GEOTECHNICAL FEASIBILITY STUDY
PROPOSED MIXED USE DEVELOPMENT

SEC North Vineyard Avenue and East 4th Street
Ontario, California
for
Sares Regis Group

April 3, 2014

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Sares Regis Group
18802 Bardeen Avenue
Irvine, California 92612-2213

Attention: Mr. Patrick Russell

Project No.: **14G122-1**

Subject: **Geotechnical Feasibility Study**
Proposed Mixed-Use Development
SEC North Vineyard Avenue and East 4th Street
Ontario, California

Gentlemen:

In accordance with your request, we have conducted a geotechnical feasibility study 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.

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1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of the geotechnical feasibility study. It should be noted that some of these design parameters are based on preliminary project information and assumptions. It is expected that additional subsurface exploration, laboratory testing and engineering analysis will be required.

Preliminary Site Preparation Recommendations

- Site stripping should be performed in any existing vegetated areas. All vegetation, organic soils, and root mass materials should be disposed of off-site.
- A portion of Inland Empire Boulevard will be relocated to a position north of its existing alignment. It is therefore expected that the existing portion of Inland Empire Boulevard, located in the west ½± of parcel PA-2, will be demolished. Additionally, if the existing elementary school located in the northeast area of parcel PA-1 will not remain with the proposed development, the existing improvements should be demolished. Any existing improvements that will not remain in place for use with the new development should be demolished and removed in their entirety. This should include all foundations, floor slabs, utilities, and any other subsurface improvements associated with the existing structure and modular buildings. 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 CMB, if desired.
- The proposed development is considered to be feasible with respect to the geotechnical conditions encountered at the boring locations. However, remedial grading will be necessary in order to support the proposed structures on conventional shallow foundation systems due to the presence of variable density, potentially collapsible native alluvial soils within 5 to 10± feet of the ground surface. Since plans for site development are conceptual and since no grading plans are available at this time, detailed grading recommendations cannot be provided at this time. Preliminary remedial grading and foundation design recommendations have been provided herein, based on the assumed site grading and assumed foundation loads.
- Based on these preliminary assumptions, remedial grading is recommended within the proposed building areas in order to remove a portion of the near surface native alluvial soils.
- Preliminarily, the existing soils within the proposed building areas should be overexcavated to a depth of at least 5 feet below existing grade and to a depth of at least 5 feet below proposed pad grade. Within the building areas, the proposed foundation influence zones should be overexcavated to a depth of 3 feet below proposed foundation bearing grade within the influence zones of any new foundations. These recommendations are subject to review and may be revised after further geotechnical investigation.
- Following completion of the recommended overexcavation, the exposed soils should be evaluated by the geotechnical engineer. After the overexcavation subgrade soils have been approved by the geotechnical engineer, the resulting soils may 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.

Preliminary Foundation Design Recommendations

- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,000 to 3,000 lbs/ft^2 maximum allowable soil bearing pressure.
- Reinforcement consisting of two (2) to four (4) No. 5 rebars in strip footings. Additional reinforcement may be necessary for structural considerations.

Preliminary Floor Slab Design Recommendations

- Conventional Slabs-on-Grade, minimum 5 to 6 inches thick.
- The actual thickness and reinforcement of the floor slabs should be determined by the structural engineer based on the imposed loading.

Pavements

- The near surface soils have been estimated to possess R-values ranging from 50 to 60.
- Preliminary pavement design parameters for on-site pavements and new streets, including Inland Empire Boulevard, are based upon an assumed R-value of 50:

ASPHALT PAVEMENTS (R = 50)							
Materials	**Thickness (inches)**						
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic					
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0	TI = 10.0	TI = 11.0
Asphalt Concrete	3	3½	4	5	5½	6½	7
Aggregate Base	3	4	5	5	7	8	9
Compacted Subgrade	12	12	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS						
Materials	**Thickness (inches)**					
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic				
		TI = 7.0	TI = 8.0	TI = 9.0	TI = 10.0	TI = 11.0
PCC	5	6½	8	9	10	11
Compacted Subgrade (95% minimum compaction)	12	12	12	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 14P157, dated February 25, 2014. 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, parking lot pavements, and new street 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 feasibility study.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the southeast corner of East 4th Street and North Vineyard Avenue in Ontario, California. The site is bounded to the north by East 4th Street and the Cucamonga Guasti Regional Park, to the east by North Archibald Avenue and the Cucamonga Canyon Channel, to the south by the Interstate 10 Freeway, and to the west by North Vineyard Avenue. The general location of the site is illustrated on the Site Location Map included as Plate 1 in Appendix A of this report.

The subject site consists of four (4) parcels, totaling 239.6± acres in size. A Conceptual Land Use Exhibit, provided to our office by the client, identifies these parcels as PA-1 through PA-4. The exhibit also identifies an additional 2.7 acre triangle shaped parcel, PA-5, which is not a part of this investigation.

PA-1 is a 150.0± acre parcel located at the northwest corner of the intersection of Inland Empire Boulevard and the Cucamonga Canyon Channel. The majority of the site is vacant and undeveloped, except near the northeast corner of parcel PA-1. Ground surface cover throughout the majority of this parcel consists of sparse to moderate native grass and weed growth with limited areas of exposed soil. A natural drainage course, generally trending northwest to southeast, is located in the east-central region of the parcel and slopes downward to the southeast. The bottom of the drainage course is approximately 1 to 3 feet below adjacent site grades. An elementary school is present in the northeast region of the parcel. The school occupies less than 2 percent of PA-1. The campus consists of one (1) single-story wood frame structure and several modular classroom buildings. The single-story wood frame structure is assumed to be supported by a conventional shallow foundation system and a concrete slab-on-grade floor.

PA-2 is a 41.6± acre parcel located at the southwest corner of the intersection of Inland Empire Boulevard and the Cucamonga Canyon Channel. PA-2 is vacant of any structures. However, Inland Empire Boulevard traverses the western half of PA-2 trending northwest to southeast.

PA-3 is a 26.1± acre parcel located at the southeast corner of the intersection of Inland Empire Boulevard and the Cucamonga Canyon Channel. PA-3 is vacant and undeveloped. Ground surface cover throughout the parcel generally consists of sparse to moderate grass and weed growth. A drainage course, which generally trends north to south, is present in the eastern region of the parcel. The bottom of the drainage course is approximately 1 to 3 feet below adjacent site grades. Several large trees are located at the northern portion of the drainage course. Several soil stockpiles, approximately 2 to 5 feet in height and approximately 8 to 10 feet in diameter, are located near the banks of the drainage course. An ascending slope is located along the southern and eastern boundaries of PA-3. These slopes range in height from 2 to 15½ feet in height with an inclination of 2h:1v. These slopes are assumed to have been created during grading for Interstate 10 Freeway and the North Archibald Avenue overpass.

PA-4 is a vacant 21.9 acre parcel located at the northeast corner of the intersection of Inland Empire Boulevard and the Cucamonga Canyon Channel. Ground surface cover throughout this this parcel generally consists of sparse to moderate grass and weed growth. In the eastern portion of PA-4, two silt fences, approximately 15 feet apart, are supported by two parallel rows of steel beams/steel fence posts. The posts are approximately 4 feet on center. The two fences generally trend north-south extend approximately 2± feet above adjacent site grades. The area between the fences is generally 2 to 3± feet below adjacent site grades.

Detailed topographic information was not available at the time of this report. Visually, the overall site topography slopes gently downward to the south at an estimated gradient of approximately 2 percent. Localized variations in site topography include earthen berms, with estimated heights of 1 to 2± feet, located on the south side of 4th Street and the aforementioned drainage courses.

3.2 Proposed Development

We understand that detailed site plans indicating building locations or type of construction are currently unavailable. However based on conversations with the client, the site will be developed with multiple large and small commercial/industrial buildings, retail buildings, office buildings, and multi-family residential buildings. It is anticipated that the structures will be surrounded by asphaltic concrete pavements in the automobile parking and drive lanes. Additionally, Portland cement concrete pavements will be located in the truck loading dock areas for the commercial/industrial buildings.

Based on the shape and size of parcel PA-1, the parcel will likely be developed with commercial/industrial buildings of various sizes, some of which may be larger than 500,000 ft^2 in size. We expect that parcels PA-2, PA-3 and PA-4 may be developed with retail and/or office buildings, based on the shapes, sizes, and locations of these parcels.

The existing elementary school in the northeast portion of PA-1 is currently operational. As of the time of this report, we have not received information indicating whether the existing elementary school will be demolished or if it will remain with the proposed development. If the existing elementary school will not remain with the proposed development, then we expect that it will be necessary to demolish the campus, including the existing structures, in order to facilitate new development.

The Conceptual Land Use Exhibit indicates that the portion of Inland Empire Boulevard, located in the western half of parcel PA-2, will be realigned to a position north of its current alignment. The exhibit indicates that Inland Empire Boulevard will terminate at North Vineyard Avenue approximately 300 feet north of its current position. Based on a discussion with personnel from RBF, the project civil engineer, we understand that a design traffic index has not yet been assigned for this street.

Detailed structural information has not been provided. We assume that the commercial/industrial structures will be of concrete tilt-up construction, typically supported on conventional shallow foundation systems and concrete slab-on-grade floors. 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. The retail, office, and multi-family residential buildings are assumed to be one to two-story structures of wood-frame or masonry block construction, typically supported on conventional shallow foundation systems and concrete slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 50 kips and 2 to 4 kips per linear foot, respectively.

Preliminary grading plans were not available at the time of this report. Based on the existing topography, and assuming a relatively balanced site, cuts and fills on the order of 8 to 10± feet are expected to be necessary to achieve the proposed site grades across the site. With the exception of some small retaining walls in the area of the truck loading docks, the proposed structures are not expected to incorporate any significant below grade construction such as basements or crawl spaces.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of seventeen (17) borings advanced to depths of 15 to 31± feet below 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 conventional truck-mounted drill 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

Alluvium

Native alluvial soils were encountered at the ground surface at all of the boring locations extending to at least the maximum depth explored of 31± feet below existing site grades. The alluvial soils encountered within the upper 8 to 12± feet generally consist of interbedded layers of loose to medium dense silty fine sands, fine sands, and fine to coarse sands with varying fine to coarse gravel content and occasional well graded sand strata possessing minor to moderate cobble content. At greater depths, the native alluvial soils consist of medium dense to very dense silty fine to medium sands, fine to coarse sands, and well graded sandy gravels. In general, the soils encountered at depths greater than 8 to 12± feet possessed greater quantities of fine to coarse gravel and cobbles. Four of the borings were terminated between depths of 16 and 21½± feet due to refusal conditions within gravelly or cobbly strata.

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 31± 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. The 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 Moisture Content

The moisture content has been determined for selected representative samples. 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.

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-16 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557 and are presented on Plate C-17 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**	**Expansive Potential**
B-5 @ 0 to 5 feet	0	Very Low (Non-expansive)

Soluble Sulfates

Representative samples of the near-surface soils were 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 presented below, and are discussed further in a subsequent section of this report.

Sample Identification	**Soluble Sulfates (%)**	**ACI Classification**
B-1 @ 0 to 5 feet	< 0.001	Negligible
B-7 @ 0 to 5 feet	< 0.001	Negligible
B-11 @ 0 to 5 feet	< 0.001	Negligible
B-14 @ 0 to 5 feet	< 0.001	Negligible
B-17 @ 0 to 5 feet	< 0.001	Negligible

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.

Based on the preliminary nature of this investigation, further geotechnical investigation(s) will be required prior to construction of the proposed development. 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 completion 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 structure 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. Furthermore, SCG did not identify any evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low.

The potential for other geologic hazards such as seismically induced settlement, lateral spreading, tsunamis, inundation, seiches, flooding, and subsidence affecting the site is considered low.

Seismic Design Parameters

The 2013 California Building Code (CBC) was adopted by all municipalities within Southern California on January 1, 2014. 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 2013 CBC Seismic Design Parameters have been generated using U.S. Seismic Design Maps, a web-based 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 2013 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:

2013 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
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 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 plasticity 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). Non-sensitive clayey (cohesive) soils which possess a plasticity index of at least 18 (Bray and Sancio, 2006) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The California Geological Survey (CGS) has not yet conducted detailed seismic hazards mapping for the area of the subject site. The general liquefaction susceptibility of the site was determined by research of the San Bernardino County Official Land Use Plan, General Plan, Geologic Hazard Overlay. Map FH28 for the Guasti 7.5 Minute Quadrangle indicates that the subject site is not located within an area of liquefaction susceptibility. Based on the mapping performed by the County of San Bernardino and the subsurface conditions encountered at the boring locations, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

The near surface native soils in the upper 5 to 10± feet vary in density and composition. These soils consist of loose to medium dense silty fine to medium sands, fine sands and fine to coarse sands. The near surface soils possess varying fine to coarse gravel content and occasional cobbles throughout. Results of laboratory testing indicate that some of the near surface soils may be collapsible and subject to minor consolidation under the anticipated foundation loads. Based on their variable strengths and densities, in their present condition, these soils are not expected to be suitable to support the foundation loads of new structures, and could result in excessive post-construction settlements. The underlying soils generally consist of higher strength, medium dense to very dense, silty sands, well graded sands, and gravelly sands and sandy gravels with cobbles.

Based on these conditions, remedial grading is considered warranted within new building pad areas in order to remove a portion of the near surface, potentially compressible and collapsible soils.

The proposed development is considered to be feasible with respect to the geotechnical conditions encountered at the boring locations at the site. However, remedial grading will be necessary in order to support the proposed structures on conventional shallow foundation systems. Since plans for site development and grading plans are not available at this time, detailed grading recommendations cannot be provided at this time. However, preliminary grading and foundation design recommendations have been provided herein, based on the assumed construction, assumed site grading, and assumed foundation loads. Based on these preliminary assumptions, remedial grading should be performed within the proposed building areas, to remove the upper portion of the alluvial soils, and replace them as compacted fill for support of the floor slabs and foundations.

Settlement

The recommended remedial grading will remove the upper portion of the potentially compressible/collapsible alluvium from new building pad areas. The native soils that will remain in place below the recommended depth of overexcavation are generally dense to very dense and will not be subject to significant load increases from the foundations of the new structure. Therefore, following completion of the recommended remedial grading, post-construction settlements are expected to be within tolerable limits.

Soluble Sulfates

The results of the soluble sulfate testing indicate that the selected samples of the on-site soils contain negligible concentrations of soluble sulfates with respect to the American Concrete Institute (ACI) Publication 318-05 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at pad grade within the building areas.

Expansion

Laboratory testing performed on a representative sample of the near surface soils indicates that these materials possess very low expansion potential (EI = 0). Based on these test results, no design considerations related to expansive soils are considered warranted for this site. It is recommended that additional expansion index testing be conducted during subsequent geotechnical investigation and at the completion of rough grading to verify the expansion potential of the as-graded building pad.

Shrinkage/Subsidence

Removal and recompaction of the near surface fill soils and alluvium is estimated to result in an average shrinkage of 10 to 15 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 0.10 to 0.15± feet.

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.

Additional Geotechnical Investigation

As discussed above, the focus of the current phase of investigation was to determine the geotechnical feasibility of the proposed development at the subject site. Prior to preparing detailed grading or foundation plans, a detailed geotechnical investigation should be performed. The purpose of this supplementary investigation will be to obtain more detailed data regarding the subsurface conditions at the subject site. The scope of this future investigation should be sufficient to provide detailed grading recommendations as well as foundation, floor slab, and pavement design recommendations.

6.3 Preliminary Site Grading Recommendations

The preliminary grading recommendations presented below are based on the subsurface conditions encountered at the boring and trench locations and our understanding of the proposed development. More detailed grading recommendations may be provided following additional geotechnical exploration. 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

Initial site preparation should include stripping of any topsoil, vegetation and organic debris on the site. Based on conditions observed at the time of the subsurface exploration, this will include native grass and weed growth and localized areas of shrubs and trees. These materials should be disposed of off-site. The actual extent of stripping should be determined in the field by a representative of the geotechnical engineer, based on the organic content and the stability of the encountered materials.

A portion of Inland Empire Boulevard will be relocated to a position north of its existing alignment. It is therefore expected that the existing portion of Inland Empire Boulevard in the eastern half of parcel PA-2 will be demolished. Additionally, if the existing elementary school located in the northeast area of parcel PA-1 will not remain with the proposed development, then the campus should be demolished. Any existing improvements that will not remain in place for use with the new development should be demolished and removed in their entirety. This should include all foundations, floor slabs, utilities, and any other subsurface improvements associated with the existing structure and modular buildings. 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 CMB, if desired.

Treatment of Existing Soils: Building Pads

The following recommendations regarding preparation for the building pads are based on the preliminary master site plan and assumptions regarding the proposed grading and foundation loads. These recommendations are subject to revision following additional geotechnical investigation and review of grading and foundation plans, when they become available.

Remedial grading should be performed within the building pad areas to remove all of the undocumented fill soils and a portion of the near surface alluvial soils. To provide uniform support characteristics for the proposed structures, it is also recommended that the existing soils within the proposed building areas be overexcavated to a depth of at least 5 feet below the proposed building pad subgrade elevation, and to a depth of at least 5 feet below existing grade. Within the influence zones of any new foundations, the overexcavation should extend to a depth of 3 feet below proposed foundation bearing grade. The overexcavation must also extend to a depth sufficient to remove any undocumented fill soils which may be present in the previously developed areas, and any soils disturbed during demolition.

The overexcavation areas should extend at least 5 feet beyond the building perimeters and foundations, and to an extent equal to the depth of fill below the new foundations. If the proposed structures incorporate 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 areas 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 structures. 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 additional fill materials or 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, moisture treated to 2 to 4 percent above optimum, and recompacted. 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 2 feet below foundation bearing grade and replaced as compacted structural fill as discussed above for the proposed building pad. Within the retaining wall areas, the depth of overexcavation should also be sufficient to remove any undocumented fill soils.

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 Areas and New Streets

Subgrade preparation in any new parking 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. The subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 2 to 4 percent above optimum moisture content, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength alluvium throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

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 CBC and the grading code of the City of Ontario.
- 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.

