APPENDIX A

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Key to Log of Boring/Rock Core

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer, tsf	Graphic Log	MATERIAL DESCRIPTION		Well Graphic	REMARKS AND OTHER DETAILS
1	2	3	4	5	6	7	8	9		10	11	12

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows required to advance driven sampler each 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop.

6 **Recovery:** Percentage of driven sample length actually recovered.

7 **Pocket Penetrometer:** Pocket penetrometer field consistency measurement in tons per square foot (tsf).

8 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

9 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density/consistency.

10 **Water Content** Water content of soil sample measured in laboratory, expressed as percent of dry weight of sample.

11 **Well Graphic:** Diagram of well installation

12 **Remarks and Other Details:** Comments and observations regarding drilling or sampling made by driller or field personnel. Also includes well details and laboratory testing results.

TYPICAL MATERIAL GRAPHIC SYMBOLS

- BOTTOM ASH
- FLY ASH
- FILL
- SEDIMENTS
- TOPSOIL
- WATER
- PEAT (PT)
- Fat Organic CLAY (OH)
- Lean Organic CLAY (OL)
- Lean CLAY (CL)
- Fat CLAY (CH)
- SILT (ML)
- Clayey SAND (SC)
- Silty SAND (SM)
- Poorly-graded SAND (SP)
- Poorly-graded SAND (SP-SM)
- Clayey GRAVEL (GC)
- Silty GRAVEL (GM)
- Clayey GRAVEL (GC)
- COAL
- LIMESTONE
- SANDSTONE
- SHALE

TYPICAL WELL GRAPHIC SYMBOLS

- Filter Sand
- Natural fill
- PVC Pipe in Bentonite Seal
- PVC Pipe in Bentonite Grout
- Bentonite Plug
- PVC Pipe in Filter Sand
- Slotted PVC Pipe in Filter Sand

OTHER GRAPHIC SYMBOLS

- First water encountered at time of drilling and sampling (ATD)
- Water level at time indicated on log
- Minor change in material properties within a lithologic stratum
- ---- Inferred or gradational lithologic contact

ATD At Time of Drilling
NR Not Recorded
NA Not Applicable

TYPICAL SAMPLER GRAPHIC SYMBOLS

- Split-spoon
- Core Barrel
- Shelby-tube
- Piston Tube
- Core

MINOR SOIL TYPE(s)

"trace" When the soil type's percentage is estimated, using visual/manual procedures, to be between 1 and 15 percent of the total sample.

"with" When the soil type's percentage is estimated, using visual/manual procedures, to be greater than 15 percent and less than 30 percent of the total sample.

"y" When the soil type's percentage is estimated, using visual/manual procedures, to be greater than 30 percent of the total sample.

Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced; they are not warranted to be representative of subsurface conditions at other locations or times.

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KEY TO DESCRIPTIVE TERMS USED ON CORE LOGS

DISCONTINUITY DESCRIPTORS

a Dip of discontinuity, measured relative to a plane normal to the core axis.

b **Discontinuity Type:**

- F - Fault
- J - Joint
- Sh - Shear
- Fo - Foliation
- V - Vein
- B - Bedding

c **Aperture (inches):**

- W - Wide (0.5-2.0)
- MW - Moderately Wide (0.1-0.5)
- N - Narrow (0.05-0.1)
- VN - Very Narrow (<0.05)
- T - Tight (0)

d **Type of Infilling:**

- Cl - Clay
- Ca - Calcite
- Ch - Chlorite
- Fe - Iron Oxide
- Gy - Gypsum
- H - Healed
- Mn - Manganese Oxide
- No - None
- Py - Pyrite
- Qz - Quartz
- Sd - Sand

e **Amount of Infilling:**

- Su - Surface Stain
- Sp - Spotty
- Pa - Partially Filled
- Fi - Filled
- No - None

f **Surface Shape of Joint:**

- Pl - Planar
- Wa - Wavy
- St - Stepped
- Ir - Irregular

g **Roughness of Surface:**

- Slk - Slickensided [surface has smooth, glassy finish with visual evidence of striations]
- S - Smooth [surface appears smooth and feels so to the touch]
- SR - Slightly Rough [asperities on the discontinuity surfaces are distinguishable and can be felt]
- R - Rough [some ridges and side-angle steps are evident; asperities are clearly visible, and discontinuity surface feels very abrasive]
- VR - Very Rough [near-vertical steps and ridges occur on the discontinuity surface]

h **Discontinuity Spacing (feet):**

- EW - Extremely Wide (>6)
- W - Wide (2-6)
- M - Moderate (0.7-2)
- C - Close (0.2-0.7)
- VC - Very Close (<0.2)

ROCK WEATHERING / ALTERATION

Description	Recognition
Residual Soil	Original minerals of rock have been entirely decomposed to secondary minerals, and original rock fabric is not apparent; material can be easily broken by hand
Completely Weathered/Altered	Original minerals of rock have been almost entirely decomposed to secondary minerals, although original fabric may be intact; material can be granulated by hand
Highly Weathered/Altered	More than half of the rock is decomposed; rock is weakened so that a minimum 2-inch-diameter sample can be broken readily by hand across rock fabric
Moderately Weathered/Altered	Rock is discolored and noticeably weakened, but less than half is decomposed; a minimum 2-inch-diameter sample cannot be broken readily by hand across rock fabric
Slightly Weathered/Altered	Rock is slightly discolored, but not noticeably lower in strength than fresh rock
Fresh/Unweathered	Rock shows no discoloration, loss of strength, or other effect of weathering/alteration

ROCK STRENGTH

Description	Recognition	Approximate Uniaxial Compressive Strength (psi)
Extremely Weak Rock	Can be indented by thumbnail	35 - 150
Very Weak Rock	Can be peeled by pocket knife	150 - 700
Weak Rock	Can be peeled with difficulty by pocket knife	700 - 3,500
Medium Strong Rock	Can be indented 5 mm with sharp end of pick	3,500 - 7,200
Strong Rock	Requires one hammer blow to fracture	7,200 - 14,500
Very Strong Rock	Requires many hammer blows to fracture	14,500 - 35,000
Extremely Strong Rock	Can only be chipped with hammer blows	> 35,000

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-1 (MW-1201)

Date(s) Drilled	**4/10/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**HSA, HQ Wireline Core**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**49.5 ft**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**799.4 ft above msl**
Borehole Backfill	**Borehole finished as monitoring well MW-1201**	Sampling Method(s)	**Split-spoon, HQ Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 252,798.0 E 2,099,724.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	Sample Type	Sample Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0									
		SS	SS-1	WOH	50	1.0		Stiff, moist, brown to reddish brown lean CLAY (CL), trace silt and sand		Grout
	1			2		2.0				
				2		2.0		Stiff to very stiff, moist, brown to reddish brown, very fine sandy lean CLAY (CL) [RESIDUUM]		SCH 40 PVC 2" diameter riser
				3		3.25				
	2							becomes very stiff to hard		
		SS	SS-2	5	50	3.5				
	3			5		4.5			17.7	*PL=17 LL=35 PI=18 %F=67.9*
				5		3.5				
				7		4.5				
	4									
795		SS	SS-3	2	63	1.75		becomes mottled reddish brown and light gray		
	5			2		3.0				
				5		4.0				
				7		3.0				
	6									
		SS	SS-4	7	100			Medium dense, moist, dark reddish brown fine to medium clayey SAND (SC) with trace oxidized sandstone gravel, with tan and light gray mottling [RESIDUUM]		
	7			10		3.5				
				11		4.5				
				11		4.25				
	8									
		SS	SS-5	3	92	3.5		Very stiff to hard, moist, light gray to light tan, fat CLAY (CH), trace sand [RESIDUUM]		
	9			6		>4.5		1/4" dark red-brown, highly weathered shale seam		
790				7		3.5				
				9		>4.5				
	10									
		SS	SS-6	2	92	3.75				
	11			5		4.0				
				9		4.25				
				15		4.25				
	12	SS	SS-7	50/5"	8	>4.5		becomes gray to light gray		
								Quartz SANDSTONE, gray, slight to no weathering, very strong, slight to moderate HCL reaction (4.5"-6"), grading more flaggy and micaceous at 9"		*Auger/spoon refusal at 12.5 ft bgs*
	13		R1	24%	50					
	14							Fracture #1: 0, B, N, None ,None, Ir, SR, M		
785										
	15									
	16									
	17		R2	30%	50			SHALE, gray, slight to moderately weathered, very weak		
								Fracture #2: 0, B, 0, None, None, Pl, SR, VC		
	18									
	19									
780										
	20		R3	27%	77					

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Log of Boring/Rock Core
HB-1 (MW-1201)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20							becomes dark gray and slightly fossiliferous		*Brush creek limestone*
	21							Microcrystalline LIMESTONE, gray, slight to no weathering, very strong, fossiliferous		**SCH 40 PVC 2" diameter riser**
	22		R3	27%	77			SHALE, dark gray, slight to moderate weathering, very weak, slightly fossiliferous		
	23							Microcrystalline LIMESTONE, light gray to gray, slight to moderate weathering, strong		*Brush creek limestone*
								Fracture #3: 0, B, N to MW, None, None, Ir, R, EW		
	24							SHALE, dark gray, slight to moderate weathering, very weak		
775								becomes gray		
	25									
	26							becomes green, slight to no weathering, strong with trace brown clay in bedding planes		
	27		R4	13%	30			COAL, black, slight to no weathering, very weak		
	28							MUDSTONE, black to dark gray, slight to moderate weathering, medium strong		
	29							becomes gray		
770										
	30									
	31									
	32		R5	68%	87					
	33									
	34									
765										
	35							becomes with sand, trace mica (muscovite)		**Bentonite seal**
	36							becomes slightly fissile		
	37		R6	45%	100			2-inch gray sandstone seam		
								becomes wavy bedding		
	38							becomes without wavy bedding, without muscovite		**Filter sand**
	39									
760								becomes with sand, semi-fissile		
	40									**SCH 40 PVC 2" diameter 0.01" slotted screen**
	41									
			R7	52%	92					
	42							Quartz SANDSTONE with biotite and muscovite, slight weathering, medium strong, ~15° dip, cross bedded		
								Fracture #4: 15%, B, T, Ca, Pa, Pl, SR, VC		
	43									

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Log of Boring/Rock Core
HB-1 (MW-1201)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44		R7	52%	92						Filter sand
755	45										
	46										
	47		R8	85%	100						
	48										
	49										
750	50							End of Boring at 49.5´ bgs			
	51										
	52										
	53										
	54										
745	55										
	56										
	57										
	58										
	59										
740	60										
	61										
	62										
	63										
	64										
735	65										
	66										

Project: AEP Big Sandy Landfill Investigation
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Log of Boring/Rock Core
HB-2/SB-1 (MW-1202)

Date(s) Drilled	**4/13/12**	Logged By	**S. Becker**	Checked By	**J. Lach/V. Gautam**
Drilling Method	**HSA, HQ Wireline Core**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**44.5 ft**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**849.6 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1202**	Sampling Method(s)	**Split-spoon, HQ Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 254,651.6 E 2,101,180.0**	Groundwater Level(s)	**Water level @ 28.85 ft bgs**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0										
		SS	SS-1	2 3 3 3	100	1.5 3.5 2.0 1.5		Loose, moist, brown, sandy CLAY (SC), trace gravel (topsoil)			Grout
	1							Loose, moist, brown sandy CLAY (SC), trace gravel [RESIDUUM]			SCH 40 PVC 2" diameter riser
								becomes mottled brown and gray			
	2							Stiff to very stiff, moist, tannish brown and gray mottled lean CLAY (CL), trace sand, trace gravel [RESIDUUM]			
		SS	SS-2	3 4 5 5	83	2.5 2.5 2.75 2.5		becomes reddish brown and gray mottled			
	3										
	4							becomes with weathered brown shale fragments			
845											
	5	SS	SS-3	2 4 5 6	21						
	6							becomes without shale fragments, hard			
		SS	SS-4	4 6 8 9	13	3.25					
	7										
	8							becomes gray and tan mottled, without sand, dry to moist, without gravel			
		SS	SS-5	3 6 9 12	58	3.0 4.5 4.5 3.5			17.7		*PL=21 LL=45 PI=24 %F=91*
840	9										
	10							becomes light gray			
		SS	SS-6	3 5 8 11	79	4.25 3.0 2.5					
	11										
	12							becomes brownish red			
		SS	SS-7	6 10 13 12	63	4.0 4.5 4.5		becomes gray to light gray, without silt			
	13										
	14										
835		SS	SS-8	6 16 16 24	75	>4.5		SHALE, greenish gray, highly weathered, very to extremely weak			
	15										
	16							becomes brownish gray, dry			
		SS	SS-9	24 49 50/4"	75			becomes greenish gray			
	17										
	18										
	19										*18 to 20 ft bgs - No Split Spoon Collected*
830											
	20										

URS

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-2/SB-1 (MW-1202)

Elevation, feet	Depth, feet	SAMPLES: Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20			9						
	21	SS	SS-10	12 15 16	96					SCH 40 PVC 2" diameter riser
	22	SS	SS-11	50/4"	63					
	23									
	24									*Augered 24-25 ft bgs to begin setup for wireline coring*
825	25							22.4 to 25 ft, bgs - No Recovery - HSA Only becomes with 1-2" weathered limestone 25 ft, bgs - Begin HQ Rock Coring		
	26							becomes with iron-stained lamina, slightly to moderately weathered, strong to very strong		
	27	R	R1	41%	48					*Dry run* *No water*
	28									Bentonite seal
	29									
820	30							Quartz SANDSTONE, gray, slightly to moderately weathered, strong, micaceous (muscovite), with iron-staining, thinly bedded		*Dry run* *No water*
	31							becomes with biotite Fracture #1: 0, B, T-N, Fe, Su, Ir, SR, M		Filter sand
	32	R	R2	27%	70			Fracture #2: 0, B, T, Fe, Su, Ir, SR, VC		SCH 40 PVC 2" diameter 0.01" slotted screen
	33							becomes wet		
	34									
815	35									*Water used*
	36							becomes without iron staining, no weathering, very strong to strong Fracture #3: 0, B, T-VN, --, No, Pl-Wa, SR, VC		
	37	R	R3	98%	103			Fracture #4: 0, B, MW-W, Fe, Su, Pl-Wa, R, M		
	38									
	39									
810	40									
	41									
	42	R	R4	68%	98			SHALE, greenish gray, no weathering, very weak		
	43							Fracture #5: 0, B, T, Cl-No, Su -No, Pl, S-SR, VC		

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Log of Boring/Rock Core
HB-2/SB-1 (MW-1202)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44	R4	68%	98						Filter sand
805	45						End of Boring at 44.5´ bgs			
	46									
	47									
	48									
	49									
800	50									
	51									
	52									
	53									
	54									
795	55									
	56									
	57									
	58									
	59									
790	60									
	61									
	62									
	63									
	64									
785	65									
	66									

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Log of Boring
HB-3 (MW-1206)

Date(s) Drilled	**4/23/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**Rotosonic (No vibration), Wireline**	Drill Bit Size/Type	**8.0" ID steel casing, 4.0" ID core barrel**	Total Depth of Borehole	**124.5 ft**
Drill Rig Type	**Versa-Sonic**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**695.4 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1206**	Sampling Method(s)	**Rotosonic Core Barrel**	Hammer Data	**Not Applicable**
Boring Location	**N 251,617.9 E 2,104,243.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
695	0						See log for PB-7 from 0-111 ft bgs			Bentonite chips
	1									
	2									
	3									SCH 40 PVC 2" diameter riser
	4									
690	5									
	6									
	7									
	8									
	9									
685	10									
	11									
	12									
	13									
	14									
680	15									
	16									
	17									
	18									
	19									
	20									

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Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
675	20								
	21								Bentonite chips
	22								
	23								SCH 40 PVC 2" diameter riser
	24								
	25								
670	26								
	27								
	28								
	29								
	30								
665	31								
	32								
	33								
	34								
	35								
660	36								
	37								
	38								
	39								
	40								
655	41								
	42								
	43								

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Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44									
	45									Bentonite chips
650	46									
	47									SCH 40 PVC 2" diameter riser
	48									
	49									
	50									
645	51									
	52									
	53									
	54									
	55									
640	56									
	57									
	58									
	59									
	60									
635	61									
	62									
	63									
	64									
	65									
630	66									

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Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67								Bentonite chips
	68								
	69								SCH 40 PVC 2" diameter riser
	70								
625									
	71								
	72								
	73								
	74								
	75								
620									
	76								
	77								
	78								
	79								
	80								
615									
	81								
	82								
	83								
	84								
	85								
610									
	86								
	87								
	88								
	89								
	90								

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Log of Boring
HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES Type Number	SAMPLES Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES Recovery, %	SAMPLES Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
605	91								Bentonite chips
	92								
	93								SCH 40 PVC 2" diameter riser
	94								
	95								
600	96								
	97								
	98								
	99								
	100								
595	101								
	102								
	103								
	104								
	105								
590	106								
	107								
	108								
	109								Bentonite seal
	110								
585	111				0.5		Soft, moist to wet, dark gray to dark greenish gray, sandy lean CLAY (CL) [ALLUVIUM]		
	112	CB-1		90	0.5				# 5 filter sand
	113						becomes greenish gray, trace oxidized red and gray		

Report: GEO_CR_WELL; File K:\PROJECTS\AAEP\13815141_BSLF\DOCS\LOGS\AEPBORINGS-6-10-13.GPJ; 6/10/2013 11:23:15 AM

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring HB-3 (MW-1206)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	114					2.5		becomes very stiff with sand seams		SCH 40 PVC 2" diameter 0.01" slotted screen
						2.5				
	115							becomes with trace gray to dark gray sandstone fragments		
580						2.75				
	116									
						2.25				
	117	CB	CB-1		90					
						3.0				
	118									
						2.5				
	119									# 5 filter sand
						2.5				
	120							becomes greenish brown		
575						4.5				
	121									
						1.5		becomes brownish gray, intermittent sandy clay seams		
	122									
						2.0		becomes with trace sandy shale and sandstone cobbles and gravel		
	123	CB	CB-2		95					*Install MW-1206 at 123.5 ft on 4/24/2012*
						1.25		becomes stiff, grayish brown		*Clay expansion to 123.6 ft overnight*
	124									
								End of Boring at 124.5´ bgs		*Core barrel refusal at 124.5 ft bgs*
	125									
570										
	126									
	127									
	128									
	129									
	130									
565										
	131									
	132									
	133									
	134									
	135									
560										
	136									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-4/SB-5 (MW-1204)

Date(s) Drilled	**4/18/12**	Logged By	**J. Lach**	Checked By	**V. Gautam**
Drilling Method	**HSA, HQ Wireline Coring**	Drill Bit Size/Type	**6 1/4" HSA, 6" OD bit with HQ core**	Total Depth of Borehole	**35.0 ft**
Drill Rig Type	**CME 550 Truck**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**721.3 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1204**	Sampling Method(s)	**Split-spoon, HQ Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 252,025.3 E 2,102,075.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0			6				Light brown, heavily weathered sandstone (access road)		2.5 ft stickup
				22						Grout 20% mix ~30 gallons used
	1			42	86	>4.5		Hard, dry, light brown, lean CLAY (CL) [RESIDUUM OR FILL]		
720				50/3						
	2							Heavily weathered SANDSTONE, light brown, with some lean clay, dry (Auger Cuttings)		SCH 40 PVC 2" diameter riser
	3									*No recovery - HSA cuttings consist of mixture of lean clay and heavily weathered sandstone fragments - all dry*
	4									
	5							Fine to medium grained SANDSTONE, brown, moderately weathered, strong		*Auger refusal at 5.0 ft bgs*
	6							MUDSTONE, greenish brown, moderately weathered, weak Fracture #1: 0, B, No, W, VN, Pl, SR		
715	7		R1	18%	70			Fracture #2: 0, B, No, W, VN, Pl, SR		
	8									
	9							2" brown lean clay seam Fracture #3: 0, B, No, W, VN, Pl, SR		
	10							becomes lightly weathered, extremely weak, micaceous, with iron staining		
	11									
710	12		R2	22%	23					*Driller reported constant down pressure. Little to no H20 loss*
	13									
	14							Micaceous SANDSTONE, greenish gray, strong		
								becomes brown, moderately weathered (14.5 to 14.6 ft)		
	15							becomes greenish gray, very strong		
								becomes brown, slightly weathered		Bentonite Hydrated
	16									
705								becomes greenish gray, micaceous, cross-bedded, very weak		
	17							Fracture #4: 0, B, No, W, VN, Pl, SR		
	18		R3	85%	90					#5 filter sand
								becomes mottled with partial brown iron staining and greenish gray, strong in brown stained portions		
	19									
	20							becomes greenish gray, weak, with iron staining		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-4/SB-5 (MW-1204)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20							becomes greenish gray, micaceous, weak			SCH 40 PVC 2" diameter 0.1" slotted screen
	21										
700								Fracture #5: 0, B, No, W, VN, Pl, SR			
	22							becomes brown, coarse, very strong, micaceous			
								becomes greenish gray, strong, very micaceous, wet,			#5 filter sand
	23	R	R4	65%	82			coarse grained			
								becomes brown, coarse, very strong			
	24							becomes dark brown, moderately weathered, strong			
								becomes light gray, coarse, very strong with some			
	25							sections of slight weathering, brown			
	26										
695											
	27							becomes gray, coarse-grained, micaceous, weak with			
		R	R5	80%	100			stained sections (strong where stained)			
	28										
	29							Fracture #6: 90, J, Su, W, VN, Ir, VR			
	30							Fracture #7: 0, B, No, W, VN, Pl, SR			2" diameter sump
	31							SHALE, gray, fissile, strong			
690								MUDSTONE, gray, very weak, slightly fissile			
	32										
		R	R6	75%	88			becomes with decreasing fissility			
	33							SHALE, gray, fissile, weak			
								becomes with brown staining			
	34							MUDSTONE, gray, very weak, not fissile			
	35							End of Boring at 35´ bgs			
	36										
685											
	37										
	38										
	39										
	40										
	41										
680											
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-5 (MW-1205)

Sheet 1 of 3

Date(s) Drilled	**4/19/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**HSA, HQ Wireline Coring**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**54.5 ft**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**714.3 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1205**	Sampling Method(s)	**Split-spoon, HQ Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,131.0 E 2,104,397.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0										
		SS	SS-1	2 1 2 1	100			Very loose, moist, black bottom ash, trace gravel [BOTTOM ASH]			**Bentonite grout**
	1										**SCH 40 PVC 2" diameter riser**
	2										
		SS	SS-2	2 1 3 4	33	2.0		Medium stiff to very stiff, moist, brown to tan lean CLAY (CL) with sand and trace gravel [RESIDUUM]			
	4										
710		SS	SS-3	9 5 8 8	100	2.75 1.0 2.75 1.5		3" red sand seam	15.8		*PL=17 LL=33 PI=16 %F=47.6* *Shelby tube sample 5-7' bgs* *Down pressure (psi) = 200-600 psi*
	5										
	6							becomes stiff to very stiff, reddish-brown, trace sand			
		SS	SS-4	9 6 7 8	83	2.0 1.75 3.5 >4.5		becomes with trace tan-brown shale fragments	16.1		*PL=16 LL=32 PI=16 %F=49.5*
	8							SHALE, tan, moderate to highly weathered, weak to extremely weak, dry to moist			
705	9	SS	SS-5	8 15 12 12	75						
	10							becomes dry			
		SS	SS-6	4 17 23 19	100						
	12										
		SS	SS-7	21 28 29 35	83						
	14										
700		SS	SS-8	11 20 21 20	100			becomes white/gray			
	16	SS	SS-9	50/3"	100			becomes greenish gray			*Outside of spoon wet*
	17										
	18										
	19										
695		R	R1	17%	37			becomes gray, slight weathering, very weak to extremely weak			*Auger to 19.5 ft to begin coring.*
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-5 (MW-1205)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21									SCH 40 PVC 2" diameter riser
	22		R1	17%	37					
	23									Bentonite grout
	24									
690								becomes red		
	25									
	26							becomes black and red		
	27		R2	47%	70					
	28							becomes gray		
	29									
685										
	30							Fracture #1: 0, B, T, Cl-No, Su-No, Pl, S, M-W		
	31									
	32		R3	35%	57					
	33									
	34									
680										
	35									
	36							becomes sandy		Bentonite chips
	37		R4	0%	100			SANDSTONE, gray, moderately to highly weathered, weak to medium strong, micaceous, thinly bedded, with numerous bedding plane fractures		
	38							Fracture #2: 0, B, T, Cl-No, Su-No, Pl, S, M		Filter sand
	39									
675										
	40									SCH 40 PVC 2" diameter 0.01 slotted screen
	41									
	42		R5	42%	100			becomes slightly-moderately weathered		
	43									

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-5 (MW-1205)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
670	44		R5	42%	100						
	45										
	46										SCH 40 PVC 2" diameter 0.01 slotted screen
	47		R6	55%	93						
	48										
665	49										
	50										Filter sand
	51										
	52		R7		100			Sandy SHALE, gray, moderately weathered, moderately strong to weak			
	53							becomes less sandy			
	54							coal seam, 2" coal seam, 3"			
660								End of Boring at 54.5´ bgs			
	55										
	56										
	57										
	58										
	59										
655	60										
	61										
	62										
	63										
	64										
650	65										
	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
HB-6 (MW-1207)

Sheet 1 of 8

Date(s) Drilled	**4/24/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**Rotosonic (No vibration), Wireline HQ**	Drill Bit Size/Type	**8" ID steel casing, 6" OD bit HQ Wireline**	Total Depth of Borehole	**166.0 ft**
Drill Rig Type	**Vibra-Sonic**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**695.0 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1207**	Sampling Method(s)	**HQ Wireline**	Hammer Data	**Not applicable**
Boring Location	**N 251,598.3 E 2,104,256.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
695	0							See log for boring PB-7		**Bentonite grout**
	1									**SCH 40 PVC 2" diameter riser**
	2									*Augered to 126 ft without sampling*
	3									
	4									
690	5									
	6									
	7									
	8									
	9									
685	10									
	11									
	12									
	13									
	14									
680	15									
	16									
	17									
	18									
	19									
675	20									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
675	20									
	21									SCH 40 PVC 2" diameter riser
	22									Bentonite grout
	23									
	24									
670	25									
	26									
	27									
	28									
	29									
665	30									
	31									
	32									
	33									
	34									
660	35									
	36									
	37									
	38									
	39									
655	40									
	41									
	42									
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44									SCH 40 PVC 2" diameter riser
650	45									
	46									Bentonite grout
	47									
	48									
	49									
645	50									
	51									
	52									
	53									
	54									
640	55									
	56									
	57									
	58									
	59									
635	60									
	61									
	62									
	63									
	64									
630	65									
	66									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	67									SCH 40 PVC 2" diameter riser
	68									
	69									Bentonite grout
625	70									
	71									
	72									
	73									
	74									
620	75									
	76									
	77									
	78									
	79									
615	80									
	81									
	82									
	83									
	84									
610	85									
	86									
	87									
	88									
	89									
605	90									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91								SCH 40 PVC 2" diameter riser
	92								
	93								Bentonite grout
	94								
600	95								
	96								
	97								
	98								
	99								
595	100								
	101								
	102								
	103								
	104								
590	105								
	106								
	107								
	108								
	109								
585	110								
	111								
	112								
	113								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	114									SCH 40 PVC 2" diameter riser
580	115									Bentonite grout
	116									
	117									
	118									
	119									
575	120									
	121									
	122									
	123									
	124									
570	125									
	126							No recovery 126-131. Driller notes "softer material"		
	127									
	128	HQ	HQ1	0%	0					
	129									
565	130									
	131							No recovery 131-136. Shale cuttings		
	132									
	133									
	134	HQ	HQ2	0%	0					
560	135									
	136									
		HQ	HQ3	18%	80			SHALE, light gray to gray, moderately weathered, very to extremely weak		

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	137							Fracture #1: 0, B, N-T, Cl, SP, Pl, S-SR, VC-M		SCH 40 PVC 2" diameter riser
	138									
	139		HQ3	18%	80					Bentonite grout
555	140							becomes with trace gray sandstone layers (occasional), up to 1/4"		
	141									
	142									
	143									
	144		HQ4	0%	50					
550	145									
	146							becomes dark gray to greenish gray, without sandstone seams		
	147							becomes dark gray to black		
	148							becomes light gray		
	149		HQ5	38%	38					
545	150									Bentonite seal
	151							3" layer of light gray, moist clay, with shale fragments		
	152									
	153							becomes interbedded with gray micaceous sandstone layers up to 1/4"		#5 filter sand
	154		HQ6	37%	83					
540	155									SCH 40 PVC 2" diameter 0.01" slotted screen
	156							6" sandstone, gray, slightly weathered, strong, thinly bedded to shaly		
	157							becomes extremely weak, highly fractured		
	158		HQ7	25%	73					
	159							interbedded sandstone up to 1/4"		
535	160							becomes dark gray, with thin light gray clay deposits on bedding		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
HB-6 (MW-1207)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
			HQ7	25%	73						
	161							SANDSTONE, gray, moderately weathered medium strong to very strong, flaggy, with thinly interbedded shale, micaceous			**SCH 40 PVC 2" diameter 0.01" slotted screen**
	162										
	163							Fracture #2: 0, B, T-VN, Cl, SP, Pl, S-SR, VC-M			**#5 filter sand**
			HQ8	42%	100						
	164										
530	165										
	166							End of Boring at 166´ bgs			
	167										
	168										
	169										
525	170										
	171										
	172										
	173										
	174										
520	175										
	176										
	177										
	178										
	179										
515	180										
	181										
	182										
	183										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-7/SB-2 (MW-1203)

Date(s) Drilled	**4/16/12**	Logged By	**S. Becker**	Checked By	**J. Lach**
Drilling Method	**HSA, HQ Wireline Coring**	Drill Bit Size/Type	**6 1/4" HSA/6" OD bit with HQ core**	Total Depth of Borehole	**54.5 ft**
Drill Rig Type	**CME 55**	Drilling Contractor	**Frontz Drilling**	Surface Elevation	**728.7 ft above msl**
Borehole Backfill	**Finished as monitoring well MW-1203**	Sampling Method(s)	**Split-spoon/Wireline**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 252,205.1 E 2,101,406.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0			3				Loose, moist, brown clayey SAND (SC), trace sandstone gravel [FILL]			**Grout**
	1	SS	SS-1	2 2 4	50	0.75 1.5			16.4		*PL=18 LL=31 PI=13 %G=8.3 %S=44.5 %F=47.2*
	2			4		3.5		Stiff to very stiff, moist, reddish brown, lean CLAY (CL) [FILL]			**SCH 40 PVC 2" diameter riser**
	3	SS	SS-2	4 5	71	3.0		1" red-brown medium sand seam 2" medium reddish brown sand seam with sandstone fragments			
725	4			6		3.0					
	5	SS	SS-3	3 4 7 7	83	3.5 4.5 4.5 3.5		becomes with sandstone fragments (gravel) with red-brown sand iron-staining	16.7		*PL=17 LL=31 PI=15*
	6			14		4.5		Dense, dry to moist, red to brown, clayey SAND (SC) with gravel [ALLUVIUM]			*Iron staining on sand and gravel*
	7	SS	SS-4	15 17 20	92	4.5 >4.5 >4.5					
	8			7		4.0		becomes mottled brown and orange			
720	9	SS	SS-5	12 13 16	100	4.0 4.5 4.0			10.4		*%G=19.3 %S=49.8 %F=30.9*
	10			5							
	11	SS	SS-6	13 14 12	100			becomes increasing sand and gravel content			
	12			11		3.5		Very stiff to hard, moist red-brown fat CLAY (CH) trace sand and gravel [ALLUVIUM]			
	13	SS	SS-7	17 27	92	3.25 3.5			17.6		
715	14			17		>4.5		4" reddish brown sand layer with trace clay			
	15	SS	SS-8	3 6 10 8	100	1.0 2.0 3.0		Medium stiff to stiff, moist, red-brown silty, clayey SAND (SC-SM) with weathered sandstone gravel [ALLUVIUM]			
	16			23		1.0					
	17	SS	SS-9	15 13 12	83	3.0 2.5 3.5		2" sandstone fragment in spoon	12.2		*PL=15 LL=20 PI=5 %G=16.6 %S=53.6 %F=29.8*
	18			4				Loose, moist to wet, red-brown clayey SAND (SC), trace sandstone gravel [ALLUVIUM]			
710	19	SS	SS-10	3 6 6	63						
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-7/SB-2 (MW-1203)

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20			9				becomes brown		Grout
	21	SS	SS-11	4 5 24	58				13.9	SCH 40 PVC 2" diameter riser
	22			11				becomes medium dense		
	23	SS	SS-12	10 12	100					
705	24			9						
	25	SS	SS-13	4 8 10 17	83	3.5 4.5 >4.5 >4.5		Hard, moist, tan and brown mottled lean CLAY (CL), trace sand [RESIDUUM]		
	26	SS	SS-14	40 50/4"	40			SHALE, greenish tan, moderately weathered, extremely weak		
	27									
	28	SS	SS-15	50/4"	50			becomes greenish gray, slightly-moderately weathered		
700	29									
	30							Fracture#1: 0, B, T, Cl-No, Su-No, Ir, S-SR, VC		
	31							becomes brown		
	32	R	R1	44%	78			becomes mottled gray, light brown and red Fracture#2: 38, Sh, T, Cl, Su, Pl, S, VC		Bentonite seal
	33							Fracture#3: 30, Sh, N, Cl, Su, Pl, S, VC		
695	34									
	35							becomes greenish gray		Filter sand
	36									
	37	R	R2	58%	85			SANDSTONE, gray with very light black banding, slightly weathered, strong, micaceous (muscovite and biotite)		SCH 40 PVC 2" diameter 0.01" slotted screen
	38							Fracture#4: 0, B, MW, No, No, St, SR-S, C		
690	39									
	40							Fracture#5: 0, B, T, No-Sd, Sp, Pl, S-SR, VC		
	41	R	R3		100					
	42							Fracture#6: 25, Sh, T, Fe, Su, Pl-Wa, SR, VC		
	43							7" area Fe staining		

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
HB-7/SB-2 (MW-1203)

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
685	44	R3			100			Fracture#7: 25, Sh, T, Cl, Pa, Pl, SR, VC 5" Fe staining 12" Fe staining			SCH 40 PVC 2" diameter 0.01" slotted screen
	45										
	46							Fracture#8: 0-15, B, T, Fe, Su, Pl, SR, VC			
	47	R4		70%	100			Fe staining			Filter sand
	48										
680	49										
	50										
	51										
	52	R5		92%	92						
	53										
675	54										
	55							End of Boring at 54.5´ bgs			
	56										
	57										
	58										
670	59										
	60										
	61										
	62										
	63										
665	64										
	65										
	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-1

Sheet 1 of 3

Date(s) Drilled	**4/18/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**Rotary/Water**	Drill Bit Size/Type	**4"**	Total Depth of Borehole	**57.0 ft**
Drill Rig Type	**Acker**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**Top of water el. 695.1 ft above msl**
Borehole Backfill	**Cement Bentonite Grout**	Sampling Method(s)	**Piston tube/Split-spoon**	Hammer Data	**140#/30" Manual drop**
Boring Location	**38°10'57.4" N 83°38'41.3" W**	Groundwater Level(s)	**0' bgs**		

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
695	0						Water ▽			*Barge drilling- water @ 695.1.*
	1									
	2									
	3									
	4									
690	5									
	6									
	7									
	8									
	9									
685	10									
	11									
	12									
	13									
	14									
680	15									
	16									
	17									
	18									
	19									
	20									

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-1

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
675	20										
	21										
	22										
	23							Soft sediments			*Top of sediment @ 22.5 ft. Casing sank to 27.5 ft.*
	24										
670	25										
	26										
	27	SS-1		1 WH 0 0	38			Loose, wet fly ash as silty sand (SM) [FLY ASH]			
	28										
	29										
665	30	P-1			91						
	31										
	32										
	33										
	34										
660	35	P-2			77						
	36										
	37	SS-2		3 6 8 5	100						
	38										
	39										
655	40										*Rods sank to 42'*
	41										
	42							12" loose, wet, fly ash as silt (ML), trace fine sand [FLY ASH]			
	43					<0.5					

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-1

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44					2.0		Soft, moist, dark gray, lean CLAY (CL) [ALLUVIUM]			
								becomes stiff, yellow, some sand, trace gravel			
650	45							becomes very stiff, yellow brown with orange iron staining, with sand, trace gravel			
	46	SS-3		3 3 4 5	38	2.5					
	47										
	48										
	49										
645	50							becomes stiff to very stiff, sandy, trace gravel			
	51	SS-4		6 7 12 12	33	1.0 2.5					
	52										
	53										
	54							Shale, gray, dry, crushed			*Drilling change encountered @ 53.5 ft bgs*
640	55										
	56	SS-5		45 50/2"	33						
	57							End of Boring at 57´ bgs			
	58										
	59										
635	60										
	61										
	62										
	63										
	64										
630	65										
	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
PB-2

Sheet 1 of 4

Date(s) Drilled	**4/17/12-4/18/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**Rotary/Water**	Drill Bit Size/Type	**4"**	Total Depth of Borehole	**77.0 ft**
Drill Rig Type	**Acker**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**Top of water el. 695.1 ft above msl**
Borehole Backfill	**Bentonite chips**	Sampling Method(s)	**Piston/Split-spoon/Shelby-tube**	Hammer Data	**140#/30" Manual drop**
Boring Location	**38°10'52.5" N 83°33'35.2" W**	Groundwater Level(s)	**0 ft bgs**		

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
695	0						Water			*Pond elevation - 695.1 ft*
	1									
	2									
	3									
	4									
690	5									
	6									
	7									
	8									
	9									
685	10									
	11									
	12									
	13									
	14									
680	15									
	16									
	17									
	18									
	19									
	20									

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Project Location: Louisa, KY
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Log of Boring PB-2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
675	20										
	21										
	22										
	23							Soft sediments			*Pond bottom @ 23' bgs*
	24										
670	25										*Casing sank to 25'*
	26	SS	SS-1	2 1 2 3	17			Very loose, wet, gray bottom ash as medium to fine SAND (SP-SM) with some gravel and shale fragments, trace plant fragments [BOTTOM ASH]			
	27										
	28										
	29										
665	30										
	31	P	P-1		0			Loose, wet, fly ash as silty SAND (SM), light and dark laminations [FLY ASH]			
	32										*1 blow for 24 inches*
	33	SS	SS-2	1 0 0 0	0						
	34										
660	35										
	36										
	37										
	38	P	P-2		91						
	39										
655	40	SS	SS-3	2 1 1 2	27						
	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-2

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44										
650	45										*Push to 45' bgs - casing sank to 46' bgs*
	46							becomes gray, with silty sand			
	47	SS-4		1 0 0 0							
	48										
	49										
645	50	P-3			99						
	51							becomes with silt and some fine black sand			
	52	SS-5		WH 0 0 0	100	>1.0		Very soft to stiff, moist, dark gray, lean CLAY (CL) [ALLUVIUM]			
	53										
	54										
640	55							becomes yellow			
	56	P-4									
	57							becomes soft, moist, grey/yellow, some silt, trace gravel, sand at base - root			
	58	SS-6		3 3 6 14	75	0.5 1.0		becomes stiff	20.6		*PL=16 LL=27 PI=12*
	59										
635	60										
	61	ST-1			50						
	62							becomes stiff, yellow brown with orange mottles, with gravel and trace sand			
	63	SS-7		7 8 9 5	25	1.5 2.0					
	64										
630	65										
	66	SS-8		3 WR WR	33	0.5		Loose, moist, orange brown with gray mottles, sandy CLAY (SC), trace gravel [ALLUVIUM]			

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring PB-2

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	67			6							*End at 67' 4/17/12* *Start on 4/18/12* *Begin by drilling to 70'*
	68										
	69							Very stiff, moist, yellow brown with gray mottles, silty CLAY (CL), some sand and gravel [RESIDUUM]			
625	70			5							
	71		SS-9	7 13 11	38	2.5 3.0			16.8		*PL=17 LL=24 PI=7*
	72										
	73										
	74							Shale, light gray, moderately weathered, dry			
620	75										
	76		SS-10	50/3"	13						
	77							End of Boring at 77´ bgs			
	78										
	79										
615	80										
	81										
	82										
	83										
	84										
610	85										
	86										
	87										
	88										
	89										
	90										

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Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-3

Sheet 1 of 5

Date(s) Drilled	**4/9/12-4/10/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary with recirculated mud**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricore mud-rotary**	Total Depth of Borehole	**93.0 ft**
Drill Rig Type	**CME 55 Track Mounted and ATV-remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**698.3 ft above msl**
Borehole Backfill	**Finished as 2" PVC riser pipe set w/ grout**	Sampling Method(s)	**Split-spoon/Piston/Shelby-tube**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,582.4 E 2,102,704.0**	Groundwater Level(s)	**4' ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0							Bottom ash access road [BOTTOM ASH]		2.5' stickup; Grout
	1									SCH 40 PVC 2" diameter riser
	2									
	3									*Augered to 6' without sampling*
695	4									
	5									
	6	SS	SS-1	1 2 WOH 1	63			Very loose, wet, fly ash as interbedded light and dark sandy SILT (ML) and silty SAND (SM), trace root fibers [FLY ASH]		
	7									
690	8	SS	SS-2	1 2 1 1						
	9									
	10									
	11									
	12									
	13	SS	SS-3	WOH 0 0 0	79			becomes without root fibers		
685	14									
	15									
	16									
	17									
	18	SS	SS-4	WOR 0 0 1	75					
680	19									
	20									

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Project Location: Louisa, KY
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Log of Boring PB-3

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21		P-1		71					
	22									
	23			WOH						
675	24		SS-5	0	0					
	25			0						
	26									
	27							Medium dense, moist, dark gray trace brown, bottom ash as medium to fine sand (SM), trace coal gravel [BOTTOM ASH]		*Increased drilling resistance @ 27' bgs*
	28		SS-6	7	67					
670	29			13						
	30			13				Wet, light to dark gray, fly ash as silty SAND (SM) to silt (ML) [FLY ASH]		
	31			14						
	32									
	33		P-2		0			Very loose, wet, black, bottom ash and coal fragments as coarse SAND (SP-SM) with gravel [BOTTOM ASH]		
665	34									
	35									
	36									
	37									
	38		P-3		0					
660	39									
	40			1				becomes black and gray, medium to coarse, with gravel		
	41		SS-7	1	100					
	42			1				becomes gravelly		*coal gravel up to 7/8"*
	43		SS-8	2	8					
655				1						

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring PB-3

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44	SS	SS-8	0 1 0	8					
	45									
	46									
	47									
650	48	SS	SS-9	1 0 0 0	0					*Sample @ 47.5-49.5' bgs was driven to 50.5' bgs with 1 blow*
	49									
	50									
	51									
	52									
645	53	SS	SS-10	WOH 0 1 1	0			becomes coarse to fine		
	54									
	55									
	56							Very loose, wet, light gray, fly ash as sandy SILT (ML) with interbedded fine sand [FLY ASH]		
	57									
640	58	P	P-4		67					
	59									
	60									
	61									
	62									
635	63	SS	SS-11	1 1 1 3	92			becomes with minor interbedded silty sand-laminations		
	64									
	65									
	66									

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Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-3

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									
	68	P	5		83					
630	69									
	70									
	71									
	72									
	73									
625	74							Loose, moist, brown and black, clayey SAND (SC) with decayed plant matter (topsoil)		
	75	SS	12	4 5 5 7	58	1.75 <0.5 1.25		becomes sandy silty clay (CL-ML), trace reddish brown root fibers Soft to stiff, moist, brown with gray mottling sandy lean CLAY (CL) [ALLUVIUM]		
	76									
	77									
	78	ST	1	4 5 5 7	79			Medium dense, moist, variably brown with dark gray and gray mottling, gravelly clayey SAND (SC) [ALLUVIUM]		
620	79									*1 5/8" sandstone on bottom of tube*
	80	SS	13	18 6 6 9	33					
	81									
	82									
	83	SS	14	8 11 17 20	50			Medium dense, moist, variably brown with gray mottling, oxidation staining, clayey GRAVEL (GC), as completely to highly weathered sandstone, horizontal bedding [RESIDUUM]		
615	84									
	85									
	86							Medium dense, moist, variably brown with gray mottling, clayey SAND (SC), with gravel as completely weathered sandstone [RESIDUUM]		
	87									
	88	SS	15	4 6 12 15	100					
610	89									
	90									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring
PB-3

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91						Sandy silty shale, gray with oxidation staining, moderately weathered, weak		
	92								
	93	SS-16	50/4.5"	100					
605	93						End of Boring at 93´ bgs		*Set PVC casing at 93' bgs. Cement-bentonite grout placed using tremie pipe*
	94								
	95								
	96								
	97								
600	98								
	99								
	100								
	101								
	102								
	103								
595	104								
	105								
	106								
	107								
	108								
590	109								
	110								
	111								
	112								
	113								
585									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-4

Sheet 1 of 5

Date(s) Drilled	**4/11/12-4/13/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricone bit**	Total Depth of Borehole	**112.2 ft**
Drill Rig Type	**CME 55 Rubber Track ATV, Remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**700.0 ft above msl**
Borehole Backfill	**2" PVC riser pipe set with grout**	Sampling Method(s)	**Piston/Split-spoon/Shelby-tube**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,302.5 E 2,103,601.0**	Groundwater Level(s)	**Encountered at 7.6' bgs ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
700	0									2.5' stickup
										Grout
	1									*Bottom ash access road*
	2									
	3									
	4									
695	5									
	6	SS	SS-1	2 2 2 2	83			Very loose, moist, dark gray bottom ash as coarse to fine SAND (SP-SM), trace gravel [BOTTOM ASH]		
	7									
	8	SS	SS-2	2 2 2 1	33			Very loose, wet, light gray to dark gray fly ash as silty SAND (SM) with minor interbedded sandy silt (ML) trace cat-tail roots [FLY ASH]		
	9									
690	10									
	11									
	12									
	13	SS	SS-3	2 1 1 1	75			becomes without cat-tails		
	14							becomes horizontally bedded		
685	15									
	16									
	17									
	18	P	P-1		98					*@ 18' bgs begin open hole mud rotary*
	19									
680	20									

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Project Location: Louisa, KY
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Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
680	20									*sand becoming finer*
	21	SS	SS-4	WOH 2 2 1	46					
	22									
	23									
	24	SS	SS-5	2 1 1 1	50					
675	25									
	26									
	27									
	28	P	P-2		54					
	29									
670	30	SS	SS-6	1 2 2 1	58					
	31									
	32									
	33	P	P-3		50					
	34									
665	35	SS	SS-7	WOH 1 0 1	54					
	36									
	37							becomes mostly sand silt (ML) with minor silty sand (SM)		*Split-spoon intended at 37-39 fell to 43' bgs on WOH.*
	38	SS	SS-8	WOH 0 0 0	58					
	39									
660	40									
	41									
	42									
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44								
655	45								
	46								
	47								
	48	P-4		50					
	49								
650	50	SS-9	WOH 0 0 1	67					
	51								
	52								
	53								
	54								
645	55						Loose, wet, variably gray, trace brown bottom ash as medium fine SAND (SP-SM), trace gravel, with interbedded minor fly ash as sandy silt (ML), mostly laminated [BOTTOM ASH]		
	56								
	57								
	58	SS-10	3 4 4 4	71					
	59								
640	60								
	61						Very loose, wet, gray, fly ash as fine silty SAND (SP-SM), with minor interbedded sandy silt [FLY ASH]		
	62								
	63	P-5		98					
	64								
635	65	SS-11	WOH 0 1 0	63					
	66								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-4

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									
	68									
	69							becomes mostly sandy SILT (ML), with minor interbedded silty sand (SM) [FLY ASH]		
630	70									
	71									
	72			1						
	73		SS-12	0 0 0	75					*1 blow for 6 ft when attempting to sample @ 72-74' bgs. Driven to 78' bgs*
	74									
625	75									
	76									
	77									
	78									
	79									
620	80									
	81							Loose, wet, mostly dark gray with interbedded light gray, bottom ash as medium fine SAND (SP-SM), with interbedded fly ash as fine silty sand to sandy silt [BOTTOM ASH]		*Drilling resistance increases @ 80.5'*
	82			4						
	83		SS-13	4 5 3	58					
	84									
615	85									
	86							Stiff, moist, brown and red sandy lean CLAY (CL), trace gravel as sandstone gravel [ALLUVIUM]		
	87			2		2.0				*Topsoil in slough of sample @ 87-89' bgs.*
	88		SS-14	7 10 11	83	1.5 1.25 2.0		becomes orange-brown		
	89									
			ST-1		100					*400 to 600 psi down pressure*
610	90									

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Log of Boring PB-4

Elevation, feet	Depth, feet	Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91	ST-1			100	2.5		becomes very stiff		
	92							Medium dense, moist, variably orange-brown with trace black and gray mottling, clayey SAND (SC) to sandy lean clay (CL), trace weathered sandstone gravel, trace coal particles [ALLUVIUM]		
	93	SS-15		10 7 7 12	63	2.0 0.75 1.0				
	94									
605	95									
	96									
	97							becomes brownish-gray		
	98	SS-16		WOH 0 14 5	100	0.75 0.75 0.5		Medium stiff, moist, gray with black peat particles, organic CLAY (OH), trace sand seams [ALLUVIUM]		
	99							Medium stiff, moist, dark brownish-gray fibrous PEAT (PT) with interbedded clayey SAND (SC), trace undecayed stems [ALLUVIUM]		
600	100	ST-2			100	0.5				*150 to 300 psi down pressure*
	101									
	102							Medium stiff, moist, brown, organic lean CLAY (OL) with greenish-gray sand seams, trace peat particles [ALLUVIUM]		
	103	SS-17		WOH 0 3 7	83	0.75 0.75 0.75				
	104									
595	105									
	106							Medium dense, moist, greenish-gray with brown oxidation staining, clayey SAND (SC) with horizontally bedded sandstone gravel [RESIDUUM]		*Increased drilling resistance @ 106' bgs.*
	107									
	108	SS-18		11 11 9 11	38				12.0	*PL=15 LL=25 PI=10 %G=24.8 %S=35.3 %F=39.9*
	109									
590	110									
	111							Sandstone, medium to fine, gray, slightly weathered, medium strong		*Increased drilling resistance @ 111' bgs.*
	112	SS-19		50/1/2"	100			End of Boring at 112.15´ bgs		*Set PVC casing at 112' Cement-bentonite grout placed using tremie pipe.*
	113									

Project: AEP Big Sandy Landfill Investigation
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Log of Boring PB-5

Sheet 1 of 3

Date(s) Drilled	**4/13/12,4/16/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricone bit**	Total Depth of Borehole	**57.1 ft**
Drill Rig Type	**CME 55 Rubber Track ATV, Remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**700.9 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,174.1 E 2,103,663.0**	Groundwater Level(s)	**Encountered 8' bgs ATD, W.L. @ 10.5' bgs on 4/16/12**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0										**Grout**
700	1							Very loose, moist, dark gray bottom ash as coarse to fine sand (SP-SM to SM), trace gravel [BOTTOM ASH]			**SCH 40 PVC 2" diameter riser**
	2										*Bottom ash access road material to 10.5 ft*
	3										*Auger to 7 ft without sampling.*
	4										
	5										
695	6										
	7			2							
	8	SS-	1	1 1	92			becomes wet	▽		
	9										
	10										
690	11							Very loose, wet, light and dark gray fly ash as interbedded fine silty SAND (SM) and sandy SILT (ML) [FLY ASH]			
	12			3							
	13	SS-	2	2 1	71						
	14										
	15										
685	16										
	17			WOR				becomes all fine silty sand, mostly light gray			
	18	SS-	3	0 WOH	42						
	19			0							
	20										

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Log of Boring PB-5

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
680	21									
	22			WOH				becomes interbedded with sandy silt (ML)		*Pushed piston tube in offset borehole 22.5-24.5 ft bgs. 17% recovery*
	23	SS	SS-4	0	17					
	24			0				becomes fine sand in bottom of tube		
	25			1						
675	26									
	27									
	28	P	P-1		0					
	29			WOH				becomes mostly fine silty sand, with minor interbedded sandy silt		
	30	SS	SS-5	1	79					
670	31			1						
	32			2						
	33									
	34									
	35									
665	36									
	37							Loose, moist, brown with gray mottling, silty, clayey SAND (SC-SM), trace sandstone gravel [ALLUVIUM]		*No fly ash in tube*
	38	P	P-2		17					
	39			5						
	40	SS	SS-6	3	50				20.2	*PL=16 LL=23 PI=7 %G=7.7 %S=55.6 %F=36.7*
	41			3						
660	42			3						
	43	SS	SS-7	3	54			Dense, moist, light brown with oxidation staining, medium		

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Log of Boring PB-5

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44		SS-7	5 25 22	54			to fine SAND (SP-SM), with completely weathered sandstone gravel [ALLUVIUM]		
	45									
655	46									*Lose mud return between 42-47' bgs*
	47							Loose, moist, dark brown, clayey SAND (SC) to sandy lean CLAY (CL) with decayed plant matter [ALLUVIUM]		
	48		SS-8	3 4 5 10	75			Loose, moist, light brown, medium to fine SAND (SP-SM) with gravel as completely weathered sandstone [ALLUVIUM]		
	49									
	50									
650	51							Very dense, moist, brown with gray mottling, oxidation staining, silty SAND (SM) as completely to highly weathered sandstone [RESIDUUM]		
	52									
	53		SS-9	22 38 46 50/2"	85					*%G=4.0 %S=56.6 %F=39.4*
	54									
	55							Sandstone, fine to medium, gray, slightly weathered to fresh, medium strong		
645	56									
	57		SS-10	50/1/4"	100			End of Boring at 57.1´ bgs		*Set PVC casing at 57' bgs. Cement-bentonite grout placed using tremie pipe*
	58									
	59									
	60									
640	61									
	62									
	63									
	64									
	65									
635	66									

Project: AEP Big Sandy Landfill Investigation
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Log of Boring
PB-6

Sheet 1 of 5

Date(s) Drilled	**4/2/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricone bit**	Total Depth of Borehole	**100.0 ft**
Drill Rig Type	**CME 55 Track Mounted Remote-control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**698.6 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon/Shelby-tube**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,301.0 E 2,103,083.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0							Bottom ash access road [BOTTOM ASH]		2.6' stickup Grout
	1									*Drilled without sampling to 13' bgs.*
	2									
	3									2" SCH 40 PVC riser pipe
695	4									
	5									
	6									
	7									
	8									
690	9									
	10									
	11									
	12									
	13							Very loose, wet, gray with dark gray streaks fly ash as fine silty SAND (SM) [FLY ASH]		
685	14	SS-1		1 2 1 2	25					
	15									
	16									
	17	P-1			75					
	18									
680	19									
	20									

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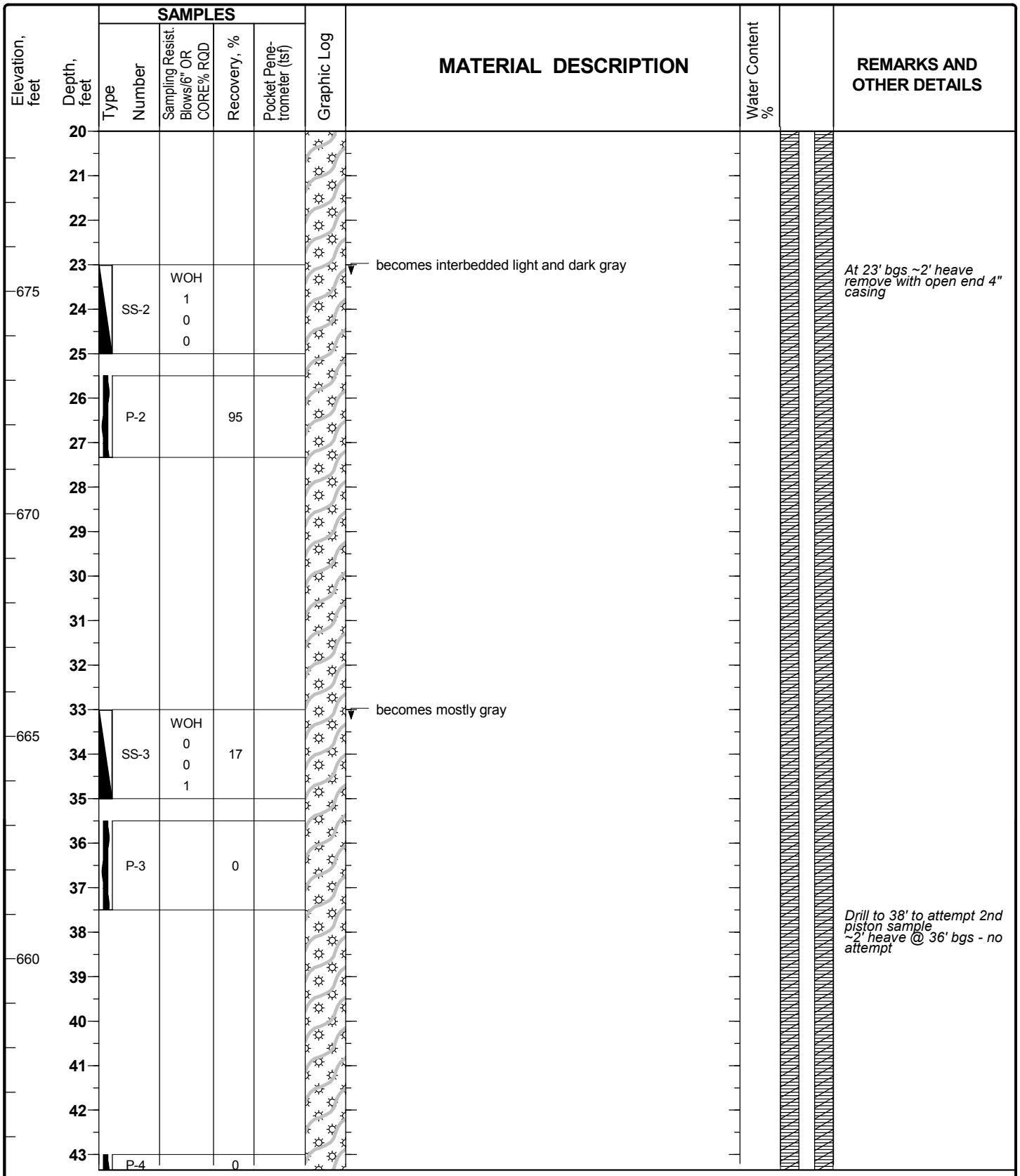
Log of Boring PB-6



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Log of Boring PB-6

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
655	44	P	P-4		0			Very loose, wet, dark gray and black sandy coal as GRAVEL (GM)		
	45									
	46	P	P-5		88			Loose, wet, light and dark gray fly ash as fine silty SAND (SM) [FLY ASH]		
	47							becomes mostly sandy silt (ML) with interbedded silty clay (CL-ML) [FLY ASH]		
	48	SS	SS-4	3 3 4 3	33					
650	49									
	50									
	51									
	52									
	53	P	P-6		73					
645	54									
	55	SS	SS-5	WOH 0 0 0	0					
	56							becomes mostly silty SAND (SM), trace decayed root fibers [FLY ASH]		
	57	SS	SS-6	WOH 1 2 3	92			3/4" brown and gray mottled/layered lean clay (CL)		
	58							becoming coarser ash particles		
640	59									
	60									
	61									
	62									
	63	P	P-7		96			becomes light gray		
635	64									
	65	SS	SS-7	2 3 5	100			12" loose, wet, gray fly ash as sandy silt		
	66							becomes light and dark gray		

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Log of Boring PB-6

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67			6						
	68									
630	69									
	70									
	71									*tube bent*
	72									
	73	P	P-8		100			Wet, brown, silty GRAVEL (GM), as sandstone fragments [ALLUVIUM]		*Fly ash mixed with gravel*
625	74									
	75									
	76									
	77							Stiff, moist, brown with oxidation staining, sandy lean CLAY (CL) to clayey sand (SC), trace gravel, trace root fibers [ALLUVIUM]		*Drilling resistance change @ 76.5' bgs*
	78			4		1.75				
620	79	SS	SS-8	7 7 17	54	1.5 1.5				
	80									
	81	ST	ST-1		50			Medium dense, moist, variably brown with oxidation staining, medium to fine SAND (SP-SM), trace gravel as sandstone fragments [ALLUVIUM]		*Shelby tube sample: 250 to 750 psi down pressure*
	82			7						
	83	SS	SS-9	6 9 9	4				14.4	
615	84									
	85									
	86							Stiff to very stiff, moist, grayish-green, trace oxidation staining, lean CLAY (CL), with sand, trace shale particles [ALLUVIUM]		
	87									
	88			3		1.25		1" clayey sand seam		
610	89	SS	SS-10	6 10 10	63	1.5 2.5				
	90									

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Log of Boring PB-6

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91									
	92							Loose, moist, greenish-grayish brown to brown with oxidation staining, fine to medium clayey SAND (SC), with interbedded lean clay seams, trace sandstone gravel [ALLUVIUM]		
	93			5						
605	94		SS-11	3 3 5	50	<0.5				
	95									
	96									
	97							Stiff, moist, grayish-brown, sandy lean CLAY (CL), trace peat [ALLUVIUM]		
	98			WOR		1.0				
600	99		SS-12	12 50/3"	100	1.0 1.25			21.8	*PL=17 LL=31 PI=14 %F=60.7*
	100							Sandstone, fine, gray with oxidation staining, moderately weathered, very weak to weak		
	101							End of Boring at 100´ bgs		*Set PVC casing @ 100' bgs. Cement-bentonite grout placed using tremie pipe.*
	102									
	103									
595	104									
	105									
	106									
	107									
	108									
590	109									
	110									
	111									
	112									
	113									

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Log of Boring PB-7

Sheet 1 of 6

Date(s) Drilled	**4/17/12-4/19/12**	Logged By	**T. George**	Checked By	**V. Gautam**
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricore mud-rotary**	Total Depth of Borehole	**127.0 ft**
Drill Rig Type	**CME 55 Tracked ATV**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**695.3 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,635.0 E 2,104,228.0**	Groundwater Level(s)	**Encountered 8' ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
695	0							Bottom ash access road [BOTTOM ASH]		2.5' stickup; Grout
	1									
	2									*Augered to 8' without sampling.*
	3									
	4									2" SCH 40 PVC riser pipe
	5									
690	6									
	7									
	8								▽	
	9	SS	SS-1	2 1 1 1	58			Very loose, wet, light gray with interbedded dark gray fly ash as mostly fine SAND (SP-SM to SM) with interbedded minor sandy SILT (ML) [FLY ASH]		
	10									
685	11									
	12									
	13							becomes mostly sandy silt (ML)		
	14	SS	SS-2	1 0 0 0	67					
	15									
680	16									
	17									
	18									
	19	SS	SS-3	1 0 1 1	58					
	20									

Report: GEO_CR_WELL; File K:\PROJECTS\AEP\13815141_BSLF\DOCS\LOGS\AEPBORINGS-6-10-13.GPJ; 6/10/2013 11:23:42 AM

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Project: AEP Big Sandy Landfill Investigation
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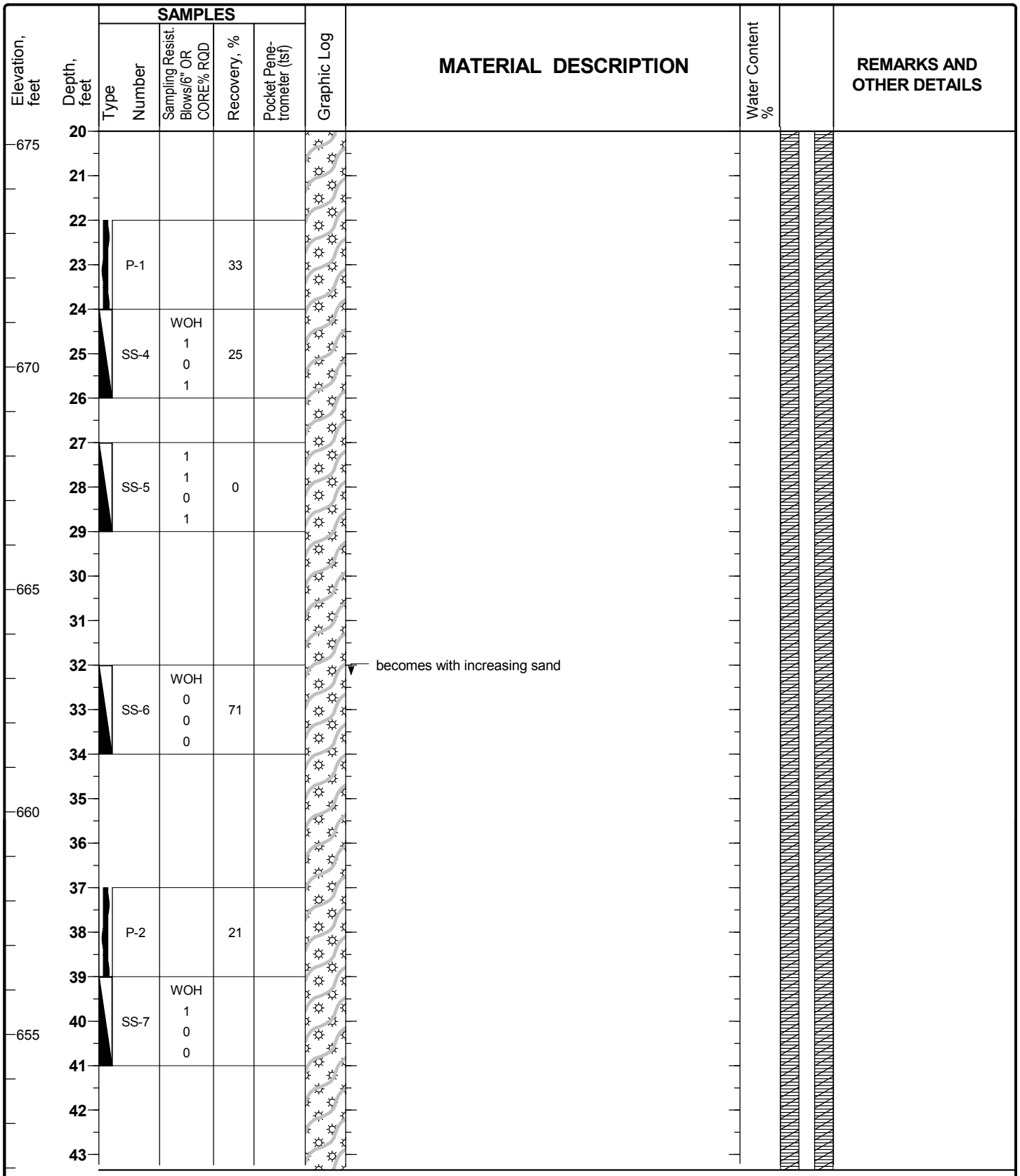
Log of Boring PB-7



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Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	44									
	45									
650	46									
	47							becomes with trace root fibers		
	48	P	P-3		31					*Piston tube bent.*
	49									
	50									
645	51									
	52							becomes without root fibers		
	53	P	P-4		75					
	54							becomes mostly sand (SP-SM to SM) with minor sandy silt and occasional seams of bottom ash		
	55	SS	SS-8	1 2 2 3	67					
640	56									
	57									
	58	P	P-5		56					
	59							becomes mostly silt (ML) with interbedded silty sand (SM)		
	60									
635	61									
	62									
	63	P	P-6		96					
	64									*Split-spoon @ 64-66' bgs driven 4 ft with 1 blow*
	65	SS	SS-9	1 0 0 0	0					
630	66									

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Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									
	68									
	69									
625	70									
	71									
	72									
	73		P-7		92					
	74									
	75		SS-10	2 1 3 6	92			becomes interbedded SM/SP/ML with light brown lean clay laminae		
620	76									
	77									
	78		P-8		75			becomes light brown and gray SILT (ML) with interbedded sand (SP-SM to SM), trace grass		
	79									
	80		SS-11	1 1 1 2	0					
615	81									
	82									
	83		P-9		92					
	84							becomes mostly sandy silt (ML)		
	85		SS-12	2 2 2 4	83			becomes mostly fine silty sand (SM)		
610	86									
	87									
	88		P-10		75					
	89							becomes mostly fine silty sand (SM) with minor interbedded sandy silt (ML)		
	90		SS-13	WOR 0	100					*Sample at 89-91' bgs fell to 96' bgs under weight of rods*

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Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
605	90									
	91	SS	13	0 0	100					
	92									
	93									
	94									
	95									
600	96									
	97	SS	14	WOR 0 0 0	0					*Split-spoon @ 97-99' bgs fell to 101.5' bgs*
	98									
	99									
	100									
595	101									
	102	SS	15	4 6 6 10	25			Medium dense, wet to moist, tan to brown with black staining and oxidation staining, clayey GRAVEL (GC), trace root fibers [ALLUVIUM]		*Gravel is sandstone fragments up to 1/2" diameter*
	103									
	104									
	105									
590	106							Loose, wet, brown with oxidation staining, medium to fine SAND (SP-SM), trace interbedded lean clay [ALLUVIUM]		*Lean clay layers are <1" thick*
	107	SS	16	3 4 3 2	71				23.7	*%G=0.0 %S=72.5 %F=27.5*
	108									
	109									
	110									
585	111							Medium dense, moist, brown with oxidation staining, gray and greenish gray, trace white, clayey SAND (SC) interbedded with silty sand (SM), trace sandstone gravel [ALLUVIUM]		
	112	SS	17	10 9 5	25					
	113									

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Log of Boring PB-7

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	114	SS	SS-17	4	25					
	115									
580	116									
	117							becomes all clayey sand (SC) with sandstone gravel		
	118	SS	SS-18	12 11 11 11	54			Very stiff, moist, gray to dark brown and greenish gray lean CLAY (CL) with sand, trace sandstone gravel [ALLUVIUM]	15.1	*%G=11.8 %S=53.3 %F=34.9*
	119									
	120							Very dense, moist, variably brown with gray mottling, with oxidation staining, medium to fine SAND (SP-SM), with gravel as sandstone fragments [RESIDUUM]		
575	121									
	122									
	123	SS	SS-19	10 30 33 50/1½"	71				14.1	*%G=11.1 %S=67.8 %F=21.1*
	124							Gray and dark gray shale, moderately weathered, weak		*Hard drilling 124-127' bgs*
	125									
570	126									
	127	SS	SS-20	50/½"	100			becomes silty, dark gray, fresh, medium strong End of Boring at 127´ bgs		*Set PVC casing at 127' bgs. Cement-bentonite grout placed using tremie pipe.*
	128									
	129									
565	130									
	131									
	132									
	133									
	134									
	135									
560	136									

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Log of Boring
PB-8

Sheet 1 of 7

Date(s) Drilled	**4/20/12,4/23/12-4/25/12**	Logged By	**T. George**	Checked By	
Drilling Method	**HSA, Mud rotary**	Drill Bit Size/Type	**4 1/4" ID/8" OD HSA, 4" tricore mud-rotary**	Total Depth of Borehole	**153.0 ft**
Drill Rig Type	**CME 55 Rubber Track ATV, Remote control**	Drilling Contractor	**Pennsylvania Drilling**	Surface Elevation	**674.0 ft above msl**
Borehole Backfill	**2" SCH 40 PVC riser grouted in place**	Sampling Method(s)	**Piston/Split-spoon**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 253,100.3 E 2,105,679.0**	Groundwater Level(s)	**3.1 ft ATD**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0							Bottom ash splitter dike [BOTTOM ASH]		3.0' stickup; Grout
	1									SCH 40 PVC 2" diameter riser
	2									
	3								▽	*Drilled to 13' bgs without sampling*
670	4									
	5									
	6									
	7									
	8									
665	9									
	10									
	11									
	12									
	13							Very loose, wet, dark gray, bottom ash as coarse to fine SAND (SP-SM) trace gravel [BOTTOM ASH]		*Split-spoon @ 13' driven with 1 blow to 16'*
660	14	SS-1		1 0 0 0	100					*Bottom ash splitter dike*
	15									
	16									
	17									
	18									*~6" heave noted*
655	19	SS-2		1 0 1 0	100					
	20									

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	20									
	21									
	22							becomes loose		
	23	SS	SS-3	5 5 3 1	75					
650	24							Very loose, wet, gray fly ash as fine silty SAND (SM) [FLY ASH]		*Bottom of splitter dike @ 23.5' bgs*
	25									
	26									
	27	SS	SS-4	1 0 1 1						*Sample @ 27-29' fell 6" to 29.5' bgs*
645	29									
	30									
	31									
	32									
	33	P	P-1		88			becomes very loose, wet, gray, SILT (ML) with fine sand		
640	34	SS	SS-5	WOR 0 0 0	0					*Split-spoon @ 34'-36' WOR from 34'-41' bgs*
	36									
	37									
	38									
635	39									
	40									
	41									
	42	SS	SS-6	1 0 0	8			becomes light gray, interbedded with minor silty sand (SM)		*Split-spoon @ 42-44' 1 blow drives spoon 4 ft to 46' bgs*
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
630	44	SS-6	0	8					
	45								
	46								
	47						becomes mostly silty sand (SM) with interbedded sandy silt (ML)		*At 47-49' bgs rods fell 13' from 47-60' bgs*
	48	SS-7	WOR 0 0 0	100					
625	49								
	50								
	51								
	52								
	53								
620	54								
	55								
	56								
	57								
	58								
615	59								
	60								
	61								
	62								
	63	P-2		92					
610	64								*Split-spoon @ 64-66' fell to 67' bgs*
	65	SS-8	WOR 0 0 0	100					
	66								

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	67									*Roller bit to 67'*
	68	SS	SS-9	WOH 0 0 0	33					
605	69									
	70							Very loose, wet, dark gray bottom ash as coarse to medium SAND (SP-SM), trace gravel [BOTTOM ASH]		
	71									
	72									
	73	SS	SS-10	1 1 1 1	33			Very loose, wet, gray fly ash as fine silty SAND (SM) [FLY ASH]		
600	74									
	75									*Drill rods clogged. Remove and flush.*
	76									
	77									*Bottom of piston tube is fly ash as sandy silt (ML)*
	78	P	P-3		88					
595	79									
	80	SS	SS-11	WOR 0 0 0	0					
	81									
	82									
	83									
590	84									
	85									
	86									
	87									
	88	P	P-4		88					
585	89									*Split-spoon @ 89-91' fell to 91.5' bgs*
	90	SS	SS-12	WOR 0	0					

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	91	SS	12	0 0	0					
	92									
	93									
580	94									
	95									
	96									
	97	P	5		96					*Bottom of piston tube is fly ash as silty sand (SM)*
	98									
575	99							becomes loose, interbedded light and dark gray, medium to fine SAND (SP-SM) to silty SAND (SM), with minor interbedded sandy silt [FLY ASH]		
	100	SS	13	2 2 3 2	63					
	101									
	102									
	103									
570	104							becomes very loose, mostly sandy SILT (ML) to silty SAND (SM) with minor interbedded (SP-SM)		
	105									
	106									
	107									
	108	SS	14	1 0 0 1	79					
565	109									
	110									
	111									
	112							becomes mostly silty sand (SM) with minor interbedded sandy silt (ML)		
	113	SS	15	2 1 0	58					

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
560	114	SS-15	1	58					
	115								
	116								
	117								
	118	P-6		96					
555	119						becomes mostly sandy silt (ML)		
	120	SS-16	WOR 0 0 0	13					
	121								
	122								
	123								
550	124								
	125								
	126						becomes light gray with interbedded grayish brown mostly sandy SILT (ML) with minor interbedded silty sand, trace decayed plant stems		
	127								*Split-spoon at 127-129' fell to 131' bgs*
	128	SS-17	WOR 0 0 0	88					
545	129								
	130								
	131								*Roller bit dropped to 132' when reinserted at 127'*
	132								
	133						Dense, wet, dark gray, medium to fine silty SAND (SM) with brown sandstone gravel [ALLUVIUM]		*Material is possibly a fill*
540	134								
	135								
	136								

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring PB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	137									
	138	SS	SS-18	20 17 18 21	79					
535	139									
	140							becomes moist, variably brown with gray mottling, trace greenish-gray, trace brownish-red		
	141									
	142									
	143	SS	SS-19	19 17 26 31	79					
530	144									
	145									
	146									
	147									
	148	SS	SS-20	21 2 1 11	25			No material in sampler representative of blow counts @ 147.5-149	14.3	*Split-spoon at 147': 6" recovery appears the same as sample @ 142'. Blow counts may not be representative of material.* *%G=31.4 %S=49.3 %F=19.3*
525	149									
	150									*Drill change at 150'*
	151							becomes with trace decayed vegetation		
	152	SS	SS-21	15 50/1"	100					
	153							Micaceous, silty sandstone, light gray, slightly weathered, weak to medium strong End of Boring at 153´ bgs		*Set PVC casing @ 152.5 ft bgs. Cement-bentonite grout placed using tremie pipe.*
520	154									
	155									
	156									
	157									
	158									
515	159									
	160									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

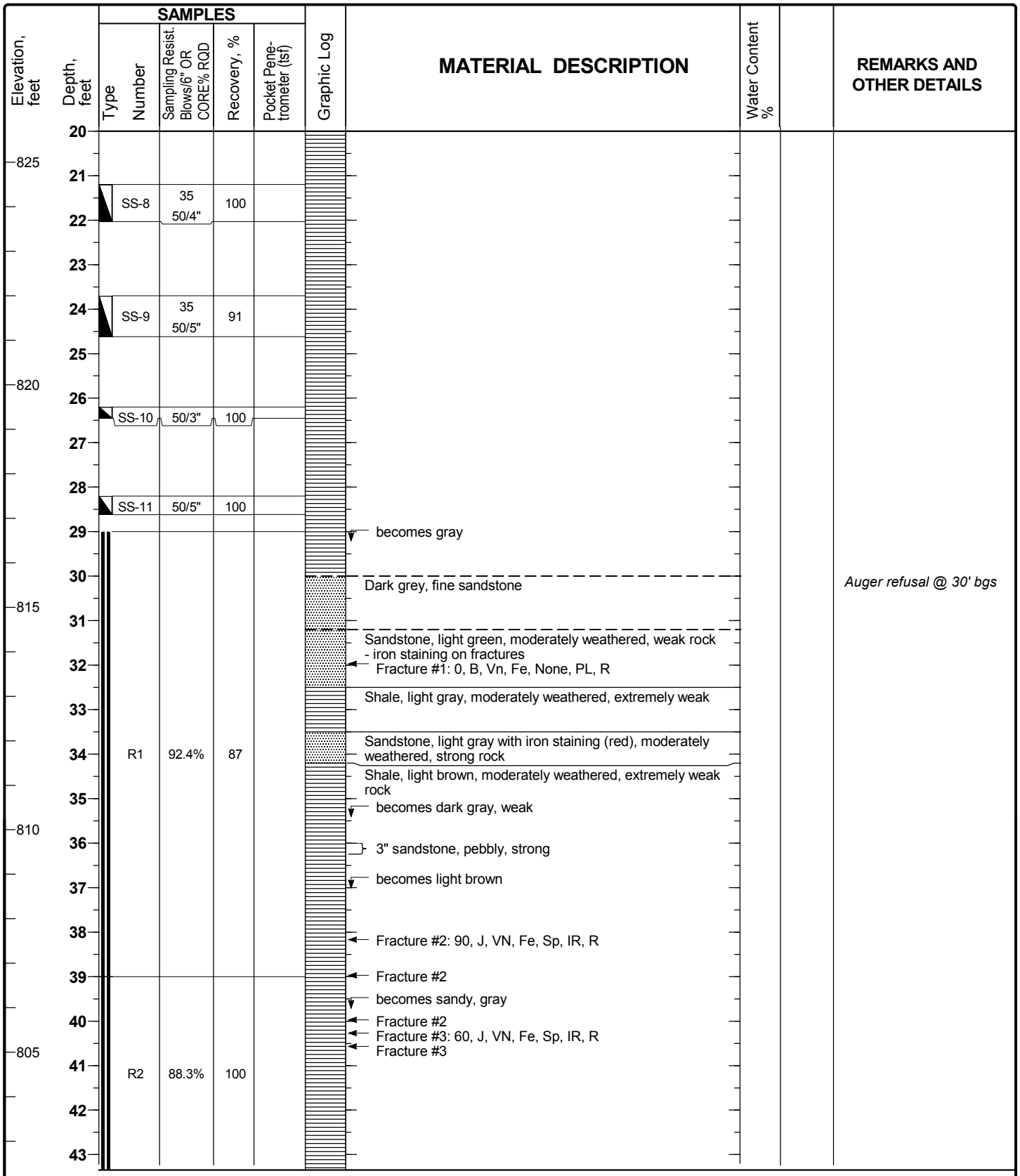
Log of Boring/Rock Core
SB-3

Date(s) Drilled	**4/11/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA/NX Core**	Drill Bit Size/Type	**3 1/4" HSA/2" Core**	Total Depth of Borehole	**54.0 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**845.7 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 253,542.1 E 2,102,379.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
845	0	SS	SS-1	50/4"	100			Dense, moist, medium to fine grained SAND (SP) [FILL]			*Road material as weathered sandstone*
	1										
	2										
	3	SS	SS-2	50/5"	100						
	4										
	5	SS	SS-3	50/4"	100						
840	6										
	7										
	8										
	9										
	10										*Shale in cuttings*
835	11										
	12	SS	SS-4	18 31 50/4"	75			Shale, gray brown, highly to completely weathered			
	13										
	14	SS	SS-5	20 50/5"	100						
	15										
830	16										
	17	SS	SS-6	21 36 50/4"	88						
	18										
	19	SS	SS-7	36 50/4"	80			becomes light brown			*Vertical filled fracture noted*
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-3



Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
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Log of Boring/Rock Core
SB-3

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44										
	45							Sandstone, gray, moderately weathered, weak, medium grained			
800	46		R2	88.3%	100						
	47							← Fracture #4: 45, J, None, None, None, IR, R			
	48										
	49							Light gray shale, extremely weak becomes with sandy laminae			
	50										
795	51		R3	83.3%	80						
	52										
	53										
	54							End of Boring at 54´ bgs			
	55										
790	56										
	57										
	58										
	59										
	60										
785	61										
	62										
	63										
	64										
	65										
780	66										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-4

Date(s) Drilled	**4/10/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA**	Drill Bit Size/Type	**3 1/4" HSA/NX Core**	Total Depth of Borehole	**30.0 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**794.0 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,829.7 E 2,101,718.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0							Stiff, moist, light brown with gray mottling lean CLAY (CL) [RESIDUUM]			
	1	SS-1		3 4 5 9	21				23.8		
	2							becomes very stiff with no mottling			
	3	SS-2		4 6 10 22	67				20.2		*PL=23 LL=45 PI=22 %F=96.5*
790	4										
	5							becomes with gray mottling			
	6	SS-3		5 15 26 50/1"	89			becomes buff to tan, sandy	12.6		
	7							Sandstone, light brown to tan, moderately weathered, strong, mica on split surfaces			
	8	R1		84.7%	100			Fracture #1: 0, B, VN, CL, Sn, Wa, S, C			
785	9							Shale, brown, extremely weak			
	10							Fracture #2: 90, J, VN, Fe, Fi becomes orange-stained			
	11							1" sandstone, strong becomes with iron staining, orange to gray, extremely weak			
	12	R2		50%	60			Sandstone, dark brown, strong, quartz crystal lined, iron stained			
	13							Fracture #1 Fracture #3: 90, B, VN, Fe, Pa, Ir			
780	14										
	15							becomes fine-grained, iron staining			
	16							Fracture #1 Fracture #3			
	17	R3		56.7%	61			Fracture #3			
	18							Shale, gray to black, extremely weak			
775	19										
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-4

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20										
	21										
	22		R3	56.7%	61						
	23										
770	24										
	25							becomes moderately weathered, extremely weak to very weak			
	26										
	27		R4	85%	100			Fracture #4: 90, J, T, None, None, Wa, S			
	28							becomes sandy, weak to very weak, slightly weathered, no fractures			
765	29										
	30							End of Boring at 30´ bgs			
	31										
	32										
	33										
760	34										
	35										
	36										
	37										
	38										
755	39										
	40										
	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-6

Date(s) Drilled	**4/12/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA/NX Core**	Drill Bit Size/Type	**3 1/4" HSA/2" Core**	Total Depth of Borehole	**39.3 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**768.8 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,202.5 E 2,102,399.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %	REMARKS AND OTHER DETAILS
	0							1" dark brown topsoil		
	1	SS	SS-1	4 3 7 6	38	2.25		Stiff, moist, light brown with trace dark brown mottling, fat CLAY (CH) [RESIDUUM]		
	2							2" sandstone gravel		
	3	SS	SS-2	2 3 5 11	58	2.25 to 3.25		becomes stiff to very stiff, with brown mottles	26.3	*PL=23 LL=62 PI=37 %F=89.6*
765	4							2" cemented shale with red/orange iron stains		
	5							becomes hard		
	6	SS	SS-3	3 5 9 22	83	>4.5		becomes black	29.5	*PL=30 LL=59 PI=29*
	7									
	8	SS	SS-4	19 25 21 38	96	>4.5		9" coal seam		
760	9							becomes with coal		
	10									
	11	SS	SS-5	12 21 27 50/3"	100	2.5		5 1/2" coal seam becomes stiff, black and gray 2 1/2" coal seam becomes with black coal		
	12									
	13	SS	SS-6	30 50/5"	100			3" coal seam		
755	14							3" shale, light gray, very weathered 3" coal seam Shale, gray with some black partings		
	15	SS	SS-7	49 50/3"	100					
	16									
	17									*Back of spoon wet* *Auger refusal @ 17.2' bgs*
	18							becomes light gray, moderately weathered, weak		
750	19	R	R1	70.7%	97			Fracture #1: 60, V, N, Cl, Fi, Wa, R		
	20									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-6

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20							Fracture #2: 90, V, N, Cl, Fi, Wa, R			
	21										
	22	R	1	70.7%	97			becomes sandy shale			*Interbedded sandy shale and shale interbeds with sand are 3" to 1/8"; shale beds are 1/8 to 1 1/2" thick*
	23										
745	24										
	25										
	26							Fracture #3: 30 to 90, J, N, None, None, Ir, Vr Fracture #3			
	27										
	28										
740	29	R	2	61.6%	98			Sandstone, light gray, some lamination, some iron staining, slightly weathered, strong rock			
	30										
	31										
	32										
	33										
735	34										
	35							Shale, gray, moderately weathered, weak rock			
	36										
	37	R	3	100%				Sandy shale, light gray, slightly weathered, strong rock, interbeds of sandy shale and shale			
	38										
730	39										
	40							End of Boring at 39.3´ bgs			
	41										
	42										
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-7

Date(s) Drilled	**4/10/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA/Core**	Drill Bit Size/Type	**3 1/4" HSA/3" Core**	Total Depth of Borehole	**29.7 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**850.4 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 252,280.4 E 2,103,342.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
850	0							Medium stiff, moist, brown, lean CLAY (CL) (topsoil)			
	1		SS-1	4 3 3 8	38	1 2.0		becomes stiff, trace brown mottles [RESIDUUM]			
	2										
	3		SS-2	3 5 8 15	42	3.5 to 4.5		becomes very stiff to hard, light brown with red mottles			
	4										
	5										
845	6		SS-3	10 22 40 50/3"	86	3.5 >4.0		becomes dark red becomes with red mottles	10.4		*PL=19 LL=39 PI=20 %F=71.7*
	7							Shale, sandy, light brown, moderately weathered, weak			
	8										
	9							becomes very weak			
840	10										
	11		R1	15%	29						
	12										
	13										
	14										
	15							becomes shale fragments, moderately weathered, very weak with iron-staining			
835	16										
	17		R2	0%	18						
	18							8" sandstone fragments, brown with iron staining, strong, but fractured vertically and horizontal			
	19										
	20										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-7

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
830	20									
	21									*Shale is mechanically broken-- no fractures observable*
	22	R2	0%	18						
	23									
	24									
	25						becomes brown shale, moderately weathered, weak			*25-27' bgs: shale is soft--mechanically broken No fractures observable*
825	26									
	27	R3	20%	20						
	28									
	29									
	30						End of Boring at 29.7´ bgs			
820	31									
	32									
	33									
	34									
	35									
815	36									
	37									
	38									
	39									
	40									
810	41									
	42									
	43									

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-8

Date(s) Drilled	**4/12/12**	Logged By	**J. Ristow**	Checked By	**V. Gautam**
Drilling Method	**HSA**	Drill Bit Size/Type	**3 1/4" HSA/NX Core**	Total Depth of Borehole	**49.3 ft**
Drill Rig Type	**D-120**	Drilling Contractor	**AEP**	Surface Elevation	**711.3 ft above msl**
Borehole Backfill	**Bentonite grout**	Sampling Method(s)	**Split-spoon/NX Core**	Hammer Data	**140#/30" Drop Auto**
Boring Location	**N 251,071.0 E 2,103,738.0**	Groundwater Level(s)	**Not encountered**		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pene-trometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	0							3" Bottom ash (road fill)			
		SS	SS-1	4 3 5 15	58	3.25 to 3.5		Very stiff, moist, light yellow/brown, lean CLAY (CL) [RESIDUUM]			
710	1							Shale, light yellow brown, with orange red iron oxidation staining, completely to moderately weathered			
	2										
	3	SS	SS-2	9 6 8 13	13						
	4										
	5										
	6	SS	SS-3	9 19 31 34	96						
705	7										
	8	SS	SS-4	11 21 32 50	58			becomes light gray, without iron oxidation			
	9										
	10							becomes with red mottle staining			
	11	SS	SS-5	10 18 47 50/3"	76			becomes red with gray mottles			
700	12										
	13	SS	SS-6	21 49 50/3"	80			2" crushed chert nodules becomes gray with red mottles to light gray			
	14										
	15	SS	SS-7	15 18 50/3"	80			becomes gray with some red mottles			
695	16										
	17										
	18	SS	SS-8	12 50/5"	100			becomes with some orange mottles			
	19										
	20										

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Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-8

Elevation, feet	Depth, feet	SAMPLES: Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	20			18				becomes with orange staining			
	21	SS	SS-9	31	100						
690				50/5"							
	22										
		SS	SS-10	50/3"	100			becomes without orange staining, crushed			
	23										
	24										
	25	SS	SS-11	50/5"	100			1" sandstone, gray, crushed			
	26										
685											
	27										
	28										
	29							Sandstone, gray with zones of iron staining, moderately weathered, medium strong, fine-grained Fracture #1: 10, J, VN, Fe, Su, PL, SR			*Auger refusal @ 28.4' bgs*
	30							Fracture #1			
	31	R	R1	85.7%	95			Fracture #1			
680											
	32										
	33										
	34										
	35							becomes with shale fragments			
	36							becomes sandstone massive with orange Fe staining			
675											
	37							Fracture #1			
	38							shale, orange concretion			
	39	R	R2	93.3%	100			becomes gray, slightly weathered, strong, no fractures			
	40										
	41										
670											
	42							becomes slightly weathered to fresh, strong, medium-grained			
	43										

Project: AEP Big Sandy Landfill Investigation
Project Location: Louisa, KY
Project Number: 13815141.10000

Log of Boring/Rock Core
SB-8

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Penetrometer (tsf)	Graphic Log	MATERIAL DESCRIPTION	Water Content %		REMARKS AND OTHER DETAILS
	44		R2	93.3%	100			becomes with orange staining			*No natural fractures*
	45										
	46										
665	47		R3	100%	100						
	48										
	49										
								End of Boring at 49.3´ bgs			
	50										
	51										
660	52										
	53										
	54										
	55										
	56										
655	57										
	58										
	59										
	60										
	61										
650	62										
	63										
	64										
	65										
	66										
645											

APPENDIX B

TABLE 12: LABORATORY TEST RESULTS FOR NATIVE SOILS

Boring Number	Sample Number	Sample Depth (feet)	Soil Description	Atterberg Limits (%)			Finer than # 200 Sieve (%)%F/%G/%S	Moisture Content (%)	Unconsolidated Undrained Compressive Strength (TSF)	One-dimensional Consolidation Results
				Liquid Limit	Plastic Limit	Plasticity Index				
HB-1	SS-2	2.0-4.0	RESIDUUM	35	18	17	68	18		17.7
HB-2	SS-5	8.0-10.0	RESIDUUM	45	21	24	91	18		17.7
HB-5	ST-1*	5.0-7.0	RESIDUUM	33	17	16	48	16		15.8
HB-5	SS-4	6.0-8.0	RESIDUUM	32	16	16	50	16		16.1
HB-7/SB-2	SS-1	0-2.0	FILL	31	18	13	47.2/8.3/44.5	16		16.4
HB-7/SB-2	SS-3	4.0-6.0	FILL	31	17	14		17		16.7
HB-7/SB-2	SS-5	8.0-10.0	ALLUVIUM				30.9/19.3/49.8	10		10.4
HB-7/SB-2	SS-7	12.0-14.0	ALLUVIUM					18		17.6
HB-7/SB-2	SS-9	16.0-18.0	ALLUVIUM	20	15	5	29.8/16.6/53.6	12		12.2
HB-7/SB-2	SS-11	20.0-22.0	ALLUVIUM					14		13.9
PB-2	SS-6	57-59	ALLUVIUM	27	16	12		21		20.6
PB-2	SS-9	70-72	RESIDUUM	24	17	7		17		16.8
PB-3	ST-1	77.0-79.0	ALLUVIUM	35	20	15				Pc=1.7 tsf, Cc = 0.162, Cr=0.019, Cs = 0.012
PB-4	ST-1	89.5-91.5	ALLUVIUM	35	18	17		16	3.31	Pc=4.3 tsf, Cc = 0.122, Cr=0.017, Cs = 0.012
PB-4	ST-2	99.5-101.5	ALLUVIUM	50	26	24				Pc=4.1 tsf, Cc = 0.343, Cr=0.015, Cs = 0.030
PB-4	SS-18	107-109	RESIDUUM	25	15	10	39.9/24.8/35.3	12		12.0
PB-5	SS-6	39-41	ALLUVIUM	23	16	7	36.7/7.7/55.6	20		20.2
PB-5	SS-9	52-53.5	RESIDUUM				39.4/4/56.6			
PB-6	SS-9	82-84	ALLUVIUM					14		14.4
PB-6	SS-12	98-99.3	ALLUVIUM	31	17	14	61	22		21.8
PB-7	SS-16	107-109	ALLUVIUM				27.5/0/72.5	24		23.7
PB-7	SS-18	117-119	ALLUVIUM				34.9/11.8/53.3	15		15.1
PB-7	SS-19	122-124	RESIDUUM				21.1/11.1/67.8	14		14.1
PB-8	SS=20	147-149	ALLUVIUM				19.3/31.4/49.3	14		14.3
SB-4	SS-1	0-2	RESIDUUM					24		23.8
SB-4	SS-2	2,5-4.5	RESIDUUM	45	23	22	97	20		20.2
SB-4	SS-3	5-6.5	RESIDUUM					13		12.6
SB-6	SS-2	2.5-4.5	RESIDUUM	62	25	37	90	26		26.3
SB-6	SS-3	5.0-7.0	RESIDUUM	59	30	29		30		29.5
SB-7	SS-3	5-6.8	RESIDUUM	39	19	20	72	10		10.4

NOTE: The above table does not include results ortesting assigned to the ash samples as the ash samples tested were reconstituted from the undistubed testing samples obtained. The ash samples tested are composite samples and do not relate to a specific boring or depth.

