~	~~100~~	~~22.3~~
P3	10	66	16.2
P5	6	48	7.6
~~P8~~	~~5~~	~~93~~	~~17.5~~
TP2	6-7	40	11.9
			35.7

N = 3

$\bar{x}$ = 11.9

Canonie Environmental

D-7

By mpp Date 2/15/91 Subject UNIC SOIL COVER Sheet No. ____ of ____

Chkd. By SWM Date 2-1-91 LONG-TERM MOISTURE Proj. No. [illegible]

1/4" X 1/4"

DETERMINE OVERALL AVERAGE

$$\frac{417 + 49 + 35.7 + 103}{29 + 8 + 3 + 7} = \frac{604.7}{47} = 12.9$$

GEOTECHNICAL AND DESIGN DEVELOPMENT INVESTIGATION REPORT

Tailings Disposal Systems Analysis

United Nuclear Church Rock Mill

Church Rock, New Mexico

July 1978

SHB Job No. E78-1041
Volume No. 2

SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS
PHOENIX • ALBUQUERQUE • EL PASO • TUCSON

7

TABULATION OF TEST RESULTS

Job No. E78-1041

Project Tailings Disposal System Analysis

Material

Source

HOLE NO	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING 200	100	40	16	10	4	¼	⅜	¾	1	1½	2	LAB NO
1	See Site Plan	4½'-6'	SM	23	1	44	78	97	98	99	99	99	100					104
1	See Site Plan	34½'-36'	ML-CL	23	4	51	77	92	95	97	99	100						
1	See Site Plan	59½'-61'	CL	30	15	82	92	97	98	98	99	100						
3	See Site Plan	0'-1'	CL	29	13	60	86	97		99	100							
3	See Site Plan	5½'-7'	CL	30	13	60	82	94	95	96	97	98	98	100				
3	See Site Plan	13'-14'	CL	29	12	59	85	95		97	100						10%	
3	See Site Plan	15'1"-16'1"	CL	31	14	65	88	97		98	100							
3	See Site Plan	56½'-57½'	CL	35	18	66	90	98		100								
3	See Site Plan	69½'-70½'	SC	27	8	34	60	73		80	84	100						
4	See Site Plan	½'-2'	CL-ML	26	6	56	81	95	97	97	99	100						
4	See Site Plan	14½'-16'	CL	32	16	61	86	97	98	98	99	99	100					
4	See Site Plan	24½'-25½'	ML	21	3	69	80	95	95	95	98	98	100					
4	See Site Plan	44½'-46'	SM	22	2	37	52	64	71	76	87	91	97	100				
4	See Site Plan	59½'-61'	CL	34	15	89	99	100										
5	See Site Plan	15½'-18'	ML-CL	28	7	51	79	95	96	97	98	99	100					

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TABULATIC OF TEST RESULTS

Job No. E78-1041

Project Tailings Disposal System Analysis

Material

Source

HOLE NO.	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS - ACCUM % PASSING												LAB NO
						200	100	40	16	10	4	¼	⅜	¾	1	1½	2	
6	See Site Plan	4½'-6'	CL	26	8	64	87	98	99	99	100							104 -9
6	See Site Plan	14½'-15½'	CL	30	13	59	84	95	97	98	99	100						-10
6	See Site Plan	39½'-40½'	CL	30	12	74	92	99	100									-10
6	See Site Plan	59½'-60½'	CL	36	20	72	92	99		100								-1
7	See Site Plan	2½'-4½'	ML-CL	26	5	57	84	99	100									-11
7	See Site Plan	6'-7'	SM		NP	31	67	99	100									-11
7	See Site Plan	40½'-41½'	SM		NP	34	82	100										-14
7	See Site Plan	54'-55½'	CL	34	15	51	74	95		97	100							-1
8	See Site Plan	9½'-10½'	CL	31	14	63	84	96	97	98	100							-15
8	See Site Plan	34½'-35½'	CL	44	28	76	93	99	100									-33
9	See Site Plan	6½'-9'	SM-SP		NP	10	20	82	99	100								-34
9	See Site Plan	20½'-23'	SM-SP		NP	8	17	71	98	100								-35
9	See Site Plan	28'-30½'	SM-SC	25	5	44	74	93	95	96	97	97	98	100				-35
10	See Site Plan	2½'-4'	CL	29	13	67	85	95		99	100							-1
10	See Site Plan	10'-11½'	CL	25	19	71	86	96		99	100						12%	-1

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TABULATION OF TEST RESULTS

Job No. E78-1041

Project Tailings Disposal Systems Analysis

Material

Source

HOLE NO	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM. % PASSING												LAB NO
						200	100	40	16	10	4	¼	⅜	¾	1	1½	2	
10	See Site Plan	17½'-19'	CL	31	13	69	90	98		99	100							1041-R10
10	See Site Plan	29'-29½'	CL	32	16	66	82	96		99	100							-R11
10	See Site Plan	33'-34½'	CL	29	15	57	84	96		98	100							-R12
10	See Site Plan	72'-73½'	CL	39	22	69	88	96		98	100							-R13
10	See Site Plan	77'-77'5"	CL	30	13	59	86	97		99	100							-R14
11	See Site Plan	4½'-5½'	CL	27	12	60	86	95		98	100						12%	-R15
11	See Site Plan	19½'-20½'	CL	33	18	62	89	98		99	100							-R16
11	See Site Plan	34½'-35½'	CL	29	14	57	84	97		98	100							-R17
11	See Site Plan	79½'-80½'	CL	39	21	55	84	94		100								-R18
12	See Site Plan	4½'-6'	CL	34	17	66	86	96	97	97	99	99	100					-218
12	See Site Plan	34½'-35½'	CL	28	9	59	82	96	98	99	100							-224
12	See Site Plan	54½'-55½'	CL	32	16	70	91	99	99	100								-228
12	See Site Plan	59½'-61'	CL	27	9	58	87	100										-229
13	See Site Plan	0'-1½'	SM	22	1	49	81	99	100									-234
13	See Site Plan	14½'-16'	CL	28	12	60	83	94	95	96	97	97	99	100				-237

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TABULATION OF TEST RESULTS

Job No. E78-1041

Project Tailings Disposal System Analysis

Material

Source

HOLE NO.	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING												LAB I
						200	100	40	16	10	4	¼	⅜	¾	1	1½	2	
13	See Site Plan	39½'-40½'	ML	40	12	88	99	100										1041-R1
14	See Site Plan	0'-1½'	CL	28	12	57	80	91	93	94	95	97	99	100				-24
14	See Site Plan	19½'-20½'	CL	31	10	96	98	99	100									-24
14	See Site Plan	34½'-35½'	CL	49	29	89	98	100										-25
15	See Site Plan	9½'-10½'	CL	32	10	75	93	99		100							14%	-R2
15	See Site Plan	24½'-25'	CL	42	22	75	90	99		99	100							-R2
17	See Site Plan	19½'-20½'	CL	30	12	63	88	98		99	100							-R2
19	See Site Plan	2'-3½'	CL	29	13	61	86	99	99	100								-27
19	See Site Plan	9½'-11'	CL	23	8	50	72	94	96	97	98	99	100				10%	-28
19	See Site Plan	32'-33½'	SM		NP	46	88	99		100								-R2
19	See Site Plan	36'-37½'	CL	41	22	74	94	99		100								-R2
19	See Site Plan	40'-41½'	CH	61	38	73	80	99		100								-R2
19	See Site Plan	44'-45'	CH	67	41	78	87	97		100								-R2
20	See Site Plan	9½'-10½'	CL	28	13	63	86	97	98	99	100							-29
20	See Site Plan	19½'-20½'	SM		NP	16	35	98	100									-30

TABULATION OF TEST RESULTS

Job No. E78-1041

Project Tailings Disposal System Analysis

Material

Source

HOLE NO	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING												LAB NO
						200	100	40	16	10	4	¼	⅜	¾	1	1½	2	
20	See Site Plan	39½'-40½'	CH	57	31	93	96	100										1041-
21	See Site Plan	4½'-6'	CL	34	16	77	90	96	97	97	98	98	99	100				-30
21	See Site Plan	19½'-21'	CL	39	21	72	88	100										-30
21	See Site Plan	39½'-40½'	CH	50	32	84	94	100										-R2
22	See Site Plan	8'-9½'	CL	26	10	55	78	100									21%	-R2
22	See Site Plan	12'-13½'	CL	27	10	56	69	99		100								-R3
24	See Site Plan	6½'-9'	SM		NP	13	25	84	100									-32
24	See Site Plan	15½'-17'	CL	42	23	83	93	99		100							24%	-R3
24	See Site Plan	22'-23½'	CL	42	21	87	97	100										-
25	See Site Plan	5'-6½'	SM		NP	14	25	69	98	98	100							-35
25	See Site Plan	15½'-18'	SM		NP	14	25	75	98	99	100							-35
25	See Site Plan	23'-24½'	CL	35	17	59	81	100										-36
25	See Site Plan	27'-29½'	SC	28	12	42	79	100										-36
26	See Site Plan	6½'-9'	SM		NP	22	43	93	100									-36
26	See Site Plan	15½'-18'	SM		NP	14	23	74	99	100								-36

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TABULATIC OF TEST RESULTS

Job No. E78-1041

Project Tailings Disposal System Analysis

Material

Source

HOLE NO.	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING 200	100	40	16	10	4	¼	⅜	¾	1	1½	2	LAB #
26	See Site Plan	19½'-22'	SM		NP	20	33	86	100									1041-37
26	See Site Plan	31'-32½'	CL	39	22	78	91	98	99	100								-37
27	See Site Plan	9½'-11'	CL	37	15	86	95	100										-38
27	See Site Plan	14½'-15½'	CL	42	21	66	78	88		92	94		96	100				-38
27	See Site Plan	19½'-21'	CL	31	11	89	98	100										-38
27	See Site Plan	44½'-45½'	CL	40	20	80	93	100										-38
28	See Site Plan	4½'-6'	CL	41	21	92	98	100										-39
28	See Site Plan	34½'-36'	CL	36	16	90	98	100										-39
	Bulk Sample Tailings		SM-SP	NV	NP	5	11	60	100									-40
30	See Site Plan	9½'-11'	SM	NV	NP	23	74	100										-41
31	See Site Plan	4½'-6'	CL	29	14	55	79	90		95	98		100					-41
33	See Site Plan	4½'-6'	SC	27	13	39	70	94		100								-43
33	See Site Plan	9½'-11'	CL	42	27	70	88	98		100								-43
34	See Site Plan	14½'-16'	CL	29	14	75	93	99		100								-44
34	See Site Plan	24½'-26'	CL	44	21	84	93	99		100								-44

