TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-1 Station 72+98E Range 25+05N Surface El 608.7

Date Drilled 12-9-80 To 12-9-80 Prepared By JLB Checked By CBC

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CL	19.1	28	11		
	605							
5			CH	18.0	70	45		
								BEDROCK
	600							
10								
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Shee
1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-2 Station 75+82E Range 22+23N Surface El 609.9

Date Drilled 12-9-80 To 12-9-80 Prepared By JLB Checked By CB

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CL	16.0	41	22		
5	605			18.5	53	30		
10	600		CH	21.7				
					69	48		
				28.3				
15	595		▨					BEDROCK
20	590							
25								
30								
35								

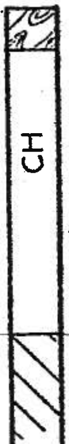
TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet
1 Of

Project WIDOWS CREEK N. P. Feature BORROW AREA

Boring PAH-3 Station 78 + 65E Range 19 + 40N Surface El 610.2

Date Drilled 12-9-80 To 12-9-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0	610							
				25.3	51	33		
			CH					
5	605			23.0	70	45		
								BEDROCK
10	600							
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-4 Station 81+48E Range 16+58N Surface El 617.6

Date Drilled 12-4-80 To 12-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CL	20.6	32	14		
	615							
5			CH	20.2	58	37		
	610							
								BEDROCK
10								
	605							
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S.P Feature BORROW AREA
Boring PAH-5 Station 84+32E Range 13+76N Surface El 620.2
Date Drilled 12-3-80 To 12-3-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0	620							
				37.3	79	47		
				36.6				
5	615							BEDROCK
10	610							
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-6 Station 87 + 15E Range 10 + 94N Surface El 607. 6

Date Drilled 12-3-80 To 12-3-80 Prepared By JLB Checked By CBK

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
				18.5				
	605		CL		40	21		
				19.0				
5								
				20.6	63	37		
	600							
10								
			CH	25.1				
	595							
					58	37		
15								
				27.0				
	590							
								BEDROCK
20								
	585							
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-7 Station 89 + 97E Range 13 + 77N Surface El 626 . 8

Date Drilled 12-3-80 To 12-3-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0			▨					
	625			29.7	63	37		
				30.2	79	47		
5			CH					
	620			26.9				
					58	37		
10								
	615			28.2				
15			▨					BEDROCK
	610							
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-8 Station 92 + 80E Range 16 +60N Surface El 630.2

Date Drilled 12-3-80 To 12-3-80 Prepared By JLB Checked By

Depth 1"=5'	El	SPT (N)	Log	W	LL	PI	X	Remarks
0	630							
			CL	21.7	42	18		
				27.1	48	25		
5	625							
			CH	26.9	58	37		
10	620							
				28.2	58	36		
								BEDROCK
15	615							
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet
1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-9 Station 87+14E Range 16+59N Surface El 623.7

Date Drilled 12-3-80 To 12-3-80 Prepared By JLB Checked By CBG

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
				25.3	63	13		
	620			26.4				
5			CH					
				30.9	65	40		
	615							
10				28.2				
								BEDROCK
	610							
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

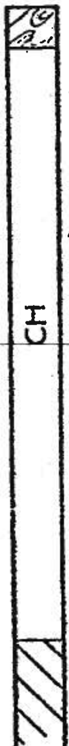
Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-10 Station 84+31E Range 19+42N Surface El 623.4

Date Drilled 12-3-80 To 12-3-80 Prepared By JLB Checked By CBL

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
				29.6				
	620				63	37		
5				28.7				
			CH					
	615							
10				33.4				
					77	47		
	610							
				30.2				
15								BEDROCK
	605							
20								
25								
30								
35								



TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-12 Station 87+13E Range 22+25N Surface El 612 .6

Date Drilled 12-3-80 To 12-3-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0			▨					
				30.1				
	610							
				31.6	67	44		
5			CH					
				24.2				
	605							
				27.7	63	41		
10								
	600		▨					BEDROCK
15								
	595							
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-11 Station 89+06E Range 19 + 43N Surface El 621.0

Date Drilled 12-3-80 To 12-3-80 Prepared By JLB Checked By

Depth 1"=5'	El	SPT (N)	Log	W	LL	PI	X	Remarks
0								
	620							
				33.9				
					79	47		
				32.1				
5								
	615		CH					
				22.8	67	44		
10								
				23.2	65	40		
	610							
								BEDROCK
15								
	605							
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA
Boring PAH-13 Station 70 + 16E Range 22 + 22N Surface El 607. 3
Date Drilled 12-19-80 To 12-19-80 Prepared By JLB Checked By CB

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	605			19.7	41	25		
			CL	18.5				
5								
					41	22		
	600							
				18.8				
10								
								BEDROCK
	595							
15								
	590							
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-14 Station 67+34E Range 19+38N Surface El 605.9

Date Drilled 12-8-80 To 12-8-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	605							
				19.7	51	33		
5	600		CH	21.1				
					51	35		
				19.2				
10	595							BEDROCK
15	590							
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-15 Station 64+51E Range 16+55N Surface El 608 . 7

Date Drilled 12-8-80 To 12-8-80 Prepared By ______ Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CL	26.1	47	25		
	605							
5				20.3	43	20		
	600							
10				20.2	46	24		
	595		CH					
15				28.6	51	35		
			▨					BEDROCK
	590							
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-16 Station 64+51E Range 16+55N Surface El 607.5

Date Drilled 12-9-8 To 12-9-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
				22.9	51	33		
	605		CH					
5				20.8	51	35		
	600							
								BEDROCK
10								
	595							
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-17 Station 70 + 17E Range 16 + 56N Surface El 606.3

Date Drilled 12-5-80 To 12-5-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	605		CL	18.7	49	25		
			CH	21.5	53	30		
5	600							
			CL	22.1	41	25		
10	595							DISCONTINUED
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-18 Station 67+35E Range 13+73N Surface El 606.1

Date Drilled 12-8-80 To 12-8-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	605			18.3				
					43	20		
5			CL	17.7				
	600							
				21.0	47	25		
								BEDROCK
10								
	595							
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-19 Station 64+52E Range 10+89N Surface El 604.0

Date Drilled 12-8-80 To 12-8-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CH	19.1	53	30		
	600							
5				18.7	49	25		
			CL					
	595							
10				24.2	46	24		
								BEDROCK
	590							
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-20 Station 75 + 83E Range 16 + 57N Surface El 610 .3

Date Drilled 12-9-80 To 12-9-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0	610							
			CH	28 .7				
					51	33		
				26 .8				
5	605							
								BEDROCK
10	600							
15								
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-21 Station 78 + 66E Range 13 + 75N Surface El 614.4

Date Drilled 12-4-80 To 12-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CL	25.9	42	18		
	610							
5				25.8				
			MH		51	21		
	605							
10				23.7				
	600							
15			CH	24.2	58	37		
								BEDROCK
	595							
20								
25								
30								
35								

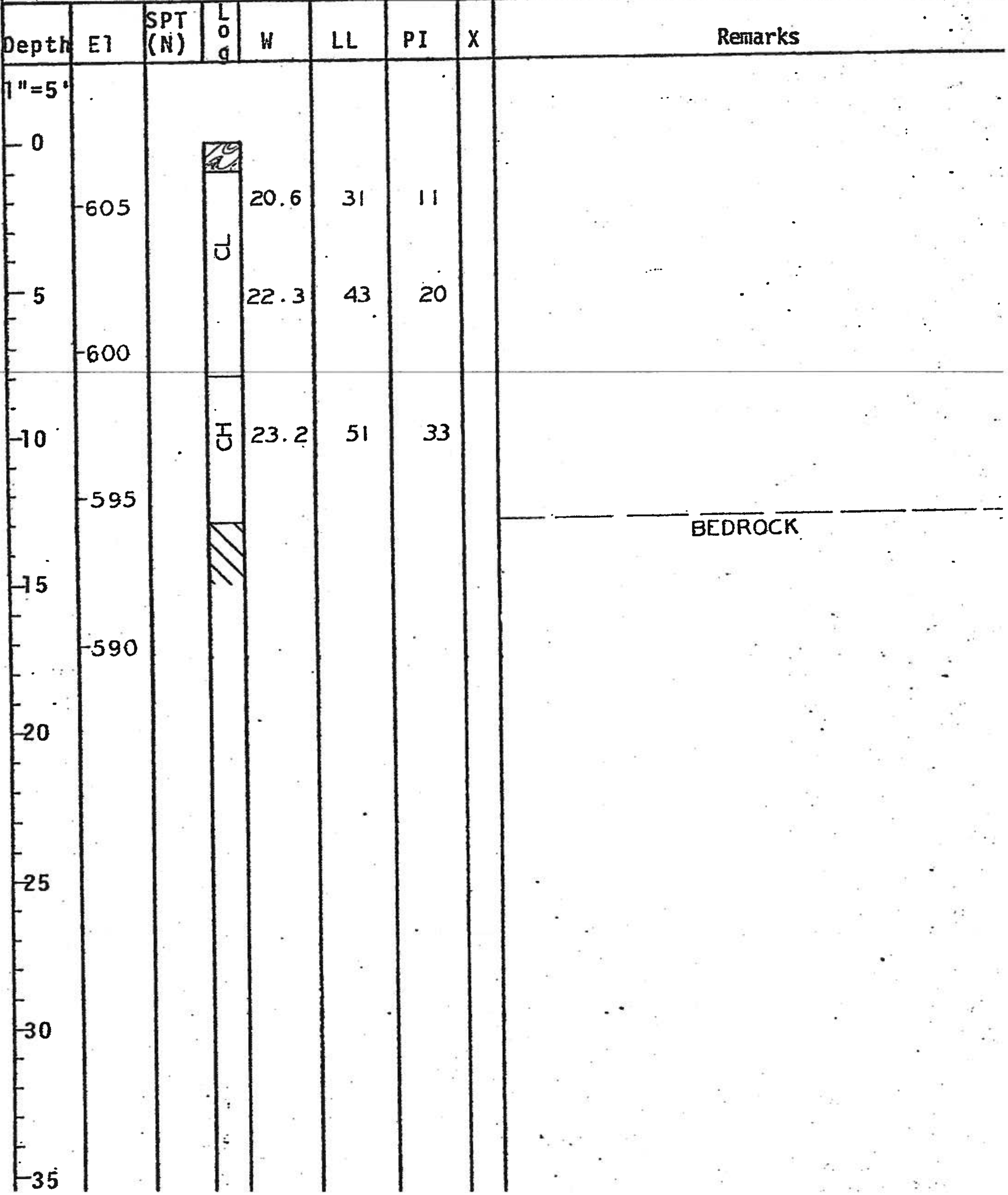
TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH 22 Station 73 + 00E Range 13 + 74W Surface El 607.1

Date Drilled 12-5-80 To 12-5-80 Prepared By JLB Checked By



Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
			CL	20.6	31	11		
				22.3	43	20		
			CH	23.2	51	33		
								BEDROCK

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-23 Station 75 + 84E Range 10 + 91N Surface El 613 .2

Date Drilled 12-4-80 To 12-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0			▨					
				25.0				
	610							
5				24.7				
	605							
10			MH	22.8	51	21		
	600							
15				24.2				
	595							
20				21.9				
	590							
25			CH	32.5	56	31		
								DISCONTINUED
	585							
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

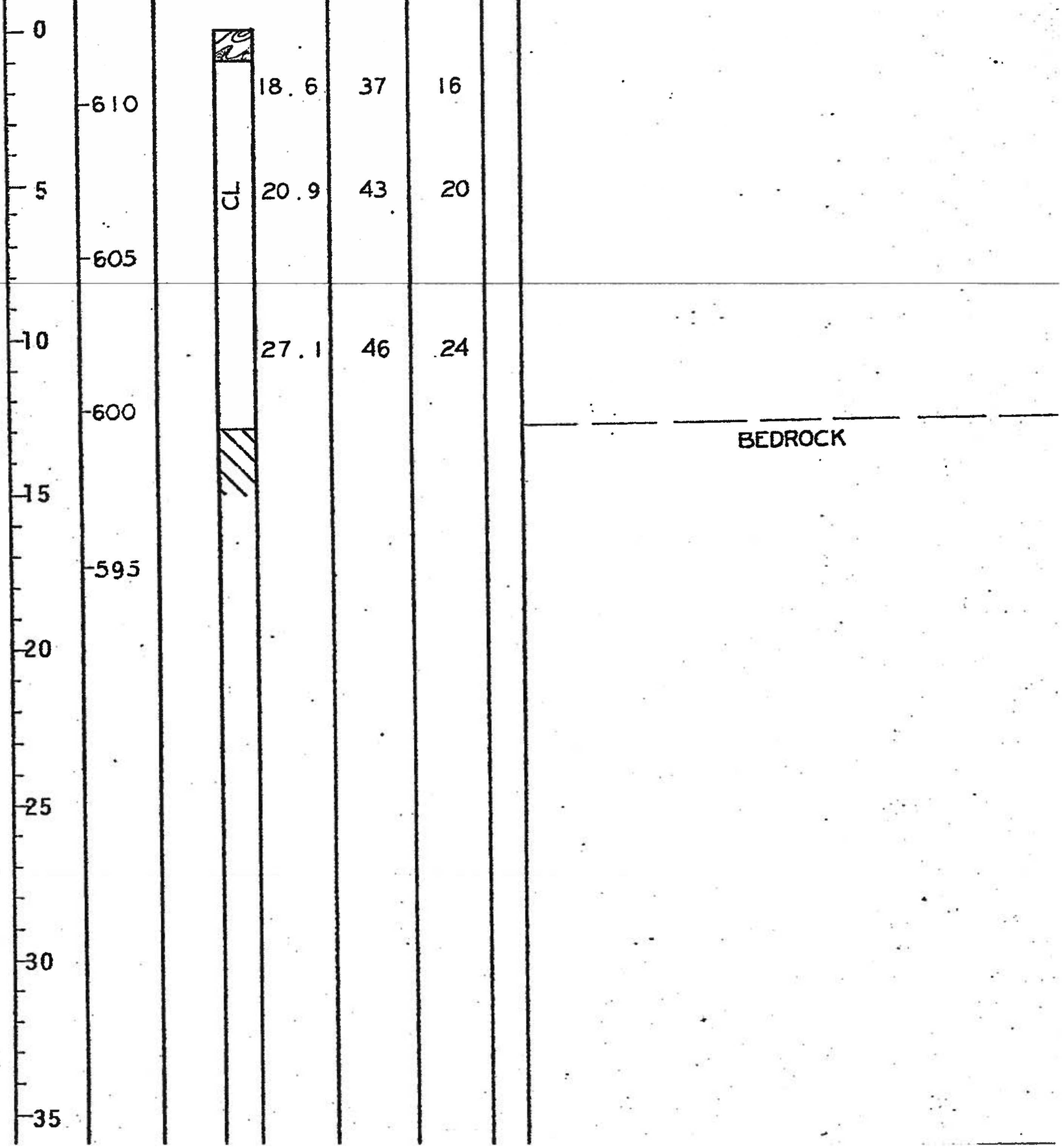
Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH 24 Station 70 + 18E Range 10 + 90 Surface El 612.4

Date Drilled 12 - 8 - 80 To 12 - 8 - 80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
				18.6	37	16		
			CL	20.9	43	20		
				27.1	46	24		
								BEDROCK



TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

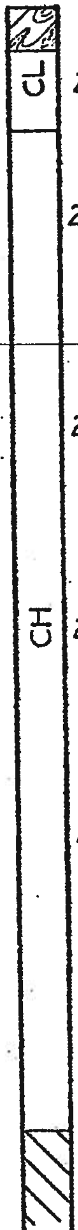
Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-25 Station 73+01E Range 8+08N Surface El 628.6

Date Drilled 12-4-80 To 12-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CL	25.1	42	18		
	625							
5				23.0	55	28		
	620							
10				24.7				
					56	31		
	615							
15			CH	26.1				
	610							
20				26.2				
					60	37		
	605							
25				26.1				
								BEDROCK
	600							
30								
35								



TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-26 Station 67+36E Range 8+07N Surface El 617.1

Date Drilled 12 8 80 To 12 8 80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	615			23.2	37	16		
5			CL	23.7				
	610				43	20		
10				29.5				
	605							
15				27.1				
	600				64	34		
20			CH	28.7				
	595							
25				30.0	69	48		
	590							DISCONTINUED
30								
	585							
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-27 Station 70 + 19E Range 5 + 25N Surface El 634.3

Date Drilled 12-4-80 To 12-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CH	22.4	56	31		
	630							
5			CL	23.7	42	18		
	625							
10				30.5				
	620							
15			MH	27.6	62	29		
	615							
20				27.4				
	610							
25			CH	30.9	63	37		
	605							DISCONTINUED
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-28 Station 64 + 53E Range 5 + 24 W Surface El 624.4

Date Drilled 12-8-80 To 12-8-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CH	33.1	70	45		
	620							
5			CL	29.9	49	25		
	615							
10				32.1				
			CH		53	30		
	610							
15				36.4				
								DISCONTINUED
	605							
20								
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-29 Station 81 + 49E Range 10 + 92N Surface El 607.2

Date Drilled 12-4-80 To 12-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	605		CL	22.9	42	18		
5			MH	21.9	51	21		
	600							
10				26.8				
	595				60	36		
15			CH	27.6				
	590							
20				27.4	63	41		
	585							BEDROCK
25								
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-30 Station 78 + 67E Range 8 + 09N Surface El 624. 1

Date Drilled 12-4-80 To 12-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
				25.0				
	620							
5				21.9	62	29		
			MH					
	615							
10				26.8				
	610							
15				26.5	51	21		
	605							
20				29.7				
			CH		55	28		
	600							
25				30.9				
								BEDROCK
	595							
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature BORROW AREA

Boring PAH-31 Station 75 + 85E Range 5+26N Surface El 643.8

Date Drilled 12-4-80 To 12-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
			CL	21.0	31	11		
	640							
5			MH	18.0	51	21		
	635							
10				24.7	60	36		
	630							
15			CH	24.5	55	28		
	625							
				26.3	60	37		
20								
			▨					BEDROCK
	620							
25								
30								
35								

1" = 400'
CI = 5' 4th Boco

CALCOMP DATA SHEET

TITLE: Widows Creek
Scrubber Sludge Borrow
Page 1 of 3

PAH-1
SLH-1

0 CNTL 4	6 X·COORD. 15	16 Y·COORD. 25	26 Z·VALUE 35 TOR	
PAH-1	1200	3600	600.7	606.7
PAH-2	1600	3600	594.9	600.9
PAH-3	2000	3600	602.2	608.2
PAH-4	2400	3600	609.6	615.6
PAH-5	2800	3600	615.2	621.2
PAH-6	3200	3600	589.6	595.6
PAH-7	3200	4000	611.8	617.8
PAH-8	3200	4400	618.2	624.2
PAH-9	2800	4000	611.3	617.3
PAH-10	2400	4000	607.7	613.7
PAH-11	2800	4400	609.4	615.4
PAH-12	2400	4400	600.2	606.2
PAH-13	1200	3200	596.3	602.3
PAH-14	1200	2800	594.9	600.9
PAH-15	1200	2400	591.7	597.7
PAH-16	1600	3200	599.5	605.5
PAH-17	1600	2800	(-595.3)	601.3
PAH-18	1600	2400	596.6	602.6
PAH-19	1600	2000	591.0	597.0
PAH-20	2000	3200	603.3	609.3
PAH-21	2400	3200	596.7	602.7
PAH-22	2000	2800	594.1	600.1
PAH-23	2400	2800	(-585.2)	591.2
PAH-24	2000	2400	599.4	605.4
PAH-25	2400	2400	601.1	607.1
PAH-26	2000	2000	(-589.1)	595.1
PAH-27	2400	2000	(-606.3)	612.3

CALCOMP DATA SHEET

Widows Creek
Scrubber Sludge Borrow
Page 2 of 3

0 CNTL 4	6 X·COORD. 15	16 Y·COORD. 25	26 Z·VALUE 35		TOR
PAH-28	2000	1600	(-6 06.4)		612.4
PAH-29	2800	3200	585.2		591.2
PAH-30	2800	2800	596.1		602.1
PAH-31	2800	2400	622.3		628.3
				★	1/10/85
SLH-1	3200	4800	607.2	620.7	613.2
SLH-2	3000	4600	608.1	618.9	614.1
SLH-3	3000	4200	610.1	623.2	616.1
SLH-4	3000	3800	602.0	612.2	608.0
SLH-5	3000	3400	593.8	604.6	599.8
SLH-6	2600	4600	598.6	610.4	604.6
SLH-7	2600	4200	601.9	614.7	607.9
SLH-8	2600	3800	608.2	618.4	614.2
SLH-9	2600	3400	600.5	613.5	606.5
SLH-10	2600	3000	589.3		595.3
SLH-11	2200	4200	600.3	610.7	606.3
SLH-12	2200	3800	600.4	611.0	606.4
SLH-13	2200	3400	595.6	608.7	601.6
SLH-14	2200	3000	587.9		593.9
SLH-15	2200	2600	579.2		585.2
SLH-16	2000	4400	593.9	605.9 [illegible]	599.9
SLH-17	2000	4000	599.4	608.7	605.4
SLH-18	1800	4200	593.6	605.0	599.6
SLH-19	1800	3800	598.6	609.7	604.6
SLH-20	1800	3400	598.7	606.9	604.7

CALCOMP DATA SHEET

Widow Creek
Scrubber Sludge Borrow
Page 3 of 3

TOR

0 CNTL 4	6 X·COORD. 15	16 Y·COORD. 25	26 Z·VALUE 35	
SLH-21	1800	3000	588.2 602.1	594.2
SLH-22	1800	2600	594.2 604.3	600.2
SLH-23	1600	4000	592.2 604.3	598.2
SLH-24	1400	4200	591.6 602.0	597.6
SLH-25	1400	3800	595.6 607.9	601.6
SLH-26	1400	3400	593.5 604.9	599.5
SLH-27	1400	3000	589.5 602.0 ~~605.0~~	595.5
SLH-28	1200	4000	589.8 601.4	595.8
SLH-29	1000	4200	583.0 597.0	589.0
SLH-30	1000	3800	586.3	592.3
[illegible]	[illegible]	47[illegible]		[illegible]
RP-1	3120	[illegible]		~~[illegible]~~
RP-[illegible]	[illegible]	4410		616.[illegible]
R[illegible]	2815	4000		615.1
[illegible]	[illegible]	41[illegible]		6[illegible]

TVA 488 (EN DES-3-77)

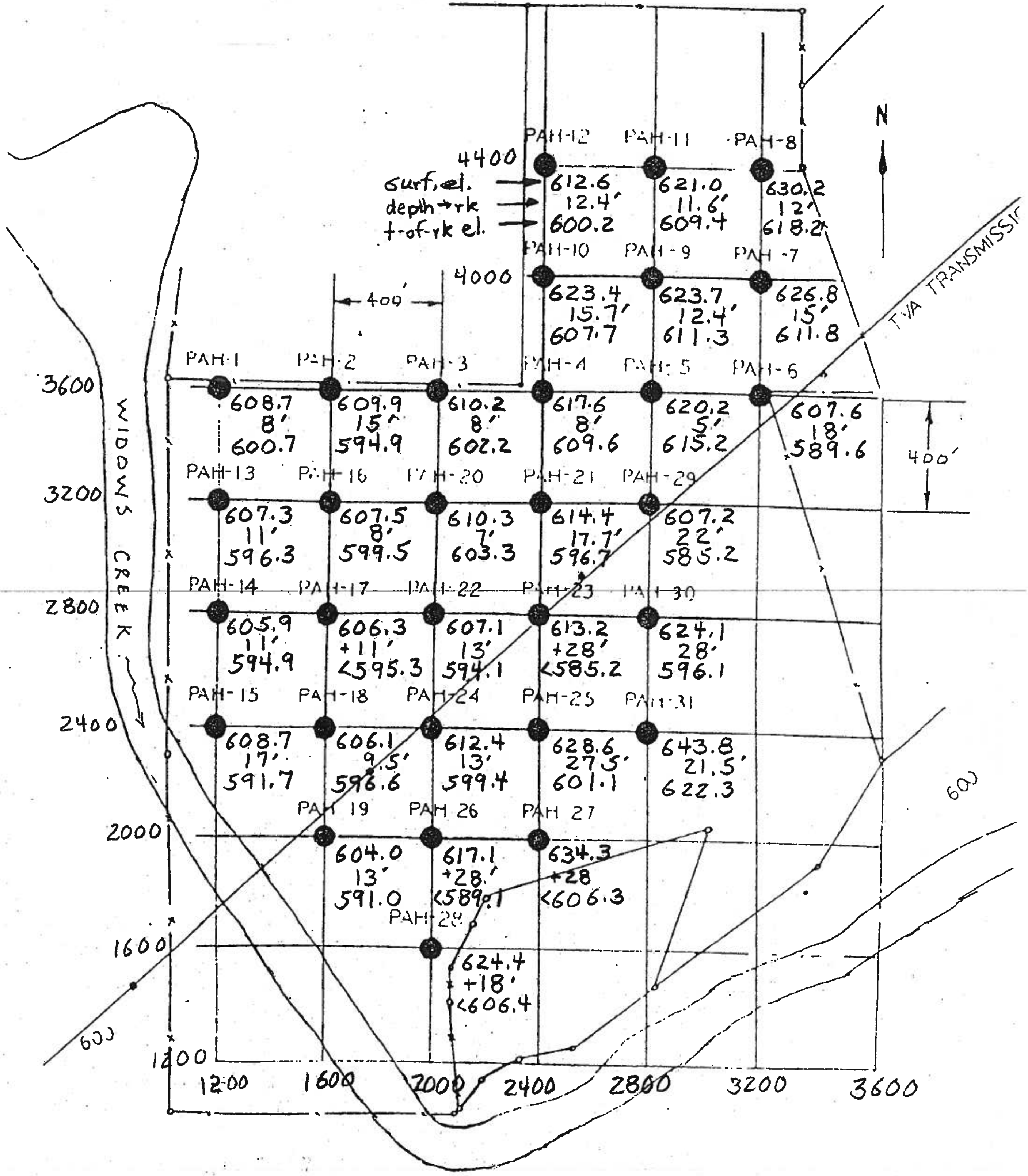
SHEET ______ OF ______

To Plant Coord.

COMPUTED ______ DATE ______

CHECKED ______ DATE ______

Sta.	SE	Sta. Range	TR depth	Elev.	
PAK-1	608.7	72+98E - 25+05N	8.0'	600.7	
" 2	609.9	75+82E - 22+23N	15.0'	594.9	
" 3	610.2	78+65E - 19+40N	8.0'	602.2	
" 4	617.6	81+48E - 16+58N	8.0'	609.6	
" 5	620.2	84+32E - 13+76N	5.0'	615.2	
" 6	607.6	87+15E - 10+94N	18.0'	589.6	
" 7	626.8	89+97E - 13+77N	15.0'	611.8	
" 8	630.2	92+80E - 16+60N	12.0'	618.2	
" 9	623.7	87+14E - 16+59N	12.4'	611.3	
" 10	623.4	84+31E - 19+42N	15.7'	607.7	
" 11.	621.0	89+06E - 19+43N	11.6'	609.4	
" 12	612.6	87+13E - 22+25N	12.4'	600.2	
" 13	607.3	70+16E - 22+22N	11.0'	596.3	
" 14	605.9	67+34E - 19+38N	11.0'	594.9	
" 15	608.7	64+51E - 16+55N	17.0'	591.7	
" 16	607.5	72+99E - 19+39N	8.0'	599.5	
" 17	606.3	70+17E - 16+56N			Discontinued at 11.0', or 595.3
" 18	606.1	67+35E - 13+73N	9.5'	596.6	
" 19	604.0	64+52E - 10+89N	13.0'	591.0	
" 20	610.3	75+83E - 16+57N	7.0'	606.3	
" 21	614.4	78+66E - 13+75N	17.7'	596.7	
" 22	607.1	73+00E - 13+74N	13.0'	594.1	
" 23	613.2	75+84E - 10+91N			Discont. at 28' or 585.2
" 24	612.4	70+18E - 10+90N	13.0'	599.4	
" 25	628.6	73+01E - 8+08N	27.5'	601.1	
" 26	617.1	67+36E - 8+07N			Discont. at 28' or 589.1
" 27	634.3	70+19E - 5+25N			Discont. at 28' or 605.3
" 28	624.4	64+53E - 5+24N			Discont. at 18' or 606.4
" 29	607.2	81+49E - 10+92N	22.0'	585.2	
" 30	624.1	78+67E - 8+09N	28.0'	596.1	
" 31	643.8	75+85E - 5+26N	21.5'	622.3	



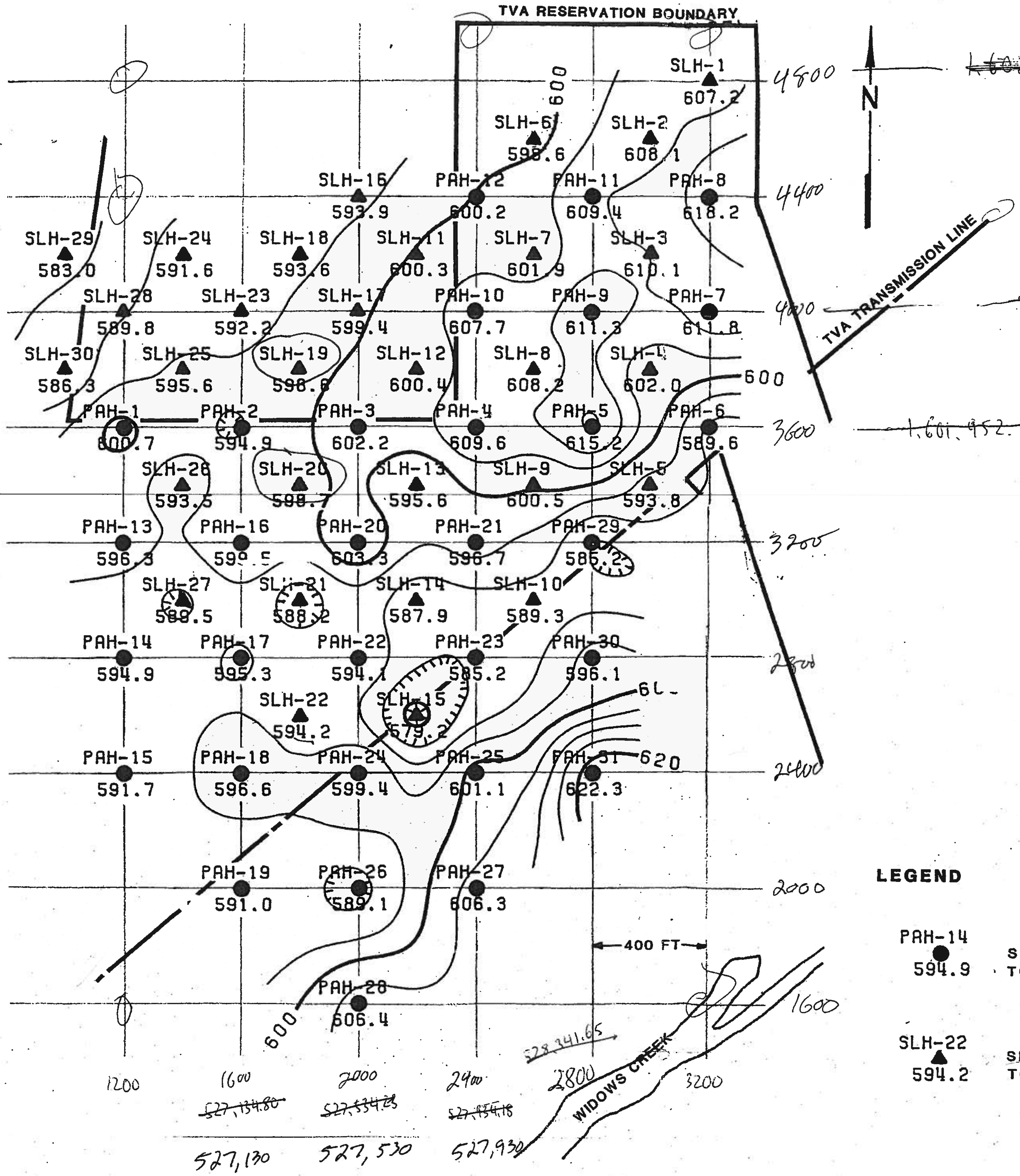
These core borings indicate depths to refusal in the range of 6-28 ft., AVE = 15 ft. Soils WERE predominantly highly plastic clay AN silt (70%) AND lean clay (30%). Based ON index properties soil permeabilities were estimated at 10^{-6} - 10^{-8} cm/sec. This SECTION represts about 75 % of phase I.

1/10/85 RAH

CALCOMP DATA SHEET

TR TR+G'

0 CNTL 4	6 X·COORD. 15	16 Y·COORD. 25	26 Z·VALUE 35	
SS-1	1110	2990		598.8
SS-2	1120	3385		603.5
SS-3	1140	3785		599.4
SS-4	1205	4050		592.5
SS-5	1605	4150		599.5
SS-6	2000	4275		604.8
SS-7	2270	4340		609.0
SS-8	2610	4510		608.6
SS-9	2890	4610		619.2
SS-10	3090	4395		626.3
SS-11	3120	4120		609.9
SS-12	3170	3800	replace w/ US-12 ✓	597.4
SS-13	3120	3560		600.7
SS-14	2985	3360		601.0
SS-15	2700	3160	replace w/ US-15A ✓	581.2
SS-16	2480	2950		593.1
SS-17	2760 ⟷	2250 ✓	589.8 ✓ ~~590~~ →	598.8
SS-18	2560 ⟷	2020		597.0
SS-19	2570 ⟷	1600		601.0
SS-20	1405	3190		603.7
SS-21	1400	3990		597.5
SS-22	1005	3185		603.3
SS-23	1005	3590	599.5 ✓ ~~600.5~~ →	610.8
SS-24	1005	3985	replace w/ US-24 ✓	571.2
SS-25	1205	4385		591.8
SS-26	1605	4390		599.4



This drawing is located @
1714\active\171468118\environmental\
Client Files\Data Mining\WCF\
SCANNED DOCUMENTS by Worley
Parsons\Scrubber Sludge Pond Dike
Borrow Top of Rock
02 WCF 1982 Top-of-rock cont map
↳ page 3

LEGEND

PAH-14 ● 594.9	SOIL BORING TOP-OF-ROCK ELEVATION
SLH-22 ▲ 594.2	SEISMIC REFRACTION STATION TOP-OF-ROCK ELEVATION

SCALE

0 200 400 FEET

CONTOUR INTERVAL IS 5 FEET

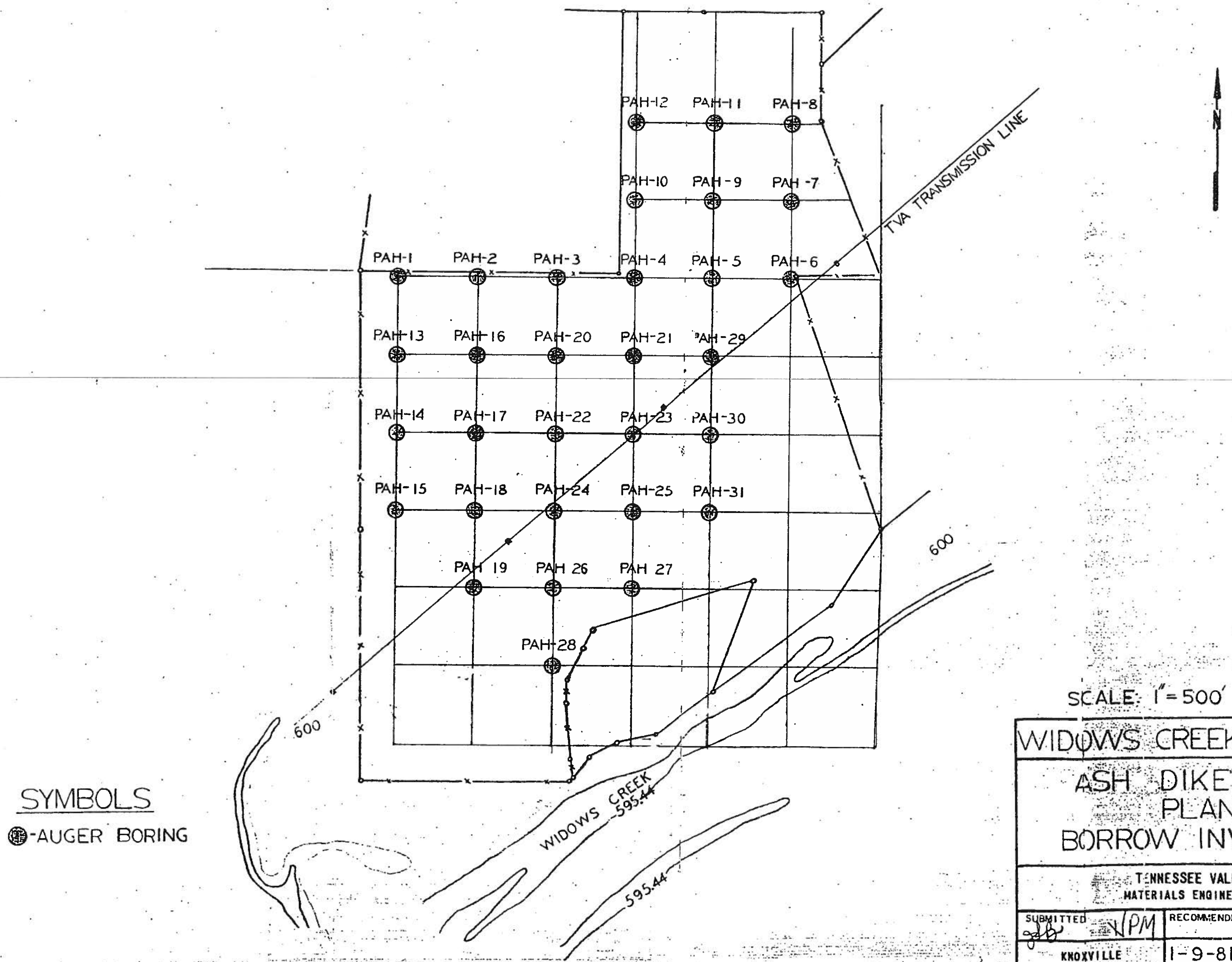
BORROW AREA FOR SCRUBBER
SLUDGE POND DIKE RAISING

TOP-OF-ROCK CONTOUR MAP

WIDOWS CREEK STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

~~SUBMITTED~~	~~RECOMMENDED~~	~~APPROVED~~

KNOXVILLE | 12-17-82 | 34 | GE



WIDOWS CREEK STEAM PLANT

ASH DIKE RAISING
PLAN OF
BORROW INVESTIGATION

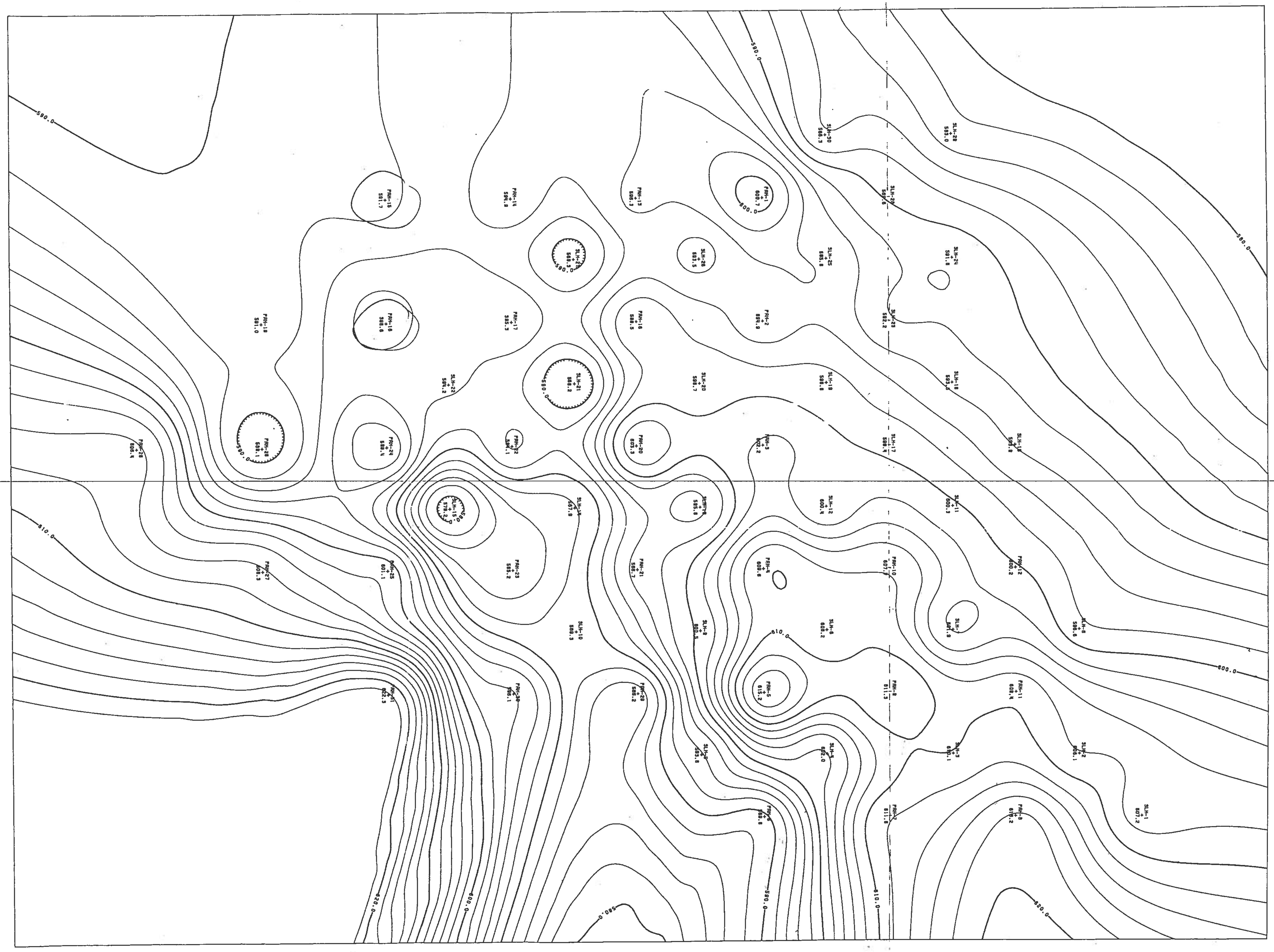
TENNESSEE VALLEY AUTHORITY
MATERIALS ENGINEERING LABORATORY

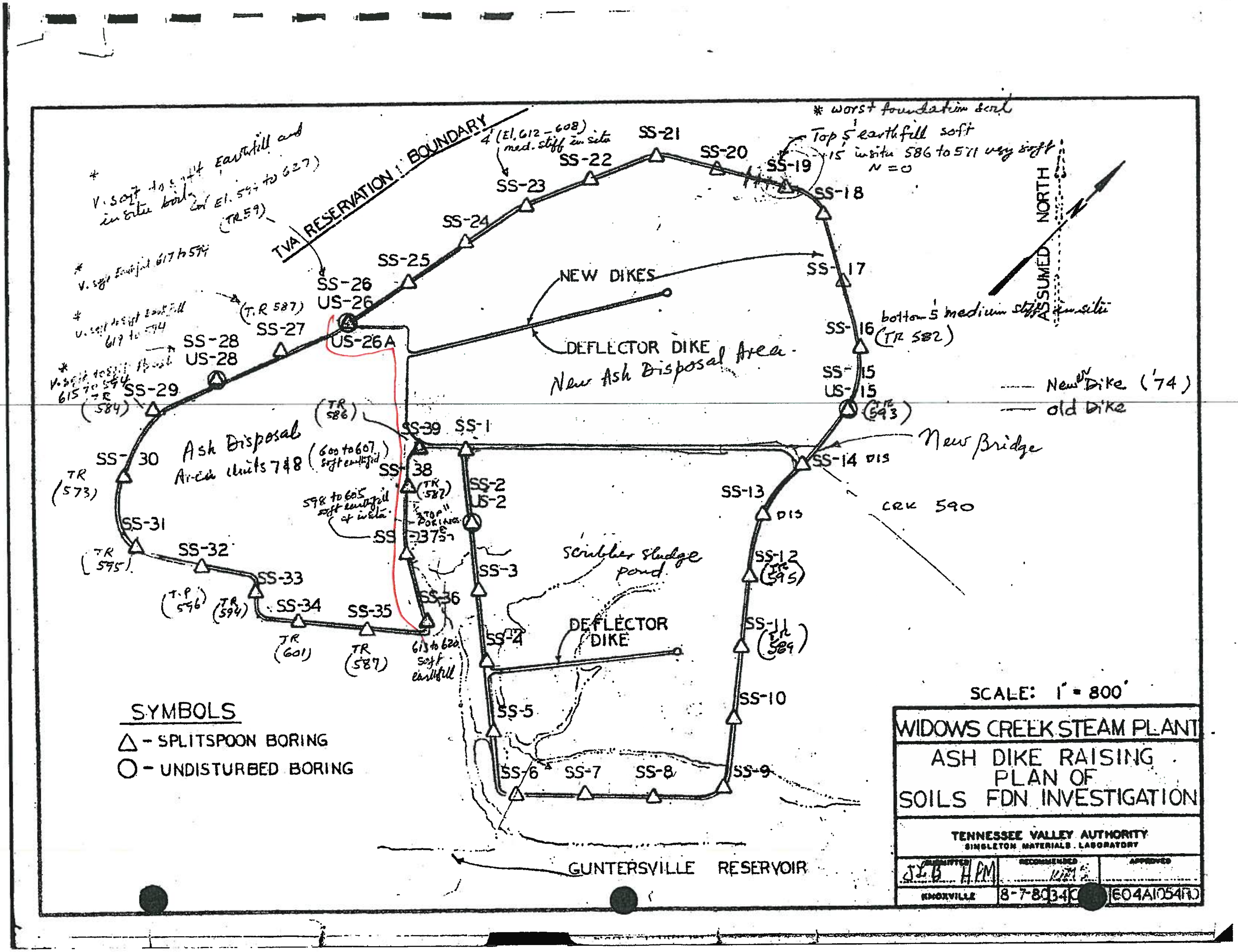
SUBMITTED JB WPM	RECOMMENDED WJHC	APPROVED RR
KNOXVILLE	1-9-81	34 CS 3 604B1062R0

JOB WIDOWS CREEK SCRUBBER SLUDGE BORROW - TOP OF ROCK

SCALE FACTORS - X 100.00 Y 100.00 UNITS/INCH

WCF SCRUBBER SLUDGE BORROW TOP OF ROCK (30% of Scale): Top of Rock: 1-30-2009 2:55:14, 2/24/2009 09:03 AM



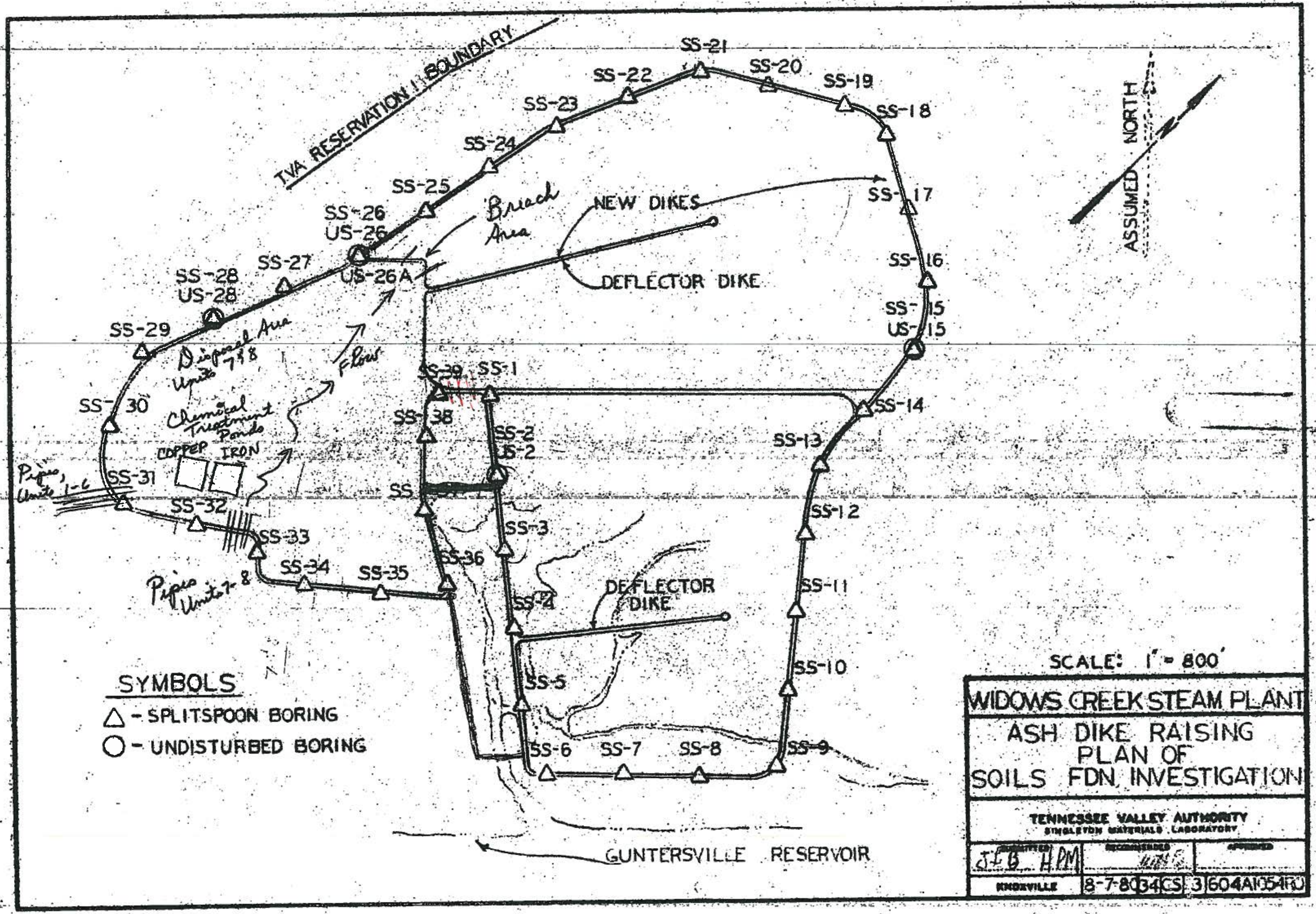


WIDOWS CREEK STEAM PLANT

ASH DIKE RAISING
PLAN OF
SOILS FDN INVESTIGATION

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS LABORATORY

SUBMITTED	RECOMMENDED	APPROVED
JLB HPM	[illegible]	
KNOXVILLE	8-7-80 34C	E04A1054R0



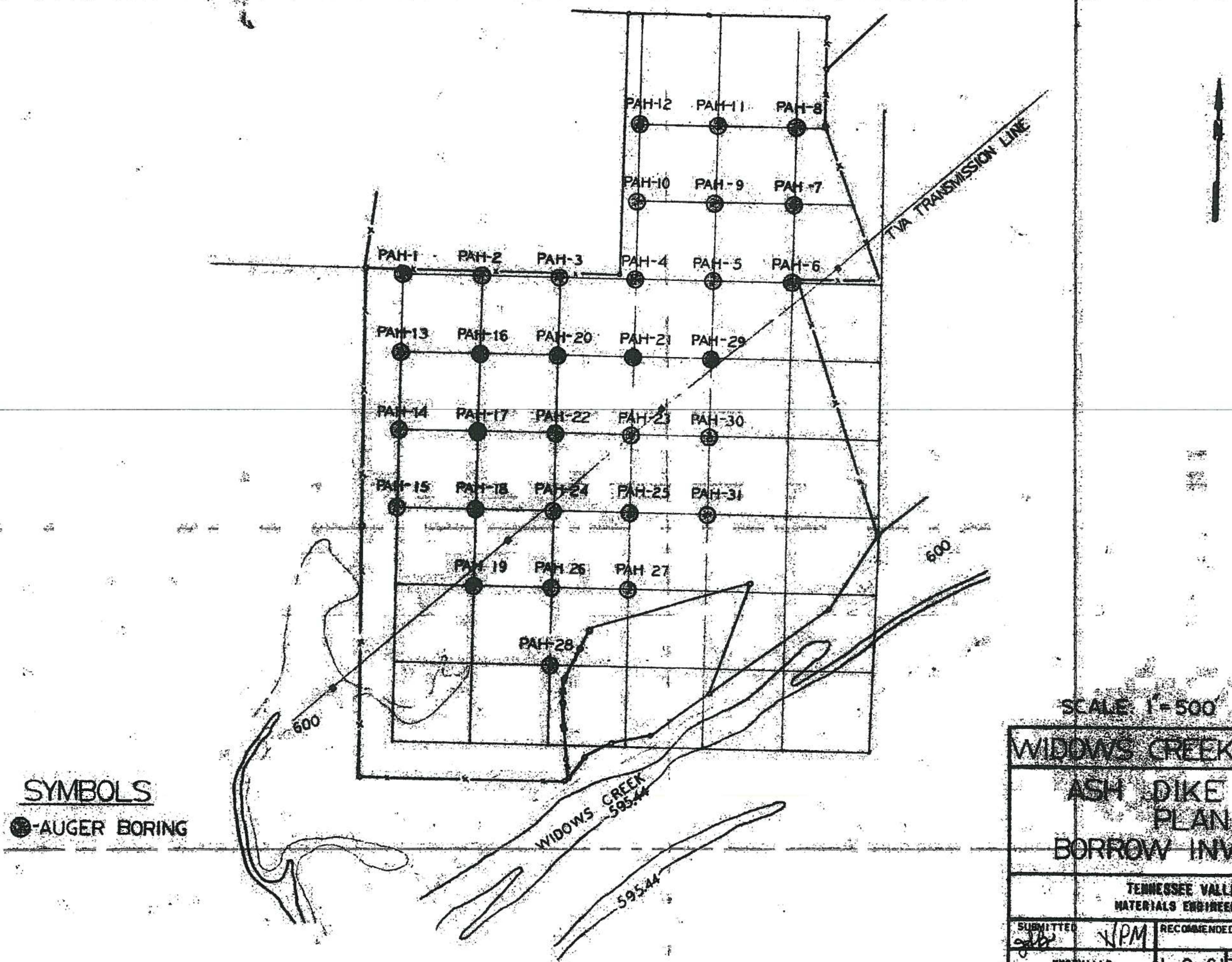
SCALE: 1" = 800'

WIDOWS CREEK STEAM PLANT

ASH DIKE RAISING
PLAN OF
SOILS FDN. INVESTIGATION

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS LABORATORY

SUBMITTED	RECOMMENDED	APPROVED
JLB HPM	[illegible]	
KNOXVILLE	8-7-80 34 CS 3	604A1054R0

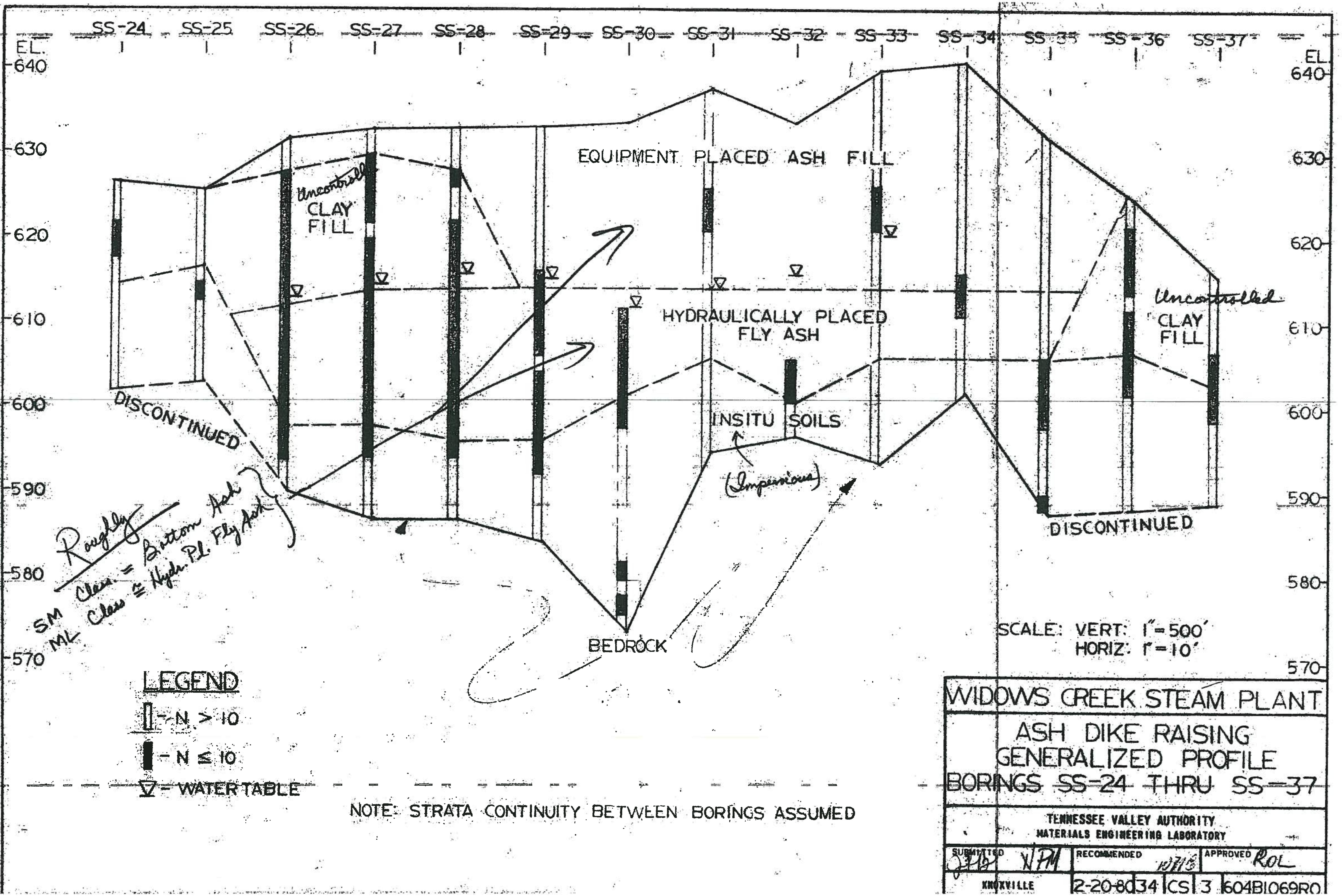


SCALE: 1"=500'

WIDOWS CREEK STEAM PLANT
ASH DIKE RAISING
PLAN OF
BORROW INVESTIGATION

TENNESSEE VALLEY AUTHORITY
MATERIALS ENGINEERING LABORATORY

SUBMITTED VPM	RECOMMENDED	APPROVED			
KNOXVILLE	1-9-81	34	CS	3	604B1062R0



NOTE: STRATA CONTINUITY BETWEEN BORINGS ASSUMED

SCALE: VERT: 1" = 500'
HORIZ: 1" = 10'

WIDOWS CREEK STEAM PLANT

ASH DIKE RAISING
GENERALIZED PROFILE
BORINGS SS-24 THRU SS-37

TENNESSEE VALLEY AUTHORITY
MATERIALS ENGINEERING LABORATORY

SUBMITTED JHB VPM	RECOMMENDED 10/7/15	APPROVED ROL
KNOXVILLE	2-20-80 34 CS 3	604BI069R0

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE LEGEND AND SYMBOLS

DEPTH 1"=5'	EL	SPT (N)	LOG	W	LL	PI	X	REMARKS OR TEST RESULTS
Boring Depth and Scale	Elevation	Blows/Foot (SS Boring)	Lab Soil Type	Moisture Content	Liquid Limit	Plasticity Index	Soil Letter	

LEGEND

≋	Topsoil
CL, etc	Soil Type (Unified Classification)
Mat'l	Notation of Soil Not Sampled (SS, PA, HA Logs)
(Core) Type	Bedrock (Note Core if Cored)
Assumed Material ▨	Refusal (Impractical to Penetrate with Boring Equipment Used)
▽ ▼	Watertable 1 hour 24 hours
├─┤	Explanation of UD Sampling Limits if Applicable

BORING SYMBOLS

SS - 2" OD Splitspoon Boring
SPT - Standard Penetration Test Blows Per Foot with 2" Splitspoon
UD - Undisturbed Sample Boring
PA - Power Auger Boring
HA - Hand Auger Boring
TP - Test Pit or Trench

IN BLOCKS BESIDE UD BORING SAMPLES

Test	Engineering Test Results	
Q, R, R̄, S	Friction Angle (Degrees)	Cohesion (tsf)
UC	Unconfined Compressive Strength (tsf)	Sensitivity Ratio
C	Compression Index	Preconsolidation Pressure (tsf)
k	Coefficient of Permeability (cm/sec x 10^{-4})	

Example: Blocks as Required:

Q	12.0	0.62	R	19.6	0.21	S	34.0	0
UC	4.0	2.6	C	0.27	2.0	k	5.6	

SOIL TEST SYMBOLS

Q - Unconsolidated-Undrained Triaxial Compression
R - Consolidated-Undrained Triaxial Compression
R̄ - Effective Consolidated-Undrained Triaxial Compression
S - Consolidated-Drained Direct Shear
UC - Unconfined Compression
C - Consolidation
k - Permeability
X - Letter Identification of Soil Type. Lower Case (a, etc.), By Index Tests. Capital (A, etc.), Subjected to Additional Tests.

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-1 Station 37+51E Range 21+48N Surface El 624.7

Date Drilled 8-7-80 To 8-8-80 Prepared By JLB Checked By CBG

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
		14	CL-CH	25.9				EARTHFILL
					49	29		
		11		25.8				
	620							
5		12		18.1				
		15		18.6				
					42	22		
	615							
10		10		22.7				
		11		20.6				RESIDUUM
			CL					
		8		19.8	40	19		
	610							
15								
		10		21.7				
		10		21.2				
					48	27		
	605							
20		11		23.2				DISCONTINUED
25	600							
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATIO

Boring SS-2 Station 38+08E Range 16+53N Surface El 626.6

Date Drilled 8-1-80 To 8-1-80 Prepared By JLB Checked By CBL

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		12	CL	18.5	42	20		EARTHFILL
5		15		18.1				
	620	16		18.8	43	20		
		9						NO SAMPLE RECOVERY
10								
	615	12	CL	23.9				
		10		21.3	43	20	▼	EARTHFILL
15		12		20.0				
	610	14		24.1	48	25		
		17		19.0	45	22		
20		15	CL-CH	20.1				
	605				50	27		
		16		18.2				RESIDUUM
25		11	CH	23.1	52	31		
	600	13	CL	26.3	42	20		
		18		22.9	47	23		
30		9	CH	24.7				
	595						▽	
		7		25.5	52	31		
		13		21.2				

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								RESIDUUM
35		13	CH	21.2	52	31		
	590							DISCONTINUED
40								
45								
50								
55								
60								
65								
70								
75								
80								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Shee
1 Of

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATIO

Boring SS-3 Station 38+75E Range 11+57N Surface El 624.2

Date Drilled 7 31 80 To 7 31 80 Prepared By JLB Checked By CB

Depth 1"=5'	El	SPT (N)	Log	W	LL	PI	X	Remarks
0								
		16	CL-ML	22.6	49	21		
	620	9	CL	24.1	43	20		
5		8	CH	20.9	52	27		
		17		23.9				EARTHFILL
	615				43	20		
10		11		21.8				
		9		22.8	42	20		
	610	9	CL	21.1	39	17		▼
15		22		18.3	40	19		
		23		20.1				
	605				47	23		
20		25		19.8				
		18	CH	25.9	52	31		
	600	14		22.5				
25					35	14		RESIDUUM
		10	CL	19.1				▽
		20		18.5	44	22		
	595							
30		16	CL-CH	23.2				
					50	25		
		9		26.8				
		18	CL	27.2	42	21		DISCONTINUED
35	590							

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL FOUNDATION

Boring SS-4 Station 39+37E Range 6+90N Surface El 624.9

Date Drilled 7-30-80 To 7-31-80 Prepared By JLB Checked By NBC

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
		15	CL	20.4	—	—		
		14		20.2	48	25		
5	620							
		11	CH	19.9	52	27		
		20	CL-CH	18.0	49	28		EARTHFILL
10	615	16		22.0				
		21	CH	24.2	52	27		
		8	CL-CH	25.9	50	25		
15	610							▼
		18	CL-ML	21.9	49	21		
		18		20.4				
20	605	13	CH	23.8	52	27		
		30	CL	23.5	48	25		
		19	CL-CH	22.5	50	26		
25	600							
		14	CL	29.9	48	24		
		14		20.5				RESIDUUM
30	595	11		22.8	42	20		
		11		25.3				
		15	CL-CH	32.0	50	26		▽
35	590							

Project WIDOWS CREEK S. P. Boring SS-4 2 Of

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
35								
		6		32.1				
		19		27.2	47	27		RESIDUUM
40	585	19	CL	26.1				
		20		24.2	41	22		
		16		23.1	47	27		DISCONTINUED
45	580							
50								
55								
60								
65								
70								
75								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-5 Station 40+03E Range 1+96N Surface El 625.7

Date Drilled 7-30-80 To 7-30-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0	625							
		19	CL	18.4	44	22		
		22		18.0				
5	620	16	CL-CH	20.5	49	28		EARTHFILL
		18		20.1		-		
10	615	16		21.6	50	25		
		15	CH	20.6	52	27		
		8	CL-CH	21.6	50	25		
15	610	11	CL	23.9	40	19		
		22		20.2	42	20		▼
20	605	21	CL-CH	24.8	50	26		
		21		23.6	48	24		
		16	CL	23.7				▽ RESIDUUM
25	600	16		21.4	48	25		
		15	CL-CH	22.6	50	25		
30	595	14	CL	23.1	48	24		
		18		19.8				DISCONTINUED
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S.P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-7 Station 46+35E Range 2+40S Surface El 625.8

Date Drilled 7-29-80 To 7-29-80 Prepared By JJLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		20	CL-CH	17.9	49	23		
		21	CL	15.5	44	22		
5	620							
		12	CL-CH	23.0	50	25		EARTHFILL
		32	CL	18.1	48	25		
10		23	CH	21.9	52	27		
	615							
		19		22.8				
					48	25		
		14	CL	22.7				~610
15	610							
		13		24.7	48	24		
		25	CL-CH	24.2	50	26		
20		17	CL	26.2	48	24		
	605							
		24	CL-CH	21.8	50	26		RESIDUUM
		21		24.4				
25	600							
		19	CL	25.0	48	24		
		17		24.5				
30		19		24.2	46	23		DISCONTINUED
	595							
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATI

Boring SS-6 Station 41+35E Range 2+42S Surface El 626.0

Date Drilled 7-28-80 To 7-29-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		23	CL	18.1	42	20		
		38	CL-CH	17.2	49	23		
5	620	20		17.2				
		32	CL	27.1	44	22		EARTHFILL
10		27	CL-CH	19.8	50	25		
	615	21	CL	24.0	48	25		
		18		23.5				
15					45	22		
	610	22		24 4				
		30	CL-CH	26.1	50	26		
20		22	CL	23.6	46	23		
	605	23		19.3	48	24		
		25	CL-CH	23.9				▽ ▼
25	600	26		24.8				
		26		27.0	50	26		RESIDUUM
30		33		26.8				
	595	32		27.5				
		30	CL	27.4	48	24		
35								

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
35								
	590	26		24.5	48	24		
		18	CL	30.3	46	23		RESIDUUM
40		20		24.4	41	22		DISCONTINUED
	585							
45								
50								
55								
60								
65								
70								
75								
80								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S.P. Feature ASH DIKE FILL AND FOUNDATI

Boring SS-8 Station 51 +34E Range 2+42S Surface El 626.0

Date Drilled 7-29-80 To 7-29-80 Prepared By JLB Checked By CB

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		29		CL-CH 19.8	49	23		
		19	CL	19.6	44	22		EARTHFILL
5								
	620	22		CL-CH 21.7	49	23		
		21	CL	20.6	40	19		
10		19	CH	18.1	52	27		
	615							
		10		25.1	45	22		
		21		22.9				
15					48	24		
	610	17	CL	24.1				RESIDUUM
		17		23.2	46	23		
20		18		22.8	45	22		
	605							
		27		CL-CH 22.1	50	26		DISCONTINUED
25								
	600							
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATI

Boring SS-9 Station 56+88E Range 2+25S Surface El 625.1

Date Drilled 7-30-80 To 7-30-80 Prepared By JLB Checked By CB

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0	625							
		20	CL-CH	20.9				
					50	25		
		13		24.1				
5	620	19		26.9	49	23		EARTHFILL
		12	CH	28.3				
					52	27		
10	615	23		22.3				
		12	CL-CH	20.4	50	25		
		14	CL	22.0	44	22		
15	610	22	CL-CH	21.7	50	26		
		16	CL	24.3	45	22		
20	605	20	CH	22.0	52	31		
		25	CL	22.9	44	22		RESIDUUM
		28		21.2	46	23		
25	600	23	CL-CH	21.7				
					50	26		
		20		18.6				
30	595	14	CL	25.6	47	27		DISCONTINUED

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 2

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-10 Station 57+81E Range 2+53N Surface El 625.9

Date Drilled 7-30-80 To 7-31-80 Prepared By JLB Checked By CBL

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		21		20.4				
					50	25		
		20		20.5				
5	620	12		21.5				
		22		22.9	49	-23		EARTHFILL
10		23		23.0				
	615		CL-CH					
		9		27.2				
					50	25		
		14		23.3				
15								
	610	11		23.0				
		17		21.3	49	23		▽ ▼
20		16		25.2				
	605							
		10		22.9				
					42	20		
		6		27.5				
25			CL					
	600	18		24.1				
					42	21		
		19		24.1				RESIDUUM
30		21		27.5				
	595		CH		64	37		
		25		26.3				
		36	CL	22.7	46	23		
35								

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5' 35								
	590	26	CL	26.0	45	22		
		29	CH	25.8	64	37		RESIDUUM
40	585	23	CL	28.0	47	27		
		13		30.8				DISCONTINUED
45	580							
50								
55								
60								
65								
70								
75								
80								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of

Project WIDOWS CREEK S. P Feature ASH DIKE FILL AND FOUNDATION

Boring SS-11 Station 58+35E Range 7+49N Surface El 626.3

Date Drilled 7-31-80 To 8-1-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625	19	CL	22.7	48	25		
		16		21.3				
5	620	20		19.3	46	24		
		18	CL-CH	19.8	50	28		
10		26	CL	25.7	45	25		
	615	18		25.6	43	24		EARTHFILL
		20		24.4	43	21		
15	610	25		16.3	47	24		▼
		25		18.8				
20		16		28.3	44	23		
	605	8		25.5	47	22		
		16		23.3				▽
25	600	20		28.0	43	21		
		18		22.9	48	22		
30		15	CL-CH	23.0	50	33		RESIDUUM
	595	16		24.1				
		23	CH	28.2	51	32		

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
35								RESIDUUM
	590	38	CL	26.1	31	14		
			▨					BEDROCK
40								
	585							
45								
50								
55								
60								
65								
70								
75								
80								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

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Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-12 Station 58 + 88E Range 12 + 45N Surface El 626.8

Date Drilled 8-1-80 To 8-4-80 Prepared By JLB Checked By OBL

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625	16	CL	23.1	48	25		
		10	CH	24.3	54	31		
5		7	CL	25.5	46	24		
	620	8		CL-CH 22.0	50	28		EARTHFILL
10		26		20.3	45	25		
	615	22		16.2	43	24		
		17		19.9	43	21		
15		14		22.4				▽
	610				47	24		
		23		19.9				
20		13	CL	24.4	44	23		
	605	18		25.5				
					42	22		
		16		17.9				
25		7		24.3	42	21		
	600							RESIDUUM
		14		21.8	48	28		
30		19		16.8	47	31		
	595	50		CLCH 22.4	50	33		BEDROCK
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
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Project WIDOWS CREEK S. P. Feature ASH DIKE AND FILL FOUNDATIO

Boring SS-13 Station 59+54E Range 17+39E Surface El 627.2

Date Drilled 8-4-80 To 8-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625	17	CL	22.5	48	25		EARTHFILL
		12		17.9	44	26		
5		13	CH	19.1	54	33		
	620	23	CL-CH	19.5	50	28		
10		18		17.1	45	25		
	615	18		26.2	49	29		
		20		17.4	46	27		
15		19		19.3				RESIDUUM
					41	21		
	610	16		19.3				
20		11	CL	18.7	47	31		
	605	21		21.0	42	21		▼
		14		19.3				
25					42	22		
		8		18.1				
	600	18		20.9	43	23		
30		15		19.5	42	25		DISCONTINUED
	595							

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SINGLETON MATERIALS ENGINEERING LABORATORY
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Project WIDOWS CREEK S. P. Feature ASH FILL AND FOUNDATION

Boring SS-14 Station 63+12E Range 22+48N Surface El 626.2

Date Drilled 8-4-80 To 8-5-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625	15	CL	22.6	48	25		
		9	CH	23.4	54	31		
5								
	620	10	CL	19.9	46	24		EARTHFILL
		28	CL-CH	12.8	50	28		
10		18		14.2	45	25		
	615	14		14.6	49	29		
		22		14.4	48	25		
15								
	610	23		17.3	43	23		
		18		21.2				▽ ▼
20		16	CL	19.1	42	21		
	605	23		24.8	42	22		RESIDUUM
		29		18.2				
25								
	600	38		18.6	39	19		
		31		22.3	48	28		
30		39		18.1				DISCONTINUED
	595							

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

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Project WIDOWS CREEK S.P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-15 Station 66+29E Range 26+36N Surface El 626.3

Date Drilled 8-5-80 To 8-5-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								EARTHFILL
	625	18	CL	18.4	43	27		
		27	CH	19.6	54	31		
5	620	27	CL	18.9	46	24		
		15	CL-CH	15.7	50	28		
10		14		19.2	45	25		
	615	19		14.6	49	29		
		15		18.0	43	21		
15								
	610	14		18.2	46	27		
		23		14.2	43	23		RESIDUUM
20		24	CL	14.4				
					42	22		
	605	26		17.3				
		12		26.9	41	21		
25								
	600	12		16.6	31	14		
		9		18.4	41	21		
30		13		18.3	42	25		
	595	14	CL-CH	14.3	50	33		
		50+	CH	16.1	51	32		BEDROCK

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Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-16 Station 66+96E Range 31+17N Surface El 625.8

Date Drilled 8-5-80 To 8-14-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0	625							
		19		21.7				
		21		14.0	44	26		
5	620	16		18.9				
		19		15.6				
10	615	12		14.7	43	26		EARTHFILL
		10		15.6				
15	610	20		13.1	46	28		
		18	CL	19.4				
		18		19.5	48	29		
20	605	6		17.9				
		15		16.4				
					39	23		
25	600	19		18.5				
		11		18.7	34	16		▽
		9		19.2	44	27		
30	595	10	CH	19.6	56	38		RESIDUUM
		8	CL	18.6	39	23		
		12	CH	21.3	56	38		

Project WIDOWS CREEK S. P. Boring SS-16 2 of

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
35	590	12	CH	21.3				
		11		25.8	56	38		RESIDUUM
		6		23.6				
40	585	8	CL	30.0	44	27		
		6	CH	33.0	56	38		
			▨					BEDROCK
45	580							
50								
55								
60								
65								
70								
75								
80								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

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Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-17 Station 65 + 68E Range 35 + 98N Surface El 626.2

Date Drilled 8-1-80 To 8-4-80 Prepared By JLB Checked By CBG

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625	15	CL	22.3	41	23		
		9	CH	16.3	54	31		
5		16	SC	21.6	38	17		EARTHFILL
	620	11		16.3	41	22		
10		22	CL	16.2	45	25		
	615	11		13.7	49	29		
		8		16.3	43	24		
15	610	15	GC	17.3	51	34		
		16		6.6	32	16		
20		25		13.8	42	21		RESIDUUM
	605	12	CL	19.7				
		11		12.4	46	27		
25	600	19		19.3	39	19		
		17		19.8	42	21		DISCONTINUED
30	595							
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

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Project WIDOWS CREEK S.P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-18 Station 64 + 34E Range 40 + 78N Surface El 626.0

Date Drilled 8-4-80 To 8-4-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		9		16.6				
					48	25		
		9		17.5				
5								
	620	6		20.5	43	27		
		15		17.0				EARTHFILL
			CL		41	22		
10		11		27.0				
	615							
		19		15.5	44	23		
		15		15.8	43	24		
15								
	610	11		15.5	49	29		
		22	SC	14.4	35	18		
20		16		12.4	32	16		
	605							
		17		14.8	46	27		
		28	CL	13.8	32	16		
25								
	600	17		20.5				
					42	21		RESIDUUM
		29		18.5				
								▼
30		21		18.0				
			SC		29	11		
	595							
		26		19.1				
								▽
		22	GC	17.3	51	34		
35								

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
35								
	590	12	CH	31.4	57	40		RESIDUUM
		8	CL	38.4	46	27		
		50+	SC	42.8	55	32		
			▨					BEDROCK
40			▨					
	585							
45								
50								
55								
60								
65								
70								
75								
80								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
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Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-19 Station 60+11E Range 42+97N Surface El 625.8

Date Drilled 8-4-80 To 8-5-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		8		20.5				
					41	23		
		4	CL	21.1				
5	620	10		21.4	44	26		
			CL-CH					
		24		20.4	50	28		
								EARTHFILL
10		20		14.4	45	25		
	615							
		15		15.7	43	24		
		17	CL	16.4	43	21		
15	610	27		12.9				
					44	25		
		20		10.1				
20		21	SC	14.3	35	18		
	605							
		14		20.0				
					37	17		
		20		11.1				
25	600	12		15.6	31	14		▼
			CL					
		11		20.2	48	28		
								RESIDUUM
30	595	12		20.5	42	25		
		19		22.1	43	23		
								NO SAMPLE RECOVERY
		15		—	—	—		
35								RESIDUUM

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
35	590	28	SC	15.5	29	11		
		15		15.9	57	40		▽
40	585	8		27.6				
		1		38.0				
		0		88.1				RESIDUUM
45	580	0	CH	103.9	73	48		
		1		76.8				
50	575	0		78.3				
		0		108.1				
		1		—	—	—		NO SAMPLE RECOVERY
55	570	21	SM	10.5	23	3		RESIDUUM
								DISCONTINUED
60	565							
65								
70								
75								
80								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
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Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-20 Station 56+21E Range 43+95N Surface El 626.0

Date Drilled 8-5-80 To 8-5-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		13	CL	20.5	41	23		
		10	CH	18.4	54	31		
5								
	620	14		15.6	54	33		
		16		19.9	41	22		EARTHFILL
10		7		17.7	44	26		
	615							
		20		14.2	43	24		
		10	CL	17.4				
15								
	610	16		18.8	41	21		
		9		18.9	32	16		
20		13		12.2	43	23		
	605							
		13	CH	20.3	57	40		RESIDUUM
								▼
		14		15.6	42	22		
25								
	600	11		17.4	39	19		
		12	CL	16.0	48	28		
30		15		19.8	39	19		
	595							
		11		18.9	43	23		
								DISCONTINUED
35								

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SINGLETON MATERIALS ENGINEERING LABORATORY
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Project WIDOWS CREEK S. P. Feature ASH FILL AND FOUNDATION

Boring SS-21 Station 51 + 51E Range 44 + 66 Surface El 625.6

Date Drilled 8-6-80 To 8-6-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		11		17.2	44	24		
		14		17.6	37	20		
5			CL					EARTHFILL
	620							
		13		17.3				
					42	24		
		15		12.5				
								NO SAMPLE RECOVERY
10		8		—	—	—		
	615							
		8		17.2	41	26		EARTHFILL
		13		18.2	36	19		
15								
	610	12		18.7				
					37	22		
		16		18.5				
			CL					RESIDUUM
20		11		16.6	36	19		
	605							
		17		17.2	37	22		
		16		20.8	42	22		
25								
	600	14		23.2	44	24		
								DISCONTINUED
30								
	595							
35								

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SOIL PROFILE (SS, PA, HA, TP BORING)

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Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-22 Station 47+71E Range 43+42N Surface El 626.1

Date Drilled 8-6-80 To 8-6-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625							
		11		16.8	37	20		
		10		17.3	44	25		
5								EARTHFILL
	620	9		19.4	42	24		
		9		18.1	36	19		
10		12		16.8	42	24		
	615							
		12		17.0	37	21		
			CL					
		14		17.8				
15								
	610	10		17.4	37	22		
								RESIDUUM
		15		18.6				
20		12		17.4	44	25		
	605							
		13		19.8	37	22		
		14		18.4	41	24		DISCONTINUED
25								
	600							
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-23 Station 43 + 06E Range 41 + 54N Surface El 625.4

Date Drilled 8 - 7 - 80 To 8 - 7 - 80 Prepared By JLB Checked By CBE

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0	625							
		12		20.4				
					44	24		
		12		22.2				
5	620	12		18.7				EARTHFILL
		9		18.2	42	24		
10	615	16	CL	16.7				
		10		16.2				
					37	22		
		6		17.3				
15	610	8		17.9	41	24		RESIDUUM
		12		16.7	36	19		
20	605	11		20.5	44	25		DISCONTINUED
25	600							
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (SS, PA, HA, TP BORING)

Sheet 1 Of 1

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring SS-24 Station 38 + 71E Range 39 + 06N Surface El 626.4

Date Drilled 8-7-80 To 8-7-80 Prepared By JLB Checked By

Depth	El	SPT (N)	Log	W	LL	PI	X	Remarks
1"=5'								
0								
	625	15		18.5	44	25		
		12		21.3	44	24		
5								EARTHFILL
	620	10		20.4	45	26		
		9		24.3	44	24		
10		11		18.1	36	19		
	615	11		17.6				
		9	CL	19.7	41	24		
15								
	610	11		18.2	37	21		
		12		15.0	36	19		RESIDUUM
20		24		14.7	41	24		
	605	18		21.6	44	24		
		15		20.4	42	22		DISCONTINUED
25								
	600							
30								
35								

TENNESSEE VALLEY AUTHORITY
SINGLETON MATERIALS ENGINEERING LABORATORY
SOIL PROFILE (UD BORING)

1 Of 1

Project WIDOWS CREEK S. P. Feature ASH DIKE FILL AND FOUNDATION

Boring US-28 Station 18 + 63E Range 26 +57N Surface El 632.9

Date Drilled 8-13-80 To 8 - 13 -80 Prepared By JLB Checked By

Depth	El	Log	W	LL	PI	X	Engineering Test Results
1"=5'							
0							
	630						
5							
	625						
10							
	620						
15							
	615						
		ML	49.0	NP	NP		R 24.6 0.05
20							
		ML	52.6	NP	NP		
	610						
25							
	605						
30							
35							

Widows Creek

I Research / Setup

A. - Previous work   on-site or nearby

1. Soil auger holes
   a) refusal depths
   b) soil column
2. Seismic data
   a. Rock Velocity = 16,000'/sec
   b. Intermediate layers - unpredictable velocities -
3. Site Geology

B. Field parameters

1. Scope - actually define rock ∴ 3+ phones @ 16K
2. 5' centers to define intersections - then 10-20'
3. Review procedures for data reduction
   a) Program
   b) total time (f = n)
4. Equipment to be used (data desired)

II Field data acquisition

A. Site conditions

1. Topography - lines ∥ topography not ⊥
2. Lines long enough to satisfy B1
3. Rain etc -
4. Record anything that might influence data (signatures)
5. Keep settings same

B. Data acquisition

1. Label all records
2. Try to maintain continuity - signatures and/or picks
3. Occupy drill locations

III. Data reduction

A. What to input.

V_1 1200

V_2 3000-4000 - closer to 4000 due to wet conditions

V_3 16000 rock

B. Reduce drill locations first.

1. Compare results - if adj. necessary - try to get constant correction factor

C. Reduce remaining data in similar fashion trying as with acquisition keeping consistent (however if site conditions are expected to change allow for this)

Keep in Widows Ck File

INFORMATION PERTAINING TO
THE WIDOWS CREEK PROPOSED SCRUBBER
SLUDGE DISPOSAL PROJECT

Hal, This is the info packet I talked to you about Monday, if you need any other info contact me.

D. Allen

General Information

The proposed wet stacking of the oxidized scrubber sludge is expected to commence operation sometime in December 1984. The disposal project will encompass approximately 200 acres and will proceed in two phases, that is, there will be two identical stacks.

This information package includes design schematics, maps, soils reports, and other pertinent information to the project. In order the attachments are:

1. Schematic of wet stack contruction.

2. A map depicting the location of the disposal facility, private wells, waterways of concern, etc.

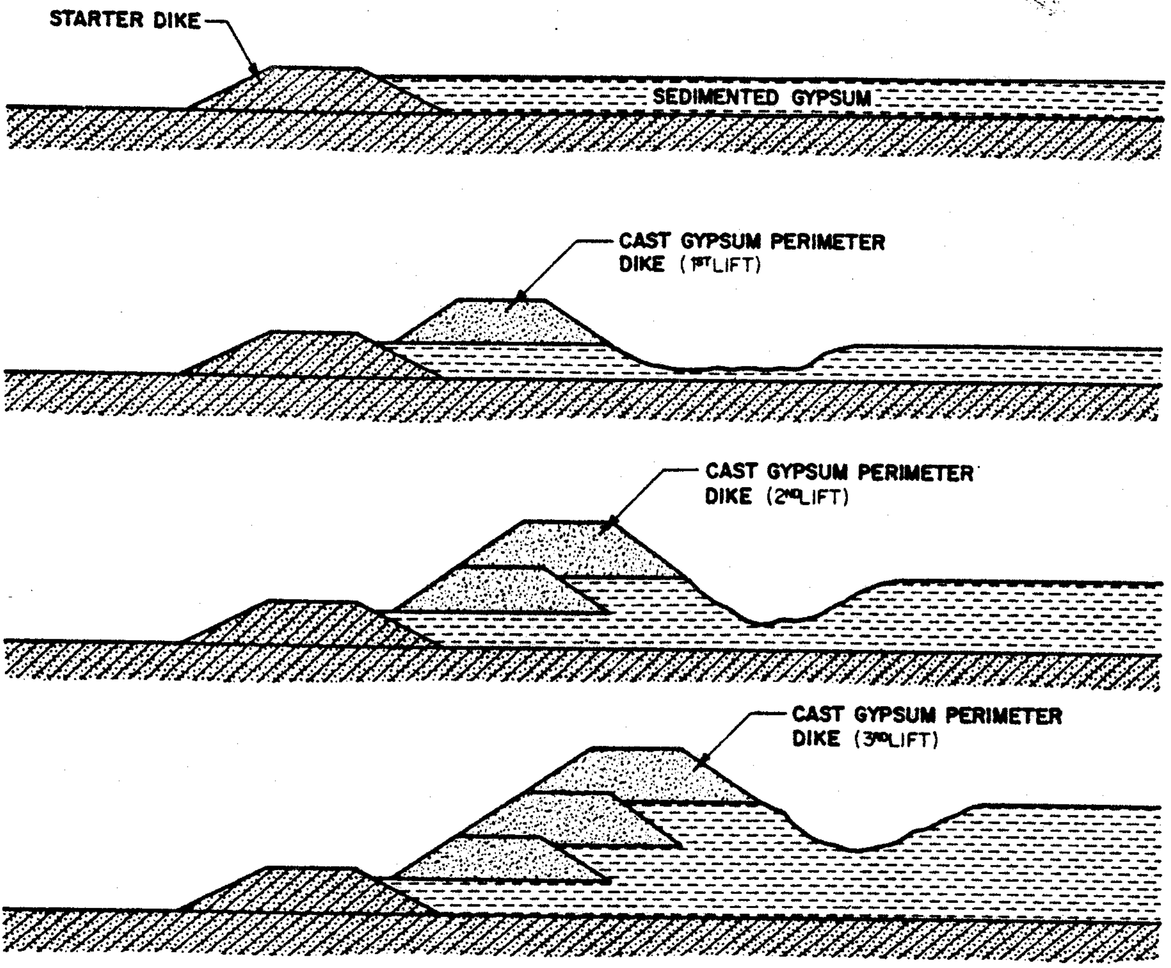
3. A map showing the expected land acquistion needed to complete the project.

4. A map showing the location of recent TVA core borings in the area of concern.

5. A soils report prepared by Ardaman and Associates, Inc., on the area where the wet stacking pilot study has been proposed. (Approximately 3/4 miles to the west of the proposed large scale disposal facility.)

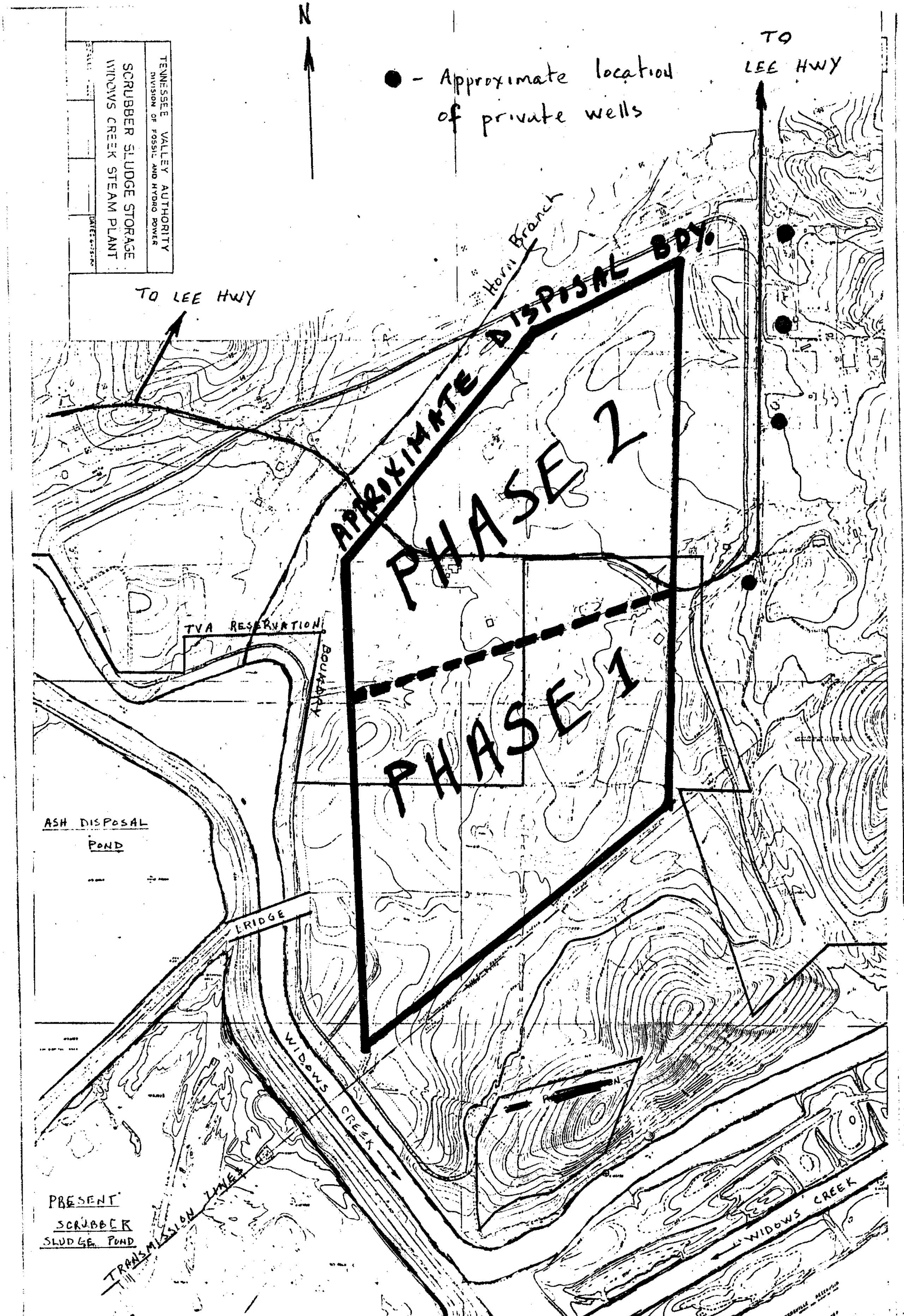
6. Seepage patterns to be expected with various soil conditions. Figure 16-7 best represents what we expect at Widows Creek Steam Plant.

7. RCRA extraction studies performed on scrubber sludge from the existing scrubber pond.

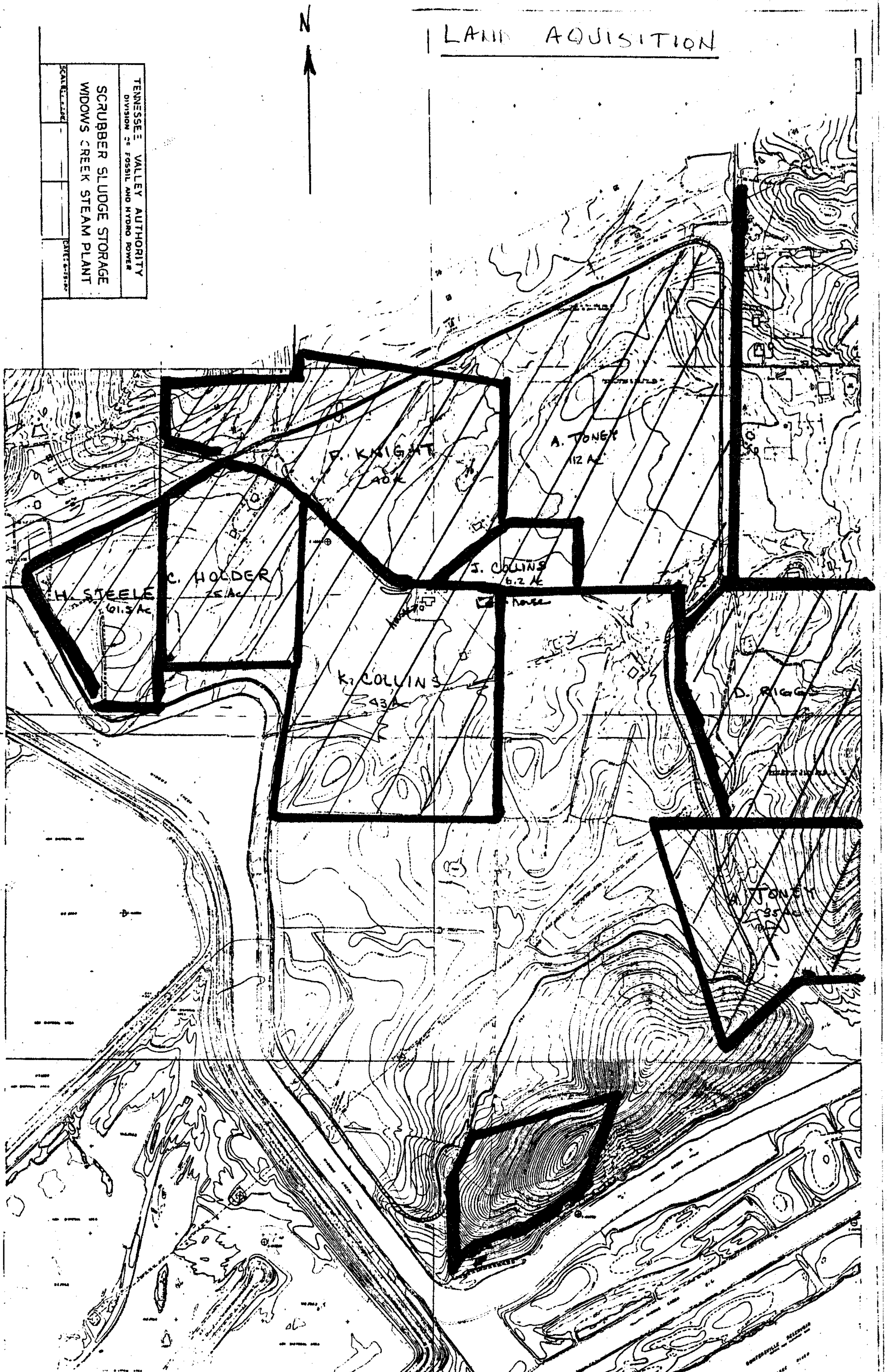


Upstream Method of Gypsum Stack Construction

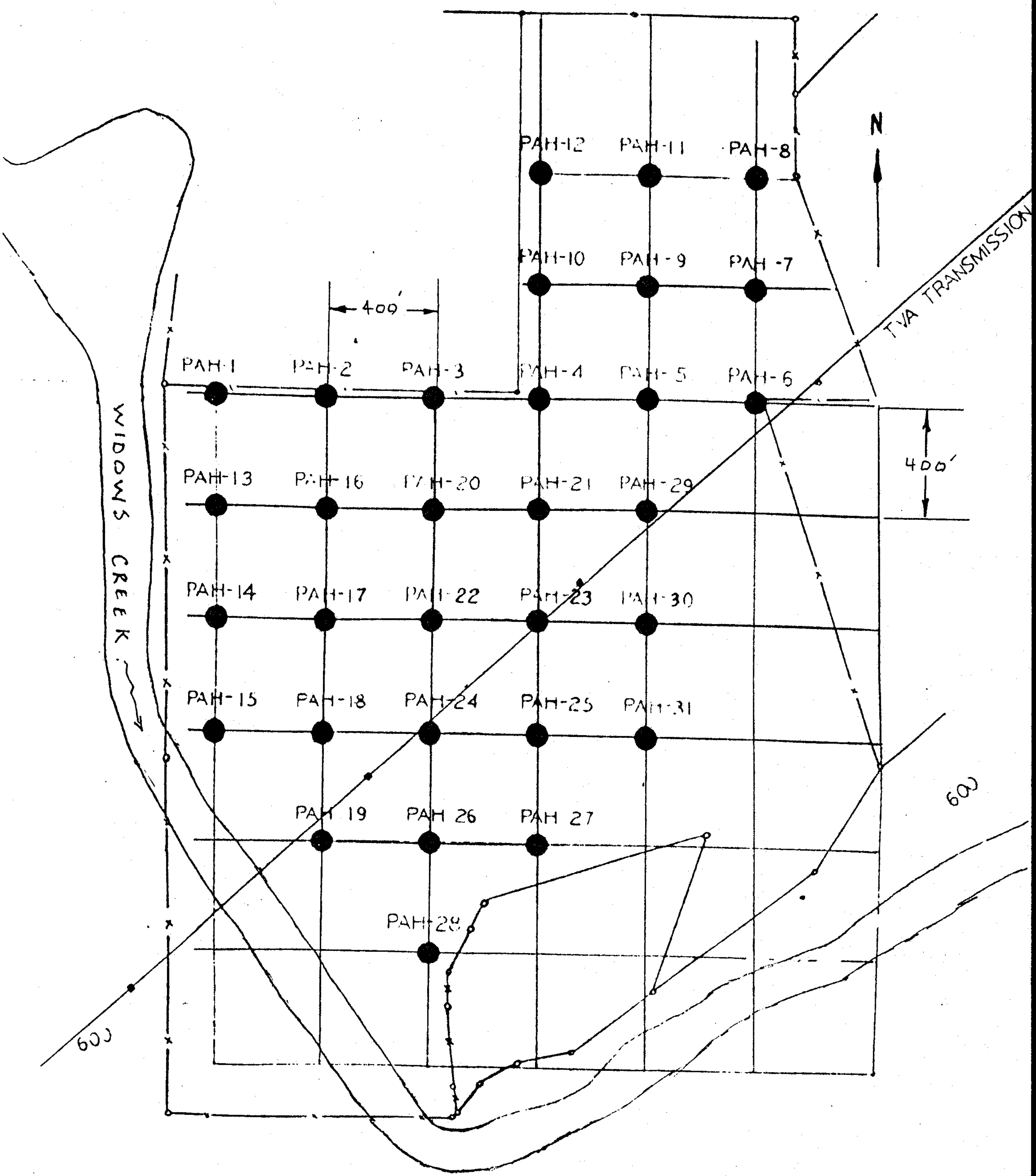
OPERATION OVERVIEW



LAND AQUISITION



TENNESSEE VALLEY AUTHORITY
DIVISION OF FOSSIL AND HYDRO POWER
SCRUBBER SLUDGE STORAGE
WIDOWS CREEK STEAM PLANT



These Auger ~~core~~ borings indicate depths to refusal in the range of 6-28 ft., AVE = 15 ft. Soils WERE predominantly highly plastic clay And silt (70%) AND lean clay (30%). Based ON index properties soil permeabilities were estimated at 10^{-6} - 10^{-8} cm/sec. This SECTION represents ~~represts~~ about 75% of phase I.

SITE CONDITIONS

The proposed site of the disposal area is currently adjoined on two sides by existing dikes which are built 3 to 5 feet above adjacent ground, and on one side by an existing road. The proposed site is currently used as an equipment and materials storage area and is covered with gravel from an off-site borrow area.

A soils investigation consisting of two hollow-stem auger borings was performed in the disposal area on December 9 and 10, 1981 by the Tennessee Valley Authority (TVA). Based on this investigation, the site is characterized by approximately 5 feet of uncontrolled fill composed of rubble mixed with a slightly sandy lean clay, overlying 15 to 20 feet of fill composed of slightly sandy lean to fat clay. One undisturbed sample and one disturbed sample from the upper 5 feet of the profile indicated that the clay is characterized by: a natural moisture content of 31%; an in-place dry density of 86 lb/ft^3; a fines content (i.e., percent silt and clay size material by dry weight) of 85 to 90%; liquid limits of 31 to 44%; and plasticity indices of 11 to 20%. One laboratory permeability test on an undisturbed sample from these soils indicated a relatively low coefficient of permeability, k, of $8.4\text{x}10^{-8}$ cm/sec.

Underlying the upper 5 feet of uncontrolled fill is 15 to 20 feet of relatively soft, slightly sandy lean to fat clays which are also reported as fill. These soils are characterized by a natural moisture content of 26%; an in-place dry density of 98 lb/ft^3; a fines content of 75 to 95%; liquid limits of 32 to 52%; and plasticity indices of 13 to 26%. Two laboratory permeability tests on undisturbed samples yielded relatively low coefficients of permeability of $8.4\text{x}10^{-8}$ and $7.8\text{x}10^{-9}$ cm/sec. Underlying these soils is bedrock or an approximately 5-foot thick layer of residual sandy silt overlying bedrock.

At the time of the soils investigation, the groundwater level was reported at 1-foot below ground surface.

Overall, the results reported by the TVA soils investigation indicate that the disposal area is underlain by fill largely composed of slightly sandy lean to fat clays with rubble within the upper 5 feet. Laboratory permeability tests indicate relatively impervious foundation conditions ($k < 10^{-7}$ cm/sec), although the *in situ* coefficient of permeability may be greater since the fills were apparently randomly placed and also contain rubble. Borrow material used to construct the starter dike for the disposal area is scheduled to be obtained from within the disposal area. The high natural moisture content of the clays, the presence of rubble, and the high water table, however may make excavation and subsequent fill placement and compaction difficult.

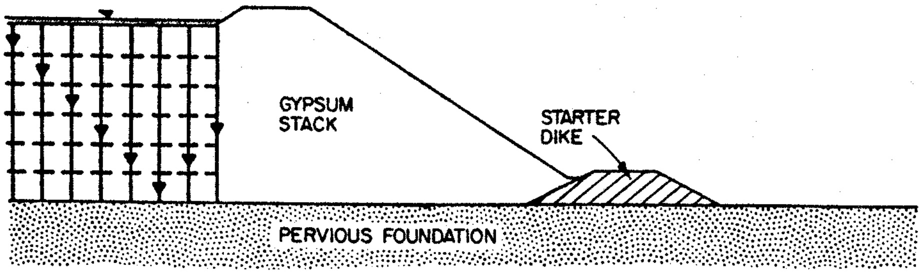


Figure 16-6. Seepage Pattern through a Gypsum Stack on a Pervious Foundation

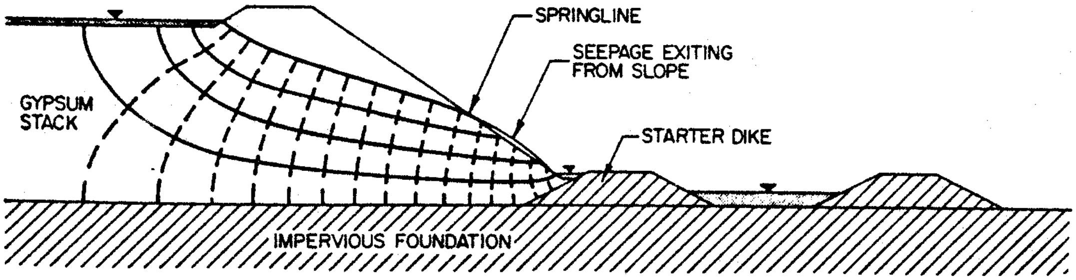
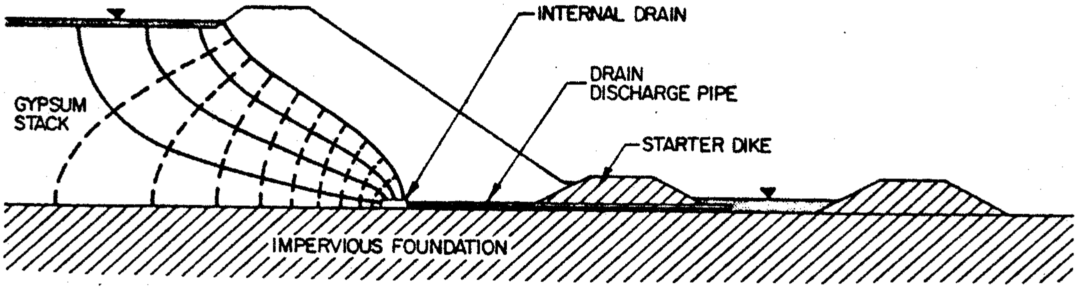


Figure 16-7. Seepage Pattern through a Gypsum Stack on an Impervious Foundation



Effect of Internal Drain on Seepage Pattern through a Gypsum Stack on an Impervious Foundation

CHEMICAL ANALYSES OF FGD SLUDGE EXTRACTS AND INTERSTITIAL WATER FROM EXISTING SCRUBBER POND

	Concentration, mg/L	
	Pond core sludge extract[a]	Pond core sludge interstitial water[b]
Arsenic	0.004	0.090
Barium	2.7	0.64
Beryllium	<0.010	<0.010
Boron	15	20
Calcium	2,100	130
Cadmium	<0.001	0.001
Chromium	<0.005	<0.005
Copper	0.050	0.030
Iron	0.150	0.230
Lead	<0.010	0.015
Magnesium	19	2.8
Manganese	0.620	0.040
Mercury	<0.0002	<0.0002
Nickel	0.220	0.100
Selenium	0.014	0.034
Silver	0.040	0.030
Thallium	0.430	0.250
Zinc	0.030	0.020
Chloride	90	700
Sulfate	480	1,500

---

a. EPA extraction procedure extract of sludge from a layer of pond sediment between 10 and 50 cm below the solid-liquid interface.

b. Interstitial water physically extracted from the same sludge sample.

WMB

TVA 64 (OS-9-65)

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

TO : William M. McMaster, Chief, Data Services Branch, 350 EB-K

FROM : R. O. Barnett, Chief, Civil Engineering Support Branch, W9D224 C-K

DATE : OCT 14 1982

SUBJECT: WIDOWS CREEK STEAM PLANT - BORROW AREA FOR THE SCRUBBER SLUDGE POND DIKE RAISING

References:
1. Memorandum from H. S. Fox to M. N. Sprouse dated September 20, 1982 (DES 820921 007)
2. Memorandum from G. L. Buchanan to Frank Van Meter dated August 6, 1979 (CDB 790806 015)

In response to a request for a top-of-rock map for the borrow area for the scrubber sludge pond at Widows Creek Steam Plant (reference 1), we request that the grid system previously utilized during a Widows Creek Steam Plant soils investigation in this area (reference 2) be reestablished. Thirty additional stations for a seismic refraction survey need to be located as shown on the attachment. These locations should be given an appropriate alpha-numeric designation. Additionally, we request that four random original soil borings be relocated. All location stakes should be marked with the appropriate grid coordinates and elevations. A table with all pertinent data should be transmitted to us upon completion of your work.

The attachment to this memorandum identifies the survey site so the Land Branch of the Division of Property and Services can obtain the required permits for access to private land tracts as requested in reference 1. The Land Branch should be aware that seismic survey activities will include the use of a 4-wheel-drive vehicle and small subsurface blasts that will create minimal noise and, depending on soil conditions, possibly a crater 2 feet deep and 3 feet in diameter. All craters will be backfilled.

By copy of this memorandum, we request that the Cultural Resources Program of the Division of Land and Forestry Resources assess the potential impact of the seismic survey operations, described above, upon the site (attachment).

Any questions regarding budgetary matters related to operations should be directed to T. F. Manseill of the Division of Fossil and Hydro Power at extension 3505 in Chattanooga.

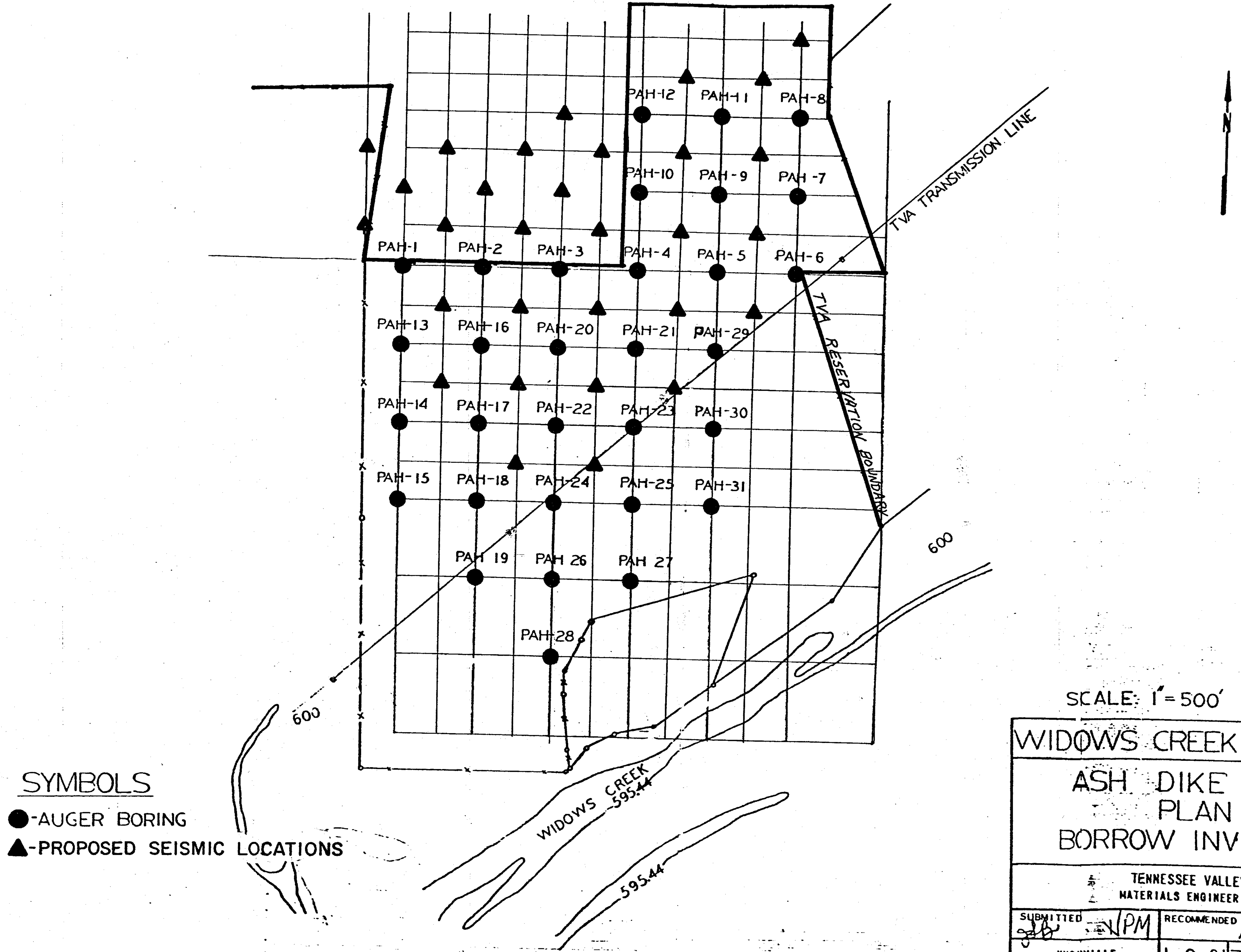
If you have any questions concerning these requests, please contact Bill Seay at extension 4775.

R. Joe Hunt
for R. O. Barnett

WCW
ROB:WCW:DDM
WMS
Attachment
cc (Attachment):
- C. L. Olive, Jr., 464 LB-C
- R. A. Painter, E5C80 C-K
- M. D. Ramsey, FOR B-N
- M. N. Sprouse, W11A9 C-K
- J. T. Thompson, 705 EB-C
- O. P. Thornton, 102 SPT-K

MNS:DDM -
cc (Attachment):
- MEDS, W5B63 C-K
- M. G. Msarsa, 268 401B-C

Principally Prepared By: Wade C. Whitaker, extension 4779



SYMBOLS

● -AUGER BORING

▲ -PROPOSED SEISMIC LOCATIONS

SCALE: 1" = 500'

WIDOWS CREEK STEAM PLANT

ASH DIKE RAISING
PLAN OF
BORROW INVESTIGATION

TENNESSEE VALLEY AUTHORITY
MATERIALS ENGINEERING LABORATORY

SUBMITTED VPM | RECOMMENDED | APPROVED

KNOXVILLE | 1-9-81 | 34 | CS | 3 | 604B1062R0

WIDOWS CREEK FOSSIL PLANT

ASH POND

DREDGE CELL

STABILITY ANALYSIS

(using PCSTABL5M)

ATTACHMENT 1

Widows Creek - Scrubber Sludge & Ash Pond Dikes (Old & New)

COMPUTED SBA DATE 4-24-'81
CHECKED DATE

#	Soil Identification	Unit Weight (Pcf)			Shear Strength						Remarks
					Q		R		$\bar{R}$		
		γ_{moist}	γ_{SAT}	γ_{SUB}	C (tsf)	Φ (0)	C (tsf)	Φ (0)	$\bar{C}$ (tsf)	$\bar{\Phi}$ (0)	
#1	Borrow Earthfill	118	122	60	1600 0.8	6	0.1	14	0	24	Compacted to 95% of max. dry density at opt. ±3% moisture.
#2	Controlled Earthfill	129	131	69	1900 0.95	10	0.55	20	0	31	Inplace - Scrubber sludge & New Ash Pond Dikes
#3	Uncontrolled Earthfill	119	123	61	1200 0.6	0	0.30	14	0	28	Inplace - old Ash Disposal Dike (units 7 & 8)
#4	Fly Ash	108	110	48	800 0.4	14	0.05 ~~0~~	22	0	28	Hydraulically placed - old Ash Disposal Dike
#5	Bottom Ash	117	122	60	2000 1.0	5	0.6	20	0	35	No Test Data - Properties estimated from tests on Bottom Ash from Kingston & Colbert S.P.
#6	In-situ Residuum (Foundation soil)	127	129	67	2000 1.0	7	0.45	16	0	31	Foundation soil under all dikes
#7	Fly Ash	100	100						ϕ	20°	

Recommended Soil Properties for Stability Analysis

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18a of 35

FEP '841114 001

ckd JPHS

```
? N
160 -9399,-22,-77,-22,-110,20,28,0,0
? 150
150 159,-38,9399,-129,0,31,0,0
? C/-2
ARGUMENT ERROR
? C/-129/-38,-129/
   159,-38,9399,-38,-129,0,31,0,0
? 0,,RL
RADBT3  REPLACED
DBT3  IS A LOCAL FILE
EADY.
FTN
 READY.
OLD,SLOPE2
 READY.
GET,TAPE5=RADBT3
 READY.
RUN

 84/11/07. 13.03.31.
OGRAM   SLOPE2

104 WCF - RBAR TEST - RAISING ASH DIKE (SS-26,US-26) - "OVER EARTH"
ERQF=       .05     DEPTH OF ROCK=   48.0 FT)


                THESE ARE THE INPUT DATA LINES

    X1        Y1       X2        Y2       W         F2       F1        C2       C1

 -9399.0    -48.0  9399.0    -48.0 -1000.0     31.0    100.0      0.0   9999.0
      .0    -48.0  9399.0    -48.0  -129.0     28.0     31.0      0.0      0.0
      .0    -38.0   100.0    -38.0  -129.0     28.0     31.0      0.0      0.0
   100.0    -38.0   159.0    -38.0  -129.0     28.0     31.0      0.0      0.0
   159.0    -38.0  9399.0    -38.0  -129.0      0.0     31.0      0.0      0.0
  9399.0    -22.0   -77.0    -22.0  -110.0     20.0     28.0      0.0      0.0
   -77.0    -22.0    14.0    -22.0  -110.0     35.0     28.0      0.0      0.0
   -18.0    -38.0    14.0    -22.0  -123.0     28.0     28.0      0.0      0.0
    14.0    -22.0    26.5    -15.8  -123.0     35.0     28.0      0.0      0.0
    26.5    -15.8   100.0    -38.0  -123.0     28.0     28.0      0.0      0.0
   -77.0    -22.0   -60.0    -14.0  -122.0     20.0     35.0      0.0      0.0
   -60.0    -14.0   -36.0    -14.0  -122.0     20.0     35.0      0.0      0.0
   -36.0    -14.0    21.0    -14.0  -122.0     24.0     35.0      0.0      0.0
    21.0    -14.0    26.5    -15.8  -122.0     35.0     35.0      0.0      0.0
    21.0    -14.0    30.0    -14.0   117.0     24.0     35.0      0.0      0.0
    26.5    -15.8    30.0    -14.0   119.0     35.0     28.0      0.0      0.0
    30.0    -14.0    38.0    -10.0   119.0     24.0     28.0      0.0      0.0
    38.0    -10.0    68.0    -10.0   119.0      0.0     28.0      0.0      0.0
    66.0    -10.0   107.0    -24.0   119.0      0.0     28.0      0.0      0.0
   107.0    -24.0   124.0    -24.0   119.0      0.0     28.0      0.0      0.0
   124.0    -24.0   159.0    -38.0   119.0      0.0     28.0      0.0      0.0
  9399.0     -8.0   -24.0     -8.0  -100.0      0.0     20.0      0.0      0.0
   -36.0    -14.0   -24.0     -8.0  -122.0     20.0     24.0      0.0      0.0
   -24.0     -8.0   -16.0     -4.0  -122.0      0.0     24.0      0.0      0.0
   -16.0     -4.0    21.0    -14.0  -122.0     24.0     24.0      0.0      0.0
   -16.0     -4.0    -8.0      0.0   118.0      0.0     24.0      0.0      0.0
       0      0.0     8.0      0.0   118.0      0.0     24.0      0.0      0.0
              0.0    38.0    -10.0   118.0      0.0     24.0      0.0      0.0
  9399.0     -4.0   -16.0     -4.0   -62.4      0.0      0.0      0.0      0.0


  T=     5.0     YT=    -3.0     XB=  -45.0     YB=  -48.0

  GRIDX=   20.0    GRIDY=   10.0    XMAX=   70.0    YMAX=   60.0
```

18 21

FEP '841114 001

```
THE MAXIMUM F.S. TO BE PRINTED IS    0.00

THE MAXIMUM E.F.S. TO BE PRINTED IS    0.00


            TEST POINTS


THE MIN. FS=   1.59   EFS=   1.33   H(X)=  30.00   G(Y)=  30.00   R=  41.41

THE MIN. EFS=   1.33   FS=   1.59   H(X)=  30.00   G(Y)=  30.00   R=  41.41

SBU     43.507 UNTS.

 RUN COMPLETE.
I=5
CI ACCEPTED..
OLD,RADBT3
 READY.
510 65,-13,15,-40
520 80,0,130,50,10,10,10
530 0,0
REP
 READY.
FTN
 READY.
OLD,SLOPE2
 READY.
[illegible]APE5=RADBT3
 READY.
RUN

 84/11/07. 13.07.45.
PROGRAM   SLOPE2

H04 WCF - RBAR TEST - RAISING ASH DIKE (SS-26,US-26) - "OVER EARTH"
 (ERQF=       .05     DEPTH OF ROCK=   48.0 FT)


              THESE ARE THE INPUT DATA LINES

     X1        Y1       X2        Y2       W         F2       F1        C2       C1

  -9399.0    -48.0   9399.0    -48.0 -1000.0     31.0    100.0       0.0   9999.0
  -9399.0    -48.0   9399.0    -48.0  -129.0     28.0     31.0       0.0      0.0
    -18.0    -38.0    108.0    -38.0  -129.0     28.0     31.0       0.0      0.0
    108.0    -38.0    159.0    -38.0  -129.0     28.0     31.0       0.0      0.0
    159.0    -38.0   9399.0    -38.0  -129.0      0.0     31.0       0.0      0.0
  -9399.0    -22.0    -77.0    -22.0  -110.0     28.0     28.0       0.0      0.0
    -77.0    -22.0     14.0    -22.0  -110.0     35.0     28.0       0.0      0.0
    -18.0    -38.0     14.0    -22.0  -123.0     28.0     28.0       0.0      0.0
     14.0    -22.0     26.5    -15.8  -123.0     35.0     28.0       0.0      0.0
     26.5    -15.8    108.0    -38.0  -123.0     28.0     28.0       0.0      0.0
 [illegible].0    -22.0    -60.0    -14.0  -122.0     20.0     35.0       0.0      0.0
 [illegible].0    -14.0    -36.0    -14.0  -122.0     20.0     35.0       0.0      0.0
    -36.0    -14.0     21.0    -14.0  -122.0     24.0     35.0       0.0      0.0
     21.0    -14.0     26.5    -15.8  -122.0     35.0     35.0       0.0      0.0
     21.0    -14.0     30.0    -14.0   117.0     24.0     35.0       0.0      0.0
     26.5    -15.8     30.0    -14.0   119.0     35.0     28.0       0.0      0.0
     30.0    -14.0     38.0    -12.0   119.0     24.0     29.2       0.0      0.0
 [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]
```

R̄ @ FULL POOL

18 22

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```
     68.0   -10.0   107.0   -24.0   119.0     0.0    28.0     0.0     0.0
    107.0   -24.0   124.0   -24.0   119.0     0.0    28.0     0.0     0.0
    124.0   -24.0   159.0   -38.0   119.0     0.0    28.0     0.0     0.0
  -9399.0    -8.0   -24.0    -8.0  -100.0     0.0    28.0     0.0     0.0
    -36.0   -14.0   -24.0    -8.0  -122.0    28.0    24.0     0.0     0.0
    -24.0    -8.0   -16.0    -4.0  -122.0     0.0    24.0     0.0     0.0
    -16.0    -4.0    21.0   -14.0  -122.0    24.0    24.0     0.0     0.0
      6.0    -4.0    -8.0     0.0   118.0     0.0    24.0     0.0     0.0
     -8.0     0.0     8.0     0.0   118.0     0.0    24.0     0.0     0.0
      8.0     0.0    38.0   -10.0   118.0     0.0    24.0     0.0     0.0
  -9399.0    -4.0   -16.0    -4.0   -62.4     0.0     0.0     0.0     0.0


 XT=   65.0     YT=  -13.0     XB=   15.0     YB=  -40.0

 GRIDX=   80.0     GRIDY=    0.0     XMAX=  130.0     YMAX=   50.0

 INCX= 10     INCY= 10     INCR= 10

 THE MAXIMUM F.S. TO BE PRINTED IS    0.00

 THE MAXIMUM E.F.S. TO BE PRINTED IS    0.00



           TEST POINTS


  THE MIN. FS=   1.69   EFS=   1.44   H(X)= 100.00   G(Y)=  40.00   R=  63.52

    MIN. EFS=   1.44   FS=   1.69   H(X)= 100.00   G(Y)=  40.00   R=  63.52

SBU     20.226 UNTS.

 RUN COMPLETE.
OLD,RADBT3
 READY.
510 121,-27,71,-40
520 130,-20,120,30,10,10,10
REP
 READY.
FTN
 READY.
OLD,SLOPE2
 READY.
GET,TAPE3=RADBT3
 READY.
RUN

 84/11/07. 13.11.34.
PROGRAM   SLOPE2

104 WCF - RBAR TEST - RAISING ASH DIKE (SS-26,US-26) - "OVER EARTH"
 (ERGF=      .05    DEPTH OF ROCK=   40.0 FT)


             THESE ARE THE INPUT DATA LINES

       X1      Y1      X2      Y2       W      F2      F1      C2      C1

  -9399.0   -48.0  9399.0   -48.0 -1000.0    31.0   100.0     0.0  9999.0
  -9399.0   -48.0  9399.0   -48.0  -129.0    28.0    31.0     0.0     0.0
    -16.0   -38.0   100.0   -38.0  -129.0    28.0    31.0     0.0     0.0
```

R̄ @ FULL POOL

18 23

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```
   159.0   -38.0  9399.0   -38.0  -129.0    0.0    31.0    0.0    0.0
 -9399.0   -22.0   -77.0   -22.0  -110.0   28.0    28.0    0.0    0.0
   -77.0   -22.0    14.0   -22.0  -110.0   35.0    28.0    0.0    0.0
   -18.0   -38.0    14.0   -22.0  -123.0   28.0    28.0    0.0    0.0
    14.0   -22.0    26.5   -15.8  -123.0   35.0    28.0    0.0    0.0
    26.5   -15.8   108.0   -38.0  -123.0   28.0    28.0    0.0    0.0
    77.0   -22.0   -60.0   -14.0  -122.0   20.0    35.0    0.0    0.0
   -60.0   -14.0   -36.0   -14.0  -122.0   20.0   -35.0    0.0    0.0
   -36.0   -14.0    21.0   -14.0  -122.0   24.0    35.0    0.0    0.0
    21.0   -14.0    26.5   -15.8  -122.0   35.0    35.0    0.0    0.0
    21.0   -14.0    30.0   -14.0   117.0   24.0    35.0    0.0    0.0
    26.5   -15.8    30.0   -14.0   119.0   35.0    28.0    0.0    0.0
    30.0   -14.0    38.0   -10.0   119.0   24.0    28.0    0.0    0.0
    38.0   -10.0    68.0   -10.0   119.0    0.0    28.0    0.0    0.0
    68.0   -10.0   107.0   -24.0   119.0    0.0    28.0    0.0    0.0
   107.0   -24.0   124.0   -24.0   119.0    0.0    28.0    0.0    0.0
   124.0   -24.0   159.0   -38.0   119.0    0.0    28.0    0.0    0.0
 -9399.0    -8.0   -24.0    -8.0  -100.0    0.0    20.0    0.0    0.0
   -36.0   -14.0   -24.0    -8.0  -122.0   20.0    24.0    0.0    0.0
   -24.0    -8.0   -16.0    -4.0  -122.0    0.0    24.0    0.0    0.0
   -16.0    -4.0    21.0   -14.0  -122.0   24.0    24.0    0.0    0.0
   -16.0    -4.0    -8.0     0.0   118.0    0.0    24.0    0.0    0.0
    -8.0     0.0     8.0     0.0   118.0    0.0    24.0    0.0    0.0
     8.0     0.0    38.0   -10.0   118.0    0.0    24.0    0.0    0.0
 -9399.0    -4.0   -16.0    -4.0   -62.4    0.0     0.0    0.0    0.0


XT=  121.0     YT=  -27.0     XB=   71.0     YB=  -40.0

GRIDX=  130.0    GRIDY=  -20.0    XMAX=  180.0    YMAX=   30.0

   X= 10     INCY= 10     INCR= 10

THE MAXIMUM F.S. TO BE PRINTED IS    0.00

THE MAXIMUM E.F.S. TO BE PRINTED IS    0.00



          TEST POINTS


THE MIN. FS=   1.56   EFS=   1.33   H(X)= 150.00   G(Y)=  10.00   R=  47.02

 THE MIN. EFS=   1.33   FS=   1.56   H(X)= 150.00   G(Y)=  10.00   R=  47.02

SBU    13.298 UNITS.

RUN COMPLETE.
```

1861

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```
 -9399.0   -48.0  9399.0   -48.0 -1000.0    31.0   100.0     0.0  9999.0
 9399.0   -48.0  9399.0   -48.0  -129.0    28.0    31.0     0.0     0.0
  -18.0   -38.0   108.0   -38.0  -129.0    28.0    31.0     0.0     0.0
  108.0   -38.0   159.0   -38.0  -129.0    28.0    31.0     0.0     0.0
  159.0   -38.0  9399.0   -38.0  -129.0     0.0    31.0     0.0     0.0
 9399.0   -22.0   -77.0   -22.0  -110.0    20.0    28.0     0.0     0.0
   77.0   -22.0    14.0   -22.0  -110.0    35.0    28.0     0.0     0.0
     .0   -30.0    14.0   -22.0  -123.0    20.0    28.0     0.0     0.0
   14.0   -22.0    26.5   -15.8  -123.0    35.0    28.0     0.0     0.0
   26.5   -15.8   108.0   -38.0  -123.0    28.0    28.0     0.0     0.0
  -77.0   -22.0   -60.0   -14.0  -122.0    20.0    35.0     0.0     0.0
  -60.0   -14.0   -36.0   -14.0  -122.0    20.0    35.0     0.0     0.0
  -36.0   -14.0    21.0   -14.0  -122.0    24.0    35.0     0.0     0.0
   21.0   -14.0    26.5   -15.8  -122.0    35.0    35.0     0.0     0.0
   21.0   -14.0    30.0   -14.0   117.0    24.0    35.0     0.0     0.0
   26.5   -15.8    30.0   -14.0   119.0    35.0    28.0     0.0     0.0
   30.0   -14.0    38.0   -10.0   119.0    24.0    28.0     0.0     0.0
   38.0   -10.0    68.0   -10.0   119.0     0.0    28.0     0.0     0.0
   68.0   -10.0   107.0   -24.0   119.0     0.0    28.0     0.0     0.0
  107.0   -24.0   124.0   -24.0   119.0     0.0    28.0     0.0     0.0
  124.0   -24.0   159.0   -38.0   119.0     0.0    28.0     0.0     0.0
 9399.0    -8.0   -24.0    -8.0  -100.0     0.0    20.0     0.0     0.0
  -36.0   -14.0   -24.0    -8.0  -122.0    20.0    24.0     0.0     0.0
  -24.0    -8.0   -16.0    -4.0  -122.0     0.0    24.0     0.0     0.0
  -16.0    -4.0    21.0   -14.0  -122.0    24.0    24.0     0.0     0.0
  -16.0    -4.0    -8.0     0.0   118.0     0.0    24.0     0.0     0.0
   -8.0     0.0     8.0     0.0   118.0     0.0    24.0     0.0     0.0
    8.0     0.0    38.0   -10.0   118.0     0.0    24.0     0.0     0.0
 9399.0    -4.0   -16.0    -4.0   -62.4     0.0     0.0     0.0     0.0


 T=   37.0     YT=  -11.0     XB=  -13.0     YB=  -40.0

 GRIDX=  120.0     GRIDY=   80.0     XMAX=  170.0     YMAX=  130.0

 INCX= 10     INCY= 10     INCR= 10

 THE MAXIMUM F.S. TO BE PRINTED IS    0.00

 THE MAXIMUM E.F.S. TO BE PRINTED IS    0.00



                TEST POINTS



 THE MIN. FS=   2.15   EFS=   1.72   H(X)= 130.00   G(Y)=  90.00   R= 137.31

 THE MIN. EFS=   1.72   FS=   2.15   H(X)= 130.00   G(Y)=  90.00   R= 137.31
```

$\bar{R}$ @ FULL POOL

FOR SIDE TWO

```
                THESE ARE THE INPUT DATA LINES

     X1      Y1      X2      Y2      G      F2      F1      C2      C1

  9399.0   -48.0 -9399.0   -48.0 -1000.0   31.0   100.0     0.0  9999.0
```

1862

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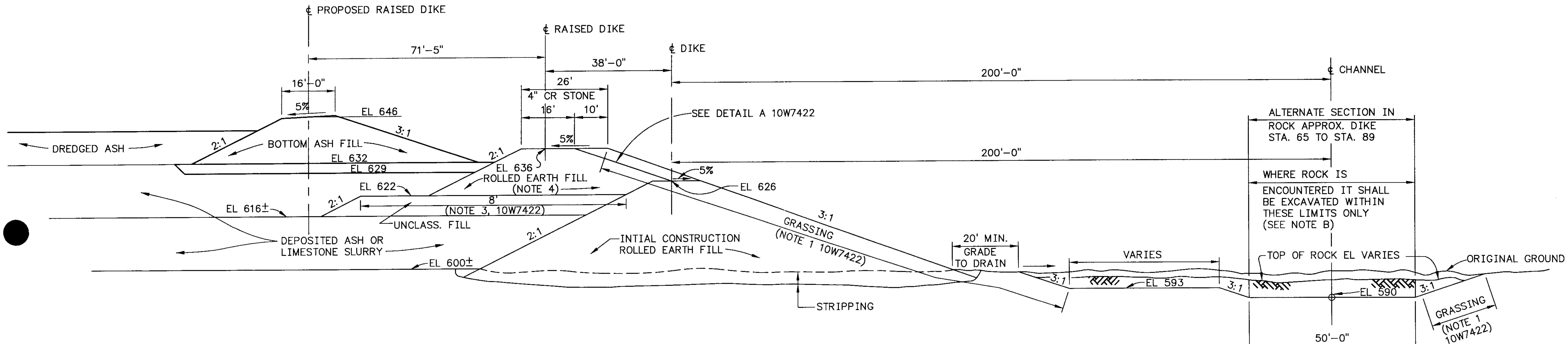
```
9399.0   -40.0 -9399.0   -40.0  -129.0    28.0    31.0     0.0     0.0
  18.0   -38.0  -100.0   -38.0  -129.0    28.0    31.0     0.0     0.0
-100.0   -38.0  -159.0   -38.0  -129.0    28.0    31.0     0.0     0.0
-159.0   -38.0 -9399.0   -38.0  -129.0     0.0    31.0     0.0     0.0
9399.0   -22.0    77.0   -22.0  -110.0    28.0    28.0     0.0     0.0
  77.0   -22.0   -14.0   -22.0  -110.0    35.0    28.0     0.0     0.0
   8.0   -38.0   -14.0   -22.0  -123.0    28.0    28.0     0.0     0.0
    .0   -22.0   -26.5   -15.8  -123.0    35.0    28.0     0.0     0.0
 -26.5   -15.8  -100.0   -38.0  -123.0    28.0    28.0     0.0     0.0
  77.0   -22.0    60.0   -14.0  -122.0    20.0    35.0     0.0     0.0
  60.0   -14.0    36.0   -14.0  -122.0    20.0    35.0     0.0     0.0
  36.0   -14.0   -21.0   -14.0  -122.0    24.0    35.0     0.0     0.0
 -21.0   -14.0   -26.5   -15.8  -122.0    35.0    35.0     0.0     0.0
 -21.0   -14.0   -30.0   -14.0   117.0    24.0    35.0     0.0     0.0
 -26.5   -15.8   -30.0   -14.0   119.0    35.0    28.0     0.0     0.0
 -30.0   -14.0   -38.0   -10.0   119.0    24.0    28.0     0.0     0.0
 -38.0   -10.0   -68.0   -10.0   119.0     0.0    28.0     0.0     0.0
 -68.0   -10.0  -107.0   -24.0   119.0     0.0    28.0     0.0     0.0
-107.0   -24.0  -124.0   -24.0   119.0     0.0    28.0     0.0     0.0
-124.0   -24.0  -159.0   -38.0   119.0     0.0    28.0     0.0     0.0
9399.0    -8.0    24.0    -8.0  -100.0     0.0    20.0     0.0     0.0
  36.0   -14.0    24.0    -8.0  -122.0    20.0    24.0     0.0     0.0
  24.0    -8.0    16.0    -4.0  -122.0     0.0    24.0     0.0     0.0
  16.0    -4.0   -21.0   -14.0  -122.0    24.0    24.0     0.0     0.0
  16.0    -4.0     8.0     0.0   118.0     0.0    24.0     0.0     0.0
   8.0     0.0    -8.0     0.0   118.0     0.0    24.0     0.0     0.0
  -8.0     0.0   -38.0   -10.0   118.0     0.0    24.0     0.0     0.0
9399.0    -4.0    16.0    -4.0   -62.4     0.0     0.0     0.0     0.0


T=   35.0     YT=  -15.0     XB=  -15.0     YB=  -40.0

   DX=   40.0     GRIDY=    0.0     XMAX=   90.0     YMAX=   50.0

 INCX= 10     INCY= 10     INCR= 10

 THE MAXIMUM F.S. TO BE PRINTED IS    0.00

 THE MAXIMUM E.F.S. TO BE PRINTED IS    0.00



           TEST POINTS



  THE MIN. FS=   2.50   EFS=   1.69   H(X)=  40.00   G(Y)=  50.00   R=  65.20


THE MIN. EFS=   1.69   FS=   2.50   H(X)=  40.00   G(Y)=  50.00   R=  65.20

SBU     46.747 UNTS.

 RUN COMPLETE.
OLD,RADBT3
 READY.
620 40,40,90,90,10,10,10

   DY.
FTN
 READY.
OLD,SLOPE2
 READY.
GET,TAPE5=RADBT3
 READY.
```



SECTION B-B

SCALE: 1"=20'
STATION 50+00± TO
STATION 95+00±
(10W7420)
REVISION 6: STATION 69+00± TO
STATION 95+00

NOTE B: WHERE ROCK ELEV. IS NO HIGHER THAN 591 @ ¢ CHANNEL, A CHANNEL 12' WIDE SHALL BE CONSTRUCTED @ ELEV. 590.

```
PROFIL
WCF DREDGE CELL (18a OF 35, RBAR-Values)Wcf18a07.in
20 9
0.0 598.0 303.0 598.0 6
303.0 598.0 338.0 612.0 3
338.0 612.0 355.0 612.0 3
355.0 612.0 394.0 626.0 3
394.0 626.0 424.0 626.0 3
424.0 626.0 454.0 636.0 1
454.0 636.0 470.0 636.0 1
470.0 636.0 486.0 628.0 1
486.0 628.0 1300.0 628.0 7
486.0 628.0 498.0 622.0 1
498.0 622.0 522.0 622.0 5
522.0 622.0 539.0 614.0 5
539.0 614.0 1300.0 614.0 4
424.0 626.0 432.0 622.0 3
432.0 622.0 498.0 622.0 5
432.0 622.0 448.0 614.0 3
448.0 614.0 539.0 614.0 4
448.0 614.0 480.0 598.0 3
480.0 598.0 1300.0 598.0 6
303.0 598.0 480.0 598.0 6
SOIL
7
118. 122. 0. 24. 0. 0. 1
129. 131. 0. 31. 0. 0. 1
119. 123. 0. 28. 0. 0. 1
108. 110. 0. 28. 0. 0. 1
117. 122. 0. 35. 0. 0. 1
127. 129. 0. 31. 0. 0. 1
100. 100. 0. 31. 0. 0. 1
WATER
1 0.
7
0.0 598.0
303.0 598.0
354.0 598.0
435.5 620.2
441.0 622.0
478.0 632.0
1300.0 632.0
LIMITS
1 1
0.0 588.0 1300.0 588.0
CIRCLE
1 2
13 25
230. 330. 460. 800.
0. 5. 0. 0.
```

```
PROFIL
WCF DREDGE CELL ( 3:1 inside el 630, 10W7421 Sect B-B, RBAR-Values)31BB
28 12
0.0 630.0 175.7 630.0 7
175.7 630.0 178.7 632.0 5
178.7 632.0 186.2 632.0 5
186.2 632.0 227.0 645.6 5
227.0 645.6 243.0 646.4 5
243.0 646.4 286.2 632.0 5
286.2 632.0 291.2 632.0 5
291.2 632.0 298.4 635.6 1
298.4 635.6 324.4 636.9 1
324.4 636.9 352.4 626.4 1
352.4 626.4 431.6 600.0 3
431.6 600.0 700.0 600.0 6
186.2 632.0 286.2 632.0 5
171.2 627.0 175.7 630.0 5
171.2 627.0 281.2 627.0 7
281.2 627.0 291.2 632.0 1
0.0 616.0 237.2 616.0 4
237.2 616.0 249.2 622.0 5
249.2 622.0 271.2 622.0 5
271.2 622.0 281.2 627.0 1
271.2 622.0 329.2 622.0 5
329.2 622.0 336.4 625.6 3
336.4 625.6 352.4 626.4 3
237.2 616.0 317.2 616.0 3
317.2 616.0 329.2 622.0 3
0.0 600.0 285.2 600.0 6
285.2 600.0 317.2 616.0 3
285.2 600.0 431.6 600.0 6
SOIL
7
125. 125. 500. 22. 0. 0. 1
125. 125. 500. 22. 0. 0. 1
125. 125. 500. 22. 0. 0. 1
90. 90. 100. 0. 0. 0. 1
120. 120. 0. 29. 0. 0. 1
125. 125. 200. 29. 0. 0. 1
90. 90. 100. 0. 0. 0. 1
WATER
1 0.
7
0.0 630.0
175.7 630.0
287.2 630.0
330.174 622.487
401.6 610.0
431.6 600.0
700.0 600.0
LIMITS
1 1
0.0 588.0 700.0 588.0
CIRCLE
1 2
19 25
90. 185. 230. 530.
0. 5. 0. 0.
```

```
PROFIL
WCF DREDGE CELL ( inside el 630, 10W7421 Sect B-B, RBAR-Values)81BB
28 12
0.0 630.0 191.8 630.0 7
191.8 630.0 194.8 632.0 5
194.8 632.0 199.8 632.0 5
199.8 632.0 227.0 645.6 5
227.0 645.6 243.0 646.4 5
243.0 646.4 286.2 632.0 5
286.2 632.0 291.2 632.0 5
291.2 632.0 298.4 635.6 1
298.4 635.6 324.4 636.9 1
324.4 636.9 352.4 626.4 1
352.4 626.4 431.6 600.0 3
431.6 600.0 700.0 600.0 6
199.8 632.0 286.2 632.0 5
187.3 627.0 191.8 630.0 5
187.3 627.0 281.2 627.0 7
281.2 627.0 291.2 632.0 1
0.0 616.0 237.2 616.0 4
237.2 616.0 249.2 622.0 5
249.2 622.0 271.2 622.0 5
271.2 622.0 281.2 627.0 1
271.2 622.0 329.2 622.0 5
329.2 622.0 336.4 625.6 3
336.4 625.6 352.4 626.4 3
237.2 616.0 317.2 616.0 3
317.2 616.0 329.2 622.0 3
0.0 600.0 285.2 600.0 6
285.2 600.0 317.2 616.0 3
285.2 600.0 431.6 600.0 6
SOIL
7
125. 125. 500. 22. 0. 0. 1
125. 125. 500. 22. 0. 0. 1
125. 125. 500. 22. 0. 0. 1
90. 90. 100. 0. 0. 0. 1
120. 120. 0. 29. 0. 0. 1
125. 125. 200. 29. 0. 0. 1
90. 90. 100. 0. 0. 0. 1
WATER
1 0.
7
0.0 630.0
191.8 630.0
287.2 630.0
330.174 622.487
401.6 610.0
431.6 600.0
700.0 600.0
LIMITS
1 1
0.0 588.0 700.0 588.0
CIRCLE
1 2
15 25
155. 225. 230. 530.
0. 5. 0. 0.
```

```
PROFIL
WCF DREDGE CELL (10W7421 Sect B-B, RBAR-Values)BB01
38 17
0.0 600.0 32.2 600.0 6
32.2 600.0 62.2 590.0 6
62.2 590.0 112.2 590.0 6
112.2 590.0 121.2 593.0 6
121.2 593.0 159.0 593.0 6
159.0 593.0 180.0 600.0 6
180.0 600.0 200.0 600.0 6
200.0 600.0 279.2 626.4 3
279.2 626.4 307.2 636.9 1
307.2 636.9 317.2 636.4 1
317.2 636.4 333.2 635.6 1
333.2 635.6 340.4 632.0 1
340.4 632.0 345.4 632.0 5
345.4 632.0 388.6 646.4 5
388.6 646.4 404.6 645.6 5
404.6 645.6 411.8 642.0 5
411.8 642.0 700.0 642.0 7
411.8 642.0 431.8 632.0 5
431.8 632.0 436.8 632.0 5
436.8 632.0 439.8 630.0 5
439.8 630.0 700.0 630.0 7
439.8 630.0 444.3 627.0 5
340.4 632.0 350.4 627.0 1
350.4 627.0 444.3 627.0 7
350.4 627.0 360.4 622.0 1
360.4 622.0 382.4 622.0 5
382.4 622.0 394.4 616.0 5
394.4 616.0 700.0 616.0 4
279.2 626.4 287.2 626.0 3
287.2 626.0 317.2 636.4 1
287.2 626.0 295.2 625.6 3
295.2 625.6 302.4 622.0 3
302.4 622.0 360.4 622.0 5
302.4 622.0 314.4 616.0 3
314.4 616.0 394.4 616.0 4
314.4 616.0 346.4 600.0 3
346.4 600.0 700.0 600.0 6
200.0 600.0 346.4 600.0 6
SOIL
7
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129. 131. 0. 31. 0. 0. 1
119. 123. 0. 28. 0. 0. 1
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127. 129. 0. 31. 0. 0. 1
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WATER
1 0.
14
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62.2 590.0
112.2 590.0
121.2 593.0
159.0 593.0
180.0 600.0
200.0 600.0
232.001 610.667
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298.781 623.809
340.4 632.0
345.4 632.0
355.399 635.333
411.8 642.0
700.0 642.0
LIMITS
1 1
0.0 588.0 700.0 588.0
CIRCLE
1 2
20 25
110. 300. 310. 600.
0. 10. 0. 0.
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PROFIL
WCF DREDGE CELL (10W7421 Sect B-B, RBAR-Values)BB21
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32.2 600.0 62.2 590.0 6
62.2 590.0 112.2 590.0 6
112.2 590.0 121.2 593.0 6
121.2 593.0 159.0 593.0 6
159.0 593.0 180.0 600.0 6
180.0 600.0 200.0 600.0 6
200.0 600.0 279.2 626.4 3
279.2 626.4 307.2 636.9 1
307.2 636.9 317.2 636.4 1
317.2 636.4 333.2 635.6 1
333.2 635.6 340.4 632.0 1
340.4 632.0 345.4 632.0 5
345.4 632.0 388.6 646.4 5
388.6 646.4 404.6 645.6 5
404.6 645.6 411.8 642.0 5
411.8 642.0 700.0 642.0 7
411.8 642.0 431.8 632.0 5
431.8 632.0 436.8 632.0 5
436.8 632.0 439.8 630.0 5
439.8 630.0 700.0 630.0 7
439.8 630.0 444.3 630.0 5
340.4 632.0 350.4 627.0 1
350.4 627.0 444.3 627.0 7
350.4 627.0 360.4 622.0 1
360.4 622.0 382.4 622.0 5
382.4 622.0 394.4 616.0 5
394.4 616.0 700.0 616.0 4
279.2 626.4 287.2 626.0 3
287.2 626.0 317.2 636.4 1
287.2 626.0 295.2 625.6 3
295.2 625.6 302.4 622.0 3
302.4 622.0 360.4 622.0 5
302.4 622.0 314.4 616.0 3
314.4 616.0 394.4 616.0 4
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200.0 600.0 346.4 600.0 6
SOIL
7
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WATER
1 0.
14
0.0 595.0
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112.2 590.0
121.2 593.0
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180.0 600.0
200.0 600.0
232.001 610.667
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340.4 632.0
345.4 632.0
355.399 635.333
411.8 642.0
700.0 642.0
LIMITS
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CIRCLE
1 2
21 25
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121.2 593.0 159.0 593.0 6
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180.0 600.0 200.0 600.0 6
200.0 600.0 279.2 626.4 3
279.2 626.4 307.2 636.9 1
307.2 636.9 317.2 636.4 1
317.2 636.4 333.2 635.6 1
333.2 635.6 340.4 632.0 1
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345.4 632.0 388.6 646.4 5
388.6 646.4 404.6 645.6 5
404.6 645.6 415.4 642.0 5
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415.4 642.0 445.4 632.0 5
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350.4 627.0 460.4 627.0 7
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382.4 622.0 394.4 616.0 5
394.4 616.0 700.0 616.0 4
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287.2 626.0 317.2 636.4 1
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295.2 625.6 302.4 622.0 3
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302.4 622.0 314.4 616.0 3
314.4 616.0 394.4 616.0 4
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200.0 600.0 346.4 600.0 6
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WATER
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14
0.0 595.0
62.2 590.0
112.2 590.0
121.2 593.0
159.0 593.0
180.0 600.0
200.0 600.0
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232.001 610.667
298.781 623.809
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355.399 635.333
415.4 642.0
700.0 642.0
LIMITS
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CIRCLE
1 2
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200. 300. 345. 420.
0. 5. 0. 0.
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180.0 600.0 200.0 600.0 6
200.0 600.0 279.2 626.4 3
279.2 626.4 307.2 636.9 1
307.2 636.9 317.2 636.4 1
317.2 636.4 333.2 635.6 1
333.2 635.6 340.4 632.0 1
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388.6 646.4 404.6 645.6 5
404.6 645.6 411.8 642.0 5
411.8 642.0 700.0 642.0 7
411.8 642.0 431.8 632.0 5
431.8 632.0 436.8 632.0 5
436.8 632.0 439.8 630.0 5
439.8 630.0 700.0 630.0 7
439.8 630.0 444.3 627.0 5
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350.4 627.0 444.3 627.0 7
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360.4 622.0 382.4 622.0 5
382.4 622.0 394.4 616.0 5
394.4 616.0 700.0 616.0 4
279.2 626.4 287.2 626.0 3
287.2 626.0 317.2 636.4 1
287.2 626.0 295.2 625.6 3
295.2 625.6 302.4 622.0 3
302.4 622.0 360.4 622.0 5
302.4 622.0 314.4 616.0 3
314.4 616.0 394.4 616.0 4
314.4 616.0 346.4 600.0 3
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200.0 600.0 346.4 600.0 6
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WATER
1 0.
14
0.0 595.0
62.2 590.0
112.2 590.0
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159.0 593.0
180.0 600.0
200.0 600.0
232.001 610.667
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298.781 623.809
340.4 632.0
345.4 632.0
355.399 635.333
411.8 642.0
700.0 642.0
LIMITS
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CIRCLE
1 2
20 25
110. 300. 310. 600.
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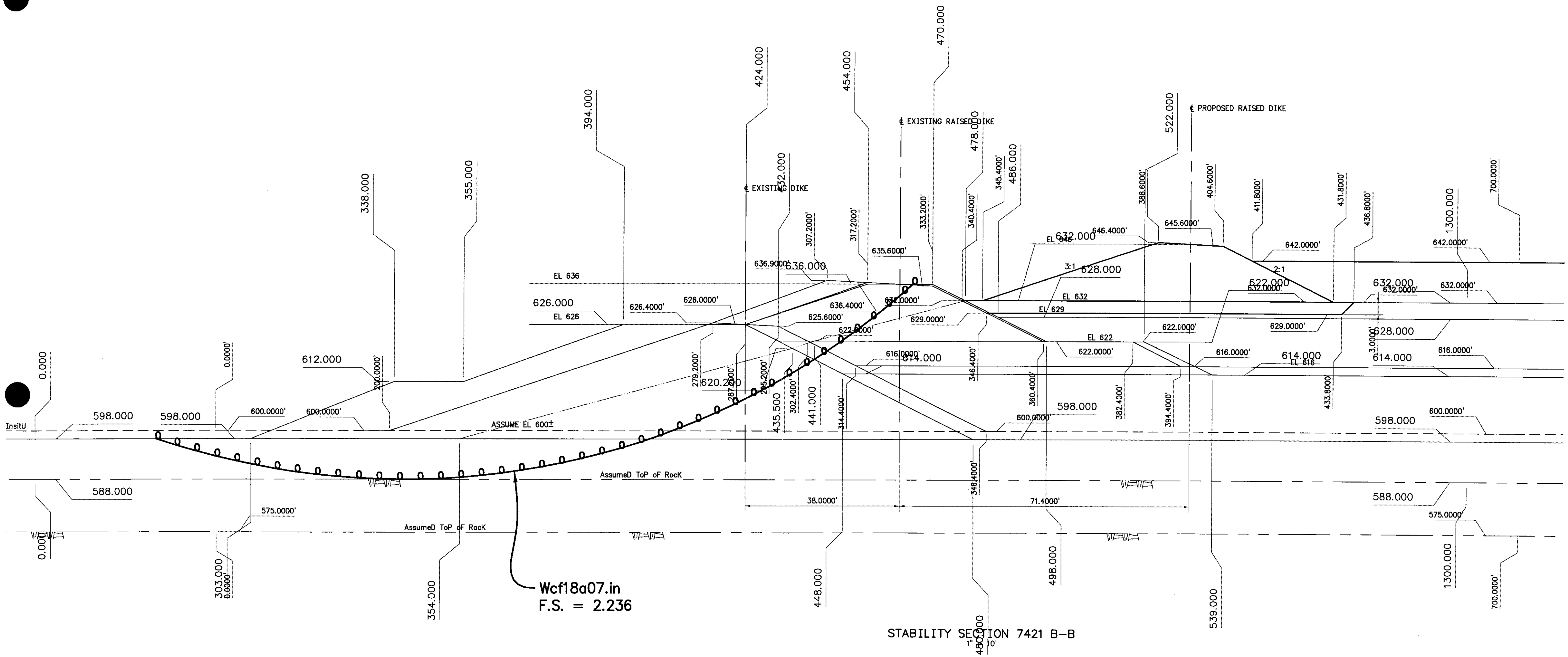
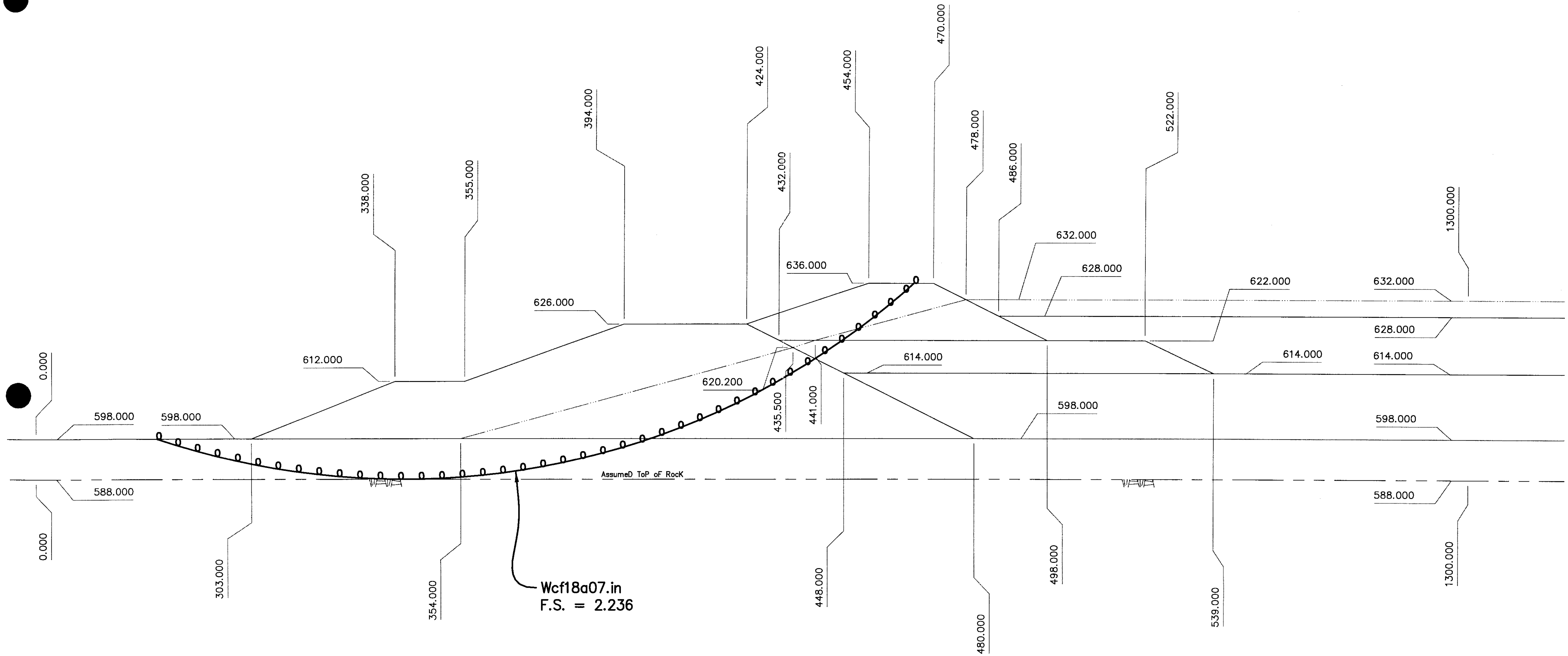


18a of 35 T/D EL 636.

