GEOTECHNICAL FEASIBILITY STUDY PROPOSED COMMERCIAL/INDUSTRIAL BUILDING

Pepper Avenue, South of Foothill Freeway
Rialto, California
for
Howard Industrial Partners

SoCalGeo

SOUTHERN
CALIFORNIA
GEOTECHNICAL
A California Corporation

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December 15, 2020

Howard Industrial Partners
1944 North Tustin Street, Suite 122
Orange, California 92865

Attention: Mr. Mike Tunney
Vice President

Project No.: **20G234-1**

Subject: **Geotechnical Feasibility Investigation**
Proposed Commercial/Industrial Building
Pepper Avenue, South of Foothill Freeway
Rialto, California

Dear Mr. Tunney:

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

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

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Ricardo Frias, RCE 91772
Staff Engineer

REGISTERED PROFESSIONAL ENGINEER
RICARDO FRIAS
No. 91772
CIVIL
STATE OF CALIFORNIA

Robert G. Trazo, GE 2655
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
ROBERT TRAZO
No. 2655
GEOTECHNICAL
STATE OF CALIFORNIA

Distribution: (1) Addressee

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1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report. It should be noted that this investigation was focused on determining the geotechnical feasibility of the proposed development. **Results found in this report are contingent on the results of the concurrent fault study and should be referred to once they become available. This report is not a design-level investigation. Future studies will be necessary to refine the preliminary design parameters that are presented within this report**.

Geotechnical Design Considerations

- The subject site is not located in a mapped liquefaction hazard zone. However, the subject site is located in a mapped fault zone. A concurrent fault study will be prepared for this site.
- Native alluvial soils were encountered at all of the boring locations, extending at least to the maximum depth explored of 50± feet.
- The near-surface native alluvial soils generally consist of non-expansive loose to medium dense silty sands, sandy silts and well-graded sands.
- Developing this site with a new commercial/industrial building is considered to be feasible, contingent on the results of the concurrent fault study, with respect to the geotechnical conditions encountered at the boring locations at the site. Preliminary remedial grading and foundation design recommendations have been provided herein, based on the preliminary site plan, assumed site grading, and assumed foundation loads.

Preliminary Geotechnical Design Recommendations

- Initial site stripping should include removal of the surficial vegetation from the site. These materials should be properly disposed of off-site.
- Remedial grading will be necessary within the proposed building pad area to remove a portion of the near-surface alluvial soils and replace these materials as compacted structural fill.
- Preliminarily, the overexcavation within the building area is recommended to extend to depths of at least 4 to 6 feet below existing and proposed building pad subgrade elevations. The overexcavation should also extend to a depth of at least 3 to 4 feet below bearing grade within the influence zones of any new foundations. These recommendations may be revised based on the results of a design-level geotechnical investigation.
- Overexcavated soils may be compacted and reused as structural fill.
- Preliminarily, the new parking area subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned to within 0 to 4 percent above the optimum moisture content and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Some overexcavation may be warranted in isolated areas.

Preliminary Foundation Design Recommendations

- Conventional shallow foundations, supported in newly placed compacted structural fill.
- 2,500 to 3,000 lbs/ft^2 maximum allowable soil bearing pressure.
- The design of the foundations will depend on the results of a future design-level geotechnical study. Minimum recommended reinforcement based on geotechnical conditions

is expected to consist of two (2) to four (4) No. 5 rebars in strip footings. Additional reinforcement may be necessary for structural considerations.

Preliminary Floor Slab Design Recommendations

- Conventional slab-on-grade, minimum 6 to 7 inches thick.
- Modulus of Subgrade Reaction: k = 100 to 150 psi/in.
- Reinforcement is not required for geotechnical conditions. The design of the floor slab will depend on the results of a future design-level geotechnical study. The actual thickness and reinforcement of the floor slabs should be determined by the structural engineer.

Preliminary 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. 20P409, dated November 12, 2020. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to determine the geotechnical feasibility of the proposed development. This report also contains preliminary design criteria for building foundations, building floor slab, and parking lot pavements. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical feasibility study. **Results found in this report are contingent on the results of the concurrent fault study and should be referred to once they become available.**

It should be noted that additional subsurface exploration, laboratory testing and engineering analysis will be necessary to provide a design-level geotechnical investigation with specific foundation, floor slab, and grading recommendations.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located on the east side of Pepper Avenue, approximately 500 feet south of the intersection of Pepper Avenue and the Foothill Freeway (CA-210) in Rialto, California. The site is bounded to the north and east by vacant lots, to the west by Pepper Avenue, and to the south by a vacant lot and a detention basin with an above-ground storage tank (AST). The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The site consists of an "L"-shaped parcel, 24.23± acres in size. The site is currently vacant and undeveloped. The ground surface cover consists of exposed soil with sparse to moderate native grass and weed growth. Tree trunks and debris are scattered around the northern region of the site.

As part of our research for this project, we reviewed historical aerial photographs, which were readily available from the internet. Based on our review, the site appears to have been previously utilized as an orchard from the years 1938 to 1995. Since then, the site has been cleared of most trees and shrubs.

Topographic information by Inland Aerial Surveys, Inc. was provided by the client. The site topography ranges from 1267± feet mean sea level (msl) located in the southeast corner of the site to 1290± msl in the northwest corner of the site. The site generally slopes downward to the southeast at a gradient of 1½± percent.

3.2 Proposed Development

Based on a conceptual site plan, prepared by Architects Orange (AO), provided to our office by the client, the subject site will be developed with one (1) new commercial/industrial building, 493,000± ft² in size, located in the north-central area of the site. Dock-high doors will be constructed along portions of the north and south building walls. The building will be surrounded by asphaltic concrete pavements in the parking and drive lanes, Portland cement concrete pavements in the loading dock areas, concrete flatwork, and limited areas of landscape planters throughout.

Detailed structural information has not been provided. It is assumed that the new building will be a single-story structure of tilt-up concrete construction, supported on a conventional shallow foundation system with a concrete slab-on-grade floor. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 80 to 100 kips and 4 to 7 kips per linear foot, respectively.

Grading plans for the proposed development were not available at the time of this report. No significant amounts of below-grade construction such as basements or crawl spaces are expected to be included in the proposed development. Based on the assumed topography, cuts and fills of 7 to 10± feet are expected to be necessary to achieve the proposed site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of four (4) borings advanced to a depth of 50± feet below the existing site grades. All of the borings were logged during drilling by a member of our staff.

The borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. 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

Alluvium

Native alluvium was encountered beneath at the ground surface at all of the boring locations, extending to at least the maximum depth explored of 50± feet below the existing site grades. The near-surface alluvium generally consists of very loose to medium dense silty sands, sandy silts, gravelly sands, and well-graded sands, with varying silt and gravel content, extending to depths of 7 to 10± feet. The underlying alluvium generally consists of medium dense to dense silty sands, sandy silts, and well graded sands with varying fine gravel and silt content, extending to depths of 15 to 20± feet. At greater depths and extending to the maximum depth explored of 50± feet, the alluvial soils generally consist of dense to very dense silty sands, gravely sands, sandy gravels, and well graded sands, with varying silt, gravel and cobble content.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings and the moisture contents of the recovered soil samples, the static groundwater is considered to have existed at a depth in excess of 50± feet at the time of the subsurface exploration.

As part of our research, we reviewed readily available groundwater data in order to determine regional groundwater depths. The primary reference used to determine the groundwater depths in the subject site area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well is located approximately 800 feet southeast from the site. Water level readings within this monitoring well indicates a high groundwater level of 418 feet below the ground surface in September 2020.

5.0 LABORATORY TESTING

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

Classification

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

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

One representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557 and are presented on Plate C-9 in Appendix C of this report. This test is generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date.

Expansion Index

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

Sample Identification	Expansion Index	Expansive Potential
B-4 @ 5 to 10 feet	0	Non-Expansive

Soluble Sulfates

A representative sample of the near-surface soil was 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 (%)	Sulfate Classification
B-1 @ 0 to 5 feet	0.001	Not Applicable (S0)

Corrosivity Testing

One representative bulk sample of the near-surface soils was submitted to a subcontracted corrosion engineering laboratory to identify potentially corrosive characteristics with respect to common construction materials. The corrosivity testing included a determination of the electrical resistivity, pH, and chloride and nitrate concentrations of the soils, as well as other tests. The results of some of these tests are presented below.

Sample Identification	Saturated Resistivity (ohm-cm)	pH	Chlorides (mg/kg)	Nitrates (mg/kg)
B-1 @ 0 to 5 feet	10,000	7.3	5.1	29

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing, and geotechnical analysis, the proposed development, which will consist of a new commercial/industrial building, is considered feasible from a geotechnical standpoint. **Results found in this report are contingent on the results of the concurrent fault study and should be referred to once they become available.** The recommendations contained in this report should be taken into the design, construction, and grading considerations. The recommendations are contingent upon all grading and foundation construction activities being monitored by the geotechnical engineer of record.

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

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The 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 structure should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting and Seismicity

Research of available maps indicates that the subject site is located within an Alquist-Priolo Earthquake Fault Zone. A fault study was not part of this investigation. However, SCG will be perform a concurrent fault study at the site and the results of this investigation will be released at a later date.

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 2019 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 2019 edition of the California Building Code (CBC), which was adopted on January 1, 2020.

The 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 7-16, upon which the 2019 CBC is based. 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 Plate E-1 in Appendix E of this report.

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 11.4.8 applies to the proposed structure at this site. However, the structural engineer should verify that this exception is applicable to the proposed structure.** 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 Spectral Acceleration at 0.2 sec Period	S_S	2.425
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.972
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	2.425
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	1.652
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.617
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	1.102

It should be noted that the site coefficient F_v and the parameters S_{M1} and S_{D1} 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 S_1 obtained from the Seismic Design Maps Tool, assuming that a site-specific ground motion hazards analysis is not required for the proposed building 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 seismic hazard mapping in the area of the subject site. The San Bernardino County Land Use Plan, Geologic Hazard Overlays, Fontana Quadrangle, FH29C, and the San Bernardino County Land Use Plan, Geologic Hazard Overlays, San Bernardino South, FH30C, indicate that the subject site is not located within a zone 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

Based on the subsurface condition encountered at the boring locations, the subject site is underlain by native alluvial soils, extending to the maximum depth explored of 50± feet below the existing site grades. The near-surface alluvium encountered at the boring locations consists of very loose to medium dense silty sands, sandy silts, gravelly sands, and well-graded sands, with varying silt and gravel content. Some of the near-surface native alluvial soils possess moisture contents well below the optimum moisture content for compaction. Based on these conditions, the near-surface alluvial soils, in their present condition, are not considered suitable to support the foundation loads of the new building. At greater depths, the underlying alluvial soils generally consist of high strength, dense to very dense, well graded sands and gravelly sands with varying amounts of silt, and occasional cobbles. Based on these conditions, remedial grading is considered warranted within the proposed building area in order to remove a portion of the near-surface native alluvial soils.

Settlement

Laboratory testing indicates that the upper portion of the near-surface soils possesses a potential for collapse when inundated with water. Some of these soils also possess a potential for consolidation when exposed to load increases in the range of those that will be exerted by the foundations of the new structure. The recommended remedial grading will remove most of these soils from within the zone of influence of the new foundations. The native alluvium that will remain in place below the recommended depth of overexcavation will not be significantly influenced by the foundation loads of the new structure. Provided that the recommended remedial grading is completed, the post construction settlements of the proposed structure are expected to be within tolerable limits.

Expansion

The results of the EI testing indicate non-expansive potentials for the soils. Based upon the recent laboratory results, no further recommendations with regard to expansive soils are considered warranted at this time.

Soluble Sulfates

The result of the soluble sulfate testing indicates that the selected sample of the on-site soils corresponds to Class S0 with respect to the American Concrete Institute (ACI) Publication 318-05 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at pad grade within the building area.

Corrosion Potential

The results of laboratory testing indicate that the tested sample of the on-site soils possesses a saturated resistivity value of 10,000 ohm-cm, and a pH value of 7.3. 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. Sulfides, and redox potential are factors that are also used in the evaluation procedure. 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 not considered to be corrosive to ductile iron pipe. **However, SCG does not practice in the area of corrosion engineering. Therefore, the client may also wish to contact a corrosion engineer to provide a more thorough evaluation.**

A relatively low concentration (5.1 mg/kg) of chlorides was detected in the sample submitted for corrosivity testing. In general, soils possessing chloride concentrations in excess of 500 parts per million (ppm) are considered to be corrosive with respect to steel reinforcement within reinforced concrete. Based on the lack of any significant chlorides in the tested sample, the site is considered to have a C1 chloride exposure in accordance with the American Concrete Institute (ACI) Publication 318 Building Code Requirements for Structural Concrete and Commentary. Therefore, a specialized concrete mix design for reinforced concrete for protection against chloride exposure is not considered warranted.

Nitrates

Nitrates present in soil can be corrosive to copper tubing at concentrations greater than 50 mg/kg. The tested sample possesses a nitrate concentration of 29 mg/kg. Based on this test result, the on-site soils are not considered to be corrosive to copper pipe. Since SCG does not practice in the area of corrosion engineering, we recommend that the client contact a corrosion engineer to provide a more thorough evaluation.

Shrinkage/Subsidence

Removal and recompaction of the near-surface native soils is estimated to result in an average shrinkage of 9 to 21 percent. Shrinkage estimates for the individual samples range between 4 and 28 percent based on the results of density testing and the assumption that the on-site soils will be compacted to approximately 92 percent of the ASTM D-1557 maximum dry density. It should be noted that the 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 to 0.15± feet. This estimate may be used for grading in areas that are underlain by native alluvial soils.

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

Grading and Foundation Plan Review

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

6.3 Preliminary Site Grading Recommendations

The preliminary grading recommendations presented below are based on the design details that were available at the time of this report, and the subsurface conditions encountered at our boring locations. These recommendations are general and preliminary in nature, and should be confirmed as part of the future design-level geotechnical investigation.

