APPENDIX E5

LABORATORY TESTS

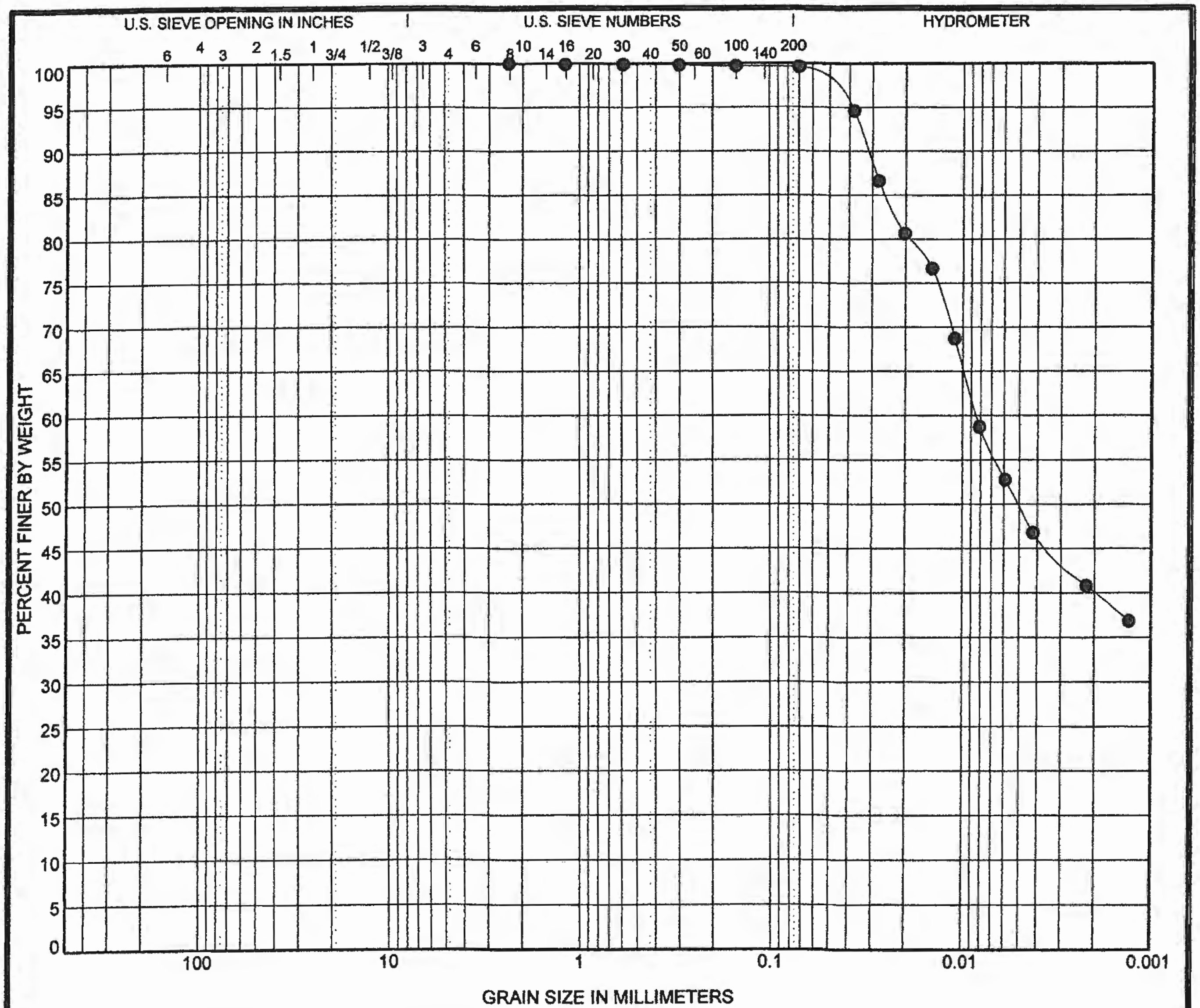
Technically Complete October 28, 2014

130 Environmental Park
Summary of Laboratory
Results

Stratum	USCS	Boring No.	Depth, ft.	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	In situ Perm cm/sec
I	CH	BME-10	3			71	25	46	87	
I	CH	BME-03	3			62	16	46		5.90E-08
I	CH	BME-15	1			71	26	45	93	
Number of test in Stratum I				*0*	*0*	*3*	*3*	*3*	*2*	*1*
Average Properties in Stratum I						*68.0*	*22.3*	*45.7*	*90.0*	
II	CH	BME-01	11	28.6	88.9	75	32	43	96	3.00E-08
II	CH	BME-01	19	28.3	94.0	72	31	41	81	
II	CH	BME-01	27	24.9	98.8	70	29	41	87	
II	CH	BME-01	37	28.9	95.8	74	31	43	92	
II	CH	BME-01	47	32.9	85.7	84	36	48	85	
II	CH	BME-03	27	24.6	96.8	75	28	47	97	
II	CH	BME-05	19	31.5		87	36	51	97	
II	CH	BME-05	35	28.6	95.9	75	34	41	97	2.70E-08
II	CH	BME-07	19	27.5		84	32	52	99	
II	CH	BME-08	11	28.3		83	34	49	100	
II	CH	BME-08	19	28.5		78	32	46	100	
II	CH	BME-08	31	30.3		81	29	52	99	
II	CH	BME-08	41	28.9		79	28	51	99	
II	CH	BME-08	49	28.9		70	26	44	94	
II	CH	BME-09	19	25.2		75	30	45	98	
II	CH	BME-09	39	23.2	102.7	76	27	49	99	
II	CH	BME-11	7	21.9						
II	CH	BME-11	35	27.6		80	32	48	98	
II	CH	BME-12	29	24.8	102.8					
II	CH	BME-13	9	23.4	95.7	86	29	57	100	
II	CH	BME-16	15	25.8	99.8	84	29	55	97	
II	CH	BME-19	17			88	26	62	98	
II	CH	BME-19	21			78	28	50	99	
II	CH	BME-19	33			92	26	66	100	
II	CH	BME-19	41			86	29	57	99	
II	CH	BME-24	19	21.9		67	26	41	97	
II	CH	BME-24	39	24.1		73	26	47	97	
II	CH	BME-27	9	23.5		72	25	47	93	4.40E-08
II	CH	BME-27	19	24.9		67	24	43	99	
II	CH	BME-27	37	26.3		74	28	46	100	
II	CH	BME-27	45	25.5		73	28	45	99	
II	CH	BME-28	9	15.6		52	23	29	83	
II	CH	BME-28	13	16.1		49	24	25	89	
II	CH	BME-28	19	20.0		60	26	34	82	5.20E-08
II	CH	BME-28	33	22.3		76	30	46	97	
II	CH	BME-28	39	25.1		72	25	47	96	
II	CH	BME-29	13	13.4	109.4	48	26	22	91	
II	CH	BME-29	21	18.7	105.1	73	26	47	100	
II	CH	BME-29	45	21.4	117.1	59	26	33	86	
II	CH	BME-30	17	14.6	109.6	56	23	33	94	
II	CH	BME-31	23	15.7	97.1	46	26	20	84	
II	CH	BME-32	9	15.2		54	20	34	78	
II	CH	BME-32	19	17.8		59	25	34	96	
II	CH	BME-32	31	23.5		61	27	34	96	
II	CH	BME-32	43	23.7		57	26	31	98	
Number of test in Stratum II				*41*	*16*	*43*	*43*	*43*	*43*	*4*
Average Properties in Stratum II				*23.9*	*99.7*	*71.6*	*28.0*	*43.6*	*94.6*	*3.83E-08*

130 Environmental Park
Summary of Laboratory Results
(continued)

Stratum	USCS	Boring No.	Depth, ft.	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	In situ Perm cm/sec
III	CH	BME-02	79	23.6	90.1	86	37	49	98	2.10E-08
III	CH	BME-02	99	24.7	103	70	32	38	89	1.10E-08
III	CH	BME-03	69	27.2	91.6	67	32	35	95	
III	CH	BME-03	114	23.6		57	28	29	92	
III	CH	BME-08	53	26.2		77	27	50	99	
III	CH	BME-09	99	22.4	100.2	65	28	37	87	1.20E-08
III	CH	BME-11	57	23.8		62	29	33	89	
III	CH	BME-14	74	21.8	104.1	68	24	44	97	
III	CH	BME-16	69	24.0		70	28	42	99	
III	CH	BME-19	54			65	27	38	100	
III	CH	BME-24	54	24.7		76	27	49	97	
III	CH	BME-24	74	33.5		79	29	50	99	
III	CH	BME-24	79	25.7		70	30	40	97	
III	CH	BME-27	54	25.5		80	27	53	99	
III	CH	BME-27	74	25.3		80	31	49	97	
III	CH	BME-27	84	24.4		71	27	44	98	
III	CH	BME-28	44	27.9		69	26	43	95	
III	CH	BME-28	54	22.8		69	28	41	100	
III	CH	BME-28	69	23.6		59	23	36	99	
III	CH	BME-28	95	25.6		78	29	49	99	
III	CH	BME-32	49	22.7		57	24	33	95	
III	CH	BME-32	66	21.4		68	27	41	99	
Number of test in Stratum III				21	5	22	22	22	22	3
Average Properties In Stratum III				24.8	97.8	70.1	28.2	42.0	96.3	1.47E-08



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-08	19.0	CLAY, silty, tan & gray, mottled	78	32	46		
		STRATUM II					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-08	19.0	2.38	0.008			0.0	0.4	49.8	49.8

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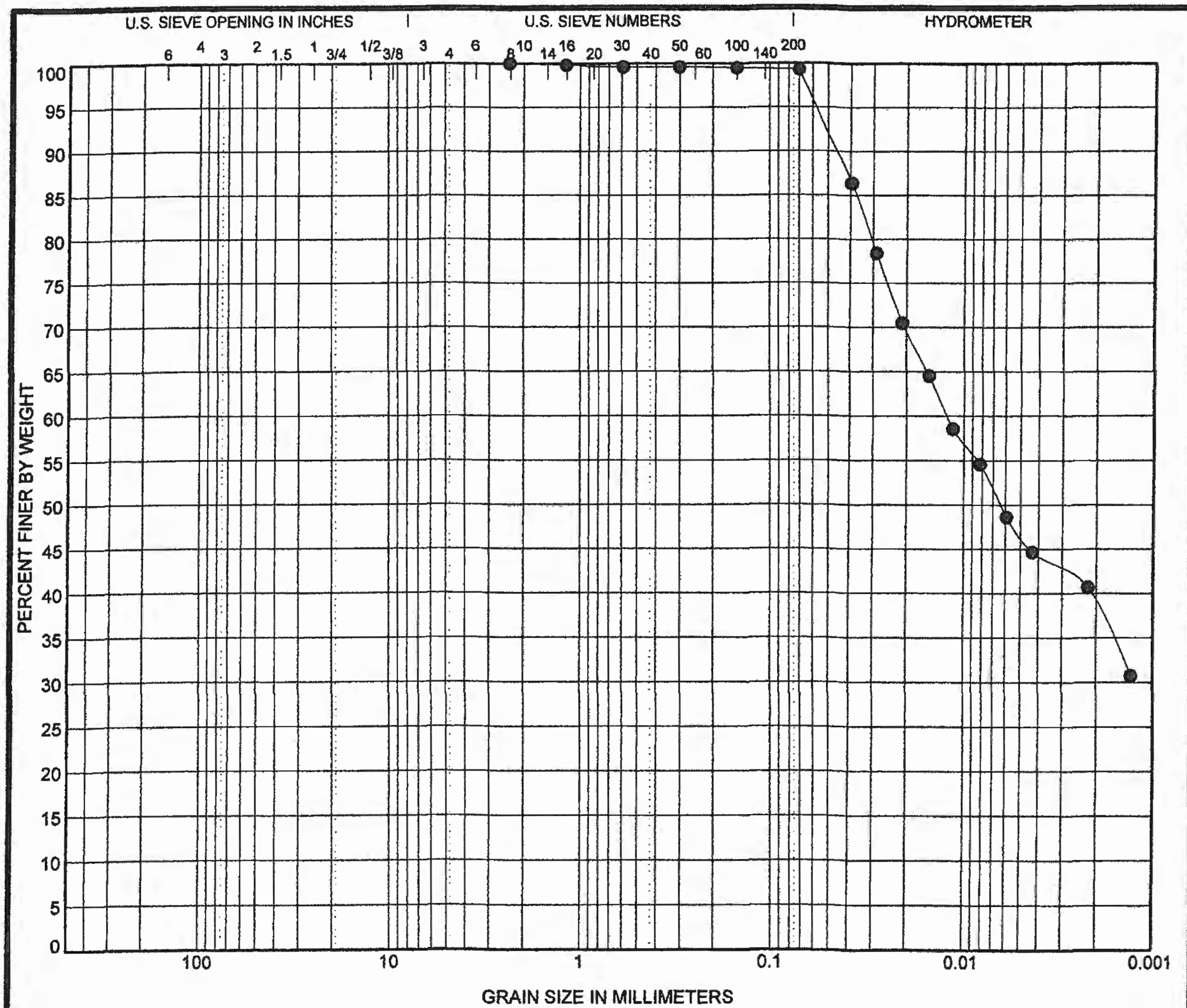

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-08	41.0	CLAY, silty, tan & gray, mottled	79	28	51		
		STRATUM II					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-08	41.0	2.38	0.012			0.0	0.7	52.8	46.5

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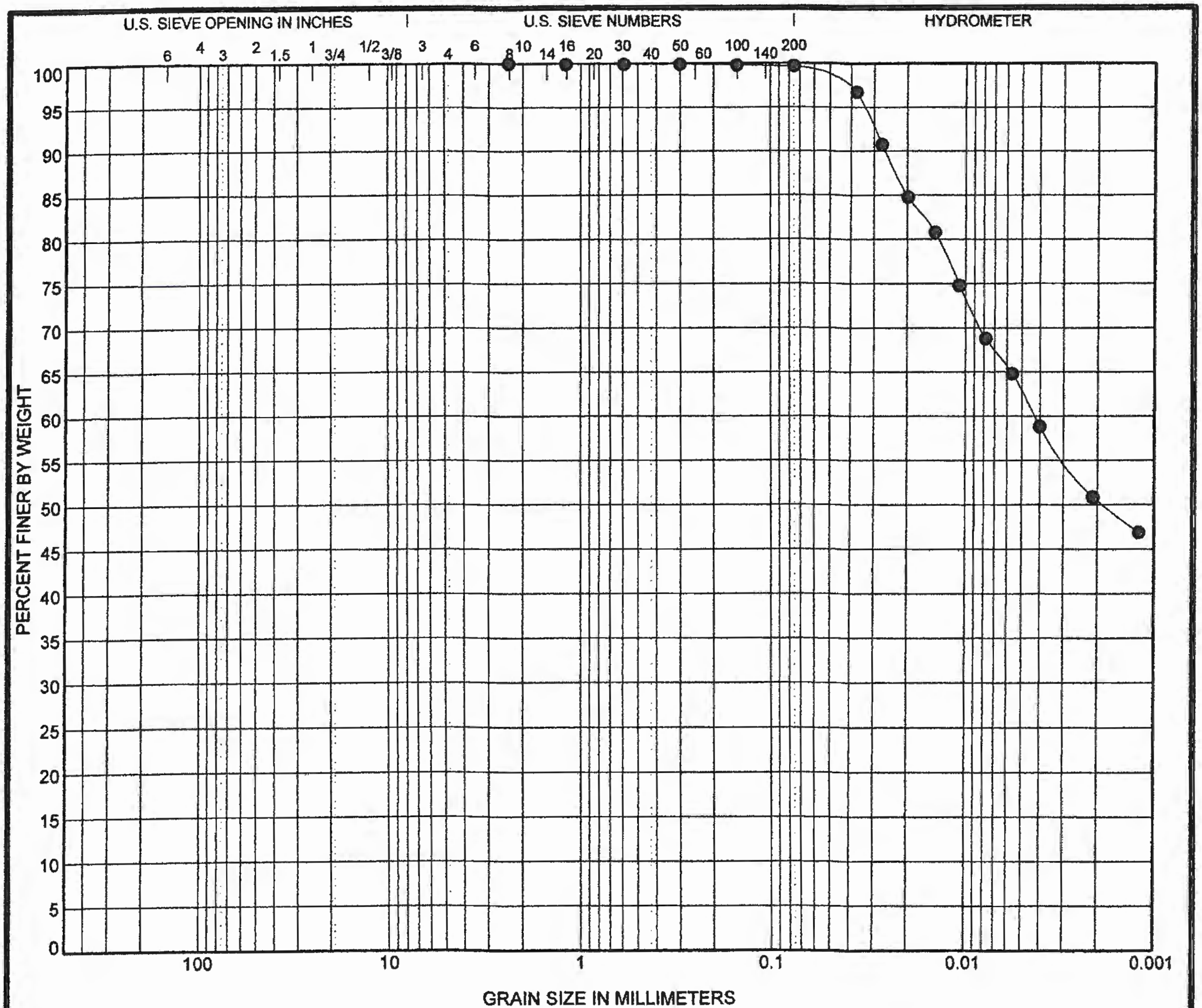

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**BME-13**	**9.0**	**CLAY, silty, tan & brown**	**86**	**29**	**57**		
			STRATUM II					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BME-13**	**9.0**	**2.38**	**0.004**			**0.0**	**0.3**	**36.9**	**62.8**

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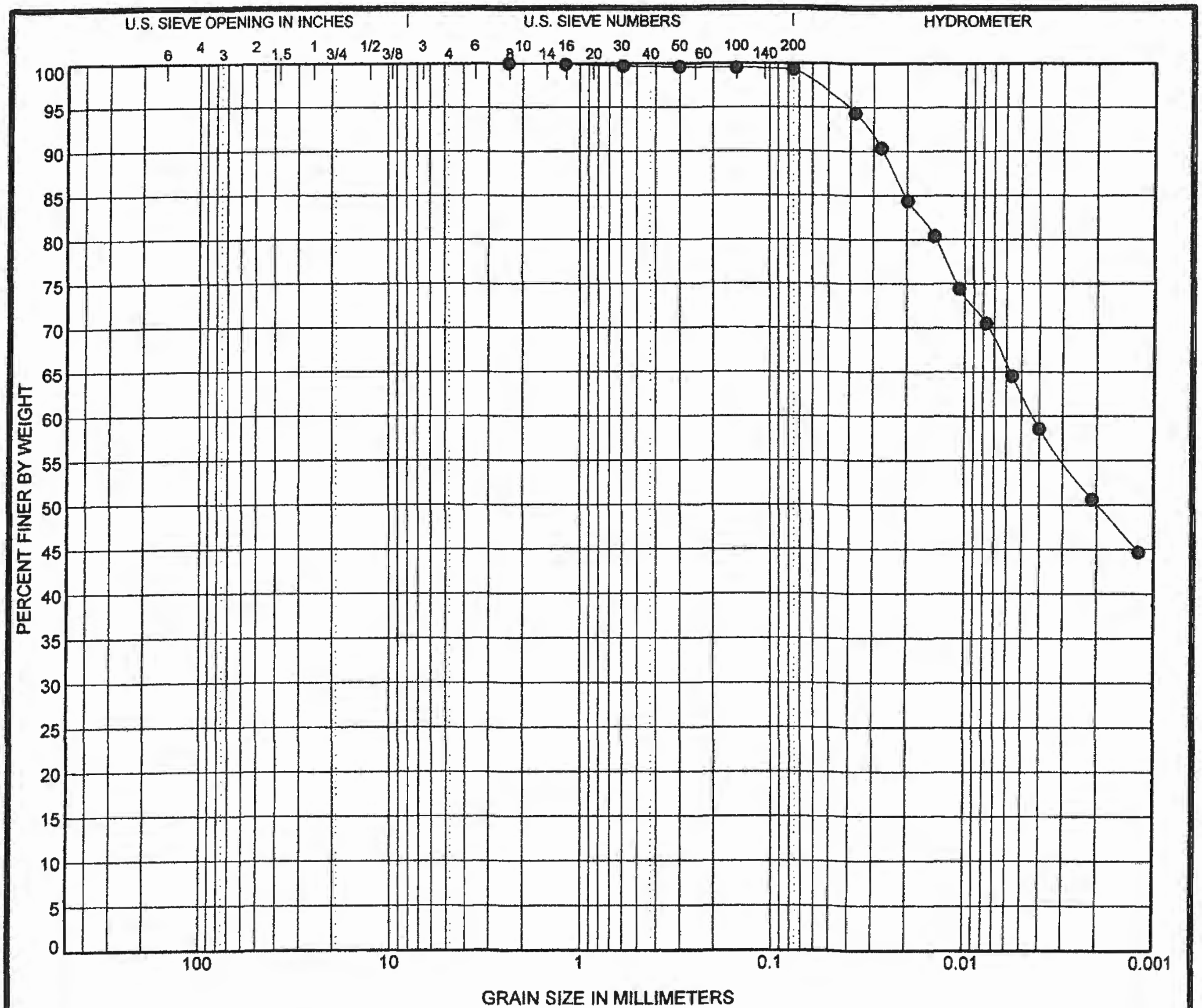

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **BME-19**	**21.0**	**CLAY, silty, tan & gray, mottled**	**78**	**28**	**50**		
		STRATUM II					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **BME-19**	**21.0**	**2.38**	**0.004**			**0.0**	**0.7**	**36.8**	**62.5**

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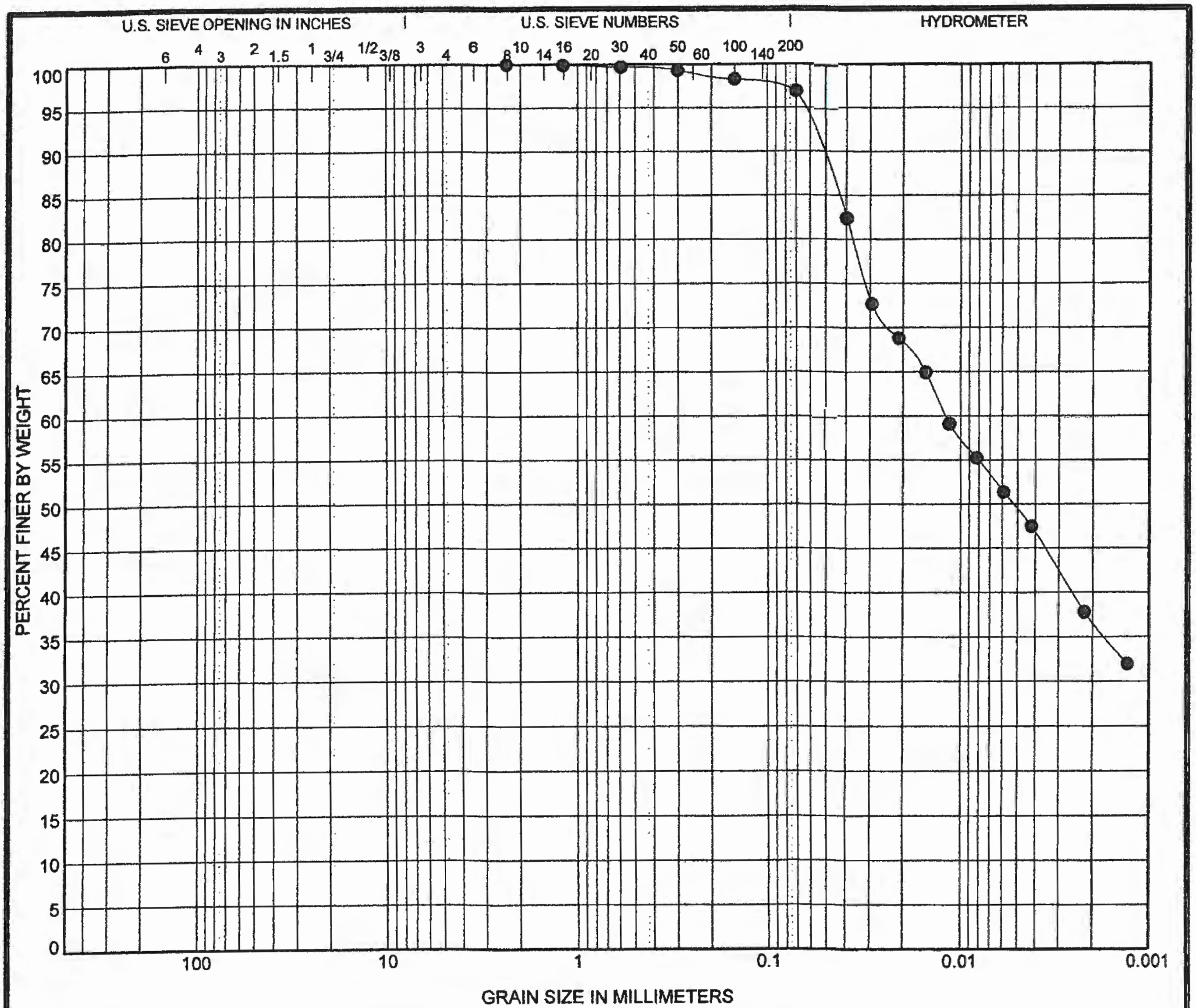

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-24	19.0	**CLAY, silty, gray & tan, mottled**	**67**	**26**	**41**		
		STRATUM II					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-24	19.0	**2.38**	**0.012**			**0.0**	**3.0**	**47.6**	**49.5**

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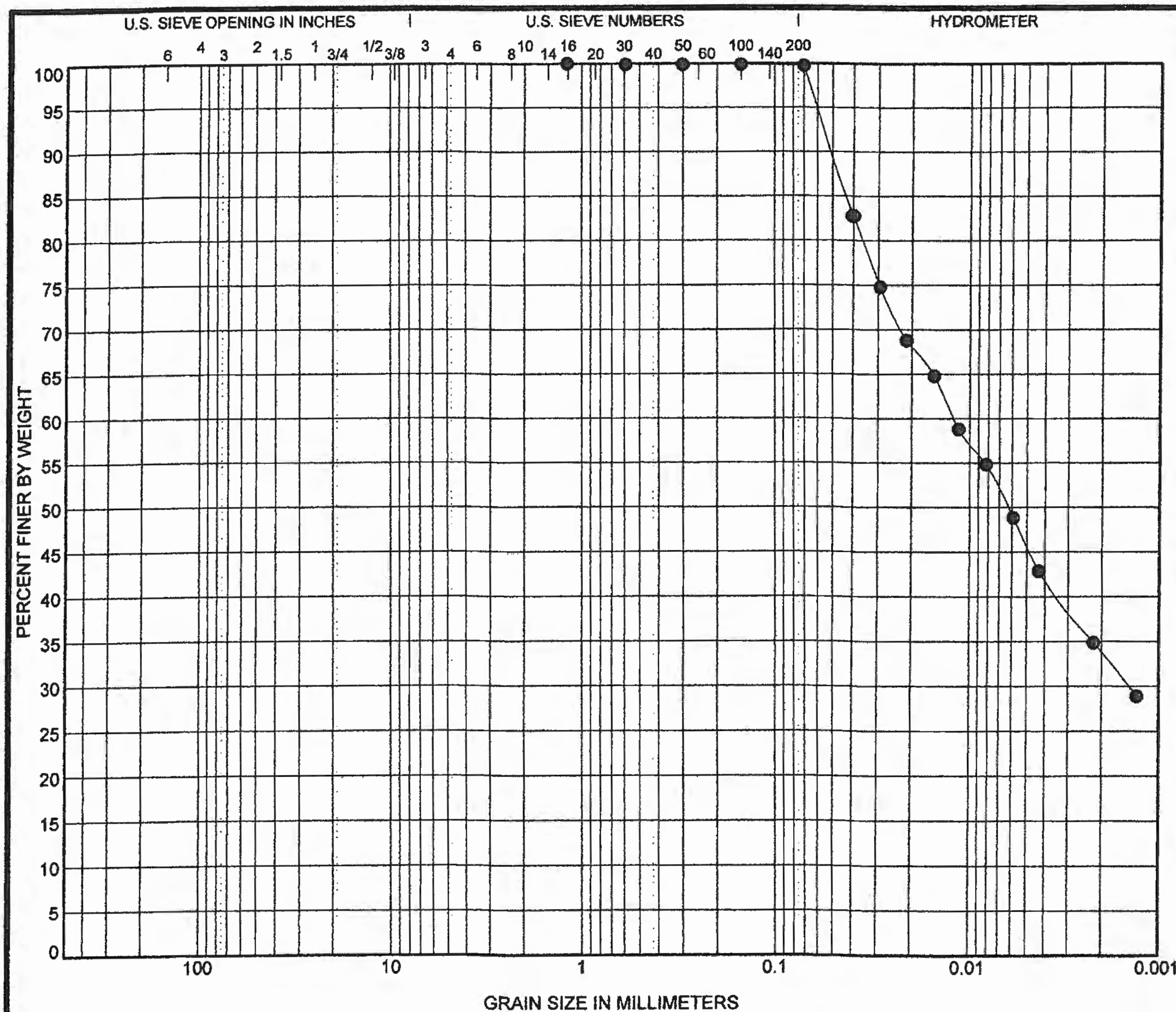

