APPENDIX E

GEOTECHNICAL INVESTIGATION REPORT

GEOTECHNICAL INVESTIGATION
PROPOSED RETAIL DEVELOPMENT

NEC Sycamore Canyon Boulevard and Central Avenue
Riverside, California
For
KA Enterprises

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

December 11, 2017

KA Enterprises
5820 Oberlin Drive, Suite 201
San Diego, California 92121

Attention: Mr. Eugene Marini

Project No.: **17G134-3**

Subject: **Geotechnical Investigation**
Proposed Retail Development
NEC Sycamore Canyon Boulevard and Central Avenue
Riverside, California

Gentlemen:

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

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

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

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

Site Preparation

- Initial site preparation should include stripping of any surficial vegetation. The surficial vegetation, weeds, grasses, shrubs and any organic soils should be properly disposed of off-site.
- Artificial fill soils were encountered at several of the boring and all of the trench locations, extending from the ground surface to depths of 1 to 9½± feet. Bedrock was encountered at the ground surface and beneath the fill soils at all of the boring and trench locations.
- The fill soils possess occasional to extensive debris content and possess varying strengths. In addition, the existing fill soils are considered to represent undocumented fill. These soils, in their present condition, are not considered suitable for support of the foundation loads of the new structures.
- Remedial grading is recommended to be performed within the new building pad areas. The existing soils within the building pad areas should be overexcavated to a depth of 2 feet below existing grade and to a depth of 2 feet below proposed pad grade, whichever is greater. All existing artificial fill materials should also be removed from the new building pad areas. The soils within the proposed foundation influence zones should be overexcavated to a depth of at least 2 feet below proposed foundation bearing grades.
- After overexcavation has been completed, the resulting subgrade soils should be evaluated by the geotechnical engineer to identify any additional soils that should be overexcavated, moisture conditioned, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.
- The new parking area subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Building Foundations

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

Building Floor Slab

- Conventional Slab-on-Grade, 5 inches thick.
- Minimum 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.

Pavements

ASPHALT PAVEMENTS (R = 40)		
Materials	**Thickness (inches)**	
	Auto Parking and Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic (TI = 6.0)
Asphalt Concrete	3	3½
Aggregate Base	4	6
Compacted Subgrade	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS		
Materials	**Thickness (inches)**	
	Autos Parking and Drive Lanes (TI = 4.0 & 5.0)	Truck Traffic (TI = 6.0)
PCC	5	5½
Compacted Subgrade (95% minimum compaction)	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in general accordance with our Proposal No. 17P350, dated September 25, 2017. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slabs, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the northeast corner of Sycamore Canyon Boulevard and Central Avenue in Riverside, California. The site is bounded to the north and east by the Central Avenue off-ramp of the eastbound Moreno Valley Freeway (Highway 60), to the south by Central Avenue, and to the west by Sycamore Canyon Boulevard. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The subject site consists of several irregular-shaped contiguous parcels which total 2.5± acres in size. The site is currently vacant and undeveloped except for a cell phone tower located near the north corner of the site. A soil stockpile, approximately 50 feet in diameter and 6 to 8 feet in height, is located in the central area of the site. A slope is present along the western property line which descends downward toward Sycamore Canyon Boulevard. The height of the slope ranges from approximately 3 to 15± feet with an inclination of approximately 2h:1v. The ground surface consists of exposed soil with sparse native grass and weed growth and exposed soil with moderate to heavy grass and weed growth on the existing slope.

Topographical information for the subject site was obtained from a map provided by Omega Engineering Consultants, Inc., the project civil engineer. The site topography ranges from 1370± feet mean sea level (msl) in the northern area of the site to 1353± feet msl in the southwestern corner of the site. The maximum elevation differential across the site is approximately 17 feet.

3.2 Proposed Development

Based on a conceptual grading plan prepared by Omega Engineering Consultants, Inc., the site will be developed with a convenience store and a restaurant building. The convenience store will be located in the south-central region of the site and will be 3,200± ft² in size. A fuel island and canopy structure will be constructed south of the convenience store and a car wash building will be located in the southeastern area of the site. The restaurant building will be located in the north-central area of the site and will be 3,800± ft² in size. A drive-thru lane will be constructed along the northern, western, and southern sides of the restaurant. The buildings will be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the drive-thru lanes, concrete flatwork, and limited areas of landscape planters. A slope will be constructed along the northern portion of the western property line. The slope will be approximately 6 feet in height and have an inclination of 2h:1v. Retailing walls will also be located in the western portion of the site. The northern wall will range from 1 to 13± feet in height and the southern wall will range from 2 to 12½± feet in height. A retaining wall will also be constructed along the southern portion of the eastern property line. This retaining wall will range from 1 to 7± feet in height.

Detailed structural information has not been provided. It is assumed that the new buildings will be single -story structures of wood frame or masonry block construction and supported on conventional shallow foundations with concrete slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 30 kips and 1 to 3 kips per linear foot, respectively.

No significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the conceptual grading plan provided to our office, cuts of up to 8± feet and fills of up to 8± feet are expected to be necessary to achieve the proposed site grades.

3.3 Previous Studies

Southern California Geotechnical, Inc. (SCG) previously performed two investigations for the subject site. The results of the previous investigations are documented in the reports referenced below:

> Results of Limited Geotechnical Reconnaissance and Research, Proposed Retail Development, Northeast Corner of Sycamore Canyon Boulevard and Central Avenue, Riverside, California, prepared by Southern California Geotechnical, Inc. (SCG) for KA Enterprises, SCG Project No. 17G134-1, dated April 10, 2017.

SCG performed visual reconnaissance and performed research of the available geologic literature for this site. Our observations and the results of this study are presented in the report referenced above. As part of this study, an SCG certified engineering geologist (CEG) conducted a site reconnaissance. No subsurface exploration was performed as part of this study. Bedrock materials were observed at the ground surface in limited areas along the southern property line and on a portion of the surface of the slope along the western property line. In addition, bedrock materials were observed beneath the surficial soils at a couple locations in the central area of the site. SCG reported that the site was likely underlain by Val Verde Formation tonalite bedrock. SCG recommended that a geophysical rippability study be performed at the subject site.

> Seismic Refraction Study, Proposed Retail Development, Northeast Corner of Sycamore Canyon Boulevard and Central Avenue, Riverside, California, prepared by SCG for KA Enterprises, SCG Project No. 17G134-2, dated April 25, 2017.

SCG previously performed a seismic refraction study at the subject site. Four (4) 150-foot long seismic refraction lines were performed at the site. SCG concluded that the very weathered tonalite bedrock was considered marginally rippable to depths of 7 to 30 feet. However, SCG did indicate that if deeper cuts were expected, blasting would be expected in any areas where less weathered bedrock materials would be encountered.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of five (5) soil borings drilled to depths of 10 to 25± feet below existing site grades and six (6) trenches excavated to depths of 4 to 15± feet below currently existing site grades. All of the borings and trenches were logged during drilling and trenching by our engineering geology personnel.

The trenches were excavated using a track mounted excavator equipped with a 24-inch wide bucket. All of the borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. Representative bulk and relatively undisturbed soil samples were taken during drilling and trenching. Relatively undisturbed 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. Relatively undisturbed 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 and trenches are indicated on the Boring and Trench Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs and Trench Logs, which illustrate the conditions encountered at the boring and trench locations, as well as the results of some of the laboratory testing, are included in Appendix B.

4.2 Geotechnical Conditions

Artificial Fill

Artificial fill soils were encountered at the ground surface at three (3) of the boring locations and all of the trench locations extending to depths of 1 to 9½± feet below the existing site grades. The fill soils generally consist of silty fine to coarse sands with varying amounts of gravel content. Construction debris including concrete, asphalt, tile, metal, plastic, and rebar were observed within Trench Nos. T-3, T-4, and T-5. The construction debris ranged in size from 1-inch to 4-feet. The fill soils possess abundant debris content, variable strengths and a disturbed appearance, resulting in their classification as fill.

Alluvium

Native alluvial soil were encountered beneath the fill soils at Trench No T-6 and Boring No. B-4. The native soils extended to depths of 12 to 13± feet below the existing site grades. The alluvial soils consist of loose to medium dense silty fine to medium sands and silty fine to coarse sands.

Val Verde Tonalite

Val Verde Formation Tonalite bedrock was encountered at the ground surface or beneath the fill or alluvium at all of the boring and trench locations. The bedrock materials encountered throughout the site consists of dense to very dense, light brown to dark gray brown fine to coarse grained tonalite, jointed, weathered and friable. Gouge filled joints were observed at Trench Nos. T-2 and T-3. Joints with no gouge were observed at Trench No. T-5. The bedrock was generally massive.

Groundwater

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

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the groundwater depths in this area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. However, there are no wells within 1 mile of the subject site.

4.3 Geologic Conditions

Regional geologic conditions were obtained from the Preliminary Geologic Map of the Riverside East 7.5 Minute Quadrangle, Riverside County, California, published by the California Geological Survey (CGS) by Morton and Cox, 1997. This map indicates that the site is underlain by Cretaceous age Val Verde Formation tonalite (Map Symbol Kvt). The Val Verde Formation is described as gray, weathered, relatively homogeneous, massive, medium- to coarse-grained tonalite. A portion of this map, indicating the location of the subject site, is included as Plate 3 in Appendix A.

Based on the materials encountered in the exploratory borings and trenches, it is our opinion the site is underlain by Val Verde Tonalite. Bedrock was encountered at all of the boring and trench locations. The bedrock consists of dense to very dense, fine to coarse grained, jointed, weathered tonalite of the Val Verde formation. The geologic conditions at the site are consistent with the mapped geologic conditions.

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 and Trench Logs and are periodically referenced throughout this report.

Density and Moisture Content

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

Consolidation

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

Maximum Dry Density and Optimum Moisture Content

Representative bulk samples were tested for their maximum dry densities and optimum moisture contents. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557. These tests are generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil type or soil mixes may be necessary at a later date. The results of the testing are plotted on Plates C-9 and C-10 in Appendix C of this report.

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-2 @ 0 to 5 feet	0.005	Negligible
B-4 @ 0 to 5 feet	0.008	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. The recommendations are provided with the assumption that an adequate program of client consultation, construction monitoring, and testing will be performed during the final design and construction phases to verify compliance with these recommendations. Maintaining Southern California Geotechnical, Inc., (SCG) as the geotechnical consultant from the beginning to the end of the project will provide continuity of services. The geotechnical engineering firm providing testing and observation services shall assume the responsibility of Geotechnical Engineer of Record.

The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

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

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. 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

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2016 edition of the California Building Code (CBC). The CBC provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configurations of the structures 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 2016 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 2016 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:

2016 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	0.611
Site Class	---	C
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.500
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.794
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.000
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.529

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 grain size characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Clayey (cohesive) soils or soils which possess clay particles ($d<0.005$mm) in excess of 20 percent (Seed and Idriss, 1982) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

Based on mapping performed by the California Geological Survey (CGS) the subject site is not located within a designated liquefaction hazard zone. In addition, the subsurface conditions encountered at the boring and trench locations are not considered to be conducive to liquefaction. Based on the mapping performed by CGS and the 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 subject site is underlain by artificial fill soils, extending to depths of up to 9½± feet. All of the fill soils on site are considered to be undocumented fill since the fill soils were not placed under engineering controlled conditions. The fill soils possess extensive debris content, variable strengths, and based on the results of laboratory testing, are highly collapsible. Therefore, remedial grading is recomended to overexcavate and recompact these soils.

The most significant geotechnical design consideration that will impact the proposed development is the excavation characteristics of the bedrock that underlies the subject site. Bedrock was encountered at the ground surface, and beneath the fill and native alluvial soils, where present. Based on conditions encountered at the boring, trench, and seismic refraction line locations, the bedrock is considered marginally rippable within the depths of the expected cut depths. Gouge filled joints were observed at two of the trench locations. If the gouge filled joints are exposed during the grading operation, an engineering geologist or geotechnical engineer should evaluate the gouge filled joints to determine the appropriate remediation, if necessary.

Another geotechnical design consideration is the differing support conditions of engineered fill and bedrock at foundation bearing surfaces. A portion of the near-surface bedrock is recommended to be overexcavated and recompacted as structural fill in order to provide more uniform support characteristics for the proposed structures.

Potential Surcharge Loads

Based on our review of the preliminary grading plan, the proposed restaurant building will be located near the proposed retaining wall along the western property line. The restaurant building foundation may induce a surcharge load on the western retaining wall if the retaining wall is located within the foundation influence zone of the building foundations. For the purpose of detrmining the surcharge potential, the foundation influence zone is considered to be the area within a 1h:1v projection downward from the bottom of the building foundation. Therefore, in order to avoid potential surcharge of the retaining wall, we recommend that the building foundation along the western wall be placed at a depth such that the retaining wall is not located within the foundation influence zone.

Settlement

The recommended remedial grading will remove all of the existing undocumented fill, as well as a portion of the near-surface bedrock, and replace them as compacted fill soils. The underlying bedrock is not considered to be susceptible to significant settlement from the foundation loads of the proposed structures. Provided that the recommended remedial grading is completed, the post-construction static settlement of the proposed structure is expected to be within tolerable limits.

Expansion

The near-surface soils generally consist of silty sands and tonalite bedrock. These materials have been visually classified as very low to non-expansive. Therefore, no design considerations related to expansive soils are considered warranted for this site.

Shrinkage/Subsidence

Removal and recompaction of the fill soils is estimated to result in an average shrinkage of 12 to 16 percent. Excavation of the bedrock and placement as compacted fill is estimated to result in bulking of 0 to 5 percent.

No significant subsidence is expected to occur in excavations that are underlain by bedrock materials.

These estimates are based on previous experience and the subsurface conditions encountered at the trench and boring locations. The actual amount of subsidence is expected to be variable and will be dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

This report was prepared in consideration of the preliminary grading plan that was provided to our office. However, foundation plans were not available at the time of this report. It is therefore recommended that we be provided with copies of precise grading and preliminary foundation plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

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

Site Stripping and Demolition

Initial site stripping should include removal of any surficial vegetation. This should include any weeds, grasses, and shrubs. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pads

Remedial grading should be performed within the proposed building areas in order to remove all existing fill soils. Based on conditions encountered at the boring and trench locations, the existing materials within the proposed building pad areas are recommended to be overexcavated to a depth of at least 2 feet below proposed building pad subgrade elevation and to a depth of at least 2 feet below existing grade, whichever is greater. **The depth of the overexcavation should also extend to a depth sufficient to remove all undocumented fill soils**. The undocumented fill soils at extend to depths up to 9½± feet. Additional overexcavation should be performed within the influence zones of the new foundations, to provide for a new layer of compacted structural fill extending to a depth of at least 2 feet below proposed bearing grades. In areas of cut/fill transitions, it is recommended that grading be performed in order to remove and replace a portion of the bedrock as compacted structural fill. This grading is considered warranted, in order to soften the transition from the fill soils to the bedrock, thereby reducing the potential for excessive future settlements.

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

Following completion of the overexcavation, the subgrade soils and/or bedrock materials 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 and/or bedrock materials should be scarified to a depth of at least 12 inches, thoroughly moisture conditioned, and recompacted. Overexcavation bottoms should be thoroughly moisture conditioned to achieve a moisture content of 0 to 4 percent above the optimum moisture content, extending to a depth of 18 to 24 inches below the overexcavation subgrade. The previously excavated soils may then be replaced as compacted structural fill.

Treatment of Existing Soils: Cut and Fill Slopes

New cut and fill slopes will be constructed around the perimeter of the project. Maximum heights of cut and fill slopes are indicated on the plan to be 6± feet. All slopes should be at an inclination of 2h:1v. A keyway should be excavated at the toe of new fill slopes which are not located in fill areas. The keyway should be at least 15 feet in width and 3 feet deep. The recommended width of the keyway is based on 1½ times the width of typical grading equipment. If smaller equipment is utilized, a smaller keyway may be suitable, at the discretion of the geotechnical engineer. The base of the keyway should slope at least 1 foot downward into the slope. Following completion of the keyway cut, the subgrade soils should be evaluated by the geotechnical engineer to verify that the keyway is founded into competent materials. The resulting subgrade soils should then be scarified to a depth of 10 to 12 inches, moisture conditioned to 0 to 4 percent above optimum moisture content and recompacted. During construction of the new fill slope, the existing slope should be benched in accordance with the detail presented on Plate D-4. Benches less than 4 feet in height may be used at the discretion of the geotechnical engineer.

Cut slopes in bedrock may be cut to grade, undercut and replaced as stability fills. Stability fills for cut slopes will provide a more uniform appearance and allow landscaping on the slope. A keyway should be excavated at the toe of any stability fill slope. The keyway should be at least 15 feet in width. The recommended width of the keyway is based on 1½ times the width of typical grading equipment. If smaller equipment is utilized, a smaller keyway may be suitable, at the discretion of the geotechnical engineer. Following completion of the keyway cut, the subgrade soils should be evaluated by the geotechnical engineer to verify that the keyway is founded into competent materials. The resulting subgrade soils should then be scarified to a depth of 10 to 12 inches, moisture conditioned to 0 to 4 percent above optimum moisture content and recompacted. During construction of the new fill slope, the existing slope should be benched in accordance with the detail presented on Plate D-5. Benches less than 4 feet in height may be used at the discretion of the geotechnical engineer.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of proposed retaining and non-retaining site walls should be overexcavated to a depth of at least 2 feet below foundation bearing grade and replaced as compacted structural fill as discussed above for the proposed building pad. Any undocumented fill soils within any of these foundation influence areas should be removed in their entirety. The overexcavation should extend at least 5 feet beyond the foundation perimeters, and to an extent equal to the depth of fill below the new foundations. Please note that erection pads are considered to be part of the foundation system. These overexcavation recommendations apply to erection pads also. 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, as discussed for the building areas. The previously excavated soils may then be replaced as compacted structural fill.

Treatment of Existing Soils: Parking Areas

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

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 0 to 4 percent above the 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 surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed flatwork, parking and drive areas assume that the owner and/or developer can tolerate minor amounts of settlement within the proposed flatwork, parking and drive areas. The grading recommendations presented above do not completely mitigate the extent of existing fill soils that may be present in the flatwork, parking and drive areas. As such, some settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the flatwork, parking and drive areas should be overexcavated to a depth of 2 feet below proposed pavement subgrade elevation, with the resulting soils replaced as compacted structural fill.