Table 13 - Index Tests Results for Ash Samples

URS Corporation #13815141
AEP Big Sandy Landfill
LABORATORY TESTING DATA SUMMARY

SAMPLE IDENTIFICATION				INDEX TESTS										REMARKS
BORING NO.	DEPTH (ft)	VISUAL DIVISION	% SAMPLE by TUW (%)	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	
PB-1	30-32										102.0			
PB-1		Coarse	89%	42.7				ML	79.3	1	100.5	70.4		
PB-1		Fine	11%	32.3				ML	81.6	1	107.4	81.1		
PB-2	49-51										103.3			void in tube
PB-2		Coarse	85%	32.3				ML	70.8	2	104.5	78.9		
PB-2		Fine	15%	27.8	np	np	np	ML	88.0	4				
PB-3	67.5-69.5										86.8			void in tube
PB-3		Coarse	79%	26.1				ML	89.3	4				
PB-3		Fine	21%	20.4	np	np	np	ML	92.5	5	120.3	99.9	2.397	
PB-5	22.5-24.5										99.1			
PB-5		Coarse	67%	38.6				ML	75.4	2	105.3	75.9		
PB-5		Fine	33%	24.2				ML	94.3	4	120.9	97.4		
PB-6	25.5-27.3										100.8			
PB-6		Coarse	72%	32.1				ML	78.8	3	109.1	82.6		
PB-6		Fine	28%	40.6				ML	88.7	5	101.0	71.8		
PB-6	45-47										100.2			Uniform
PB-6	63-65										101.2			layered
PB-6	63-65	Fines			np	np	np	ML	90.0	4			2.354	
PB-6	63-65	Sand						SM	40.7	2			2.277	

URS Corporation #13815141
AEP Big Sandy Landfill
LABORATORY TESTING DATA SUMMARY

SAMPLE IDENTIFICATION				INDEX TESTS										REMARKS
BORING NO.	DEPTH (ft)	VISUAL DIVISION	% SAMPLE by TUW (%)	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	
PB-7	52-54										98.7			void in tube
PB-7		Coarse	81%	27.7				ML	75.0					
PB-7		Fine	19%	22.9				ML	94.8					
PB-7	62-64										100.8			void in tube
PB-7		Coarse		49.9				ML	71.0	2	94.5*	63.0*		*Trial Preparation Specimen
PB-7		Coarse	64%	47.7				ML	71.3	2				
PB-7		Fine	36%	17.6	np	np	np	ML	86.5	2				
PB-7	72-74										108.2			void in tube
PB-7		Coarse	4%	43.9										
PB-7		Fine	96%	25.0				ML	95.5		113.9	91.2		
PB-8	62-64										90.9			void in tube
PB-8		Coarse	46%	32.5				ML	91.0	7				
PB-8		Fine	54%	25.8	np	np	np	ML	95.8	5			2.352	

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.

A P P E N D I X B.1

FILL

A P P E N D I X B.1A

FILL – MOISTURE CONTENT

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MOISTURE CONTENT

ASTM D 2216-05 (SOP-S1)

Client	URS
Client Reference	AEP BIG SANDY LF 13815141
Project No.	2012-245-01

Lab ID	01	02	03	04	05
Boring No.	HB-1	HB-2/ SB-1	HB-7/ SB-2	HB-7/ SB-2	HB-7/ SB-2
Depth (ft)	2-4	8-10	0-2	4-6	8-10
Sample No.	NA	NA	NA	NA	NA
Tare Number	49	10	37	38	25
Wt. of Tare & WS (gm)	50.45	60.98	58.58	168.17	199.17
Wt. of Tare & DS (gm)	44.12	53.1	51.53	145.35	181.11
Wt. of Tare (gm)	8.35	8.58	8.43	8.35	8.2
Wt. of Water (gm)	6.33	7.88	7.05	22.82	18.06
Wt. of DS (gm)	35.77	44.52	43.1	137	172.91
Water Content (%)	**17.7**	**17.7**	**16.4**	**16.7**	**10.4**

Lab ID	06	07	08	09	10
Boring No.	HB-7/ SB-2	HB-7/ SB-2	HB-7/ SB-2	PB-2	PB-2
Depth (ft)	12-14	16-18	20-22	57-59	70-72
Sample No.	NA	NA	NA	NA	NA
Tare Number	31	57	50	16	46
Wt. of Tare & WS (gm)	189.88	189.58	201.23	64.3	40.61
Wt. of Tare & DS (gm)	162.67	169.87	177.69	54.76	35.97
Wt. of Tare (gm)	8.28	8.3	8.64	8.36	8.42
Wt. of Water (gm)	27.21	19.71	23.54	9.54	4.64
Wt. of DS (gm)	154.39	161.57	169.05	46.4	27.55
Water Content (%)	**17.6**	**12.2**	**13.9**	**20.6**	**16.8**

Notes : *NA*

Alluv. Resid. Alluv. Resid. Fill Fill Alluv.

Tested By PC *Date* 5/22/12 *Checked By* JN *Date* 5/23/12

DCN: CT-S1 DATE 1-21-10 REVISION: 3

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A P P E N D I X B.1B

FILL – GRAIN SIZE DISTRIBUTION

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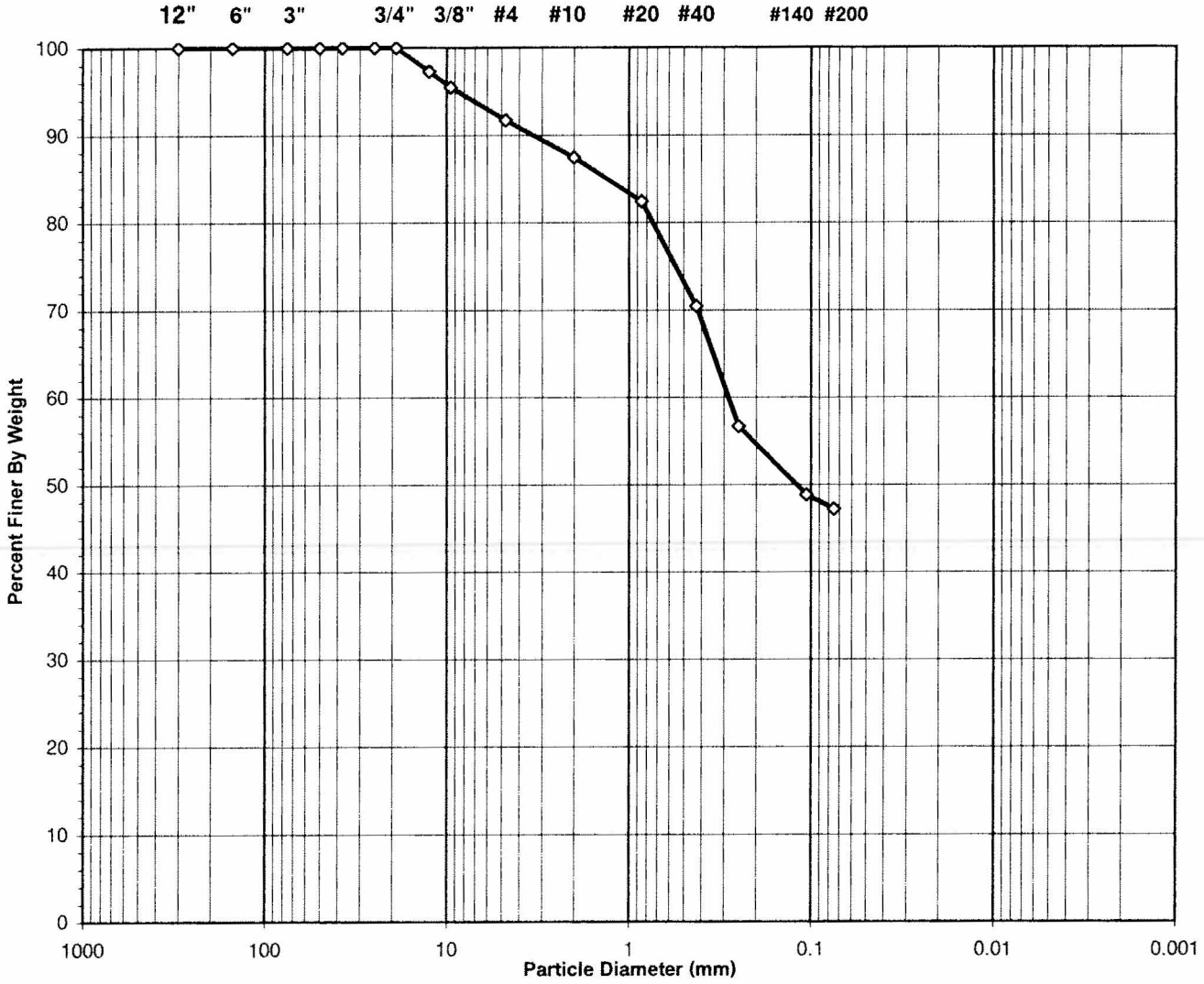
SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	HB-7 / SB-2
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	0-2
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-03	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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INTEGRITY IN TESTING

WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	HB-7 / SB-2
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	0-2
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-03	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1456	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	518.09	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	518.09	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.28	Weight of Tare (gm)	NA
Weight of Water (gm)	0.00	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	372.81	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**0.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	372.81
Dry Weight - 3/4" Sample (gm)	196.9	Weight of minus #200 material (gm)	175.94
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	196.87
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	10.10	2.71	2.71	97.29	**97.29**
3/8"	9.50	6.76	1.81	4.52	95.48	**95.48**
#4	4.75	14.03	3.76	8.29	91.71	**91.71**
#10	2.00	15.95	4.28	12.56	87.44	**87.44**
#20	0.850	18.67	5.01	17.57	82.43	**82.43**
#40	0.425	44.68	11.98	29.56	70.44	**70.44**
#60	0.250	51.33	13.77	43.33	56.67	**56.67**
#140	0.106	29.26	7.85	51.17	48.83	**48.83**
#200	0.075	6.09	1.63	52.81	47.19	**47.19**
Pan	-	175.94	47.19	100.00	-	-

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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A P P E N D I X B.1C

FILL – ATTERBERG LIMITS

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	HB-7 / SB-2
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	0-2
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-03	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

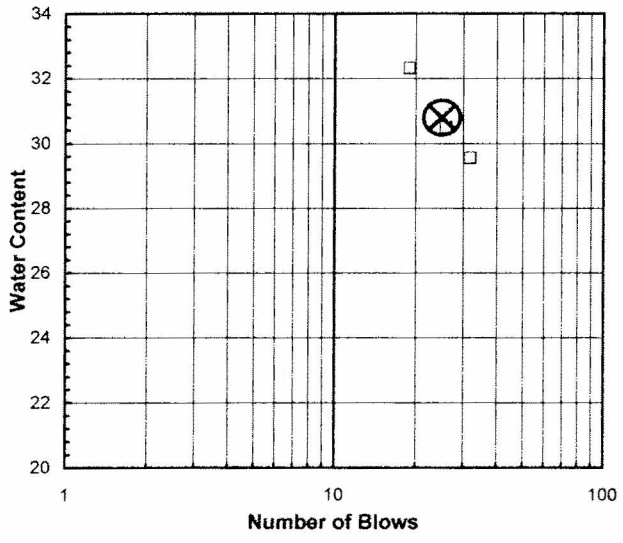
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	402	421	429	**U**
Wt. of Tare & WS (gm)	33.43	41.40	33.13	**L**
Wt. of Tare & DS (gm)	28.05	36.30	27.67	**T**
Wt. of Tare (gm)	9.84	19.57	10.77	**I**
Wt. of Water (gm)	5.4	5.1	5.5	**P**
Wt. of DS (gm)	18.2	16.7	16.9	**O**
				I
Moisture Content (%)	**29.5**	**30.5**	**32.3**	**N**
Number of Blows	**32**	**26**	**19**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	360	361	
Wt. of Tare & WS (gm)	25.94	23.86	
Wt. of Tare & DS (gm)	24.53	22.77	
Wt. of Tare (gm)	16.63	16.80	
Wt. of Water (gm)	1.4	1.1	
Wt. of DS (gm)	7.9	6.0	
Moisture Content (%)	**17.8**	**18.3**	**-0.4**

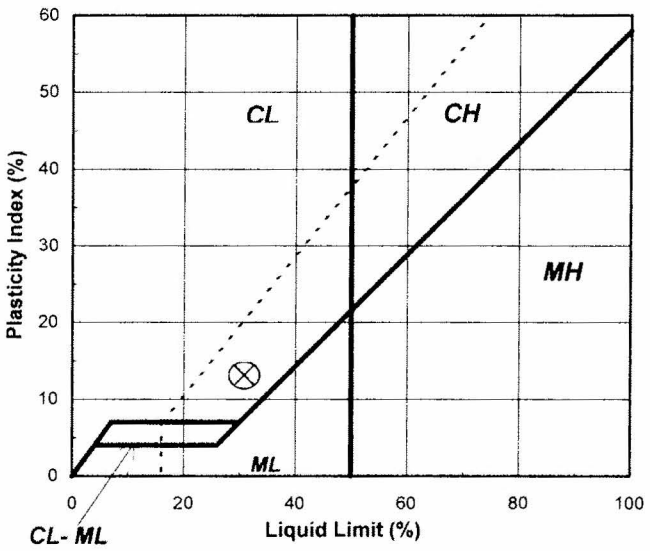
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**31**
Plastic Limit (%)	**18**
Plasticity Index (%)	**13**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By JP *Date* 6/1/12 *Checked By* KC *Date* 6-4-12

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	HB-7/SB-2
Client Reference	AEP BIG SANDY LF 13815141	Depth (ft)	4-6
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-04	Soil Description	**BROWN LEAN CLAY**

Note: The* USCS *symbol used with this test refers only to the minus No. 40 (Minus No. 40 sieve material, Airdried)
sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.

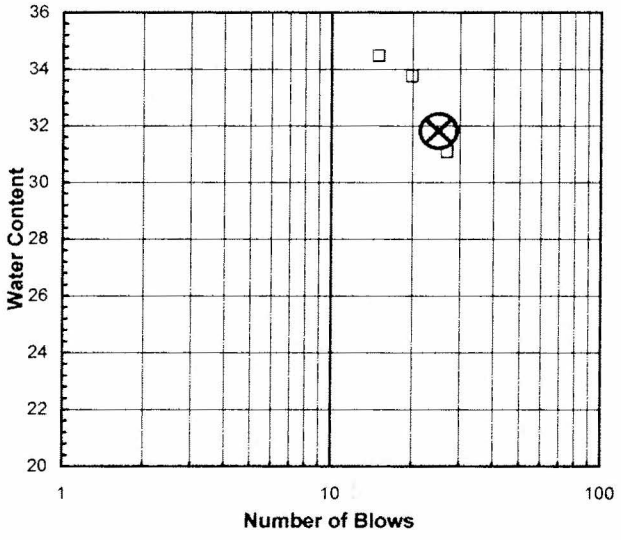
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	40A	410	416	**U**
Wt. of Tare & WS (gm)	40.92	34.79	39.66	**L**
Wt. of Tare & DS (gm)	35.35	28.77	33.04	**T**
Wt. of Tare (gm)	17.42	10.93	13.83	**I**
Wt. of Water (gm)	5.6	6.0	6.6	**P**
Wt. of DS (gm)	17.9	17.8	19.2	**O**
				I
Moisture Content (%)	**31.1**	**33.7**	**34.5**	**N**
Number of Blows	**27**	**20**	**15**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	287	376	
Wt. of Tare & WS (gm)	25.83	21.38	
Wt. of Tare & DS (gm)	24.79	20.34	
Wt. of Tare (gm)	18.80	14.36	
Wt. of Water (gm)	1.0	1.0	
Wt. of DS (gm)	6.0	6.0	
Moisture Content (%)	**17.4**	**17.4**	**0.0**

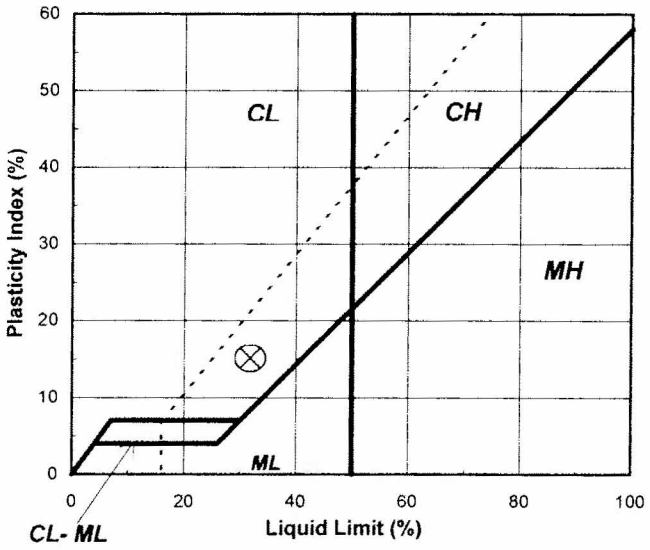
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**32**
Plastic Limit (%)	**17**
Plasticity Index (%)	**15**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By MC *Date* 5/29/12 *Checked By* KC *Date* 6-30-12

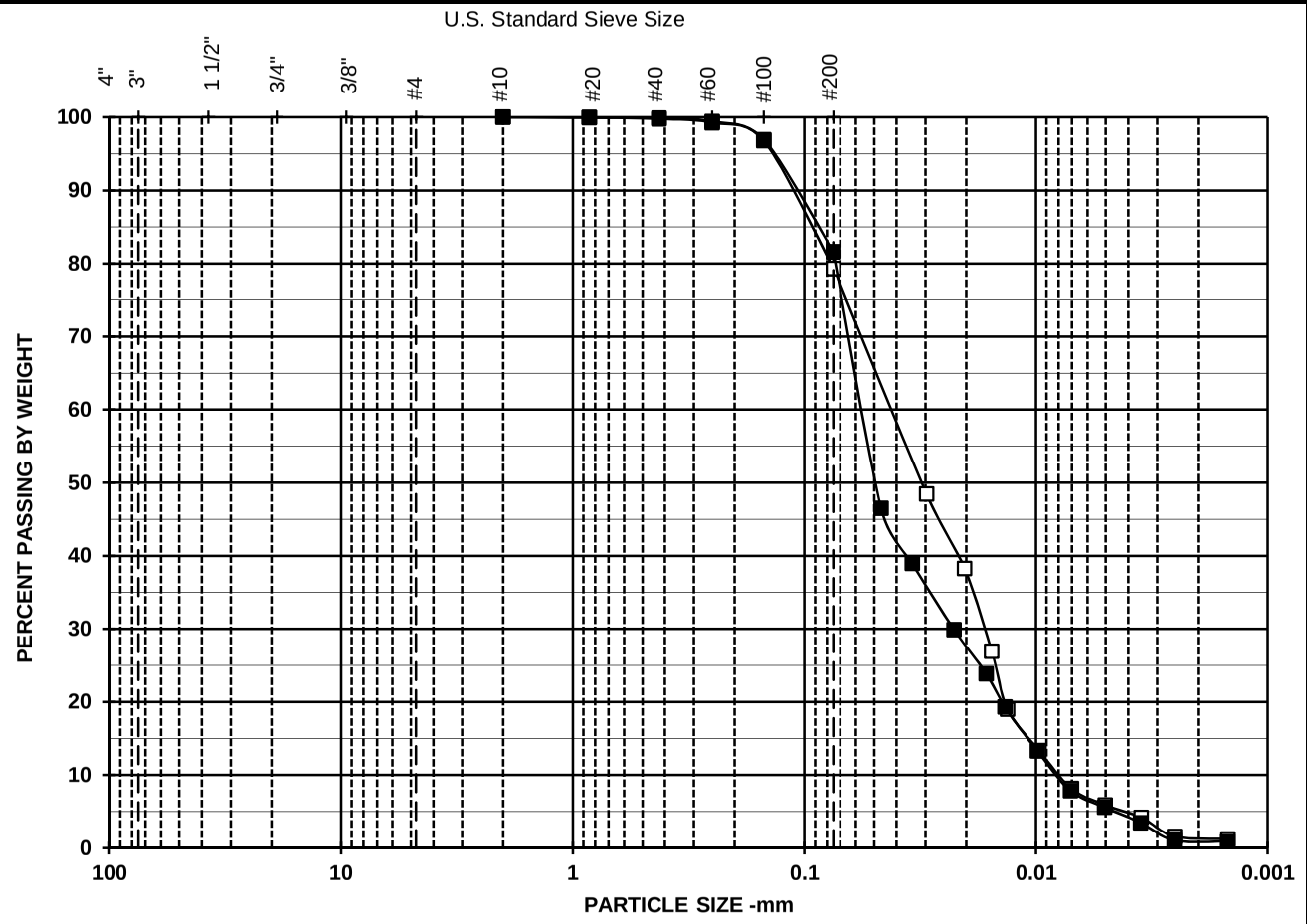
A P P E N D I X B.2

ASH

A P P E N D I X B.2A

ASH – GRAIN SIZE DITRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					ML	Gray, Silt with sand	5/11/2012
■					ML	Gray, Silt with sand	5/11/2012
○							

Symbol	□	■	○
Boring	PB-1	PB-1	
Sample	Coarse	Fine	
Depth	30-32	30-32	
% +3"	0.0	0.0	
% Gravel	0.0	0.0	
% SAND	20.7	18.4	
%C SAND	0.0	0.0	
%M SAND	0.2	0.1	
%F SAND	20.4	18.3	
% FINES	79.3	81.6	
% -2μ	1	1	
D_{100} (mm)	2.00	2.00	
D_{60} (mm)	0.05	0.06	
D_{30} (mm)	0.02	0.02	
D_{10} (mm)			
Cc			
Cu			

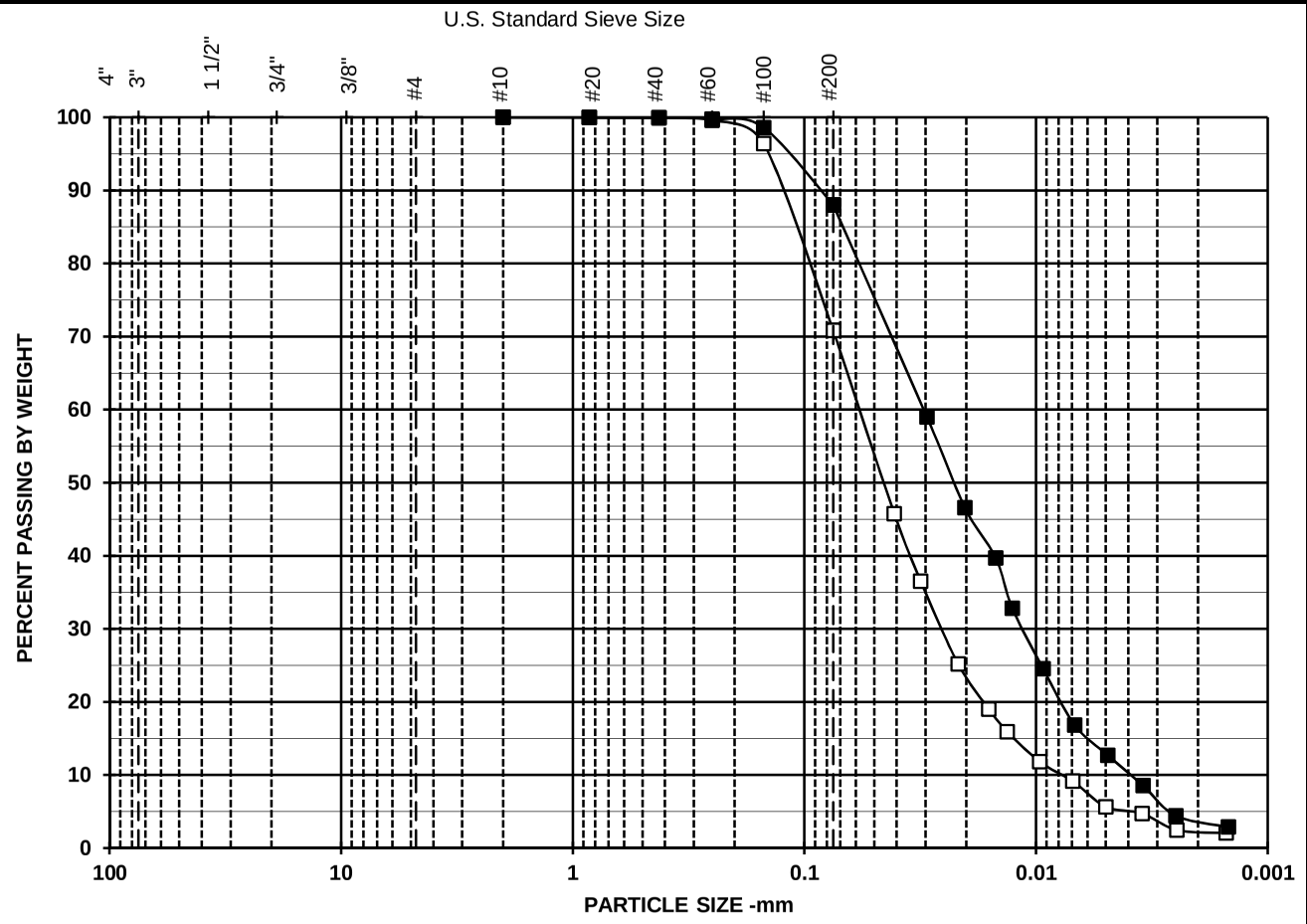
Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"			
4			
10	100.0	100.0	
20	99.9	100.0	
40	99.8	99.9	
60	99.3	99.4	
100	96.8	96.9	
200	79.3	81.6	

TerraSense, LLC	URS Corporation
T13815141	13815141

PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

Analysis File: 3SV-MasterRev3

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					ML	Gray, Silt with sand	5/11/2012
■		np	np	np	ML	Gray, Silt	5/11/2012
○							

Symbol	□	■	○
Boring	PB-2	PB-2	
Sample	Coarse	Fine	
Depth	49-51	49.51	
% +3"	0.0	0.0	
% Gravel	0.0	0.0	
% SAND	29.2	12.0	
%C SAND	0.0	0.0	
%M SAND	0.1	0.1	
%F SAND	29.1	11.9	
% FINES	70.8	88.0	
% -2μ	2	4	
D_{100} (mm)	2.00	2.00	
D_{60} (mm)	0.06	0.03	
D_{30} (mm)	0.03	0.01	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"			
4			
10	100.0	100.0	
20	100.0	100.0	
40	99.9	99.9	
60	99.6	99.8	
100	96.4	98.6	
200	70.8	88.0	

TerraSense, LLC	URS Corporation
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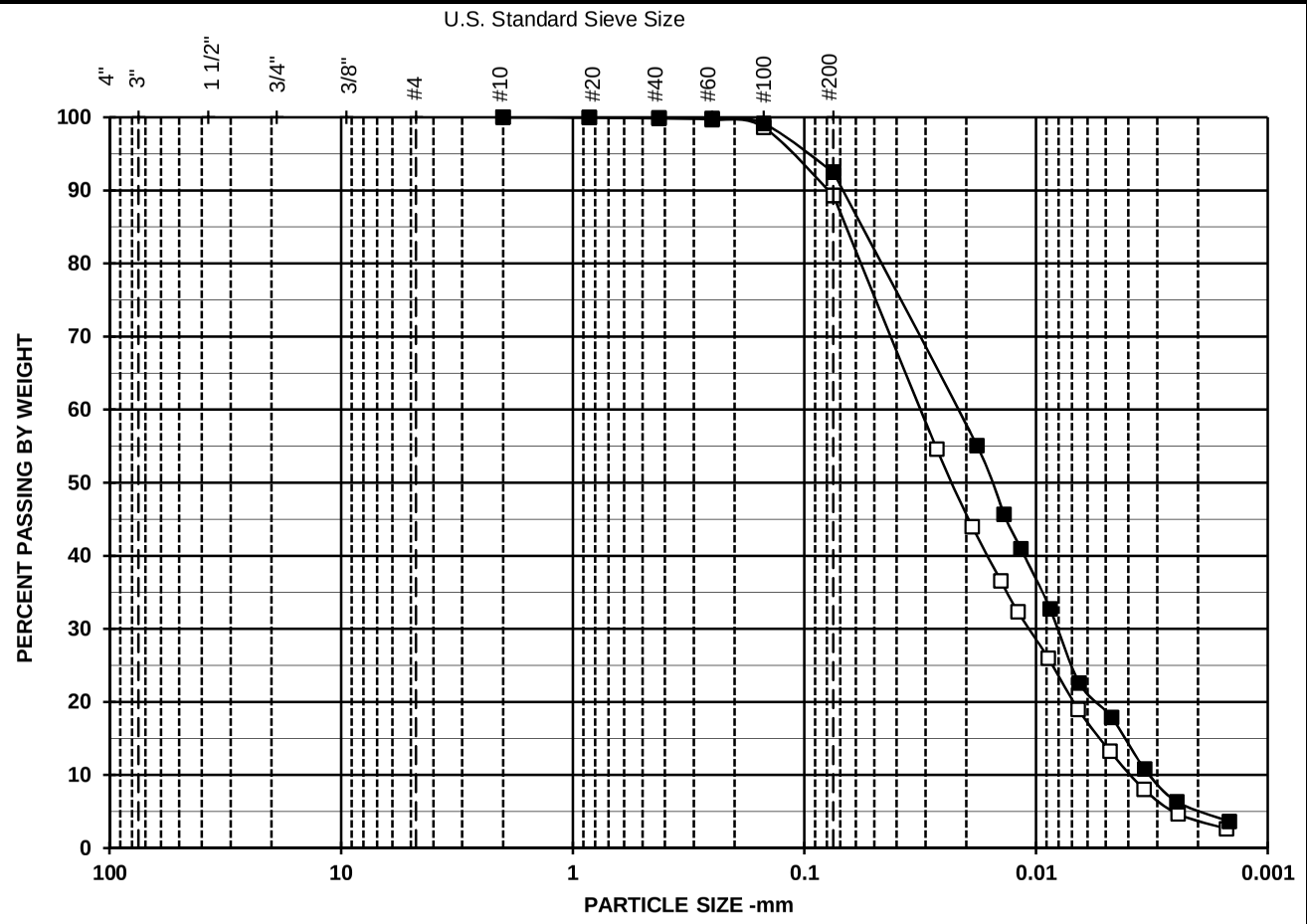
PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

Analysis File: 3SV-MasterRev3

sieve2b.xls 5/17/2012

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					ML	Gray, Silt	5/11/2012
■		np	np	np	ML	Gray, Silt	5/11/2012
○							

Symbol	□	■	○
Boring	PB-3	PB-3	
Sample	Coarse	Fine	
Depth	67.5-69.5	67.5-69.5	
% +3"	0.0	0.0	
% Gravel	0.0	0.0	
% SAND	10.7	7.5	
%C SAND	0.0	0.0	
%M SAND	0.2	0.1	
%F SAND	10.5	7.5	
% FINES	89.3	92.5	
% -2μ	4	5	
D_{100} (mm)	2.00	2.00	
D_{60} (mm)	0.03	0.03	
D_{30} (mm)	0.01	0.01	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"			
4			
10	100.0	100.0	
20	100.0	100.0	
40	99.8	99.9	
60	99.7	99.9	
100	98.6	99.1	
200	89.3	92.5	

TerraSense, LLC	URS Corporation
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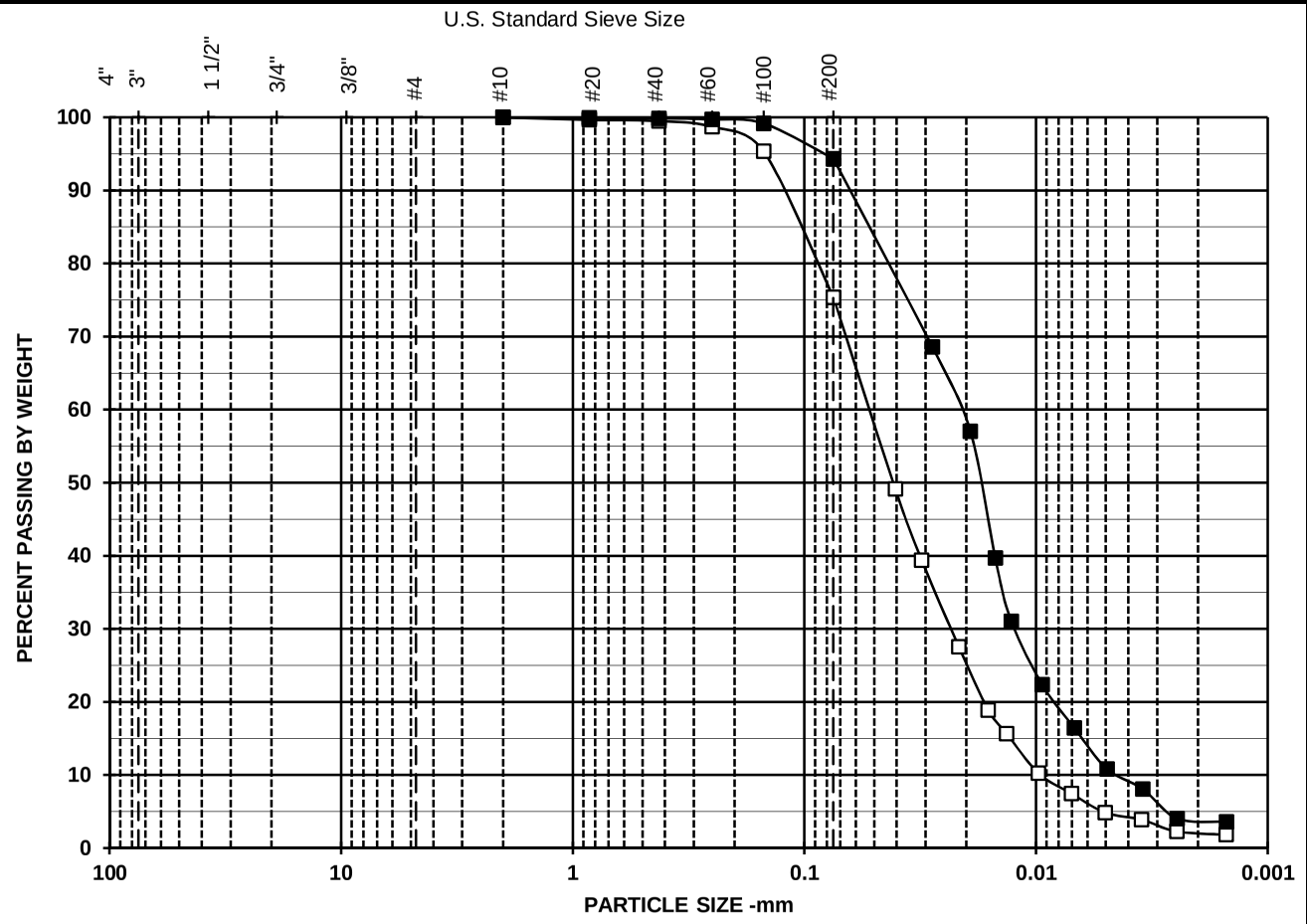
PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

Analysis File: 3SV-MasterRev3

siev2c.xls 5/17/2012

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					ML	Gray, Silt with sand	5/11/2012
■					ML	Gray, Silt	5/11/2012
○							

Symbol	□	■	○
Boring	PB-5	PB-5	
Sample	Coarse	Fine	
Depth	22.5-24.5	22.5-24.5	
% +3"	0.0	0.0	
% Gravel	0.0	0.0	
% SAND	24.6	5.7	
%C SAND	0.0	0.0	
%M SAND	0.5	0.2	
%F SAND	24.1	5.5	
% FINES	75.4	94.3	
% -2μ	2	4	
D_{100} (mm)	4.75	2.00	
D_{60} (mm)	0.05	0.02	
D_{30} (mm)	0.02	0.01	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"			
4			
10	100.0	100.0	
20	99.7	99.9	
40	99.5	99.8	
60	98.7	99.7	
100	95.3	99.2	
200	75.4	94.3	

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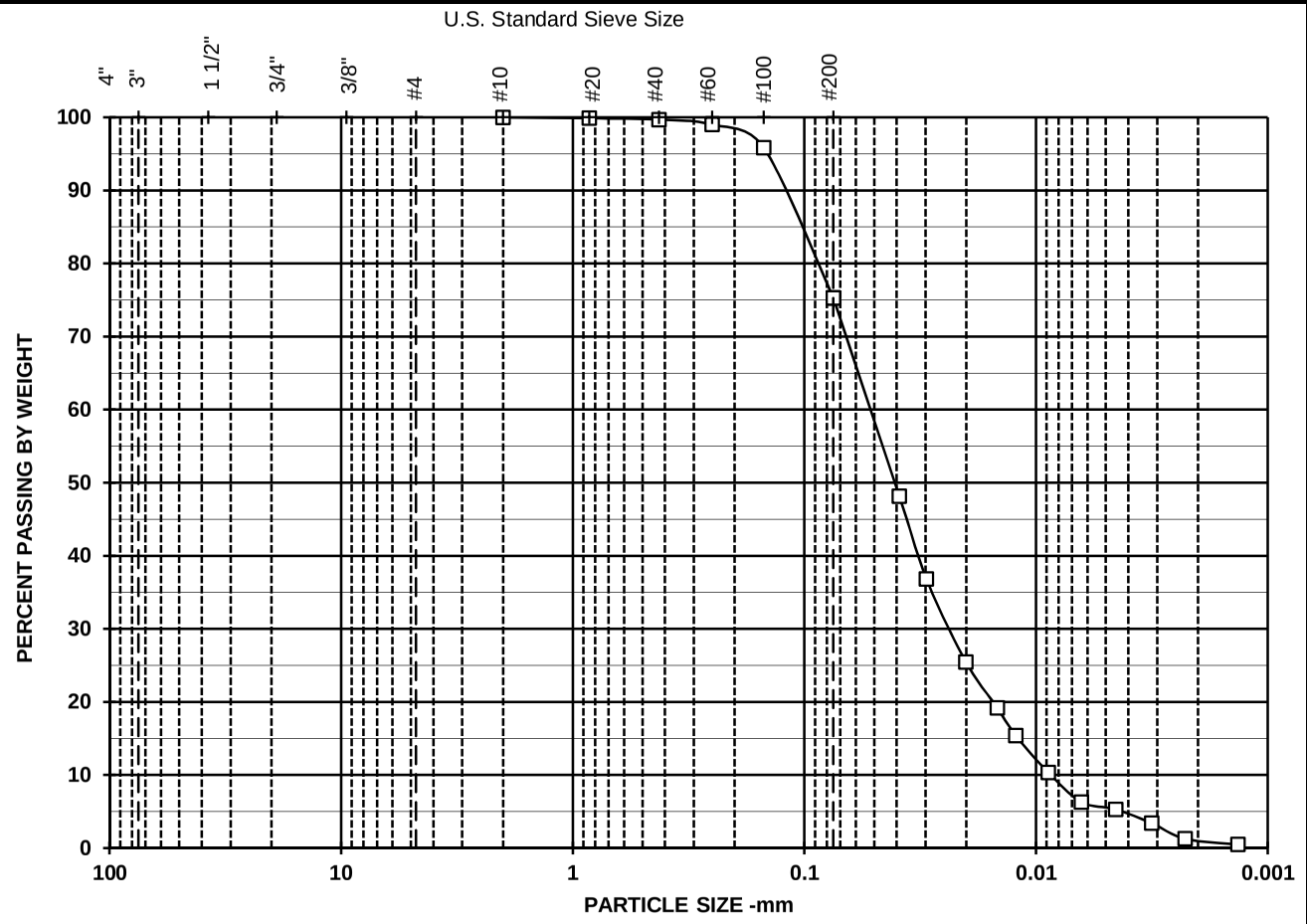
PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

Analysis File: 3SV-MasterRev3

sieve2d.xls 5/17/2012

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Symbol	□	■	○
Boring	Selected		
Sample	Coarse		
Depth	Composite		
% +3"	0.0		
% Gravel	0.0		
% SAND	24.7		
%C SAND	0.0		
%M SAND	0.3		
%F SAND	24.4		
% FINES	75.3		
% -2μ	1		
D_{100} (mm)	4.75		
D_{60} (mm)	0.05		
D_{30} (mm)	0.02		
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"			
4			
10	100.0		
20	99.9		
40	99.7		
60	99.0		
100	95.9		
200	75.3		

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	2.0				ML	Brown, Silt with sand	6/11/2012
■							
○							

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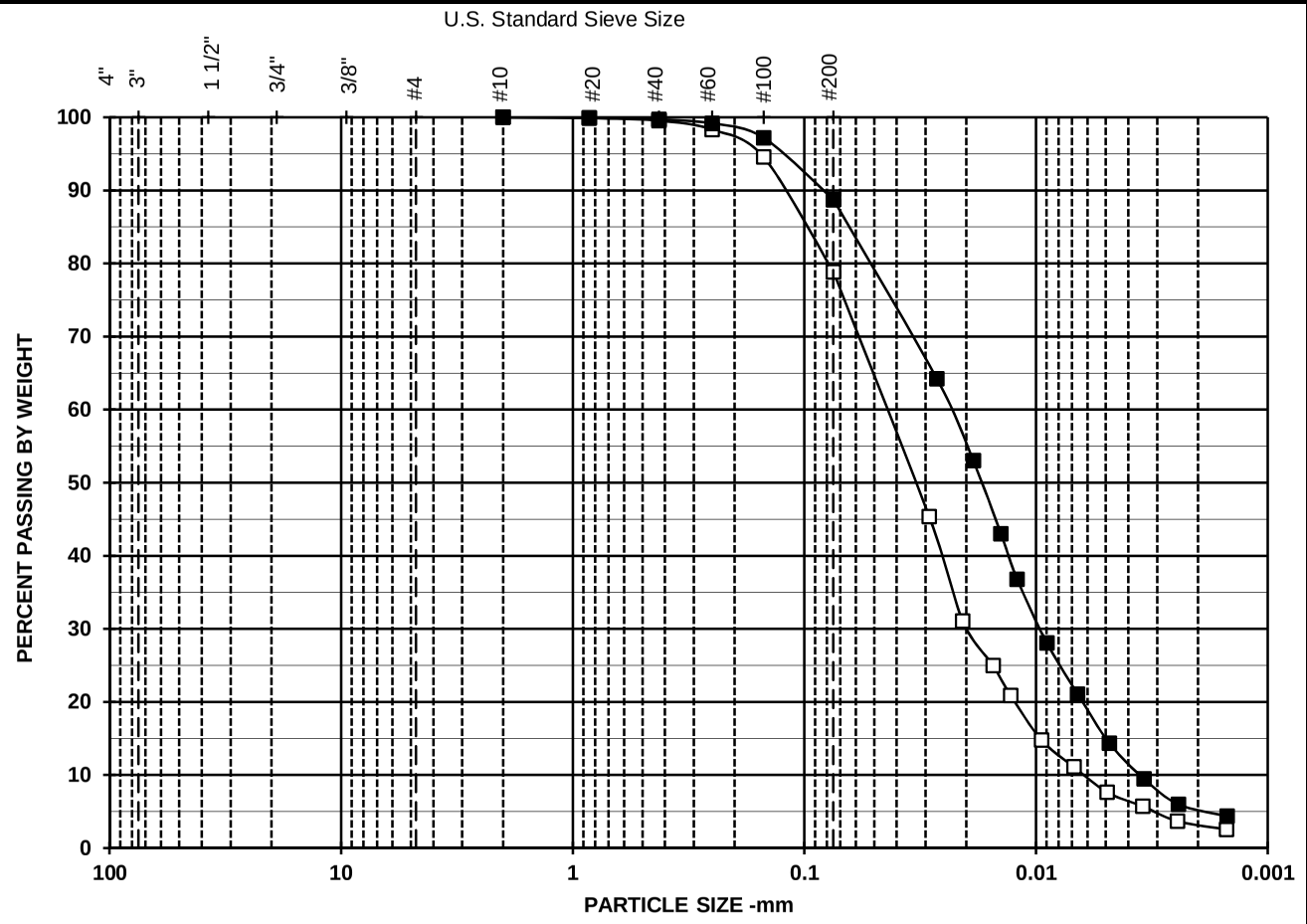
PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					ML	Gray, Silt with sand	5/11/2012
■					ML	Gray, Silt	5/11/2012
○							

Symbol	□	■	○
Boring	PB-6	PB-6	
Sample	Coarse	Fine	
Depth	25.5-27.3	25.5-27.3	
% +3"	0.0	0.0	
% Gravel	0.0	0.0	
% SAND	21.2	11.3	
%C SAND	0.0	0.0	
%M SAND	0.5	0.3	
%F SAND	20.7	11.0	
% FINES	78.8	88.7	
% -2μ	3	5	
D_{100} (mm)	2.00	2.00	
D_{60} (mm)	0.05	0.02	
D_{30} (mm)	0.02	0.01	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"			
4			
10	100.0	100.0	
20	99.9	99.9	
40	99.5	99.7	
60	98.3	99.2	
100	94.6	97.2	
200	78.8	88.7	

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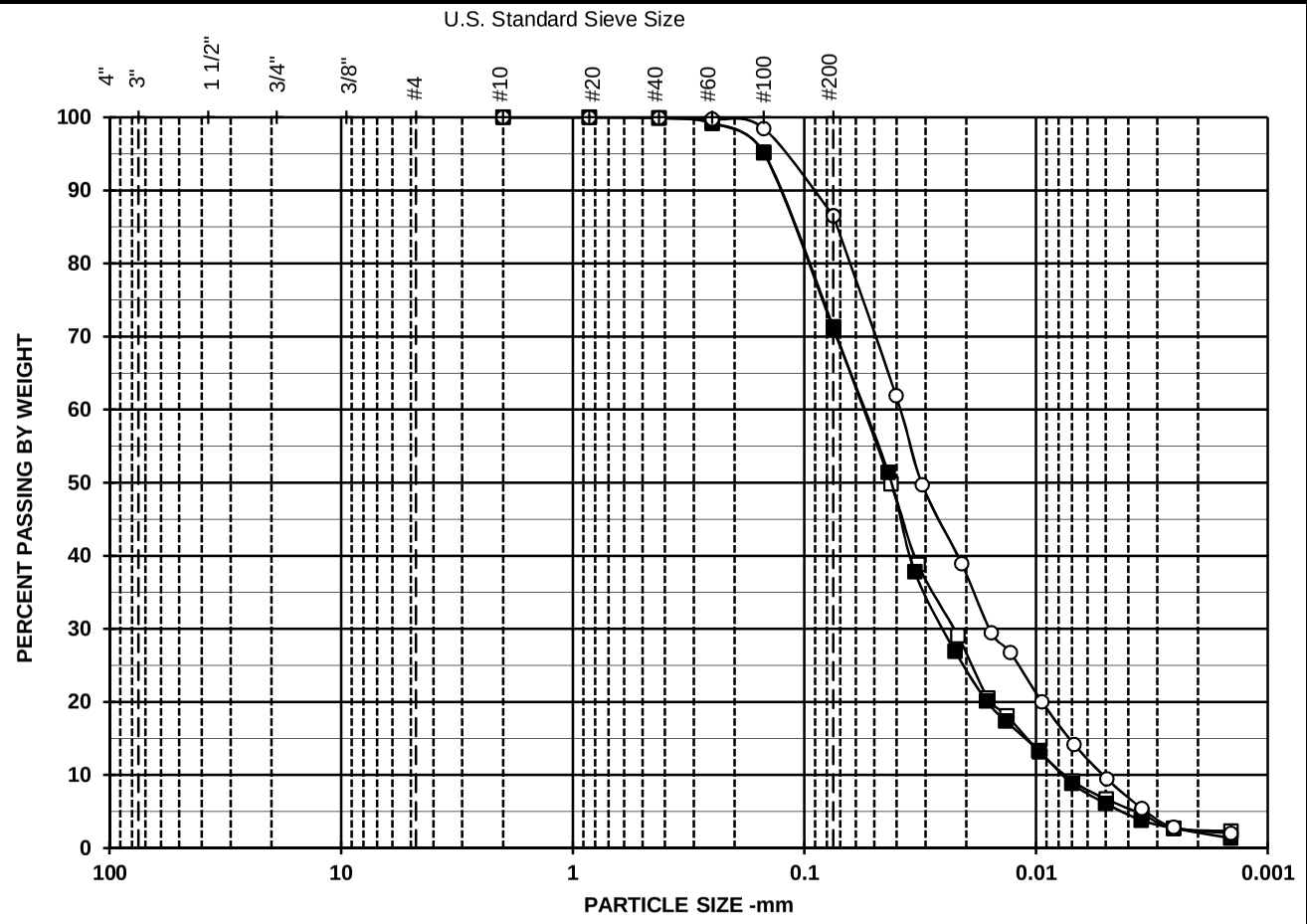
PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

Analysis File: 3SV-MasterRev3

sieve2e.xls 5/17/2012

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					ML	Gray, Silt with sand	5/10/2012
■					ML	Gray, Silt with sand trial preparation specimen	5/10/2012
○	17.6	np	np	np	ML	Gray, Silt	5/10/2012

Symbol	□	■	○
Boring	PB-7	PB-7	PB-7
Sample	Coarse	Coarse	Fine
Depth	62-64	trial specimen	62-64
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.0	0.0
% SAND	28.7	29.0	13.5
%C SAND	0.0	0.0	0.0
%M SAND	0.1	0.1	0.1
%F SAND	28.6	28.9	13.4
% FINES	71.3	71.0	86.5
% -2μ	3	2	2
D_{100} (mm)	0.85	0.85	2.00
D_{60} (mm)	0.06	0.06	0.04
D_{30} (mm)	0.02	0.03	0.02
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"			
4			
10	100.0	100.0	100.0
20	100.0	100.0	100.0
40	99.9	99.9	99.9
60	99.2	99.2	99.7
100	95.2	95.1	98.5
200	71.3	71.0	86.5

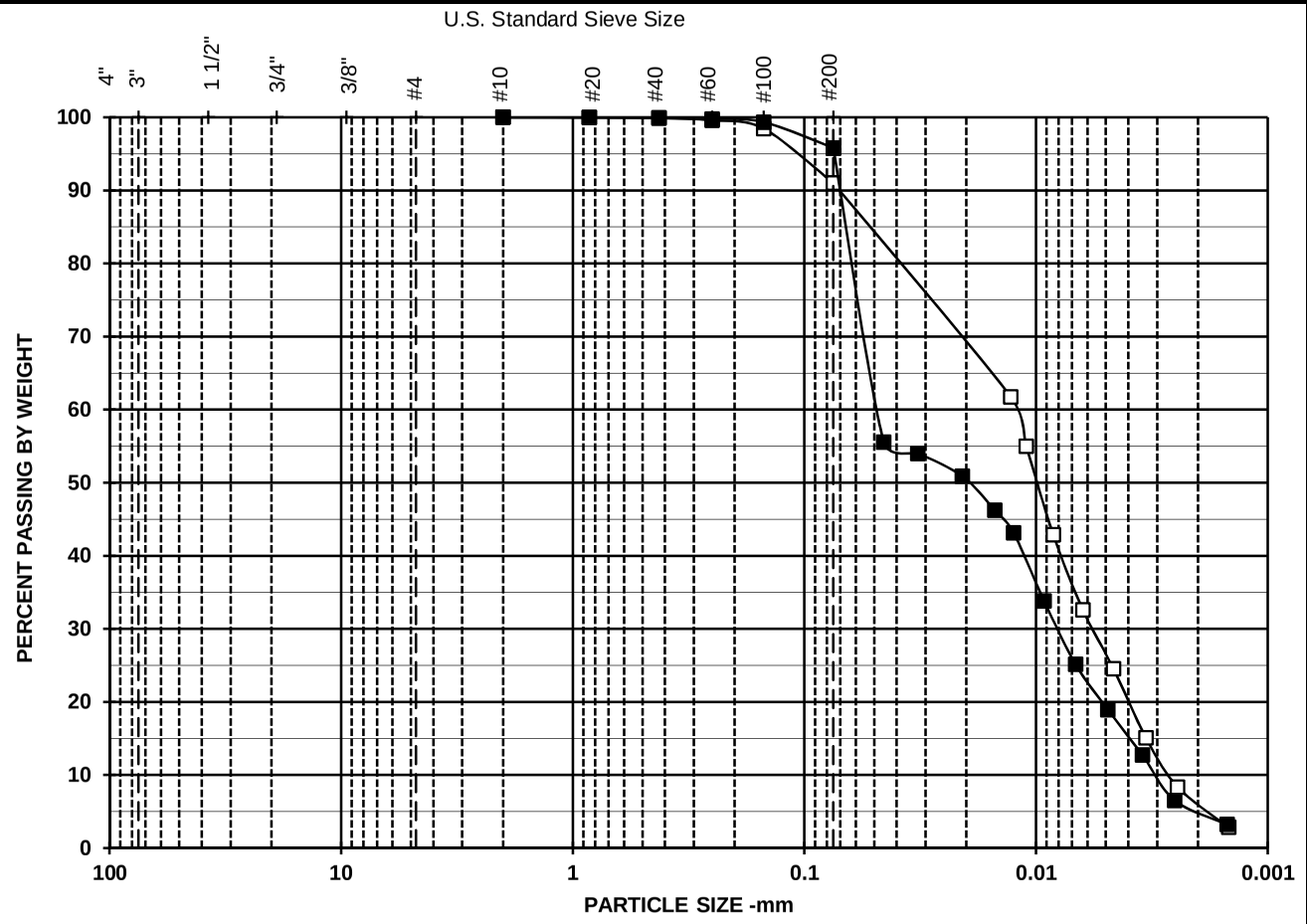
TerraSense, LLC	URS Corporation
T13815141	13815141

PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

Analysis File: 3SV-MasterRev3

siev2f.xls 5/17/2012

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					ML	Gray, Silt	5/11/2012
■					ML	Gray, Silt	5/11/2012
○							

Symbol	□	■	○
Boring	PB-8	PB-8	
Sample	Coarse	Fine	
Depth	62-64	62-64	
% +3"	0.0	0.0	
% Gravel	0.0	0.0	
% SAND	9.0	4.2	
%C SAND	0.0	0.0	
%M SAND	0.1	0.1	
%F SAND	8.9	4.1	
% FINES	91.0	95.8	
% -2μ	6	5	
D_{100} (mm)	2.00	2.00	
D_{60} (mm)	0.01	0.05	
D_{30} (mm)	0.01	0.01	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"			
4			
10	100.0	100.0	
20	100.0	100.0	
40	99.9	99.9	
60	99.6	99.8	
100	98.4	99.3	
200	91.0	95.8	

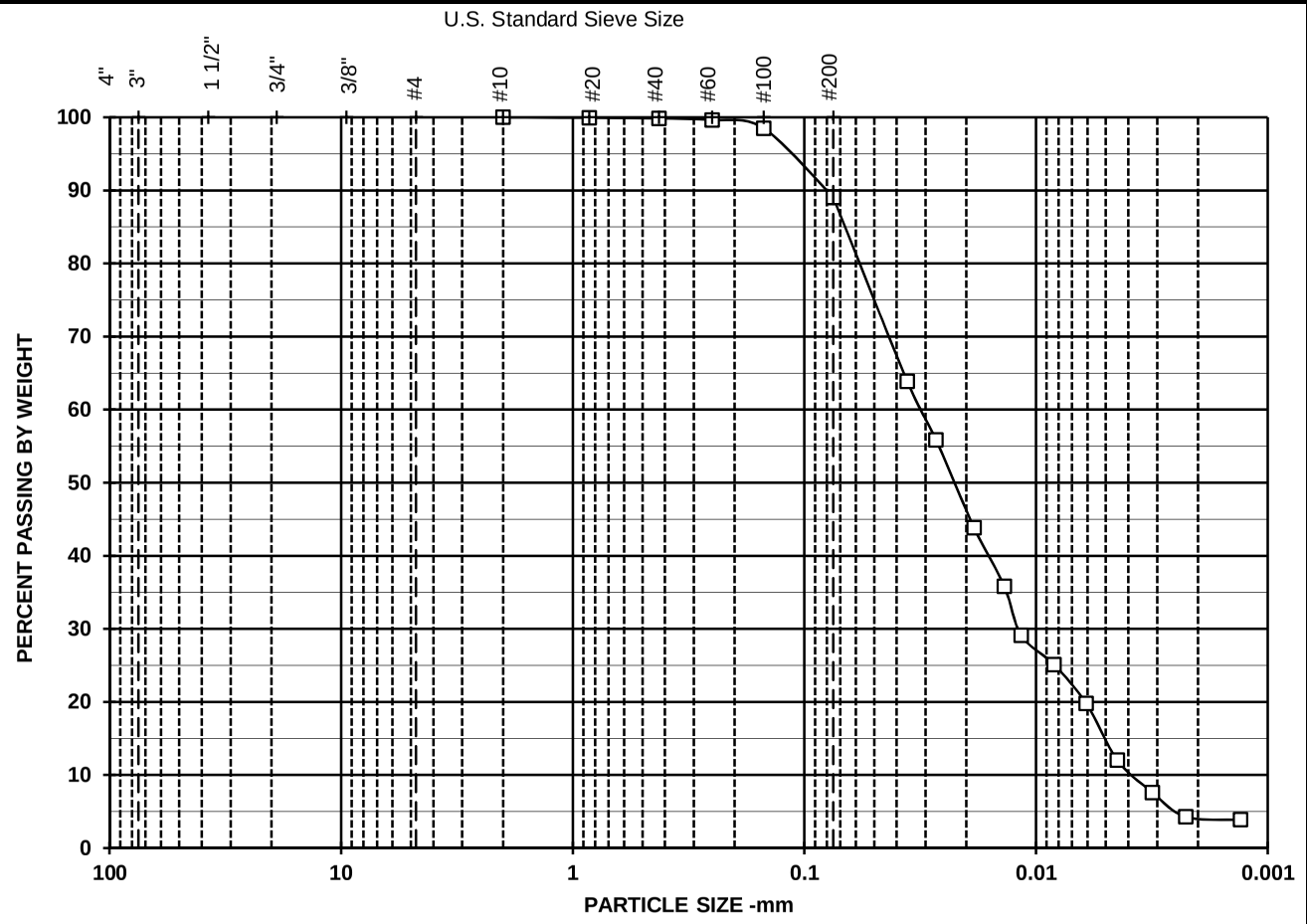
TerraSense, LLC	URS Corporation
T13815141	13815141

PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

Analysis File: 3SV-MasterRev3

sieve2g.xls 5/17/2012

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					ML	Gray, Silt	7/26/2012
■							
○							

Symbol	□	■	○
Boring	Fine		
Sample	Composite 1		
Depth			
% +3"	0.0		
% Gravel	0.0		
% SAND	11.0		
%C SAND	0.0		
%M SAND	0.1		
%F SAND	10.8		
% FINES	89.0		
% -2μ	4		
D_{100} (mm)	2.00		
D_{60} (mm)	0.03		
D_{30} (mm)	0.01		
D_{10} (mm)			
Cc			
Cu			

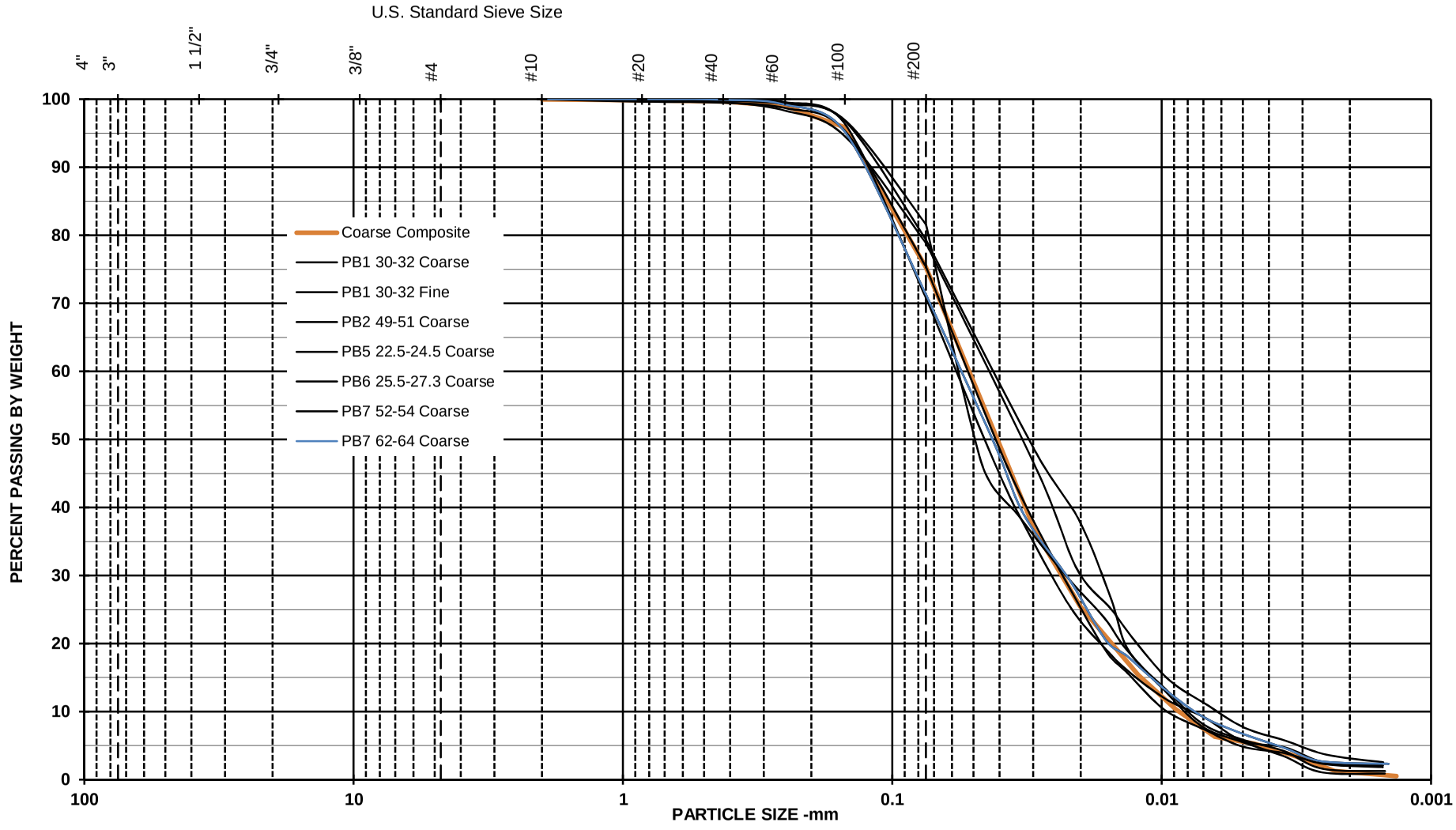
Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"			
4			
10	100.0		
20	99.9		
40	99.9		
60	99.6		
100	98.5		
200	89.0		

TerraSense, LLC	URS Corporation
T13815141	13815141

PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

Analysis File: 3SV-MasterRev3

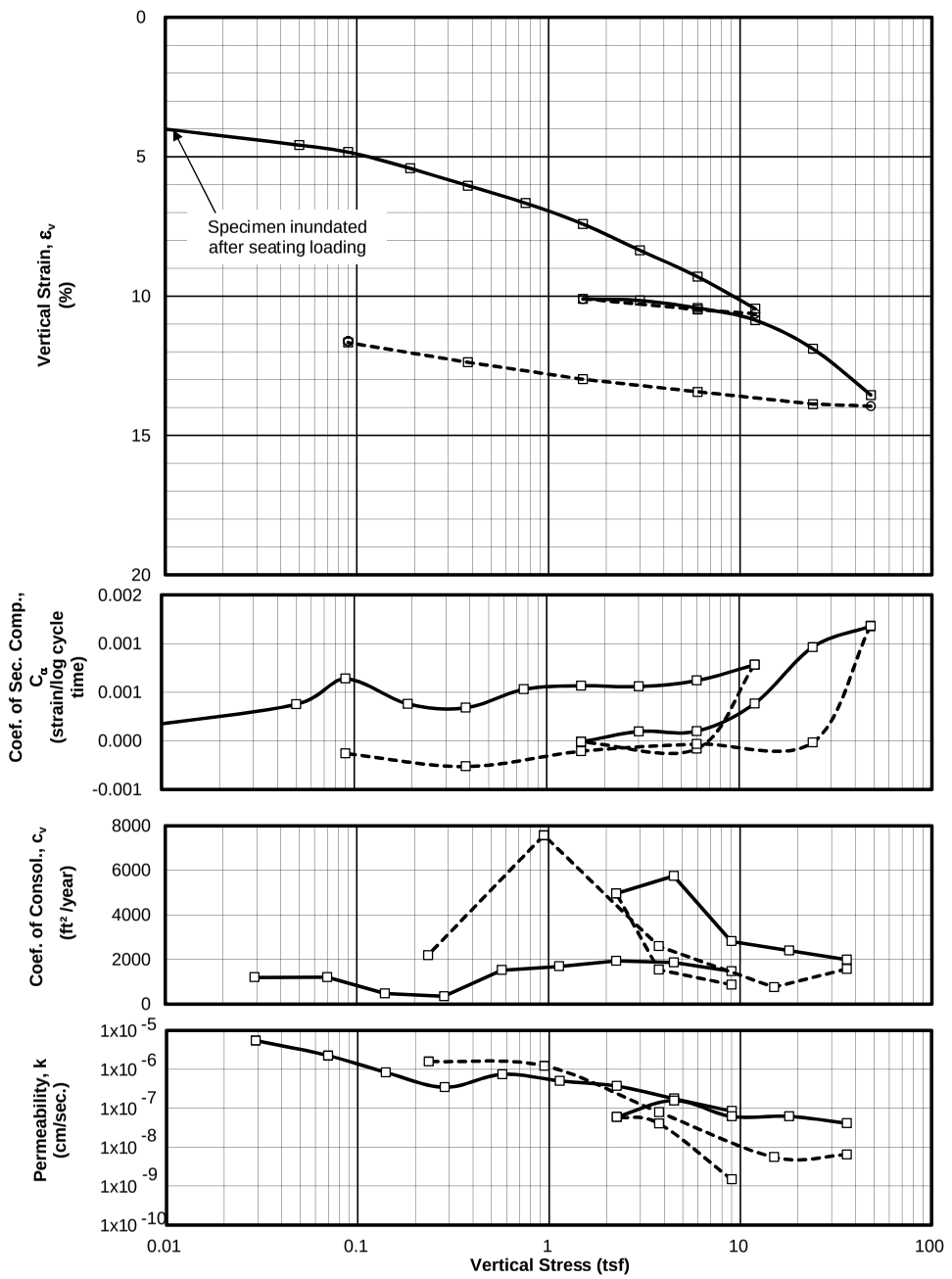
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Project No. T13815141	**TerraSense, LLC**	**AEP Big Sandy Landfill**	**PARTICLE SIZE DISTRIBUTION** Selected "Coarse" Materials

A P P E N D I X B.2B

ASH – CONSOLIDATION



SAMPLE INFORMATION

Boring:	Fine
Sample:	Composite 1
Depth:	
Elevation:	
Type:	water sedimented
Description:	ML, gray silt

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.88	inch
Diameter:	2.50	inch

Initial water content:	36.3	%
Initial total unit weight:	106.6	pcf
Initial dry unit weight:	78.2	pcf
Initial void ratio:	0.836	
Initial degree of saturation:	100	%
Final water content:	32.9	%
Final total unit weight:	108.3	pcf
Final dry unit weight:	81.5	pcf
Final void ratio:	0.761	
Final degree of saturation:	99	% (assumed specific gravity = 2.30)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.051
Compression Index (void ratio per log cycle stress):	0.094
Swell Ratio (strain per log cycle stress):	0.007
Swell Index (void ratio per log cycle stress):	0.013
Recompression Ratio (strain per log cycle stress):	0.009
Recompression Index (void ratio per log cycle stress):	0.017
Remarks:	

LEGEND: □ End of primary o End of Stage ——— Loading - - - - - - - Unloading

Test Date: 7/30/12 Tested By: CMJ Checked By: GET

URS Corporation Project No. 13815141	AEP Big Sandy Landfill	ONE DIMENSIONAL CONSOLIDATION TEST Fine Composite 1
TerraSense, LLC	Project No. T13815141	August 2012

PROJECT:	AEP Big Sandy Landfill					
PROJECT NO.:	T13815141	Initial height:	0.880 inch	Final height:	0.841 inch	
BORING:	Fine	Initial water content:	36.3 %	Final water content:	32.9 %	
SAMPLE:	Composite 1	Initial dry density:	78.2 pcf	Final dry density:	81.5 pcf	
TEST:	C12118	Initial total density:	106.6 pcf	Final total density:	108.3 pcf	
DEPTH, feet:		Initial saturation:	100 %	Final saturation:	99 %	
BY:	CMJ	Initial void ratio:	0.836	Final void ratio:	0.761	
TEST DATE:	7/30/2012			Final strain:	4.4 %	

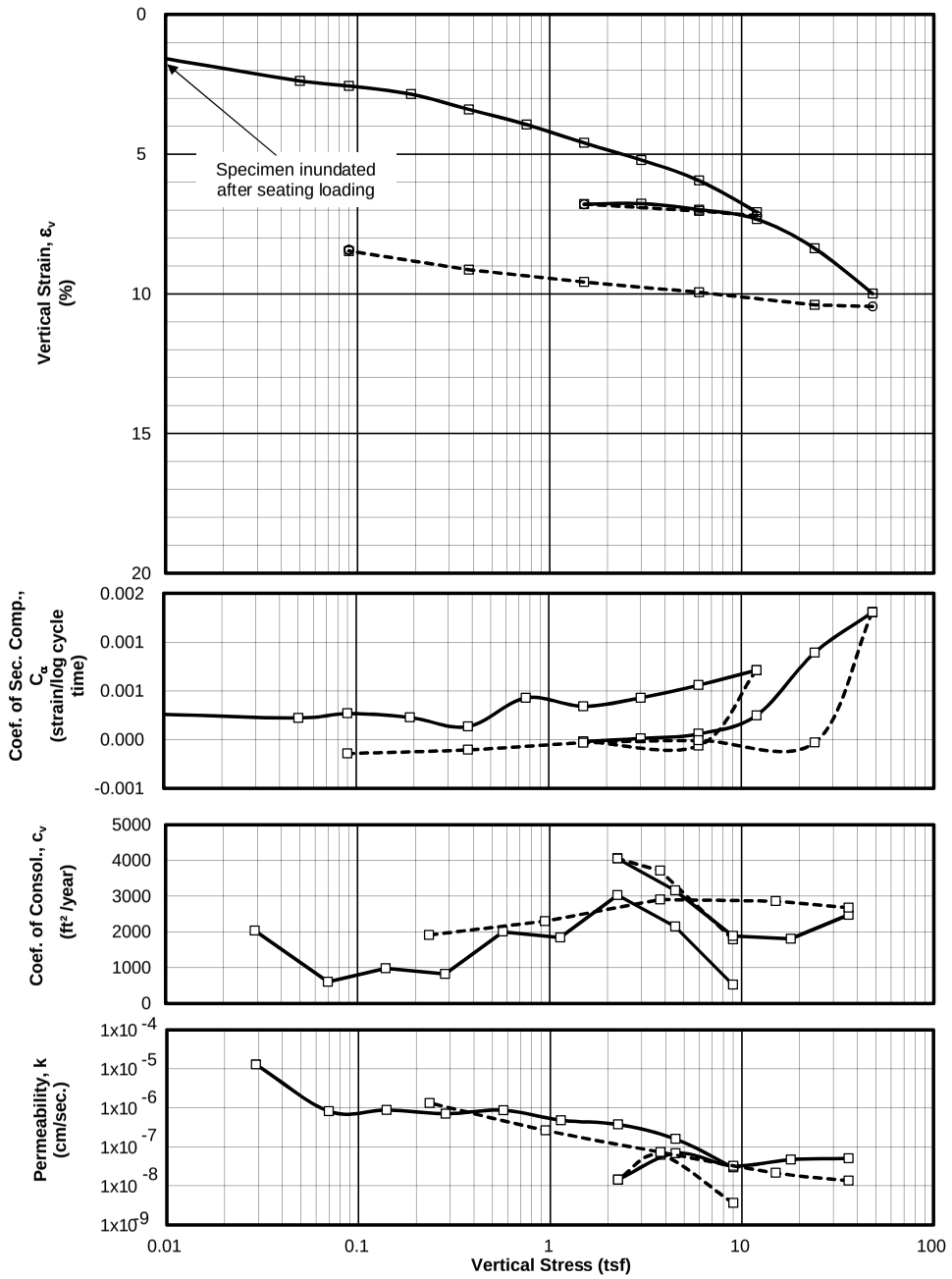
EQUIPMENT: SPECIMEN DESCRIPTION: ML, gray silt

Load Frame No.: 3

Ring Diameter: 2.5 inch

G	LL	PL	PI
2.3			

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.009	0.0348	3.953	0.763	3.988	0.762	1048.41	0.0002	0.22	1.47E-04
2	0.050	0.0403	4.586	0.751	4.678	0.750	1195.91	0.0004	6.55	5.51E-06
3	0.090	0.0426	4.837	0.747	4.959	0.745	1201.50	0.0006	15.94	2.27E-06
4	0.190	0.0477	5.422	0.736	5.497	0.735	474.99	0.0004	17.10	8.38E-07
5	0.380	0.0532	6.046	0.725	6.145	0.723	350.06	0.0003	30.45	3.47E-07
6	0.760	0.0586	6.666	0.713	6.812	0.711	1518.26	0.0005	61.26	7.48E-07
7	1.51	0.0652	7.414	0.700	7.553	0.697	1687.17	0.0006	100.23	5.08E-07
8	3.00	0.0736	8.362	0.682	8.505	0.679	1938.15	0.0006	157.25	3.72E-07
9	6.00	0.0819	9.310	0.665	9.445	0.662	1859.03	0.0006	316.27	1.77E-07
10	12.0	0.0920	10.454	0.644	10.634	0.640	1467.87	0.0008	524.76	8.44E-08
11	6.00	0.0923	10.488	0.643	10.465	0.644	864.09	-0.0001	17558.99	1.48E-09
12	1.51	0.0888	10.098	0.650	10.108	0.650	1546.05	0.0000	1152.23	4.05E-08
13	3.00	0.0894	10.158	0.649	10.188	0.649	4960.96	0.0001	2513.63	5.95E-08
14	6.00	0.0918	10.431	0.644	10.466	0.643	5748.28	0.0001	1096.59	1.58E-07
15	12.0	0.0956	10.866	0.636	10.967	0.634	2812.54	0.0004	1378.98	6.15E-08
16	24.0	0.1046	11.892	0.617	12.133	0.613	2402.43	0.0010	1169.99	6.19E-08
17	48.0	0.1192	13.548	0.587	13.949	0.580	1989.34	0.0012	1449.11	4.14E-08
18	24.0	0.1221	13.874	0.581	13.873	0.581	1567.55	0.0000	7369.87	6.42E-09
19	6.00	0.1182	13.437	0.589	13.435	0.589	753.97	0.0000	4120.82	5.52E-09
20	1.51	0.1142	12.982	0.597	12.954	0.598	2593.83	-0.0001	986.97	7.93E-08
21	0.380	0.1088	12.371	0.609	12.275	0.610	7569.54	-0.0003	184.96	1.23E-06
22	0.090	0.1026	11.664	0.621	11.625	0.622	2181.19	-0.0001	41.02	1.60E-06



SAMPLE INFORMATION

Boring:	Coarse
Sample:	Composite 1
Depth:	
Elevation:	
Type:	water sedimented
Description:	ML, gray silt with sand

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.89	inch
Diameter:	2.50	inch

Initial water content:	42.9	%
Initial total unit weight:	104.4	pcf
Initial dry unit weight:	73.0	pcf
Initial void ratio:	1.009	
Initial degree of saturation:	100	%
Final water content:	36.0	%
Final total unit weight:	107.5	pcf
Final dry unit weight:	79.1	pcf
Final void ratio:	0.855	
Final degree of saturation:	99	% (assumed specific gravity = 2.35)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.048
Compression Index (void ratio per log cycle stress):	0.096
Swell Ratio (strain per log cycle stress):	0.004
Swell Index (void ratio per log cycle stress):	0.008
Recompression Ratio (strain per log cycle stress):	0.006
Recompression Index (void ratio per log cycle stress):	0.012
Remarks:	

LEGEND: □ End of primary o End of Stage ——— Loading - - - - - - - Unloading

Test Date: 7/30/12 Tested By: CMJ/TK Checked By: GET

URS Corporation Project No. 13815141	AEP Big Sandy Landfill	ONE DIMENSIONAL CONSOLIDATION TEST Coarse Composite 1
TerraSense, LLC	Project No. T13815141	August 2012

PROJECT:	AEP Big Sandy Landfill					
PROJECT NO.:	T13815141	Initial height:	0.889 inch	Final height:	0.811 inch	
BORING:	Coarse	Initial water content:	42.9 %	Final water content:	36.0 %	
SAMPLE:	Composite 1	Initial dry density:	73.0 pcf	Final dry density:	79.1 pcf	
TEST:	C12117	Initial total density:	104.4 pcf	Final total density:	107.5 pcf	
DEPTH, feet:		Initial saturation:	100 %	Final saturation:	99 %	
BY:	CMJ/TK	Initial void ratio:	1.009	Final void ratio:	0.855	
TEST DATE:	7/30/2012			Final strain:	8.7 %	