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-27	37.0	**CLAY, silty, gray & tan, mottled**	**74**	**28**	**46**		
		STRATUM II					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-27	37.0	1.19	0.012	0.001		0.0	0.2	54.1	45.7

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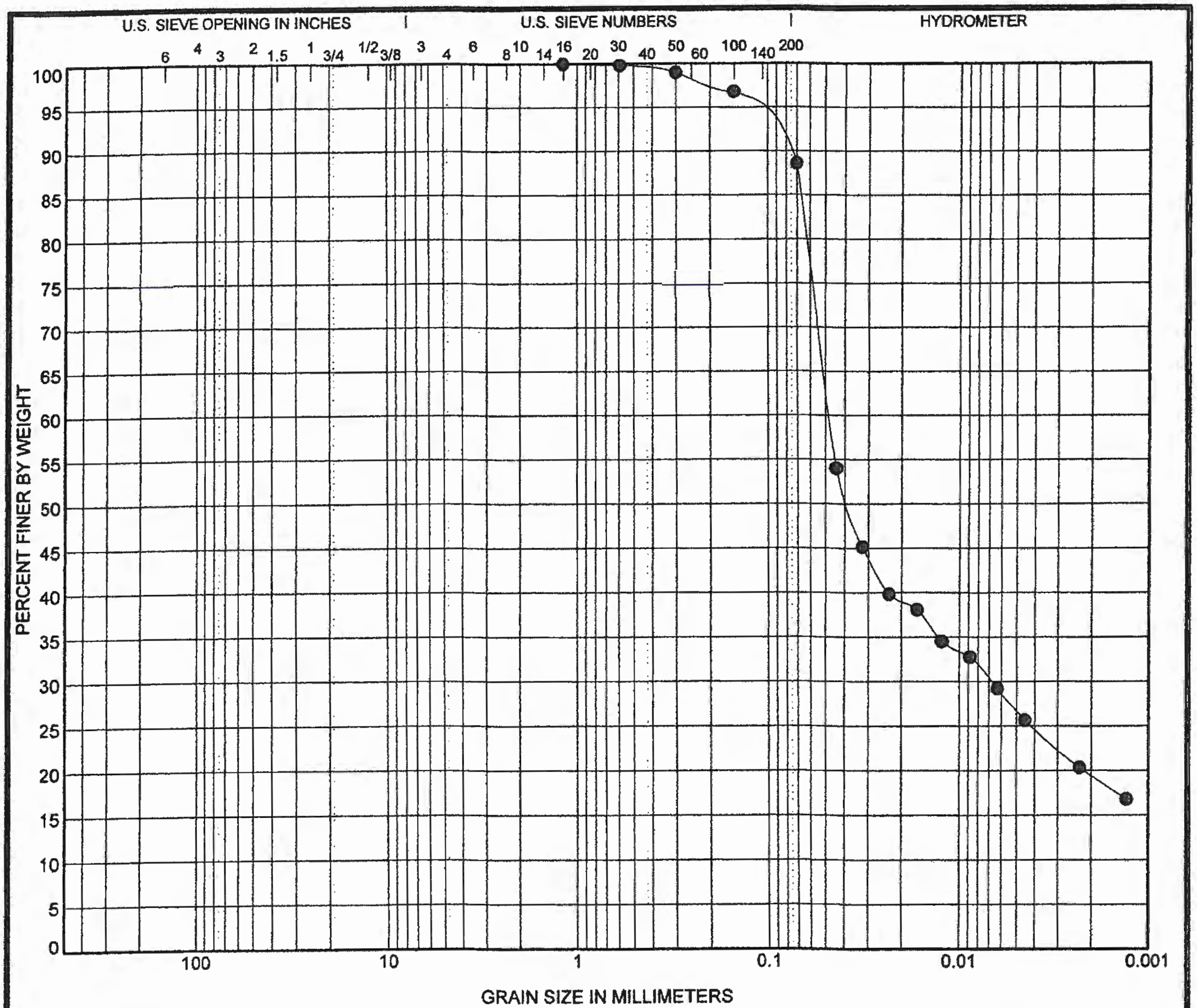

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	BME-28	13.0	CLAY, silty, tan & brown	49	24	25		
			STRATUM II					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BME-28	13.0	1.19	0.048	0.007		0.0	10.7	62.6	26.8

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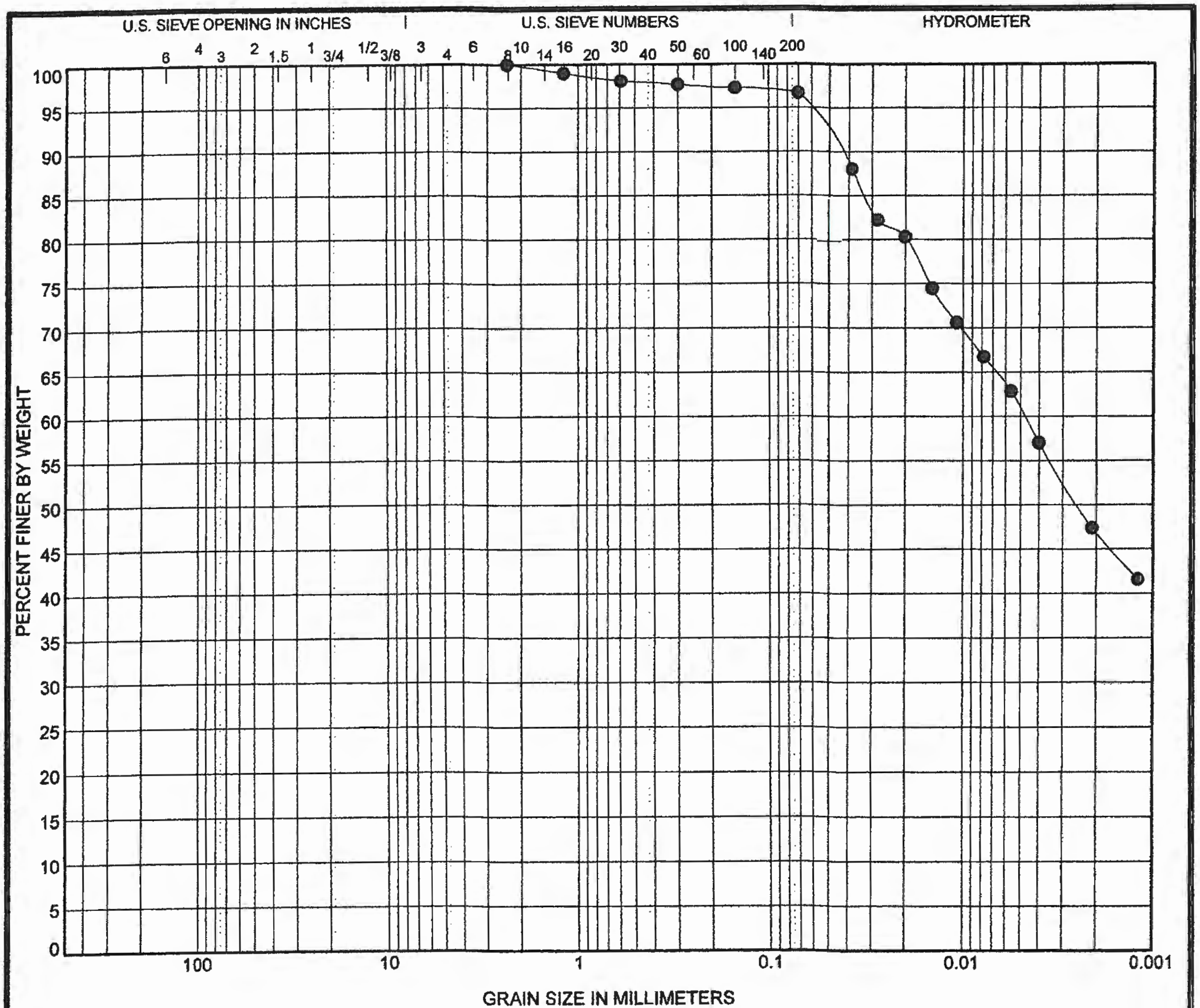

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-28	33.0	CLAY, silty, gray & tan, mottled	76	30	46		
		STRATUM II					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-28	33.0	2.38	0.005			0.0	3.2	35.8	60.9

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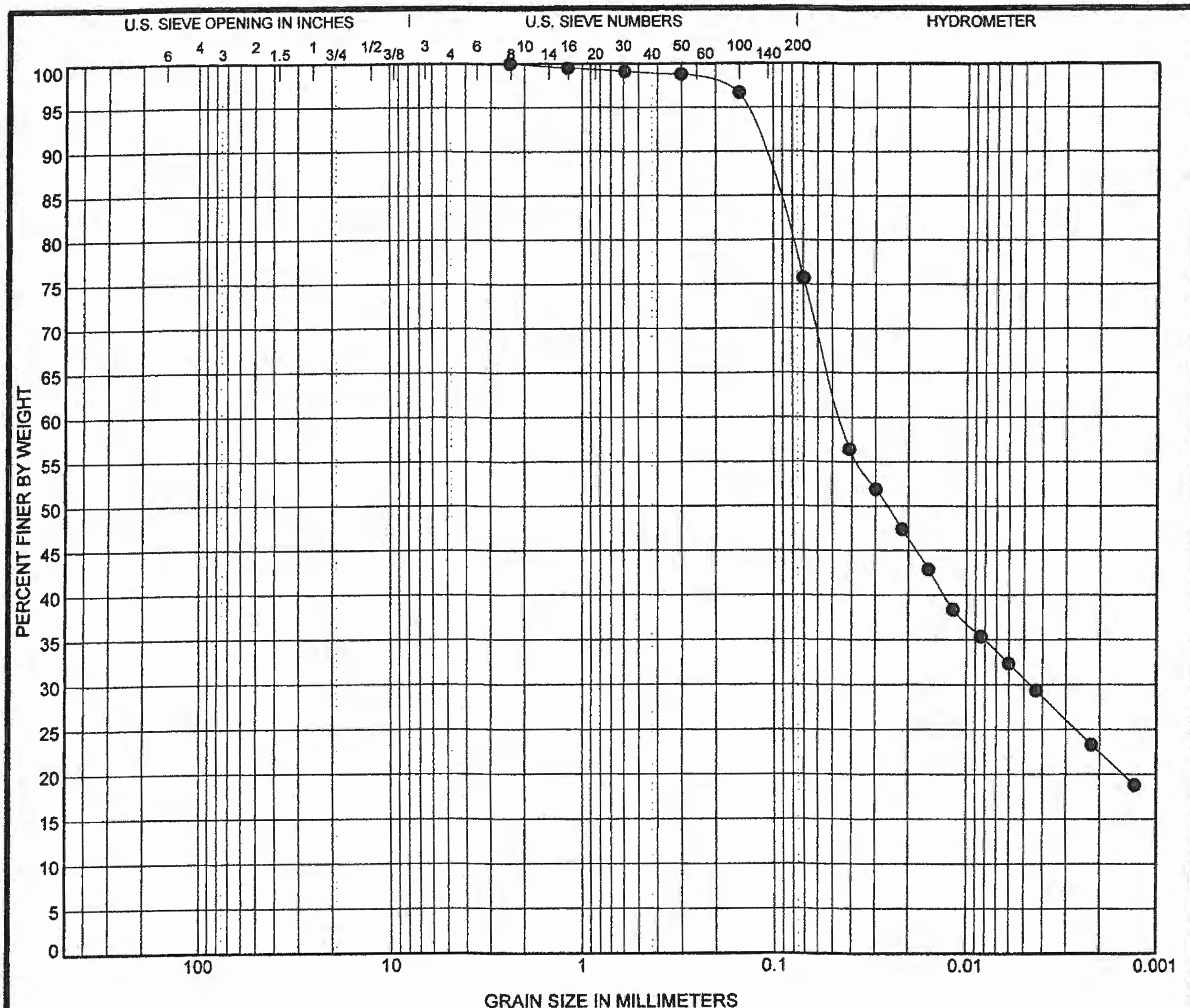

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BME-32	9.0	CLAY, silty, tan & brown w/calcareous nodules	54	20	34		
			STRATUM II					

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BME-32	9.0	2.38	0.045	0.005		0.0	22.4	46.9	30.7

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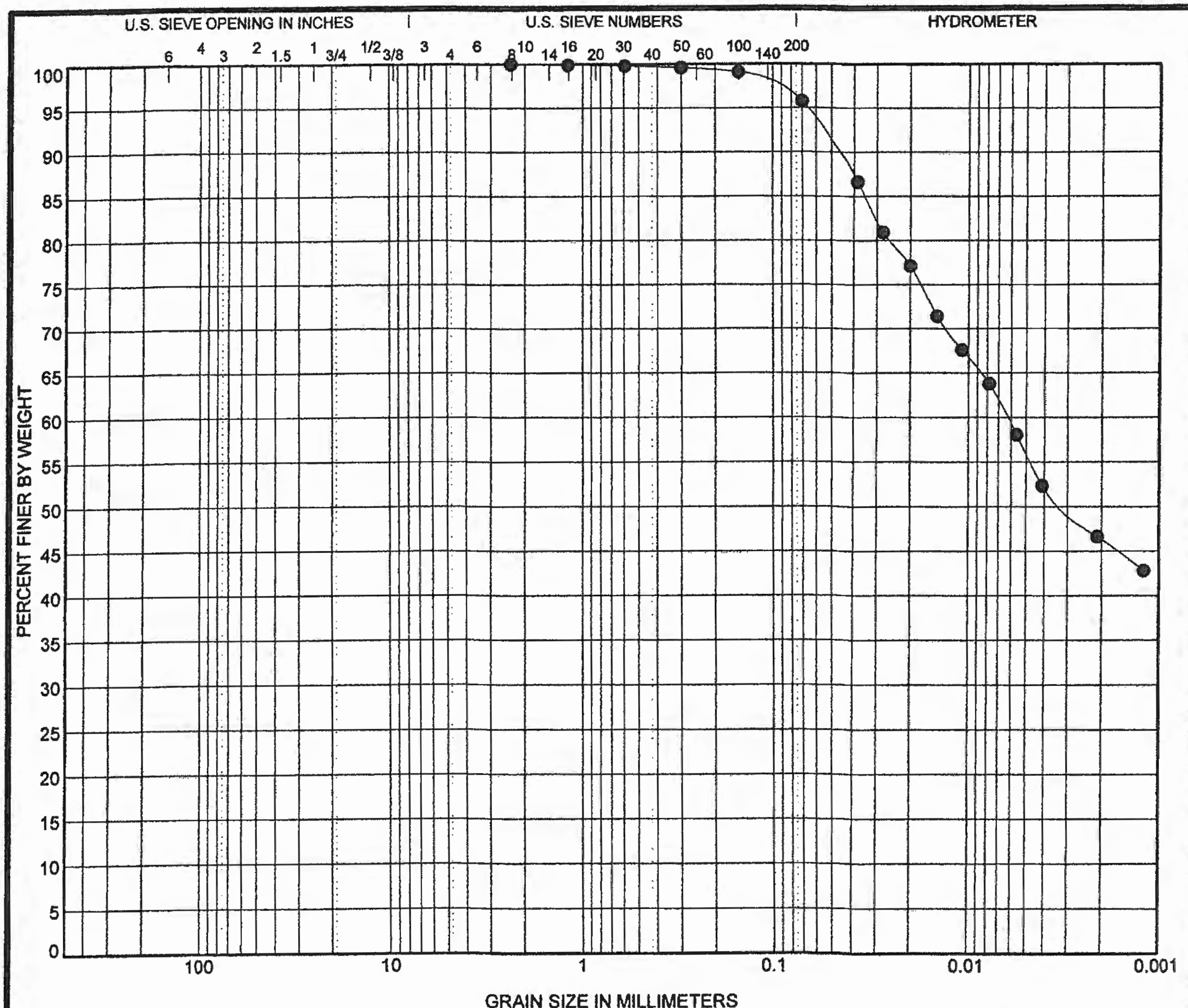

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	BME-32	19.0	CLAY, silty, tan & gray, mottled	59	25	34		
			STRATUM II					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BME-32	19.0	2.38	0.006			0.0	3.9	40.1	56.0

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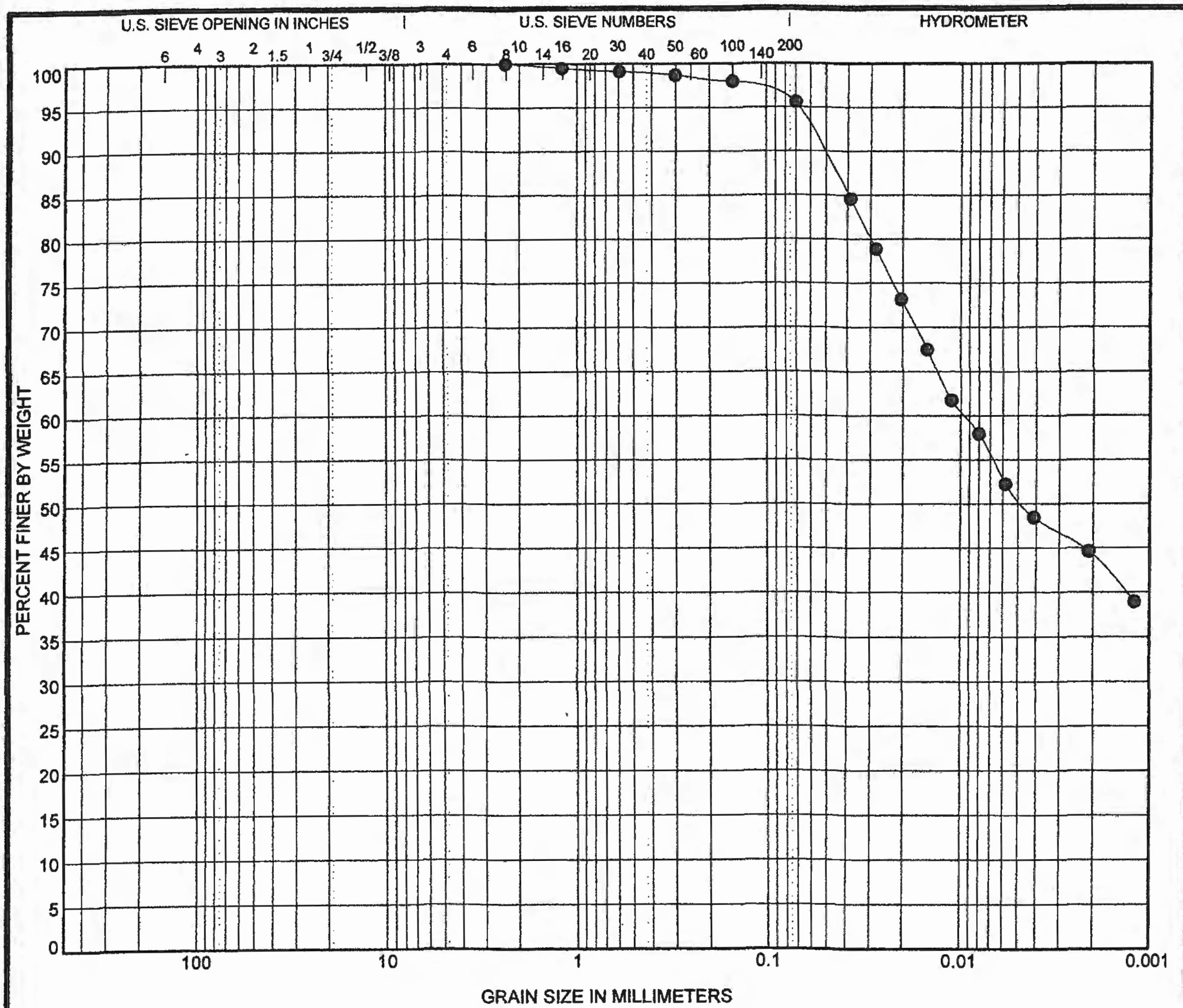

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-32	31.0	CLAY, silty, gray & tan, mottled	61	27	34		
		STRATUM II					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-32	31.0	2.38	0.01			0.0	4.2	45.2	50.6

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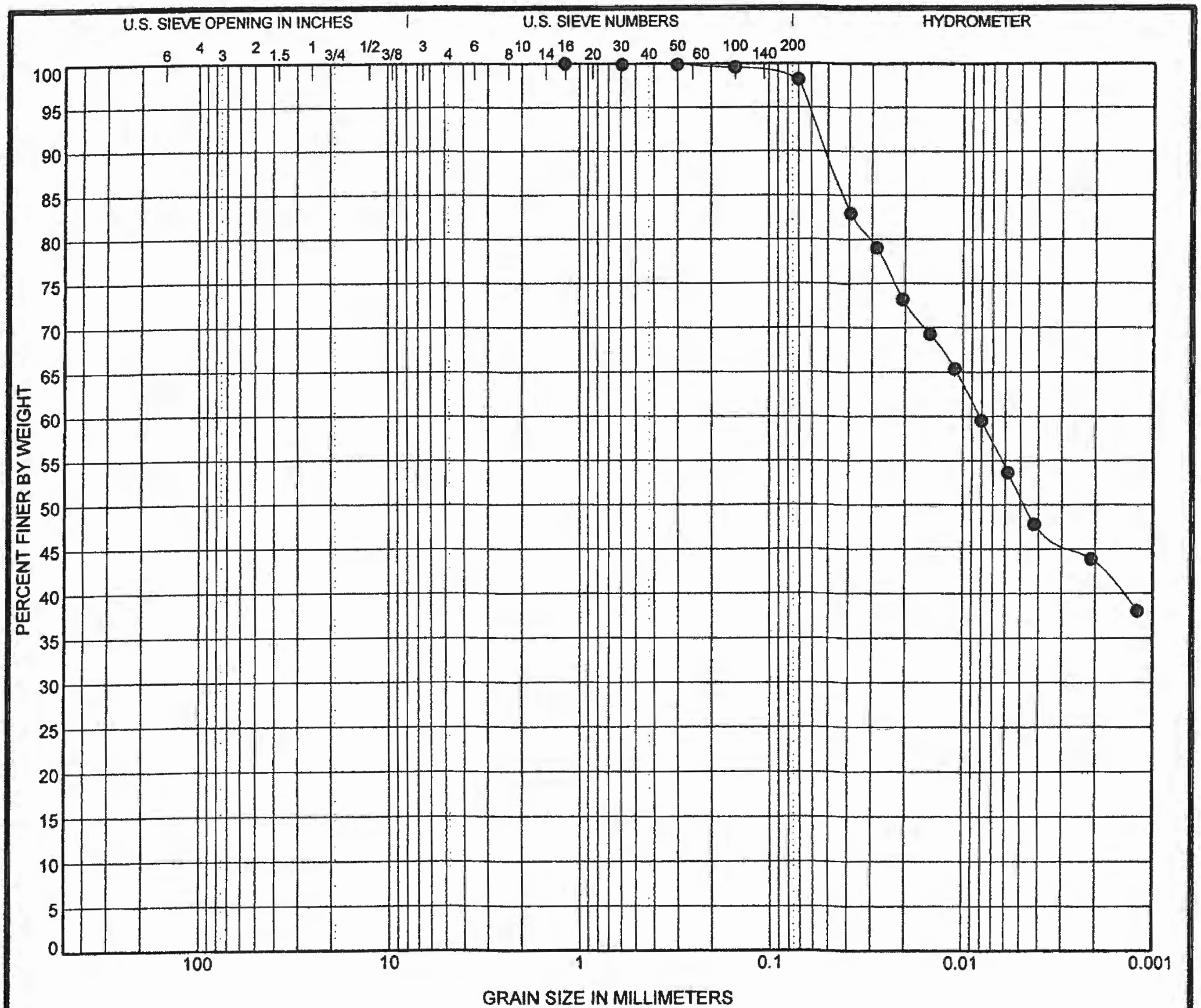

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	BME-32	43.0	CLAY, silty, gray & tan, mottled	57	26	31		
			STRATUM II					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BME-32	43.0	1.19	0.008			0.0	1.7	47.4	51.0

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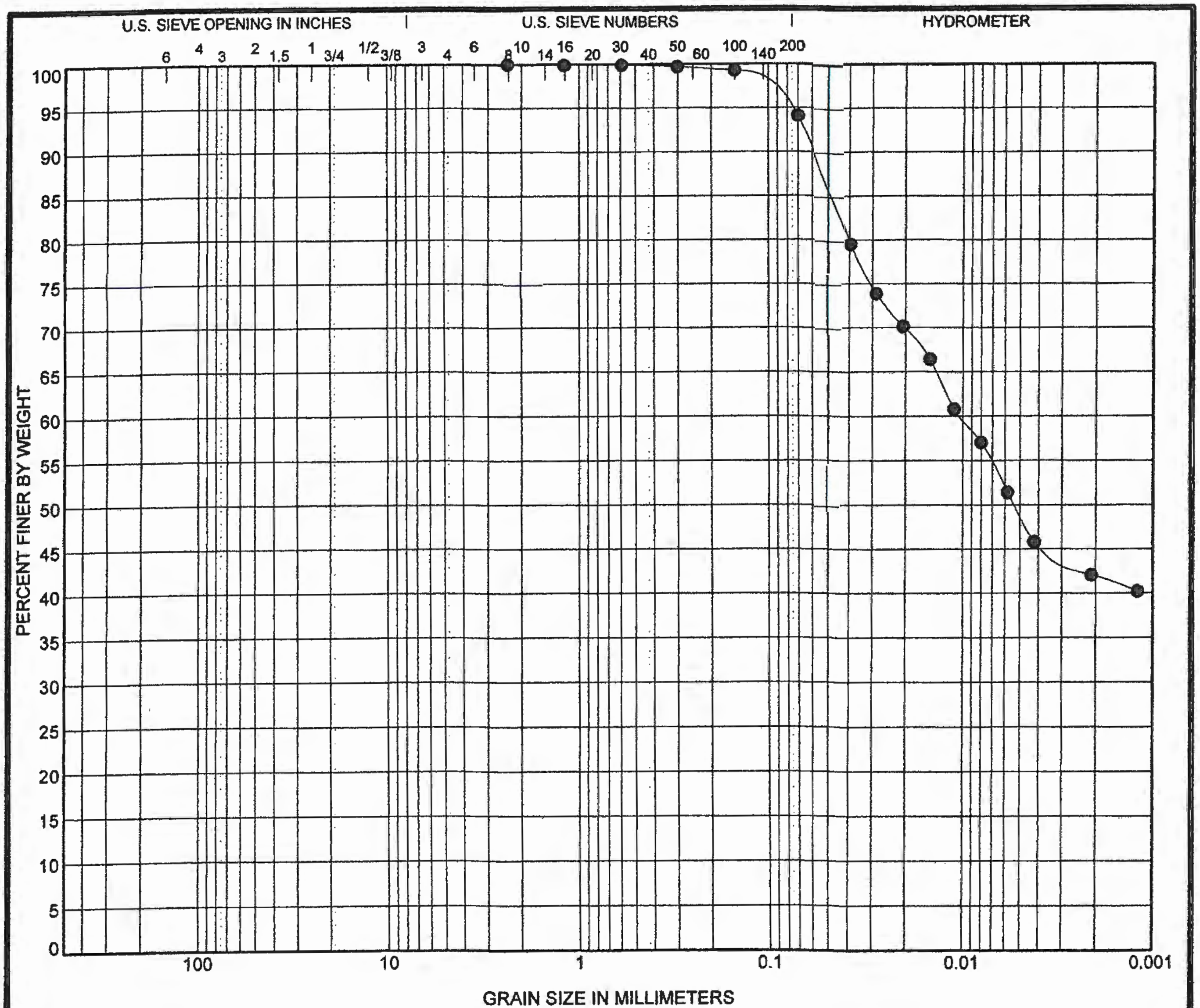

