4.2.1 *Conventional Foundation Recommendations (WRI Methodology)*

Shallow foundation slabs may be designed in accordance with the Wire Reinforcement Institute, Inc. method (WRI/CRSI-81 Design of Slab-on-ground Foundations - with 1996 Update) using an effective plasticity index value of 15 for the subgrade soils. From a geotechnical perspective, we recommend a minimum slab thickness of 4 inches.

4.2.2 *Post-Tensioned Foundation Recommendations*

A post-tensioned slab should be designed by the foundation designer using the parameters in Table 3. The geotechnical parameters presented in Table 3 were determined in general accordance with the 2010 California Building Code (C.B.C.)

TABLE 3

Post-Tensioned Foundation Design Parameters

Parameter	PT Slab with Perimeter Footing
Thornthwaite Moisture Index	-20
Depth to Constant Soil Suction (depth to constant moisture content over time, but within C.B.C. limits)	7 feet
Constant Soil Suction	PF 3.6
Moisture Velocity	0.7 in/month
Center Lift Edge moisture variation distance, e_m Center lift, y_m	 9.0 feet 0.50 inches
Edge Lift Edge moisture variation distance, e_m Edge lift, y_m	 5.5 feet 0.75 inch
Minimum Perimeter footing embedment below finish grade	12 inches
Minimum slab thickness	5 inches[1]

4.3 *Bearing Pressure*

A soil bearing pressure of 2,000 psf may be used for a minimum of 12-inch-wide continuous footings extending a minimum of 12 inches below adjacent pad grade. Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. A coefficient of friction of 0.35 may be assumed with dead-load forces. An ultimate passive lateral earth pressure of 300 psf per foot of depth to a maximum of 3,000 psf may be used for the sides of footings poured against properly compacted fill. This passive pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions only.

Bearing values indicated above are for total dead loads and frequently applied live loads. The above vertical bearing may be increased by ⅓ for short durations of loading which will include the effect of wind or seismic forces. The passive pressure may be increased by ⅓ due to wind or seismic forces. These lateral and frictional resistance values represent ultimate values, so appropriate safety factors should be applied by the structural designer during design.

4.4 Slab Underlayment

Slab underlayment (for the purpose of reducing moisture transmission through the slab) should, at a minimum, comprise of a 10-mil polyolefin (or approved equivalent) moisture/vapor retarder. The vapor retarder should meet or exceed the permeance, puncture resistance and tensile strength requirements of an ASTM E 1745 Class A material, and be properly installed in accordance with ACI publication 302. The use of a sand or gravel layer above and/or below the vapor retarder is the purview of the foundation engineer.

4.5 Non-structural Concrete Flatwork

Concrete flatwork (such as walkways, patio slabs, etc.) has a potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete should be designed in accordance with the guidelines outlined in Table 4. These guidelines will help reduce the potential for irregular cracking and promote cracking along construction joints, but will not eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress.

TABLE 4

Preliminary Geotechnical Parameters for Non-structural Concrete Flatwork

	Homeowner Sidewalks	Private Drives	Patios/Entryways	City Sidewalk Curb and Gutters
Minimum Thickness (in.)	4 (nominal)	4 (full)	4 (full)	City/Agency Standard
Presoaking	Wet down prior to placing	Wet down prior to placing	Wet down prior to placing	City/Agency Standard
Reinforcement	—	No. 3 at 36 inches on-centers	No. 3 at 36 inches on-centers	City/Agency Standard
Thickened Edge	—	8 inches wide x 8 inches total thickness	—	City/Agency Standard
Crack Control Joints	Saw cut or tool joint minimum 0.75 inches	Saw cut or tool joint minimum 0.75 inches	Saw cut or tool joint minimum 0.75 inches	City/Agency Standard
Maximum Joint Spacing	10 feet	10 feet or quarter cut whichever is closer	6 feet	City/Agency Standard
Aggregate Base Thickness (in.)	—	—	—	City/Agency Standard

To reduce the potential for sidewalks to separate from the building slab, the owner may elect to install dowels to tie these two elements together.

4.6 Pavement Recommendations

We recommend that the pavement sections within the subject area be designed in accordance with the City of Lake Forest's Standards. Based on the City of Lake Forest's Street Section Standard (163), a pavement section consisting of 4 inches of asphalt over 4 inches of crushed aggregate base for a local road is considered geotechnically adequate. This design shall be confirmed after grading, and should be confirmed with final traffic indices provided by the civil engineer and the City of Lake Forest.

4.7 Excavation Stability and Shoring Requirements

During earthwork operations and site construction, temporary excavations should be made in accordance with the requirements of Cal/OSHA Construction Safety Orders. It is the contractor's responsibility to ensure that these requirements are met. In general, vertical excavations up to approximately 3 feet in height may be considered temporarily stable. Given the sandy nature of the site soils, excavations deeper than 3 feet may need to be either laid back at a 1.5:1 (horizontal to vertical)

gradient or may require the use of shoring. Special consideration may be necessary when working adjacent to sensitive improvements.

4.8 Storm Water Mitigation System

It is our understanding that a portion of the onsite storm water may be infiltrated into the subsurface soils. It should be noted that intentionally collecting and concentrating surface water for the purpose of subsurface infiltration has conflicting objectives with the fundamentals of geotechnical engineering as it relates to satisfactory performance of slopes, foundations, and other improvements. In general we recommend that surface water be collected and transported off of the site in a storm drain system and not infiltrated into the subsurface soils. However, we have conducted a field infiltration evaluation because we understand the local agency is requiring infiltration of storm water.

Given the results of our infiltration testing, and that the majority of the site near-surface materials consist of a combination of well sorted sands and fine grained materials, the recommended design infiltration rate is 0.25 inches per hour. Due to the relatively low infiltration rate, any infiltration system proposed for the site should have an overflow system that connects to the local storm drain system. This rate shall be confirmed once the type of the infiltration system has been determined and the corresponding head of water is known.

The design infiltration rate assumes that the storm water system which is entering the system is clear and does not contain suspended soil particles. The presence of suspended solids may clog the pores within the soil and thereby reduce the infiltration rate.

Please note, as a result of directing large quantities of water into the underlying soils, there is the potential for soil settlement (hydro collapse) to occur and/or to have nuisance related water issues, etc. It is our opinion that if soil settlement occurs, the majority of it will occur within 10 to 20 feet from the edge of the infiltration system. Therefore, we recommend that settlement sensitive improvements not be constructed within this zone. As for nuisance water related issues, due to variability in geologic and hydraulic conductivity characteristics, these effects may be experienced at the onsite locations and/or potentially at other locations beyond the physical limits of the subject site.

4.9 Control of Surface Water and Drainage Control

Positive drainage of surface water away from structures is very important. Water should not be allowed to pond adjacent to buildings or to flow freely down a graded slope. Positive drainage may be accomplished by providing drainage away from buildings. Where necessary, drainage paths may be shortened by use of area drains and collector pipes. Eave gutters are recommended and should reduce water infiltration into the subgrade soils if the downspouts are properly connected to appropriate outlets.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, such as catch basins, liners, and/or area drains, are made. Over watering must be avoided.

4.10 Construction Observation, Testing, & Geotechnical Plan Review

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during grading operations by a representative of LGC Geotechnical.

Construction observation and testing should also be performed by LGC Geotechnical during future earthwork grading at the site. Grading plans and final project drawings should be reviewed by this office prior to the start of construction.

Observation and/or testing should be performed by LGC Geotechnical at the following stages:

- During rough grading, precise grading, and pad recertification process (where applicable);
- After building footing and retaining wall footing excavation and prior to placing concrete and/or reinforcing;
- During installation of retaining wall drainage and placing backfill;
- After moisture conditioning of building pads and other concrete-flatwork subgrades, but prior to the placement of concrete;
- During preparation of subgrade and placing of aggregate base; and
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

5.0 LIMITATIONS

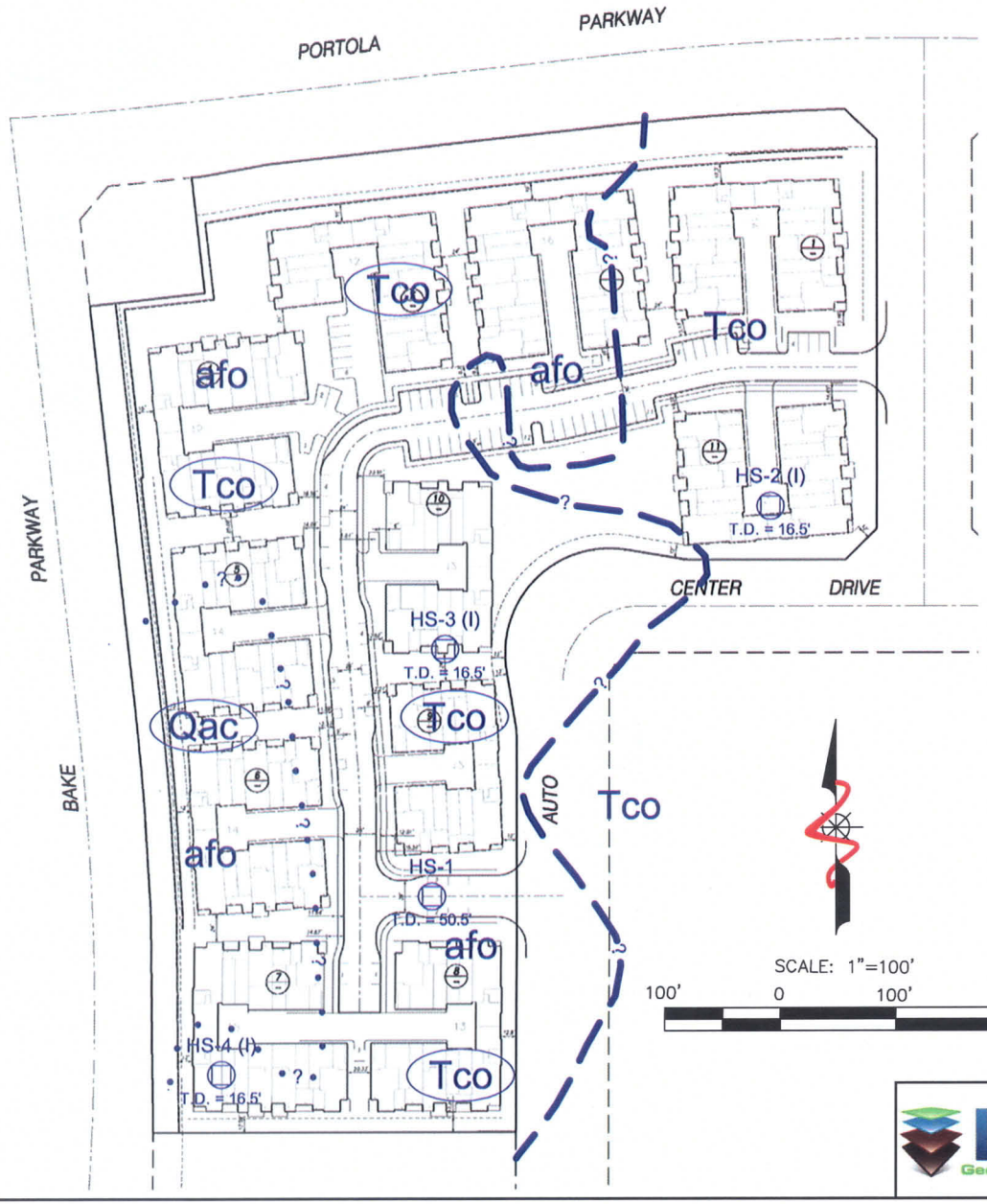
Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

This report is based on data obtained from limited observations of the site, which have been extrapolated to characterize the site. While the scope of services performed is considered suitable to adequately characterize the site geotechnical conditions relative to the proposed development, no practical evaluation can completely eliminate uncertainty regarding the anticipated geotechnical conditions in connection with a subject site. Variations may exist and conditions not observed or described in this report may be encountered during construction.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the other consultants and incorporated into the plans. The contractor should properly implement the recommendations during construction and notify the owner if they consider any of the recommendations presented herein to be unsafe, or unsuitable.

