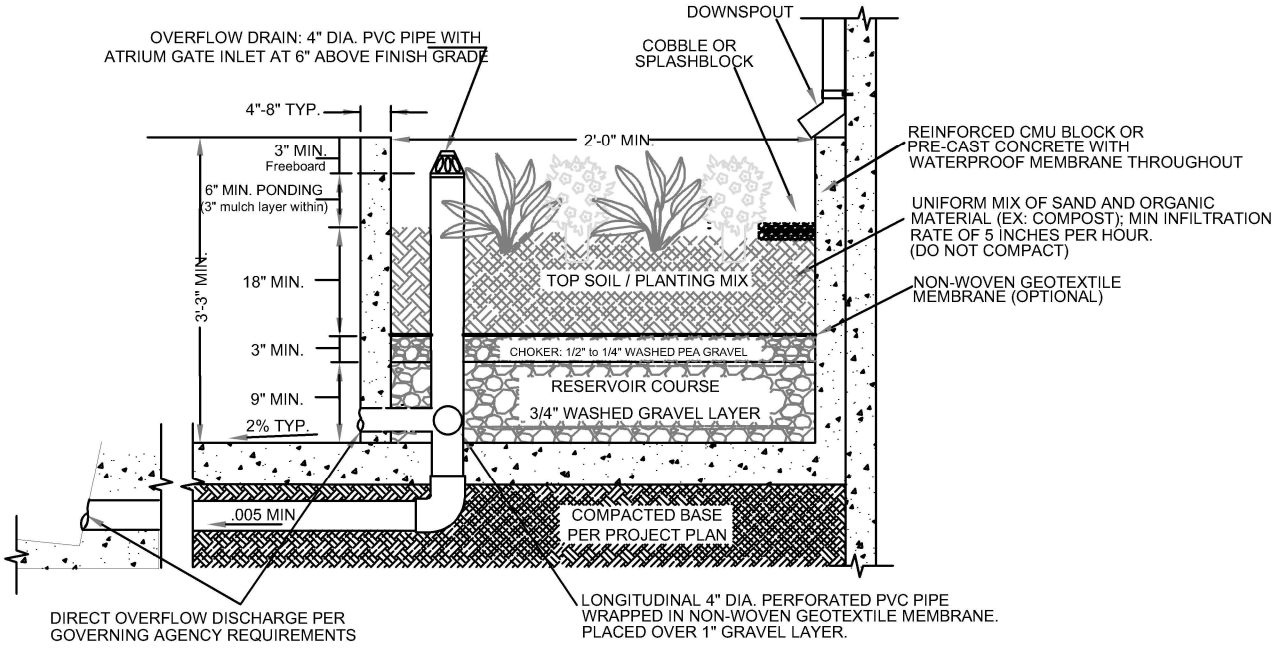
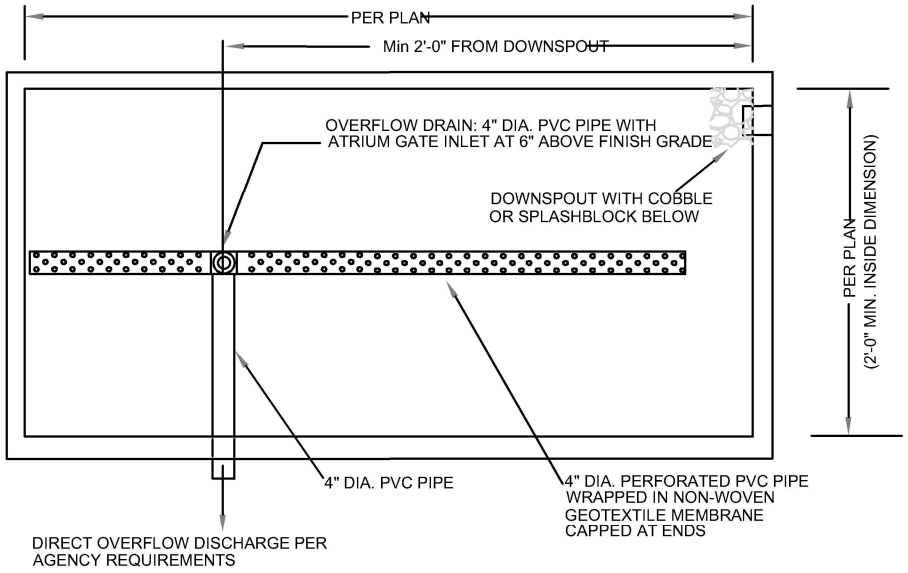


SECTION NOT TO SCALE



PLAN NOT TO SCALE

NOTES:

1. AT LEAST 9 INCHES SHALL BE PROVIDED BETWEEN THE PLANTING SURFACE AND THE CREST OF EACH PLANTER
2. PLANTERS SHALL NOT BE LOCATED ON UNEVEN OR SLOPED SURFACES.
3. TOP SOIL/PLANTING MIX IS AT LEAST 18" DEEP.
4. TOP SOIL CONTAINS NO MORE THAN 30% COMPOST.
5. MINIMUM GRAVEL LAYER SHALL BE 12" DEEP.
6. DIRECT OVERFLOW DISCHARGE PER AGENCY REQUIREMENTS.
7. PLANTING IS REQUIRED. CONSULT LANDSCAPE ARCHITECT FOR SPECIFIC PLANT TYPES.

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GeoMat Testing Laboratories, Inc.
9980 Indiana Avenue, Suite 14
Riverside, California 92503

DWN BY:	AM
CHK'D BY:	MN
DATUM:	--
PROJECTION:	--
SCALE:	N.T.S.
REV. NO.:	--

PROJECT: PRELIMINARY SOIL INVESTIGATION REPORT
APN: 191-150-031, 032 & 033
RIVERSIDE, CALIFORNIA

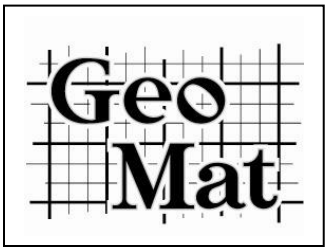
TITLE: TYPICAL STORMWATER PLANTER DETAIL

DATE: APRIL 2020

PROJECT NO.: 20112-01

FIGURE NO.: Plate 4

APPENDIX A



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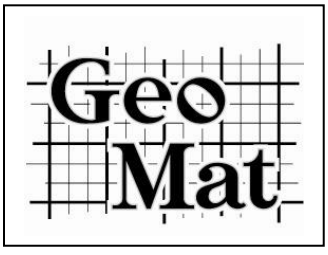
APPENDIX B



SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Dual symbols are used to indicate gravels or sand with 5-12% fines and soils with fines classifying as CL-ML. Symbols separated by a slash

RELATIVE DENSITY		**CONSISTENCY**		UNCONFINED COMPRESSIVE
SANDS AND GRAVELS	SPT, N	SILTS AND CLAYS	SPT, N	STRENGTH, tsf
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 -10	SOFT	2 - 4	0.25 - 0.50
MEDIUM DENSE	10 - 30	MEDIUM FIRM	4 - 8	0.50 - 1.00
DENSE	30 - 50	FIRM	8 - 15	1.00 - 2.00
VERY DENSE	50+	VERY FIRM	15 - 30	2.00 - 4.00
		HARD	30+	>4.00

Sampler and Symbol Descriptions

B — Bulk "grab" sample taken from the auger cuttings or excavated soil

S — 1.4" I.D./2" O.D. Standard Penetration Test (ASTM D1586) sampler (SPT)

R — 2.5" I.D./3" O.D. Modified California Ring Sampler (Ring)

D — 2.5" I.D./3" O.D. Dames and Moore Manual Ring Sampler

MOISTURE CONDITION	
DESCRIPTION	CRITERIA
DRY	Absence of moisture, dusty, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table

CONSTITUENT DESCRIPTIONS			
DESCRIPTION	CRITERIA	DESCRIPTION	CRITERIA
TRACE	Less than 5%	SOME	30% to 45%
FEW	5% to 10%	MOSTLY	50% to 100%
LITTLE	15% to 25%		

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KEY TO BORING LOGS

APPENDIX B

PROJECT: **APN: 191-150-031, 032 & 033 Riverside, California**

Log of Boring B-1

Project No.	**20068-01**	Boring Location:	**See Plate 1**
Drill Company/Rig	**Geoboden/CME-75**	Date Started:	**4/3/2020**
Drilling Method:	**Hollow Stem Auger**	Date Finished:	**4/3/2020**
Hammer Weight/Drop:	**140 lbs./30-inches**	Hammer Type:	**Automatic**

Logged by: **AM**

Notes: Groundwater @ 25' bgs

Sampler(s): California Ring (R), Standard Penetration Test (S), Bulk "Grab" Sample (B)

LABORATORY TEST DATA

DEPTH (FT)	SAMPLES Type	Sample	Blows / 6"	SPT "N" Value	Graphic Log	Classification (USCS)	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
0	B					SC	**CLAYEY SAND/SANDY LEAN CLAY** reddish-brown clayey sand and sandy lean clay very moist at surface cohesive						
5	R		22 38 27	42			dense red-brown clayey sand becoming more sandy with depth less cohesive	15	109	43			
10	S		21 50/3"	>50			**GRANITIC BEDROCK** light gray granitic bedrock weathered, slightly moist drills like well-graded sand with silt	6		7			
15	S		32 50/5"	>50			very dense slightly moist						
20	S		50/5"	>50			very dense slightly moist						
25						▽	GROUNDWATER AT 25 FEET BGS						
	S		50/5"	>50			very dense very moist to wet						
30	S		50/4"	>50			very dense very moist to wet	16		10			
35	S		50/3"	>50			very dense very moist to wet						
40	S		50/4"	>50			very dense very moist to wet						
45	S		50/5"	>50			very dense very moist to wet						
50	S		50/3"	>50			very dense very moist to wet	17		7			
							TD = 50'						

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This log is part of the report prepared by GeoMat for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with tiume. Data presented are a simplification of actual conditions encountered.

PROJECT NO. 20068-01

APPENDIX B

PROJECT: **APN: 191-150-031, 032 & 033**
Riverside, California

Log of Boring B-2

Project No.	**20068-01**	Boring Location:	**See Plate 1**
Drill Company/Rig	**Geoboden/CME-75**	Date Started:	**4/3/2020**
Drilling Method:	**Hollow Stem Auger**	Date Finished:	**4/3/2020**
Hammer Weight/Drop:	**140 lbs./30-inches**	Hammer Type:	**Automatic**

Logged by: **AM**

Notes: Groundwater @ 15' bgs

Sampler(s): California Ring (R), Standard Penetration Test (S), Bulk "Grab" Sample (B)

DEPTH (FT)	SAMPLES Type	Sample	Blows / 6"	SPT "N" Value	Graphic Log	Classification (USCS)	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
0	B					SC	**CLAYEY SAND/SANDY LEAN CLAY** reddish-brown clayey sand and sandy lean clay very moist at surface						
	R		9 15 25	26			very cohesive very firm clay, tree roots encountered	22	103				
5	R		6 8 15	15			**GRANITIC BEDROCK** light gray decomposed granitic bedrock weathered slightly moist						
10	S		18 38 46	>50			very dense granitic bedrock moist drills like well-graded sand with silt						
15						▽	GROUNDWATER AT 15 FEET BGS						
	S		37 50/3"	>50			very dense slightly moist TD = 15'						
20													
25													
30													
35													
40													
45													
50													

This log is part of the report prepared by GeoMat for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with tiume. Data presented are a simplification of actual conditions encountered.

PROJECT NO. 20068-01

APPENDIX B

PROJECT: **APN: 191-150-031, 032 & 033 Riverside, California**

Log of Boring B-3

Project No.	**20068-01**	Boring Location:	**See Plate 1**
Drill Company/Rig	**Geoboden/CME-75**	Date Started:	**4/3/2020**
Drilling Method:	**Hollow Stem Auger**	Date Finished:	**4/3/2020**
Hammer Weight/Drop:	**140 lbs./30-inches**	Hammer Type:	**Automatic**

Logged by: **AM**

Notes: Groundwater @ 15' bgs

Sampler(s): California Ring (R), Standard Penetration Test (S), Bulk "Grab" Sample (B)

DEPTH (FT)	SAMPLES Type	Sample	Blows / 6"	SPT "N" Value	Graphic Log	Classification (USCS)	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Moisture Content (%)	Dry Density (pcf)	Fines (%)	Liquid Limit	Plastic Limit	Plast. Index
0	B					SC	**CLAYEY SAND/SANDY LEAN CLAY** reddish-brown clayey sand and sandy lean clay very moist at surface						
	R		13 30 34	42			very cohesive, hard sandy lean clay	15	118				
5	R		12 21 25	30			light reddish brown to olive brown clayey sand medium dense moist, very cohesive grading into weathered granitics						
10	S		13 28 50/3"	>50			**GRANITIC BEDROCK** light gray decomposed granitic bedrock weathered, slightly moist less cohesive						
						▽	GROUNDWATER AT 15 FEET BGS						
15	S		25 50/5"	>50			very dense TD = 15'						
20													
25													
30													
35													
40													
45													
50													

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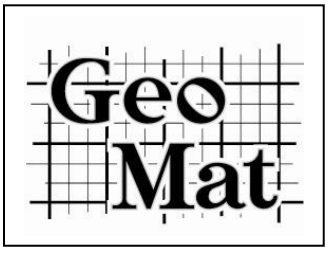
This log is part of the report prepared by GeoMat for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with tiume. Data presented are a simplification of actual conditions encountered.

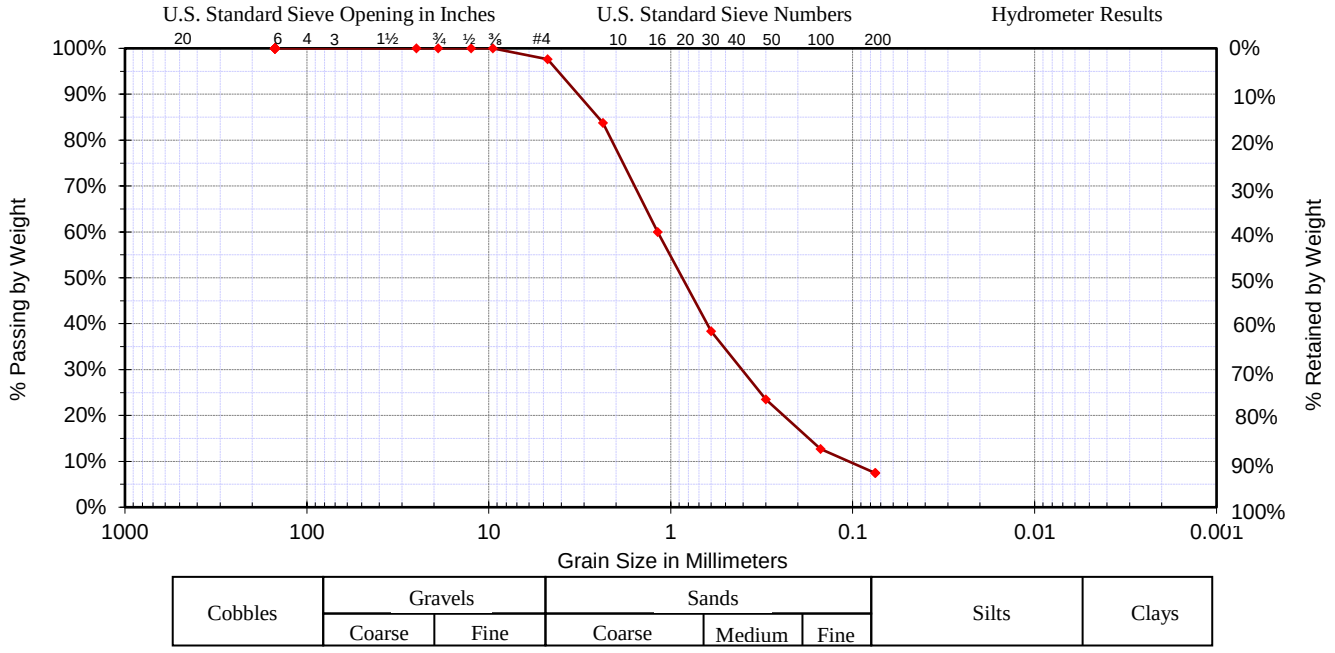
PROJECT NO. 20068-01

APPENDIX B

APPENDIX C



LABORATORY TEST RESULTS



Date :	04/16/20	D_{10} =	0.11	**Classification**	% Gravel
Sample #:		D_{30} =	0.43	SW-SM, Well-graded Sand with Silt	2.41%
Sample ID:	B-1 @ 10'	D_{60} =	1.18		% Sand
Source:	SPT	C_C =	1.41	**Specifications**	90.16%
Project:	APN: 191-150-031, 032, 033	C_{U} =	10.57	custom specs 1	% Silt & Clay
Location:	SEC of Arlington Avenue and Monroe Street, Rivers	Liquid Limit=	n/a		7.43%
Boring #:	B-1	Plastic Limit=	n/a	Fineness Modulus	Sample Moisture
Depth:	10'	Plasticity Index=	n/a	2.84	**6.4%**

Coarse Section Sieve Size US	Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50		100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		98.4%		
#4	4.75	97.6%	97.6%		

Fines Section Sieve Size US	Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
#4	4.750	97.6%	97.6%		
#8	2.360	83.7%	83.7%		
#10	2.000		76.5%		
#16	1.180	60.0%	60.0%		
#20	0.850		47.7%		
#30	0.600	38.3%	38.3%		
#40	0.425		29.7%		
#50	0.300	23.5%	23.5%		
#60	0.250		19.9%		
#80	0.180		14.8%		
#100	0.150	12.7%	12.7%		
#140	0.106		9.6%		
#170	0.090		8.5%		
#200	0.075	7.4%	7.4%		
#270	0.053				

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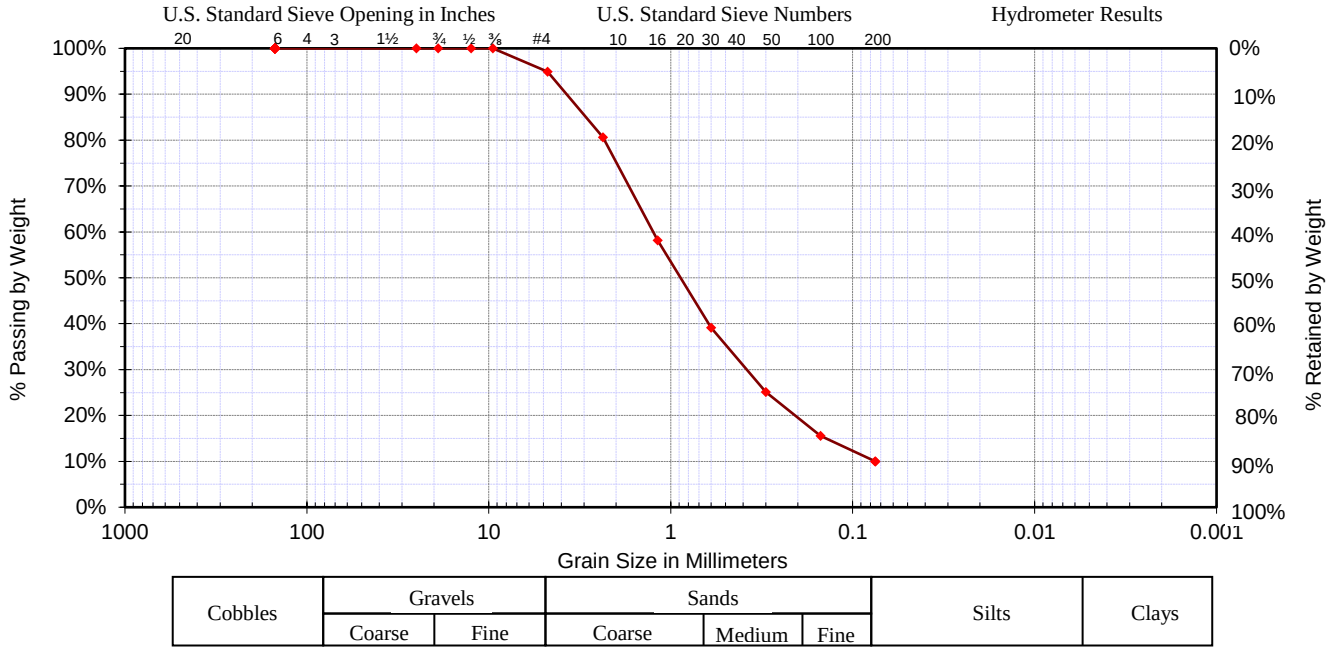
LABORATORY TEST RESULTS



Date :	04/16/20	D_{10} =	0.08	**Classification**	% Gravel
Sample #:		D_{30} =	0.40	SW-SM, Well-graded Sand with Silt	5.09%
Sample ID:	B-1 @ 30'	D_{60} =	1.28		% Sand
Source:	SPT	C_C =	1.71	**Specifications**	84.92%
Project:	APN: 191-150-031, 032, 033	C_{U} =	16.96	custom specs 1	% Silt & Clay
Location:	SEC of Arlington Avenue and Monroe Street, Rivers	Liquid Limit=	n/a		9.98%
Boring #:	B-1	Plastic Limit=	n/a	Fineness Modulus	Sample Moisture
Depth:	30'	Plasticity Index=	n/a	2.87	**15.7%**

Coarse Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50		100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		96.6%		
#4	4.75	94.9%	94.9%		

Fines Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
#4	4.750	94.9%	94.9%		
#8	2.360	80.6%	80.6%		
#10	2.000		73.8%		
#16	1.180	58.2%	58.2%		
#20	0.850		47.3%		
#30	0.600	39.1%	39.1%		
#40	0.425		31.0%		
#50	0.300	25.1%	25.1%		
#60	0.250		21.9%		
#80	0.180		17.5%		
#100	0.150	15.5%	15.5%		
#140	0.106		12.3%		
#170	0.090		11.1%		
#200	0.075	10.0%	10.0%		
#270	0.053				

