APPENDIX F

Geotechnical Investigation, Results of Infiltration Testing, and Paleontological Resource Assessment

Kimley»Horn

GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL DEVELOPMENT

11171 Cherry Avenue
Fontana, California
for
Hillwood

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

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A California Corporation

April 7, 2023

Hillwood
36 Discovery, Suite 130
Irvine, California 92688

Attention: Ms. Kathy Hoffer
Vice President, Development

Project No.: **23G117-1**

Subject: **Geotechnical Investigation**
Proposed Industrial Development
11171 Cherry Avenue
Fontana, California

Ms. Hoffer:

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

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

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

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1.0 EXECUTIVE SUMMARY

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

Geotechnical Design Considerations

- Artificial fill soils were encountered at the ground surface at all of the boring locations, extending to depths of 1½ to 5½± feet below the existing site grades.
- Based on a lack of documentation regarding the placement and compaction of the existing fill materials, these soils are considered to consist of undocumented fill, and are not suitable for the support of the foundation loads of the proposed buildings.
- The fill soils are underlain by native alluvium which possesses varying strengths and densities. The results of laboratory testing indicate that the near-surface soils within the upper 5 to 6± feet generally possess a potential for minor to severe collapse when exposed to moisture infiltration as well as minor to moderate consolidation when exposed to load increases in the range of those that will be exerted by the new foundations. The near-surface soils, in their present condition, are not considered suitable to support the foundation loads of the new buildings, and could result in excessive post-construction settlements.
- Boring Nos. B-10 and B-5 encountered loose soils at depths of 6½ and 8± feet below the ground surface, respectively.
- Based on these conditions, remedial grading is considered warranted within the proposed building areas in order to remove all of the undocumented fill soils in their entirety, the upper portion of the near-surface alluvium, and any soils disturbed during the demolition process.

Site Preparation Recommendations

- Demolition of the existing structures will be required in order to allow for the new development. Demolition should include all foundations, floor slabs, pavements, utilities and any other subsurface improvements that will not remain in place with the new development. Debris resultant from demolition should be disposed of off-site. Concrete and asphalt debris may be processed to a maximum 2-inch particle size, well mixed with sands, and incorporated into new structural fills, or it may be crushed into miscellaneous base (CMB).
- Site stripping within vegetated areas should remove include all vegetation, including tree root masses and any organic topsoil.
- Remedial grading is recommended to be performed within the proposed building areas in order to remove all of the undocumented fill soils in their entirety, any soils disturbed during the demolition process, and the upper portion of the near-surface native alluvial soils, and replace these materials as compacted structural fill soils. The soils within the proposed building areas should be overexcavated to a depth of 4 feet below existing grade and to a depth of at least 3 feet below proposed building pad subgrade elevations.
- The depth of overexcavation should also be sufficient to remove any existing fill soils. The proposed foundation influence zones should be overexcavated to a depth of at least 3 feet below proposed foundation bearing grade.
- The overexcavation areas should extend at least 5 feet beyond the building and foundation perimeters, and to an extent equal to the depth of fill placed below the foundation bearing grade, whichever is greater.

- Some localized areas of deeper excavation may be required if additional fill materials or loose, porous, or low-density native soils are encountered at the base of the overexcavation.
- Following completion of the overexcavation, the exposed soils should be scarified to a depth of at least 12 inches, and thoroughly flooded to raise the moisture content of the underlying soils to at least 0 to 4 percent above optimum moisture content. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.
- The new pavement and flatwork subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Foundation Design Recommendations

- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,500 lbs/ft^2 maximum allowable soil bearing pressure.
- Maximum, net allowable soil bearing pressure: 1,500 lbs/ft^2 for new footings if the full lateral extent of remedial grading cannot be achieved.
- Reinforcement consisting of at least two (2) No. 5 rebars (1 top and 1 bottom) in strip footings. Additional reinforcement may be necessary for structural considerations.

Building Floor Slab Design Recommendations

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

Pavement Design Recommendations

ASPHALT PAVEMENTS (R=40)					
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	4	6	7	8	10
Compacted Subgrade	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS (R=40)				
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. 23P177, dated March 6, 2023. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slabs, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the northeast corner of Cherry Avenue and Jurupa Avenue in Fontana, California. The site is also referenced by the street address 11171 Cherry Avenue. The site is bound to the north by existing commercial/industrial developments, to the west by Cherry Avenue, to the south by Jurupa Avenue, and to the east by Redwood Avenue and an existing commercial/industrial development. The general location of the site is illustrated on the Site Location Map, included as Plate 1 in Appendix A of this report.

The subject site is an L-shaped property and consists of two (2) rectangular-shaped parcels which total 29.6± acres in size. The northern parcel is developed with two (2) industrial buildings, 16,500 ft² and 20,000± ft² in size, and is mainly used for equipment and trailer storage. The buildings are single-story structures of metal frame and metal siding construction, and are presumed to be supported on conventional shallow foundations with concrete slab-on-grade floors. Ground surface cover immediately surrounding the existing structures consist of Portland cement concrete (PCC) and asphaltic concrete (AC) pavements. The existing pavements are in poor condition with severe cracking throughout. Ground surface cover for the remainder of the northern parcel consists of open-graded gravel areas, and exposed soil. The southern parcel is developed with a few steel-framed canopies with ground surface cover consisting of open-graded gravel areas, and exposed soil. This parcel is mainly used for equipment and material storage. A tree line is present in most areas between the two parcels.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the overall site topography slopes downward to the south at a gradient of 2± percent.