The findings of this report are valid as of the present date. However, changes in the conditions of a site can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. The findings, conclusions, and recommendations presented in this report can be relied upon only if LGC Geotechnical has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site. This report is intended exclusively for use by the client, any use of or reliance on this report by a third party shall be at such party's sole risk.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification.



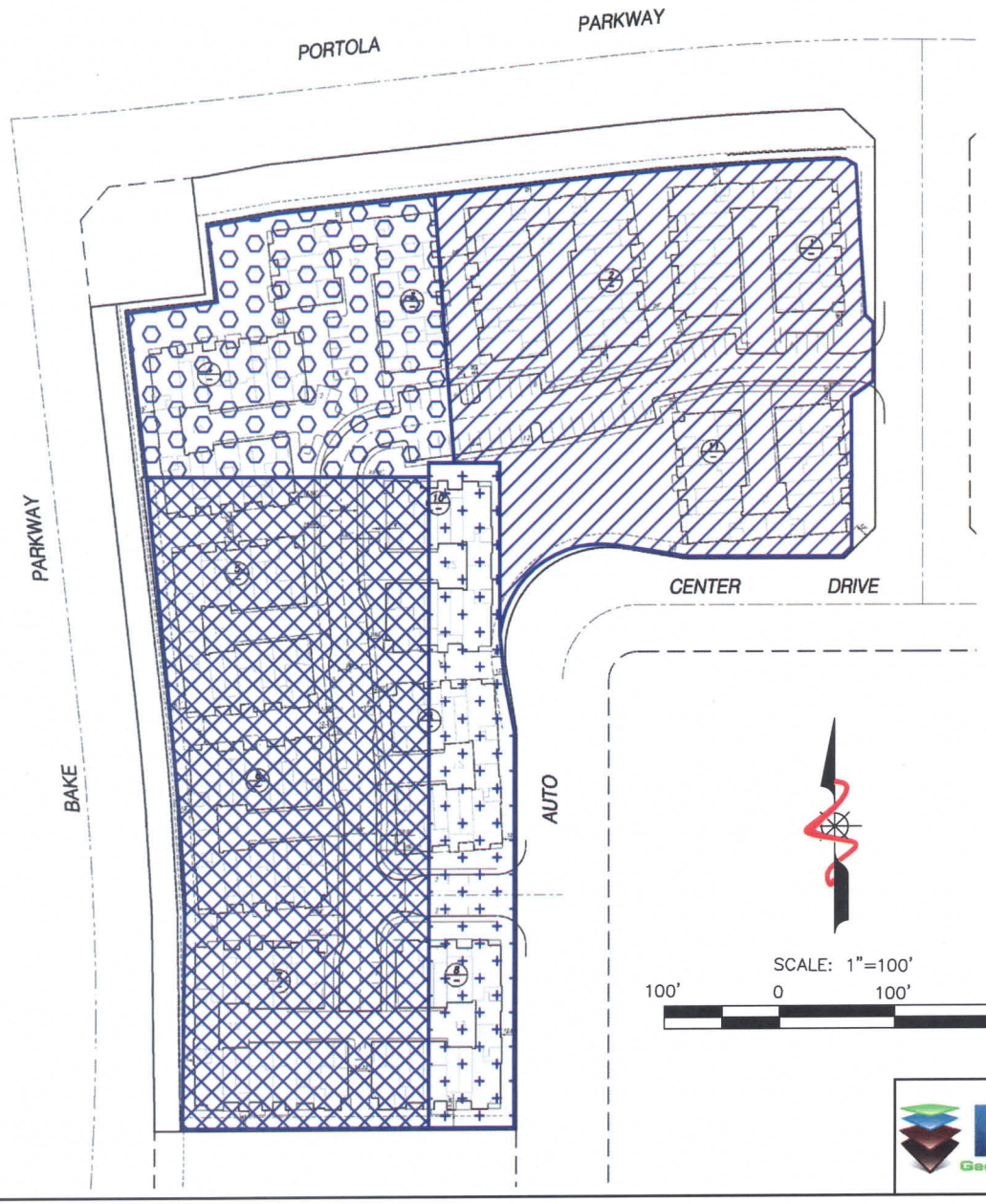
LEGEND:

afo	Older artificial fill by others (undifferentiated)
Qac	Quaternary alluvium/colluvium, circled where buried
Tco	Tertiary Capistrano formation, Oso member, circled where buried
—?—	Approximate location of geologic contact, queried where uncertain
· · ·?· ·	Approximate location of buried geologic contact, queried where uncertain
HS-4 (I) T.D. = 16.5'	Approximate location of hollow-stem auger boring with total depth in feet. "(I)" indicates infiltration test location

LGC Geotechnical, Inc.

FIGURE 2
Geotechnical Map

PROJECT NAME	Brookfield - Lake Forest
PROJECT NO.	11142-01
ENG. / GEOL.	DJB / KTM
SCALE	1" = 100'
DATE	November 2011



LEGEND OF RECOMMENDED REMEDIAL EARTHWORK:

- Five (5) foot overexcavation below **finished pad grade**
- Ten (10) foot overexcavation below **finished pad grade** (Note - western boundary is approximate)
- Two (2) foot removal below **existing grade**
- Three (3) foot removal below **existing grade**

LGC Geotechnical, Inc.

FIGURE 3
Remedial Measures Map

PROJECT NAME	Brookfield - Lake Forest
PROJECT NO.	11142-01
ENG. / GEOL.	DJB / KTM
SCALE	1" = 100'
DATE	November 2011

Appendix A
References

APPENDIX A

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Appendix B
Boring Logs

Geotechnical Boring Log Borehole HS-1

Date: 9/22/2011 | **Drilling Company:** Martini Drilling

Project Name: Brookfield - Lake Forest | **Type of Rig:** HSA

Project Number: 11142-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~788' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By KTM
Sampled By KTM
Checked By BJE

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
755	0							Grass covered topsoil; Gravelly SAND: dark brown, dry, very dense **Older Artificial Fill: Afo**	
750	5	B-1	R-1	10 23 30	115.9	8.8	SM-SP	Silty SAND to SAND with Silt and trace Clay: mottled light gray and brown with black biotite grains, moist, dense to very dense, very fine to medium subangular grains	EI
745	10		R-2	10 17 21	120.1	11.9	SP	SAND with Silt and trace Clay: light gray with dark specks, moist, dense to very dense, subangular grains	#20
740	15		R-3	13 30 50/5"	127.5	8.9	SP	SAND with Silt: light gray with dark specks, moist, very dense, coarse grains	DS
735	20		R-4	8 17 31	120.5	10.9	SW	SAND with some Silt: mottled light gray and light brown, moist, very dense, fine to coarse subangular grains, few fine gravels	
730	25	B-2	R-5	8 19 30	120.2	9.4	SC-SM	Interbedded Sandy CLAY to Clayey SAND and Silty SAND: gray and brown, moist, dense to very dense	
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 10/6/2011

Geotechnical Boring Log Borehole HS-1

Date: 9/22/2011 | **Drilling Company:** Martini Drilling

Project Name: Brookfield - Lake Forest | **Type of Rig:** HSA

Project Number: 11142-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~788' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By KTM
Sampled By KTM
Checked By BJE

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
725	30		R-6	10 18 33	119.5	7.2	SM	Silty SAND: light gray brown, moist, dense to very dense, fine to coarse grains	#200
720	35		R-7	10 20 32	120.8	7.2	SM	Silty SAND: light gray brown, moist, dense to very dense, fine to medium grains with few coarse	
715	40		R-8	31 50/3"	107.9	5.9	SM	Silty SAND: light gray/white with faint greenish oxidation, moist, very dense, well indurated near shoe, possibly bedrock **Tertiary Capistrano Formation, Oso Member (Tso)**	
710	45		R-9	50/6"	96.8	5.9	[SM]	Silty SANDSTONE: light gray/white with faint greenish oxidation, moist, very dense, lacks cementation	
705	50		R-10	50/5"	107.3	6.5	[SM]	same as above	
								Total Depth = 50.5' Groundwater Not Encountered Backfilled with Cuttings on 9/22/2011	
700	55								
	60								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
⏚	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Geotechnical Boring Log Borehole HS-2

Date: 9/22/2011 | **Drilling Company:** Martini Drilling

Project Name: Brookfield - Lake Forest | **Type of Rig:** HSA

Project Number: 11142-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~791' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By KTM
Sampled By KTM
Checked By BJE

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
755	0	B-1						3" Asphalt over 4" base **Tertiary Capistrano Formation, Oso Member (Tso)**	
750	5		R-1	6 15 20	121.3	7.9	[SM]	Silty SANDSTONE with trace Clay: mottled light gray and brown, moist, dense, very fine to coarse subangular grains	
745	10		R-2	30 50/3"	122.7	7.7	[SM]	Silty SANDSTONE with trace Clay: light gray, moist, very dense, fine to coarse subangular grains, well indurated, lacks cementation	#2(
740	15		R-3	19 50/4"	111.3	7.8	[SM]	same as above	S&H, Perm
735	20							Total Depth = 16' Groundwater Not Encountered Backfilled with 2" Diameter Slotted PVC Pipe and Pea Gravel on 9/22/2011; Pipe Pulled and Cuttings Placed in Void on 9/23/11	
730	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
⏚	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 10/6/2011

Geotechnical Boring Log Borehole HS-3

Date: 9/22/2011 | **Drilling Company:** Martini Drilling

Project Name: Brookfield - Lake Forest | **Type of Rig:** HSA

Project Number: 11142-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~787' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By KTM
Sampled By KTM
Checked By BJE

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
755	0							Grass covered topsoil; dark brown, dry, dense **Older Artificial Fill (Afo)**	
750	5		R-1	10 22 26	124.2	7.6	[SM]	**Tertary Capistrano Formation, Oso Member (Tso)** Silty SANDSTONE: light gray and brown, moist, dense, very fine to coarse subangular grains, well indurated, lacks cementation	
745	10		R-2	12 21 34	123.3	8.4	[SM]	same as above	
740	15		R-3	12 18 31	125.3	7.5	[SM]	same as above	S&H, Perm
735	20							Total Depth = 16' Groundwater Not Encountered Backfilled with 2" Diameter Slotted PVC Pipe and Pea Gravel on 9/22/2011; Pipe Pulled and Cuttings Placed in Void on 9/23/11	
730	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
⏚	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
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CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 10/6/2011

Geotechnical Boring Log Borehole HS-4

Date: 9/22/2011 | **Drilling Company:** Martini Drilling

Project Name: Brookfield - Lake Forest | **Type of Rig:** HSA

Project Number: 11142-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~786' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By KTM
Sampled By KTM
Checked By BJE

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
755	0							Grass covered topsoil; dark brown, dry, dense **Older Artificial Fill (Afo)**	
	5	B-1	R-1	10 15 16	119.2	9.8	SC-CL	Clayey SAND - Sandy CLAY: brown, moist, dense, sand is very fine to medium with few coarse grains	EI CR
750									
	10		R-2	7 12 18	119.2	12.1	SC	Clayey SAND: brown, moist, dense, sand is very fine to medium with few coarse grains	
745									
	15		R-3	8 14 28	120.5	12.1	SC	Clayey SAND: brown, moist, dense, sand is fine to coarse	#200
740									
	20							Total Depth = 16' Groundwater Not Encountered Backfilled with 2" Diameter Slotted PVC Pipe and Pea Gravel on 9/22/2011; Pipe Pulled and Cuttings Placed in Void on 9/23/11	
735									
	25								
730									
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
▽	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Last Edited: 10/6/2011

Appendix C
Laboratory Test Results

Location	Sample No.	Depth (ft)	Molding Moisture Content (%)	Initial Dry Density (pcf)	Final Moisture Content (%)	Expansion Index	Expansion Classification[1]
LGC-1	B-1	5'-8'	7.6	110.5	14.5	8	Very Low

[1] Per ASTM D4829-08a

LGC Geotechnical, Inc.