STD6E

STD4E

1" = 20'

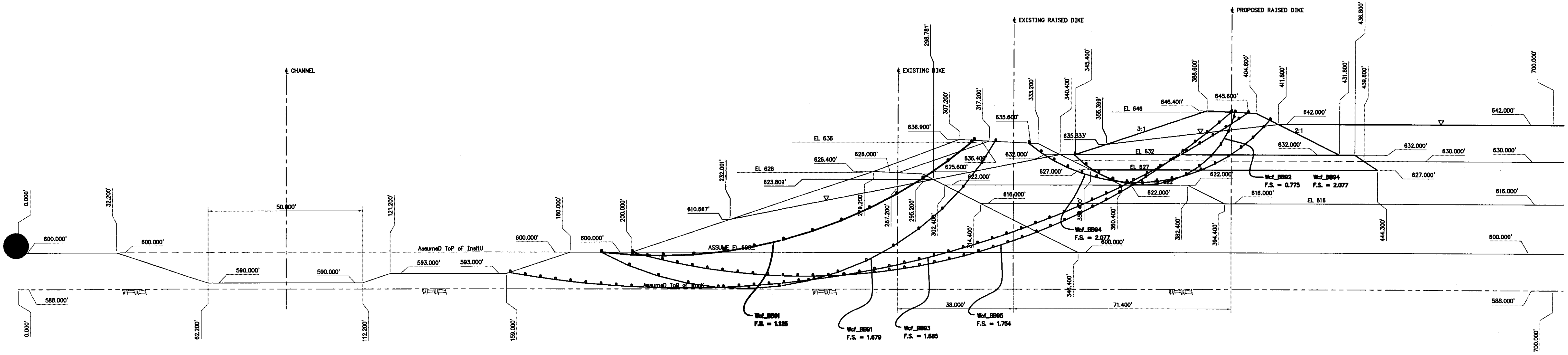


18a of 35 T/D EL 636.

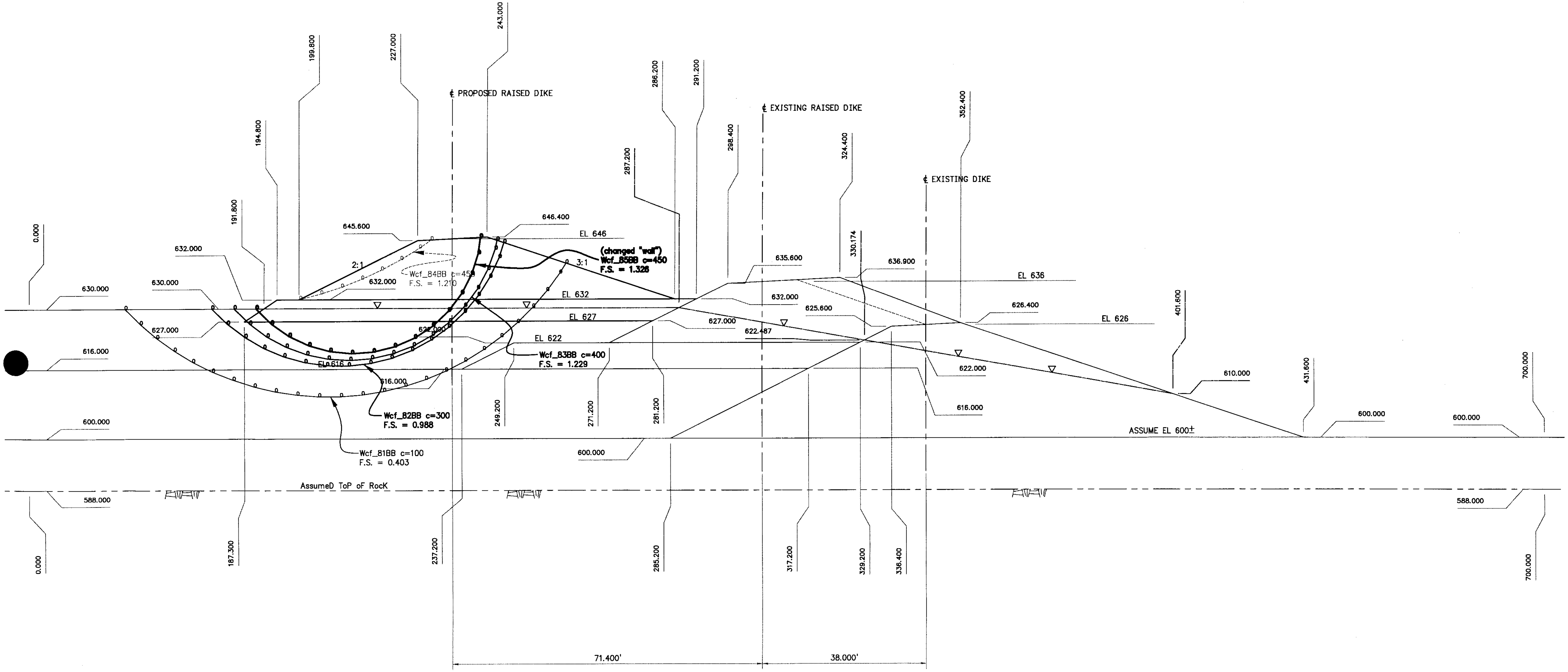
STD6E

STD4E

1" = 20'

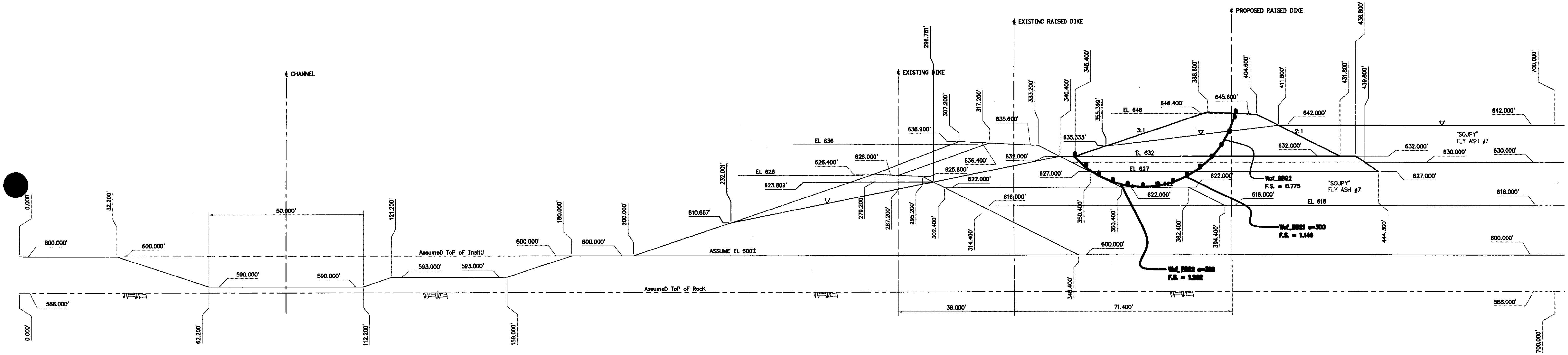


STABILITY SECTION 7421 B-B
1" = 10'

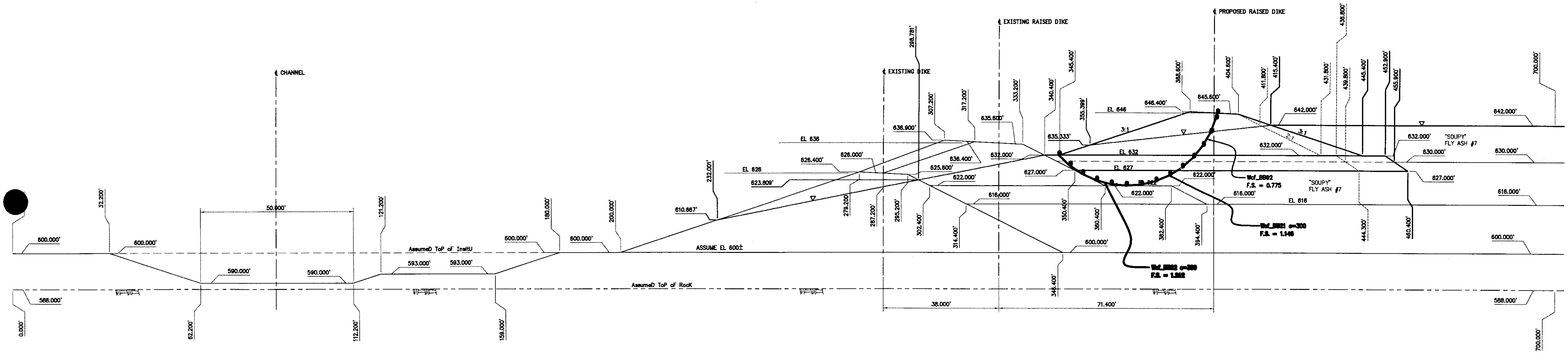


STABILITY SECTION 7421 B–B inside EL 630.0

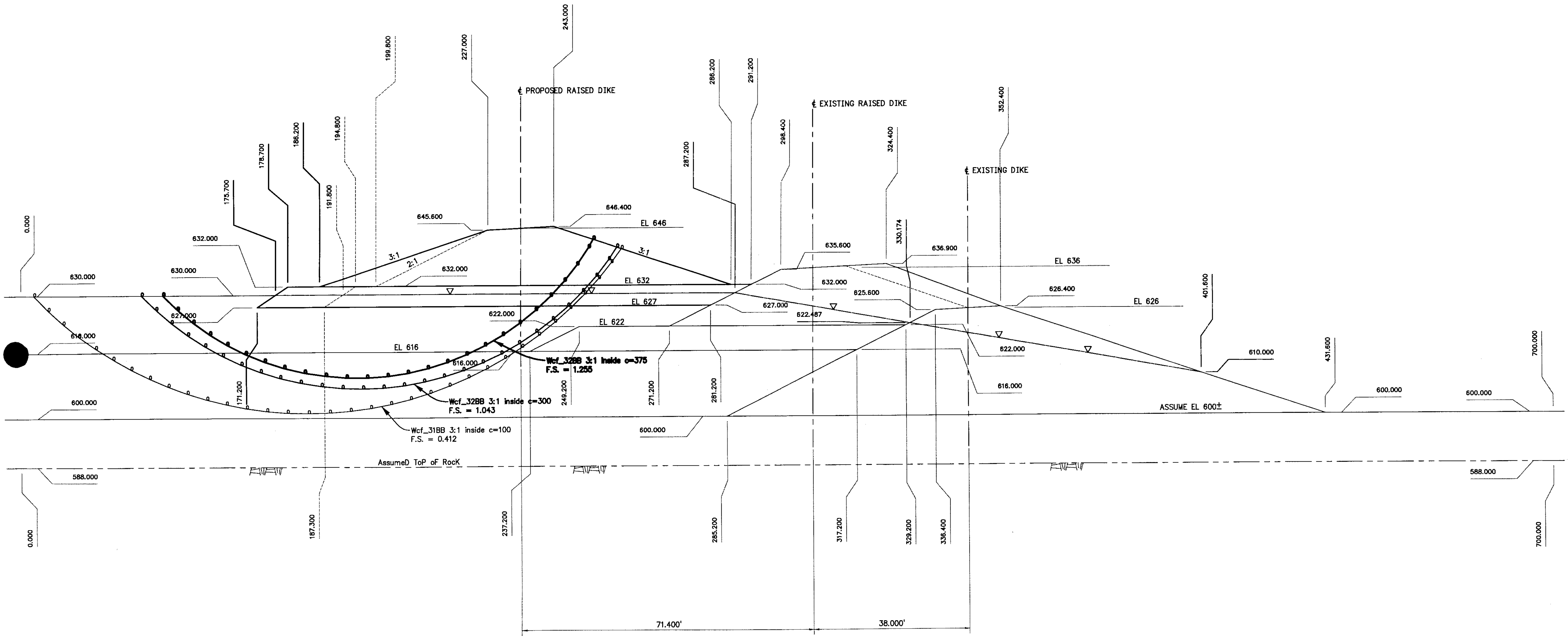
1" = 10'



STABILITY SECTION 7421 B–B (Wcf_BB21 series)
1" = 10'



STABILITY SECTION 7421 B–B with 3:1 inside (Wcf_BB21 series)
1" = 10'



STABILITY SECTION 7421 B–B inside EL 630.0
1" = 10'

TVA 64 (OS-9-65)
UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

CEB '82 1206 012

TO : R. O. Barnett, Chief, Civil Engineering Support Branch, W9D224 C-K

FROM : W. M. McMaster, Chief, Data Services Branch, 350 EB-K

DATE : December 2, 1982

SUBJECT: WIDOWS CREEK STEAM PLANT - BORROW AREA FOR THE SCRUBBER SLUDGE POND DIKE RAISING

In reference to your memorandum to me dated October 21, 1982, attached is a tabulation listing the plant grid coordinates and elevations of thirty seismic stations at Widows Creek.

W. M. McMaster

KWK:KYR
Attachment
cc: H. S. Fox, 716 EB-C
S. E. Griffith, 6411 EBR-C (Attachment)
C. L. Olive, Jr., 464 LB-C
R. A. Painter, E5C80 C-K
M. D. Ramsey, FOR B-N
M. N. Sprouse, W11A9 C-K
O. P. Thornton, 102 SPT-K
DSB-TR, 335 EB-K (Attachment)

Prepared by Kary W. Kaley

ROB:KMP --12/6/82
cc: MEDS, W5B63 C-K (Attachment)

CIVIL ENGINEERING BRANCH
DEC 6 1982

IN				OUT	
N	Date	Time		Date	Time
✓			ROB	✓	
			KLW		
			JWM		
			TCC		
			WAE		
✓	8	11	RWA	8	12
✓	8	1	WMS	8	1
✓	7		RJH	8	8
Cy			KWK		
			ROH		
			TAR		

1 December 1982

TENNESSEE VALLEY AUTHORITY
DATA SERVICES BRANCH
AND MAPPING SERVICES BRANCH

WIDOWS CREEK STEAM PLANT
SEISMIC LOCATIONS
4TH ORDER

(Field Books: ESS-3064 Pages 1-7
ES-815 Pages 13-14)

Hole	Plant Grid Coordinates	Elevation (Feet)
SLH-1	E 95+62.0 N 19+43.6	624.1
SLH-2	E 92+79.1 N 19+43.1	621.8
SLH-3	E 89+96.8 N 16+59.7	625.9
SLH-4	E 87+14.5 N 13+76.3	615.1
SLH-5	E 84+32.2 N 10+92.9	607.0
SLH-6	E 89+95.7 N 22+25.4	613.4
SLH-7	E 87+13.4 N 19+42.0	617.8
SLH-8	E 84+31.1 N 16+58.6	622.5
SLH-9	E 81+48.8 N 13+75.2	621.3
SLH-10	E 78+66.6 N 10+91.8	610.1
SLH-11	E 84+30.1 N 22+24.3	612.2

Hole	Plant Grid Coordinates	Elevation (Feet)
SLH-12	E 81+47.8 N 19+40.9	611.4
SLH-13	E 78+65.5 N 16+57.5	613.9
SLH-14	E 75+83.2 N 13+74.2	608.6
SLH-15	E 73+00.9 N 10+90.8	608.6
SLH-16	E 84+29.5 N 25+07.2	609.1
SLH-17	E 81+47.2 N 22+23.8	608.4
SLH-18	E 81+46.7 N 25+06.6	606.6
SLH-19	E 78+64.4 N 22+23.2	610.3
SLH-20	E 75+82.1 N 19+39.8	609.9
SLH-21	E 72+99.8 N 16+56.4	608.4
SLH-22	E 70+17.5 N 13+73.1	605.6
SLH-23	E 78+63.8 N 25+06.1	607.6
SLH-24	E 78+63.3 N 27+88.9	602.6
SLH-25	E 75+81.0 N 25+05.5	610.7
SLH-26	E 72+98.7 N 22+22.1	607.9
SLH-27	E 70+16.4 N 19+38.8	606.6
SLH-28	E 75+80.4 N 27+88.4	606.2

Hole	Plant Grid Coordinates	Elevation (Feet)
SLH-29	E 75+79.9 N 30+71.2	601.2
SLH-30	E 72+97.6 N 27+87.8	603.4

SHEET ______ OF ______

Widows Creek

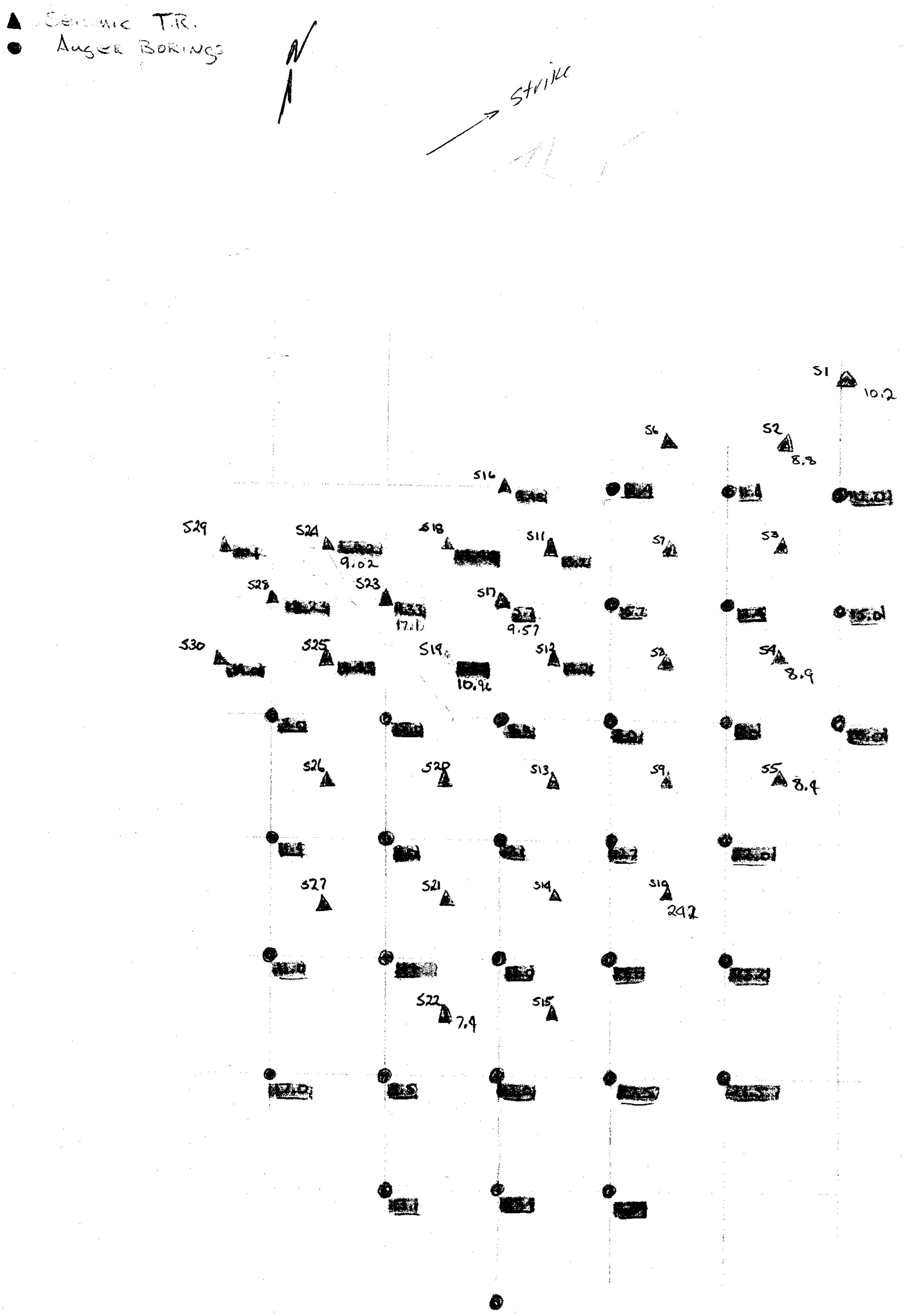
Ash Dike Raising plan Borrow Invest.

Top of Rock

Seismic & Auger Boring

COMPUTED JAO DATE 16 Nov 82

CHECKED ______ DATE ______



TVA 11030 (WM-7-75)

TVA 64 (OS-9-65)

WMS

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

TO : O. P. Thornton, Project Manager, Fossil Design Projects, 102 SPT-K

FROM : R. O. Barnett, Chief, Civil Engineering Support Branch, W9D224 C-K

DATE : JAN 11 1983

SUBJECT: WIDOWS CREEK STEAM PLANT - BORROW AREA FOR SCRUBBER SLUDGE POND DIKE RAISING - TOP-OF-ROCK CONTOUR MAP

Reference: Memorandum from H. S. Fox to M. N. Sprouse dated September 20, 1982 (DES 820921 007)

On December 22, 1982, W. M. Seay of CEB hand carried the contour map requested in the reference memorandum to M. H. Miller of FDP for incorporation into a construction drawing to be issued by FDP. The map was at a scale of 1" = 100', contour interval of 2 feet, had 6 feet added to all contours and data points, and was contoured from both the soil boring and seismic refraction data.

During a meeting on December 20, 1982, between M. H. Miller and J.P.H. Stivers of FHP; R. J. Hunt, H. K. McLean, and W. M. Seay of CEB; and C. D. Loflin of CSB, caution was urged in utilizing the map to achieve an excavation with a final bottom configuration very much like the contour map but with some set soil thickness remaining. Due to the fairly broad (200± feet) data centers and the saw-toothed character of the top-of-rock surface, there is some likelihood that rock between data points will occasionally be encountered higher than that indicated by the contour map. As such, the map should be used as only a guide to excavation, and the 6-foot elevation addition to the contours should provide sufficient buffer, thereby significantly reducing the likelihood of encountering rock.

As was also discussed, if we can assist CSB during excavation by providing additional seismic refraction, please contact us.

R. Joe Hunt
for R. O. Barnett

WMS

ROB:WMS:DDM
cc: MEDS, W5B63 C-K
M. N. Sprouse, W11A9 C-K

Principally Prepared By: W. M. Seay, Extension 4775

Attend / Date / Other

STATES GOVERNMENT

Memorandum

DES '820921 007

TENNESSEE VALLEY AUTHORITY

M53 82091

✓10

SEP 21 '82

ENGINEERING DESIGN MANAGER'S OFFICE

Note	962	Noted
	Sprouse	
	Bowen	
	Burroughs	
	Contrell	
✓	Dorrer	✓
✓	MEDS	

TO : M. N. Sprouse, Manager of Engineering Design, W11A9 C-K

FROM : H. S. Fox, Director of Fossil and Hydro Power, 716 EB-C

DATE : SEP 20 1982

SUBJECT: WIDOWS CREEK STEAM PLANT - BORROW AREA FOR THE SCRUBBER SLUDGE POND DIKE RAISING

We have been informed by representatives of the Construction Services Branch (CSB) that rock has been encountered in the borrow area to the south of the transmission lines. As agreed in the meeting of June 17, 1982 between the Offices of Power and Natural Resources and the Division of Engineering Design, we will complete the top of rock map prior to removing any borrow from the site of the new scrubber sludge wet stacking area.

Because of the problems encountered by the construction forces, it may become necessary to begin borrow activities in the area north of the powerlines in a short period of time. Therefore, we request that the top of rock map for phase I of the disposal area be prepared and provided to CSB as soon as possible to avoid potential project delays.

This work should be charged to the existing accounts for preliminary studies for the new wet stacking area (Job Order No. 31401-J83). Any questions regarding this matter should be directed to T. F. Manseill at extension 3505 in Chattanooga.

By copy of this memorandum, we request the Land Branch to obtain the required permits for access to any private tracts. Further information will be forwarded to Wade Cowan informally to expedite the project.

for H. S. Fox

CIVIL ENGINEERING BRANCH

SEP 29 1982

Received

SEP 23 '82

ENVIRONMENTAL DESIGN PROJECT

N	Supv	Date	N	Supv	Date
2	SBJ			WAG	
Copy				WAB	
3	JAB			RNK	
2A	REH			RFS	
1	JAK	23			
	RWJ			LJC	
				KLS	
	RED				
	JAF			BLH	
	DAK				
				FPSR	

CCS:JTT:TFM:MLD

cc: ARMS, 810 EB-C
D. R. Gengozian, 115 LSB-K
H. H. Mull, E7B24 C-K
Gonro L. Olive, Jr., 464 LB-C
Power Plant Superintendent, Widows Creek

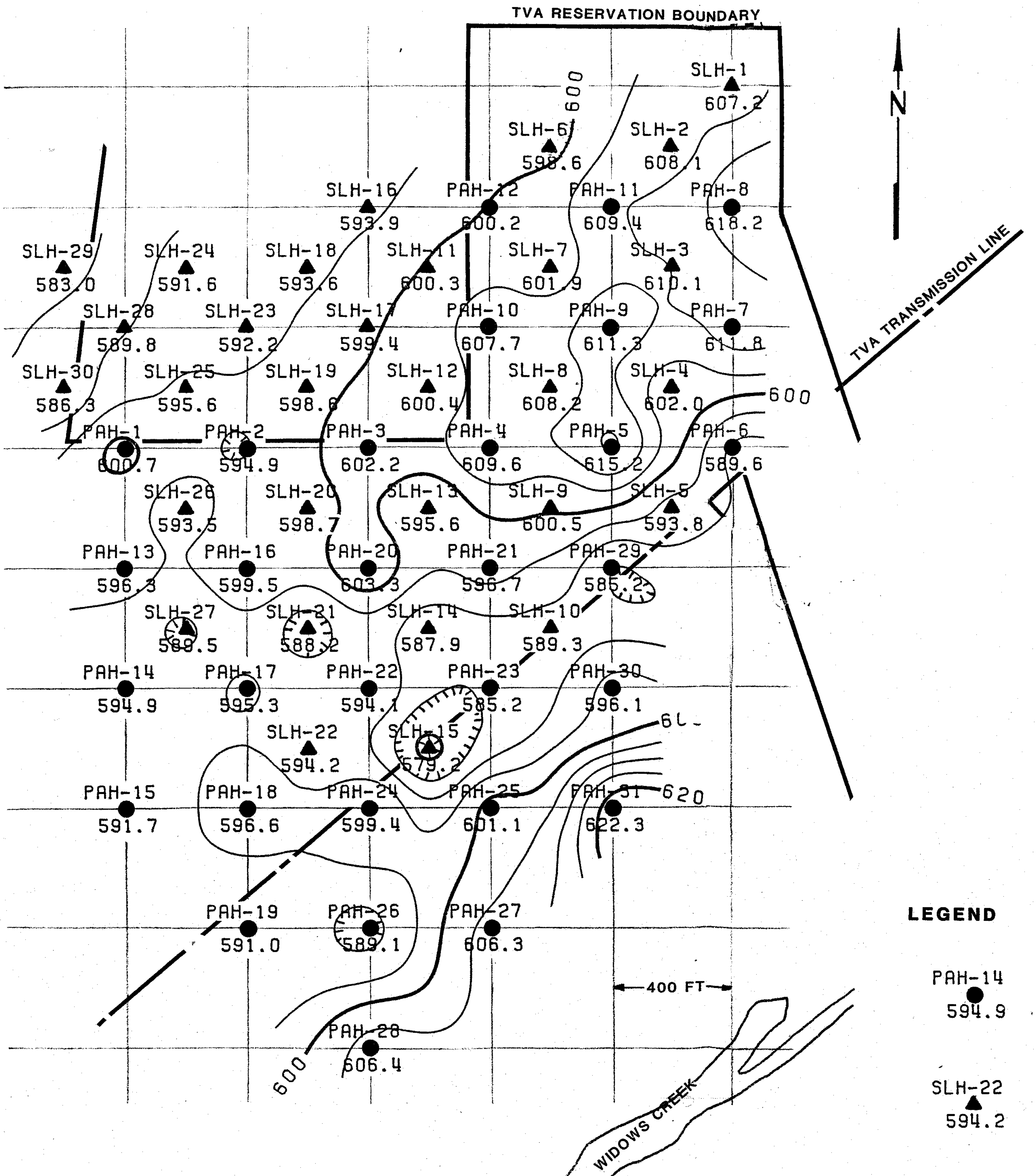
9/21/82 - RGD:JL
cc: MEDS, W5B63 C-K
O. P. Thornton, 102 SPT-K - Please handle.--MNS

9/28/82 - OPT:DKP

FDP '82 0928 005

cc: R. O. Barnett, W9D224 C-K - Please provide top of rock map as soon as possible. --OPT
J. E. Holladay, W2D224 C-K - Information only.
xc: MEDS, W5B63 C-K

30 3/30 RWA 10/2
4 12 WMS 1/11 10



LEGEND

PAH-14 ● 594.9	SOIL BORING TOP-OF-ROCK ELEVATION
SLH-22 ▲ 594.2	SEISMIC REFRACTION STATION TOP-OF-ROCK ELEVATION

SCALE

0 200 400 FEET

CONTOUR INTERVAL IS 5 FEET

BORROW AREA FOR SCRUBBER
SLUDGE POND DIKE RAISING

TOP-OF-ROCK CONTOUR MAP

WIDOWS CREEK STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED

KNOXVILLE 12-17-82 34 GE

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

M53 850717 959

TO : R. G. Domer, Director of Engineering Projects, W12A5 C-K

FROM : C. C. Schonhoff, Director of Fossil and Hydro Power, 716 EB-C

DATE : AUG 20 1985

SUBJECT: WIDOWS CREEK FOSSIL PLANT UNITS 7 AND 8 - ASH DISPOSAL AREA - BENTONITE SLURRY CUTOFF WALL SEEPAGE MONITORING PROGRAM

Reference: Memorandum from Robert G. Spencer to Fossil Engineering Project Files dated June 3, 1985, with attachment on the above subject (B65 850603 002)

The status of the Nos. 2, 3, and 4 recommendations mentioned in your file note is as follows:

2. As discussed with Bill Martin, of your staff, the ditch along the toe of the dike will be cleaned and graded after completion of the units 7 and 8 ash sluice piping project.
3. Same as item 2.
4. Work to fill the two ponding areas is virtually complete.

As previously discussed, completion of items 2 and 3 (while construction of the ash sluice lines is underway) would be counterproductive; and work on these items will be performed promptly after the ash sluice line construction (at least in the vicinity of the ditch line) is finished. Also, we will observe the red water discharges after the two ponding areas between the dikes are filled and sloped to drain. (pipe?) This will hopefully alleviate water seeping through the ash dikes currently constructed. The attached sketch shows "before" and "after" red water discharge areas for your information.

Pipe thru Slurry Wall? Steve Potent – We agreed to this in the field – Steve remembered – O.K. [illegible]

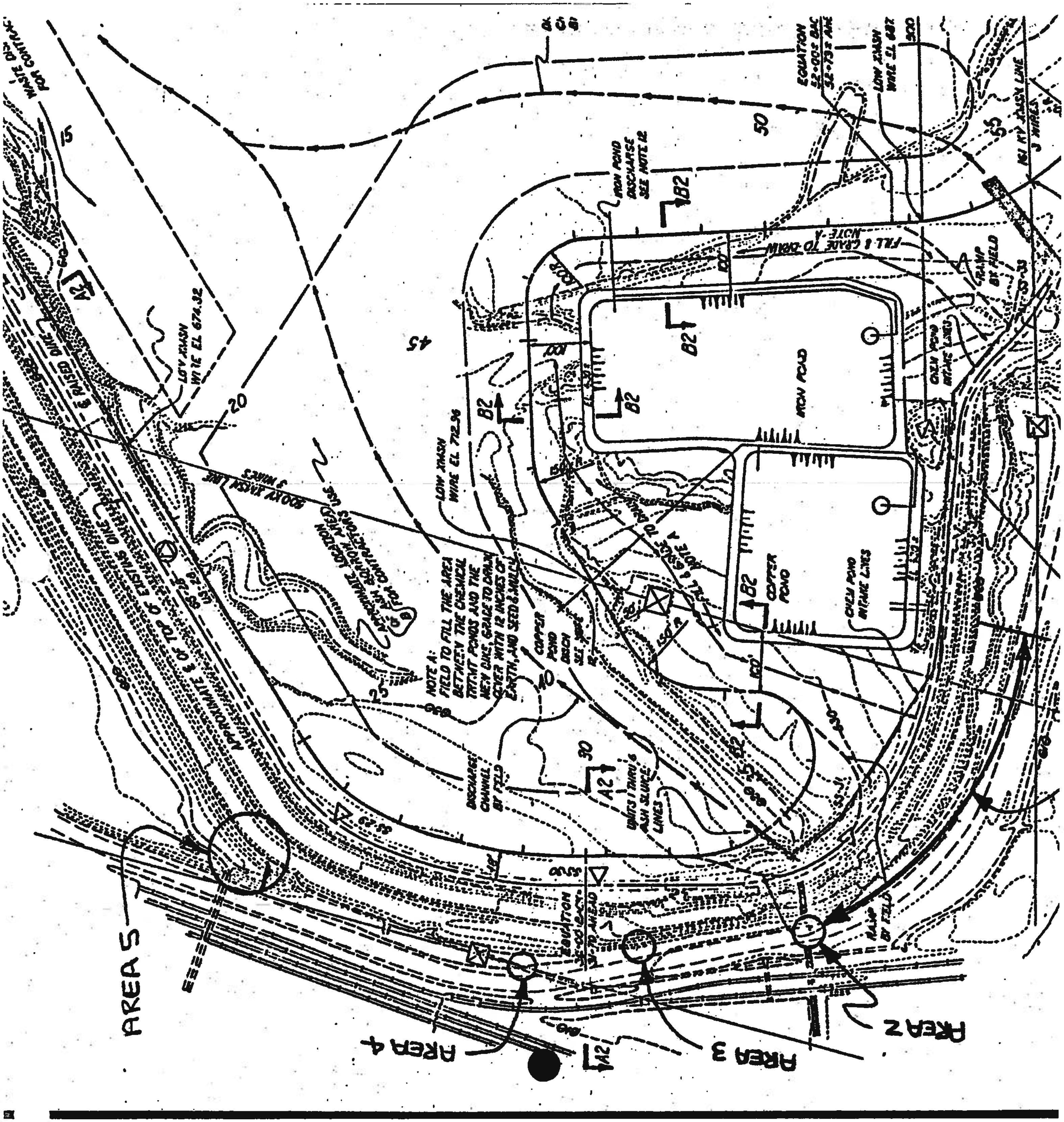
for C. C. Schonhoff

PW:JTT:MSP:SRS
Attachment
cc: RIMS, 810 EB-C
C. A. McLaughlin, Widows Creek

8/22/85 - RGD:JL
cc (Attachment):
O. P. Thornton, W3D224 C-K - Please handle.--RGD

✓D.
AUG 22'85
ENGINEERING PROJECTS
DIRECTOR'S OFFICE

Note		Noted
✓	Domer	
	Control	
	Armstrout	
	Bowen	
	Dilworth	
	Holl	
	RIMS	


AREA 5
AREA 4
AREA 3
AREA 2
NOTE A: FIELD TO FILL THE AREA BETWEEN THE CHEMICAL TRTMT PONDS AND THE NEW DIKE, GRADE TO DRAIN COVER WITH 12 INCHES OF EARTH, AND SEED & MULCH
IRON POND
COPPER POND
IRON POND DISCHARGE SEE NOTE 12
CHEM POND INTAKE LINES
COPPER POND DISCH
DISCHARGE CHANNEL BY FIELD
UNITS 1 THRU 6 ASH SLUICE LINES
LOW XMSN WIRE EL 712.36
LOW XMSN WIRE EL 674.32
RAMP BY FIELD
EQUATION
WASTE DISP FOR CONTRAC
APPROXIMATE ℄ OF TOP OF EXISTING DIKE
℄ RAISED DIKE
FILL & GRADE TO DRAIN NOTE A
A2
B2
45
50
55
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10

TVA 64 (OS-9-65)

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

W. M. Martin
W2D207 C-1

B65 '85 0603 002

( ) : Fossil Engineering Project Files

FROM : Robert G. Spencer, Civil Engineer (Geology and Geotechnical Engineering Group), 161 LB-K

DATE : JUN 03 1985

SUBJECT: WIDOWS CREEK STEAM PLANT UNITS 7 AND 8 - ASH DISPOSAL AREA - BENTONITE SLURRY CUTOFF WALL SEEPAGE MONITORING PROGRAM

Reference: (1) Memorandum from Robert G. Spencer to Fossil Engineering Project Files dated January 16, 1985 (FEP 850116 002)

(2) Memorandum from Robert G. Spencer to Fossil Engineering Project Files dated February 6, 1985 (FEP 850208 004)

On March 6, 1985, W. M. Martin and I (OE) inspected the units 7 and 8 ash disposal area dike as part of the bentonite slurry cutoff wall seepage monitoring program. We were accompanied by K. W. Burnett (OE) and M. S. Poteet (FHP). This was the fourth inspection made as part of this seepage monitoring program. The last inspection was made on January 18, 1985 (reference 2). See reference 1 for background information on this monitoring program.

General Observations

As with the last two inspections, this inspection focused on the segment of dike between cutoff wall station 25+50± and the southwest corner of the copper pond. This is the only segment of the dike containing the slurry wall along which apparent seepage water was found. In general, seepage water was found in the same areas along this segment of dike as during previous inspections. Overall, the quantity of seepage appeared to be about the same as that observed during the last inspection. Specific findings for the areas are provided below. See reference 1 for a description of the overall drainage flow pattern for seepage from these areas. The water elevations in the ash and chemical ponds located in the vicinity of the slurry wall were approximately the same as during the last inspection (ash pond EL=618±, copper pond EL=627±, iron pond EL=623±).

Specific Findings

See attached copy of a portion of drawing 34-C-10W7465-01 for location of following areas.

Area 1 - Dike segment between units 1-6 sluice pipes (station 34+50±) and copper pond

The beginning point of visible seepage accumulation in the ditch was located opposite the copper pond 650± feet (measured along the road from the units 1-6 ash sluice pipes. The quantity of accumulated flow collected along this 650-foot segment of ditch from seeps along the dike slope was estimated to be in the 100 to 200 gph range.

The major portion of this flow was accumulated along a 240±-foot segment of the ditch. The distance from the sluice pipes to the center of this 240-foot segment was 350± feet. The estimated elevation of the uppermost seep points on the slope was 616±.

Area 2 - Ditch at units 1-6 ash sluice pipes crossing (opposite station 34+50±)

As with the previous inspections, these sluice pipes were still blocking the ditch, thereby creating a pool at this location. The accumulated flow along the ditch increases significantly at this location. The ditch flow just upstream of this location was estimated to be no more than 200 gph (from area 1), whereas 500± gph was estimated to flow from this location. The ponding made it impossible to determine if the increase in flow was attributable to a leaking sluice pipe. The ditch elevation at this location is 611±. The elevation of the bottom of the cutoff wall opposite this location ranges from 600 to 605.

Area 3 - Seep opposite station 32+50±

Seepage on the dike slope was still present at this location. The quantity (estimated at 25± to 50± gph) of seepage produced by this seep appeared to have increased since the last inspection. The elevation of the seep was estimated to be 611±. The distance from the sluice pipe crossing to this seep was 250 feet±.

Ares 3A- Dike segment between area 3 and area 4

Although no water was actually seeping at this time, some evidence of recent seepage was found at four locations along this segment of dike. Previous inspections made after the slurry wall was installed have not revealed any evidence of seepage along this dike segment. These four possible seeps were located at distances of 20, 60, 75, and 95 feet downstream of area 3. The elevation of these possible seeps was estimated at 611± (2-3 feet above the ditch line). The bottom of the slurry wall opposite these locations is 602±.

Area 4 - Catch Basin opposite station 29±

The amount of flow (accumulated upstream seepage) from the ditch to the catch basin was estimated to be in the 500 to 600 gph range.

Fossil Engineering Project Files
JUN 03 1985

WIDOWS CREEK STEAM PLANT UNITS 7 AND 8 - ASH DISPOSAL AREA - BENTONITE SLURRY CUTOFF WALL SEEPAGE MONITORING PROGRAM

Area 5 - Opposite station 25+50±

The storm sewer drainage from the area 4 catch basin outlets into a pool at this location. No water was found in the ditch along the top of the dike between this location and the catch basin. However, some seepage (estimated at 5-10 gph) was observed on the slope of the dike at this location. The estimated elevation of the highest point of any seepage was 607±. The total accumulated flow from this location was estimated to be approximately 1500 gph. As explained in reference 1, only a portion (say 600 gph) of this flow can be attributed to the unit 7 and 8 areas associated with the slurry wall.

Action on Reference 1 Recommendations

1. According to information provided to Bill Martin (OE) by Leon Massey (FHP), the recommended observation wells will not be installed.

2. The ditch along the toe of the dike has not been cleaned or graded to prevent ponding.

3. The storm drain system has not been maintained so that the flow can be inspected and evaluated.

4. No work has been done to prevent the ponding of storm water between the slurry wall and the copper pond.

5. According to Dennis Allen (FHP), no chemical analysis will be made on the seepage water near the copper pond. He does not feel that the analysis would be beneficial in determining the source of the seepage.

Note: According to Mr. Massey, WCF plant representatives have promised to pursue the necessary work to correct items 2 through 4.

Robert G. Spencer
Robert G. Spencer

RJH
CDTs
ADd
REH

RGS:BSH
Attachment
cc (Attachment):
R. O. Barnett, W9D224 C-K
O. P. Thornton, W3D224 C-K

OPT:RGS:BSH - JUN 03 1985
cc (Attachment):
C. A. Chandley, W7C126 C-K
R. G. Domer, W12A5 C-K

RGD:OPT:BSH JUN 03 1985
cc (Attachment):
RIMS, SL26 C-K
C. C. Schonhoff, 716 EB-C*
xc: R. O. Barnett, W9D224 C-K

*Please notify me when recommendation
2 through 4 have been completed.
--RGD

TVA 64 (OS-9-68)

WMM, your copy MHM

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

M52 850321 910

TO : R. G. Domer, Director of Engineering Projects, W12A5 C-K

FROM : C. C. Schonhoff, Director of Fossil and Hydro Power, 716 EB-C

DATE : APR 10 1985

SUBJECT: WIDOWS CREEK FOSSIL PLANT - ACTIVE ASH DISPOSAL AREA - BENTONITE SLURRY CUTOFF WALL SEEPAGE MONITORING PROGRAM

✓D
✓ APR 11 '85

ENGINEERING PROJECT
DIRECTOR'S OFFICE

Note		Ne
✓	Domer	
	Cantrell	
	Armentrout	
	Bowen	
	Dilworth	
	Hall	
	RIMS	

References: 1. Your memorandum to me dated January 24, 1985, with attached memorandum from Robert G. Spencer to Fossil Engineering Projects Files (M01 850129 180) dated January 16, 1985, regarding the above subject (M01 850129 179) (FEP 850124 002)

2. Memorandum from Robert G. Spencer to Fossil Engineering Projects Files dated February 6, 1985, with attachment on the subject, "Widows Creek Steam Plant Units 7 And 8 - Ash Disposal Area - Bentonite Slurry Cutoff Wall Seepage Monitoring Program" (M01 850212 500)

Reference 2 makes six recommendations for evaluating the effectiveness of the Bentonite slurry cutoff wall at Widows Creek. Each recommendation is addressed below:

1. We agree to the usefulness of periodic inspection trips to determine the effectiveness of the cutoff wall. To prepare as-constructed drawings, $50,000 was allotted to the Office of Engineering in the work order overclosure. Overruns on this account will not be permitted; therefore, care should be exercised in expending manpower and money in the monitoring program.

2. We do not plan to install observation wells at the present time but reserve this as an option for future study.

3. Upon completion of the units 7 and 8 ash sluice lines, the plant will clean out the storm sewers and grade the ditch to achieve free flow throughout the length of the ditch.

4. See No. 3 (above).

5. We are currently filling in one ponding area adjacent to the units 7 and 8 ash sluice lines and will also fill in the ponding area around the units 1-6 ash sluice lines. Both areas will be filled with bottom ash, capped with clay, and seeded. Surface drainage will be into the chemical ponds.

6. Chemical analyses have previously been performed on the seepage water near the copper pond, and no evidence could be found to support the theory that it is leaking. Dennis Allen, of this division, is currently monitoring the pH at various points around the dike; however, no plans for additional testing are impending.

I wish to reiterate that overrunning a work order overclosure account is not permitted. If additional work, scope changes, or expenditures are needed beyond those already budgeted, regardless of their priority, a separate work order will be required. Any questions on this subject should be directed to M. S. Poteet at extension 3532 in Chattanooga.

Paul Wade
for C. C. Schonhoff

PW:JTT:MSP:SRS
cc: RIMS, 810 EB-C
C. A. McLaughlin, Widows Creek

B60 '85 0411 001

4/11/85 - RGD:JL
xc: RIMS, 640 CST2-C
O. P. Thornton, W3D224 C-K - Please handle.--RGD
What is status of expenditures?--RGD

Martin E. Rivers, Director of En onmental Quality, 201 SPB-K

NOV 8 1984

WIDOWS CREEK STEAM PLANT (WCF) - NPDES PERMIT VIOLATIONS (M10.922)

Attached is a copy of an October 15 letter from Treena Givens, Alabama Department of Environmental Management, regarding NPDES permit violations for DSNs 018 and 019 at WCF. This letter was telecopied to your staff on October 19. Please prepare revised plans for treating these wastewater discharges and provide my staff with a draft of the plans by December 31.

If you have questions regarding this matter, please call Michael Hines or Stephen R. Wells at extension 2971 in Muscle Shoals.

Original Signed By
M. Paul Schmierbach

Martin E. Rivers

SRW:BC
Attachment
cc (Attachment):
- B. J. Bond, 1E61 OCH-K
- B. W. Brown, 140 EB-K
- R. W. Cantrell, W11A9 C-K
- C. L. Massey, 100 IBM-C
- C. A. McLaughlin, WCF
- G. G. Park, 940 CST2-C
- mwP 11/13 W. M. Pearse, W7A68 C-K
- H. S. Sanger, Jr., E11B33 C-K

018- coal pile area

019- slurry trench area

TVA 64 (OS-9-65)

WMM copy 4 15

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

FEP '850208 004

TO : Fossil Engineering Project Files

FROM : Robert G. Spencer, Civil Engineer (Geology and Geotechnical Engineering Group), 161 LB-K

DATE : February 6, 1985

SUBJECT: WIDOWS CREEK STEAM PLANT UNITS 7 AND 8 - ASH DISPOSAL AREA - BENTONITE SLURRY CUTOFF WALL SEEPAGE MONITORING PROGRAM

Reference: Memorandum from Robert G. Spencer to Fossil Engineering Project Files dated January 16, 1985 (FEP 850116 002).

On January 18, 1985, W. M. Martin, Syed Ahmed, and I (OE) inspected the units 7 and 8 ash disposal area dike as part of the bentonite slurry cutoff wall seepage monitoring program. We were accompanied by M. H. Miller and R. S. Harris (OE), and Dennis L. Allen (FHP). This was the third inspection made as part of this seepage monitoring program. The last inspection was made on December 17, 1984 (reference). See reference for background information on this monitoring program.

General Observations

As with the December 1984 inspection, this inspection focused on the segment of dike between cutoff wall station 25+50± and the southwest corner of the copper pond. This is the only segment of the dike containing the slurry wall along which apparent seepage water has been found. The seepage water was found in the same areas along this segment of dike as during the December inspection. The quantity of seepage in some of the areas appeared to have decreased somewhat since the December inspection. Specific findings for the areas are provided below. See reference for a description of the overall drainage flow pattern for seepage from these areas. The water elevations in the ash and chemical ponds located in the vicinity of the slurry wall were approximately the same as during the December inspection.

Specific Findings

See attached copy of a portion of drawing 34-C-10W7465-01 for location of following areas.

Area 1 - Dike segment between units 1-6 sluice pipes (station 34+50±) and copper pond

The beginning point of visible seepage accumulation in ditch was located opposite the copper pond 650± feet (measured along the road) from the units 1-6 ash sluice pipes. The quantity of accumulated flow collected along this 650-foot segment of ditch from seeps along the dike slope was estimated to be at least 100 gph.

The major portion of this flow was accumulated along a 240±-foot segment of the ditch. The distance from the sluice pipes to the center of this 240-foot segment was 350± feet. The estimated elevation of the uppermost seep points on the slope was 616±.

Area 2 - Ditch at units 1-6 ash sluice pipes crossing (opposite station 34+ 50±)

As with the December 1984 inspection, these sluice pipes were still blocking the ditch, thereby creating a pool at this location. The accumulated flow along the ditch increases significantly at this location. The estimated ditch flow just upstream of this location was at least 100 gph (from area 1), whereas at least 500 gph was estimated to flow from this location. The ponding made it impossible to determine if the increase in flow was attributable to a leaking sluice pipe. The ditch elevation at this location is 611±. The elevation of the bottom of the cutoff wall opposite this location ranges from 600 to 605.

Area 3 - Seep opposite station 32+50±

An isolated seep on the dike slope was still present at this location. However, this seep makes an insignificant contribution to the accumulated flow in ditch at this location. The elevation of the seep was estimated to be 611±. The distance from the sluice pipe crossing to this seep was 250 feet±.

Area 4 - Catch Basin opposite station 29±

The amount of flow (accumulated upstream seepage) from the ditch to the catch basin was estimated to be at least 500 gph.

Area 5 - Opposite station 25+50±

The storm sewer drainage from the area 4 catch basin outlets into a pool at this location. No water was found in the ditch along the toe of the dike between this location and the catch basin. However, one small seep was observed on the slope of the dike at this location. This seep makes an insignificant contribution to the amount of accumulated flow at this location. The estimated elevation of the seep was 607±. The total accumulated flow at this location was estimated to be at least 1500 gph. See reference for further discussion on sources of this flow.

WIDOWS CREEK STEAM PLANT UNITS 7 AND 8 - ASH DISPOSAL AREA - BENTONITE SLURRY CUTOFF WALL SEEPAGE MONITORING PROGRAM

Discussion

No conclusions or recommendations beyond those made in the reference are offered at this time. However, we must continue to endorse and attempt to implement the recommendations made in the reference. These recommendations were discussed with Dennis Allen during this inspection. Mr. Allen agreed to pursue recommendation No. 6 (see reference) which involves making a chemical analysis on some of the seepage water at the above areas.

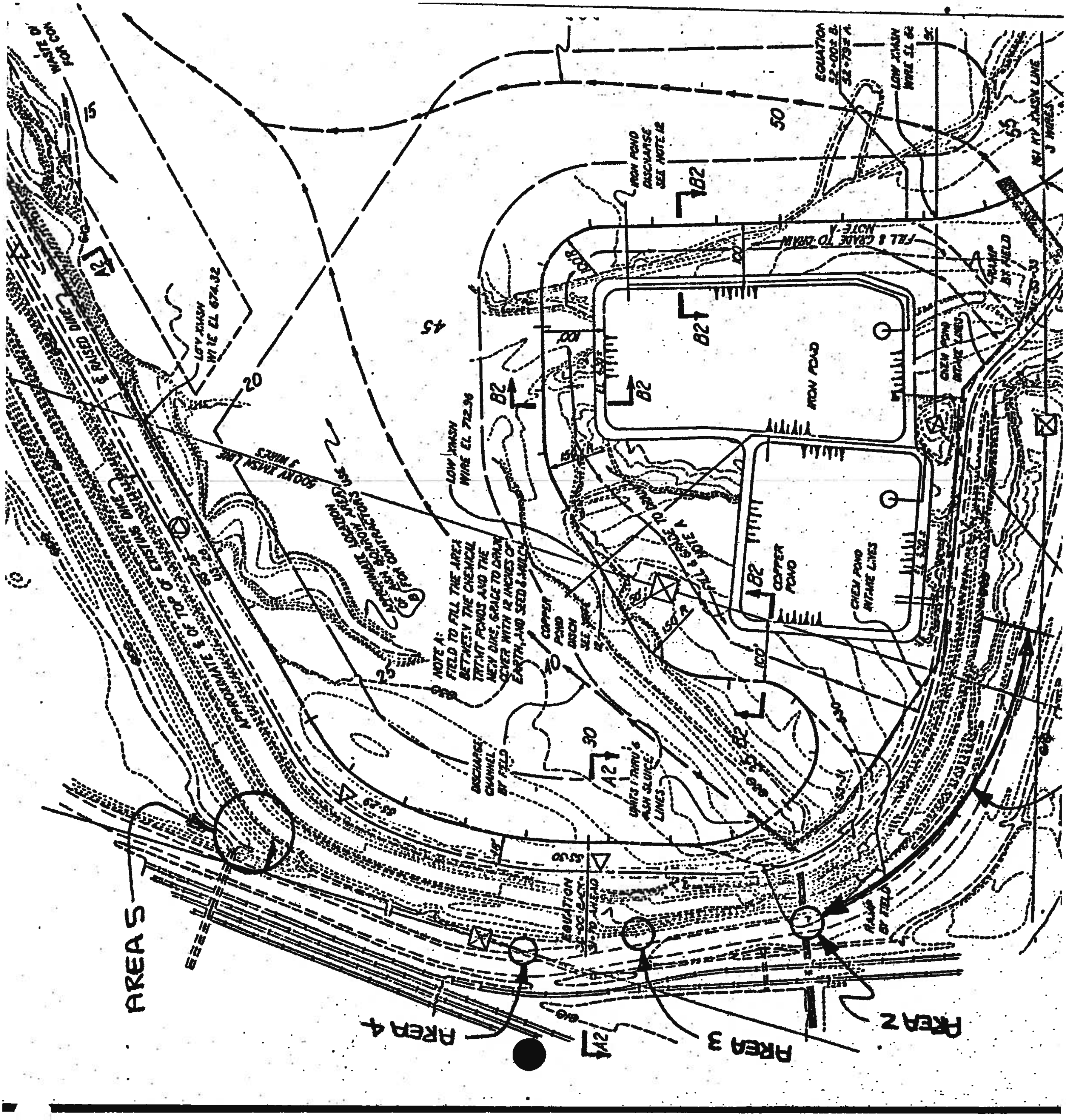
Robert G. Spencer
Robert G. Spencer

BCDm
BJH
COT
MHM
REH

RGS:CFM
Attachment
cc (Attachment):
    R. O. Barnett, W9D224 C-K
    O. P. Thornton, 102 SPT-K

OPTy
OPT:RGS:CFM -- 2/6/85
cc (Attachment):
    C. A. Chandley, W7C126 C-K
    R. G. Domer, W11A6 C-K

RGD:OPT:BSH -- 2/6/85
cc (Attachment):
    MEDS, W5B63 C-K
    C. C. Schonhoff, 716 EB-C
xc: R. O. Barnett, W9D224 C-K


AREA 5
AREA 4
AREA 3
AREA 2
NOTE A: FIELD TO FILL THE AREA BETWEEN THE CHEMICAL TREATMENT PONDS AND THE NEW DIKE, GRADE TO DRAIN, COVER WITH 12 INCHES OF EARTH, AND SEED & MULCH.
IRON POND
COPPER POND
IRON POND DISCHARGE SEE NOTE 12
CHEM POND INTAKE LINES
UNITS 1 THRU 6 ASH SLUICE LINES
DISCHARGE CHANNEL BY FIELD
COPPER POND DITCH
LOW XMSN WIRE EL 712.36
LOW XMSN WIRE EL 674.32
500KV XMSN LINE 3 WIRES
161 KV XMSN LINE 3 WIRES
LOW XMSN WIRE
EQUATION 52+00± B. 52+79± A.
FILL & GRADE TO DRAIN NOTE A
RAMP BY FIELD
APPROXIMATE ℄ OF TOP OF EXISTING DIKE
℄ RAISED DIKE
B2
A2
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TVA 64 (OS-9-65)
UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

FEP '84 1107 003

TO : R. E. Harris, Civil Project Engineer, Fossil Engineering Projects, 338 SPT-K

FROM : J. P. Hillier Stivers, Civil Engineer, Fossil Engineering Projects, 337 SPT-K

DATE : NOV 07 1984

SUBJECT: WIDOWS CREEK STEAM PLANT UNITS 7 AND 8 - AREA DIKE RAISING - BENTONITE SLURRY CUTOFF WALL SEEPAGE MONITORING PROGRAM

On September 28, 1984, R. G. Spencer, Geology and Geotechnical Engineering Group, W. M. Martin, FEP, and I inspected the units 7 and 8 area dike seepage at Widows Creek Steam Plant. The approximate pond elevation at the time of this inspection was 618. Our findings are listed below (see attached drawing 34-C-10W7465R3 for station references.)

Area 1. Opposite station 35+00± to station 36+50± (radially, i.e., opposite the southwest corner of the copper pond)

This area has several small red water seeps, and water is accumulated in small ponds along the ditch line with no visable running water ~~with~~ ditch. Also, an area approximately 150 feet long has fairly steady but very slight amount of seeping water.

Area 2. Opposite station 34+00± to station 35+00± (units 1-6 ash sluice pipe crossing)

This is the first point along the ditch line where running water (roughly 5 gal/hr) in the ditch was observed. It was difficult to determine if the water was coming from an accumulation of the seepage only or was coming from another source. The sluice lines of units 1-6 block the ditch, making it difficult to get a clear picture of the seepage situation at this point.

Area 3. Opposite station 32+50± to station 34+00±

This area has a small amount of seepage with no appreciable change in the amount of running water in the ditch line between stations 34+00± and 32+50±. Somewhere in the vicinity of station 29 to 30±, the accumulated ditch flow disappears. The water probably seeps into the underground storm sewer.

Area 4. Opposite station 25+50± to station 26+50±

The seepage in this area has now reduced (since the August 15 inspection) so that spots on the slope of the original dike are only damp with no running water. Opposite approximate station 26+50, the storm sewer outlets into an open ditch with an estimated discharge of 15 to 20 gal/hr and runs over a small bed of crushed limestone, then enters a swampy area.

NOV 07 1984

WIDOWS CREEK STEAM PLANT UNITS 7 AND 8 - AREA DIKE RAISING - BENTONITE SLURRY CUTOFF WALL

Area 5. Opposite station 22+00± to station 23+00±.

This area shows the dike slope to be damp and soft in spots with no running water visible.

Area 6. Opposite station 13+00± to 22+00±

This area is slightly damp in spots along the toe of the dike. We could not determine if the dampness was from seepage or from the swamp adjacent to the dike.

Area 7. Opposite station 12+00± to station 13+00±

The toe of the dike in this area was damp in spots.

In addition to inspecting for seepage, we walked the top of the finished earth dike. The surface was cracked with the cracks ranging from very small cracks to cracks that were at least 1-1/2 inches wide and at least 12 inches deep.

While at the site, we recommended to Jerry DeAtley and Steve Bailey of CSB that the top few inches of the raised dike be plowed and recompacted according to specifications prior to applying the crushed stone surfacing. On October 11, 1984, Steve Bailey informed us that the top of the dike had been prepared as we had recommended.

A follow-up dike seepage inspection should be made this November.

J. P. Hillier Stivers
J. P. Hillier Stivers

CCT

MHM
JDA
REA
BCM

JPHS:EFS
Attachment
cc (Attachment):
O. P. Thornton, 102 SPT-K

NOV 07 1984

OPT:EFS -
cc (Attachment):
R. G. Domer, W11A6 C-K
MEDS, W5B63 C-K

Principally Prepared By: J. P. Hillier Stivers, Extension 7072

S64296.01

TVA 64 (OS-9-65)

UNITED STATES GOVERNMENT

Memorandum **TENNESSEE VALLEY AUTHORITY**

TO : R. E. Harris, Civil Project Engineer, Fossil Engineering Projects,
338 SPT-K

FROM : J. P. Hillier Stivers, Civil Engineer, Fossil Engineering Projects,
337 SPT-K

DATE :

SUBJECT: WIDOWS CREEK STEAM PLANT UNITS 7 AND 8 - AREA DIKE RAISING - BENTONITE SLURRY CUTOFF WALL SEEPAGE MONITORING PROGRAM RGS

On September 28, 1984, R. G. Spencer, Geology and Geotechnical Engineering Group, W. M. Martin, FEP, and I inspected the units 7 and 8 area dike ~~raising and~~ seepage at Widows Creek Steam Plant. Our findings are listed below (see drawing 34-C-10W7465R3, attached for station references.)

Area 1. Opposite station 35+00 ± to station 36+50 ± (radially, i.e., opposite the southwest corner of the copper pond)

This area has several small red water seeps, and water is accumulated in small ponds along the ditch line with no visable running water within ditch. Also, an area approximately 150 feet long has fairly steady but very slight amount of seeping water.

Area 2. Opposite station 34+00 ± to sta. 35+00 ± (units 1-6 ash sluice pipe crossing)

This is the first point along the ditch line where running water (roughly 5 gal/~~min~~hr) in the ditch was observed. It was difficult to determine if the water was coming from an accumulation of the seepage only or was coming from another source. The sluice lines of units 1-6 block the ditch, making it difficult to get a clear picture of the seepage situation at this point.

Area 3. Opposite station 32+50 ± to station 34+00 ±

This area has a small amount of seepage with no appreciable change in the amount of running water observed at 34+00 ± in the ditch line. Somewhere in the vicinity of station 29 to 30 ±, the accumulated ditch flow disappears. The water probably seeps into the underground storm sewer.

Area 4. Opposite station 25+50 ± to station 26+50 ±

The seepage in spots on this area has now reduced (since the August 15 inspection) until the slope of the original dike ~~is~~ are damp only with no running water. Opposite approximate station 26+50, the storm sewer outlets into an open ditch with an estimated discharge of 15 to 20 gal/hr and runs over a small bed of crushed limestone, then enters a swampy area.

Area 5. Opposite station 22+00 ± to station 23+00 ± .

This area shows dike slope to be damp ~~wet~~ and soft in spots with no running water visible.

WIDOWS CREEK STEAM PLANT UNITS 7 AND 8 - AREA DIKE RAISING - BENTONITE SLURRY CUTOFF WALL

Area 6. Opposite station 13+00 ± to 22+00 ±

This area is slightly damp in spots along the toe of the dike. We could not determine if the dampness was from seepage or from the swamp adjacent to the dike.

Area 7. Opposite station 12+00 ± to station 13+00 ±

The toe of the dike in this area was damp in spots.

In addition to inspecting for seepage, we walked the top of the finished earth dike. The surface was cracked with the cracks ranging from very small cracks to cracks that were at least 1-1/2 inches wide and at least 12 inches deep.

While at the site, we recommended to Jerry DeAlley and Steve Bailey of CSB that the top few inches of the raised dike be plowed and recompacted according to specifications prior to applying the crushed stone surfacing.

On October 11, 1984, Steve Bailey informed us that the top of the dike had been prepared as we had recommended. The pond approximate elevation at the time of this inspection was elevation 618. ~~The plant was beginning to use this pond again; and when the elevation reaches 621.5 (an elevation which will furnish makeup water into the limestone waste pond)~~, A follow-up inspection should be made some time in November to observe and evaluate ~~effect of the higher water elevation on the~~ dike seepage.

J. P. Hillier Stivers

JPH:EFS Attachment
cc: O. P. Thornton, 102 SPT-K

OPT:EFS - Attachments
cc: R. O. Barnett, W9D224 C-K
R. G. Domer, W11A6 C-K
MEDS, W5B63 C-K

Principally Prepared By: J. P. Hillier Stivers, Extension 7072

S64296.01

FOR

NAME

DATE

ADDRESS

Chatta ☐ Knox ☐ M.S. ☐

Fold here for return

FROM

NAME

EXTENSION

ADDRESS

Chatta ☐ Knox ☐ M.S. ☐

[illegible]

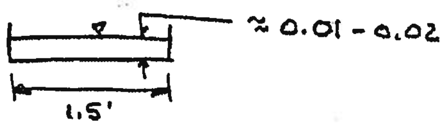
☐ Per Your Request
☑ Information
☐ Per Conversation
☐ Comment
☐ Handle
☐ Prepare Reply
☐ Note and Return
☐ Distribute
☐ Circulate
☐ Approval
☐ Signature
☐ Destroy
☐ Call Me
☐ See Me
☐ File

TVA 45B (OS-2-74) INTEROFFICE MAILING SLIP

Reference: See Memo from Bob Spencer to FEP files dated 1/16/85 for locations /Areas

Area 1 (Just Upstream of Units 1-6 Sluice pipe Xing - Sta 35±)

Flow across upstream sluice pipe



checked flow by homemade 90° V-Notch Weir

depth of flow = 0.08'

Some water bypassing Weir

$Q \approx 2.5H^{2.5} = 2.5(0.08)^{2.5} = 0.0045$ CFS

= 120 gph

Area 2 (AT units 1-6 Sluice Pipe X-ing) - STA 35±

Measured flow just (≈65') downstream of Sluice pipe X'ing

using 90° V-Notch weir ⇒ depth of flow = 0.16'

$Q \approx 2.5H^{2.5} = 2.5(0.16)^{2.5} = 0.0256$ CFS

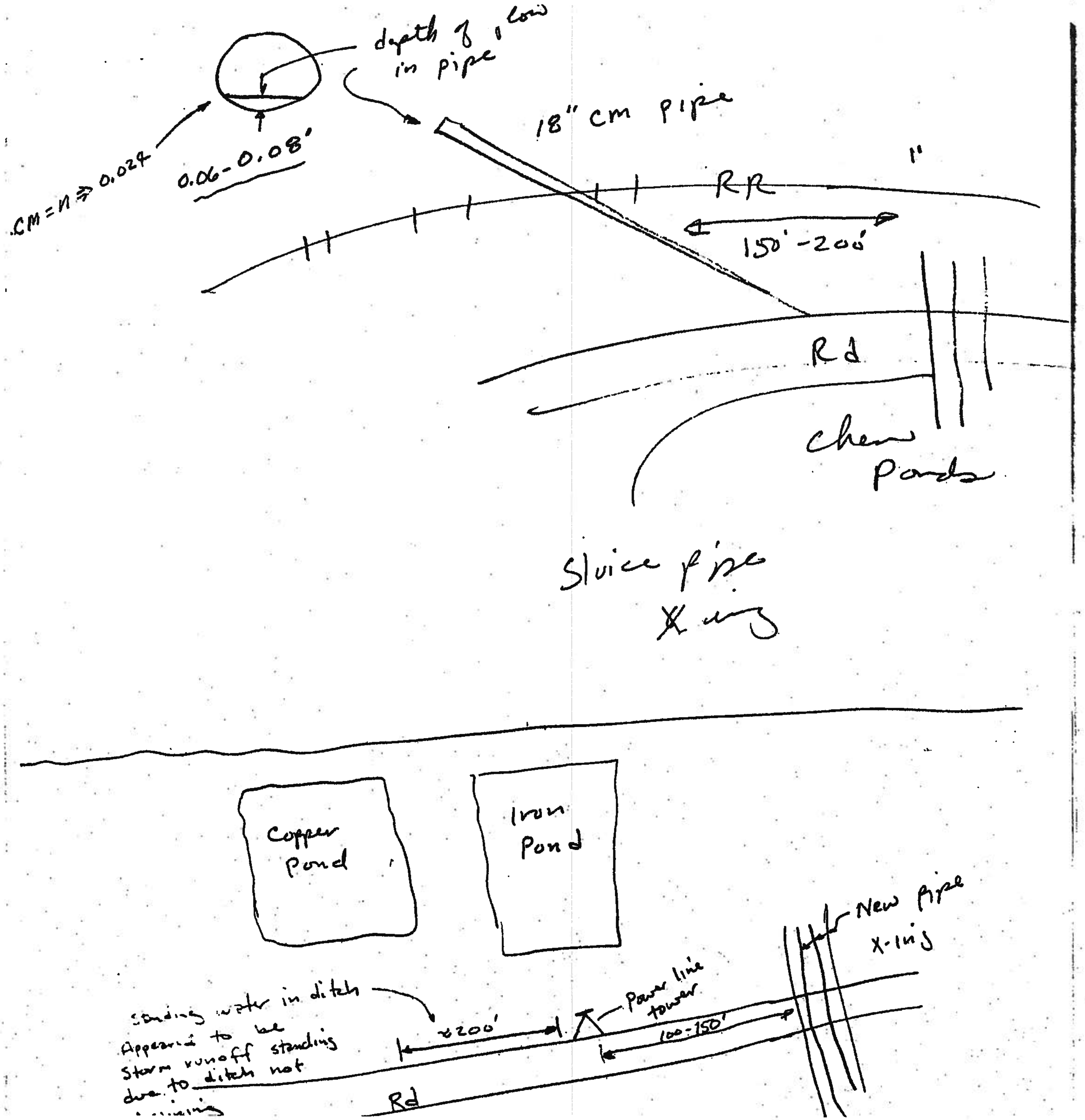
= 690 gph

Some Water bypassing Weir

Area 5 (opposite Sta 25+50±)

Using 90° V-Notch Weir ⇒ depth = 0.20' *

large amount of



Standing water in ditch
Appeared to be
Storm runoff standing
due to ditch not
draining

FOR
NAME
DATE
ADDRESS
☐ Chatta ☐ M. S.
☐ Knox ☐ Nor.

Fold here for return

FROM
NAME (Richard Hodges)
EXTENSION
ADDRESS Widows Creek
☐ Chatta ☐ M. S.
☐ Knox ☐ Nor.

C Paul Jones 2325 Refer to
Wilbey Harris Norris 4460
from Water Systems Development

June 1 & 2 1981

	Top casing	Depth to W.S.	W.S. Elev.
ST-1	626.0	-21.4	604.6
ST-4	626.0	30.0	596.0
3-9	622.0	20.8	601.2
L-7	606.0	11.0	596.0
L-1	626.0	14.3	611.8
L-2	630.0	23.5	606.5
L-3	630.0	31.4	598.6
L-4	633.0	27.2	605.8
L-5	629.0	22.5	606.0
L-8	636.0	13.8	617.3
L-11	634.0	31.9	602.1

Drent Reser 594.4

TVA 45D (OS-9-80) INTEROFFICE MAILING SLIP

1) Two or maybe · re possible pond locations.

2) A lot is unknown about past hist.

a) Were former spillways discharge pipes left in place?. plugged? not plugged?

b) Why didn't slurry trench excavation hit discharge pipes?

1) Are the proposed (CSO) outfall collection pond the most desirable solution?
(probably)

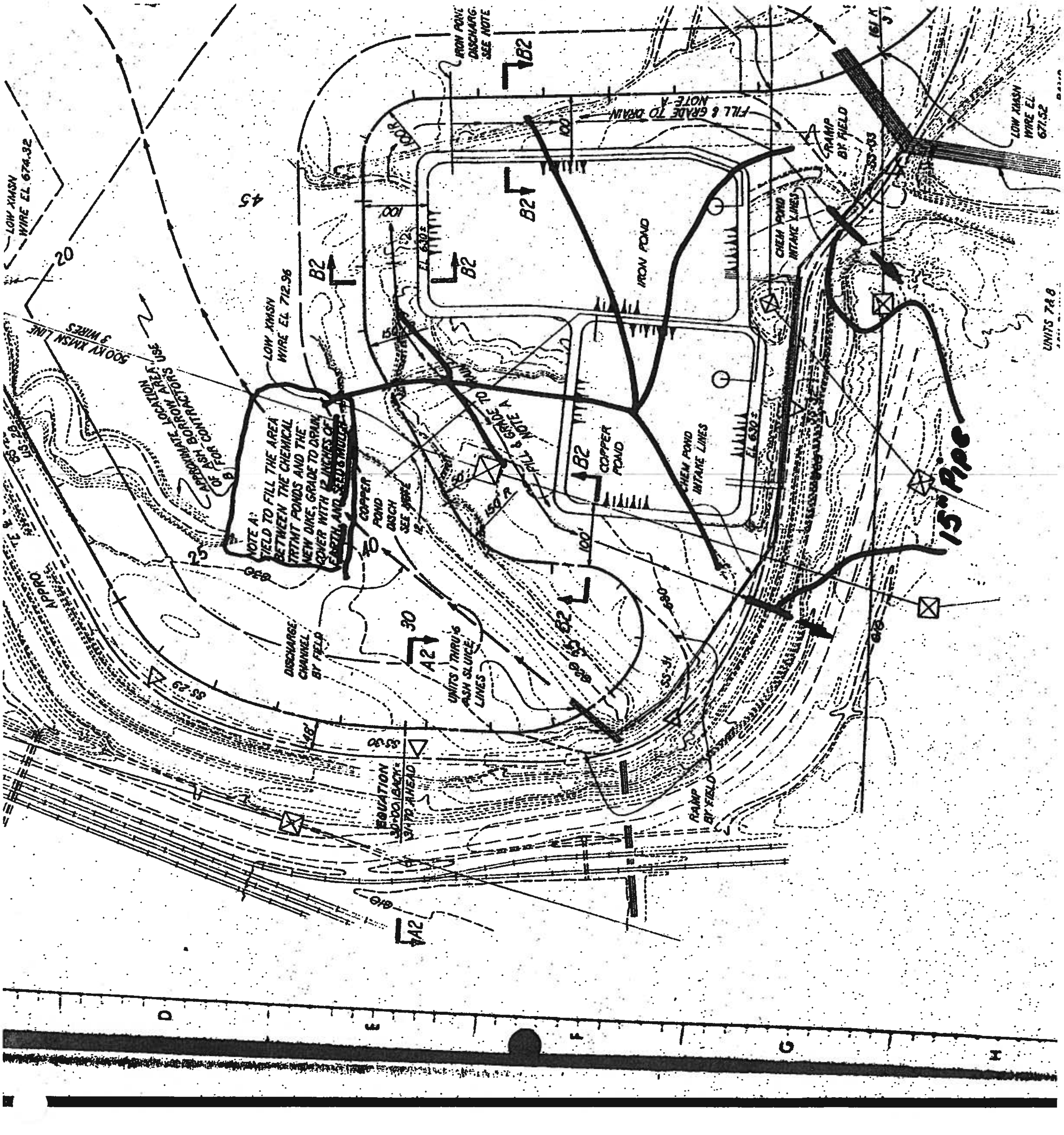
a) What is the depth of clay in this area?

b) Will a pond liner be required or desirable?

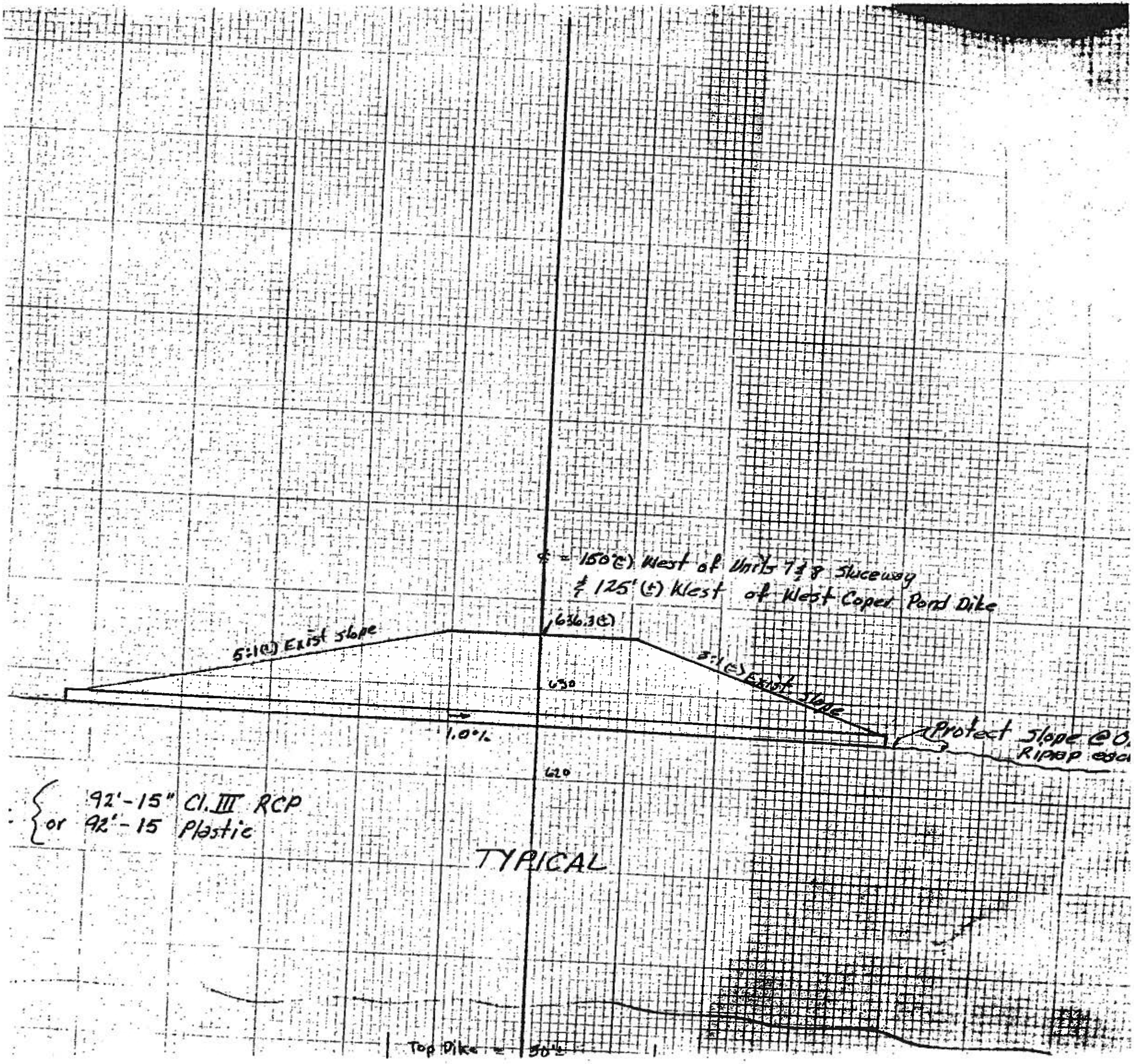
2) Is a sump and pumps on the north side of RR tracks a desirable and feasable alternative to (1)

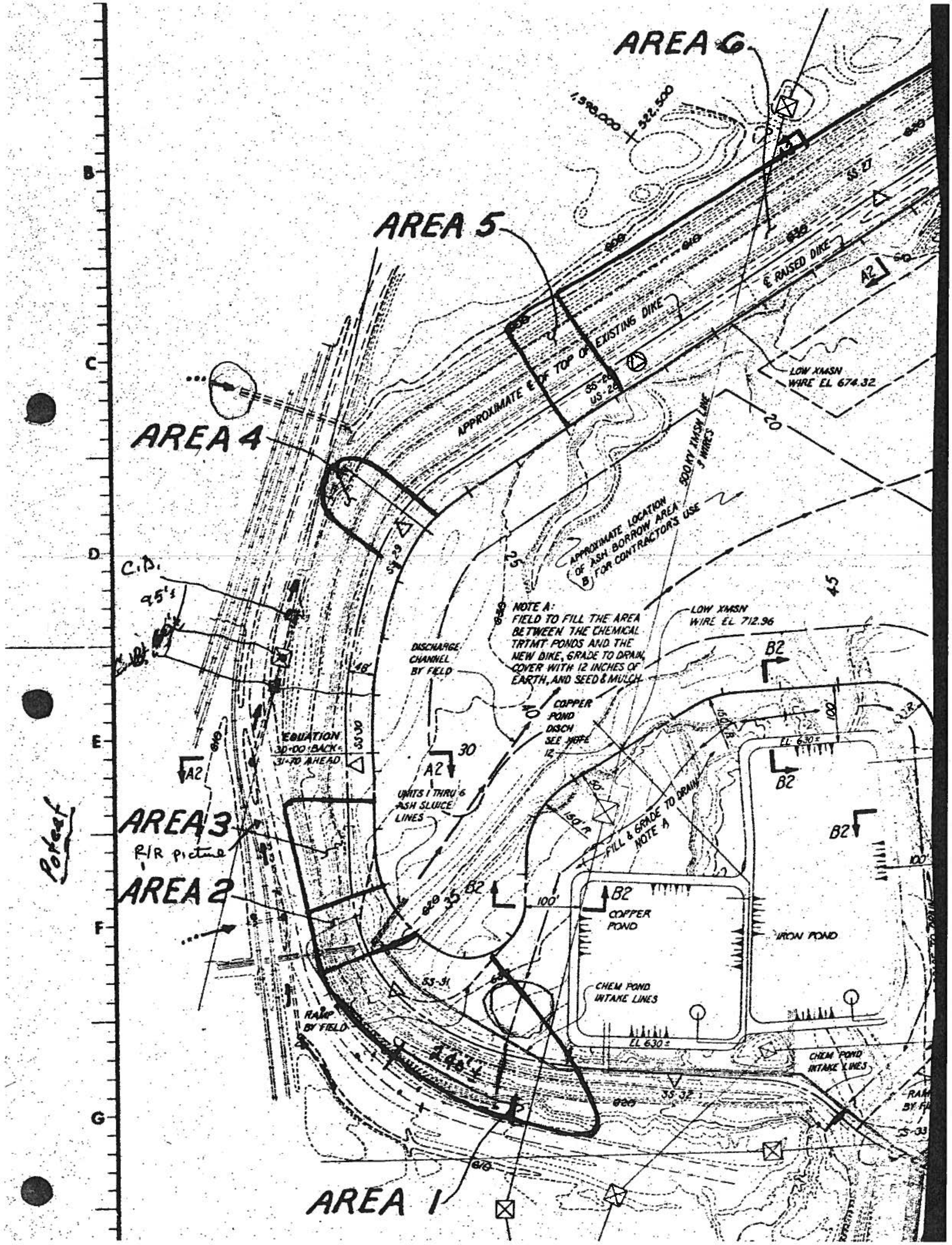
a) How will pumps discharge across RR tracks

b) What will it discharge into?
(1) Exist pond?
(2) new pond?

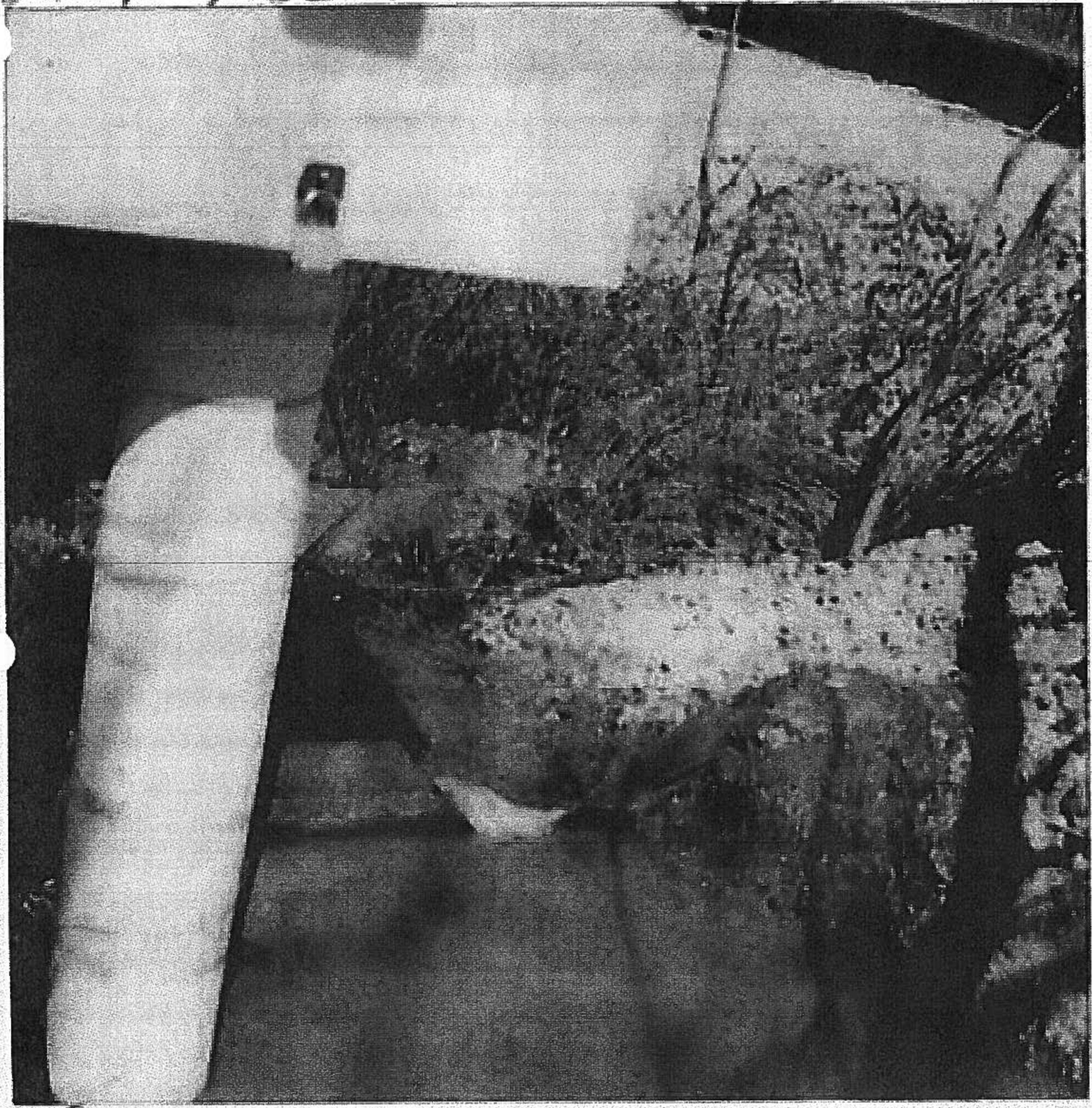


IRON POND DISCHARG. SEE NOTE
B2
FILL & GRADE TO DRAIN NOTE A
RAMP BY FIELD
161 K
LOW XMSN WIRE EL 671.52
SS-33
LOW XMSN WIRE EL 674.32
20
45
IRON POND
CHEM POND INTAKE LINES
UNITS 7 & 8
LOW XMSN WIRE EL 712.96
500 KV XMSN LINE 3 WIRES
APPROXIMATE LOCATION OF ASH BORROW AREA FOR CONTRACTORS USE
NOTE A: FIELD TO FILL THE AREA BETWEEN THE CHEMICAL TRTMT PONDS AND THE NEW DIKE, GRADE TO DRAIN, COVER WITH 12 INCHES OF EARTH AND SEED & MULCH
COPPER POND DISCH SEE NOTE
FILL & GRADE TO DRAIN SEE NOTE A
COPPER POND
CHEM POND INTAKE LINES
EL 630±
15" Pipe
25
40
30
DISCHARGE CHANNEL BY FIELD
A2
UNITS 1 THRU 6 ASH SLUICE LINES
SS-29
SS-30
SS-31
EQUATION 30+00 BACK = 31+70 AHEAD
RAMP BY FIELD
APPRO
US 25
610
630
100'
150'
D
E
F
G
H


℄ = 150'(±) West of Units 7 & 8 Sluceway
& 125' (±) West of West Coper Pond Dike
636.3(±)
5:1(±) Exist Slope
3:1(±) Exist Slope
630
1.0%
620
Protect Slope @ O
Ripap esc
92'-15" Cl. III RCP
or 92'-15 Plastic
TYPICAL
Top Dike = 30'±


AREA 6
AREA 5
AREA 4
AREA 3
R/R picture
AREA 2
AREA 1
C.D.
95's
1,590,000
322,500
APPROXIMATE ℄ OF TOP OF EXISTING DIKE
℄ RAISED DIKE
SS-26
US-26
SS 27
SS-29
SS-31
SS 32
SS-33
LOW XMSN WIRE EL 674.32
LOW XMSN WIRE EL 712.96
500 KV XMSN LINE 3 WIRES
APPROXIMATE LOCATION OF ASH BORROW AREA B FOR CONTRACTOR'S USE
NOTE A:
FIELD TO FILL THE AREA BETWEEN THE CHEMICAL TRTMT PONDS AND THE NEW DIKE, GRADE TO DRAIN, COVER WITH 12 INCHES OF EARTH, AND SEED & MULCH
DISCHARGE CHANNEL BY FIELD
COPPER POND DISCH SEE NOTE 12
FILL & GRADE TO DRAIN NOTE A
UNITS I THRU 6 ASH SLUICE LINES
EQUATION 30+00 BACK= 31+70 AHEAD
48'
150' R
100'
EL 630 ±
COPPER POND
IRON POND
CHEM POND INTAKE LINES
RAMP BY FIELD
A2
B2
20
25
30
35
40
45
600
610
620
630
640
B
C
D
E
F
G
Portrait

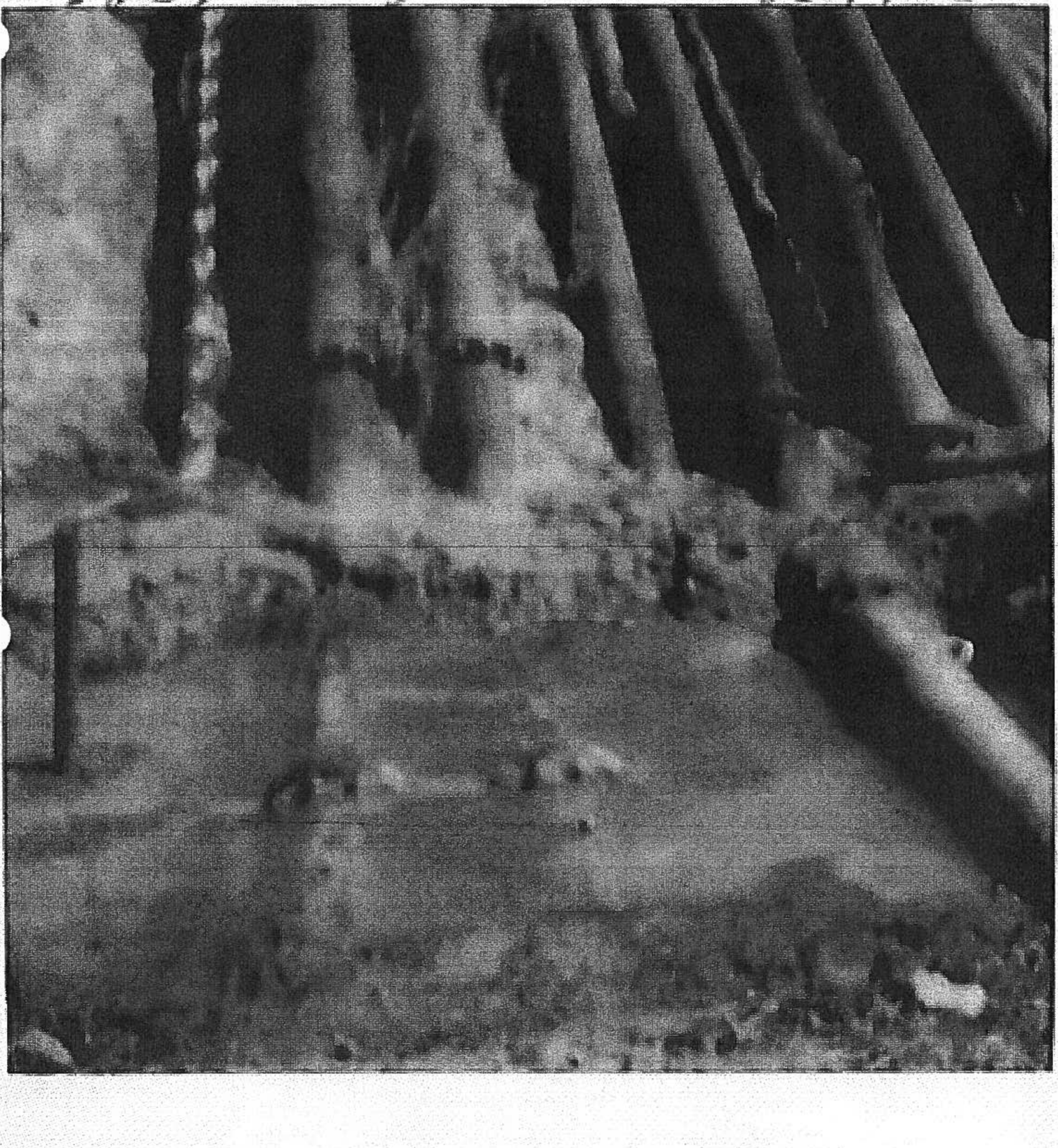
WCF Red H2O 3/6/85



6 Ph monitor

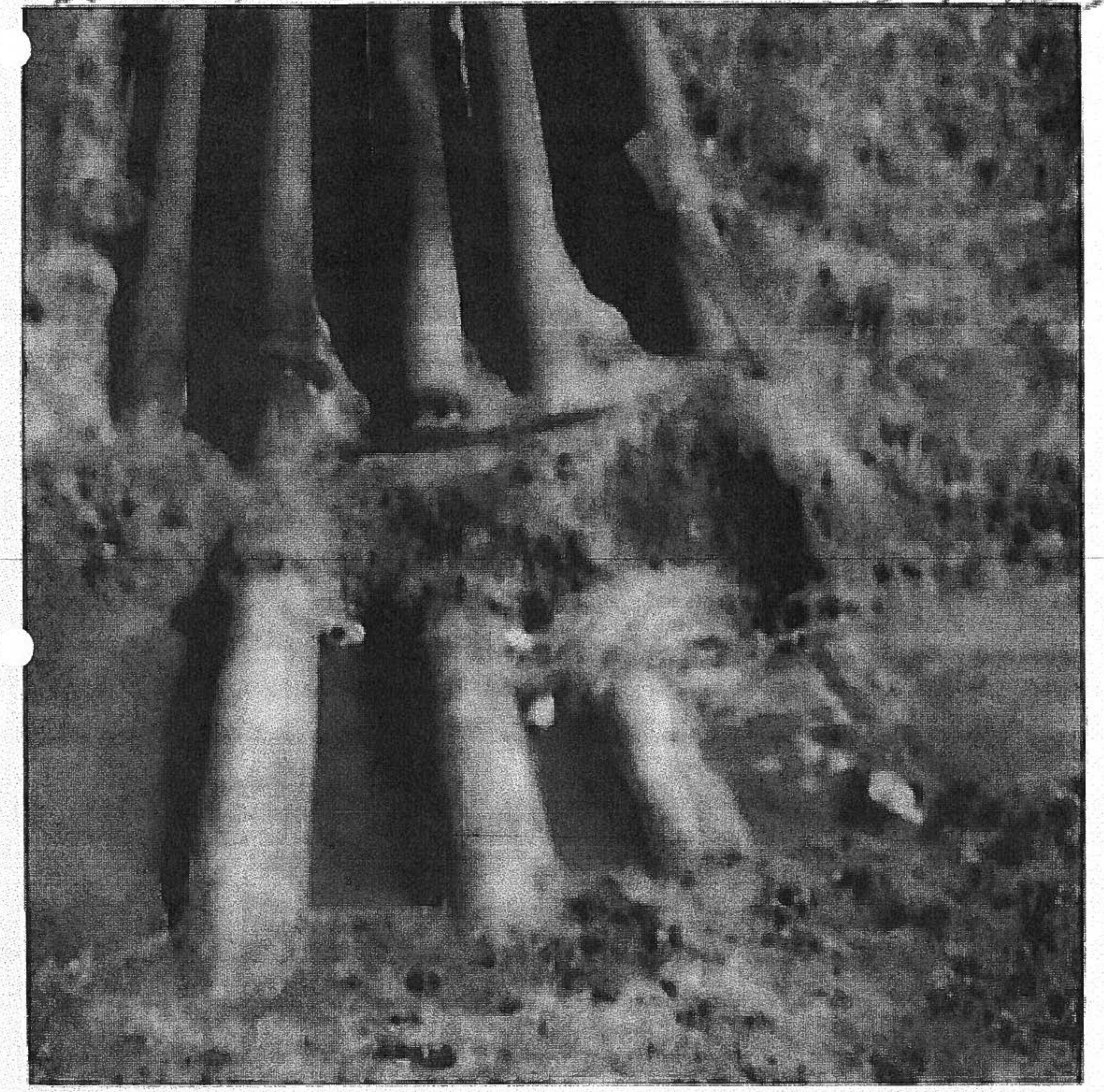
1

WCF 3-6-85 Red H2O



2

WCF Red H_2O (Units 1-6) 3/6/85



3

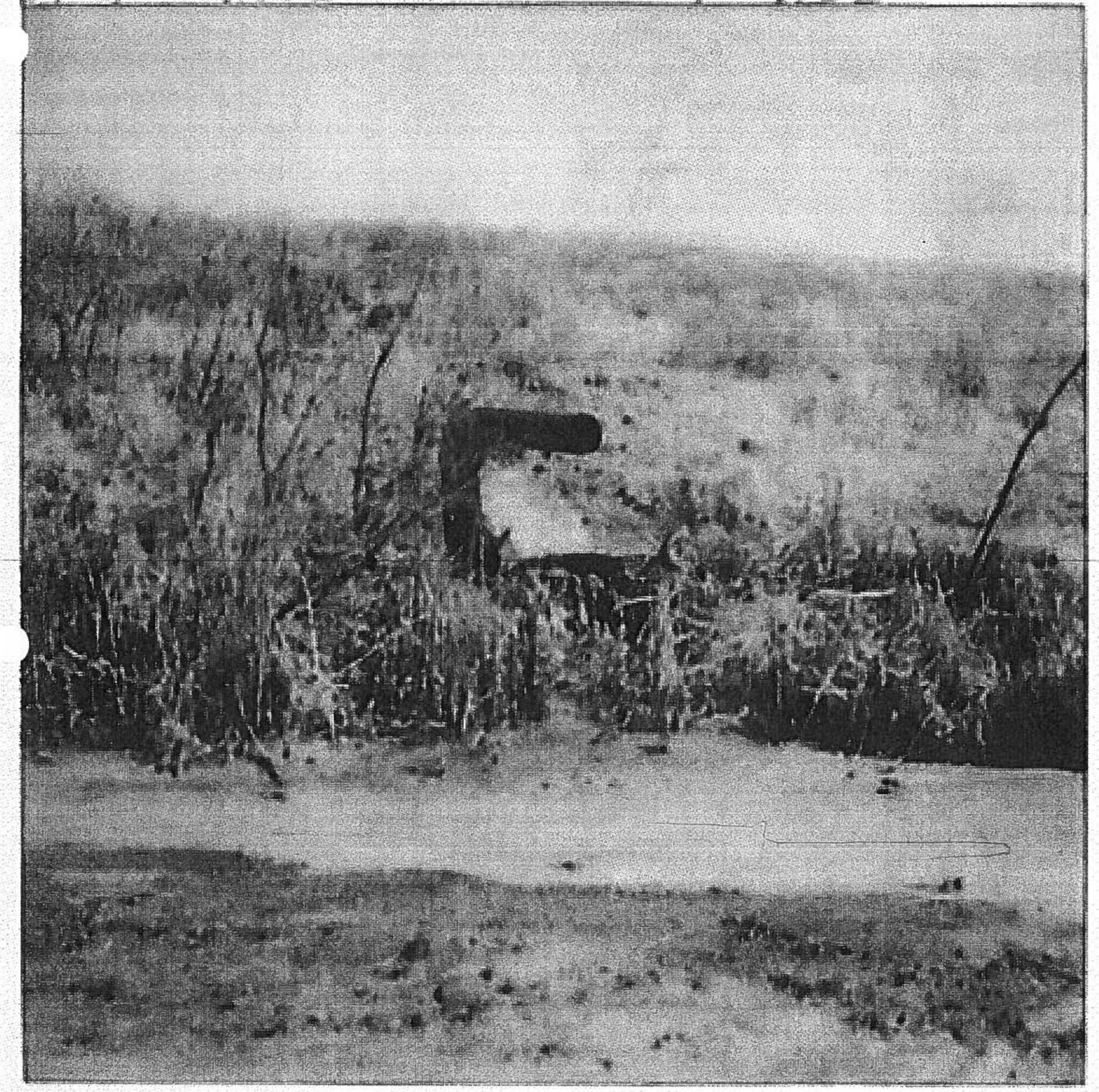
WCF - Red H_2O 3/6/85

6

WCF - Red H_2O 3/6/85

7

WCF Red H2O 3/6/85



11

WCF - Red H_2O 3/6/85

BANK @ AREA 5

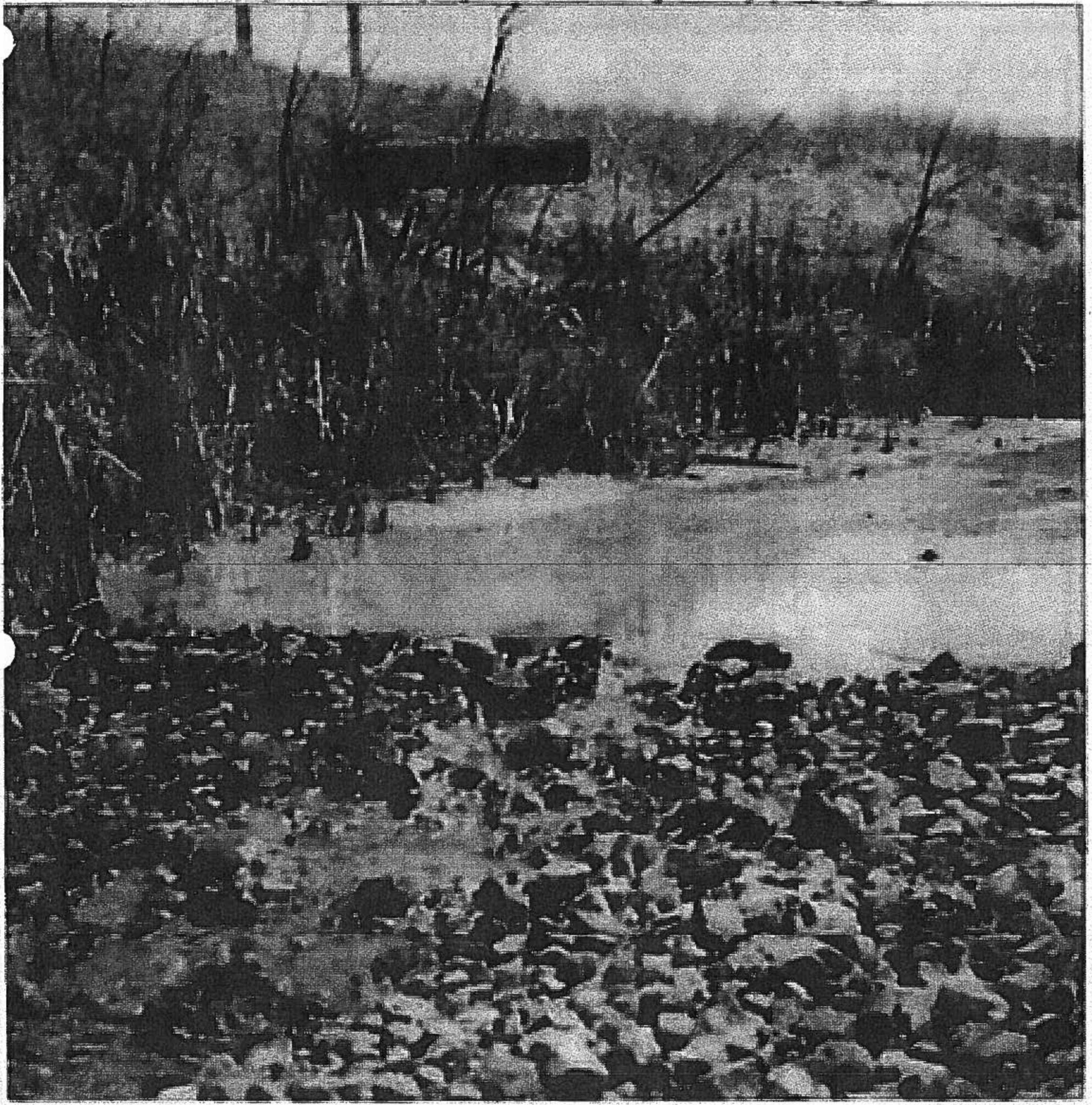
10

WCF - Red H_2O 3/6/85

Weir By Spencer

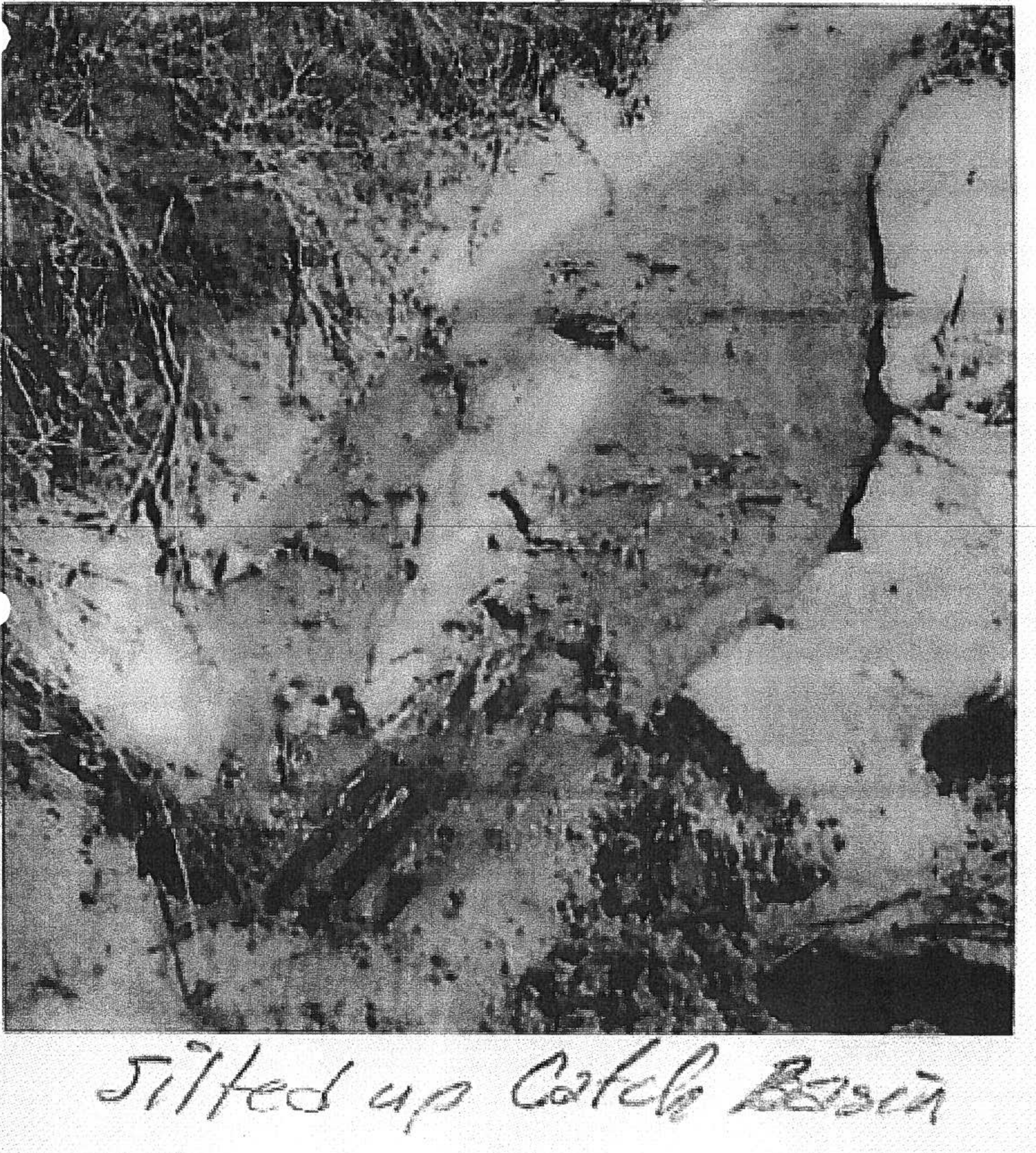
8

Red H20 WCF 3/6/85



9 Looking @ overflow
@ AREA 5

WCF-Red H_2O 3/6/85

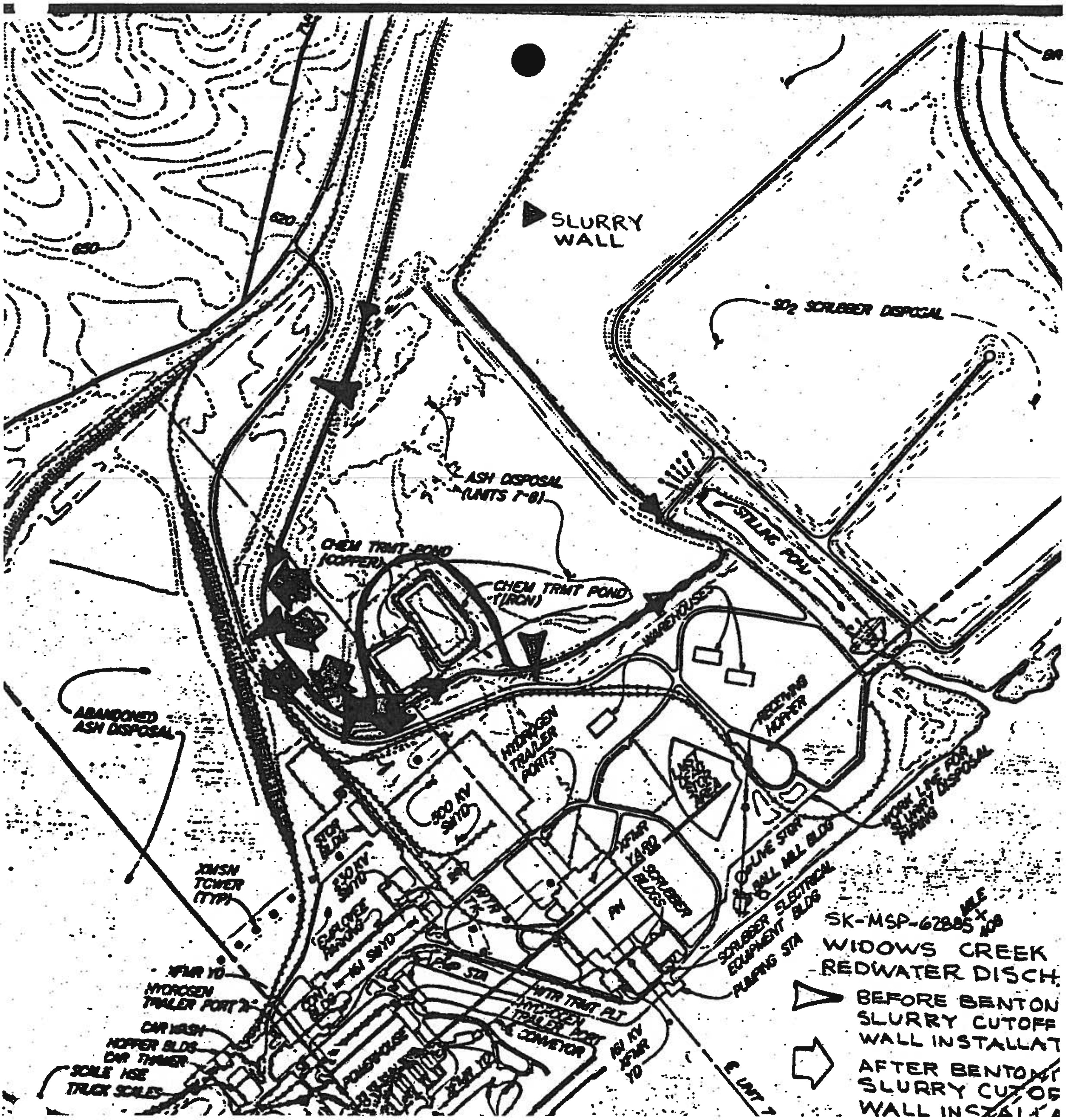


Silted up Catch Basin

5

WCF-Red Water 3/6/85

4


SLURRY WALL
620
650
SO2 SCRUBBER DISPOSAL
ASH DISPOSAL (UNITS 7-8)
STILLING POND
CHEM TRMT POND (COPPER)
CHEM TRMT POND (IRON)
WAREHOUSES
RECEIVING HOPPER
ABANDONED ASH DISPOSAL
HYDROGEN TRAILER PORTS
500 KV SWYD
XFMR YARD
SCRUBBER BLDGS
WORK LINE FOR SLURRY DISPOSAL PIPING
ON-LINE STOR
BALL MILL BLDG
SCRUBBER ELECTRICAL EQUIPMENT BLDG
PUMPING STA
XMSN TOWER (TYP)
STOR BLDG
230 KV SWYD
161 SWYD
XFMR YD
HYDROGEN TRAILER PORT
CAR WASH
HOPPER BLDG
CAR THAWER
SCALE HSE
TRUCK SCALES
POWERHOUSE
PMP STA
WTR TRMT PLT
HYDROGEN TRAILER PORT
CONVEYOR
161 KV XFMR YD
℄ UNIT 7
SK-MSP-62885 X
WIDOWS CREEK
-REDWATER DISCH
BEFORE BENTON
SLURRY CUTOFF
WALL INSTALLAT
AFTER BENTONI
SLURRY CUTOF
WALL INSTALLA

ADEM

ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

George C. Wallace
Governor

1751 Federal Drive
Montgomery, AL
36130
205 271-7700

Field Offices:

P.O. Box 953
Decatur, AL
35602
205 353-1713

Unit 806, Building 8
225 Oxmoor Circle
Birmingham, AL
35209
205 942-6168

4358 Midmost Drive
Mobile, AL
36609
205 343-7841

October 15, 1984

Mr. Martin Rivers
Director of Environmental Quality
Tennessee Valley Authority
Knoxville, TN 37902

Dear Mr. Rivers:

Re: Widows Creek Steam Plant
Stevenson, Alabama
NPDES No. AL0003875

A review of our files has revealed the following permit violations on Outfall Numbers 018 and 019 at your facility:

Outfall No.: 018

October 3, 1984	pH 4.7 s.u.
September 26, 1984	pH 4.3 s.u.
September 19, 1984	pH 4.4 s.u.
September 5, 1984	pH 5.6 s.u.
July 10, 1984	pH 5.7 s.u.
July 5, 1984	pH 5.2 s.u.

Outfall No.: 019

September 26, 1984	pH 4.9 s.u.
May 24, 1984	pH 4.7 s.u.

It is our understanding that these violations occurred because the waster did not have enough contact time with the limestone dikes prior to discharge.

Further, previous correspondence from your facility has indicated that other methods for achieving discharge limits are being considered.

RECEIVED
OCT 17 1984
ENVIRONMENTAL
COMPLIANCE BRANCH

10/31/84

F 1/10/85

Your facility will be required to submit to this office within 90 days of the date of this communication plans and specifications for treating the pH of these wastewater discharges (Outfall 018 and 019) to the permit limits.

If you have any questions, please feel free to call.

Sincerely,

Treena J. Givens, Engineer
Industrial Branch
Water Division

TJG:bjp

cc: Mr. Mike Hines
Mr. Carl A. McLaughlin

WIDOWS CREEK

Ponded Fly Ash (Ash Pond)
Scrubber Gypsum
Bottom Ash - From Pond

WIDOWS CREEK

Ponded Fly Ash (Ash Pond)

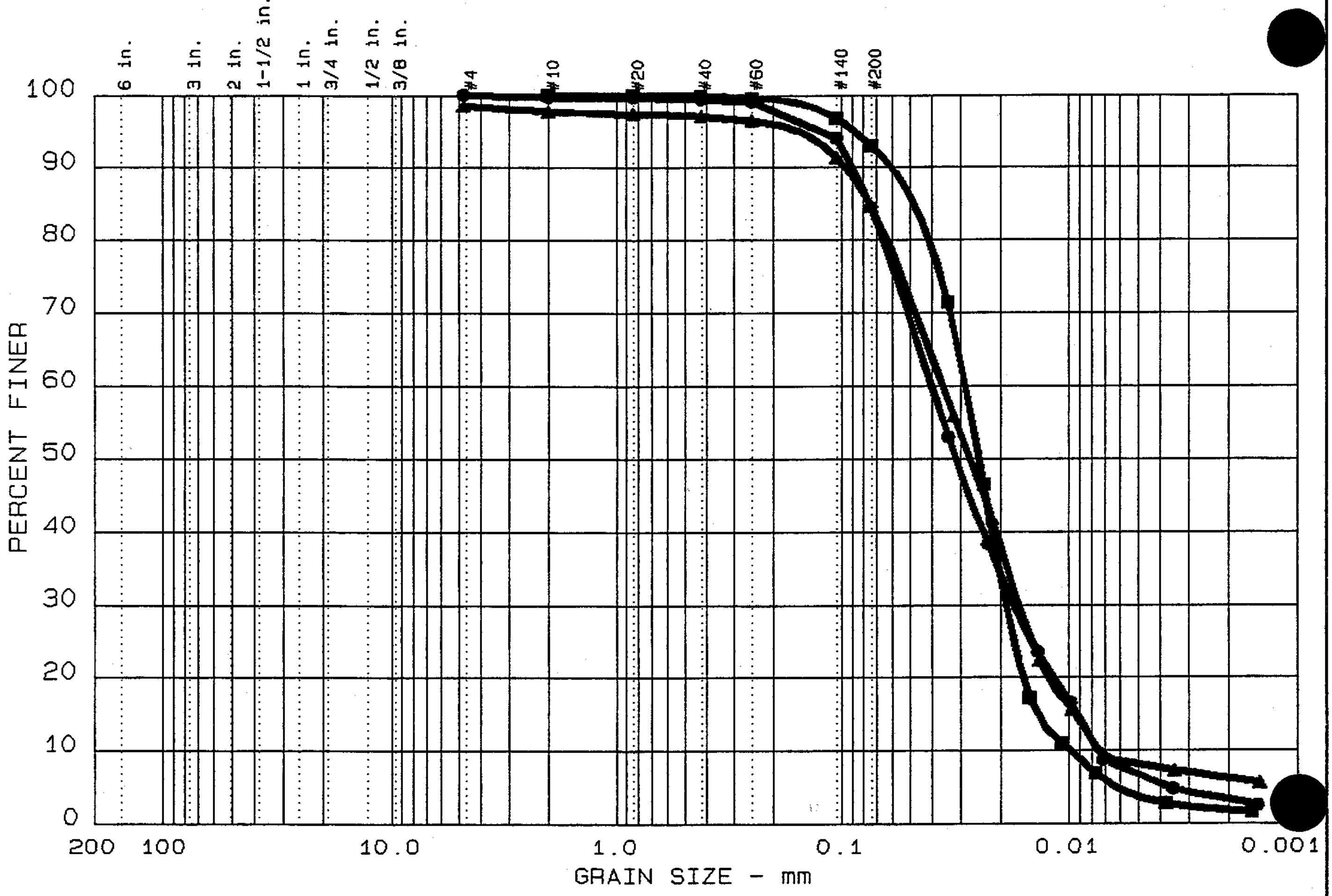
Grain Size Distribution Test Report
Moisture-Density Relationship (Standard Proctor)
Moisture-Density Relationship (Modified Proctor)
Consolidation Test Report
Hydraulic Conductivity - Falling Head (2 Pages)
Triaxial Compression Test (2 Pages)
Direct Shear Test
California Bearing Ratio
Resilient Modulus (Standard Proctor) (9 Pages)
Resilient Modulus (Modified Proctor) (9 Pages)

TVA - WIDOWS CREEK
PONDED FLY ASH (ASH POND)

Description	**Test Method**	**Property**	**Sample 1**	**Sample 2**	**Sample 3**
Grain Size	ASTM D 422	Percent Retained on the #4 Sieve	0.0	1.5	0.0
		Percent Passing the #200 Sieve	84.5	84.6	92.9
		Percent Passing the 0.005 mm Sieve	6.7	8.2	3.6
Atterberg Limits	ASTM D 4318	Liquid Limit	NL	NL	NL
		Plastic Limit	NP	NP	NP
		Plasticity Index	N/A	N/A	N/A
Specific Gravity	ASTM D 854	Specific Gravity at 20°C	2.38	2.40	2.22
Classification	ASTM D 2487	Unified Soil Classification System (USCS)	ML	ML	ML
	AASHTO M 145	AASHTO Classification	A-4(0.0)	A-4(0.0)	A-4(0.0)
			Composite Sample		
Moisture-Density Relations (Standard Effort)	ASTM D 698	Maximum Dry Density, pcf	67.0		
		Optimum Moisture Content, %	39.8		
Moisture-Density Relations (Modified Effort)	ASTM D 1557	Maximum Dry Density, pcf	73.5		
		Optimum Moisture Content, %	27.8		
			Result	**Dry Density, pcf**	**Moisture Content, %**
Consolidation	ASTM D2435	Compression Index C_C	0.12	64.6	38.5
Hydraulic Conductivity	ASTM D 5084	Hydraulic Conductivity, cm/sec	1.8E-4	64.5	38.1
Triaxial Shear Strength Consolidated-Undrained (CU)	ASTM D4767	Effective Stress, Cohesion, c', ksf	1.85	64.4	38.3
		Effective Stress, Internal Friction Angle, ϕ', degrees	25.5		
		Total Stress, Cohesion, c, ksf	1.94	64.4	38.3
		Total Stress, Internal Friction Angle, ϕ, degrees	21.5		
Direct Shear Strength	ASTM D 3080	Cohesion, c, ksf	1.70	63.6	40.0
		Internal Friction Angle, ϕ, degrees	31.2		
California Bearing Ratio	ASTM D 1883	CBR, %	3	66.1	35.7
Resilient Modulus (Standard Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	2,384	63.2	38.2
Resilient Modulus (Modified Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	5,500	66.8	27.8
Soil Resistivity	AASHTO T 288	Minimum Resistivity, Ohm-cm	1,400		
pH of Soil	AASHTO T 289	pH	9.2		
Water Soluble Sulfate Ion	AASHTO T 290	Sulfate Ion Content, mg/kg	1060		
Water Soluble Chloride Ion	AASHTO T 290	Chloride Ion Content, mg/kg	<10		

wcf-fa.xls

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	15	0.0	0.0	15.5	77.8	6.7
▲	16	0.0	1.5	13.9	76.4	8.2
■	17	0.0	0.0	7.1	89.3	3.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NL	NP	0.07		0.03	0.017	0.0092	0.0075	1.00	5.3
▲	NL	NP	0.07		0.03	0.017	0.0094	0.0074	1.03	4.9
■	NL	NP			0.02	0.019	0.0138	0.0097	1.28	2.9

MATERIAL DESCRIPTION	USCS	AASHTO
● Ash Pond	ML	A-4(0.0)
▲ Ash Pond	ML	A-4(0.0)
■ Ash Pond	ML	A-4(0.0)

Project No.: 5810860101
Project: TVA - Widows Creek
● Location: Ponded Fly Ash A & B
▲ Location: Ponded Fly Ash C & D
■ Location: Ponded Fly Ash E & F
Date: July 18, 1995

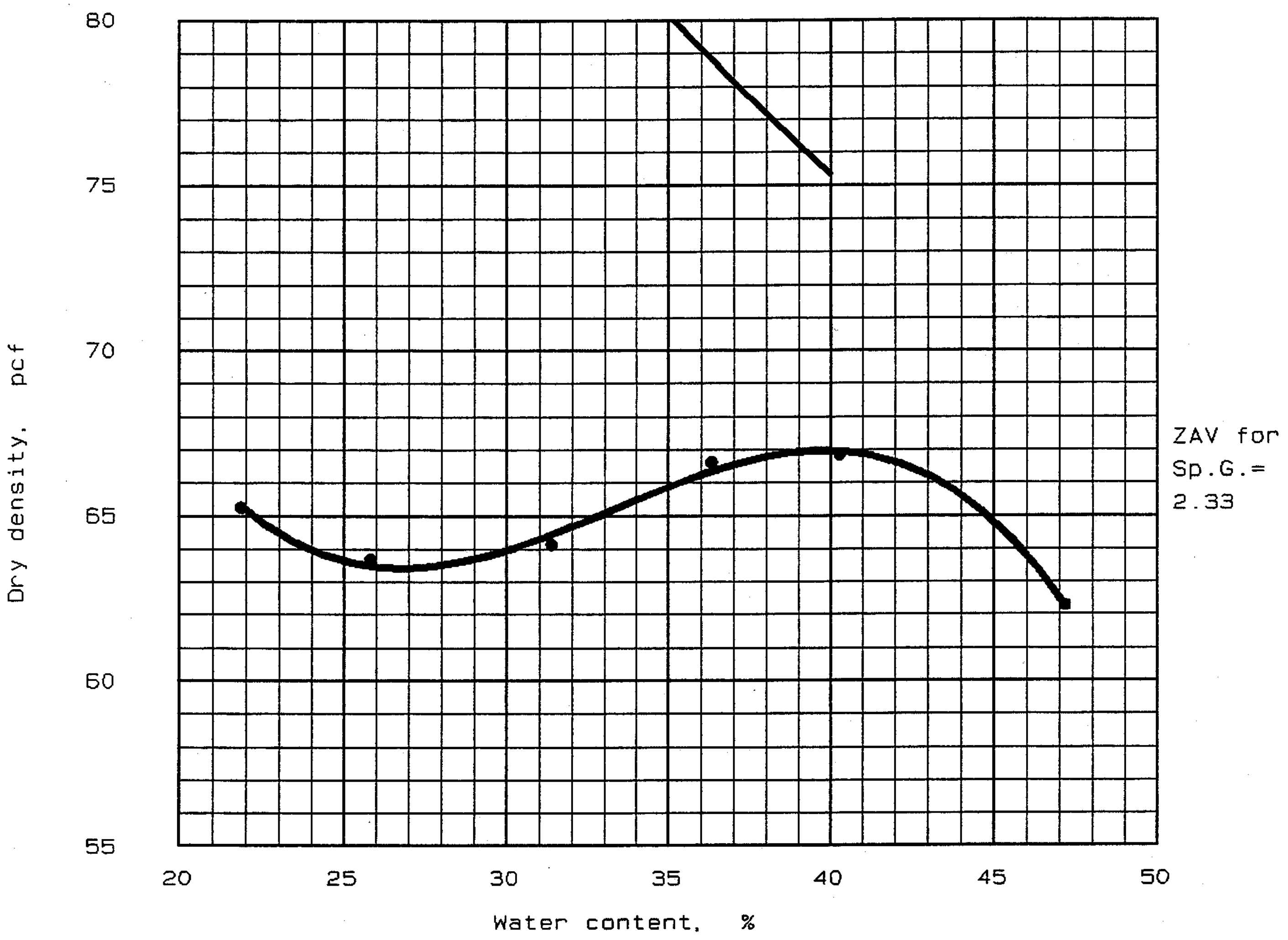
Remarks:
Tested by: JCR
Reviewed by:

GRAIN SIZE DISTRIBUTION TEST REPORT

LAW ENGINEERING, INC.

Figure No.

MOISTURE-DENSITY RELATIONSHIP



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	ML	A-4(0.0)	60.3 %	2.33	NL	NP	0.5 %	87.3 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 39.8 % Maximum dry density = 67.0 pcf	

Project No.: 5810860101
Project: TVA - Widows Creek
Location: Ponded Fly Ash
Ash Pond
Date: July 25, 1995

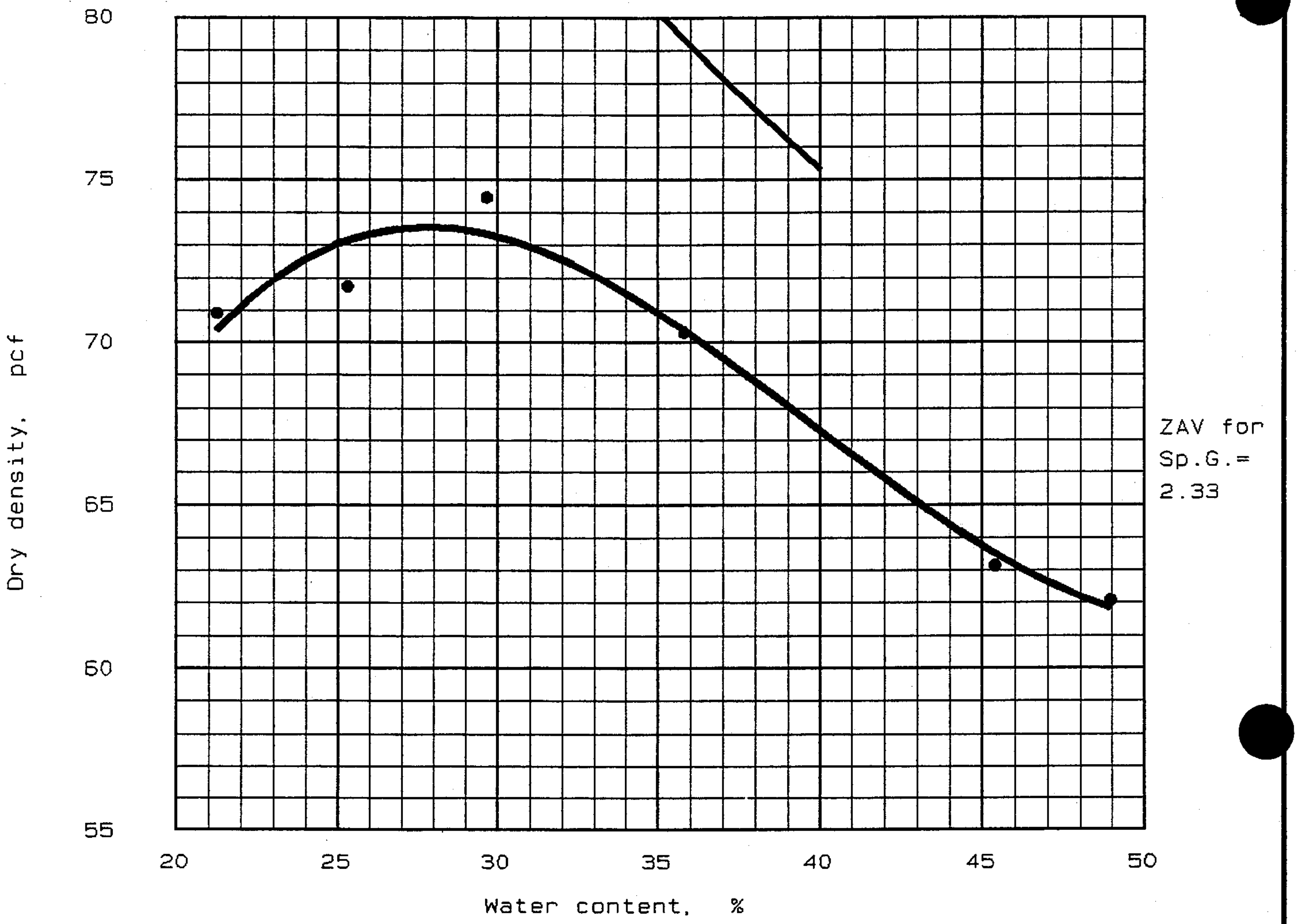
Remarks:
Tested by: JCR
Reviewed by: RCB

MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

Figure No. ______

MOISTURE-DENSITY RELATIONSHIP



"Modified" Proctor, ASTM D 1557, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	ML	A-4 (0.0)	60.3 %	2.33	NL	NP	0.5 %	87.3 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 27.8 % Maximum dry density = 73.5 pcf	

Project No.: 5810860101
Project: TVA - Widows Creek
Location: Ponded Fly Ash
Ash Pond
Date: July 25, 1995

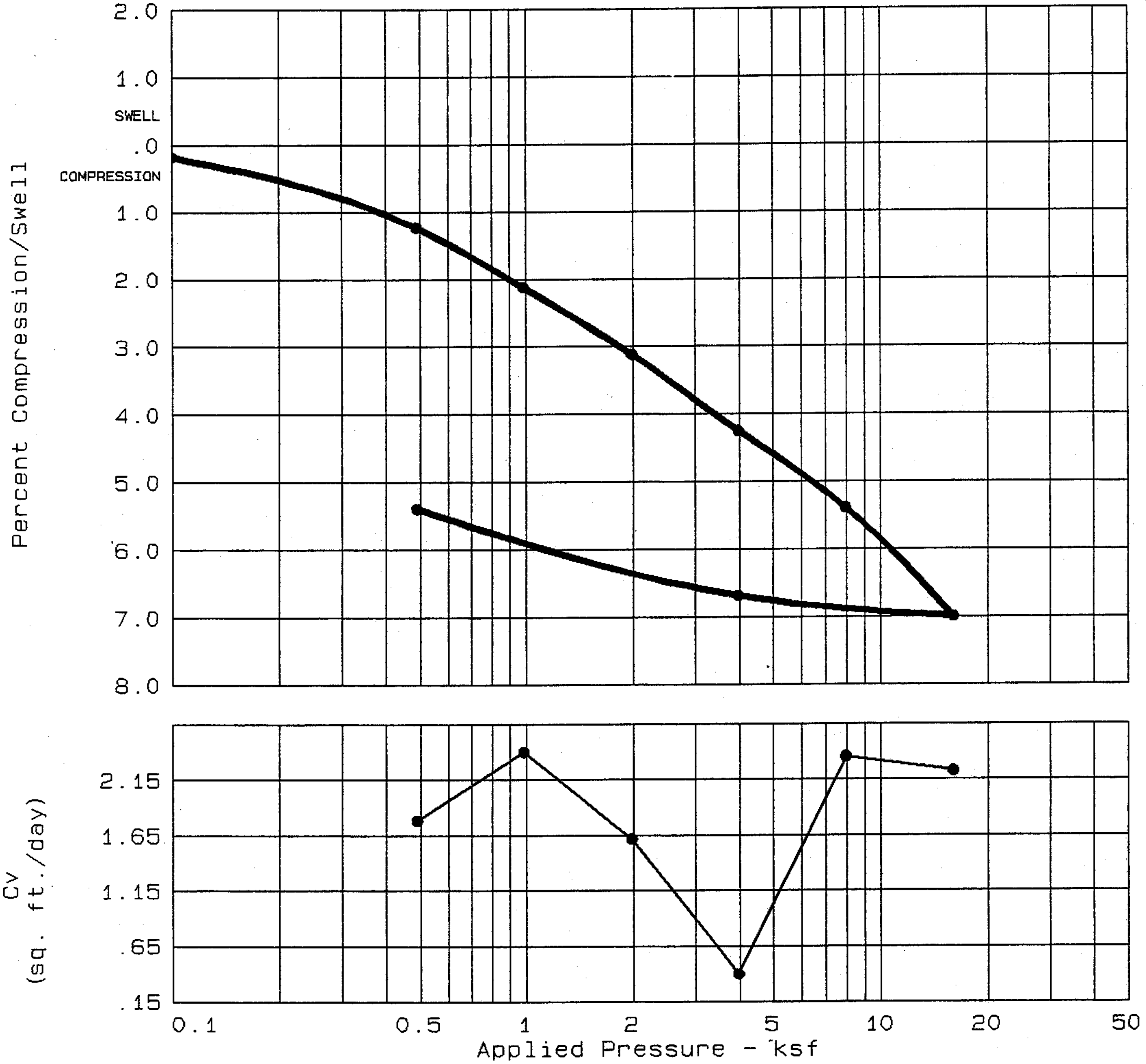
Remarks:
Tested by: JCR
Reviewed by: RUB

MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

Figure No. ______

CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_0
71.6 %	38.5	64.6	NL	NP	2.332	8.00	0.12	1.2530

TEST RESULTS

Compression Index = 0.12

Project No.: 5810860101
Project: TVA - Widows Creek
Location: Ponded Fly Ash
Ash Pond
Date: August 22, 1995

CONSOLIDATION TEST REPORT

LAW ENGINEERING, INC.

MATERIAL DESCRIPTION

Class: ML, A-4(0.0)

Remarks:

Tested by: AsK
Reviewed by:

Fig. No.

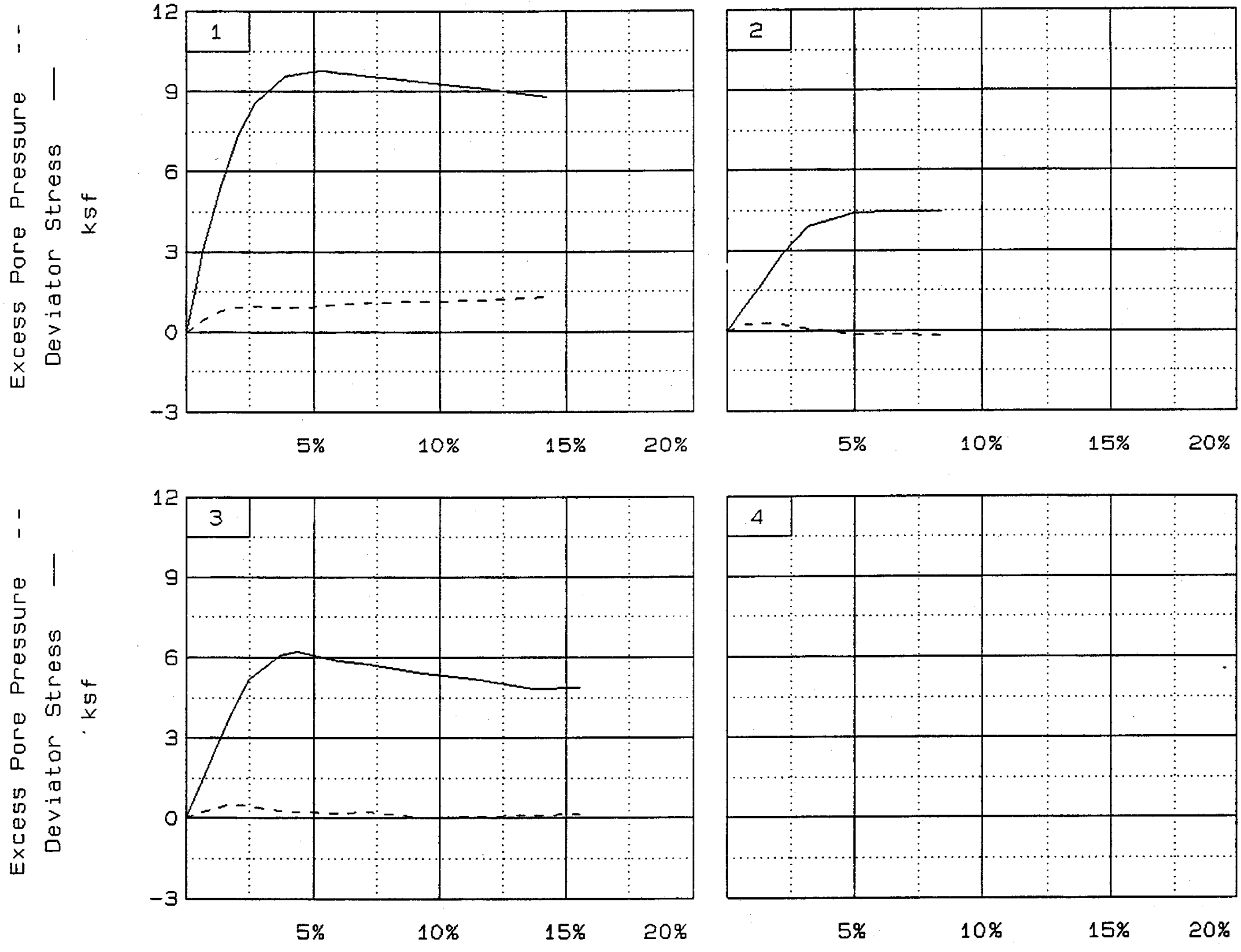
HYDRAULIC CONDUCTIVITY

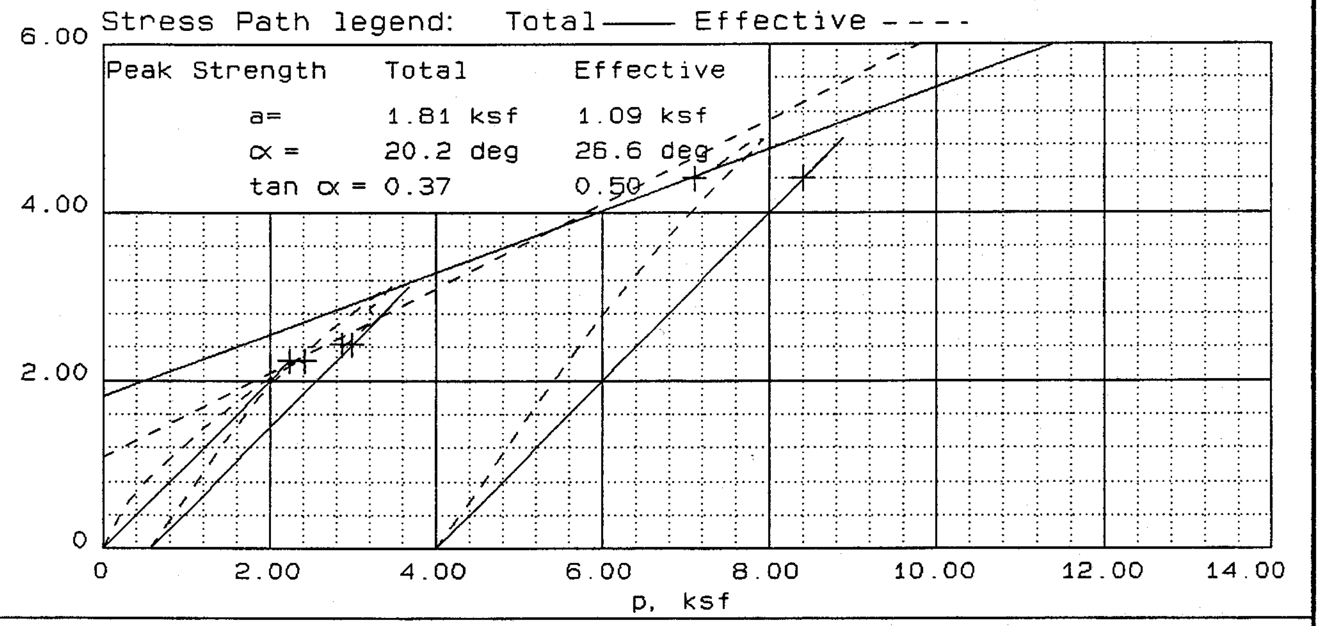
LAW ENGINEERING

Project No.	*5810860101*	Tested By	*HEJ*
Project Name	*TVA - Widows Creek*	Test Date	*07/22/95*
Material (Source)	*Ponded Fly Ash* *(Ash Pond)*	Reviewed By	*RLB*
		Review Date	*09/06/95*

ASTM D5084 - Falling Head

Sample Type:	*Remolded*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*38.1*
Wet Unit Weight, pcf:	*89.0*
Dry Unit Weight, pcf:	*64.5*
Compaction, %:	*96.2*
Hydraulic Conductivity, cm/sec. @20 °C:	***1.8E-04***



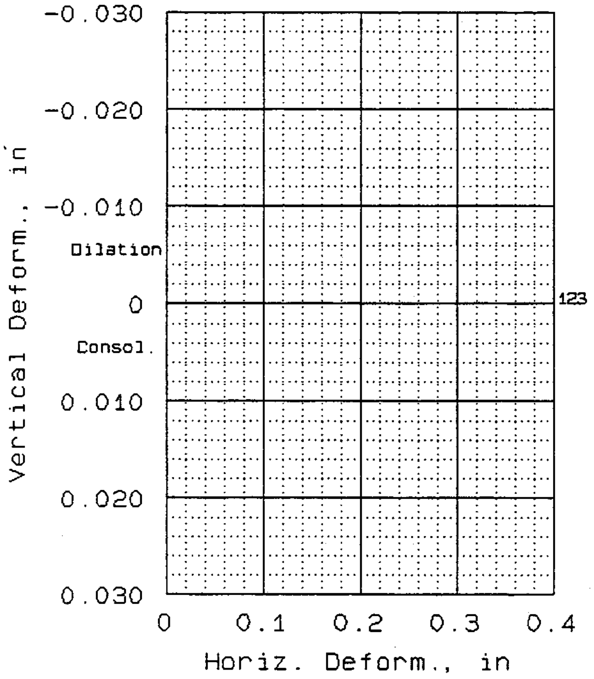


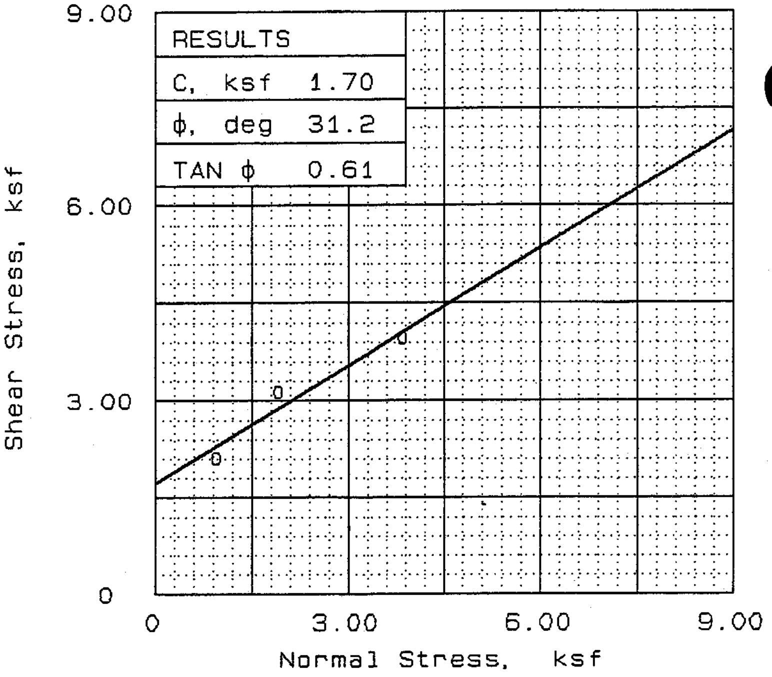
Client:

Project: TVA - Widows Creek

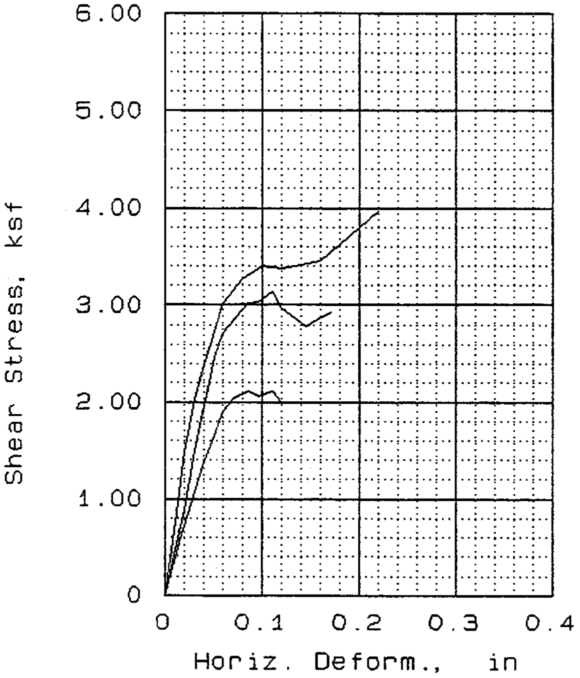
Location: Ponded Fly Ash Ash Pond

File: 86010 Project No.: 5810860101 Page 2/2 Fig. No. ____





RESULTS	
C, ksf	1.70
ϕ, deg	31.2
TAN ϕ	0.61



	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	40.0	39.7	40.3
	DRY DENSITY, pcf	64.3	64.3	62.1
	SATURATION, %	73.7	73.3	69.9
	VOID RATIO	1.264	1.262	1.342
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	0.81	0.81	0.81
AT TEST	WATER CONTENT, %	40.0	39.7	40.3
	DRY DENSITY, pcf	64.3	64.3	62.1
	SATURATION, %	73.7	73.3	69.9
	VOID RATIO	1.264	1.262	1.342
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	0.81	0.81	0.81
	NORMAL STRESS, ksf	0.97	1.94	3.88
	MAX. SHEAR, ksf	2.12	3.14	3.96
	STRAIN RATE, %/min.	0.500	0.500	0.500
	ULT. SHEAR, ksf			

SAMPLE DATA

SAMPLE TYPE: Remolded

DESCRIPTION:

LL= NL PL= NP PI=

SPECIFIC GRAVITY= 2.33

REMARKS: Tested by:

Reviewed by: RWB

FIG. NO.

CLIENT:

PROJECT: TVA - Widows Creek

SAMPLE LOCATION: Ponded Fly Ash
East Cell

PROJ. NO.: 5810860101 DATE: 9/6/95

DIRECT SHEAR TEST

LAW ENGINEERING, INC.