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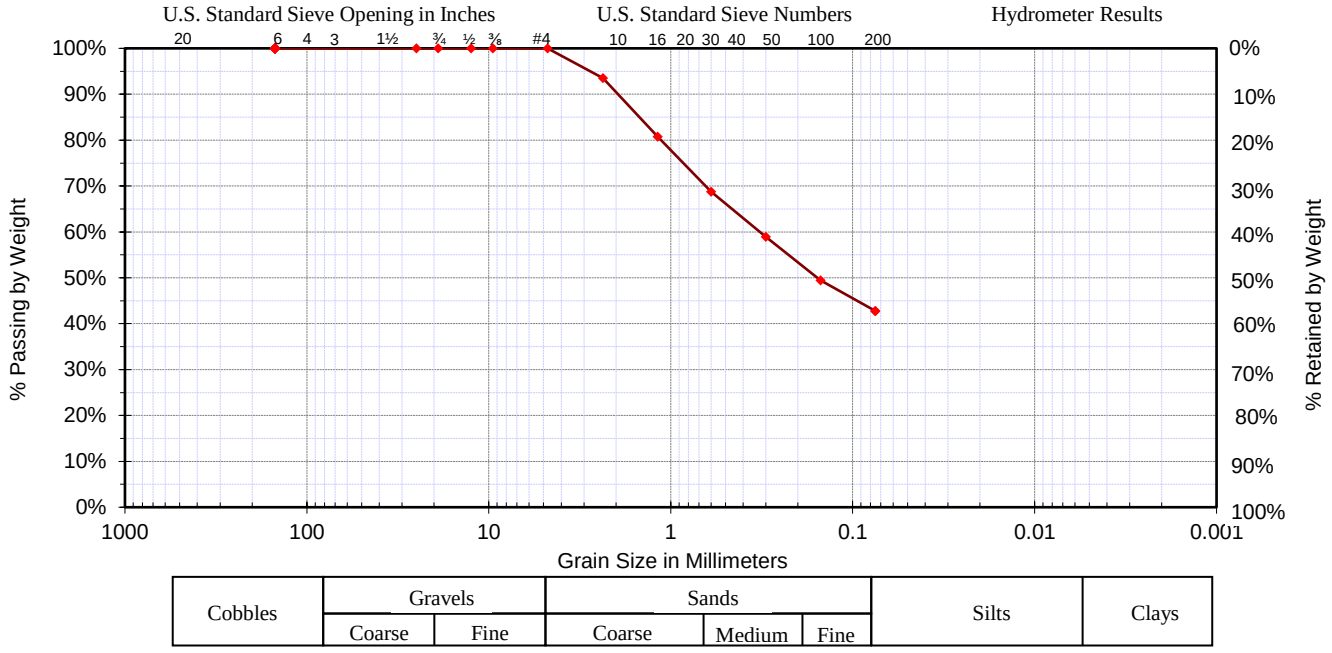
LABORATORY TEST RESULTS



Date :	04/16/20	D_{10} =	0.02	**Classification**	% Gravel
Sample #:		D_{30} =	0.05	SC, Clayey Sand	0.00%
Sample ID:	B-1 @ 5'	D_{60} =	0.33		% Sand
Source:	Ring	C_C =	0.47	**Specifications**	57.23%
Project:	APN: 191-150-031, 032, 033	C_U =	19.01	custom specs 1	% Silt & Clay
Location:	SEC of Arlington Avenue and Monroe Street, Rivers	Liquid Limit=	n/a		42.77%
Boring #:	B-1	Plastic Limit=	n/a	Fineness Modulus	Sample Moisture
Depth:	5'	Plasticity Index=	n/a	1.49	**14.5%**

Coarse Section Sieve Size US	Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50		100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		100.0%		
#4	4.75	100.0%	100.0%		

Fines Section Sieve Size US	Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
#4	4.750	100.0%	100.0%		
#8	2.360	93.5%	93.5%		
#10	2.000		89.6%		
#16	1.180	80.8%	80.8%		
#20	0.850		74.0%		
#30	0.600	68.8%	68.8%		
#40	0.425		63.0%		
#50	0.300	58.9%	58.9%		
#60	0.250		55.7%		
#80	0.180		51.3%		
#100	0.150	49.4%	49.4%		
#140	0.106		45.5%		
#170	0.090		44.1%		
#200	0.075	42.8%	42.8%		
#270	0.053				

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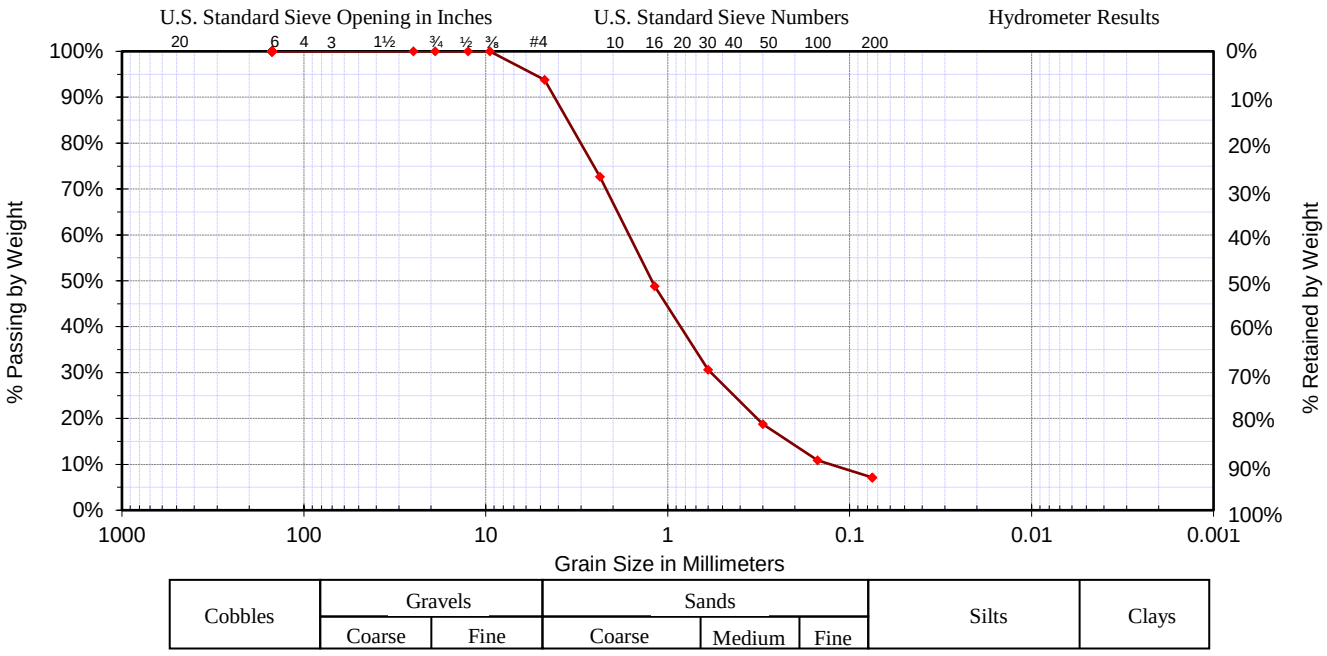
LABORATORY TEST RESULTS



Date :	04/16/20	D_{10} =	0.13	**Classification**	% Gravel
Sample #:		D_{30} =	0.58	SW-SM, Well-graded Sand with Silt	6.22%
Sample ID:	B-1 @ 50'	D_{60} =	1.73		% Sand
Source:	SPT	C_C =	1.48	**Specifications**	86.66%
Project:	APN: 191-150-031, 032, 033	C_{U} =	13.06	custom specs 1	% Silt & Clay
Location:	SEC of Arlington Avenue and Monroe Street, Rivers	Liquid Limit=	n/a		7.12%
Boring #:	B-1	Plastic Limit=	n/a	Fineness Modulus	Sample Moisture
Depth:	50'	Plasticity Index=	n/a	3.25	**17.2%**

Coarse Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50		100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		95.8%		
#4	4.75	93.8%	93.8%		

Fines Section		Actual Cumulative	Interpolated Cumulative		
Sieve Size		Percent	Percent	Specs	Specs
US	Metric	Passing	Passing	Max	Min
#4	4.750	93.8%	93.8%		
#8	2.360	72.6%	72.6%		
#10	2.000		65.4%		
#16	1.180	48.8%	48.8%		
#20	0.850		38.5%		
#30	0.600	30.6%	30.6%		
#40	0.425		23.7%		
#50	0.300	18.8%	18.8%		
#60	0.250		16.1%		
#80	0.180		12.4%		
#100	0.150	10.9%	10.9%		
#140	0.106		8.7%		
#170	0.090		7.9%		
#200	0.075	7.1%	7.1%		
#270	0.053				

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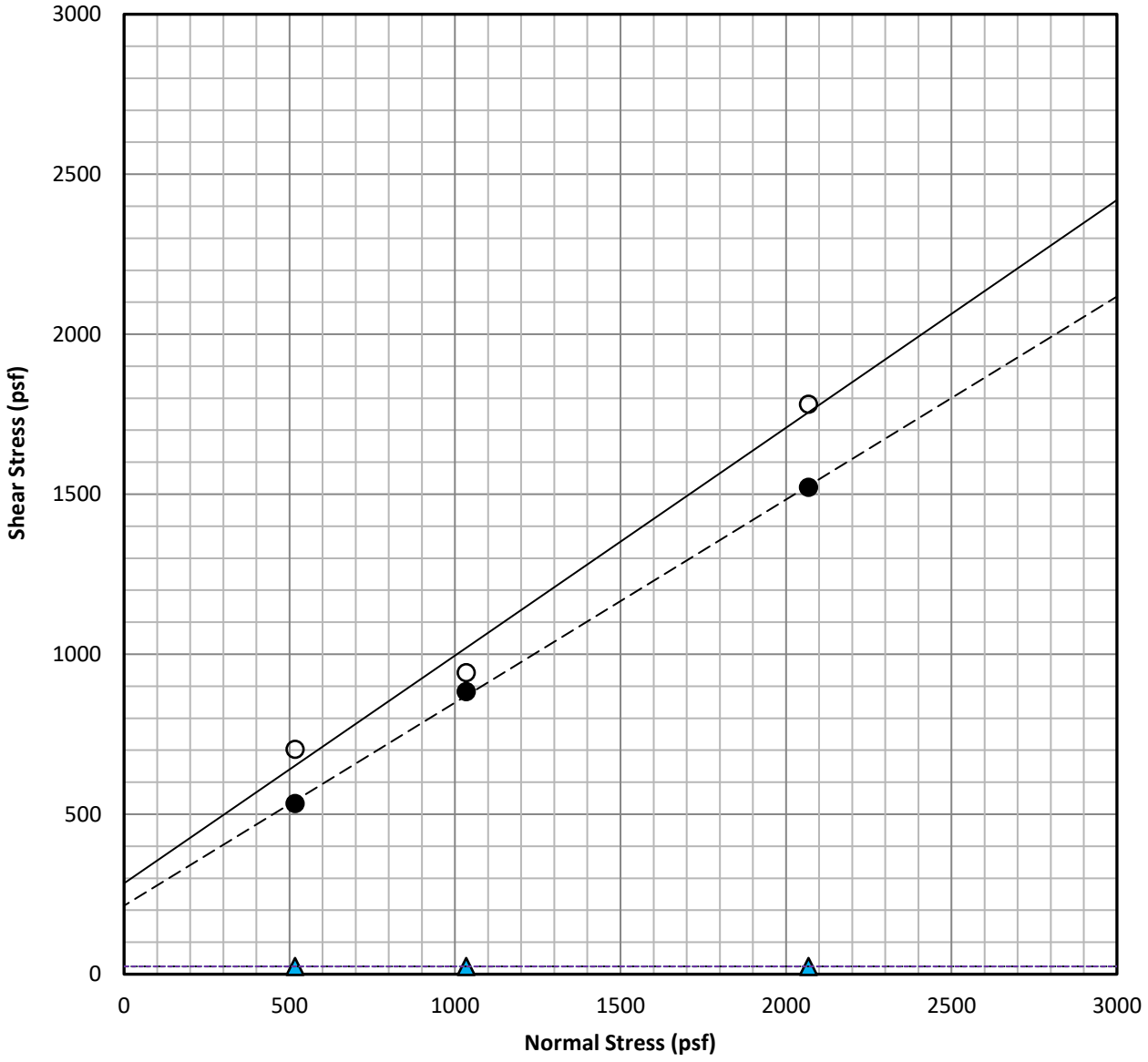
DIRECT SHEAR TEST RESULTS



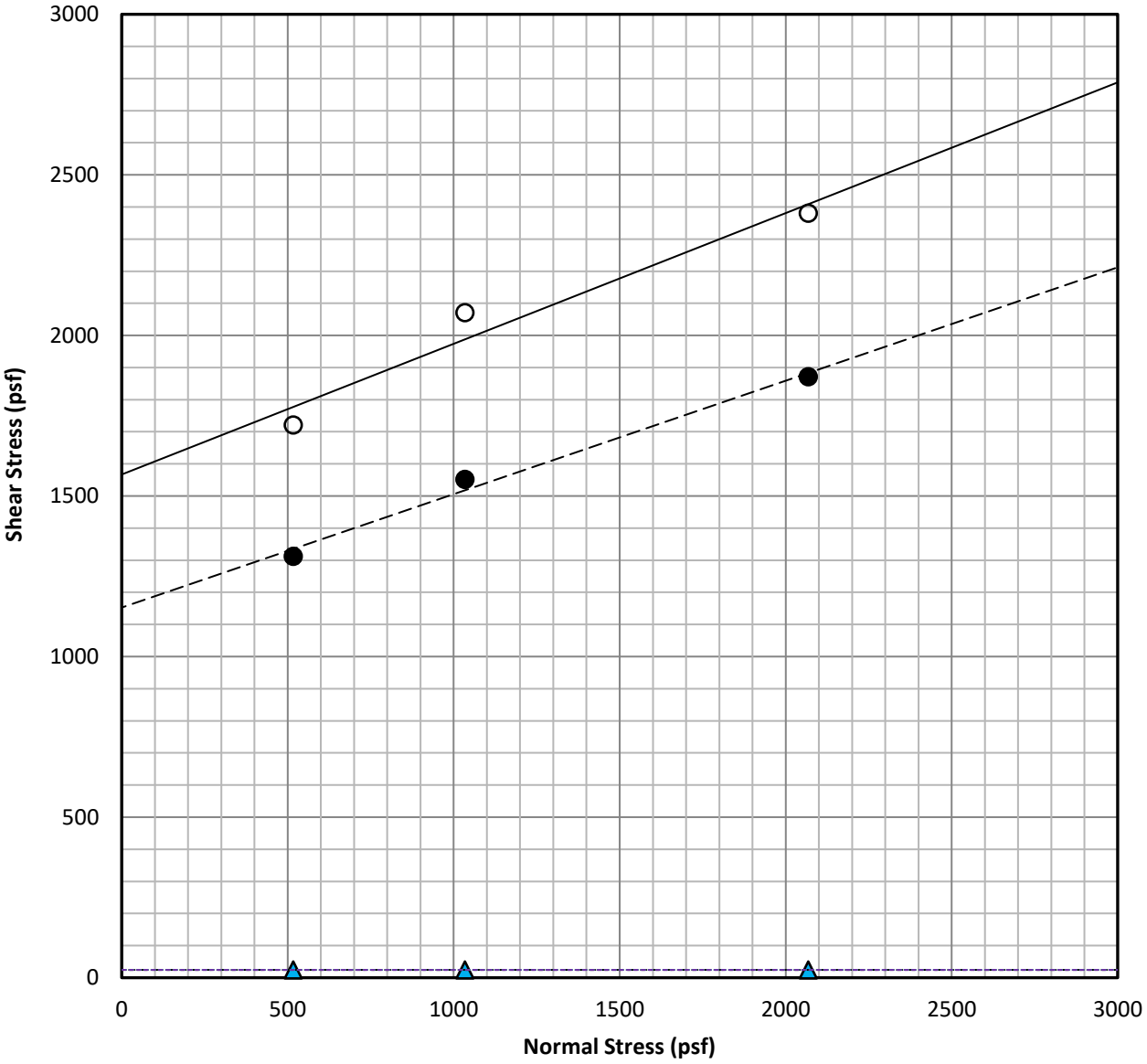
Sample	Symbol	Description	Soil Type [USCS]	Shear Strength	Friction Angle, ϕ [degrees]	Cohesion, c [psf]
B-1 @ 5'	—○—	Clayey Sand	SC	Peak	35.4	284
B-1 @ 5'	— ● —	Clayey Sand	SC	Ultimate	32.4	214
B-1 @ 5'	- - △ - -	Clayey Sand	SC	*Residual	N/A	N/A

Sample Moisture [%]	Saturated Moisture [%]	Dry Unit Weight [pcf]
13.1	24.1	109.0

ASTM D-3080

*Residual results were determined from the lowest re-shear values obtained after 5 re-shears

DIRECT SHEAR TEST RESULTS



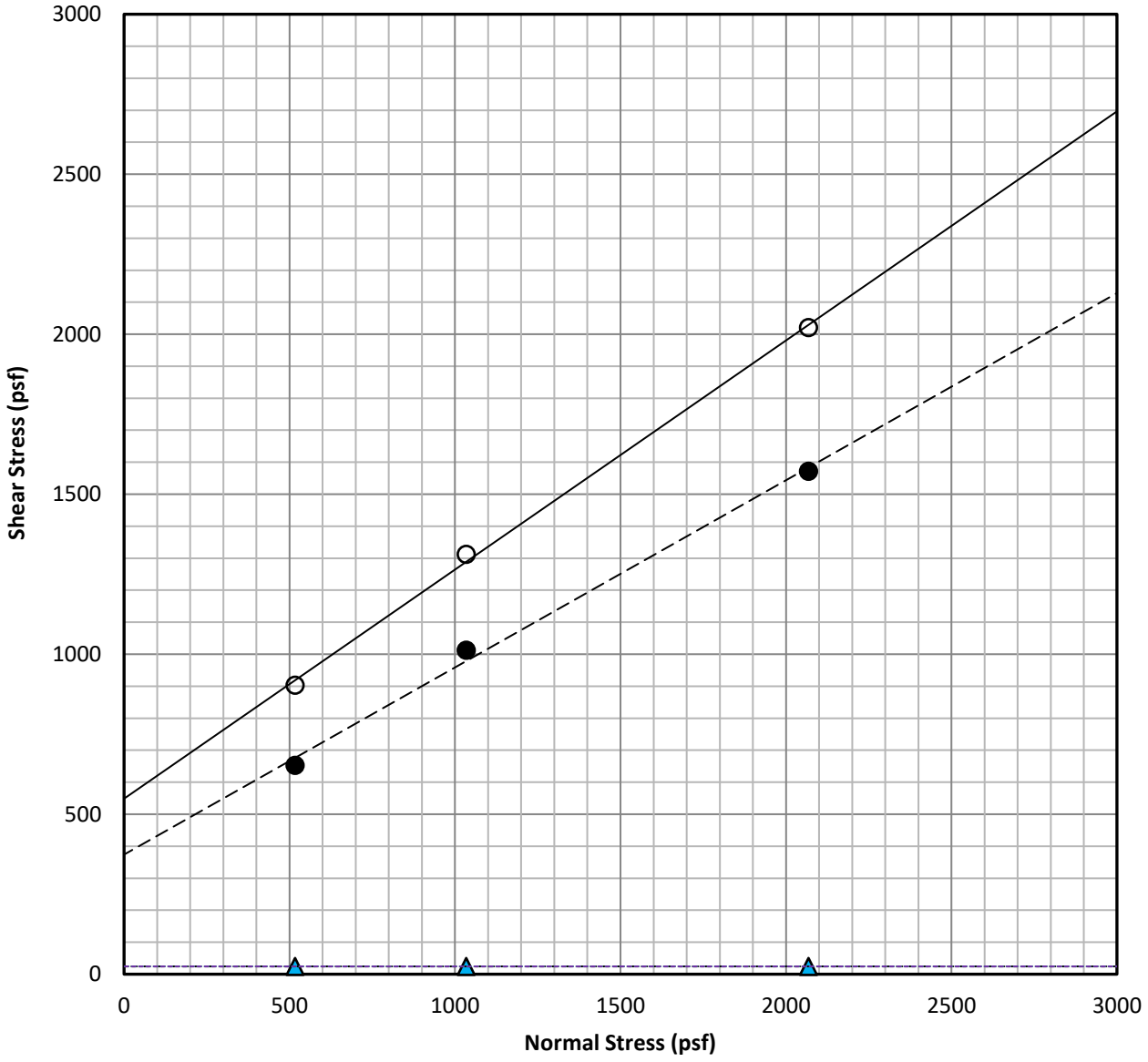
Sample	Symbol	Description	Soil Type [USCS]	Shear Strength	Friction Angle, ϕ [degrees]	Cohesion, c [psf]
B-2 @ 3'	—○—	Sandy Lean Clay	CL	Peak	22.1	1567
B-2 @ 3'	— ● —	Sandy Lean Clay	CL	Ultimate	19.5	1153
B-2 @ 3'	- - △ - -	Sandy Lean Clay	CL	*Residual	N/A	N/A

Sample Moisture [%]	Saturated Moisture [%]	Dry Unit Weight [pcf]
21.8	30.5	102.5

ASTM D-3080

*Residual results were determined from the lowest re-shear values obtained after 5 re-shears

DIRECT SHEAR TEST RESULTS



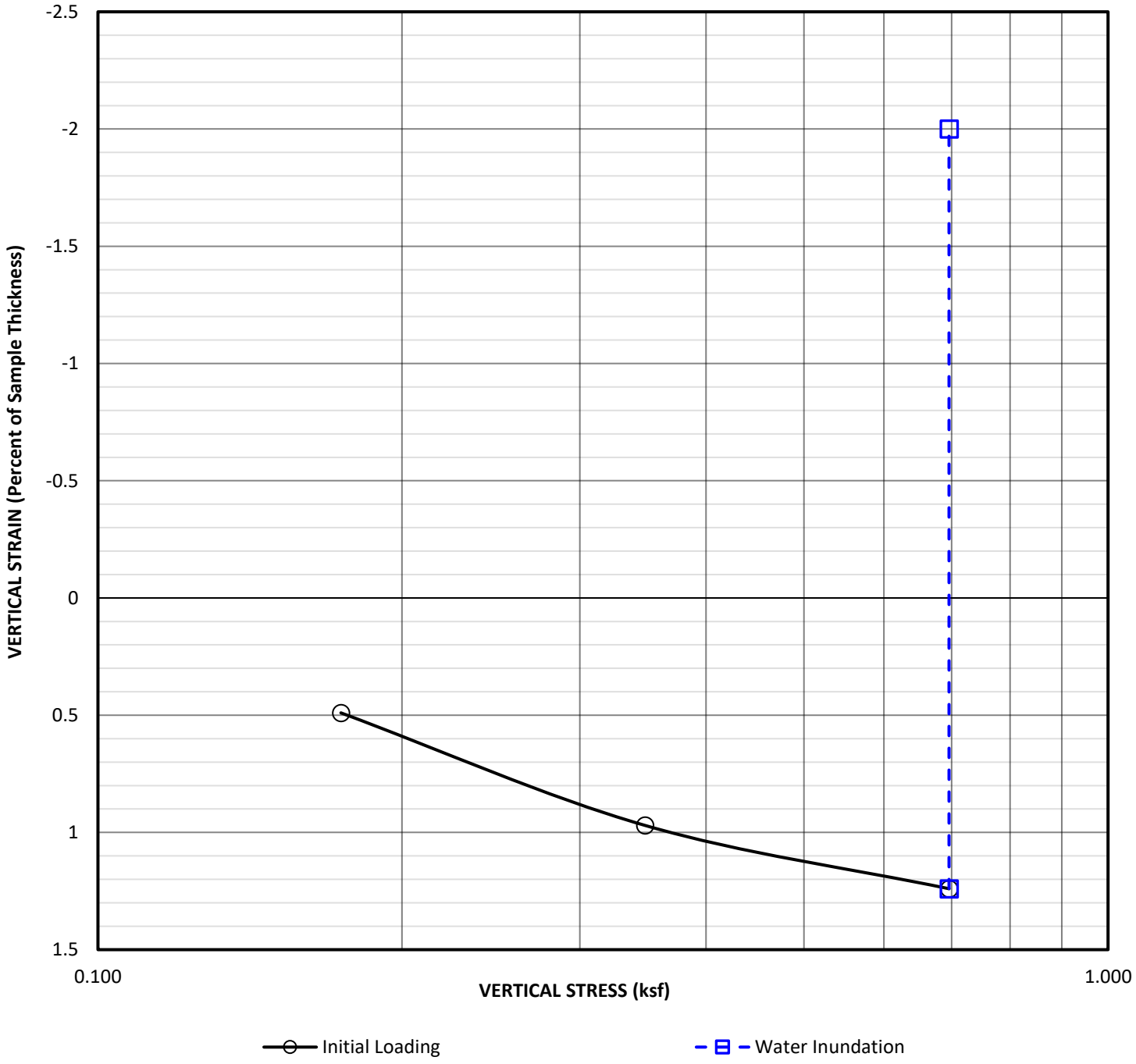
Sample	Symbol	Description	Soil Type [USCS]	Shear Strength	Friction Angle, ϕ [degrees]	Cohesion, c [psf]
B-3 @ 3'	—○—	Clayey Sand	SC	Peak	35.6	549
B-3 @ 3'	— ● —	Clayey Sand	SC	Ultimate	30.3	374
B-3 @ 3'	- - △ - -	Clayey Sand	SC	*Residual	N/A	N/A