EXPANSION INDEX
(ASTM D 4829)

Project Number: 11142-01
Date: Nov-11

Brookfield Lake Forest

Location	Sample No.	Depth (ft)	Percent Passing No. 200 Sieve
LGC-1	R-2	10	19
LGC-1	R-6	30	19
LGC-2	R-2	10	17
LGC-4	R-3	15	26

LGC Geotechnical, Inc.	**PERCENT PASSING THE No. 200 SIEVE**	**Project Number:**	11142-01
		Date:	Nov-11
		Brookfield Lake Forest	

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: Lake Forest
Project No. : 11142-01
Exploration No.: LGC-2
Sample No.: R-3
Soil Identification: White clayey sand (SC)

Tested By : A. Santos
Data Input By: J. Ward
Depth (feet) : 15.0

Date: 10/18/11
Date: 10/27/11

% Gravel	0
% Sand	79
% Fines	21

Soil Type: SC

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	154.64
Wt.of Air-Dry Soil + Cont. (g)	512.10	Wt. of Container No.___ (g)	1.00	1.00	76.37
Wt. of Container	109.15	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	402.95	Wt. of Dry Soil (g)			78.27

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	27.59	93.2
Pan		

Sieve after Hydrometer & Wet Sieve

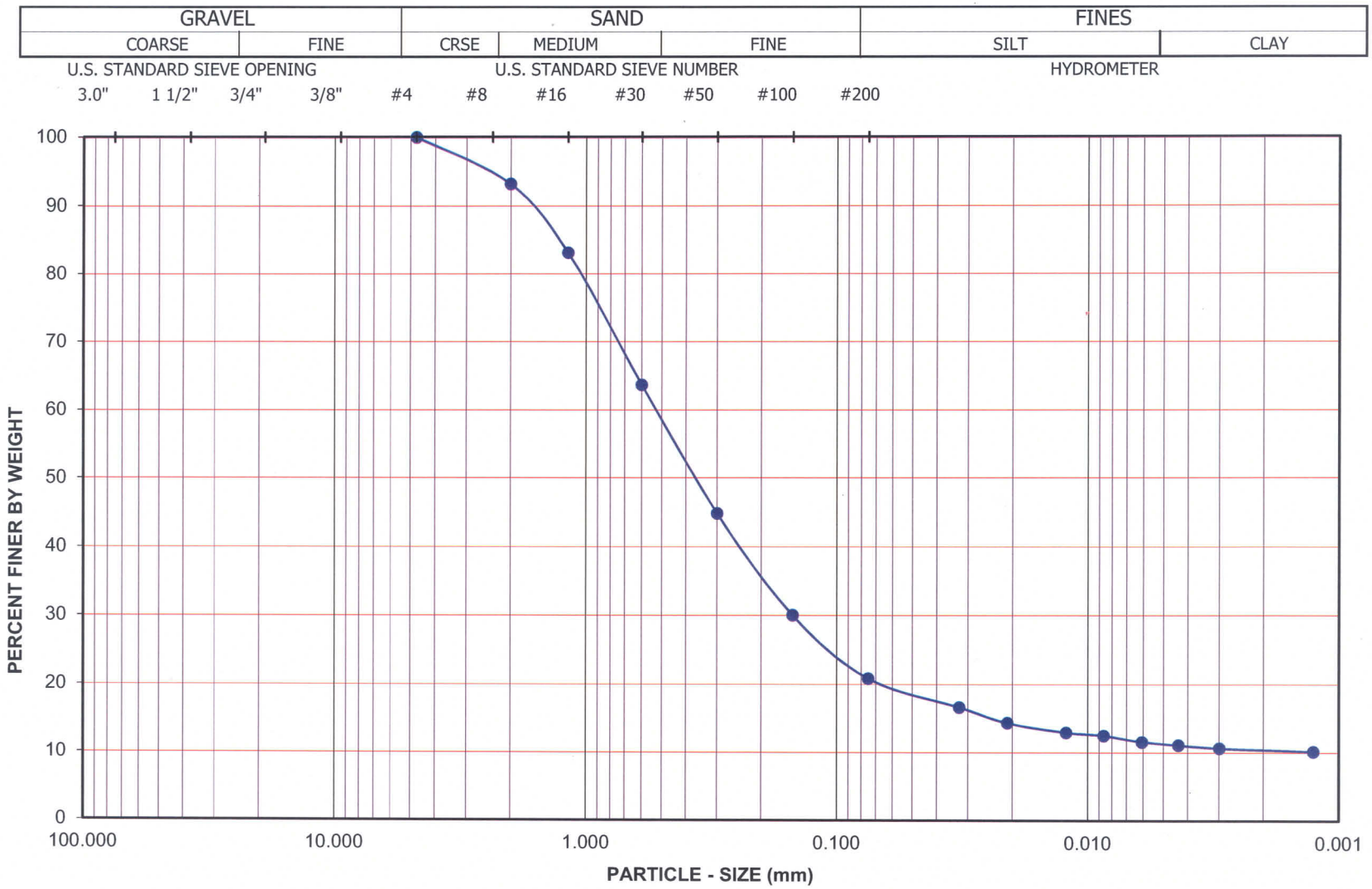
U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	93.2
No. 16	10.82	89.2	83.1
No. 30	31.69	68.3	63.7
No. 50	51.95	48.1	44.8
No. 100	67.86	32.2	30.0
No. 200	77.72	22.4	20.8
Pan			

Hydrometer

Wt. of Air-Dry Soil (g): 100.10
Wt. of Dry Soil (g): 100.10

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Oct-11	9:29	0		6.5			
	9:31	2	22.7	6.5	24.5	16.6	0.0325
	9:34	5	22.7	6.5	22.0	14.3	0.0209
	9:44	15	22.8	6.5	20.5	12.9	0.0122
	9:59	30	22.9	6.5	20.0	12.5	0.0086
	10:29	60	23.1	6.5	19.0	11.5	0.0061
	11:29	120	22.9	6.5	18.5	11.1	0.0044
	13:39	250	23.2	6.5	18.0	10.6	0.0030
20-Oct-11	9:29	1440	22.6	6.5	17.5	10.2	0.0013



Project Name: Lake Forest

Project No.: 11142-01

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LGC-2 Sample No.: R-3

Depth (feet) : 15.0 Soil Type : SC

Soil Identification: White clayey sand (SC)

GR:SA:FI : (%) 0 : 79 : 21

Oct-11

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: Lake Forest | Tested By : A. Santos | Date: 10/18/11

Project No. : 11142-01 | Data Input By: J. Ward | Date: 10/27/11

Exploration No.: LGC-3

Sample No.: R-3 | Depth (feet) : 15.0

Soil Identification: Very light gray clayey sand (SC)

% Gravel	**0**	**Soil Type**
% Sand	**79**	**SC**
% Fines	**21**	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	153.78
Wt.of Air-Dry Soil + Cont. (g)	554.80	Wt. of Container No.___ (g)	1.00	1.00	75.17
Wt. of Container	108.50	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	446.30	Wt. of Dry Soil (g)			78.61

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.45	99.9
No. 10	26.05	94.2
Pan		

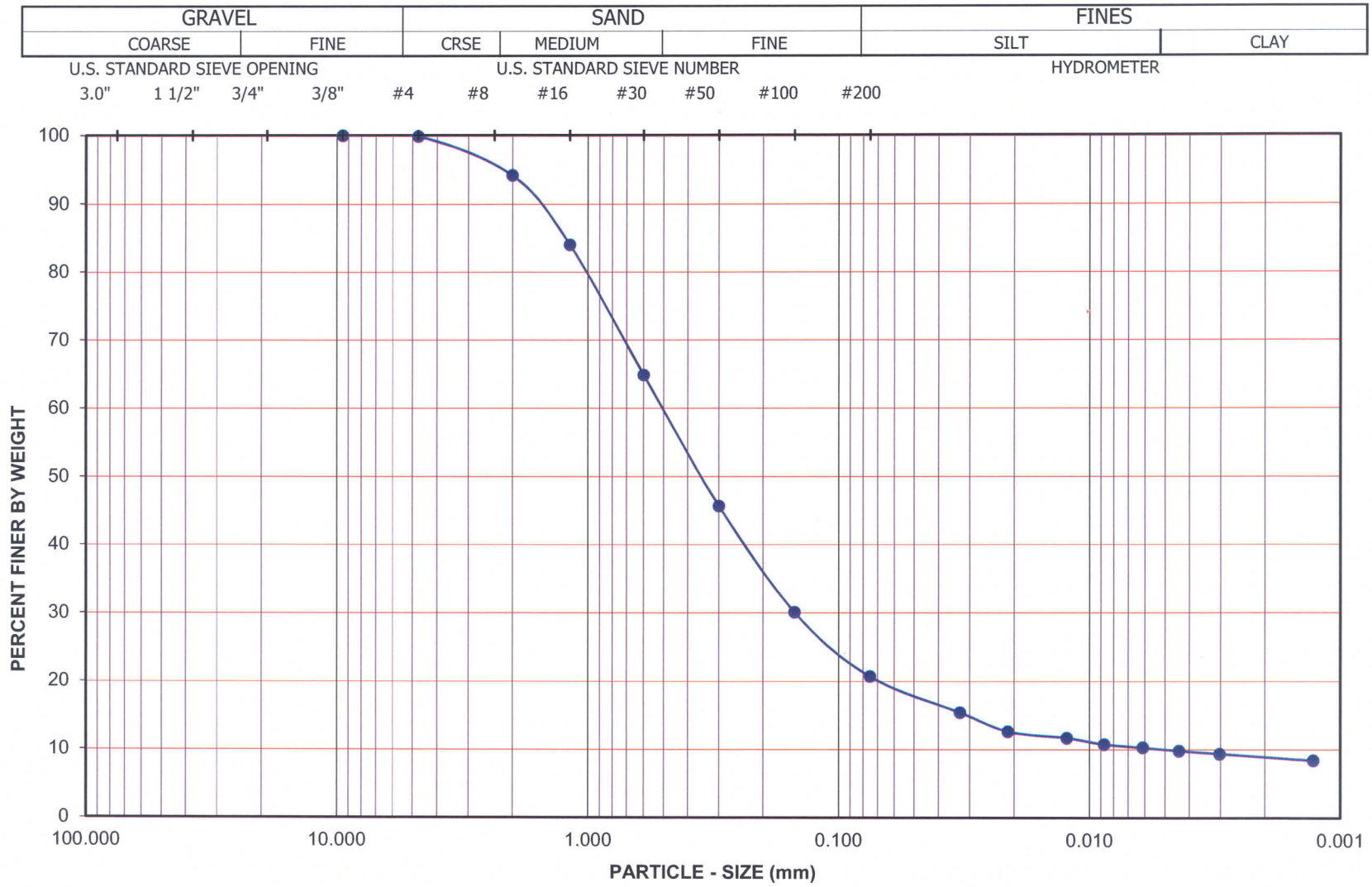
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	94.2
No. 16	10.81	89.2	84.0
No. 30	31.18	68.9	64.9
No. 50	51.59	48.5	45.7
No. 100	68.20	31.9	30.1
No. 200	78.17	22.0	20.7
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 100.20 Wt. of Dry Soil (g) 100.20

