Technical Appendix E

Geotechnical Investigation

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL/INDUSTRIAL BUILDING

First Industrial Logistic Phase III Development
SWC Nandina Avenue at Indian Street
Moreno Valley, California
for
First Industrial Realty Trust, Inc.

April 12, 2013

First Industrial Realty Trust
698 North Sepulveda, Suite 750
El Segundo, California 90245

Attention: Mr. Larry Cochrun

Project No.: **13G123-1**

Subject: **Geotechnical Investigation**
Proposed Commercial/Industrial Building
First Industrial Logistic Phase III Development
SWC Nandina Avenue at Indian Street
Moreno Valley, California

Dear Mr. Cochrun:

In accordance with your request, we have conducted a geotechnical investigation at the subject site. We are pleased to present this report summarizing the conclusions and recommendations developed from our investigation.

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Daryl R. Kas, CEG 2467
Project Geologist

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Principal Engineer

Distribution: (2) Addressee

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1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report.

Site Preparation

- Demolition of several existing buildings and structures will be required in order to facilitate construction of the new facility. It is also expected that the existing pavements, which appear to be in good condition, will be demolished. Debris resultant from demolition should be disposed of offsite. Alternatively, concrete and asphalt debris may be pulverized to a maximum 2 inch particle size, well mixed with the on-site soils, and incorporated into new structural fills or it may be crushed and made into crushed miscellaneous base, if desired.
- The site is generally underlain by potentially compressible alluvium, extending to depths of up to 8± feet. Also near-surface alluvial soils extending to depths of up to 4± feet exhibit unfavorable collapse characteristics, and they are not considered suitable for support of the new structure.
- Remedial grading is recommended to be performed within the new building pad area. The existing soils within the building area should be overexcavated to a depth of 5 feet below existing grade and to a depth of 5 feet below proposed pad grades. The soils within the proposed foundation influence zones should be overexcavated to a depth of 3 feet below proposed foundation bearing grades.
- After overexcavation has been completed, the resulting subgrade soils should be evaluated by the geotechnical engineer to identify any additional soils that should be overexcavated, moisture conditioned, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.
- The new parking area subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Building Foundations

- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,500 lbs/ft^2 maximum allowable soil bearing pressure.
- Reinforcement consisting of at least two (2) No. 5 rebars (1 top and 1 bottom) in strip footings. Additional reinforcement may be necessary for structural considerations.

Building Floor Slabs

- Conventional Slab-on-Grade, 5 inches thick.
- Minimum slab reinforcement: No. 3 bars at 18-inches on center, in both directions. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

Pavements

ASPHALT PAVEMENTS (R = 30)				
Materials	**Thickness (inches)**			
	Auto Parking (TI = 4.0)	Auto Drive Lanes (TI = 5.0)	Light Truck Traffic (TI = 6.0)	Moderate Truck Traffic (TI = 7.0)
Asphalt Concrete	3	3	3½	4
Aggregate Base	3	6	8	10
Compacted Subgrade (90% minimum compaction)	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS			
Materials	**Thickness (inches)**		
	Auto Parking & Drives (TI = 5.0)	Light Truck Traffic (TI =6.0)	Moderate Truck Traffic (TI =7.0)
PCC	5	5½	7
Compacted Subgrade	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 13P163R3, dated April 1, 2013. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slabs, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located on southwest corner of Indian Street and Nandina Avenue in the city of Moreno Valley, California. The site is bounded to the north by Nandina Avenue, to the east by Indian Street, to the south by vacant lots, and to the west by. The general location of the site is illustrated on the Site Location Map included as Plate 1 in Appendix A of this report.

The site consists of several contiguous parcels, which total 72.7± acres in size. The western half of the site is currently vacant and undeveloped. The ground surface within the western half of the site appears to have been recently disced or tilled and consists of exposed soil with sparse to moderate native grass and weed growth.

Mueller Lane transects the eastern half of the subject site in a north-to-south direction extending from Nandina Avenue to the south property line. One (1) single story commercial/industrial building, 12,800± ft^2 and three (3) metal canopy structures, ranging in size from 5,000± ft^2 to 12,000± ft^2 are located on the parcel southwest of Nandina Avenue and Mueller Lane. Ground surface cover surrounding the commercial/industrial building and canopies consists of Portland cement concrete pavements. These pavements appear to be in good condition with little to no cracking.

One (1) large soil stockpile is located on the parcel at the southeast corner of Nandina Avenue and Mueller Lane. This stock pile was approximately 300± feet long by 150± feet wide and approximately 5 to 8± feet in height. Two (2) small concrete slabs 1,000± and 1,350± ft^2 in size, were observed immediately south of the soil stockpile. One (1) mobile home unit was located near the central portion of the eastern half of the overall site. Several small stockpiles of trash, wooden pallets, scrap metal and miscellaneous items were located in the vicinity of the mobile home unit. Several truck trailers were located within the southern parcel, west of Mueller Lane. Ground surface cover in this parcel consists of open-graded gravel.

One (1) single story single family residence is located in the southeast portion of the site. Ground surface cover surrounding the single family residence consists of open-graded gravel. Ground surface cover located within the northeast and the northwest portion of the eastern half of the overall site consists of exposed soil with sparse to moderate native grass and weed growth. Several medium to large trees were observed throughout the eastern half of the site.

Topographic information was provided by an ALTA survey provided by Thienes Engineering. The site slopes gently to the southeast at a gradient of approximately 1± percent. The topographic high is located near the northwest portion of the overall site at an elevation of 1488.7± feet mean sea level (msl). The topographic low is located in the southeast portion of the overall site at an elevation of 1479.6± feet msl. There is 9± feet of elevation differential across the site.

3.2 Proposed Development

Based on a conceptual site plan prepared by HPA architecture, the overall site will be developed with one (1) commercial/industrial building, 1,388,250± ft^2 in size. The site plan also indicates that loading docks will be constructed along the north and south sides of the building. The building will be surrounded by asphaltic concrete pavements for parking and drive lanes and Portland cement concrete pavements for the loading dock area. Several landscape planters and concrete flatwork will be included throughout the western and eastern sides of the site.

Detailed structural information has not been provided. It is assumed that the new building will be a single story structure of tilt-up concrete construction. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 80 kips and 3 to 5 kips per linear foot, respectively.

No significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the assumed topography, minor cuts and fills are expected to be necessary to achieve the proposed site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of twenty (20) borings advanced to depths of 5 to 25± feet below currently existing site grades. All of the borings were logged during drilling by a member of our staff.

The borings were advanced with hollow-stem augers, by a truck-mounted drilling rig. Representative bulk and in-situ soil samples were taken during drilling. Relatively undisturbed in-situ samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. In-situ samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

The approximate locations of the borings are indicated on the Boring Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B.

4.2 Geotechnical Conditions

Pavements

Pavements were encountered at the ground surface at Boring Nos. B-1 and B-2. The pavements encountered generally consist of 6± inches of Portland cement concrete with no discernible underlying layer of aggregate base.

Open-graded gravel

Boring Nos. B-14 and B-15 encountered open graded gravel at the ground surface extending to depths of 3 to 4± inches below existing site grades.

Artificial Fill

Artificial fill soils were encountered beneath the pavements or open graded gravel at Boring Nos. B-1, B-2, B-14 and B-15 extending to depths of 2½ to 5½± feet below existing site grades. The fill soils generally consist of loose to medium dense clayey fine to medium sands, silty fine to medium sands, and medium stiff fine sandy clays. The fill soils possess a disturbed appearance and trace amounts of artificial material including asphaltic concrete fragments, resulting in their classification as fill.

Disturbed Alluvium

Disturbed alluvial soils were encountered at the ground surface at all of the boring locations, except Boring Nos. B-1, B-2, B-14, and B-15, extending to depths of 2½ to 3½± feet below existing site grades. The disturbed alluvial soils generally consist of loose to medium dense silty fine sands and fine sands with varying amounts of clay, medium sand, fine root fibers, calcareous nodules and porosity. The disturbed alluvial soils possess a disturbed appearance presumably from previous tilling operations, resulting in their classification as disturbed alluvium.

Alluvium

Native alluvial soils were encountered beneath the artificial fill, open-graded gravel and/or disturbed alluvial soils at all boring locations extending to the maximum explored depth of 25± feet below existing site grades. The alluvial soils encountered generally consist of loose to medium dense silty fine to medium sands with varying amounts of clay, loose to medium dense fine to coarse sands with varying amounts of fine gravel, loose to medium dense clayey fine sands and stiff to very stiff sandy clays and silty clays. The on-site alluvial soils possessed varying amounts of cementation, porosity and calcareous deposits.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

5.0 LABORATORY TESTING

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

Classification

All recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. Field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring Logs and are periodically referenced throughout this report.

In-situ Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Soluble Sulfates

Representative samples of the near-surface soils have been submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The results of the soluble sulfate testing are not yet available. These results, along with recommendations for any appropriate sulfate-resistant concrete mix designs will be presented in an addendum report.

Consolidation

Selected soil samples have been tested to determine their consolidation potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-8 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample was tested for its maximum dry density and optimum moisture content. The results were obtained using the Modified Proctor procedure, per ASTM D-1557.

These test results are enclosed in presented on Plate C-9 in Appendix C of this report. This test is generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date.

Expansion Index

The expansion potential of the on-site soils was determined in general accordance with ASTM D-4829. The testing apparatus is designed to accept a 4-inch diameter, 1-in high, remolded sample. The sample is initially remolded to 50± 1 percent saturation and then loaded with a surcharge equivalent to 144 pounds per square foot. The sample is then inundated with water, and allowed to swell against the surcharge. The resultant swell or consolidation is recorded after a 24-hour period. The results of the EI testing are as follows:

Sample Identification	**Expansion Index**	**Expansion Potential**
B-3 @ 0 to 5 feet	37	Low
B-18 @ 0 to 5 feet	29	Low

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing and geotechnical analysis, the proposed development is considered feasible from a geotechnical standpoint. The recommendations contained in this report should be taken into the design, construction, and grading considerations. The recommendations are contingent upon all grading and foundation construction activities being monitored by the geotechnical engineer of record. The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The performance of a site specific seismic hazards analysis was beyond the scope of this investigation. However, numerous faults capable of producing significant ground motions are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structures should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. Therefore, the possibility of significant fault rupture on the site is considered to be low.

Seismic Design Parameters

Based on standards in place at the time of this report, the proposed development must be designed in accordance with the requirements of the 2010 edition of the California Building Code (CBC).

The CBC provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

The 2010 CBC Seismic Design Parameters have been generated using Earthquake Ground Motion Parameters, a software application developed by the United States Geological Survey. This software application, available at the USGS web site calculates seismic design parameters in accordance with the 2010 CBC, utilizing a database of deterministic site accelerations at 0.01 degree intervals. The table below is a compilation of the data provided by the USGS application.

A copy of the output generated from this program is included in Appendix E of this report. A copy of the Design Response Spectrum, as generated by the USGS application is also included in Appendix E. Based on this output, the following parameters may be utilized for the subject site:

2010 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.500
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.600
Site Class	---	D
Short-Period Site Coefficient at 0.2 sec Period	F_a	1.0
Long-Period Site Coefficient at 1.0 sec Period	F_v	1.5
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.500
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.900
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.000
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.600

Liquefaction

Liquefaction is the loss of the strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and grain size characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Clayey (cohesive) soils or soils which possess clay particles (d<0.005mm) in excess of 20 percent (Seed and Idriss, 1982) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The Riverside County Land Information System indicates that the subject site is located within a zone of low liquefaction susceptibility. In addition, the subsurface conditions encountered at the boring locations are not considered to be susceptible to liquefaction. These conditions consist of medium dense well-graded granular soils, and the lack of a shallow groundwater table. Based on these conditions, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

Most of the subject site is underlain by native alluvial soils that possess unfavorable consolidation characteristics, extending to depths of up to 8± feet. In addition, several soil samples collected from depths of up to 4± feet exhibit high degrees of collapse when exposed to moisture infiltration. In addition, portions of the site are underlain by undocumented fill soils. The subsurface profile encountered at the boring locations is not considered suitable to support to foundation loads of the new structures and could result in excessive post-construction settlements. Therefore, remedial grading is considered warranted within the proposed building areas in order to remove and replace these soils as compacted structural fill.

Settlement

Laboratory testing indicates that most of the near surface alluvial soils possess a potential for collapse when exposed to moisture infiltration as well as a potential for moderate consolidation when exposed to load increases in the range of those that will exerted by the foundations of the new structures. The proposed remedial grading will remove the existing undocumented fill soils, as well as highly collapsible and potentially compressible native alluvium from within the proposed building areas. The native alluvium that will remain in place below the recommended depth of overexcavation will not be significantly influenced by the foundation loads of the new structures. Therefore, following completion of the recommended grading, the post-construction settlements are expected to be within tolerable limits.

Expansion

The on-site soils consist of sands, silty sands and clayey sands as well as sandy clays and silty clays. The results of expansion index testing indicate that these materials are low to non-expansive (EI = 29 and 37). Based on the presence of potentially expansive soils at this site, care should be taken to properly moisture condition and maintain adequate moisture content within all subgrade soils as well as newly placed fill soils. The foundation and floor slab recommendations contained within this report are made in consideration of the expansion index test results. It is recommended that additional expansion index testing be conducted at the completion of rough grading to verify the expansion potential of the as-graded building pads.

Shrinkage/Subsidence

Based on the results of the laboratory testing, removal and recompaction of the near surface native soils is estimated to result in an average shrinkage of 12 to 17 percent. Removal and recompaction of the existing fill soils is expected to result in an average shrinkage of 5 to 10± percent. Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be 0.1 ±feet. This estimate may be used for grading in areas that are underlain by native alluvial soils. These estimates are based on previous experience and the subsurface conditions encountered at the boring locations. The actual amount of subsidence is expected to be variable and will be dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

No grading and foundation plans were available at the time of this report. It is therefore recommended that we be provided with copies of the preliminary plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations and our understanding of the proposed development. We recommend that all grading activities be completed in accordance with the Grading Guide Specifications included as Appendix D of this report, unless superseded by site-specific recommendations presented below.

Site Stripping and Demolition

The proposed development will require demolition of several existing buildings, structures, and pavements. Additionally, any existing improvements that will not remain in place for use with the new development should be removed in their entirety. This should include all foundations, floor slabs, equipment pads, utilities, and any other subsurface improvements associated with the existing structures. The existing pavements are in poor condition and it is not expected that they will be reused with the new development. Debris resultant from demolition should be disposed of offsite. Alternatively, concrete and asphalt debris may be pulverized to a maximum 2 inch particle size, well mixed with the on-site soils, and incorporated into new structural fills or it may be crushed and made into crushed miscellaneous base (CMB), if desired.

Initial site preparation should include stripping of any trees, shrubs, vegetation and organic debris from the undeveloped areas of the site. Removal of these materials should also include all associated root masses. Any organic materials should also be stripped and disposed of off-site or in non-structural areas of the site. The actual extent of site stripping should be determined by the geotechnical engineer at the time of rough grading, based on the organic content and stability of the encountered materials.

Treatment of Existing Soils: Building Pad

Remedial grading should be performed within the proposed building area in order to remove the existing potentially compressible/collapsible near-surface native alluvium. Based on conditions encountered at the boring locations, the existing soils within the proposed building area are recommended to be overexcavated to a depth of at least 5 feet below proposed building pad subgrade elevation and to a depth of at least 5 feet below existing grade, whichever is greater.

Where not encompassed within the general building pad overexcavations, additional overexcavation should be performed within the influence zones of the new foundations, to provide for a new layer of compacted structural fill extending to a depth of 5 feet below proposed bearing grade.

The overexcavation areas should extend at least 5 feet beyond the building perimeter, and to an extent equal to the depth of fill below the new foundation. If the proposed structure incorporates any exterior columns (such as for a canopy or overhang) the overexcavation should also encompass these areas.

Following completion of the overexcavation, the subgrade soils within the building area should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structure. At minimum, the soils exposed at the base of the overexcavation should possess an in-situ density equal to at least 85 percent of the ASTM D-1557 maximum dry density. This evaluation should include proofrolling and probing to identify any soft, loose or otherwise unstable soils that must be removed. Some localized areas of deeper excavation may be required if loose, porous, or low density native soils are encountered at the base of the overexcavation.