Selective Grading and Oversized Material Placement

Some of the native alluvial soils within the upper 5 to 10± feet possess occasional cobble content. It is expected that large scrapers (Caterpillar 657 or equivalent) will be adequate to move the cobble containing soils. If any oversized materials are encountered during grading, they should be placed in accordance with the Grading Guide Specifications, in Appendix D of this report.

Since the proposed grading will require excavation of cobble containing soils, it may be desirable to selectively grade the proposed building pad area. The presence of particles greater than 3 inches in diameter within the upper 1 to 3 feet of the building pad subgrade will impact the utility and foundation excavations. Depending on the depths of fills required within the proposed parking areas, it may be feasible to sort the on-site soils, placing the materials greater than 3 inches in diameter within the lower depths of the fills, and limiting the upper 1 to 3 feet of soils to materials less than 3 inches in size. Oversized materials could also be placed within the lower depths of the recommended overexcavations. In order to achieve this grading, it would likely be necessary to use rock buckets and/or rock sieves to separate the oversized materials from the remaining soil. Although such selective grading will facilitate further construction activities, it is not considered mandatory and a suitable subgrade could be achieved without such extensive sorting. However, in any case it is recommended that all materials greater than 6 inches in size be excluded from the upper 1 foot of the surface of any compacted fills. **The placement of any oversized materials should be performed in accordance with the grading guide specifications included in Appendix D of this report**. If disposal of oversized materials is required, rock blankets or windrows should be used and such areas should be observed during construction and placement by a representative of the geotechnical engineer.

Imported Structural Fill

All imported structural fill should consist of very low to non-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 should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the City of Ontario. 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 silty sands and sands with varying silt and gravel content. These materials will be subject to caving within shallow excavations. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, temporary excavation slopes should be made no steeper than 2h:1v. 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.

Groundwater

Based on the conditions encountered in the borings and trenches, groundwater is not present within 31± feet of the ground surface. Based on the current depth to groundwater, it is not expected that the groundwater will affect excavations for the foundations or utilities.

6.5 Preliminary Foundation Design Parameters

Depending upon the proposed site grading and types of new structures, shallow foundations are considered to be the most feasible means of supporting new structures at the site. This assumes that the foundations for the new structures will be underlain by newly placed engineered fill soils. As discussed in Section 6.3 of this report, moderate amounts of remedial grading are expected to be necessary prior to utilizing a shallow foundation system to support any new structures. Presented below are preliminary design parameters for a typical shallow foundation system that may be suitable for the subject site.

Building Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2000 lbs/ft^2 to 3,000 lbs/ft^2.
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Two (2) to Four (4) No. 5 rebars.
- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 24 inches below adjacent 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. Within the new building areas, 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 or competent native alluvial soils, 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, under static conditions. Differential movements are expected to occur over a 30-foot span, thereby resulting in an angular distortion of less than 0.003 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 suitable compacted structural fill. The maximum allowable passive pressure is 2500 lbs/ft^2.

6.6 Preliminary Recommendations for 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 floors of the proposed structures may be constructed as conventional slabs-on-grade supported on newly placed structural fill. Based on geotechnical considerations, the floor slabs may be designed as follows:

- Minimum slab thickness: 5 to 6 inches.
- Minimum slab reinforcement: Not required for geotechnical considerations assuming a very low expansion index pad. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.
- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the area of the proposed slabs. 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 slab should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.7 Preliminary Retaining Wall Design and Construction

Although not indicated on the site plan, the proposed development may require some small retaining walls to facilitate the new site grades and in loading docks. Retaining walls are also expected to be necessary within the truck dock areas of proposed buildings.

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 assuming the use of on-site sands and silty sands for retaining wall backfill.

If desired, SCG could provide design parameters for an alternative select backfill material behind the retaining walls. The use of select backfill material could result in lower lateral earth pressures. 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° from horizontal. If select backfill material behind the retaining wall is desired, SCG should be contacted for supplementary recommendations.

RETAINING WALL DESIGN PARAMETERS

Design Parameter	**Soil Type**
	On-Site Sands and Silty Sands
Internal Friction Angle (ϕ)	30°
Unit Weight	125 lbs/ft^3
Equivalent Fluid Pressure:	42 lbs/ft^3
	67 lbs/ft^3
	63 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 foundation subgrade soils for the new retaining should be prepared in accordance with the grading recommendations presented in Section 6.3 of this report. The foundations should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Seismic Lateral Earth Pressures

In accordance with the 2013 CBC, any retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. If walls 6 feet or more are required for this site, the geotechnical engineer should be contacted for supplementary seismic lateral earth pressure recommendations.

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 be used. If the drainage composite 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 drainage composite 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 one cubic foot gravel pocket surrounded by a suitable geotextile 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.

6.8 Preliminary 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 supported on the existing fill and/or native soils that have been scarified, moisture conditioned, and recompacted. These materials generally consist of sands and silty fine sands. Following the completion of grading, these on-site sands and silty sands are expected to exhibit good to excellent pavement support characteristics with R-values ranging from 50 to 60. Since R-value testing was not included in the scope of services for this feasibility study, the subsequent pavement designs are based upon an assumed R-value of 50. 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 may be desirable to perform R-value testing after the completion of rough grading to verify the R-value of the as-graded parking subgrade.

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. Based on a conversation with the project civil engineer, a traffic index has not yet been assigned for the new portion of Inland Empire Boulevard. 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
8.0	35
9.0	93
10.0	225
11.0	503

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 = 50)							
Materials	**Thickness (inches)**						
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic					
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0	TI = 10.0	TI = 11.0
Asphalt Concrete	3	3½	4	5	5½	6½	7
Aggregate Base	3	4	5	5	7	8	9
Compacted Subgrade	12	12	12	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 Portland cement 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)**					
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic				
		TI = 7.0	TI = 8.0	TI = 9.0	TI = 10.0	TI = 11.0
PCC	5	6½	8	9	10	11
Compacted Subgrade (95% minimum compaction)	12	12	12	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. Reinforcing within all pavements should be designed by the structural engineer. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness. The actual joint spacing and reinforcing of the Portland cement concrete pavements should be determined by the structural engineer.

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: SAN BERNARDINO COUNTY THOMAS GUIDE, 2013

SITE LOCATION MAP

PROPOSED MIXED USE DEVELOPMENT

ONTARIO, CALIFORNIA

SCALE: 1" = 2400'	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: BI CHKD: JAS	
SCG PROJECT 14G122-1	
PLATE 1	

GEOTECHNICAL LEGEND

APPROXIMATE BORING LOCATION

NORTH

NOTE: AERIAL IMAGE OBTAINED FROM GOOGLE EARTH.
CONCEPTUAL LAND USE EXHIBIT PROVIDED BY THE CLIENT

BORING LOCATION PLAN

PROPOSED MIXED USE DEVELOPMENT

ONTARIO, CALIFORNIA

SCALE: 1" = 500'

DRAWN: ENT
CHKD: DWN

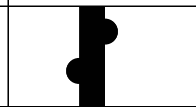
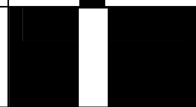
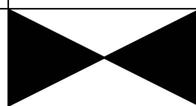
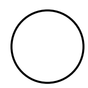
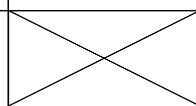
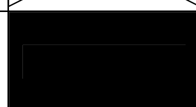
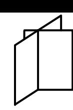
SCG PROJECT
14G122-1

PLATE 2

SOUTHERN CALIFORNIA GEOTECHNICAL

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		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE 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.: 14G122	DRILLING DATE: 3/11/14	WATER DEPTH: Dry
PROJECT: Mixed Use Development	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 6 feet
LOCATION: Ontario, 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
					ALLUVIUM: Brown fine Sand, trace medium Sand, trace Silt, loose-damp							
		7				94	3					
		9			@ 3 to 4 feet, little Silt, trace fine Gravel, trace fine to coarse Sand	106	2					
5		14				106	2					
					Light Gray Brown fine to coarse Sand, trace fine to coarse Gravel, occasional Cobbles, loose-dry to damp							
		10			Brown Silty fine Sand, trace medium Sand, slightly porous, loose-damp to moist	105	8					
10		11				101	6					
					Gray Brown fine to coarse Sand, fine to coarse Gravel, occasional Cobbles, medium dense-dry to damp							
15		23					2					
20		28					2					
					Brown fine to medium Sand, trace coarse Sand, trace fine to coarse Gravel, medium dense-dry to damp							
25		26					3					
					Light Brown fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, dense-damp							
30		78					4					
					Boring Terminated at 30'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/11/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 5 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: Brown Silty fine to medium Sand, medium dense-damp							
		17				101	5					
					ALLUVIUM: Light Brown fine to coarse Sand, trace fine Gravel, medium dense-damp to moist							
		12										No Sample Recovered
5					Light Brown fine to coarse Sand, some fine to coarse Gravel, medium dense-dry							
		17				109	1					
		15				136	1					
					Dark Brown Silty fine Sand, trace medium Sand, trace fine Gravel, loose-damp to moist							
		12				107	8					
10												
		24										No Sample Recovered
15												

Boring Terminated at 17' due to refusal on coarse Gravel/Cobbles

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/11/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 4 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
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)	COMMENTS
					ALLUVIUM: Brown to Dark Brown fine Sand, trace Silt, trace fine root fibers, loose-damp to moist							
	X	5					6					
					ALLUVIUM: Light Brown fine to coarse Sand, loose-dry to damp							
	X	7					2					
5												
	X	14					2					
	X	14			@ 8½ to 10 feet, trace to little fine Gravel		2					
10												
					Light Gray Brown fine to coarse Sand, little to some fine to coarse Gravel, medium dense-dry to damp							
	X	26					2					
15												
					Light Gray Brown Gravelly fine to coarse Sand, very dense-dry to damp							
	X	53					2					
20												
					Boring Terminated at 20'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/11/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 4 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	9			ALLUVIUM: Dark Brown fine to medium Sand, little coarse Sand, little fine to coarse Gravel, trace Silt, trace fine root fibers, loose-damp to moist	105	5					
	X	9										No Sample Recovered
5	X	19			Light Brown fine Sand, trace coarse Sand, medium dense-dry to damp	100	2					
	X	19			Brown fine to coarse Sand, trace fine to coarse Gravel, medium dense-dry to damp	106	2					
10	X	22				106	3					
					Brown fine to coarse Sandy Gravel, very dense-damp to moist							
15	X	70/11"				103	8					

Boring Terminated at 16' due to refusal on coarse Gravel/Cobbles

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/11/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

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

SURFACE ELEVATION: --- MSL

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG		DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	
	X	5			ALLUVIUM: Dark Brown Silty fine Sand, trace medium Sand, trace fine root fibers, loose-damp to moist		7					EI = 0 @ 0 to 5'
5	X	12			Gray Brown to Brown Silty fine Sand, loose-damp		4					
	X	13			Red Brown to Dark Brown Silty fine Sand, little calcareous veining, medium dense-damp to moist		5					
10	X	22					7					
15	X	30			Interbedded lenses of Brown fine Sand and Gray Brown to Brown Silty fine Sand, medium dense to dense-damp to moist		7					
20	X	49			Light Brown fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, dense to very dense-damp		3					
25	X	78/11"					3					
30	X	17			Dark Brown fine Sandy Silt, little Clay, medium dense-moist		16					
					Boring Terminated at 30'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/11/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 5 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
					ALLUVIUM: Dark Brown fine to medium Sand, little Silt, medium dense-damp							
		10				100	7					
					Light Brown to Gray Brown Gravelly fine to coarse Sand, loose-dry							
		12										No Sample Recovered
					Light Brown fine Sand, trace medium Sand, little Silt, trace fine Gravel, medium dense-dry to damp							
5		19				105	2					
					Light Gray Brown fine to coarse Gravel, occasional Cobbles, trace Silt, medium dense-dry to damp							
		21					1					Disturbed Sample
		41					2					Disturbed Sample
10												
					Gray Brown fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, medium dense to very dense-dry to damp							
		17					2					
15												
		50/2"										No Sample Recovered

Boring Terminated at 18' due to refusal on coarse Gravel and/or Cobbles

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-7

JOB NO.: 14G122	DRILLING DATE: 3/11/14	WATER DEPTH: Dry
PROJECT: Mixed Use Development	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 12 feet
LOCATION: Ontario, 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
		6			ALLUVIUM: Brown to Dark Brown Silty fine Sand, trace coarse Sand, trace fine Gravel, loose-damp	100	4					
		14				102	5					
5		12			Light Brown fine Sand, trace to little Silt, trace medium Sand, loose-damp	110	4					
		23			Brown to Dark Brown Silty fine to medium Sand, trace fine to coarse Gravel, medium dense-damp	111	6					
10		14			Gray fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, medium dense-dry to damp							No Sample Recovered
15		28					2					
20		19					6					
25		16			Red Brown to Brown Silty fine Sand, trace fine Gravel, medium dense-damp to moist		8					
		12			Light Brown to Brown fine Sand, little Silt, medium dense-damp to moist		6					
30		15				116	11					
					Boring Terminated at 31'							

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-8

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/11/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 5 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
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)	COMMENTS
	X	3			ALLUVIUM: Dark Brown fine Sand, some fine root fibers, little Silt, very loose-damp to moist		8					
	X	9			Gray Brown fine to medium Sand, trace coarse Sand, loose-damp		4					
5												
	X	10			Brown fine to medium Sand, trace Silt, loose to medium dense-damp		3					
	X	14			@ 8½ feet, trace coarse Sand, trace fine to coarse Gravel		4					
10												
	X	30			Light Brown fine to coarse Sand, little to some fine to coarse Gravel, occasional Cobbles, medium dense to dense-dry to damp		2					
15												
					Boring Terminated at 15'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-9

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California
DRILLING DATE: 3/11/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen
WATER DEPTH: Dry
CAVE DEPTH: 9 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	6			ALLUVIUM: Dark Brown Silty fine Sand, trace medium Sand, trace fine root fibers, loose-damp to moist		9					
5	X	6			Gray Brown to Brown fine Sand, trace coarse Sand, loose-dry to damp		3					
	X	7			Brown fine Sand, little Silt, trace medium to coarse Sand, loose-dry to damp		3					
10	X	10			Light Brown fine Sand, trace coarse Sand, loose-dry to damp		3					
15	X	15			Light Gray Brown fine to medium Sand, trace caorse Sand, little fine Gravel, medium dense-dry to damp		3					
20	■	10			Red Brown to Brown Silty fine Sand to fine Sandy Silt, slightly porous, loose-moist	104	13					
25	X	24			Brown fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, medium dense-dry to damp		3					
					Boring Terminated at 25'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-10

JOB NO.: 14G122	DRILLING DATE: 3/12/14	WATER DEPTH: Dry
PROJECT: Mixed Use Development	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 11 feet
LOCATION: Ontario, California	LOGGED BY: Brett Isen	READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

FIELD RESULTS						LABORATORY RESULTS						
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
					ALLUVIUM: Dark Brown fine Sand, trace medium Sand, trace Silt, trace fine root fibers, loose-moist							
	X	10				102	9					
					Light Gray Brown fine to coarse Sand, trace fine Gravel, loose-dry to damp							
	X	10				109	2					
5	X	22			@ 5 to 6' little fine to coarse Gravel	112	1					
					Dark Brown to Brown Silty fine Sand, trace medium Sand, loose-moist							
	X	13				107	8					
					Dark Brown fine to coarse Sand, trace Silt, medium dense-dry to damp							
	X	20				129	2					
10					Brown Silty fine Sand, medium dense-dry to damp							
					Gray Brown fine to coarse Sand, little fine to coarse Gravel, extensive Cobbles, very dense-dry to damp							
	X	50/3"					2					
15												
					Red Brown to Brown Silty fine Sand, trace medium Sand, medium dense-damp							
	X	15					6					
20												
					Brown to Light Brown fine to coarse Sand, trace to little Silt, little fine to coarse Gravel, occasional Cobbles, very dense-damp to moist							
	X	54					7					
25												
					Light Brown fine to coarse Sand, some fine to coarse Gravel, occasional Cobbles, very dense-dry to damp							
	X	68					2					
30												
					Boring Terminated at 30'							

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-11

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/12/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 4 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
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)	COMMENTS
	X	6			ALLUVIUM: Dark Brown fine Sand, trace Silt, trace fine root fibers, loose-damp		6					
5	X	11			Light Brown fine Sand, trace to little Silt, trace fine Gravel, medium dense-dry to damp		2					
	X	14			Brown Silty fine Sand, trace medium Sand, medium dense-damp to moist		8					
10	X	39			Gray Brown Gravelly fine to coarse Sand, extensive Cobbles, dense-dry to damp		2					
15	X	44					2					
					Boring Terminated at 15'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-12

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/12/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 4 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
					ALLUVIUM: Brown Silty fine to coarse Sand, trace fine Gravel, loose-dry to damp							
	X	7				100	2					
					Light Gray Brown fine Sand, little Silt, loose-dry to damp							
	X	7				97	2					
5	X	7			Gray Brown fine Sand, trace Silt, trace medium Sand, loose-damp	92	3					
	X	9			Brown fine Sand, loose-dry to damp	94	2					
10	X	10			Gray Brown fine to medium Sand, trace coarse Sand, trace fine Gravel, loose-dry	105	1					
					Gray Brown fine to coarse Sandy Gravel, extensive Cobbles, medium dense to very dense-dry							
15	X	50/4"				102	1					
	X	41			@ 19 feet, Cobble fragments in sampler		0					Disturbed Sample
20	X	50/5"			@ 20 feet, Cobble/Gravel fragments in sampler		0					Disturbed Sample
					Boring Terminated at 21½' due to refusal on Cobbles							

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-13

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/12/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 5 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
					ALLUVIUM: Brown to Dark Brown fine Sand, trace medium Sand, loose-damp							
	X	5					4					
	X	7										No Sample Recovered
5					Light Brown fine to coarse Sand, trace to little fine Gravel, medium dense-dry							
	X	16					1					
					Brown to Dark Brown Silty fine Sand, trace medium Sand, loose-damp to moist							
	X	7					7					
10												
					Light Brown fine Sand, trace medium to coarse Sand, trace fine Gravel, occasional Cobbles, medium dense-damp							
	X	19					3					
15												
					Brown fine Sand, trace Clay, medium dense-moist							
	X	17					9					
20												
					Boring Terminated at 20'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-14