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Oct-11	9:25	0		6.5			
	9:27	2	22.7	6.5	23.0	15.4	0.0328
	9:30	5	22.7	6.5	20.0	12.6	0.0212
	9:40	15	22.8	6.5	19.0	11.7	0.0123
	9:55	30	22.9	6.5	18.0	10.7	0.0087
	10:25	60	23.1	6.5	17.5	10.3	0.0061
	11:25	120	22.9	6.5	17.0	9.8	0.0044
	13:35	250	23.2	6.5	16.5	9.3	0.0030
20-Oct-11	9:25	1440	22.6	6.5	15.5	8.4	0.0013



Project Name: Lake Forest

Project No.: 11142-01

PARTICLE - SIZE DISTRIBUTION ASTM D 422

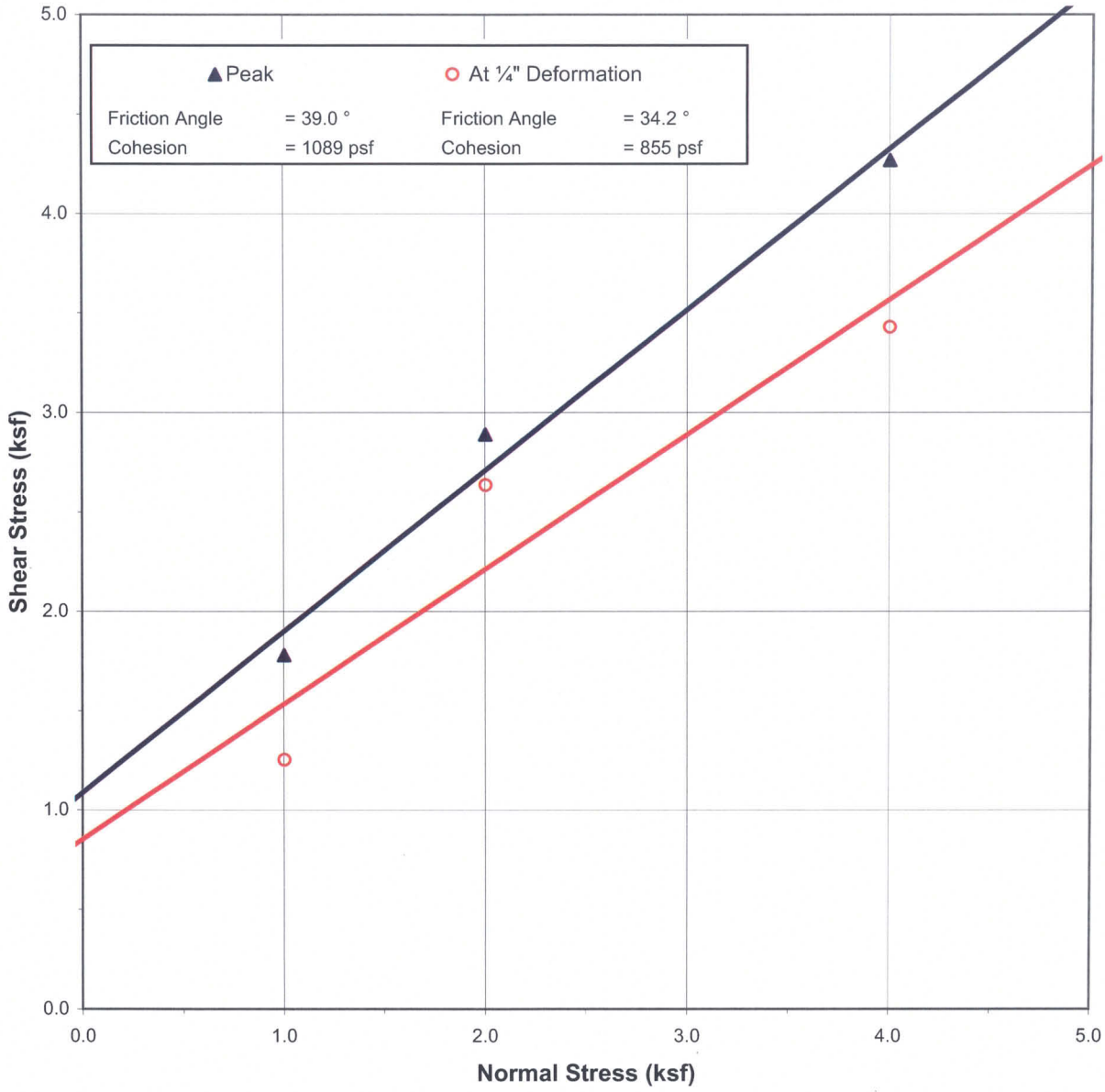
Exploration No.: LGC-3 Sample No.: R-3

Depth (feet) : 15.0 Soil Type : SC

Soil Identification: Very light gray clayey sand (SC)

GR:SA:FI : (%) 0 : 79 : 21

Oct-11



Location:	Sample No.:	Depth (ft)	Sample Type	Shear Rate (inch/min)	Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)
LGC-1	**R-3**	**15**		**0.004**	**127.5**	**8.9**	**15.3**

Sample Description: Silty Sand

LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 11142-01
Date: Nov-11

Brookfield Lake Forest

SATURATED HYDRAULIC CONDUCTIVITY

FALLING HEAD METHOD

ASTM D 5084

Project Name:	Lake Forest	Tested by:	A. Santos	Date:	10/17/11
Project No.:	11142-01	Input By:	J. Ward	Date:	10/27/11
Boring No.:	LGC-2	Sample Type:		Drive	
Sample No.:	R-3	Depth (ft.)	15.0		
Soil Identification:	White clayey sand (SC)				

		INITIAL CONDITION	FINAL CONDITION
Diameter (in)	1	2.424	2.416
	2	2.425	2.415
	3	2.423	2.410
	Average	2.424	2.414
Height (in)	1	2.998	2.984
	2	3.001	2.994
	3	2.997	2.990
	Average	2.999	2.989
Moisture Content (%)		7.82	16.15
Wt. Wet Sample + Container (g)		543.60	545.30
Wt. Dry Sample + Container (g)		512.10	479.80
Wt. Container (g)		109.15	74.26
Density and Saturation			
Wt. Wet Sample + Container (g)		544.60	Calculated from initial dry weight and final moisture
Wt. Container (g)		102.70	
Wet Density (pcf)		121.6	132.6
Dry Density (pcf)		112.8	114.2
Void Ratio		0.494	0.476
Total Porosity		0.331	0.323
Pore Volume (cc)		75.0	72.3
% Saturation		42.7	91.5

Specific Gravity, Gs (assumed) = 2.70

Back Pressure Saturation

B Value (%) = 97

Consolidation

Cell Pressure (psi) =	113.65	Burette Area (sq. in.)=	0.380
Back Pressure(psi) =	101.30	Initial Burette Ht.(cm)=	15.6
Effective Pressure (psi) =	12.35	Final Burette Ht.(cm)=	16.8

SATURATED HYDRAULIC CONDUCTIVITY

FALLING HEAD METHOD (ASTM D 5084)

Project Name:	Lake Forest	Cell Pressure:	113.65	psi	Initial Sample Height:	2.9987	in
Project No:	11142-01	Bottom Pressure (Pb):	102.90	psi	Initial Area of Sample:	4.6148	in.²
Boring No.:	LGC-2	Top Pressure (Pt):	101.30	psi	Final Sample Ht.* (L):	2.9857	in
Sample No. :	R-3	Consolidation Pressure:	12.35	psi	Final Sample Area* (A):	4.5747	in.²
Depth(ft):	15.0	Burette Area (influent) (Ai):	0.390	in.²			
Sample Type:	Drive	Burette Area (effluent) (Ao):	0.380	in.²			
Soil Identification:	White clayey sand (SC)	Vol. Change During Consol.:	0.180	in.³			

* After Consolidation

Date	Time (min.)	Incremental Elapsed Time (t) (min)	Temperature (°C)	Water Height Influent Burette (hi) (cm)	Water Height Effluent Burette (ho) (cm)	Uncorrected Hydraulic Conductivity (cm/sec)	Corrected Conductivity at 20 °C (cm/sec)	Inflow Rate / Outflow Rate
20-Oct-11	09:04:00	0		27.9	2.9	Initial Reading		
20-Oct-11	09:14:00	10	22.7	25.1	5.9	2.3E-05	2.2E-05	0.96
20-Oct-11	09:24:00	10	22.8	22.7	8.4	2.0E-05	1.9E-05	0.99
20-Oct-11	09:34:00	10	22.8	20.4	10.7	2.0E-05	1.8E-05	1.03
20-Oct-11	09:44:00	10	22.8	18.3	12.8	1.9E-05	1.7E-05	1.03
20-Oct-11	09:54:00	10	22.8	16.5	14.6	1.6E-05	1.5E-05	1.03
20-Oct-11	10:04:00	10	22.8	14.8	16.3	1.6E-05	1.5E-05	1.03

RESULTS	
Hydraulic Conductivity (cm/sec)	
Average of Last 4 Readings	**1.7E-05**
Upper Limit	2.1E-05
Lower Limit	1.2E-05
Remarks	

k=Ai.Ao.L.ln(h1/h2)/(A.t.(Ai+Ao)) where h1, h2= ((Pb-Pt)/Y+(hi-ho) at t0-(change in hi + change in ho) at t1 and t2

SATURATED HYDRAULIC CONDUCTIVITY

FALLING HEAD METHOD

ASTM D 5084

Project Name:	Lake Forest		Tested by:	A. Santos	Date: 10/17/11
Project No.:	11142-01		Input By:	J. Ward	Date: 10/27/11
Boring No.:	LGC-3		Sample Type:		Drive
Sample No.:	R-3		Depth (ft.)	15.0	
Soil Identification:	Very light gray clayey sand (SC)				

		INITIAL CONDITION	FINAL CONDITION
Diameter (in)	1	2.423	2.423
	2	2.422	2.424
	3	2.425	2.424
	Average	2.423	2.424
Height (in)	1	3.015	3.016
	2	3.016	3.019
	3	3.014	3.018
	Average	3.015	3.018
Moisture Content (%)		7.51	12.49
Wt. Wet Sample + Container (g)		588.30	579.70
Wt. Dry Sample + Container (g)		554.80	523.80
Wt. Container (g)		108.60	76.20
Density and Saturation			
Wt. Wet Sample + Container (g)		594.90	Calculated from initial dry weight and final moisture
Wt. Container (g)		102.70	
Wet Density (pcf)		134.8	140.9
Dry Density (pcf)		125.4	125.3
Void Ratio		0.344	0.346
Total Porosity		0.256	0.257
Pore Volume (cc)		58.3	58.6
% Saturation		58.9	97.6