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches, and moisture conditioned to achieve a moisture content of 2 to 4 percent above optimum moisture content to a depth of at least 24 inches. The moisture conditioning of the overexcavation subgrade soils should be verified by the geotechnical engineer. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of any proposed retaining walls should be overexcavated to a depth of 3 feet below foundation bearing grade and replaced as compacted structural fill as discussed above for the proposed building pads. The foundation areas for non-retaining site walls should be overexcavated to a depth of 1 foot below proposed foundation bearing grade. The overexcavation subgrade soils should be evaluated by the geotechnical engineer prior to scarifying, moisture conditioning, and recompacting the upper 12 inches of exposed subgrade soils. The previously excavated soils may then be replaced as compacted structural fill.

Treatment of Existing Soils: Parking and Drive Areas

Based on economic considerations, overexcavation of the existing soils in the new parking and drive areas is not considered warranted, with the exception of areas where lower strength, or unstable, soils are identified by the geotechnical engineer during grading. Subgrade preparation in the new parking and drive areas should initially consist of removal of all soils disturbed during stripping and demolition operations.

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to at least 2 to 4 percent above optimum, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed parking area assume that the owner and/or developer can tolerate minor amounts of settlement within the proposed parking areas. The grading recommendations presented above do not completely mitigate the extent of compressible native alluvium in the parking areas. As such, settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the parking area should be graded in a manner similar to that described for the building areas.

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 2 to 4 percent above the optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2010 CBC and the grading code of the City of Moreno Valley.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Imported Structural Fill

All imported structural fill should consist of very low expansive (EI < 20), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve). Additional specifications for structural fill are presented in the Grading Guide Specifications, included as Appendix D.

Utility Trench Backfill

In general, all utility trench backfill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. It is recommended that materials in excess of 3 inches in size not be used for utility trench backfill. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by City of Moreno Valley. All utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

Utility trenches which parallel a footing, and extending below a 1h:1v plane projected from the outside edge of the footing should be backfilled with structural fill soils, compacted to at least 90 percent of the ASTM D-1557 standard. Pea gravel backfill should not be used for these trenches.

6.4 Construction Considerations

Excavation Considerations

The near surface soils generally consist of sands and silty sands. These materials are expected to be subject to caving within shallow excavations. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Moisture Sensitive Subgrade Soils

Most of the near surface soils possess occasional silt and clay content. If grading occurs during a period of relatively wet weather, an increase in subgrade instability should also be expected.

If the construction schedule dictates that site grading will occur during a period of wet weather, allowances should be made for costs and delays associated with drying the on-site soils or import of a less moisture sensitive fill material. Grading during wet or cool weather may also increase the depth of overexcavation in the pad areas.

Expansive Soils

Although the near-surface soils have been determined to be low expansive, some zones of soil with increased clay content were encountered at depths below 5± feet. Some of these clayey soils may be utilized as fill within the proposed building areas. Therefore, care should be given to proper moisture conditioning of all building pad subgrade soils to a moisture content of 2 to 4 percent above the Modified Proctor optimum during site grading. All imported fill soils should have very low expansive characteristics. In addition to adequately moisture conditioning the subgrade soils and fill soils during grading, special care must be taken to maintain the moisture content of these soils at 2 to 4 percent above the Modified Proctor optimum. This will require the contractor to frequently moisture condition these soils throughout the grading process, unless grading occurs during a period of relatively wet weather.

Groundwater

The static groundwater table at this site is considered to exist at a depth in excess of 25± feet. Therefore, groundwater is not expected to impact grading or foundation construction activities.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pad will be underlain by structural fill soils used to replace existing potentially compressible/collapsible near-surface alluvial soils. These new structural fill soils are expected to extend to depths of at least 5 feet below proposed foundation bearing grade, underlain by 1± foot of additional soil that has been densified and moisture conditioned in place. Based on this subsurface profile, the proposed structure may be supported on conventional shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Two (2) No. 5 rebars (1 top and 1 bottom).
- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent exterior grade. Interior column footings may be placed immediately beneath the floor slab.
- It is recommended that the perimeter building foundations be continuous across all exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing pressures presented above may be increased by 1/3 when considering short duration wind or seismic loads. The minimum steel reinforcement recommended above is based on geotechnical considerations; additional reinforcement may be necessary for structural considerations. The actual design of the foundations should be determined by the structural engineer.

Foundation Construction

The foundation subgrade soils should be evaluated at the time of overexcavation, as discussed in Section 6.3 of this report. It is further recommended that the foundation subgrade soils be evaluated by the geotechnical engineer immediately prior to steel or concrete placement. Soils suitable for direct foundation support should consist of newly placed structural fill, compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Any unsuitable materials should be removed to a depth of suitable bearing compacted structural fill, with the resulting excavations backfilled with compacted fill soils. As an alternative, lean concrete slurry (500 to 1,500 psi) may be used to backfill such isolated overexcavations.

The foundation subgrade soils should also be properly moisture conditioned to 2 to 4 percent above the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. Since it is typically not feasible to increase the moisture content of the floor slab and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process.

Estimated Foundation Settlements

Post-construction total and differential settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively. Differential movements are expected to occur over a 30-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 300 lbs/ft^3
- Friction Coefficient: 0.30

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against compacted structural fill. The maximum allowable passive pressure is 2500 lbs/ft^2.

6.6 Floor Slab Design and Construction

Subgrades which will support new floor slabs should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, the floor of the new structure may be constructed as a conventional slab-on-grade supported on newly placed structural fill, extending to a depth of at least 5 feet below existing grade. Based on geotechnical considerations, the floor slab may be designed as follows:

- Minimum slab thickness: 5 inches.

- Minimum slab reinforcement: No. 3 bars at 18-inches on center, in both directions. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

- Slab underlayment: Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire area of the proposed slab. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated, the vapor barrier may be eliminated.

- Moisture condition the floor slab subgrade soils to 2 to 4 percent above the Modified Proctor optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to concrete placement.

- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

The actual design of the floor slabs should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.7 Trash Enclosure Design Parameters

Although not indicated on the site plan provided to our office, the proposed development may include one or more trash enclosures. It is expected that the trash enclosures as well as the approach slabs will be subjected to relatively heavy wheel loads imposed by trash removal equipment.

The subgrade soils in the area of the trash enclosures and the approach slabs should be prepared in accordance with the recommendations for the parking areas, presented in Section 6.3 of this report. As such, it is expected that the trash enclosures will be underlain by structural fill soils, extending to a depth of 1 foot below proposed subgrade elevation. Based on geotechnical considerations, the following recommendations are provided for the design of the trash enclosures and the trash enclosure approach slabs:

- The trash enclosure may consist of a 6-inch thick concrete slab incorporating a perimeter footing or a turned down edge, extending to a depth of at least 12 inches below adjacent finished grade. If the trash enclosure will incorporate rigid walls such as masonry block or tilt-up concrete, the perimeter foundations should be designed in accordance with the recommendations previously presented in Section 6.5 of this report.

- Reinforcement within the trash enclosure slab should consist of at least No. 3 bars at 18-inches on-center, in both directions.

- The trash enclosure approach slab should be constructed of Portland cement concrete, at least 6 inches in thickness. Reinforcement within the approach slab should consist of at least No. 3 bars at 18-inches on-center, in both directions.

- The trash enclosure and approach slab subgrades should be moisture conditioned to 2 to 4 percent above the optimum moisture content to a depth of 12 inches. The trash enclosure slab and the approach slab should be structurally connected, to reduce the potential for differential movement between the two slabs.

- The actual design of the trash enclosure and the trash enclosure approach slab should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.8 Retaining Wall Design and Construction

Although not indicated on the site plan, some small retaining walls may be required to facilitate the new site grades. It is also expected that some retaining walls will be required around the perimeter of the truck loading dock areas. All of these walls are expected to be less than 3 to 5± feet in height. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. We have provided parameters for two different types of wall backfill: on-site soils and imported select granular material. The on-site soils generally consist of sands, clayey sands and silty sands. **It is recommended that the on-site sandy clays and silty clays not be used to backfill any proposed on-site retaining walls.** Based on their composition, these on-site soils have been assigned a friction angle of 30 degrees. In order to use the design parameters for the imported select fill, this material must be placed within the entire active failure wedge. This wedge is defined as extending from the heel of the retaining wall upwards at an angle of approximately 60 degrees.

RETAINING WALL DESIGN PARAMETERS

Design Parameter		Soil Type: Imported Aggregate Base	Soil Type: On-Site Sands
Internal Friction Angle (ϕ)		38°	30°
Unit Weight		130 lbs/ft^3	135 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	30 lbs/ft^3	45 lbs/ft^3
	Active Condition (2h:1v backfill)	44 lbs/ft^3	71 lbs/ft^3
	At-Rest Condition (level backfill)	50 lbs/ft^3	68 lbs/ft^3

Regardless of the backfill type, the walls should be designed using a soil-footing coefficient of friction of 0.30 and an equivalent passive pressure of 300 lbs/ft^3. The structural engineer should incorporate appropriate factors of safety in the design of the retaining walls.

The active earth pressure may be used for the design of retaining walls that do not directly support structures or support soils that in turn support structures and which will be allowed to deflect. The at-rest earth pressure should be used for walls that will not be allowed to deflect such as those which will support foundation bearing soils, or which will support foundation loads directly.

Where the soils on the toe side of the retaining wall are not covered by a "hard" surface such as a structure or pavement, the upper 1 foot of soil should be neglected when calculating passive resistance due to the potential for the material to become disturbed or degraded during the life of the structure.

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed compacted structural fill, extending to a depth of at least 3 feet below the proposed bearing grade. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Seismic Lateral Earth Pressures

In addition to the lateral earth pressures presented above, retaining walls which are more than 4 feet in height should be designed for a seismic lateral earth pressure, in accordance with the 2010 CBC. The recommended seismic pressure distribution is triangular in shape, with a maximum magnitude of 21H lbs/ft^2, where H is the overall height of the wall. The maximum pressure should be assumed to occur at the top of the wall, decreasing to 0 at the base of the wall. The seismic pressure distribution is based on the Mononobe-Okabe equation, utilizing a peak ground acceleration of 0.40g. This peak site acceleration was obtained in accordance with the 2007 CBC, and is equal to $S_{DS}/2.5$.

Backfill Material

On-site soils may be used to backfill the retaining walls. However, all backfill material placed within 3 feet of the back wall face should have a particle size no greater than 3 inches. The retaining wall backfill materials should be well graded.

It is recommended that a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls, may be used. If the layer of free-draining material is not covered by an impermeable surface, such as a structure or pavement, a 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils. The layer of free draining granular material should be separated from the backfill soils by a suitable geotextile, approved by the geotechnical engineer

All retaining wall backfill should be placed and compacted under engineering controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557-91). Care should be taken to avoid over-compaction of the soils behind the retaining walls, and the use of heavy compaction equipment should be avoided.

Subsurface Drainage

As previously indicated, the retaining wall design parameters are based upon drained backfill conditions. Consequently, some form of permanent drainage system will be necessary in conjunction with the appropriate backfill material. Subsurface drainage may consist of either:

- A weep hole drainage system typically consisting of a series of 4-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 8-foot on-center spacing. The weep holes should include a 2 cubic foot pocket of open graded gravel, surrounded by an approved geotextile fabric, at each weep hole location.

- A 4-inch diameter perforated pipe surrounded by 2 cubic feet of gravel per linear foot of drain placed behind the wall, above the retaining wall footing. The gravel layer should be wrapped in a suitable geotextile fabric to reduce the potential for migration of fines. The footing drain should be extended to daylight or tied into a storm drainage system.

6.9 Pavement Design Parameters

Site preparation in the pavement area should be completed as previously recommended in the ***Site Grading Recommendations*** section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The on-site soils generally consist of sands, silty sands and clayey sands. Based on their classification, these materials are expected to possess good pavement support characteristics, with R-values in the range of 30 to 50. Since R-value was not included in the scope of services for this project, the subsequent pavement design is based upon an assumed R-value of 30. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering controlled conditions. It is recommended that R-value testing be performed after completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

Presented below are the recommended thicknesses for new flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI's) indicated. The client and/or civil engineer should verify that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20 year design life, assuming six operational traffic days per week.

Traffic Index	No. of Heavy Trucks per Day
4.0	0
5.0	1
6.0	3
7.0	11

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.

ASPHALT PAVEMENTS (R = 30)				
Materials	**Thickness (inches)**			
	Auto Parking (TI = 4.0)	Auto Drive Lanes (TI = 5.0)	Light Truck Traffic (TI = 6.0)	Moderate Truck Traffic (TI = 7.0)
Asphalt Concrete	3	3	3½	4
Aggregate Base	3	6	8	10
Compacted Subgrade	12	12	12	12

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the Marshall maximum density, as determined by ASTM D-2726. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the “Greenbook” Standard Specifications for Public Works Construction.

Portland Cement Concrete

The preparation of the subgrade soils within concrete pavement areas should be performed as previously described for proposed asphalt pavement areas. The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS			
Materials	**Thickness (inches)**		
	Auto Parking & Drives (TI = 5.0)	Light Truck Traffic (TI =6.0)	Moderate Truck Traffic (TI =7.0)
PCC	5	5½	7
Compacted Subgrade	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. Reinforcing and joint spacing within the pavements should be designed by the structural engineer based on ACI requirements and the expected loading conditions.

7.0 GENERAL COMMENTS

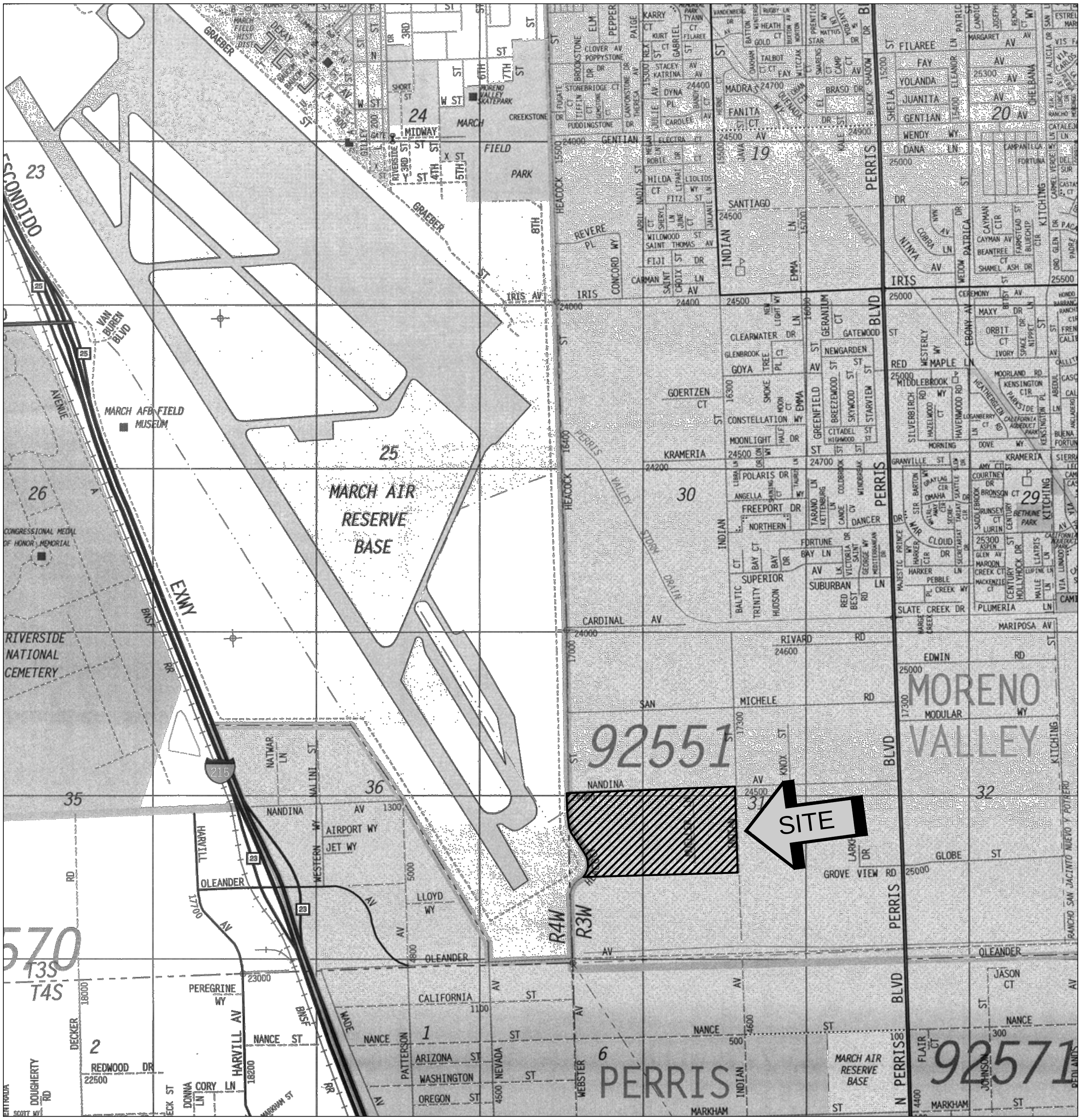
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, civil engineer, and/or structural engineer. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