EQUIPMENT: SPECIMEN DESCRIPTION: ML, gray silt with sand

Load Frame No.: 2

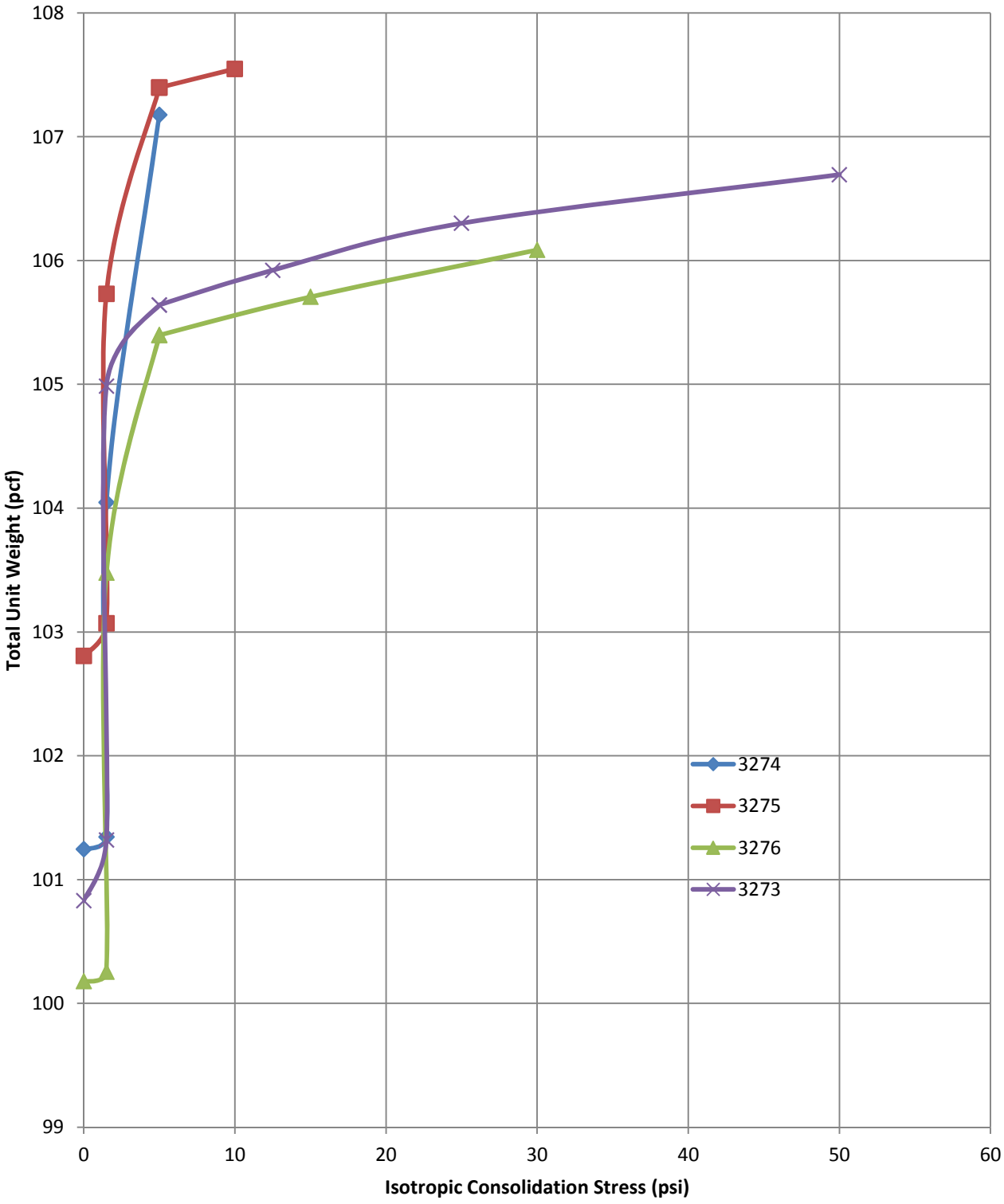
Ring Diameter: 2.5 inch

G	LL	PL	PI
2.35			

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.008	0.0133	1.498	0.979	1.542	0.978	100.71	0.0003	0.56	5.46E-06
2	0.050	0.0212	2.381	0.961	2.440	0.960	2035.58	0.0002	4.72	1.30E-05
3	0.090	0.0228	2.561	0.957	2.610	0.956	601.92	0.0003	22.19	8.18E-07
4	0.190	0.0254	2.860	0.951	2.915	0.950	979.34	0.0002	33.51	8.82E-07
5	0.380	0.0302	3.402	0.941	3.435	0.940	823.72	0.0001	35.06	7.09E-07
6	0.760	0.0351	3.949	0.930	4.075	0.927	2003.34	0.0004	69.41	8.71E-07
7	1.51	0.0409	4.601	0.916	4.672	0.915	1837.51	0.0003	115.02	4.82E-07
8	3.00	0.0463	5.213	0.904	5.329	0.902	3027.03	0.0004	243.48	3.75E-07
9	6.00	0.0529	5.950	0.889	6.086	0.887	2150.08	0.0006	407.11	1.59E-07
10	12.0	0.0629	7.077	0.867	7.206	0.864	523.97	0.0007	532.32	2.97E-08
11	6.00	0.0626	7.037	0.868	7.002	0.868	1785.96	-0.0001	14910.03	3.61E-09
12	1.51	0.0604	6.790	0.873	6.798	0.872	3714.57	0.0000	1816.29	6.17E-08
13	3.00	0.0602	6.772	0.873	6.779	0.873	4050.57	0.0000	8519.12	1.43E-08
14	6.00	0.0621	6.987	0.869	7.006	0.868	3156.68	0.0001	1394.34	6.83E-08
15	12.0	0.0652	7.332	0.862	7.388	0.861	1887.31	0.0002	1742.21	3.27E-08
16	24.0	0.0744	8.373	0.841	8.578	0.837	1806.67	0.0009	1152.14	4.73E-08
17	48.0	0.0888	9.993	0.808	10.452	0.799	2472.55	0.0013	1481.98	5.03E-08
18	24.0	0.0924	10.396	0.800	10.400	0.800	2673.93	0.0000	5950.78	1.36E-08
19	6.00	0.0884	9.949	0.809	9.953	0.809	2859.79	0.0000	4022.78	2.14E-08
20	1.51	0.0851	9.573	0.817	9.584	0.816	2902.19	0.0000	1195.21	7.33E-08
21	0.380	0.0812	9.140	0.825	9.065	0.827	2294.56	-0.0001	261.29	2.65E-07
22	0.090	0.0753	8.469	0.839	8.433	0.840	1913.01	-0.0001	43.19	1.34E-06

A P P E N D I X B.2C

ASH – STATIC CONSOLIDATED UNDRAINED TRIAXIAL



URS Corporation **Project # 13815141**	**AEP** **Big Sandy Landfill**	**STATIC TRIAXIAL TEST** **CONSOLIDATION DATA**
TerraSense, LLC **Project # T13815141**		**Coarse Composite SUMMARY**

SUMMARY FOR STATIC CIU' TRIAXIAL TESTS SPECIMENS

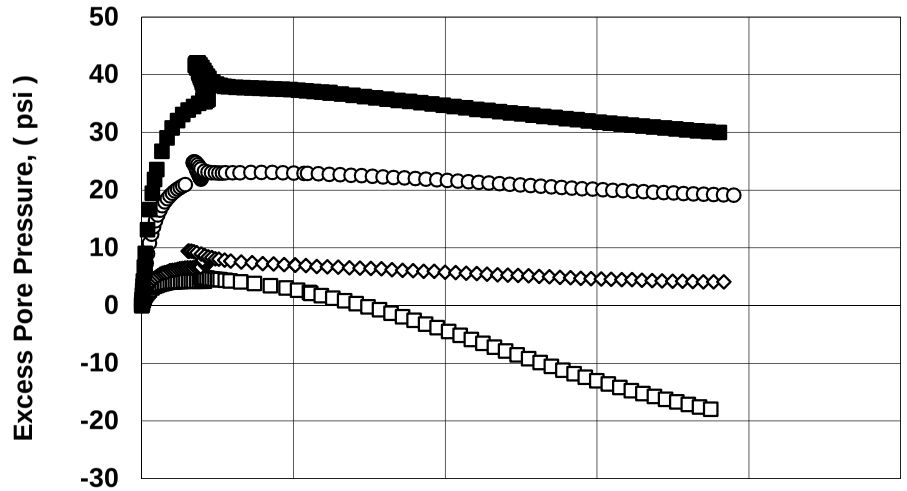
Test No	Boring No	Sample Section No	Depth Elev ()	USCS Group Symbol Gs	w_o w_c (%)	$\gamma_{t,o}$ $\gamma_{t,c}$ (pcf)	$\gamma_{d,o}$ $\gamma_{d,c}$ (pcf)	$\sigma'_{c,max}$ OCR	$\sigma'_{v,c}$ $K_c = \frac{\sigma'_{v,c}}{\sigma'_{h,c}}$	$\varepsilon_{a,c}$ $\varepsilon_{v,c}$ (%)	B factor (%) ε_{rate} (%/hr)	at Peak Deviator Stress: ε_a (%)	at Peak Obliquity: $\frac{\sigma_1 - \sigma_3}{2}$ (psi)	$\frac{\sigma'_1 + \sigma'_3}{2}$ (psi)	σ'_1 / σ'_3	A factor	ϕ' for c'=0
T3274	Coarse Composite	B		ML	37.8	101.24	73.47	5.00	5.00	0.6		18.7	23.07	46.05	3.01	-0.390	30.1
				(2.35)	36.9	107.55	78.55	1.0	1.00	6.5	1.2	2.0	0.36	0.46	7.57	6.879	50.1
T3275	Coarse Composite	C		ML	37.9	102.81	74.58	10.00	10.00	0.8	99.5	18.8	5.85	11.77	2.98	0.349	29.8
				(2.35)	36.9	107.55	78.54	1.0	1.00	5.1	1.1	7.9	4.01	7.67	3.19	0.790	31.5
T3276	Coarse Composite	D		ML	41.6	100.18	70.77	30.00	30.00	0.8	99.6	19.5	11.09	21.99	3.03	0.861	30.3
				(2.35)	39.6	106.09	76.00	1.0	1.00	6.9	1.1	9.0	8.82	16.82	3.20	1.247	31.6
T3273	Coarse Composite	A		ML	41.9	100.83	71.04	50.00	50.00	2.1	99.2	19.0	20.33	40.33	3.03	0.738	30.3
				(2.35)	38.5	106.69	77.06	1.0	1.00	7.8	1.1	12.1	17.56	34.15	3.12	0.951	30.9

Test No	Description of Material Tested and Remarks
T3274	ML, Gray silt with sand
T3275	ML, Gray silt with sand
T3276	ML, Gray silt with sand
T3273	ML, Gray silt with sand
	Specimens unloaded at 2% strain then shear continued

Strength Envelope Summary						
Test Series	Failure Criteria	ϕ' (deg)	c' (psi)	α' (deg)	a' (psi)	Correlation Coefficient
1	1	30.2	0.000	26.7	0.000	--
	2	30.8	0.152	27.1	0.131	1.000

Failure Criteria: 1 - Peak Deviator Stress; 2 - Peak Obliquity

Project No. T13815141	**AEP Big Sandy Landfill** **URS Corporation**	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements Coarse Composite SUMMARY	June 2012
TerraSense, LLC			



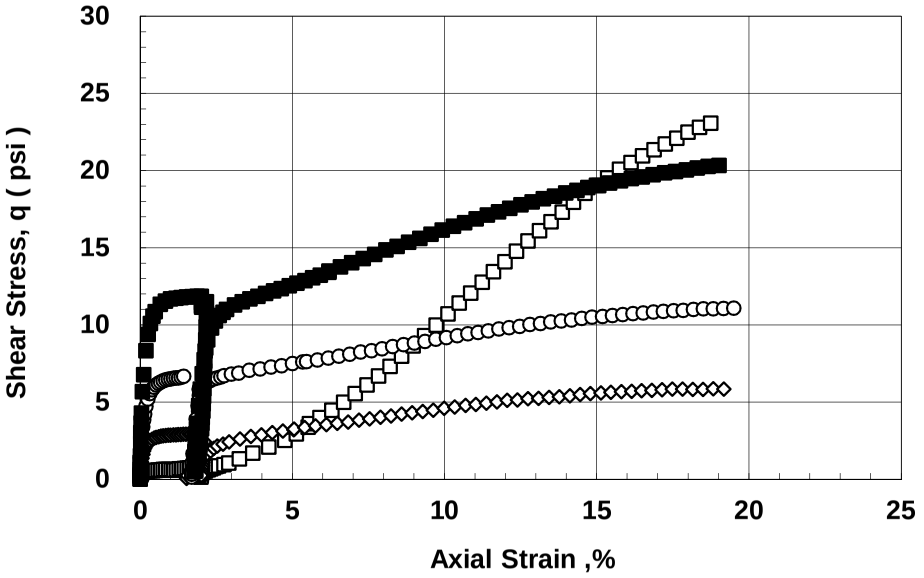
LEGEND AND SUMMARY INFORMATION

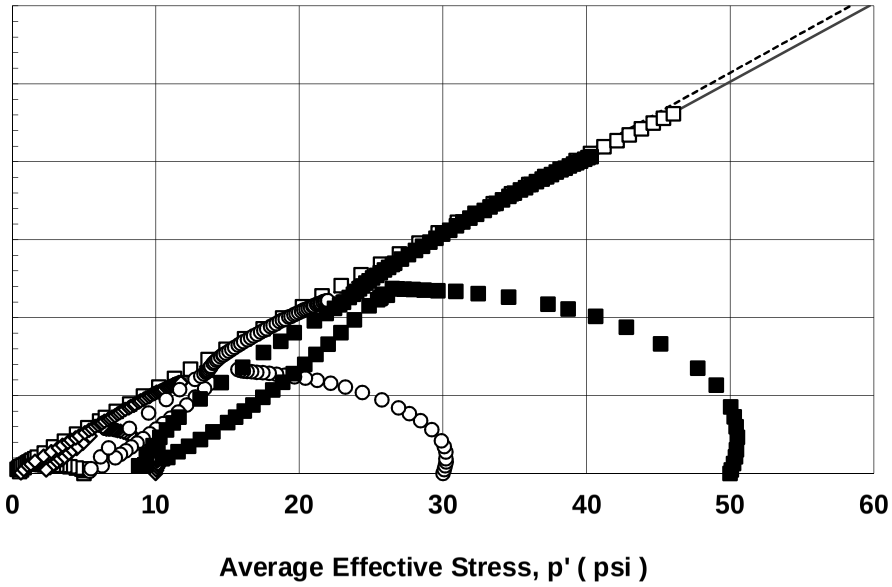
Symbol	Test	Sample	Specimen	w_o (%)	γ_{to} (pcf)	σ'_c (psi)
□	T3274	Coarse Composite	B	37.8	101.2	5.0
◊	T3275	Coarse Composite	C	37.9	102.8	10.0
○	T3276	Coarse Composite	D	41.6	100.2	30.0
■	T3273	Coarse Composite	A	41.9	100.8	50.0

Specimens unloaded at 2% strain then shear continued

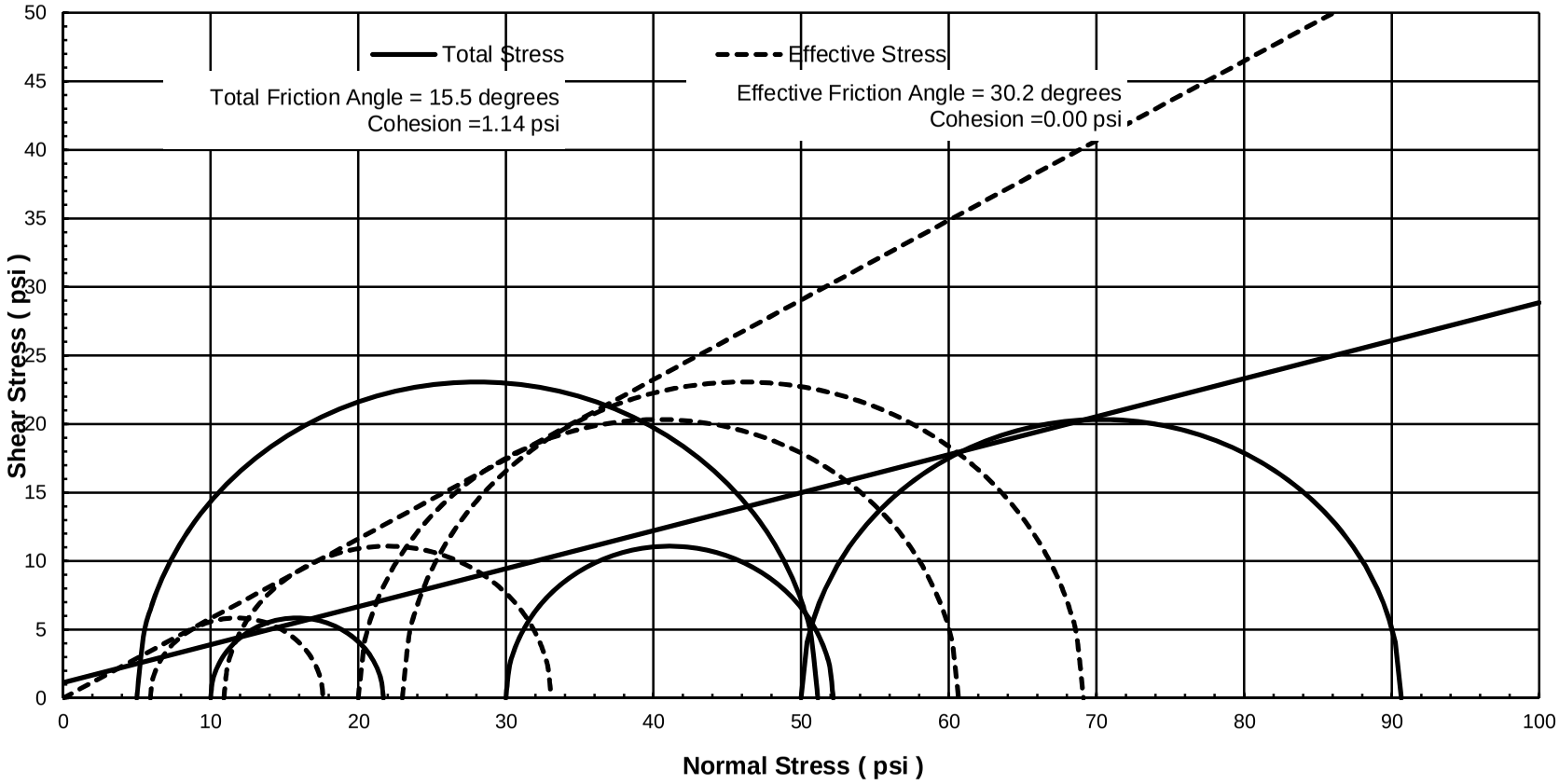
SERIES SUMMARY

Notation	Failure Criteria	c' (psi)	Φ' (degrees)
———	Peak Deviator Stress	0.00	30.2
·····	Peak Obliquity	0.15	30.8



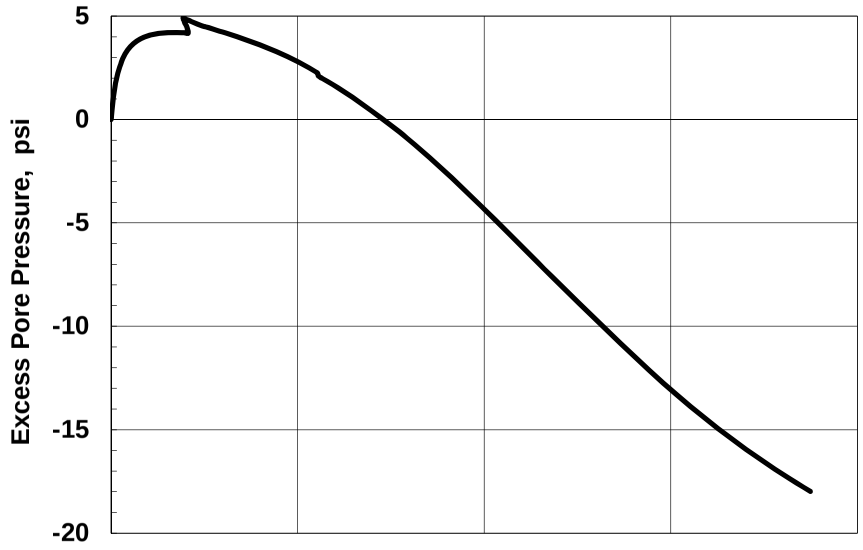


Project No. T13815141	**AEP** **URS Corporation**	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements Coarse Composite SUMMARY	Figure 1
Prepared by: C. Jordan Checked by: G. Thomas	**TerraSense, LLC**		June 2012



Test at 5-psi effective consolidation stress excluded from Total Friction strength envelope

Project No. T13815141	AEP URS Corporation	Mohr Circles of Total and Effective Stresses at Peak CIU' Triaxial Test	Figure 2
TerraSense, LLC		Coarse Composite SUMMARY	June 2012



SAMPLE INFORMATION

Boring: Coarse Composite Sample: B Depth: ft
Type: Water Sedimented
Description: ML, Gray silt with sand

SPECIMEN INFORMATION (Initial)

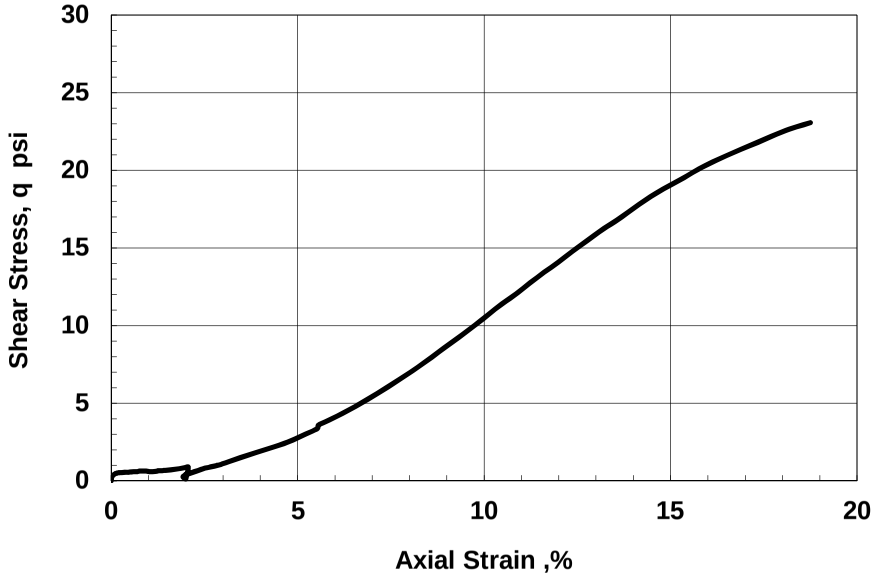
Height: 6.14 inch Diameter: 2.93 inch Area: 6.73 in²
Water Content: 37.8 % Total Unit Weight: 101.2 pcf

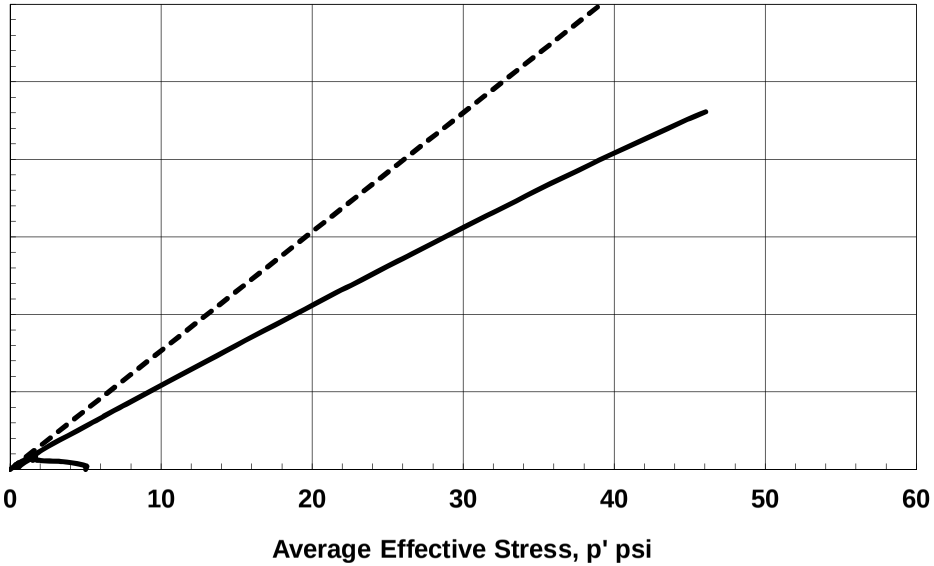
TEST SUMMARY

Consolidation Stresses: 5.00 psi vertical, 5.00 psi lateral
Water Content: 36.9 % Total Unit Weight: 107.6 pcf
B Coefficient: Strain Rate: 0.020 %/min
Peak Shear Strength: 23.07 psi @ 18.7 % Strain
Peak Effective Friction Angle: 50.1°

Failure Sketch

REMARKS: Specimen unloaded at 2% strain then shear continued





Test by: DT	Project No. T13815141	URS Corporation AEP Big Sandy Landfill	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	**TerraSense, LLC**		Boring: Coarse Composite Sample: B	June-12

SAMPLE INFORMATION

Boring: Coarse Composite Sample: C Depth: ft
Type: Water Sedimented
Description: ML, Gray silt with sand

SPECIMEN INFORMATION (Initial)

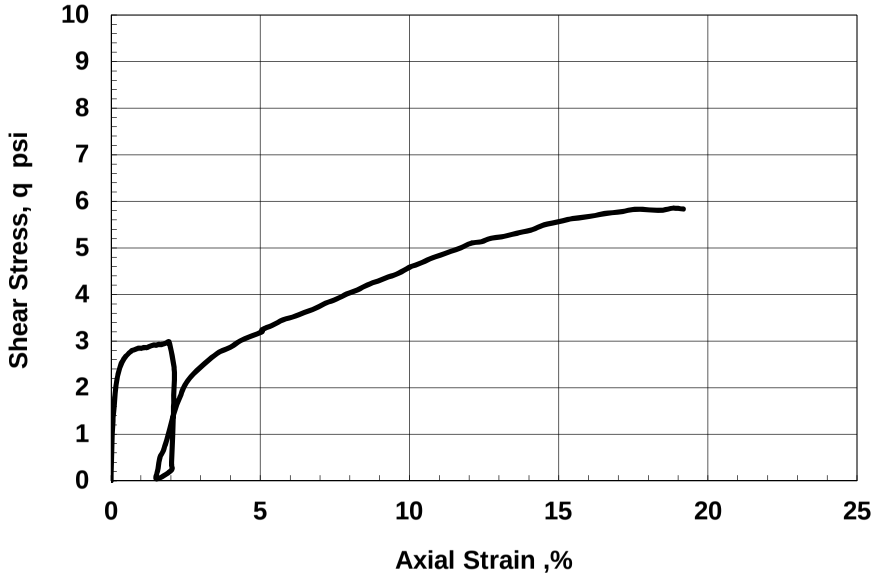
Height: 6.17 inch Diameter: 2.93 inch Area: 6.73 in²
Water Content: 37.9 % Total Unit Weight: 102.8 pcf

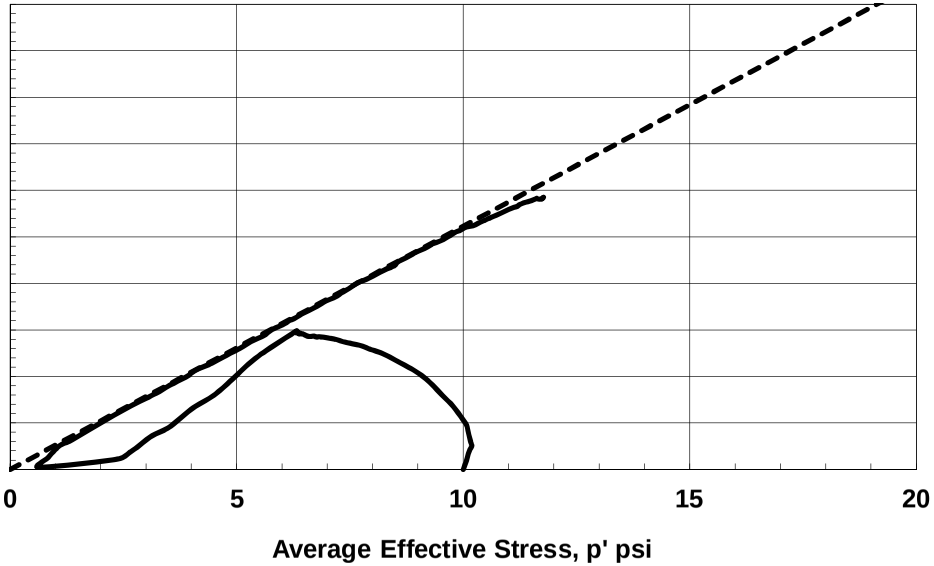
TEST SUMMARY

Consolidation Stresses: 10.00 psi vertical, 10.00 psi lateral
Water Content: 36.9 % Total Unit Weight: 107.5 pcf
B Coefficient: 99.5 Strain Rate: 0.018 %/min
Peak Shear Strength: 5.85 psi @ 18.8 % Strain
Peak Effective Friction Angle: 31.5°

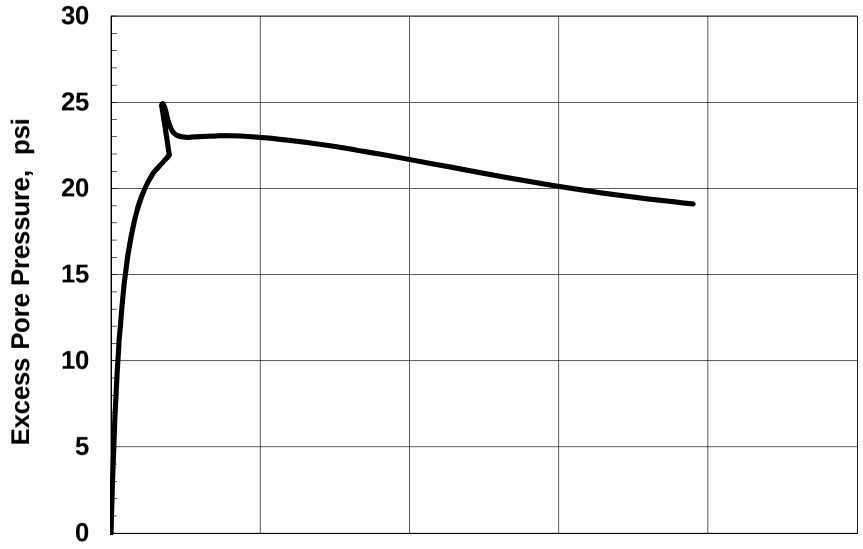
Failure Sketch

REMARKS: Specimen unloaded at 2% strain then shear continued





Test by: DT	Project No. T13815141	URS Corporation AEP Big Sandy Landfill	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	**TerraSense, LLC**		Boring: Coarse Composite Sample: C	June-12



SAMPLE INFORMATION

Boring: Coarse Composite Sample: D Depth: ft
Type: Water Sedimented
Description: ML, Gray silt with sand

SPECIMEN INFORMATION (Initial)

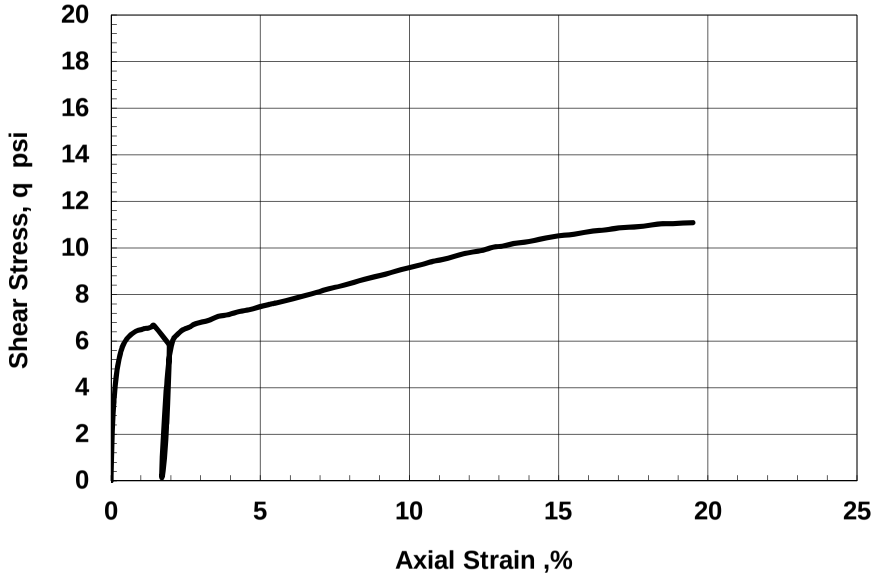
Height: 6.19 inch Diameter: 2.93 inch Area: 6.73 in²
Water Content: 41.6 % Total Unit Weight: 100.2 pcf

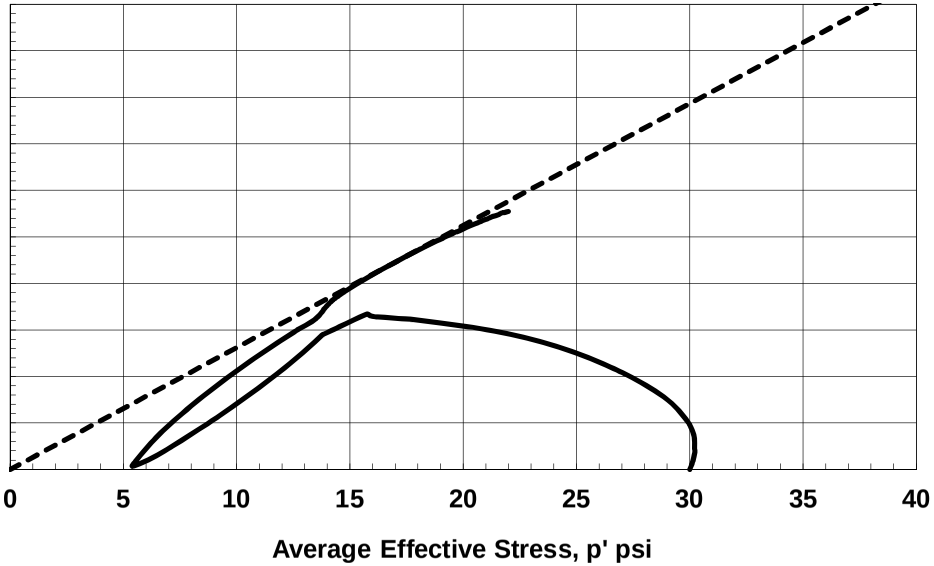
TEST SUMMARY

Consolidation Stresses: 30.00 psi vertical, 30.00 psi lateral
Water Content: 39.6 % Total Unit Weight: 106.1 pcf
B Coefficient: 99.6 Strain Rate: 0.019 %/min
Peak Shear Strength: 11.09 psi @ 19.5 % Strain
Peak Effective Friction Angle: 31.6°

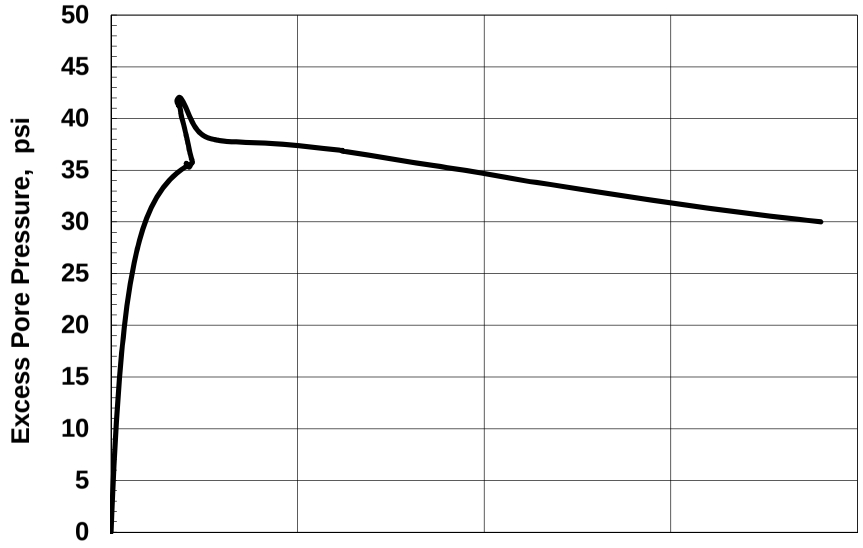
Failure Sketch

REMARKS: Specimen unloaded at 2% strain then shear continued





Test by: DT	Project No. T13815141	URS Corporation AEP Big Sandy Landfill	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements
Checked by: GET	**TerraSense, LLC**		Boring: Coarse Composite Sample: D
			June-12



SAMPLE INFORMATION

Boring: Coarse Composite Sample: A Depth: ft
Type: Water Sedimented
Description: ML, Gray silt with sand

SPECIMEN INFORMATION (Initial)

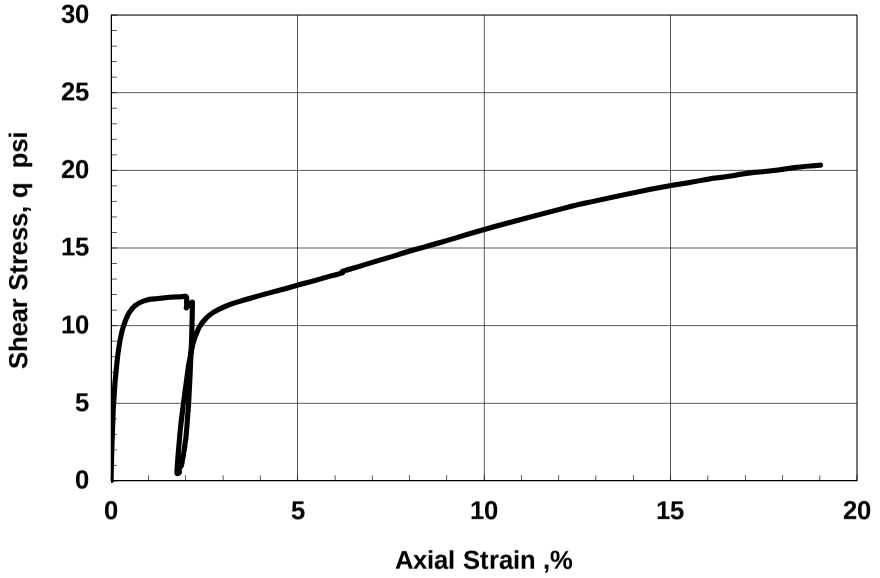
Height: 6.18 inch Diameter: 2.93 inch Area: 6.73 in²
Water Content: 41.9 % Total Unit Weight: 100.8 pcf

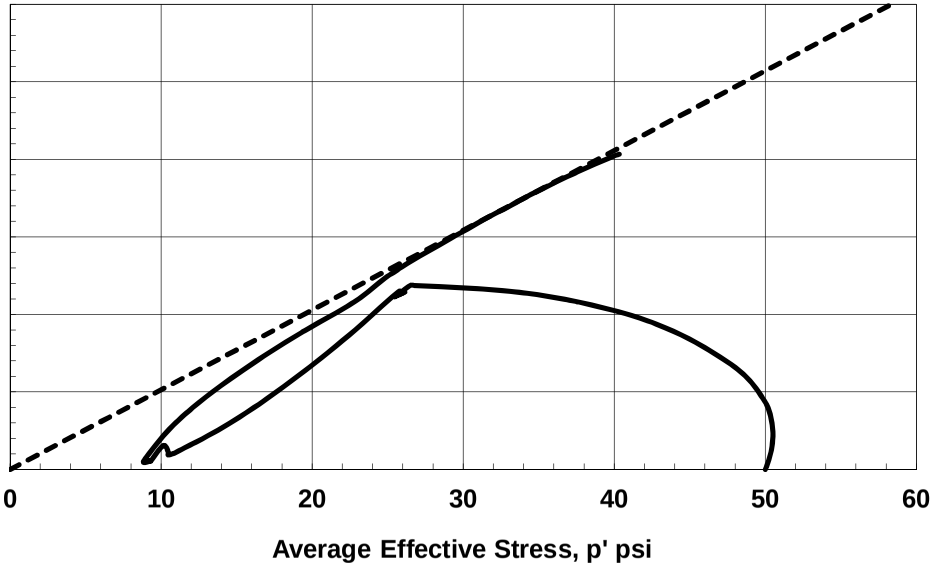
TEST SUMMARY

Consolidation Stresses: 50.00 psi vertical, 50.00 psi lateral
Water Content: 38.5 % Total Unit Weight: 106.7 pcf
B Coefficient: 99.2 Strain Rate: 0.019 %/min
Peak Shear Strength: 20.33 psi @ 19.0 % Strain
Peak Effective Friction Angle: 30.9°

Failure Sketch

REMARKS: Specimen unloaded at 2% strain then shear continued





Test by: DT	Project No. T13815141	URS Corporation AEP Big Sandy Landfill	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	**TerraSense, LLC**		Boring: Coarse Composite Sample: A	June-12

A P P E N D I X B.2D

ASH – CYCLIC CONSOLIDATED UNDRAINED TRIAXIAL

SAMPLE

Sample: Coarse Composite

Type: Water
Sedimented

SPECIMEN

Depth:

w_o: 41.1 %

γ_{to}: 102.1 pcf

γ_{do}: 72.4 pcf

Specimen Description

USCS: ML

Gray silt with sand

TEST CONDITIONS

w_c: 37.2 %

γ_{tc}: 107.4 pcf

γ_{dc}: 78.3 pcf

σ_{vc}: 20 psi

ε_{ac}: 1.6

ε_{vc}: 7.6

Saturation 100. %

Summary

Method: ASTM D 5311

Load Form: Sinusoidal

Frequency: 0.5 Hz

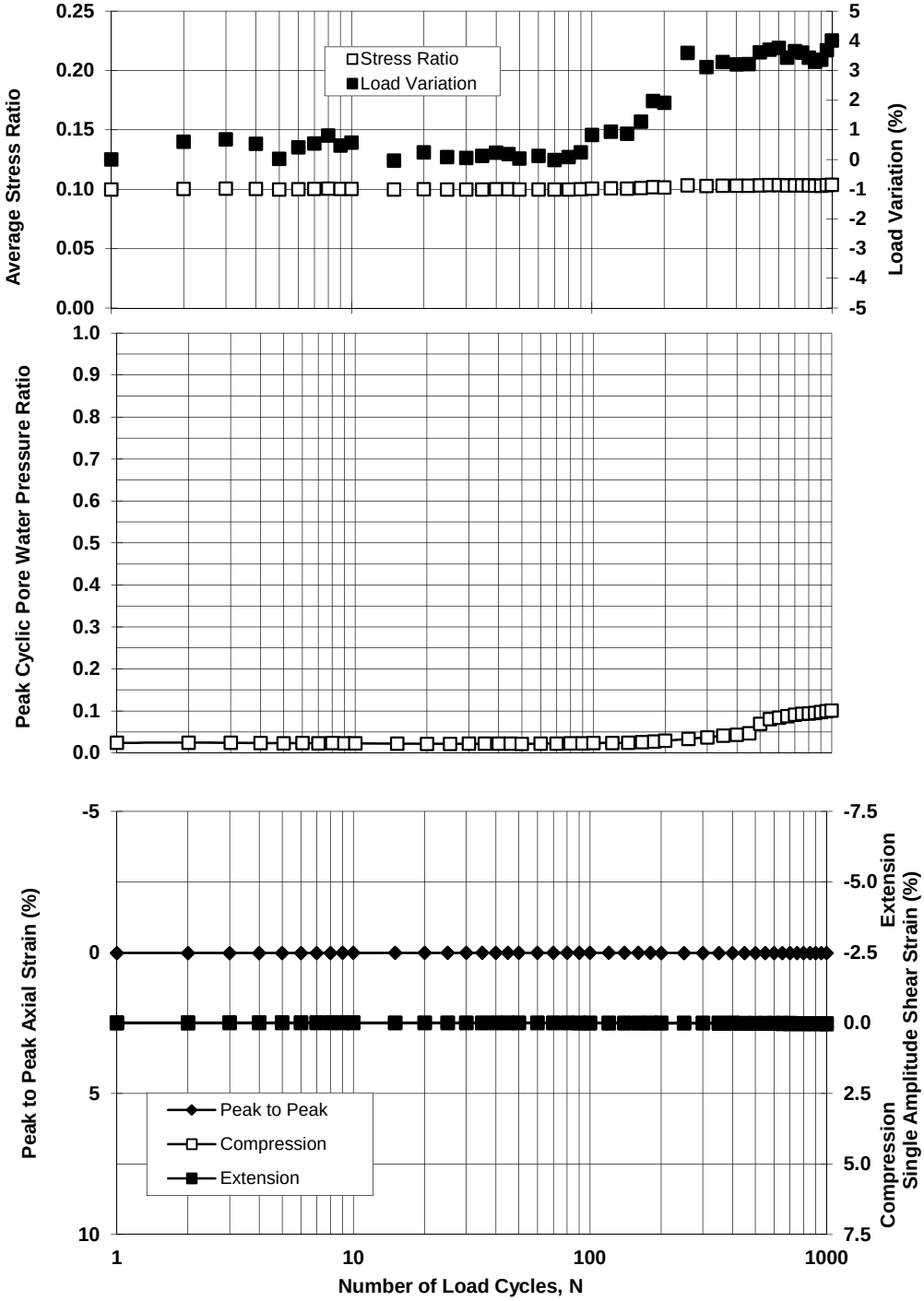
SRm
0.10

N for eda (%) of			
2.5	5.0	10	15
>999	>999	>999	>999

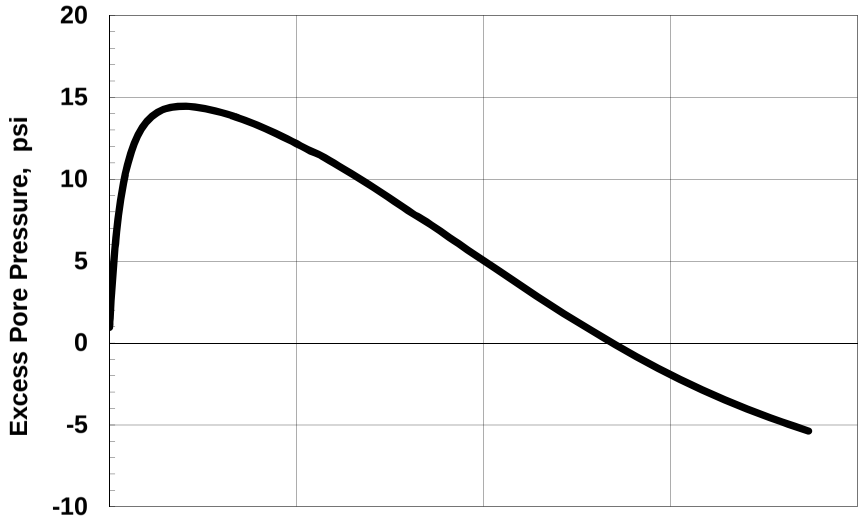
N for PP Ratio of			
0.1	0.2	0.5	0.95
850	>999	>999	>999

Test by: DT/GT

Checked by: GET



Project No. T13815141	AEP Big Sandy Landfill	**LOAD CONTROL CYCLIC TRIAXIAL STRENGTH TEST** Sample Coarse Composite	6/23/12
TerraSense, LLC			



SAMPLE INFORMATION

Sample: Coarse Composite

Type: Water Sedimented

SPECIMEN INFORMATION (Initial)

Description: ML, Gray silt with sand

Height: 6.14 inch Diameter: 2.88 inch Area: 6.51 in²

Water Content: 40.9 %

Total Unit Weight: 104.8 pcf Dry Unit Weight: 74.4 pcf

TEST SUMMARY

Consolidation Stresses: 20.00 psi vertical, 20.00 psi lateral

Water Content: 37.2 % B Coefficient: 99.80

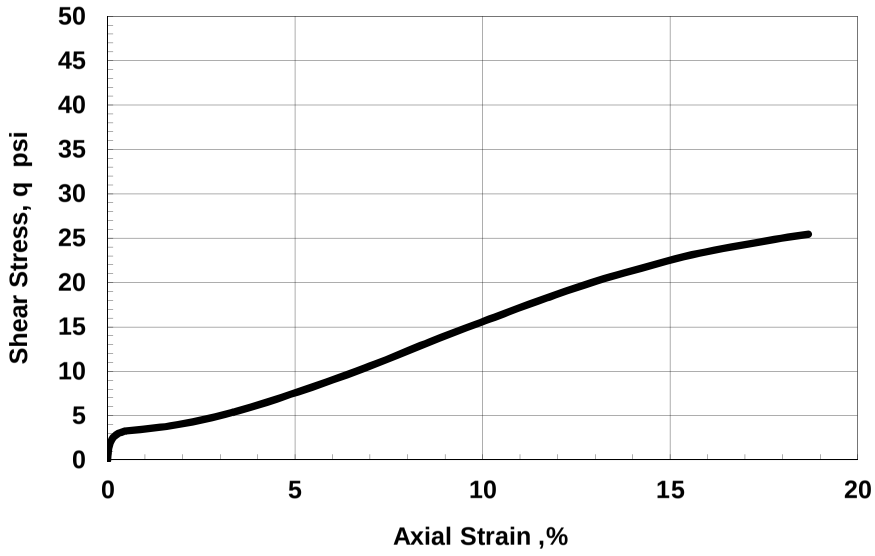
Total Unit Weight: 107.4 pcf Dry Unit Weight: 78.3 pcf

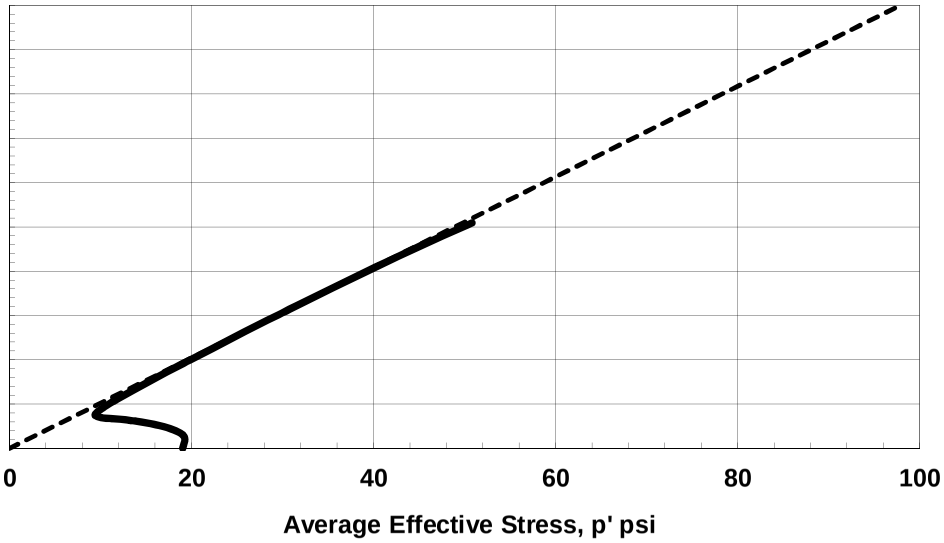
Peak Shear Strength: 25.45 psi @ 18.7 % Strain Strain Rate: 0.021 %/min

Peak Effective Friction Angle: 30.7°

REMARKS: Static Shear performed after undrained cyclic loading

Failure Sketch





Test by: DT

Checked by: GET

URS Corporation
AEP Big Sandy Landfill -

TerraSense, LLC

Project No.
T13815141

CONSOLIDATED UNDRAINED
TRIAXIAL COMPRESSION
with Pore Pressure Measurements
Sample: Coarse Composite

SAMPLE

Sample: Coarse Composite

Type: Water Sedimented

SPECIMEN

Section No.:

Depth: ft

w_o: 36.2 %

γ_{to}: 103.8 pcf

γ_{do}: 76.2 pcf

Specimen Description

USCS: ML

Gray silt with sand

TEST CONDITIONS

w_c: 35.0 %

γ_{tc}: 108.7 pcf

γ_{dc}: 80.5 pcf

σ_{vc}: 20 psi

ε_{ac}: 0.9

ε_{vc}: 5.3

Saturation 100. %

Summary

Method: ASTM D 5311

Load Form: Sinusoidal

Frequency: 0.5 Hz

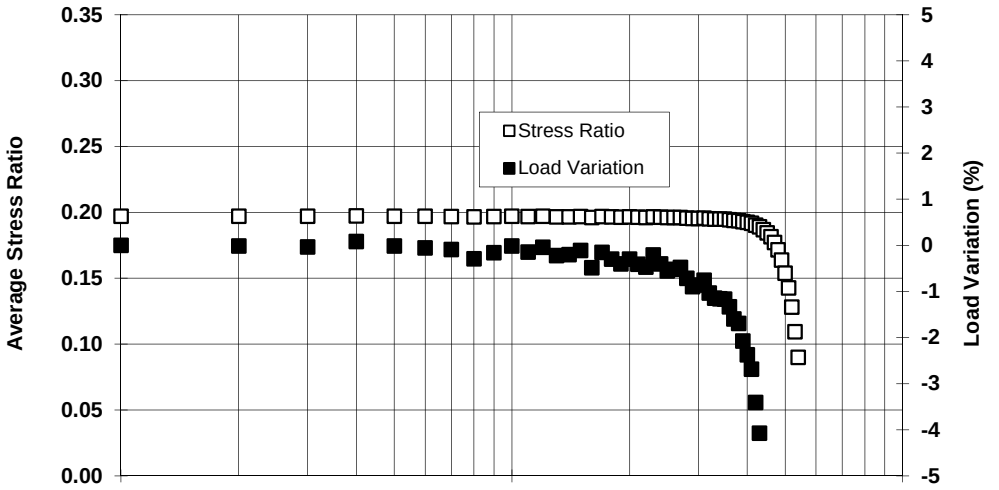
SRm
0.19

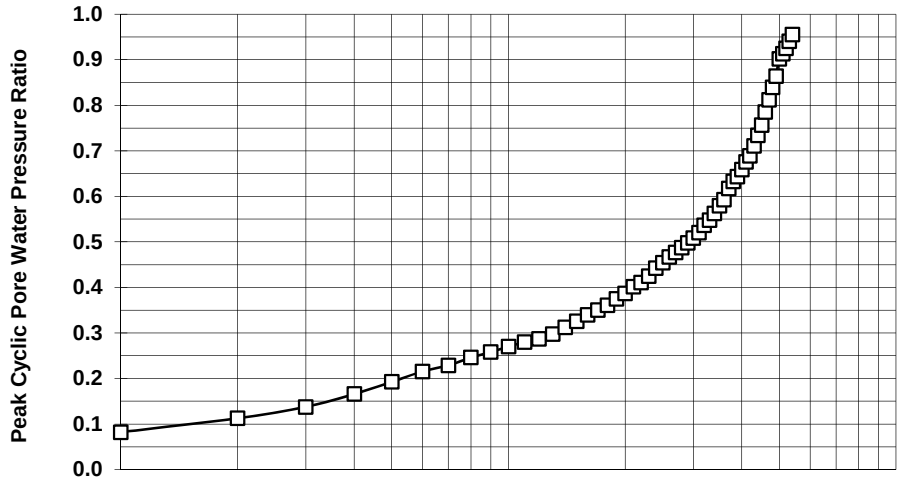
N for eda (%) of			
2.5	5.0	10	15
>54	>54	>54	>54

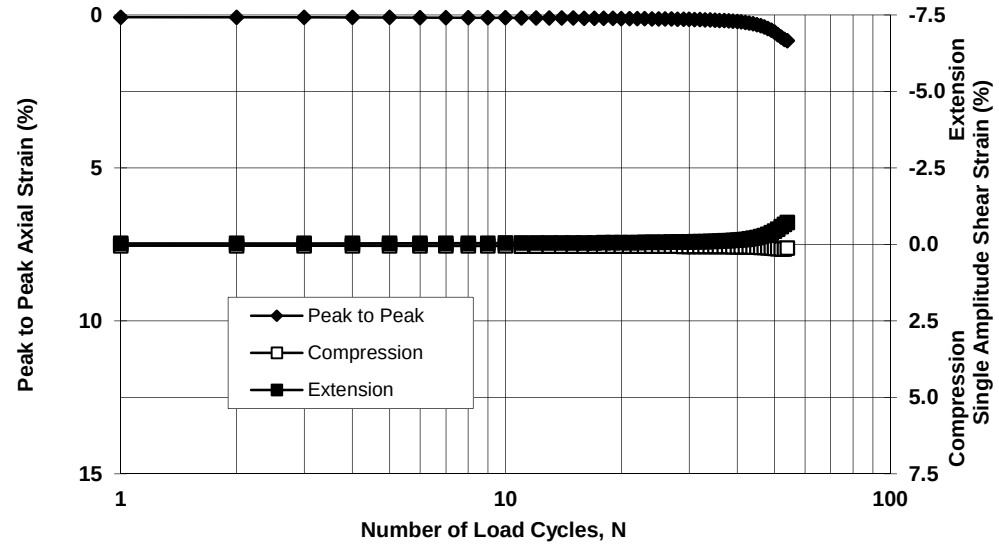
N for PP Ratio of			
0.1	0.2	0.5	0.95
2	6	28	54

Test by: DT/GT

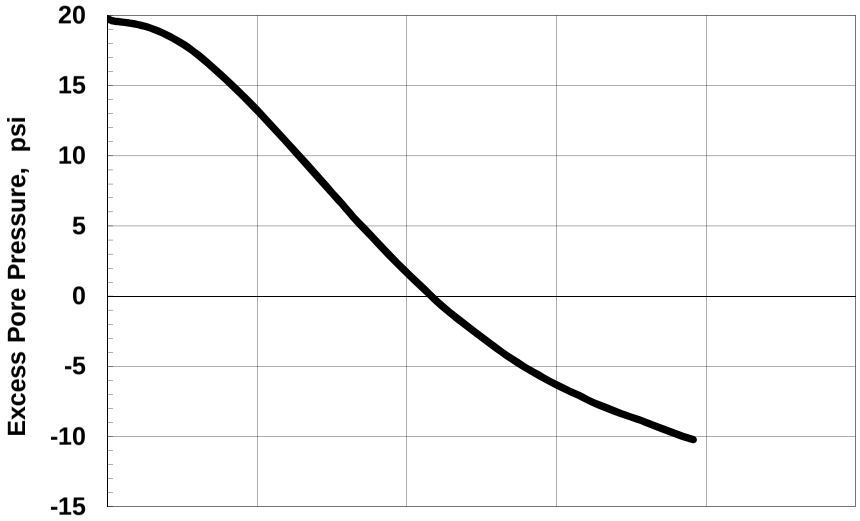
Checked by: GET







Project No. T13815141	AEP Big Sandy Landfill	**LOAD CONTROL CYCLIC TRIAXIAL STRENGTH TEST** Sample: Coarse Composite	6/23/12
TerraSense, LLC			



SAMPLE INFORMATION

Sample: Coarse Composite

Type: Water Sedimented

SPECIMEN INFORMATION (Initial)

Description: ML, Gray silt with sand

Height: 6.14 inch Diameter: 2.90 inch Area: 6.60 in²

Water Content: 36.1 %

Total Unit Weight: 106.4 pcf Dry Unit Weight: 78.2 pcf

TEST SUMMARY

Consolidation Stresses: 20.00 psi vertical, 20.00 psi lateral

Water Content: 35.0 % B Coefficient: 99.80

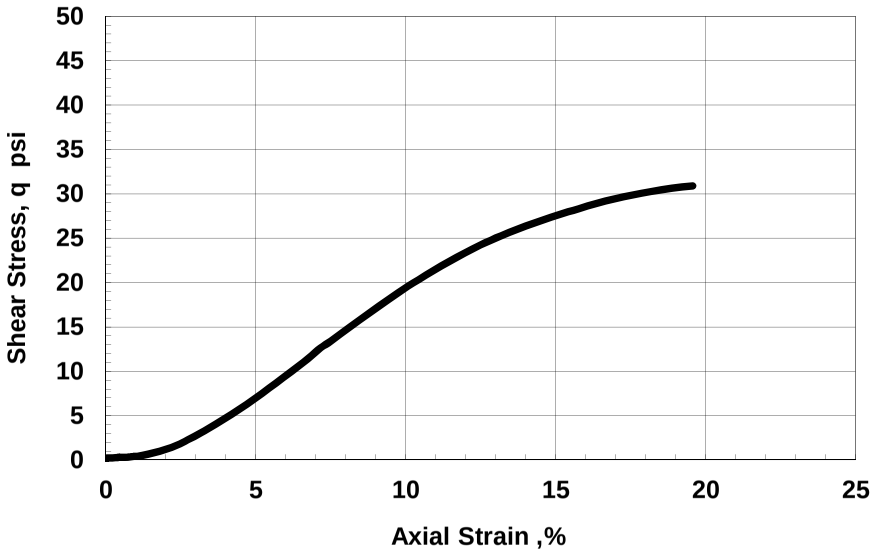
Total Unit Weight: 108.7 pcf Dry Unit Weight: 80.5 pcf

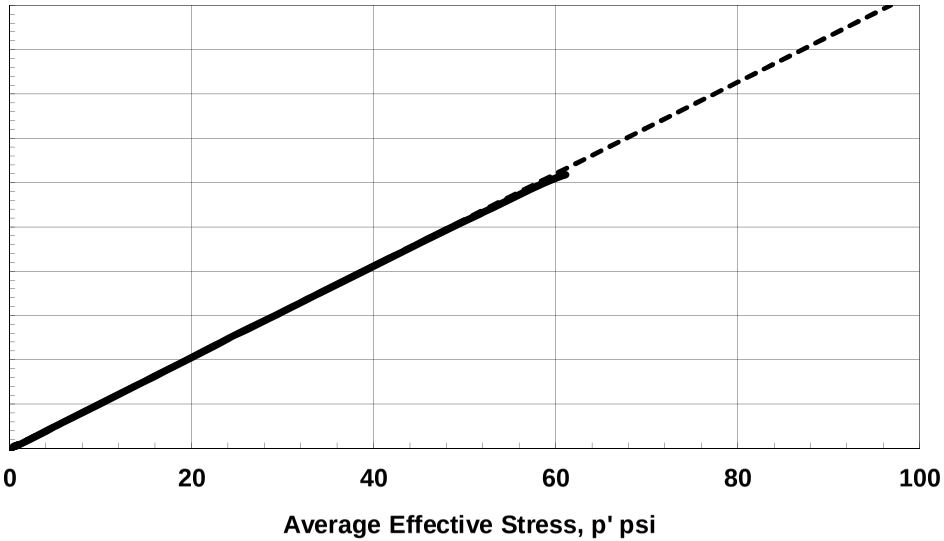
Peak Shear Strength: 30.88 psi @ 19.6 % Strain Strain Rate: 0.019 %/min

Peak Effective Friction Angle: 31.1°

REMARKS: Static Shear performed after undrained cyclic loading

Failure Sketch





Test by: DT

Checked by: GET

URS Corporation
AEP Big Sandy Landfill -

TerraSense, LLC

Project No.
T13815141

CONSOLIDATED UNDRAINED
TRIAXIAL COMPRESSION
with Pore Pressure Measurements
Sample: Coarse Composite

SAMPLE

Sample: Fine Composite
Type: Water Sedimented

SPECIMEN

Section No.:
Depth: ft
w_o: 34.5 %
γ_{to}: 103.3 pcf
γ_{do}: 76.8 pcf

Specimen Description
USCS: ML

Gray silt

TEST CONDITIONS

w_c: 31.1 %
γ_{tc}: 109.7 pcf
γ_{dc}: 83.7 pcf
σ_{vc}: 20 psi
ε_{ac}: 1.4
ε_{vc}: 8.2
Saturation 100. %

Summary

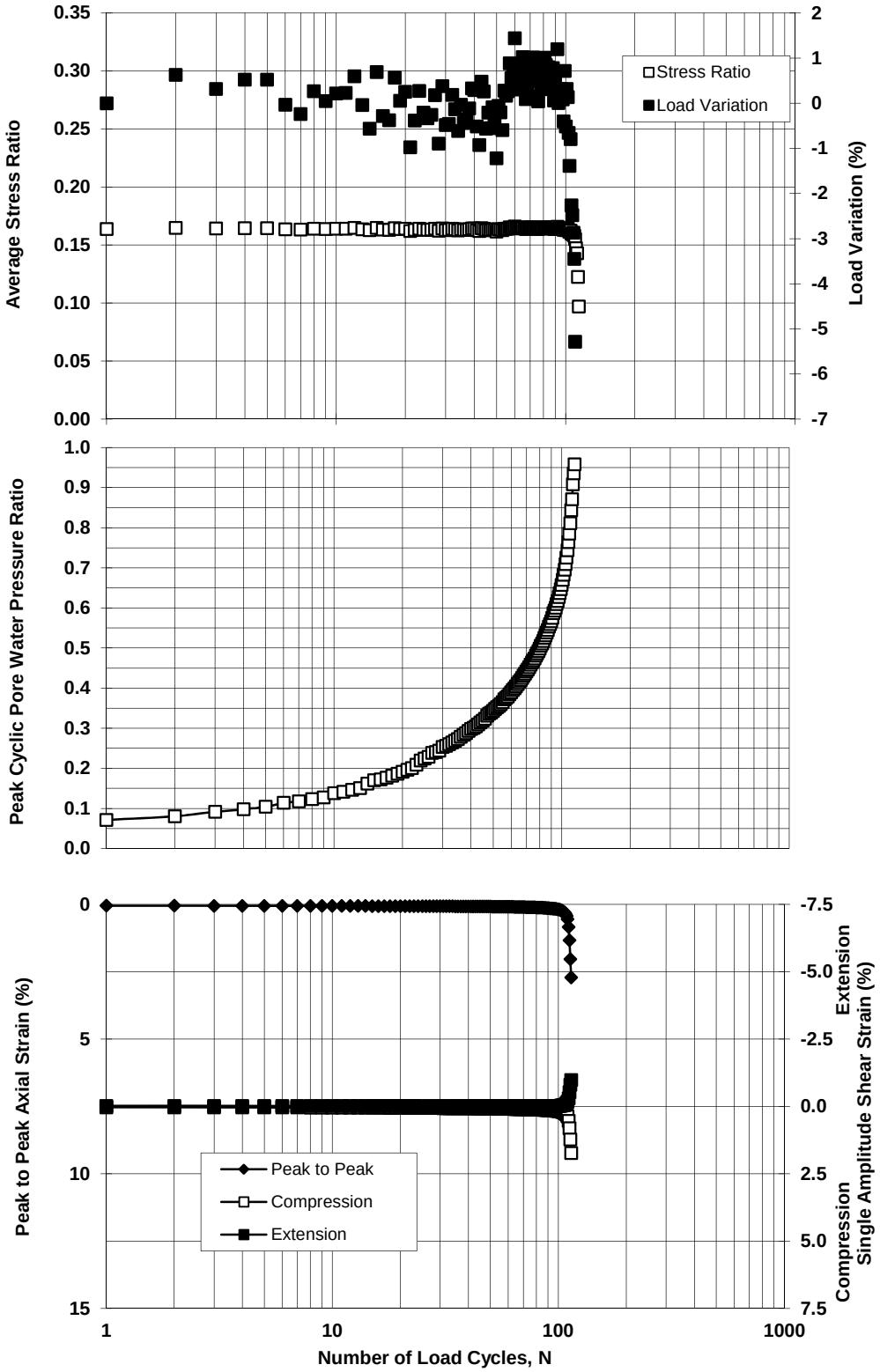
Method: ASTM D 5311
Load Form: Sinusoidal
Frequency: 0.5 Hz

SRm
0.16

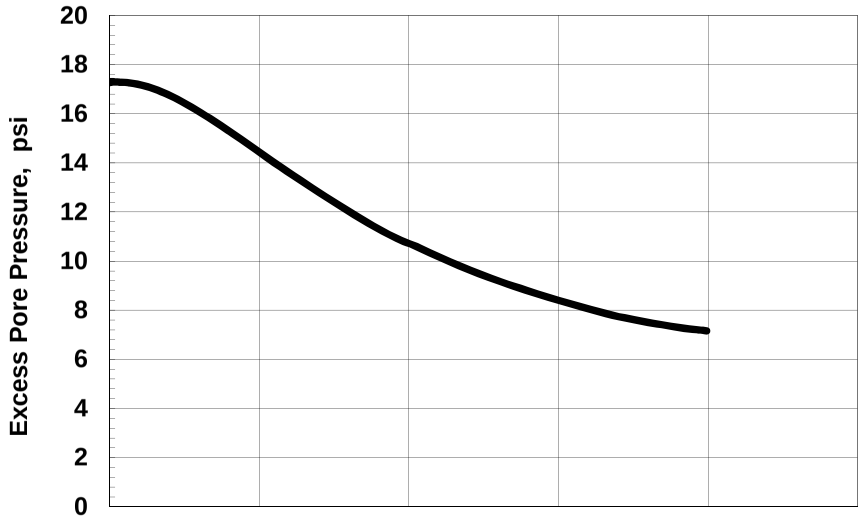
N for eda (%) of			
2.5	5.0	10	15
114	>114	>114	114

N for PP Ratio of			
0.1	0.2	0.5	0.95
4	21	80	114

Test by: DT/GT
Checked by: GET



Project No. T13815141	AEP Big Sandy Landfill	**LOAD CONTROL CYCLIC TRIAXIAL STRENGTH TEST** Sample: Fine Composite	8/13/12
TerraSense, LLC			



SAMPLE INFORMATION

Sample: Fine Composite

Type: Water Sedimented

SPECIMEN INFORMATION (Initial)

Description: ML, Gray silt

Height: 6.16 inch Diameter: 2.88 inch Area: 6.51 in²

Water Content: 34.3 %

Total Unit Weight: 106.6 pcf Dry Unit Weight: 79.3 pcf

TEST SUMMARY

Consolidation Stresses: 20.00 psi vertical, 20.00 psi lateral

Water Content: 31.1 % B Coefficient: 99.80

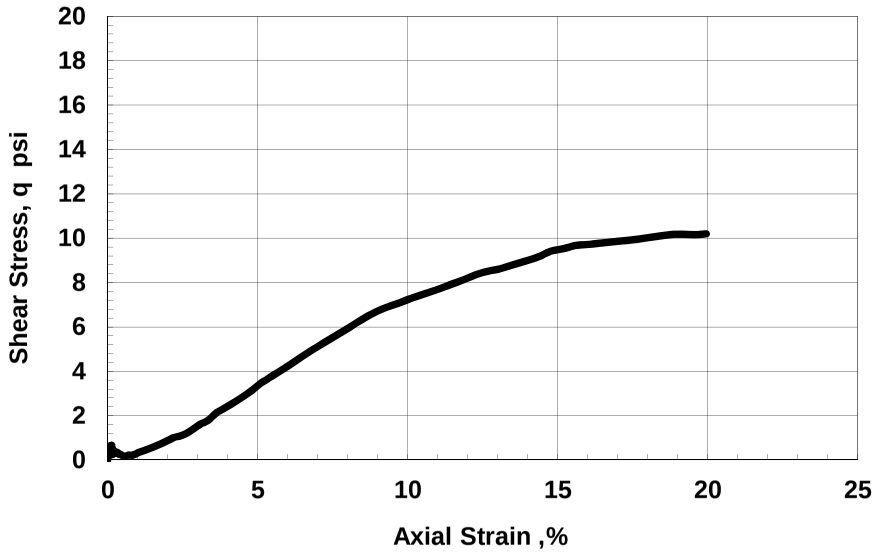
Total Unit Weight: 109.7 pcf Dry Unit Weight: 83.7 pcf

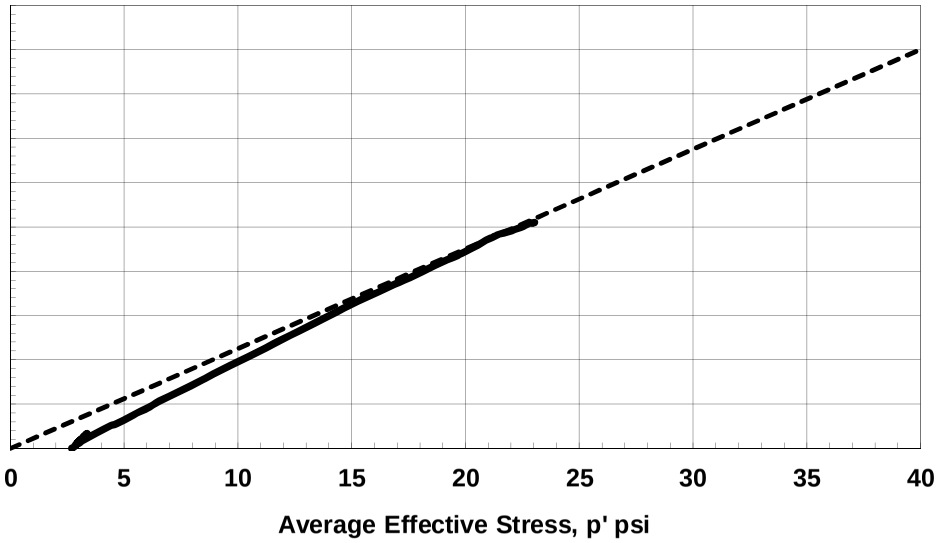
Peak Shear Strength: 10.20 psi @ 20.0 % Strain Strain Rate: 0.024 %/min

Peak Effective Friction Angle: 26.8°

REMARKS: Static Shear performed after undrained cyclic loading

Failure Sketch





Test by: DT

Checked by: GET

URS Corporation AEP Big Sandy Landfill -		CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements Sample: Fine Composite
TerraSense, LLC	Project No. T13815141	

SAMPLE

Sample: Fine Composite

Type: Water Sedimented

SPECIMEN

Section No.:

Depth: ft

w_o: 35.9 %

γ_{to}: 102.8 pcf

γ_{do}: 75.6 pcf

Specimen Description

USCS: ML

Gray silt

TEST CONDITIONS

w_c: 33.5 %

γ_{tc}: 108.3 pcf

γ_{dc}: 81.1 pcf

σ_{vc}: 20 psi

ε_{ac}: 0.9

ε_{vc}: 6.7

Saturation 100. %

Summary

Method: ASTM D 5311

Load Form: Sinusoidal

Frequency: 0.5 Hz

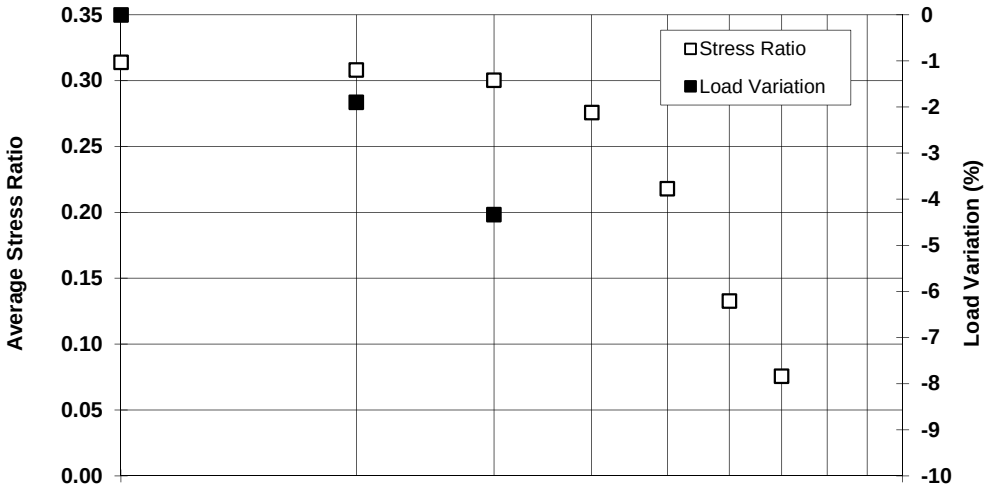
SRm
0.23 (0.3 most)

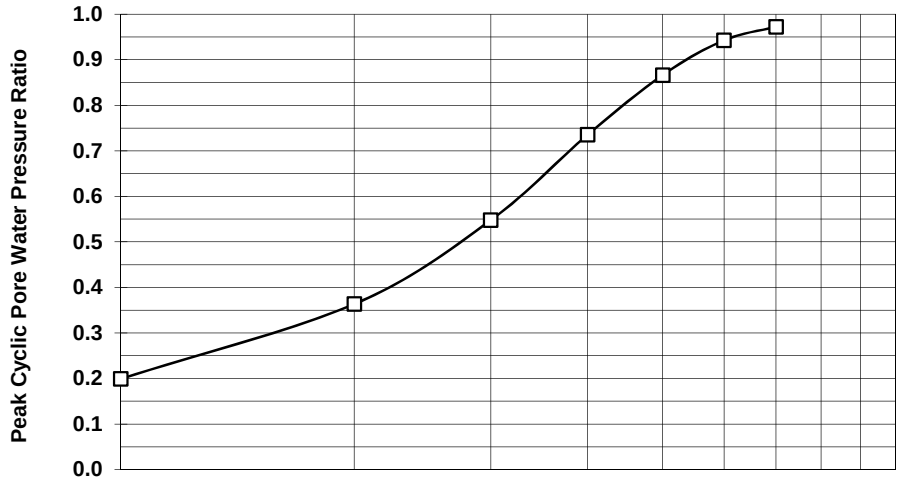
N for eda (%) of			
2.5	5.0	10	15
6	>7	>7	>7

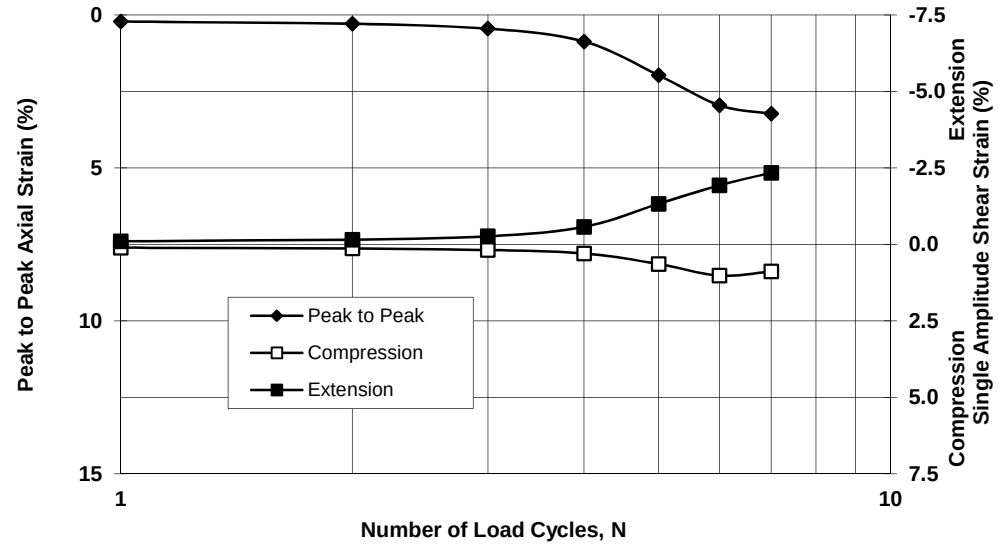
N for PP Ratio of			
0.1	0.2	0.5	0.95
1	1	3	7

Test by: DT/GT

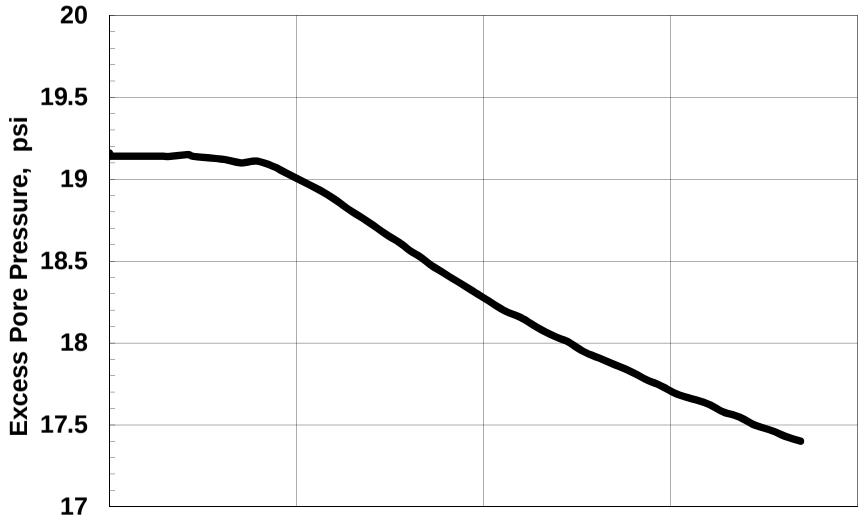
Checked by: GET







Project No. T13815141	AEP Big Sandy Landfill	**LOAD CONTROL CYCLIC TRIAXIAL STRENGTH TEST** Sample: Fine Composite	8/13/12
TerraSense, LLC			



SAMPLE INFORMATION

Sample: Fine Composite
Type: Water Sedimented

SPECIMEN INFORMATION (Initial)

Description: ML, Gray silt

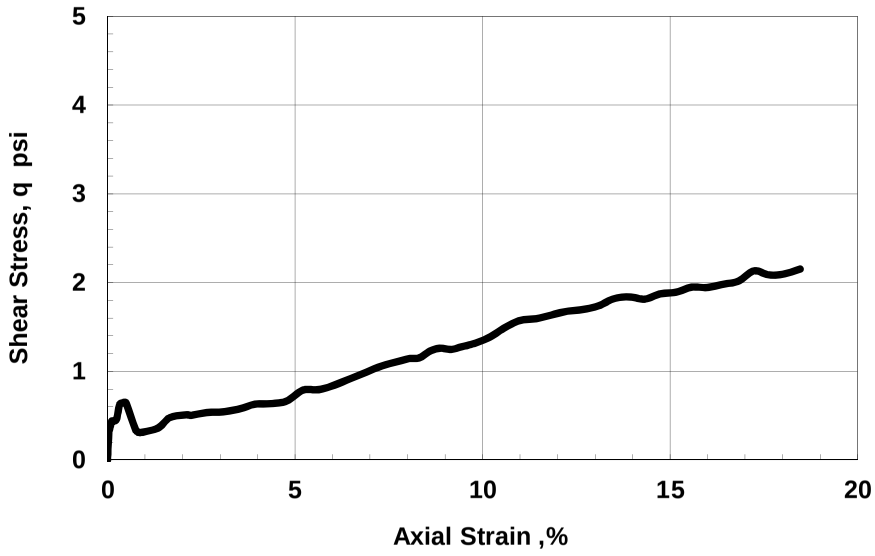
Height: 6.07 inch Diameter: 2.88 inch Area: 6.53 in²
Water Content: 35.8 %
Total Unit Weight: 105.6 pcf Dry Unit Weight: 77.8 pcf

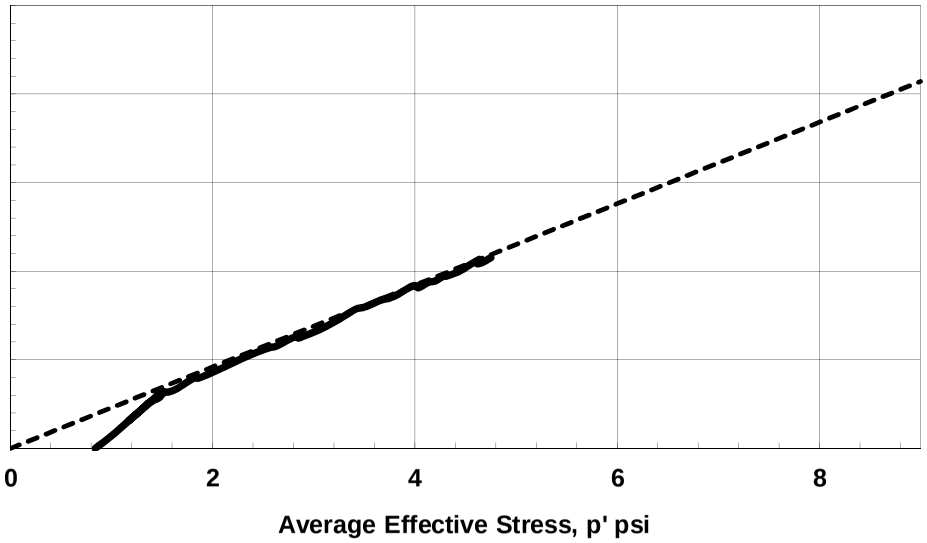
TEST SUMMARY

Consolidation Stresses: 20.00 psi vertical, 20.00 psi lateral
Water Content: 33.5 % B Coefficient: 99.60
Total Unit Weight: 108.3 pcf Dry Unit Weight: 81.1 pcf
Peak Shear Strength: 2.15 psi @ 18.5 % Strain Strain Rate: 0.023 %/min
Peak Effective Friction Angle: 27.4°

Failure Sketch

REMARKS: Static Shear performed after undrained cyclic loading





Test by: DT

Checked by: GET

URS Corporation
AEP Big Sandy Landfill -

TerraSense, LLC

Project No.
T13815141

CONSOLIDATED UNDRAINED
TRIAXIAL COMPRESSION
with Pore Pressure Measurements
Sample: Fine Composite

SAMPLE

Sample: PB-8

Type: Intact tube sample

SPECIMEN

Section No.: C

Depth: 98.45 ft

w_o: 29.4 %

γ_{to}: 105.8 pcf

γ_{do}: 81.7 pcf

Specimen Description

USCS: ML

Gray silt

TEST CONDITIONS

w_c: 28.8 %

γ_{tc}: 111.2 pcf

γ_{dc}: 86.4 pcf

σ_{vc}: 30 psi

ε_{ac}: 0.5

ε_{vc}: 5.4

Saturation 100. %

Summary

Method: ASTM D 5311

Load Form: Sinusoidal

Frequency: 0.5 Hz

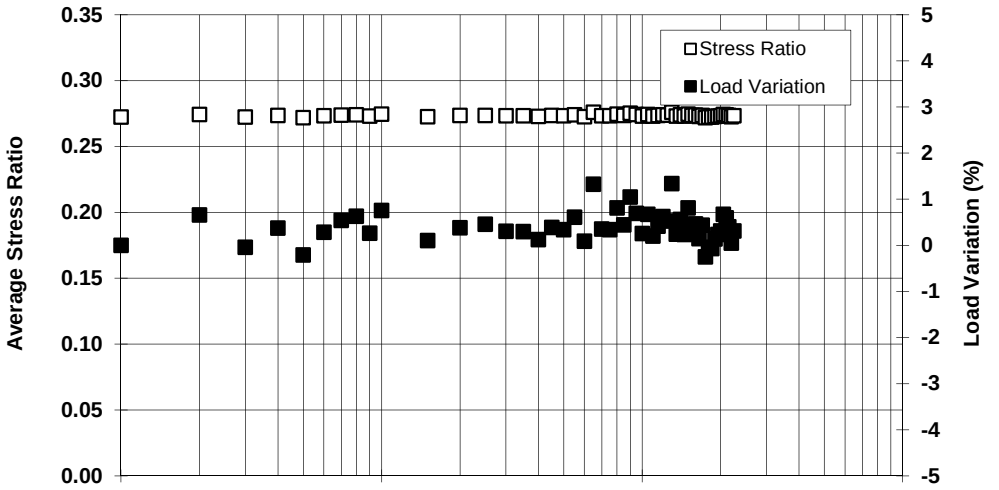
SRm
0.27

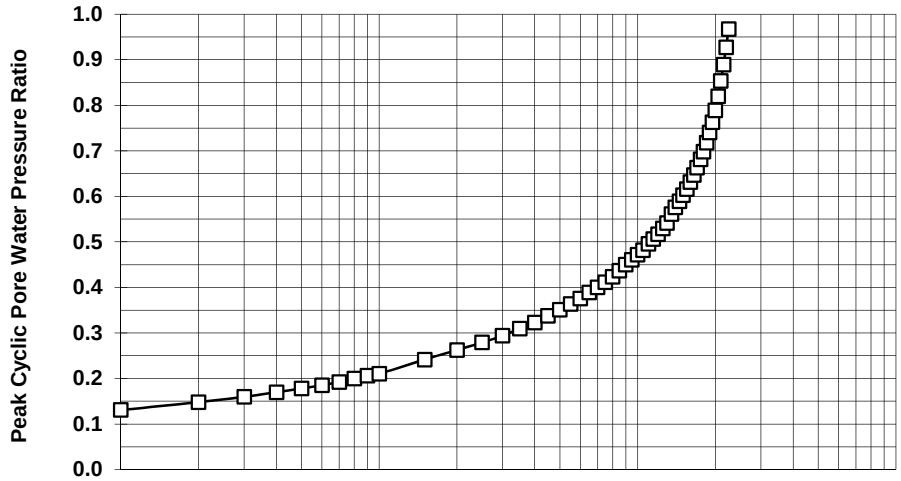
N for eda (%) of			
2.5	5.0	10	15
>225	>225	>225	>225

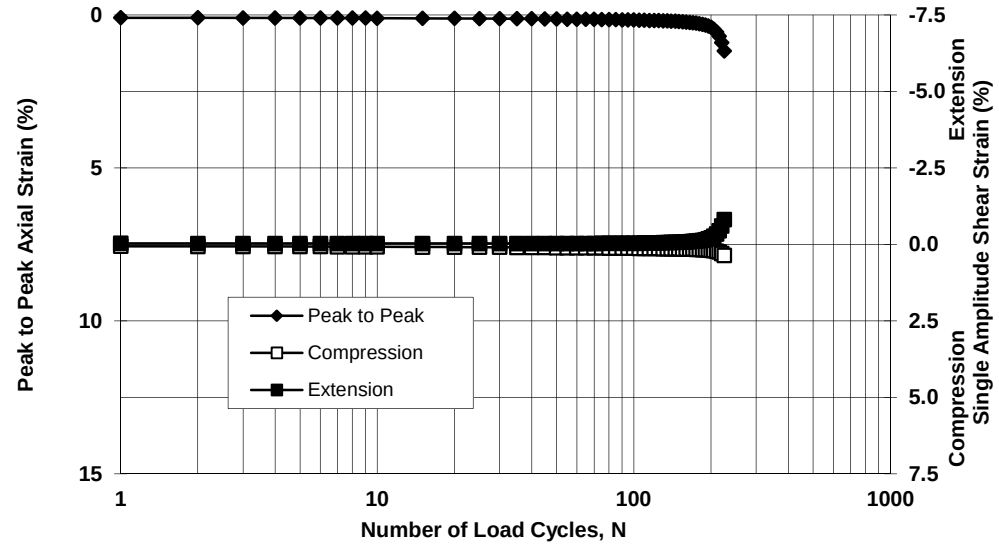
N for PP Ratio of			
0.1	0.2	0.5	0.95
1	8	110	225