Specific Gravity, Gs (assumed) = 2.70

Back Pressure Saturation

B Value (%) = 97

Consolidation

Cell Pressure (psi) =	103.40	Burette Area (sq. in.)=	0.391
Back Pressure(psi) =	91.04	Initial Burette Ht.(cm)=	19.1
Effective Pressure (psi) =	12.36	Final Burette Ht.(cm)=	20.0

SATURATED HYDRAULIC CONDUCTIVITY

FALLING HEAD METHOD (ASTM D 5084)

Project Name:	Lake Forest	Cell Pressure:	103.40	psi	Initial Sample Height:	3.0150	in
Project No:	11142-01	Bottom Pressure (Pb):	94.06	psi	Initial Area of Sample:	4.6123	in.²
Boring No.:	LGC-3	Top Pressure (Pt):	91.04	psi	Final Sample Ht.* (L):	3.0050	in
Sample No. :	R-3	Consolidation Pressure:	12.36	psi	Final Sample Area* (A):	4.5815	in.²
Depth(ft):	15.0	Burette Area (influent) (Ai):	0.382	in.²			
Sample Type:	Drive	Burette Area (effluent) (Ao):	0.391	in.²			
Soil Identification:	Very light gray clayey sand (SC)	Vol. Change During Consol.:	0.139	in.³			

* After Consolidation

Date	Time (min.)	Incremental Elapsed Time (t) (min)	Temperature (°C)	Water Height Influent Burette (hi) (cm)	Water Height Effluent Burette (ho) (cm)	Uncorrected Hydraulic Conductivity (cm/sec)	Corrected Conductivity at 20 °C (cm/sec)	Inflow Rate / Outflow Rate
20-Oct-11	09:17:00	0		26.00	4.10	Initial Reading		
20-Oct-11	09:27:00	10	22.8	25.90	4.20	4.6E-07	4.3E-07	0.98
20-Oct-11	10:00:00	33	22.8	25.60	4.50	4.2E-07	3.9E-07	0.98
20-Oct-11	10:30:00	30	22.8	25.35	4.75	3.8E-07	3.6E-07	0.98
20-Oct-11	11:00:00	30	22.9	25.10	5.00	3.8E-07	3.6E-07	0.98
20-Oct-11	11:30:00	30	22.9	24.85	5.25	3.8E-07	3.6E-07	0.98
20-Oct-11	12:00:00	30	23.0	24.60	5.50	3.9E-07	3.6E-07	0.98

RESULTS	
Hydraulic Conductivity (cm/sec)	
Average of Last 4 Readings	**3.6E-07**
Upper Limit	4.5E-07
Lower Limit	2.7E-07
Remarks	

k=Ai.Ao.L.ln(h1/h2)/(A.t.(Ai+Ao)) where h1, h2= ((Pb-Pt)/Y+(hi-ho) at t0-(change in hi + change in ho) at t1 and t2

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	Lake Forest		Tested By:	S. Felter	Date: 11/01/11
Project No. :	11142-01		Checked By:	J. Ward	Date: 11/03/11
Boring No.:	LGC-4		Depth (ft.)	4-7	
Sample No. :	B-4				
Soil Identification:	Very dark gray clayey sand (SC)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0240
Wt. Comp. Soil + Mold	(g)	611.50	428.34
Wt. of Mold	(g)	208.70	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	798.10	637.04
Dry Wt. of Soil + Cont.	(g)	725.50	574.90
Wt. of Container	(g)	0.00	208.70
Moisture Content	(%)	10.01	16.97
Wet Density	(pcf)	121.5	126.2
Dry Density	(pcf)	110.4	107.9
Void Ratio		0.526	0.563
Total Porosity		0.345	0.360
Pore Volume	(cc)	71.4	76.3
Degree of Saturation (%) [S_{meas}]		**51.3**	81.4

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
11/01/11	8:00	1.0	0	0.2220
11/01/11	8:10	1.0	10	0.2220
Add Distilled Water to the Specimen				
11/01/11	10:44	1.0	154	0.2445
11/02/11	6:12	1.0	1322	0.2460
11/02/11	7:15	1.0	1385	0.2460

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**24**

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: Lake Forest Tested By : V. Juliano Date: 10/31/11

Project No. : 11142-01 Data Input By: J. Ward Date: 11/03/11

Boring No.	LGC-4			
Sample No.	B-4			
Sample Depth (ft)	4-7			
Soil Identification:	Very dark gray (SC)			
Wet Weight of Soil + Container (g)	155.20			
Dry Weight of Soil + Container (g)	152.50			
Weight of Container (g)	56.00			
Moisture Content (%)	2.80			
Weight of Soaked Soil (g)	100.20			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	8			
Crucible No.	21			
Furnace Temperature (°C)	830			
Time In / Time Out	7:50/8:35			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	18.8063			
Wt. of Crucible (g)	18.8050			
Wt. of Residue (g) (A)	0.0013			
PPM of Sulfate (A) x 41150	53.50			
PPM of Sulfate, Dry Weight Basis	**55**			

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30			
ml of AgNO3 Soln. Used in Titration (C)	0.5			
PPM of Chloride (C -0.2) * 100 * 30 / B	30			
PPM of Chloride, Dry Wt. Basis	**31**			

pH TEST, DOT California Test 532/643

pH Value	**7.25**			
Temperature °C	20.5			

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: Lake Forest
Project No. : 11142-01
Boring No.: LGC-4
Sample No. : B-4
Soil Identification:* Very dark gray (SC)

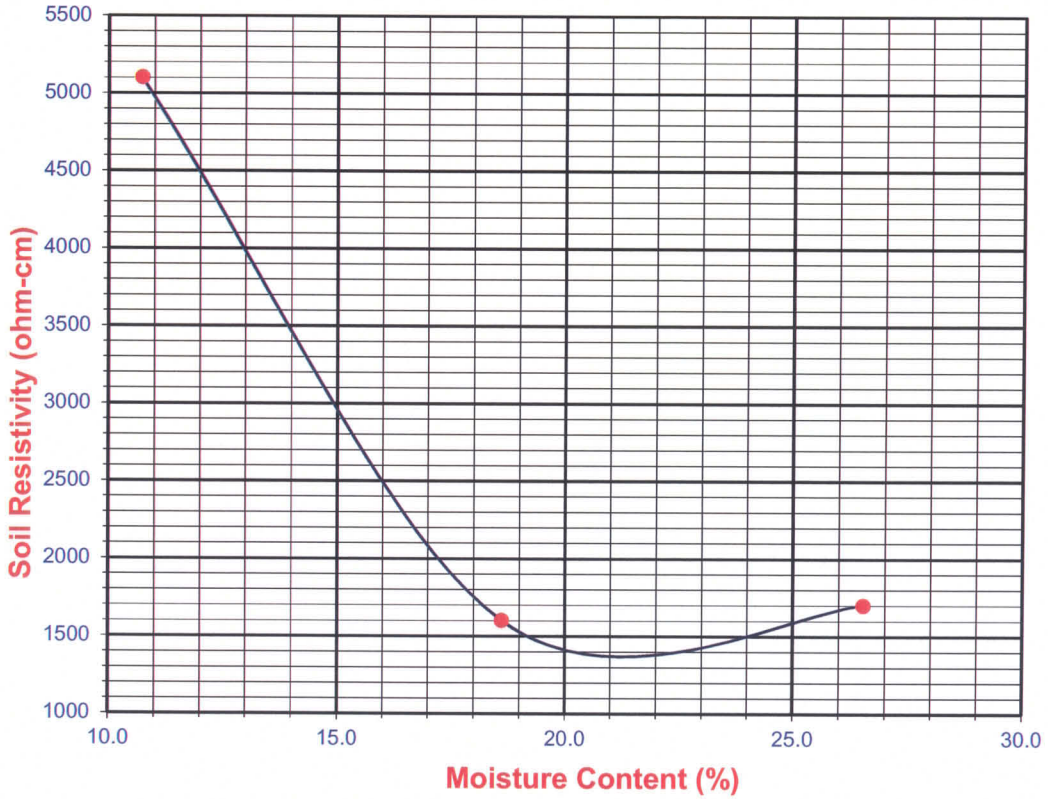
Tested By : V. Juliano Date: 11/01/11
Data Input By: J. Ward Date: 11/03/11
Depth (ft.) : 4-7

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	10.71	5100	5100
2	20	18.61	1600	1600
3	30	26.52	1700	1700
4				
5				

Moisture Content (%) (MCi)	2.80
Wet Wt. of Soil + Cont. (g)	155.20
Dry Wt. of Soil + Cont. (g)	152.50
Wt. of Container (g)	56.00
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
1350	**21.2**	**55**	**31**	**7.25**	**20.5**



Appendix D
General Earthwork and Grading Specifications for Rough Grading

APPENDIX D

General Earthwork and Grading Specifications For Rough Grading

1.0 General

1.1 ***Intent:*** These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 ***The Geotechnical Consultant of Record:*** Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 ***The Earthwork Contractor:*** The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "equipment" of work and the estimated quantities of daily earthwork contemplated for the

site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 Preparation of Areas to be Filled

2.1 ***Clearing and Grubbing:*** Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 ***Processing:*** Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 ***Overexcavation:*** In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 ***Benching:*** Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 ***Evaluation/Acceptance of Fill Areas:*** All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 *Fill Material*

3.1 ***General:*** Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 ***Oversize:*** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 ***Import:*** If importing of fill material is required for grading, proposed import material shall meet the requirements of the geotechnical consultant. The potential import source shall be given to the Geotechnical Consultant at least 96 hours (4 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 ***Fill Layers:*** Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 ***Fill Moisture Conditioning:*** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 ***Compaction of Fill:*** After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 ***Compaction of Fill Slopes:*** In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 ***Compaction Testing:*** Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 ***Frequency of Compaction Testing:*** Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 ***Compaction Test Locations:*** The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

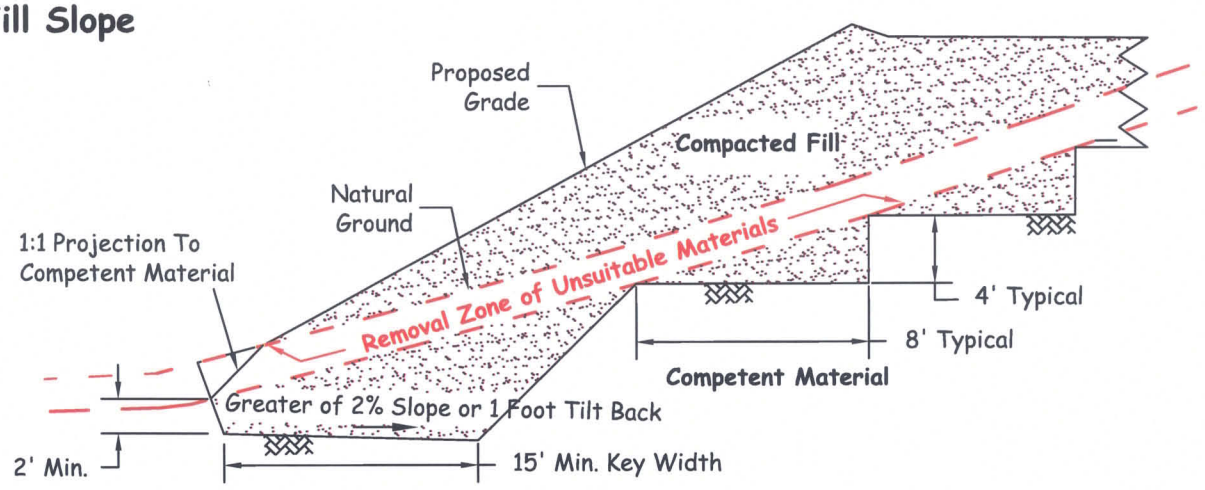
7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