Site Stripping and Demolition

Initial site stripping should include removal of the surficial vegetation from the site. Stripping should include native grass, weeds, shrubs, trees, tree trunks and debris. Root systems associated with the shrubs and trees should be removed in their entirety, and the resultant excavations should be backfilled with compacted structural fill soils. These materials should be properly disposed of off-site. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pad

Remedial grading will be necessary within the proposed building pad area to remove a portion of the near-surface alluvial soils and replace these materials as compacted structural fill. The depth of overexcavation should be determined during the design-level geotechnical investigation. On a preliminary basis, overexcavation to depths of 4 to 6 feet below existing and proposed building pad grades should be anticipated. Greater overexcavation depths may be expected if loose and/or soft soils are encountered at the bottom of the recommended building overexcavation. Overexcavation within the foundation areas will likely extend to depths of 3 to 4 feet below foundation bearing grades.

Treatment of Existing Soils: Retaining Walls and Site Walls

Although not indicated on the site plan, it may be necessary to construct some small retaining walls or site walls at or near the existing ground surface. Overexcavation will also be necessary in these areas to remove the variable strength alluvium. The overexcavation depth should be expected to be on the order of 2 to 3 feet below proposed foundation bearing grade, and to depths of 3 to 4 feet below existing grade.

Treatment of Existing Soils: Parking and Drive Areas

Based on economic considerations, overexcavation of the existing near-surface soils in the 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. Preliminarily, subgrade preparation in the new parking and drive areas should initially consist of removal of all soils disturbed during stripping and demolition operations.

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 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.

These preliminary grading recommendations for the proposed parking and drive areas assume that the owner and/or developer can tolerate minor amounts of settlement within the proposed parking and drive areas. The grading recommendations presented above do not completely mitigate the extent of variable-density alluvium that may be present in the 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 within 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 2019 CBC and the grading code of the city of Rialto and/or the county of San Bernardino.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Imported Structural Fill

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

Utility Trench Backfill

In general, all utility trench backfill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. It is recommended that materials in excess of 3 inches in size not be used for utility trench backfill. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by city of Rialto and/or the county of San Bernardino. 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 Preliminary Construction Considerations

Excavation Considerations

The near-surface soils are predominately granular in composition. These materials will likely be subject to caving within shallow excavations. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, the inclination of temporary slopes should not exceed 2h:1v. 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 at this site is considered to exist at a depth greater than 50± feet. Therefore, groundwater is not expected to impact the grading or foundation construction activities.

6.5 Preliminary Foundation Design Recommendations

Based on the preceding geotechnical design considerations and preliminary grading recommendations, it is assumed that the new building will be underlain by newly placed structural fill soils, extending to depths of at least 3 to 4 feet below foundation bearing grades. Based on this subsurface profile, the proposed structure may be supported on conventional shallow foundations.

The foundation design parameters presented below provide anticipated ranges for the allowable soil bearing pressures. These ranges should be refined during the subsequent design-level geotechnical investigation.

Preliminary Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 to 3,000 lbs/ft^2.
- Minimum longitudinal steel reinforcement within strip footings: Two (2) to four (4) No. 5 rebars.

General Foundation Design Recommendations

The allowable bearing pressures presented above may be increased by one-third when considering short duration wind or seismic loads. Additional reinforcement may be necessary for structural considerations. The actual design of the foundations should be determined by the structural engineer.

Estimated Foundation Settlements

Typically, foundations designed in accordance with the preliminary foundation design parameters presented above will experience total and differential static settlements of less than 1.0 and 0.5 inches, respectively. A detailed settlement analysis should be conducted as part of the design-level geotechnical investigation, once detailed foundation loading information is available.

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: 250 to 350 lbs/ft^3
- Friction Coefficient: 0.28 to 0.35

6.6 Preliminary Floor Slab Design and Construction

Subgrades which will support the new floor slab should be prepared in accordance with the preliminary recommendations contained in the ***Preliminary Site Grading Recommendations*** section of this report with any additional recommendations provided in the design-level geotechnical report. Preliminarily, the floor of the proposed structure may be constructed as a conventional slab-on-grade supported on newly placed structural fill. Based on geotechnical considerations, the floor slab may be designed as follows:

- Minimum slab thickness: 6 to 7 inches.

- Modulus of Subgrade Reaction: k = 100 to 150 psi/in.

- Minimum slab reinforcement: Not required based on geotechnical considerations. Additional expansion index testing should be performed to confirm this recommendation at the time of the design level investigation. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire areas of the proposed slabs where floor slab 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.

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

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

6.7 Preliminary Retaining Wall Design and Construction

Small retaining walls are expected to be necessary in the dock-high areas of the building and may also be required to facilitate the new site grades. Preliminary design parameters recommended for use in the design of these walls are presented below. These recommendations should be refined during the design-level geotechnical investigation.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. We have provided parameters assuming the use of on-site soils for retaining wall backfill. The on-site soils generally consist of silty sands and sandy silts with varying gravel content. Based on their classification, these materials are expected to possess a friction angle of at least 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.

PRELIMINARY RETAINING WALL DESIGN PARAMETERS

Design Parameter		**Soil Type**
		On-Site Silty Sands
Internal Friction Angle (ϕ)		30°
Unit Weight		124 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	41 lbs/ft^3
	Active Condition (2h:1v backfill)	67 lbs/ft^3
	At-Rest Condition (level backfill)	62 lbs/ft^3

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

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

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed compacted structural fill, extending to depths of 2 to 3 feet below the proposed bearing grade. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Seismic Lateral Earth Pressures

In addition to the lateral earth pressures presented in the previous section, retaining walls which are more than 6 feet in height should be designed for a seismic lateral earth pressure, in accordance with the 2019 CBC. Based on the current site plan, it is not expected that any walls in excess of 6 feet in height will be required for this project. If any such walls are proposed, our office should be contacted for supplementary design recommendations.

Backfill Material

On-site sands and silty sands 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 placed against the face on the back side of the retaining walls. This material should extend from the top of the retaining wall footing to within 1 foot of the ground surface on the back side of the retaining wall. 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.

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

Subsurface Drainage

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

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

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

6.8 Preliminary Pavement Design Parameters

Presented below are preliminary recommendations for pavements that may be required in the proposed development. Grading recommendations for these pavement areas should be developed during the design level geotechnical investigation.

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 sandy silts. Based on their classification, these materials are expected to possess good pavement support characteristics, with R-values in the range of 50 to 60. Since R-value testing was not included in the scope of services for this feasibility study, the subsequent pavement design is 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 during the design-level geotechnical investigation, or at the completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

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

Traffic Index	No. of Heavy Trucks per Day
4.0	0
5.0	1
6.0	3
7.0	11
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. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness. The actual joint spacing and reinforcing of the Portland cement concrete pavements should be determined by the structural engineer.

7.0 GENERAL COMMENTS

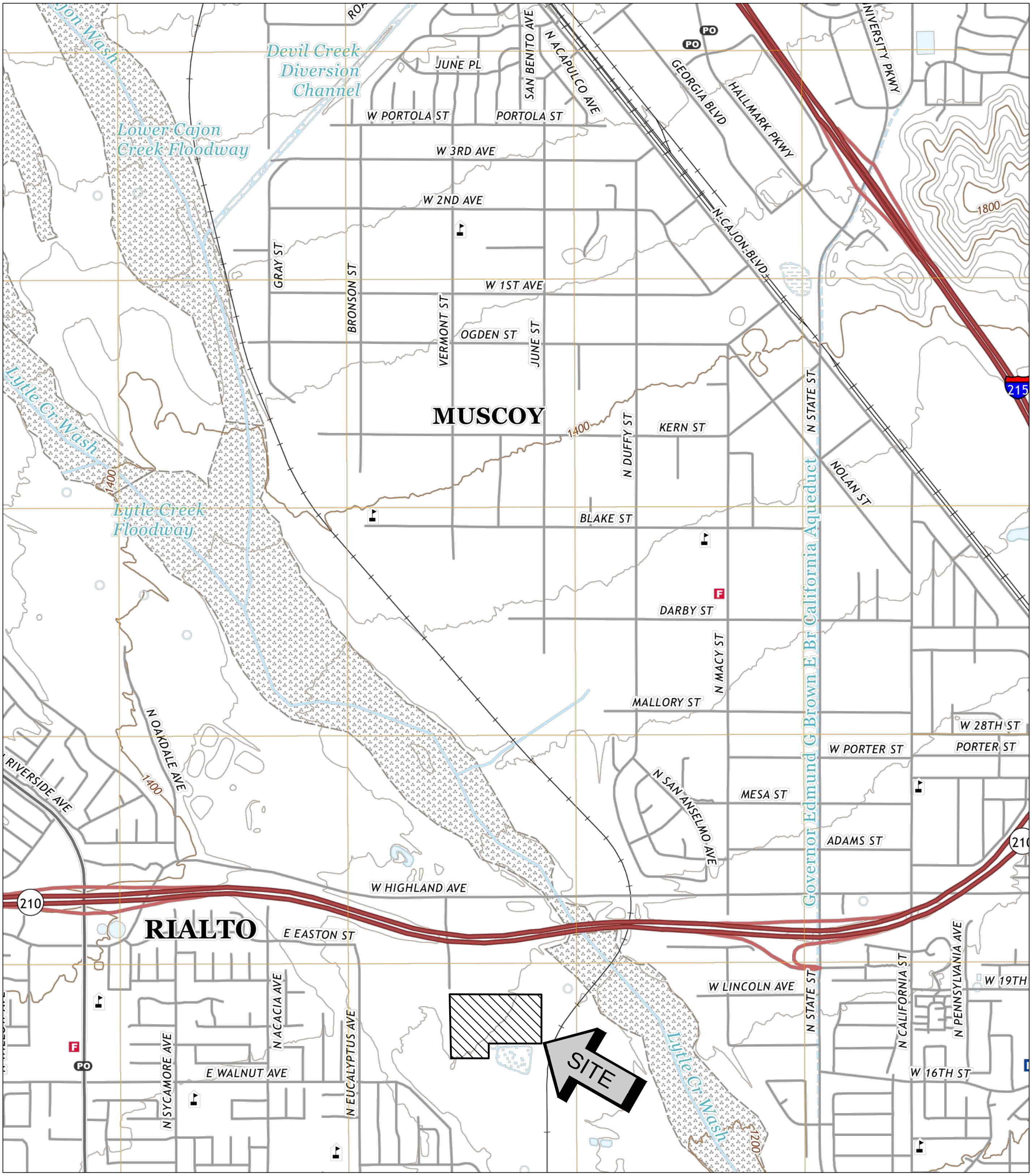
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other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

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

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



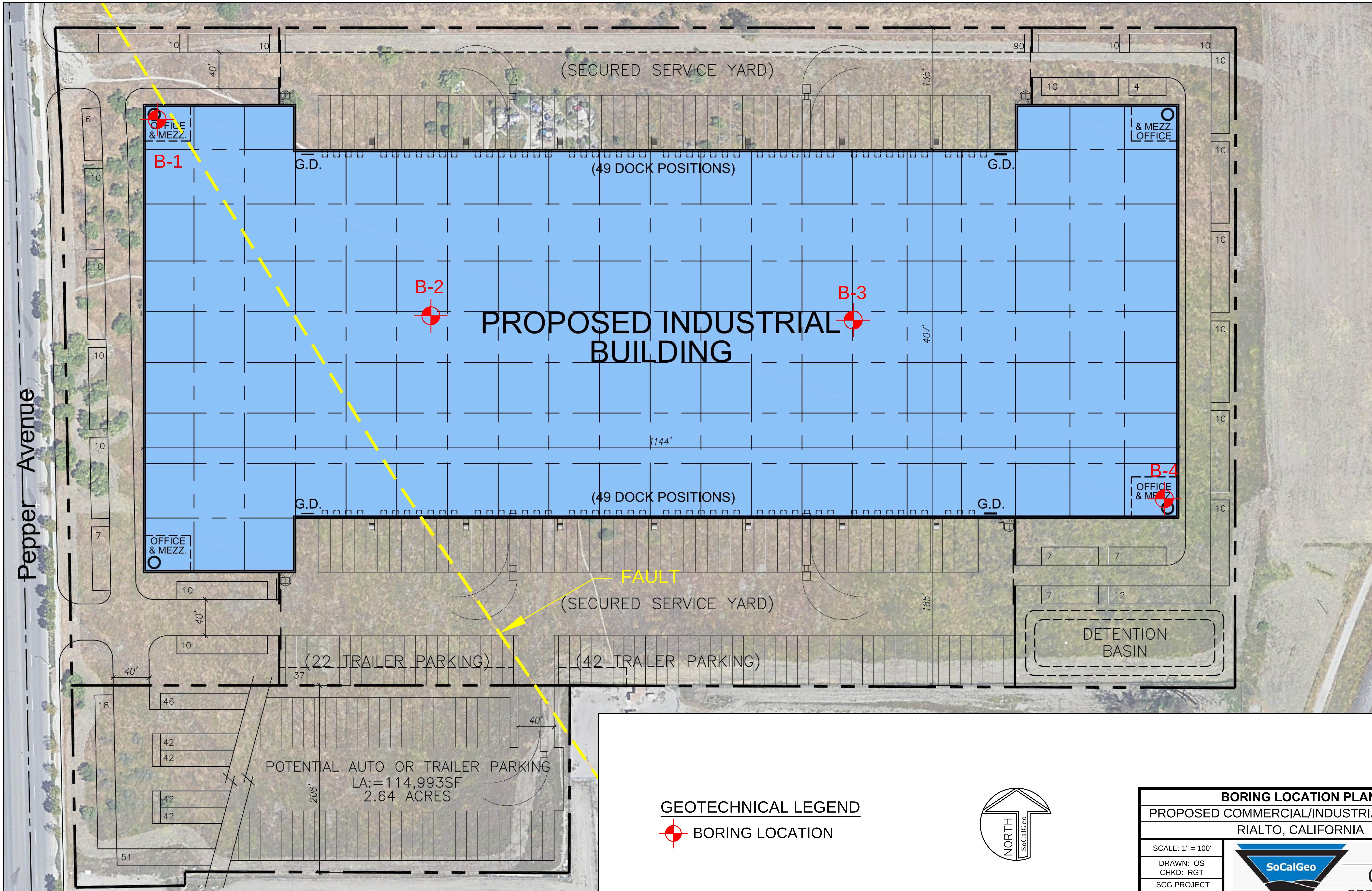
SOURCE: USGS TOPOGRAPHIC MAPS OF THE SAN BERNARDINO NORTH QUADRANGLES, SAN BERNARDINO COUNTY, CALIFORNIA, 2018.