Test by: DT/GT

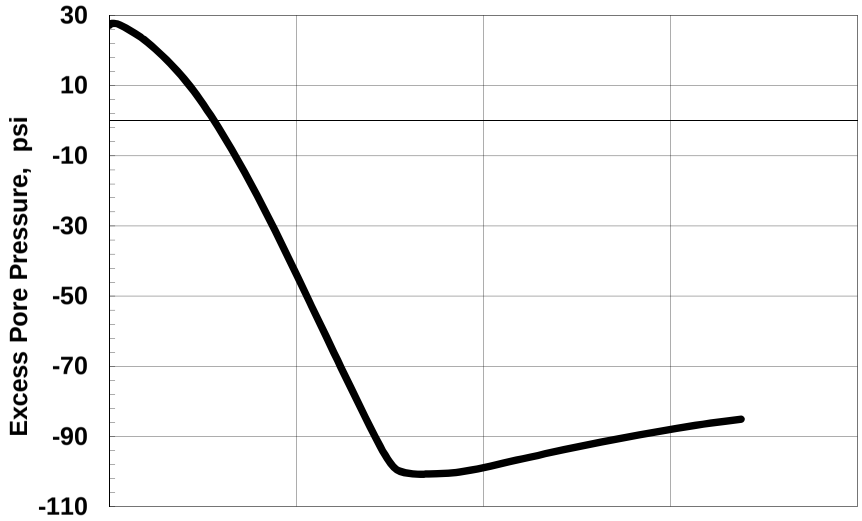
Checked by: GET







Project No. T13815141	AEP Big Sandy Landfill	**LOAD CONTROL CYCLIC TRIAXIAL STRENGTH TEST** Sample: PB-8	8/13/12
TerraSense, LLC			



SAMPLE INFORMATION

Sample: PB-8 Depth: 98.45 ft

Type: Intact tube sample

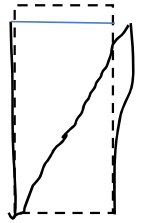
SPECIMEN INFORMATION (Initial)

Description: ML, Gray silt

Height: 5.97 inch Diameter: 2.88 inch Area: 6.51 in²

Water Content: 30.2 %

Total Unit Weight: 106.4 pcf Dry Unit Weight: 81.7 pcf


Failure Sketch

TEST SUMMARY

Consolidation Stresses: 30.00 psi vertical, 30.00 psi lateral

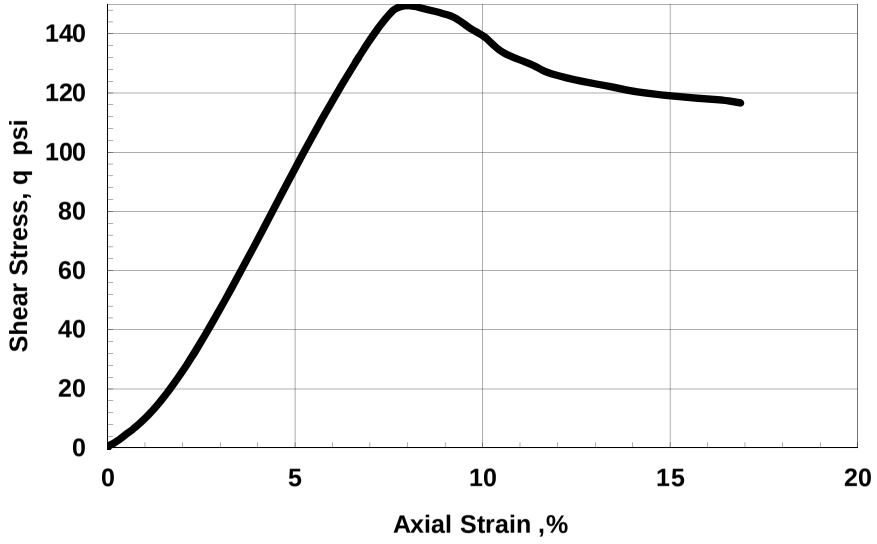
Water Content: 28.8 % B Coefficient: 99.60

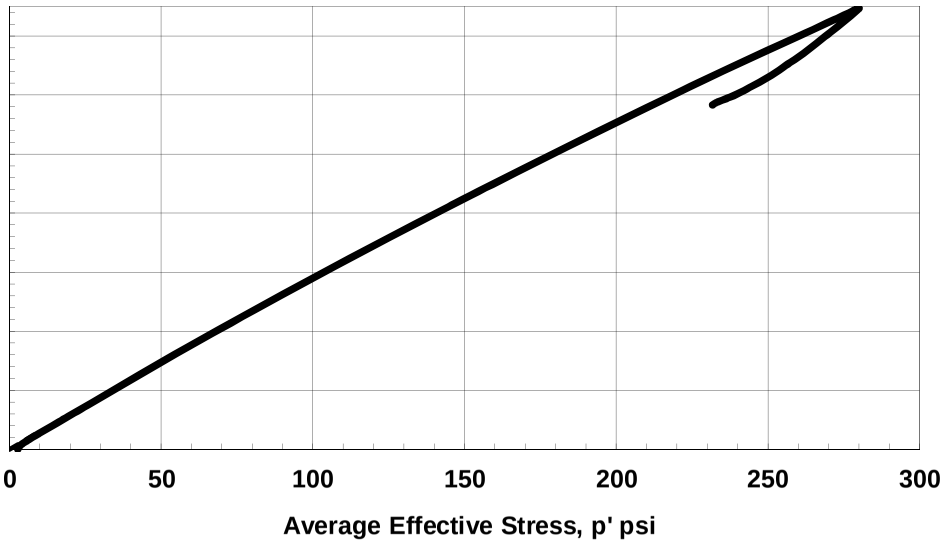
Total Unit Weight: 111.2 pcf Dry Unit Weight: 86.4 pcf

Peak Shear Strength: 149.45 psi @ 7.9 % Strain Strain Rate: 0.022 %/min

Peak Effective Friction Angle: 36.2°

REMARKS: Static Shear performed after undrained cyclic loading





Test by: DT

Checked by: GET

URS Corporation
AEP Big Sandy Landfill -

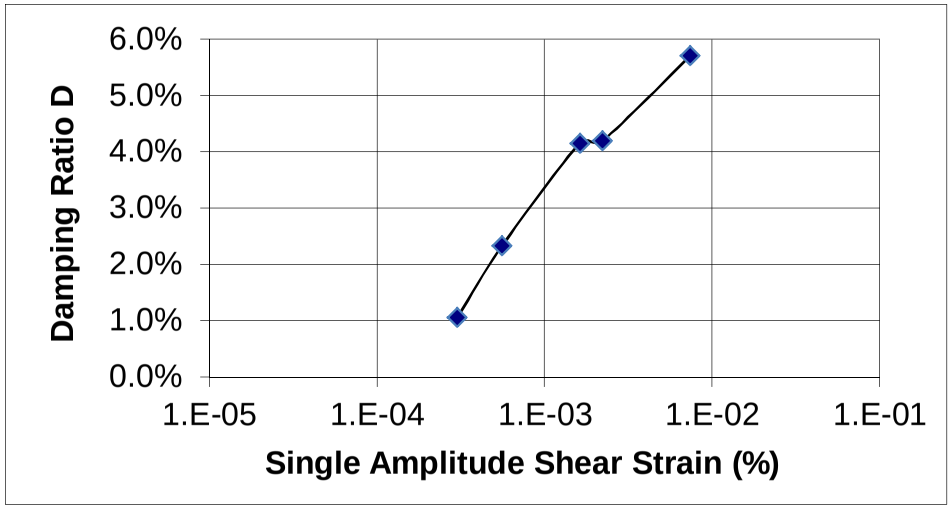
TerraSense, LLC

Project No.
T13815141

CONSOLIDATED UNDRAINED
TRIAXIAL COMPRESSION
with Pore Pressure Measurements
Sample: PB-8 Depth: 98.45 ft

A P P E N D I X B.2E

ASH – RESONANT COLUMN

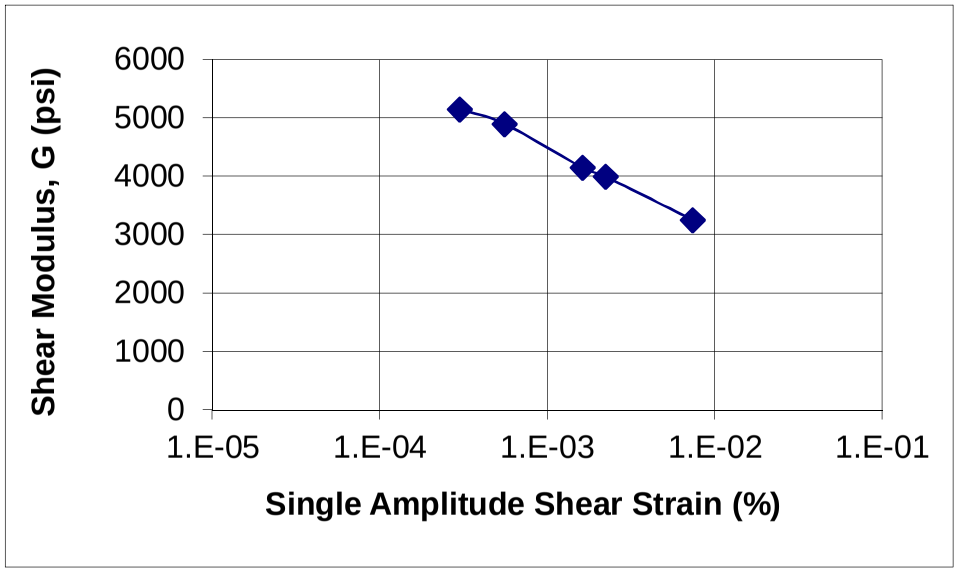


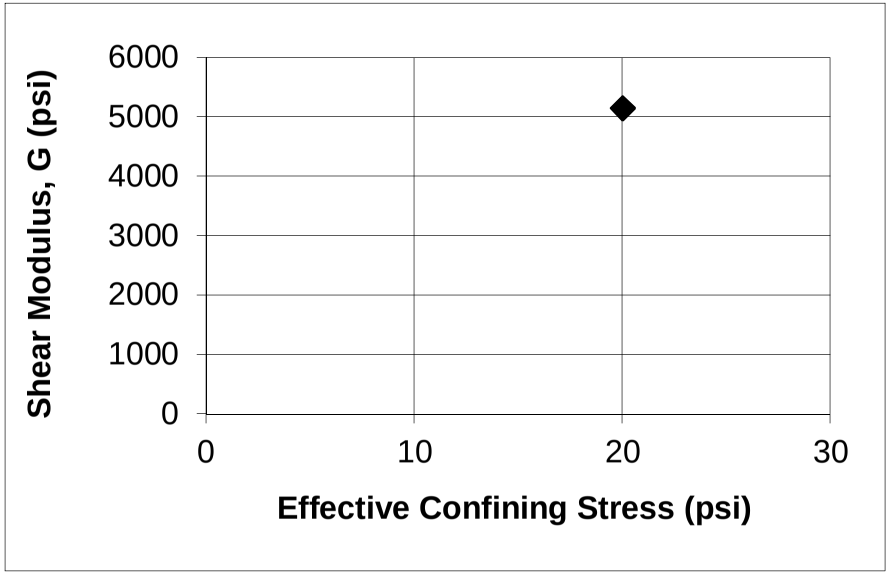
Sample

SAMPLE: Fine
Sample No.: Composite 1

Summary

Test Stage		Initial	1	2	3
Symbol			◆	□	■
σ'_c	(psi)		20.00		
w	(%)	38.4	36.0		
γ_t	(pcf)	101.1	106.1		
γ_d	(pcf)	73.0	78.0		
G_{max}	(psi)		5151		
E_{max}	(psi)		12568		





	URS Corporation	AEP Big Sandy Landfill	**RESONANT COLUMN TEST ASTM D4015**
Test by: D. Tso			SAMPLE: Fine Composite 1
Checked by: GET	**TerraSense, LLC**	Project No. T13815141	August 24, 2012 Test: RC0139

RESONANT COLUMN TEST RESULTS

Test Stage: 1

Project No.: T13815141
Project Name: AEP Big Sandy Landfill
Test: RC0139
Boring: Fine
Sample: Composite 1
Depth (ft) 0
Operator: D. Tso
Stage Date: 8/9/2012

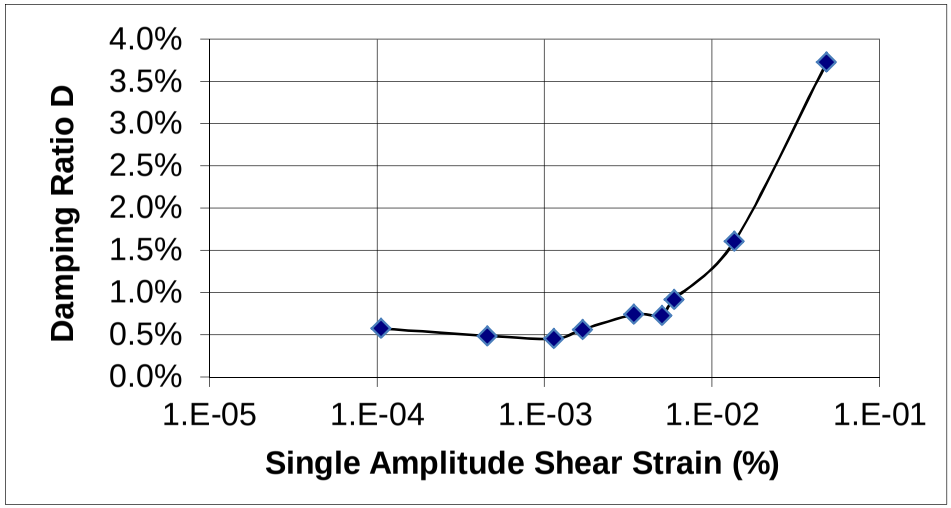
Back Pressure 70.00 psi
B value start shear
Saturation 98.6
Kc start stage 1.000
Laboratory induced vertical OCR at start: 1.0

Specimen Description: ML, Gray silt
USCS: Water Sedimented
Gravity of Solids: 2.3

ε_{ac} = 5.3%
ε_{vc} = 0.4%

Stage	Sigma' V (psi)	Sigma' H (psi)	Height (inch)	Diameter (inch)	Area (in²)	Water Content (%)	Dry Density (pcf)	Total Density (pcf)	Void Ratio (-)	Saturation	Axial Strain	Mc (gm*sec^2/cm)	Ic
Initial (Tube or mold)			4.049	1.962	3.022	38.43	73.04	101.11	0.966	91.5		0.33129	1.02809
a			3.948	1.962	3.022	36.31	74.89	102.09	0.917	91.1		0.32622	1.01237
b			3.948	1.962	3.022	36.31	74.89	102.09	0.917	91.1		0.32622	1.01237
c			3.948	1.962	3.022	36.31	74.89	102.09	0.917	91.1		0.32622	1.01237
d	7.00	7.00	3.948	1.962	3.022	36.31	74.89	102.09	0.917	91.1		0.32622	1.01237
Specimen Measured	7.00	7.00	3.948	1.925	2.911	36.31	77.75	105.98	0.847	98.6	0.00%	0.32622	0.97522
Consolidation 1	10.00	10.00	3.948	1.925	2.911	36.31	77.75	105.98	0.847	98.6	0.00%	0.32622	0.97522
Consolidation 2	14.00	14.00	3.948	1.925	2.911	36.31	77.75	105.98	0.847	98.6	0.00%	0.32622	0.97522
Consolidation 3	14.00	14.00	3.834	1.950	2.987	36.02	78.03	106.14	0.840	98.6	2.88%	0.32553	0.99843
Consolidation 4	20.00	20.00	3.834	1.950	2.987	36.02	78.03	106.14	0.840	98.6	2.88%	0.32553	0.99843
Consolidation 5	20.00	20.00	3.834	1.950	2.987	36.02	78.03	106.14	0.840	98.6	2.88%	0.32553	0.99843
Consolidation 6	20.00	20.00	3.834	1.950	2.987	36.02	78.03	106.14	0.840	98.6	2.88%	0.32553	0.99843
RC1 7	20.00	20.00	3.834	1.950	2.987	36.01	78.04	106.14	0.840	98.6	2.88%	0.32551	0.99826
Consolidation 8	20.00	20.00	3.834	1.950	2.987	36.01	78.04	106.14	0.840	98.6	2.88%	0.32551	0.99826
Consolidation 9	20.00	20.00	3.834	1.950	2.987	36.01	78.04	106.14	0.840	98.6	2.88%	0.32551	0.99826
Test Stage End of# **6**													
This Stage Initial Values	20.00	20.00	3.834	1.950	2.987	36.02	78.03	106.14	0.840	98.6	2.88%	0.3255	0.9984

Stage		1	2	3	4	5
	γ	3.00E-04	5.56E-04	1.62E-03	2.22E-03	7.39E-03
Vs (m/s)		144.50	140.91	129.70	127.28	114.87
G (kg/m^2)		3621520	3443547	2917623	2809681	2288454
G (psi)		5151	4898	4150	3996	3255
Damping	$\lambda 1$	0.20%	3.11%	3.83%	4.58%	6.44%
	$\lambda 2$	1.81%	1.82%	3.86%	3.89%	6.59%
	$\lambda 3$	1.23%	2.20%	3.59%	5.58%	4.27%
	$\lambda 4$	0.99%	2.21%	5.32%	2.74%	5.54%
	$\lambda 5$					
	λav	1.06%	2.33%	4.15%	4.20%	5.71%

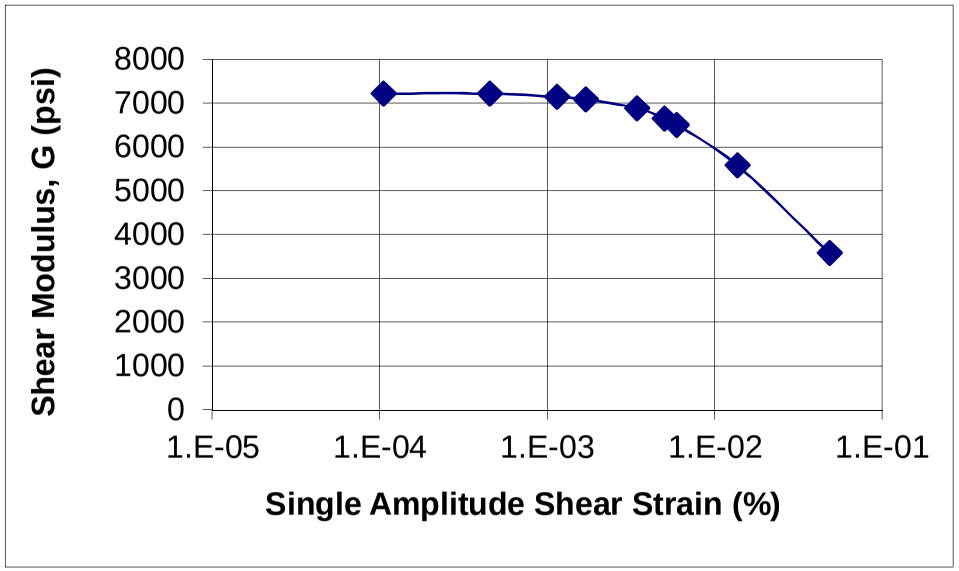


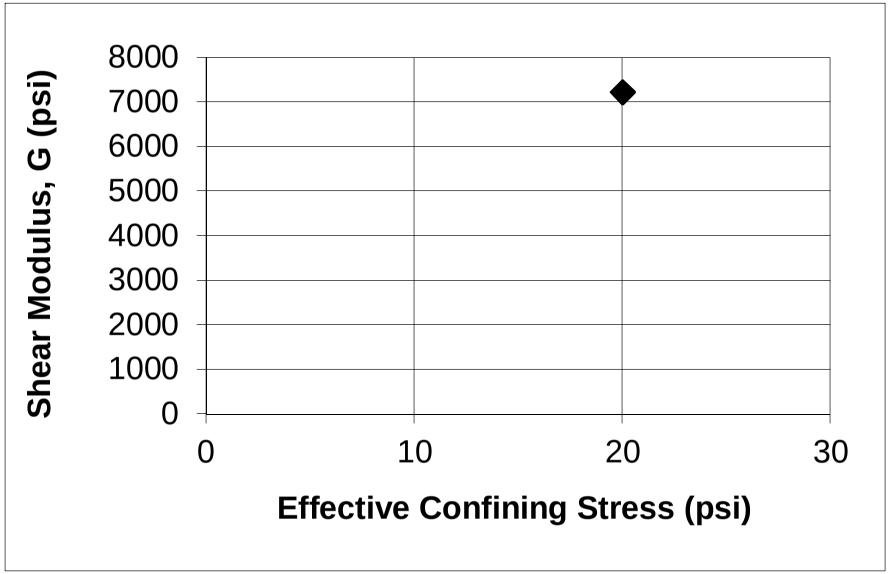
Sample

SAMPLE: Coarse
Sample No.: Composite 1

Summary

Test Stage		Initial	1	2	3
Symbol			◆	□	■
σ'_c	(psi)		20.00		
w	(%)	47.2	40.8		
γ_t	(pcf)	100.6	104.5		
γ_d	(pcf)	68.4	74.2		
G_{max}	(psi)		7226		
E_{max}	(psi)		17632		





	URS Corporation	AEP Big Sandy Landfill	**RESONANT COLUMN TEST ASTM D4015**
Test by: D. Tso			SAMPLE: Coarse Composite 1
Checked by: GET	**TerraSense, LLC**	Project No. T13815141	August 24, 2012 Test: RC0138

RESONANT COLUMN TEST RESULTS

Test Stage: 1

Project No.: T13815141
Project Name: AEP Big Sandy Landfill
Test: RC0138
Boring: Coarse
Sample: Composite 1
Depth (ft) 0
Operator: D. Tso
Stage Date: 8/8/2012

Back Pressure 70.00 psi
B value start shear
Saturation 98.0
Kc start stage 1.000
Laboratory induced vertical OCR at start: 1.0

Specimen Description: ML
USCS: ater Sedimented
Gravity of Solids: 2.35

ε_{ac} = 6.6%
ε_{vc} = 0.9%

Stage	Sigma' V (psi)	Sigma' H (psi)	Height (inch)	Diameter (inch)	Area (in²)	Water Content (%)	Dry Density (pcf)	Total Density (pcf)	Void Ratio (-)	Saturation	Axial Strain	Mc (gm*sec^2/cm)	Ic
Initial (Tube or mold)			4.041	1.959	3.014	47.18	68.38	100.64	1.145	96.8		0.32827	1.01595
a			3.790	1.959	3.014	41.49	72.92	103.17	1.012	96.4		0.31559	0.97671
b			3.790	1.959	3.014	41.49	72.92	103.17	1.012	96.4		0.31559	0.97671
c			3.790	1.959	3.014	41.49	72.92	103.17	1.012	96.4		0.31559	0.97671
d	5.00	5.00	3.790	1.959	3.014	41.49	72.92	103.17	1.012	96.4		0.31559	0.97671
Specimen Measured	5.00	5.00	3.790	1.950	2.987	41.49	73.57	104.09	0.994	98.1	0.00%	0.31559	0.96809
Consolidation 1	3.00	3.00	3.789	1.950	2.987	41.46	73.60	104.11	0.993	98.1	0.01%	0.31552	0.96762
Consolidation 2	5.00	5.00	3.788	1.949	2.984	41.36	73.68	104.16	0.991	98.1	0.05%	0.31530	0.96621
Consolidation 3	10.00	10.00	3.784	1.948	2.981	41.20	73.82	104.24	0.987	98.1	0.14%	0.31494	0.96416
Consolidation 4	10.00	10.00	3.782	1.949	2.983	41.18	73.84	104.25	0.987	98.1	0.22%	0.31489	0.96446
Consolidation 5	10.00	10.00	3.781	1.949	2.983	41.18	73.84	104.25	0.987	98.1	0.22%	0.31489	0.96455
Consolidation 6	20.00	20.00	3.774	1.946	2.974	40.76	74.21	104.45	0.977	98.0	0.42%	0.31396	0.95887
RC1 7	20.00	20.00	3.762	1.944	2.967	40.29	74.63	104.69	0.966	98.0	0.74%	0.31290	0.95325
Consolidation 8	20.00	20.00	3.762	1.944	2.967	40.29	74.63	104.69	0.966	98.0	0.74%	0.31290	0.95325
Consolidation 9	20.00	20.00	3.762	1.944	2.967	40.29	74.63	104.69	0.966	98.0	0.74%	0.31290	0.95325
Test Stage End of# **6**													
This Stage Initial Values	20.00	20.00	3.774	1.946	2.974	40.76	74.21	104.45	0.977	98.0	0.42%	0.3140	0.9589

Stage		1	2	3	4	5	6	7	8	9
	γ	1.05E-04	4.53E-04	1.13E-03	1.69E-03	3.41E-03	4.99E-03	5.92E-03	1.36E-02	4.82E-02
Vs (m/s)		172.53	172.49	171.60	170.96	168.51	165.58	163.73	151.70	121.54
G (kg/m^2)		5080691	5078626	5026388	4988993	4846875	4679548	4575853	3927841	2521294
G (psi)		7226	7223	7149	7096	6894	6656	6508	5587	3586
Damping	$\lambda 1$	0.79%	0.51%	0.39%	0.82%	0.62%	0.53%	0.91%	1.46%	3.72%
	$\lambda 2$	0.72%	0.68%	0.52%	0.77%	0.38%	0.81%	0.74%	1.48%	3.65%
	$\lambda 3$	0.27%	0.27%	0.52%	0.64%	0.70%	0.70%	0.85%	1.73%	3.66%
	$\lambda 4$	0.54%	0.50%	0.38%	0.03%	1.26%	0.89%	1.18%	1.77%	3.88%
	$\lambda 5$									
	λav	0.58%	0.49%	0.45%	0.57%	0.74%	0.73%	0.92%	1.61%	3.73%

A P P E N D I X B.2F

ASH – SAMPLE PHOTOS

URS

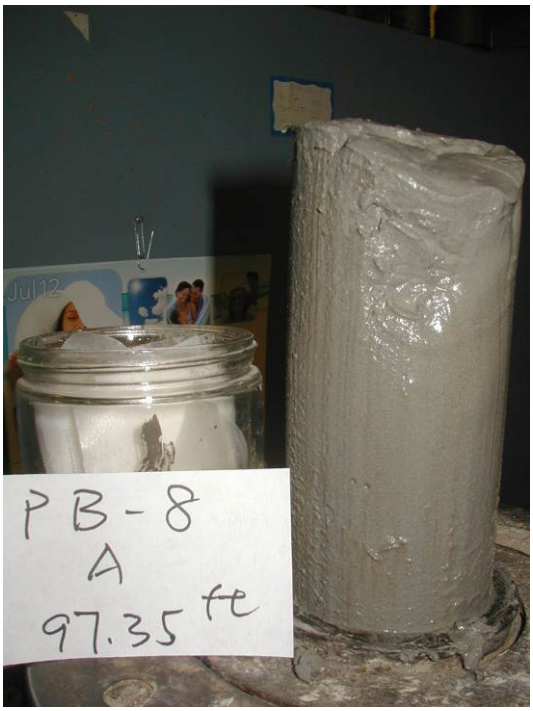
PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Sample No. PB-8	Date:

Description:

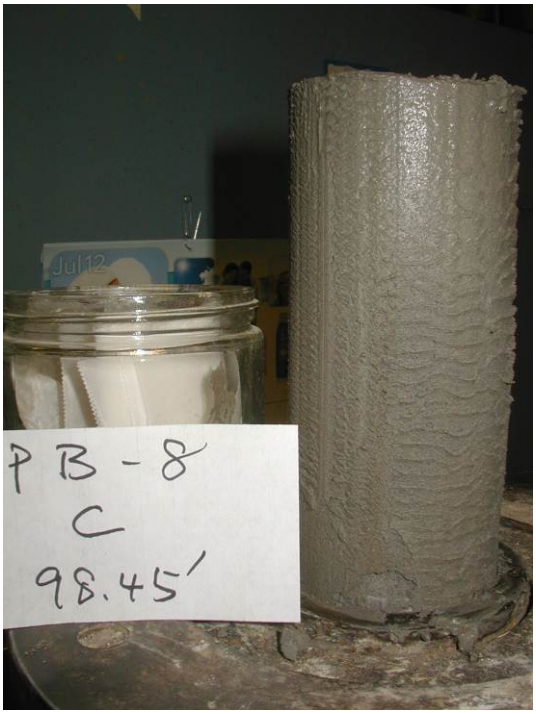
Fly Ash Piston Tube Samples (PB - 8, P-5)



Sample No. PB-8	Date:

Description:

Fly Ash Piston Tube Samples (PB - 8, P-5)



URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Sample No. PB-6	Date:

Description:

Fly Ash Piston Tube Samples (PB - 8, P-6)

Sample No. PB-7	Date:

Description:

Fly Ash Piston Tube Samples (PB - 7, 52-54). Note layered structure of ash deposit.

A P P E N D I X B.3

ALLUVIUM

A P P E N D I X B.3A

ALLUVIUM – MOISTURE CONTENT

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MOISTURE CONTENT

ASTM D 2216-05 (SOP-S1)

Client	URS
Client Reference	AEP BIG SANDY LF 13815141
Project No.	2012-245-01

Lab ID	01	02	03	04	05
Boring No.	HB-1	HB-2/ SB-1	HB-7/ SB-2	HB-7/ SB-2	HB-7/ SB-2
Depth (ft)	2-4	8-10	0-2	4-6	8-10
Sample No.	NA	NA	NA	NA	NA
Tare Number	49	10	37	38	25
Wt. of Tare & WS (gm)	50.45	60.98	58.58	168.17	199.17
Wt. of Tare & DS (gm)	44.12	53.1	51.53	145.35	181.11
Wt. of Tare (gm)	8.35	8.58	8.43	8.35	8.2
Wt. of Water (gm)	6.33	7.88	7.05	22.82	18.06
Wt. of DS (gm)	35.77	44.52	43.1	137	172.91
Water Content (%)	**17.7**	**17.7**	**16.4**	**16.7**	**10.4**

Lab ID	06	07	08	09	10
Boring No.	HB-7/ SB-2	HB-7/ SB-2	HB-7/ SB-2	PB-2	PB-2
Depth (ft)	12-14	16-18	20-22	57-59	70-72
Sample No.	NA	NA	NA	NA	NA
Tare Number	31	57	50	16	46
Wt. of Tare & WS (gm)	189.88	189.58	201.23	64.3	40.61
Wt. of Tare & DS (gm)	162.67	169.87	177.69	54.76	35.97
Wt. of Tare (gm)	8.28	8.3	8.64	8.36	8.42
Wt. of Water (gm)	27.21	19.71	23.54	9.54	4.64
Wt. of DS (gm)	154.39	161.57	169.05	46.4	27.55
Water Content (%)	**17.6**	**12.2**	**13.9**	**20.6**	**16.8**

Notes : *NA*

Alluv. Resid. Alluv. Resid. Fill Fill Alluv.

Tested By PC *Date* 5/22/12 *Checked By* JN *Date* 5/23/12

DCN: CT-S1 DATE 1-21-10 REVISION: 3

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MOISTURE CONTENT

ASTM D 2216-05 (SOP-S1)

Client	URS
Client Reference	AEP BIG SANDY LF 13815141
Project No.	2012-245-01

Lab ID	11	12	14	15	16
Boring No.	PB-4	PB-5	PB-6	PB-6	PB-7
Depth (ft)	107-109	39-41	82-84	98-99.3	122-124
Sample No.	NA	NA	NA	NA	NA
Tare Number	65	43	5	18	40
Wt. of Tare & WS (gm)	57.82	52.19	57.62	40.36	54.51
Wt. of Tare & DS (gm)	52.54	44.8	51.44	34.61	48.82
Wt. of Tare (gm)	8.72	8.3	8.47	8.28	8.38
Wt. of Water (gm)	5.28	7.39	6.18	5.75	5.69
Wt. of DS (gm)	43.82	36.5	42.97	26.33	40.44
Water Content (%)	**12.0**	**20.2**	**14.4**	**21.8**	**14.1**

Alluv. Resid.

Lab ID	17	18	19	20	21
Boring No.	PB-7	PB-7	PB-8	SB-4	SB-4
Depth (ft)	107-109	117-119	147-149	2.5-4.5	0-2
Sample No.	NA	NA	NA	S2	S1
Tare Number	45	21	30	7	11
Wt. of Tare & WS (gm)	50.14	50.62	50.4	57.91	163.48
Wt. of Tare & DS (gm)	42.16	45.07	45.16	49.54	133.68
Wt. of Tare (gm)	8.52	8.28	8.41	8.16	8.51
Wt. of Water (gm)	7.98	5.55	5.24	8.37	29.8
Wt. of DS (gm)	33.64	36.79	36.75	41.38	125.17
Water Content (%)	**23.7**	**15.1**	**14.3**	**20.2**	**23.8**

Alluv. Alluv. Alluv. Resid. Alluv. Resid.

Notes : *NA*

Tested By PC *Date* 5/22/12 *Checked By* JW *Date* 5/23/12

DCN: CT-S1 DATE 1-21-10 REVISION: 3

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A P P E N D I X B.3B

ALLUVIUM – GRAIN SIZE DISTRIBUTION

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PERCENT PASSING # 200 SIEVE

ASTM D 1140-00 (SOP-S54)

Client	URS CORPORATION
Client Reference	AEP Big Sandy LF 13815141
Project No.	2012-245-01

Lab Id.	01	02	15	20	23	
Boring No.	HB-1	HB-2 / SB-1	PB-6	SB-4	SB-6	
Depth (ft)	2-4	8-10	98-99.3	2.5-4.5	2.5-4.5	
Sample No.	NA	NA	NA	S2	S2	
Tare Number	1416	1423	1438	1450	1433	
Wt. of Tare & WS (gm)	342.49	335.22	284.48	279.13	283.66	
Wt. of Tare & DS (gm)	342.49	335.22	284.48	279.13	283.66	
Wt. of Tare (gm)	145.7	143.89	144.62	144.97	144.74	
Wt. of Water (gm)	0	0	0	0	0	
Wt. of DS (gm)	196.79	191.33	139.86	134.16	138.92	
Water Content (%)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	
Wt. of Washed Soil & Tare	208.81	161.13	199.65	149.7	159.12	
Percent Passing #200	**67.9**	**91.0**	**60.7**	**96.5**	**89.6**	
		Resid.				Resid.

Lab Id.	25	26	27	
Boring No.	SB-7	HB-5	HB-5	
Depth (ft)	5-7	4-6	6-8	
Sample No.	S3	NA	NA	
Tare Number	1447	1418	1449	
Wt. of Tare & WS (gm)	277.55	633.87	824.39	
Wt. of Tare & DS (gm)	277.55	633.87	824.39	
Wt. of Tare (gm)	145.46	145.25	145.64	
Wt. of Water (gm)	0	0	0	
Wt. of DS (gm)	132.09	488.62	678.75	
Water Content (%)	**0.0**	**0.0**	**0.0**	
Wt. of Washed Soil & Tare	182.88	401.5	488.6	
Percent Passing #200	**71.7**	**47.6**	**49.5**	
	Resid.	Resid.	Resid.	Resid.
			Alluv.	
			Resid.	
			Resid.	

Tested By JP *Date* 6/5/12 *Checked By* KC *Date* 6-7-12

DCN: CT-S54 DATE: 12/30/05 REVISION: 3

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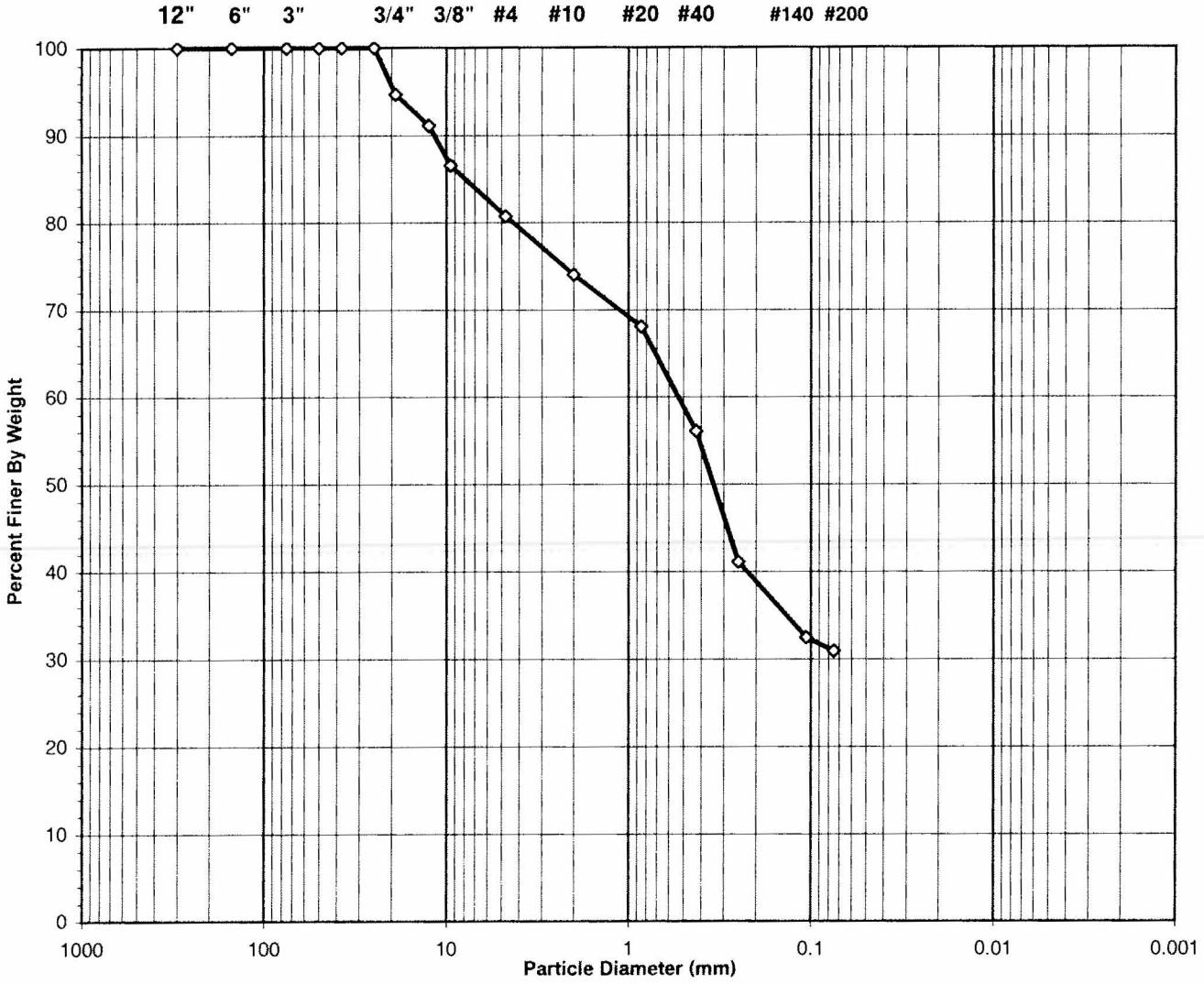
SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	HB-7/SB-2
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	8-10
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-05	Soil Color	**BROWN**

	SIEVE ANALYSIS		HYDROMETER
USCS	gravel	sand	silt and clay



USCS Symbol ***sc, ASSUMED***

USCS Classification ***CLAYEY SAND WITH GRAVEL***

Tested By PC Date 5/30/12 Checked By KC Date 5-31-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	HB-7/SB-2
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	8-10
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-05	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1445	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	851.50	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	785.10	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	146.21	Weight of Tare (gm)	NA
Weight of Water (gm)	66.40	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	638.89	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**10.4**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	638.89
Dry Weight - 3/4" Sample (gm)	407.6	Weight of minus #200 material (gm)	197.48
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	441.41
Dry Weight + 3/4" Sample (gm)	33.84		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	33.84	5.30	5.30	94.70	**94.70**
1/2"	12.50	22.83	3.57	8.87	91.13	**91.13**
3/8"	9.50	29.30	4.59	13.46	86.54	**86.54**
#4	4.75	37.16	5.82	19.27	80.73	**80.73**
#10	2.00	42.86	6.71	25.98	74.02	**74.02**
#20	0.850	37.92	5.94	31.92	68.08	**68.08**
#40	0.425	76.69	12.00	43.92	56.08	**56.08**
#60	0.250	95.70	14.98	58.90	41.10	**41.10**
#140	0.106	55.17	8.64	67.53	32.47	**32.47**
#200	0.075	9.94	1.56	69.09	30.91	**30.91**
Pan	-	197.48	30.91	100.00	-	-

Tested By PC Date 5/30/12 Checked By KC Date 5-31-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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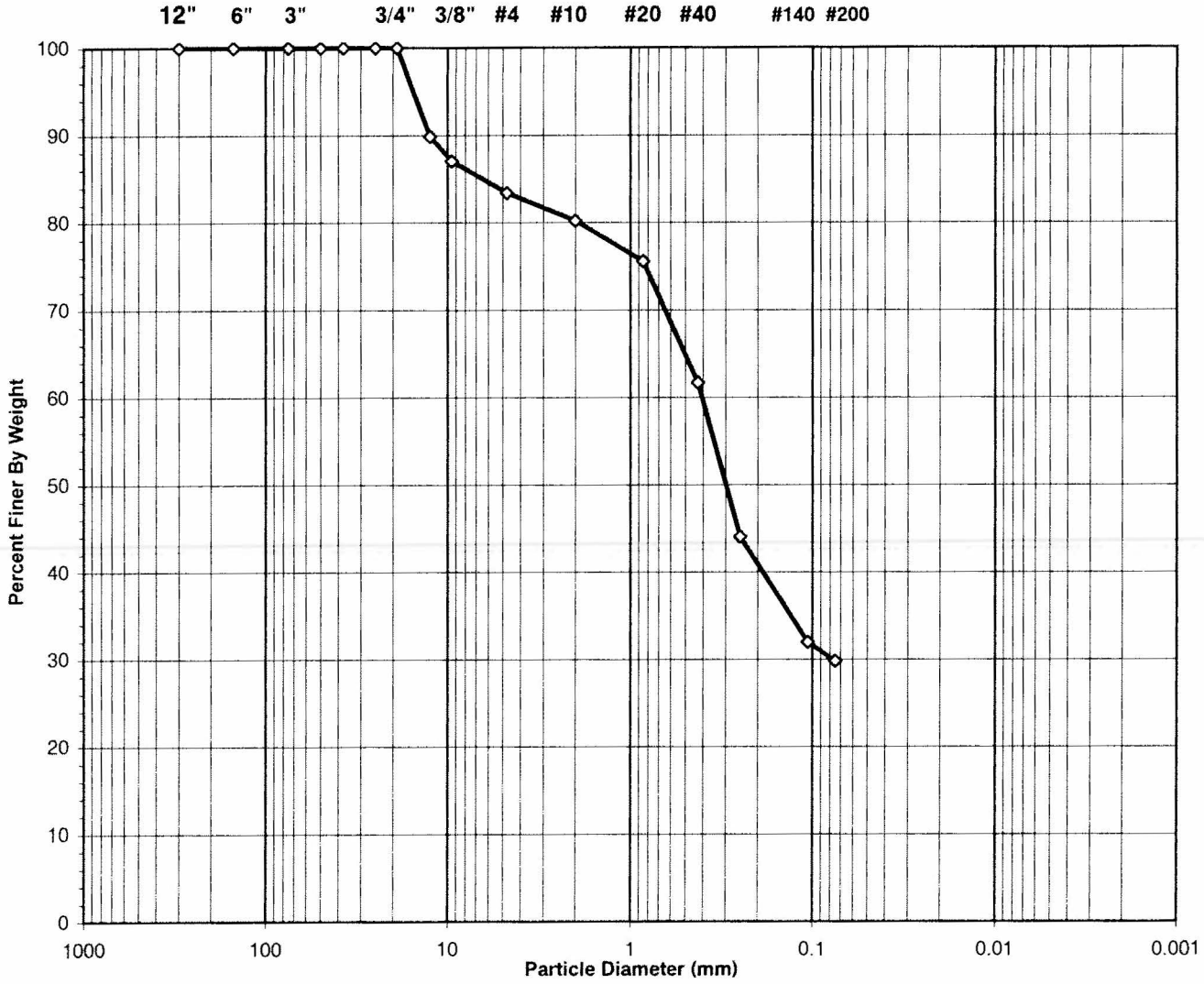
SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	HB-7 / SB-2
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	16-18
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-07	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SC-SM, TESTED***

USCS Classification ***SILTY, CLAYEY SAND WITH GRAVEL***

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	HB-7 / SB-2
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	16-18
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-07	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1440	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	991.68	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	991.68	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.74	Weight of Tare (gm)	NA
Weight of Water (gm)	0.00	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	845.94	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**0.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	845.94
Dry Weight - 3/4" Sample (gm)	594.1	Weight of minus #200 material (gm)	251.85
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	594.09
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	85.92	10.16	10.16	89.84	**89.84**
3/8"	9.50	23.79	2.81	12.97	87.03	**87.03**
#4	4.75	30.71	3.63	16.60	83.40	**83.40**
#10	2.00	27.05	3.20	19.80	80.20	**80.20**
#20	0.850	39.16	4.63	24.43	75.57	**75.57**
#40	0.425	117.39	13.88	38.30	61.70	**61.70**
#60	0.250	149.43	17.66	55.97	44.03	**44.03**
#140	0.106	101.99	12.06	68.02	31.98	**31.98**
#200	0.075	18.65	2.20	70.23	29.77	**29.77**
Pan	-	251.85	29.77	100.00	-	-

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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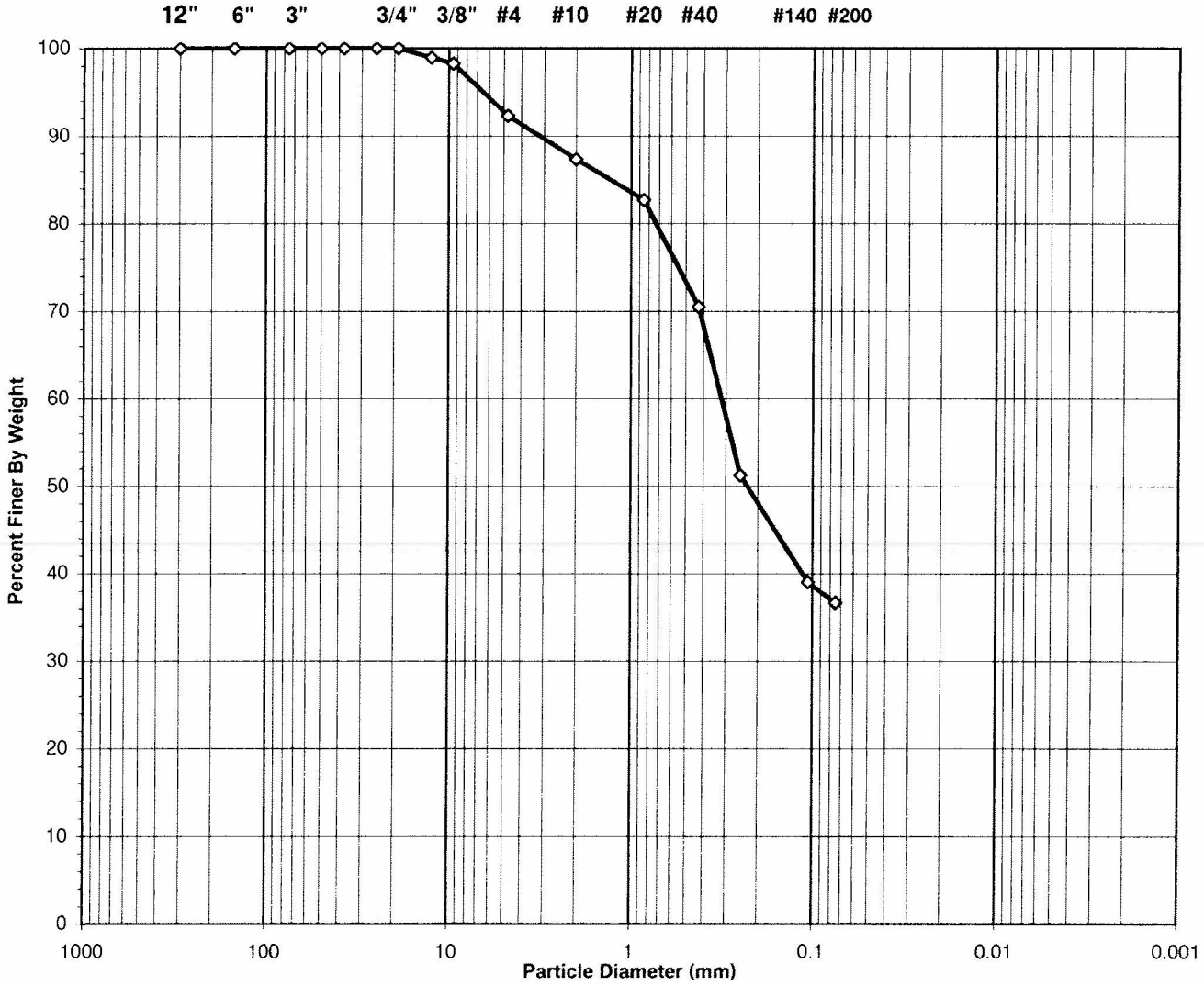
SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-5
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	39-41
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-12	Soil Color	**BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***SC-SM, TESTED***

USCS Classification ***SILTY, CLAYEY SAND***

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-5
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	39-41
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-12	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1417	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	322.57	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	322.57	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	146.78	Weight of Tare (gm)	NA
Weight of Water (gm)	0.00	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	175.79	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**0.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	175.79
Dry Weight - 3/4" Sample (gm)	111.4	Weight of minus #200 material (gm)	64.44
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	111.35
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	1.91	1.09	1.09	98.91	**98.91**
3/8"	9.50	1.17	0.67	1.75	98.25	**98.25**
#4	4.75	10.46	5.95	7.70	92.30	**92.30**
#10	2.00	8.71	4.95	12.66	87.34	**87.34**
#20	0.850	8.16	4.64	17.30	82.70	**82.70**
#40	0.425	21.41	12.18	29.48	70.52	**70.52**
#60	0.250	33.87	19.27	48.75	51.25	**51.25**
#140	0.106	21.52	12.24	60.99	39.01	**39.01**
#200	0.075	4.14	2.36	63.34	36.66	**36.66**
Pan	-	64.44	36.66	100.00	-	-

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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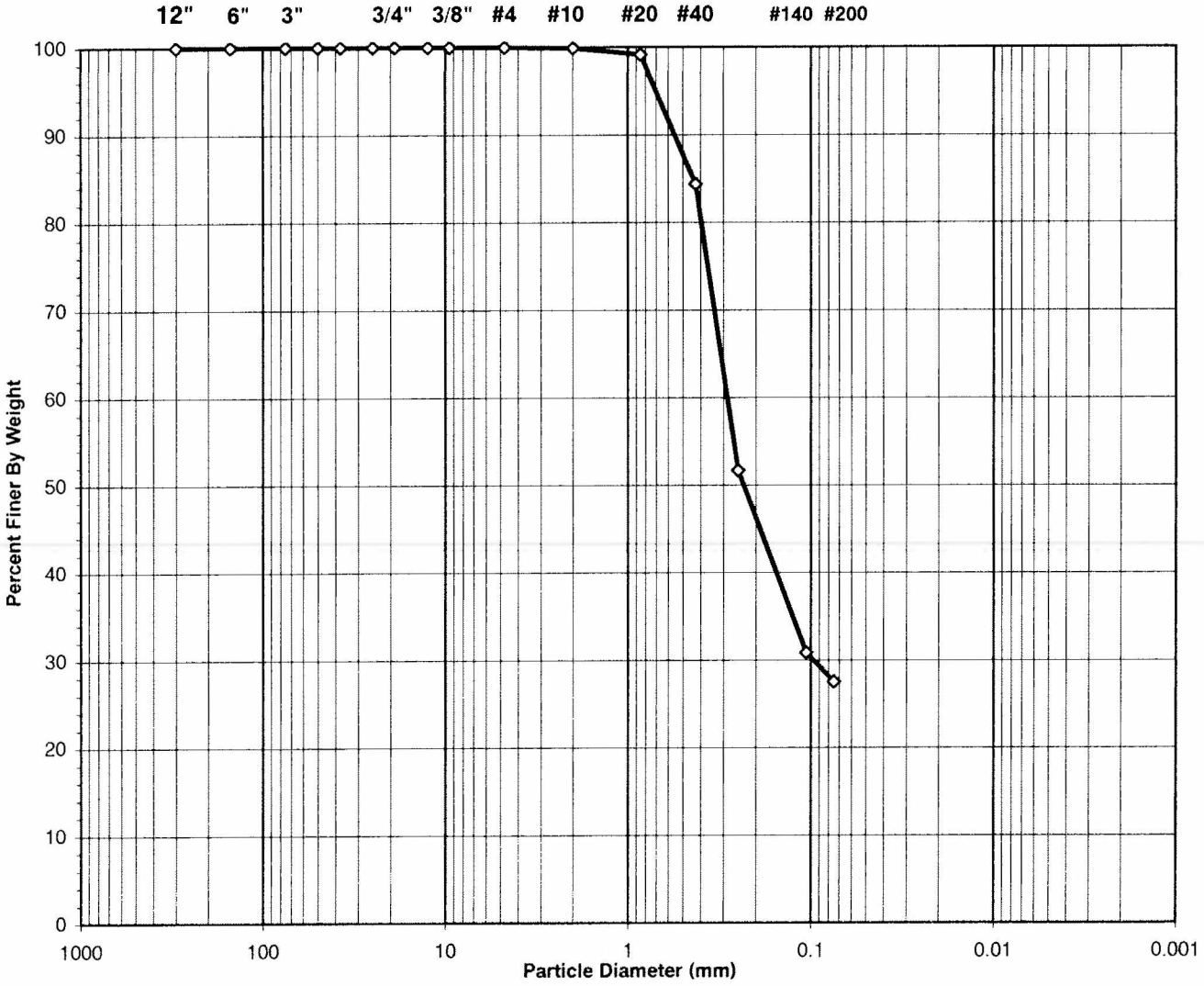
SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-7
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	107-109
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-17	Soil Color	**BROWN**

	SIEVE ANALYSIS		HYDROMETER
USCS	gravel	sand	silt and clay



USCS Symbol ***sc, ASSUMED***

USCS Classification ***CLAYEY SAND***

Tested By PC Date 5/30/12 Checked By KC Date 5-31-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-7
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	107-109
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-17	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	637	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	295.32	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	257.84	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	97.48	Weight of Tare (gm)	NA
Weight of Water (gm)	37.48	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	160.36	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**23.4**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	160.36
Dry Weight - 3/4" Sample (gm)	116.2	Weight of minus #200 material (gm)	44.15
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	116.21
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.14	0.09	0.09	99.91	**99.91**
#20	0.850	1.19	0.74	0.83	99.17	**99.17**
#40	0.425	23.72	14.79	15.62	84.38	**84.38**
#60	0.250	52.44	32.70	48.32	51.68	**51.68**
#140	0.106	33.41	20.83	69.16	30.84	**30.84**
#200	0.075	5.31	3.31	72.47	27.53	**27.53**
Pan	-	44.15	27.53	100.00	-	-

Tested By PC Date 5/30/12 Checked By KL Date 5-31-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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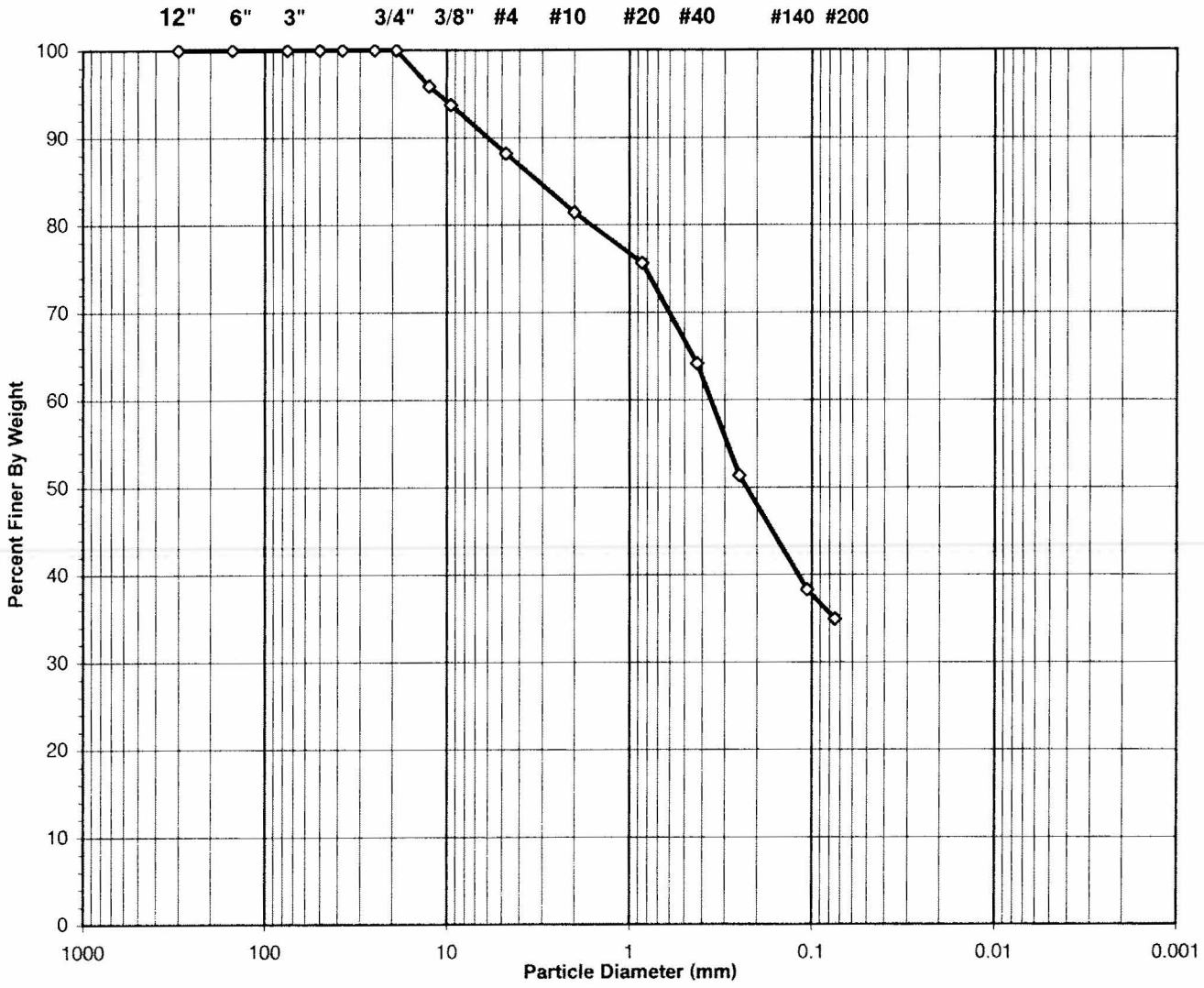
SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-7
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	117-119
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-18	Soil Color	**GRAY**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***sc, ASSUMED***

USCS Classification ***CLAYEY SAND***

Tested By PC Date 5/30/12 Checked By KC Date 5-31-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-7
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	117-119
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-18	Soil Color	**GRAY**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	686	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	251.95	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	231.61	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	95.98	Weight of Tare (gm)	NA
Weight of Water (gm)	20.34	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	135.63	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**15.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	135.63
Dry Weight - 3/4" Sample (gm)	88.3	Weight of minus #200 material (gm)	47.37
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	88.26
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	5.60	4.13	4.13	95.87	**95.87**
3/8"	9.50	2.88	2.12	6.25	93.75	**93.75**
#4	4.75	7.57	5.58	11.83	88.17	**88.17**
#10	2.00	9.17	6.76	18.59	81.41	**81.41**
#20	0.850	7.85	5.79	24.38	75.62	**75.62**
#40	0.425	15.52	11.44	35.83	64.17	**64.17**
#60	0.250	17.39	12.82	48.65	51.35	**51.35**
#140	0.106	17.73	13.07	61.72	38.28	**38.28**
#200	0.075	4.55	3.35	65.07	34.93	**34.93**
Pan	-	47.37	34.93	100.00	-	-

Tested By PC Date 5/30/12 Checked By KC Date 5-31-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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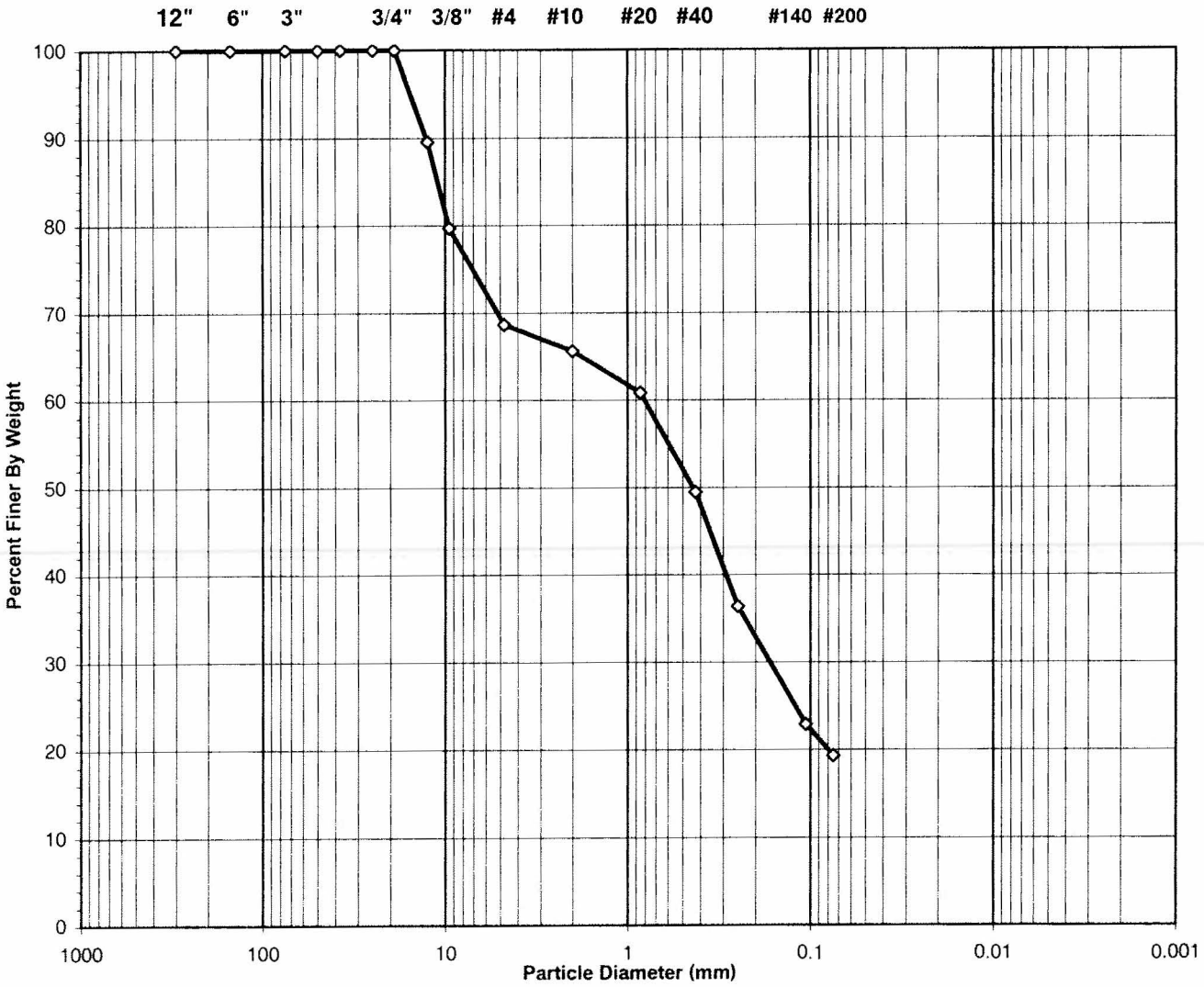
SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-8
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	147-149
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-19	Soil Color	**BROWN**

	SIEVE ANALYSIS		HYDROMETER
USCS	gravel	sand	silt and clay



USCS Symbol ***SM, TESTED***

USCS Classification ***SILTY SAND WITH GRAVEL (NON-PLASTIC FINES)***

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-8
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	147-149
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-19	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	958	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	252.22	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	242.03	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	99.89	Weight of Tare (gm)	NA
Weight of Water (gm)	10.19	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	142.14	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**7.2**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	142.14
Dry Weight - 3/4" Sample (gm)	114.7	Weight of minus #200 material (gm)	27.46
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	114.68
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	14.85	10.45	10.45	89.55	**89.55**
3/8"	9.50	13.99	9.84	20.29	79.71	**79.71**
#4	4.75	15.75	11.08	31.37	68.63	**68.63**
#10	2.00	4.31	3.03	34.40	65.60	**65.60**
#20	0.850	6.78	4.77	39.17	60.83	**60.83**
#40	0.425	16.15	11.36	50.53	49.47	**49.47**
#60	0.250	18.63	13.11	63.64	36.36	**36.36**
#140	0.106	19.13	13.46	77.10	22.90	**22.90**
#200	0.075	5.09	3.58	80.68	19.32	**19.32**
Pan	-	27.46	19.32	100.00	-	-

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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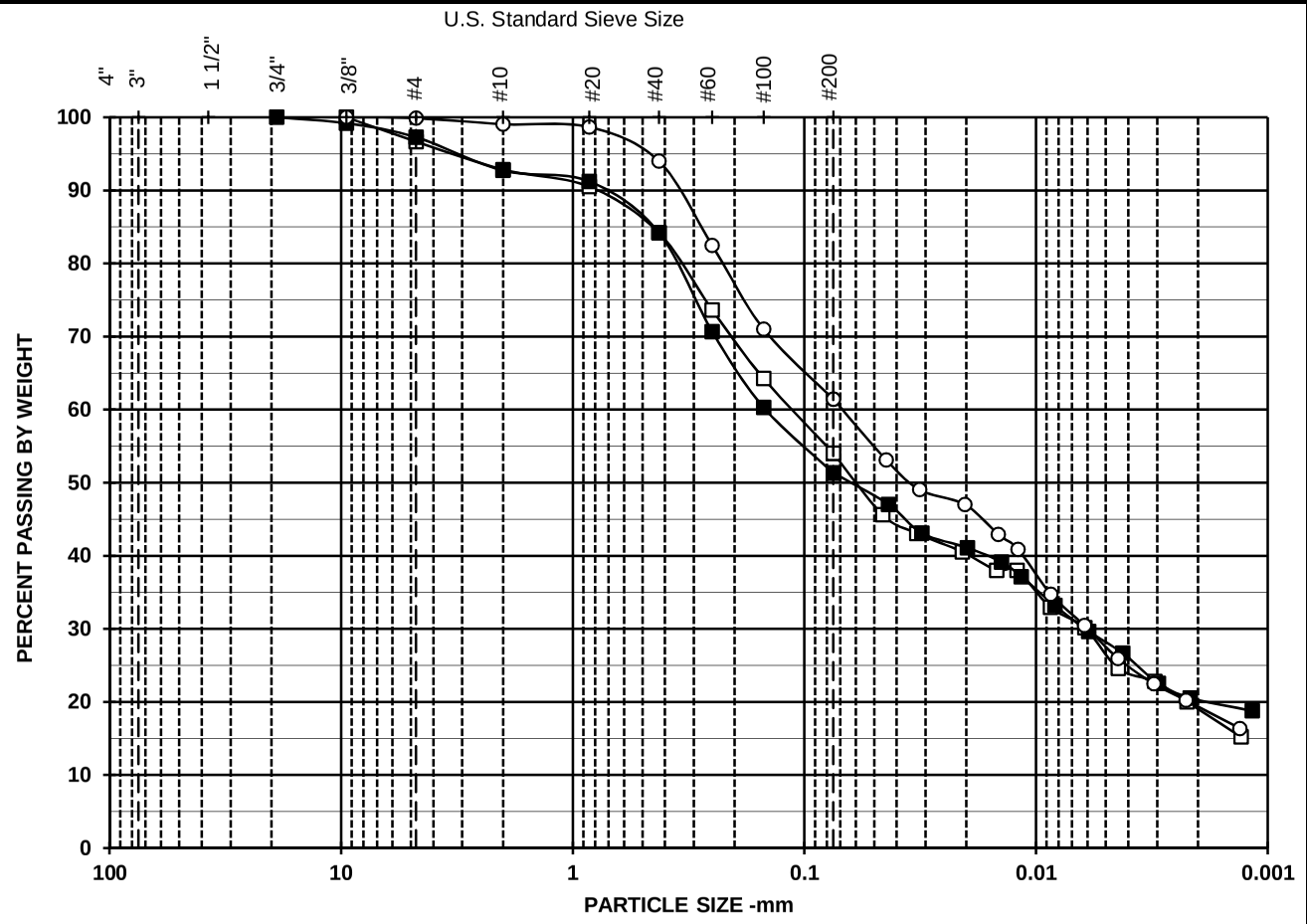
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Symbol	□	■	○
Boring	PB-3	PB-4	PB-4
Sample	A	B	C
Depth	77.6	90.6	100.75
% +3"	0.0	0.0	0.0
% Gravel	3.3	2.7	0.1
% SAND	42.7	46.0	38.5
%C SAND	3.9	4.5	0.8
%M SAND	8.6	8.5	5.1
%F SAND	30.2	32.9	32.6
% FINES	54.0	51.3	61.4
% -2μ	19	20	19
D_{100} (mm)	9.50	19.00	9.50
D_{60} (mm)	0.12	0.15	0.07
D_{30} (mm)	0.01	0.01	0.01
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"		100.0	
3/8"	100.0	99.2	100.0
4	96.7	97.3	99.9
10	92.8	92.7	99.1
20	90.5	91.2	98.7
40	84.2	84.2	94.0
60	73.6	70.7	82.5
100	64.3	60.3	71.0
200	54.0	51.3	61.4

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□		35	20	15	CL	Brown, Sandy lean clay	6/1/2012
■		35	18	17	CL	Brown, Sandy lean clay	5/31/2012
○		50	26	24	CH	Gray, Sandy fat clay	6/1/2012

TerraSense, LLC	URS Corporation
T13815141	13815141

PARTICLE SIZE DISTRIBUTION
AEP Big Sandy Landfill

Analysis File: 3SV-MasterRev3

siev3a.xls 6/21/2012

A P P E N D I X B.3C

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	HB-7 / SB-2
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	16-18
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-07	Soil Description	**BROWN SILTY CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**
Tare Number	213	339	414
Wt. of Tare & WS (gm)	43.00	41.41	36.89
Wt. of Tare & DS (gm)	39.02	37.79	32.91
Wt. of Tare (gm)	18.88	19.63	13.70
Wt. of Water (gm)	4.0	3.6	4.0
Wt. of DS (gm)	20.1	18.2	19.2
Moisture Content (%)	**19.8**	**19.9**	**20.7**
Number of Blows	**29**	**24**	**17**

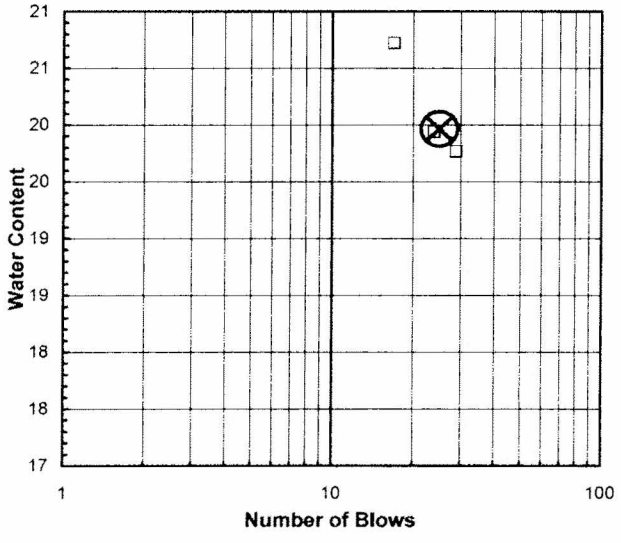
MULTIPOINT

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	423	426	
Wt. of Tare & WS (gm)	22.89	23.46	
Wt. of Tare & DS (gm)	21.86	22.51	
Wt. of Tare (gm)	15.00	15.87	
Wt. of Water (gm)	1.0	0.9	
Wt. of DS (gm)	6.9	6.6	
Moisture Content (%)	**15.0**	**14.3**	**0.7**

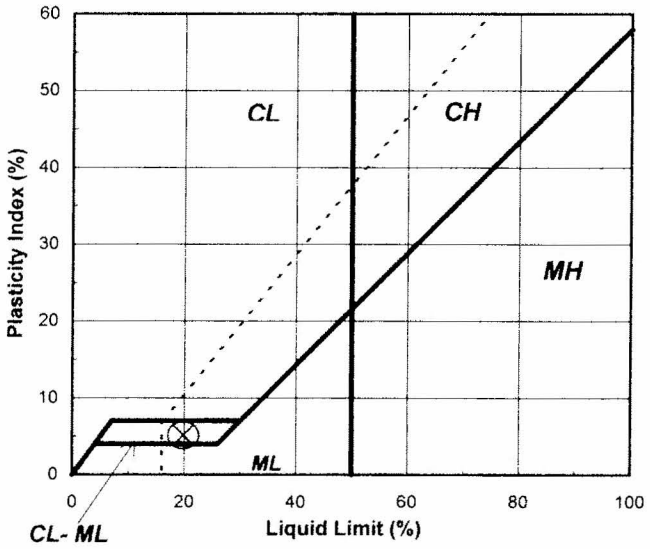
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**20**
Plastic Limit (%)	**15**
Plasticity Index (%)	**5**
USCS Symbol	**CL-ML**

Flow Curve



Plasticity Chart



Tested By MC *Date* 6/1/12 *Checked By* KC *Date* 6-4-12

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	PB-2
Client Reference	AEP BIG SANDY LF 13815141	Depth (ft)	57-59
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-09	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**
Tare Number	282	316	377
Wt. of Tare & WS (gm)	40.39	40.37	35.98
Wt. of Tare & DS (gm)	35.78	35.72	31.04
Wt. of Tare (gm)	18.14	18.33	13.14
Wt. of Water (gm)	4.6	4.7	4.9
Wt. of DS (gm)	17.6	17.4	17.9
Moisture Content (%)	**26.1**	**26.7**	**27.6**
Number of Blows	**33**	**26**	**20**

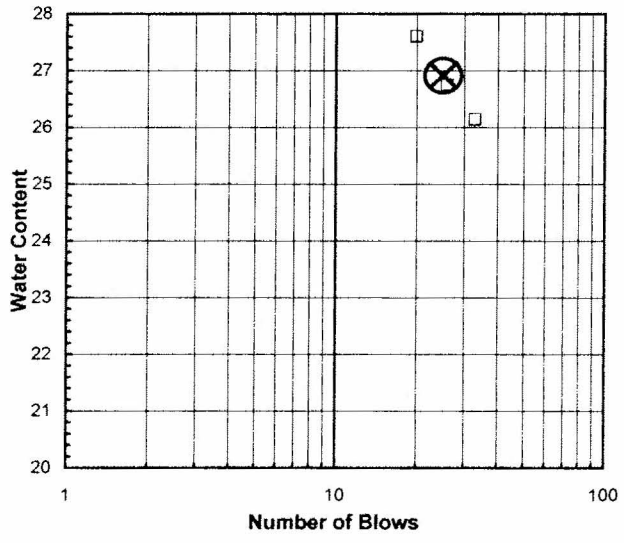
MULTIPOINT

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	189	368	
Wt. of Tare & WS (gm)	25.99	24.02	
Wt. of Tare & DS (gm)	25.13	23.24	
Wt. of Tare (gm)	19.65	17.96	
Wt. of Water (gm)	0.9	0.8	
Wt. of DS (gm)	5.5	5.3	
Moisture Content (%)	**15.7**	**14.8**	**0.9**

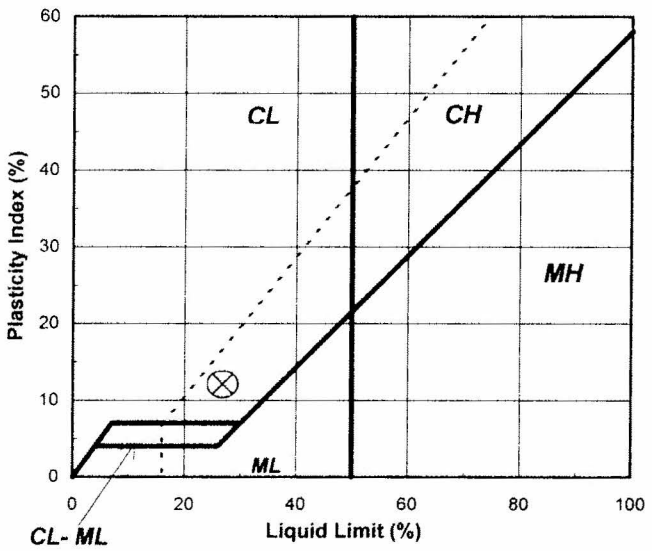
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**27**
Plastic Limit (%)	**15**
Plasticity Index (%)	**12**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By JP *Date* 5/29/12 *Checked By* KC *Date* 5-30-12

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INTEGRITY IN TESTING

ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	PB-5
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	39-41
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-12	Soil Description	**BROWN SILTY CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

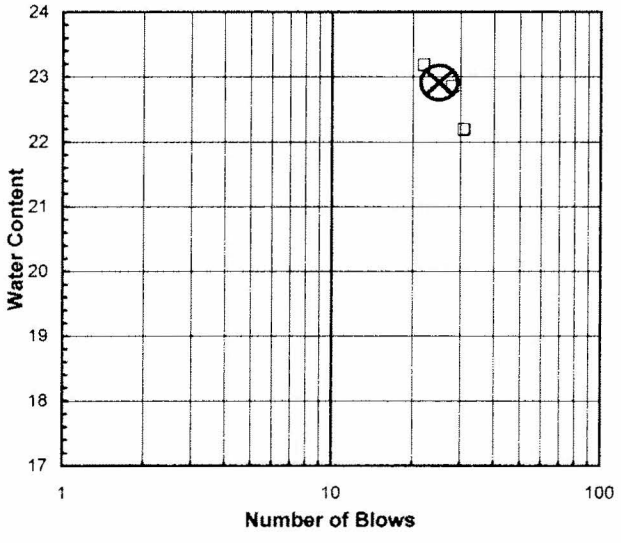
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	245	0	390	**U**
Wt. of Tare & WS (gm)	41.84	43.04	38.00	**L**
Wt. of Tare & DS (gm)	37.88	38.78	33.74	**T**
Wt. of Tare (gm)	20.03	20.13	15.36	**I**
Wt. of Water (gm)	4.0	4.3	4.3	**P**
Wt. of DS (gm)	17.9	18.7	18.4	**O**
				I
Moisture Content (%)	**22.2**	**22.8**	**23.2**	**N**
Number of Blows	**31**	**28**	**22**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	301	312	
Wt. of Tare & WS (gm)	25.31	27.40	
Wt. of Tare & DS (gm)	24.42	26.30	
Wt. of Tare (gm)	18.71	19.30	
Wt. of Water (gm)	0.9	1.1	
Wt. of DS (gm)	5.7	7.0	
Moisture Content (%)	**15.6**	**15.7**	**-0.1**

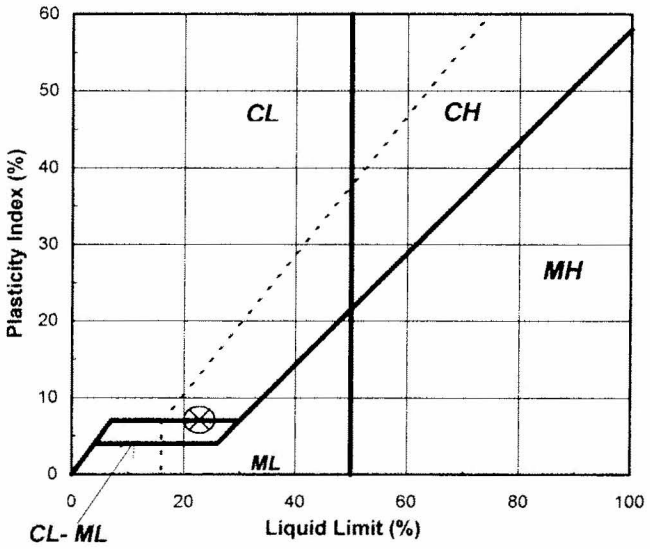
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**23**
Plastic Limit (%)	**16**
Plasticity Index (%)	**7**
USCS Symbol	**CL-ML**

Flow Curve



Plasticity Chart



Tested By MC *Date* 6/1/12 *Checked By* KC *Date* 6-4-12

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INTEGRITY IN TESTING

ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	PB-6
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	98-99.3
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-15	Soil Description	**GRAY LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

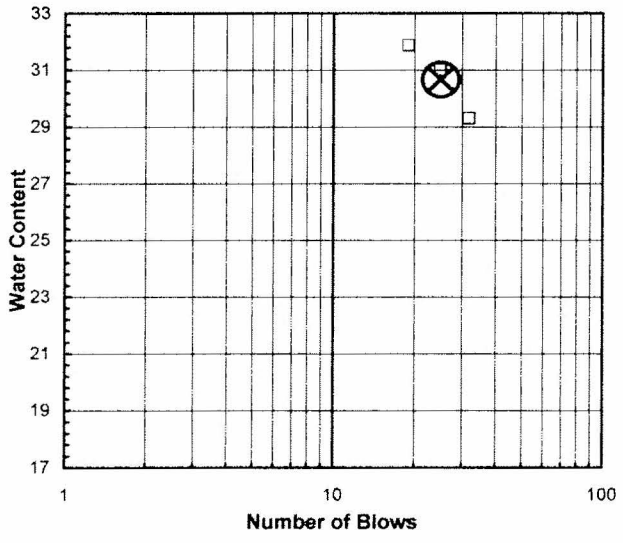
Liquid Limit Test	**1**	**2**	**3**	**MULTIPOINT**
Tare Number	296	349	375	
Wt. of Tare & WS (gm)	32.64	31.42	27.75	
Wt. of Tare & DS (gm)	29.50	28.33	24.23	
Wt. of Tare (gm)	18.78	18.36	13.18	
Wt. of Water (gm)	3.1	3.1	3.5	
Wt. of DS (gm)	10.7	10.0	11.1	
Moisture Content (%)	**29.3**	**31.0**	**31.9**	
Number of Blows	**32**	**25**	**19**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	383	386	
Wt. of Tare & WS (gm)	24.58	26.88	
Wt. of Tare & DS (gm)	23.71	25.99	
Wt. of Tare (gm)	18.56	20.62	
Wt. of Water (gm)	0.9	0.9	
Wt. of DS (gm)	5.2	5.4	
Moisture Content (%)	**16.9**	**16.6**	**0.3**

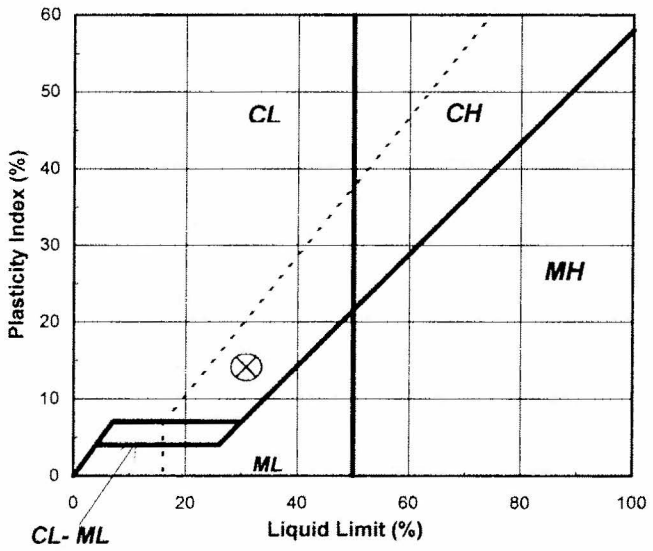
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**31**
Plastic Limit (%)	**17**
Plasticity Index (%)	**14**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By JP *Date* 6/1/12 *Checked By* KC *Date* 6-4-12

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ATTERBERG LIMIT

ASTM D 4318-00 (SOP - S4)

Client	URS CORPORATION	Boring No.	PB-8
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	147-149
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-19	Visual	**BROWN SILT**
			(MInus No. 40 sieve material, Airdried)

NON - PLASTIC MATERIAL

Tested By JP *Date* 6/1/12 *Checked By* KC *Date* 6-1-12

DCN: CT-S4C DATE: 7-11-97 REVISION : 2

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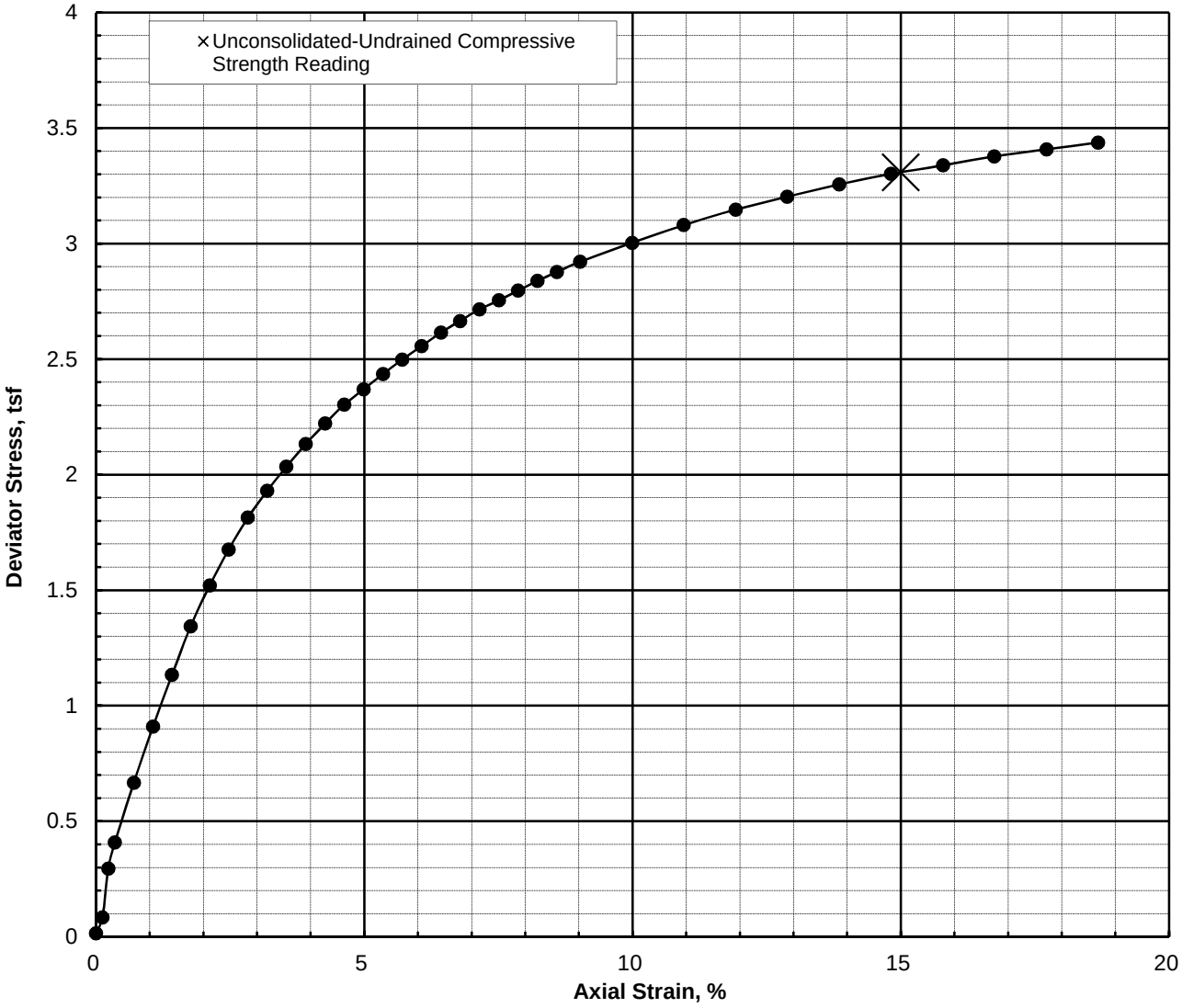
A P P E N D I X B.3D

ALLUVIUM – UNCONSOLIDATED UNDRAINED STRENGTH

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

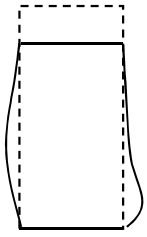
Sample Type: Intact

Description and/or Classification: CL, brown sandy lean clay

Cell Pressure (tsf)	Water (1) Content (%)	Wet Unit Weight (pcf)	Dry Unit (1) Weight (pcf)	Void Ratio (-)	Saturation (2) (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/ PL (-)	PI (-)	Specific (2) Gravity (-)
0 (Initial)	15.7	136.7	118.1	0.46	94.6	6.040	2.849	2.1			2.76
2.2	15.7	138.5	119.7	0.44	98.6	6.014	2.836	2.1			

Failure Summary

U-U Compressive Strength (tsf)	U-U Shear Strength, s_u (tsf)	Strain to to Peak (%)	Strain Rate (%/min)
3.31	1.655	15.0	0.72



FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: DT Reviewed by: GET

Test Date: 5/31/2012 Review Date: 6/21/2012

URS Corporation **Project # 13815141**	**AEP Big Sandy Landfill**	**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**
TerraSense, LLC **Project # T13815141**		**Boring: PB-4 Sample: Section: C Depth: 91.15 ft.**

Standard Test Method for Unconsolidated-undrained Compression

ASTM D 2850

Project Number: T13815141 | Test Number: 112J152a | Boring: PB-4

Project Name: AEP Big Sandy Landfill | Test Date: 5/31/2012 | Sample:

Client: URS Corporation | Liquid Limit: | Section: C

Test by: DT | Plastic Limit: | Depth: 91.15

Specimen Description and/or Classification: CL, brown sandy lean clay

SPECIMEN TYPE			
Intact:	Remold:	Reconstituted	
X			
		Max. DUW (pcf):	
		OPT. WC (%)	
		% points Wet/ Dry of Opt.:	
		% Comp.	