PERMEABILITY TEST - FALLING HEAD
(ASTM D5084 - 90)

LAW ENGINEERING

Job Number 5810860101
Project Name TVA - Widows Creek
Material (Source) Ponded Fly Ash (Ash Pond)

Tested By HEJ
Test Date 07/22/95
Reviewed By RLB
Review Date 09/06/95

Sample Data

Length, in		Diameter, in		Pan No.	
Location 1	6.000	Location 1	2.830	Dry Soil+Pan, grams	638.78
Location 2	6.000	Location 2	2.830	Pan Weight, grams	0.00
Location3	6.000	Location 3	2.830		
Average	6.000	Average	2.830	Moisture Content, %	38.1
		Wet Soil + Tare, grams	882.06	Wet Unit Wt, pcf	89.0
		Tare Weight, grams	0.00	Dry Unit Wt, pcf	64.5

Chamber Pressure, psi 37
Back Pressure, psi 23
Confining Pressure, psi 14

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	Division Start	Division Finish	H_0 (cm)	H_f (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				245	50.0	0.0	169.13	119.13	1.8E-04	21	1.8E-04
				246	50.0	0.0	169.13	119.13	1.8E-04	21	1.8E-04
				247	50.0	0.0	169.13	119.13	1.8E-04	21	1.8E-04

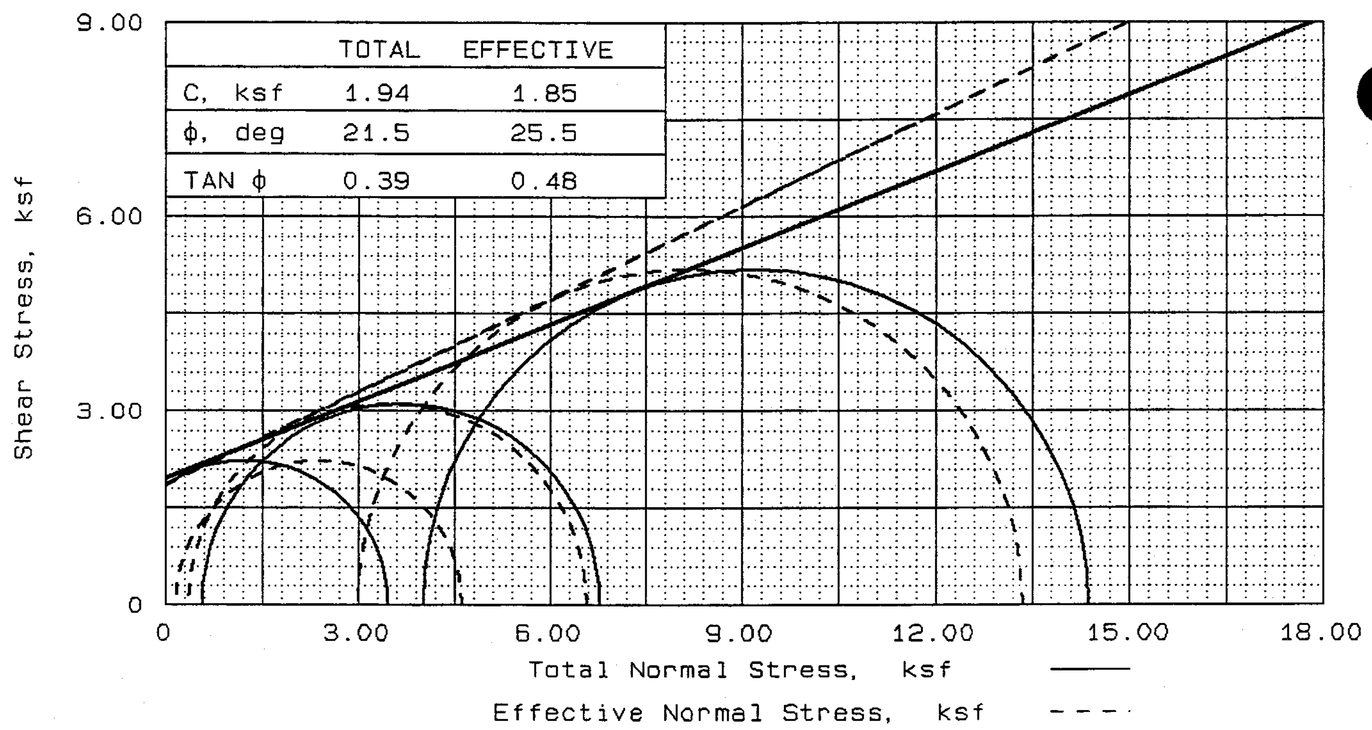
No. of Trial	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
3	Remolded	67.0	96.2	Vertical

Avg. k at 20 °C 1.8E-04 cm/sec

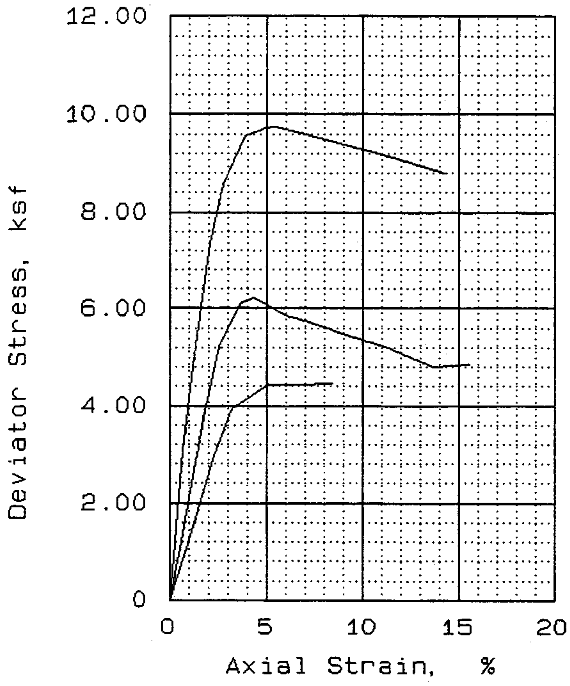
a = area of burette in cm^2
L = length of sample in cm
A = area of sample in cm^2

H_0 = initial head in cm
H_f = final head in cm
t = time in seconds

a = 0.34 cm^2
A = 40.582 cm^2
L = 15.24 cm



	TOTAL	EFFECTIVE
C, ksf	1.94	1.85
ϕ, deg	21.5	25.5
TAN ϕ	0.39	0.48



SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	38.4	38.5	38.1
	DRY DENSITY, pcf	64.4	64.3	64.5
	SATURATION, %	71.0	70.9	70.7
	VOID RATIO	1.260	1.264	1.256
	DIAMETER, in	2.83	2.83	2.83
	HEIGHT, in	6.00	6.00	6.00
AT TEST	WATER CONTENT, %	27.3	22.7	24.2
	DRY DENSITY, pcf	88.9	95.2	93.0
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.636	0.529	0.564
	DIAMETER, in	2.42	2.33	2.36
	HEIGHT, in	5.93	5.98	6.00
BACK PRESSURE, ksf		3.38	4.26	3.56
CELL PRESSURE, ksf		7.39	3.27	4.12
FAILURE STRESS, ksf		10.36	4.46	6.22
PORE PRESSURE, ksf		4.39	3.11	3.77
STRAIN RATE, %/min.		0.100	0.100	0.100
ULTIMATE STRESS, ksf				
PORE PRESSURE, ksf				
$\bar{\sigma}_1$ FAILURE, ksf		13.36	4.62	6.57
$\bar{\sigma}_3$ FAILURE, ksf		3	0.16	0.35

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: Remolded
DESCRIPTION:

LL= NL PL= NP PI=
SPECIFIC GRAVITY= 2.33
REMARKS: Tested by:

Reviewed by:

FIG. NO.

CLIENT:

PROJECT: TVA - Widows Creek

SAMPLE LOCATION: Ponded Fly Ash
Ash Pond

PROJ. NO.: 5810860101 DATE: August 30, 1995

TRIAXIAL COMPRESSION TEST

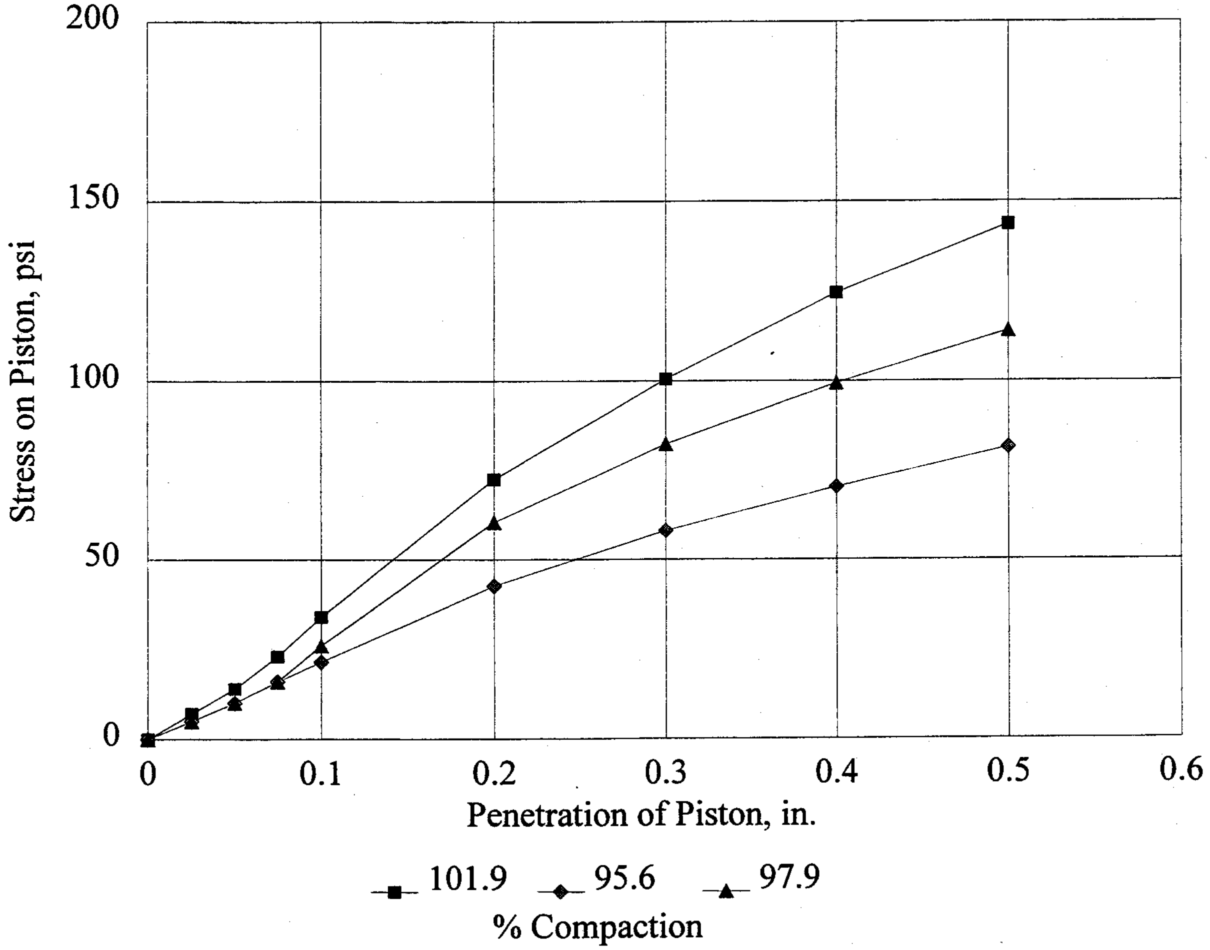
LAW ENGINEERING, INC.

California Bearing Ratio
(ASTM D1883-92)

LAW ENGINEERING

Project No.	5810860101	**Tested By**	EM
Project Name	TVA - Widows Creek	**Test Date**	08/18/95
Material (Source)	Ponded Fly Ash (Ash Pond)	**Reviewed By**	RLB
		Review Date	08/23/95

Compaction, %	101.9	95.6	97.9
Before Soak Dry Density, pcf	68.4	64.2	65.7
Before Soak Moisture Content,	36.8	35.0	35.4
After Soak Dry Density, pcf	66.9	62.8	64.1
After Soak Moisture Content, %	51.3	53.3	52.0
CBR @ 0.1 in.	3.4	2.2	2.6
CBR @ 0.2 in.	4.8	2.8	4.0



SHEET NO 1 OF 2

LABORATORY MATERIAL HANDLING AND TESTING
LABORATORY MATERIAL TEST DATA
RESILIENT MODULUS OF UNBOUND GRANULAR BASE/SUBBASE MATERIALS AND SUBGRADE SOILS
LAB DATA SHEET T46 - RECOMPACTED SAMPLES

UNBOUND GRANULAR BASE/SUBBASE LAYERS AND SUBGRADE SOILS
SHRP TEST DESIGNATION UG07, SS07/SHRP PROTOCOL P46

LABORATORY PERFORMING TEST: **LAW ENGINEERING, INC. - ATLANTA, GEORGIA**

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study

LAW PROJECT NO.: 5810860101

1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Ponded fly Ash (Ash Pond)
3.	*REMOLDING TARGETS:*	95% Standard Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE* (Type 1 or Type 2)	2
5.	*TEST INFORMATION*	
	PRECONDITIONING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - NUMBER OF LOAD SEQUENCES COMPLETED (0 - 15)	15
6.	*SPECIMEN INFO.:*	
	SPECIMEN DIAM., inch	
	TOP	2.86
	MIDDLE	2.85
	BOTTOM	2.85
	AVERAGE	2.85
	MEMBRANE THICKNESS (1), inch	0.01
	MEMBRANE THICKNESS (2), inch	0.01
	NET DIAM., inch	2.83
	HEIGHT OF SPECIMEN, CAP AND BASE, inch	6.14
	HEIGHT OF CAP AND BASE, inch	0.00
	INITIAL LENGTH, L_0 , inch	6.14
	INITIAL AREA, A_0 , in^2	6.29
	INITIAL VOLUME $A_0 L_0$, in^3	38.60
7.	*SOIL SPECIMEN WEIGHT:*	
	INITIAL WEIGHT OF CONTAINER AND WET SOIL, grams	1077.00
	FINAL WEIGHT OF CONTAINER AND WET SOIL, grams	190.90
	WEIGHT OF WET SOIL USED, grams	886.10
8.	*SOIL PROPERTIES.:*	
	IN SITU MOISTURE CONTENT (NUCLEAR), %	N/A
	IN SITU WET DENSITY (NUCLEAR), pcf	N/A
	or	
	OPTIMUM MOISTURE CONTENT, %	39.8
	MAX. DRY DENSITY, pcf	67.0
	95 % MAX. DRY DENSITY, pcf	63.7
9.	*SPECIMEN PROPERTIES:*	
	COMPACTION MOISTURE CONTENT, %	38.2
	MOISTURE CONTENT AFTER RESILIENT MODULUS TESTING, %	38.2
	COMPACTION DRY DENSITY, γ_d pcf	63.2
10.	*QUICK SHEAR TEST*	
	STRESS - STRAIN PLOT ATTACHED (Y = YES, N = NO)	Y
	TRIAXIAL SHEAR MAXIMUM STRENGTH (MAX. LOAD/X-SECTION AREA), psi	23.5
	SPECIMEN FAIL DURING TRIAXIAL SHEAR? (Y = YES, N = NO)	Y
11.	*COMMENTS* (Section 10.4 of Protocol P46)	
	(a) *CODE*	0 0 0 0 0 0
	(b) *NOTE*	
12.	*TEST DATE*	08-24-1995

GENERAL REMARKS:

SUBMITTED BY, DATE

9/10/95

LABORATORY MANAGER

SHEET NO 2 OF 2

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.: 5810860101
1. *MATERIAL SOURCE:* Widows Creek
2. *MATERIAL DESCRIPTION:* Ponded fly Ash (Ash Pond)
3. *REMOLDING TARGETS:* 95% Standard Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE* 2
5. *TEST DATE* 08-24-1995
6. *RESILIENT MODULUS TESTING*

COLUMN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PARAMETER	*Chamber Confining Pressure*	*Nominal Maximum Axial Stress*	*Cycle No.*	*Actual Applied Max. Axial Load*	*Actual Applied Cyclic Load*	*Actual Applied Contact Load*	*Actual Applied Max. Axial Stress*	*Actual Applied Cyclic Stress*	*Actual Applied Contact Stress*	*Recov. Def. LVDT #1 Reading*	*Recov. Def. LVDT #2 Reading*	*Average Recov Def. LVDT 1 and 2*	*Resilient Strain*	*Resilient Modulus*
DESIGNATION	S_3	S_{cyclic}	c_1	P_{max}	P_{cyclic}	$P_{contact}$	S_{max}	S_{cyclic}	$S_{contact}$	H_1	H_2	H_{avg}	ε_r	M_r
UNIT	psi	psi	---	lbs	lbs	lbs	psi	psi	psi	in.	in.	in.	in/in	psi
PRECISION	___._	___._	_	____._	___._	___._	___._	___._	__._	_._____	_._____	_._____	_.____	___.
SEQUENCE 1	6.0	2.0	1	12.3	11.0	1.3	2.0	1.8	0.2	0.00303	0.00284	0.00293	0.00048	3,660
			2	12.3	10.9	1.3	1.9	1.7	0.2	0.00303	0.00284	0.00294	0.00048	3,636
			3	12.3	11.0	1.3	2.0	1.7	0.2	0.00303	0.00283	0.00293	0.00048	3,647
			4	12.3	11.0	1.3	2.0	1.7	0.2	0.00303	0.00284	0.00293	0.00048	3,651
			5	12.3	11.0	1.3	2.0	1.7	0.2	0.00304	0.00284	0.00294	0.00048	3,649
	COLUMN AVERAGE			12.3	11.0	1.3	2.0	1.7	0.2	0.00303	0.00284	0.00294	0.00048	3,649
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00000	0.00000	0.00000	9

Source: Widows Creek Description: Ponded fly Ash (Ash Pond) 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 2	6.0	4.0	1	25.0	22.6	2.4	4.0	3.6	0.4	0.00627	0.00599	0.00613	0.00100	3,594
			2	25.0	22.6	2.4	4.0	3.6	0.4	0.00628	0.00600	0.00614	0.00100	3,589
			3	25.0	22.6	2.4	4.0	3.6	0.4	0.00627	0.00598	0.00613	0.00100	3,598
			4	25.0	22.9	2.1	4.0	3.6	0.3	0.00632	0.00602	0.00617	0.00101	3,620
			5	25.1	22.7	2.4	4.0	3.6	0.4	0.00628	0.00600	0.00614	0.00100	3,608
	COLUMN AVERAGE			25.0	22.7	2.3	4.0	3.6	0.4	0.00629	0.00600	0.00614	0.00100	3,602
	STANDARD DEV.			0.0	0.1	0.1	0.0	0.0	0.0	0.00002	0.00002	0.00002	0.00000	12
SEQUENCE 3	6.0	6.0	1	36.7	33.1	3.6	5.8	5.3	0.6	0.00972	0.00935	0.00954	0.00155	3,387
			2	36.7	33.1	3.6	5.8	5.3	0.6	0.00972	0.00935	0.00953	0.00155	3,389
			3	36.8	33.2	3.6	5.8	5.3	0.6	0.00974	0.00934	0.00954	0.00155	3,391
			4	36.8	33.2	3.6	5.9	5.3	0.6	0.00971	0.00935	0.00953	0.00155	3,402
			5	36.8	33.2	3.6	5.9	5.3	0.6	0.00974	0.00935	0.00954	0.00156	3,398
	COLUMN AVERAGE			36.8	33.2	3.6	5.8	5.3	0.6	0.00972	0.00935	0.00954	0.00155	3,394
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	6
SEQUENCE 4	6.0	8.0	1	49.5	44.6	4.8	7.9	7.1	0.8	0.01331	0.01288	0.01309	0.00213	3,324
			2	49.5	44.6	4.8	7.9	7.1	0.8	0.01328	0.01288	0.01308	0.00213	3,328
			3	49.5	44.6	4.8	7.9	7.1	0.8	0.01332	0.01285	0.01309	0.00213	3,328
			4	49.5	44.6	4.8	7.9	7.1	0.8	0.01327	0.01287	0.01307	0.00213	3,331
			5	49.4	44.6	4.8	7.9	7.1	0.8	0.01329	0.01286	0.01307	0.00213	3,327
	COLUMN AVERAGE			49.5	44.6	4.8	7.9	7.1	0.8	0.01329	0.01287	0.01308	0.00213	3,328
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00002	0.00001	0.00001	0.00000	2

Source: Widows Creek Description: Ponded fly Ash (Ash Pond) 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 5	6.0	10.0	1	62.1	56.0	6.1	9.9	8.9	1.0	0.01662	0.01617	0.01640	0.00267	3,332
			2	62.2	56.1	6.1	9.9	8.9	1.0	0.01659	0.01619	0.01639	0.00267	3,337
			3	62.1	56.0	6.1	9.9	8.9	1.0	0.01662	0.01618	0.01640	0.00267	3,332
			4	62.1	56.1	6.1	9.9	8.9	1.0	0.01661	0.01617	0.01639	0.00267	3,338
			5	62.2	56.1	6.1	9.9	8.9	1.0	0.01662	0.01619	0.01641	0.00267	3,335
	COLUMN AVERAGE			62.1	56.1	6.1	9.9	8.9	1.0	0.01661	0.01618	0.01640	0.00267	3,335
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	3
SEQUENCE 6	4.0	2.0	1	12.5	10.8	1.7	2.0	1.7	0.3	0.00368	0.00346	0.00357	0.00058	2,947
			2	12.6	10.9	1.7	2.0	1.7	0.3	0.00372	0.00350	0.00361	0.00059	2,939
			3	12.5	10.8	1.7	2.0	1.7	0.3	0.00370	0.00349	0.00360	0.00059	2,929
			4	12.6	10.8	1.7	2.0	1.7	0.3	0.00371	0.00348	0.00359	0.00059	2,943
			5	12.5	10.8	1.7	2.0	1.7	0.3	0.00370	0.00347	0.00359	0.00058	2,947
	COLUMN AVERAGE			12.5	10.8	1.7	2.0	1.7	0.3	0.00370	0.00348	0.00359	0.00059	2,941
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00002	0.00001	0.00000	7
SEQUENCE 7	4.0	4.0	1	24.6	22.2	2.4	3.9	3.5	0.4	0.00870	0.00838	0.00854	0.00139	2,537
			2	24.5	22.1	2.4	3.9	3.5	0.4	0.00869	0.00839	0.00854	0.00139	2,526
			3	24.7	22.3	2.4	3.9	3.5	0.4	0.00872	0.00842	0.00857	0.00140	2,535
			4	24.5	22.1	2.4	3.9	3.5	0.4	0.00870	0.00840	0.00855	0.00139	2,520
			5	24.5	22.1	2.4	3.9	3.5	0.4	0.00872	0.00842	0.00857	0.00140	2,516
	COLUMN AVERAGE			24.6	22.2	2.4	3.9	3.5	0.4	0.00870	0.00840	0.00855	0.00139	2,527
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	9

Source: Widows Creek Description: Ponded fly Ash (Ash Pond) 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 8	4.0	6.0	1	36.9	33.3	3.6	5.9	5.3	0.6	0.01337	0.01300	0.01319	0.00215	2,464
			2	37.0	33.3	3.6	5.9	5.3	0.6	0.01339	0.01295	0.01317	0.00215	2,469
			3	36.9	33.3	3.6	5.9	5.3	0.6	0.01339	0.01294	0.01316	0.00215	2,468
			4	36.9	33.3	3.6	5.9	5.3	0.6	0.01340	0.01298	0.01319	0.00215	2,462
			5	37.0	33.4	3.6	5.9	5.3	0.6	0.01341	0.01297	0.01319	0.00215	2,467
	COLUMN AVERAGE			36.9	33.3	3.6	5.9	5.3	0.6	0.01339	0.01297	0.01318	0.00215	2,466
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00002	0.00001	0.00000	3
SEQUENCE 9	4.0	8.0	1	49.7	44.8	4.9	7.9	7.1	0.8	0.01713	0.01664	0.01689	0.00275	2,589
			2	49.8	44.9	4.8	7.9	7.1	0.8	0.01713	0.01664	0.01689	0.00275	2,596
			3	49.7	44.9	4.9	7.9	7.1	0.8	0.01710	0.01665	0.01688	0.00275	2,594
			4	49.7	44.8	4.9	7.9	7.1	0.8	0.01713	0.01662	0.01688	0.00275	2,591
			5	49.7	44.8	4.9	7.9	7.1	0.8	0.01709	0.01665	0.01687	0.00275	2,590
	COLUMN AVERAGE			49.7	44.9	4.9	7.9	7.1	0.8	0.01711	0.01664	0.01688	0.00275	2,592
	STANDARD DEV.			0.0	0.1	0.0	0.0	0.0	0.0	0.00002	0.00001	0.00001	0.00000	3
SEQUENCE 10	4.0	10.0	1	62.5	56.4	6.1	9.9	9.0	1.0	0.02048	0.01999	0.02024	0.00330	2,718
			2	62.5	56.4	6.1	9.9	9.0	1.0	0.02049	0.01998	0.02023	0.00330	2,719
			3	62.7	56.5	6.1	10.0	9.0	1.0	0.02046	0.01995	0.02021	0.00329	2,729
			4	62.8	56.7	6.1	10.0	9.0	1.0	0.02047	0.01998	0.02023	0.00330	2,732
			5	62.8	56.8	6.1	10.0	9.0	1.0	0.02047	0.01998	0.02023	0.00330	2,737
	COLUMN AVERAGE			62.6	56.5	6.1	10.0	9.0	1.0	0.02047	0.01998	0.02023	0.00330	2,727
	STANDARD DEV.			0.2	0.2	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	8

Source: Widows Creek Description: Ponded fly Ash (Ash Pond) 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 11	2.0	2.0	1	13.1	11.0	2.1	2.1	1.8	0.3	0.00527	0.00504	0.00515	0.00084	2,088
			2	13.1	11.0	2.1	2.1	1.7	0.3	0.00528	0.00507	0.00518	0.00084	2,066
			3	13.2	11.1	2.1	2.1	1.8	0.3	0.00525	0.00507	0.00516	0.00084	2,093
			4	13.1	11.0	2.1	2.1	1.8	0.3	0.00527	0.00505	0.00516	0.00084	2,080
			5	13.2	11.1	2.1	2.1	1.8	0.3	0.00529	0.00505	0.00517	0.00084	2,093
	COLUMN AVERAGE			13.1	11.0	2.1	2.1	1.8	0.3	0.00527	0.00506	0.00516	0.00084	2,084
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00002	0.00001	0.00000	11
SEQUENCE 12	2.0	4.0	1	24.5	22.1	2.4	3.9	3.5	0.4	0.01212	0.01178	0.01195	0.00195	1,805
			2	24.6	22.1	2.4	3.9	3.5	0.4	0.01210	0.01181	0.01196	0.00195	1,807
			3	24.6	22.2	2.4	3.9	3.5	0.4	0.01213	0.01180	0.01196	0.00195	1,808
			4	24.6	22.1	2.4	3.9	3.5	0.4	0.01212	0.01182	0.01197	0.00195	1,805
			5	24.6	22.2	2.4	3.9	3.5	0.4	0.01212	0.01179	0.01196	0.00195	1,814
	COLUMN AVERAGE			24.6	22.2	2.4	3.9	3.5	0.4	0.01212	0.01180	0.01196	0.00195	1,808
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	4
SEQUENCE 13	2.0	6.0	1	37.7	34.1	3.7	6.0	5.4	0.6	0.01783	0.01740	0.01762	0.00287	1,887
			2	37.5	33.9	3.6	6.0	5.4	0.6	0.01784	0.01741	0.01762	0.00287	1,875
			3	37.5	33.8	3.6	6.0	5.4	0.6	0.01782	0.01739	0.01761	0.00287	1,875
			4	37.6	33.9	3.6	6.0	5.4	0.6	0.01781	0.01742	0.01762	0.00287	1,879
			5	37.5	33.9	3.6	6.0	5.4	0.6	0.01781	0.01742	0.01762	0.00287	1,877
	COLUMN AVERAGE			37.6	33.9	3.6	6.0	5.4	0.6	0.01782	0.01741	0.01762	0.00287	1,879
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	5

Source: Widows Creek Description: Ponded fly Ash (Ash Pond) 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 14	2.0	8.0	1	50.6	45.7	4.9	8.0	7.3	0.8	0.02171	0.02126	0.02149	0.00350	2,072
			2	50.5	45.6	4.9	8.0	7.2	0.8	0.02169	0.02127	0.02148	0.00350	2,071
			3	50.5	45.6	4.9	8.0	7.3	0.8	0.02172	0.02125	0.02149	0.00350	2,072
			4	50.5	45.6	4.9	8.0	7.3	0.8	0.02168	0.02125	0.02147	0.00350	2,073
			5	50.4	45.5	4.9	8.0	7.2	0.8	0.02170	0.02124	0.02147	0.00350	2,068
	COLUMN AVERAGE			50.5	45.6	4.9	8.0	7.3	0.8	0.02170	0.02126	0.02148	0.00350	2,071
	STANDARD DEV.			0.0	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	2
SEQUENCE 15	2.0	10.0	1	63.3	57.1	6.1	10.1	9.1	1.0	0.02545	0.02491	0.02518	0.00410	2,213
			2	63.2	57.1	6.2	10.1	9.1	1.0	0.02543	0.02490	0.02517	0.00410	2,212
			3	63.3	57.2	6.2	10.1	9.1	1.0	0.02544	0.02489	0.02516	0.00410	2,217
			4	63.4	57.2	6.1	10.1	9.1	1.0	0.02542	0.02490	0.02516	0.00410	2,219
			5	63.4	57.2	6.2	10.1	9.1	1.0	0.02543	0.02488	0.02515	0.00410	2,219
	COLUMN AVERAGE			63.3	57.2	6.2	10.1	9.1	1.0	0.02543	0.02489	0.02516	0.00410	2,216
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	3

SUBMITTED BY, DATE

RJ Boudreau 9/10/95

LABORATORY MANAGER

FIGURE 1 - Logarithmic Plot of Resilient Modulus (M_R) vs Cyclic Stress (S_C)

PROJECT NAME:		TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.:		5810860101
1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Ponded fly Ash (Ash Pond)
3.	*REMOLDING TARGETS:*	95% Standard Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE*	2
5.	*TEST DATE*	08-24-1995

$$M_R = K1\,(S_C)^{K2}\,(1+S_3)^{K5}$$

$K1 =$ 1,026
$K2 =$ -0.02608
$K5 =$ 0.63430
$R^2 =$ 0.92

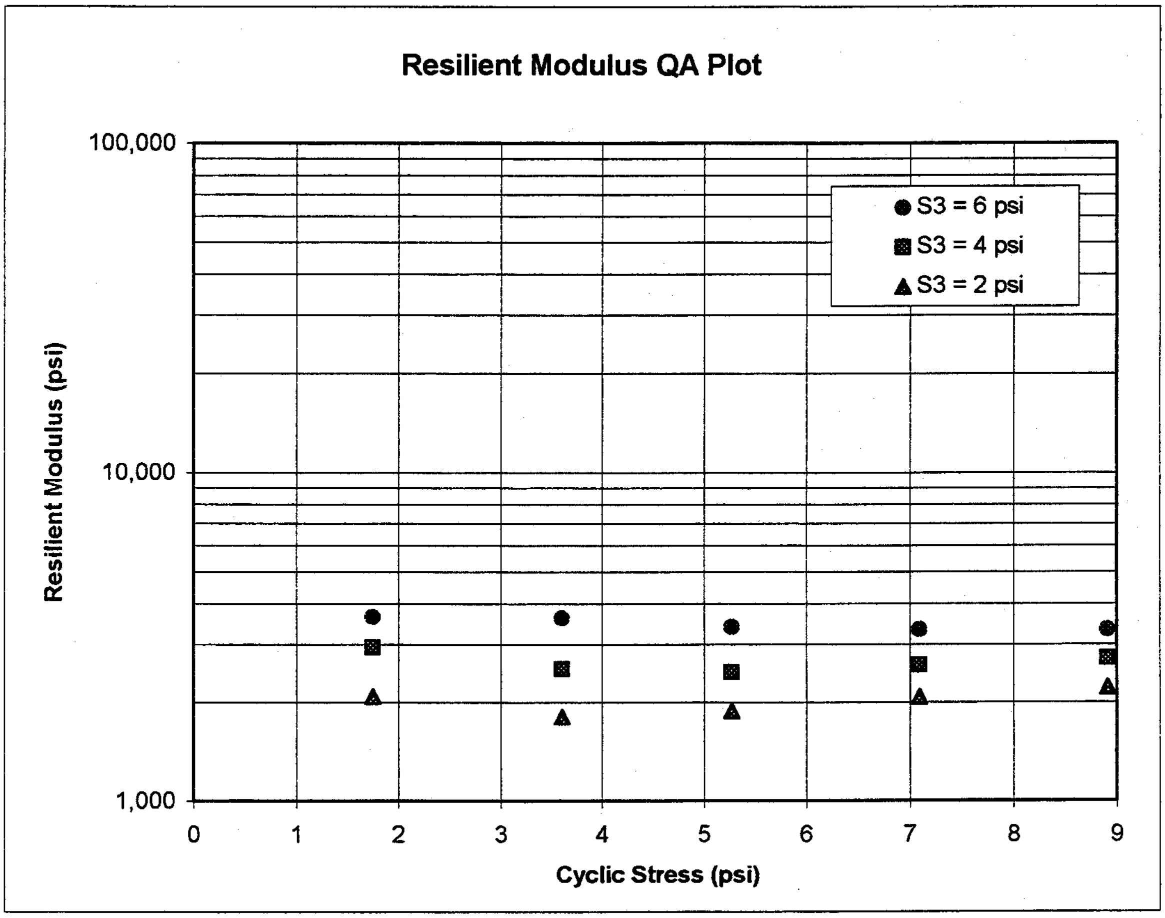
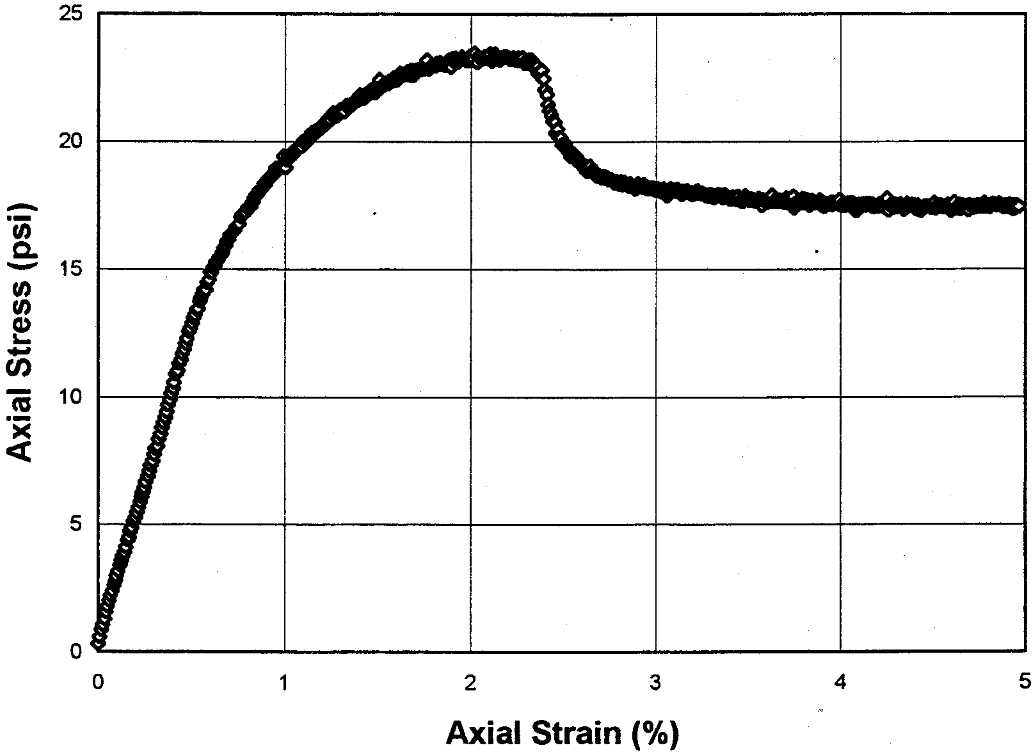


FIGURE 2 - Quick Shear Stress vs Strain

PROJECT NAME:		TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.:		5810860101
1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Ponded fly Ash (Ash Pond)
3.	*REMOLDING TARGETS:*	95% Standard Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE*	2
5.	*TEST DATE*	08-24-1995



SHEET NO 1 OF 2

LABORATORY MATERIAL HANDLING AND TESTING
LABORATORY MATERIAL TEST DATA
RESILIENT MODULUS OF UNBOUND GRANULAR BASE/SUBBASE MATERIALS AND SUBGRADE SOILS
LAB DATA SHEET T46 - RECOMPACTED SAMPLES

UNBOUND GRANULAR BASE/SUBBASE LAYERS AND SUBGRADE SOILS
SHRP TEST DESIGNATION UG07, SS07/SHRP PROTOCOL P46

LABORATORY PERFORMING TEST: **LAW ENGINEERING, INC. - ATLANTA, GEORGIA**

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study

LAW PROJECT NO.: 5810860101

1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Ponded Fly Ash (Ash Pond)
3.	*REMOLDING TARGETS:*	95% Modified Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE* (Type 1 or Type 2)	2
5.	*TEST INFORMATION*	
	PRECONDITIONING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - NUMBER OF LOAD SEQUENCES COMPLETED (0 - 15)	15
6.	*SPECIMEN INFO.:*	
	SPECIMEN DIAM., inch	
	TOP	2.86
	MIDDLE	2.87
	BOTTOM	2.87
	AVERAGE	2.87
	MEMBRANE THICKNESS (1), inch	0.01
	MEMBRANE THICKNESS (2), inch	0.01
	NET DIAM., inch	2.84
	HEIGHT OF SPECIMEN, CAP AND BASE, inch	6.20
	HEIGHT OF CAP AND BASE, inch	0.00
	INITIAL LENGTH, L_0, inch	6.20
	INITIAL AREA, A_0, in^2	6.35
	INITIAL VOLUME A_0L_0, in^3	39.32
7.	*SOIL SPECIMEN WEIGHT:*	
	INITIAL WEIGHT OF CONTAINER AND WET SOIL, grams	882.29
	FINAL WEIGHT OF CONTAINER AND WET SOIL, grams	0.00
	WEIGHT OF WET SOIL USED, grams	882.29
8.	*SOIL PROPERTIES.:*	
	IN SITU MOISTURE CONTENT (NUCLEAR), %	N/A
	IN SITU WET DENSITY (NUCLEAR), pcf	N/A
	or	
	OPTIMUM MOISTURE CONTENT, %	27.8
	MAX. DRY DENSITY, pcf	73.5
	95 % MAX. DRY DENSITY, pcf	69.8
9.	*SPECIMEN PROPERTIES:*	
	COMPACTION MOISTURE CONTENT, %	27.8
	MOISTURE CONTENT AFTER RESILIENT MODULUS TESTING, %	27.8
	COMPACTION DRY DENSITY, γ_d pcf	66.8
10.	*QUICK SHEAR TEST*	
	STRESS - STRAIN PLOT ATTACHED (Y = YES, N = NO)	Y
	TRIAXIAL SHEAR MAXIMUM STRENGTH (MAX. LOAD/X-SECTION AREA), psi	39.5
	SPECIMEN FAIL DURING TRIAXIAL SHEAR? (Y = YES, N = NO)	Y
11.	*COMMENTS* (Section 10.4 of Protocol P46)	
	(a) *CODE*	0 0 0 0 0 0
	(b) *NOTE*	
12.	*TEST DATE*	09-15-1995

GENERAL REMARKS:

SUBMITTED BY, DATE

9/10/95

LABORATORY MANAGER

SHEET NO 2 OF 2

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.: 5810860101
1. *MATERIAL SOURCE:* Widows Creek
2. *MATERIAL DESCRIPTION:* Ponded Fly Ash (Ash Pond)
3. *REMOLDING TARGETS:* 95% Modified Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE* 2
5. *TEST DATE* 09-15-1995
6. *RESILIENT MODULUS TESTING*

COLUMN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PARAMETER	*Chamber Confining Pressure*	*Nominal Maximum Axial Stress*	*Cycle No.*	*Actual Applied Max. Axial Load*	*Actual Applied Cyclic Load*	*Actual Applied Contact Load*	*Actual Applied Max. Axial Stress*	*Actual Applied Cyclic Stress*	*Actual Applied Contact Stress*	*Recov. Def. LVDT #1 Reading*	*Recov. Def. LVDT #2 Reading*	*Average Recov Def. LVDT 1 and 2*	*Resilient Strain*	*Resilient Modulus*
DESIGNATION	S_3	S_{cyclic}	c_1	P_{max}	P_{cyclic}	$P_{contact}$	S_{max}	S_{cyclic}	$S_{contact}$	H_1	H_2	H_{avg}	ε	
UNIT	psi	psi	---	lbs	lbs	lbs	psi	psi	psi	in.	in.	in.	in/in	psi
PRECISION	___._	___._	_	____._	___._	___._	___._	___._	__._	_._____	_._____	_._____	_._____	___.
SEQUENCE 1	6.0	2.0	95	12.6	11.3	1.3	2.0	1.8	0.2	0.00222	0.00230	0.00226	0.00036	4,884
			96	12.6	11.3	1.3	2.0	1.8	0.2	0.00221	0.00230	0.00226	0.00036	4,871
			97	12.6	11.3	1.3	2.0	1.8	0.2	0.00221	0.00230	0.00226	0.00036	4,902
			98	12.6	11.3	1.3	2.0	1.8	0.2	0.00222	0.00231	0.00226	0.00036	4,890
			100	12.6	11.3	1.3	2.0	1.8	0.2	0.00221	0.00230	0.00225	0.00036	4,897
	COLUMN AVERAGE			12.6	11.3	1.3	2.0	1.8	0.2	0.00221	0.00230	0.00226	0.00036	4,889
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00000	0.00000	0.00000	12

Source: Widows Creek Description: Ponded Fly Ash (Ash Pond) 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 2	6.0	4.0	95	25.5	23.1	2.4	4.0	3.6	0.4	0.00453	0.00465	0.00459	0.00074	4,920
			96	25.5	23.1	2.4	4.0	3.6	0.4	0.00453	0.00466	0.00459	0.00074	4,921
			97	25.4	23.0	2.4	4.0	3.6	0.4	0.00453	0.00466	0.00460	0.00074	4,893
			98	25.4	23.0	2.4	4.0	3.6	0.4	0.00452	0.00466	0.00459	0.00074	4,893
			100	25.5	23.1	2.4	4.0	3.6	0.4	0.00453	0.00466	0.00460	0.00074	4,907
	COLUMN AVERAGE			25.5	23.1	2.4	4.0	3.6	0.4	0.00453	0.00466	0.00459	0.00074	4,907
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00000	0.00000	14
SEQUENCE 3	6.0	6.0	95	37.5	33.9	3.6	5.9	5.3	0.6	0.00723	0.00745	0.00734	0.00118	4,503
			96	37.5	33.9	3.6	5.9	5.3	0.6	0.00724	0.00743	0.00734	0.00118	4,510
			97	37.5	33.9	3.6	5.9	5.3	0.6	0.00724	0.00743	0.00733	0.00118	4,512
			98	37.6	33.9	3.6	5.9	5.3	0.6	0.00726	0.00743	0.00734	0.00119	4,511
			100	37.5	33.8	3.6	5.9	5.3	0.6	0.00721	0.00742	0.00731	0.00118	4,515
	COLUMN AVERAGE			37.5	33.9	3.6	5.9	5.3	0.6	0.00724	0.00743	0.00733	0.00118	4,510
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00002	0.00001	0.00001	0.00000	5
SEQUENCE 4	6.0	8.0	95	50.0	45.1	4.9	7.9	7.1	0.8	0.00998	0.01025	0.01011	0.00163	4,351
			96	50.1	45.2	4.9	7.9	7.1	0.8	0.00999	0.01025	0.01012	0.00163	4,363
			97	50.0	45.1	4.9	7.9	7.1	0.8	0.00996	0.01024	0.01010	0.00163	4,361
			98	49.9	45.0	4.9	7.9	7.1	0.8	0.00999	0.01024	0.01012	0.00163	4,344
			100	50.1	45.2	4.9	7.9	7.1	0.8	0.01000	0.01025	0.01012	0.00163	4,363
	COLUMN AVERAGE			50.0	45.1	4.9	7.9	7.1	0.8	0.00998	0.01024	0.01011	0.00163	4,357
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	8

Source: Widows Creek Description: Ponded Fly Ash (Ash Pond) 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 5	6.0	10.0	95	63.2	57.0	6.2	10.0	9.0	1.0	0.01256	0.01290	0.01273	0.00205	4,376
			96	63.2	57.1	6.1	10.0	9.0	1.0	0.01257	0.01289	0.01273	0.00205	4,378
			97	63.1	57.0	6.2	10.0	9.0	1.0	0.01258	0.01290	0.01274	0.00206	4,365
			98	63.1	56.9	6.2	9.9	9.0	1.0	0.01257	0.01290	0.01274	0.00206	4,363
			100	63.1	56.9	6.2	9.9	9.0	1.0	0.01257	0.01290	0.01273	0.00206	4,363
	COLUMN AVERAGE			63.2	57.0	6.2	10.0	9.0	1.0	0.01257	0.01289	0.01273	0.00206	4,369
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00001	0.00000	7
SEQUENCE 6	4.0	2.0	95	12.9	11.2	1.7	2.0	1.8	0.3	0.00261	0.00267	0.00264	0.00043	4,142
			96	12.9	11.2	1.7	2.0	1.8	0.3	0.00262	0.00267	0.00265	0.00043	4,125
			97	12.9	11.2	1.7	2.0	1.8	0.3	0.00264	0.00268	0.00266	0.00043	4,114
			98	12.9	11.2	1.7	2.0	1.8	0.3	0.00263	0.00268	0.00266	0.00043	4,112
			100	13.0	11.3	1.7	2.0	1.8	0.3	0.00263	0.00267	0.00265	0.00043	4,158
	COLUMN AVERAGE			12.9	11.2	1.7	2.0	1.8	0.3	0.00262	0.00268	0.00265	0.00043	4,130
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00001	0.00000	20
SEQUENCE 7	4.0	4.0	95	24.6	22.2	2.4	3.9	3.5	0.4	0.00597	0.00609	0.00603	0.00097	3,593
			96	24.7	22.3	2.4	3.9	3.5	0.4	0.00596	0.00610	0.00603	0.00097	3,604
			97	24.7	22.3	2.4	3.9	3.5	0.4	0.00596	0.00611	0.00603	0.00097	3,607
			98	24.6	22.2	2.4	3.9	3.5	0.4	0.00594	0.00609	0.00602	0.00097	3,599
			100	24.7	22.3	2.4	3.9	3.5	0.4	0.00596	0.00609	0.00603	0.00097	3,606
	COLUMN AVERAGE			24.6	22.2	2.4	3.9	3.5	0.4	0.00596	0.00609	0.00603	0.00097	3,602
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	6

Source: Widows Creek Description: Ponded Fly Ash (Ash Pond) 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 8	4.0	6.0	95	37.0	33.4	3.6	5.8	5.3	0.6	0.00934	0.00951	0.00943	0.00152	3,454
			96	36.9	33.3	3.7	5.8	5.2	0.6	0.00931	0.00952	0.00942	0.00152	3,450
			97	37.0	33.4	3.6	5.8	5.3	0.6	0.00931	0.00954	0.00942	0.00152	3,455
			98	37.0	33.4	3.6	5.8	5.3	0.6	0.00934	0.00953	0.00943	0.00152	3,454
			100	36.9	33.3	3.6	5.8	5.2	0.6	0.00932	0.00952	0.00942	0.00152	3,451
	COLUMN AVERAGE			37.0	33.3	3.6	5.8	5.3	0.6	0.00932	0.00952	0.00942	0.00152	3,453
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	2
SEQUENCE 9	4.0	8.0	95	49.2	44.4	4.8	7.7	7.0	0.8	0.01223	0.01251	0.01237	0.00200	3,499
			96	49.1	44.3	4.8	7.7	7.0	0.8	0.01224	0.01253	0.01239	0.00200	3,488
			97	49.0	44.2	4.8	7.7	7.0	0.8	0.01225	0.01253	0.01239	0.00200	3,485
			98	49.1	44.3	4.8	7.7	7.0	0.8	0.01221	0.01250	0.01236	0.00199	3,497
			100	49.0	44.2	4.8	7.7	7.0	0.8	0.01223	0.01252	0.01237	0.00200	3,488
	COLUMN AVERAGE			49.1	44.3	4.8	7.7	7.0	0.8	0.01223	0.01252	0.01238	0.00200	3,491
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	6
SEQUENCE 10	4.0	10.0	95	62.4	56.4	6.0	9.8	8.9	0.9	0.01473	0.01505	0.01489	0.00240	3,697
			96	62.4	56.3	6.0	9.8	8.9	1.0	0.01474	0.01504	0.01489	0.00240	3,693
			97	62.4	56.4	6.1	9.8	8.9	1.0	0.01474	0.01504	0.01489	0.00240	3,696
			98	62.5	56.4	6.1	9.8	8.9	1.0	0.01476	0.01507	0.01492	0.00241	3,690
			100	62.3	56.2	6.0	9.8	8.9	0.9	0.01471	0.01506	0.01488	0.00240	3,689
	COLUMN AVERAGE			62.4	56.3	6.0	9.8	8.9	1.0	0.01474	0.01505	0.01489	0.00240	3,693
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00002	0.00001	0.00001	0.00000	4

Source: Widows Creek Description: Ponded Fly Ash (Ash Pond) 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 11	2.0	2.0	95	13.6	11.5	2.1	2.1	1.8	0.3	0.00262	0.00270	0.00266	0.00043	4,215
			96	13.5	11.4	2.1	2.1	1.8	0.3	0.00262	0.00271	0.00267	0.00043	4,186
			97	13.5	11.5	2.1	2.1	1.8	0.3	0.00262	0.00271	0.00267	0.00043	4,196
			98	13.5	11.4	2.1	2.1	1.8	0.3	0.00263	0.00271	0.00267	0.00043	4,158
			100	13.5	11.4	2.1	2.1	1.8	0.3	0.00263	0.00269	0.00266	0.00043	4,189
	COLUMN AVERAGE			13.5	11.4	2.1	2.1	1.8	0.3	0.00263	0.00270	0.00266	0.00043	4,189
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00000	0.00000	21
SEQUENCE 12	2.0	4.0	95	24.3	21.9	2.4	3.8	3.4	0.4	0.00600	0.00612	0.00606	0.00098	3,522
			96	24.2	21.8	2.4	3.8	3.4	0.4	0.00600	0.00614	0.00607	0.00098	3,509
			97	24.2	21.8	2.4	3.8	3.4	0.4	0.00598	0.00614	0.00606	0.00098	3,513
			98	24.1	21.7	2.4	3.8	3.4	0.4	0.00599	0.00613	0.00606	0.00098	3,495
			100	24.2	21.7	2.4	3.8	3.4	0.4	0.00600	0.00614	0.00607	0.00098	3,496
	COLUMN AVERAGE			24.2	21.8	2.4	3.8	3.4	0.4	0.00600	0.00613	0.00606	0.00098	3,507
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	12
SEQUENCE 13	2.0	6.0	95	37.8	34.2	3.6	6.0	5.4	0.6	0.00707	0.00722	0.00714	0.00115	4,680
			96	37.9	34.3	3.6	6.0	5.4	0.6	0.00702	0.00720	0.00711	0.00115	4,709
			97	37.9	34.3	3.6	6.0	5.4	0.6	0.00706	0.00722	0.00714	0.00115	4,693
			98	37.9	34.3	3.6	6.0	5.4	0.6	0.00702	0.00719	0.00710	0.00115	4,712
			100	37.9	34.3	3.6	6.0	5.4	0.6	0.00705	0.00721	0.00713	0.00115	4,692
	COLUMN AVERAGE			37.9	34.3	3.6	6.0	5.4	0.6	0.00704	0.00721	0.00713	0.00115	4,697
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00002	0.00001	0.00002	0.00000	13

Source: Widows Creek Description: Ponded Fly Ash (Ash Pond) 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 14	2.0	8.0	95	50.8	45.9	4.9	8.0	7.2	0.8	0.00897	0.00920	0.00908	0.00147	4,933
			96	50.8	46.0	4.8	8.0	7.2	0.8	0.00899	0.00919	0.00909	0.00147	4,937
			97	50.8	45.9	4.9	8.0	7.2	0.8	0.00899	0.00919	0.00909	0.00147	4,930
			98	50.8	45.9	4.9	8.0	7.2	0.8	0.00899	0.00921	0.00910	0.00147	4,924
			100	50.9	46.0	4.9	8.0	7.2	0.8	0.00899	0.00921	0.00910	0.00147	4,934
	COLUMN AVERAGE			50.8	45.9	4.9	8.0	7.2	0.8	0.00899	0.00920	0.00909	0.00147	4,931
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	5
SEQUENCE 15	2.0	10.0	95	63.5	57.4	6.1	10.0	9.0	1.0	0.01066	0.01089	0.01077	0.00174	5,197
			96	63.6	57.5	6.1	10.0	9.1	1.0	0.01063	0.01085	0.01074	0.00173	5,226
			97	63.6	57.5	6.1	10.0	9.1	1.0	0.01065	0.01088	0.01076	0.00174	5,215
			98	63.6	57.5	6.1	10.0	9.1	1.0	0.01065	0.01088	0.01076	0.00174	5,216
			100	63.6	57.5	6.1	10.0	9.1	1.0	0.01060	0.01086	0.01073	0.00173	5,228
	COLUMN AVERAGE			63.6	57.5	6.1	10.0	9.1	1.0	0.01064	0.01087	0.01075	0.00174	5,217
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00002	0.00002	0.00002	0.00000	12

SUBMITTED BY, DATE

9/10/95

LABORATORY MANAGER

FIGURE 1 - Logarithmic Plot of Resilient Modulus (M_R) vs Cyclic Stress (S_C)

PROJECT NAME:		TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.:		5810860101
1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Ponded Fly Ash (Ash Pond)
3.	*REMOLDING TARGETS:*	95% Modified Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE*	2
5.	*TEST DATE*	09-15-1995

$$M_R = K1\,(S_c)^{K2}\,(1+S_3)^{K5}$$

K1 = 3,283

K2 = -0.01625

K5 = 0.38843

R^2 = 0.89

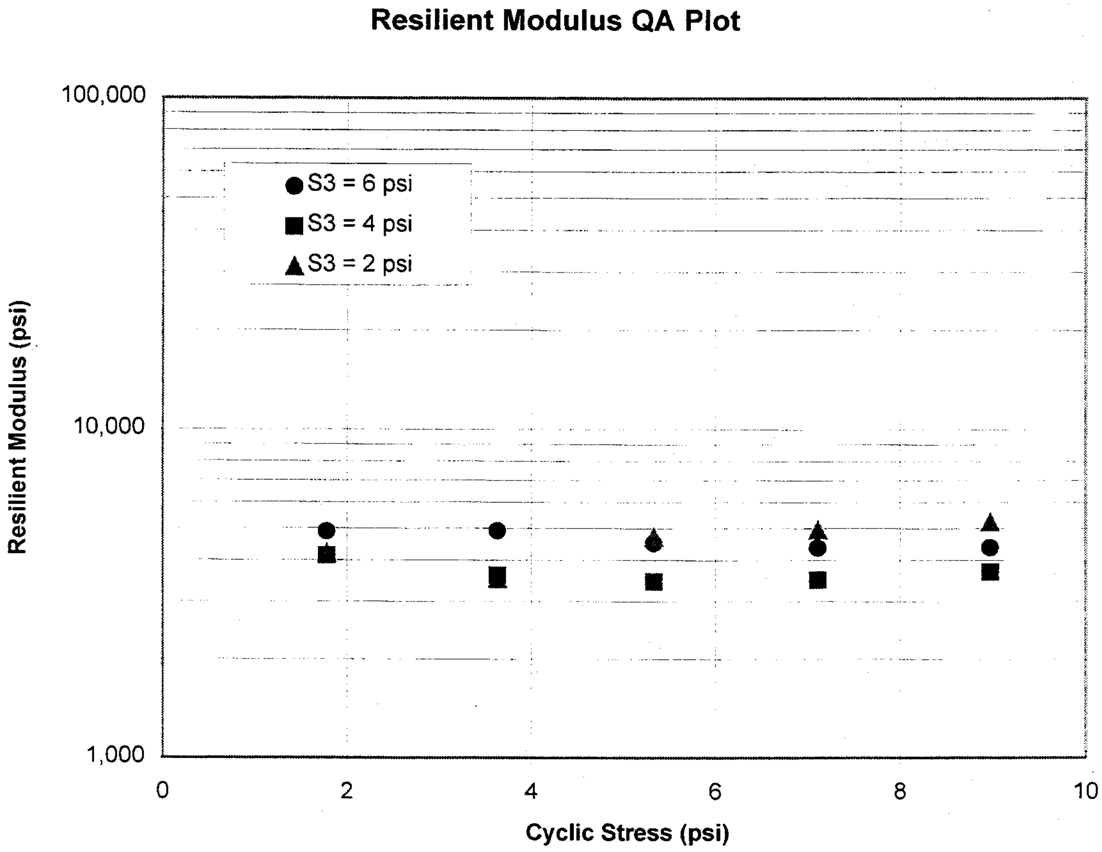
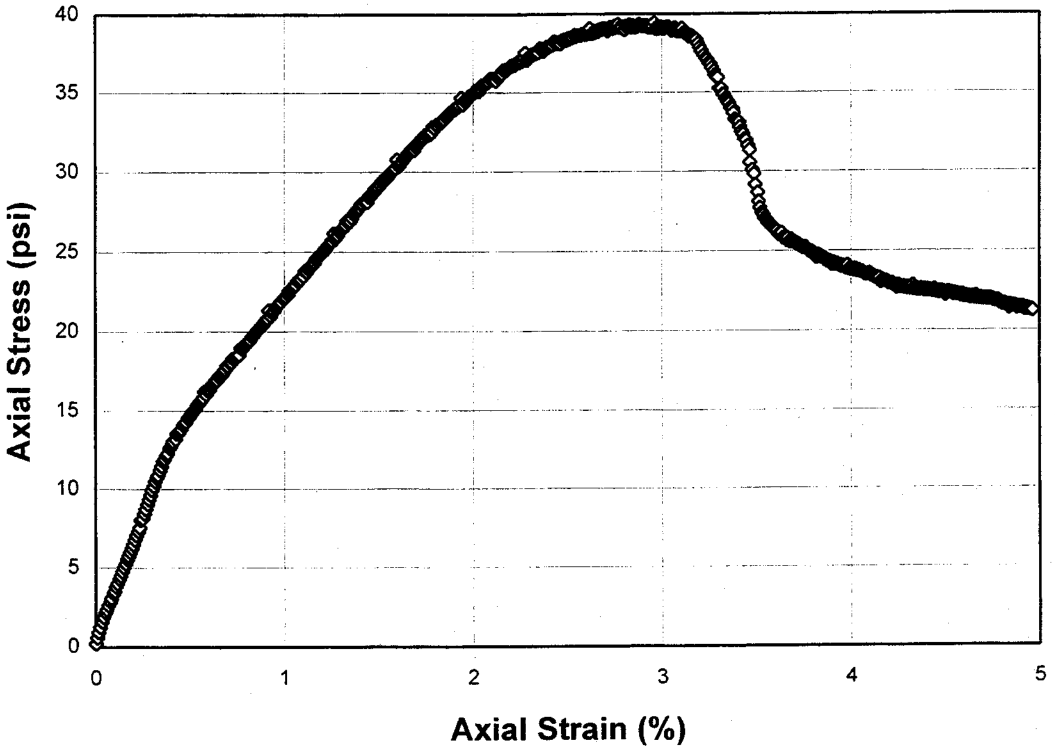


FIGURE 2 - Quick Shear Stress vs Strain

PROJECT NAME:	TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.:	5810860101
1. *MATERIAL SOURCE:*	Widows Creek
2. *MATERIAL DESCRIPTION:*	Ponded Fly Ash (Ash Pond)
3. *REMOLDING TARGETS:*	95% Modified Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE*	2
5. *TEST DATE*	09-15-1995



WIDOWS CREEK

Scrubber Gypsum

Grain Size Distribution Test Report (**Not Performed**)
Moisture-Density Relationship (Standard Proctor)
Moisture-Density Relationship (Modified Proctor)
Consolidation Test Report
Hydraulic Conductivity - Falling Head (2 Pages)
Triaxial Compression Test (2 Pages)
Direct Shear Test
California Bearing Ratio
Resilient Modulus (Standard Proctor) (9 Pages)
Resilient Modulus (Modified Proctor) (9 Pages)

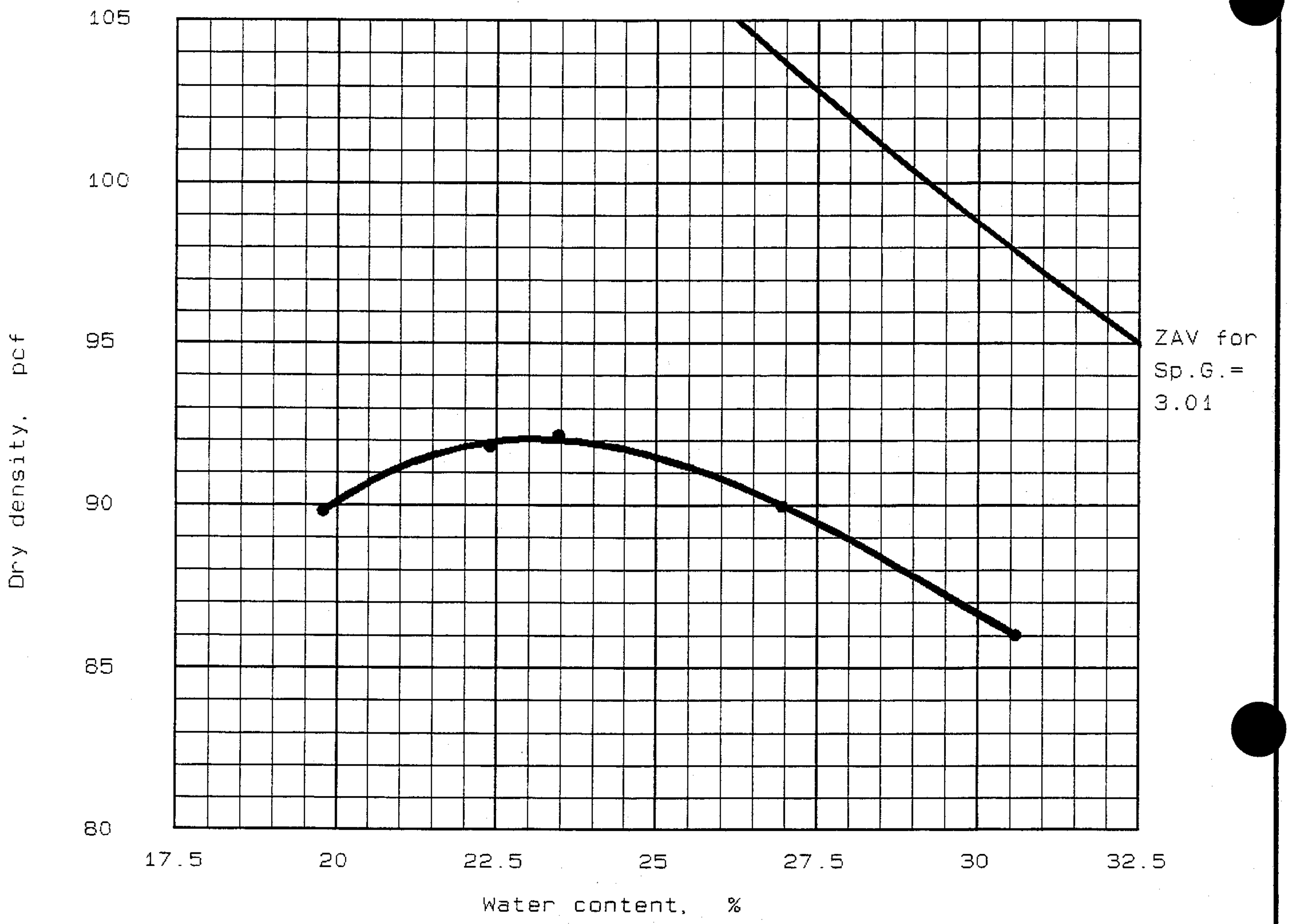
TVA - WIDOWS CREEK
SCRUBBER GYPSUM

Description	**Test Method**	**Property**	**Sample 1**	**Sample 2**	**Sample 3**
Grain Size	ASTM D 422	Percent Retained on the #4 Sieve	see note 1	see note 1	see note 1
		Percent Passing the #200 Sieve	see note 1	see note 1	see note 1
		Percent Passing the 0.005 mm Sieve	see note 1	see note 1	see note 1
Atterberg Limits	ASTM D 4318	Liquid Limit	NL	NL	NL
		Plastic Limit	NP	NP	NP
		Plasticity Index	N/A	N/A	N/A
Specific Gravity	ASTM D 854	Specific Gravity at 20°C		3.01 (see note 2)	
Classification	ASTM D 2487	Unified Soil Classification System (USCS)	see note 3	see note 3	see note 3
	AASHTO M 145	AASHTO Classification	see note 3	see note 3	see note 3
			Composite Sample		
Moisture-Density Relations (Standard Effort)	ASTM D 698	Maximum Dry Density, pcf	92.0		
		Optimum Moisture Content, %	23.1		
Moisture-Density Relations (Modified Effort)	ASTM D 1557	Maximum Dry Density, pcf	99.9		
		Optimum Moisture Content, %	19.4		
			Result	**Dry Density, pcf**	**Moisture Content, %**
Consolidation	ASTM D2435	Compression Index C_C	0.07	84.5	25.8
Hydraulic Conductivity	ASTM D 5084	Hydraulic Conductivity, cm/sec	3.9E-4	87.2	22.2
Triaxial Shear Strength Consolidated-Undrained (CU)	ASTM D4767	Effective Stress, Cohesion, c', ksf	0.00	87.2	22.9
		Effective Stress, Internal Friction Angle, ϕ',degrees	37.8		
		Total Stress, Cohesion, c, ksf	3.01	87.2	22.9
		Total Stress, Internal Friction Angle, ϕ, degrees	33.1		
Direct Shear Strength	ASTM D 3080	Cohesion, c, ksf	0.55	83.0	25.4
		Internal Friction Angle, ϕ, degrees	28.9		
California Bearing Ratio	ASTM D 1883	CBR, %	15	87.5	23.0
Resilient Modulus (Standard Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	12,513	85.7	24.7
Resilient Modulus (Modified Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	13,079	90.2	24.3
Soil Resistivity	AASHTO T 288	Minimum Resistivity, Ohm-cm	1,200		
pH of Soil	AASHTO T 289	pH	6.7		
Water Soluble Sulfate Ion	AASHTO T 290	Sulfate Ion Content, mg/kg	3050		
Water Soluble Chloride Ion	AASHTO T 290	Chloride Ion Content, mg/kg	130		

Note 1: Material observed to chrystalize/set-up upon wetting. Test could not be performed.
Note 2: A test was performed on a composite sample from the 3 independant samples.
Note 3: A classification could not be performed without the ASTM D 422 results.

wcf-gy.xls

MOISTURE-DENSITY RELATIONSHIP



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				3.01	NL			

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 23.1 % Maximum dry density = 92.0 pcf	Gypsum

Project No.: 5810860101
Project: TVA - Widows Creek
Location: Scrubber Gypsum

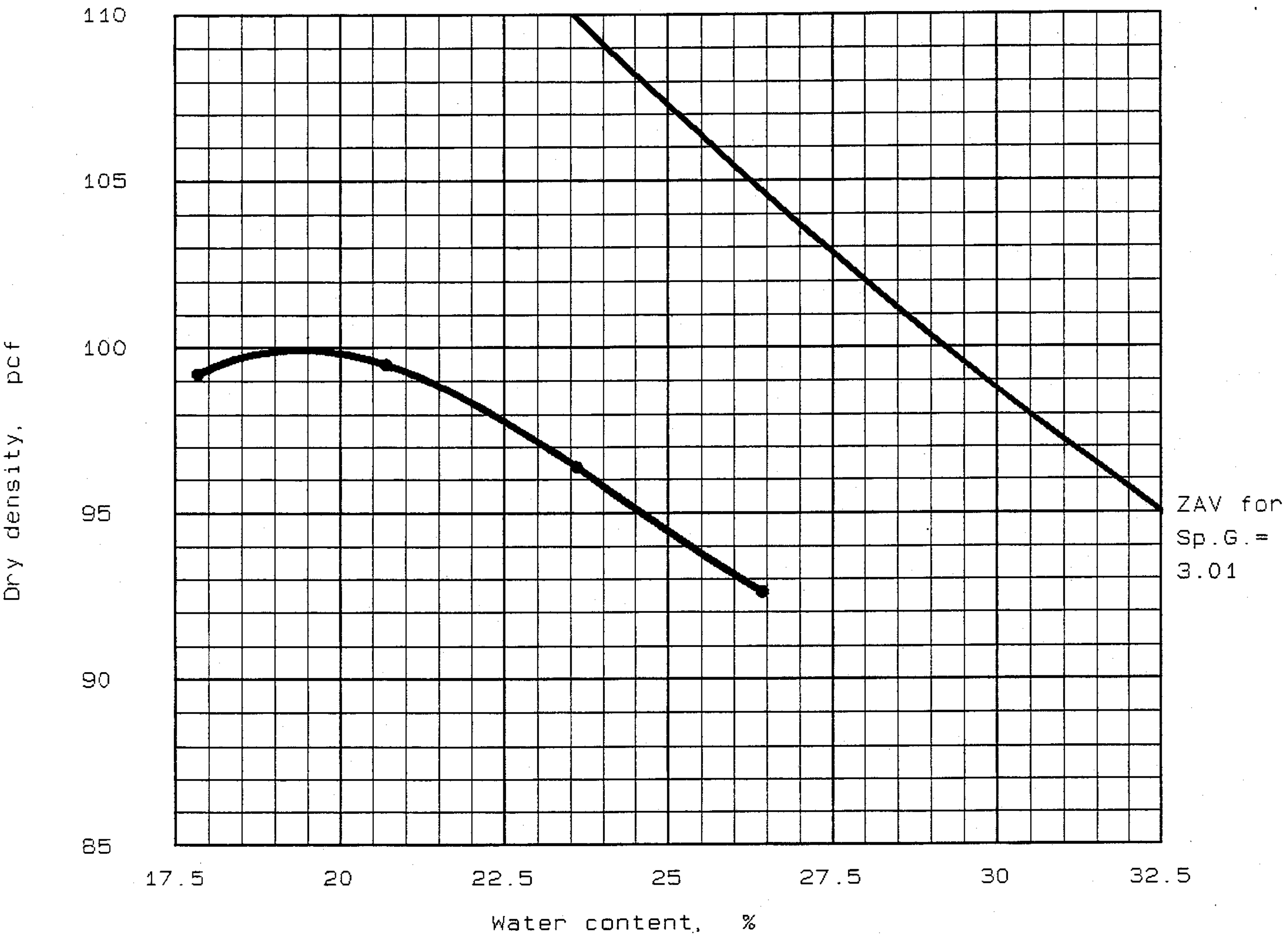
Date: September 26, 1995

Remarks:
Tested by: CS
Reviewed by: Hb

MOISTURE-DENSITY RELATIONSHIP
LAW ENGINEERING, INC.

Figure No. ______

MOISTURE-DENSITY RELATIONSHIP



"Modified" Proctor, ASTM D 1557, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				3.01	NL	NP		

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 19.4 % Maximum dry density = 99.9 pcf	Gypsum

Project No.: 5810860101
Project: TVA -Widows Creek
Location: Scrubber Gypsum

Date: September 26, 1995

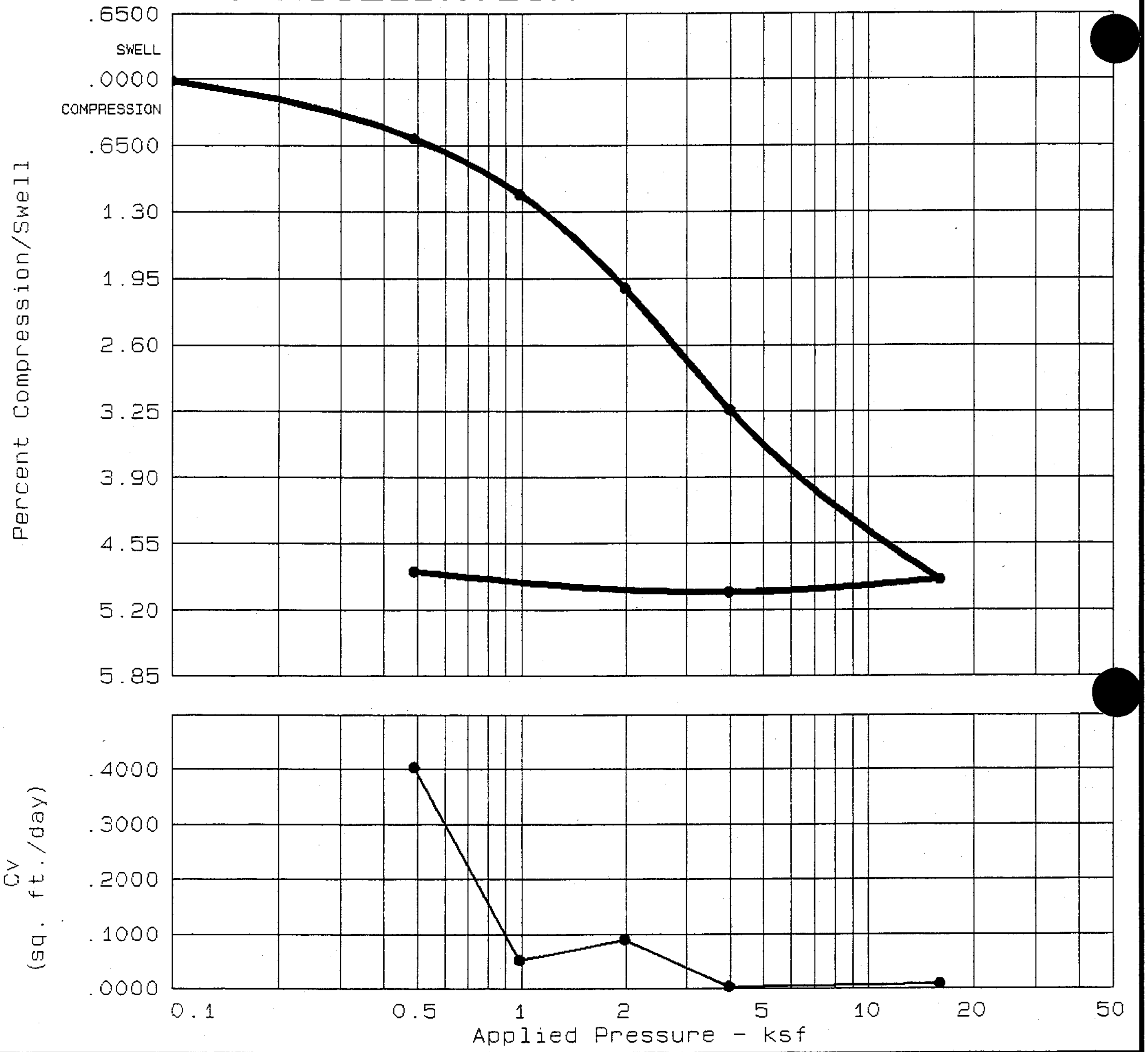
MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

Remarks:
Tested by: CS
Reviewed by: Hb

Figure No. ______

CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_0
63.5 %	25.8	84.5	NL	NP	3.010	1.93	0.07	1.2220

TEST RESULTS

Compression Index = 0.07

Project No.: 5910860101
Project: TVA - Widows Creek
Location: Scrubber Gypsum

Date: 9/28/95

CONSOLIDATION TEST REPORT

LAW ENGINEERING, INC.

MATERIAL DESCRIPTION

Remarks:
Tested by:
Reviewed by:

Fig. No.______

HYDRAULIC CONDUCTIVITY

LAW ENGINEERING

Project No.	*5810860101*	Tested By	*HEJ*
Project Name	*TVA -Widows Creek*	Test Date	*10/09/95*
Boring No.	*Scrubber Gypsum*	Reviewed By	*RLB*
Sample No.	*Bag*	Review Date	10/19/95
Sample Depth			
Sample Description	*Gypsum*		

ASTM D5084 - Falling Head

Sample Type:	*Bag*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*22.2*
Wet Unit Weight, pcf:	*106.5*
Dry Unit Weight, pcf:	*87.2*
Compaction, %:	*94.7*
Hydraulic Conductivity, cm/sec. @20 °C:	***3.9E-04***

PERMEABILITY TEST - FALLING HEAD
(ASTM D5084 - 90)

LAW ENGINEERING

Job Number 5810860101
Project Name TVA -Widows Creek
Boring No. Scrubber Gypsum
Sample No. Bag
Sample Depth
Sample Description Gypsum

Tested By HEJ
Test Date 10/09/95
Reviewed By RLB
Review Date 10/19/95

Sample Data

Length, in		Diameter, in		Pan No.	AB-30
Location 1	6.000	Location 1	2.830	Dry Soil+Pan, grams	947.13
Location 2	6.000	Location 2	2.830	Pan Weight, grams	83.66
Location3	6.000	Location 3	2.830		
Average	6.000	Average	2.830	Moisture Content, %	22.2
		Wet Soil + Tare, grams	1054.96	Wet Unit Wt, pcf	106.5
		Tare Weight, grams	0.00	Dry Unit Wt, pcf	87.2

Chamber Pressure, psi	49
Back Pressure, psi	35
Confining Pressure, psi	14

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	Division Start	Division Finish	H0 (cm)	Hf (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				242	50.0	0.0	93.94	43.94	4.0E-04	21	3.9E-04
				242	50.0	0.0	93.94	43.94	4.0E-04	21	3.9E-04
				243	50.0	0.0	93.94	43.94	4.0E-04	21	3.9E-04

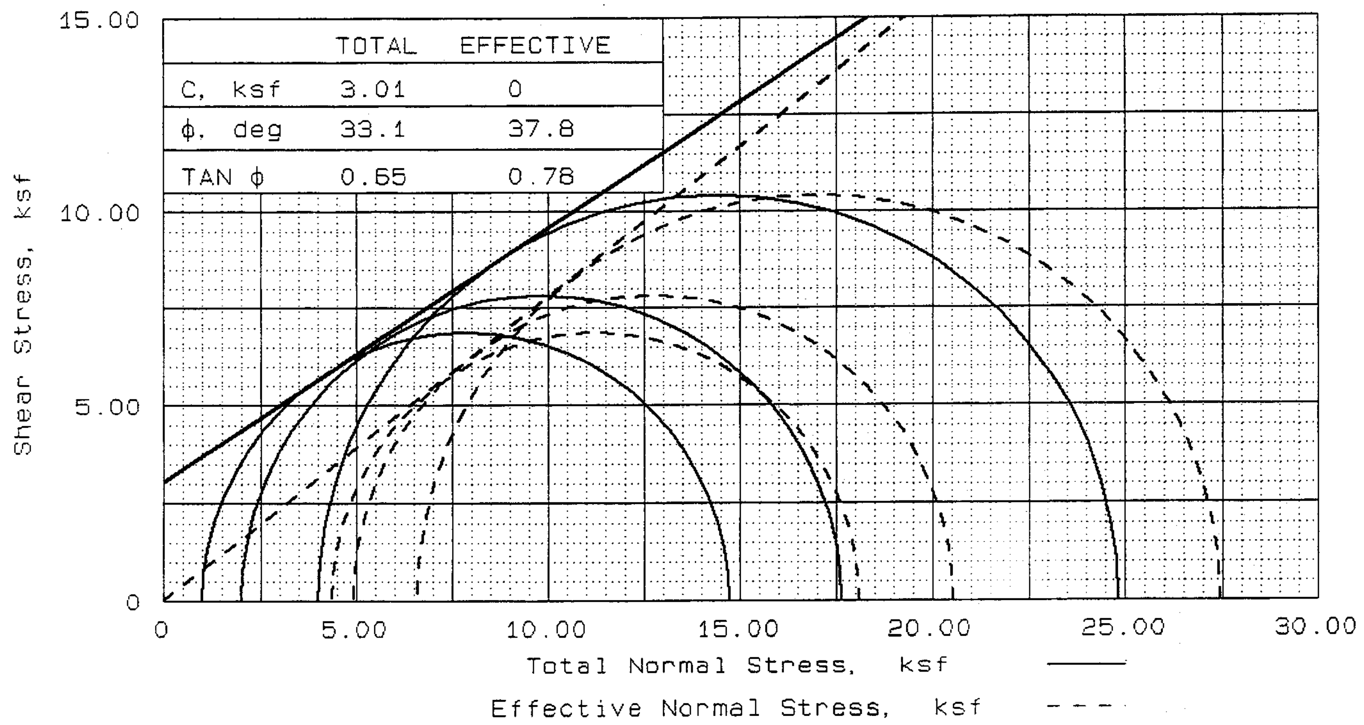
No. of Tria	Sample Type	Max. Densit (pcf)	Compaction %	Sample Orientation
3	Bag	92	94.7	Vertical

Avg. k at 20 °C 3.9E-04 cm/sec

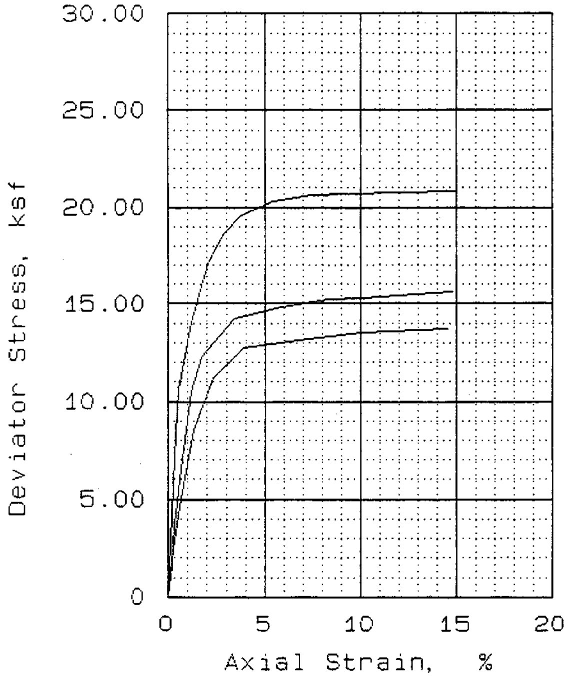
a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

H_0 = initial head in cm
H_f = final head in cm
t = time in seconds

a = 0.34 cm²
A = 40.582 cm²
L = 15.24 cm



	TOTAL	EFFECTIVE
C, ksf	3.01	0
ϕ, deg	33.1	37.8
TAN ϕ	0.65	0.78



	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	23.5	22.2	23.1
	DRY DENSITY, pcf	87.2	87.2	87.2
	SATURATION, %	61.2	57.7	60.1
	VOID RATIO	1.155	1.156	1.155
	DIAMETER, in	2.83	2.83	2.83
	HEIGHT, in	6.00	6.00	6.00
AT TEST	WATER CONTENT, %	38.0	37.5	37.0
	DRY DENSITY, pcf	87.7	88.3	88.9
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.143	1.128	1.113
	DIAMETER, in	2.83	2.82	2.81
	HEIGHT, in	5.98	5.95	5.96
	BACK PRESSURE, ksf	5.00	5.08	5.01
	CELL PRESSURE, ksf	6.00	7.08	9.01
	FAILURE STRESS, ksf	13.73	15.64	20.83
	PORE PRESSURE, ksf	1.63	2.17	2.42
	STRAIN RATE, %/min.	0.100	0.100	0.100
	ULTIMATE STRESS, ksf			
	PORE PRESSURE, ksf			
	$\bar{\sigma}_1$ FAILURE, ksf	18.09	20.55	27.42
	$\bar{\sigma}_3$ FAILURE, ksf	4.37	4.91	6.59

TYPE OF TEST:
CU with pore pressures

SAMPLE TYPE: Remolded

DESCRIPTION: Gypsum

LL= NL PL= NP PI=

SPECIFIC GRAVITY= 3.01

REMARKS: Tested by:

Reviewed by: RLB

FIG. NO.

CLIENT: TVA

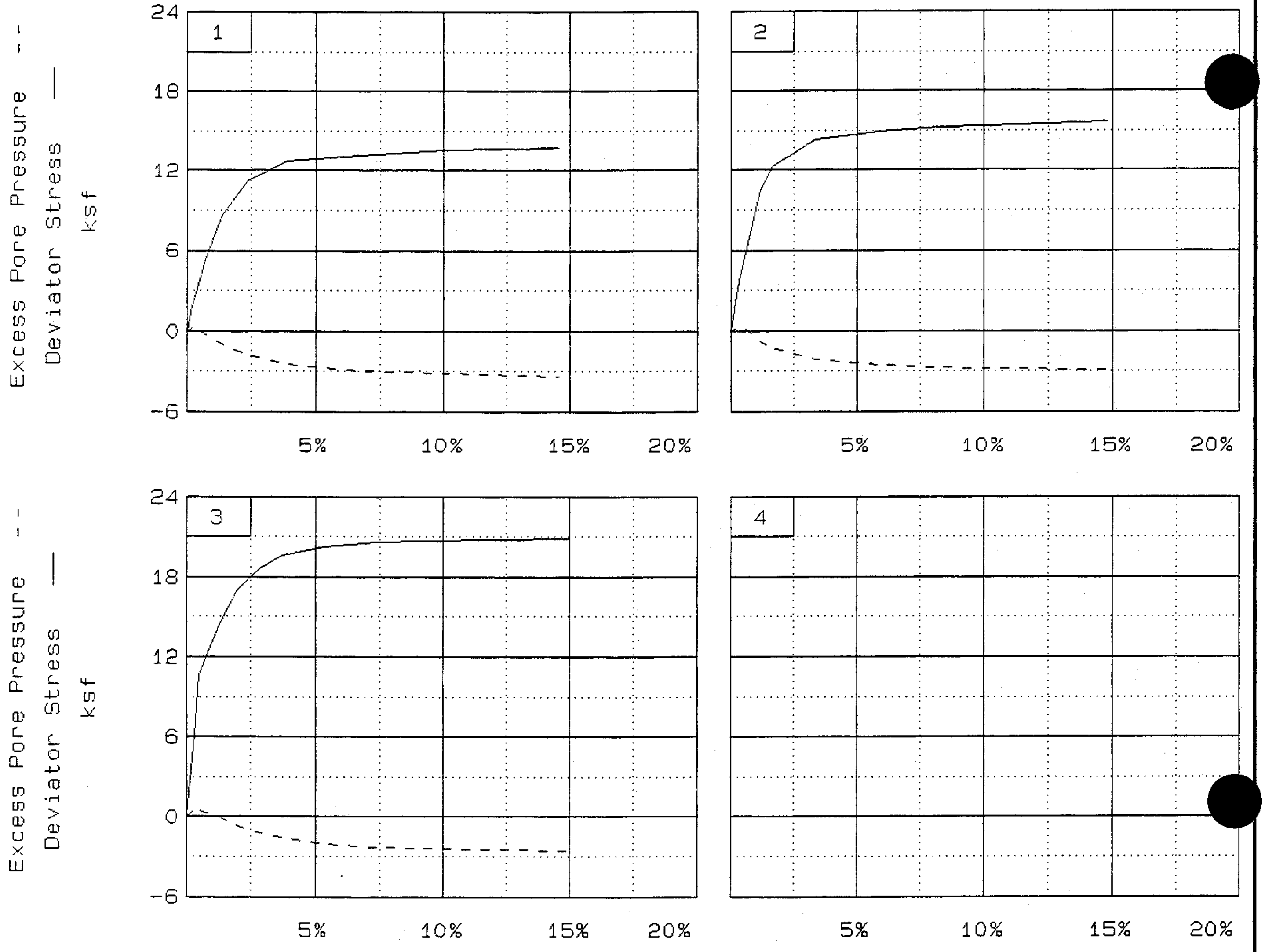
PROJECT: TVA-Widows Creek

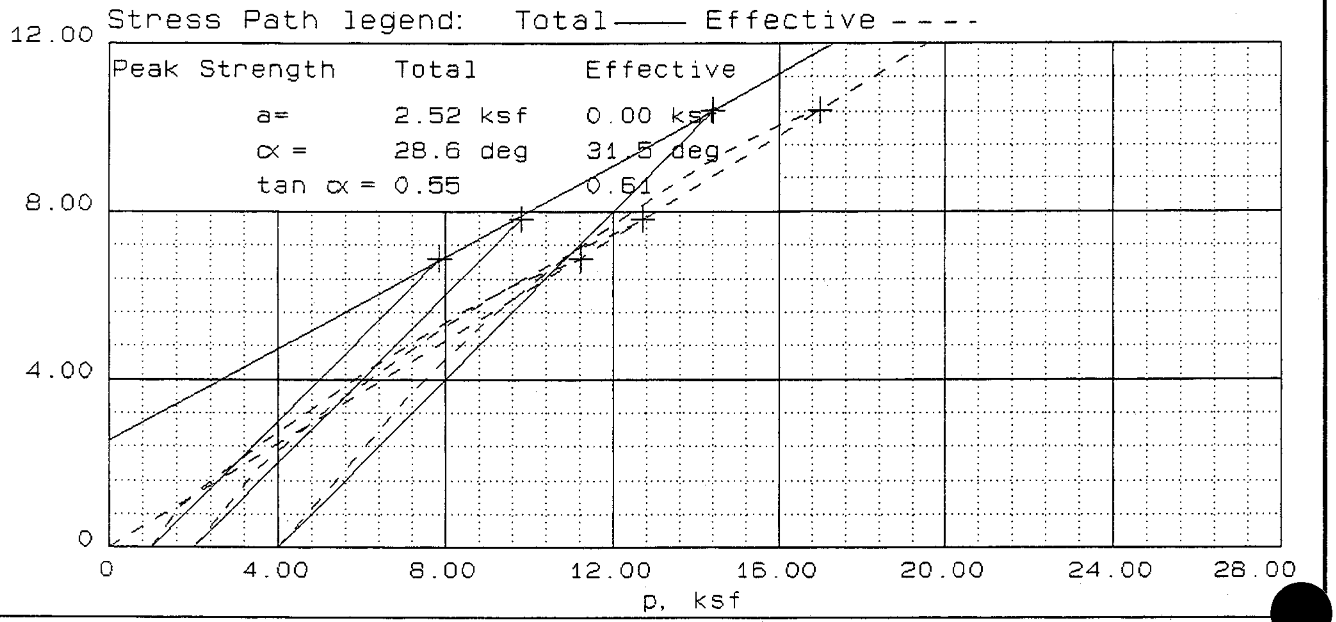
SAMPLE LOCATION: Scrubber Gypsum

PROJ. NO.: 5810860101 DATE: 10/23/95

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING, INC.





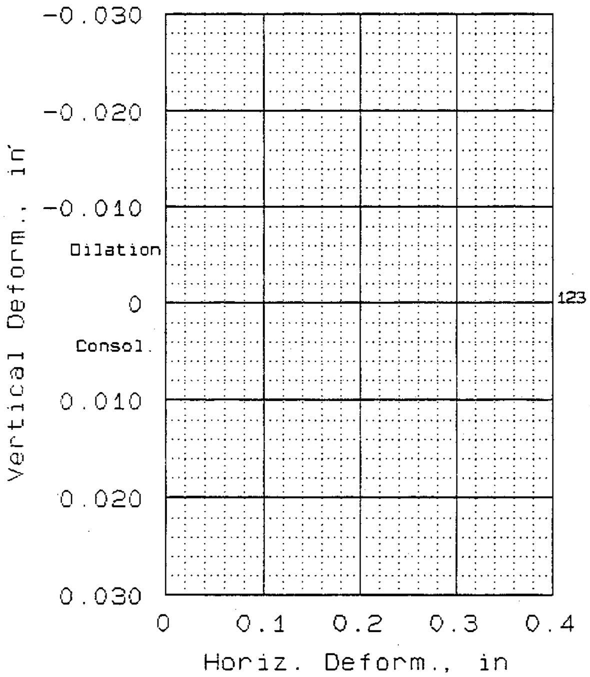
Peak Strength	Total	Effective
a=	2.52 ksf	0.00 ksf
α =	28.6 deg	31.5 deg
tan α =	0.55	0.61

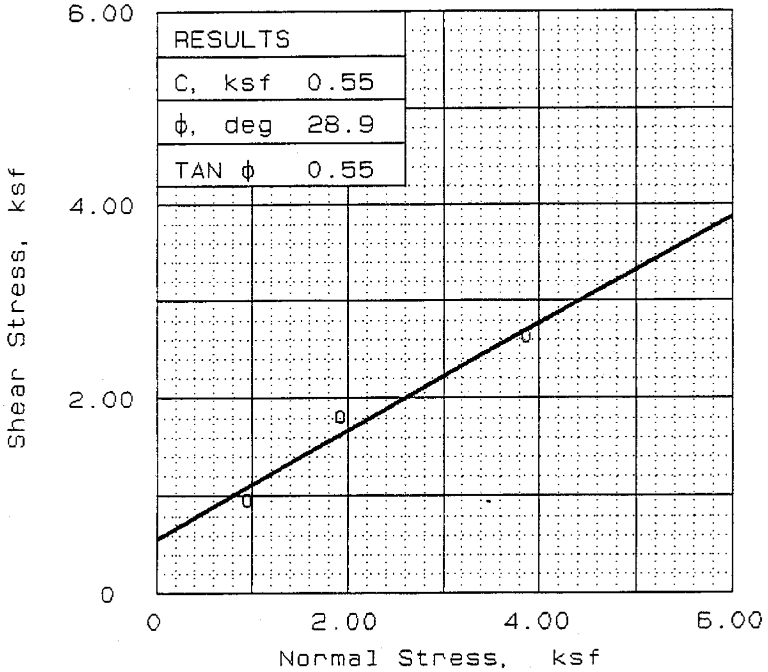
Client: TVA

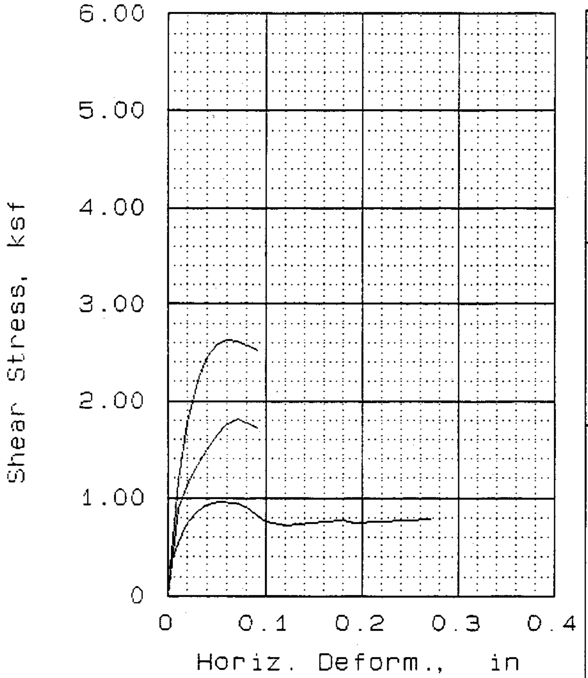
Project: TVA-Widows Creek

Location: Scrubber Gypsum

File: 8601R Project No.: 5810860101 Page 2/2 Fig. No. ____







	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	25.4	25.8	25.0
	DRY DENSITY, pcf	82.4	82.1	84.6
	SATURATION, %	66.8	67.3	69.3
	VOID RATIO	1.007	1.016	0.955
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	0.81	0.81	0.81
AT TEST	WATER CONTENT, %	25.4	25.8	25.0
	DRY DENSITY, pcf	82.4	82.1	84.6
	SATURATION, %	66.8	67.3	69.3
	VOID RATIO	1.007	1.016	0.955
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	0.81	0.81	0.81
	NORMAL STRESS, ksf	0.97	1.94	3.88
	MAX. SHEAR, ksf	0.96	1.81	2.63
	STRAIN RATE, %/min.	0.500	0.500	0.500
	ULT. SHEAR, ksf			

SAMPLE DATA

SAMPLE TYPE: Remolded

DESCRIPTION:

LL= NL PL= NP PI=

SPECIFIC GRAVITY= 3.01

REMARKS: Tested by: HJ

Reviewed by: RLB

FIG. NO.

CLIENT:

PROJECT: TVA - Widows Creek

SAMPLE LOCATION: Scrubber Gypsum

PROJ. NO.: 5810860101 DATE: 10/11/95

DIRECT SHEAR TEST

LAW ENGINEERING, INC.

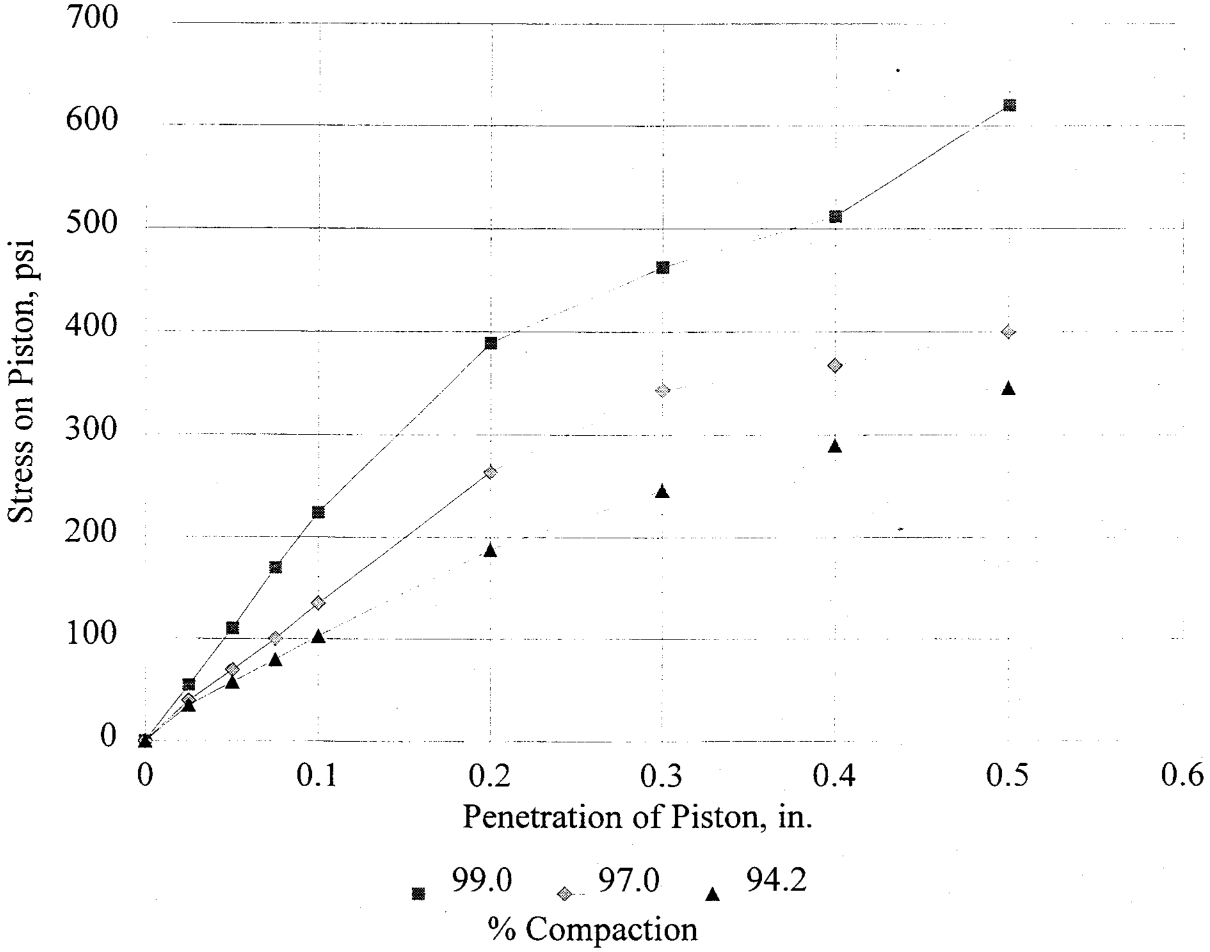
California Bearing Ratio

(ASTM D1883-92)

LAW ENGINEERING

Project No.	5810860101	**Tested By**	EM
Project Name	TVA - Widows Creek	**Test Date**	10/09/95
Material (Source)	Gypsum	**Reviewed By**	RLB
		Review Date	10/10/95

Compaction, %	99.0	97.0	94.2
Before Soak Dry Density, pcf	91.3	89.4	86.9
Before Soak Moisture Content,	24.7	23.3	22.6
After Soak Dry Density, pcf	91.2	89.3	86.7
After Soak Moisture Content, %	31.2	31.6	32.0
CBR @ 0.1 in.	22.4	13.5	10.3
CBR @ 0.2 in.	26.0	17.6	12.5



SHEET NO 1 OF 2

LABORATORY MATERIAL HANDLING AND TESTING
LABORATORY MATERIAL TEST DATA
RESILIENT MODULUS OF UNBOUND GRANULAR BASE/SUBBASE MATERIALS AND SUBGRADE SOILS
LAB DATA SHEET T46 - RECOMPACTED SAMPLES

UNBOUND GRANULAR BASE/SUBBASE LAYERS AND SUBGRADE SOILS
SHRP TEST DESIGNATION UG07, SS07/SHRP PROTOCOL P46

LABORATORY PERFORMING TEST: **LAW ENGINEERING, INC. - ATLANTA, GEORGIA**

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study

LAW PROJECT NO.: 5810860101

1. *MATERIAL SOURCE:* Widows Creek
2. *MATERIAL DESCRIPTION:* Gypsum
3. *REMOLDING TARGETS:* 95% Standard Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE* (Type 1 or Type 2) 2
5. *TEST INFORMATION*
   - *PRECONDITIONING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)* N
   - *TESTING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)* N
   - *TESTING - NUMBER OF LOAD SEQUENCES COMPLETED (0 - 15)* 15
6. *SPECIMEN INFO.:*
   - *SPECIMEN DIAM.,* inch
     - *TOP* 2.85
     - *MIDDLE* 2.85
     - *BOTTOM* 2.85
     - *AVERAGE* 2.85
     - *MEMBRANE THICKNESS (1),* inch 0.01
     - *MEMBRANE THICKNESS (2),* inch 0.01
   - *NET DIAM., inch* 2.83
   - *HEIGHT OF SPECIMEN, CAP AND BASE,* inch 6.03
   - *HEIGHT OF CAP AND BASE,* inch 0.00
   - *INITIAL LENGTH,* L_0, inch 6.03
   - *INITIAL AREA,* A_0, in^2 6.29
   - *INITIAL VOLUME* $A_0 L_0$, in^3 37.92
7. *SOIL SPECIMEN WEIGHT:*
   - *INITIAL WEIGHT OF CONTAINER AND WET SOIL,* grams 1065.33
   - *FINAL WEIGHT OF CONTAINER AND WET SOIL,* grams 0.00
   - *WEIGHT OF WET SOIL USED,* grams 1065.33
8. *SOIL PROPERTIES.:*
   - *IN SITU MOISTURE CONTENT (NUCLEAR), %* N/A
   - *IN SITU WET DENSITY (NUCLEAR),* pcf N/A
   - or
   - *OPTIMUM MOISTURE CONTENT, %* 23.1
   - *MAX. DRY DENSITY,* pcf 92.2
   - *95 % MAX. DRY DENSITY,* pcf 87.6
9. *SPECIMEN PROPERTIES:*
   - *COMPACTION MOISTURE CONTENT, %* 24.7
   - *MOISTURE CONTENT AFTER RESILIENT MODULUS TESTING, %* 24.7
   - *COMPACTION DRY DENSITY,* γ_d pcf 85.7
10. *QUICK SHEAR TEST*
    - *STRESS - STRAIN PLOT ATTACHED* (Y = YES, N = NO) Y
    - *TRIAXIAL SHEAR MAXIMUM STRENGTH* (MAX. LOAD/X-SECTION AREA), psi 37.4
    - *SPECIMEN FAIL DURING TRIAXIAL SHEAR?* (Y = YES, N = NO) Y
11. *COMMENTS* (Section 10.4 of Protocol P46)
    - (a) *CODE* 0 0 0 0 0 0
    - (b) *NOTE*
12. *TEST DATE* 10-05-1995

GENERAL REMARKS:

SUBMITTED BY, DATE

Richard P. Boudreau 10/18/95

LABORATORY MANAGER

SHEET NO 2 OF 2

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.: 5810860101
1. *MATERIAL SOURCE:* Widows Creek
2. *MATERIAL DESCRIPTION:* Gypsum
3. *REMOLDING TARGETS:* 95% Standard Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE* 2
5. *TEST DATE* 10-05-1995
6. *RESILIENT MODULUS TESTING*

COLUMN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PARAMETER	*Chamber Confining Pressure*	*Nominal Maximum Axial Stress*	*Cycle No.*	*Actual Applied Max. Axial Load*	*Actual Applied Cyclic Load*	*Actual Applied Contact Load*	*Actual Applied Max. Axial Stress*	*Actual Applied Cyclic Stress*	*Actual Applied Contact Stress*	*Recov. Def. LVDT #1 Reading*	*Recov. Def. LVDT #2 Reading*	*Average Recov Def. LVDT 1 and 2*	*Resilient Strain*	*Resilient Modulus*
DESIGNATION	S_3	S_{cyclic}	c_1	P_{max}	P_{cyclic}	$P_{contact}$	S_{max}	S_{cyclic}	$S_{contact}$	H_1	H_2	H_{avg}	ε_r	M_r
UNIT	psi	psi	---	lbs	lbs	lbs	psi	psi	psi	in.	in.	in.	in/in	psi
PRECISION	___._	___._	_	____._	___._	___._	___._	___._	__._	_._____	_._____	_._____	_._____	___.
SEQUENCE 1	6.0	2.0	95	12.6	11.4	1.3	2.0	1.8	0.2	0.00083	0.00088	0.00085	0.00014	12,771
			96	12.6	11.4	1.3	2.0	1.8	0.2	0.00086	0.00087	0.00086	0.00014	12,667
			97	12.6	11.4	1.3	2.0	1.8	0.2	0.00084	0.00088	0.00086	0.00014	12,677
			98	12.7	11.5	1.2	2.0	1.8	0.2	0.00084	0.00089	0.00086	0.00014	12,777
			100	12.7	11.5	1.3	2.0	1.8	0.2	0.00083	0.00089	0.00086	0.00014	12,804
	COLUMN AVERAGE			12.7	11.4	1.3	2.0	1.8	0.2	0.00084	0.00088	0.00086	0.00014	12,739
	STANDARD DEV.			0.0	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	63

Source: Widows Creek Description: Gypsum 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 2	6.0	4.0	95	25.1	22.7	2.4	4.0	3.6	0.4	0.00147	0.00162	0.00154	0.00026	14,130
			96	25.2	22.8	2.4	4.0	3.6	0.4	0.00147	0.00162	0.00155	0.00026	14,133
			97	25.2	22.8	2.4	4.0	3.6	0.4	0.00146	0.00162	0.00154	0.00026	14,197
			98	25.2	22.8	2.4	4.0	3.6	0.4	0.00147	0.00163	0.00155	0.00026	14,111
			100	25.1	22.7	2.4	4.0	3.6	0.4	0.00144	0.00162	0.00153	0.00025	14,217
	COLUMN AVERAGE			25.2	22.8	2.4	4.0	3.6	0.4	0.00146	0.00162	0.00154	0.00026	14,158
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	46
SEQUENCE 3	6.0	6.0	95	37.7	34.1	3.6	6.0	5.4	0.6	0.00208	0.00235	0.00221	0.00037	14,756
			96	37.7	34.1	3.6	6.0	5.4	0.6	0.00210	0.00234	0.00222	0.00037	14,711
			97	37.7	34.1	3.6	6.0	5.4	0.6	0.00208	0.00235	0.00221	0.00037	14,773
			98	37.7	34.1	3.6	6.0	5.4	0.6	0.00207	0.00235	0.00221	0.00037	14,823
			100	37.7	34.1	3.6	6.0	5.4	0.6	0.00208	0.00233	0.00221	0.00037	14,803
	COLUMN AVERAGE			37.7	34.1	3.6	6.0	5.4	0.6	0.00208	0.00234	0.00221	0.00037	14,773
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	43
SEQUENCE 4	6.0	8.0	95	50.2	45.3	4.9	8.0	7.2	0.8	0.00268	0.00310	0.00289	0.00048	15,026
			96	50.2	45.3	4.9	8.0	7.2	0.8	0.00270	0.00308	0.00289	0.00048	15,059
			97	50.2	45.3	4.9	8.0	7.2	0.8	0.00269	0.00309	0.00289	0.00048	15,051
			98	50.2	45.3	4.9	8.0	7.2	0.8	0.00270	0.00308	0.00289	0.00048	15,036
			100	50.2	45.3	4.9	8.0	7.2	0.8	0.00268	0.00308	0.00288	0.00048	15,082
	COLUMN AVERAGE			50.2	45.3	4.9	8.0	7.2	0.8	0.00269	0.00309	0.00289	0.00048	15,051
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	22

Source: Widows Creek Description: Gypsum 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 5	6.0	10.0	95	62.9	56.8	6.1	10.0	9.0	1.0	0.00329	0.00379	0.00354	0.00059	15,403
			96	63.0	56.8	6.1	10.0	9.0	1.0	0.00330	0.00378	0.00354	0.00059	15,403
			97	63.0	56.9	6.1	10.0	9.0	1.0	0.00330	0.00379	0.00355	0.00059	15,375
			98	63.0	56.9	6.1	10.0	9.0	1.0	0.00329	0.00378	0.00354	0.00059	15,427
			100	62.9	56.8	6.1	10.0	9.0	1.0	0.00329	0.00379	0.00354	0.00059	15,385
	COLUMN AVERAGE			63.0	56.8	6.1	10.0	9.0	1.0	0.00330	0.00379	0.00354	0.00059	15,399
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00000	0.00000	20
SEQUENCE 6	4.0	2.0	95	13.0	11.3	1.7	2.1	1.8	0.3	0.00083	0.00091	0.00087	0.00014	12,553
			96	13.0	11.4	1.7	2.1	1.8	0.3	0.00082	0.00089	0.00086	0.00014	12,747
			97	13.0	11.3	1.7	2.1	1.8	0.3	0.00083	0.00090	0.00086	0.00014	12,576
			98	13.0	11.3	1.7	2.1	1.8	0.3	0.00082	0.00090	0.00086	0.00014	12,610
			100	13.0	11.4	1.7	2.1	1.8	0.3	0.00082	0.00089	0.00085	0.00014	12,805
	COLUMN AVERAGE			13.0	11.4	1.7	2.1	1.8	0.3	0.00082	0.00090	0.00086	0.00014	12,658
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00001	0.00000	111
SEQUENCE 7	4.0	4.0	95	25.2	22.8	2.4	4.0	3.6	0.4	0.00155	0.00174	0.00164	0.00027	13,285
			96	25.1	22.7	2.4	4.0	3.6	0.4	0.00156	0.00175	0.00165	0.00027	13,184
			97	25.2	22.8	2.4	4.0	3.6	0.4	0.00156	0.00176	0.00166	0.00027	13,193
			98	25.2	22.8	2.4	4.0	3.6	0.4	0.00156	0.00175	0.00165	0.00027	13,258
			100	25.1	22.8	2.4	4.0	3.6	0.4	0.00156	0.00174	0.00165	0.00027	13,223
	COLUMN AVERAGE			25.2	22.8	2.4	4.0	3.6	0.4	0.00156	0.00175	0.00165	0.00027	13,229
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00000	0.00000	43

Source: Widows Creek Description: Gypsum 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 8	4.0	6.0	95	37.6	34.0	3.7	6.0	5.4	0.6	0.00222	0.00251	0.00237	0.00039	13,773
			96	37.6	34.0	3.6	6.0	5.4	0.6	0.00222	0.00252	0.00237	0.00039	13,766
			97	37.7	34.0	3.6	6.0	5.4	0.6	0.00223	0.00251	0.00237	0.00039	13,773
			98	37.6	34.0	3.6	6.0	5.4	0.6	0.00223	0.00252	0.00238	0.00039	13,707
			100	37.6	34.0	3.6	6.0	5.4	0.6	0.00223	0.00253	0.00238	0.00039	13,698
	COLUMN AVERAGE			37.6	34.0	3.6	6.0	5.4	0.6	0.00223	0.00252	0.00237	0.00039	13,743
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	37
SEQUENCE 9	4.0	8.0	95	50.3	45.5	4.9	8.0	7.2	0.8	0.00290	0.00330	0.00310	0.00051	14,090
			96	50.4	45.5	4.8	8.0	7.2	0.8	0.00290	0.00329	0.00310	0.00051	14,115
			97	50.4	45.5	4.9	8.0	7.2	0.8	0.00288	0.00329	0.00309	0.00051	14,145
			98	50.3	45.4	4.9	8.0	7.2	0.8	0.00289	0.00328	0.00308	0.00051	14,133
			100	50.3	45.5	4.9	8.0	7.2	0.8	0.00291	0.00330	0.00310	0.00051	14,055
	COLUMN AVERAGE			50.3	45.5	4.9	8.0	7.2	0.8	0.00290	0.00329	0.00309	0.00051	14,108
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	36
SEQUENCE 10	4.0	10.0	95	63.1	57.0	6.1	10.0	9.1	1.0	0.00359	0.00407	0.00383	0.00063	14,281
			96	63.1	56.9	6.1	10.0	9.1	1.0	0.00359	0.00408	0.00383	0.00064	14,243
			97	62.9	56.8	6.1	10.0	9.0	1.0	0.00359	0.00408	0.00384	0.00064	14,207
			98	63.0	56.9	6.1	10.0	9.0	1.0	0.00359	0.00408	0.00384	0.00064	14,223
			100	62.9	56.8	6.1	10.0	9.0	1.0	0.00359	0.00407	0.00383	0.00063	14,239
	COLUMN AVERAGE			63.0	56.9	6.1	10.0	9.0	1.0	0.00359	0.00408	0.00383	0.00064	14,239
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00000	0.00000	28

Source: Widows Creek Description: Gypsum 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 11	2.0	2.0	95	13.3	11.2	2.1	2.1	1.8	0.3	0.00094	0.00102	0.00098	0.00016	10,985
			96	13.3	11.2	2.1	2.1	1.8	0.3	0.00092	0.00101	0.00097	0.00016	11,113
			97	13.3	11.2	2.1	2.1	1.8	0.3	0.00093	0.00100	0.00096	0.00016	11,127
			98	13.2	11.1	2.1	2.1	1.8	0.3	0.00094	0.00101	0.00098	0.00016	10,957
			100	13.3	11.2	2.1	2.1	1.8	0.3	0.00093	0.00099	0.00096	0.00016	11,259
	COLUMN AVERAGE			13.3	11.2	2.1	2.1	1.8	0.3	0.00093	0.00101	0.00097	0.00016	11,088
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	122
SEQUENCE 12	2.0	4.0	95	25.1	22.7	2.4	4.0	3.6	0.4	0.00183	0.00203	0.00193	0.00032	11,268
			96	25.2	22.8	2.4	4.0	3.6	0.4	0.00183	0.00203	0.00193	0.00032	11,368
			97	25.2	22.8	2.4	4.0	3.6	0.4	0.00181	0.00203	0.00192	0.00032	11,387
			98	25.1	22.7	2.4	4.0	3.6	0.4	0.00185	0.00203	0.00194	0.00032	11,268
			100	25.2	22.8	2.4	4.0	3.6	0.4	0.00184	0.00203	0.00193	0.00032	11,305
	COLUMN AVERAGE			25.2	22.8	2.4	4.0	3.6	0.4	0.00183	0.00203	0.00193	0.00032	11,319
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00001	0.00000	56
SEQUENCE 13	2.0	6.0	95	37.6	33.9	3.6	6.0	5.4	0.6	0.00260	0.00291	0.00275	0.00046	11,821
			96	37.6	34.0	3.6	6.0	5.4	0.6	0.00259	0.00292	0.00276	0.00046	11,829
			97	37.6	34.0	3.6	6.0	5.4	0.6	0.00259	0.00293	0.00276	0.00046	11,837
			98	37.6	34.0	3.6	6.0	5.4	0.6	0.00259	0.00293	0.00276	0.00046	11,808
			100	37.5	33.9	3.6	6.0	5.4	0.6	0.00257	0.00294	0.00275	0.00046	11,806
	COLUMN AVERAGE			37.6	34.0	3.6	6.0	5.4	0.6	0.00259	0.00292	0.00276	0.00046	11,820
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	13

Source: Widows Creek   Description: Gypsum   95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 14	2.0	8.0	95	50.4	45.5	4.9	8.0	7.2	0.8	0.00334	0.00377	0.00356	0.00059	12,267
			96	50.4	45.5	4.9	8.0	7.2	0.8	0.00336	0.00376	0.00356	0.00059	12,284
			97	50.4	45.6	4.8	8.0	7.3	0.8	0.00334	0.00376	0.00355	0.00059	12,319
			98	50.4	45.5	4.9	8.0	7.2	0.8	0.00334	0.00376	0.00355	0.00059	12,293
			100	50.4	45.5	4.8	8.0	7.2	0.8	0.00334	0.00375	0.00355	0.00059	12,322
	COLUMN AVERAGE			50.4	45.5	4.9	8.0	7.2	0.8	0.00334	0.00376	0.00355	0.00059	12,297
	STANDARD DEV.			0.0	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	23
SEQUENCE 15	2.0	10.0	95	63.0	56.9	6.1	10.0	9.1	1.0	0.00411	0.00464	0.00437	0.00073	12,491
			96	63.1	57.0	6.1	10.0	9.1	1.0	0.00414	0.00463	0.00439	0.00073	12,473
			97	63.1	57.0	6.1	10.0	9.1	1.0	0.00414	0.00465	0.00439	0.00073	12,455
			98	63.1	56.9	6.1	10.0	9.1	1.0	0.00414	0.00463	0.00438	0.00073	12,461
			100	63.1	57.0	6.1	10.0	9.1	1.0	0.00414	0.00465	0.00440	0.00073	12,435
	COLUMN AVERAGE			63.1	57.0	6.1	10.0	9.1	1.0	0.00413	0.00464	0.00439	0.00073	12,463
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	21

SUBMITTED BY, DATE
10/18/95
LABORATORY MANAGER

FIGURE 1 - Logarithmic Plot of Resilient Modulus (M_R) vs Cyclic Stress (S_C)

PROJECT NAME:		TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.:		5810860101
1.	MATERIAL SOURCE:	Widows Creek
2.	MATERIAL DESCRIPTION:	Gypsum
3.	REMOLDING TARGETS:	95% Standard Dry Density at Optimum Moisture Content
4.	MATERIAL TYPE	2
5.	TEST DATE	10-05-1995

$$M_R = K1\ (S_c)^{K2}(1+S_3)^{K5}$$

K1 = 7,937

K2 = 0.08949

K5 = 0.23891

R^2 = 0.97

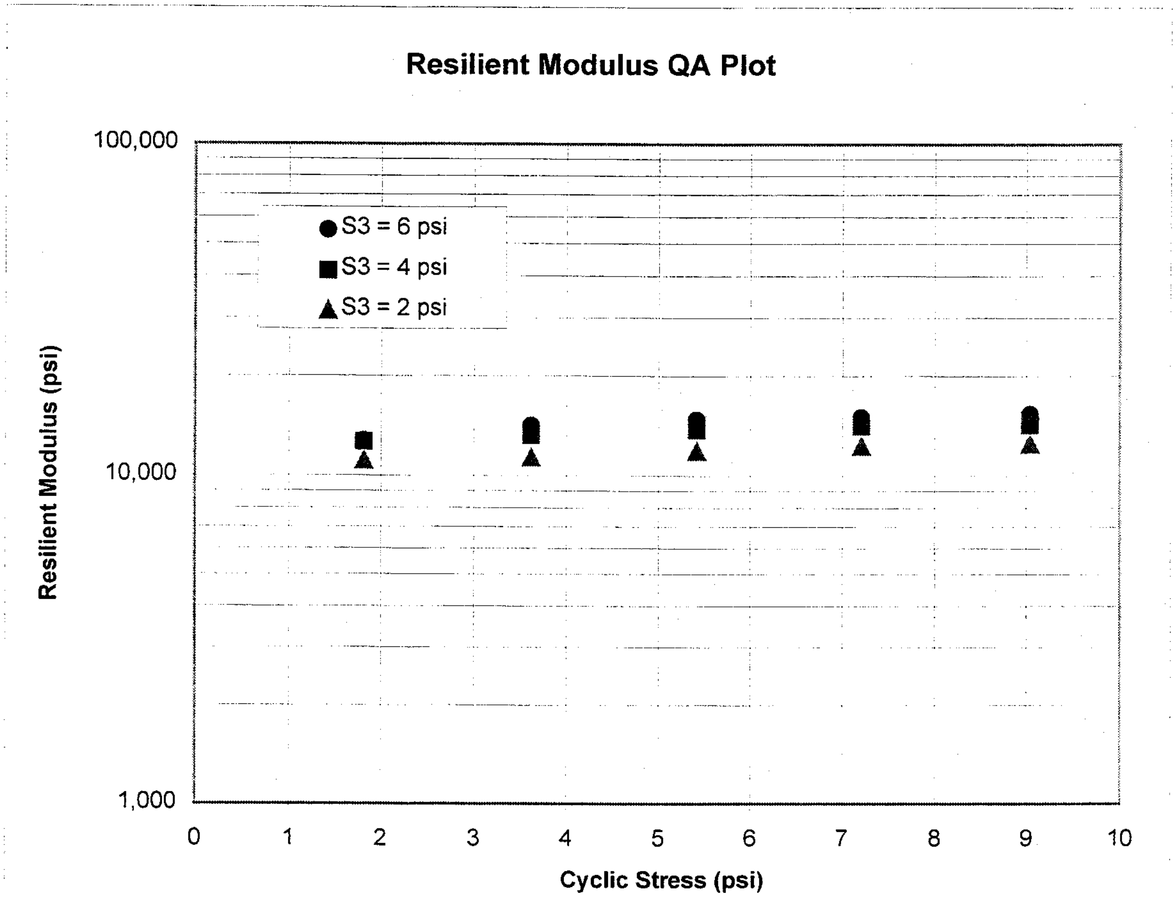
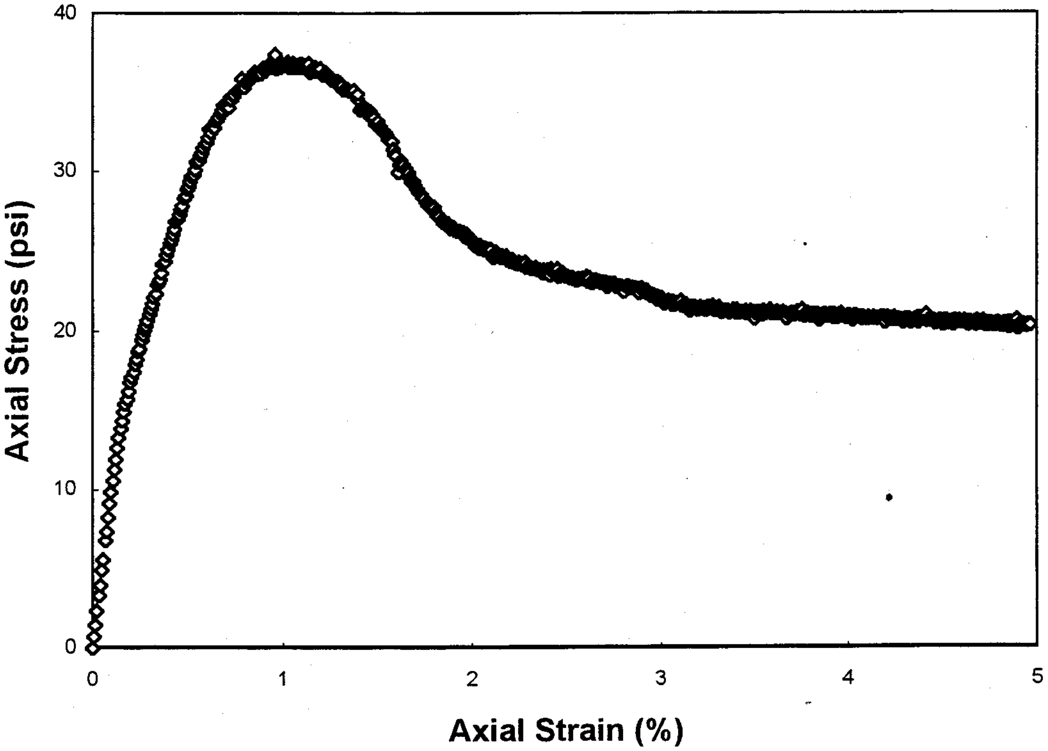


FIGURE 2 - Quick Shear Stress vs Strain

	PROJECT NAME:	TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
	LAW PROJECT NO.:	5810860101
1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Gypsum
3.	*REMOLDING TARGETS:*	95% Standard Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE*	2
5.	*TEST DATE*	10-05-1995



SHEET NO 1 OF 2

LABORATORY MATERIAL HANDLING AND TESTING
LABORATORY MATERIAL TEST DATA
RESILIENT MODULUS OF UNBOUND GRANULAR BASE/SUBBASE MATERIALS AND SUBGRADE SOILS
LAB DATA SHEET T46 - RECOMPACTED SAMPLES

UNBOUND GRANULAR BASE/SUBBASE LAYERS AND SUBGRADE SOILS
SHRP TEST DESIGNATION UG07, SS07/SHRP PROTOCOL P46

LABORATORY PERFORMING TEST: **LAW ENGINEERING, INC. - ATLANTA, GEORGIA**

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study

LAW PROJECT NO.: 5810860101

1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Gypsum
3.	*REMOLDING TARGETS:*	95% Modified Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE* (Type 1 or Type 2)	2
5.	*TEST INFORMATION*	
	PRECONDITIONING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - NUMBER OF LOAD SEQUENCES COMPLETED (0 - 15)	15
6.	*SPECIMEN INFO.:*	
	SPECIMEN DIAM., inch	
	TOP	2.86
	MIDDLE	2.86
	BOTTOM	2.86
	AVERAGE	2.86
	MEMBRANE THICKNESS (1), inch	0.01
	MEMBRANE THICKNESS (2), inch	0.01
	NET DIAM., inch	2.83
	HEIGHT OF SPECIMEN, CAP AND BASE, inch	6.05
	HEIGHT OF CAP AND BASE, inch	0.00
	INITIAL LENGTH, L_0, inch	6.05
	INITIAL AREA, A_0, in^2	6.29
	INITIAL VOLUME $A_0 L_0$, in^3	38.05
7.	*SOIL SPECIMEN WEIGHT:*	
	INITIAL WEIGHT OF CONTAINER AND WET SOIL, grams	1121.10
	FINAL WEIGHT OF CONTAINER AND WET SOIL, grams	0.00
	WEIGHT OF WET SOIL USED, grams	1121.10
8.	*SOIL PROPERTIES.:*	
	IN SITU MOISTURE CONTENT (NUCLEAR), %	N/A
	IN SITU WET DENSITY (NUCLEAR), pcf	N/A
	or	
	OPTIMUM MOISTURE CONTENT, %	19.4
	MAX. DRY DENSITY, pcf	99.9
	95 % MAX. DRY DENSITY, pcf	94.9
9.	*SPECIMEN PROPERTIES:*	
	COMPACTION MOISTURE CONTENT, %	24.3
	MOISTURE CONTENT AFTER RESILIENT MODULUS TESTING, %	24.3
	COMPACTION DRY DENSITY, γ_d pcf	90.2
10.	*QUICK SHEAR TEST*	
	STRESS - STRAIN PLOT ATTACHED (Y = YES, N = NO)	Y
	TRIAXIAL SHEAR MAXIMUM STRENGTH (MAX. LOAD/X-SECTION AREA), psi	53.9
	SPECIMEN FAIL DURING TRIAXIAL SHEAR? (Y = YES, N = NO)	Y
11.	*COMMENTS* (Section 10.4 of Protocol P46)	
	(a) *CODE*	0 0 0 0 0 0
	(b) *NOTE*	
12.	*TEST DATE*	10-05-1995

GENERAL REMARKS:

SUBMITTED BY, DATE

10/18/95

LABORATORY MANAGER

SHEET NO 2 OF 2

PROJECT NAME: TVA - Fly Ash. Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.: 5810860101
1. *MATERIAL SOURCE:* Widows Creek
2. *MATERIAL DESCRIPTION:* Gypsum
3. *REMOLDING TARGETS:* 95% Modified Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE* 2
5. *TEST DATE* 10-05-1995
6. *RESILIENT MODULUS TESTING*

COLUMN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PARAMETER	*Chamber Confining Pressure*	*Nominal Maximum Axial Stress*	*Cycle No.*	*Actual Applied Max. Axial Load*	*Actual Applied Cyclic Load*	*Actual Applied Contact Load*	*Actual Applied Max. Axial Stress*	*Actual Applied Cyclic Stress*	*Actual Applied Contact Stress*	*Recov. Def. LVDT #1 Reading*	*Recov. Def. LVDT #2 Reading*	*Average Recov Def. LVDT 1 and 2*	*Resilient Strain*	*Resilient Modulus*
DESIGNATION	S_3	S_{cyclic}	c_1	P_{max}	P_{cyclic}	$P_{contact}$	S_{max}	S_{cyclic}	$S_{contact}$	H_1	H_2	H_{avg}	ε_r	M_r
UNIT	psi	psi	---	lbs	lbs	lbs	psi	psi	psi	in.	in.	in.	in/in	psi
PRECISION	___._	___._	_	____._	___._	___._	___._	___._	__._	_._____	_._____	_._____	_._____	___
SEQUENCE 1	6.0	2.0	95	12.6	11.4	1.3	2.0	1.8	0.2	0.00078	0.00074	0.00076	0.00013	14,381
			96	12.7	11.4	1.3	2.0	1.8	0.2	0.00077	0.00076	0.00076	0.00013	14,326
			97	12.7	11.5	1.3	2.0	1.8	0.2	0.00078	0.00076	0.00077	0.00013	14,283
			98	12.7	11.4	1.3	2.0	1.8	0.2	0.00077	0.00076	0.00076	0.00013	14,334
			100	12.7	11.4	1.3	2.0	1.8	0.2	0.00078	0.00075	0.00077	0.00013	14,314
	COLUMN AVERAGE			12.7	11.4	1.3	2.0	1.8	0.2	0.00078	0.00075	0.00076	0.00013	14,328
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	35

Source: Widows Creek Description: Gypsum 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 2	6.0	4.0	95	25.1	22.7	2.4	4.0	3.6	0.4	0.00153	0.00141	0.00147	0.00024	14,842
			96	25.2	22.9	2.3	4.0	3.6	0.4	0.00153	0.00140	0.00146	0.00024	14,985
			97	25.2	22.8	2.4	4.0	3.6	0.4	0.00153	0.00141	0.00147	0.00024	14,921
			98	25.2	22.8	2.4	4.0	3.6	0.4	0.00153	0.00141	0.00147	0.00024	14,887
			100	25.1	22.7	2.4	4.0	3.6	0.4	0.00151	0.00139	0.00145	0.00024	15,018
	COLUMN AVERAGE			25.1	22.8	2.4	4.0	3.6	0.4	0.00152	0.00141	0.00146	0.00024	14,931
	STANDARD DEV.			0.0	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	71
SEQUENCE 3	6.0	6.0	95	37.8	34.1	3.6	6.0	5.4	0.6	0.00223	0.00206	0.00214	0.00035	15,305
			96	37.8	34.2	3.7	6.0	5.4	0.6	0.00223	0.00205	0.00214	0.00035	15,341
			97	37.8	34.1	3.6	6.0	5.4	0.6	0.00223	0.00205	0.00214	0.00035	15,330
			98	37.8	34.2	3.6	6.0	5.4	0.6	0.00224	0.00205	0.00214	0.00035	15,305
			100	37.8	34.1	3.6	6.0	5.4	0.6	0.00224	0.00205	0.00214	0.00035	15,288
	COLUMN AVERAGE			37.8	34.2	3.6	6.0	5.4	0.6	0.00223	0.00205	0.00214	0.00035	15,314
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	22
SEQUENCE 4	6.0	8.0	95	50.4	45.5	4.9	8.0	7.2	0.8	0.00291	0.00270	0.00280	0.00046	15,601
			96	50.3	45.4	4.9	8.0	7.2	0.8	0.00292	0.00271	0.00281	0.00047	15,499
			97	50.3	45.4	4.9	8.0	7.2	0.8	0.00290	0.00271	0.00280	0.00046	15,571
			98	50.3	45.4	4.9	8.0	7.2	0.8	0.00291	0.00269	0.00280	0.00046	15,566
			100	50.3	45.5	4.8	8.0	7.2	0.8	0.00293	0.00269	0.00281	0.00046	15,543
	COLUMN AVERAGE			50.3	45.4	4.9	8.0	7.2	0.8	0.00291	0.00270	0.00281	0.00046	15,556
	STANDARD DEV.			0.0	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	38

Source: Widows Creek Description: Gypsum 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 5	6.0	10.0	95	63.1	57.1	6.1	10.0	9.1	1.0	0.00362	0.00332	0.00347	0.00057	15,783
			96	63.1	57.0	6.1	10.0	9.1	1.0	0.00361	0.00330	0.00345	0.00057	15,858
			97	63.0	56.9	6.1	10.0	9.0	1.0	0.00362	0.00330	0.00346	0.00057	15,805
			98	63.2	57.0	6.1	10.0	9.1	1.0	0.00360	0.00332	0.00346	0.00057	15,830
			100	63.1	57.0	6.1	10.0	9.1	1.0	0.00361	0.00333	0.00347	0.00057	15,778
	COLUMN AVERAGE			63.1	57.0	6.1	10.0	9.1	1.0	0.00361	0.00331	0.00346	0.00057	15,811
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	33
SEQUENCE 6	4.0	2.0	95	13.0	11.4	1.6	2.1	1.8	0.3	0.00079	0.00081	0.00080	0.00013	13,578
			96	12.9	11.3	1.6	2.1	1.8	0.3	0.00080	0.00081	0.00080	0.00013	13,495
			97	13.0	11.3	1.7	2.1	1.8	0.3	0.00081	0.00081	0.00081	0.00013	13,457
			98	12.9	11.3	1.7	2.1	1.8	0.3	0.00079	0.00080	0.00080	0.00013	13,532
			100	13.2	11.6	1.6	2.1	1.8	0.3	0.00081	0.00082	0.00082	0.00014	13,587
	COLUMN AVERAGE			13.0	11.4	1.7	2.1	1.8	0.3	0.00080	0.00081	0.00081	0.00013	13,530
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	55
SEQUENCE 7	4.0	4.0	95	25.3	22.9	2.4	4.0	3.6	0.4	0.00162	0.00154	0.00158	0.00026	13,901
			96	25.3	22.9	2.4	4.0	3.6	0.4	0.00164	0.00154	0.00159	0.00026	13,822
			97	25.3	22.9	2.4	4.0	3.6	0.4	0.00162	0.00153	0.00158	0.00026	13,966
			98	25.3	22.9	2.4	4.0	3.6	0.4	0.00162	0.00153	0.00158	0.00026	13,942
			100	25.3	22.9	2.4	4.0	3.6	0.4	0.00162	0.00155	0.00159	0.00026	13,859
	COLUMN AVERAGE			25.3	22.9	2.4	4.0	3.6	0.4	0.00163	0.00154	0.00158	0.00026	13,898
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	59

Source: Widows Creek Description: Gypsum 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 8	4.0	6.0	95	37.7	34.1	3.6	6.0	5.4	0.6	0.00240	0.00223	0.00232	0.00038	14,146
			96	37.7	34.1	3.6	6.0	5.4	0.6	0.00241	0.00223	0.00232	0.00038	14,116
			97	37.8	34.2	3.6	6.0	5.4	0.6	0.00239	0.00222	0.00231	0.00038	14,220
			98	37.7	34.1	3.6	6.0	5.4	0.6	0.00240	0.00223	0.00232	0.00038	14,147
			100	37.7	34.1	3.6	6.0	5.4	0.6	0.00240	0.00222	0.00231	0.00038	14,187
	COLUMN AVERAGE			37.7	34.1	3.6	6.0	5.4	0.6	0.00240	0.00223	0.00231	0.00038	14,163
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	41
SEQUENCE 9	4.0	8.0	95	50.4	45.6	4.9	8.0	7.2	0.8	0.00312	0.00292	0.00302	0.00050	14,505
			96	50.5	45.6	4.9	8.0	7.2	0.8	0.00314	0.00292	0.00303	0.00050	14,463
			97	50.4	45.5	4.9	8.0	7.2	0.8	0.00312	0.00292	0.00302	0.00050	14,485
			98	50.4	45.6	4.9	8.0	7.2	0.8	0.00314	0.00293	0.00303	0.00050	14,421
			100	50.3	45.4	4.9	8.0	7.2	0.8	0.00313	0.00290	0.00302	0.00050	14,465
	COLUMN AVERAGE			50.4	45.5	4.9	8.0	7.2	0.8	0.00313	0.00292	0.00302	0.00050	14,468
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	31
SEQUENCE 10	4.0	10.0	95	63.2	57.1	6.1	10.0	9.1	1.0	0.00388	0.00363	0.00375	0.00062	14,598
			96	63.2	57.1	6.1	10.0	9.1	1.0	0.00387	0.00363	0.00375	0.00062	14,634
			97	63.2	57.1	6.1	10.0	9.1	1.0	0.00387	0.00363	0.00375	0.00062	14,626
			98	63.2	57.1	6.1	10.0	9.1	1.0	0.00387	0.00363	0.00375	0.00062	14,620
			100	63.1	57.0	6.1	10.0	9.0	1.0	0.00388	0.00363	0.00375	0.00062	14,577
	COLUMN AVERAGE			63.2	57.1	6.1	10.0	9.1	1.0	0.00387	0.00363	0.00375	0.00062	14,611
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00000	0.00000	0.00000	0.00000	23

Source: Widows Creek Description: Gypsum 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 11	2.0	2.0	95	13.3	11.3	2.1	2.1	1.8	0.3	0.00089	0.00095	0.00092	0.00015	11,756
			96	13.3	11.3	2.0	2.1	1.8	0.3	0.00089	0.00096	0.00092	0.00015	11,735
			97	13.4	11.4	2.0	2.1	1.8	0.3	0.00091	0.00094	0.00093	0.00015	11,822
			98	13.4	11.3	2.1	2.1	1.8	0.3	0.00090	0.00094	0.00092	0.00015	11,815
			100	13.4	11.3	2.1	2.1	1.8	0.3	0.00090	0.00094	0.00092	0.00015	11,796
	COLUMN AVERAGE			13.4	11.3	2.1	2.1	1.8	0.3	0.00090	0.00095	0.00092	0.00015	11,785
	STANDARD DEV.			0.0	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	38
SEQUENCE 12	2.0	4.0	95	25.1	22.8	2.4	4.0	3.6	0.4	0.00189	0.00184	0.00186	0.00031	11,740
			96	25.2	22.8	2.4	4.0	3.6	0.4	0.00189	0.00184	0.00187	0.00031	11,756
			97	25.2	22.8	2.4	4.0	3.6	0.4	0.00188	0.00185	0.00186	0.00031	11,755
			98	25.1	22.8	2.4	4.0	3.6	0.4	0.00187	0.00185	0.00186	0.00031	11,780
			100	25.2	22.8	2.4	4.0	3.6	0.4	0.00190	0.00184	0.00187	0.00031	11,743
	COLUMN AVERAGE			25.2	22.8	2.4	4.0	3.6	0.4	0.00188	0.00184	0.00186	0.00031	11,755
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00000	0.00000	16
SEQUENCE 13	2.0	6.0	95	37.6	34.0	3.6	6.0	5.4	0.6	0.00275	0.00263	0.00269	0.00044	12,134
			96	37.6	34.0	3.6	6.0	5.4	0.6	0.00277	0.00263	0.00270	0.00045	12,104
			97	37.6	34.0	3.6	6.0	5.4	0.6	0.00276	0.00262	0.00269	0.00044	12,153
			98	37.8	34.2	3.6	6.0	5.4	0.6	0.00277	0.00262	0.00270	0.00045	12,159
			100	37.5	33.9	3.6	6.0	5.4	0.6	0.00277	0.00262	0.00269	0.00045	12,087
	COLUMN AVERAGE			37.6	34.0	3.6	6.0	5.4	0.6	0.00276	0.00262	0.00269	0.00045	12,128
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	31

Source: Widows Creek Description: Gypsum 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 14	2.0	8.0	95	50.5	45.6	4.9	8.0	7.3	0.8	0.00358	0.00338	0.00348	0.00058	12,593
			96	50.6	45.7	4.9	8.0	7.3	0.8	0.00360	0.00338	0.00349	0.00058	12,580
			97	50.5	45.6	4.9	8.0	7.2	0.8	0.00358	0.00340	0.00349	0.00058	12,561
			98	50.5	45.6	4.9	8.0	7.2	0.8	0.00359	0.00340	0.00349	0.00058	12,541
			100	50.4	45.5	4.9	8.0	7.2	0.8	0.00356	0.00338	0.00347	0.00057	12,592
	COLUMN AVERAGE			50.5	45.6	4.9	8.0	7.2	0.8	0.00358	0.00339	0.00348	0.00058	12,574
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	22
SEQUENCE 15	2.0	10.0	95	63.2	57.1	6.1	10.0	9.1	1.0	0.00441	0.00419	0.00430	0.00071	12,746
			96	63.2	57.1	6.1	10.0	9.1	1.0	0.00442	0.00421	0.00432	0.00071	12,693
			97	63.2	57.1	6.1	10.0	9.1	1.0	0.00442	0.00420	0.00431	0.00071	12,737
			98	63.2	57.1	6.1	10.0	9.1	1.0	0.00442	0.00419	0.00430	0.00071	12,753
			100	63.2	57.0	6.1	10.0	9.1	1.0	0.00441	0.00420	0.00430	0.00071	12,726
	COLUMN AVERAGE			63.2	57.1	6.1	10.0	9.1	1.0	0.00442	0.00420	0.00431	0.00071	12,731
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	24

SUBMITTED BY, DATE
Richard P. Boudreau 10/18/95
LABORATORY MANAGER

FIGURE 1 - Logarithmic Plot of Resilient Modulus (M_R) vs Cyclic Stress (S_C)

PROJECT NAME:		TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.:		5810860101
1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Gypsum
3.	*REMOLDING TARGETS:*	95% Modified Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE*	2
5.	*TEST DATE*	10-05-1995

$$M_R = K1\,(S_C)^{K2}(1+S_3)^{K5}$$

K1 = 8,454

K2 = 0.05337

K5 = 0.26140

R^2 = 0.99

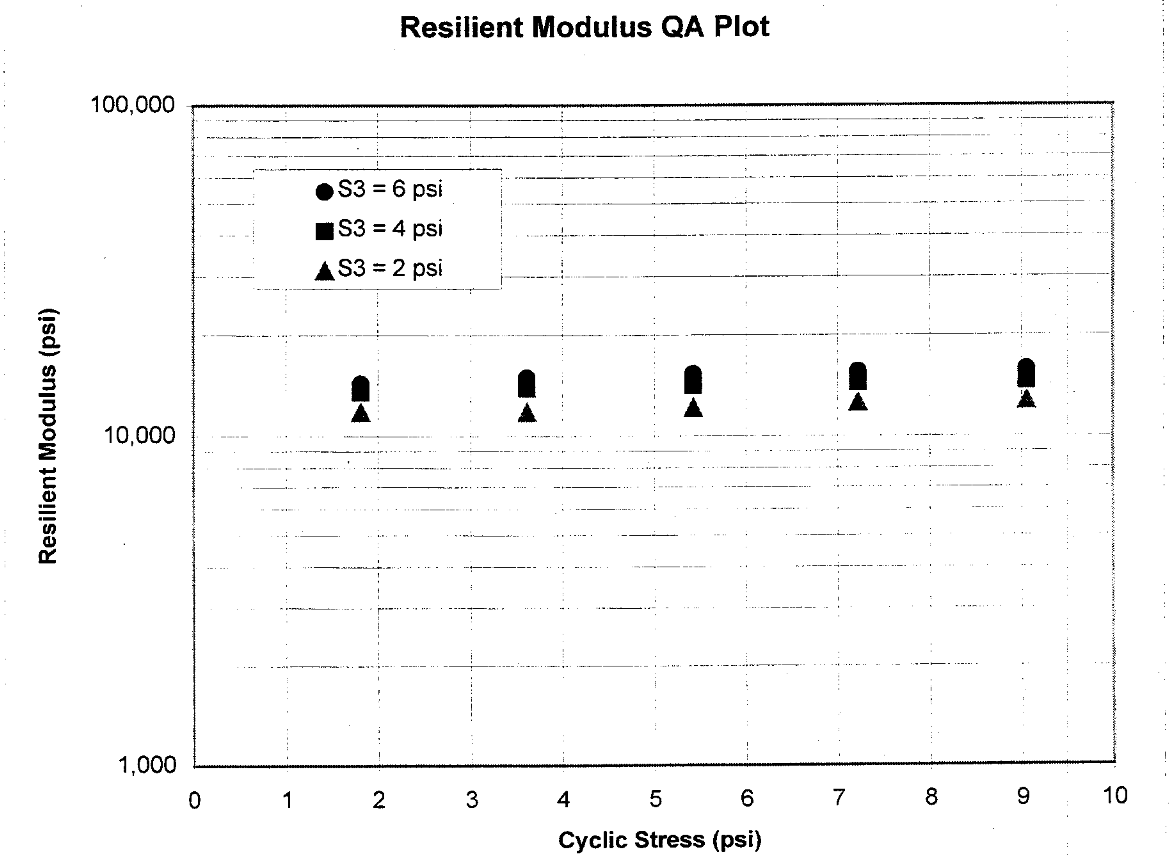
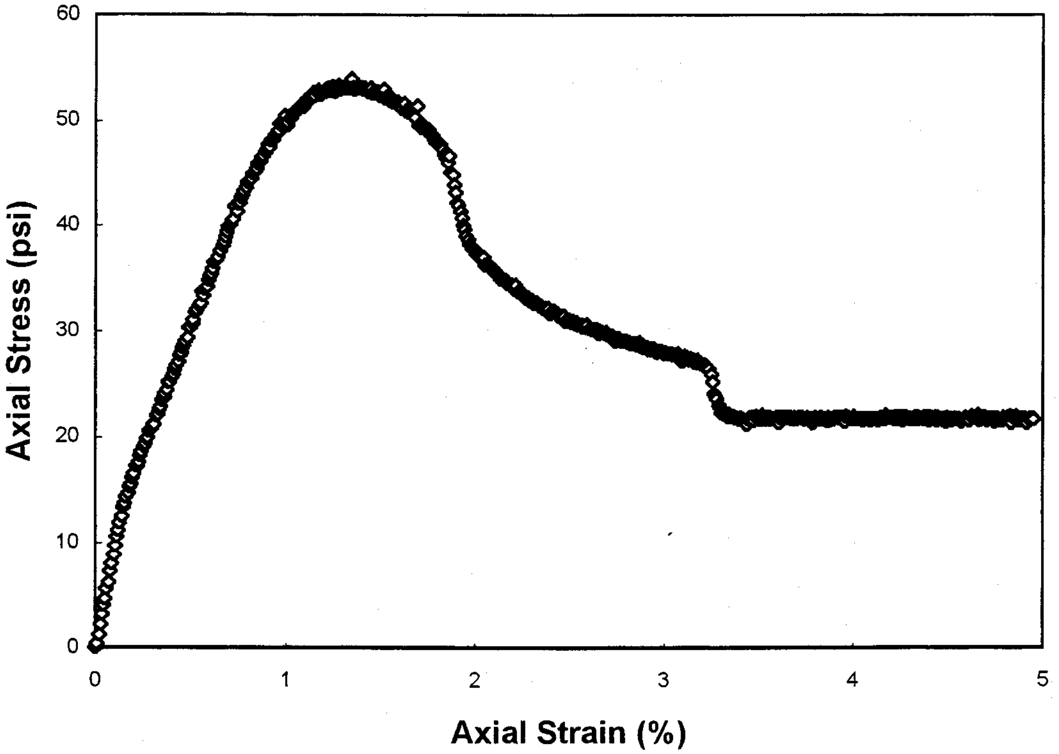


FIGURE 2 - Quick Shear Stress vs Strain

PROJECT NAME:	TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.:	5810860101
1. *MATERIAL SOURCE:*	Widows Creek
2. *MATERIAL DESCRIPTION:*	Gypsum
3. *REMOLDING TARGETS:*	95% Modified Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE*	2
5. *TEST DATE*	10-05-1995



WIDOWS CREEK

Bottom Ash - From Pond

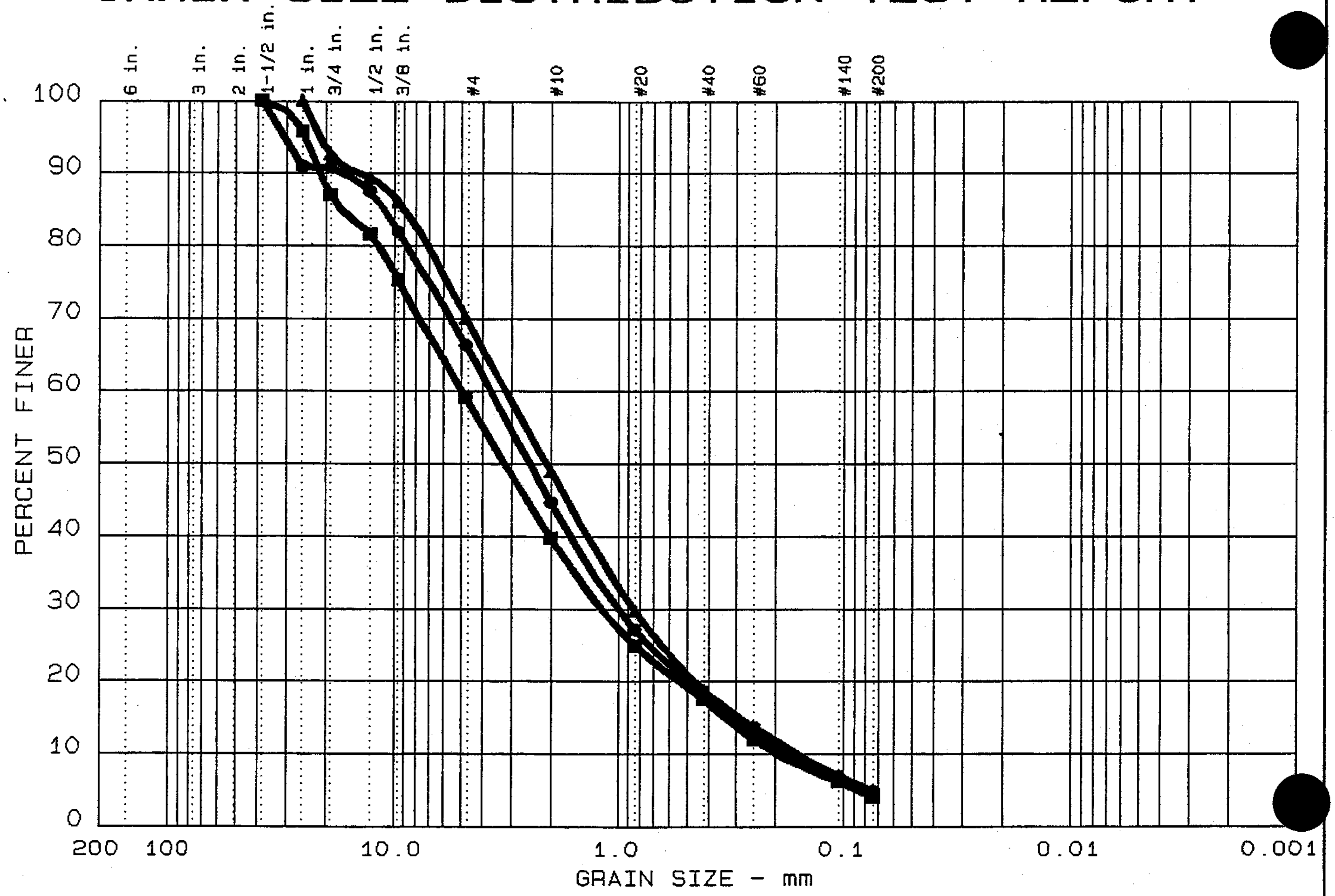
Grain Size Distribution Test Report
Moisture-Density Relationship (Standard Proctor)
Moisture-Density Relationship (Modified Proctor)
Relative Density Test
Hydraulic Conductivity - Constant Head (2 Pages)
California Bearing Ratio
Resilient Modulus (Standard Proctor) (9 Pages)
Resilient Modulus (Modified Proctor) (9 Pages)

TVA - WIDOWS CREEK
BOTTOM ASH - FROM POND

Description	Test Method	Property	Sample 1	Sample 2	Sample 3
Grain Size	ASTM D 422	Percent Retained on the #4 Sieve Percent Passing the #200 Sieve	33.7 4.8	29.9 4.1	40.9 4.5
Atterberg Limits	ASTM D 4318	Liquid Limit Plastic Limit Plasticity Index	NL NP N/A	NL NP N/A	NL NP N/A
Specific Gravity	ASTM D 854	Specific Gravity at 20°C	2.74	2.60	2.67
Classification	ASTM D 2487 AASHTO M 145	Unified Soil Classification System (USCS) AASHTO Classification	SW A-1-a	SW A-1-a	SW A-1-a
				Composite Sample	
Moisture-Density Relations (Standard Effort)	ASTM D 698	Maximum Dry Density, pcf Optimum Moisture Content, %	106.2 17.6		
Moisture-Density Relations (Modified Effort)	ASTM D 1557	Maximum Dry Density, pcf Optimum Moisture Content, %	120.8 15.8		
Relative Density	ASTM D 4254 ASTM D 4253	Minimum Dry Density, pcf Maximum Dry Density (Dry Method), pcf	83.0 103.3		
			Result	**Dry Density, pcf**	**Moisture Content, %**
Hydraulic Conductivity	ASTM D 2434	Hydraulic Conductivity, cm/sec	3.4E-2	90.8	0.0
Angle of Repose	LAW TP6	Angle of Repose, degrees	29.0	83.0	0.0
California Bearing Ratio	ASTM D 1883	CBR, %	30	95.2	16.4
Resilient Modulus (Standard Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	7,379	104.5	12.0
Resilient Modulus (Modified Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	4,788	117.1	11.2
Soil Resistivity	AASHTO T 288	Minimum Resistivity, Ohm-cm	3,100		
pH of Soil	AASHTO T 289	pH	8.0		
Water Soluble Sulfate Ion	AASHTO T 290	Sulfate Ion Content, mg/kg	4070		
Water Soluble Chloride Ion	AASHTO T 290	Chloride Ion Content, mg/kg	130		

wcf-ba.xls

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	20	0.0	33.7	61.5	4.8	
▲	19	0.0	29.9	66.0	4.1	
■	18	0.0	40.9	54.6	4.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NL	NP	10.96	3.67	2.48	0.989	0.2884	0.1567	1.70	23.4
▲	NL	NP	8.91	3.16	2.09	0.851	0.3090	0.1841	1.24	17.2
■	NL	NP	16.98	4.95	3.20	1.175	0.3311	0.1972	1.41	25.1

	MATERIAL DESCRIPTION	USCS	AASHTO
●		SW	A-1-a
▲		SW	A-1-a
■		SW	A-1-a

Project No.: 5810860101
Project: TVA - Widows Creek
● Location: Bottom Ash A & B
▲ Location: Bottom Ash C & D
■ Location: Bottom Ash E & F
Date: July 18, 1995

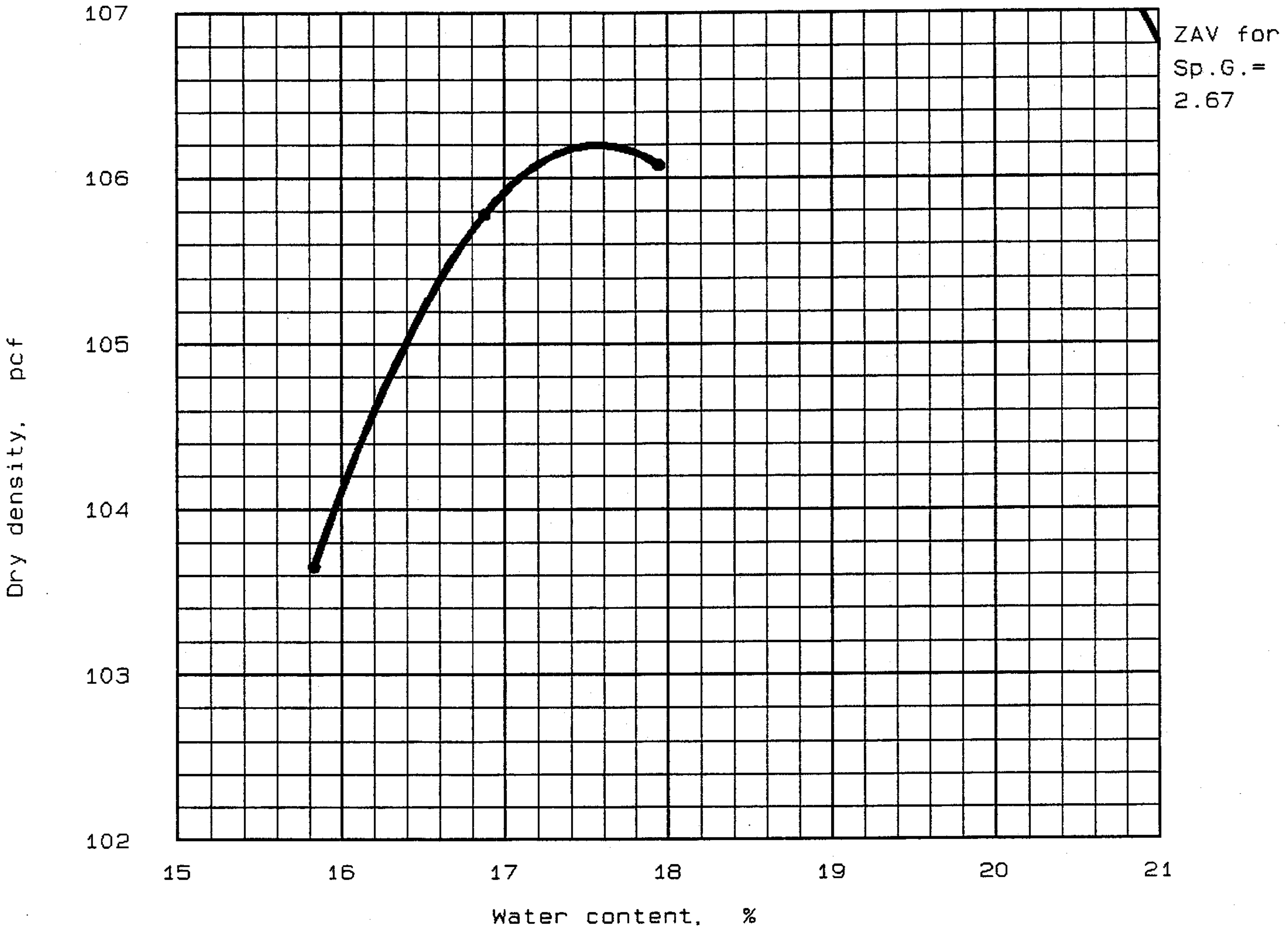
Remarks:
Tested by: JCR
Reviewed by: HS

GRAIN SIZE DISTRIBUTION TEST REPORT

LAW ENGINEERING, INC.