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-32	49.0	CLAY, silty, dark gray	57	24	33		
		STRATUM II					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-32	49.0	2.38	0.01			0.0	5.4	45.7	48.8

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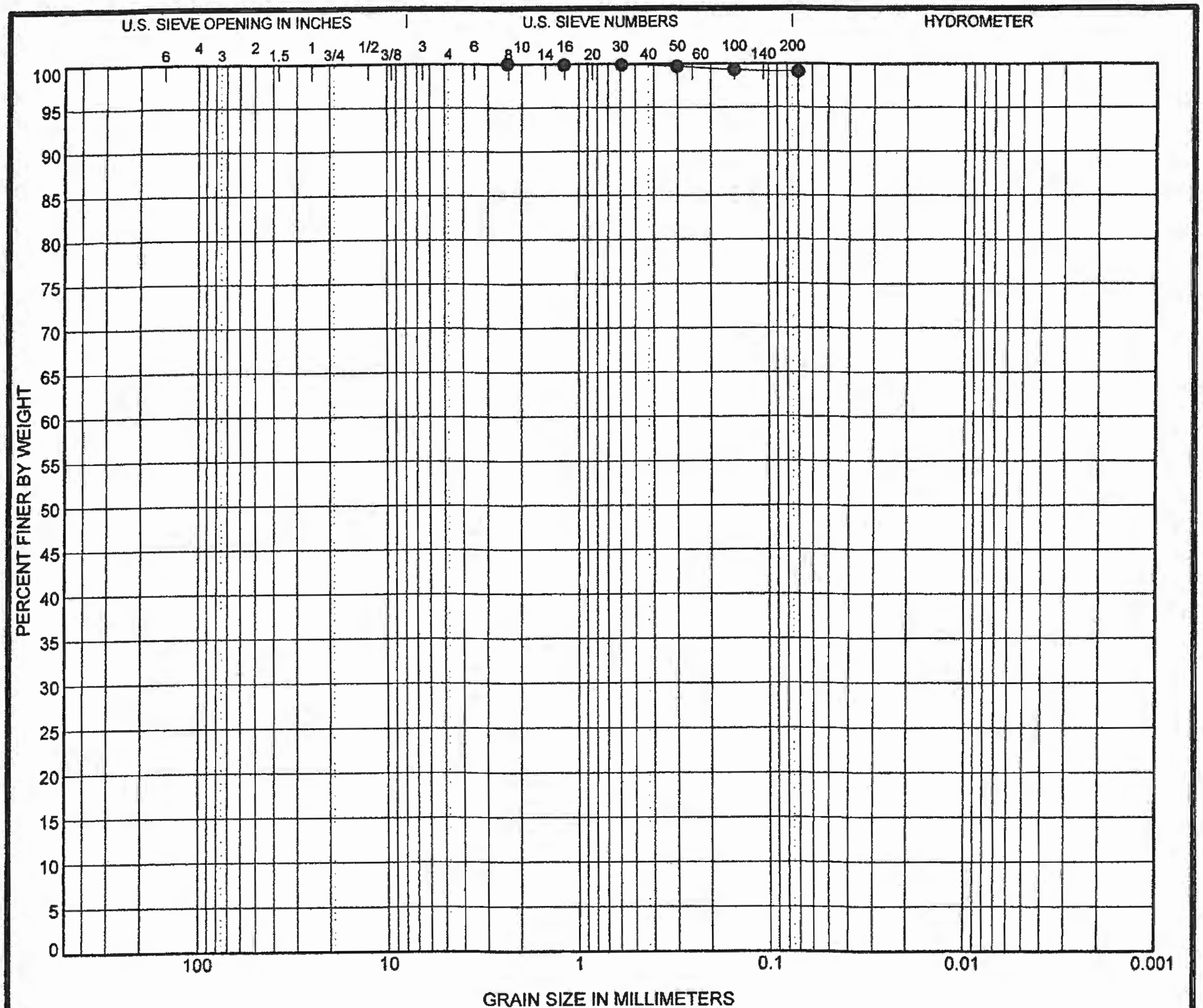

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-32	66.0	CLAY, silty, dark gray	68	27	41		
		STRATUM II					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-32	66.0	2.38				0.0	0.9	99.1	

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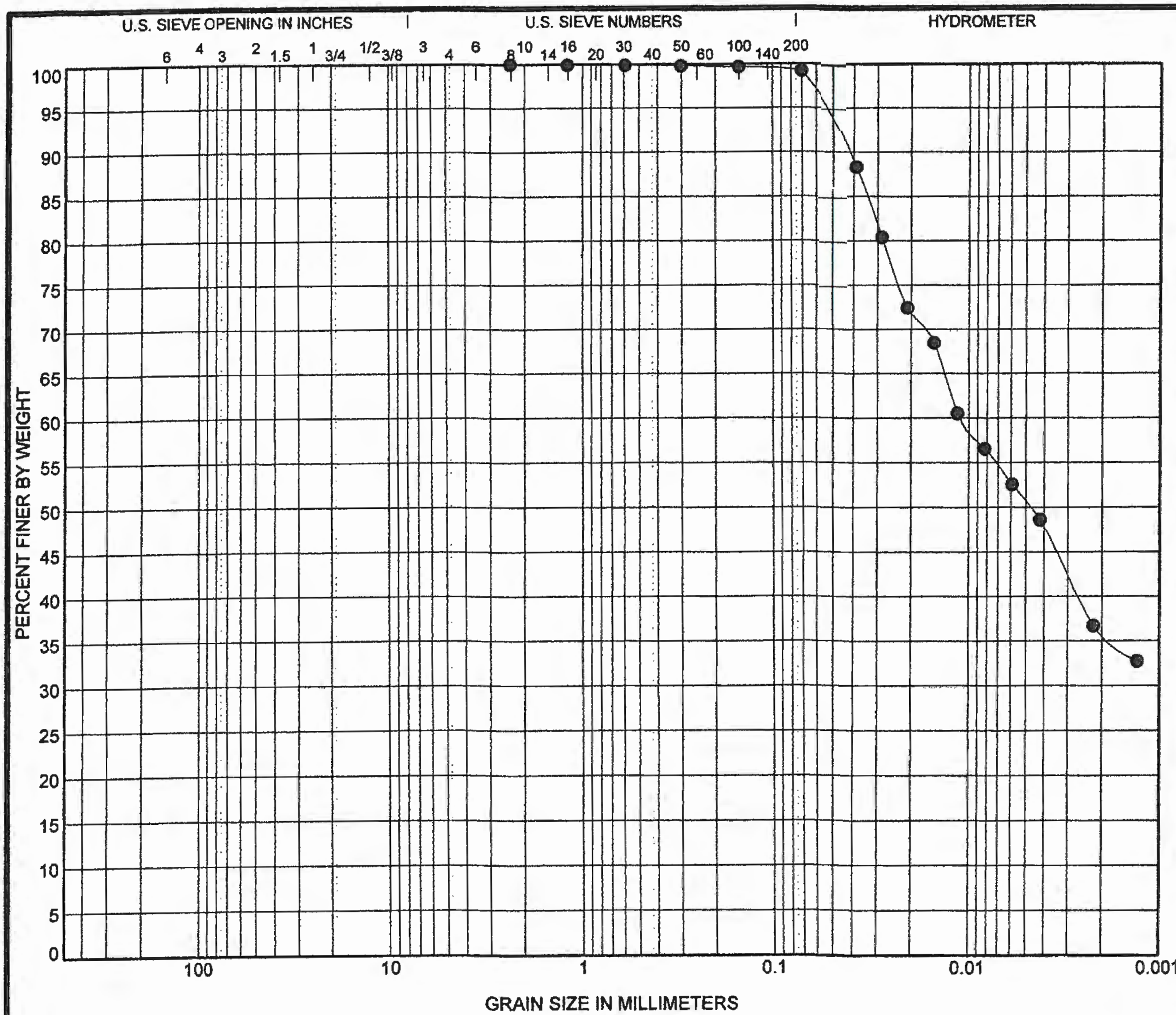

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-28	69.0	CLAY, silty, dark gray	59	23	36		
		STRATUM III					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-28	69.0	2.38	0.011			0.0	0.8	48.6	50.6

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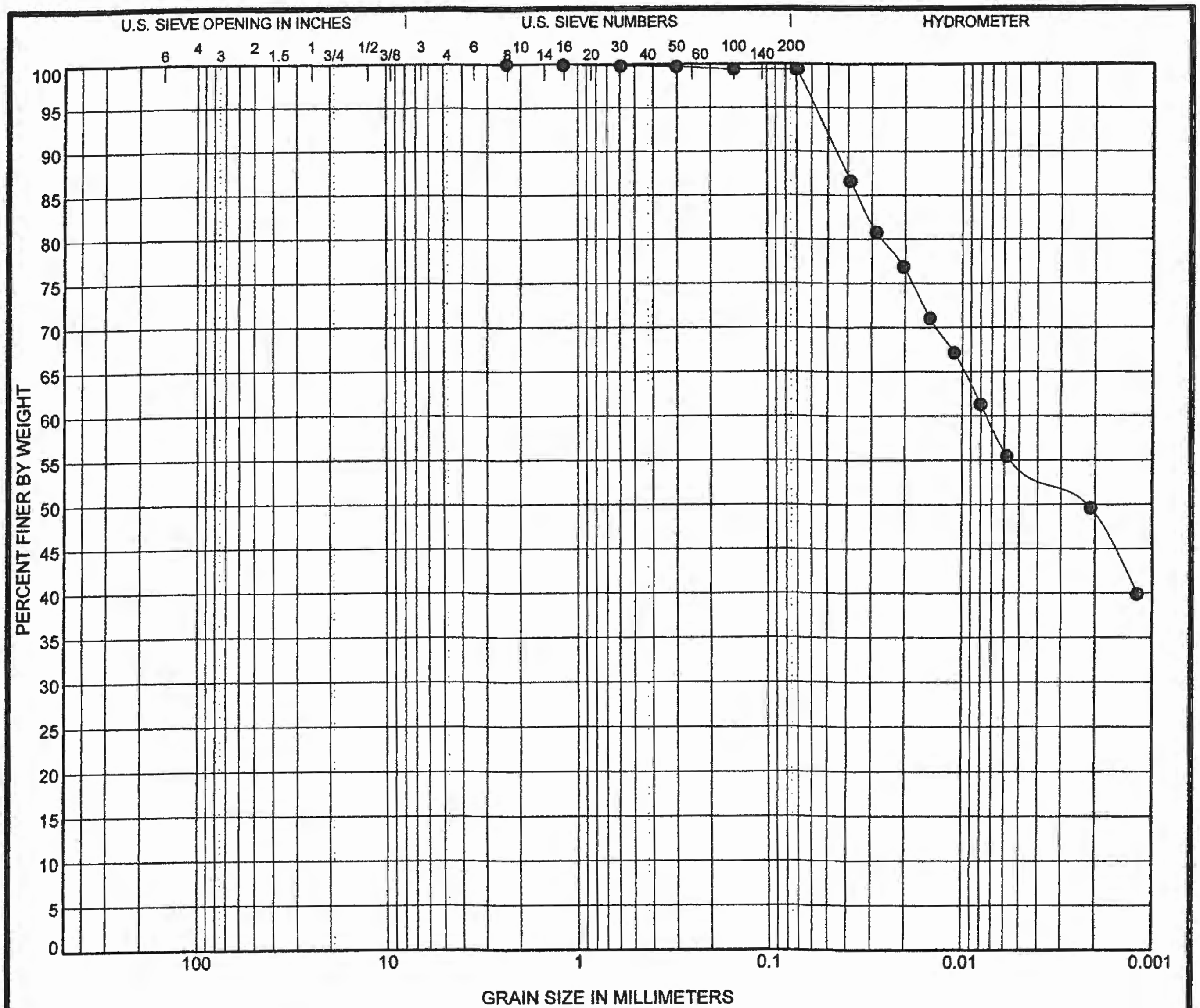

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BME-08	53.0	CLAY, silty, dark gray	77	27	50		
		STRATUM III					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● BME-08	53.0	2.38	0.007			0.0	0.6	44.8	54.6

US GRAIN SIZE 1914 130 ENVIRONMENTAL PARK.GPJ LANDTEC.GDT 12/18/13

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GRAIN SIZE DISTRIBUTION

Project: 130 Environmental Park
Central Texas

Project No.: 0813-1914 Date: 9/11/2013

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REPORT DATE: 9/9/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL: CLAY, silty, tan & brown, Stratum II
BORING: BME-1
PROCTOR #: N/A

LAB START DATE: 9/5/2013
LAB RPT. DATE: 9/9/2013
TECHNICIAN: MLT
DEPTH/LIFT: 10.0'-12.0'
PERM FLUID USED: De-aired Tap Water

SAMPLE ORIENTATION: Horizontal
Remold ______

a. Length of Specimen, L: 1 in
c. Sample Volume (π b^2 / 4 * a): 4.91 cu in

b. Avg. Diameter of Specimen: 2.50 in
d. Wet Unit Weight: [(e * 3.8095) / c)]: 116.8 pcf

INITIAL CONDITIONS

e. Wet Weight Soil: 150.5 gms
f. Wet Weight Soil + Tare: 239.7 gms
g. Dry Weight Soil + Tare: 206.3 gms
h. Tare Weight: 89.2 gms
i. Moisture Content [(f-g)/(g-h)]*100: 28.5 %
j. Unit Dry Weight [d/(1+(i/100))]: 90.9 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 242.6 gms
l. Dry Weight Soil + Tare: 206.3 gms
m. Tare Weight: 89.2 gms
n. Moisture Content [(k-l)/(l-m)]*100: 31.0 %

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 7.83 cm
Maximum Gradient, i: 30.0 cm/cm

B COEFFICIENT DETERMINATION						PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow hs, in	Outflow ha, out
		10							
		10							
		10							
8-Sep	50	10	47	56.8	0.98	1	50	47	47

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
9/8/2013	06:36		7.80				
9/8/2013	06:45	540	7.10	0.70	22	0.953	4.4E-08
9/8/2013	06:54	1080	6.60	1.20	22	0.953	3.9E-08
9/8/2013	07:10	2040	6.00	1.80	22	0.953	3.3E-08
9/8/2013	07:20	2640	5.70	2.10	22	0.953	3.1E-08
9/8/2013	07:30	3240	5.40	2.40	22	0.953	3.0E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

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REPORT DATE: 9/9/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL: CLAY, silty, dark gray, Stratum III
BORING: BME-2
PROCTOR #: N/A

LAB START DATE: 9/5/2013
LAB RPT. DATE: 9/9/2013
TECHNICIAN: MLT
DEPTH/LIFT: 78.0'-80.0'

SAMPLE ORIENTATION: Vertical
Remold ______

PERM FLUID USED: De-aired Tap Water

a. Length of Specimen, L: 2.2 in
b. Avg. Diameter of Specimen: 2.85 in
c. Sample Volume ($\pi b^2 / 4 * a$): 14.03 cu in
d. Wet Unit Weight: [(e * 3.8095) / c)]: 118.4 pcf

INITIAL CONDITIONS

e. Wet Weight Soil: 436.1 gms
f. Wet Weight Soil + Tare: 444.1 gms
g. Dry Weight Soil + Tare: 337.3 gms
h. Tare Weight: 8.0 gms
i. Moisture Content [(f-g)/(g-h)]*100: 32.4 %
j. Unit Dry Weight [d/(1+(i/100))]: 89.4 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 447.9 gms
l. Dry Weight Soil + Tare: 337.3 gms
m. Tare Weight: 8.0 gms
n. Moisture Content [(k-l)/(l-m)]*100: 33.6 %

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 14.83 cm
Maximum Gradient, i: 30.0 cm/cm

B COEFFICIENT DETERMINATION						PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow hs, in	Outflow hs, out
		10							
		10							
		10							
8-Sep	50	10	25	34.7	0.97	1	50	25	25

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
9/8/2013	08:35		14.80				
9/8/2013	08:45	600	13.70	1.10	22	0.953	4.6E-08
9/8/2013	08:58	1380	13.20	1.60	22	0.953	3.0E-08
9/8/2013	09:10	2100	12.80	2.00	22	0.953	2.5E-08
9/8/2013	09:21	2760	12.50	2.30	22	0.953	2.2E-08
9/8/2013	09:30	3300	12.20	2.60	22	0.953	2.1E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

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REPORT DATE: 9/9/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL: CLAY, silty, dark gray, Stratum III
BORING: BME-2
PROCTOR #: N/A

LAB START DATE: 9/5/2013
LAB RPT. DATE: 9/9/2013
TECHNICIAN: MLT
DEPTH/LIFT: 98.0'-100.0'
PERM FLUID USED: De-aired Tap Water

SAMPLE ORIENTATION: Vertical
Remold ______

a. Length of Specimen, L: 2 in
c. Sample Volume (π b^2 / 4 * a): 13.67 cu in

b. Avg. Diameter of Specimen: 2.95 in
d. Wet Unit Weight: [(e * 3.8095) / c)]: 119.1 pcf

INITIAL CONDITIONS

e. Wet Weight Soil: 427.3 gms
f. Wet Weight Soil + Tare: 435.3 gms
g. Dry Weight Soil + Tare: 351.3 gms
h. Tare Weight: 8.0 gms
i. Moisture Content [(f-g)/(g-h)]*100: 24.5 %
j. Unit Dry Weight [d/(1+(i/100))]: 95.7 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 439.5 gms
l. Dry Weight Soil + Tare: 351.3 gms
m. Tare Weight: 8.0 gms
n. Moisture Content [(k-l)/(l-m)]*100: 25.7 %

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 13.67 cm
Maximum Gradient, i: 30.0 cm/cm

B COEFFICIENT DETERMINATION						PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow ha, in	Outflow ha, out
		10							
		10							
		10							
8-Sep	50	10	20	29.5	0.95	1	50	20	20

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
9/8/2013	09:35		13.60				
9/8/2013	09:43	480	13.20	0.40	22	0.953	1.9E-08
9/8/2013	09:50	900	12.90	0.70	22	0.953	1.8E-08
9/8/2013	10:00	1500	12.70	0.90	22	0.953	1.4E-08
9/8/2013	10:11	2160	12.50	1.10	22	0.953	1.2E-08
9/8/2013	10:24	2940	12.20	1.40	22	0.953	1.1E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

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REPORT DATE: 6/21/2014

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET
FALLING HEAD - FIXED WALL PERMEAMETER

MATERIAL: CLAY, silty, dark brown, Stratum I
BORING: BME-03
PROCTOR # : N/A

SAMPLE ORIENTATION: Horizontal

LAB START DATE: 6/19/2014
LAB RPT. DATE: 6/21/2014
TECHNICIAN: MLT
DEPTH/LIFT: 2.0'-4.0'
PERM FLUID USED: De-aired Tap Water

a. Length of Specimen, L: 1.0 in
c. Sample Volume
(π b^2 / 4 * a): 4.909 cu in

b. Avg. Diameter of Specimen: 2.5 in
d. Wet Unit Weight:
[((f-h)*3.8095)/c)]: 115.6 pcf

INITIAL CONDITIONS

e. Ring + Wet Weight Soil: 663.6 gms
f. Wet Weight Soil + Tare: 240.3 gms
g. Dry Weight Soil + Tare: 222.0 gms
h. Tare Weight: 91.4 gms
i. Moisture Content
[(f-g)/(g-h)]*100: 14.0 %
j. Unit Dry Weight
[d/(1+(i/100))]: 101.4 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 245.8 gms
l. Dry Weight Soil + Tare: 222.0 gms
m. Tare Weight: 91.4 gms
n. Moisture Content
[(k-l)/(l-m)]*100: 18.2 %
o. Unit Dry Weight
[d/(1+(n/100))]: 97.7 pcf
p. Ring Weight: 514.7 gms

Date	Time	t sec	Initial Height, ho	Corrected ho - C	Final Height, hf	Corrected hf - C	Temp C	Rt	k @ 20C cm/sec
19-Jun	16:43		38.8	31.3					
20-Jun	6:23	49200			36.1	28.6	22	0.953	1.3E-07
20-Jun	6:23		36.1	28.6					
20-Jun	11:49	19560			35.5	28.0	22	0.953	7.7E-08
20-Jun	11:49		35.5	28.0					
20-Jun	16:47	17880			35.0	27.5	22	0.953	7.2E-08
20-Jun	16:47		35.0	27.5					
20-Jun	22:00	18780			34.6	27.1	22	0.953	5.6E-08
20-Jun	22:00		34.6	27.1					
21-Jun	6:42	31320			34.1	26.6	22	0.953	4.2E-08
20-Jun	6:23		36.1	28.6					
21-Jun	6:42	87540			34.1	26.6	22	0.953	5.9E-08

Height of Top of Specimen
From Top of Table: 7.47 cm

Standpipe Diameter 1.09 cm

Standpipe Area 0.933 sq cm

Test Method: Corps of Engineers EM 1110-2-1906, Appendix VII

Hx-C = Hx-Ht

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REPORT DATE: 10/18/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL: CLAY, silty, tan, Stratum II
BORING: BME-5
PROCTOR # : N/A

LAB START DATE: 10/15/2013
LAB RPT. DATE: 10/18/2013
TECHNICIAN: MLT
DEPTH/LIFT: 34.0'-36.0'
PERM FLUID USED: De-aired Tap Water

SAMPLE ORIENTATION: Horizontal
Remold

a. Length of Specimen, L: 1 in
c. Sample Volume
(π b^2 / 4 * a): 4.91 cu in

b. Avg. Diameter of Specimen: 2.50 in
d. Wet Unit Weight:
[(e * 3.8095) / c)]: 119.2 pcf

INITIAL CONDITIONS

e. Wet Weight Soil: 153.6 gms
f. Wet Weight Soil + Tare: 244.9 gms
g. Dry Weight Soil + Tare: 211.1 gms
h. Tare Weight: 91.3 gms
i. Moisture Content
[(f-g)/(g-h)]*100: 28.2 %
j. Unit Dry Weight
[d/(1+(i/100))]: 93.0 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 248.9 gms
l. Dry Weight Soil + Tare: 211.1 gms
m. Tare Weight: 91.3 gms
n. Moisture Content
[(k-l)/(l-m)]*100: 31.6 %

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 7.83 cm
Maximum Gradient, i: 30.0 cm/cm

	B COEFFICIENT DETERMINATION					PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow hs, in	Outflow hs, out
		10							
		10							
		10							
17-Oct	50	10	25	34.5	0.95	1	50	25	25

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
10/17/2013	06:49		7.80				
10/17/2013	07:00	660	6.90	0.90	22	0.953	4.7E-08
10/17/2013	07:10	1260	6.60	1.20	22	0.953	3.4E-08
10/17/2013	07:13	1440	6.50	1.30	22	0.953	3.2E-08
10/17/2013	07:28	2340	6.00	1.80	22	0.953	2.9E-08
10/17/2013	07:40	3060	5.70	2.10	22	0.953	2.7E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

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REPORT DATE: 9/9/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL: CLAY, silty, dark gray, Stratum III
BORING: BME-9
PROCTOR #: N/A

LAB START DATE: 9/5/2013
LAB RPT. DATE: 9/9/2013
TECHNICIAN: MLT
DEPTH/LIFT: 98.0'-100.0'
PERM FLUID USED: De-aired Tap Water

SAMPLE ORIENTATION: Vertical
Remold ______

a. Length of Specimen, L: 2.7 in
b. Avg. Diameter of Specimen: 2.90 in
c. Sample Volume (π b^2 / 4 * a): 17.83 cu in
d. Wet Unit Weight: [(e * 3.8095) / c)]: 123.9 pcf

INITIAL CONDITIONS

e. Wet Weight Soil: 580.1 gms
f. Wet Weight Soil + Tare: 678.7 gms
g. Dry Weight Soil + Tare: 576.6 gms
h. Tare Weight: 98.6 gms
i. Moisture Content [((f-g)/(g-h)]*100: 21.4 %
j. Unit Dry Weight [d/(1+(i/100))]: 102.1 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 682.4 gms
l. Dry Weight Soil + Tare: 576.6 gms
m. Tare Weight: 98.6 gms
n. Moisture Content [(k-l)/(l-m)]*100: 22.1 %

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 17.75 cm
Maximum Gradient, i: 30.0 cm/cm

B COEFFICIENT DETERMINATION						PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow he, in	Outflow he, out
		10							
		10							
		10							
8-Sep	50	10	20	29.6	0.96	1	50	20	20

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
9/8/2013	07:34		17.70				
9/8/2013	07:47	780	17.10	0.60	22	0.953	1.8E-08
9/8/2013	07:59	1500	16.80	0.90	22	0.953	1.4E-08
9/8/2013	08:07	1980	16.40	1.30	22	0.953	1.6E-08
9/8/2013	08:15	2460	16.20	1.50	22	0.953	1.5E-08
9/8/2013	08:28	3240	16.10	1.60	22	0.953	1.2E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

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REPORT DATE: 9/2/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL: CLAY, silty, tan & brown, Stratum II
BORING: BME-27
PROCTOR # : N/A

LAB START DATE: 8/27/2013
LAB RPT. DATE: 9/2/2013
TECHNICIAN: MLT
DEPTH/LIFT: 8.0'-10.0'
PERM FLUID USED: De-aired Tap Water

SAMPLE ORIENTATION: Vertical
Remold ______

a. Length of Specimen, L: 2.35 in
c. Sample Volume (π b^2 / 4 * a): 15.31 cu in

b. Avg. Diameter of Specimen: 2.88 in
d. Wet Unit Weight [(e * 3.8095) / c)]: 116.4 pcf

INITIAL CONDITIONS

e. Wet Weight Soil: 467.9 gms
f. Wet Weight Soil + Tare: 561.9 gms
g. Dry Weight Soil + Tare: 474.7 gms
h. Tare Weight: 94.0 gms
i. Moisture Content [(f-g)/(g-h)]*100: 22.9 %
j. Unit Dry Weight [d/(1+(i/100))]: 94.7 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 566.9 gms
l. Dry Weight Soil + Tare: 474.7 gms
m. Tare Weight: 94.0 gms
n. Moisture Content [(k-l)/(l-m)]*100: 24.2 %