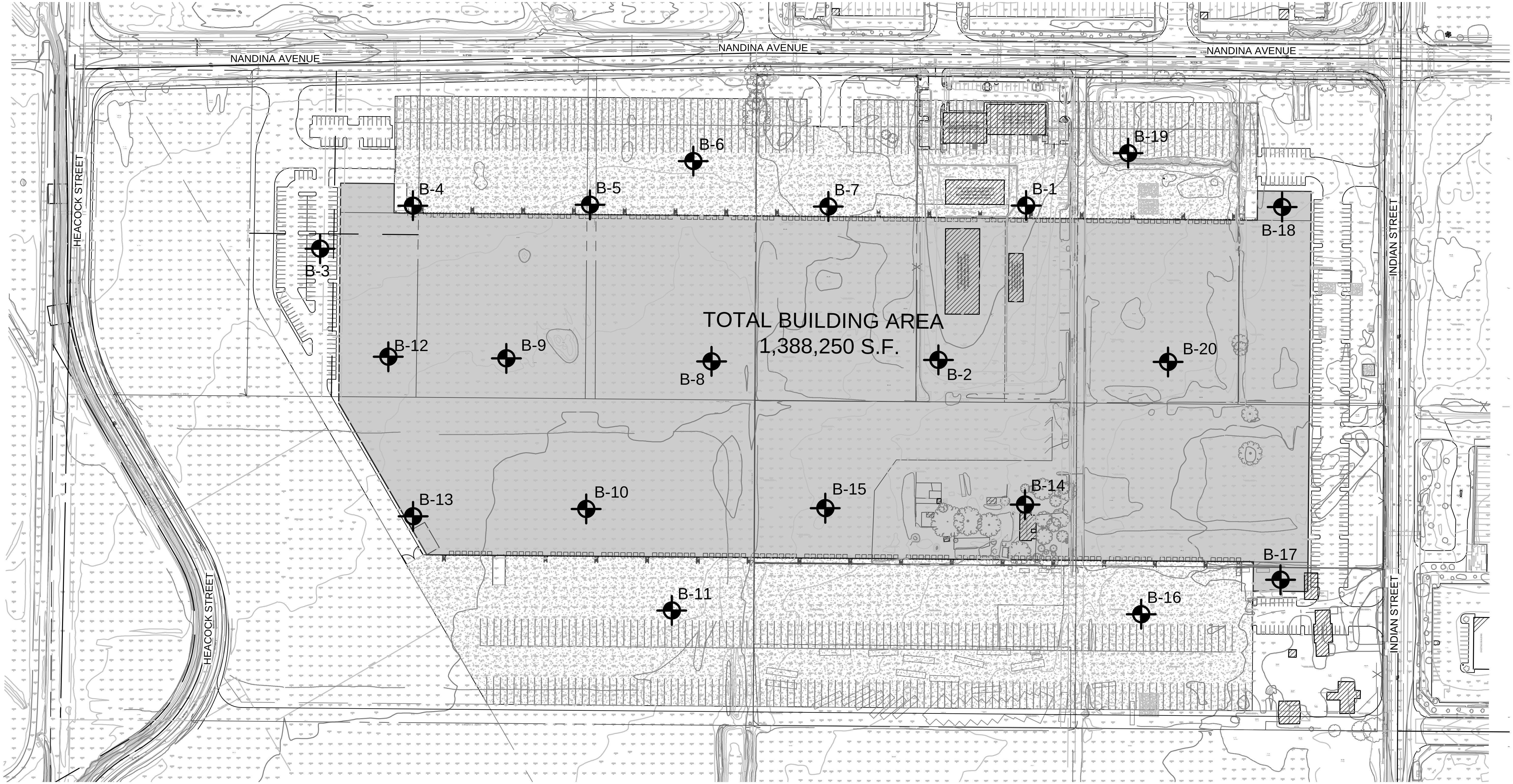
The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

APPENDIX A



SOURCE: RIVERSIDE COUNTY
THOMAS GUIDE, 2009

SITE LOCATION MAP	
PROPOSED COMMERCIAL/INDUSTRIAL BUILDING	
MORENO VALLEY, CALIFORNIA	
SCALE: 1" = 2400'	SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: ENT CHKD: RGT	
SCG PROJECT 13G123-1	
PLATE 1	



GEOTECHNICAL LEGEND

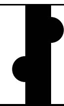
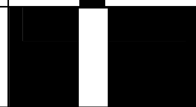
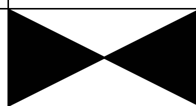
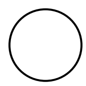
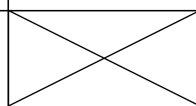
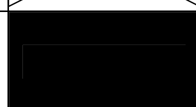
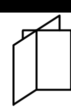
- APPROXIMATE BORING LOCATION
- PROPOSED BUILDING
- EXISTING BUILDINGS

NOTE: BASE MAP PREPARED BY HPA, INC.

BORING LOCATION PLAN	
PROPOSED COMMERCIAL/INDUSTRIAL BUILDING	
MORENO VALLEY, CALIFORNIA	
SCALE: 1" = 200'	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: ENT CHKD: RGT	
SCG PROJECT 13G123-1	
PLATE 2	

APPENDIX B

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3” indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

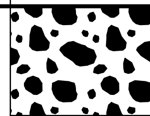
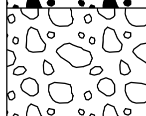
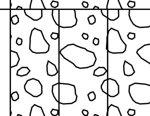
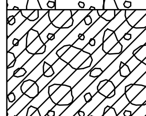
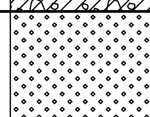
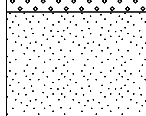
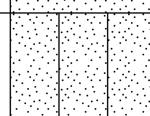
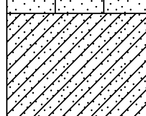
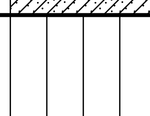
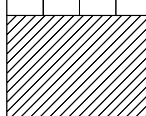
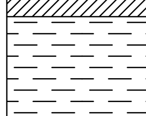
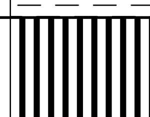
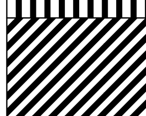
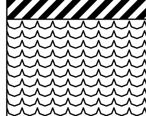
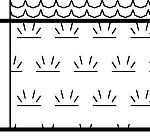
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	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
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				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 BORDERLINE SOIL CLASSIFICATIONS

BORING NO. B-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/4/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 12 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					6± inches Portland cement concrete, no discernible Aggregate base							
	X	10			FILL: Dark Brown to Black Silty fine Sand, trace medium Sand, trace calcareous nodules, loose-moist		10					
	X	14			ALLUVIUM: Dark Brown Clayey fine Sand, trace medium Sand, slightly porous, medium dense-moist		10					
5												
	X	17			Brown to Dark Red Brown Silty fine to medium Sand, slightly cemented, medium dense-moist		10					
	X	11					12					
10												
					Dark Red Brown Clayey fine to medium Sand, slightly cementationed, medium dense-damp							
	X	26					12					
15												

Boring Terminated at 15'

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

TEST BORING LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/4/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 22 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
				6± inches Portland cement concrete, no discernible Aggregate base							
	X	12		FILL: Mottled Dark Gray to Black Silty fine to medium Sand, trace Clay, loose to medium dense-moist		11					
	X	20				9					
5											
	X	12		ALLUVIUM: Dark Red Brown Silty fine to medium Sand, slightly cemented, loose-moist		10					
	X	70		Dark Brown Silty fine Sand, trace Clay, heavily cemented, moderate calcareous veining, very dense-moist to very moist		16					
10											
				Brown Silty Clay, trace fine Sand, moderate calcareous veining, very stiff-moist							
	X	17	4.5			19					
15											
				Red Brown fine Sand, trace Silt, medium dense-moist							
	X	15				12					
20											

Boring Terminated at 20'

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

SOUTHERN CALIFORNIA GEOTECHNICAL

BORING NO. B-3

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/3/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 20 feet
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					DISTURBED ALLUVIUM: Dark Red Brown Silty fine Sand, trace fine root fibers, calcareous nodules, little Clay, loose-damp							
	X	11				103	8					EI = 37 @ 0 to 5'
					ALLUVIUM: Red Brown to Brown Silty fine Sand, little Clay trace Mica, moderately porous, loose-damp							
	X	12				94	9					
5	X	11			@ 5 to 6 feet, trace Iron oxide staining	104	6					
					Mottled Light Gray Brown to Red Brown fine Sandy Clay to Clayey fine Sand, trace Silt, trace medium Sand, slightly porous, trace calcareous nodules, moderate Iron oxide staining, very stiff-damp							
	X	36	4.5+			121	12					
	X	49	4.5+			124	9					
10												
					Red Brown fine to coarse Sand, trace fine Gravel, trace Clay, slightly cemented, medium dense-damp							
	X	21					6					
15												
					Light Red Brown fine to coarse Sand, trace Clay, trace fine Gravel, slightly cemented, medium dense-damp							
	X	31				118	13					
20												
					Red Brown Silty fine Sand, trace Clay, medium dense-damp							
	X	24					9					
25					Boring Terminated at 25'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/3/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 14 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	
	X	5			DISTURBED ALLUVIUM: Dark Red Brown Silty fine Sand, trace medium Sand, trace fine root fibers, loose-damp		6					
5	X	7			ALLUVIUM: Red Brown Silty fine to medium Sand, trace Clay, loose-damp		6					
	X	4			Dark Red Brown fine to coarse Sand, slightly cemented, loose-damp		4					
10	X	27	4.5+		Red Brown Silty Clay, trace fine Sand, very stiff-damp		14					
15	X	8			Light Red Brown fine to medium Sand, trace to little Clay, loose-damp to moist		7					
					Boring Terminated at 15'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

TEST BORING LOG

BORING NO. B-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 13G123	DRILLING DATE: 4/3/13	WATER DEPTH: Dry
PROJECT: Proposed C/I Building	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 17 feet
LOCATION: Moreno Valley, California	LOGGED BY: Brett Isen	READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
	X	17			DISTURBED ALLUVIUM: Brown Silty fine Sand, trace medium Sand, trace fine root fibers, trace Clay, slightly porous, medium dense-damp	110	6					
	X	14			ALLUVIUM: Dark Brown Silty fine Sand, trace medium Sand, slightly porous, slightly cemented, loose-damp	110	6					
5	X	21			Dark Red Brown Clayey fine Sand, trace medium Sand, slightly cemented, medium dense-damp	120	9					
	X	15			Dark Brown Silty fine Sand, moderate Mica, slight Iron oxide staining, medium dense-damp	107	12					
	X	16			Light Orange Brown fine to coarse Sand, slightly cemented, trace fine Gravel, medium dense-dry	101	2					
10												
	X	11			@ 13½ to 19½ feet, moist		7					
15												
	X	24					7					
20					Brown to Light Gray Brown fine Sandy Silt, trace fine Sand, trace Clay, medium dense-moist		15					

Boring Terminated at 20'

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 13G123	DRILLING DATE: 4/3/13	WATER DEPTH: Dry
PROJECT: Proposed C/I Building	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 2 feet
LOCATION: Moreno Valley, California	LOGGED BY: Brett Isen	READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
	X	10			DISTURBED ALLUVIUM: Light Gray Brown to Brown Silty fine Sand, trace medium Sand, trace fine root fibers, medium dense-dry		3					
5	X	16			ALLUVIUM: Red Brown Silty fine Sand, trace medium to coarse Sand, trace Clay, medium dense-moist		10					
					Boring Terminated at 5'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-7

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/3/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 11 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
	X	12			DISTURBED ALLUVIUM: Light Gray Brown Silty fine Sand, trace fine root fibers, trace medium Sand, medium dense-damp		5					
	X	12			ALLUVIUM: Red Brown Silty fine Sand, trace Clay, trace medium Sand, slightly cemented, medium dense-moist		11					
5												
	X	13					10					
	X	48	4.5		Dark Brown Clayey fine Sand, trace medium Sand, slightly cemented, dense-damp		10					
10												
					Light Red Brown fine to medium Sand, trace coarse Sand, trace Clay, slightly cemented, medium dense-damp							
	X	16					5					
15												
	X	22					4					
20												
					Boring Terminated at 20'							

BORING NO. B-8

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/3/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 17 feet
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
		14			DISTURBED ALLUVIUM: Red Brown Silty fine Sand, trace fine root fibers, trace medium Sand, loose-damp	106	5					
		13	4.5+		ALLUVIUM: Red Brown fine Sandy Clay, trace Silt, trace medium Sand, moderately porous, stiff-damp	119	10					
5		21			Red Borwn Clayey fine to medium Sand, slightly porous, moderately cemented, trace calcareous veining, medium dense-damp	121	10					
		38			Brown to Red Brown Silty fine Sand, trace Mica, slightly porous, medium dense-moist to very moist	116	14					
10		80/11"			@ 9 to 10 feet, trace calreous veining, moderately cemented, trace to little Clay, very dense	118	12					
15		40				117	13					
20		17					14					
25		14			@ 23½ to 25 feet, Gray Brown		12					

Boring Terminated at 25'

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

TEST BORING LOG

BORING NO. B-9

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/3/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 13 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					DISTURBED ALLUVIUM: Brown Silty fine Sand, trace medium Sand, trace fine root fibers, loose-damp							
	X	7					7					
					ALLUVIUM: Dark Red Brown Silty fine Sand, trace Silt, slightly cemented, loose-damp							
	X	8					7					
5												
	X	44			@ 6 to 7 feet, dense		8					
					Brown Silty fine Sand, trace Clay, slightly cemented, dense-moist		11					
	X	51					11					
10												
	X	37					12					
15					Boring Terminated at 15'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

BORING NO. B-10

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/3/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 17 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
	X	20			DISTURBED ALLUVIUM: Light Red Brown Silty fine to medium Sand, trace coarse Sand, trace fine root fibers, moderately porous, medium dense-damp	106	4					
	X	16			ALLUVIUM: Red Brown Silty fine Sand, trace medium Sand, slightly porous, trace to little Clay, medium dense-damp	110	7					
5	X	19	4.5+		Dark Brown fine Sandy Clay, trace Silt, trace calcareous veining, slightly porous, stiff-damp to moist	117	12					
	X	15	4.5+			116	15					
10	X	23			Red Brown fine to medium Sand, trace to little Clay, trace coarse Sand, trace Silt, medium dense-damp to moist	109	7					
	X	22	4.5		Dark Red Brown Clayey fine Sand to fine Sandy Clay, trace medium Sand, medium dense-damp to moist		13					
15												
	X	24			Dark Brown Silty fine Sand to fine Sandy Silt, little Clay, medium dense-moist		13					
20					Boring Terminated at 20'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

TEST BORING LOG **PLATE B-10**

BORING NO. B-11

JOB NO.: 13G123	DRILLING DATE: 4/3/13	WATER DEPTH: Dry
PROJECT: Proposed C/I Building	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 4 feet
LOCATION: Moreno Valley, California	LOGGED BY: Brett Isen	READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
	X	10			DISTURBED ALLUVIUM: Dark Red Brown Silty fine Sand, little medium Sand, trace fine root fibers, loose-damp		8					
5	X	10			ALLUVIUM: Dark Brown Clayey fine Sand to fine Sandy Clay, trace medium Sand, loose to medium dense-damp		10					
					Boring Terminated at 5'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