Figure No.

MOISTURE-DENSITY RELATIONSHIP



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SW	A-1-a	3.55 %	2.67	NL	NP	34.8 %	4.47 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 17.6 % Maximum dry density = 106.2 pcf	

Project No.: 5810860101

Project: TVA - Widows Creek

Location: Bottom Ash

Date: July 25, 1995

MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

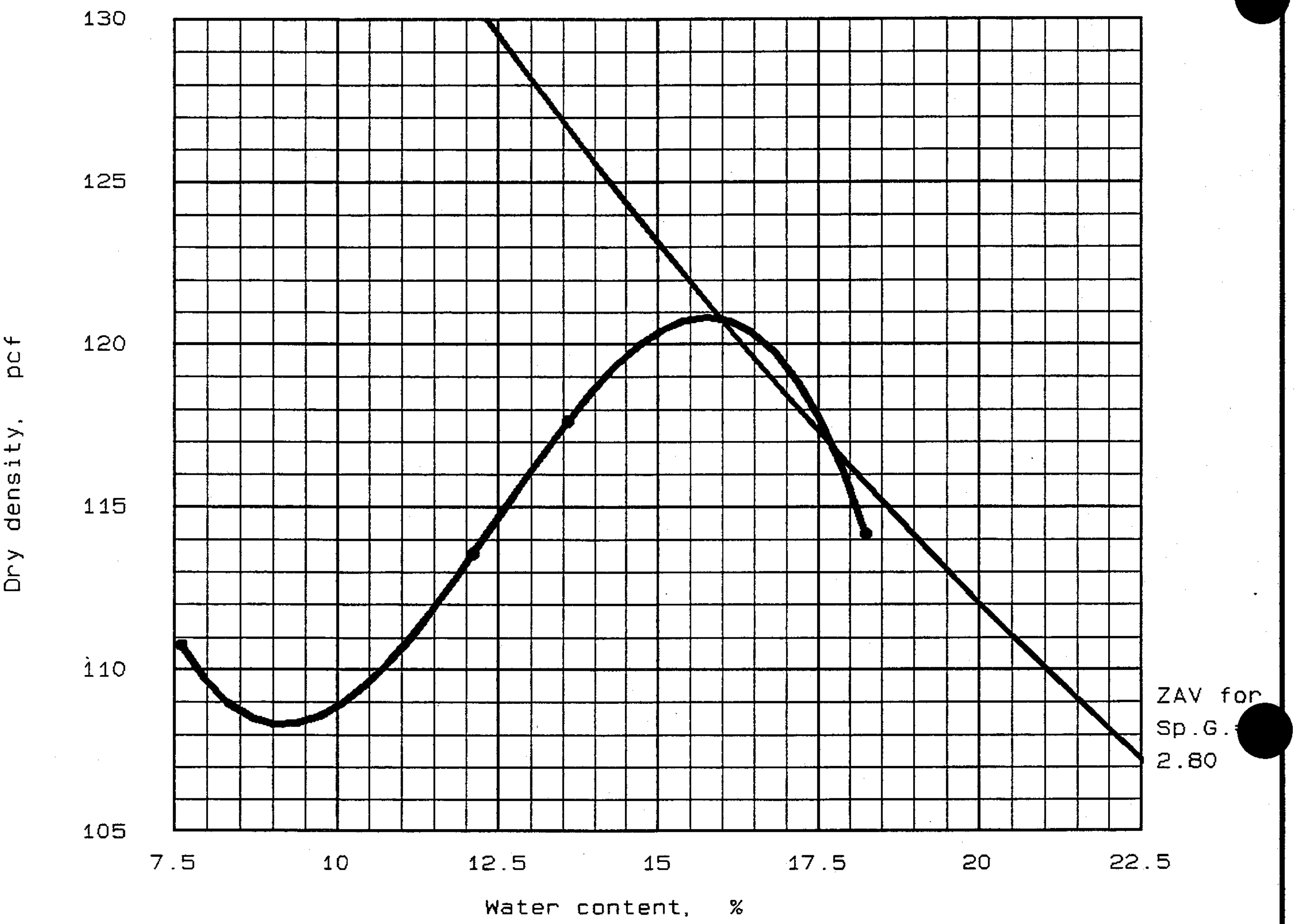
Remarks:

Tested by: JCN

Reviewed by: RWB

Figure No. ______

MOISTURE-DENSITY RELATIONSHIP



"Modified" Proctor, ASTM D 1557, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SW	A-1-a	3.55 %	2.67	NL	NP	34.8 %	4.47 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 15.8 % Maximum dry density = 120.8 pcf	

Project No.: 5810860101

Project: TVA - Widows Creek

Location: Bottom Ash

Date: July 25, 1995

MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

Remarks:

Tested by: JCR

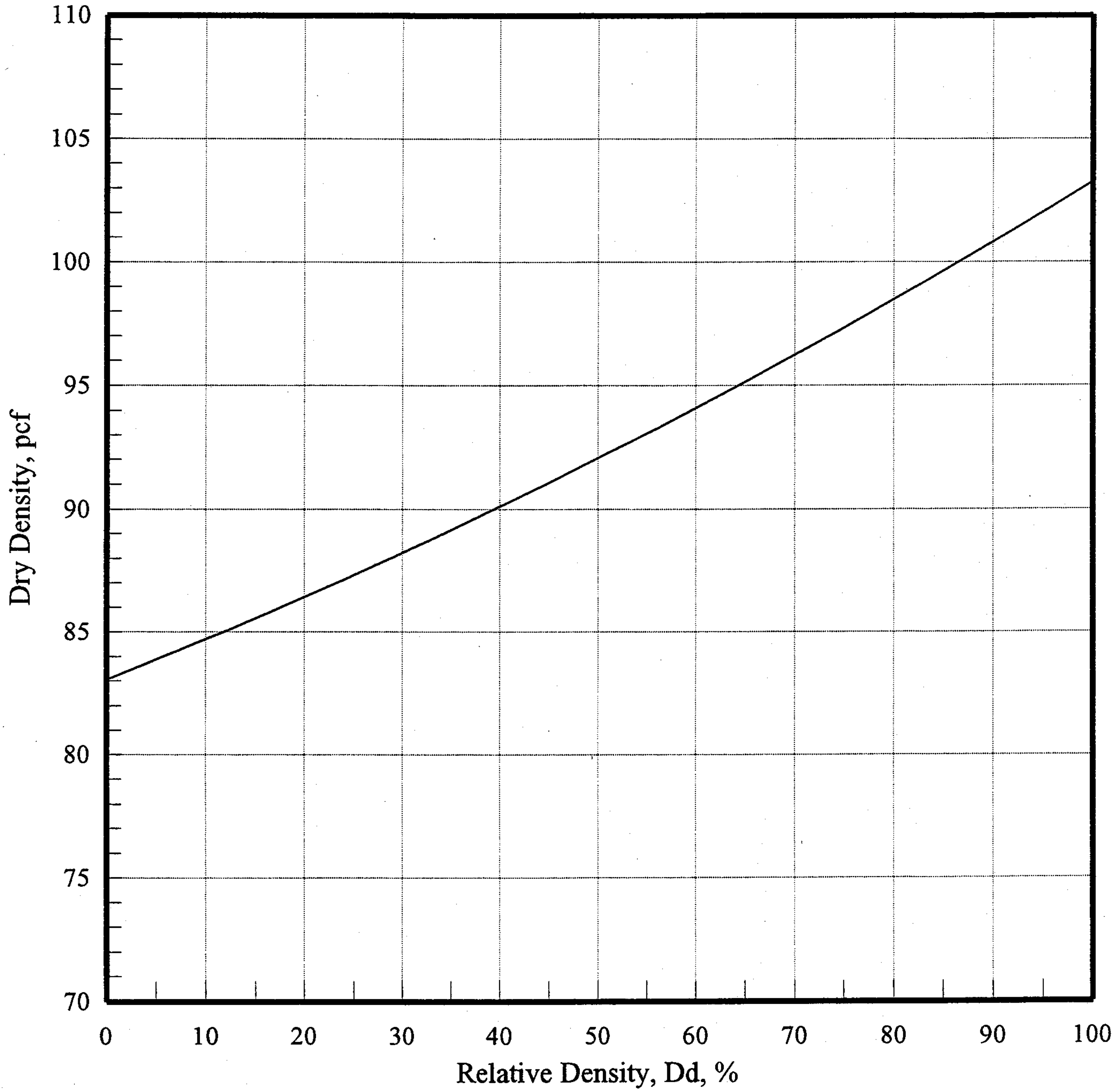
Reviewed by: RWB

Figure No. ______

Relative Density Test

TVA - Widows Creek, Bottom Ash

Law Project No. 5810860101



HYDRAULIC CONDUCTIVITY

LAW ENGINEERING

Project No.	*5810860101*	Tested By	*JCR*
Project Name	*TVA - Widows Creek*	Test Date	*08/17/95*
Material	*Bottom Ash*	Reviewed By	*RLB*
		Review Date	*09/06/95*

ASTM D2434-68 Constant Head Permeability

Sample Type:	*Remolded*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*0.0*
Wet Unit Weight, pcf:	*90.8*
Dry Unit Weight, pcf:	*90.8*
Compaction, %:	*85.5*
Hydraulic Conductivity, cm/sec. @20° C:	***3.4E-02***

PERMEABILITY TEST - Constant Head
(ASTM D2434 - 68)

LAW ENGINEERING

Project No.	5810860101	Tested By	JCR
Project Name	TVA - Widows Creek	Test Date	08/17/95
Material	Bottom Ash	Reviewed By	RLB
		Review Date	09/06/95

Sample Data

Length, in		Diameter, in		Pan No.	
Location 1	5.636	Location 1	2.858	Wet Soil + Pan, grams	857.45
Location 2	5.513	Location 2	2.875	Dry Soil+Pan, grams	857.45
Location3	5.577	Location 3	2.868	Pan Weight, grams	0.00
Average	5.575	Average	2.867	Moisture Content, %	0.0
		Sample wet weight, grams	857.45	Wet Unit Wt, pcf	90.8
		Membrane, Cap weight, grams	0.00	Dry Unit Wt, pcf	90.8

Time (sec)	Q (cm ³)	H (cm)	k (cm/sec)	Temp ° C	k (cm/sec at 20° C)	i (cm/cm)
600	325.00	5.08	3.6E-02	20.0	3.6E-02	0.36
1200	610.00	5.08	3.4E-02	20.0	3.4E-02	0.36

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
2	Remolded	106.2	85.5	Vertical

L = length of sample in cm
A = area of sample in cm²

H = constant head in cm
t = time in seconds

A = 41.65 cm²
L = 14.161 cm

Avg. k at 20° C 3.4E-02 cm/sec

California Bearing Ratio

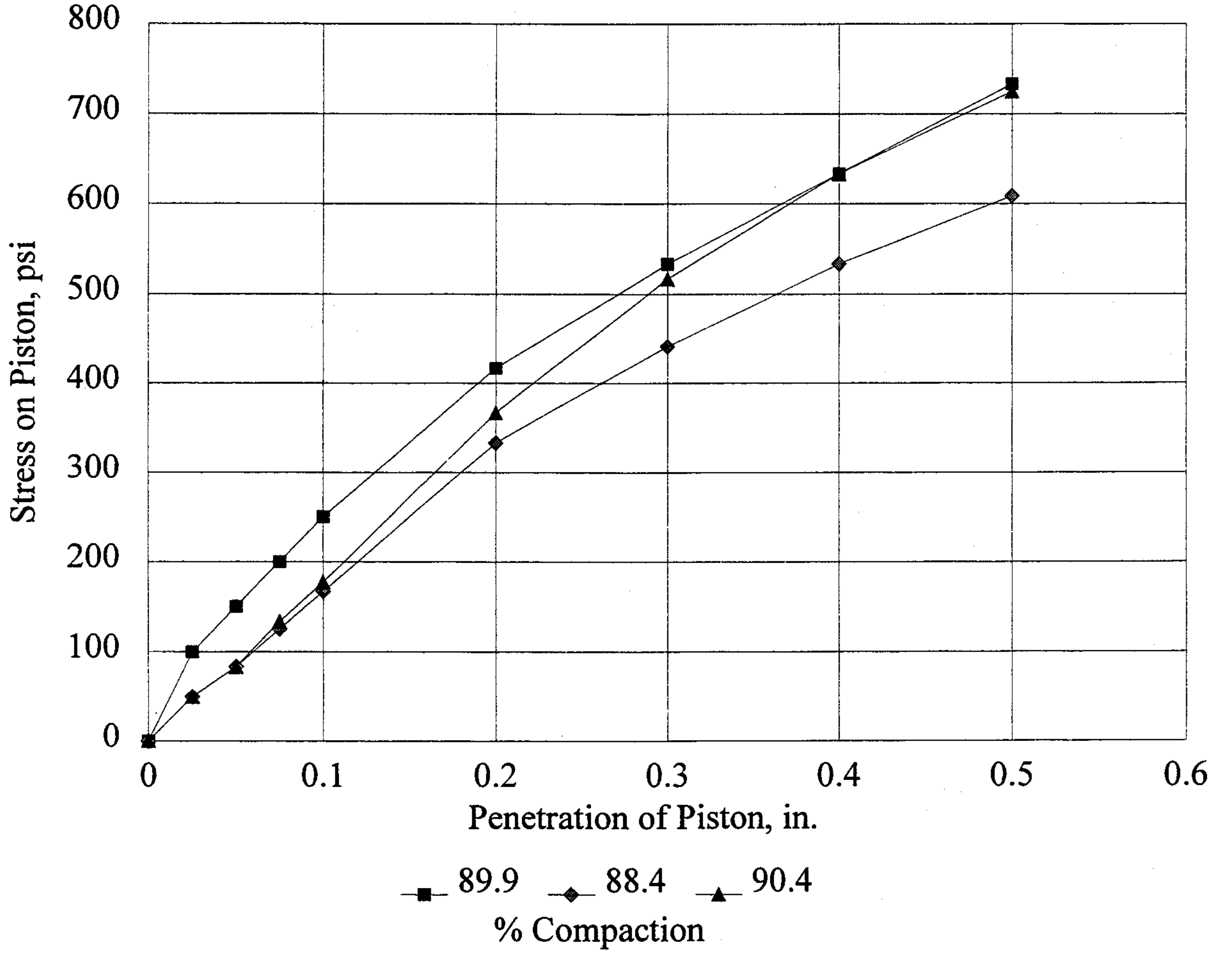
(ASTM D1883-92)

LAW ENGINEERING

Project No. 5810860101
Project Name TVA - Widows Creek
Material (Source) Bottom Ash

Tested By EM
Test Date 08/18/95
Reviewed By RLB
Review Date 08/23/95

Compaction, %	89.9	88.4	90.4
Before Soak Dry Density, pcf	95.5	94.0	96.1
Before Soak Moisture Content,	15.7	16.6	16.9
After Soak Dry Density, pcf	96.5	94.3	96.5
After Soak Moisture Content, %	17.9	18.9	18.2
CBR @ 0.1 in.	25.0	16.7	17.7
CBR @ 0.2 in.	27.8	22.2	24.4



SHEET NO 1 OF 2

LABORATORY MATERIAL HANDLING AND TESTING
LABORATORY MATERIAL TEST DATA
RESILIENT MODULUS OF UNBOUND GRANULAR BASE/SUBBASE MATERIALS AND SUBGRADE SOILS
LAB DATA SHEET T46 - RECOMPACTED SAMPLES

UNBOUND GRANULAR BASE/SUBBASE LAYERS AND SUBGRADE SOILS
SHRP TEST DESIGNATION UG07, SS07/SHRP PROTOCOL P46

LABORATORY PERFORMING TEST: **LAW ENGINEERING, INC. - ATLANTA, GEORGIA**

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study

LAW PROJECT NO.: 5810860101

1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Bottom Ash
3.	*REMOLDING TARGETS:*	95% Standard Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE* (Type 1 or Type 2)	2
5.	*TEST INFORMATION*	
	PRECONDITIONING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - NUMBER OF LOAD SEQUENCES COMPLETED (0 - 15)	15
6.	*SPECIMEN INFO.:*	
	SPECIMEN DIAM., inch	
	TOP	2.86
	MIDDLE	2.86
	BOTTOM	2.87
	AVERAGE	2.86
	MEMBRANE THICKNESS (1), inch	0.01
	MEMBRANE THICKNESS (2), inch	0.01
	NET DIAM., inch	2.84
	HEIGHT OF SPECIMEN, CAP AND BASE, inch	6.06
	HEIGHT OF CAP AND BASE, inch	0.00
	INITIAL LENGTH, L_0, inch	6.06
	INITIAL AREA, A_0, in^2	6.32
	INITIAL VOLUME $A_0 L_0$, in^3	38.28
7.	*SOIL SPECIMEN WEIGHT:*	
	INITIAL WEIGHT OF CONTAINER AND WET SOIL, grams	1580.50
	FINAL WEIGHT OF CONTAINER AND WET SOIL, grams	403.90
	WEIGHT OF WET SOIL USED, grams	1176.60
8.	*SOIL PROPERTIES.:*	
	IN SITU MOISTURE CONTENT (NUCLEAR), %	N/A
	IN SITU WET DENSITY (NUCLEAR), pcf	N/A
	or	
	OPTIMUM MOISTURE CONTENT, %	17.6
	MAX. DRY DENSITY, pcf	106.2
	95 % MAX. DRY DENSITY, pcf	100.9
9.	*SPECIMEN PROPERTIES:*	
	COMPACTION MOISTURE CONTENT, %	12.0
	MOISTURE CONTENT AFTER RESILIENT MODULUS TESTING, %	12.0
	COMPACTION DRY DENSITY, γ_d pcf	104.5
10.	*QUICK SHEAR TEST*	
	STRESS - STRAIN PLOT ATTACHED (Y = YES, N = NO)	Y
	TRIAXIAL SHEAR MAXIMUM STRENGTH (MAX. LOAD/X-SECTION AREA), psi	36.0
	SPECIMEN FAIL DURING TRIAXIAL SHEAR? (Y = YES, N = NO)	Y
11.	*COMMENTS* (Section 10.4 of Protocol P46)	
	(a) *CODE*	0 0 0 0 0 0
	(b) *NOTE*	
12.	*TEST DATE*	08-23-1995

GENERAL REMARKS:

SUBMITTED BY, DATE

9/10/95

LABORATORY MANAGER

SHEET NO 2 OF 2

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.: 5810860101
1. *MATERIAL SOURCE:* Widows Creek
2. *MATERIAL DESCRIPTION:* Bottom Ash
3. *REMOLDING TARGETS:* 95% Standard Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE* 2
5. *TEST DATE* 08-23-1995
6. *RESILIENT MODULUS TESTING*

COLUMN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PARAMETER	*Chamber Confining Pressure*	*Nominal Maximum Axial Stress*	*Cycle No.*	*Actual Applied Max. Axial Load*	*Actual Applied Cyclic Load*	*Actual Applied Contact Load*	*Actual Applied Max. Axial Stress*	*Actual Applied Cyclic Stress*	*Actual Applied Contact Stress*	*Recov. Def. LVDT #1 Reading*	*Recov. Def. LVDT #2 Reading*	*Average Recov Def. LVDT 1 and 2*	*Resilient Strain*	*Resilient Modulus*
DESIGNATION	S_3	S_{cyclic}	c_1	P_{max}	P_{cyclic}	$P_{contact}$	S_{max}	S_{cyclic}	$S_{contact}$	H_1	H_2	H_{avg}	ε_r	M_r
UNIT	psi	psi	---	lbs	lbs	lbs	psi	psi	psi	in.	in.	in.	in/in	psi
PRECISION	___._	___._	_	____._	___._	___._	___._	___._	__._	_._____	_._____	_._____	_._____	___.
SEQUENCE 1	6.0	2.0	1	12.8	11.5	1.3	2.0	1.8	0.2	0.00108	0.00125	0.00116	0.00019	9,514
			2	12.9	11.6	1.3	2.0	1.8	0.2	0.00107	0.00125	0.00116	0.00019	9,614
			3	12.8	11.5	1.3	2.0	1.8	0.2	0.00107	0.00125	0.00116	0.00019	9,488
			4	12.8	11.5	1.3	2.0	1.8	0.2	0.00107	0.00125	0.00116	0.00019	9,510
			5	12.9	11.6	1.3	2.0	1.8	0.2	0.00109	0.00126	0.00117	0.00019	9,477
	COLUMN AVERAGE			12.8	11.6	1.3	2.0	1.8	0.2	0.00108	0.00125	0.00116	0.00019	9,521
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	55

Source: Widows Creek Description: Bottom Ash 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 2	6.0	4.0	1	25.5	23.1	2.4	4.0	3.7	0.4	0.00185	0.00210	0.00198	0.00033	11,215
			2	25.4	23.0	2.4	4.0	3.6	0.4	0.00185	0.00210	0.00198	0.00033	11,170
			3	25.5	23.1	2.4	4.0	3.7	0.4	0.00185	0.00208	0.00197	0.00032	11,280
			4	25.5	23.1	2.4	4.0	3.7	0.4	0.00185	0.00210	0.00198	0.00033	11,223
			5	25.4	23.0	2.4	4.0	3.6	0.4	0.00185	0.00208	0.00197	0.00032	11,246
	COLUMN AVERAGE			25.5	23.1	2.4	4.0	3.7	0.4	0.00185	0.00209	0.00197	0.00033	11,227
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00001	0.00000	40
SEQUENCE 3	6.0	6.0	1	38.0	34.3	3.6	6.0	5.4	0.6	0.00269	0.00298	0.00284	0.00047	11,618
			2	37.9	34.3	3.6	6.0	5.4	0.6	0.00270	0.00297	0.00284	0.00047	11,615
			3	37.9	34.3	3.6	6.0	5.4	0.6	0.00269	0.00297	0.00283	0.00047	11,619
			4	37.9	34.3	3.6	6.0	5.4	0.6	0.00270	0.00296	0.00283	0.00047	11,626
			5	37.9	34.3	3.6	6.0	5.4	0.6	0.00270	0.00298	0.00284	0.00047	11,586
	COLUMN AVERAGE			37.9	34.3	3.6	6.0	5.4	0.6	0.00270	0.00297	0.00283	0.00047	11,613
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00000	0.00000	16
SEQUENCE 4	6.0	8.0	1	50.8	45.9	4.9	8.0	7.3	0.8	0.00357	0.00387	0.00372	0.00061	11,843
			2	50.8	45.9	4.9	8.0	7.3	0.8	0.00358	0.00387	0.00372	0.00061	11,846
			3	50.8	45.9	4.9	8.0	7.3	0.8	0.00357	0.00388	0.00373	0.00061	11,820
			4	50.9	46.0	4.9	8.1	7.3	0.8	0.00356	0.00388	0.00372	0.00061	11,849
			5	50.8	45.9	4.9	8.0	7.3	0.8	0.00357	0.00389	0.00373	0.00062	11,821
	COLUMN AVERAGE			50.8	45.9	4.9	8.0	7.3	0.8	0.00357	0.00388	0.00372	0.00061	11,836
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00000	0.00000	14

Source: Widows Creek Description: Bottom Ash 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 5	6.0	10.0	1	63.6	57.5	6.1	10.1	9.1	1.0	0.00439	0.00475	0.00457	0.00075	12,071
			2	63.5	57.4	6.1	10.1	9.1	1.0	0.00440	0.00475	0.00458	0.00076	12,038
			3	63.6	57.5	6.1	10.1	9.1	1.0	0.00441	0.00476	0.00458	0.00076	12,034
			4	63.6	57.4	6.1	10.1	9.1	1.0	0.00440	0.00475	0.00458	0.00076	12,038
			5	63.6	57.5	6.1	10.1	9.1	1.0	0.00441	0.00475	0.00458	0.00076	12,031
	COLUMN AVERAGE			63.6	57.5	6.1	10.1	9.1	1.0	0.00440	0.00475	0.00458	0.00076	12,042
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00000	0.00000	16
SEQUENCE 6	4.0	2.0	1	13.0	11.4	1.6	2.1	1.8	0.3	0.00140	0.00157	0.00148	0.00024	7,377
			2	13.0	11.4	1.7	2.1	1.8	0.3	0.00139	0.00156	0.00147	0.00024	7,408
			3	13.0	11.4	1.6	2.1	1.8	0.3	0.00141	0.00157	0.00149	0.00025	7,356
			4	13.0	11.3	1.6	2.1	1.8	0.3	0.00139	0.00156	0.00147	0.00024	7,387
			5	13.0	11.3	1.6	2.1	1.8	0.3	0.00139	0.00156	0.00147	0.00024	7,381
	COLUMN AVERAGE			13.0	11.4	1.6	2.1	1.8	0.3	0.00139	0.00156	0.00148	0.00024	7,382
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00001	0.00000	19
SEQUENCE 7	4.0	4.0	1	25.6	23.3	2.3	4.1	3.7	0.4	0.00269	0.00294	0.00281	0.00046	7,948
			2	25.6	23.3	2.4	4.1	3.7	0.4	0.00267	0.00294	0.00281	0.00046	7,956
			3	25.6	23.3	2.4	4.1	3.7	0.4	0.00266	0.00294	0.00280	0.00046	7,988
			4	25.7	23.3	2.4	4.1	3.7	0.4	0.00267	0.00294	0.00281	0.00046	7,971
			5	25.6	23.2	2.4	4.1	3.7	0.4	0.00267	0.00294	0.00281	0.00046	7,945
	COLUMN AVERAGE			25.6	23.3	2.4	4.1	3.7	0.4	0.00267	0.00294	0.00281	0.00046	7,962
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00001	0.00000	18

Source: Widows Creek Description: Bottom Ash 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 8	4.0	6.0	1	38.1	34.5	3.6	6.0	5.5	0.6	0.00364	0.00394	0.00379	0.00063	8,740
			2	38.0	34.4	3.6	6.0	5.5	0.6	0.00363	0.00393	0.00378	0.00062	8,742
			3	38.2	34.6	3.6	6.0	5.5	0.6	0.00364	0.00394	0.00379	0.00062	8,763
			4	38.2	34.6	3.6	6.1	5.5	0.6	0.00364	0.00394	0.00379	0.00062	8,771
			5	38.2	34.6	3.6	6.0	5.5	0.6	0.00363	0.00394	0.00379	0.00062	8,769
	COLUMN AVERAGE			38.1	34.6	3.6	6.0	5.5	0.6	0.00364	0.00394	0.00379	0.00062	8,757
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00000	0.00000	0.00000	0.00000	15
SEQUENCE 9	4.0	8.0	1	50.9	46.1	4.9	8.1	7.3	0.8	0.00450	0.00484	0.00467	0.00077	9,466
			2	50.9	46.1	4.9	8.1	7.3	0.8	0.00450	0.00482	0.00466	0.00077	9,479
			3	50.9	46.1	4.8	8.1	7.3	0.8	0.00450	0.00482	0.00466	0.00077	9,483
			4	50.8	46.0	4.8	8.0	7.3	0.8	0.00450	0.00482	0.00466	0.00077	9,470
			5	50.9	46.1	4.9	8.1	7.3	0.8	0.00451	0.00482	0.00467	0.00077	9,473
	COLUMN AVERAGE			50.9	46.0	4.9	8.1	7.3	0.8	0.00450	0.00483	0.00466	0.00077	9,474
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00000	0.00000	7
SEQUENCE 10	4.0	10.0	1	63.8	57.7	6.1	10.1	9.1	1.0	0.00545	0.00578	0.00562	0.00093	9,857
			2	63.8	57.7	6.1	10.1	9.1	1.0	0.00545	0.00578	0.00561	0.00093	9,864
			3	63.9	57.7	6.1	10.1	9.1	1.0	0.00546	0.00579	0.00563	0.00093	9,853
			4	64.0	57.9	6.1	10.1	9.2	1.0	0.00544	0.00578	0.00561	0.00093	9,895
			5	63.9	57.8	6.1	10.1	9.2	1.0	0.00544	0.00578	0.00561	0.00093	9,889
	COLUMN AVERAGE			63.9	57.8	6.1	10.1	9.1	1.0	0.00545	0.00578	0.00562	0.00093	9,872
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	19

Source: Widows Creek Description: Bottom Ash 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 11	2.0	2.0	1	13.2	11.1	2.0	2.1	1.8	0.3	0.00201	0.00217	0.00209	0.00034	5,118
			2	13.2	11.2	2.0	2.1	1.8	0.3	0.00200	0.00218	0.00209	0.00035	5,139
			3	13.3	11.3	2.0	2.1	1.8	0.3	0.00202	0.00219	0.00210	0.00035	5,151
			4	13.3	11.2	2.0	2.1	1.8	0.3	0.00201	0.00218	0.00209	0.00035	5,153
			5	13.3	11.3	2.0	2.1	1.8	0.3	0.00202	0.00219	0.00210	0.00035	5,160
	COLUMN AVERAGE			13.3	11.2	2.0	2.1	1.8	0.3	0.00201	0.00218	0.00210	0.00035	5,144
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	17
SEQUENCE 12	2.0	4.0	1	25.6	23.3	2.3	4.1	3.7	0.4	0.00379	0.00407	0.00393	0.00065	5,685
			2	25.6	23.2	2.4	4.1	3.7	0.4	0.00378	0.00406	0.00392	0.00065	5,692
			3	25.5	23.2	2.3	4.0	3.7	0.4	0.00378	0.00406	0.00392	0.00065	5,688
			4	25.5	23.2	2.3	4.0	3.7	0.4	0.00378	0.00406	0.00392	0.00065	5,677
			5	25.5	23.2	2.4	4.0	3.7	0.4	0.00379	0.00407	0.00393	0.00065	5,664
	COLUMN AVERAGE			25.6	23.2	2.3	4.0	3.7	0.4	0.00378	0.00406	0.00392	0.00065	5,681
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00001	0.00000	11
SEQUENCE 13	2.0	6.0	1	38.4	34.8	3.6	6.1	5.5	0.6	0.00492	0.00519	0.00505	0.00083	6,616
			2	38.3	34.7	3.6	6.1	5.5	0.6	0.00492	0.00520	0.00506	0.00083	6,589
			3	38.4	34.8	3.6	6.1	5.5	0.6	0.00492	0.00519	0.00506	0.00083	6,611
			4	38.3	34.7	3.6	6.1	5.5	0.6	0.00492	0.00518	0.00505	0.00083	6,593
			5	38.2	34.6	3.6	6.0	5.5	0.6	0.00492	0.00518	0.00505	0.00083	6,578
	COLUMN AVERAGE			38.3	34.7	3.6	6.1	5.5	0.6	0.00492	0.00519	0.00505	0.00083	6,597
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00000	0.00000	16

Source: Widows Creek Description: Bottom Ash 95% Standard Dry Density at Optimum Moisture Content

SEQUENCE 14	2.0	8.0	1	50.8	46.0	4.8	8.0	7.3	0.8	0.00606	0.00633	0.00620	0.00102	7,128
			2	50.8	46.0	4.8	8.0	7.3	0.8	0.00605	0.00632	0.00618	0.00102	7,142
			3	50.8	46.0	4.8	8.0	7.3	0.8	0.00606	0.00632	0.00619	0.00102	7,135
			4	50.8	46.1	4.8	8.1	7.3	0.8	0.00605	0.00633	0.00619	0.00102	7,142
			5	50.9	46.1	4.8	8.1	7.3	0.8	0.00606	0.00633	0.00620	0.00102	7,136
	COLUMN AVERAGE			50.8	46.0	4.8	8.0	7.3	0.8	0.00606	0.00633	0.00619	0.00102	7,136
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	6
SEQUENCE 15	2.0	10.0	1	63.8	57.7	6.1	10.1	9.1	1.0	0.00719	0.00748	0.00734	0.00121	7,547
			2	63.8	57.8	6.1	10.1	9.1	1.0	0.00720	0.00747	0.00733	0.00121	7,558
			3	63.8	57.7	6.1	10.1	9.1	1.0	0.00719	0.00748	0.00734	0.00121	7,549
			4	63.9	57.8	6.1	10.1	9.2	1.0	0.00719	0.00747	0.00733	0.00121	7,569
			5	63.9	57.8	6.1	10.1	9.2	1.0	0.00719	0.00748	0.00734	0.00121	7,565
	COLUMN AVERAGE			63.8	57.8	6.1	10.1	9.1	1.0	0.00719	0.00748	0.00733	0.00121	7,558
	STANDARD DEV.			0.0	0.1	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00000	0.00000	10

SUBMITTED BY, DATE

9/10/95

LABORATORY MANAGER

FIGURE 1 - Logarithmic Plot of Resilient Modulus (M_R) vs Cyclic Stress (S_C)

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.: 5810860101
1. *MATERIAL SOURCE:* Widows Creek
2. *MATERIAL DESCRIPTION:* Bottom Ash
3. *REMOLDING TARGETS:* 95% Standard Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE* 2
5. *TEST DATE* 08-23-1995

$$M_R = K1\,(S_C)^{K2}\,(1+S_3)^{K5}$$

K1 = 2,258
K2 = 0.19103
K5 = 0.66319
R^2 = 0.98

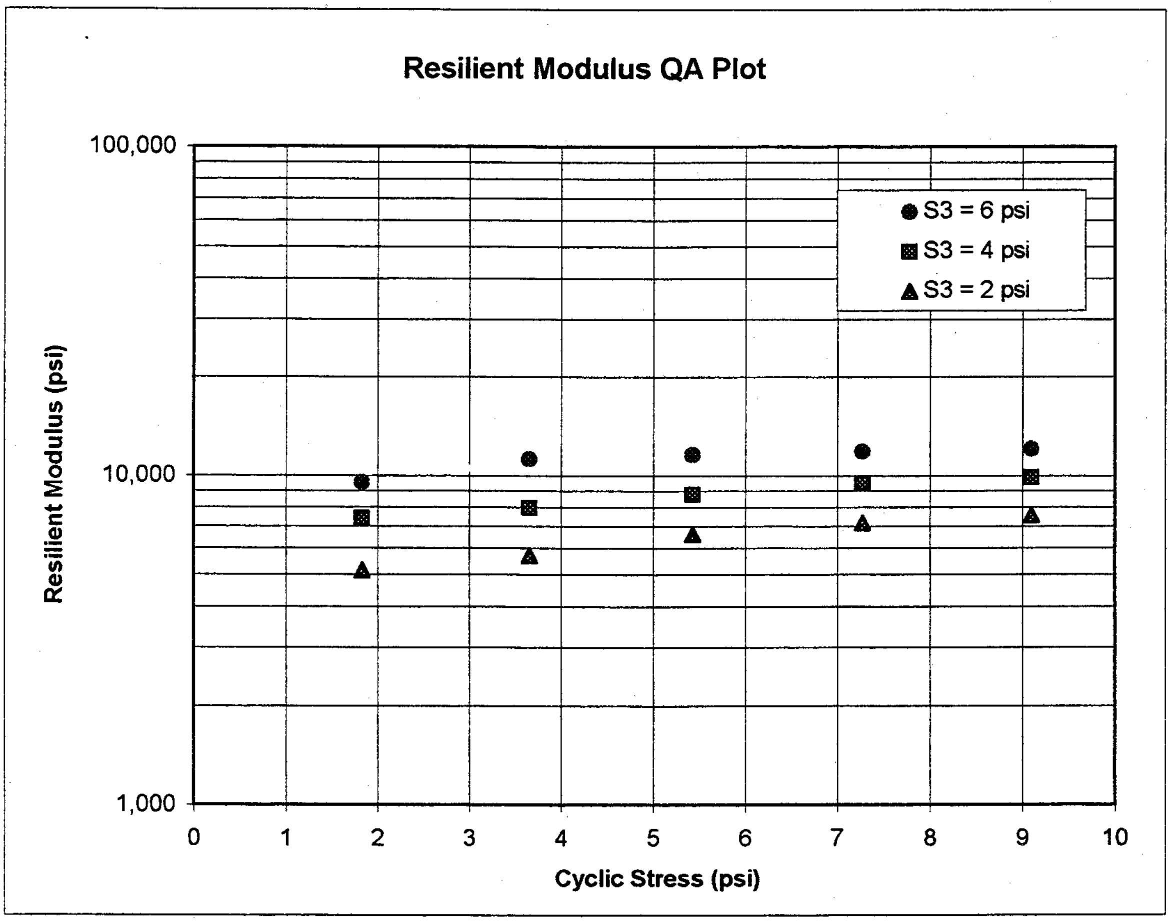
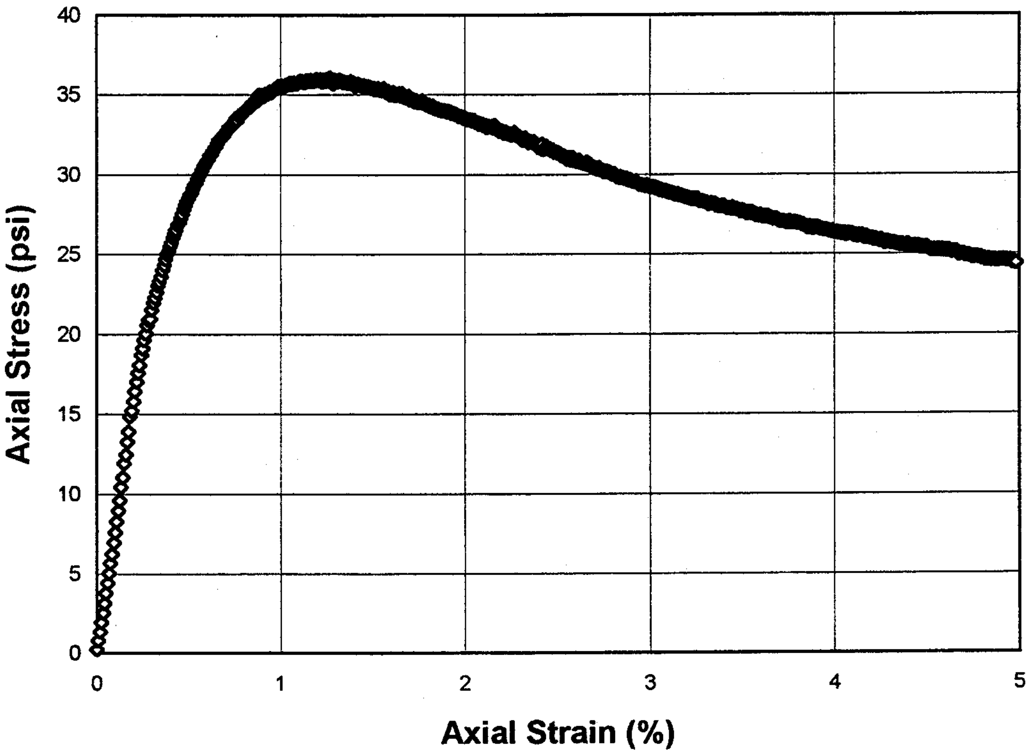


FIGURE 2 - Quick Shear Stress vs Strain

PROJECT NAME:		TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.:		5810860101
1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Bottom Ash
3.	*REMOLDING TARGETS:*	95% Standard Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE*	2
5.	*TEST DATE*	08-23-1995



SHEET NO 1 OF 2

LABORATORY MATERIAL HANDLING AND TESTING
LABORATORY MATERIAL TEST DATA
RESILIENT MODULUS OF UNBOUND GRANULAR BASE/SUBBASE MATERIALS AND SUBGRADE SOILS
LAB DATA SHEET T46 - RECOMPACTED SAMPLES

UNBOUND GRANULAR BASE/SUBBASE LAYERS AND SUBGRADE SOILS
SHRP TEST DESIGNATION UG07, SS07/SHRP PROTOCOL P46

LABORATORY PERFORMING TEST: **LAW ENGINEERING, INC. - ATLANTA, GEORGIA**

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study

LAW PROJECT NO.: 5810860101

1.	*MATERIAL SOURCE:*	Widows Creek
2.	*MATERIAL DESCRIPTION:*	Bottom Ash
3.	*REMOLDING TARGETS:*	95% Modified Dry Density at Optimum Moisture Content
4.	*MATERIAL TYPE* (Type 1 or Type 2)	2
5.	*TEST INFORMATION*	
	PRECONDITIONING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - GREATER THAN 5% PERM. STRAIN? (Y = YES OR N = NO)	N
	TESTING - NUMBER OF LOAD SEQUENCES COMPLETED (0 - 15)	15
6.	*SPECIMEN INFO .:*	
	SPECIMEN DIAM., inch	
	TOP	2.86
	MIDDLE	2.86
	BOTTOM	2.86
	AVERAGE	2.86
	MEMBRANE THICKNESS (1), inch	0.01
	MEMBRANE THICKNESS (2), inch	0.01
	NET DIAM., inch	2.84
	HEIGHT OF SPECIMEN, CAP AND BASE, inch	6.09
	HEIGHT OF CAP AND BASE, inch	0.00
	INITIAL LENGTH, L_0 , inch	6.09
	INITIAL AREA, A_0 , in^2	6.32
	INITIAL VOLUME $A_0 L_0$, in^3	38.48
7.	*SOIL SPECIMEN WEIGHT:*	
	INITIAL WEIGHT OF CONTAINER AND WET SOIL, grams	1649.70
	FINAL WEIGHT OF CONTAINER AND WET SOIL, grams	333.10
	WEIGHT OF WET SOIL USED , grams	1316.60
8.	*SOIL PROPERTIES .:*	
	IN SITU MOISTURE CONTENT (NUCLEAR), %	N/A
	IN SITU WET DENSITY (NUCLEAR), pcf	N/A
	or	
	OPTIMUM MOISTURE CONTENT, %	15.8
	MAX. DRY DENSITY, pcf	120.8
	95 % MAX. DRY DENSITY, pcf	114.8
9.	*SPECIMEN PROPERTIES:*	
	COMPACTION MOISTURE CONTENT, %	11.2
	MOISTURE CONTENT AFTER RESILIENT MODULUS TESTING, %	11.2
	COMPACTION DRY DENSITY, γ_d pcf	117.1
10.	*QUICK SHEAR TEST*	
	STRESS - STRAIN PLOT ATTACHED (Y = YES, N = NO)	Y
	TRIAXIAL SHEAR MAXIMUM STRENGTH (MAX. LOAD/X-SECTION AREA), psi	29.2
	SPECIMEN FAIL DURING TRIAXIAL SHEAR? (Y = YES, N = NO)	Y
11.	*COMMENTS* (Section 10.4 of Protocol P46)	
	(a) *CODE*	0 0 0 0 0 0
	(b) *NOTE*	
12.	*TEST DATE*	08-24-1995

GENERAL REMARKS:

SUBMITTED BY, DATE

RJ Boudreau 9/10/95

LABORATORY MANAGER

PROJECT NAME: TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.: 5810860101
1. MATERIAL SOURCE: Widows Creek
2. MATERIAL DESCRIPTION: Bottom Ash
3. REMOLDING TARGETS: 95% Modified Dry Density at Optimum Moisture Content
4. MATERIAL TYPE 2
5. TEST DATE 08-24-1995
6. RESILIENT MODULUS TESTING

COLUMN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PARAMETER	Chamber Confining Pressure	Nominal Maximum Axial Stress	Cycle No.	Actual Applied Max. Axial Load	Actual Applied Cyclic Load	Actual Applied Contact Load	Actual Applied Max. Axial Stress	Actual Applied Cyclic Stress	Actual Applied Contact Stress	Recov. Def. LVDT #1 Reading	Recov. Def. LVDT #2 Reading	Average Recov Def. LVDT 1 and 2	Resilient Strain	Resilient Modulus
DESIGNATION	S_3	S_{cyclic}	c_1	P_{max}	P_{cyclic}	$P_{contact}$	S_{max}	S_{cyclic}	$S_{contact}$	H_1	H_2	H_{avg}	ε_r	M_r
UNIT	psi	psi	---	lbs	lbs	lbs	psi	psi	psi	in.	in.	in.	in/in	psi
PRECISION	___._	___._	_	____._	___._	___._	___._	___._	__._	_._____	_._____	_._____	_.____	___.
SEQUENCE 1	6.0	2.0	1	12.4	11.1	1.3	2.0	1.8	0.2	0.00210	0.00199	0.00205	0.00034	5,245
			2	12.4	11.1	1.3	2.0	1.8	0.2	0.00211	0.00199	0.00205	0.00034	5,234
			3	12.4	11.1	1.3	2.0	1.8	0.2	0.00210	0.00199	0.00205	0.00034	5,218
			4	12.4	11.1	1.3	2.0	1.8	0.2	0.00210	0.00199	0.00204	0.00034	5,238
			5	12.4	11.1	1.3	2.0	1.8	0.2	0.00212	0.00200	0.00206	0.00034	5,213
	COLUMN AVERAGE			12.4	11.1	1.3	2.0	1.8	0.2	0.00211	0.00199	0.00205	0.00034	5,230
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00001	0.00000	14

Source: Widows Creek Description: Bottom Ash 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 2	6.0	4.0	1	25.1	22.7	2.4	4.0	3.6	0.4	0.00381	0.00355	0.00368	0.00060	5,949
			2	25.1	22.7	2.4	4.0	3.6	0.4	0.00382	0.00355	0.00369	0.00060	5,936
			3	25.1	22.7	2.4	4.0	3.6	0.4	0.00381	0.00355	0.00368	0.00060	5,949
			4	25.1	22.7	2.4	4.0	3.6	0.4	0.00381	0.00354	0.00368	0.00060	5,949
			5	25.1	22.7	2.4	4.0	3.6	0.4	0.00382	0.00355	0.00369	0.00060	5,937
	COLUMN AVERAGE			25.1	22.7	2.4	4.0	3.6	0.4	0.00381	0.00355	0.00368	0.00060	5,944
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00000	0.00000	7
SEQUENCE 3	6.0	6.0	1	37.6	34.0	3.7	6.0	5.4	0.6	0.00569	0.00523	0.00546	0.00090	6,000
			2	37.7	34.0	3.7	6.0	5.4	0.6	0.00568	0.00522	0.00545	0.00089	6,019
			3	37.7	34.0	3.7	6.0	5.4	0.6	0.00568	0.00523	0.00546	0.00090	6,013
			4	37.7	34.0	3.7	6.0	5.4	0.6	0.00569	0.00523	0.00546	0.00090	6,015
			5	37.7	34.0	3.7	6.0	5.4	0.6	0.00569	0.00524	0.00547	0.00090	6,006
	COLUMN AVERAGE			37.7	34.0	3.7	6.0	5.4	0.6	0.00569	0.00523	0.00546	0.00090	6,010
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00000	0.00001	0.00001	0.00000	8
SEQUENCE 4	6.0	8.0	1	50.9	46.0	4.9	8.1	7.3	0.8	0.00721	0.00668	0.00695	0.00114	6,387
			2	50.8	45.9	4.9	8.0	7.3	0.8	0.00720	0.00666	0.00693	0.00114	6,392
			3	50.9	46.0	4.9	8.1	7.3	0.8	0.00721	0.00667	0.00694	0.00114	6,389
			4	50.9	46.0	4.9	8.1	7.3	0.8	0.00720	0.00668	0.00694	0.00114	6,400
			5	50.9	46.0	4.9	8.1	7.3	0.8	0.00721	0.00668	0.00695	0.00114	6,391
	COLUMN AVERAGE			50.9	46.0	4.9	8.1	7.3	0.8	0.00721	0.00668	0.00694	0.00114	6,392
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	5

Source: Widows Creek Description: Bottom Ash 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 5	6.0	10.0	1	63.7	57.6	6.1	10.1	9.1	1.0	0.00835	0.00774	0.00805	0.00132	6,907
			2	63.8	57.6	6.1	10.1	9.1	1.0	0.00835	0.00774	0.00805	0.00132	6,908
			3	63.8	57.7	6.1	10.1	9.1	1.0	0.00836	0.00774	0.00805	0.00132	6,911
			4	63.8	57.7	6.1	10.1	9.1	1.0	0.00836	0.00773	0.00804	0.00132	6,914
			5	63.8	57.7	6.1	10.1	9.1	1.0	0.00834	0.00776	0.00805	0.00132	6,910
	COLUMN AVERAGE			63.8	57.6	6.1	10.1	9.1	1.0	0.00835	0.00774	0.00805	0.00132	6,910
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	3
SEQUENCE 6	4.0	2.0	1	12.9	11.2	1.7	2.0	1.8	0.3	0.00296	0.00272	0.00284	0.00047	3,811
			2	12.8	11.2	1.7	2.0	1.8	0.3	0.00295	0.00270	0.00283	0.00046	3,812
			3	12.9	11.3	1.6	2.0	1.8	0.3	0.00296	0.00272	0.00284	0.00047	3,831
			4	12.9	11.2	1.6	2.0	1.8	0.3	0.00297	0.00273	0.00285	0.00047	3,798
			5	12.9	11.2	1.7	2.0	1.8	0.3	0.00298	0.00274	0.00286	0.00047	3,793
	COLUMN AVERAGE			12.9	11.2	1.7	2.0	1.8	0.3	0.00296	0.00272	0.00284	0.00047	3,809
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	15
SEQUENCE 7	4.0	4.0	1	25.2	22.9	2.4	4.0	3.6	0.4	0.00559	0.00526	0.00542	0.00089	4,073
			2	25.2	22.7	2.4	4.0	3.6	0.4	0.00559	0.00527	0.00543	0.00089	4,039
			3	25.2	22.8	2.5	4.0	3.6	0.4	0.00557	0.00524	0.00541	0.00089	4,064
			4	25.1	22.7	2.4	4.0	3.6	0.4	0.00558	0.00525	0.00541	0.00089	4,048
			5	25.1	22.7	2.4	4.0	3.6	0.4	0.00557	0.00524	0.00540	0.00089	4,053
	COLUMN AVERAGE			25.2	22.8	2.4	4.0	3.6	0.4	0.00558	0.00525	0.00542	0.00089	4,055
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	13

Source: Widows Creek Description: Bottom Ash 95% Modified Dry Density at Optimum Moisture Content

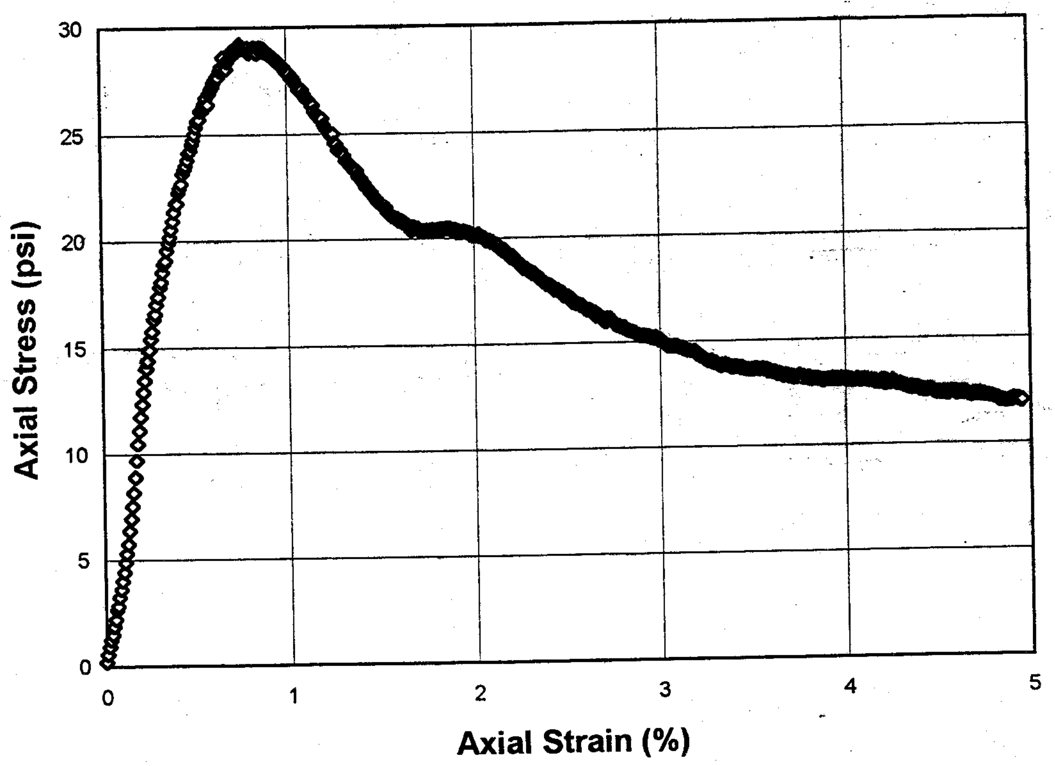
SEQUENCE 8	4.0	6.0	1	38.5	34.9	3.7	6.1	5.5	0.6	0.00697	0.00663	0.00680	0.00112	4,948
			2	38.5	34.9	3.7	6.1	5.5	0.6	0.00698	0.00662	0.00680	0.00112	4,950
			3	38.4	34.7	3.7	6.1	5.5	0.6	0.00697	0.00662	0.00680	0.00112	4,926
			4	38.4	34.7	3.7	6.1	5.5	0.6	0.00698	0.00662	0.00680	0.00112	4,923
			5	38.1	34.5	3.7	6.0	5.5	0.6	0.00698	0.00662	0.00680	0.00112	4,889
	COLUMN AVERAGE			38.4	34.7	3.7	6.1	5.5	0.6	0.00698	0.00662	0.00680	0.00112	4,927
	STANDARD DEV.			0.2	0.2	0.0	0.0	0.0	0.0	0.00001	0.00000	0.00000	0.00000	25
SEQUENCE 9	4.0	8.0	1	51.3	46.4	4.9	8.1	7.4	0.8	0.00792	0.00755	0.00774	0.00127	5,792
			2	51.3	46.4	4.9	8.1	7.3	0.8	0.00793	0.00754	0.00773	0.00127	5,786
			3	51.3	46.4	4.9	8.1	7.4	0.8	0.00792	0.00756	0.00774	0.00127	5,785
			4	51.3	46.4	4.9	8.1	7.3	0.8	0.00791	0.00753	0.00772	0.00127	5,791
			5	51.3	46.4	4.9	8.1	7.3	0.8	0.00792	0.00755	0.00774	0.00127	5,781
	COLUMN AVERAGE			51.3	46.4	4.9	8.1	7.3	0.8	0.00792	0.00755	0.00773	0.00127	5,787
	STANDARD DEV.			0.0	0.0	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00001	0.00000	4
SEQUENCE 10	4.0	10.0	1	63.7	57.6	6.2	10.1	9.1	1.0	0.00863	0.00825	0.00844	0.00139	6,579
			2	63.7	57.6	6.2	10.1	9.1	1.0	0.00865	0.00827	0.00846	0.00139	6,565
			3	63.8	57.7	6.2	10.1	9.1	1.0	0.00867	0.00829	0.00848	0.00139	6,560
			4	63.8	57.7	6.2	10.1	9.1	1.0	0.00867	0.00829	0.00848	0.00139	6,562
			5	63.8	57.6	6.2	10.1	9.1	1.0	0.00865	0.00828	0.00846	0.00139	6,565
	COLUMN AVERAGE			63.8	57.6	6.2	10.1	9.1	1.0	0.00865	0.00828	0.00847	0.00139	6,566
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00002	0.00001	0.00002	0.00000	7

Source: Widows Creek Description: Bottom Ash 95% Modified Dry Density at Optimum Moisture Content

SEQUENCE 11	2.0	2.0	1	13.3	11.3	2.0	2.1	1.8	0.3	0.00310	0.00281	0.00296	0.00049	3,676
			2	13.3	11.5	1.8	2.1	1.8	0.3	0.00314	0.00285	0.00299	0.00049	3,719
			3	13.1	11.3	1.8	2.1	1.8	0.3	0.00314	0.00280	0.00297	0.00049	3,677
			4	13.3	11.6	1.7	2.1	1.8	0.3	0.00319	0.00285	0.00302	0.00050	3,693
			5	13.3	11.2	2.1	2.1	1.8	0.3	0.00308	0.00283	0.00295	0.00048	3,674
	COLUMN AVERAGE			13.3	11.4	1.9	2.1	1.8	0.3	0.00313	0.00283	0.00298	0.00049	3,688
	STANDARD DEV.			0.1	0.2	0.2	0.0	0.0	0.0	0.00004	0.00002	0.00003	0.00000	19
SEQUENCE 12	2.0	4.0	1	25.7	23.4	2.4	4.1	3.7	0.4	0.00589	0.00551	0.00570	0.00094	3,952
			2	25.5	23.2	2.4	4.0	3.7	0.4	0.00590	0.00548	0.00569	0.00093	3,926
			3	25.5	23.2	2.4	4.0	3.7	0.4	0.00591	0.00550	0.00570	0.00094	3,923
			4	25.7	23.3	2.3	4.1	3.7	0.4	0.00591	0.00549	0.00570	0.00094	3,945
			5	25.6	23.3	2.3	4.1	3.7	0.4	0.00590	0.00550	0.00570	0.00094	3,943
	COLUMN AVERAGE			25.6	23.3	2.4	4.1	3.7	0.4	0.00590	0.00550	0.00570	0.00094	3,938
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00001	0.00001	0.00000	0.00000	13
SEQUENCE 13	2.0	6.0	1	38.8	35.1	3.7	6.1	5.6	0.6	0.00732	0.00693	0.00712	0.00117	4,758
			2	38.6	35.0	3.7	6.1	5.5	0.6	0.00730	0.00689	0.00709	0.00116	4,757
			3	38.8	35.2	3.7	6.1	5.6	0.6	0.00732	0.00692	0.00712	0.00117	4,768
			4	38.7	35.1	3.7	6.1	5.6	0.6	0.00728	0.00689	0.00709	0.00116	4,772
			5	38.7	35.1	3.7	6.1	5.6	0.6	0.00733	0.00692	0.00712	0.00117	4,750
	COLUMN AVERAGE			38.7	35.1	3.7	6.1	5.6	0.6	0.00731	0.00691	0.00711	0.00117	4,761
	STANDARD DEV.			0.1	0.1	0.0	0.0	0.0	0.0	0.00002	0.00002	0.00002	0.00000	9

FIGURE 2 - Quick Shear Stress vs Strain

PROJECT NAME:	TVA - Fly Ash, Bottom Ash and Scrubber Gypsum Study
LAW PROJECT NO.:	5810860101
1. *MATERIAL SOURCE:*	Widows Creek
2. *MATERIAL DESCRIPTION:*	Bottom Ash
3. *REMOLDING TARGETS:*	95% Modified Dry Density at Optimum Moisture Content
4. *MATERIAL TYPE*	2
5. *TEST DATE*	08-24-1995



November 10, 1995

Cheri Miller
Tennessee Valley Authority
Fossil Fuels Group
1101 Market Street
Chattanooga, Tennessee 37402-2801

Subject: **FINAL REPORT TRANSMITTAL**
Fly Ash, Bottom Ash and Scrubber Gypsum Study
Contract No. TV-92657V, Phase 1
Law Engineering - Knoxville Project No. 50385-5-0400 (Phase 1)
Law Engineering - Atlanta Project No. 5810860101

Dear Cheri:

I've sent a special messenger (courier) to deliver this final report. The package consists of five final report letters (for distribution to all who received the five sets I brought up last month) and the original test reports for all the work performed in this test phase. I've also copied the Excel spreadsheet files that you may find helpful. They are: Prgrm.xls - *contains all the information you see in the 11x17 fold-out sheets*; and 29 additional .xls files which contain a summary of results for each individual material/source tested, which are shown in each of the sections following a colored sheet of paper.

In speaking with Don Armour, he made a lot of sense when describing why the gypsums, a water soluble material, behaved the way they did. Essentially, the air-dry method of achieving an air-dried condition most certainly chemically altered the material. Additionally, because of the water soluble nature of the material, he recommends using gypsum saturated water when performing the saturation steps for the majority of the geotechnical tests performed. There is apparently some literature available in the Electric Power Research Institute (EPRI). I suggest that if we research the gypsum materials further, we retain Mr. Armour as a technical consultant to help us understand what is going on.

Thank you for the opportunity to be of service to you on this project. If you have any questions or require any additional information, please contact me.

Sincerely,
LAW ENGINEERING, INC.

Dick

Richard L. Boudreau, P.E.
Senior Materials Engineer

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

November 7, 1995

Tennessee Valley Authority
Fossil Fuels Group
1101 Market Street
Chattanooga, Tennessee 37402-2801

Subject: **FINAL REPORT**
Fly Ash, Bottom Ash and Scrubber Gypsum Study
Contract No. TV-92657V, Phase 1
Law Engineering - Knoxville Project No. 50385-5-0400 (Phase 1)
Law Engineering - Atlanta Project No. 5810860101

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ONE OF THE LAW COMPANIES

Soils Classification System (USCS) symbol are provided based on the Particle-Size Analysis and Atterberg Limits results. Similarly, an AASHTO classification is provided based on guidelines set forth in *The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO M145.*

Volumetric Testing

Several tests were performed to provide the general volumetric properties of each material. The tests outlined below were performed on one composite sample from each of the twenty-seven fly ash, bottom ash, boiler slag and scrubber gypsum sources.

Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3), ASTM D 698. This method defines the moisture content versus dry density relationship of the material using the standard specified level of energy. The method is commonly referred to as the Standard Proctor.

Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3), ASTM D 1557. This method defines the moisture content versus dry density relationship of the material using the standard specified level of energy. The method is commonly referred to as the Modified Proctor.

Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table. ASTM D 4253 and *Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density, ASTM D 4254.* Because the Standard and Modified Proctors do not necessarily define a good relationship between dry density and moisture content (typically because of the free draining nature of granular materials), the minimum and maximum index densities were determined for the nine bottom ash samples.

Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435. Samples of the fly ash, boiler slag and scrubber gypsum were remolded in nominal 2.5-inch diameter by 1.0-inch high rings to approximately 95 percent of the maximum dry density at the optimum moisture content as determined by the Standard Proctor. Nominal load increments of 0.5, 1.0, 2.0, 4.0, 8.0 and 16.0 ksf were applied. Moist porous stones were used; however, samples were not inundated for the test.

Hydraulic Conductivity and Static Strength Testing

Test Method for Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, ASTM D 5084. The fly ash, boiler slag and scrubber gypsum materials were remolded to approximately 95 percent of the maximum dry density at the optimum moisture content as determined by the Standard Proctor and tested for hydraulic conductivity. An effective confining pressure of 14 psi was used as the standard for all tests. The samples were remolded to a nominal 2.88-inch diameter by 6.0-in high specimen.

Test Method for Permeability of Granular Soils (Constant Head), ASTM D 2434. The bottom ash materials were remolded to approximately 95 percent of the maximum dry density as determined

Electro-Chemical Testing

Determining the Minimum Laboratory Soil Resistivity, AASHTO T 288. A supersaturated slurry was prepared for each of the fly ash, bottom ash, boiler slag and gypsum/spent bed/char materials (fraction passing the #10 sieve) and the minimum resistivity value was measured.

Determining pH of Soil for Use in Corrosion Testing, AASHTO T 289. Each of the fly ash, bottom ash, boiler slag and gypsum/spent bed/char materials (fraction passing the #10 sieve) was prepared and the pH value was measured.

Determining Water Soluble Sulfate Ion Content in Soil, AASHTO T 290. Each of the fly ash, bottom ash, boiler slag and gypsum/spent bed/char materials (fraction passing the #10 sieve) was prepared and the water soluble sulfate ion content was measured using the Turbidimetric Method (Method B).

Determining Water Soluble Chloride Ion Content in Soil, AASHTO T 291. Each of the fly ash, bottom ash, boiler slag and gypsum/spent bed/char materials (fraction passing the #10 sieve) was prepared and the water soluble chloride ion content was measured using the pH/mV Meter Method (Method B).

PECULIARITIES AND TEST RESULTS

Based on our years of experience with the testing of geotechnical materials and our experience derived from this test program, we have highlighted some instances in which these materials behaved differently than others, either visually or by test results that varied significantly from results calculated for similar materials.

- Both the spent bed material (Shawnee) and the char (Shawnee) were observed to react upon treatment with water. This phenomenon created complications with all the geotechnical tests (classification, volumetric, and strength test). Only the electro-chemical tests were performed on these materials. Because of the highly reactive nature of the spent bed material, the resistivity test was unable to be performed.

- The scrubber gypsum materials were observed to react upon treatment with water following the air dry preparation of these materials. The samples were air-dried overnight in a temperature controlled room set at 140 °F. This phenomenon created complications with the successful completion of the classification tests, although we were able to perform a specific gravity test on a composite sample of each source. We note that the scrubber gypsum materials exhibit relatively more strength than the other materials tested in this program when tested under dynamic conditions at low applied strains (Resilient Modulus). This may indicate that a weak chemical bond is created between particles.

- Beside the noticeable color difference of the Cumberland Dry Fly Ash (tan/brown as opposed to gray for all other fly ashes in this program) that was sampled from Units 1 and 2 on April 17, 18 and 19, 1995, several of the observations and test results are worth noting:

LAW

Technical Procedures
for
Tennessee Valley Authortiy

TITLE: DETERMINING THE ANGLE OF REPOSE OF NON-COHESIVE GRANULAR SAMPLES

These procedures meet the Quality Assurance Program requirements for this project. LAW's Quality Assurance Program Description and all of its invoked documents govern the preparation, approval, and use of these procedures.

Copy Number ____

PREPARED BY:

Richard L. Boudreau
Richard L. Boudreau, P.E.

9/11/95
Date

APPROVALS:

James W. Niehoff, P.E.
Chief Engineer

9/19/95
Date

____
Date

____
Date

Revision 0
August 28, 1995

Procedure: TP6-TVA

3.1.6 Calculate the angle of repose, using the average of the 2 measurements taken, using the following equations:

$$\phi_1 = \mathrm{Tan}^{-1}\,[(V_1 - V_0)/H_1]$$

$$\phi_2 = \mathrm{Tan}^{-1}\,[(V_2 - V_1)/(H_2 - H_1)]$$

$$\phi_{avg} = (\phi_1 + \phi_2)/2$$

where: $H_{1,2}$ = Horizontal distance from mound peak along horizontal plane, inches

$V_{0,1,2}$ = Vertical distance from horizontal offset along horizontal plane to the surface of the mound, inches

4.0 REPORTING

4.1 The following information shall be reported:

- Sample I.D.
- Visual description
- Average angle of repose value

TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Classification (Index Property) Summary
Law Engineering Project No. 5810860101

Source	Code	Material	Bucket Code	Date Collected	Moisture Content, %	Grain Size - ASTM D422			Atterberg Limits ASTM D4318			Specific Gravity	USCS Classification	AASHTO Classification
						%Ret. on No. 4	%Pass No. 200	%Pass 0.005mm	LL	PL	PI			
Allen	ALF	Boiler Slag - Fine Reed Rejects	A-B	5/11/95	0.06	0.0	18.2	0.8	NL	NP	N/A	2.75	SM	A-2-4(0.0)
			C-D		0.12	0.0	14.6	0.8	NL	NP	N/A	2.79	SM	A-2-4(0.0)
			E-F		0.10	0.0	16.0	0.8	NL	NP	N/A	2.81	SM	A-2-4(0.0)
Bull Run	BRF	Dry Fly Ash	A-B	4/4/95	0.02	0.0	91.2	16.6	NL	NP	N/A	2.36	ML	A-4(0.0)
			C-D	4/5/95	0.05	0.0	91.2	19.5	NL	NP	N/A	2.28	ML	A-4(0.0)
			E-F	4/6/95	0.03	0.0	90.7	17.5	NL	NP	N/A	2.37	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	3/29/95	6.99	23.0	4.0	----	NL	NP	N/A	2.31	SW	A-1-b
			C-D		6.07	21.3	6.9	----	NL	NP	N/A	2.29	SW-SM	A-1-b
			E-F		6.74	17.9	5.9	----	NL	NP	N/A	2.35	SW-SM	A-1-b
Colbert	COF	Dry Fly Ash - Units 1&2	A	5/25/95										
		- Units 3&4	B	5/25/95	0.01	0.0	81.6	14.9	NL	NP	N/A	2.02	ML	A-4(0.0)
		- Units 1&2	C	5/26/95										
		- Units 3&4	D	5/26/95	0.01	0.0	69.9	11.5	NL	NP	N/A	2.00	ML	A-4(0.0)
		- Units 1&2	E	5/30/95										
		- Units 3&4	F	5/30/95	0.12	0.0	83.6	3.9	NL	NP	N/A	1.95	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	5/25/95	8.02	7.2	13.6	----	NL	NP	N/A	2.15	SM	A-1-b
			C-D		6.86	15.9	10.8	----	NL	NP	N/A	2.08	SP-SM	A-1-b
			E-F		7.92	12.8	10.5	----	NL	NP	N/A	2.10	SP-SM	A-1-b
Cumberland	CUF	Dry Fly Ash - Units 1&2	A-B	4/17/95	0.31	0.0	95.1	30.0	NL	NP	N/A	2.57	ML	A-4(0.0)
		- Units 1&2	C-D	4/18/95		0.0	92.0	20.7	NL	NP	N/A	2.64	ML	A-4(0.0)
		- Units 1&2	E-F	4/19/95	0.01	0.0	93.2	29.8	NL	NP	N/A	2.65	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	4/6/95	14.32	30.9	1.1	----	NL	NP	N/A	2.59	SW	A-1-a
			C-D		13.66	46.2	2.2	----	NL	NP	N/A	2.66	SW	A-1-a
			E-F		5.08	32.2	2.8	----	NL	NP	N/A	2.63	SW	A-1-a
		Scrubber Gypsum	A-B	4/6/95	30.44	----	----	----	NL	NP	N/A	----	----	----
			C-D		30.39	----	----	----	NL	NP	N/A	3.41	----	----
			E-F		29.41	----	----	----	NL	NP	N/A	----	----	----
Gallatin	GAF	Dry Fly Ash - Unit 2 Hoppers	A-B	6/9/95	0.03	0.0	94.2	12.0	NL	NP	N/A	2.37	ML	A-4(0.0)
			C-D		0.01	0.0	95.2	13.8	NL	NP	N/A	2.40	ML	A-4(0.0)
			E-F		0.01	0.0	95.5	14.8	NL	NP	N/A	2.39	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	6/9/95	19.11	18.2	5.9	----	NL	NP	N/A	2.56	SP-SM	A-1-b
			C-D		7.32	27.0	4.0	----	NL	NP	N/A	2.57	SW	A-1-b
			E-F		10.20	18.8	5.6	----	NL	NP	N/A	2.52	SW-SM	A-1-b
John Sevier	JSF	Dry Fly Ash - Unit 4, Hoppers 11&12	A	5/25/95										
		- Unit 3, Hoppers 11&12	B		0.06	0.0	94.2	17.4	NL	NP	N/A	2.27	ML	A-4(0.0)
		- Unit 4, Hoppers 9, 10&13	C	5/25/95										
		- Unit 3, Hoppers 9&10	D		0.01	0.0	96.1	22.1	NL	NP	N/A	2.35	ML	A-4(0.0)
		- Unit 4, Hopper 15,	E	5/25/95										
		- Unit 3, Hopper 16			0.20	0.0	94.1	28.0	NL	NP	N/A	2.43	ML	A-4(0.0)
		- Unit 4, Hopper 15	F											
		Bottom Ash - From Pond	A-B	4/12/95	26.68	22.8	4.3	----	NL	NP	N/A	2.25	SP	A-1-a
			C-D		27.22	22.2	3.3	----	NL	NP	N/A	2.24	SW	A-1-a
			E-F		30.70	27.8	3.7	----	NL	NP	N/A	2.22	SW	A-1-a

TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Classification (Index Property) Summary
Law Engineering Project No. 5810860101

Source	Code	Material	Bucket Code	Date Collected	Moisture Content, %	Grain Size - ASTM D422			Atterberg Limits ASTM D4318			Specific Gravity	USCS Classification	AASHTO Classification
						%Ret. on No. 4	%Pass No. 200	%Pass 0.005mm	LL	PL	PI			
Johnsonville	JOF	Ponded Fly Ash (New Dredge Cell)	A-B	6/7/95	28.82	3.2	47.1	2.4	NL	NP	N/A	2.36	SM	A-4(0.0)
			C-D		39.10	0.0	54.4	4.2	NL	NP	N/A	2.56	ML	A-4(0.0)
			E-F		31.07	1.8	59.2	3.5	NL	NP	N/A	2.31	ML	A-4(0.0)
		Ponded Fly Ash (Old Dredge Cell)	A-B	6/7/95	13.61	3.6	33.6	0.0	NL	NP	N/A	2.41	SM	A-2-4(0.0)
			C-D		10.98	8.7	42.2	4.1	NL	NP	N/A	2.43	SM	A-2-4(0.0)
			E-F		15.11	2.5	41.4	2.1	NL	NP	N/A	2.23	SM	A-4(0.0)
		Ponded Fly Ash (Active Ash Pond)	A-B	6/7/95	28.09	0.0	95.0	15.6	NL	NP	N/A	2.48	ML	A-4(0.0)
			C-D		31.07	0.0	94.8	14.8	NL	NP	N/A	2.48	ML	A-4(0.0)
			E-F		32.70	0.0	93.9	16.8	NL	NP	N/A	2.50	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	6/7/95	13.28	15.6	26.3	----	NL	NP	N/A	2.39	SM	A-1-b
			C-D		11.92	23.0	16.8	----	NL	NP	N/A	2.39	SM	A-1-b
			E-F		11.51	29.8	18.1	----	NL	NP	N/A	2.39	SM	A-1-b
Kingston	KIF	Ponded Fly Ash (Cell I)	A-B	5/3/95	28.28	0.0	86.4	13.6	NL	NP	N/A	2.28	ML	A-4(0.0)
			C-D		33.95	0.0	97.1	13.2	NL	NP	N/A	2.31	ML	A-4(0.0)
			E-F		30.95	0.0	94.0	13.1	NL	NP	N/A	2.30	ML	A-4(0.0)
		Ponded Fly Ash (Cell III)	A-B	5/3/95	36.09	0.0	96.5	22.6	NL	NP	N/A	2.31	ML	A-4(0.0)
			C-D			0.0	98.3	25.0	NL	NP	N/A	2.29	ML	A-4(0.0)
			E-F		36.19	0.0	96.1	18.4	NL	NP	N/A	2.34	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	5/3/95	9.62	21.9	9.7	----	NL	NP	N/A	2.37	SW-SM	A-1-b
			C-D		10.91	19.3	10.7	----	NL	NP	N/A	2.34	SP-SM	A-1-b
			E-F		17.15	18.4	11.3	----	NL	NP	N/A	2.33	SP-SM	A-1-b
Paradise	PAF	Ponded Fly Ash (East Cell)	A-B	5/17/95	----	0.0	99.4	20.9	NL	NP	N/A	2.82	ML	A-4(0.0)
			C-D		----	0.0	98.1	11.4	NL	NP	N/A	2.77	ML	A-4(0.0)
			E-F		----	0.0	98.5	18.7	NL	NP	N/A	2.93	ML	A-4(0.0)
		Boiler Slag (Reed Rejects)	A-B	5/18/95	----	0.0	5.8	0.0	NL	NP	N/A	2.78	SP-SM	A-1-b
			C-D		----	0.0	12.5	0.0	NL	NP	N/A	2.84	SM	A-2-4(0.0)
			E		----	1.0	10.2	0.0	NL	NP	N/A	2.73	SW-SM	A-1-b
		Scrubber Gypsum	A-B	5/17/95	----	----	----	----	NL	NP	N/A	----	----	----
			C-D		----	----	----	----	NL	NP	N/A	3.00	----	----
			E		----	----	----	----	NL	NP	N/A	----	----	----
Shawnee	SHF	Dry Fly Ash	A-B	4/6/95	0.14	0.0	91.6	7.6	NL	NP	N/A	2.14	ML	A-4(0.0)
			C-D	4/7/95	0.13	0.0	91.2	6.4	NL	NP	N/A	2.09	ML	A-4(0.0)
			E-F	4/10/95	0.16	0.0	90.1	7.5	NL	NP	N/A	2.11	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	4/5/95	23.64	20.0	11.2	----	NL	NP	N/A	2.14	SP-SM	A-1-b
			C-D		23.83	14.7	9.1	----	NL	NP	N/A	2.14	SP-SM	A-1-b
			E-F		21.11	18.3	9.3	----	NL	NP	N/A	2.09	SP-SM	A-1-b
		Spent Bed Material (SBM)	A-B	4/6/95	0.00	----	----	----	NL	NP	N/A	2.93	----	----
			C-D	4/7/95	0.00	----	----	----	NL	NP	N/A	2.86	----	----
			E-F	4/10/95	0.00	----	----	----	NL	NP	N/A	2.92	----	----
		Char	A-B	4/6/95	0.00	----	----	----	NL	NP	N/A	3.00	----	----
			C-D	4/7/95	0.00	----	----	----	NL	NP	N/A	2.99	----	----
			E-F	4/10/95	0.00	----	----	----	NL	NP	N/A	3.00	----	----
Widows Creek	WCF	Ponded Fly Ash (Ash Pond)	A-B	4/28/95	42.20	0.0	84.5	6.7	NL	NP	N/A	2.38	ML	A-4(0.0)
			C-D		75.19	1.5	84.6	8.2	NL	NP	N/A	2.40	ML	A-4(0.0)
			E-F		63.46	0.0	92.9	3.6	NL	NP	N/A	2.22	ML	A-4(0.0)
		Scrubber Gypsum	A-B	4/28/95	----	----	----	----	NL	NP	N/A	----	----	----
			C-D		----	----	----	----	NL	NP	N/A	3.01	----	----
			E-F		----	----	----	----	NL	NP	N/A	----	----	----
		Bottom Ash - From Pond	A-B	4/28/95	4.25	33.7	4.8	----	NL	NP	N/A	2.74	SW	A-1-a
			C-D		2.36	29.9	4.1	----	NL	NP	N/A	2.60	SW	A-1-a
			E-F		4.03	40.9	4.5	----	NL	NP	N/A	2.67	SW	A-1-a

TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Volumetric Testing Summary
Law Engineering Project No. 5810860101

			Standard Proctor		Modified Proctor		Relative Density, Dry Method (pcf)	
Source	**Code**	**Material**	Max. Dry Dens. (pcf)	Opt. Moisture (%)	Max. Dry Dens. (pcf)	Opt. Moisture (%)	**Minimum**	**Maximum**
Allen	ALF	Boiler Slag (Fine Reed Rejects)	95.3	21.5	102.6	23.2	----	----
Bull Run	BRF	Dry Fly Ash	91.6	17.4	95.7	15.1	----	----
		Bottom Ash - From Pond	91.9	22.6	98.7	18.5	73.9	92.1
Colbert	COF	Dry Fly Ash (Units 1-4)	56.7	45.4	62.9	40.3	----	----
		Bottom Ash - From Pond	64.2	27.4	73.2	17.2	55.7	71.2
Cumberland	CUF	Dry Fly Ash (Units 1-2)	111.4	13.2	116.3	11.5	----	----
		Bottom Ash - From Pond	90.1	15.4	103.3	15.7	67.0	87.1
		Scrubber Gypsum	77.6	40.6	85.9	29.7	----	----
Gallatin	GAF	Dry Fly Ash (Unit 2 Hoppers)	86.6	21.4	88.9	18.8	----	----
		Bottom Ash - From Pond	92.0	25.5	102.5	20.9	71.3	90.7
John Sevier	JSF	Dry Fly Ash (Units 3-4)	83.7	18.6	86.7	17.8	----	----
		Bottom Ash - From Pond	78.9	30.3	96.2	21.9	55.7	73.9
Johnsonville	JOF	Ponded Fly Ash (New Dredge Cell)	75.8	31.4	92.5	20.6	----	----
		Ponded Fly Ash (Old Dredge Cell)	89.5	20.5	96.0	16.1	----	----
		Ponded Fly Ash (Active Ash Pond)	86.6	22.8	91.7	18.0	----	----
		Bottom Ash - From Pond	99.2	18.0	104.1	12.0	80.2	99.2
Kingston	KIF	Ponded Fly Ash (Cell I)	81.0	25.2	84.7	24.1	----	----
		Ponded Fly Ash (Cell III)	81.0	23.5	84.4	23.7	----	----
		Bottom Ash - From Pond	89.0	24.1	97.6	21.0	71.0	88.4
Paradise	PAF	Ponded Fly Ash (East Cell)	110.0	16.5	114.4	13.7	----	----
		Boiler Slag (Reed Rejects)	112.5	18.2	116.0	18.7	----	----
		Scrubber Gypsum	85.7	31.7	87.4	30.8	----	----
Shawnee	SHF	Dry Fly Ash	72.4	28.3	77.2	24.4	----	----
		Bottom Ash - From Pond	71.7	30.5	81.4	26.1	57.4	74.0
		Spent Bed Material (SBM)	----	----	----	----	----	----
		Char	----	----	----	----	----	----
Widows Creek	WCF	Ponded Fly Ash (Ash Pond)	67.0	39.8	73.5	27.8	----	----
		Scrubber Gypsum	92.0	23.1	99.9	19.4	----	----
		Bottom Ash - From Pond	106.2	17.6	120.8	15.8	83.0	103.3

TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Consolidation/Hydraulic Conductivity/Chemical Testing Summary
Law Engineering Project No. 5810860101

Source	Code	Material	Consolidation Compression Index, C_c	Hydraulic Conductivity (cm/sec)	Resistivity (Ohm-cm)	pH	Water Soluble Sulfate (mg/kg)	Water Soluble Chloride (mg/kg)
Allen	ALF	Boiler Slag (Fine Reed Rejects)	0.04	9.0E-4	30000	7.5	43	<10
Bull Run	BRF	Dry Fly Ash	0.04	4.0E-5	690	8.4	4630	<10
		Bottom Ash - From Pond	----	1.8E-2	7300	7.2	370	<10
Colbert	COF	Dry Fly Ash (Units 1-4)	0.08	2.8E-4	850	9.4	1660	<10
		Bottom Ash - From Pond	----	1.6E-2	4500	5.4	215	<10
Cumberland	CUF	Dry Fly Ash (Units 1-2)	0.01	2.2E-5	2600	11.6	5020	<10
		Bottom Ash - From Pond	----	6.8E-2	1200	2.7	4790	<10
		Scrubber Gypsum	0.12	1.2E-3	1100	7.8	4830	<10
Gallatin	GAF	Dry Fly Ash (Unit 2 Hoppers)	0.05	7.7E-5	420	10.6	5800	<10
		Bottom Ash - From Pond	----	2.9E-2	1600	2.8	1660	<10
John Sevier	JSF	Dry Fly Ash (Units 3-4)	0.05	5.5E-5	440	4.1	4910	<10
		Bottom Ash - From Pond	----	2.6E-2	5200	6.8	285	<10
Johnsonville	JOF	Ponded Fly Ash (New Dredge Cell)	0.06	5.0E-4	2800	8.1	83	<10
		Ponded Fly Ash (Old Dredge Cell)	0.10	5.8E-4	2600	6.8	1520	20
		Ponded Fly Ash (Active Ash Pond)	0.11	3.5E-5	690	8.4	2960	60
		Bottom Ash - From Pond	----	4.7E-3	740	6.0	2200	<10
Kingston	KIF	Ponded Fly Ash (Cell I)	0.05	8.3E-5	7700	7.6	200	<10
		Ponded Fly Ash (Cell III)	0.05	3.4E-5	6400	6.8	140	<10
		Bottom Ash - From Pond	----	9.1E-3	1900	4.0	490	<10
Paradise	PAF	Ponded Fly Ash (East Cell)	0.04	1.0E-5	2600	8.1	340	<10
		Boiler Slag (Reed Rejects)	----	1.3E-3	9700	4.3	220	<10
		Scrubber Gypsum	0.13	1.5E-4	1100	7.7	4630	10
Shawnee	SHF	Dry Fly Ash	0.04	9.2E-5	1000	11.5	2270	<10
		Bottom Ash - From Pond	----	8.9E-3	3000	8.1	4200	10
		Spent Bed Material (SBM)	----	----	----	12.0	4190	150
		Char	----	----	190	12.0	4130	980
Widows Creek	WCF	Ponded Fly Ash (Ash Pond)	0.12	1.8E-4	1400	9.2	1060	<10
		Scrubber Gypsum	0.07	3.9E-4	1200	6.7	3050	<10
		Bottom Ash - From Pond	----	3.4E-2	3100	8.0	4070	130

Note: Consolidation and Hydraulic Conductivity test specimen were remolded to approximately 95 percent of the Standard Proctor maximum dry density

TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Strength Testing Summary
Law Engineering Project No. 5810860101

Source	Code	Material	Triaxial CU with pore pressure				Direct Shear		Angle of Repose
			Effective Stress		Total Stress		Cohesion, c (ksf)	Internal friction, ϕ	
			Cohesion, c' (ksf)	Internal friction, ϕ'	Cohesion, c (ksf)	Internal friction, ϕ			
Allen	ALF	Boiler Slag (Fine Reed Rejects)	0.00	37.3	1.15	39.2	2.32	25.2	----
Bull Run	BRF	Dry Fly Ash	0.31	27.7	1.12	21.2	1.36	27.4	----
		Bottom Ash - From Pond	----	----	----	----	----	----	32.4
Colbert	COF	Dry Fly Ash (Units 1-4)	0.34	27.6	0.69	19.9	1.31	28.6	----
		Bottom Ash - From Pond	----	----	----	----	----	----	30.9
Cumberland	CUF	Dry Fly Ash (Units 1-2)	0.00	53.5	1.70	50.5	2.53	33.4	----
		Bottom Ash - From Pond	----	----	----	----	----	----	30.8
		Scrubber Gypsum	0.00	38.1	3.33	33.4	1.32	41.4	----
Gallatin	GAF	Dry Fly Ash (Unit 2 Hoppers)	0.00	31.7	0.57	26.2	1.37	34.5	----
		Bottom Ash - From Pond	----	----	----	----	----	----	31.8
John Sevier	JSF	Dry Fly Ash (Units 3-4)	0.22	22.4	0.26	17.7	1.11	33.6	----
		Bottom Ash - From Pond	----	----	----	----	----	----	27.4
Johnsonville	JOF	Ponded Fly Ash (New Dredge Cell)	0.23	32.4	1.26	25.8	1.29	32.4	----
		Ponded Fly Ash (Old Dredge Cell)	0.12	30.5	0.66	15.2	2.14	39.3	----
		Ponded Fly Ash (Active Ash Pond)	0.00	22.6	0.01	15.8	1.41	36.6	----
		Bottom Ash - From Pond	----	----	----	----	----	----	30.8
Kingston	KIF	Ponded Fly Ash (Cell I)	0.14	26.1	0.36	19.6	0.82	39.1	----
		Ponded Fly Ash (Cell III)	0.03	24.4	0.00	17.8	1.47	37.6	----
		Bottom Ash - From Pond	----	----	----	----	----	----	31.3
Paradise	PAF	Ponded Fly Ash (East Cell)	0.37	21.2	0.55	15.6	2.27	20.2	----
		Boiler Slag (Reed Rejects)	0.06	40.6	2.00	40.3	----	----	----
		Scrubber Gypsum	0.00	39.7	3.07	35.5	0.97	45.7	----
Shawnee	SHF	Dry Fly Ash	1.24	22.4	1.79	14.7	1.10	39.8	----
		Bottom Ash - From Pond	----	----	----	----	----	----	31.6
		Spent Bed Material (SBM)	----	----	----	----	----	----	----
		Char	----	----	----	----	----	----	----
Widows Creek	WCF	Ponded Fly Ash (Ash Pond)	1.85	25.5	1.94	21.5	1.70	31.2	----
		Scrubber Gypsum	0.00	37.8	3.01	33.1	0.55	28.9	----
		Bottom Ash - From Pond	----	----	----	----	----	----	29.0

Note: Triaxial CU and Direct Shear test specimen were remolded to approximately 95 percent of the Standard Proctor maximum dry density at or near optimum moisture content

lab soil tva prgm.xls (Static)

TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Strength Testing Summary
Law Engineering Project No. 5810860101

Source	Code	Material	CBR	Resilient Modulus (Standard Effort)				Resilient Modulus (Modified Effort)			
			%	K1	K2	K5	M_R at S_c=4psi, S_3=4psi	K1	K2	K5	M_R at S_c=4psi, S_3=4psi
Allen	ALF	Boiler Slag (Fine Reed Rejects)	37	2,662	0.09516	0.53980	6,419	2,468	0.14322	0.51069	6,110
Bull Run	BRF	Dry Fly Ash	2	3,225	-0.17750	0.54531	5,370	3,283	-0.01625	0.38843	5,500
		Bottom Ash - From Pond	35	1,857	0.10936	0.78070	6,378	1,977	0.13522	0.76648	6,901
Colbert	COF	Dry Fly Ash (Units 1-4)	9	1,353	-0.00868	0.56321	2,918	1,639	0.01011	0.53301	3,480
		Bottom Ash - From Pond	24	2,368	0.11934	0.58242	6,264	2,455	0.09488	0.59309	6,372
Cumberland	CUF	Dry Fly Ash (Units 1-2)	24	7,531	-0.03317	0.34550	11,612	10,959	0.14896	0.24877	19,021
		Bottom Ash - From Pond	15	2,194	0.09530	0.67882	6,417	1,994	0.13866	0.76150	6,945
		Scrubber Gypsum	20	9,623	0.09590	0.25471	15,646	11,738	0.08396	0.20475	17,515
Gallatin	GAF	Dry Fly Ash (Unit 2 Hoppers)	2	2,713	-0.09930	0.47991	4,598	3,602	-0.12389	0.45133	5,671
		Bottom Ash - From Pond	30	1,972	0.20995	0.65540	6,545	2,427	0.20416	0.61364	7,541
John Sevier	JSF	Dry Fly Ash (Units 3-4)	1	2,965	-0.08694	0.43636	4,813	4,033	-0.09489	0.39276	6,095
		Bottom Ash - From Pond	40	2,156	0.08085	0.76340	6,949	2,108	0.09702	0.69867	6,352
Johnsonville	JOF	Ponded Fly Ash (New Dredge Cell)	12	1,487	0.03358	0.63725	3,769	2,541	-0.01211	0.48836	4,917
		Ponded Fly Ash (Old Dredge Cell)	28	1,495	0.03707	0.78260	4,657	2,255	0.09559	0.65332	6,368
		Ponded Fly Ash (Active Ash Pond)	1	2,146	-0.18159	0.60215	3,844	3,980	-0.14235	0.42844	5,917
		Bottom Ash - From Pond	50	2,373	0.16927	0.51994	6,169	2,389	0.13323	0.56010	6,247
Kingston	KIF	Ponded Fly Ash (Cell I)	2	1,803	0.07728	0.41203	3,553	2,374	-0.04388	0.47386	4,309
		Ponded Fly Ash (Cell III)	1	2,592	-0.10787	0.48134	4,350	3,254	-0.09252	0.43051	5,199
		Bottom Ash - From Pond	60	1,427	0.13665	0.75876	4,938	1,822	0.19126	0.64487	5,807
Paradise	PAF	Ponded Fly Ash (East Cell)	4	5,929	-0.09595	0.40269	9,071	5,551	-0.06155	0.44309	9,421
		Boiler Slag (Reed Rejects)	55	1,661	0.06737	0.79102	5,460	1,715	0.08023	0.76411	5,529
		Scrubber Gypsum	14	9,420	0.10296	0.23790	15,110	10,977	0.08137	0.20492	16,325
Shawnee	SHF	Dry Fly Ash	9	2,390	-0.04340	0.45385	4,222	2,774	-0.03472	0.41978	4,731
		Bottom Ash - From Pond	25	1,928	0.11134	0.73640	6,244	1,558	0.08323	0.76224	5,030
		Spent Bed Material (SBM)	----	----	----	----	----	----	----	----	----
		Char	----	----	----	----	----	----	----	----	----
Widows Creek	WCF	Ponded Fly Ash (Ash Pond)	3	1,026	-0.02608	0.63430	2,384	3,283	-0.01625	0.38843	5,500
		Scrubber Gypsum	15	7,937	0.08949	0.23891	12,513	8,454	0.05337	0.26140	13,079
		Bottom Ash - From Pond	30	2,258	0.19103	0.66319	7,379	2,260	0.28011	0.26147	4,788

Note: CBR and Resilient Modulus test specimen were remolded to approximately 95 percent of the Standard Proctor (and Modified Proctor for Res. Mod.) maximum dry density at or near optimum moisture content

MACTEC

REPORT OF GEOTECHNICAL EXPLORATION

PROPOSED ASH POND DIKE RAISE
WIDOWS CREEK FOSSIL PLANT
STEVENSON, ALABAMA

Prepared for:

TENNESSEE VALLEY AUTHORITY

Chattanooga, Tennessee

February 4, 2003

MACTEC

February 4, 2003

Mr. Ron Purkey
Tennessee Valley Authority
1101 Market Street, LP-2G
Chattanooga, TN 37402

Subject: **Report of Geotechnical Exploration**
Proposed Ash Pond Dike Raise
Widows Creek Fossil Plant
Stevenson, Alabama
MACTEC Project 50300-8-2075/0081/800

Dear Mr. Purkey:

We at MACTEC Engineering and Consulting of Georgia, Inc., (MACTEC) are pleased to submit this Report of Geotechnical Exploration for your project. Our services, as authorized through TAO No. LAW-81-0047 were provided in general accordance with our proposal number 50399-0-2304 dated October 24, 2002.

This report reviews the information provided to us, discusses the site and subsurface conditions, and presents our conclusions and recommendations relative to the properties of the foundation materials for support of the proposed new dike. The Appendices contain a brief description of Field Exploratory Procedures, the Test Boring Records, Subsurface Profile Sections, and the Laboratory Test Results.

We anticipate further dialog and interaction with TVA as the design proceeds and will be happy to provide any additional information or interpretation of the data and recommendations presented here in which may be necessary.

We will be pleased to discuss our recommendations with you and would welcome the opportunity to provide the engineering and material testing services needed to successfully complete your project.

Sincerely,

MACTEC ENGINEERING AND CONSULTING OF GEORGIA, INC.
f/k/a LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

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REPORT OF GEOTECHNICAL EXPLORATION

PROPOSED ASH POND DIKE RAISE
WIDOWS CREEK FOSSIL PLANT
STEVENSON, ALABAMA

Prepared for:

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Chattanooga, Tennessee

MACTEC Engineering and Consulting of Georgia, Inc.

Knoxville, Tennessee

February 4, 2003

MACTEC Project 50300-8-2075/0081/800

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EXECUTIVE SUMMARY

We were selected by the Tennessee Valley Authority (TVA) to perform a geotechnical exploration for the proposed Ash Pond Dike Raise at the Widows Creek Fossil Plant near Stevenson, Alabama. The objectives of our exploration were to determine existing subsurface conditions, and provide foundation material properties and recommendations to use in the design of the proposed dike raise.

The exploration consisted of drilling three test borings, two vane shear tests, and two cone penetrometer resistance tests. The test borings were drilled in the existing clayey dike to evaluate its in-place density. The cone penetration tests (CPTs) and the vane shear tests were performed in the test fill area to evaluate the shear strength of the gypsum material. The major findings and recommendations of our subsurface exploration are as follows:

- The existing dike consists of clayey fill classified as CH to CL with in-situ standard penetration test resistances of 9 blows per foot or more.
- The gypsum deposit encountered consists of very soft, silty material with high moisture content. The estimated in-situ shear strength is approximately 100 to 200 psf.
- Based on our understanding of the project and the expected loads, we recommend the site be evaluated in terms of bearing capacity and slope stability using the material properties recommended in our report.

We recommend experienced geotechnical personnel observe subgrades, foundation excavations, fill placement, and other construction procedures. We recommend that MACTEC be a part of these services based on our familiarity with the project, the subsurface conditions, the intent of the recommendations, and our experience in this area. This summary is only an overview and should not be used as a separate document or in place of reading the entire report, including the appendices.

1.0 INTRODUCTION

The Widows Creek Fossil Plant is owned and operated by the Tennessee Valley Authority (TVA). The plant is located near Stevenson, Alabama on the Tennessee River.

During the power generating process, fly ash, bottom ash, and scrubber sludge are produced and require safe disposal. The fly ash is collected in the electrostatic precipitators and pumped to the fly ash pond. The bottom ash is the coarser refuse material and is collected from the boiler bottom hoppers and also is pumped to the bottom ash disposal area where bottom ash is dry-stacked in stock piles. The scrubber sludge is the by-product of the reacted lime slurry with the flue gas containing sulfur dioxide. The scrubber sludge is also pumped and deposited in the scrubber sludge pond.

In the past, a separator dike was constructed in the fly ash pond and the gypsum/scrubber sludge product was discharged in the southwest corner of the pond. Since then, scrubber sludge is being pumped to a separate pond and fly ash continued to be pumped to the northwest corner of the fly ash pond.

In the 1980s, the storage capacity of the fly ash pond was increased by constructing a 20 feet high dike upstream of the original perimeter dike. Scrubber sludge and fly ash continued to be pumped to the southwest and northwest corners of the pond, respectively.

Since the storage capacity of the existing fly ash pond is decreasing, TVA is proposing to raise the existing fly ash perimeter dike 10 feet. The proposed dike is approximately 1.7 miles long and approximately 0.6 miles will be constructed on previously deposited scrubber sludge/gypsum material. The remaining 1.1 miles of dike will be primarily constructed on fly ash deposits.

An exploration program was performed to evaluate the shear strength parameters of the proposed dike foundation materials. The parameters will be used to model the staged dike and estimate its factor of safety against slope instability, as well as, its ability to impede seepage from the fly ash pond.

This report presents the findings of our subsurface exploration and laboratory testing and geotechnical evaluations recently performed for the proposed Fly Ash Pond dike raise at TVA's Widows Creek Fossil Plant. Our services were authorized by Mr. Ron Purkey of the Tennessee Valley Authority.

2.0 OBJECTIVES OF EXPLORATION

The objectives of our exploration were to determine general subsurface conditions and to obtain data to aid in evaluating the existing foundation material and in providing design parameters for the proposed fly ash pond dike construction. An assessment of site environmental conditions, or for the presence or absence of pollutants in the soil, bedrock, waste materials, fly ash, scrubber sludge, surface water, or ground water of the site were beyond the proposed objectives of our exploration.

3.0 SCOPE OF EXPLORATION

Our evaluation was based on our proposal number 50399-0-0000/2304 dated October 24, 2002. In general, our scope includes the following:

- Reconnaissance of the immediate site
- Review of existing geotechnical and foundation information
- Subsurface exploration
- Field observation
- Field and laboratory testing
- Geotechnical report summarizing our findings and recommendations

Specifically, the scope of exploration included a site reconnaissance, drilling five borings (designated B-1 through B-3 and V-1 through V-2). Three of the borings were test borings where the soil density was evaluated using standard penetration testing and the other two borings were primarily drilled for the use of the vane shear testing device. The test borings were advanced to a depth of approximately 25 feet. Field testing included standard penetration testing (SPT), cone penetration testing (CPT), and vane shear testing.

Although we made several attempts to collect relatively undisturbed Shelby tube samples of the gypsum materials, we were unable to retrieve "good" testable samples. However, we collected approximately six relatively undisturbed soil samples from the existing dike. Laboratory testing included triaxial compression strength testing on soil and bottom ash samples, classification testing, and index tests. The scope of exploration included analyzing the field and laboratory data and reviewing available geotechnical information to determine foundation design parameters. Our analysis of the field and laboratory results is presented in the respective sections. The field exploration procedures and the results of our field testing are presented in the Appendices A and B; the results of our laboratory testing are presented in Appendix C.

The drilling and sampling were performed in general accordance with ASTM procedures. The procedures are summarized in Appendix A. The field exploration was performed between November 19 and November 21, 2002. The equipment used consisted of a Model 55 ATV-mounted CME drill rig equipped with an automatic hammer. Standard Penetration Tests (SPTs) were performed at 2-1/2-foot vertical intervals in the upper 10 feet of the borings and at 5-foot vertical intervals thereafter. In conjunction with the drilling, we performed CPT testing and vane shear testing at three locations.

Two of the cone penetration tests were performed using the drill rig to advance the core beneath the test fill area while the third attempt was made by pushing the cone through the delta by hand. Similarly, the vane shear testing was performed in two borings by the drill rig in the test fill area with another attempt being made by pushing the vane by hand in the delta area to estimate its in-situ unconfined strength.

Ground-water measurements were made after the completion of the augering in each boring.

Upon completion of drilling, the dike borings (B-1 and B-2) were plugged and abandoned by backfilling full depth with cement-bentonite grout. The test borings in the bottom ash test fill area was backfilled with bottom ash. We transported the samples to our laboratories in Knoxville, Tennessee, and Charlotte, North Carolina, where we selected samples for laboratory testing. We performed classification and index tests on selected soil samples.

The field exploration and laboratory testing are summarized as follows:

Field Testing

- 5 Borings (3 Soil Test Borings and 2 for the Vane Shear Testing)
- Cone Penetration Tests in 3 separate locations
- Vane Shear Strength Measurements at 3 different soil profiles

Laboratory Testing

- 4 Triaxial compression tests (on soil specimens of the dike material)
- 2 Direct Shear Tests on remolded bottom ash samples
- 12 Plasticity (Atterberg limits)
- 23 Natural Moisture Content of soils
- 3 Soil Permeability Tests
- 10 Sieve Analysis Tests
- 4 Specific Gravity Tests on dike clay soil, gypsum, and the finer portion of the bottom ash material

Our field exploration procedures are described in Appendix A and the subsurface conditions encountered during our exploration are presented on the Test Boring Records in Appendix B. The laboratory testing results are presented in Appendix C.

4.0 PROJECT INFORMATION AND SITE CONDITIONS

The Widows Creek Fossil plant is approximately 5 miles northeast of the City of Stevenson, Alabama. The Widows Creek power plant is located on the west bank of the Tennessee River. The distance between the site and the river is approximately 300 feet. The average water elevation in the Tennessee River during the site exploration was approximately 594 feet msl. The site is relatively flat with a nominal ground surface/top of dike elevation of approximately 636 feet above mean sea level (msl). The proposed dike raise will consist of constructing a 10-foot-high dike on the upstream side of the existing dike.

The proposed dike will be constructed using bottom ash materials. Existing deposits of fly ash and unoxidized gypsum will provide foundation support for the proposed dike. The proposed dike will be approximately 1.7 miles long and will consist of approximately 20 foot wide crest and 2:1 side slopes. Based on preliminary calculations approximately 400,000 to 500,000 cubic yards of bottom ash will be required to complete the proposed project construction.

5.0 AREA AND SITE GEOLOGY

Stevenson, Alabama, is located in the Appalachian Valley and Ridge Physiographic Province. This province extends as a continuous belt from central Alabama, through Georgia and Tennessee, northward into Pennsylvania. The formations that underlie this province consist primarily of limestone, dolostone, shale, and sandstone, which have been folded and faulted in the geologic past. These formations range in age from Cambrian to Pennsylvanian and have been subject to at least one extensive period of erosion since their structural deformation. The erosion has produced a series of subparallel, alternating ridges and valleys. The valleys are formed over more soluble bedrock (interbedded limestone and limestone), whereas bedrock more resistant to solution weathering forms ridges (sandstone, shale, and cherty dolostone).

In particular, the subject site is geologically mapped to be underlain by the Sequatchie Formation. The Sequatchie Formation is mainly composed of light olive-gray and dusky red calcareous shale interbedded with light to dark gray limestone.

6.0 SUBSURFACE CONDITIONS

Subsurface conditions for the project were explored with five borings drilled in general accordance with the procedures discussed in Appendix A. The boring locations were proposed by TVA and the depths were proposed by MACTEC. The boring locations were established by measurements from prominent permanent site features. Boring elevations were estimated based on previous construction drawings. The boring locations shown on Figure 2 and the boring elevations shown on the Test Boring Records in Appendix B should be considered approximate.

Subsurface conditions encountered at each boring location are shown on the Test Boring Records in Appendix B. The Test Boring Records represent our interpretation of the subsurface conditions, based on the field logs and visual examination of the samples by one of our engineers. The lines designating the interfaces between various strata on the Test Boring Records represent the approximate interface locations. Subsurface profile sections are included in Appendix B. The approximate locations of the subsurface sections with respect to the boring locations are shown in Figure 2.

In general, the materials encountered at this site consisted of fill materials. The fill materials include soil fill and bottom ash underlain by scrubber sludge and fly ash materials. The test borings typically encountered fill material with variable consistencies. Unlike natural residual soils, fill soils are those soils that have been transported to their present location by man. On this site fill material has been placed to build the fly ash pond dikes. Bottom ash materials were also encountered on the site along with fly ash and gypsum material.

6.1 FILL SOIL IN POND DIKE AREA

Boring B-1 was drilled in the existing dike near the existing concrete bridge over the relocated Widows Creek, and B-2 was drilled in the southern side of the dike. The borings encountered similar subsurface conditions. Specifically, the borings encountered approximately 15 feet of compacted orange-brown clayey fill. The borings encountered a dark grayish granular ash material below the clayey fill. The grayish fill extended from 15 to 20 feet deep (i.e., approximately 5 feet thick). Below the granular ash materials, the boring encountered dark brown, and light brown mottled silty clay material with rootlets. This material appears to be the cultivated upstream slope of the original dike. The SPT values for this fill ranged from 9 to 37 blows per foot (bpf), indicating firm to hard consistency. The majority of the blow-count values fell in the stiff range.

6.2 BOTTOM ASH TEST FILL

A test fill consisting of bottom ash was placed in the fly ash / scrubber sludge pond to provide access for the drilling equipment and to provide a working pad to test and sample the underlying gypsum material. The bottom ash material was not sampled.

6.3 GYPSUM MATERIAL

Boring B-3 was drilled in the bottom ash test fill area. The boring encountered approximately 10 feet of bottom ash fill above the grayish unoxidized gypsum/scrubber sludge. The boring was advanced to a depth of 25 feet and was terminated since the gypsum material continued to heave or run into the inside the augers. The SPT values ranged from 0 to 4 bpf indicating very soft to soft material.

In addition, vane shear testing and cone penetration testing was performed in the test fill area as shown on Figure 2. The cone was advanced to a depth of 47 and 42 feet in borings C-1 and C-2, respectively. Vane shear measurements were made at intermittent depths between 6.5 and 19.0 feet. Specifically, the vane shear measurements were performed in V-1 and V-2 in the test area. Vane shear measurements were made at 8.0, 10.0, 12.0, and 14.6 feet below the surface in V-2 and were made at 12.0 and 14.6 feet deep in V-1.

The results of the CPT and vane shear strength tests indicated that the in-situ shear strength of the gypsum material ranges from 100 to 200 pounds per square foot (psf). Graphical presentations of the field CPT and vane shear results are included in Appendix B. It should be noted that the CPT results revealed an alternating sequence of hard and very soft layers throughout the gypsum deposit. This phenomena was explained during our laboratory testing program. During laboratory index property testing, the material appeared to be non-plastic; however, when it was oven dried and rehydrated, the gypsum hardened within a few seconds to mortar consistency. Based on our observations, we speculate that as the gypsum material was discharged from the discharge pipes, the coarser material settled near the discharge end of the pipe forming a delta, while the finer material / slimes remained suspended and were carried and deposited further away. As the upper surface of the deposited material which is exposed to the sunlight and summer heat is dried and rehydrated in the winter, it formed a cementious material, while the material deposited and covered in the winter remained in its soft (slimy) state.

This condition was detected by the continuous nature of the CPT testing as it penetrated the subsequent soft and hard layers. The vane shear test provided an average strength value of these alternating soft and hard layers since it covered an approximate 2-inch test zone which included several thin alternating layers.

During our site visit, we observed a dry section of the previously deposited gypsum/scrubber sludge material near the south west corner of the ash pond. Based on our observations, we believe this delta has formed during the discharge of scrubber sludge at the southwest corner of the ash pond. The coarser particles settled first near the discharge end of the pipe while the slimes/finer particles remained suspended in the water and settled further away from the slurry discharge pipe.

Even though the delta was firm enough to support a human walking on it, it was too soft to support the weight of a drill rig. We attempted the use of fiberglass mats to support the ATV mounted drill rig, but our attempt to drive the drill rig on the delta was unsuccessful.

We observed the gypsum material in the delta to be saturated below the crusted dry surface layer and it is highly susceptible to developing pore water pressures upon loading. Specifically, when this gypsum material was loaded using a bulldozer a "mud wave" was formed which rendered the foundation material extremely soft and flexible. However when a small specimen of this material was collected and allowed to dry, it appeared to have a cohesionless texture and relatively higher compression strength. Therefore, in our opinion, this gypsum material makes a suitable foundation material only if allowed to dry and proper drainage is provided.

7.0 LABORATORY TESTING AND RESULTS

This section discusses the geotechnical laboratory testing program for this project. The ASTM laboratory test procedures and test results are listed in Appendix C. The following paragraphs provide a short discussion of the general types of testing and the test results.

7.1 INDEX PROPERTIES AND MOISTURE CONTENT TESTING

Liquid limit and plastic limit (Atterberg limits) tests and grain size analyses were performed on selected split-spoon samples of gypsum materials and clayey fill and bulk samples of the bottom ash. These tests were used to confirm our visual-manual classifications and to evaluate the volume change potential of the samples tested. Natural moisture content tests were also performed on split-spoon samples. The results of the laboratory tests will be discussed for the various materials.

7.1.1 Clay Fill

Plasticity indices (PIs) ranged from 22 to 31. The soils that were tested were classified as CL and CH according to the Unified Soil Classification System. Natural moisture contents ranged from 22 to 24 percent in boring B-1 and 19 to 27 percent in boring B-2. However, the average moisture content was 23 percent.

7.1.2 Bottom Ash

The bottom ash material was determined to be non-plastic, mostly sand size material with 5 percent passing the No. 200 sieve. The bottom ash was classified as SM and SW according to the Unified Soil Classification System with a moisture content of 17 percent.

7.1.3 Gypsum Material

Index properties testing was performed on the gypsum material and it was observed to be non-plastic, silt size material with 80 to 95 percent passing the No. 200 sieve. However, the natural moisture content of the tested samples ranged from 3.9 to 59 percent.

7.2 MOISTURE-DENSITY RELATIONSHIP TESTS

Two standard Proctor tests were performed on different bulk samples of the bottom ash materials. The maximum dry density ranged from 113.3 to 113.9 pcf with an average of 113.6 pcf and an optimum moisture content of 17 percent. These test results were used to remold the laboratory direct shear test specimens to the desired dry density. The test results can also be used during dike construction to measure percent compaction during quality control testing.

7.3 TRIAXIAL SHEAR STRENGTH TESTS

7.3.1 Clay Fill

Four triaxial shear strength (two consolidated-undrained triaxial compression with pore pressure measurements and two unconsolidated-undrained triaxial compression) tests were performed on the clay fill materials obtained from borings B-1 and B-2. All of the tests were performed on relatively undisturbed samples. Based on the results of our consolidated-undrained with pore pressure measurements triaxial compression testing, the effective cohesion values varied from 1,380 to 220 pounds per square foot (psf) while Φ values varied from 17 to 25 degrees. Undrained triaxial compression tests were also performed to determine the total shear strength parameters. The consolidated-undrained with pore pressure measurements triaxial compression tests produced a total stress cohesion value that varied from about 1,000 to 2,600 psf and a Φ that varied from about 6 to 16 degrees. The unconsolidated-undrained (UU) triaxial compression tests produced a cohesion that varied from about 620 to 1,450 psf and a Φ value that varied from 2 to 8 degrees.

7.3.2 Bottom Ash

We attempted to perform triaxial shear testing on the bottom ash material. However, due to the cohesionless nature of the bottom ash, the test specimens had a tendency to slump when the mold was removed. Therefore, we performed two direct shear tests with three different normal stresses per test. One of these tests was performed on a specimen remolded to 90 percent of its maximum dry density. The other test was performed on a specimen remolded to approximately 95 percent of its maximum dry density. Both samples indicated an average Φ value of about 29 degrees and a C value from 500 to 950 psf. It should be noted that the additional compactive effort did not impact the shear strength of the bottom ash.

7.4 GRADATION TESTS

7.4.1 Clay Fill

Three gradation tests were performed on the clayey specimen obtained from the dike. The specimen had a fines content (i.e., percent finer than a No. 200 sieve) of 72 to 85 percent indicating clayey material.

7.4.2 Bottom Ash

Two gradation tests were performed on the bottom ash material. The material contained approximately 5 percent fines with the majority falling in the SM and SW range.

7.4.3 Gypsum

Four sieve analyses with hydrometer were performed on gypsum samples. The test results indicated the gypsum has approximately 83 to 97 percent material finer than a No. 200 sieve with most of it in the silt size range.

7.5 UNCONFINED COMPRESSION TEST

7.5.1 Clay Fill

One unconfined compression test was performed on a relatively undisturbed clayey sample from boring B-2. The test results indicate a maximum unconfined strength of 2,800 psf and an undrained shear strength of 1,400 psf.

7.5.1 Gypsum

Two unconfined compression strength tests were performed on gypsum samples obtained from the “crusted delta / beach” in the ash pond. The test results indicated an unconfined shear strength of approximately 1,100 to 2,600 psf with undrained shear strength of 550 to 1,300 psf.

It should be noted that the test specimens were supported with a rubber membrane during testing because the samples did not have enough cohesion to support their own weight. Also, these samples were collected by pushing a Shelby tube manually in the upper dried layer of the delta material. The specimens were tested a few weeks after they were collected and could possibly have begun to dewater or dry. This indicates that drying of the samples increased the shear strength of the material.

7.6 PERMEABILITY TESTING

7.6.1 Clay Fill

One falling head permeability test was performed in a relatively undisturbed specimen obtained from boring B-1. The test results indicate a hydraulic conductivity of approximately 21.4 x 10^{-8} cm/sec.

7.6.2 Bottom Ash

Two permeability tests were performed on remolded bottom ash samples. The test specimens were remolded to 90 and 95 percent of their maximum dry density. The test results indicate the hydraulic conductivity for the bottom ash is 9.3 x 10^{-3} and 4.2 x 10^{-3} cm/sec for the 90 and 95 percent compactions, respectively.

These values suggest that additional measures are needed to impede seepage of water through the proposed bottom ash dike.

8.0 GROUND-WATER CONDITIONS

Ground water was encountered in borings B-1 and B-2 approximately 20 feet below the surface. The initial ground-water depth in the rest of the borings was not determined. Therefore, only 24-hour levels were recorded. It should be noted that borings B-1 and B-2 collapsed approximately 15 feet below the ground surface. From our experience, boreholes usually collapse at or around the ground-water elevation. As such, we judge that the 24-hour water readings are approximately 15 feet below the top of dike elevation. This depth appears to be reasonable since the water surface elevation in the pond is approximately six feet below the top of dike elevation.

9.0 RECOMMENDED DESIGN PARAMETERS

Based on our field and laboratory test results, we recommend the feasibility of the proposed dike construction be evaluated with the following engineering parameters.

	Clay Fill	Bottom Ash	Gypsum
Moist Unit Weight	125 pcf	120 pcf	90 pcf
Total Φ	7 degrees	---	0 degrees
Total C	1,000 psf	---	100 psf*
Effective $\overline{\Phi}$	22 degrees	29 degrees	---
Effective $\overline{C}$	500 psf	0 psf	---
*Based on field undrained shear strength $C = S_u = \frac{q_u}{2} = 100$ psf			

Detailed stability analyses should be performed to properly design the proposed dike. The designer must account for the gypsum material susceptibility to large pore water pressure increases.

9.0 COMPACTED BOTTOM ASH FILL

We recommend bottom ash fill be placed over the existing gypsum and fly ash foundation material. Initially, a base lift should be placed over the gypsum or fly ash deposit to provide a working surface. The base layer should be advanced around the perimeter of the work zone.

We recommend you monitor the foundation material during bottom ash fill placement to observe signs of foundation failure and possible instability or displacement. In addition, we recommend that you install pneumatic piezometers beneath the fill placement and monitor for increases in the pore water pressures in the foundation material. Should excessive pore water pressures or fill instability be observed, fill placement operations should be stopped and the pore water pressures be allowed to dissipate.

We recommend that bottom ash fill be placed by spreading bottom ash in loose lifts not exceed 8 inches and compacted to a minimum of 90 percent of its maximum dry density. We recommend the moisture content of the bottom ash be maintained within ±3 percentage points of the optimum moisture content as determined from standard Proctor testing (ASTM D698).

We recommend the fill be compacted using smooth-drummed rollers and loaded rubber-tired equipment. We recommend frequent fill density tests of bottom ash fill as it is placed to verify that adequate compaction is achieved.

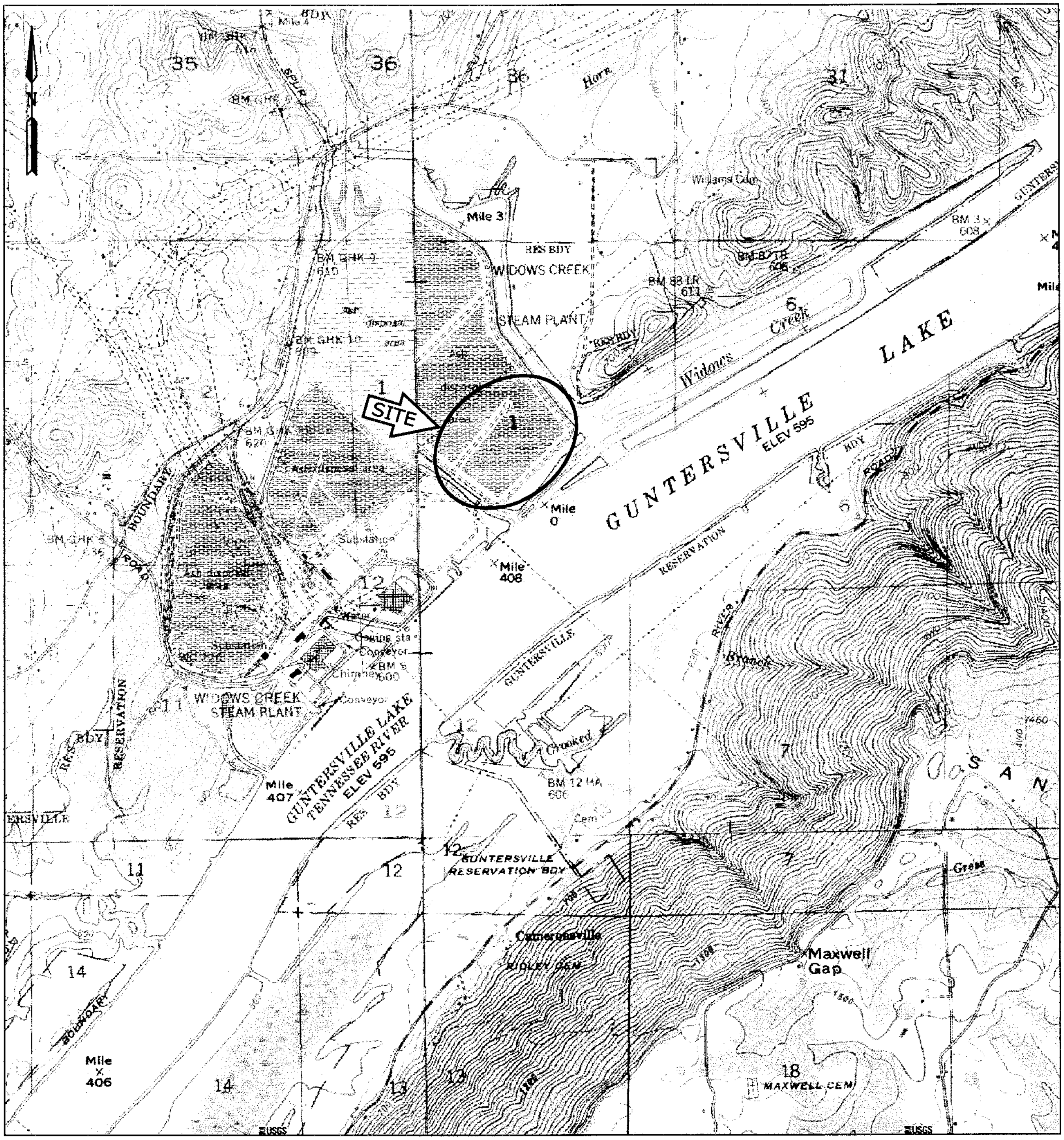
13.0 BASIS OF RECOMMENDATIONS

The recommendations provided herein are based on the subsurface conditions and on project information provided to us; they apply only to the specific project and site discussed in this report. If the project information section in this report contains incorrect information or if additional information becomes available, you should convey the corrected or additional information to us and retain us to review our recommendations. We will then modify them if the new information has rendered them inappropriate for the proposed project.

Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions between test borings will differ from those at specific test boring locations, and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process may itself alter soil conditions. Therefore, experienced geotechnical personnel should observe and document the construction procedures used and the conditions encountered. Unanticipated conditions and inappropriate procedures will be reported to the design team, along with timely recommendations to solve the problems created. We recommend that the owner retain MACTEC to provide this service, based upon our familiarity with the subsurface conditions, the project design, and the intent of the recommendations.

Our exploration services include storing the collected samples and making them available for inspection for a period of 30 days. The samples are then discarded unless you request otherwise.

FIGURES



SOURCE: USGS TOPOGRAPHIC MAPS OF BRIDGEPORT, DORAN COVE, STEVENSON, AND FLAT ROCK, AL QUADRANGLES

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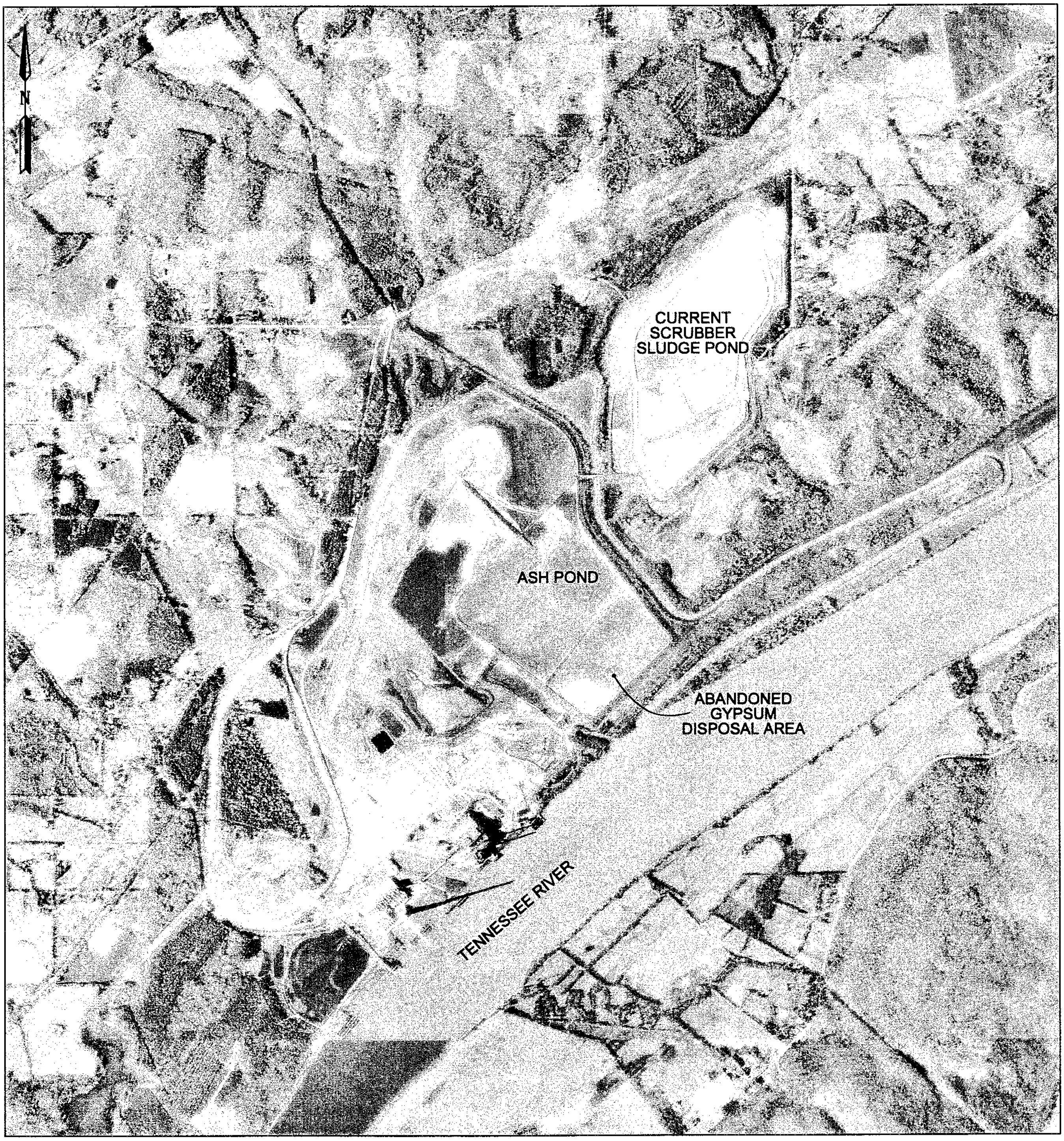
FIGURE 1(a): SITE LOCATION MAP
TVA - WIDOWS CREEK FOSSIL PLANT
STEVENSON, ALABAMA

DRAFTING BY:	PREPARED BY: MMN	CHECKED BY:
JOB NUMBER: 50300-8-2075/0081/800	DATE: JANUARY 31, 2003	SCALE: NOT TO SCALE

COORDINATES: N XX°XX'XX" W XX°XX'XX"



SOURCE: USGS AERIAL PHOTOGRAPH OF BRIDGEPORT ALABAMA, DATED APRIL 6, 1998.

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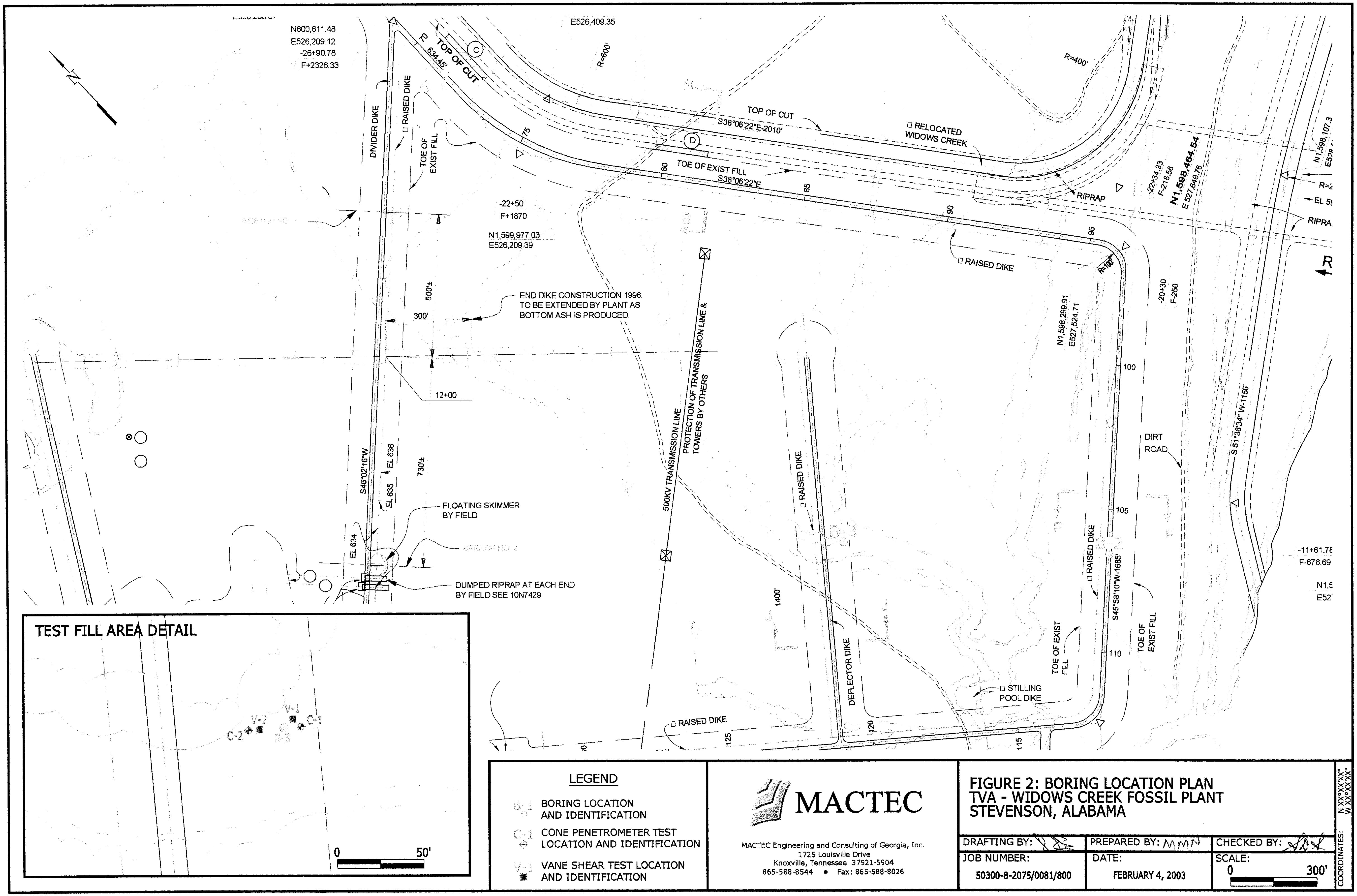
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026

FIGURE 1(b): AERIAL PHOTOGRAPH TVA - WIDOWS CREEK FOSSIL PLANT STEVENSON, ALABAMA

DRAFTING BY:	PREPARED BY: MMN	CHECKED BY:
JOB NUMBER: 50300-8-2075/0081/800	DATE: JANUARY 31, 2003	SCALE: NOT TO SCALE

COORDINATES: N XX°XX'XX" W XX°XX'XX"



LEGEND

B-1 BORING LOCATION AND IDENTIFICATION

C-1 ⊕ CONE PENETROMETER TEST LOCATION AND IDENTIFICATION

V-1 ■ VANE SHEAR TEST LOCATION AND IDENTIFICATION

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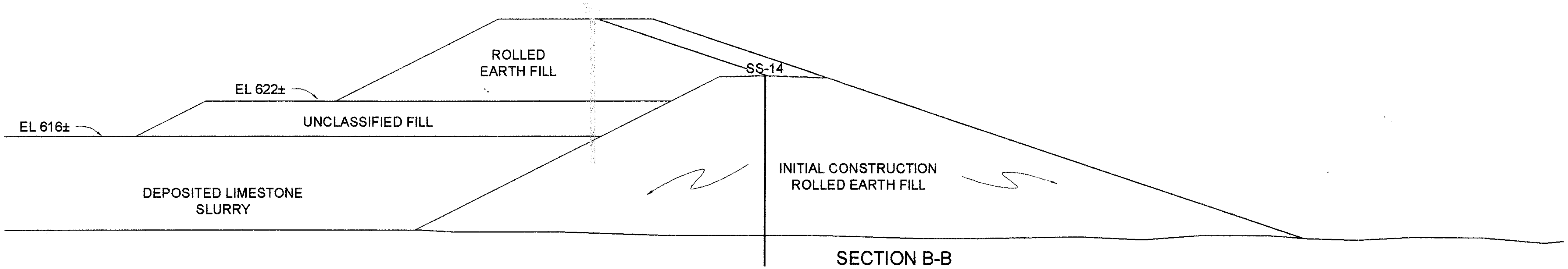
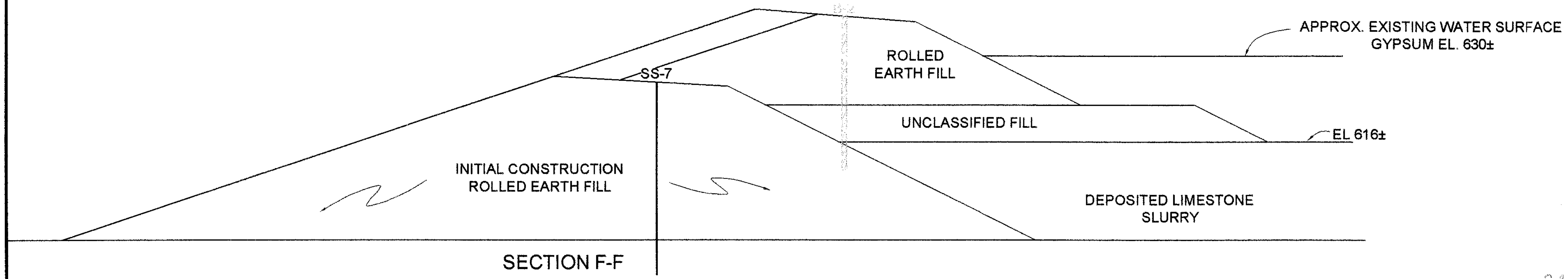
FIGURE 2: BORING LOCATION PLAN TVA - WIDOWS CREEK FOSSIL PLANT STEVENSON, ALABAMA

DRAFTING BY:	PREPARED BY: MMN	CHECKED BY:
JOB NUMBER: 50300-8-2075/0081/800	DATE: FEBRUARY 4, 2003	SCALE: 0 300'

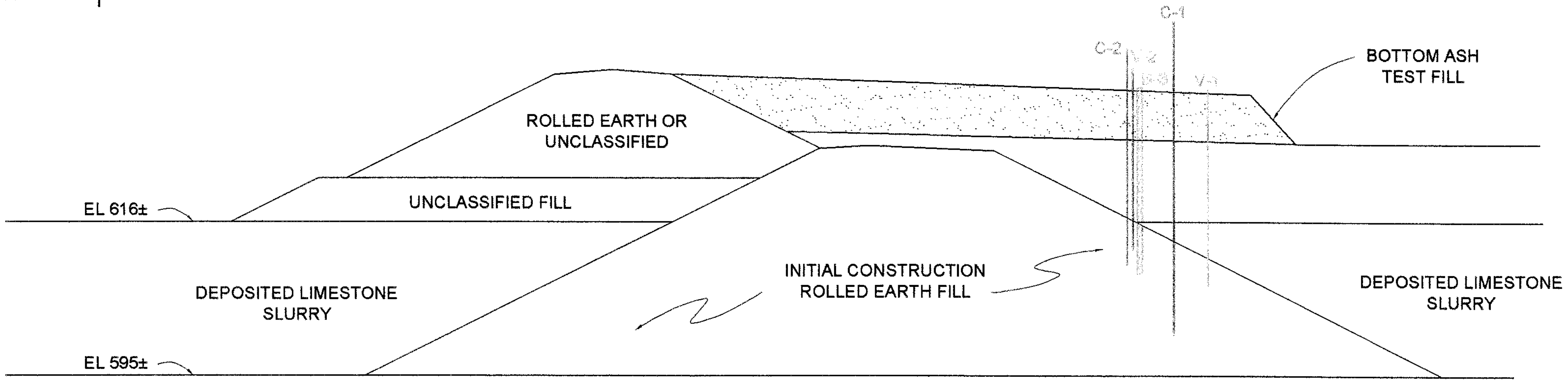
COORDINATES: N XX°XX'XX" W XX°XX'XX"



SECTION B-B



SECTION F-F



SECTION J-J

LEGEND

V-1	VANE SHEAR TEST LOCATION
C-1	CONE PENETROMETER TEST LOCATION
B-1	BORINGS PERFORMED BY MACTEC IN 2002
SS-7	BORINGS PERFORMED IN 1980'S

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FIGURE 3: CROSS SECTIONS
TVA - WIDOWS CREEK FOSSIL PLANT
STEVENSON, ALABAMA

DRAFTING BY: DJS	PREPARED BY: MMN	CHECKED BY:
JOB NUMBER: 50300-8-2075/0081/800	DATE: FEBRUARY 4, 2003	SCALE: 0 20'

COORDINATES: N XX°XX'XX" W XX°XX'XX"

APPENDIX A

FIELD EXPLORATORY PROCEDURES

FIELD EXPLORATORY PROCEDURES

Soil Test Boring (Hollow Stem)

All boring and sampling operations were conducted in general accordance with ASTM D 1586. The borings were advanced by mechanically twisting continuous steel hollow-stem auger flights into the ground. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot of penetration was recorded and is designated the "standard penetration resistance (SPT)". Proper evaluation of the penetration resistance provides an index to the soil's strength, density, and ability to support foundations.

Representative portions of the soil samples obtained from the split-tube sampler were sealed in glass jars and transported to our laboratory, where they were examined by our engineer to verify the driller's field classifications. Test Boring Records are attached, graphically showing the soil descriptions and penetration resistances.

Boring Backfill

Borings B1 and B-2 were backfilled to the ground surface with cement-bentonite grout. The rest of the borings were backfilled with auger cuttings.

You are advised that, even with this backfill technique, there is the possibility of future borehole subsidence depending on actual subsurface conditions, surface drainage, etc. The property owner should monitor the boring locations over time to discover subsidence and make the necessary repairs.

Dutch Cone Penetrometer

The cone penetrometer test was performed in general accordance with ASTM D3441. The soil resistance was measured by advancing a 35-mm long metal cone with a tip angle of 60 degrees. The metal cone is attached to standard drilling rods and advanced at a rate of 2 to 4 feet per minute.

The tip resistance and side friction data are measured as the cone is advanced through the subgrade. The changes in tip resistance and side friction are used to identify the subsurface soil layers and provide an estimate of the in-situ shear strength.

Vane Shear Testing

Vane shear testing was performed in general accordance with ASTM Method D 2573. The vane shear equipment consists of a four-bladed steel vane, typically 2 to 4 inches wide. Each vane is attached to a 3/4-inch steel rod that is in turn attached to steel drill rods. The vane is pushed to the desired test depth. The rods extend above the ground surface where a steel frame and geared torque assembly is clamped onto the rods. During a test, the rods and vane are slowly rotated at a rate of about 1 degree every 10 seconds. A force gauge attached to the assembly measures applied torque. Readings of force are collected at 15-second intervals until a peak reading is achieved, typically after 3 to 5 minutes.

APPENDIX B

KEY TO SYMBOLS AND DESCRIPTIONS

SOIL TEST BORING RECORDS

CONE PENETROMETER TEST RESULTS

VANE SHEAR TEST RESULTS

GROUP SYMBOLS	TYPICAL NAMES	GROUP SYMBOLS	TYPICAL NAMES
▓	**TOPSOIL**	▒	**CONCRETE**
■	**ASPHALT**	▤	**DOLOMITE**
▒	**GRAVEL**	▦	**LIMESTONE**
▒	**FILL**	▤	**SHALE**
▦	**SUBSOIL**	▤	**LIMESTONE/SHALE** - Limestone with shale interbeds
▤	**ALLUVIUM**	░	**SANDSTONE**
▤	**COLLUVIUM**	▥	**SILTSTONE**
▨	**RESIDUUM** - Soft to firm	▥	**AUGER BORING**
▨	**RESIDUUM** - Stiff to very hard	▮	**UNDISTURBED SAMPLE ATTEMPT**

■	Undisturbed Sample 1.5-2.0 = Recovered (ft) / Pushed (ft)		
▒	Split Spoon Sample	▓	Auger Cuttings
▥	Rock Core 60-100 = RQD / Recovery	▩	Dilatometer
☐	No Sample	▧	Crandall Sampler
|	Rotary Drill	▒	Pressure Meter
▽	Water Table at time of drilling	○	No Recovery
		▼	Water Table after 24 hours

Correlation of Penetration Resistance
with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 20	Firm	5 - 8	Firm
21 - 30	Very Firm	9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
Over 50	Very Dense	31 - 50	Hard
		Over 50	Very Hard

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

KEY TO SYMBOLS AND DESCRIPTIONS

MACTEC, Inc.