SITE LOCATION MAP

PROPOSED COMMERCIAL/INDUSTRIAL BUILDING

RIALTO, CALIFORNIA

SCALE: 1" = 2000'	SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: OS CHKD: RGT	
SCG PROJECT 20G234-1	
PLATE 1	



GEOTECHNICAL LEGEND

BORING LOCATION

NORTH

SoCalGeo

NOTE: AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH. SITE PLAN PROVIDED BY THE CLIENT.

BORING LOCATION PLAN

PROPOSED COMMERCIAL/INDUSTRIAL BUILDING

RIALTO, CALIFORNIA

SCALE: 1" = 100'

DRAWN: OS

CHKD: RGT

SCG PROJECT 20G234-1

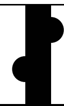
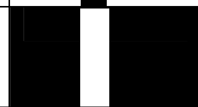
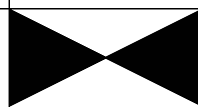
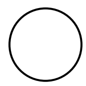
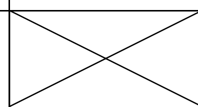
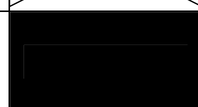
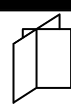
PLATE 2

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

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

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

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

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

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

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

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 20G234-1
PROJECT: Proposed C/I Building
LOCATION: Rialto, California

DRILLING DATE: 11/23/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Oscar Sandoval

WATER DEPTH: Dry
CAVE DEPTH: 19 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
					ALLUVIUM: Gray Brown Silty fine Sand, trace medium to coarse Sand, very loose to loose-damp to moist							
		6				98	4					
		6			@ 3 feet, trace fine root fibers	97	9					
5		9			Gray Gravelly fine to coarse Sand, loose to very dense-dry to damp	107	2					
		12					2					Disturbed Sample
10		32			@ 9 feet, Silty fine Sand, trace coarse Sand lense, trace iron oxide staining	107	2					
15		27					1					
20		38			@ 18½ feet, trace Silt		2					
25		58					2					
30		50/3"			Gray Brown Silty fine to coarse Sand, little fine Gravel, very dense-dry to damp		1					
		50/3"					3					

TBL 20G234-1.GPJ SOCALGEO.GDT 12/16/20

BORING NO. B-1

JOB NO.: 20G234-1
PROJECT: Proposed C/I Building
LOCATION: Rialto, California

DRILLING DATE: 11/23/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Oscar Sandoval

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

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	(Continued)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
					Gray Brown Silty fine to coarse Sand, little fine Gravel, very dense-dry to damp							
	X	50/6"					2					
40												
	X	50/5"			@ 43½ feet, occasional Cobbles		1					
45												
	X	50/3"					3					
50												
					Boring Terminated at 50 feet							

TBL 20G234-1.GPJ SOCALGEO.GDT 12/16/20

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 20G234-1
PROJECT: Proposed C/I Building
LOCATION: Rialto, California

DRILLING DATE: 11/23/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Oscar Sandoval

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
					ALLUVIUM: Gray Brown Silty fine Sand to fine Sandy Silt, trace coarse Sand, trace fine root fibers, very loose to loose-damp							
	X	4					6					
					Light Gray Brown fine to coarse Sand, trace Silt, trace fine Gravel, medium dense-damp							
	X	11					3					
5												
					Dark Gray Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, loose-moist							
	X	5					12					
	X	7					15					
10												
					Dark Gray Brown Silty fine Sand, trace coarse Sand, trace fine Gravel, very dense-moist							
	X	50/5"					7					
15												
					Light Gray Brown fine to coarse Sand, trace fine Gravel, dense to very dense-dry to damp							
	X	36					2					
20												
	X	46			@ 23½ feet, trace fine to coarse Gravel		2					
25												
	X	50/2"			@ 28½ feet, occasional Cobbles		1					
30												
					Light Gray Brown Gravelly fine to coarse Sand, trace Silt, very dense-dry							
	X	50/4"					1					

TBL 20G234-1.GPJ SOCALGEO.GDT 12/16/20

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 20G234-1
PROJECT: Proposed C/I Building
LOCATION: Rialto, California

DRILLING DATE: 11/23/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Oscar Sandoval

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION (Continued)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					Light Gray Brown Gravelly fine to coarse Sand, trace Silt, very dense-dry							
	X	50/6"					1					
40												
	X	50/6"					1					
45												
					Gray Brown fine to coarse Sand, little fine to coarse Gravel, trace Silt, very dense-dry to damp							
	X	50/5"					2					
50												
					Boring Terminated at 50 feet							

TBL 20G234-1.GPJ SOCALGEO.GDT 12/16/20

BORING NO. B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 20G234-1
PROJECT: Proposed C/I Building
LOCATION: Rialto, California

DRILLING DATE: 11/23/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Oscar Sandoval

WATER DEPTH: Dry
CAVE DEPTH: 19 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
					ALLUVIUM: Gray Brown Silty fine Sand, trace fine Gravel, trace fine root fibers, very loose to medium dense-dry to damp							
	X	4					3					
	X	25					2					
5					Light Gray Brown fine Sandy Silt, trace iron oxide staining, medium dense-damp to very moist							
	X	16					6					
	X	15					7					
10												
	X	28					14					
15												
					Light Gray Brown fine to coarse Sand, trace fine to coarse Gravel-dense to very dense-dry to damp							
	X	44					3					
20												
	X	32					3					
25												
	X	58					2					
30												
	X	70/9"					3					

TBL 20G234-1.GPJ SOCALGEO.GDT 12/16/20

TEST BORING LOG **PLATE B-3a**

BORING NO. B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 20G234-1	DRILLING DATE: 11/23/20	WATER DEPTH: Dry
PROJECT: Proposed C/I Building	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 19 feet
LOCATION: Rialto, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	(Continued)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
					Light Gray Brown fine to coarse Sand, trace fine to coarse Gravel-dense to very dense-dry to damp							
					Dark Gray Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, very dense-damp							
	X	50/6"					4					
40												
	X	50/2"					4					
45												
					Dark Gray Brown fine to coarse Sandy Gravel, very dense-damp							
	X	50/6"					3					
50												
					Boring Terminated at 50 feet							

TBL 20G234-1.GPJ SOCALGEO.GDT 12/16/20

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 20G234-1
PROJECT: Proposed C/I Building
LOCATION: Rialto, California

DRILLING DATE: 11/23/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Oscar Sandoval

WATER DEPTH: Dry
CAVE DEPTH: 35 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
			ALLUVIUM: Dark Brown fine Sandy Silt, very loose to loose-moist							
	4			109	9					
			Light Gray fine Sand, loose to medium dense-damp							
	10			82	8					
			Dark Gray Brown fine Sandy Silt, loose to medium dense-moist to very moist							
5	10			86	10					
	17			92	18					
			Gray Brown fine Sand, trace medium Sand, trace Silt, medium dense-damp							
	22			107	4					
10										
			Gray Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, dense-damp							
	33				5					
15										
			Brown Silty fine to coarse Sand, trace fine Gravel, very dense-dry to damp							
	75				2					
20										
			Gray Brown Gravelly fine to coarse Sand, dense to very dense-dry to damp							
	74				2					
25										
	44		@ 28½ feet, occasional Cobbles		2					
30										
	50/2"				2					

TBL 20G234-1.GPJ SOCALGEO.GDT 12/16/20

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 20G234-1
PROJECT: Proposed C/I Building
LOCATION: Rialto, California

DRILLING DATE: 11/23/20
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Oscar Sandoval

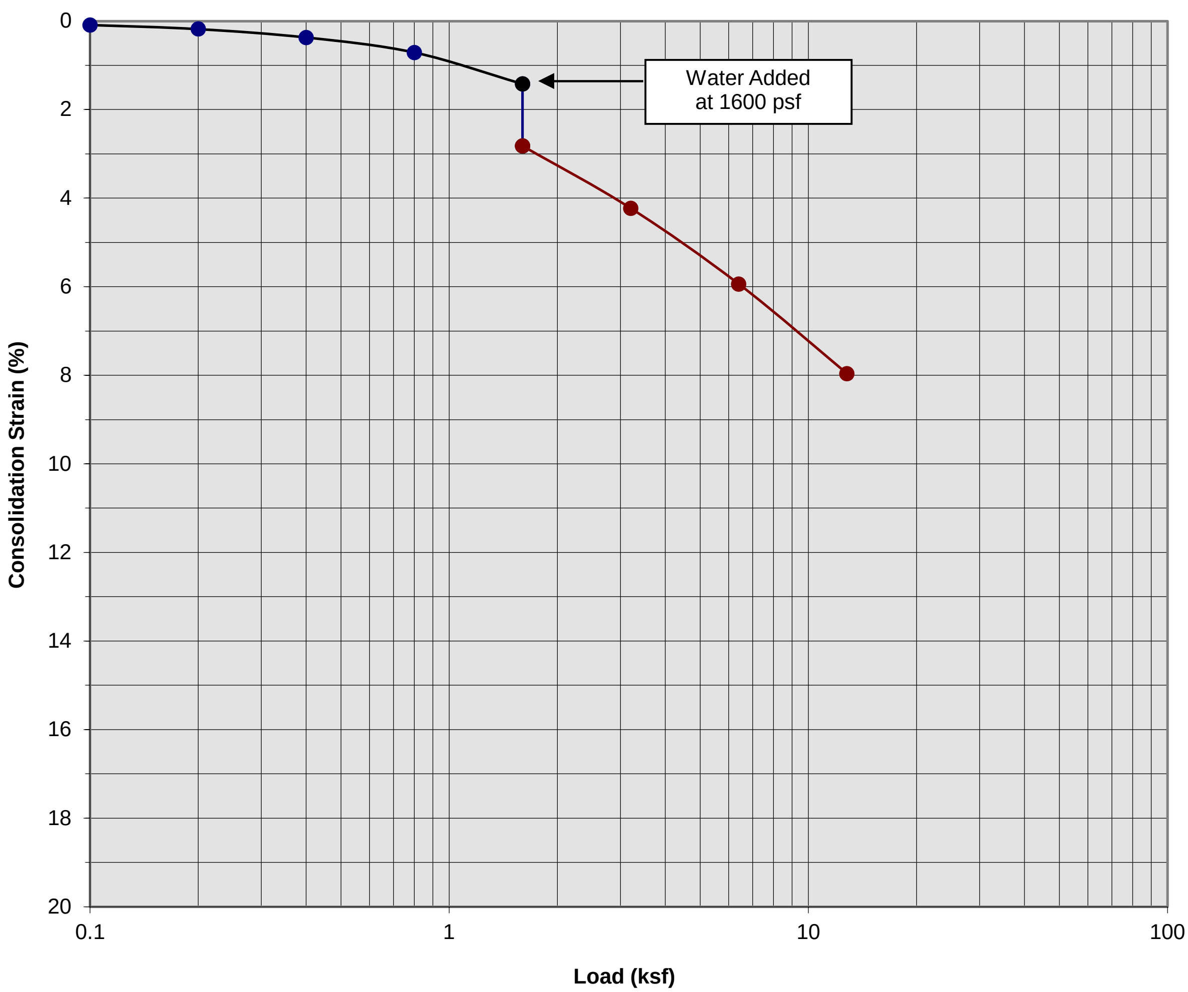
WATER DEPTH: Dry
CAVE DEPTH: 35 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION (Continued)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					Gray Brown Gravelly fine to coarse Sand, dense to very dense-dry to damp							
	X	50/5"			@ 38½ feet, trace calcareous nodules, trace iron oxide staining		3					
40												
					Dark Gray Brown Silty fine Sand, trace fine Gravel, very dense-damp							
	X	50/5"					4					
45												
					Gray Brown Gravelly fine to coarse Sand, very dense-dry to damp							
	X	50/4"					2					
50												
					Boring Terminated at 50 feet							