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/12/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 10 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
	X	6			ALLUVIUM: Brown to Dark Brown fine Sand, little Silt, loose-moist		10					
	X	9			Light Brown Silty fine Sand, trace medium Sand, trace fine Gravel, loose to medium dense-dry to damp		2					
5	X	20					3					
	X	18			Brown fine Sand, trace Silt, trace coarse Sand, medium dense-damp		4					
10												
					Brown Silty fine Sand, medium dense-damp							
	X	17					4					
15												
	X	35					6					
					Gray Brown fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, dense-damp		3					
20												
	X	50/3"			@ 23½ to 25' extensive Cobbles		3					
25												
	X	50/5"										No Sample Recovered
30												
					Boring Terminated at 30'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-15

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/12/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 3 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
					ALLUVIUM: Dark Brown fine Sand, trace Silt, trace medium Sand, medium dense-damp							
	X	35				107	4					
					Light Gray Brown Silty fine Sand, trace medium Sand, medium dense-damp							
	X	24				102	3					
5	X	34			Light Brown fine Sand, little Silt, slightly cemented, slightly porous, medium dense-damp	106	4					
	X	40				109	3					
	X	20			Light Gray Brown to Light Brown fine Sand, medium dense-dry	99	1					
10												
					Orange Brown Silt, trace fine Sand, trace Clay, slightly cemented, very stiff to medium dense-moist							
	X	35				93	15					
15												
					Boring Terminated at 15'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

TEST BORING LOG

PLATE B-15

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-16

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

DRILLING DATE: 3/12/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 4 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

FIELD RESULTS						LABORATORY RESULTS						
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
					ALLUVIUM: Light Brown fine to coarse Sand, trace Silt, trace fine Gravel, dense to very dense-dry to damp							
	X	82/11"					2					
	X	36					1					
5					Light Gray Brown fine Sandy Silt, loose-damp							
	X	5					3					
					Light Gray Brown Silty fine Sand, medium dense-dry to damp							
	X	13					2					
10												
					Brown fine Sand, medium dense-dry to damp							
	X	18					2					
15												

Boring Terminated at 15'

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

TEST BORING LOG

BORING NO. B-17

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 14G122
PROJECT: Mixed Use Development
LOCATION: Ontario, California

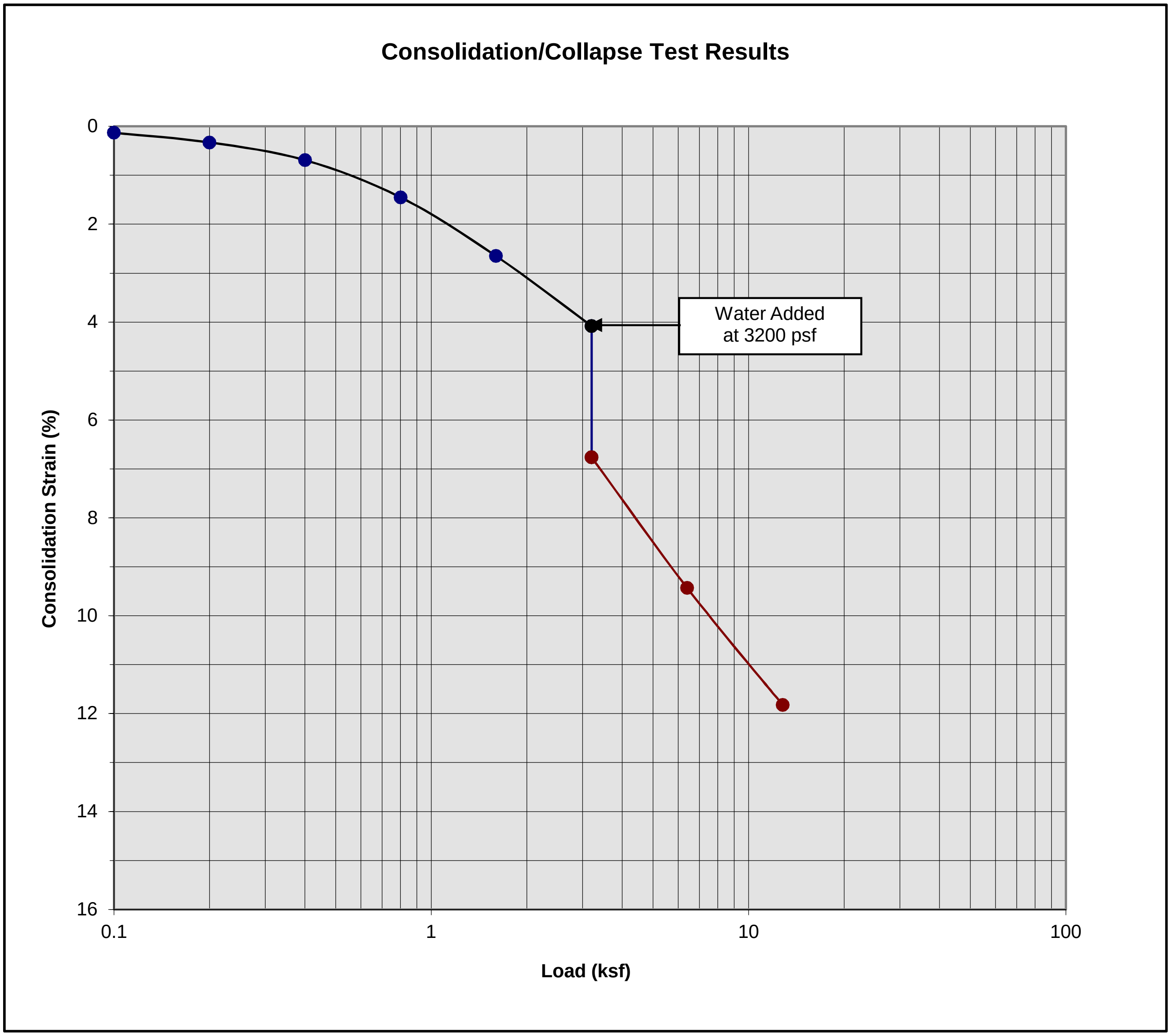
DRILLING DATE: 3/12/14
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Brett Isen

WATER DEPTH: Dry
CAVE DEPTH: 8 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
					ALLUVIUM: Brown fine Sand, trace medium Sand, trace Silt, medium dense-damp							
	X	28					4					
	X	13										No Sample Recovered
5												
					Light Gray Brown fine Sand, trace to little Silt, medium dense-dry to damp							
	X	14					1					
	X	13					2					
10												
					Brown fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, dense-dry							
	X	40					1					
15												
					Gray Brown fine to coarse Sandy Gravel, extensive Cobbles, very dense-dry to damp							
	X	82				127	2					
20												
					Dark Brown to Brown Silty fine Sand, trace medium Sand, medium dense-moist							
	X	20					10					
25												
					Boring Terminated at 25'							

TBL 14G122.GPJ SOCALGEO.GDT 4/4/14

APPENDIX C

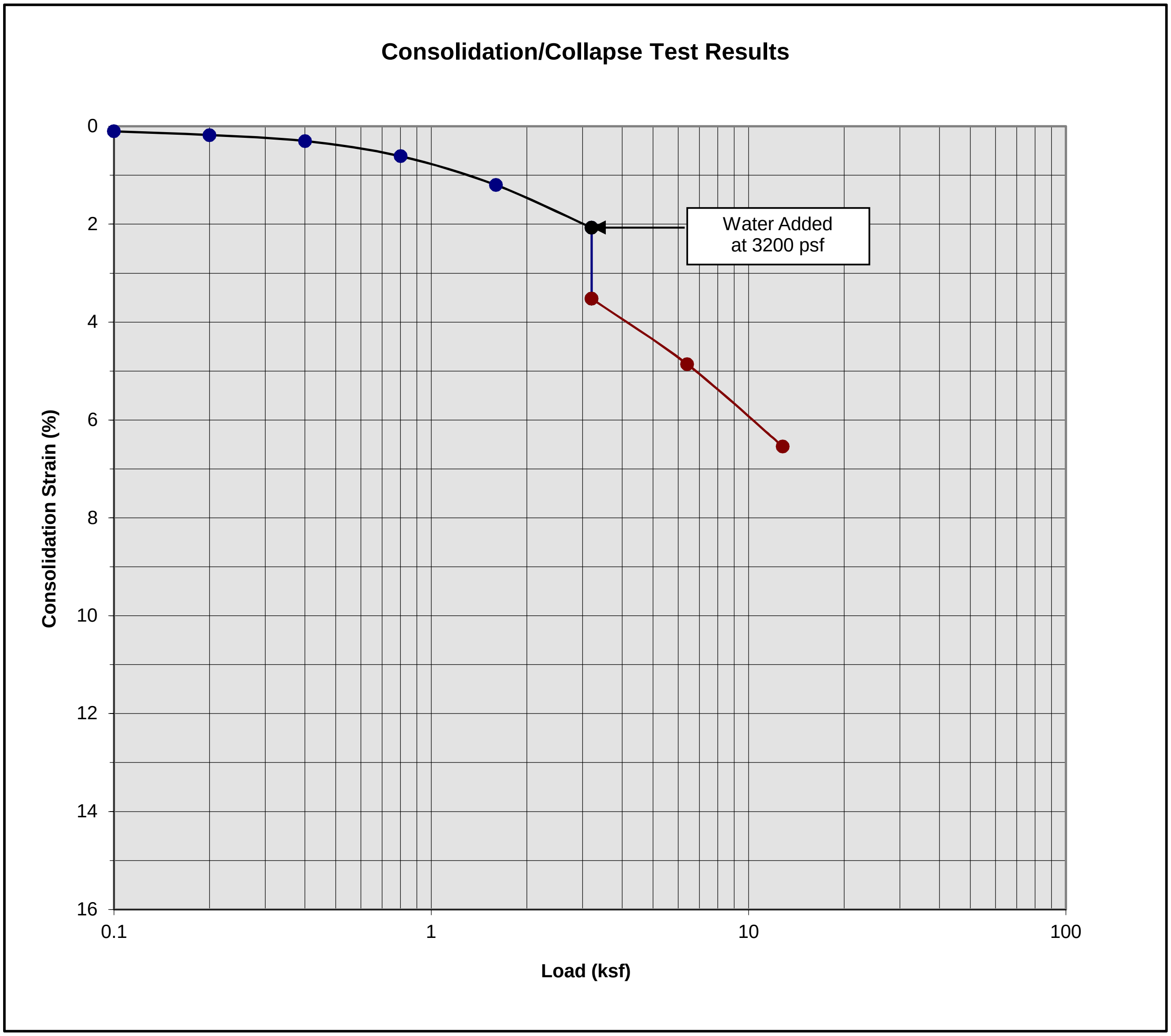


Classification: Brown fine Sand, trace medium Sand, trace Silt

Boring Number:	B-1	Initial Moisture Content (%)	3
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	1 to 2	Initial Dry Density (pcf)	94.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	107.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.68

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Classification: Brown fine Sand, trace medium Sand, trace Silt

Boring Number:	B-1	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	3 to 4	Initial Dry Density (pcf)	106.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	113.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.45

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 2

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
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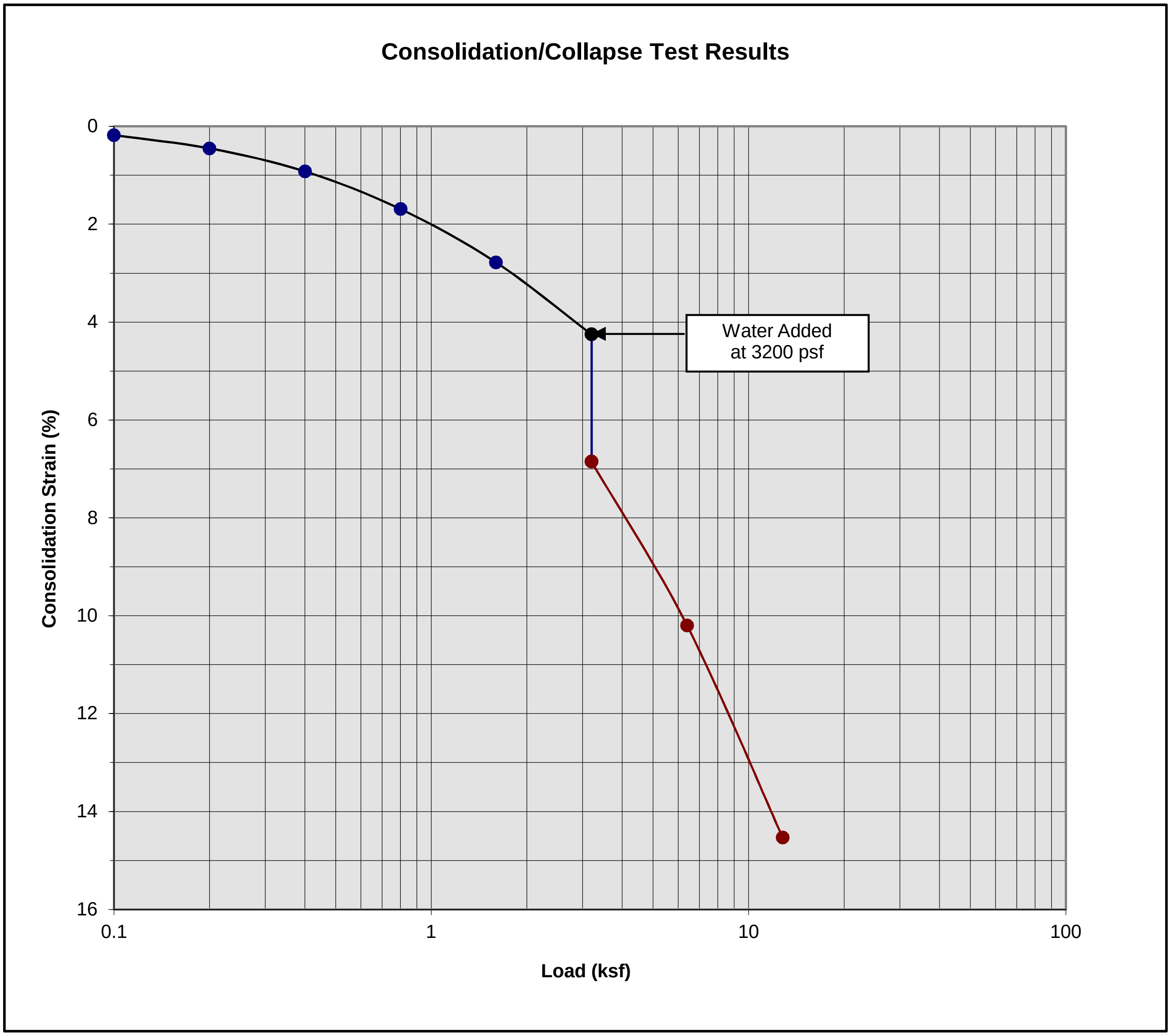


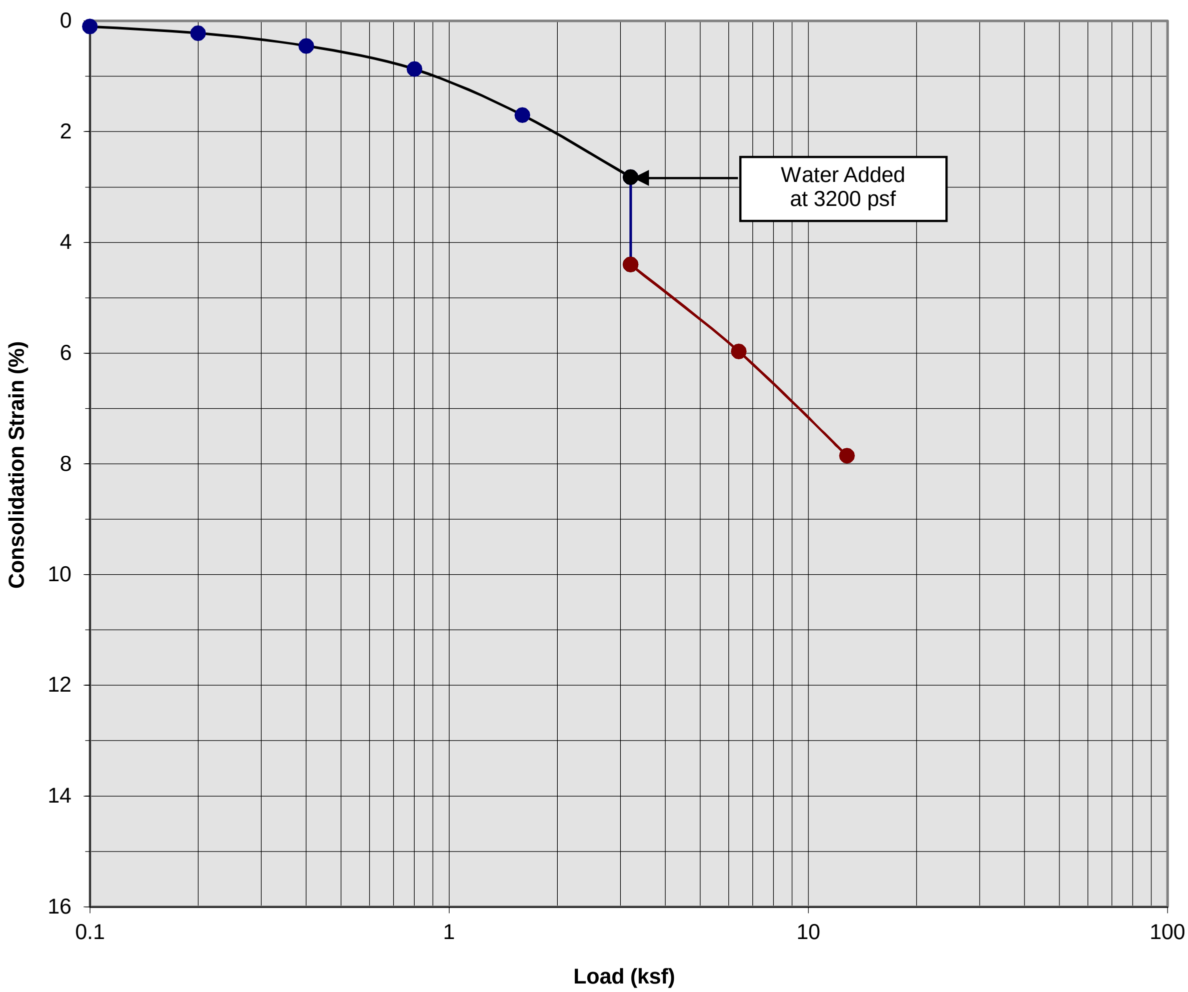
Classification: Brown Silty fine Sand, trace medium Sand