Sample Moisture [%]	Saturated Moisture [%]	Dry Unit Weight [pcf]
15.2	18.9	117.7

ASTM D-3080

*Residual results were determined from the lowest re-shear values obtained after 5 re-shears

COLLAPSE TEST REPORT



Sampler Type:	California Ring Sampler			Condition:	Before Test			After Test			
Diameter(in):	2.41	Height(in):	1.0	Water Content:	w_0	12.5	%	w_f	20.0	%	
Overburden Pressure, P_0	0.3	tsf		Void Ratio:	e_0	0.432		e_f	0.461		
Preconsol. Pressure, P_c	N/A	ksf		Saturation:	S_0	75.4	%	S_f	113.1	%	
LL: --	PL: --	PI: --		Dry Density:	γ_d	113.2	pcf	γ_d	111.1	pcf	
% Collapse:	-3.24 %	"No Collapse"		Specific Gravity, G_S		2.6		(Assumed)			
Sample Location:	B1 @ 5'			Hydro-Collapse Test				geomat			
Soil Classification:	Clayey Sand										

EXPANSION INDEX TEST

(ASTM D4829)

BORING NUMBER AND SAMPLE DEPTH:	B-1 @ 0-5'
SOIL TYPE (USCS):	SC
CONFINING PRESSURE (psf):	144
INITIAL MOISTURE CONTENT (%):	9.1
FINAL MOISTURE CONTENT (%):	19.1
DRY DENSITY (pcf):	105.7
EXPANSION INDEX:	15
EXPANSION POTENTIAL:	Very Low
DATE TESTED:	4/21/2020
TESTED BY:	HMN

GeoMat Testing Laboratories, Inc.

Soil Engineering, Environmental Engineering, Materials Testing, Geology

SOLUBLE SULFATE AND CHLORIDE TEST RESULTS

Project Name	APN: 191-150-031, 032 & 033, Riverside, California	**Test Date**	04/22/2020
Project No.	20112-01	**Date Sampled**	04/16/2020
Project Location	APN: 191-150-031, 032 & 033, Riverside, California	**Sampled By**	AN
Location in Structure	B-1 @ 0-5'	**Sample Type**	Bulk
Sampled Classification	SC	**Tested By**	HMN

TESTING INFORMATION

Sample weight before drying	
Sample weight after drying	
Sample Weight Passing No. 10 Sieve	100.0 g
Moisture	

Location	Mixing Ratio	Dilution Factor	Sulfate Reading (ppm)	Sulfate Content (ppm)	Sulfate Content (%)
B-1	3	1	55	165	0.0165
			Average		

Chloride Reading (ppm)	Chloride Content (ppm)	Chloride Content (%)
Average		

pH	
Average	

ACI 318-19 Table 19.3.2.1 - Requirements for Concrete by Exposure Class

Exposure Class		Water-Soluble Sulfate (%)	Maximum *w/cm*	Minimum f'*c* (psi)	Cementitous Material (Types)			Calcium Chloride Admixture
					ASTM C150-	ASTM C595	ASTM C1157	
S0		<0.10	N/A	2500	No Type Restriction	No Type Restriction	No Type Restriction	No Restriction
S1		0.10 to 0.20	0.50	4000	II	Type IP, IS, or IT with (MS) Designation	MS	No Restriction
S2		0.20 to 2.00	0.45	4500	V	Type IP, IS, or IT with (HS) Designation	HS	Not Permitted
S3	Option 1	>2.00	0.45	4500	V + Pozzolan or Slag Cement	Type IP, IS, or IT with (HS) Designation + Pozzolan or Slag Cement	HS + Pozzolan or Slag Cement	Not Permitted
	Option 2	>2.00	0.40	5000	V	Types with (HS) designation	HS	Not Permitted

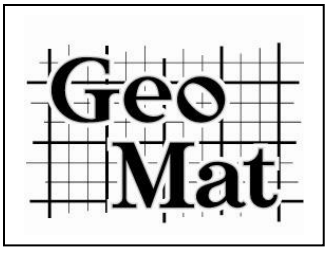
Exposure Class	Maximum *w/cm*	Minimum f'*c* (psi)	Maximum Water-Soluble Chloride ion (Cl^-) Content in Concrete, Percent by Wight of Cement		Additional Provisions
			Nonprestressed Concrete	Prestressed Concrete	
C0	N/A	2500	1.00	0.06	None
C1	N/A	2500	0.30	0.06	None
C2	0.40	5000	0.15	0.06	Concrete Cover

Caltrans classifies a site as corrosive to structural concrete as an area where soil and/or water contains >500pp chloride, >2000ppm sulfate, or has a pH <5.5. A minimum resistivity of less than 1000 ohm-cm indicates the potential for corrosive environment requiring testing for the above criteria.

The information in this form is not intended for corrosion engineering design. If corrosion is critical, a corrosion specialist should be contacted to provide further recommendations.

9980 Indiana Avenue ● Suite 14 ● Riverside ● California ● 92503 ● Phone (951) 688-5400 ● Fax (951) 688-5200
www.geomatlabs.com, contact: e-mail: info@geomatlabs.com

APPENDIX D



OSHPD

Latitude, Longitude: 33.945495, -117.444606



Date	4/23/2020, 10:54:52 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S_S	1.5	MCE_R ground motion. (for 0.2 second period)
S_1	0.566	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.8	Site-modified spectral acceleration value
S_{M1}	0.812	Site-modified spectral acceleration value
S_{DS}	1.2	Numeric seismic design value at 0.2 second SA
S_{D1}	0.541	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	1.434	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.556	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.644	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.566	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.613	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.946	Mapped value of the risk coefficient at short periods
C_{R1}	0.923	Mapped value of the risk coefficient at a period of 1 s

DISCLAIMER

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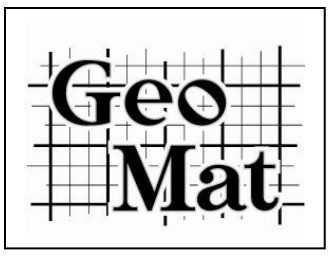
APPENDIX E



LIQUEFACTION EVALUATION AND ANALYSIS

Liquefaction analysis in this spreadsheet is conducted in accordance with the requirements of Special Publication 117A (CDMG, 2008), and currently accepted practice (SCEC, 1997).
The liquefaction potential is evaluated using the empirical method described in "Soil Liquefaction During Earthquakes" I.M. Idriss & R.W. Boulanger, EERI MNO-12, 2008
Dynamic unsaturated settlement is estimated per the "Procedues to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils," by Pradel, JGGE, Vol. 124, No.4, ASCE, (April 1998)

Project Name	SEC Arlington Ave and Monroe Street
Project Location	APN: 191-150-031, 032 & 033, Riverside, CA
Project Number	20112-01
Boring No.	B-1
Date Drilled	4/16/2020

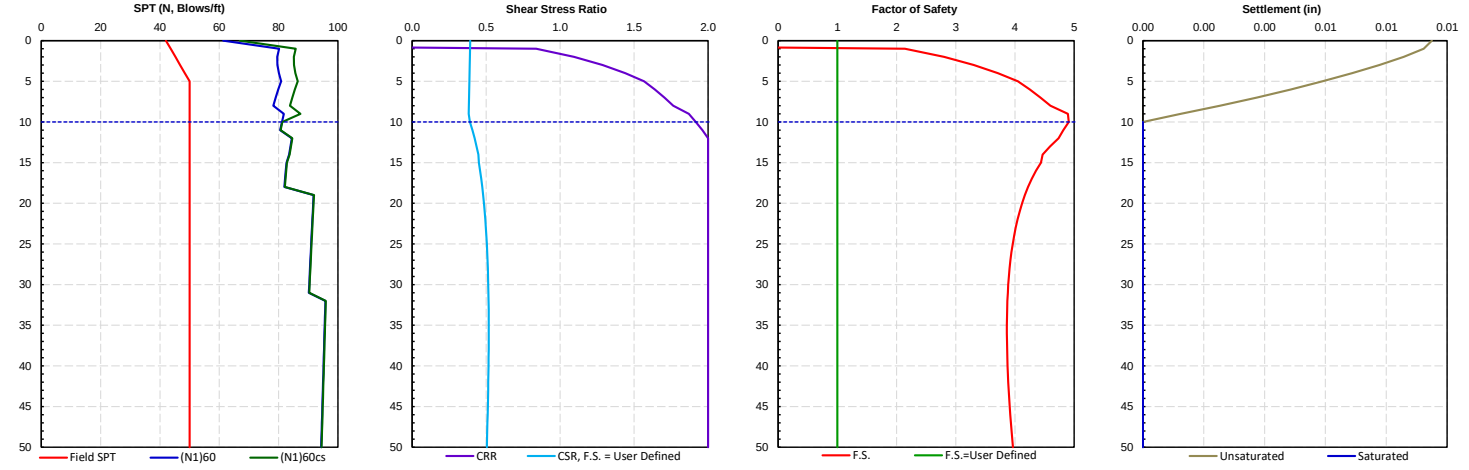
Design Earthquake Magnitude	7.3	
MCEG Design Acceleration (PGAm)	0.6	(g)
Historic High Depth to Groundwater	10	(ft)
Depth to Groundwater at Time of Drilling	15	(ft)
Borehole Diameter	8	(in)
Total Depth of Borehole	50	(ft)
Total Unit Weight of Soil (Above GW)	120	(pcf)
Total Unit Weight of Soil (Below GW)	130	(pcf)
Energy Correction (Hammer Energy Ratio)	1.3	
User Defined Factor of Safety	1	

DEPTH (ft)	LAYER (ft)	USCS	SPT	FINES	LIQ?	SETTLEMENT DRY (in)	SETTLEMENT LIQ (in)
0	(0-5)	SC	42	43	Liquefiable	0.00	0.00
5	(5-10)	SC	50	43	Liquefiable	0.01	0.00
10	(10-15)	SWSM	50	7	Liquefiable	0.00	0.00
15	(15-20)	SWSM	50	7	Liquefiable	0.00	0.00
20	(20-25)	SWSM	50	7	Liquefiable	0.00	0.00
25	(25-30)	SWSM	50	7	Liquefiable	0.00	0.00
30	(30-35)	SWSM	50	7	Liquefiable	0.00	0.00
35	(35-40)	SWSM	50	7	Liquefiable	0.00	0.00
40	(40-45)	SWSM	50	7	Liquefiable	0.00	0.00
45	(45-50)	SWSM	50	7	Liquefiable	0.00	0.00
50	(50-51)	SWSM	50	7	Liquefiable	0.00	0.00
						0.01	0.00

TOTAL SETTLEMENT = 0.01 (in)

Notes:
(1) Energy Correction for N_{90} of automatic hammer to standard N_{60}
(2) Borehole Diameter Correction (Skempton, 1986)
(3) Correction of split-spoon sampler with room for liners, but liners are absent (Seed, et al., 1984, 2001)
(4) Overburden Correction, Calculated by Eq. 39 (Boulanger and Idriss, 2008)
(5) Rod Length Correction for Samplers <10m in depth
(6) N-value corrected for energy, borehole diameter, sampler with absent liners, rod length, and overburden
(7) N-value corrected for fines content per Eqs. 75 and 76 (Boulanger and Idriss, 2008)
(8) Stress Reduction Coefficient calculated by Eq. 22 (Boulanger and Idriss, 2008)
(9) Magnitude Scaling Factor calculated by Eqs. A.8 & A.10 (Boulanger and Idriss, 2014)
(10) Overburden Correction Factor calculated by Eq. 54 (Boulanger and Idriss, 2008)
(11) Calculated by Eq. 70 (Boulanger and Idriss, 2008)
(12) Calculated by Eq. 72 (Boulanger and Idriss, 2008)
(13) Calculated by Eq. 25 (Boulanger and Idriss, 2008)
(14) Calculated by Eq. 86 (Boulanger and Idriss, 2008)
(15) Calculated by Eq. 93 (Boulanger and Idriss, 2008)
(16) Calculated by Eqs. 90, 91, and 92 (Boulanger and Idriss, 2008)
(17) Volumeteric Strain Induced in a Liquefiable Layer, Calculated by Eq. 96 (Boulanger and Idriss, 2008) (Strain N/A if Factor of Safety against Liquefaction > 1.3)

Layer No.	Depth to Top of Layer (ft)	Depth to Bottom of Layer (ft)	Soil Type (USCS)	Uncorrected SPT N-Value	Unit Weight of Soil (pcf)	Fines Content (%)	Energy Correction (1)	Depth to Soil Layer Midpoint (ft)	CB (2)	CS (3)	CN (4)	Rod Length Correction (5)	(N1)60 (6)	(N1)60CS (7)	Overburden Stress (σ) (psf)	Eff. Overburden Stress (Historical Water) (σ') (psf)	Eff. Overburden Stress (Current Water) (σ') (psf)	Stress Reduction Coefficient (rd) (8)	MSF (9)	Ks (10)	Cyclic Resistance Ratio (M=7.5) (11)	Cyclic Resistance Ratio (M=Design Magnitude) (12)	Cyclic Stress Ratio Induced by Design Earthquake (13)	Factor of Safety	Comments	Limiting Shear Strain γlim (14)	Parameter Rd (15)	Maximum Shear Strain γmax (16)	Height of Layers	Vertical Reconsolidation Strain εv (17)	Total Deformation of Layer (in)	Cumulative Settlement (in)
1	0	1	SC	42.0	120	43	1.3	0.50	1.15	1.30	1.00	0.75	61.3	66.9	60	60	60	1.01	1.08	-2.28	2.00	-4.93	0.39	-12.56	Liquefiable	0.00	-3.02	0.00	1.00	0.000	0.000	0.009
2	1	2	SC	43.6	120	43	1.3	1.50	1.15	1.30	1.26	0.75	80.2	85.8	180	180	180	1.00	1.08	0.39	2.00	0.84	0.39	2.14	Liquefiable	0.00	-4.73	0.00	1.00	>1.3	0.001	0.009
3	2	3	SC	45.2	120	43	1.3	2.50	1.15	1.30	1.21	0.75	79.5	85.1	300	300	300	1.00	1.08	0.51	2.00	1.09	0.39	2.80	Liquefiable	0.00	-4.67	0.00	1.00	>1.3	0.001	0.009
4	3	4	SC	46.8	120	43	1.3	3.50	1.15	1.30	1.17	0.75	79.6	85.2	420	420	420	1.00	1.08	0.59	2.00	1.29	0.39	3.30	Liquefiable	0.00	-4.67	0.00	1.00	>1.3	0.001	0.008
5	4	5	SC	48.4	120	43	1.3	4.50	1.15	1.30	1.14	0.75	80.1	85.7	540	540	540	1.00	1.08	0.67	2.00	1.44	0.39	3.71	Liquefiable	0.00	-4.72	0.00	1.00	>1.3	0.001	0.007
6	5	6	SC	50.0	120	43	1.3	5.50	1.15	1.30	1.11	0.75	80.8	86.4	660	660	660	0.99	1.08	0.72	2.00	1.57	0.39	4.05	Liquefiable	0.00	-4.79	0.00	1.00	>1.3	0.001	0.006
7	6	7	SC	50.0	120	43	1.3	6.50	1.15	1.30	1.10	0.75	79.9	85.5	780	780	780	0.99	1.08	0.76	2.00	1.64	0.39	4.25	Liquefiable	0.00	-4.70	0.00	1.00	>1.3	0.001	0.005
8	7	8	SC	50.0	120	43	1.3	7.50	1.15	1.30	1.08	0.75	79.0	84.6	900	900	900	0.99	1.08	0.79	2.00	1.70	0.38	4.43	Liquefiable	0.00	-4.62	0.00	1.00	>1.3	0.001	0.004
9	8	9	SC	50.0	120	43	1.3	8.50	1.15	1.30	1.07	0.75	78.2	83.8	1020	1020	1020	0.98	1.08	0.82	2.00	1.76	0.38	4.60	Liquefiable	0.00	-4.55	0.00	1.00	>1.3	0.001	0.003
10	9	10	SC	50.0	120	43	1.3	9.50	1.15	1.30	1.05	0.80	81.8	87.4	1140	1140	1140	0.98	1.08	0.86	2.00	1.87	0.38	4.89	Liquefiable	0.00	-4.87	0.00	1.00	>1.3	0.001	0.001
11	10	11	SWSM	50.0	120	7	1.3	10.50	1.15	1.30	1.04	0.80	81.1	81.3	1260	1229	1260	0.98	1.08	0.89	2.00	1.92	0.39	4.91	Liquefiable	0.00	-4.31	0.00	1.00	>1.3	0.000	0.000
12	11	12	SWSM	50.0	120	7	1.3	11.50	1.15	1.30	1.04	0.80	80.5	80.7	1380	1286	1380	0.97	1.08	0.91	2.00	1.96	0.41	4.82	Liquefiable	0.00	-4.26	0.00	1.00	>1.3	0.000	0.000
13	12	13	SWSM	50.0	120	7	1.3	12.50	1.15	1.30	1.02	0.85	84.5	84.6	1500	1344	1500	0.97	1.08	0.94	2.00	2.00	0.42	4.74	Liquefiable	0.00	-4.62	0.00	1.00	>1.3	0.000	0.000
14	13	14	SWSM	50.0	120	7	1.3	13.50	1.15	1.30	1.02	0.85	84.0	84.1	1620	1402	1620	0.97	1.08	0.95	2.00	2.00	0.44	4.59	Liquefiable	0.00	-4.58	0.00	1.00	>1.3	0.000	0.000
15	14	15	SWSM	50.0	120	7	1.3	14.50	1.15	1.30	1.01	0.85	83.5	83.7	1740	1459	1740	0.96	1.08	0.97	2.00	2.00	0.45	4.47	Liquefiable	0.00	-4.53	0.00	1.00	>1.3	0.000	0.000
16	15	16	SWSM	50.0	130	7	1.3	15.50	1.15	1.30	1.00	0.85	82.7	82.8	2015	1672	1984	0.96	1.08	1.00	2.00	2.00	0.45	4.44	Liquefiable	0.00	-4.45	0.00	1.00	>1.3	0.000	0.000
17	16	17	SWSM	50.0	130	7	1.3	16.50	1.15	1.30	1.00	0.85	82.4	82.6	2145	1739	2051	0.95	1.08	1.01	2.00	2.00	0.46	4.36	Liquefiable	0.00	-4.43	0.00	1.00	>1.3	0.000	0.000
18	17	18	SWSM	50.0	130	7	1.3	17.50	1.15	1.30	0.99	0.85	82.2	82.3	2275	1807	2119	0.95	1.08	1.01	2.00	2.00	0.47	4.28	Liquefiable	0.00	-4.41	0.00	1.00	>1.3	0.000	0.000
19	18	19	SWSM	50.0	130	7	1.3	18.50	1.15	1.30	0.99	0.85	81.9	82.1	2405	1875	2187	0.95	1.08	1.02	2.00	2.00	0.47	4.22	Liquefiable	0.00	-4.39	0.00	1.00	>1.3	0.000	0.000
20	19	20	SWSM	50.0	130	7	1.3	19.50	1.15	1.30	0.99	0.95	91.8	91.9	2535	1942	2254	0.94	1.08	1.02	2.00	2.00	0.48	4.17	Liquefiable	0.00	-5.30	0.00	1.00	>1.3	0.000	0.000
21	20	21	SWSM	50.0	130	7	1.3	20.50	1.15	1.30	0.99	0.95	91.6	91.8	2665	2010	2322	0.94	1.08	1.03	2.00	2.00	0.49	4.12	Liquefiable	0.00	-5.29	0.00	1.00	>1.3	0.000	0.000
22	21	22	SWSM	50.0	130	7	1.3	21.50	1.15	1.30	0.99	0.95	91.5	91.6	2795	2077	2389	0.93	1.08	1.03	2.00	2.00	0.49	4.08	Liquefiable	0.00	-5.28	0.00	1.00	>1.3	0.000	0.000
23	22	23	SWSM	50.0	130	7	1.3	22.50	1.15	1.30	0.99	0.95	91.4	91.5	2925	2145	2457	0.93	1.08	1.04	2.00	2.00	0.49	4.04	Liquefiable	0.00	-5.26	0.00	1.00	>1.3	0.000	0.000
24	23	24	SWSM	50.0	130	7	1.3	23.50	1.15	1.30	0.99	0.95	91.2	91.4	3055	2213	2525	0.93	1.08	1.04	2.00	2.00	0.50	4.01	Liquefiable	0.00	-5.25	0.00	1.00	>1.3	0.000	0.000
25	24	25	SWSM	50.0	130	7	1.3	24.50	1.15	1.30	0.99	0.95	91.1	91.2	3185	2280	2592	0.92	1.08	1.05	2.00	2.00	0.50	3.99	Liquefiable	0.00	-5.24	0.00	1.00	>1.3	0.000	0.000
26	25	26	SWSM	50.0	130	7	1.3	25.50	1.15	1.30	0.99	0.95	91.0	91.1	3315	2348	2660	0.92	1.08	1.05	2.00	2.00	0.50	3.96	Liquefiable	0.00	-5.23	0.00	1.00	>1.3	0.000	0.000
27	26	27	SWSM	50.0	130	7	1.3	26.50	1.15	1.30	0.98	0.95	90.8	91.0	3445	2415	2727	0.91	1.08	1.06	2.00	2.00	0.51	3.94	Liquefiable	0.00	-5.21	0.00	1.00	>1.3	0.000	0.000
28	27	28	SWSM	50.0	130	7	1.3	27.50	1.15	1.30	0.98	0.95	90.7	90.8	3575	2483	2795	0.91	1.08	1.06	2.00	2.00	0.51	3.92	Liquefiable	0.00	-5.20	0.00	1.00	>1.3	0.000	0.000
29	28	29	SWSM	50.0	130	7	1.3	28.50	1.15	1.30	0.98	0.95	90.6	90.7	3705	2551	2863	0.90	1.08	1.07	2.00	2.00	0.51	3.91	Liquefiable	0.00	-5.19	0.00	1.00	>1.3	0.000	0.000
30	29	30	SWSM	50.0	130	7	1.3	29.50	1.15	1.30	0.98	0.95	90.4	90.6	3835	2618	2930	0.90	1.08	1.07	2.00	2.00	0.51	3.90	Liquefiable	0.00	-5.18	0.00	1.00	>1.3	0.000	0.000
31	30	31	SWSM	50.0	130	7	1.3	30.50	1.15	1.30	0.98	0.95	90.3	90.5	3965	2686	2998	0.89	1.08	1.08	2.00	2.00	0.51	3.89	Liquefiable	0.00	-5.16	0.00	1.00	>1.3	0.000	0.000
32	31	32	SWSM	50.0	130	7	1.3	31.50	1.15	1.30	0.98	0.95	90.2	90.3	4095	2753	3065	0.89	1.08	1.08	2.00	2.00	0.52	3.88	Liquefiable	0.00	-5.15	0.00	1.00	>1.3	0.000	0.000
33	32	33	SWSM	50.0	130	7	1.3	32.50	1.15	1.30	0.99	1.00	95.8	95.9	4225	2821	3133	0.88	1.08	1.07	2.00	2.00	0.52	3.87	Liquefiable	0.00	-5.68	0.00	1.00	>1.3	0.000	0.000
34	33	34	SWSM	50.0	130	7	1.3	33.50	1.15	1.30	0.98	1.00	95.7	95.8	4355	2889	3201	0.88	1.08	1.08	2.00	2.00	0.52	3.87	Liquefiable	0.00	-5.67	0.00	1.00	>1.3	0.000	0.000
35	34	35	SWSM	50.0	130	7	1.3	34.50	1.15	1.30	0.98	1.00	95.6	95.7	4485	2956	3268	0.87	1.08	1.08	2.00	2.00	0.52	3.87	Liquefiable	0.00	-5.66	0.00	1.00	>1.3	0.000	0.000
36	35	36	SWSM	50.0	130	7	1.3	35.50	1.15	1.30	0.98	1.00	95.5	95.7	4615	3024	3336	0.87	1.08	1.08	2.00	2.00	0.52	3.86	Liquefiable	0.00	-5.66	0.00	1.00	>1.3	0.000	0.000
37	36	37	SWSM	50.0	130	7	1.3	36.50	1.15	1.30	0.98	1.00	95.5	95.6	4745	3091	3403	0.86	1.08	1.09	2.00	2.00	0.52	3.86	Liquefiable	0.00	-5.65	0.00	1.00	>1.3	0.000	0.000
38	37	38	SWSM	50.0	130	7	1.3	37.50	1.15	1.30	0.98	1.00	95.4	95.5	4875	3159	3471	0.86	1.08	1.09	2.00	2.00	0.52	3.87	Liquefiable	0.00	-5.64	0.00	1.00	>1.3	0.000	0.000
39	38	39	SWSM	50.0	130	7	1.3	38.50	1.15	1.30	0.98	1.00	95.3	95.4	5005	3227	3539	0.85	1.08	1.10	2.00	2.00	0.52	3.87	Liquefiable	0.00	-5.63	0.00	1.00	>1.3	0.000	0.000
40	39	40	SWSM	50.0	130	7	1.3	39.50	1.15	1.30	0.98	1.00	95.2	95.3	5135	3294	3606	0.85	1.08	1.10	2.00	2.00	0.52	3.87	Liquefiable	0.00	-5.63	0.00	1.00	>1.3	0.000	0.000
41	40	41	SWSM	50.0	130	7	1.3	40.50	1.15	1.30	0.98	1.00	95.1	95.3	5265	3362	3674	0.84	1.08	1.10	2.00	2.00	0.52	3.88	Liquefiable	0.00	-5.62	0.00	1.00	>1.3	0.000	0.000
42	41	42	SWSM	50.0	130	7	1.3	41.50	1.15	1.30	0.98	1.00	95.1	95.2	5395	3429	3741	0.84	1.08	1.10	2.00	2.00	0.52	3.88	Liquefiable	0.00	-5.61	0.00	1.00	>1.3	0.000	0.000
43	42	43	SWSM	50.0	130	7	1.3	42.50	1.15	1.30	0.98	1.00	95.0	95.1	5525	3497	3809	0.83	1.08	1.10	2.00	2.00	0.51	3.89	Liquefiable	0.00	-5.60	0.00	1.00	>1.3	0.000	0.000
44	43	44	SWSM	50.0	130	7	1.3	43.50	1.15	1.30	0.98	1.00	94.9	95.0	5655	3565	3877	0.83	1.08	1.10	2.00	2.00	0.51	3.89	Liquefiable	0.00	-5.60	0.00	1.00	>1.3	0.000	0.000
45	44	45	SWSM	50.0	130	7	1.3	44.50	1.15	1.30	0.98	1.00	94.8	95.0	5785	3632	3944	0.83	1.08	1.10	2.00	2.00	0.51	3.90	Liquefiable	0.00	-5.59	0.00	1.00	>1.3	0.000	0.000
46	45	46	SWSM	50.0	130	7	1.3	45.50	1.15	1.30	0.97	1.00	94.7	94.9	5915	3700	4012	0.82	1.08	1.10	2.00	2.00	0.51	3.91	Liquefiable	0.00	-5.58	0.00	1.00	>1.3	0.000	0.000
47	46	47	SWSM	50.0	130	7	1.3	46.50	1.15	1.30	0.97	1.00	94.7	94.8	6045	3767	4079	0.82	1.08	1.10	2.00	2.00	0.51	3.92	Liquefiable	0.00	-5.57	0.00	1.00	>1.3	0.000	0.000
48	47	48	SWSM	50.0	130	7	1.3	47.50	1.15	1.30	0.97	1.00	94.6	94.7	6175	3835	4147	0.81	1.08	1.10	2.00	2.00	0.51	3.93	Liquefiable	0.00	-5.57	0.00	1.00	>1.3	0.000	0.000
49	48	49	SWSM	50.0	130	7	1.3	48.50	1.15	1.30	0.97	1.00	94.5	94.6	6305	3903	4215	0.81	1.08	1.10	2.00	2.00	0.51	3.94	Liquefiable	0.00	-5.56	0.00	1.00	>1.3	0.000	0.000
50	49	50	SWSM	50.0	130	7	1.3	49.50	1.15	1.30	0.97	1.00	94.4	94.6	6435	3970	4282	0.80	1.08	1.10	2.00	2.00	0.51	3.95	Liquefiable	0.00	-5.55	0.00	1.00	>1.3	0.000	0.000
51	50	51	SWSM	50.0	130	7	1.3	50.50	1.15	1.30	0.97	1.00	94.3	94.5	6565	4038	4350	0.80	1.08	1.10	2.00	2.00	0.50	3.97	Liquefiable	0.00	-5.54	0.00	1.00	>1.3	0.000	0.000