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 0 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 2016 CBC and the grading code of the city of Riverside.
- 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

At several of the trench locations, the existing fill soils possess occasional to extensive amounts of cobble to boulder size debris. 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 Riverside. 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. 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

In addition, the soils from 7 to 30± feet below the existing site grades are considered marginally rippable with a single shank dozer. If any deeper cuts are proposed at this site to facilitate construction of the proposed buildings and improvements, localized blasting could be expected in areas where the less weathered bedrock materials are encountered.

Groundwater

Based on the conditions encountered in the trenches and borings, groundwater is not present within 25± feet of the ground surface. Based on the anticipated depth to groundwater, it is not expected that the groundwater will affect excavations for the foundations or utilities.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pads will be underlain by structural fill soils used to replace the existing fill and bedrock materials. These new structural fill soils are expected to extend to depths of at least 2 feet below proposed foundation bearing grade, underlain by 1± foot of additional soil or bedrock that has been scarified, moisture conditioned, and recompacted. Based on this subsurface profile, the proposed structures may be supported on conventional shallow foundations.

Building Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Two (2) No. 5 rebars (1 top and 1 bottom).
- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent grade.
- 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 rigidity 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 bedrock materials, 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 0 to 4 percent of the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. **Since it is typically not feasible to increase the moisture content of the floor slab and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process**.

Estimated Foundation Settlements

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

Lateral Load Resistance

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

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

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against compacted structural fill. The maximum allowable passive pressure is 2,500 lbs/ft^2.

6.6 Floor Slab Design and Construction

Subgrades which will support new floor slabs should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, the floors of the new structures may be constructed as conventional slabs-on-grade supported on newly placed structural fill, extending to a depth of at least 2 feet below finished pad grade. Based on geotechnical considerations, the floor slab may be designed as follows:

- Minimum slab thickness: 5 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.

- If moisture sensitive floor coverings will be used, then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire slab area where the moisture sensitive floor coverings are expected. 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.

- Moisture condition the floor slab subgrade soils to 0 to 4 percent of 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 floor slab should be structurally connected to the foundations as detailed by the structural engineer.

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

6.7 Retaining Wall Design and Construction

Retaining walls are will be constructed along the western property line to heights up to 13± feet and along the eastern property line to heights up to 7± feet. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. The following parameters assume that only the on-site soils will be utilized for retaining wall backfill. The on-site soils generally consist of silty fine to medium sands with varying gravel content. Based on their composition, the on-site soils have been assigned a friction angle of 30 degrees.

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 Sandy Soils
Internal Friction Angle (ϕ)		30°
Unit Weight		125 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	42 lbs/ft^3
	Active Condition (2h:1v backfill)	67 lbs/ft^3

	At-Rest Condition (level backfill)	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.

Seismic Lateral Earth Pressures

In accordance with the 2016 CBC, any retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. The recommended seismic pressure distribution is triangular in shape, with a maximum magnitude of 18H lbs/ft^2, where H is the overall height of the wall. The maximum pressure should be assumed to occur at the top of the wall, decreasing to 0 at the base of the wall. The seismic pressure distribution is based on the Mononobe-Okabe equation, utilizing a design acceleration of 0.38g. The 2016 CBC does not provide definitive guidance on determination of the design acceleration to be used in generating the seismic lateral earth pressure. In accordance with standard geotechnical practice, we have calculated the design acceleration as $^2/_3$ of the PGA_M.

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed compacted structural fill, extending to a depth of at least 2 feet below the proposed bearing grade. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

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 minimum 1 foot thick layer of free-draining granular material (less than 5 percent passing the No. 200 sieve) be placed against the face of the retaining walls. This material should extend from the top of the retaining wall footing to within 1 foot of the ground surface on the back side of the retaining wall. This material should be approved by the geotechnical engineer. In lieu of the 1 foot thick layer of free-draining material, a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls, may be used. If the layer of free-draining material is not covered by an impermeable surface, such as a structure or pavement, a 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils. The layer of free draining granular material should be separated from the backfill soils by a suitable geotextile, approved by the geotechnical engineer.

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

Subsurface Drainage

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

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

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

6.8 Pavement Design Parameters

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

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of recompacted soil and bedrock materials. The on-site soils generally consist of silty sands with varying amounts of gravel. These soils are considered to possess good pavement support characteristics with estimated R-values of 40 to 50. Since R-value testing was not included in the scope of services for this project, the subsequent pavement design is based upon a conservatively assumed R-value of 40. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering controlled conditions. It is recommended that R-value testing be performed after completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

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

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

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 = 40)		
Materials	**Thickness (inches)**	
	Auto Parking and Drive Lanes (TI = 4.0 to 5.0)	Light Truck Traffic (TI = 6.0)
Asphalt Concrete	3	3½
Aggregate Base	4	6
Compacted Subgrade	12	12

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

Portland Cement Concrete

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

PORTLAND CEMENT CONCRETE PAVEMENTS		
Materials	**Thickness (inches)**	
	Autos and Drive Lanes (TI = 4.0 & 5.0)	Light Truck Traffic TI = 6.0
PCC	5	5½
Compacted Subgrade (95% minimum compaction)	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. 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

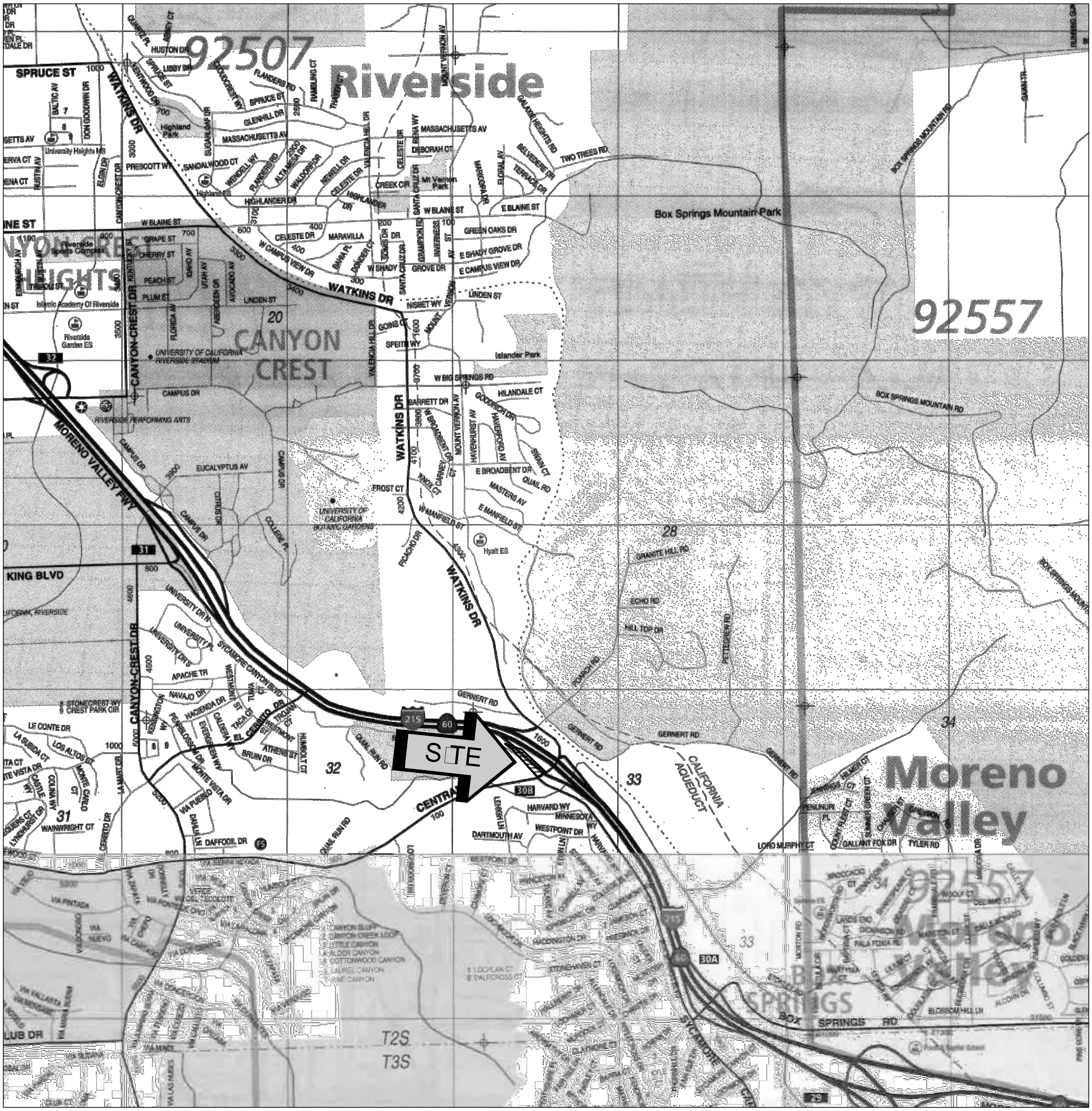
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other 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.

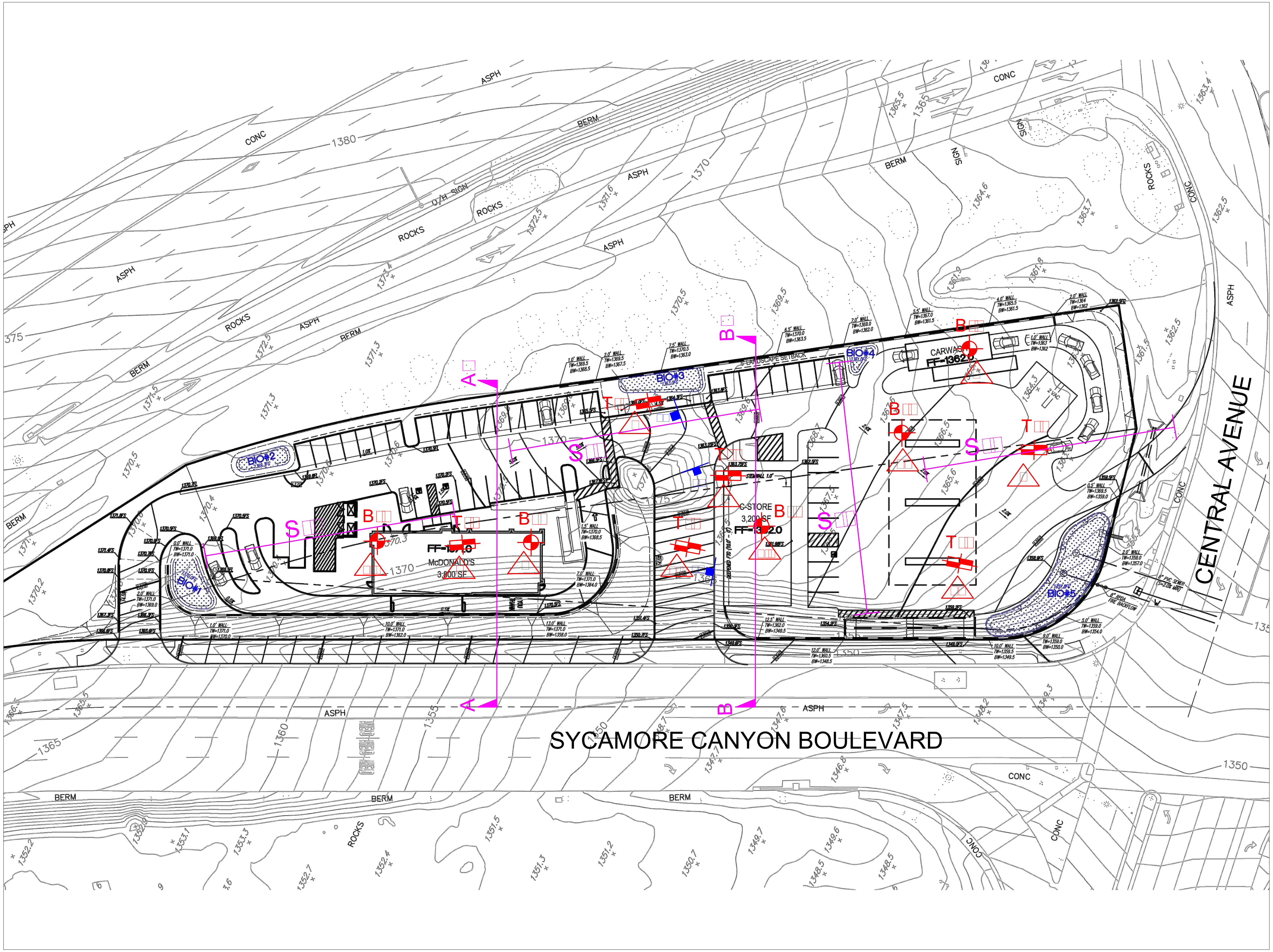
The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

APPENDIX A



SOURCE: RIVERSIDE COUNTY
THOMAS GUIDE [illegible]

SITE LOCATION MAP	
PROPOSED RETAIL DEVELOPMENT	
RIVERSIDE, CALIFORNIA	
SCALE: [illegible]	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: [illegible] CHKD: [illegible]	
SCG PROJECT [illegible]	
PLATE 1	



GEOTECHNICAL LEGEND

- APPROXIMATE BORING LOCATION
- APPROXIMATE TRENCH LOCATION
- JOINTS
- ARTIFICIAL FILL DEPTH (FEET)
- CROSS SECTION LINE
- PREVIOUS SEISMIC LINE (SCG PROJECT NO. [illegible])

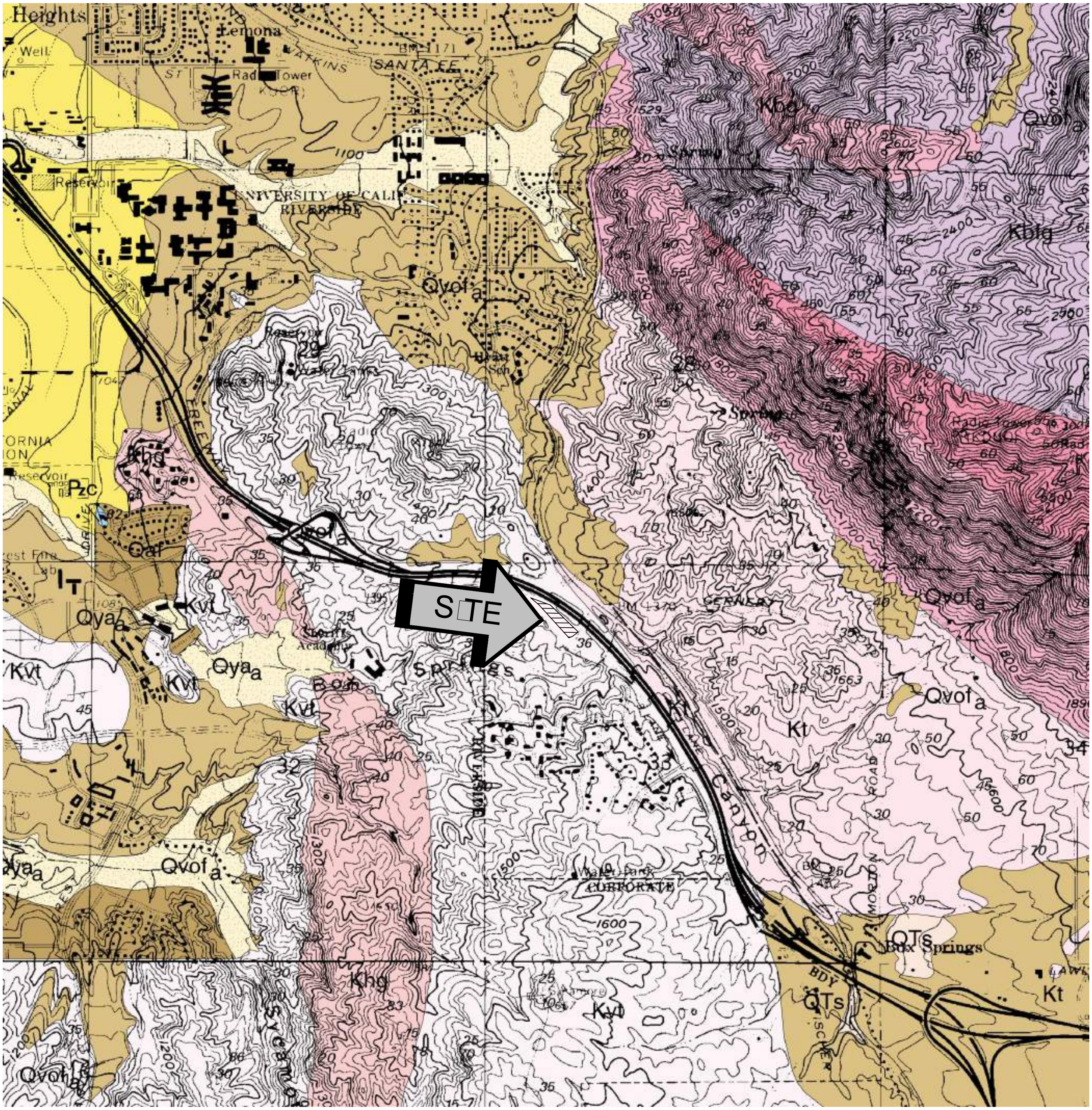
NOTE: BASE MAP PREPARED BY OMEGA ENGINEERING CONSULTANTS, INC.

BORING AND TRENCH LOCATION PLAN

PROPOSED RETAIL DEVELOPMENT

RIVERSIDE, CALIFORNIA

SCALE: [illegible]	SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: [illegible] CHKD: [illegible]	
SCG PROJECT [illegible]	
PLATE 2	



DESCRIPTION OF MAP UNITS

Kvt

Val Verde tonalite—Gray-weathering, relatively homogeneous, massive- to well-foliated, medium- to coarse-grained, hypautomorphic-granular biotite-hornblende tonalite; principal rock type of Val Verde pluton. Contains subequal biotite and hornblende, quartz and plagioclase. Potassium feldspar generally less than two percent of rock. Where present, foliation typically strikes northwest and dips moderately to steeply northeast. Northern part of pluton contains younger, intermittently developed, northeast-striking foliation. In central part of pluton, tonalite is mostly massive, and contains few segregational masses of mesocratic to melanocratic tonalite. Elliptical- to pancake-shaped, meso-to melanocratic inclusions are common.