BORING NO. B-12

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/4/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 12 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
	X	14	4.5+		DISTURBED ALLUVIUM: Dark Red Brown Clayey fine Sand to fine Sandy Clay, trace medium Sand, trace fine root fibers, slightly porous, trace Iron oxide staining, medium dense to stiff-damp		8					
	X	25	4.5+		ALLUVIUM: Light Brown fine Sandy Clay, trace Silt, slight cementation, moderate Iron oxide staining, moderate calcareous veining, very stiff to hard-damp		7					
5												
	X	32	4.5+				9					
	X	36			Light Red Silty fine Sand, medium dense-moist		12					
10												
					Red Brown fine Sandy Clay, little Clay, trace coarse Sand, trace Iron oxide staining, stiff-damp							
	X	11					6					
15												

Boring Terminated at 15'

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-13

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/4/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					DISTURBED ALLUVIUM: Dark Brown Silty fine Sand, trace medium Sand, trace Clay, loose-damp to moist							
		11				113	9					
		6				109	8					
					ALLUVIUM: Red Brown to Dark Brown fine Sand, trace medium to coarse Sand, trace Clay, loose-moist							
5		20	4.5+		Dark Brown to Dark Red Brown fine Sandy Clay to Clayey fine Sand, trace Silt, slightly porous, medium dense to stiff-damp to moist	118	13					
		22	4.5+			127	11					
		29			Light Red Brown Silty fine to medium Sand, little Clay, trace calcareous veining, medium dense-moist	118	13					
10												
					Brown Silty Clay, trace fine Sand, trace calcareous veining, trace calcareous nodules, stiff-damp to moist							
		13	4.5+				15					
15												
					Gray Brown fine to medium Sand, trace to little Clay, slightly cemented, medium dense-damp to moist							
		14					7					
20												
					Gray to Gray Brown fine Sandy Clay, trace to little Silt, very stiff-damp to moist							
		26	4.5+				11					
25					Boring Terminated at 25'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

BORING NO. B-14

JOB NO.: 13G123	DRILLING DATE: 4/4/13	WATER DEPTH: Dry
PROJECT: Proposed C/I Building	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 12 feet
LOCATION: Moreno Valley, California	LOGGED BY: Brett Isen	READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					3± inches Open-Graded Gravel							
	X	7	3.25		FILL: Dark Brown Clayey fine Sand to fine Sandy Clay, trace fine Gravel, trace Asphaltic concrete fragments, loose to medium stiff-damp	117	10					
	X	10	4.5+		ALLUVIUM: Dark Red Brown Clayey fine to coarse Sand to fine to coarse Sandy Clay, little medium Sand, slightly porous, loose-damp to moist	118	10					
5	X	11	4.5+		@ 5 to 6 feet, Red Brown	118	13					
	X	14	4.5+		@ 7 to 8 feet, moderate calcareous nodules	121	11					
10	X	17	4.5+			120	6					
					Orange Brown to Brown Clayey fine Sand, medium dense-moist							
15	X	24				114	17					

Boring Terminated at 15'

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

TEST BORING LOG

BORING NO. B-15

JOB NO.: 13G123	DRILLING DATE: 4/4/13	WATER DEPTH: Dry
PROJECT: Proposed C/I Building	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 16 feet
LOCATION: Moreno Valley, California	LOGGED BY: Brett Isen	READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					4± inches Open-graded Gravel							
	X	5			FILL: Dark Brown Clayey fine to medium Sand, trace coarse Sand, trace Asphaltic concrete fragments, loose-damp		10					
	X	4			ALLUVIUM: Red Brown fine to coarse Sand, trace Clay, loose to medium dense-moist		9					
5												
	X	12					6					
	X	13					7					
10												
					Red Brown to Gray Brown Clayey fine to coarse Sand, medium dense-damp							
	X	15					12					
15												
	X	14					18					
20					Boring Terminated at 20'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-16

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/4/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 2 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					4± inches Topsoil							
	X	13			DISTURBED ALLUVIUM: Light Brown Silty fine Sand, trace medium Sand, trace fine root fibers, medium dense-dry to damp		5					
5	X	15			ALLUVIUM: Red Brown Clayey fine Sand, trace medium Sand, medium dense-damp		8					
					Boring Terminated at 5'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-17

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/4/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 21 feet
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION (SURFACE ELEVATION: --- MSL)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
		19			DISTURBED ALLUVIUM: Light Brown Silty fine Sand, trace medium Sand, trace fine root fibers, moderately porous, medium dense-dry	105	3					
		30	2.25		ALLUVIUM: Gray Brown Clayey fine Sand to fine Sandy Clay, moderate calcareous nodules and veining, moderately porous, medium dense to very stiff-dry to damp	111	5					
5		42	4.5+			113	8					
		20			Red Brown to Dark Red Silty fine Sand, trace medium Sand, slightly porous, trace calcareous nodules, medium dense-damp to moist	112	8					
10		17			Dark Brown Clayey fine Sand, trace medium Sand, trace Silt, slightly cemented, trace calcareous veining, medium dense-damp	122	11					
15		18			Brown to Gray Brown fine Sandy Clay to Clayey fine Sand, trace fine Sand, trace calcareous veining, slightly cemented, very stiff to medium dense-moist		17					
20		15			Dark Gray Brown fine Sandy Silt to Silty fine Sand, trace medium Sand, medium dense-moist to very moist		17					
25		36				118	11					

Boring Terminated at 25'

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

BORING NO. B-18

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/4/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
	X	23			DISTURBED ALLUVIUM: Light Brown Silty fine Sand, trace medium Sand, trace fine root fibers, highly porous, medium dense-dry	87	3					EI = 29 @ 0 to 5'
	X	30			ALLUVIUM: Dark Brown Silty fine Sand, trace medium Sand, trace Clay, little calcareous nodules, slightly cemented, medium dense-moist to very moist	119	10					
5	X	19				103	14					
	X	30	4.5+		Light Brown fine Sandy Clay, trace Silt, trace medium Sand, stiff to very stiff-damp to moist	117	14					
10	X	33			Brown Silty fine Sand, little calcareous veining, medium dense-moist	116	13					
15	X	19			Red Brown Clayey fine Sand to fine Sandy Clay, slightly cemented, slightly porous, trace calcarous nodules, medium dense to very stiff-damp		13					
20	X	19			Light Brown fine Sand, medium dense-moist		8					
25	X	18			Brown fine to medium Sand, trace coarse Sand, weakly cemented, trace Silt, medium dense-damp		4					
					Boring Terminated at 25'							

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

TEST BORING LOG

BORING NO. B-19

JOB NO.: 13G123	DRILLING DATE: 4/4/13	WATER DEPTH: Dry
PROJECT: Proposed C/I Building	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 5 feet
LOCATION: Moreno Valley, California	LOGGED BY: Brett Isen	READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	
	X	15			DISTURBED ALLUVIUM: Light Brown fine Sand, trace medium Sand, trace Silt, trace fine root fibers, slightly porous, medium dense-damp		5					
	X	18			ALLUVIUM: Light Red Brown Clayey fine to medium Sand to fine Sandy Clay, medium dense to very stiff-damp		10					
5												
					Boring Terminated at 5'							

BORING NO. B-20

JOB NO.: 13G123
PROJECT: Proposed C/I Building
LOCATION: Moreno Valley, California

DRILLING DATE: 4/4/13
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 14 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

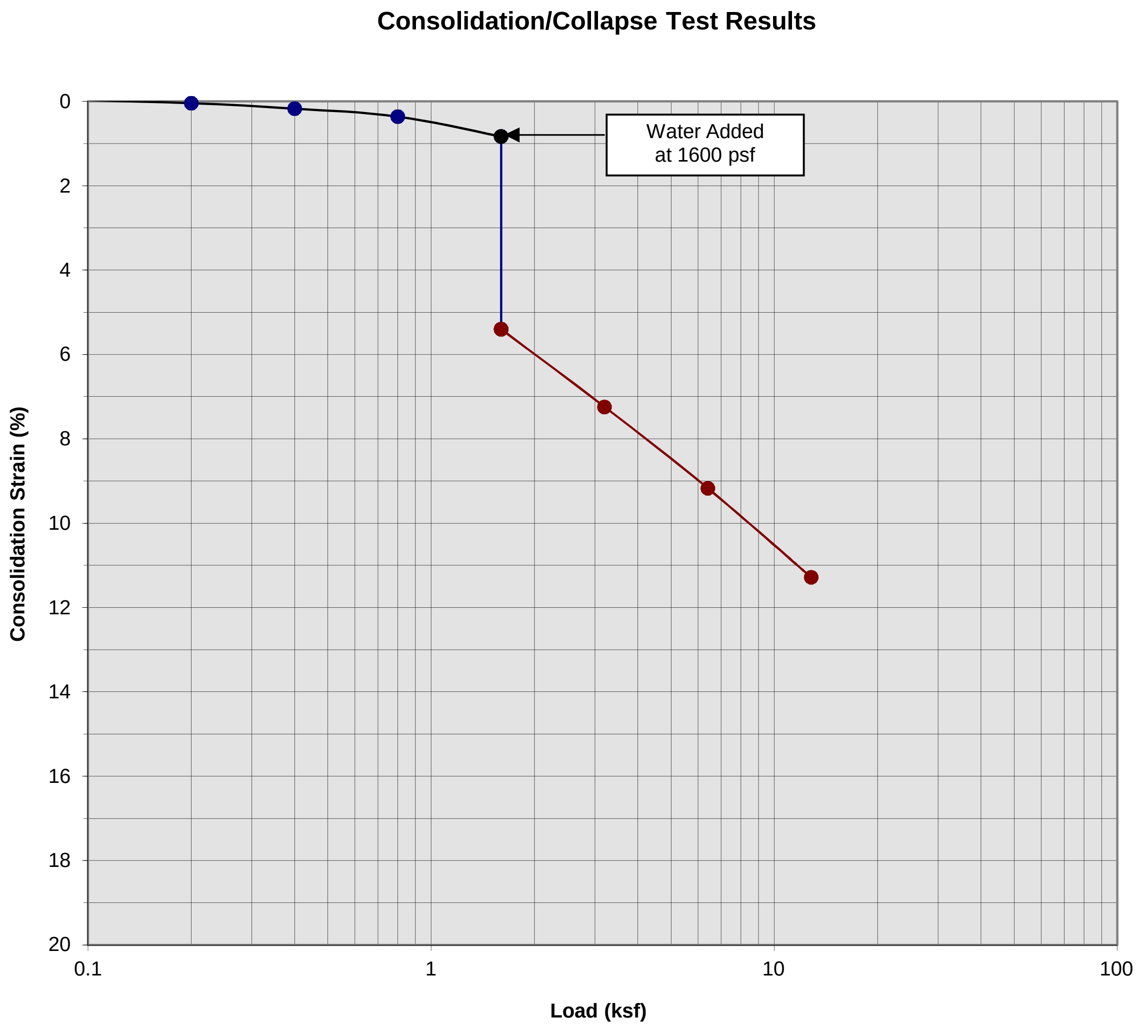
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
	X	11			DISTURBED ALLUVIUM: Light Brown Silty fine Sand, trace fine root fibers, trace medium Sand, medium dense-dry		3					
	X	5			ALLUVIUM: Brown Silty fine Sand, trace medium Sand, loose-dry		4					
5												
	X	9			Brown Clayey fine to coarse Sand, trace Silt, loose-dry		7					
	X	17	4.5+		Brown to Gray Brown Silty Clay, trace fine Sand, very stiff-damp		12					
10												
					Brown to Red Brown Silty fine Sand, little medium Sand, medium dense-moist							
	X	30					11					
15												

Boring Terminated at 15'

TBL 13G123.GPJ SOCALGEO.GDT 4/12/13

TEST BORING LOG

APPENDIX C

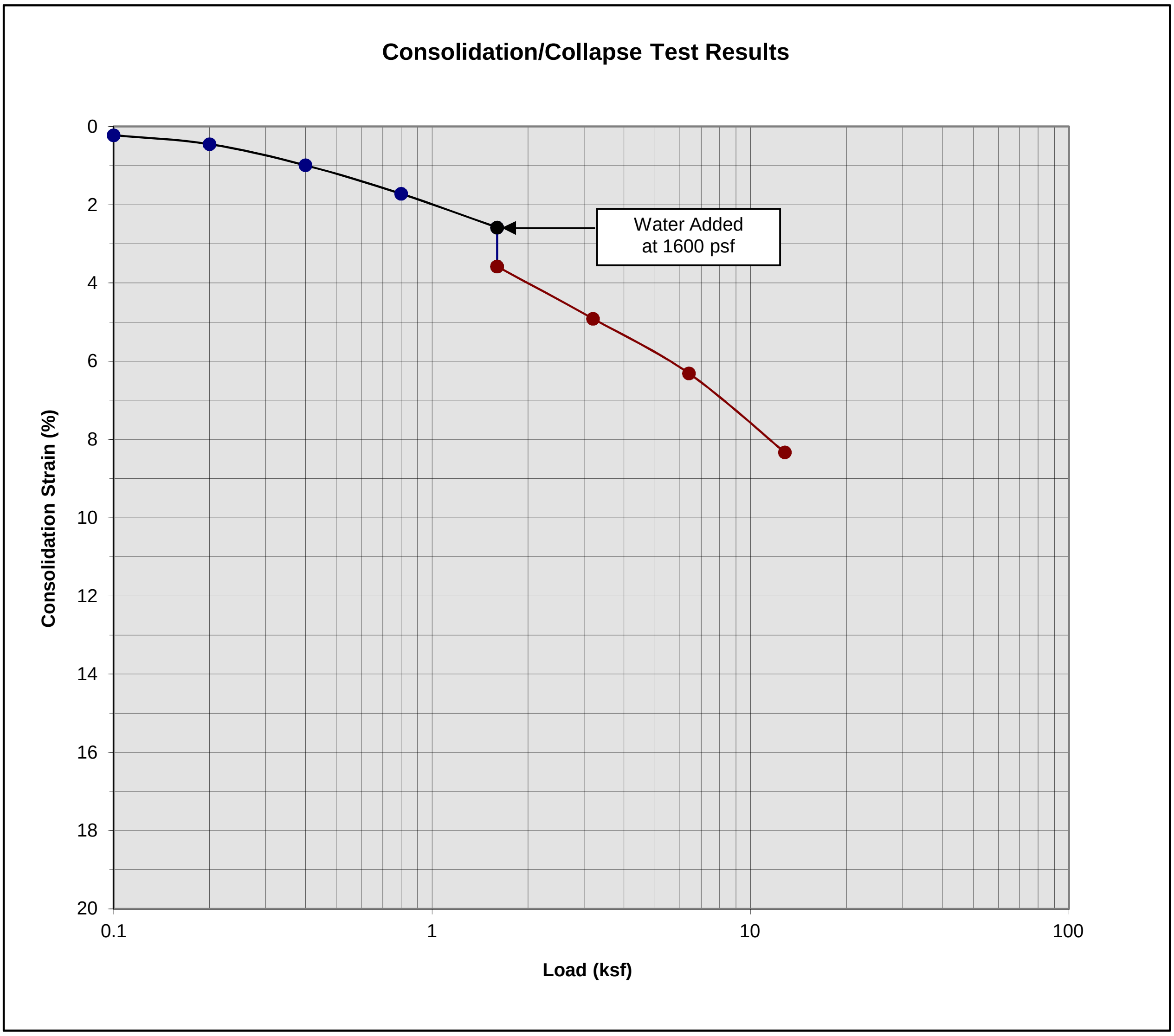


Classification: ALLUVIUM: Dark Brown Silty fine Sand, trace medium Sand

Boring Number:	B-5	Initial Moisture Content (%)	6
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	3 to 4	Initial Dry Density (pcf)	110.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	124.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	4.57

Proposed C/I Building
Moreno Valley, California
Project No. 13G123
PLATE C- 1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