MACTEC Engineering and Consulting of Georgia, Inc.
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026

SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

DEPTH (ft) | LEGEND | ELEV (ft)

GRAVEL (0.6')

VERY STIFF, RED-BROWN SILTY CLAY - FILL

MOIST, RED-BROWN SILTY CLAY - FILL

BLACK GRANULAR BOTTOM ASH AND FLY ASH

LIGHT TAN AND LIGHT BROWN, SILTY CLAY (PLASTIC) WITH WATER - FILL

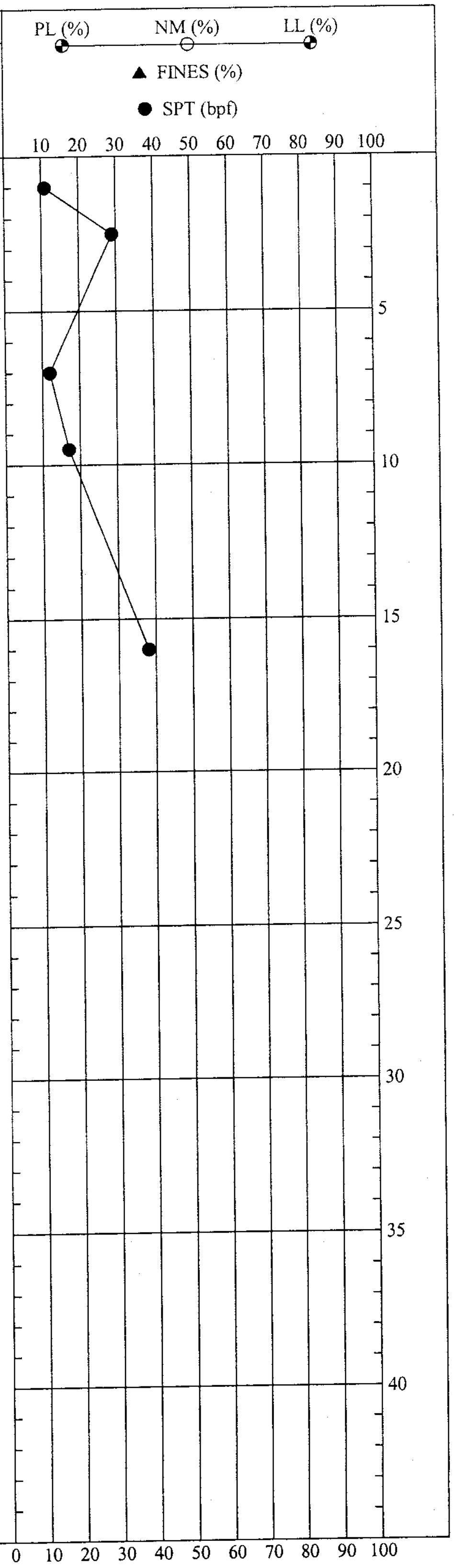
▽

TAN AND LIGHT BROWN SILTY CLAY (PLASTIC) WITH CHERT FRAGMENTS - RESIDUUM

BORING TERMINATED AT 23.5'

SAMPLES

IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
SPT-1	▨	19-5-6
SPT-2	▨	9-14-15
UD-1	■	??-2.0
SPT-3	▨	3-5-7
SPT-4	▨	3-8-9
UD-2	■	2.0-2.0
SPT-5	▨	6-19-19
UD-3	■	1.6-2.0
SPT-6	▨	3-4



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

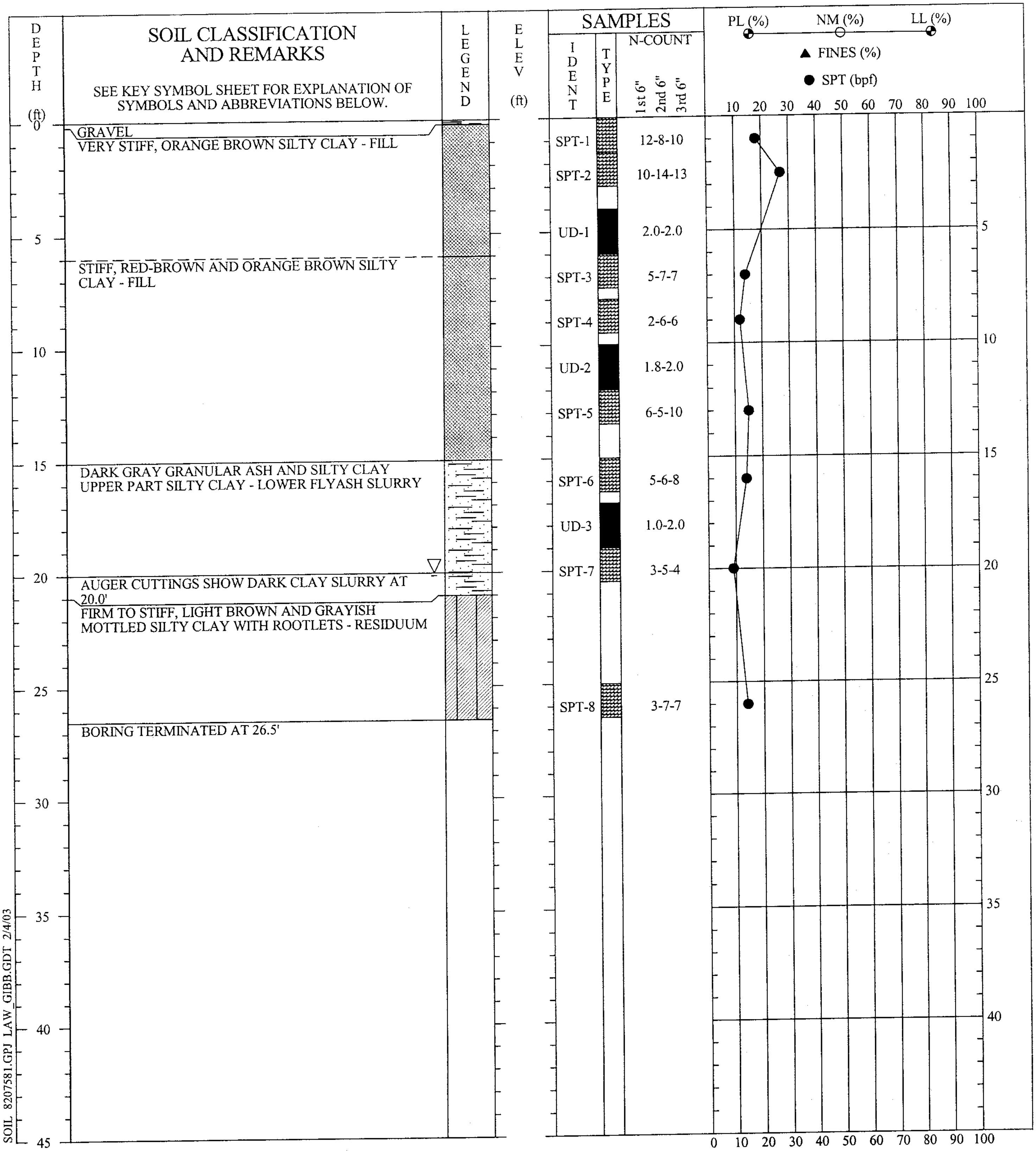
PROJECT: TVA - Widows Creek Ash Dike

DRILLED: November 19, 2002 **BORING NO.:** B-1

PROJ. NO.: 50300-8-2075/0081/800 **PAGE** 1 **OF** 1

MACTEC

SOIL 8207581.GPJ LAW_GIBB.GDT 2/4/03



SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

GRAVEL

VERY STIFF, ORANGE BROWN SILTY CLAY - FILL

STIFF, RED-BROWN AND ORANGE BROWN SILTY CLAY - FILL

DARK GRAY GRANULAR ASH AND SILTY CLAY UPPER PART SILTY CLAY - LOWER FLYASH SLURRY

AUGER CUTTINGS SHOW DARK CLAY SLURRY AT 20.0'

FIRM TO STIFF, LIGHT BROWN AND GRAYISH MOTTLED SILTY CLAY WITH ROOTLETS - RESIDUUM

BORING TERMINATED AT 26.5'

SAMPLES

IDENT	N-COUNT 1st 6" 2nd 6" 3rd 6"
SPT-1	12-8-10
SPT-2	10-14-13
UD-1	2.0-2.0
SPT-3	5-7-7
SPT-4	2-6-6
UD-2	1.8-2.0
SPT-5	6-5-10
SPT-6	5-6-8
UD-3	1.0-2.0
SPT-7	3-5-4
SPT-8	3-7-7

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: TVA - Widows Creek Ash Dike

DRILLED: November 19, 2002 **BORING NO.:** B-2

PROJ. NO.: 50300-8-2075/0081/800 **PAGE** 1 **OF** 1

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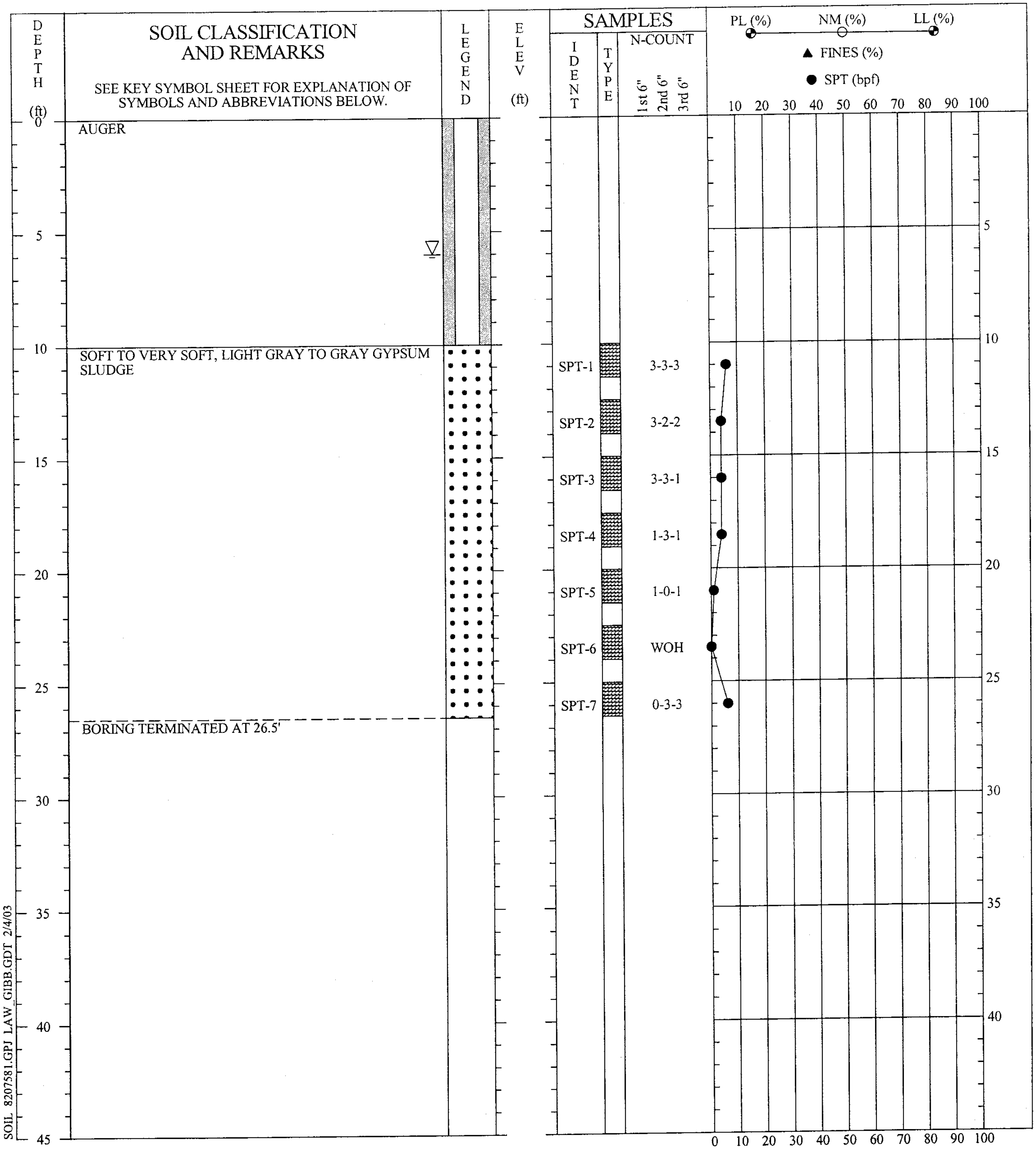

SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS
0	AUGER
10	SOFT TO VERY SOFT, LIGHT GRAY TO GRAY GYPSUM SLUDGE
26.5	BORING TERMINATED AT 26.5'

SAMPLES

IDENT	N-COUNT (1st 6" 2nd 6" 3rd 6")
SPT-1	3-3-3
SPT-2	3-2-2
SPT-3	3-3-1
SPT-4	1-3-1
SPT-5	1-0-1
SPT-6	WOH
SPT-7	0-3-3

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: TVA - Widows Creek Ash Dike

DRILLED: November 21, 2002 **BORING NO.:** B-3

PROJ. NO.: 50300-8-2075/0081/800 **PAGE** 1 **OF** 1

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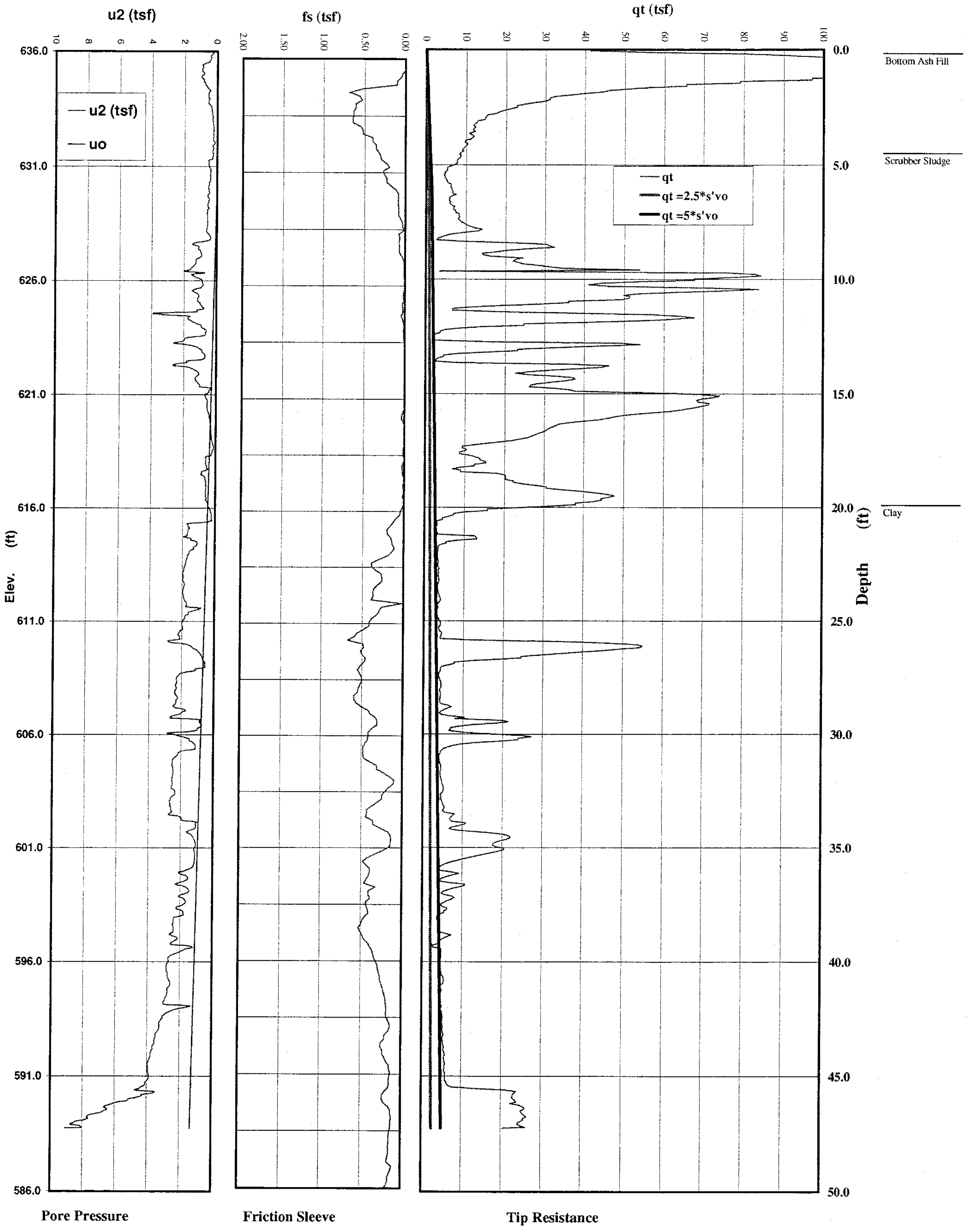
CONE PENETROMETER TEST RESULTS



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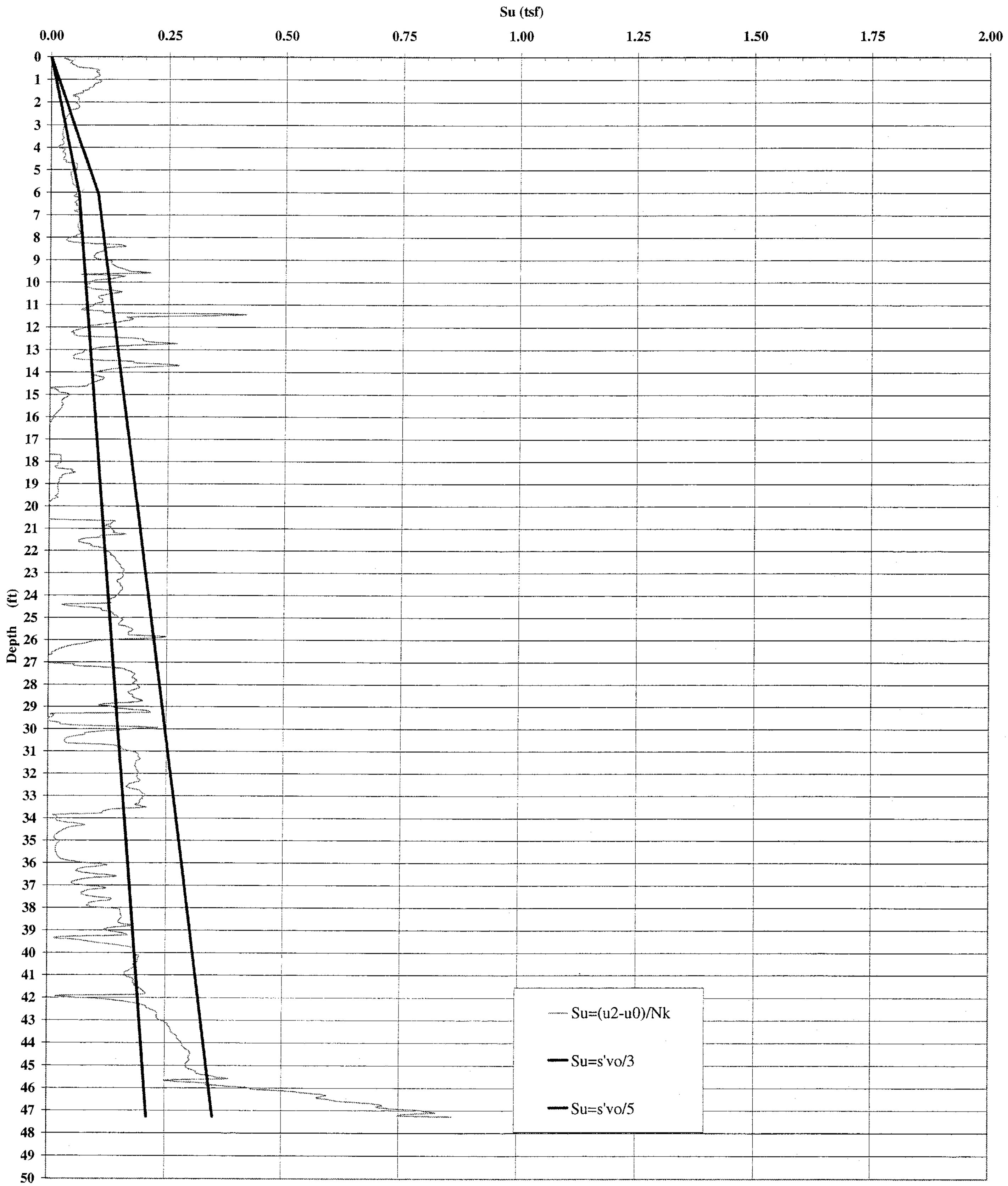
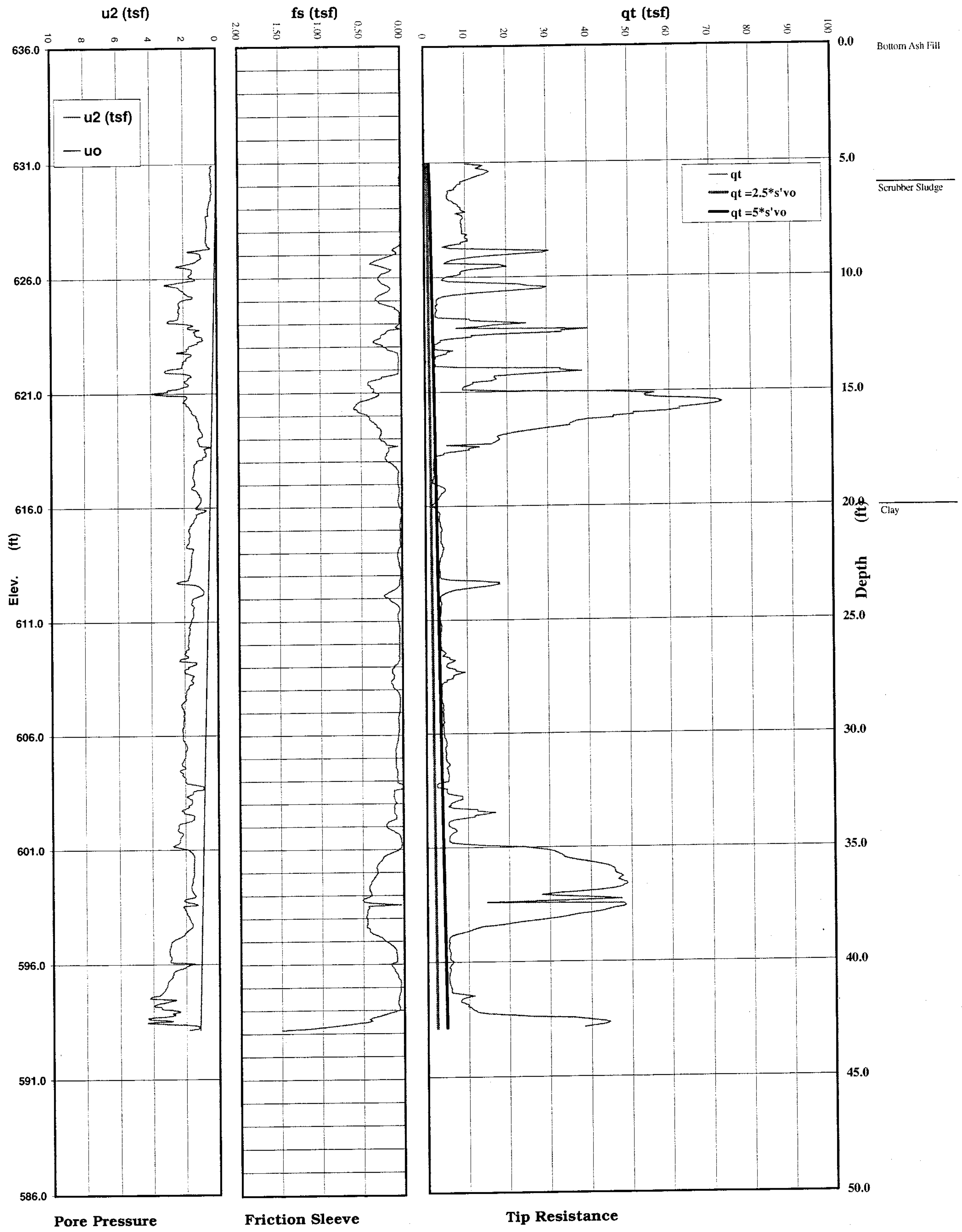
PROJECT: TVA Widow Creek
PROJ. NO: 50300-8-2075
PROBE ID: C-1
DATE: 11/20/02

SURFACE ELEV.: 636 feet

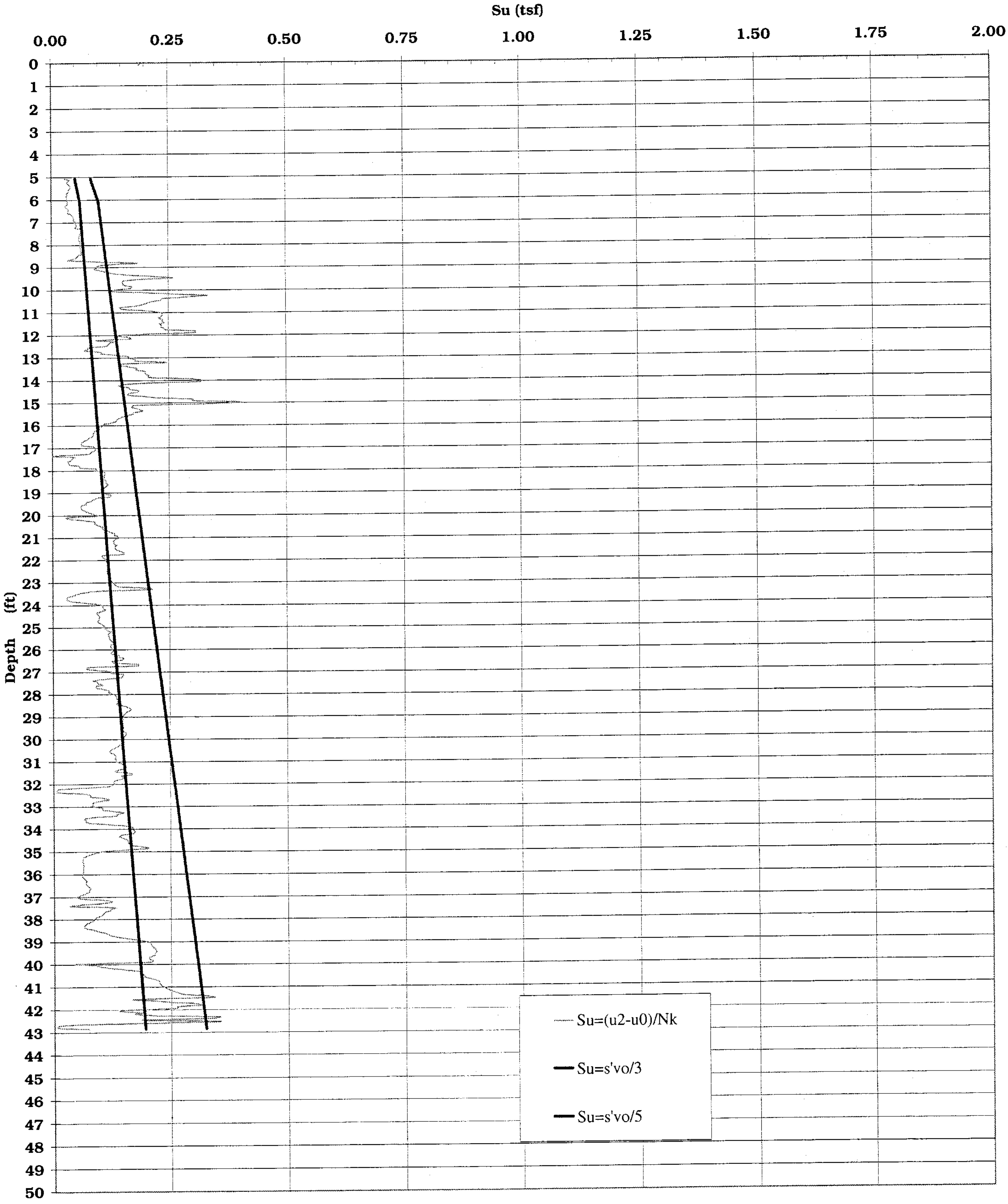


PROJECT:	TVA Widow Creek
PROJ. NO:	50300-8-2075
PROBE ID:	C-1
DATE:	11/20/02
SURFACE ELEV.:	636 feet



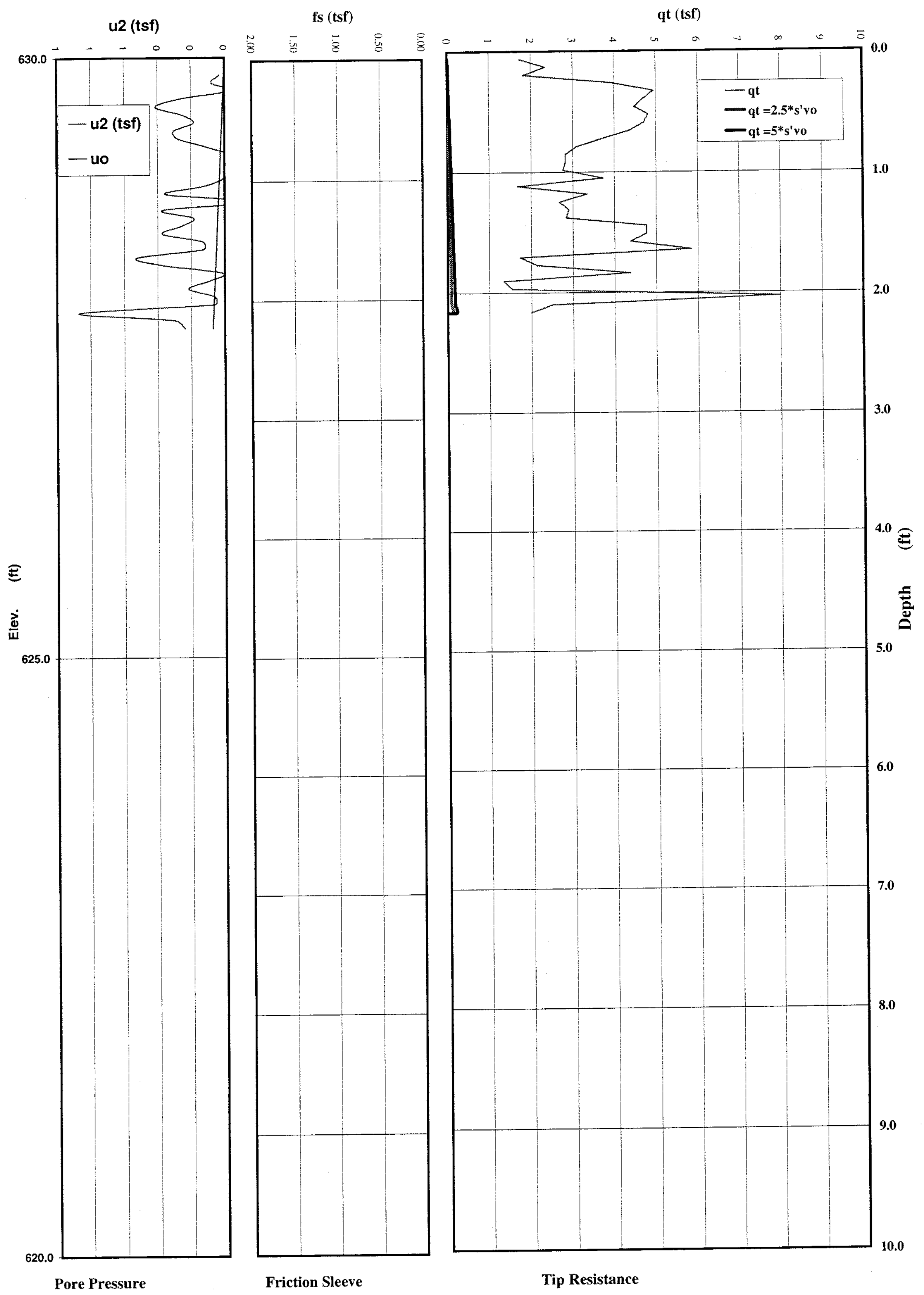
PROJECT: TVA Widow Creek
PROJ. NO: 50300-8-2075
PROBE ID: C-2
DATE: 11/20/02

SURFACE ELEV.: 636 feet



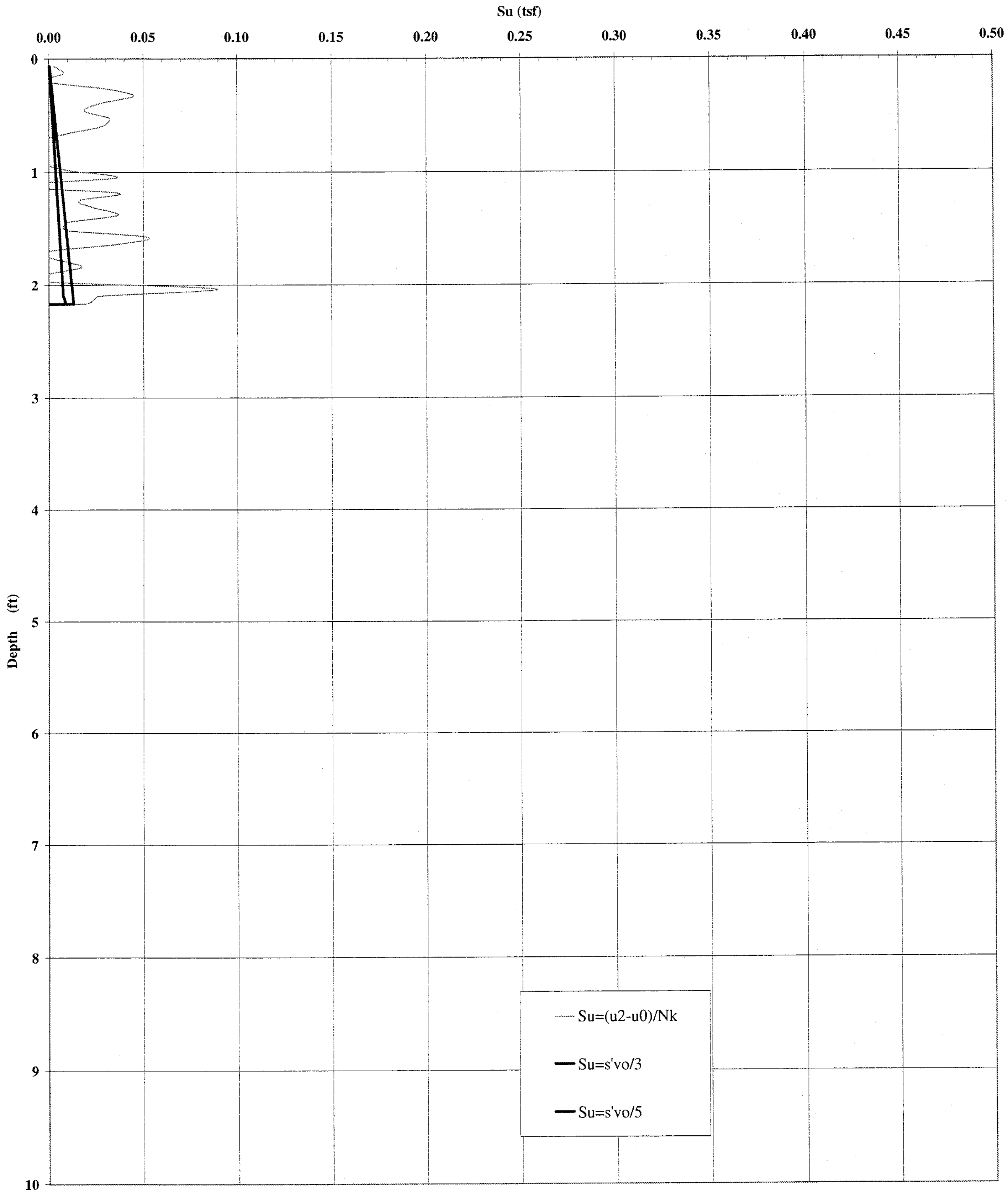
MACTEC

PROJECT:	TVA Widow Creek
PROJ. NO:	50300-8-2075
PROBE ID:	C-2
DATE:	11/20/02
SURFACE ELEV.:	636 feet



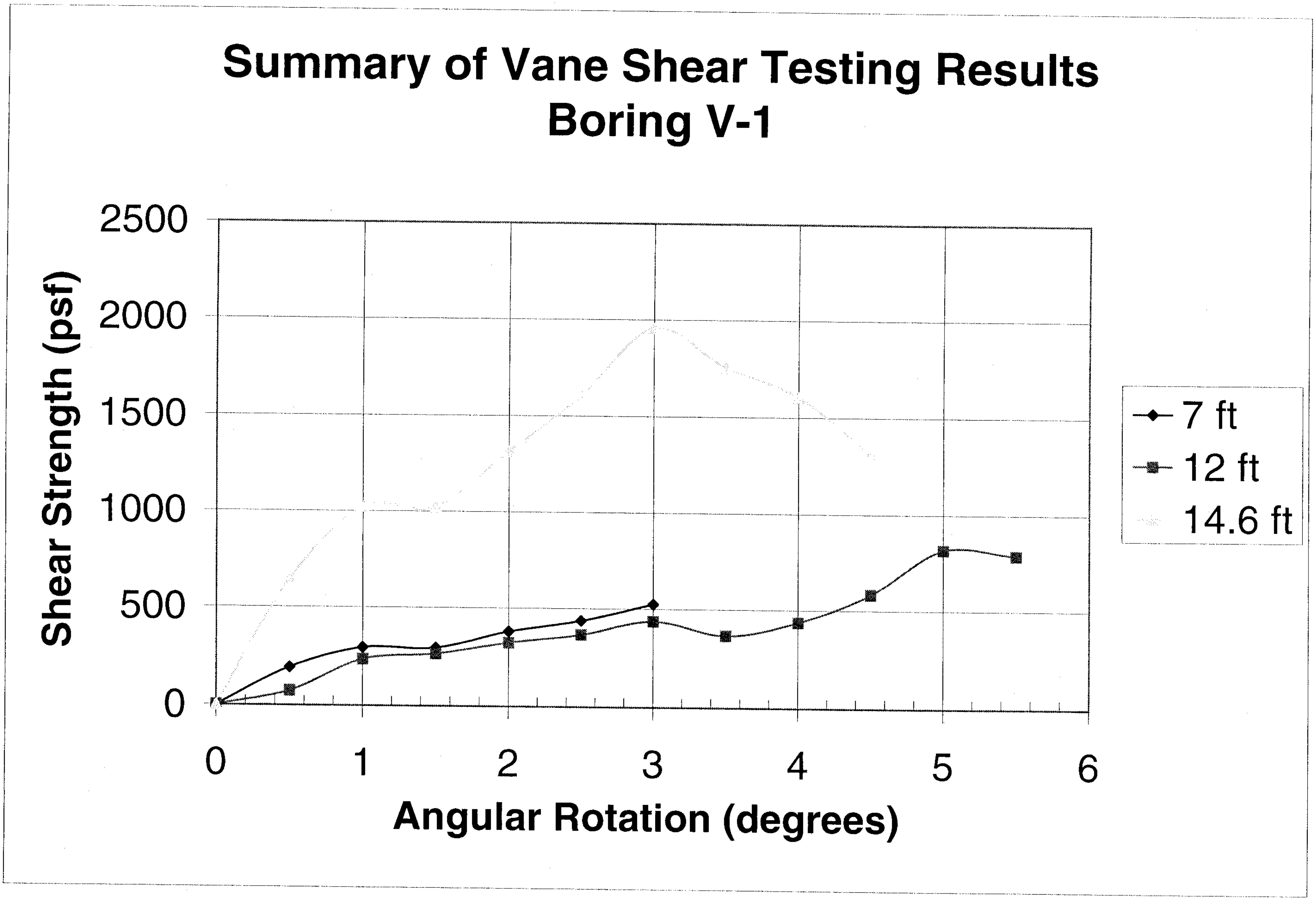
MACTEC

PROJECT:	TVA Widow Creek
PROJ. NO:	50300-8-2075
PROBE ID:	C-3
DATE:	11/21/02
SURFACE ELEV.:	630 feet

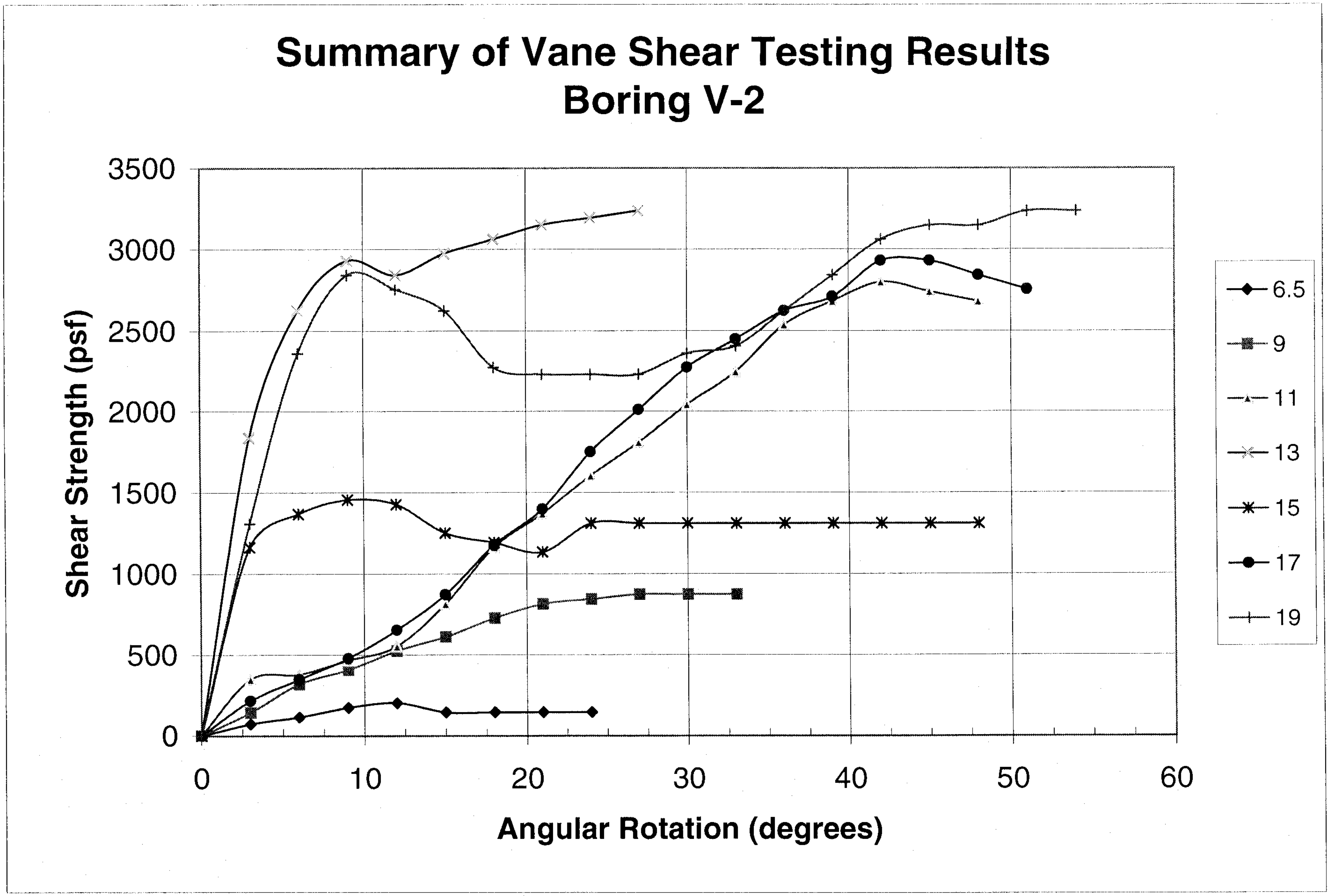


PROJECT:	TVA Widow Creek
PROJ. NO:	50300-8-2075
PROBE ID:	C-3
DATE:	11/21/02
SURFACE ELEV.:	630 feet

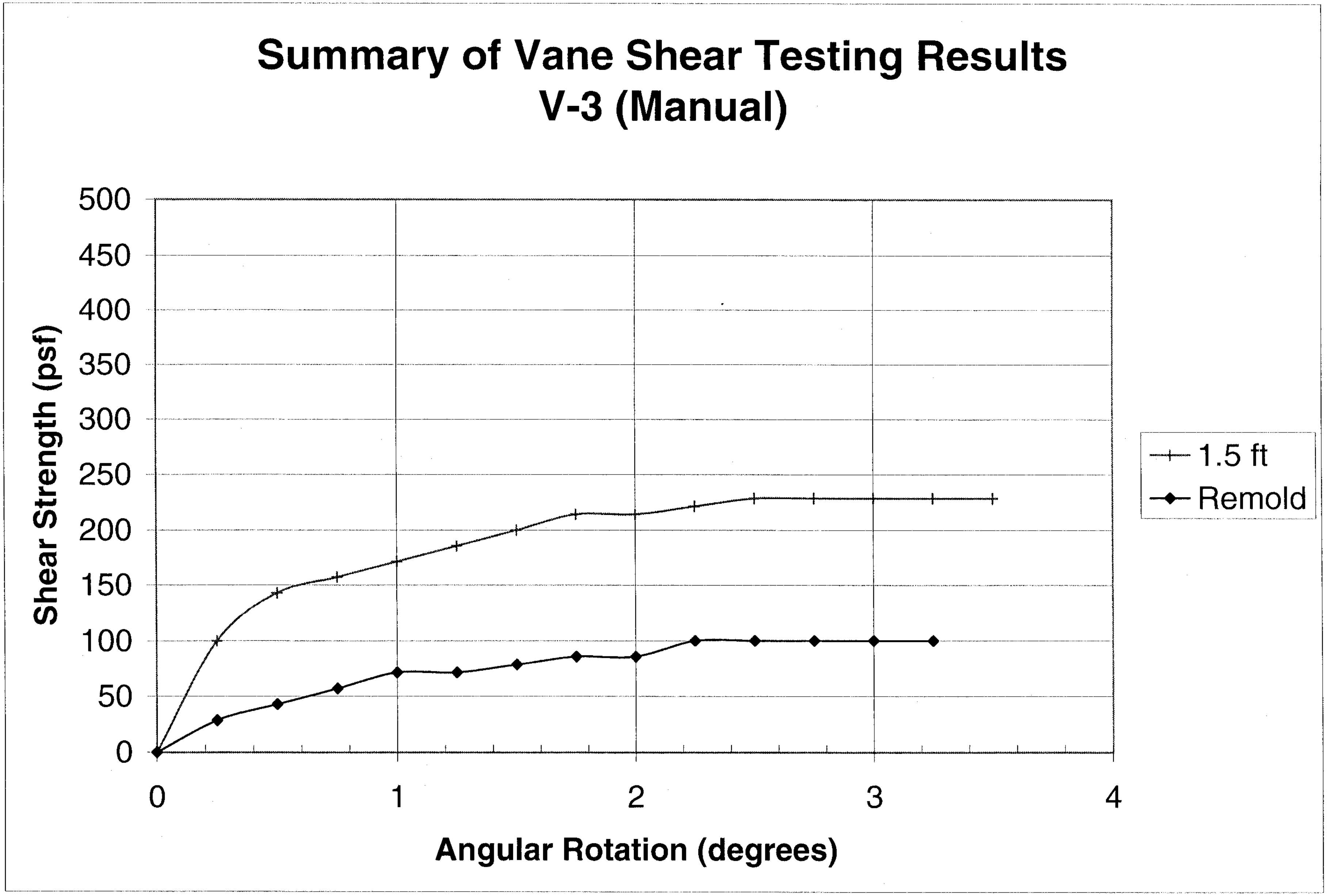
VANE SHEAR TEST RESULTS



Summary of Vane Shear Testing Results
Boring V-1



Summary of Vane Shear Testing Results
Boring V-2


Summary of Vane Shear Testing Results
V-3 (Manual)
Shear Strength (psf)
500
450
400
350
300
250
200
150
100
50
0
0
1
2
3
4
Angular Rotation (degrees)
1.5 ft
Remold

APPENDIX C

LABORATORY TEST PROCEDURES

SUMMARY OF LABORATORY TEST RESULTS

GYPSUM MATERIAL TEST RESULTS

BOTTOM ASH MATERIAL TEST RESULTS

EXISTING DIKE MATERIAL TEST RESULTS

LABORATORY TEST PROCEDURES

Atterberg Limits (Plasticity Index)

Originally, the Atterberg Limits consisted of seven "limits of consistency" of fine-grained soils. In current engineering usage, the term usually refers only to the liquid limit (LL) and plastic limit (PL). The LL (between the liquid and plastic states) is the water content at which a trapezoidal groove of specified shape, cut in moist soil held in a special cup, is closed after 25 taps on a hard rubber plate. The PL (between plastic and semi-solid states) is the water content at which the soil crumbles when rolled into threads of 1/8 inch in diameter.

The LL has been found to be proportional to the compressibility of the normally consolidated soil. The Plasticity Index (PI) is the calculated difference in water contents between the LL and PL. Together the LL and PI are used to classify silts and clays according to the Unified Soils Classification System (ASTM D 2487). The PI is used to predict the potential for volume changes in confined soils beneath foundations or grade slabs. The LL, PL, and PI are determined in accordance with ASTM D 4318.

Moisture Content

The moisture content in a given mass of soil is the ratio, expressed as a percentage, of the weight of the water to the weight of the solid particles. This test was conducted in accordance with ASTM D-2216.

Grain Size Distribution

Grain Size Tests are performed to aid in determining the soil classification and the grain size distribution. The soil samples are prepared for testing according to ASTM D 421 (dry preparation) or ASTM D 2217 (wet preparation). If only the grain size distribution of soils coarser than a number 200 sieve (0.074-mm opening) is desired, the grain size distribution is determined by washing the sample over a number 200 sieve and, after drying, passing the samples through a standard set of nested sieves. If the grain size distribution of the soils finer than the number 200 sieve is also desired, the grain size distribution of the soils coarser than the number 10 sieve is determined by passing the sample through a set of nested sieves. Materials passing the number 10 sieve are dispersed with a dispersing agent and suspended in water, and the grain size distribution calculated from the measured settlement rate of the particles. These tests are conducted in accordance with ASTM D 422.

Specific Gravity

The specific gravity (relative density) of an aggregate is the ratio of its weight to the weight of an equal absolute volume of water (water displaced on immersion). The test methods for determining the specific gravities on the Bottom Ash sample are described in ASTM C 127, "Test Method for Specific Gravity and Absorption of Coarse Aggregate" in conjunction with ASTM C 128, "Test Method for Specific Gravity and Absorption of Fine Aggregate".

The specific gravity of soil solids is the ratio of the mass of a unit volume of a soil solids to the mass of the same volume of gas-free distilled water at 20C. The test method for determining the specific gravity of soil solids that passes the 4.75-mm (No. 4) sieve using a water pycnometer is described in ASTM D 854, Method B, "Test Methods for Specific Gravity of Soil Solids by Water Pycnometer".

Unconfined Compression of Soil

The unconfined compression test is an unconsolidated-undrained shear test with no lateral confining pressure. This test is used to determine the undrained shear strength of a clayey soil. An unconfined compression test is conducted in general accordance with ASTM D 2166 on a single section of an undisturbed sample extruded from a sampling tube. The sample is trimmed to a length of between 2-and 2-1/2-times its diameter and placed in the testing device. The sample is loaded at a constant strain rate until the sample fails. Strain measurements are made during the testing on some samples and the results are plotted and reported as stress-strain curves. The results from our unconfined compression tests are provided in this report.

Triaxial Shear Tests

Triaxial shear tests are used to determine the strength characteristics and friction angle of a given soil sample. Triaxial tests are also used to determine the elastic properties of the soil specimen.

Triaxial shear tests are performed on several sections of a relatively undisturbed sample extruded from the sampling tube. The samples are trimmed into cylinders 1.4 to 2.8 inches in diameter and encased in rubber membranes. Each is then placed in a compression chamber and confined by all-around air pressure. The test results are presented in the form of stress-strain curves and Mohr envelopes, or p-q plots on the accompanying Triaxial Shear Test Sheets.

One of three types of triaxial tests is normally performed, the most suitable type being determined by the loading conditions imposed on the soil in the field and the soil characteristics.

1. Consolidated-Undrained (Designated as a CU or R Test)
2. Consolidated-Drained (designated as a CD or S Test)
3. Unconsolidated-Undrained (designated as a UU or Q Test)

Compaction Tests (Moisture-Density Relationship)

Compaction tests are performed on representative soil samples to determine the maximum dry density and optimum moisture content. The results of the tests are used in conjunction with other tests to determine engineering properties relating to settlement, bearing capacity, shear strength, and permeability. The results may also be used as a standard to determine the percent compaction of any soil embankment.

The two most commonly used compaction tests are the standard Proctor test and the modified Proctor test. They are performed in accordance with ASTM D 698 and D 1557, respectively. Generally, the standard Proctor compaction test is run on samples from building areas and areas where moderate loads are anticipated. The modified Proctor compaction test is generally used for analyses of highways and other areas where large building loads are expected. Both tests have three procedures, depending upon soil particle size:

Test	Procedure	Hammer Weight	Hammer Fall	Mold Diameter	Screen Size (Material Finer Than)	Number of Layers	Number of Blows per Layer
Standard (D 698)	A	5.5 lb.	12"	4"	No. 4 sieve	3	25
	B	5.5 lb.	12"	4"	No. 3/8" sieve	3	25
	C	5.5 lb.	12"	6"	3/4" sieve	3	56
Modified (D 1557)	A	10 lb.	18"	4"	No. 4 sieve	5	25
	B	10 lb.	18"	4"	No. 3/8" sieve	5	25
	C	10 lb.	18"	6"	3/4" sieve	5	56

Test results are presented as a curve depicting dry unit weight versus moisture content. The compaction method used and any deviations from the recommended procedures are noted in the report.

Falling Head Permeability Test

The test sample was taken from the bottom of the undisturbed sample. The physical dimensions and weight were obtained and the sample was encased in a rubber membrane and placed in a triaxial chamber. The sample was then back-pressure saturated until a B value of 0.95 or greater was reached. After saturation was obtained, the sample was consolidated under 10-psi confining stress. Upon completion of consolidation, a falling head permeability test was performed.

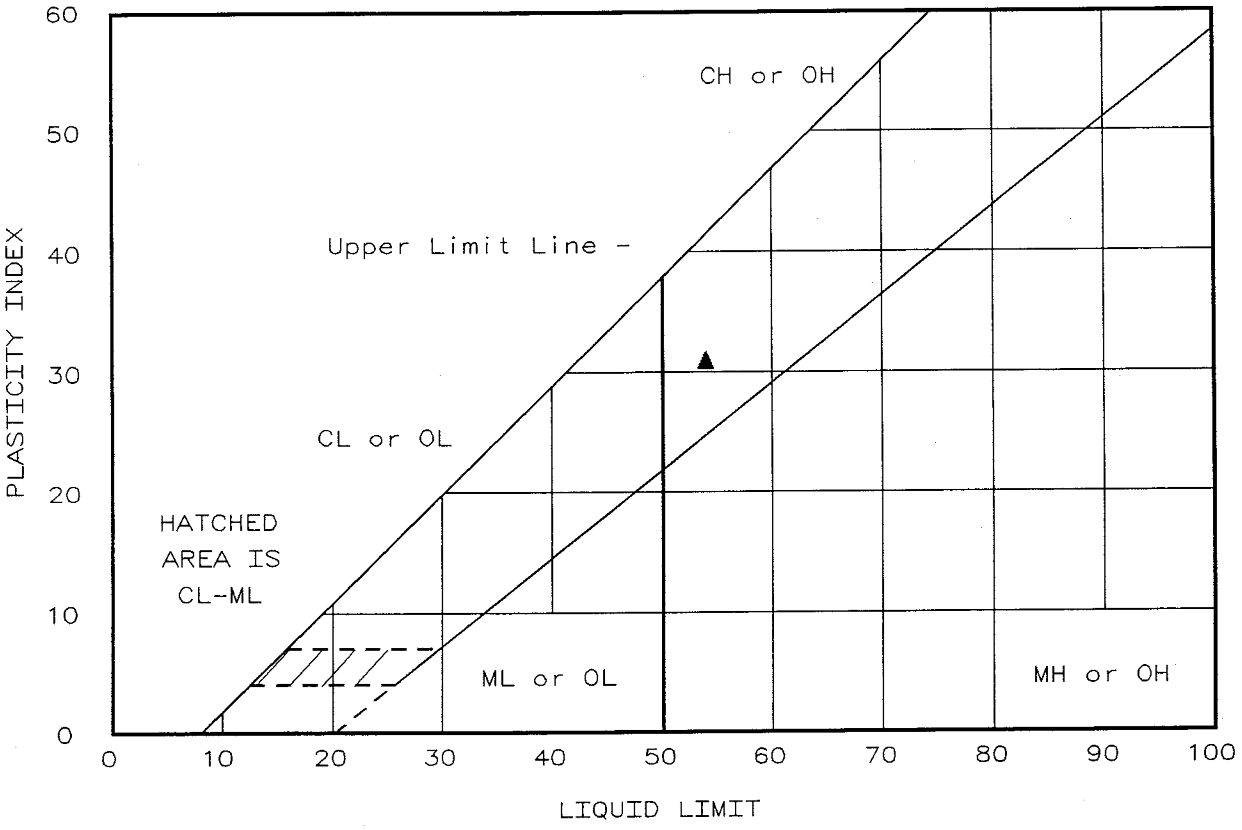
SUMMARY OF LABORATORY TEST RESULTS

Summary of Laboratory Test Results
Proposed Ash Pond Dike Raise
TVA Widows Creek Fossil Plant
MACTEC Project 50300-8-2075/0081/800

										Shear Strength Parameters									
Material	Boring ID	Sample ID	Depth (Feet)	Moisture (%)	Dry Unit Weight (pcf)	Specific Gravity	Fines Passing No. 200 Sieve (%)	Plasticity Index	USCS Classification	Unconfined	UU Total Φ (Degrees)	UU Total C (psf)	CU w/ PP Total Φ (Degrees)	CU w/ PP Total C (psf)	Effective Φ (Degrees)	Effective C (psf)	Permeability (cm/sec)	Standard Proctor (γ dry max/OMC)	Percent Compaction
Dike Material	B-1	S-1	0 - 1.5	24			84.6	31	CH										
		S-2	1.5 - 3	23															
		S-3	6 - 7.5	23															
		S-4	8.5 - 10	24															
		S-6	22 - 23.5	23				32											
		UD-3	20 - 22	22	106	2.74	72.3	27	CL		2.7	620					1.40E-08		
	B-2	S-1	0 - 1.5	22				34											
		S-2	1.5 - 3	26															
		S-3	6 - 7.5	27															
		S-5	12 - 13.5	27															
		S-6	15 - 16.5	19															
		S-7	19 - 20.5	24				22											
		S-8	22 - 26	27															
		UD-1	4 - 6	25.5	100	2.70	83.3				8.9	1,450							
		UD-2	13 - 15	21	106		85.7	29	CH				6.4	2,590	17.3	1,380			
		UD-3	17 - 19	25.3	101.3	2.70				2836			16.2	1,090	25.9	220			
Bottom Ash		Bag	NA			2.76	5.7	NP										113.3 / 8.8	
		Bag	NA																
		Bag	NA	17	102.6		5.0	NP							29.5	533	9.30E-03	113.9 / 17.3	90
		Bag	NA	17.3	108.3		5.0	NP							30.0	958	4.20E-03		95
Gypsum			Surface				90.0	NP / ML											
			Surface	45.3	73	2.83	97.0	NP / ML		1137									
			Surface	42.2	77.3	2.84				2597									
	B-3	S-1	10	56															
		S-2	13	51			94.6	NP / ML											
		S-3	18	39			83.4	NP / ML											
		S-4	21	107															

Prepared By MMN Date 2/4/03 Checked By Date 2/4/03

LIQUID AND PLASTIC LIMITS TEST REPORT



	Location + Description	LL	PL	PI	-200	USCS	AASHTO
●	Ash pile bulk sample, sample no. 2726+ Black bottom ash sand & gravel	NV	NP		6.0	SP-SM	A-1-a
▲	Boring B-1 SPT 1 to 4 + Light brown silty clay with sand	54	23	31	84.6	CH	A-7-6(28)
■	Boring B-3, SPT 10-11.5 & 12.4-14 + Gray brown ash	NV	NP		94.6	ML	A-4(0)
◆	Boring B-3, SPT 17.5-19 & 20-21.5' + Gray ash	NV	NP		83.4	ML	A-4(0)

NV – Non-Viscous   NP – Non-Plastic

Project No.: 5030082075
Project: Widows Creek Fossil Plant Ash Pile, TVA

Client: TVA
Location:

Date: 12-12-2002

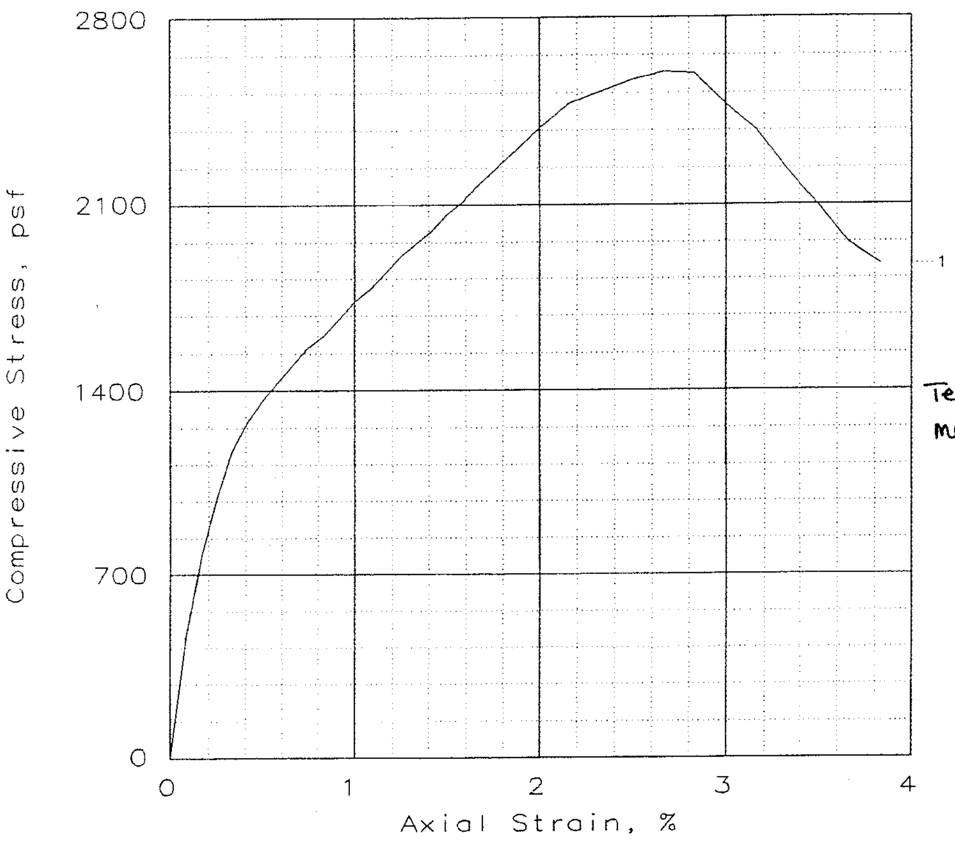
Remarks:
Phase 0081

LIQUID AND PLASTIC LIMITS TEST REPORT
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Fig. No. 0081

GYPSUM MATERIAL TEST RESULTS

UNCONFINED COMPRESSION TEST



Test performed with membrane.

SAMPLE NO.:	1			
Unconfined strength, psf	2597			
Undrained shear strength, psf	1298			
Failure strain, %	2.7			
Strain rate, %/min	0.50			
Water content, %	42.2			
Wet density, pcf	110.0			
Dry density, pcf	77.3			
Saturation, %	93.0			
Void ratio	1.2843			
Specimen diameter, in	2.84			
Specimen height, in	6.00			
Height/diameter ratio	2.11			

Description: Gypsum Sample

GS= 2.83

Type: Shelby Tube

Project No.: 50300-8-2075/81/800

Date: 01-16-03

Remarks:
Sample tested with
membrane on

Fig. No.: ——

Client: TVA

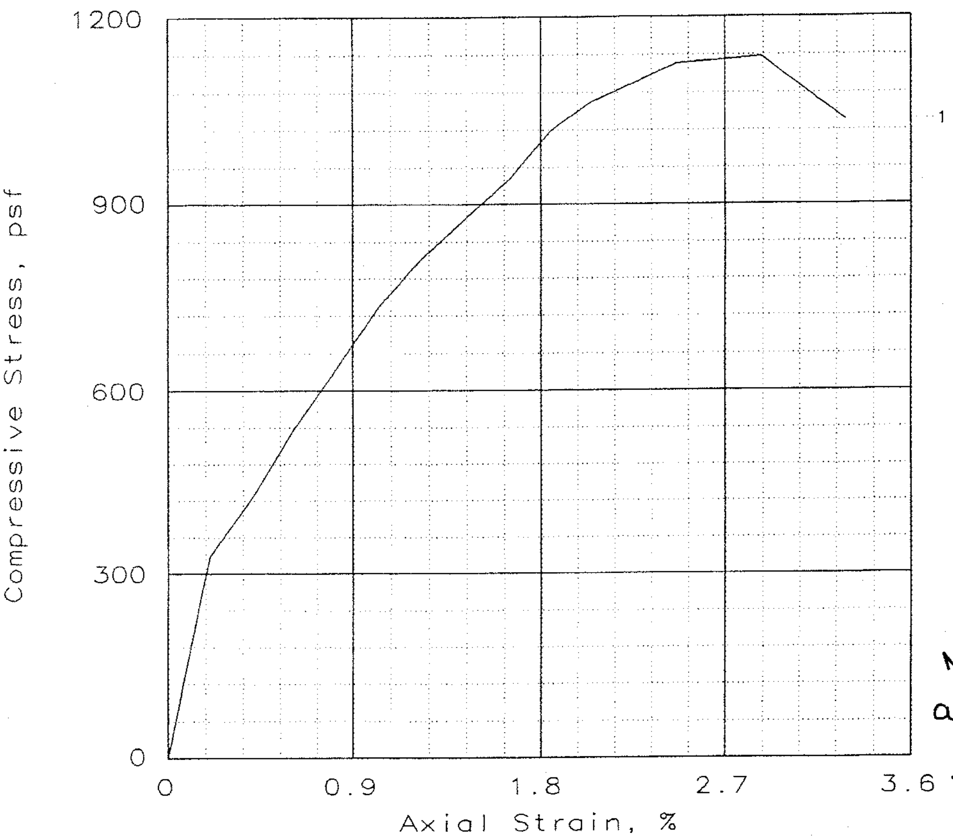
Project: TVA WCF Ash Pond Dike

Location:

UNCONFINED COMPRESSION TEST

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

UNCONFINED COMPRESSION TEST



No membrane
also h/d ratio
less than 2.0

SAMPLE NO.:	1			
Unconfined strength, psf	1137			
Undrained shear strength, psf	568			
Failure strain, %	2.9			
Strain rate, %/min	0.50			
Water content, %	45.3			
Wet density, pcf	106.4			
Dry density, pcf	73.2			
Saturation, %	90.7			
Void ratio	1.4131			
Specimen diameter, in	2.83			
Specimen height, in	4.87			
Height/diameter ratio	1.72			

Description: Gypsum Sample

GS= 2.83

Type: Shelby Tube

Project No.: 50300-8-2075/81/800

Date: 01-16-03

Remarks:
no membrane

Fig. No.: ——

Client: TVA

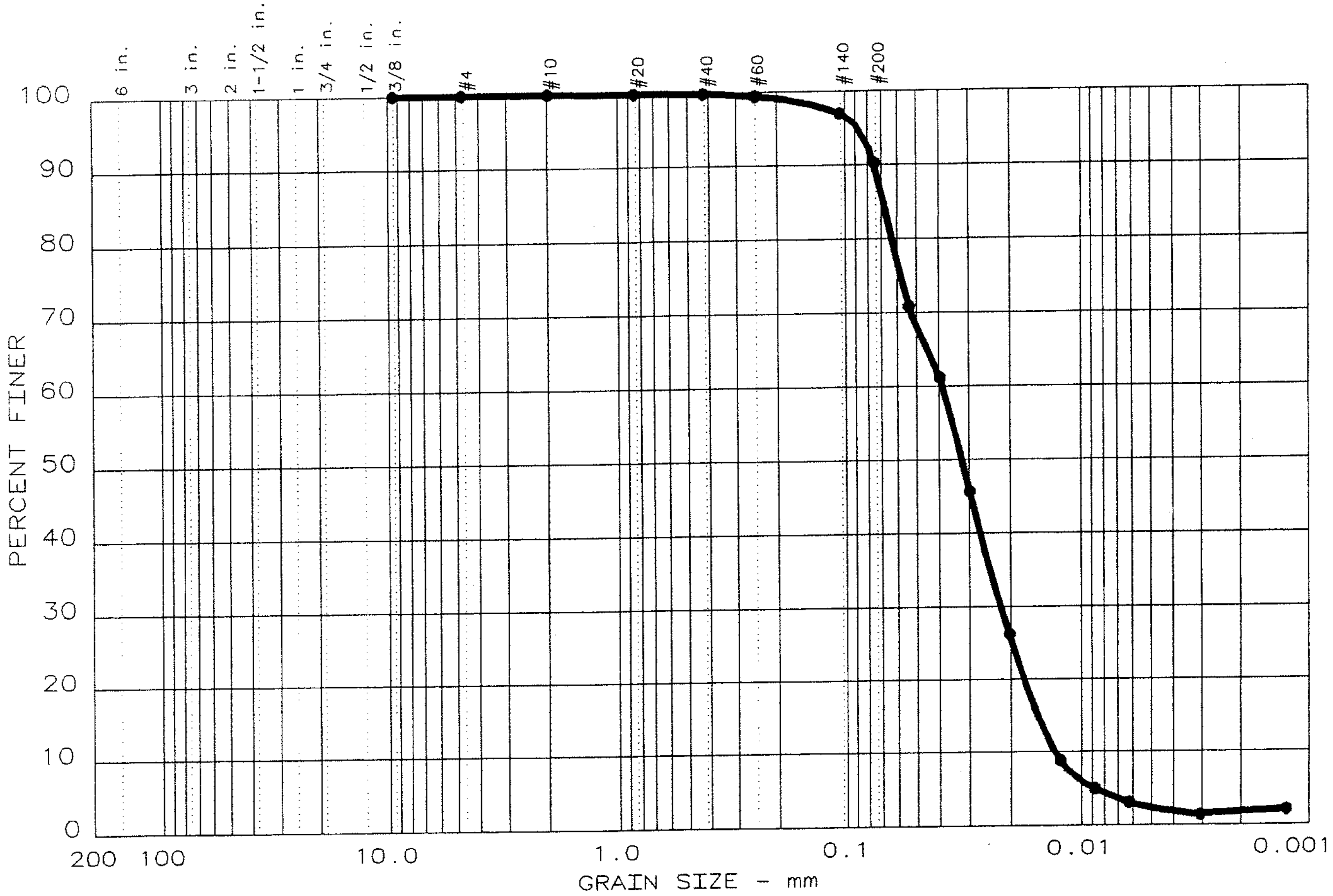
Project: TVA WCF Ash Pond Dike

Location:

UNCONFINED COMPRESSION TEST

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

PARTICLE SIZE ANALYSIS REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	18	0.0	0.0	9.8	87.9	2.3		NV	NP

SIEVE inches size	PERCENT FINER ●		
0.375	100.0		
	GRAIN SIZE		
D_{60}	0.0387		
D_{30}			
D_{10}	0.0129		
	COEFFICIENTS		
C_c	0.97		
C_u	3.0		

SIEVE number size	PERCENT FINER ●		
4	100.0		
10	100.0		
20	99.9		
40	99.8		
60	99.4		
140	96.9		
200	90.2		

Sample information:
● Gypsum Sample

Remarks:

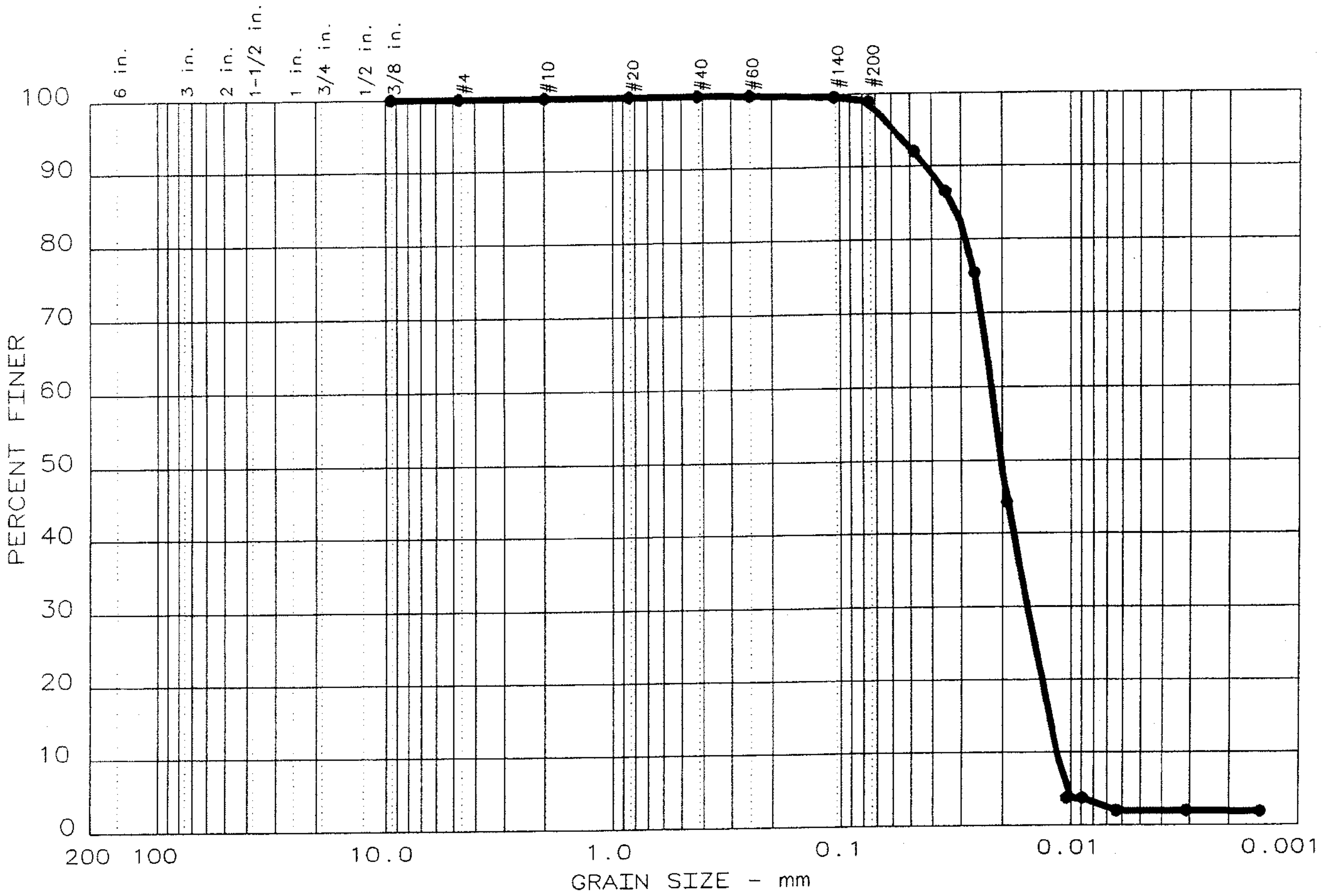
LAW ENGINEERING AND ENVIRONMENTAL SERVICES

Project No.: 50300-8-2075/81/800
Project: TVA WCF Ash Pond Dike

Date: 01-15-03

Fig. No.:______

PARTICLE SIZE ANALYSIS REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	19	0.0	0.0	1.1	97.0	1.9			

SIEVE inches size	PERCENT FINER		
	●		
0.375	100.0		

	GRAIN SIZE		
D_{60}	0.0221		
D_{30}			
D_{10}	0.0115		

	COEFFICIENTS		
C_c	0.94		
C_u	1.9		

SIEVE number size	PERCENT FINER		
	●		
4	100.0		
10	100.0		
20	100.0		
40	100.0		
60	99.9		
140	99.6		
200	98.9		

Sample information:

● Gypsum Sample

Remarks:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

Project No.: 50300-8-2075/81/800

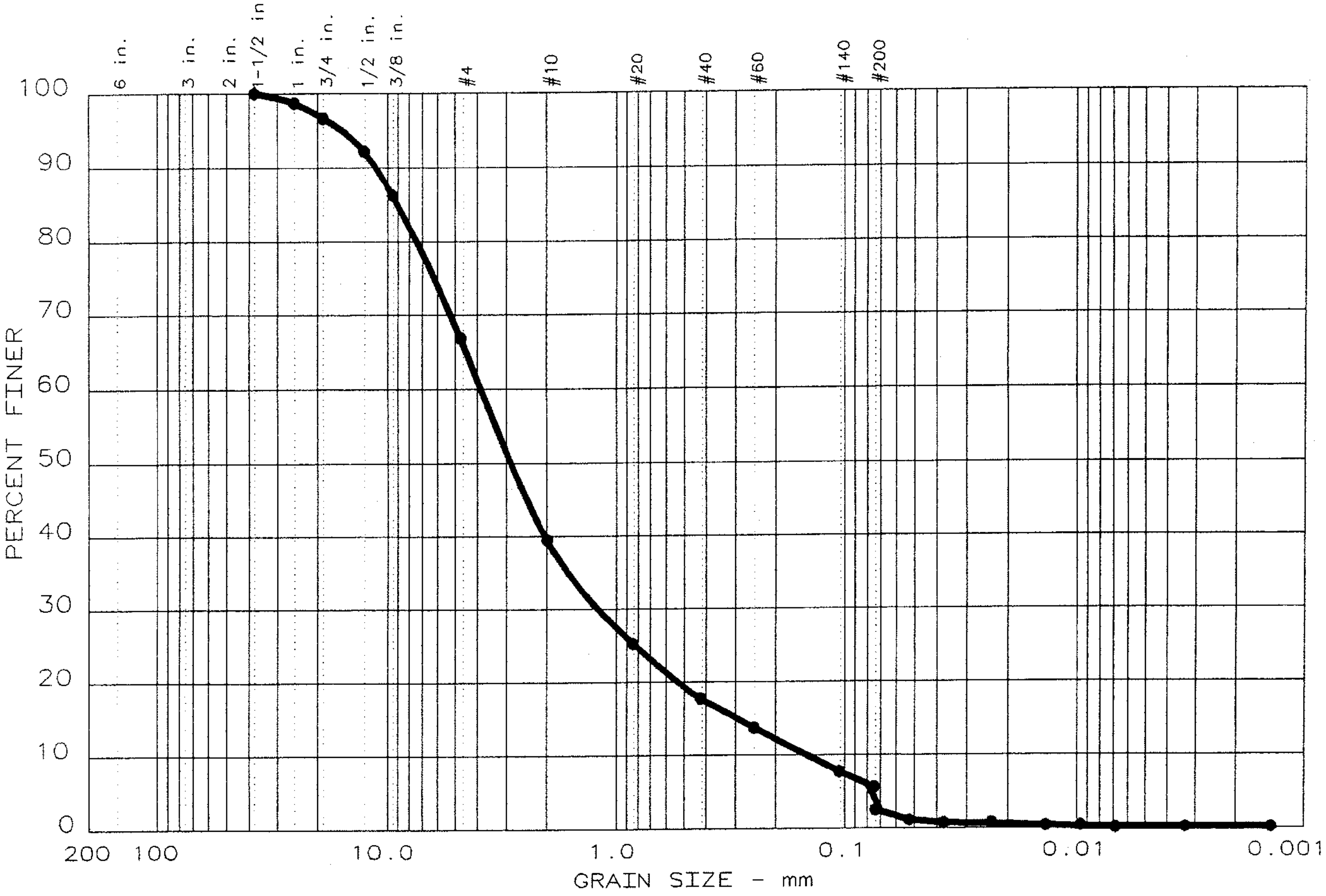
Project: TVA WCF Ash Pond Dike

Date: 01-15-03

Fig. No.:______

BOTTOM ASH MATERIAL TEST RESULTS

PARTICLE SIZE ANALYSIS REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	20	0.0	33.1	61.2	5.7		SW-SM	NV	NP

SIEVE inches size	PERCENT FINER ●		
1.5	100.0		
1	98.7		
0.75	96.7		
0.5	92.2		
0.375	86.2		
	GRAIN SIZE		
D_{60}	3.85		
D_{30}			
D_{10}	0.145		
	COEFFICIENTS		
C_c	2.60		
C_u	26.6		

SIEVE number size	PERCENT FINER ●		
4	66.9		
10	39.5		
20	25.3		
40	17.8		
60	13.8		
140	7.8		
200	5.6		

Sample information:

●

Bottom Ash Bulk Sample

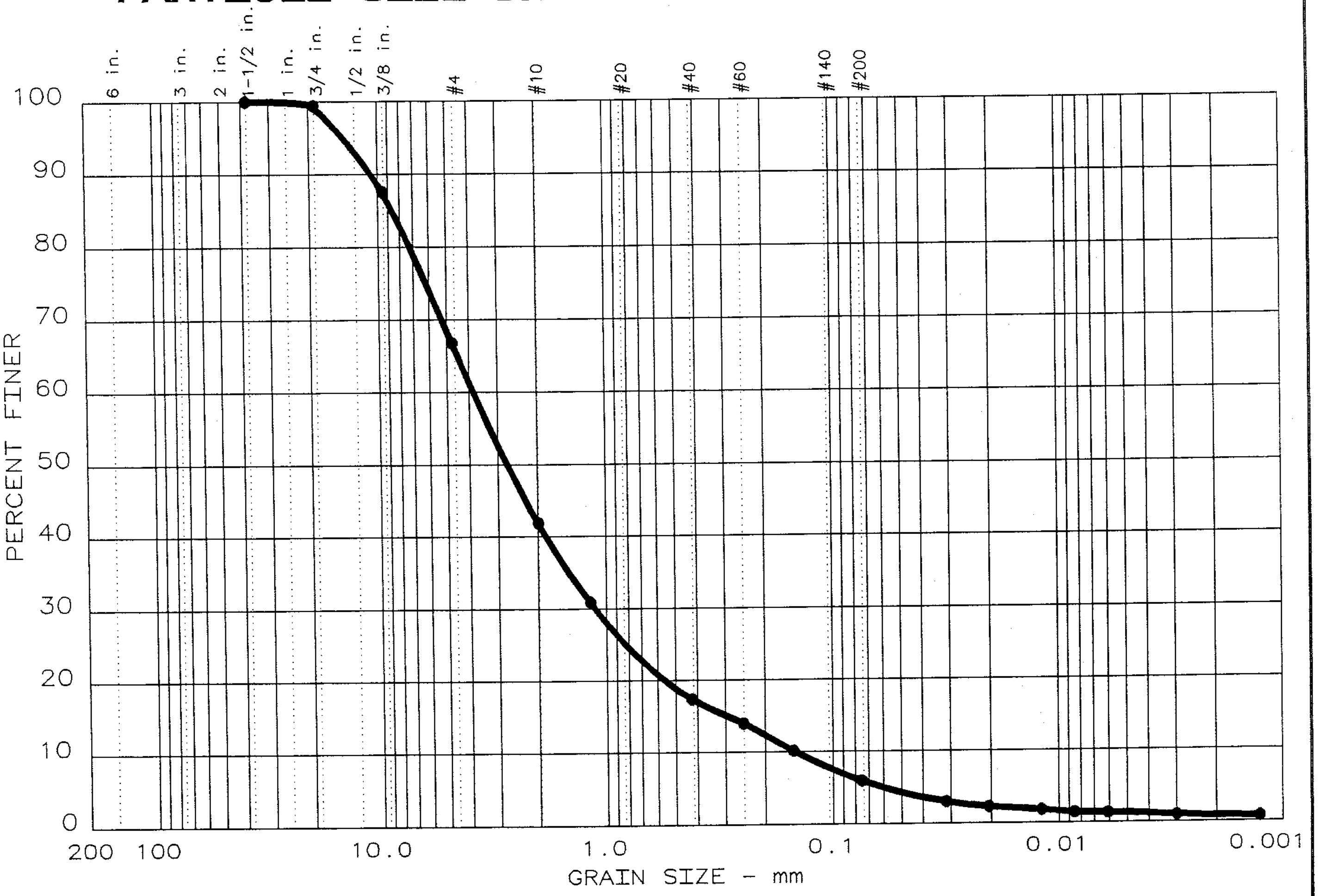
Remarks:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

Project No.: 50300-8-2075/81/800
Project: TVA WCF Ash Pond Dike

Date: 01-15-03 Fig. No.:______

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	5	0.0	33.2	60.8	4.8	1.2	SW-SM	NT	NT

SIEVE inches size	PERCENT FINER ●		
1.5	100.0		
0.75	99.4		
0.375	87.5		

	GRAIN SIZE		
D_{60}	3.80		
D_{30}			
D_{10}	0.146		

	COEFFICIENTS		
C_c	2.21		
C_u	26.0		

SIEVE number size	PERCENT FINER ●		
4	66.8		
10	41.8		
16	30.9		
40	17.4		
60	14.0		
100	10.2		
200	6.0		

Sample information:

● Ash pile
Black bottom ash sand
and gravel

Remarks:
Methods: Particle Size:
ASTM D 422-63(1998);
Gs: ASTM D854-00;
LL/PI: NT- No Test

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Project No.: 50300-8-2075/0081
Project: Colbert Fossil Plant Ash Pond, TVA

Date: 12-04-2002

Fig. No.: 726

PROCTOR TEST REPORT

Test specification: ASTM D 698-91 Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
CURVE 1 Maximum dry density = 113.9 pcf Optimum moisture = 17.3 %	Bottom Ash

Project No.: 50300-8-2075/81/800

Project: TVA WCF Ash Pond Dike

Location:

Date: 01-09-03

PROCTOR TEST REPORT

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

Client:

TVA

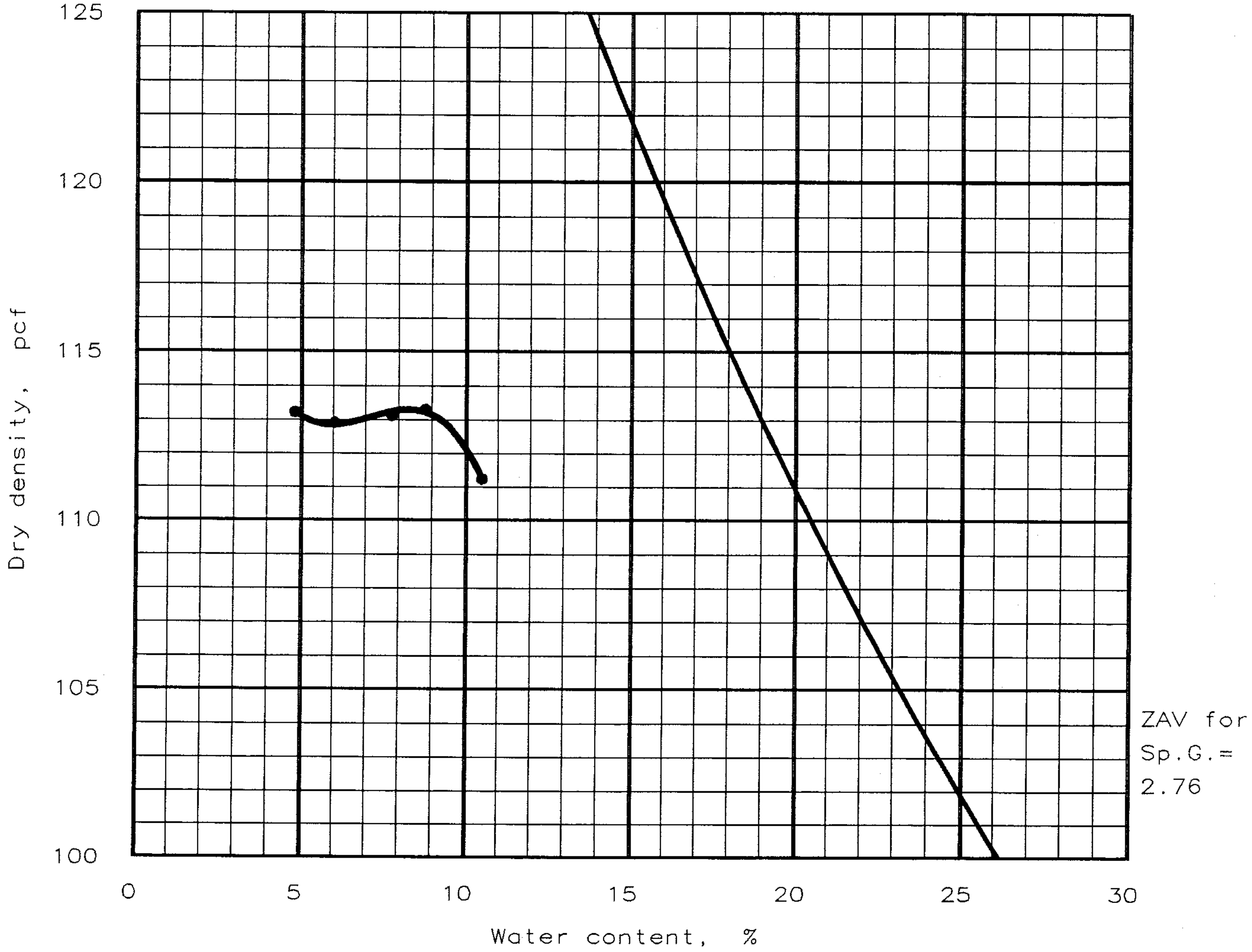
Proposed Use:

Remarks:

Bottom Ash Bulk SAmple

Curve No. 1

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-00a Procedure C, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in	% < No.200
	USCS	AASHTO						
DNS	SW-SM	A-1-a(0)	9.2 %	2.76	NT	NT	0.6 %	6.0 %

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 113.3 pcf Optimum moisture = 8.8 %	Black bottom ash sand and gravel

Project No.: 50300-8-2075/0081

Project: TVA Widows Creek Fossil Plant Ash Pond

Location: Ash pile

Date: 12-05-2002

Remarks:

Sample No. 2726

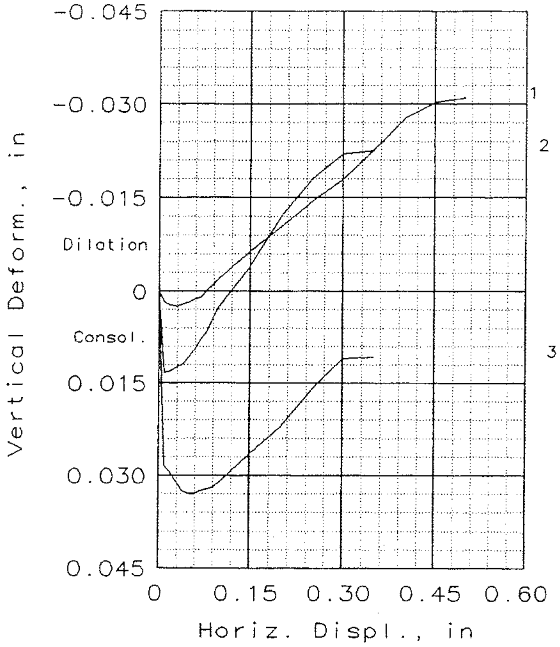
NT- No Test

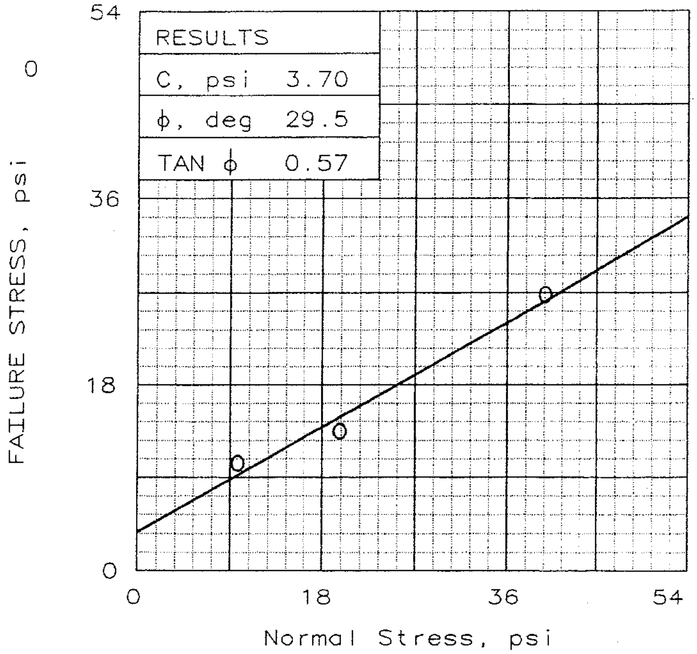
DNS- Data Not Submitted

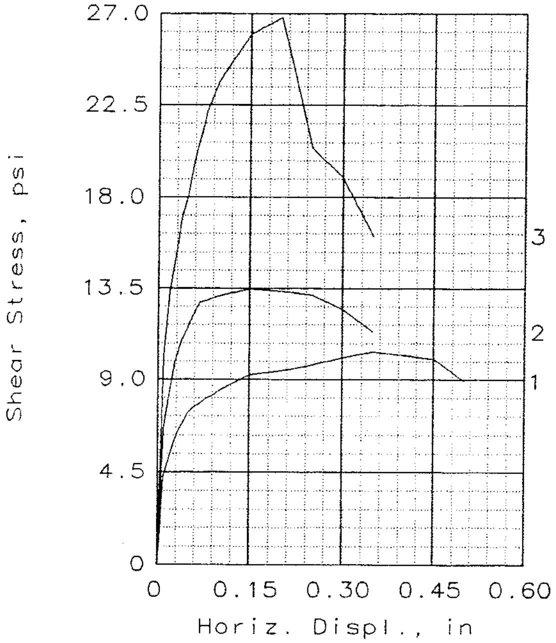
MOISTURE-DENSITY RELATIONSHIP TEST

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Fig. No. 2726







SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	17.3	17.3	17.3
	DRY DENSITY, pcf	102.6	102.6	102.6
	SATURATION, %	72.6	72.6	72.6
	VOID RATIO	0.643	0.643	0.643
	DIAMETER, in	2.51	2.51	2.51
	HEIGHT, in	0.97	0.97	0.97
AT TEST	WATER CONTENT, %	13.6	13.0	12.5
	DRY DENSITY, pcf	103.8	103.9	105.5
	SATURATION, %	58.8	56.7	56.3
	VOID RATIO	0.623	0.622	0.598
	DIAMETER, in	2.51	2.51	2.51
	HEIGHT, in	0.95	0.95	0.94
NORMAL STRESS, psi		10.0	20.0	40.0
FAILURE STRESS, psi		10.4	13.5	26.8
DISPLACEMENT, in		0.35	0.15	0.20
ULTIMATE STRESS, psi				
DISPLACEMENT, in				
Strain rate, in/min		0.0400	0.0400	0.0400

SAMPLE TYPE: Remolded Sample
DESCRIPTION:

SPECIFIC GRAVITY= 2.7
REMARKS: Remolded to 90% MDD @
Optimum Moisture Content of
Standard Proctor

Fig. No.: ______

CLIENT: TVA

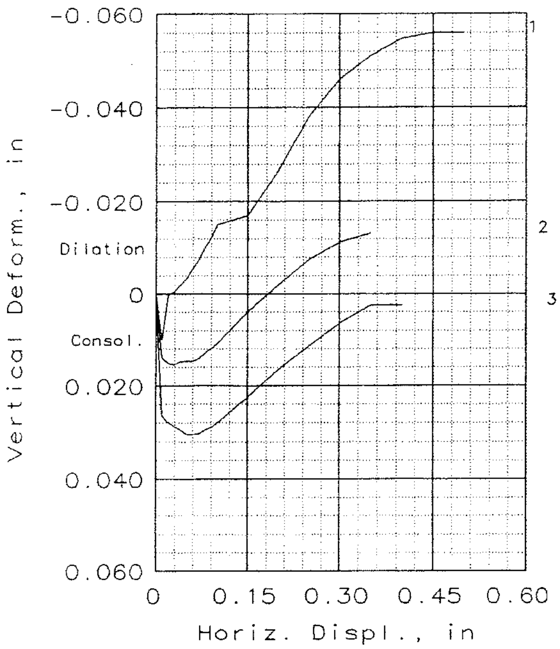
PROJECT: TVA WCF Ash Pond Dike

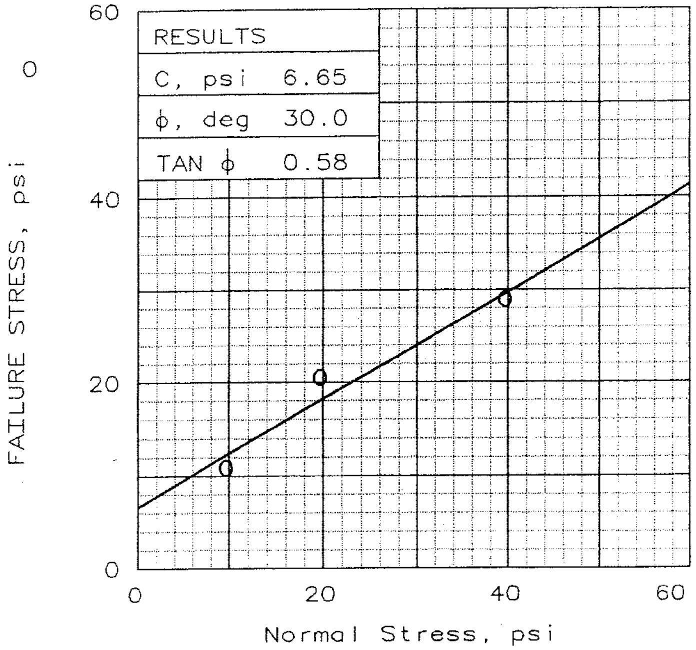
SAMPLE LOCATION: Bottom Ash Bulk Sample

PROJ. NO.: 50300-8-2075/81/800 DATE: 01-09-03

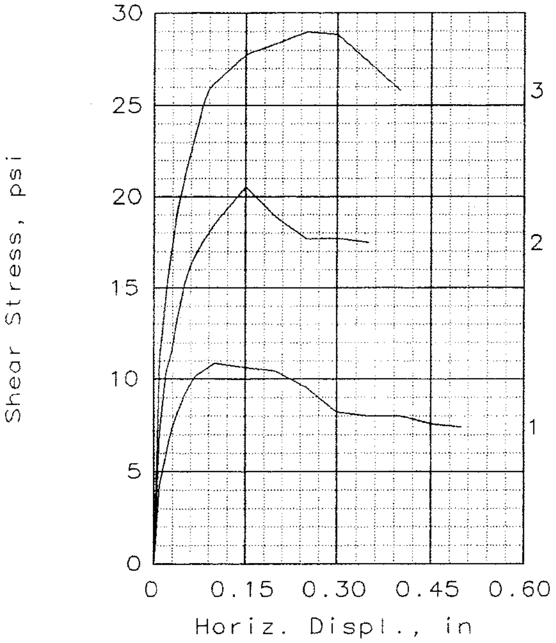
DIRECT SHEAR TEST REPORT

LAW ENGINEERING AND ENVIRONMENTAL SERVICES





RESULTS	
C, psi	6.65
ϕ, deg	30.0
TAN ϕ	0.58



	SAMPLE NO.:	1	2	3
INITIAL	WATER CONTENT, %	17.3	17.3	17.3
	DRY DENSITY, pcf	108.3	108.3	108.3
	SATURATION, %	83.9	83.9	83.9
	VOID RATIO	0.556	0.556	0.556
	DIAMETER, in	2.51	2.51	2.51
	HEIGHT, in	0.97	0.97	0.97
AT TEST	WATER CONTENT, %	17.9	14.8	13.3
	DRY DENSITY, pcf	109.5	109.7	110.9
	SATURATION, %	89.6	74.6	69.4
	VOID RATIO	0.540	0.537	0.519
	DIAMETER, in	2.51	2.51	2.51
	HEIGHT, in	0.96	0.95	0.94
	NORMAL STRESS, psi	10.0	20.0	40.0
	FAILURE STRESS, psi	10.9	20.5	29.0
	DISPLACEMENT, in	0.10	0.15	0.25
	ULTIMATE STRESS, psi			
	DISPLACEMENT, in			
	Strain rate, in/min	0.0400	0.0400	0.0400

SAMPLE TYPE: Remolded Sample
DESCRIPTION:

SPECIFIC GRAVITY= 2.7
REMARKS: Remolded to 95% MDD @
Optimum Moisture Content of
Standard Proctor

Fig. No.: ______

CLIENT: TVA

PROJECT: TVA WCF Ash Pond Dike

SAMPLE LOCATION: Bottom Ash Bulk Sample

PROJ. NO.: 50300-8-2075 DATE: 01-09-02

DIRECT SHEAR TEST REPORT

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

MACTEC

PERMEABILITY TEST - Constant Head
(ASTM D2434 - 68)

Project No.	50300-8-2075/81/800	Tested By	JA
Project Name	TVA WCF Ash Pond Dike	Test Date	Jan. 8, 2003
Location	N/A	Reviewed By	MH
Sample No.	Bulk Sample #1	Review Date	Jan. 9, 2003
Sample Dept	N/A		

Sample Description Bottom Ash Sample @ 95% Compaction

Sample Data

Length, in		Diameter, in		Pan No.	1
Location 1	5.500	Location 1	2.478	Wet Soil + Pan, grams	500.00
Location 2	5.500	Location 2	2.478	Dry Soil+Pan, grams	426.26
Location3	5.500	Location 3	2.478	Pan Weight, grams	0.00
Average	5.500	Average	2.478	Moisture Content, %	17.3
		Sample wet weight, grams	884.50	Wet Unit Wt, pcf	127.0
				Dry Unit Wt, pcf	108.3

Time (sec)	Q (cm ^{3})	H (cm)	k (cm/sec)	Temp ° C	k (cm/sec at 20° C)	i (cm/cm)
60	41.50	65.41	4.8E-03	22.8	4.4E-03	4.68
60	42.00	65.41	4.8E-03	22.8	4.5E-03	4.68
60	38.60	65.41	4.4E-03	22.8	4.1E-03	4.68
60	38.10	65.41	4.4E-03	22.8	4.1E-03	4.68
60	35.50	65.41	4.1E-03	22.8	3.8E-03	4.68

No. of Trials	Sample Type	Max. Density Std. Proctor	Compaction	Optimum Moisture	Sample Orientation
		pcf	%	%	
5	Bag	113.9	95.0	17.5	Vertical

L = length of sample in cm

A = area of sample in cm²

H = constant head in cm

t = time in seconds

A = 31.07 cm²

L = 13.97 cm

Avg. k at 20° C **4.2E-03 cm/sec**

HYDRAULIC CONDUCTIVITY

Project No.	*50300-8-2075/81/800*	Tested By	*JA*
Project Name	*TVA WCF Ash Pond Dike*	Test Date	*Jan. 8, 2003*
Boring No.	*N/A*	Reviewed B	*MH*
Sample No.	*Bulk Sample #1*	Review Date	*Jan. 9, 2003*
Sample Depth	*N/A*		
Sample Description	*Bottom Ash Sample @ 95% Compaction*		

ASTM D2434-68 Constant Head Permeability

Sample Type:	*Bag*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*17.3*
Wet Unit Weight, pcf:	*127.0*
Dry Unit Weight, pcf:	*108.3*
Compaction, %:	*95*
Hydraulic Conductivity, cm/sec. @20° C:	***4.2E-03***

MACTEC

PERMEABILITY TEST - Constant Head
(ASTM D2434 - 68)

Project No. 50300-8-2075/81/800
Project Name TVA WCF Ash Pond Dike
Location N/A
Sample No. Bulk Sample #1
Sample Dept N/A
Sample Description Bottom Ash Sample @ 90% Compaction

Tested By JA
Test Date Jan. 8, 2003
Reviewed By MH
Review Date Jan. 9, 2003

Sample Data

Length, in		Diameter, in		Pan No.	1
Location 1	5.500	Location 1	2.478	Wet Soil + Pan, grams	500.00
Location 2	5.500	Location 2	2.478	Dry Soil+Pan, grams	426.26
Location3	5.500	Location 3	2.478	Pan Weight, grams	0.00
Average	5.500	Average	2.478	Moisture Content, %	17.3
		Sample wet weight, grams	837.60	Wet Unit Wt, pcf	120.3
				Dry Unit Wt, pcf	102.6

Time (sec)	Q (cm ^{3})	H (cm)	k (cm/sec)	Temp ° C	k (cm/sec at 20° C)	i (cm/cm)
60	86.65	65.41	9.9E-03	22.8	9.3E-03	4.68
60	86.48	65.41	9.9E-03	22.8	9.3E-03	4.68
60	87.65	65.41	1.0E-02	22.8	9.4E-03	4.68
60	87.61	65.41	1.0E-02	22.8	9.4E-03	4.68
60	84.86	65.41	9.7E-03	22.8	9.1E-03	4.68

No. of Trials	Sample Type	Max. Density Std. Proctor	Compaction	Optimum Moisture	Sample Orientation
		pcf	%	%	
5	Bag	113.9	95.0	17.5	Vertical

L = length of sample in cm
A = area of sample in cm²

H = constant head in cm
t = time in seconds

A = 31.07 cm²
L = 13.97 cm

Avg. k at 20° C **9.3E-03 cm/sec**

HYDRAULIC CONDUCTIVITY

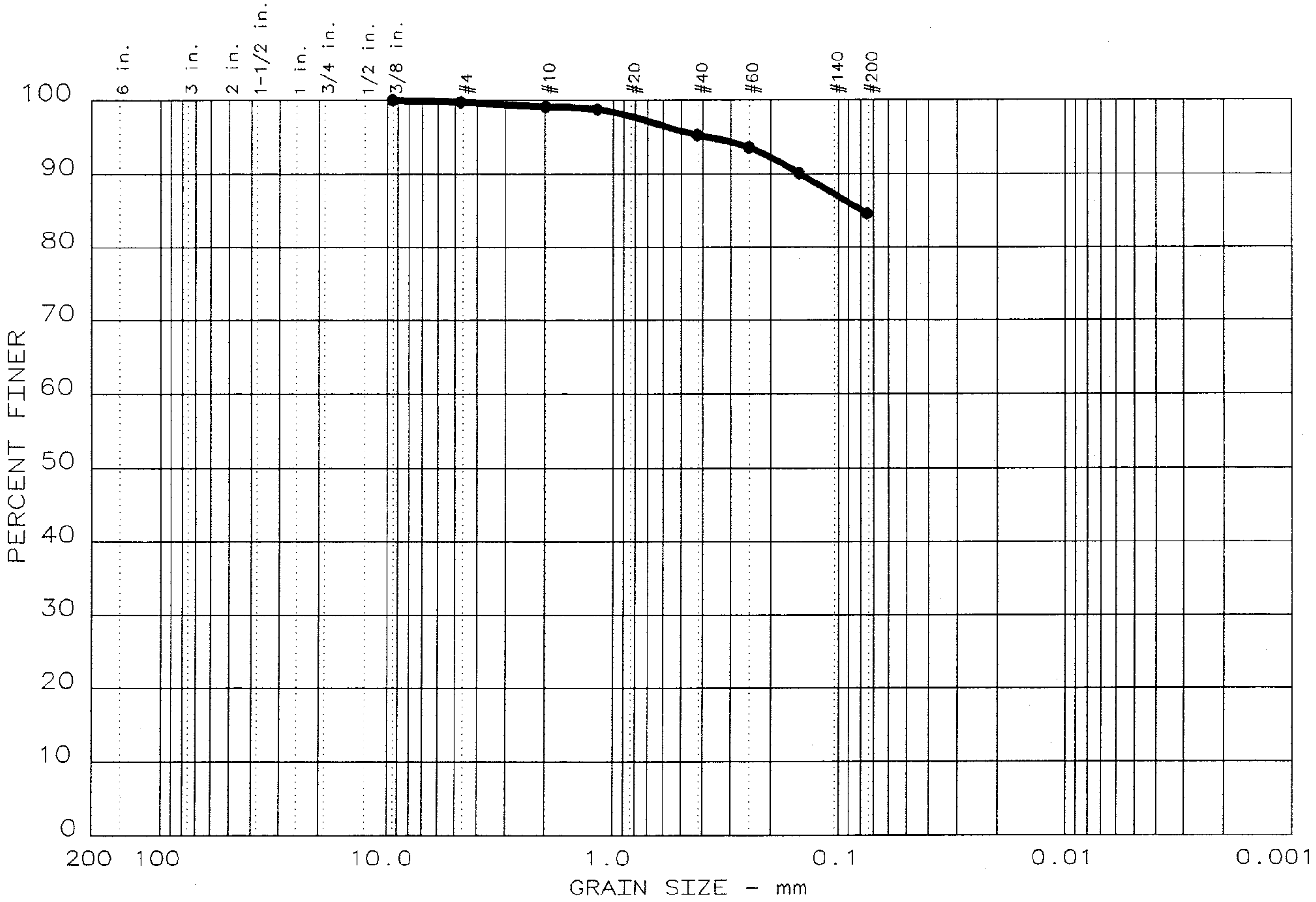
Project No.	*50300-8-2075/81/800*	Tested By	*JA*
Project Name	*TVA WCF Ash Pond Dike*	Test Date	*Jan. 8, 2003*
Boring No.	*N/A*	Reviewed B	*MH*
Sample No.	*Bulk Sample #1*	Review Date	*Jan. 9, 2003*
Sample Depth	*N/A*		
Sample Description	*Bottom Ash Sample @ 90% Compaction*		

ASTM D2434-68 Constant Head Permeability

Sample Type:	*Bag*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*17.3*
Wet Unit Weight, pcf:	*120.3*
Dry Unit Weight, pcf:	*102.6*
Compaction, %:	*90*
Hydraulic Conductivity, cm/sec. @20° C:	***9.3E-03***

EXISTING DIKE MATERIAL TEST RESULTS

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	6	0.0	0.3	15.1	84.6		CH	54	31

SIEVE inches size	PERCENT FINER		
	●		
0.375	100.0		
	GRAIN SIZE		
D60			
D30			
D10			
	COEFFICIENTS		
Cc			
Cu			

SIEVE number size	PERCENT FINER		
	●		
4	99.7		
10	99.1		
16	98.7		
40	95.3		
60	93.6		
100	90.1		
200	84.6		

Sample information:

●Boring B-1, SPT 1 to 4
Light brown silty clay
with sand

Remarks:
Methods: Particle Size:
ASTM D 422-63(1998);
Gs: ASTM D854-00;
LL/PI: NT- No Test

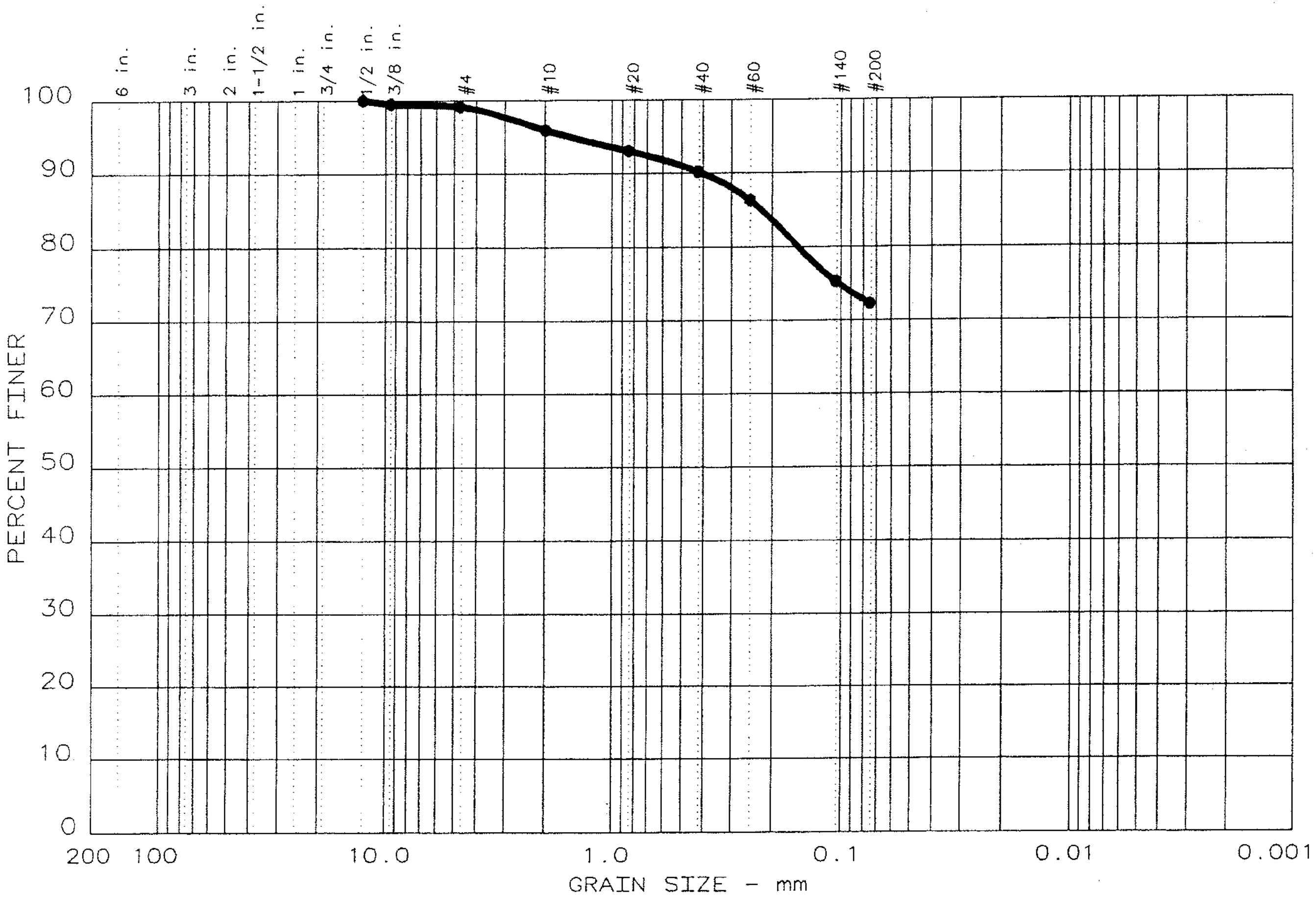
**LAW ENGINEERING
AND ENVIRONMENTAL
SERVICES, INC.**

Project No.: 50300-8-2075/0081
Project: Colbert Fossil Plant Ash Pond, TVA

Date: 12-09-2002

Fig. No.: B-1

PARTICLE SIZE ANALYSIS REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	2	0.0	0.8	26.9	72.3		CL	48	27

SIEVE inches size	PERCENT FINER ●		
0.5	100.0		
0.375	99.5		
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
4	99.2		
10	96.0		
20	93.1		
40	90.2		
60	86.3		
140	75.3		
200	72.3		

Sample information:

● B-1, UD-3 @ 20.0'-22.0'
Yellow-Brown Silty Clay
with Sand

Remarks:

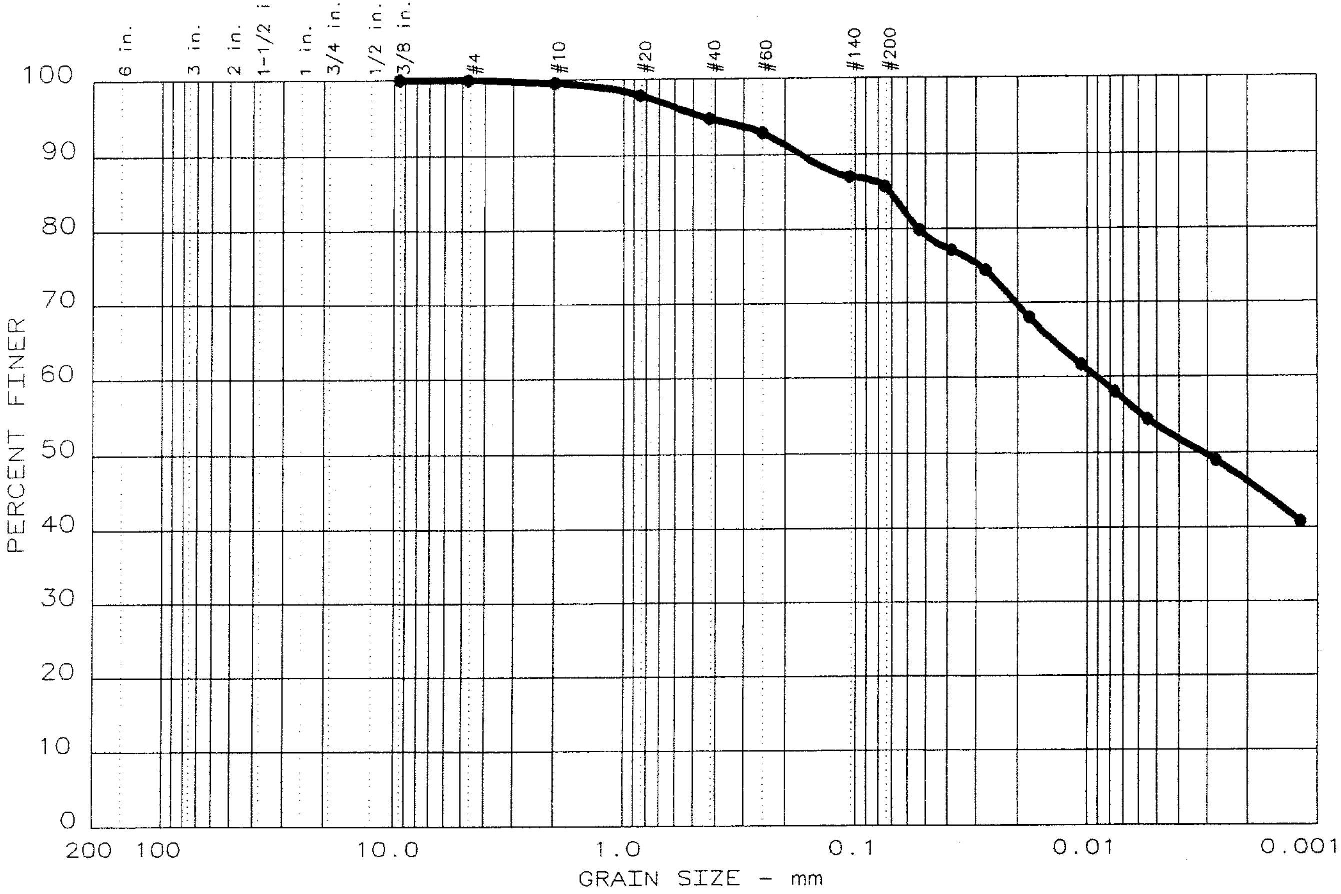
LAW ENGINEERING AND ENVIRONMENTAL SERVICES

Project No.: 50300-8-2075/81/800
Project: TVA WCF Ash Pond Dike

Date: 01-10-03

Fig. No.:______

PARTICLE SIZE ANALYSIS REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	1	0.0	0.0	14.3	32.2	53.5	CH	52	29

SIEVE inches size	PERCENT FINER		
	●		
0.375	100.0		
	GRAIN SIZE		
D_{60}	0.0091		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER		
	●		
4	100.0		
10	99.5		
20	97.9		
40	94.7		
60	92.9		
140	87.0		
200	85.7		

Sample information:

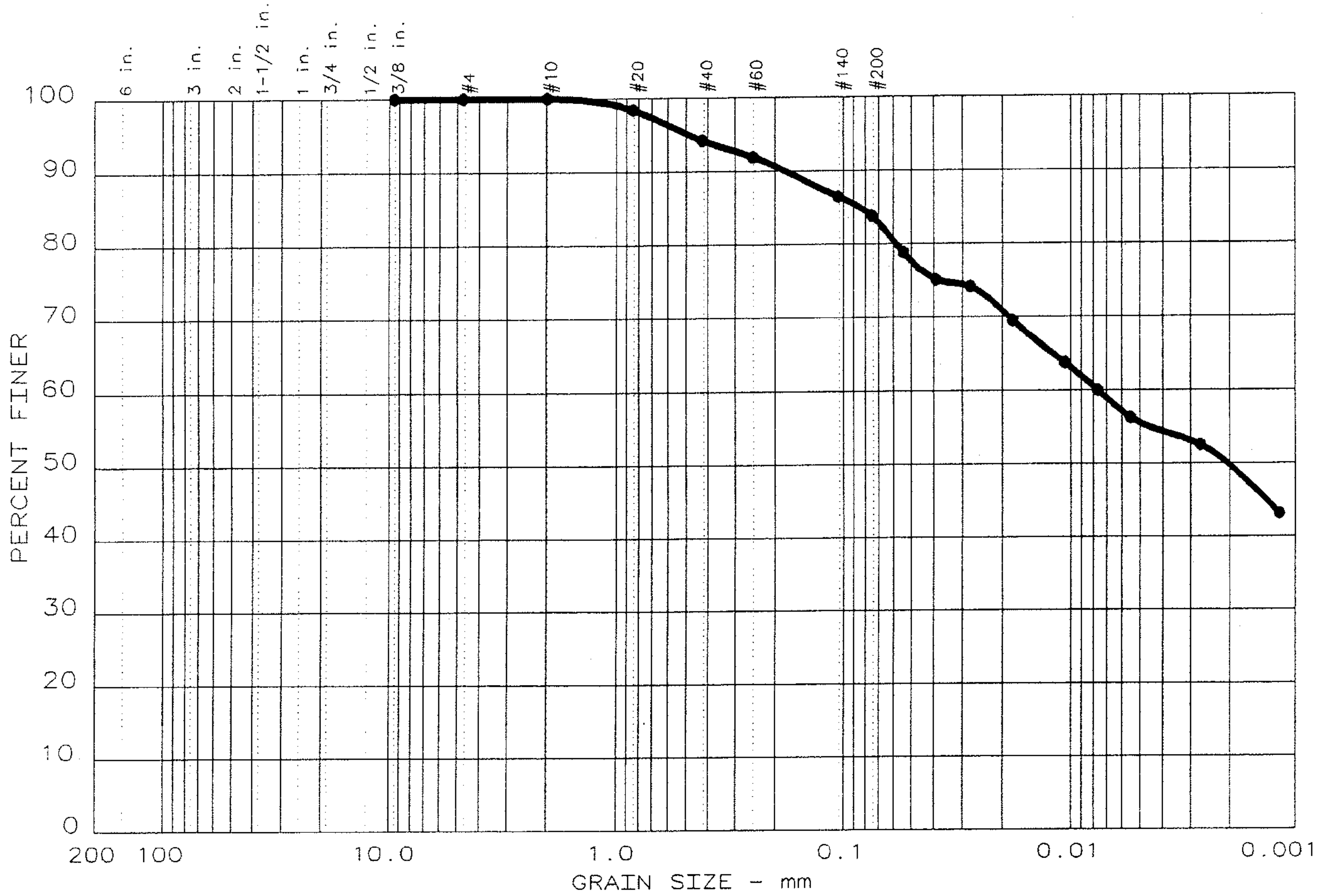
●B-1, UD-2 @ 13.0'-15.0'
Brown Silty Clay

Remarks:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

Project No.: 50300-8-2075/81/800
Project: TVA WCF Ash Pond Dike
Date: 01-10-03
Fig. No.:______

PARTICLE SIZE ANALYSIS REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	3	0.0	0.0	16.2	28.3	55.5			

SIEVE inches size	PERCENT FINER ●		
0.375	100.0		
	GRAIN SIZE		
D_{60}	0.0076		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
4	100.0		
10	100.0		
20	98.4		
40	94.2		
60	91.9		
140	86.5		
200	83.8		

Sample information:

● B-2, UD-1 @ 4.0'-6.0'
Orange-Brown Sandy
Silty Clay (visual)

Remarks:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

Project No.: 50300-8-2075/81/800
Project: TVA WCF Ash Pond Dike

Date: 01-10-03
Fig. No.:______

PERMEABILITY TEST REPORT

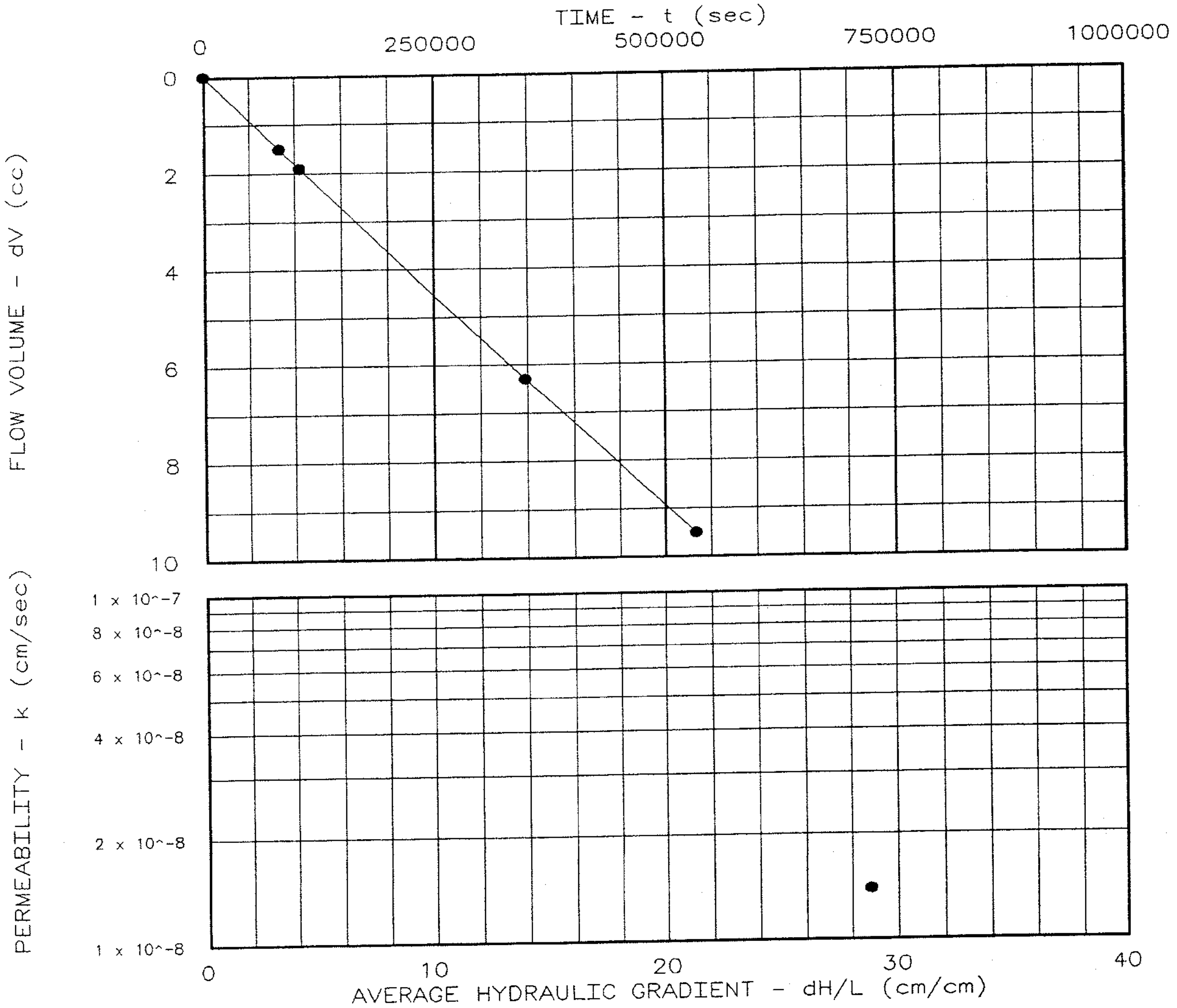
TEST DATA:
Specimen Height (cm): 4.79
Specimen Diameter (cm): 7.28
Dry Unit Weight (pcf): 95.0
Moisture Before Test (%): 25.6
Moisture After Test (%): 27.3
Run Number: 1 ● 2 ▲
Cell Pressure (psi): 67.0
Test Pressure(psi): 62.0
Back Pressure(psi): 60.0
Diff. Head (psi): 2.0
Flow Rate (cc/sec): 1.79 x 10^-5
Perm. (cm/sec): 1.40 x 10^-8

SAMPLE DATA:
Sample Identification: B-1, UD 3 @ 20'-22'

Visual Description: Yellow-Brown Silty Clay with Sand, CL
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: Flexible Wall
Sample type: Shelby Tube

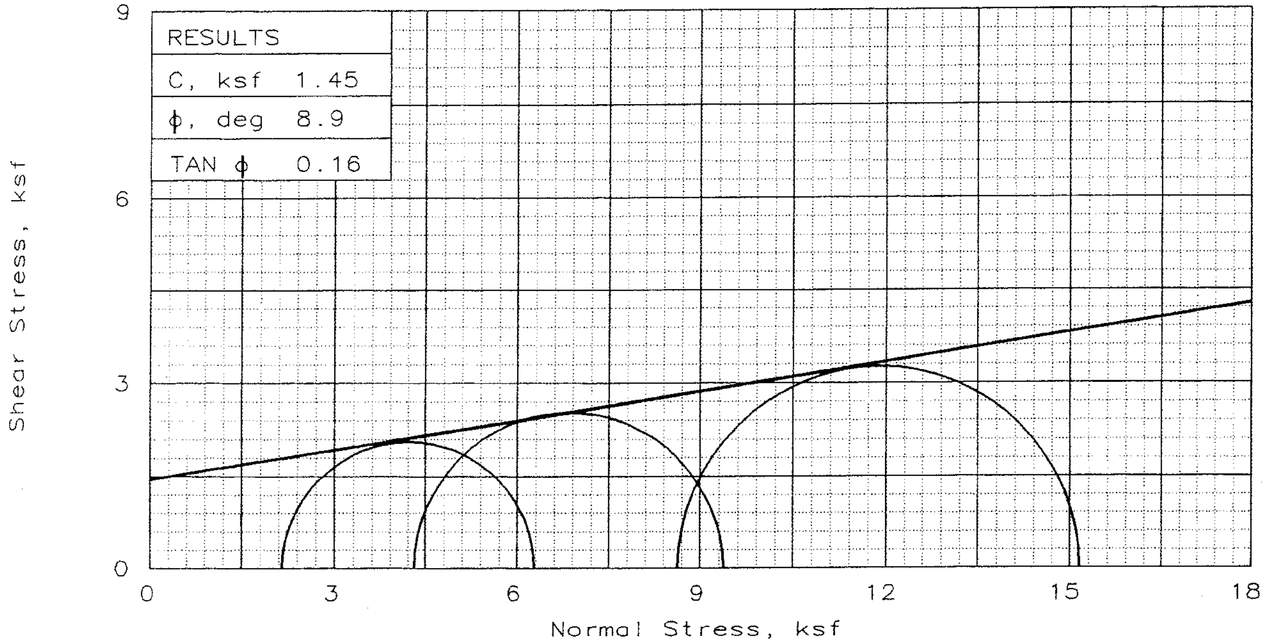


Project: TVA WCF Ash Pond Dike
Location:
Date: 01-09-03

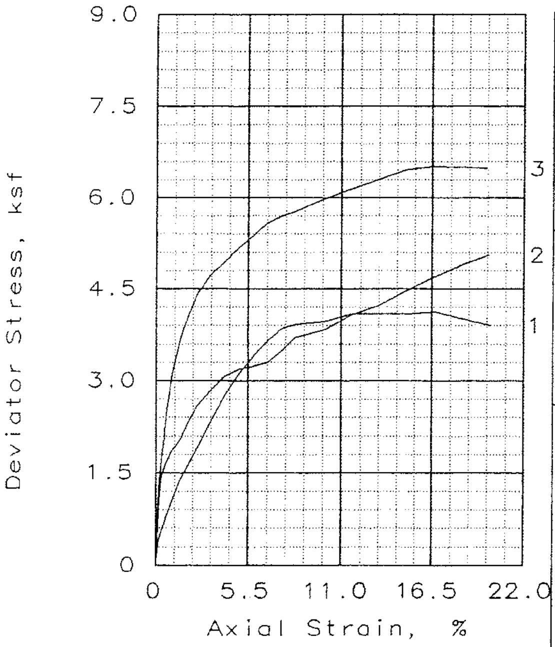
PERMEABILITY TEST REPORT

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

Project No.: 5030082075
File No.:
Lab No.:
Tested by: JA
Checked by: MH
Test: CH - Constant head



RESULTS	
C, ksf	1.45
ϕ, deg	8.9
TAN ϕ	0.16



SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	24.8	24.9	25.3
	DRY DENSITY, pcf	99.4	100.4	97.9
	SATURATION, %	96.1	96.4	94.5
	VOID RATIO	0.695	0.710	0.722
	DIAMETER, in	2.88	2.88	2.86
	HEIGHT, in	6.00	6.03	6.08
AT TEST	WATER CONTENT, %	25.6	25.8	25.3
	DRY DENSITY, pcf	99.4	100.4	97.9
	SATURATION, %	99.3	99.9	94.5
	VOID RATIO	0.695	0.710	0.722
	DIAMETER, in	2.88	2.88	2.86
	HEIGHT, in	6.00	6.03	6.08
Strain rate, %/min		0.33	0.33	0.33
BACK PRESSURE, ksf		0.0	0.0	0.0
CELL PRESSURE, ksf		2.2	4.3	8.6
FAIL. STRESS, ksf		4.1	5.1	6.5
ULT. STRESS, ksf				
σ_1 FAILURE, ksf		6.3	9.4	15.2
σ_3 FAILURE, ksf		2.2	4.3	8.6

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Shelby Tube

DESCRIPTION: Orange-Brown Sandy Silty Clay (Visual)

SPECIFIC GRAVITY= 2.7

REMARKS:

Fig. No.: ______

CLIENT: TVA

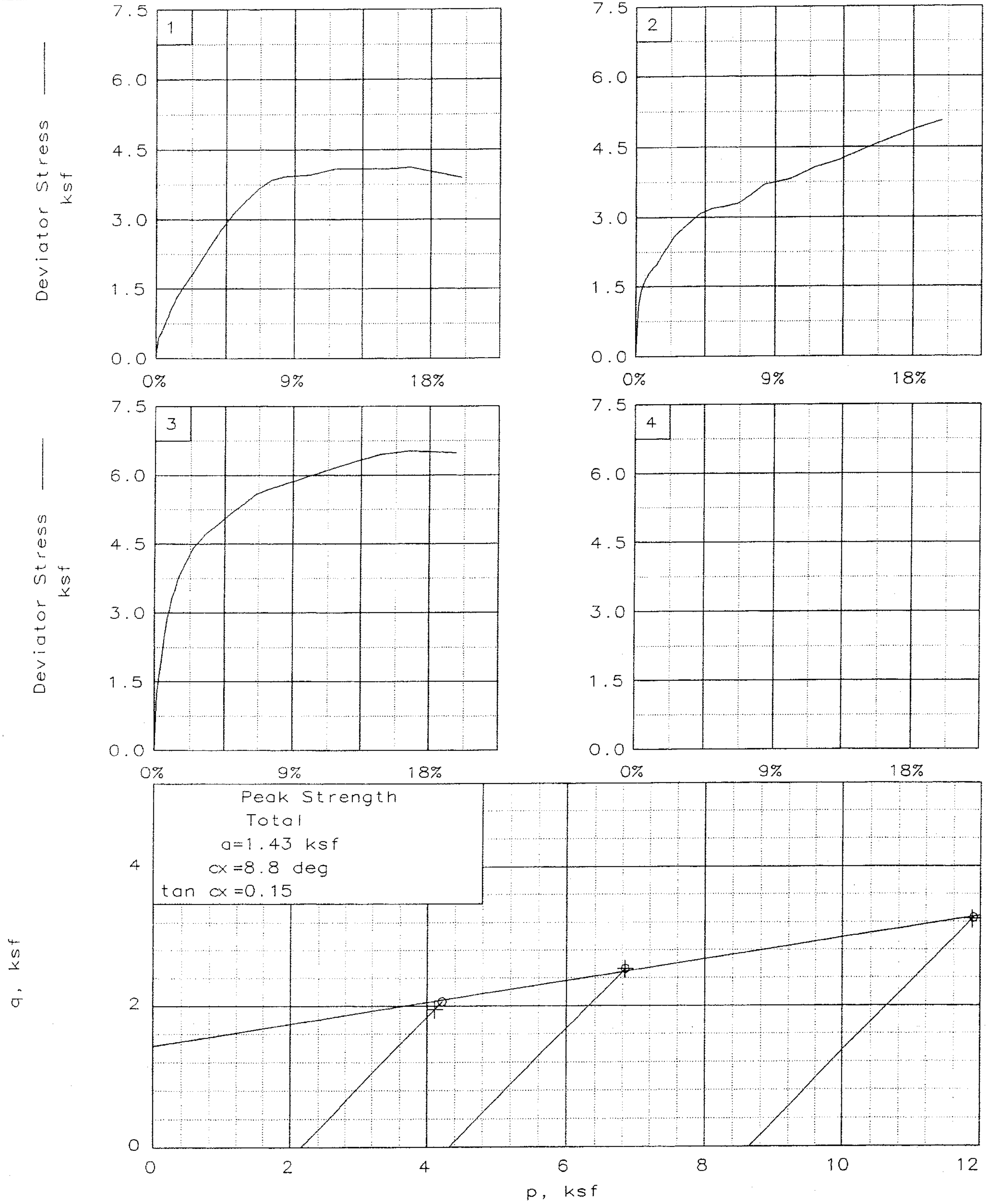
PROJECT: TVA WCF Ash Pond Dike

SAMPLE LOCATION: B-2, UD-1 @ 4.0'-6.0'

PROJ. NO.: 50300-8-2075/81/800 DATE: 01-10-03

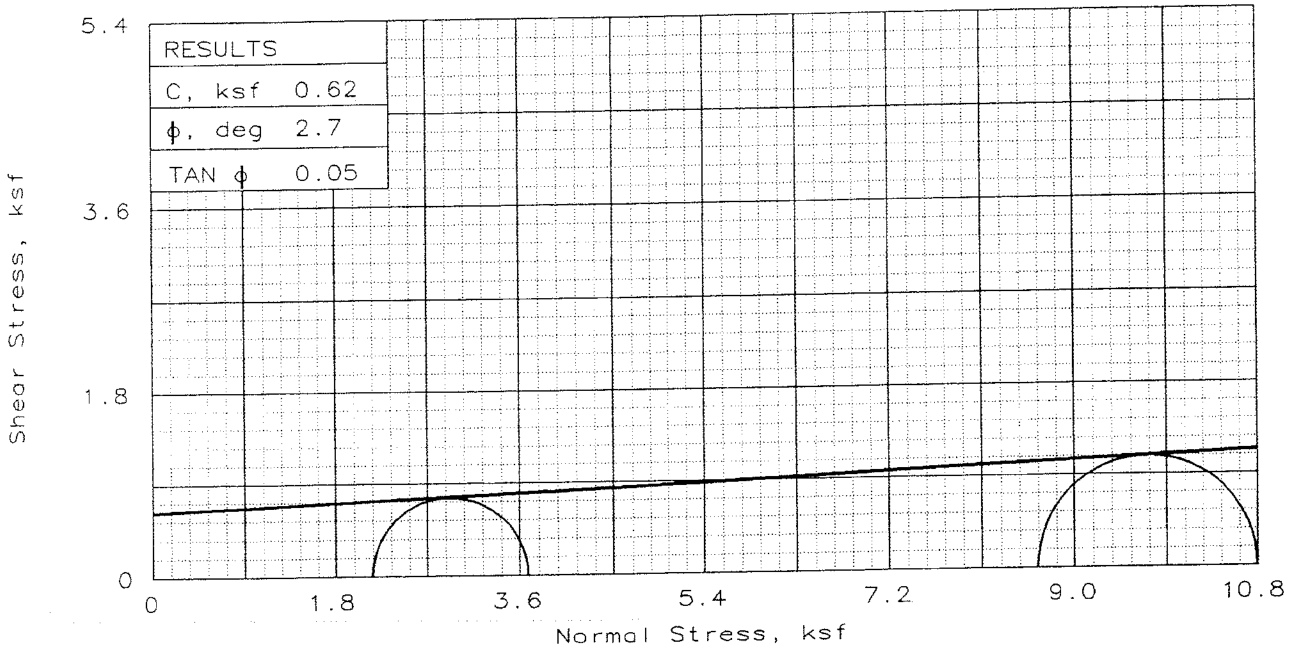
TRIAXIAL SHEAR TEST REPORT

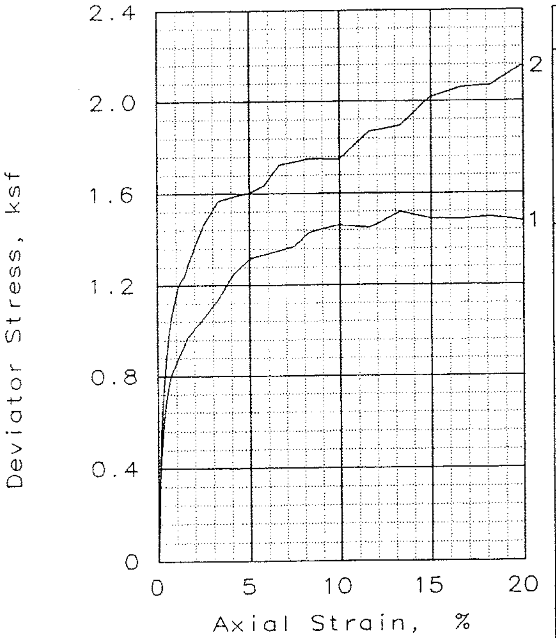
LAW ENGINEERING AND ENVIRONMENTAL SERVICES



Stress Paths: + indicates end ○ indicates peak

Client: TVA
Project: TVA WCF Ash Pond Dike
Location: B-2, UD-1 @ 4.0'-6.0'
File: TVA-4 Project No.: 50300-8-2075/81/800 Fig. No.: ____





SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	22.3	20.5
	DRY DENSITY, pcf	105.6	106.8
	SATURATION, %	98.6	92.9
	VOID RATIO	0.620	0.608
	DIAMETER, in	2.88	2.88
	HEIGHT, in	6.02	6.03
AT TEST	WATER CONTENT, %	22.6	21.8
	DRY DENSITY, pcf	105.6	106.8
	SATURATION, %	99.9	98.6
	VOID RATIO	0.620	0.608
	DIAMETER, in	2.88	2.88
	HEIGHT, in	6.02	6.03
Strain rate, %/min		0.3300	0.3300
BACK PRESSURE, ksf		0.0	0.0
CELL PRESSURE, ksf		2.2	8.6
FAIL. STRESS, ksf		1.5	2.2
ULT. STRESS, ksf			
σ_1 FAILURE, ksf		3.7	10.8
σ_3 FAILURE, ksf		2.2	8.6

TYPE OF TEST:
Unconsolidated Undrained
SAMPLE TYPE: Shelby Tube
DESCRIPTION: Yellow-Brown Silty Clay with Sand, CL
LL= 48 PL= 21 PI= 27
SPECIFIC GRAVITY= 2.74
REMARKS:

Fig. No.: ______

CLIENT: TVA

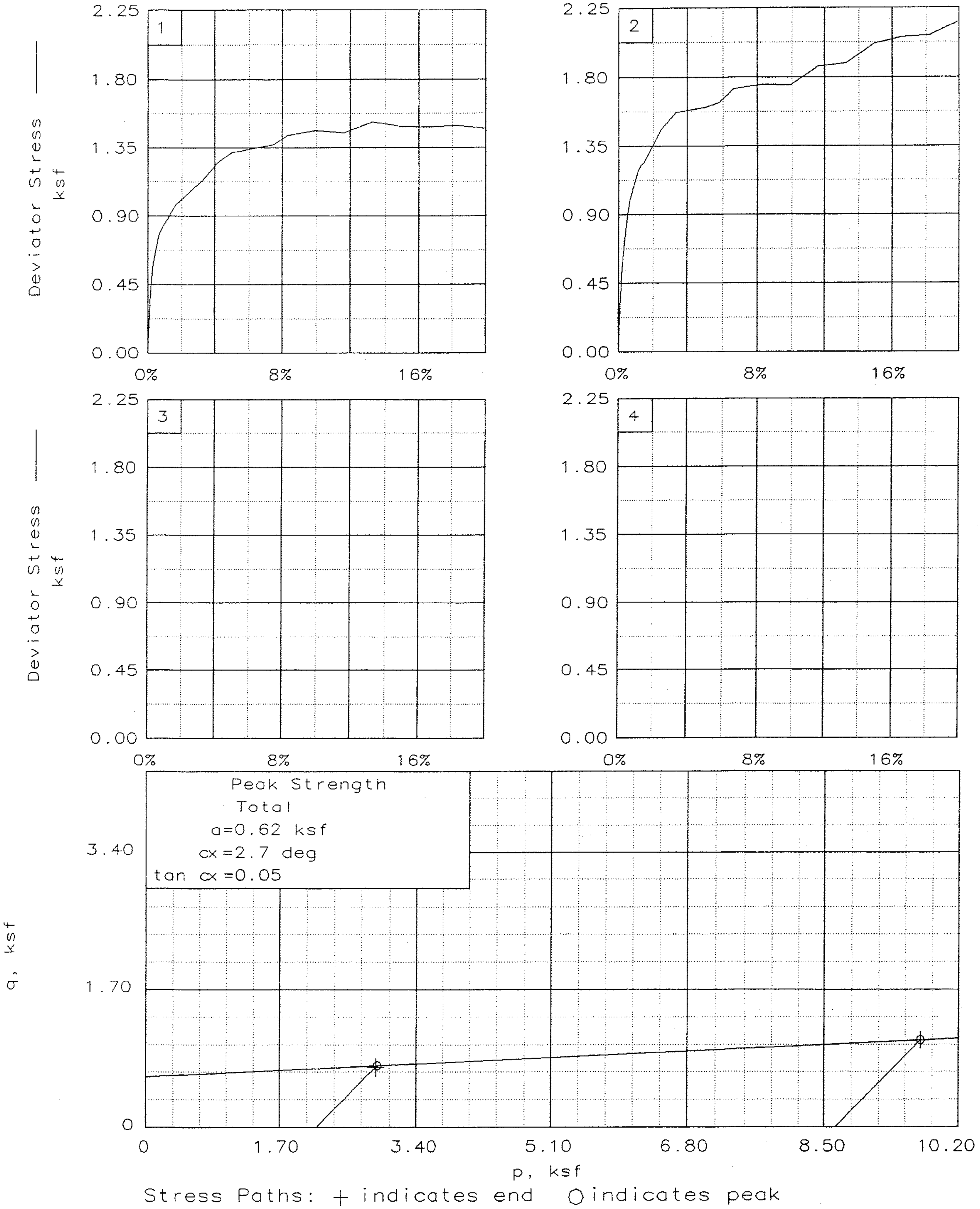
PROJECT: TVA WCF Ash Pond Dike

SAMPLE LOCATION: B-1, UD 3 @ 20.0'-22.0'

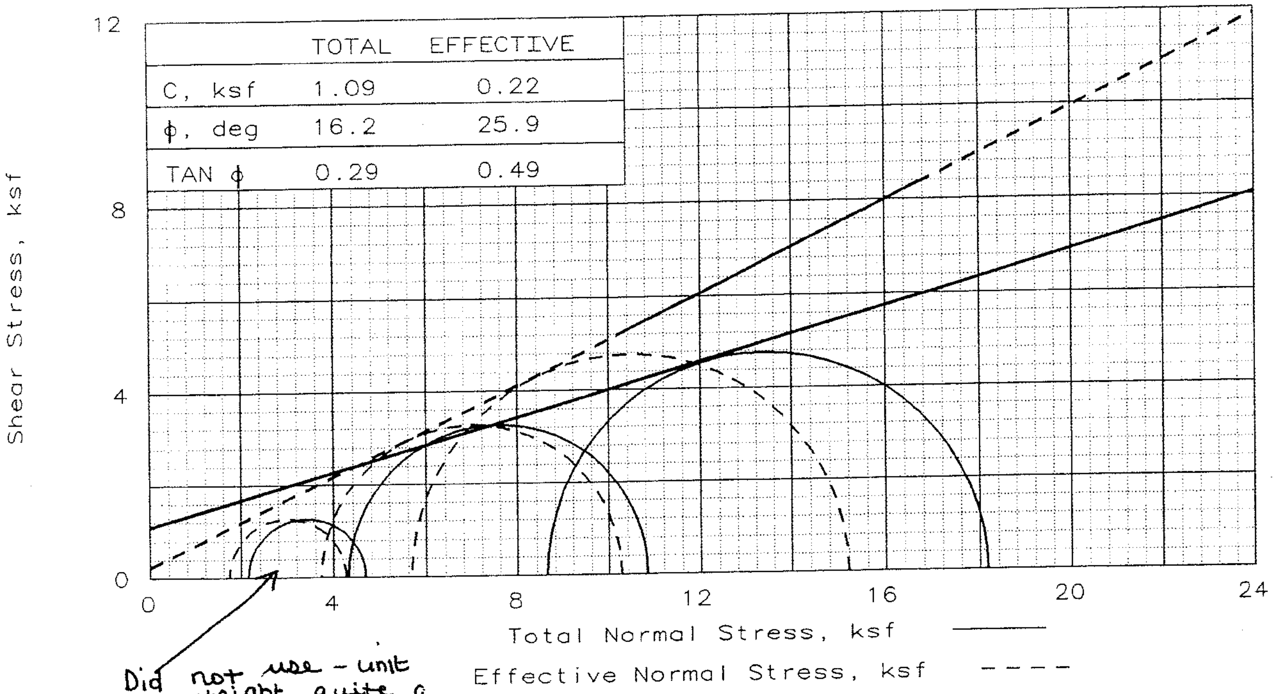
PROJ. NO.: 50300-8-2075/81/800 DATE: 01-09-03

TRIAXIAL SHEAR TEST REPORT

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

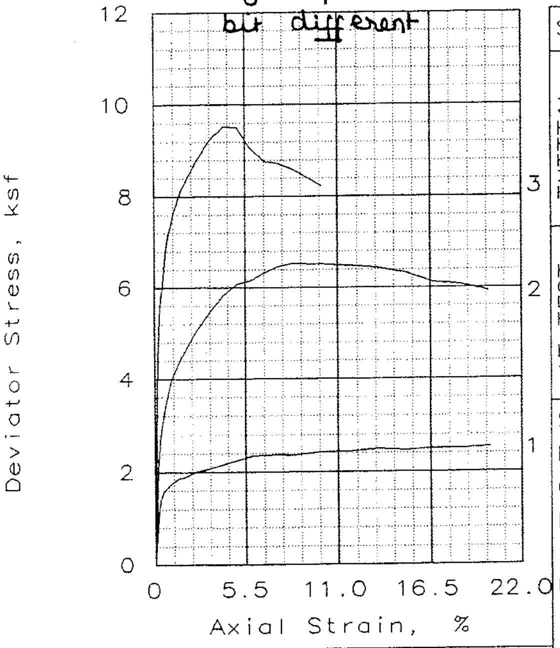


Client: TVA
Project: TVA WCF Ash Pond Dike
Location: B-1, UD 3 @ 20.0'-22.0'
File: TVA-1 Project No.: 50300-8-2075/81/800 Fig. No.: ____



	TOTAL	EFFECTIVE
C, ksf	1.09	0.22
ϕ, deg	16.2	25.9
TAN ϕ	0.29	0.49

Did not use - unit weight quite a bit different



	SAMPLE NO.:	1	2	3
INITIAL	WATER CONTENT, %	31.9	19.5	24.1
	DRY DENSITY, pcf	89.8	103.0	100.9
	SATURATION, %	98.3	82.8	97.2
	VOID RATIO	0.877	0.637	0.671
	DIAMETER, in	2.88	2.88	2.88
	HEIGHT, in	6.03	6.07	6.02
AT TEST	WATER CONTENT, %	33.4	19.9	24.0
	DRY DENSITY, pcf	88.7	109.6	102.3
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.901	0.538	0.648
	DIAMETER, in	2.91	2.80	2.87
	HEIGHT, in	5.99	6.02	5.99
	Strain rate, %/min	0.17	0.17	0.17
	BACK PRESSURE, ksf	5.8	5.8	5.8
	CELL PRESSURE, ksf	7.9	10.1	14.4
	FAIL. STRESS, ksf	2.5	6.5	9.5
	TOTAL PORE PR., ksf	6.2	6.3	8.7
	ULT. STRESS, ksf			
	TOTAL PORE PR., ksf			
	$\bar{\sigma}_1$ FAILURE, ksf	4.3	10.3	15.2
	$\bar{\sigma}_3$ FAILURE, ksf	1.7	3.7	5.7

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Shelby Tube
DESCRIPTION: Orange-Brown Silty Clay (visual)

SPECIFIC GRAVITY= 2.7
REMARKS:

Fig. No.: ______

CLIENT: TVA

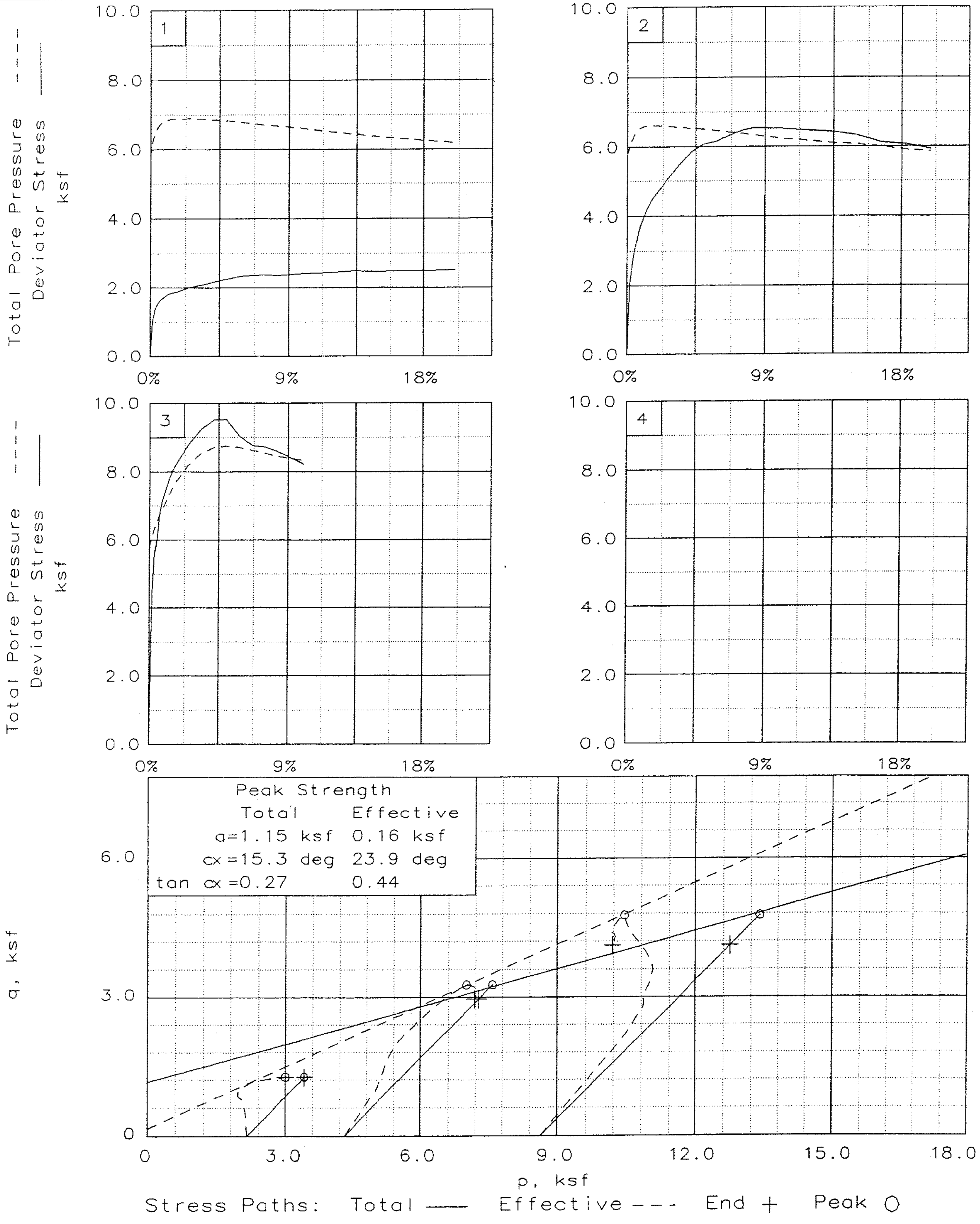
PROJECT: TVA WCF Ash Pond Dike

SAMPLE LOCATION: B-2, UD-2 @ 10.0'-12.0'

PROJ. NO.: 50300-8-2075/81/800 DATE: 01-10-03

TRIAXIAL SHEAR TEST REPORT

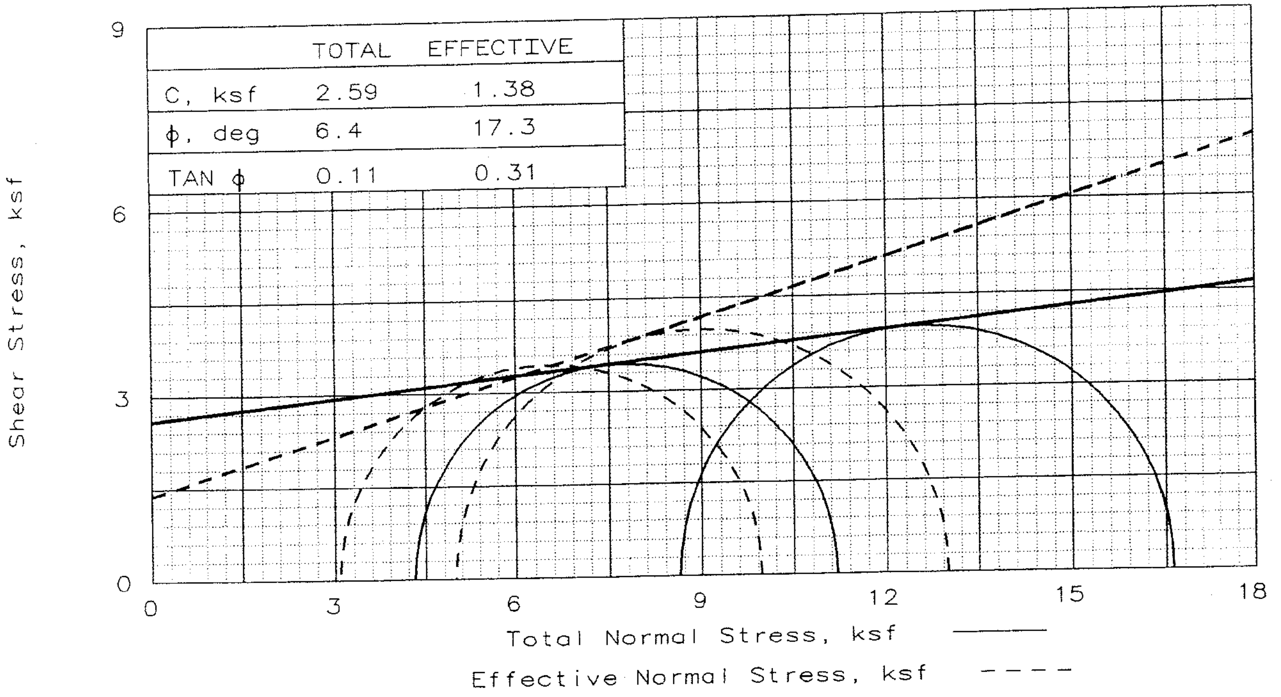
LAW ENGINEERING AND ENVIRONMENTAL SERVICES



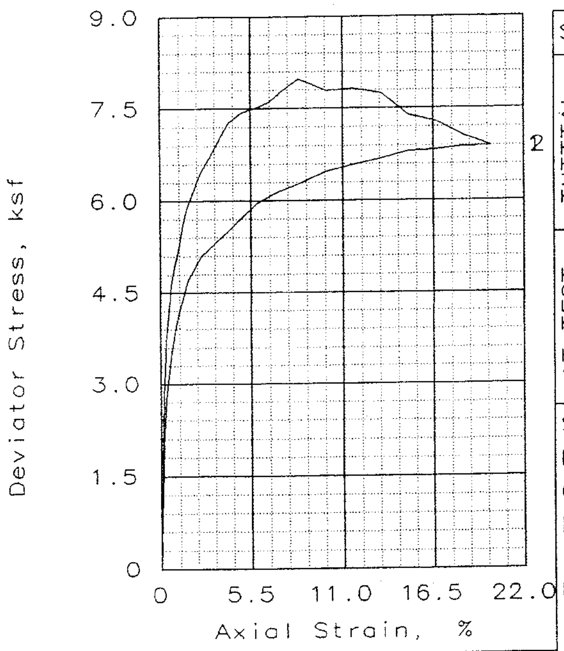
Peak Strength

	Total	Effective
a=	1.15 ksf	0.16 ksf
α =	15.3 deg	23.9 deg
tan α =	0.27	0.44

Client: TVA
Project: TVA WCF Ash Pond Dike
Location: B-2, UD-2 @ 10.0'-12.0'
File: TVA-5 Project No.: 50300-8-2075/81/800 Fig. No.: ____



	TOTAL	EFFECTIVE
C, ksf	2.59	1.38
ϕ, deg	6.4	17.3
TAN ϕ	0.11	0.31



	SAMPLE NO.:	1	2
INITIAL	WATER CONTENT, %	18.5	22.0
	DRY DENSITY, pcf	101.6	102.5
	SATURATION, %	76.0	92.3
	VOID RATIO	0.658	0.644
	DIAMETER, in	2.88	2.88
	HEIGHT, in	6.01	6.00
AT TEST	WATER CONTENT, %	19.6	22.7
	DRY DENSITY, pcf	110.2	104.5
	SATURATION, %	100.0	100.0
	VOID RATIO	0.529	0.612
	DIAMETER, in	2.77	2.85
	HEIGHT, in	6.01	6.00
	Strain rate, ~~in~~%/min	0.3300	0.3300
	BACK PRESSURE, ksf	7.2	7.2
	CELL PRESSURE, ksf	11.5	15.8
	FAIL. STRESS, ksf	6.9	8.0
	TOTAL PORE PR., ksf	8.4	10.8
	ULT. STRESS, ksf		
	TOTAL PORE PR., ksf		
	$\bar{\sigma}_1$ FAILURE, ksf	10.0	13.0
	$\bar{\sigma}_3$ FAILURE, ksf	3.1	5.0

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: Shelby Tube
DESCRIPTION: Brown Silty Clay (CH)
LL= 52 PL= 23 PI= 29
SPECIFIC GRAVITY= 2.7
REMARKS: Effective parameters based on principal effective stress ratio

Fig. No.: ______

CLIENT: TVA

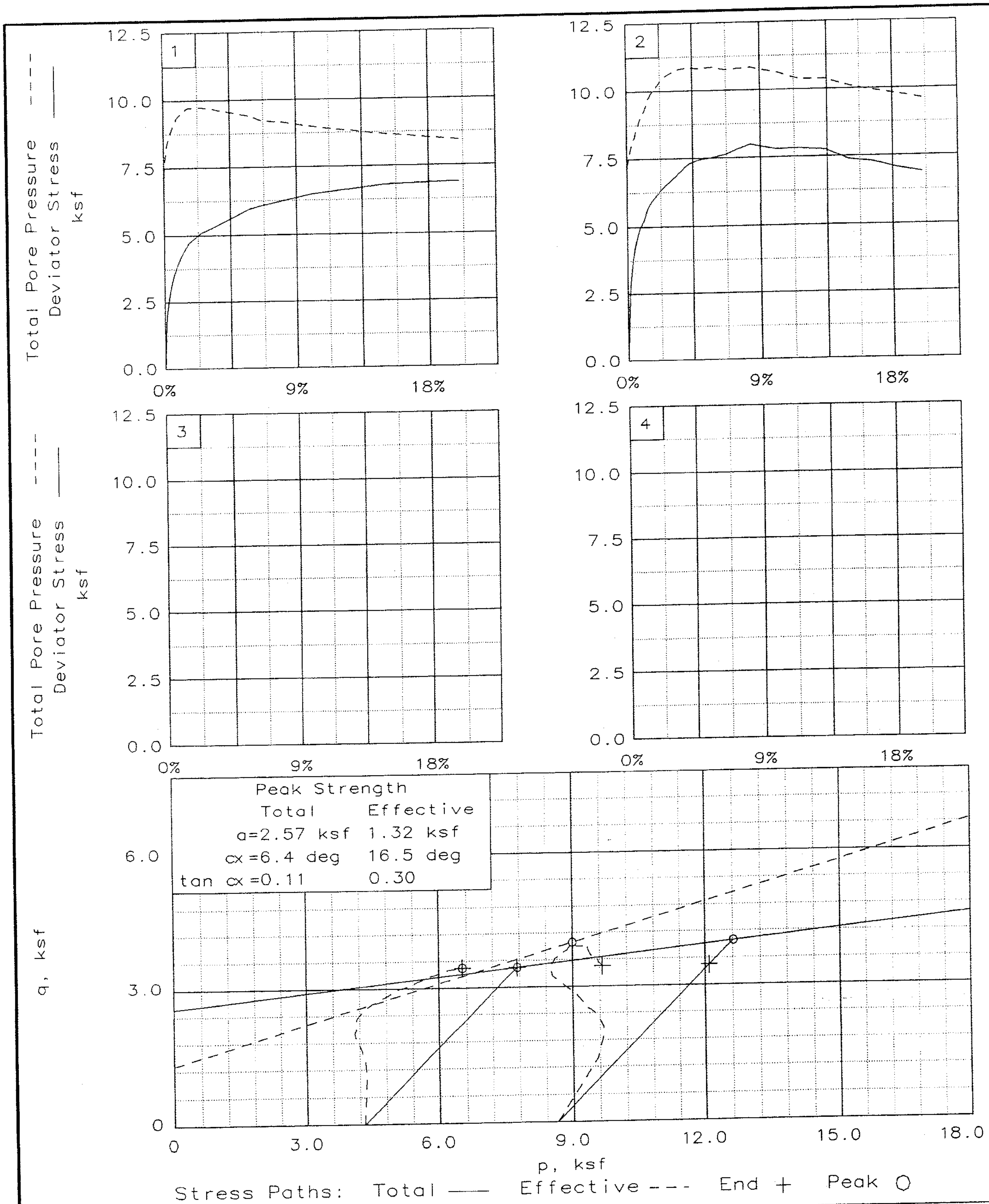
PROJECT: TVA WCF Ash Pond Dike

SAMPLE LOCATION: B-1, UD 2 @ 13.0'-15.0'

PROJ. NO.: 50300-8-2075/81/800 DATE: 01-09-03

TRIAXIAL SHEAR TEST REPORT

LAW ENGINEERING AND ENVIRONMENTAL SERVICES



Peak Strength

	Total	Effective
a=	2.57 ksf	1.32 ksf
cx =	6.4 deg	16.5 deg
tan cx =	0.11	0.30

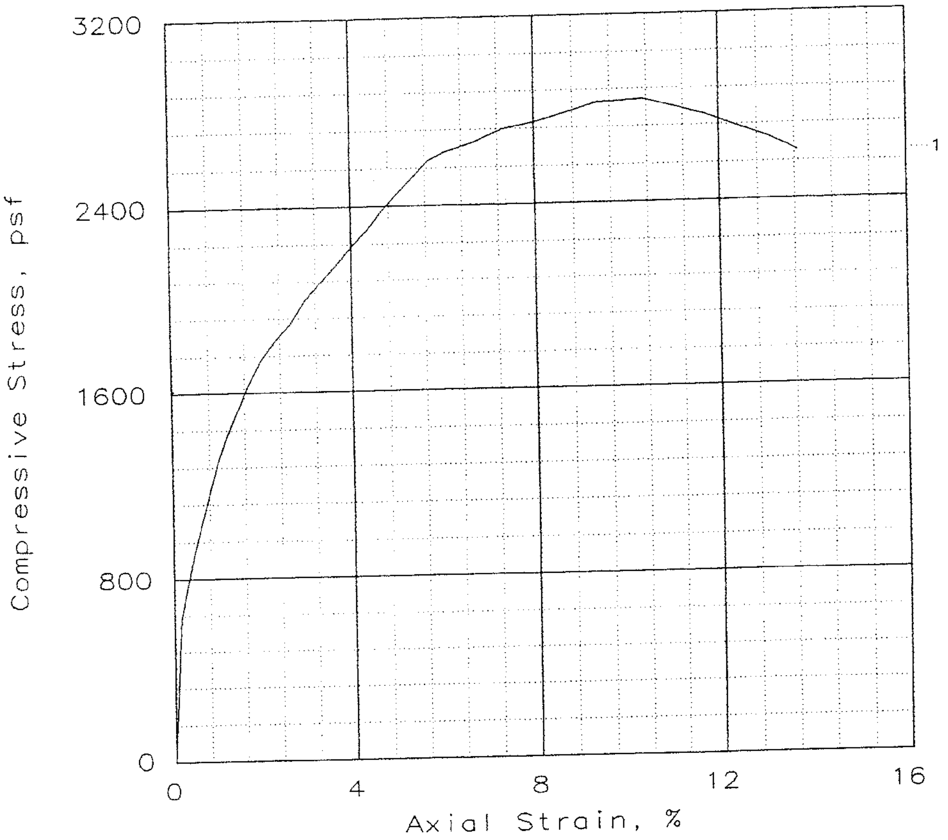
Client: TVA

Project: TVA WCF Ash Pond Dike

Location: B-1, UD 2 @ 13.0'-15.0'

File: TVA   Project No.: 50300-8-2075/81/800 Fig. No.: ____

UNCONFINED COMPRESSION TEST



SAMPLE NO.:	1			
Unconfined strength, psf	2836			
Undrained shear strength, psf	1418			
Failure strain, %	10.4			
Strain rate, %/min	1.00			
Water content, %	25.3			
Wet density, pcf	126.9			
Dry density, pcf	101.3			
Saturation, %	100.0			
Void ratio	0.6953			
Specimen diameter, in	2.86			
Specimen height, in	5.99			
Height/diameter ratio	2.09			

Description: Orange-Brown Silty Clay (visual)

GS= 2.75

Type: Shelby Tube

Project No.: 50300-8-2075/81/800

Date: 01-10-03

Remarks:

Fig. No.: ——

Client: TVA

Project: TVA WCF Ash Pond Dike

Location: B-2, UD-3 @ 17.0'-19.0'

UNCONFINED COMPRESSION TEST

LAW ENGINEERING AND ENVIRONMENTAL SERVICES

REPORT OF CONE PENETROMETER TESTING

DREDGE CELL DIKE
WIDOWS CREEK FOSSIL PLANT
STEVENSON, ALABAMA

Prepared For:

TENNESSEE VALLEY AUTHORITY

Chattanooga, Tennessee

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.