SOURCE: "GEOLOGIC MAP OF THE RIVERSIDE EAST [illegible] QUADRANGLE, RIVERSIDE COUNTY, CALIFORNIA" MORTON AND CO[illegible] REVISED [illegible]

GEOLOGIC MAP

PROPOSED RETAIL DEVELOPMENT

RIVERSIDE, CALIFORNIA

SCALE: 1" = [illegible]

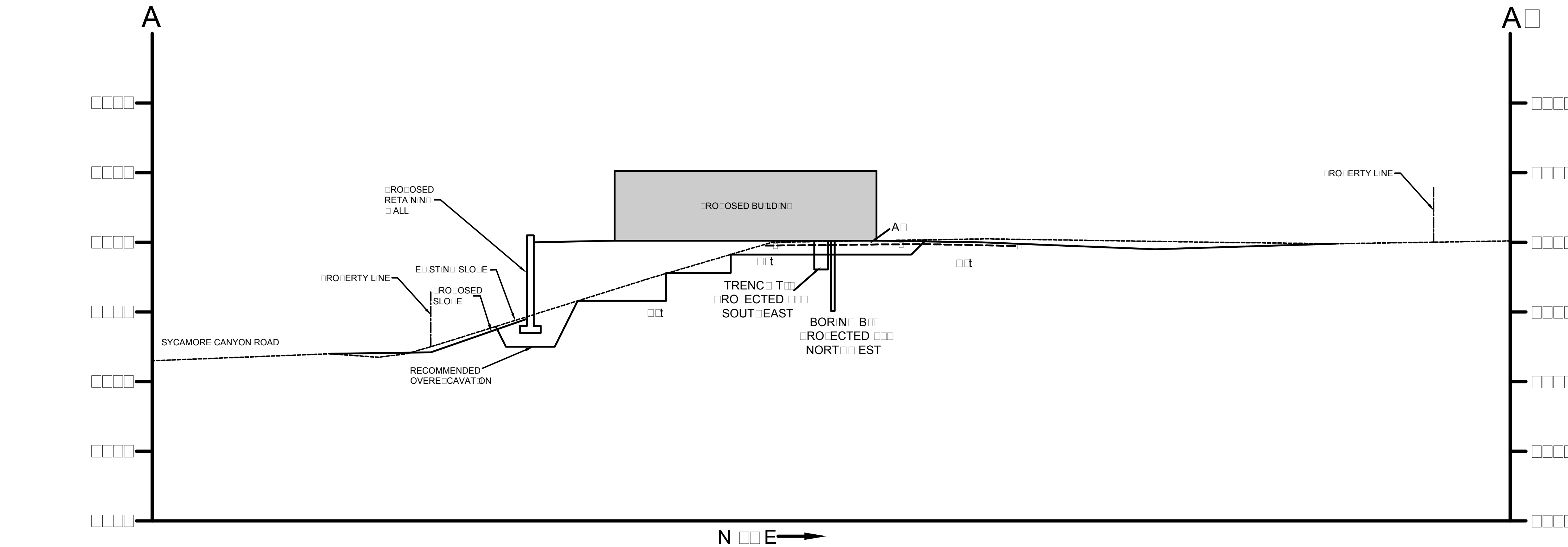
DRAWN: [illegible]LL

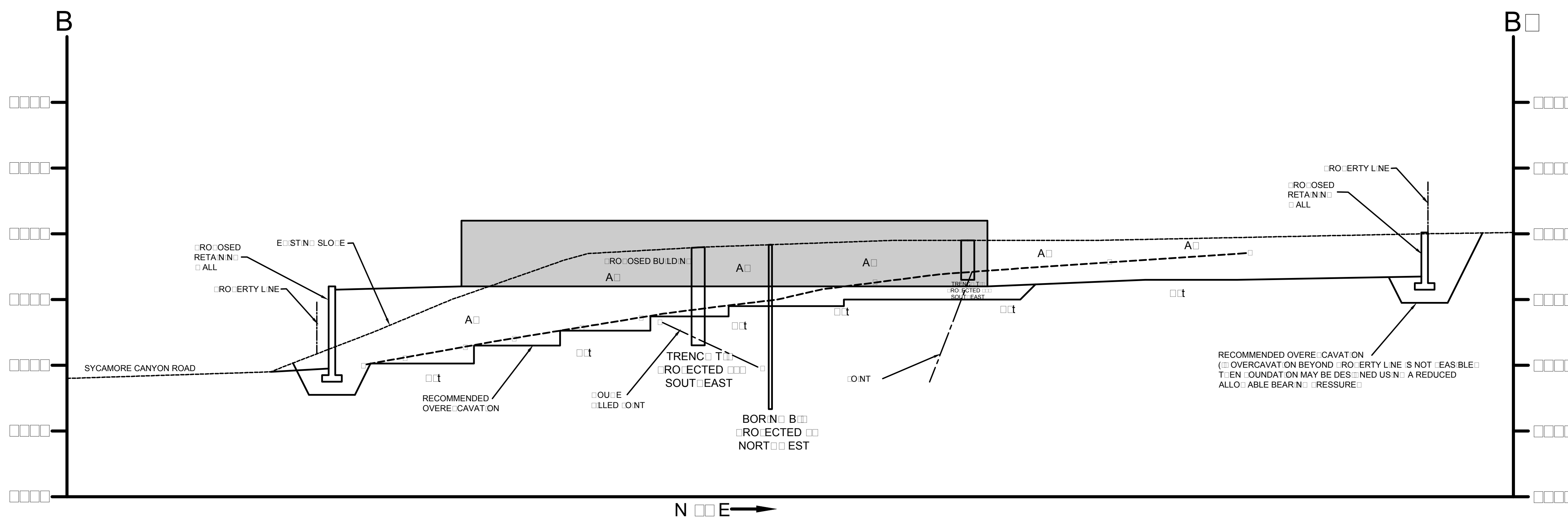
CHKD: RGT

SCG PROJECT [illegible]

PLATE 3

SOUTHERN CALIFORNIA GEOTECHNICAL





□EOTEC□N□CAL LE□END

A□□Arti□icial □ill

□□t □Val Verde □ormation Bedroc□

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CROSS-SECTION A-A' AND B-B'

□RO□OSED RETA□L DEVELO□MENT

R□VERS□DE□CAL□□ORN□A

SCALE□□" □ □□□

DRA□ N□DR□
C□□D□R□T

SC□ □RO□ECT
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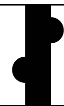
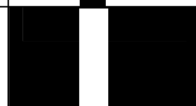
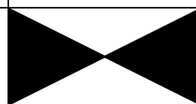
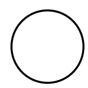
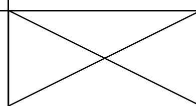
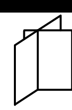
PLATE 4

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 17G134-3
PROJECT: Proposed Retail Development
LOCATION: Riverside, California

DRILLING DATE: 11/10/17
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daryl Kas

WATER DEPTH: Dry
CAVE DEPTH: 9 feet
READING TAKEN: At Completion

SURFACE ELEVATION: 1370.5 feet MSL

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
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
					FILL: Light Brown coarse Gravel, trace to little fine to coarse Sand, very dense-dry							
							1					
		67/10"				111	2					
					VAL VERDE FORMATION BEDROCK: Light Brown fine to coarse grained Tonalite Bedrock, friable, slightly weathered, very dense-dry							
		100/6"				109	2					
5												
		50/3"					2					
		50/3"					1					
10												

Boring Terminated at 10'

TBL 17G134.GPJ SOCALGEO.GDT 12/11/17

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 17G134-3
PROJECT: Proposed Retail Development
LOCATION: Riverside, California

DRILLING DATE: 11/10/17
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daryl Kas

WATER DEPTH: Dry
CAVE DEPTH: 5.5 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1370.5 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					VAL VERDE FORMATION BEDROCK: Light Gray fine to coarse grained Tonalite Bedrock, friable, slightly weathered, very dense-dry to damp							
		50/3"					1					Disturbed Sample
		50/5"					1					
5												
		66/9"					3					
		50/2"										No Sample Recovered
10					Boring Terminated at 10'							

TBL 17G134.GPJ SOCALGEO.GDT 12/11/17

TEST BORING LOG

BORING NO. B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 17G134-3
PROJECT: Proposed Retail Development
LOCATION: Riverside, California

DRILLING DATE: 11/10/17
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daryl Kas

WATER DEPTH: Dry
CAVE DEPTH: 13.5 feet
READING TAKEN: At Completion

SURFACE ELEVATION: 1368 feet 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
					FILL: Gray Brown Silty fine to coarse Sand, trace fine Gravel, medium dense-damp							
	X	38				111	4					
	X	21				115	3					
5	X	28				108	4					
					FILL: Brown fine to coarse Sand, trace to little Silt, loose-damp							
	X	6				98	3					
					VAL VERDE FORMATION BEDROCK: Light Gray fine to coarse grained Tonalite Bedrock, friable, weathered, dense to very dense-dry							
10	X	48				121	1					
15	X	50/3"					1					
20	X	50/4"					1					
25	X	50/3"					1					

Boring Terminated at 25'

TBL 17G134.GPJ SOCALGEO.GDT 12/11/17

BORING NO. B-4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 17G134-3
PROJECT: Proposed Retail Development
LOCATION: Riverside, California

DRILLING DATE: 11/10/17
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daryl Kas

WATER DEPTH: Dry
CAVE DEPTH: 8.5 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1367 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					FILL: Brown Silty fine to coarse Sand, loose to medium dense-damp							
	X	29				106	4					
	X	10				103	5					
5	X	9				105	2					
	X	6			@ 7 to 8 feet, very loose to loose	94	5					
	X	7			ALLUVIUM: Brown Silty fine to medium Sand, little coarse Sand, loose-damp	93	4					
10												
					VAL VERDE FORMATION BEDROCK: Light Gray fine to coarse grained Tonalite Bedrock, friable, highly weathered, very dense-dry to damp							
	X	69/"				103	3					
15												

Boring Terminated at 15'

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 17G134-3
PROJECT: Proposed Retail Development
LOCATION: Riverside, California

DRILLING DATE: 11/10/17
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daryl Kas

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1365.5 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					VAL VERDE FORMATION BEDROCK: Light Gray Brown fine to coarse grained Tonalite Bedrock, friable, slightly weathered, very dense-dry							
	X	50/5"					2					
	X	67/9"					2					
5												
	X	50/5"					2					
	X	50/4"					1					
10												
	X	50/5"					1					
15												
					Boring Terminated at 15'							

TBL 17G134.GPJ SOCALGEO.GDT 12/11/17

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. T-1

□OB NO□□□□□ □□□□□	E□U□□MENT USED□Bac□□oe	□ ATER DE□T□□Dry
□RO□ECT□□roposed Retail De□elopment	LO□□□ED BY□Daryl □as	SEE□A□E DE□T□□Dry
LOCAT□ON□Ri□erside□CA	OR□ENTAT□ON□N □□ □	READ□N□S TA□EN□At Completion
DATE□□□□□□□□□□□	TO□ O□ TRENC□ ELEVAT□ON□□□□□□□	

DE□T□	SAM□LE	DRY DENS□TY (□C□)	MO□STURE (□ □)	EART□ MATER□ALS DESCR□□T□ON
	b		□	A□□LL□Bro□n Silty □ine to coarse Sand□little □ine to coarse □ra□el□trace □lastic □ra□ments□loose to medium dense □dry
	b		□	B□VAL VERDE □ORMAT□ON BEDROC□□Li□□t □ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□□ery dense □ dry
	b		□	
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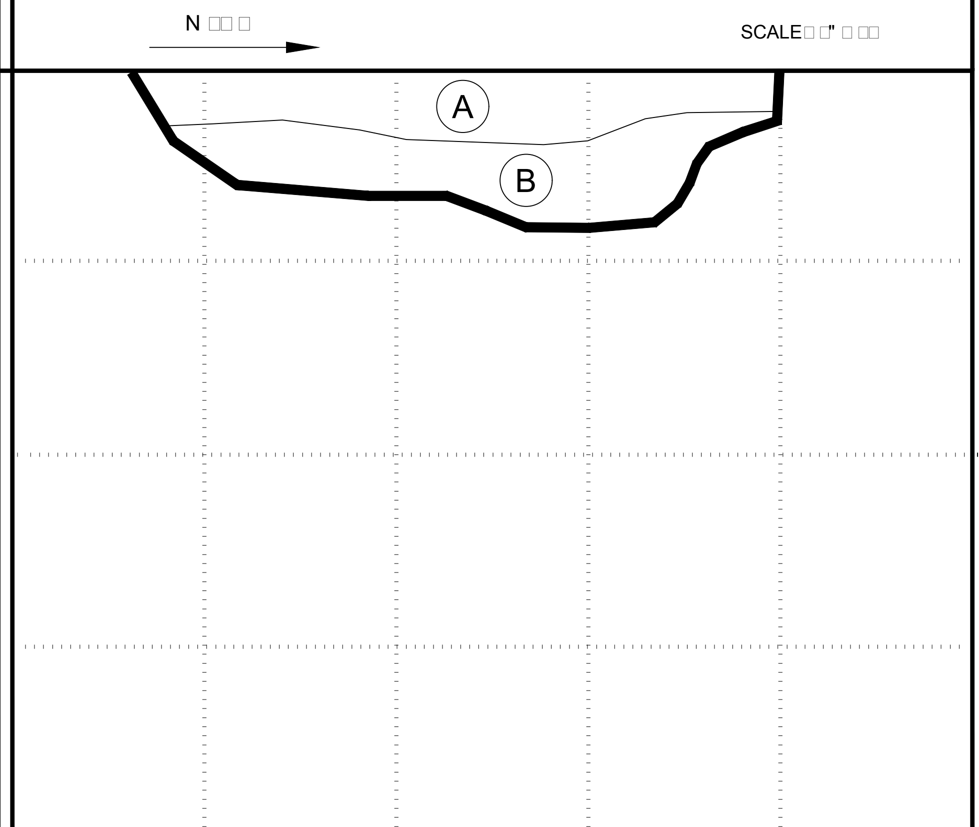

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TRENCH LOG

PLATE B-6

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
T-2

□OB NO□□□□□ □□□□□	E□U□□MENT USED□Bac□□oe	□ ATER DE□T□□Dry
□RO□ECT□□roposed Retail De□elopment	LO□ □ED BY□Daryl □as	SEE□A□E DE□T□□Dry
LOCAT□ON□Ri□erside□CA	OR□ENTAT□ON□N □□ □	READ□N□S TA□EN□At Completion
DATE□□□□□□□□□□□	TO□ O□ TRENC□ ELEVAT□ON□□□□□□□	

DE□T□	SAM□LE	DRY DENS□TY (□C□□	MO□STURE (□ □	EART□ MATER□ALS DESCR□□T□ON
	b		□	A□□□LL□□ray Bro□n Silty □ine to coarse Sand□trace to little □ine to coarse □ra□el□loose □dry
	b		□	B□VAL VERDE □ORMAT□ON BEDROC□□Dar□ □ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□ointed□□ery dense □dry
	b		□	
□				□oint□N□□E□□□N□
	b		□	
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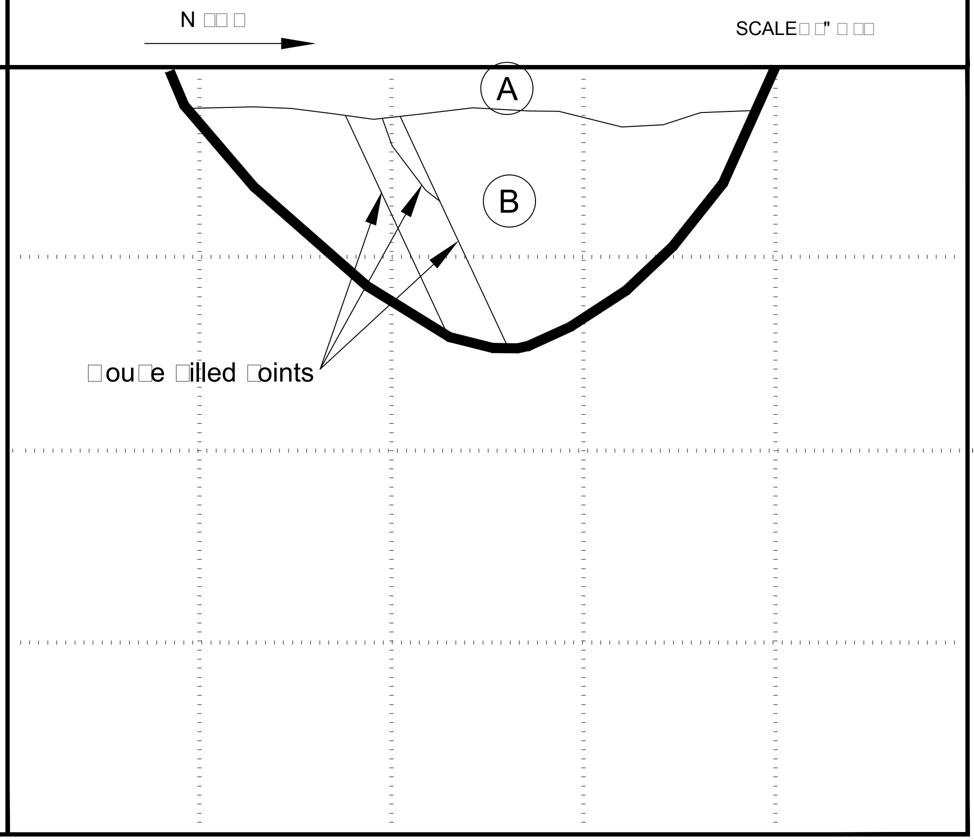

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TRENCH LOG

PLATE B-7

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. T-3

□OB NO□□□□□ □□□□□	E□U□□MENT USED□Bac□□oe	□ ATER DE□T□□Dry
□RO□ECT□□roposed Retail De□elopment	LO□ □ED BY□Daryl □as	SEE□A□E DE□T□□Dry
LOCAT□ON□Ri□erside□CA	OR□ENTAT□ON□N □□ □	READ□N□S TA□EN□At Completion
DATE□□□□□□□□□□	TO□ O□ TRENC□ ELEVAT□ON□□□□□□□	