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 15.71 cm
Maximum Gradient, i: 30.0 cm/cm

B COEFFICIENT DETERMINATION						PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow ha, in	Outflow ha, out
		10							
		10							
		10							
31-Aug	50	10	44	53.5	0.95	1	50	44	44

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
8/31/2013	07:00		15.70				
8/31/2013	07:15	900	13.20	2.50	22	0.953	7.3E-08
8/31/2013	07:32	1920	11.60	4.10	22	0.953	6.0E-08
8/31/2013	07:43	2580	10.80	4.90	22	0.953	5.6E-08
8/31/2013	07:57	3420	10.20	5.50	22	0.953	4.9E-08
8/31/2013	08:10	4200	9.80	5.90	22	0.953	4.4E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

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REPORT DATE: 9/2/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL:	CLAY, silty, gray & tan, mottled, Stratum II	LAB START DATE:	8/27/2013
BORING:	BME-28	LAB RPT. DATE:	9/2/2013
PROCTOR # :	N/A	TECHNICIAN:	MLT
		DEPTH/LIFT:	18.0'-20.0'
SAMPLE ORIENTATION:	Vertical	PERM FLUID USED:	De-aired Tap Water
	Remold ____		

a. Length of Specimen, L: 2.55 in
b. Avg. Diameter of Specimen: 2.83 in
c. Sample Volume (π b^2 / 4 * a): 16.04 cu in
d. Wet Unit Weight: [(e * 3.8095) / c)]: 128.2 pcf

INITIAL CONDITIONS

e. Wet Weight Soil: 539.6 gms
f. Wet Weight Soil + Tare: 631.3 gms
g. Dry Weight Soil + Tare: 543.3 gms
h. Tare Weight: 91.7 gms
i. Moisture Content [(f-g)/(g-h)]*100: 19.5 %
j. Unit Dry Weight [d/(1+(i/100))]: 107.3 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 638.6 gms
l. Dry Weight Soil + Tare: 543.3 gms
m. Tare Weight: 91.7 gms
n. Moisture Content [(k-l)/(l-m)]*100: 21.1 %

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 16.87 cm
Maximum Gradient, i: 30.0 cm/cm

	B COEFFICIENT DETERMINATION					PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow ha, in	Outflow ha, out
		10							
		10							
		10							
31-Aug	50	10	44	53.5	0.95	1	50	44	44

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
8/31/2013	08:16		16.80				
8/31/2013	08:27	660	14.30	2.50	22	0.953	1.0E-07
8/31/2013	08:40	1440	12.80	4.00	22	0.953	8.0E-08
8/31/2013	08:56	2400	11.60	5.20	22	0.953	6.6E-08
8/31/2013	09:07	3060	11.10	5.70	22	0.953	5.8E-08
8/31/2013	09:20	3840	10.50	6.30	22	0.953	5.2E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

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CLIENT: Biggs & Mathews Environmental, Inc.
1700 Robert Road, Suite 100
Mansfield, Texas 76063

REPORT DATE: 9/13/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL: CLAY, silty, tan, brown & gray, Stratum II
BORING: BME-32,19,23
PROCTOR # : EP-1

LAB START DATE: 9/10/2013
LAB RPT. DATE: 9/13/2013
TECHNICIAN: MLT
DEPTH/LIFT: 10.0'-36.0'

SAMPLE ORIENTATION: Vertical
Remold X

PERM FLUID USED: De-aired Tap Water

a. Length of Specimen, L: 3 in
c. Sample Volume (π b^2 / 4 * a): 4.29 cu in

b. Avg. Diameter of Specimen: 1.35 in
d. Wet Unit Weight: [(e * 3.8095) / c)]: 110.6 pcf

INITIAL CONDITIONS

e. Wet Weight Soil: 124.7 gms
f. Wet Weight Soil + Tare: 133.4 gms
g. Dry Weight Soil + Tare: 108.1 gms
h. Tare Weight: 8.7 gms
i. Moisture Content [(f-g)/(g-h)]*100: 25.5 %
j. Unit Dry Weight [d/(1+(i/100))]: 88.2 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 139.7 gms
l. Dry Weight Soil + Tare: 108.1 gms
m. Tare Weight: 8.7 gms
n. Moisture Content [(k-l)/(l-m)]*100: 31.8 %

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 19.50 cm
Maximum Gradient, i: 30.0 cm/cm

B COEFFICIENT DETERMINATION						PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow ha, in	Outflow ha, out
		10							
		10							
		10							
12-Sep	50	10	45	54.8	0.98	1	50	45	45

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
9/12/2013	07:00		19.00				
9/12/2013	07:11	660	18.50	0.50	22	0.953	8.3E-08
9/12/2013	07:23	1380	18.20	0.80	22	0.953	6.4E-08
9/12/2013	07:32	1920	18.00	1.00	22	0.953	5.8E-08
9/12/2013	07:45	2700	17.90	1.10	22	0.953	4.5E-08
9/12/2013	07:55	3300	17.80	1.20	22	0.953	4.1E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

LANDTEC engineers

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Mansfield, Texas 76063
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REPORT DATE: 9/13/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL: CLAY, silty, tan, brown & gray, Stratum II
BORING: BME-9
PROCTOR #: EP-2

LAB START DATE: 9/10/2013
LAB RPT. DATE: 9/13/2013
TECHNICIAN: MLT
DEPTH/LIFT: 10.0'-40.0'
PERM FLUID USED: De-aired Tap Water

SAMPLE ORIENTATION: Vertical
Remold X

a. Length of Specimen, L: 3 in
b. Avg. Diameter of Specimen: 1.35 in
c. Sample Volume (π b^2 / 4 * a): 4.29 cu in
d. Wet Unit Weight: [(e * 3.8095) / c)]: 106.4 pcf

INITIAL CONDITIONS		FINAL CONDITIONS	
e. Wet Weight Soil:	119.9 gms	k. Wet Weight Soil + Tare:	131.7 gms
f. Wet Weight Soil + Tare:	127.8 gms	l. Dry Weight Soil + Tare:	102.2 gms
g. Dry Weight Soil + Tare:	102.2 gms	m. Tare Weight:	7.9 gms
h. Tare Weight:	7.9 gms	n. Moisture Content [(k-l)/(l-m)]*100:	31.3 %
i. Moisture Content [(f-g)/(g-h)]*100:	27.1 %		
j. Unit Dry Weight [d/(1+(i/100))]:	83.7 pcf		

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 19.50 cm
Maximum Gradient, i: 30.0 cm/cm

B COEFFICIENT DETERMINATION						PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow ha, in	Outflow ha, out
		10							
		10							
		10							
12-Sep	50	10	45	54.7	0.97	1	50	45	45

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
9/12/2013	07:59		19.00				
9/12/2013	08:10	660	18.50	0.50	22	0.953	8.3E-08
9/12/2013	08:20	1260	18.10	0.90	22	0.953	7.9E-08
9/12/2013	08:28	1740	17.90	1.10	22	0.953	7.1E-08
9/12/2013	08:35	2160	17.70	1.30	22	0.953	6.8E-08
9/12/2013	08:48	2940	17.60	1.40	22	0.953	5.4E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

LANDTEC engineers

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CLIENT: Biggs & Mathews Environmental, Inc.
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Mansfield, Texas 76063

REPORT DATE: 9/13/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL:	CLAY, silty, tan & gray, Stratum II	LAB START DATE:	9/10/2013
BORING:	BME-23, 32	LAB RPT. DATE:	9/13/2013
PROCTOR # :	EP-3	TECHNICIAN:	MLT
		DEPTH/LIFT:	32.0'-57.0'
SAMPLE ORIENTATION:	Vertical Remold X	PERM FLUID USED:	De-aired Tap Water

a. Length of Specimen, L: 3 in

b. Avg. Diameter of Specimen: 1.35 in

c. Sample Volume (π b^2 / 4 * a): 4.29 cu in

d. Wet Unit Weight: [(e * 3.8095) / c)]: 111.0 pcf

INITIAL CONDITIONS		FINAL CONDITIONS	
e. Wet Weight Soil:	125.1 gms	k. Wet Weight Soil + Tare:	136.8 gms
f. Wet Weight Soil + Tare:	133.7 gms	l. Dry Weight Soil + Tare:	107.7 gms
g. Dry Weight Soil + Tare:	107.7 gms	m. Tare Weight:	8.6 gms
h. Tare Weight:	8.6 gms	n. Moisture Content [(k-l)/(l-m)]*100:	29.4 %
i. Moisture Content [(f-g)/(g-h)]*100:	26.2 %		
j. Unit Dry Weight [d/(1+(i/100))]:	87.9 pcf		

		Equilibrium Head, R_{eq}:	2.0 cm
Specific Gravity of Mercury, d_{Hg}:	13.55	Maximum Pipet Head, R_p:	19.50 cm
Specific Gravity of Water, d_w:	1.00	Maximum Gradient, i:	30.0 cm/cm

B COEFFICIENT DETERMINATION						PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow hs, in	Outflow hs, out
		10							
		10							
		10							
12-Sep	50	10	45	54.6	0.96	1	50	45	45

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
9/12/2013	08:55		19.00				
9/12/2013	09:09	840	18.40	0.60	22	0.953	7.9E-08
9/12/2013	09:15	1200	18.20	0.80	22	0.953	7.4E-08
9/12/2013	09:26	1860	18.00	1.00	22	0.953	6.0E-08
9/12/2013	09:35	2400	17.90	1.10	22	0.953	5.1E-08
9/12/2013	09:48	3180	17.80	1.20	22	0.953	4.2E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

LANDTEC engineers

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CLIENT: Biggs & Mathews Environmental, Inc.
1700 Robert Road, Suite 100
Mansfield, Texas 76063

REPORT DATE: 9/14/2013

PROJECT NO.: 0813-1914

PROJECT: 130 Environmental Park, Central Texas

HYDRAULIC CONDUCTIVITY WORKSHEET

FALLING HEAD, RISING TAILWATER, CONSTANT VOLUME - FLEXIBLE WALL PERMEAMETER

MATERIAL: CLAY, silty, tan & gray, Stratum II
BORING: BME-27
PROCTOR # : EP-4

LAB START DATE: 9/11/2013
LAB RPT. DATE: 9/14/2013
TECHNICIAN: MLT
DEPTH/LIFT: 10.0'-20.0'
PERM FLUID USED: De-aired Tap Water

SAMPLE ORIENTATION: Vertical
Remold X

a. Length of Specimen, L: 3 in
c. Sample Volume (π b^2 / 4 * a): 4.29 cu in

b. Avg. Diameter of Specimen: 1.35 in
d. Wet Unit Weight: [(e * 3.8095) / c)]: 108.9 pcf

INITIAL CONDITIONS

e. Wet Weight Soil: 122.8 gms
f. Wet Weight Soil + Tare: 131.1 gms
g. Dry Weight Soil + Tare: 105.5 gms
h. Tare Weight: 8.3 gms
i. Moisture Content [(f-g)/(g-h)]*100: 26.3 %
j. Unit Dry Weight [d/(1+(i/100))]: 86.2 pcf

FINAL CONDITIONS

k. Wet Weight Soil + Tare: 136.7 gms
l. Dry Weight Soil + Tare: 105.5 gms
m. Tare Weight: 8.3 gms
n. Moisture Content [(k-l)/(l-m)]*100: 32.1 %

Specific Gravity of Mercury, d_{Hg}: 13.55
Specific Gravity of Water, d_w: 1.00

Equilibrium Head, R_{eq}: 2.0 cm
Maximum Pipet Head, R_p: 19.50 cm
Maximum Gradient, i: 30.0 cm/cm

B COEFFICIENT DETERMINATION						PRESSURE, psi			
	P3	Delta Pressure	Back Pressure, bp	Pore Pressure	B Coeff.	Trial	P3 cp	Inflow hs, in	Outflow hs, out
		10							
		10							
		10							
13-Sep	50	10	45	54.6	0.96	1	50	45	45

	Time	Cumul. Time, s	Head Reading H, cm	Total Head Loss Dz_p, cm	Temp C	Rt	k @ 20C cm/sec
9/13/2013	06:32		19.00				
9/13/2013	06:45	780	18.30	0.70	22	0.953	9.9E-08
9/13/2013	06:57	1500	18.00	1.00	22	0.953	7.4E-08
9/13/2013	07:10	2280	17.60	1.40	22	0.953	6.9E-08
9/13/2013	07:22	3000	17.40	1.60	22	0.953	6.0E-08
9/13/2013	07:30	3480	17.20	1.80	22	0.953	5.9E-08

Test Method ASTM D 5084-90

Pipet Area = 0.031416 sq cm
Annulus Area = 0.767120 sq cm

CONSOLIDATION TEST REPORT

MATERIAL DESCRIPTION	USCS	AASHTO
CLAY, silty, gray & tan mottled - Stratum II		

LL	PI	Sp. Gr.	Overburden (tsf)	Dry Dens. (pcf) Init.	Dry Dens. (pcf) Final	Moisture Init.	Moisture Final	Saturation Init.	Saturation Final	Void Ratio Init.	Void Ratio Final	P_c (tsf)	C_c
				85.2								4.88	

Preparation Process:	D2435 Method		Swell Press. (tsf)	Swell %
Condition of Test:				

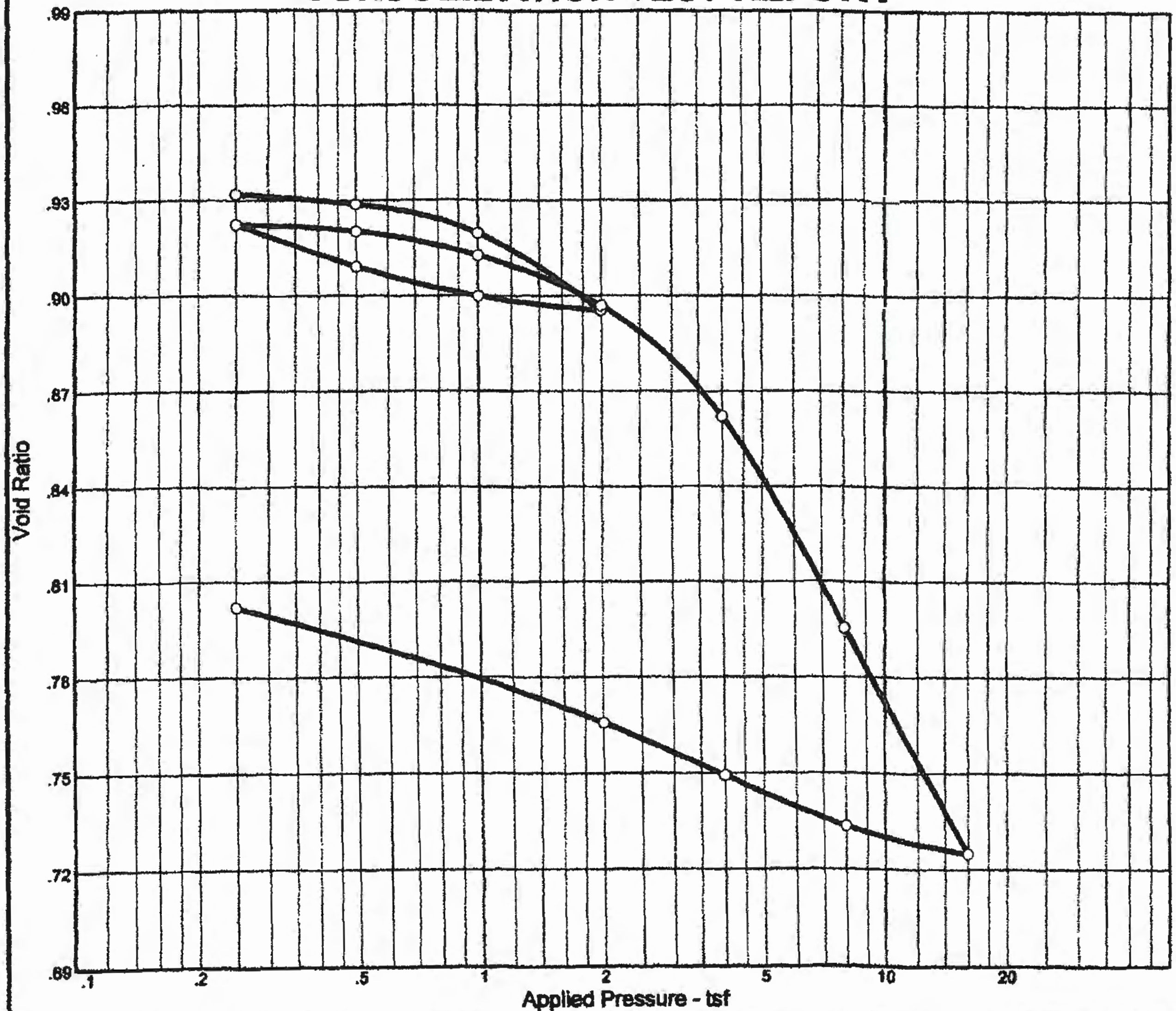
Project No. 1914

Project: 130 Environmental Park

Source: BME-1 @ 47'

LANDTEC ENGINEERS, LLC

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
CLAY, silty, dark gray - Stratum III		

LL	PI	Sp. Gr.	Overburden (tsf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (tsf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
				85.6								4.12	

	D2435 Method		Swell Press. (tsf)	Swell %
Preparation Process:				
Condition of Test:				

Project No. 1914

Project: 130 Environmental Park

Source: BME-3 @ 69'

LANDTEC ENGINEERS, LLC

CONSOLIDATION TEST REPORT

MATERIAL DESCRIPTION	USCS	AASHTO
CLAY, silty, gray & tan mottled - Stratum II		

LL	PI	Sp. Gr.	Overburden (tsf)	Dry Dens. (pcf) Init.	Dry Dens. (pcf) Final	Moisture Init.	Moisture Final	Saturation Init.	Saturation Final	Void Ratio Init.	Void Ratio Final	P_c (tsf)	C_c
				97.1					100.0 %		0.718	4.90	0.14

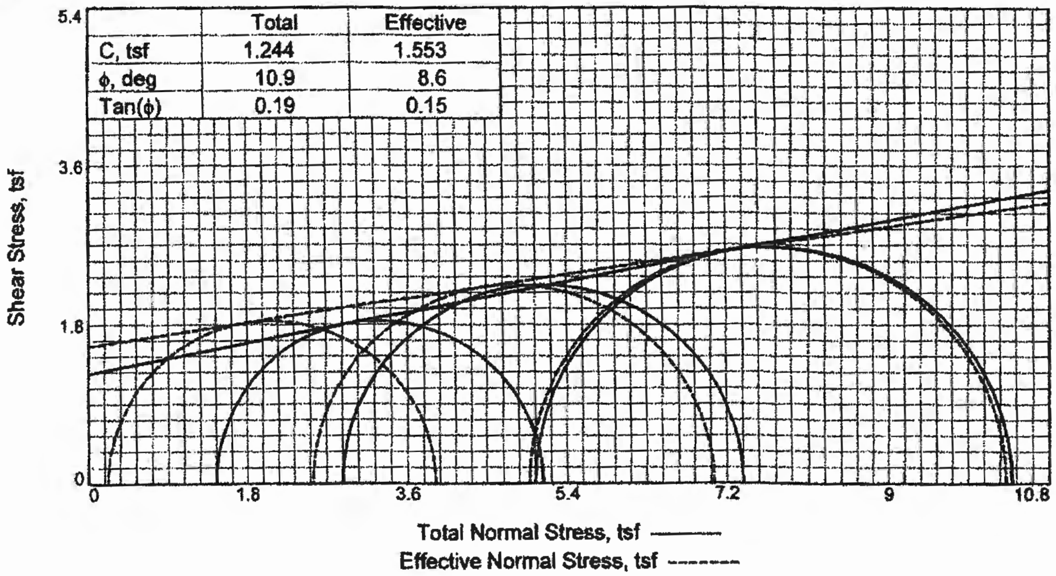
	D2435 Method	C_r	Swell Press. (tsf)	Swell %
Preparation Process:				
Condition of Test:		0.05		

Project No. 1914

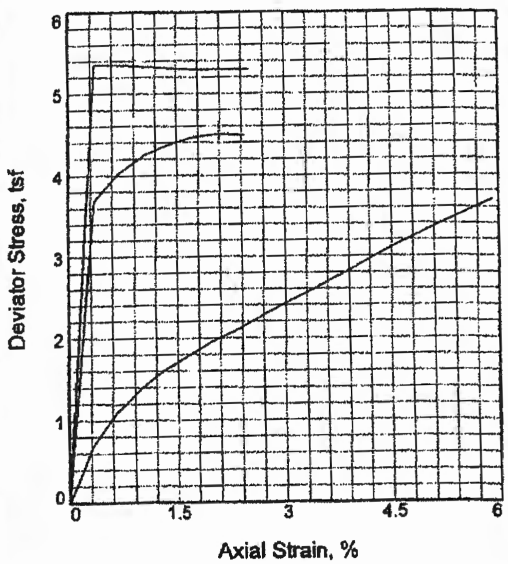
Project: 130 Environmental Park

Source: BME-27 @ 19'

LANDTEC ENGINEERS, LLC



	Total	Effective
C, tsf	1.244	1.553
ϕ, deg	10.9	8.6
Tan(ϕ)	0.19	0.15



	Sample No.	1	2	3
Initial	Water Content, %	26.0	26.0	26.0
	Dry Density, pcf	94.3	94.3	94.3
	Saturation, %	89.9	89.9	89.9
	Void Ratio	0.7745	0.7745	0.7745
	Diameter, in.	1.40	1.40	1.40
	Height, in.	3.05	3.05	3.05
At Test	Water Content, %	28.9	28.9	28.9
	Dry Density, pcf	94.3	94.3	94.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7745	0.7745	0.7745
	Diameter, in.	1.40	1.44	1.46
	Height, in.	3.05	2.87	2.80
	Strain rate, in./min.	0.03	0.03	0.03
	Back Pressure, psi	10.00	10.00	10.00
	Cell Pressure, psi	30.00	50.00	80.00
	Fail. Stress, tsf	3.7	4.5	5.4
	Total Pore Pr., tsf	1.9	1.1	0.8
	Ult. Stress, tsf			
	Total Pore Pr., tsf			
	$\bar{\sigma}_1$ Failure, tsf	3.9	7.1	10.3
	$\bar{\sigma}_3$ Failure, tsf	0.2	2.5	5.0

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: CLAY, silty, tan & brown, Stratum II

Assumed Specific Gravity= 2.68

Remarks:

Project: 130 environmental Park

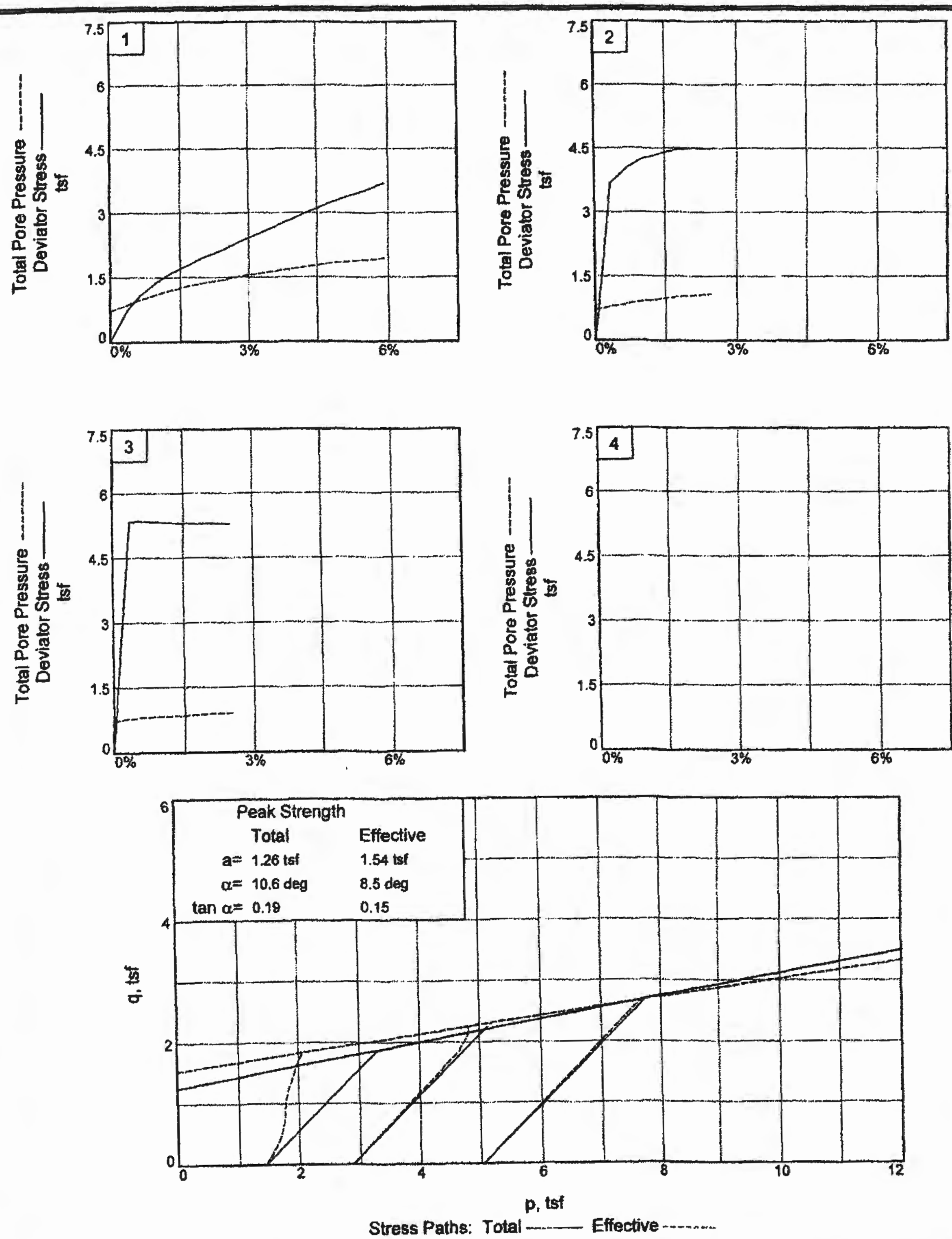
Location: BME-01

Depth: 26.0'-28.0'