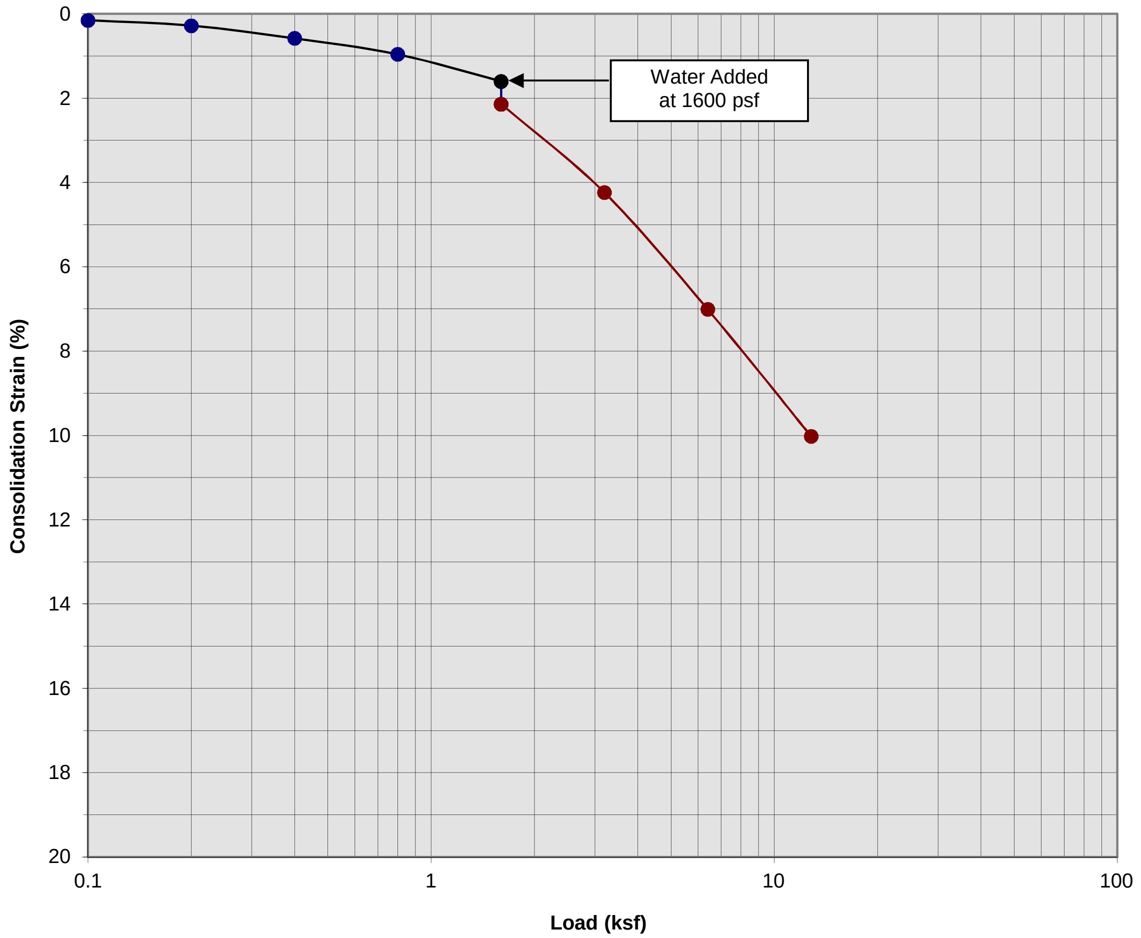
Classification: Dark Red Brown Clayey fine Sand, trace medium Sand

Boring Number:	B-5	Initial Moisture Content (%)	9
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	5 to 6	Initial Dry Density (pcf)	120.3
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	130.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.00

Proposed C/I Building
Moreno Valley, California
Project No. 13G123
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

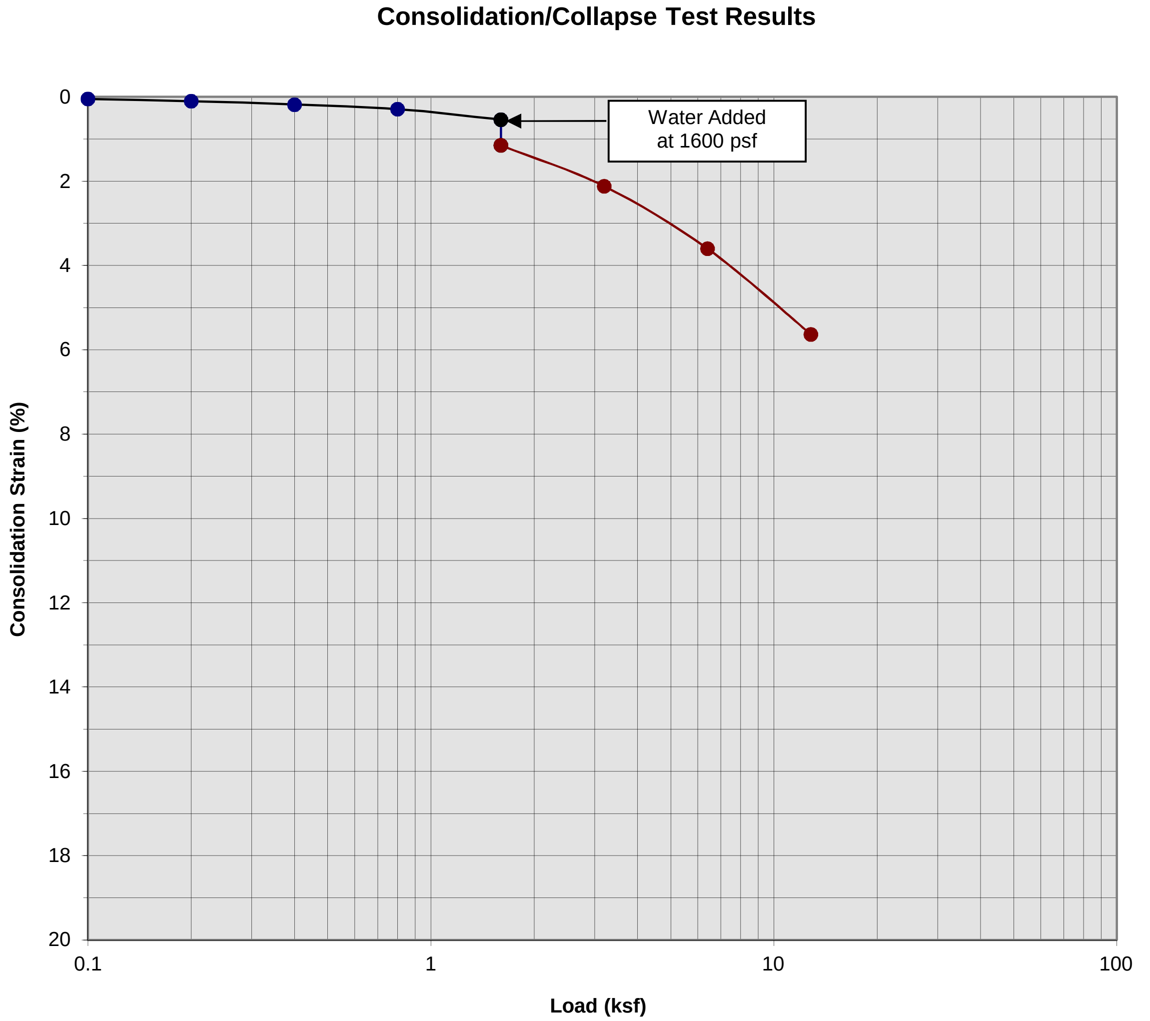


Classification: Dark Brown Silty fine Sand

Boring Number:	B-5	Initial Moisture Content (%)	12
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	7 to 8	Initial Dry Density (pcf)	107.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	119.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.54

Proposed C/I Building
Moreno Valley, California
Project No. 13G123
PLATE C- 3

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



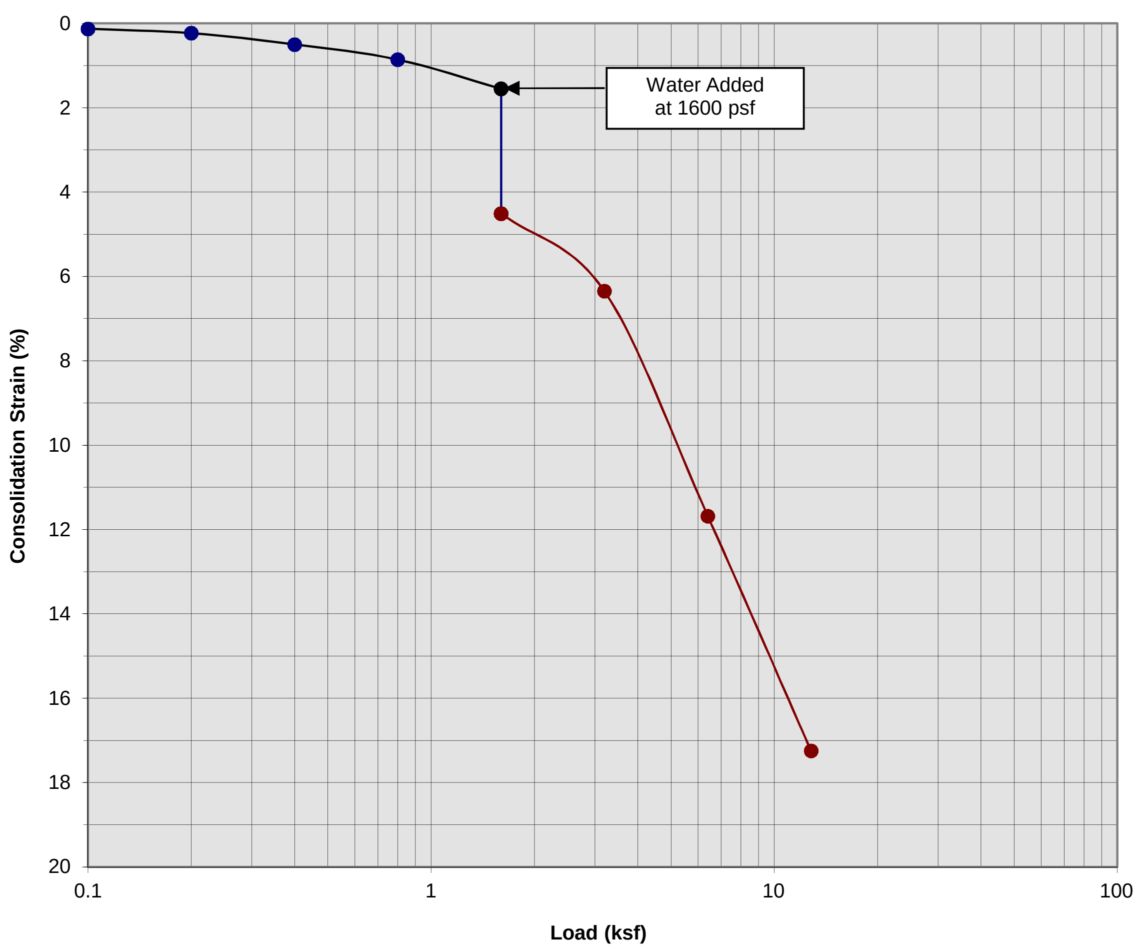
Classification: Light Orange Brown fine to coarse Sand

Boring Number:	B-5	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	17
Depth (ft)	9 to 10	Initial Dry Density (pcf)	101.4
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	107.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.61

Proposed C/I Building
Moreno Valley, California
Project No. 13G123
PLATE C- 4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



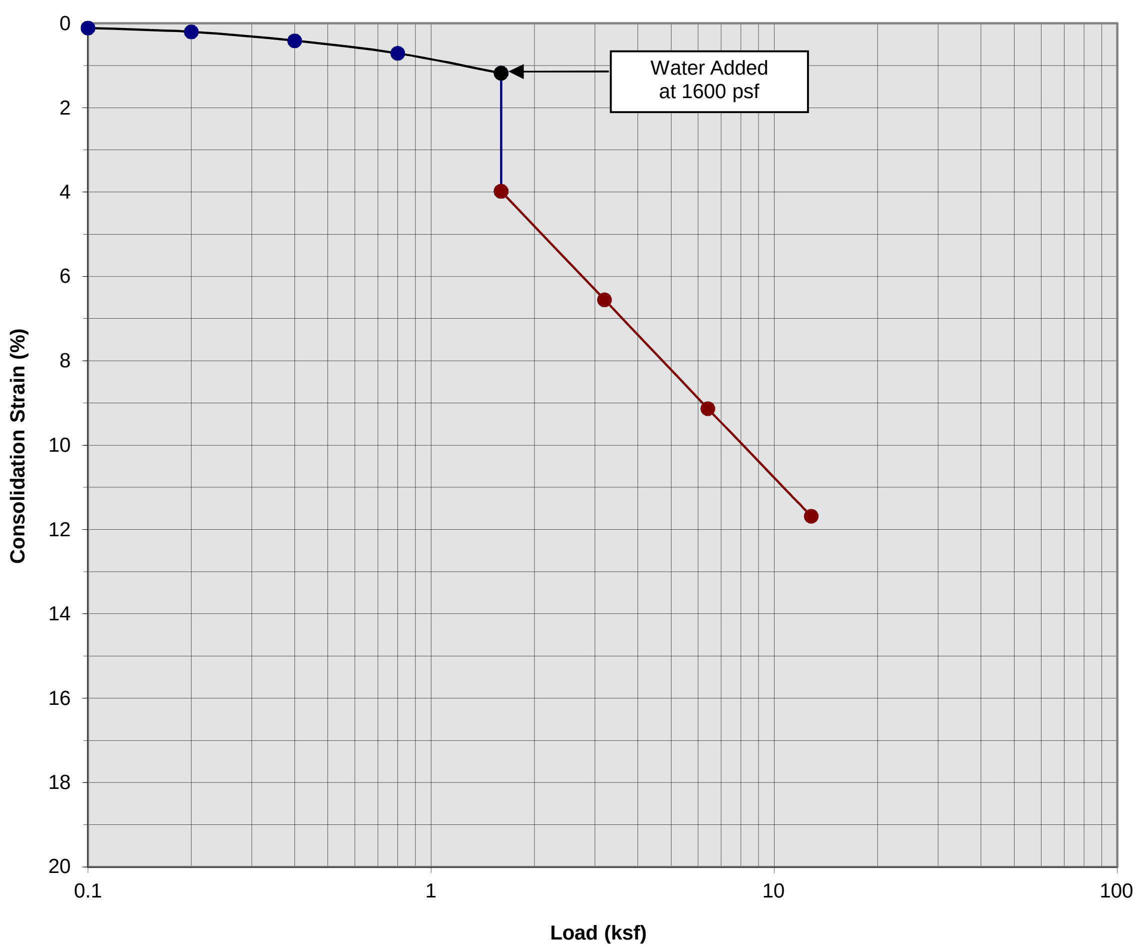
Classification: DISTURBED ALLUVIUM: Dark Brown Silty fine Sand, tr. med. Sand

Boring Number:	B-13	Initial Moisture Content (%)	9
Sample Number:	---	Final Moisture Content (%)	13
Depth (ft)	1 to 2	Initial Dry Density (pcf)	113.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	137.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.96

Proposed C/I Building
Moreno Valley, California
Project No. 13G123
PLATE C- 5

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



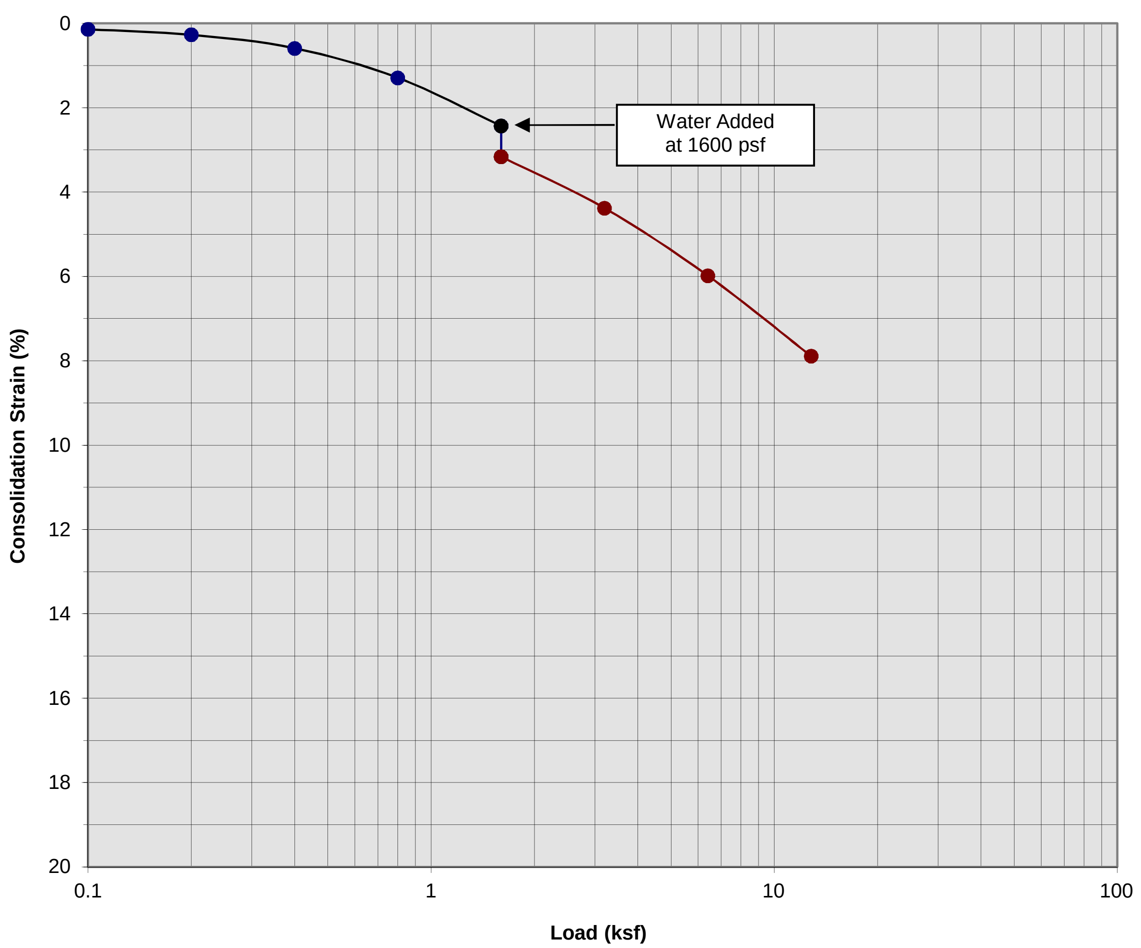
Classification: ALLUVIUM: Red Brown to Dark Brown fine Sand, trace med. to coarse Sand