TBL 20G234-1.GPJ SOCALGEO.GDT 12/16/20

APPENDIX C

Consolidation/Collapse Test Results

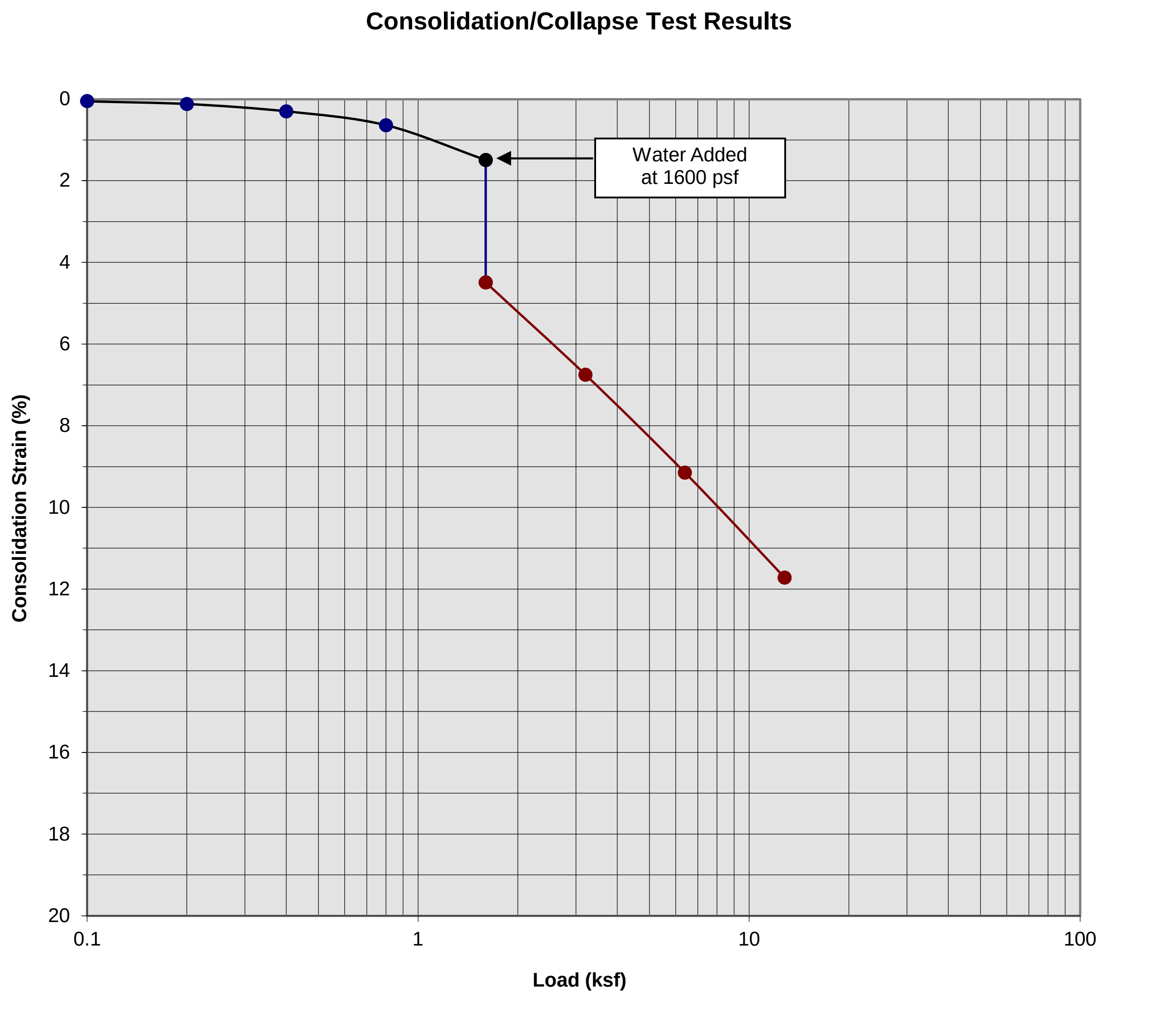


Classification: Gray Brown Silty fine Sand, trace medium to coarse Sand

Boring Number:	B-1	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	1 to 2	Initial Dry Density (pcf)	98.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	106.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.40

Proposed Commercail/Industrial Building
Rialto, California
Project No. 20G234-1
PLATE C- 1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

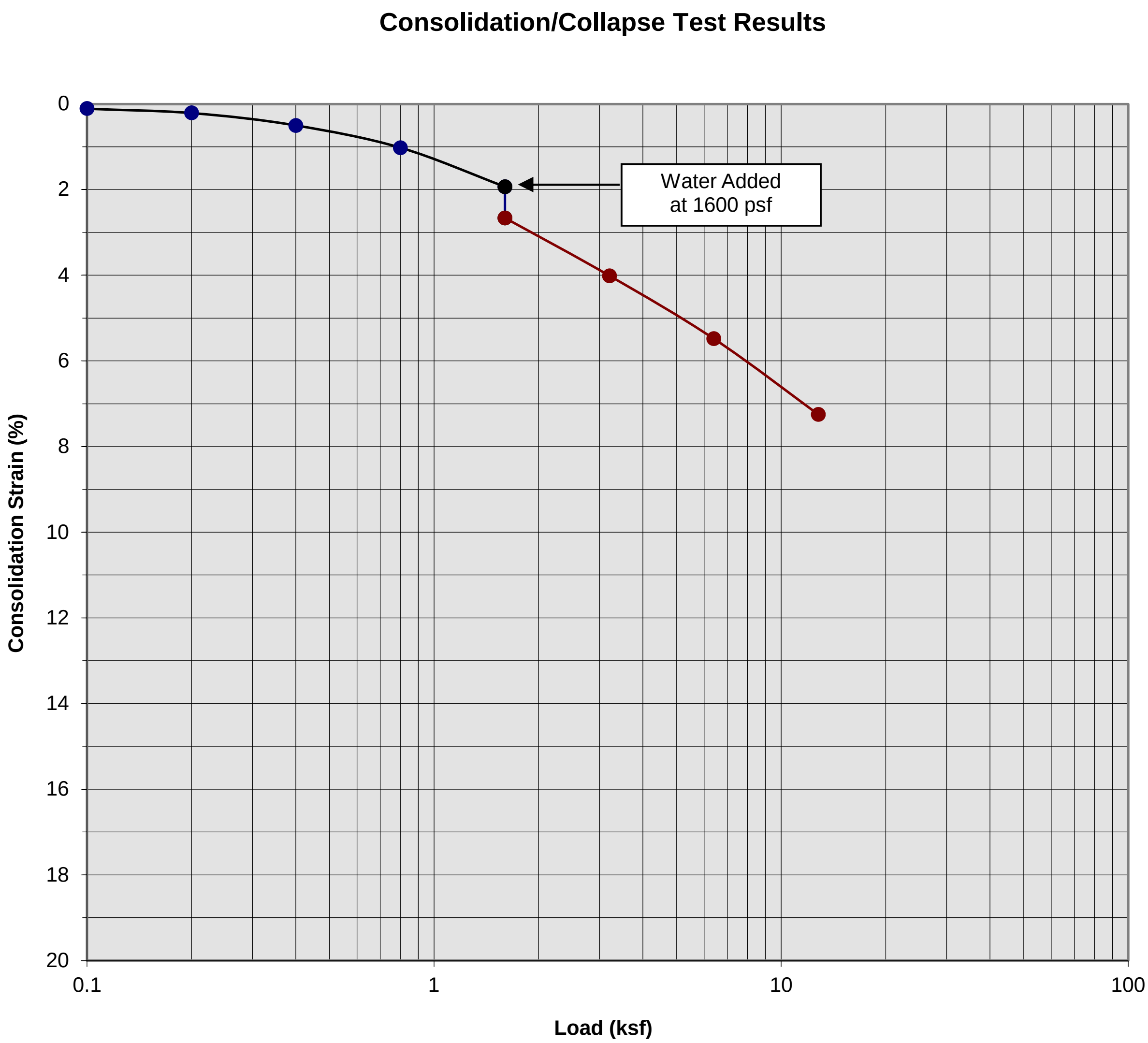


Classification: Gray Brown Silty fine Sand, trace medium to coarse Sand

Boring Number:	B-1	Initial Moisture Content (%)	9
Sample Number:	---	Final Moisture Content (%)	21
Depth (ft)	3 to 4	Initial Dry Density (pcf)	97.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	110.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	3.00

Proposed Commercail/Industrial Building
Rialto, California
Project No. 20G234-1
PLATE C- 2

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



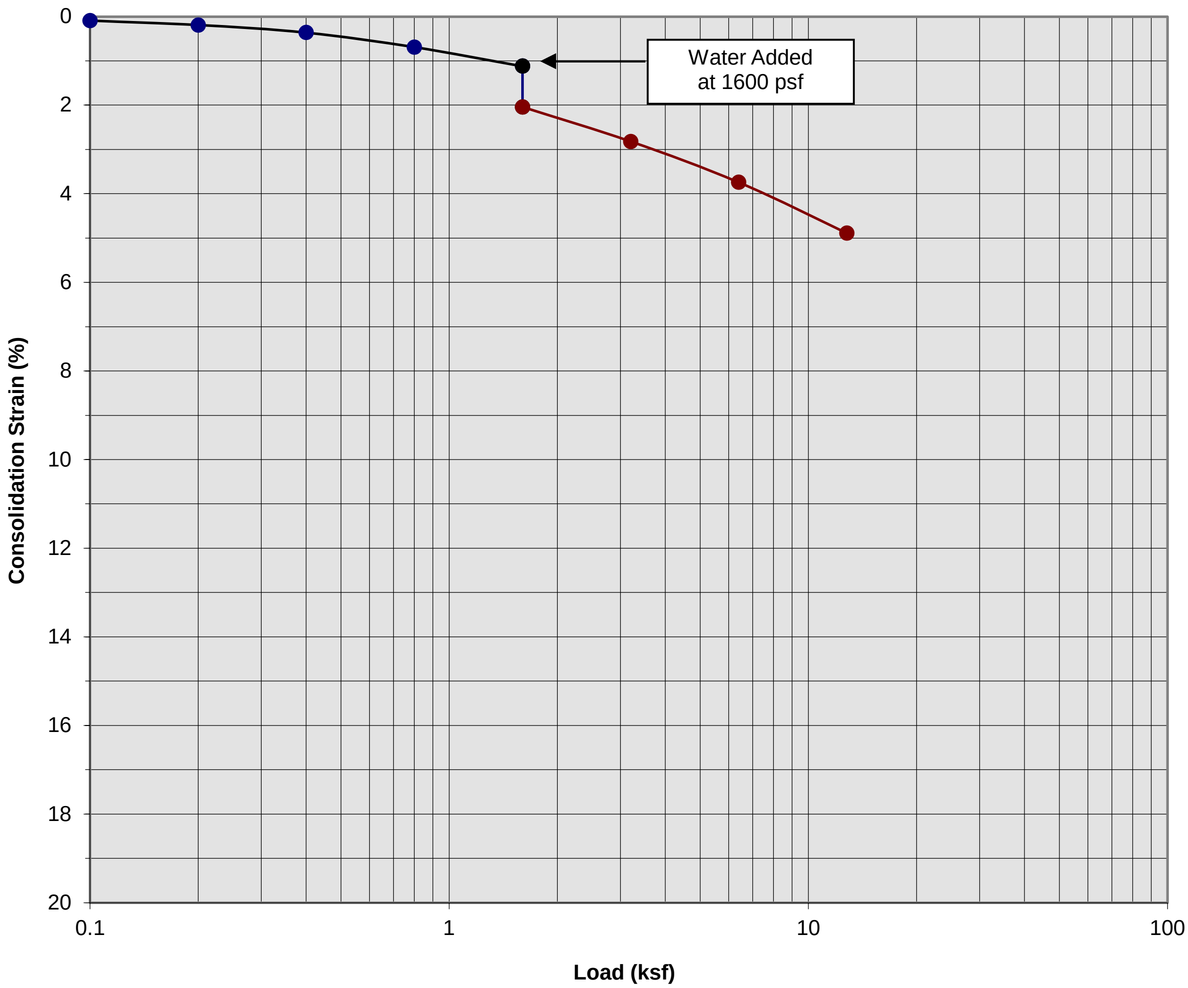
Classification: Gray Gravelly fine to coarse Sand

Boring Number:	B-1	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	26
Depth (ft)	5 to 6	Initial Dry Density (pcf)	107.3
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	115.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.73

Proposed Commercail/Industrial Building
Rialto, California
Project No. 20G234-1
PLATE C- 3

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

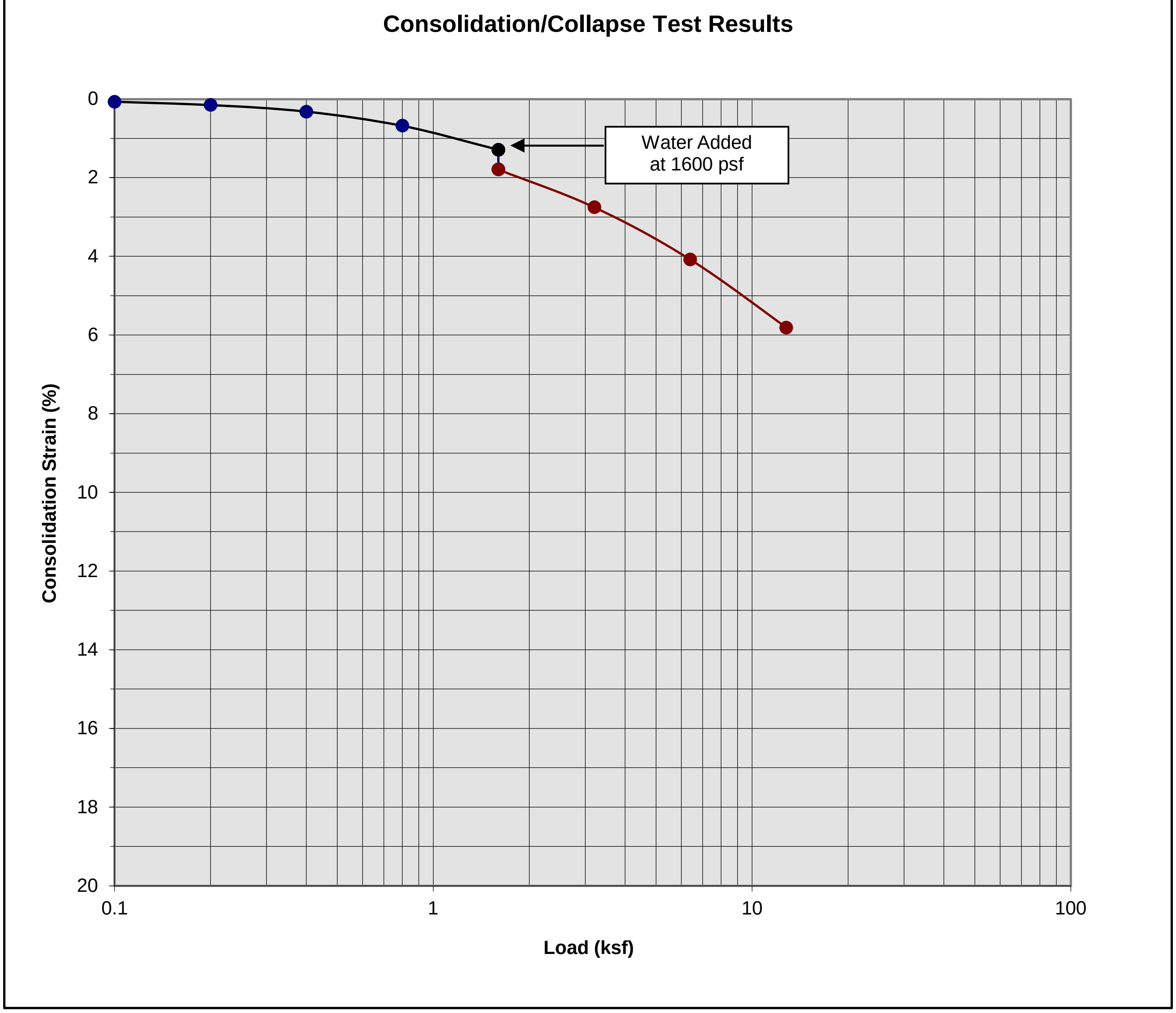


Classification: Gray Gravelly fine to coarse Sand

Boring Number:	B-1	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	9 to 10	Initial Dry Density (pcf)	107.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	112.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.92