3.2 Proposed Development

A conceptual site plan prepared by HPA, Inc., has been provided to our office by the client. Based on this plan, the subject site will be developed with two (2) warehouses (identified as Building 1 and Building 2). The proposed buildings will be developed as follows:

Building	Warehouse (ft^2)	Office (ft^2)	Location on site
1	473,980	3,500	West
2	229,000	3,500	East

Dock-high doors will be constructed along portions of at least one building wall for each of the buildings. The proposed buildings are expected to be surrounded by AC pavements in the parking and drive areas, PCC pavements in the loading dock areas, and concrete flatwork and landscaped planters throughout the site.

Detailed structural information has not been provided. We assume that the new buildings will be single-story structures of tilt-up concrete construction, typically supported on conventional shallow foundation systems with concrete slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

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 up to 7± feet are expected to be necessary to achieve the proposed site grades. It should be noted that this estimate does not include any remedial grading, recommendations for which are presented in a subsequent section of this report.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of eleven (11) borings (identified as Boring Nos. B-1 through B-11) advanced to depths of 15 to 25± feet below the existing site grades. All of the borings were logged during drilling by a member of our staff. All of the boring locations were cleared by a private geophysical testing company prior to drilling.

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

Artificial Fill

Artificial fill soils were encountered at the ground surface at all of the boring locations, extending to depths of 1½ to 5½± feet below the existing site grades. The fill soils generally consist of medium dense to very dense silty sands and sandy silts with varying fine to coarse gravel content. Boring No. B-1 encountered a stratum consisting of dense sandy silts with little fine gravel content at a depth of 4½ to 5½± feet. Boring No. B-7 encountered a stratum consisting of medium dense gravelly sands with little silt content extending to a depth of 1½± feet from the ground surface. Boring Nos. B-9 and B-11 encountered a stratum consisting of medium dense silty sands to sandy silts with traces of fine to coarse gravel extending to depths of 2½ to 3± feet from the ground surface. The fill soils possess a disturbed and mottled appearance, with a sample possessing debris such as brick fragments, resulting in their classification as artificial fill.

Alluvium

Native alluvial soils were encountered beneath the fill soils at all of the boring locations, extending to at least the maximum depth explored of 25± feet below the existing site grades. The near-surface alluvium generally consists of loose to dense gravelly sands, sandy silts, and silty sands, extending to depths 4½ to 8± feet. At greater depths, the alluvium becomes denser with occasional medium dense sands.

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 table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

As part of our research, we reviewed readily available groundwater data in order to determine regional groundwater depths. Recent water level data was obtained from the California Department of Water Resources, Water Data Library Station Map, website, https://wdl.water.ca.gov/waterdatalibrary/. One monitoring well on record (identified as Local Well: CHINO-1207068) is located as close as 705 feet west of the site. Water level readings within this monitoring well indicate a high groundwater level of 225± feet below the ground surface in January 2000.

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

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

Soluble Sulfates

Representative samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The results of the soluble sulfate testing are presented below, and are discussed further in a subsequent section of this report.

Sample Identification	**Soluble Sulfates (%)**	**Sulfate Classification**
B-7 @ 1 to 5 feet	0.005	Not Applicable (S0)
B-10 @ 1 to 5 feet	0.005	Not Applicable (S0)

Corrosivity Testing

Representative bulk samples of the near-surface soils were submitted to a subcontracted corrosion engineering laboratory for determination of electrical resistivity, pH, and chloride concentrations. The resistivity of the soils is a measure of their potential to attack buried metal improvements such as utility lines. The results of some of these tests are presented below.

Sample Identification	**Saturated Resistivity (ohm-cm)**	**pH**	**Chlorides (mg/kg)**	**Nitrates (mg/kg)**	**Sulfides (mg/kg)**	**Redox Potential (mV)**
B-7 @ 1 to 5 feet	6,432	7.7	15.7	12.0	0.4	101
B-10 @ 1 to 5 feet	4,958	7.7	18.0	90.5	< 0.01	131

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing and geotechnical analysis, the proposed development is considered feasible from a geotechnical standpoint. The recommendations contained in this report should be taken into the design, construction, and grading considerations.

The recommendations are contingent upon grading and foundation construction activities being monitored by the geotechnical engineer of record. The recommendations are provided with the assumption that an adequate program of client consultation, construction monitoring, and testing will be performed during the final design and construction phases to verify compliance with these recommendations. Maintaining Southern California Geotechnical, Inc., (SCG) as the geotechnical consultant from the beginning to the end of the project will provide continuity of services. The geotechnical engineering firm providing testing and observation services shall assume the responsibility of Geotechnical Engineer of Record.

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

6.1 Seismic Design Considerations

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

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. Furthermore, SCG did not identify any evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low.

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

Seismic Design Parameters

The 2022 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 the adoption of the 2022 CBC on January 1, 2023, we expect that the proposed development will be designed in accordance with the 2022 CBC.

The 2022 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 2022 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 table below was created using data obtained from the application. The output generated from this program is attached to this letter.