DE□T□	SAM□LE	DRY DENS□TY (□C□□)	MO□STURE (□ □)	EART□ MATER□ALS DESCR□□T□ON
	b		□	A□□□LL□Bro□n Silty □ine to coarse Sand□little □ine to coarse □ra□el□ abundant □lastic □ra□ments□loose □dry
	b		□	B□□□LL□□ray Bro□n Silty □ine to coarse Sand□trace □ine □ra□el□medium dense □damp
□	b		□	
				C□□□LL□□ray Bro□n □ine to coarse Sand□trace Silt□abundant Debris (Concrete□Bric□□Tiles□medium dense □dry
□□	b		□	
	b		□	D□VAL VERDE □ORMAT□ON BEDROC□□Dar□ □ray to Li□□t □ray □ine to coarse □rained Tonalite Bedroc□□riable□sli□□tly □eat□ered□□ointed□ dense to □ery dense □dry
	b		□	
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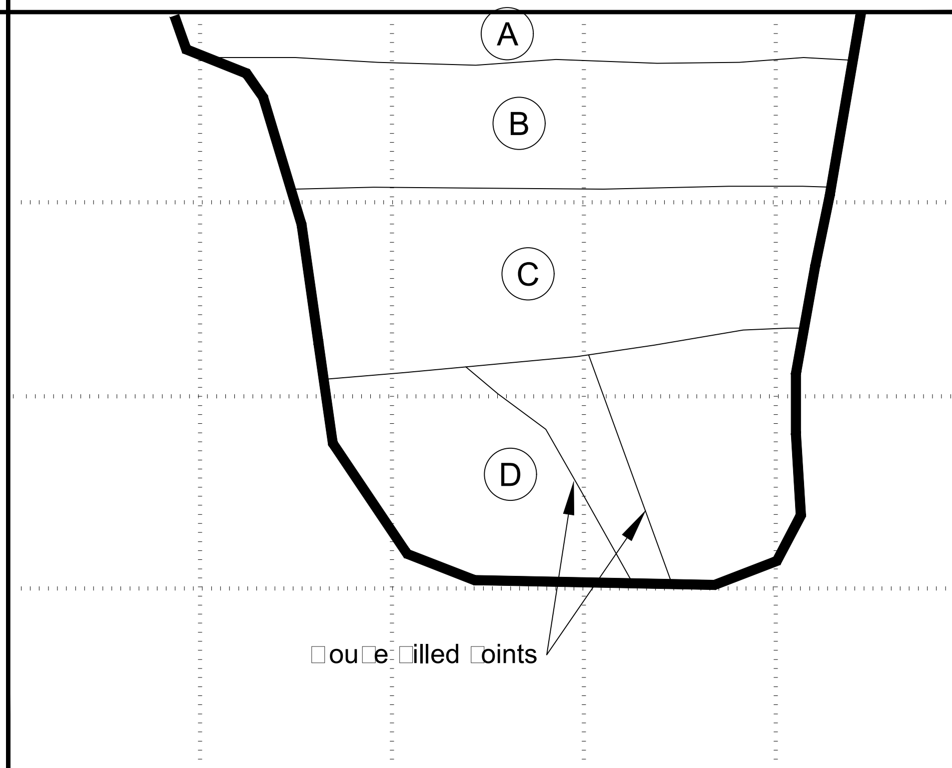

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TRENCH LOG

PLATE B-8

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
T-4

□OB NO□□□□□ □□□□□
□RO□ECT□□roposed Retail De□elopment
LOCAT□ON□Ri□erside□CA
DATE□□□□□□□□□□□

E□U□□MENT USED□Bac□□oe
LO□□□ED BY□Daryl □as
OR□ENTAT□ON□S □□E
TO□ O□ TRENC□ ELEVAT□ON□□□□□

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SEE□A□E DE□T□□Dry
READ□N□S TA□EN□At Completion

DE□T□	SAM□LE	DRY DENS□TY (□C□)	MO□STURE (□□	EART□ MATER□ALS DESCR□□T□ON
				A□□□LL□Bro□n Silty □ine to coarse Sand□loose □dry
	b		□	B□□□LL□□ray Bro□n □ra□elly □ine to coarse Sand□abundant Debris (Concrete□Asp□alt□Metal□Tile□ □ra□ments□Debris up to □ □eet in diameter□loose □dry
□	b		□	
				C□□□LL□□ray Bro□n Silty □ine to coarse Sand□abundant Debris (Concrete□Asp□alt□Metal□□ra□ments□loose to medium dense dry
				D□□□LL□□ray Bro□n Silty □ine to coarse Sand□trace □ine □ra□el□medium dense □dry to damp
□□	b		□	E□VAL VERDE □ORMAT□ON BEDROC□□Dar□□ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□□ery dense □dry
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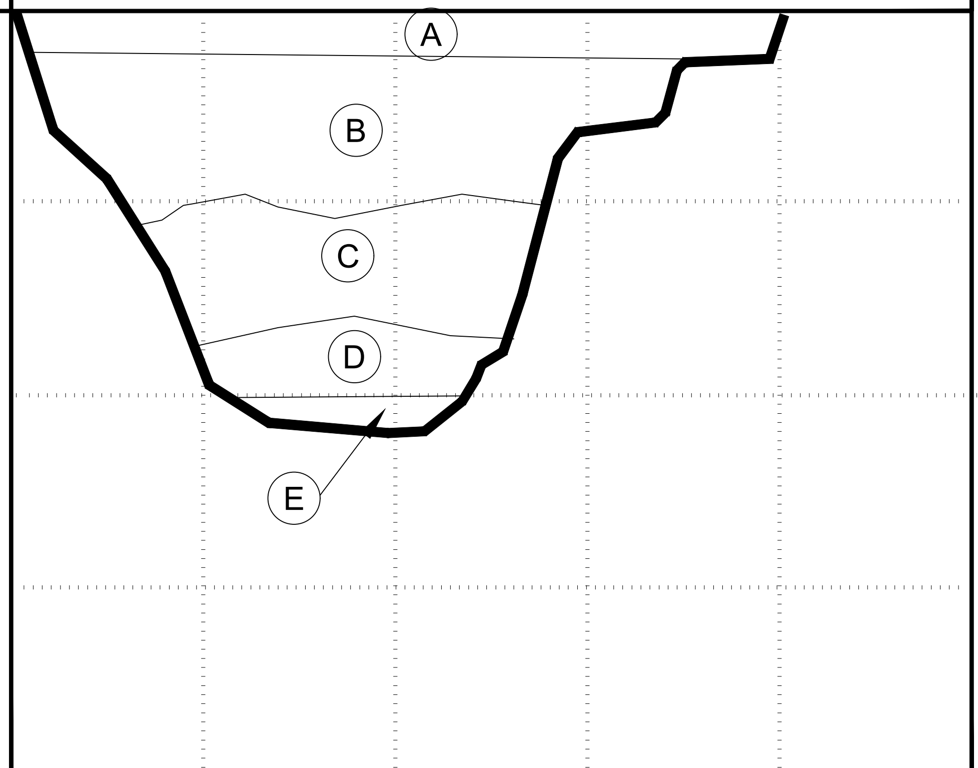

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TRENCH LOG

PLATE B-9

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
T-5

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□RO□ECT□□roposed Retail De□elopment	LO□□□ED BY□Daryl □as	SEE□A□E DE□T□□Dry
LOCAT□ON□Ri□erside□CA	OR□ENTAT□ON□N □□ □	READ□N□S TA□EN□At Completion
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DE□T□	SAM□LE	DRY DENS□TY (□C□□)	MO□STURE (□□	EART□ MATER□ALS DESCR□□T□ON
	b		□	A□□□LL□Bro□n Silty □ine to coarse Sand□abundant □ine to coarse □ra□el□ trace Asp□alt and Concrete □ra□ments□loose □dry
□	b		□	B□BASE□Crus□ed A□□re□ate Base (CAB□appro□imately □inc□es t□ic□□ C□VAL VERDE □ORMAT□ON BEDROC□□Li□□t □ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□ointed□□ery dense □dry □oint□N□□□ □□□SE
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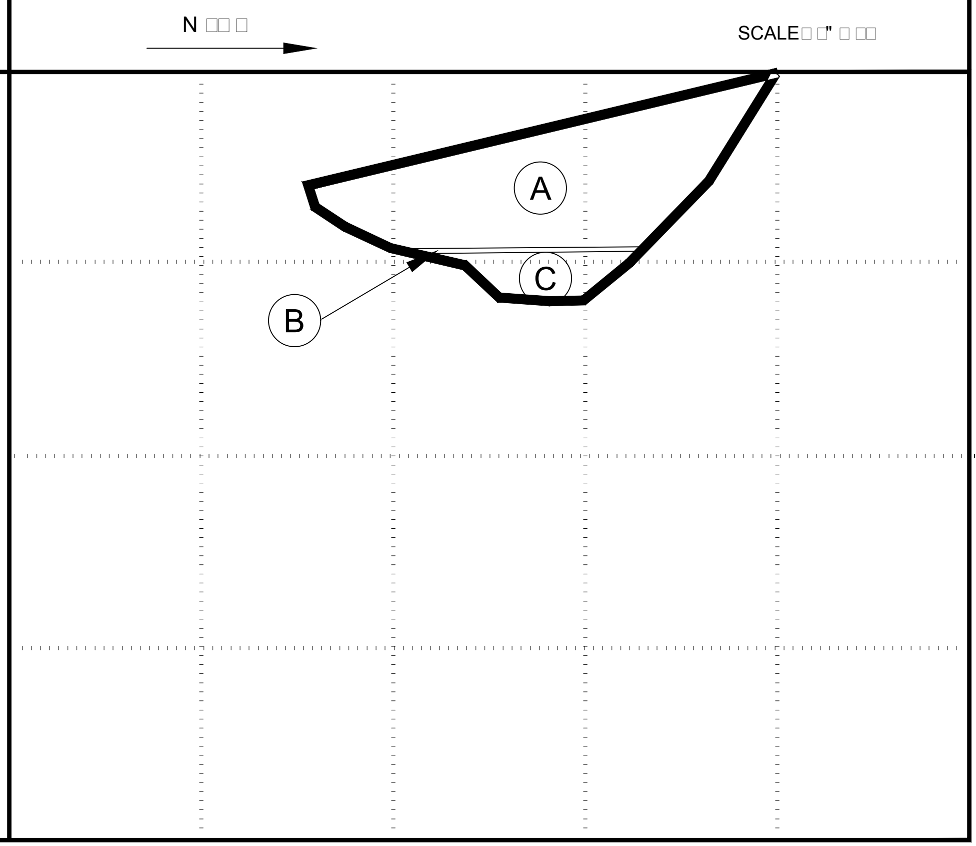

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TRENCH LOG

PLATE B-10

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
T-6

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□RO□ECT□□roposed Retail De□elopment	LO□ □ED BY□Daryl □as	SEE□A□E DE□T□□Dry
LOCAT□ON□Ri□erside□CA	OR□ENTAT□ON□N □□ □	READ□N□S TA□EN□At Completion
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DE□T□	SAM□LE	DRY DENS□TY (□C□□)	MO□STURE (□ □)	EART□ MATER□ALS DESCR□□T□ON
	b		□	A□□□LL□□ray Bro□n Silty □ine to coarse Sand trace □ine to coarse □ra□el□ Occasional Cobbles and Boulders□loose □dry
□	b		□	B□ALLUV□UM□Bro□n Silty □ine to coarse Sand□medium dense □dry
□□	b		□	C□VAL VERDE □ORMAT□ON BEDROC□□Dar□ □ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□□ery dense □ dry
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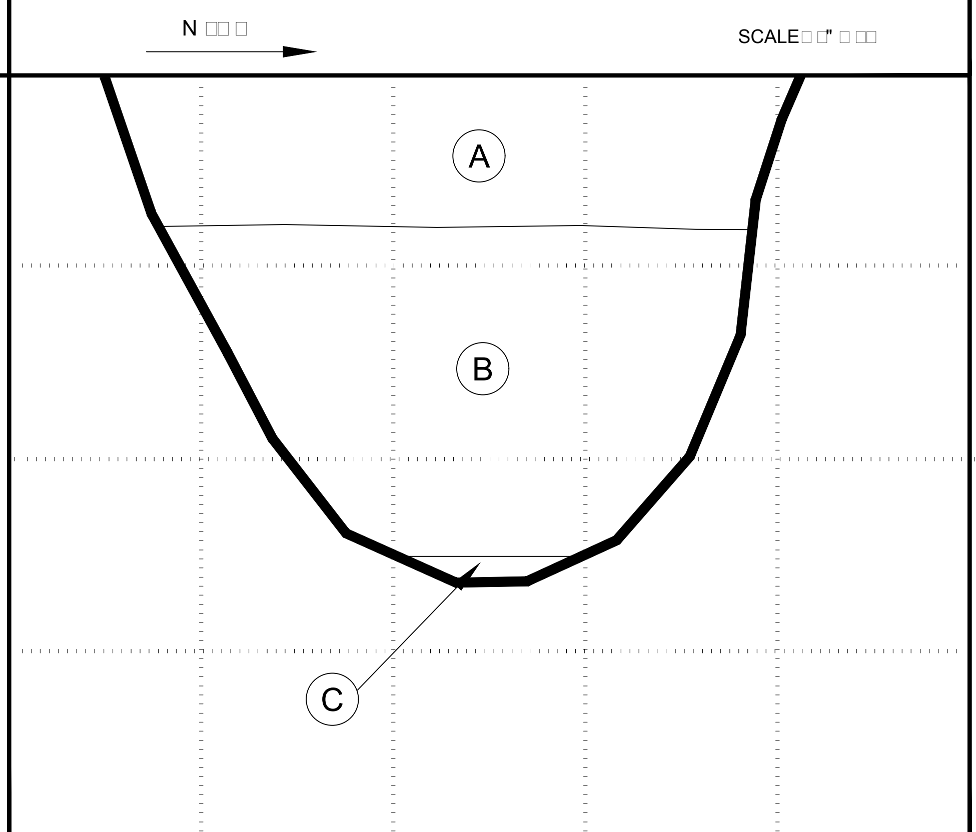

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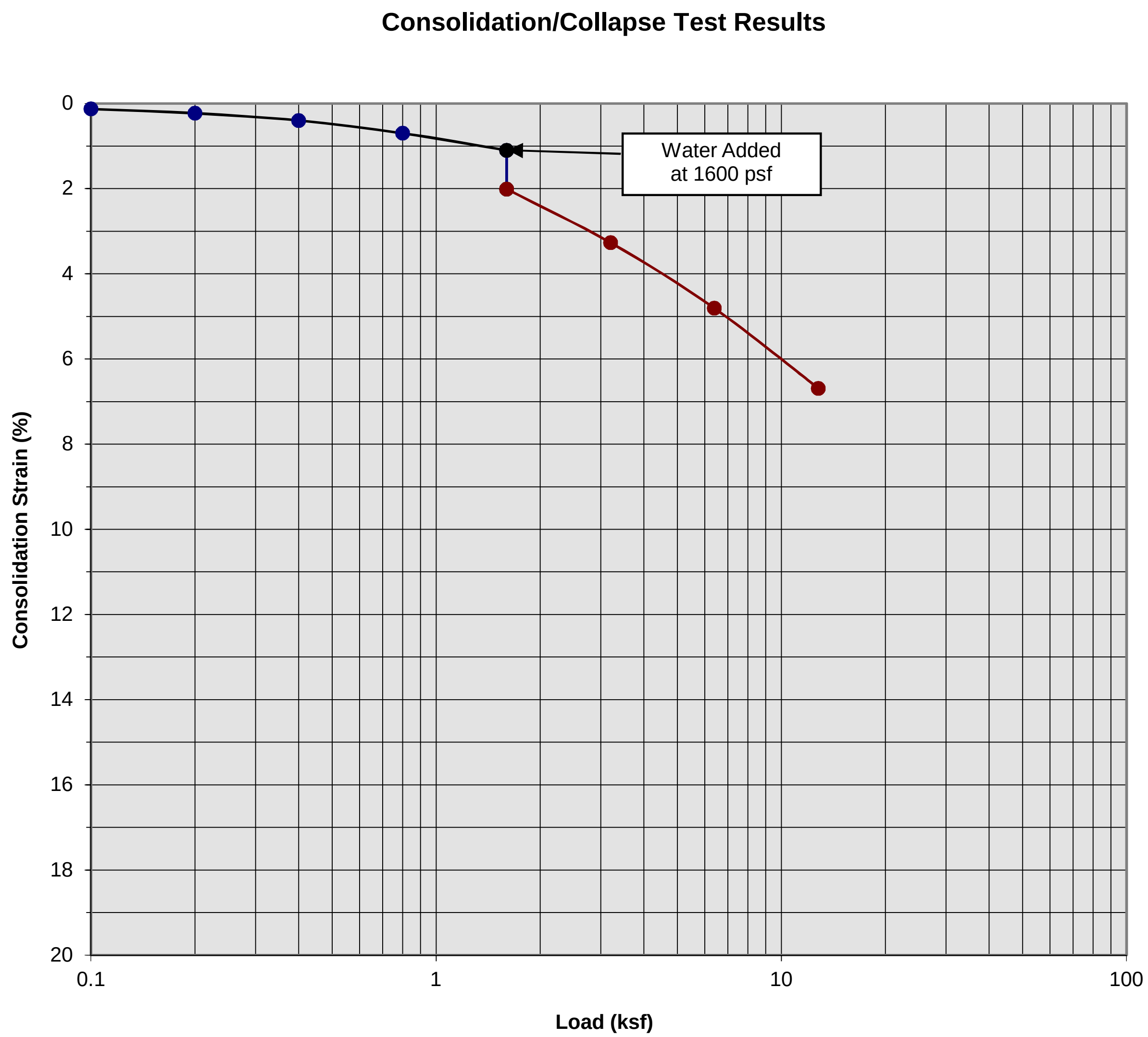
TRENCH LOG