Proposed Commercail/Industrial Building
Rialto, California
Project No. 20G234-1
PLATE C- 4

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

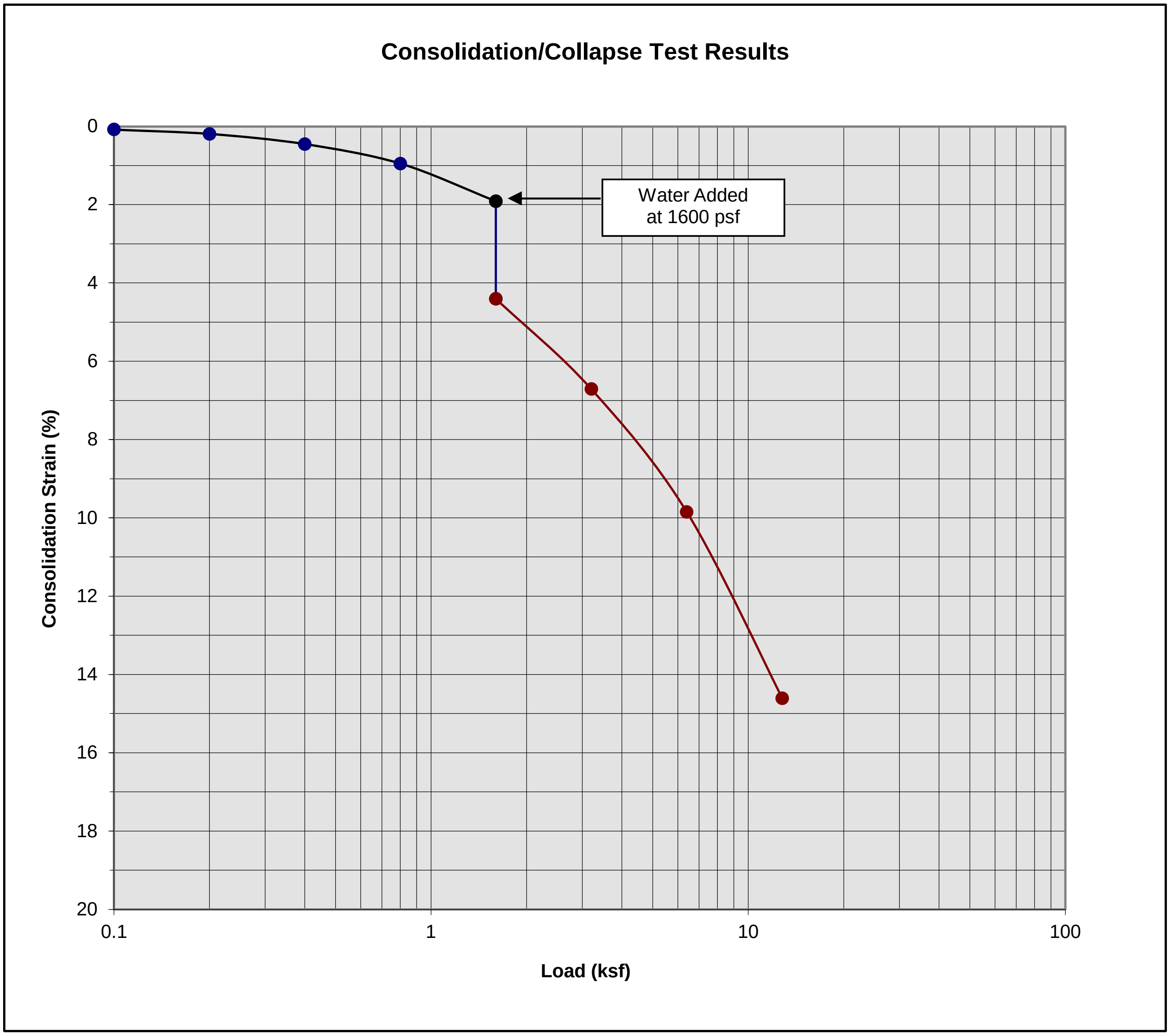


Classification: Light Gray fine Sand

Boring Number:	B-4	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	28
Depth (ft)	3 to 4	Initial Dry Density (pcf)	82.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	87.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.50

Proposed Commercail/Industrial Building
Rialto, California
Project No. 20G234-1
PLATE C- 5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

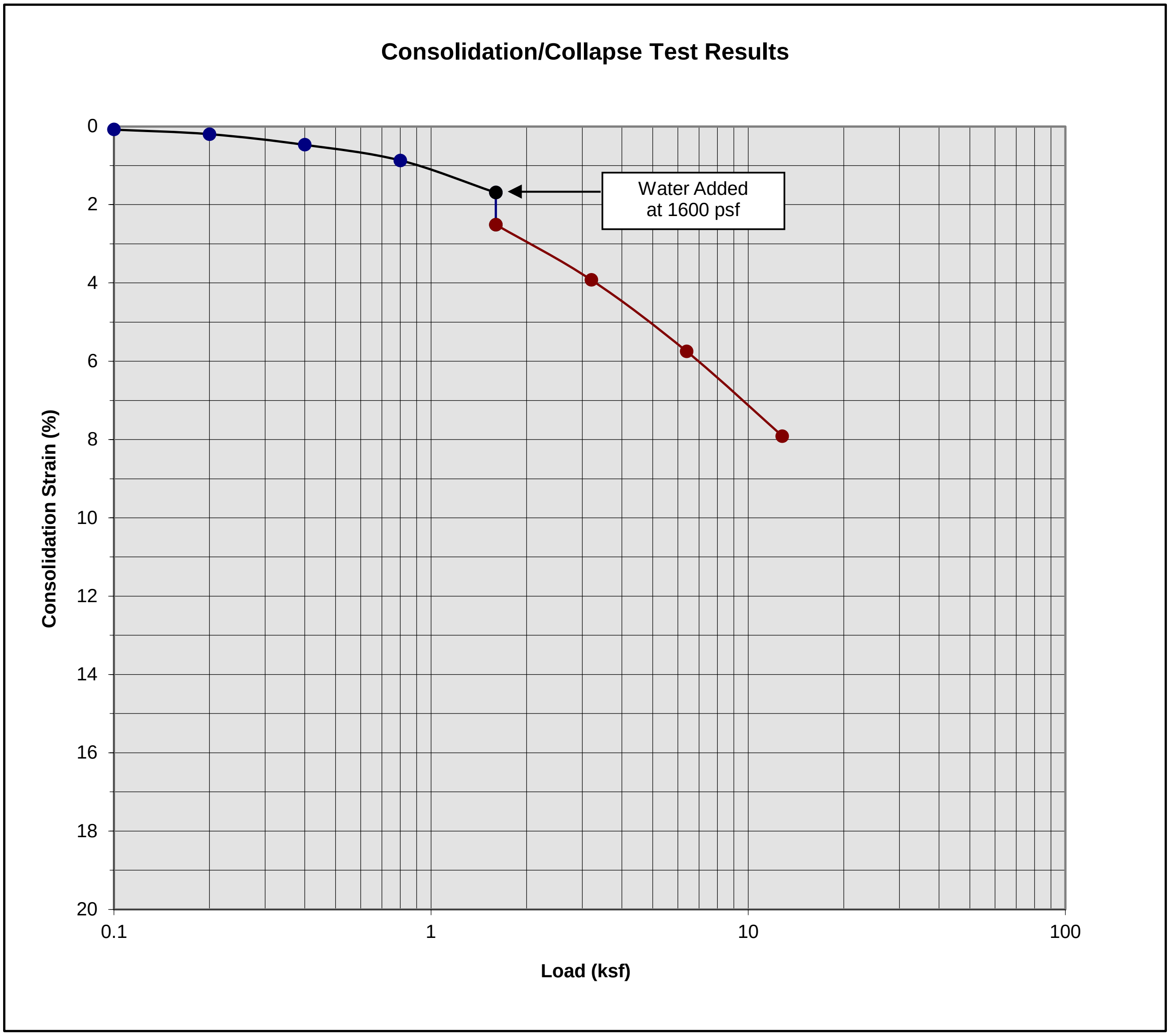


Classification: Dark Gray Brown fine Sandy Silt

Boring Number:	B-4	Initial Moisture Content (%)	10
Sample Number:	---	Final Moisture Content (%)	29
Depth (ft)	5 to 6	Initial Dry Density (pcf)	86.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	100.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.49

Proposed Commercail/Industrial Building
Rialto, California
Project No. 20G234-1
PLATE C- 6

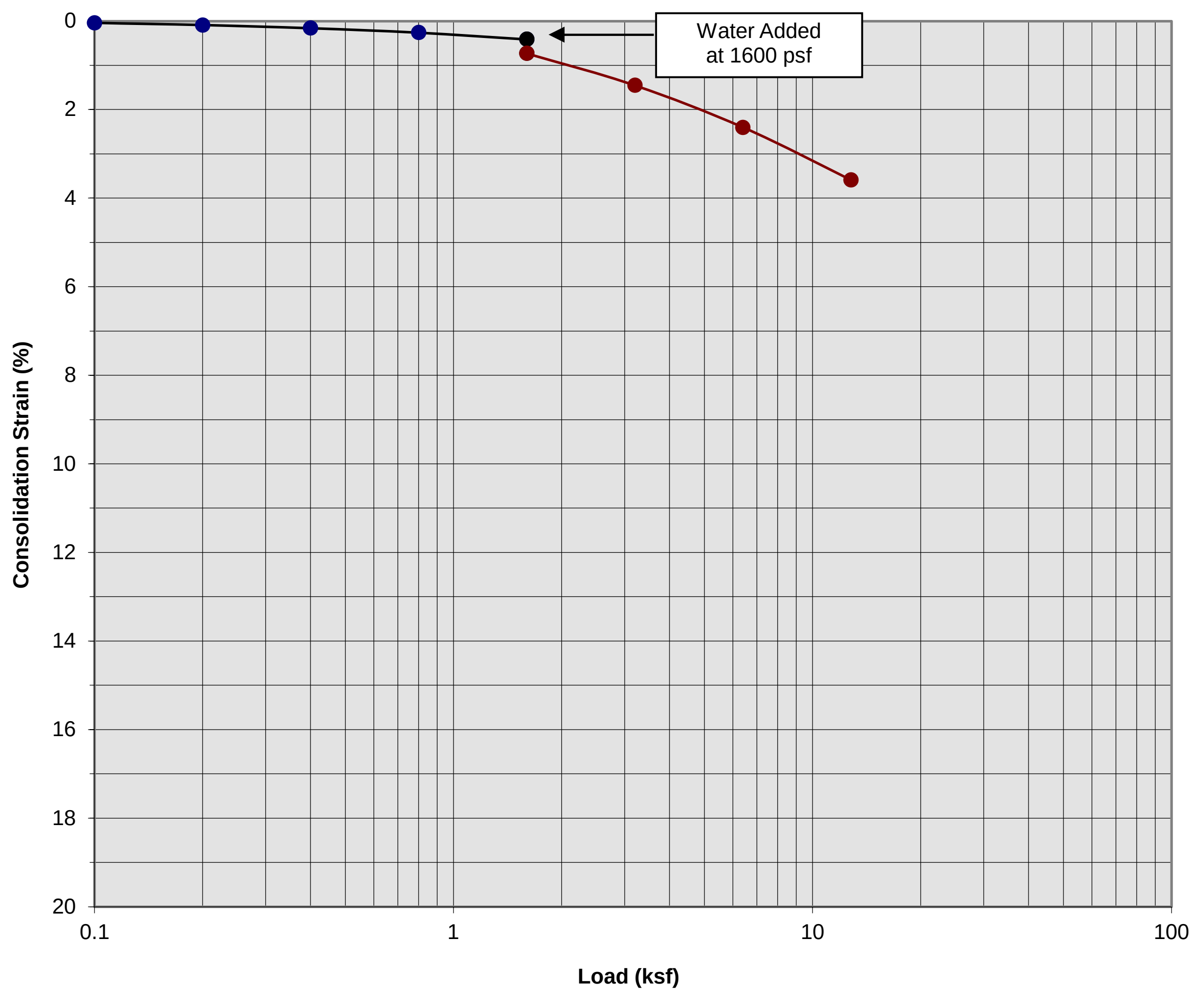
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Classification: Dark Gray Brown fine Sand Silt

Boring Number:	B-4	Initial Moisture Content (%)	18
Sample Number:	---	Final Moisture Content (%)	31
Depth (ft)	7 to 8	Initial Dry Density (pcf)	91.3
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	99.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.82