The 2022 CBC states that for Site Class D sites with a mapped S1 value greater than 0.2, a site-specific ground motion analysis may be required in accordance with Section 11.4.8 of ASCE 7-16. Supplement 3 to ASCE 7-16, modifies Section 11.4.8 of ASCE 7-16 and states that "a ground motion hazard analysis is not required where the value of the parameter SM1 determined by Eq. (11.4-2) is increased by 50% for all applications of SM1 in this Standard. The resulting value of the parameter SD1 determined by Eq. (11.4-4) shall be used for all applications of SD1 in this Standard."

The seismic design parameters presented in the table below were calculated using the site coefficients (Fa and Fv) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2022 CBC. It should be noted that the site coefficient Fv and the parameters SM1 and SD1 were not included in the SEAOC/OSHPD Seismic Design Maps Tool output for the ASCE 7-16 standard. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2022 CBC using the value of S1 obtained from the Seismic Design Maps Tool. The values of SM1 and SD1 tabulated below were determined using equations 11.4-2 and 11.4-4 of ASCE 7-16 (Equations 16-20 and 16-23, respectively, of the 2022 CBC) and **do not include a 50 percent increase.** As discussed above, if a site-specific analysis has not been performed, SM1 and SD1 must be increased by 50 percent for all applications with respect to the ASCE 7-16 standard.

2022 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.721
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.638
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.721
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	1.085*
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.147
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.723*

*Note: These values must be increased by 50 percent if a site-specific ground motion hazard analysis has not been performed. However, this increase is not expected to affect the design of the structure type proposed for this site. This assumption should be confirmed by the project structural engineer. The values tabulated above do not include a 50-percent increase.

Liquefaction

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

The 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, indicates that the subject site is not located within a zone of liquefaction susceptibility. In addition, the subsurface conditions at the boring locations are not considered to be conducive to liquefaction. These conditions generally consist of medium dense to very dense, silty sands and sandy silts, and no evidence of a historic high ground water table within the upper 50± feet of the ground surface. Based on the mapping performed by San Bernardino County and the conditions encountered at the boring locations, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

Artificial fill soils were encountered at the ground surface at all of the boring locations, extending to depths of 1½ to 5½± feet below the existing site grades. Based on a lack of documentation regarding the placement and compaction of the existing fill materials, these soils are considered to consist of undocumented fill, and are not suitable for the support of the foundation loads of the proposed buildings. These fill soils are underlain by native alluvium which possesses varying strengths and densities. The results of laboratory testing indicate that the near-surface soils within the upper 5 to 6± feet generally possess a potential for minor to severe collapse when exposed to moisture infiltration as well as minor to moderate consolidation when exposed to load increases in the range of those that will be exerted by the new foundations. The near-surface soils, in their present condition, are not considered suitable to support the foundation loads of the new buildings, and could result in excessive post-construction settlements. The native soils at greater depths generally will experience less influence from the new foundation loads. Boring Nos. B-10 and B-5 encountered loose soils at depths of 6½ and 8± feet below the ground surface, respectively. Based on these conditions, remedial grading is considered warranted within the proposed building areas in order to remove all of the undocumented fill soils in their entirety, the upper portion of the near-surface alluvium, and any soils disturbed during the demolition process, and replace these materials as compacted structural fill soils.

Settlement

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

Expansion

The near-surface soils consist of gravelly sands, sandy silts, and silty sands with no appreciable clay content. These materials have been visually classified as non-expansive. Therefore, no design considerations related to expansive soils are considered warranted for this site.

Soluble Sulfates

The results of the soluble sulfate testing indicate that the selected samples of the on-site soils correspond 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 areas.

Corrosion Potential

The results of laboratory testing indicate that the tested samples of the on-site soils possess saturated resistivity values of 4,958 and 6,432 ohm-cm, and a pH value of 7.7. The soils possess redox potentials of 101 and 131 mV and only trace sulfide concentrations of less than 1 part per million. These test results have been evaluated in accordance with guidelines published by the Ductile Iron Pipe Research Association (DIPRA). The DIPRA guidelines consist of a point system by which characteristics of the soils are used to quantify the corrosivity characteristics of the site. Resistivity, pH, sulfide concentration, redox potential, and moisture content are the five factors that enter into the evaluation procedure. Based on these factors, the on-site soils are considered to be mildly corrosive to ferrous pipes. Therefore, corrosion protection is expected to be required for cast iron or ductile iron pipes.

Based on American Concrete Institute (ACI) Publication 318 Building Code Requirements for Structural Concrete and Commentary, reinforced concrete that is exposed to external sources of chlorides requires corrosion protection for the steel reinforcement contained within the concrete. ACI 318 defines concrete exposed to moisture and an external source of chlorides as "severe" or exposure category C2. ACI 318 does not clearly define a specific chloride concentration at which contact with the adjacent soil will constitute a "C2" or severe exposure. However, the Caltrans Memo to Designers 10-5, Protection of Reinforcement Against Corrosion Due to Chlorides, Acids and Sulfates, dated June 2010, indicates that soils possessing chloride concentrations greater than 500 mg/kg are considered to be corrosive to reinforced concrete. The results of the laboratory testing indicate chloride concentrations ranging from 15.7 and 18.0 mg/kg. Although the soils contain some chlorides, we do not expect that the chloride concentrations of the tested soils are high enough to constitute a "severe" or C2 chloride exposure. Therefore, a chloride exposure category of C1 is considered appropriate for this site.