Proj. No.: 1914 **Date Sampled:** 10/15/2013

TRIAXIAL SHEAR TEST REPORT

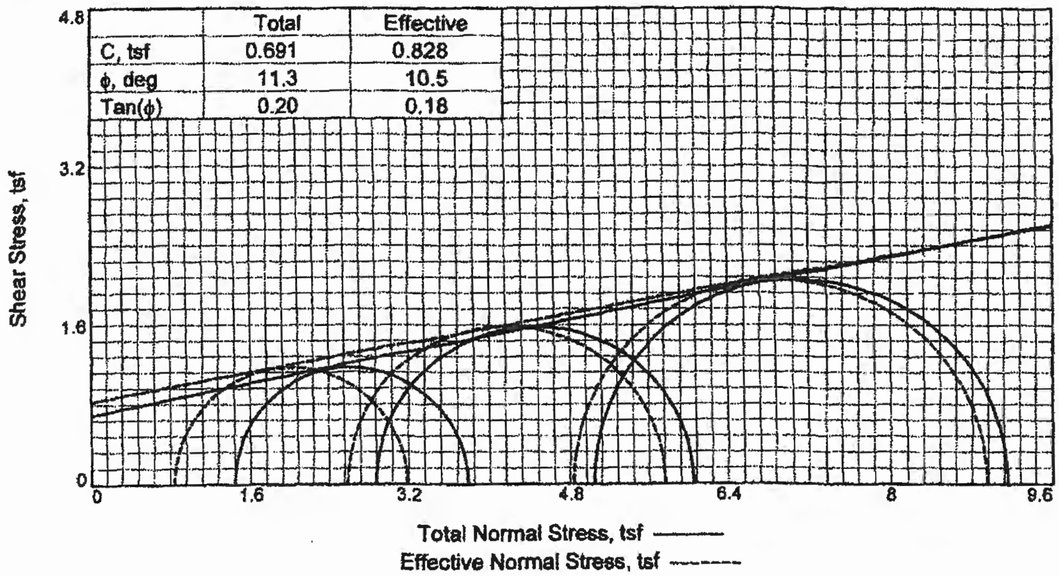
LANDTEC ENGINEERS, LLC

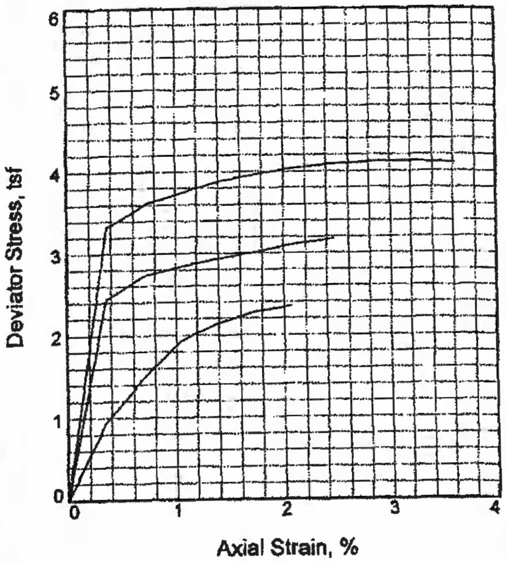


Project: 130 environmental Park
Location: BME-01 **Depth:** 26.0'-28.0'
Project No.: 1914

LANDTEC ENGINEERS, LLC

	Total	Effective
C, tsf	0.691	0.828
ϕ, deg	11.3	10.5
Tan(ϕ)	0.20	0.18





Sample No.		1	2	3
Initial	Water Content, %	35.2	35.2	35.2
	Dry Density, pcf	83.5	83.5	83.5
	Saturation, %	94.2	94.2	94.2
	Void Ratio	1.0026	1.0026	1.0026
	Diameter, in.	1.40	1.40	1.40
	Height, in.	2.90	2.90	2.90
At Test	Water Content, %	37.4	37.4	37.4
	Dry Density, pcf	83.5	83.5	83.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.0026	1.0026	1.0026
	Diameter, in.	1.40	1.41	1.43
	Height, in.	2.90	2.84	2.77
Strain rate, in./min.		0.03	0.03	0.03
Back Pressure, psi		10.00	10.00	10.00
Cell Pressure, psi		30.00	50.00	80.00
Fail. Stress, tsf		2.35	3.17	4.12
Total Pore Pr., tsf		1.32	1.01	0.93
Ult. Stress, tsf				
Total Pore Pr., tsf				
$\bar{\sigma}_1$ Failure, tsf		3.19	5.76	8.95
$\bar{\sigma}_3$ Failure, tsf		0.84	2.59	4.83

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: CLAY, silty, tan & gray, Stratum II

Assumed Specific Gravity= 2.68

Remarks:

Project: 130 environmental Park

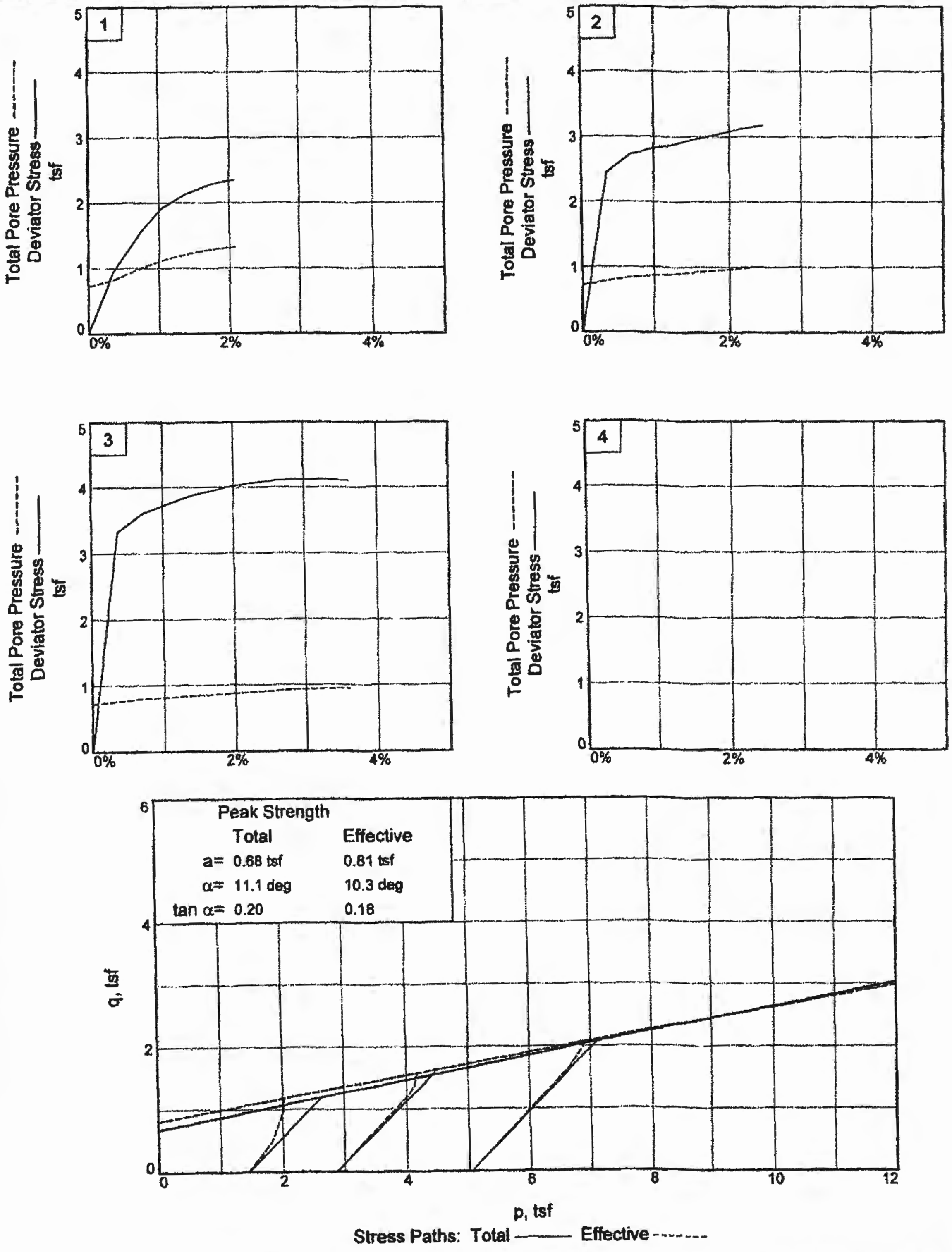
Location: BME-01

Depth: 46.0'-48.0'

Proj. No.: 1914 **Date Sampled:** 10/15/2013

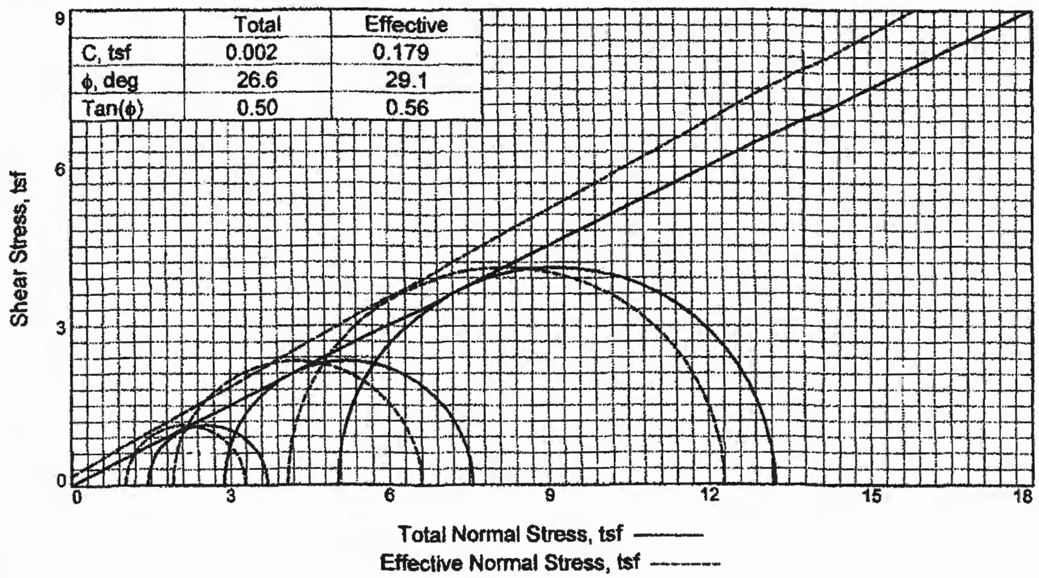
TRIAXIAL SHEAR TEST REPORT

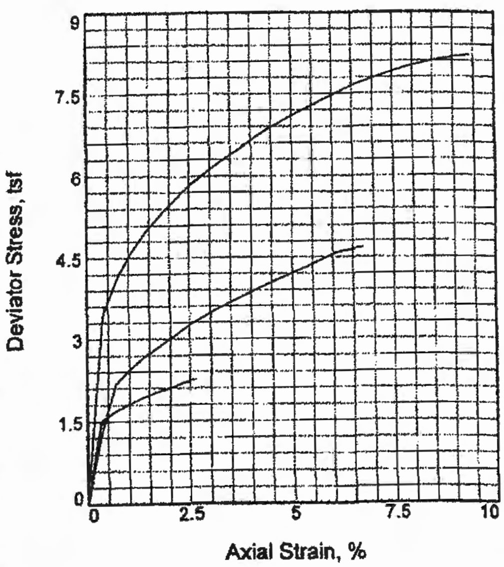
LANDTEC ENGINEERS, LLC



Project: 130 environmental Park
Location: BME-01 **Depth:** 46.0'-48.0'
Project No.: 1914

LANDTEC ENGINEERS, LLC





Sample No.		1	2	3
Initial	Water Content, %	19.8	19.8	19.8
	Dry Density, pcf	93.8	93.8	93.8
	Saturation, %	68.8	68.8	68.8
	Void Ratio	0.7636	0.7636	0.7636
	Diameter, in.	1.35	1.35	1.35
	Height, in.	3.05	3.05	3.05
At Test	Water Content, %	28.8	28.8	28.8
	Dry Density, pcf	93.8	93.8	93.8
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7636	0.7636	0.7636
	Diameter, in.	1.35	1.37	1.42
	Height, in.	3.05	2.97	2.77
Strain rate, in./min.		0.03	0.03	0.03
Back Pressure, psi		10.00	10.00	10.00
Cell Pressure, psi		30.00	50.00	80.00
Fail. Stress, tsf		2.3	4.7	8.2
Total Pore Pr., tsf		1.1	1.7	1.7
Ult. Stress, tsf				
Total Pore Pr., tsf				
$\bar{\sigma}_1$ Failure, tsf		3.3	6.6	12.3
$\bar{\sigma}_3$ Failure, tsf		1.0	1.9	4.1

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: CLAY, silty, gray & tan, Stratum II

Assumed Specific Gravity= 2.65

Remarks:

Project: 130 environmental Park

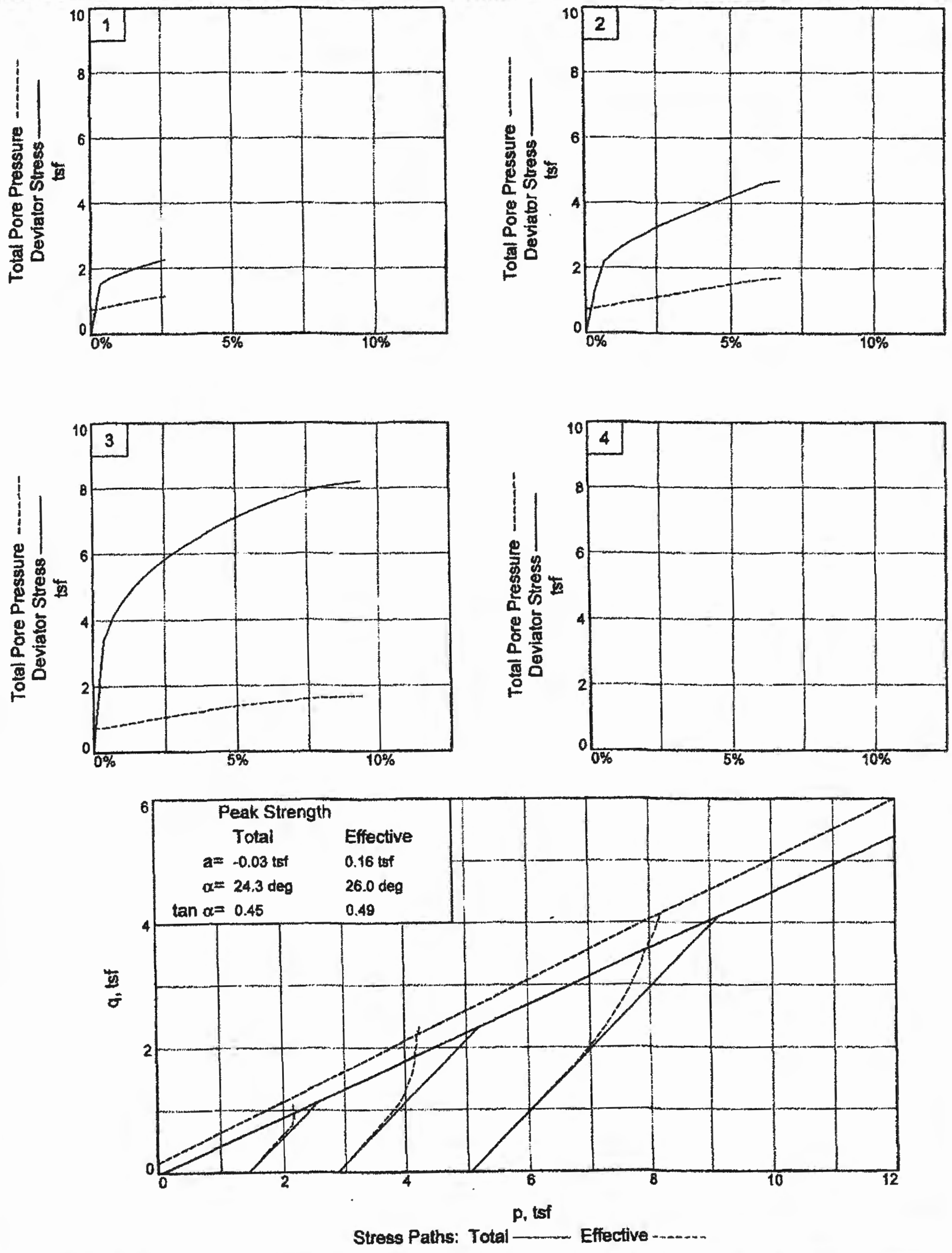
Location: BME-31

Depth: 22.0'-24.0'

Proj. No.: 1914 **Date Sampled:** 10/15/2013

TRIAXIAL SHEAR TEST REPORT

LANDTEC ENGINEERS, LLC



Project: 130 environmental Park
Location: BME-31 **Depth:** 22.0'-24.0'
Project No.: 1914

LANDTEC ENGINEERS, LLC

LANDTEC engineers

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CLIENT: Biggs & Mathews Environmental, Inc.
1700 Robert Road, Suite 100
Mansfield, Texas 76063

REPORT DATE: 9/11/13

PROJECT NO.: 0813-1914

ATTN: Gregg Adams, P.E.

PROJECT: 130 Environmental Park, Central Texas

MOISTURE/DENSITY RELATIONSHIP

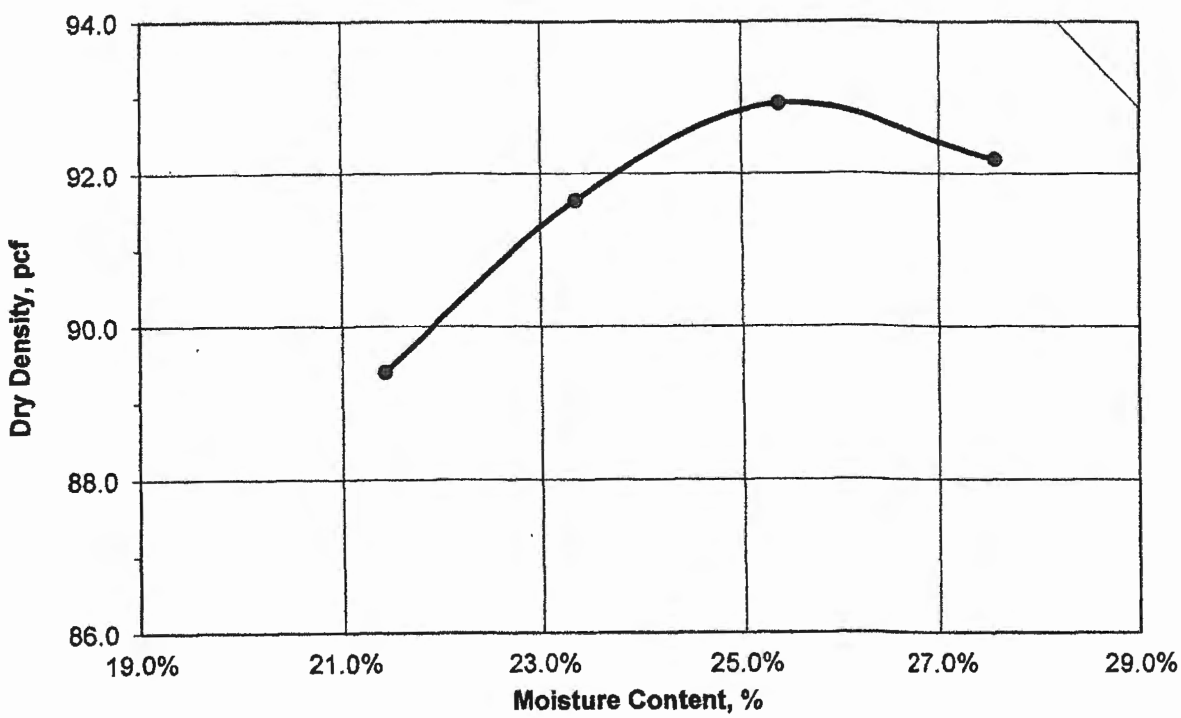
ASTM D 698A

Rammer Type: Manual
Sampled By: Gregg Adams
Sample Prep: Dry
Sample Date: 8/30/13
Sample Location: BME-32, 19, 23; 10' - 36'

Description: CLAY, silty, tan, brown & gray
Liquid Limit: 75
Plastic Limit: 30
Plastic Index: 45
- # 200 Mesh Sieve: 98%
Classification (USCS): CH

PROCTOR NO. EP-1

Maximum Dry Density, pcf: 93.0
Optimum Moisture Content, %: 25.6



LANDTEC engineers

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REPORT DATE: 9/11/13

PROJECT NO.: 0813-1914

ATTN: Gregg Adams, P.E.

PROJECT: 130 Environmental Park, Central Texas

MOISTURE/DENSITY RELATIONSHIP

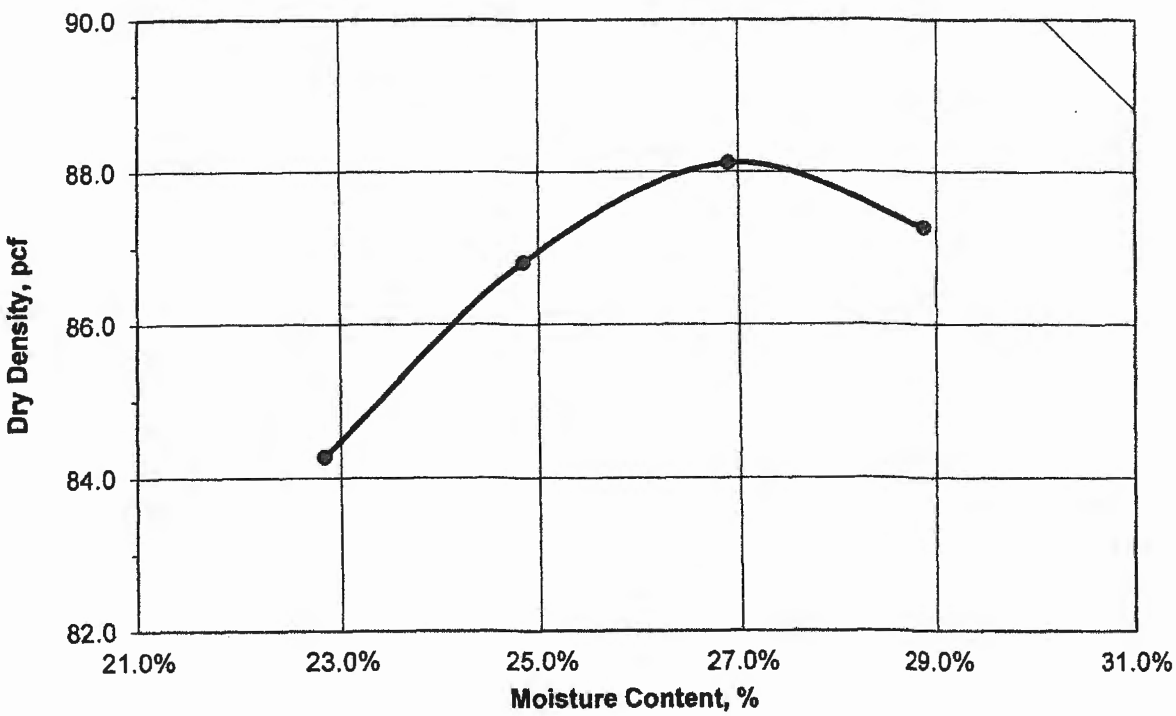
ASTM D 698A

Rammer Type: Manual
Sampled By: Gregg Adams
Sample Prep: Dry
Sample Date: 8/30/13
Sample Location: BME-9; 10' - 40'

Description: CLAY, silty, tan, brown & gray
Liquid Limit: 75
Plastic Limit: 30
Plastic Index: 45
- # 200 Mesh Sieve: 98%
Classification (USCS): CH

PROCTOR NO. EP-2

Maximum Dry Density, pcf: 88.1
Optimum Moisture Content, %: 27.0



LANDTEC engineers

1700 Robert Road, Suite 101
Mansfield, Texas 76063
Metro 817.572.2818
Fax 817.453.9984

CLIENT: Biggs & Mathews Environmental, Inc.
1700 Robert Road, Suite 100
Mansfield, Texas 76063

REPORT DATE: 9/11/13

PROJECT NO.: 0813-1914

ATTN: Gregg Adams, P.E.

PROJECT: 130 Environmental Park, Central Texas

MOISTURE/DENSITY RELATIONSHIP

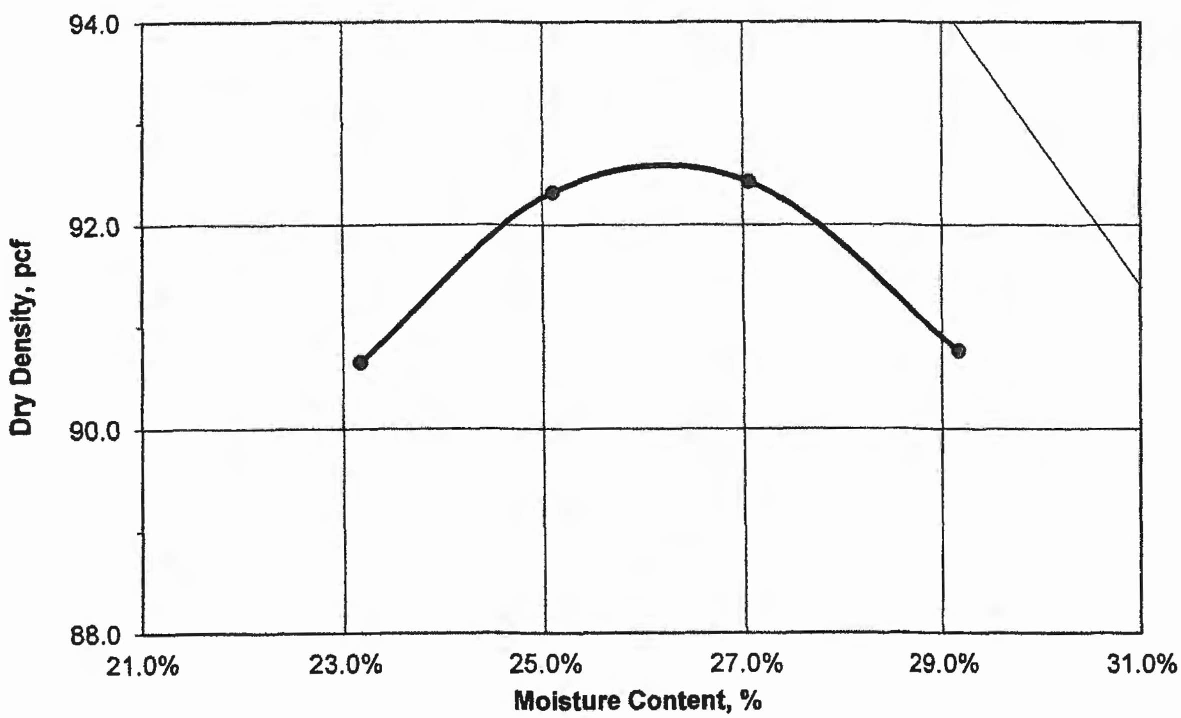
ASTM D 698A

Rammer Type: Manual
Sampled By: Gregg Adams
Sample Prep: Dry
Sample Date: 8/30/13
Sample Location: BME-23 & 32; 32' - 57'

Description: CLAY, silty, tan & gray
Liquid Limit: 57
Plastic Limit: 26
Plastic Index: 31
-# 200 Mesh Sieve: 98%
Classification (USCS): CH

PROCTOR NO. EP-3

Maximum Dry Density, pcf: 92.6
Optimum Moisture Content, %: 26.2



LANDTEC engineers

1700 Robert Road, Suite 101
Mansfield, Texas 76063
Metro 817.572.2818
Fax 817.453.9984

CLIENT: Biggs & Mathews Environmental, Inc.
1700 Robert Road, Suite 100
Mansfield, Texas 76063

REPORT DATE: 9/18/13

PROJECT NO.: 0813-1914

ATTN: Gregg Adams, P.E.