Consolidation/Collapse Test Results

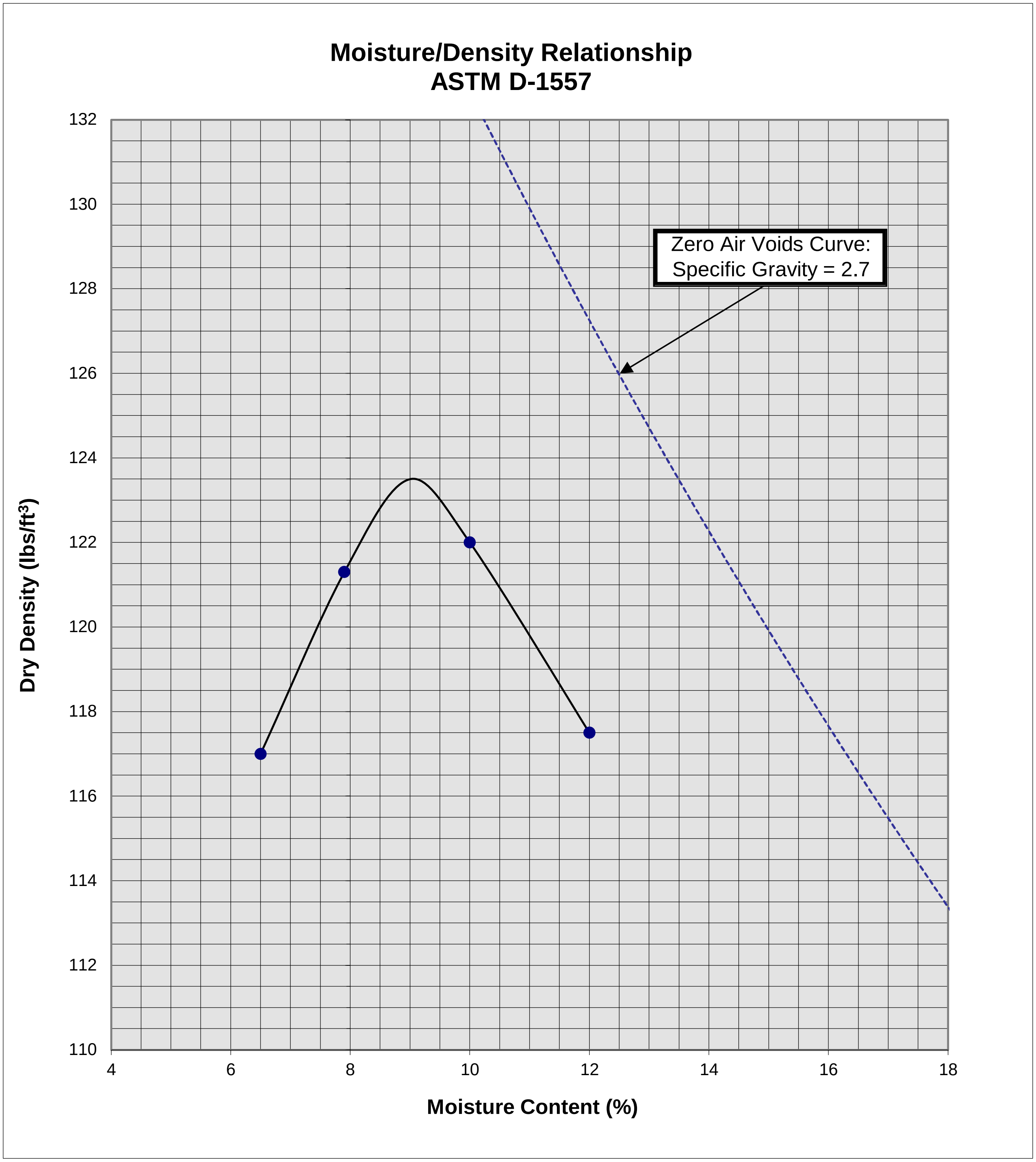


Classification: Gray Brown fine Sand, trace medium Sand, trace Silt

Boring Number:	B-4	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	9 to 10	Initial Dry Density (pcf)	107.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	111.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.32

Proposed Commercail/Industrial Building
Rialto, California
Project No. 20G234-1
PLATE C- 8

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Soil ID Number	B-1 @ 0 to 5'
Optimum Moisture (%)	9
Maximum Dry Density (pcf)	123.5
Soil Classification	Gray Brown Silty fine Sand, trace medium Sand

Proposed Commercial/Industrial Building
Rialto, California
Project No. 20G234-1
PLATE C-9

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX D

GRADING GUIDE SPECIFICATIONS

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

General

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

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

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

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

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

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

Site Preparation

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

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

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

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

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

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

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

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

<u>Compacted Fills</u>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Foundations

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

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

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

Fill Slopes

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

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

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

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

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

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

Cut Slopes

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

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

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

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

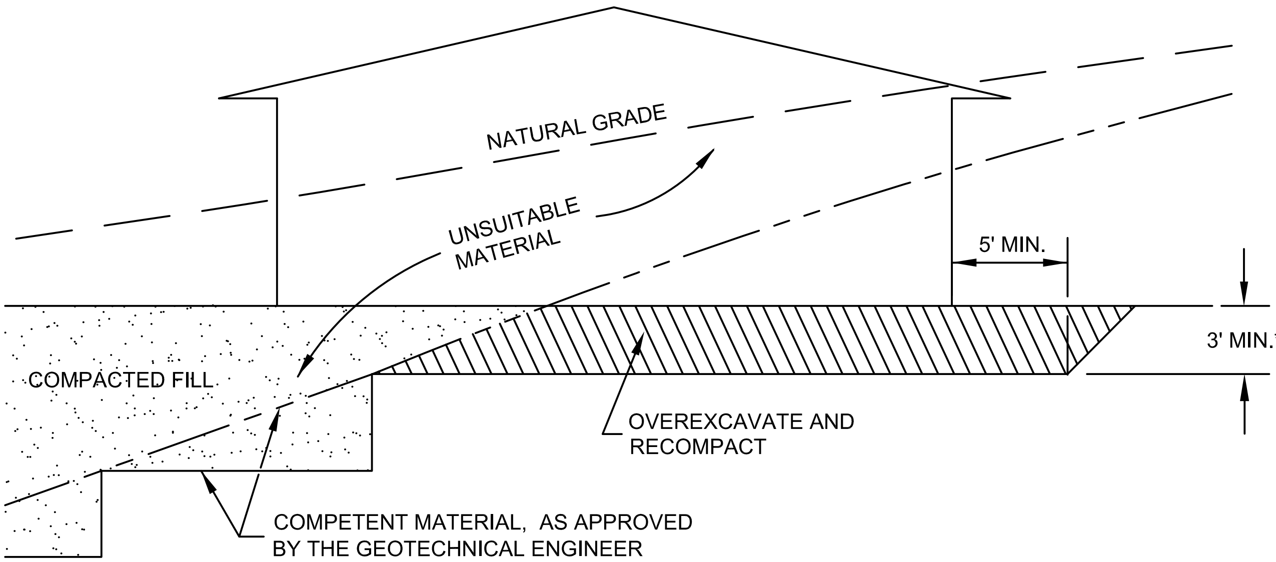
Subdrains

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

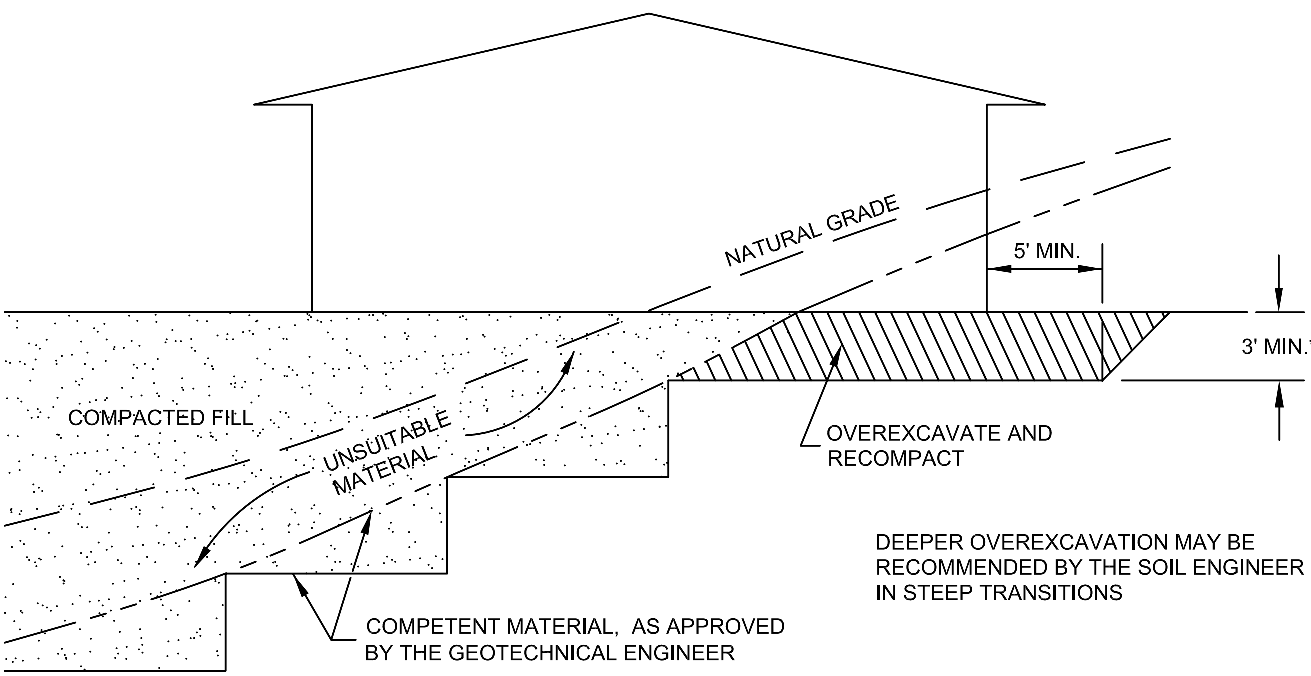
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

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

CUT LOT



CUT/FILL LOT (TRANSITION)



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

TRANSITION LOT DETAIL

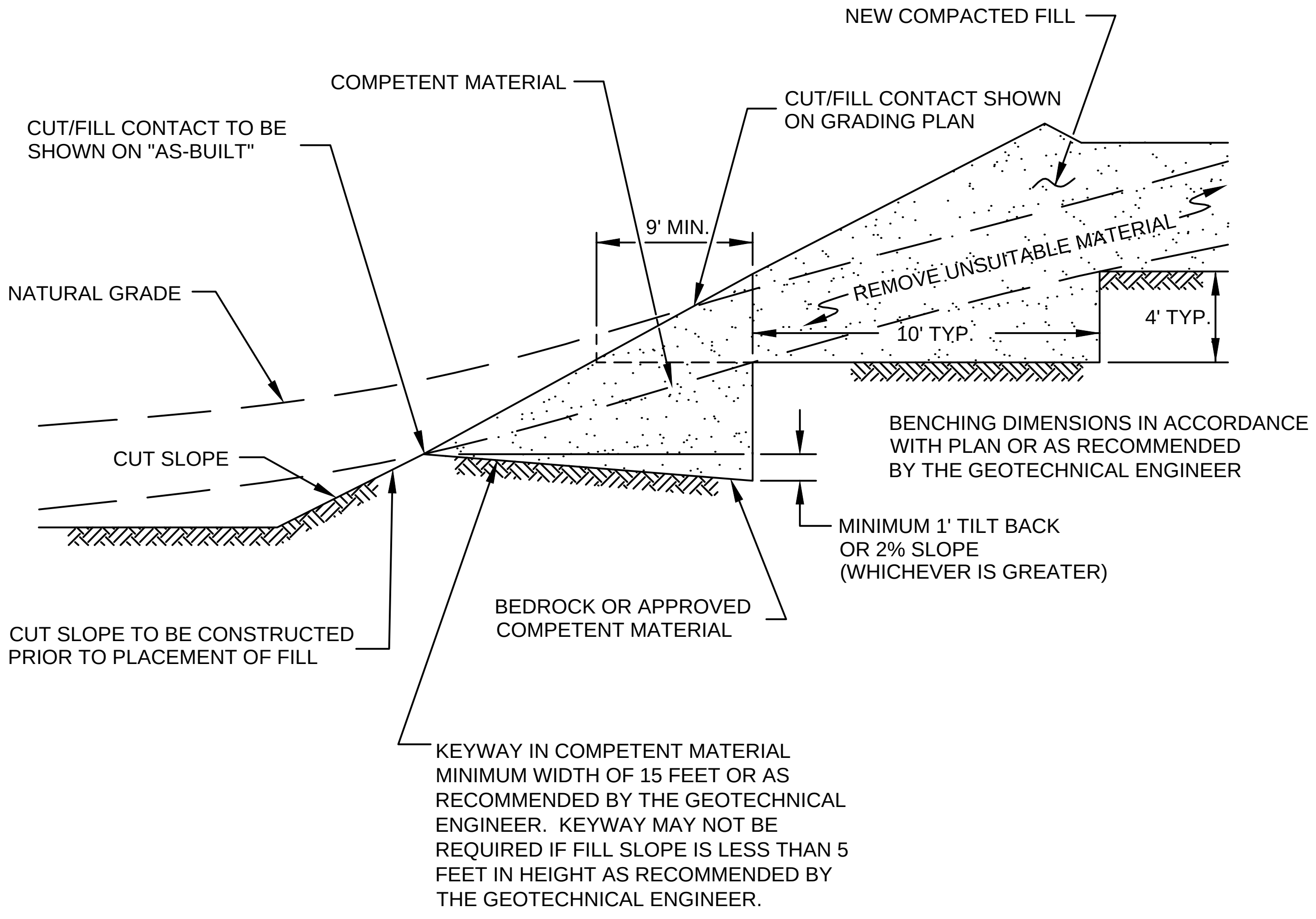
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