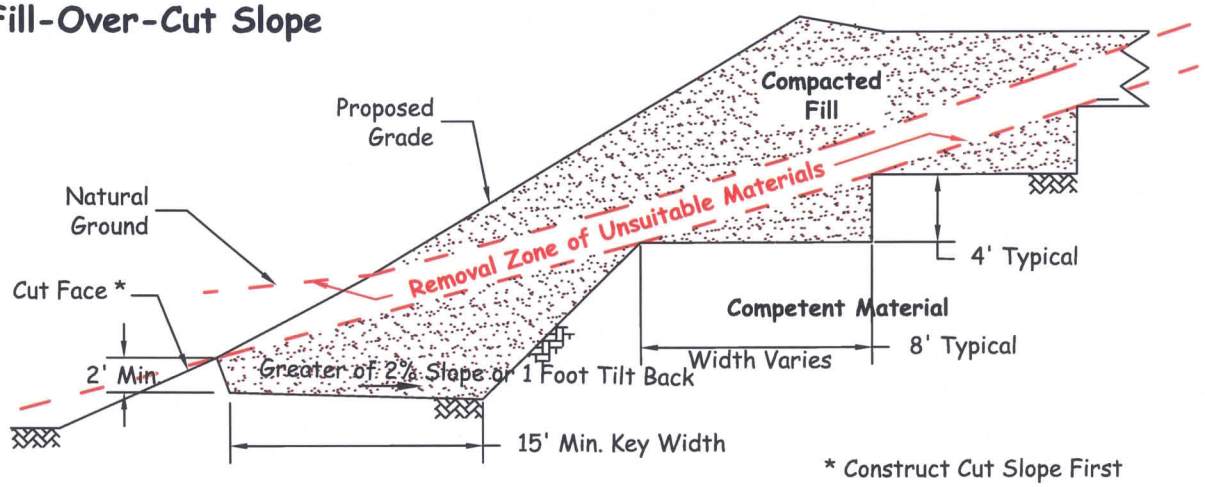
7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

Fill Slope

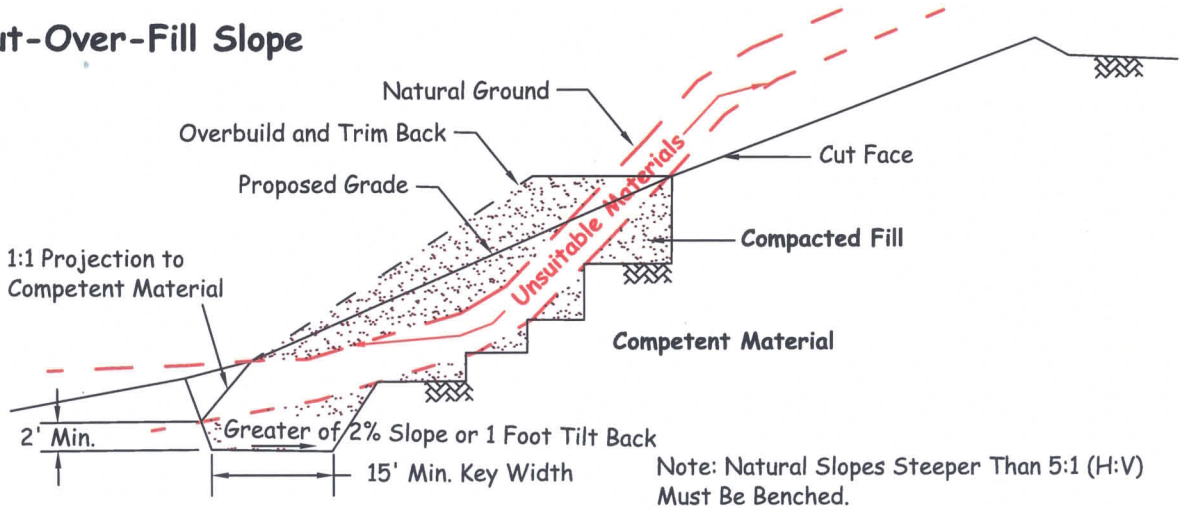


Fill-Over-Cut Slope



* Construct Cut Slope First

Cut-Over-Fill Slope



Note: Natural Slopes Steeper Than 5:1 (H:V) Must Be Benched.

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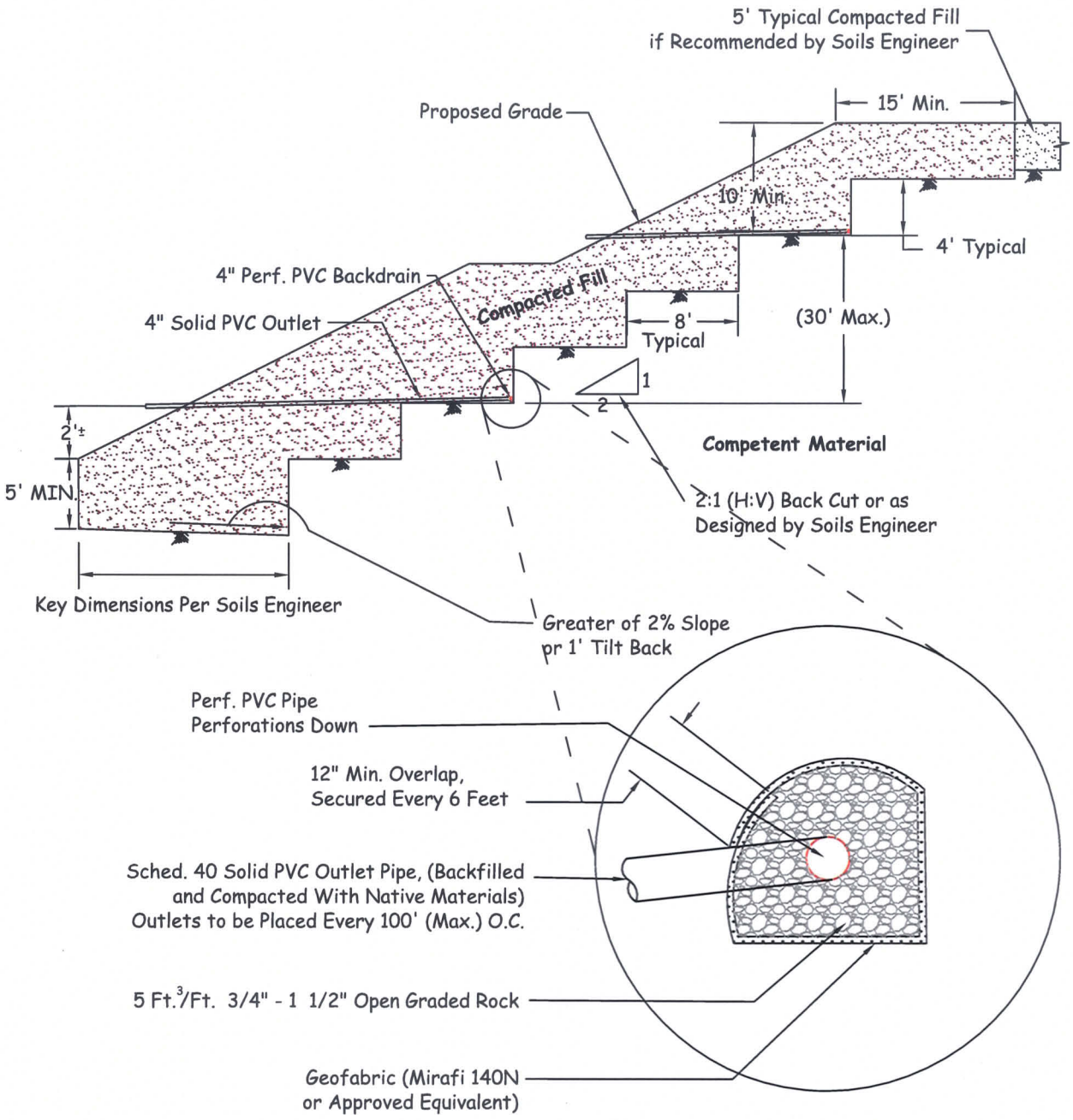
KEYING AND BENCHING



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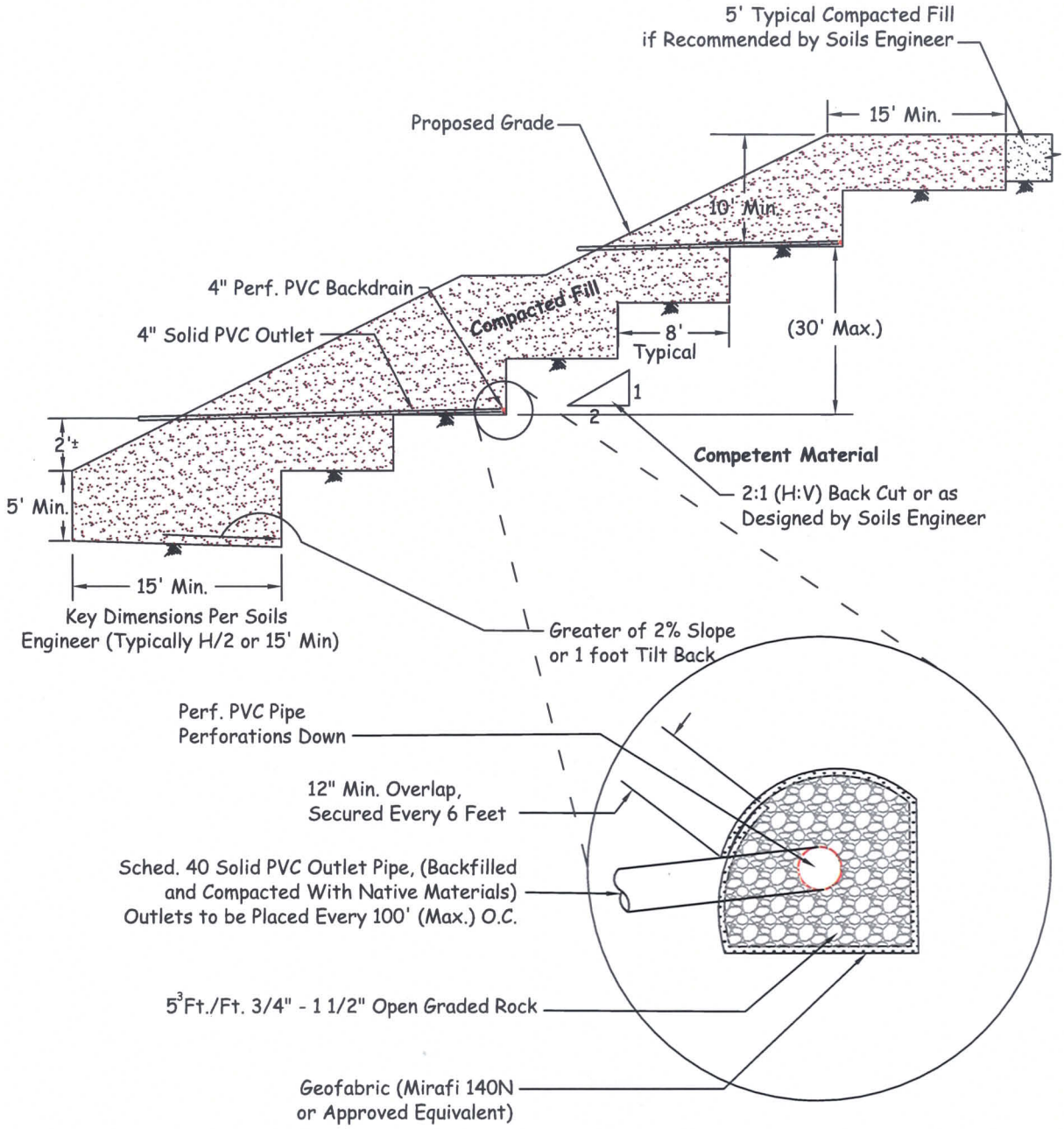
TYPICAL BUTTRESS DETAIL