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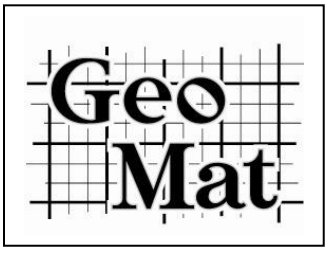
APPENDIX F



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GENERAL

The guidelines contained herein and the standard details attached hereto represent this firm's standard recommendation for grading and other associated operations on construction projects. These guidelines should be considered a portion of the project specifications.
All plates attached hereto shall be considered as part of these guidelines.
The Contractor should not vary from these guidelines without prior recommendation by the Geotechnical Consultant and the approval of the Client or his authorized representative. Recommendation by the Geotechnical Consultant and/or Client should not be considered to preclude requirements for the approval by the controlling agency prior to the execution of any changes.
These Standard Grading Guidelines and Standard Details may be modified and/or superseded by recommendations contained in the text of the preliminary Geotechnical Report and/or subsequent reports.
If disputes arise out of the interpretation of these grading guidelines or standard details, the Geotechnical Consultant shall provide the governing interpretation.

DEFINITION OF TERMS

ALLUVIUM
Unconsolidated soil deposits resulting from flow of water, including sediments deposited in river beds, canyons, flood plains, lakes, fans and estuaries.
AS-GRADED (AS-BUILT): The surface and subsurface conditions at completion of grading.
BACKCUT: A temporary construction slope at the rear of earth retaining structures such as buttresses, shear keys, stabilization fills or retaining walls.
BACKDRAIN: Generally a pipe and gravel or similar drainage system placed behind earth retaining structures such buttresses, stabilization fills, and retaining walls.
BEDROCK: Relatively undisturbed formational rock, more or less solid, either at the surface or beneath superficial deposits of soil.
BENCH: A relatively level step and near vertical rise excavated into sloping ground on which fill is to be placed.
BORROW (Import): Any fill material hauled to the project site from off-site areas.
BUTTRESS FILL::A fill mass, the configuration of which is designed by engineering calculations to retain slope conditions containing adverse geologic features. A buttress is generally specified by minimum key width and depth and by maximum backcut angle. A buttress normally contains a back-drainage system.
CIVIL ENGINEER: The Registered Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topographic conditions.
CLIENT: The Developer or his authorized representative who is chiefly in charge of the project. He shall have the responsibility of reviewing the findings and recommendations made by the Geotechnical Consultant and shall authorize the Contractor and/or other consultants to perform work and/or provide services.
COLLUVIUM: Generally loose deposits usually found near the base of slopes and brought there chiefly by gravity through slow continuous downhill creep (also see Slope Wash).
COMPACTION : Densification of man-placed fill by mechanical means.
CONTRACTOR – A person or company under contract or otherwise retained by the Client to perform demolition, grading and other site improvements.
DEBRIS: All products of clearing, grubbing, demolition, and contaminated soil materials unsuitable for reuse as compacted fill, and/or any other material so designated by the Geotechnical Consultant.
ENGINEERING GEOLOGIST: A Geologist holding a valid certificate of registration in the specialty of Engineering Geology.
ENGINEERED FILL: A fill of which the Geotechnical Consultant or his representative, during grading, has made sufficient tests to enable him to conclude that the fill has been placed in substantial compliance with the recommendations of the Geotechnical Consultant and the governing agency requirements.
EROSION: The wearing away of ground surface as a result of the movement of wind, water, and/or ice.
EXCAVATION: The mechanical removal of earth materials.
EXISTING GRADE: The ground surface configuration prior to grading.
FILL: Any deposits of soil, rock, soil-rock blends or other similar materials placed by man.
FINISH GRADE: The ground surface configuration at which time the surface elevations conform to the approved plan.

GEOFABRIC: Any engineering textile utilized in geotechnical applications including subgrade stabilization and filtering.
GEOLOGIST: A representative of the Geotechnical Consultant educated and trained in the field of geology.
GEOTECHNICAL CONSULTANT: The Geotechnical Engineering and Engineering Geology consulting firm retained to provide technical services for the project. For the purpose of these specifications, observations by the Geotechnical Consultant include observations by the Soil Engineer, Geotechnical Engineer, Engineering Geologist and those performed by persons employed by and responsible to the Geotechnical Consultants.
GEOTECHNICAL ENGINEER: A licensed Geotechnical Engineer or Civil Engineer who applies scientific methods, engineering principles and professional experience to the acquisition, interpretation and use of knowledge of materials of the earth's crust for the evaluation of engineering problems. Geotechnical Engineering encompasses many of the engineering aspects of soil mechanics, rock mechanics, geology, geophysics, hydrology and related sciences.
GRADING: Any operation consisting of excavation, filling or combinations thereof and associated operations.
LANDSIDE DEBRIS: Material, generally porous and of low density, produced from instability of natural or man-made slopes.
MAXIMUM DENSITY: Standard laboratory test for maximum dry unit weight. Unless otherwise specified, the maximum dry unity weight shall be determined in accordance with ASTM Method of Test D 1557-91.
OPTIMUM MOISTURE – Soil moisture content at the test maximum density.
RELATIVE COMPACTION: The degree of compaction (expressed as a percentage) of dry unit weight of a material as compared to the maximum dry unit weight of the material.
ROUGH GRADE: The ground surface configuration at which time the surface elevations approximately conform to the approved plan.
SITE: The particular parcel of land where grading is being performed.
SHEAR KEY: Similar to buttress, however, it is generally constructed by excavating a slot within a natural slope, in order to stabilize the upper portion of the slope without grading encroaching into the lower portion of the slope.
SLOPE: An inclined ground surface, the steepness of which is generally specified as a ration of horizontal:vertical (e.g., 2:1)
SLOPE WASH: Soil and/or rock material that has been transported down a slope by action of gravity assisted by runoff water not confined by channels (also see Colluvium).
SOIL: Naturally occurring deposits of sand, silt, clay, etc., or combinations thereof.
SOIL ENGINEER: Licensed Geotechnical Engineer or Civil Engineer experienced in soil mechanics (also see Geotechnical Engineer).
STABILIZATION FILL: A fill mass, the configuration of which is typically related to slope height and specified by the standards of practice for enhancing the stability of locally adverse conditions. A stabilization fill is normally specified by minimum key width and depth and by maximum backcut angle. A stabilization fill may or may not have a backdrainage system specified.
SUBDRAIN: Generally a pipe and gravel or similar drainage system placed beneath a fill in the alignment of canyons or formed drainage channels.
SLOUGH: Loose, non-compacted fill material generated during grading operations.
TAILINGS: Non-engineered fill which accumulates on or adjacent to equipment haul-roads.
TERRACE: Relatively level step constructed in the face of a graded slope surface for drainage control and maintenance purposes.
TOPSOIL: The presumable fertile upper zone of soil, which is usually darker in color and loose.
WINDROW: A string of large rocks buried within engineered fill in accordance with guidelines set forth by the Geotechnical Consultant.

OBLIGATIONS OF PARTIES

The Geotechnical Consultant should provide observation and testing services and should make evaluations in order to advise the Client on Geotechnical matters. The Geotechnical Consultant should report his findings and recommendations to the Client or his authorized representative.
The client should be chiefly responsible for all aspects of the project. He or his authorized representative has the responsibility of reviewing the findings and recommendations of the Geotechnical Consultant. He shall authorize or cause to have authorized the Contractor and/or other consultants to perform work and/or provide services.

During grading the Client or his authorized representative should remain on-site or should remain reasonably accessible to all concerned parties in order to make decisions necessary to maintain the flow of the project.
The Contractor should be responsible for the safety of the project and satisfactory completion of all grading and other associated operations on construction projects, including but not limited to, earthwork in accordance with the project plans, specifications and controlling agency requirements. During grading, the Contractor or his authorized representative should remain on-site. Overnight and on days off, the Contractor should remain accessible.

SITE PREPARATION

The Client, prior to any site preparation or grading, should arrange and attend a meeting among the Grading Contractor, the Design Engineer, the Geotechnical Consultant, representatives of the appropriate governing authorities as well as any other concerned parties. All parties should be given at least 48 hours notice.
Clearing and grubbing should consist of the removal of vegetation such as brush, grass, woods, stumps, trees, roots of trees and otherwise deleterious natural materials from the areas to be graded. Clearing and grubbing should extend to the outside of all proposed excavation and fill areas.
Demolition should include removal of buildings, structures, foundations, reservoirs, utilities (including underground pipelines, septic tanks, leach fields, seepage pits, cisterns, mining shafts, tunnels, etc.) and man-made surface and subsurface improvements from the areas to be graded. Demolition of utilities should include proper capping and/or re-routing pipelines at the project perimeter and cutoff and capping of wells in accordance with the requirements of the governing authorities and the recommendations of the Geotechnical Consultant at the time of the demolition.
Trees, plants or man-made improvements not planned to be removed or demolished should be protected by the Contractor from damage or injury.
Debris generated during clearing, grubbing and/or demolition operations should be wasted from areas to be graded and disposed off-site. Clearing, grubbing and demolition operations should be performed under the observation of the Geotechnical Consultant.
The Client or Contractor should obtain the required approvals for the controlling authorities for the project prior, during and/or after demolition, site preparation and removals, etc. The appropriate approvals should be obtained prior to proceeding with grading operations.

SITE PROTECTION

Protection of the site during the period of grading should be the responsibility of the Contractor. Unless other provisions are made in writing and agreed upon among the concerned parties, completion of a portion of the project should not be considered to preclude that portion or adjacent areas from the requirements for site protection until such time as the entire project is complete as identified by the Geotechnical Consultant, the Client and the regulating agencies.
The Contractor should be responsible for the stability of all temporary excavations. Recommendations by the Geotechnical Consultant pertaining to temporary excavations (e.g., backcuts) are made in consideration of stability of the completed project and therefore, should not be considered to preclude the responsibilities of the Contractor. Recommendations by the Geotechnical Consultant should not be considered to preclude more restrictive requirements by the regulating agencies.
Precautions should be taken during the performance of site clearing, excavations and grading to protect the work site from flooding, ponding, or inundation by poor or improper surface drainage. Temporary provisions should be made during the rainy season to adequately direct surface drainage away from and off the work site. Where low areas can not be avoided, pumps should be kept on hand to continually remove water during periods of rainfall.
During periods of rainfall, plastic sheeting should be kept reasonably accessible to prevent unprotected slopes from becoming saturated. Where necessary during periods of rainfall, the Contractor should install check-dams de-silting basins, rip-rap, sandbags or other devices or methods necessary to control erosion and provide safe conditions.
During periods of rainfall, the Geotechnical Consultant should be kept informed by the Contractor as to the nature of remedial or preventative work being performed (e.g., pumping, placement of sandbags or plastic sheeting, other labor, dozing, etc.).

Following periods of rainfall, the Contractor should contact the Geotechnical Consultant and arrange a walk-over of the site in order to visually assess rain related damage. The Geotechnical Consultant may also recommend excavations and testing in order to aid in his assessments. At the request of the Geotechnical Consultant, the Contractor shall make excavations in order to evaluate the extent of rain related damage.
Rain-related damage should be considered to include, but may not be limited to, erosion, silting, saturation, swelling, structural distress and other adverse conditions identified by the Geotechnical Consultant. Soil adversely affected should be classified as Unsuitable Materials and should be subject to overexcavation and replaced with compacted fill or other remedial grading as recommended by the Geotechnical Consultant.
Relatively level areas, where saturated soils and/or erosion gullies exist to depths greater then 1 foot, should be overexcavated to unaffected, competent material. Where less than 1 foot in depth, unsuitable materials may be processed in-place to achieve near optimum moisture conditions, then thoroughly recompacted in accordance with the applicable specifications. If the desired results are not achieved, the affected materials should be overexcavated then replaced in accordance with the applicable specifications.
In slope areas, where saturated soil and/or erosion gullies exist to depths of greater than 1 foot, should be over-excavated to unaffected, competent material. Where affected materials exist to depths of 1 foot or less below proposed finished grade, remedial grading by moisture conditioning in-place, followed by thorough recompaction in accordance with the applicable grading guidelines herein may be attempted. If the desired results are not achieved, all affected materials should be overexcavated and replaced as compacted fill in accordance with the slope repair recommendations herein. As field conditions dictate, other slope repair procedures may be recommended by the Geotechnical Consultant.

EXCAVATIONS

UNSUITABLE MATERIALS:
Materials which are unsuitable should be excavated under observation and recommendations of the Geotechnical Consultant. Unsuitable materials include, but may not be limited to dry, loose, soft, wet, organic compressible natural soils and fractured, weathered, soft, bedrock and nonengineered or otherwise deleterious fill materials.
Materials identified by the Geotechnical Consultant as unsatisfactory due to its moisture conditions should be overexcavated, watered or dried, as needed, and thoroughly blended to uniform near optimum moisture condition (per Moisture guidelines presented herein) prior to placement as compacted fill.

CUT SLOPES:
Unless otherwise recommended by the Geotechnical Consultant and approved by the regulating agencies, permanent cut slopes should not be steeper than 2:1 (horizontal:vertical).
If excavations for cut slopes expose loose, cohesionless, significantly fractured or otherwise suitable material, overexcavation and replacement of the unsuitable materials with a compacted stabilization fill should be accomplished as recommended by the Geotechnical Consultant. Unless otherwise specified by the Geotechnical Consultant, stabilization fill construction should conform to the requirements of the Standard Details.
The Geotechnical Consultant should review cut slopes during excavation. The Geotechnical Consultant should be notified by the contractor prior to beginning slope excavations.
If during the course of grading, adverse or potentially adverse geotechnical conditions are encountered which were not anticipated in the preliminary report, the Geotechnical Consultant should explore, analyze and make recommendations to treat these problems.
When cuts slopes are made in the direction of the prevailing drainage, a non-erodible diversion swale (brow ditch) should be provided at the top-of-cut.

PAD AREAS:
All lot pad areas, including side yard terraces, above stabilization fills or buttresses should be over-excavated to provide for a minimum of 3-feet (refer to Standard Details) of compacted fill over the entire pad area. Pad areas with both fill and cut materials exposed and pad areas containing both very shallow (less than 3-feet) and deeper fill should be over- thickness (refer to Standard Details).
Cut areas exposing significantly varying material types should also be overexcavated to provide for at least a 3-foot thick compacted fill blanket. Geotechnical conditions may require greater depth of overexcavation. The actual depth should be delineated by the Geotechnical Consultant during grading.

For pad areas created above cut or natural slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm and/or an appropriate pad gradient. A gradient in soil areas away from the top-of-slope of 2 percent or greater is recommended.

COMPACTED FILL

All fill materials should be compacted as specified below or by other methods specifically recommended by the Geotechnical Consultant. Unless otherwise specified, the minimum degree of compaction (relative compaction) should be 90 percent of the laboratory maximum density.

PLACEMENT

Prior to placement of compacted fill, the Contractor should request a review by the Geotechnical Consultant of the exposed ground surface. Unless otherwise recommended, the exposed ground surface should then be scarified (6-inches minimum), watered or dried as needed, thoroughly blended to achieve near optimum moisture conditions, then thoroughly compacted to a minimum of 90 percent of the maximum density. The review by the Geotechnical Consultants should not be considered to preclude requirements of inspection and approval by the governing agency.