Boring Number:	B-1	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	7 to 8	Initial Dry Density (pcf)	105.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	123.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.60

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



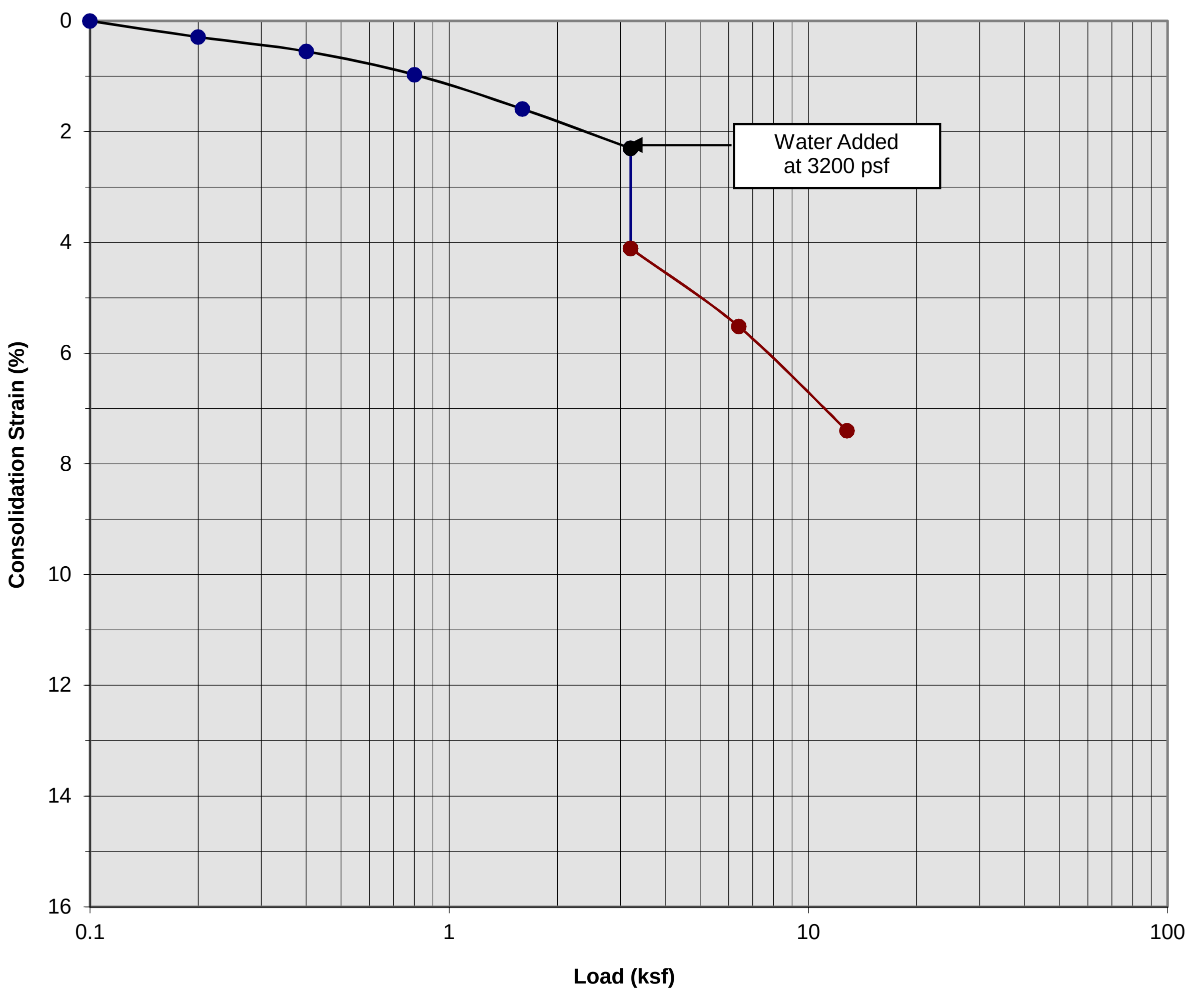
Classification: Brown Silty fine Sand, trace medium Sand

Boring Number:	B-1	Initial Moisture Content (%)	6
Sample Number:	---	Final Moisture Content (%)	18
Depth (ft)	9 to 10	Initial Dry Density (pcf)	101.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	109.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.58

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



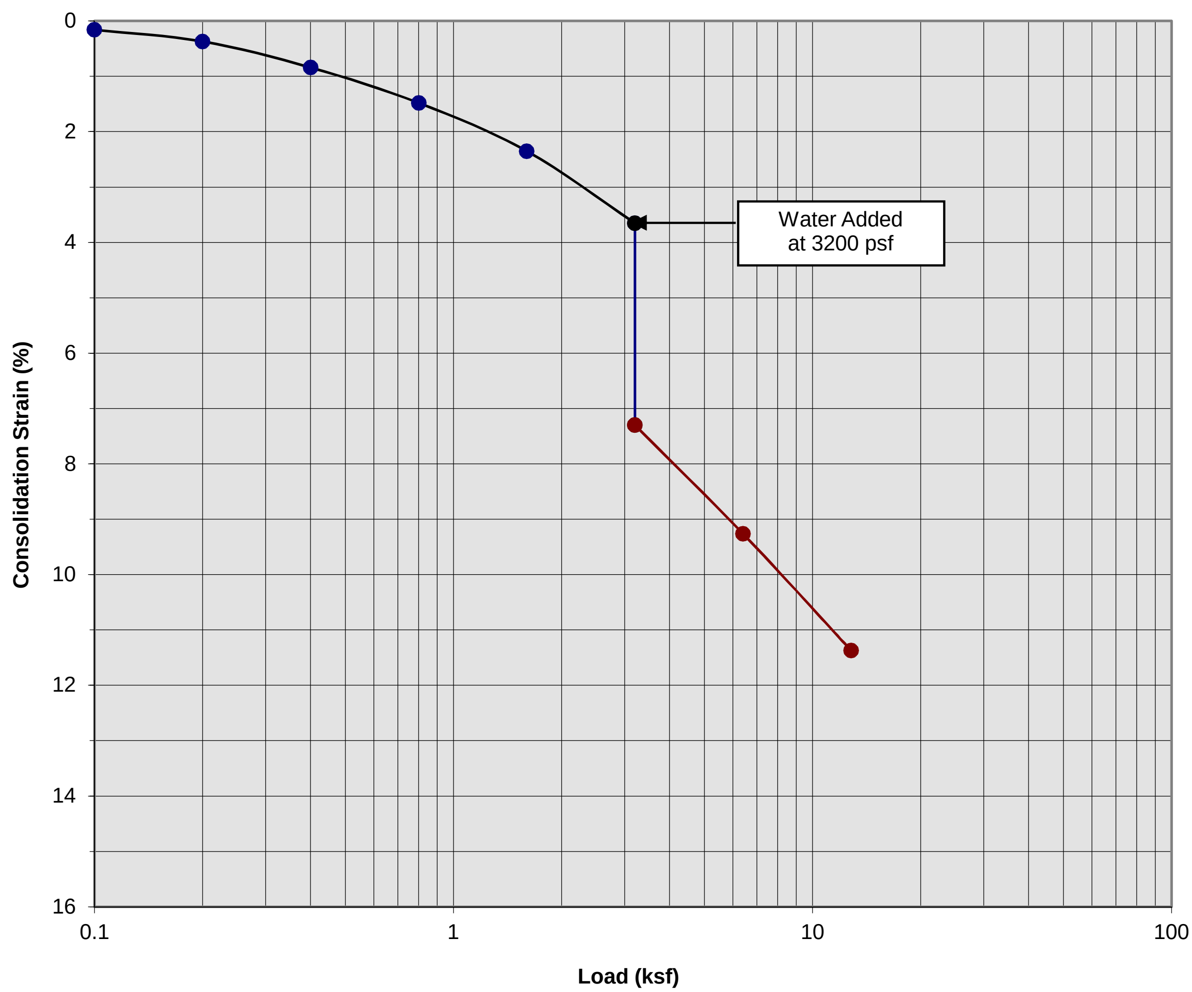
Classification: Brown to Dark Brown Silty fine Sand, trace coarse Sand

Boring Number:	B-7	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	22
Depth (ft)	1 to 2	Initial Dry Density (pcf)	99.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	104.0
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.81

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

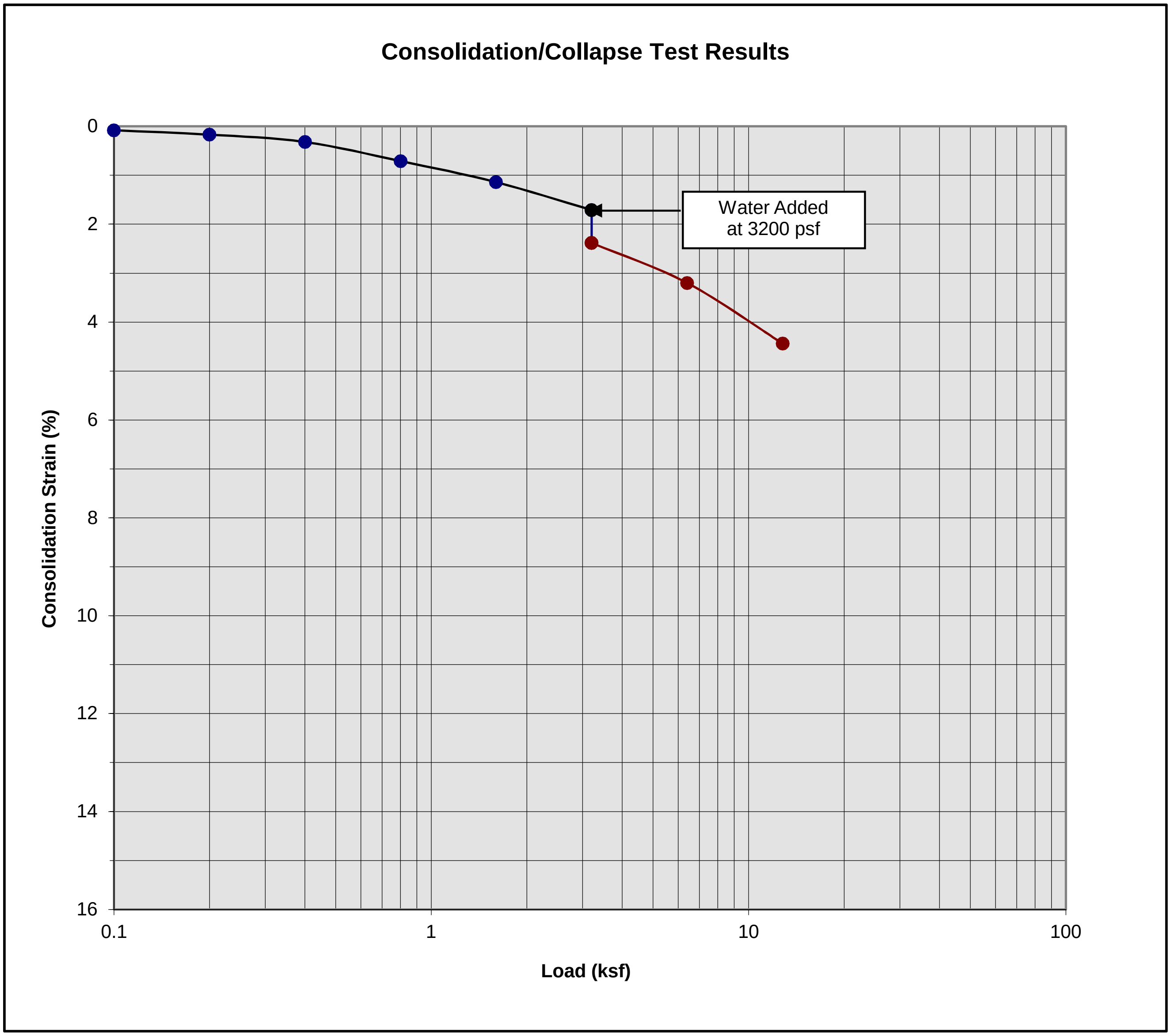


Classification: Brown to Dark Brown Silty fine Sand, trace coarse Sand

Boring Number:	B-7	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	18
Depth (ft)	3 to 4	Initial Dry Density (pcf)	101.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	113.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	3.65

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 6

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

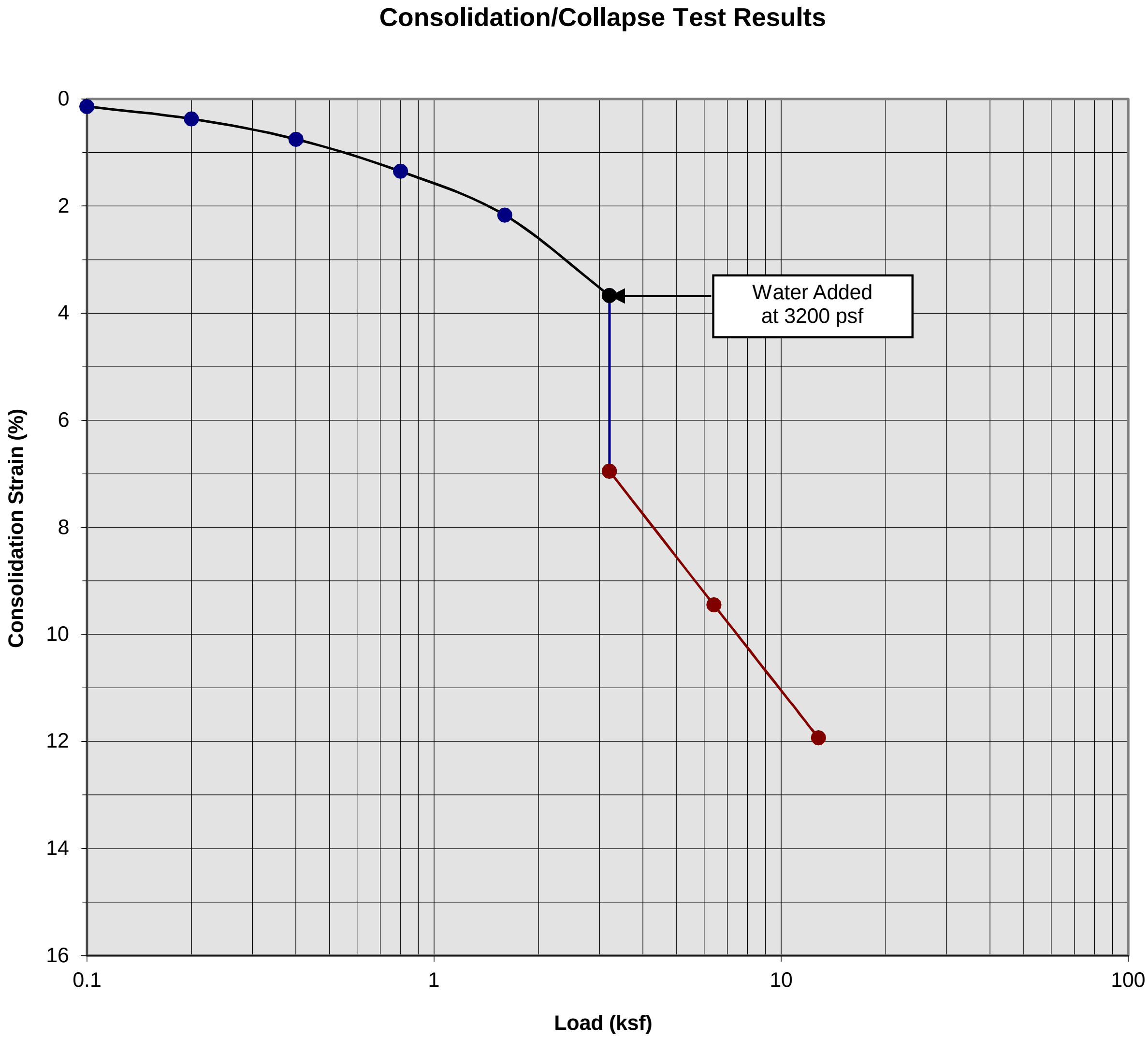


Classification: Light Brown fine Sand, trace to little Silt, trace medium Sand

Boring Number:	B-7	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	17
Depth (ft)	5 to 6	Initial Dry Density (pcf)	109.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	114.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.67