Nitrates present in soil can be corrosive to copper tubing at concentrations greater than 50 mg/kg. The tested samples possess nitrate concentrations of 12.0 and 90.5 mg/kg. **Based on these test results, the on-site soils are 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 of these test results.

Shrinkage/Subsidence

Removal and recompaction of the near-surface alluvium is estimated to result in an average shrinkage of 6 to 16 percent. However, potential shrinkage for individual samples ranged locally between 2 and 25 percent. The potential shrinkage estimate is based on dry density testing performed on small-diameter samples 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 0.15 feet.

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

Grading and Foundation Plan Review

Grading and foundation plans were unavailable at the time of this report. It is therefore recommended that we be provided with copies of the preliminary grading and foundation plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

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

Demolition and Site Stripping

Demolition of the existing structures including pavements and any associated improvements will be necessary to facilitate the construction of the proposed development. Demolition should include any foundations, floor slabs, and any associated utilities. Any septic systems encountered during demolition and/or grading (if present) should be removed in their entirety. Any associated leach fields or other existing underground improvements should also be removed in their entirety. Debris resultant from demolition should be disposed of off-site in accordance with local regulations. Alternatively, concrete and asphalt debris may be crushed to a maximum 2-inch particle size, well mixed with sands, and incorporated into new structural fills or it may be crushed and made into crushed miscellaneous base (CMB), if desired. Furthermore, the contractor should take necessary precautions to protect the adjacent improvements during demolition.

Detailed structural information regarding the existing structures has not been provided to our office. Therefore, the foundation systems supporting the existing structures are generally unknown by SCG. We expect that the existing structures are supported on conventional shallow foundations. However, if any of the structures are supported on deep foundations, any existing piles or drilled piers located within the proposed building area should be cut off at a depth of at least 2 feet below the bottom of the planned overexcavation. Where drilled pier or pile foundations are encountered within proposed pavement areas, they should be cut off at a depth of at least 2 feet below the proposed pavement subgrade or at a depth of at least 1 foot below the bottom of any planned utilities.

Initial site stripping should also include removal of any surficial vegetation from the unpaved areas of the site. This should include any weeds, grasses, shrubs, and trees. Root systems associated with the trees should be removed in their entirety, and the resultant excavations should be backfilled with compacted structural fill soils. Any organic materials should be removed and disposed of off-site, or in non-structural areas of the property. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pads

Remedial grading should be performed within the proposed building area in order to remove the existing undocumented fill soils, any soils disturbed during demolition, and a portion of the near-surface native alluvium. Based on conditions encountered at the boring locations, the existing soils within the proposed building areas are recommended to be overexcavated to a depth of at least 4 feet below existing grade, and to a depth of at least 3 feet below proposed building pad subgrade elevations, whichever is greater. The depth of the overexcavation should also extend to a depth sufficient to remove all undocumented fill soils and soils disturbed during demolition. Undocumented fill soils were encountered at all of the boring locations, extending to depths of 1½ to 5½± feet below the existing site grades. Deeper fill soils may be encountered during demolition of the existing structures. Within the influence zones of the new foundations, the overexcavation should extend to a depth of at least 3 feet below proposed foundation bearing grade.

The overexcavation areas should extend at least 5 feet beyond the building and foundation perimeters, and to an extent equal to the depth of fill placed below the foundation bearing grade, whichever is greater. If the proposed structures incorporate any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

Following completion of the overexcavation, the subgrade soils within the overexcavation areas should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structures. This evaluation should include proofrolling and probing to identify any soft, loose or otherwise unstable soils that must be removed. **Some localized areas of deeper excavation may be required if additional fill materials or loose, porous, or low-density native soils are encountered at the base of the overexcavation**. It should be noted that Boring Nos. B-10 and B-5 encountered loose soils at depths of 6½ and 8± feet below the ground surface, respectively.

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

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

The existing soils within the areas of any proposed retaining walls and site walls should be overexcavated to a depth of 3 feet below foundation bearing grade and replaced as compacted structural fill as discussed above for the proposed building pads. Any undocumented fill soils or disturbed native alluvium within any of these foundation areas should be removed in their entirety. The overexcavation areas should extend at least 3 feet beyond the foundation perimeters, and to an extent equal to the depth of fill below the new foundations. Any erection pads for tilt-up concrete walls are considered to be part of the foundation system. Therefore, these overexcavation recommendations are applicable to erection pads. The overexcavation subgrade soils should be evaluated by the geotechnical engineer prior to scarifying, thoroughly moisture conditioning to within 0 to 4 percent above the optimum moisture content, and recompacting the upper 12 inches of exposed subgrade soils. The previously excavated soils may then be replaced as compacted structural fill.

If the full lateral recommended remedial grading cannot be completed for the proposed retaining walls and site walls located along property lines, the foundations for those walls should be designed using a reduced allowable bearing pressure. Furthermore, the contractor should take necessary precautions to protect the adjacent improvements during rough grading. Specialized grading techniques, such as A-B-C slot cuts, will likely be required during remedial grading. The geotechnical engineer of record should be contacted if additional recommendations, such as shoring design recommendations, are required during grading.

