UPDATED GEOTECHNICAL INVESTIGATION
TWO PROPOSED WAREHOUSES

12434 4th Street
Rancho Cucamonga, California
for
Bridge Development Partners

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

January 12, 2021

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Bridge Development Partners
1600 E Franklin Ave., Suite D
El Segundo, CA 90245

Attention: Ms. Angela Noah
Manager, Development

Project No.: **19G188-1R3**

Subject: **Geotechnical Investigation**
Two Proposed Warehouses
12434 4th Street
Rancho Cucamonga, California

Ms. Noah:

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. This report has been updated using the most recent site plan for the proposed development.

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.

Robert G. Trazo, M.Sc., GE 2655
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER ROBERT TRAZO No. 2655 Exp. 12/31/22 GEOTECHNICAL STATE OF CALIFORNIA

Gregory K. Mitchell, GE 2364
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER GREGORY K. MITCHELL No. 2364 Exp. 09/30/22 GEOTECHNICAL STATE OF CALIFORNIA

Distribution: (1) Addressee

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.

Geotechnical Design Considerations

- Artificial fill soils were encountered at some of the boring locations, extending from the ground surface to depths of 1½ to 5½± feet. Please note that additional artificial fill soils may be present within the existing building area.
- The fill soils and near-surface alluvial soils possess varying strengths and densities. 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 will be necessary to remove the existing fill soils and a portion of the near-surface alluvial soils and replace these materials as compacted structural fill.

Site Preparation Recommendations

- Initial site stripping should include removal of any surficial vegetation from the site. Stripping should include any grape vines, weeds, grasses, and any organic top soils.
- Demolition of existing asphalt and PCC pavements will be necessary in the northern portion of the site. Debris resultant from demolition should be disposed of off-site. Alternatively, asphalt debris may be pulverized to a maximum 2-inch particle size, well mixed with the on-site soils, and incorporated into new structural fills. It may also be crushed and made into crushed miscellaneous base (CMB), if desired.
- We recommend that remedial grading be performed within the proposed building areas in order to remove all of the artificial fill soils and a portion of the near-surface alluvium. The soils present within the proposed building areas should be overexcavated to a depth of 3 feet below existing grade and to a depth of at least 3 feet below proposed building pad subgrade elevations. The proposed foundation influence zones should also be overexcavated to a depth of at least 2 feet below proposed foundation bearing grade. Additional overexcavation may be necessary in areas where loose or otherwise unsuitable soils are encountered at the base off the overexcavation.
- 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. The resulting soils should be scarified and moisture conditioned to 0 to 4 percent above the optimum moisture content, to a depth of at least 12 inches. The overexcavation subgrade soils should then be recompacted under the observation of the geotechnical engineer. The previously excavated soils may then be replaced as compacted structural fill.
- The new pavement and flatwork 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.

Foundation Design Recommendations

- 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 Design Recommendations
- Conventional Slab-on-Grade: minimum 6-inch thickness.
- Modulus of Subgrade Reaction: k = 150 psi/in.
- Reinforcement is not expected to be necessary for geotechnical considerations.
- The actual thickness and reinforcement of the floor slab should be determined by the structural engineer.

Pavement Design Recommendations

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

PORTLAND CEMENT CONCRETE PAVEMENTS (R=50)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 19P322, dated August 13, 2019, and our Change Order No. 19G188-CO4, dated January 7, 2021. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slabs, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located on the north side of 4th Street, 180± feet west of the intersection of 4th Street and Barrington Avenue, and is referenced by the address of 12434 4th Street in Rancho Cucamonga, California. The site is bounded to the north by 6th Street, to the west by existing commercial/industrial buildings, to the south by 4th Street, and to the east by an existing commercial/industrial building and the West Valley Detention Center. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site is presently developed with a Big Lots warehouse and distribution facility, consisting of two (2) rectangular-shaped parcels, which total 91.39 acres in size. The southern parcel is developed with a commercial/industrial building, 1,380,000± ft² in size, located in the northwestern region of the parcel. The building is of concrete tilt-up construction, supported on a conventional shallow foundation with concrete slab-on-grade floors. The building possesses dock-high doors along the eastern and northern building walls, and is surrounded by concrete pavements in the loading dock and drive lane areas. A smaller building, 26,800± ft² in size, is located in the southwestern corner of the parcel. The smaller building appears to also be of concrete tilt-up construction, supported on a conventional shallow foundation with a concrete slab-on-grade floor. Two (2) asphaltic concrete parking lots are located in the southeastern and southwestern areas of the parcel. The pavements in the southern parcel are generally in fair to poor condition with moderate cracking throughout. Areas of turf grass and landscape planters containing large-sized trees are also located in the southern area of the southern parcel.

The northern parcel is vacant of any structures. The northern area of this parcel is presently being utilized as a grape vineyard. The ground surface cover consists of exposed soil with rows of grape vines. The central and southwestern portions of the northern parcel are presently being utilized as trailer parking lots. The ground surface cover in the central trailer lot consists of crushed aggregate base (CAB) and the southwestern lot is developed with concrete pavements. An asphaltic concrete parking lot is located in the southeastern area of the parcel. The pavements in the northern parcel are generally in fair condition with moderate cracking throughout.

Detailed topographic information was obtained from the preliminary conceptual grading plan prepared by Thienes Engineering, Inc. The existing site topography ranges from 1090± feet mean sea level (msl) in the northwestern area of the site, to 1040± feet msl in the southwestern area of the site. The overall site topography slopes downward to the south at a gradient of less 2± percent. However, the northern parcel is terraced and is approximately 8 feet greater in elevation than the southern parcel. The north and south parcels are separated by a 3h:1v (horizontal to vertical) slope which extends downward to the south. This slope also trends along the central portion of the western property line and slopes downward from the adjacent western property to the site an inclination of 3h:1v. The height of the existing slope at the western property line is approximately 15 feet.

3.2 Proposed Development

The most recent site plan (dated December 28, 2020) prepared by RGA, the project architect, was provided to the office by the client. Based on the site plan, two (2) new warehouses (identified as Building 1 and Building 2) will be constructed at the subject site. Building 1 will be located in the southern region of the site and will possess a footprint of 1,403,500± ft^2. Building 2 will be located in the northern region of the site and will possess a footprint of 738,270± ft^2. Dock-high doors will be constructed along a portion of the north and south Building 2 walls, and along a portion of the east and west Building 1 walls. It is expected that the new warehouses will be surrounded by asphaltic concrete pavements in the parking and drive areas, and Portland cement concrete in the loading dock areas. Limited areas of landscaped planters and concrete flatwork may also be included in the proposed development. A new rod way, identified as Street "A" will be constructed along the eastern property line. Street "A" will extend between 4th Street and 6th Street.

Detailed structural information has not been provided. It is assumed that the new buildings will be single-story structures of tilt-up concrete construction, 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 100 kips and 4 to 7 kips per linear foot, respectively.

3.3 Conceptual Grading Plan Review

Our office was provided with the preliminary conceptual grading plan for the project, which was prepared by Thienes Engineering, Inc, dated January 11, 2021. Based on our review of this plans, cuts of 3 to 15± feet and fills of 4 to 18± feet will be required to establish the new site grades. Several new retaining walls will be constructed as part of the new development. The new retaining walls will range from 6 to 15± feet in height. The conceptual grading plans identifies two retaining walls, Retaining Walls B and C, which will be constructed immediately adjacent to the western property line. These walls will be constructed in a zero lot-line condition and will require cuts of 11 to 19± feet against the property line. **Therefore, as indicated on the grading plans, shoring will be required in order to achieve the remedial grading and construct the proposed retaining wall structures.** The proposed grading will also require several new cut and fill slopes. The new slopes will range from 7 to 14± feet in height and will possess maximum inclinations of 2h:1v (horizontal to vertical). The recommendations presented in this report have been prepared in consideration of the conceptual grading plan. Additional grading and shoring design recommendations generated from our plan review are included herein.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of twenty (20) borings advanced to depths of 15 to 25± feet below the existing site grades. All of the borings were logged during drilling by a member of our staff.

Boring Nos. B-9, B-11, B-12, B-16, and B-14 were advanced by a limited access track-mounted drilling rig with hollow-stem augers; all other borings were advanced by a conventional truck-mounted drilling rig, also equipped with hollow stem augers. Representative bulk and relatively undisturbed soil samples were taken during drilling. Relatively undisturbed soil samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. In-situ samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

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

4.2 Geotechnical Conditions

Pavements

Asphaltic concrete pavements were present at the ground surface at Boring Nos. B-2, B-15, and B-18. The pavements at these locations consist of 3 to 5± inches of asphaltic concrete with 0 to 18± inches of underlying aggregate base. Portland cement concrete was encountered at the ground surface of Boring Nos. B-6 through B-8, and B-10 through B-17. The pavements at these locations consist of 5½ to 12± inches of Portland cement concrete.

Artificial Fill

Artificial fill soils were encountered beneath the pavements and at the ground surface at Boring Nos. B-2, B-3, B-4, B-6, and B-9 through B-14, inclusive. The fill soils extend to depths of 1½ to 5½± feet at the boring locations and generally consist of medium dense to dense silty fine sands and fine sands with variable amounts of medium to coarse sand, fine to coarse gravel, and occasional calcareous veining. The fill soils possess a highly disturbed appearance, resulting in their classification as artificial fill.

Alluvium

Native alluvial soils were encountered at the ground surface of Boring Nos. B-1, B-5, B-9, B-19, and B-20 and beneath the pavements and fill soils at all of the other boring locations. The alluvium extends to at least the maximum depth explored of 25± feet. The alluvial soils generally consist of loose to very dense fine sands with variable amounts of medium to coarse sands and gravel, and loose to very dense silty fine to coarse sands with variable amounts of clay, gravel, and occasional calcareous veining. Occasional loose to medium dense fine sandy silt layers with trace amounts of iron oxide staining and calcareous veining, were encountered within the upper 2½ to 8± feet and between 12 to 20± feet below the ground surface. Boring No. B-10 encountered a clayey silt layer from 17 to 19½± feet.

Groundwater

Groundwater was not encountered at any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet below existing site grades, at the time of the subsurface investigation.

As part of our research, we reviewed readily available groundwater data in order to determine regional groundwater depths. Recent water level data was obtained from the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well on record is located approximately 8,484 feet south of the site. Water level readings within this monitoring well indicate a groundwater level of 283± feet (March 2019) below the ground surface.

5.0 LABORATORY TESTING

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

Classification

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

Density and Moisture Content

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

Consolidation

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

Maximum Dry Density and Optimum Moisture Content

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 and are presented on Sheets C-9 and C-10 in Appendix C of this report. 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 types or soil mixes may be necessary at a later date.

Expansion Index

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

Sample Identification	Expansion Index	Expansive Potential
B-9 @ 0 to 5 feet	0	Very Low
B-19 @ 0 to 5 feet	0	Very Low

Soluble Sulfates

Two (2) 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 (%)	Severity
B-5 @ 0 to 5 feet	<0.001	Not Applicable (S0)
B-13 @ 0 to 5 feet	<0.001	Not Applicable (S0)

Corrosivity Testing

Two (2) representative bulk samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of electrical resistivity, pH, and chloride concentrations as well as other potentially corrosive ions, including ammonium and nitrates. The resistivity of the soils is a measure of their potential to attack buried metal improvements such as utility lines. The results of the resistivity and pH testing are presented below:

Sample Identification	Resistivity (ohm-cm)	pH	Chlorides (mg/kg)	Ammonium (mg/kg)	Nitrate (mg/kg)
B-5 @ 0 to 5 feet	20,800	8.0	<0.1	<0.1	9.8
B-13 @ 0 to 5 feet	12,400	8.9	5.4	<0.1	9.9

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

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

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). However, it is also possible that the proposed development may be designed using the 2019 CBC, which will be adopted on January 1, 2020. Therefore, this report provides design parameters for both the 2016 CBC and the 2019 CBC. Other design consultants should verify the version of the code under which the proposed development will be submitted.

The 2016 and 2019 CBC Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool, a web-based software application available at the website www.seismicmaps.org. This software application calculates seismic design parameters in accordance with several building code reference documents, including ASCE 7-10 and ASCE 7-16, upon which the 2016 CBC and 2019 CBC are based, respectively. The application utilizes a database of risk-targeted maximum considered earthquake (MCE_R) site accelerations at 0.01-degree intervals for each of the code documents. The tables below were created using data obtained from the application. The output generated from this program is included as Plates E-1A (2016 CBC) and E-1B (2019 CBC) in Appendix E of this report. 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	0.600
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.500
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.900
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.000
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.600

The 2019 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped S_1 value greater than 0.2. However, Section 11.4.8 of ASCE 7-16 also indicates an exception to the requirement for a site-specific ground motion hazard analysis for certain structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11 of ASCE 7-16) indicates that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." **Based on our understanding of the proposed development, the seismic design parameters presented below were calculated assuming that the exception in Section 11.8.4 applies to the proposed structures at this site. However, the structural engineer should verify that this exception is applicable to the proposed structures.** Based on the exception, the spectral response accelerations presented below were calculated using the site coefficients (F_a and F_v) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2019 CBC.

2019 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped MCE_R Acceleration at 0.2 sec Period	S_S	1.726
Mapped MCE_R Acceleration at 1.0 sec Period	S_1	0.642
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.726
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	1.091
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.151
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.727

It should be noted that the site coefficient Fv and the parameters SM1 and SD1 were not included in the SEAOC/OSHPD Seismic Design Maps Tool output for the 2019 CBC. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2019 CBC using the value of S1 obtained from the Seismic Design Maps Tool, assuming that a site-specific ground motion hazards analysis is not required for the proposed buildings at this site.

Liquefaction

Liquefaction is the loss of strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and plasticity characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Non-sensitive clayey (cohesive) soils which possess a plasticity index of at least 18 (Bray and Sancio, 2006) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

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

6.2 Geotechnical Design Considerations

General

The near-surface soils encountered at the boring locations consist of artificial fill soils and native alluvium. The artificial fill soils, where encountered, extend to depths of 1½ to 5½± feet below the existing site grades. The fill soils possess variable strengths and densities. Based on these considerations, and a lack of documentation of the placement and compaction of these soils, the existing fill materials are considered to consist of undocumented fill, unsuitable for the support of the proposed structure. The near-surface alluvium also possesses variable strengths, densities, and composition. Additionally, it is anticipated that demolition of the existing structure and associated improvements will cause disturbance of the upper 3 to 5 feet of soil. Therefore, remedial grading is considered warranted within the proposed building areas in order to remove all of the undocumented fill soils in their entirety, the upper portion of the near-surface native alluvial soils, and any soils disturbed during the demolition process, and replace these materials as compacted structural fill soils.

Settlement

The recommended remedial grading will remove the existing undocumented fill soils and a portion of the near-surface native alluvial soils and replace these materials as compacted structural fill. The native soils that will remain in place below the recommended depth of overexcavation will not be subject to significant stress increases from the foundations of the new structures. Therefore, following completion of the recommended grading, post-construction settlements are expected to be within tolerable limits.

Slope Stability

No evidence of landslides or deep-seated slope instability was noted during our investigation. However, the loose granular soils on sloping ground surfaces could be prone to surficial failures.

Newly constructed fill slopes, comprised of properly compacted engineered fill, at inclinations of 2h:1v will possess adequate gross stability. In addition, cut slopes within alluvium with inclinations of 2h:1v are expected to possess adequate stability. However, cut slopes excavated within the existing granular artificial fill or alluvial soils may be subject to surficial instability due to the lack of cohesion within these materials. **Therefore, stability fills may be required within these areas. This condition may affect the proposed cut slopes at the site. The need for stability fills should be determined by SCG during rough grading procedures.**

Expansion

The near-surface soils encountered at the boring locations consist of silty sands, sandy silts and sands. The results of expansion index testing performed on soils from the upper 5± feet at Boring Nos. B-9 and B-19 indicate that these soils possess a very low expansion potential (EI = 0 for both). Therefore, no design considerations related to expansive soils are considered warranted for this site.

Soluble Sulfates

The results of the soluble sulfate testing indicate that the selected samples of the on-site soils contain sulfate concentrations that correspond to Class S0 with respect to the American Concrete Institute (ACI) Publication 318-14 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at pad grade within the building area.

Corrosion Potential

The results of the electrical resistivity and pH testing indicate that samples of the on-site soils have resistivity values ranging from 12,400 to 20,800 ohm-cm, and pH values ranging from 8.0 to 8.9. These test results have been evaluated in accordance with guidelines published by the Ductile Iron Pipe Research Association (DIPRA). The DIPRA guidelines consist of a point system by which characteristics of the soils are used to quantify the corrosivity characteristics of the site. Resistivity and pH are two of the five factors that enter into the evaluation procedure. Redox potential, relative soil moisture content and sulfides are also included. Although sulfide testing was not part of the scope of services for this project, we have evaluated the corrosivity characteristics of the on-site soils using resistivity, pH and moisture content. **Based on these factors, and utilizing the DIPRA procedure, the on-site soils are considered to be moderately corrosive to ductile iron pipe. Therefore, polyethylene protection is expected to be required for cast iron or ductile iron pipes.** It should be noted that SCG does not practice in the field of corrosion engineering, and therefore, the client may also wish to contact a corrosion engineer to provide a more thorough evaluation.