PLATE B-11

APPENDIX C

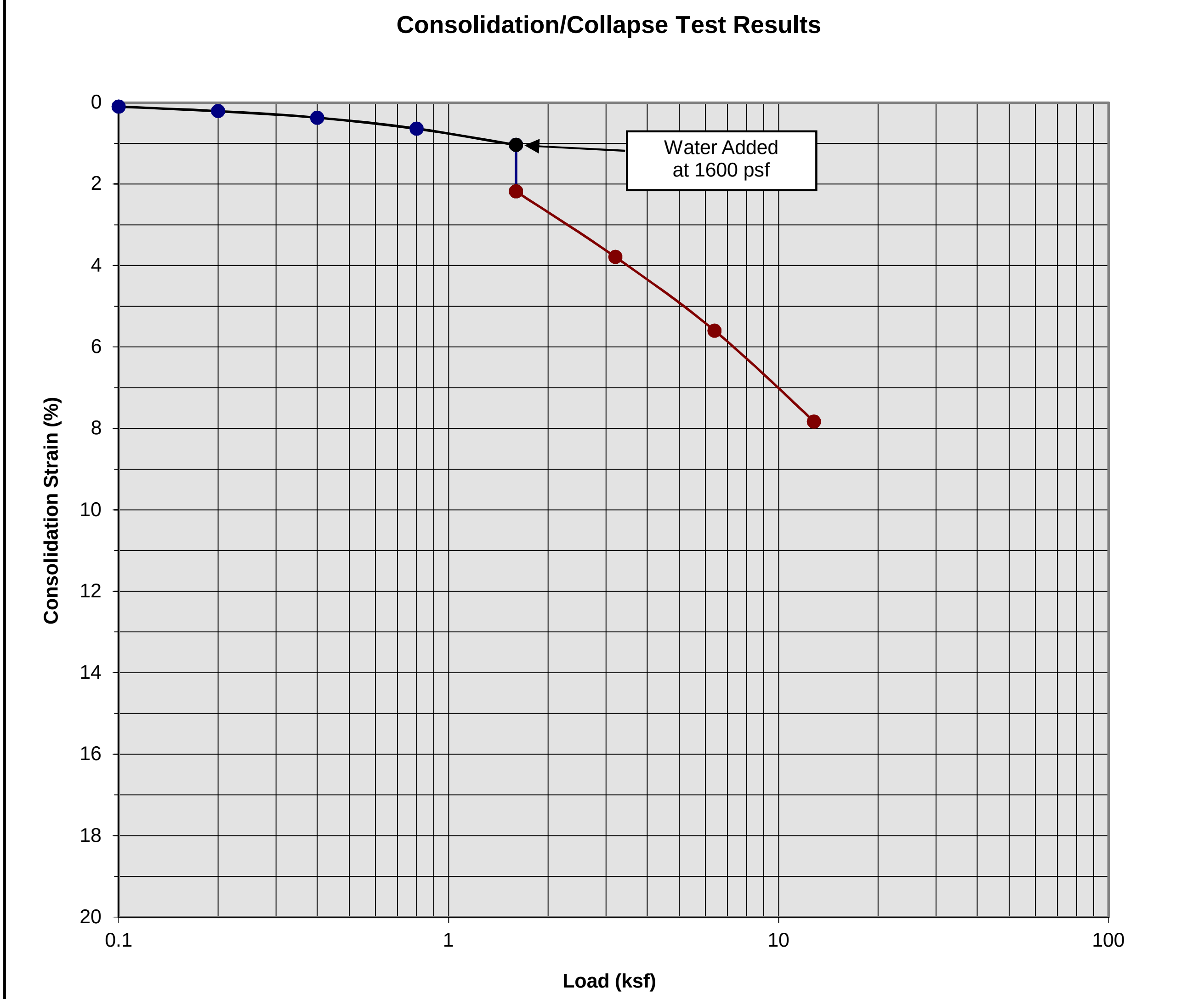


Classification: FILL: Gray Brown Silty fine to coarse Sand, trace fine Gravel

Boring Number:	B-3	Initial Moisture Content (%)	3
Sample Number:	---	Final Moisture Content (%)	11
Depth (ft)	3 to 4	Initial Dry Density (pcf)	115.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	124.4
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.91

Proposed Retail Development
Riverside, California
Project No. 17G134-3
PLATE C- 1

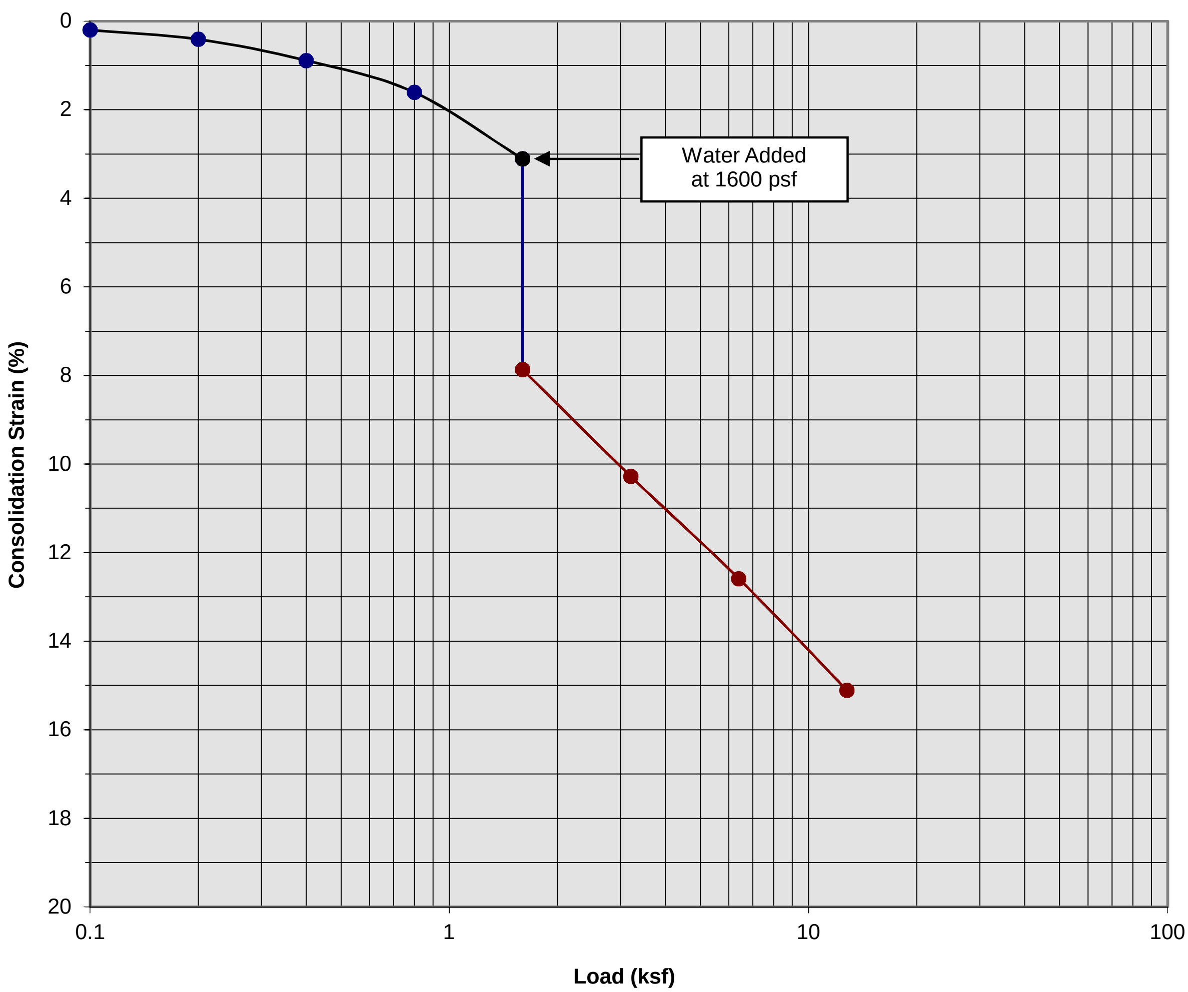
SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



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

Boring Number:	B-3	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	5 to 6	Initial Dry Density (pcf)	108.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.14

Consolidation/Collapse Test Results



Classification: FILL: Brown fine to coarse Sand, trace to little Silt

Boring Number:	B-3	Initial Moisture Content (%)	3
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	7 to 8	Initial Dry Density (pcf)	98.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	115.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	4.76

Proposed Retail Development
Riverside, California
Project No. 17G134-3
PLATE C- 3

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
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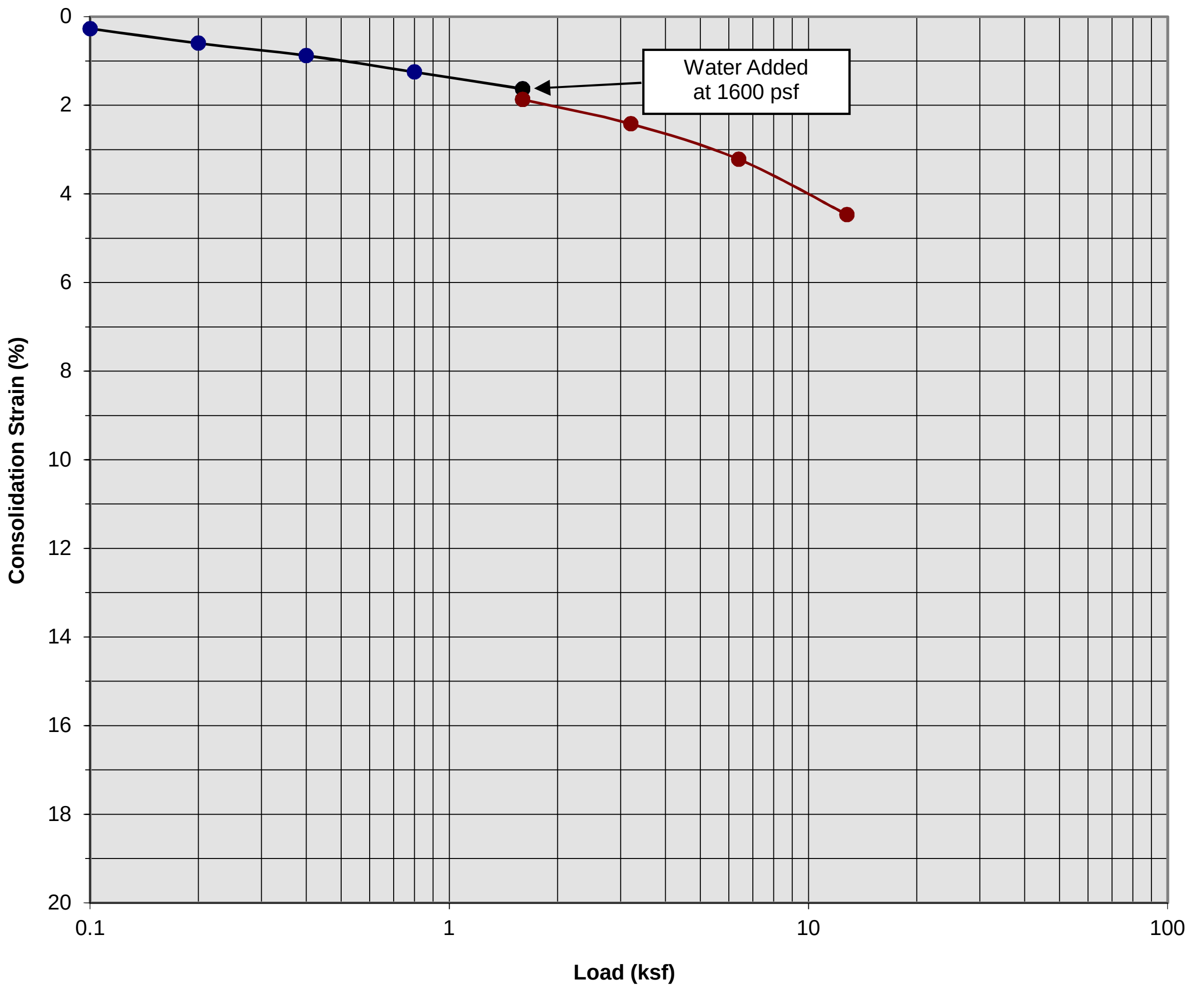
Consolidation/Collapse Test Results



Classification: Light Gray fine to coarse grained Tonalite Bedrock

Boring Number:	B-3	Initial Moisture Content (%)	1
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	9 to 10	Initial Dry Density (pcf)	120.4
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	125.4
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.24

Proposed Retail Development
Riverside, California
Project No. 17G134-3
PLATE C- 4

SoCalGeo
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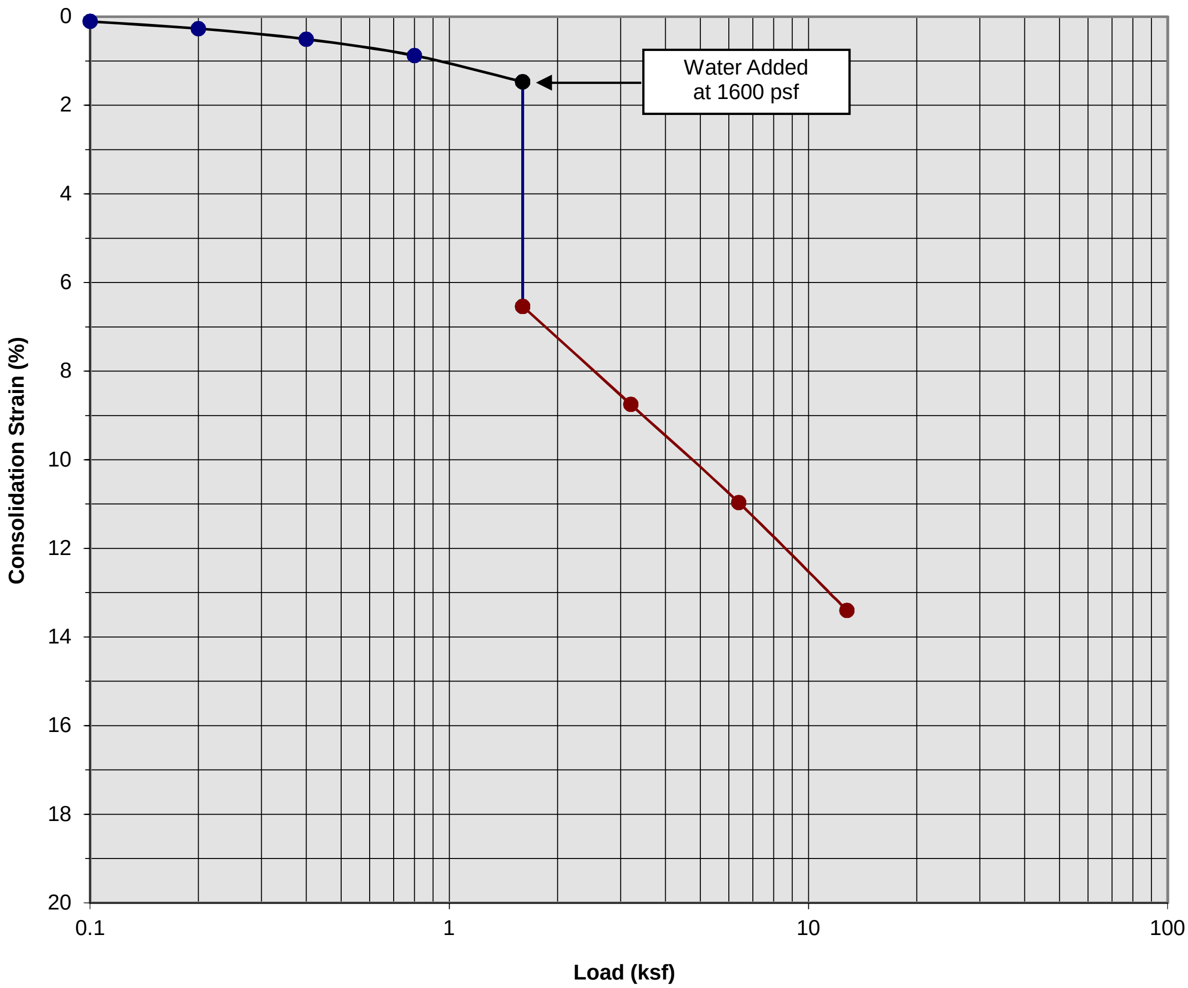
Consolidation/Collapse Test Results



Classification: FILL: Brown Silty fine to coarse Sand

Boring Number:	B-4	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	3 to 4	Initial Dry Density (pcf)	103.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	122.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	5.07

Proposed Retail Development
Riverside, California
Project No. 17G134-3
PLATE C- 5

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
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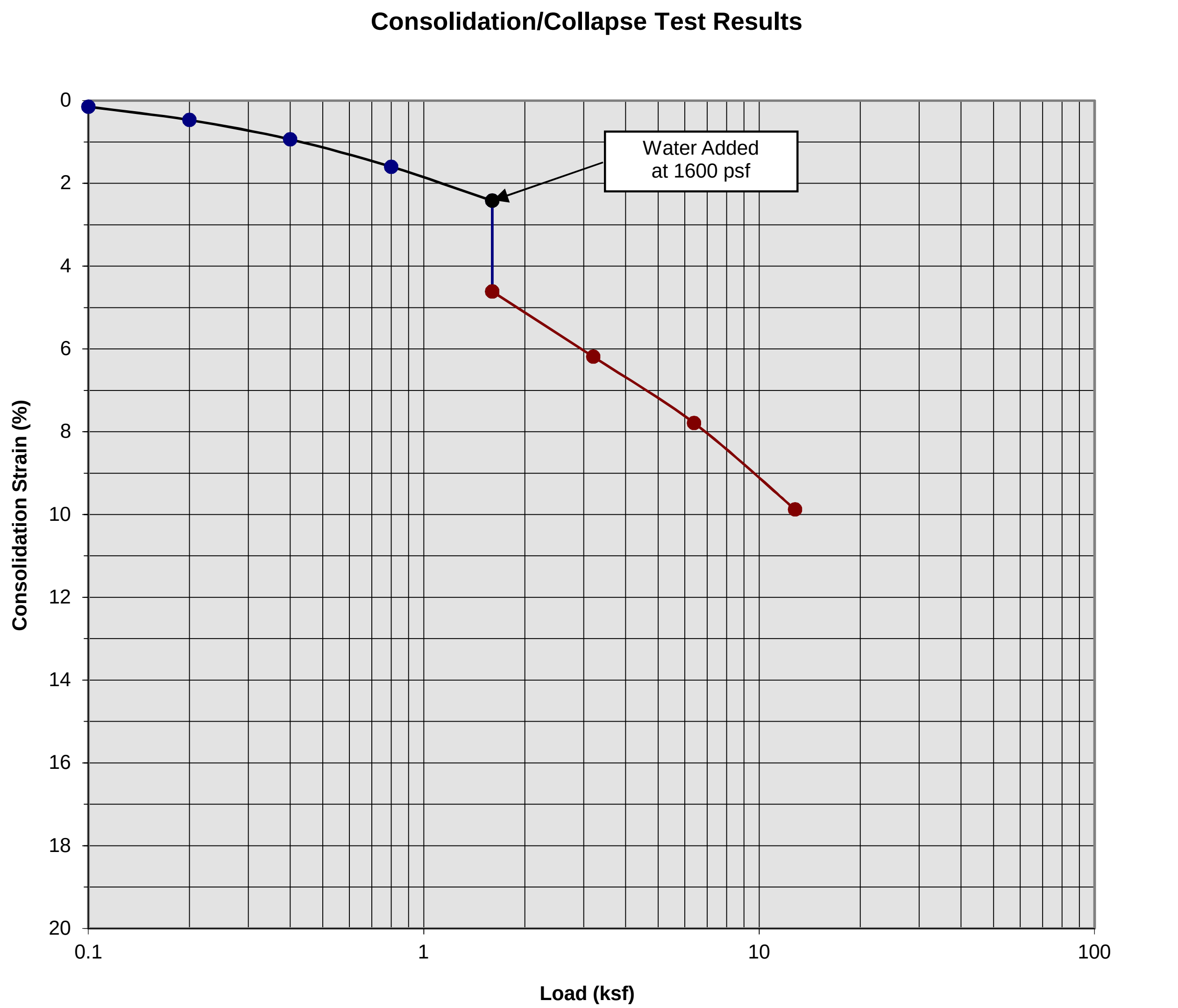