Knoxville, Tennessee

MACTEC Project 3043041017/0001

May 5, 2004

MACTEC

MACTEC

DRAFT

May 5, 2004

Mr. Ron Purkey
Tennessee Valley Authority
1101 Market Street, LP-2G
Chattanooga, TN 37402

Subject: **Report of Cone Penetrometer Testing**
Dredge Cell Dike
TVA Widows Creek Fossil Plant
Stevenson, Alabama
MACTEC Project 3043041017/0001

Dear Mr. Purkey:

We at MACTEC Engineering and Consulting, Inc., (MACTEC) are pleased to submit this Report of Cone Penetrometer Testing for your project. Our services, as authorized through TAO No. MAC-0695-0053 were provided in general accordance with our proposal number Prop04Knox/133 dated April 8, 2004.

This report reviews the information provided to us, discusses the cone penetrometer testing (CPT) performed and presents the data obtained for the dredge cell dike. The Appendices contain a brief description of the CPT procedures and presents the field test results and the estimated material properties.

This repot presents and summarizes the CPT testing data in accordance with the project's scope of work. We will be pleased to provide detailed interpretation of the field data and/or assist with the engineering analysis required for this project as you desire.

We will be pleased to discuss the testing results with you and would welcome the opportunity to provide the engineering services needed for this project.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Hussein A. Benkhayal, P.E.
Senior Engineer
Alabama Registration No. 25302

Carl D. Tockstein, P.E.
Chief Engineer - Tennessee Operations

HAB/CDT:sjm

REPORT OF CONE PENETROMETER TESTING

DREDGE CELL DIKE
WIDOWS CREEK FOSSIL PLANT
STEVENSON, ALABAMA

DRAFT

Prepared For:

TENNESSEE VALLEY AUTHORITY

Chattanooga, Tennessee

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.

Knoxville, Tennessee

MACTEC Project 3043041017/0001

May 5, 2004

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EXECUTIVE SUMMARY

MACTEC was selected by the Tennessee Valley Authority (TVA) to perform cone penetrometer testing (CPT) at the existing dredge cell dike at the Widows Creek Fossil Plant in Stevenson, Alabama. The objectives of the CPT testing were to obtain data to evaluate the subsurface conditions along the dredge cell dike.

DRAFT

The exploration consisted of performing cone penetrometer testing at six locations (CPT-1 through CPT-6). The testing was performed to a depth of about 50 feet or refusal. The major findings of the CPT are as follows:

- The CPT testing revealed that the dike is underlain by soft to very soft ash material at areas explored except for the east side (CPT-3 and CPT-3A). A transition zone appears to exist between the dike material and the soft to very soft ash layer.
- The dike material ranged in consistency from stiff to very hard. The apparent transition layer ranged in consistency from firm to stiff.
- The thickness of the soft to very soft layer ranged from about 2 to 15 feet. The depth to this layer ranged from about 9 to 20 feet.
- CPT-3 and CPT-3A which were performed along the east side of the dike encountered shallow refusal at depths of 10.8 and 10.0 feet, respectively. Based on information provided by on-site personnel, it appears the east side of the dike was constructed on top of a gypsum stack.

This summary is only an overview and should not be used as a separate document or in place of reading the entire report, including the appendices.

1.0 INTRODUCTION

This report presents the results of cone penetrometer testing (CPT) recently performed for the existing dredge cell dike at TVA's Widows Creek Fossil Plant. Our services were authorized by Mr. Ron Purkey of TVA.

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2.0 OBJECTIVES OF EXPLORATION

The objectives of the CPT testing were to obtain data to evaluate the subsurface conditions along the dredge cell dike. An assessment of site environmental conditions, or an assessment for the presence or absence of pollutants in the soil, bedrock, surface water, or ground water of the site was beyond the proposed objectives of our exploration.

3.0 SCOPE OF EXPLORATION

The scope of the CPT testing was based on our proposal number Prop04Knox/133 dated April 8, 2004, and the scope of work outlined in the project's Request for Proposal prepared by TVA. It includes the following:

- Reconnaissance of the immediate site
- Mobilization of one Cone Penetrometer Rig
- Performing CPT testing at six locations
- Backfilling the CPT testing holes
- Geotechnical report presenting and summarizing the field data

The testing was performed on April 21, 2004. A truck-mounted CPT rig with a 20-ton capacity cone was used to perform the testing. During the CPT testing, continuous measurements are taken of the cone tip resistance, sleeve friction, and dynamic pore pressure. Pore pressure dissipation testing was performed only once in each CPT location to estimate the depth to ground water.

Upon completion of the CPT testing, the holes were plugged and abandoned by backfilling the full depth with cement grout. The CPT testing procedures are presented in Appendix A and the results are presented in Appendix B.

4.0 PROJECT INFORMATION AND SITE CONDITIONS

DRAFT

Project information was provided to us by TVA in the form of a Request for Proposal and a CPT testing location plan. The existing facility consists of an ash disposal area. The site of the dredge cell is located north of the Widows Creek Fossil Plant. The ground surface elevation along the top of the dike varies by as much as about 10 feet in the areas explored. The area explored is along the top of the existing dike.

5.0 AREA AND SITE GEOLOGY

Stevenson, Alabama, is located in the Appalachian Valley and Ridge Physiographic Province. This province extends as a continuous belt from central Alabama, through Georgia and Tennessee, northward into Pennsylvania. The formations that underlie this province consist primarily of limestone, dolostone, shale, and sandstone, which have been folded and faulted in the geologic past. These formations range in age from Cambrian to Pennsylvanian and have been subject to at least one extensive period of erosion since their structural deformation. The erosion has produced a series of subparallel, alternating ridges and valleys. The valleys are formed over more soluble bedrock (interbedded limestone and limestone), whereas bedrock more resistant to solution weathering forms ridges (sandstone, shale, and cherty dolostone).

In particular, the subject site is geologically mapped to be underlain by the Sequatchie Formation. The Sequatchie Formation is mainly composed of light olive-gray and dusky red calcareous shale interbedded with light to dark gray limestone.

6.0 SUBSURFACE CONDITIONS

The subsurface conditions at the dredge cell dike were explored with six CPT test locations (CPT-1 through CPT-6) performed in general accordance with ASTM Standard D5778-95 and the procedures in Appendix A. The CPT testing locations were proposed by TVA. MACTEC personnel established the CPT testing locations in the field in the general areas that were recommended by TVA. Therefore, the CPT locations shown on Figure 2: Cone Penetrometer Test Location Plans should be considered approximate.

During the CPT testing, the cone is pushed into the ground at a constant rate. Measurement of tip resistance (q_c), sleeve friction (f_s), and dynamic pore pressure (U) are obtained at small intervals (approximately 2-inch intervals). Using published correlations, the collected data is used to estimate several soil parameters such as unit weight, strength parameters, standard penetration test (SPT) value, relative density, and others. Graphs in Appendix B show plots of recorded field data versus depth. The estimated SPT values are also plotted versus depth. The estimated parameters are presented in table format in Appendix B in addition to the correlations used to develop them.

The CPT testing was performed to a depth of about 50 feet or refusal. Refusal was encountered in CPT-3 at a depth of about 10.8 feet. An offset CPT test (CPT-3A) was performed along the same side of the dike. Shallow refusal at about 10.0 feet was encountered at CPT-3A. Ground water was estimated to range in depth from about 5 to16 feet.

The CPT testing revealed that, with the exception of the east side (CPT-3 and CPT-3A), the dredge cell dike is underlain by a layer of a soft to very soft ash material. This layer ranges in thickness from approximately 2 to 15 feet. The depth to the soft to very soft ash layer ranged from about 9 to 20 feet. The estimated SPT values indicate that the dike material ranged in consistency from stiff to very hard. A transition zone appears to exist between the dike material and the soft to very soft ash layer. The consistency of the transition layer ranged from firm to stiff. The material consistencies are based on SPT values obtained from correlation with CPT testing results.

Based on the shallow refusal encountered in CPT-3 and CPT-3A and based on our discussion with on-site personnel, it appears that the dike along the east side was constructed on top of an existing gypsum stack. The apparent gypsum material could not be penetrated with the cone. Although the cone encountered refusal on a hard layer, there is a possibility that this layer can be penetrated with regular geotechnical drilling techniques. Also, the extent of the hard layer is not known; therefore, it is possible that softer material may exist below the hard layer. A summary of the CPT testing is presented in Table 1.

Table 1
CPT Testing Summary

CPT Number	Refusal Depth (Feet)	CPT Termination Depth (Feet)	Depth to Ground Water (Feet)	Location of Very Soft Material (Feet)
CPT-1	Not Encountered	55.0	8.0	11.0 to 18.0
CPT-2	Not Encountered	50.0	5.0	9.0 to 22.0
CPT-3	10.8	10.8	Not Determined	Not Encountered
CPT-3A	10.0	10.0	Not Determined	Not Encountered
CPT-4	Not Encountered	50.0	12.0	9.0 to 11.0 and 28.0 to 33.0
CPT-5	Not Encountered	50.0	8.0	20.0 to 35.0
CPT-6	Not Encountered	50.0	16.0*	12.0 to 18.0

*Based on pore pressure plot and field observation.

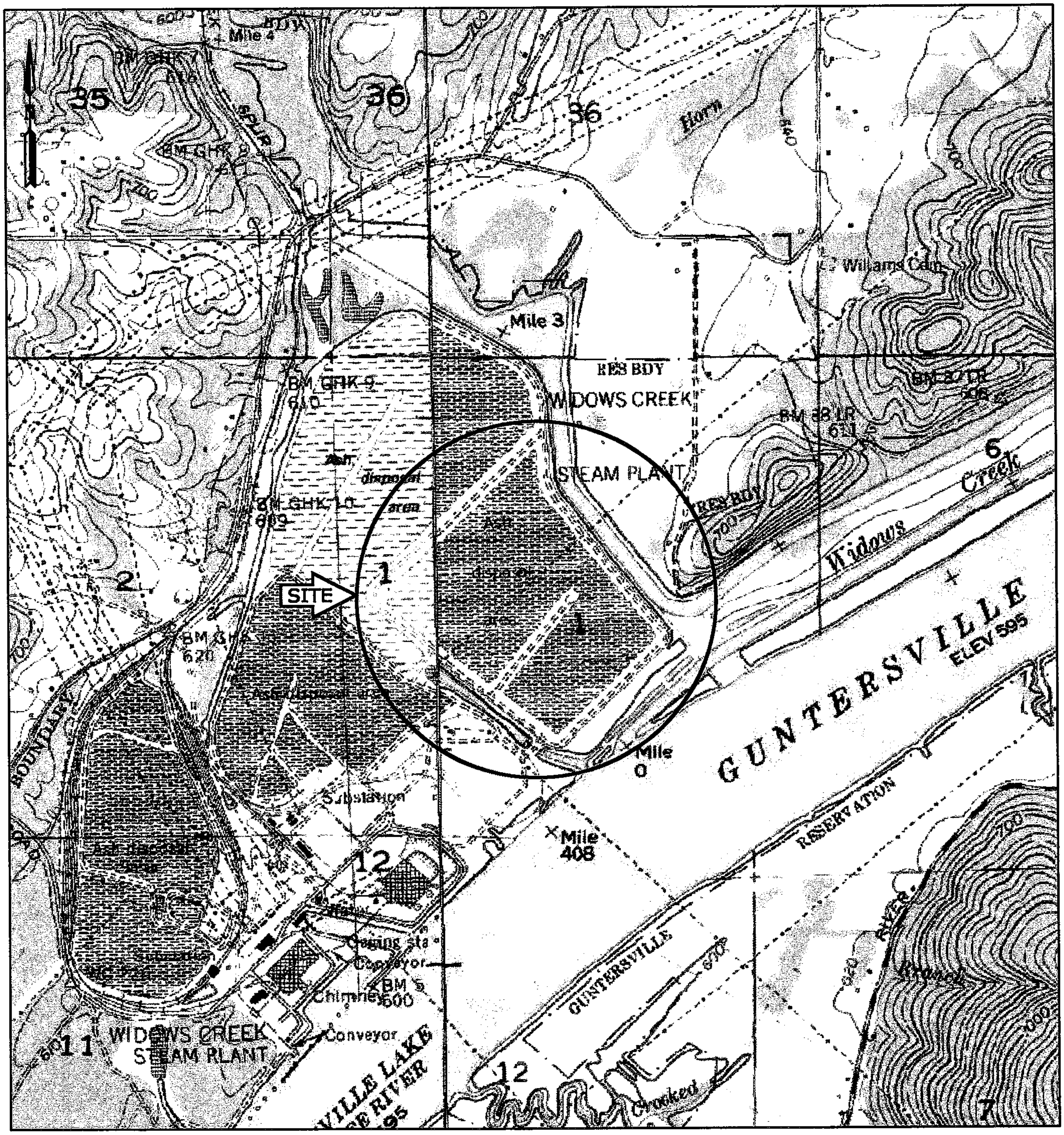
Prepared By ____________ Date ____________ Checked By ____________ Date ____________

7.0 BASIS OF RESULTS

The results provided herein are based on the encountered subsurface conditions related to the specific project and site discussed in this report.

Regardless of the thoroughness of a field exploration, there is always a possibility that conditions between test locations will differ from those at specific test locations, and that conditions may not be anticipated. In addition, interpretation of the data is critical to the intended design and/or analysis. Therefore, experienced geotechnical engineer should interpret the field data and review any analysis or design that incorporates the field data. We recommend that TVA retain MACTEC to provide this service, based upon our familiarity with the subsurface conditions, the field data, and our experience.

FIGURES



SOURCE: USGS TOPOGRAPHIC MAPS OF BRIDGEPORT AND DORAN COVE, AL QUADRANGLES

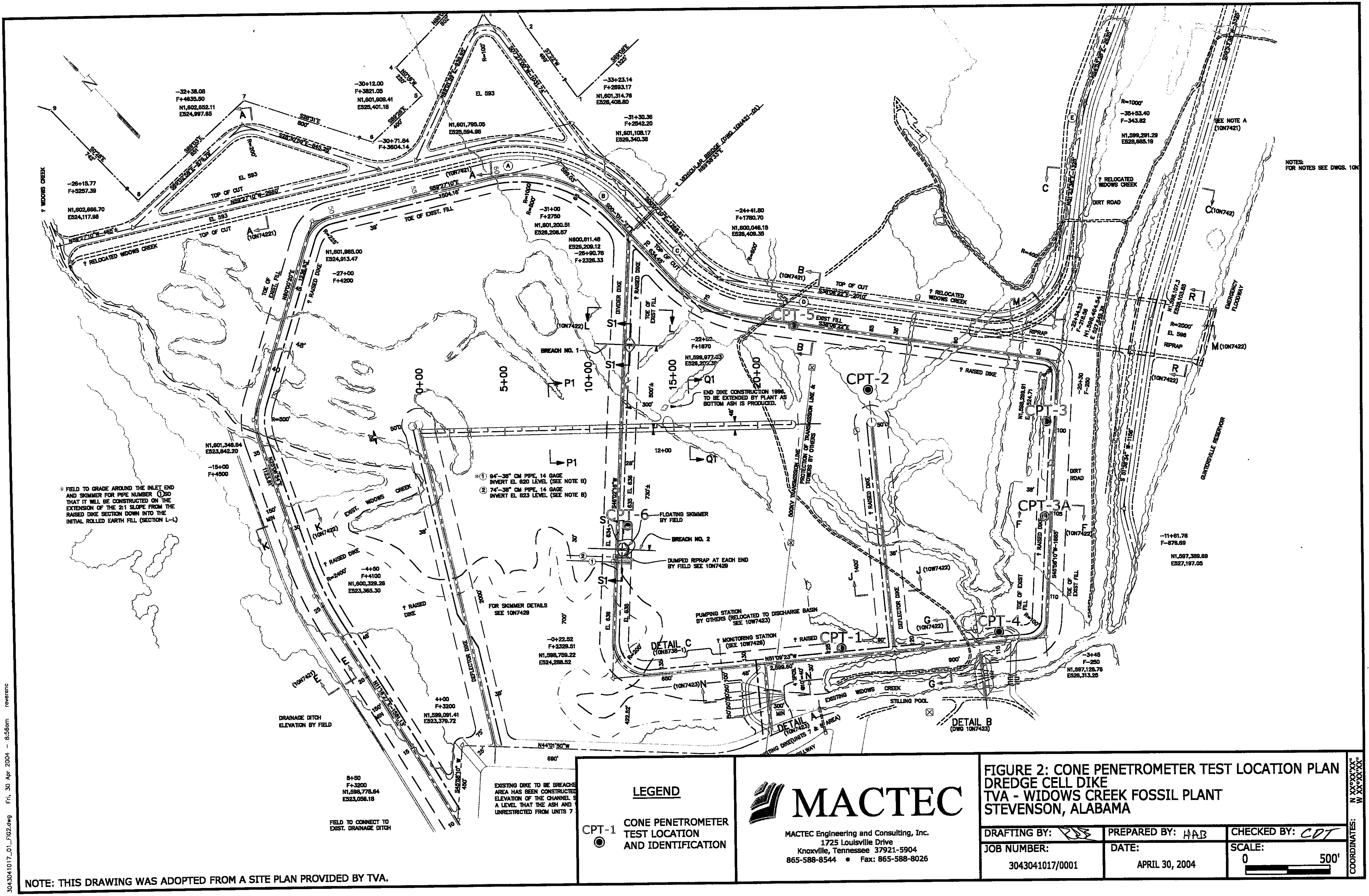
MACTEC

MACTEC Engineering and Consulting, Inc.
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026

FIGURE 1: SITE LOCATION MAP
CONE PENETROMETER TESTING DREDGE CELL DIKE
TVA WIDOWS CREEK FOSSIL PLANT
STEVENSON, ALABAMA

DRAFTING BY:
PREPARED BY: HAB
CHECKED BY: CDT
JOB NUMBER: 3043041017/0001
DATE: APRIL 30, 2004
SCALE: 0 2000'

COORDINATES: N XX°XX'XX" W XX°XX'XX"



NOTES:
FOR NOTES SEE DWGS. 10N

FIELD TO GRADE AROUND THE INLET END AND SKIMMER FOR PIPE NUMBER ① SO THAT IT WILL BE CONSTRUCTED ON THE EXTENSION OF THE 2:1 SLOPE FROM THE RAISED DIKE SECTION DOWN INTO THE INITIAL ROLLED EARTH FILL (SECTION L-L)

DRAINAGE DITCH ELEVATION BY FIELD

FIELD TO CONNECT TO EXIST. DRAINAGE DITCH

EXISTING DIKE TO BE BREACHE
AREA HAS BEEN CONSTRUCTED
ELEVATION OF THE CHANNEL S
A LEVEL THAT THE ASH AND
UNRESTRICTED FROM UNITS 7

NOTE: THIS DRAWING WAS ADOPTED FROM A SITE PLAN PROVIDED BY TVA.

LEGEND

CPT-1 ● CONE PENETROMETER TEST LOCATION AND IDENTIFICATION

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1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026

FIGURE 2: CONE PENETROMETER TEST LOCATION PLAN
DREDGE CELL DIKE
TVA - WIDOWS CREEK FOSSIL PLANT
STEVENSON, ALABAMA

DRAFTING BY:	PREPARED BY: HAB	CHECKED BY: CDT
JOB NUMBER: 3043041017/0001	DATE: APRIL 30, 2004	SCALE: 0 500'

COORDINATES: N XX°XX'XX" W XX°XX'XX"

3043041017_01_FIG2.dwg Fri, 30 Apr 2004 - 8:56am reverenc

APPENDIX A

CONE PENETROMETER TESTING PROCEDURES

Cone Penetration Testing Procedure (CPT)

Gregg In Situ, Inc. carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*. The soundings were conducted using a 20 ton capacity cone with a tip area of 15 cm^2 and a friction sleeve area of 225 cm^2. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.85.

The cone takes measurements of cone bearing (q_c), sleeve friction (f_s) and dynamic pore water pressure (u_2) at 5-cm intervals during penetration to provide a nearly continuous hydrogeologic log. CPT data reduction and interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are simultaneously printed and stored on disk for further analysis and reference. All CPT soundings are performed in accordance with ASTM standards (D 5778-95).

The cone also contains a porous filter element located directly behind the cone tip, *Figure CPT*. It consists of porous plastic and is 5.0mm thick. The filter element is used to obtain Pore Pressure Dissipation Tests (PPDT's) at 5 second intervals during appropriate pauses in penetration. It should be noted that prior to penetration, the element is fully saturated with silicon oil under vacuum pressure to ensure accurate and fast dissipation.

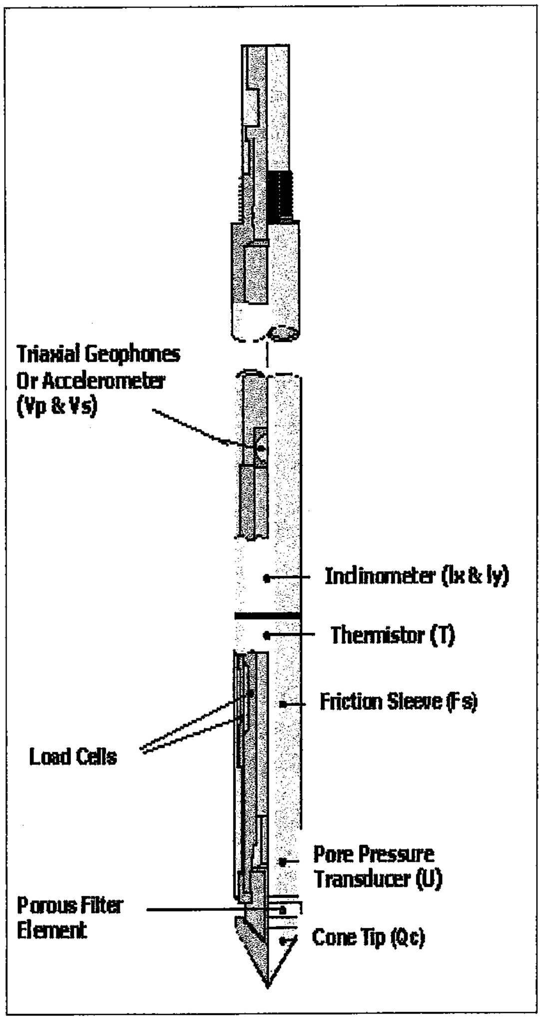


Figure CPT

When the soundings are complete, the test holes are grouted using a Gregg In Situ support rig. The grouting procedure consists of pushing a hollow CPT rod with a "knock out" plug to the termination depth of the test hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

Pore Pressure Dissipation Tests (PPDT)

Pore Pressure Dissipation Tests (PPDT's) conducted at various intervals measured hydrostatic water pressures and determined the approximate depth of the ground water table. A PPDT is conducted when the cone is halted at specific intervals determined by the field representative. The variation of the penetration pore pressure (*u*) with time is measured behind the tip of the cone and recorded by a computer system.
Pore pressure dissipation data can be interpreted to provide estimates of:

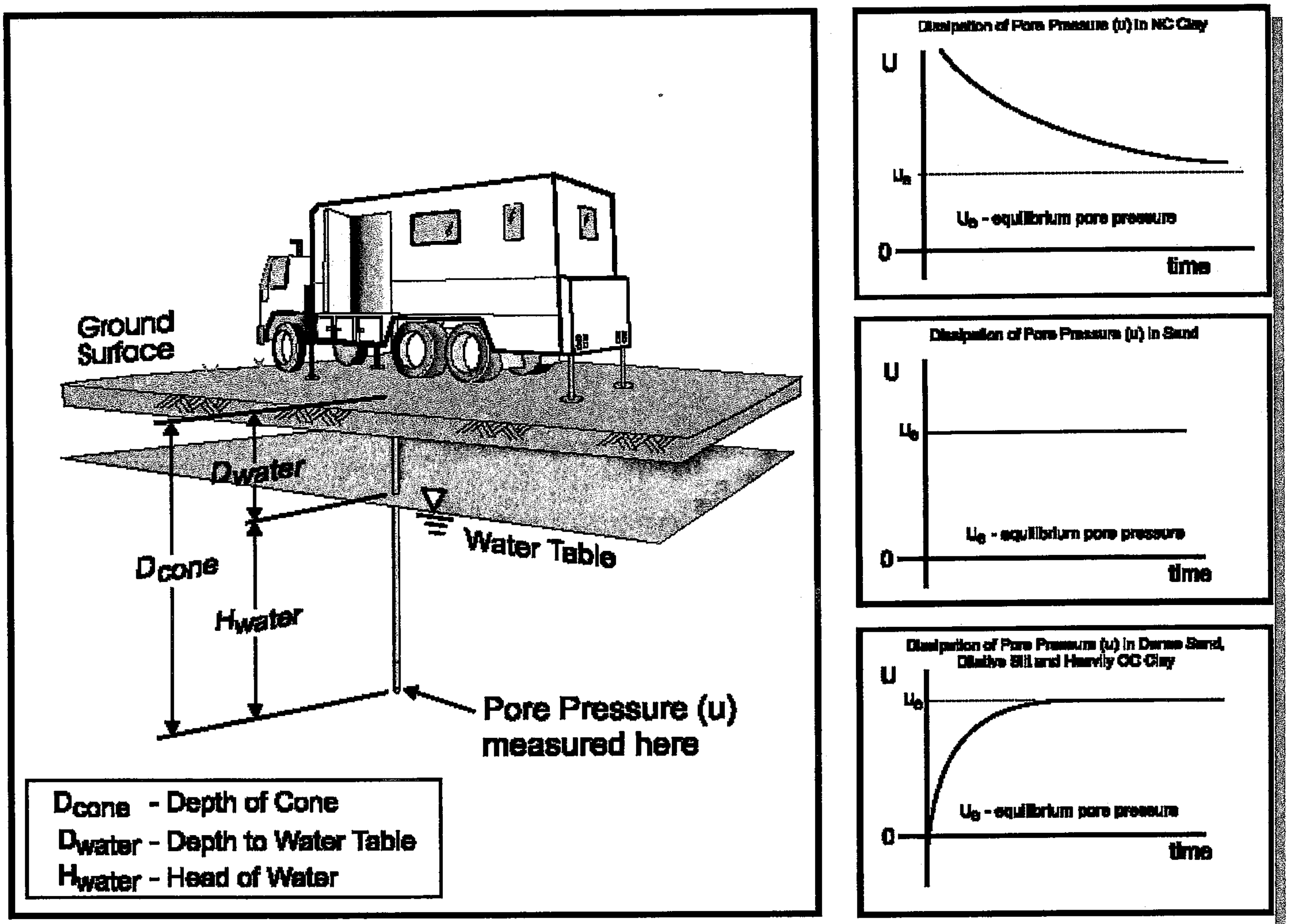
- Equilibrium piezometric pressure
- Phreatic Surface
- In situ horizontal coefficient of consolidation (c_h)
- In situ horizontal coefficient of permability (k_h)

In order to correctly interpret the equilibrium piezometric pressure and/or the phreatic surface, the pore pressure must be monitored until such time as there is no variation in pore pressure with time (refer to Figure PPD). This time is commonly referred to as t_{100}, the point at which 100% of the excess pore pressure has dissipated.

Interpretation of either c_h and k_h from dissipation results can be most easily achieved using either of two analytical approaches: cavity-expansion theory or the strain-path approach. Comparisons of the available solutions and results from field studies suggest that the cavity-expansion method of Torstensson (1977) and the strain-path approaches of Levadous (1980) and Teh (1987) all provide similar predications of consolidation parameters from CPTU dissipation data (Gillespie 1981; Kabir and Lutenegger 1990; Robertson et al. (1991). Robertson et al. (1991) have shown that these methods, although developed for normally consolidated soils, can be equally applied to overconsolidated soils. Furthermore, comparisons of field and laboratory data indicate that the trends in the measured (laboratory) and predicated (CPTU) data are consistent provided the micro fabric and nature of the soils being tested are taken into consideration. (Danziger 1990; Robertson et al. 1991).

A complete reference on pore pressure dissipation tests is presented by Robertson et al. 1991.

A summary of the pore pressure dissipation tests is summarized in Table PPD (Appendix PPD). Pore pressure dissipation data is presented in Appendix PPD.



Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

Useful Conversion Factors:

1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

Figure PPD

APPENDIX B

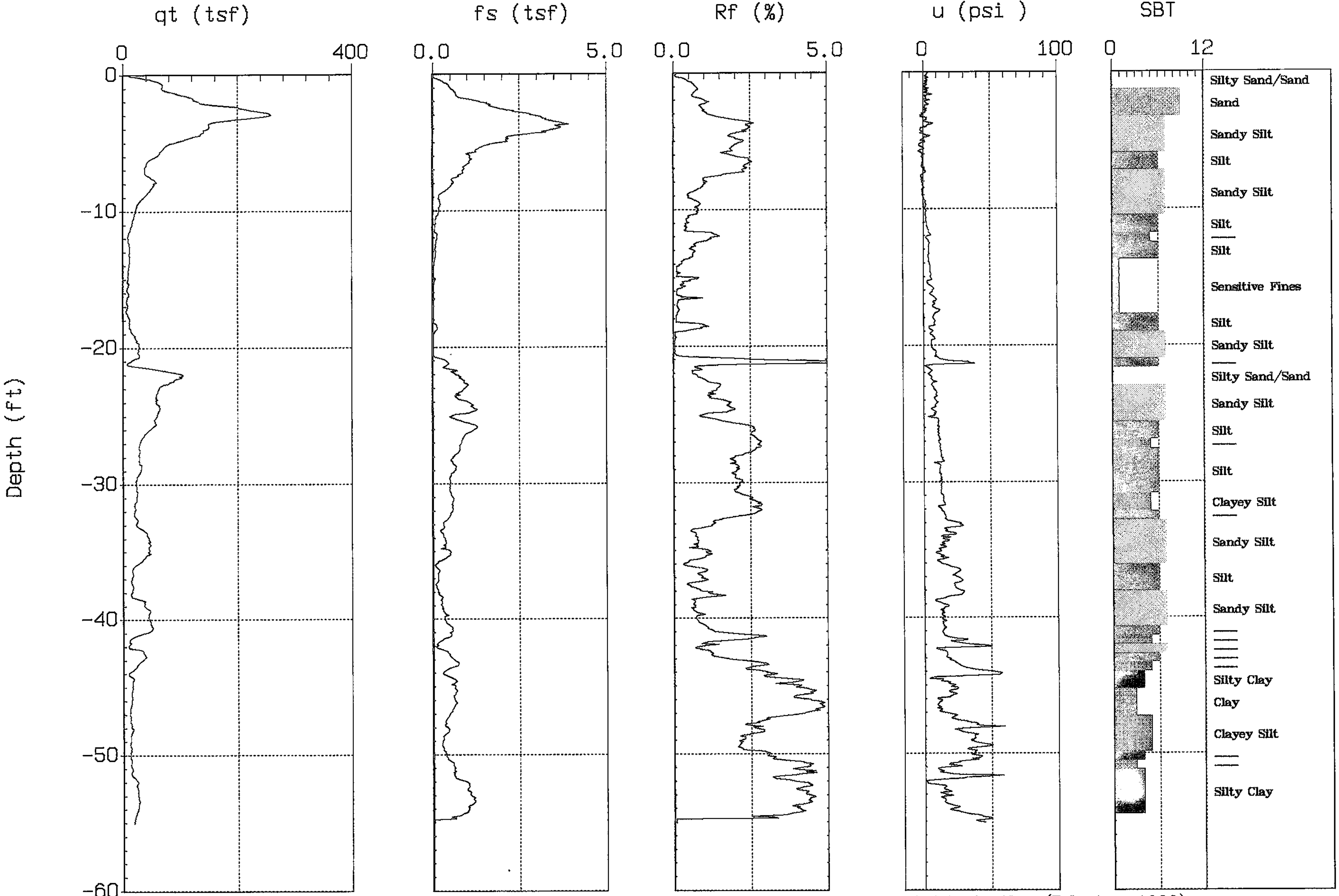
CONE PENETROMETER TESTING RESULTS AND GRAPHS

GREGG

MACTEC

Sounding: CPT-01
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 09:24



Max. Depth: 55.05 (ft)

Depth Inc.: 0.066 (ft)

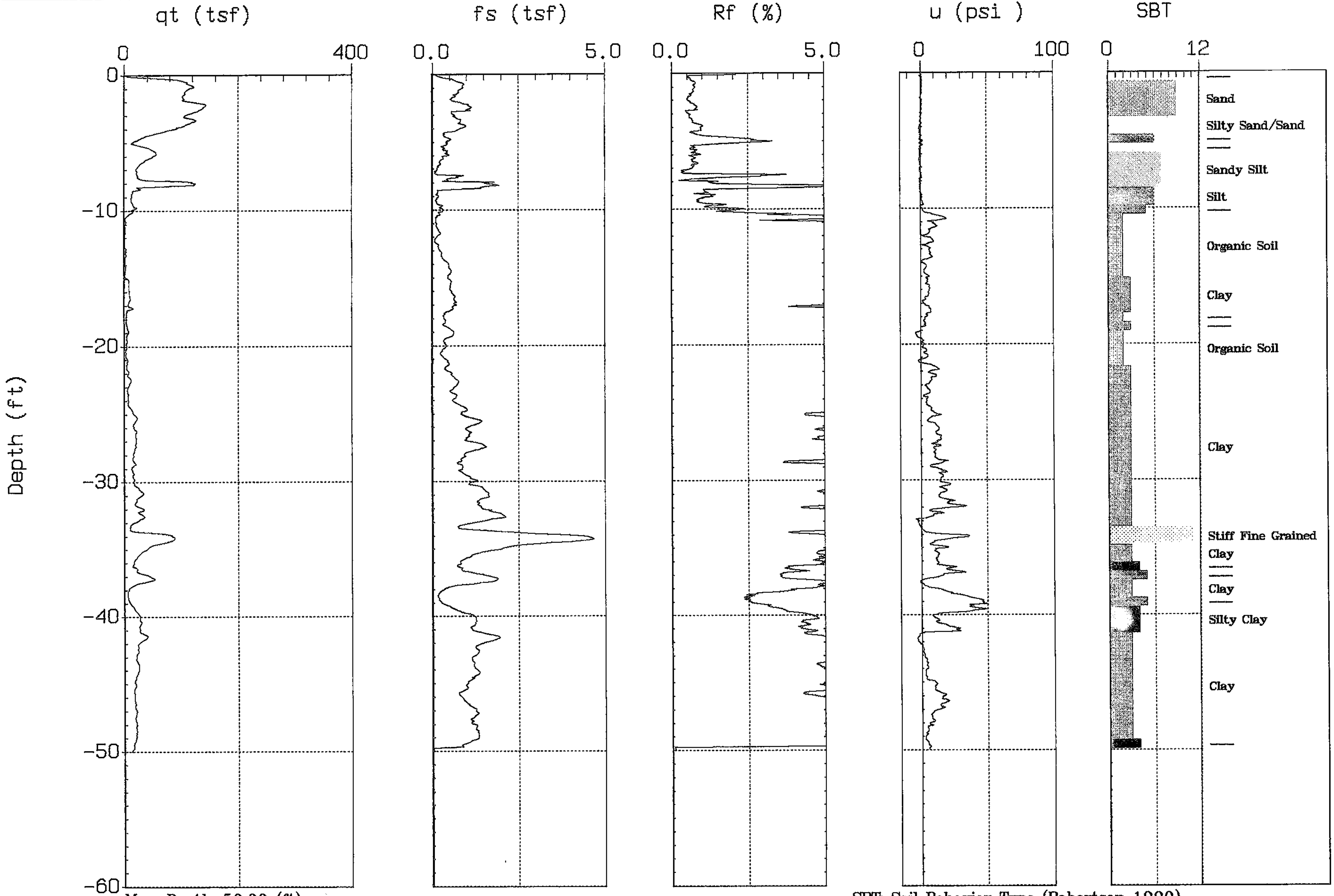
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-02
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 10:31



Max. Depth: 50.00 (ft)
Depth Inc.: 0.066 (ft)

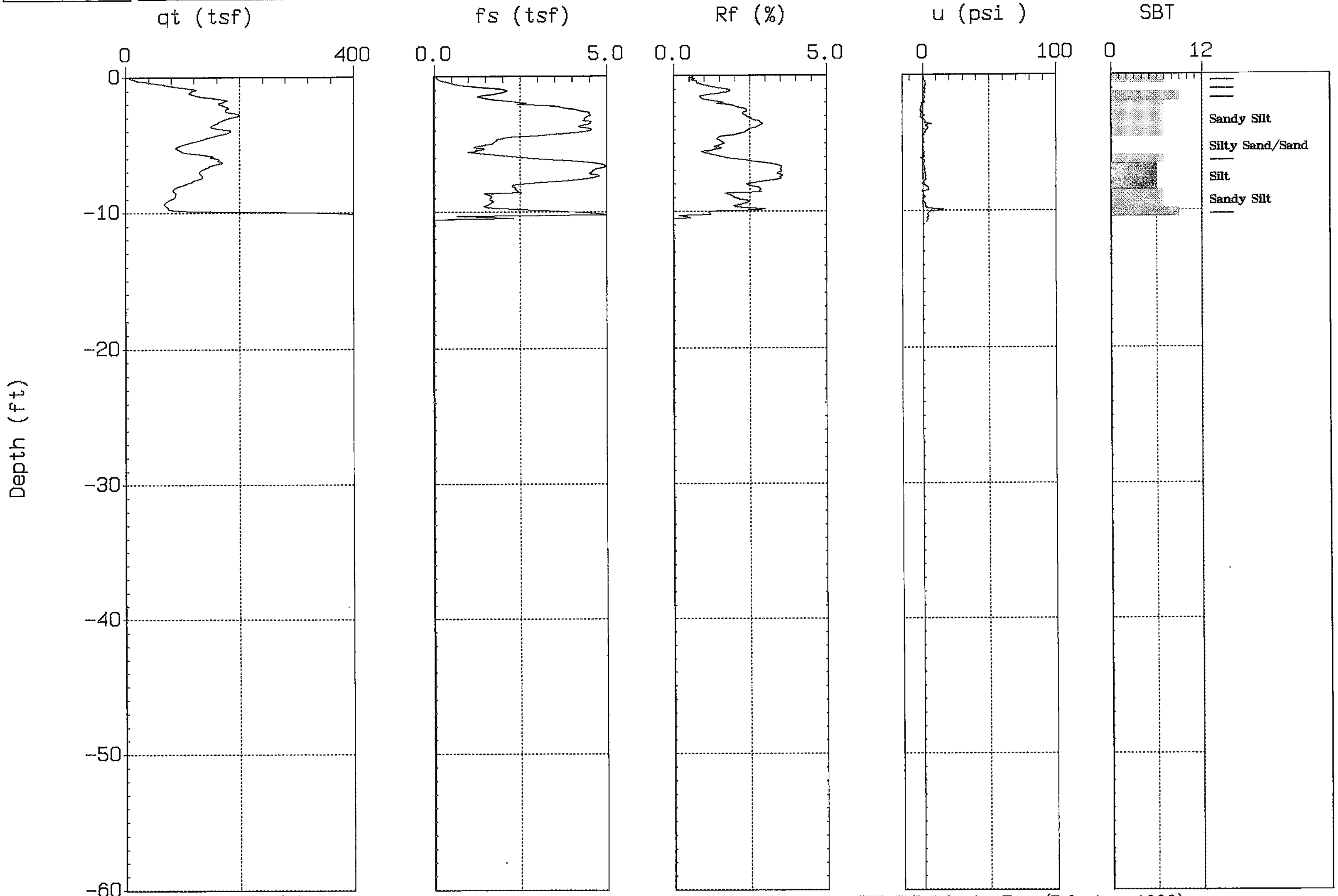
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-03
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 11:52



Max. Depth: 10.83 (ft)

Depth Inc.: 0.066 (ft)

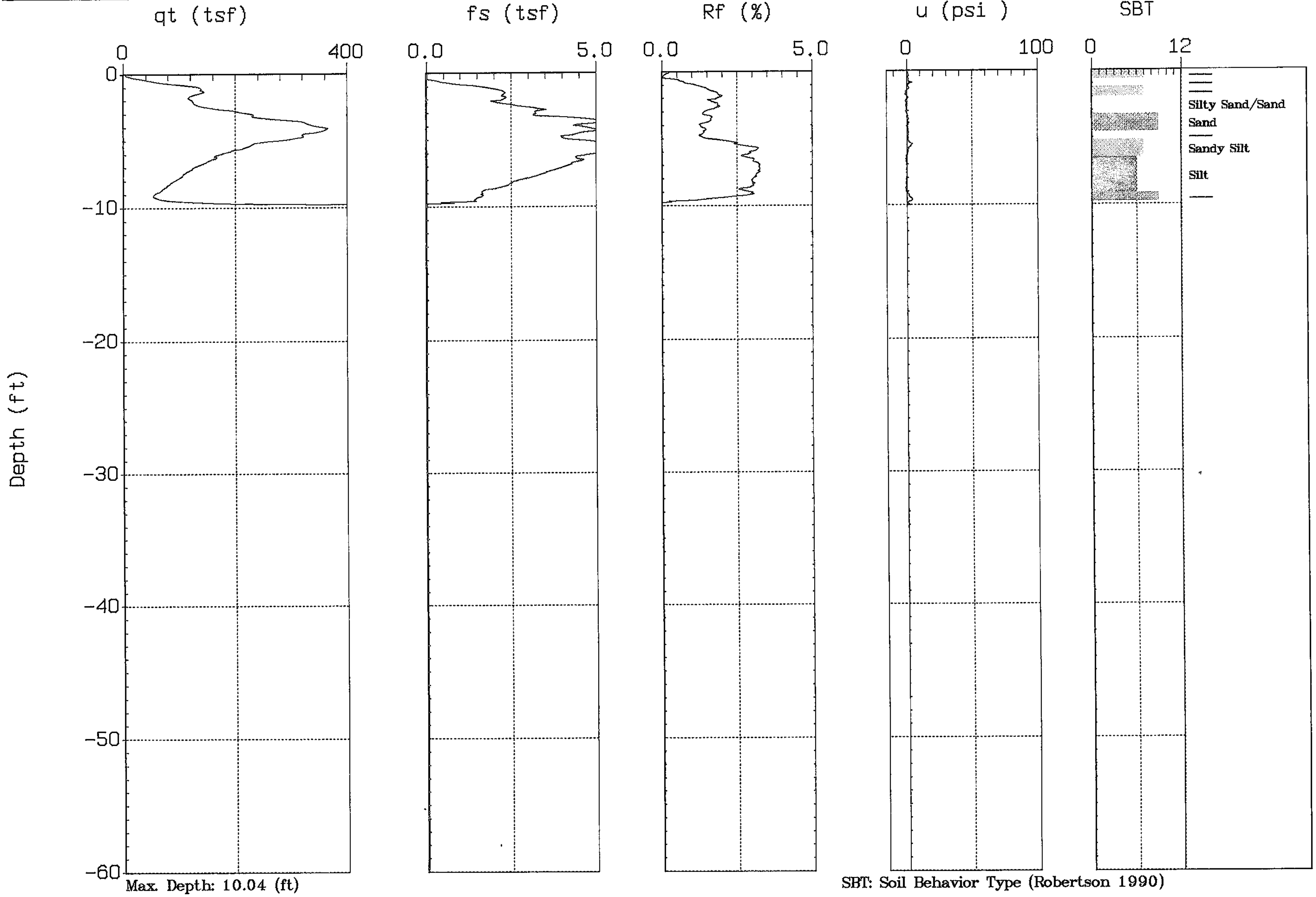
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-03A
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 12:15



Max. Depth: 10.04 (ft)
Depth Inc.: 0.066 (ft)

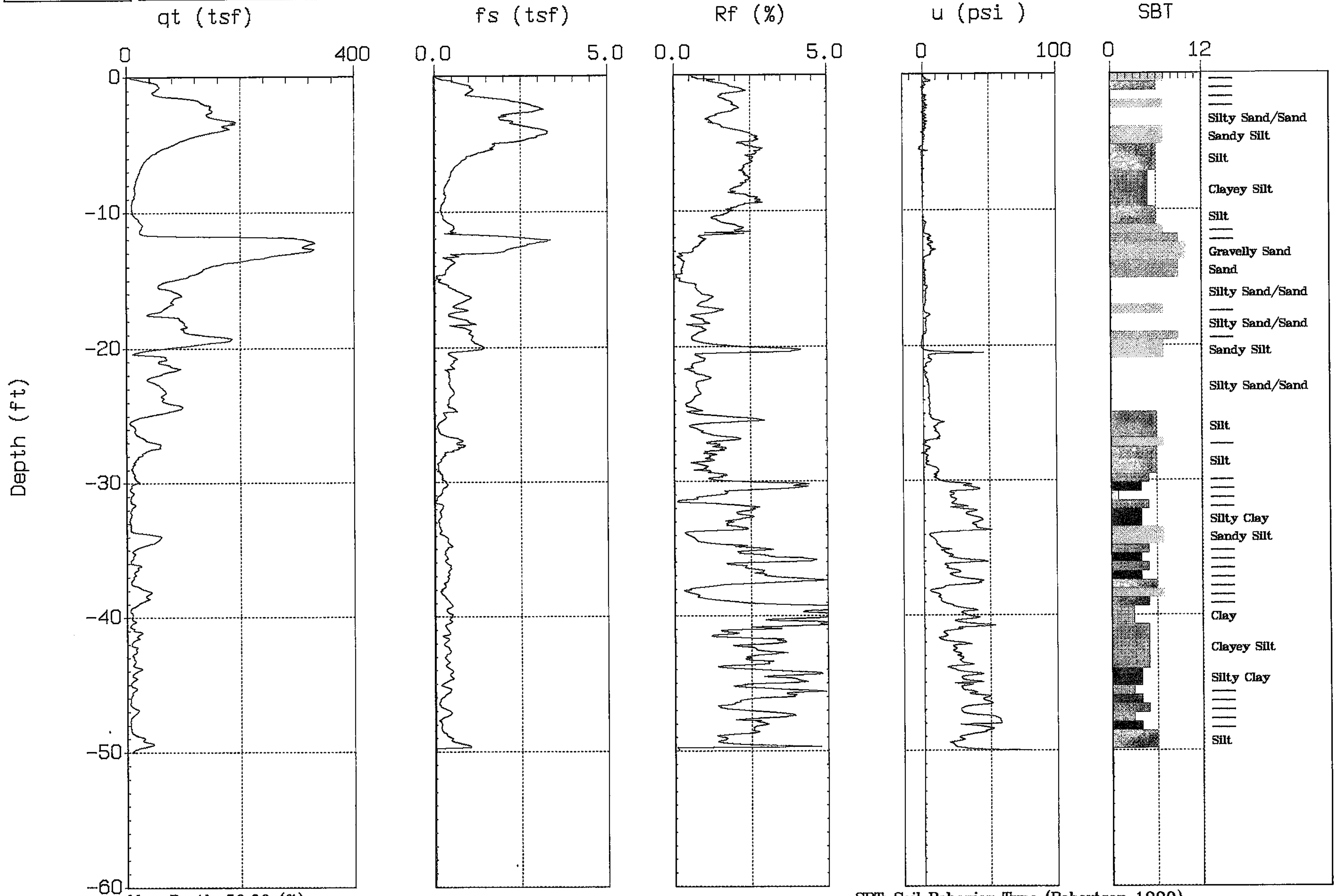
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-04
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 13:01



Max. Depth: 50.00 (ft)

Depth Inc.: 0.066 (ft)

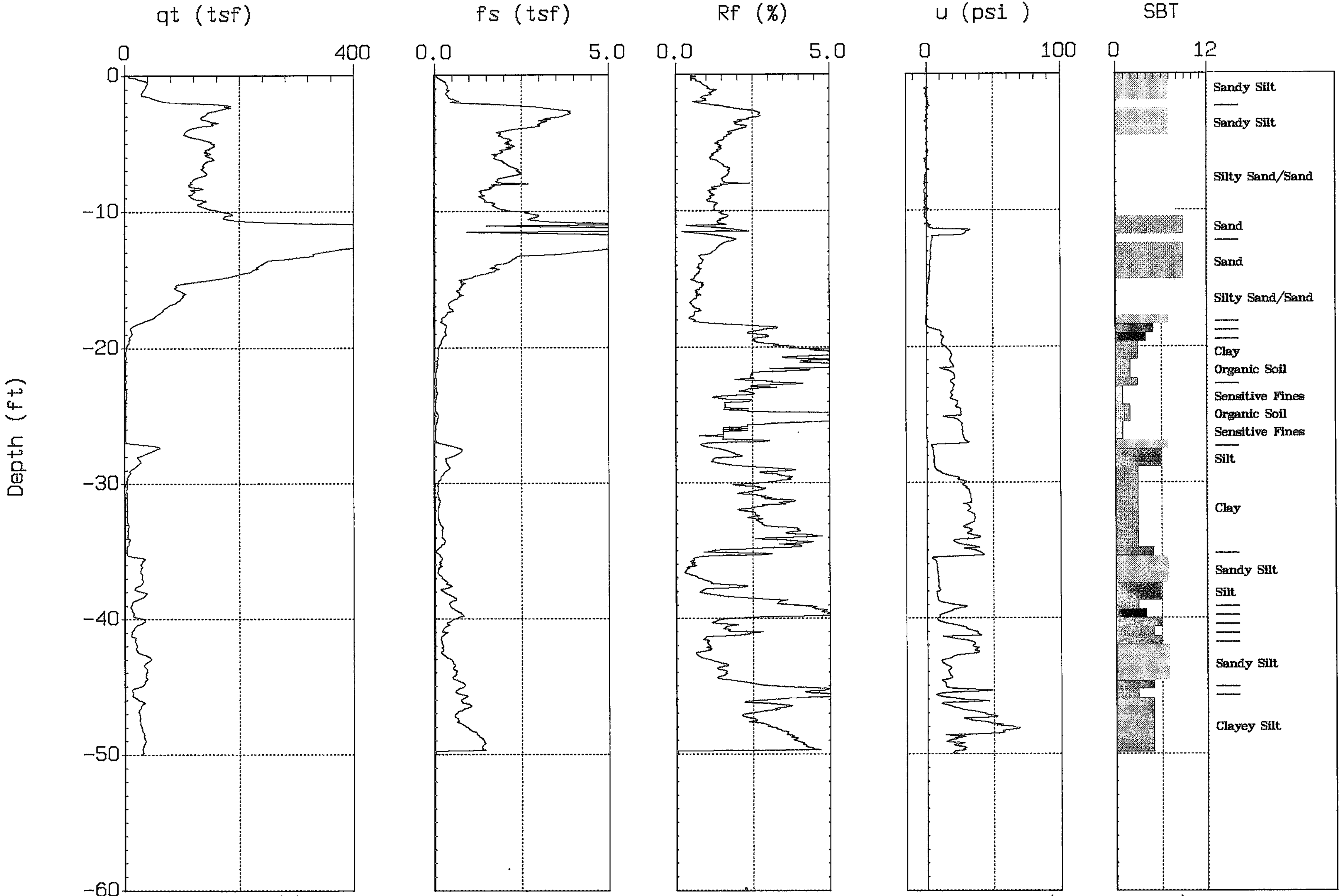
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-05
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 13:50



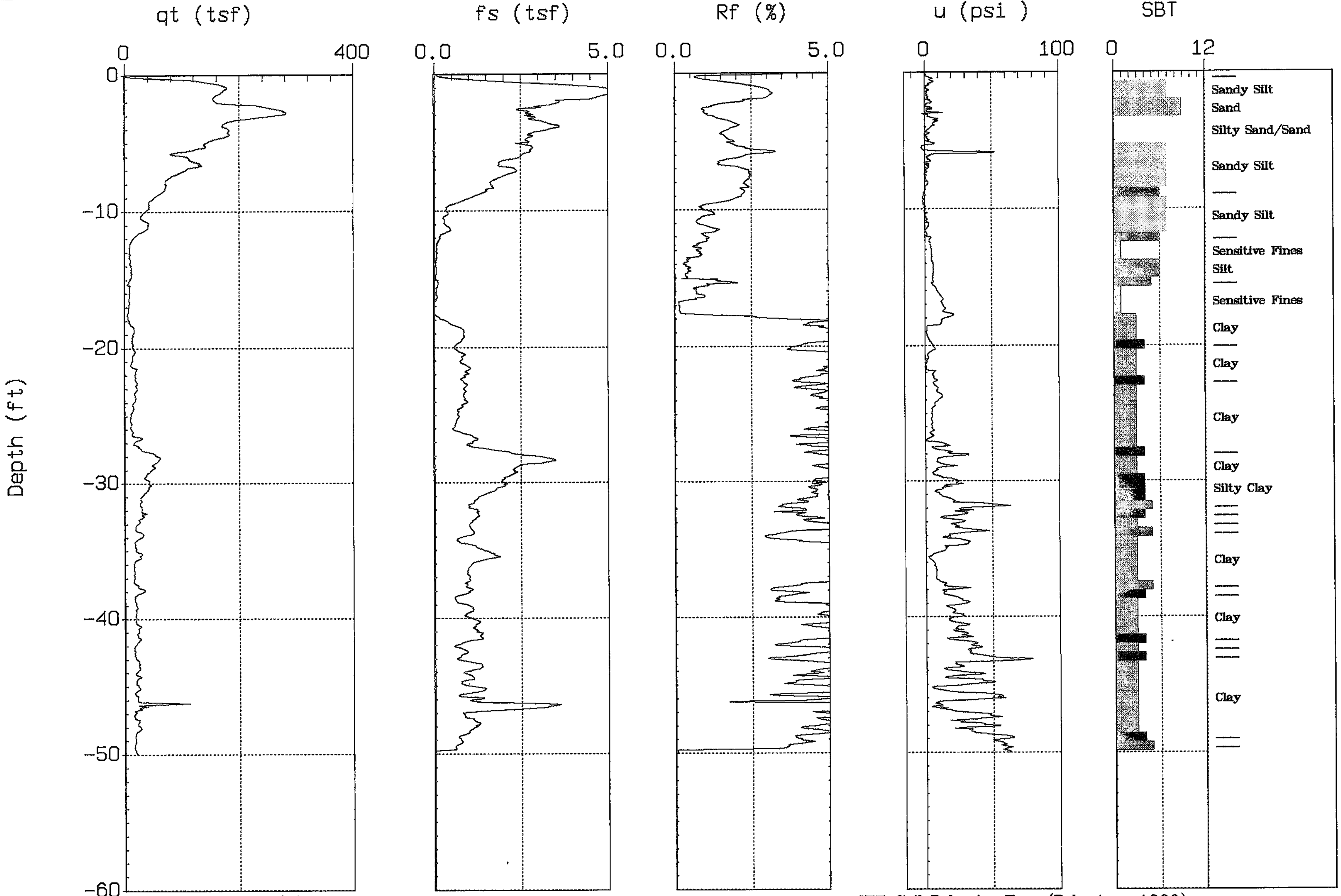
Max. Depth: 50.00 (ft)
Depth Inc.: 0.066 (ft)

SBT: Soil Behavior Type (Robertson 1990)

MACTEC

Sounding: CPT-06
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 15:47



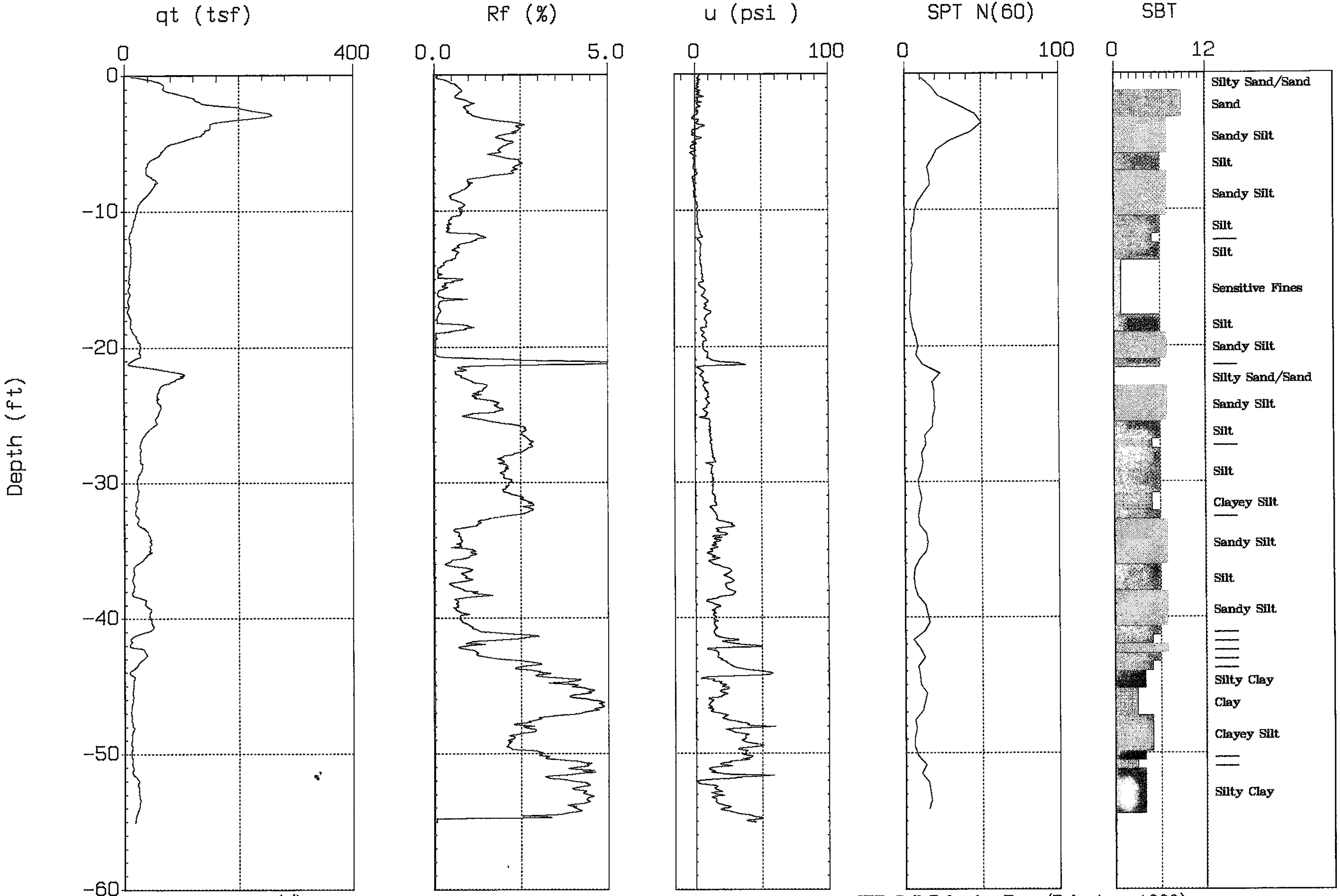
Max. Depth: 50.00 (ft)
Depth Inc.: 0.066 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG | *MACTEC*

Sounding: CPT-01
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 09:24



Max. Depth: 55.05 (ft)

Depth Inc.: 0.066 (ft)

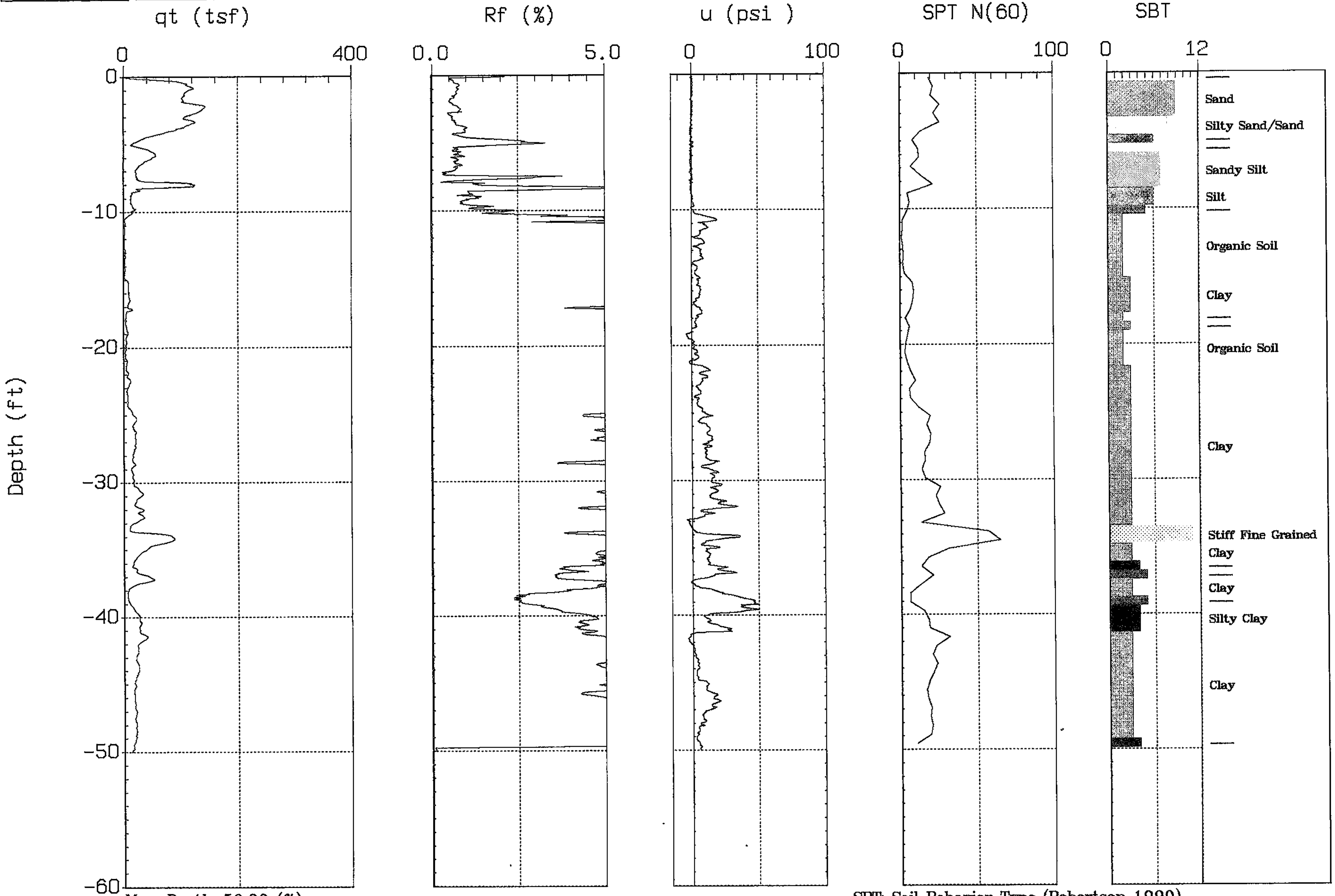
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-02
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 10:31



Max. Depth: 50.00 (ft)
Depth Inc.: 0.066 (ft)

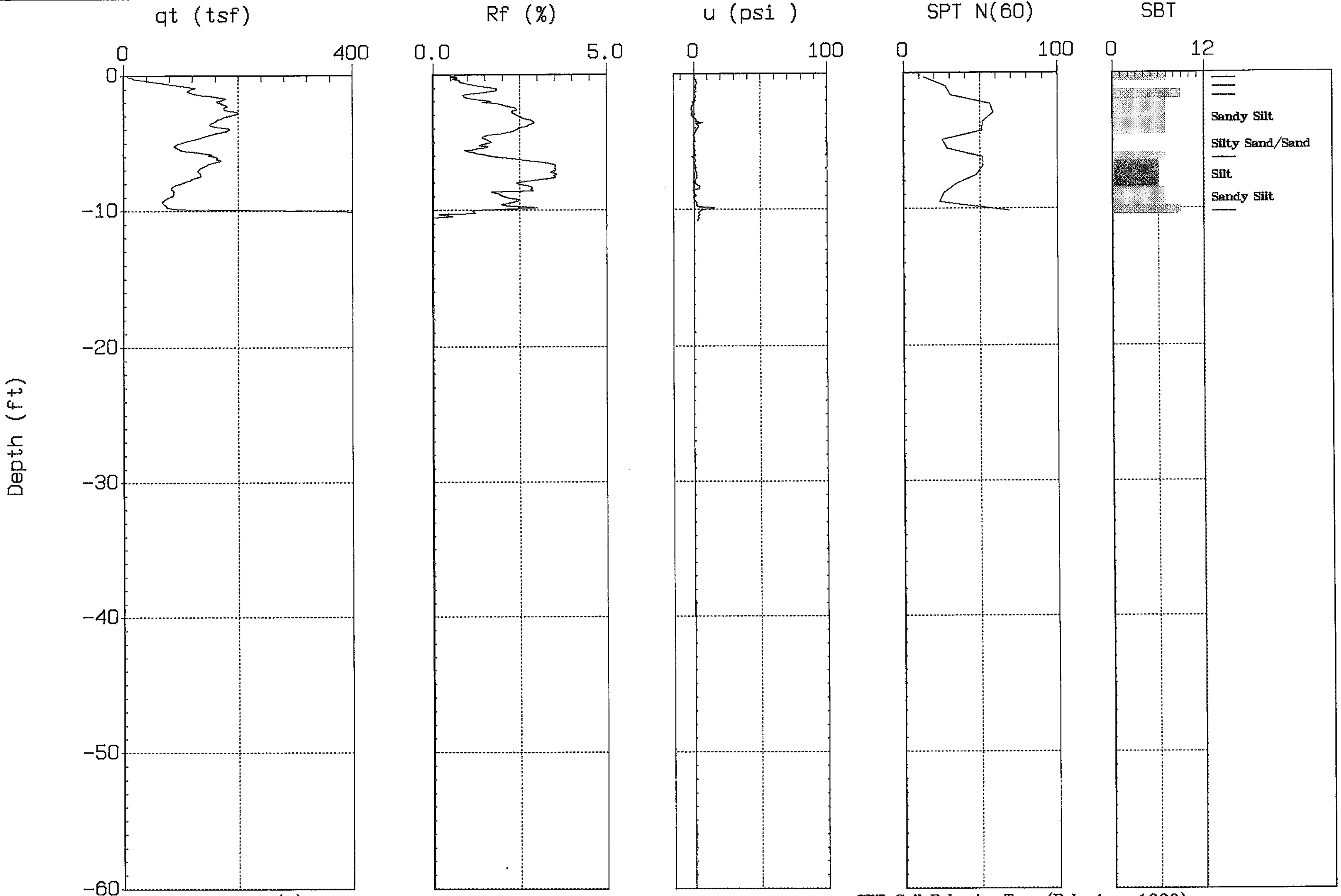
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-03
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 11:52



Max. Depth: 10.83 (ft)
Depth Inc.: 0.066 (ft)

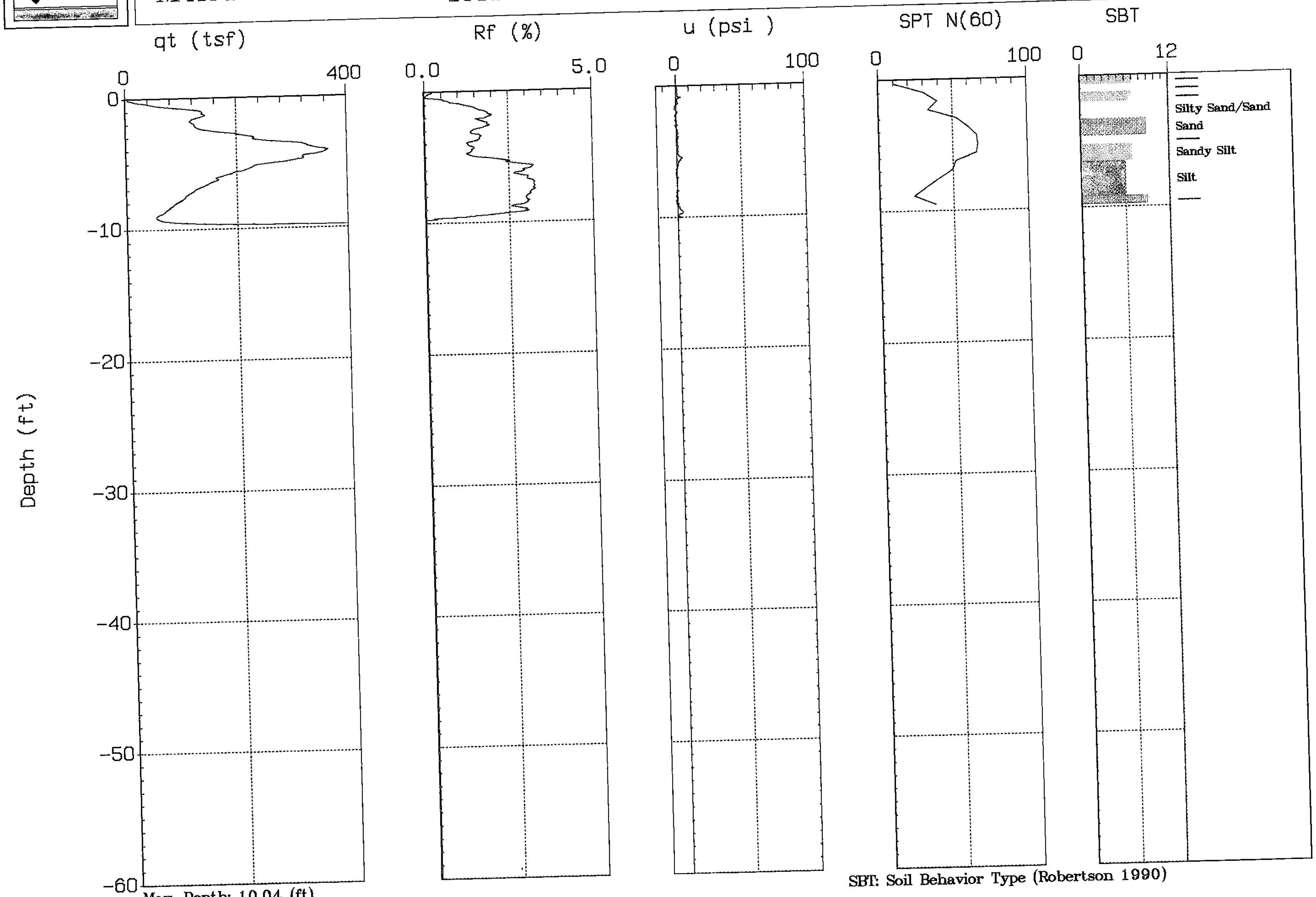
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-03A
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 12:15



Max. Depth: 10.04 (ft)
Depth Inc.: 0.066 (ft)

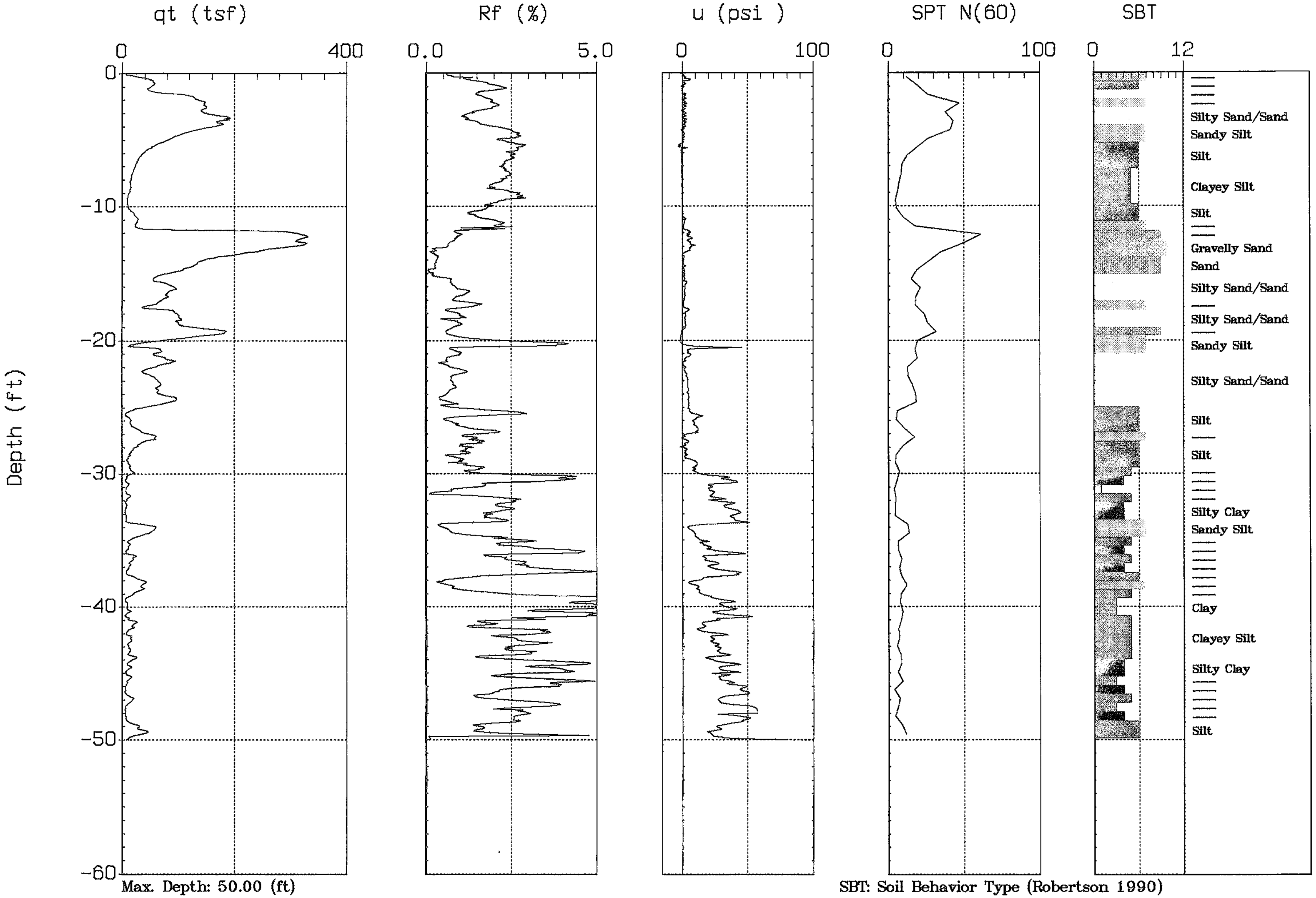
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-04
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 13:01



Max. Depth: 50.00 (ft)
Depth Inc.: 0.066 (ft)

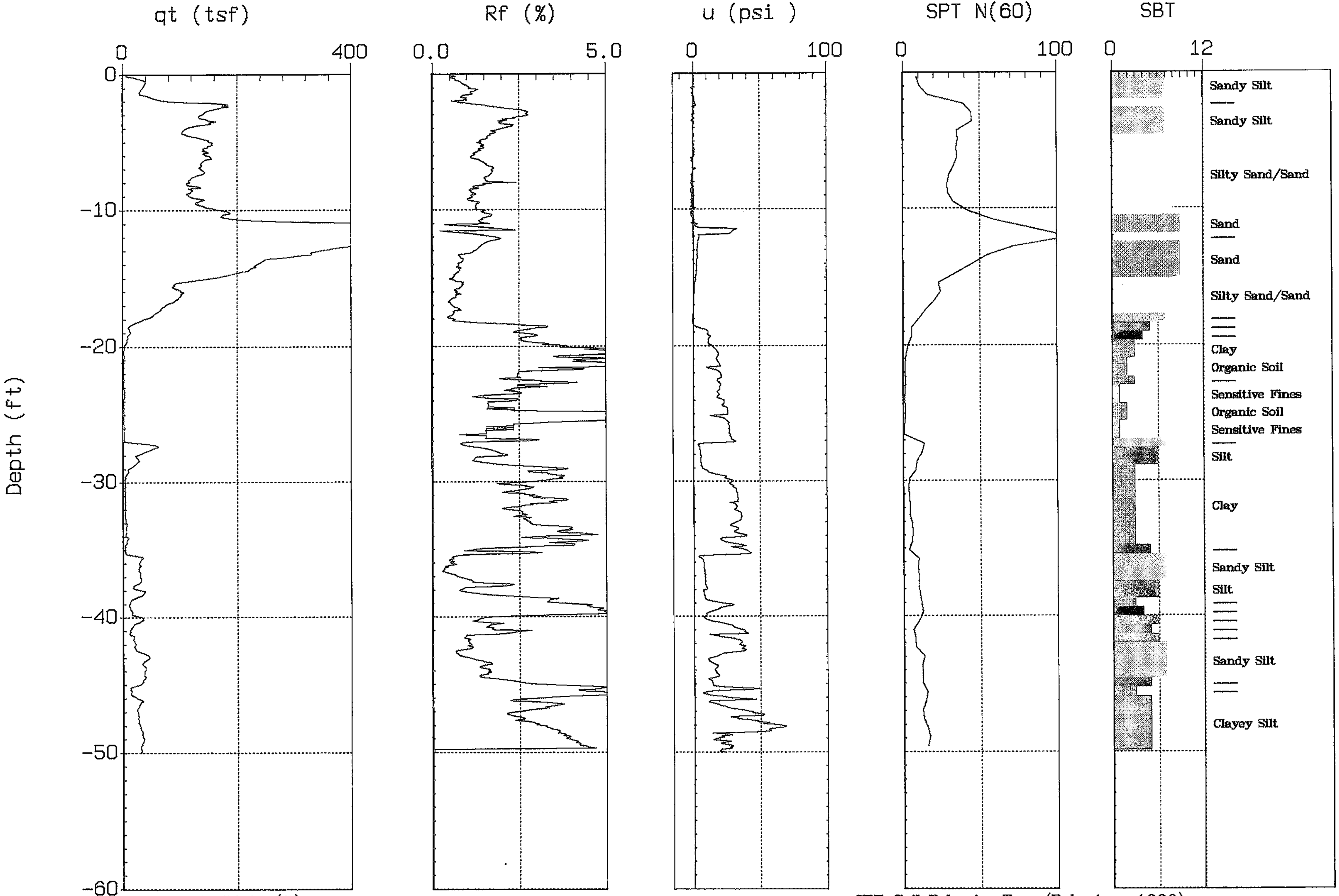
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-05
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 13:50



Max. Depth: 50.00 (ft)

Depth Inc.: 0.066 (ft)

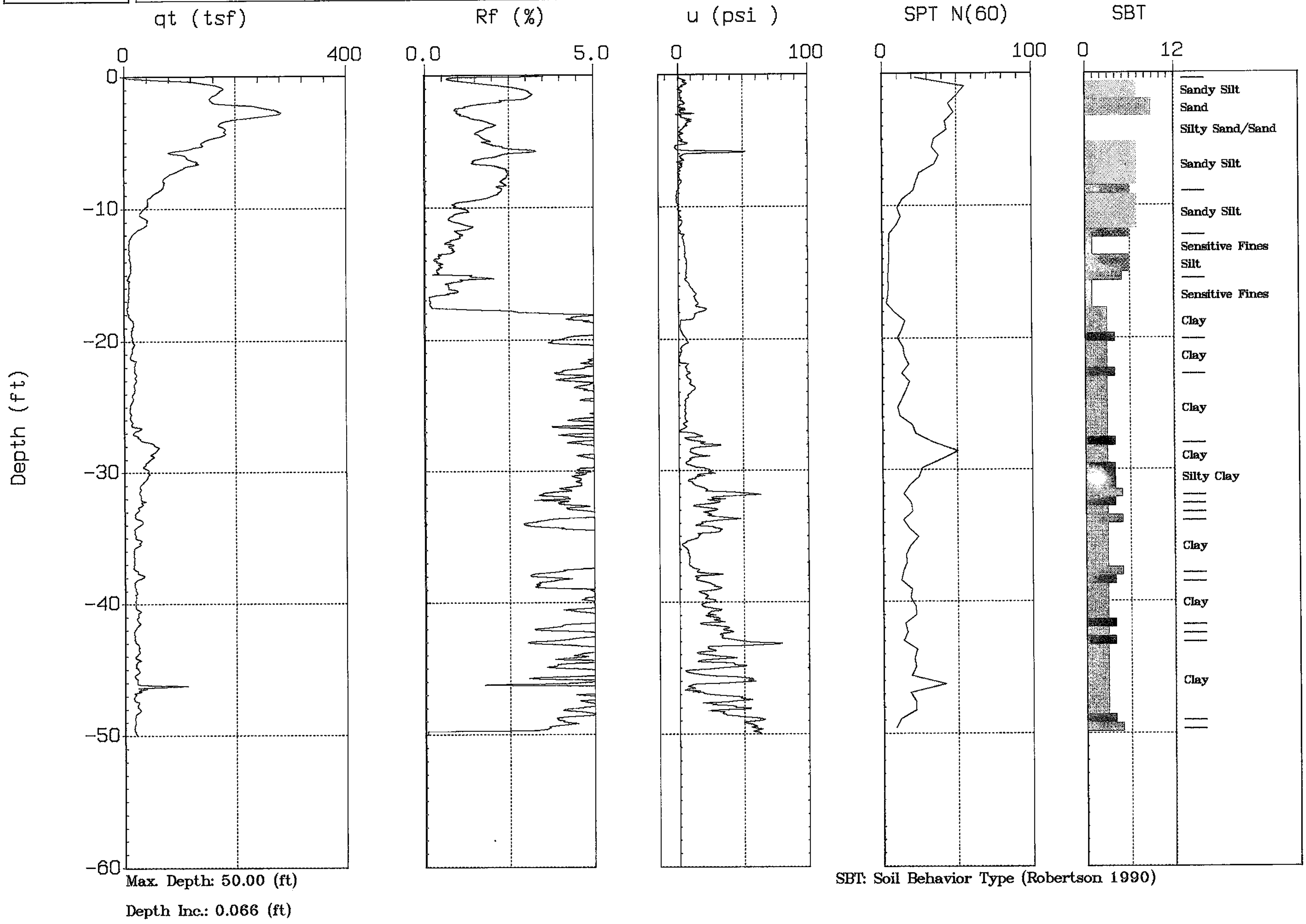
SBT: Soil Behavior Type (Robertson 1990)

GREGG

MACTEC

Sounding: CPT-06
Location: TVA

Oversite: H. Benkhayal
Date: 04:21:04 15:47



Max. Depth: 50.00 (ft)
Depth Inc.: 0.066 (ft)

SBT: Soil Behavior Type (Robertson 1990)

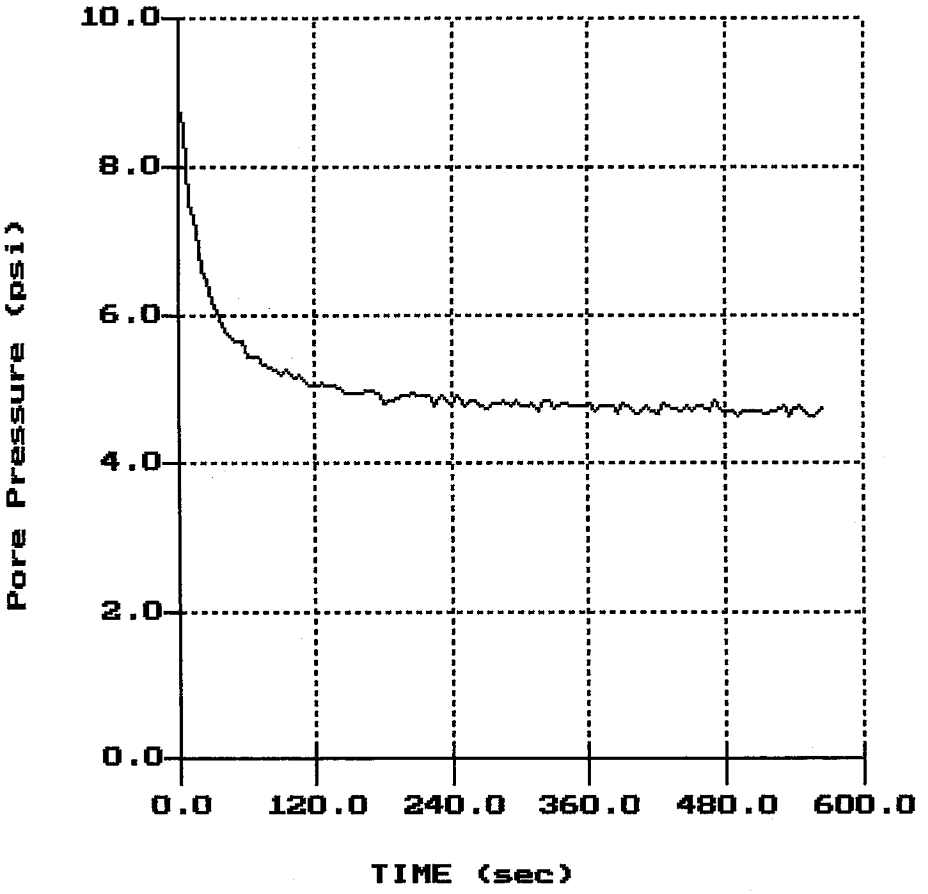
MACTEC

Sounding:CPT-01
Location:TVA

Oversight:H. Benkhay
Date:04:21:04 09:24

File: 064CP01.PPD
Depth (m): 5.66
(ft): 18.57
Duration : 565.0s
U-min: 4.62 555.0s
U-max: 8.81 0.0s

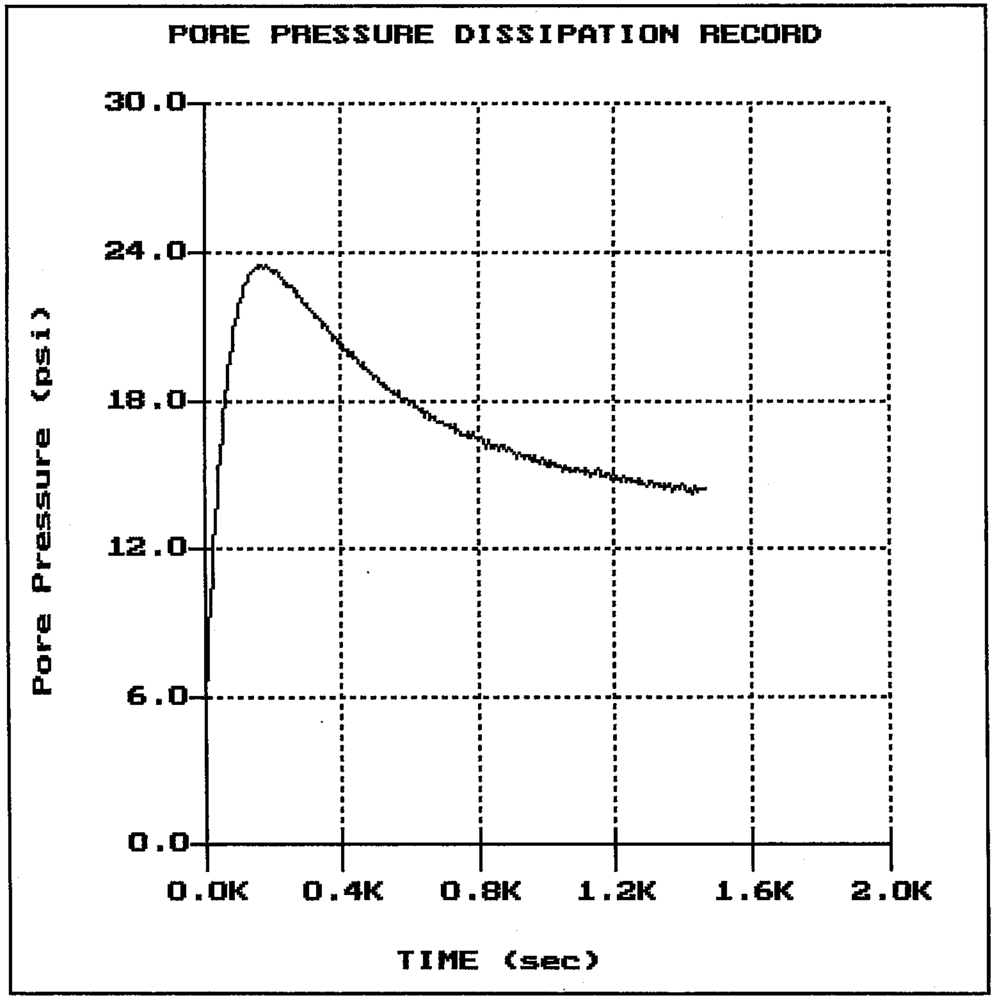
PORE PRESSURE DISSIPATION RECORD



MACTEC

Sounding:CPT-02
Location:TVA

Oversight:H. Benkhay
Date:04:21:04 10:31

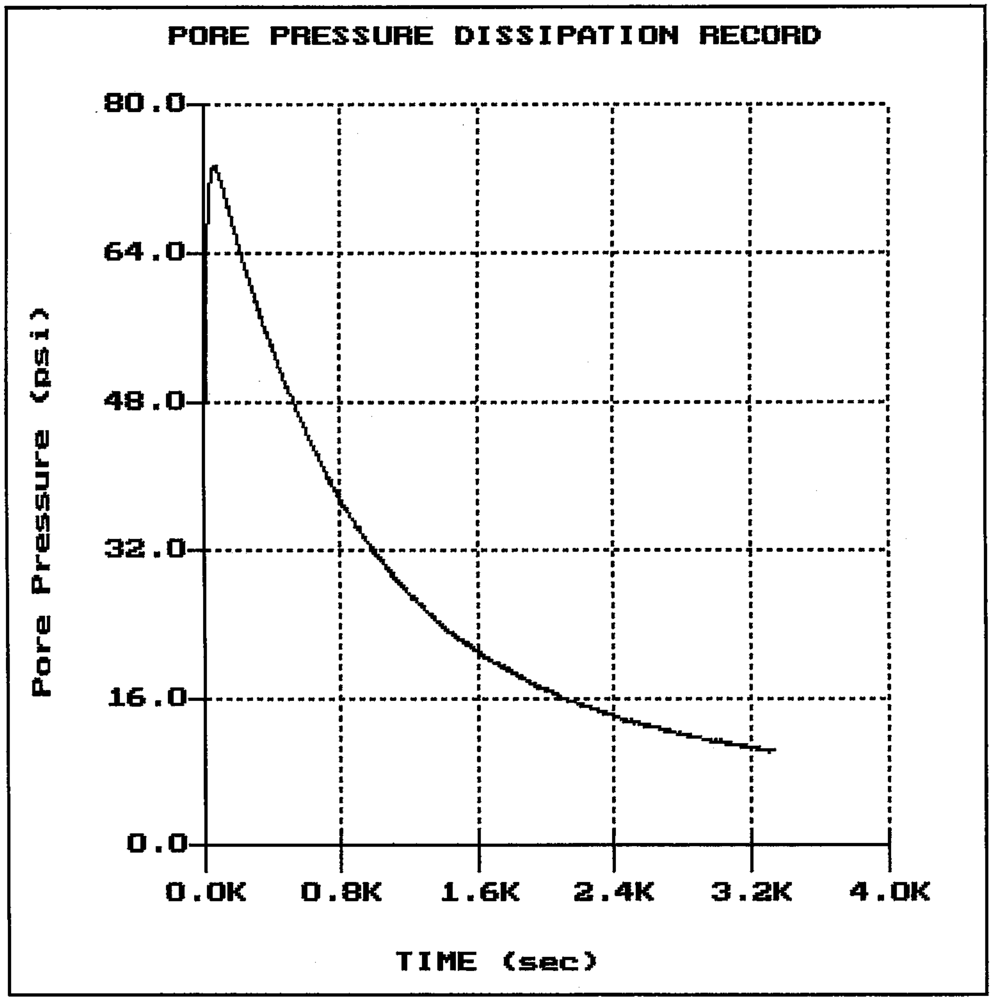


```
File: 064CP02.PPD
Depth (m): 11.56
     (ft): 37.93
Duration : 1460.0s
U-min:  5.86   0.0s
U-max: 23.48 180.0s
```

MACTEC

Sounding:CPT-05
Location:TVA

Oversight:H. Benkhay
Date:04:21:04 13:50



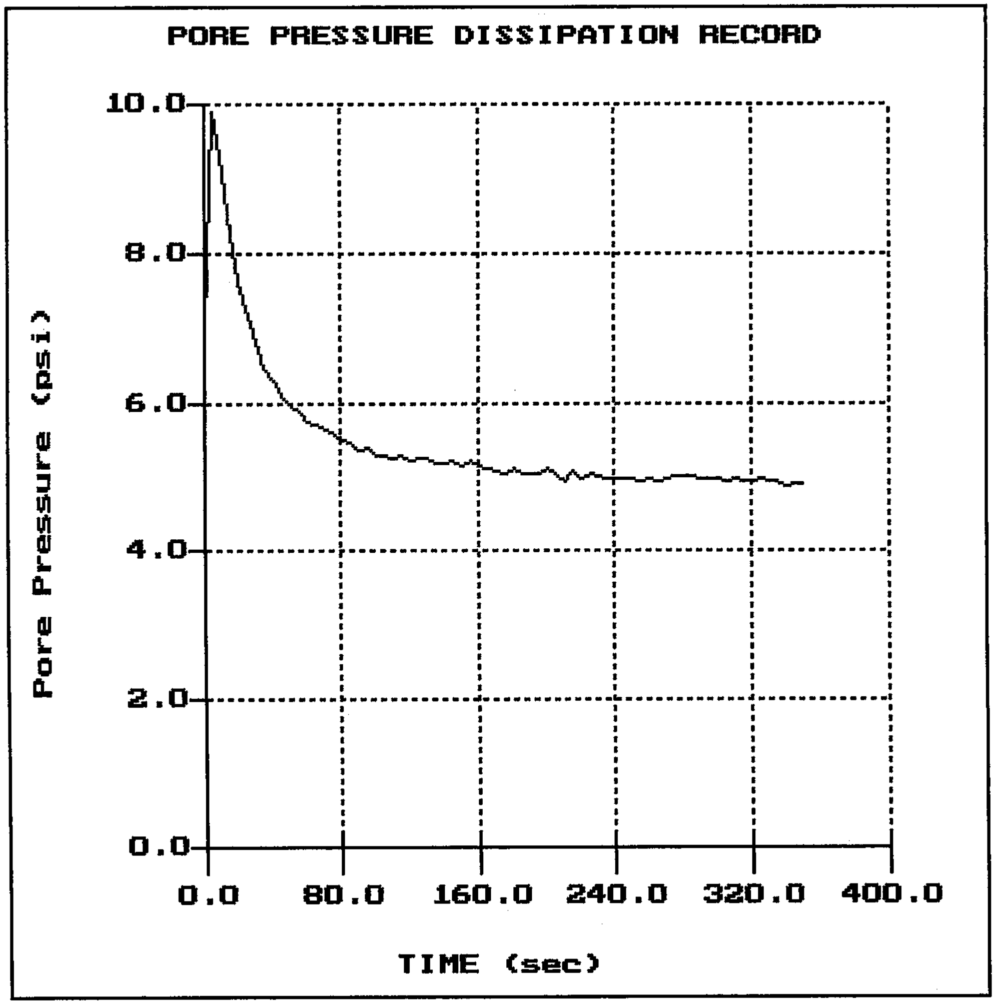
File: 064CP05.PPD
Depth (m): 15.24
(ft): 50.00
Duration : 3330.0s
U-min: 10.07 3305.0s
U-max: 73.36 65.0s

MACTEC

Sounding:CPT-06
Location:TVA

Oversight:H. Benkhay
Date:04:21:04 15:47

File: 064CP06.PPD
Depth (m): 4.68
(ft): 15.35
Duration : 350.0s
U-min: 4.86 340.0s
U-max: 9.91 5.0s



PORE PRESSURE DISSIPATION RECORD

GREGG IN SITU CPT Interpretations as of July 31, 2002 (Release 1.20c)

GREGG IN SITU's interpretation routine provides a tabular output of geotechnical parameters based on current published CPT correlations and is subject to change to reflect the current state of practice. The interpreted values are not considered valid for all soil types. The interpretations are presented only as a guide for geotechnical use and should be carefully scrutinized for consideration in any geotechnical design. Reference to current literature is strongly recommended. GREGG IN SITU, Inc. and GREGG DRILLING & TESTING Inc. do not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the program and can not assume liability for any use of the results in any design or review. Representative hand calculations should be made for any parameter that is critical for design purposes. The end user of the interpreted output should also be fully aware of the techniques and the limitations of any method used in this program. The purpose of this document is to inform the user as to which methods were used and what the appropriate papers and/or publications are for further reference.

The CPT interpretations are based on values of tip, sleeve friction and pore pressure averaged over a user specified interval (e.g. 0.20m). Note that q_t is the recorded tip value, q_c, corrected for pore pressure effects. Since all GREGG IN SITU cones have equal end area friction sleeves, pore pressure corrections to sleeve friction, Fs, are not required.

The tip correction is: $q_t = q_c + (1-a) \bullet u_2$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the cone (typically 0.85 for GREGG IN SITU cones)

The total stress calculations are based on soil unit weights that have been assigned to the Soil Behavior Type zones, from a user defined unit weight profile or by using a single value throughout the profile. Effective vertical overburden stresses are calculated based on a hydrostatic distribution of equilibrium pore pressures below the water table or from a user defined equilibrium pore pressure profile (this can be obtained from CPT dissipation tests). For over water projects the effects of the column of water have been taken in to account as has the appropriate unit weight of water. How this is done depends on where the instruments were zeroed (i.e. on deck or at mud line).

Details regarding the interpretation methods for all of the interpreted parameters are provided in Table 1. The appropriate references cited in Table 1 are listed in Table 2. Where methods are based on charts or techniques that are too complex to describe in this summary the user should reference to the cited references.

The estimated Soil Behavior Types (normalized and non-normalized) are based on the charts developed by Robertson and Campanella shown in Figures 1 and 2.

Where the results of a calculation/interpretation are declared *'invalid'* the value will be represented by the text strings "-9999" or "-9999.0". Invalid results will occur because of (and not limited to) one or a combination of:

1. Invalid or undefined CPT data (e.g. drilled out section or data gap).
2. Where the interpretation method is inappropriate, for example, drained parameters in an undrained material (and vice versa).
3. Where interpretation input values are beyond the range of the referenced charts or specified limitations of the interpretation method.
4. Where pre-requisite or intermediate interpretation calculations are invalid.

The parameters selected for output from the program are often specific to a particular project. As such, not all of the interpreted parameters listed in Table 1 may be included in the output files delivered with this report.

Table 1
CPT Interpretation Methods

Interpreted Parameter	Description	Equation	Ref
Depth	Mid Layer Depth *(where interpretations are done at each point then Mid Layer Depth = Recorded Depth)*	*Depth (Layer Top) + Depth (Layer Bottom) / 2.0*	
Elevation	Elevation of Mid Layer based on sounding collar elevation supplied by client	Elevation = Collar Elevation - Depth	
Avgqc	Averaged recorded tip value (q_c)	$Avgqc = \frac{1}{n}\sum_{i=1}^{n} q_c$ *n=1 when interpretations are done at each point*	
Avgqt	Averaged corrected tip (q_t) where: $q_t = q_c + (1-a) \bullet u$	$Avgqt = \frac{1}{n}\sum_{i=1}^{n} q_t$ *n=1 when interpretations are done at each point*	
Avgfs	Averaged sleeve friction (f_s)	$Avgfs = \frac{1}{n}\sum_{i=1}^{n} fs$ *n=1 when interpretations are done at each point*	
AvgRf	Averaged friction ratio (Rf) where friction ratio is defined as: $Rf = 100\% \bullet \frac{fs}{qt}$	$AvgRf = 100\% \bullet \frac{Avgfs}{Avgqt}$ *n=1 when interpretations are done at each point*	
Avgu	Averaged dynamic pore pressure *(u)*	$Avgu = \frac{1}{n}\sum_{i=1}^{n} u_i$ *n=1 when interpretations are done at each point*	
AvgRes	Averaged Resistivity (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} RESISTIVITY_i$ *n=1 when interpretations are done at each point*	
AvgUVIF	Averaged UVIF ultra-violet induced fluorescence (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} UVIF_i$ *n=1 when interpretations are done at each point*	
AvgTemp	Averaged Temperature (this data is not always available since it is a specialized test)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} TEMPERATURE_i$ *n=1 when interpretations are done at each point*	
AvgGamma	Averaged Gamma Counts (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} GAMMA_i$ *n=1 when interpretations are done at each point*	
SBT	Soil Behavior Type as defined by Robertson and Campanella	See Figure 1	2, 5
U.Wt.	Unit Weight of soil determined from one of the following user selectable options: 1) uniform value 2) value assigned to each SBT zone 3) user supplied unit weight profile	See references	5
T. Stress σ_v	Total vertical overburden stress at Mid Layer Depth. *A layer is defined as the averaging interval specified by the user. For data interpreted at each point the Mid Layer Depth is the same as the recorded depth.*	$TStress = \sum_{i=1}^{n} \gamma_i h_i$ *where* γ_i is layer unit weight h_i is layer thickness	

CPT Interpretations

Interpreted Parameter	Description	Equation	Ref
E. Stress σ_v'	Effective vertical overburden stress at Mid Layer Depth	$Estress = Tstress - u_{eq}$	
Ueq	Equilibrium pore pressure determined from one of the following user selectable options: 1) hydrostatic from water table depth 2) user supplied profile	For hydrostatic option: $u_{eq} = \gamma_w \bullet (D - D_{wt})$ where u_{eq} is equilibrium pore pressure γ_w is unit weight of water D is the current depth D_{wt} is the depth to the water table	
Cn	SPT N_{60} overburden correction factor	$Cn = (\sigma_v')^{-0.5}$ where σ_v' is in tsf $0.5 < C_n < 2.0$	
N_{60}	SPT N value at 60% energy calculated from qt/N ratios assigned to each SBT zone. This method has abrupt N value changes at zone boundaries.	*See Figure 1*	4, 5
N_{60} (Ic)	SPTN Value at 60% energy. This method is a slight modification of the Jefferies and Davies technique whereby the qt/N ratio varies across soil classification zones based on the Ic parameter. This techniques is limited to zones 2 through 7 on the normalized Soil Behavior Type Chart	*See Figure 1*	5, 8
$(N_1)_{60}$	SPT N_{60} value corrected for overburden pressure	$(N_1)_{60} = Cn \bullet N_{60}$	4
$\Delta(N_1)_{60}$	Equivalent Clean Sand Correction to $(N_1)_{60}$	$\Delta(N_1)_{60} = \frac{K_{SPT}}{1 - K_{SPT}} \bullet (N_1)_{60}$ Where: K_{SPT} is defined as: 0.0 for $FC < 5\%$ $0.0167 \bullet (FC - 5)$ for $5\% < FC < 35\%$ 0.5 for $FC > 35\%$ FC - Fines Content in %	4
$(N_1)_{60cs}$	Equivalent Clean Sand $(N_1)_{60}$	$(N1)_{60cs} = (N1)_{60} + \Delta(N1)_{60}$	4
Su	Undrained shear strength - N_{kt} is user selectable	$Su = \frac{qt - \sigma_v}{N_{kt}}$	1, 5
k	Coefficient of permeability (assigned to each SBT zone)		5
Bq	Pore pressure parameter	$Bq = \frac{\Delta u}{qt - \sigma_v}$ *where:* $\Delta u = u - u_{eq}$ *and* u = *dynamic pore pressure* u_{eq} = *equilibrium pore pressure*	1, 5
Q_t	Normalized q_t for Soil Behavior Type classification as defined by Robertson, 1990	$Qt = \frac{qt - \sigma_v}{\sigma_v'}$	2, 5
F_r	Normalized Friction Ratio for Soil Behavior Type classification as defined by Robertson, 1990	$Fr = 100\% \bullet \frac{fs}{qt - \sigma_v}$	2, 5
SBTn	Normalized Soil Behavior Type as defined by Robertson and Campanella	See Figure 2	2, 5

CPT Interpretations

Interpreted Parameter	Description	Equation	Ref
q_{c1}	q_t normalized for overburden stress used for seismic analysis	$q_{c1} = q_t \bullet (Pa/\sigma_v')^{0.5}$ where: Pa = atm. Pressure q_t is in MPa	3
q_{c1N}	q_{c1} in dimensionless form used for seismic analysis	$q_{c1N} = q_{c1} / Pa$ where: Pa = atm. pressure	3
K_c	Equivalent clean sand correction for q_{c1N}	$K_c = 1.0$ for $I_c \leq 1.64$ $K_c = f(I_c)$ for $I_c > 1.64$ (see reference) $K_c = 1.0$ for $1.64 < I_c < 2.36$ and $Fc < 0.5\%$	3
q_{c1Ncs}	Clean Sand equivalent q_{c1N}	$q_{c1Ncs} = q_{c1N} \bullet K_c$	3
I_c	Soil index for estimating grain characteristics	$Ic = [(3.47 - \log_{10}Q)^2 + (\log_{10} Fr + 1.22)^2]^{0.5}$ *Where:* $Q = \left(\frac{qt - \sigma_v}{P_{a2}}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *And* *Fr is in percent* P_a *= atmospheric pressure* P_{a2} *= atmospheric pressure* *n varies from 0.5 to 1.0 and is selected in an iterative manner based on the resulting* I_c	3, 8
FC	Apparent fines content (%)	$FC=1.75(Ic^{3.25}) - 3.7$ $FC=100$ for $Ic > 3.5$ $FC=0$ for $Ic < 1.26$ $FC = 5\%$ if $1.64 < Ic < 2.6$ AND $F_r<0.5$	3
Ic Zone	This parameter is the Soil Behavior Type zone based on the Ic parameter (valid for zones 2 through 7 on SBTn chart)	$Ic < 1.31$ Zone = 7 $1.31 < Ic < 2.05$ Zone = 6 $2.05 < Ic < 2.60$ Zone = 5 $2.60 < Ic < 2.95$ Zone = 4 $2.95 < Ic < 3.60$ Zone = 3 $Ic > 3.60$ Zone = 2	3
PHI ϕ	Friction Angle determined from one of the following user selectable options: a) Campanella and Robertson b) Durgunoglu and Mitchel c) Janbu	See reference	5
Dr	Relative Density determined from one of the following user selectable options: a) Ticino Sand b) Hokksund Sand c) Schmertmann 1976 d) Jamiolkowski - All Sands	See reference	5
OCR	Over Consolidation Ratio – 2 methods available	a) Based on Schmertmann's method involving a plot of $S_u/\sigma_v' / (S_u/\sigma_v')_{NC}$ and OCR b) Based on $OCR = K \bullet \left(\frac{qt - \sigma_v}{\sigma_v'}\right)$ where an average value of k=0.3 is used	5
State Parameter	The state parameter is used to describe whether a soil is contractive (SP is positive) or dilative (SP is negative) at large strains based on the work by Been and Jefferies	See reference	9, 7, 5

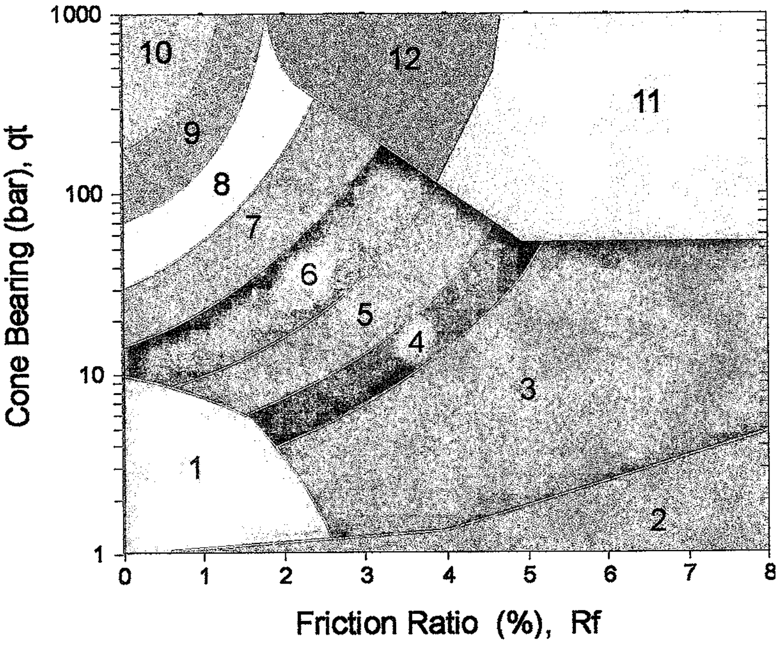
CPT Interpretations

Interpreted Parameter	Description	Equation	Ref
CRR	Cyclic Resistance Ratio (for M=7.5)	For $(q_{c1N})_{cs} < 160$: $CRR = 93 \bullet \left(\frac{(q_{c1N})cs}{1000}\right)^3 + 0.08$ For $(q_{c1N})_{cs} < 50$: $CRR = 0.833 \bullet \left(\frac{(q_{c1N})cs}{1000}\right)^3 + 0.05$	5
Youngs Modulus E	Youngs Modulus based on the work by Baldi. There are three types of sands considered in this technique. The user selects the approriate type for the site from: a) OC Sands b) Aged NC Sands c) Recent NC Sands Each sand type has a family of curves that depend on mean normal stress. The program calculates mean normal stress and linearly interpolates between the two extremes provided in Baldi's chart.	Mean normal stress is evaluated from: $\sigma'_m = \frac{1}{3} \bullet (\sigma'_v + \sigma'_h + \sigma'_h)^3$ where σ_v'= vertical effective stress σ_h'= horizontal effective stress and $\sigma_h = K_o * \sigma_v'$ with Ko assumed to be 0.5	5
K_o	Coefficient of lateral earth pressure at rest.	$K_o = 0.1 \bullet \left(\frac{q_t - \sigma_{v0}}{\sigma'_v}\right)$	5

Savannah River Site Specific Parameters

Interpreted Parameter	Description	Equation	Ref
Ic	Ic based on normalized data at the Savannah River Site; developed by Frank Syms and SGS	$Ic = [(1.95 - \log_{10}Q)^2 + (\log_{10} Fr + 1.78)^2]^{0.5}$ *Where: Q is the normalized tip resistance* *And Fr is the normalized friction ratio*	10
FC	Fines content based on the normalized Savannah River Site Ic parameter; developed by Frank Syms and SGS	$FC =(5.31 * (I_c)^{2.31}) + 9.61$ For FC > 100 and $q_t < 15$ tsf the material is flagged as a soft zone	10
FC	Fines Content directly from non-normalized data at the Savannah River Site; developed by Frank Syms and SGS	$FC = [(3.58 - \log_{10}(qtsf))^2 + (1.43 + \log_{10} (Rf))^2)^{1.8.}$ For FC > 100 and $q_t < 15$ tsf the material is flagged as a soft zone *Where:* *qtsf is the non-normalized tip resistance in tsf* *Rf is the non-normalized friction ratio*	11

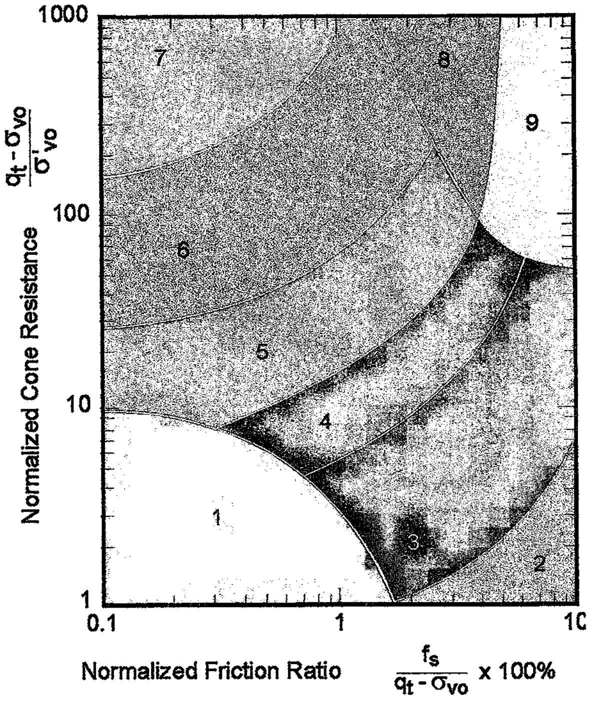
Figure 1
Non-Normalized Behavior Type Classification Chart



Zone		qt / N	Soil Behavior Type
1	■	2	sensitive fine grained
2	■	1	organic material
3	■	1	clay
4	■	1.5	silty clay to clay
5	■	2	clayey silt to silty clay
6	■	2.5	sandy silt to clayey silt
7	■	3	silty sand to sandy silt
8	□	4	sand to silty sand
9	■	5	sand
10	□	6	gravelly sand to sand
11	□	1	very stiff fine grained *
12	■	2	sand to clayey sand *

* overconsolidated or cemented

Figure 2
Normalized Behavior Type Classification Chart



Zone		Normalized Soil Behavior Type
1	■	sensitive fine grained
2	■	organic material
3	■	clay to silty clay
4	■	clayey silt to silty clay
5	■	silty sand to sandy silt
6	■	clean sands to silty sands
7	□	gravelly sand to sand
8	■	very stiff sand to clayey sand
9	□	very stiff fine grained

Table 2
References

No.	References
1	Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, "Use of Piezometer Cone Data", Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.
2	Robertson, P.K., 1990, "Soil Classification Using the Cone Penetration Test", Canadian Geotechnical Journal, Volume 27.
3	Robertson, P.K. and Fear, C.E., 1998, "Evaluating cyclic liquefaction potential using the cone penetration test", Canadian Geotechnical Journal, 35: 442-459.
4	Robertson, P.K. and Wride, C.E., 1998, "Cyclic Liquefaction and its Evaluation Based on SPT and CPT", NCEER Workshop Paper, January 22, 1997
5	Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, " Cone Penetration Testing in Geotechnical Practice," Blackie Academic and Professional.
6	GREGG IN SITU Internal Report
7	Plewes, H.D., Davies, M.P. and Jefferies, M.G., 1992, "CPT Based Screening Procedure for Evaluating Liquefaction Susceptibility", 45th Canadian Geotechnical Conference, Toronto, Ontario, October 1992.
8	Jefferies, M.G. and Davies, M.P., 1993. "Use of CPTu to Estimate equivalent N_{60}", Geotechnical Testing Journal, 16(4): 458-467.
9	Been, K. and Jefferies, M.P., 1985, "A state parameter for sands", Geotechnique, 35(2), 99-112.
10	Frank Syms, Bechtel Corp (Savannah River Site), 2001, "CPTU Fines Content Determination", Calculation No. K-CIC-G-00065 Revision 0.
11	Frank Syms, Bechtel Corp (Savannah River Site) – personal communication

```
Gregg In Situ, Inc. - CPT Interpretation
Interpretation Output - Release   1.20I
Run No:                           04-0426-1745-1877
Job No:                           02-100
Client:                           MACTEC
Project:                          TVA - Stevenson, Alabama
Site:                             CPT-01
Location:                         TVA
Cone:                             H. Benkhayal
CPT Date:                         04/21/04
CPT Time:                         09:24
CPT File:                         064CP01.COR
Northing  (m):                      0.000000
Easting   (m):                      0.000000
Elevation (m):                        0.000000
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Water Table (m):                   3.05              (ft):      10.0
Unit Weight of Water (default):    62.40    pcf
Averaging Increment (m):          0.0        (Every Data Point)
Phi Method :                      Robertson and Campanella, 1983
Su Nkt used:                       15.00            Su/P' (nc):  0.30
Dr  Method :                      Jamiolkowski - All Sands
State Parameter M:                 1.20
Used Unit Weights Assigned to Soil Zones
```

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
6	0.066	10.86	10.90	0.01	3.58	0.09	114.6	0.004	0.000	0.004	4.2	8.3	5.0E-05	83.1	50.0	0.726	10.0	-9999.0	-9999.0
13	0.525	63.11	63.14	0.28	2.63	0.44	120.9	0.031	0.000	0.031	15.1	30.2	5.0E-03	95.0	50.0	-9999.0	-9999.0	128.1	2.029
21	1.050	68.55	68.55	0.52	0.47	0.76	120.9	0.063	0.000	0.063	16.4	32.8	5.0E-03	95.0	50.0	-9999.0	-9999.0	135.8	1.981
28	1.509	105.28	105.29	0.67	1.25	0.64	124.1	0.091	0.000	0.091	20.2	40.3	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
36	2.034	133.83	133.89	1.40	5.39	1.05	120.9	0.123	0.000	0.123	32.1	64.1	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
43	2.493	210.49	210.51	1.90	1.72	0.90	124.1	0.152	0.000	0.152	40.3	80.6	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
51	3.018	254.51	254.50	2.94	-1.04	1.15	124.1	0.184	0.000	0.184	48.7	97.5	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
59	3.543	152.17	152.18	3.71	0.94	2.44	117.7	0.216	0.000	0.216	48.6	97.2	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
66	4.003	146.42	146.44	3.61	2.55	2.46	117.7	0.243	0.000	0.243	46.7	93.5	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
74	4.528	123.80	123.81	2.30	0.55	1.85	117.7	0.274	0.000	0.274	39.5	75.5	5.0E-04	91.3	48.0	-9999.0	-9999.0	-9999.0	-9999.0
82	5.052	82.34	82.35	1.84	0.57	2.24	117.7	0.305	0.000	0.305	26.3	47.6	5.0E-04	78.1	46.0	-9999.0	-9999.0	158.5	1.925
89	5.512	67.97	67.98	1.25	0.26	1.84	117.7	0.332	0.000	0.332	21.7	37.7	5.0E-04	71.4	46.0	-9999.0	-9999.0	139.8	2.056
97	6.037	54.68	54.69	1.07	0.28	1.96	117.7	0.363	0.000	0.363	17.5	29.0	5.0E-04	63.9	44.0	-9999.0	-9999.0	122.6	2.243
104	6.496	41.59	41.59	1.06	-0.02	2.55	114.6	0.389	0.000	0.389	15.9	25.5	5.0E-05	55.0	42.0	2.747	10.0	106.9	2.569
112	7.021	38.26	38.26	0.87	0.02	2.28	114.6	0.419	0.000	0.419	14.7	22.6	5.0E-05	51.6	42.0	2.523	10.0	104.4	2.729
120	7.546	48.36	48.34	0.68	-1.56	1.41	117.7	0.449	0.000	0.449	15.4	23.0	5.0E-04	57.3	42.0	-9999.0	-9999.0	119.6	2.474
127	8.005	54.74	54.73	0.54	-0.77	0.99	117.7	0.477	0.000	0.477	17.5	25.3	5.0E-04	60.0	42.0	-9999.0	-9999.0	129.7	2.370
135	8.530	45.80	45.79	0.35	-0.59	0.77	117.7	0.508	0.000	0.508	14.6	20.5	5.0E-04	54.0	42.0	-9999.0	-9999.0	119.8	2.616
143	9.055	33.41	33.41	0.16	-0.28	0.48	117.7	0.539	0.000	0.539	10.7	14.5	5.0E-04	44.1	40.0	-9999.0	-9999.0	104.2	3.119
150	9.514	25.04	25.05	0.22	1.23	0.88	117.7	0.566	0.000	0.566	8.0	10.6	5.0E-04	35.1	38.0	-9999.0	-9999.0	90.5	3.614
158	10.039	20.57	20.59	0.17	1.48	0.83	114.6	0.596	0.001	0.595	7.9	10.2	5.0E-05	30.0	36.0	1.333	10.0	-9999.0	-9999.0
165	10.499	18.66	18.67	0.09	1.74	0.48	117.7	0.623	0.016	0.607	6.0	7.6	5.0E-04	30.0	36.0	-9999.0	-9999.0	-9999.0	-9999.0
173	11.023	15.65	15.67	0.06	2.35	0.38	114.6	0.653	0.032	0.621	6.0	7.6	5.0E-05	30.0	34.0	1.001	9.6	-9999.0	-9999.0
181	11.548	11.05	11.09	0.04	3.74	0.36	114.6	0.683	0.048	0.635	4.2	5.3	5.0E-05	30.0	32.0	0.694	5.2	-9999.0	-9999.0
188	12.008	9.52	9.55	0.12	2.55	1.26	114.6	0.710	0.063	0.647	4.6	5.7	5.0E-06	-9999.0	-9999.0	0.589	4.0	-9999.0	-9999.0
196	12.533	10.48	10.52	0.07	4.58	0.67	114.6	0.740	0.079	0.661	4.0	5.0	5.0E-05	30.0	32.0	0.652	4.5	-9999.0	-9999.0
204	13.058	11.31	11.35	0.08	3.95	0.71	114.6	0.770	0.095	0.674	4.3	5.3	5.0E-05	30.0	32.0	0.705	4.9	-9999.0	-9999.0
211	13.517	11.50	11.54	0.06	3.64	0.52	114.6	0.796	0.110	0.686	4.4	5.3	5.0E-05	30.0	32.0	0.716	4.9	-9999.0	-9999.0
219	14.042	10.48	10.53	0.02	4.74	0.19	114.6	0.826	0.126	0.700	4.0	4.8	5.0E-05	30.0	32.0	0.647	4.0	-9999.0	-9999.0
226	14.501	9.13	9.19	0.01	5.15	0.11	111.4	0.852	0.141	0.711	4.4	5.2	1.0E-07	-9999.0	-9999.0	0.556	3.2	-9999.0	-9999.0
234	15.026	8.50	8.56	0.07	5.59	0.82	111.4	0.881	0.157	0.724	4.1	4.8	1.0E-07	-9999.0	-9999.0	0.512	2.8	-9999.0	-9999.0
242	15.551	8.05	8.09	0.02	4.11	0.25	111.4	0.910	0.173	0.737	3.9	4.5	1.0E-07	-9999.0	-9999.0	0.479	2.4	-9999.0	-9999.0
249	16.010	8.81	8.89	0.01	6.93	0.11	111.4	0.936	0.188	0.748	4.3	4.9	1.0E-07	-9999.0	-9999.0	0.530	2.8	-9999.0	-9999.0
257	16.535	6.84	6.93	0.03	9.09	0.43	111.4	0.965	0.204	0.761	3.3	3.8	1.0E-07	-9999.0	-9999.0	0.398	1.8	-9999.0	-9999.0
265	17.060	7.79	7.87	0.01	7.70	0.13	111.4	0.994	0.220	0.774	3.8	4.3	1.0E-07	-9999.0	-9999.0	0.459	2.2	-9999.0	-9999.0
272	17.519	7.22	7.35	0.01	12.03	0.14	111.4	1.020	0.235	0.785	3.5	4.0	1.0E-07	-9999.0	-9999.0	0.422	1.9	-9999.0	-9999.0
280	18.044	11.50	11.58	0.01	7.70	0.09	114.6	1.050	0.251	0.798	4.4	5.0	5.0E-05	30.0	32.0	0.702	3.8	-9999.0	-9999.0
287	18.504	10.54	10.63	0.11	8.59	1.04	114.6	1.076	0.266	0.810	4.1	4.5	5.0E-05	30.0	30.0	0.637	3.2	-9999.0	-9999.0
295	19.029	18.39	18.47	0.01	6.54	0.05	117.7	1.106	0.282	0.824	5.9	6.5	5.0E-04	30.0	34.0	-9999.0	-9999.0	-9999.0	-9999.0
303	19.554	23.45	23.54	0.01	8.77	0.04	117.7	1.137	0.298	0.839	7.5	8.2	5.0E-04	30.0	36.0	-9999.0	-9999.0	-9999.0	-9999.0
310	20.013	28.11	28.17	0.01	5.79	0.04	117.7	1.164	0.313	0.851	9.0	9.7	5.0E-04	32.6	36.0	-9999.0	-9999.0	-9999.0	-9999.0
318	20.538	27.98	28.08	0.01	9.73	0.04	117.7	1.195	0.329	0.866	9.0	9.6	5.0E-04	32.3	36.0	-9999.0	-9999.0	-9999.0	-9999.0
326	21.063	9.77	9.94	0.41	15.70	4.13	111.4	1.225	0.345	0.880	9.5	10.2	5.0E-08	-9999.0	-9999.0	0.581	2.5	-9999.0	-9999.0
333	21.522	48.42	48.43	0.33	0.90	0.68	120.9	1.252	0.360	0.892	11.6	12.3	5.0E-03	47.5	40.0	-9999.0	-9999.0	143.4	2.961
341	22.047	104.38	104.42	0.75	3.74	0.72	120.9	1.284	0.376	0.907	25.0	26.2	5.0E-03	69.3	42.0	-9999.0	-9999.0	221.9	2.125
348	22.506	81.64	81.71	0.89	6.52	1.09	120.9	1.311	0.390	0.921	19.6	20.4	5.0E-03	62.0	42.0	-9999.0	-9999.0	190.2	2.327
356	23.031	62.41	62.49	0.89	7.33	1.43	117.7	1.343	0.407	0.936	19.9	20.6	5.0E-04	54.1	40.0	-9999.0	-9999.0	165.1	2.642

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
363	23.491	58.13	58.24	0.79	9.89	1.36	117.7	1.370	0.421	0.948	18.6	19.1	5.0E-04	51.9	40.0	-9999.0	-9999.0	160.1	2.749
371	24.015	57.69	57.79	1.01	9.32	1.75	117.7	1.401	0.438	0.963	18.4	18.8	5.0E-04	51.5	40.0	-9999.0	-9999.0	160.3	2.774
379	24.540	63.88	63.97	1.27	7.68	1.99	117.7	1.431	0.454	0.977	20.4	20.7	5.0E-04	54.2	40.0	-9999.0	-9999.0	169.5	2.649
386	25.000	58.39	58.49	0.53	8.95	0.91	120.9	1.459	0.468	0.990	14.0	14.1	5.0E-03	51.4	40.0	-9999.0	-9999.0	162.8	2.783
394	25.525	56.67	56.79	1.04	11.53	1.84	117.7	1.490	0.485	1.005	18.1	18.1	5.0E-04	50.4	40.0	-9999.0	-9999.0	161.2	2.839
402	26.050	43.70	43.82	1.16	11.47	2.65	114.6	1.520	0.501	1.019	16.8	16.6	5.0E-05	42.7	38.0	2.820	10.0	142.5	3.251
409	26.509	34.94	35.06	0.90	11.02	2.57	114.6	1.546	0.515	1.031	13.4	13.2	5.0E-05	36.2	36.0	2.234	10.0	127.0	3.623
417	27.034	28.62	28.74	0.81	11.53	2.82	114.6	1.577	0.532	1.045	13.8	13.5	5.0E-06	-9999.0	-9999.0	1.811	10.0	-9999.0	-9999.0
425	27.559	28.62	28.75	0.76	12.35	2.65	114.6	1.607	0.548	1.058	11.0	10.7	5.0E-05	30.1	34.0	1.810	10.0	-9999.0	-9999.0
432	28.018	28.24	28.39	0.57	13.59	2.01	114.6	1.633	0.563	1.070	10.9	10.5	5.0E-05	30.0	34.0	1.783	10.0	-9999.0	-9999.0
440	28.543	32.52	32.60	0.60	7.96	1.84	114.6	1.663	0.579	1.084	12.5	12.0	5.0E-05	33.4	36.0	2.063	10.0	123.7	3.793
447	29.002	30.47	30.61	0.63	12.14	2.06	114.6	1.689	0.593	1.096	11.7	11.2	5.0E-05	31.4	36.0	1.928	10.0	-9999.0	-9999.0
455	29.527	24.28	24.42	0.49	12.76	2.01	114.6	1.719	0.610	1.110	9.4	8.9	5.0E-05	30.0	34.0	1.513	7.3	-9999.0	-9999.0
463	30.052	22.35	22.50	0.48	13.53	2.14	114.6	1.749	0.626	1.123	8.6	8.1	5.0E-05	30.0	32.0	1.383	6.3	-9999.0	-9999.0
470	30.511	24.28	24.42	0.48	13.31	1.97	114.6	1.776	0.640	1.135	9.4	8.8	5.0E-05	30.0	34.0	1.510	7.1	-9999.0	-9999.0
478	31.036	23.07	23.23	0.58	14.72	2.50	114.6	1.806	0.657	1.149	11.1	10.4	5.0E-06	-9999.0	-9999.0	1.428	6.3	-9999.0	-9999.0
485	31.496	19.68	19.84	0.54	15.11	2.73	114.6	1.832	0.671	1.161	9.5	8.8	5.0E-06	-9999.0	-9999.0	1.201	4.8	-9999.0	-9999.0
493	32.021	19.36	19.50	0.55	13.14	2.83	114.6	1.862	0.688	1.175	9.3	8.6	5.0E-06	-9999.0	-9999.0	1.176	4.6	-9999.0	-9999.0
501	32.546	24.02	24.20	0.43	16.45	1.78	114.6	1.892	0.704	1.188	9.3	8.5	5.0E-05	30.0	32.0	1.487	6.4	-9999.0	-9999.0
508	33.005	23.13	23.42	0.30	27.49	1.28	114.6	1.919	0.718	1.200	9.0	8.2	5.0E-05	30.0	32.0	1.434	6.0	-9999.0	-9999.0
516	33.530	39.48	39.66	0.22	17.44	0.56	117.7	1.949	0.735	1.215	12.7	11.5	5.0E-04	37.4	36.0	-9999.0	-9999.0	143.0	3.604
524	34.055	44.65	44.86	0.34	19.71	0.76	117.7	1.980	0.751	1.229	14.3	12.9	5.0E-04	40.7	38.0	-9999.0	-9999.0	153.3	3.417
531	34.514	46.82	46.99	0.30	15.07	0.64	120.9	2.007	0.765	1.242	11.2	10.1	5.0E-03	41.9	38.0	-9999.0	-9999.0	157.6	3.353
539	35.039	43.44	43.57	0.52	12.35	1.20	117.7	2.038	0.782	1.257	13.9	12.4	5.0E-04	39.6	36.0	-9999.0	-9999.0	152.0	3.490
546	35.498	34.94	35.08	0.35	12.29	1.00	117.7	2.065	0.796	1.269	11.2	9.9	5.0E-04	33.2	36.0	-9999.0	-9999.0	135.1	3.853
554	36.023	19.87	20.01	0.06	13.53	0.30	117.7	2.096	0.813	1.284	6.4	5.6	5.0E-04	30.0	32.0	-9999.0	-9999.0	-9999.0	-9999.0
562	36.548	15.91	16.20	0.16	26.98	0.99	114.6	2.127	0.829	1.298	6.2	5.4	5.0E-05	30.0	30.0	0.938	2.8	-9999.0	-9999.0
569	37.007	14.44	14.70	0.13	24.89	0.89	114.6	2.153	0.843	1.310	5.6	4.9	5.0E-05	30.0	30.0	0.837	2.4	-9999.0	-9999.0
577	37.532	16.74	16.98	0.08	22.38	0.47	114.6	2.183	0.860	1.323	6.5	5.7	5.0E-05	30.0	30.0	0.987	3.0	-9999.0	-9999.0
585	38.057	13.48	13.80	0.17	29.59	1.23	114.6	2.213	0.876	1.337	5.3	4.6	5.0E-05	30.0	30.0	0.773	2.1	-9999.0	-9999.0
592	38.517	31.37	31.54	0.24	16.23	0.76	117.7	2.239	0.890	1.349	10.1	8.7	5.0E-04	30.0	34.0	-9999.0	-9999.0	-9999.0	-9999.0
600	39.042	37.56	37.74	0.26	16.73	0.69	117.7	2.270	0.907	1.364	12.0	10.3	5.0E-04	34.3	36.0	-9999.0	-9999.0	144.1	3.818
607	39.501	45.36	45.51	0.32	14.06	0.70	117.7	2.298	0.921	1.377	14.5	12.4	5.0E-04	39.5	36.0	-9999.0	-9999.0	160.4	3.523
615	40.026	45.67	45.82	0.33	13.55	0.72	117.7	2.329	0.937	1.391	14.6	12.4	5.0E-04	39.6	36.0	-9999.0	-9999.0	161.5	3.525
623	40.551	50.59	50.75	0.51	14.49	1.01	117.7	2.360	0.954	1.406	16.2	13.7	5.0E-04	42.3	38.0	-9999.0	-9999.0	171.0	3.369
630	41.010	35.46	35.61	0.48	13.82	1.35	117.7	2.387	0.968	1.418	11.4	9.5	5.0E-04	32.0	34.0	-9999.0	-9999.0	-9999.0	-9999.0
638	41.535	10.86	11.13	0.26	25.34	2.34	114.6	2.417	0.985	1.432	5.3	4.5	5.0E-06	-9999.0	-9999.0	0.581	1.4	-9999.0	-9999.0
646	42.060	9.07	9.58	0.08	47.32	0.84	114.6	2.447	1.001	1.446	4.6	3.8	5.0E-06	-9999.0	-9999.0	0.476	1.1	-9999.0	-9999.0
653	42.519	35.90	36.07	0.44	16.47	1.22	117.7	2.474	1.015	1.458	11.5	9.5	5.0E-04	32.0	34.0	-9999.0	-9999.0	-9999.0	-9999.0
661	43.044	31.50	31.71	0.61	19.91	1.93	114.6	2.505	1.032	1.473	12.1	10.0	5.0E-05	30.0	34.0	1.947	7.0	-9999.0	-9999.0
668	43.503	21.84	22.13	0.63	26.23	2.85	114.6	2.531	1.046	1.485	10.6	8.7	5.0E-06	-9999.0	-9999.0	1.306	3.8	-9999.0	-9999.0
676	44.028	8.37	8.94	0.27	52.76	3.03	114.6	2.561	1.062	1.498	5.7	4.7	5.0E-07	-9999.0	-9999.0	0.425	1.0	-9999.0	-9999.0
684	44.553	15.84	15.98	0.67	13.43	4.20	111.4	2.591	1.079	1.512	15.3	12.4	5.0E-08	-9999.0	-9999.0	0.893	2.2	-9999.0	-9999.0
691	45.013	15.21	15.44	0.63	21.22	4.09	111.4	2.617	1.093	1.524	14.8	12.0	5.0E-08	-9999.0	-9999.0	0.855	2.0	-9999.0	-9999.0
699	45.538	13.79	14.03	0.63	21.67	4.50	111.4	2.646	1.110	1.537	13.4	10.8	5.0E-08	-9999.0	-9999.0	0.759	1.7	-9999.0	-9999.0
706	45.997	13.92	14.03	0.62	9.48	4.43	111.4	2.672	1.124	1.548	13.4	10.8	5.0E-08	-9999.0	-9999.0	0.757	1.7	-9999.0	-9999.0
714	46.522	11.82	11.93	0.58	10.33	4.87	111.4	2.701	1.140	1.561	11.4	9.1	5.0E-08	-9999.0	-9999.0	0.615	1.3	-9999.0	-9999.0

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
722	47.047	10.80	10.99	0.46	18.17	4.19	111.4	2.731	1.157	1.574	10.5	8.4	5.0E-08	-9999.0	-9999.0	0.551	1.2	-9999.0	-9999.0
729	47.506	11.56	11.81	0.35	22.95	2.97	114.6	2.757	1.171	1.586	7.5	6.0	5.0E-07	-9999.0	-9999.0	0.603	1.3	-9999.0	-9999.0
737	48.031	15.40	16.04	0.41	59.52	2.56	114.6	2.787	1.187	1.599	7.7	6.1	5.0E-06	-9999.0	-9999.0	0.884	2.0	-9999.0	-9999.0
744	48.490	12.58	12.94	0.32	32.99	2.48	114.6	2.813	1.202	1.611	6.2	4.9	5.0E-06	-9999.0	-9999.0	0.675	1.4	-9999.0	-9999.0
752	49.015	12.01	12.38	0.26	34.21	2.11	114.6	2.843	1.218	1.625	5.9	4.7	5.0E-06	-9999.0	-9999.0	0.636	1.3	-9999.0	-9999.0
760	49.540	12.58	13.01	0.28	40.18	2.16	114.6	2.873	1.235	1.639	6.2	4.9	5.0E-06	-9999.0	-9999.0	0.676	1.4	-9999.0	-9999.0
768	50.065	11.31	11.68	0.36	34.79	3.09	114.6	2.903	1.251	1.652	7.5	5.8	5.0E-07	-9999.0	-9999.0	0.585	1.2	-9999.0	-9999.0
775	50.524	13.29	13.63	0.52	31.52	3.82	114.6	2.930	1.265	1.664	8.7	6.7	5.0E-07	-9999.0	-9999.0	0.714	1.4	-9999.0	-9999.0
783	51.049	14.76	14.89	0.60	12.53	4.04	114.6	2.959	1.282	1.677	9.5	7.3	5.0E-07	-9999.0	-9999.0	0.795	1.6	-9999.0	-9999.0
790	51.509	14.63	14.86	0.59	21.38	3.98	114.6	2.985	1.296	1.689	9.5	7.3	5.0E-07	-9999.0	-9999.0	0.791	1.6	-9999.0	-9999.0
798	52.033	24.59	24.60	0.98	0.90	3.99	114.6	3.015	1.312	1.703	15.7	12.0	5.0E-07	-9999.0	-9999.0	1.439	3.5	-9999.0	-9999.0
805	52.493	23.89	24.05	0.99	14.78	4.13	114.6	3.041	1.327	1.714	15.4	11.7	5.0E-07	-9999.0	-9999.0	1.400	3.4	-9999.0	-9999.0
813	53.018	24.40	24.57	1.08	15.72	4.41	114.6	3.071	1.343	1.728	15.7	11.9	5.0E-07	-9999.0	-9999.0	1.433	3.5	-9999.0	-9999.0
821	53.543	26.12	26.28	1.17	14.54	4.46	114.6	3.101	1.360	1.742	16.8	12.7	5.0E-07	-9999.0	-9999.0	1.545	3.8	-9999.0	-9999.0
828	54.002	24.85	25.11	1.01	23.92	4.03	114.6	3.128	1.374	1.754	16.0	12.1	5.0E-07	-9999.0	-9999.0	1.465	3.5	-9999.0	-9999.0
836	54.527	20.44	20.86	0.71	38.83	3.41	114.6	3.158	1.390	1.768	10.0	7.5	5.0E-06	-9999.0	-9999.0	1.180	2.5	-9999.0	-9999.0
844	55.052	16.99	17.48	0.01	44.90	0.06	117.7	3.188	1.407	1.782	5.6	4.2	5.0E-04	30.0	30.0	-9999.0	-9999.0	-9999.0	-9999.0

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Gregg In Situ, Inc. - CPT Interpretation
Interpretation Output - Release    1.20l
Run No:                            04-0426-1745-1943
Job No:                            02-100
Client:                            MACTEC
Project:                           TVA - Stevenson, Alabama
Site:                              CPT-02
Location:                          TVA
Cone:                              H. Benkhayal
CPT Date:                          04/21/04
CPT Time:                          10:31
CPT File:                          064CP02.COR
Northing  (m):                       0.000000
Easting   (m):                       0.000000
Elevation (m):                         0.000000
--------------------------------------------
Water Table (m):                    3.05           (ft):     10.0
Unit Weight of Water (default):      62.40    pcf
Averaging Increment (m):           0.0        (Every Data Point)
Phi Method :                       Robertson and Campanella, 1983
Su Nkt used:                        15.00          Su/P' (nc):  0.30
Dr  Method :                       Jamiolkowski - All Sands
State Parameter M:                  1.20
Used Unit Weights Assigned to Soil Zones
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	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
6	0.066	5.24	5.24	0.11	0.18	2.10	114.6	0.004	0.000	0.004	3.3	6.7	5.0E-07	-9999.0	-9999.0	0.349	10.0	-9999.0	-9999.0
13	0.525	110.71	110.72	0.72	0.83	0.65	124.1	0.032	0.000	0.032	21.2	42.4	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
21	1.050	112.17	112.18	0.84	0.69	0.75	124.1	0.064	0.000	0.064	21.5	43.0	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
28	1.509	103.17	103.18	0.60	0.90	0.58	124.1	0.093	0.000	0.093	19.8	39.5	5.0E-02	95.0	50.0	-9999.0	-9999.0	207.6	2.012
36	2.034	129.10	129.11	0.77	0.92	0.60	124.1	0.125	0.000	0.125	24.7	49.5	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
43	2.493	135.18	135.18	1.11	0.63	0.82	124.1	0.154	0.000	0.154	25.9	51.8	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
50	2.953	107.51	107.51	0.60	-0.08	0.56	124.1	0.182	0.000	0.182	20.6	41.2	5.0E-02	93.1	50.0	-9999.0	-9999.0	-9999.0	-9999.0
51	3.018	105.79	105.79	0.65	0.14	0.62	124.1	0.186	0.000	0.186	20.3	40.5	5.0E-02	92.3	50.0	-9999.0	-9999.0	-9999.0	-9999.0
59	3.543	116.13	116.13	0.80	-0.20	0.69	124.1	0.219	0.000	0.219	22.2	44.5	5.0E-02	92.7	48.0	-9999.0	-9999.0	-9999.0	-9999.0
66	4.003	86.30	86.29	0.80	-0.90	0.93	120.9	0.247	0.000	0.247	20.7	41.3	5.0E-03	82.5	48.0	-9999.0	-9999.0	162.2	1.880
74	4.528	36.41	36.41	0.32	0.22	0.88	117.7	0.278	0.000	0.278	11.6	22.0	5.0E-04	56.0	44.0	-9999.0	-9999.0	92.0	2.526
82	5.052	12.39	12.40	0.39	0.87	3.15	114.6	0.309	0.000	0.309	7.9	14.3	5.0E-07	-9999.0	-9999.0	0.806	10.0	-9999.0	-9999.0
89	5.512	49.95	49.95	0.30	-0.18	0.60	120.9	0.335	0.000	0.335	12.0	20.7	5.0E-03	62.4	44.0	-9999.0	-9999.0	114.3	2.288
97	6.037	50.02	50.02	0.28	-0.49	0.56	120.9	0.367	0.000	0.367	12.0	19.8	5.0E-03	61.2	44.0	-9999.0	-9999.0	116.5	2.329
104	6.496	29.58	29.57	0.20	-0.79	0.68	117.7	0.394	0.000	0.394	9.4	15.0	5.0E-04	45.1	40.0	-9999.0	-9999.0	90.7	3.066
112	7.021	20.63	20.63	0.13	-0.39	0.63	117.7	0.425	0.000	0.425	6.6	10.1	5.0E-04	33.7	38.0	-9999.0	-9999.0	76.2	3.695
120	7.546	23.45	23.45	0.69	0.69	2.95	114.6	0.456	0.000	0.456	11.2	16.6	5.0E-06	-9999.0	-9999.0	1.533	10.0	-9999.0	-9999.0
127	8.005	125.01	125.01	1.49	-0.55	1.19	120.9	0.483	0.000	0.483	29.9	43.1	5.0E-03	83.5	46.0	-9999.0	-9999.0	235.5	1.884
135	8.530	14.44	14.43	0.15	-0.43	1.04	114.6	0.513	0.000	0.513	5.5	7.7	5.0E-05	30.0	36.0	0.928	10.0	-9999.0	-9999.0
143	9.055	11.82	11.83	0.16	0.73	1.36	114.6	0.543	0.000	0.543	5.7	7.7	5.0E-06	-9999.0	-9999.0	0.752	7.5	-9999.0	-9999.0
150	9.514	14.82	14.83	0.14	1.60	0.95	114.6	0.570	0.000	0.570	5.7	7.5	5.0E-05	30.0	34.0	0.951	10.0	-9999.0	-9999.0
158	10.039	14.18	14.20	0.31	1.76	2.19	114.6	0.600	0.001	0.599	6.8	8.8	5.0E-06	-9999.0	-9999.0	0.907	8.7	-9999.0	-9999.0
165	10.499	2.18	2.30	0.14	11.47	6.10	79.6	0.625	0.016	0.610	2.2	2.8	1.0E-15	-9999.0	-9999.0	0.112	0.7	-9999.0	-9999.0
173	11.023	1.40	1.51	0.12	9.85	7.97	79.6	0.650	0.032	0.618	1.4	1.8	1.0E-15	-9999.0	-9999.0	0.057	0.5	-9999.0	-9999.0
181	11.548	1.47	1.54	0.19	6.13	12.37	82.7	0.672	0.048	0.624	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
188	12.008	1.00	1.02	0.11	1.60	10.81	82.7	0.691	0.063	0.628	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
196	12.533	1.00	1.07	0.17	5.85	15.99	82.7	0.712	0.079	0.633	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
204	13.058	2.04	2.12	0.24	6.50	11.37	82.7	0.735	0.095	0.639	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
211	13.517	1.59	1.69	0.28	8.59	16.64	82.7	0.754	0.110	0.644	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
219	14.042	1.47	1.50	0.47	2.31	31.44	82.7	0.775	0.126	0.649	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
226	14.501	1.98	2.02	0.54	2.98	26.84	82.7	0.794	0.141	0.654	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
234	15.026	6.58	6.65	0.45	6.58	6.79	111.4	0.817	0.157	0.660	6.4	7.8	5.0E-08	-9999.0	-9999.0	0.389	2.1	-9999.0	-9999.0
242	15.551	7.99	8.03	0.52	4.09	6.49	111.4	0.846	0.173	0.673	7.7	9.4	5.0E-08	-9999.0	-9999.0	0.479	2.8	-9999.0	-9999.0
249	16.010	8.62	8.69	0.55	6.50	6.34	111.4	0.871	0.188	0.684	8.3	10.1	5.0E-08	-9999.0	-9999.0	0.521	3.1	-9999.0	-9999.0
257	16.535	11.05	11.08	0.62	3.46	5.61	111.4	0.901	0.204	0.697	10.6	12.7	5.0E-08	-9999.0	-9999.0	0.679	4.4	-9999.0	-9999.0
265	17.060	8.43	8.47	0.61	3.72	7.22	111.4	0.926	0.220	0.706	8.1	9.7	5.0E-08	-9999.0	-9999.0	0.503	2.8	-9999.0	-9999.0
272	17.519	4.09	4.17	0.39	7.58	9.37	82.7	0.949	0.235	0.714	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
280	18.044	3.71	3.74	0.35	3.29	9.37	82.7	0.970	0.251	0.719	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
287	18.504	4.85	4.89	0.33	3.58	6.76	111.4	0.990	0.266	0.724	4.7	5.5	5.0E-08	-9999.0	-9999.0	0.260	1.2	-9999.0	-9999.0
295	19.029	6.97	6.96	0.61	-0.22	8.78	82.7	1.014	0.282	0.732	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
303	19.554	4.98	4.99	0.34	0.67	6.83	111.4	1.036	0.298	0.738	4.8	5.6	5.0E-08	-9999.0	-9999.0	0.264	1.2	-9999.0	-9999.0
310	20.013	3.96	3.99	0.40	2.78	10.05	82.7	1.057	0.313	0.745	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
318	20.538	2.88	2.92	0.23	4.27	7.89	79.6	1.079	0.329	0.750	2.8	3.2	1.0E-15	-9999.0	-9999.0	0.123	0.7	-9999.0	-9999.0
326	21.063	6.06	6.10	0.42	3.48	6.90	111.4	1.103	0.345	0.757	5.8	6.7	5.0E-08	-9999.0	-9999.0	0.333	1.5	-9999.0	-9999.0
333	21.522	3.71	3.80	0.41	8.10	10.83	82.7	1.123	0.360	0.763	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
341	22.047	5.68	5.75	0.57	5.89	9.94	82.7	1.150	0.376	0.774	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
348	22.506	11.82	11.90	0.72	7.76	6.06	111.4	1.173	0.390	0.782	11.4	12.9	5.0E-08	-9999.0	-9999.0	0.715	4.0	-9999.0	-9999.0