Compacted fill should be placed in thin horizontal lifts not exceeding 8-inches in loose thickness prior to compaction. Each lift should be watered or dried as needed, thoroughly blended to achieve near optimum moisture conditions then thoroughly compacted by mechanical methods to a minimum of 90 percent of laboratory maximum dry density. Each lift should be treated in a like manner until the desired finished grades are achieved.

The Contractor should have suitable and sufficient mechanical compaction equipment and watering apparatus on the job site to handle the amount of fill being placed in consideration of moisture retention properties of the materials. If necessary, excavation equipment should be “shut down” temporarily in order to permit proper compaction of fills. Earth moving equipment should only be considered a supplement and not substituted for conventional compaction equipment.

When placing fill in horizontal lifts adjacent to areas sloping steeper than 5:1 (horizontal:vertical), horizontal keys and vertical benches should be excavated into the adjacent slope area. Keying and benching should be sufficient to provide at least 6-foot wide benches and minimum of 4-feet of vertical bench height within the firm natural ground, firm bedrock or engineered compacted fill. No compacted fill should be placed in an area subsequent to keying and benching until the area has been reviewed by the Geotechnical Consultant. Material generated by the benching operation should be moved sufficiently away from the bench area to allow for the recommended review of the horizontal bench prior to placement of fill. Typical keying and benching details have been included within the accompanying Standard Details.

Within a single fill area where grading procedures dictate two or more separate fills, temporary slopes (false slopes) may be created. When placing fill adjacent to a false slope, benching should be conducted in the same manner as above described. At least a 3-foot vertical bench should be established within the firm core of adjacent approved compacted fill prior to placement of additional fill. Benching should proceed in at least 3-foot vertical increments until the desired finished grades are achieved.

Fill should be tested for compliance with the recommended relative compaction and moisture conditions. Field density testing should conform to ASTM Method of Testing D 1556-64, D 2922-78 and/or D2937-71. Tests should be provided for about every 2 vertical feet or 1,000 cubic yards of fill placed. Actual test intervals may vary as field conditions dictate. Fill found not to be in conformance with the grading recommendations should be removed or otherwise handled as recommended by the Geotechnical Consultant.

The Contractor should assist the Geotechnical Consultant and/or his representative by digging test pits for removal determinations and/or for testing compacted fill.

As recommended by the Geotechnical Consultant, the Contractor should “shutdown” or remove any grading equipment from an area being tested.

The Geotechnical Consultant should maintain a plan with estimated locations of field tests. Unless the client provides for actual surveying of test locations, by the Geotechnical Consultant should only be considered rough estimates and should not be utilized for the purpose of preparing cross sections showing test locations or in any case for the purpose of after-the-fact evaluating of the sequence of fill placement.

MOISTURE

For field testing purposes, “near optimum” moisture will vary with material type and other factors including compaction procedures. “Near optimum” may be specifically recommended in Preliminary Investigation Reports and/or may be evaluated during grading.

Prior to placement of additional compacted fill following an overnight or other grading delay, the exposed surface of previously compacted fill should be processed by scarification, watered or dried as needed, thoroughly blended to near-optimum moisture conditions, then recompacted to a minimum of 90 percent of laboratory maximum dry density. Where wet or other dry or other unsuitable materials exist to depths of greater than one foot, the unsuitable materials should be overexcavated.

Following a period of flooding, rainfall or overwatering by other means, no additional fill should be placed until damage assessments have been made and remedial grading performed as described herein.

FILL MATERIAL

Excavated on-site materials which are acceptable to the Geotechnical Consultant may be utilized as compacted fill, provided trash, vegetation and other deleterious materials are removed prior to placement.

Where import materials are required for use on-site, the Geotechnical Consultant should be notified at least 72 hours in advance of importing, in order to sample and test materials from proposed borrow sites. No import materials should be delivered for use on-site without prior sampling and testing by Geotechnical Consultant.

Where oversized rock or similar irreducible material is generated during grading, it is recommended, where practical, to waste such material off-site or on-site in areas designated as “nonstructural rock disposal areas”. Rock placed in disposal areas should be placed with sufficient fines to fill voids. The rock should be compacted in lifts to an unyielding condition. The disposal area should be covered with at least 3-feet of compacted fill, which is free of oversized material. The upper 3-feet should be placed in accordance with the guidelines for compacted fill herein.

Rocks 3 inches in maximum dimension and smaller may be utilized within the compacted fill, provided they are placed in such a manner that nesting of the rock in avoided. Fill should be placed and thoroughly compacted over and around all rock. The amount of rock should not exceed 40 percent by dry weight passing the $^{3}/_{4}$-inch sieve size. The 3-inch and 40 percent recommendations herein may vary as field conditions dictate.

During the course of grading operations, rocks or similar irreducible materials greater than 3-inch maximum dimension (oversized material) may be generated. These rocks should not be placed within the compacted fill unless placed as recommended by the Geotechnical Consultant.

Where rocks or similar irreducible materials of greater that 3-inches but less than 4-feet of maximum dimension are generated during grading, or otherwise desired to be placed within an engineered fill, special handling in accordance with the accompanying Standard Details is recommended. Rocks greater than 4 feet should be broken down or disposed off-site. Rocks up to 4-feet maximum dimension should be placed below the upper 10-feet of any fill and should not be closer than 20-feet to any slope face. These recommendations could vary as locations of improvements dictate. Where practical, oversized material should not be placed below areas where structures of deep utilities are proposes.

Oversized material should be placed in windrows on a clean, overexcavated or unyielding compacted fill or firm natural ground surface. Select native or imported granular soil (S.E. 30 or higher) should be placed and thoroughly flooded over and around all windrowed rock, such that voids are filled. Windrows of oversized material should be staggered so that successive strata of oversized material are not in the same vertical plane.

It may be possible to dispose of individual larger rock as field conditions dictate and as recommended by the Geotechnical Consultant at time of placement.

Material that is considered unsuitable by the Geotechnical Consultant should not be utilized in the compacted fill.

During grading operations, placing and mixing the materials from the cut and/or borrow areas may result in soil mixtures which possess unique physical properties. Testing may be required of samples obtained directly from the fill areas in order to verify conformance with the specifications. Processing of these additional samples may take two or more working days. The Contractor may elect to move the operation to other areas within the project, or may continue placing compacted fill pending laboratory and field test results. Should he elect the second alternative, fill placed is done so at the Contractor’s risk.

Any fill placed in areas not previously reviewed and evaluated by the Geotechnical Consultant, and/or in other areas, without prior notification to the Geotechnical Consultant may require removal and recompaction at the Contractor's expense. Determination of overexcavations should be made upon review of field conditions by the Geotechnical Consultant.

FILL SLOPES

Unless otherwise recommended by the Geotechnical Consultant and approved by the regulating agencies, permanent fill slopes should not be steeper than 2:1 (horizontal to vertical).

Except as specifically recommended otherwise or as otherwise provided for in these grading guidelines (Reference Fill Materials), compacted fill slopes should be overbuilt and cut back to grade, exposing the firm, compacted fill inner core. The actual amount of overbuilding may vary as field conditions dictate. If the desired results are not achieved, the existing slopes should be overexcavated and reconstructed under the guidelines of the Geotechnical Consultant. The degree of overbuilding shall be increased until the desired compacted slope surface condition is achieved. Care should be taken by the Contractor to provide thorough mechanical compaction to the outer edge of the overbuilt slope surface.

Although no construction procedure produces a slope free from risk of future movement, overfilling and cutting back of slope to a compacted inner core is, given no other constraints, the most desirable procedure. Other constraints, however, must often be considered. These constraints may include property line situations, access, the critical nature of the development, and cost. Where such constraints are identified, slope face compaction may be attempted by conventional construction procedures including backrolling techniques upon specific recommendations by the Geotechnical Consultant.

As a second best alternative for slopes of 2:1 (horizontal to vertical) or flatter, slope construction may be attempted as outlined herein. Fill placement should proceed in thin lifts, (i.e., 6 to 8 inch loose thickness). Each lift should be moisture conditioned and thoroughly compacted. The desired moisture condition should be maintained and/or reestablished, where necessary, during the period between successive lifts. Selected lifts should be tested to ascertain that desired compaction is being achieved. Care should be taken to extend compactive effort to the outer edge of the slope. Each lift should extend horizontally to the desired finished slope surface or more as needed to ultimately establish desired grades. Grade during construction should not be allowed to roll off at the edge of the slope. It may be helpful to elevate slightly the outer edge of the slope. Slough resulting from the placement of individual lifts should not be allowed to drift down over previous lifts. At intervals not exceeding 4-feet in vertical slope height or the capability of available equipment, whichever is less, fill slopes should be thoroughly backrolled utilizing a conventional sheepsfoot-type roller. Care should be taken to maintain the desired moisture conditions and/or reestablishing same as needed prior to backrolling. Upon achieving final grade, the slopes should again be moisture conditioned and thoroughly backrolled. The use of a side-boom roller will probably be necessary and vibratory methods are strongly recommended. Without delay, so as to avoid (if possible) further moisture conditioning, the slopes should then be grid-rolled to achieve a relatively smooth surface and uniformly compact condition.

In order to monitor slope construction procedures, moisture and density tests will be taken at regular intervals. Failure to achieve the desired results will likely result in a recommendation by the Geotechnical Consultant to overexcavate the slope surfaces followed by reconstruction of the slopes utilizing overfilling and cutting back procedures and/or further attempt at the conventional backrolling approach. Other recommendations may also be provided which would be commensurate with field conditions.

Where placement of fill above a natural slope or above a cut slope is proposed, the fill slope configuration as presented in the accompanying standard Details should be adopted.

For pad areas above fill slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm and pad gradients of at least 2-percent in soil area.

OFF-SITE FILL

Off-site fill should be treated in the same manner as recommended in these specifications for site preparation, excavation, drains, compaction, etc.

Off-site canyon fill should be placed in preparation for future additional fill, as shown in the accompanying Standard Details.

Off-site fill subdrains temporarily terminated (up canyon) should be surveyed for future relocation and connection.

DRAINAGE

Canyon sub-drain systems specified by the Geotechnical Consultant should be installed in accordance with the Standard Details.
Typical sub-drains for compacted fill buttresses, slope stabilization or sidehill masses, should be installed in accordance with the specifications of the accompanying Standard Details.
Roof, pad and slope drainage should be directed away from slopes and areas of structures to suitable disposal areas via non-erodible devices (i.e., gutters, downspouts, concrete swales).
For drainage over soil areas immediately away from structures (i.e., within 4-feet), a minimum of 4 percent gradient should be maintained. Pad drainage of at least 2 percent should be maintained over soil areas. Pad drainage may be reduced to at least 1 percent for projects where no slopes exist, either natural or man-made, or greater than 10-feet in height and where no slopes are planned, either natural or man-made, steeper than 2:1 (horizontal to vertical slope ratio).
Drainage patterns established at the time of fine grading should be maintained throughout the life of the project. Property owners should be made aware that altering drainage patterns can be detrimental to slope stability and foundation performance.

STAKING

In all fill areas, the fill should be compacted prior to the placement of the stakes. This particularly is important on fill slopes. Slope stakes should not be placed until the slope is thoroughly compacted (backrolled). If stakes must be placed prior to the completion of compaction procedures, it must be recognized that they will be removed and/or demolished at such time as compaction procedures resume.
In order to allow for remedial grading operations, which could include overexcavations or slope stabilization, appropriate staking offsets should be provided. For finished slope and stabilization backcut areas, we recommend at least 10-feet setback from proposed toes and tops-of-cut.

SLOPE MAINTENANCE LANDSCAPE PLANTS

In order to enhance superficial slope stability, slope planting should be accomplished at the completion of grading. Slope planting should consist of deep-rooting vegetation requiring little watering. Plants native to the Southern California area and plants relative to native plants are generally desirable. Plants native to other semiarid and arid areas may also be appropriate. A Landscape Architect would be the best party to consult regarding actual types of plants and planting configuration.

IRRIGATION

Irrigation pipes should be anchored to slope faces, not placed in trenches excavated into slope faces.
Slope irrigation should be minimized. If automatic timing devices are utilized on irrigation systems, provisions should be made for interrupting normal irrigation during periods of rainfall.
Though not a requirement, consideration should be give to the installation of near-surface moisture monitoring control devices. Such devices can aid in the maintenance of relatively uniform and reasonably constant moisture conditions.
Property owners should be made aware that overwatering of slopes is detrimental to slope stability.

MAINTENANCE

Periodic inspections of landscaped slope areas should be planned and appropriate measures should be taken to control weeds and enhance growth of the landscape plants. Some areas may require occasional replanting and/or reseeding.
Terrace drains and downdrains should be periodically inspected and maintained free of debris. Damage to drainage improvements should be repaired immediately.
Property owners should be made aware that burrowing animals can be detrimental to slope stability. A preventative program should be established to control burrowing animals.
As a precautionary measure, plastic sheeting should be readily available, or kept on hand, to protect all slope areas from saturation by periods of heavy or prolonged rainfall. This measure is strongly recommended, beginning with the period of time prior to landscape planting.

REPAIRS

If slope failures occur, the Geotechnical Consultant should be contacted for a field review of site conditions and development of recommendations for evaluation and repair.

If slope failure occurs as a result of exposure to periods of heavy rainfall, the failure areas and currently unaffected areas should be covered with plastic sheeting to protect against additional saturation.

In the accompanying Standard Details, appropriate repair procedures are illustrated for superficial slope failures (i.e., occurring typically within the outer 1 foot to 3 feet of a slope face).

TRENCH BACKFILL

Utility trench backfill should, unless otherwise recommended, be compacted by mechanical means. Unless otherwise recommended, the degree of compaction should be a minimum of 95 percent of the laboratory maximum density.

Approved granular material (sand equivalent greater than 30) should be used to bed and backfill utilities to a depth of at least 1 foot over the pipe. This backfill should be uniformly watered, compacted and/or wheel-rolled from the surface to a firm condition for pipe support.

The remainder of the backfill shall be typical on-site soil or imported soil which should be placed in lifts not exceeding 8 inches in thickness, watered or aerated to at least 3 percent above the optimum moisture content, and mechanically compacted to at least 95 percent of maximum dry density (based on ASTM D1557).

Backfill of exterior and interior trenches extending below a 1:1 projection from the outer edge of foundations should be mechanically compacted to a minimum of 95 percent of the laboratory maximum density.

Within slab areas, but outside the influence of foundations, trenches up to 1 foot wide and 2 feet deep may be backfilled with sand and consolidated by uniformly watering or by mechanical means. If on-site materials are utilized, they should be wheel-rolled, tamped or otherwise compacted to a firm condition. For minor interior trenches, density testing may be deleted or spot testing may be elected if deemed necessary, based on review of back-fill operations during construction.

If utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, the Contractor may elect the utilization of light weight compaction equipment and/or shading of the conduit with clean, granular material, which should be thoroughly jetted in-place above the conduit, prior to initiating mechanical compaction procedures. Other methods of utility trench compaction may also be appropriate, upon review by the Geotechnical Consultant at the time of construction.

In cases where clean granular materials are proposed for use in lieu of native materials or where flooding or jetting is proposed, the procedures should be considered subject to review by the Geotechnical Consultant.

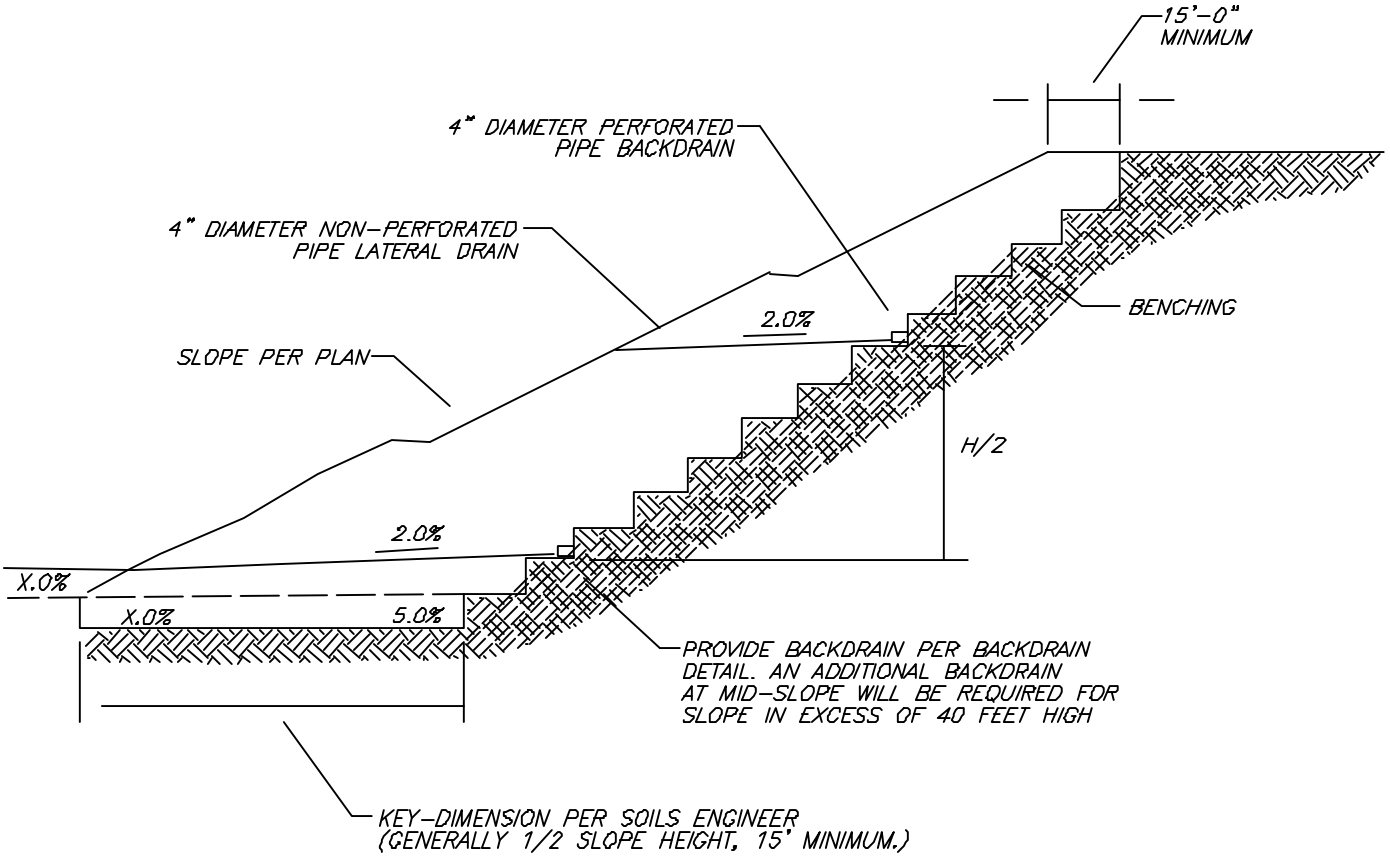
Clean Granular backfill and/or bedding are not recommended in slope areas unless provisions are made for a drainage system to mitigate the potential build-up of seepage forces.

STATUS OF GRADING

Prior to proceeding with any grading operation, the Geotechnical Consultant should be notified at least two working days in advance in order to schedule the necessary observation and testing services.

Prior to any significant expansion of cut back in the grading operation, the Geotechnical Consultant should be provided with adequate notice (i.e., two days) in order to make appropriate adjustments in observation and testing services.

Following completion of grading operations and/or between phases of a grading operation, the Geotechnical Consultant should be provided with at least two working days notice in advance of commencement of additional grading operations.