<u>Treatment of Existing Soils: Flatwork, Parking and Drive Areas</u>

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

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 0 to 4 percent above the optimum moisture content, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

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

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 0 to 4 percent above the optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2022 CBC and the grading code of the City of Fontana.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Imported Structural Fill

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, utility trench backfill should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. As an alternative, a clean sand (minimum Sand Equivalent of 30) may be placed within trenches and compacted in place (jetting or flooding is not recommended). Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the City of Fontana. 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 (horizontal to vertical) 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.

Soils used to backfill voids around subsurface utility structures, such as manholes or vaults, should be placed as compacted structural fill. If it is not practical to place compacted fill in these areas, then such void spaces may be backfilled with lean concrete slurry. Uncompacted pea gravel or sand is not recommended for backfilling these voids since these materials have a potential to settle and thereby cause distress of pavements placed around these subterranean structures.

6.4 Construction Considerations

Moisture Sensitive Subgrade Soils

Some of the near-surface soils possess appreciable silt content and may become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. In addition, based on their granular content, some of the on-site soils will also be susceptible to erosion. The site should, therefore, be graded to prevent ponding of surface water and to prevent water from running into excavations.

Excavation Considerations

The near-surface soils generally consist of silty sands, sandy silts and gravelly sands. These materials may will be subject to moderate caving within shallow excavations. Where caving does occur, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, the inclination of temporary slopes should not exceed 2h:1v. Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Groundwater

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

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pads will be underlain by structural fill soils used to replace the upper portion of the near-surface alluvial soils. These new structural fill soils are expected to extend to a depth of at least 3 feet below proposed foundation bearing grade, underlain by 1± foot of additional soil that has been densified and moisture conditioned in place. Based on this subsurface profile, the proposed structures may be supported on conventional shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Maximum, net allowable soil bearing pressure: 1,500 lbs/ft^2 if the full recommended lateral extent of remedial grading cannot be achieved.
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Two (2) No. 5 rebars (1 top and 1 bottom).
- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent exterior grade. Interior column footings may be placed immediately beneath the floor slabs.
- It is recommended that the perimeter building foundations be continuous across all exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

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

Foundation Construction

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

The foundation subgrade soils should also be properly moisture conditioned to 0 to 4 percent above the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. Since it is typically not feasible to increase the moisture content of the floor slabs and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process.

Estimated Foundation Settlements

Post-construction total and differential settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively. Differential movements are expected to occur over a 50-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

Lateral Load Resistance

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

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

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against compacted structural fill soils. The maximum allowable passive pressure is 3,000 lbs/ft^2.

6.6 Floor Slab Design and Construction

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

- Minimum slab thickness: 6 inches.

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

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

- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire area of the proposed slab where such moisture sensitive floor coverings are anticipated. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. A polyolefin material such as a 15-mil Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated, the vapor barrier may be eliminated.

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

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

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

6.7 Retaining Wall Design and Construction

Although not indicated on the site plans, some small (less than 6 feet in height) retaining walls may be required to facilitate the new site grades. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. The following parameters assume that only the on-site soils will be utilized for retaining wall backfill. The near-surface soils generally consist of silty sands, sandy silts and gravelly sands. Based on their classification, these materials are expected to possess an internal angle of friction of at least 30 degrees when compacted to at least 90 percent of the ASTM D-1557 maximum dry density.

If desired, SCG could provide design parameters for an alternative select backfill material behind the retaining walls. The use of select backfill material could result in lower lateral earth pressures. In order to use the design parameters for the imported select fill, this material must be placed within the entire active failure wedge. This wedge is defined as extending from the heel of the retaining wall upwards at an angle of approximately 60° from horizontal. If select backfill material behind the retaining wall is desired, SCG should be contacted for supplementary recommendations.

RETAINING WALL DESIGN PARAMETERS

Design Parameter		Soil Type: On-site Silty Sands and Sandy Silts
Internal Friction Angle (ϕ)		30°
Unit Weight		131 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	44 lbs/ft^3
	Active Condition (2h:1v backfill)	71 lbs/ft^3
	At-Rest Condition (level backfill)	66 lbs/ft^3

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

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

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

Seismic Lateral Earth Pressures

In accordance with the 2022 CBC, any retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. If walls 6 feet or more are required for this site, the geotechnical engineer should be contacted for supplementary seismic lateral earth pressure recommendations.

Retaining Wall Foundation Design

The retaining wall foundations should be underlain by at least 3 feet of newly placed structural fill. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Backfill Material

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

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

All retaining wall backfill should be placed and compacted under engineering controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557). 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 2-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 10-foot on-center spacing. Alternatively, 4-inch diameter holes at an approximate 20-foot on-center spacing can be used for this type of drainage system. In addition, 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. The actual design of this type of system should be determined by the civil engineer to verify that the drainage system possesses the adequate capacity and slope for its intended use.

Weep holes or a footing drain will not be required for building stem walls.

6.8 Pavement Design Parameters

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

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The near-surface soils generally consist of gravelly sands, sandy silts, and silty sands. Based on their classification, these materials are expected to possess good to excellent pavement support characteristics, with R-values in the range of 40 to 60. Since R-value testing was not included in the scope of services for this project, the subsequent pavement design is based upon an assumed R-value of 40. 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 observed and tested conditions. It is recommended that R-value testing be performed after completion of rough grading to verify that the pavement design recommendations presented herein are valid.