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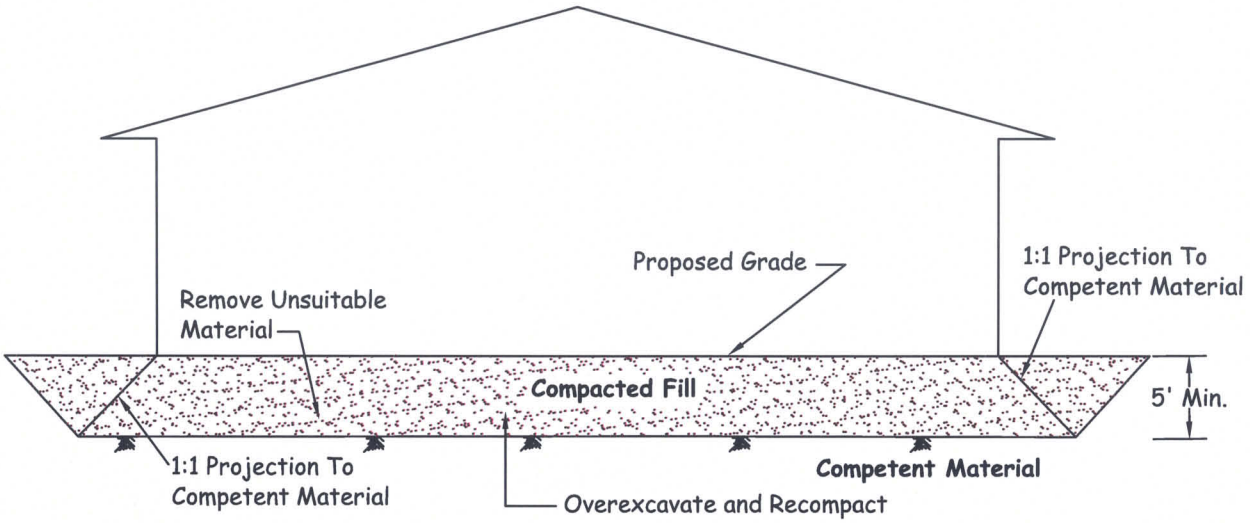
TYPICAL STABILIZATION FILL DETAIL

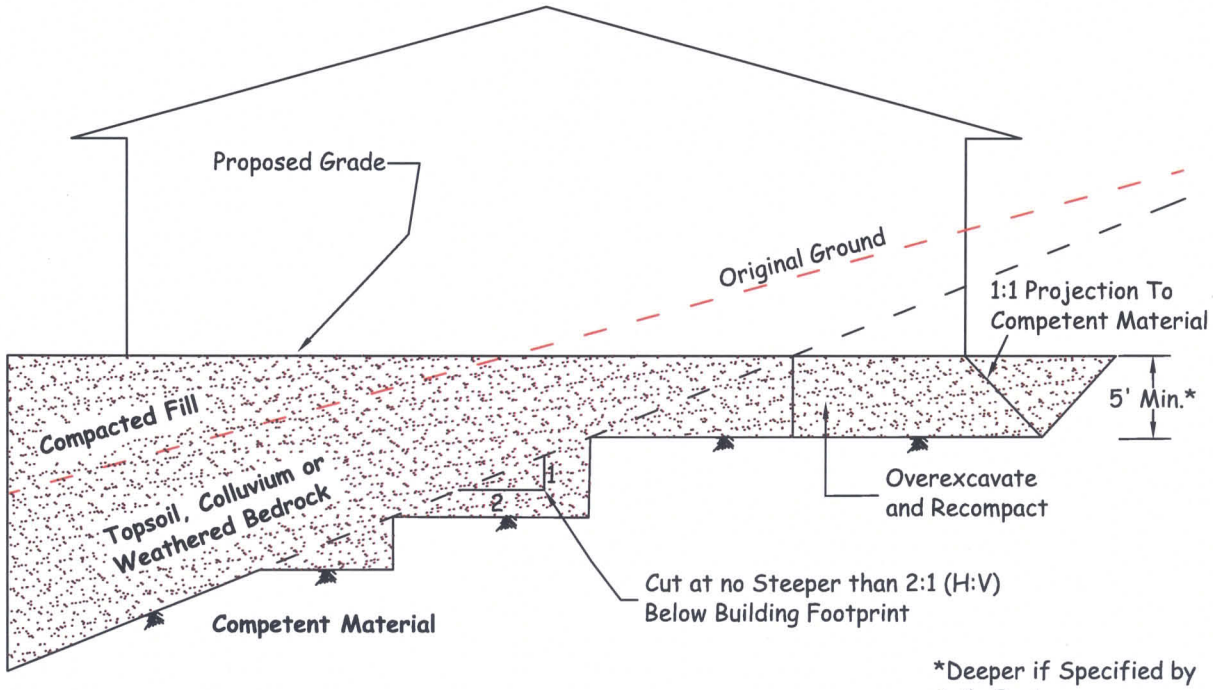
Cut Lot
(Exposing Unsuitable Soils at Design Grade)



Note 1: Removal Bottom Should be Graded With Minimum 2% Fall Towards Street or Other Suitable Area (as Determined by Soils Engineer) to Avoid Ponding Below Building

Note 2: Where Design Cut Lots are Excavated Entirely Into Competent Material, Overexcavation May Still be Required for Hard-Rock Conditions or for Materials With Variable Expansion Characteristics.

Cut/Fill Transition Lot



*Deeper if Specified by Soils Engineer

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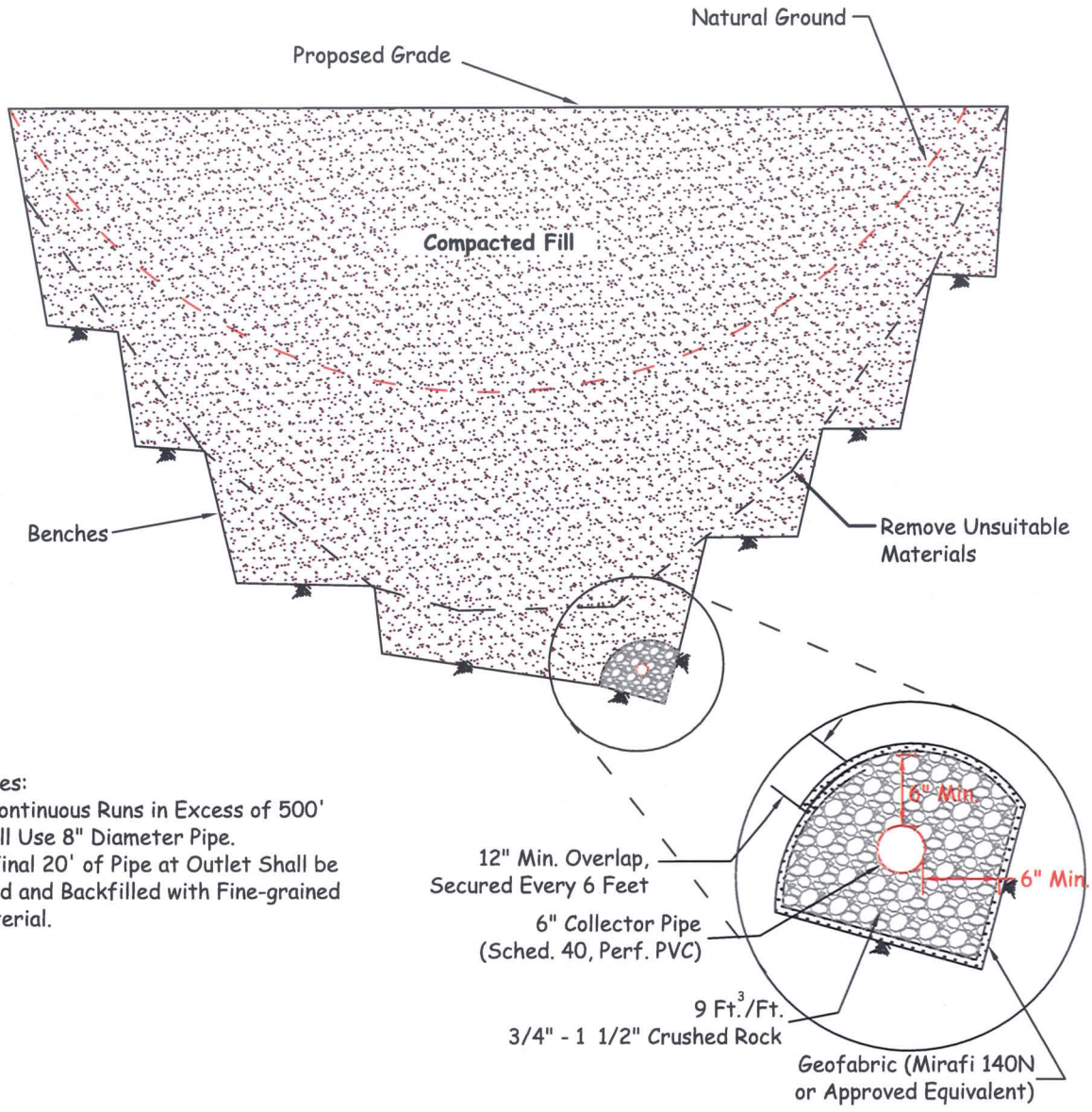
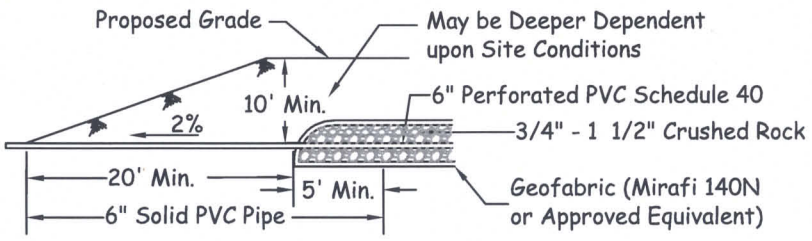
CUT AND TRANSITION LOT OVEREXCAVATION DETAIL



Notes:
1) Continuous Runs in Excess of 500' Shall Use 8" Diameter Pipe.
2) Final 20' of Pipe at Outlet Shall be Solid and Backfilled with Fine-grained Material.