Boring Number:	B-13	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	3 to 4	Initial Dry Density (pcf)	109.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	123.4
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.80

Proposed C/I Building
Moreno Valley, California
Project No. 13G123
PLATE C- 6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



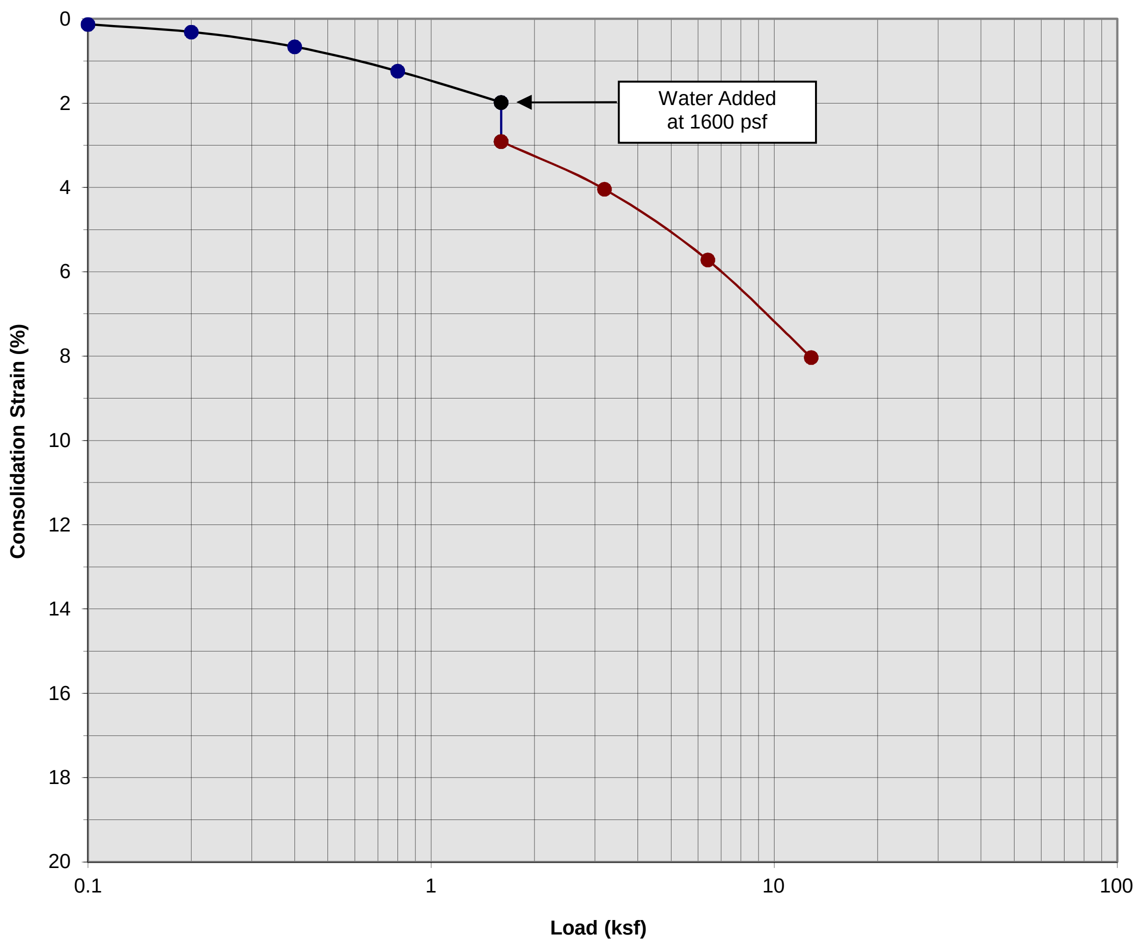
Classification: Dark Brown to Dark Red Brown fine Sandy Clay to Clayey fine Sand

Boring Number:	B-13	Initial Moisture Content (%)	13
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	5 to 6	Initial Dry Density (pcf)	117.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	127.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.73

Proposed C/I Building
Moreno Valley, California
Project No. 13G123
PLATE C- 7

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

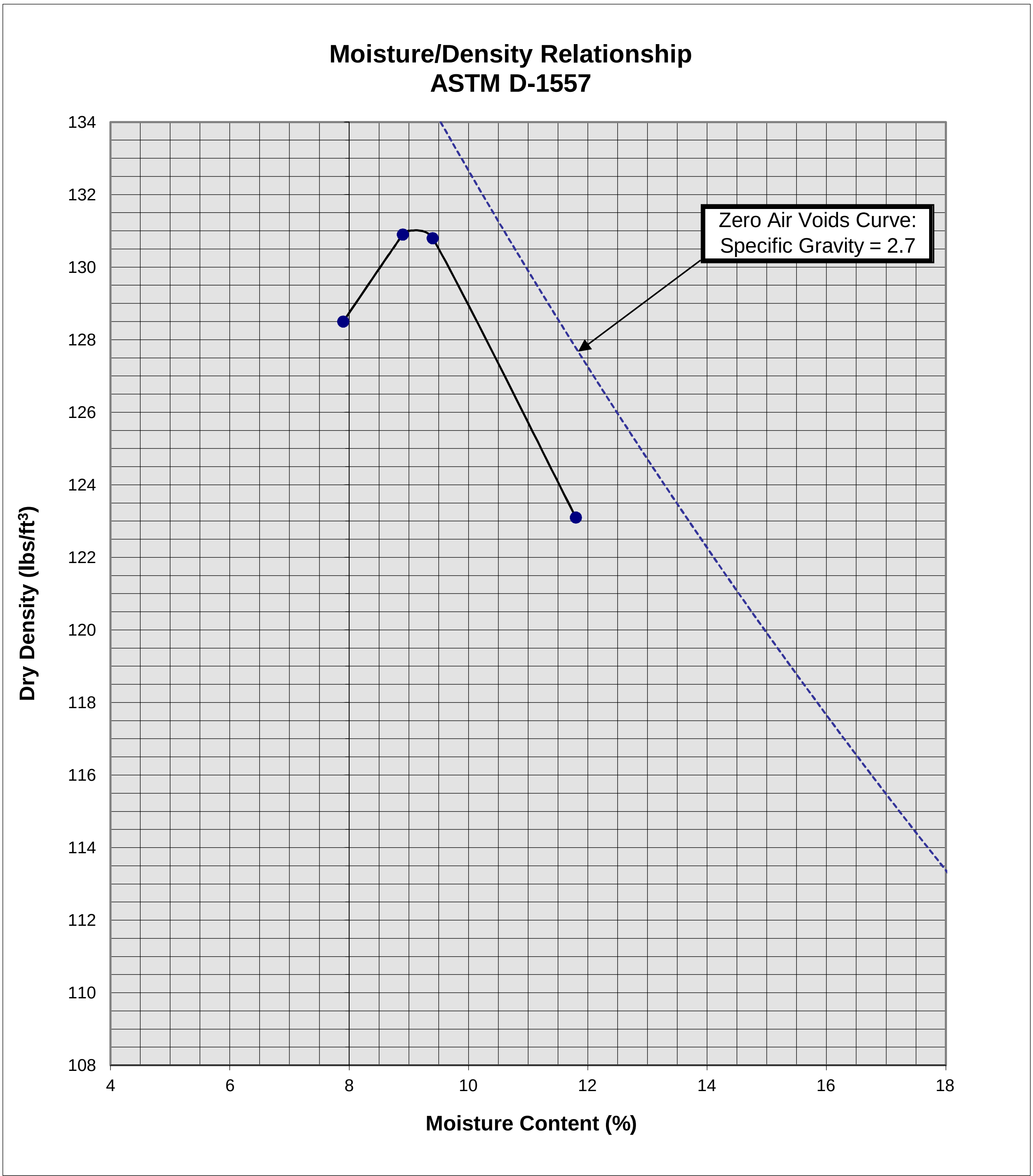


Classification: Dark Brown to Dark Red fine Sandy Clay to Clayey fine Sand

Boring Number:	B-13	Initial Moisture Content (%)	11
Sample Number:	---	Final Moisture Content (%)	11
Depth (ft)	7 to 8	Initial Dry Density (pcf)	127.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	138.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.93

Proposed C/I Building
Moreno Valley, California
Project No. 13G123
PLATE C- 8

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Soil ID Number	B-13 @ 0 to 5'
Optimum Moisture (%)	9
Maximum Dry Density (pcf)	131
Soil Classification	Brown Silty fine Sand

Proposed C/I Building
Moreno Valley, California
Project No. 13G123

PLATE C-9

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX D

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.
- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.
- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.
- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.
- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.
- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.
- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.

- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.

- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.

- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.

- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted

- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

Compacted Fills

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as "contaminated," and shall be very low to non-expansive with a maximum expansion index (EI) of 50. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.

- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.

- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.

- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:

  - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.

  - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.

- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.

- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.

- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.

- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.

- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.

- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.

- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.

- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.

- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.

- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a ½ horizontal to 1 vertical (0.5:1) inclination.

- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.

- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core

- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.

- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.

- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).

- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.

- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

Cut Slopes

- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.

- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.

- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.

- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

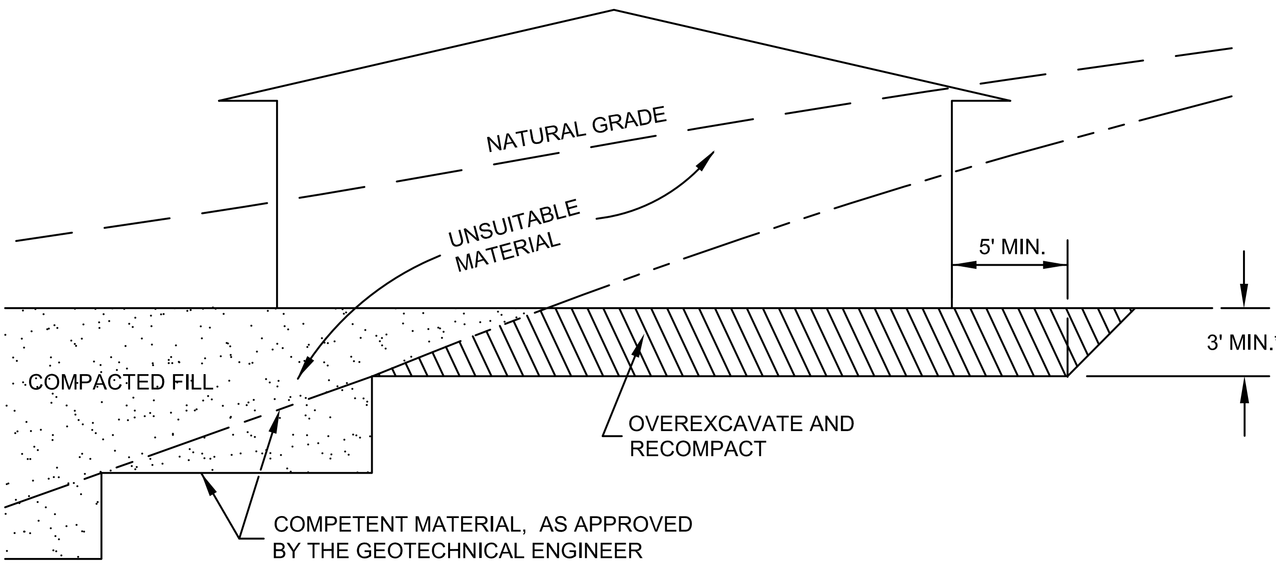
Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.

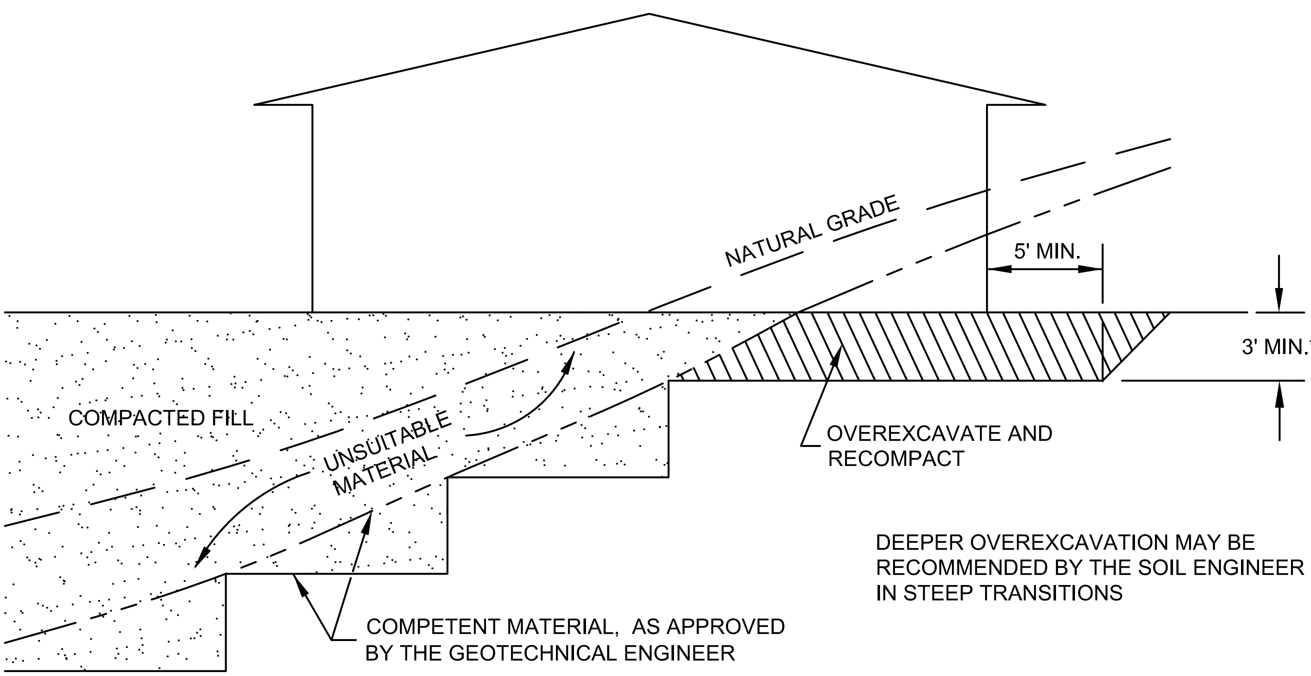
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean ¾-inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT



CUT/FILL LOT (TRANSITION)



*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION.
ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