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
356	23.031	6.58	6.61	0.63	3.44	9.55	82.7	1.200	0.407	0.793	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
363	23.491	6.71	6.78	0.59	7.01	8.72	82.7	1.219	0.421	0.798	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
371	24.015	7.67	7.72	0.57	4.33	7.41	111.4	1.241	0.438	0.803	7.4	8.2	5.0E-08	-9999.0	-9999.0	0.432	1.9	-9999.0	-9999.0
379	24.540	10.99	11.05	0.93	5.91	8.44	82.7	1.263	0.454	0.809	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
386	25.000	16.99	17.10	0.81	10.16	4.75	111.4	1.288	0.468	0.820	16.4	18.1	5.0E-08	-9999.0	-9999.0	1.054	6.7	-9999.0	-9999.0
394	25.525	18.98	19.04	1.44	5.77	7.58	111.4	1.318	0.485	0.833	18.2	20.0	5.0E-08	-9999.0	-9999.0	1.181	7.8	-9999.0	-9999.0
402	26.050	17.63	17.78	0.97	13.31	5.47	111.4	1.346	0.501	0.845	17.0	18.5	5.0E-08	-9999.0	-9999.0	1.095	6.8	-9999.0	-9999.0
409	26.509	20.00	20.12	1.07	11.49	5.33	111.4	1.372	0.515	0.856	19.3	20.8	5.0E-08	-9999.0	-9999.0	1.250	8.2	-9999.0	-9999.0
417	27.034	20.82	20.98	1.05	14.96	5.02	111.4	1.401	0.532	0.869	20.1	21.6	5.0E-08	-9999.0	-9999.0	1.305	8.5	-9999.0	-9999.0
425	27.559	18.01	18.12	1.41	9.87	7.80	111.4	1.430	0.548	0.882	17.4	18.5	5.0E-08	-9999.0	-9999.0	1.113	6.5	-9999.0	-9999.0
432	28.018	15.91	16.02	0.92	10.69	5.76	111.4	1.456	0.563	0.893	15.3	16.2	5.0E-08	-9999.0	-9999.0	0.971	5.2	-9999.0	-9999.0
440	28.543	18.46	18.69	0.73	20.44	3.92	114.6	1.485	0.579	0.906	11.9	12.5	5.0E-07	-9999.0	-9999.0	1.147	6.5	-9999.0	-9999.0
447	29.002	12.65	12.73	0.85	7.23	6.69	111.4	1.511	0.593	0.917	12.2	12.7	5.0E-08	-9999.0	-9999.0	0.748	3.4	-9999.0	-9999.0
455	29.527	14.70	14.86	0.99	15.39	6.68	111.4	1.540	0.610	0.930	14.2	14.8	5.0E-08	-9999.0	-9999.0	0.888	4.2	-9999.0	-9999.0
463	30.052	16.29	16.44	1.09	14.10	6.65	111.4	1.569	0.626	0.943	15.7	16.2	5.0E-08	-9999.0	-9999.0	0.992	4.9	-9999.0	-9999.0
470	30.511	25.42	25.57	1.47	13.98	5.76	111.4	1.595	0.640	0.954	24.5	25.1	5.0E-08	-9999.0	-9999.0	1.599	10.0	-9999.0	-9999.0
478	31.036	27.92	28.07	1.61	14.08	5.75	111.4	1.624	0.657	0.967	26.9	27.3	5.0E-08	-9999.0	-9999.0	1.763	10.0	-9999.0	-9999.0
485	31.496	19.04	19.31	1.29	25.34	6.70	111.4	1.650	0.671	0.979	18.5	18.7	5.0E-08	-9999.0	-9999.0	1.177	6.0	-9999.0	-9999.0
493	32.021	33.98	34.19	1.48	18.88	4.34	114.6	1.679	0.688	0.992	21.8	21.9	5.0E-07	-9999.0	-9999.0	2.167	10.0	-9999.0	-9999.0
501	32.546	35.65	35.74	2.08	9.09	5.81	111.4	1.709	0.704	1.005	34.2	34.2	5.0E-08	-9999.0	-9999.0	2.269	10.0	-9999.0	-9999.0
508	33.005	15.46	15.44	1.24	-1.66	8.05	82.7	1.734	0.718	1.015	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
516	33.530	10.35	10.35	1.04	0.04	10.08	82.7	1.760	0.735	1.025	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
524	34.055	86.56	86.92	4.48	33.77	5.15	130.5	1.789	0.751	1.038	83.2	81.7	1.0E-15	62.1	42.0	-9999.0	-9999.0	204.2	2.349
531	34.514	67.14	67.25	3.50	9.95	5.20	130.5	1.819	0.765	1.054	64.4	62.7	1.0E-15	54.5	40.0	-9999.0	-9999.0	178.2	2.649
539	35.039	35.65	35.76	1.85	10.35	5.19	111.4	1.849	0.782	1.068	34.2	33.1	5.0E-08	-9999.0	-9999.0	2.261	10.0	-9999.0	-9999.0
546	35.498	22.29	22.44	1.12	13.27	5.00	111.4	1.875	0.796	1.079	21.5	20.7	5.0E-08	-9999.0	-9999.0	1.371	6.6	-9999.0	-9999.0
554	36.023	16.23	16.36	0.80	12.33	4.90	111.4	1.904	0.813	1.092	15.7	15.0	5.0E-08	-9999.0	-9999.0	0.964	3.8	-9999.0	-9999.0
562	36.548	21.53	21.73	0.84	18.76	3.87	114.6	1.934	0.829	1.105	13.9	13.2	5.0E-07	-9999.0	-9999.0	1.320	6.0	-9999.0	-9999.0
569	37.007	45.67	45.85	1.64	16.65	3.59	114.6	1.960	0.843	1.117	22.0	20.8	5.0E-06	-9999.0	-9999.0	2.926	10.0	-9999.0	-9999.0
577	37.532	22.42	22.42	1.32	-0.87	5.90	111.4	1.990	0.860	1.130	21.5	20.2	5.0E-08	-9999.0	-9999.0	1.362	6.1	-9999.0	-9999.0
585	38.057	6.84	6.98	0.27	13.73	3.87	111.4	2.019	0.876	1.143	6.7	6.3	5.0E-08	-9999.0	-9999.0	0.331	1.0	-9999.0	-9999.0
592	38.517	5.30	5.65	0.15	31.76	2.66	111.4	2.045	0.890	1.155	5.4	5.0	5.0E-08	-9999.0	-9999.0	0.240	0.7	-9999.0	-9999.0
600	39.042	10.67	11.17	0.29	46.95	2.60	114.6	2.075	0.907	1.168	5.4	5.0	5.0E-06	-9999.0	-9999.0	0.607	1.8	-9999.0	-9999.0
607	39.501	17.95	18.42	0.66	43.54	3.59	114.6	2.101	0.921	1.180	11.8	10.8	5.0E-07	-9999.0	-9999.0	1.088	4.0	-9999.0	-9999.0
615	40.026	26.57	26.67	1.22	8.40	4.59	114.6	2.131	0.937	1.194	17.0	15.6	5.0E-07	-9999.0	-9999.0	1.636	7.4	-9999.0	-9999.0
623	40.551	28.30	28.42	1.23	11.65	4.34	114.6	2.161	0.954	1.207	18.1	16.5	5.0E-07	-9999.0	-9999.0	1.751	8.1	-9999.0	-9999.0
630	41.010	26.19	26.51	1.14	29.00	4.31	114.6	2.187	0.968	1.219	16.9	15.3	5.0E-07	-9999.0	-9999.0	1.621	7.1	-9999.0	-9999.0
638	41.535	38.96	38.95	1.93	-1.54	4.97	111.4	2.217	0.985	1.233	37.3	33.6	5.0E-08	-9999.0	-9999.0	2.449	10.0	-9999.0	-9999.0
646	42.060	23.45	23.43	1.36	-1.19	5.82	111.4	2.247	1.001	1.246	22.4	20.1	5.0E-08	-9999.0	-9999.0	1.412	5.5	-9999.0	-9999.0
653	42.519	24.02	24.03	1.33	1.31	5.55	111.4	2.272	1.015	1.257	23.0	20.5	5.0E-08	-9999.0	-9999.0	1.451	5.7	-9999.0	-9999.0
661	43.044	20.38	20.40	1.13	2.17	5.55	111.4	2.301	1.032	1.270	19.5	17.3	5.0E-08	-9999.0	-9999.0	1.207	4.2	-9999.0	-9999.0
668	43.503	23.89	23.93	1.19	3.85	4.99	111.4	2.327	1.046	1.281	22.9	20.3	5.0E-08	-9999.0	-9999.0	1.440	5.4	-9999.0	-9999.0
676	44.028	24.72	24.76	1.29	3.68	5.22	111.4	2.356	1.062	1.294	23.7	20.8	5.0E-08	-9999.0	-9999.0	1.494	5.7	-9999.0	-9999.0
684	44.553	20.25	20.29	1.12	3.40	5.53	111.4	2.385	1.079	1.307	19.4	17.0	5.0E-08	-9999.0	-9999.0	1.193	4.0	-9999.0	-9999.0
691	45.013	18.52	18.64	0.99	10.79	5.32	111.4	2.411	1.093	1.318	17.9	15.6	5.0E-08	-9999.0	-9999.0	1.082	3.4	-9999.0	-9999.0
699	45.538	16.16	16.27	0.87	10.04	5.36	111.4	2.440	1.110	1.331	15.6	13.5	5.0E-08	-9999.0	-9999.0	0.922	2.7	-9999.0	-9999.0
706	45.997	17.18	17.36	0.83	16.83	4.79	111.4	2.466	1.124	1.342	16.6	14.4	5.0E-08	-9999.0	-9999.0	0.993	2.9	-9999.0	-9999.0

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
714	46.522	18.52	18.71	1.04	17.03	5.57	111.4	2.495	1.140	1.355	17.9	15.4	5.0E-08	-9999.0	-9999.0	1.081	3.3	-9999.0	-9999.0
722	47.047	21.14	21.27	1.24	11.53	5.85	111.4	2.524	1.157	1.368	20.4	17.4	5.0E-08	-9999.0	-9999.0	1.249	4.0	-9999.0	-9999.0
729	47.506	18.46	18.55	1.18	7.56	6.38	111.4	2.550	1.171	1.379	17.8	15.1	5.0E-08	-9999.0	-9999.0	1.066	3.1	-9999.0	-9999.0
737	48.031	21.08	21.14	1.23	5.63	5.83	111.4	2.579	1.187	1.392	20.2	17.2	5.0E-08	-9999.0	-9999.0	1.238	3.8	-9999.0	-9999.0
744	48.490	21.14	21.19	1.31	4.78	6.20	111.4	2.605	1.202	1.403	20.3	17.1	5.0E-08	-9999.0	-9999.0	1.239	3.8	-9999.0	-9999.0
752	49.015	19.55	19.58	1.31	2.78	6.71	111.4	2.634	1.218	1.416	18.7	15.8	5.0E-08	-9999.0	-9999.0	1.130	3.3	-9999.0	-9999.0
760	49.540	15.65	15.70	0.83	5.03	5.30	111.4	2.663	1.235	1.429	15.0	12.6	5.0E-08	-9999.0	-9999.0	0.869	2.2	-9999.0	-9999.0

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Gregg In Situ, Inc. - CPT Interpretation                                                     Page:      1
Interpretation Output - Release   1.20I
Run No:                           04-0426-1745-2003
Job No:                           02-100
Client:                           MACTEC
Project:                          TVA - Stevenson, Alabama
Site:                             CPT-03
Location:                         TVA
Cone:                             H. Benkhayal
CPT Date:                         04/21/04
CPT Time:                         11:52
CPT File:                         064CP03.COR
Northing  (m):                      0.000000
Easting   (m):                      0.000000
Elevation (m):                        0.000000
-----------------------------------------------
Water Table (m):                    3.05              (ft):       10.0
Unit Weight of Water (default):     62.40    pcf
Averaging Increment (m):          0.0        (Every Data Point)
Phi Method :                      Robertson and Campanella, 1983
Su Nkt used:                        15.00          Su/P' (nc):  0.30
Dr  Method :                      Jamiolkowski - All Sands
State Parameter M:                  1.20
Used Unit Weights Assigned to Soil Zones
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	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
6	0.066	6.33	6.33	0.04	0.20	0.63	111.4	0.004	0.000	0.004	3.0	6.1	1.0E-07	-9999.0	-9999.0	0.422	10.0	-9999.0	-9999.0
13	0.525	66.18	66.20	0.50	1.74	0.76	120.9	0.031	0.000	0.031	15.8	31.7	5.0E-03	95.0	50.0	-9999.0	-9999.0	132.5	2.001
21	1.050	116.01	116.03	2.12	2.00	1.82	117.7	0.062	0.000	0.062	37.0	74.1	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
28	1.509	150.76	150.76	1.26	0.43	0.84	124.1	0.090	0.000	0.090	28.9	57.8	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
36	2.034	170.62	170.63	2.42	0.77	1.42	120.9	0.122	0.000	0.122	40.9	81.7	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
43	2.493	176.00	175.98	4.17	-1.78	2.37	117.7	0.150	0.000	0.150	56.2	112.4	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
51	3.018	181.68	181.67	4.38	-1.19	2.41	117.7	0.180	0.000	0.180	58.0	116.0	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
59	3.543	152.49	152.51	4.45	1.52	2.92	117.7	0.211	0.000	0.211	48.7	97.4	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
66	4.003	184.94	184.97	4.51	3.31	2.44	117.7	0.238	0.000	0.238	59.0	118.1	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
74	4.528	140.98	140.98	2.10	-0.35	1.49	120.9	0.270	0.000	0.270	33.8	65.0	5.0E-03	95.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
82	5.052	95.12	95.12	1.50	-0.04	1.58	117.7	0.301	0.000	0.301	30.4	55.3	5.0E-04	82.4	46.0	-9999.0	-9999.0	178.6	1.878
89	5.512	100.29	100.29	1.24	-0.08	1.24	120.9	0.329	0.000	0.329	24.0	41.9	5.0E-03	82.7	46.0	-9999.0	-9999.0	188.4	1.878
97	6.037	163.60	163.61	2.82	1.29	1.72	120.9	0.360	0.000	0.360	39.2	65.3	5.0E-03	95.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
104	6.496	152.93	152.94	4.89	0.77	3.20	114.6	0.387	0.000	0.387	58.6	94.1	5.0E-05	92.4	48.0	10.170	10.0	-9999.0	-9999.0
112	7.021	130.26	130.27	4.60	1.48	3.53	114.6	0.418	0.000	0.418	49.9	77.2	5.0E-05	86.8	46.0	8.657	10.0	261.6	2.008
120	7.546	127.57	127.59	4.49	2.17	3.52	114.6	0.448	0.000	0.448	48.9	73.1	5.0E-05	85.2	46.0	8.476	10.0	245.1	1.921
127	8.005	99.08	99.08	2.38	-0.47	2.40	117.7	0.474	0.000	0.474	31.6	45.9	5.0E-04	77.1	46.0	-9999.0	-9999.0	192.5	1.943
135	8.530	87.77	87.80	2.48	2.07	2.82	114.6	0.505	0.000	0.505	33.6	47.4	5.0E-05	72.7	44.0	5.819	10.0	178.1	2.029
143	9.055	76.08	76.09	1.61	0.41	2.12	117.7	0.535	0.000	0.535	24.3	33.2	5.0E-04	67.8	44.0	-9999.0	-9999.0	162.7	2.138
150	9.514	71.42	71.45	1.53	2.23	2.15	117.7	0.562	0.000	0.562	22.8	30.4	5.0E-04	65.3	44.0	-9999.0	-9999.0	157.4	2.203
158	10.039	365.21	365.28	4.22	6.91	1.16	124.1	0.593	0.001	0.592	70.0	91.0	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
165	10.499	417.40	417.44	2.31	3.70	0.55	127.3	0.622	0.016	0.606	66.6	85.6	5.0E+00	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0

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Gregg In Situ, Inc. - CPT Interpretation
Interpretation Output - Release    1.20I
Run No:                            04-0426-1745-2042
Job No:                            02-100
Client:                            MACTEC
Project:                           TVA - Stevenson, Alabama
Site:                              CPT-03A
Location:                          TVA
Cone:                              H. Benkhayal
CPT Date:                          04/21/04
CPT Time:                          12:15
CPT File:                          064CP03A.COR
Northing  (m):                       0.000000
Easting   (m):                       0.000000
Elevation (m):                         0.000000
------------------------------------------------
Water Table (m):                    3.05          (ft):       10.0
Unit Weight of Water (default):     62.40    pcf
Averaging Increment (m):           0.0       (Every Data Point)
Phi Method :                       Robertson and Campanella, 1983
Su Nkt used:                        15.00         Su/P' (nc):  0.30
Dr  Method :                       Jamiolkowski - All Sands
State Parameter M:                  1.20
Used Unit Weights Assigned to Soil Zones
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	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
6	0.066	4.41	4.42	0.01	0.41	0.23	111.4	0.004	0.000	0.004	2.1	4.2	1.0E-07	-9999.0	-9999.0	0.294	10.0	-9999.0	-9999.0
13	0.525	52.07	52.08	0.20	1.02	0.38	120.9	0.031	0.000	0.031	12.5	24.9	5.0E-03	95.0	50.0	-9999.0	-9999.0	112.1	2.152
21	1.050	138.18	138.19	1.69	0.98	1.23	120.9	0.062	0.000	0.062	33.1	66.2	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
28	1.509	129.23	129.23	2.32	-0.61	1.79	120.9	0.090	0.000	0.090	30.9	61.9	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
36	2.034	123.99	124.00	2.21	0.73	1.78	117.7	0.121	0.000	0.121	39.6	79.2	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
43	2.493	152.49	152.49	2.84	-0.12	1.86	120.9	0.149	0.000	0.149	36.5	73.0	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
51	3.018	231.89	231.88	3.24	-0.75	1.40	120.9	0.180	0.000	0.180	55.5	111.0	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
59	3.543	318.45	318.46	5.18	0.98	1.63	120.9	0.212	0.000	0.212	76.2	152.5	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
66	4.003	360.22	360.24	4.58	1.19	1.27	124.1	0.241	0.000	0.241	69.0	138.0	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
74	4.528	320.62	320.63	4.48	1.04	1.40	124.1	0.273	0.000	0.273	61.4	117.5	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
82	5.052	261.59	261.61	4.64	1.29	1.77	120.9	0.306	0.000	0.306	62.6	113.3	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
89	5.512	216.50	216.53	5.95	3.58	2.75	117.7	0.333	0.000	0.333	69.1	119.8	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
97	6.037	168.01	168.02	4.98	0.69	2.97	117.7	0.364	0.000	0.364	53.6	88.9	5.0E-04	95.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
104	6.496	151.72	151.72	4.64	0.06	3.06	114.6	0.391	0.000	0.391	58.1	93.0	5.0E-05	92.1	48.0	10.089	10.0	-9999.0	-9999.0
112	7.021	124.31	124.31	4.05	-0.16	3.26	114.6	0.421	0.000	0.421	47.6	73.4	5.0E-05	85.3	46.0	8.259	10.0	239.5	1.926
120	7.546	106.68	106.68	3.43	0.12	3.21	114.6	0.451	0.000	0.451	40.9	60.9	5.0E-05	79.9	46.0	7.082	10.0	202.3	1.897
127	8.005	90.14	90.14	2.74	-0.28	3.04	114.6	0.477	0.000	0.477	34.5	50.0	5.0E-05	74.3	44.0	5.977	10.0	180.0	1.997
135	8.530	72.51	72.50	2.19	-0.33	3.01	114.6	0.507	0.000	0.507	27.8	39.0	5.0E-05	67.2	44.0	4.800	10.0	156.1	2.153
143	9.055	53.79	53.80	1.60	0.77	2.98	114.6	0.537	0.000	0.537	20.6	28.1	5.0E-05	57.8	42.0	3.551	10.0	132.0	2.454
150	9.514	102.85	102.89	1.41	3.50	1.37	120.9	0.564	0.000	0.564	24.6	32.8	5.0E-03	75.7	44.0	-9999.0	-9999.0	202.7	1.970
158	10.039	678.55	678.57	0.01	2.17	0.00	127.3	0.597	0.001	0.596	108.3	140.3	5.0E+00	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0

```
Gregg In Situ, Inc. - CPT Interpretation
Interpretation Output - Release     1.20I
Run No:                             04-0426-1745-2086
Job No:                             02-100
Client:                             MACTEC
Project:                            TVA - Stevenson, Alabama
Site:                               CPT-04
Location:                           TVA
Cone:                               H. Benkhayal
CPT Date:                           04/21/04
CPT Time:                           13:01
CPT File:                           064CP04.COR
Northing  (m):                        0.000000
Easting   (m):                        0.000000
Elevation (m):                          0.000000
--------------------------------------------------
Water Table (m):                     3.05             (ft):      10.0
Unit Weight of Water (default):      62.40    pcf
Averaging Increment (m):            0.0       (Every Data Point)
Phi Method :                        Robertson and Campanella, 1983
Su Nkt used:                         15.00            Su/P' (nc):  0.30
Dr  Method :                        Jamiolkowski - All Sands
State Parameter M:                   1.20
Used Unit Weights Assigned to Soil Zones
```

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
6	0.066	6.78	6.78	0.04	0.51	0.59	111.4	0.004	0.000	0.004	3.2	6.5	1.0E-07	-9999.0	-9999.0	0.452	10.0	-9999.0	-9999.0
13	0.525	54.62	54.68	0.72	5.69	1.32	117.7	0.030	0.000	0.030	17.5	34.9	5.0E-04	95.0	50.0	-9999.0	-9999.0	115.9	2.119
21	1.050	49.76	49.77	1.11	0.55	2.24	114.6	0.061	0.000	0.061	19.1	38.1	5.0E-05	86.7	50.0	3.314	10.0	108.8	2.186
28	1.509	86.56	86.56	1.28	-0.20	1.48	117.7	0.088	0.000	0.088	27.6	55.3	5.0E-04	95.0	50.0	-9999.0	-9999.0	162.7	1.879
36	2.034	139.52	139.52	2.71	0.37	1.94	117.7	0.119	0.000	0.119	44.5	89.1	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
43	2.493	151.27	151.30	3.02	3.42	1.99	117.7	0.147	0.000	0.147	48.3	96.6	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
51	3.018	152.55	152.58	1.86	2.90	1.22	120.9	0.178	0.000	0.178	36.5	73.1	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
59	3.543	175.93	175.95	2.34	1.76	1.33	120.9	0.210	0.000	0.210	42.1	84.2	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
66	4.003	163.86	163.89	3.24	2.70	1.98	117.7	0.238	0.000	0.238	52.3	104.6	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
74	4.528	108.28	108.30	2.97	1.45	2.74	117.7	0.269	0.000	0.269	34.6	66.7	5.0E-04	87.8	48.0	-9999.0	-9999.0	-9999.0	-9999.0
82	5.052	78.32	78.32	1.75	0.22	2.24	117.7	0.300	0.000	0.300	25.0	45.7	5.0E-04	76.9	46.0	-9999.0	-9999.0	152.4	1.946
89	5.512	52.39	52.36	1.48	-2.92	2.83	114.6	0.326	0.000	0.326	20.1	35.1	5.0E-05	64.2	44.0	3.469	10.0	117.0	2.235
97	6.037	35.65	35.64	0.92	-0.43	2.59	114.6	0.356	0.000	0.356	13.7	22.9	5.0E-05	51.9	42.0	2.352	10.0	96.8	2.715
104	6.496	28.05	28.04	0.69	-0.41	2.47	114.6	0.383	0.000	0.383	10.7	17.4	5.0E-05	44.0	40.0	1.844	10.0	87.7	3.125
112	7.021	22.81	22.80	0.49	-0.39	2.15	114.6	0.413	0.000	0.413	8.7	13.6	5.0E-05	37.0	40.0	1.493	10.0	80.1	3.514
120	7.546	17.95	17.95	0.44	-0.14	2.46	114.6	0.443	0.000	0.443	8.6	12.9	5.0E-06	-9999.0	-9999.0	1.167	10.0	-9999.0	-9999.0
127	8.005	14.95	14.94	0.34	-0.20	2.28	114.6	0.469	0.000	0.469	7.2	10.4	5.0E-06	-9999.0	-9999.0	0.965	10.0	-9999.0	-9999.0
135	8.530	15.40	15.40	0.29	-0.02	1.89	114.6	0.499	0.000	0.499	7.4	10.4	5.0E-06	-9999.0	-9999.0	0.993	10.0	-9999.0	-9999.0
143	9.055	10.86	10.86	0.29	-0.02	2.68	114.6	0.529	0.000	0.529	5.2	7.1	5.0E-06	-9999.0	-9999.0	0.688	6.8	-9999.0	-9999.0
150	9.514	9.01	9.01	0.21	0.02	2.34	114.6	0.556	0.000	0.556	4.3	5.8	5.0E-06	-9999.0	-9999.0	0.564	4.7	-9999.0	-9999.0
158	10.039	10.61	10.61	0.19	0.10	1.80	114.6	0.586	0.001	0.584	5.1	6.6	5.0E-06	-9999.0	-9999.0	0.668	5.6	-9999.0	-9999.0
165	10.499	20.51	20.51	0.25	0.33	1.22	114.6	0.612	0.016	0.596	7.9	10.2	5.0E-05	30.0	36.0	1.327	10.0	-9999.0	-9999.0
173	11.023	27.41	27.43	0.54	2.37	1.97	114.6	0.642	0.032	0.610	10.5	13.5	5.0E-05	36.7	38.0	1.786	10.0	96.8	3.530
181	11.548	25.10	25.11	0.63	0.92	2.51	114.6	0.672	0.048	0.624	9.6	12.2	5.0E-05	33.8	38.0	1.629	10.0	92.6	3.687
188	12.008	316.41	316.46	2.98	4.58	0.94	124.1	0.700	0.063	0.637	60.6	75.9	5.0E-02	95.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
196	12.533	310.65	310.70	2.59	3.85	0.83	124.1	0.732	0.079	0.653	59.5	73.6	5.0E-02	95.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
204	13.058	286.38	286.45	1.68	6.38	0.59	127.3	0.766	0.095	0.670	45.7	55.9	5.0E+00	95.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
211	13.517	213.05	213.06	0.50	0.81	0.24	127.3	0.795	0.110	0.685	34.0	41.1	5.0E+00	93.8	46.0	-9999.0	-9999.0	-9999.0	-9999.0
219	14.042	143.54	143.55	0.43	0.81	0.30	124.1	0.828	0.126	0.701	27.5	32.8	5.0E-02	82.1	46.0	-9999.0	-9999.0	269.6	1.878
226	14.501	124.50	124.51	0.31	1.13	0.25	124.1	0.856	0.141	0.715	23.8	28.2	5.0E-02	77.7	44.0	-9999.0	-9999.0	240.5	1.931
234	15.026	72.96	72.98	0.12	1.98	0.16	120.9	0.889	0.157	0.732	17.5	20.4	5.0E-03	62.1	42.0	-9999.0	-9999.0	167.7	2.298
242	15.551	58.19	58.20	0.42	0.77	0.72	120.9	0.920	0.173	0.747	13.9	16.1	5.0E-03	55.3	40.0	-9999.0	-9999.0	148.8	2.557
249	16.010	93.53	93.55	0.81	2.37	0.87	120.9	0.948	0.188	0.760	22.4	25.7	5.0E-03	68.7	42.0	-9999.0	-9999.0	198.1	2.117
257	16.535	78.70	78.72	0.89	1.90	1.13	120.9	0.980	0.204	0.776	18.8	21.4	5.0E-03	63.4	42.0	-9999.0	-9999.0	177.6	2.256
265	17.060	65.99	66.00	0.60	1.13	0.91	120.9	1.012	0.220	0.791	15.8	17.8	5.0E-03	58.1	42.0	-9999.0	-9999.0	161.3	2.443
272	17.519	35.33	35.34	0.42	1.21	1.19	117.7	1.039	0.235	0.804	11.3	12.6	5.0E-04	40.0	38.0	-9999.0	-9999.0	118.5	3.352
280	18.044	98.82	98.85	0.97	2.45	0.98	120.9	1.070	0.251	0.819	23.7	26.2	5.0E-03	69.2	42.0	-9999.0	-9999.0	208.7	2.112
287	18.504	98.12	98.14	0.75	2.13	0.77	120.9	1.098	0.266	0.833	23.5	25.8	5.0E-03	68.7	42.0	-9999.0	-9999.0	208.5	2.124
295	19.029	136.45	136.48	1.03	2.41	0.76	124.1	1.130	0.282	0.848	26.1	28.4	5.0E-02	77.9	44.0	-9999.0	-9999.0	264.3	1.937
303	19.554	162.06	162.06	1.12	-0.39	0.69	124.1	1.163	0.298	0.864	31.0	33.4	5.0E-02	82.6	44.0	-9999.0	-9999.0	305.7	1.886
310	20.013	62.92	62.91	1.43	-1.00	2.28	114.6	1.191	0.313	0.878	24.1	25.7	5.0E-05	55.2	40.0	4.115	10.0	162.3	2.580
318	20.538	56.79	57.28	0.40	45.37	0.70	120.9	1.221	0.329	0.892	13.7	14.5	5.0E-03	52.3	40.0	-9999.0	-9999.0	155.6	2.717
326	21.063	56.67	56.74	0.56	6.40	0.99	120.9	1.252	0.345	0.907	13.6	14.3	5.0E-03	51.8	40.0	-9999.0	-9999.0	155.8	2.745
333	21.522	95.37	95.40	0.55	2.47	0.58	124.1	1.280	0.360	0.920	18.3	19.0	5.0E-02	66.5	42.0	-9999.0	-9999.0	209.5	2.196
341	22.047	49.13	49.15	0.42	2.23	0.86	117.7	1.312	0.376	0.936	15.7	16.2	5.0E-04	47.3	38.0	-9999.0	-9999.0	146.7	2.985
348	22.506	47.01	47.05	0.43	3.54	0.92	117.7	1.339	0.390	0.948	15.0	15.4	5.0E-04	45.8	38.0	-9999.0	-9999.0	144.2	3.065
356	23.031	64.40	64.44	0.49	4.31	0.76	120.9	1.371	0.407	0.964	15.4	15.7	5.0E-03	54.6	40.0	-9999.0	-9999.0	169.3	2.628

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
363	23.491	61.52	61.56	0.54	4.23	0.88	120.9	1.398	0.421	0.977	14.7	14.9	5.0E-03	53.1	40.0	-9999.0	-9999.0	166.2	2.700
371	24.015	70.59	70.64	0.41	4.74	0.58	120.9	1.430	0.438	0.992	16.9	17.0	5.0E-03	56.8	40.0	-9999.0	-9999.0	179.3	2.538
379	24.540	90.65	90.70	0.57	4.76	0.63	120.9	1.462	0.454	1.008	21.7	21.6	5.0E-03	63.7	42.0	-9999.0	-9999.0	207.8	2.291
386	25.000	35.14	35.18	0.29	4.58	0.83	117.7	1.490	0.468	1.022	11.2	11.1	5.0E-04	36.4	36.0	-9999.0	-9999.0	126.9	3.607
394	25.525	5.75	5.88	0.13	12.06	2.21	114.6	1.520	0.485	1.035	3.8	3.7	5.0E-07	-9999.0	-9999.0	0.291	0.9	-9999.0	-9999.0
402	26.050	14.57	14.66	0.11	8.34	0.75	114.6	1.550	0.501	1.049	5.6	5.5	5.0E-05	30.0	30.0	0.874	3.5	-9999.0	-9999.0
409	26.509	23.38	23.50	0.28	11.53	1.19	114.6	1.576	0.515	1.061	9.0	8.7	5.0E-05	30.0	34.0	1.462	7.5	-9999.0	-9999.0
417	27.034	54.17	54.20	0.68	2.76	1.26	117.7	1.607	0.532	1.075	17.3	16.7	5.0E-04	48.1	38.0	-9999.0	-9999.0	161.2	2.974
425	27.559	39.29	39.34	0.67	5.03	1.71	117.7	1.638	0.548	1.090	12.6	12.0	5.0E-04	38.7	38.0	-9999.0	-9999.0	137.6	3.497
432	28.018	20.76	20.77	0.29	0.77	1.40	114.6	1.665	0.563	1.102	8.0	7.6	5.0E-05	30.0	32.0	1.274	5.7	-9999.0	-9999.0
440	28.543	14.89	14.93	0.10	3.99	0.67	114.6	1.695	0.579	1.116	5.7	5.4	5.0E-05	30.0	30.0	0.882	3.2	-9999.0	-9999.0
447	29.002	9.13	9.23	0.09	9.16	0.98	114.6	1.721	0.593	1.128	4.4	4.2	5.0E-06	-9999.0	-9999.0	0.501	1.5	-9999.0	-9999.0
455	29.527	12.78	12.87	0.22	7.94	1.71	114.6	1.751	0.610	1.141	6.2	5.8	5.0E-06	-9999.0	-9999.0	0.741	2.4	-9999.0	-9999.0
463	30.052	11.44	11.60	0.32	15.15	2.76	114.6	1.781	0.626	1.155	5.6	5.2	5.0E-06	-9999.0	-9999.0	0.655	2.0	-9999.0	-9999.0
470	30.511	5.30	5.72	0.22	38.22	3.86	111.4	1.807	0.640	1.166	5.5	5.1	5.0E-08	-9999.0	-9999.0	0.261	0.8	-9999.0	-9999.0
478	31.036	7.60	7.84	0.10	22.58	1.28	114.6	1.837	0.657	1.180	3.8	3.5	5.0E-06	-9999.0	-9999.0	0.400	1.1	-9999.0	-9999.0
485	31.496	10.80	11.05	0.01	23.36	0.09	114.6	1.862	0.671	1.191	4.2	3.9	5.0E-05	30.0	30.0	0.612	1.8	-9999.0	-9999.0
493	32.021	6.58	6.86	0.18	26.04	2.63	114.6	1.892	0.688	1.205	4.4	4.0	5.0E-07	-9999.0	-9999.0	0.331	0.9	-9999.0	-9999.0
501	32.546	6.39	6.75	0.17	33.89	2.52	114.6	1.923	0.704	1.219	4.3	3.9	5.0E-07	-9999.0	-9999.0	0.322	0.9	-9999.0	-9999.0
508	33.005	5.75	6.21	0.12	42.13	1.94	114.6	1.949	0.718	1.231	4.0	3.6	5.0E-07	-9999.0	-9999.0	0.284	0.8	-9999.0	-9999.0
516	33.530	6.20	6.64	0.16	41.16	2.42	114.6	1.979	0.735	1.244	4.2	3.8	5.0E-07	-9999.0	-9999.0	0.311	0.9	-9999.0	-9999.0
524	34.055	59.28	59.33	0.31	4.39	0.52	120.9	2.010	0.751	1.259	14.2	12.7	5.0E-03	48.4	38.0	-9999.0	-9999.0	177.9	2.999
531	34.514	41.39	41.49	0.38	9.50	0.92	117.7	2.038	0.765	1.272	13.2	11.7	5.0E-04	38.0	36.0	-9999.0	-9999.0	148.7	3.584
539	35.039	9.77	9.96	0.32	17.27	3.22	114.6	2.068	0.782	1.286	6.4	5.6	5.0E-07	-9999.0	-9999.0	0.526	1.4	-9999.0	-9999.0
546	35.498	10.35	10.58	0.32	21.71	3.03	114.6	2.094	0.796	1.298	6.8	5.9	5.0E-07	-9999.0	-9999.0	0.566	1.5	-9999.0	-9999.0
554	36.023	12.39	12.91	0.34	48.06	2.64	114.6	2.124	0.813	1.311	6.2	5.4	5.0E-06	-9999.0	-9999.0	0.719	2.0	-9999.0	-9999.0
562	36.548	14.76	14.97	0.40	19.79	2.68	114.6	2.154	0.829	1.325	7.2	6.2	5.0E-06	-9999.0	-9999.0	0.854	2.4	-9999.0	-9999.0
569	37.007	11.69	11.91	0.35	20.66	2.95	114.6	2.180	0.843	1.337	7.6	6.6	5.0E-07	-9999.0	-9999.0	0.649	1.7	-9999.0	-9999.0
577	37.532	7.60	8.05	0.25	41.76	3.11	114.6	2.210	0.860	1.350	5.1	4.4	5.0E-07	-9999.0	-9999.0	0.389	1.0	-9999.0	-9999.0
585	38.057	40.57	40.67	0.21	9.24	0.52	117.7	2.240	0.876	1.364	13.0	11.1	5.0E-04	36.4	36.0	-9999.0	-9999.0	150.4	3.697
592	38.517	36.73	36.86	0.28	12.37	0.76	117.7	2.267	0.890	1.377	11.8	10.0	5.0E-04	33.5	34.0	-9999.0	-9999.0	142.6	3.868
600	39.042	18.46	18.63	0.46	15.21	2.48	114.6	2.298	0.907	1.391	8.9	7.6	5.0E-06	-9999.0	-9999.0	1.089	3.2	-9999.0	-9999.0
607	39.501	5.55	5.90	0.32	32.40	5.43	111.4	2.324	0.921	1.403	5.7	4.8	5.0E-08	-9999.0	-9999.0	0.239	0.7	-9999.0	-9999.0
615	40.026	7.67	8.03	0.47	33.83	5.86	111.4	2.353	0.937	1.416	7.7	6.5	5.0E-08	-9999.0	-9999.0	0.379	0.9	-9999.0	-9999.0
623	40.551	6.39	6.71	0.32	29.86	4.78	111.4	2.383	0.954	1.429	6.4	5.4	5.0E-08	-9999.0	-9999.0	0.288	0.7	-9999.0	-9999.0
630	41.010	15.53	15.84	0.38	28.60	2.41	114.6	2.408	0.968	1.440	7.6	6.3	5.0E-06	-9999.0	-9999.0	0.895	2.3	-9999.0	-9999.0
638	41.535	21.46	21.63	0.30	15.92	1.39	114.6	2.439	0.985	1.454	8.3	6.9	5.0E-05	30.0	32.0	1.280	3.8	-9999.0	-9999.0
646	42.060	7.41	7.76	0.24	32.52	3.10	114.6	2.468	1.001	1.467	5.0	4.1	5.0E-07	-9999.0	-9999.0	0.353	0.8	-9999.0	-9999.0
653	42.519	16.23	16.49	0.44	23.86	2.68	114.6	2.495	1.015	1.479	7.9	6.5	5.0E-06	-9999.0	-9999.0	0.933	2.4	-9999.0	-9999.0
661	43.044	11.31	11.60	0.27	26.90	2.33	114.6	2.525	1.032	1.493	5.6	4.5	5.0E-06	-9999.0	-9999.0	0.605	1.4	-9999.0	-9999.0
668	43.503	10.74	11.05	0.34	28.74	3.09	114.6	2.551	1.046	1.505	7.1	5.7	5.0E-07	-9999.0	-9999.0	0.566	1.3	-9999.0	-9999.0
676	44.028	16.35	16.61	0.49	23.82	2.96	114.6	2.581	1.062	1.519	8.0	6.5	5.0E-06	-9999.0	-9999.0	0.935	2.3	-9999.0	-9999.0
684	44.553	15.97	16.28	0.51	28.90	3.14	114.6	2.611	1.079	1.532	7.8	6.3	5.0E-06	-9999.0	-9999.0	0.911	2.2	-9999.0	-9999.0
691	45.013	6.27	6.51	0.17	22.69	2.62	114.6	2.636	1.093	1.543	4.2	3.3	5.0E-07	-9999.0	-9999.0	0.258	0.7	-9999.0	-9999.0
699	45.538	8.94	9.27	0.42	30.83	4.54	111.4	2.666	1.110	1.557	8.9	7.1	5.0E-08	-9999.0	-9999.0	0.441	0.9	-9999.0	-9999.0
706	45.997	4.34	4.87	0.19	49.22	3.91	111.4	2.692	1.124	1.568	4.7	3.7	5.0E-08	-9999.0	-9999.0	0.145	0.5	-9999.0	-9999.0
714	46.522	5.11	5.66	0.11	51.00	1.95	114.6	2.722	1.140	1.582	3.6	2.9	5.0E-07	-9999.0	-9999.0	0.196	0.6	-9999.0	-9999.0

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
722	47.047	17.31	17.61	0.44	27.51	2.50	114.6	2.752	1.157	1.595	8.4	6.7	5.0E-06	-9999.0	-9999.0	0.990	2.3	-9999.0	-9999.0
729	47.506	5.30	5.87	0.21	52.58	3.59	111.4	2.778	1.171	1.607	5.6	4.4	5.0E-08	-9999.0	-9999.0	0.206	0.6	-9999.0	-9999.0
737	48.031	4.98	5.59	0.17	56.72	3.05	111.4	2.807	1.187	1.620	5.4	4.2	5.0E-08	-9999.0	-9999.0	0.186	0.6	-9999.0	-9999.0
744	48.490	7.35	7.86	0.20	47.82	2.55	114.6	2.833	1.202	1.632	5.0	3.9	5.0E-07	-9999.0	-9999.0	0.335	0.7	-9999.0	-9999.0
752	49.015	29.32	29.60	0.49	26.02	1.66	114.6	2.864	1.218	1.645	11.3	8.8	5.0E-05	30.0	32.0	1.783	5.1	-9999.0	-9999.0
760	49.540	36.35	36.59	0.95	22.06	2.60	114.6	2.894	1.235	1.659	14.0	10.9	5.0E-05	30.6	34.0	2.246	7.3	-9999.0	-9999.0

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Gregg In Situ, Inc. - CPT Interpretation                                          Page:      1
Interpretation Output - Release   1.201
Run No:                           04-0426-1745-2135
Job No:                           02-100
Client:                           MACTEC
Project:                          TVA - Stevenson, Alabama
Site:                             CPT-05
Location:                         TVA
Cone:                             H. Benkhayal
CPT Date:                         04/21/04
CPT Time:                         13:50
CPT File:                         064CP05.COR
Northing  (m):                      0.000000
Easting   (m):                      0.000000
Elevation (m):                        0.000000
-------------------------------------------------
Water Table (m):                  3.05            (ft):       10.0
Unit Weight of Water (default):   62.40   pcf
Averaging Increment (m):          0.0      (Every Data Point)
Phi Method :                      Robertson and Campanella, 1983
Su Nkt used:                      15.00          Su/P' (nc):  0.30
Dr  Method :                      Jamiolkowski - All Sands
State Parameter M:                1.20
Used Unit Weights Assigned to Soil Zones
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	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
6	0.066	6.06	6.07	0.03	0.10	0.50	111.4	0.004	0.000	0.004	2.9	5.8	1.0E-07	-9999.0	-9999.0	0.404	10.0	-9999.0	-9999.0
13	0.525	39.80	39.80	0.32	0.37	0.81	117.7	0.030	0.000	0.030	12.7	25.4	5.0E-04	90.3	50.0	-9999.0	-9999.0	95.1	2.389
21	1.050	32.84	32.82	0.34	-1.56	1.04	117.7	0.061	0.000	0.061	10.5	21.0	5.0E-04	74.7	48.0	-9999.0	-9999.0	85.9	2.617
28	1.509	34.30	34.30	0.38	-0.16	1.11	117.7	0.088	0.000	0.088	10.9	21.9	5.0E-04	70.7	48.0	-9999.0	-9999.0	87.8	2.561
36	2.034	114.22	114.22	0.86	0.71	0.75	124.1	0.120	0.000	0.120	21.9	43.8	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
43	2.493	168.07	168.08	3.40	1.29	2.02	117.7	0.148	0.000	0.148	53.7	107.3	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
51	3.018	134.03	134.02	3.70	-0.14	2.76	117.7	0.179	0.000	0.179	42.8	85.6	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
59	3.543	151.91	151.91	3.06	0.18	2.01	117.7	0.210	0.000	0.210	48.5	97.0	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
66	4.003	110.01	110.01	2.27	-0.02	2.06	117.7	0.237	0.000	0.237	35.1	70.2	5.0E-04	90.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
74	4.528	114.86	114.86	1.93	0.02	1.68	120.9	0.268	0.000	0.268	27.5	53.1	5.0E-03	89.5	48.0	-9999.0	-9999.0	-9999.0	-9999.0
82	5.052	157.08	157.08	2.02	-0.49	1.29	120.9	0.300	0.000	0.300	37.6	68.7	5.0E-03	95.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
89	5.512	140.47	140.48	1.87	0.65	1.33	120.9	0.328	0.000	0.328	33.6	58.8	5.0E-03	92.4	48.0	-9999.0	-9999.0	-9999.0	-9999.0
97	6.037	152.10	152.10	1.72	0.35	1.13	120.9	0.359	0.000	0.359	36.4	60.8	5.0E-03	93.3	48.0	-9999.0	-9999.0	-9999.0	-9999.0
104	6.496	138.69	138.68	2.04	-0.41	1.47	120.9	0.387	0.000	0.387	33.2	53.4	5.0E-03	89.6	48.0	-9999.0	-9999.0	-9999.0	-9999.0
112	7.021	137.85	137.88	2.37	2.17	1.72	120.9	0.419	0.000	0.419	33.0	51.0	5.0E-03	88.3	48.0	-9999.0	-9999.0	-9999.0	-9999.0
120	7.546	124.95	124.95	1.99	0.00	1.60	120.9	0.451	0.000	0.451	29.9	44.6	5.0E-03	84.5	46.0	-9999.0	-9999.0	237.4	1.900
127	8.005	112.30	112.31	2.71	0.85	2.41	117.7	0.479	0.000	0.479	35.9	51.8	5.0E-04	80.5	46.0	-9999.0	-9999.0	212.2	1.889
135	8.530	122.91	122.89	1.29	-1.56	1.05	120.9	0.510	0.000	0.510	29.4	41.2	5.0E-03	82.2	46.0	-9999.0	-9999.0	230.8	1.878
143	9.055	121.43	121.43	1.40	-0.75	1.16	120.9	0.542	0.000	0.542	29.1	39.5	5.0E-03	81.0	46.0	-9999.0	-9999.0	228.9	1.885
150	9.514	127.32	127.31	1.70	-1.10	1.34	120.9	0.570	0.000	0.570	30.5	40.4	5.0E-03	81.6	46.0	-9999.0	-9999.0	239.4	1.880
158	10.039	175.93	175.92	2.70	-0.92	1.53	120.9	0.602	0.001	0.600	42.1	54.4	5.0E-03	90.2	46.0	-9999.0	-9999.0	-9999.0	-9999.0
165	10.499	172.74	172.72	2.87	-1.39	1.66	120.9	0.629	0.016	0.614	41.4	52.8	5.0E-03	89.3	46.0	-9999.0	-9999.0	-9999.0	-9999.0
173	11.023	419.32	419.30	6.92	-1.39	1.65	120.9	0.662	0.032	0.630	100.4	126.5	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
181	11.548	434.52	434.85	0.94	30.17	0.22	127.3	0.694	0.048	0.646	69.4	86.4	5.0E+00	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
188	12.008	455.28	455.33	8.49	4.58	1.86	120.9	0.723	0.063	0.660	109.0	134.2	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
196	12.533	427.24	427.28	6.13	3.62	1.44	124.1	0.755	0.079	0.676	81.8	99.6	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
204	13.058	335.25	335.29	3.95	3.04	1.18	124.1	0.787	0.095	0.692	64.2	77.2	5.0E-02	95.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
211	13.517	276.29	276.33	2.26	3.29	0.82	124.1	0.816	0.110	0.706	52.9	63.0	5.0E-02	95.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
219	14.042	232.98	233.00	1.75	2.49	0.75	124.1	0.849	0.126	0.722	44.6	52.5	5.0E-02	95.0	46.0	-9999.0	-9999.0	-9999.0	-9999.0
226	14.501	211.51	211.54	1.57	2.57	0.74	124.1	0.877	0.141	0.736	40.5	47.2	5.0E-02	92.5	46.0	-9999.0	-9999.0	-9999.0	-9999.0
234	15.026	146.16	146.19	0.71	1.96	0.49	124.1	0.910	0.157	0.753	28.0	32.3	5.0E-02	81.6	44.0	-9999.0	-9999.0	274.9	1.880
242	15.551	88.80	88.81	0.76	0.92	0.86	120.9	0.942	0.173	0.768	21.3	24.3	5.0E-03	67.0	42.0	-9999.0	-9999.0	191.5	2.157
249	16.010	106.68	106.69	0.70	0.81	0.66	124.1	0.970	0.188	0.782	20.4	23.1	5.0E-02	72.0	44.0	-9999.0	-9999.0	218.0	2.043
257	16.535	93.84	93.84	0.51	0.61	0.54	124.1	1.002	0.204	0.798	18.0	20.1	5.0E-02	68.1	42.0	-9999.0	-9999.0	200.2	2.134
265	17.060	71.35	71.36	0.42	0.35	0.59	120.9	1.034	0.220	0.813	17.1	18.9	5.0E-03	59.9	42.0	-9999.0	-9999.0	169.7	2.378
272	17.519	58.26	58.26	0.36	0.08	0.62	120.9	1.061	0.235	0.827	13.9	15.3	5.0E-03	53.9	40.0	-9999.0	-9999.0	153.2	2.630
280	18.044	34.24	34.24	0.22	-0.31	0.64	117.7	1.093	0.251	0.842	10.9	11.9	5.0E-04	38.4	38.0	-9999.0	-9999.0	118.1	3.449
287	18.504	10.54	10.54	0.34	0.39	3.23	114.6	1.120	0.266	0.854	6.7	7.3	5.0E-07	-9999.0	-9999.0	0.628	2.9	-9999.0	-9999.0
295	19.029	12.71	12.83	0.33	11.06	2.58	114.6	1.150	0.282	0.868	6.1	6.6	5.0E-06	-9999.0	-9999.0	0.779	3.9	-9999.0	-9999.0
303	19.554	7.35	7.47	0.19	11.42	2.55	114.6	1.180	0.298	0.881	4.8	5.1	5.0E-07	-9999.0	-9999.0	0.419	1.6	-9999.0	-9999.0
310	20.013	2.94	3.09	0.12	14.12	3.89	111.4	1.206	0.313	0.893	3.0	3.1	5.0E-08	-9999.0	-9999.0	0.126	0.6	-9999.0	-9999.0
318	20.538	1.40	1.60	0.10	18.49	6.25	79.6	1.231	0.329	0.902	1.5	1.6	1.0E-15	-9999.0	-9999.0	0.025	0.5	-9999.0	-9999.0
326	21.063	1.40	1.59	0.07	17.68	4.40	79.6	1.256	0.345	0.911	1.5	1.6	1.0E-15	-9999.0	-9999.0	0.023	0.5	-9999.0	-9999.0
333	21.522	1.15	1.37	0.07	20.44	5.11	79.6	1.276	0.360	0.916	1.3	1.4	1.0E-15	-9999.0	-9999.0	0.007	0.5	-9999.0	-9999.0
341	22.047	1.00	1.23	0.03	20.68	2.45	79.6	1.298	0.376	0.921	1.2	1.2	1.0E-15	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
348	22.506	1.40	1.60	0.05	17.93	3.14	111.4	1.319	0.390	0.929	1.5	1.6	5.0E-08	-9999.0	-9999.0	0.019	0.5	-9999.0	-9999.0
356	23.031	1.40	1.62	0.04	19.89	2.48	111.4	1.342	0.407	0.936	0.8	0.8	1.0E-07	-9999.0	-9999.0	0.018	0.5	-9999.0	-9999.0

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
363	23.491	2.62	2.82	0.07	18.94	2.49	111.4	1.368	0.421	0.947	2.7	2.8	5.0E-08	-9999.0	-9999.0	0.097	0.5	-9999.0	-9999.0
371	24.015	1.00	1.25	0.03	23.20	2.40	79.6	1.395	0.438	0.957	1.2	1.2	1.0E-15	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
379	24.540	1.00	1.27	0.03	25.00	2.36	111.4	1.423	0.454	0.969	0.6	0.6	1.0E-07	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
386	25.000	1.00	1.28	0.10	25.78	7.83	79.6	1.445	0.468	0.977	1.2	1.2	1.0E-15	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
394	25.525	1.00	1.28	0.05	25.34	3.93	79.6	1.466	0.485	0.981	1.2	1.2	1.0E-15	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
402	26.050	1.00	1.29	0.02	26.74	1.55	111.4	1.493	0.501	0.992	0.6	0.6	1.0E-07	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
409	26.509	1.00	1.30	0.01	27.26	0.77	111.4	1.518	0.515	1.003	0.6	0.6	1.0E-07	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0
417	27.034	10.74	11.08	0.14	31.64	1.27	114.6	1.547	0.532	1.015	5.3	5.3	5.0E-06	-9999.0	-9999.0	0.635	2.3	-9999.0	-9999.0
425	27.559	50.02	50.07	0.78	4.80	1.56	117.7	1.578	0.548	1.029	16.0	15.8	5.0E-04	46.4	38.0	-9999.0	-9999.0	152.8	3.052
432	28.018	22.68	22.73	0.49	5.31	2.16	114.6	1.604	0.563	1.042	8.7	8.5	5.0E-05	30.0	34.0	1.409	7.2	-9999.0	-9999.0
440	28.543	24.08	24.14	0.35	5.51	1.45	114.6	1.634	0.579	1.055	9.2	9.0	5.0E-05	30.0	34.0	1.500	7.8	-9999.0	-9999.0
447	29.002	9.45	9.53	0.37	7.01	3.89	111.4	1.661	0.593	1.067	9.1	8.8	5.0E-08	-9999.0	-9999.0	0.525	1.7	-9999.0	-9999.0
455	29.527	4.28	4.50	0.17	20.62	3.78	111.4	1.690	0.610	1.081	4.3	4.1	5.0E-08	-9999.0	-9999.0	0.188	0.7	-9999.0	-9999.0
463	30.052	3.58	3.88	0.09	27.90	2.33	111.4	1.719	0.626	1.093	3.7	3.6	5.0E-08	-9999.0	-9999.0	0.144	0.6	-9999.0	-9999.0
470	30.511	2.94	3.28	0.09	31.84	2.75	111.4	1.745	0.640	1.105	3.1	3.0	5.0E-08	-9999.0	-9999.0	0.102	0.5	-9999.0	-9999.0
478	31.036	3.26	3.61	0.10	32.91	2.77	111.4	1.774	0.657	1.117	3.5	3.3	5.0E-08	-9999.0	-9999.0	0.123	0.6	-9999.0	-9999.0
485	31.496	3.32	3.68	0.13	33.05	3.55	111.4	1.800	0.671	1.129	3.5	3.3	5.0E-08	-9999.0	-9999.0	0.125	0.6	-9999.0	-9999.0
493	32.021	4.34	4.68	0.10	31.17	2.14	114.6	1.829	0.688	1.142	3.0	2.8	5.0E-07	-9999.0	-9999.0	0.190	0.7	-9999.0	-9999.0
501	32.546	3.90	4.29	0.10	36.16	2.34	111.4	1.859	0.704	1.155	4.1	3.8	5.0E-08	-9999.0	-9999.0	0.162	0.6	-9999.0	-9999.0
508	33.005	5.04	5.39	0.15	31.94	2.79	111.4	1.884	0.718	1.166	5.2	4.8	5.0E-08	-9999.0	-9999.0	0.234	0.7	-9999.0	-9999.0
516	33.530	5.11	5.48	0.22	33.58	4.03	111.4	1.913	0.735	1.179	5.2	4.8	5.0E-08	-9999.0	-9999.0	0.237	0.7	-9999.0	-9999.0
524	34.055	7.67	8.10	0.24	39.47	2.97	114.6	1.943	0.751	1.192	5.2	4.7	5.0E-07	-9999.0	-9999.0	0.410	1.1	-9999.0	-9999.0
531	34.514	6.00	6.27	0.21	24.83	3.36	111.4	1.969	0.765	1.203	6.0	5.5	5.0E-08	-9999.0	-9999.0	0.287	0.8	-9999.0	-9999.0
539	35.039	3.07	3.48	0.04	38.26	1.15	111.4	1.998	0.782	1.216	1.7	1.5	1.0E-07	-9999.0	-9999.0	0.099	0.5	-9999.0	-9999.0
546	35.498	33.09	33.14	0.21	4.48	0.64	117.7	2.024	0.796	1.228	10.6	9.5	5.0E-04	32.1	34.0	-9999.0	-9999.0	-9999.0	-9999.0
554	36.023	28.24	28.32	0.15	7.42	0.53	117.7	2.055	0.813	1.242	9.0	8.1	5.0E-04	30.0	34.0	-9999.0	-9999.0	-9999.0	-9999.0
562	36.548	27.41	27.49	0.08	7.80	0.29	117.7	2.086	0.829	1.257	8.8	7.8	5.0E-04	30.0	34.0	-9999.0	-9999.0	-9999.0	-9999.0
569	37.007	29.83	29.93	0.21	8.63	0.70	117.7	2.113	0.843	1.269	9.6	8.5	5.0E-04	30.0	34.0	-9999.0	-9999.0	-9999.0	-9999.0
577	37.532	24.47	24.56	0.46	8.67	1.88	114.6	2.143	0.860	1.284	9.4	8.3	5.0E-05	30.0	32.0	1.495	5.7	-9999.0	-9999.0
585	38.057	37.94	38.02	0.29	7.31	0.76	117.7	2.174	0.876	1.298	12.1	10.7	5.0E-04	35.2	36.0	-9999.0	-9999.0	142.5	3.749
592	38.517	22.68	22.76	0.61	8.10	2.69	114.6	2.200	0.890	1.310	10.9	9.5	5.0E-06	-9999.0	-9999.0	1.371	4.9	-9999.0	-9999.0
600	39.042	10.54	10.80	0.44	24.67	4.08	111.4	2.231	0.907	1.324	10.3	9.0	5.0E-08	-9999.0	-9999.0	0.571	1.5	-9999.0	-9999.0
607	39.501	14.63	14.81	0.70	17.01	4.74	111.4	2.256	0.921	1.335	14.2	12.3	5.0E-08	-9999.0	-9999.0	0.837	2.3	-9999.0	-9999.0
615	40.026	33.66	33.74	0.53	7.56	1.57	114.6	2.286	0.937	1.348	12.9	11.1	5.0E-05	31.2	34.0	2.097	9.0	-9999.0	-9999.0
623	40.551	18.66	18.91	0.33	23.86	1.75	114.6	2.316	0.954	1.362	7.2	6.2	5.0E-05	30.0	30.0	1.106	3.4	-9999.0	-9999.0
630	41.010	12.01	12.41	0.35	37.47	2.83	114.6	2.342	0.968	1.374	5.9	5.1	5.0E-06	-9999.0	-9999.0	0.671	1.7	-9999.0	-9999.0
638	41.535	17.95	18.21	0.16	23.51	0.88	114.6	2.372	0.985	1.388	7.0	5.9	5.0E-05	30.0	30.0	1.056	3.0	-9999.0	-9999.0
646	42.060	20.44	20.81	0.23	33.89	1.11	114.6	2.403	1.001	1.402	8.0	6.7	5.0E-05	30.0	32.0	1.227	3.7	-9999.0	-9999.0
653	42.519	25.81	26.23	0.17	38.40	0.65	117.7	2.429	1.015	1.414	8.4	7.0	5.0E-04	30.0	32.0	-9999.0	-9999.0	-9999.0	-9999.0
661	43.044	44.46	44.61	0.48	13.98	1.08	117.7	2.460	1.032	1.428	14.2	11.9	5.0E-04	38.4	36.0	-9999.0	-9999.0	160.6	3.600
668	43.503	33.66	33.82	0.57	15.07	1.69	114.6	2.487	1.046	1.441	13.0	10.8	5.0E-05	30.4	34.0	2.089	8.1	-9999.0	-9999.0
676	44.028	37.31	37.48	0.60	15.82	1.60	117.7	2.518	1.062	1.455	12.0	9.9	5.0E-04	33.2	34.0	-9999.0	-9999.0	146.4	3.907
684	44.553	36.16	36.32	0.63	14.70	1.74	114.6	2.548	1.079	1.469	13.9	11.5	5.0E-05	32.1	34.0	2.251	8.8	-9999.0	-9999.0
691	45.013	24.40	24.55	0.83	13.86	3.39	114.6	2.575	1.093	1.481	11.8	9.7	5.0E-06	-9999.0	-9999.0	1.465	4.5	-9999.0	-9999.0
699	45.538	14.24	14.36	0.69	10.85	4.82	111.4	2.604	1.110	1.494	13.8	11.3	5.0E-08	-9999.0	-9999.0	0.784	1.8	-9999.0	-9999.0
706	45.997	23.58	23.85	0.74	25.59	3.11	114.6	2.630	1.124	1.506	11.4	9.3	5.0E-06	-9999.0	-9999.0	1.415	4.1	-9999.0	-9999.0
714	46.522	28.11	28.31	1.02	18.60	3.61	114.6	2.660	1.140	1.520	13.6	11.0	5.0E-06	-9999.0	-9999.0	1.710	5.4	-9999.0	-9999.0