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 7

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

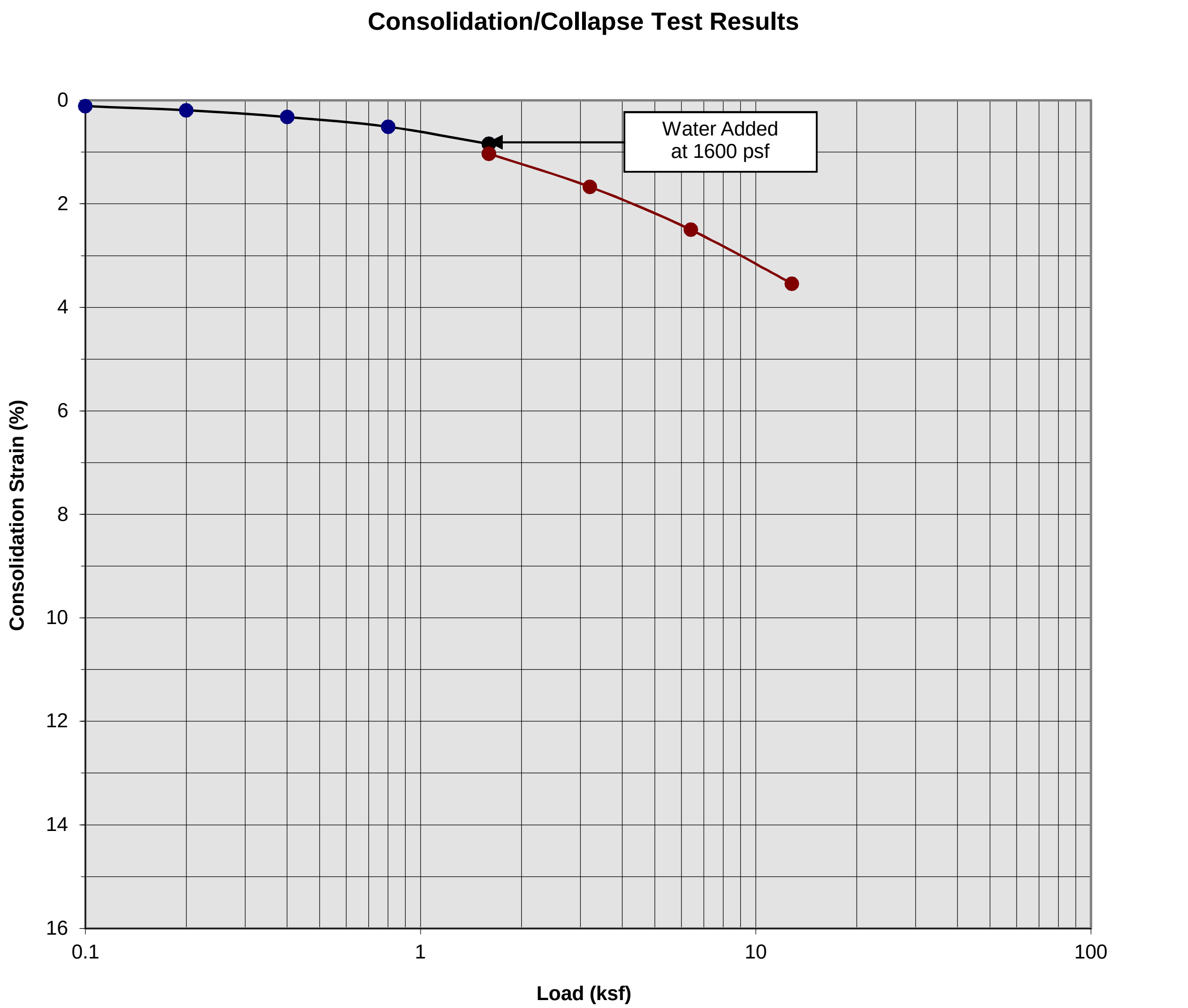


Classification: Brown to Dark Brown Silty fine to medium Sand, trace fine to coarse Gravel

Boring Number:	B-7	Initial Moisture Content (%)	6
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	7 to 8	Initial Dry Density (pcf)	110.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	3.28

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 8

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

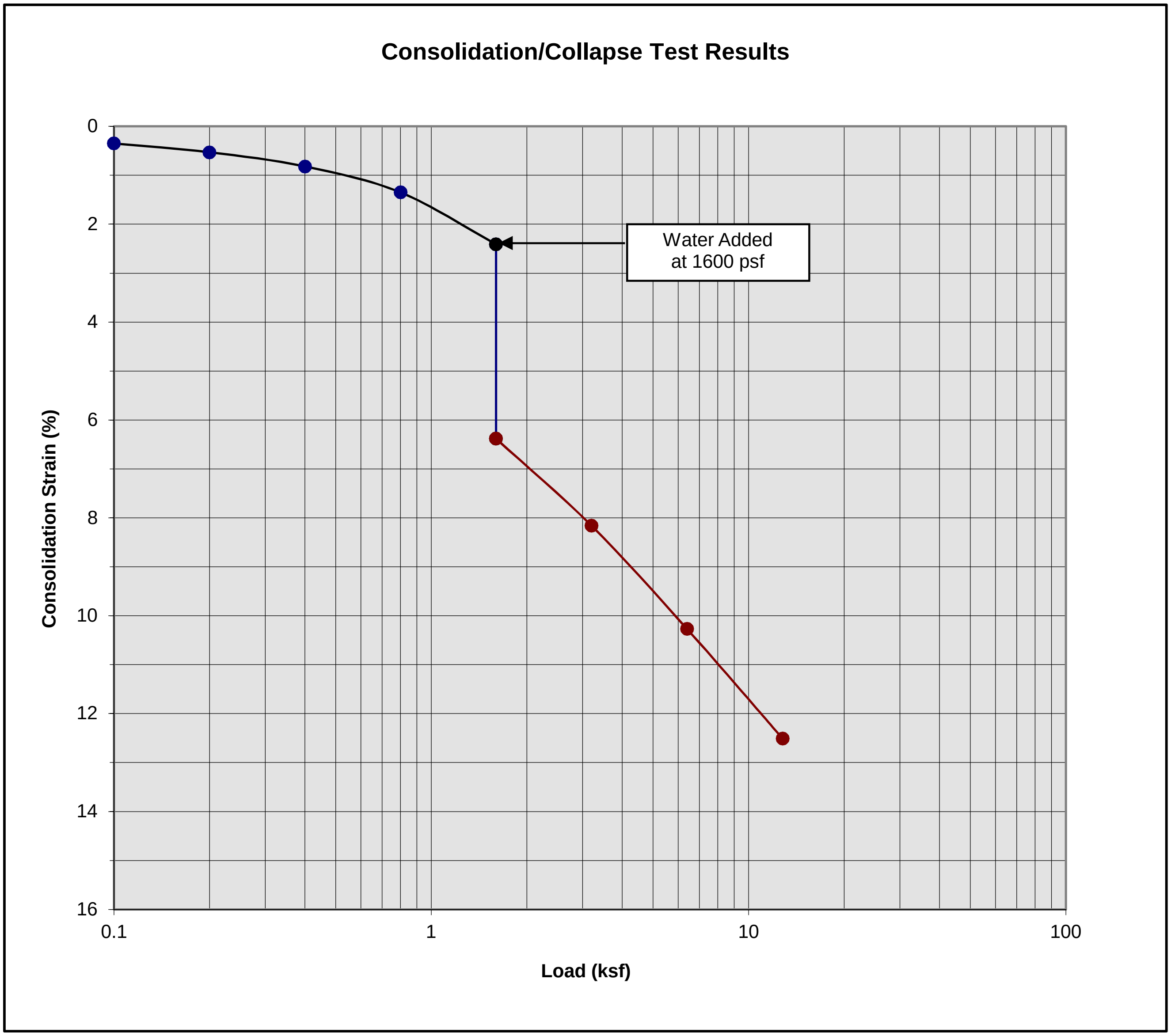


Classification: Light Gray Brown fine to coarse Sand, trace fine Gravel

Boring Number:	B-10	Initial Moisture Content (%)	7
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	1 to 2	Initial Dry Density (pcf)	101.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	105.8
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.19

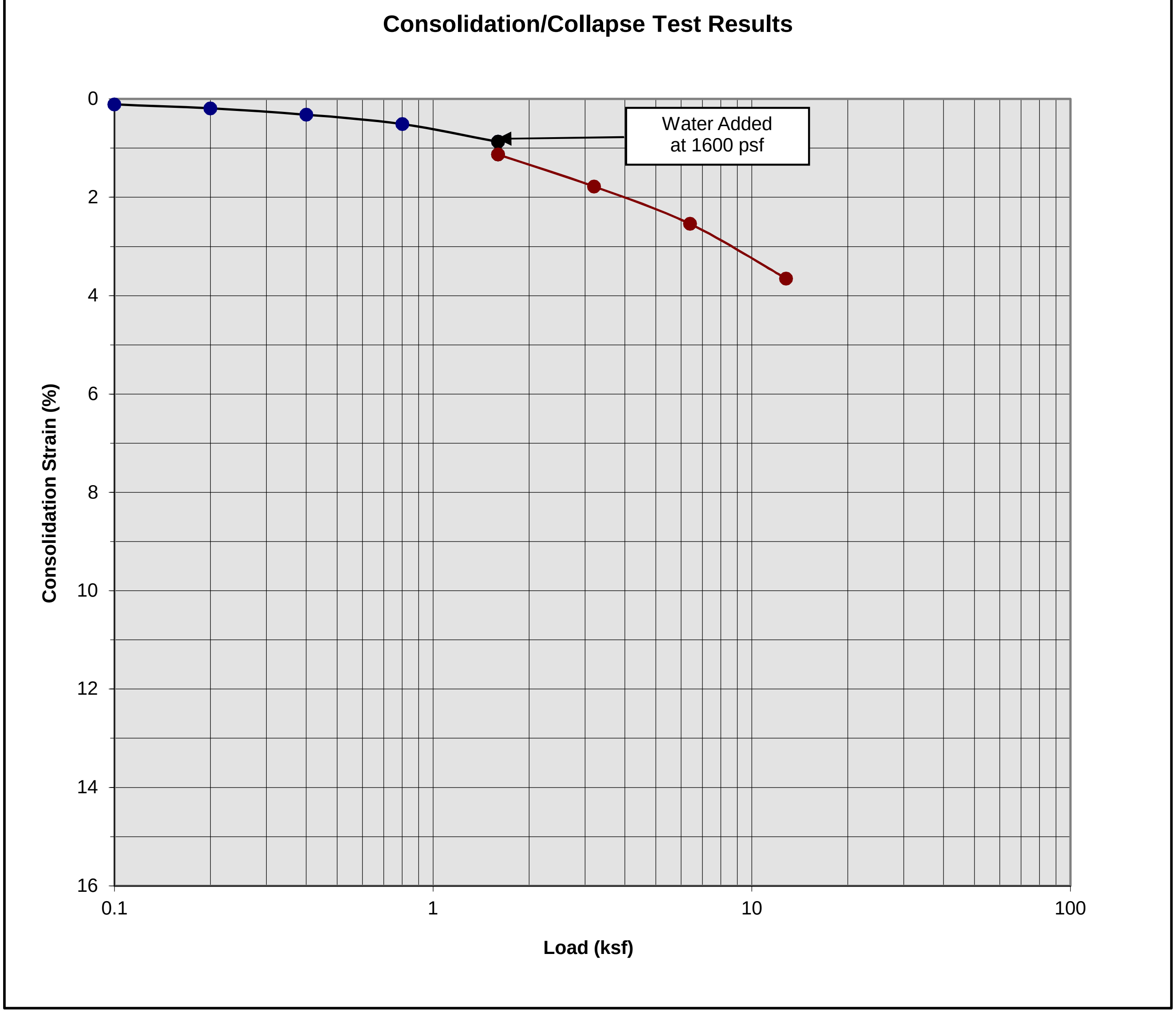
Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 9

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Classification: Light Gray Brown fine to coarse Sand, trace fine Gravel

Boring Number:	B-10	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	3 to 4	Initial Dry Density (pcf)	108.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	121.8
Specimen Thickness (in)	1.0	Percent Collapse (%)	3.97



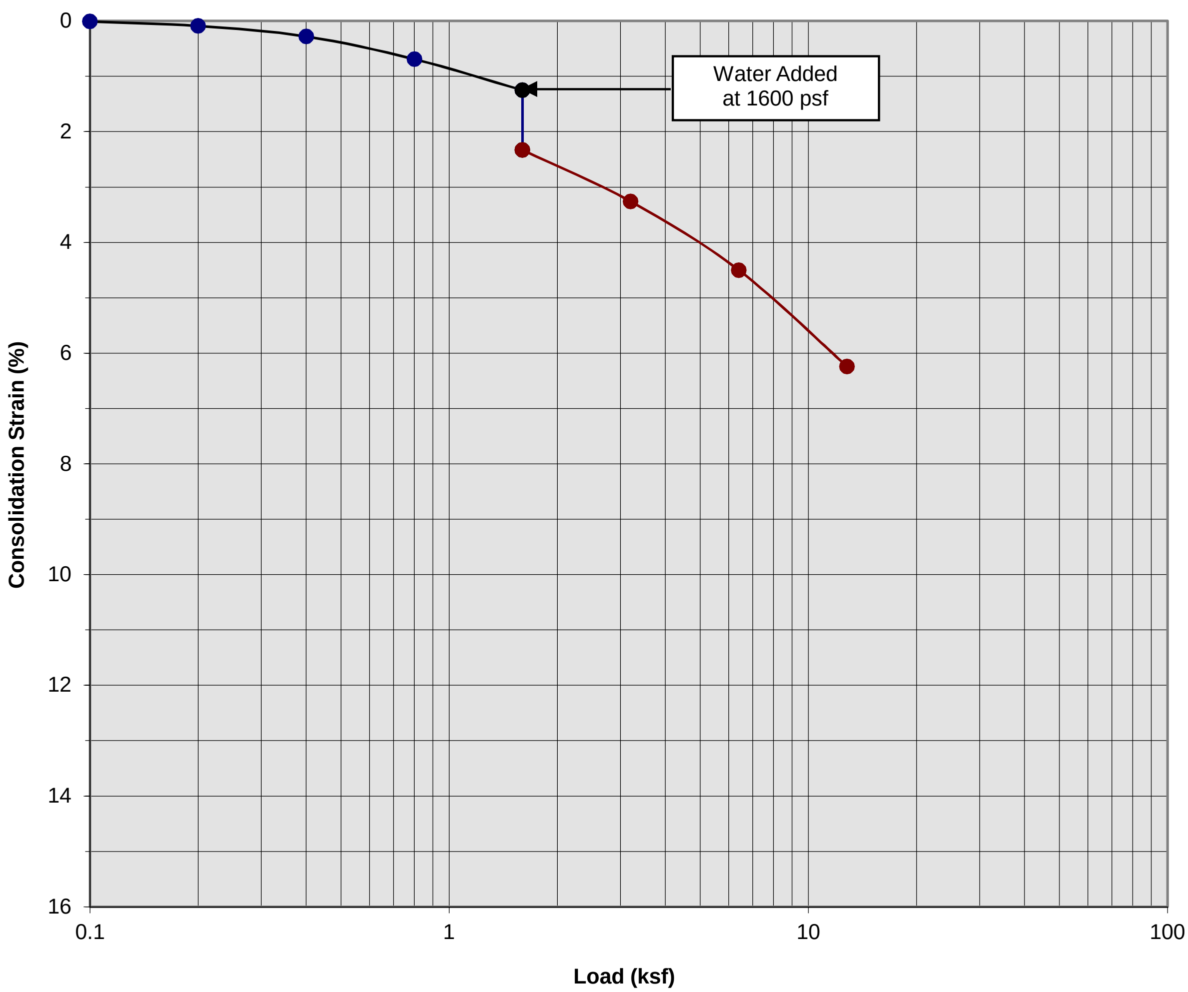
Classification: Light Gray Brown fine to coarse Sand, trace fine Gravel

Boring Number:	B-10	Initial Moisture Content (%)	1
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	5 to 6	Initial Dry Density (pcf)	112.3
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	116.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.26

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 11

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

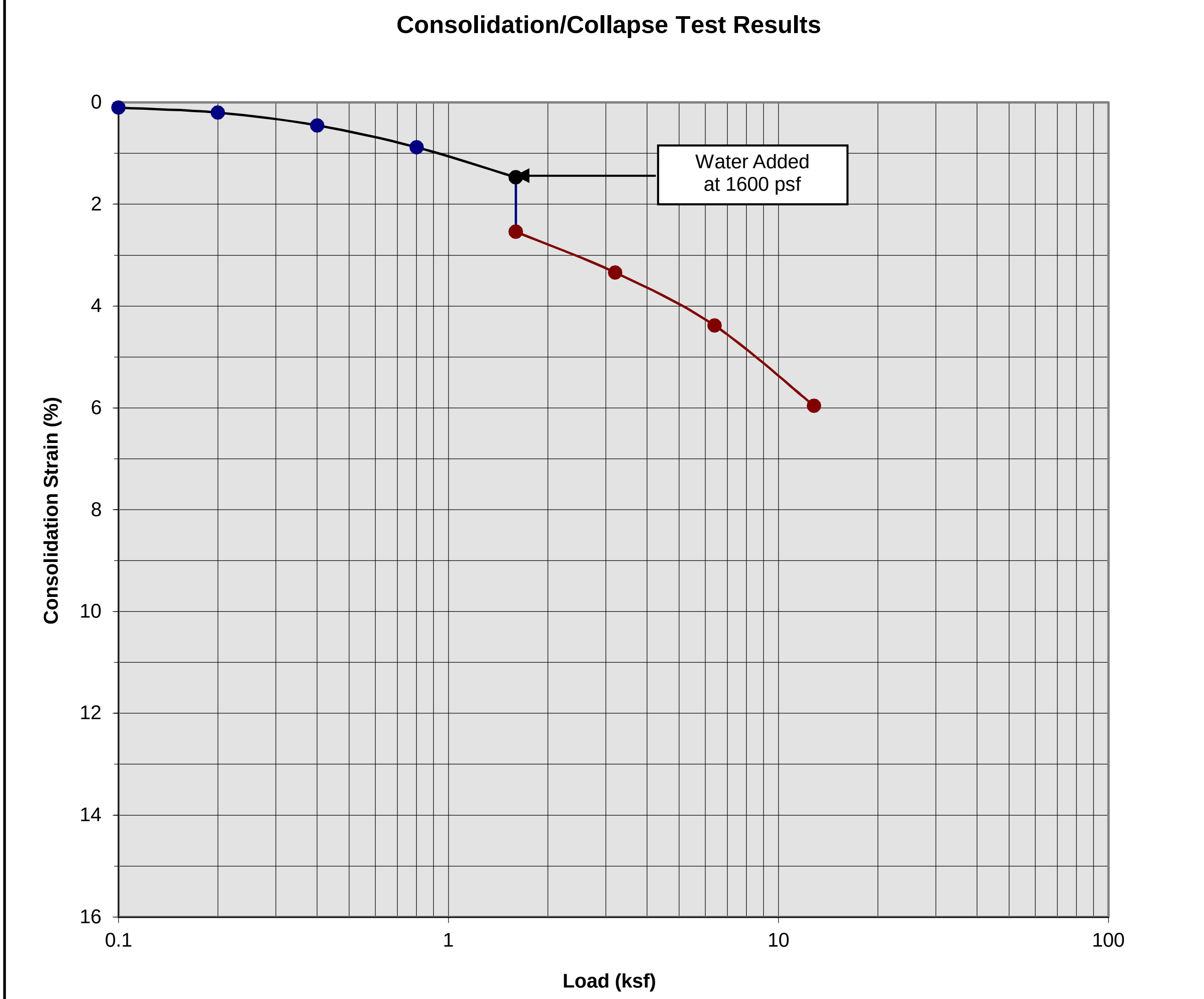


Classification: Dark Brown to Brown Silty fine Sand, trace medium Sand

Boring Number:	B-10	Initial Moisture Content (%)	8
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)	114.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.08