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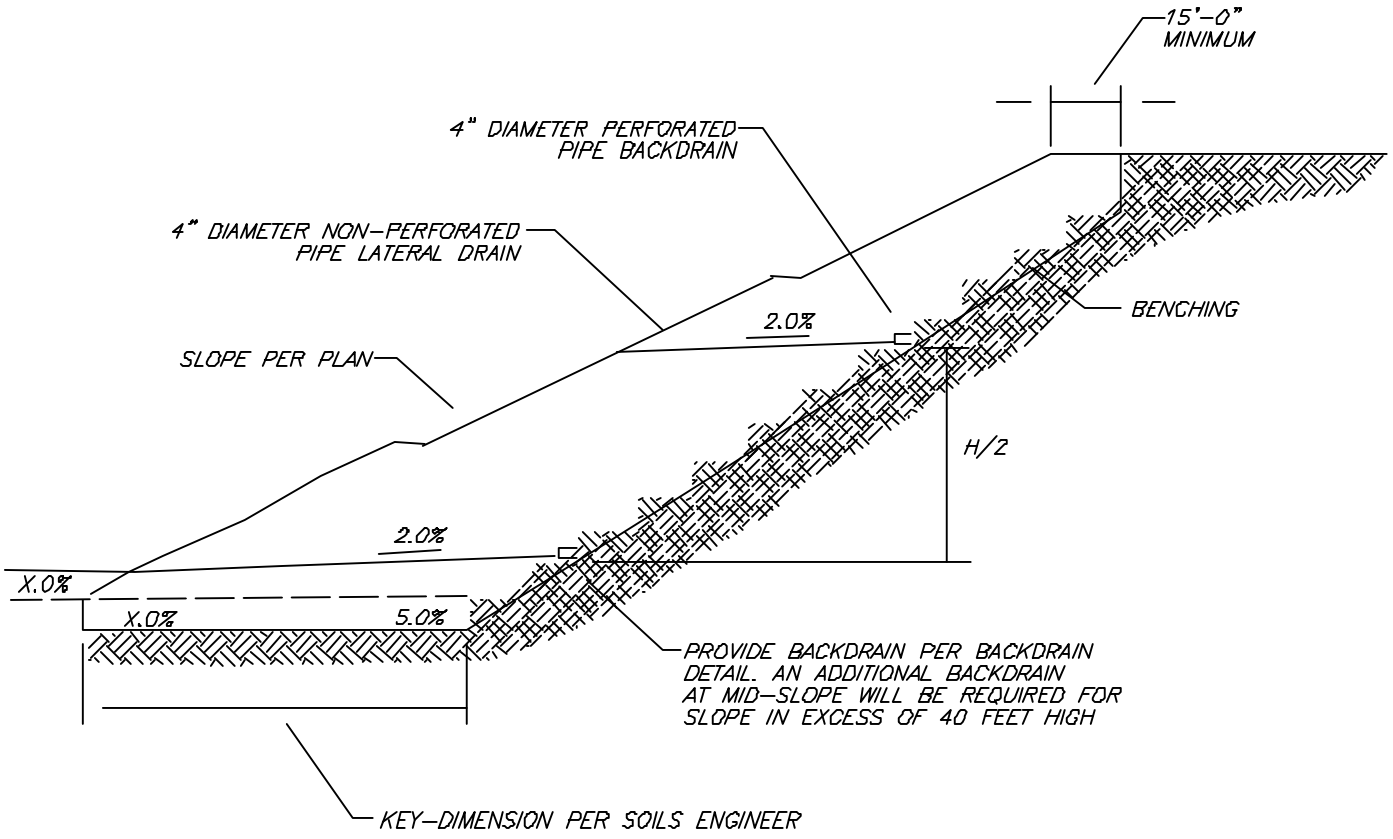
TYPICAL STABILIZATION FILL DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 1



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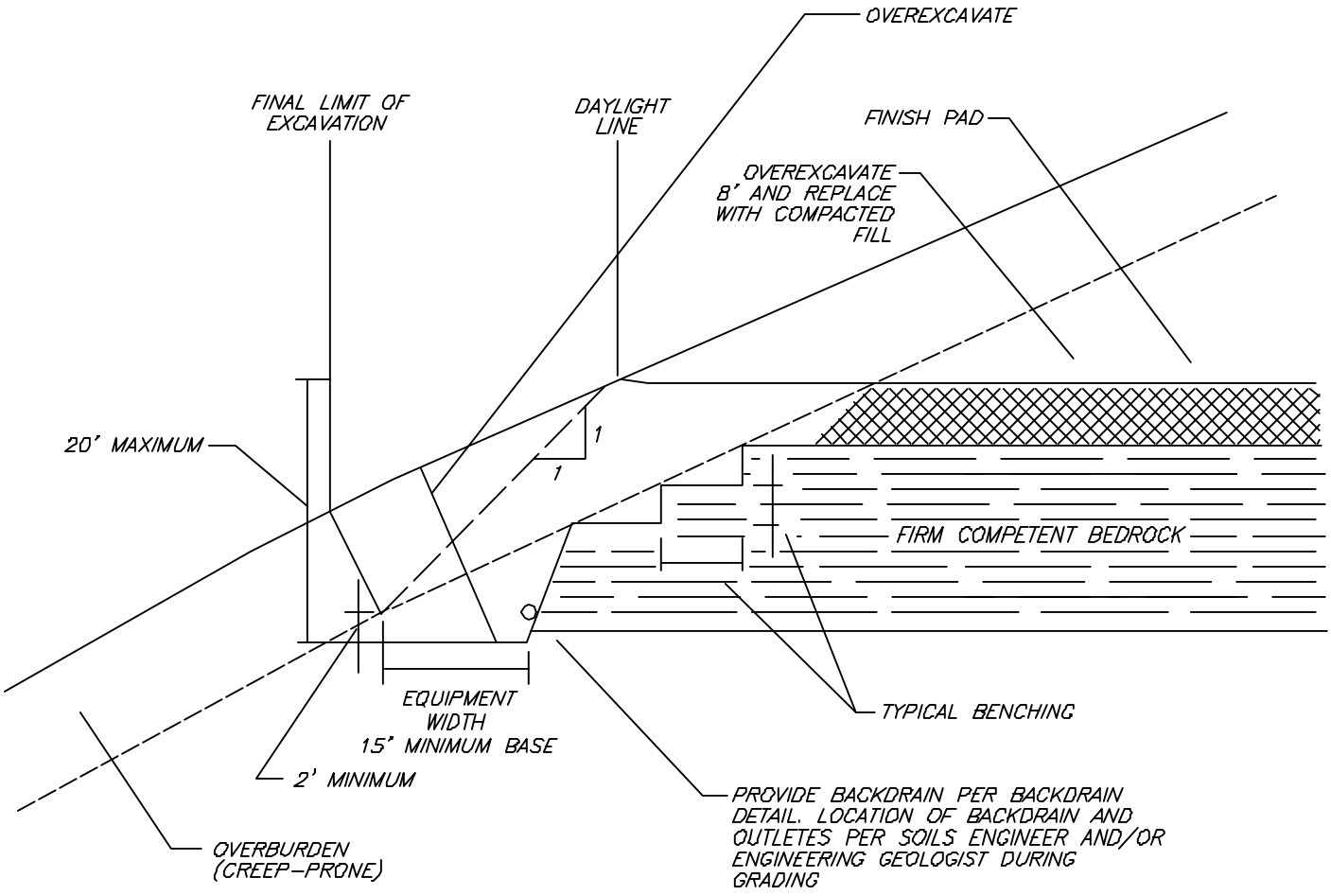
TYPICAL BUTTRESS FILL DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 2



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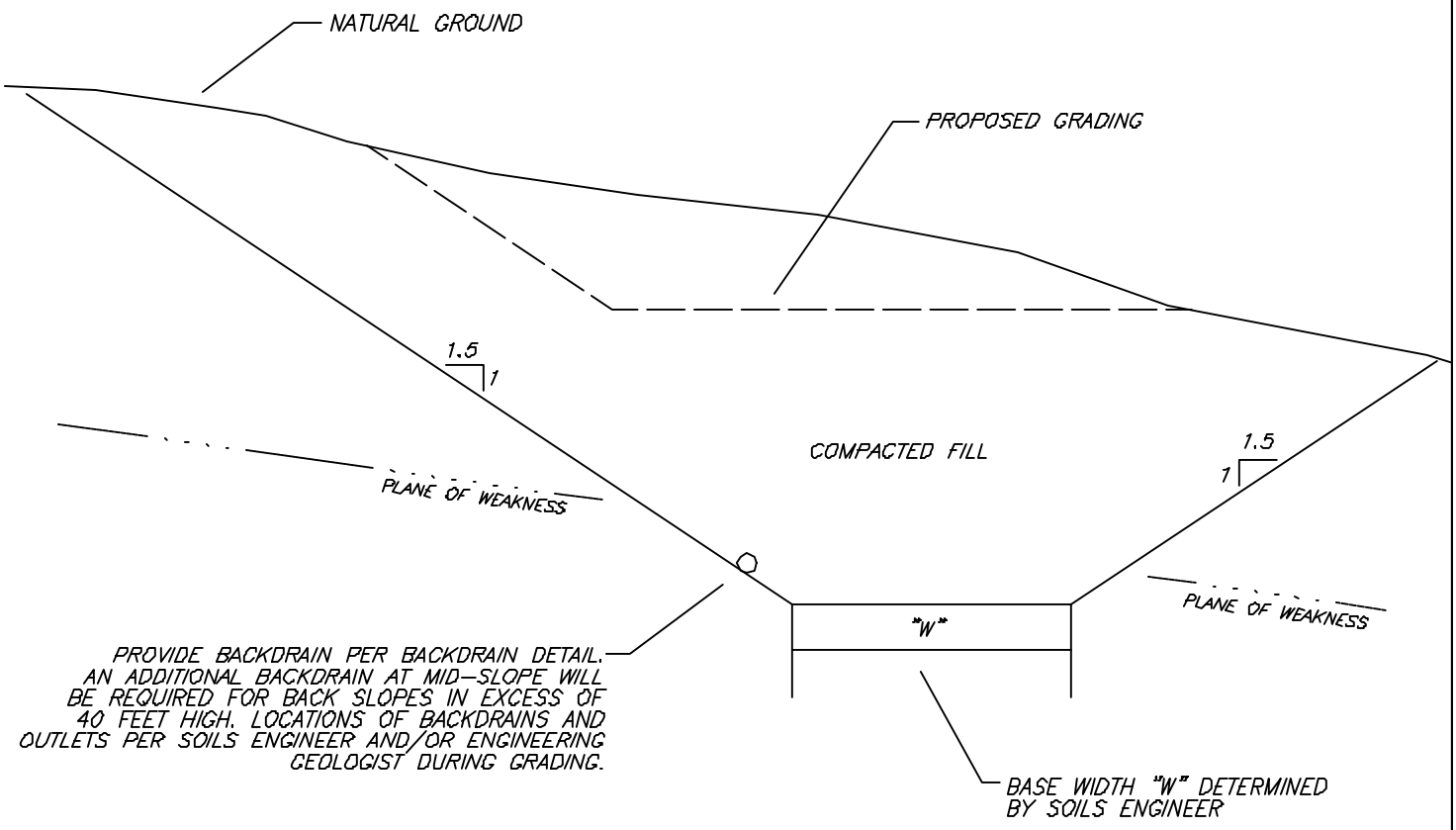
DAYLIGHT SHEAR KEY DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 3



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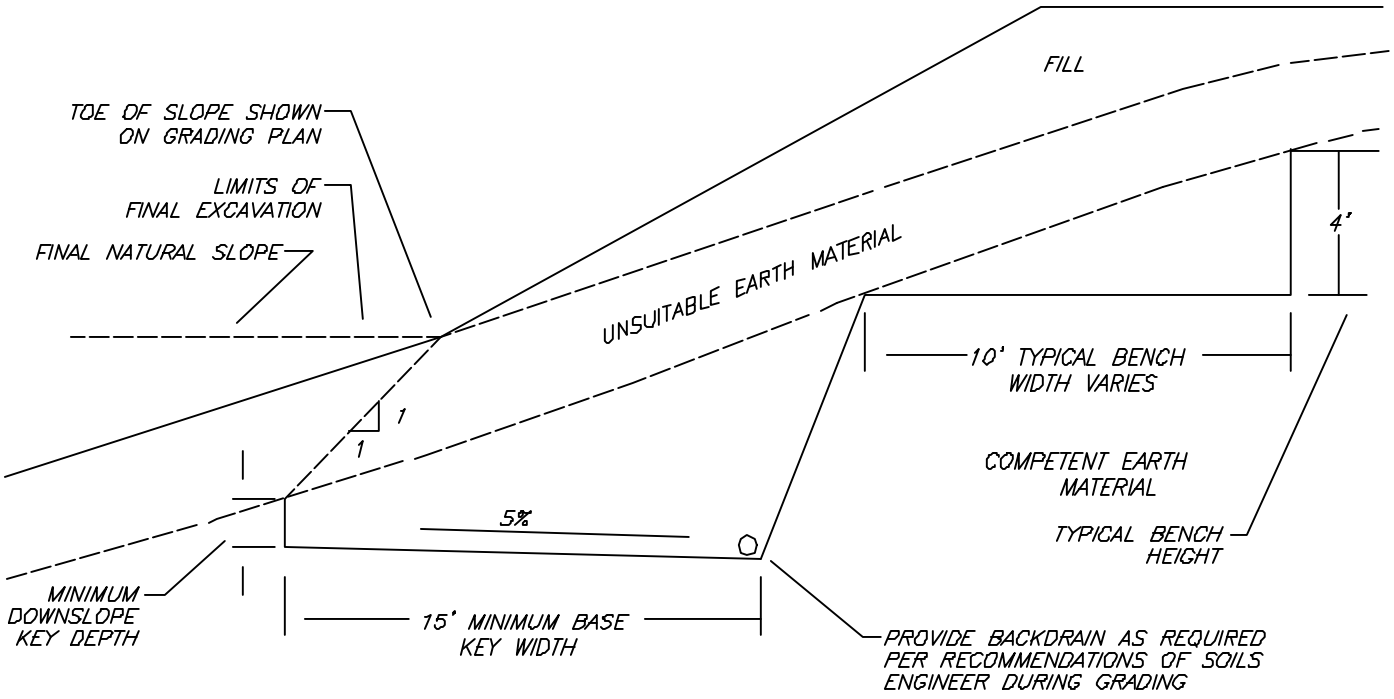
TYPICAL SHEAR KEY DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 4



WHERE NATURAL SLOPE IS 5:1 OR LESS, BENCHING IS NOT NECESSARY, HOWEVER, FILL IS NOT TO BE PLACED ON COMPRESSIBLE OR UNSUITABLE MATERIAL.

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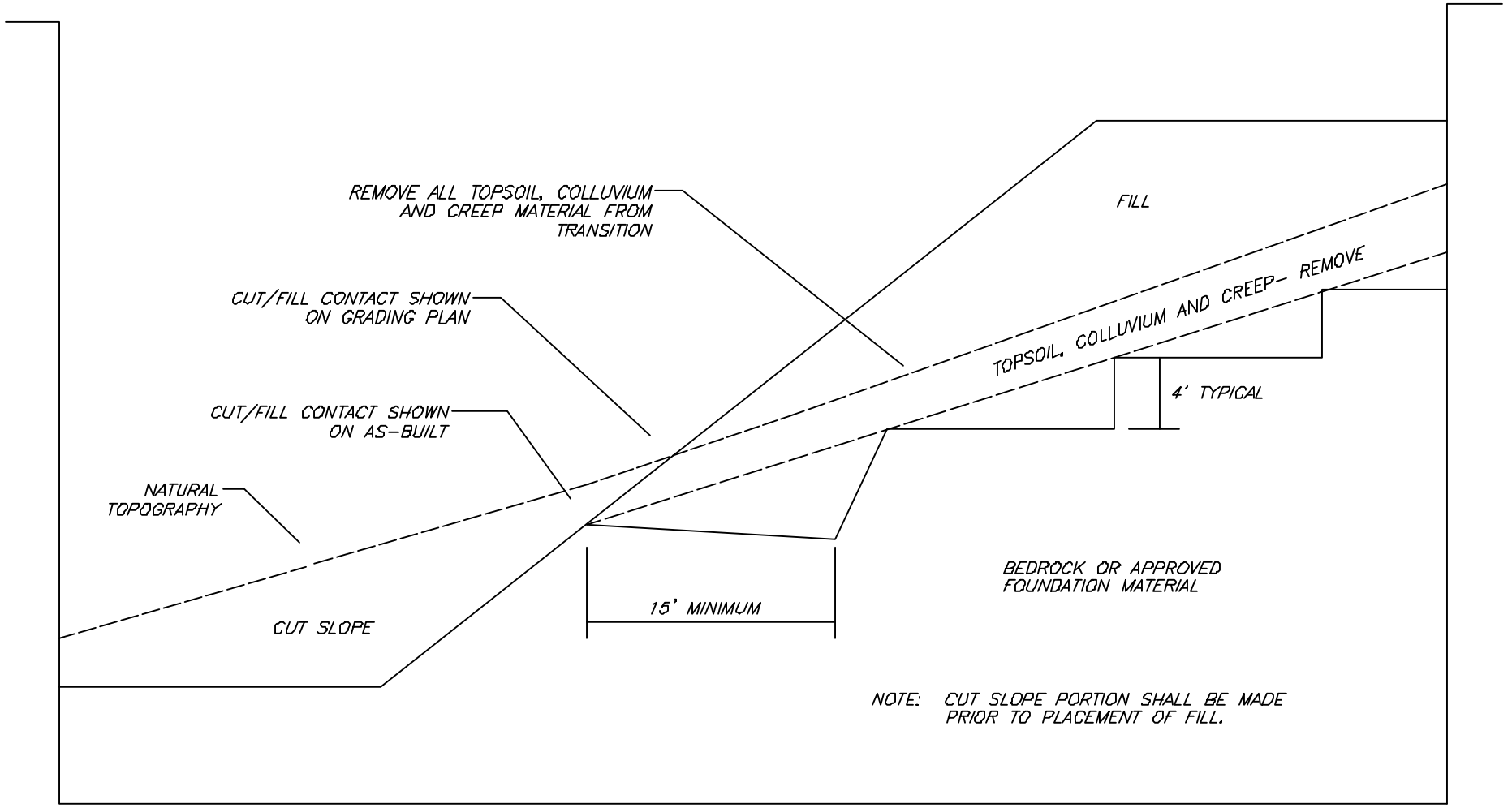
FILL SLOPE ABOVE NATURAL GROUND DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 5



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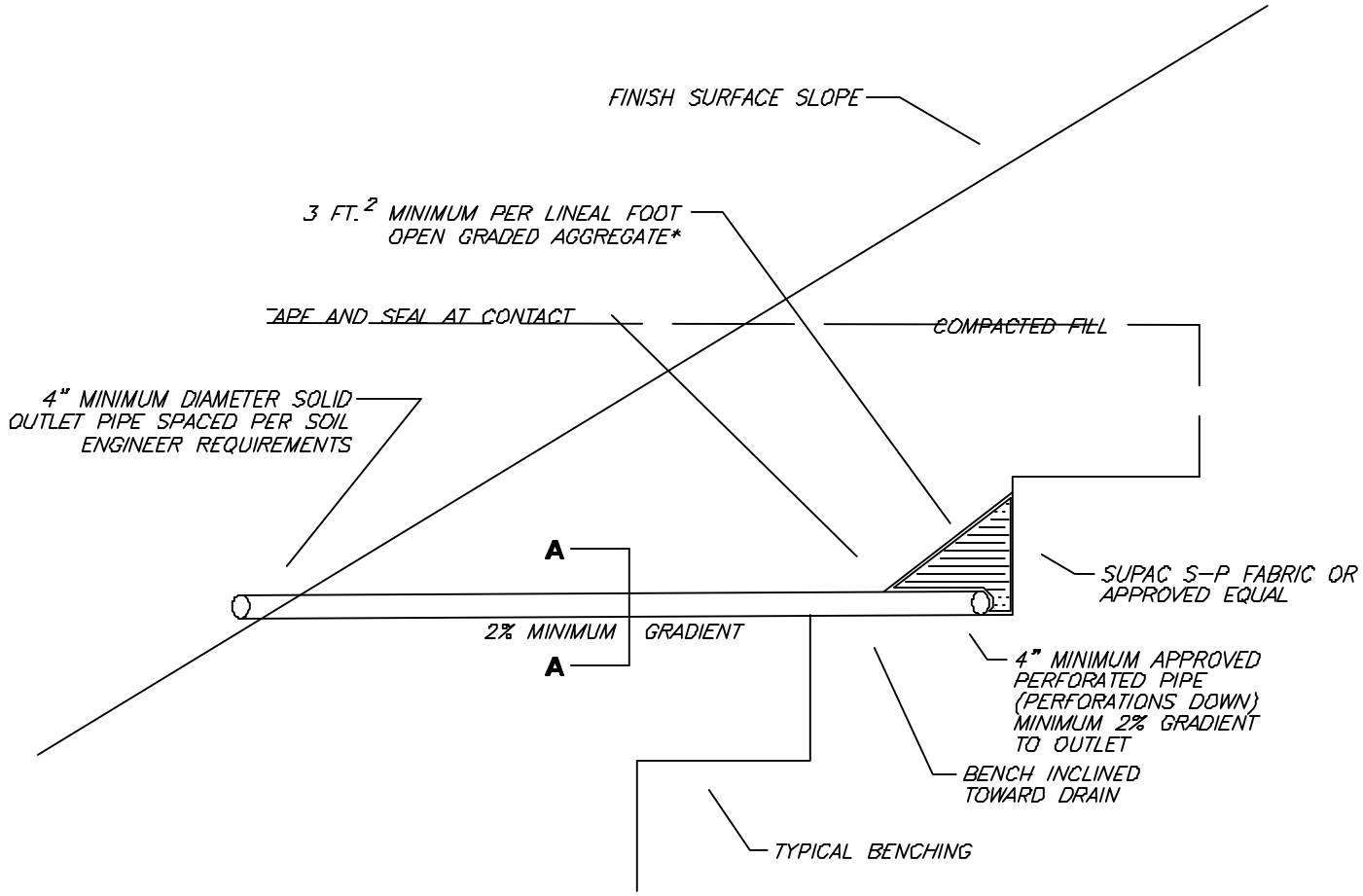
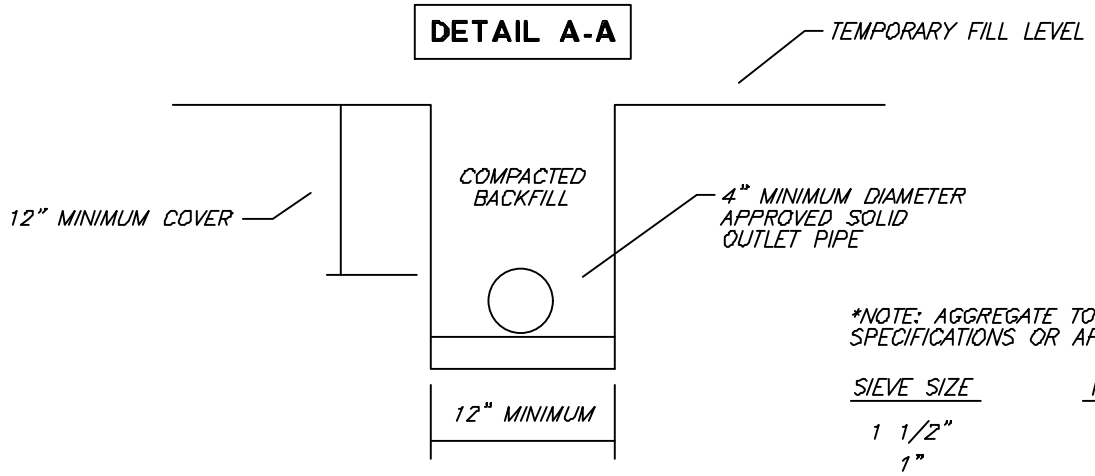
FILL SLOPE ABOVE CUT SLOPE DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 6



DETAIL A-A



*NOTE: AGGREGATE TO MEET FOLLOWING SPECIFICATIONS OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1 1/2"	100
1"	5-40
3/4"	0-17
3/8"	0-7
NO. 200	0-3