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TABULATION OF TEST RESULTS

Job No. E78-1041

Project Tailings Disposal System Analysis

Material

Source

HOLE NO	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING												LAB NO
						200	100	40	16	10	4	¼	⅜	¾	1	1½	2	
37	See Site Plan	4½'-6'	SM	27	NP	48	78	95		99	100							1041-498
37	See Site Plan	9½'-11'	SC-SM	24	7	49	83	97		99	100							-499
37	See Site Plan	19½'-21'	CL	33	17	55	83	95		98	99		100					-501
37	See Site Plan	29½'-31'	SM	22	NP	32	73	97		100								-503
41	See Site Plan	4½'-6'	CL	35	18	81	93	98		99	100							-508
41	See Site Plan	14½'-16'	CL	40	21	85	94	99		100								-510
41	See Site Plan	34½'-36'	CL	39	22	77	89	98		99	100							-514
42	See Site Plan	4½'-6'	CL	28	14	65	74	82		87	92		96	100				-465
42	See Site Plan	19½'-21'	SM	19	NP	24	45	80		87	93		99	100				-468
42	See Site Plan	29½'-31'	SC	29	9	37	51	62		74	81		89	96		100		-470
42	See Site Plan	39½'-41'	CL	40	18	90	90	92		95	99		100					-472
47	See Site Plan	0'-5'	SC	26	8	42	71	92		95	97		98	100				-523
48	See Site Plan	4½'-6'	SM	19	NP	18	38	66		76	83		90	94		100		-526
50	See Site Plan	4½'-6'	CL	28	8	64	87	99		100								-555
50	See Site Plan	14½'-16'	SM	21	NP	29	62	92		99	100							-556

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TABULATION OF TEST RESULTS

Job No. E78-1041

Project Tailings Disposal System Analysis

Material

Source

HOLE NO.	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING 200	100	40	16	10	4	¼	⅜	¾	1	1½	2	LAB NO
52	See Site Plan	5'-10'	SC	27	11	4[illegible]	73	91		95	98		100					1041-5[illegible]
55	See Site Plan	24½'-26'	SC	29	14	49	72	90		95	98		99	100				-544
57	See Site Plan	½'-2'	CL	26	9	51	78	94		97	99		100					-560
57	See Site Plan	9½'-11'	CL	29	10	72	86	95		96	97		99	100				-562
59	See Site Plan	4½'-6'	SC	39	19	38	62	88		92	96		100					-56[illegible]
61	See Site Plan	4½'-6'	SM	22	NP	50	77	95		98	99		100					-567
61	See Site Plan	9½'-11'	SM		NP	22	37	63		65	69		76	82		100		-56[illegible]
63	See Site Plan	0'-5'	SM		NP	22	44	63		76	83		90	94		100		-571
64	See Site Plan	½'-2'	SC-SM	23	7	46	64	79		87	94		100					-5[illegible]
64	See Site Plan	2'-4½'	SM		NP	27	54	60		64	68		77	86		100		-57[illegible]
64	See Site Plan	4½'-6'	GM	20	NP	25	28	42		46	54		76	100				-57[illegible]
68	See Site Plan	4½'-6'	SM	20	NP	31	48	59		67	74		80	92		100		-57[illegible]
68	See Site Plan	9½'-11'	SM	21	NP	40	60	64		70	80		93	100				-580
68	See Site Plan	14½'-16'	CL	32	12	93	95	98		100								-581
74	See Site Plan	0'-10'	CL	31	13	72	86	98		100								-601

SERGENT, HAUSKINS & BECKWITH

TABULATION OF TEST RESULTS

Job No. E78-1041

Project Tailings Disposal System Analysis

Material

Source

HOLE NO	LOCATION	DEPTH	UNIFIED CLASS	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING												LAB NO
						200	100	40	16	10	4	¼	⅜	¾	1	1½	2	
76	See Site Plan	0'-5'	CL	33	16	71	77	98		100								1041-608
76	See Site Plan	5'-10'	CL	42	21	79	92	100										-609
76	See Site Plan	16'-19½'	ML	23	NP	52	84	98		100								-610
78	See Site Plan	6'-10'	SM	23	NP	48	81	95		98	100							-616
78	See Site Plan	17'-20'	SC	26	9	49	67	78		83	87		93	100				-61
78	See Site Plan	22'-25'	CL	33	15	75	90	96		99	100							-618
83	See Site Plan	4½'-6'	SM	NV	NP	26	51	81		87	94		100					-63
83	See Site Plan	9½'-11'	SM	NV	NP	24	49	89		94	97		100					-634
85	See Site Plan	4½'-6'	CL	33	15	60	77	95		100								-6
85	See Site Plan	9½'-11'	SM		NP	34	62	88		94	97		100					-639
85	See Site Plan	14½'-16'	CL	35	16	80	93	99		100								-640
85	See Site Plan	19½'-21'	CL	34	15	74	87	96		98	99		100					-641

SERGENT HAUSKINS & BECKWITH

SERGENT, HAUSKINS & BECKWITH CONSULTING SOIL AND FOUNDATION ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

S. DWAINE SERGENT, P.E.
DALE V. BEDENKOP, P.E.
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BUD WOODWARD

October 26, 1978

United Nuclear Corporation
4801 Indian School Road, N.E.
Albuquerque, New Mexico 87110

SHB Job No. E78-1096

Attention: Mr. John Abbiss

Re: Embankment Volumes-Borrow Quantities
Tailings Disposal Systems Analysis
UNC Church Rock Mill Site
Church Rock, New Mexico

Gentlemen:

Our Engineering Analysis Report relative to available borrow quantities and required embankment volumes for various schemes of future construction on the referenced project is herewith submitted. The report includes the results of test drilling, laboratory analyses and estimated quantities of borrow and embankment materials. Also included are estimated data relative to tailings storage volumes and reservoir life based upon projected future milling rates.

Should any questions arise concerning this report, we would be pleased to discuss them with you.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By Robert D. Booth
Robert D. Booth, P.E.

REPLY TO: 2821 GIRARD BLVD., N.E., ALBUQUERQUE, NEW MEXICO 87107

PHOENIX (602) 272-6848
ALBUQUERQUE (505) 345-8306
EL PASO (915) 591-8188
TUCSON (602) 884-9333

TABULATION OF TEST RESULTS

Job No. E78-1096

Project Embankment Volumes - Borrow Quantities

Church Rock, New Mexico

Material

Source

HOLE NO	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING											% Moist	Lab No.
						200	100	40	16	10	4	¼	⅜	¾	1	1½		
1	See Site Plan	4½'	ML	26	NP	54	85	94		98	100						6	96-1
2	See Site Plan	9½'	CL	25	10	53	72	84		90	95		98	100			7	96-2
3	See Site Plan	14½'	SM	NV	NP	48	91	99		100							5	96-3
4	See Site Plan	4½'	CL	34	16	79	95	99		100							8	96-4
5	See Site Plan	4½'	CL	32	15	76	91	98		100							7	96-5
5	See Site Plan	14½'	CL	30	13	62	80	93		100							8	96-6
6	See Site Plan	4½'	CL-ML	24	5	61	84	96		98	99		100				5	96-7
7	See Site Plan	9½'	SM	23	NP	44	85	97		99	100						5	96-8
8	See Site Plan	24½'	CL	33	14	94	99	100									13	96-9
9	See Site Plan	9½'	CL	42	18	93	94	96		98	99		100				11	96-1
10	See Site Plan	9½'	SM	NV	NP	22	43	57		69	79		87	96		100	4	96-1
11	See Site Plan	4½'	CL	31	11	64	86	95		97	99		100				5	96-1
12	See Site Plan	½'	CL	30	8	56	84	91		94	96		99	100			6	96-1
16	See Site Plan	4½'	CH	54	29	93	95	97		99	100						13	96-1
18	See Site Plan	4½'	CL	26	11	52	79	90		95	99		100				4	96-1

SERGENT, HAUSKINS & BECKW.

TABULATION OF TEST RESULTS

Job No. E78-1096

Project Embankment Volumes - Borrow Quantities

Church Rock, New Mexico

Material

Source

HOLE NO	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING 200	100	40	16	10	4	¼	⅜	¾	1	1½	% Moist	LAB NO
18	See Site Plan	14½'	CL	32	11	92	98	99		100							38	96-16
19	See Site Plan	4½'	SM	22	NP	41	64	82		88	94		98	100			5	96-17
21	See Site Plan	4½'	SM	NV	NP	21	58	85		90	95		99	100			3	96-18
22	See Site Plan	4½'	CL	28	9	51	74	84		90	95		99	100			5	96-19
23	See Site Plan	4½'	CL	30	9	56	80	92		94	96		96	98		100	7	96-20
24	See Site Plan	9½'	CL	43	18	96	97	98		100							10	96-21
25	See Site Plan	9½'	CL-ML	25	5	52	80	93		98	99		100				20	96-2[illegible]
26	See Site Plan	14½'	SM	NV	NP	22	42	52		63	77		91	100			2	96-2[illegible]
29	See Site Plan	4½'	CL	49	22	97	98	98		100							10	96-[illegible]
30	See Site Plan	4½'	CL	27	11	55	73	80		86	92		96	100			8	96-2[illegible]
31	See Site Plan	9½'	CL	26	11	52	83	98		99	100						5	96-2[illegible]
32	See Site Plan	4½'	SM	NV	NP	29	70	96		100							5	96-2[illegible]
32	See Site Plan	24½'	CL-ML	25	6	61	92	99		100							6	96-2[illegible]
33	See Site Plan	4½'	CL	27	9	51	77	98		100							7	96-2[illegible]
33	See Site Plan	14½'	SM	21	NP	47	86	99		100							5	96-3[illegible]