TRANSITION LOT DETAIL

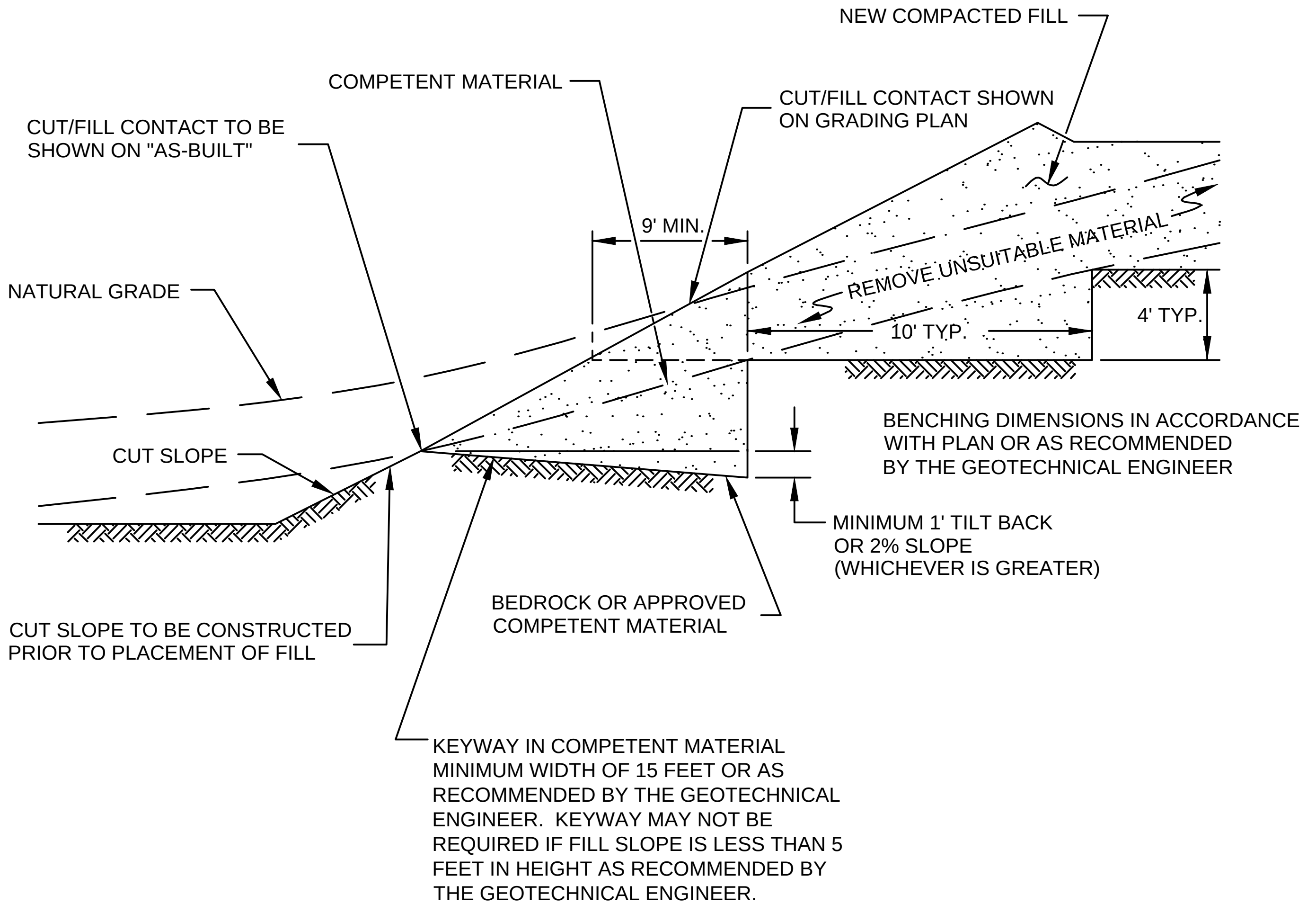
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

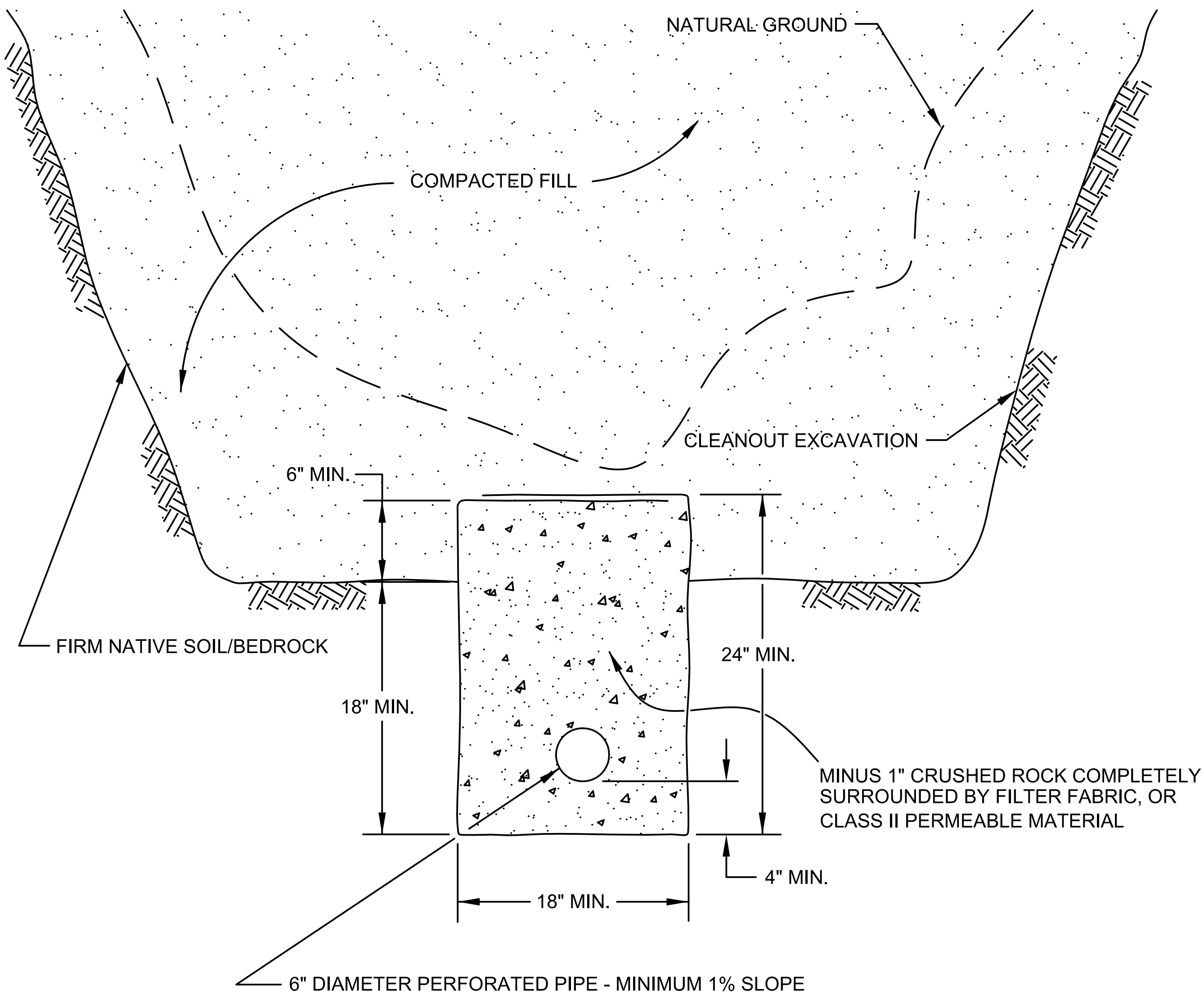
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

SOCALGEO
SOUTHERN CALIFORNIA GEOTECHNICAL



PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL

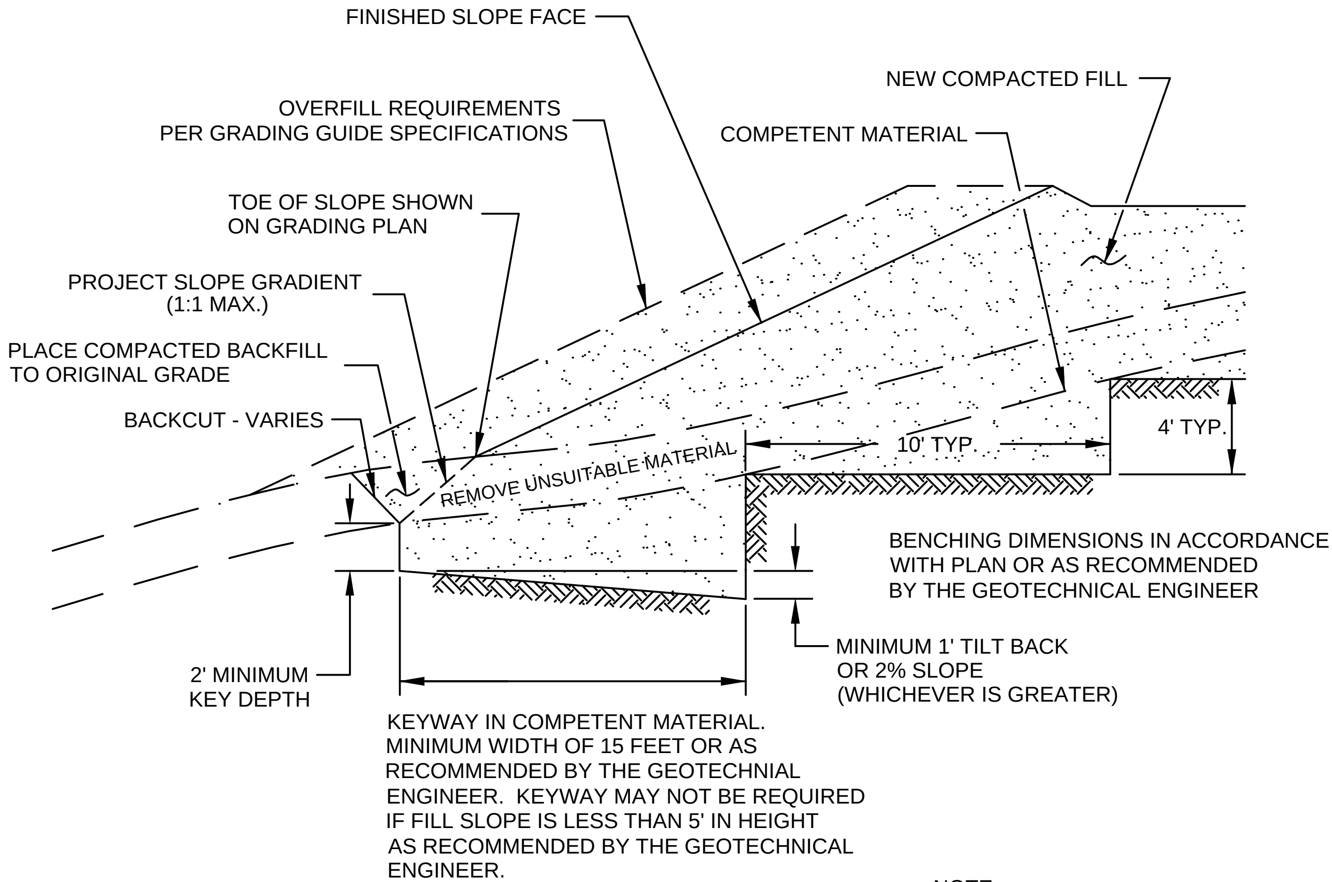
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



NOTE:
BENCHING SHALL BE REQUIRED
WHEN NATURAL SLOPES ARE
EQUAL TO OR STEEPER THAN 5:1
OR WHEN RECOMMENDED BY
THE GEOTECHNICAL ENGINEER.

FILL ABOVE NATURAL SLOPE DETAIL

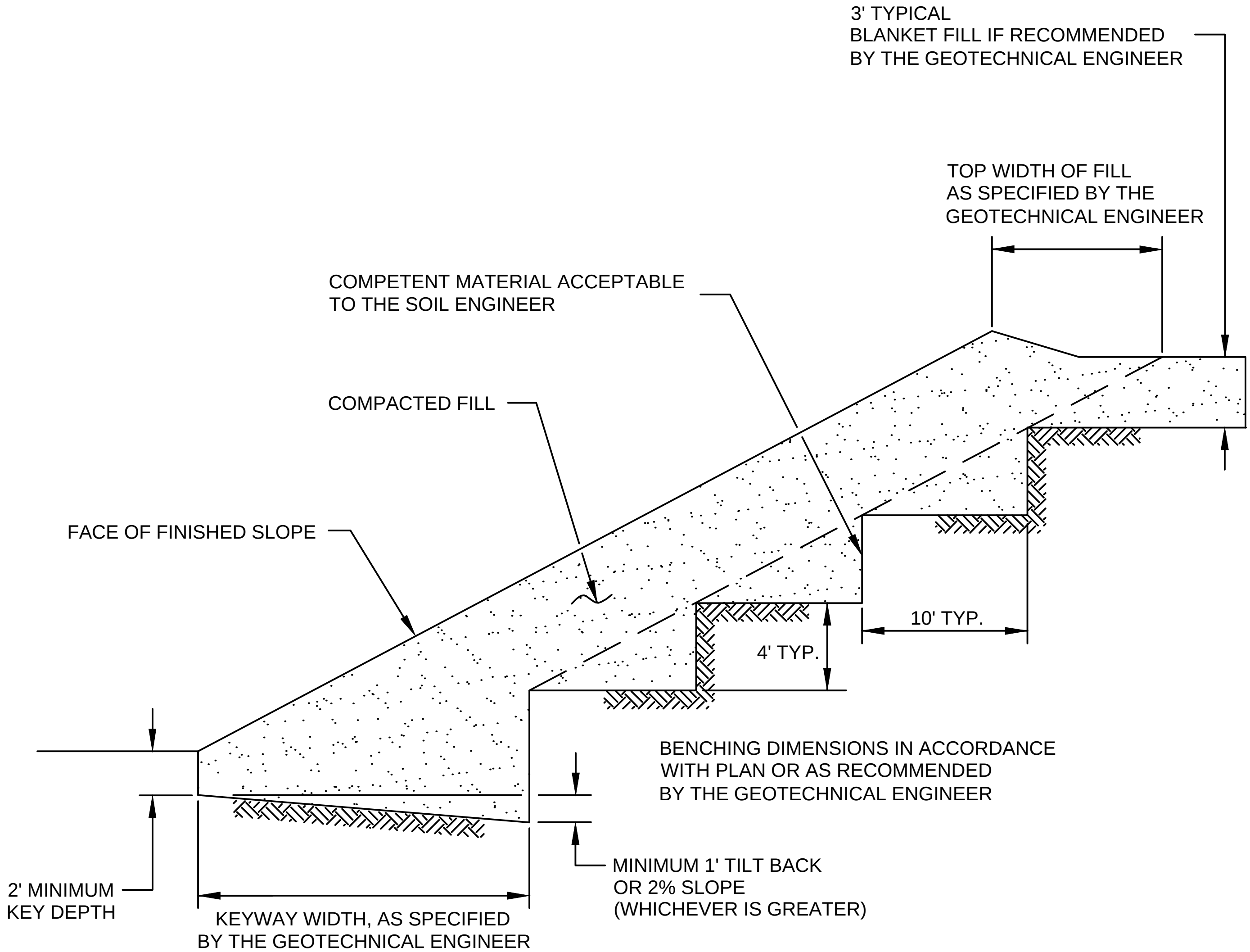
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

GRADING GUIDE SPECIFICATIONS

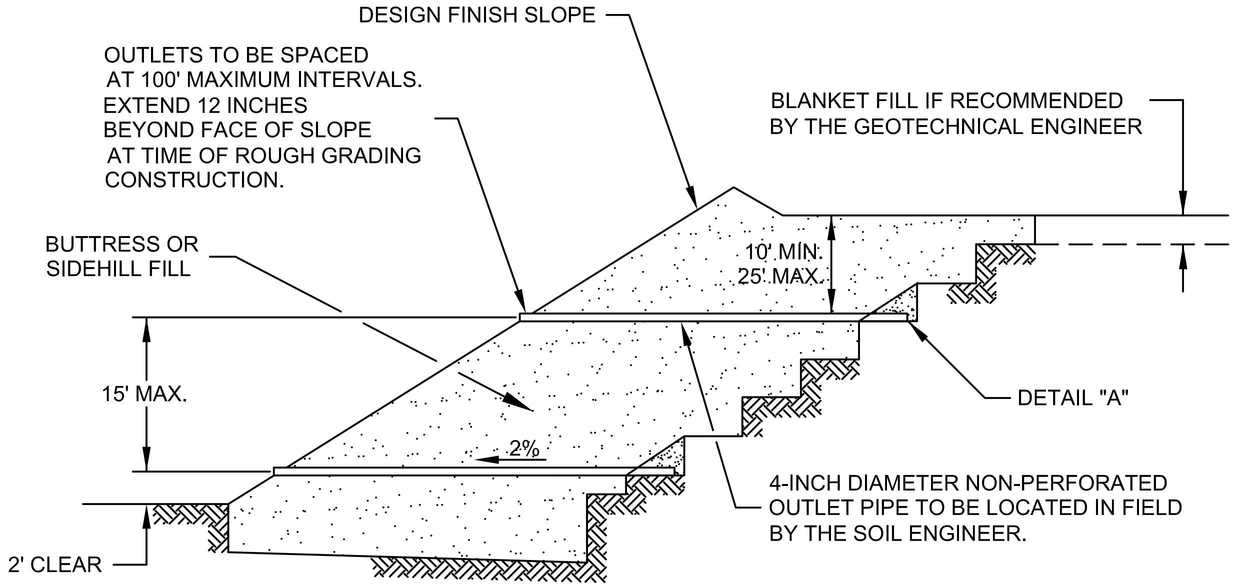
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