PROJECT: 130 Environmental Park, Central Texas

MOISTURE/DENSITY RELATIONSHIP

ASTM D 698A

Rammer Type: Manual
Sampled By: Gregg Adams
Sample Location: BME-27; 10' - 20'

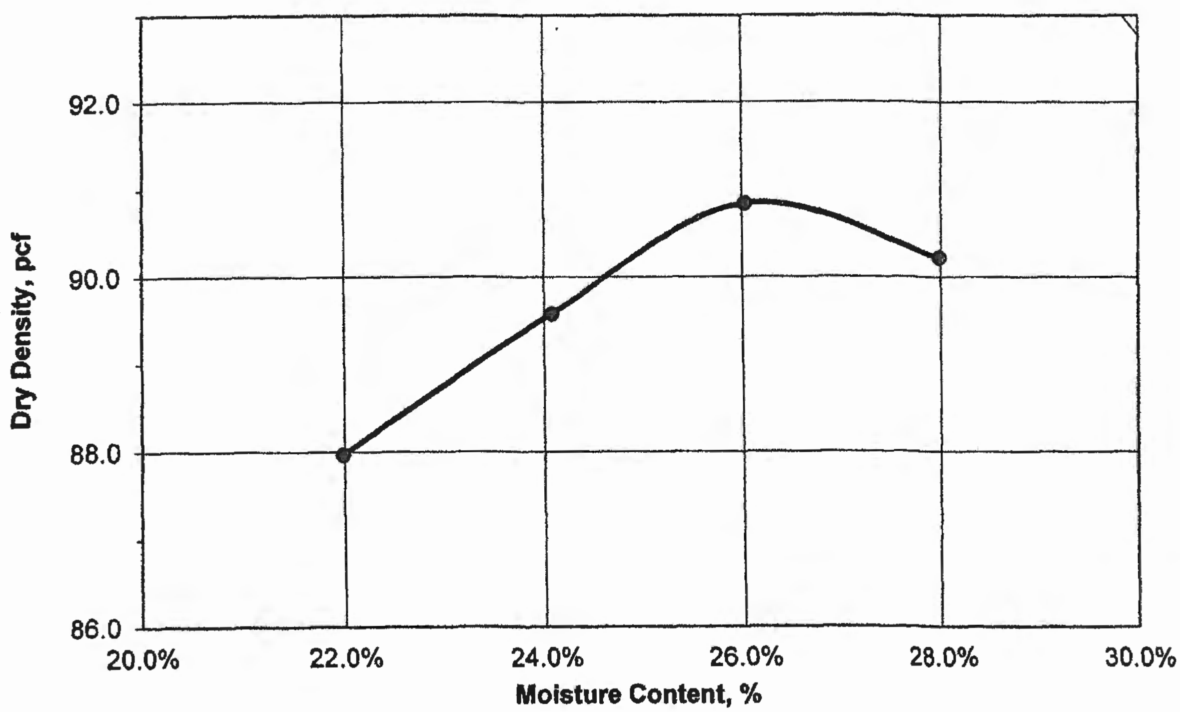
Sample Prep: Dry
Sample Date: 9/6/13

Description: CLAY, silty, tan & gray
Liquid Limit: 72
Plastic Limit: 25
Plastic Index: 47

- # 200 Mesh Sieve: 93%
Classification (USCS): CH

PROCTOR NO. EP-4

Maximum Dry Density, pcf: 90.8
Optimum Moisture Content, %: 26.3



APPENDIX E6

SITE HYDROGEOLOGIC DATA

Technically Complete October 28, 2014

COMPUTATION SHEET

Project Title:	130 Environmental Park	Project No.:	129.06.101
Description:	Groundwater Flow Velocity Calculations	Sheet	1 of 1
Prep. By: ESF	Date: 8/7/2014 Chkd. By: JMS	Date:	8/7/2014

GROUNDWATER VELOCITY CALCULATIONS

$$v = (k * i) / n_e$$

WHERE:

V = Groundwater Flow Velocity			
K = Hydraulic Conductivity	K = 3.84E-08	cm/sec[(1)]	
i = Hydraulic Gradient	i = i1 through i8 below	ft/ft[(2)]	
n_e = Effective Porosity	n_e = 0.05	[(3)]	
Multiplier to convert cm/sec to ft/day	2835	[(4)]	

RESULTS FOR HYDRAULIC CONDUCTIVITY LINES (i1 through i8):

i1	0.0420	0.00009 ft/day	0.03	ft/year
i2	0.0260	0.00006 ft/day	0.02	ft/year
i3	0.0170	0.00004 ft/day	0.01	ft/year
i4	0.0250	0.00005 ft/day	0.02	ft/year
i5	0.0210	0.00005 ft/day	0.02	ft/year
i6	0.0500	0.00011 ft/day	0.04	ft/year
i7	0.0130	0.00003 ft/day	0.01	ft/year
i8	0.0190	0.00004 ft/day	0.02	ft/year
			0.02	average ft/year

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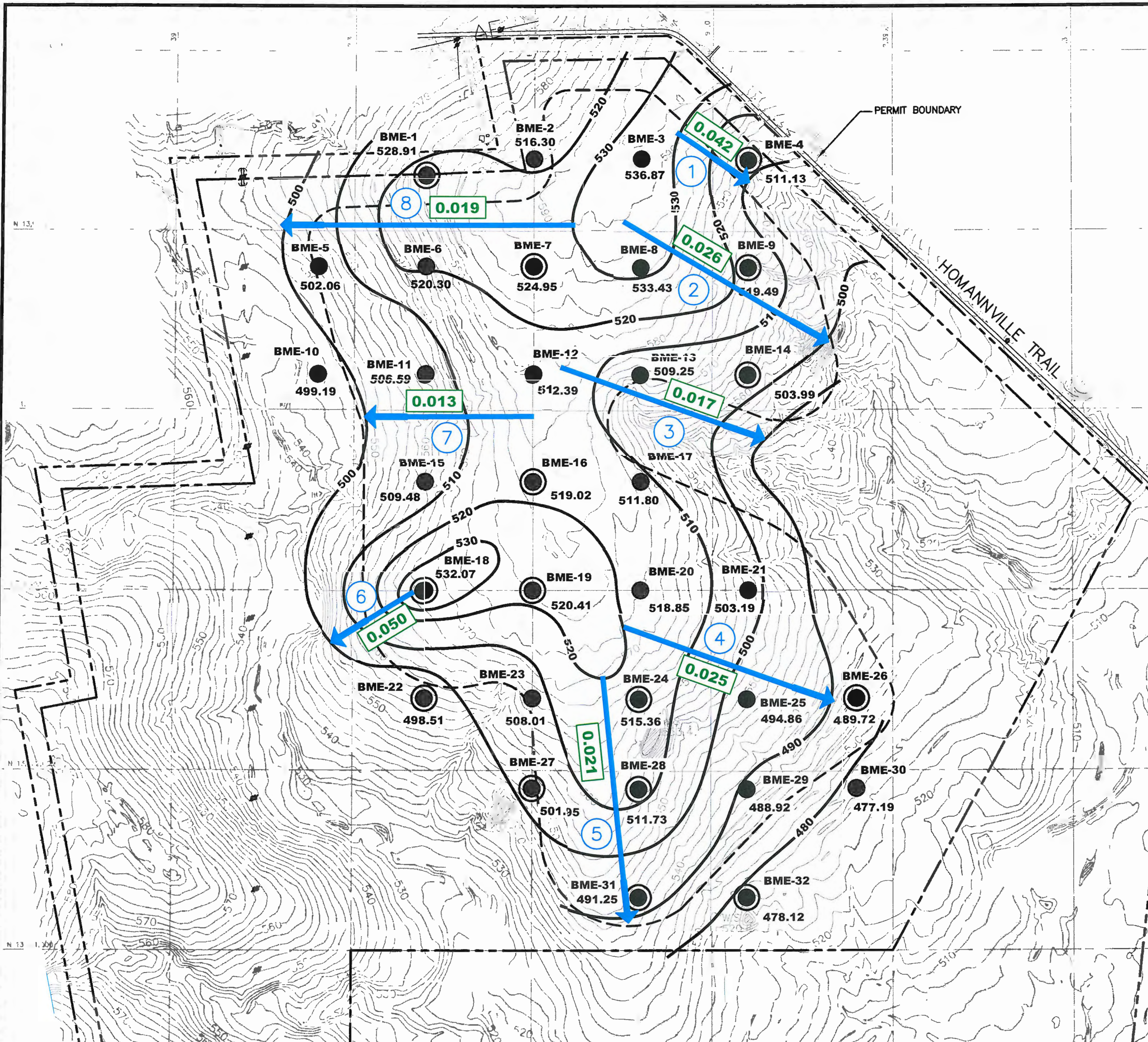
[1]Arithmetic mean of Stratum II values, see Table E-11.)

[2]Hydraulic gradient values (i) calculated from Figure E6-2.

[3]Effective porosity value (n_e) from Pettijohn, 1975.

[4]2835 is a multiplier that converts cm/sec to ft/day.



0 300 600
SCALE IN FEET

LEGEND

- PROPERTY BOUNDARY
- FACILITY BOUNDARY
- LANDFILL FOOTPRINT
- 540 — 2' CONTOUR INTERVAL
- BME-12 — BORING
- BME-9 — BORING AND PIEZOMETER
- 500 — TOP OF DARK GRAY CLAY 10' CONTOUR (STRATUM 3)
- GROUNDWATER FLOW PATH
- 3 — GROUNDWATER FLOWPATH IDENTIFICATION NUMBER
- 0.013 — AVERAGE GRADIENT FOR CORRESPONDING FLOWLINE

NOTES:

1. CONTOURS AND ELEVATIONS PROVIDED BY DALLAS AERIAL SERVICE FROM AERIAL PHOTOGRAPHY FLOWN MAY 13, 2013. HORIZONTAL DATUM IS TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE (NAD 83). ELEVATIONS ARE RELATIVE TO NAVD88 – GEOID 12A.
2. DUE TO THE LACK OF GROUNDWATER POTENTIOMETRIC SURFACE, THE INTERFACE OF THE WEATHERED MIDWAY AND UNWEATHERED MIDWAY IS BEING USED AS A PROXY TO ESTIMATE A GROUNDWATER GRADIENT.

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GROUNDWATER GRADIENT EVALUATION

130 ENVIRONMENTAL PARK, LLC
130 ENVIRONMENTAL PARK
TYPE I PERMIT APPLICATION

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD • WICHITA FALLS
817-563-1144
TBPE FIRM NO. F-256 | TBPG FIRM NO. 50222

REVISIONS

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
–	10/28/14	TECHNICALLY COMPLETE	SRC	ESF	JMS	JMS

DSN. JMS	DATE : 8/14	FIGURE
DWN. SRC	SCALE : GRAPHIC	E6–2
CHK. ESF	DWG : E6_2_TWGradientEval.dwg	

J:\129\06 130 Park\101\AttE\E6_2_TWGradientEval.dwg Layout: E6-2 User: scundiff

130 ENVIRONMENTAL PARK
CALDWELL COUNTY, TEXAS
TCEQ PERMIT APPLICATION NO. MSW 2383

TYPE I PERMIT APPLICATION

PART III – FACILITY INVESTIGATION AND DESIGN

ATTACHMENT F
GROUNDWATER SAMPLING AND ANALYSIS PLAN

Prepared for

130 ENVIRONMENTAL PARK, LLC

Technically Complete October 28, 2014

STATE OF TEXAS
JOHN MICHAEL SNYDER
GEOLOGY
595
LICENSED
PROFESSIONAL GEOSCIENTIST

11-6-2014

Biggs & Mathews Environmental, Inc.
Firm Registration No. 50222

Prepared by

BIGGS & MATHEWS ENVIRONMENTAL
1700 Robert Road, Suite 100 • Mansfield, Texas 76063 • 817-563-1144

TEXAS BOARD OF PROFESSIONAL ENGINEERS
FIRM REGISTRATION NO. F-256

TEXAS BOARD OF PROFESSIONAL GEOSCIENTISTS
FIRM REGISTRATION NO. 50222

And

BIGGS & MATHEWS, INC.
2500 Brook Avenue • Wichita Falls, Texas 76301 • 940-766-0156

TEXAS BOARD OF PROFESSIONAL ENGINEERS
FIRM REGISTRATION NO. F-834

STATE OF TEXAS
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11-6-2014

Biggs & Mathews Environmental, Inc.
Firm Registration No. 50222

CONTENTS

GROUNDWATER MONITORING SYSTEM DESIGN CERTIFICATION

General Site Information

Site:	130 Environmental Park
Site Location:	Caldwell County, Texas
MSW Permit No.:	2383

Qualified Groundwater Scientist Statement

I, John Michael Snyder, am a licensed professional geoscientist in the State of Texas and a qualified groundwater scientist as defined in §330.3. I have reviewed the groundwater monitoring system and supporting data contained herein. In my professional opinion, the groundwater monitoring system is in compliance with the groundwater monitoring requirements specified in 30 TAC §330.401 through §330.421. This system has been designed for specification application to 130 Environmental Park (Permit No. MSW 2383). The only warranty made by me in connection with this document is that I have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of my profession, practicing in the same or similar locality. No other warranty, expressed or implied, is intended.

Firm/Address: Biggs and Mathews Environmental, Inc.
1700 Robert Road, Suite 100
Mansfield, Texas 76063

Seal, Signature & Date:

STATE OF TEXAS
JOHN MICHAEL SNYDER
GEOLOGY
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LICENSED
PROFESSIONAL GEOSCIENTIST

11-6-2014

Biggs & Mathews Environmental, Inc.
Firm Registration No. 50222

1 GROUNDWATER MONITORING PROGRAM

30 TAC §§330.63(f)(3)-(4), 330.403, 330.405, 330.421

1.1 Site Hydrogeology

Regional Tertiary and Quaternary aquifers that supply groundwater to wells in Caldwell County are the Carrizo-Wilcox and the Leona formations, respectively. The Carrizo-Wilcox is characterized by the Texas Water Development Board (TWDB) as a major aquifer. The Leona Formation is not characterized by the TWDB as either a major or minor aquifer. The Geologic Map (Attachment E, Appendix E1, Figure E1-1) shows that the Leona outcrops at the site, however, field investigations including borings show only remnant pebbles and cobbles of the alluvial deposits that have settled into the underlying weathered Midway clay. Very little sand or other permeable media were observed in this interval. No major or minor aquifers exist beneath the site. Most groundwater produced in northern Caldwell County is from wells tapping the Carrizo-Wilcox Formation, located east of the site. The primary outcrop of the Leona Formation, from which some groundwater is produced, is located several miles south of the site.

The site is founded on the outcrop of the clays of the Midway Group. The Midway in the area consists primarily of dense, silty, fat clay and based on published literature is between 400 and 600 feet thick beneath the site. Within the top two to six feet of the weathered clay there are occurrences of discontinuous pebbles, cobbles and some gravel.

Groundwater occurs at the site under unconfined water table conditions in shallow weathered silty fat clay (Stratum II), just above its interface with the underlying Stratum III unweathered Midway, under unconfined, water table conditions. Shallow groundwater occurs in this unit from precipitation infiltration. Weathering in the clay decreases with depth, as shown on the boring logs. The lack of weathering effects in the deeper, unweathered clay (Stratum III) results in Stratum III functioning as an aquitard or lower confining unit to the groundwater in the above weathered clay, thus creating a pathway for groundwater to move at the interface of Stratum II and Stratum III. This zone of groundwater occurrence at the site is not characterized as a major or minor aquifer by the Texas Water Development Board and there are no known wells completed in this zone within one mile of the site. Groundwater in this zone does not occur in sufficient amounts to supply usable quantities to wells that could support industrial, irrigation, domestic, or livestock use. However, the volume of water observed in piezometers on the site would be sufficient for sampling and analysis in accordance with TCEQ Municipal Solid Waste rules. As a result, this zone satisfies the criteria used by the TCEQ Municipal Solid Waste Permits Section for characterization of an aquifer pursuant to those rules and, based on those criteria and rule, this zone is the uppermost aquifer at the site.

Due to the lack of weathering and the resulting lower hydraulic conductivity, the unweathered clay (Stratum III) is the lower confining unit to the overlying weathered clay.

Hydraulic conductivity values for Stratum III ranged from 1.1 x 10^{-8} to 2.1 x 10^{-8} (see Table E-11 of Attachment E).

1.2 Groundwater Flow Direction and Rate

Groundwater occurs at the site above the interface of weathered clay (Stratum II) and unweathered clay (Stratum III). The groundwater monitoring network (Attachment F, Appendix F1, Figure F1-1) is designed to monitor the interface of the weathered and unweathered clay. Groundwater flow direction is influenced by the depth of weathering and the unweathered surface, which is influenced by the topography. Permeability in the clay of the Midway Group is related to the depth of weathering and is thus related to the surface topographic expression. The structural contour map of the top of the unweathered clay (Figure E3-10) shows a strong resemblance to the surface topography. Groundwater flow from the site may occur to the northwest, west, southwest, south, southeast, and east.

Groundwater flow velocity was estimated using an arithmetic mean for hydraulic conductivity from laboratory test results is estimated to flow at approximately 0.01 to 0.04 feet per year in Stratum II. Hydraulic gradient across the site was evaluated using the structural contour on the top of Stratum III – Dark Gray Clay (Figure E3-10). This evaluation is described in Attachment E, Section 5.6.3.1. Based on this evaluation, eight separate flowlines were identified that are representative of the range of gradient variability throughout the site (Figure E6-2, Attachment E, Appendix E6). Groundwater flow at the Stratum II/III interface will mimic the surface topography. All input values and calculations to determine groundwater velocity are shown on the groundwater velocity calculation sheet in Attachment E, Appendix E6 (Figure E6-1).

2 OPERATIONAL CONSIDERATIONS FOR GROUNDWATER SYSTEM DESIGN

2.1 Relationship of Excavation Bottom to Uppermost Aquifer

The landfill of 130 Environmental Park is designed to remain primarily in the Stratum II weathered clay. Weathering and permeability decrease with depth. Groundwater flows laterally at the interface of the weathered and unweathered clay. The unweathered clay correlation is based primarily on the color change from tan near the upper parts of Stratum II to tan and gray and eventually gray as it transitions to the unweathered dark gray clay of Stratum III. It is also indicated by the decrease in permeability and increase in density.

2.2 Leachate Sump Design

The 130 Environmental Park Landfill containment system and excavation are designed to accommodate a Subtitle D leachate collection system (LCS). The excavation bottom over the site will be lined with a composite liner sloped to direct leachate flow to the lowest areas where sumps are designed to collect the leachate. Leachate is then pumped out of the sumps. While leachate will not remain for lengthy periods of time nor at significant depths, the sump locations are the lowest areas of the excavation. While a leak from the Subtitle D cell is unlikely, if one were to occur, it would be more likely to be at the lowest leachate collection points in the sumps. Sump locations at 130 Environmental Park are shown on Figure F1-1. There are 15 sumps in the leachate sump design at 130 Environmental Park.

2.3 Critical Receptors

Critical receptors to groundwater flow downgradient of any landfill could include public drinking water supply wells, individual drinking water or livestock wells, and surface water bodies used for drinking water supply. There are five individual domestic wells to the east and south of the site. These wells are screened in the Wilcox Formation which outcrops east of the site. The Wilcox Formation is not hydraulically connected to any formations on site. The Wilcox is part of the larger Carrizo-Wilcox Aquifer. The well depths there are shallow and range from 20 to 49 feet deep. The nearest surface water bodies are the Soil Conservation Service Site 21 Reservoir, which is located south of the facility, and Dry Creek, which is located east and south of the facility.

2.4 Contaminant Pathway Analysis

In the unlikely event of a leachate release (i.e., failure of multiple, redundant engineered containment systems such as composite liners and a leachate collection system), contaminants would move downward through the unsaturated portion of the weathered Midway clay (Stratum II). If the leachate were to reach the groundwater, just above the interface of Stratum II and the lower, unweathered Stratum III, the miscible contaminants would be diluted by the groundwater and would move laterally at the interface of the weathered and unweathered clay. Due to the relative difference in hydraulic conductivity between the weathered portions of the Midway (Stratum II) and the deeper unweathered Midway (Stratum III), leachate migration in the lower clay confining layer is unlikely. Groundwater flow direction would likely be to the northeast, west, southwest, south, southeast and east sides of the site, based on the slope of the top surface of the Stratum III interval (Figure E-3.10). A point of compliance has been established and is shown on Figure F1-1, that encompasses these flow directions. There is a short interval in the far north part of the site which is not downgradient from the waste footprint and thus would be the upgradient part of the site.

3 SUBTITLE D GROUNDWATER MONITORING SYSTEM

A groundwater monitoring system has been designed for the facility in accordance with the requirements for 30 TAC §330.403 based on site specific technical information including the identification of the uppermost aquifer and the lower confining unit beneath the uppermost aquifer that also includes a thorough characterization of the aquifer thickness and groundwater flow rate and direction (including the possibility of seasonal and temporal effects on the groundwater flow direction and rate). The design also considered the thickness, stratigraphy, lithology, and hydraulic characteristics of the geologic units above the groundwater, the materials of the uppermost aquifer, and the materials and characteristics of the lower confining unit beneath the uppermost aquifer.

As each phase of monitoring well installation is completed and prior to placement of waste in new landfill units, the owner or operator will submit a certification in accordance with 30 TAC §330.401(e) that the facility is in compliance with the groundwater monitoring requirements of §§330.403, 330.405, 330.407, and 330.409.

3.1 Monitoring Well Locations

For groundwater monitoring purposes, the uppermost aquifer beneath 130 Environmental Park Landfill has been identified as the weathered clay of the Midway Group (Stratum II). Stratum II is present and is correlatable across the site. Monitoring wells are designed to be screened across the interface of the weathered and unweathered Midway contact (Stratum II/III).

Twenty-five groundwater monitoring wells have been designed along a point of compliance that has been identified on the site perimeter (Figure F1-1). Point of compliance monitoring well locations are spaced at less than 600 feet between wells.

In addition, one monitoring well has been designed along the north side of the site as background (upgradient) well.

3.2 Sampling and Analysis Procedures

Appendix F2 – Groundwater Sampling and Analysis Plan contains the general requirements, sampling procedures, and statistical analysis information required in 30 TAC §330.405(a)-(f).

3.3 Monitor Well Design and Construction

In accordance with §330.421 – Monitor Well Construction Specifications, a licensed Texas driller will install monitoring wells in accordance with the regulations. Wells will be drilled by a method that will not introduce contaminants into the borehole or casing. A licensed professional geoscientist or engineer who is familiar with the geology of the area will supervise monitoring well installation and development and will provide a log of the boring. Equivalent alternatives to construction specifications in TCEQ rules may be used if prior written approval is obtained from the executive director. Monitoring well construction details, including proposed screen intervals, well locations and elevations, filter pack and bentonite seal elevations, and surface completion are shown in Figure F1-2. Monitoring well construction will be completed in accordance with §§330.63, 330.403, and 330.421.

If any fluid is required in the drilling of monitoring wells, clean, treated water shall be used and a chemical analysis provided to the executive director. No glue or solvents will be used in monitoring well construction.

After installation, monitoring wells will be developed to remove drilling artifacts and open the water-bearing zone for maximum flow until all water used or affected during drilling activities is removed and field measurements of pH, specific conductance, and temperature are stabilized.

A registered professional land surveyor will survey the well location and elevation.

Within 30 days of completion of a monitoring well or any other part of a monitoring system, an installation report will be submitted to TCEQ. The report will include construction and installation details for each well on forms available from the commission, a site map drawn to scale showing the location of all monitoring wells and the relevant point(s) of compliance, well elevations to the nearest 0.01 foot above msl (with year of datum shown), latitude and longitude or landfill grid location of each well, copies of detailed geologic logs including soil sample data, and copies of driller's reports required by other agencies.

Damaged monitoring wells that are no longer usable will be reported to the executive director for a determination whether to replace or repair the well. In accordance with 30 TAC §305.70, if a compromised well requires replacement a permit modification request will be submitted within 45 days of the discovery.

Plugging and abandonment of monitoring wells will be performed in accordance with 16 TAC §76.702 and §76.1004. No abandonment will be performed without prior written authorization.

All parts of the groundwater monitoring system will be operated and maintained so that they perform at least to design specifications through the life of the groundwater monitoring program.

The facility must notify the executive director if changes in site construction or operation or changes in adjacent property affect or are likely to affect the direction and rate of groundwater flow and the potential for detecting groundwater contamination from the facility.

4 GROUNDWATER QUALITY

4.1 Plume of Contamination

A description of any plume of contamination that has entered the groundwater is required by 30 TAC §330.63(f)(2). There is no existing MSW management unit at the site so there is no plume of contamination that has entered the groundwater. Because there is no existing MSW facility at the site, groundwater at the site has not yet been sampled or analyzed. Therefore, it is not known whether any contaminants are already present in the groundwater. General groundwater chemistry of the aquifers in the area is described in Attachment E, Section 3.1 – Regional Aquifers.

Any future plume of contamination identified during groundwater monitoring will be managed in accordance with 30 TAC Subchapter J – Groundwater Monitoring and Corrective Action.

4.2 Background and Detection Monitoring

In accordance with 30 TAC §330.63(f)(5), the following is a discussion of the groundwater monitoring program.

A Subtitle D Groundwater Monitoring System, as described in Section 2, has been designed for this facility. Background values will be established for the Subtitle D groundwater monitoring wells during sampling events soon after groundwater monitoring wells have been installed.

No previous groundwater monitoring activity has occurred at the facility site thus no historical analytical results for a site groundwater monitoring system are available in response to 30 TAC §330.63(e)(5)(E).

For new, or any replaced monitoring wells that may be added to the system, background water quality will be established as described in Appendix F2 – Groundwater Sampling and Analysis Plan. After the background analyses have been completed, the data will be statistically evaluated and background concentrations established for each parameter. Reporting requirements during background and detection monitoring are discussed in Appendix F2.

4.3 Assessment Monitoring

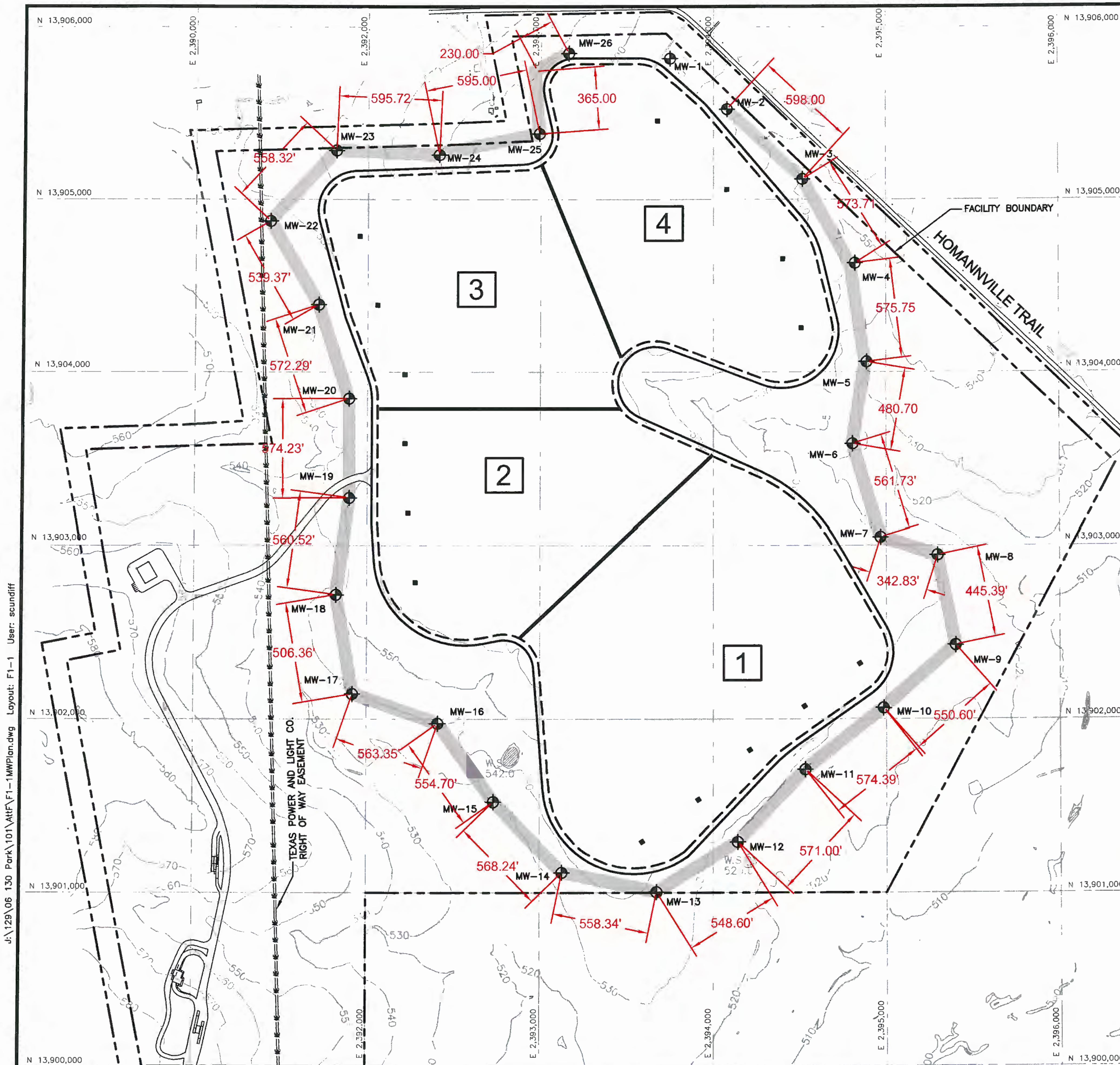
An assessment monitoring program, if it should become required, will be initiated in accordance with the requirements of 30 TAC, Subchapter J, as described in Appendix F2 – Groundwater Sampling and Analysis Plan.