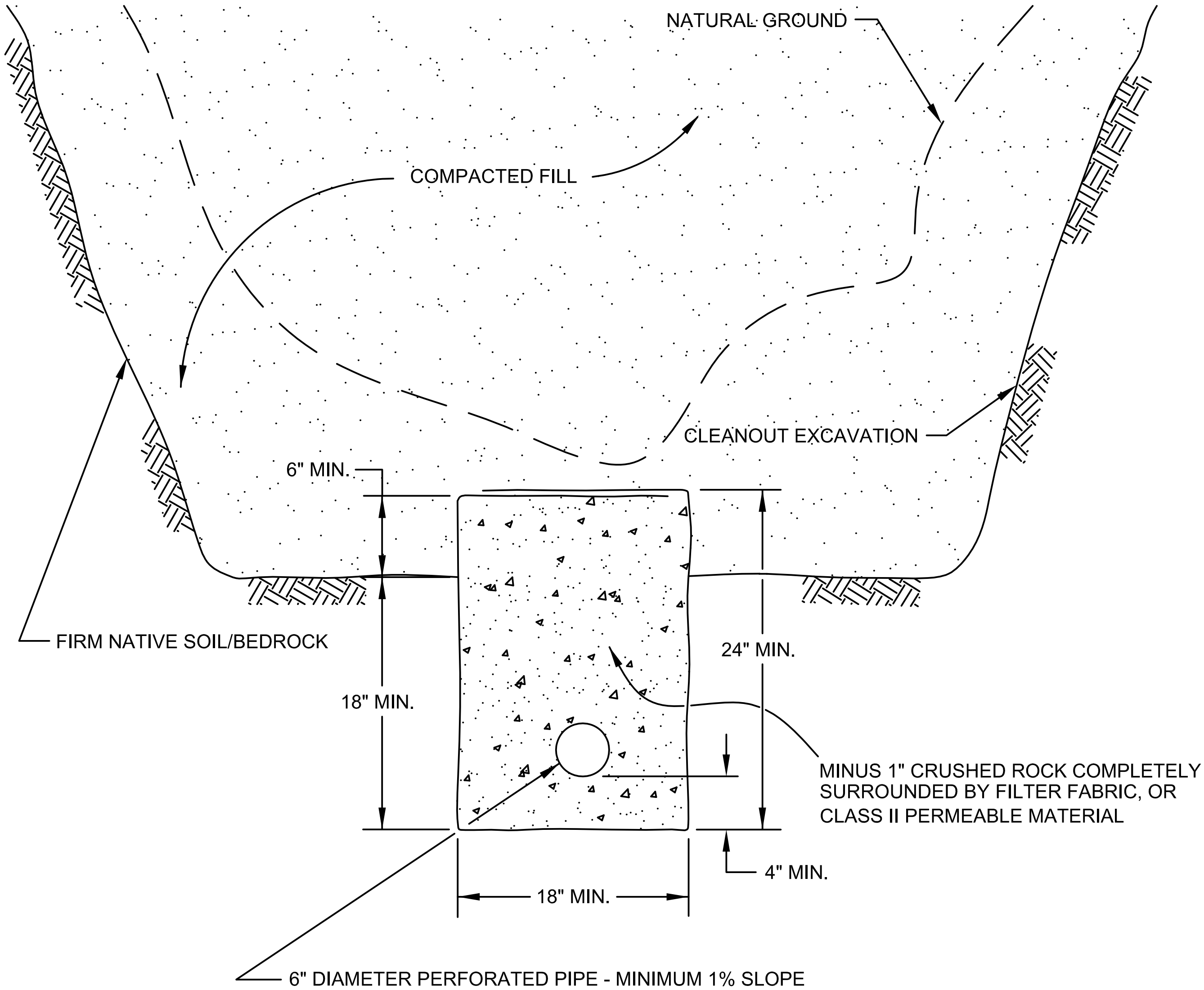
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

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

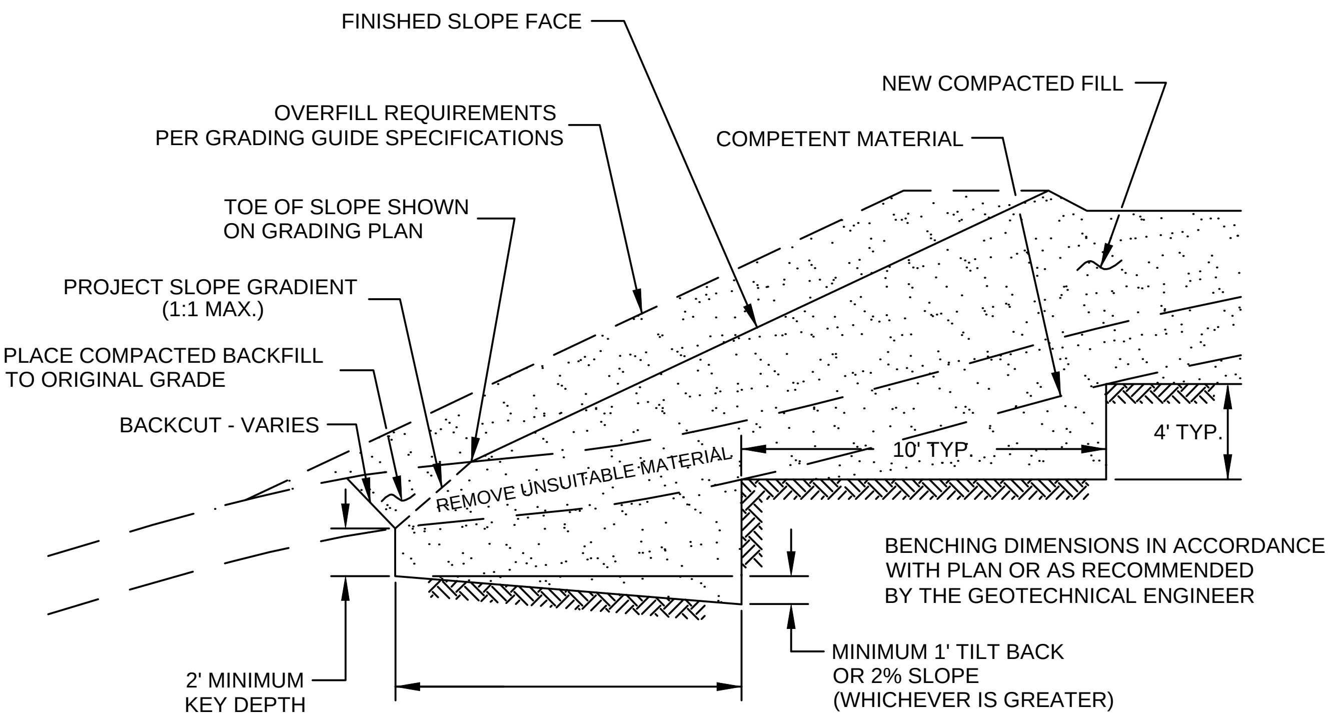
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL



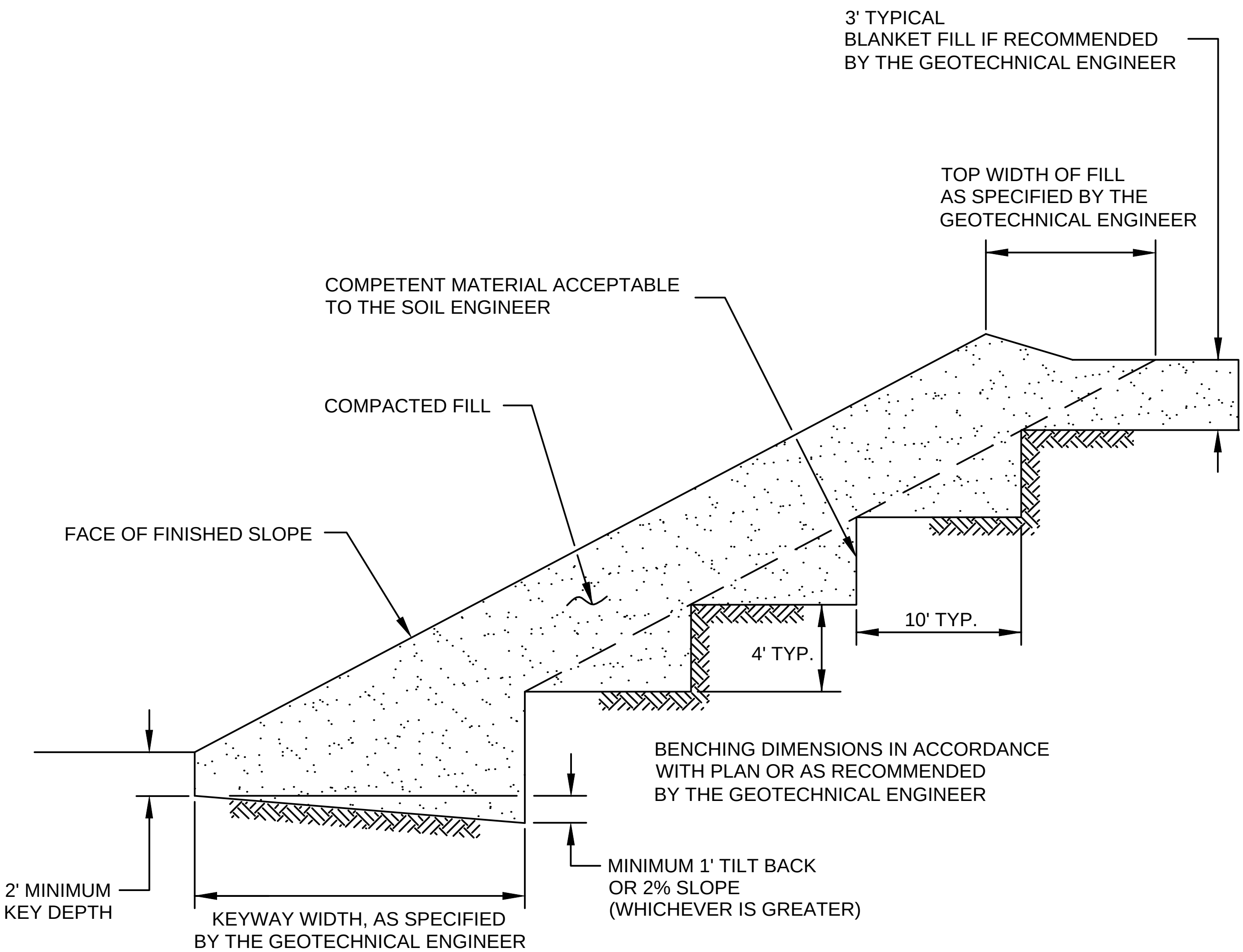
KEYWAY IN COMPETENT MATERIAL. MINIMUM WIDTH OF 15 FEET OR AS RECOMMENDED BY THE GEOTECHNIAL ENGINEER. KEYWAY MAY NOT BE REQUIRED IF FILL SLOPE IS LESS THAN 5' IN HEIGHT AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER.

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	SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-4	



STABILIZATION FILL DETAIL

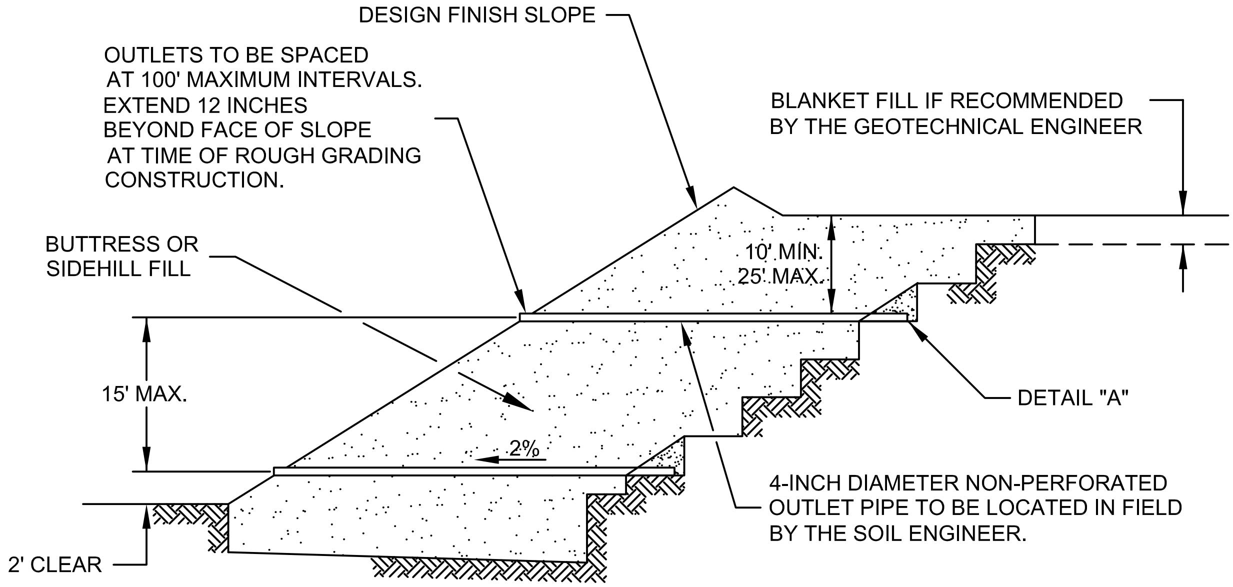
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SOUTHERN CALIFORNIA GEOTECHNICAL