No. of Membranes: 1 @ Thickness: 0.012

Piston Diameter (in) 0.375

Piston Correction 6.7422768 lb

Weight of Top Cap (lb) 1.3146175

INITIAL MEASUREMENTS

Height (in):	Diameter (in):
6.038	2.854
6.042	2.849
6.045	2.848
6.040	2.844
6.036	2.850
	2.846
Average: 6.040	2.849

Cell Pressure (psi): 30.00 2.16 tsf

ΔH consolidation (in): 0.026

	Set Up	Pre-test	Final
Mass of wet soil (gm):	1381.20		1381.20
	Trimmings		**After Test**
Container No.:			418
Wet Soil + Cont. (g):			501.52
Dry Soil + Cont. (g):			462
Mass of Cont. (g):			210.65
Water content (%):			**15.72**
Selected Water Content (%):		**15.72**	

Specific Gravity measured? n G for Sc=100

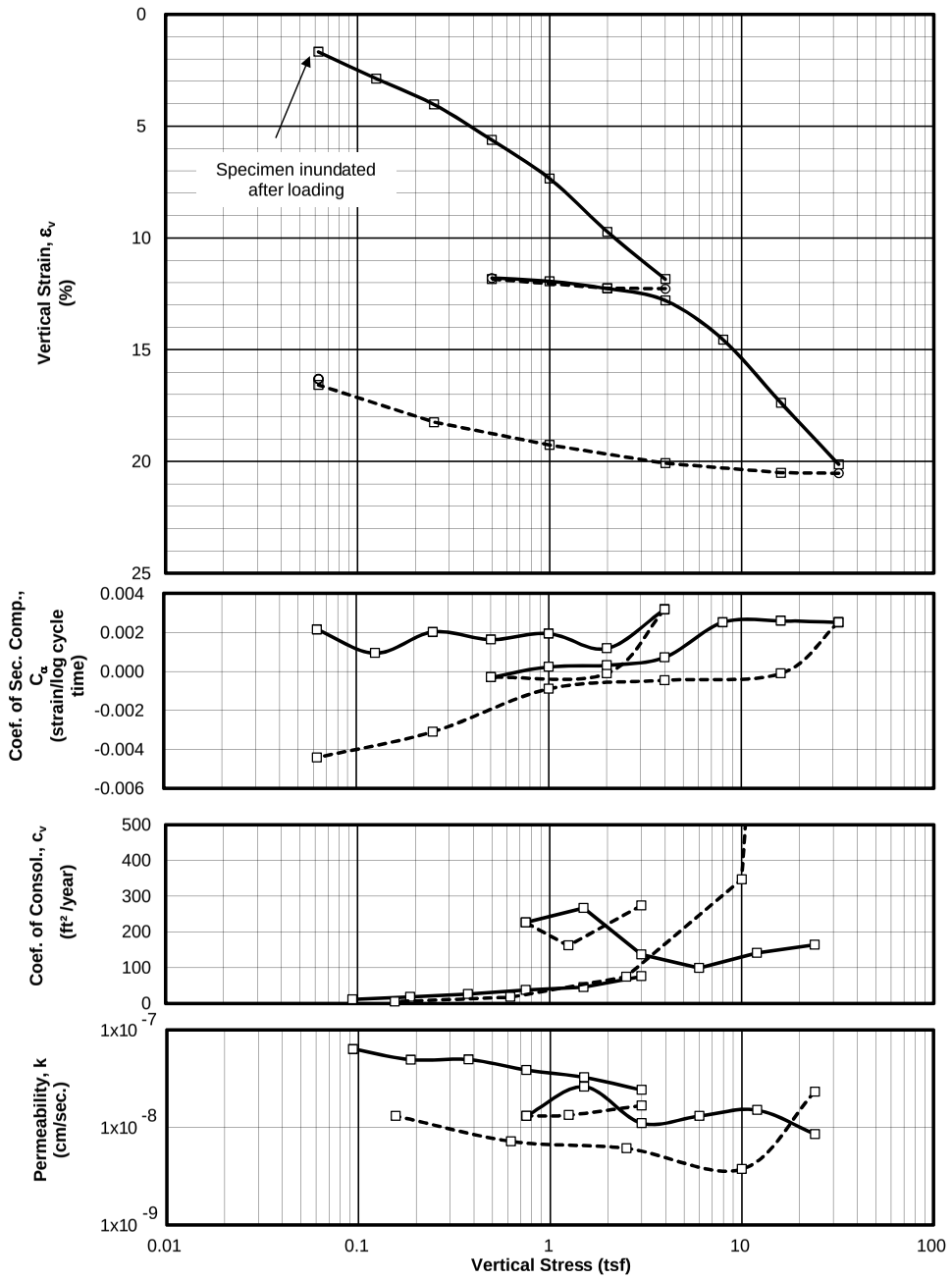
Specific Gravity, Gs : 2.76 (2.744)

	Set Up	Pre-test
Height (in):	6.040	6.014
Diameter (in):	2.849	2.836
Area (in^2):	6.373	6.318
Volume (cm^3):	630.8	622.7
Wet unit weight (pcf):	136.7	138.5
Dry unit weight (pcf):	118.1	119.7
Saturation (%):	94.6	98.6
Void Ratio (-):	0.46	0.44

Test File:	112J152a		Data Reduction		
	CH. # 22	CH. # 21			
Elapsed Time (min)	Dial Reading (in)	Load Cell (lb)	Axial Strain (%)	Corr. Area (in^2)	Compressive Stress (tsf)
0.00	0.083	6.742	0.00	6.318	0.01
0.17	0.090	12.842	0.12	6.325	0.08
0.33	0.097	31.464	0.23	6.332	0.30
0.50	0.104	41.417	0.35	6.340	0.41
1.00	0.125	64.533	0.70	6.363	0.67
1.50	0.147	86.365	1.06	6.386	0.91
2.00	0.168	106.592	1.41	6.409	1.13
2.50	0.189	125.856	1.76	6.431	1.34
3.00	0.210	142.230	2.12	6.455	1.52
3.50	0.232	156.678	2.47	6.478	1.68
4.00	0.253	169.841	2.83	6.502	1.81
4.50	0.275	181.078	3.19	6.526	1.93
5.00	0.296	191.352	3.55	6.550	2.04
5.50	0.318	200.984	3.91	6.575	2.13
6.00	0.340	209.974	4.27	6.600	2.22
6.50	0.361	218.321	4.62	6.624	2.30
7.00	0.383	225.385	4.99	6.650	2.37
7.50	0.405	232.448	5.35	6.675	2.44
8.00	0.426	239.190	5.71	6.700	2.50
8.50	0.448	245.612	6.07	6.726	2.56
9.00	0.469	252.033	6.43	6.752	2.61
9.50	0.491	257.812	6.78	6.778	2.66
10.00	0.513	263.591	7.15	6.804	2.71
10.50	0.534	268.407	7.51	6.831	2.75
11.00	0.556	273.544	7.87	6.857	2.80
11.50	0.578	278.681	8.23	6.884	2.84
12.00	0.599	283.497	8.59	6.911	2.88
12.60	0.626	289.276	9.02	6.945	2.92
13.93	0.684	300.513	9.99	7.019	3.00
15.27	0.742	311.429	10.95	7.095	3.08
16.60	0.800	321.703	11.92	7.173	3.15
17.93	0.858	331.014	12.88	7.252	3.20
19.27	0.916	340.324	13.85	7.334	3.26
20.60	0.974	348.993	14.82	7.417	3.30
1 21.93	1.032	357.020	15.79	7.502	3.34
23.27	1.090	365.367	16.74	7.588	3.38
24.60	1.148	373.073	17.71	7.678	3.41
25.93	1.206	380.778	18.68	7.769	3.44

A P P E N D I X B.3E

ALLUVIUM – CONSOLIDATION



SAMPLE INFORMATION

Boring:	PB-3
Sample:	A
Depth:	77.60 feet
Elevation:	
Type:	3-inch thin wall tube
Description:	CL, brown sandy lean clay

LL = 35, PL = 20, PI = 15

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.61	inch
Diameter:	2.51	inch

Initial water content:	27.4	%
Initial total unit weight:	123.3	pcf
Initial dry unit weight:	96.8	pcf
Initial void ratio:	0.743	
Initial degree of saturation:	100	%
Final water content:	19.6	%
Final total unit weight:	131.9	pcf
Final dry unit weight:	110.3	pcf
Final void ratio:	0.529	
Final degree of saturation:	100	%

(measured specific gravity = 2.70)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	1.7 (Range: 1.4 to 2.4)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.093
Compression Index (void ratio per log cycle stress):	0.162
Swell Ratio (strain per log cycle stress):	0.007
Swell Index (void ratio per log cycle stress):	0.012
Recompression Ratio (strain per log cycle stress):	0.011
Recompression Index (void ratio per log cycle stress):	0.019
Remarks:	

LEGEND: □ End of primary o End of Stage ——— Loading - - - - - - - Unloading

Test Date: 6/1/12 Tested By: CMJ Checked By: GET

URS Corporation Project No. 13815141	AEP Big Sandy Landfill	ONE DIMENSIONAL CONSOLIDATION TEST Boring: PB-3 Depth: 77.60 feet
TerraSense, LLC	Project No. T13815141	June 2012

PROJECT:	AEP Big Sandy Landfill						
PROJECT NO.:	T13815141	Initial height:	0.613	inch	Final height:	0.538	inch
BORING:	PB-3	Initial water content:	27.4	%	Final water content:	19.6	%
SAMPLE:	A	Initial dry density:	96.8	pcf	Final dry density:	110.3	pcf
TEST:	C12083	Initial total density:	123.3	pcf	Final total density:	131.9	pcf
DEPTH, feet:	77.6	Initial saturation:	100	%	Final saturation:	100	%
BY:	CMJ	Initial void ratio:	0.743		Final void ratio:	0.529	
TEST DATE:	6/1/2012				Final strain:	12.3	%

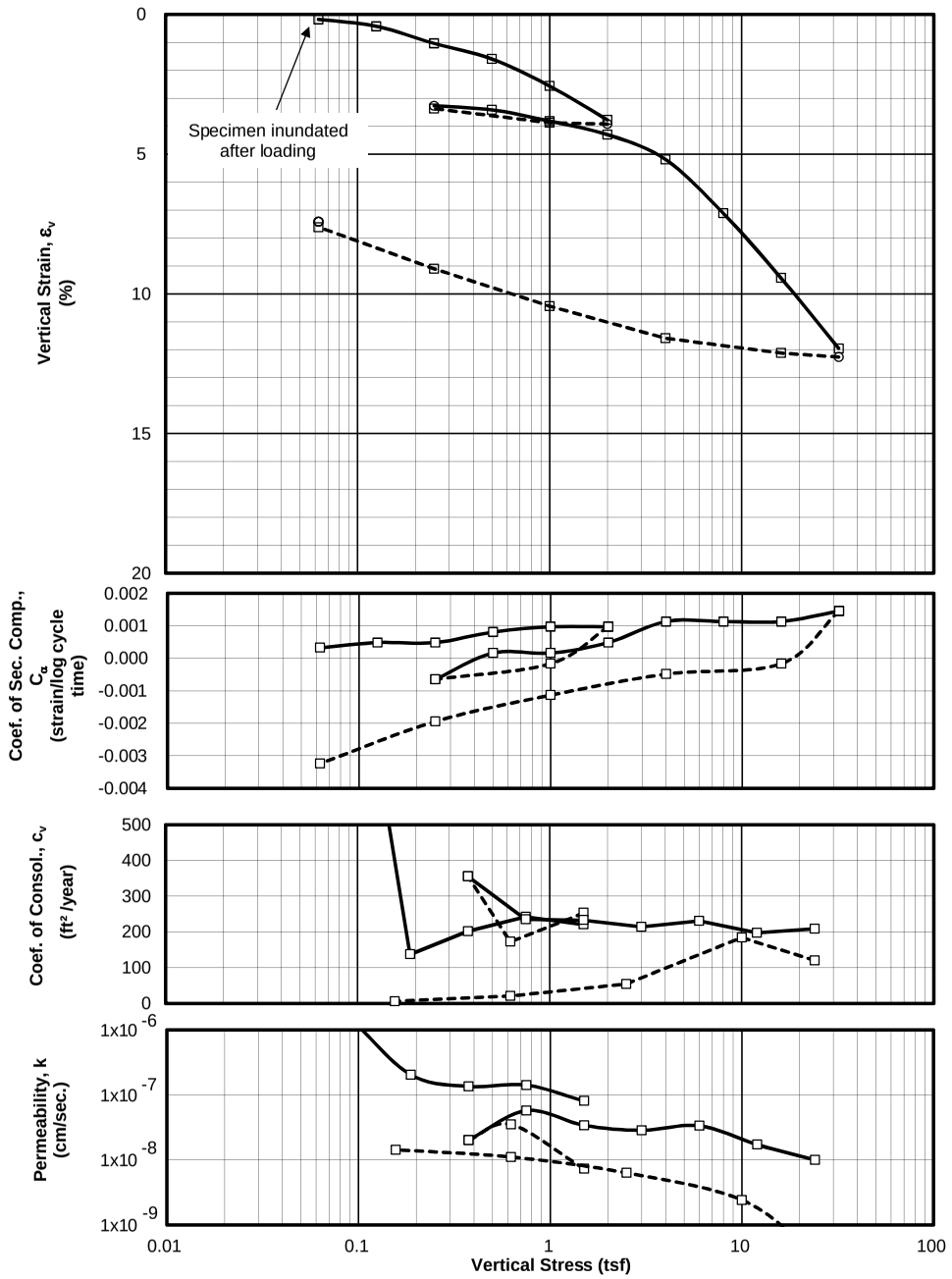
EQUIPMENT: SPECIMEN DESCRIPTION: CL, brown sandy lean clay

Load Frame No.: 6

Ring Diameter: 2.505 inch

G	LL	PL	PI
2.702	35	20	15

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft^2/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0103	1.680	0.714	1.876	0.710	14.02	0.0022	3.72	1.14E-07
2	0.125	0.0176	2.877	0.693	3.023	0.690	11.05	0.0009	5.22	6.38E-08
3	0.250	0.0247	4.035	0.673	4.279	0.668	17.71	0.0020	10.79	4.95E-08
4	0.500	0.0345	5.623	0.645	5.916	0.640	25.93	0.0016	15.74	4.97E-08
5	1.00	0.0451	7.350	0.615	7.627	0.610	37.25	0.0019	28.95	3.88E-08
6	2.00	0.0596	9.730	0.573	9.958	0.569	45.39	0.0012	42.02	3.26E-08
7	4.00	0.0726	11.848	0.536	12.273	0.529	75.60	0.0032	94.39	2.42E-08
8	2.00	0.0751	12.255	0.529	12.222	0.530	273.62	-0.0001	492.20	1.68E-08
9	0.500	0.0726	11.844	0.536	11.795	0.537	161.68	-0.0003	365.14	1.34E-08
10	1.00	0.0732	11.940	0.535	11.989	0.534	225.95	0.0002	519.74	1.31E-08
11	2.00	0.0752	12.265	0.529	12.314	0.528	267.04	0.0003	308.08	2.61E-08
12	4.00	0.0785	12.801	0.520	12.997	0.516	136.34	0.0007	372.68	1.10E-08
13	8.00	0.0892	14.554	0.489	14.913	0.483	98.86	0.0025	228.17	1.31E-08
14	16.0	0.1065	17.375	0.440	17.734	0.434	141.38	0.0026	283.66	1.50E-08
15	32.0	0.1234	20.130	0.392	20.521	0.385	164.13	0.0025	580.76	8.53E-09
16	16.0	0.1257	20.503	0.386	20.471	0.386	3283.77	-0.0001	4281.32	2.31E-08
17	4.00	0.1231	20.076	0.393	19.995	0.394	346.70	-0.0005	2809.52	3.72E-09
18	1.00	0.1180	19.258	0.407	19.062	0.411	73.95	-0.0009	366.46	6.09E-09
19	0.250	0.1118	18.243	0.425	18.064	0.428	17.60	-0.0031	73.94	7.18E-09
20	0.063	0.1016	16.576	0.454	16.315	0.459	4.89	-0.0044	11.25	1.31E-08



SAMPLE INFORMATION

Boring:	PB-4
Sample:	B
Depth:	90.60 feet
Elevation:	
Type:	3-inch thin wall tube
Description:	CL, brown sandy lean clay

LL = 35, PL = 18, PI = 17

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.62	inch
Diameter:	2.50	inch

Initial water content:	16.9	%
Initial total unit weight:	132.4	pcf
Initial dry unit weight:	113.3	pcf
Initial void ratio:	0.522	
Initial degree of saturation:	89	%

Final water content:	16.5	%
Final total unit weight:	138.0	pcf
Final dry unit weight:	118.5	pcf
Final void ratio:	0.456	
Final degree of saturation:	100	%

(measured specific gravity = 2.76)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	4.3 (Range: 2.6 to 4.8)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.080
Compression Index (void ratio per log cycle stress):	0.122
Swell Ratio (strain per log cycle stress):	0.008
Swell Index (void ratio per log cycle stress):	0.012
Recompression Ratio (strain per log cycle stress):	0.011
Recompression Index (void ratio per log cycle stress):	0.017
Remarks:	

LEGEND: □ End of primary o End of Stage ——— Loading - - - - - - - Unloading

Test Date: 5/31/12 Tested By: CMJ Checked By: GET

URS Corporation Project No. 13815141	AEP Big Sandy Landfill	ONE DIMENSIONAL CONSOLIDATION TEST Boring: PB-4 Depth: 90.60 feet
TerraSense, LLC	Project No. T13815141	June 2012

PROJECT:	AEP Big Sandy Landfill					
PROJECT NO.:	T13815141	Initial height:	0.617 inch	Final height:	0.590 inch	
BORING:	PB-4	Initial water content:	16.9 %	Final water content:	16.5 %	
SAMPLE:	B	Initial dry density:	113.3 pcf	Final dry density:	118.5 pcf	
TEST:	C12082	Initial total density:	132.4 pcf	Final total density:	138.0 pcf	
DEPTH, feet:	90.6	Initial saturation:	89 %	Final saturation:	100 %	
BY:	CMJ	Initial void ratio:	0.522	Final void ratio:	0.456	
TEST DATE:	5/31/2012			Final strain:	4.4 %	

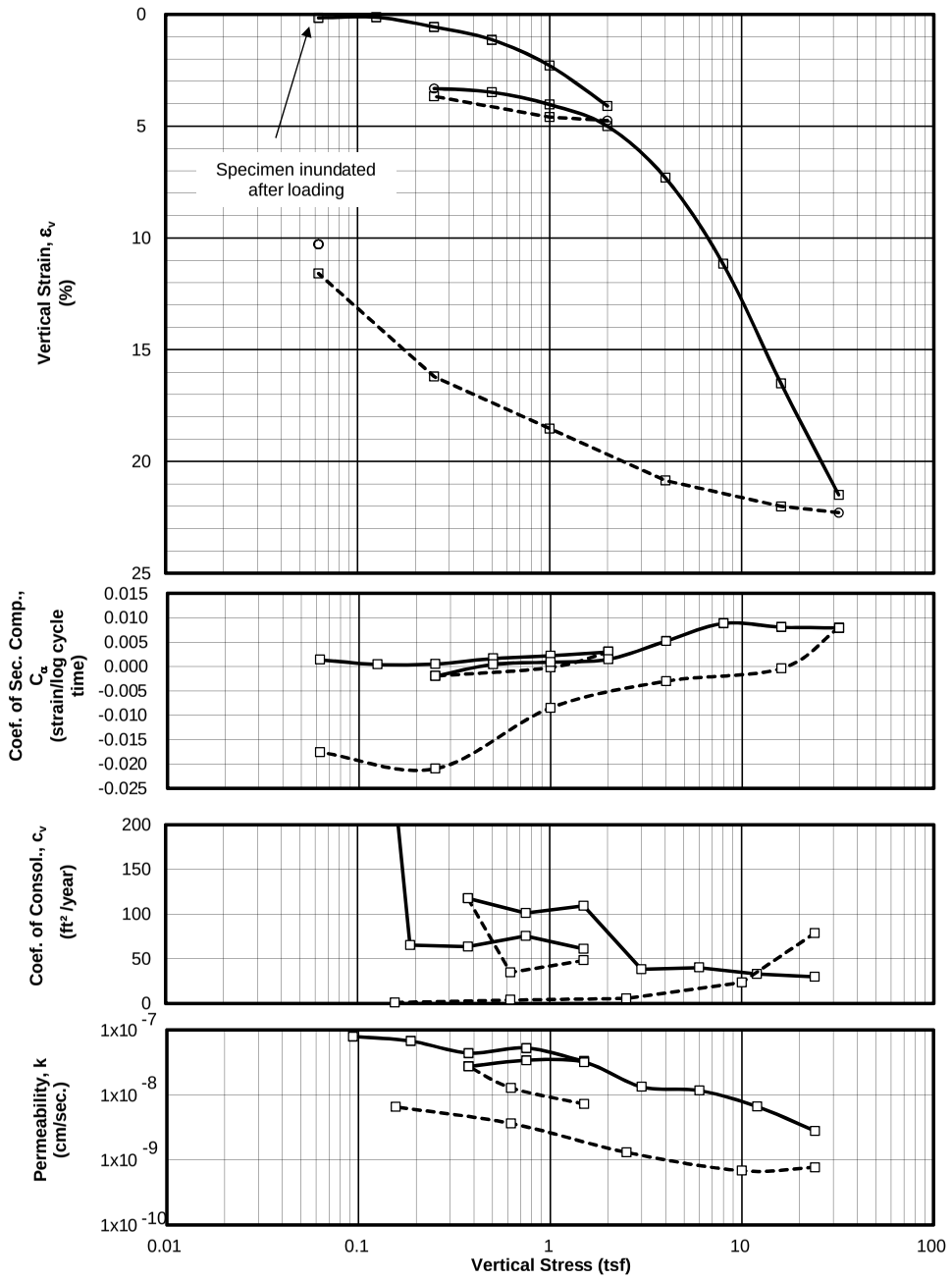
EQUIPMENT: SPECIMEN DESCRIPTION: CL, brown sandy lean clay

Load Frame No.: 3

Ring Diameter: 2.5 inch

G	LL	PL	PI
2.762	35	18	17

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft^2/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0011	0.178	0.520	0.178	0.520	760.13	0.0003	35.08	6.54E-07
2	0.125	0.0026	0.427	0.516	0.702	0.512	1133.42	0.0005	25.17	1.36E-06
3	0.250	0.0064	1.042	0.506	1.123	0.505	137.12	0.0005	20.31	2.04E-07
4	0.500	0.0099	1.598	0.498	1.841	0.494	201.46	0.0008	44.96	1.35E-07
5	1.00	0.0159	2.568	0.483	2.730	0.481	242.12	0.0010	51.55	1.42E-07
6	2.00	0.0233	3.781	0.465	3.927	0.463	220.53	0.0010	82.45	8.07E-08
7	1.00	0.0239	3.877	0.463	3.844	0.464	253.08	-0.0002	1044.88	7.31E-09
8	0.250	0.0208	3.371	0.471	3.274	0.473	172.22	-0.0006	148.50	3.50E-08
9	0.500	0.0211	3.418	0.470	3.451	0.470	355.34	0.0002	532.77	2.01E-08
10	1.00	0.0236	3.822	0.464	3.854	0.464	235.00	0.0002	123.99	5.72E-08
11	2.00	0.0266	4.306	0.457	4.452	0.455	232.87	0.0005	206.51	3.40E-08
12	4.00	0.0320	5.188	0.443	5.366	0.441	214.22	0.0011	226.72	2.85E-08
13	8.00	0.0439	7.114	0.414	7.340	0.411	230.49	0.0011	207.74	3.35E-08
14	16.0	0.0582	9.428	0.379	9.719	0.374	197.52	0.0011	345.69	1.72E-08
15	32.0	0.0738	11.953	0.340	12.260	0.336	208.77	0.0015	633.71	9.94E-09
16	16.0	0.0748	12.113	0.338	12.081	0.338	120.25	-0.0002	9969.31	3.64E-10
17	4.00	0.0716	11.592	0.346	11.511	0.347	183.87	-0.0005	2302.13	2.41E-09
18	1.00	0.0644	10.439	0.363	10.309	0.365	54.35	-0.0011	260.20	6.30E-09
19	0.250	0.0562	9.108	0.384	8.768	0.389	20.66	-0.0019	56.34	1.11E-08
20	0.063	0.0470	7.615	0.406	7.420	0.409	5.96	-0.0032	12.56	1.43E-08



SAMPLE INFORMATION

Boring:	PB-4
Sample:	C
Depth:	100.75 feet
Elevation:	
Type:	3-inch thin wall tube
Description:	CH, gray sandy clay
	fine sand pocket present
	LL = 50, PL = 26, PI = 24

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.61	inch
Diameter:	2.50	inch

Initial water content:	35.8	%
Initial total unit weight:	111.7	pcf
Initial dry unit weight:	82.3	pcf
Initial void ratio:	0.995	
Initial degree of saturation:	94	%
Final water content:	32.5	%
Final total unit weight:	116.0	pcf
Final dry unit weight:	87.6	pcf
Final void ratio:	0.874	
Final degree of saturation:	98	% (measured specific gravity = 2.63)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	4.1 (Range: 3.2 to 4.2)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.172
Compression Index (void ratio per log cycle stress):	0.343
Swell Ratio (strain per log cycle stress):	0.015
Swell Index (void ratio per log cycle stress):	0.030
Recompression Ratio (strain per log cycle stress):	0.015
Recompression Index (void ratio per log cycle stress):	0.030
Remarks:	

LEGEND: □ End of primary o End of Stage ——— Loading - - - - - - - Unloading

Test Date: 6/1/12 Tested By: CMJ Checked By: GET

URS Corporation Project No. 13815141	AEP Big Sandy Landfill	ONE DIMENSIONAL CONSOLIDATION TEST Boring: PB-4 Depth: 100.75 feet
TerraSense, LLC	Project No. T13815141	June 2012

PROJECT:	AEP Big Sandy Landfill						
PROJECT NO.:	T13815141	Initial height:	0.614	inch	Final height:	0.577	inch
BORING:	PB-4	Initial water content:	35.8	%	Final water content:	32.5	%
SAMPLE:	C	Initial dry density:	82.3	pcf	Final dry density:	87.6	pcf
TEST:	C12084	Initial total density:	111.7	pcf	Final total density:	116.0	pcf
DEPTH, feet:	100.75	Initial saturation:	94	%	Final saturation:	98	%
BY:	CMJ	Initial void ratio:	0.995		Final void ratio:	0.874	
TEST DATE:	6/1/2012				Final strain:	6.1	%

EQUIPMENT:
Load Frame No.: 1
Ring Diameter: 2.5 inch

SPECIMEN DESCRIPTION: CH, gray sandy clay
fine sand pocket present

G	LL	PL	PI
2.629	50	26	24

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft^2/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0010	0.157	0.992	0.188	0.991	137.27	0.0014	39.88	1.04E-07
2	0.125	0.0008	0.134	0.992	0.231	0.990	720.50	0.0004	273.71	7.94E-08
3	0.250	0.0034	0.562	0.984	0.663	0.982	65.31	0.0005	29.22	6.74E-08
4	0.500	0.0070	1.137	0.972	1.329	0.969	63.54	0.0016	43.43	4.41E-08
5	1.00	0.0141	2.296	0.949	2.526	0.945	75.45	0.0022	43.17	5.27E-08
6	2.00	0.0252	4.101	0.913	4.747	0.900	61.02	0.0030	55.40	3.32E-08
7	1.00	0.0282	4.599	0.903	4.571	0.904	48.16	-0.0002	200.74	7.24E-09
8	0.250	0.0226	3.675	0.922	3.321	0.929	34.50	-0.0020	81.19	1.28E-08
9	0.500	0.0214	3.482	0.926	3.541	0.924	117.57	0.0004	129.45	2.74E-08
10	1.00	0.0248	4.040	0.915	4.163	0.912	101.04	0.0009	89.64	3.40E-08
11	2.00	0.0307	5.007	0.895	5.230	0.891	109.11	0.0015	103.36	3.18E-08
12	4.00	0.0449	7.310	0.849	8.288	0.830	38.27	0.0052	86.84	1.33E-08
13	8.00	0.0685	11.161	0.772	12.128	0.753	40.09	0.0089	103.88	1.16E-08
14	16.0	0.1013	16.506	0.666	17.342	0.649	32.88	0.0081	149.66	6.63E-09
15	32.0	0.1319	21.488	0.566	22.288	0.550	29.71	0.0079	321.19	2.79E-09
16	16.0	0.1351	22.005	0.556	21.899	0.558	78.59	-0.0004	3094.91	7.66E-10
17	4.00	0.1280	20.848	0.579	20.614	0.584	23.36	-0.0030	1037.14	6.80E-10
18	1.00	0.1137	18.522	0.626	18.338	0.629	5.58	-0.0085	129.02	1.30E-09
19	0.250	0.0995	16.201	0.672	15.253	0.691	3.89	-0.0210	32.31	3.63E-09
20	0.063	0.0712	11.589	0.764	10.283	0.790	0.88041	-0.0176	4.06	6.53E-09

A P P E N D I X B.3F

ALLUVIUM – PHOTOS

URS

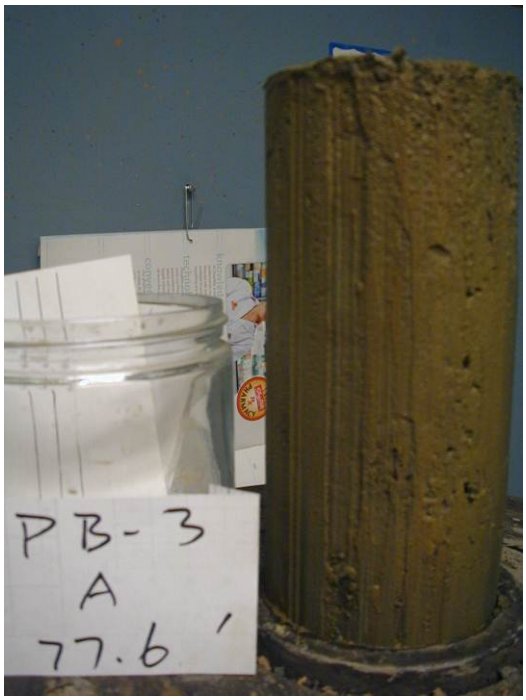
PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Sample No. PB-3	Date:

Description:

Alluvium Shelby Tube Samples (PB-3, ST-1)



Sample No. PB-3	Date:

Description:

Alluvium Shelby Tube Samples (PB-3, ST-1)

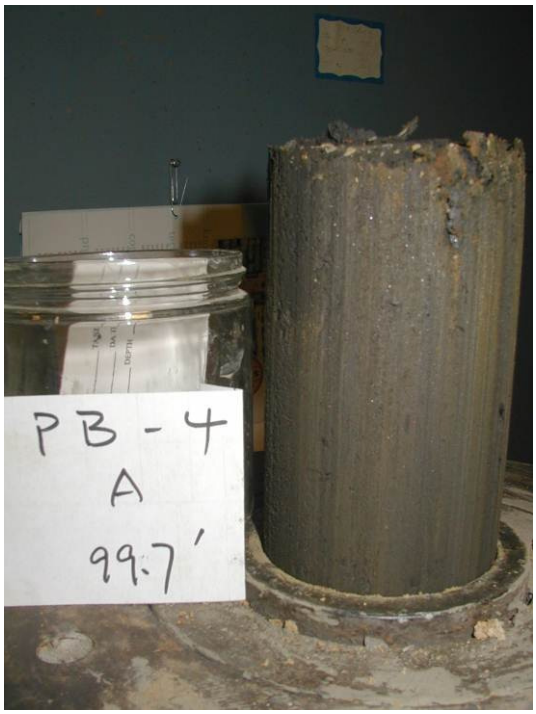
URS	PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Sample No. PB-4	Date:

Description:

Alluvium Shelby Tube Samples (PB-4, ST-2)



URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Sample No. PB-4	Date:

Description:

Alluvium Shelby Tube Samples (PB-4, ST-2)

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Sample No. PB-4	Date:

Description:

Alluvium Shelby Tube Samples (PB-4, ST-2)

Sample No. PB-4	Date:

Description:

Alluvium Shelby Tube Samples (PB-4, ST-2)

A P P E N D I X B.4

RESIDIUUM

A P P E N D I X B.4A

RESIDUUM – MOISTURE CONTENT

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MOISTURE CONTENT

ASTM D 2216-05 (SOP-S1)

Client	URS
Client Reference	AEP BIG SANDY LF 13815141
Project No.	2012-245-01

Lab ID	01	02	03	04	05
Boring No.	HB-1	HB-2/ SB-1	HB-7/ SB-2	HB-7/ SB-2	HB-7/ SB-2
Depth (ft)	2-4	8-10	0-2	4-6	8-10
Sample No.	NA	NA	NA	NA	NA
Tare Number	49	10	37	38	25
Wt. of Tare & WS (gm)	50.45	60.98	58.58	168.17	199.17
Wt. of Tare & DS (gm)	44.12	53.1	51.53	145.35	181.11
Wt. of Tare (gm)	8.35	8.58	8.43	8.35	8.2
Wt. of Water (gm)	6.33	7.88	7.05	22.82	18.06
Wt. of DS (gm)	35.77	44.52	43.1	137	172.91
Water Content (%)	**17.7**	**17.7**	**16.4**	**16.7**	**10.4**

Lab ID	06	07	08	09	10
Boring No.	HB-7/ SB-2	HB-7/ SB-2	HB-7/ SB-2	PB-2	PB-2
Depth (ft)	12-14	16-18	20-22	57-59	70-72
Sample No.	NA	NA	NA	NA	NA
Tare Number	31	57	50	16	46
Wt. of Tare & WS (gm)	189.88	189.58	201.23	64.3	40.61
Wt. of Tare & DS (gm)	162.67	169.87	177.69	54.76	35.97
Wt. of Tare (gm)	8.28	8.3	8.64	8.36	8.42
Wt. of Water (gm)	27.21	19.71	23.54	9.54	4.64
Wt. of DS (gm)	154.39	161.57	169.05	46.4	27.55
Water Content (%)	**17.6**	**12.2**	**13.9**	**20.6**	**16.8**

Notes : *NA*

Alluv. Resid. Alluv. Resid. Fill Fill Alluv.

Tested By PC *Date* 5/22/12 *Checked By* JN *Date* 5/23/12

DCN: CT-S1 DATE 1-21-10 REVISION: 3

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MOISTURE CONTENT

ASTM D 2216-05 (SOP-S1)

Client	URS
Client Reference	AEP BIG SANDY LF 13815141
Project No.	2012-245-01

Lab ID	11	12	14	15	16
Boring No.	PB-4	PB-5	PB-6	PB-6	PB-7
Depth (ft)	107-109	39-41	82-84	98-99.3	122-124
Sample No.	NA	NA	NA	NA	NA
Tare Number	65	43	5	18	40
Wt. of Tare & WS (gm)	57.82	52.19	57.62	40.36	54.51
Wt. of Tare & DS (gm)	52.54	44.8	51.44	34.61	48.82
Wt. of Tare (gm)	8.72	8.3	8.47	8.28	8.38
Wt. of Water (gm)	5.28	7.39	6.18	5.75	5.69
Wt. of DS (gm)	43.82	36.5	42.97	26.33	40.44
Water Content (%)	**12.0**	**20.2**	**14.4**	**21.8**	**14.1**

Alluv. Resid.

Lab ID	17	18	19	20	21
Boring No.	PB-7	PB-7	PB-8	SB-4	SB-4
Depth (ft)	107-109	117-119	147-149	2.5-4.5	0-2
Sample No.	NA	NA	NA	S2	S1
Tare Number	45	21	30	7	11
Wt. of Tare & WS (gm)	50.14	50.62	50.4	57.91	163.48
Wt. of Tare & DS (gm)	42.16	45.07	45.16	49.54	133.68
Wt. of Tare (gm)	8.52	8.28	8.41	8.16	8.51
Wt. of Water (gm)	7.98	5.55	5.24	8.37	29.8
Wt. of DS (gm)	33.64	36.79	36.75	41.38	125.17
Water Content (%)	**23.7**	**15.1**	**14.3**	**20.2**	**23.8**

Alluv. Alluv. Alluv. Resid. Alluv. Resid.

Notes : *NA*

Tested By PC *Date* 5/22/12 *Checked By* JW *Date* 5/23/12

DCN: CT-S1 DATE 1-21-10 REVISION: 3

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MOISTURE CONTENT

ASTM D 2216-05 (SOP-S1)

Client	URS
Client Reference	AEP BIG SANDY LF 13815141
Project No.	2012-245-01

Lab ID	22	23	24	25	26
Boring No.	SB-4	SB-6	SB-6	SB-7	HB-5
Depth (ft)	5-7	2.5-4.5	5-7	5-7	4-6
Sample No.	S3	S2	S3	S3	NA
Tare Number	9	51	23	22	20
Wt. of Tare & WS (gm)	250.31	64.02	48.19	46.92	114.78
Wt. of Tare & DS (gm)	223.2	52.45	39.1	43.29	100.23
Wt. of Tare (gm)	8.25	8.38	8.28	8.42	8.35
Wt. of Water (gm)	27.11	11.57	9.09	3.63	14.55
Wt. of DS (gm)	214.95	44.07	30.82	34.87	91.88
Water Content (%)	**12.6**	**26.3**	**29.5**	**10.4**	**15.8**

Resid.

Lab ID	27
Boring No.	HB-5
Depth (ft)	6-8
Sample No.	NA
Tare Number	32
Wt. of Tare & WS (gm)	153.13
Wt. of Tare & DS (gm)	133.07
Wt. of Tare (gm)	8.72
Wt. of Water (gm)	20.06
Wt. of DS (gm)	124.35
Water Content (%)	**16.1**

Resid.

Resid.

Resid.

Resid.

Resid.

Notes : *NA*

Tested By *PC* *Date* *5/22/12* *Checked By* JW *Date* 5/23/12

DCN: CT-S1 DATE 1-21-10 REVISION: 3

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A P P E N D I X B.4B

RESIDUUM – GRAIN SIZE DISTRIBUTION

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PERCENT PASSING # 200 SIEVE

ASTM D 1140-00 (SOP-S54)

Client	URS CORPORATION
Client Reference	AEP Big Sandy LF 13815141
Project No.	2012-245-01

Lab Id.	01	02	15	20	23	
Boring No.	HB-1	HB-2 / SB-1	PB-6	SB-4	SB-6	
Depth (ft)	2-4	8-10	98-99.3	2.5-4.5	2.5-4.5	
Sample No.	NA	NA	NA	S2	S2	
Tare Number	1416	1423	1438	1450	1433	
Wt. of Tare & WS (gm)	342.49	335.22	284.48	279.13	283.66	
Wt. of Tare & DS (gm)	342.49	335.22	284.48	279.13	283.66	
Wt. of Tare (gm)	145.7	143.89	144.62	144.97	144.74	
Wt. of Water (gm)	0	0	0	0	0	
Wt. of DS (gm)	196.79	191.33	139.86	134.16	138.92	
Water Content (%)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	
Wt. of Washed Soil & Tare	208.81	161.13	199.65	149.7	159.12	
Percent Passing #200	**67.9**	**91.0**	**60.7**	**96.5**	**89.6**	
		Resid.				Resid.

Lab Id.	25	26	27	
Boring No.	SB-7	HB-5	HB-5	
Depth (ft)	5-7	4-6	6-8	
Sample No.	S3	NA	NA	
Tare Number	1447	1418	1449	
Wt. of Tare & WS (gm)	277.55	633.87	824.39	
Wt. of Tare & DS (gm)	277.55	633.87	824.39	
Wt. of Tare (gm)	145.46	145.25	145.64	
Wt. of Water (gm)	0	0	0	
Wt. of DS (gm)	132.09	488.62	678.75	
Water Content (%)	**0.0**	**0.0**	**0.0**	
Wt. of Washed Soil & Tare	182.88	401.5	488.6	
Percent Passing #200	**71.7**	**47.6**	**49.5**	
	Resid.	Resid.	Resid.	Resid.
			Alluv.	
			Resid.	
			Resid.	

Tested By JP *Date* 6/5/12 *Checked By* KC *Date* 6-7-12

DCN: CT-S54 DATE: 12/30/05 REVISION: 3

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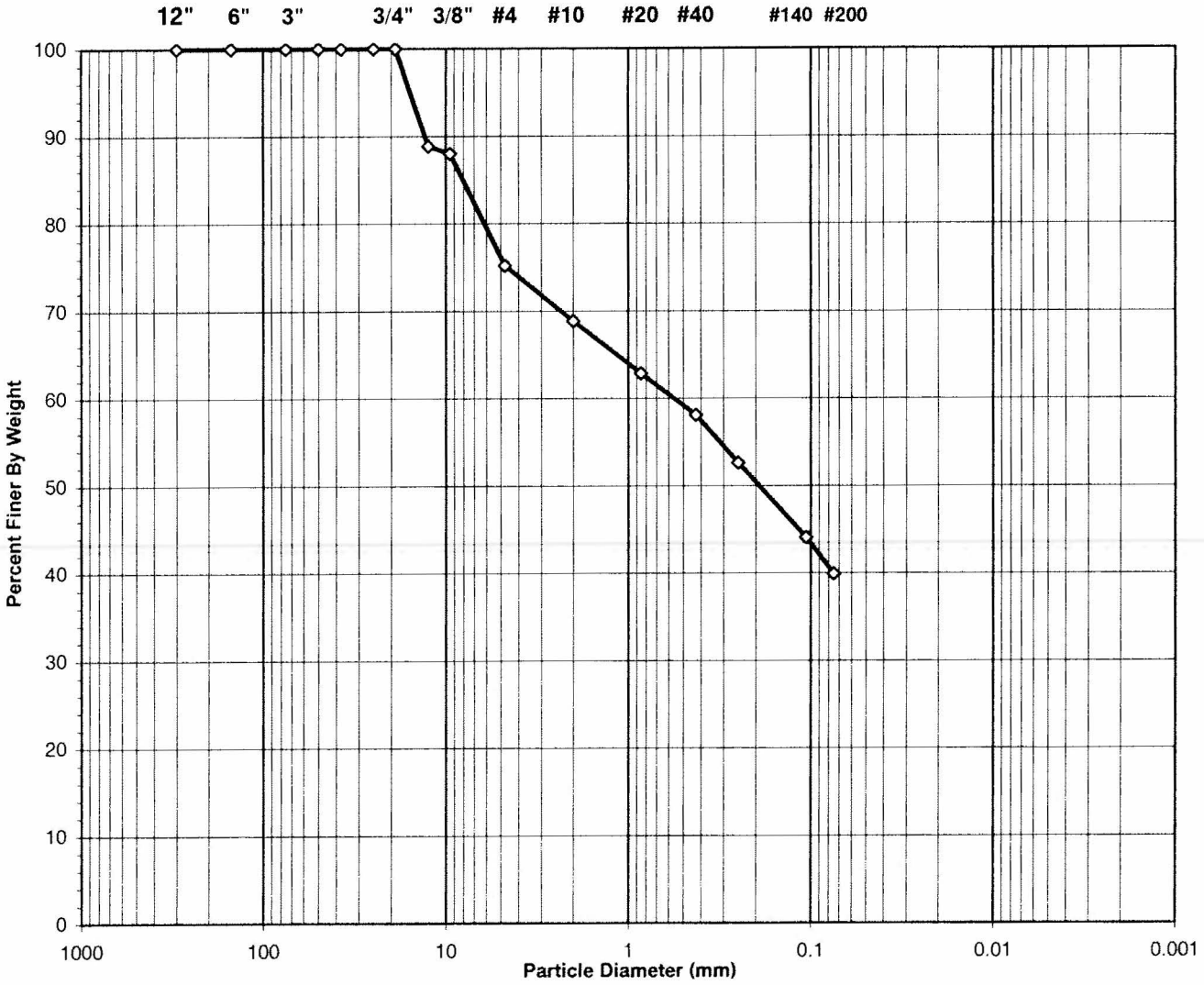
SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-4
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	107-109
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-11	Soil Color	**BROWN / GRAY**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND WITH GRAVEL***

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-4
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	107-109
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-11	Soil Color	**BROWN / GRAY**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1439	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	302.60	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	302.60	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.63	Weight of Tare (gm)	NA
Weight of Water (gm)	0.00	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	156.97	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**0.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	156.97
Dry Weight - 3/4" Sample (gm)	94.4	Weight of minus #200 material (gm)	62.62
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	94.35
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	17.50	11.15	11.15	88.85	**88.85**
3/8"	9.50	1.36	0.87	12.02	87.98	**87.98**
#4	4.75	20.10	12.80	24.82	75.18	**75.18**
#10	2.00	9.96	6.35	31.17	68.83	**68.83**
#20	0.850	9.40	5.99	37.15	62.85	**62.85**
#40	0.425	7.45	4.75	41.90	58.10	**58.10**
#60	0.250	8.61	5.49	47.38	52.62	**52.62**
#140	0.106	13.41	8.54	55.93	44.07	**44.07**
#200	0.075	6.56	4.18	60.11	39.89	**39.89**
Pan	-	62.62	39.89	100.00	-	-

Tested By MC Date 6/4/12 Checked By KC Date 6-4-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-5
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	52-54
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-13	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay

USCS Symbol ***sc, ASSUMED***

USCS Classification ***CLAYEY SAND***

Tested By PC Date 5/30/12 Checked By KC Date 5-31-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-5
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	52-54
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-13	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1453	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	390.13	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	363.62	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.58	Weight of Tare (gm)	NA
Weight of Water (gm)	26.51	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	218.04	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**12.2**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	218.04
Dry Weight - 3/4" Sample (gm)	132.3	Weight of minus #200 material (gm)	85.79
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	132.25
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	8.75	4.01	4.01	95.99	**95.99**
#10	2.00	10.36	4.75	8.76	91.24	**91.24**
#20	0.850	6.82	3.13	11.89	88.11	**88.11**
#40	0.425	34.59	15.86	27.76	72.24	**72.24**
#60	0.250	42.93	19.69	47.45	52.55	**52.55**
#140	0.106	23.58	10.81	58.26	41.74	**41.74**
#200	0.075	5.22	2.39	60.65	39.35	**39.35**
Pan	-	85.79	39.35	100.00	-	-

Tested By PC Date 5/30/12 Checked By KC Date 5-31-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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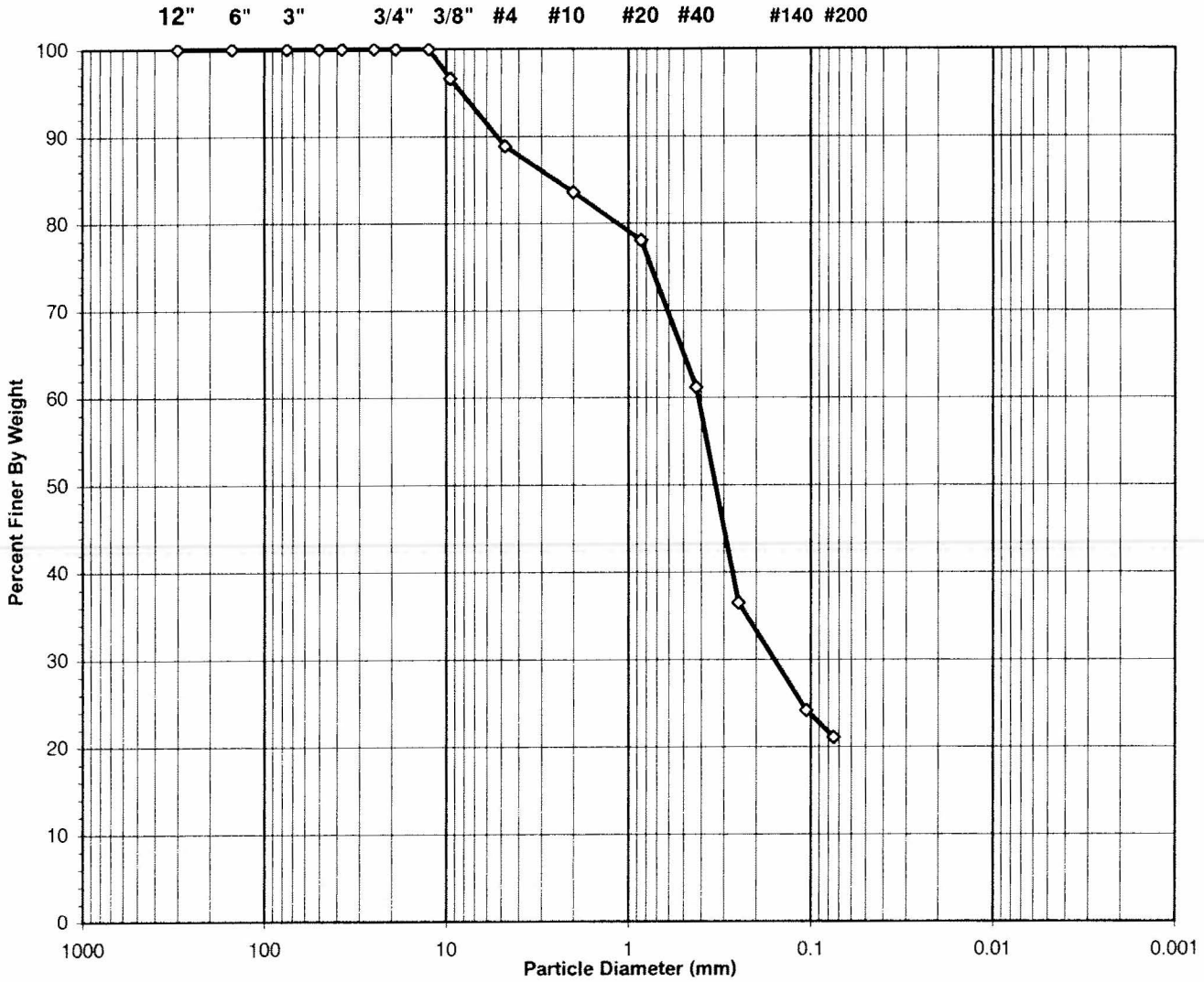
SIEVE ANALYSIS
ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-7
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	122-124
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-16	Soil Color	**BROWN**

	SIEVE ANALYSIS		HYDROMETER
USCS	gravel	sand	silt and clay



USCS Symbol ***sm, ASSUMED***

USCS Classification ***SILTY SAND***

UNABLE TO RUN HYDROMETER

Tested By MC Date 6/8/12 Checked By VC Date 6-8-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007) SOP-S3

Client	URS CORPORATION	Boring No.	PB-7
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	122-124
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-16	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1427	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	367.08	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	341.01	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	145.66	Weight of Tare (gm)	NA
Weight of Water (gm)	26.07	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	195.35	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**13.3**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	195.35
Dry Weight - 3/4" Sample (gm)	154.2	Weight of minus #200 material (gm)	41.15
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	154.20
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	6.58	3.37	3.37	96.63	**96.63**
#4	4.75	15.13	7.75	11.11	88.89	**88.89**
#10	2.00	10.38	5.31	16.43	83.57	**83.57**
#20	0.850	10.82	5.54	21.97	78.03	**78.03**
#40	0.425	32.90	16.84	38.81	61.19	**61.19**
#60	0.250	48.23	24.69	63.50	36.50	**36.50**
#140	0.106	24.07	12.32	75.82	24.18	**24.18**
#200	0.075	6.09	3.12	78.94	21.06	**21.06**
Pan	-	41.15	21.06	100.00	-	-

Tested By MC Date 6/8/12 Checked By KC Date 6-8-12

DCN: CT-S3C DATE 6-25-98 REVISION: 2

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A P P E N D I X B.4C

RESIDUUM – ATTERBERG LIMITS

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	HB-1
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	2-4
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-01	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

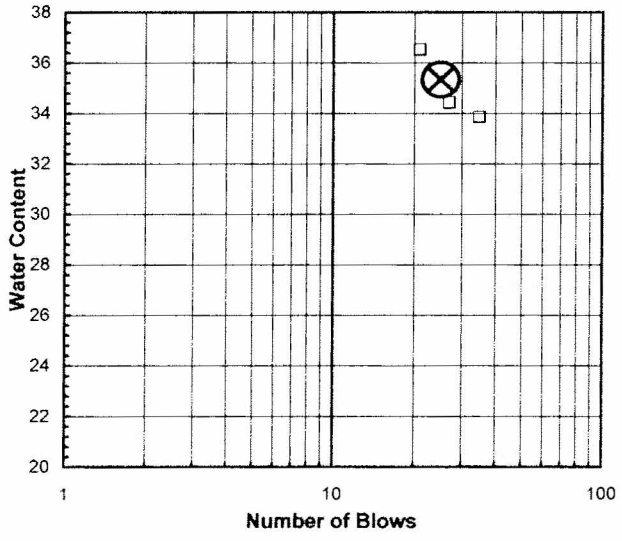
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	279	284	378	**U**
Wt. of Tare & WS (gm)	39.28	39.88	35.10	**L**
Wt. of Tare & DS (gm)	33.76	34.37	29.02	**T**
Wt. of Tare (gm)	17.45	18.36	12.37	**I**
Wt. of Water (gm)	5.5	5.5	6.1	**P**
Wt. of DS (gm)	16.3	16.0	16.7	**O**
				I
Moisture Content (%)	**33.8**	**34.4**	**36.5**	**N**
Number of Blows	**35**	**27**	**21**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	387	388	
Wt. of Tare & WS (gm)	25.30	17.69	
Wt. of Tare & DS (gm)	24.38	16.68	
Wt. of Tare (gm)	18.96	11.03	
Wt. of Water (gm)	0.9	1.0	
Wt. of DS (gm)	5.4	5.7	
Moisture Content (%)	**17.0**	**17.9**	**-0.9**

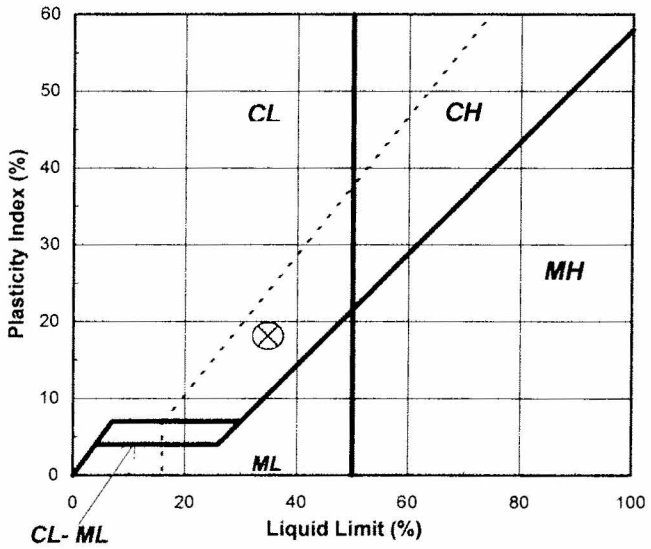
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**35**
Plastic Limit (%)	**17**
Plasticity Index (%)	**18**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By JP *Date* 6/1/12 *Checked By* VC *Date* 6-4-12

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	HB-2 / SB-1
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	8-10
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-02	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

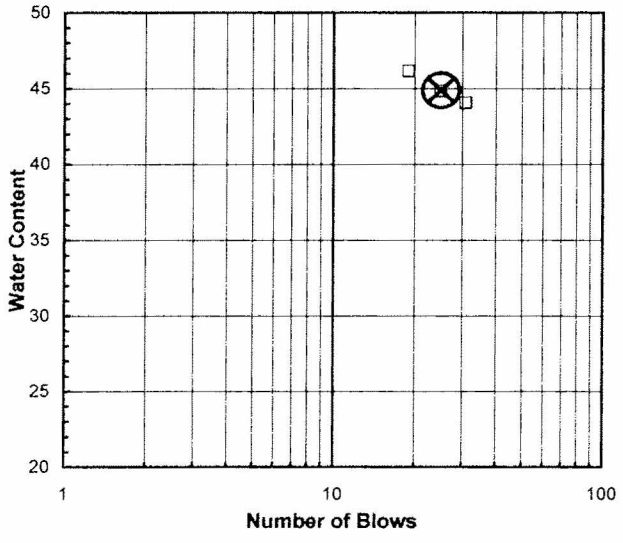
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	117	329	380	**U**
Wt. of Tare & WS (gm)	42.12	39.39	33.95	**L**
Wt. of Tare & DS (gm)	35.42	32.87	27.22	**T**
Wt. of Tare (gm)	20.20	18.32	12.63	**I**
Wt. of Water (gm)	6.7	6.5	6.7	**P**
Wt. of DS (gm)	15.2	14.6	14.6	**O**
				I
Moisture Content (%)	**44.0**	**44.8**	**46.1**	**N**
Number of Blows	**31**	**25**	**19**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	410	411	
Wt. of Tare & WS (gm)	17.09	19.91	
Wt. of Tare & DS (gm)	16.04	18.85	
Wt. of Tare (gm)	10.92	13.79	
Wt. of Water (gm)	1.1	1.1	
Wt. of DS (gm)	5.1	5.1	
Moisture Content (%)	**20.5**	**20.9**	**-0.4**

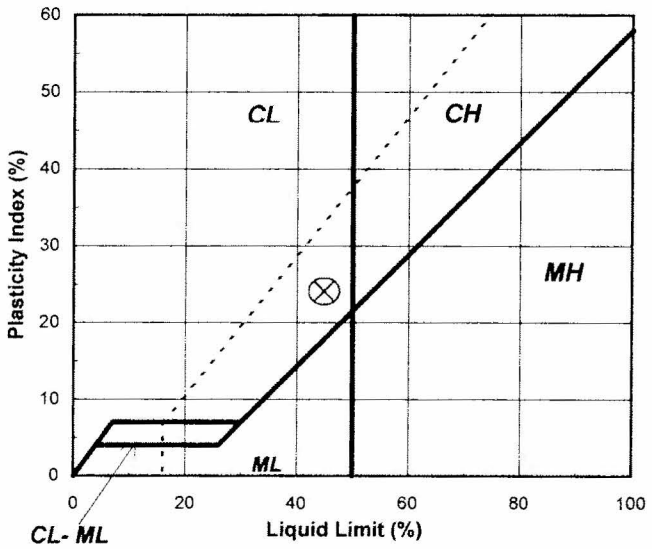
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**45**
Plastic Limit (%)	**21**
Plasticity Index (%)	**24**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By JP *Date* 6/1/12 *Checked By* KC *Date* 6-4-12

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	PB-2
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	70-72
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-10	Soil Description	**BROWN / GRAY SILTY CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

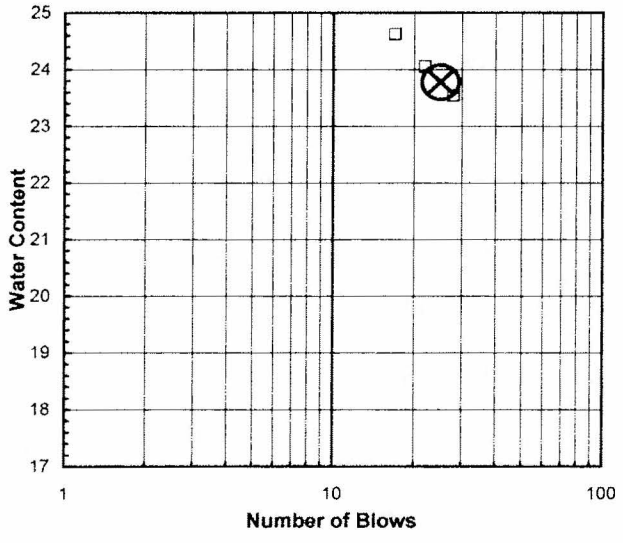
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	365	366	393	**U**
Wt. of Tare & WS (gm)	39.49	39.83	37.47	**L**
Wt. of Tare & DS (gm)	34.62	35.41	33.33	**T**
Wt. of Tare (gm)	13.93	17.03	16.51	**I**
Wt. of Water (gm)	4.9	4.4	4.1	**P**
Wt. of DS (gm)	20.7	18.4	16.8	**O**
				I
Moisture Content (%)	**23.5**	**24.0**	**24.6**	**N**
Number of Blows	**28**	**22**	**17**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	2301	2303	
Wt. of Tare & WS (gm)	26.71	25.51	
Wt. of Tare & DS (gm)	25.73	24.46	
Wt. of Tare (gm)	19.80	18.38	
Wt. of Water (gm)	1.0	1.1	
Wt. of DS (gm)	5.9	6.1	
Moisture Content (%)	**16.5**	**17.3**	**-0.7**

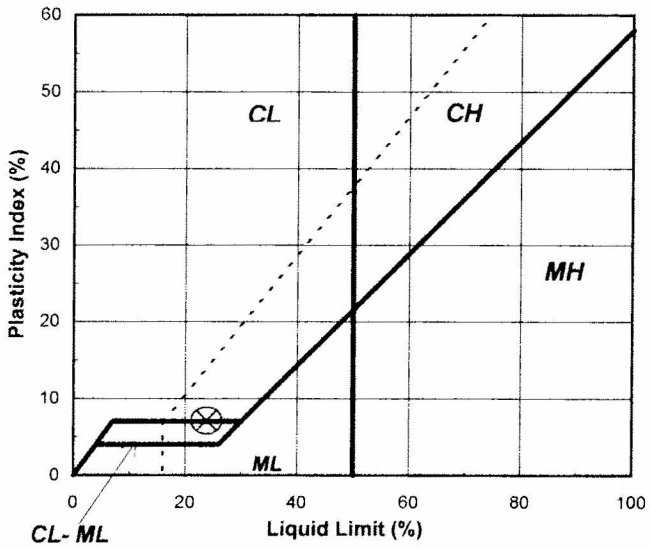
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**24**
Plastic Limit (%)	**17**
Plasticity Index (%)	**7**
USCS Symbol	**CL-ML**

Flow Curve



Plasticity Chart



Tested By MC *Date* 6/1/12 *Checked By* MC *Date* 6-4-12

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	PB-4
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	107-109
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-11	Soil Description	**BROWN / GRAY LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

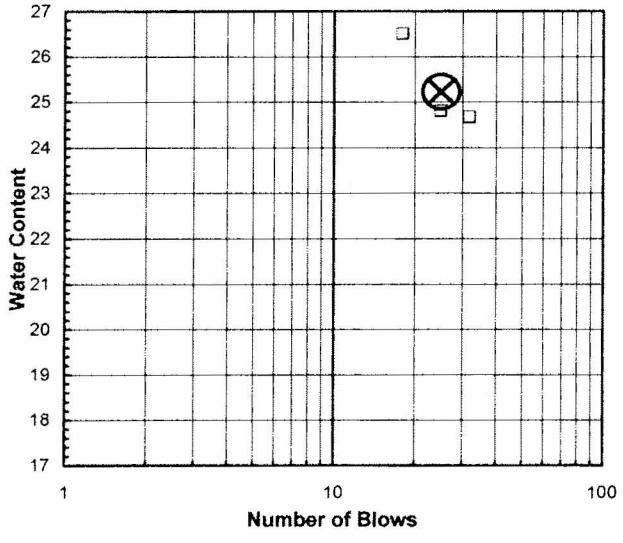
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	40A	31	392	**U**
Wt. of Tare & WS (gm)	33.24	34.55	27.10	**L**
Wt. of Tare & DS (gm)	30.11	31.55	24.45	**T**
Wt. of Tare (gm)	17.42	19.45	14.45	**I**
Wt. of Water (gm)	3.1	3.0	2.7	**P**
Wt. of DS (gm)	12.7	12.1	10.0	**O**
				I
Moisture Content (%)	**24.7**	**24.8**	**26.5**	**N**
Number of Blows	**32**	**25**	**18**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	317	355	
Wt. of Tare & WS (gm)	24.82	24.43	
Wt. of Tare & DS (gm)	24.03	23.61	
Wt. of Tare (gm)	18.74	18.18	
Wt. of Water (gm)	0.8	0.8	
Wt. of DS (gm)	5.3	5.4	
Moisture Content (%)	**14.9**	**15.1**	**-0.2**

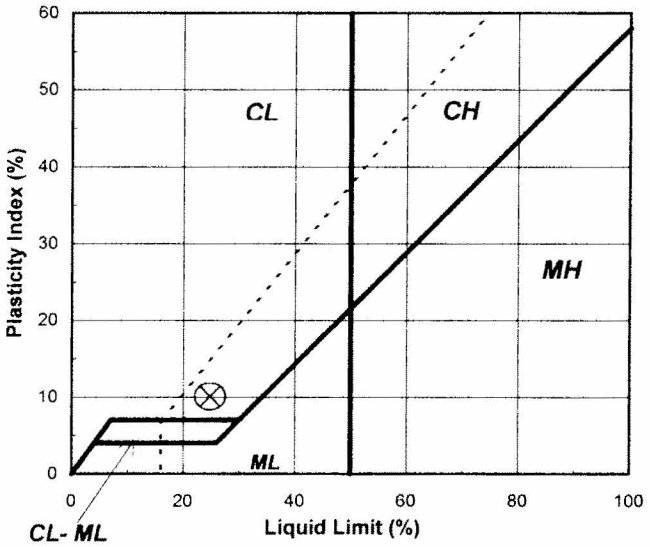
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**25**
Plastic Limit (%)	**15**
Plasticity Index (%)	**10**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	SB-4
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	2.5-4.5
Project No.	2012-245-01	Sample No.	S2
Lab ID	2012-245-01-20	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

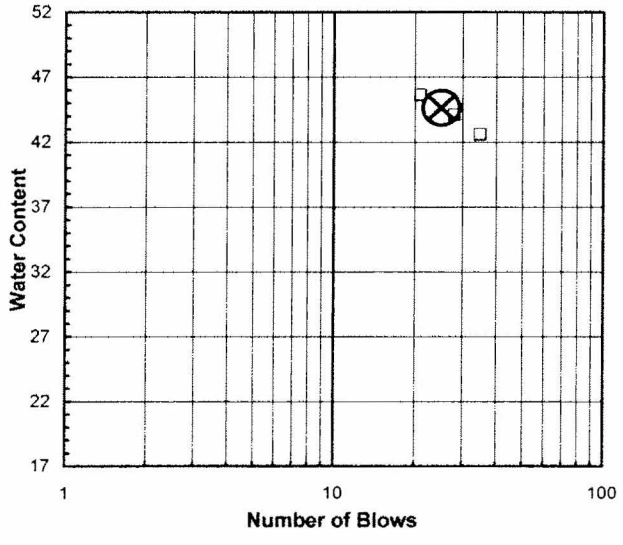
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	363	367	416	**U**
Wt. of Tare & WS (gm)	39.78	42.88	35.71	**L**
Wt. of Tare & DS (gm)	32.60	36.00	28.86	**T**
Wt. of Tare (gm)	15.73	20.39	13.84	**I**
Wt. of Water (gm)	7.2	6.9	6.9	**P**
Wt. of DS (gm)	16.9	15.6	15.0	**O**
				I
Moisture Content (%)	**42.6**	**44.1**	**45.6**	**N**
Number of Blows	**35**	**28**	**21**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	354	394	
Wt. of Tare & WS (gm)	24.85	21.14	
Wt. of Tare & DS (gm)	23.65	19.80	
Wt. of Tare (gm)	18.45	14.07	
Wt. of Water (gm)	1.2	1.3	
Wt. of DS (gm)	5.2	5.7	
Moisture Content (%)	**23.1**	**23.4**	**-0.3**

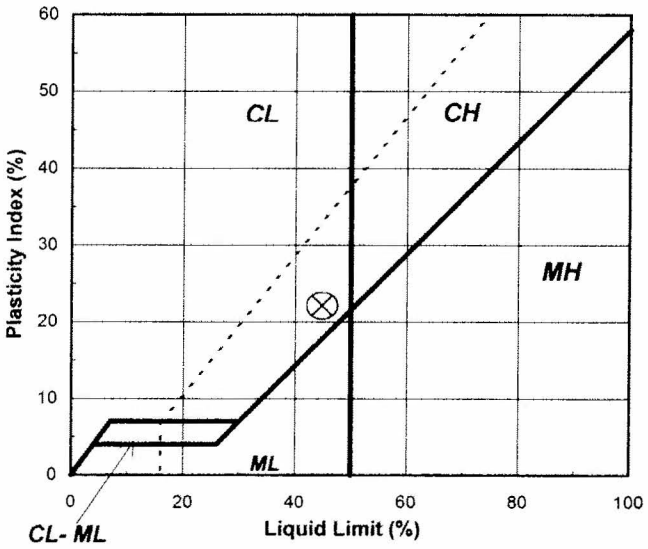
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**45**
Plastic Limit (%)	**23**
Plasticity Index (%)	**22**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	SB-6
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	2.5-4.5
Project No.	2012-245-01	Sample No.	S2
Lab ID	2012-245-01-23	Soil Description	**BROWN FAT CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**
Tare Number	120	403	404
Wt. of Tare & WS (gm)	33.73	34.51	34.52
Wt. of Tare & DS (gm)	27.84	28.44	27.87
Wt. of Tare (gm)	17.87	18.59	17.32
Wt. of Water (gm)	5.9	6.1	6.7
Wt. of DS (gm)	10.0	9.9	10.6
Moisture Content (%)	**59.1**	**61.6**	**63.0**
Number of Blows	**32**	**27**	**21**

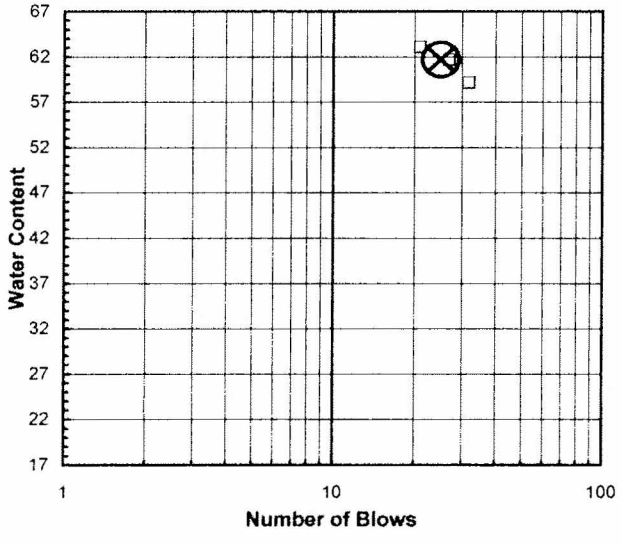
MULTIPOINT

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	409	412	
Wt. of Tare & WS (gm)	20.92	25.55	
Wt. of Tare & DS (gm)	19.71	24.34	
Wt. of Tare (gm)	14.88	19.42	
Wt. of Water (gm)	1.2	1.2	
Wt. of DS (gm)	4.8	4.9	
Moisture Content (%)	**25.1**	**24.6**	**0.5**

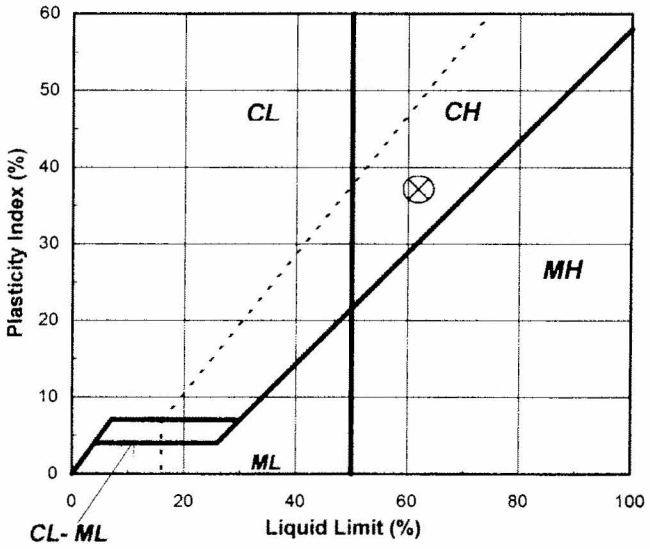
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**62**
Plastic Limit (%)	**25**
Plasticity Index (%)	**37**
USCS Symbol	**CH**

Flow Curve



Plasticity Chart



Tested By MC *Date* 6/1/12 *Checked By* KC *Date* 6-4-12

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INTEGRITY IN TESTING

ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	SB-6
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	5-7
Project No.	2012-245-01	Sample No.	S3
Lab ID	2012-245-01-24	Soil Description	**BROWN/BLACK FAT CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

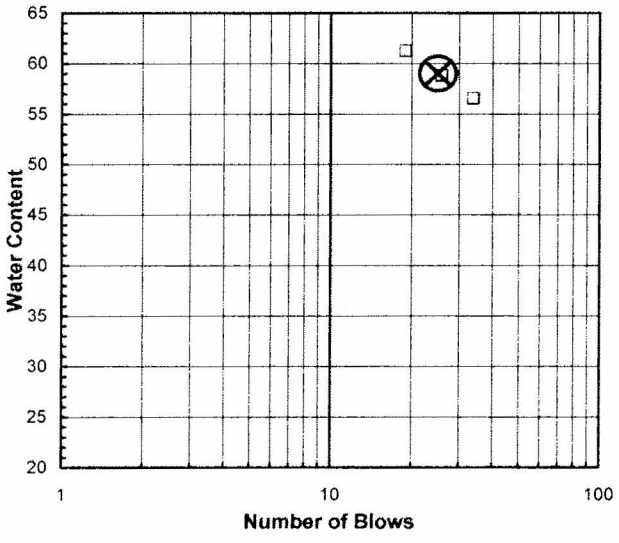
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	38	297	319	**U**
Wt. of Tare & WS (gm)	39.07	38.83	38.62	**L**
Wt. of Tare & DS (gm)	31.58	31.05	30.90	**T**
Wt. of Tare (gm)	18.33	17.81	18.29	**I**
Wt. of Water (gm)	7.5	7.8	7.7	**P**
Wt. of DS (gm)	13.3	13.2	12.6	**O**
				I
Moisture Content (%)	**56.5**	**58.8**	**61.2**	**N**
Number of Blows	**34**	**26**	**19**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	394	421	
Wt. of Tare & WS (gm)	20.13	25.71	
Wt. of Tare & DS (gm)	18.71	24.30	
Wt. of Tare (gm)	14.06	19.57	
Wt. of Water (gm)	1.4	1.4	
Wt. of DS (gm)	4.7	4.7	
Moisture Content (%)	**30.5**	**29.8**	**0.7**

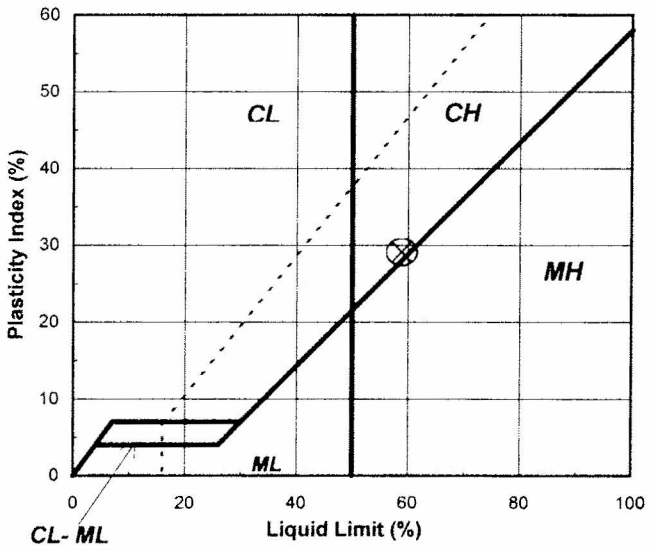
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**59**
Plastic Limit (%)	**30**
Plasticity Index (%)	**29**
USCS Symbol	**CH**

Flow Curve



Plasticity Chart



Tested By BS *Date* 6/5/12 *Checked By* KC *Date* 6-6-12

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INTEGRITY IN TESTING

ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	SB-7
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	5-7
Project No.	2012-245-01	Sample No.	S3
Lab ID	2012-245-01-25	Soil Description	**BROWN SILT**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

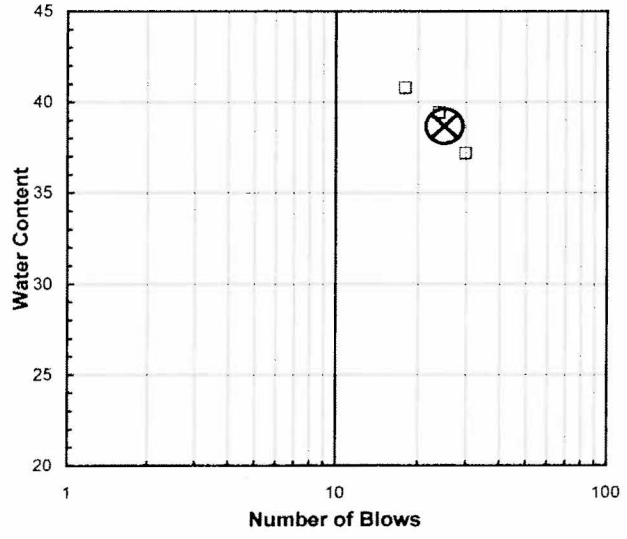
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	367	390	414	**U**
Wt. of Tare & WS (gm)	40.56	35.73	37.78	**L**
Wt. of Tare & DS (gm)	35.09	29.97	30.80	**T**
Wt. of Tare (gm)	20.37	15.35	13.68	**I**
Wt. of Water (gm)	5.5	5.8	7.0	**P**
Wt. of DS (gm)	14.7	14.6	17.1	**O**
				I
Moisture Content (%)	**37.2**	**39.4**	**40.8**	**N**
Number of Blows	**30**	**24**	**18**	T

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	117	329	
Wt. of Tare & WS (gm)	26.14	24.40	
Wt. of Tare & DS (gm)	25.22	23.61	
Wt. of Tare (gm)	20.11	19.48	
Wt. of Water (gm)	0.9	0.8	
Wt. of DS (gm)	5.1	4.1	
Moisture Content (%)	**18.0**	**19.1**	**-1.1**

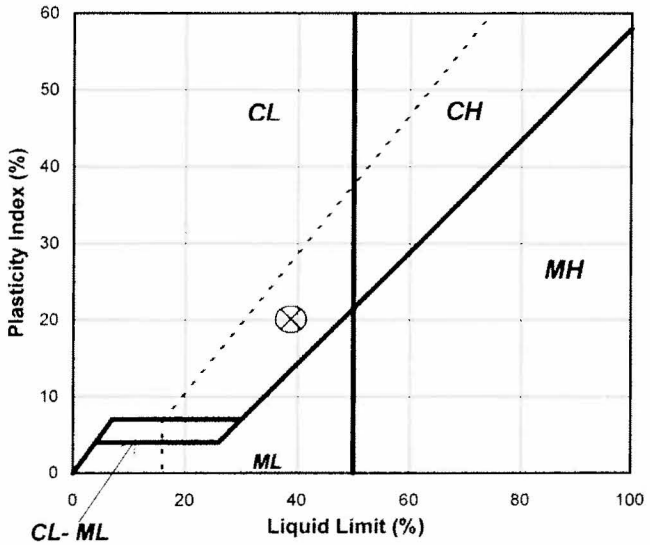
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**39**
Plastic Limit (%)	**19**
Plasticity Index (%)	**20**
USCS Symbol	**ML**

Flow Curve



Plasticity Chart



Tested By MC *Date* 6/4/12 *Checked By* Jam *Date* 6-5-12

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	HB-5
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	4-6
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-26	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

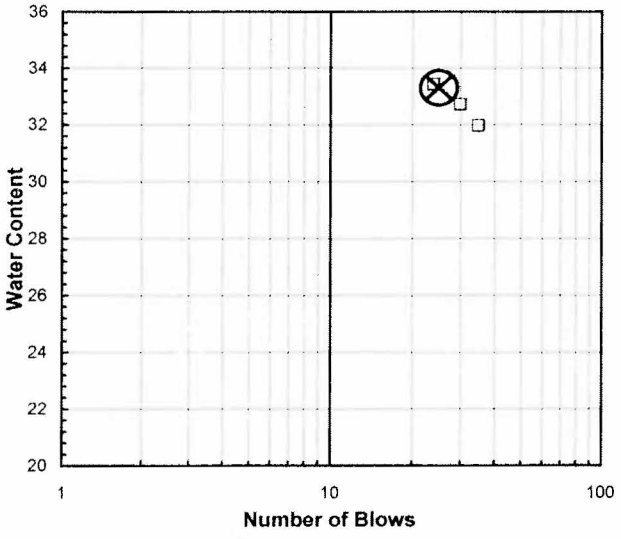
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	120	310	404	**U**
Wt. of Tare & WS (gm)	41.17	38.97	39.29	**L**
Wt. of Tare & DS (gm)	35.53	33.99	33.79	**T**
Wt. of Tare (gm)	17.88	18.76	17.33	**I**
Wt. of Water (gm)	5.6	5.0	5.5	**P**
Wt. of DS (gm)	17.7	15.2	16.5	**O**
				I
Moisture Content (%)	**32.0**	**32.7**	**33.4**	**N**
Number of Blows	**35**	**30**	**24**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	387	389	
Wt. of Tare & WS (gm)	25.00	21.14	
Wt. of Tare & DS (gm)	24.13	20.22	
Wt. of Tare (gm)	18.97	14.61	
Wt. of Water (gm)	0.9	0.9	
Wt. of DS (gm)	5.2	5.6	
Moisture Content (%)	**16.9**	**16.4**	**0.5**

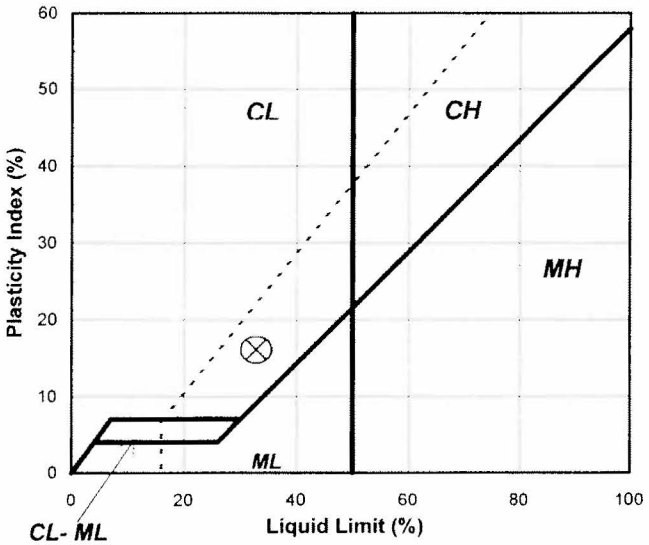
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**33**
Plastic Limit (%)	**17**
Plasticity Index (%)	**16**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By JP *Date* 6/4/12 *Checked By* Jm *Date* 6-5-12

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ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89 (SOP - S4A)

Client	URS CORPORATION	Boring No.	HB-5
Client Reference	AEP Big Sandy LF 13815141	Depth (ft)	6-8
Project No.	2012-245-01	Sample No.	NA
Lab ID	2012-245-01-27	Soil Description	**BROWN LEAN CLAY**

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

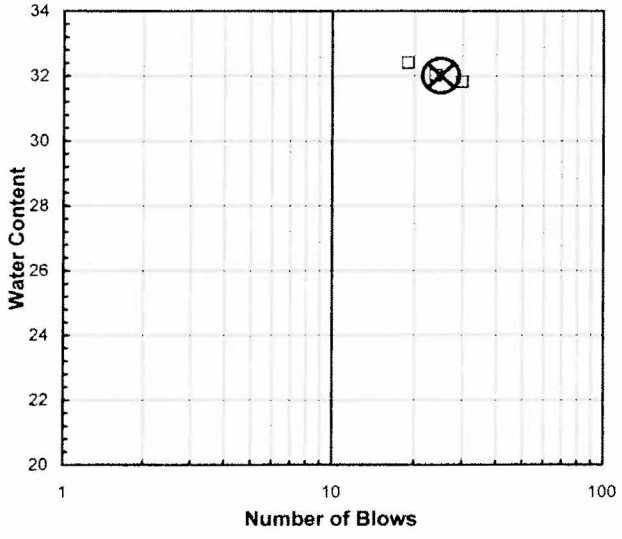
Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	378	402	429	**U**
Wt. of Tare & WS (gm)	32.84	34.44	33.40	**L**
Wt. of Tare & DS (gm)	27.90	28.47	27.86	**T**
Wt. of Tare (gm)	12.37	9.82	10.76	**I**
Wt. of Water (gm)	4.9	6.0	5.5	**P**
Wt. of DS (gm)	15.5	18.7	17.1	**O**
				I
Moisture Content (%)	**31.8**	**32.0**	**32.4**	**N**
Number of Blows	**30**	**24**	**19**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	359	392	
Wt. of Tare & WS (gm)	19.36	20.82	
Wt. of Tare & DS (gm)	18.52	19.94	
Wt. of Tare (gm)	12.98	14.44	
Wt. of Water (gm)	0.8	0.9	
Wt. of DS (gm)	5.5	5.5	
Moisture Content (%)	**15.2**	**16.0**	**-0.8**

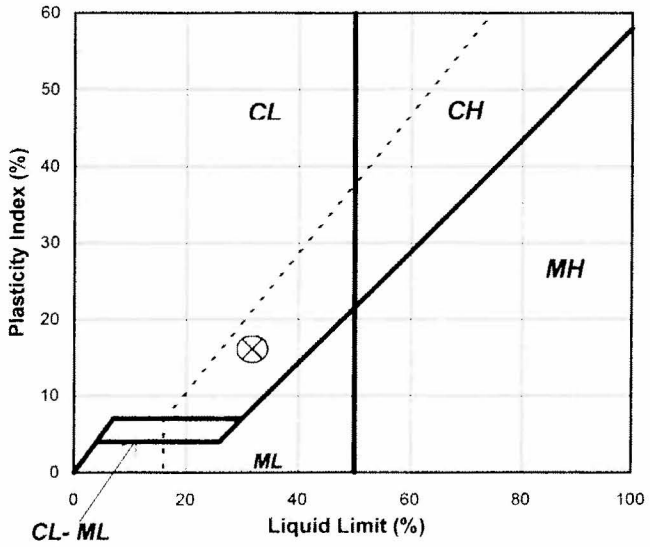
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**32**
Plastic Limit (%)	**16**
Plasticity Index (%)	**16**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By JW *Date* 6/4/12 *Checked By* [signature] *Date* 6-5-12

A P P E N D I X B.5

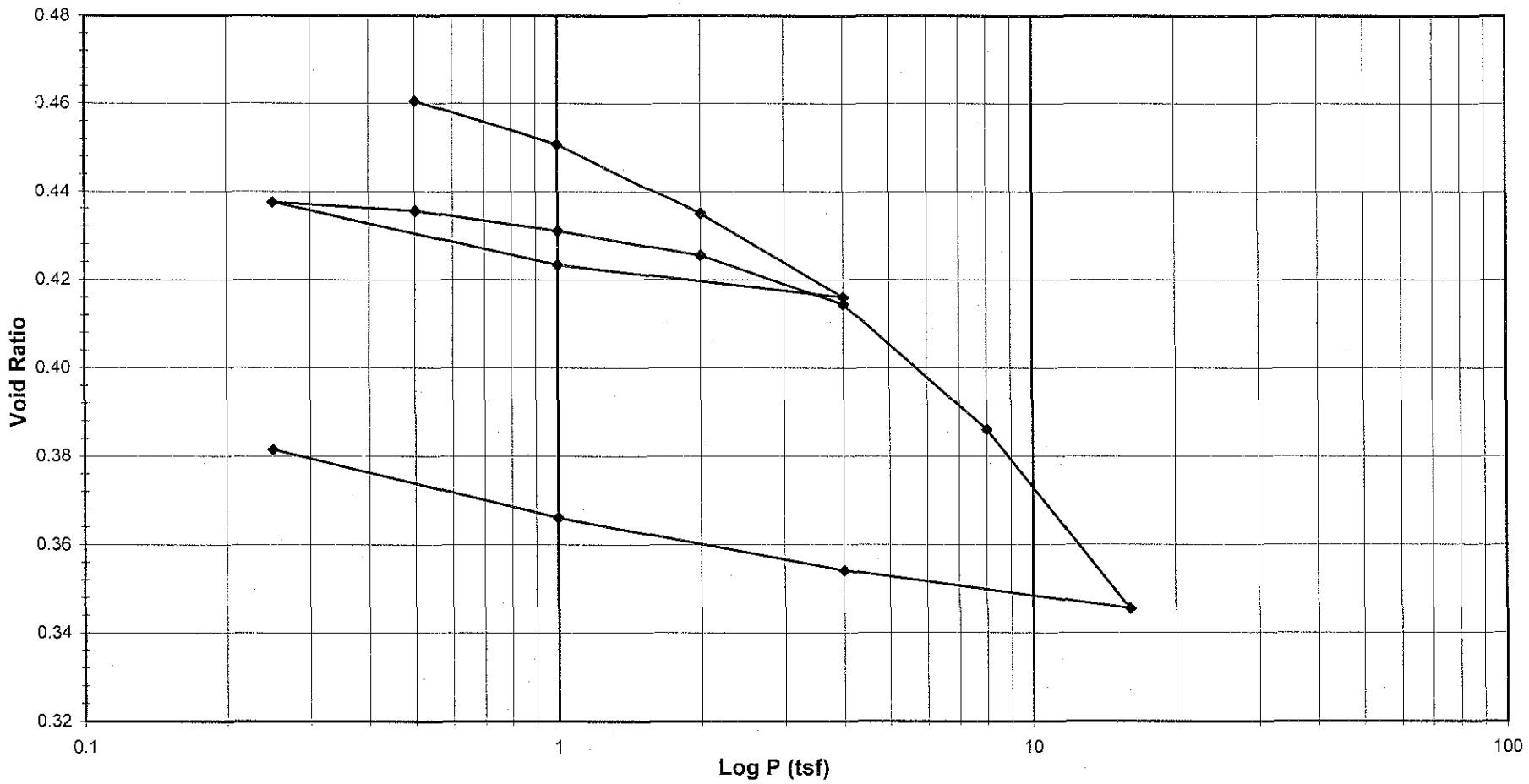
BORROW MATERIALS – CONSOLIDATION

ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Reference	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED



Tested By DB *Date* 11/4/12 *Approved By* TM *Date* 11-12-12

DCN: CT-24E Date: 5/3/12 Revision: 6 *C:\Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]FINAL PLOT*

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ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Reference	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED
Consolidometer No. G1424
1 Division = 0.0001 (in.)