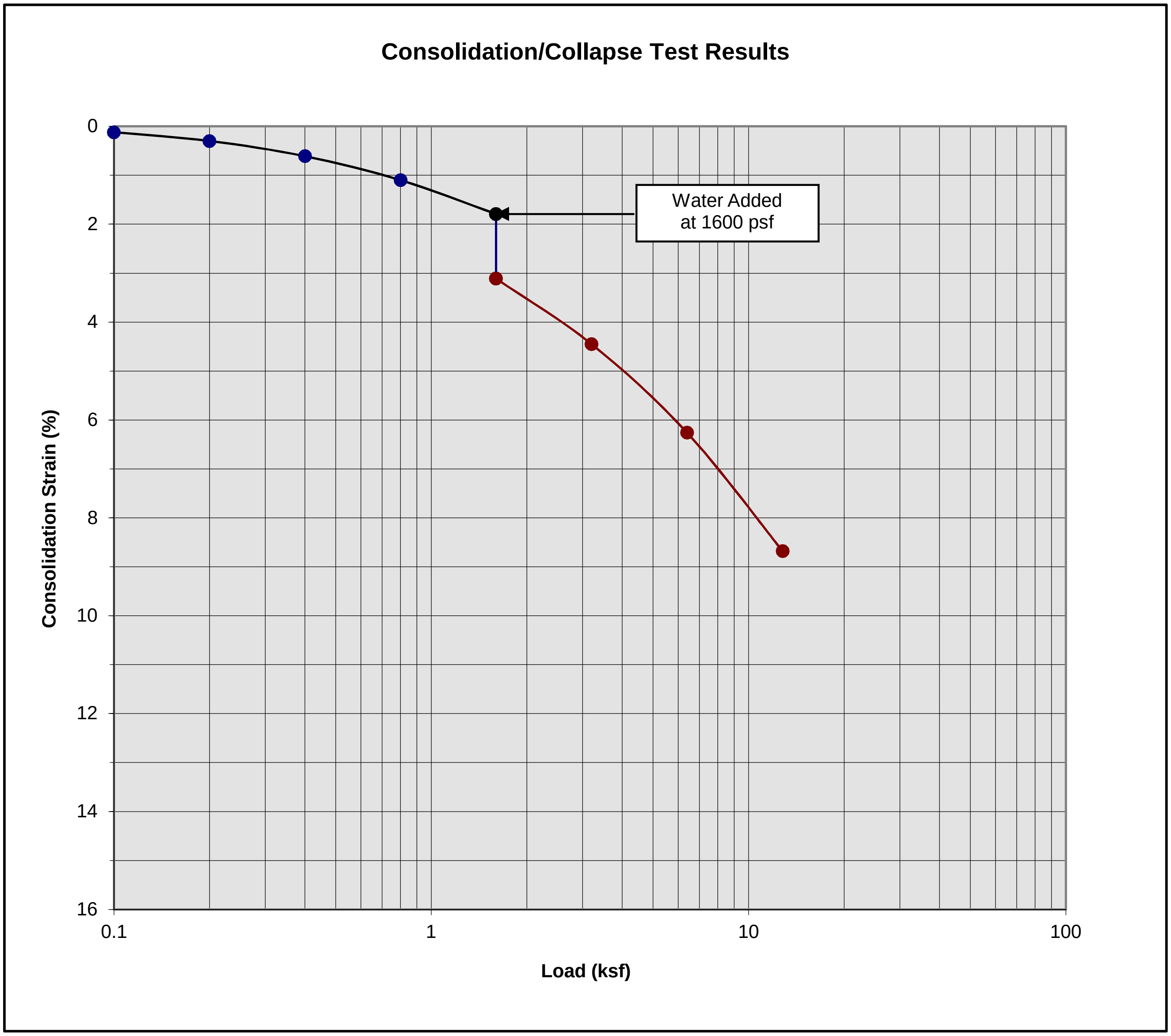
Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 12

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Classification: Brown Silty fine to coarse Sand, trace fine Gravel

Boring Number:	B-12	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	18
Depth (ft)	1 to 2	Initial Dry Density (pcf)	100.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	108.4
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.07

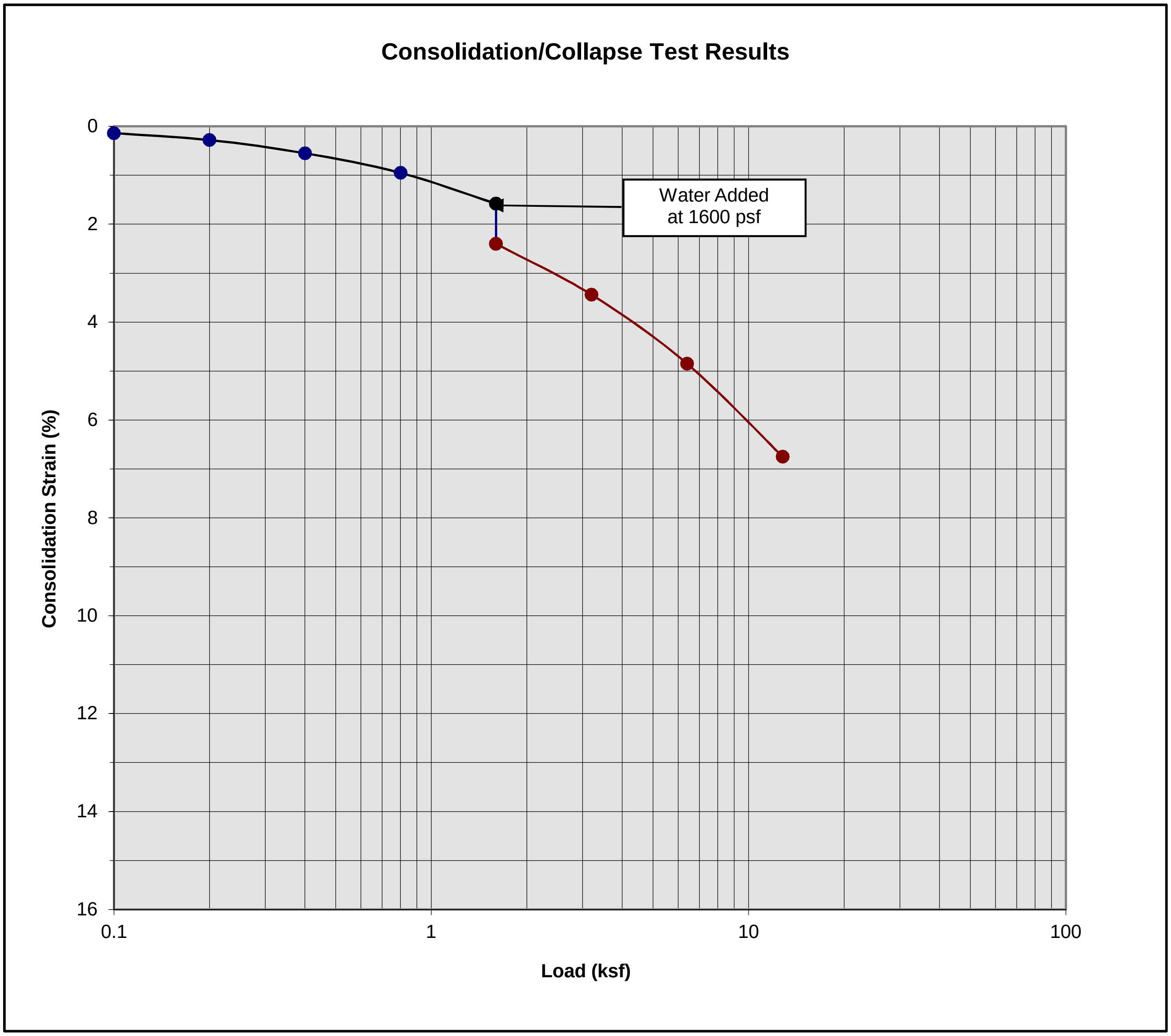


Classification: Light Gray Brown fine Sand, little Silt

Boring Number:	B-12	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	17
Depth (ft)	3 to 4	Initial Dry Density (pcf)	96.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	105.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.32

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 14

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



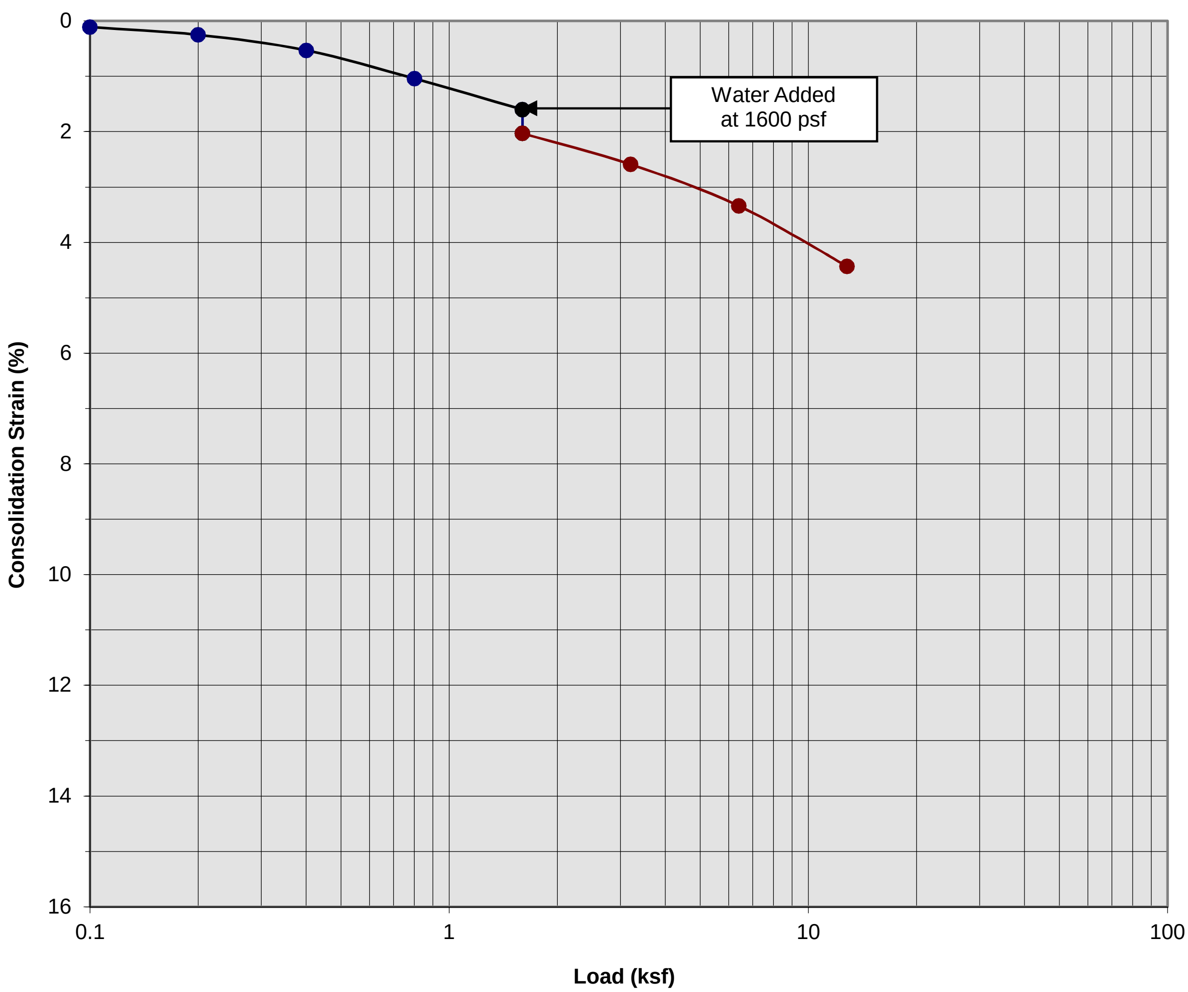
Classification: Gray Brown fine Sand, trace Silt, trace medium Sand

Boring Number:	B-12	Initial Moisture Content (%)	3
Sample Number:	---	Final Moisture Content (%)	21
Depth (ft)	5 to 6	Initial Dry Density (pcf)	92.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	98.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.82

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C- 15

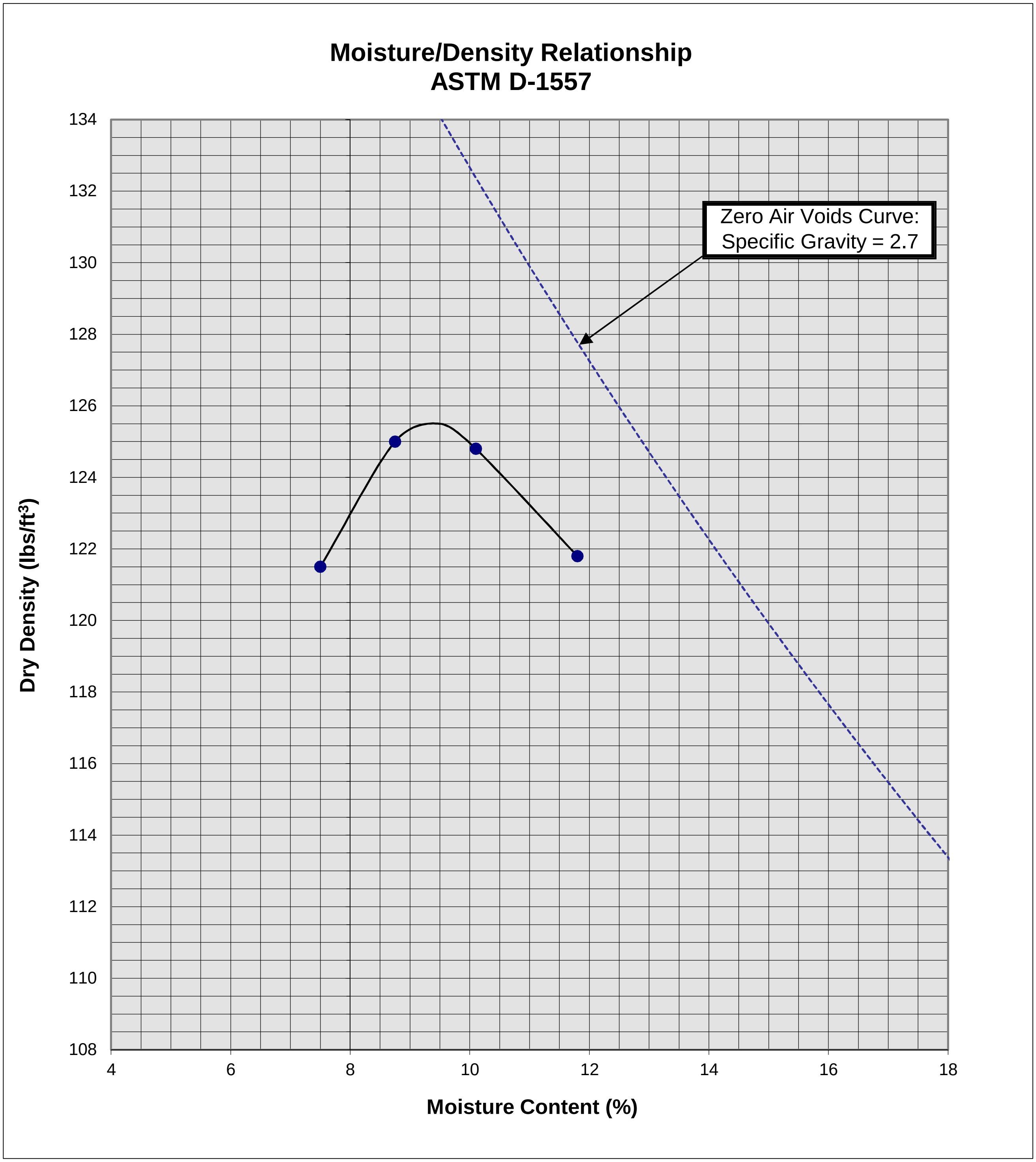
SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Brown fine Sand

Boring Number:	B-12	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	7 to 8	Initial Dry Density (pcf)	94.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	98.8
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.43



Soil ID Number	B-17 @0 to 5'
Optimum Moisture (%)	9.5
Maximum Dry Density (pcf)	125.5
Soil Classification	Brown fine to medium Sand, trace fine Gravel, trace Silt

Mixed Use Development
Ontario, California
Project No. 14G122
PLATE C-17

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.