Shrinkage/Subsidence

Based on the results of the laboratory testing, removal and recompaction of the loose to medium dense near-surface soils, extending to depths of 3 to 6± feet, is estimated to result in an average shrinkage of 7 to 13 percent. It should be noted that this shrinkage estimate is based on the results of dry density testing performed on small-diameter samples of the existing soils taken at the boring locations. If a more accurate and precise shrinkage estimate is desired, SCG can perform a shrinkage study involving several excavated test-pits where in-place densities are determined using in-situ testing methods instead of laboratory density testing on small-diameter samples. Please contact SCG for details and a cost estimate regarding a shrinkage study, if desired.

Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be 0.1± feet. This estimate may be used for grading in areas that are underlain by native alluvial soils.

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

Grading and Foundation Plan Review

As previously discussed, the report was prepared in consideration of the preliminary conceptual grading plans prepared by Thienes Engineering, Inc. However, foundation plans were not available at the time of this report. It is therefore recommended that we be provided with copies of the precise grading and 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 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 from the site. Stripping should include any grass and weed growth as well as any organic top soils and grape vines, trees and associated root balls. 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.

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

Treatment of Existing Soils: Building Pads

Remedial grading should be performed within the proposed building pad areas in order to remove any soils disturbed during demolition, the existing undocumented fill soils, and the upper portion of the near-surface native alluvium. Based on conditions encountered at the boring locations, we recommend that the existing soils within the proposed building areas be overexcavated to a depth of at least 3 feet below existing grades and to a depth of at least 3 feet below proposed building pad subgrade elevations, whichever is greater. **The depth of the overexcavation should also extend to a depth sufficient to remove all undocumented fill soils**. The undocumented fills extend to depths of 1½ to 5½± feet and most of the boring locations. Please note that additional artificial fill soils may be present within the existing building areas. 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.

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 structures incorporate 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 within the overexcavation 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**. It should be noted that some of the borings, including Boring Nos. B-1, B-3, B-6, B-13, B-15, B-18, and B-19 encountered loose soils extending to depths of 8 to 15± feet, and Boring Nos. B-6 and B-20 encountered loose soils to a depth of 20± feet.

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches and moisture treated to 0 to 4 percent above optimum moisture content. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.

<u>Treatment of Existing Soils: Cut and Fill Slopes</u>

New cut and fill slopes will be constructed within and around the perimeter of the project site. The maximum heights of cut and fill slopes are indicated on the plan to range between 7± to 14± feet. All slopes should be at an inclination of 2h:1v or flatter. 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 wide and 3 feet deep. The recommended width of the keyway is based on 1.5 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 which expose artificial fill soils or loose granular native alluvium may require stability fills. Should a stability fill for a cut slope be necessary, the recommendations for the stability fill are included in the grading guide specifications included with this report. Cuts slopes should also be evaluated at the time of grading by an SCG field representative in order to provide stability fill recommendations.

<u>Treatment of Existing Soils: Retaining Walls and Site Walls</u>

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 pads. Any undocumented fill soils within any of these foundation areas should be removed in their entirety. The overexcavation areas should extend at least 5 feet beyond the foundation perimeters, and to an extent equal to the depth of fill below the new foundations. Any erection pads for tilt-up concrete walls are considered to be part of the foundation system. Therefore, these overexcavation recommendations are applicable to erection pads. 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 area. The previously excavated soils may then be replaced as compacted structural fill.

If the recommended remedial grading can not be completed for screen walls located along property lines, such walls should be designed for a reduced allowable bearing pressure. The allowable bearing pressure will be determined based on the actual extent of remedial grading that can be accomplished.

Treatment of Existing Soils: Flatwork, Parking and Drive 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 current CBC and the grading code of the city of Rancho Cucamonga.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not

be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Imported Structural Fill

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

Utility Trench Backfill

In general, all utility trench backfill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. It is recommended that materials in excess of 3 inches in size not be used for utility trench backfill. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the city of Rancho Cucamonga. 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, sandy silts, and sands. These materials will likely be subject to minor to moderate caving within shallow excavations. Where caving does occur, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, the inclination of temporary slopes should not exceed 2h:1v. Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Groundwater

The static groundwater table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration. Therefore, groundwater is not expected to impact the grading or foundation construction activities.

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 soils and a portion of the near-surface alluvial soils. 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 that has been scarified, moisture conditioned, and recompacted. Based on this subsurface profile, the proposed structures may be supported on conventional shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

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

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

Foundation Construction

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

The foundation subgrade soils should also be properly moisture conditioned to 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 soils. The maximum allowable passive pressure is 3,000 lbs/ft^2.

6.6 Floor Slab Design and Construction

Subgrades which will support the new floor slabs should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, the floor of the proposed structures may be constructed as conventional slabs-on-grade supported on newly placed structural fill (or densified existing soils), extending to a depth of at least 3 feet below finished pad grades. Based on geotechnical considerations, the floor slabs may be designed as follows:

- Minimum slab thickness: 6 inches.

- Modulus of Subgrade Reaction: k = 150 psi/in.

- Minimum slab reinforcement: Reinforcement is not considered necessary from a geotechnical standpoint. The actual floor slab reinforcement should be determined by the structural engineer, based on the imposed slab loading.

- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire area of the proposed slab where such moisture sensitive floor coverings are anticipated. 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. A polyolefin material such as Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated, the vapor barrier may be eliminated.

- Moisture condition the floor slab subgrade soils to 0 to 4 percent above the Modified Proctor optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to concrete placement.

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

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

6.7 Retaining Wall Design and Construction

Although not indicated on the site plan, some small (less than 6 feet in height) retaining walls may be required to facilitate the new site grades. 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 near-surface soils generally consist of silty sands, sandy silts and sands. 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 Silty Sands, Sandy Silts and Sands
Internal Friction Angle (ϕ)		30°
Unit Weight		130 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	43 lbs/ft^3
	Active Condition (2h:1v backfill)	70 lbs/ft^3
	At-Rest Condition (level backfill)	65 lbs/ft^3

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 2019 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, assumed to occur at the top of the wall, decreasing to 0 at the base of the wall. For a level backfill condition behind the top of the wall, the seismic lateral earth pressure is 28H lbs/ft^2, where H is the overall height of the wall. Where the ground surface above the wall consists of a 2h:1v (horizontal to vertical) sloping condition, the seismic lateral earth pressure is 56H lbs/ft^2. The seismic pressure distribution is based on the Mononobe-Okabe equation, utilizing a design acceleration of 0.537g. The 2019 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. However, for combinations of high ground motion and steep slopes above the wall, the Mononobe-Okabe equation gives unrealistic high estimates of active earth pressures. Therefore, the seismic earth pressure for the sloping condition presented above was derived using a design acceleration equal to ½ 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 proposed foundation 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 properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls be used. If the drainage composite material is not covered by an impermeable surface, such as a structure or pavement, a 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils. The drainage composite should be separated from the backfill soils by a suitable geotextile, approved by the geotechnical engineer.

All retaining wall backfill should be placed and compacted under engineering controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557). 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 Temporary Shoring Recommendations

Based on the plans prepared by Thienes Engineering, Inc., it is expected that temporary shoring will be required to facilitate the overexcavation and construction of the new retaining walls located along the western property line. Shoring heights of 11 to 19± feet will be required in order to facilitate the remedial grading recommendations included in this report.

The following recommendations assume that the retained soil heights will not exceed 20± feet. Based on the potential for various sources of surcharge loads on a construction site, such as the subject project, potential construction surcharge loads must be considered by the shoring engineer.

The proposed shoring is also expected to be required in order to protect the adjacent property. The contractor should take all necessary precautions to maintain the integrity of the exiting retaining walls.

<u>Lateral Earth Pressures</u>

The gradient behind the shoring system will be relatively level. Based on the assumed type of shoring, a triangular earth pressure distribution is considered appropriate. Plate 3 included in this report illustrates the at-rest and active lateral earth pressure distributions. As shown on Plate 2, the at-rest and active pressures to be used in the shoring design should be 60H and 40H, respectively. These distributions are based on static conditions.

As previously discussed, if surcharge loads are imposed upon the shoring, they must be considered by the shoring engineer. In accordance with the Caltrans Trenching and Shoring Manual, a construction surcharge of 72 lbs/ft^2, per foot of depth, should also be applied to the back of the shoring system, extending to a depth of 10 feet below the top of the shoring system or to the excavation line, whichever is less. These loads assume normal construction traffic, consisting of lightly loaded vehicles and storage of small amounts of materials. If large stockpiles of soil, concentrated pallet loads, or crane loads are expected, SCG should be contacted for additional surcharge load recommendations. In the areas where automobile traffic is anticipated within 10 feet of the back of the shoring system, a traffic surcharge load of 250 lbs/ft^2 should be utilized in addition to the construction load described above. These loads are considered to be rectangular distributions acting at the back of the shoring system. The passive resistance value of the soil below the level of excavation may be assumed to be 300 lbs/ft^2, per foot of depth, to a maximum of 2,000 lbs/ft^2. The passive resistance was calculated in accordance with Section 6 of the Caltrans Trenching and Shoring Manual using the equations $s_P = \gamma k_P$ where $k_P = \tan^2(45+\phi/2)$ and γ is the unit weight of the soil.

<u>Shoring Construction</u>

If soldier piles are utilized, they should be spaced no closer than 3 times the nominal soldier pile diameter. The contractor should take all necessary provisions to assure firm contact between the retained soils and the shoring system. A 2-sack cement slurry may be used to fill voids where inadequate contact between the shoring system and the retained soils are observed.

Since the shoring system will be designed as a cantilever wall, some deflection will occur. In order to develop the full active pressure, a deflection of ½ to 1 inch is expected to occur at the top of the shoring system. The design of the shoring system as well as the protection of adjacent improvements should take this deflection into consideration.

6.9 Pavement Design Parameters

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

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The near-surface soils generally consist of silty sands and sands with occasional interbedded sandy silt, sandy clay, and silty clay strata. These soils are generally considered to possess good pavement support characteristics, with R-values in the range of 50 to 60. The subsequent pavement design is therefore based upon an assumed R-value of 50. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering controlled conditions. It is recommended that R-value testing be performed after completion of rough grading to verify that the pavement design recommendations presented herein are valid.

Asphaltic Concrete

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

Traffic Index	No. of Heavy Trucks per Day
4.0	0
5.0	1
6.0	3
7.0	11
8.0	35
9.0	93

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

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

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

Portland Cement Concrete

The preparation of the subgrade soils within 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 (R=50)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

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

7.0 GENERAL COMMENTS

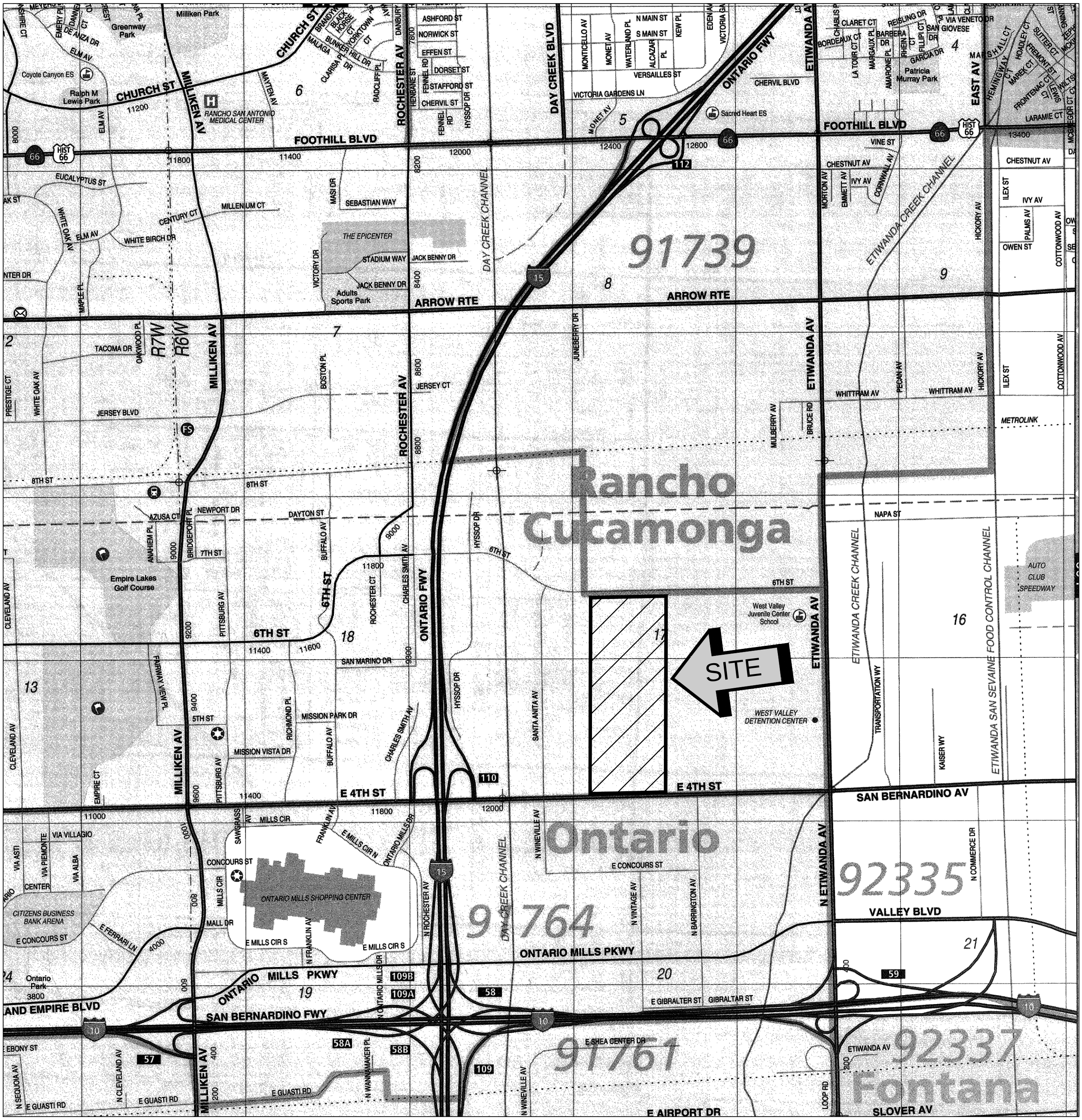
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other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

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

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

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

APPENDIX A



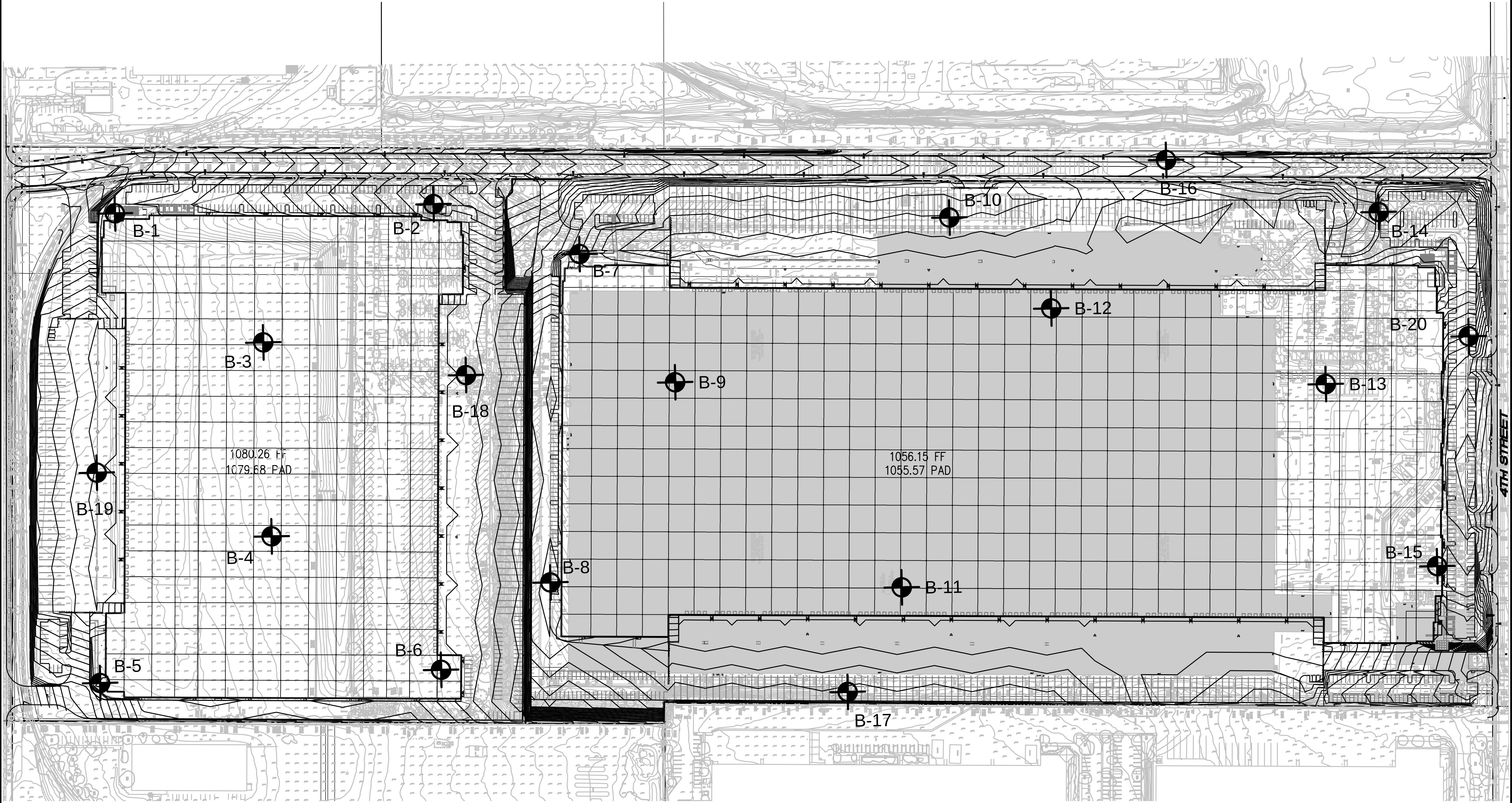
SOURCE: SAN BERNARDINO COUNTY
THOMAS GUIDE, 2013

SITE LOCATION MAP

TWO PROPOSED WAREHOUSES

RANCHO CUCAMONGA, CALIFORNIA

SCALE: 1" = 2400'	SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JLL CHKD: RGT	
SCG PROJECT 19G188-1R	
PLATE 1	



GEOTECHNICAL LEGEND

APPROXIMATE BORING LOCATION

EXISTING BUILDING TO BE DEMOLISHED

NORTH
SoCalGeo

NOTE: BASE SITE PLAN PREPARED BY THIENES ENGINEERING, INC.