Asphaltic Concrete

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

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

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

ASPHALT PAVEMENTS (R=40)					
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	4	6	7	8	10
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 batch plant-reported maximum density. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

The preparation of the subgrade soils within Portland cement concrete pavement areas should be performed as previously described in Section 6.3 "Treatment of Existing Soils: Flatwork, Parking, and Drive Areas". The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS (R=40)				
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. Reinforcing within all pavements should be designed by the structural engineer. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness. The actual joint spacing and reinforcing of the Portland cement concrete pavements should be determined by the structural engineer.

7.0 GENERAL COMMENTS

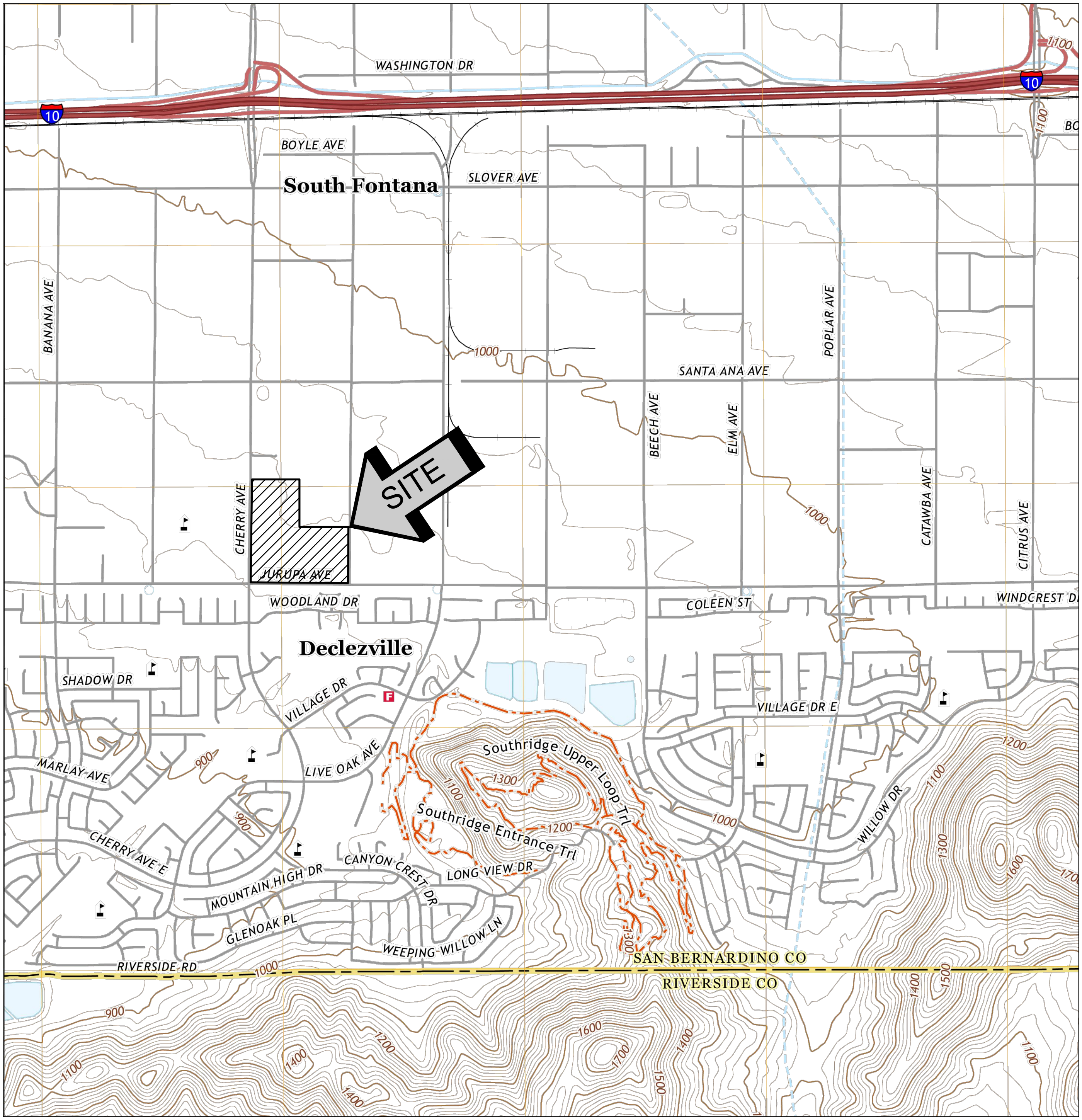
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other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