Sample Properties	**Initial**	**Final**
Water Content		
Tare Number	2546	2548
Wt. Tare & WS (gm)	106.17	175.46
Wt. Tare & DS (gm)	96.63	153.27
Wt. Water (gm)	9.54	22.19
Wt. Tare (gm)	6.66	6.63
Wt. DS (gm)	89.97	146.64
Water Content (%)	10.60	15.13
Sample Parameters		
Sample Diameter (in)	2.5	2.5
Sample Height (in)	1.0000	0.9315
Sample Volume (cc)	80.44	74.93
Wt. Wet Sample + Ring (gm)	376.22	382.85
Wt. of Ring (gm)	214.25	214.25
Wt. of Wet Sample (gm)	161.97	168.60
Wet Density (pcf)	125.65	140.41
Wet Density (g/cc)	2.01	2.25
Water Content (%)	10.60	15.13
Wt. of Dry Sample (gm)	146.44	146.44
Dry Density (pcf)	113.60	121.95
Dry Density (g/cc)	1.82	1.95
Void Ratio	0.4831	0.3815
Saturation (%)	59.26	107.10
Specific Gravity	2.70	*Assumed*

Test Data Summary

Applied Pressure (tsf)	**Final Dial Reading** (div)	**Machine Deflection** (div)	**Corrected Reading** (div)	**Height of Sample** (mm)	**Volume** (cc)	**Dry Density** (g/cc)	**Void Ratio**
Seating	0	0	0	25.400	80.440	1.82052	**0.48310**
0.25	156.8	17.7	139.1	25.047	79.321	1.84620	**0.46246**
0.5	186.1	33.7	152.5	25.013	79.213	1.84870	**0.46048**
1	267.3	49.2	218.1	24.846	78.686	1.86110	**0.45075**
2	399.5	74.0	325.5	24.573	77.822	1.88177	**0.43482**
4	561.5	109.0	452.5	24.251	76.800	1.90680	**0.41599**
1	468.4	65.2	403.2	24.376	77.197	1.89699	**0.42330**
0.25	341.5	33.0	308.5	24.617	77.959	1.87846	**0.43735**
0.5	359.7	38.1	321.6	24.583	77.852	1.88102	**0.43539**
1	403.3	51.7	351.6	24.507	77.611	1.88686	**0.43095**
2	464.6	75.8	388.8	24.412	77.312	1.89416	**0.42544**
4	573.0	109.6	463.4	24.223	76.713	1.90897	**0.41438**
8	812.6	158.1	654.5	23.738	75.175	1.94802	**0.38602**
16	1155.8	228.0	927.8	23.043	72.976	2.00670	**0.34549**
4	1016.0	146.5	869.5	23.191	73.446	1.99388	**0.35414**
1	863.2	73.7	789.5	23.395	74.089	1.97657	**0.36600**
0.25	724.4	39.4	685.0	23.660	74.929	1.95440	**0.38150**

Tested By DB *Date* 11/4/12 *Input Checked By* TM *Date* 11-12-12

DCN: CT-24E Date: 5/3/12 Revision: 6 *C:\Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]FINAL PLOT*

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ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

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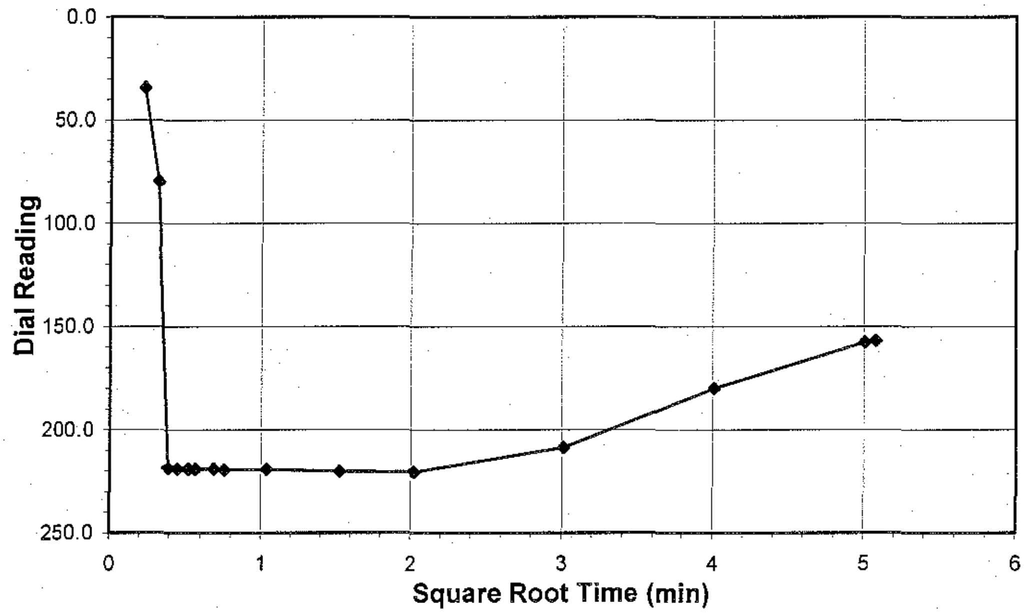
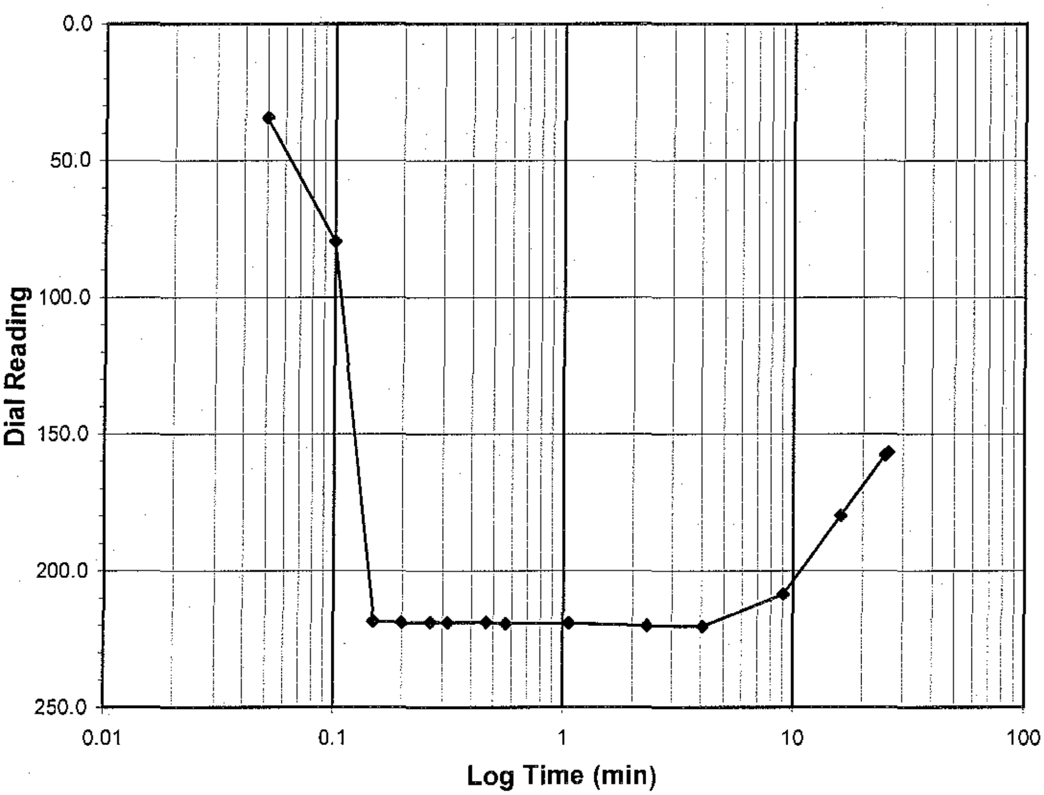
Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED



Test Load	**(tsf)**	**0.0-0.25**
Final Reading	**(div)**	**156.8**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/4/12
Start Time		18:03:07

Elapsed Time (min)	Dial Reading (div)
Initial	**0.0**
0.05	34.2
0.10	79.6
0.15	218.5
0.20	218.9
0.27	218.9
0.32	218.9
0.47	218.9
0.57	219.3
1.07	219.2
2.32	220.1
4.07	220.4
9.07	208.5
16.07	179.8
25.07	157.6
25.78	156.8



Tested By DB *Date* 11/4/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Date: 5/0 ... and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]STEP 1

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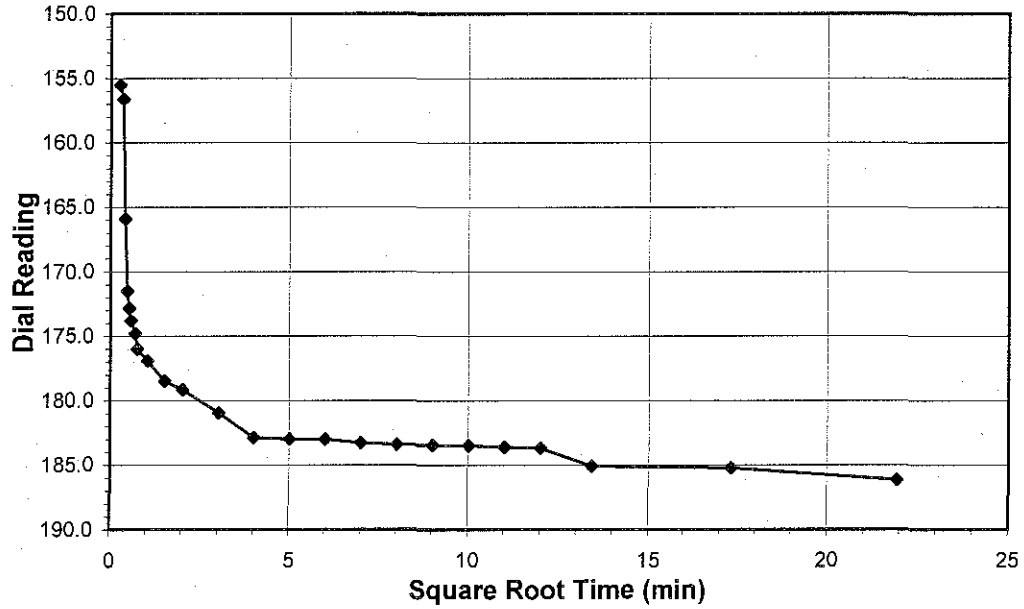
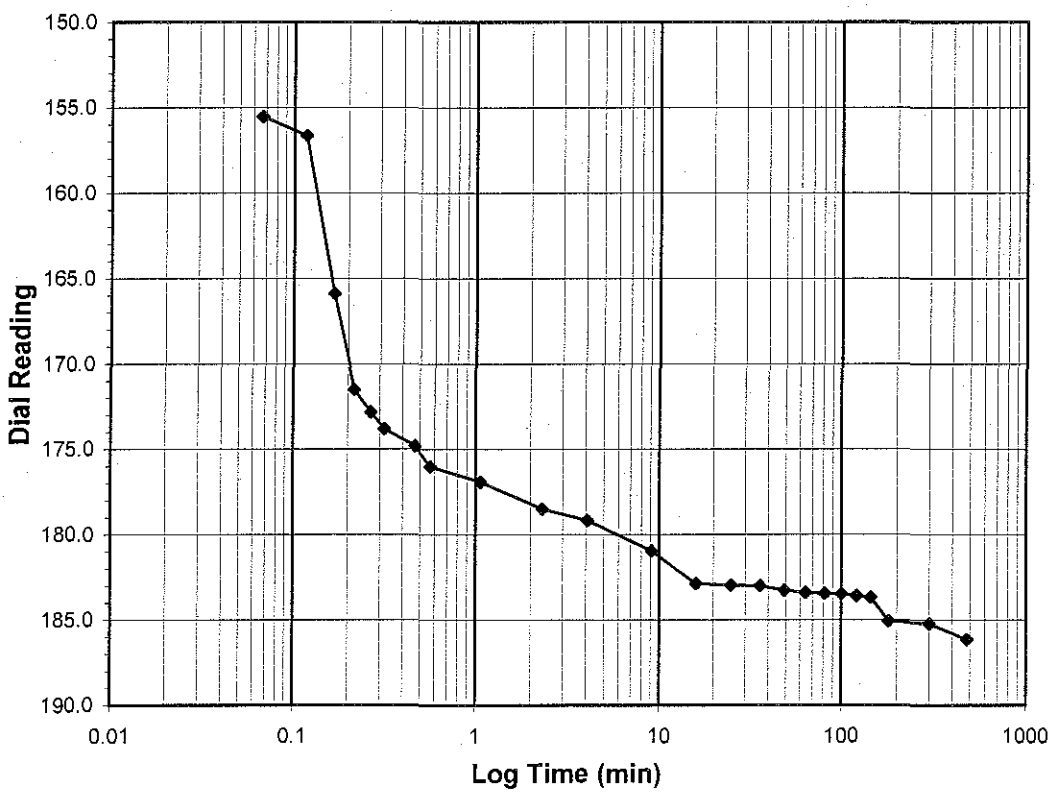
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**0.25-0.5**
Final Reading	**(div)**	**186.1**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/4/12
Start Time		18:28:55

Elapsed Time (min)	Dial Reading (div)
Initial	**156.8**
0.07	155.5
0.12	156.6
0.17	165.9
0.22	171.5
0.27	172.8
0.32	173.8
0.47	174.8
0.57	176.0
1.07	176.9
2.32	178.5
4.07	179.2
9.08	181.0
16.08	182.9
25.08	183.0
36.08	183.0
49.08	183.3
64.08	183.4
81.08	183.4
100.08	183.5
121.08	183.6
144.08	183.7
180.08	185.1
300.08	185.2
480.03	186.1

Tested By DB *Date* 11/4/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Date: 6/6/2011 Path: C:\Users\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]STEP 2

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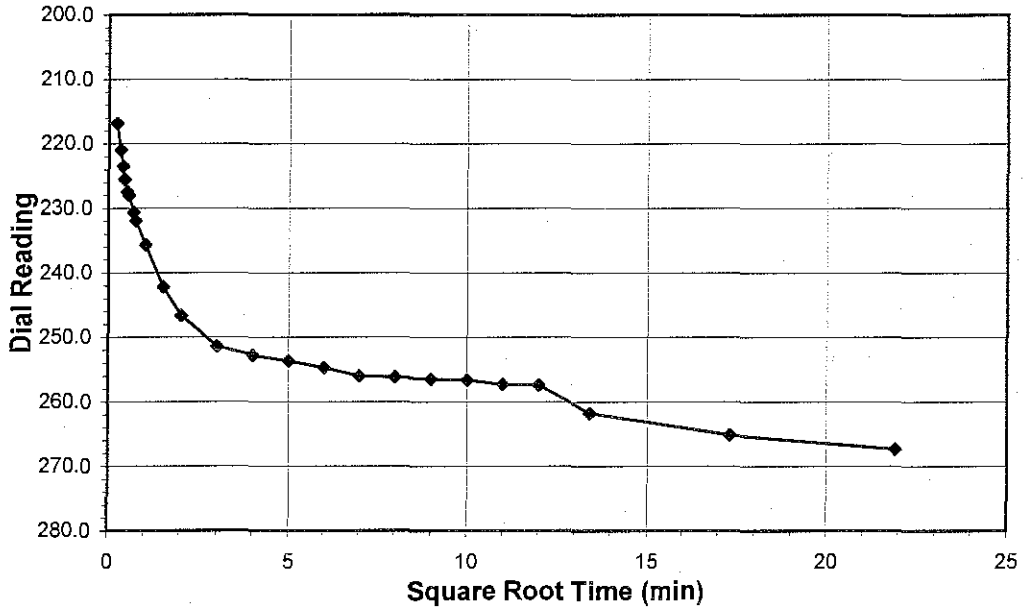
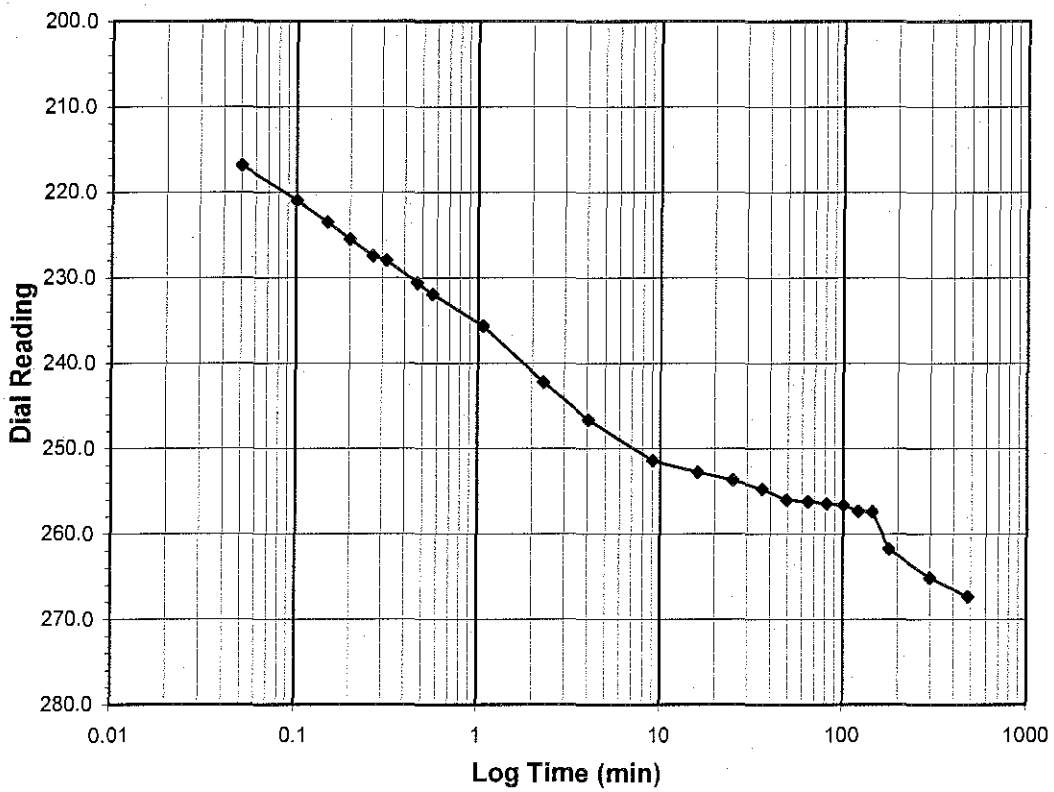
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**0.5-1.0**
Final Reading	**(div)**	**267.3**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/5/12
Start Time		2:28:56

Elapsed Time (min)	Dial Reading (div)
Initial	**186.1**
0.05	216.8
0.10	221.0
0.15	223.5
0.20	225.5
0.27	227.4
0.32	228.0
0.47	230.6
0.57	231.9
1.07	235.7
2.32	242.2
4.07	246.6
9.07	251.4
16.07	252.8
25.07	253.7
36.08	254.7
49.08	256.0
64.08	256.2
81.08	256.5
100.08	256.6
121.08	257.3
144.08	257.4
180.08	261.8
300.08	265.1
480.25	267.3

Tested By DB *Date* 11/5/12 *Checked By* TM *Date* 11-12-12

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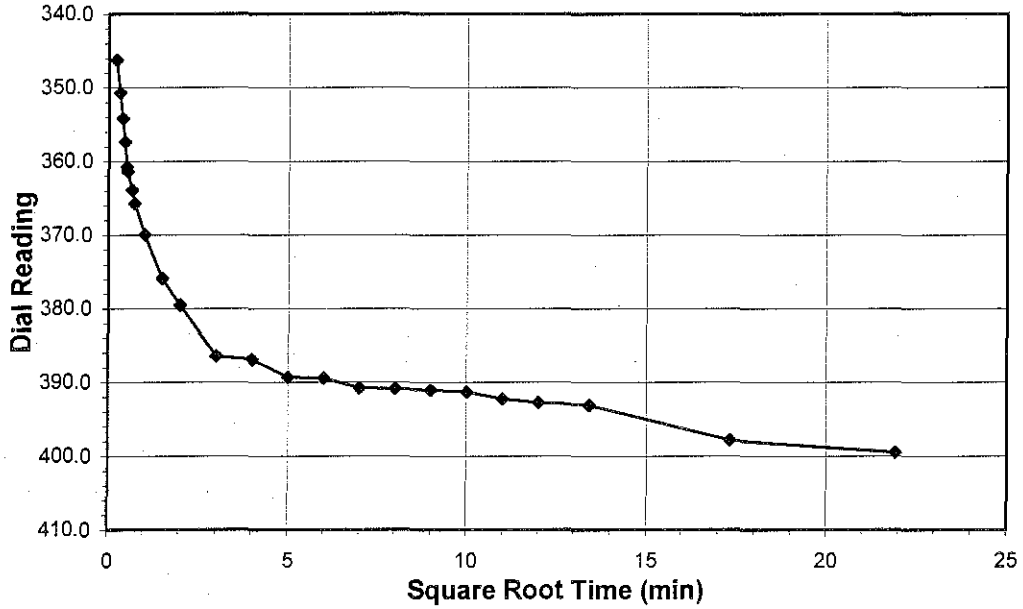
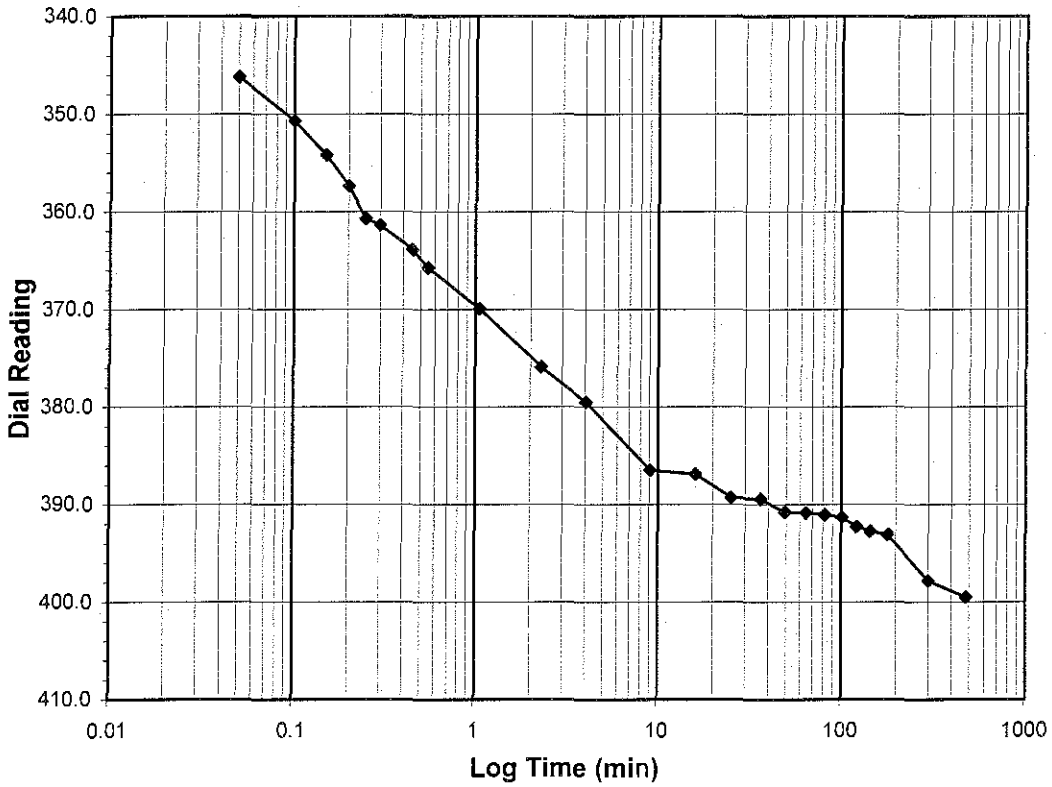
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**1.0-2.0**
Final Reading	**(div)**	**399.5**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/5/12
Start Time		10:29:11

Elapsed Time (min)	Dial Reading (div)
Initial	**267.3**
0.05	346.2
0.10	350.7
0.15	354.2
0.20	357.4
0.25	360.7
0.30	361.4
0.45	363.9
0.55	365.7
1.05	369.9
2.30	375.9
4.05	379.5
9.07	386.5
16.07	386.9
25.07	389.3
36.07	389.4
49.07	390.8
64.07	390.9
81.07	391.0
100.07	391.3
121.07	392.3
144.07	392.7
180.07	393.1
300.07	397.8
480.25	399.5

Tested By DB *Date* 11/5/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Date and Time: C:\Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]STEP 4

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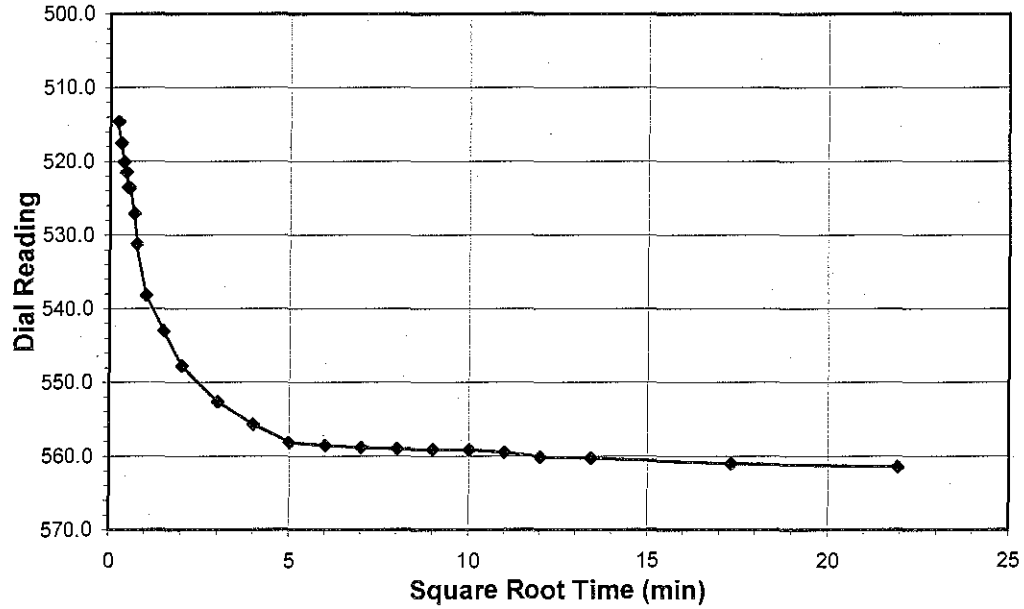
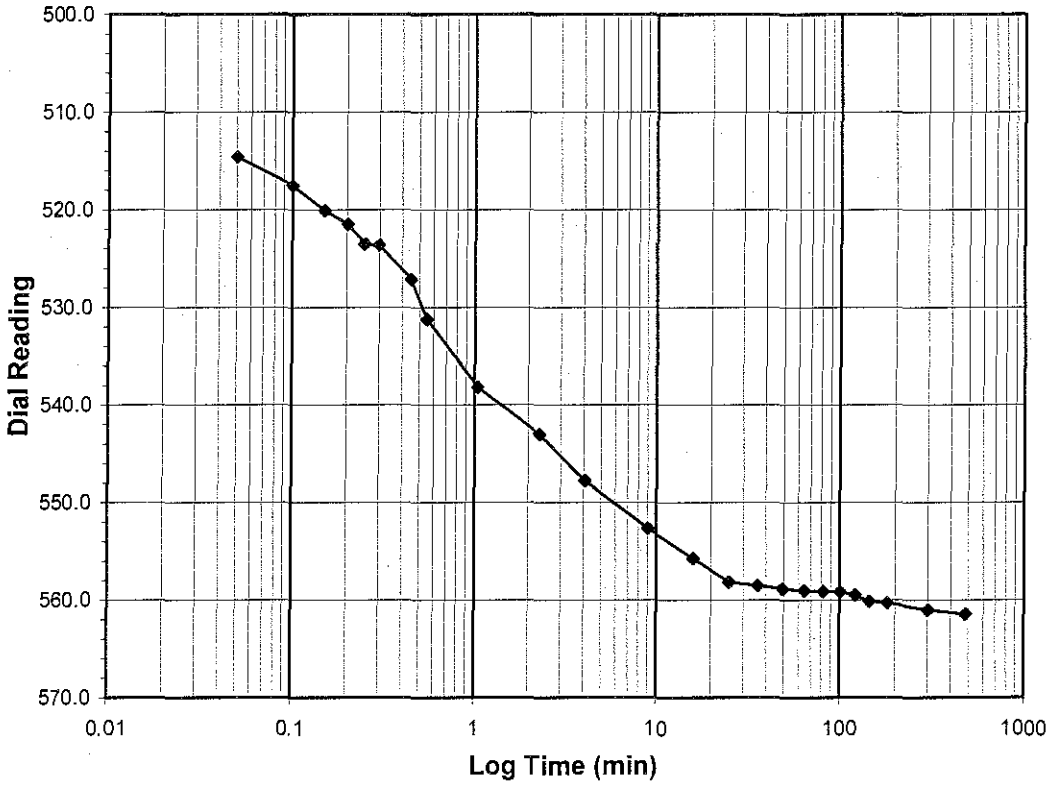
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**2.0-4.0**
Final Reading	**(div)**	**561.5**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/5/12
Start Time		18:29:26

Elapsed Time (min)	Dial Reading (div)
Initial	**399.5**
0.05	514.6
0.10	517.6
0.15	520.1
0.20	521.5
0.25	523.5
0.30	523.6
0.45	527.1
0.55	531.2
1.05	538.2
2.30	543.0
4.05	547.7
9.05	552.7
16.05	555.7
25.05	558.2
36.05	558.5
49.05	558.8
64.07	559.0
81.07	559.1
100.07	559.1
121.07	559.5
144.07	560.1
180.07	560.3
300.07	561.0
480.23	561.5

Tested By DB *Date* 11/5/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Data and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]STEP 5

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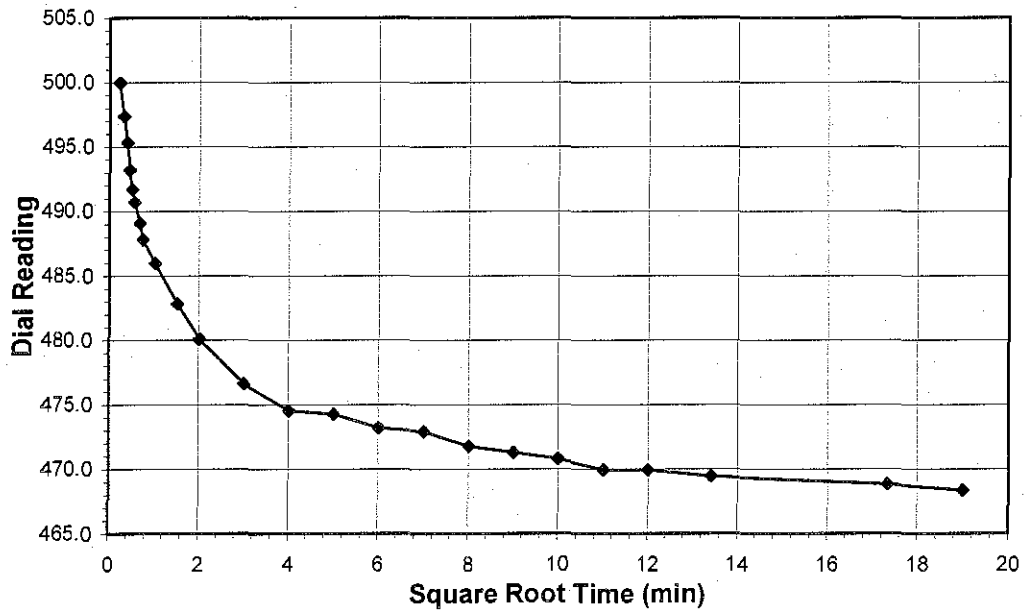
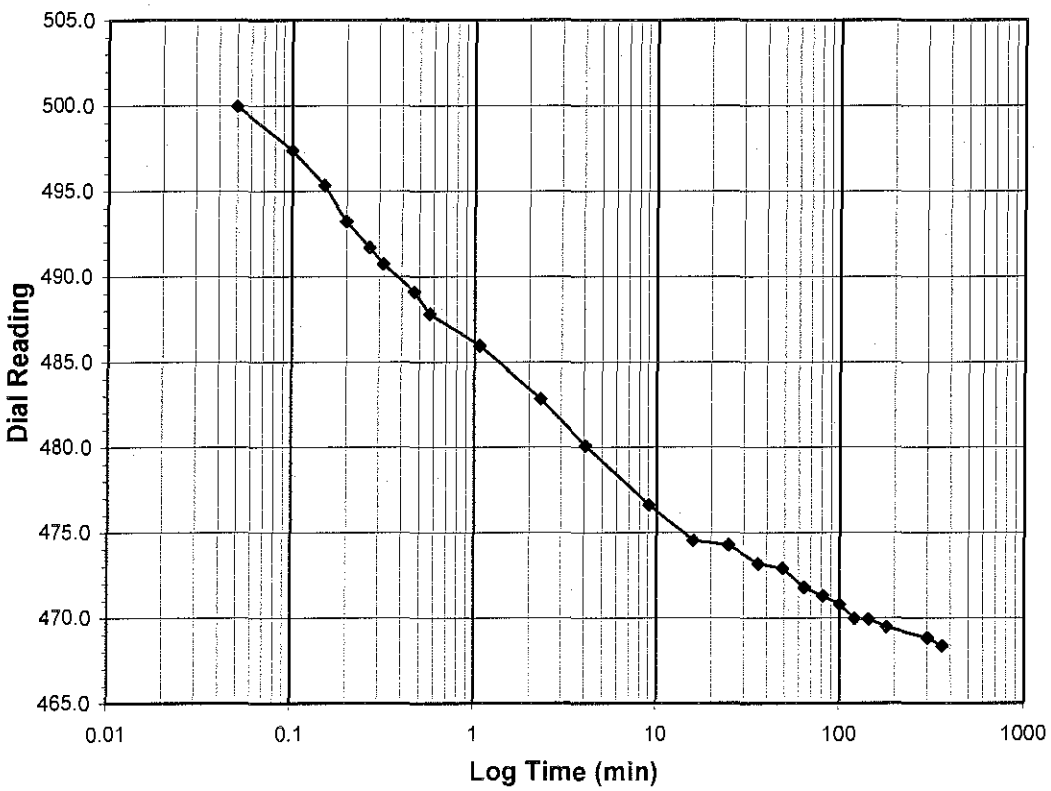
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**4.0-1.0**
Final Reading	**(div)**	**468.4**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/6/12
Start Time		2:29:40

Elapsed Time (min)	Dial Reading (div)
Initial	**561.5**
0.05	500.0
0.10	497.4
0.15	495.3
0.20	493.2
0.27	491.7
0.32	490.7
0.47	489.1
0.57	487.8
1.07	485.9
2.32	482.8
4.07	480.1
9.07	476.6
16.07	474.5
25.07	474.3
36.07	473.2
49.07	472.9
64.07	471.8
81.07	471.3
100.07	470.8
121.07	470.0
144.08	469.9
180.08	469.5
300.08	468.8
360.47	468.4

Tested By DB *Date* 11/6/12 *Checked By* JM *Date* 11-12-12

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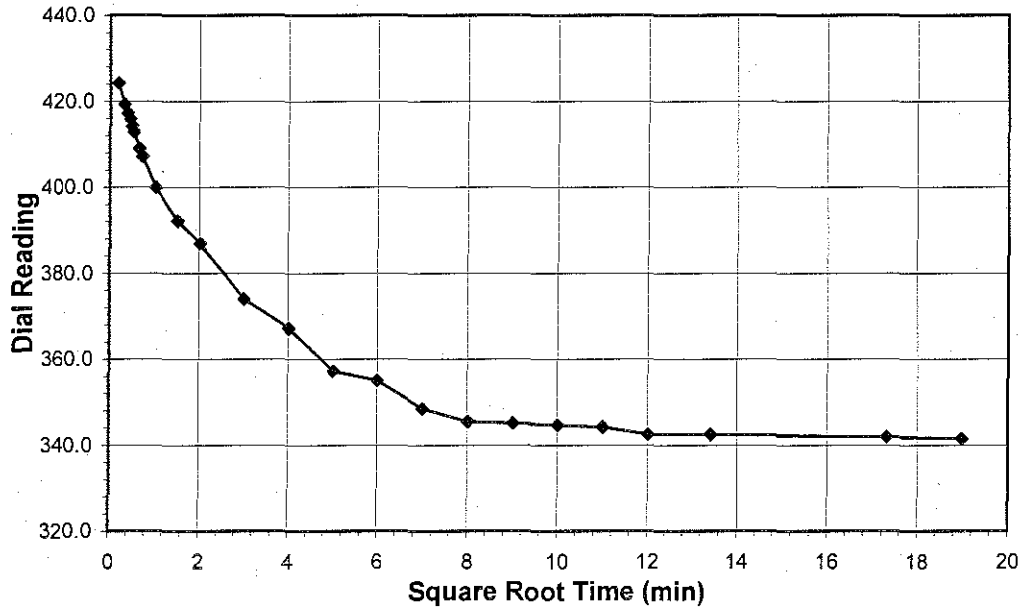
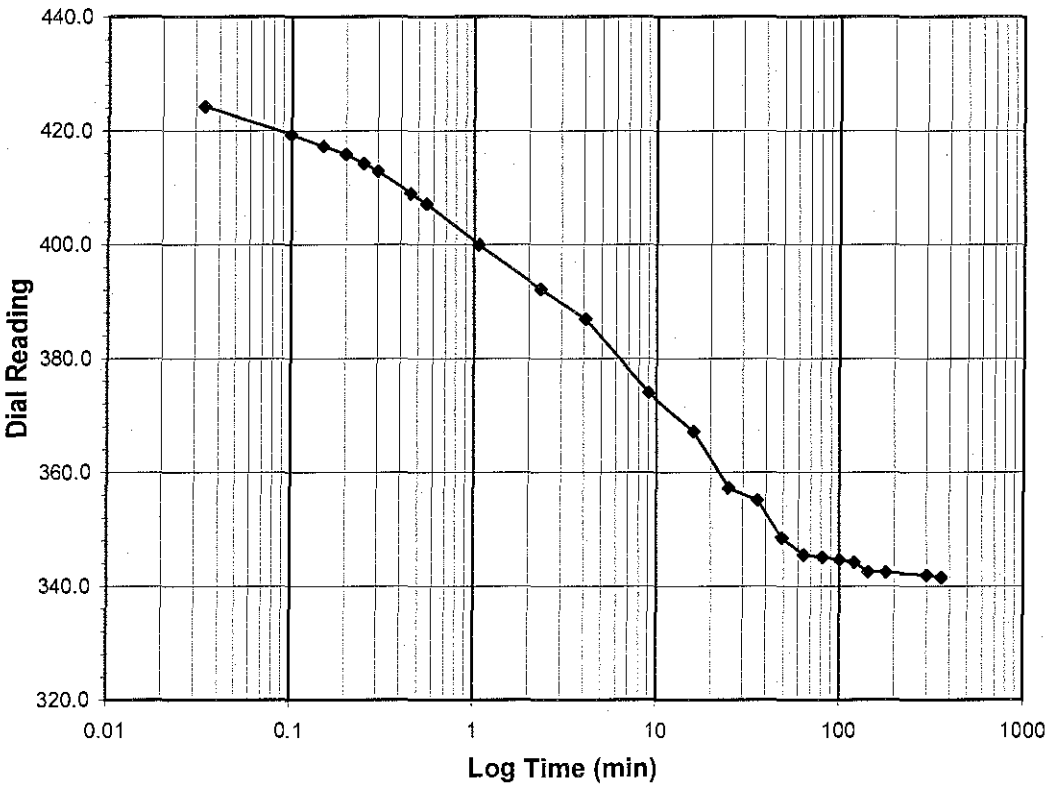
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**1.0-0.25**
Final Reading	**(div)**	**341.5**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/6/12
Start Time		8:30:07

Elapsed Time (min)	Dial Reading (div)
Initial	**468.4**
0.03	424.2
0.10	419.3
0.15	417.3
0.20	415.8
0.25	414.2
0.30	412.9
0.45	409.0
0.55	407.2
1.07	399.9
2.32	392.1
4.07	386.9
9.07	374.0
16.07	367.2
25.07	357.3
36.07	355.1
49.07	348.5
64.07	345.5
81.07	345.1
100.07	344.7
121.07	344.2
144.07	342.5
180.07	342.5
300.07	341.9
360.47	341.5

Tested By DB *Date* 11/6/12 *Checked By* TM *Date* 11-12-12

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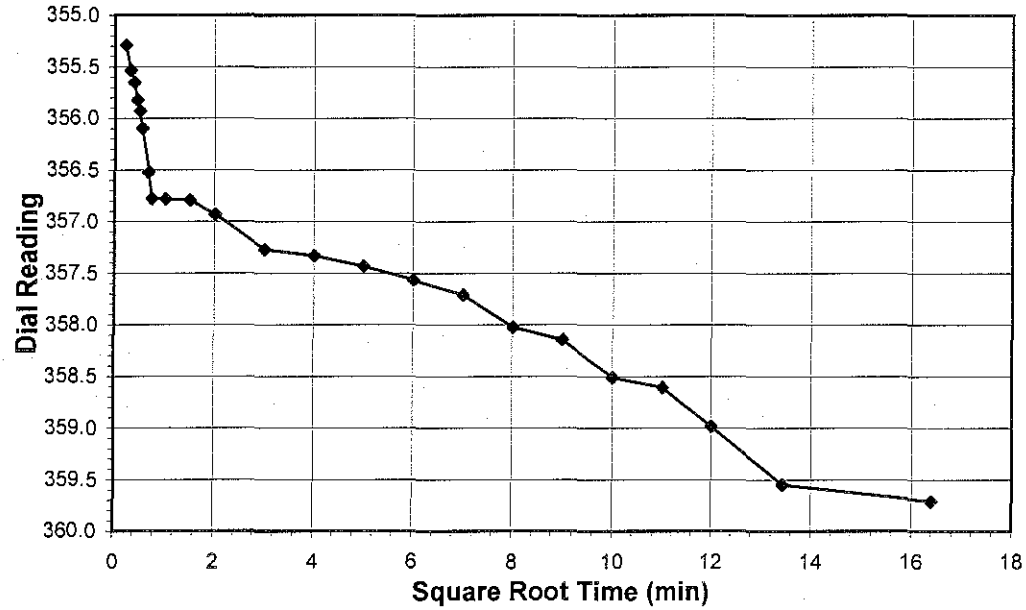
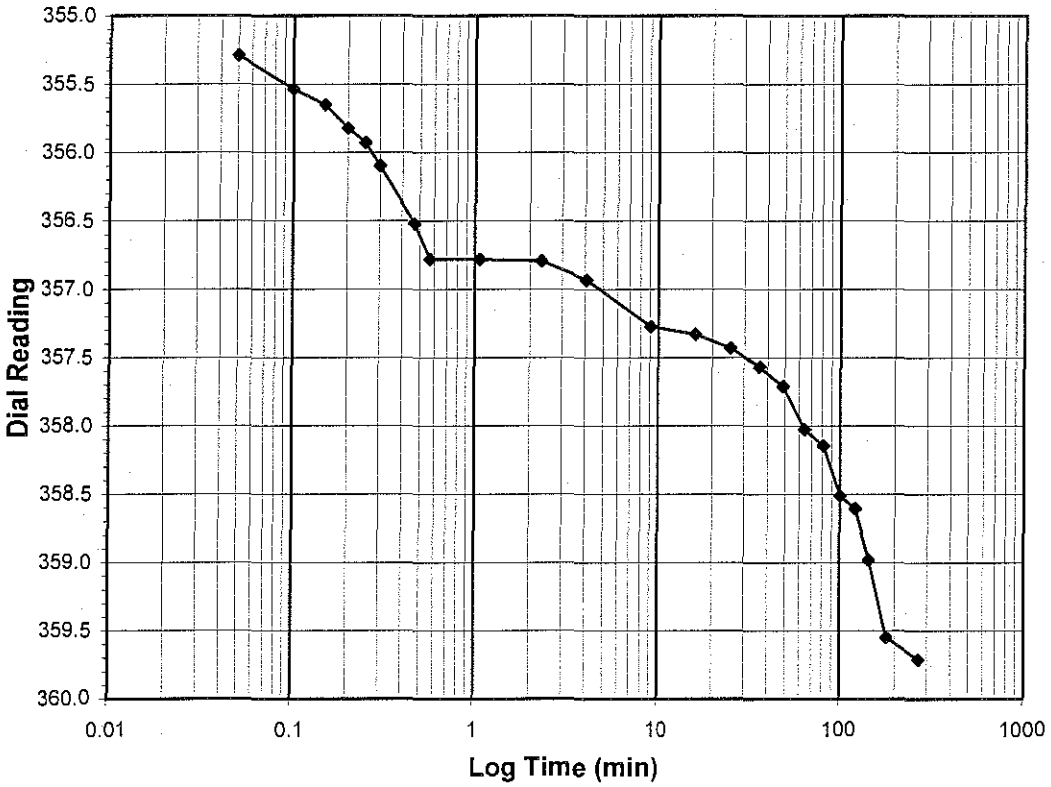
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**0.25-0.5**
Final Reading	**(div)**	**359.7**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/6/12
Start Time		14:30:36

Elapsed Time (min)	Dial Reading (div)
Initial	**341.5**
0.05	355.3
0.10	355.5
0.15	355.7
0.20	355.8
0.25	355.9
0.30	356.1
0.47	356.5
0.57	356.8
1.07	356.8
2.32	356.8
4.07	356.9
9.07	357.3
16.07	357.3
25.07	357.4
36.07	357.6
49.07	357.7
64.07	358.0
81.07	358.1
100.07	358.5
121.07	358.6
144.07	359.0
180.07	359.5
268.88	359.7

Tested By DB *Date* 11/6/12 *Checked By* JM *Date* 11-12-12

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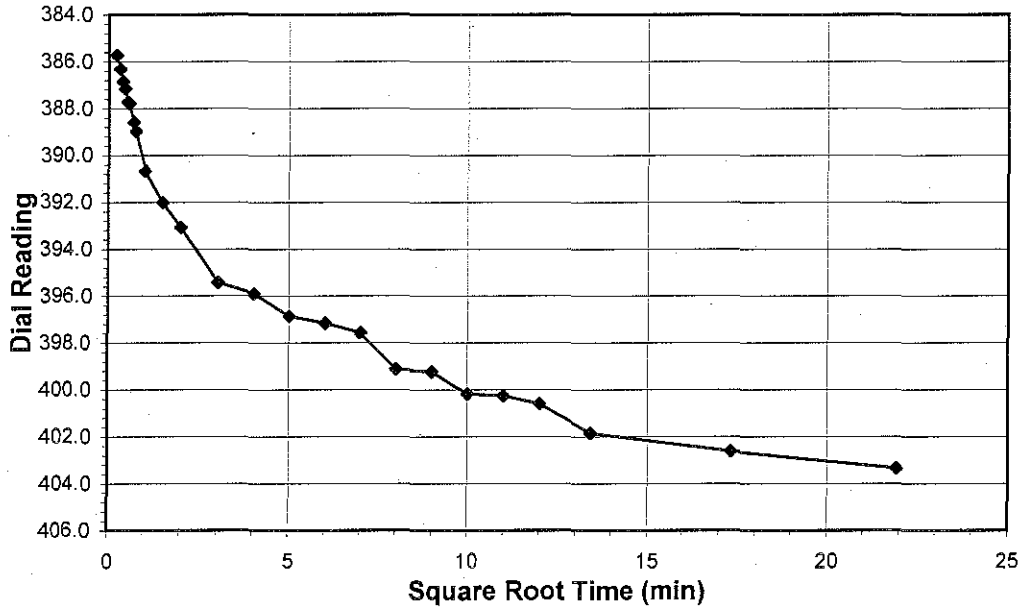
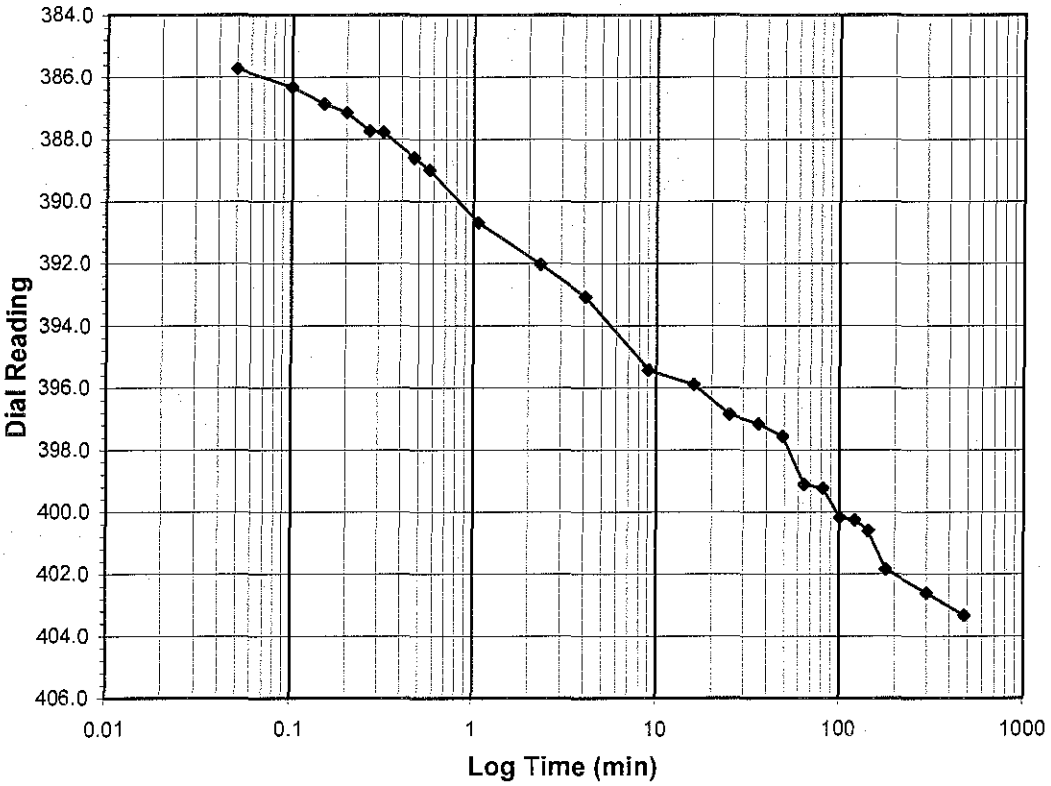
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**0.5-1.0**
Final Reading	**(div)**	**403.3**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/6/12
Start Time		18:59:29

Elapsed Time (min)	Dial Reading (div)
Initial	**359.7**
0.05	385.7
0.10	386.3
0.15	386.8
0.20	387.1
0.27	387.7
0.32	387.8
0.47	388.6
0.57	389.0
1.07	390.7
2.32	392.0
4.07	393.1
9.07	395.4
16.07	395.9
25.07	396.9
36.07	397.2
49.07	397.6
64.07	399.1
81.08	399.2
100.08	400.2
121.08	400.3
144.08	400.6
180.08	401.8
300.08	402.6
480.20	403.3

Tested By DB *Date* 11/6/12 *Checked By* TM *Date* 11-12-12

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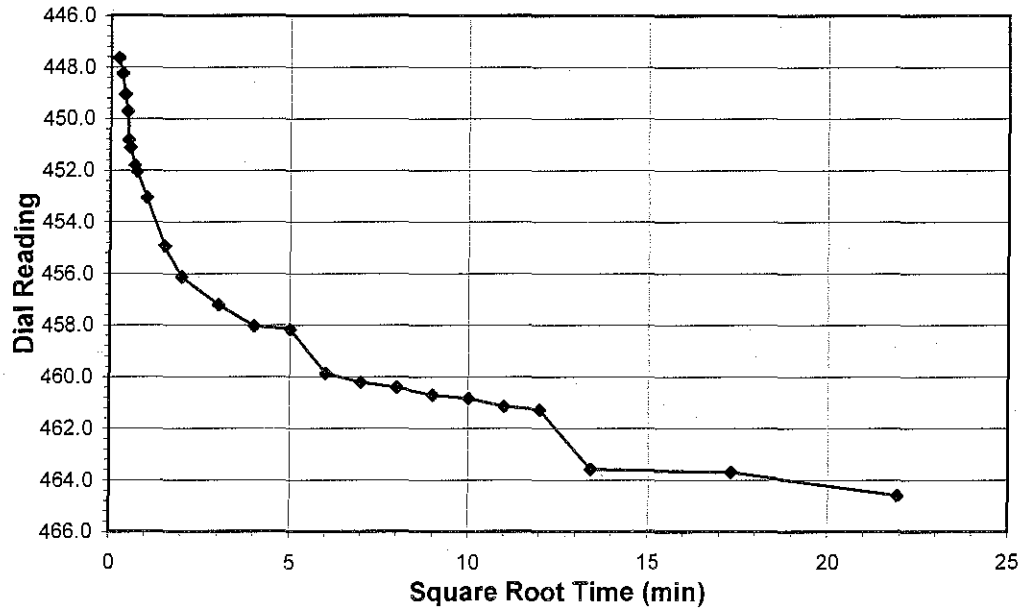
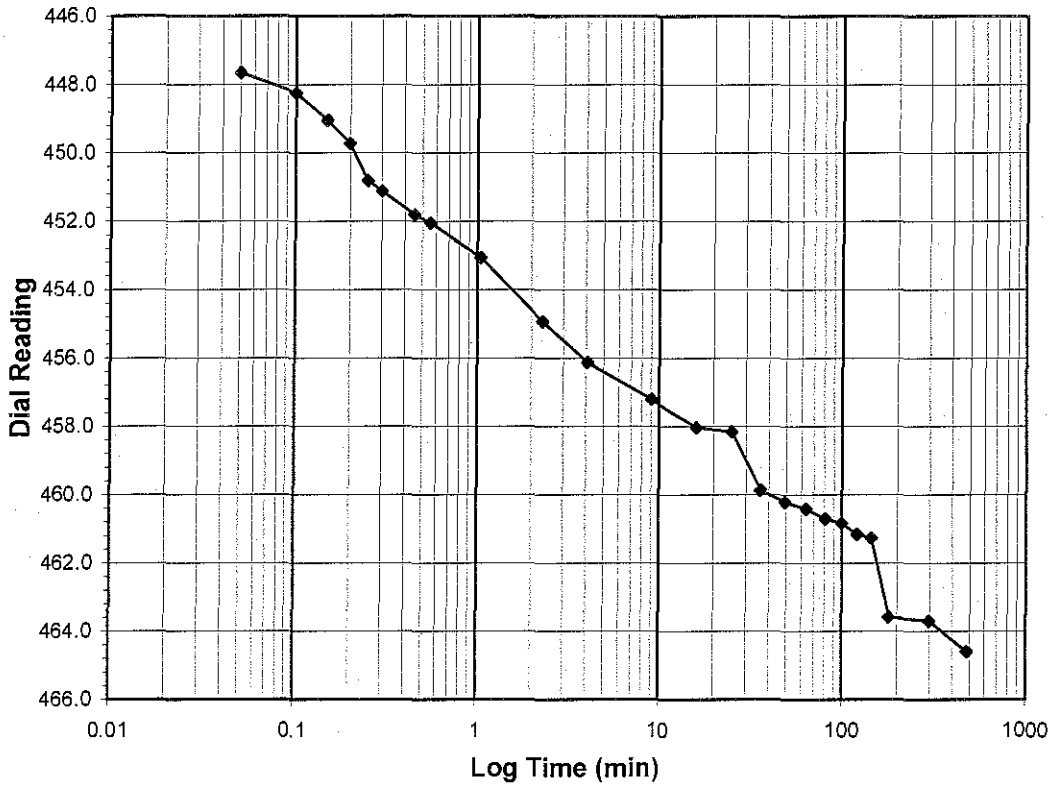
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load (tsf)	**1.0-2.0**
Final Reading (div)	**464.6**
Consolidometer No.	**G1424**
1 Division (in)	0.0001
Start Date	11/7/12
Start Time	2:59:41

Elapsed Time (min)	Dial Reading (div)
Initial	**403.3**
0.05	447.7
0.10	448.2
0.15	449.0
0.20	449.7
0.25	450.8
0.30	451.1
0.45	451.8
0.55	452.0
1.05	453.1
2.30	454.9
4.05	456.1
9.07	457.2
16.07	458.0
25.07	458.2
36.07	459.9
49.07	460.2
64.07	460.4
81.07	460.7
100.07	460.8
121.07	461.2
144.07	461.3
180.07	463.6
300.07	463.7
480.22	464.6

Tested By DB *Date* 11/7/12 *Checked By* TM *Date* 11-12-12

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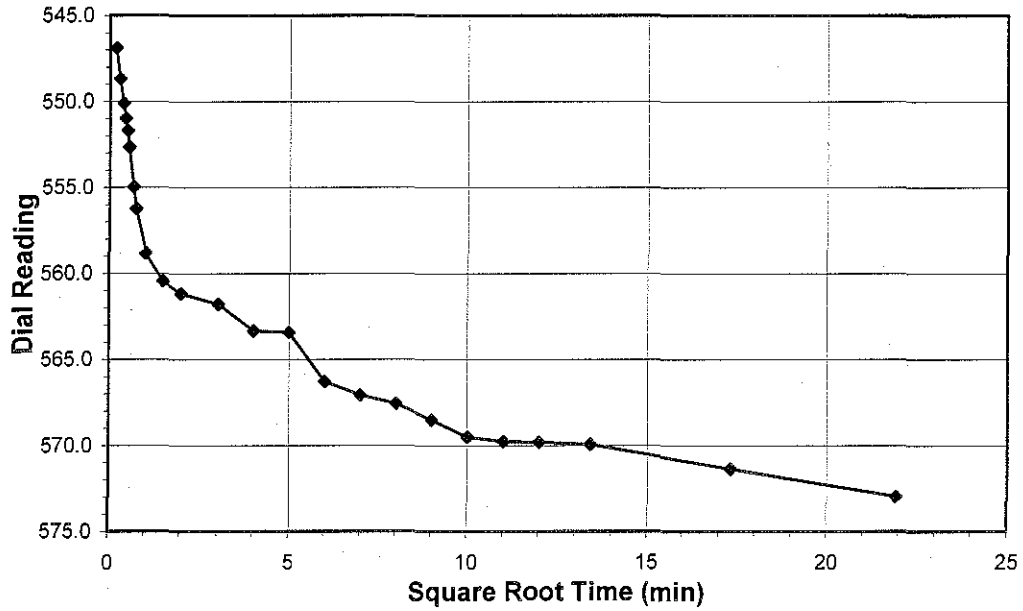
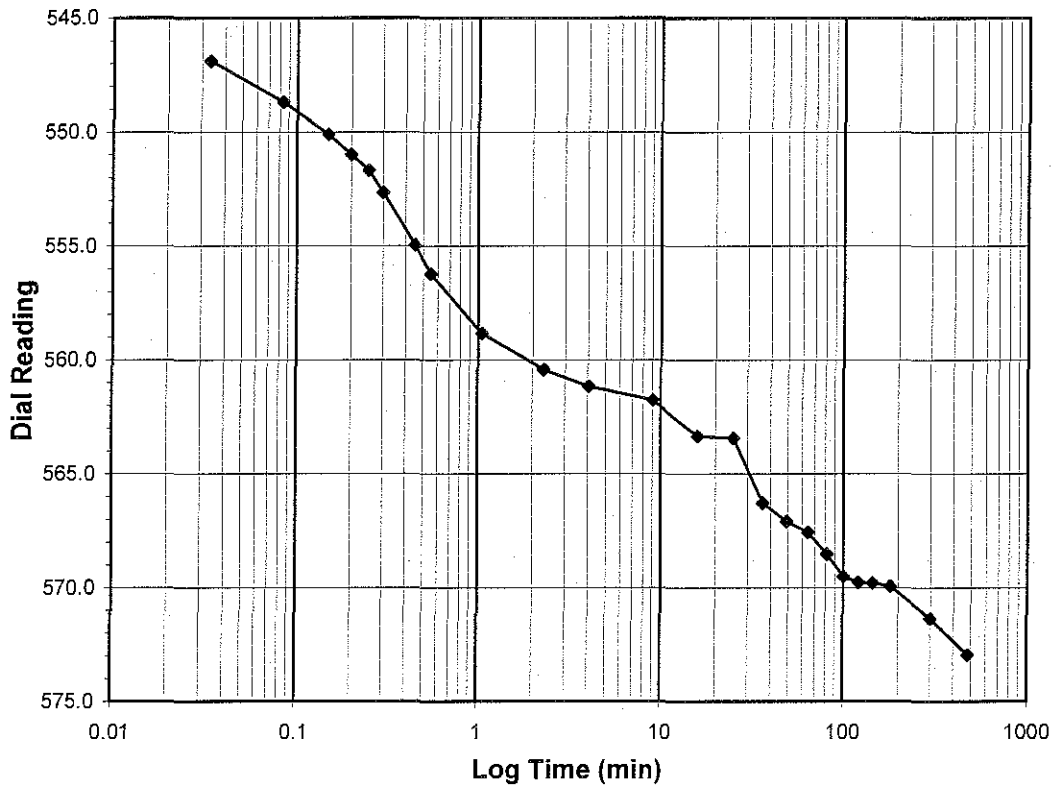
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**2.0-4.0**
Final Reading	**(div)**	**573.0**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/7/12
Start Time		10:59:54

Elapsed Time (min)	Dial Reading (div)
Initial	**464.6**
0.03	546.9
0.08	548.7
0.15	550.1
0.20	551.0
0.25	551.7
0.30	552.7
0.45	555.0
0.55	556.2
1.05	558.8
2.30	560.4
4.05	561.2
9.05	561.8
16.05	563.3
25.05	563.4
36.07	566.3
49.07	567.1
64.07	567.6
81.07	568.5
100.07	569.5
121.07	569.8
144.07	569.8
180.07	569.9
300.07	571.4
480.23	573.0

Tested By DB *Date* 11/7/12 *Checked By* JM *Date* 11-12-12

DCN: CT-24E Data:\Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]STEP 11

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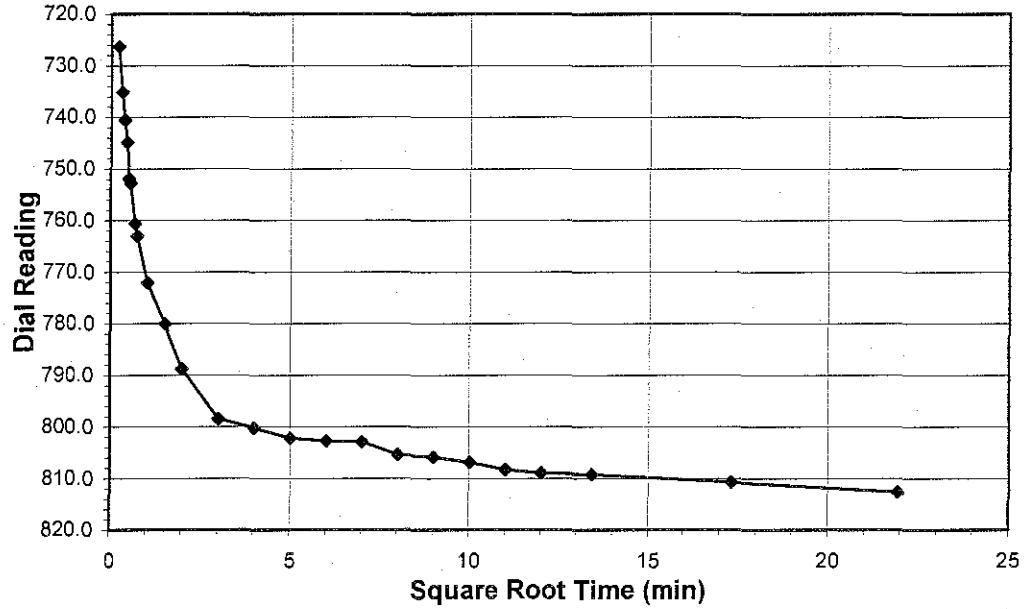
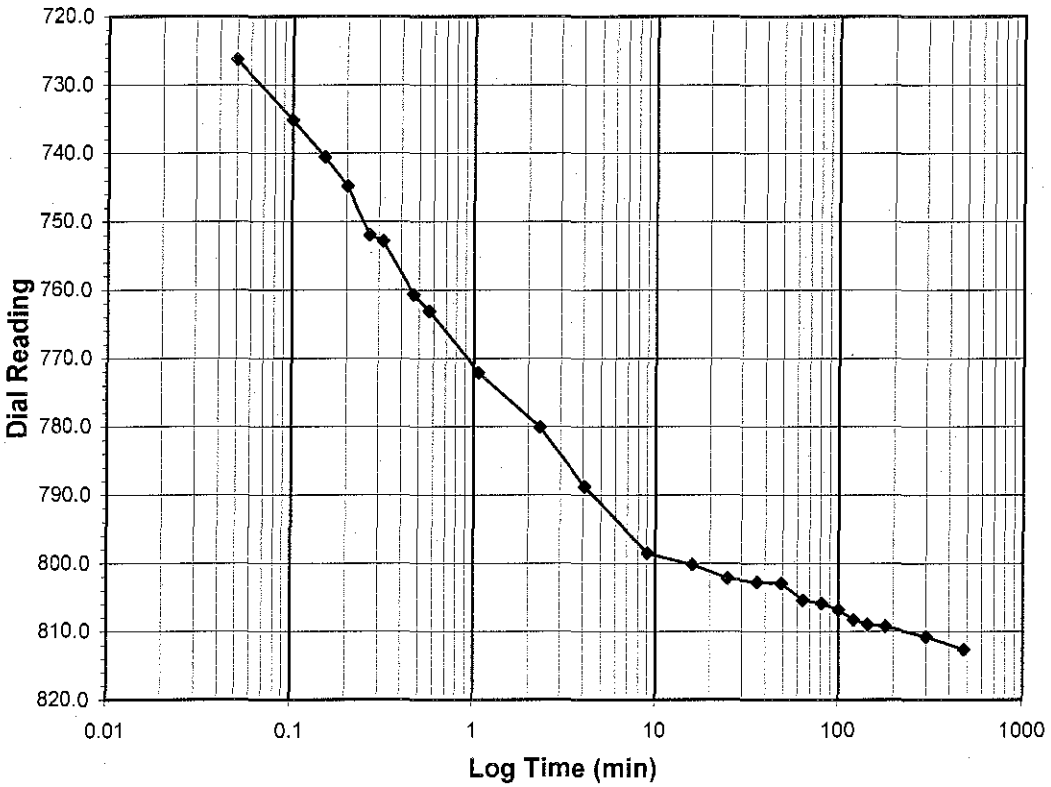
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**4.0-8.0**
Final Reading	**(div)**	**812.6**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/7/12
Start Time		19:00:09

Elapsed Time (min)	Dial Reading (div)
Initial	**573.0**
0.05	726.3
0.10	735.1
0.15	740.5
0.20	744.8
0.27	752.0
0.32	752.8
0.47	760.7
0.57	763.1
1.07	772.1
2.32	780.1
4.07	788.8
9.07	798.5
16.07	800.2
25.07	802.2
36.07	802.7
49.07	802.9
64.07	805.4
81.07	805.9
100.07	806.8
121.08	808.3
144.08	809.0
180.08	809.2
300.08	810.7
480.25	812.6

Tested By DB *Date* 11/7/12 *Checked By* TM *Date* 11-12-12

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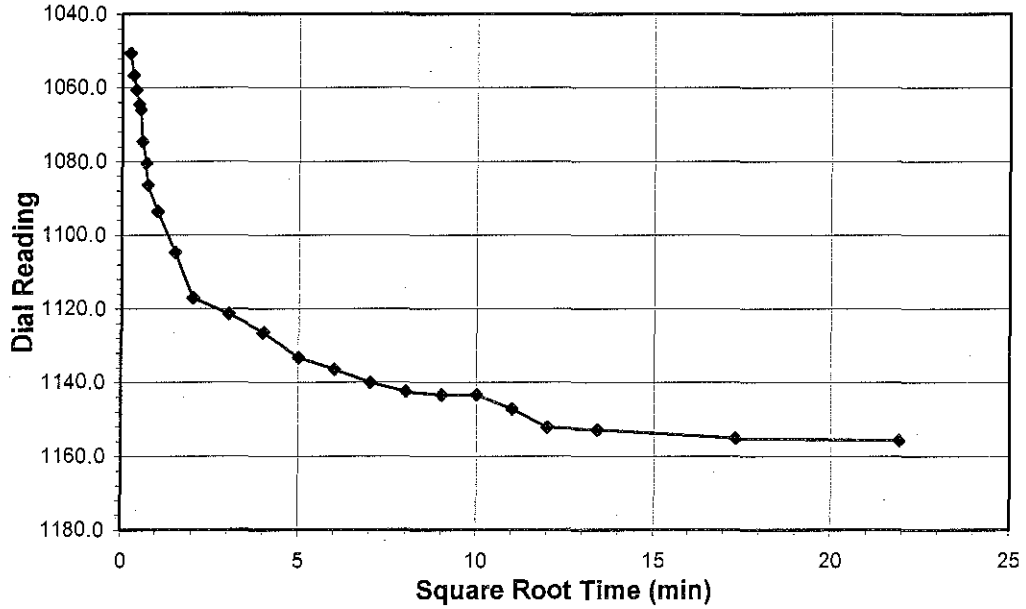
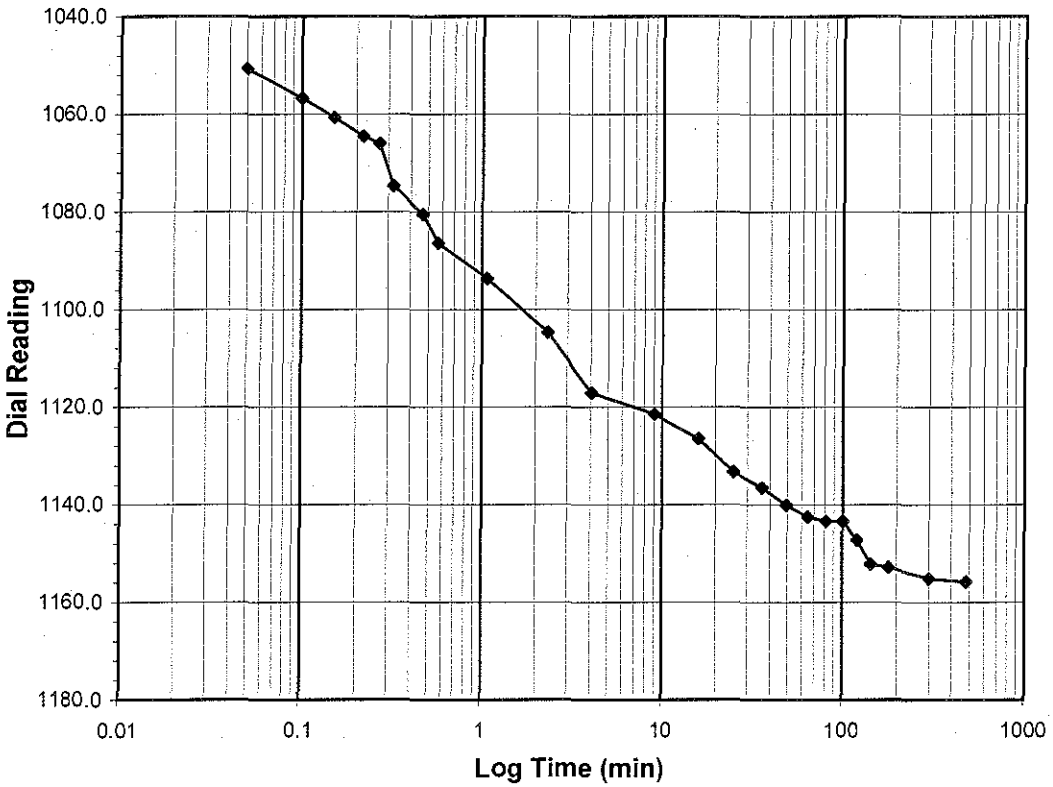
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**8.0-16.0**
Final Reading	**(div)**	**1155.8**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/8/12
Start Time		3:00:24

Elapsed Time (min)	Dial Reading (div)
Initial	**812.6**
0.05	1050.7
0.10	1056.7
0.15	1060.6
0.22	1064.5
0.27	1066.0
0.32	1074.7
0.47	1080.5
0.57	1086.4
1.07	1093.6
2.32	1104.7
4.07	1117.1
9.07	1121.4
16.07	1126.5
25.07	1133.3
36.07	1136.5
49.07	1140.0
64.07	1142.5
81.07	1143.4
100.07	1143.4
121.07	1147.2
144.07	1152.1
180.07	1152.8
300.07	1155.1
480.25	1155.8

Tested By DB *Date* 11/8/12 *Checked By* TM *Date* 11-12-12

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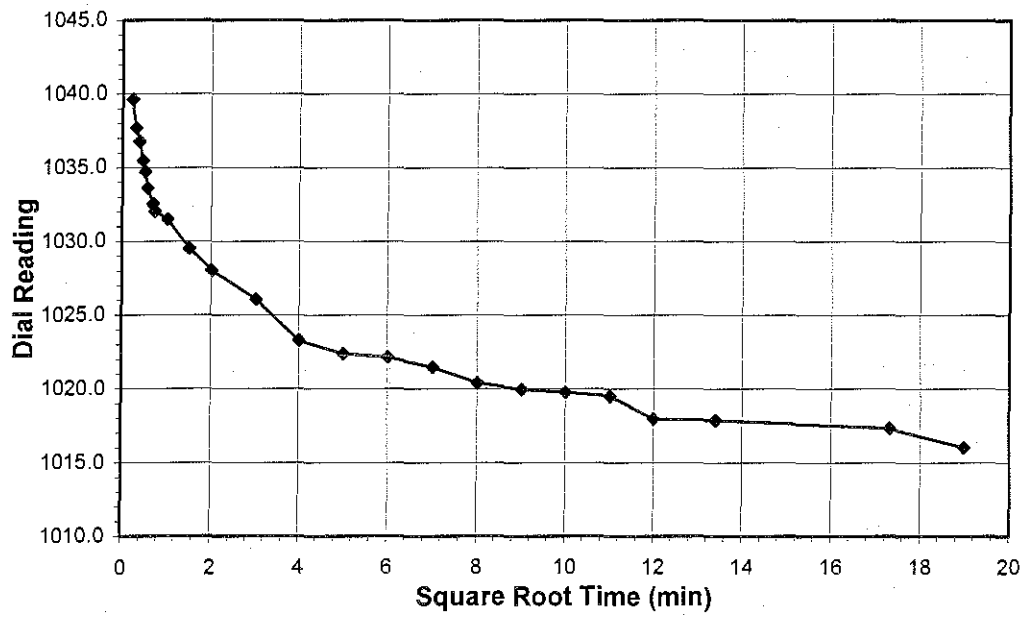
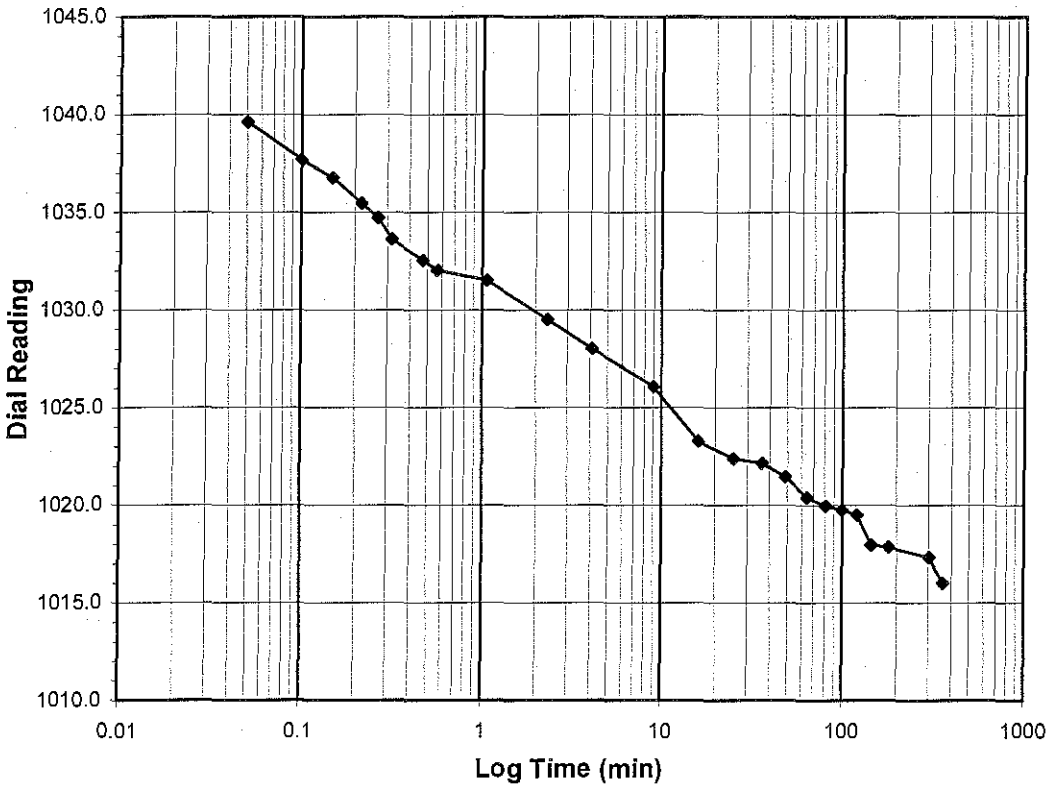
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**16.0-4.0**
Final Reading	**(div)**	**1016.0**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/8/12
Start Time		11:00:39

Elapsed Time (min)	Dial Reading (div)
Initial	**1155.8**
0.05	1039.6
0.10	1037.7
0.15	1036.8
0.22	1035.5
0.27	1034.7
0.32	1033.6
0.47	1032.5
0.57	1032.0
1.07	1031.5
2.32	1029.5
4.07	1028.0
9.07	1026.1
16.07	1023.3
25.07	1022.4
36.07	1022.2
49.07	1021.5
64.07	1020.4
81.07	1020.0
100.07	1019.8
121.07	1019.5
144.07	1018.0
180.07	1017.9
300.07	1017.3
360.35	1016.0

Tested By DB *Date* 11/8/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]STEP 14

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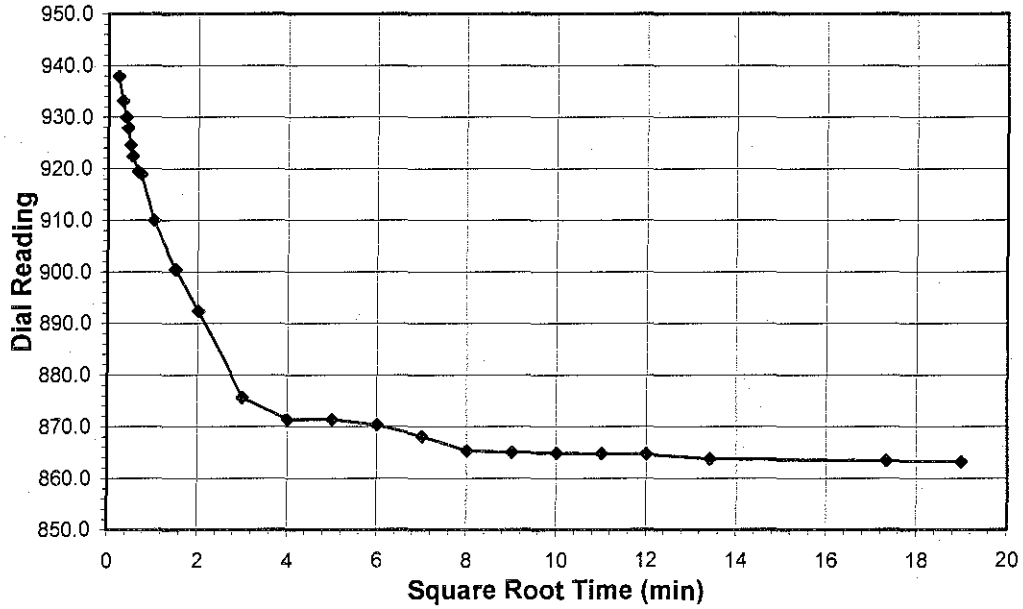
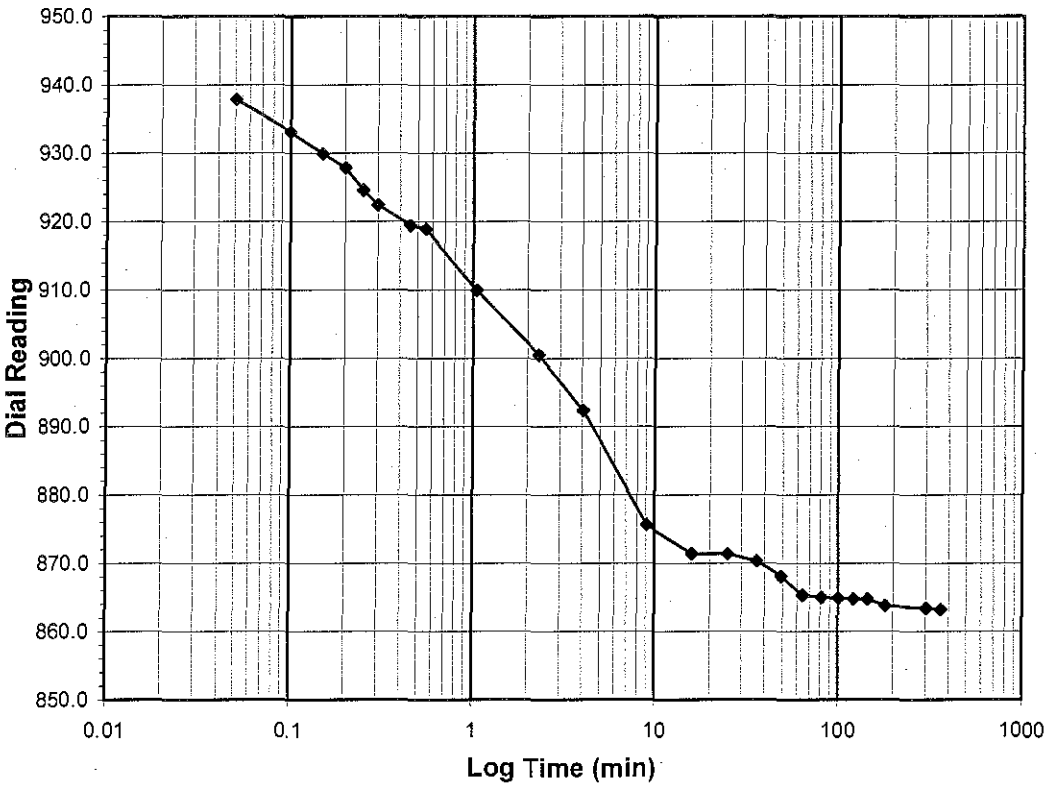
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-96 (SOP-S24A)

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**4.0-1.0**
Final Reading	**(div)**	**863.2**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/8/12
Start Time		17:01:00

Elapsed Time (min)	Dial Reading (div)
Initial	**1016.0**
0.05	937.9
0.10	933.1
0.15	929.9
0.20	927.9
0.25	924.6
0.30	922.4
0.45	919.4
0.55	918.9
1.05	910.0
2.30	900.5
4.05	892.3
9.05	875.6
16.05	871.4
25.07	871.4
36.07	870.3
49.07	868.1
64.07	865.3
81.07	865.0
100.07	864.9
121.07	864.7
144.07	864.7
180.07	863.8
300.07	863.4
360.37	863.2

Tested By DB *Date* 11/8/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]STEP 15

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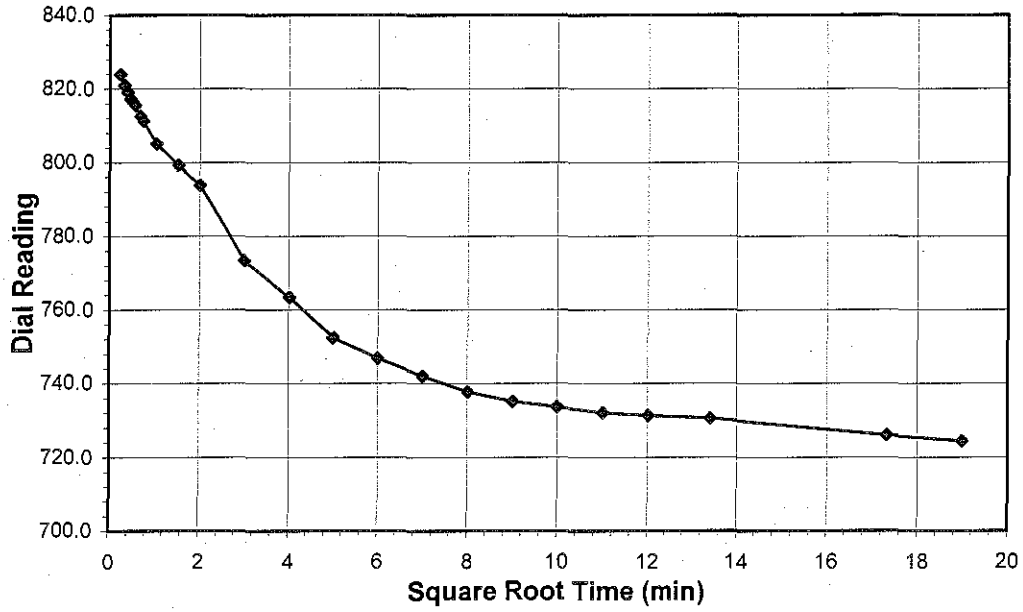
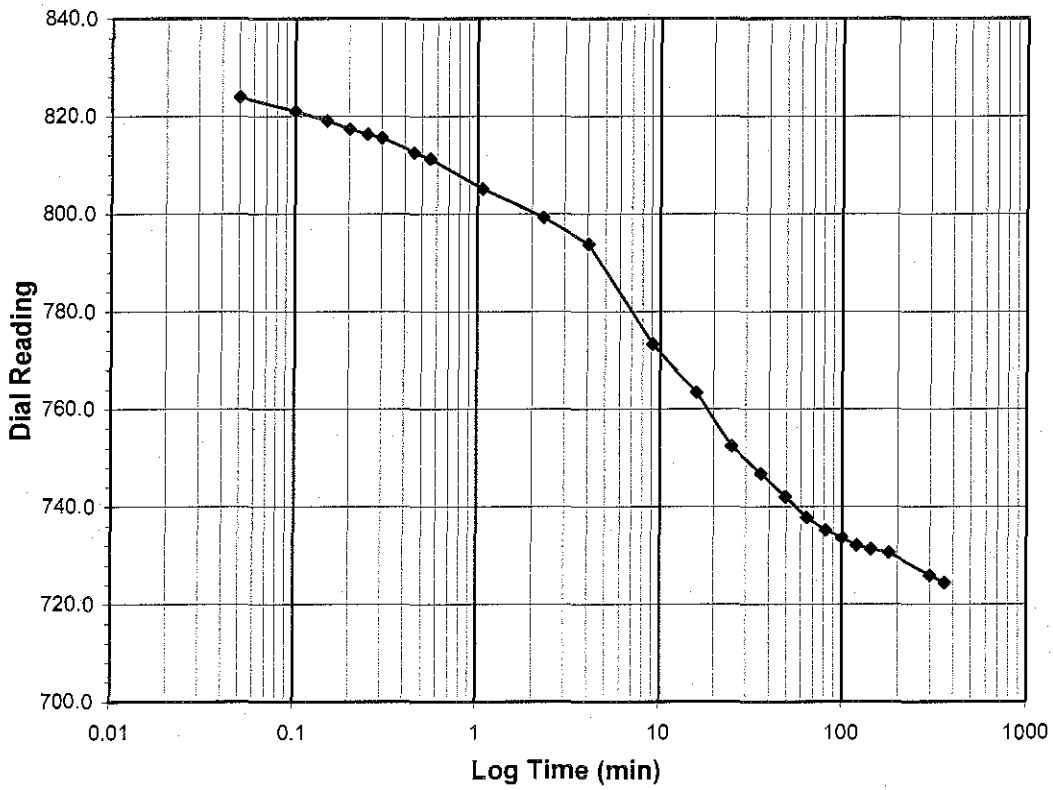
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	0.5-5.0
Project No.	2012-284-02	Sample No.	TP-7
Lab ID	2012-284-02-01	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**1.0-0.25**
Final Reading	**(div)**	**724.4**
Consolidometer No.		**G1424**
1 Division	(in)	0.0001
Start Date		11/8/12
Start Time		23:01:22

Elapsed Time (min)	Dial Reading (div)
Initial	**863.2**
0.05	824.0
0.10	821.0
0.15	819.0
0.20	817.3
0.25	816.3
0.30	815.6
0.45	812.6
0.55	811.3
1.07	805.1
2.32	799.3
4.07	793.8
9.07	773.3
16.07	763.4
25.07	752.4
36.07	746.8
49.07	742.1
64.07	737.8
81.07	735.2
100.07	733.7
121.08	732.1
144.08	731.3
180.08	730.6
300.08	726.0
360.48	724.4

Tested By DB *Date* 11/8/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Data\Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1424\[URS2012-284-02-01CONSOL.xls]STEP 16

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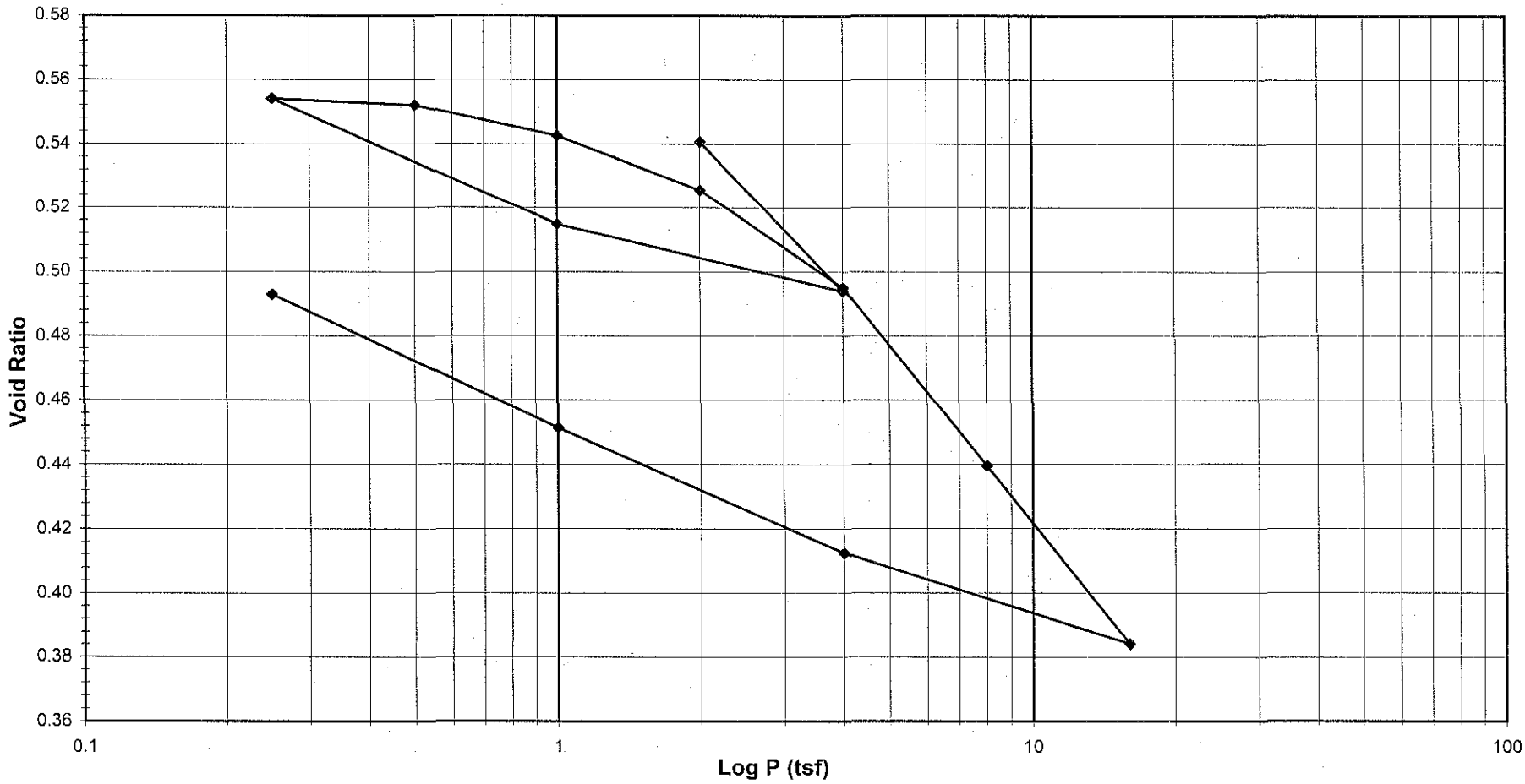
ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Reference	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED



Tested By DB *Date* 11/4/12 *Approved By* TM *Date* 11-12-12

DCN: CT-24E Date: 5/3/12 Revision: 6 *C:\Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]FINAL PLOT*

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ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Reference	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED
Consolidometer No. G1427
1 Division = 0.0001 (in.)