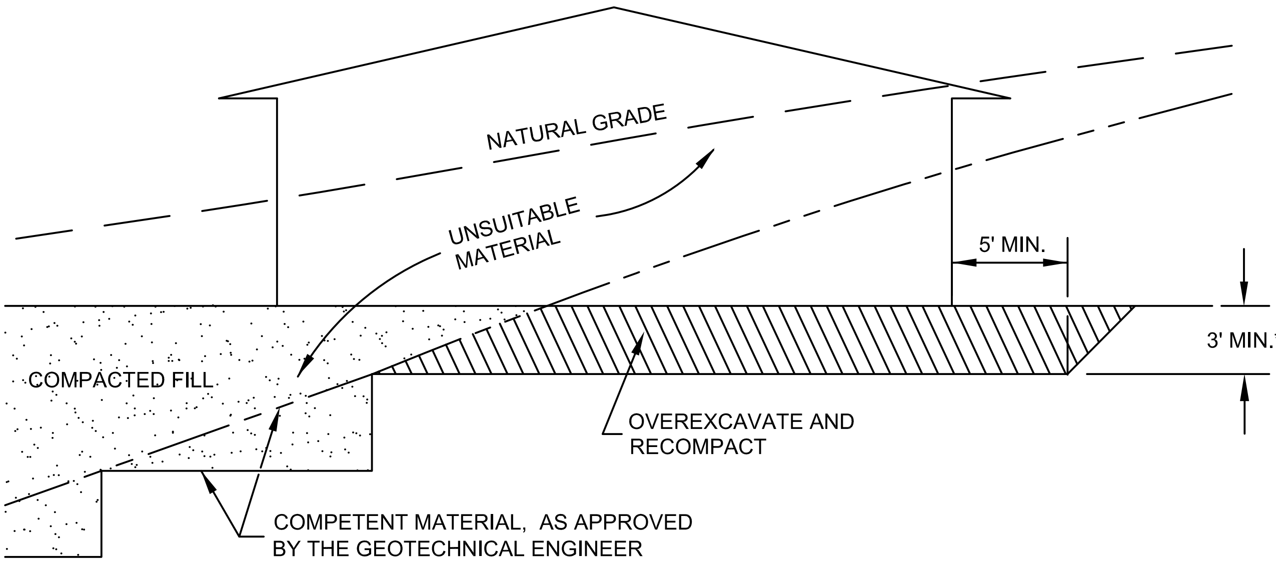
Subdrains

- 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.

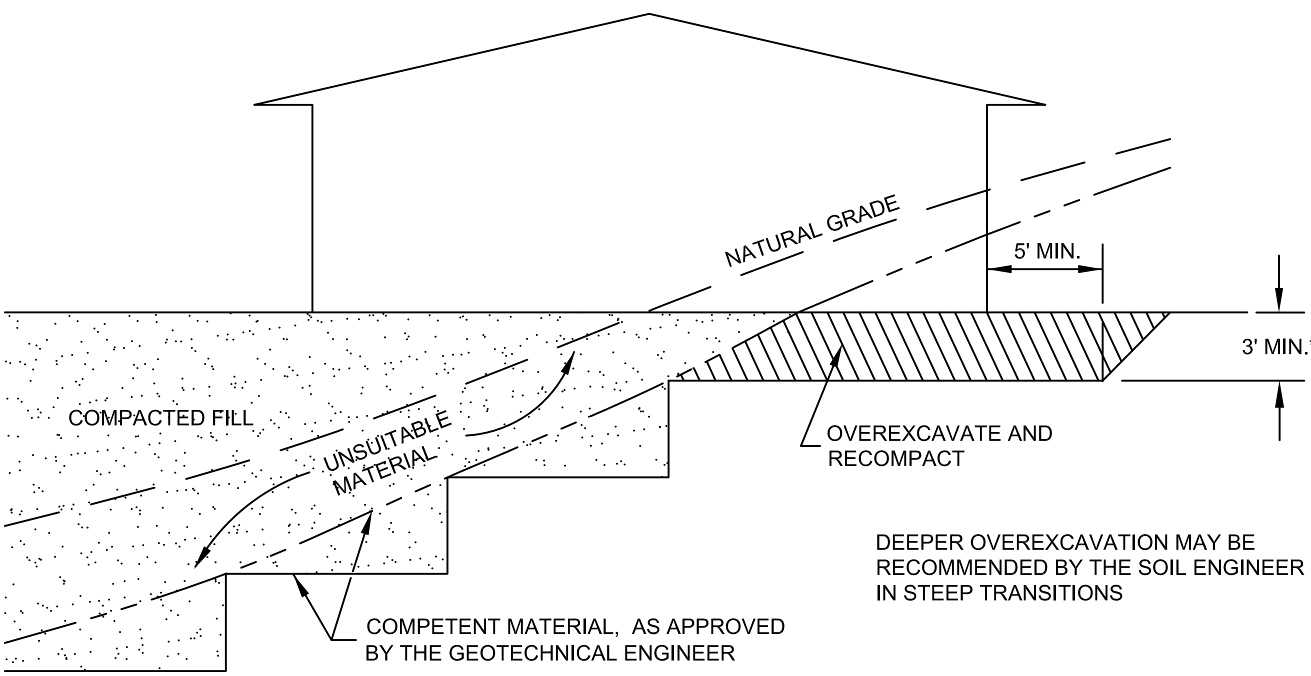
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- 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)



DEEPER OVEREXCAVATION MAY BE RECOMMENDED BY THE SOIL ENGINEER IN STEEP TRANSITIONS

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

TRANSITION LOT DETAIL

GRADING GUIDE SPECIFICATIONS

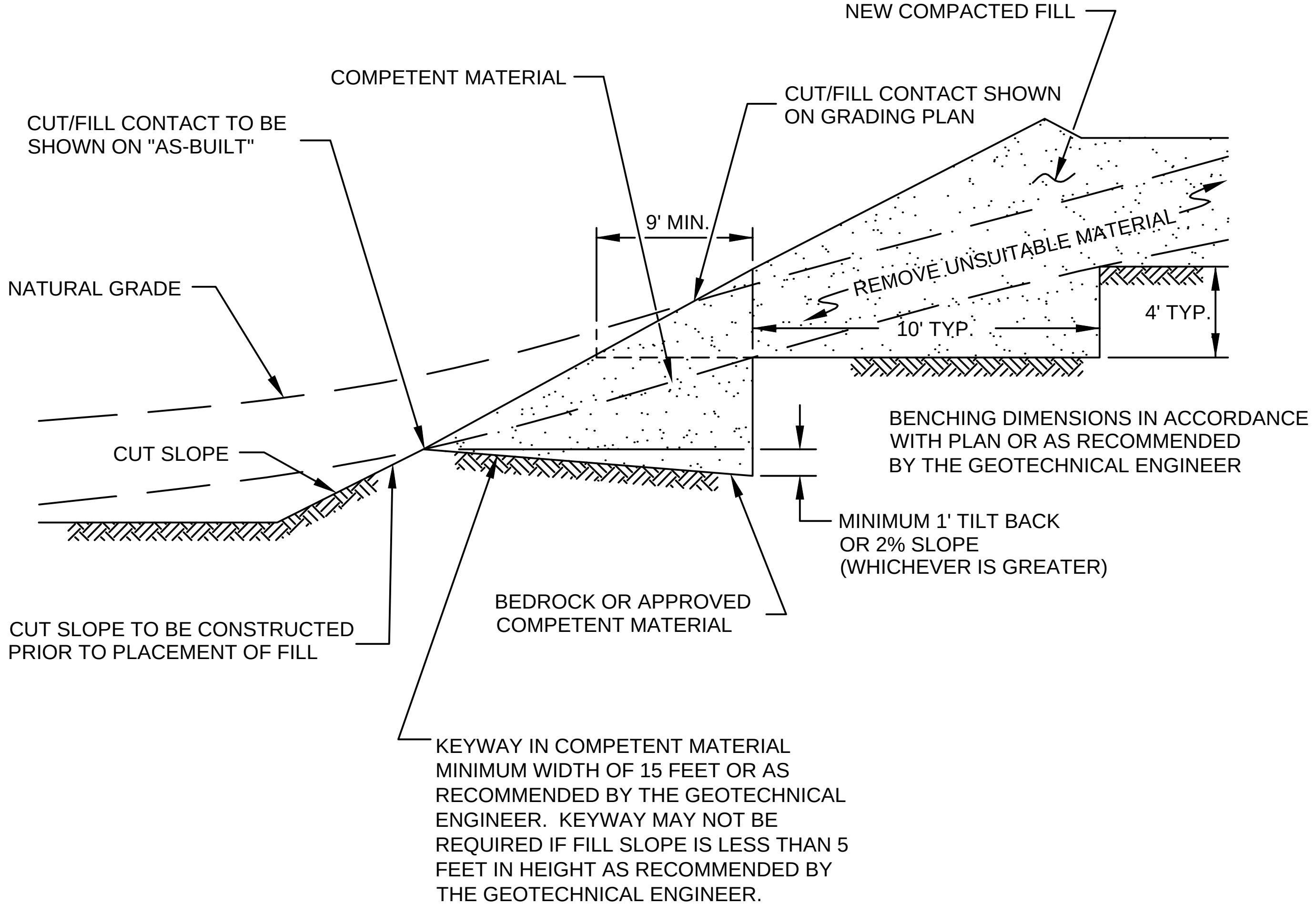
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

GRADING GUIDE SPECIFICATIONS

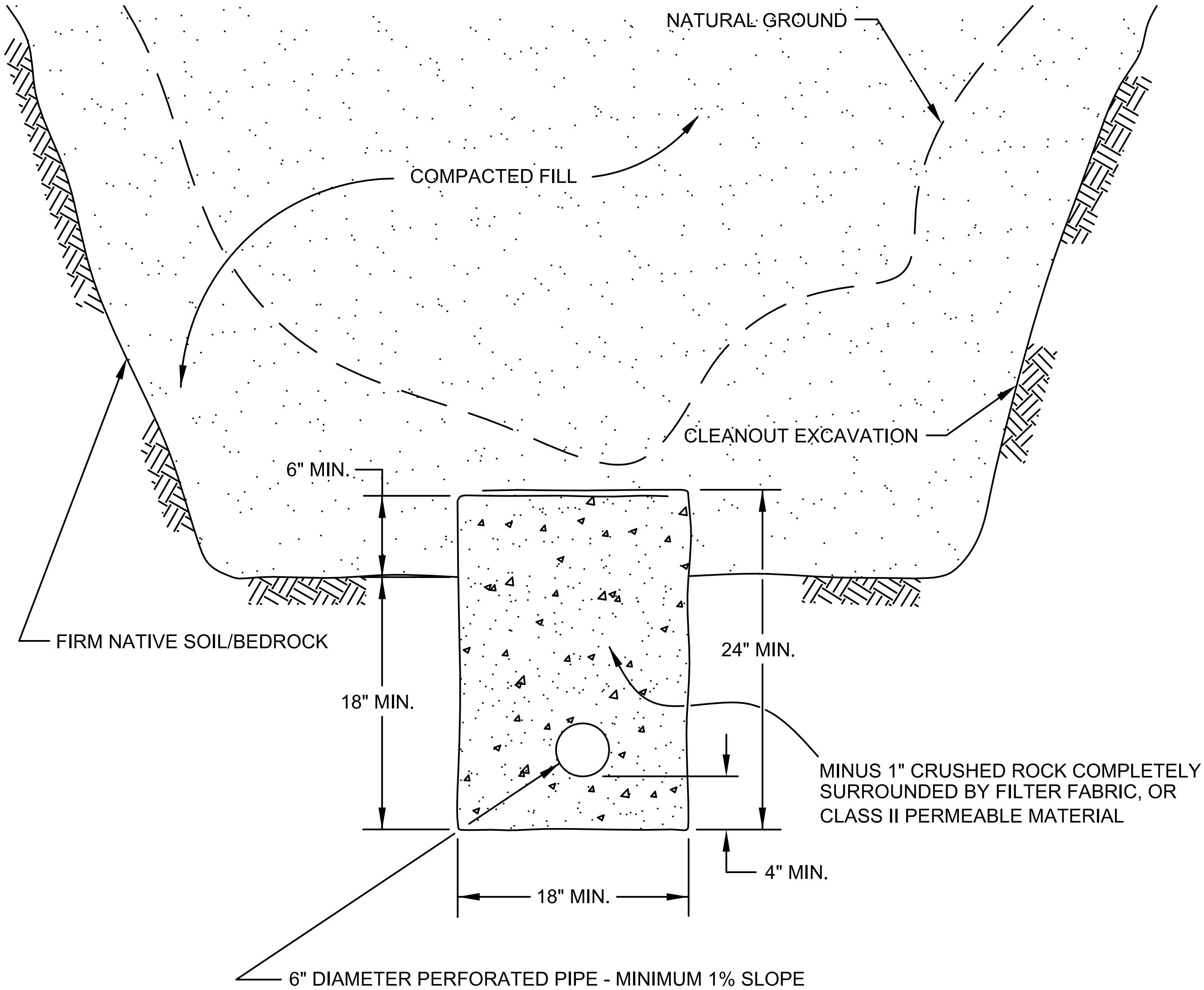
NOT TO SCALE

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

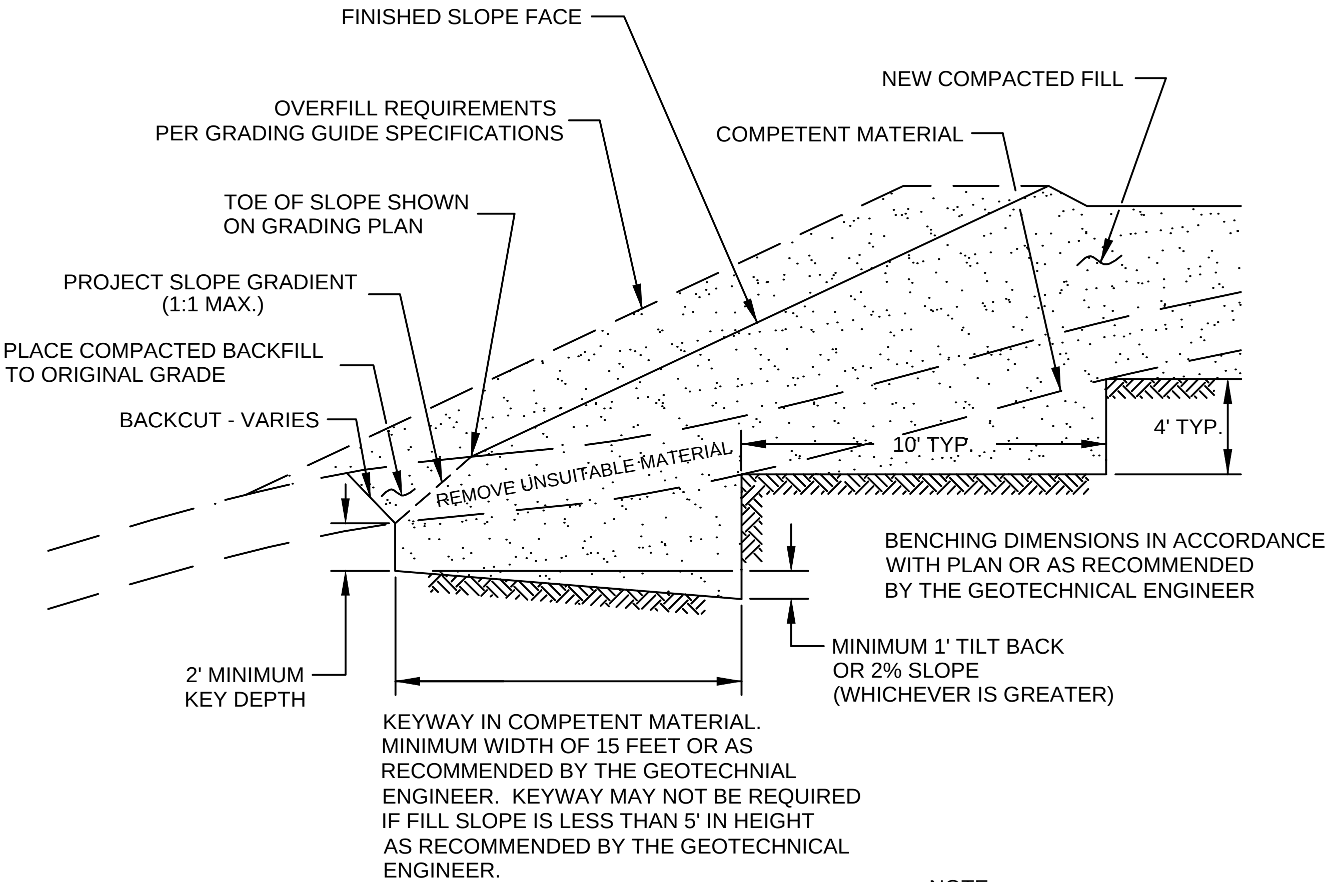
GRADING GUIDE SPECIFICATIONS

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

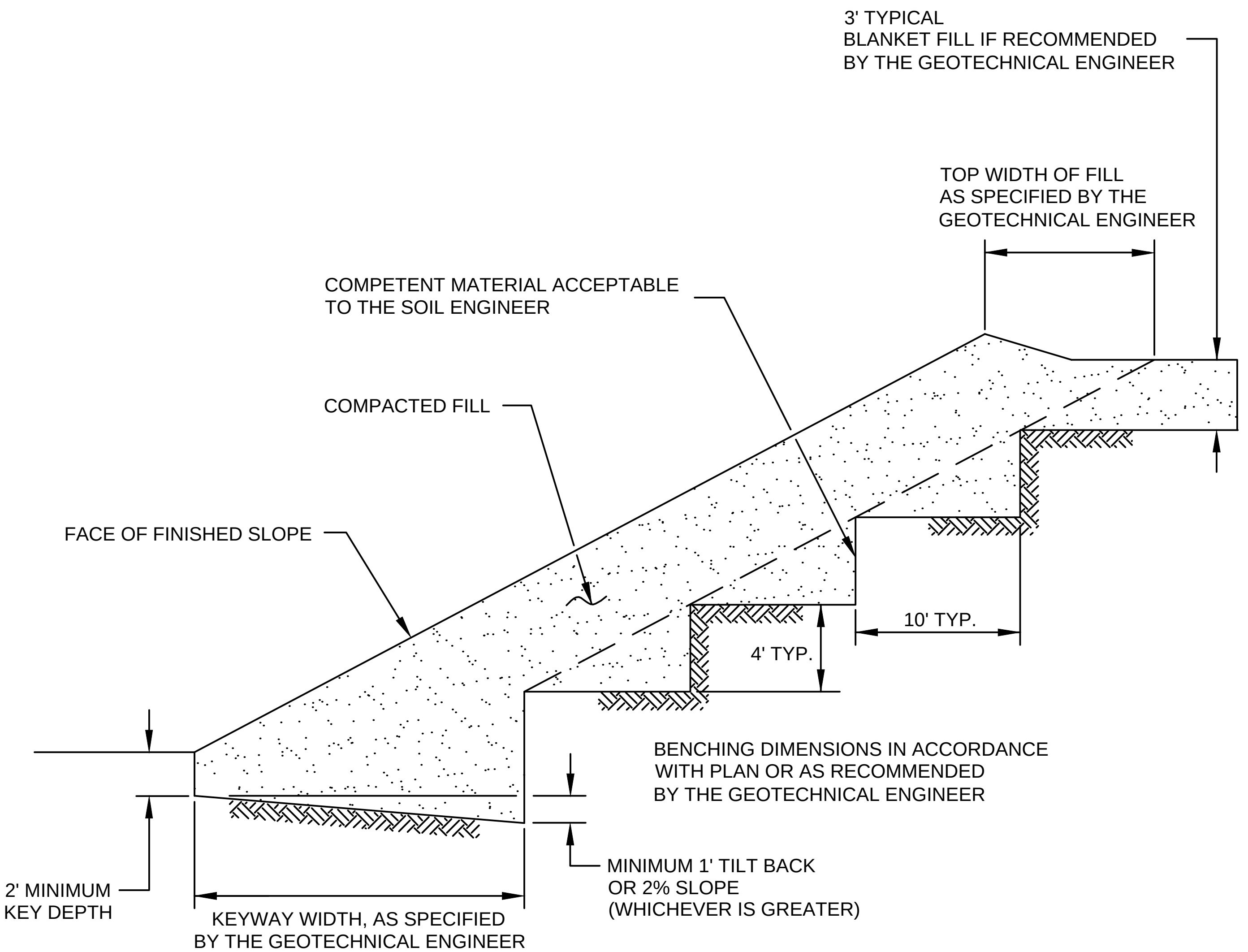
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