BORING LOCATION PLAN

PROPOSED WAREHOUSE DEVELOPMENT

RANCHO CUCAMONGA, CALIFORNIA

SCALE: 1" = 200'

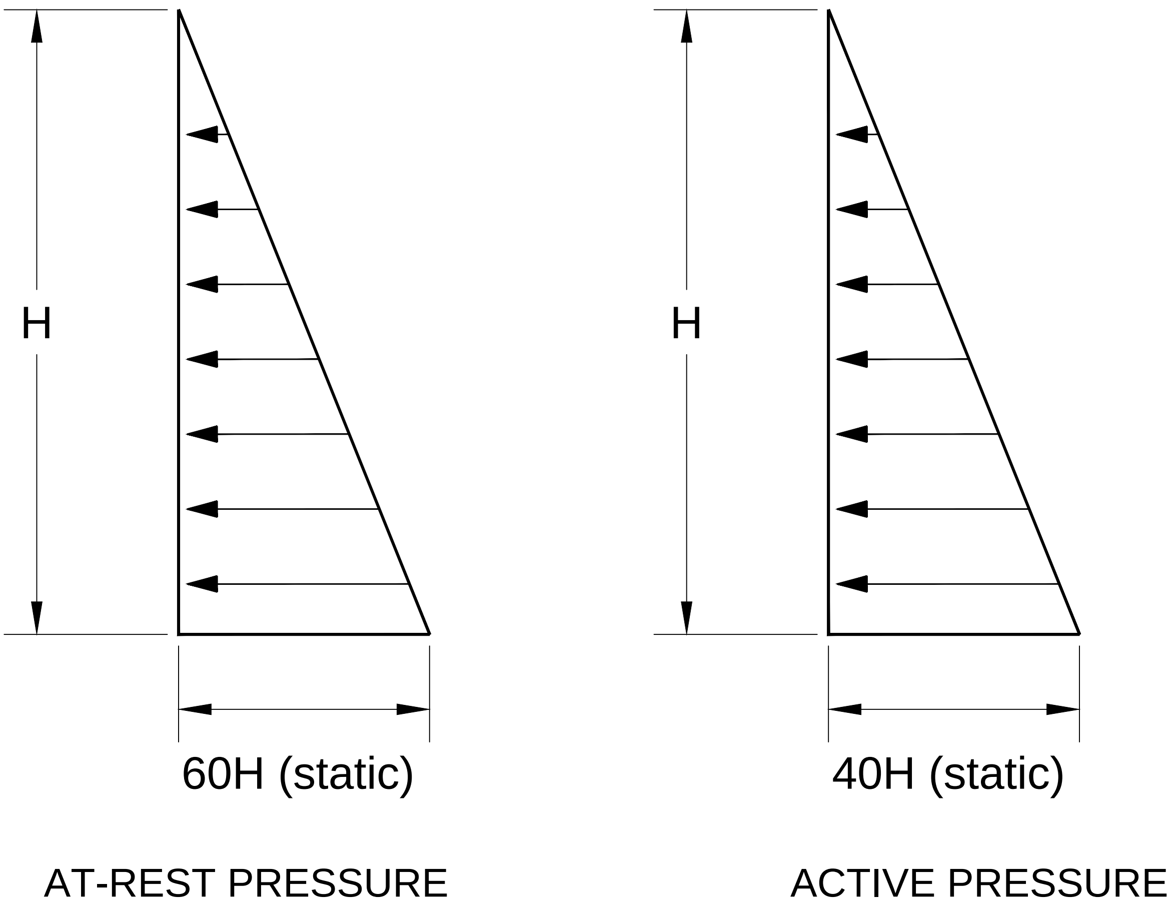
DRAWN: PM
CHKD: GKM

SCG PROJECT
19G188-1R3

PLATE 2

SoCalGeo

SOUTHERN
CALIFORNIA
GEOTECHNICAL

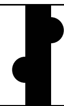
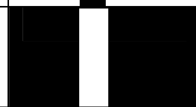
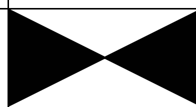
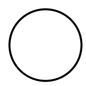
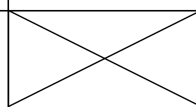
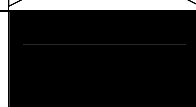
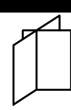


NOTES: THE LATERAL EARTH PRESSURES DEPICTED IN THIS DIAGRAM DO NOT INCLUDE ANY SURCHARGE LOADS.

PRESSURE DIAGRAM FOR SHORING	
NOT TO SCALE	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: PM CHKD: GKM	
SCG PROJECT 19G188-1R3	
PLATE 3	

APPENDIX B

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

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

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

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

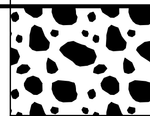
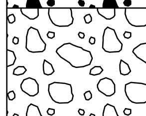
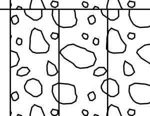
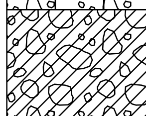
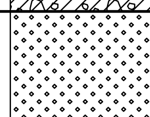
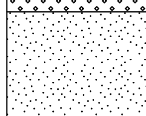
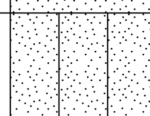
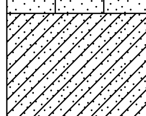
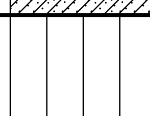
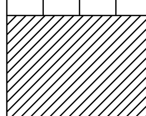
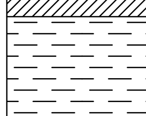
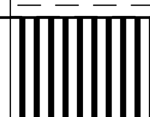
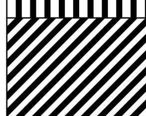
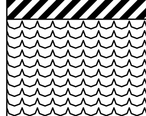
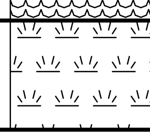
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

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

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

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/9/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: Dry
CAVE DEPTH: 19 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		42			ALLUVIUM: Gray Brown fine to medium Sand, trace coarse Sand, medium dense-dry @ 1½ feet some fine to coarse Gravel	112	2					
		15			Brown fine Sand, trace Silt, trace coarse Sand, loose to medium dense-moist	97	9					
5		11			Brown to Red Brown Silty fine Sand, trace medium Sand, loose to medium dense-moist	99	10					
		11				112	10					
10		16				112	10					
15		31			Red Brown fine Sandy Silt, trace medium Sand, medium dense-moist	95	13					
20		17			Gray Brown fine Sand, trace to little Silt medium dense-moist		10					
25		47			Gray Brown fine to coarse Sand, trace fine to coarse Gravel, dense-damp		3					
					Boring Terminated at 25'							

SOUTHERN CALIFORNIA GEOTECHNICAL

A California Corporation

BORING NO. B-2

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/9/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: Dry
CAVE DEPTH: 15 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					4± inches Asphaltic concrete, 18± inches Aggregate base							
	X	22			FILL: Light Gray Brown fine to coarse Sand, trace Silt, little fine to coarse Gravel, medium dense-damp		3					
	X	17			ALLUVIUM: Light Brown fine Sandy Silt, trace calcareous veining trace iron oxide staining, medium dense-damp to moist		9					
5												
	X	14			Light Brown Silt, trace fine root fibers, medium dense-damp to moist		10					
	X	13			@ 8½ feet trace fine Sand		7					
10												
					Brown Silty fine Sand, trace fine to coarse Gravel, trace iron oxide staining, dense-damp							
	X	40					6					
15												
					Light Gray Brown fine Sand, trace to little Silt, dense-damp							
	X	30					4					
20												
					Boring Terminated at 20'							

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California
DRILLING DATE: 9/9/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward
WATER DEPTH: Dry
CAVE DEPTH: 11½ feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Gray Brown fine to coarse Sand, trace fine to coarse Gravel, medium dense-dry to damp							
	X	16				111	3					
					ALLUVIUM: Brown Silty fine Sand, trace medium Sand, loose to medium dense-damp							
	X	12				100	7					
5					Brown fine Sandy Silt, trace medium Sand, trace calcareous veining, loose-moist							
	X	12				108	11					
					Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, loose to medium dense-damp							
	X	15				106	6					
	X	13			@ 9 feet trace iron oxide staining, trace calcareous veining	107	6					
10												
	X	17			@ 14 feet Red Brown, dry	119	1					
15												

Boring Terminated at 15'

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

BORING NO. B-4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California
DRILLING DATE: 9/9/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward
WATER DEPTH: Dry
CAVE DEPTH: 13 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Brown Silty fine Sand, trace medium to coarse Sand, medium dense-damp							
		21				107	6					
		20			@ 3 feet trace fine Gravel	103	4					
5		17			ALLUVIUM: Light Brown Silty fine Sand, trace coarse Sand, medium dense-damp	108	5					
		15			@ 7 feet trace calcareous veining	86	6					
		15			Light Gray fine to medium Sand, trace coarse Sand, medium dense-dry	104	1					
10												
					Brown fine Sandy Silt, trace Clay, medium dense-damp to moist							
		10					9					
15		20			Red Brown Silty fine Sand, trace medium to coarse Sand, moderate calcareous veining, medium dense-moist	110	10					

Boring Terminated at 15'

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 19G188	DRILLING DATE: 9/9/19	WATER DEPTH: Dry
PROJECT: Proposed Warehouse Development	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 18 feet
LOCATION: Rancho Cucamonga, California	LOGGED BY: Jamie Hayward	READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
					ALLUVIUM: Gray Brown fine to medium Sand, loose-damp							
	X	6					5					
	X	5			@ 3½ feet trace to little Silt		6					
5												
	X	7					6					
					Gray Brown fine to coarse Sand, trace fine to coarse Gravel, medium dense-damp							
	X	14					3					
10												
					Brown Silty fine Sand, medium dense-damp to moist							
	X	11					8					
15												
	X	12					10					
20												
	X	16					6					
25												
					Boring Terminated at 25'							

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/9/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

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

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					6± inches PCC pavement							
	X	32			FILL: Dark Red Brown Silty fine Sand, trace medium to coarse Sand, trace Clayey Silt nodules, medium dense-moist	119	10					
	X	18			ALLUVIUM: Gray Brown fine Sandy Silt, trace medium Sand, trace calcareous veining, medium dense-moist to very moist	110	14					
5	X	13			Gray Brown SIlty fine Sand, trace calcareous veining, loose-damp to very moist	106	14					
	X	12				110	7					
10	X	10				106	11					
					Red Brown Silty fine Sand, loose-moist							
15	X	12				112	10					
					Orange Brown Silty fine Sand, trace medium to coarse Sand, trace calcareous nodules, very dense-damp to moist							
20	X	73				118	8					
					Gray Brown fine to coarse Sand, little fine to coarse Gravel, moderately cemented, dense-damp							
25	X	64				120	4					

Boring Terminated at 25'

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-7

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California
DRILLING DATE: 9/10/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward
WATER DEPTH: Dry
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					6± inches PCC pavement							
		35			ALLUVIUM: Light Brown to Light Gray Brown fine to medium Sand, trace coarse Sand, trace Silt, medium dense to dense-dry to damp	114	3					
		41			@ 3 feet trace iron oxide staining, trace fine Gravel	112	3					
5		52				110	4					
		50				109	2					
10		60				109	2					
					Gray Brown fine Sand, trace medium to coarse Sand, dense-damp							
15		32					3					
20		30					4					
25		31					3					
					Boring Terminated at 25'							

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-8

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California
DRILLING DATE: 9/10/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward
WATER DEPTH: Dry
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					6± inches PCC pavement							
					ALLUVIUM: Light Brown fine to medium Sand, trace coarse Sand, trace fine to coarse Gravel, medium dense-damp							
	X	10					6					
	X	14					6					
5												
					Light Gray Brown fine Sand, with 4 inch Silty fine Sand lense, medium dense-damp to moist							
	X	16					8					
					Light Brown Silty fine Sand, trace medium to coarse Sand, medium dense-moist to very moist							
	X	16					15					
10												
	X	17					10					
15												
					Light Brown fine Sandy Silt to Silty fine Sand, medium dense-very moist							
	X	22					17					
20												

Boring Terminated at 20'

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-9

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/14/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

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

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Light Brown to Brown Silty fine Sand, medium dense-damp							
		37				115	5					EI = 0 @ 0 to 5 feet
					ALLUVIUM: Brown to Orange Brown, Silty fine Sand, trace medium to coarse Sand, trace calcareous veining, medium dense to dense-damp							
		44				110	5					
5		46				114	7					
					Gray Brown to Red Brown fine to coarse Sand, trace fine to coarse Gravel, trace iron oxide staining, slightly to moderately cemented, dense to very dense-damp							
		91/9"				126	3					
		69				106	4					
10												
		36					4					
15												

Boring Terminated at 15'

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-10

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California
DRILLING DATE: 9/10/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward
WATER DEPTH: Dry
CAVE DEPTH: 19 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					12± inches PCC pavement							
		48			FILL: Gray Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, mottled, medium dense to dense-damp to moist	122	8					
		37			@ 3 feet slightly laminated	124	13					
5		26			ALLUVIUM: Brown to Red Brown Silty fine Sand, trace to little Clay, trace calcareous veining, laminated, slightly mottled, medium dense-moist	121	12					
		21			Light Brown Silty fine Sand, trace medium to coarse Sand, trace calcareous veining, medium dense-moist	130	9					
10		40			Brown to Red Brown Silty fine Sand, trace to little Clay, trace calcareous veining, laminated, trace iron oxide staining, medium dense-moist	119	9					
					Brown fine Sand, trace to little Silt, medium dense-damp to moist							
15		18					7					
					Light Brown Clayey Silt, little iron oxide veining, laminated, very stiff-very moist							
		19					29					
20					Brown Silty fine Sand, medium dense-moist		16					
					Boring Terminated at 20'							

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-11

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/14/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: Dry
CAVE DEPTH: 18 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					7± inches PCC pavement							
		56			FILL: Light Gray Brown to Gray Brown fine Sand, trace medium to coarse Sand, trace coarse Gravel, medium dense to dense-dry to damp	114	2					
		27				105	4					
5		30			ALLUVIUM: Brown fine Sand, trace Silt, trace coarse Sand, medium dense-damp	114	4					
		32			Brown to Red Brown Silty fine Sand, trace calcareous veining, medium dense-damp to moist	116	8					
10		77			Gray Brown fine to coarse Sand, trace to little fine to coarse Gravel, very dense-damp	124	5					
15		15			Brown Silty fine Sand to fine Sand Silt, trace iron oxide staining, medium dense-moist		9					
20		33			Gray Brown fine Sand, little Silt, trace to little medium to coarse Sand, trace fine to coarse Gravel, medium dense to dense-damp		6					
25		28					5					
					Boring Terminated at 25'							

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-12

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/14/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

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

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					7± inches PCC pavement							
					FILL: Gray Brown fine Sand, trace to little Silt, trace medium to coarse Sand, dense-damp							
	X	37					6					
	X	34					7					
5												
					ALLUVIUM: Gray Brown Silty fine Sand, trace medium to coarse Sand, dense-damp							
	X	34					7					
					Brown fine Sand, trace Silt, trace calcareous veining, medium dense-moist							
	X	26					9					
10												
					Brown Silty fine Sand, trace iron oxide staining, trace calcareous veining, medium dense-damp							
	X	27					7					
15												
					Gray Brown fine Sand, trace Silt, trace iron oxide staining, trace calcareous veining, medium dense, damp							
	X	25					5					
20												
					Boring Terminated at 20'							