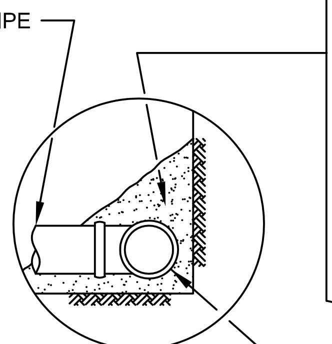
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50



DETAIL "A"

NOTES:
1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

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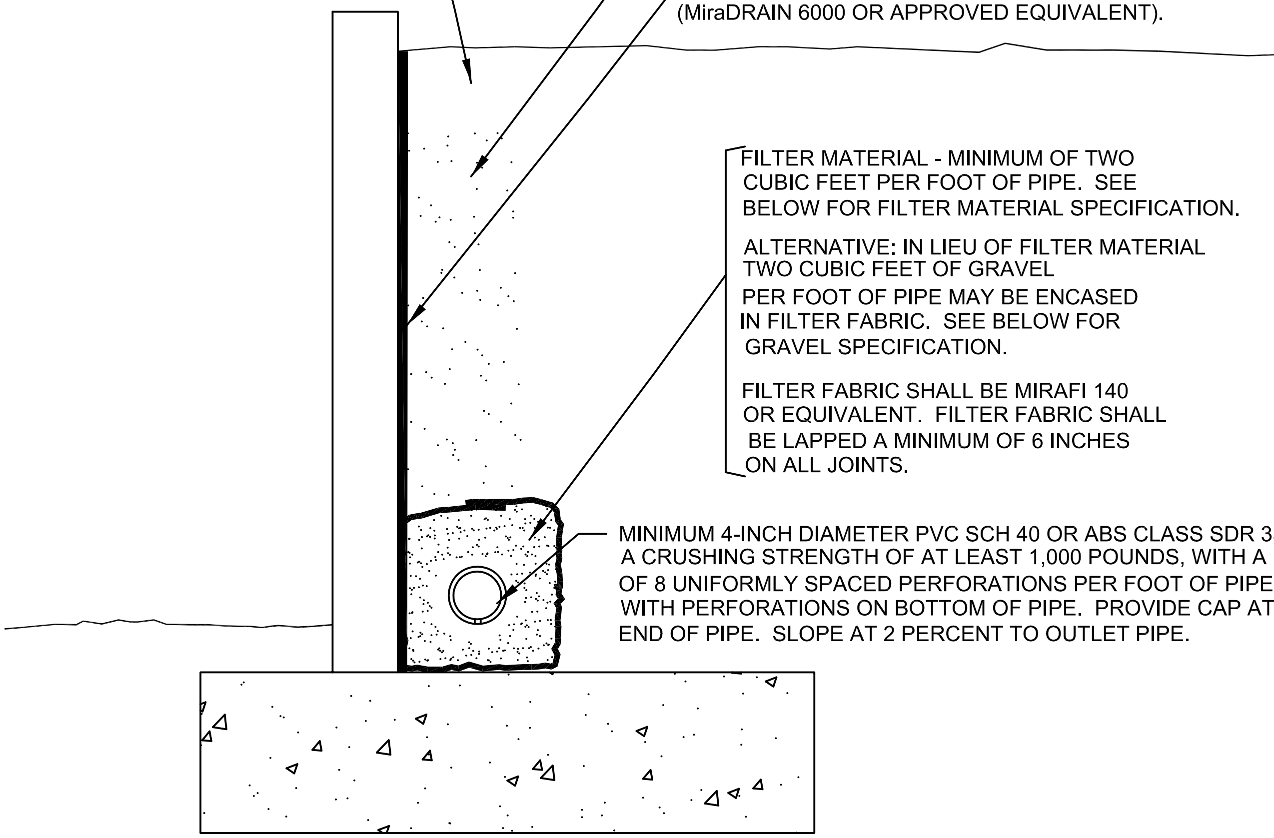
SOUTHERN CALIFORNIA GEOTECHNICAL

MINIMUM ONE FOOT THICK LAYER OF LOW PERMEABLILITY SOIL IF NOT COVERED WITH AN IMPERMEABLE SURFACE

MINIMUM ONE FOOT WIDE LAYER OF FREE DRAINING MATERIAL (LESS THAN 5% PASSING THE #200 SIEVE)
OR
PROPERLY INSTALLED PREFABRICATED DRAINAGE COMPOSITE (MiraDRAIN 6000 OR APPROVED EQUIVALENT).



FILTER MATERIAL - MINIMUM OF TWO CUBIC FEET PER FOOT OF PIPE. SEE BELOW FOR FILTER MATERIAL SPECIFICATION.

ALTERNATIVE: IN LIEU OF FILTER MATERIAL TWO CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE BELOW FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 6 INCHES ON ALL JOINTS.

MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEAST 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

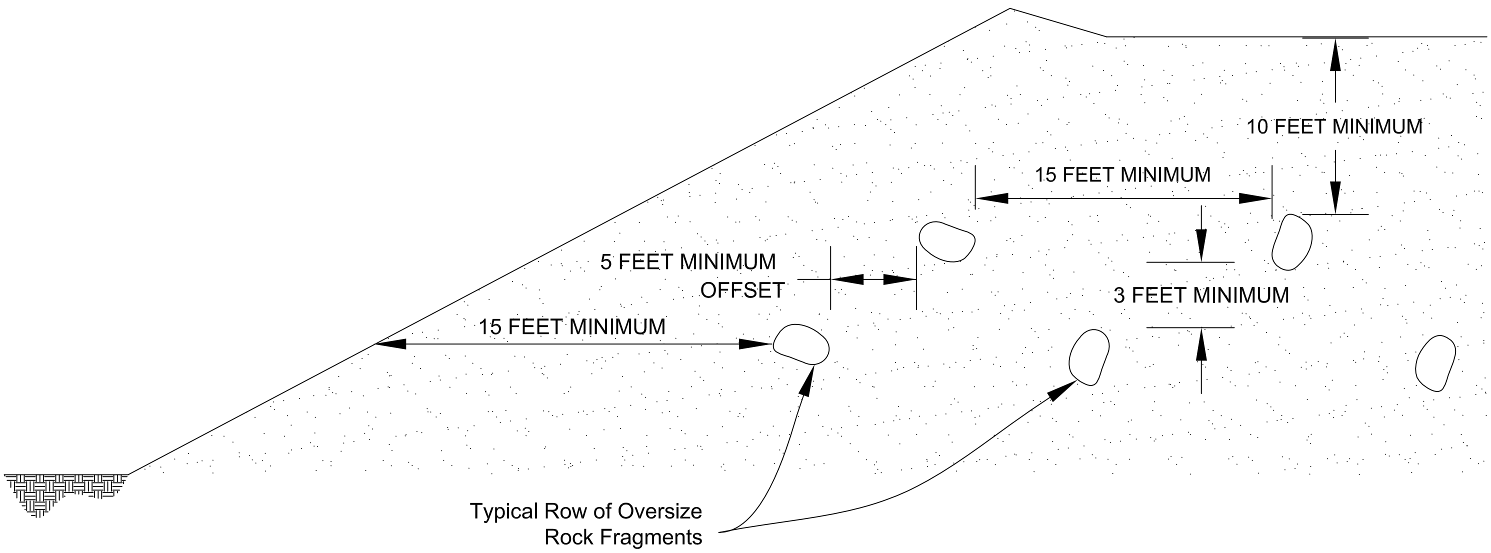
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

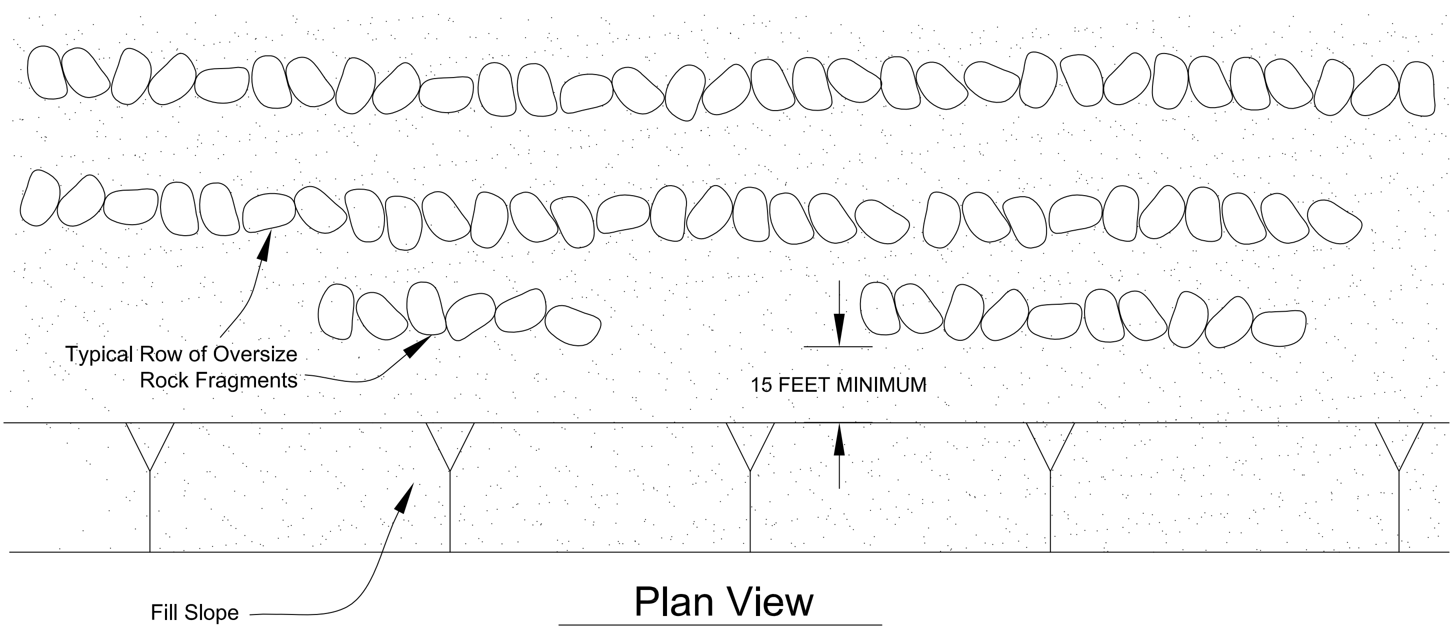
DRAWN: JAS
CHKD: GKM

PLATE D-7

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

PLATE D-8

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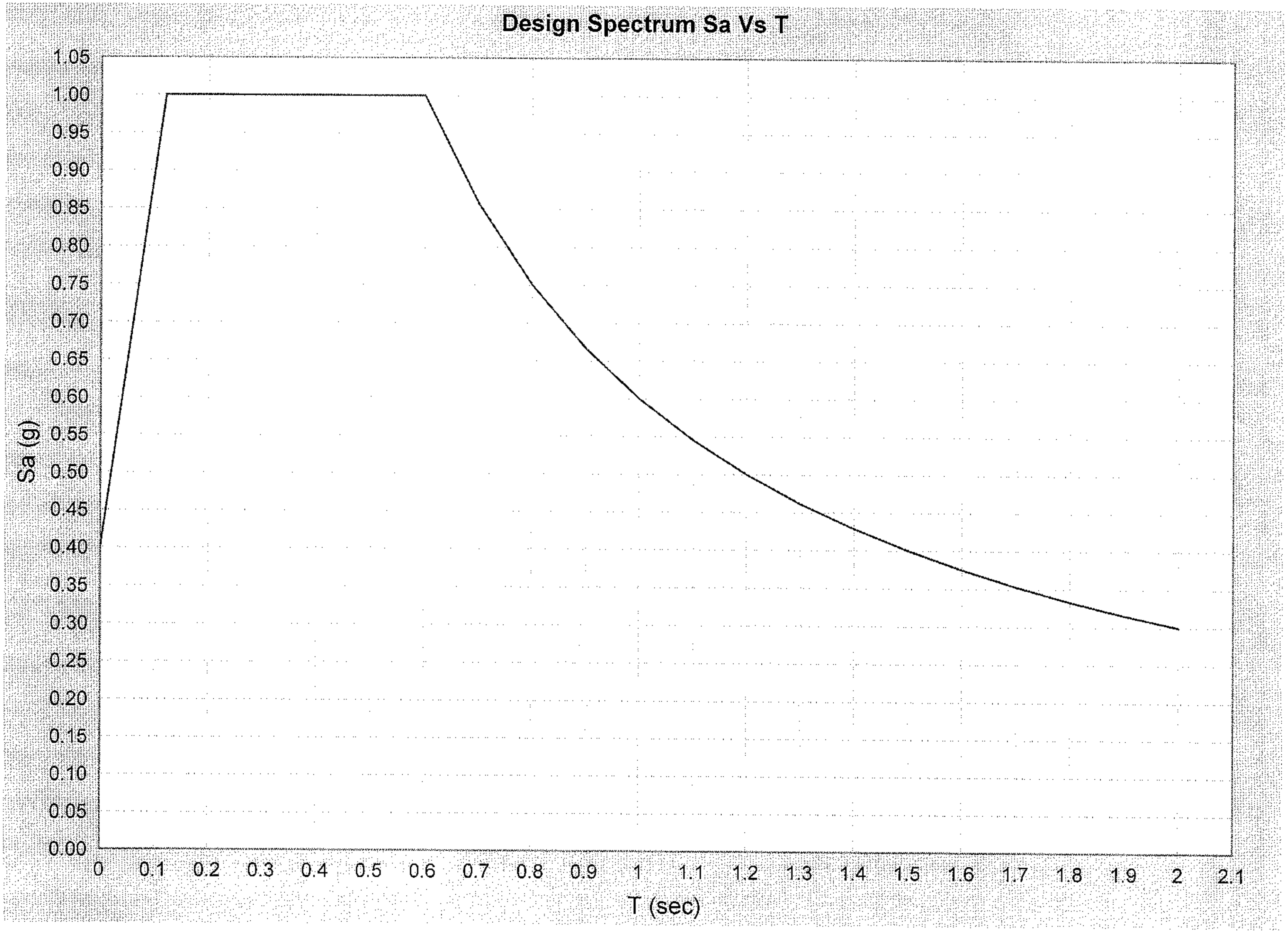
GEOTECHNICAL

APPENDIX E



Design Spectrum Sa Vs T
Sa (g)
1.05
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
T (sec)

Conterminous 48 States
2009 International Building Code
Latitude = 33.864597
Longitude = -117.23819499999999
Spectral Response Accelerations Ss and S1
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B - Fa = 1.0 ,Fv = 1.0
Data are based on a 0.01 deg grid spacing

Period (sec)	Sa (g)	
0.2	1.500	(Ss, Site Class B)
1.0	0.600	(S1, Site Class B)

Conterminous 48 States
2009 International Building Code
Latitude = 33.864597
Longitude = -117.23819499999999
Spectral Response Accelerations SMs and SM1
SMs = Fa x Ss and SM1 = Fv x S1
Site Class D - Fa = 1.0 ,Fv = 1.5

Period (sec)	Sa (g)	
0.2	1.500	(SMs, Site Class D)
1.0	0.900	(SM1, Site Class D)

Conterminous 48 States
2009 International Building Code
Latitude = 33.864597
Longitude = -117.23819499999999
Design Spectral Response Accelerations SDs and SD1
SDs = 2/3 x SMs and SD1 = 2/3 x SM1
Site Class D - Fa = 1.0 ,Fv = 1.5

Period (sec)	Sa (g)	
0.2	1.000	(SDs, Site Class D)
1.0	0.600	(SD1, Site Class D)