SERGENT, HAUSKINS & BECKWI[illegible]

TABULA[illegible] OF TEST RESULTS

Job No. E78-1096

Project Embankment Volumes - Borrow Quantities

Church Rock, New Mexico

Material

Source

HOLE NO	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING											% Moist	LAB [illegible]
						200	100	40	16	10	4	¼	⅜	¾	1	1½		
34	See Site Plan	14½'	SM	18	NP	40	69	96		98	98		99	100			5	96-
35	See Site Plan	9½'	SC	24	6	47	75	94		97	98		98	100			5	96-
36	See Site Plan	4½'	SM	NV	NP	25	55	91		96	99		100				2	96-
37	See Site Plan	4½'	SM	22	NP	45	78	88		89	90		100				6	96-

SERGENT, HAUSKINS & BECKW[illegible]

FIELD MOISTURE TESTS

Test Pit No.	Sample No.	Depth (ft.)	% Moisture
A-3	A3-6	1.5	13
	A3-7	3.0	7
	A3-8	6.0	20
	A3-9	2.0	13
A-4	A4-1	9.0	12
	A4-2	5.5	12
	A4-3	4.0	7
	A4-4	1.5	7
	A4-5	5.5	5
	A4-6	9.5	18
	A4-7	2.5	7
	A4-8	1.5	9
A-5	A5-1	10.5	8
	A5-2	9.0	4
	A5-3	7.5	13
	A5-4	6.5	8
	A5-5	5.0	5
	A5-6	2.5	12
	A5-7	.5	16
	A5-8	8.0	14
	A5-9	5.0	9
	A5-10	2.0	10
A-6	A6-1	11.5	21
	A6-2	5.5	9
	A6-3	4.5	8
	A6-4	2.0	8

FIELD MOISTURE TESTS

Test Pit No.	Sample No.	Depth (ft.)	% Moisture
A-6	A6-5	1.0	12
	A6-6	6.5	18
	A6-7	4.5	6
	A6-8	3.5	8
	A6-9	1.0	14
A-7	A7-1	7.0	6
	A7-2	5.0	6
	A7-3	3.0	12
	A7-4	6.5	7
	A7-5	5.0	5
	A7-6	3.0	14
	A7-7	2.0	11
C-1	C1-1	0	18
	C1-2	.5	22
	C1-3	1.8	15
	C1-4	2.2	22
	C1-4	3.0	13
	C1-6	4.0	24
	C1-7	5.0	18
	C1-8	6.0	21
	C1-9	8.0	22
	C1-10	8.0	19
	C1-11	9.0	18
	C1-12	10.0	20
	C1-13	11.0	21
	C1-14	12.0	21

FIELD MOISTURE TESTS

Test Pit No.	Sample No.	Depth (ft.)	% Moisture
C-1	C1-15	13.0	17
	C1-16	14.0	17
	C1-17	7.2	13
	C1-18	8.2	13
	C1-19	9.0	22
	C1-20	10.0	18
	C1-21	11.0	12
	C1-22	12.5	14
	C1-23	14.0	12
	C1-24	14.0	14
	C1-25	9.0	16
	C1-26	7.0	21
C-2	C2-4	7.0	8
	C2-5	5.0	19
	C2-6	3.0	12
	C2-7	2.0	11
	C2-8	5.0	16
	C2-9	2.0	12
C-3	C3-2	6.5	11
	C3-4	5.5	17
	C3-5	4.5	12
	C3-6	3.5	14
	C3-7	5.0	14
	C3-8	2.5	14
	C3-9	.5	12

FIELD MOISTURE TESTS

Test Pit No.	Sample No.	Depth (ft.)	% Moisture
C-3	C3-10	2.5	11
	C3-11	3.5	14
	C3-12	4.5	17
	C3-13	5.5	14
	C3-14	6.5	19
	C3-15	7.5	17
C-4	C4-1	1.0	13
	C4-2	2.5	10
	C4-3	4.0	13
	C4-4	6.0	10
	C4-5	9.0	20
	C4-6	1.5	13
	C4-7	3.0	7
	C4-8	4.0	9
	C4-10	6.0	12
	C4-12	8.0	18
	C4-13	8.0	19
	C4-14	5.0	7
	C4-15	7.5	19
	C4-16	8.2	15
	C4-17	9.0	18
	C4-18	9.8	17
	C4-19	2.2	8
	C4-20	3.5	7
	C4-21	4.5	6
	C4-25	7.5	6
	C4-26	8.5	9
	C4-28	6.0	9

FIELD MOISTURE TESTS

Section No.	Sample No.	Depth (ft.)	% Moisture
D-1	D1-1	6.0	12
	D1-2	7.0	12
	D1-3	8.0	10
	D1-4	10.0	8
	D1-5	12.0	10
	D1-6	15.0	10
	D1-7	16.0	10
	D1-8	17.0	13
	D1-9	18.0	11
	D1-10	19.0	12
	D1-11	20.0	16
	D1-12	21.0	12
	D1-13	22.0	12
	D1-14	23.0	9
	D1-15	24.0	10
	D1-16	25.0	12
	D1-17	26.0	14
	D1-18	27.0	14
	D1-19	28.0	14
	D1-20	29.0	11
D-2	D2-1	2.0	16
	D2-2	3.0	2
	D2-3	4.0	10
	D2-4	5.0	14
	D2-5	6.0	10

GOODSON & ASSOCIATES, INC.

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO: 6583.01

Boring No.	Depth (feet)	Sample Identification	Type of Sample	Visual Description	Natural Moisture (%)	Specific Gravity	Other Testing	Remarks
P-1	3	P-1-1B, 3.5-4, Qal	SS	brown sandy silt	12.8			
P-1	6	P-1-2B, 6.5-7, Qal	SS	tan clay	34.8			
P-1	15	P-1-4B, 15.5-16, Zone 3	SS	gray-white silty sand	7.0			
P-2	5	P-2-1A, 6-6.5, Qal	SS	tan sand, some clay lumps	9.8			
P-2	10	P-2-2B, 10.5-11, Qal	SS	brown clay, some organics	20.3		gradation	10 % [illegible]
P-2	15	P-2-3B, 15.5-16, Qal	SS	gray clay, some sand	20.2			
P-3	5	P-3-1A, 6-6.5, Qal	SS	gray sandy clay	29.2			
P-3	10	P-3-2B, 10.5-11, Qal	SS	brown silty sand, some organics	16.2		gradation	
P-3	15	P-3-3B, 15.5-16, Qal	SS	brown sandy clay	21.4			
P-4	5	P-4-1B, 5.5-6, Qal	SS	tan sand, some clay	10.6		gradation	[illegible] % [illegible]
P-4	10	P-4-2B, 10.5-11, Qal	SS	brown clay, slightly sandy	16.8			
P-4	15	28-30, P-4-3B, 15.5-16, Qal	SS	brown clay	13.0			
P-5	5	P-5-1A, 6-6.5, Qal	SS	brown silty clay, slightly sandy	7.6		gradation	
P-5	10	P-5-2A, 11-11.5, Qal	SS	tan silty sand	4.6			
P-5	15	3-4-3, P-4, 3B, 15.5-16, Qal	SS	brown silty sand	19.4			
P-6	5	P-6-1A, 6-6.5, Qal	SS	brown slightly sandy clay	6.6			
P-6	10	P-6-2A, 11-11.5, Qal	SS	brown silty sand	3.6			

Note: All split spoon (ss) jar samples had loose lids when received. Several bag samples had holes in the bags. lids were tightened and bags double-bagged when received.

GOODSON & ASSOCIATES, INC.

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO: 6583.01

Boring No.	Depth (feet)	Sample Identification	Type of Sample	Visual Description	Natural Moisture (%)	Specific Gravity	Other Testing	Remarks
P-8	5	P-8-1A, 6-6.5, Qal	SS	brown slightly sandy clay	17.0			
P-8	10	P-8-2A, 11-11.5, Qal	SS	brown slightly sandy clay	17.5		hydrometer, gradation	
P-8	15	P-8-3B, 15.5-16, Qal	SS	brown slightly sandy clay	23.0			
B-4	5	B-4-1B, 5.5-6, Mancos	SS	gray claystone	28.5			
B-4	10	B-4-2B, 10.5-11, Mancos	SS	gray claystone	22.9	2.57	hydrometer, gradation	
B-4	15	B-4-3B, 15.5-16, Mancos	SS	gray claystone	23.3			
TP-1	5-6	sand	bag	brown silty sand	7.8		gradation, standard proctor	
TP-2	4-5	sand	bag	brown silty sand	11.8			
TP-2	6-7	sand	bucket	brown silty sand	11.9		gradation, standard proctor	
TP-3	7-8	silt	bag	brown silty sand	6.7			
TP-3	11-12	sand	bag	brown silty sand	27.0			hole in bag when received
~~TP-4~~	~~2-3~~	~~silt~~	~~bucket~~	~~brown sandy clay~~	~~13.6~~	~~2.56~~	~~hydrometer, gradation, stan. proctor~~	
TP-4	8-9	sand	bag	brown silty sand	6.5	2.62	gradation	
TP-5	1-2	sand	bag	brown silty sand	13.6			
TP-5	6	sand	bag	brown silty sand	5.0			
TP-6	1	silt	bag	brown silty sand	14.1			
TP-6	9-10	silt/sand	bag	brown silty sand	8.5	2.63	hydrometer, gradation	

GOODSON & ASSOCIATES, INC.