Sample Properties	**Initial**	**Final**
Water Content		
Tare Number	2561	2538
Wt. Tare & WS (gm)	114.78	175.36
Wt. Tare & DS (gm)	103.08	145.74
Wt. Water (gm)	11.70	29.62
Wt. Tare (gm)	6.58	6.73
Wt. DS (gm)	96.50	139.01
Water Content (%)	12.12	21.31
Sample Parameters		
Sample Diameter (in)	2.5	2.5
Sample Height (in)	1.0000	0.9584
Sample Volume (cc)	80.44	77.10
Wt. Wet Sample + Ring (gm)	371.27	384.07
Wt. of Ring (gm)	214.93	214.93
Wt. of Wet Sample (gm)	156.34	169.14
Wet Density (pcf)	121.28	136.90
Wet Density (g/cc)	1.94	2.19
Water Content (%)	12.12	21.31
Wt. of Dry Sample (gm)	139.43	139.43
Dry Density (pcf)	108.16	112.85
Dry Density (g/cc)	1.73	1.81
Void Ratio	0.5576	0.4929
Saturation (%)	58.71	116.72
Specific Gravity	2.70	*Assumed*

Test Data Summary

Applied Pressure (tsf)	Final Dial Reading (div)	Machine Deflection (div)	Corrected Reading (div)	Height of Sample (mm)	Volume (cc)	Dry Density (g/cc)	Void Ratio
Seating	0	0	0	25.400	80.440	1.73340	**0.55763**
0.25	48.6	17.2	31.4	25.320	80.187	1.73886	**0.55274**
0.5	13.1	28.4	-15.3	25.439	80.563	1.73075	**0.56001**
1	59.1	48.7	10.4	25.374	80.356	1.73521	**0.55601**
2	185.7	76.9	108.8	25.124	79.565	1.75246	**0.54069**
4	518.5	109.2	409.4	24.360	77.147	1.80739	**0.49387**
1	347.4	72.5	274.9	24.702	78.228	1.78241	**0.51481**
0.25	60.2	37.0	23.1	25.341	80.254	1.73742	**0.55403**
0.5	74.8	39.0	35.8	25.309	80.152	1.73963	**0.55206**
1	150.5	53.8	96.8	25.154	79.661	1.75034	**0.54256**
2	285.5	79.8	205.7	24.878	78.785	1.76980	**0.52560**
4	511.7	109.2	402.6	24.378	77.202	1.80611	**0.49493**
8	902.0	143.6	758.5	23.473	74.339	1.87566	**0.43949**
16	1310.9	195.5	1115.3	22.567	71.468	1.95100	**0.38391**
4	1064.4	131.8	932.6	23.031	72.938	1.91168	**0.41237**
1	760.7	78.4	682.3	23.667	74.952	1.86033	**0.45136**
0.25	460.3	44.8	415.5	24.345	77.097	1.80855	**0.49291**

Tested By DB *Date* 11/4/12 *Input Checked By* TM *Date* 11-12-12

DCN: CT-24E Date: 5/3/12 Revision: 6 *C:\Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]FINAL PLOT*

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ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

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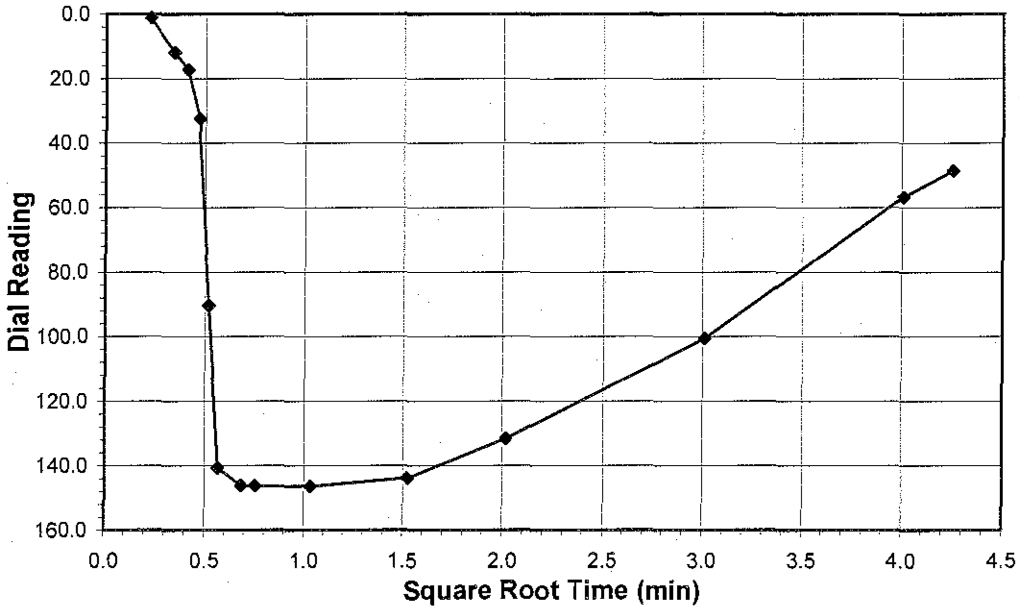
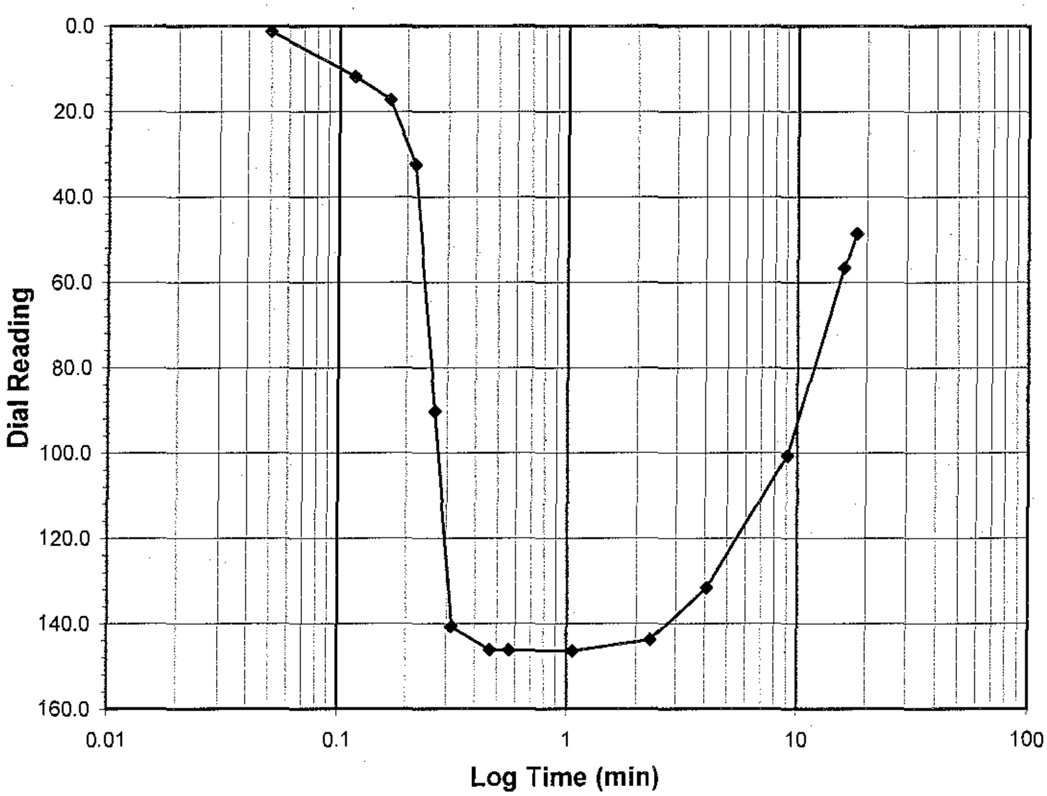
Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**0.0-0.25**
Final Reading	**(div)**	**48.6**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/4/12
Start Time		18:10:38

Elapsed Time (min)	Dial Reading (div)
Initial	**0.0**
0.05	1.2
0.12	11.8
0.17	17.2
0.22	32.4
0.27	90.3
0.32	140.6
0.47	146.2
0.57	146.2
1.07	146.4
2.32	143.8
4.07	131.6
9.07	100.6
16.07	56.7
18.10	48.6

Tested By DB *Date* 11/4/12 *Checked By* TM *Date* 11-12-12

 DCN: CT-24E Date: ...\Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 1

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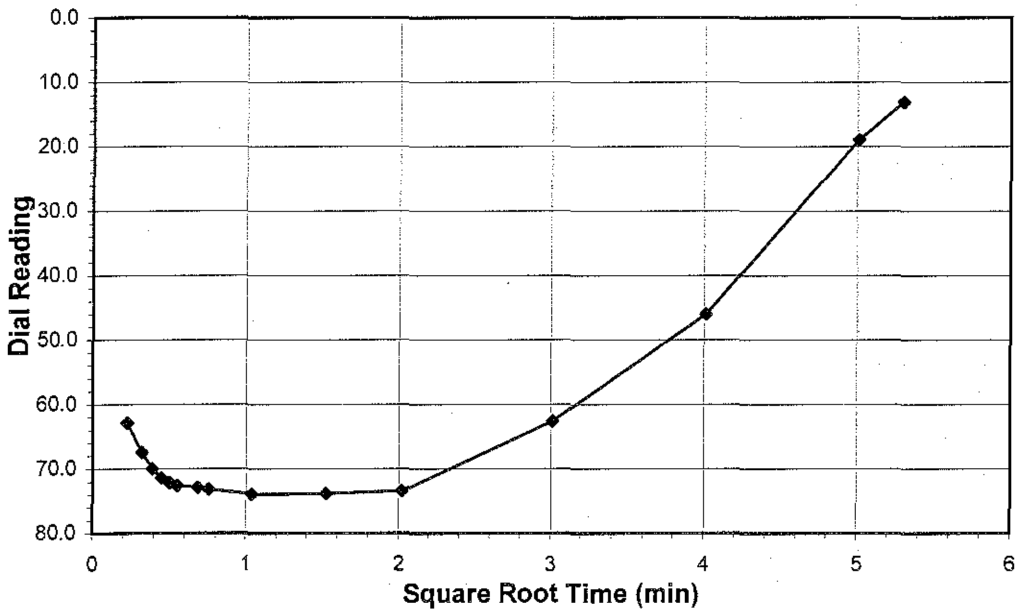
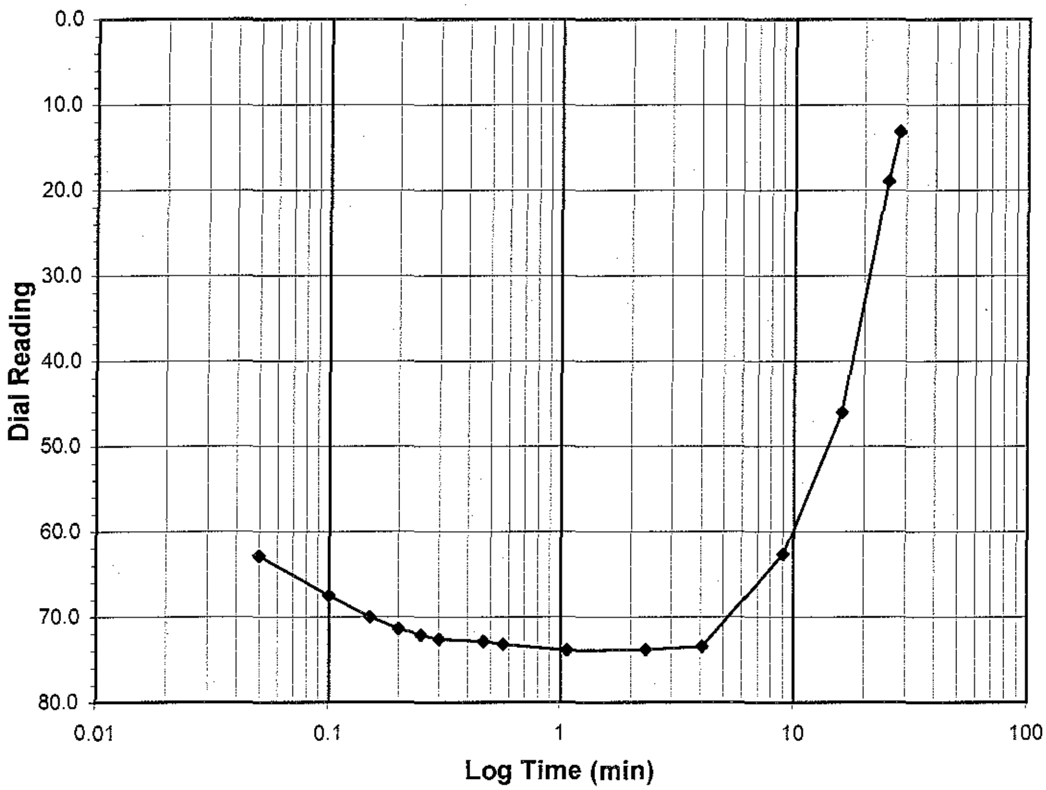
ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**0.25-0.5**
Final Reading	**(div)**	**13.1**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/4/12
Start Time		18:28:45

Elapsed Time (min)	Dial Reading (div)
Initial	**48.6**
0.05	62.9
0.10	67.5
0.15	70.0
0.20	71.4
0.25	72.1
0.30	72.6
0.47	72.9
0.57	73.2
1.07	73.9
2.32	73.8
4.07	73.4
9.07	62.6
16.07	46.0
25.07	18.9
28.07	13.1

Tested By DB *Date* 11/4/12 *Checked By* TM *Date* 11-12-12

ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

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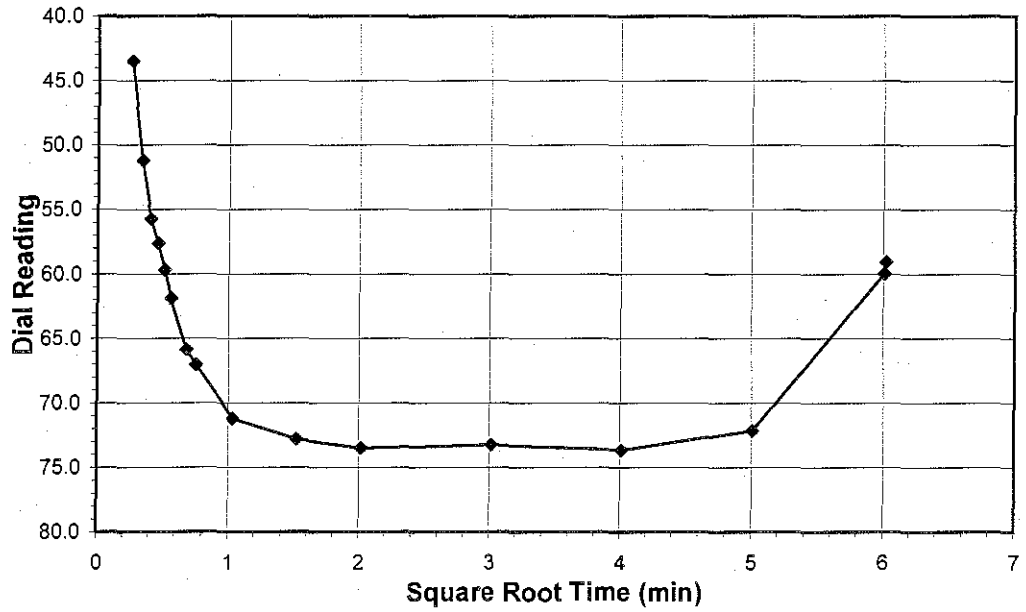
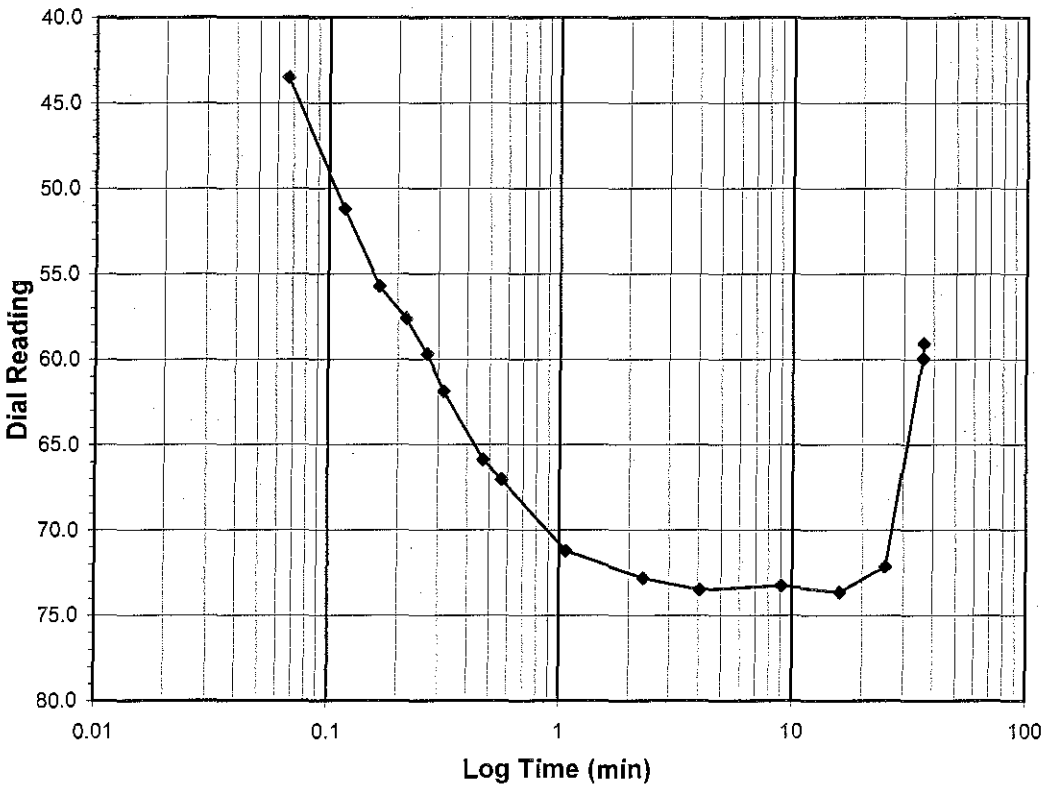
Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**0.5-1.0**
Final Reading	**(div)**	**59.1**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/4/12
Start Time		18:56:50

Elapsed Time (min)	Dial Reading (div)
Initial	**13.1**
0.07	43.5
0.12	51.2
0.17	55.7
0.22	57.6
0.27	59.7
0.32	61.9
0.47	65.9
0.57	67.0
1.07	71.2
2.32	72.8
4.07	73.5
9.08	73.2
16.08	73.6
25.08	72.1
36.08	60.0
36.23	59.1

Tested By DB *Date* 11/4/12 *Checked By* TM *Date* 11-12-12

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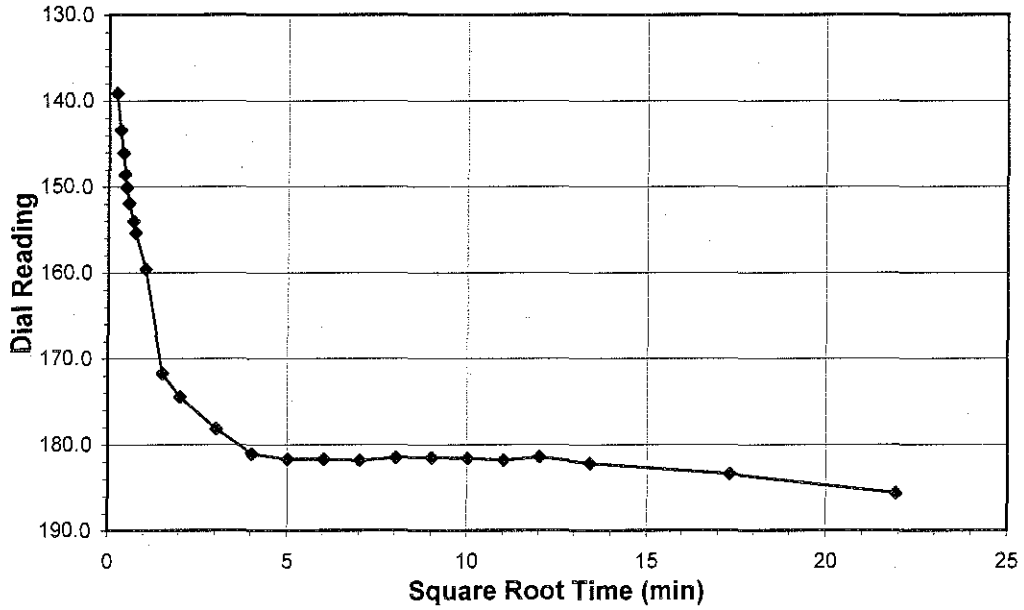
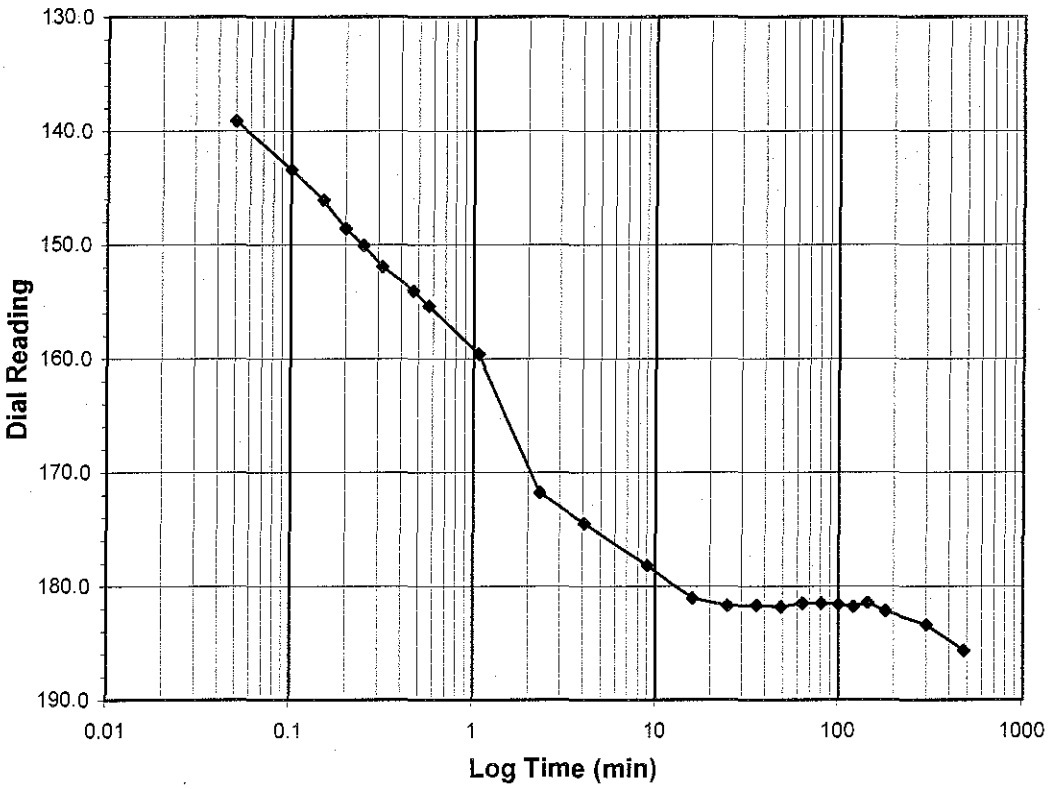
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**1.0-2.0**
Final Reading	**(div)**	**185.7**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/4/12
Start Time		19:33:03

Elapsed Time (min)	Dial Reading (div)
Initial	**59.1**
0.05	139.1
0.10	143.4
0.15	146.1
0.20	148.6
0.25	150.1
0.32	151.9
0.47	154.0
0.57	155.4
1.07	159.6
2.32	171.8
4.07	174.5
9.07	178.2
16.07	181.1
25.07	181.7
36.07	181.7
49.07	181.8
64.07	181.5
81.07	181.5
100.07	181.6
121.07	181.8
144.07	181.5
180.07	182.2
300.07	183.4
480.15	185.7

Tested By DB *Date* 11/4/12 *Checked By* JM *Date* 11-12-12

DCN: CT-24E Date and Time: Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 4

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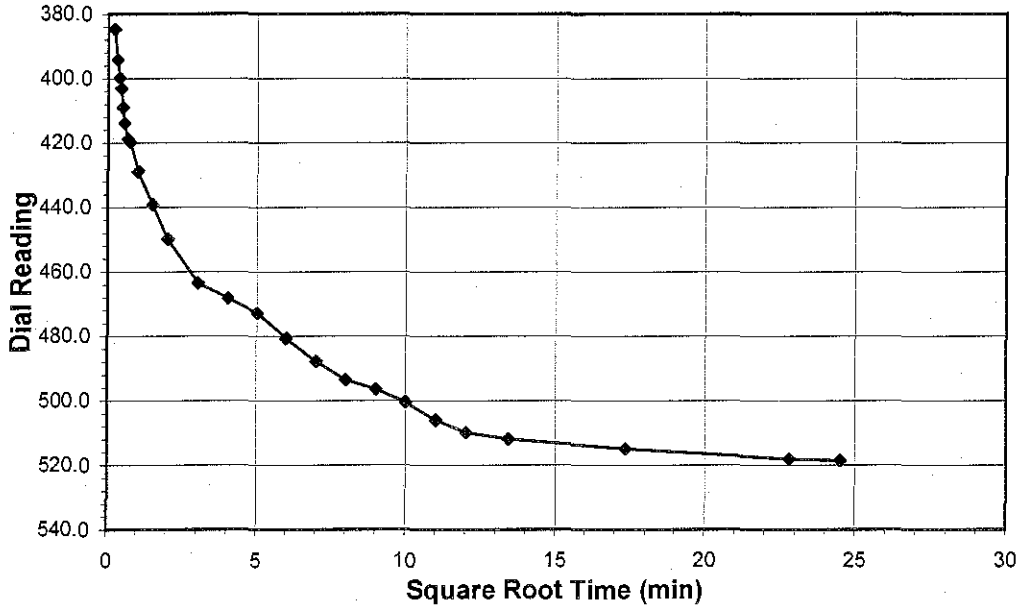
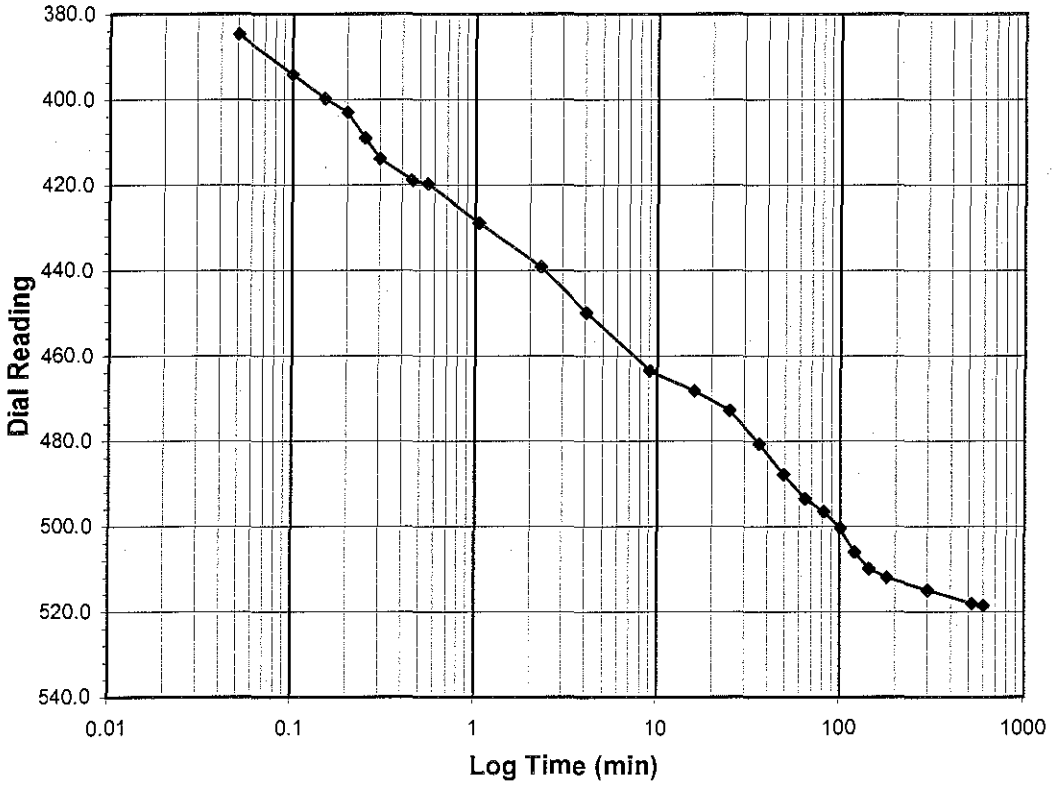
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**2.0-4.0**
Final Reading	**(div)**	**518.5**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/5/12
Start Time		3:33:12

Elapsed Time (min)	Dial Reading (div)
Initial	**185.7**
0.05	384.7
0.10	394.1
0.15	399.8
0.20	403.0
0.25	409.1
0.30	413.9
0.45	418.9
0.55	419.8
1.05	428.9
2.30	439.2
4.07	449.9
9.07	463.5
16.07	468.3
25.07	472.8
36.07	480.7
49.07	487.8
64.07	493.5
81.07	496.5
100.07	500.4
121.07	506.0
144.08	509.9
180.08	511.9
300.08	514.9
520.08	518.0
600.30	518.5

Tested By DB *Date* 11/5/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Data and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 5

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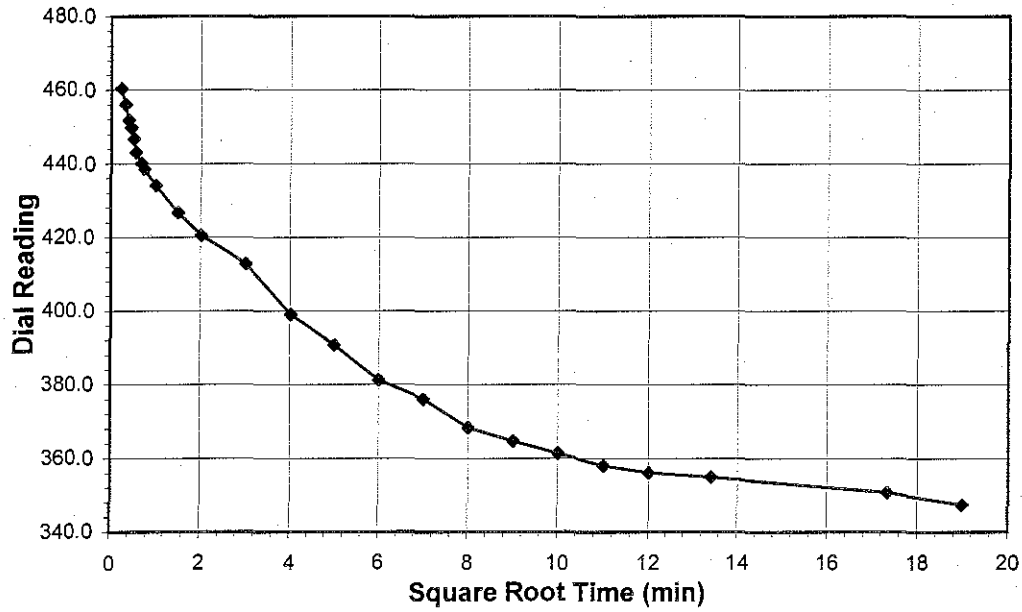
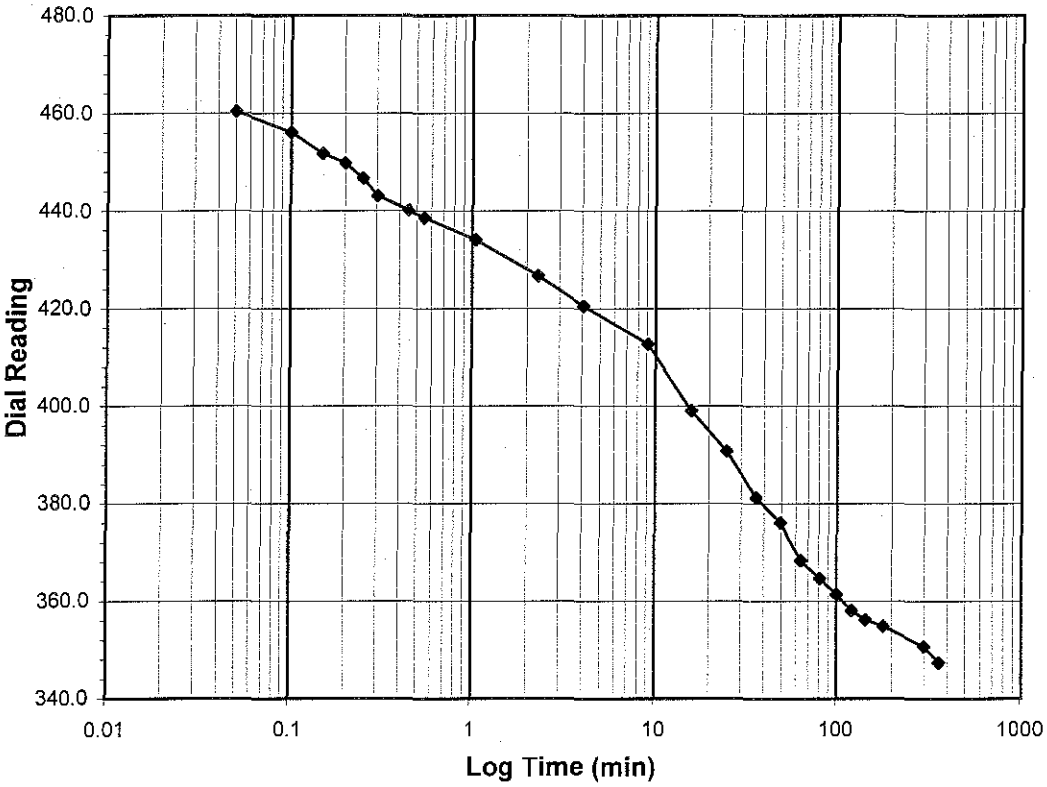
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**4.0-1.0**
Final Reading	**(div)**	**347.4**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/5/12
Start Time		13:33:30

Elapsed Time (min)	Dial Reading (div)
Initial	**518.5**
0.05	460.4
0.10	456.1
0.15	451.8
0.20	449.8
0.25	446.7
0.30	443.1
0.45	440.1
0.55	438.6
1.05	434.1
2.30	426.7
4.05	420.5
9.07	412.7
16.07	399.1
25.07	390.7
36.07	381.3
49.07	376.1
64.07	368.4
81.07	364.7
100.07	361.4
121.07	358.1
144.07	356.2
180.07	354.9
300.07	350.8
360.38	347.4

Tested By DB *Date* 11/5/12 *Checked By* JM *Date* 11-12-12

DCN: CT-24E Data Entered By: Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 6

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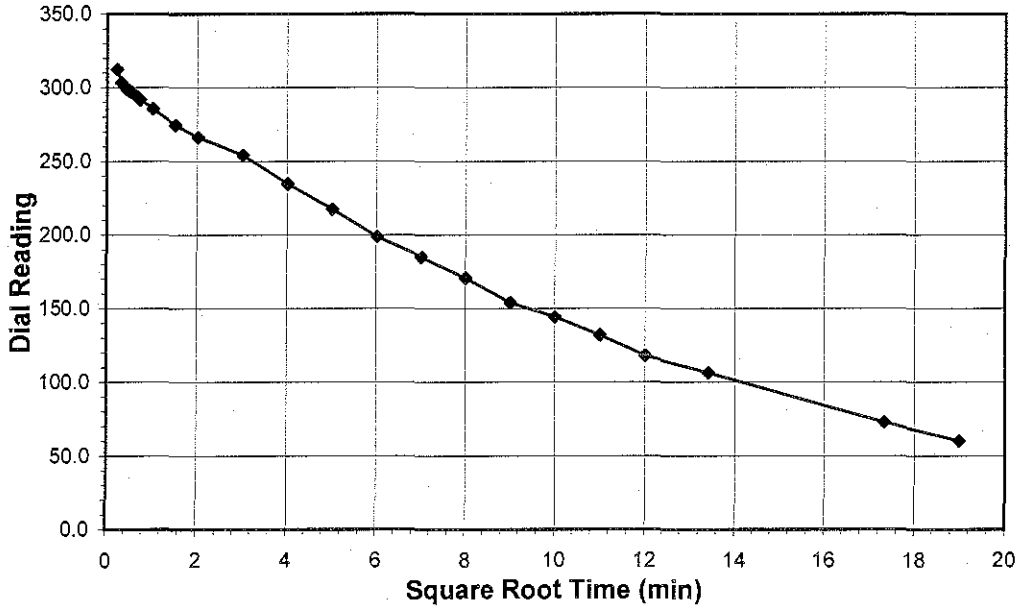
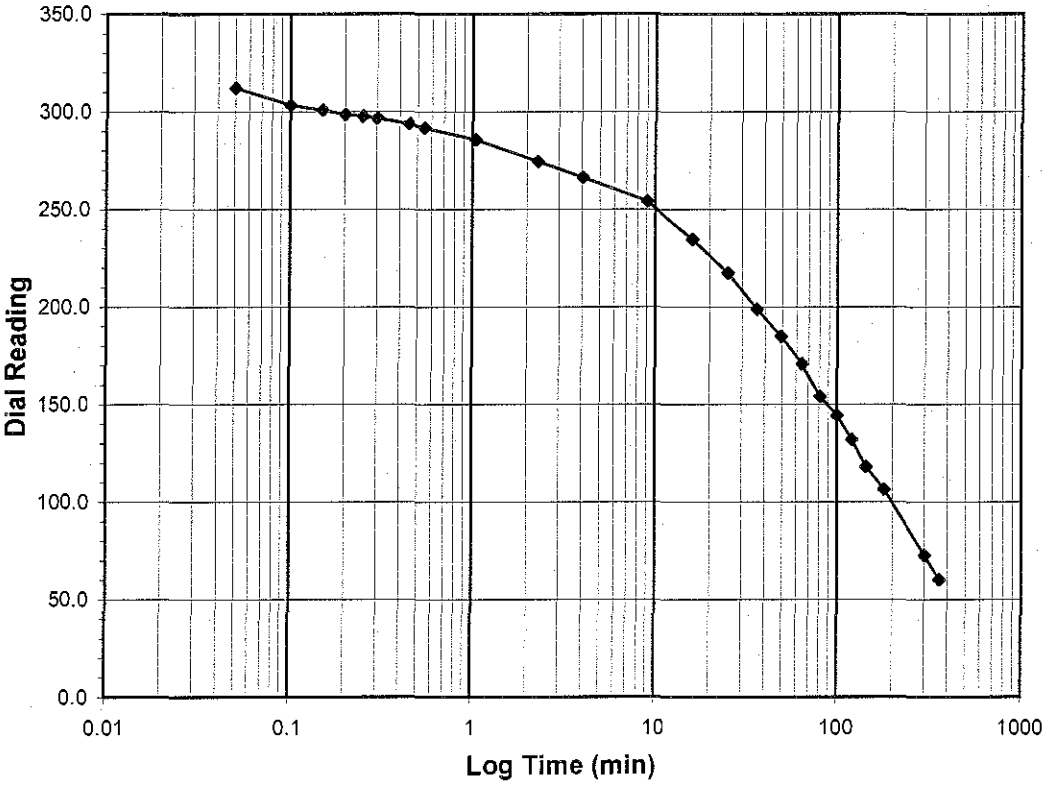
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**1.0-0.25**
Final Reading	**(div)**	**60.2**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/5/12
Start Time		19:33:53

Elapsed Time (min)	Dial Reading (div)
Initial	**347.4**
0.05	312.2
0.10	303.3
0.15	300.8
0.20	298.5
0.25	297.7
0.30	296.7
0.45	293.7
0.55	291.7
1.05	285.6
2.30	274.5
4.05	266.3
9.07	254.0
16.07	234.6
25.07	217.4
36.07	198.7
49.07	185.0
64.07	170.8
81.07	153.9
100.07	144.3
121.07	132.0
144.07	118.1
180.07	106.5
300.07	72.7
360.37	60.2

Tested By DB *Date* 11/5/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Date and Setting\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 7

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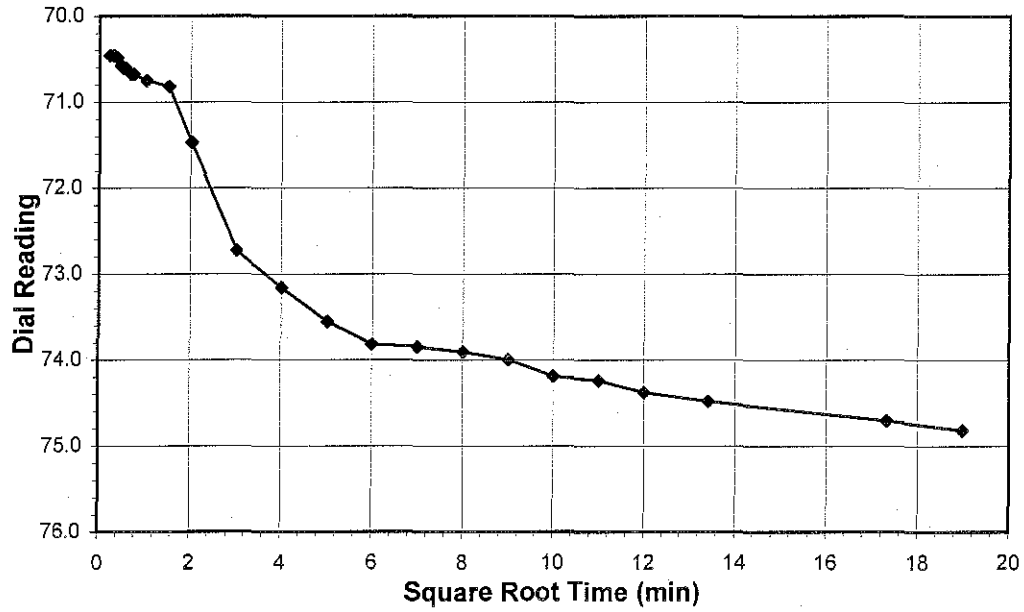
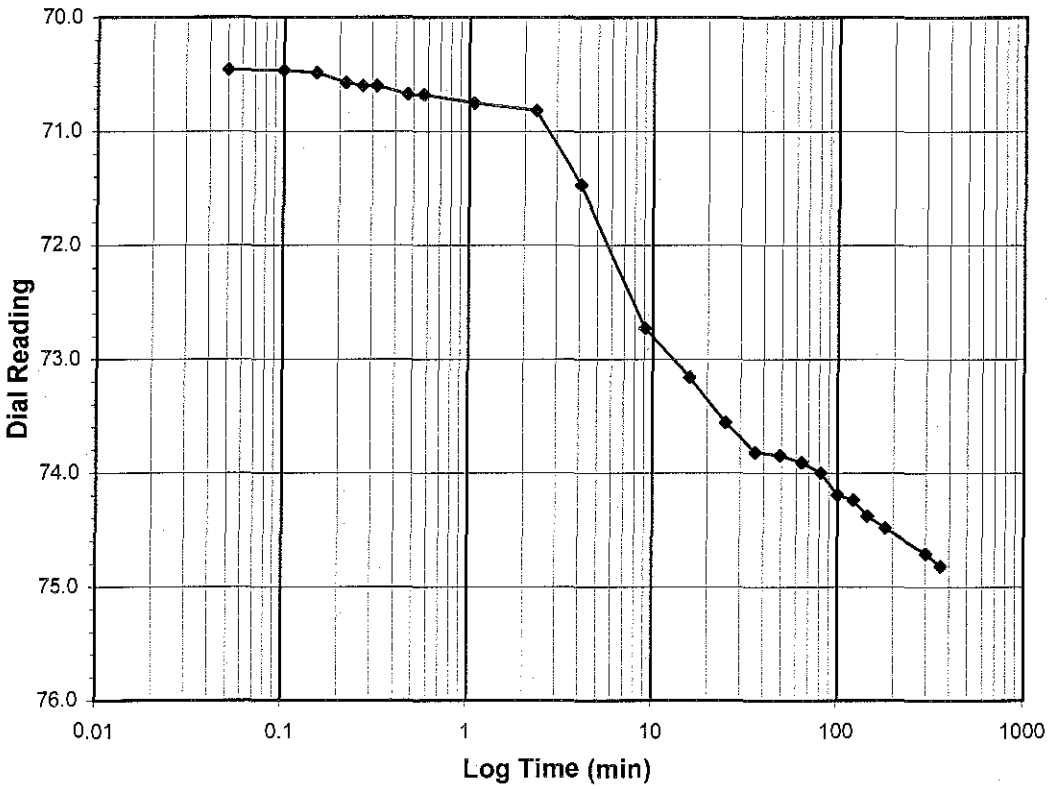
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**0.25-0.5**
Final Reading	**(div)**	**74.8**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/6/12
Start Time		1:34:15

Elapsed Time (min)	Dial Reading (div)
Initial	**60.2**
0.05	70.5
0.10	70.5
0.15	70.5
0.22	70.6
0.27	70.6
0.32	70.6
0.47	70.7
0.57	70.7
1.07	70.7
2.32	70.8
4.07	71.5
9.07	72.7
16.07	73.2
25.07	73.6
36.07	73.8
49.07	73.8
64.07	73.9
81.07	74.0
100.08	74.2
121.08	74.2
144.08	74.4
180.08	74.5
300.08	74.7
360.43	74.8

Tested By DB *Date* 11/6/12 *Checked By* JM *Date* 11-12-12

DCN: CT-24E Data and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 8

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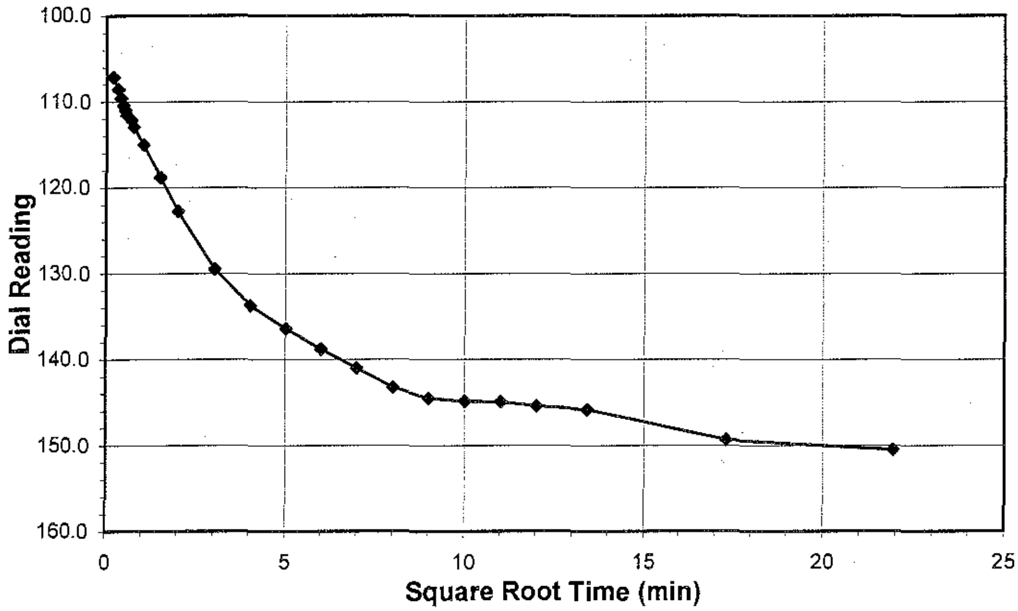
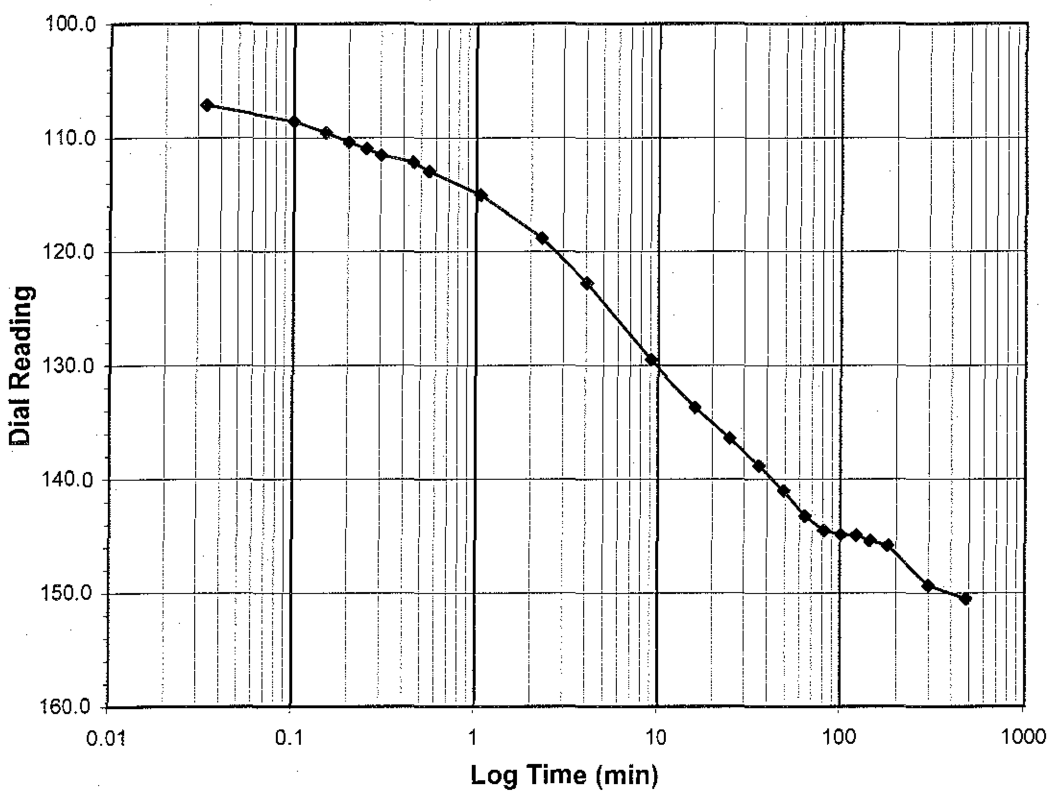
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**0.5-1.0**
Final Reading	**(div)**	**150.5**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/6/12
Start Time		7:34:41

Elapsed Time (min)	Dial Reading (div)
Initial	**74.8**
0.03	107.1
0.10	108.6
0.15	109.6
0.20	110.4
0.25	111.0
0.30	111.5
0.45	112.2
0.55	112.9
1.05	115.0
2.30	118.8
4.05	122.8
9.05	129.5
16.07	133.7
25.07	136.4
36.07	138.8
49.07	141.0
64.07	143.3
81.07	144.5
100.07	144.9
121.07	144.9
144.07	145.4
180.07	145.8
300.07	149.4
480.27	150.5

Tested By DB *Date* 11/6/12 *Checked By* TM *Date* 11-12-12

 DCN: CT-24E Date: *and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 9*

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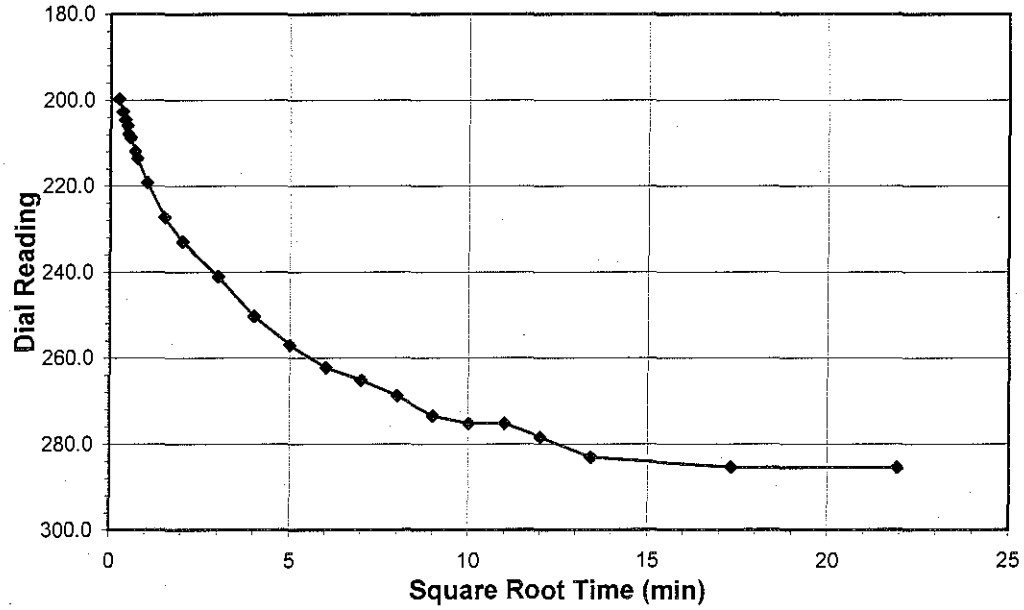
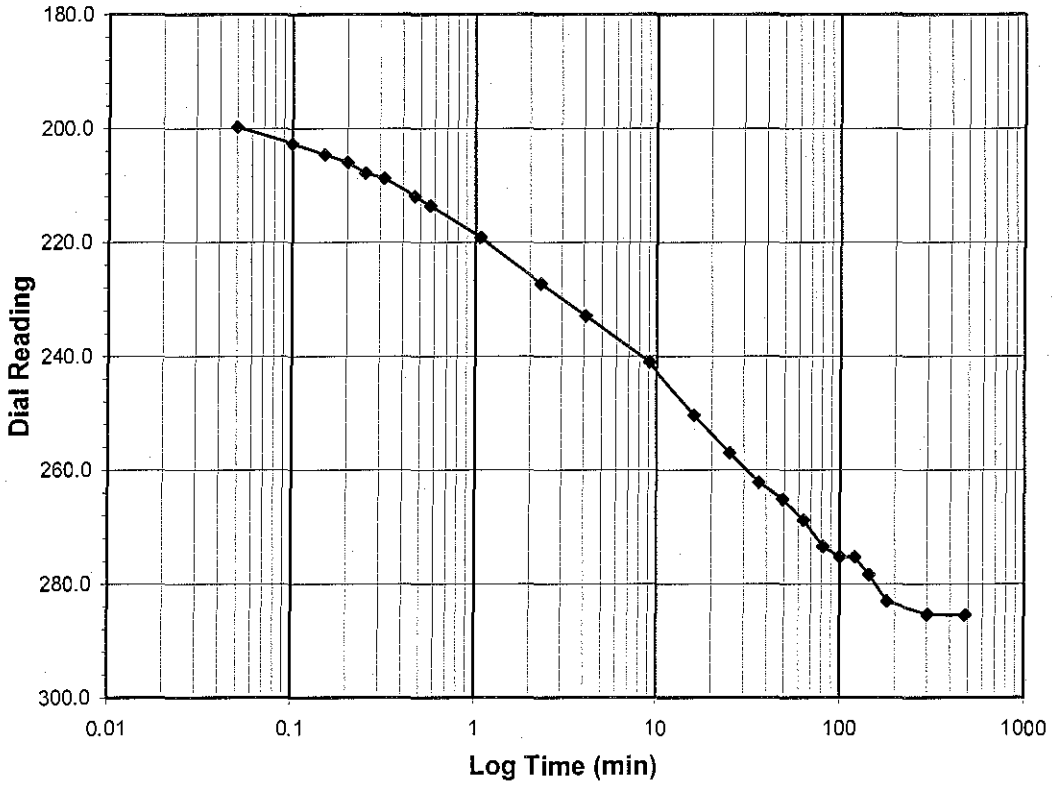
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**1.0-2.0**
Final Reading	**(div)**	**285.5**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/6/12
Start Time		15:34:58

Elapsed Time (min)	Dial Reading (div)
Initial	**150.5**
0.05	199.8
0.10	202.7
0.15	204.6
0.20	205.9
0.25	207.9
0.32	208.8
0.47	212.0
0.57	213.5
1.07	219.2
2.32	227.3
4.07	232.9
9.07	241.1
16.07	250.4
25.07	257.0
36.07	262.2
49.07	265.1
64.07	268.8
81.07	273.4
100.07	275.3
121.07	275.3
144.07	278.4
180.07	283.1
300.07	285.4
480.25	285.5

Tested By DB *Date* 11/6/12 *Checked By* JM *Date* 11-12-12

DCN: CT-24E Data\DocSettings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 10

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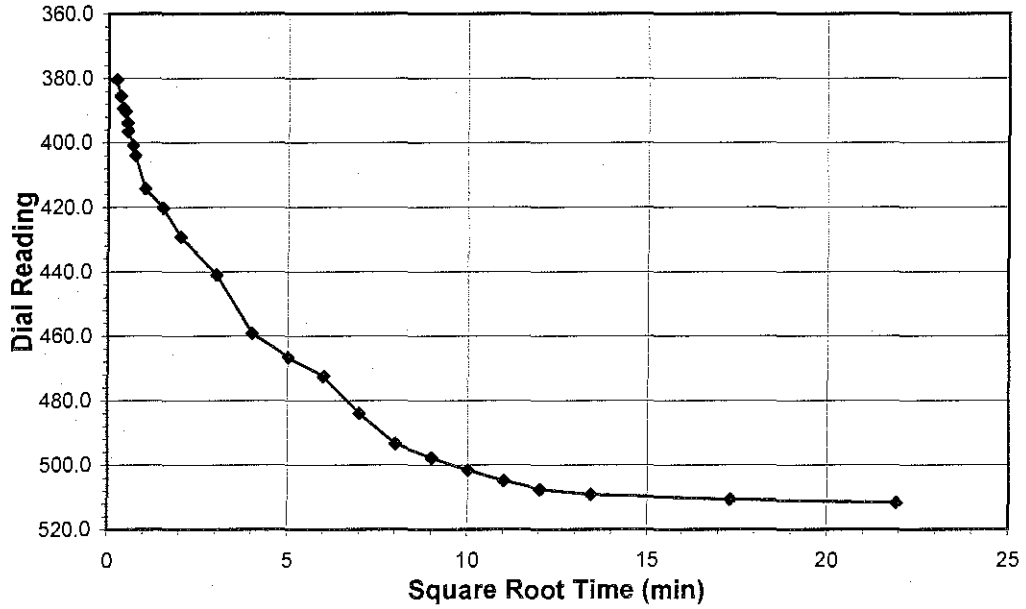
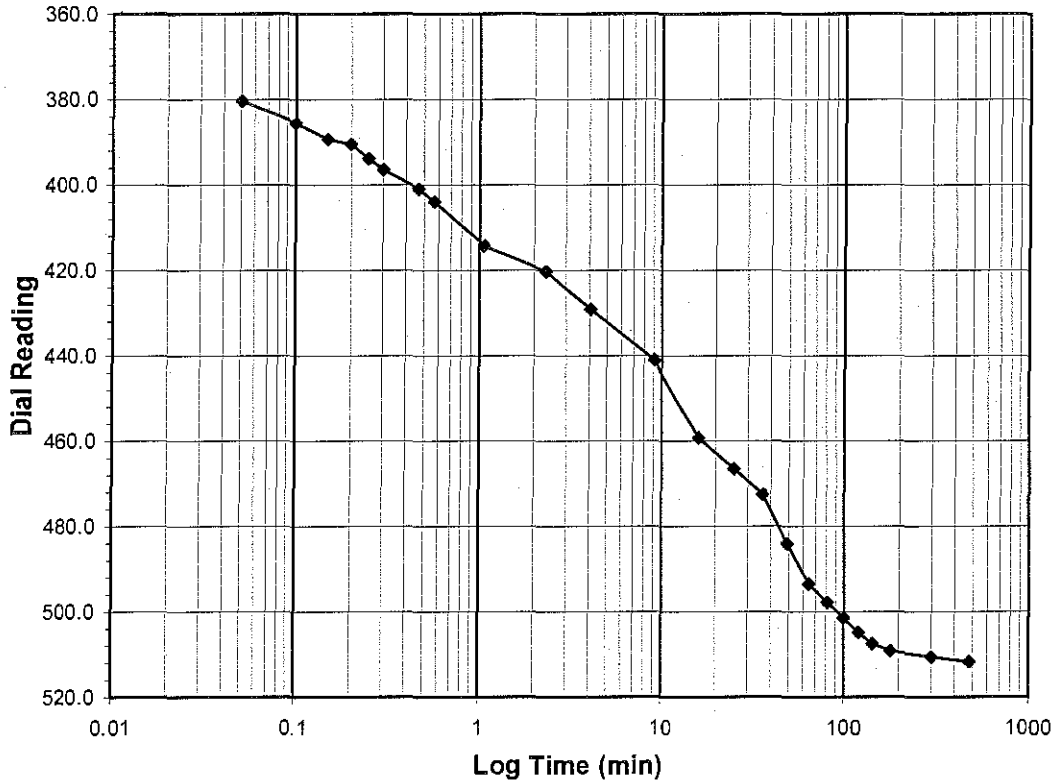
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**2.0-4.0**
Final Reading	**(div)**	**511.7**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/6/12
Start Time		23:35:13

Elapsed Time (min)	Dial Reading (div)
Initial	**285.5**
0.05	380.4
0.10	385.5
0.15	389.3
0.20	390.4
0.25	393.9
0.30	396.5
0.47	400.9
0.57	404.0
1.07	414.3
2.32	420.2
4.07	429.2
9.07	441.0
16.07	459.2
25.07	466.5
36.07	472.5
49.07	484.1
64.07	493.4
81.07	497.8
100.07	501.5
121.07	504.9
144.07	507.5
180.07	509.2
300.08	510.6
480.17	511.7

Tested By DB *Date* 11/6/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Data:\Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 11

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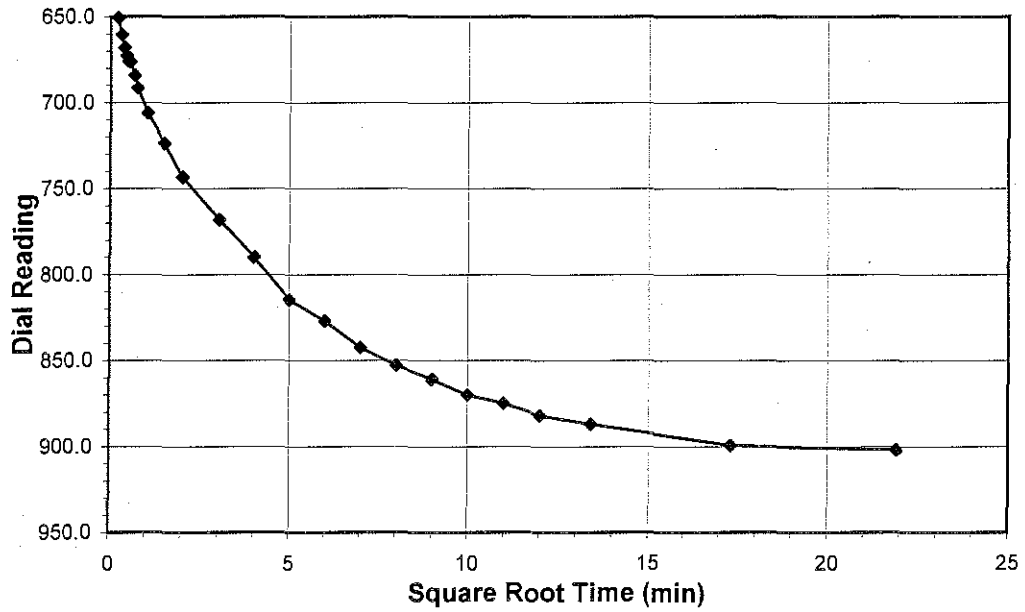
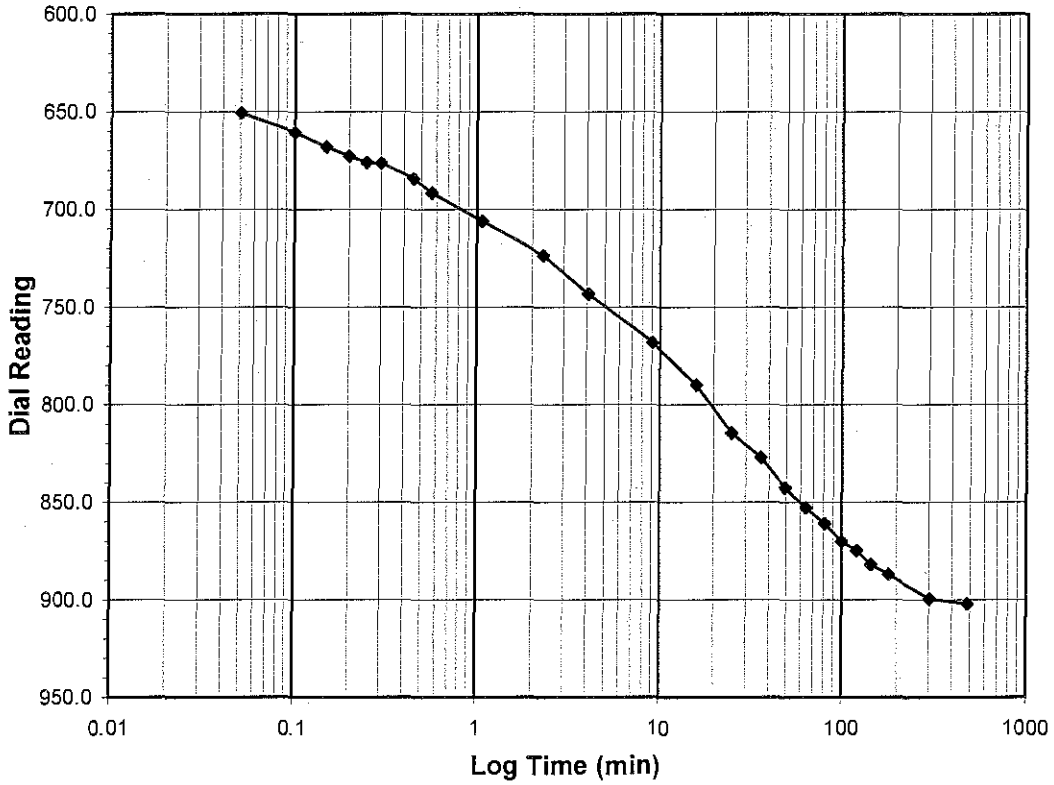
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**4.0-8.0**
Final Reading	**(div)**	**902.0**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/7/12
Start Time		7:35:23

Elapsed Time (min)	Dial Reading (div)
Initial	**511.7**
0.05	650.6
0.10	660.5
0.15	668.0
0.20	672.7
0.25	676.0
0.30	676.4
0.45	684.3
0.57	691.5
1.07	706.1
2.32	723.6
4.07	743.3
9.07	768.2
16.07	790.0
25.07	814.6
36.07	827.0
49.07	842.5
64.07	852.8
81.07	860.8
100.07	870.0
121.07	874.8
144.07	882.0
180.07	887.0
300.07	899.4
480.22	902.0

Tested By DB *Date* 11/7/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Data Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 12

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ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

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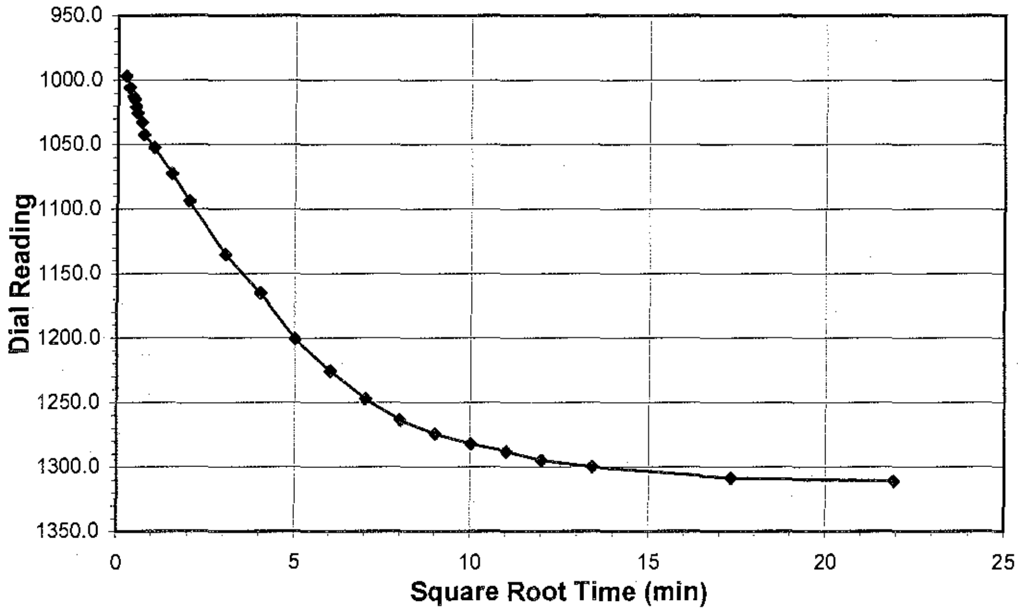
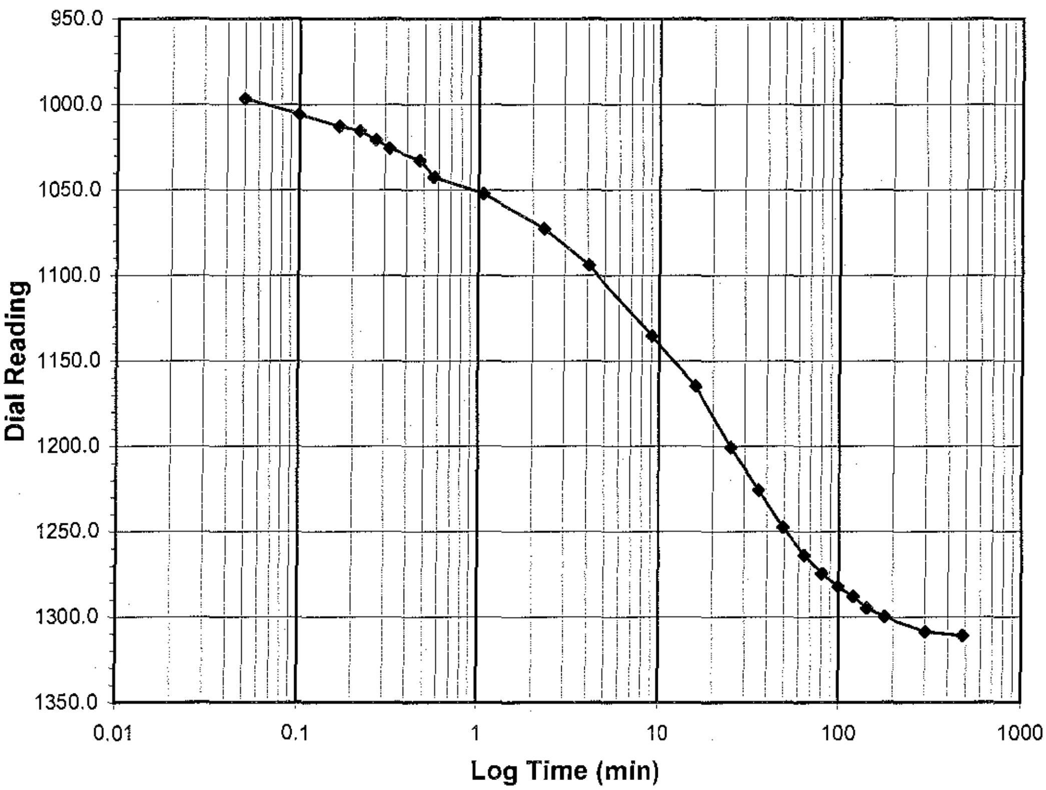
Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**8.0-16.0**
Final Reading	**(div)**	**1310.9**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/7/12
Start Time		15:35:36

Elapsed Time (min)	Dial Reading (div)
Initial	**902.0**
0.05	996.7
0.10	1005.7
0.17	1012.9
0.22	1015.4
0.27	1020.7
0.32	1025.6
0.47	1032.8
0.57	1042.5
1.07	1052.3
2.32	1072.5
4.07	1094.0
9.08	1135.5
16.08	1165.0
25.08	1200.7
36.08	1225.6
49.08	1247.4
64.08	1263.6
81.08	1274.4
100.08	1282.2
121.08	1287.9
144.08	1295.0
180.08	1299.8
300.08	1308.7
480.22	1310.9

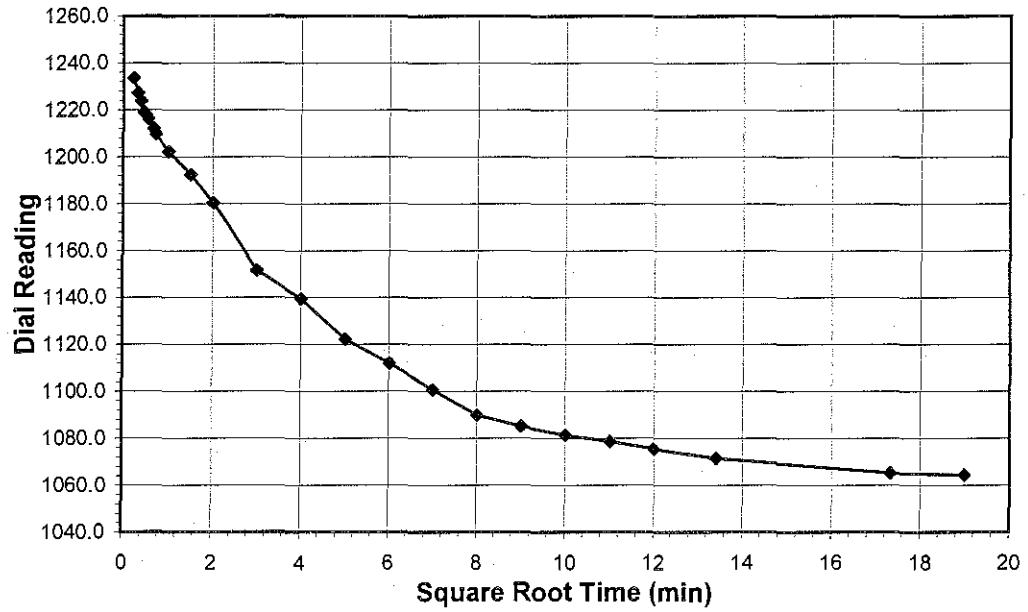
Tested By DB *Date* 11/7/12 *Checked By* TM *Date* 11-12-12

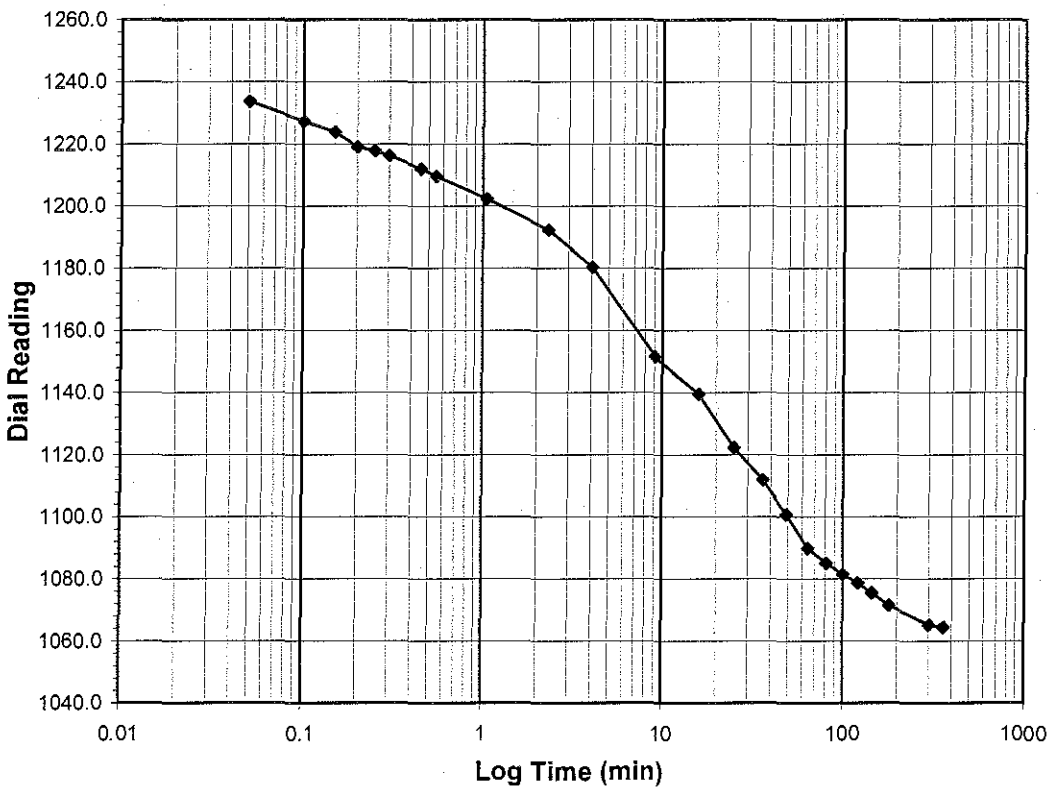
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**16.0-4.0**
Final Reading	**(div)**	**1064.4**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/7/12
Start Time		23:35:49