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
722	47.047	24.53	25.00	0.57	43.81	2.29	114.6	2.690	1.157	1.533	9.6	7.7	5.0E-05	30.0	32.0	1.488	4.4	-9999.0	-9999.0
729	47.506	25.23	25.58	0.67	32.17	2.63	114.6	2.716	1.171	1.545	12.2	9.9	5.0E-06	-9999.0	-9999.0	1.524	4.5	-9999.0	-9999.0
737	48.031	28.68	29.37	0.93	64.29	3.17	114.6	2.746	1.187	1.559	14.1	11.3	5.0E-06	-9999.0	-9999.0	1.775	5.5	-9999.0	-9999.0
744	48.490	32.26	32.82	1.19	51.87	3.63	114.6	2.773	1.202	1.571	15.7	12.5	5.0E-06	-9999.0	-9999.0	2.003	6.6	-9999.0	-9999.0
752	49.015	35.27	35.44	1.39	16.33	3.93	114.6	2.803	1.218	1.585	17.0	13.5	5.0E-06	-9999.0	-9999.0	2.176	7.4	-9999.0	-9999.0
760	49.540	30.40	30.72	1.36	28.84	4.44	114.6	2.833	1.235	1.598	19.6	15.5	5.0E-07	-9999.0	-9999.0	1.859	5.7	-9999.0	-9999.0

```
Gregg In Situ, Inc. - CPT Interpretation
Interpretation Output - Release   1.20I
Run No:                           04-0426-1745-2239
Job No:                           02-100
Client:                           MACTEC
Project:                          TVA - Stevenson, Alabama
Site:                             CPT-06
Location:                         TVA
Cone:                             H. Benkhayal
CPT Date:                         04/21/04
CPT Time:                         15:47
CPT File:                         064CP06.COR
Northing  (m):                      0.000000
Easting   (m):                      0.000000
Elevation (m):                        0.000000
--------------------------------------------------
Water Table (m):                   3.05          (ft):       10.0
Unit Weight of Water (default):   62.40    pcf
Averaging Increment (m):          0.0      (Every Data Point)
Phi Method :                      Robertson and Campanella, 1983
Su Nkt used:                       15.00        Su/P' (nc):  0.30
Dr  Method :                      Jamiolkowski - All Sands
State Parameter M:                 1.20
Used Unit Weights Assigned to Soil Zones
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	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
6	0.066	1.98	1.99	0.07	0.31	3.53	111.4	0.004	0.000	0.004	1.9	3.8	5.0E-08	-9999.0	-9999.0	0.132	10.0	-9999.0	-9999.0
13	0.525	141.43	141.47	1.89	3.64	1.34	120.9	0.031	0.000	0.031	33.9	67.7	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
21	1.050	175.81	175.82	5.02	1.15	2.86	117.7	0.062	0.000	0.062	56.1	112.3	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
28	1.509	158.81	158.82	5.03	1.58	3.17	114.6	0.089	0.000	0.089	60.8	121.7	5.0E-05	95.0	50.0	10.582	10.0	-9999.0	-9999.0
36	2.034	164.30	164.35	3.62	4.35	2.20	117.7	0.120	0.000	0.120	52.5	104.9	5.0E-04	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
43	2.493	264.40	264.42	2.50	1.54	0.94	124.1	0.148	0.000	0.148	50.6	101.3	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
51	3.018	254.32	254.30	2.62	-1.74	1.03	124.1	0.180	0.000	0.180	48.7	97.4	5.0E-02	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
59	3.543	173.06	173.17	3.25	10.33	1.88	120.9	0.212	0.000	0.212	41.5	82.9	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
66	4.003	182.89	182.95	3.31	4.82	1.81	120.9	0.240	0.000	0.240	43.8	87.6	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
74	4.528	176.44	176.46	2.85	2.02	1.61	120.9	0.271	0.000	0.271	42.2	81.1	5.0E-03	95.0	50.0	-9999.0	-9999.0	-9999.0	-9999.0
82	5.052	138.18	138.20	2.35	1.86	1.70	120.9	0.303	0.000	0.303	33.1	60.1	5.0E-03	93.0	48.0	-9999.0	-9999.0	-9999.0	-9999.0
89	5.512	114.99	114.96	2.78	-2.25	2.42	117.7	0.330	0.000	0.330	36.7	63.9	5.0E-04	86.5	48.0	-9999.0	-9999.0	229.0	1.992
97	6.037	110.64	110.68	2.50	3.93	2.26	117.7	0.361	0.000	0.361	35.3	58.8	5.0E-04	84.2	46.0	-9999.0	-9999.0	209.6	1.894
104	6.496	132.23	132.28	1.86	4.70	1.41	120.9	0.388	0.000	0.388	31.7	50.8	5.0E-03	88.2	48.0	-9999.0	-9999.0	-9999.0	-9999.0
112	7.021	103.55	103.58	2.38	2.80	2.29	117.7	0.419	0.000	0.419	33.1	51.1	5.0E-04	80.1	46.0	-9999.0	-9999.0	196.2	1.894
120	7.546	77.87	77.89	1.91	1.60	2.46	117.7	0.450	0.000	0.450	24.9	37.1	5.0E-04	70.9	44.0	-9999.0	-9999.0	161.0	2.067
127	8.005	72.19	72.21	1.63	2.17	2.26	117.7	0.477	0.000	0.477	23.1	33.4	5.0E-04	67.9	44.0	-9999.0	-9999.0	154.1	2.135
135	8.530	67.39	67.40	1.52	0.43	2.26	117.7	0.508	0.000	0.508	21.5	30.2	5.0E-04	65.1	44.0	-9999.0	-9999.0	148.9	2.209
143	9.055	49.44	49.43	1.02	-0.92	2.07	114.6	0.538	0.000	0.538	18.9	25.8	5.0E-05	55.3	42.0	3.259	10.0	126.3	2.556
150	9.514	42.92	42.91	0.56	-1.39	1.31	117.7	0.565	0.000	0.565	13.7	18.2	5.0E-04	50.6	40.0	-9999.0	-9999.0	119.2	2.778
158	10.039	34.56	34.57	0.36	0.24	1.04	117.7	0.596	0.001	0.594	11.0	14.3	5.0E-04	43.7	40.0	-9999.0	-9999.0	108.6	3.143
165	10.499	28.56	28.57	0.26	0.65	0.91	117.7	0.622	0.016	0.607	9.1	11.7	5.0E-04	37.9	38.0	-9999.0	-9999.0	98.9	3.462
173	11.023	41.39	41.42	0.32	2.70	0.77	117.7	0.653	0.032	0.621	13.2	16.8	5.0E-04	48.2	40.0	-9999.0	-9999.0	120.1	2.899
181	11.548	26.12	26.13	0.35	0.71	1.34	114.6	0.684	0.048	0.636	10.0	12.6	5.0E-05	34.7	38.0	1.696	10.0	95.1	3.640
188	12.008	14.37	14.39	0.16	1.66	1.11	114.6	0.710	0.063	0.648	5.5	6.9	5.0E-05	30.0	34.0	0.912	7.7	-9999.0	-9999.0
196	12.533	9.07	9.12	0.07	4.15	0.77	114.6	0.740	0.079	0.661	4.4	5.4	5.0E-06	-9999.0	-9999.0	0.558	3.5	-9999.0	-9999.0
204	13.058	8.56	8.62	0.07	5.13	0.81	111.4	0.770	0.095	0.674	4.1	5.0	1.0E-07	-9999.0	-9999.0	0.523	3.1	-9999.0	-9999.0
211	13.517	9.90	9.96	0.04	5.37	0.40	114.6	0.796	0.110	0.686	3.8	4.6	5.0E-05	30.0	32.0	0.611	3.8	-9999.0	-9999.0
219	14.042	10.80	10.86	0.04	6.30	0.37	114.6	0.826	0.126	0.699	4.2	5.0	5.0E-05	30.0	32.0	0.669	4.3	-9999.0	-9999.0
226	14.501	11.50	11.57	0.06	6.48	0.52	114.6	0.852	0.141	0.711	4.4	5.3	5.0E-05	30.0	32.0	0.714	4.6	-9999.0	-9999.0
234	15.026	8.81	8.88	0.02	6.07	0.23	111.4	0.882	0.157	0.725	4.3	5.0	1.0E-07	-9999.0	-9999.0	0.533	2.9	-9999.0	-9999.0
242	15.551	8.43	8.49	0.09	5.83	1.06	114.6	0.912	0.173	0.739	4.1	4.7	5.0E-06	-9999.0	-9999.0	0.505	2.6	-9999.0	-9999.0
249	16.010	8.30	8.40	0.06	9.26	0.72	111.4	0.938	0.188	0.750	4.0	4.6	1.0E-07	-9999.0	-9999.0	0.498	2.5	-9999.0	-9999.0
257	16.535	6.97	7.11	0.05	13.55	0.70	111.4	0.967	0.204	0.763	3.4	3.9	1.0E-07	-9999.0	-9999.0	0.410	1.9	-9999.0	-9999.0
265	17.060	6.52	6.66	0.01	13.59	0.15	111.4	0.996	0.220	0.776	3.2	3.6	1.0E-07	-9999.0	-9999.0	0.378	1.7	-9999.0	-9999.0
272	17.519	5.17	5.32	0.01	13.63	0.19	111.4	1.022	0.235	0.787	2.5	2.9	1.0E-07	-9999.0	-9999.0	0.287	1.2	-9999.0	-9999.0
280	18.044	8.24	8.39	0.32	14.04	3.82	111.4	1.051	0.251	0.800	8.0	9.0	5.0E-08	-9999.0	-9999.0	0.489	2.3	-9999.0	-9999.0
287	18.504	15.59	15.69	0.70	9.54	4.47	111.4	1.077	0.266	0.811	15.0	16.7	5.0E-08	-9999.0	-9999.0	0.974	6.0	-9999.0	-9999.0
295	19.029	13.86	13.88	0.82	1.39	5.92	111.4	1.106	0.282	0.824	13.3	14.6	5.0E-08	-9999.0	-9999.0	0.852	4.8	-9999.0	-9999.0
303	19.554	12.90	12.93	0.77	3.00	5.97	111.4	1.135	0.298	0.837	12.4	13.5	5.0E-08	-9999.0	-9999.0	0.787	4.1	-9999.0	-9999.0
310	20.013	14.44	14.50	0.57	5.97	3.94	114.6	1.161	0.313	0.848	9.3	10.1	5.0E-07	-9999.0	-9999.0	0.889	4.9	-9999.0	-9999.0
318	20.538	14.30	14.34	0.89	2.98	6.22	111.4	1.191	0.329	0.862	13.7	14.8	5.0E-08	-9999.0	-9999.0	0.876	4.7	-9999.0	-9999.0
326	21.063	11.31	11.33	0.73	1.84	6.46	111.4	1.220	0.345	0.875	10.8	11.6	5.0E-08	-9999.0	-9999.0	0.674	3.1	-9999.0	-9999.0
333	21.522	21.53	21.54	1.04	0.83	4.84	111.4	1.244	0.360	0.884	20.6	21.9	5.0E-08	-9999.0	-9999.0	1.353	8.8	-9999.0	-9999.0
341	22.047	17.88	17.95	0.85	5.97	4.75	111.4	1.273	0.376	0.897	17.2	18.2	5.0E-08	-9999.0	-9999.0	1.112	6.3	-9999.0	-9999.0
348	22.506	21.33	21.43	0.82	9.12	3.84	114.6	1.299	0.390	0.908	13.7	14.4	5.0E-07	-9999.0	-9999.0	1.342	8.3	-9999.0	-9999.0
356	23.031	21.53	21.63	0.84	8.79	3.89	114.6	1.329	0.407	0.922	13.8	14.4	5.0E-07	-9999.0	-9999.0	1.353	8.2	-9999.0	-9999.0

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
363	23.491	18.01	18.13	0.84	10.73	4.64	111.4	1.354	0.421	0.933	17.4	18.0	5.0E-08	-9999.0	-9999.0	1.118	6.0	-9999.0	-9999.0
371	24.015	15.78	15.89	0.96	9.99	6.06	111.4	1.384	0.438	0.946	15.2	15.6	5.0E-08	-9999.0	-9999.0	0.967	4.7	-9999.0	-9999.0
379	24.540	14.82	14.88	0.69	5.65	4.65	111.4	1.413	0.454	0.959	14.2	14.6	5.0E-08	-9999.0	-9999.0	0.898	4.1	-9999.0	-9999.0
386	25.000	10.61	10.66	0.68	4.76	6.40	111.4	1.438	0.468	0.970	10.2	10.4	5.0E-08	-9999.0	-9999.0	0.615	2.4	-9999.0	-9999.0
394	25.525	11.76	11.81	0.63	5.01	5.35	111.4	1.468	0.485	0.983	11.3	11.4	5.0E-08	-9999.0	-9999.0	0.690	2.7	-9999.0	-9999.0
402	26.050	12.33	12.38	0.54	4.96	4.37	111.4	1.497	0.501	0.996	11.9	11.9	5.0E-08	-9999.0	-9999.0	0.726	2.9	-9999.0	-9999.0
409	26.509	19.55	19.60	1.08	4.44	5.52	111.4	1.522	0.515	1.007	18.8	18.7	5.0E-08	-9999.0	-9999.0	1.205	6.0	-9999.0	-9999.0
417	27.034	15.46	15.46	1.10	0.10	7.13	111.4	1.552	0.532	1.020	14.8	14.7	5.0E-08	-9999.0	-9999.0	0.927	3.9	-9999.0	-9999.0
425	27.559	29.83	29.90	1.66	6.01	5.57	111.4	1.582	0.548	1.033	28.6	28.2	5.0E-08	-9999.0	-9999.0	1.888	10.0	-9999.0	-9999.0
432	28.018	57.75	58.10	2.85	32.11	4.90	114.6	1.608	0.563	1.045	37.1	36.3	5.0E-07	-9999.0	-9999.0	3.766	10.0	-9999.0	-9999.0
440	28.543	50.15	50.24	3.06	8.53	6.09	111.4	1.640	0.579	1.061	48.1	46.7	5.0E-08	-9999.0	-9999.0	3.240	10.0	-9999.0	-9999.0
447	29.002	45.93	46.04	2.27	9.75	4.92	114.6	1.666	0.593	1.072	29.4	28.4	5.0E-07	-9999.0	-9999.0	2.958	10.0	-9999.0	-9999.0
455	29.527	33.98	34.06	2.12	7.25	6.21	111.4	1.695	0.610	1.085	32.6	31.3	5.0E-08	-9999.0	-9999.0	2.158	10.0	-9999.0	-9999.0
463	30.052	42.61	42.88	2.11	24.87	4.91	114.6	1.725	0.626	1.099	27.4	26.1	5.0E-07	-9999.0	-9999.0	2.744	10.0	-9999.0	-9999.0
470	30.511	39.36	39.49	1.78	12.43	4.52	114.6	1.751	0.640	1.111	25.2	23.9	5.0E-07	-9999.0	-9999.0	2.516	10.0	-9999.0	-9999.0
478	31.036	27.41	27.53	1.27	11.75	4.62	114.6	1.781	0.657	1.124	17.6	16.6	5.0E-07	-9999.0	-9999.0	1.717	8.8	-9999.0	-9999.0
485	31.496	26.00	26.24	1.13	21.57	4.32	114.6	1.807	0.671	1.136	16.8	15.7	5.0E-07	-9999.0	-9999.0	1.629	7.9	-9999.0	-9999.0
493	32.021	28.87	29.14	1.23	25.22	4.23	114.6	1.838	0.688	1.150	18.6	17.4	5.0E-07	-9999.0	-9999.0	1.820	9.3	-9999.0	-9999.0
501	32.546	28.68	28.87	1.20	17.64	4.17	114.6	1.868	0.704	1.164	18.4	17.1	5.0E-07	-9999.0	-9999.0	1.800	9.0	-9999.0	-9999.0
508	33.005	21.27	21.57	1.02	27.83	4.74	111.4	1.894	0.718	1.175	20.7	19.1	5.0E-08	-9999.0	-9999.0	1.312	5.4	-9999.0	-9999.0
516	33.530	21.65	22.00	1.11	32.35	5.06	111.4	1.923	0.735	1.188	21.1	19.3	5.0E-08	-9999.0	-9999.0	1.339	5.5	-9999.0	-9999.0
524	34.055	24.98	25.17	0.73	17.93	2.91	114.6	1.953	0.751	1.202	12.1	11.0	5.0E-06	-9999.0	-9999.0	1.548	6.7	-9999.0	-9999.0
531	34.514	17.69	18.04	0.92	32.31	5.11	111.4	1.979	0.765	1.214	17.3	15.7	5.0E-08	-9999.0	-9999.0	1.071	3.8	-9999.0	-9999.0
539	35.039	21.78	21.94	1.53	14.41	6.99	111.4	2.008	0.782	1.227	21.0	19.0	5.0E-08	-9999.0	-9999.0	1.329	5.1	-9999.0	-9999.0
546	35.498	27.79	27.84	1.80	4.46	6.48	111.4	2.034	0.796	1.238	26.7	24.0	5.0E-08	-9999.0	-9999.0	1.720	7.6	-9999.0	-9999.0
554	36.023	16.10	16.17	1.06	6.54	6.57	111.4	2.063	0.813	1.251	15.5	13.8	5.0E-08	-9999.0	-9999.0	0.940	3.0	-9999.0	-9999.0
562	36.548	16.42	16.50	0.94	7.87	5.71	111.4	2.092	0.829	1.263	15.8	14.1	5.0E-08	-9999.0	-9999.0	0.961	3.0	-9999.0	-9999.0
569	37.007	16.55	16.64	1.00	7.87	6.03	111.4	2.118	0.843	1.275	15.9	14.1	5.0E-08	-9999.0	-9999.0	0.968	3.0	-9999.0	-9999.0
577	37.532	22.87	23.03	0.94	15.37	4.09	114.6	2.147	0.860	1.288	14.7	13.0	5.0E-07	-9999.0	-9999.0	1.392	5.1	-9999.0	-9999.0
585	38.057	29.45	29.58	1.02	11.97	3.46	114.6	2.177	0.876	1.301	14.2	12.4	5.0E-06	-9999.0	-9999.0	1.827	7.7	-9999.0	-9999.0
592	38.517	16.61	16.86	0.57	22.89	3.39	114.6	2.204	0.890	1.313	10.8	9.4	5.0E-07	-9999.0	-9999.0	0.977	3.0	-9999.0	-9999.0
600	39.042	20.06	20.36	0.99	27.63	4.87	111.4	2.234	0.907	1.327	19.5	16.9	5.0E-08	-9999.0	-9999.0	1.208	4.0	-9999.0	-9999.0
607	39.501	19.49	19.72	1.04	21.85	5.29	111.4	2.259	0.921	1.338	18.9	16.3	5.0E-08	-9999.0	-9999.0	1.164	3.7	-9999.0	-9999.0
615	40.026	18.79	19.02	1.10	21.24	5.80	111.4	2.288	0.937	1.351	18.2	15.7	5.0E-08	-9999.0	-9999.0	1.115	3.4	-9999.0	-9999.0
623	40.551	28.17	28.51	1.16	31.98	4.08	114.6	2.318	0.954	1.364	18.2	15.6	5.0E-07	-9999.0	-9999.0	1.746	6.7	-9999.0	-9999.0
630	41.010	22.61	22.83	1.19	20.19	5.22	111.4	2.344	0.968	1.375	21.9	18.6	5.0E-08	-9999.0	-9999.0	1.366	4.5	-9999.0	-9999.0
638	41.535	25.93	26.14	1.31	19.05	5.02	111.4	2.373	0.985	1.388	25.0	21.2	5.0E-08	-9999.0	-9999.0	1.584	5.6	-9999.0	-9999.0
646	42.060	16.61	16.97	0.55	33.70	3.25	114.6	2.403	1.001	1.402	8.1	6.9	5.0E-06	-9999.0	-9999.0	0.971	2.7	-9999.0	-9999.0
653	42.519	16.48	16.84	0.93	33.20	5.54	111.4	2.428	1.015	1.413	16.1	13.6	5.0E-08	-9999.0	-9999.0	0.961	2.6	-9999.0	-9999.0
661	43.044	21.40	22.00	0.66	55.78	3.01	114.6	2.458	1.032	1.426	10.5	8.8	5.0E-06	-9999.0	-9999.0	1.303	4.0	-9999.0	-9999.0
668	43.503	23.77	24.01	1.34	22.04	5.60	111.4	2.484	1.046	1.438	23.0	19.2	5.0E-08	-9999.0	-9999.0	1.435	4.5	-9999.0	-9999.0
676	44.028	18.27	18.54	0.81	24.57	4.38	111.4	2.513	1.062	1.451	17.8	14.7	5.0E-08	-9999.0	-9999.0	1.068	2.9	-9999.0	-9999.0
684	44.553	19.10	19.30	0.98	18.76	5.09	111.4	2.543	1.079	1.464	18.5	15.3	5.0E-08	-9999.0	-9999.0	1.117	3.1	-9999.0	-9999.0
691	45.013	23.45	23.75	1.11	27.87	4.69	111.4	2.569	1.093	1.476	22.7	18.7	5.0E-08	-9999.0	-9999.0	1.412	4.3	-9999.0	-9999.0
699	45.538	17.44	17.66	0.93	20.46	5.28	111.4	2.598	1.110	1.489	16.9	13.9	5.0E-08	-9999.0	-9999.0	1.004	2.6	-9999.0	-9999.0
706	45.997	20.63	21.26	1.11	58.44	5.23	111.4	2.624	1.124	1.500	20.4	16.6	5.0E-08	-9999.0	-9999.0	1.242	3.4	-9999.0	-9999.0
714	46.522	28.17	28.30	3.28	11.75	11.58	82.7	2.652	1.140	1.512	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0	-9999.0

	2	5	6	7	8	9	10	11	12	13	16	17	18	19	20	22	23	32	33
1	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
2	Col-02	Col-05	Col-06	Col-07	Col-08	Col-09	Col-10	Col-11	Col-12	Col-13	Col-16	Col-17	Col-18	Col-19	Col-20	Col-22	Col-23	Col-32	Col-33
3	Depth	qc	qt	fs	u	Rf	Unit Wt	T Stress	U Stress	E Stress	N60	N1(60)	k	Dr	Phi	Su	OCR	YoungE	E/qc
4	(ft)	(tsf)	(tsf)	(tsf)	(psi)	(%)	(pcf)	(tsf)	(tsf)	(tsf)	(blows/ft)	(blows/ft)	(cm/s)	(%)	(Deg)	(tsf)		(tsf)	
5	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
722	47.047	16.67	16.98	0.80	28.58	4.72	111.4	2.677	1.157	1.521	16.3	13.2	5.0E-08	-9999.0	-9999.0	0.953	2.3	-9999.0	-9999.0
729	47.506	23.38	23.83	1.11	41.78	4.67	111.4	2.703	1.171	1.532	22.8	18.4	5.0E-08	-9999.0	-9999.0	1.408	4.0	-9999.0	-9999.0
737	48.031	25.93	26.52	1.16	54.70	4.38	114.6	2.732	1.187	1.545	16.9	13.6	5.0E-07	-9999.0	-9999.0	1.586	4.7	-9999.0	-9999.0
744	48.490	17.50	17.89	0.92	35.65	5.16	111.4	2.758	1.202	1.556	17.1	13.7	5.0E-08	-9999.0	-9999.0	1.009	2.4	-9999.0	-9999.0
752	49.015	17.56	18.17	0.74	55.76	4.08	114.6	2.788	1.218	1.570	11.6	9.3	5.0E-07	-9999.0	-9999.0	1.025	2.5	-9999.0	-9999.0
760	49.540	15.72	16.35	0.59	58.94	3.62	114.6	2.818	1.235	1.583	10.4	8.3	5.0E-07	-9999.0	-9999.0	0.902	2.1	-9999.0	-9999.0

WIDOWS CREEK FOSSIL PLANT
ANNUAL ASH POND DIKE STABILITY INSPECTION
2008

The waste disposal areas at Widows Creek Fossil Plant (WCF) were inspected for dike structural stability on December 5 and 6, 2007 by Kelly Evans of TVA Fossil Engineering Design Services (EDS) and Robert Knox of TVA Fuel By-products. The previous annual inspection was performed on November 27, 28, and 29, 2006. The results of the inspection of the Coal Yard Drainage Basin, Coal Yard Perimeter Ditch, Limestone Pile Drainage Basin, Wet Gypsum Stacking Area, Stilling Pond for the Wet Gypsum Stacking Area, Active Ash Pond, Stilling Pond for Active Ash Pond, Stilling Pond for the Active Ash Pond, Perimeter Dikes, Red Water Pond, Chemical Treatment Pond, and the Abandoned Ash Disposal Area are listed below. A summary of recommendations is also provided.

COAL YARD DRAINAGE BASIN


Photo 1

- **Location** - West of Powerhouse and Coal Pile (Directions based on Plant North).
- **Effluent** - Pumped to Active Ash Pond.
- **Observations (see sketch API08-1 for photo locations)**
  - Interior Slopes - Satisfactory; sparse vegetation on slopes. No significant erosion. (Photos 1 and 2).
  - Sediment Level - Excellent - Pond was cleaned in 2007
    - Small retention basin before pond inlet is full of coal fines (Photos 3 and 4).
    - Wooden weir in retention basin damaged (photo 3).
  - Pump
    - Platform needs painting and repair to handrail. This is a future potential safety issue.
    - Last inspection plant personnel stated that float switch not operable. Pump manual switch must be wired opened. Unable to verify if this was corrected. (Photos 5 and 6).

Photo 2

COAL YARD DRAINAGE BASIN (continued)

- **Actions Since Previous Inspection**
  - Pond cleaned.

- **Recommendations**
  - Monitor the East interior slope. If erosions starts, place suitable earth material on slope prior to seeding and mulching.
    - Notify EDS of any changes.
  - Repair pump float switch so that pump can run in automatic mode. If this has been corrected disregard.
  - Repair pump platform handrail. Paint platform within next two to three years.
  - Clean sediment in retention basin and repair weir.

Coal Yard Pond retention basin discharge pipes - damaged weir

Photo 3

Coal Yard Pond retention basin.

Photo 4

COAL YARD DRAINAGE BASIN - photos continued

Coal Yard Pond Platform - corroded handrail

Photo 5

Photo 6

COAL YARD PERIMETER DITCH

- **Location** - Perimeter of Coal Yard West of the Powerhouse.
- **Effluent** - Drains to the coal yard drainage basin.
- **Observations (see sketch API08-1 for photo locations)**
  - Significant improvement since last inspection.
  - Sediment and coal fines filling ditch in one area on the west side of coal yard and along the length of the south side of the coal yard. (Photos 7-10).

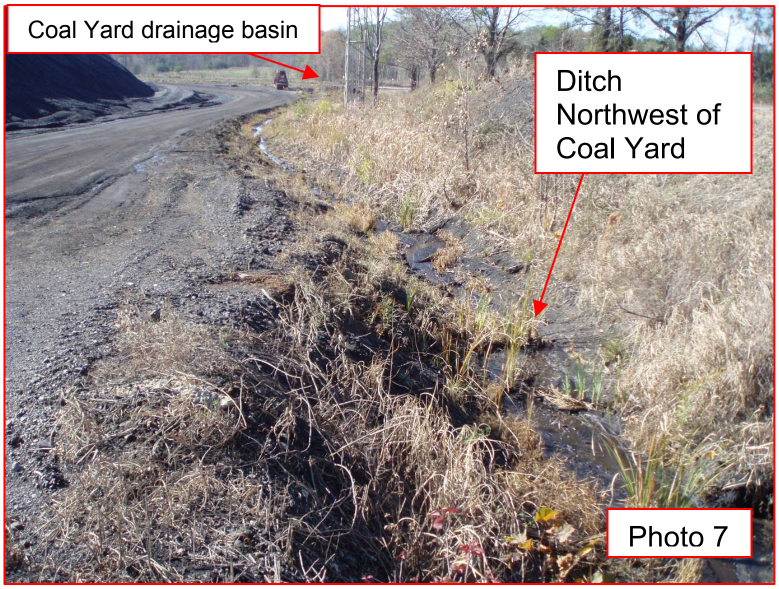


Photo 7

- **Actions Since Previous Inspection**
  - Ditch cleaned as part of routine maintenance.
- **Recommendation**
  - Continue routine cleaning of the perimeter ditch.

Photo 8

COAL YARD PERIMETER DITCH - photos continued

LIMESTONE PILE DRAINAGE BASIN

- **Location** - East of Powerhouse.
- **Effluent**
  - Discharges to a series of stilling ponds.
  - Final stilling pool discharges to Outfall 005 into Guntersville Reservoir.
- **Observations (see sketch API08-1 for photo locations)**
  - Interior Slopes - Satisfactory condition with no vegetation (See Photo 11).
    - ♦ No erosion detected.
  - Sediment Level - Pond appears to be filling up again. (See Photos 11 & 12).
  - Discharge - submerged
  - Final Stilling Pond
    - ♦ Interior slopes - Good condition
    - ♦ Discharge structure - Good condition - replaced on 2005 (See Photo 13)
- **Actions Since Previous Inspection**
  - Pond cleaned December 2006.
- **Recommendations**
  - Continue good management practices utilized in maintaining the Limestone Pile Drainage Basin.
  - Clean sediment around inlet. Monitor and clean-out pond as required.

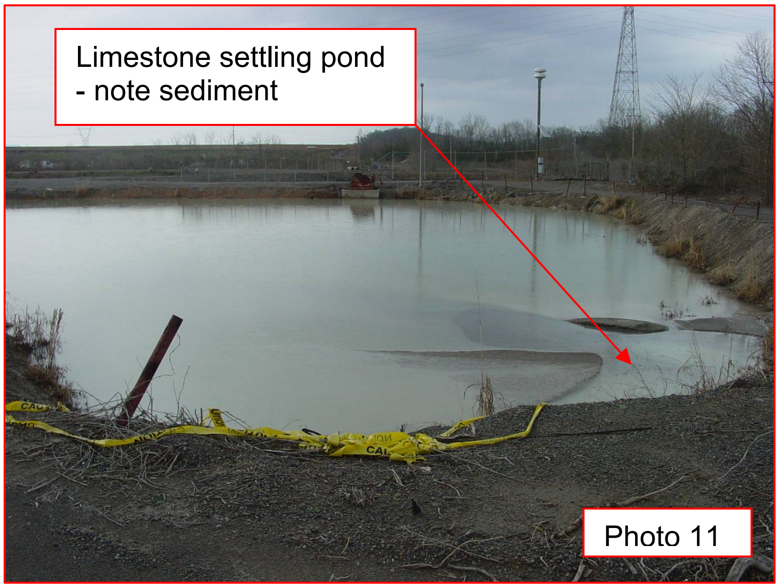

Limestone settling pond - note sediment

Photo 11

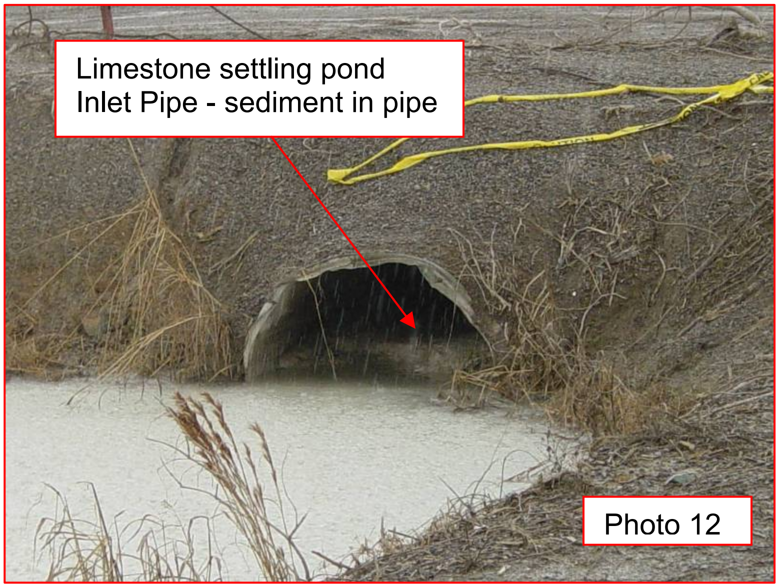

Limestone settling pond Inlet Pipe - sediment in pipe

Photo 12

LIMESTONE PILE DRAINAGE BASIN - photos continued

Settling Pond for Outfall 005

Photo 13

WET GYPSUM STACKING AREA

Gypsum Stack - southeast corner looking toward plant

Photo 14

- **Location** - East side of Widows Creek which borders the East side of the Active Ash Pond.
- **Effluent** - Discharges into Gypsum Stilling Pond.
- **Observations (see sketch API08-2 & 3 for photo locations)**
  - The development of the dry stack area appears to be in general accordance with the stacking plan. See TVA drwgs 10W235-1 thru 16 for details. (Photos 14-20).
  - Lower perimeter dikes were generally in good condition.
    - General terrain at base of lower perimeter dike is low lying and drains poorly. This is worse on the South and East dikes.

WET GYPSUM STACKING AREA - continued

Gypsum Stack - southeast corner looking southwest

Photo 15

- **Observations - continued**
  - Lower perimeter dikes - continued
    - Bottom 15 feet and toe of slope was saturated for ~80 feet in an area along the southern perimeter dike (see note on attached drawing API08).
    - Bare spots (4) noted on the previous inspection at the base of the northwest perimeter dike have been corrected and were barely visible.
    - Woody growth was noted on the southwest slope (see note on attached sketch API08-2).
    - Overall, slopes were well vegetated and properly maintained.
  - Upper slopes have various degrees of erosion; however, there is significant improvement since last inspection.
    - Soil cover has been placed up to bench elevation 650.
    - Sparse vegetation existed on soil cover allowing some erosion.
    - Reels are present on all slopes (Photos 21 & 22).
    - Toe drains installed at bench elevation 650.
    - Ruts and sloughing is present along the Northwest slope. Sloughing was worse between toe drain outlets 13 and 12. (Photos 23 & 24).
    - The far west outlet of the no. 12 toe drain outlet was not flowing (Photo 25).
    - The east PVC drain inspection well of no.12 toe drain outlets was damaged. A hole in the side will allow sediment to enter (Photos 26 and 27).

Gypsum Stack - southeast corner looking west

Photo 16

WET GYPSUM STACKING AREA - continued

- **Observations - continued**
  - Upper slopes - continued
    - Sloughing of the lower portion of the West slope next to the stilling pond was noted. This area does not have toe drains installed yet because the total construction width has not been completed.
    - Erosion is present at the South discharge outlet (Photo 33).
  - Toe drains installed at bench elevation 650.
  - Storm run-off is starting to erode access road at the north corner of the stack (Photo 35).


Gypsum Stack - west side sluice discharge pipes

Photo 17

  - Toe drain outlet pipes are covered with sediment material at various locations.
  - Several bench drain outlet pipes were also covered with sediment.
  - Sediment accumulation was noted in the perimeter ditch due to soil erosion (Photo 36).
  - Metal sluice lines in contact with bottom ash. This will corrode these lines (Photo 34).

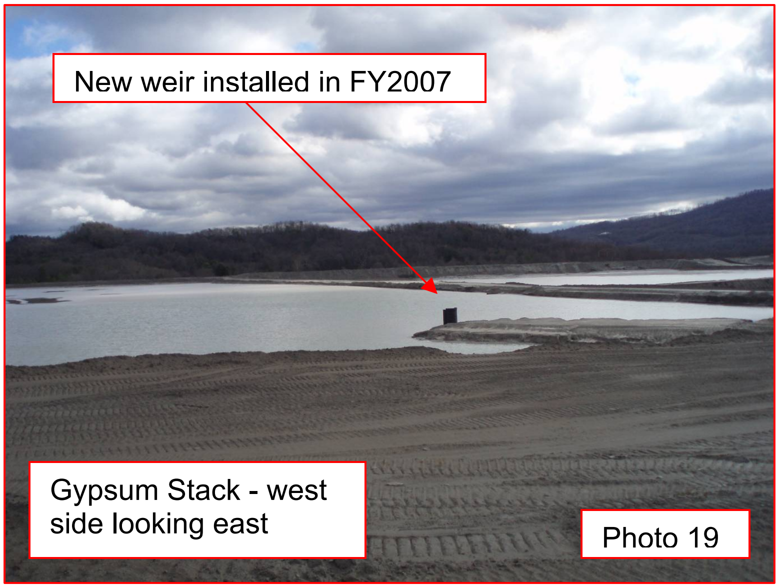
- **Actions Since Previous Inspection**
  - Soil cover placed on slopes up to first bench.
  - Cleaned and re-graded perimeter ditch to drain.
  - Weir installed on west side of gypsum sluicing operations.
  - Bench drains installed on west side of stack next to stilling pond.
  - Erosion repaired around sluice lines at the base of stack next to stilling pond.
  - Continued operations in accordance with existing permit.


Gypsum Stack - west side looking north

Photo 18

WET GYPSUM STACKING AREA (continued)

- **Recommendations**



New weir installed in FY2007

Gypsum Stack - west side looking east

Photo 19

  - Continue operations in accordance with the existing permit requirements.
  - Monitor wet area along the Southern lower perimeter dike.
  - Remove trees and woody growth from the Southwest lower perimeter dike.
  - Repair erosion along gypsum upper perimeter dike slopes on a continuous basis until vegetation is established.
  - Rework a portion of the West slope next to the Stilling Pond. Install toe drains as soon as the construction sequencing will allow. This will reduce saturation of the slope toe and will reduce sloughing in this area.
  - Re-grade perimeter road surface and stabilize to prevent erosion. This is at the north corner of the stack as shown on drawing API08-2.
    - Estimated Area - 50 yd^2.
  - Clean-out all toe drain outlets and verify that there are no obstructions in the lines.
  - Uncover bench drain outlets and place rip-rap as required. Several of these outlets were covered.
  - Pump the PVC drainage basins/inspection wells for toe drains 11, 12, and 13 toe drains to remove sediment. This may open outlets that were not flowing. This activity must be done in the spring or summer months.
  - Engineering Design to develop recommendations to address sloughing along the northwest slope. This will take approximately 80 man-hours ($5,000). In order to limit degradation of this area, improvement should be implemented before next fall.

Gypsum Stack - west side looking south

Photo 20

WET GYPSUM STACKING AREA (continued)

- **Recommendations**
  - Remove sediment from perimeter ditch to insure drainage. This will be on a continuous basis until vegetation is established on the upper slopes.
  - Continue maintenance of the dike slopes by mowing annually. This will also inhibit woody growth.


Gypsum Stack - Upper Slope South Corner

Photo 21

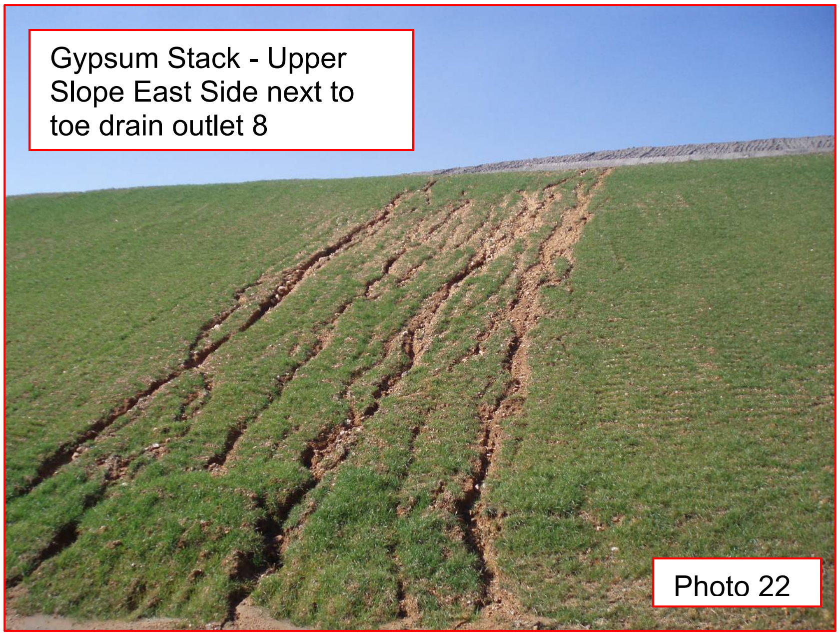
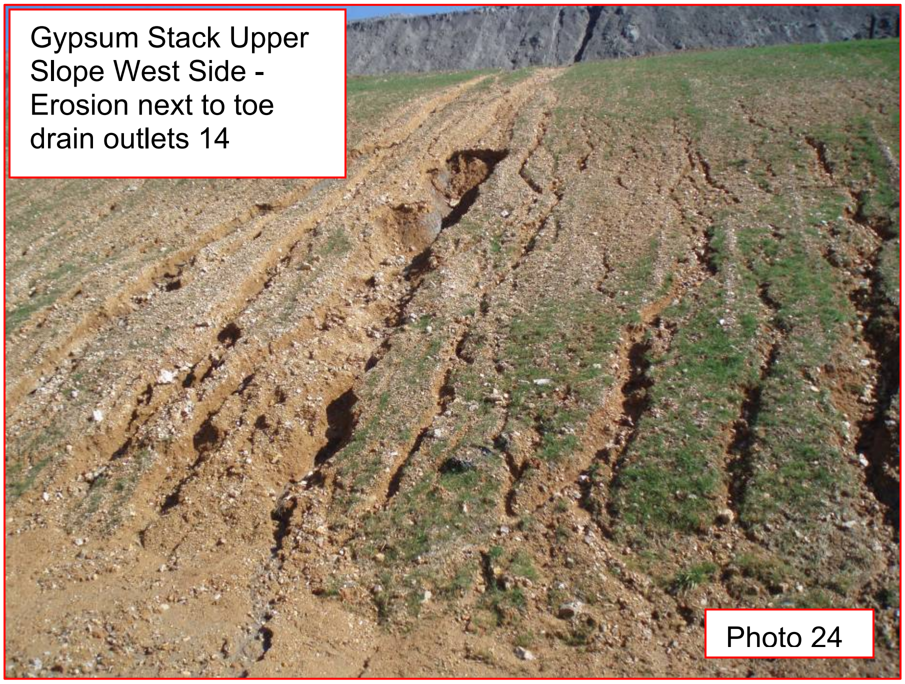

Gypsum Stack - Upper Slope East Side next to toe drain outlet 8

Photo 22

WET GYPSUM STACKING AREA - photos continued

Gypsum Stack Upper Slope Northwest Side - Sloughing between toe drain outlets 12 and 13

Photo 23



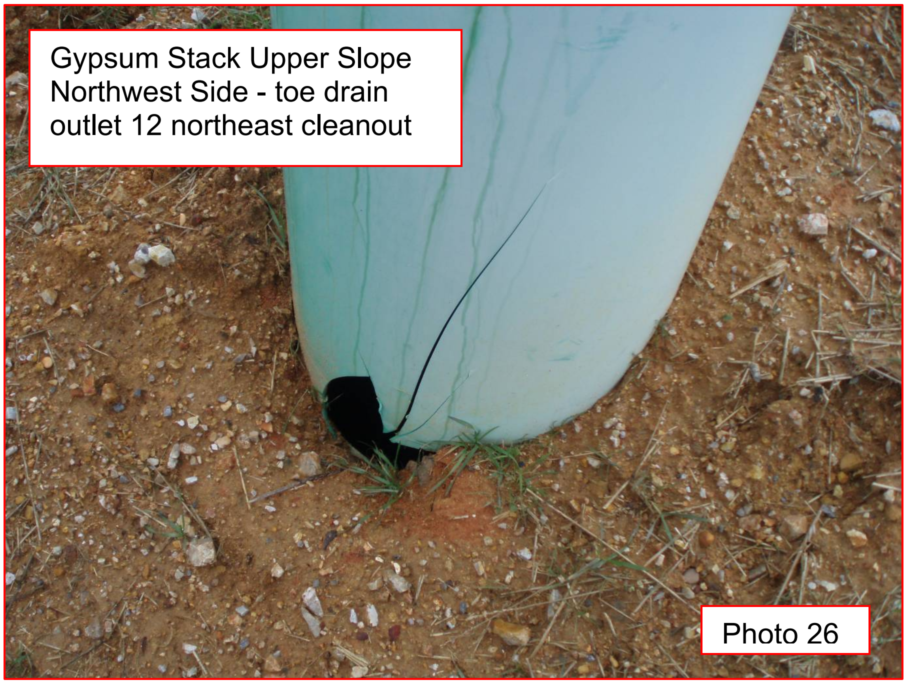
Gypsum Stack Upper Slope West Side - Erosion next to toe drain outlets 14

Photo 24

WET GYPSUM STACKING AREA - photos continued

Gypsum Stack Upper Slope Northwest Side - toe drain outlet 12

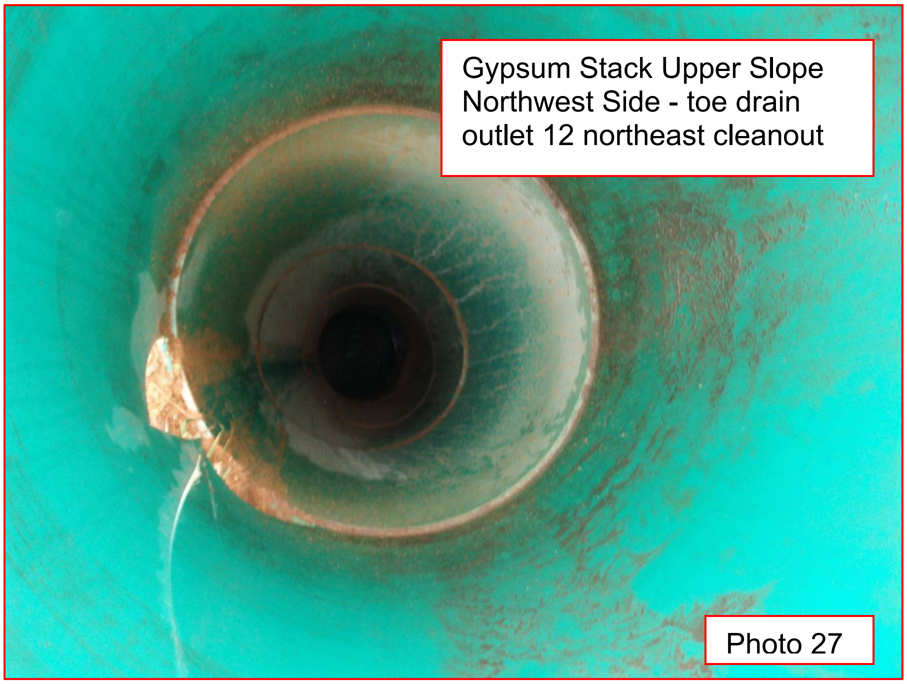
Photo 25



Gypsum Stack Upper Slope Northwest Side - toe drain outlet 12 northeast cleanout

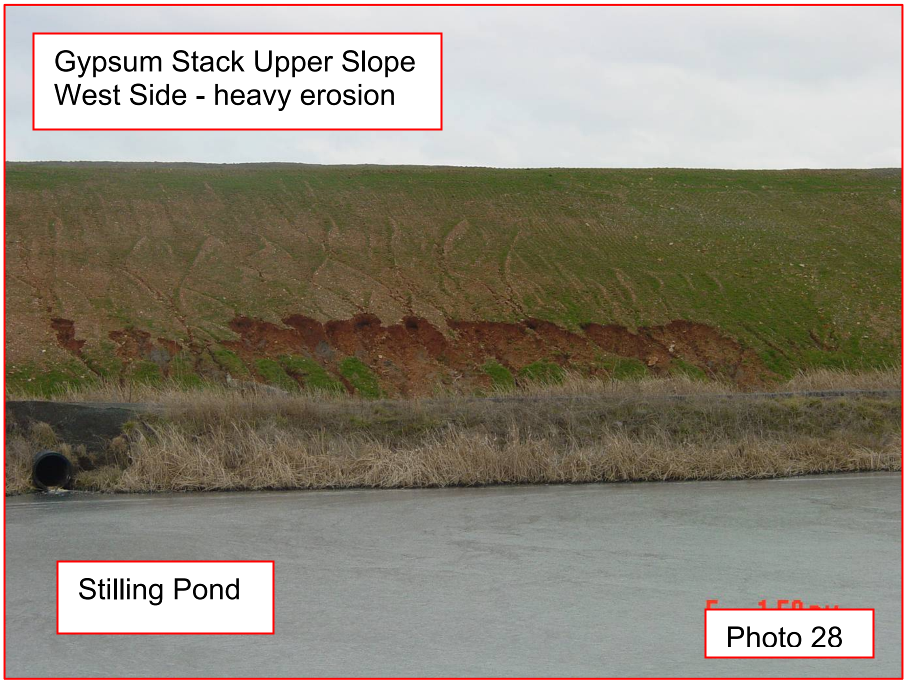
Photo 26

WET GYPSUM STACKING AREA - photos continued



Gypsum Stack Upper Slope Northwest Side - toe drain outlet 12 northeast cleanout

Photo 27

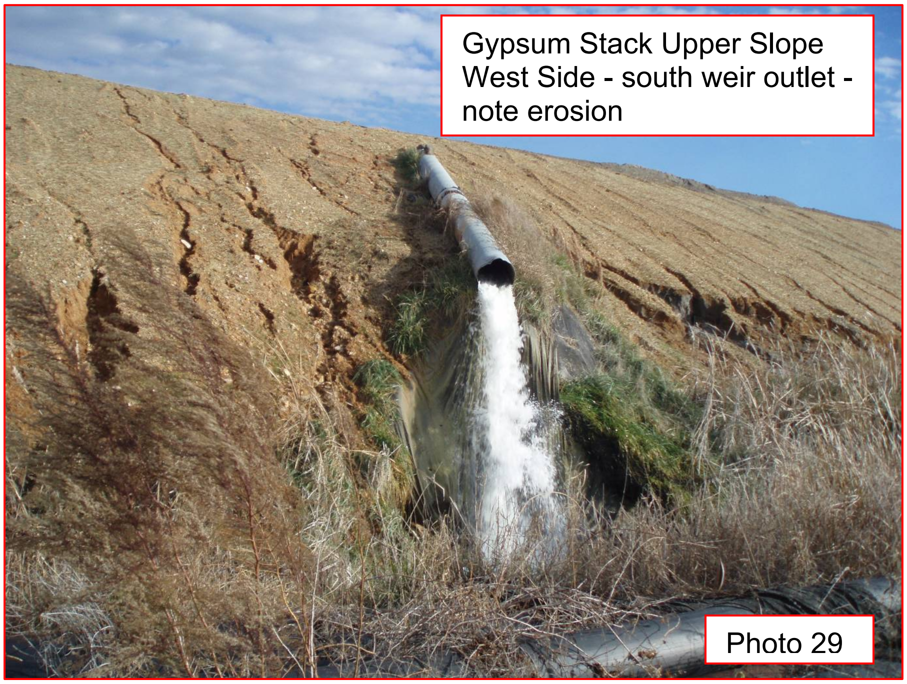


Gypsum Stack Upper Slope West Side - heavy erosion

Stilling Pond

Photo 28

WET GYPSUM STACKING AREA - photos continued



Gypsum Stack Upper Slope West Side - south weir outlet - note erosion

Photo 29

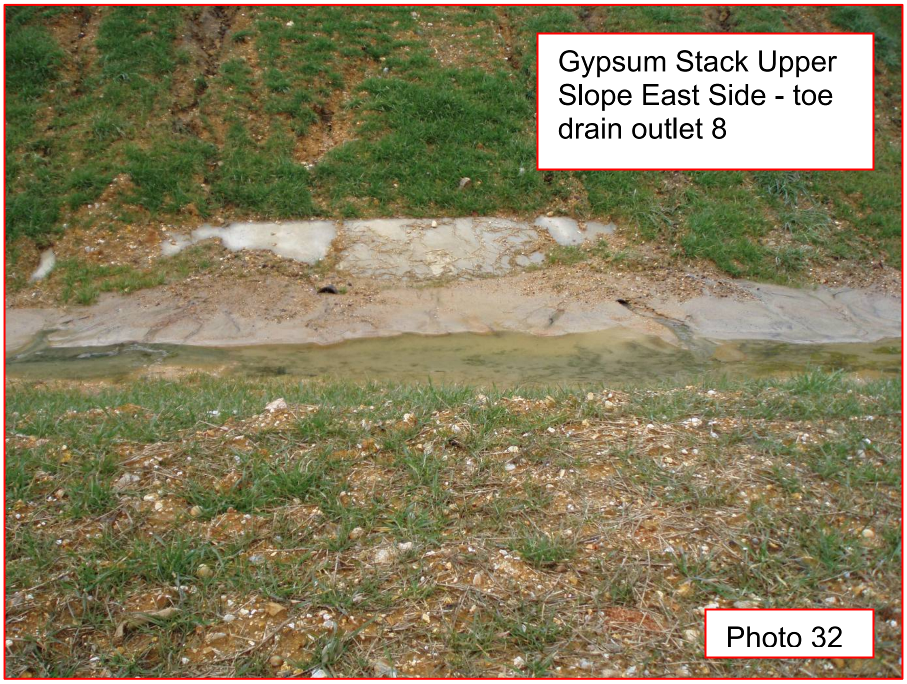
Gypsum Stack Perimeter Access Road - rutting and ponding near north corner

Photo 30

WET GYPSUM STACKING AREA - photos continued

Gypsum Stack Perimeter Access Road - erosion near north corner

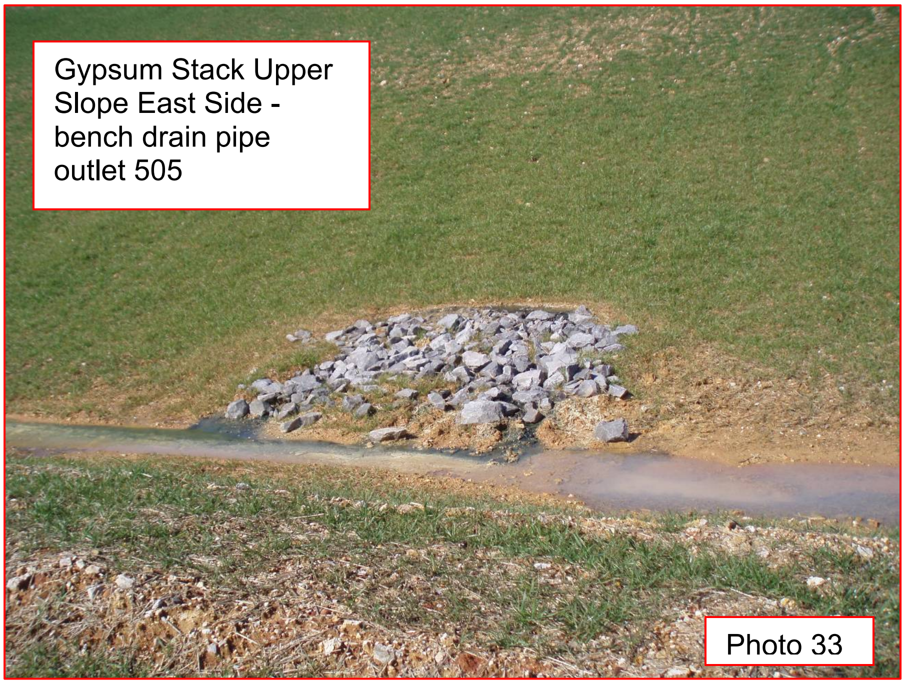
Photo 31



Gypsum Stack Upper Slope East Side - toe drain outlet 8

Photo 32

WET GYPSUM STACKING AREA - photos continued



Gypsum Stack Upper Slope East Side - bench drain pipe outlet 505

Photo 33

Sluice Lines Transfer Valves - southeast corner of stilling pond

Photo 34

STILLING POND FOR WET GYPSUM STACKING AREA

- **Location** - West of Wet Gypsum Stacking Area
- **Effluent** - Gravity Drains to Outfall 008 into Guntersville Reservoir (Photo 43).


Photo 35

- **Observations**
    - Pond Surface - good no floating debris (Photo 35)
    - Discharge pipes into Pond from Gypsum Wet Stack are in good condition (Photos 29, 36 and 37)
        - Southern Discharge is the existing concrete pipe for old gypsum discharge weir. Hole has been knocked through top of pipe wall so water from perimeter ditch can enter.
    - Wooden Discharge Structure - could not be adequately inspected.
        - Access walkway unstable.
    - Interior Slopes - established vegetation.
    - Exterior Slopes - established vegetation.


Gypsum Stack Perimeter Ditch Discharge - north end of stilling pond

Photo 36

- **Actions Since Previous Inspection**
    - Floating ash removed.
    - HDPE pipes at North end of pond installed per DCN WCF-04-1016 when construction sequence allowed.
    - Vegetation on slopes cut back.
    - New discharge pipe installed for weir installed on west side of gypsum sluicing operations (Photo 37).

STILLING POND FOR WET GYPSUM STACKING AREA (continued)

- **Recommendations**
  - Continue maintenance of the dike slopes by mowing annually. This will also inhibit woody growth.


Gypsum Stack Perimeter Weir Discharge

Photo 37

ACTIVE ASH POND

- **Location** - Northeast of Powerhouse
- **Effluent** - Discharges to Active Ash Pond Stilling Pond
- **Observations (photos taken on 2/1/08)**
  - Interior Slopes - Satisfactory (Photo 38).
  - Pond Surface - small amount of floating ash observed
  - Discharge Structures - Good condition (Photos 39 & 40)
    - Only one of five structures could be inspected.

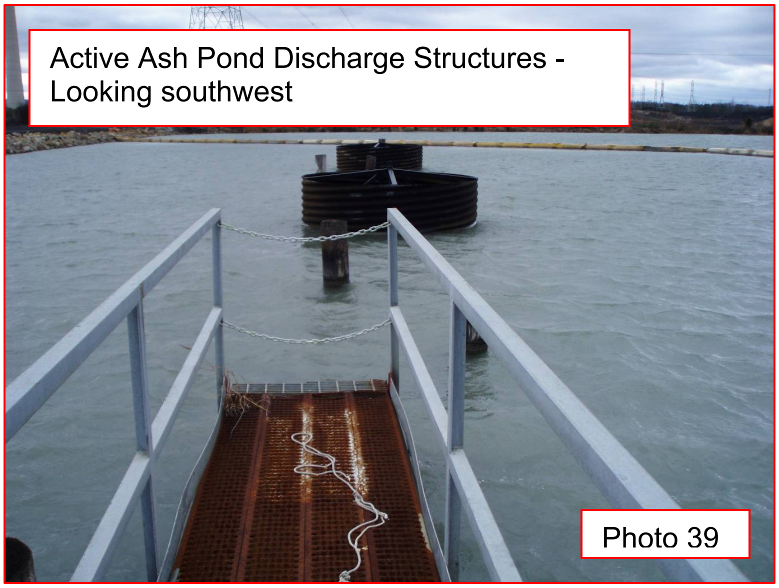

Photo 38

ACTIVE ASH POND (continued)

- **Observations - continued (photos taken on 2/1/08)**
  - Top exterior slopes - little to no vegetation (Photos 41 and 42).
    - Slopes have been seeded numerous times. Material does not support vegetation.

- **Actions Since Last Inspection**
  - Inactive Scrubber Disposal Area being developed as a dredge cell.
  - Gypsum Sluice Line moved out of perimeter ditch.
  - Upper perimeter ditched cleaned out.
  - Deficiencies on Discharge Structure access walkways addressed by removing section of walkway.

- **Recommendations**
  - Utilize Best Management Practices (BMP's) to prevent erosion on top exterior slopes.
  - Continue good maintenance and BMP's for Active Ash Pond Operations.



Active Ash Pond Discharge Structures - Looking southwest

Photo 39

Active Ash Pond Discharge Structures - Looking northeast

Photo 40

ACTIVE ASH POND - photos continued

Ash Pond Top Slopes & Perimeter Ditch - southeast corner looking northwest

Photo 41

Ash Pond Top Slopes & Perimeter Ditch - southeast corner looking southwest

Photo 42

Active Ash Pond Stilling Pond and Pumping Station Pond

- **Location** - Southeast of Active Ash Pond
- **Effluent**
  - Stilling Pond discharges to Pumping Station Pond
  - Pumping Station Pond - pumped to Condenser Cooling Water (CCW) Intake with a portion pumped to wet gypsum system or overflows into outfall 001 into Guntersville Reservoir.
- **Observations (Photos taken on 2/1/08)**
  - Stilling Pond surface had very little ash accumulation (Photo 43).
  - Interior Slopes - Good condition with vegetation.
    - ♦ Pumping Station Pump just has Riprap.
    - ♦ Seepage observed last inspection at the Pumping Station Pond interior slope was not observed. This primarily due to the higher water level in the pumping station pond (Photo 44).
  - Stilling pond discharge Structures - Good condition (Photos 45 and 46)
    - ♦ Only one structure was accessible.
  - Pump Station Pond
    - ♦ Water level higher than last inspection.
    - ♦ Potential project for discharge pipe modification or replacement.

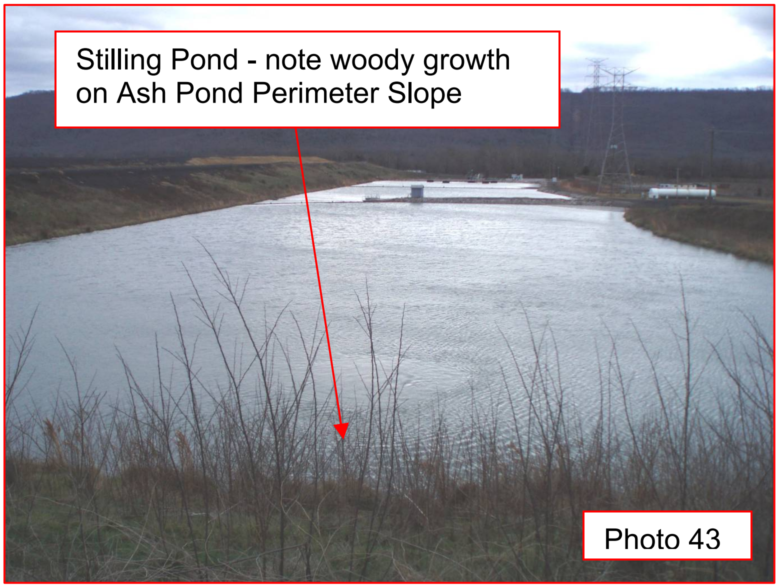

Stilling Pond - note woody growth on Ash Pond Perimeter Slope

Photo 43


Photo 44

Active Ash Pond Stilling Pond and Pumping Station Pond - continued

- **Actions Since Last Inspection**
  - Floating ash observed from last inspection removed.
- **Recommendations**
  - Continue good maintenance and BMP's for Active Ash Stilling Pond operations.
  - Monitor seep in dike between Stilling Pond and Pumping Station Pond. This can only be done when the water level in the Pumping Station Pond is lower.


Ash Pond Stilling Pond Middle Discharge Structure

Photo 45


Ash Pond Stilling Pond to the Northeast Discharge Structures

Photo 46

WIDOWS CREEK FOSSIL PLANT
ANNUAL ASH POND DIKE STABILITY INSPECTION
2008

ACTIVE ASH POND PERIMETER DIKES AND RED WATER POND

- **Location**
  - **Perimeter Dikes -** Borders all sides of the Active Ash Pond and encloses the Chemical Ponds. Runs parallel to Widows Creek on along the North and East side.
  - **Red Water Pond -** Located between the railroad tracks and West Active Ash Pond Perimeter Dike.

- **Effluent -** Surface runoff drains to various locations.
  - A portion of the South dike (starting at the Units 7 and 8 ash trench) and the entire Western dike drain into the Red Water Pond. A perimeter ditch receives run-off from the portion of the South dike and diverts water to the Red Water Pond.
  - Dike surface runoff drains into Widows Creek starting near the North corner of the Active Ash Disposal Area and extending to the South corner of the Ash Pond Area. This is essentially the entire Eastern half of the disposal area and a portion of the Southern side.
  - Surface runoff from the perimeter dike that borders the Stilling Pond flows into the Stilling Pond.
  - Surface runoff of the remaining portion of the South dike, starting at the units 7 and 8 ash trench and ending at the Stilling Pond, drain to constructed wetlands and then to a stilling pond before exiting outfall 005. This is accomplished via a perimeter ditch starting at the units 7 and 8 ash trench.

- **Observations (Photos taken on 2/1/08)**
  - Red Water Pond
    - ♦ Interior Slopes in good condition. Riprap and vegetation covers slopes. One area of erosion noted on west slope last inspection was still present but had not worsened. Woody growth noted on the east side next to the active ash pond (Photo 47).
    - ♦ Pump platform was in satisfactory condition (Photo 48).

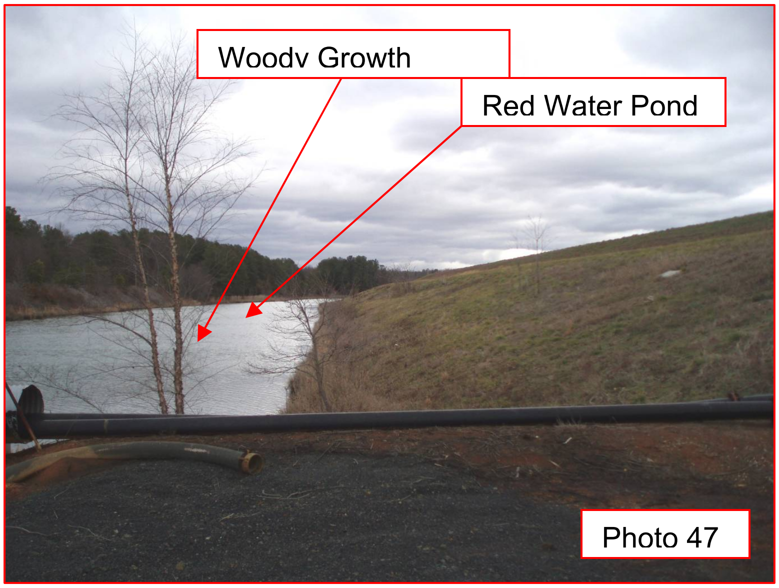


Photo 47

  - Perimeter Dikes generally have good vegetative cover. Some areas of deficiencies were observed.
    - ♦ Erosion observed on Northeast Dike between the bridge over Widows Creek and the southeast corner. This area is approximately 70 feet along the dike extending an average of 50 feet down the slope from the top. (Photo 49).

ACTIVE ASH POND PERIMETER DIKES AND RED WATER POND (continued)

- **Observations (Photos taken on 2/1/08)**
  - Perimeter Dikes -continued
    - Erosion noted last inspection on the northeast dike near southeast corner has been repair but vegetation is sparse. (Photo 50).
    - Animal burrow holes were observed at the northeast corner and North Slope as noted on sketch API2008-1.
    - Damaged manhole for the gypsum stilling pond drain line observed base of the northeast dike (Photo 51).
    - Several wet areas and some rutting was observed on the Northeast perimeter dike slope just south of the bridge accessing the Gypsum disposal area. There is a bench formed in the slope here which the Gypsum Stilling Pond discharge line is buried. The bench flows the slope of the drain line to its discharge point at outfall 008 (Photo 52 & 53). The ruts are most likely due to equipment traffic used for mowing
    - Ruts forming on bench access road on the northwest dike. This serves as the access road to the red water pumping station. Standing water was observed (Photos 54).
    - Mature trees observed on the northwest lower dike to the north and south of the red water pond.
    - Erosion observed at the southwest corner next to the units 1-6 ash pipes. It appears that this was where previous ash pipes were located (Photo 55).


Photo 48


Photo 49

ACTIVE ASH POND PERIMETER DIKES AND RED WATER POND (continued)

- **Observations (Photos taken on 2/1/08)**
  - Perimeter Dikes continued
    - Erosion noted starting at access road from the Stilling Pond and extending approximately 1400 feet west. Starts at the top of the dike and extends down the slope. The paved plant perimeter access road runs parallel to this area (Photos 56 and 57).
    - Some erosion was noted at the top of the perimeter dike next to the Stilling Pond (Photo 58).
    - Woody growth observed on perimeter dike slopes bordering the stilling pond (Photo 58).
  - The red water seepage along the southern dike parallel to the paved plant perimeter access road is still present. In comparison with the last inspection report it hasn't worsened.

Ash Pond Perimeter Dike - northeast side

Photo 50

- **Actions Since Last Inspection**
  - Animal burrow holes at the pump discharge line culverts filled in.
  - Slopes mowed.

- **Recommendations**
  - Monitor erosion at the Red Water Pond interior slope. Notify EDS if erosion worsens. Placement of riprap is the recommended repair but not warranted at this time.
  - Continue maintenance of the dike slopes by mowing annually. This will also inhibit woody growth.

Photo 51

ACTIVE ASH POND PERIMETER DIKES AND RED WATER POND (continued)

- **Recommendations - continued**
  - Repair erosion observed on Northeast Dike between the bridge over Widows Creek and the southeast corner. Place suitable earth material atop of the existing earth material that is not supporting vegetative cover. This material shall then be seeded and mulched so that vegetative cover can be established. Some type of grass matting is recommended for this area. Estimated area to be covered, graded, and seeded - 300 yd^2.
  - Repair damaged manhole for the gypsum stilling pond gravity drain. This is located at the base of the northeast perimeter dike and shown on drawing API08-1.
  - Monitor ruts and wet areas at base of the northeast perimeter dike. This will start at the bridge accessing the gypsum area and extend to where the gypsum stilling pond gravity drain line discharges to the 008 outfall ditch. Area will be assessed next inspection. Recommended repairs in out-years is to fill ruts then seed and mulch. Estimated area to be covered is 30,000 square feet (3,333 square yards).
  - Eradicate animals and fill burrow holes at locations noted on drawing API08-1 (Estimate 9 ft^3 concrete).
  - Remove woody growth along the northwest perimeter dike next to the red water pond.

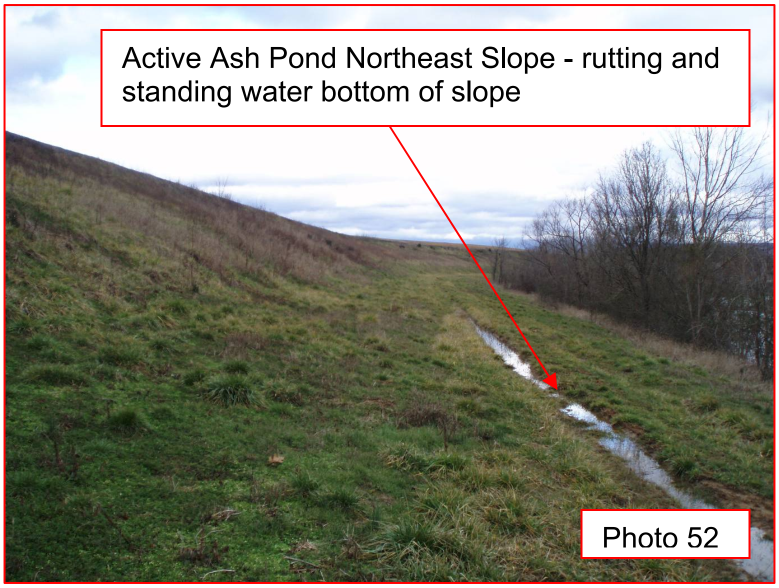

Active Ash Pond Northeast Slope - rutting and standing water bottom of slope

Photo 52


Active Ash Pond Northeast Slope - access to bottom of slope - rutting observed

Photo 53

ACTIVE ASH POND PERIMETER DIKES AND RED WATER POND (continued)

Recommendations - continued

- Ruts forming on bench access road on the northwest dike. This serves as the access road to the red water pumping station. Gravel and re-grade to prevent standing water. This is needed on approximately 2000 feet of the access road (Photo 54).
- Repair Erosion observed at the southwest corner next to the units 1-6 ash pipes (Photo 55). Re-grade, seed, and mulch approximately 3,000 square feet (333 square yards).


Active Ash Pond Northwest Slope - access road to red water pump - rutting observed

Photo 54

- Place suitable earth material atop of the existing earth material that is not supporting vegetative cover on the South perimeter dike. This material shall then be seeded and mulched so that vegetative cover can be established (Photo 56 and 57). Some type of grass matting is recommended for this area. Estimated area to be area to be covered, graded, and seeded - 6500 yd^2. If dirt access road is used in this area surface and gravel. Estimated area is 800 yd^2.
- Monitor the seepage along the South perimeter dike next to the Plant perimeter road. Notify EDS of any changes.
- Remove woody growth along the perimeter dike next to the stilling pond.

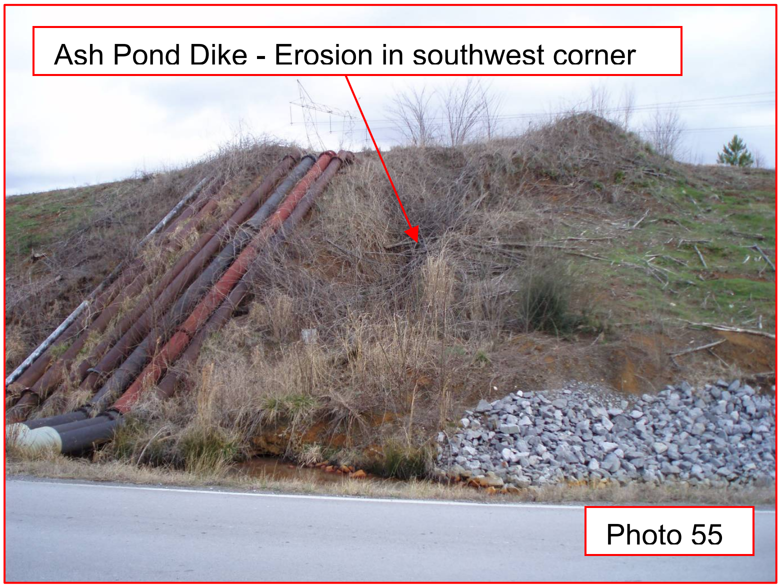

Ash Pond Dike - Erosion in southwest corner

Photo 55

ACTIVE ASH POND PERIMETER DIKES AND RED WATER POND - photos continued

Erosion along South Perimeter Dike - Looking East

Photo 56

Erosion along access road and perimeter dike slope near Ash Pond discharge structures

Photo 57

ACTIVE ASH POND PERIMETER DIKES AND RED WATER POND (continued)

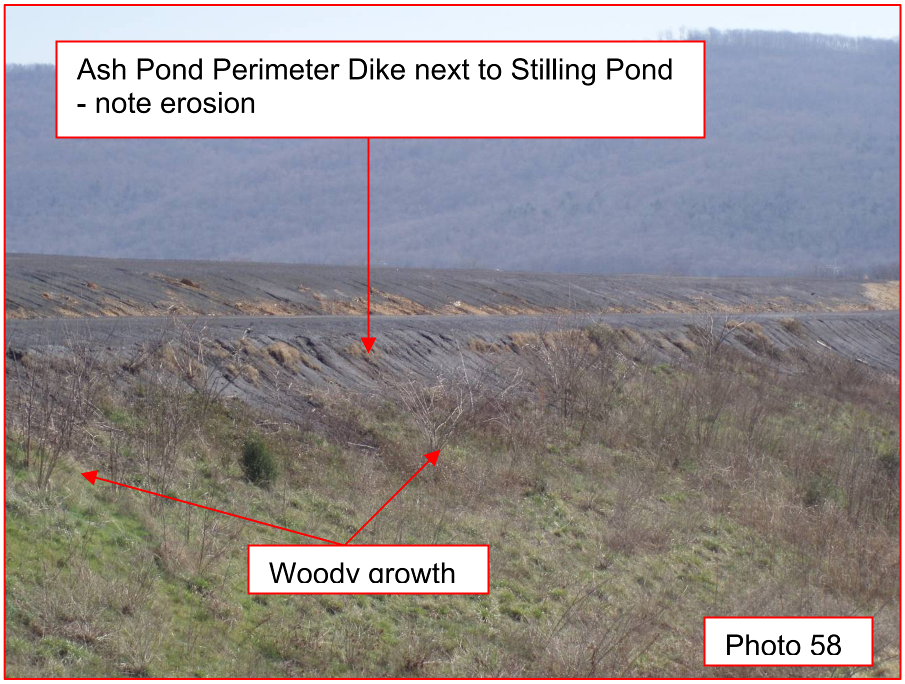


Photo 58

CHEMICAL PONDS

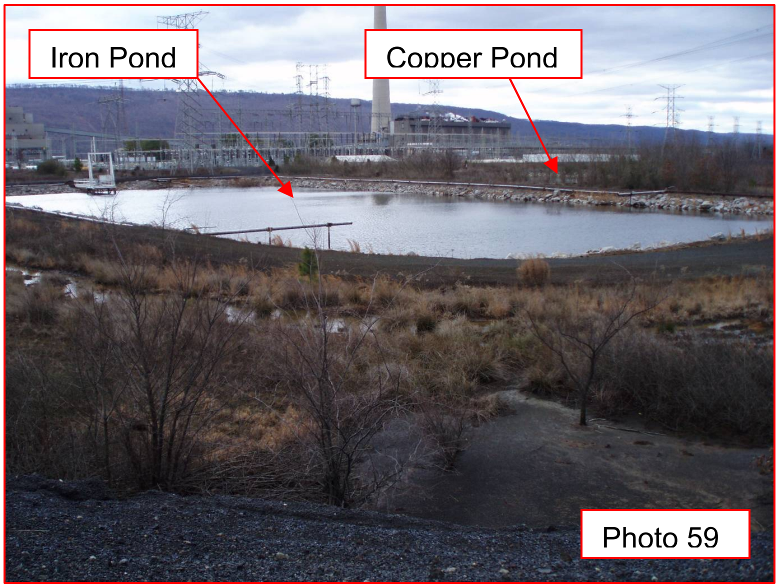


Photo 59

- **Location -** Inside the Ash Pond Perimeter Dikes Northwest of Powerhouse
- **Effluent -** Discharged into Active Ash Pond
- **Observations**
  - Interior slopes - Satisfactory with a few small trees and brush present along the edges of the Copper Pond (Photo 59).
    - Riprap cover in good condition.
  - Ponds are enclosed by perimeter dikes forming a basin
    - Runoff from this area flows through two drainage pipes which penetrate the outside perimeter dike and runs down the slope to the perimeter ditch.
    - Inlet to these two pipes is partially clogged (Photo 60)

CHEMICAL PONDS (continued)

- **Actions Since Previous Inspection**
  - None that inspector is aware of.

- **Recommendations**
  - Unclog drainage pipes and place filter fabric and riprap check dam at entrance point to catch sediment (2 yd^3).
  - Close ponds if they are not used and fill in basin area with bottom ash.

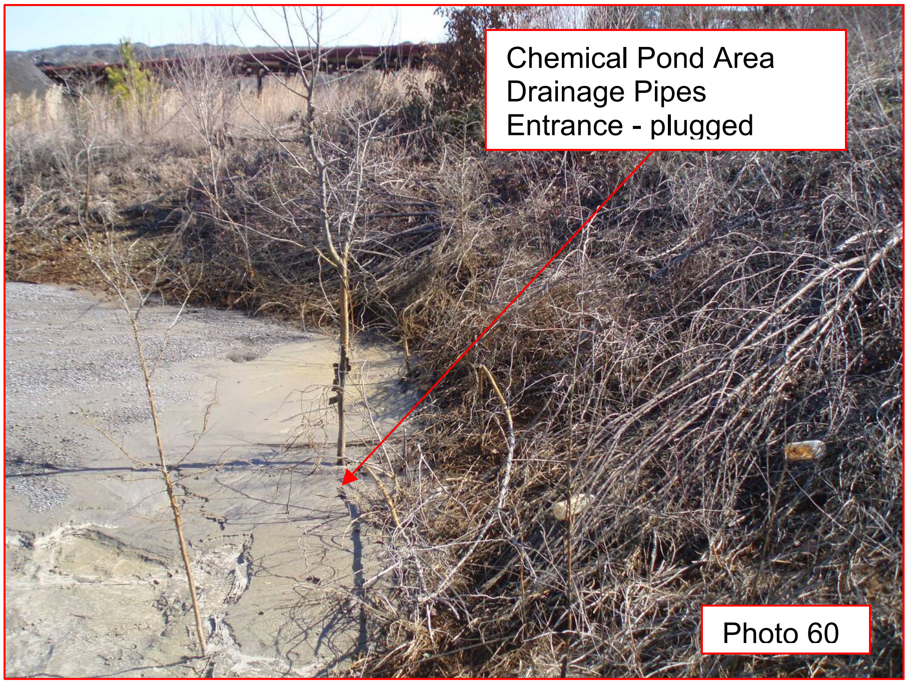
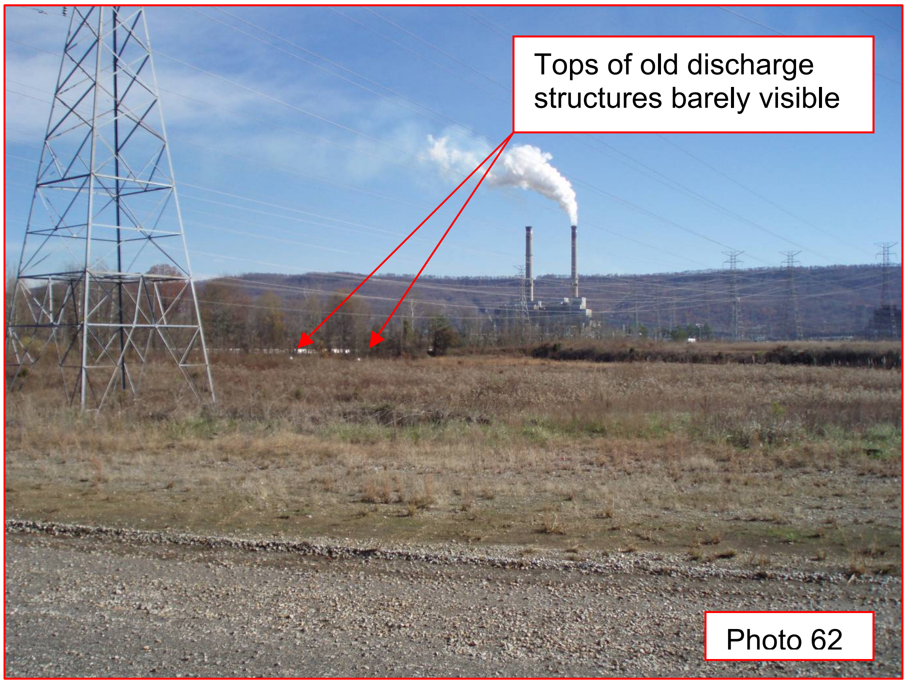

Chemical Pond Area Drainage Pipes Entrance - plugged

Photo 60

ABANDONED ASH DISPOSAL AREA

- **Location -** Inside the Railroad Loop Northwest of Powerhouse
- **Effluent -** Majority of runoff goes to the Red Water Pond
- **Observations**
  - Heavily wooded in areas with thriving vegetation throughout area (Photo 89).
  - Old discharge structures still present (Photos 90)
- **Actions Since Previous Inspection**
  - None that inspector is aware of.
- **Recommendations**
  - None

Photo 61



Tops of old discharge structures barely visible

Photo 62

WIDOWS CREEK FOSSIL PLANT
ANNUAL ASH POND DIKE STABILITY INSPECTION
2008

SUMMARY OF RECOMMENDATIONS

COAL YARD DRAINAGE BASIN

- Monitor the East interior slope. If erosions starts, place suitable earth material on slope prior to seeding and mulching. Notify EDS of any changes.
- Repair pump float switch so that pump can run in automatic mode. If this has been corrected disregard.
- Repair pump platform handrail. Paint platform within next two to three years.
- Clean sediment in retention basin and repair weir.

COAL YARD PERIMETER DITCH

- Continue routine cleaning of the perimeter ditch to allow proper drainage.

LIMESTONE PILE DRAINAGE BASIN

- Continue good management practices utilized in maintaining the Limestone Pile Drainage Basin.
- Clean sediment around inlet. Monitor and clean-out pond as required.

WET GYPSUM STACKING AREA

- Continue operations in accordance with the existing permit requirements.
- Monitor wet area along the Southern lower perimeter dike.
- Remove trees and woody growth from the Southwest lower perimeter dike.
- Repair erosion along gypsum upper perimeter dike slopes on a continuous basis until vegetation is established.
- Rework a portion of the West slope next to the Stilling Pond. Install toe drains as soon as the construction sequencing will allow. This will reduce saturation of the slope toe and will reduce sloughing in this area.
- Re-grade perimeter road surface and stabilize to prevent erosion. This is at the north corner of the stack as shown on drawing API08-2. Estimated Area - 50 yd^2.
- Clean-out all toe drain outlets and verify that there are no obstructions in the lines.
- Uncover bench drain outlets and place rip-rap as required. Several of these outlets were covered.
- Pump the PVC drainage basins/inspection wells for toe drains 11, 12, and 13 toe drains to remove sediment. This may open outlets that were not flowing. This activity must be done in the spring or summer months.
- Engineering Design to develop recommendations to address sloughing along the northwest slope. This will take approximately 100 man-hours ($6,000 - Work Order DCN based on FY2008 rates). In order to limit degradation of this area, improvement should be implemented before next fall.

WET GYPSUM STACKING STILLING POND

- Continue maintenance of the dike slopes by mowing annually. This will also inhibit woody growth.

WIDOWS CREEK FOSSIL PLANT
ANNUAL ASH POND DIKE STABILITY INSPECTION
2008

SUMMARY OF RECOMMENDATIONS (continued)

ACTIVE ASH POND

- Utilize Best Management Practices (BMP's) to prevent erosion on top exterior slopes.
- Continue good maintenance and BMP's for Active Ash Pond Operations.

ACTIVE ASH POND STILLING POND AND PUMPING STATION POND

- Remove floating ash.
- Continue good maintenance and BMP's for Active Ash Stilling Pond operations.
- Monitor seep in dike between Stilling Pond and Pumping Station Pond.

ACTIVE ASH POND PERIMETER DIKES AND RED WATER POND

- Monitor erosion at the Red Water Pond interior slope. Notify EDS if erosion worsens. Placement of riprap is the recommended repair but not warranted at this time.
- Continue maintenance of the dike slopes by mowing annually. This will also inhibit woody growth.
- Repair erosion observed on Northeast Dike between the bridge over Widows Creek and the southeast corner. Place suitable earth material atop of the existing earth material that is not supporting vegetative cover. This material shall then be seeded and mulched so that vegetative cover can be established. Some type of grass matting is recommended for this area. Estimated area to be covered, graded, and seeded - 300 yd^2.
- Repair damaged manhole for the gypsum stilling pond gravity drain. This is located at the base of the northeast perimeter dike and shown on drawing API08-1.
- Monitor ruts and wet areas at base of the northeast perimeter dike. This will start at the bridge accessing the gypsum area and extend to where the gypsum stilling pond gravity drain line discharges to the 008 outfall ditch. Area will be assessed next inspection. Recommended repairs in out-years is to fill ruts then seed and mulch. Estimated area to be covered is 30,000 square feet (3,333 square yards).
- Eradicate animals and fill burrow holes at locations noted on drawing API08-1 (Estimate 9 ft^3 concrete).
- Remove woody growth along the northwest perimeter dike next to the red water pond.
- Ruts forming on bench access road on the northwest dike. This serves as the access road to the red water pumping station. Gravel and re-grade to prevent standing water. This is needed on approximately 2000 feet of the access road (Photo 54).
- Repair Erosion observed at the southwest corner next to the units 1-6 ash pipes (Photo 55). Re-grade, seed, and mulch approximately 3,000 square feet (333 square yards).
- Place suitable earth material atop of the existing earth material that is not supporting vegetative cover on the South perimeter dike. This material shall then be seeded and mulched so that vegetative cover can be established (Photo 56 and 57). Some type of grass matting is recommended for this area. Estimated area to be area to be covered, graded, and seeded - 6500 yd^2. If dirt access road is used in this area surface and gravel. Estimated area is 800 yd^2.
- Monitor the seepage along the South perimeter dike next to the Plant perimeter road. Notify EDS of any changes.
- Remove woody growth along the perimeter dike next to the stilling pond.

SUMMARY OF RECOMMENDATIONS (continued)

CHEMICAL PONDS

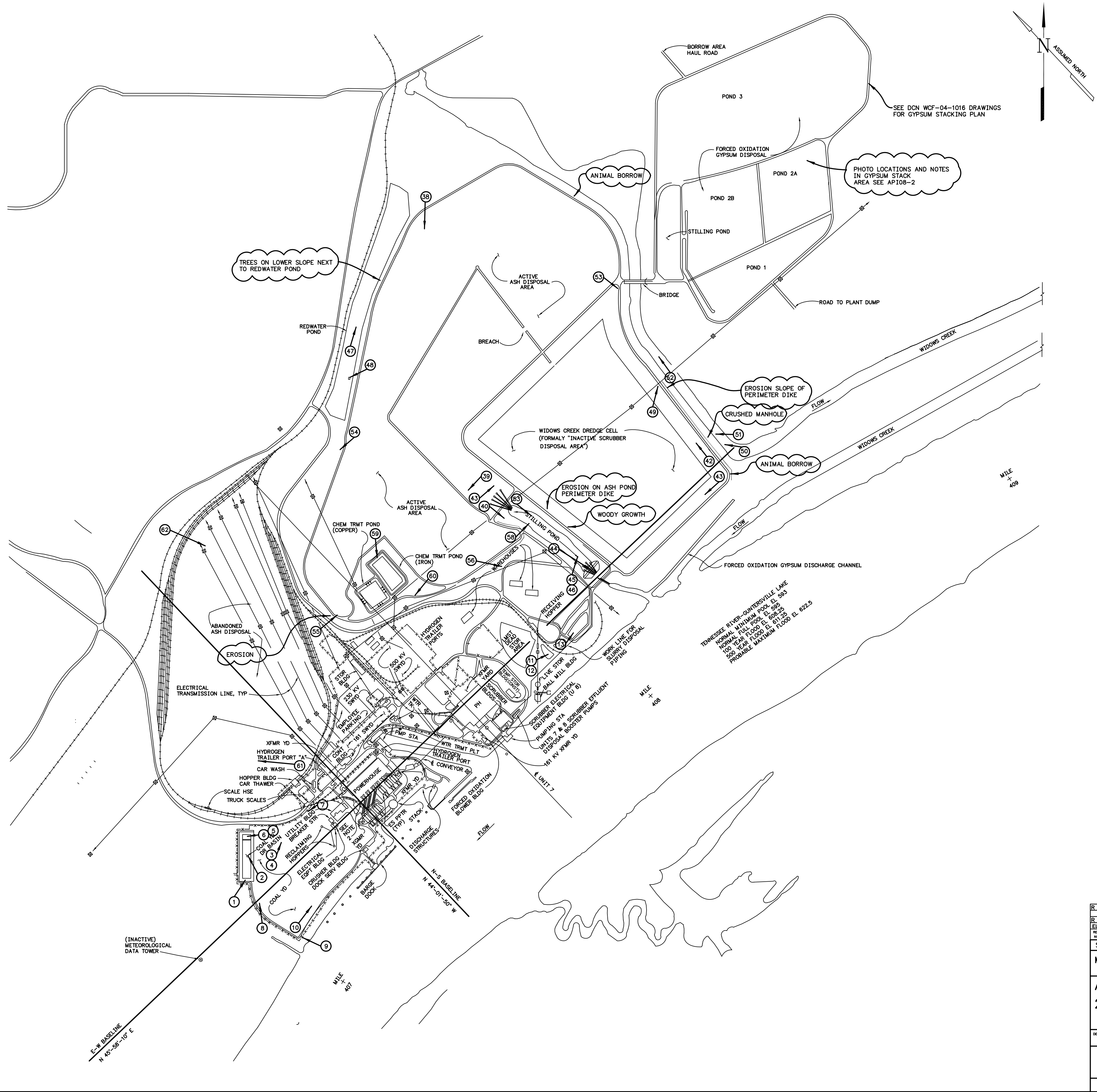
- Unclog drainage pipes and place filter fabric and riprap check dam at entrance point to catch sediment (2 yd^3).
- Close ponds if they are not used and fill in basin area with bottom ash.

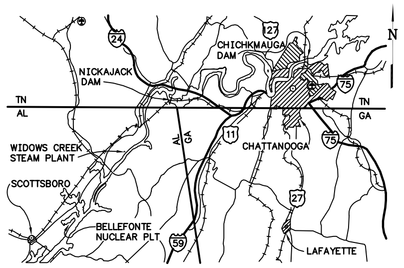
ABANDONED ASH DISPOSAL AREA

- None

TREE REMOVAL PROCEDURE

- Trees growing in the dike should be pulled out by their roots with a chain and a backhoe and the damaged area compacted back in place to repair it. All trees above the toe of the dike should be removed this way. Removing the roots removes a path for water to erode a tunnel through the dike and cause a failure. Cutting trees should be avoided because this leaves the roots in place and will leave a tunnel after the root rots. Trees larger than 3" in diameter at the base should be left in place unless they are in a place critical to dike stability (the toe of the dike and the toe of any slope at a berm). Some species of trees this large have such large root systems removing them would cause more damage than leaving them would. Mowing very small trees while mowing the dikes will not cause future problems and is the best way to control tree growth.





LOCALITY MAP

SCALE 1"=10 MILE

NOTES:

1. TOPOGRAPHY TRACED FROM REDUCED KELSH PLOTTED FROM JUNE 1975 & SEPTEMBER 1975 AERIAL PHOTOGRAPHS AND FROM U.S.G.S.–TVA 7.5 MINUTE QUADRANGLES (DORAN COVE, ALA 95–NE & BRIDGEPORT, ALA 101–NW) ENLARGED.
2. THE ALABAMA STATE RECTANGULAR COORDINATES AT THE INTERSECTION OF THE N–S AND E–W BASELINES ARE NORTH 1,594,497.07 AND EAST 523,231.25.
3. FOR PROPOSED AND TEMPORARY FEATURES SEE DWG 10E202–01.

DIRECTION PHOTO TAKEN

ELECTRONICALLY RESTORED DRAWING

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R											

DISCIPLINE INTERFACE

SCALE: EXCEPT AS NOTED

MAIN PLANT (UNITS 1–8)

ASH DISPOSAL AREA
2008 ASH POND DIKE INSPECTION

DESIGNED BY: DRAWN BY: CHECKED BY: SUPERVISED BY: REVIEWED BY: APPROVED BY: ISSUED BY:

WIDOWS CREEK FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 | DATE 12/17/80 | 34 | C | API08–1 | R

ELECTRONICALLY RESTORED DRAWING
THIS DRAWING HAS BEEN COMPLETELY REDRAWN
AND SUPERSEDES :(10E200–01 R2)

TASK COMPLETED BY: REV NO.

PLOT FACTOR:4800
E_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

NOTES (CONT.):
4. THE FILTER SAND USED IN THE TOE AND SLOPE DRAINS SHALL BE A CLEAN SILICA SAND AND EXHIBIT THE FOLLOWING GRADATION REQUIREMENTS.

U.S. STANDARD SIEVE SIZE	PERCENT PASSING (DRY WEIGHT BASIS)
3/4 INCH	100
3/8 INCH	85 – 100
NO. 4	75 – 95
NO. 8	60 – 85
NO. 16	40 – 65
NO. 20	20 – 55
NO. 40	0 – 25
NO. 50	0 – 15
NO. 60	0 – 5
NO. 100	0 – 2

NOTE: TOE DRAINS INSTALLED IN TOE AND FIRST BENCH AT TIME OF INSPECTION ONLY OUTSIDE TWO PIPES SHOULD BE FLOWING.

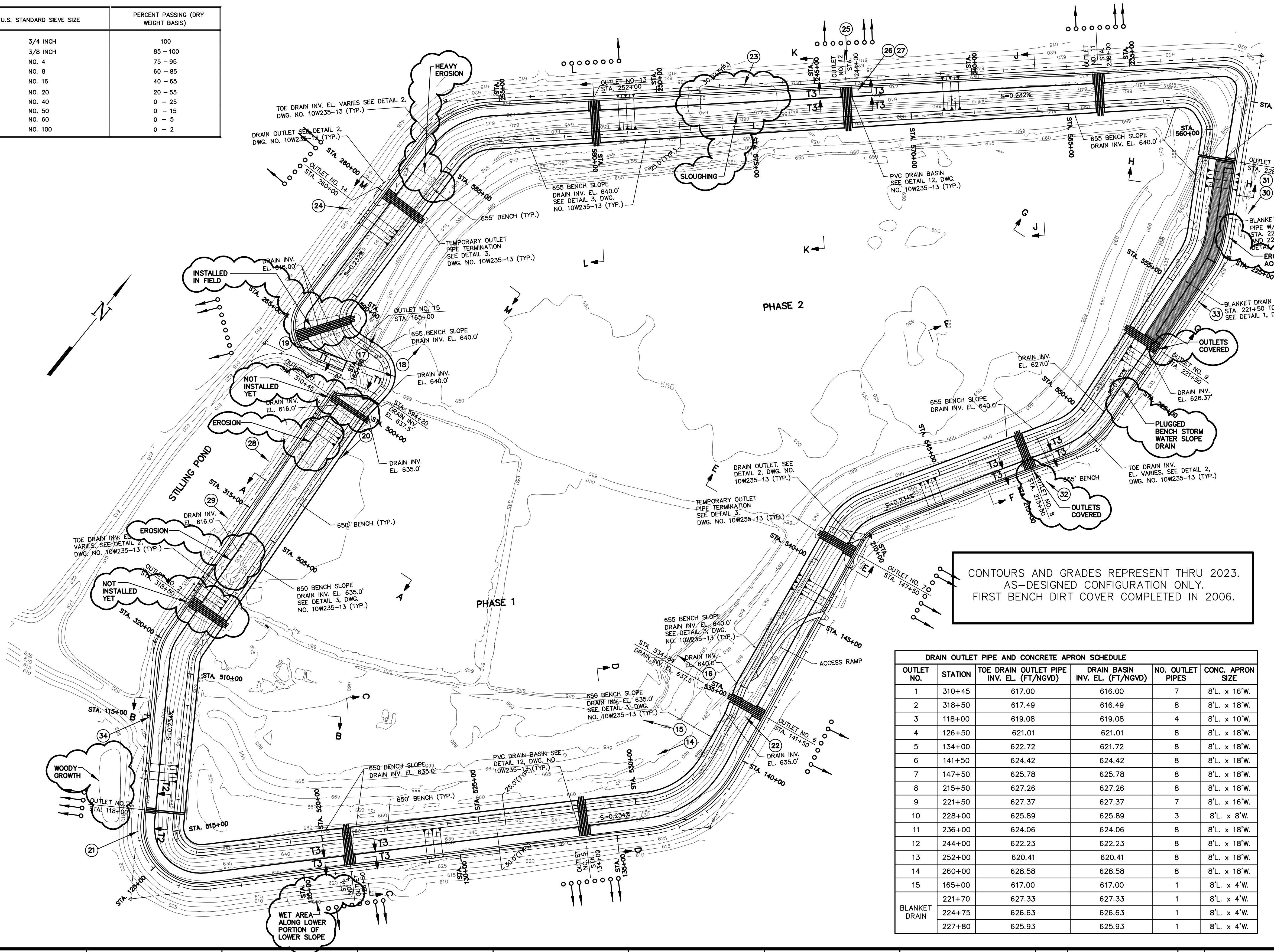
OBSERVATIONS OF TOE DRAIN OUTLETS 2/8/2008

↑ OUTLET FLOWING

○○○○○○○○ TOE DRAIN OUTLETS

←① DIRECTION PHOTO TAKEN IN

FY08 INSPECTION
NOTES FOR FY2008 ASH POND INSPECTION



CONTOURS AND GRADES REPRESENT THRU 2023.
AS-DESIGNED CONFIGURATION ONLY.
FIRST BENCH DIRT COVER COMPLETED IN 2006.

NOTES:

1. THE SEEPAGE COLLECTION DRAIN AND OUTLET PIPE SHALL CONSIST OF 6 INCH DIAMETER SLOTTED AND NON–SLOTTED CORRUGATED HDPE PIPE. THE PIPE AND FITTINGS SHALL MEET OR EXCEED THE REQUIREMENTS OF AASHTO SPECIFICATION M 252 "CORRUGATED POLYETHYLENE DRAINAGE TUBING."

   PERFORATIONS IN THE CORRUGATED HDPE PIPE SHALL CONSIST OF SLOTS CLEANLY CUT AND EVENLY SPACED ALONG 4 LINES AROUND THE PIPE CIRCUMFERENCE AND CENTERED WITHIN THE CORRUGATION VALLEYS ALONG THE LENGTH OF THE PIPE. PERFORATIONS LOCATED IN IMMEDIATELY ADJACENT CORRUGATION VALLEYS SHALL BE OFFSET BY 45 DEGREES. PERFORATIONS SHALL SATISFY THE FOLLOWING CRITERIA:

   SLOT WIDTH (INCHES) Δ 0.125
   SLOT LENGTH (INCHES) Δ 1.0
   PERFORATED AREA (IN^2/FOOT) Φ 4.0

2. THE GEOTEXTILE FILTER SOCK (NOT USED FOR ALTERNATE DRAIN) SHALL BE A MACHINE KNITTED FABRIC ENVELOPE MANUFACTURED TO FIT SNUGLY OVER THE SPECIFIED SEEPAGE COLLECTION DRAIN PIPE. THE GEOTEXTILE FILTER SOCK SHALL BE MANUFACTURED FROM 100 PERCENT POLYESTER OR POLYPROPYLENE WITH A MINIMUM FIBER SIZE OF 100 DENIER PER FILAMENT, BE UNIFORM AND HOMOGENEOUS IN APPEARANCE AND COMPOSITION, AND FREE FROM TEARS, CUTS, THIN SPOTS, OR ANY DEFECTS THAT MAY AFFECT SERVICEABILITY. THE GEOTEXTILE FILTER SOCK SHALL MEET THE FOLLOWING CRITERIA.

PROPERTY	UNITS	TEST METHOD	CRITERION
MASS PER UNIT AREA	OZ/YD^2	ASTM D 5261	> 6
APPARENT OPENING SIZE	USSS**	ASTM D 4751	> 40
MULLENBURST STRENGTH	PSI	ASTM D 3786	>135
PERMEABILITY TO WATER	CM/SEC	ASTM D 4491	> 02
**UNITED STATES STANDARD SIEVE SIZE			

3. THE GEOTEXTILE INDICATED ON THE DRAWINGS SHALL CONSIST OF A NON– WOVEN, NEEDLE PUNCHED FABRIC MANUFACTURED FROM 100 PERCENT POLYESTER OR 100 PERCENT POLYPROPYLENE. THE GEOTEXTILE SHALL BE UNIFORM AND HOMOGENEOUS IN APPEARANCE AND COMPOSITION, AND FREE FROM TEARS, CUTS, THIN SPOTS, OR ANY DEFECTS THAT MAY AFFECT SERVICEABILITY. THE GEOTEXTILE SHALL MEET THE FOLLOWING CRITERIA.

PROPERTY	UNITS	TEST METHOD	CRITERION
MASS PER UNIT AREA	OZ/YD^2	ASTM D 5261	>10
APPARENT OPENING SIZE	USSS**	ASTM D 4751	>100
GRAB TENSILE STRENGTH*	LBS	ASTM D 4632	>245
GRAB ELONGATION*	%	ASTM D 4632	>50
TRAPEZOIDAL TEAR STRENGTH*	LBS	ASTM D 4533	>95
PUNCTURE RESISTANCE	LBS	ASTM D 4833	>120
PERMEABILITY TO WATER	CM/SEC	ASTM D 4491	>0.2

* MACHINE AND TRANSVERSE DIRECTIONS.
**UNITED STATES STANDARD SIEVE SIZE

DRAIN OUTLET PIPE AND CONCRETE APRON SCHEDULE

OUTLET NO.	STATION	TOE DRAIN OUTLET PIPE INV. EL. (FT/NGVD)	DRAIN BASIN INV. EL. (FT/NGVD)	NO. OUTLET PIPES	CONC. APRON SIZE
1	310+45	617.00	616.00	7	8'L. x 16'W.
2	318+50	617.49	616.49	8	8'L. x 18'W.
3	118+00	619.08	619.08	4	8'L. x 10'W.
4	126+50	621.01	621.01	8	8'L. x 18'W.
5	134+00	622.72	621.72	8	8'L. x 18'W.
6	141+50	624.42	624.42	8	8'L. x 18'W.
7	147+50	625.78	625.78	8	8'L. x 18'W.
8	215+50	627.26	627.26	8	8'L. x 18'W.
9	221+50	627.37	627.37	7	8'L. x 16'W.
10	228+00	625.89	625.89	3	8'L. x 8'W.
11	236+00	624.06	624.06	8	8'L. x 18'W.
12	244+00	622.23	622.23	8	8'L. x 18'W.
13	252+00	620.41	620.41	8	8'L. x 18'W.
14	260+00	628.58	628.58	8	8'L. x 18'W.
15	165+00	617.00	617.00	1	8'L. x 4'W.
BLANKET DRAIN	221+70	627.33	627.33	1	8'L. x 4'W.
	224+75	626.63	626.63	1	8'L. x 4'W.
	227+80	625.93	625.93	1	8'L. x 4'W.

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R 0											

DISCIPLINE INTERFACE
1
2
3
4

SCALE: 1"=100' EXCEPT AS NOTED

YARD
UNITS 7 & 8

FORCED OXIDATION GYPSUM STACKING
PHASE 1 & 2 – TOP DRAIN, 650/655
BENCH DRAIN AND OUTLET PIPES

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:

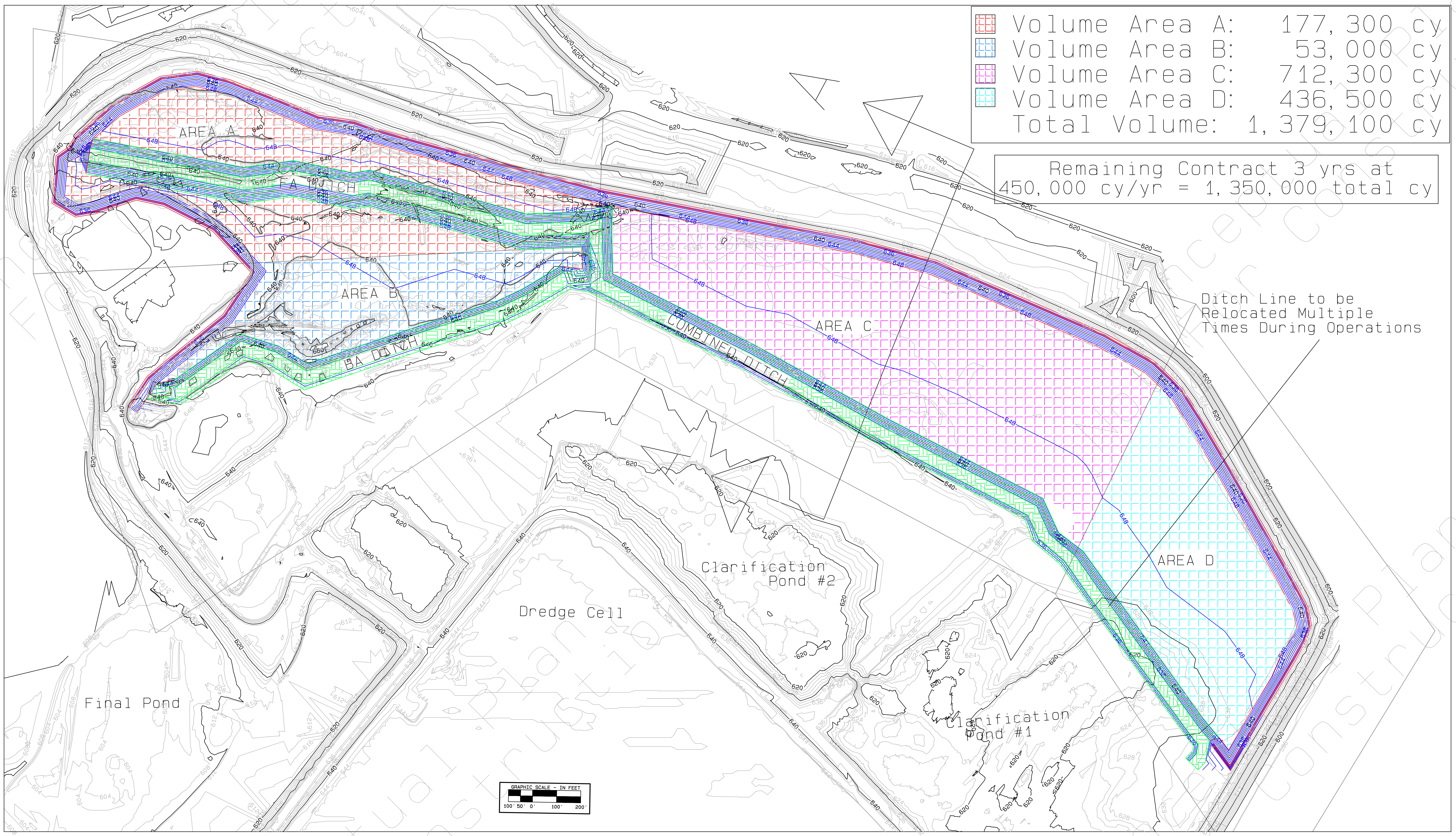
WIDOWS CREEK FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2K	DATE	34	C	API08–2	R 0

TASK COMPLETED BY:	REV NO.

PLOT FACTOR:120
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

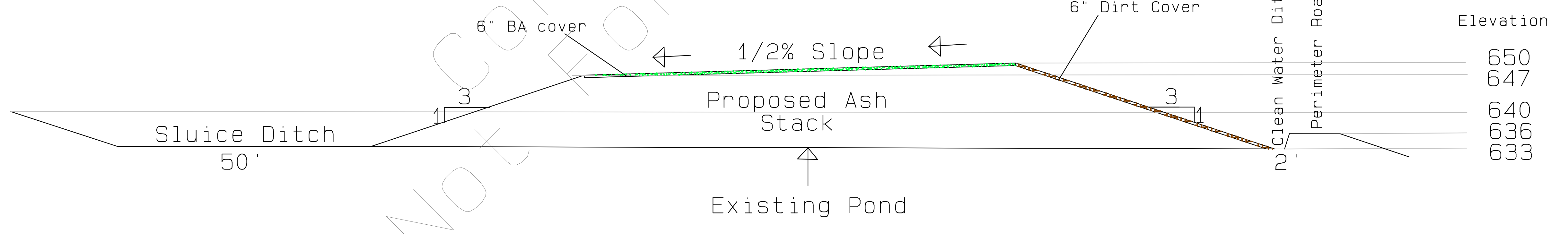


▦	Volume Area A:	177,300 cy
▦	Volume Area B:	53,000 cy
▦	Volume Area C:	712,300 cy
▦	Volume Area D:	436,500 cy
	Total Volume:	1,379,100 cy

Remaining Contract 3 yrs at
450,000 cy/yr = 1,350,000 total cy

Ditch Line to be
Relocated Multiple
Times During Operations

AA Typical Crossection
NTS'



Title / Owner:
Widows Creek - Stack Plan
TVA

Dates:
Original Drawing 1-20-09
Revisions

Original Survey 10-28-08
Final Survey NA

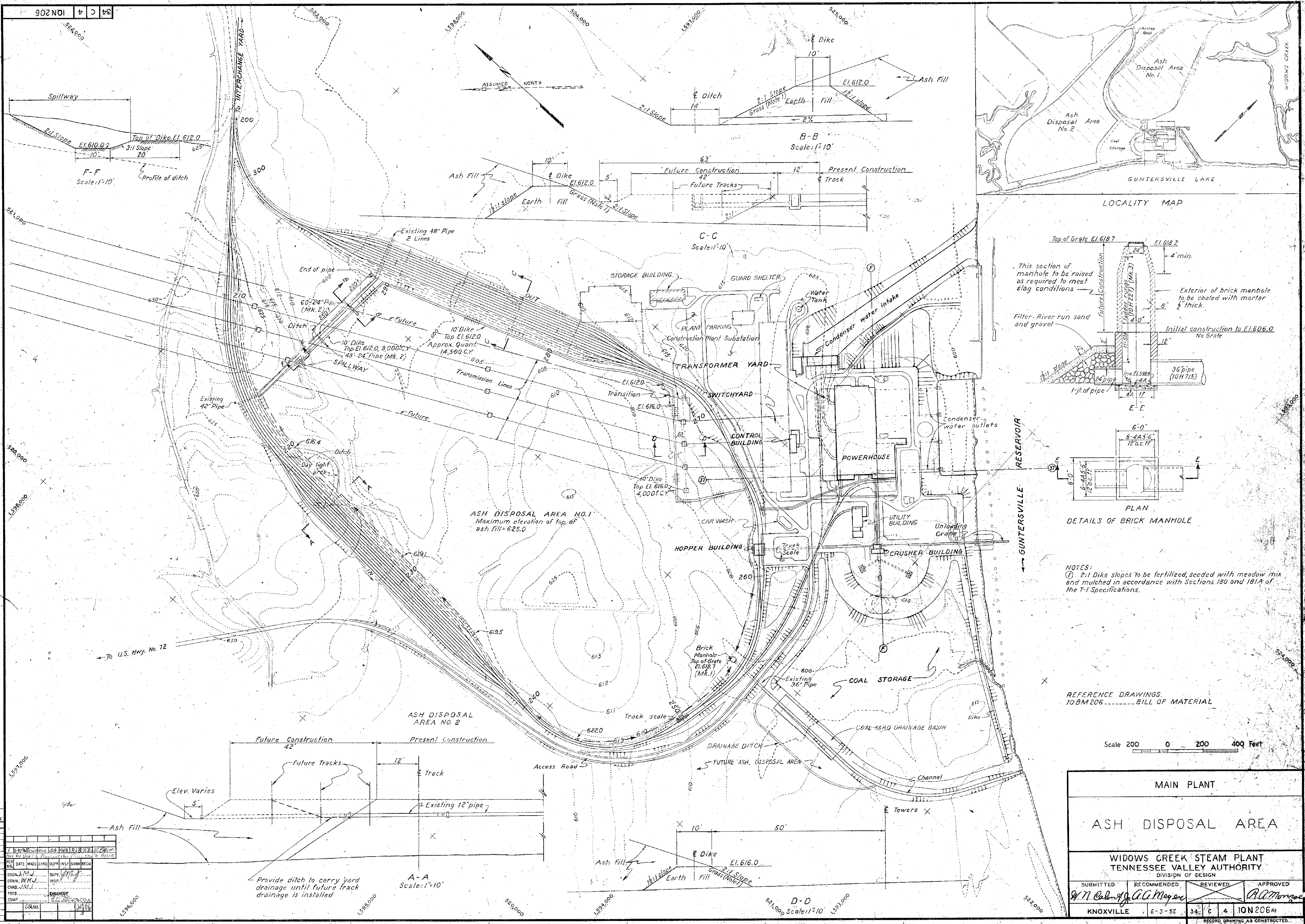
Scale:
1" = 200'

Plan View

Drawn By: Michael Gerbus
Checked By: David Stenger
Approved By:

Drawn By:
TRANS ASH
617 SHEPHERD DR.
CINCINNATI, OHIO 45215
Phone 513-733-4770 Fax: 513-554-6147

Sheet:
1 of 1



DETAILS OF BRICK MANHOLE

NOTES:
① 2:1 Dike slopes to be fertilized, seeded with meadow mix and mulched in accordance with Sections 180 and 181A of the T-1 Specifications.

REFERENCE DRAWINGS.
10BM206 .... BILL OF MATERIAL

Scale 200 0 200 400 Feet

MAIN PLANT

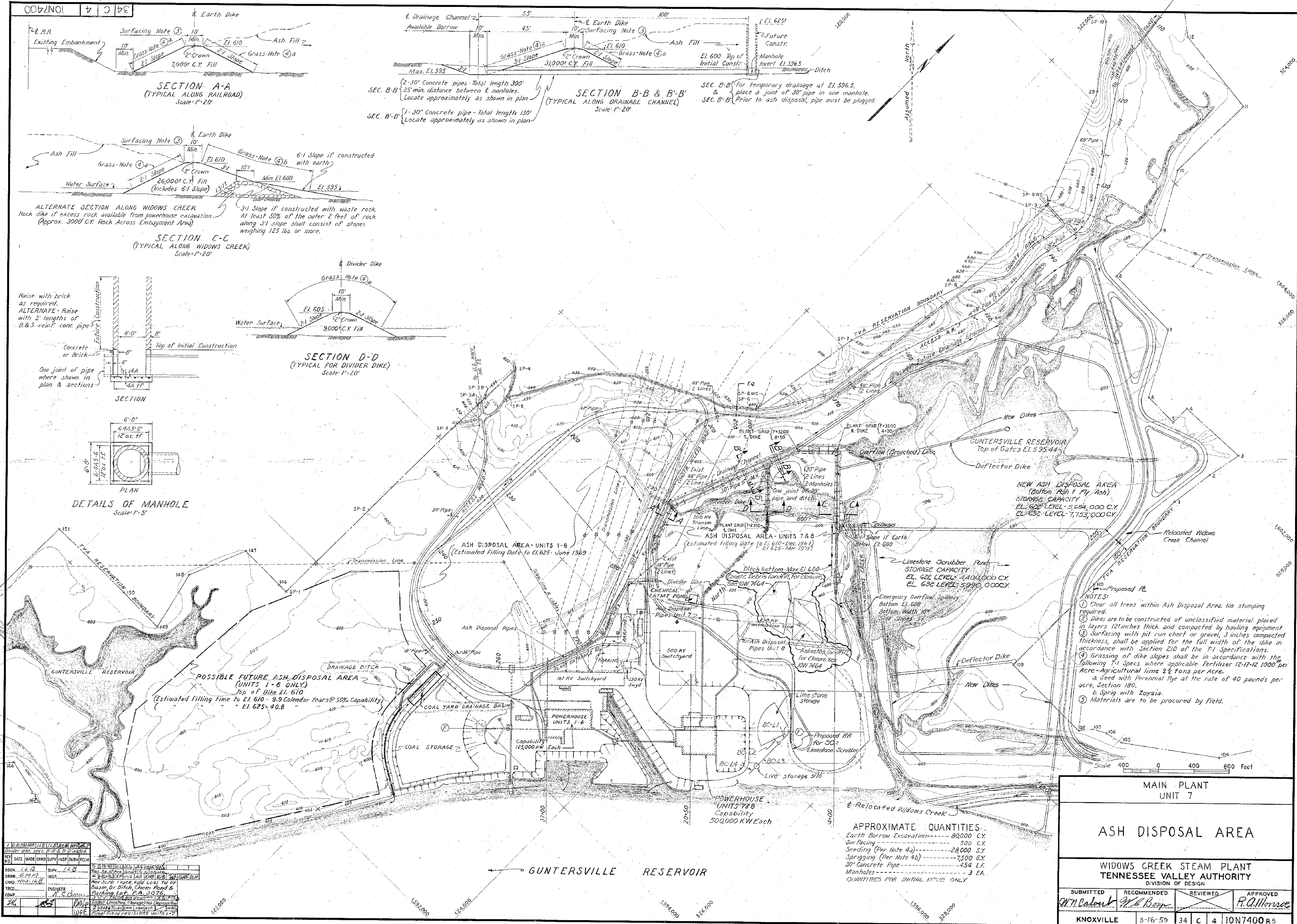
ASH DISPOSAL AREA

WIDOWS CREEK STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF DESIGN

SUBMITTED	RECOMMENDED	REVIEWED	APPROVED
W. N. Calen Jr.	A. A. Meyer		R. A. Monroe
KNOXVILLE	6-3-52	34 C 4	10N206 R1

RECORD DRAWING AS CONSTRUCTED
R1

WCF-10N206-SHT -REV 1 (38% of Scale); ash pond figures; 11-5-2009 14-45-48; 11/5/2009 02:49 PM



NOTES:

① Clear all trees within Ash Disposal Area. No stumping required.

② Dikes are to be constructed of unclassified material placed in layers 12± inches thick and compacted by hauling equipment

③ Surfacing with pit run chert or gravel, 3 inches compacted thickness, shall be applied for the full width of the dike in accordance with Section 210 of the T-1 Specifications.

④ Grassing of dike slopes shall be in accordance with the following T-1 Specs. where applicable. Fertilizer 12-12-12 1000# per Acre - Agricultural lime 2½ tons per Acre.

a. Seed with Perennial Rye at the rate of 40 pounds per acre, Section 180.

b. Sprig with Zoysia.

⑤ Materials are to be procured by field.

APPROXIMATE QUANTITIES

Earth Borrow Excavation	80,000	C.Y.
Surfacing	500	C.Y.
Seeding (Per Note 4a)	28,000	S.Y.
Sprigging (Per Note 4b)	7,500	S.Y.
30" Concrete Pipe	454	L.F.
Manholes	3	EA.

QUANTITIES FOR INITIAL ISSUE ONLY

MAIN PLANT
UNIT 7

ASH DISPOSAL AREA

WIDOWS CREEK STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF DESIGN

SUBMITTED	RECOMMENDED	REVIEWED	APPROVED
W N Calvert	W C Boop		R. A. Monroe

KNOXVILLE	3-16-59	34	C	4	10N7400 R5

RECORD DRAWING AS CONSTRUCTED
4-26-66 9-26-60

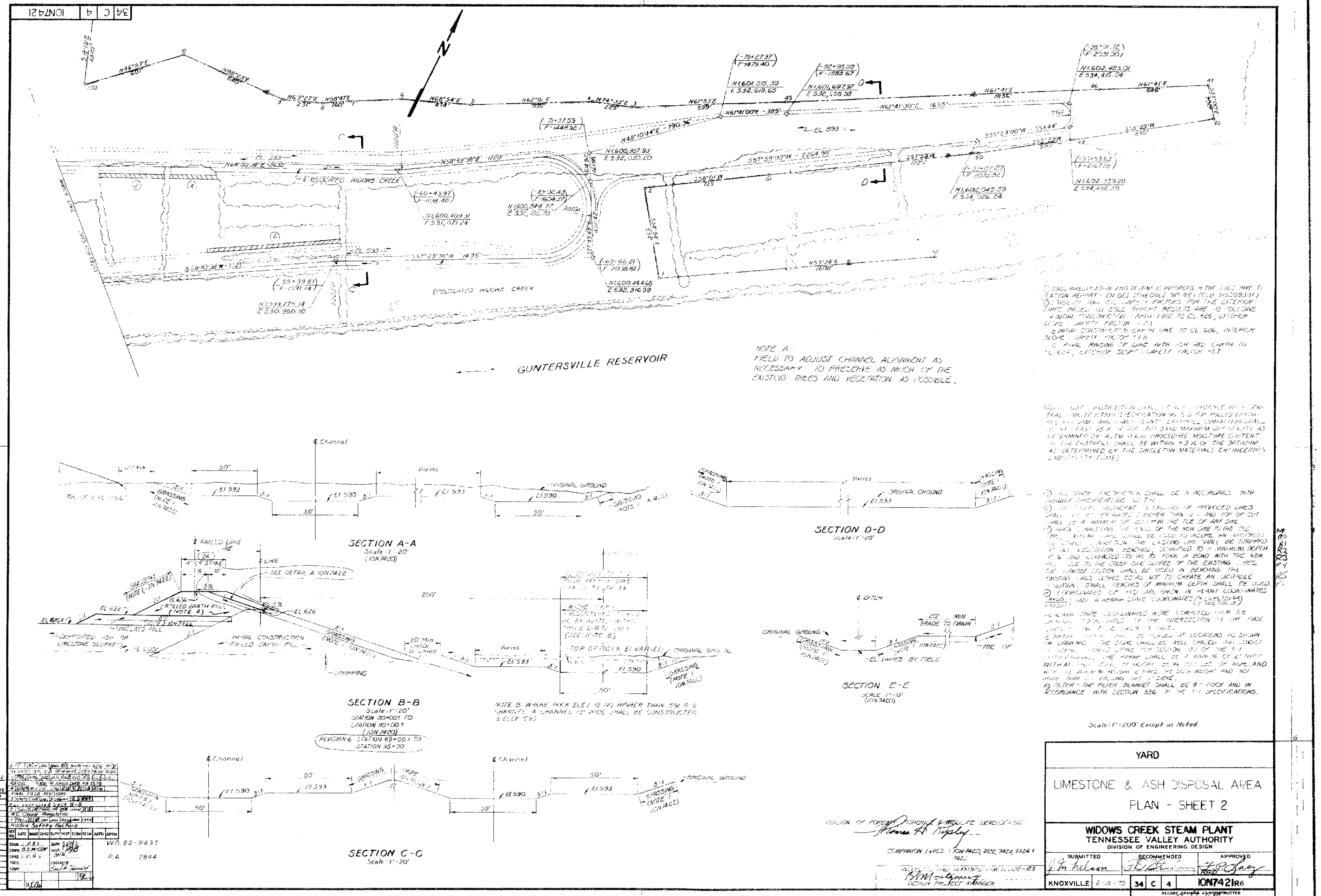
REV NO.	DATE	MADE	CHKD	SUPV	INSP	SUBM	RECM		
5	9-19-93	GCL	JLG	JLG	KWB	RGA			
Rev to show landfill closure									
4	8-26-76	CEP	JLG	JLG	KWB	RJB		GLB	BSM
Rev Scrb Track, Add Coal Yd Dr Basin, Dr Ditch, Chem Pond & Parking Lot. P.A. 3076.									
3	12-2-75	CDR		PDH					
Added Limestone Storage/Ash Disposal Area									
2	12-18-63	LBC	GMM		RCB		WHG		
Final Field revisions Units 1-7									
1	6-10-59	GMM	ILB	ILB	RCB	WHG			
Divider dike, secs. B'-B' & D-D' added.									

DSGN ILB
DRWN GMM
CHKD WHJ-ILB
TRCD
COMP
SUPV ILB
INSP
ENGINEER R. C. Barnes

WFE

① ② ③ ④ ⑤ ⑥

AG AG



NOTE A:
FIELD TO ADJUST CHANNEL ALIGNMENT AS NECESSARY TO PRESERVE AS MUCH OF THE EXISTING TREES AND VEGETATION AS POSSIBLE.

NOTE B: WHERE ROCK ELEV IS NO HIGHER THAN 591 @ ℄ CHANNEL A CHANNEL 12' WIDE SHALL BE CONSTRUCTED.

① SOILS INVESTIGATION AND TESTING IS RECORDED IN THE SOILS INVESTIGATION REPORT - EN DES SCHEDULE NO 85 (C.L.B. 310209391)
② STABILITY AND SOIL SAFETY FACTORS FOR THE EXTERIOR DIKES BASED ON SOILS REPORT RESULTS ARE AS FOLLOWS
A INITIAL CONSTRUCTION EARTH DIKE TO EL 626, EXTERIOR SLOPE SAFETY FACTOR = 2.1
B INITIAL CONSTRUCTION EARTH DIKE TO EL 626, INTERIOR SLOPE SAFETY FACTOR = 1.8
C FINAL RAISING OF DIKE WITH ASH AND EARTH TO EL 65[illegible], EXTERIOR SLOPE SAFETY FACTOR = 1.7

③ [illegible] DIKE CONSTRUCTION SHALL BE IN ACCORDANCE WITH GENERAL CONSTRUCTION SPECIFICATION NO G-9 FOR ROLLED EARTH FILL FOR DAMS AND POWER PLANT EARTHFILL COMPACTION SHALL BE AT LEAST 95% OF THE STANDARD MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D 698 PROCEDURE. MOISTURE CONTENT OF THE EARTHFILL SHALL BE WITHIN ± 3% OF THE OPTIMUM AS DETERMINED BY THE SINGLETON MATERIALS ENGINEERING LABORATORY (SMEL)

④ ALL OTHER CONSTRUCTION SHALL BE IN ACCORDANCE WITH [illegible] SPECIFICATIONS NO T-1.
⑤ [illegible] ADJACENT TO EXISTING OR PROPOSED DIKES SHALL NOT BE EXCAVATED STEEPER THAN 3:1 AND TOP OF CUT SHALL BE A MINIMUM OF [illegible] FROM THE TOE OF ANY DIKE.
⑥ WHEN CONNECTING THE ENDS OF THE NEW DIKE TO THE OLD DIKE, [illegible] SHALL BE USED TO INSURE AN [illegible] CONNECTION. THE EXISTING DIKE SHALL BE STRIPPED OF ALL VEGETATION, BENCHED, SCARIFIED TO A MINIMUM DEPTH OF 6" AND COMPACTED SO AS TO FORM A BOND WITH THE NEW FILL. DUE TO THE STEEP SIDE SLOPES OF THE EXISTING DIKES, THE UTMOST CAUTION SHALL BE USED IN BENCHING THE EXISTING DIKES SLOPES SO AS NOT TO CREATE AN UNSTABLE CONDITION. SMALL BENCHES OF MINIMUM DEPTH SHALL BE USED.
⑦ COORDINATES OF [illegible] ARE GIVEN IN PLANT COORDINATES [illegible] AND ALABAMA STATE COORDINATES [illegible]
ALABAMA STATE COORDINATES WERE COMPUTED FROM THE [illegible] OF THE INTERSECTION OF THE BASE LINES [illegible]
⑧ RIPRAP [illegible] SHALL BE PLACED AT LOCATIONS AS SHOWN ON DRAWINGS. THE STONE SHALL BE WELL GRADED AND CONSIST OF [illegible] STONE PER SECTION [illegible] OF THE T-1 [illegible]. THE RIPRAP SHALL BE A MINIMUM OF [illegible] THICK WITH AT [illegible] BY WEIGHT [illegible] LBS. OR MORE, AND [illegible] THE 50% WEIGHT AND NOT MORE THAN [illegible] PASSING THE [illegible] SIEVE.
⑩ FILTER - THE FILTER BLANKET SHALL BE 8" THICK AND IN ACCORDANCE WITH SECTION 536 OF THE T-1 SPECIFICATIONS.

Scale: 1"=200' Except as Noted

YARD

LIMESTONE & ASH DISPOSAL AREA
PLAN - SHEET 2

WIDOWS CREEK STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
J. M. Nelson		F. P. Lacy

KNOXVILLE 2-15-73 34 C 4 10N7421R6

RECORD DRAWING AS CONSTRUCTED
C. Rifflin
R3-10-31-73

W.O. 82-31635
P.A. 2844

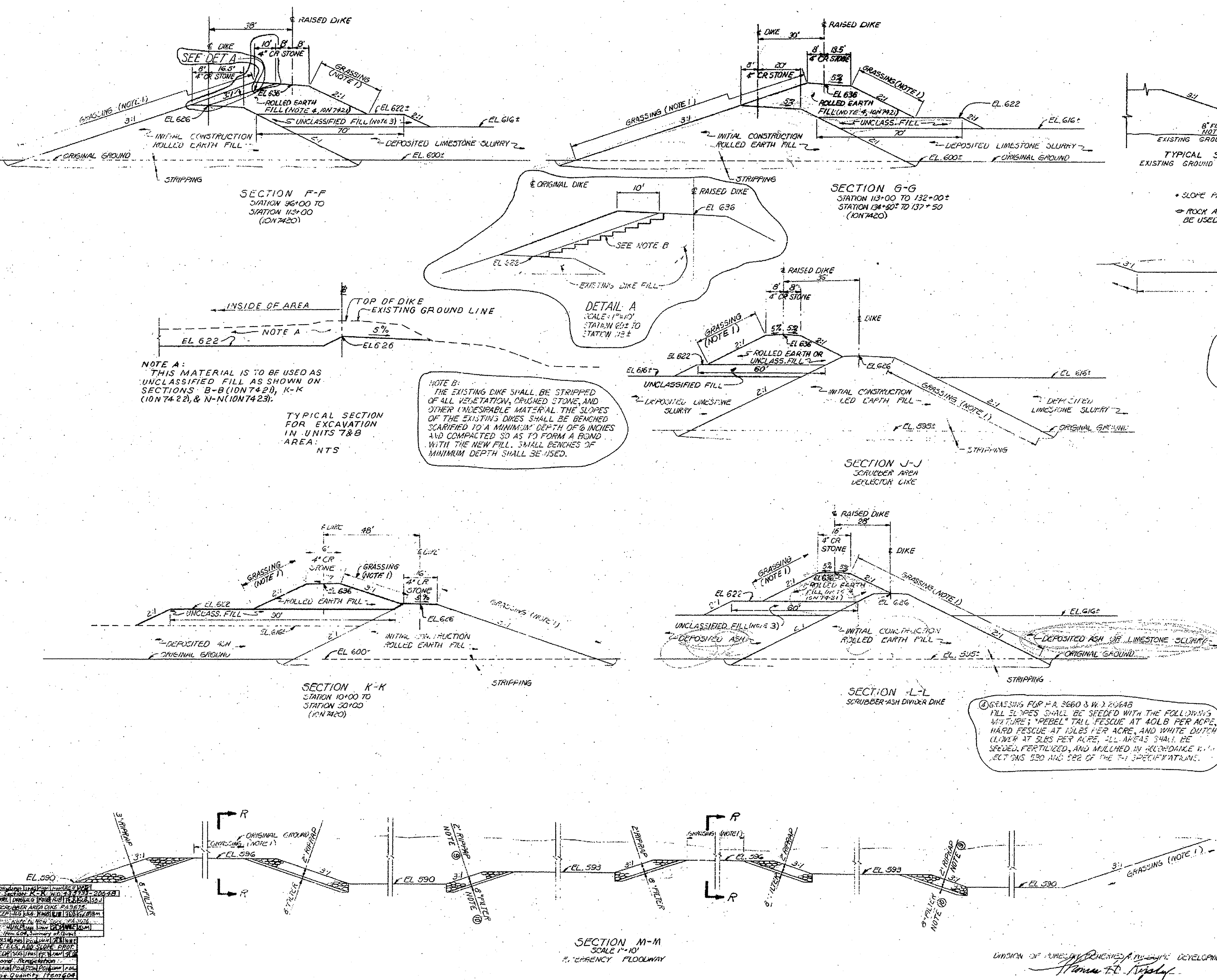
PHOTOGRAPHED
IN KNOXVILLE

30X

10497

20117 R3

34 C 4 10N7422

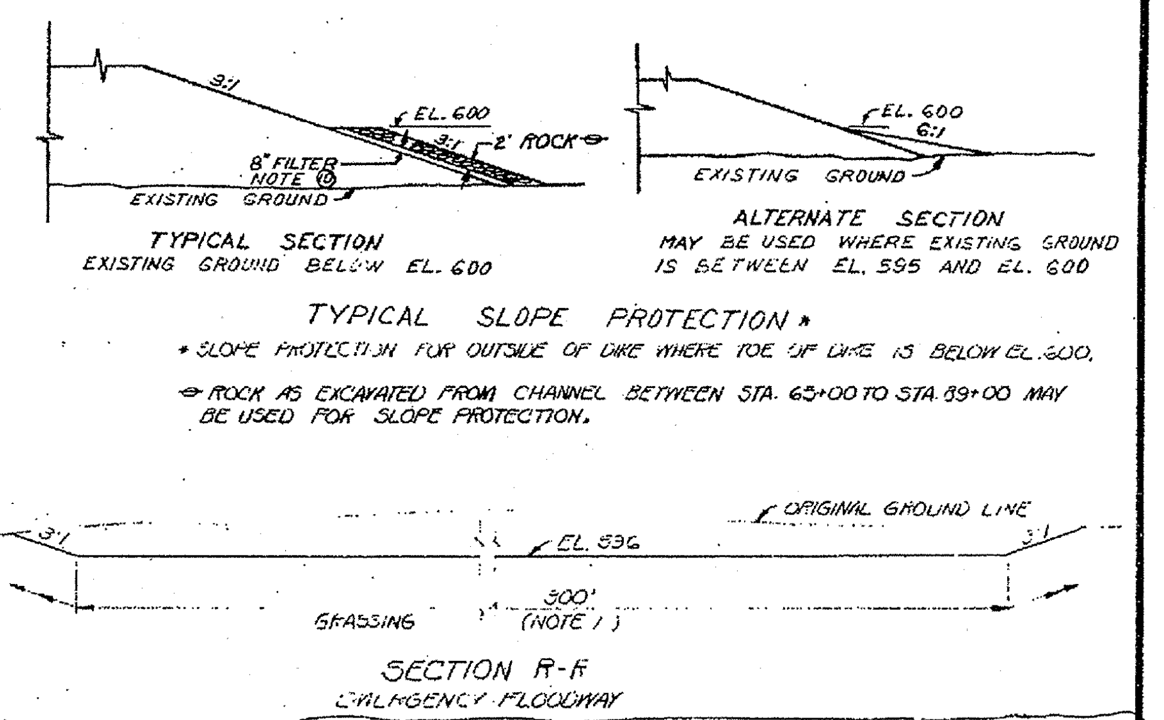


NOTE A:
THIS MATERIAL IS TO BE USED AS UNCLASSIFIED FILL AS SHOWN ON SECTIONS B-B (10N7421), K-K (10N7422), & N-N (10N7423).

TYPICAL SECTION FOR EXCAVATION IN UNITS 7&8 AREA:
NTS

NOTE B:
THE EXISTING DIKE SHALL BE STRIPPED OF ALL VEGETATION, CRUSHED STONE, AND OTHER UNDESIRABLE MATERIAL. THE SLOPES OF THE EXISTING DIKES SHALL BE BENCHED SCARIFIED TO A MINIMUM DEPTH OF 6 INCHES AND COMPACTED SO AS TO FORM A BOND WITH THE NEW FILL. SMALL BENCHES OF MINIMUM DEPTH SHALL BE USED.

④ GRASSING FOR P.A. 3660 & W.O. 20648
FILL SLOPES SHALL BE SEEDED WITH THE FOLLOWING MIXTURE; "REBEL" TALL FESCUE AT 40LB PER ACRE, HARD FESCUE AT 15LBS PER ACRE, AND WHITE DUTCH CLOVER AT 5LBS PER ACRE. ALL AREAS SHALL BE SEEDED, FERTILIZED, AND MULCHED IN ACCORDANCE WITH SECTIONS 530 AND 582 OF THE T-1 SPECIFICATIONS.



TYPICAL SECTION
EXISTING GROUND BELOW EL. 600

ALTERNATE SECTION
MAY BE USED WHERE EXISTING GROUND IS BETWEEN EL. 595 AND EL. 600

TYPICAL SLOPE PROTECTION *
- SLOPE PROTECTION FOR OUTSIDE OF DIKE WHERE TOE OF DIKE IS BELOW EL. 600.
- ROCK AS EXCAVATED FROM CHANNEL BETWEEN STA. 65+00 TO STA. 89+00 MAY BE USED FOR SLOPE PROTECTION.

SECTION R-R
EMERGENCY FLOODWAY

QUANTITIES FOR P.A. 3660			
123	EARTH BORROW	9,100CY	
305	CRUSHED STONE SURFACING	305 TN	
580 & 582	SEEDING & MULCHING	15,000CY	

SUMMARY OF QUANTITIES

ITEM NO.	DESCRIPTION	QUANTITY	QUANTITY (PA 3575)
101	CLEARING	235 AC.	
120	CHANNEL EXCAVATION	1,050,000CY	
	UNCLASSIFIED FILL WO #435733-20648		160,000CY.
123	EARTH BORROW	1,000,600CY	230,000 C.Y
129	STRUCTURAL EXCAVATION	1,700 C.Y.	
180	GRASSING	330,000S.Y.	75,000 S.Y.
210	SURFACING (4" CRUSHED STONE)	7,100 TONS	4,600 TONS
481 & 491	18" PIPE (14 GAGE) 24" PIPE (14 GAGE)		108 LF 1?? LF
401	CLASS A CONCRETE (ENDWALL)	24 C.Y.	
418	REINFORCING	240 LBS.	
830	RIPRAP	3630 C.Y	
836	FILTER	1000 TONS	
FOR BILL OF MATERIALS FOR SPILLWAYS SEE DWG. 10N7424			

NOTES.

① GRASSING: FOR GRASSING FOR P.A. 3660 & WO NO 20648 SEE NOTE 4.
A. ALL DIKE SLOPES SHALL BE SEEDED WITH TYPE 6 MIXTURE E AND FERTILIZED IN ACCORDANCE WITH SECTION 180 OF THE T-1 SPECIFICATIONS.
B. THE EMERGENCY FLOODWAY (SECTIONS M-M & R-R) SHALL BE SEEDED WITH 14 POUNDS OF BERMUDA GRASS (HULLED) AND 7 POUNDS OF ANNUAL LESPEDEZA PER ACRE AND FERTILIZED IN ACCORDANCE WITH THE T-1 SPECIFICATIONS.
C. WIDOWS CREEK CHANNEL RELOCATION AND ADJACENT DISTURBED AREAS, ABOVE THE WATER LINE AT THE DATE OF SEEDING, SHALL BE SEEDED AT THE FOLLOWING RATES (MEMORANDUM T.H. RIPLEY TO R.H. DUNHAM, APRIL 23, 1975)
(1) MARCH 15 TO AUGUST 15;

KENTUCKY 31 FESCUE	30 POUNDS PER ACRE
KOREAN LESPEDEZA	20 POUNDS PER ACRE
ANNUAL RYEGRASS	20 POUNDS PER ACRE

(2) AUGUST 15 TO NOVEMBER 30;

KENTUCKY 31 FESCUE	30 POUNDS PER ACRE
BALBO RYE	20 POUNDS PER ACRE
ALSIKE CLOVER	5 POUNDS PER ACRE

ITEMS 1 AND 2 ABOVE SHALL BE FERTILIZED AT THE RATE OF 800 POUNDS PER ACRE OF 15-15-15 COMMERCIAL FERTILIZER AND 2 TONS PER ACRE OF AGRICULTURAL LIMESTONE AND MULCHED WITH STRAW MULCH AT THE RATE OF 2 TONS PER ACRE.

② WILDLIFE SHRUBS - (10N7420 & 7421) SHALL BE PLANTED BY OR ACCORDING TO SPECIFICATIONS FURNISHED BY THE DIVISION OF FORESTRY, FISHERIES & WILDLIFE DEVELOPMENT. SEE MEMORANDUMS T.H. RIPLEY TO R.H. DUNHAM DATED APRIL 23, 1975 AND JUNE 4, 1975

③ UNCLASSIFIED FILL - DEPOSITED ASH AND/OR LIMESTONE SLURRY SHALL BE SURCHARGED WITH UNCLASS. FILL TO FORM A STABLE BASE IN 6" LAYERS AND COMPACTED WITH LOADED RUBBER TIRED HAULING EQUIPMENT TO THE ELEVATIONS SHOWN ON THE SECTIONS.

NF R0 R1 R2 R3 R4 R5 R6 R7 R8

SCALE 1" = 20'

DIVISION OF FORESTRY, FISHERIES & WILDLIFE DEVELOPMENT
Thomas H. Ripley

COMPANION DWGS. : 10N7420, 7421, 7423, 7424 & 7425

INSPECTED AND APPROVED FOR ISSUE - 123
B.M. Montgomery
DESIGN PROJECT MANAGER

W.O. 82-31635
PA 2844

YARD

LIMESTONE & ASH DISPOSAL AREA
SECTIONS & DETAILS SHEET 1

WIDOWS CREEK STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
J. M. Nelson	F.D. Stansbury	F. P. Lacy

KNOXVILLE 2-15-73 34 C 4 10N7422R8

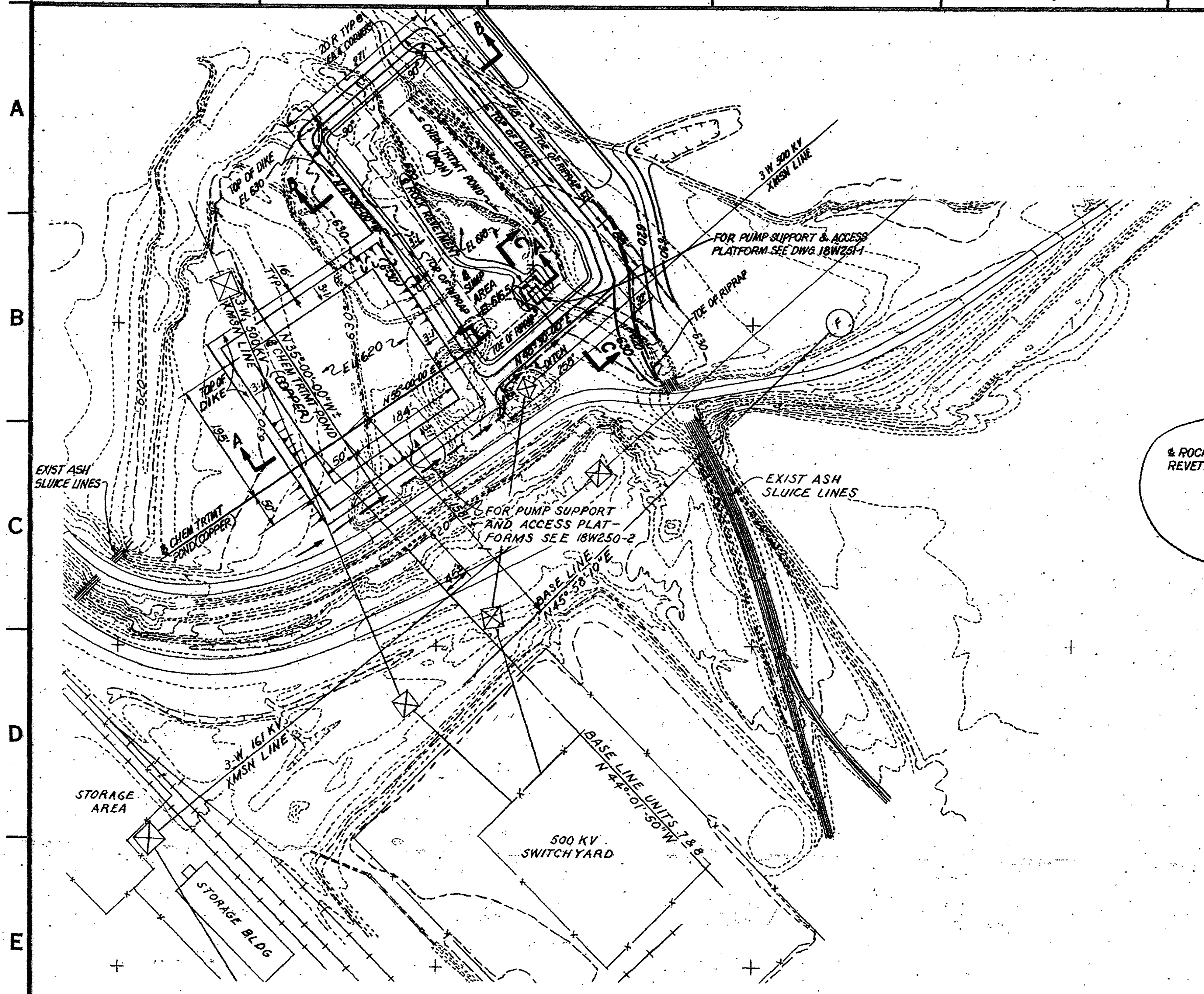
RECORD DRAWING AS CONSTRUCTED

R3 10-30-73

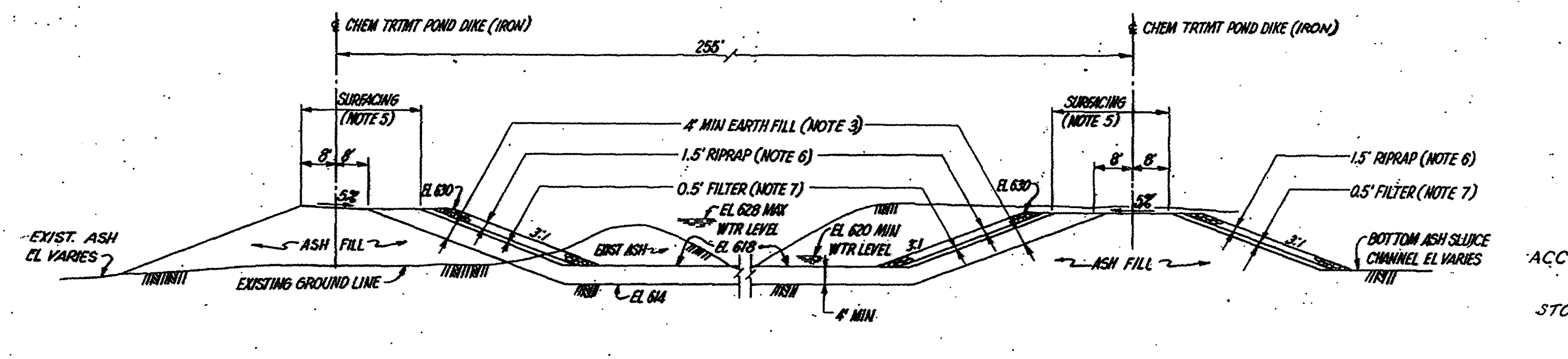
PHOTOGRAPHED IN KNOXVILLE
OCT 24 1983

30X

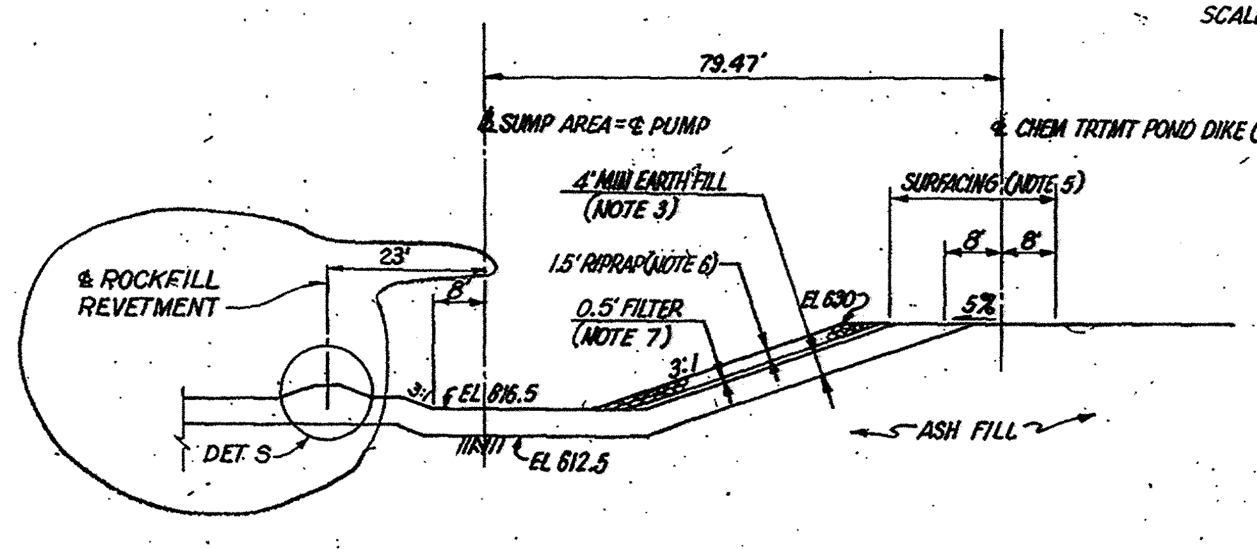
10497



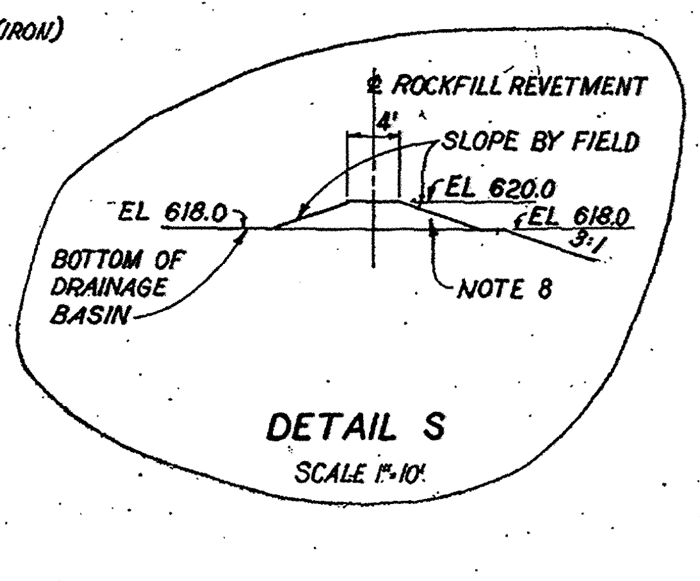
PLAN



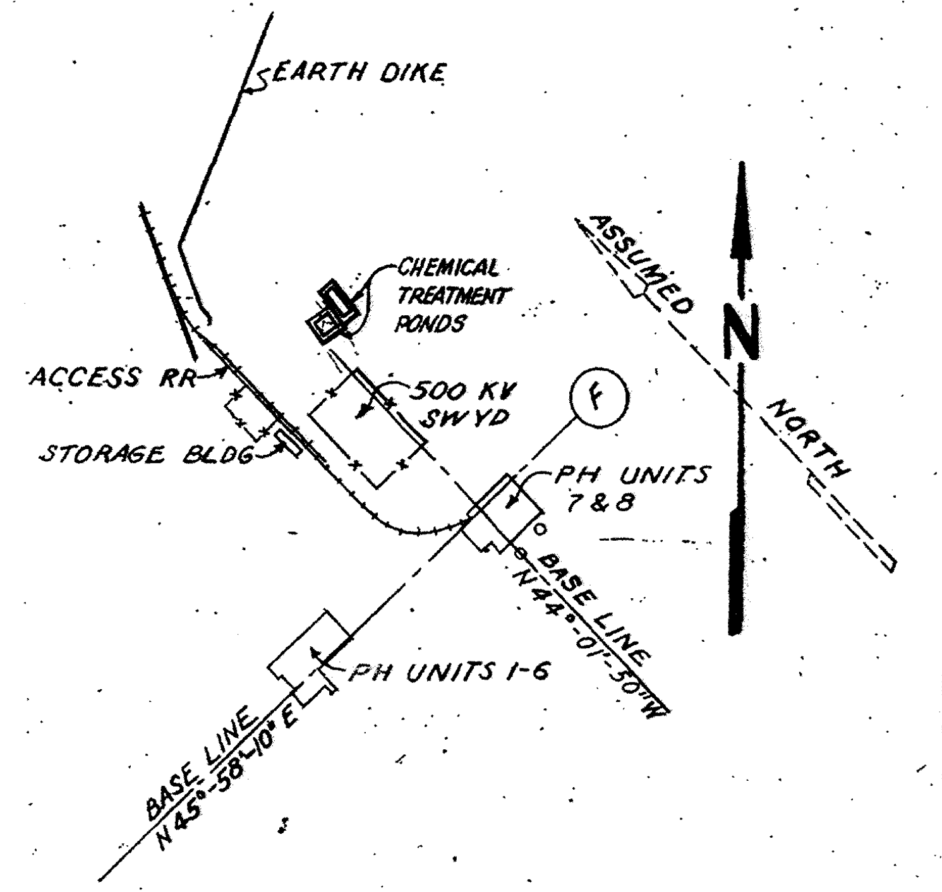
B-B
SCALE 1"=20'



C-C
SCALE 1"=20'



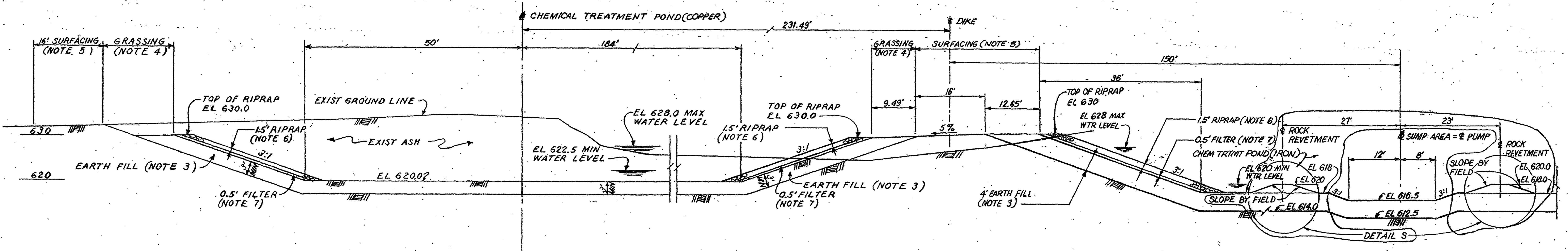
DETAIL S
SCALE 1"=10'



KEY PLAN
NOT TO SCALE

NOTES:
1. SOLID CONTOURS INDICATE FINISHED GRADE. DASHED CONTOURS INDICATE EXISTING GROUND.
2. DIKE FOUNDATION SHALL HAVE ALL WEAK SURFACE SOILS REMOVED TO MATERIAL THAT WILL EASILY BEAR THE WEIGHT OF LOADED RUBBER-TIRED EARTH HAULING EQUIPMENT.
3. EARTH FILL COMPACTION SHALL BE DONE WITH SHEEPSFOOT ROLLERS AND SHALL BE AT LEAST 95% OF STANDARD PROCTOR MAXIMUM DENSITY. FILL MOISTURE SHALL BE CONTROLLED TO ACHIEVE COMPACTION.
4. CUT AND FILL SLOPES SHALL BE SEEDED WITH TYPE 6, MIXTURE E. GRASSED AREAS ARE TO BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTIONS 180 AND 182 OF THE T-1 SPECIFICATIONS.
5. SURFACING FOR THE DIKE SHALL BE 4" OF CRUSHED STONE, PER SECTION 210 OF THE T-1 SPECS, FOR THE FULL WIDTH OF THE DIKE.
6. RIPRAP SHALL BE 18" THICK, WITH A MINIMUM OF 50% BY WEIGHT, CONSISTING OF STONES AT LEAST 100 POUNDS EACH. RIPRAP SHALL CONFORM TO SECTION 830 OF THE T-1 SPECIFICATIONS.
7. FILTER BLANKET, 6" THICK, SHALL CONFORM TO SECTION 836 OF THE T-1 SPECIFICATIONS.
8. ROCKFILL REVETMENT SHALL CONFORM TO SECTION 124 EXCEPT THAT AT LEAST 50% OF ROCKFILL SHALL CONSIST OF STONE OF SIZE GREATER THAN 6" WITH NO STONES LARGER THAN 18".

Chemical Pond Folder
Chem. Trtment Ponds Plan
(10W213)



SECTION A-A
1"=10'

SUMMARY OF QUANTITIES

ITEM NO.	DESCRIPTION	QUANTITY (COPPER)	QUANTITY (IRON)
123	EARTH BORROW	11,300 YD³	26,000 YD³
180	SEEDING	2,700 YD²	6,000 YD²
182	MULCHING	2,700 YD²	6,000 YD²
210	CRUSHED STONE	390 TONS	460 TONS
830	RIPRAP	1,800 YD³	3,900 YD³
836	FILTER	1,000 TONS	2,500 TONS
	ASH EXCAVATION		70,000 YD³

FIRST ISSUE FOR PA 3076

SCALE 1"=100'
EXCEPT AS NOTED

INSPECTED AND APPROVED FOR ISSUE
BMontgomery
DESIGN PROJECT MANAGER

REV NO.	ECN NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBM	RECM	APPR
5		1-8-82		VFE	JLG	JLG	KWB	RJB	RJB	FDS	GLB
	ADD. ROCK REVETMENT IN IRON CHEM TREAT. POND W.O. 31151										
4		6-11-81	GWM	VRL	DRG	JLG	KWB	RJB	RJB	FDS	GLB
	ADDED CHEMICAL TREATMENT POND (IRON), MINOR REVISIONS W.O. 31151										
3		1-23-79		GRC	AEM	AEM	KWB		RJB	FDS	GLB
	FINAL FIELD REVISIONS										
2		8-3-77	CEP	CEP	JLG	JLG	KWB		RJB	FDS	GLB
	ENLARGE CHEM TRTMT POND. PA 3076.										
1		10-6-76	CEP	CEP	JLG	JLG	KWB		RJB	FDS	GLB
	RELOC CHEM TRTMT POND 31' NORTH.										

DSGN C.E. PARSONS
DRWN C.E. PARSONS
CHKD J.L. GLOVER
SUPV J.L. GLOVER
INSP
ENGINEER K.W. Burnett

MAIN PLANT

CHEMICAL TREATMENT PONDS PLAN AND DETAILS

WIDOWS CREEK STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED Robert J. Bowman
RECOMMENDED
APPROVED

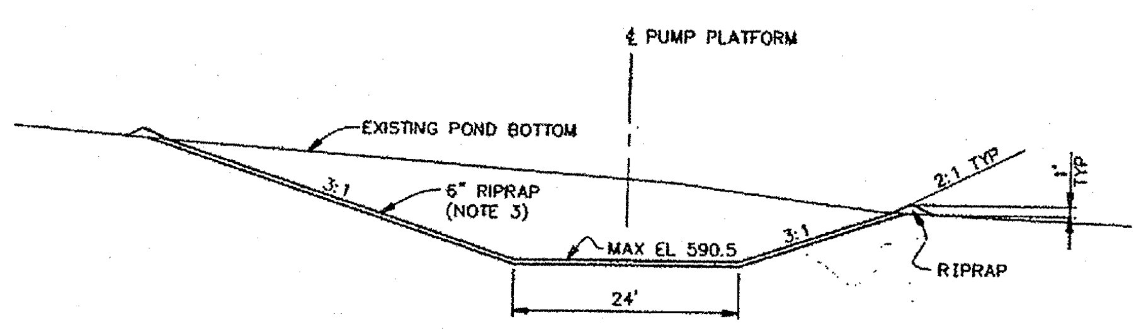
KNOXVILLE 8-26-76 | 34 | C | 4 | 10W213 | R5

RECORD DRAWING AS CONSTRUCTED
1-16-78 J.R. Dalton R3

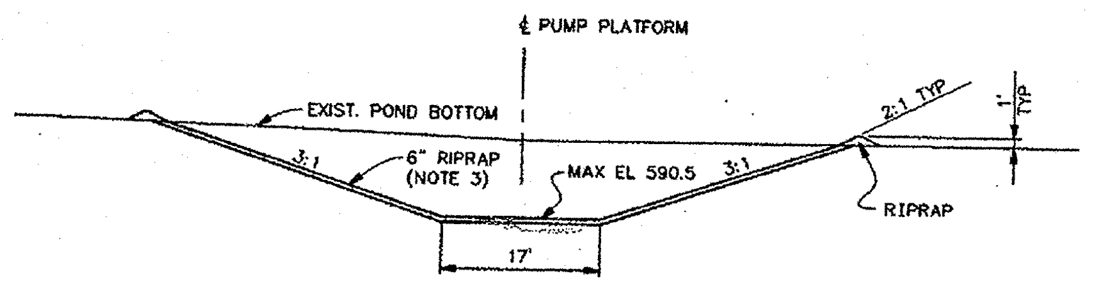
MF
R0
R1
R2
R3
R4
R5

WCF-10W7420-1SHT-REV 0 (43% of Scale); Unfiled; WCF; 2/3/2009 10:00 AM

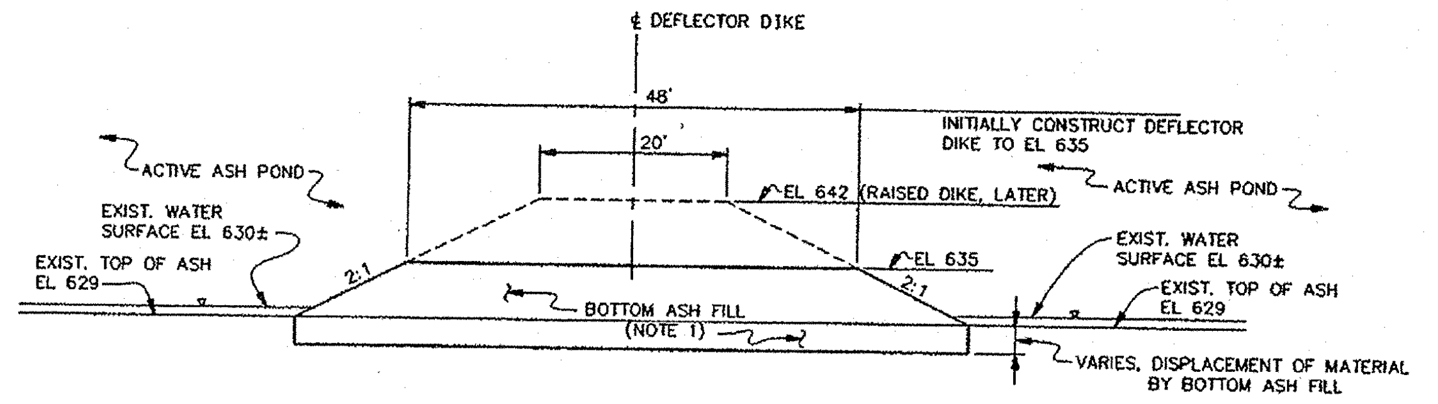
34 C 10W7420-1



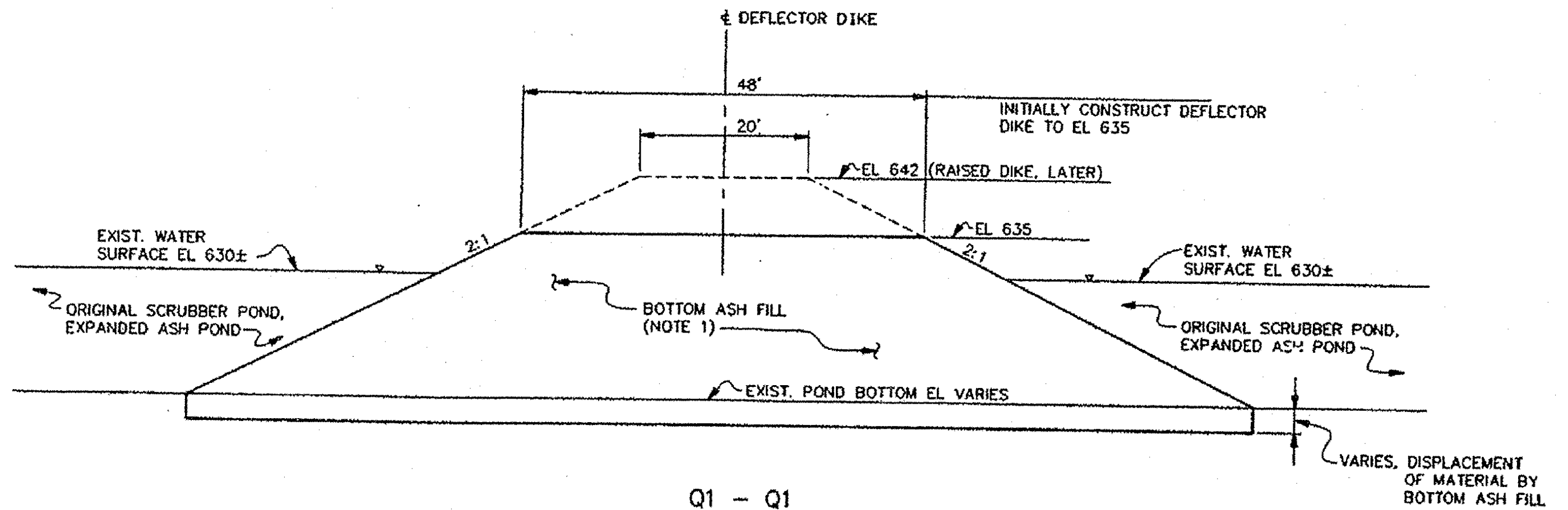
A1 - A1
SCRUBBER MAKE-UP PUMP WELL
DISCHARGE BASIN
(10W7423)



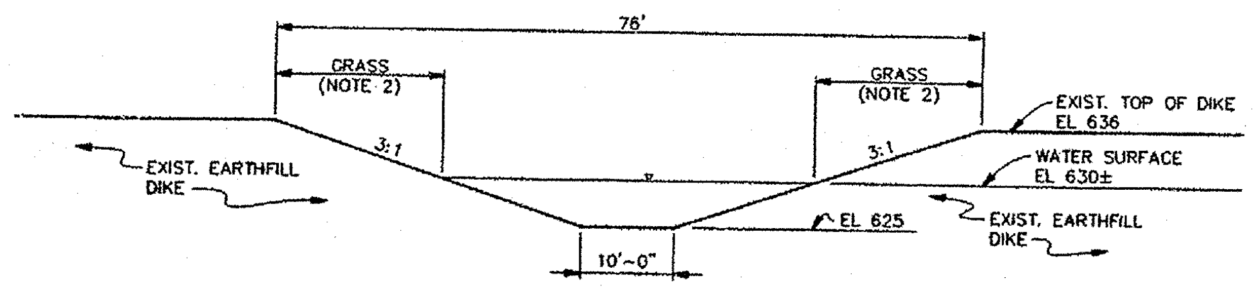
B1 - B1
SCRUBBER MAKE-UP PUMP WELL
DISCHARGE BASIN
(10W7423)



P1 - P1
TYPICAL SECTION - BOTTOM ASH
DEFLECTOR DIKE
ASH POND REACH
(10W7420)



Q1 - Q1
TYPICAL SECTION - BOTTOM ASH
DEFLECTOR DIKE
SCRUBBER POND REACH
(10W7420)



S1 - S1
TYPICAL SECTION - DIKE BREACH
2 PLACES
(10W7420)

NOTES:

1. PLACEMENT OF THE UNDERWATER ASH FILL SHALL BE BY END DUMPING ALONG THE LENGTH OF THE DIKE. THE TOP SURFACE OF THE UNDERWATER DIKE JUST ABOVE THE WATER SHALL BE THOROUGHLY COMPACTED. BOTTOM ASH FOR THAT PORTION OF THE DIKE ABOVE WATER SHALL BE PLACED IN NOT MORE THAN 9-INCH LAYERS, AND WELL COMPACTED WITH RUBBER TIRED HAULING EQUIPMENT.
2. GRASSING, WHERE NOTED, SHALL BE TYPE 8 MIXTURE 1 ACCORDING TO T-1 SPECIFICATIONS, SECTIONS 580 AND 582.
3. RIPRAP (4 TO 6-INCH STONE) SHALL CONFORM TO T-1 SPECIFICATION SECTION 1080.

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R 0 INITIAL ISSUE		JGA	MGH	JGA	JLG	KWB	RGJ	WDH	4311		D

DISCIPLINE INTERFACE

SCALE: 1" = 10' EXCEPT AS NOTED

YARD

LIMESTONE AND ASH DISPOSAL
AREAS - ASH POND LIFE EXTENSION
SECTIONS AND DETAILS

DESIGNED BY:	DRAWN BY	CHECKED BY	SUPERVISED BY	REVIEWED BY	APPROVED BY	ISSUED BY
J.G.ALBRIGHT	M.G.HRANEK	J.G.ALBRIGHT	J.L.CLOVER	K.W.BURNETT	R.G.JOHNSON	W.D.HALL

WIDOWS CREEK FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R12 | DATE | 34 | C | 10W7420-1 | R 0

PLOT FACTOR:1:120
W_TVA
FILENAME: WC7420-1.DWG

C.A.D. DRAWING
DO NOT ALTER MANUALLY

COMPANION DWGS - 10W7420, 10W7422, 10W7423

TASK COMPLETED BY: | REV NO.

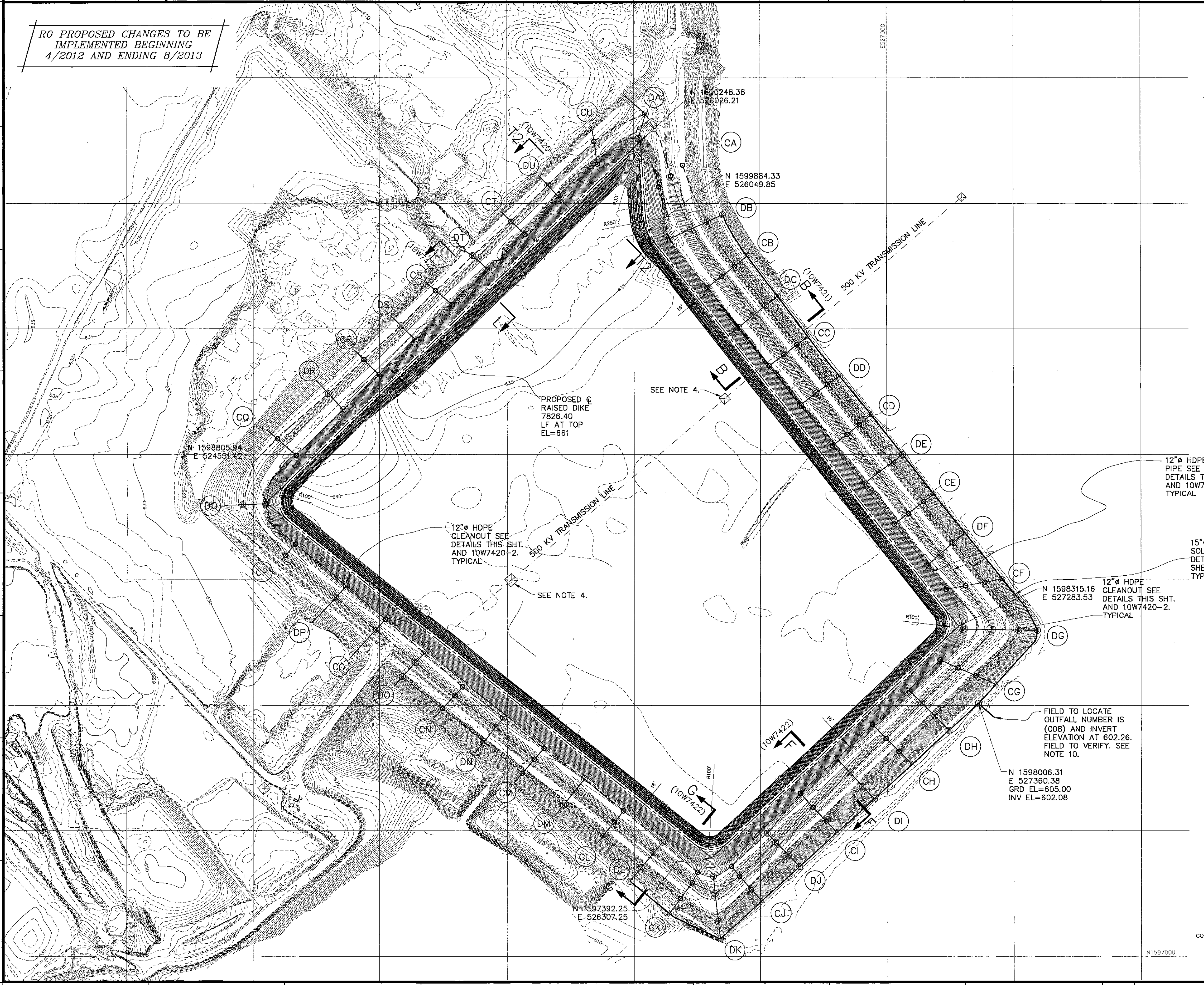
PHOTOGRAPHED
IN CHATTANOOGA
AUG 21 1996

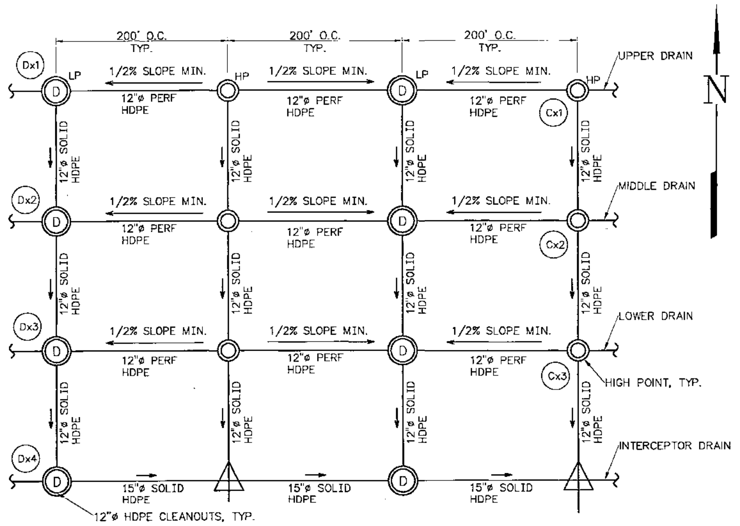
36X

50637

34 C 10W7420-3

R0 PROPOSED CHANGES TO BE IMPLEMENTED BEGINNING 4/2012 AND ENDING 8/2013





12" SOLID HDPE DOWN SLOPE
12" PERFORATED HDPE LATERAL DRAINS
15" SOLID HDPE INTERCEPTOR ALONG LOWER TOE

* CLEANOUTS @ CORNERS OF CELL

UNDER DRAIN SYSTEM LAYOUT
(NTS)

GENERAL NOTES

1. ALL UNDERDRAIN, DOWNDRAIN, AND INTERCEPTOR PIPES SHALL BE CONSTRUCTED PER MANUFACTURERS INSTRUCTIONS USING ADS N-12 SMOOTH DUAL WALL HDPE PIPE, OR EQUAL.

2. THE 12" AND 15" DIAMETER SOLID PIPES SHALL BE WATER TIGHT PIPES WHILE THE 12" DIAMETER PERFORATED PIPE SHALL BE A SOIL TIGHT PIPE, UNLESS OTHERWISE APPROVED BY THE ENGINEER.

3. WOVEN FILTER FABRIC SHALL MEET TVA T-1 SECTION 571 CLASS B, OR EQUAL.

4. #57 AND #7 STONE GRADATIONS SHALL BE IN ACCORDANCE WITH TENNESSEE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, MARCH 1, 2006.

5. THE LEGS OF THE TRANSMISSION TOWERS LOCATED WITHIN THE DREDGE CELL SHALL BE COATED TO AN ELEVATION OF 661' PER COATING SPECIFICATION NUMBER WCFTRANSTOWERS03, REVISED APRIL 7, 2003. THE COATING OF THE TRANSMISSION TOWER LEGS SHALL BE RESTRICTED FROM FEB. 1, 2008 UNTIL JULY 15, 2008, PER COMMITMENTS CONTAINED IN CEC 15080.

6. EXISTING SPILLWAY DISCHARGE PIPES SHALL BE ABANDONED IN PLACE AND SEALED WITH 3,000 PSI CONCRETE. EXISTING SPILLWAYS (WEIRS) SHALL BE REMOVED.

7. FOR NEW SPILLWAY DETAILS SEE SHEETS 10W7420-5, 10W7420-6 & 10W7420-7.

8. DIKE MATERIAL TO BE A BOTTOM ASH/FLY ASH MIXTURE STABILIZED WITH 3% LIME. LIME SHALL BE ADDED AND DISKED INTO ASH PRIOR TO COMPACTION, OR AS APPROVED BY THE ENGINEER.

9. MAXIMUM ASH PLACEMENT TO BE 12" PRIOR TO COMPACTION. DIKE COMPACTION SHALL BE AT LEAST 95% OF STANDARD MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-698. MOISTURE CONTENT OF THE ASH/LIME MIXTURE SHALL BE WITHIN 3% OF THE OPTIMUM AS DETERMINED BY MACTEC ENGINEERING.

10. CONSTRUCTOR TO PROVIDE WEEKLY FIELD COMPACTION TEST RESULTS TO THE ENGINEER.

11. FIELD TO TIE INTO 30" RCP THAT DISCHARGES TO OUTFALL 008. FIELD TO CONSTRUCT CONNECTION USING BOTTOMLESS MANHOLE (SHERMAN DIXIE OR EQUAL) PLACED ON FIELD DESIGNED CONCRETE SLAB AND SEALED PER MANUFACTURER'S RECOMMENDATIONS.

COMPANION DWGS: 10W7420, -1, -2, -4, -5, -6
10W7421. 7422.
10N7423, 7424, 7425, & 7429

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R 0	JUN 0 2 2008	BDC BDC	BDC BDC	VJD VJD							D
INITIAL ISSUE											

DISCIPLINE INTERFACE
1
2
3
4

SCALE: 1"=150' EXCEPT AS NOTED

YARD

LIMESTONE & ASH DISPOSAL AREA PLAN SHEET 2

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
BDC	BDC	VJD				

WIDOWS CREEK FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 | DATE | 34 | C | 10W7420-3 | R 0

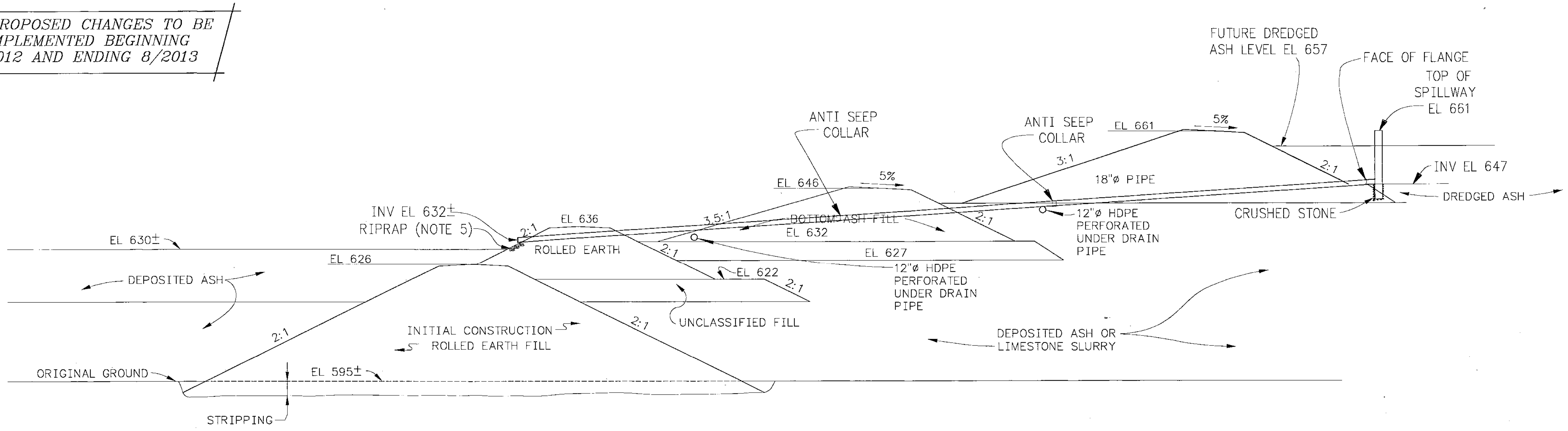
WORLEYPARSONS GROUP INC.	
TASK COMPLETED BY:	REV NO.

ELECTRONICALLY RESTORED DRAWING
THIS DRAWING HAS BEEN COMPLETELY REDRAWN
AND SUPERSEDES : (10N7420, R12)

PLOT FACTOR:150
W_TVA

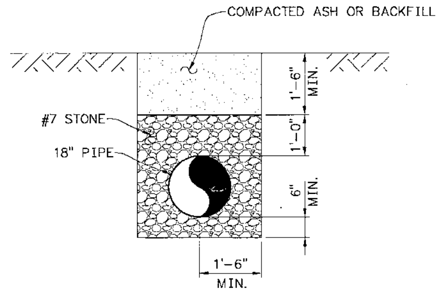
C.A.D. DRAWING
DO NOT ALTER MANUALLY

R0 PROPOSED CHANGES TO BE IMPLEMENTED BEGINNING 4/2012 AND ENDING 8/2013



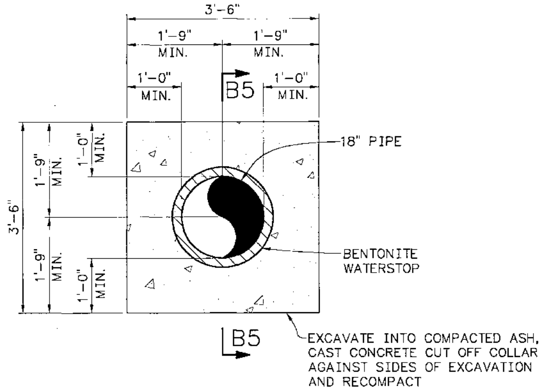
TYPICAL SECTION

TYPICAL SPILLWAY STRUCTURE AND DISCHARGE PIPING
NTS



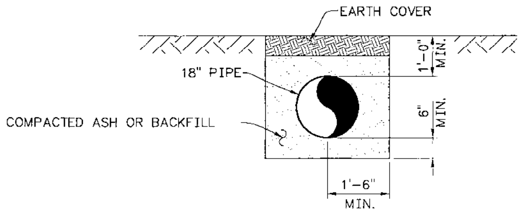
TRAFFIC/ROADWAY TRENCH DETAIL

SCALE: NTS



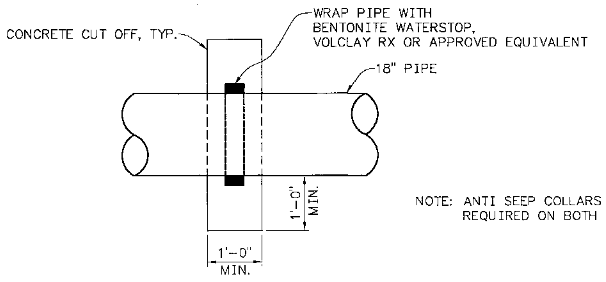
ANTI SEEP COLLAR

SCALE: NTS



NON-TRAFFIC/SLOPE TRENCH DETAIL

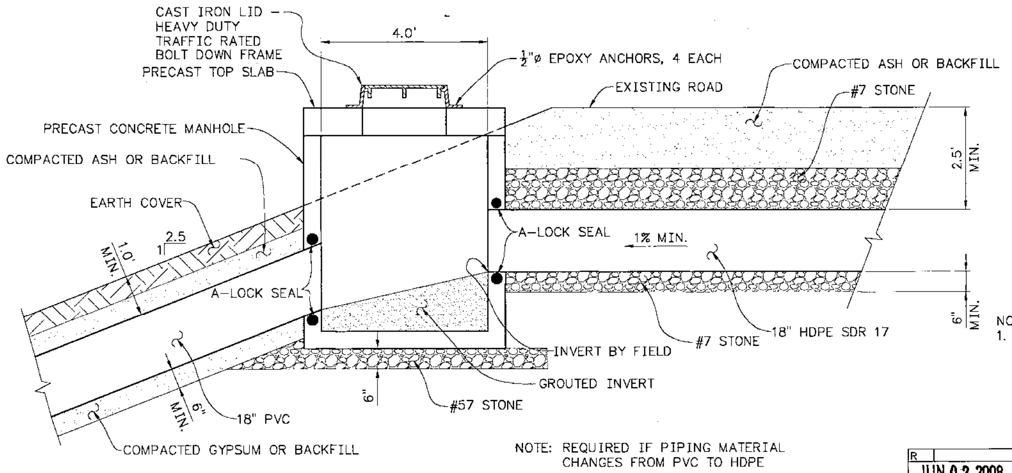
SCALE: NTS



NOTE: ANTI SEEP COLLARS REQUIRED ON BOTH DIKES

SECTION B5-B5

SCALE: NTS



NOTE: REQUIRED IF PIPING MATERIAL CHANGES FROM PVC TO HDPE

DETAIL C5
PVC-HDPE JUNCTION FOR MIXED PIPE CONFIGURATION

SCALE: NTS

NOTE:
1. PIPE SHALL BE HDPE SDR 17 WITH BUTT FUSION WELDED JOINTS -OR- CORRUGATED PVC (CONTECH A2000), PUSH ON JOINTS WITH RUBBER GASKETS SUITABLE FOR SANITARY SEWER USAGE. FUTURE MIXED CONFIGURATION (HDPE AND PVC) IS ACCEPTABLE PROVIDED THAT THE INSTALLATION IS AS DETAILED ON DRAWING.

COMPANION DRAWINGS: 10W7420, -1, -2, -3, -4, -6, 7421, 7422, 10N7423, 10N7424, 7425, & 7429

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R0	JUN 0 2 2008	BDC	BDC	VJD							D
INITIAL ISSUE											

DISCIPLINE INTERFACE
1
2
3
4

SCALE: 1"=10' EXCEPT AS NOTED

YARD UNITS 7 & 8

ASH DISPOSAL STACK
SECTIONS & DETAILS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:

WIDOWS CREEK FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

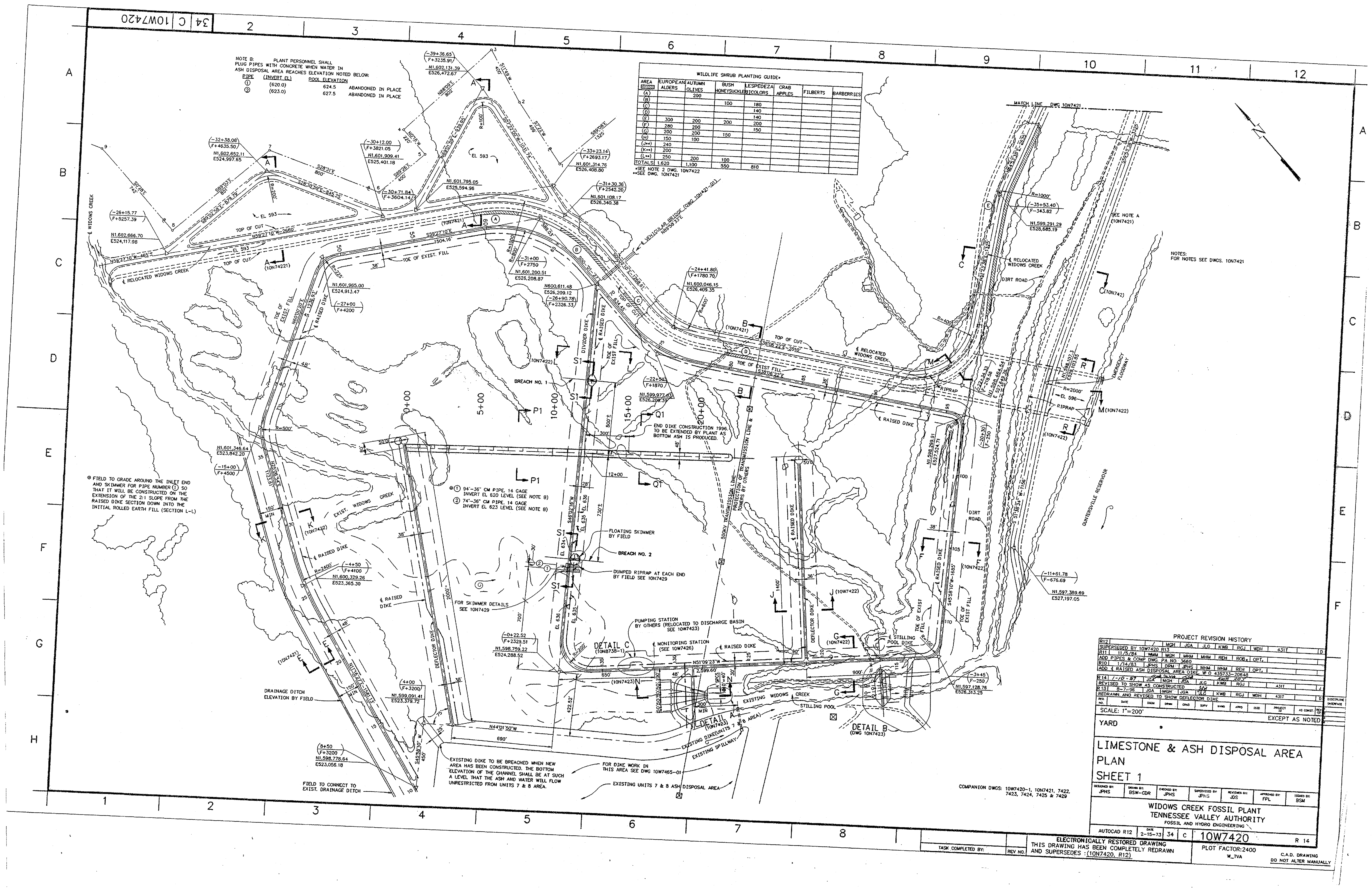
AUTOCAD R 2000	DATE	34	C	10W7420-5	R 0

PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY:	REV NO.

Limestone & Ash Disposal Area



NOTE B: PLANT PERSONNEL SHALL PLUG PIPES WITH CONCRETE WHEN WATER IN ASH DISPOSAL AREA REACHES ELEVATION NOTED BELOW:

PIPE	(INVERT EL)	POOL ELEVATION	
①	(620.0)	624.5	ABANDONED IN PLACE
②	(623.0)	627.5	ABANDONED IN PLACE

⊗① 94'–36" CM PIPE, 14 GAGE INVERT EL 620 LEVEL (SEE NOTE B)

② 74'–36" CM PIPE, 14 GAGE INVERT EL 623 LEVEL (SEE NOTE B)

⊗ FIELD TO GRADE AROUND THE INLET END AND SKIMMER FOR PIPE NUMBER ① SO THAT IT WILL BE CONSTRUCTED ON THE EXTENSION OF THE 2:1 SLOPE FROM THE RAISED DIKE SECTION DOWN INTO THE INITIAL ROLLED EARTH FILL (SECTION L-L)

END DIKE CONSTRUCTION 1996. TO BE EXTENDED BY PLANT AS BOTTOM ASH IS PRODUCED.

EXISTING DIKE TO BE BREACHED WHEN NEW AREA HAS BEEN CONSTRUCTED. THE BOTTOM ELEVATION OF THE CHANNEL SHALL BE AT SUCH A LEVEL THAT THE ASH AND WATER WILL FLOW UNRESTRICTED FROM UNITS 7 & 8 AREA.

FOR DIKE WORK IN THIS AREA SEE DWG 10W7465-01

EXISTING UNITS 7 & 8 ASH DISPOSAL AREA

WILDLIFE SHRUB PLANTING GUIDE*

AREA ▨	EUROPEAN ALDERS	AUTUMN OLIVES	BUSH HONEYSUCKLE	LESPEDEZA BICOLORS	CRAB APPLES	FILBERTS	BARBERRIES
Ⓐ		200					
Ⓑ							
Ⓒ			100	180			
Ⓓ				140			
Ⓔ	300	200	200	140			
Ⓕ	280	200		200			
Ⓖ	200	200	150	150			
Ⓗ	150	100					
(J**)	240						
(K**)	200						
(L**)	250	200	100				
TOTALS	1,620	1,100	550	810			

*SEE NOTE 2 DWG. 10N7422
**SEE DWG. 10N7421

COMPANION DWGS: 10W7420-1, 10N7421, 7422, 7423, 7424, 7425 & 7429

PROJECT REVISION HISTORY

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R12		/	MGH	JGA	JLG	KWB	RGJ	WDH	431T		D
SUPERSEDED BY 10W7420 R13											
R11	11/5/84	WMM	MGH	MHM	MHM	REH	ROB.	OPT.			
ADD PIPES & COMP DWG. PA NO. 3660											
R10	1/14/83	JPHS	DRM	JPHS	MHM	MHM	REH	OPT.			
ADD ℄ RAISED ASH DISPOSAL AREA DIKE. W.O 435733-20648											
R14	1-10-97	JGA	MGH	JGA	JLG	KWB	RGJ		431T		J
REVISED TO SHOW AS CONSTRUCTED											
R13	8-7-96	JGA	MGH	JGA	JLG	KWB	RGJ	WDH	431T		D
REDRAWN AND REVISED TO SHOW DEFLECTOR DIKE											

DISCIPLINE INTERFACE

SCALE: 1"=200' EXCEPT AS NOTED

YARD

LIMESTONE & ASH DISPOSAL AREA PLAN
SHEET 1

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
JPHS	BSW-CDR	JPHS	JPHS	JDS	FPL	BSM

WIDOWS CREEK FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

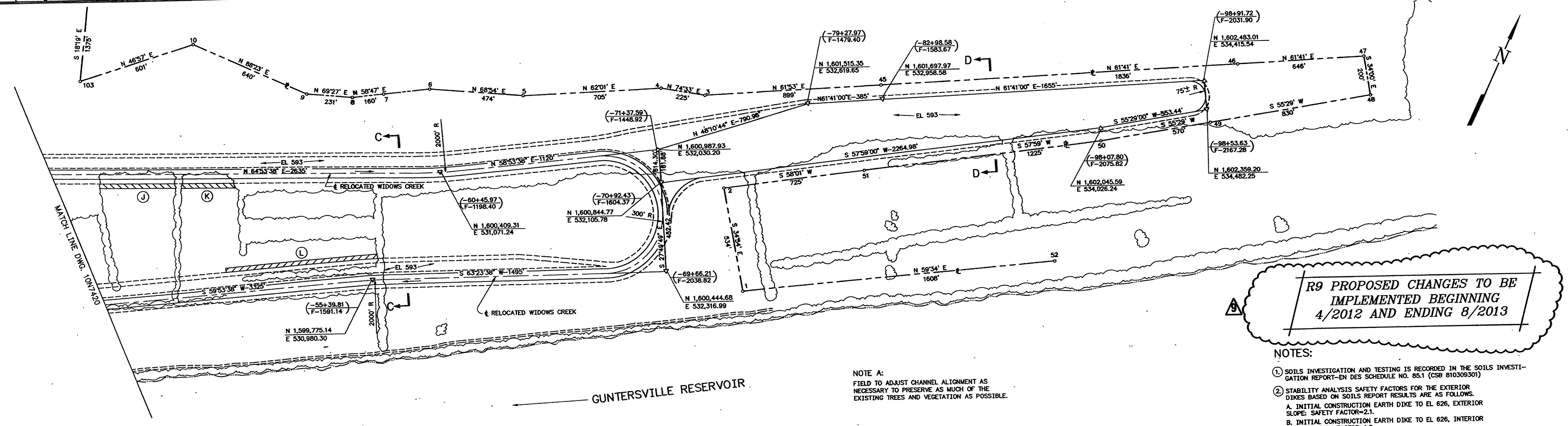
AUTOCAD R12 | DATE 2-15-73 | 34 | C | 10W7420 | R 14

ELECTRONICALLY RESTORED DRAWING
THIS DRAWING HAS BEEN COMPLETELY REDRAWN
AND SUPERSEDES :(10N7420, R12)

PLOT FACTOR:2400
W_TVA

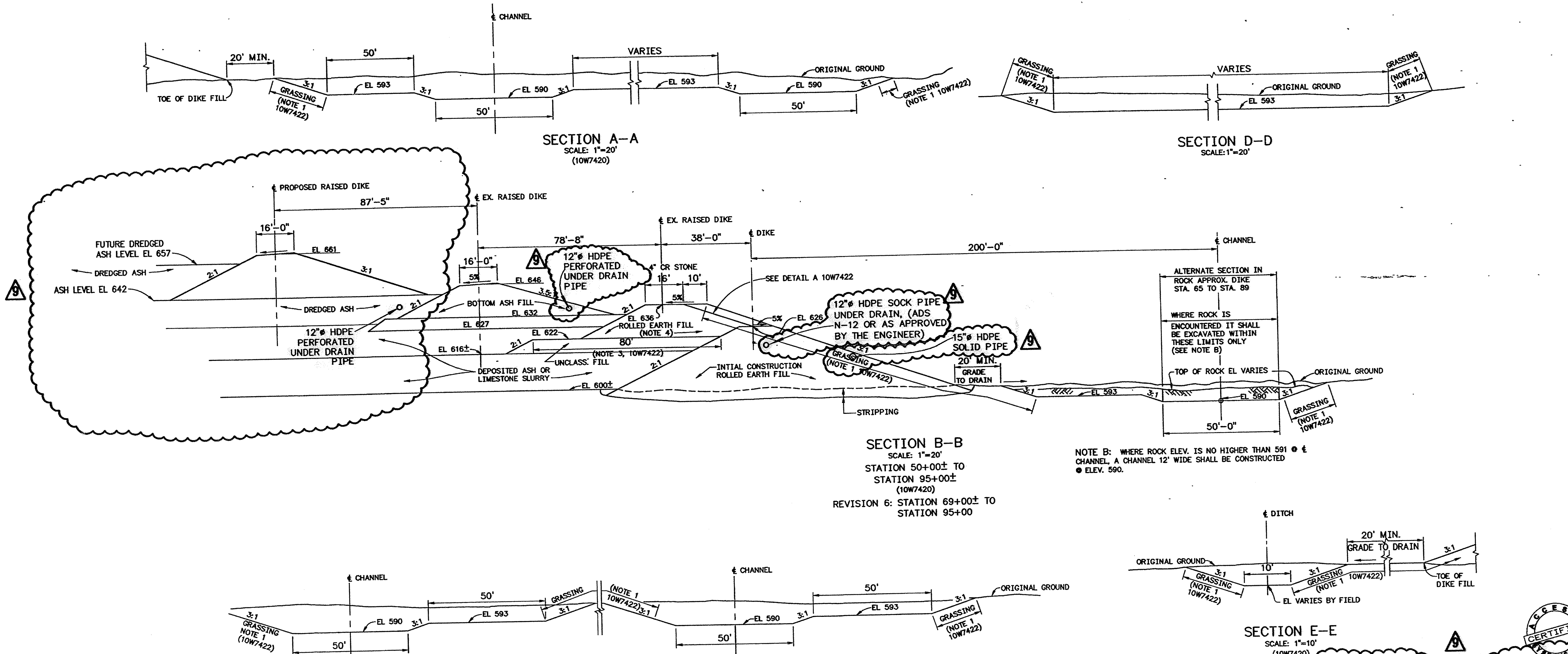
C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV. NO.



R9 PROPOSED CHANGES TO BE IMPLEMENTED BEGINNING 4/2012 AND ENDING 8/2013

NOTE A:
FIELD TO ADJUST CHANNEL ALIGNMENT AS NECESSARY TO PRESERVE AS MUCH OF THE EXISTING TREES AND VEGETATION AS POSSIBLE.



SECTION A-A
SCALE: 1"=20'
(10W7420)

SECTION D-D
SCALE: 1"=20'

SECTION B-B
SCALE: 1"=20'
STATION 50+00± TO STATION 95+00±
(10W7420)
REVISION 6: STATION 69+00± TO STATION 95+00

NOTE B: WHERE ROCK ELEV. IS NO HIGHER THAN 591 @ ℄ CHANNEL, A CHANNEL 12' WIDE SHALL BE CONSTRUCTED @ ELEV. 590.

SECTION C-C
SCALE: 1"=20'

SECTION E-E
SCALE: 1"=10'
(10W7420)

COMPANION DRAWINGS: 10W7420 SERIES, 7422, 10N7423, 10N7424, 7425 & 7429

NOTES:

① SOILS INVESTIGATION AND TESTING IS RECORDED IN THE SOILS INVESTIGATION REPORT-EN DES SCHEDULE NO. 85.1 (CSB 810309301)

② STABILITY ANALYSIS SAFETY FACTORS FOR THE EXTERIOR DIKES BASED ON SOILS REPORT RESULTS ARE AS FOLLOWS.

A. INITIAL CONSTRUCTION EARTH DIKE TO EL 626, EXTERIOR SLOPE: SAFETY FACTOR=2.1.

B. INITIAL CONSTRUCTION EARTH DIKE TO EL 626, INTERIOR SLOPE: SAFETY FACTOR=1.8

C. FINAL RAISING OF DIKE WITH ASH AND EARTH TO EL 636, EXTERIOR SLOPE : SAFETY FACTOR=1.7

④ ALL DIKE CONSTRUCTION SHALL BE IN ACCORDANCE. WITH GENERAL CONSTRUCTION SPECIFICATION NO. G-9 FOR ROLLED EARTH-FILL FOR DAMS AND POWER PLANTS. EARTHFILL COMPACTION SHALL BE AT LEAST 95% OF THE STANDARD MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-698 PROCEDURE. MOISTURE CONTENT OF THE EARTHFILL SHALL BE WITHIN ± 3% OF THE OPTIMUM, AS DETERMINED BY THE SINGLETON MATERIALS ENGINEERING LABORATORY. (SME)

⑤ ALL OTHER CONSTRUCTION SHALL BE IN ACCORDANCE WITH HIGHWAY SPECIFICATIONS NO T-1.

⑥ CUT SLOPES ADJACENT TO EXISTING OR PROPOSED DIKES SHALL NOT BE EXCAVATED STEEPER THAN 3:1 AND TOP OF CUT SHALL BE A MINIMUM OF 20' FROM THE TOE OF ANY DIKE.

⑦ WHEN CONNECTING THE ENDS OF THE NEW DIKE TO THE OLD DIKE, EXTREME CARE SHALL BE USED TO INSURE AN IMPERVIOUS AND STABLE CONNECTION. THE EXISTING DIKE SHALL BE STRIPPED OF ALL VEGETATION, BENCHED, SCARIFIED TO A MINIMUM DEPTH OF 6" AND COMPACTED SO AS TO FORM A BOND WITH THE NEW FILL. DUE TO THE STEEP SIDE SLOPES OF THE EXISTING DIKES, THE UTMOST CAUTION SHALL BE USED IN BENCHING THE EXISTING DIKES SLOPES SO AS NOT TO CREATE AN UNSTABLE CONDITION. SMALL BENCHES OF MINIMUM DEPTH SHALL BE USED.

⑧ COORDINATES OF PL'S ARE GIVEN IN PLANT COORDINATES $\left(\frac{8+50}{F+3200}\right)$ AND ALABAMA STATE COORDINATES $\left(\frac{N\ 1,598,778.64}{E\ 523,056.18}\right)$

ALABAMA STATE COORDINATES WERE COMPUTED FROM THE ORIGINAL COORDINATES OF THE INTERSECTION OF THE BASE LINES OF UNIT 7 AS GIVEN IN 1958.

⑨ RIPRAP-RIPRAP SHALL BE PLACED AT LOCATIONS AS SHOWN ON DRAWINGS. THE STONE SHALL BE WELL GRADED AND CONSIST OF SOUND, DURABLE STONE PER SECTION 830 OF THE T-1 SPECIFICATIONS. THE RIPRAP SHALL BE A MINIMUM OF 2' THICK WITH AT LEAST 50%, BY WEIGHT, BEING 200 LBS. OR MORE, AND WITH THE MAXIMUM WEIGHT 2 TIMES THE 50% WEIGHT AND NOT MORE THAN 5% PASSING THE 1" SIEVE.

⑩ FILTER-THE FILTER BLANKET SHALL BE 8" THICK AND IN ACCORDANCE WITH SECTION 836 OF THE T-1 SPECIFICATIONS.

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 9	JUN 0 2 2008	BDC	BDC	VJD							D
RAISED DIKE AND UNDER DRAIN SYSTEM											
R 8		RDP	MGH	RDP	HLP	REP		JGA			D
COMPLETELY REDRAWN AND REVISED TO SHOW NEW DREDGE CELL. DCN WCF-02-191											

DISCIPLINE INTERFACE

SCALE: 1"=200' EXCEPT AS NOTED

YARD

LIMESTONE & ASH DISPOSAL AREA PLAN-SHEET 2

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.P.H.S.	B.S.W.-C.D.R.	J.P.H.S.	J.P.H.S.			

WIDOWS CREEK FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 | DATE 2-15-73 | 34 | C | 10W7421 | R 9

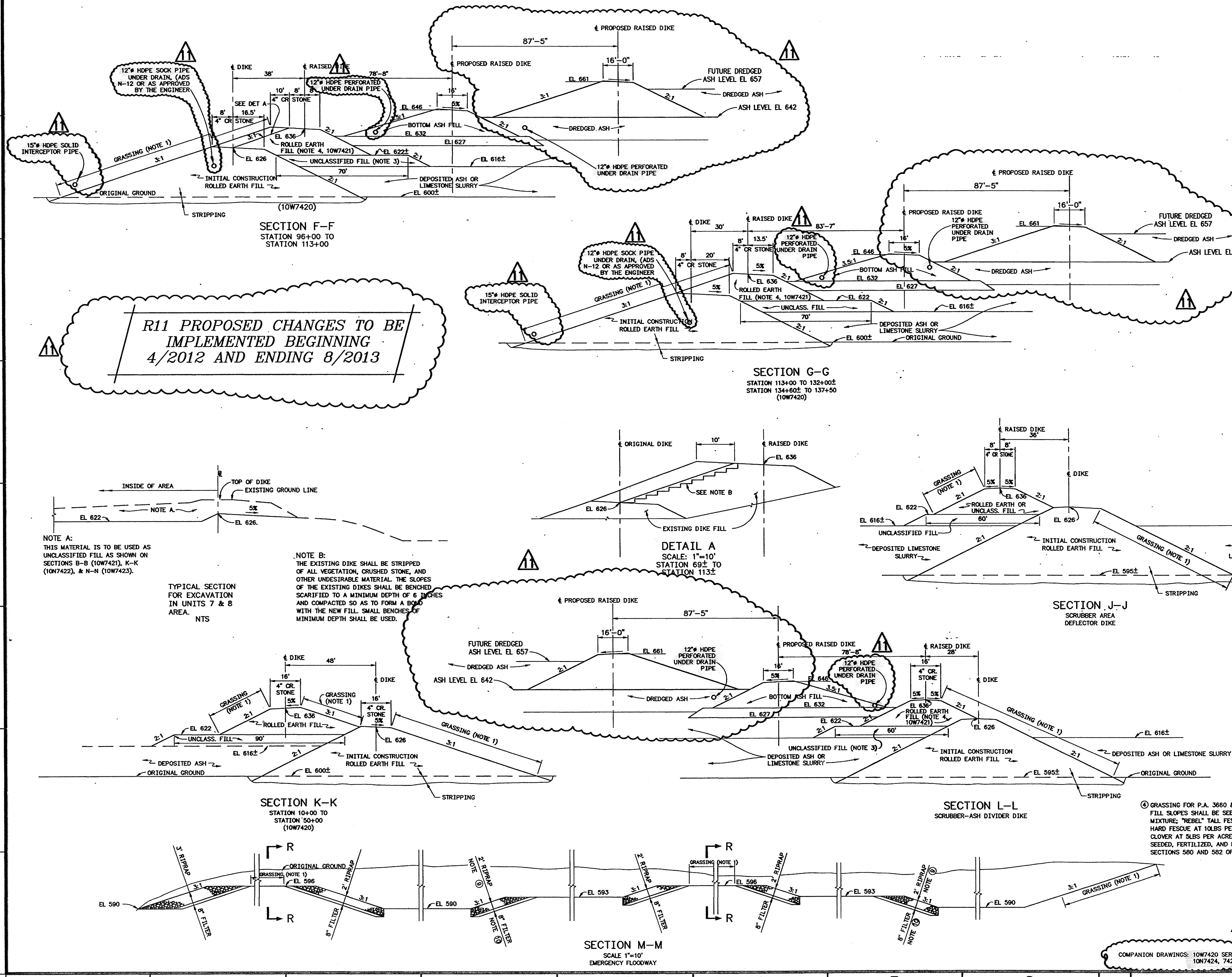
ACCESS SYSTEMS INC. CERTIFIED

ELECTRONICALLY RESTORED DRAWING
THIS DRAWING HAS BEEN COMPLETELY REDRAWN AND SUPERSEDES :(10N7421 R7)

WORLEYPARSONS GROUP INC.
TASK COMPLETED BY:
REV NO.

PLOT FACTOR:2400
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



SECTION F–F
STATION 96+00 TO
STATION 113+00

R11 PROPOSED CHANGES TO BE IMPLEMENTED BEGINNING 4/2012 AND ENDING 8/2013

SECTION G–G
STATION 113+00 TO 132+00±
STATION 134+60± TO 137+50
(10W7420)

NOTE A:
THIS MATERIAL IS TO BE USED AS UNCLASSIFIED FILL AS SHOWN ON SECTIONS B–B (10W7421), K–K (10N7422), & N–N (10W7423).

TYPICAL SECTION
FOR EXCAVATION
IN UNITS 7 & 8
AREA.
NTS

NOTE B:
THE EXISTING DIKE SHALL BE STRIPPED OF ALL VEGETATION, CRUSHED STONE, AND OTHER UNDESIRABLE MATERIAL. THE SLOPES OF THE EXISTING DIKES SHALL BE BENCHED SCARIFIED TO A MINIMUM DEPTH OF 6 INCHES AND COMPACTED SO AS TO FORM A BOND WITH THE NEW FILL. SMALL BENCHES OF MINIMUM DEPTH SHALL BE USED.

DETAIL A
SCALE: 1"=10'
STATION 69± TO
STATION 113±

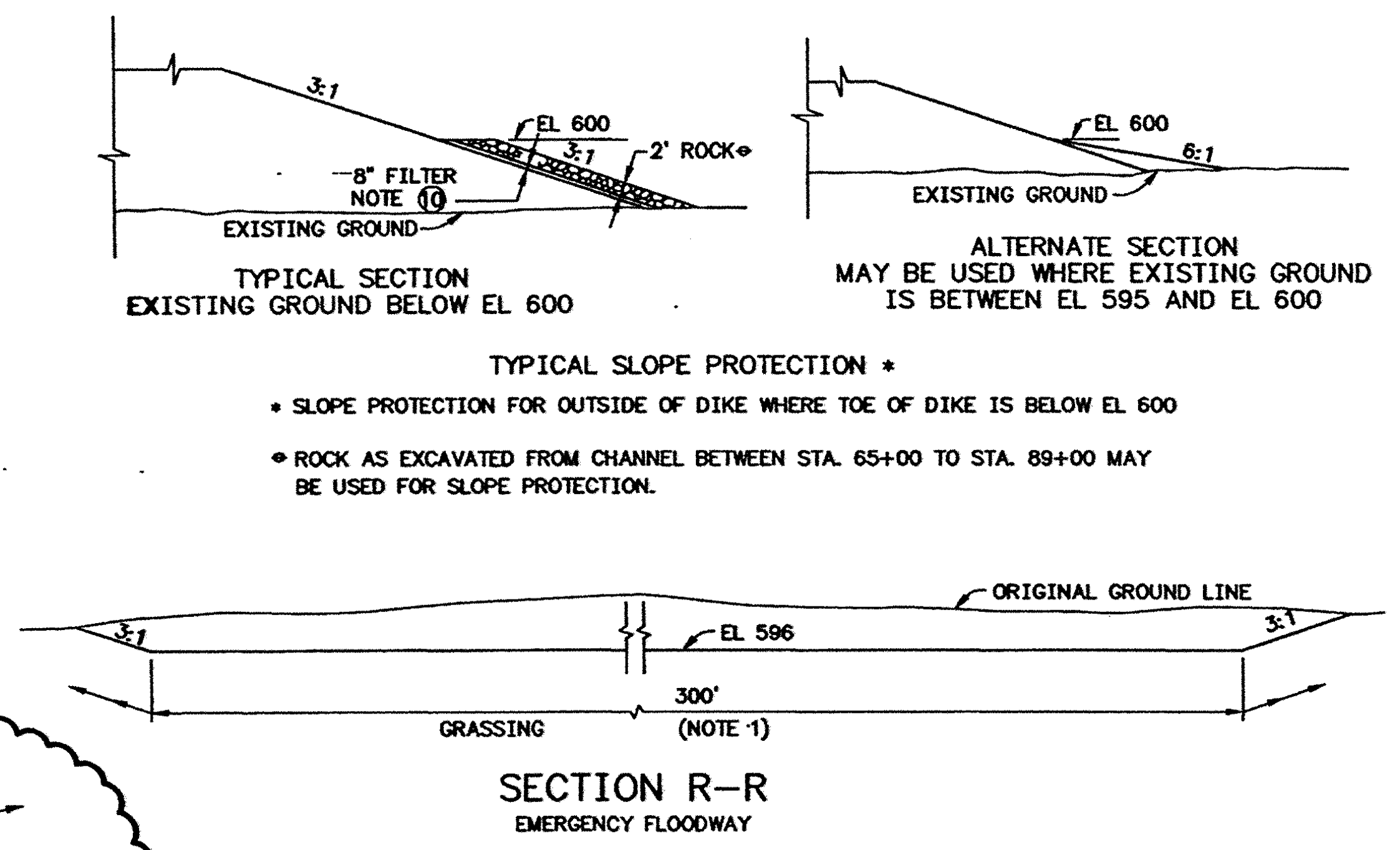
SECTION J–J
SCRUBBER AREA
DEFLECTOR DIKE

SECTION K–K
STATION 10+00 TO
STATION 50+00
(10W7420)

SECTION L–L
SCRUBBER–ASH DIVIDER DIKE

SECTION M–M
SCALE 1"=10'
EMERGENCY FLOODWAY

④ GRASSING FOR P.A. 3660 & W.O. 20648.
FILL SLOPES SHALL BE SEEDED WITH THE FOLLOWING MIXTURE; "REBEL" TALL FESCUE AT 40LB PER ACRE, HARD FESCUE AT 10LBS PER ACRE, AND WHITE DUTCH CLOVER AT 5LBS PER ACRE. ALL AREAS SHALL BE SEEDED, FERTILIZED, AND MULCHED IN ACCORDANCE WITH SECTIONS 580 AND 582 OF THE T–1 SPECIFICATIONS.



TYPICAL SECTION
EXISTING GROUND BELOW EL 600

ALTERNATE SECTION
MAY BE USED WHERE EXISTING GROUND
IS BETWEEN EL 595 AND EL 600

TYPICAL SLOPE PROTECTION *

* SLOPE PROTECTION FOR OUTSIDE OF DIKE WHERE TOE OF DIKE IS BELOW EL 600

⊕ ROCK AS EXCAVATED FROM CHANNEL BETWEEN STA. 65+00 TO STA. 89+00 MAY BE USED FOR SLOPE PROTECTION.

SECTION R–R
EMERGENCY FLOODWAY

QUANTITIES FOR P.A. 3660			
123	EARTH BORROW	9,100CY	
305	CRUSHED STONE SURFACING	305 TN	
580 & 582	SEEDING & MULCHING	15,000CY	

SUMMARY OF QUANTITIES			
ITEM NO.	DESCRIPTION	QUANTITY	QUANTITY (PA3575)
101	CLEARING	235 AC.	
120	CHANNEL EXCAVATION	1,050,000C.Y.	
	UNCLASSIFIED FILL W.O. #435733–20648		160,000 C.Y.
123	EARTH BORROW	1,000,000C.Y.	230,000 C.Y.
129	STRUCTURAL EXCAVATION	1,700C.Y.	
180	GRASSING	330,000S.Y.	75,000 S.Y.
210	SURFACING (4" CRUSHED STONE)	7,700 TONS	4,600 TONS
481 &	18" PIPE (14 GAGE)		108 LF
491	24" PIPE (14 GAGE)		144 LF
401	CLASS A CONCRETE (ENDWALL)	24 C.Y.	
418	REINFORCING	240LBS.	
830	RIPRAP	3,650 C.Y.	
836	FILTER	1,000TONS	
FOR BILL OF MATERIALS FOR SPILLWAYS SEE DWG. 10N7424			

NOTES:

① GRASSING: FOR GRASSING FOR P.A. 3660 & W.O. NO. 20648 SEE NOTE 4.
A. ALL DIKE SLOPES SHALL BE SEEDED WITH TYPE 6 MIXTURE E AND FERTILIZED. IN ACCORDANCE WITH SECTION 180 OF THE T–1 SPECIFICATIONS.
B. THE EMERGENCY FLOODWAY (SECTIONS M–M & R–R) SHALL BE SEEDED WITH 14 POUNDS OF BERMUDA GRASS (HULLED) AND 7 POUNDS OF ANNUAL LESPEDEZA PER ACRE AND FERTILIZED IN ACCORDANCE WITH THE T–1 SPECIFICATIONS.
C. WIDOWS CREEK CHANNEL RELOCATION AND ADJACENT DISTURBED AREAS, ABOVE THE WATER LINE AT THE DATE OF SEEDING, SHALL BE SEEDED AT THE FOLLOWING RATES (MEMORANDUM T.H. RIPLEY TO R.H. DUNHAM, APRIL 23, 1973)
(1) MARCH 15 TO AUGUST 15;

KENTUCKY 31 FESCUE	50 POUNDS PER ACRE
KOREAN LESPEDEZA	20 POUNDS PER ACRE
ANNUAL RYEGRASS	20 POUNDS PER ACRE

(2) AUGUST 15 TO NOVEMBER 30,

KENTUCKY 31 FESCUE	50 POUNDS PER ACRE
BALBO RYE	60 POUNDS PER ACRE
ALSIKE CLOVER	5 POUNDS PER ACRE

ITEMS 1 AND 2 ABOVE SHALL BE FERTILIZED AT THE RATE OF 600 POUNDS PER ACRE OF 15–15–15 COMMERCIAL FERTILIZER AND 2 TONS PER ACRE OF AGRICULTURAL LIMESTONE AND MULCHED WITH STRAW MULCH AT THE RATE OF 2 TONS PER ACRE.

② WILDLIFE SHRUBS– (10N7420 & 7421) SHALL BE PLANTED BY OR ACCORDING TO SPECIFICATIONS FURNISHED BY THE DIVISION OF FORESTRY FISHERIES & WILDLIFE DEVELOPMENT. SEE MEMORANDUMS T.H. RIPLEY TO R.H. DUNHAM DATED APRIL 23, 1973 AND JUNE 4, 1973.

③ UNCLASSIFIED FILL–DEPOSITED ASH AND/OR LIMESTONE SLURRY SHALL BE SURCHARGED WITH UNCLASS. FILL TO FORM A STABLE BASE IN 6" LAYERS AND COMPACTED WITH LOADED RUBBER TIRED HAULING EQUIPMENT TO THE ELEVATIONS SHOWN ON THE SECTIONS.

JUN 02 2008 ~~BDC~~ BDC VJD

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R11		BDC	BDC	VJD							D
RAISED DIKE AND UNDER DRAIN SYSTEM											
R10		RDP	MGH	RDP	HLP	REP		JGA			D
COMPLETELY REDRAWN AND REVISED TO SHOW NEW DREDGE CELL. DCN WCF–02–191											

DISCIPLINE INTERFACE

SCALE: 1"=20' EXCEPT AS NOTED

YARD

LIMESTONE & ASH DISPOSAL AREA SECTIONS & DETAILS SHEET 1

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.P.H.S	CDR	J.P.H.S				

WIDOWS CREEK FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

	DATE				
AUTOCAD R14	2–15–73	34	C	10W7422	R 11

COMPANION DRAWINGS: 10W7420 SERIES, 7421, 10N7423, 10N7424, 7425 & 7429

ACCESS SYSTEMS INC. CERTIFIED

ACCESS SYSTEMS INC. CERTIFIES THIS CONVERSION AS CORRECT WITH ANY UNINTELLIGIBLE ENTITIES NOTED BY THIS SYMBOL "?"

WORLEYPARSONS GROUP INC.

TASK COMPLETED BY: REV NO.

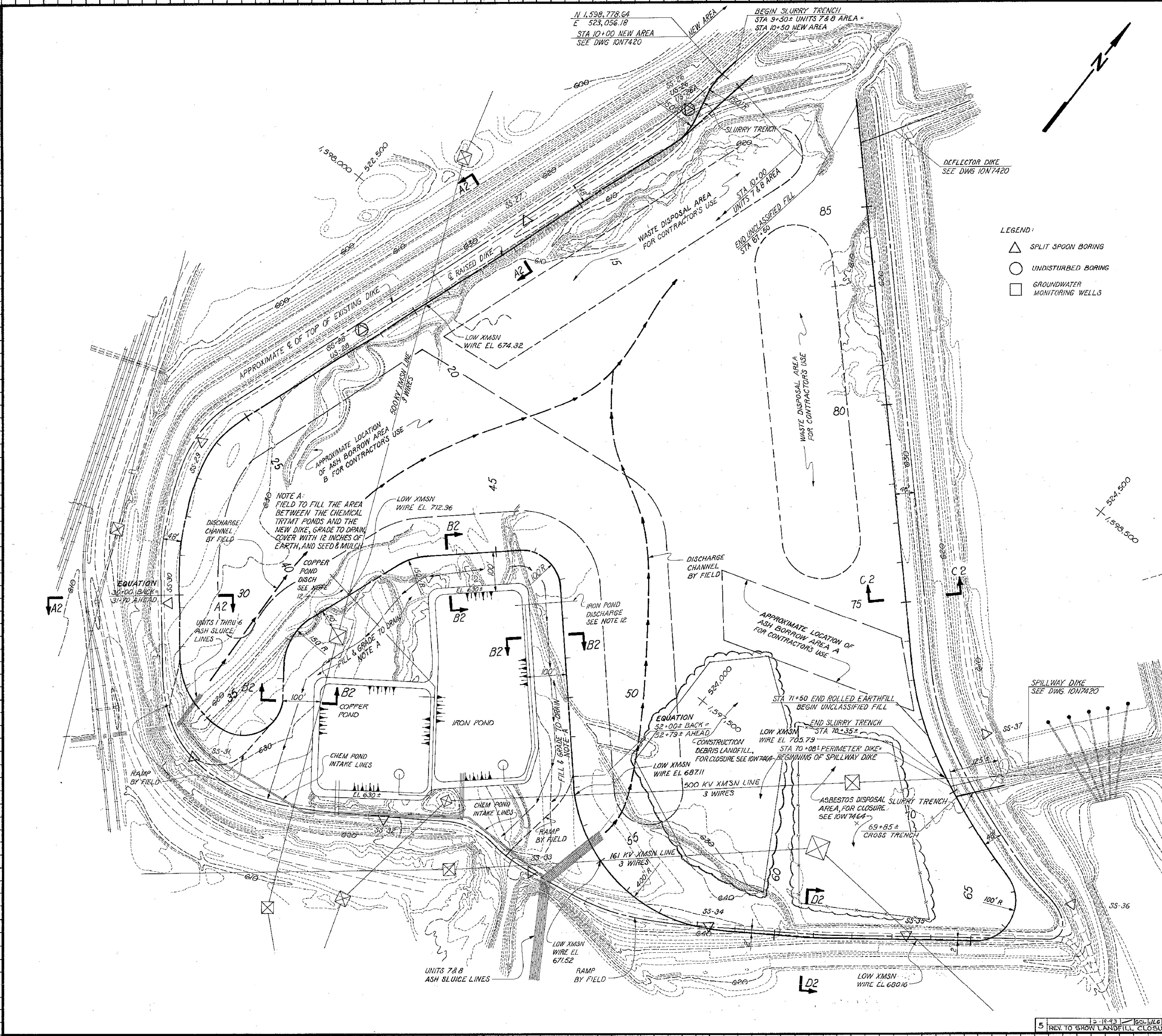
ELECTRONICALLY RESTORED DRAWING
THIS DRAWING HAS BEEN COMPLETELY REDRAWN AND SUPERSEDES :(10N7422 R9)

PLOT FACTOR:240
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

34 c 10W7465-01

10936 R0
12035 R0
12097 R0
16294 R1

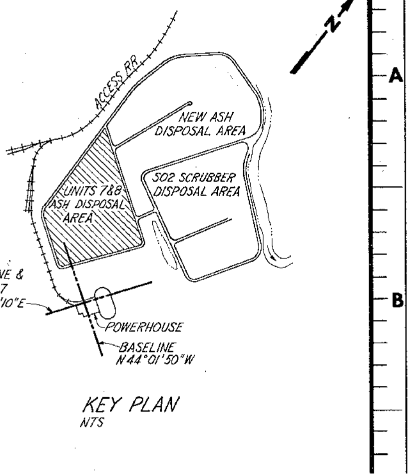


LEGEND:

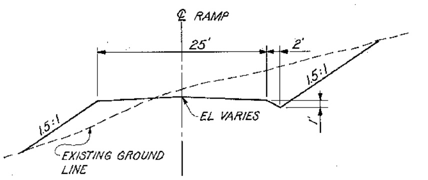
- △ SPLIT SPOON BORING
- ○ UNDISTURBED BORING
- ☐ GROUNDWATER MONITORING WELLS

NOTES CONT.:

9. WHEN CONSTRUCTING THE DIKES NEAR THE ASH SLUICE DISCHARGE PIPES, CARE SHALL BE USED TO INSURE THE DISCHARGE FROM THE PIPES WILL NOT DAMAGE THE DIKE.
10. IN-PLACE DENSITY CONTROL TESTS SHALL BE PERFORMED USING THE ASTM D-1556 OR D-2167 PROCEDURE AT LEAST ONE DENSITY TEST SHALL BE TAKEN FOR EACH 2,000 CUBIC YARDS OF FILL PLACED THROUGHOUT THE COURSE OF THE WORK. A MINIMUM OF ONE TEST SHALL BE TAKEN EACH DAY FILL IS PLACED. SEE SECTIONS 11 & 12 OF G-9 FOR COMPLETE TEST REQUIREMENTS (INCLUDING SUBMITTALS).
11. DURING EXCAVATION OF THE AREA BETWEEN STATION 55+00 AND 65+00 IF ASBESTOS IS ENCOUNTERED, R.E. HARRIS OF THE FOSSIL DESIGN PROJECT (EXTENSION 4631) KNOXVILLE IS TO BE NOTIFIED IMMEDIATELY. ALSO R. EUGENE OLIVER, FOSSIL AND HYDRO POWER, CHATTANOOGA (EXTENSION 2816) IS TO BE NOTIFIED AND ASKED FOR GUIDANCE IN DISPOSING OF THE ASBESTOS.
12. THOSE PORTIONS OF THE IRON POND DISCHARGE AND THE COPPER POND DISCHARGE TO BE LOCATED ABOVE THE RAISED DIKE WILL NOT BE CONSTRUCTED UNTIL AFTER CONSTRUCTION OF THE SLURRY TRENCH.



KEY PLAN
NTS



TYPICAL RAMP SECTION
NTS

NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE T-1 SPECIFICATIONS UNLESS OTHERWISE STATED.
2. SOILS INVESTIGATION AND TESTING IS RECORDED IN THE SOILS INVESTIGATION REPORT - EN DES SCHEDULE NO. 85.1 (CSB 810309301)
3. STABILITY ANALYSIS SAFETY FACTORS FOR THE EXTERIOR DIKES BASED ON THE SOILS REPORT RESULTS ARE AS FOLLOWS:
   A. END OF CONSTRUCTION CONDITION: MINIMUM SAFETY FACTOR IS GREATER THAN 2.0
   B. SUDDEN DRAW DOWN CONDITION: MINIMUM SAFETY FACTOR = 1.3
   C. LONG TERM - FULL DISPOSAL AREA CONDITION: MINIMUM SAFETY FACTOR IS GREATER THAN 2.0
4. ALL DIKE CONSTRUCTION SHALL BE IN ACCORDANCE WITH GENERAL CONSTRUCTION SPECIFICATION NO. G-9 FOR ROLLED EARTHFILL FOR DAMS AND POWER PLANTS. EARTHFILL COMPACTION SHALL BE AT LEAST 95% OF THE STANDARD MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-698 PROCEDURE. MOISTURE CONTENT OF THE EARTHFILL SHALL BE WITHIN ±3% OF THE OPTIMUM, AS DETERMINED BY THE SINGLETON MATERIALS ENGINEERING LABORATORY. (SME)
5. WHEN CONNECTING NEW ROLLED EARTHFILL TO EXISTING EARTHFILL, EXTREME CARE SHALL BE USED TO INSURE AN IMPERVIOUS AND STABLE CONNECTION. THE EXISTING EARTHFILL SHALL BE STRIPPED OF ALL VEGETATION, BENCHED, SCARIFIED TO A MINIMUM DEPTH OF 6 INCHES AND COMPACTED SO AS TO FORM A BOND WITH THE NEW EARTHFILL. SMALL BENCHES OF MINIMUM DEPTH SHALL BE USED.
6. DEPOSITED ASH SHALL BE SURCHARGED WITH UNCLASSIFIED FILL, PREFERABLY BOTTOM ASH, IN 6 INCH LAYERS AND ADEQUATELY COMPACTED WITH LOADED RUBBER TIRED EARTH HAULING EQUIPMENT. THE UNCLASSIFIED FILL SHALL BE BUILT TO THE ELEVATIONS SHOWN ON THE SECTIONS SO AS TO FORM A STABLE BASE FOR RAISING THE DIKES WITH EARTHFILL.
7. GRASSING: ALL DIKE SLOPES SHALL BE SEEDED WITH THE FOLLOWING MIXTURE FOR SPRING, SUMMER OR FALL SEEDING.
   "REBEL" TALL FESCUE AT 40 POUNDS PER ACRE.
   HARD FESCUE AT 10 POUNDS PER ACRE.
   WHITE DUTCH CLOVER AT 5 POUNDS PER ACRE.
   SLOPES SHALL BE SEEDED, FERTILIZED, AND MULCHED IN ACCORDANCE WITH SECTIONS 580 AND 582 OF THE T-1 SPECIFICATIONS.
8. THE FULL WIDTH OF THE EARTHFILL DIKE SHALL BE SURFACED WITH 4 INCHES OF COMPACTED CRUSHED STONE PER SECTION 305 OF THE T-1 SPECIFICATIONS.

MF
R0
R1
R2
R3
R4
R5

REV NO.	W.O. NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBM	RECM	APPD				
5		2-19-93	/	GCL	JLG	JLG	KWB	RGJ							
	REV. TO SHOW LANDFILL CLOSURE.														
4	PA 3360	7/9/84		mAH	JPHS	JPHS	MHM	/	MHM	REH	ROBH				OPT
	REV CROSS TRENCH & SPILLWAY TRENCH.														
3	20648	11/28/83	/	mAH	JPHS	JPHS	MHM	/	MHM	REH	OPT				
	REV LOC DIKE & ASH BOR AREAS.														
2	20648	10/26/83	/	mAH	JPHS	JPHS	MHM	RDB	MHM	REH	OPT				
	ADD ASH BOR AREAS, RAMPS, SOIL SMPLG LOC, WELLS & LEGEND. REV ASH SLUICE LINES. ADD TYP RAMP SECT, WASTE DPSL AREAS & NOTE 12.														
1	20648	10/3/83	/	CHP	JPHS	JPHS	MHM	/	MHM	REH	OPT				
	REV LOC DIKE, NOTE 7 & ASH SLUICE LINES. ADD NOTE 11, EQ STA 30 & WIRE EL'S														

ROBH
JEH

DSGN J. Hillis Stevens
DRWN Sherry A. Carr
CHKD Donald E. Galloway
SUPV J. Hillis Stevens

INSP Ralph G. Johnson
ENGINEER M. H. Miller

SCALE: 1" = 100'-0" EXCEPT AS NOTED

YARD

ASH DISPOSAL AREA
UNITS 7 & 8 - PLAN

WIDOWS CREEK STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
M.H. Miller	R.E. Harris	O.P. Thornton

KNOXVILLE 7/14/83 | 34 | C | 10W7465-01 | R5

RECORD DRAWING AS CONSTRUCTED

INITIAL ISSUE W.O. NO. 20648

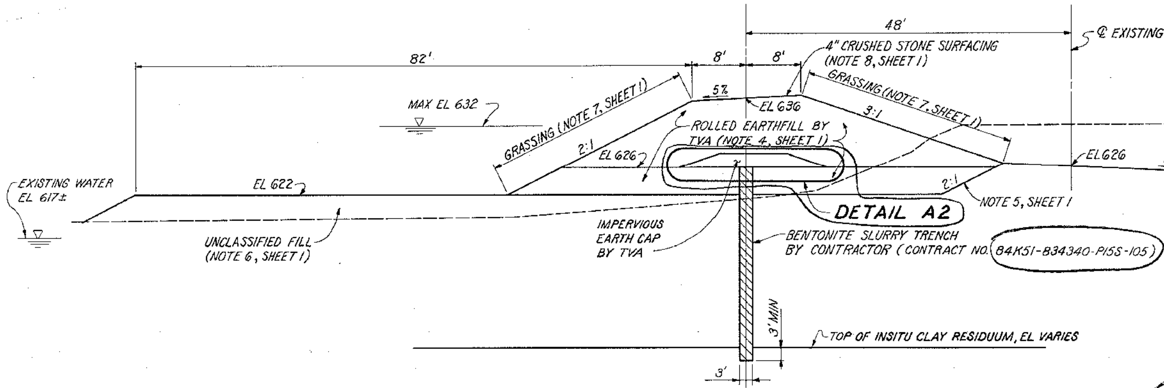
COMPANION DRAWINGS:
10W7465-02 & -03

INSPECTED AND APPROVED FOR ISSUE

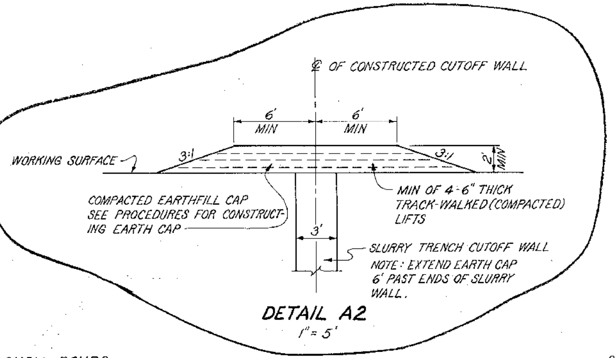
PRINT H
SIZE F
BR OR PROJ ME EE CE AD CD ED MD SW BL PA
PRINTS REQD-R

TECHNICAL INFORMATION CENTER
INDEXED KNOXVILLE

13802-R0
16284 R1



A2 - A2
STA 10+00 TO STA 35+00±
STA 54+00± TO STA 55+00±
STA 66+00± TO STA 71+50*
SEE SUGGESTED CONSTRUCTION SEQUENCE
NTS
* STATION 70+75 = END OF SLURRY TRENCH



DETAIL A2
1" = 5'

SUGGESTED CONSTRUCTION SEQUENCE FOR RAISING THE DIKES OF UNITS 7 & 8 ASH DISPOSAL AREA AT WIDOWS CREEK STEAM PLANT:

STEP 1. TVA SHALL EXCAVATE THE EXISTING DIKE TO THE LINES AND GRADES AS SHOWN ON THE SECTIONS. THE EXCAVATED MATERIAL SHALL BE USED TO CONSTRUCT THE UNCLASSIFIED FILL BASE FOR RAISING THE DIKES OF THE NEW AREA AND UNITS 7 & 8 AREA. THE UNCLASSIFIED FILL BASE SHALL BE EXCAVATED IN ACCORDANCE WITH SECTIONS A2-A2, B2-B2, AND D2-D2, AS THE EXISTING CONDITIONS DICTATE.

STEP 2. TVA SHALL LOCATE THE CENTERLINE OF THE RAISED DIKE AND CONSTRUCT THE ROLLED EARTHFILL AS SHOWN ON THE SECTION.

STEP 3. THE CONTRACTOR SHALL CONSTRUCT THE BENTONITE SLURRY TRENCH FROM THE ESTABLISHED GRADES TO THREE (3) FEET INTO THE INSITU CLAY RESIDUUM MATERIAL BENEATH THE PERIMETER DIKE.

STEP 4. TVA SHALL CONSTRUCT THE IMPERVIOUS EARTH CAP OVER THE SLURRY TRENCH IN ACCORDANCE WITH PROCEDURE ON THIS DRAWING.

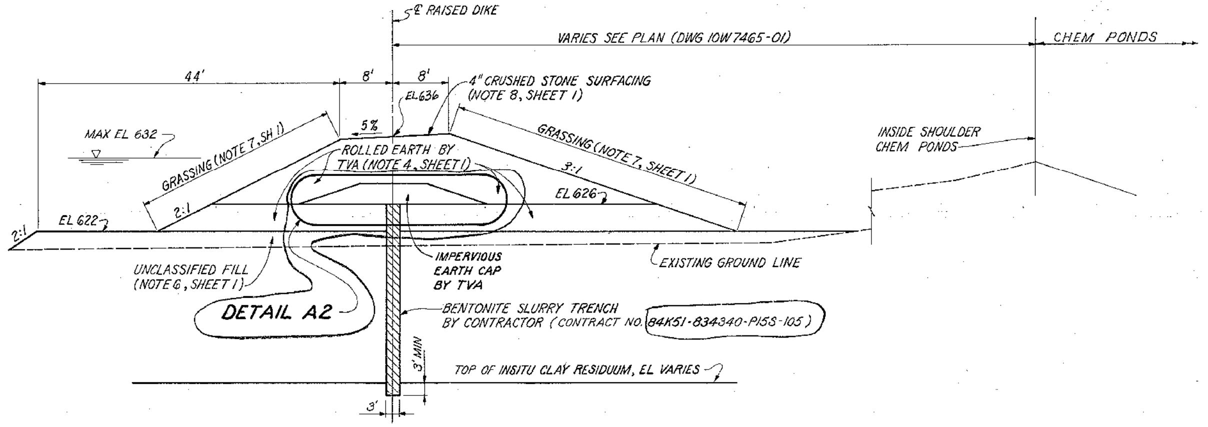
STEP 5. TVA SHALL CONSTRUCT THE REMAINDER OF THE EARTHFILL DIKE TO EL 636 AS SHOWN ON THE SECTIONS. TVA SHALL SEED AND MULCH THE SLOPES AND SURFACE THE TOP OF THE DIKE WITH 4 INCHES OF CRUSHED STONE.

STEP 6. TVA SHALL FILL THE AREA BETWEEN THE CHEMICAL PONDS AND THE NEW DIKE, GRADE TO DRAIN, COVER WITH 12 INCHES OF EARTH, SEED AND MULCH.

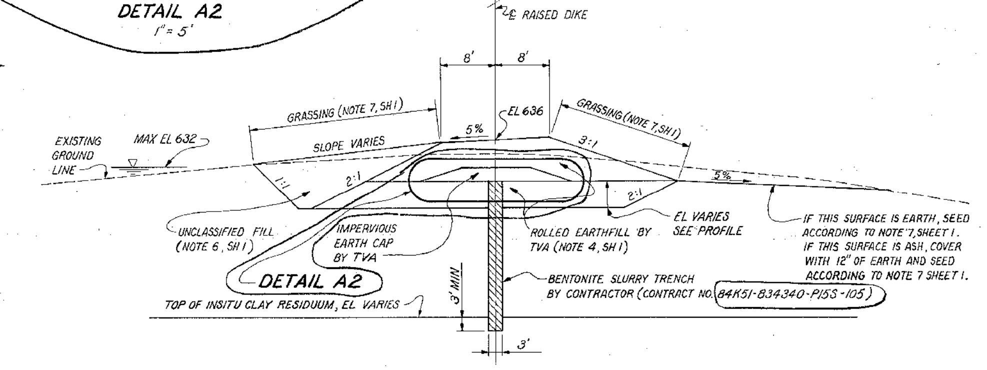
SUMMARY OF QUANTITIES

ITEM	DESCRIPTION	QUANTITIES	
		NEW AREA	UNITS 7&8 AREA
123	EARTH BORROW	195,350 CY	[1]190,750 CY
305	CRUSHED STONE SURFACING	2,785 TON	2,550 TON
580	SEEDING	56,300 SY	126,575 SY
582	MULCHING	56,300 SY	126,575 SY
	UNCLASSIFIED FILL	[2]54,100 CY	[2]35,550 CY
	UNCLASSIFIED FILL (EARTH)		[3]31,050 CY
	UNCLASSIFIED FILL (BOTTOM ASH)	[4]187,300 CY	
	BENTONITE SLURRY		[5]170,500 SF

[1] INCLUDES 76,850 CY EL 622 TO EL 626 AND 10,050 CY FOR EARTH CAP, BY TVA.
[2] DEFLECTOR DIKE FILL, BY TVA.
[3] COVERING FOR EXTERIOR SLOPES, BY TVA.
[4] CONSTRUCTION OF BASE IN NEW AREA, BY TVA.
[5] BY CONTRACTOR.



B2 - B2
STA 35+00± TO STA 54+00±
NTS
SEE SUGGESTED CONSTRUCTION SEQUENCE



D2 - D2
STA 55+00± TO STA 68+00±
NTS

NOTES:
1. FOR GENERAL NOTES SEE DRAWING 10W7465-01.
2. UNCLASSIFIED FILL MAY BE EARTH OR BOTTOM ASH CORE WITH 12 INCHES OF EARTH COVER. COMPACTION MAY BE WITH LOADED EARTHMOVING EQUIPMENT OR COMPACTION EQUIPMENT.

PROCEDURE FOR CONSTRUCTING EARTH CAP

PREPARATION OF EARTH CAP FOUNDATION

JUST PRIOR TO CONSTRUCTING THE EARTH CAP, ANY MOUNDED SLURRY TRENCH BACKFILL MATERIAL ON THE TRENCH SHALL BE REMOVED BY DOZER UNTIL THE SURFACE IS FLAT. THIS REMOVED MATERIAL SHALL BE SPREAD THINLY OVER THE WORK SURFACE ADJACENT TO THE TRENCH. THE TRACKS OF THE DOZER SHALL NOT BE ALLOWED ON THE TRENCH.

EARTH CAP MATERIAL

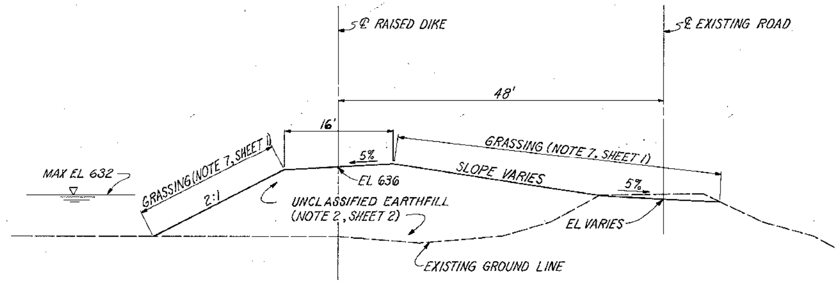
CH OR CL MATERIAL SHALL BE USED FOR CONSTRUCTING THE EARTH CAP. WHEN PLACED THE MOISTURE CONTENT OF THE MATERIAL SHALL BE WITHIN -1% TO +3% OF ITS OPTIMUM MOISTURE CONTENT. THE MOISTURE CONTENT SHALL BE DETERMINED AT 200' ℄ INTERVALS.

PLACEMENT OF MATERIAL

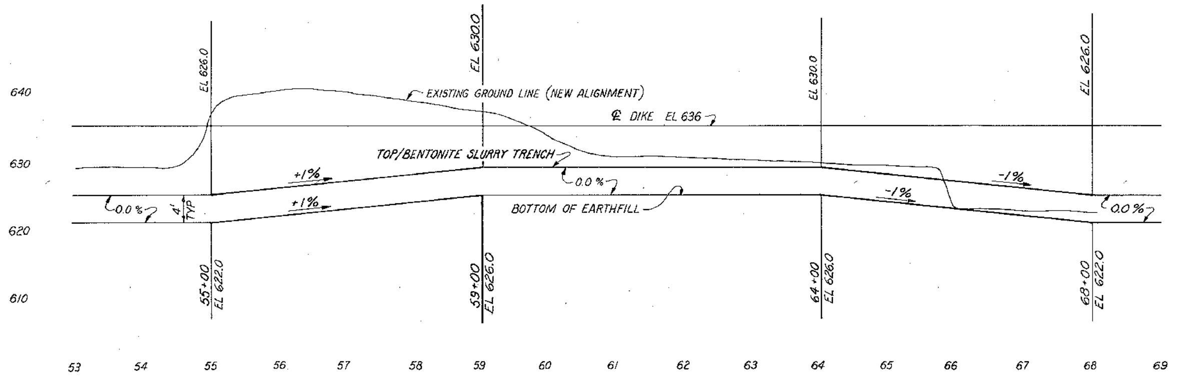
A SUFFICIENT QUANTITY OF MATERIAL SHALL BE PLACED IN A WINDROW ALONGSIDE AND PARALLEL TO THE COMPLETED SLURRY TRENCH. THE WINDROWED MATERIAL SHALL BE PLACED IN 8" THICK LOOSE LIFTS BY PUSHING ACROSS THE TRENCH FROM THE SIDE WITH A DOZER. THE TRACKS OF THE EQUIPMENT SHALL NOT BE ALLOWED ON THE TRENCH PARALLEL TO ITS ALIGNMENT. THE 8" LOOSE LIFTS SHALL BE TRACK-WALKED FOR COMPACTION TO GET 6" COMPACTED LAYERS. THE ABOVE PROCEDURE SHALL BE REPEATED FOR THE NEXT THREE LIFTS. IF AFTER PLACEMENT OF FOUR LIFTS IT IS APPARENT, BY OBSERVATION OF DOZER TRACKING, THAT SUCCEEDING LIFTS WILL NOT SUPPORT EARTHMOVING EQUIPMENT ONE OR MORE ADDITIONAL LIFTS SHALL BE PLACED BY THE ABOVE PROCEDURE.

ADDITIONAL COMPACTION OF EARTH CAP

THE COMPLETED EARTH CAP SHALL BE RECOMPACTED AT 5 DAY INTERVALS (UNTIL DIKE CONSTRUCTION ABOVE EARTH CAP COMMENCES) TO DEVELOPE AND EXPOSE ANY POSSIBLE DEPRESSION AREAS. IF ANY DEPRESSION AREAS ARE DETECTED, PLEASE NOTIFY EN DES.



C2 - C2
STA 71+50 TO STA 87+50±
NTS



PART PROFILE
STA 55+00 TO 68+00
1" = 10' VERT
1" = 100' HORIZ

INITIAL ISSUE W.O. NO. 20648

COMPANION DRAWINGS:
10W7465-01 & -03

REV NO.	W.O. NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBM	RECM	APPD				
4	20648	5/31/84	RGS	MAH	JHS	JHS	MHM		MHM	REH	ROB				OPT
	ADD DET A2, CONTR NO. & CONSTR PROCEDURE. REV QTY & STEP 4.														
3	20648	3/8/84		MAH	JHS	JHS	MHM		MHM	REH	ROB				OPT
	REVISED PART PROFILE.														
2	20648	10/26/83		MAH	JHS	JHS	MHM	[illegible]	MHM	REH	OPT				
	REV A2-A2, B2-B2, D2-D2, SUM QTY'S & CONSTR SEQUENCE.														
1	20648	10/3/83		CHP	JHS	JHS	MHM		MHM	REH	OPT				
	ADDED D2-D2 & PART PROFILE; REV SECTIONS														

DSGN J. P. Hillier Stivers
DRWN Sherry A. Carr
CHKD Donald R. Galloway
SUPV J. P. Hillier Stivers
INSP Ralph G. Johnson
ENGINEER M. H. Miller

SCALE: 1" = 10' EXCEPT AS NOTED

YARD

ASH DISPOSAL AREA
UNITS 7 & 8
SECTIONS & DETAILS

WIDOWS CREEK STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED M. H. Miller
RECOMMENDED R. E. Harris
APPROVED O. P. Thornton

INSPECTED AND APPROVED FOR ISSUE

KNOXVILLE 7/14/83 34 C 10W7465-02 R4

RECORD DRAWING AS CONSTRUCTED

PRINT H
SIZE F
BR OR PROJ ME EE CE AD CD ED MD TP EP SW BL HP YC
PRINTS REQD-R 0

TECHNICAL INFORMATION CENTER
INDEXED KNOXVILLE