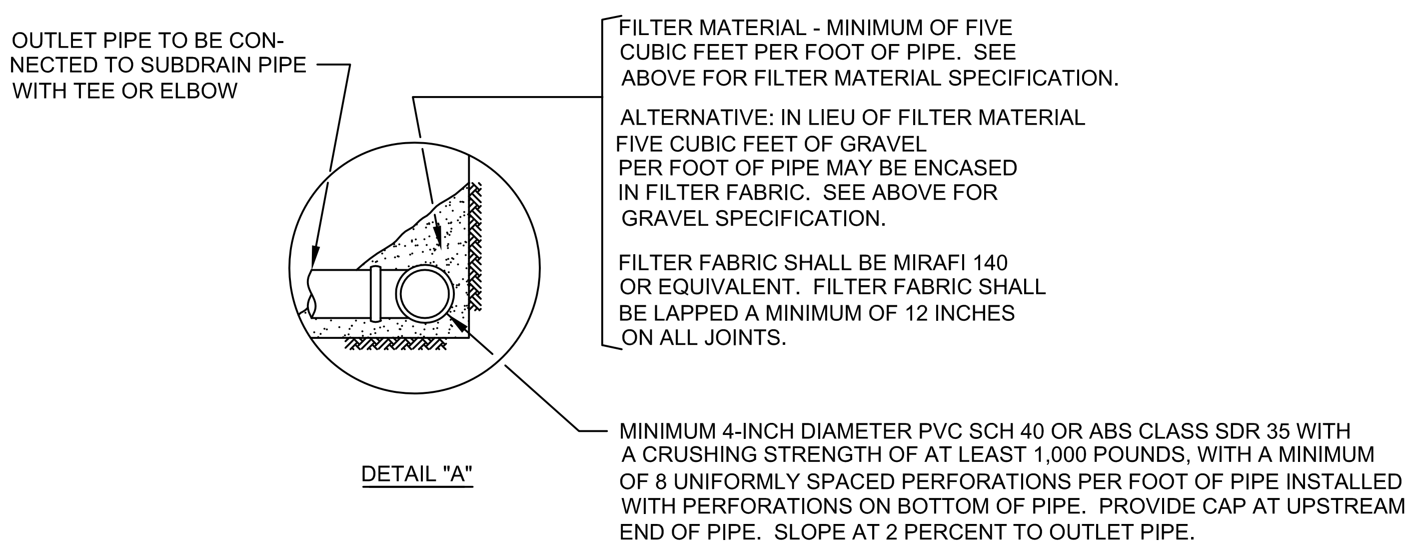
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

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



DETAIL "A"

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

SLOPE FILL SUBDRAINS

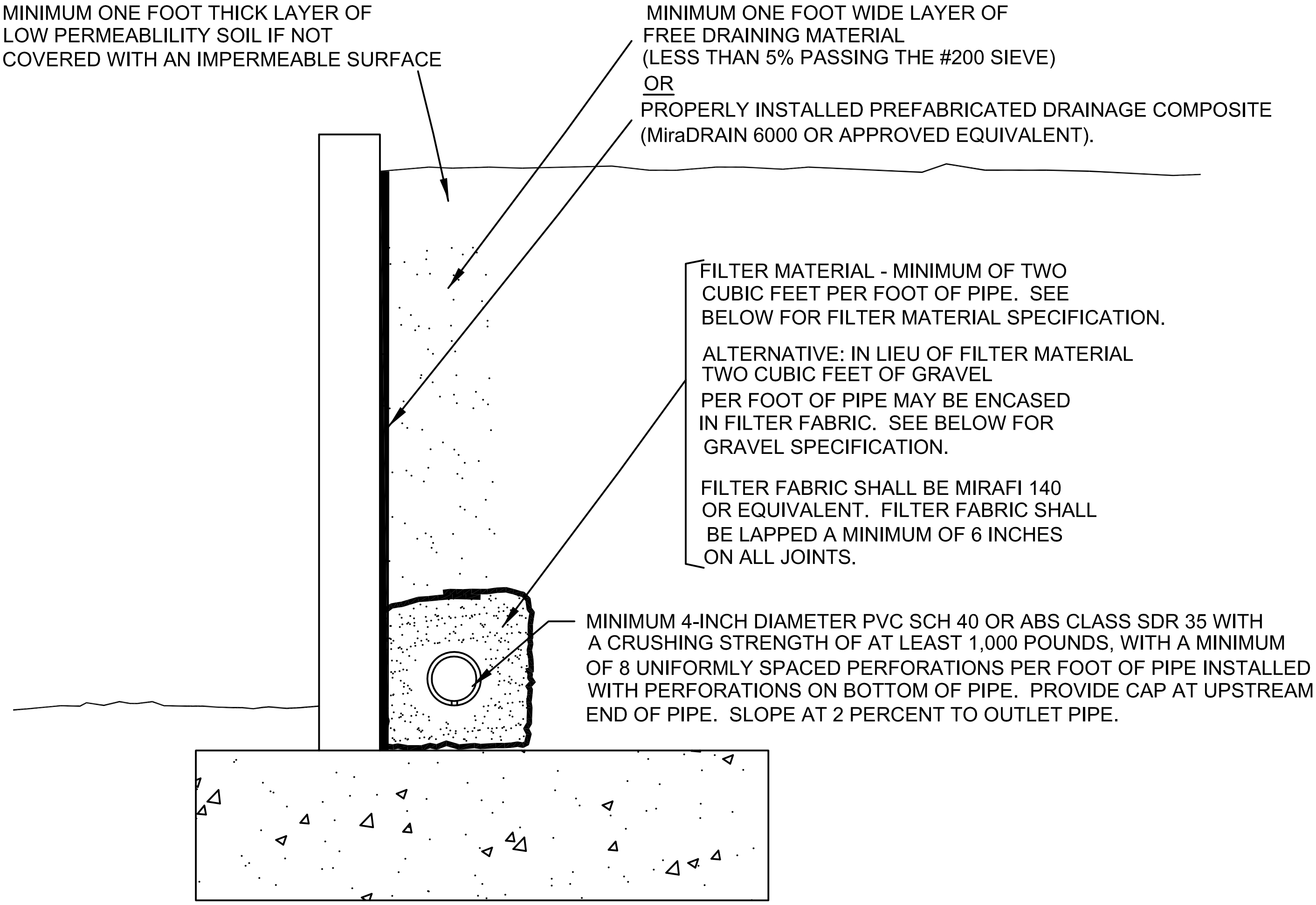
GRADING GUIDE SPECIFICATIONS

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

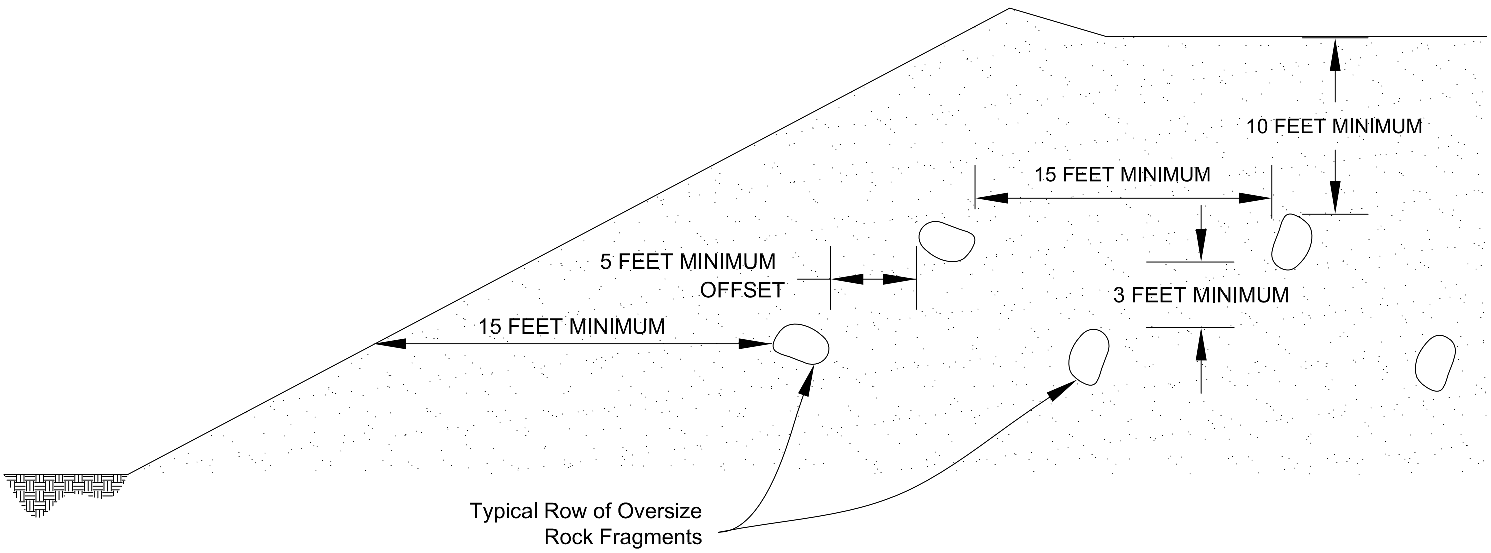
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

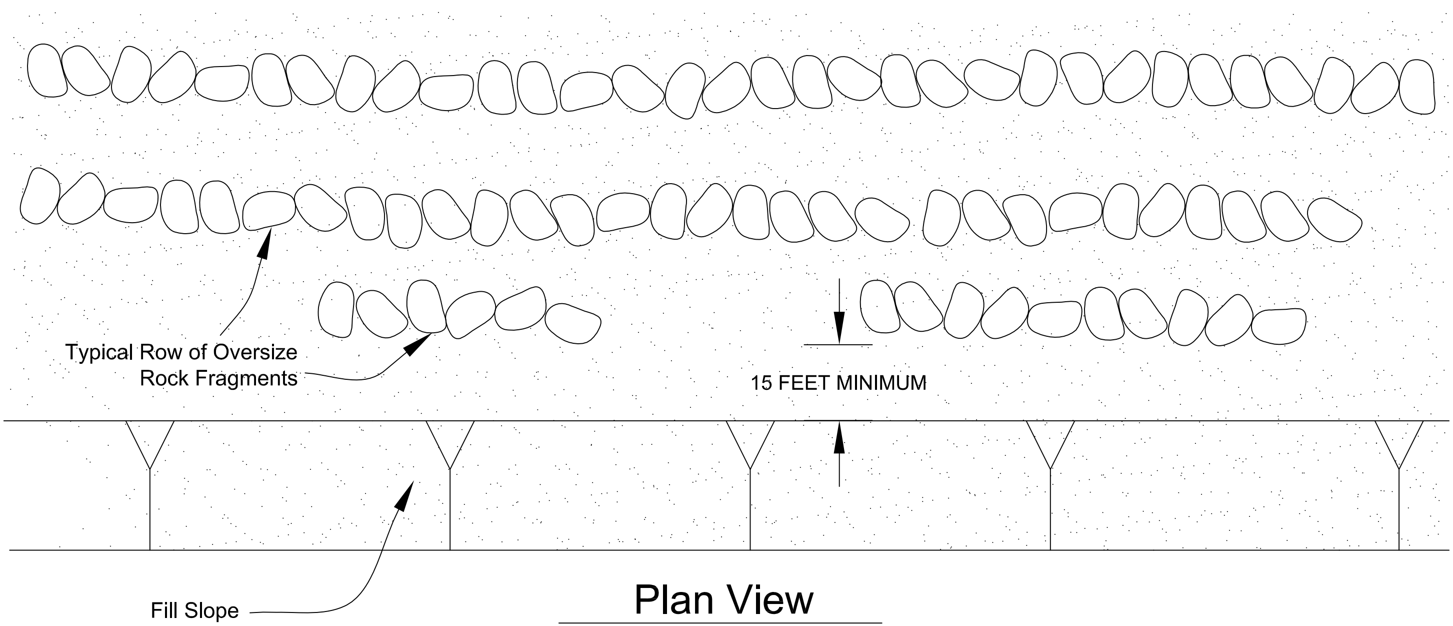
PLATE D-7

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

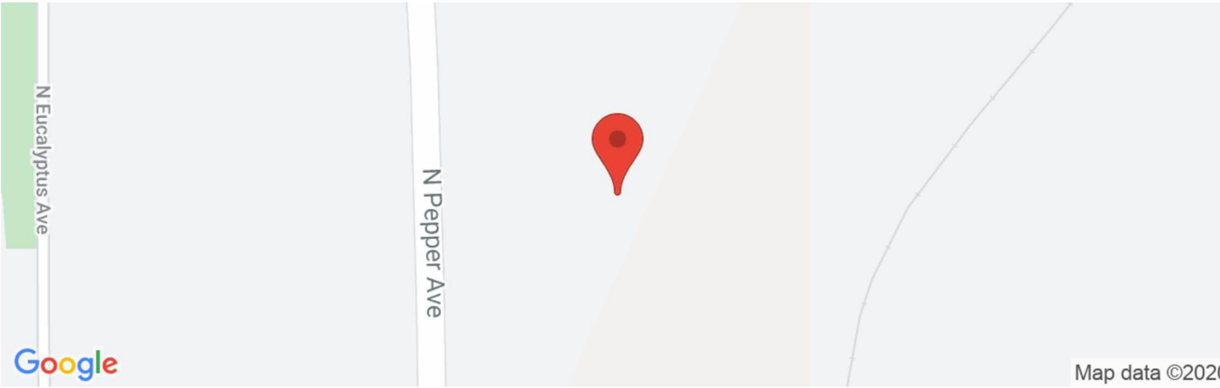
DRAWN: PM
CHKD: GKM

PLATE D-8

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

Latitude, Longitude: 34.131107, -117.350948



Date	12/2/2020, 2:44:10 PM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	2.425	MCE_R ground motion. (for 0.2 second period)
S_1	0.972	MCE_R ground motion. (for 1.0s period)
S_{MS}	2.425	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.617	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	1.021	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	1.123	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	2.664	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.922	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.425	Factored deterministic acceleration value. (0.2 second)
S1RT	1.082	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	1.221	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.972	Factored deterministic acceleration value. (1.0 second)
PGAd	1.021	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.912	Mapped value of the risk coefficient at short periods
C_{R1}	0.887	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
PROPOSED COMMERCIAL/INDUSTRIAL BUILDING
RIALTO, CALIFORNIA

DRAWN: OS
CHKD: RGT
SCG PROJECT
20G234-1
PLATE E-1

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