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO: 6583.01

Boring No.	Depth (feet)	Sample Identification	Type of Sample	Visual Description	Natural Moisture (%)	Specific Gravity	Other Testing	Remarks
TP-7	4-5	silt	bag	brown silty sand	9.7		hydrometer, gradation, stan. proctor	
TP-7	9-10	sand	bag	brown sandy silt	7.4		hydrometer, gradation	
TP-8	3-5	sand	bucket	brown sand	5.5	2.63	gradation, standard proctor	
TP-9	5	silt	bag	brown silty clay	9.0			hole in bag when received
TP-10	2-3	silt	bucket		12.4	2.63	hydrometer, gradation, stan. proctor	
TP-15	6	sand	bag	brown slightly gravelly sandy silt	5.6		gradation	
B-4	-	cuttings - Mancos	bucket		--		standard proctor	
--	-	Bentonite	bag	industrial bentonite	--		standard proctor	
TP-2	6-7	80% soil, 20% bentonite	--	---	--		standard proctor	
TP-2	6-7	95% soil, 5% bentonite	--	---	--		standard proctor	
P-1	20	P-1-5A, 20-20.2	jar	gray siltstone	8.5			
P-1	25	P-1-6A, 24.5-25	jar	gray siltstone	9.2			
P-2	20	P-2-4B, 20.5-21	jar	brown silty clay	25.0			
P-3	20	P-3-4B, 20.5-21	jar	brown silt/clay	24.9			
P-4	20	P-4-4B, 20.5-21	jar	brown silty clay	25.0			
P-4	30	P-4-5B, 30.5-31	jar	gray silty clay	24.4			24.6% after 1 wk w/ loose lid
P-5	20	P-5-4B, 20.5-21	jar	brown silty clay	9.8			12.0% after 1 wk w/ loose lid

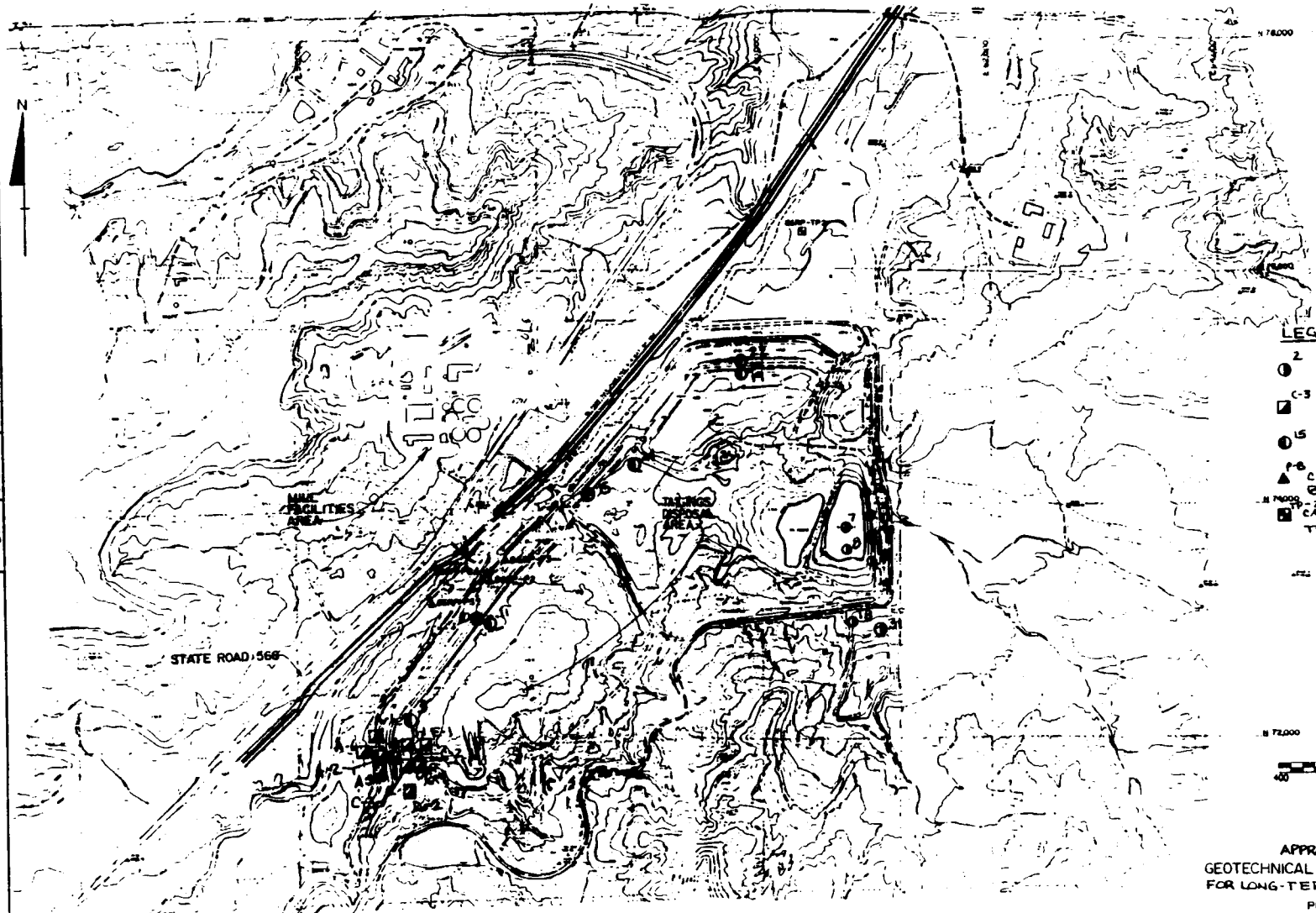
Note: P-5 @ 30' was not in the group of samples delivered on 12-24-86 for testing.

GOODSON & ASSOCIATES, INC.

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO: 6583.01

Boring No.	Depth (feet)	Sample Identification	Type of Sample	Visual Description	Natural Moisture (%)	Specific Gravity	Other Testing	Remarks
P-6	15	P-6-3B, 15.5-16	jar	brown silty clay	8.2			
P-6	20	P-6-4B, 20.5-21	jar	brown clayey silt	8.1			
P-6	30	P-6-5B, 30.5-31	jar	brown silty clay	5.2			8.2% after 1 wk with loose lid
P-8	15	P-8-3A, 16-16.5	jar	brown silty clay	21.9			23.2% after 1 wk w/ loose lid
P-8	20	P-8-4B, 20.5-21	jar	brown silty clay	22.8			
P-8	30	P-8-5A, 31-31.5	jar	brown silty clay	30.4			



LEGEND:

- 78-1096 SERIES BORING BY SHB
- 79-1096 SERIES TEST PIT BY SHB
- 78-1041 SERIES BORING BY SHB
- CANONIE RECLAMATION PLAN BORING
- CANONIE RECLAMATION PLAN TEST PIT

APPROXIMATE
GEOTECHNICAL EXPLORATION LOCATIONS
FOR LONG-TERM MOISTURE CONTENT

PREPARED FOR

UNC MINING AND MILLING
GALLUP, NEW MEXICO

Canonie Environmental

DATE	FIGURE 4-1	DRAWING NUMBER
SCALE		

DRAWN BY	CHECKED BY	DWG.	DRAWING NUMBER
J.M. Moyer 5-26-87	APPROVED BY	5-28-87	RM86-060-E56

REVISIONS	NO.	DATE

Purpose

The purpose of this calculation brief is to determine the long-term moisture content of the soil cover at the UNC site.

Summary

The moisture content was calculated to be 13.4%.

References

1) "Stability and Integrity Assessment Church Rock Tailings Dam, Church Rock New Mexico. Volume 3 - Breach Investigation." Sergent, Hauskins, and Beckwith. (SHB Job. No. E79-1096) August, 1979.

Method

The long-term moisture content was calculated as follows:

I. The most probable percentage of each of the major soil types (ie. sand, silt, and clay) that will be in the soil cover was calculated based on grain size analysis results, boring log descriptions, laboratory description, and visual analysis of representative samples obtained at depths from 0 to 20 feet within the pipeline arroyo. The depth of excavation for the cover material will not exceed twenty feet. The cover

material will be excavated primarily from the pipeline arroyo.

Attached to this calculation brief are the laboratory results and borings logs from the pipeline arroyo.

II. The average moisture content of each of the major soil types was calculated from laboratory results from soil samples obtained in test pits and soil borings by SHB and Canonie at the UNC site.

III. The composite moisture content was calculated as follows:

$$\omega_{comp} = (\%_{sand})(\bar{\omega}_{sand}) + (\%_{silt})(\bar{\omega}_{silt}) + (\%_{clay})(\bar{\omega}_{clay})$$

CALCULATIONS

I. Percentage of Soil Type

Table 1 presents the calculation for the percent sand and percent fines (ie silt and clay) in the soil cover. Soil samples were obtained at regular depth intervals of approximately five feet. The percent of sands were obtained from either gradation analysis, boring logs, laboratory classification, or visual classification.

The thickness of the strata designated by each soil sample was assumed to extend from the depth of the sample to the depth of the sample above it, or the ground surface for the top sample.

The thickness of the sands and fines was calculated by multiplying the thickness of

the strata by the percentage of the soil type. This is demonstrated in the following example for boring P-3:

Sample #1
Sample Depth = 6'
Percent Sand = 30%
Percent Fines = 70%
Thickness of Strata = 6' − 0' = 6'
Thickness of Sand = 6' × 0.30 = 1.8'
Thickness of Fines = 6' × 0.70 = 4.2'

Sample #2
Sample Depth = 10'
Percent Sand = 34%
Percent Fines = 66%
Thickness of Strata = 10' − 6' = 4'
Thickness of Sand = 4' × 0.34 = 1.36'
Thickness of Fines = 4' × 0.66 = 2.64'

As shown on Table 1,
Total Sand Thickness = 48.86'
Total Fines Thickness = 77.14'

$$\text{Percentage Sands} = \frac{48.86}{48.86 + 77.14} = 39\%$$

$$\text{Percentage Fines} = \frac{77.14}{48.86 + 77.14} = 61\%$$

Based on visual description, it is estimated that the percent of silt is 40%. Therefore -

Sand = 39%
Silt = 40%
Clay = 21%

II. CALCULATION OF MOISTURE FOR SOIL TYPE

The moisture content for each soil type was calculated by averaging the moisture contents from soil data obtained by Canonie and Sergent, Hauskins & Beckwith (SHB)

Tables 2 through 8 present the calculations of the average moisture contents. Figures 1 through 4 present a plot of moisture content versus depth for the components.

The final moisture contents were determined from the predominant soil fraction in each soil type. For example, the moisture content from a sample of sandy clay was used to determine the average for clay.