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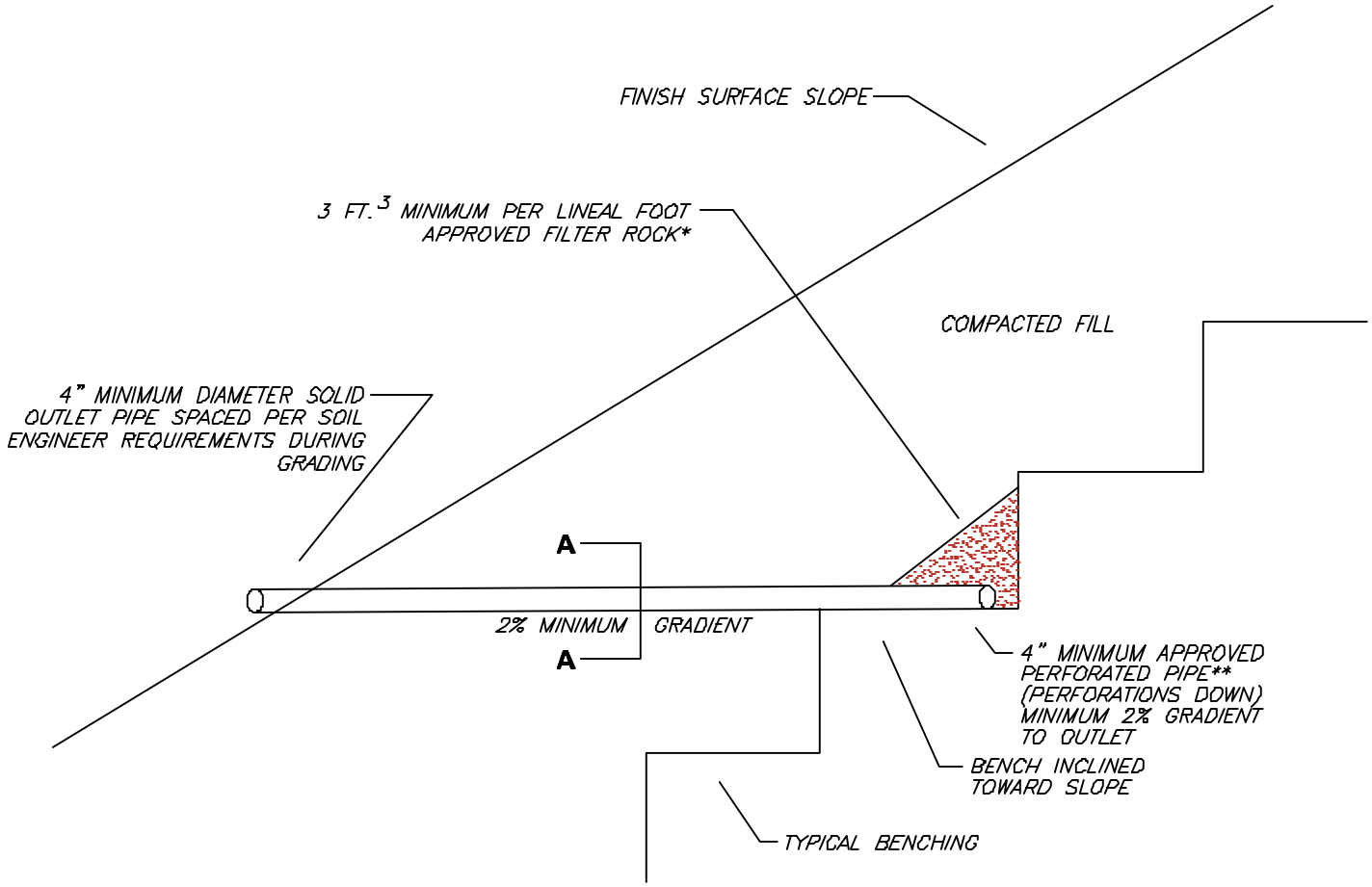
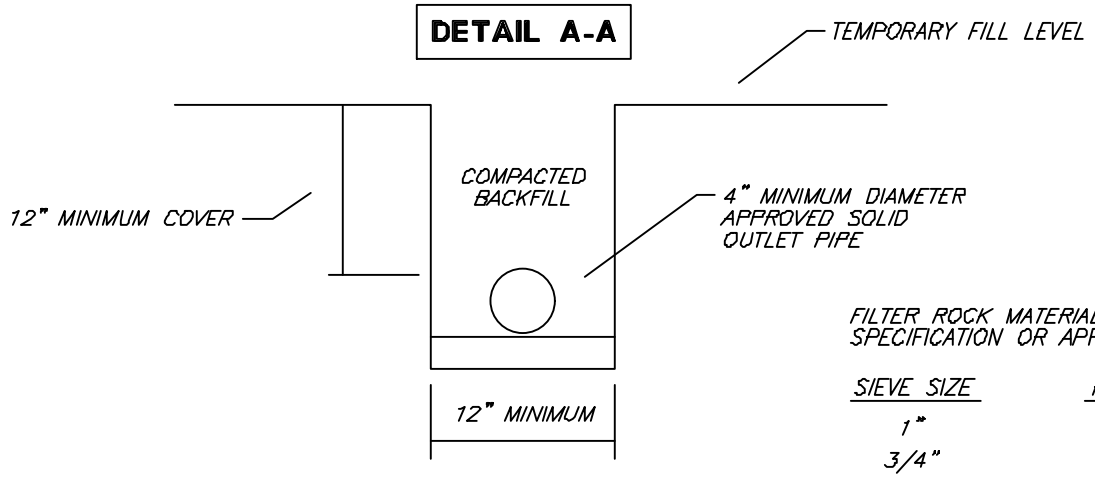
BACKDRAIN DETAIL (GEOFABRIC)

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 7



DETAIL A-A



FILTER ROCK MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE
1"	100
3/4"	90–100
3/8"	40–100
NO. 4	25–40
NO. 30	5–15
NO. 50	0–7
NO. 200	0–3

**APPROVED PIPE TYPE:

SCHEDULE 40 POLYVINYL CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 PSI.

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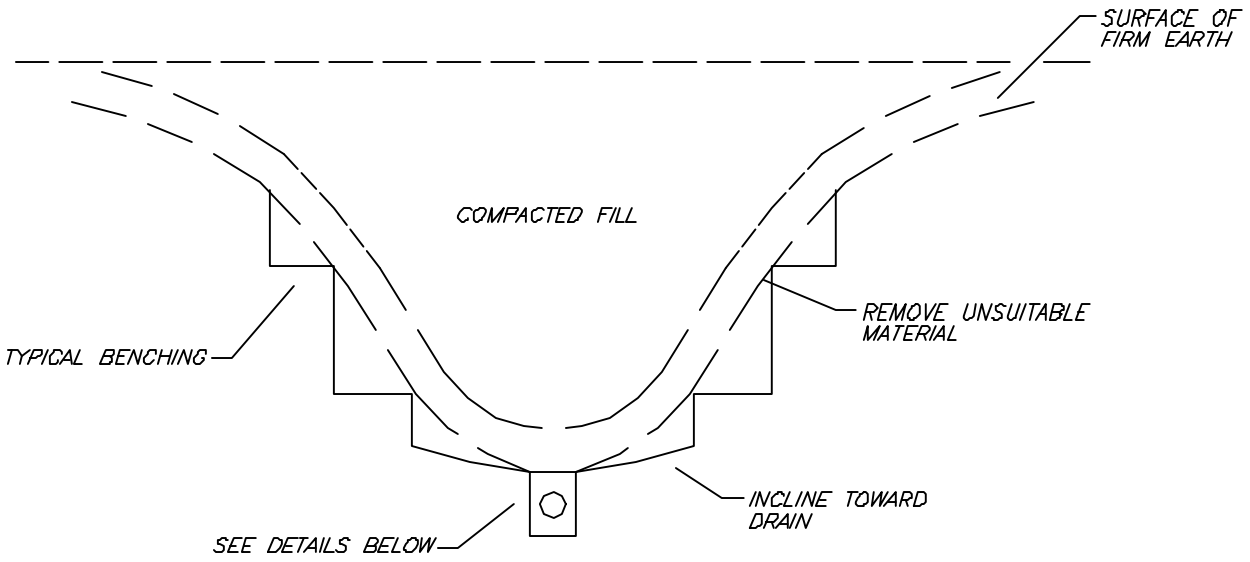
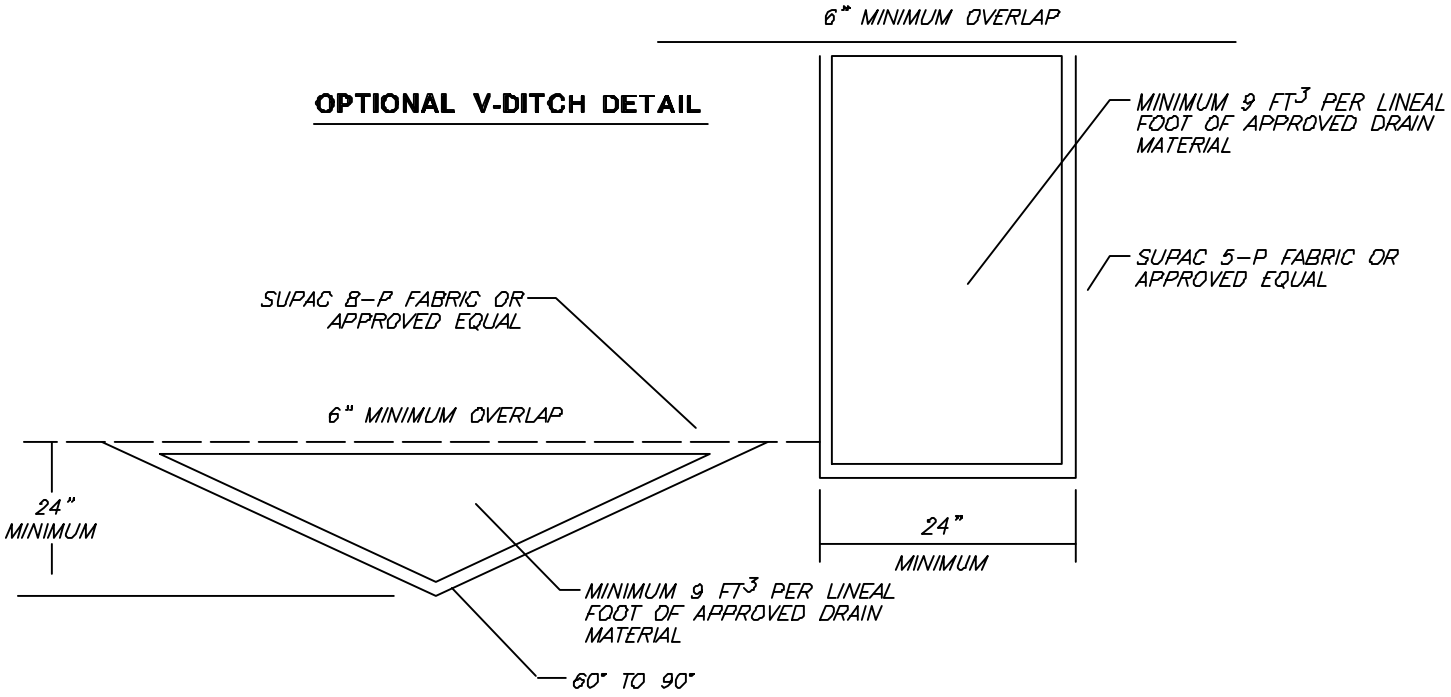
TYPICAL BACKDRAIN DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 8



TRENCH DETAIL

OPTIONAL V-DITCH DETAIL



DRAIN MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1-1/2"	88-100
1"	5-40
3/4"	0-17
3/8"	0-7
NO.:200	0-3

ADD MINIMUM 4" DIAMETER APPROVED PERFORATED PIPE WHEN GRADIENT IS LESS THAN 2%

APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi.

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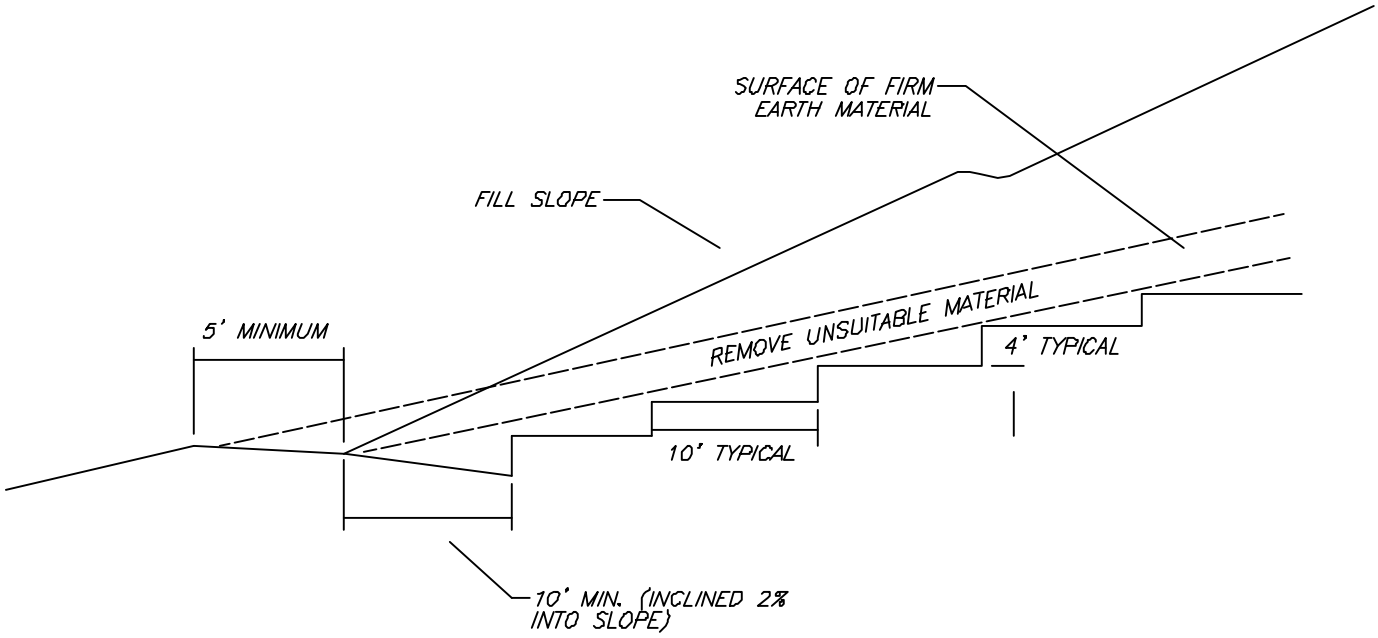
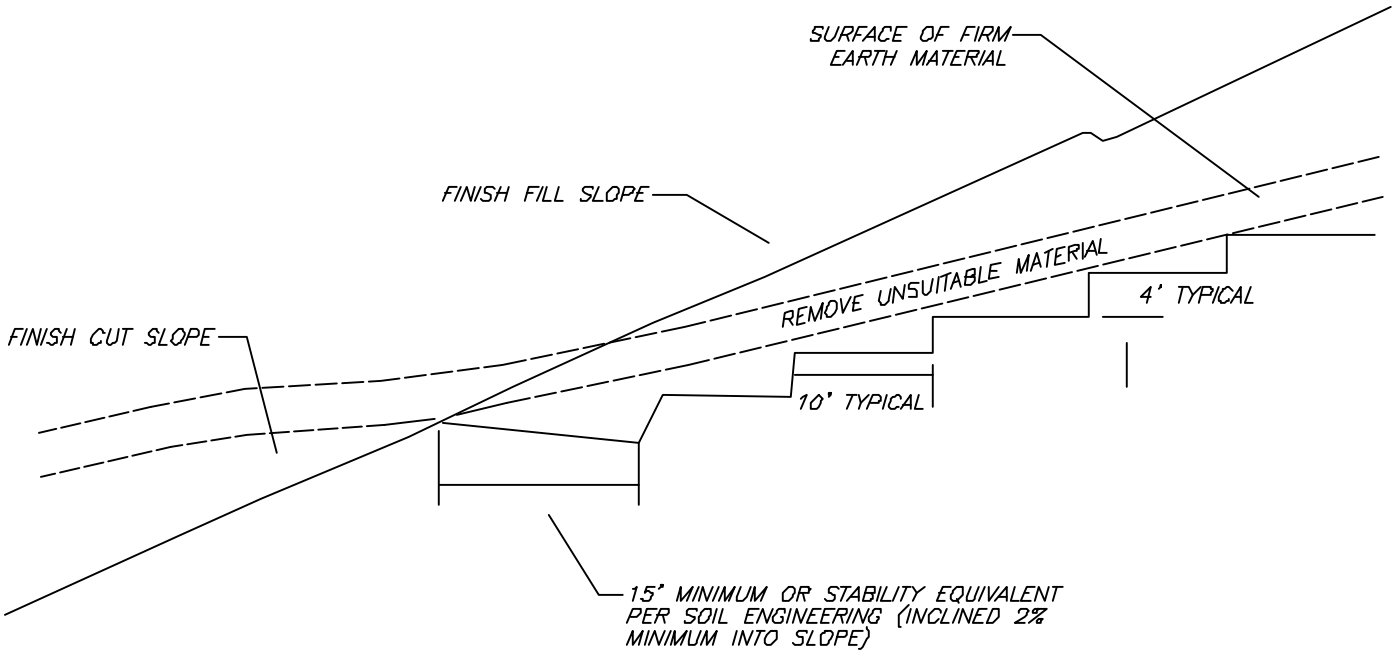
GEOFABRIC SUBDRAIN DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 9

BENCHING FILL OVER NATURAL



BENCHING FILL OVER CUT



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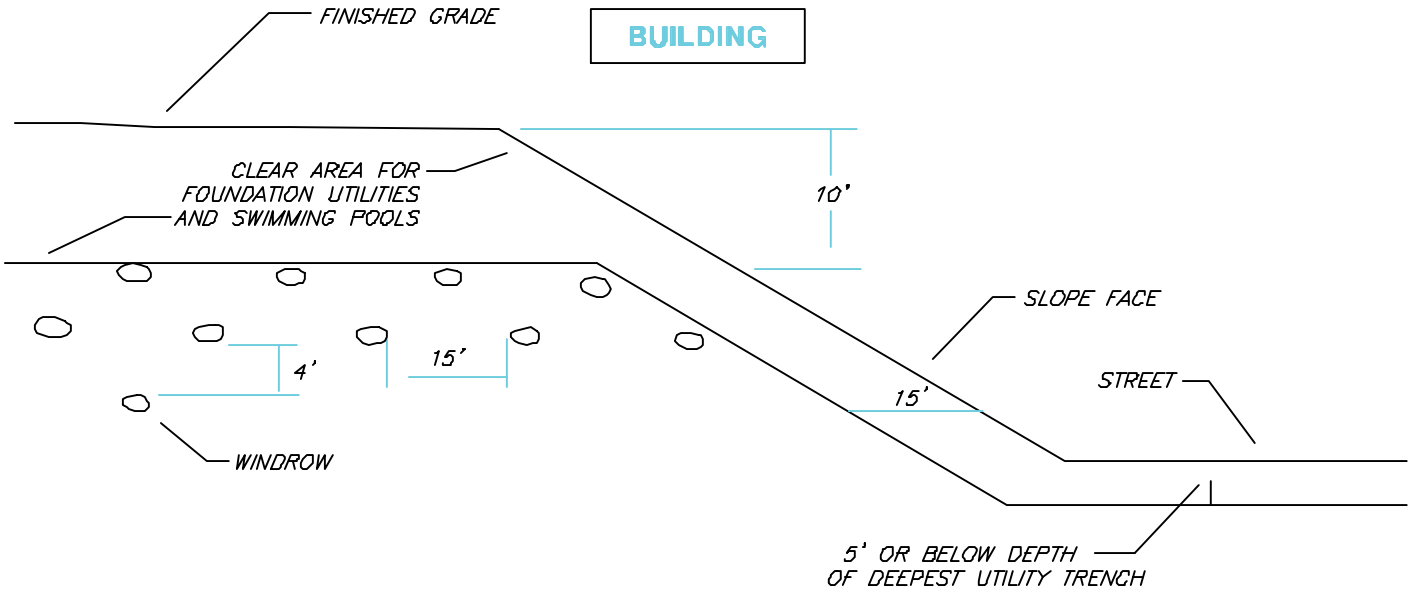
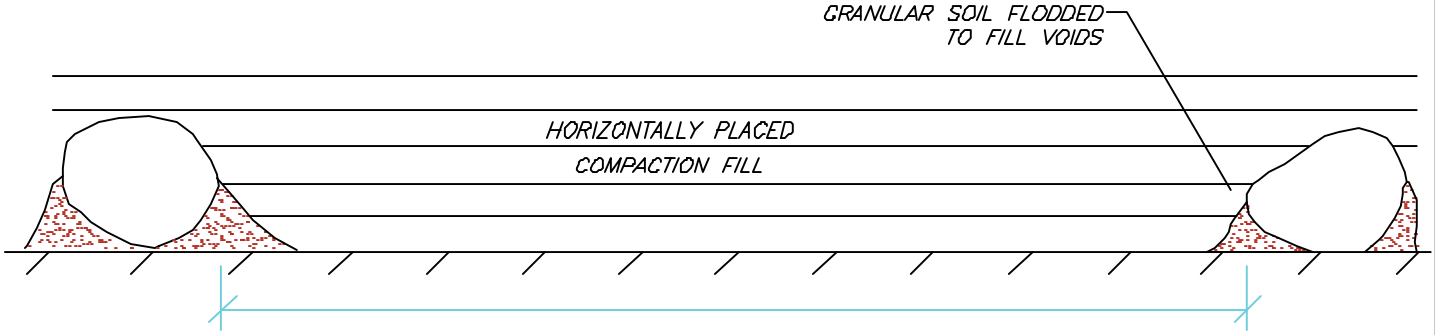
BENCHING FOR COMPACTED FILL DETAIL

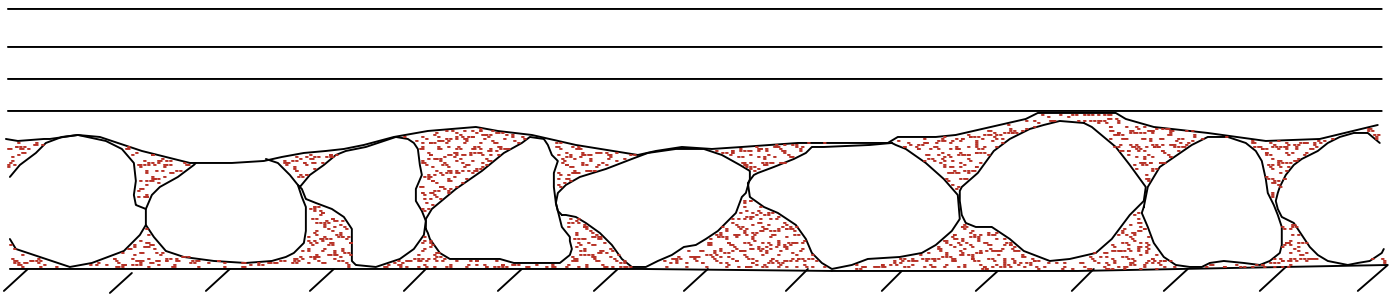
GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 10



TYPICAL WINDROW DETAIL (EDGE VIEW)