Classification: FILL: Brown Silty fine to coarse Sand

Boring Number:	B-4	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	11
Depth (ft)	5 to 6	Initial Dry Density (pcf)	105.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	119.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.19

Proposed Retail Development
Riverside, California
Project No. 17G134-3
PLATE C- 6

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
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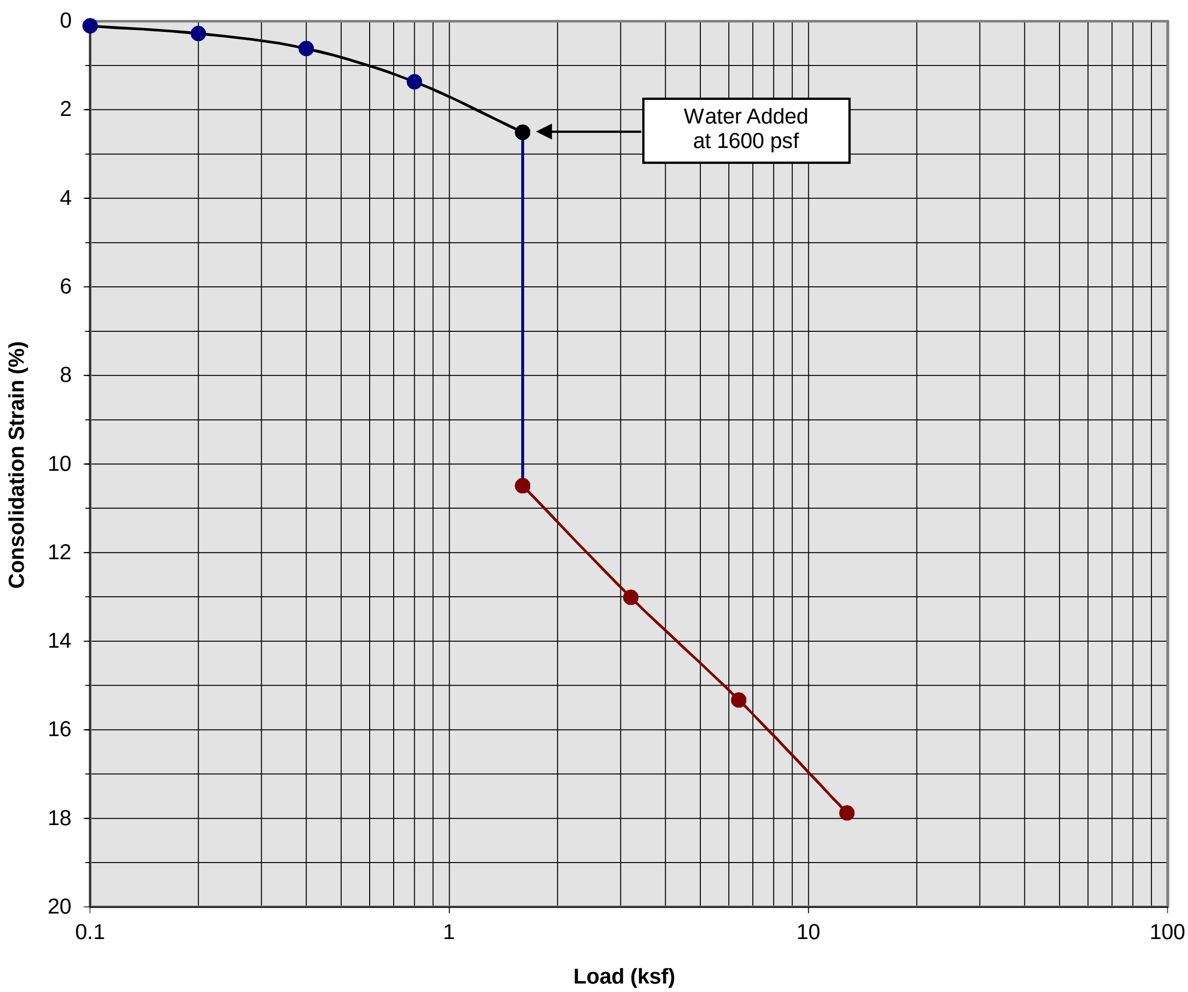
Consolidation/Collapse Test Results

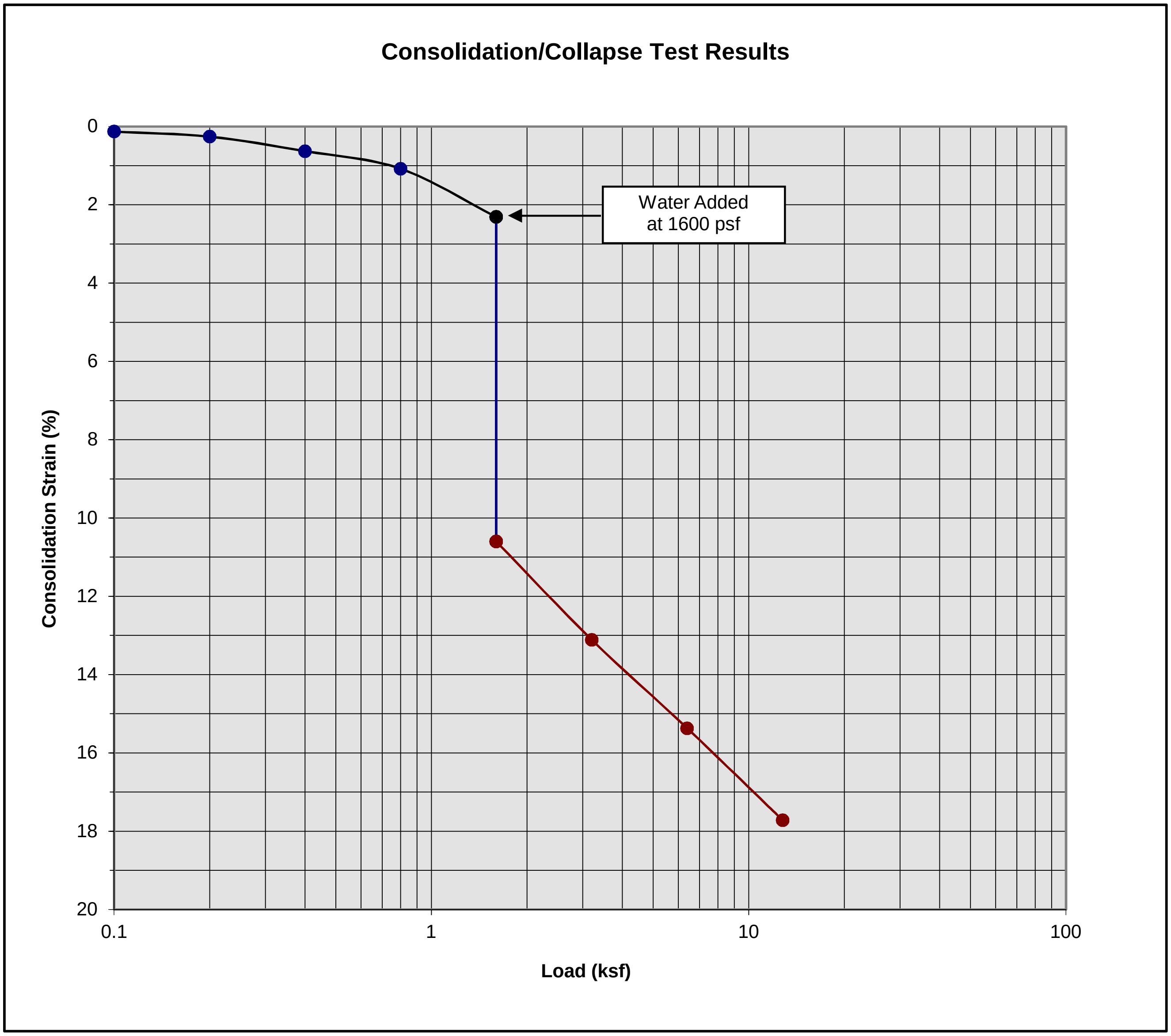


Classification: FILL: Brown Silty fine to coarse Sand

Boring Number:	B-4	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	13
Depth (ft)	7 to 8	Initial Dry Density (pcf)	95.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	7.98

Proposed Retail Development
Riverside, California
Project No. 17G134-3
PLATE C- 7

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Classification: Brown Silty fine to medium Sand, little coarse Sand

Boring Number:	B-4	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	9 to 10	Initial Dry Density (pcf)	93.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	121.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	8.29

Proposed Retail Development
Riverside, California
Project No. 17G134-3
PLATE C- 8

SOUTHERN CALIFORNIA GEOTECHNICAL
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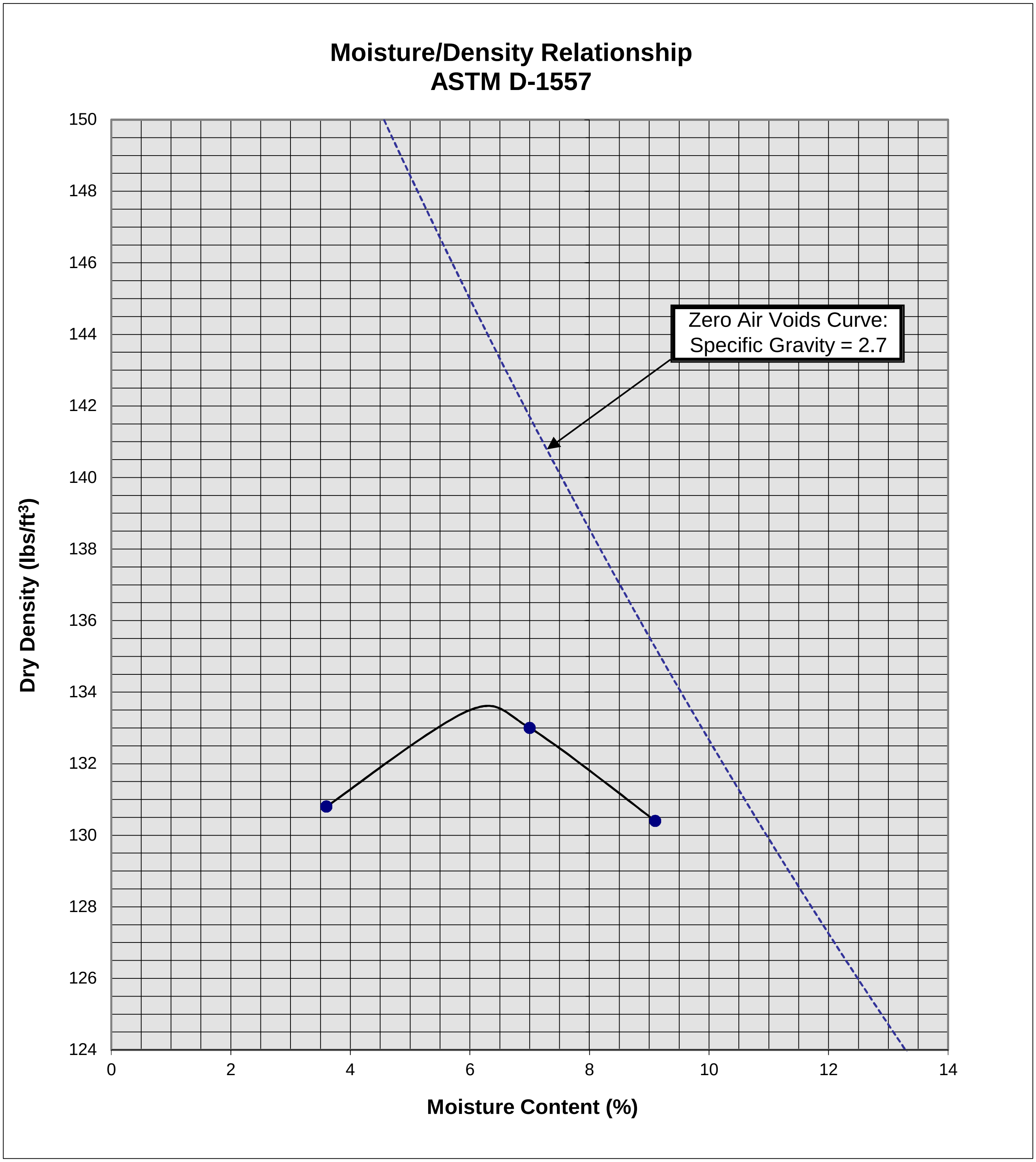

Soil ID Number	B-2 @ 0 to 5'
Optimum Moisture (%)	6
Maximum Dry Density (pcf)	133.5
Soil Classification	Derived from Crushed Bedrock: Light Gray fine to coarse Sand trace Gravel

Proposed Retail Development
Riverside, California
Project No. 17G134-3
PLATE C-9

SOUTHERN CALIFORNIA GEOTECHNICAL
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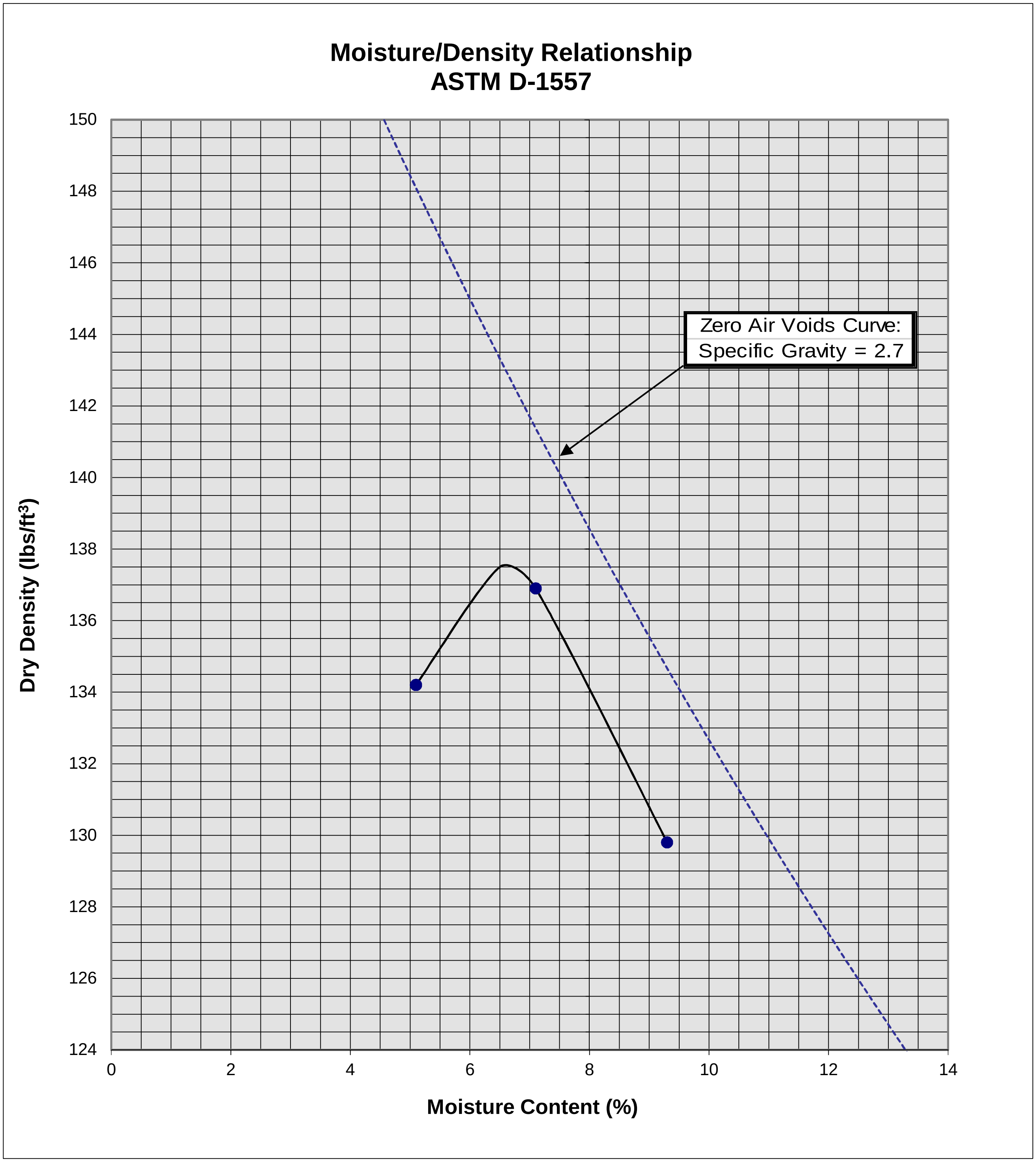

Soil ID Number	B-4 @ 0 to 5'
Optimum Moisture (%)	6.5
Maximum Dry Density (pcf)	137.5
Soil Classification	Brown Silty fine to coarse Sand

Proposed Retail Development
Riverside, California
Project No. 17G134-3
PLATE C-10

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APPENDIX D

GRADING GUIDE SPECIFICATIONS

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

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.

- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.

- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.

- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.

- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.

- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.

- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

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

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

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

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

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

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

Compacted Fills

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Foundations

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

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

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

Fill Slopes

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

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

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

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

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

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

Cut Slopes

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

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

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

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

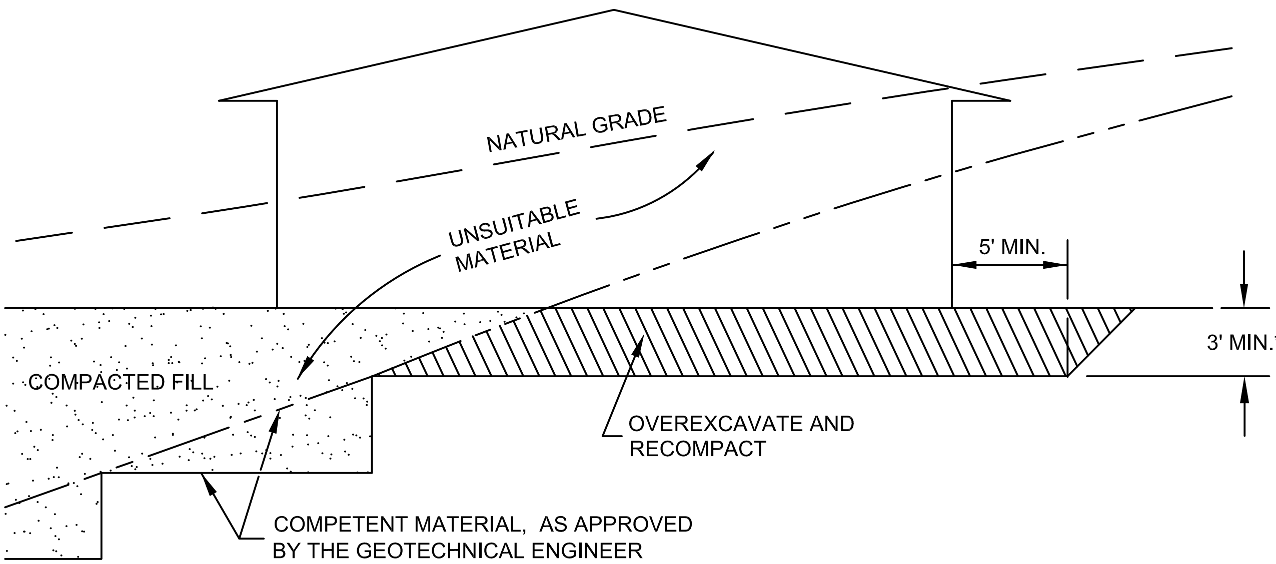
Subdrains

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

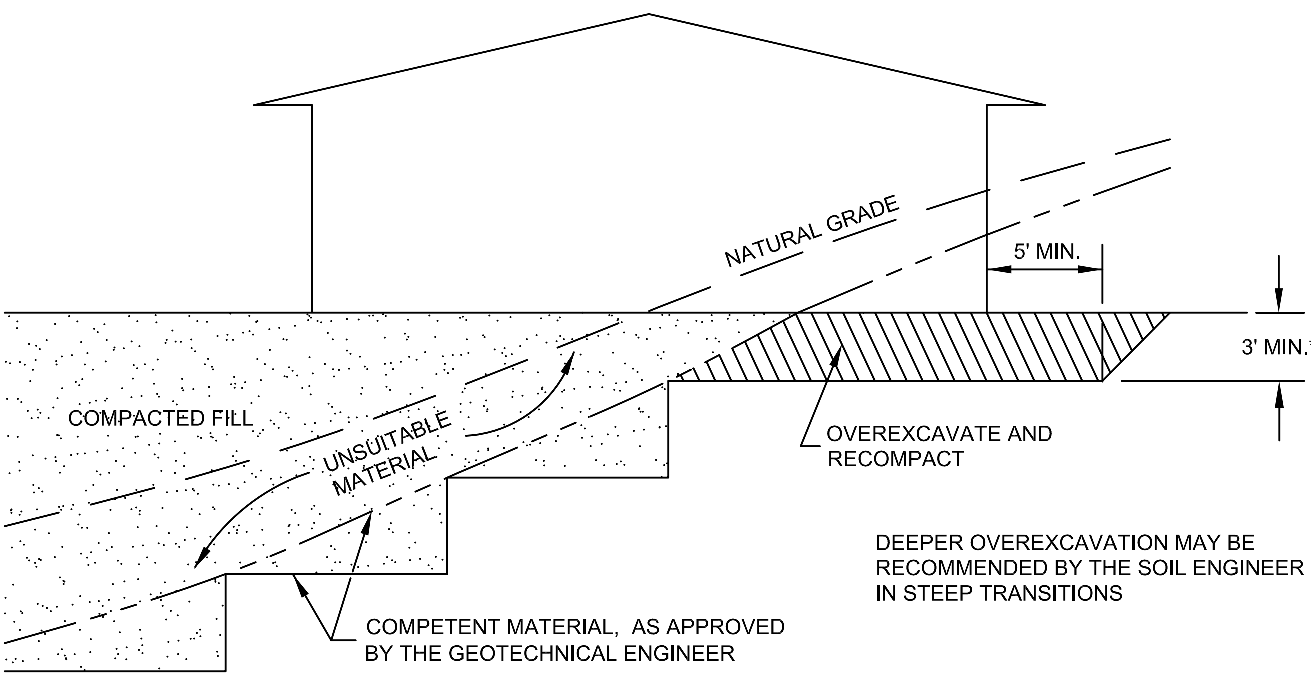
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

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

CUT LOT



CUT/FILL LOT (TRANSITION)



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

TRANSITION LOT DETAIL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

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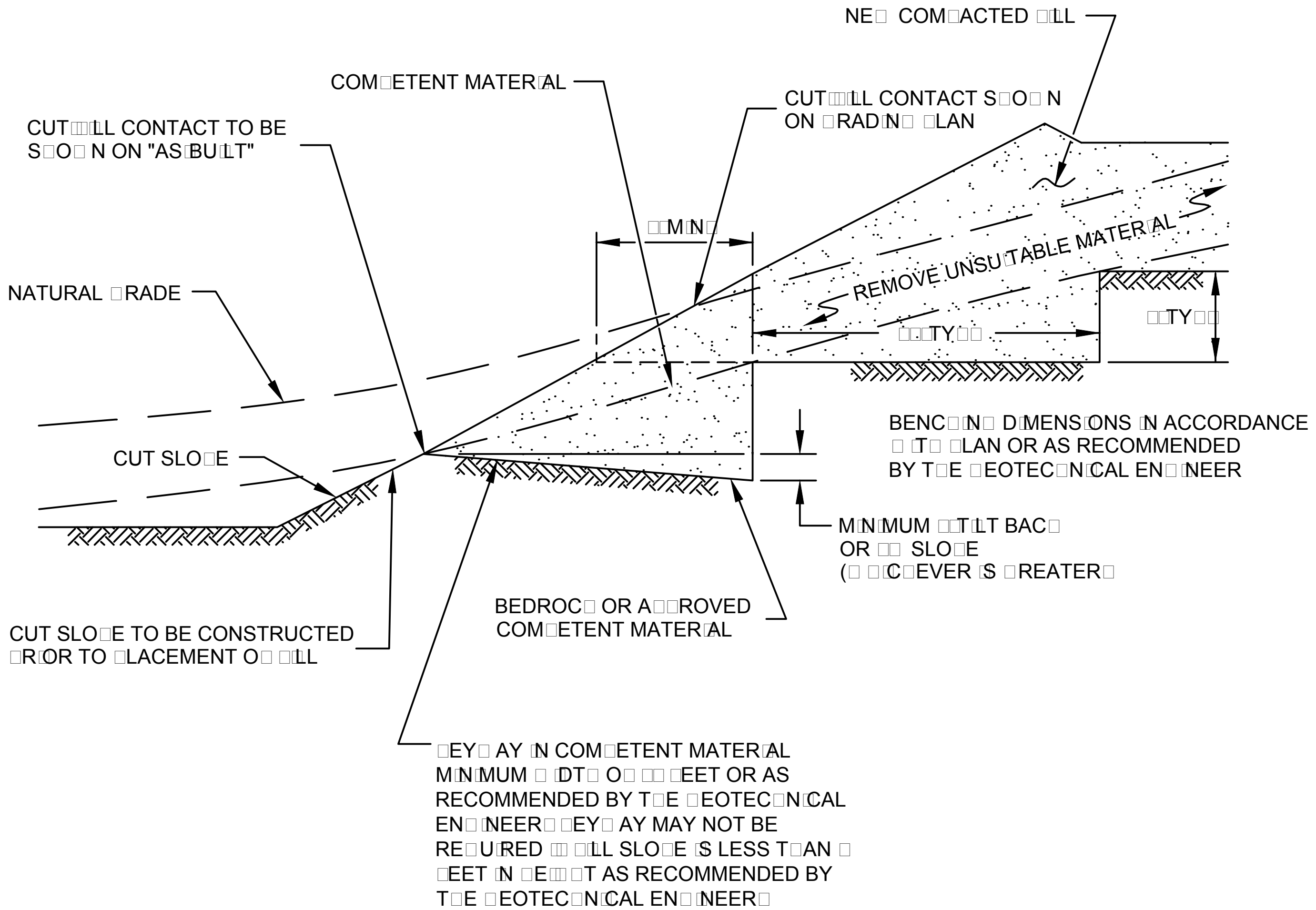


FILL ABOVE CUT SLOPE DETAIL

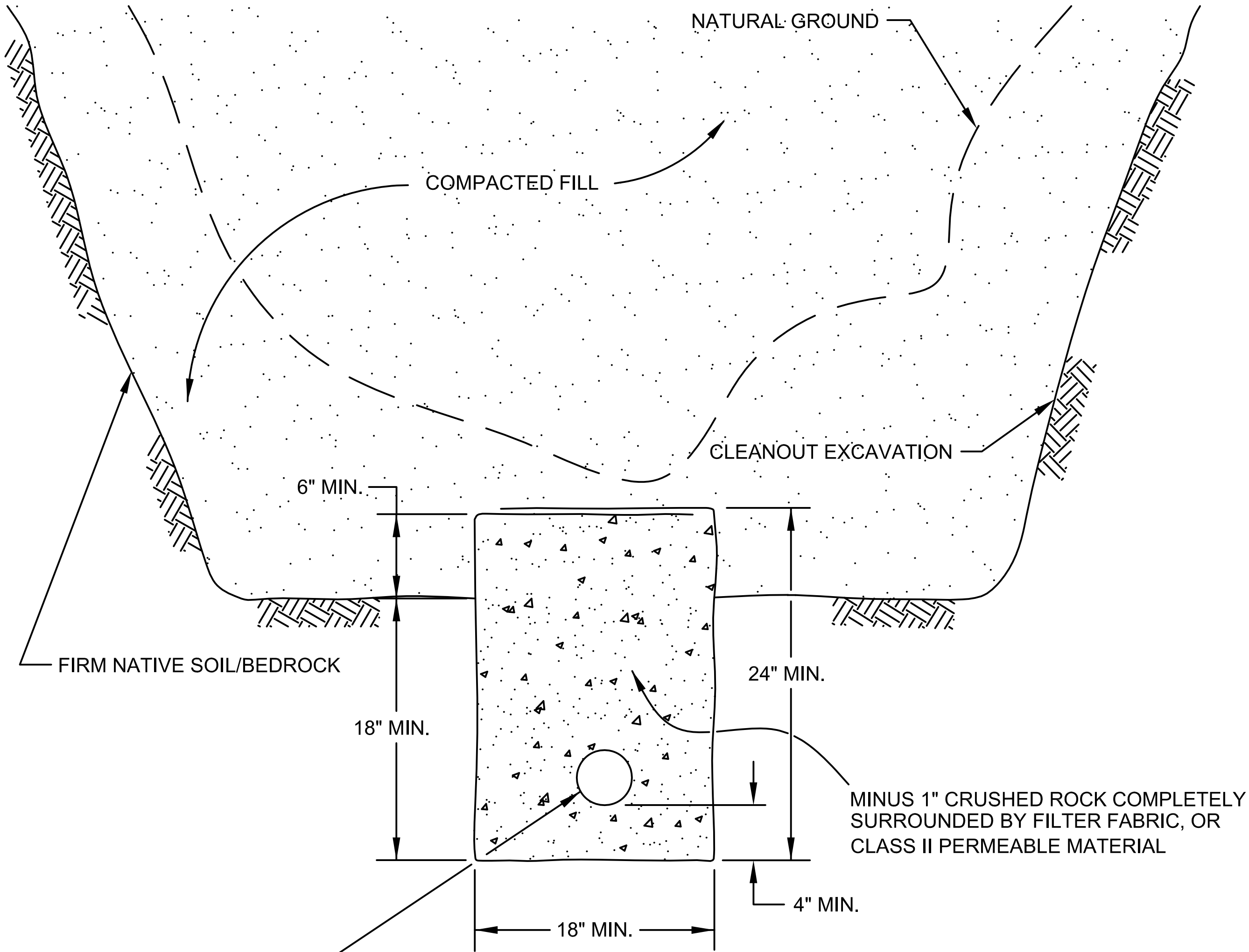
□RAD□N□ □U□DE S□EC□□□CAT□ONS

NOT TO SCALE

DRA□ N□ □AS
C□□D□□□M

PLATE D-2

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

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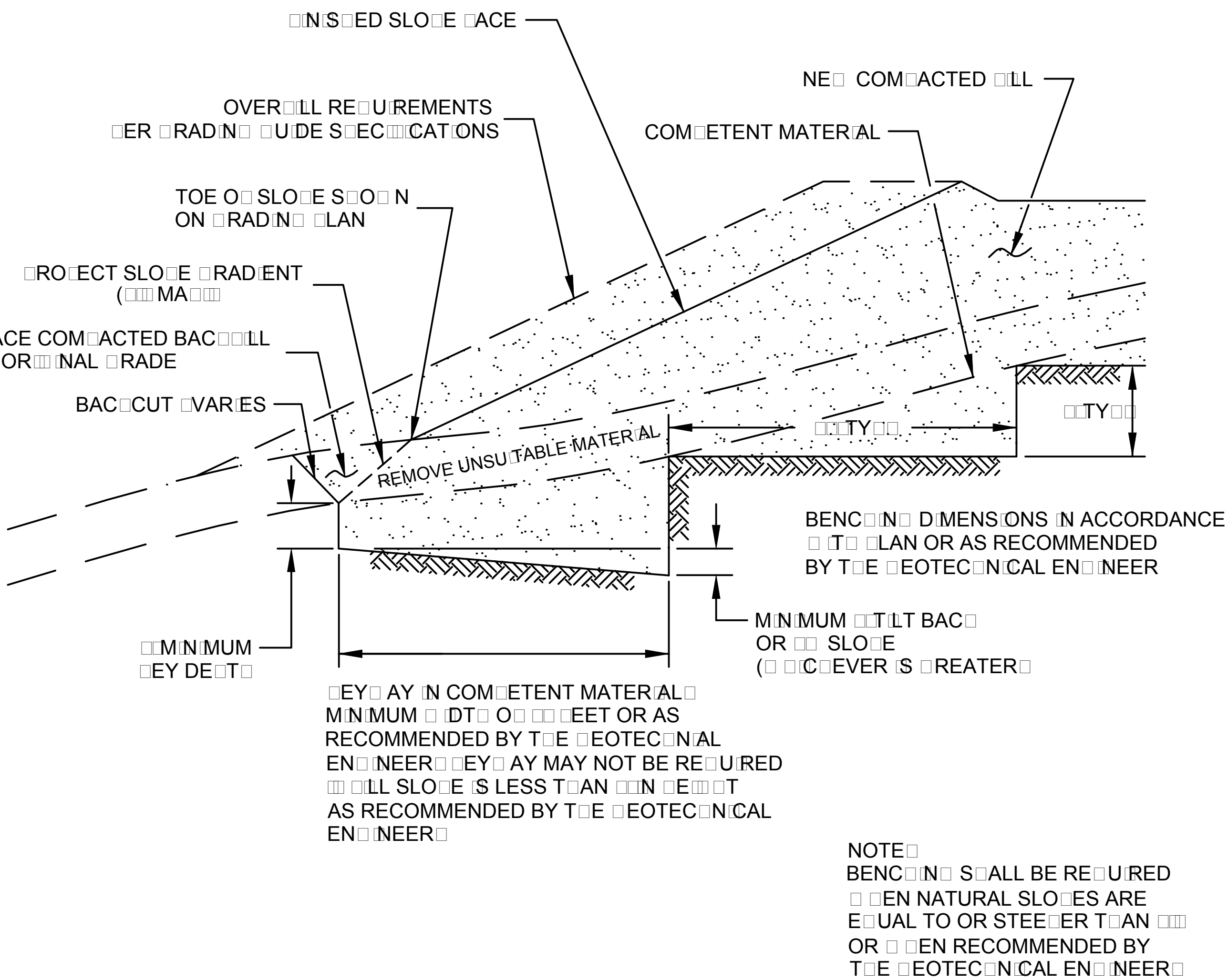