Table 9 presents a summary of the moisture contents. The average moisture contents were calculated to be:

$\bar{\omega}_{sand} = 10.12\%$

$\bar{\omega}_{silt} = 15.93\%$

$\bar{\omega}_{clay} = 14.80\%$

Canonie Environmental

D-36

By MMP Date 2/11/91 Subject LONG-TERM MOISTURE CONTENT Sheet No. 4A of 13

Chkd. By DAG Date 2/11/91 Proj. No. 96-060-01

1/4" X 1/4

BECAUSE THE IN-SITU MOISTURE CONTENT OF COARSE TAILINGS MEASURED DURING FIELD INVESTIGATIONS PERFORMED PRIOR TO RECLAMATION DESIGN IN 1986 ARE NOT CONSIDERED REPRESENTATIVE OF LONG-TERM CONDITIONS FOR THE COARSE TAILINGS, THE VALUE FROM IN-SITU MOISTURES OF NATIVE SOILS WITH APPROXIMATELY THE SAME CHARACTERISTICS AND GRADATION ARE USED. AS SHOWN ON PAGE 4 AND DESCRIBED MORE FULLY IN THE FOLLOWING PAGES, THE AVERAGE VALUE OF MOISTURE CONTENT OF NATIVE SOILS IS 10.1% THIS IS FROM A SAMPLE SIZE OF 79 SAMPLES AND IS DEFINITELY REPRESENTATIVE OF LONG-TERM MOISTURE OF THE COARSE TAILINGS

By SRP Date 6/24/88 Subject LONG-TERM MOISTURE CONTENT Sheet No. 5 of 19

Chkd. By MJG Date 6/27/88 UNC SOIL COVER Proj. No. 86-060-01

1/4 X 1/4

III COMPOSITE MOISTURE CONTENT

The composite moisture content was calculated as follows:

$$\text{Average Moisture Content} = (\%\ \text{sand})(\bar{\omega}_{sand}) + (\%\ \text{silt})(\bar{\omega}_{silt}) + (\%\ \text{clay})(\bar{\omega}_{clay})$$

Where $\bar{\omega}$ = Average Moisture Content

$$(0.39)(10.12) + (0.40)(15.93) + (0.21)(14.80) = \underline{\underline{13.4\%}}$$

Canonie Environmental

By TMK Date 2/27/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 6 of 19

Chkd. By SRP Date 3/4/87 UNC SOIL COVER Proj. No. 86-060-01

TABLE 1 – PERCENTAGE OF SANDS AND 1/4" X 1/4" FINES.

Data from Goodson & Associates Laboratory Test Results

Boring No.		Depth	% sand	% Fines	thickness sand	thickness fines
P-1		3	100	0	3	0
		6	0	100	0	3
P-2		6	90	10	5.4	.6
	*	10	0	100	0	4
		15	10	90	.5	4.5
		20	0	100	0	5
P-3		6	30	70	1.8	4.2
	*	10	34	66	1.36	2.64
		15	40	60	2	3
		20	0	100	0	5
P-4	*	5	68	32	3.4	1.6
		10	70	30	3.5	1.5
		15	100	0	5	0
		20	0	100	0	5
P-5	*	6	53	47	3.18	2.82
		10	60	40	2.4	1.6
		15	80	20	4	1
		20	0	100	0	5
P-6		6	60	40	3.6	2.4
		10	60	40	2.4	1.6
		15	60	40	3	2
		20	60	40	3	2
P-8		5	10	90	.5	4.5
	*	11	7	93	.42	5.58
		15	10	90	.4	3.6
		20	0	100	0	5
					43.86	77.4
					Total	26
					39%	61%
					sand	silt/clay

* denotes grain size analysis
other samples were
estimated for % sand and
% fines (silt/clay)

Canonie Environmental

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By Tmk Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 7 of 19

Chkd. By SRP Date 3/12/87 UNC SOIL COVER Proj. No. RMR-960-01

1/4" X 1/4"

TABLE 2

Canonie Test Pits

Boring No.	Depth (ft)	Sand Nat. Moisture	Description
P-1	15	7.0	Silty Sand
P-2	5	9.8	Sand
P-3	10	16.2	Silty Sand
P-4	5	10.6	Silty Sand
P-5	10	4.6	Silty Sand
P-5	15	19.4	Silty Sand
P-6	5	6.6	Silty Sand
P-6	10	3.6	Silty Sand
TP-1	5-6	7.8	Silty Sand
TP-2	4-5	11.8	Silty Sand
TP-2	6-7	11.9	Silty Sand
TP-3	11-12	27.0	Silty Sand
TP-4	8-9	6.5	Silty Sand
TP-5	1-2	13.6	Silty Sand
TP-5	6	5.0	Silty Sand
TP-6	9-10	8.5	Silty Sand
TP-7	9-10	7.4	Silty Sand
TP-8	3-5	5.5	Sand
TP-15	6	5.6	Silty gravel in Sand
	N = 19	Σ 188.4	

$\bar{X}$ = 9.92

S = 5.86

95% confidence interval 7.3 to 12.6

By TMK Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 8 of 17

Chkd. By SRP Date 3/12/87 UNC SOIL COVER Proj. No. KM 76-060-01

1/4" X 1/4"

TABLE 3

SHB Test Pits (Report E79-1096)

Sand

Test Pit No.	Depth (ft)	Nat. moisture
A1-7	2.0	11
A2-1	20.0	11
A2-9	2.5	11
A2-10	4.5	8
A2-11	7.5	18
A3-7	3.0	7
A4-3	4.0	7
A4-7	2.5	7
A5-5	5.0	5
A5-9	5.0	9
A6-3	4.5	8
A6-7	4.5	6
A7-2	5.0	6
A7-5	5.0	5
C3-7	5.0	14
		Σ 133

N = 15 $\bar{X}$ = 8.87

S = 3.60

95 % confidence interval 7.0 to 10.7

Canonie Environmental

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By TMK Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 9 of 19

Chkd. By [illegible] Date 3/2/87 UNC SOIL COVER Proj. No. [illegible]

1/4" X 1/4"

TABLE 4

SHB Test Pits (Report E79-1096)

Silty Sand

Test Pit No.	Depth (ft)	Nat. Moisture
A1-3	9.0	14
A1-4	3.5	7
A1-5	1.5	9
A1-6	3.5	10
A1-8	4.5	9
A1-9	5.0	14
A2-2	4.0	11
A2-3	5.6	14
A2-12	1.7	16
A2-13	3.0	15
A3-3	4.5	11
A3-4	2.0	9
A3-5	1.0	9
A3-6	1.5	13
A3-9	2.0	13
A4-1	9.0	12
A4-2	5.5	12
A4-4	1.5	7
A4-5	5.5	5
A4-6	7.5	18
A4-8	1.5	9
A5-2	9.0	4

sand + silty sand combined:

N = 60 $\bar{x}$ = 10.18

s = 3.66

95% confidence 9.3 to 11.1

Test Pit No.	Depth (ft)	Nat. Moisture
A5-3	7.5	13
A5-4	6.5	8
A5-6	2.5	12
A5-8	2.0	14
A6-2	5.5	9
A6-4	2.0	8
A6-8	3.5	8
A7-1	7.0	6
A7-4	6.5	7
A7-6	3.0	14
C3-2	6.5	11
C4-2	2.5	10
C4-3	4.0	13
C4-4	6.0	10
C4-7	3.0	7
C4-8	4.0	9
C4-10	6.0	12
C4-13	8.0	19
C4-14	5.0	7
C4-15	7.5	19
C4-19	2.2	8
C4-20	3.5	7
C4-21	4.5	6

N = 45 Σ 478

$\bar{x}$ = 10.62

s = 3.61

95% confidence interval 9.6 to 1[illegible]

By TTK Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 10 of 19

Chkd. By SEO Date 3/12/87 UNC SOIL COVER Proj. No. 86-060-01

1/4" X 1/4"

TABLE 5

Canonie Test Pits
Silt

Boring No.	Depth (ft)	Nat Moisture	Description	$(x-\bar{x})^2$
P-1	3	12.8	Sandy Silt	1.85
P-8	10	17.5	Silt	36.72
TP-3	7-8	6.7	Sandy Silt	22.47
TP-4	2-3	13.6	Sandy Silt	4.67
TP-6	1	14.1	Sandy Silt	7.08
TP-7	4-5	9.7	Sandy Silt	3.03
TP-9	5	9.0	Clayey Silt	5.95
P-6	20	8.1	Clayey Silt	11.16
	N = 8	Σ 91.5		Σ 92.9
		$\bar{x}$ = 11.44		
		S = 3.64	95% Limits 8.9 to 14.0	

By [illegible] Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 11 of 19

Chkd. By [illegible] Date 3/12/87 UNC SOIL COVER Proj. No. 86-060-01

1/4" X 1/4"

TABLE 6

SHB Test Pits (Report E79-1096)

Sandy Silt

Test Pit No	Depth (ft)	Nat. Moisture
C1-6	4.0	24
C1-7	5.0	18
C1-8	6.0	21
C1-9	8.0	22
C1-10	8.0	19
C1-11	9.0	18
C1-12	10.0	20
C1-17	7.2	13
C1-18	8.2	13
C1-19	9.0	22
C1-25	9.0	16
C1-26	7.0	21
		Σ 227

N = 12

$\bar{x}$ = 18.92 ✓ DWK 5/14/87

s = 3.50 ✓ DWK 5/14/87

95% confidence interval: 16.9 to 20.9

Canonie Environmental

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By [illegible] Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 12 of 19

Chkd. By SRP Date 3/12/87 UNC SOIL COVER Proj. No. RMPS-060-01

1/4" X 1/4"

TABLE 7

Canonie Test Pits

Clay

Boring No.	Depth (ft)	Nat. Moisture	Description	$X-\bar{X}$	$(X-$
P-1	6	34.8	Clay	14.8	21
P-2	10	20.3	Clay	0.3	.0
P-2	15	20.2	Sandy Clay	0.2	.0
X P-3	5	29.2	Sandy Clay	9.2	84.6
P-3	15	21.4	Sandy Clay	1.4	19
P-4	10	16.8	Sandy Clay	-3.2	10
X P-4	15	13.0	Clay	-7.0	49
P-5	5	7.6	Silty Clay	-12.4	15
P-8	5	17.0	Sandy Clay	-3.0	9.
P-8	15	23.0	Sandy Clay	3.0	9.
P-2	20	25.0	Silty Clay	5.0	25
P-3	20	24.9	Silty Clay	4.9	24
P-4	20	25.0	Silty Clay	5.0	25
P-4	30	24.4	Silty Clay	4.4	19.
P-5	20	9.8	Silty Clay	-10.2	104
X P-6	15	8.2	Silty Clay	-11.8	139
X P-6	30	5.2	Silty Clay	-14.8	219
P-8	15	21.9	Silty Clay	1.9	3.6
P-8	20	22.8	Silty Clay	2.8	7.8
P-8	30	30.4	Silty Clay	10.4	108
		400.9			121