PROFILE VIEW



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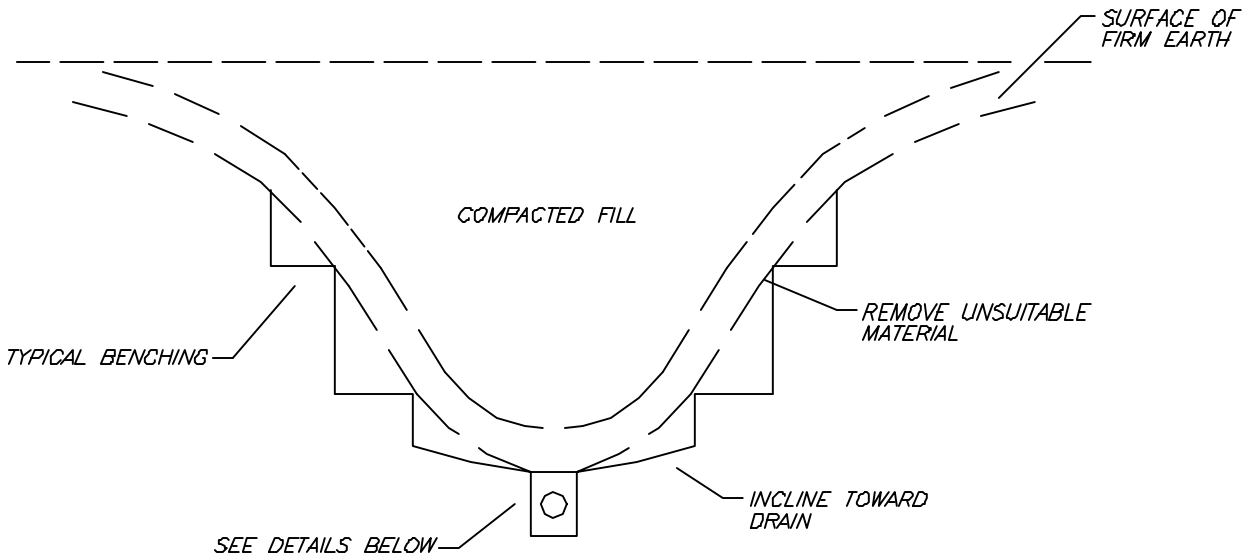
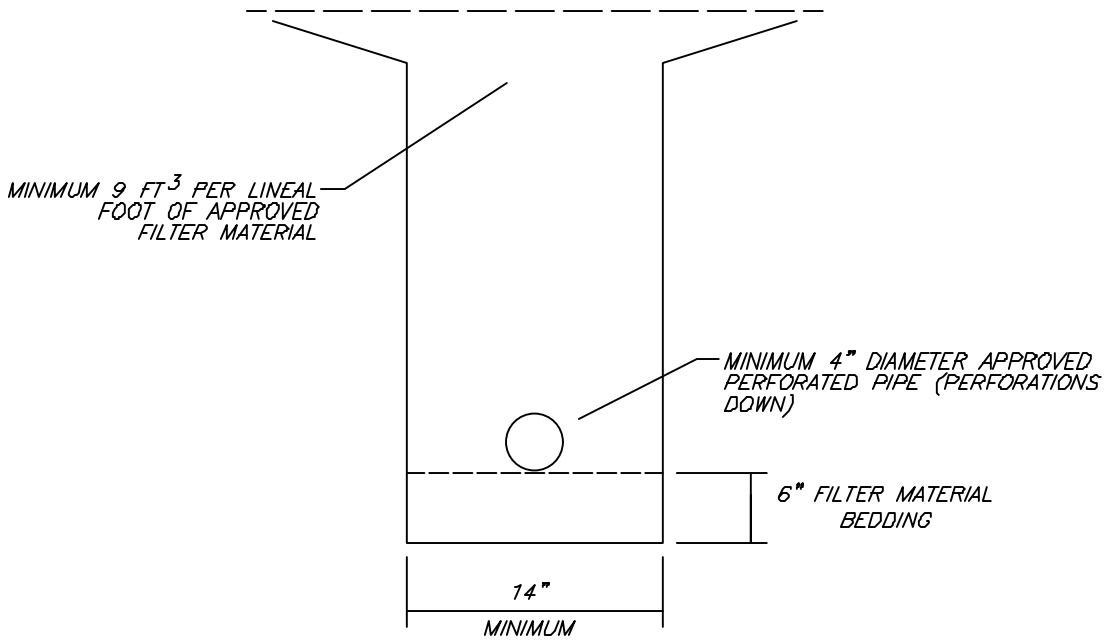
ROCK DISPOSAL DETAIL

GENERAL EARTHWORK AND
GRADING SPECIFICATIONS
SHEET 11



TRENCH DETAIL



FILTER MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE
1"	100
3/4"	90–100
3/8"	40–100
NO. 4	25–40
NO. 30	5–15
NO. 50	0–7
NO. 200	0–3

APPROVED PIPE TO BE SCHEDULE 40 POLY–VINYL–CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi.

PIPE DIAMETER TO MEET THE FOLLOWING CRITERIA. SUBJECT TO FIELD REVIEW BASED ON ACTUAL GEOTECHNICAL CONDITIONS ENCOUNTERED DURING GRADING.

LENGTH OF RUN	PIPE DIAMETER
UPPER 500'	4"
NEXT 1000'	6"
> 1500'	8"

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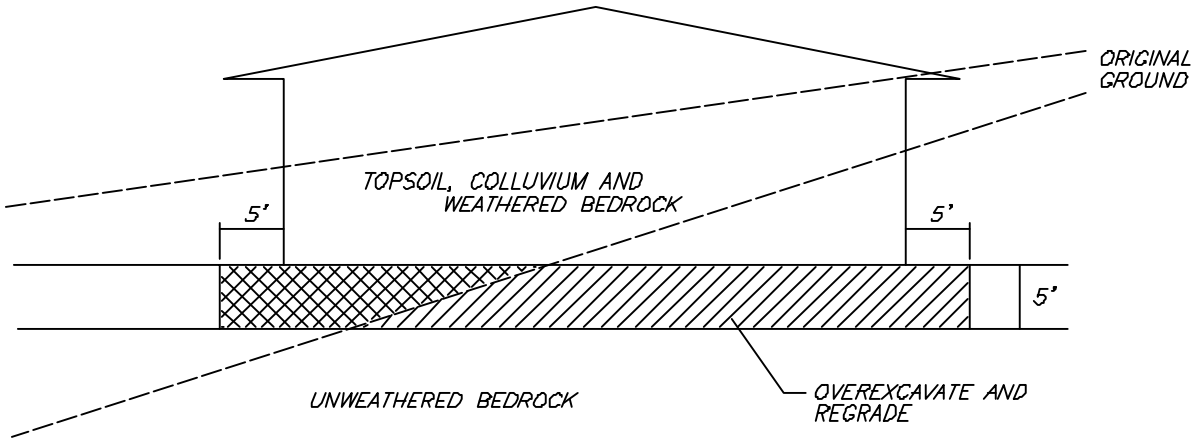
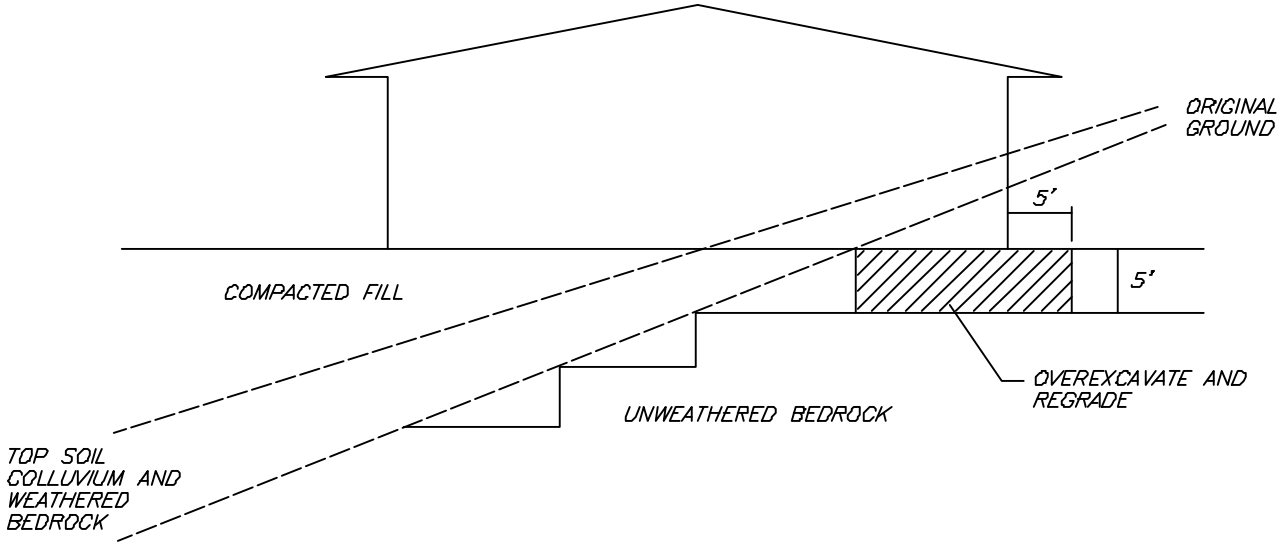
TYPICAL CANYON SUBDRAIN DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 12

CUT LOT



CUT/FILL LOT (TRANSITION)



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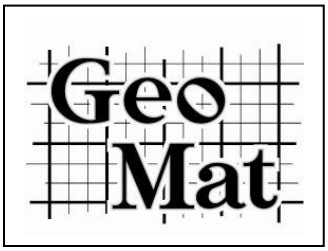
TRANSITION LOT DETAIL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
SHEET 13

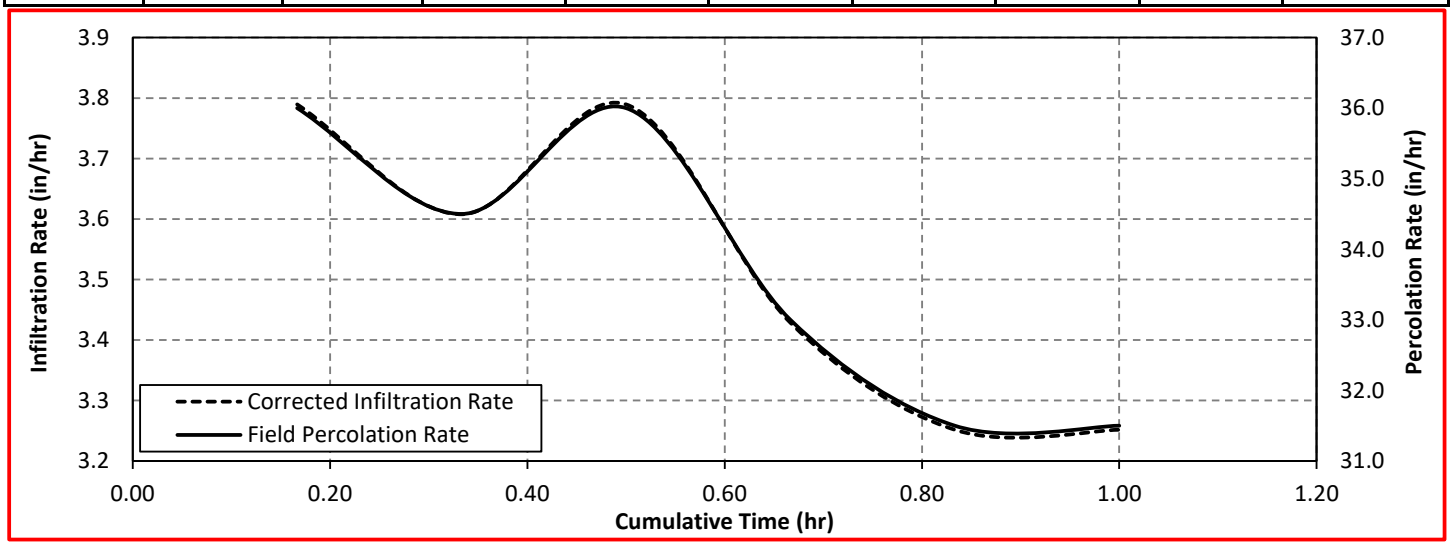
APPENDIX G



PERCOLATION TEST - P-1

Project No.	20112-01	Project Name	APN: 191-150-031, 032 & 033, Riverside, California		
Project Location	APN: 191-150-031, 032 & 033, Riverside, California			Soak Method	5 gallons
Drilling Date	4/16/2020	Soak Date	4/22/2020	Depth of Hole (in)	36
Testing Date	4/23/2020	Borehole Diameter (in)	8	Test Refill Depth (in)	20

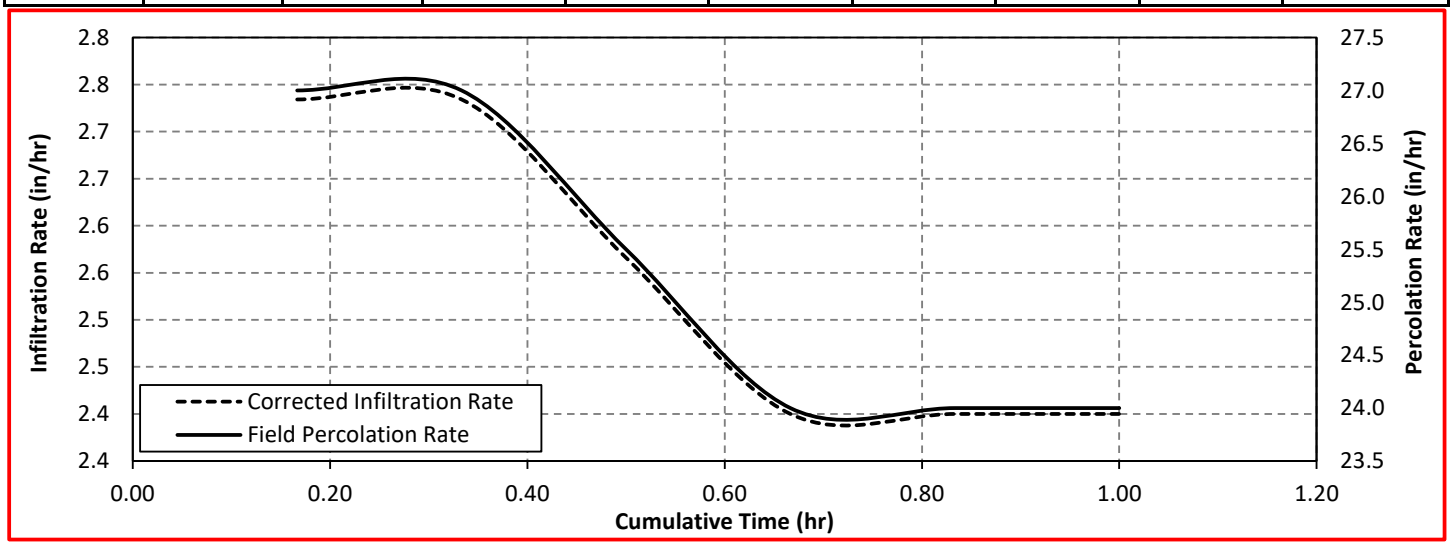
CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH, WATER DROP (in)	AVERAGE WETTED DEPTH (in)	PERC RATE (min/in)	PERC RATE (in/hr)	CORRECTED* INFILTRATION RATE (in/hr)
Sandy Soil Criteria	0:00:00	0:08:00	16	22	6	*Corrected utilizing the Porchet Method			
	0:08:00	8.00							
	0:00:00	0:09:00	16	22	6	Was Sandy Soil Criteria Met?			YES
	0:09:00	9.00							
Percolation Test Data	0:00:00	0:10:00	16	22	6	17	1.67	36.00	3.79
	0:10:00	10.00							
	0:00:00	0:10:00	16	21.75	5.75	17.125	1.74	34.50	3.61
	0:10:00	10.00							
	0:00:00	0:10:00	16	22	6	17	1.67	36.00	3.79
	0:10:00	10.00							
	0:00:00	0:10:00	16	21.5	5.5	17.25	1.82	33.00	3.43
	0:10:00	10.00							
	0:00:00	0:10:00	16	21.25	5.25	17.375	1.90	31.50	3.25
	0:10:00	10.00							
	0:00:00	0:10:00	16	21.25	5.25	17.375	1.90	31.50	3.25
	0:10:00	10.00							



PERCOLATION TEST - P-2

Project No.	20112-01	Project Name	APN: 191-150-031, 032 & 033, Riverside, California		
Project Location	APN: 191-150-031, 032 & 033, Riverside, California			Soak Method	5 gallons
Drilling Date	4/16/2020	Soak Date	4/22/2020	Depth of Hole (in)	24
Testing Date	4/23/2020	Borehole Diameter (in)	8	Test Refill Depth (in)	20

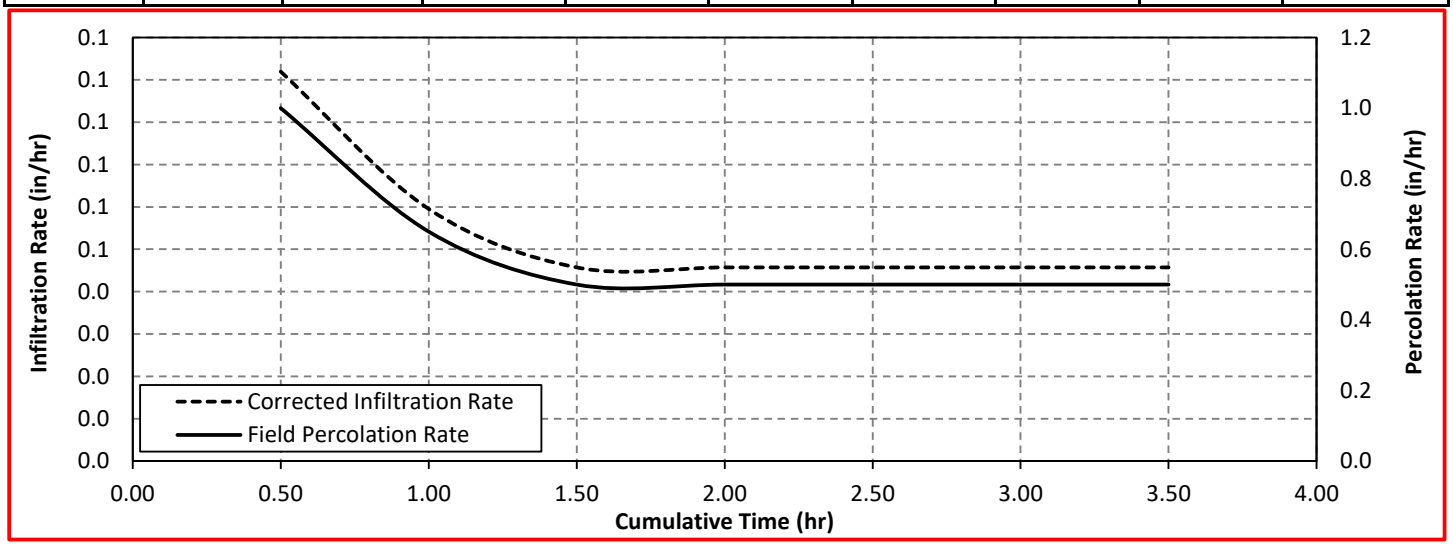
CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH, WATER DROP (in)	AVERAGE WETTED DEPTH (in)	PERC RATE (min/in)	PERC RATE (in/hr)	CORRECTED* INFILTRATION RATE (in/hr)
Sandy Soil Criteria	0:00:00	0:04:00	4	10	6	*Corrected utilizing the Porchet Method			
	0:04:00	4.00							
	0:00:00	0:08:00	4	10	6	Was Sandy Soil Criteria Met?			YES
	0:08:00	8.00							
Percolation Test Data	0:00:00	0:10:00	4	8.5	4.5	17.75	2.22	27.00	2.73
	0:10:00	10.00							
	0:00:00	0:10:00	4	8.5	4.5	17.75	2.22	27.00	2.73
	0:10:00	10.00							
	0:00:00	0:10:00	4	8.25	4.25	17.875	2.35	25.50	2.57
	0:10:00	10.00							
	0:00:00	0:10:00	4	8	4	18	2.50	24.00	2.40
	0:10:00	10.00							
	0:00:00	0:10:00	4	8	4	18	2.50	24.00	2.40
	0:10:00	10.00							
	0:00:00	0:10:00	4	8	4	18	2.50	24.00	2.40
	0:10:00	10.00							



PERCOLATION TEST - P-3

Project No.	20112-01	Project Name	APN: 191-150-031, 032 & 033, Riverside, California		
Project Location	APN: 191-150-031, 032 & 033, Riverside, California			Soak Method	5 gallons
Drilling Date	4/16/2020	Soak Date	4/22/2020	Depth of Hole (in)	108
Testing Date	4/23/2020	Borehole Diameter (in)	8	Test Refill Depth (in)	20

CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH, WATER DROP (in)	AVERAGE WETTED DEPTH (in)	PERC RATE (min/in)	PERC RATE (in/hr)	CORRECTED* INFILTRATION RATE (in/hr)
Sandy Soil Criteria						*Corrected utilizing the Porchet Method			
						Was Sandy Soil Criteria Met?			NO
Percolation Test Data	0:00:00	0:30:00	88	88.5	0.5	19.75	60.00	1.00	0.09
	0:30:00	30.00							
	0:00:00	0:30:00	88	88.325	0.325	19.8375	92.31	0.65	0.06
	0:30:00	30.00							
	0:00:00	0:30:00	88	88.25	0.25	19.875	120.00	0.50	0.05
	0:30:00	30.00							
	0:00:00	0:30:00	88	88.25	0.25	19.875	120.00	0.50	0.05
	0:30:00	30.00							
	0:00:00	0:30:00	88	88.25	0.25	19.875	120.00	0.50	0.05
	0:30:00	30.00							
	0:00:00	0:30:00	88	88.25	0.25	19.875	120.00	0.50	0.05
	0:30:00	30.00							
	0:00:00	0:30:00	88	88.25	0.25	19.875	120.00	0.50	0.05
	0:30:00	30.00							



PERCOLATION TEST - P-4

Project No.	20112-01	Project Name	APN: 191-150-031, 032 & 033, Riverside, California		
Project Location	APN: 191-150-031, 032 & 033, Riverside, California			Soak Method	5 gallons
Drilling Date	4/16/2020	Soak Date	4/22/2020	Depth of Hole (in)	108
Testing Date	4/23/2020	Borehole Diameter (in)	8	Test Refill Depth (in)	20

CRITERIA	TIME	TIME INTERVAL (min)	D_0, INITIAL DEPTH TO WATER (in)	D_f, FINAL DEPTH TO WATER (in)	ΔH, WATER DROP (in)	AVERAGE WETTED DEPTH (in)	PERC RATE (min/in)	PERC RATE (in/hr)	CORRECTED* INFILTRATION RATE (in/hr)
Sandy Soil Criteria						*Corrected utilizing the Porchet Method			
						Was Sandy Soil Criteria Met?			NO
Percolation Test Data	0:00:00	0:30:00	88	89.5	1.5	19.25	20.00	3.00	0.28
	0:30:00	30.00							
	0:00:00	0:30:00	88	89.5	1.5	19.25	20.00	3.00	0.28
	0:30:00	30.00							
	0:00:00	0:30:00	88	89.5	1.5	19.25	20.00	3.00	0.28
	0:30:00	30.00							
	0:00:00	0:30:00	88	89.5	1.5	19.25	20.00	3.00	0.28
	0:30:00	30.00							
	0:00:00	0:30:00	88	89.5	1.5	19.25	20.00	3.00	0.28
	0:30:00	30.00							
	0:00:00	0:30:00	88	89.5	1.5	19.25	20.00	3.00	0.28
	0:30:00	30.00							
	0:00:00	0:30:00	88	89.5	1.5	19.25	20.00	3.00	0.28
	0:30:00	30.00							