4.4 Corrective Action Program

A corrective action program, if it should become required, will be initiated in accordance with the requirements of 30 TAC, Subchapter J, as described in Appendix F2 – Groundwater Sampling and Analysis Plan.

APPENDIX F1

Technically Complete October 28, 2014



0 300 600
SCALE IN FEET

LEGEND

- PROPERTY BOUNDARY
- FACILITY BOUNDARY
- LANDFILL FOOTPRINT
- 510 EXISTING 10' CONTOUR
- N 6753000 STATE PLANE GRID
- OVERHEAD ELECTRIC
- MW-4 PROPOSED MONITORING WELL
- 1 PHASE DESIGNATION
- POINT OF COMPLIANCE
- SUMP

NOTES:

1. CONTOURS AND ELEVATIONS PROVIDED BY DALLAS AERIAL SERVICE FROM AERIAL PHOTOGRAPHY FLOWN MAY 13, 2013. HORIZONTAL DATUM IS TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE (NAD 83). ELEVATIONS ARE RELATIVE TO NAVD88 – GEOID 12A.
2. PROPERTY BOUNDARY, FACILITY BOUNDARY, EASEMENT LOCATIONS, AND PERMANENT BENCHMARK PROVIDED BY HODDE & HODDE LAND SURVEYING, INC.

MONITORING INSTALLATION SCHEDULE	
PHASE 1	MW-1, MW-5 THROUGH MW-17
PHASE 2	MW-18 THROUGH MW-21
PHASE 3	MW-22 THROUGH MW-26
PHASE 4	MW-2 THROUGH MW-5

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PROPOSED GROUNDWATER MONITORING PLAN

130 ENVIRONMENTAL PARK, LLC
130 ENVIRONMENTAL PARK
TYPE I PERMIT APPLICATION

BIGGS & MATHEWS ENVIRONMENTAL
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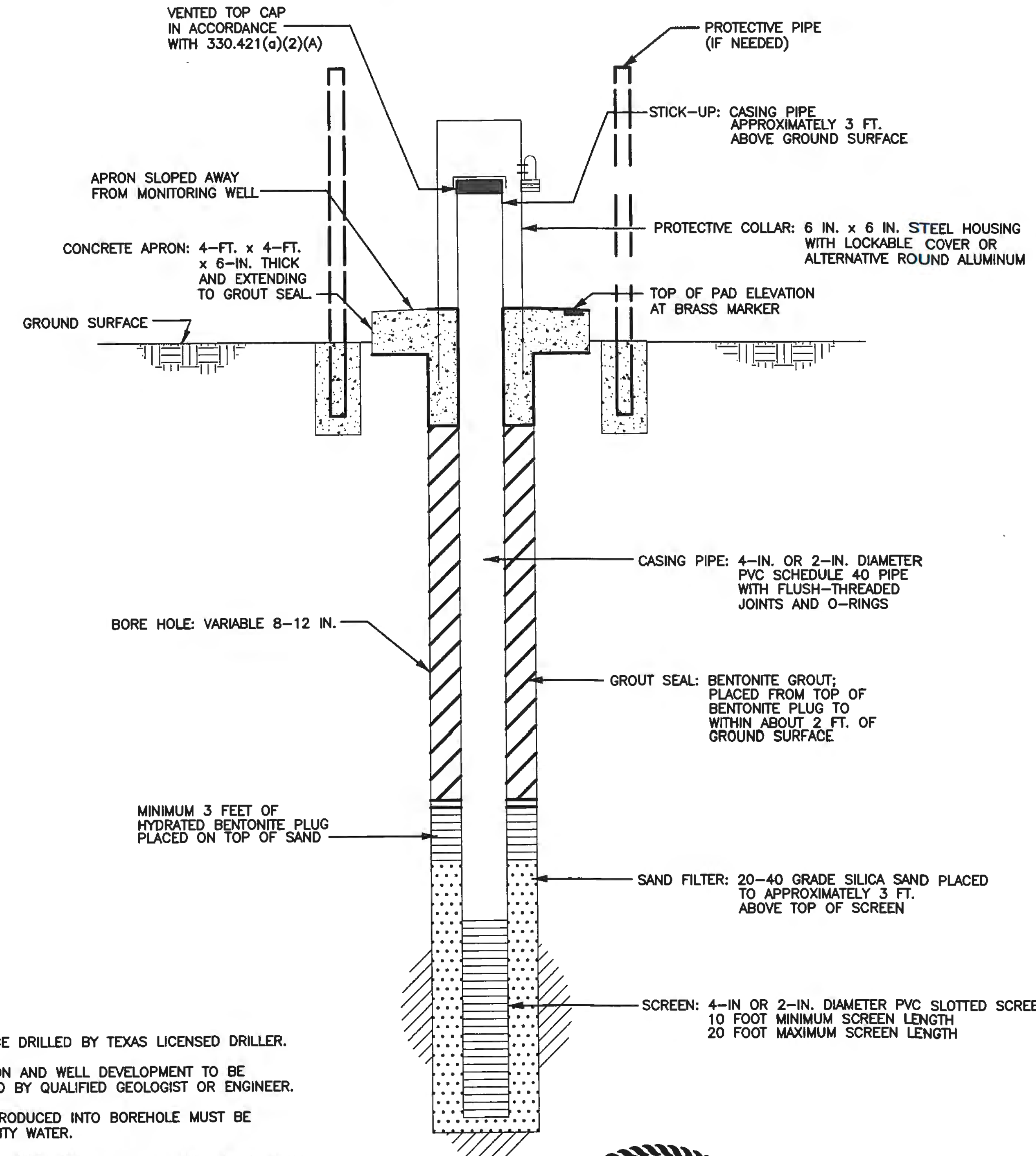
REVISIONS						
–	10/28/14	TECHNICALLY COMPLETE	GLW	ESF	JMS	JMS
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

DSN. JMS	DATE : 10/13	DRAWING
DWN. GLW	SCALE : GRAPHIC	F1-1
CHK. ESF	DWG : F1-1MWPlan.dwg	

J:\129\06 130 Park\101\Att F\F1-1MWPlan.dwg Layout: F1-1 User: scundiff

Monitoring Well No.	Unit	Designation	Northing	Easting	Ground Elevation	Top of Casing Elevation	Total Depth		Screened Interval (ft/bgs) *	
					(ft/msl)*	(ft-msl)*	Elev (ft-msl)*	(ft/bgs)*	Elevation	Depth
MW-1	II	U	13905818	2393749	592	577.0	531	61	513-503	61-41
MW-2	II	D	13905524	2394078	593	596.0	530	63	530-510	63-43
MW-3	II	D	13905118	2394518	559	562.0	507	52	507-497	52-32
MW-4	II	D	13904631	2394821	547	550.0	500	47	500-490	47-37
MW-5	II	D	13904060	2394889	533	536.0	495	38	495-485	38-18
MW-6	II	D	13903586	2394806	534	537.0	485	49	485-475	49-29
MW-7	II	D	13903048	2394969	529	532.0	480	49	480-470	49-29
MW-8	II	D	13902945	2395296	527	527.0	477	47	477-467	49-29
MW-9	II	D	13902427	2395399	526	529.0	477	49	477-467	50-30
MW-10	II	D	13902064	2394984	525	528.0	475	50	475-465	50-30
MW-11	II	D	13901711	2394533	527	530.0	475	52	475-465	52-32
MW-12	II	D	13901293	2394143	526	529.0	475	51	475-465	51-31
MW-13	II	D	13901005	2393676	538	541.0	487	51	487-477	51-31
MW-14	II	D	13901116	2393129	535	538.0	493	42	493-483	42-22
MW-15	II	D	13901523	2392711	529	532.0	497	32	497-487	32-12
MW-16	II	D	13901975	2392411	541	535.0	495	37	495-485	37-17
MW-17	II	D	13902211	2391839	539	542.0	495	44	495-485	44-24
MW-18	II	D	13902718	2391822	547	550.0	497	50	497-487	50-30
MW-19	II	D	13903273	2391897	549	552.0	497	52	497-487	52-32
MW-20	II	D	13903845	2391896	543	546.0	495	48	495-485	48-28
MW-21	II	D	13904391	2391716	545	548.0	505	40	505-495	40-20
MW-22	II	D	13904875	2391436	547	550.0	507	40	507-522	40-25
MW-23	II	D	13905285	2391815	562	565.0	505	57	505-525	57-42
MW-24	II	D	13905259	2392410	586	589.0	530	56	530-550	56-36
MW-25	II	D	13905382	2392993	590	593.0	525	65	525-545	65-45
MW-26	II	D	13905848	2393162	582	585.0	525	57	525-545	65-45

* ACTUAL VALUES WILL BE DETERMINED AT THE TIME OF INSTALLATION.



NOTES:

1. WELL TO BE DRILLED BY TEXAS LICENSED DRILLER.
2. INSTALLATION AND WELL DEVELOPMENT TO BE SUPERVISED BY QUALIFIED GEOLOGIST OR ENGINEER.
3. FLUIDS INTRODUCED INTO BOREHOLE MUST BE TREATED CITY WATER.
4. STEAMCLEAN PROCEDURES SHOULD BE USED FOR ALL EQUIPMENT THAT ENTERS BOREHOLES SUCH AS TREMIE PIPES OR DRILL PIPE.
5. WELL DEVELOPMENT SHOULD CONTINUE UNTIL pH, SPECIFIC CONDUCTANCE AND TEMPERATURE HAVE STABILIZED.
6. SCREENED INTERVAL TO MONITOR STRATUM II (WEATHERED MIDWAY) BELOW EXCAVATION BOTTOM. AT INTERFACE WITH STRATUM III (UNWEATHERED MIDWAY).
7. FILTER PACK GRAIN SIZE AND WELL SCREEN SLOT SIZE WILL BE DESIGNED USING GRAIN SIZE ANALYSIS AND ASTM D 5092–04 (2010) "STANDARD PRACTICE FOR DESIGN AND INSTALLATION OF GROUNDWATER MONITORING WELLS IN AQUIFERS" OR USEPA, REGION 4, SESD, 2008 "GUIDANCE DOCUMENT, DESIGN AND INSTALLATION OF MONITORING WELLS".

STATE OF TEXAS
JOHN MICHAEL SNYDER
GEOLOGY
595
LICENSED
PROFESSIONAL GEOSCIENTIST

11-6-2014

ISSUED FOR PERMITTING PURPOSES ONLY

GROUNDWATER MONITORING WELL DETAIL

130 ENVIRONMENTAL PARK, LLC
130 ENVIRONMENTAL PARK
TYPE I PERMIT APPLICATION

BIGGS & MATHEWS ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F–256 | TBPG FIRM NO. 50222

REVISIONS						
–	10/28/14	TECHNICALLY COMPLETE	GLW	ESF	JMS	JMS
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

DSN. ESF	DATE : 11/13	FIGURE
DWN. GLW	SCALE : GRAPHIC	F1–2
CHK. JMS	DWG : F1–2_GW_Detail.dwg	

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130 ENVIRONMENTAL PARK
CALDWELL COUNTY, TEXAS
TCEQ PERMIT APPLICATION NO. MSW 2383

TYPE I PERMIT APPLICATION

PART III – FACILITY INVESTIGATION AND DESIGN

APPENDIX F2
GROUNDWATER SAMPLING AND ANALYSIS PLAN

Prepared for

130 ENVIRONMENTAL PARK, LLC

Technically Complete October 28, 2014

STATE OF TEXAS
JOHN MICHAEL SNYDER
GEOLOGY
595
LICENSED
PROFESSIONAL GEOSCIENTIST

11-6-2014

Biggs & Mathews Environmental, Inc.
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TEXAS BOARD OF PROFESSIONAL ENGINEERS
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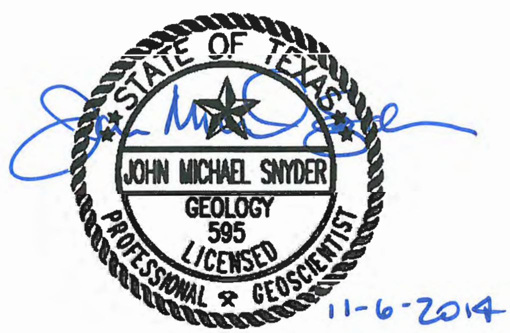
CONTENTS



Biggs & Mathews Environmental, Inc.
Firm Registration No. 50222

TABLES AND FIGURES

1 INTRODUCTION

The purpose of this document is to outline the sampling and analysis procedures that will be used to ensure that the groundwater monitoring results will provide an accurate representation of groundwater quality. The procedures outlined in this document have been designed to be protective of human health and the environment.

130 Environmental Park will employ competent, qualified consultants and laboratories to assist in all aspects of the groundwater sampling and analysis requirements.

This plan has been prepared to meet or exceed the requirements of 30 TAC Subchapter J related to Groundwater Monitoring and Corrective Action, effective March 27, 2006.

2 GROUNDWATER SAMPLING PROCEDURES

The following subsections summarize specific tasks involved in sampling the groundwater through the monitoring system.

2.1 Field Setup

Do not use insect repellent or other topical skin applications that contain organic compounds during purging or sampling. Smoking is not permitted.

Examine the well head area for anything unusual such as damage to the well head, spilled materials, etc., and record all observations in the field log book or field data sheets. Note the following:

- Is the well number clearly labeled on outer casing or lid?
- Is protective casing intact and not bent or excessively corroded?
- Is weep hole, if present, open?
- Is concrete pad intact (no evidence of cracking or erosional undercutting)?
- Is padlock functional?
- Is inner casing intact?
- Is inner casing properly capped and vented?

Calibrate pH and specific conductance instruments, following manufacturer's instructions, prior to sampling and at least once daily during a sampling event.

Use a calibrated five-gallon bucket for measuring bailed or purged well fluids and a small glass container for measuring temperature, specific conductance, and pH.

For decontamination, use a clean water bucket, rinsing bucket, phosphate-free detergent, and additional rinsing bottles.

2.2 Water Level Measurements

Prior to purging each monitoring well, measure the depth to groundwater from a permanently marked point of known elevation on the top of the well casing and record the measurement in the field log book or data sheets. Decontaminate the water level measuring device between wells. Water levels are to be measured and reported to the nearest hundredth of a foot.

Water level measurements will be collected during the first day of each sampling event prior to sampling the wells. If any site wells are known to be contaminated, groundwater samples will be taken from wells least likely to be contaminated and will proceed to those wells known to be contaminated.

2.3 Well Purging

Wells not using low-flow sampling will be purged of three well volumes of groundwater with a dedicated pump. A non-dedicated submersible pump or appropriate bailer may be used as a backup for purging, if dedicated pumps are inoperable. For wells that produce less than three well volumes of groundwater, purging will be deemed complete after the well has been purged to dryness. The field parameters of pH, specific conductance, and temperature will be measured during purging. If sufficient water is available for a full set of samples within 7 days of purging, a full set of samples will be collected. If sufficient water is available for a partial sample set within 7 days of purging, a partial set of samples will be collected in an order dictated by data needs. If sufficient water is not available for sampling within 7 days of purging for slowly recovering wells, the well will be considered dry.

Water purged from each well, along with unused water obtained during sampling, is to be collected and disposed of in accordance with TCEQ rules and directives.

2.3.1 Low-Flow Purging

Wells may be equipped with a dedicated PVC pump and HDPE discharge tubing. The wells may be purged using low-flow methods. Prior to commencement of sampling, a demonstration will be provided to the TCEQ justifying the implementation of low-flow sampling.

The wells that use low-flow sampling will be purged at a rate of less than 0.5 liter per minute until at least two pump-and-tubing volumes have been withdrawn from the well. Purge rates will be determined as part of the low-flow sampling demonstration. The pumping rate will be adjusted to prevent more than one-third foot of total drawdown and to ensure that there is no continuous drawdown of the water level. Drawdown will be monitored continually during purging. Measurements will be made of pH, specific conductance, dissolved oxygen, and temperature about every three to five minutes during purging. Purging will continue until three consecutive measurements are within ±3 percent for specific conductance, ±10 percent for dissolved oxygen, and ±0.2 units for pH. An inline flow-through cell will be used for measurements of pH, specific conductance, and dissolved oxygen. All field measurements and volumes of purged water are to be recorded in the field log book or field data sheets.

2.3.2 Pump Instructions

This section provides instructions for a pump that can be used for low-flow well purging and sample collection. In wells with adequate water column, dedicated pumps will be positioned with the pump intake near the middle of the screened interval. In low-yield wells, the pump will be placed about 1 foot above the bottom of the screen.

Purging Instructions:

1. Connect the compressed air source and pump controller to the pump per manufacturer's instructions.
2. Put on a new pair of gloves after handling the gasoline-powered compressor.

3. Set up a water level indicator to provide continual water level measurements during purging.

4. Start the pump by opening the regulator on the controller, which allows compressed air to flow into the system.

5. Adjust the controller to the appropriate flow rate (not to exceed 0.5 liter per minute) that will not result in continuous drawdown of the water level in the well and that will limit total drawdown to not more than one-third foot, except as may be authorized by the TCEQ. This rate will generally be based on data from previous events.

6. Direct the pump discharge to a calibrated container to determine the flow volume.

7. Using an inline flow-through cell, measure temperature, pH, specific conductance, and dissolved oxygen approximately every three to five minutes.

8. Continue purging until at least two pump-and-tubing volumes have been removed, drawdown is not continuous, three consecutive measurements of specific conductance are within 3 percent, three consecutive measurements of dissolved oxygen are within 10 percent, and three consecutive measurements of pH are within ±0.2 units.

9. Record all measurements in the field log book or field data sheets.

Sampling Instructions:

1. Adjust the regulator to reduce the pumping rate to less than 0.25 liter per minute, as necessary to control sampling. The pump should be set to discharge a continuous thin stream during filling of the VOC sample containers. If the purge rate was greater than 0.25 liter per minute, clear the flowlines at a flow rate of less than 0.25 liter per minute before sampling for VOCs.

2. Collect the samples by pumping directly into each of the required containers. Record the measurements in the field log book or field data sheets.

Fill the sample containers in the order specified in Section 2.4.

Any non-dedicated, reusable purging equipment is to be decontaminated in accordance with Section 2.9. A new pair of appropriate disposable gloves is to be worn at each separate well and replaced after each purging and sampling event to reduce the possibility of cross-contamination between wells.

2.4 Sample Collection

For wells using low-flow sampling, samples will be collected by low-flow methods immediately upon completion of low-flow purging. For wells that are using low-flow sampling, samples will be collected with a dedicated pump or with a disposable bailer, if the dedicated pump is inoperable. Based upon water level measurements taken prior to well purging, sampling will typically proceed from the well with the highest groundwater elevation to those with successively lower elevations. If contamination is known to be present, monitoring wells not likely to be contaminated must be sampled before those that are known to be contaminated.

Efforts shall be made to minimize turbulence and aeration during sampling. Specific instructions for the use of low-flow pumps are presented in Section 2.3.1.

The sample bottles should be filled in the order of decreasing volatilization sensitivity. Generally, that will be in the following order, as applicable:

- Volatile organic compounds (VOCs)
- Other organic compounds
- Total metals
- Other inorganic constituents

Filling the VOC sample containers requires extra care. Gently fill each vial until a positive meniscus is formed over the top of the container. After the cap has been placed on the vial and tightened, check the vial for air bubbles by turning it upside down and tapping with your finger. If an air bubble is present, discard the sample and repeat the process outlined above. If no air bubbles are present in each vial, the process is complete.

2.5 Sample Containers and Labeling

Water samples collected in the field are to be placed into laboratory-cleaned bottles of the appropriate size and construction for the chemical constituents to be analyzed. A list of chemical constituents and corresponding recommended types and sizes of sample containers are shown in Table F2-1. Sample containers must be marked as described below.

Sample labels are to be affixed to each sample container with the following information in waterproof ink, as appropriate:

- Project name and number (includes site name)
- Sample and well number
- Date and time of sample collection
- Type of preservatives added
- Special handling instructions

QA/QC samples, such as trip and equipment blanks, will be labeled accordingly. Blind well duplicates will be labeled with a nonexistent well number and will be properly identified only in the field log book or data sheets.

2.6 Sample Preservation and Shipment

Chill the groundwater samples to about 4°C upon containment in the field and during transport to the testing laboratory. For samples requiring thermal preservation to 4°C, a temperature ranging from just above the freezing temperature of water to 6°C shall be acceptable. The laboratory routinely includes a temperature blank in each sample container shipped. The temperature blank is a small plastic bottle containing deionized water that is labeled to indicate its purpose and provide return shipping instructions. Alternatively, infrared thermometers may be used by the laboratory to measure the temperature of any sample container.

Many constituents to be analyzed require a chemical additive for preservation. Table F2-1 shows preservation requirements for common organic and inorganic chemical constituents. Samples that are to be analyzed for background, detection, or assessment monitoring constituents listed in 40 CFR Part 258 Appendix I or Appendix II are not to be filtered either in the field or in the laboratory.

Samples to be shipped are to be packed in a hard-sided insulated shipping container pre-cooled with water ice. The sample containers will be sealed with a tamper-proof lock and sent to the designated analytical laboratory. All shipments will be scheduled for next day delivery. The bills of lading or receipt for cooler shipments will be attached to the chain-of-custody form upon arrival at the analytical laboratory. The sample containers must be packed to prevent breakage. Discard the water ice used to pre-cool the shipping container and add adequate chemical icepacks or water ice to maintain the temperature at about 4°C during the shipment. Dry ice must not be used.

2.7 Quality Assurance and Quality Control

To document that sample collection and handling procedures used in the field have not affected the quality of groundwater samples, blanks are to be prepared and analyzed. These blanks consist of one trip blank per sampling event and one field blank per day of sampling per event.

A trip blank is prepared by filling a water sample container with laboratory-grade distilled water before going to the site (preferably by the laboratory), transporting the container to the site, handling it as a sample, and transporting it to the laboratory for analysis. A field blank is prepared by pouring laboratory-grade distilled water into a sample container at a well *downwind* of waste. Trip and field blanks are to be analyzed for VOCs and heavy metals.

One blind duplicate will be collected at each sampling event. A blind duplicate will be a second set of samples from the same well that are labeled differently so that the laboratory is unaware that the samples are duplicates.

If non-dedicated, reusable purging or sampling equipment is used, one equipment blank per sampling event will be collected and analyzed for VOCs and heavy metals. An equipment blank is prepared by pouring or pumping laboratory-grade distilled water through the purging or sampling equipment and collecting it in a sample container.

As needed, split-samples will be collected. Analytical parameters for these samples will be selected to meet specific needs and concerns prior to sample collection.

2.8 Chain-of-Custody Documentation

A chain-of-custody (COC) form must be maintained in order to track possession and handling of samples from field collection through laboratory testing. COC records show the custody of samples at all times. Samples are in custody of an individual when they are either in the individual's sight or locked securely under the individual's control.

COC documentation is maintained on a COC record form. Each sample must be logged onto the COC record form as it is collected. The COC record form includes at least the following information, as appropriate:

- Project name and number (includes site name)
- Site location
- Sample number
- Sample date and time
- Sample type
- Number and type of sample containers
- Analyses required
- Sample preservative
- Lab destination
- Carrier/shipping number
- Special instructions
- Spaces for signatures of sampler(s) and everyone assuming sample custody
- Assessment of temperature

The COC record must contain the signatures of anyone assuming custody of the samples. Each time custody changes hands, the party releasing the sample signs under "Relinquished By" and records the date and time. The party receiving the samples signs under the heading "Received By" and records the date and time. The COC form is typically provided by the analytical laboratory.

The laboratory shall report exceedance of holding times outside the recommended limits and shall ensure that upon receipt, the condition of the sample, including any abnormalities or departures from standard conditions (i.e., preservation or temperature) as prescribed in the relevant test method be recorded. The laboratory shall store samples in accordance with conditions specified by preservation protocols.

2.9 Equipment Decontamination

Reusable purging equipment (except dedicated equipment) and measurement instruments coming in contact with the groundwater in wells or in samples are to be decontaminated before use at each well location. Non-dedicated, reusable sampling equipment is not to be used. Wash the equipment with a nonphosphate detergent and rinse with tap water and distilled water.

Properly discard any disposable equipment along with disposable health and safety garments. Dispose of water and cleaning agents in accordance with applicable regulations.

2.10 Field Documentation

Field activities must be thoroughly documented in the field log book or field data sheets. Field documentation will be placed in the facility operating record. Below is a list of the information to be documented during field activities, as appropriate for the conditions.

- Site name
- Date and time of purging and sampling activities
- Weather conditions
- Sampling personnel
- Field instrument calibration methods and remarks
- Initial equipment decontamination remarks
- Well identification number
- Well description, including casing size
- Description of well condition
- Initial water level measurement with point of reference (top of casing) and date of measurement
- Depth to the well bottom with point of reference (from well records)
- Presence and thicknesses of immiscible layers, if present
- Physical description of groundwater (color, odor, turbidity)
- Time starting and ending well purging, volume purged, and method of removal
- Water containment and disposal, if required
- Sampling equipment and remarks
- Field parameter measurements
- Sample time and date
- Description of sample
- Quality control remarks (any departures from standard conditions or procedures)
- Samples collected (number of bottles)
- Analyses to be performed
- Preservatives added, if any
- Mode of sample transport

3 LABORATORY QUALITY ASSURANCE AND QUALITY CONTROL

A NELAC (National Environmental Laboratory Accreditation Council) certified laboratory will be used for analysis of groundwater samples. Laboratory data analyses and/or a Laboratory Review Checklist will be performed and the facility will submit laboratory data and analysis prepared by a TCEQ accredited environmental testing laboratory, and in accordance with acceptable accreditation standards (e.g., NELAC). NELAC standards require that laboratories have an established quality system that includes a comprehensive laboratory quality manual (LQM) and an authorized quality assurance officer. A copy of the LQM will be maintained in the 130 Environmental Park site operating records (SOR) for use in data evaluation.

All analytical data submitted under the requirements of this permit will be examined by the owner and/or operator to ensure that the data quality objectives are considered and met prior to submittal for the commission to review. The owner or operator will determine if the results representing the sample are accurate and complete. The quality control results, supporting data, and data review by the laboratory must be included when the owner/operator reviews the data. Any potential impacts will be reported such as the bias on the quality of the data, footnotes in the report, and anything of concern that was identified in the laboratory case narrative summary.