$\bar{X} = 20.05$ SAY 20.0

$N = 20$

$S = \sqrt{\frac{\Sigma(X-\bar{X})^2}{N-1}} = 7.99$

$\bar{X} \pm 1.96\,S/\sqrt{N}$ =

= 6.64 to 23

LIMITS OF 95% CONFIDENCE INTERVAL = 16.54 to 23.55

By TMK Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 13 of 19

Chkd. By SRP Date 3/12/87 UNC SOIL COVER Proj. No. M86-260-01

1/4" X 1/4"

TABLE 8

SHB Test Pits (Report E79-1096)

Sandy Clay

Test Pit No.	Depth (ft)	Nat. Moisture
A1-1	10.5	18
A1-2	10.5	16
A2-4	7.1	16
A2-5	9.0	16
A2-6	9.0	15
A2-7	9.0	13
A2-8	9.0	17
A3-1	12.0	14
A3-2	7.0	16
A3-8	6.0	20
A5-7	0.5	16
A5-10	2.0	10
A6-1	11.5	21
A6-5	1.0	12
A6-6	6.5	18
A6-9	1.0	14
A7-3	3.0	12
A7-7	2.0	11
C1-1	0	18
C1-2	0.5	22
C1-3	1.8	15
C1-4	2.2	22
C1-5	3.0	13
C1-13	11.0	21
C1-14	12.0	21
C1-15	13.0	17
C1-16	14.0	17
C1-20	10.0	18

Test Pit No.	Depth (ft)	Nat. Moisture
C1-21	11.0	12
C1-22	12.5	14
C1-23	14.0	12
C1-24	14.0	14
C2-4	7.0	8
C2-5	5.0	19
C2-6	3.0	12
C2-7	2.0	11
C2-8	5.0	16
C2-9	2.0	12
C3-4	5.5	17
C3-5	4.5	12
C3-6	3.5	14
C3-8	2.5	14
C3-9	0.5	12
C3-10	2.5	11
C3-11	3.5	14
C3-12	4.5	17
C3-13	5.5	14
C3-14	6.5	19
C3-15	7.5	17
C4-1	1.0	13
C4-5	9.0	20
C4-6	1.5	13
C4-12	8.0	18
C4-16	8.2	15
C4-17	9.0	18
C4-18	9.8	17

Canonie Environmental

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By TMK Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 14 of 19

Chkd. By SRP Date 3/12/87 UNC SOIL COVER Proj. No. RM86-060-01

1/4" X 1/4"

Sandy Clay (cont.)

Test Pit No.	Depth (ft)	Nat. Moisture
C4-25	7.5	6
C4-26	8.5	9
D1-1	6.0	12
D1-2	7.0	12
D1-3	8.0	10
D1-4	10.0	8
D1-5	12.0	10
D1-6	15.0	10
D1-7	16.0	10
D1-8	17.0	13
D1-9	18.0	11
D1-10	19.0	12
D1-11	20.0	16
D1-12	21.0	12
D1-13	22.0	12
D1-14	23.0	9
D1-15	24.0	10
D1-16	25.0	12
D1-17	26.0	14
D1-18	27.0	14
D1-19	28.0	14
D1-20	29.0	11
D2-1	2.0	16
D2-2	3.0	2
D2-3	4.0	10
D2-4	5.0	14
D2-5	6.0	10
D2-6	7.0	6
D2-7	9.0	11

Test Pit No.	Depth (ft)	Nat. Moisture
D2-8	11.0	11
D2-9	13.0	10
D2-10	15.0	11
E1-1	1.5	4
E1-2	3.5	5
E1-3	4.5	6
E1-4	5.5	13
E1-5	6.5	17
E1-6	7.5	12
E1-7	8.5	20
E1-8	10.5	20
E1-9	11.5	7
E1-10	12.5	9
E1-11	13.0	10
E1-12	13.5	13
E1-13	14.0	15
E1-14	14.5	17
E1-15	15.0	20
E1-16	15.5	17
E1-17	15.0	12
E1-18	16.0	20
E1-19	16.8	13
E1-20	17.2	19

Σ 1493

N = 108 $\bar{x}$ = 13.82 ✓DWK 5/1

s = 4.13 ✓DWK 5

95% confidence interval 13.0 to 14.6

By SRP Date 6/24/88 Subject LONG-TERM MOISTURE CONTENT Sheet No. 15 of 19

Chkd. By [illegible] Date 6/27/88 UNC SOIL COVER Proj. No. 86-060-01

1/4" X 1/4"

TABLE 9

SUMMARY OF MOISTURE CONTENTS

	Average, $\bar{x}$	Number, n	Standard Deviation, σ	95% Confidence Interval
SAND				
Canonie	9.92	19	5.86	7.3 - 12.6
SHB	10.18	60	3.66	9.3 - 11.1
SILT				
Canonie	11.44	8	3.64	8.9 - 14.0
SHB	18.92	12	3.50	16.9 - 20.9
CLAY				
Canonie	20.05	20	7.99	16.5 - 23.6
SHB	13.82	108	4.13	13.0 - 14.6
COMBINED				
Sand	10.12	79	4.25	9.2 - 11.1
Silt	15.93	20	5.11	13.7 - 18.2
Clay	14.80	128	5.39	13.9 - 15.7

Canonie Environmental

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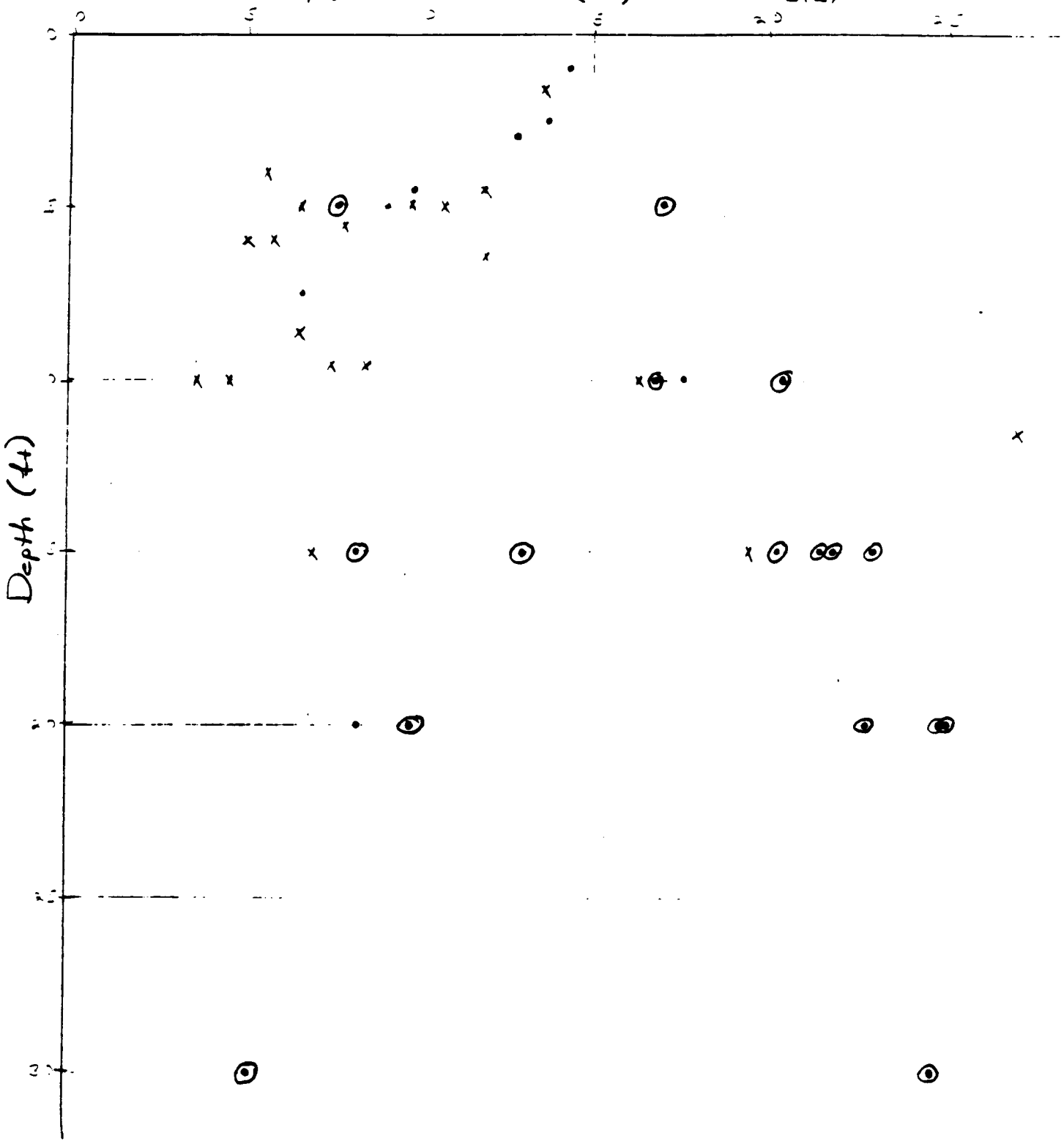
By TMK Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 16 of 19

Chkd. By SKP Date 3/2/87 UNC SOIL COVER Proj. No. PMX-363-01

1/4" X 1/4"