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-13

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/10/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: Dry
CAVE DEPTH: 10½ feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					6± inches PCC pavement							
	X	50			FILL: Brown Silty fine Sand, trace Clay, little medium to coarse Sand, dense-damp	118	6					
	X	29			ALLUVIUM: Brown fine Sand, little to some Silt, loose to medium dense-damp to moist	102	7					
5	X	14				102	7					
	X	9				100	8					
10	X	13				103	8					
					Gray Brown fine to medium Sand, trace to little coarse Sand, trace to little fine to coarse Gravel, medium dense-damp							
15	X	18					4					
					Boring Terminated at 15'							

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL

A California Corporation

BORING NO. B-14

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/14/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

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

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					5½± inches PCC pavement							
		58			FILL: Dark Gray Brown Silty fine Sand, trace Clay, trace coarse Sand, dense-damp	113	7					
		30			ALLUVIUM: Gray Brown fine Sand, trace Silt, medium dense-damp to moist	101	8					
5		22				105	8					
		28			Gray Silty fine Sand, trace medium Sand, medium dense-dry	111	2					
		24			Brown to Gray Brown fine Sand, trace Silt, medium dense-damp	99	6					
10												
		12					6					
15												
					Light Brown Silt, medium dense-very moist							
		18					16					
					Brown fine Sand, trace medium to coarse Sand, trace fine Gravel, medium dense-damp		6					
20												

Boring Terminated at 20'

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-15

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/10/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: Dry
CAVE DEPTH: 19 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					5± inches Asphaltic concrete, no discernible Aggregate base							
	X	52			ALLUVIUM: Gray Brown fine Sand, trace medium Sand, trace to little Silt, medium dense to dense-damp	111	7					
	X	40				111	4					
5	X	30				99	3					
	X	6			Gray Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, loose-damp to moist	99	8					
10	X	19			Gray Brown fine to coarse Sand, little fine Gravel, medium dense-damp	102	3					
					Light Brown fine Sand, trace Silt, trace medium Sand, trace iron oxide staining, trace calcareous veining, medium dense-damp to moist							
15	X	10					10					
20	X	18					6					
25	X	25					7					
					Boring Terminated at 25'							

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-16

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California
DRILLING DATE: 9/10/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward
WATER DEPTH: Dry
CAVE DEPTH: 14 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

FIELD RESULTS: DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS: DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					7± inches PCC pavement							
	X	13			ALLUVIUM: Gray Brown fine Sandy Silt, trace calcareous veining, medium dense-moist		12					
					Gray Brown Silty fine Sand, loose to medium dense-damp to moist							
	X	9					8					
5												
	X	7					9					
	X	10					9					
10												
					Brown fine Sand, trace to little Silt, trace medium to coarse Sand, slightly cemented, medium dense-very moist							
	X	18					12					
15												

Boring Terminated at 15'

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-17

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California
DRILLING DATE: 9/10/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward
WATER DEPTH: Dry
CAVE DEPTH: 8½ feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
					6± inches PCC pavement							
	X	16			ALLUVIUM: Brown fine Sand, trace Silt, trace medium to coarse Sand, trace fine Gravel, trace calcareous veining, medium dense-damp		6					
	X	17					6					
5												
	X	30			@ 6 feet little fine to coarse Gravel, trace iron oxide staining, dense		6					
	X	33			Light Brown to Red Brown fine to coarse Sand, trace fine Gravel, trace iron oxide staining, dense-damp		3					
10												
					Light Gray Brown fine to medium Sand, trace coarse Sand, trace fine Gravel, medium dense-damp							
	X	19					3					
15												
					Boring Terminated at 15'							

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-18

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California
DRILLING DATE: 9/9/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward
WATER DEPTH: Dry
CAVE DEPTH: 12 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					3± inches Asphaltic concrete, 5± inches Aggregate base							
		10			ALLUVIUM: Gray Brown fine Sand, trace to little Silt, trace fine to coarse Gravel, loose to medium dense-damp to moist		10					
		7					7					
5												
		8			Brown fine Sandy Silt, trace medium to coarse Sand, trace calcareous veining, loose-very moist		15					
					Brown fine Sand, trace to little Silt, trace fine to coarse Gravel, loose-moist		8					
		7			Brown Silty fine Sand, trace medium to coarse Sand, trace fine root fibers, trace calcareous veining, loose-moist		10					
10		14				111	11					
		17			@ 13½ feet trace iron oxide staining, medium dense		12					
15												

Boring Terminated at 15'

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-19

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/9/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: Dry
CAVE DEPTH: 10 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
	X	10			ALLUVIUM: Gray Brown fine Sand, trace Silt, trace medium Sand, trace fine root fibers, medium dense-dry to damp		3					EI = 0 @ 0 to 5 feet
	X	7			Gray Brown Silty fine Sand, trace fine root fibers, loose-damp		8					
5												
	X	7			Brown fine Sandy Silt, trace calcareous veining, slightly laminated, loose-very moist		14					
	X	10			Brown Silty fine Sand, medium dense-damp		8					
10												
	X	26			@ 13½ feet trace to little medium to coarse Sand, trace fine to coarse Gravel, slightly laminated, damp		6					
15												
					Boring Terminated at 15'							

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

JOB NO.: 19G188
PROJECT: Proposed Warehouse Development
LOCATION: Rancho Cucamonga, California

DRILLING DATE: 9/10/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

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

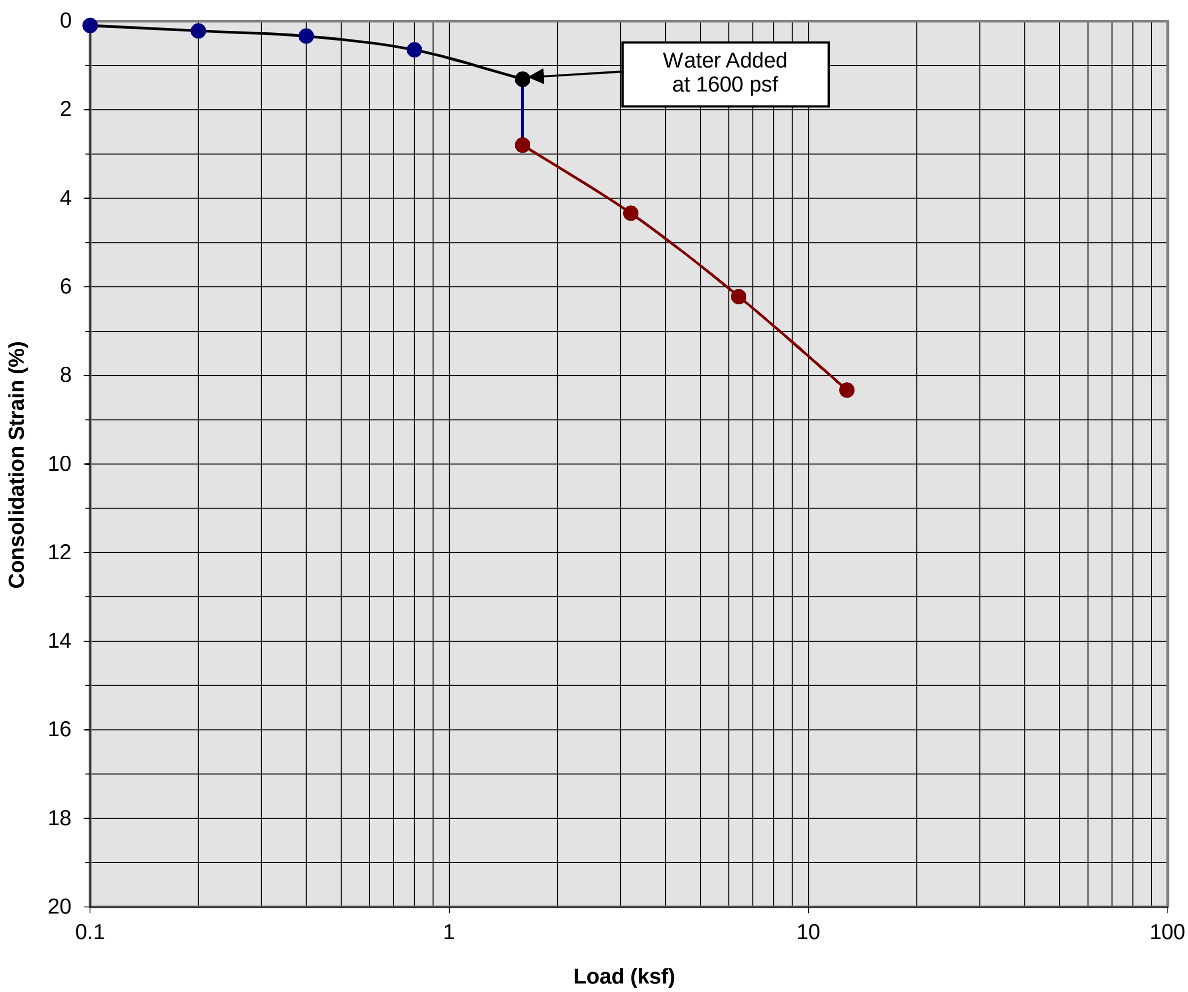
SURFACE ELEVATION: --- MSL

DEPTH (FEET)	BLOW COUNT	POCKET PEN. (TSF)	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
	20		ALLUVIUM: Brown Silty fine Sand, trace medium to coarse Sand, slightly laminated, loose to medium dense-moist to very moist		12					
	5				11					
5	6				13					
	4				18					
10	10				15					
	7		Brown fine Sandy Silt, trace Clay, loose-moist		10					
15	18		Brown Silty fine Sand, medium dense-moist		10					
20			Boring Terminated at 25'							

TBL 19G188.GPJ SOCALGEO.GDT 9/27/19

APPENDIX C

Consolidation/Collapse Test Results

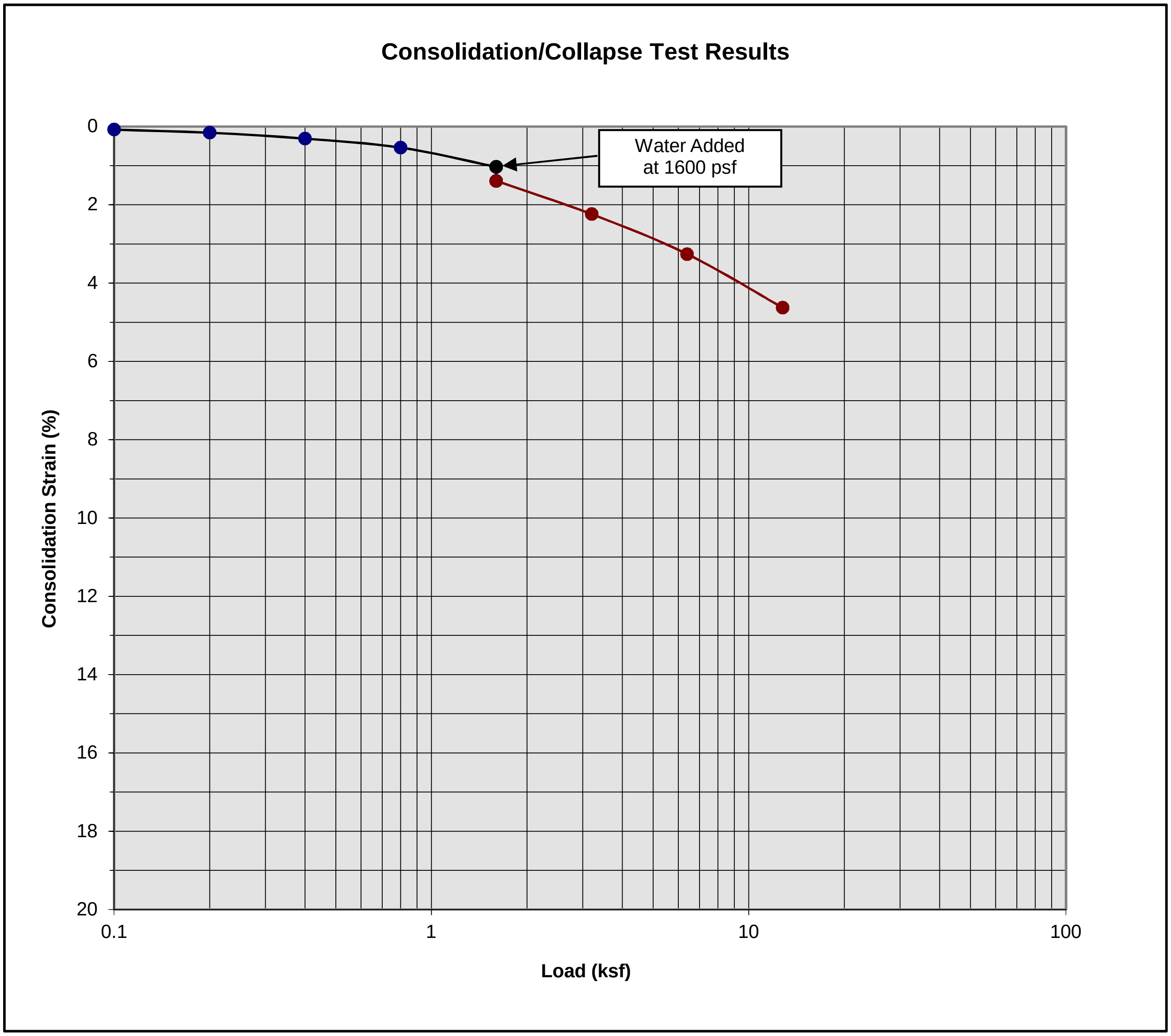


Classification: Brown fine Sand, trace Silt, trace Coarse Sand

Boring Number:	B-1	Initial Moisture Content (%)	9
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	3 to 4	Initial Dry Density (pcf)	96.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	105.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.49

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



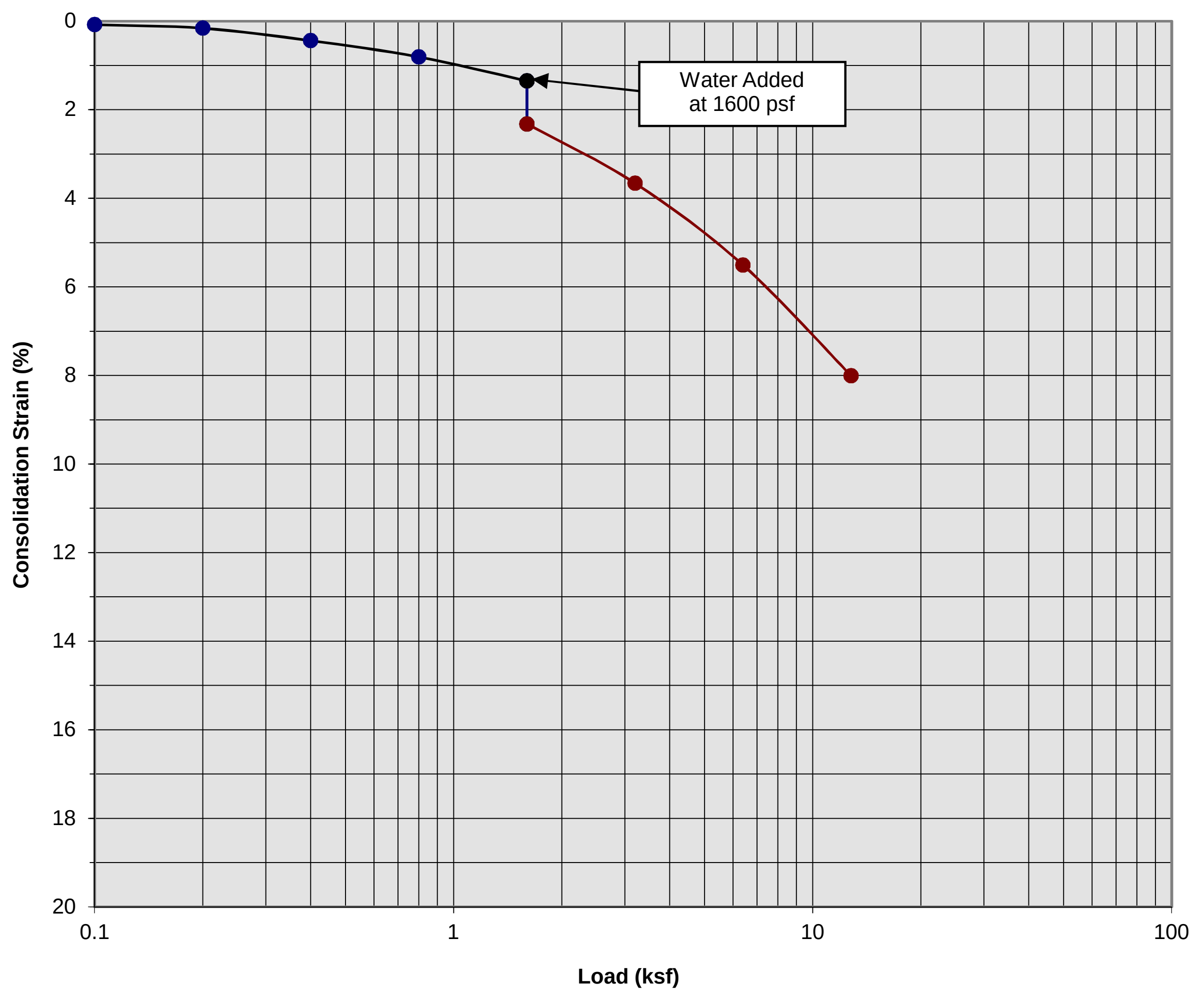
Classification: Brown to Red Brown Silty fine Sand