The owner or operator will ensure that the laboratory documents and reports all problems and observed anomalies associated with the analysis. If analysis of the data indicates that the data fails to meet the quality control goals for the laboratory's analytical data analysis program, the owner or operator will determine if the data is usable. If the owner and/or operator determines the analytical data may be utilized, any and all problems and corrective action that the laboratory identified during the analysis will be included in the report submitted to the TCEQ.

A Laboratory Case Narrative (LCN) report for all problems and anomalies observed must be submitted by the owner and/or operator. The LCN will report the following information:

1. The exact number of samples, testing parameters and sample matrix.

2. The name of the laboratory involved in the analysis. If more than one laboratory is used, all laboratories shall be identified in the case narrative.

3. The test objective regarding samples.

4. Explanation of each failed precision and accuracy measurement determined to be outside of the laboratory and/or method control limits.

5. Explanation if the effect of the failed precision and accuracy measurements on the results induces a positive or negative bias.

6. Identification and explanation of problems associated with the sample results, along with the limitations these problems have on data usability.

7. A statement on the estimated uncertainty of analytical results of the samples when appropriate and/or when requested.

8. A statement of compliance and/or noncompliance with the requirements and specifications. Exceedance of holding times and identification of matrix interferences must be identified. Dilutions shall be identified and if dilutions are necessary, they must be done to the smallest dilution possible to effectively minimize matrix interferences and bring the sample into control for analysis.

9. Identification of any and all applicable quality assurance and quality control samples that will require special attention by the reviewer.

10. A statement on the quality control of the analytical method of the permit and the analytical recoveries information shall be provided when appropriate and/or when requested.

In addition to the LCN, the following information must be submitted for all analytical data:

1. A table identifying the field sample name with the sample identification in the laboratory report.

2. Chain of custody.

3. An analytical report that documents the results and methods for each sample and analyte to be included for every analytical testing event. These test reports must document the reporting limit/method detection limit the laboratory used.

4. A release statement must be submitted from the laboratory. This statement must state "I am responsible for the release of this laboratory data package. This data package has been reviewed by the laboratory and is complete and technically compliant with the requirements of the methods used, except where noted by the laboratory in the attached exception reports. By my signature below, I affirm to the best of my knowledge, all problems/anomalies, observed by the laboratory as having the potential to affect the quality of the data, have been identified by the laboratory in the Laboratory Review Checklist, and no information or data have been knowingly withheld that would affect the quality of the data."

   If it is an in-house laboratory, it must have the following statement: "This laboratory is an in-house laboratory controlled by the person responding to rule. The official signing the cover page of the rule-required report (for example, the APAR) in which these data are used is responsible for releasing this data package and is by signature affirming the above release statement is true."

5. If the data is from soil and/or sediment samples, it must be reported on a dry weight basis with the percent solids and the percent moisture reported so that any back calculations of the wet analysis may be performed.

6. A laboratory checklist. The Laboratory Data Package Cover Page and Data Review Checklist, similar to the example provided as Figure F2, will be included with the TCEQ-0312 forms for each groundwater monitoring event. For every response of "No, NA, or NR" that is reported on the checklist, the permittee will ensure the laboratory provides a detailed description of the "exception report" in the summary of the LCN. The permittee will require the laboratory to do an equivalent of an EPA Level 3 review regarding quality control analysis.

4 GROUNDWATER MONITORING REQUIREMENTS

Groundwater monitoring for the monitoring well system is to follow the TCEQ requirements for detection, assessment, and corrective action monitoring as outlined in applicable parts of 30 TAC §§330.401-421.

4.1 Detection Monitoring Parameters and Analytical Methods

In accordance with §330.419, all monitoring wells at the site are to be sampled and analyzed for the total metals and volatile organic compounds (VOCs) listed in 40 CFR Part 258, Appendix I and Table F2-2 of this attachment.

The water quality parameters, listed in Table F2-3, may be sampled and analyzed at the discretion of the facility operator, but the results will not be subject to statistical evaluation.

EPA methods are listed for each constituent in 40 CFR Part 258, Appendix I and Table F2-2 of this attachment; equivalent or better methods may be substituted. The analytical method used must be able to attain the precision and accuracy targets shown below.

Precision and accuracy targets shown in the table below represent TCEQ guidance as of the date of this document. Should TCEQ guidance change, the targets will be adjusted accordingly.

The PQL is defined as the lowest concentration reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions and is analogous to the limit of quantitation (LOQ) definition in the most recent available NELAC Standard (National Environmental Laboratory Accreditation Conference).

The PQL is method, instrument, and analyte specific and may be updated as more data becomes available. The PQL must be below the groundwater protection standard established for that analyte as defined by 30 TAC §330.409(h) unless approved otherwise by the Texas Commission on Environmental Quality (TCEQ).

The precision and accuracy of the PQL shall be initially determined from the PQLs reported over the course of a minimum of eight groundwater monitoring events. The results obtained from these events shall be used to demonstrate that the PQLs meet the specified precision and accuracy as shown in the table below.

The PQL will be supported by analysis of a PQL check sample, which is a laboratory reagent grade sample matrix spiked with chemicals of concern at concentrations equal to or less than the PQL. At a minimum, a PQL check sample will be performed quarterly during the calendar year to demonstrate that the PQL continues to meet the specified limits for precision and accuracy as defined in the table below.

Constituent/Chemical of Concern	Precision (% RSD)	Accuracy (% Recovery)
Metals	10	70-130
Volatiles	20	50-150
Semi-Volatiles	30	50-150

For analytes that the established PQL cannot meet the precision and accuracy requirements in the table above, the owner/operator will ensure the laboratory will submit sufficient documentation and information to the TCEQ for alternate precision and accuracy limits on a case by case basis.

Non-detected results will be reported as less than the established PQL limit that meets these precision and accuracy requirements.

4.2 Monitoring Frequency

Detection monitoring of new and replacement groundwater monitoring compliance wells will continue until background has been established in the replacement wells and they become the compliance wells. Background sampling of replacement monitoring wells will begin when the proposed wells are installed.

4.2.1 Establishing Background

Background sampling will consist of eight background samples taken from each well at approximately three-month intervals. This interval is estimated to be sufficient to obtain "statistically independent" samples.

Background sampling, as described above, will be implemented for new wells or wells that have had major repairs not later than the calendar quarter after installation or repair, except as may be otherwise required by the TCEQ.

The procedure for collecting independent samples will be to collect samples during each calendar quarter until a minimum of eight samples have been obtained. This method of sample collection will provide data to assess seasonal variations in groundwater quality. If additional samples are needed to adequately perform statistical analysis, they will be collected no more frequently than quarterly. The weathered and unweathered interface will be used in potentiometric maps of groundwater monitoring events for monitoring reports when the actual groundwater measurement is below that elevation. Based on the data from the initial site investigation piezometers, little groundwater occurs beneath the site. For low production and slow recovery wells that have not completed background collection within two years (due to lack of sufficient groundwater for sampling), the wells will then be sampled, or attempted to be sampled, for background during the subsequent regularly scheduled semi-annual events.

Following each background monitoring event, the analytical results will be reviewed and compared with the results of other site wells to determine whether there is an indication of facility impact. On completion of background monitoring and during background updates, the facility will evaluate the background data to ensure that the data are representative of background groundwater constituent concentrations unaffected by waste disposal activities or other sources of contamination.

4.2.2 Detection Monitoring

After background has been established, semiannual detection monitoring of the groundwater monitoring wells will begin about six months after the last background sampling event. An effort will be made to sample consistently in the same two months each year.

4.2.3 Assessment Monitoring

Groundwater sampling for assessment and corrective action will be in accordance with 30 TAC 330 Subchapter J rules and consultation with TCEQ staff. See Section 5 – Reporting Requirements for additional information regarding statistical exceedance reporting and assessment monitoring requirements.

4.3 Statistical Methods

Statistical evaluation of detection groundwater monitoring constituents is required by 30 TAC §330.405(f). Statistical analysis will be performed on each of the Appendix I analyzed constituents, except as may be otherwise approved by the TCEQ, using methods appropriate for the distribution of the concentration values of the constituents. Statistical analysis will commence upon completion of the first detection monitoring event. The statistical method selected shall comply with 30 TAC §330.405(e) and (f).

Following completion of background where insufficient data exists for statistical analysis, due to insufficient groundwater for sampling, the facility will continue to review and compare with the analytical results following each event to determine whether there is an indication of facility impact. The facility will also re-evaluate the leachate constituents on an annual basis to monitor any increases or additions to the constituent list.

5 REPORTING REQUIREMENTS

In accordance with 30 TAC §330.407(a)(1), upon completion of background monitoring and during background updates, 130 Environmental Park will evaluate the background data to ensure that the data are representative of background groundwater constituent concentrations unaffected by waste management activities or other sources of contamination. The evaluation will be documented in a report and submitted to the executive director before the next subsequent groundwater monitoring event following the updated (or initial) background period.

Within 60 days of each groundwater sampling event, a determination will be made whether an initial (unverified) or verified exceedance of a statistically calculated background limit has occurred. If an initial (unverified) statistically significant increase (SSI) is observed, the executive director and any local pollution agency with jurisdiction that has requested notification will be notified in writing within 14 days of the initial SSI determination. If a SSI of any tested constituent at any monitoring well, including upgradient wells, has occurred, the following actions will be initiated, as appropriate for each separate SSI incident, in accordance with 30 TAC §330.407(b).

(1) The facility shall immediately place a notice in the site operating record describing the release and establish an assessment monitoring program meeting the requirements of §330.409 within 90 days of the date of the notice to the TCEQ, except as provided in (2) and (3) below:

(2) The facility shall submit results of resampling as appropriate for the statistical method within 60 days of determining the initial SSI. The resample data may be used to statistically confirm or disprove the initial SSI.

(3) If there is reasonable cause to think that another source or an error(s) in sampling, analysis, statistical evaluation, or natural variation in groundwater quality caused the SSI, then the facility may submit a report documenting the error or alternate source in accordance with §330.407(b)(3), as follows:

(A) Notify, in writing, the executive director and any local pollution agency with jurisdiction that has requested to be notified within 14 days of determining the SSI.

(B) Submit the demonstration, prepared and certified by a qualified groundwater scientist, within 90 days of SSI determination.

(C) Do not filter the sample for constituents addressed by the demonstration prior to laboratory analysis.

(D) Continue detection monitoring.

If the report is approved, then the monitoring well may remain in detection monitoring. If the owner/operator does not make a demonstration satisfactory to the executive director within 90 days after the date of notice, the owner/operator shall initiate an assessment monitoring program.

5.1.1 Annual Report

In accordance with 30 TAC §330.407(c), the annual report will include the results of all groundwater monitoring, testing, and analytical work obtained or prepared under the requirements of the permit (that is, all facility groundwater sample and field quality control sample analytical data in hard copy format on form TCEQ-0312, Groundwater Sampling Report, and in any other format requested by the executive director, for example, electronic format). The annual report will include a summary of background groundwater quality values, groundwater monitoring analyses, and statistical calculations, as well as graphs, and drawings.

Annually, within 90 days after the facility's last groundwater monitoring event in a calendar year, a report will be submitted that includes the following information gathered since the previous annual report:

(1) A statement regarding SSI(s) in any well and the status of same.

(2) The facility will submit the laboratory case narrative and either a laboratory checklist or a copy of the laboratory QA/QC and analytical data. The analytical data will be submitted in either electronic or in hard copy format, as requested by the executive director.

(3) The facility will explain any problems encountered in the laboratory analysis, either by adding additional explanations to the laboratory checklist or by extending the laboratory case narrative.

(4) Any information required in the laboratory case narrative that cannot be completed by the laboratory will be completed by the permittee.

(5) Groundwater flow rate and direction in the uppermost aquifer, using the previous year's data collected, including documentation used to determine the flow rate and direction.

(6) Contour map(s) of piezometric water levels in the uppermost aquifer based on concurrent measurements at all monitoring wells, including supporting data.

(7) Any recommendations for changes to the groundwater monitoring program.

(8) Any other items requested by the executive director.

Table F2-1
130 Environmental Park
Recommended Containers, Preservation, and Storage for Groundwater Monitoring

Parameter	Recommended Containers	Preservation	Maximum Holding Time	Minimum Volume
pH	P, G	None	Analyze immediately	25 ml
Spec. cond.	P, G	None	Analyze immediately	100 ml
Temperature	P, G	None	Analyze immediately	
Heavy metals (includes iron and manganese)	P, G	Acidify w/HNO_3 to pH<2, 4°C	6 months except 28 days for Hg	1 liter
Calcium, magnesium, sodium, potassium, fluoride, sulfate, chloride, and hardness	P, G	4°C	28 days	1 liter
TDS (may be included with above parameters)	P, G	4°C	7 days	1 liter
Nitrate	P, G	4°C	48 hrs	100 ml
Ammonia	P, G	Acidify w/H_2SO_4 to pH<2, 4°C	7 days; 28 days if acidified	500 ml
Alkalinity	P, G	4°C	Analyze immediately	200 ml
NPOC	G amber, T-lined caps	Acidify w/HCl to pH<2, 4°C	48 hrs; 28 days if acidified	100 ml/replicate
COD	P, G	Acidify w/H_2SO_4 to pH<2, 4°C	48 hrs; 28 days if acidified	100 ml
SVOC	G, T-lined caps	4°C	7 days until extraction, then analyze within 40 days	1 liter
BOD	P, G	4°C	24 hrs	1 liter
VOC	G, T-lined septa	Acidify w/HCl to pH<2, 4°C	14 days	2 x 40 ml
P = Polyethylene, G = Glass, T = Teflon				

Table F2-2
130 Environmental Park
Groundwater Background/Detection Monitoring Constituents

Parameter	Method[1]
Total heavy metals:	
Antimony	EPA 6010B
Arsenic	EPA 6010B
Barium	EPA 6010B
Beryllium	EPA 6010B
Cadmium	EPA 6010B
Chromium	EPA 6010B
Cobalt	EPA 6010B
Copper	EPA 6010B
Lead	EPA 6010B
Nickel	EPA 6010B
Selenium	EPA 6010B
Silver	EPA 6010B
Thallium	EPA 6010B
Vanadium	EPA 6010B
Zinc	EPA 6010B
Volatile organic compounds (VOCs):	
Acetone	EPA 8260B
Acrylonitrile	EPA 8260B
Benzene	EPA 8260B
Bromochloromethane	EPA 8260B
Bromodichloromethane	EPA 8260B
Bromoform (tribromomethane)	EPA 8260B
Carbon disulfide	EPA 8260B
Carbon tetrachloride	EPA 8260B
Chlorobenzene	EPA 8260B
Chloroethane (ethyl chloride)	EPA 8260B
Chloroform (trichloromethane)	EPA 8260B
Dibromochloromethane (chlorodibromomethane)	EPA 8260B
1,2-Dibromo-3-chloropropane (DBCP)[2]	EPA 8260B
1,2-Dibromoethane (ethylene dibromide, EDB)[2]	EPA 8260B
o-Dichlorobenzene (1,2-dichlorobenzene)	EPA 8260B
p-Dichlorobenzene (1,4-dichlorobenzene)	EPA 8260B

Parameter	Method[1]
Volatile organic compounds (VOCs):	
trans-1,4-Dichloro-2-butene	EPA 8260B
1,1-Dichloroethane (ethylidene chloride)	EPA 8260B
1,2-Dichloroethane (ethylene dichloride)	EPA 8260B
1,1-Dichloroethylene (1,1-dichloroethene,vinylidene chloride)	EPA 8260B
cis-1,2-Dichloroethylene (cis-1,2-dichloroethene)	EPA 8260B
trans-1,2-Dichloroethylene (trans-1,2-dichloroethene)	EPA 8260B
1,2-Dichloropropane (Propylene dichloride)	EPA 8260B
cis-1,3-Dichloropropene	EPA 8260B
trans-1,3-Dichloropropene	EPA 8260B
Ethylbenzene	EPA 8260B
2-Hexanone (methyl butyl ketone)	EPA 8260B
Methyl bromide (bromomethane)	EPA 8260B
Methyl chloride (chloromethane)	EPA 8260B
Methylene bromide (dibromomethane)	EPA 8260B
Methylene chloride (dichloromethane)	EPA 8260B
Methyl ethyl ketone (MEK, 2-butanone)	EPA 8260B
Methyl iodide (iodomethane)	EPA 8260B
4-Methyl-2-pentanone (methyl isobutyl ketone)	EPA 8260B
Styrene	EPA 8260B
1,1,1,2-Tetrachloroethane	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 8260B
Tetrachloroethylene (tetrachloroethene, perchloroethylene)	EPA 8260B
Toluene	EPA 8260B
1,1,1-Trichloroethane (methychloroform)	EPA 8260B
1,1,2-Trichloroethane	EPA 8260B
Trichloroethylene (trichloroethene)	EPA 8260B
Trichlorofluoromethane (CFC-11)	EPA 8260B
1,2,3-Trichloropropane	EPA 8260B
Vinyl acetate	EPA 8260B
Vinyl chloride	EPA 8260B
Xylenes	EPA 8260B

Notes:

[1] Equivalent or better methods may be substituted.

[2] For DBCP and EDB, any detection between the MDL (method detection limit) and PQL will be reported and flagged as estimated values.

Table F2-3
130 Environmental Park
Water Quality Parameters List

Parameter	Method[1]
Total inorganic indicator constituents:	
Ammonia	EPA 350.1
Calcium	EPA 6010
Magnesium	EPA 6010
Sodium	EPA 6010
Potassium	EPA 6010
Chloride	EPA 300.0
Sulfate	EPA 300.0
Total alkalinity	EPA 310.1
Nitrate	EPA 9210A
Carbonate	EPA 9056A

Notes:
[1] Equivalent or better methods may be substituted.

Municipal Solid Waste Laboratory Review Checklist

This data package consists of:

- ☐ This signature page, and the laboratory review checklist consisting of Table 1, Reportable Data (which includes the reportable data identified on this page), Table 2, Supporting Data, and Table 3, Exception Reports.
- ☐ R1 Field chain-of-custody documentation
- ☐ R2 Sample identification cross-reference
- ☐ R3 Test reports (analytical data sheets) for each environmental sample that includes:
  - (a) Items specified in NELAC Chapter 5 for reporting results, e.g., Section 5.5.10 in 2003 NELAC Standard
  - (b) Dilution factors
  - (c) Preparation methods
  - (d) Cleanup methods
  - (e) If required for the project, tentatively identified compounds (TICs)
- ☐ R4 Surrogate recovery data including:
  - (a) Calculated recovery (%R)
  - (b) The laboratory's surrogate QC limits
- ☐ R5 Test reports/summary forms for blank samples
- ☐ R6 Test reports/summary forms for laboratory control samples (LCSs) including:
  - (a) LCS spiking amounts
  - (b) Calculated %R for each analyte
  - (c) The laboratory's LCS QC limits
- ☐ R7 Test reports for project matrix spike/matrix spike duplicates (MS/MSDs) including:
  - (a) Samples associated with the MS/MSD clearly identified
  - (b) MS/MSD spiking amounts
  - (c) Concentration of each MS/MSD analyte measured in the parent and spiked samples
  - (d) Calculated %Rs and relative percent differences (RPDs)
  - (e) The laboratory's MS/MSD QC limits
- ☐ R8 Laboratory analytical duplicate (if applicable) recovery and precision:
  - (a) The amount of analyte measured in the duplicate
  - (b) The calculated RPD
  - (c) The laboratory's QC limits for analytical duplicates
- ☐ R9 List of method quantitation limits (MQLs) for each analyte for each method and matrix
- ☐ R10 Other problems or anomalies
- ☐ The Exception Report for every item for which the result is "No" or "NR" (Not Reviewed)

Release Statement: I am responsible for the release of this laboratory data package. This data package as been reviewed by the laboratory and is complete and technically compliant with the requirements of the methods used, except where noted by the laboratory in the attached exception reports. By my signature below, I affirm to the best of my knowledge, all problems/anomalies, observed by the laboratory as having the potential to affect the quality of the data, have been identified by the laboratory in the Laboratory Review Checklist, and no information or data have been knowingly withheld that would affect the quality of the data.

Check, if applicable: [ ] This laboratory is an in-house laboratory controlled by the person responding to rule. The official signing the cover page of the rule-required report in which these data are used is responsible for releasing this data package and is by signature affirming the above release statement is true.

Name (printed)	Signature	Official Title	Date

Table 1. Reportable Data.

Laboratory Name: ______________________________

Project Name: ______________________________

Reviewer Name: ______________________________

LRC Date: ______________________________

Laboratory Job Number: ______________________________

Prep Batch Number(s): ______________________________

Item[1]	Analytes[2]	Description	Result (Yes, No, NA, NR)[3]	Exception Report No.[4]
R1	O, I	**Chain-of-custody (COC)**		
		Did samples meet the laboratory's standard conditions of sample acceptability upon receipt?		
		Were all departures from standard conditions described in an exception report?		
R2	O, I	**Sample and quality control (QC) identification**		
		Are all field sample ID numbers cross-referenced to the laboratory ID numbers?		
		Are all laboratory ID numbers cross-referenced to the corresponding QC data?		
R3	O, I	**Test reports**		
		Were all samples prepared and analyzed within holding times?		
		Other than those results < MQL, were all other raw values bracketed by calibration standards?		
		Were calculations checked by a peer or supervisor?		
		Were all analyte identifications checked by a peer or supervisor?		
		Were sample quantitation limits reported for all analytes not detected?		
		Were all results for soil and sediment samples reported on a dry weight basis?		
		Was % moisture (or solids) reported for all soil and sediment samples?		
		If required for the project, TICs reported?		
R4	O	**Surrogate recovery data**		
		Were surrogates added prior to extraction?		
		Were surrogate percent recoveries in all samples within the laboratory QC limits?		
R5	O, I	**Test reports/summary forms for blank samples**		
		Were appropriate type(s) of blanks analyzed?		
		Were blanks analyzed at the appropriate frequency?		

Item[1]	Analytes[2]	Description	Result (Yes, No, NA, NR)[3]	Exception Report No.[4]
		Were method blanks taken through the entire analytical process, including preparation and, if applicable, cleanup procedures?		
		Were blank concentrations < MQL?		
R6	O, I	**Laboratory control samples (LCS):**		
		Were all COCs included in the LCS?		
		Was each LCS taken through the entire analytical procedure, including prep and cleanup steps?		
		Were LCSs analyzed at the required frequency?		
		Were LCS (and LCSD, if applicable) %Rs within the laboratory QC limits?		
		Does the detectability data document the laboratory's capability to detect the COCs at the MDL used to calculate the SQLs?		
		Was the LCSD RPD within QC limits?		
R7	O, I	**Matrix spike (MS) and matrix spike duplicate (MSD) data**		
		Were the project/method specified analytes included in the MS and MSD?		
		Were MS/MSD analyzed at the appropriate frequency?		
		Were MS (and MSD, if applicable) %Rs within the laboratory QC limits?		
		Were MS/MSD RPDs within laboratory QC limits?		
R8	O, I	**Analytical duplicate data**		
		Were appropriate analytical duplicates analyzed for each matrix?		
		Were analytical duplicates analyzed at the appropriate frequency?		
		Were RPDs or relative standard deviations within the laboratory QC limits?		
R9	O, I	**Method quantitation limits (MQLs):**		
		Are the MQLs for each method analyte included in the laboratory data package?		
		Do the MQLs correspond to the concentration of the lowest non-zero calibration standard?		
		Are unadjusted MQLs included in the laboratory data package?		
R10	O, I	**Other problems/anomalies**		
		Are all known problems/anomalies/special conditions noted in this LRC and ER?		
		Were all necessary corrective actions performed for the reported data?		
		Was applicable and available technology used to lower the SQL minimize the matrix interference affects on the sample results?		

Table 2. Supporting Data.

Laboratory Name: ____________________

Project Name: ____________________

Reviewer Name: ____________________

LRC Date: ____________________

Laboratory Job Number: ____________________

Prep Batch Number(s): ____________________

Item[1]	Analytes[2]	Description	Result (Yes, No, NA, NR)[3]	Exception Report No.[4]
S1	O, I	**Initial calibration (ICAL)**		
		Were response factors and/or relative response factors for each analyte within QC limits?		
		Were percent RSDs or correlation coefficient criteria met?		
		Was the number of standards recommended in the method used for all analytes?		
		Were all points generated between the lowest and highest standard used to calculate the curve?		
		Are ICAL data available for all instruments used?		
		Has the initial calibration curve been verified using an appropriate second source standard?		
S2	O, I	**Initial and continuing calibration verification (ICCV and CCV) and continuing calibration blank (CCB):**		
		Was the CCV analyzed at the method-required frequency?		
		Were percent differences for each analyte within the method-required QC limits?		
		Was the ICAL curve verified for each analyte?		
		Was the absolute value of the analyte concentration in the inorganic CCB < MDL?		
S3	O	**Mass spectral tuning:**		
		Was the appropriate compound for the method used for tuning?		
		Were ion abundance data within the method-required QC limits?		
S4	O	**Internal standards (IS):**		
		Were IS area counts and retention times within the method-required QC limits?		
S5	O, I	**Raw data (NELAC section 1 appendix A glossary, and section 5.)**		
		Were the raw data (for example, chromatograms, spectral data) reviewed by an analyst?		
		Were data associated with manual integrations flagged on the raw data?		

Item[1]	Analytes[2]	Description	Result (Yes, No, NA, NR)[3]	Exception Report No.[4]
S6	O	**Dual column confirmation**		
		Did dual column confirmation results meet the method-required QC?		
S7	O	**Tentatively identified compounds (TICs):**		
		If TICs were requested, were the mass spectra and TIC data subject to appropriate checks?		
S8	I	**Interference Check Sample (ICS) results:**		
		Were percent recoveries within method QC limits?		
S9	I	**Serial dilutions, post digestion spikes, and method of standard additions**		
		Were percent differences, recoveries, and the linearity within the QC limits specified in the method?		
S10	O, I	**Method detection limit (MDL) studies**		
		Was a MDL study performed for each reported analyte?		
		Is the MDL either adjusted or supported by the analysis of DCSs?		
S11	O, I	**Proficiency test reports:**		
		Was the laboratory's performance acceptable on the applicable proficiency tests or evaluation studies?		
S12	O, I	**Standards documentation**		
		Are all standards used in the analyses NIST-traceable or obtained from other appropriate sources?		
S13	O, I	**Compound/analyte identification procedures**		
		Are the procedures for compound/analyte identification documented?		
S14	O, I	**Demonstration of analyst competency (DOC)**		
		Was DOC conducted consistent with NELAC Chapter 5C?		
		Is documentation of the analyst's competency up-to-date and on file?		
S15	O, I	**Verification/validation documentation for methods (NELAC Chap 5n 5)**		
		Are all the methods used to generate the data documented, verified, and validated, where applicable?		
S16	O, I	**Laboratory standard operating procedures (SOPs):**		
		Are laboratory SOPs current and on file for each method performed?		

Table 3. Exception Reports.

Laboratory Name: ______________________

Project Name: ______________________

Reviewer Name: ______________________

LRC Date: ______________________

Laboratory Job Number: ______________________

Prep Batch Number(s): ______________________

Exception Report No.	Description

[1] Items identified by the letter "R" must be available as a hard copy or as a .pdf file. Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
[2] O - organic analyses; I - inorganic analyses (including general chemistry constituents, when applicable).
[3] NA - Not applicable; NR - Not reviewed.
[4] Exception Report identification number; an Exception Report should be completed for an item if the result is "No" or "NR."