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

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

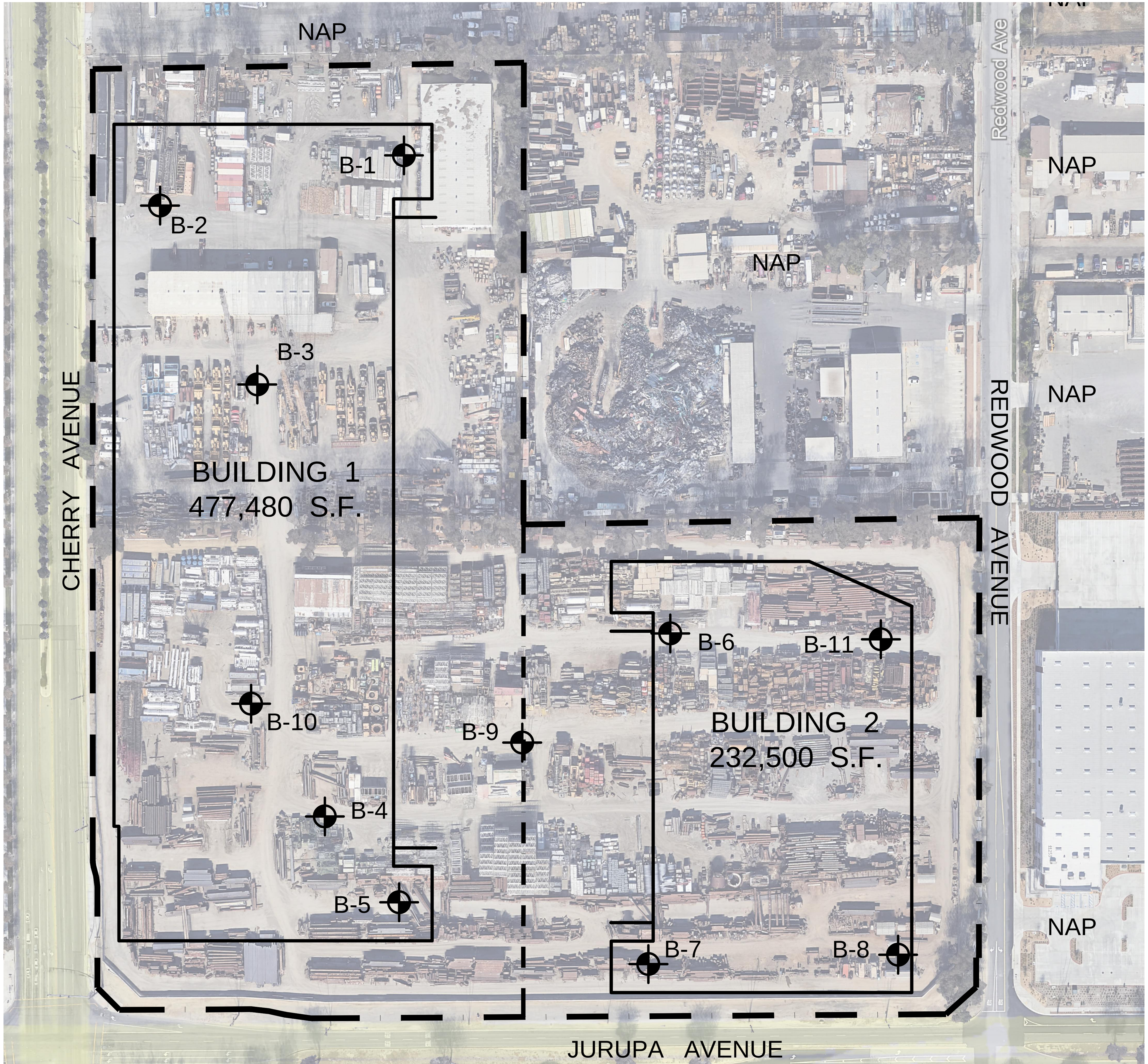
The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

APPENDIX A



SOURCE: USGS TOPOGRAPHIC MAP OF THE FONTANA QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, 2021.

SITE LOCATION MAP	
PROPOSED INDUSTRIAL DEVELOPMENT	
FONTANA, CALIFORNIA	
SCALE: 1" = 2000'	SOUTHERN CALIFORNIA GEOTECHNICAL (SoCalGeo)
DRAWN: JLL CHKD: RGT	
SCG PROJECT 23G117-1	
PLATE 1	



NORTH
SoCalGeo

GEOTECHNICAL LEGEND

⌖ APPROXIMATE BORING LOCATION

NOTE: CONCEPTUAL SITE PLAN PROVIDED BY HPA, INC.
AERIAL PHOTO OBTAINED FROM GOOGLE EARTH.

BORING LOCATION PLAN

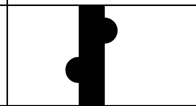
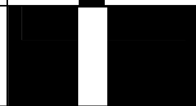
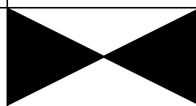
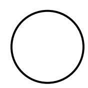
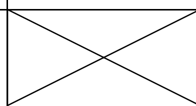
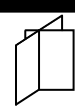
PROPOSED INDUSTRIAL DEVELOPMENT

FONTANA, CALIFORNIA

SCALE: 1" = 150'	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JLL CHKD: RGT	
SCG PROJECT 23G117-1	
PLATE 2	

APPENDIX B

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

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

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

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

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

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

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

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

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		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