Elapsed Time (min)	Dial Reading (div)
Initial	**1310.9**
0.05	1233.6
0.10	1227.3
0.15	1223.9
0.20	1219.0
0.25	1217.8
0.30	1216.2
0.45	1212.1
0.55	1209.6
1.05	1202.2
2.30	1192.4
4.05	1180.3
9.07	1151.6
16.07	1139.5
25.07	1122.2
36.07	1111.9
49.07	1100.8
64.07	1089.9
81.07	1085.1
100.07	1081.5
121.07	1078.6
144.07	1075.5
180.07	1071.5
300.07	1065.2
360.37	1064.4

Tested By DB *Date* 11/7/12 *Checked By* JM *Date* 11-12-12

DCN: CT-24E Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 14

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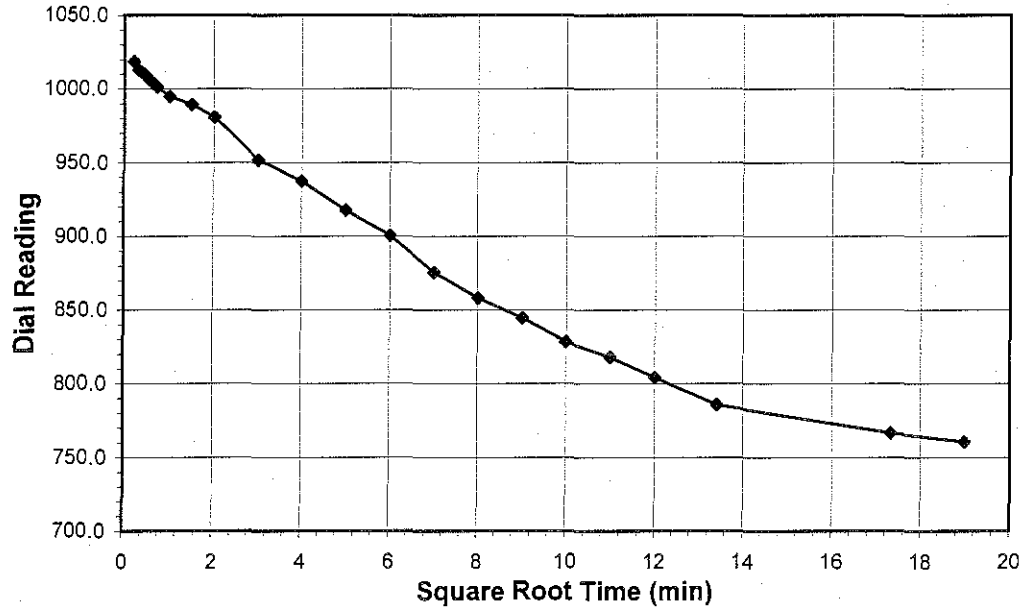
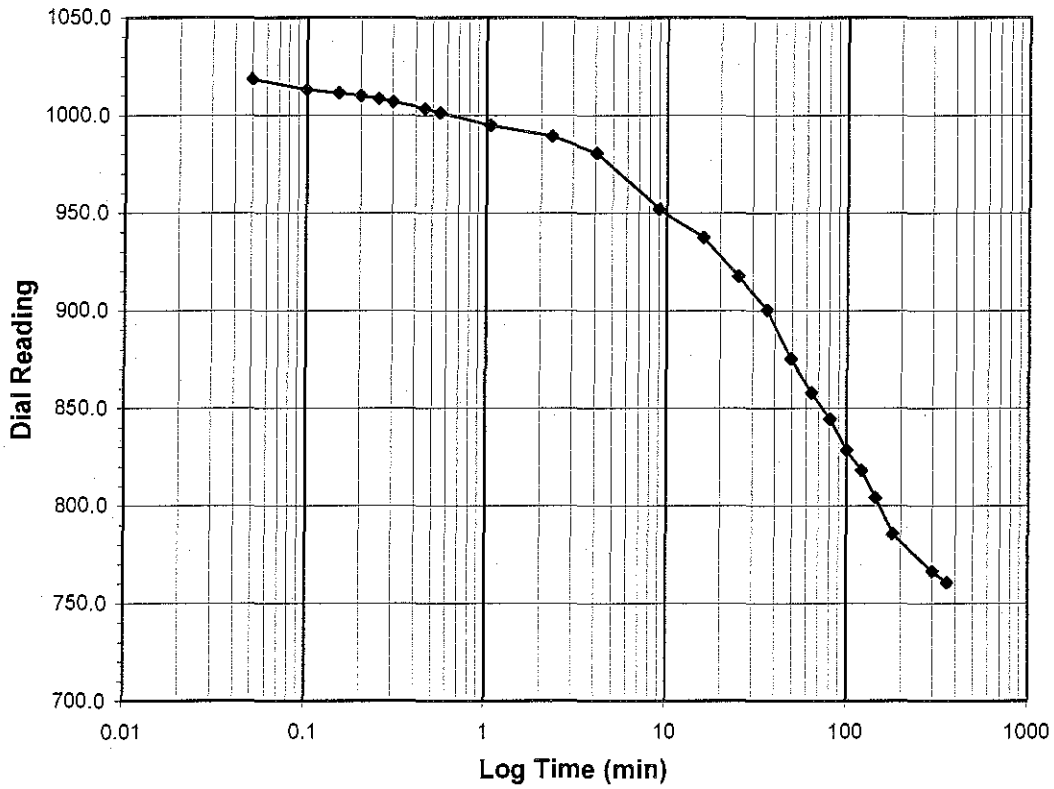
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-96 (SOP-S24A)

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**4.0-1.0**
Final Reading	**(div)**	**760.7**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/8/12
Start Time		5:36:11

Elapsed Time (min)	Dial Reading (div)
Initial	**1064.4**
0.05	1018.5
0.10	1013.1
0.15	1011.5
0.20	1010.0
0.25	1008.6
0.30	1006.8
0.45	1003.4
0.55	1001.3
1.05	994.8
2.30	989.3
4.05	980.7
9.07	951.9
16.07	937.5
25.07	917.6
36.07	900.4
49.07	875.5
64.07	858.0
81.07	844.5
100.07	828.4
121.07	818.1
144.07	804.2
180.07	785.7
300.07	766.5
360.42	760.7

Tested By DB *Date* 11/8/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Data:\Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 15

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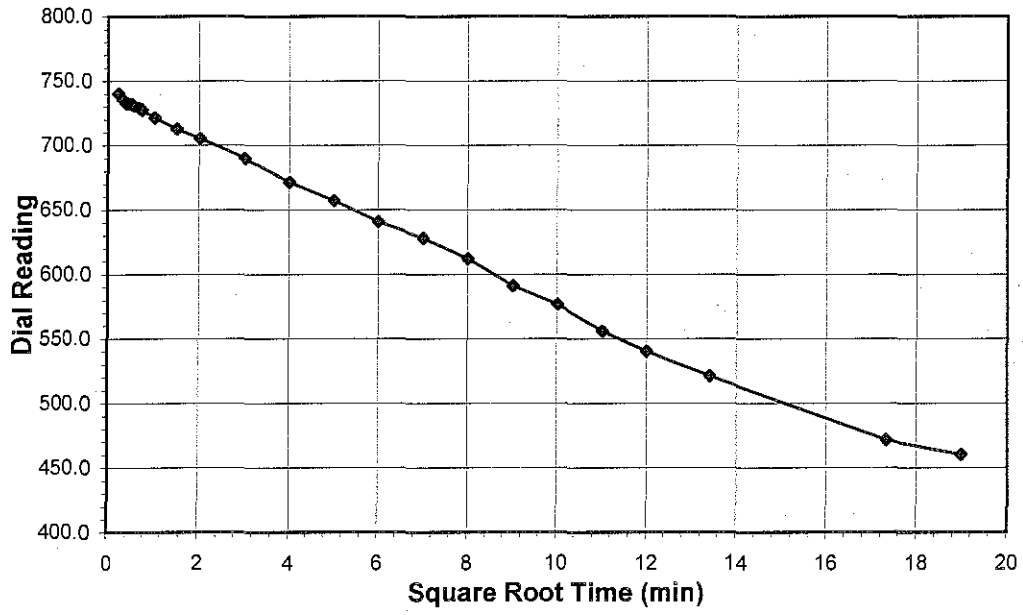
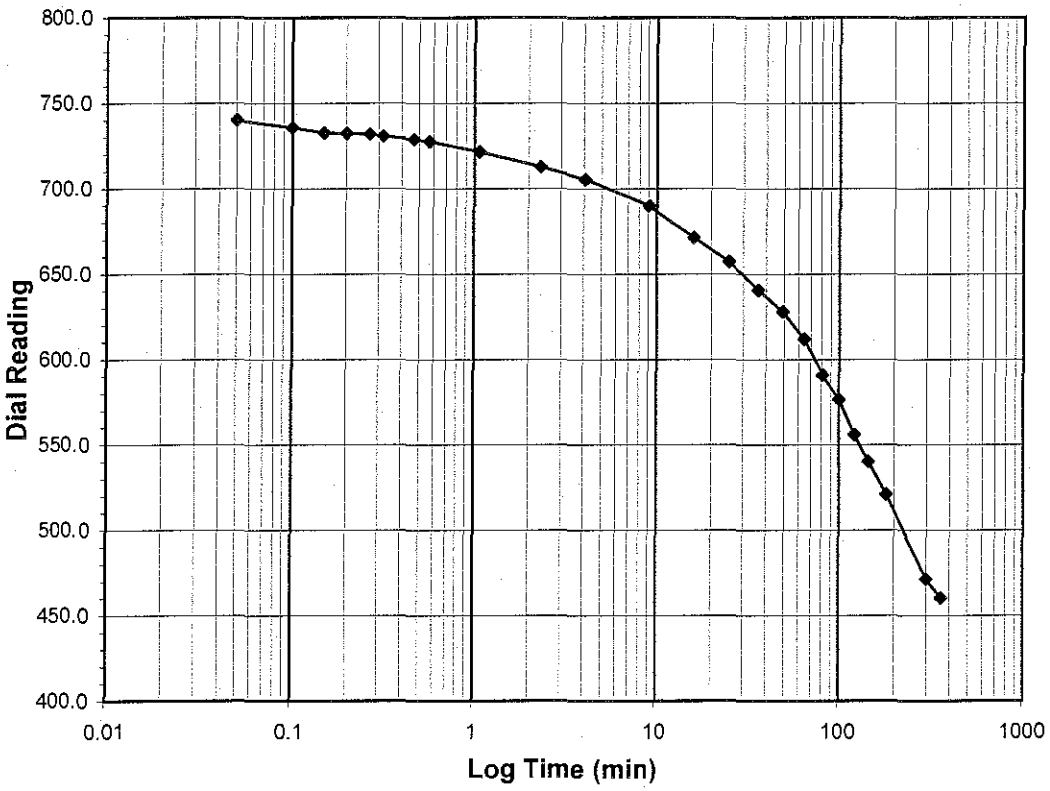
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-11

Client	URS CORPORATION	Boring No.	NA
Client Project	BIG SANDY POND CLOSURE 13815151	Depth (ft)	2.0-4.0
Project No.	2012-284-02	Sample No.	TP-19
Lab ID	2012-284-02-02	Visual Description	BROWN CLAY (-#4 MATERIAL)

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED





Test Load	**(tsf)**	**1.0-0.25**
Final Reading	**(div)**	**460.3**
Consolidometer No.		**G1427**
1 Division	(in)	0.0001
Start Date		11/8/12
Start Time		11:36:36

Elapsed Time (min)	Dial Reading (div)
Initial	**760.7**
0.05	740.2
0.10	735.7
0.15	732.7
0.20	732.3
0.27	731.8
0.32	730.7
0.47	728.9
0.57	727.6
1.07	721.5
2.32	712.7
4.07	705.4
9.07	689.9
16.08	671.5
25.08	657.2
36.08	640.7
49.08	627.9
64.08	612.0
81.08	590.9
100.08	576.7
121.08	556.1
144.08	540.3
180.08	521.0
300.08	471.5
360.42	460.3

Tested By DB *Date* 11/8/12 *Checked By* TM *Date* 11-12-12

DCN: CT-24E Documents and Settings\Administrator\My Documents\Consolidation & DShear\CONSOLIDATION\GEOJAC G1427\[URS2012-284-02-02CONSOL.xls]STEP 16

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APPENDIX C

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Photo No. 1	Date: 03/29/2012

Description:

Typical bedrock outcrop including weathered shale at the top transitioning to competent lower strata.

From existing road, facing North.

Vertical height from top to bottom is approximately 40 feet.

Photo No. 2	Date: 04/09/2012

Description:

Drilling location for PB-3 on Ash Road using track-mounted CME 55 drill rig.

Pennsylvania Drilling Company.

Facing Southeast.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Photo No. 3	Date: 04/17/2012

Description:

Barge used for drilling PB-1 and PB-2. Spud bars being anchored to maintain stability.

Pennsylvania Drilling Company.

Facing North.

Photo No. 4	Date: 4/17/2012

Description:

Drilling location for PB-7 on Ash Road using track-mounted CME 55 drill rig and mud rotary drilling.

Pennsylvania Drilling Company.

Facing Southeast.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Photo No. 5	Date: 4/17/2012

Description:

Weighing Shelby tube ash sample for PB-7 boring.

Photo No. 6	Date: 4/17/2012

Description:

Drilling location for SB-6 south of pond using track-mounted drill rig.

AEP Drilling.

Facing North.

URS	PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
American Electric Power	Louisa, Kentucky	13815141

Photo No. 7	Date: 4/24/2012

Description:

Drilling location for HB-6/MW-1207 on Ash Road using rotosonic drill rig.

Frontz Drilling Company.

Facing North.

Photo No. 8	Date: 4/25/2012

Description:

Completed borehole at drilling location for PB-8 on Ash Road using track-mounted CME 55 drill rig and mud rotary drilling.

Pennsylvania Drilling Company.

Facing Northeast.

APPENDIX D

URS

May 31, 2012

Via Email
Mr. Vik Gautam, P.E.
Senior Geotechnical Engineer
URS Corporation
1375 Euclid Avenue Suite 600
Cleveland, OH 44115

Subject: **Geophysical Investigation Report**
Seismic Velocity Surveys
American Electric Power: Big Sandy Plant
Proposed Landfill
Louisa, Kentucky

Dear Mr. Gautam:

In accordance with our proposal dated April 30, 2012, the URS Corporation (URS) Germantown, Maryland Geophysics Team is pleased to present this report on the findings of the geophysical investigation at the American Electric Power (AEP) Big Sandy Plant located near Louisa, Kentucky. The objective of the investigation was to provide data used to perform a seismic site response analysis.

The investigation consisted of vertical seismic profiling (VSP) and multichannel analysis of surface wave (MASW) surveys. The combination of the two methods provided both compressional wave (P-wave) and shear wave (S-wave) velocities of the site's subsurface materials.

Site Description

The American Electric Power Big Sandy Plant is located on the western bank of the Big Sandy River in Louisa, Kentucky. Geophysical surveying was performed within the ash reservoir located approximately ¾ mile northwest of the physical plant. "Floating" bottom ash embankments were constructed to provide access to each of the ash pond (PB) series borings presented on Figure 1 (PB-3 through PB-8). These temporary roadways provided access for the rigs during drilling operations as well as access for the subsequent geophysical surveying. At the time of the survey, PB-1 and PB-2 were inaccessible for VSP and MASW surveying.

Site Geology

Geologically, Quaternary age alluvium and residual soils are typically expected to overlay the Pennsylvanian age bedrock of interbedded shale, sandstone, conglomerates and coal found in the relatively shallow subsurface of eastern Kentucky. Onsite sampling reveals the survey area sits atop fly ash deposits found from the surface to depths in excess of 150'.

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Relatively thin sequences of clay-rich alluvium and residual soils were found to exist beneath the fly ash deposits which subsequently overlay the bedrocks of the Pennsylvanian age Conemaugh and Princess Formations.

SURVEY METHODS

The geophysical survey consisted of a combination of VSP and MASW surveys. Descriptions of the two geophysical methods are provided below.

Vertical Seismic Profiling Methodology

The VSP data were collected in general accordance with ASTM Standard D 7400-08. The boreholes were assumed to be vertical and no borehole deviation surveys were conducted prior to data acquisition. The seismic energy source was positioned at the surface a distance of 10 feet laterally from the borehole collar.

Seismic signals generated from initiation of the energy source were received by a Geostuff, Inc. BHG-3 tri-axial borehole geophone lowered at a uniform spacing down the borehole. This specialized geophone consists of one vertical sensor and two orthogonal horizontal sensors. Each sensor consists of a 4.5 Hertz geophone element. The geophone locks to the borehole (or casing) wall at each measurement depth by means of a mechanical side arm mounted to the body of the geophone. Once the source is activated, the geophone transmits the seismic signals to the seismograph located at the surface. The travel times of the pulses over the known distance from the source to the downhole geophone are subsequently used to calculate the S-wave and P-wave velocities.

Multichannel Analysis of Surface Waves (MASW) Methodology

The MASW method is a powerful tool for providing detailed soundings or profiles of seismic shear wave velocities of subsurface layers. The MASW method involves the profiling of shear wave velocities through analysis of the dispersion of surface waves. Dispersion refers to the principle that the velocity of a seismic surface wave varies as a function of the frequency of the waveform. The dispersive characteristics of surface waves are directly related to variations in physical properties of the underlying geologic layers. These variable physical properties include shear wave velocity, compressional wave velocity, density and layer geometry, with shear wave velocity providing the dominant control on the characteristics of the surface waves.

The MASW method involves three distinct steps: 1) data acquisition, 2) extraction of the surface wave dispersion curve and 3) inversion of the extracted dispersion curve to generate a profile of shear wave velocity versus depth. The analysis utilizes recorded seismic signal wave forms that are typically regarded as noise in more traditional seismic methods. That is, in traditional seismic surveys utilizing compressional wave sources, more than two-thirds of the seismic energy is imparted into surface waves. Because these traditional analytical methods involve analysis of the compressional wave, the large surface wave component of

the recorded seismic signal inhibits recognition of the compressional wave component of the signal and is thus effectively noise. However, the MASW method exploits this large surface wave component of seismic signals. MASW data are recorded using standard seismic refraction equipment and reflection surveying techniques. Additionally, MASW data are far less sensitive to cultural features, environmental noise, or geologic layering constraints, than other seismic methods. For example, seismic refraction requires that seismic velocity increases with depth, and both refraction and reflection require significant contrasts in velocity, density or acoustic impedance to resolve subsurface layering. These constraints are not applicable to the successful application of the MASW method.

MASW data are recorded using an array of geophones placed on the ground surface. For a linear geophone array a single shear wave velocity profile is modeled at the midpoint of the array. Modeling variations in shear wave velocity along a laterally continuous profile line is accomplished by recording successive data sets as the array is moved forward at a selected incremental distance along the ground surface. The distance increment utilized is selected by the investigator based on the level of lateral resolution required to accomplish the objective of the survey with consideration of the expected lateral heterogeneity of the subsurface.

SURVEY EXECUTION

Field work was conducted on May 7 through May 10, 2012, by Germantown, Maryland based representatives of URS Corporation. The VSP and MASW surveys were conducted at the proposed site of a landfill.

VSP Field Investigation

VSP data were collected by lowering the BHG-3 geophone down each boring and collecting data in increments of 5 feet. The seismic source for generating the S-wave pulses was constructed of two 6-inch x 6-inch x 10-feet long wooden planks bolted together and weighted down with the front wheels of the field vehicle and placed between 10 feet laterally from the borehole collar. A 16-pound sledgehammer was used to strike a vertically-oriented steel plate positioned at each end of the wooden plank to produce S-wave dominant seismic energy, and the corresponding vibrations were detected using the BHG-3 geophone. Data collected during the VSP survey was recorded using a Geometrics 24- channel Geode seismograph and a field PC. At each test depth, the measurements were repeated with sledgehammer strikes on the opposite end of the plank, and the records were then compared for appropriate reversal of the polarity of the S-waves.

For the P-wave component of the survey, an aluminum plate was placed flat on the ground 10 feet laterally from the borehole collar. P-wave signals were generated by striking the plate with the sledgehammer. P-wave surveying does not involve measuring reverse polarities, so only one series of P-wave measurements were recorded in each boring. For both the S-wave and the P-wave surveys, multiple hammer strikes were recorded at each

measurement location. This process, referred to as "stacking", is useful for enhancing seismic signals and minimizing the effects of unwanted noise in the data when using a sledgehammer as the energy source. After an adequate signal was recorded for the S-wave and P-wave data at each depth, the receiver was moved up the hole to the next depth in 5 foot increments.

Boring	*Depth of Casing (feet bgs)*	*Deepest Record (feet bgs)*	*Shallowest Record (feet bgs)*
PB-3	93	90.5	5.5
PB-4	112	109.6	4.6
PB-5	57	53.5	3.5
PB-6	100	97.6	2.6
PB-7	127	124.5	4.5
PB-8	153	150	5

Table 1: Boring and survey information for borings in which VSP surveying were performed

MASW Field Investigation

MASW data were collected along three transects totaling 940 linear feet. Data were collected as three separate transects, as seen on Figure 1. Transects were collected along accessible portions of the "floating" bottom fly ash embankments that were constructed to access wells PB-6, PB-7 and PB-8. The locations represent the optimal placement for MASW transects based on visual inspection of the survey area by the field crew. No data were collected along portions of the embankments deemed unsafe by URS staff.

The MASW data were collected using the same 24-channel Geometrics Geode seismograph and field PC used for the VSP survey. However, a land streamer consisting of an array of 24, 4.5 Hz geophones spaced 5 feet apart was utilized for the receivers for MASW survey. The seismic source (16-pound sledgehammer) was positioned at a fixed distance of 30 feet from the first geophone.

The MASW profiles varied in length and orientation based on the length, orientation and condition of their respective embankment. Table 2 summarizes the MASW line lengths and orientations.

MASW data were recorded at each source location. A minimum of two strikes of the sledgehammer were stacked at each source location. After the strikes, the seismic source and array were advanced 10 feet forward along the line and the next record was obtained. The advancement of the array provided an optimal balance of productivity and high resolution data.

MASW Line Name	*Length (feet)*	*Orientation*
MASW Line PB-6	150	South→North
MASW Line PB-7	350	Southeast→Northwest
MASW Line PB-8	440	Southwest→Northeast

Table 2: MASW line lengths and orientations

Positioning and Elevation Data

All VSP surveying were performed within the casing of each boring. Horizontal positional data for each of the borings was provided by URS-Cleveland. All vertical data associated with the VSP and MASW surveys relate to a ground surface elevation of 0 feet. The MASW line locations were referenced to their respective PB series boring by collecting taped distances during data acquisition.

Coordinates presented in Figure 1 are in the Kentucky North State Plane coordinate system, NAD 83, in units of U.S. Survey Feet.

Quality Control

QC measures for the seismic surveys involved conducting a noise test for the geophone array to ensure that geophones and cables were connected properly. Geophones that indicated excessive noise levels were either re-connected or re-planted to ensure adequate coupling with the ground. Plates at the base of the geophones were checked to ensure that they were sufficiently affixed. In addition, a trigger test was performed at the start of each survey to ensure that the seismograph was properly recording data. The VSP probe containing the geophones was checked at each 5 foot increment during each survey to ensure proper geophone orientation relative to north and ensure the probe was securely clamped to the well's casing wall.

DATA PROCESSING

VSP data were pre-processed using the program Pickwin™. Pre-processing of the data involved overlaying the S-wave reverse polarity seismic records on each other and determining the first arrival times of both the seismic P-wave and S-waves. The first arrival times were subsequently input into an Excel spreadsheet which was used to calculate the interval P-wave and S-wave velocities over each depth increment. The spreadsheet was also used to calculate corrected travel times to allow plotting of travel time data versus depth rather than source to receiver distance.

The MASW data were analyzed using Surfseis, Version 2.0, issued by the Kansas Geological Survey. Data processing involved editing and filtering the raw seismic records, generating velocity dispersion curves, creating 1-D shear wave velocity models, and importing the data into the program's modeling subroutine. The model results were exported into Surfer to grid

the MASW results and generate color-contoured 2-D cross-sections of subsurface shear wave velocity distribution for each profile.

RESULTS AND INTERPRETATION

VSP Results

The vertical seismic profiling completed in PB-3 through PB-8 have been presented as Figures 2 through 7 and summarized in Tables 3 through 8, respectively. The figures display corrected travel time and internal velocity plots for each of the VSP survey's compressional (P-wave) and shear wave (S-wave) readings in addition to boring stick logs and the N-values logged during the geotechnical boring of each PB series boring. The tables present interval velocity and dynamic Poisson's ratio (μ) data. The interval velocities are calculated based on the difference in the source to receiver distance for successive depths, divided by the difference in arrival times for successive depths as follows:

Vp (depth interval 1) **= $((D_2 – D_1)/ (T_2 – T_1)$**

Where:
V_P (depth interval 1) = P-wave velocity (feet/second) at 1st test depth
D_2 = Source to receiver distance (feet) at 2nd test depth
D_1 = Source to receiver distance 1 (feet) at 1st test depth
T_2 = P-wave arrival time (seconds) at 2nd test depth, and
T_1 = P-wave arrival time (seconds) at 1st test depth.

In general, the interval velocity listed for a particular depth interval represents the average velocity calculated based on the source to receiver distance differences and arrival time differences with respect to the next shallower test depth and the next deeper test depth. For example, the interval velocity listed for the P-wave for the third test depth at boring PB-3 (i.e. test depth = 15.5 feet) was calculated as follows:

Vp (depth interval 3) = **($Vp_{3\ to\ 2}$ + $Vp_{3\ to\ 4}$)/2**

Where:
Vp_3 = Interval P-wave velocity (feet/second) at third test depth (i.e. 15.5 feet)
$Vp_{3\ to\ 2}$ = Interval P-wave velocity calculated between 3rd and 2nd test depths, and
$Vp_{3\ to\ 4}$ = Interval P-wave velocity calculated between test depths 3rd and 4th test depths

The interval S-wave velocities were calculated in the same manner but using the S-wave arrival times associated with the respective test depths. Poisson's ratio was calculated using the following formula;

$$\mu = \frac{1}{2}(Vp^2 - 2Vs^2)/(Vp^2 - Vs^2)$$

Where *Vp* is the P-wave velocity and *Vs* is the S-wave velocity.

The results of the VSP at boring PB-3 are summarized in Table 3 and are presented graphically in Figure 2. The figure includes a P-wave and S-wave interval velocity plot, as well as the corrected P-wave and S-wave travel-time curves. The travel time plot accounts for the slant distance delay to allow plotting of arrival times versus depth rather than source to receiver distance.

Table 3: Vertical Seismic Profiling Results PB-3

Depth (Feet)	P-Wave Interval Velocity (Feet/Sec)	S-Wave Interval Velocity (Feet/Sec)	Dynamic Poisson's Ratio
2.6	730	248	0.44
7.6	2197	294	0.49
12.6	2697	323	0.49
17.6	4028	352	0.50
22.6	5521	446	0.50
27.6	5642	613	0.49
32.6	5718	1339	0.47
37.6	5769	1734	0.45
42.6	5804	898	0.49
47.6	5830	460	0.50
52.6	5849	519	0.50
57.6	5864	490	0.50
62.6	3639	614	0.49
67.6	5401	897	0.49
72.6	6828	995	0.49
77.6	4264	765	0.48
82.6	4268	839	0.48
87.6	3409	787	0.47

The VSP P-wave travel time curve for PB-3 (Figure 2) indicates that in the depth interval from approximately 4 to 12 feet, the average P-wave velocity is 1,320 feet/second associated with unsaturated bottom ash. In the depth interval from 12 to 28 feet the average P-wave velocity is 2100 feet/ second associated with coal sand. In the depth interval from 28 to 93 feet (bottom of casing) the average P-wave velocity is 5,270 feet/second associated with saturated flyash, alluvium and residual soils.

The VSP S-wave travel time curve for PB-3 (Figure 2) indicates that in the depth interval from approximately 10 to 28 feet, the average S-wave velocity is 305 feet/second associated with bottom ash material. In the depth interval from approximately 28 to 50 feet the average S-wave velocity is 510 feet/second associated with saturated flyash. From 50 to 93 feet (bottom of casing) the average S-wave velocity increases from 510 to 850 feet/second associated with alluvium and residual soils.

The results of the VSP at boring PB-4 are summarized in Table 4 and are presented graphically in Figure 3. The figure includes a P-wave and S-wave interval velocity plot, as well as the corrected P-wave and S-wave travel-time curves. The travel time plot accounts for the slant distance delay to allow plotting of arrival times versus depth rather than source to receiver distance.

Table 4: Vertical Seismic Profiling Results PB-4

Depth (Feet)	P-Wave Interval Velocity (Feet/Sec)	S-Wave Interval Velocity (Feet/Sec)	Dynamic Poisson's Ratio
2.6	922	604	0.12
7.6	4949	197	0.50
12.6	6024	291	0.50
17.6	6554	486	0.50
22.6	6837	515	0.50
27.6	7000	423	0.50
32.6	7103	404	0.50
37.6	7171	416	0.50
42.6	7218	462	0.50
47.6	7252	506	0.50
52.6	4916	550	0.49
57.6	4000	561	0.49
62.6	5440	577	0.49
67.6	5449	602	0.49
72.6	5456	602	0.49
77.6	5462	622	0.49
82.6	5467	723	0.49
87.6	5471	1152	0.48
88.6	3925	1321	0.44
89.6	4704	944	0.48
90.6	7033	1492	0.48
91.6	5322	1383	0.46

The VSP P-wave travel time curve for PB-4 (Figure 3) indicates that in the depth interval from approximately 4 to 10 feet, the average P-wave velocity is 825 feet/second associated with unsaturated bottom ash material. In the depth interval from about 10 to 110 feet (bottom of casing) the average P-wave velocity is 4,900 feet/second associated with saturated flyash, alluvium and residual soils.

The VSP S-wave travel time curve for PB-4 (Figure 3) indicates that in the depth interval from approximately 4 to 16 feet, the average S-wave velocity is 300 feet/second associated with bottom ash material. In the depth interval from approximately 16 to 84 feet the average S-wave velocity is 4200 feet/second associated with saturated flyash. From approximately 84 to 110 feet (bottom of casing) the average S-wave velocity is 1,000 feet/second associated with alluvium and residual soil materials.

The results of the VSP at boring PB-5 are summarized in Table 5 and are presented graphically in Figure 4. The figure includes a P-wave and S-wave interval velocity plot, as well as the corrected P-wave and S-wave travel-time curves. The travel time plot accounts for the slant distance delay to allow plotting of arrival times versus depth rather than source to receiver distance.

Table 5: Vertical Seismic Profiling Results PB-5

Depth (Feet)	P-Wave Interval Velocity (Feet/Sec)	S-Wave Interval Velocity (Feet/Sec)	Dynamic Poisson's Ratio
3.5	917	502	0.29
8.5	2484	339	0.49
13.5	4776	224	0.50
18.5	5830	238	0.50
23.5	5998	604	0.49
28.5	6061	1115	0.48
33.5	6486	1859	0.46
38.5	5447	432	0.50
43.5	5212	471	0.50
48.5	6396	498	0.50
53.5	6409	545	0.50

The VSP P-wave travel time curve for PB-5 (Figure 4) indicates that in the depth interval from approximately 4 to 8 feet, the average P-wave velocity is 980 feet/second associated with unsaturated bottom ash material. In the depth interval from about 10 to 110 feet (bottom of casing) the average P-wave velocity is 4,900 feet/second associated with saturated flyash, alluvium and residual soils.

The VSP S-wave travel time curve for PB-5 (Figure 4) indicates that in the depth interval from approximately 4 to 10 feet, the average S-wave velocity ranges from about 200 to 500 feet/second associated with bottom ash material. In the depth interval from approximately 10 to 40 feet the average S-wave velocity is approximately 200 feet/second associated with saturated flyash. From approximately 40 to 54 feet (bottom of casing) the average S-wave velocity is 490 feet/second associated with alluvium and residual soil materials.

The results of the VSP at boring PB-6 are summarized in Table 6 and are presented graphically in Figure 5. The figure includes a P-wave and S-wave interval velocity plot, as well as the corrected P-wave and S-wave travel-time curves. The travel time plot accounts for the slant distance delay to allow plotting of arrival times versus depth rather than source to receiver distance.

Table 6: Vertical Seismic Profiling Results PB-6

Depth (Feet)	P-Wave Interval Velocity (Feet/Sec)	S-Wave Interval Velocity (Feet/Sec)	Dynamic Poisson's Ratio
2.6	1110	661	0.23
7.6	5354	246	0.50
12.6	6843	283	0.50
17.6	6225	307	0.50
22.6	6098	347	0.50
27.6	4007	300	0.50
32.6	4383	360	0.50
37.6	4280	417	0.50
42.6	2692	582	0.48
47.6	2764	822	0.45
52.6	3638	714	0.48
57.6	4432	717	0.49
62.6	5087	752	0.49
67.6	4886	641	0.49
72.6	4703	856	0.48
77.6	3826	1953	0.32
82.6	3830	1848	0.35
87.6	4928	707	0.49
92.6	3942	1271	0.44
97.6	2840	1275	0.37

The VSP P-wave travel time curve for PB-6 (Figure 5) indicates that in the depth interval from approximately 4 to 12 feet, the average P-wave velocity is 1,300 feet/second associated with unsaturated bottom ash. In the depth interval from about 12 to 76 feet the average P-

wave velocity is 2,800 feet/ second associated with saturated flyash. In the depth interval from about 76 to 98 feet (bottom of casing) the average P-wave velocity is 3,500 feet/second associated with saturated alluvium.

The VSP S-wave travel time curve for PB-6 (Figure 5) indicates that in the depth interval from approximately 0 to 43 feet, the average S-wave velocity is in the range of 320 feet/second associated with bottom ash and flyash materials. In the depth interval from approximately 43 to 73 feet the average S-wave velocity is 705 feet/second associated with saturated flyash. From 78 to 98 feet (bottom of casing) the average S-wave velocity 1,200 feet/second associated with alluvium.

The results of the VSP at boring PB-7 are summarized in Table 7 and are presented graphically in Figure 6. The figure includes a P-wave and S-wave interval velocity plot, as well as the corrected P-wave and S-wave travel-time curves. The travel time plot accounts for the slant distance delay to allow plotting of arrival times versus depth rather than source to receiver distance.

Table 7: Vertical Seismic Profiling Results PB-7

Depth (Feet)	P-Wave Interval Velocity (Feet/Sec)	S-Wave Interval Velocity (Feet/Sec)	Dynamic Poisson's Ratio
4.5	855	518	0.21
9.5	5138	428	0.50
14.5	6277	342	0.50
19.5	6129	300	0.50
24.5	6552	439	0.50
29.5	7561	449	0.50
34.5	7673	456	0.50
39.5	6633	390	0.50
44.5	4951	397	0.50
49.5	4361	402	0.50
54.5	4377	407	0.50
59.5	4388	412	0.50
64.5	4398	415	0.50
69.5	5975	421	0.50
74.5	6301	440	0.50
79.5	5055	440	0.50

Table 7 (Continued): Vertical Seismic Profiling Results PB-7

Depth (Feet)	P-Wave Interval Velocity (Feet/Sec)	S-Wave Interval Velocity (Feet/Sec)	Dynamic Poisson's Ratio
84.5	5059	439	0.50
89.5	5063	449	0.50
94.5	5066	458	0.50
99.5	5069	467	0.50
104.5	5071	475	0.50
109.5	5074	489	0.50
114.5	5075	1036	0.48
119.5	5077	1410	0.46
124.5	5078	n/a	n/a

The VSP P-wave travel time curve for PB-7 (Figure 6) indicates that in the depth interval from approximately 5 to 10 feet, the average P-wave velocity is 1,020 feet/second associated with unsaturated bottom ash. In the depth interval from about 15 to 125 feet (bottom of casing) the average P-wave velocity is 5,030 feet/ second associated with saturated flyash, alluvium and residual materials.

The VSP S-wave travel time curve for PB-7 (Figure 6) indicates that in the depth interval from approximately 0 to 5 feet, the average S-wave velocity is in the range of 470 feet/second associated with bottom ash materials. In the depth interval from approximately 5 to 105 feet the average S-wave velocity ranges from about 300 to 600 feet/second associated with saturated flyash. From 105 to 125 feet (bottom of casing) the average S-wave velocity 910 feet/second associated with saturated alluvium and residual materials.

The results of the VSP at boring PB-8 are summarized in Table 8 and are presented graphically in Figure 7. The figure includes a P-wave and S-wave interval velocity plot, as well as the corrected P-wave and S-wave travel-time curves. The travel time plot accounts for the slant distance delay to allow plotting of arrival times versus depth rather than source to receiver distance.

Table 8: Vertical Seismic Profiling Results PB-8

Depth (Feet)	P-Wave Interval Velocity (Feet/Sec)	S-Wave Interval Velocity (Feet/Sec)	Dynamic Poisson's Ratio
5	942	322	0.43
10	5715	201	0.50
15	6122	273	0.50
20	6628	446	0.50
25	6899	417	0.50
30	6642	535	0.50
35	5819	598	0.49
40	5877	335	0.50
45	5406	338	0.50
50	4580	349	0.50
55	4240	367	0.50
60	4706	372	0.50
65	5349	378	0.50
70	5019	387	0.50
75	6645	394	0.50
80	7890	398	0.50
85	7138	407	0.50
90	6347	413	0.50
95	5931	420	0.50
100	8462	424	0.50
105	7526	444	0.50
110	3883	448	0.49
115	5371	453	0.50
120	7036	450	0.50
125	6792	463	0.50
130	6754	466	0.50
135	6962	478	0.50
140	6963	1382	0.48
145	6964	1603	0.47
150	6965	1086	0.49

The VSP P-wave travel time curve for PB-8 (Figure 7) indicates that in the depth interval from approximately 0 to 5 feet, the average P-wave velocity is 1,100 feet/second associated with unsaturated bottom ash. In the depth interval from about 5 to 150 feet (bottom of casing) the average P-wave velocity is 5,750 feet/ second associated with saturated flyash, alluvium and residual materials.

The VSP S-wave travel time curve for PB-8 (Figure 7) indicates that in the depth interval from approximately 0 to 25 feet, the average S-wave velocity is in the range of 350 feet/second associated with bottom ash and flyash materials. In the depth interval from approximately 25 to 135 feet the average S-wave velocity is 560 feet/second associated with saturated flyash. From 135 to 150 feet (bottom of casing) the average S-wave velocity 1,355 feet/second associated with saturated alluvium and residual materials.

MASW Results

The MASW results for survey lines MASW PB-6 through MASW PB-8 are presented as Figure 2. It should be noted that the MASW cross-sections are presented as depth sections rather than in terms of elevation. Available MASW analytical methods are currently not capable of incorporating topography, thus analysis assumes a relatively flat or uniform grade, which was the case at each of the 3 survey locations.

The results indicate that shear wave velocities range from approximately 200 to 1,000 feet/second. The relative location of each MASW transect to its associated boring has been annotated on Figure 2. Stratigraphic data acquired from borings PB-6 through PB-8 have been presented on Figure 2 in the form of stick logs. Internal S-wave velocities acquired during the VSP surveys in borings PB-6 through PB-8 have also been presented on Figure 2 at their respective locations.

MASW Line	*Depth of Investigation (feet)*	*Mean Velocity (ft/sec)*	*Minimum Velocity (ft/sec)*	*Maximum Velocity (ft/sec)*
MASW PB-6	61	447.9	211	1,296
MASW PB-7	61	415.3	213	1,010
MASW PB-8	74	463.8	212	1,141

Table 9: MASW S-wave velocity profile details

Table 9 provides a generalized summary of the velocity data portrayed as color-enhanced contours on Figure 2. As noted on the table, the mean S-wave velocities calculated through the processing of the MASW data from each of the three transects falls within the range of 415 to 464 feet/second. Chart 1 displays a histogram showing the distribution of each calculated velocity value contained within the database of each of the 3 transects.

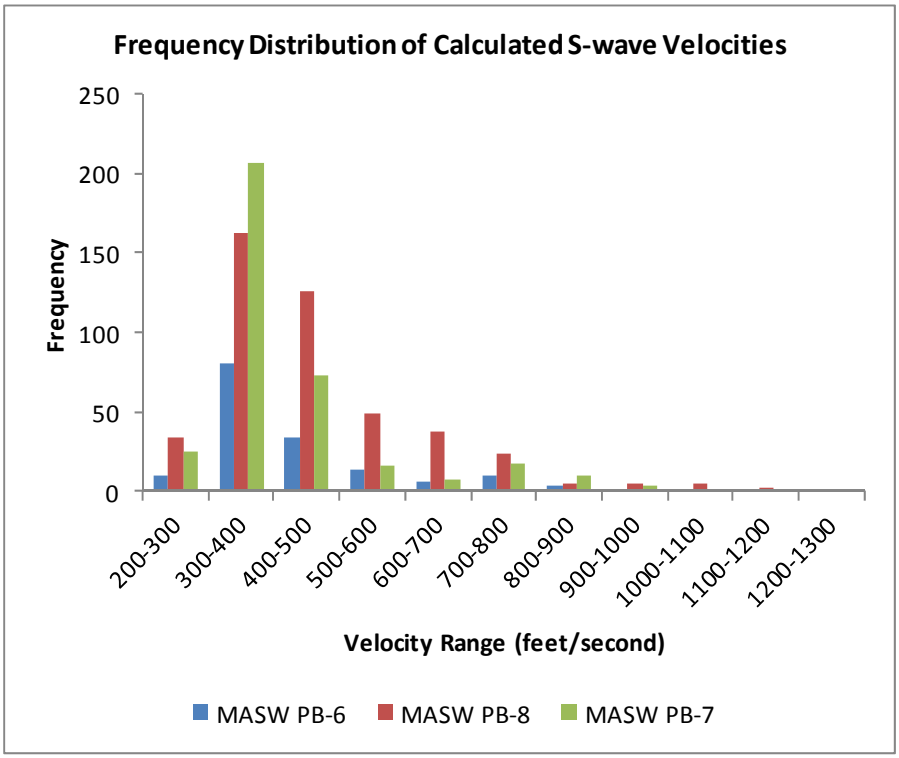


Chart 1: Frequency distribution of calculated S-wave velocities

CONCLUSIONS

The results of the VSP surveys generally correlate well with each other and with available stratigraphic information from the borings. The indicated seismic velocities are generally consistent with the ranges characteristic of the subsurface units based on other studies completed in the region.

The mean velocities presented in Table 9 as well as the distribution curve highlighted in Chart 1 reveal that a majority of the data collected as MASW lines PB-6 through PB-8 are associated with velocities in the range of 300 to 600 feet/second. These results indicate that the average shear wave velocities within the upper 100 feet of the subsurface are consistent with those associated with a designation of Site Class E, as seen on Table 10 below.

TABLE 1613.5.2				
SITE CLASS DEFINITIONS				
SITE CLASS	SOIL PROFILE NAME	AVERAGE PROPERTIES IN TOP 100 feet, SEE SECTION 1613.5.5		
		Soil shear wave velocity, V, (ft/s)	Standard penetration resistance, N	Soil undrained shear strength, S
A	Hard Rock	V > 5,000	N/A	N/A
B	Rock	2,500 < V ≤ 5,000	N/A	N/A
C	Very dense soil and soft rock	1,200 < V ≤ 2,500	N > 50	S ≥ 2,000
D	Stiff soil profile	600 ≤ V ≤ 1,200	15 ≤ N ≤ 50	1,000 ≤ S ≤ 2,000
E	Soft soil profile	V < 600	N < 15	S < 1,000
E	–	Any profile with more than 10 feet of soil having the following characteristics: 1. Plasticity index PI > 20, 2. Moisture content w ≥ 40%, and 3. Undrained shear strength S < 500 psf		
F	–	Any profile containing soils having one of more of the following characteristics: 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and/or highly organic clays (H > 10 feet of peat and/or highly organic clay where H = thickness of soil) 3. Very high plasticity clays (H > 25 feet with plasticity index PI > 75) 4. Very thick soft/medium stiff clays (H > 120 feet)		

Table 10: Seismic site class designations based on shear wave velocities of the upper 100 feet of the subsurface as provided by IBC, 2006

LIMITATIONS

This geophysical investigation was conducted in accordance with reasonable and accepted engineering geophysics practices, and the interpretations and conclusions are rendered in a manner consistent with other consultants in our profession. However, all geophysical techniques have some level of uncertainty and limitations. No other representations to the client is expressed or implied, and no warrant or guarantee is included or intended.

We greatly appreciate the opportunity to work with you on this project. Please contact us at (301) 820-3000 if you have any questions.

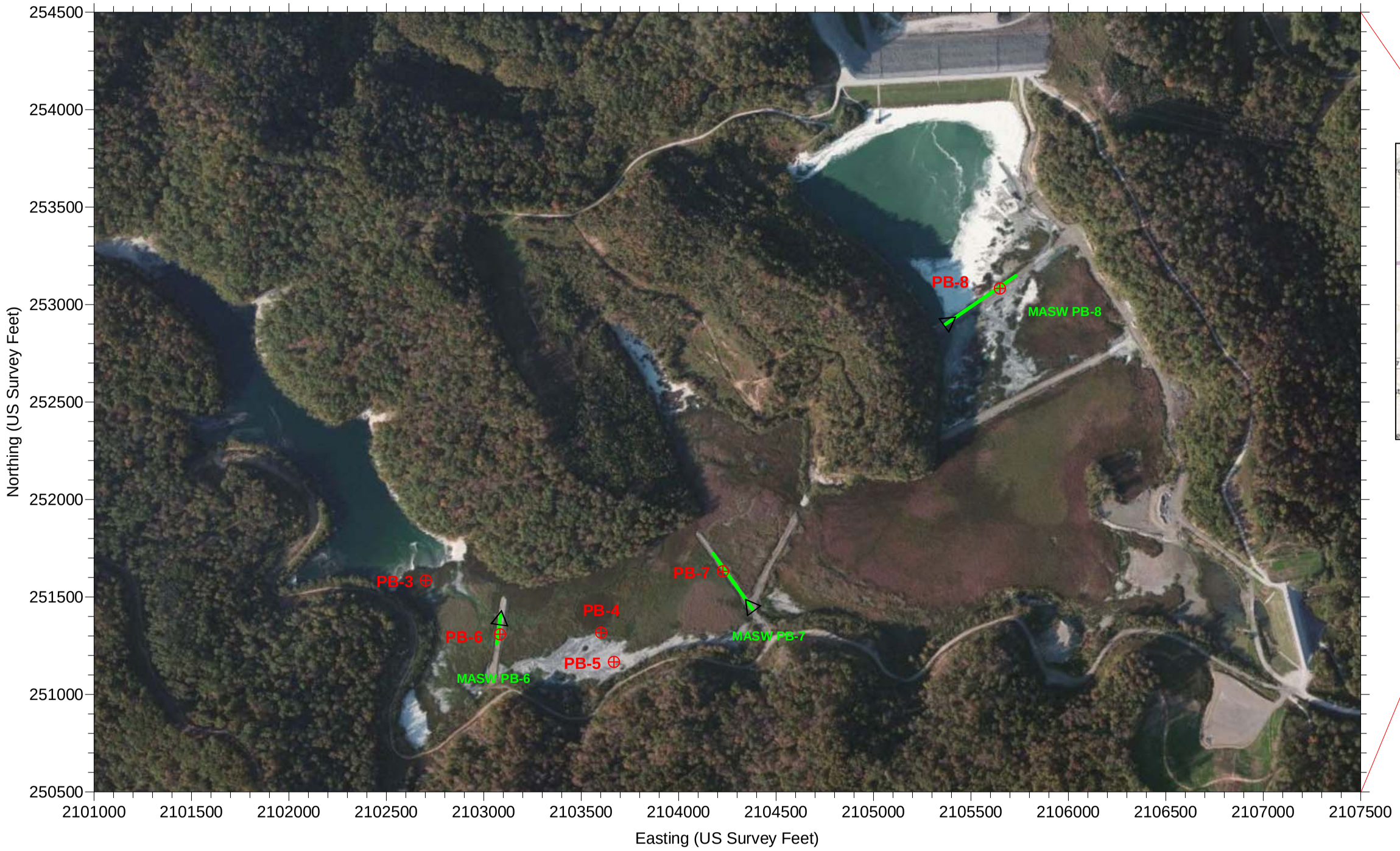
Very truly yours,
URS Corporation

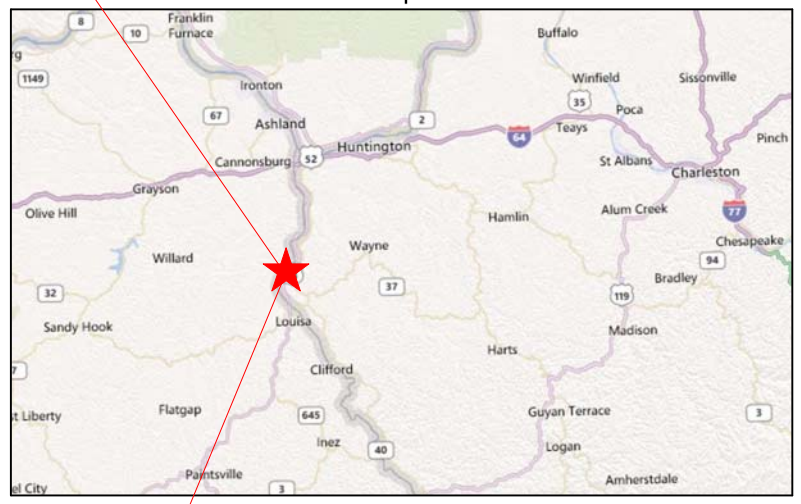
Steven J. Husted
Senior Geophysicist

Timothy J. King, P.G.
Principal Geologist

Enclosures:

Figure 1 – Site Map
Figure 2 – Vertical Seismic Profiling Results: Boring PB-3





N
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S

Notes:

Site map presented in the U.S. State Plane Coordinate System NAD83 in unit of U.S. Survey Feet

Positional data for PB series borings acquired from boring logs provided by URS Cleveland

PB-1 and PB-2 not accessible during time of survey

Map Scale
1 inch = 600 feet

0 300 600 900 1200

Legend:

- Boring
- MASW Transect Location
- Denotes Line Orientation

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Geophysical Investigation Results
Site Map

American Electric Power - Big Sandy Plant

Louisa, Kentucky

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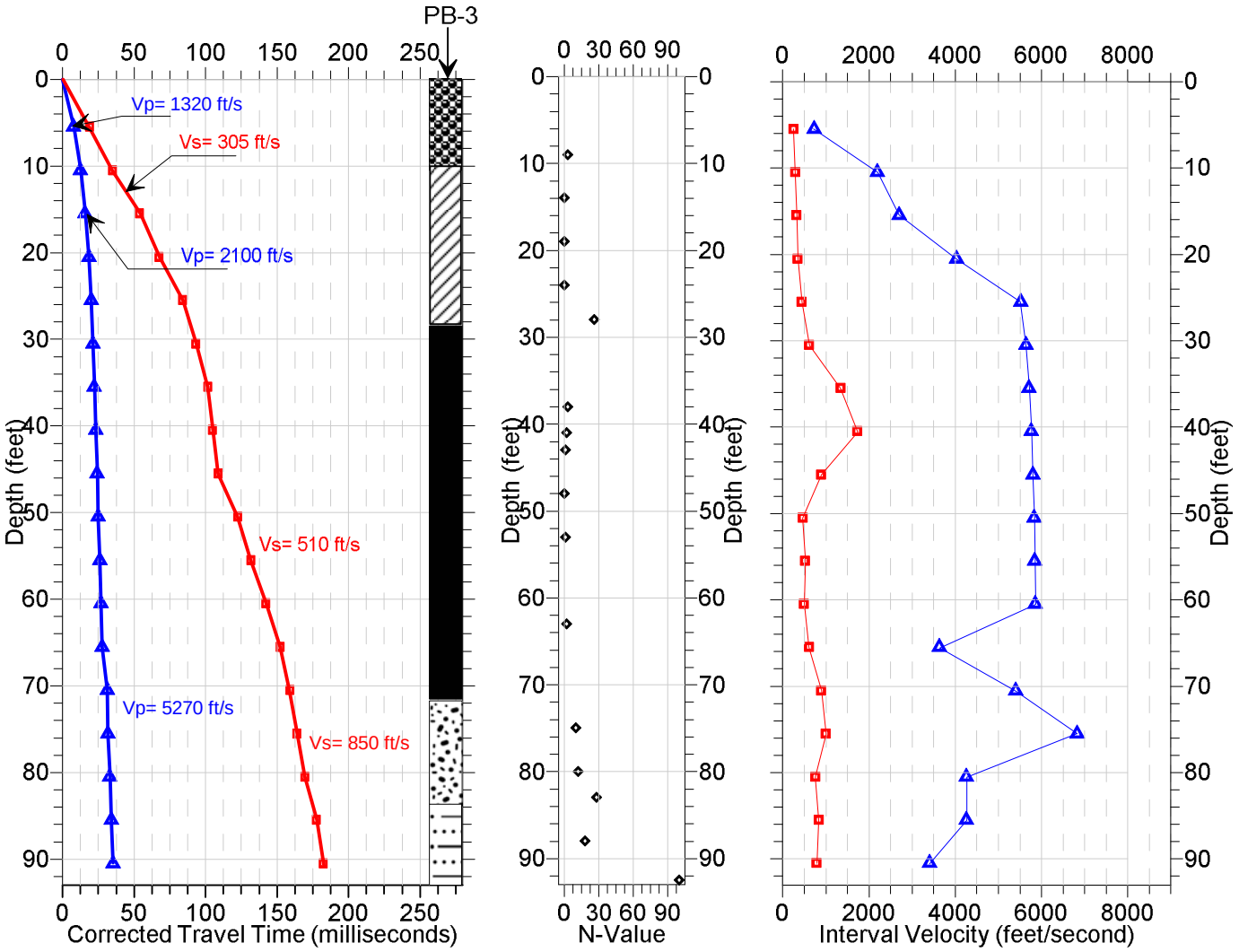
SJH	05/2012	SJH	05/2012	NB	05/2012	13815141	1



Legend:

- Compressional Wave Travel Times
- Shear Wave Travel Times

Avg Vp - Average Compressional Wave Velocity

Avg Vs - Average Shear Wave Velocity

Bottom Ash

Alluvium

Flyash

Residual Soils

Coal Sand

Legend:

- Compressional Wave Interval Velocity
- Shear Wave Interval Velocity

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Geophysical Investigation Results
Vertical Seismic Profiling Results
Boring PB-3

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Louisa, Kentucky

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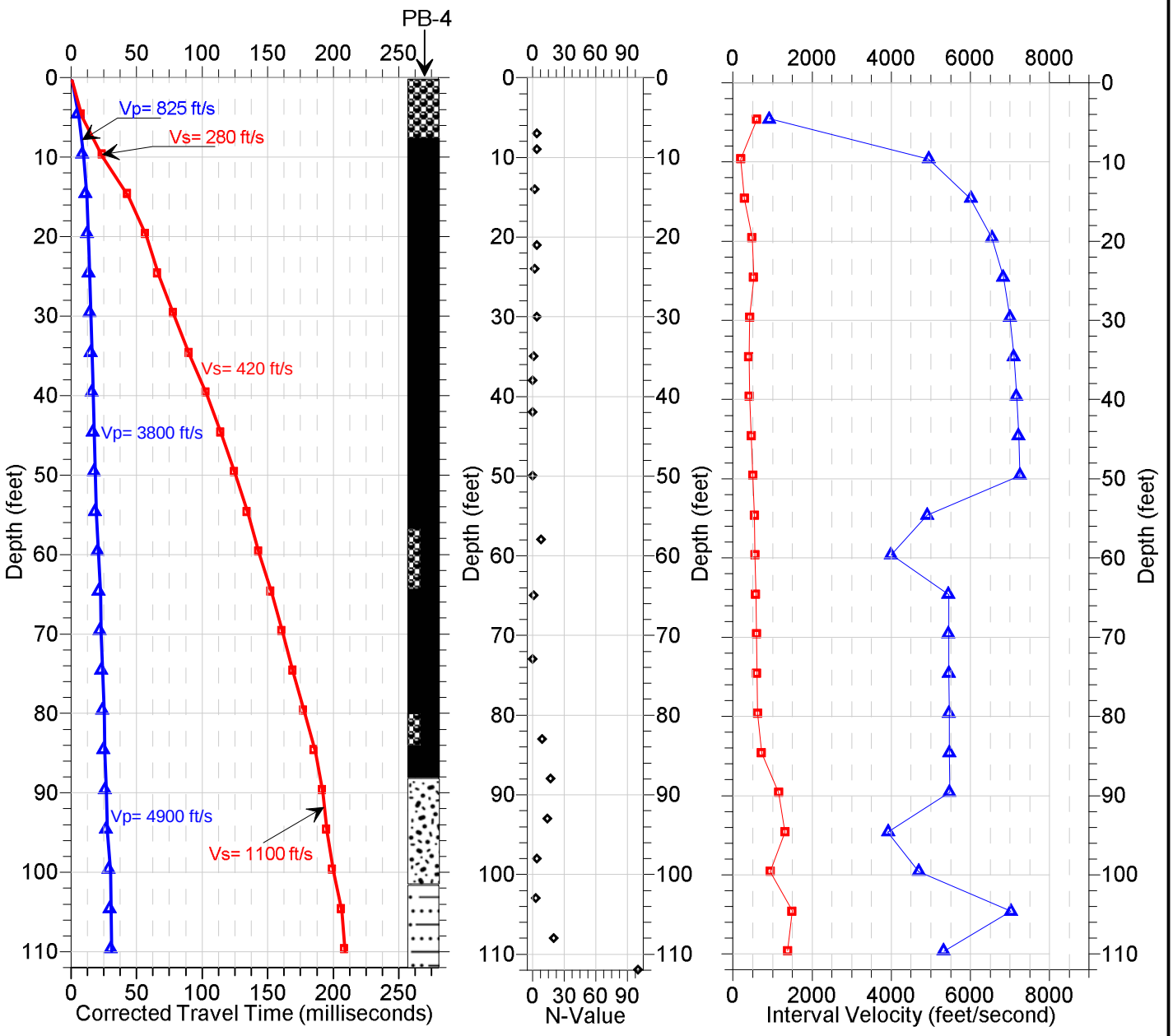

Legend:

- Compressional Wave Travel Times
- Shear Wave Travel Times

Avg Vp - Average Compressional Wave Velocity

Avg Vs - Average Shear Wave Velocity

Bottom Ash

Alluvium

Flyash

Residual Soils

Legend:

- Compressional Wave Interval Velocity
- Shear Wave Interval Velocity

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Geophysical Investigation Results
Vertical Seismic Profiling Results
Boring PB-4

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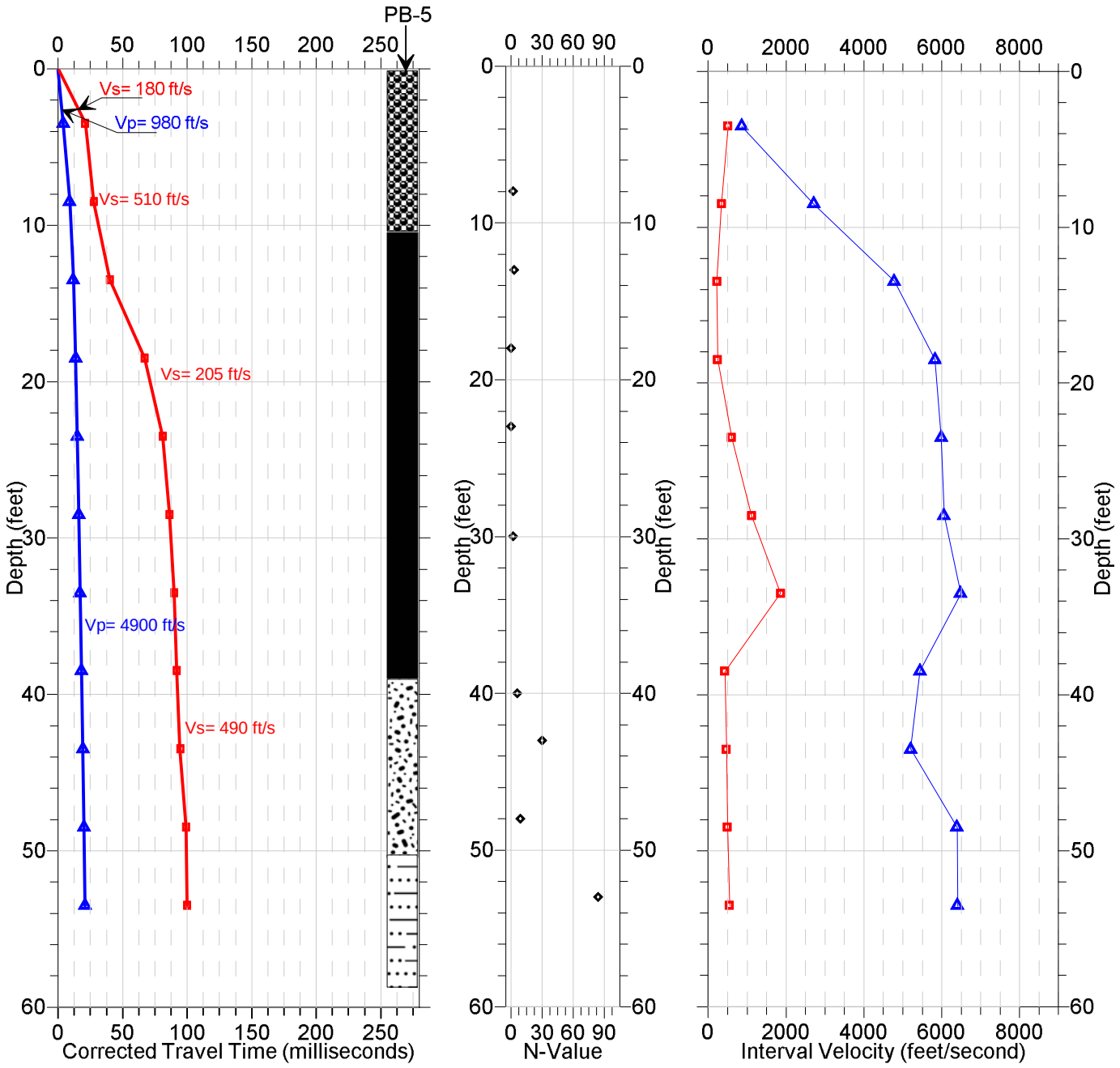

Legend:

- Compressional Wave Travel Times
- Shear Wave Travel Times

Avg Vp - Average Compressional Wave Velocity

Avg Vs - Average Shear Wave Velocity

Bottom Ash

Alluvium

Flyash

Residual Soils

Legend:

- Compressional Wave Interval Velocity
- Shear Wave Interval Velocity

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Geophysical Investigation Results
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Boring PB-5

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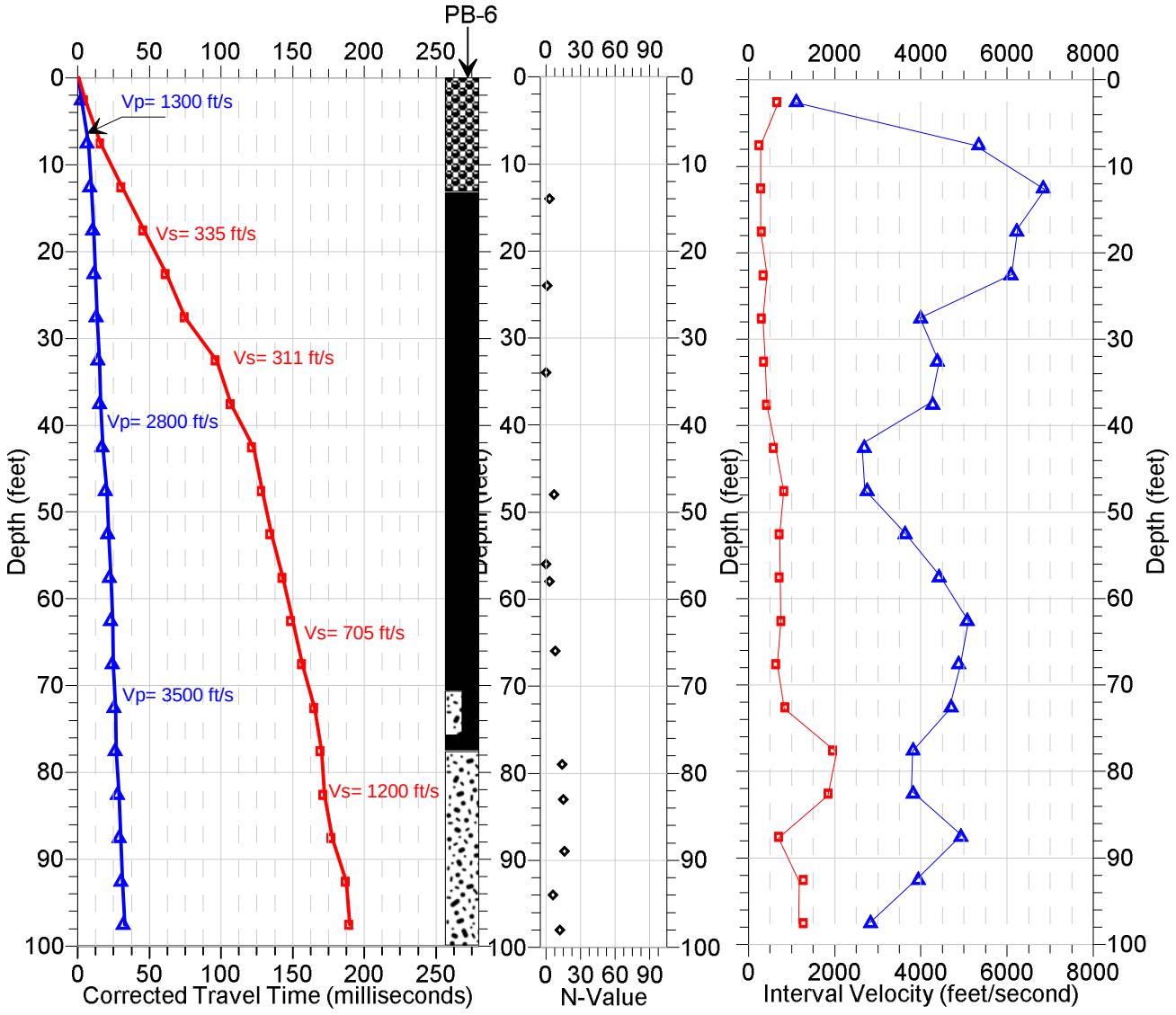

Legend:

- Compressional Wave Travel Times
- Shear Wave Travel Times

Avg Vp - Average Compressional Wave Velocity

Avg Vs - Average Shear Wave Velocity

Bottom Ash

Alluvium

Flyash

Legend:

- Compressional Wave Interval Velocity
- Shear Wave Interval Velocity

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Geophysical Investigation Results
Vertical Seismic Profiling Results
Boring PB-6

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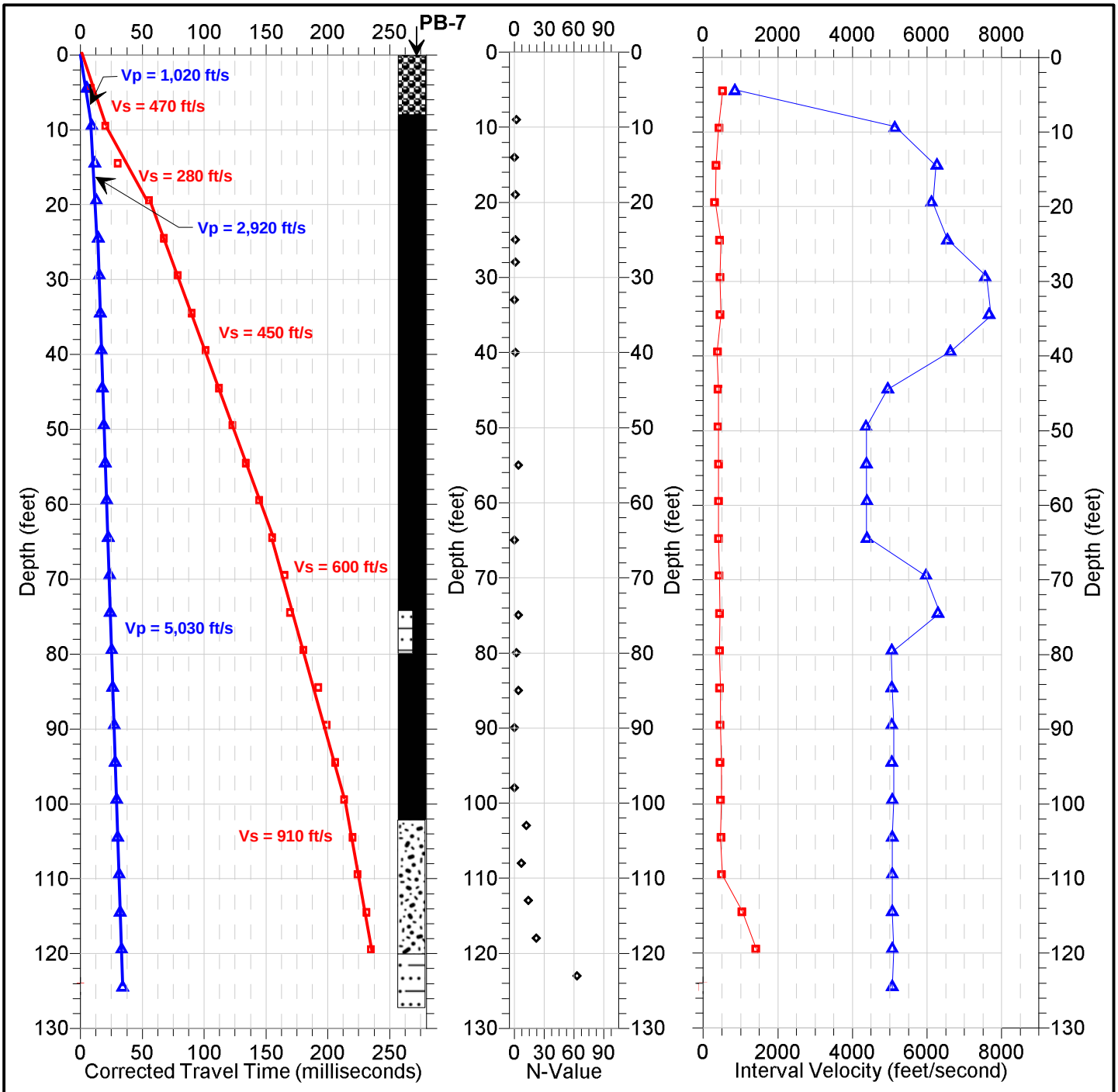

Legend:

- Compressional Wave Travel Times
- Shear Wave Travel Times

Avg Vp - Average Compressional Wave Velocity

Avg Vs - Average Shear Wave Velocity

Bottom Ash

Alluvium

Flyash

Residual Soils

Legend:

- Compressional Wave Interval Velocity
- Shear Wave Interval Velocity

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Geophysical Investigation Results
Vertical Seismic Profiling Results
Boring PB-7

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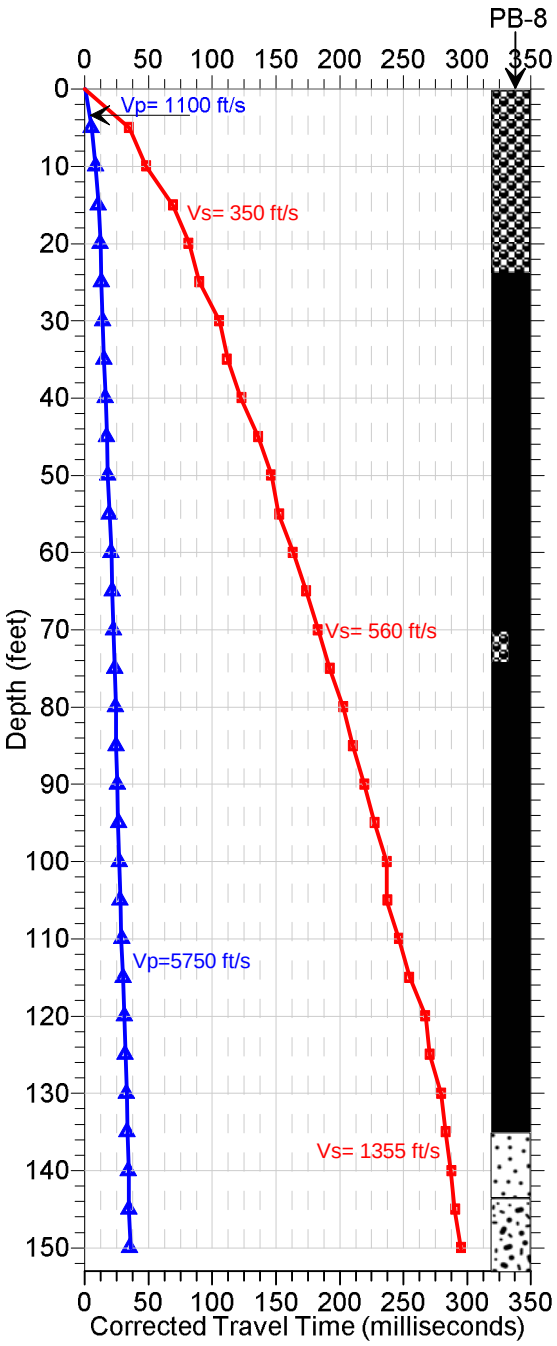

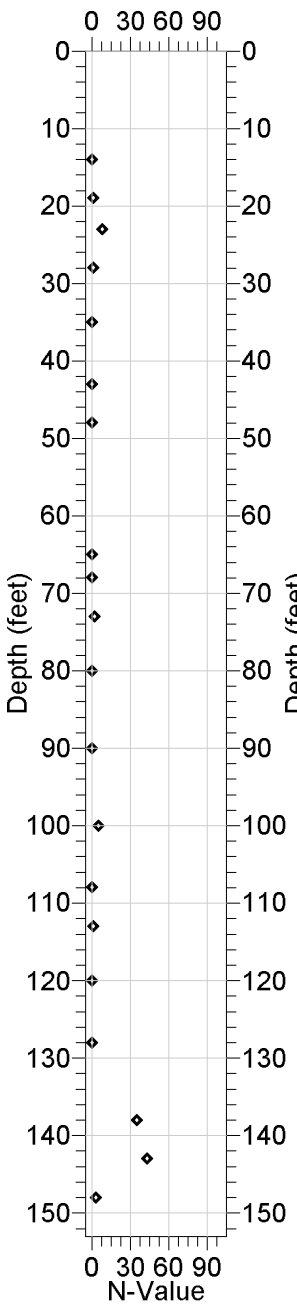

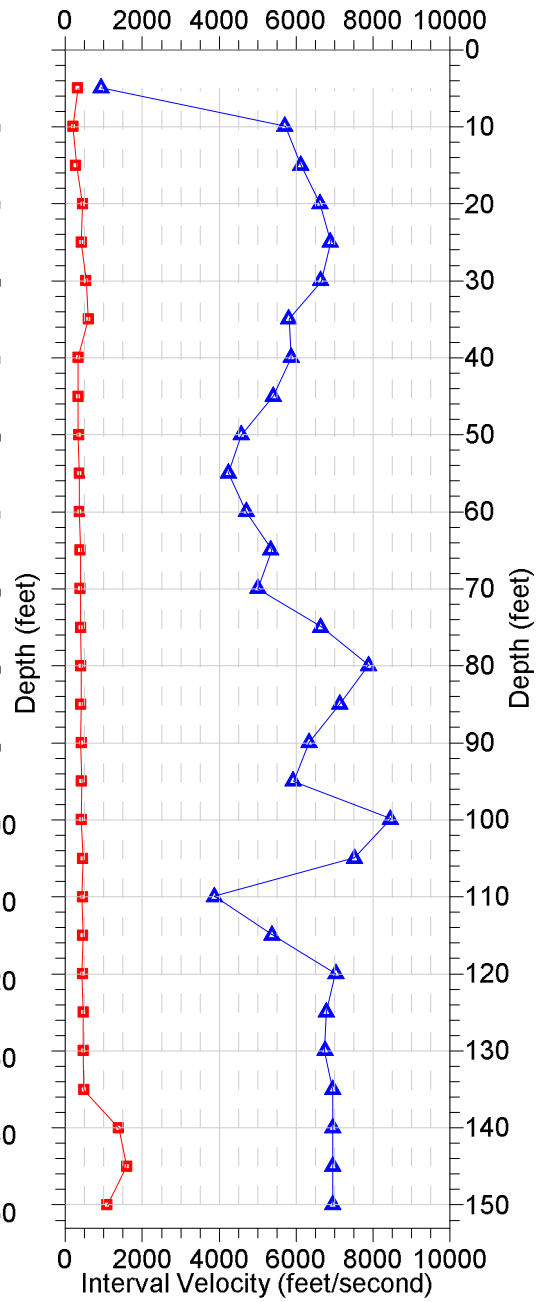

Legend:

- Compressional Wave Travel Times
- Shear Wave Travel Times

Avg Vp - Average Compressional Wave Velocity

Avg Vs - Average Shear Wave Velocity

Bottom Ash

Alluvium

Flyash

Topsoil

Legend:

- Compressional Wave Interval Velocity
- Shear Wave Interval Velocity

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Geophysical Investigation Results
Vertical Seismic Profiling Results
Boring PB-8

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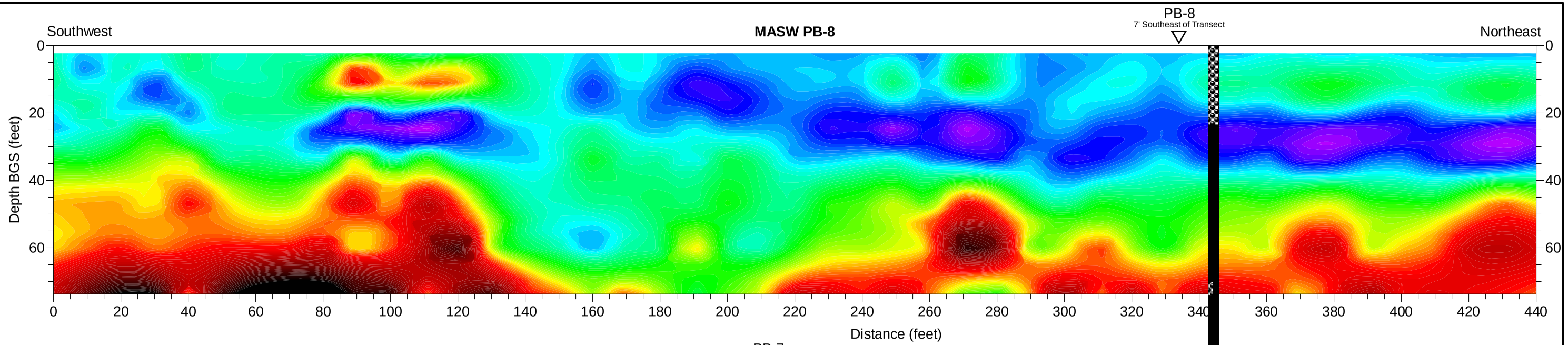

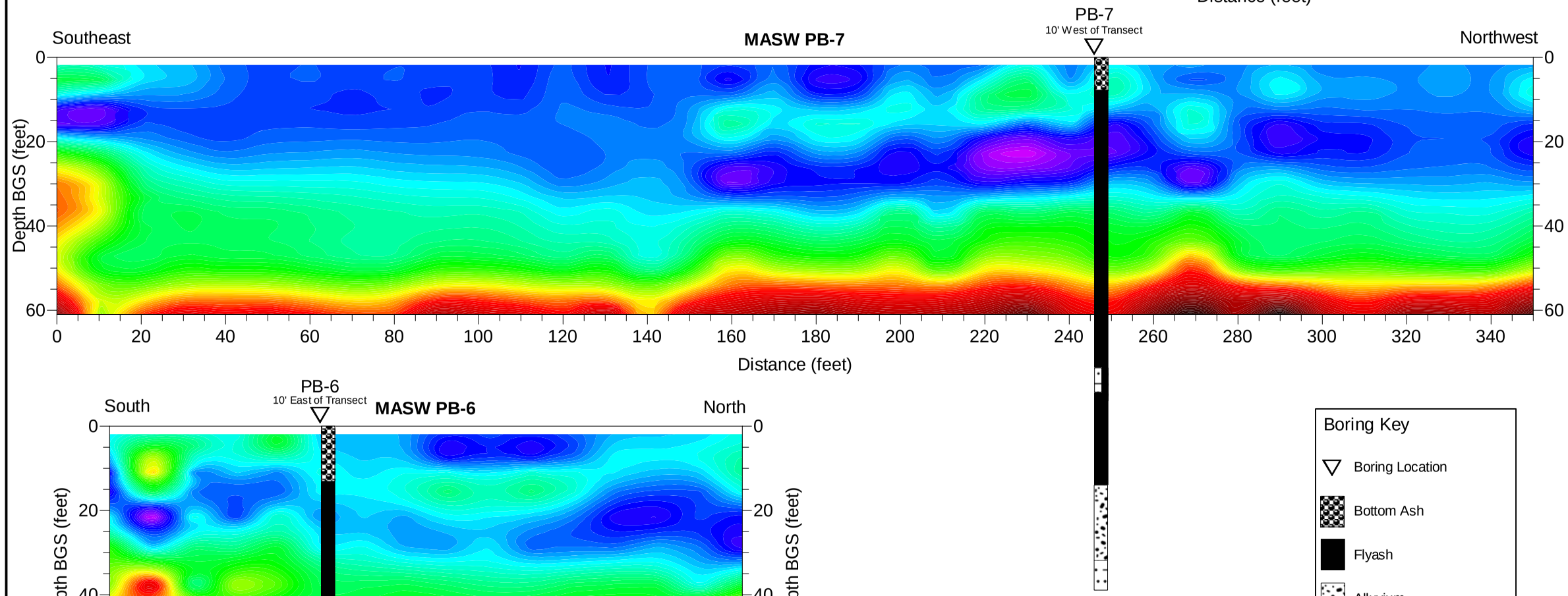

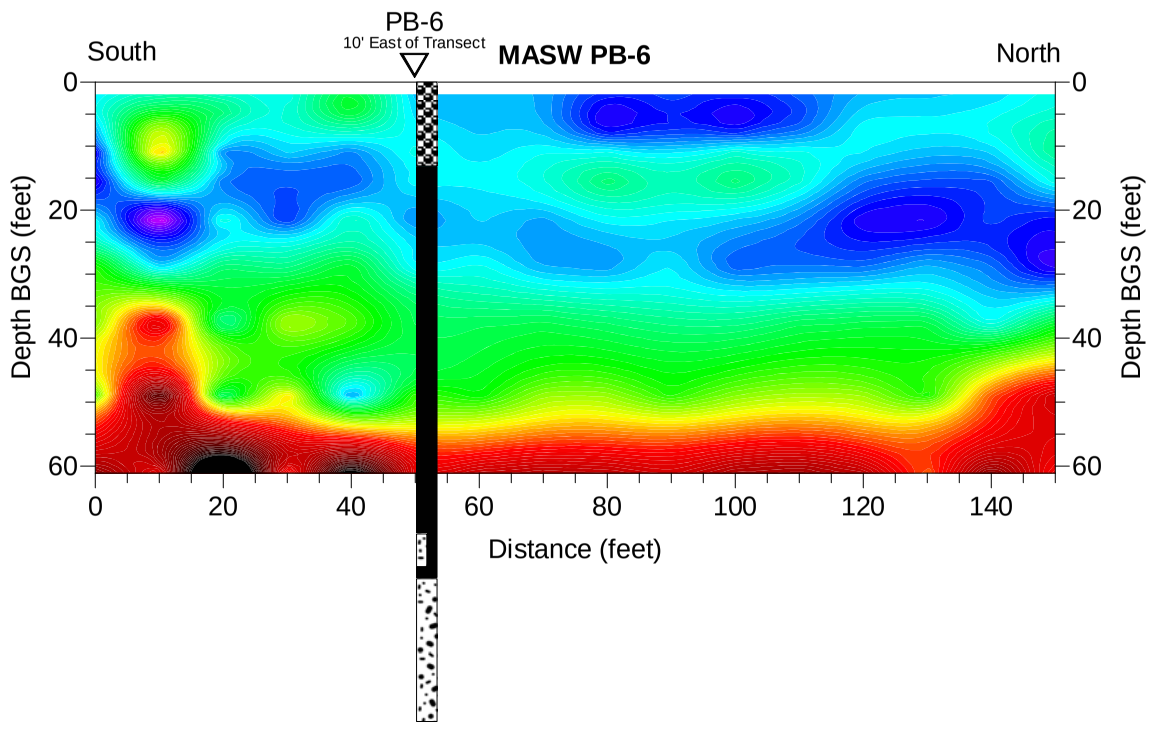

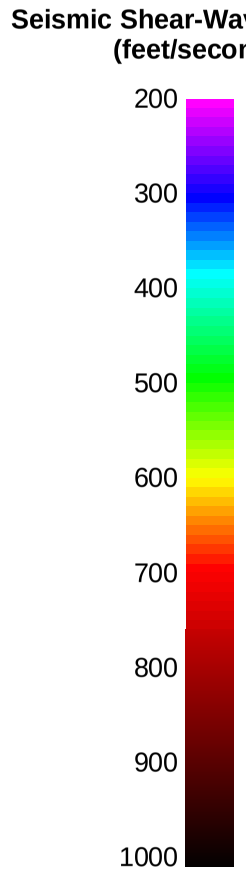

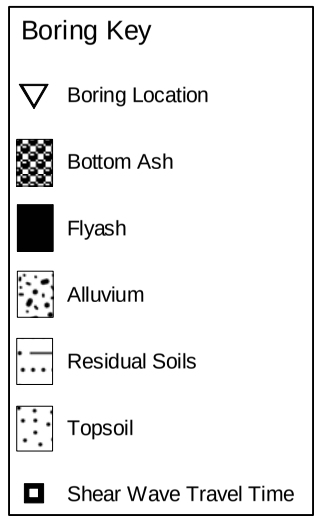

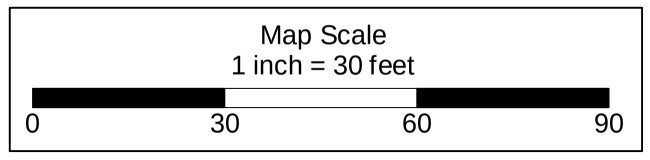

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Geophysical Investigation Results
Multichannel Analysis of Surface Waves Results
MASW PB-6 through PB-8

American Electric Power - Big Sandy Plant

Louisa, Kentucky

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