Boring Number:	B-1	Initial Moisture Content (%)	10
Sample Number:	---	Final Moisture Content (%)	20
Depth (ft)	5 to 6	Initial Dry Density (pcf)	98.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	103.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.36

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



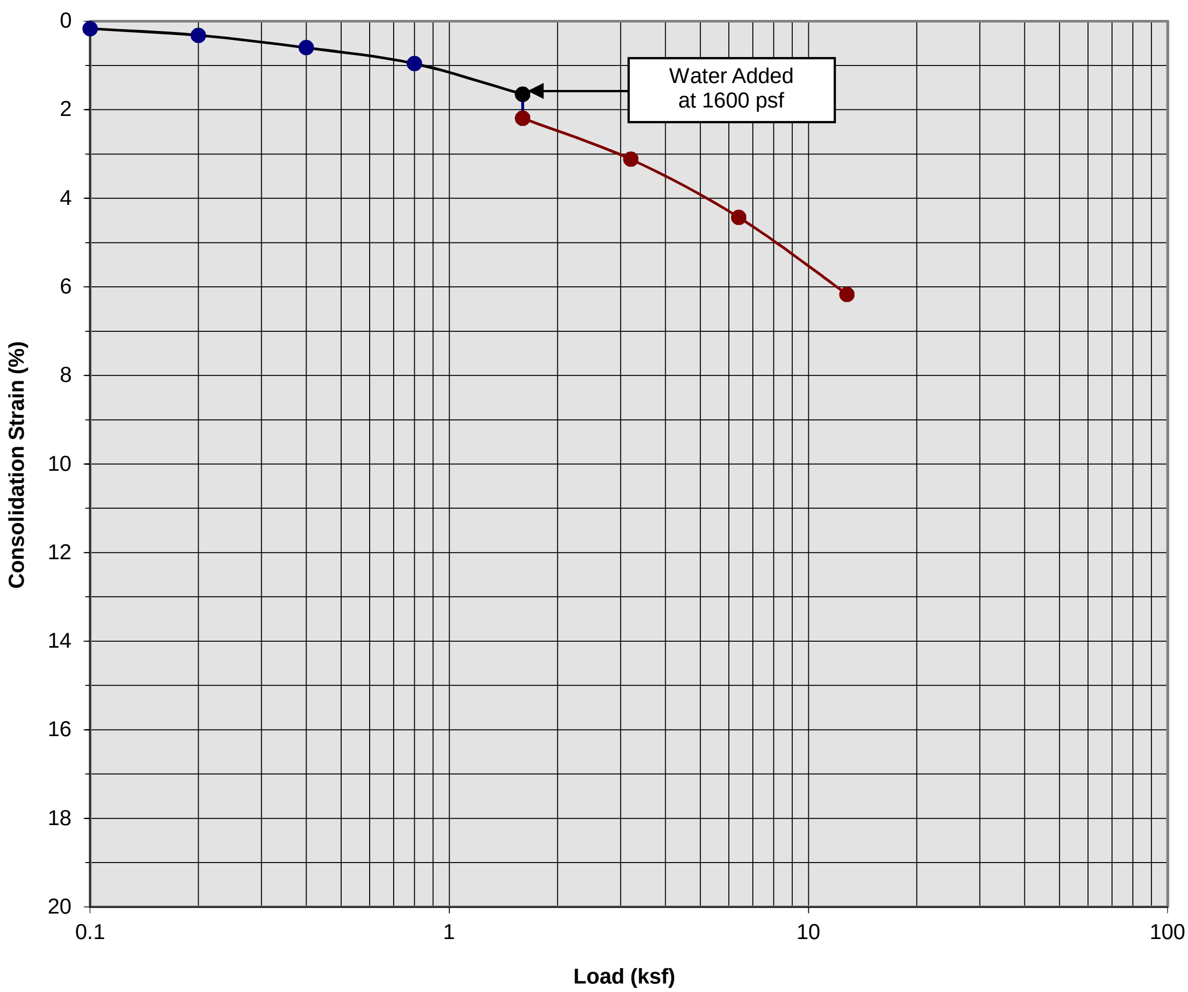
Classification: Brown to Red Brown Silty fine Sand

Boring Number:	B-1	Initial Moisture Content (%)	9
Sample Number:	---	Final Moisture Content (%)	13
Depth (ft)	7 to 8	Initial Dry Density (pcf)	112.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	121.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.97

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188
PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

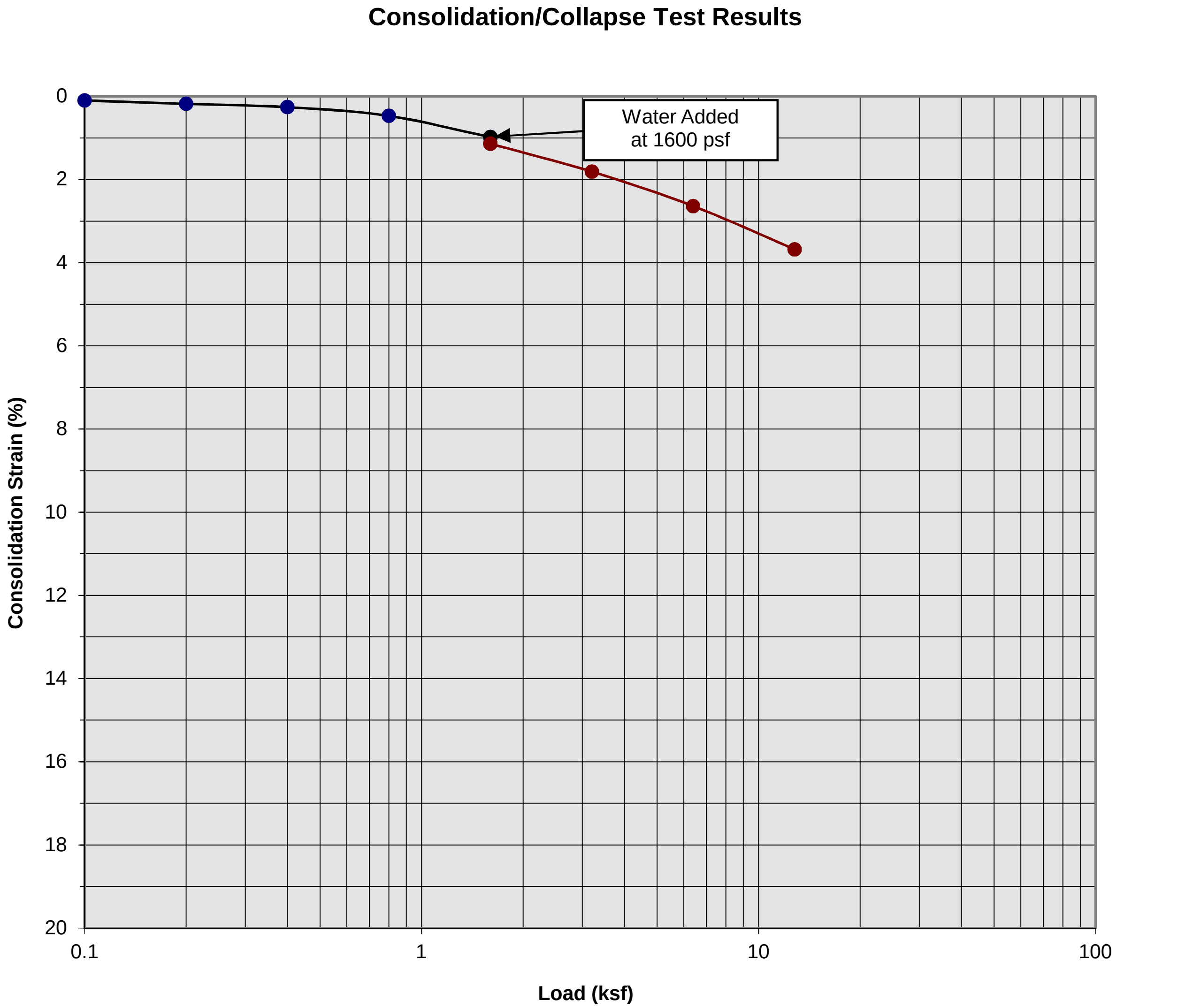


Classification: Brown to Red Brown Silty fine Sand

Boring Number:	B-1	Initial Moisture Content (%)	9
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	9 to 10	Initial Dry Density (pcf)	112.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	119.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.54

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188
PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



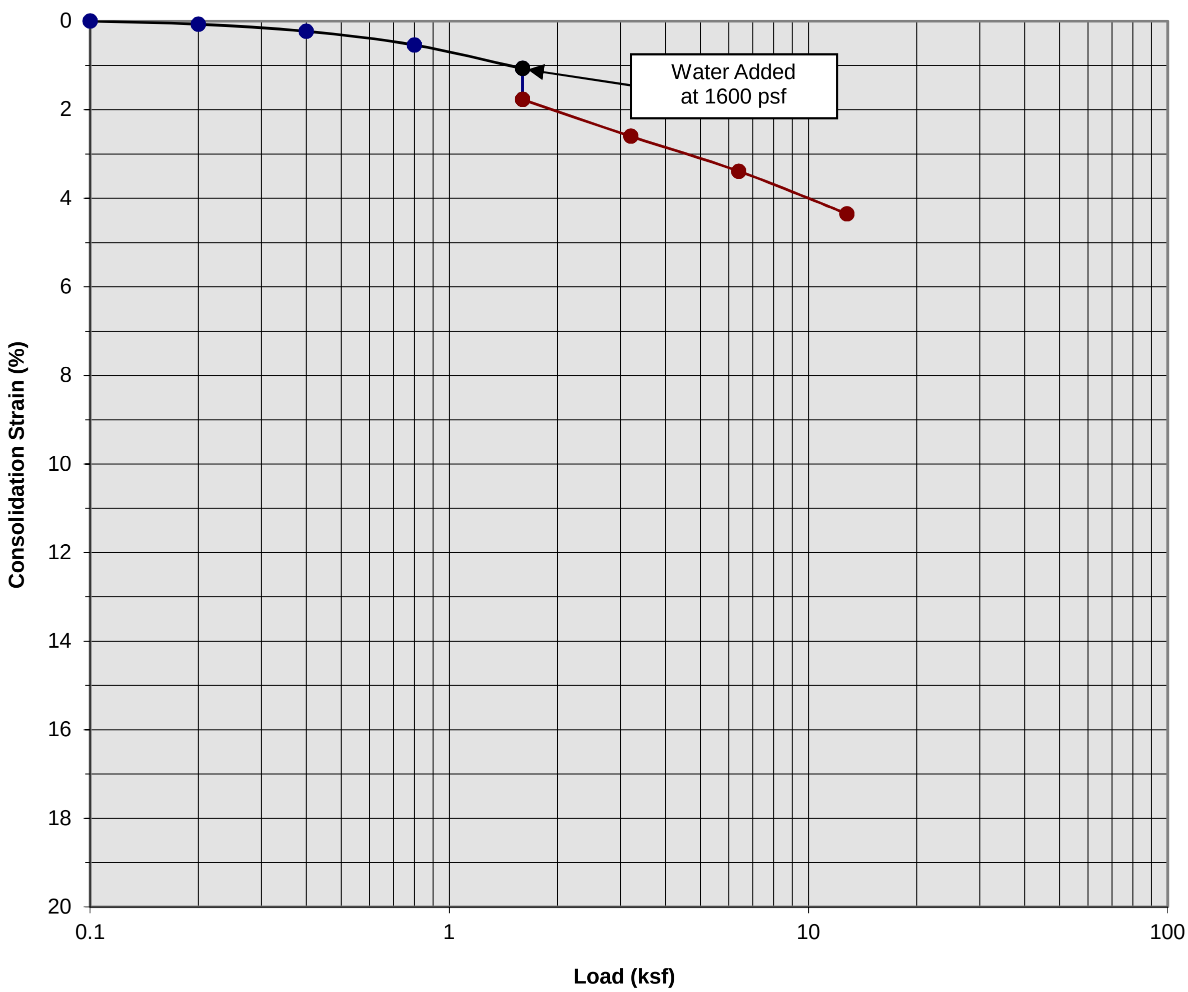
Classification: Brown fine Sand, little to some Silt

Boring Number:	B-13	Initial Moisture Content (%)	7
Sample Number:	---	Final Moisture Content (%)	20
Depth (ft)	3 to 4	Initial Dry Density (pcf)	102.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	107.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.16

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188
PLATE C- 5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



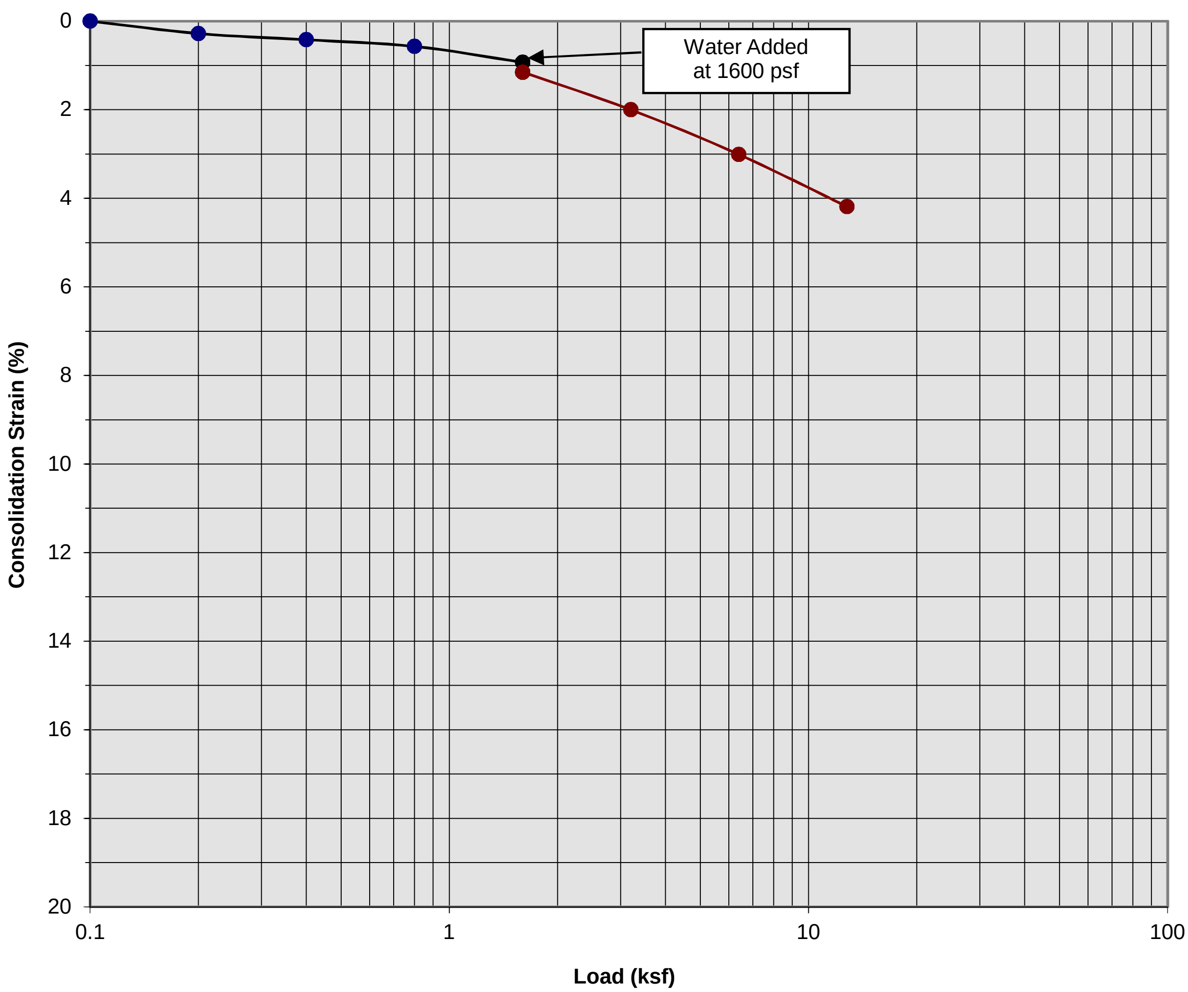
Classification: Brown fine Sand, little to some Silt

Boring Number:	B-13	Initial Moisture Content (%)	7
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	5 to 6	Initial Dry Density (pcf)	102.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	107.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.70