GRADING GUIDE SPECIFICATIONS

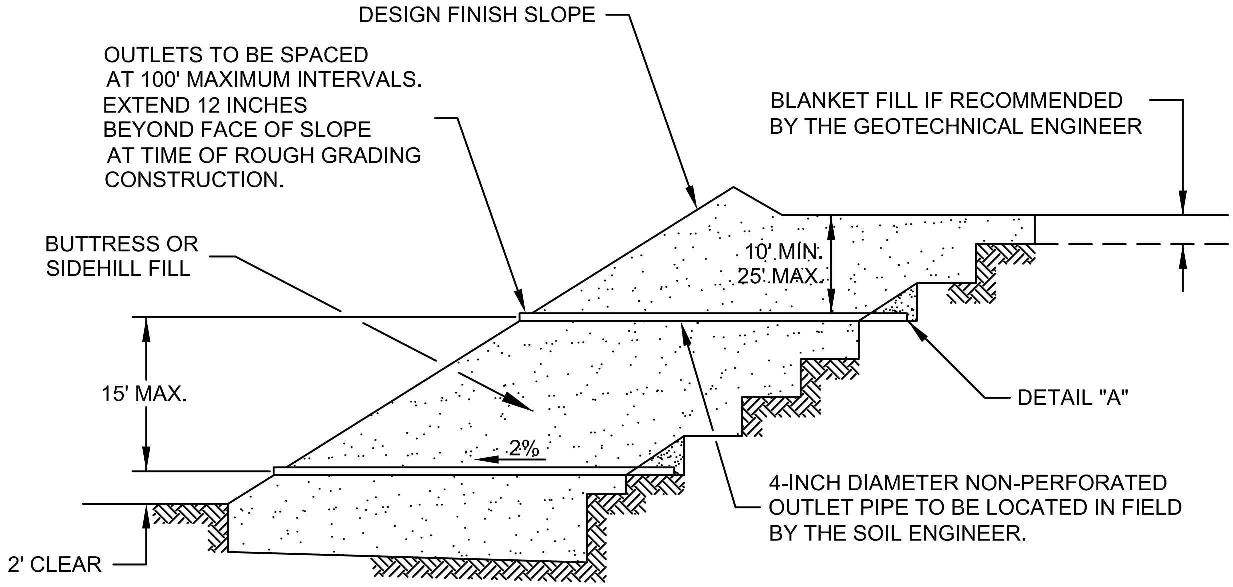
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



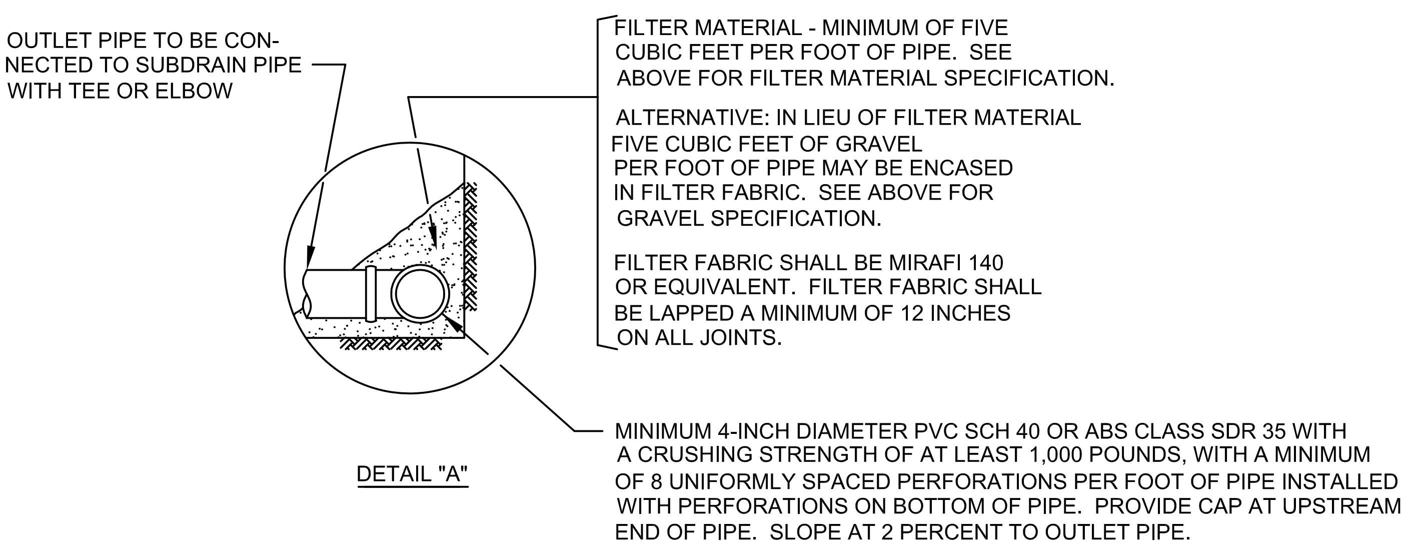
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

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

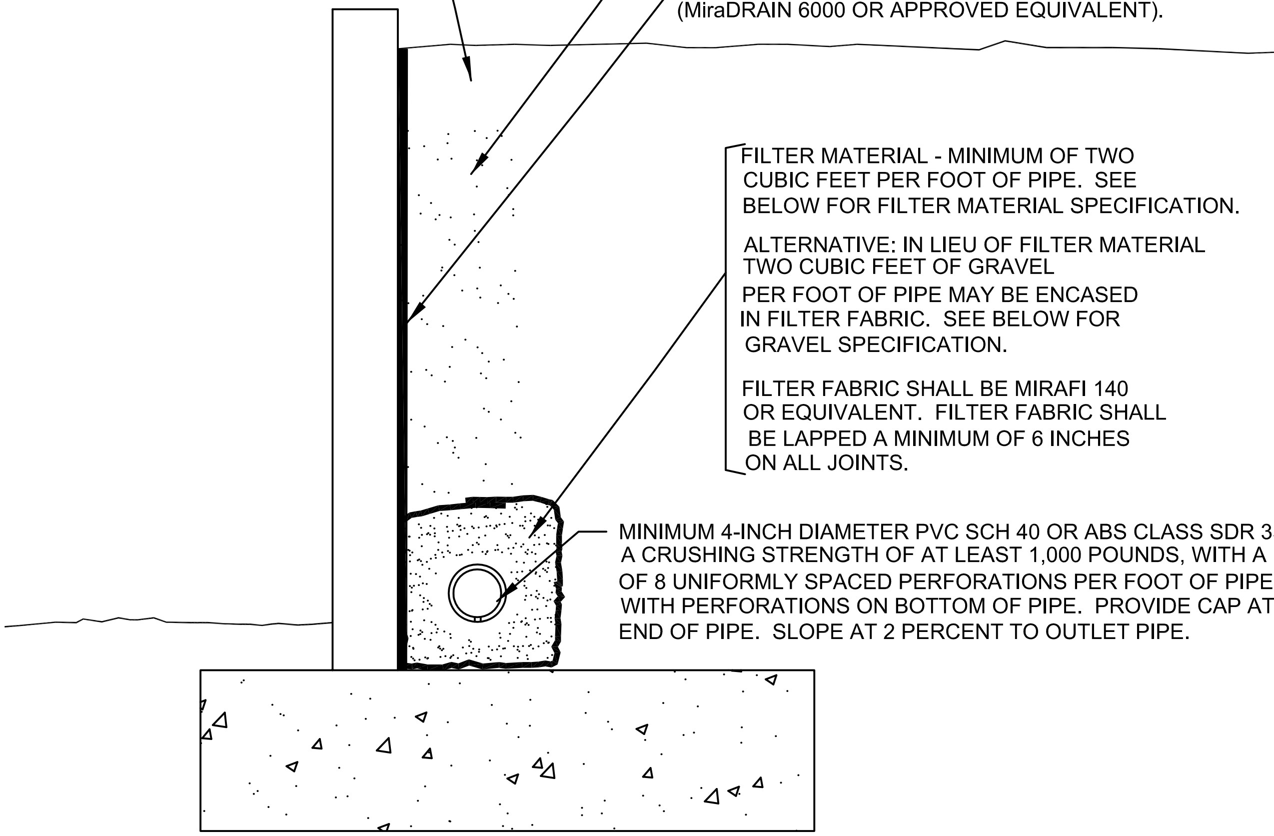
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

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

RETAINING WALL BACKDRAINS

GRADING GUIDE SPECIFICATIONS

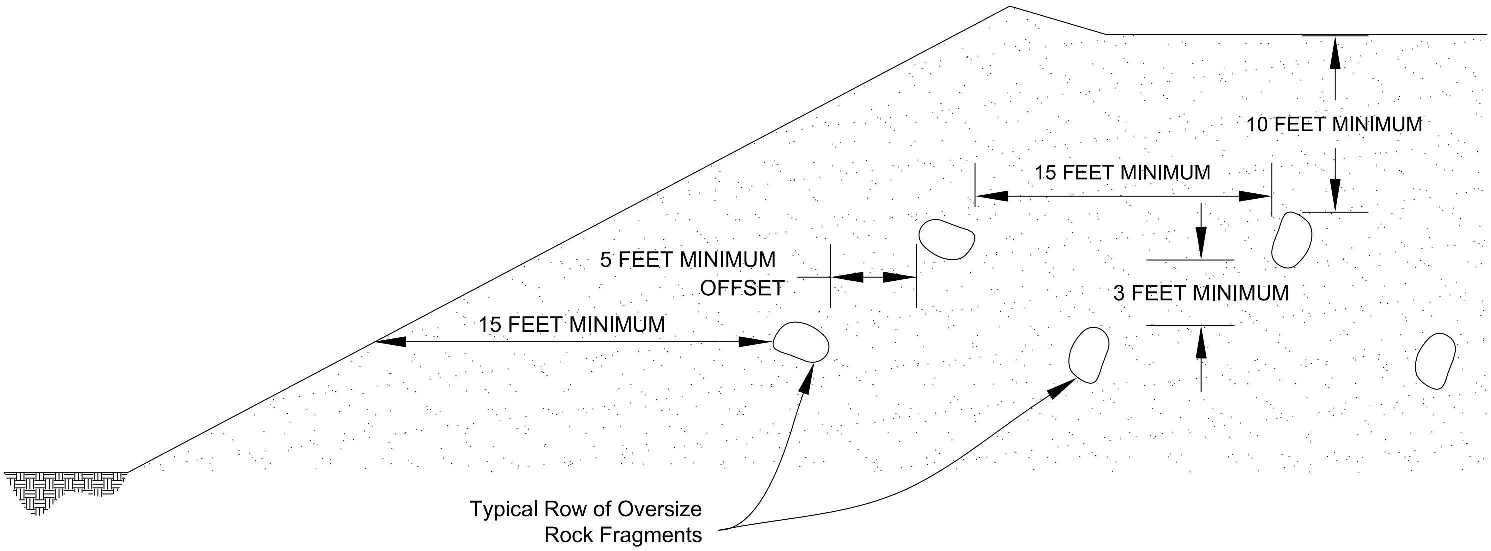
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

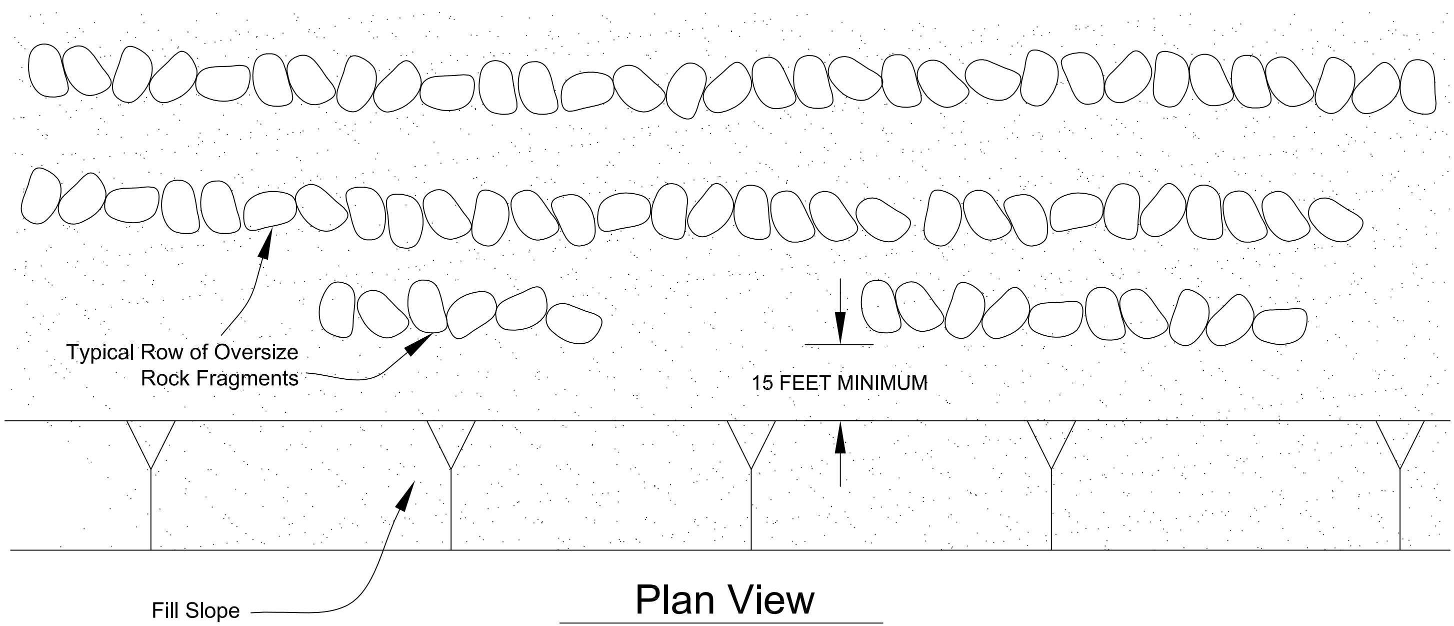
PLATE D-7

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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SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

USGS Design Maps Summary Report

User–Specified Input

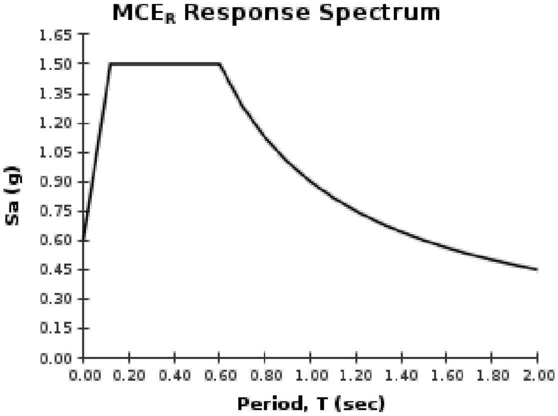
Report Title	Proposed Mixed-Use Development Mon March 17, 2014 22:03:41 UTC
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	34.07145°N, 117.60172°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

USGS–Provided Output

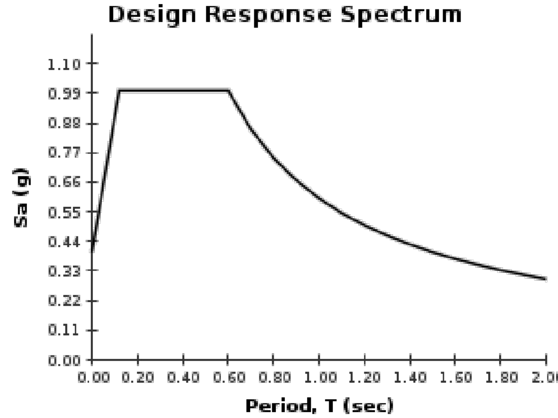
S_S =	1.500 g	S_{MS} =	1.500 g	S_{DS} =	1.000 g
S_1 =	0.600 g	S_{M1} =	0.900 g	S_{D1} =	0.600 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



SOURCE: U.S. GEOLOGICAL SURVEY (USGS)
<http://geohazards.usgs.gov/designmaps/us/application.php>

SEISMIC DESIGN PARAMETERS
PROPOSED MIXED USE DEVELOPMENT
ONTARIO, CALIFORNIA

DRAWN: BI
CHKD: JAS
SCG PROJECT
14G122-1
PLATE E-1

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