FILL ABOVE NATURAL SLOPE DETAIL

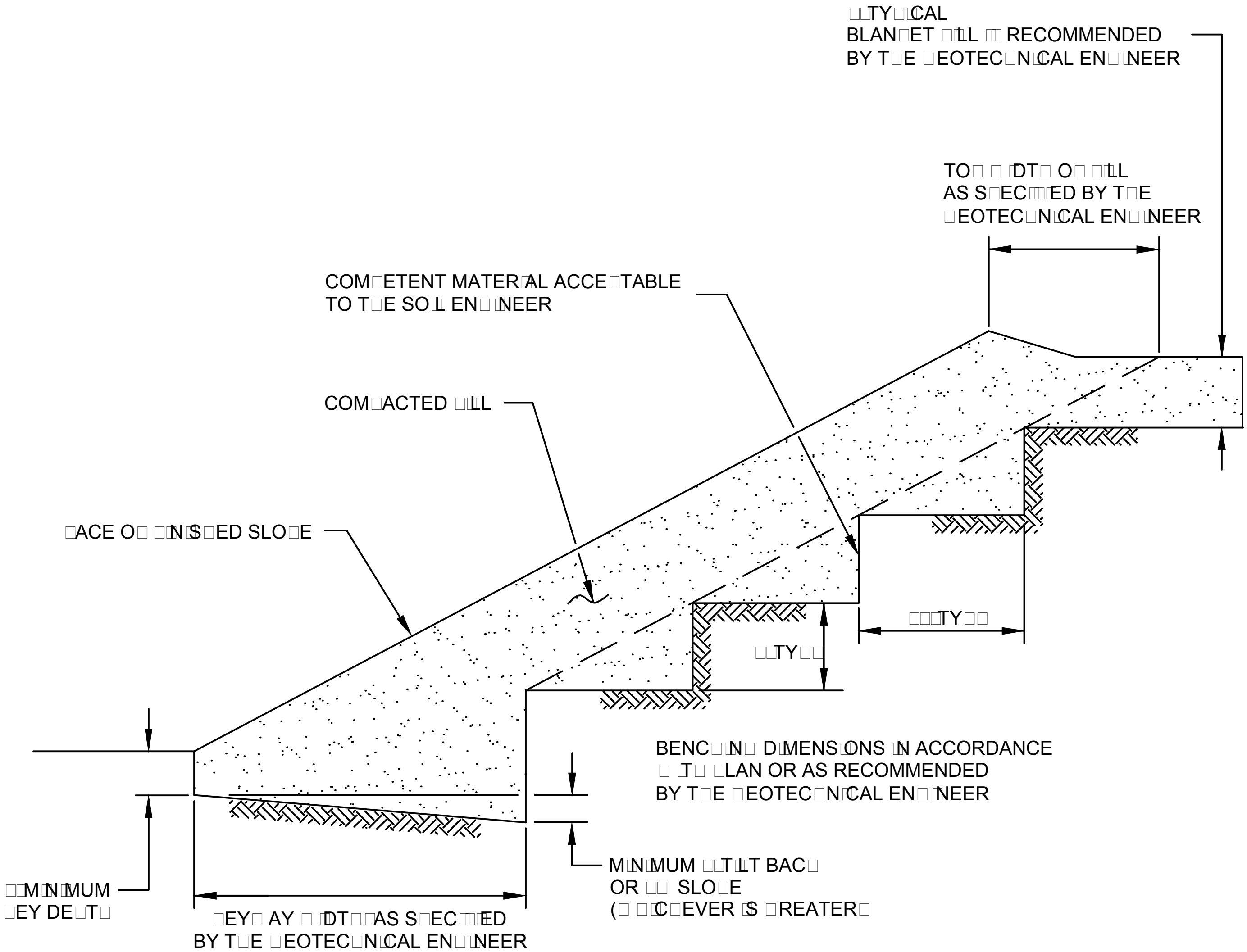
□RAD□N□ □U□DE S□EC□□□CAT□ONS

NOT TO SCALE

DRA□ N □AS
C□□D□□□M

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

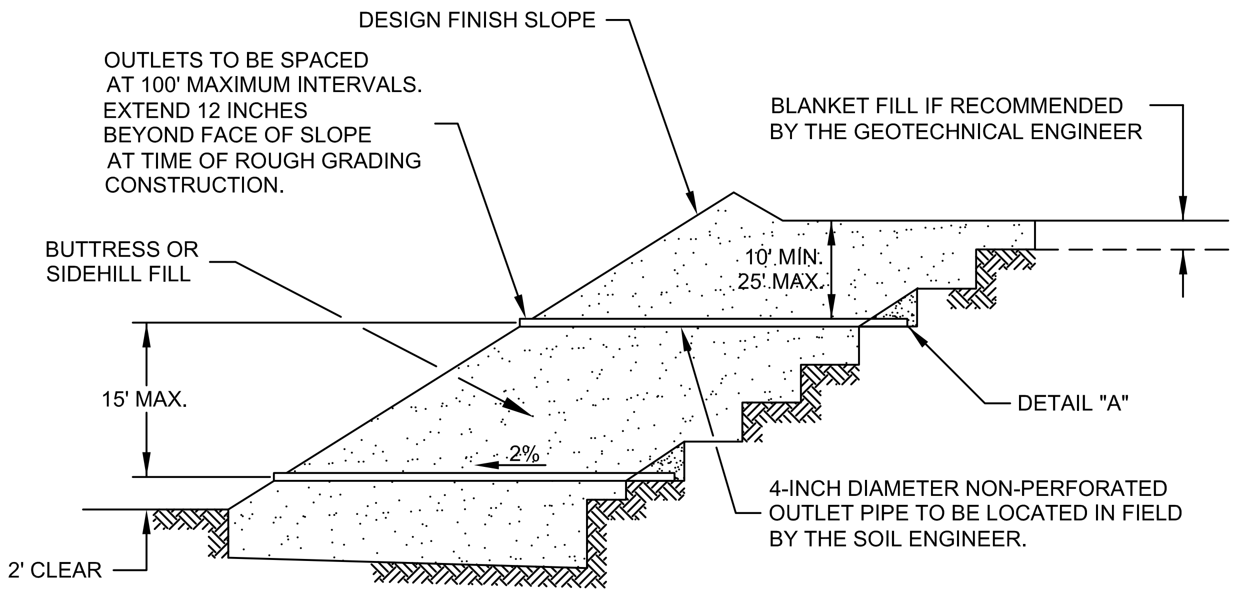
GRADING GUIDE SPECIFICATIONS

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)

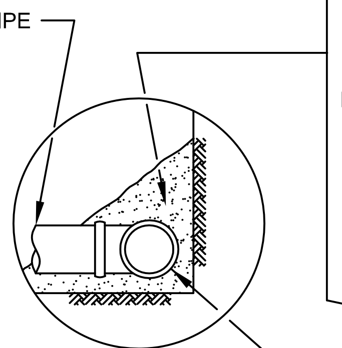
SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"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

OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW



FILTER MATERIAL - MINIMUM OF FIVE CUBIC FEET PER FOOT OF PIPE. SEE ABOVE FOR FILTER MATERIAL SPECIFICATION.

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

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

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

DETAIL "A"

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

SLOPE FILL SUBDRAINS

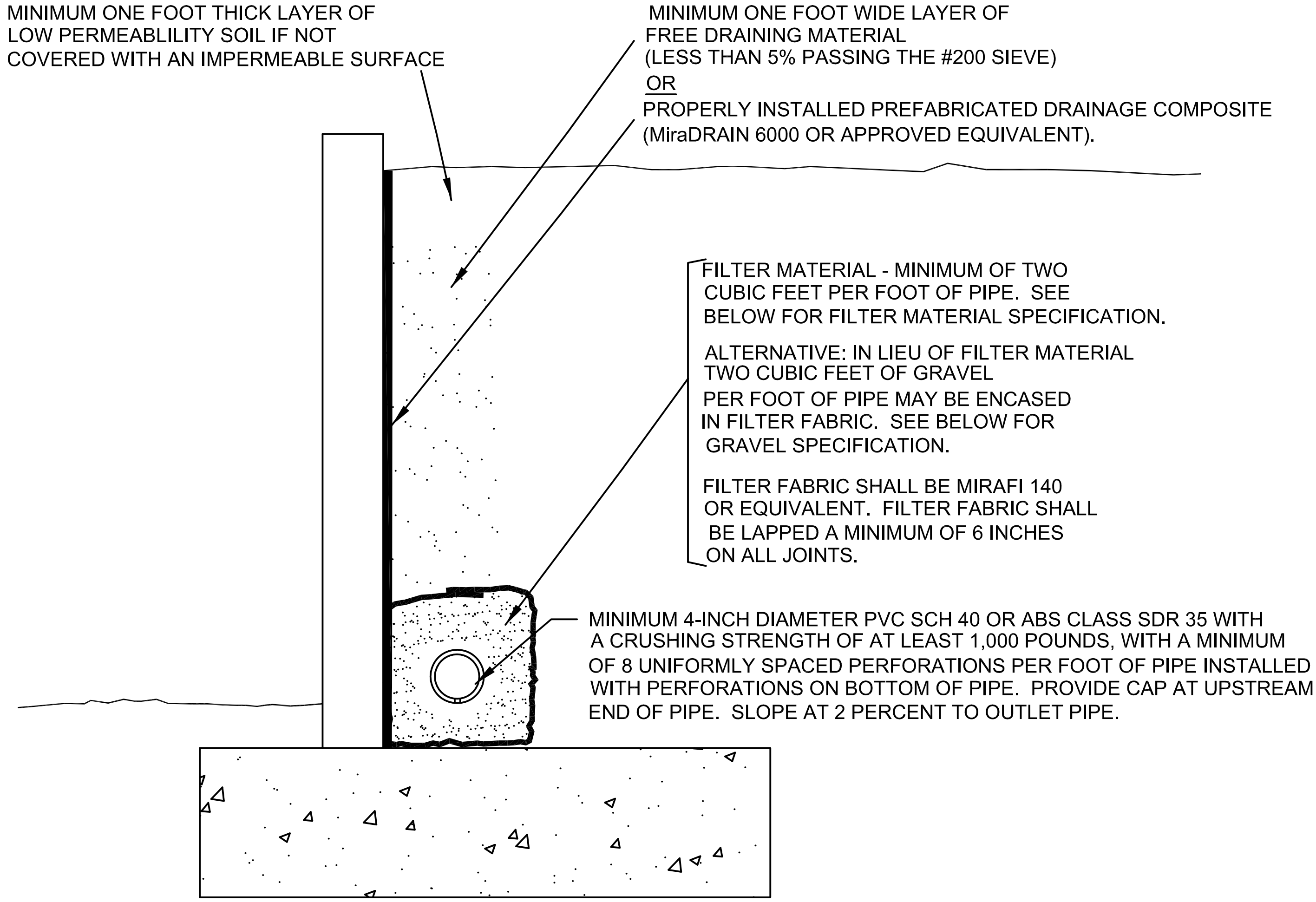
GRADING GUIDE SPECIFICATIONS

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

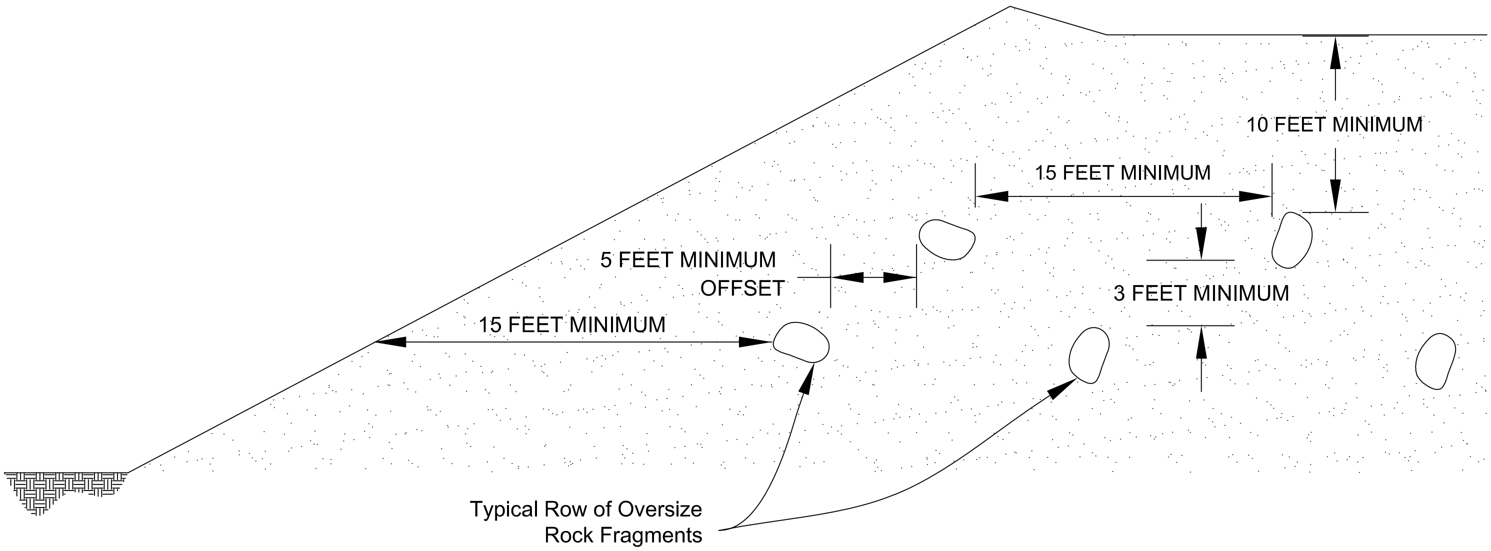
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

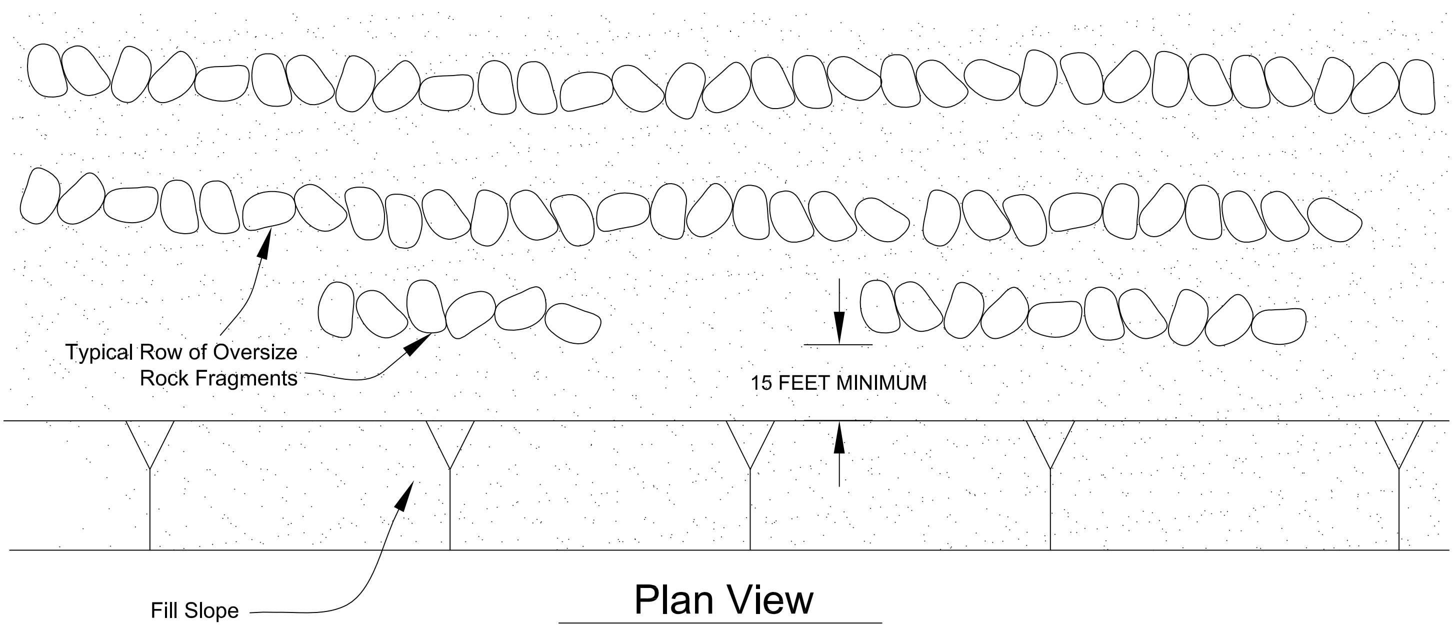
DRAWN: JAS
CHKD: GKM

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

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

Design Maps Summary Report

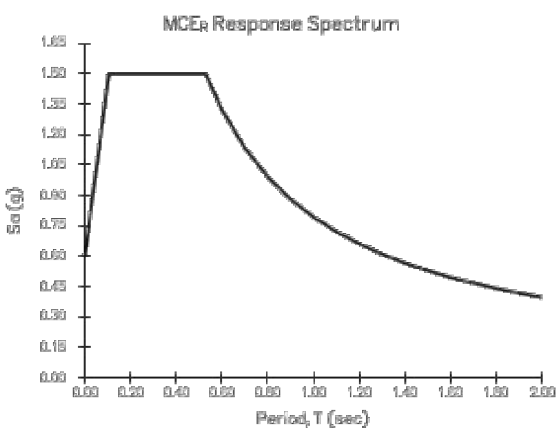
User–Specified Input

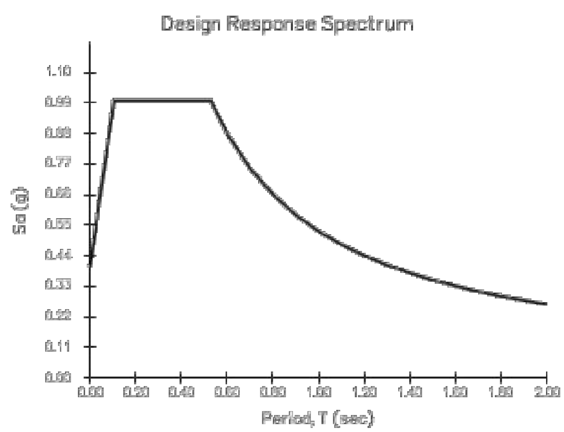
Report Title	Proposed Retail Development Mon December 11, 2017 18:18:18 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.95882°N, 117.31104°W
Site Soil Classification	Site Class C – "Very Dense Soil and Soft Rock"
Risk Category	I/II/III

USGS–Provided Output

S_S =	1.500 g	S_{MS} =	1.500 g	S_{DS} =	1.000 g
S_1 =	0.611 g	S_{M1} =	0.794 g	S_{D1} =	0.529 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.





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

SEISMIC DESIGN PARAMETERS
PROPOSED RETAIL DEVELOPMENT
RIVERSIDE, CALIFORNIA
DRAWN: DR
SCG PROJECT
PLATE E-1

SOUTHERN CALIFORNIA GEOTECHNICAL