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188
PLATE C- 6

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

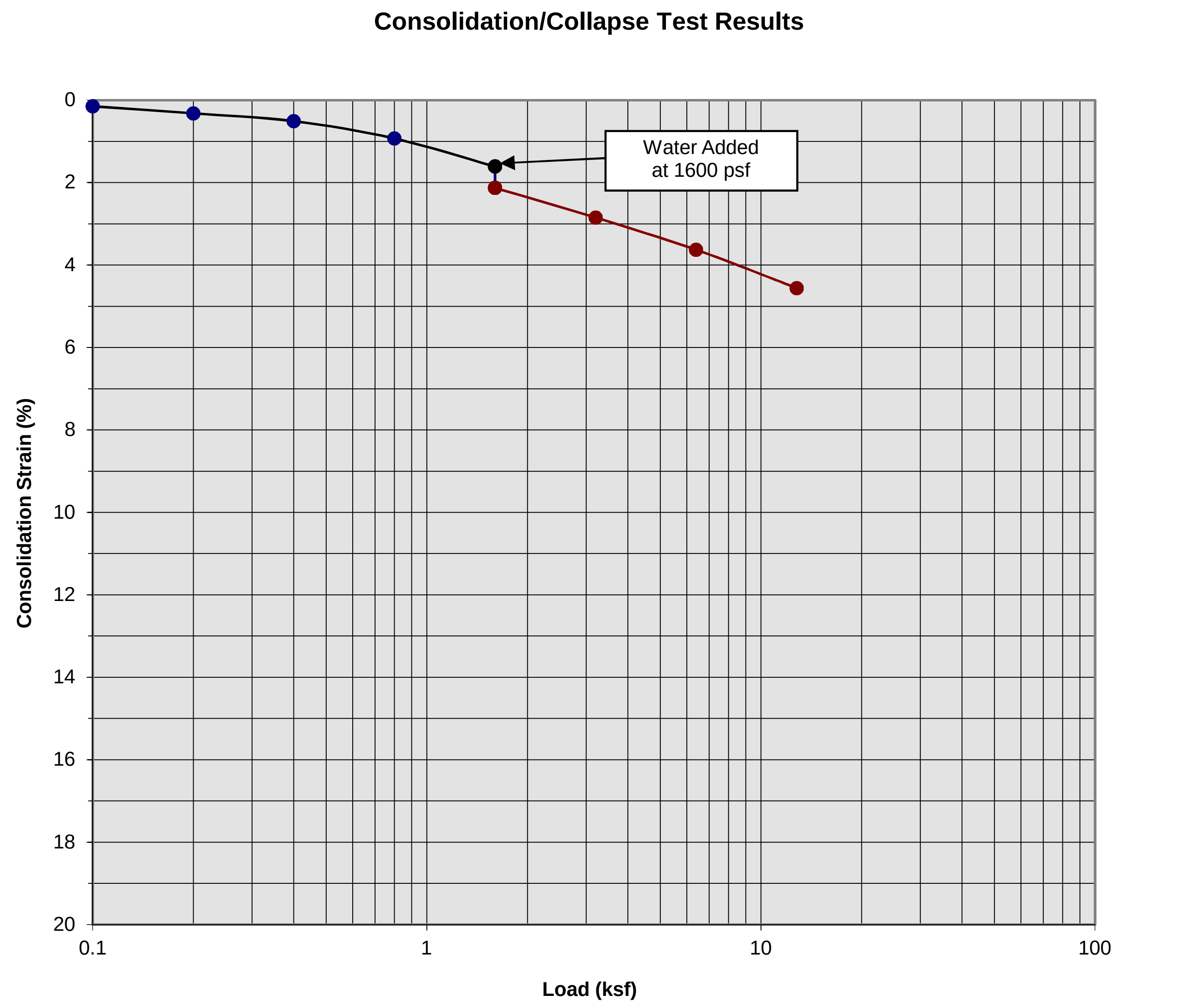


Classification: Brown fine Sand, little to some Silt

Boring Number:	B-13	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	7 to 8	Initial Dry Density (pcf)	100.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	105.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.22

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188
PLATE C- 7

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

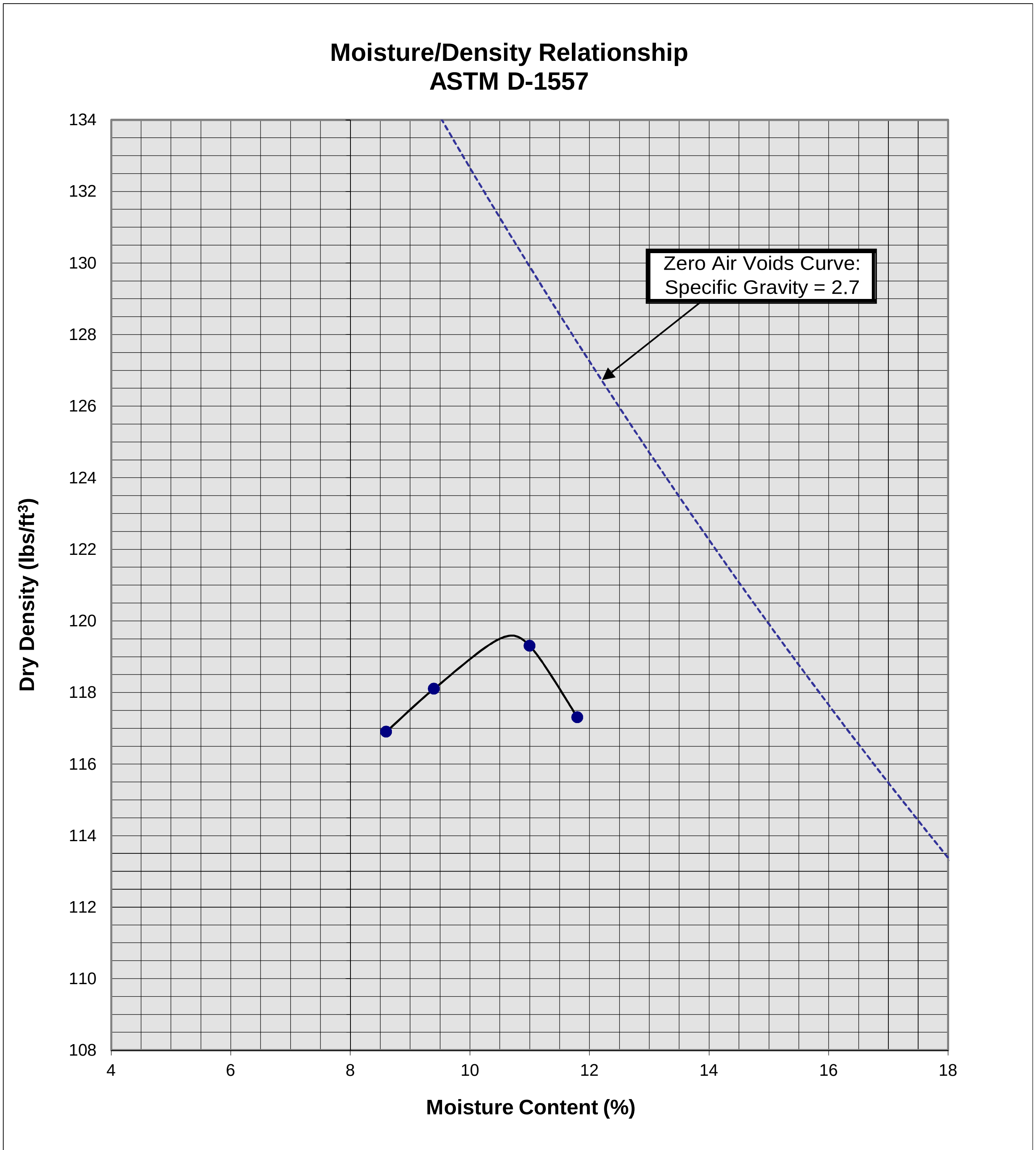


Classification: Brown fine Sand, little to some Silt

Boring Number:	B-13	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	20
Depth (ft)	9 to 10	Initial Dry Density (pcf)	102.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	107.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.52

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188
PLATE C- 8

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

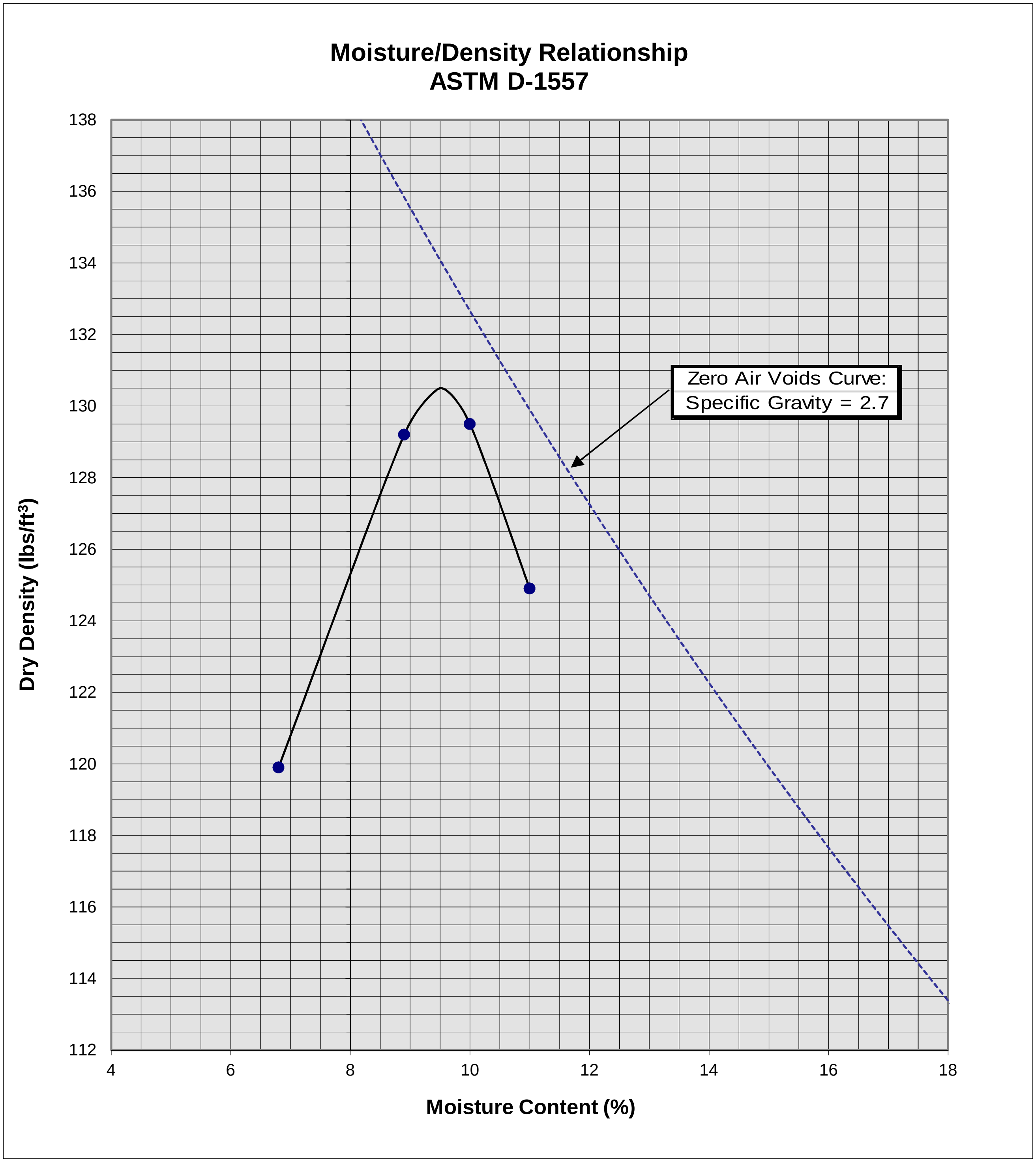


Soil ID Number	B-9 @ 0 to 5'
Optimum Moisture (%)	10.5
Maximum Dry Density (pcf)	119.5
Soil Classification	Light Brown to Brown Silty fine Sand, trace medium to coarse Sand

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188-1

PLATE C-9

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Soil ID Number	B-13 @ 0 to 5'
Optimum Moisture (%)	9.5
Maximum Dry Density (pcf)	130.5
Soil Classification	Brown Silty fine Sand, little medium to coarse Sand

Proposed Warehouse Development
Rancho Cucamonga, California
Project No. 19G188-1
PLATE C-10

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX D

GRADING GUIDE SPECIFICATIONS

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

General

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

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

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

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

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

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

Site Preparation

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

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

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

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

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

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

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

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

Compacted Fills

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Foundations

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

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

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

Fill Slopes

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

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

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

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

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

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

Cut Slopes

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

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

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

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

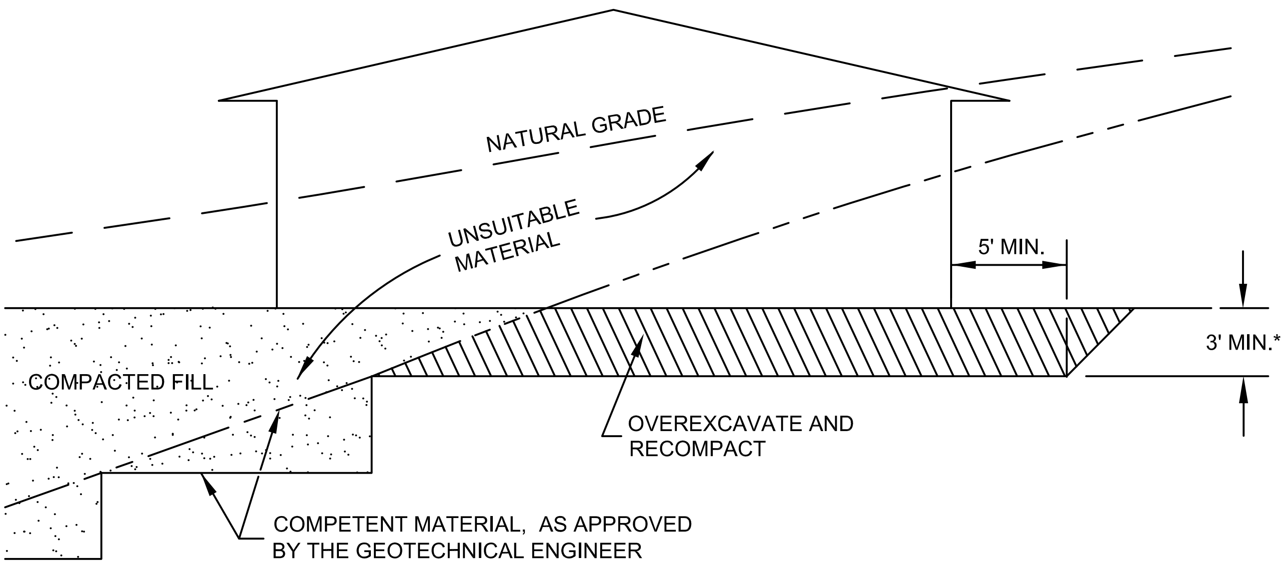
Subdrains

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

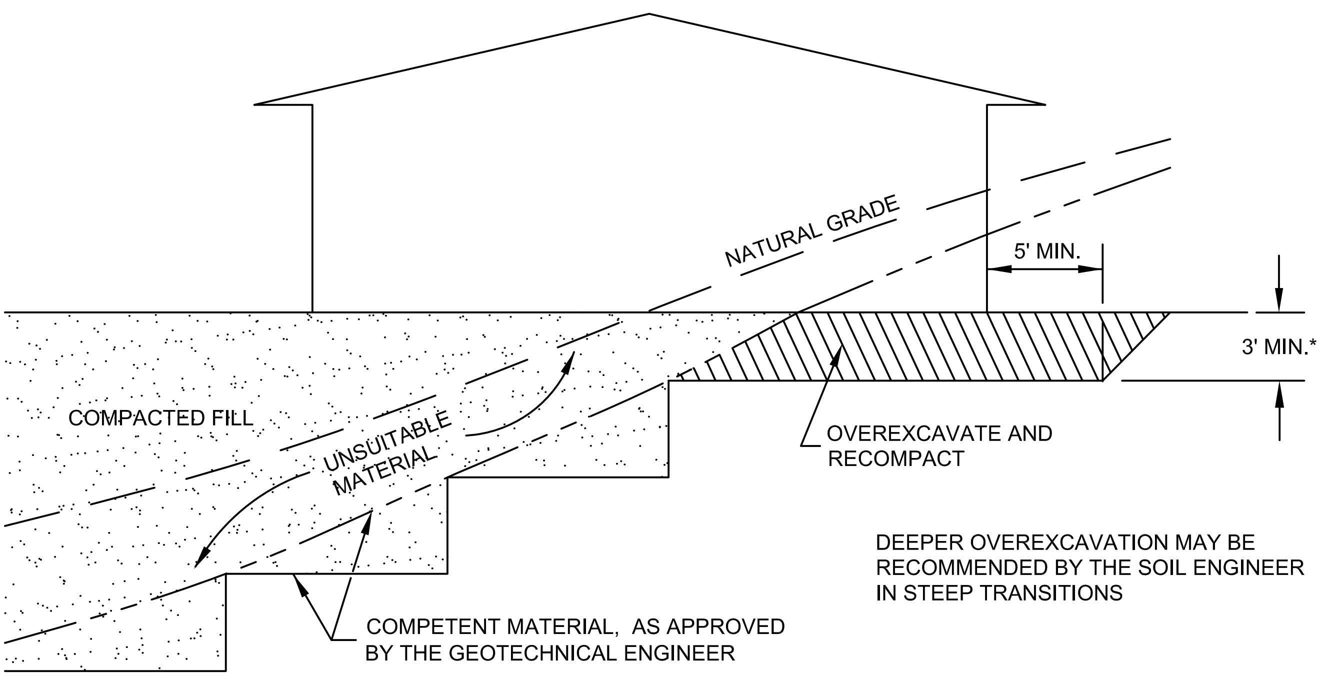
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