Figure 1
(Canonie Samples)
Natural Moisture (%)

x sand
• silt
• clay



Canonie Environmental

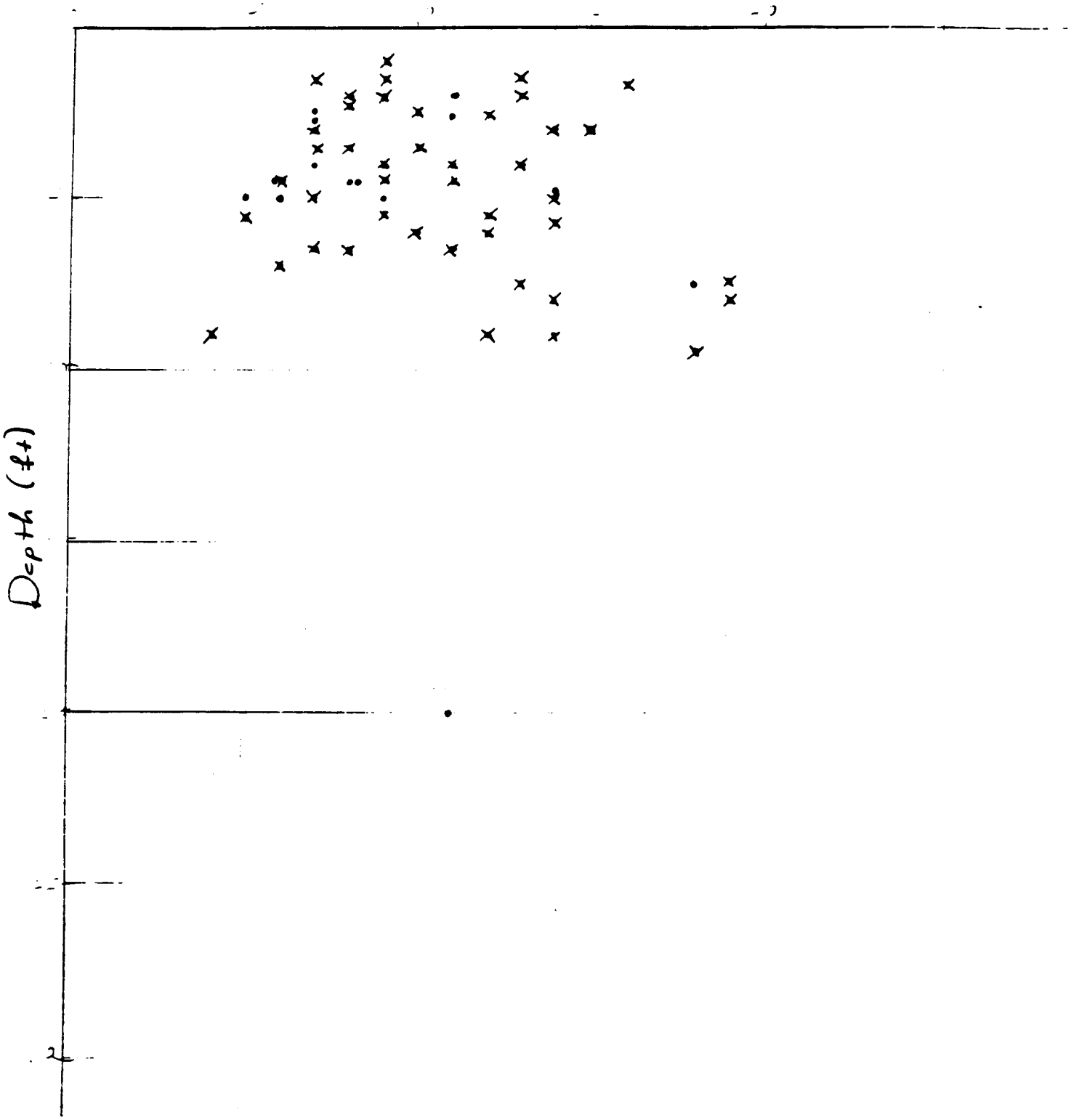
By JMK Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 17 of 19

Chkd. By CBP Date 3/12/87 UNC SOIL COVER Proj. No. RM86-060-01

1/4" X 1/4"

Figure 2
(SHB Samples)
Natural Moisture (%)

• sand
x silty sand



Canonie Environmental

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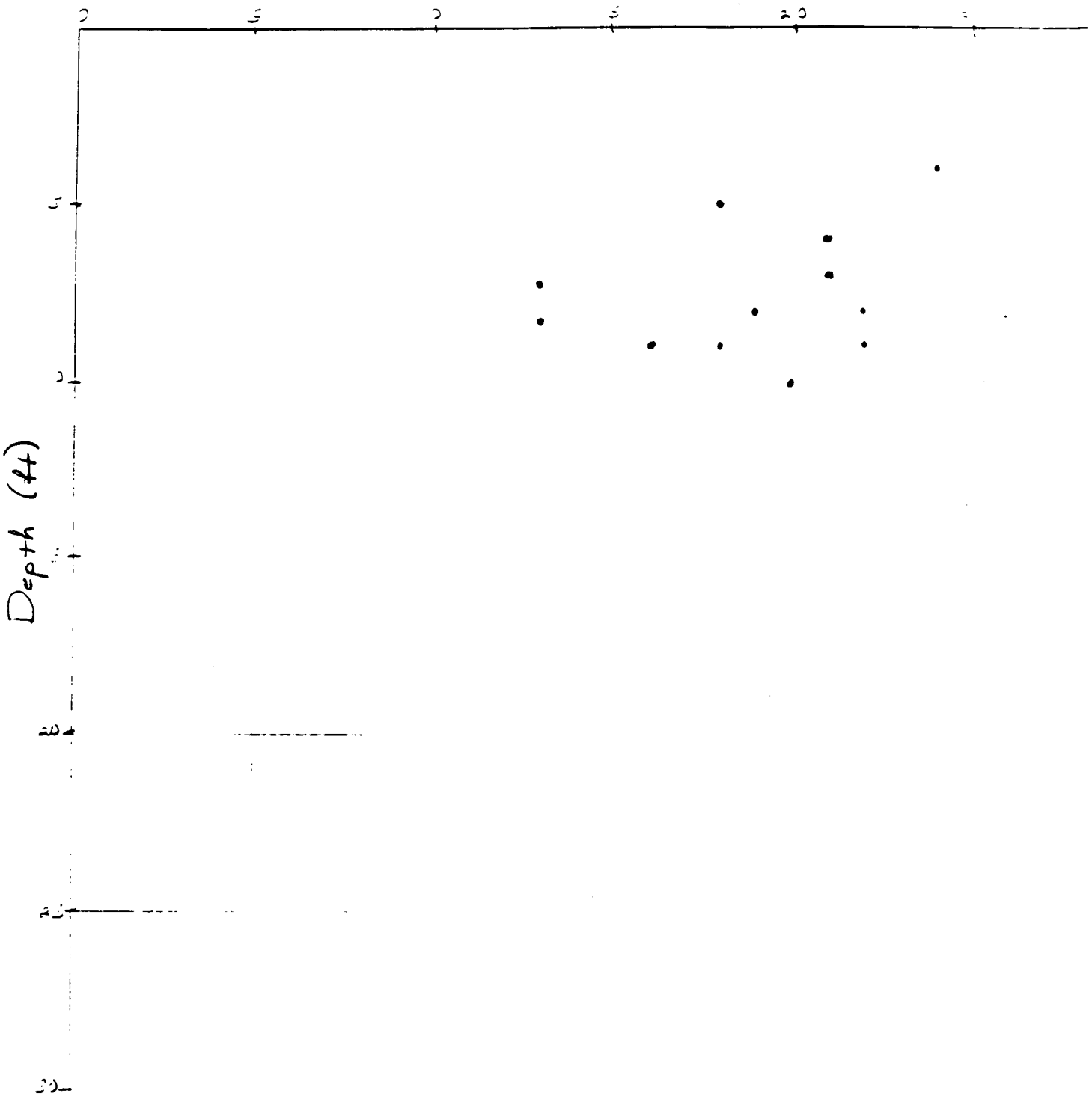
By TMK Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 18 of 19

Chkd. By SRP Date 3/12/87 UNC SOIL COVER Proj. No. RMP6-060-01

1/4" X 1/4"

Figure 3
(SHB Samples)
Natural Moisture (%)

Sandy Silt



Canonie Environmental

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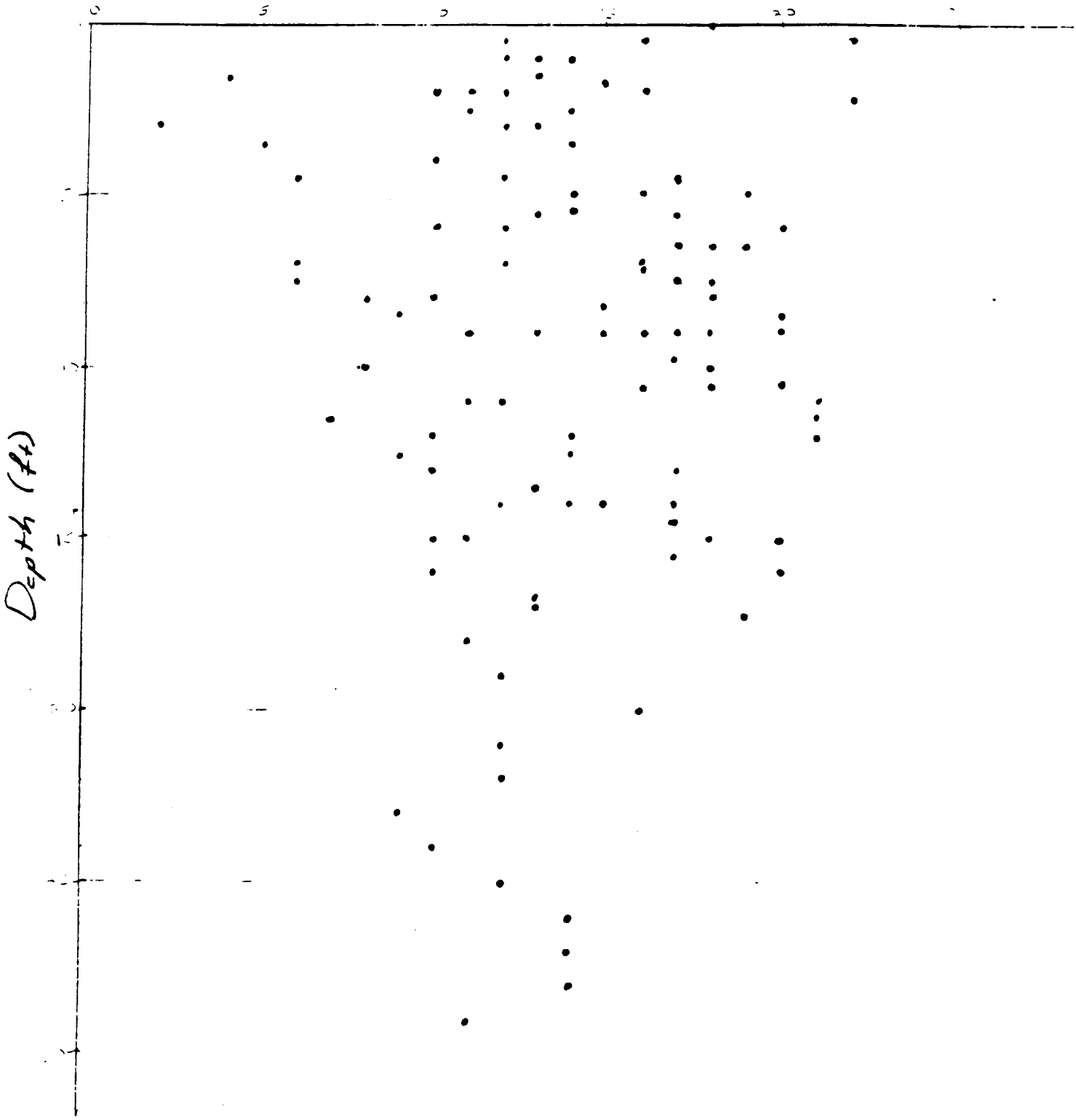
By TMK Date 1/29/87 Subject LONG-TERM MOISTURE CONTENT Sheet No. 19 of 19