Proposed Outlet Detail



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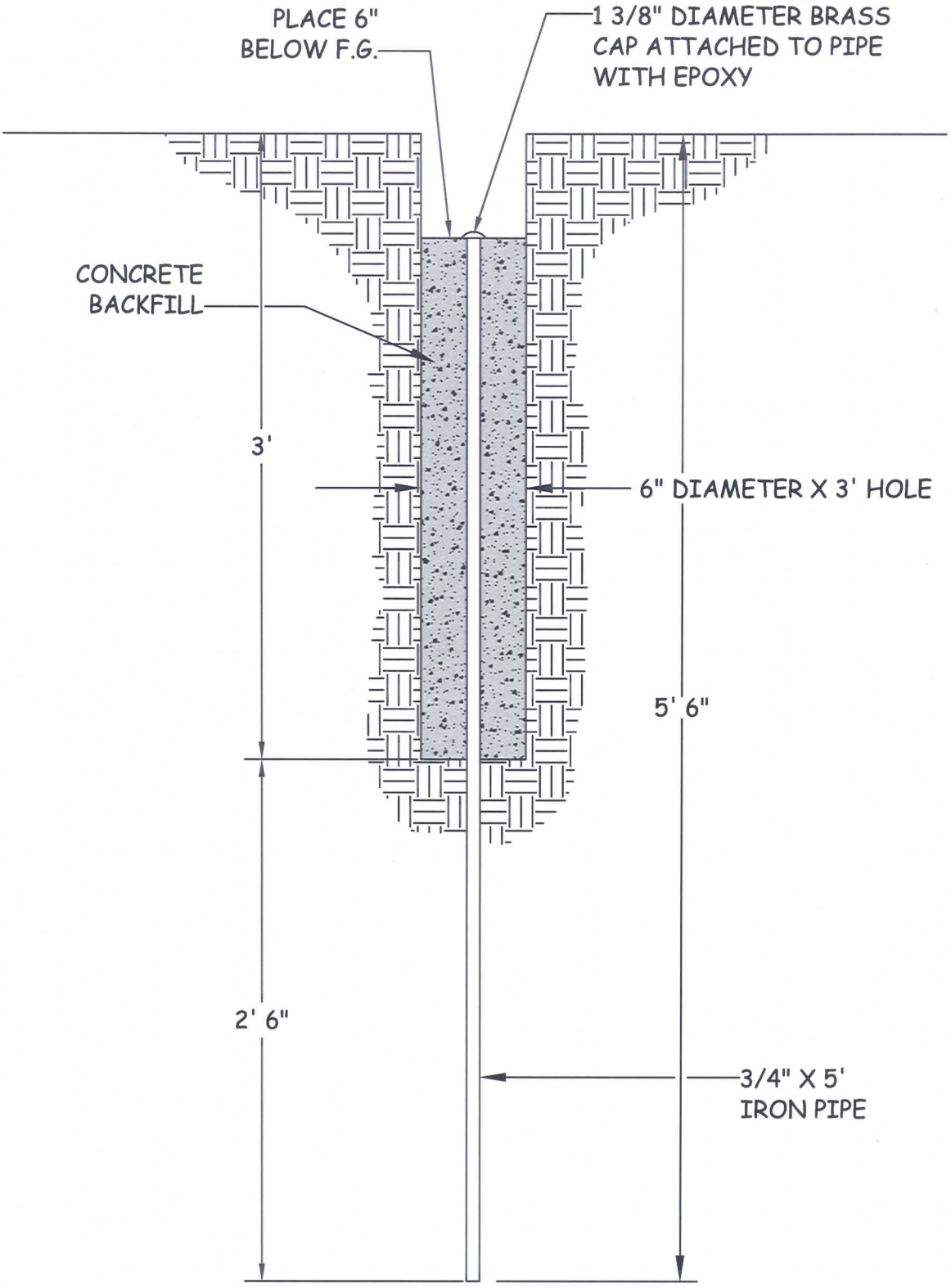
CANYON SUBDRAINS



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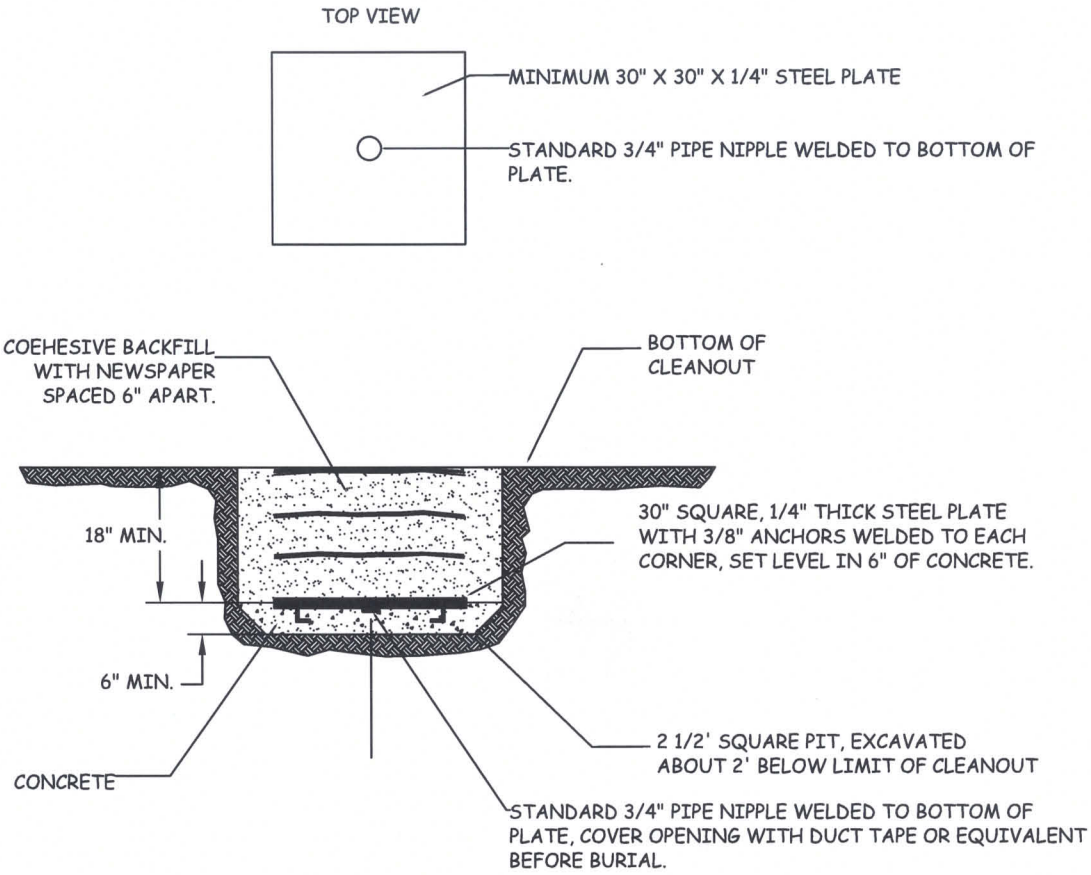
TYPICAL SURFACE SETTLEMENT MONUMENT



1. SURVEY FOR HORIZONTAL AND VERTICAL LOCATION TO NEAREST .01 INCH PRIOR TO BACKFILL USING KNOW LOCATIONS THAT WILL REMAIN INTACT DURING THE DURATION OF THE MONITORING PROGRAM. KNOW POINTS EXPLICITELY NOT ALLOWED ARE THOSE LOCATED ON FILL OR THAT WILL BE DESTROYED DURING GRADING.
2. IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE DURING GRADING, CONTRACTOR SHALL IMMEDIATELY NOTIFY THE GEOTECHNICAL ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.
3. DRILL TO RECOVER AND ATTACH RISER PIPE.

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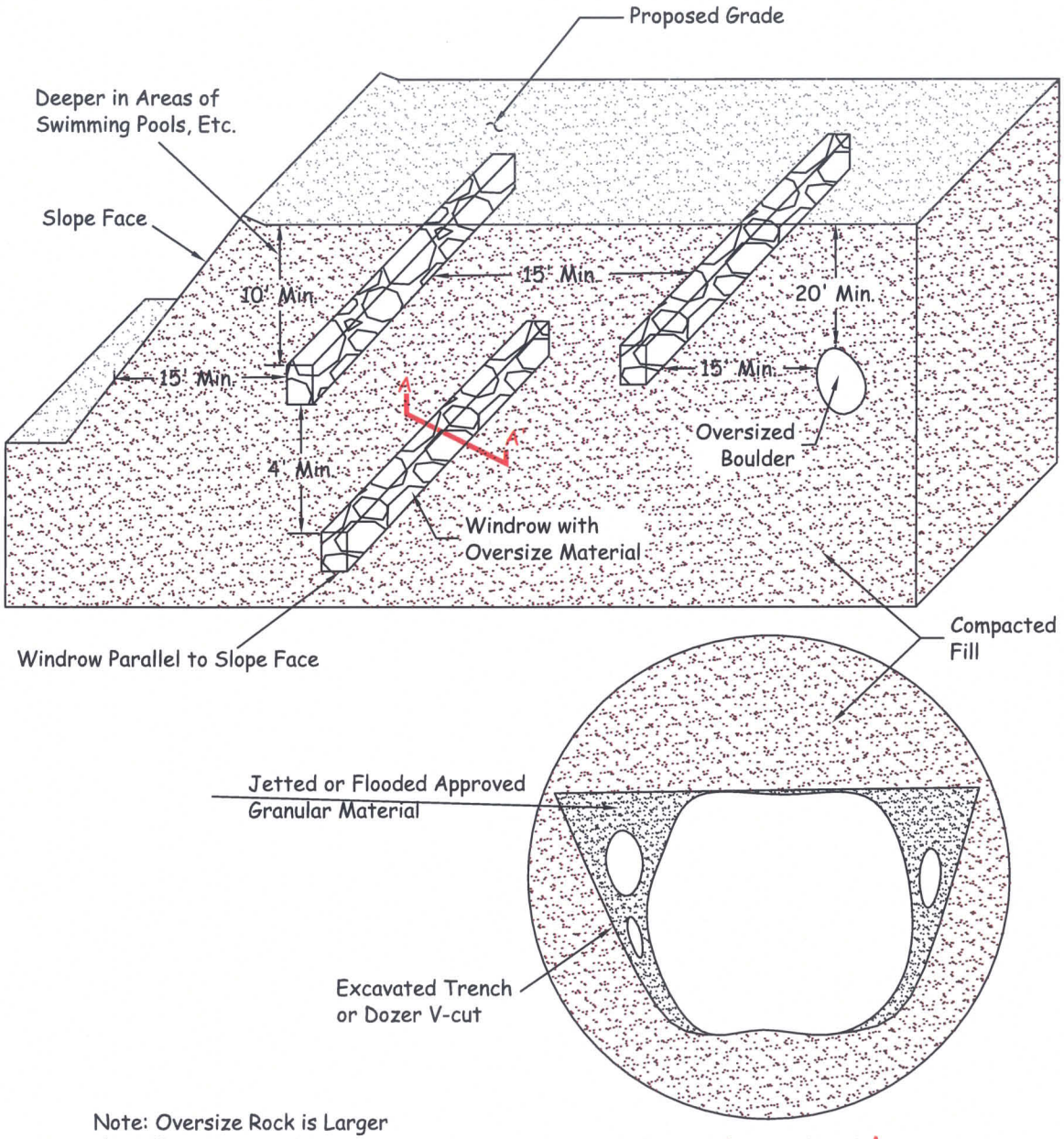
TYPICAL SETTLEMENT PLATE AND RISER



Note: Oversize Rock is Larger than 8" in Maximum Dimension.

Section A-A'

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OVERSIZE ROCK DISPOSAL DETAIL