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

CUT LOT



CUT/FILL LOT (TRANSITION)



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

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

TRANSITION LOT DETAIL

GRADING GUIDE SPECIFICATIONS

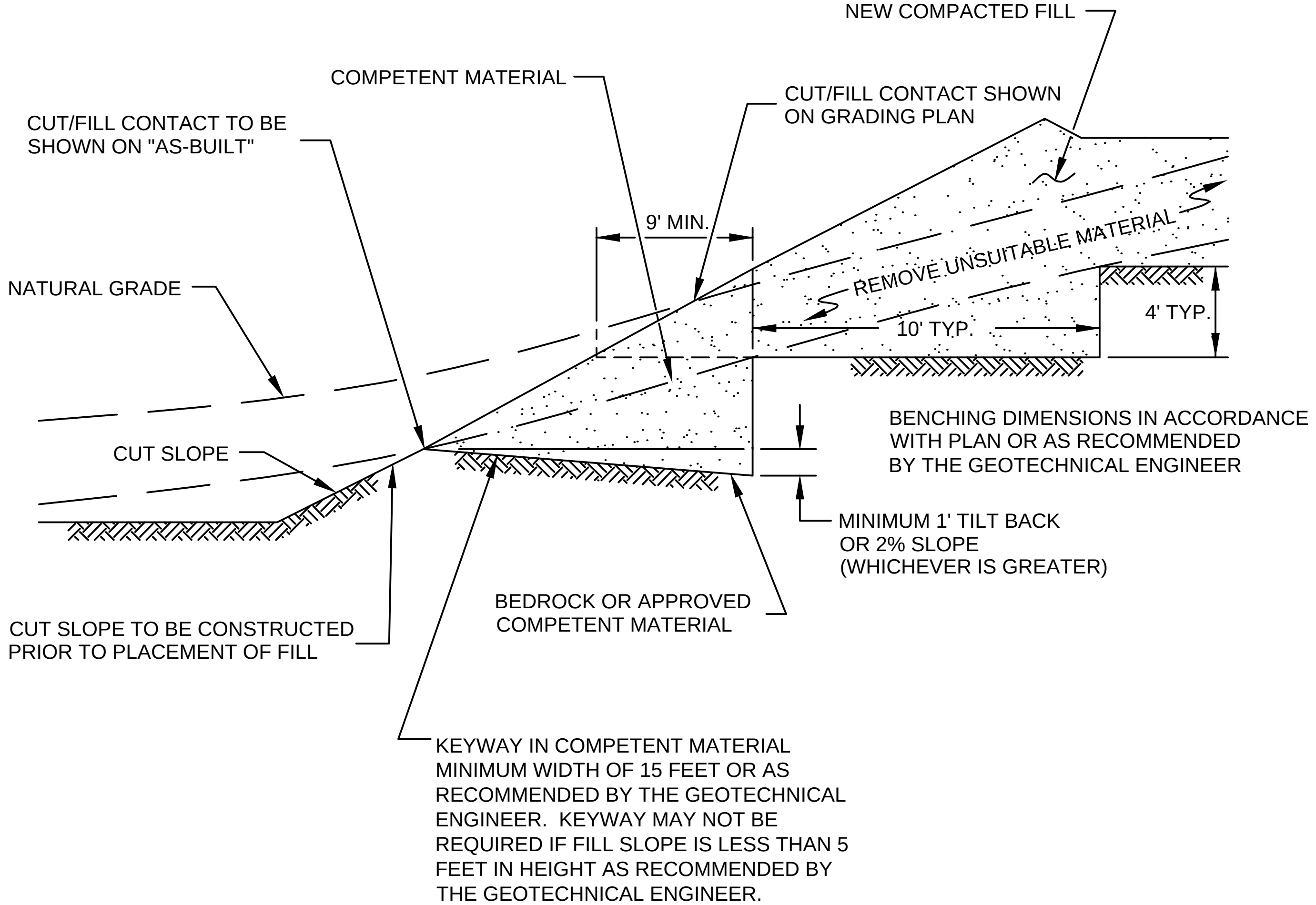
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

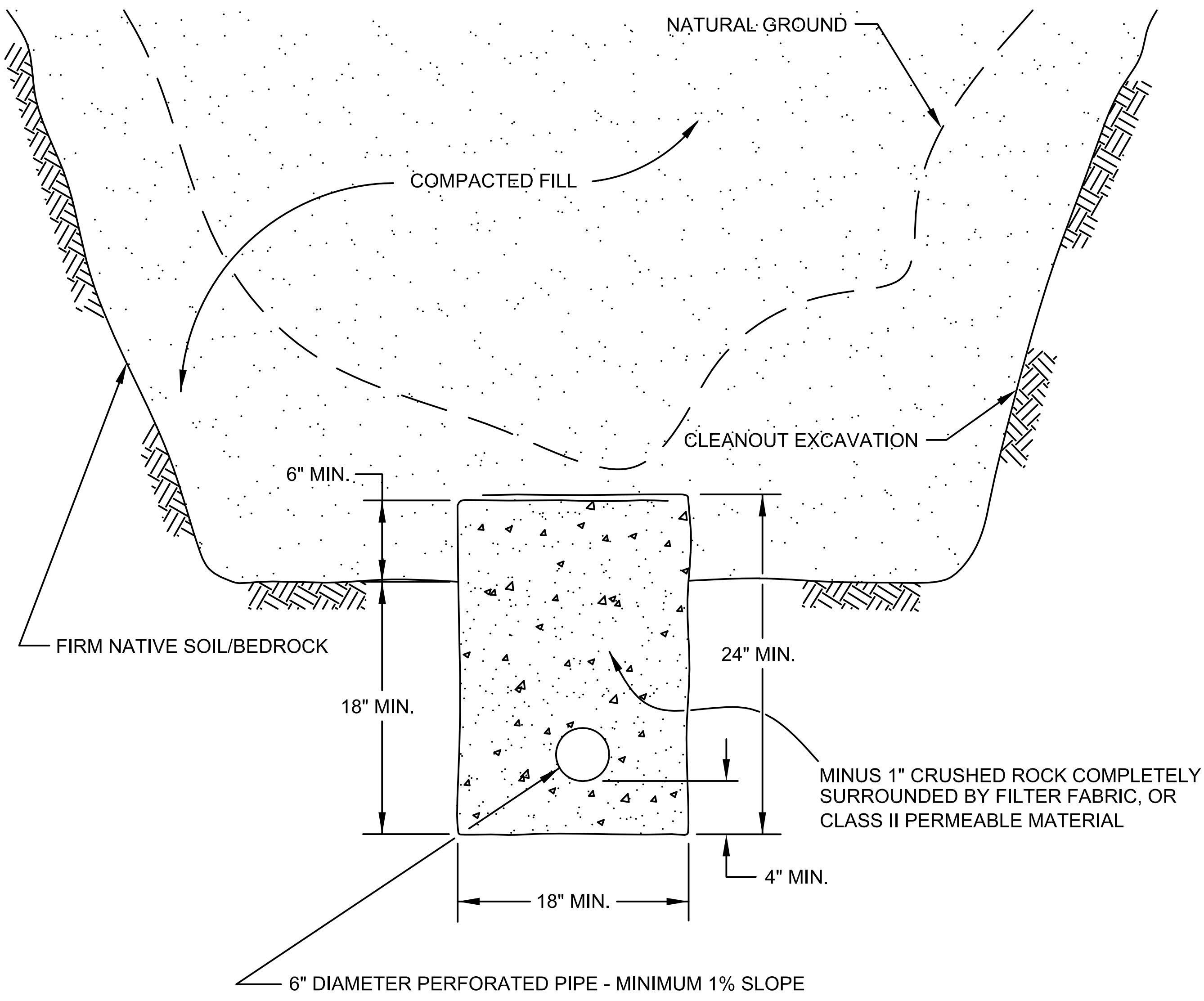
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

SOUTHERN CALIFORNIA GEOTECHNICAL



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

SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL

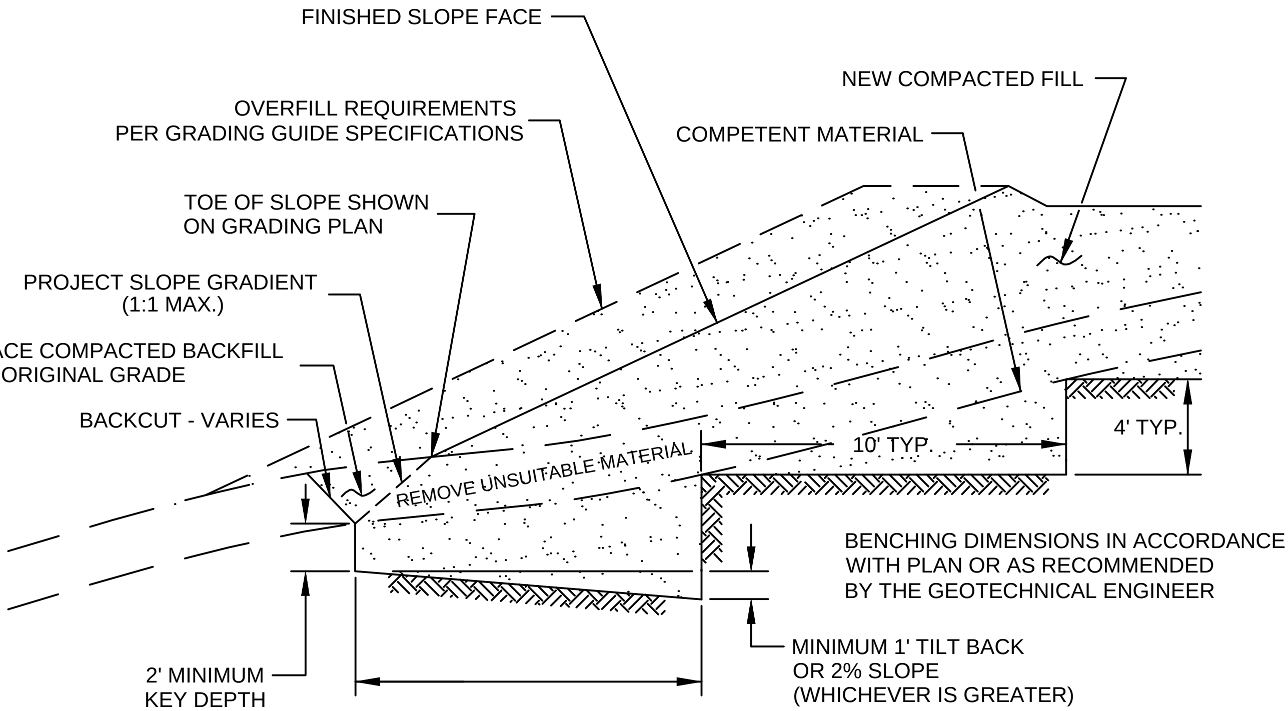
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL



KEYWAY IN COMPETENT MATERIAL. MINIMUM WIDTH OF 15 FEET OR AS RECOMMENDED BY THE GEOTECHNIAL ENGINEER. KEYWAY MAY NOT BE REQUIRED IF FILL SLOPE IS LESS THAN 5' IN HEIGHT AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER.

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

FILL ABOVE NATURAL SLOPE DETAIL

GRADING GUIDE SPECIFICATIONS

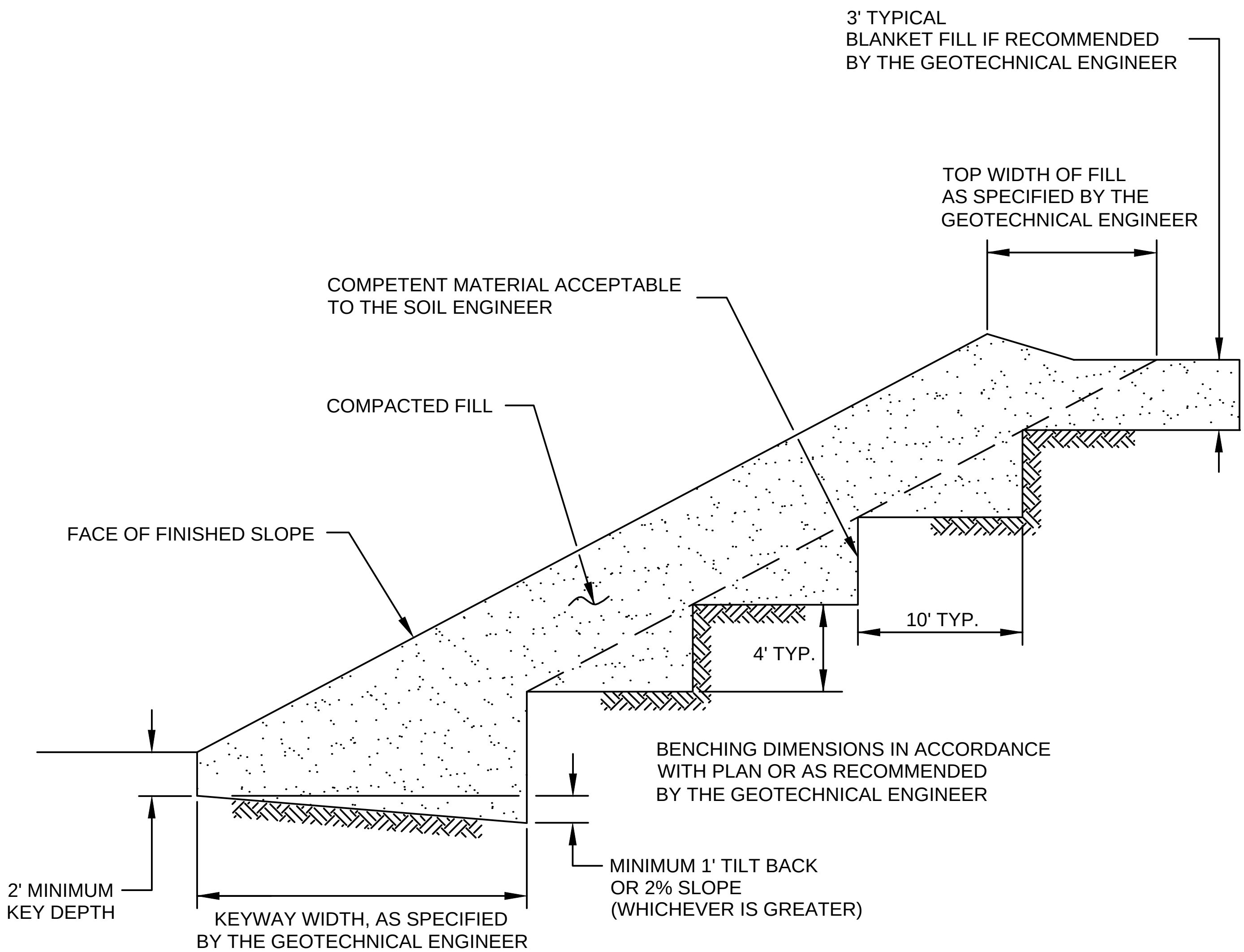
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

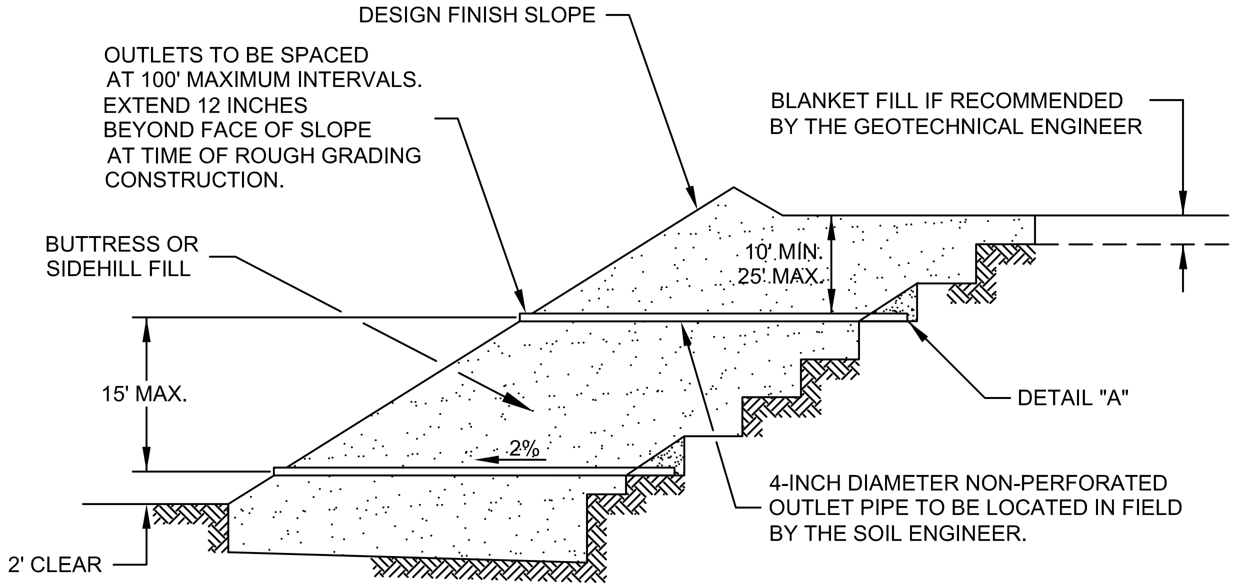
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SOUTHERN
CALIFORNIA
GEOTECHNICAL