Chkd. By SRP Date 3/12/87 UNC SOIL COVER Proj. No. RMR-060-01

1/4" X 1/4"

Figure 4
(SHB Samples)
Natural Moisture (%)

Sandy Clay



FINE TAILINGS IN-SITU MOISTURE CONTENTS

HOLE 06L
SOUTH POND

DEPTH INTERVAL FEET (SAMPLE RECOVERY)	DESCRIPTION	SOIL CLASS	% LESS THAN 200 MESH	SPECIFIC GRAVITY SOLIDS	DRY BULK DENSITY lbs/ft³	POROSITY %	MOISTURE CONTENT % OF DRY WT	STD. PROCTOR OPTIMUM MOISTURE CONTENT, %	OPTIMUM DRY DENSITY lbs./ft³	K cm/sec @ 80% STD PROCTOR	COMPRESSION INDEX @ 21 PSI	2a-2b kg/cm²	DIFFUSION COEFFICIENT cm²/s	EMBEDDING FRACTION
0-2.5	Coarse sand, damp													
2.5-5.0 (2.0')														
5.0-7.5	Coarse sand, damp													
7.5-10.0 (2.0')														
10.0-12.5	Coarse-medium sand damp			2.80	92	47	8.1					1.15±.2	4.2×10^{-2}	0.27±.02
12.5-15.0 (2.5')														
15.0-17.5	Coarse sand wet				97	49 calc.	24.1				.043			
17.5-20.0 (5.0')	Wet at 15'													
20.0-22.5	Coarse sand wet			2.78	96	36	25.1					1.08±.2	2.1×10^{-5}	0.33±.02
22.5-25.0 (4.5')														
25.0-27.5	Coarse-medium sand wet brown			2.79	94	46	23.6					1.77±.2	1.3×10^{-6}	0.28±.02
(7.5')														
27.5-30.0	Coarse-medium sand wet gray													
30.0-32.5	Coarse-medium sand wet													
32.5-35.0 (3.0')														
35.0-37.5	Medium sand wet brown			2.78	84	51	26.4					5.7±.4	6.1×10^{-6}	0.27±.01
37.5-40.0 (4.5')	Slimes wet gray				87	55 calc.	43.0				.082			
40.0-42.5	Mixed sands & slimes													
42.5-45.0 (5.0')	Wet slime to 44.0													
45.0-47.5	Contact at 44' Silt/clay alluvium wet													
47.5-50.0 (4.5')	TD = 50'													

HOLE 1660
CENTRAL CELL - EAST

DEPTH INTERVAL FEET	DESCRIPTION (SAMPLE RECOVERY)	SOIL CLASS	% LESS THAN 200 MESH	SPECIFIC GRAVITY SOLIDS	DRY BULK DENSITY lbs/ft³	POROSITY %	MOISTURE CONTENT % of DRY WT	STD. PROCTOR OPTIMUM ρ lbs./ft³	OPTIMUM MOISTURE CONTENT, %	K cm/sec @ 90% STD. PROCTOR	COMPRESSION INDEX @ 21 psi	Ra-226 pCi/g	DIFFUSION COEFFICIENT cm²/s	EMENATING FRACTION
0-2.5	Road fill													
2.5-5.0 (3.7')	Tailings sands													
5.0-7.5	Sand, damp											341±3	1.1x10⁻⁶	0.37±.01
	Slime 7.5-8.0, wet			2.81	74	58	44.2							
7.5-10.0 (4.7')	Fine sand 8.0-10.0													
10.0-12.5	Sand, wet											1099±6	1.6x10⁻⁶	0.31±.01
				2.84	94	47	60.0							
12.5-15.0 (3.7')	Clay slimes wet													
15.0-17.5	Sands wet													
17.5-20.0 (2.8')														
20.0-22.5	Coarse-fine sands wet											285±3	1.6x10⁻⁶	0.26±.01
22.5-25.0 (5.0')				2.75	89	49	32.1							
25.0-27.5	Fine sand wet													
27.5-30.0 (5.0')	Very fine sand/slime, wet													
30.0-32.5	Fine sand wet											526±4	2.7x10⁻⁶	0.28±.01
32.5-35.0 (4.5')				2.84	79	56	41.4							
35.0-37.5	Clay slime wet										1.00			
		values of 38" slimes			73	59 conc.	44.5					19±1	3.2x10⁻⁶	0.29±.10
37.5-40.0 (5.0')	Alluvium at 39.5			2.78	96	45	27.9							
40.0-42.5	Alluvium wet													
42.5-45.0 (5.0')	TD = 45'													
~~45.0-47.5~~	screened 40-45'													

HOLE 1059

CENTRAL CELL TAILINGS - CYCLONE STOCKPILE

DEPTH INTERVAL FEET (SAMPLE RECOVERY)	DESCRIPTION	SOIL CLASS	% LESS THAN 200 MESH	SPECIFIC GRAVITY SOLIDS	DRY BULK DENSITY lbs/ft³	POROSITY %	MOISTURE CONTENT % of DRY WT	STD. PROCTOR OPTIMUM A lbs./ft³	OPTIMUM MOISTURE CONTENT, %	K cm/sec @ 80% STD. PROCTOR	COMPRESSION INDEX @ 21 PSI	2a-226 pCi/g	DIFFUSION COEFFICIENT cm²/s	EMENATING FRACTION
0-7.5	Coarse sands, damp													
7.5-50 (2.0')														
5.0-7.5	Medium-coarse sands, damp			2.84	95	46	6.1					125±2	3.7×10^{-2}	0.18±.02
1.5-10.0 (2.5')														
10.0-12.5	Medium-fine sands, damp													
12.5-15.0 (2.9')														
15.0-17.5	Medium-coarse sands, damp			2.83	94	47	10.5					227±2	2.3×10^{-2}	0.21±.01
17.5-20.0 (2.5')														
20.0-22.5	Medium sand, damp													
22.5-25.0 (2.9')	Fine slimy sand wet													
25.0-27.5	Medium-coarse sands, damp			2.74	97	43	13.1					132±2	1.6×10^{-2}	0.20±.02
27.5-30.0 (2.5')														
30.0-32.5	Fine-medium sand, damp				106	47	32.0							
32.5-35.0 (5.0')				2.72	78	54	29.6					602±4	5.6×10^{-3}	0.16±.01
35.0-37.5	Sand/slim mix, wet													
37.5-40.0 (4.5')	Alluvium at 39.0													
40.0-42.5	Clay/silt alluvium, damp			2.80	85	51	24.3					4±4	1.4×10^{-3}	0.14±.04
42.5-45.0 (5.0')	TD = 45'													

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CENTRAL CELL TAILINGS - WEST

...AL DESCRIPTION (SAMPLE RECOVERY)	SOIL CLASS	% LESS THAN 200 MESH	SPECIFIC GRAVITY SOLIDS	DRY BULK DENSITY lbs/ft³	POROSITY %	MOISTURE CONTENT % of DRY WT	STD. PROCTOR OPTIMUM A lbs./ft³	OPTIMUM MOISTURE CONTENT, %	K, cm/sec @ 80% STD PROCTOR	COMPRESSION INDEX @ 21 PSI	Ra-226 pCi/g	DIFFUSION COEFFICIENT cm²/s	EMENATING FRACTION
5 Fine sands dry													
30(2')													
5 Medium sands dry			2.81	88	50	17.8					40.2±3	6.7x10⁻³	0.22±.01
2.0(2.5')													
2.5 Fine - Medium sands dry				105	40 calc.	21.4				.018			
-15.0(4.5')													
-17.5 Medium sands - damp wet at 17.5'			2.83	104	41	23.5					160±2	5.3x10⁻⁶	0.32±.02
-20.0(4.5') Fine sands & slimes wet													
20.0-22.5 Fine sand wet													
25-25.0(3.5')													
0-27.5 Wet sand			2.81	98	44	23.4					141±2	1.9x10⁻⁵	0.27±.02
-30.0(4.5')				97	55 calc.	43.6				.055			
-32.5 Wet sand													
-35.0(4.5')													
-37.5 Wet sand			2.89	92	49	31.2					212±2	2.0x10⁻⁶	0.25±.01
-40.0(5.0')													
-42.5 Wet clay/silt - alluvium													
-45.0(5.0') Contact at 40' TD = 45'													
-45 screened 40-45'													