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

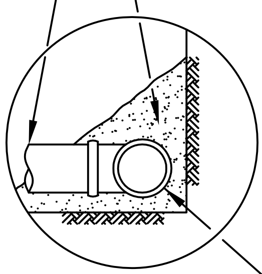
SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"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

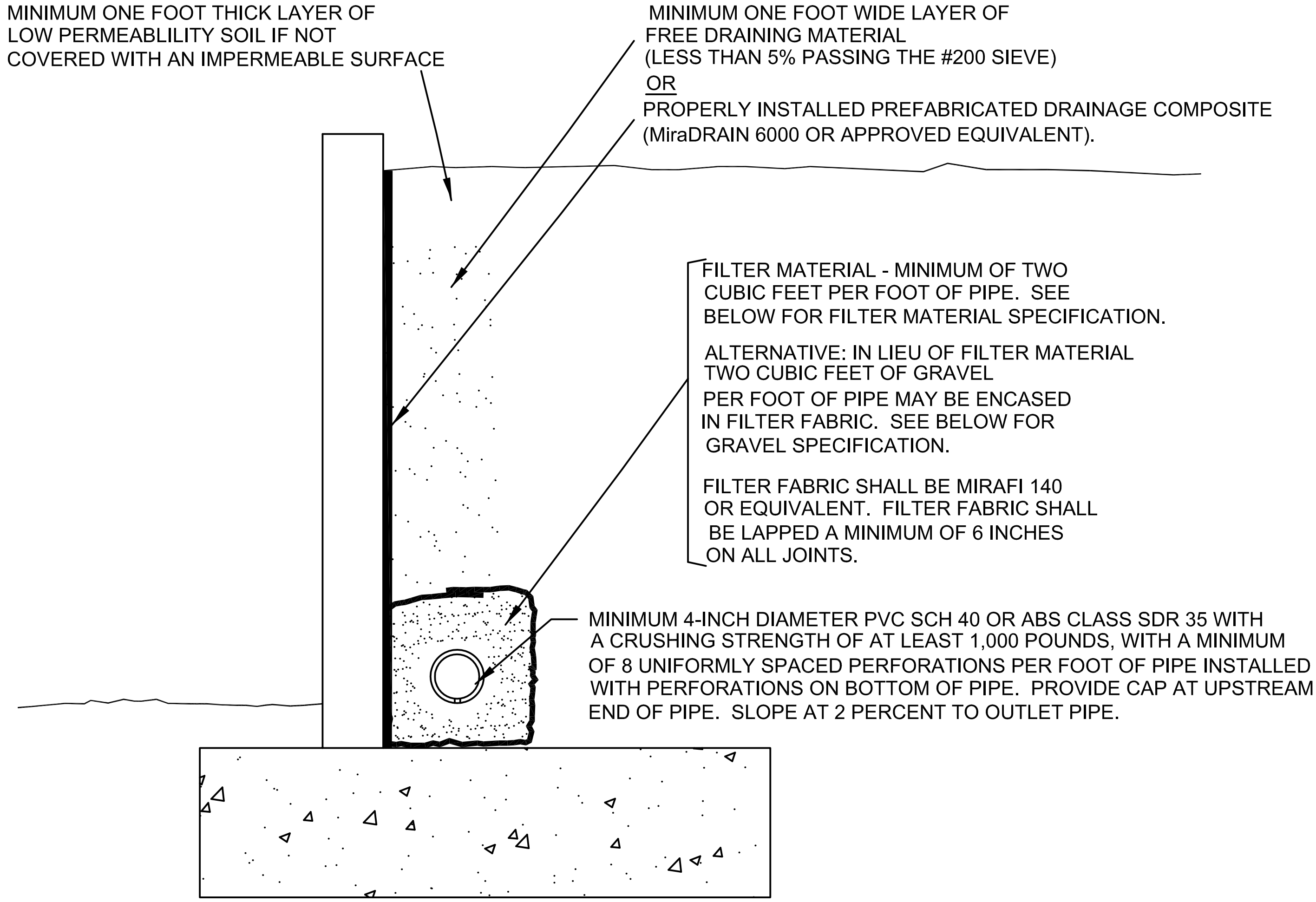
GRADING GUIDE SPECIFICATIONS

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

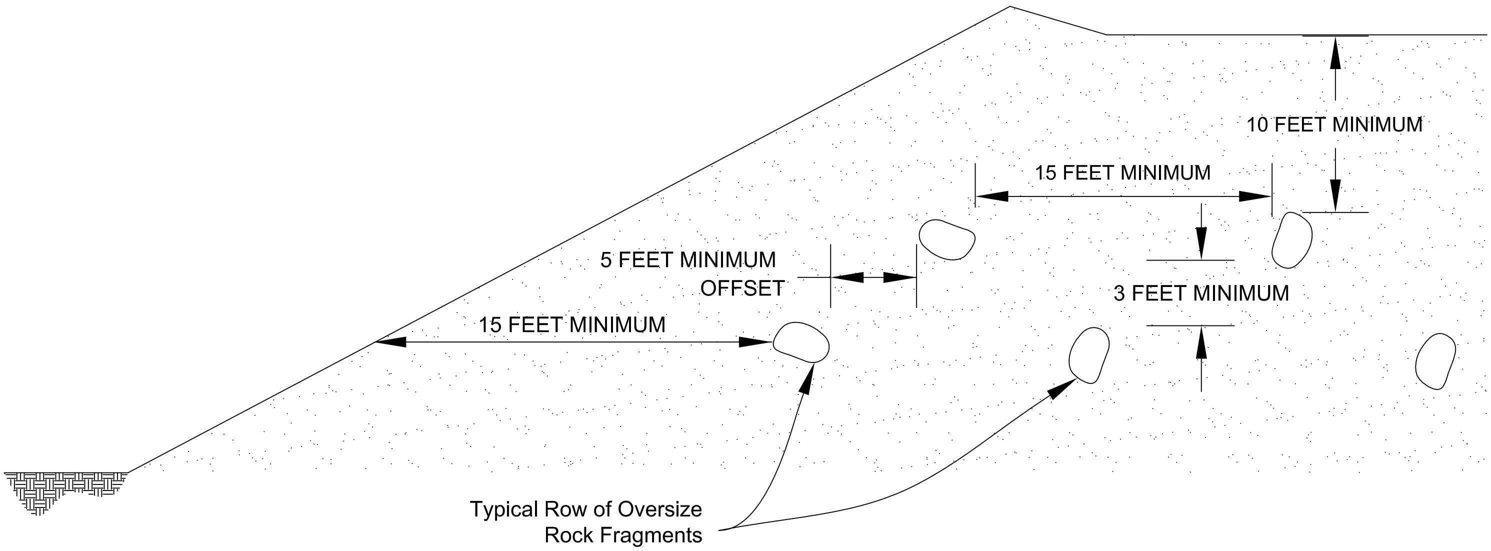
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

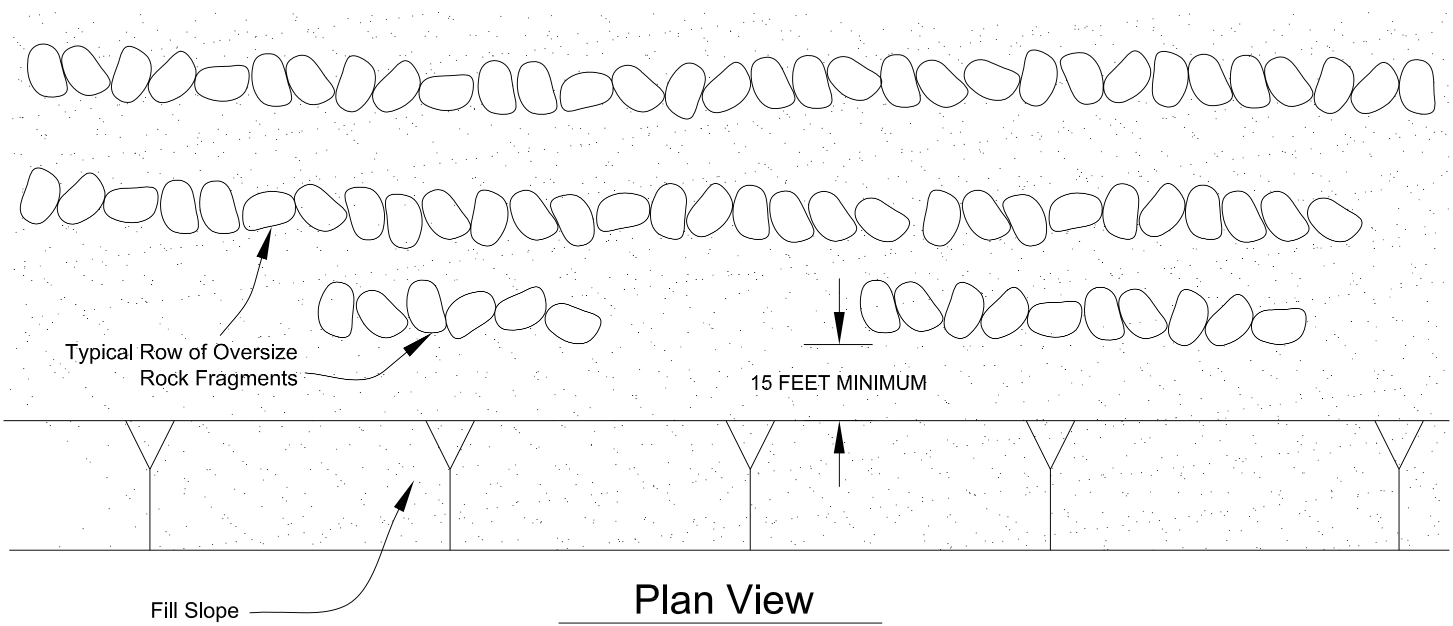
PLATE D-7

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

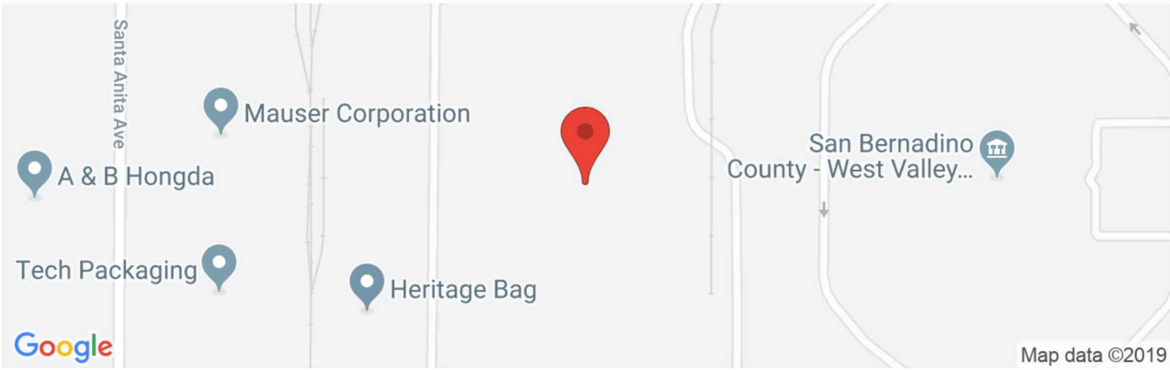
DRAWN: PM
CHKD: GKM

PLATE D-8

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

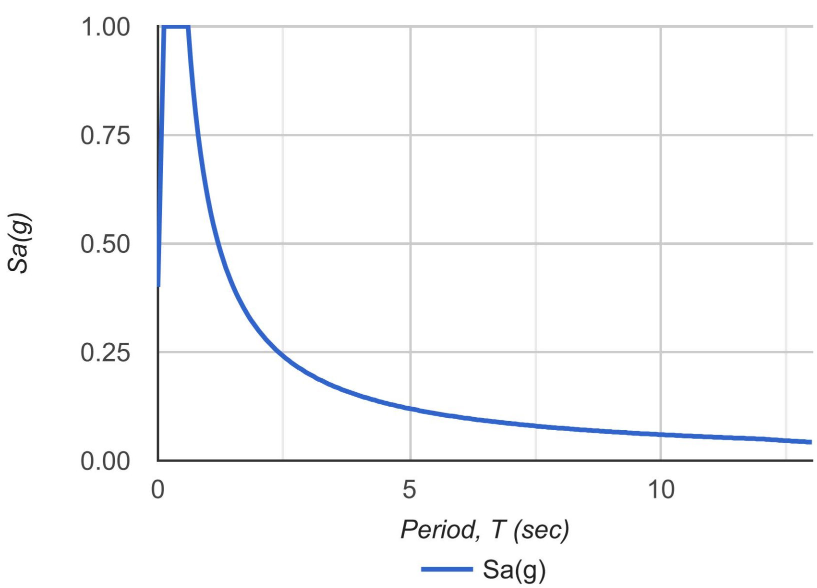
Latitude, Longitude: 34.081126, -117.533826



Date	9/13/2019, 10:42:31 AM
Design Code Reference Document	ASCE7-10
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description	Type	Value	Description
S_S	1.5	MCE_R ground motion. (for 0.2 second period)	SDC	D	Seismic design category
S_1	0.6	MCE_R ground motion. (for 1.0s period)	F_a	1	Site amplification factor at 0.2 second
S_{MS}	1.5	Site-modified spectral acceleration value	F_v	1.5	Site amplification factor at 1.0 second
S_{M1}	0.9	Site-modified spectral acceleration value	PGA	0.5	MCE_G peak ground acceleration
S_{DS}	1	Numeric seismic design value at 0.2 second SA	F_{PGA}	1	Site amplification factor at PGA
S_{D1}	0.6	Numeric seismic design value at 1.0 second SA	PGA_M	0.5	Site modified peak ground acceleration

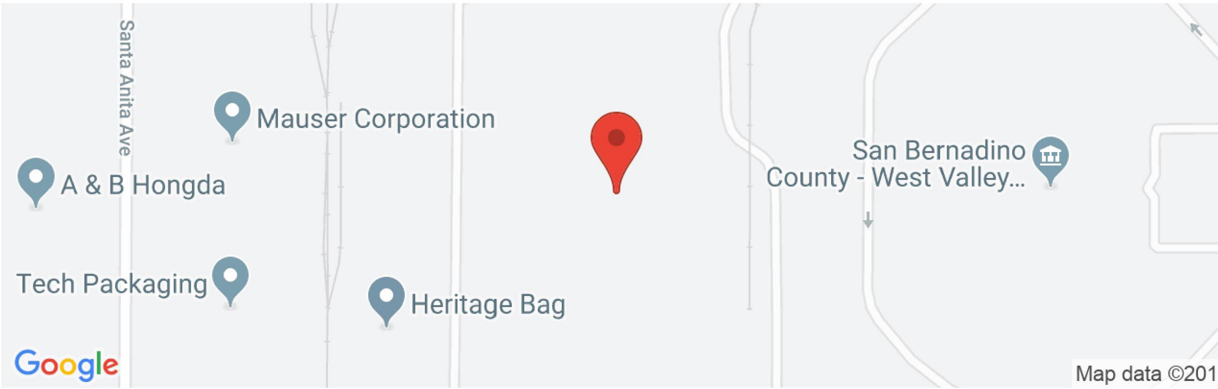
Design Response Spectrum



SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2016 CBC	
TWO PROPOSED WAREHOUSES	
RANCHO CUCAMONGA, CALIFORNIA	
DRAWN: JLL CHKD: RGT	SOUTHERN CALIFORNIA GEOTECHNICAL
SCG PROJECT 19G188-1R	
PLATE E-1A	

Latitude, Longitude: 34.081126, -117.533826



Date	9/13/2019, 10:43:01 AM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.726	MCE_R ground motion. (for 0.2 second period)
S_1	0.642	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.726	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.151	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.732	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.805	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.726	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.844	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.053	Factored deterministic acceleration value. (0.2 second)
S1RT	0.642	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.704	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.666	Factored deterministic acceleration value. (1.0 second)
PGAd	0.836	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.936	Mapped value of the risk coefficient at short periods
C_{R1}	0.913	Mapped value of the risk coefficient at a period of 1 s

SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2019 CBC

TWO PROPOSED WAREHOUSES

RANCHO CUCAMONGA, CALIFORNIA

DRAWN: JLL
CHKD: RGT

SCG PROJECT
19G188-1R

PLATE E-1B

SOUTHERN CALIFORNIA GEOTECHNICAL