BORING NO. B-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 23G117-1
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/20/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: 15 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
			FILL: Gray Brown Silty fine to medium sand, trace coarse Sand, trace fine Gravel, mottled, very dense-damp to moist							
	76			120	7					
	36		@ 3 feet, little fine to coarse Gravel. medium dense	117	5					
5			FILL: Light Brown fine to coarse Sandy Silt, little fine Gravel, dense-damp							
	63			122	3					
			ALLUVIUM: Brown Gravelly fine to coarse Sand, little Silt, medium dense to dense-dry to damp							
	25			117	1					
			Light Brown fine Sandy Silt, little Iron Oxide staining, trace medium Sand, medium dense-dry to damp							
	22			102	3					
10										
	26		@ 13½ feet, very moist		14					
15										
			Light Brown Silty fine Sand to fine Sandy Silt, medium dense-damp							
	24				8					
20										

Boring Terminated at 20'

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

BORING NO. B-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 23G117-1
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/20/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
	X	41			FILL: Brown Silty fine to coarse Sand, trace fine Gravel, mottled, dense-moist		8					
5	X	11			ALLUVIUM: Brown Silty fine Sand, trace to little medium to coarse Sand, trace fine to coarse Gravel, medium dense-damp		6					
	X	40			Brown Silty fine to medium Sand, little coarse Sand, trace fine Gravel, occasional Cobbles, dense-damp		5					
10	X	59			Gray Brown Gravelly fine to coarse Sand, dense to very dense-dry to damp		1					
15	X	47			@ 13½ feet, 3±-inch fine Sandy Silt lens		3					
20	X	43			@ 18½ feet, some Silt, moist		7					
25	X	57			@ 23½ feet, trace to little Silt		2					
					Boring Terminated at 25'							

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 23G117-1
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/27/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: 12 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
					FILL: Brown Silty fine Sand, trace medium to coarse Sand, medium dense-damp							
		38				109	5					
					ALLUVIUM: Brown Silty fine Sand, loose-damp							
		14				101	4					
5		12			@ 5 feet, trace medium to coarse Sand, trace Iron Oxide staining	98	5					
					Brown fine Sandy Silt, trace medium Sand, little Iron Oxide staining, medium dense-moist to very moist							
		32				90	17					
		34			@ 9 feet, Gray Brown, little Calcareous veining	89	24					
10												
					Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, medium dense-moist							
		15					10					
15												
					Boring Terminated at 15'							

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 23G117-1
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/27/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
					FILL: Brown Silty fine to coarse Sand, little fine to coarse Gravel, medium dense-damp							
	X	43				107	5					
					ALLUVIUM: Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, loose-moist							
	X	13				100	9					
					Light Brown fine Sandy Silt, medium dense-moist to very moist							
5	X	16				100	15					
	X	25				89	19					
	X	21			@ 9 feet, little Iron Oxide veining	86	31					
10												
	X	24			@ 13½ feet, 4±-inch Gravelly fine to coarse Sand lens, damp		5					
15												
					Brown fine Sand, trace Silt, medium dense-dry							
	X	29					2					
20												
					Boring Terminated at 20'							

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 23G117-1
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/20/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Brown Silty fine Sand, trace medium to coarse Sand, medium dense-damp							
	X	16					6					
					ALLUVIUM: Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, loose-moist							
	X	9					11					
5												
					Gray Brown to Brown fine Sandy Silt, loose to medium dense-very moist							
	X	5					16					
	X	11			@ 8½ feet, trace Calcareous veining, trace Iron Oxide staining		17					
10												
					Brown fine to coarse Sand with 3±-inch fine Sandy Silt lens, medium dense-moist							
	X	15					8					
15												
					Brown Silty fine Sand with 3±-inch fine Sandy Silt lens, medium dense-moist to very moist							
	X	20					15					
20												
	X	23					12					
25												
					Boring Terminated at 25'							

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

BORING NO. B-6

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 23G117-1
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/20/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Brown Silty fine Sand, trace medium to coarse Sand, medium dense-damp to moist							
	X	11					7					
	X	18					3					
5					ALLUVIUM: Gray Brown fine to coarse Sand, trace to little Silt, medium dense to dense-dry							
	X	34					2					
					Gray Brown Silty fine Sand to fine Sandy Silt, little Iron Oxide veining, medium dense-very moist							
	X	20					22					
10												
					Brown Silty fine Sand, trace medium to coarse Sand, trace Iron Oxide staining, medium dense-damp to moist							
	X	17					7					
15												
					Gray Silty fine Sand to fine Sandy Silt, medium dense-very moist							
	X	16					28					
20												
					Boring Terminated at 20'							

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-7

JOB NO.: 23G117-1	DRILLING DATE: 3/20/23	WATER DEPTH: Dry
PROJECT: Proposed Industrial Development	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 11 feet
LOCATION: Fontana, California	LOGGED BY: Ryan Bremer	READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Dark Brown Gravelly fine to coarse Sand, little Silt, trace brick fragments, medium dense-damp							
	X	39					6					@ 1 foot, Disturbed Sample
					ALLUVIUM: Light Brown Silty fine Sand to fine Sandy Silt, trace medium to coarse Sand, medium dense-damp to moist							
	X	19				119	11					
					Brown Silty fine to medium Sand, little fine to coarse gravel, medium dense-damp							
5	X	24				113	7					
	X	26			@ 7 feet, no fine to coarse Gravel	100	3					
					Light Gray fine Sand, trace Silt, trace medium Sand, trace Iron Oxide staining, medium dense-damp to moist							
	X	33				105	8					
10					Light Gray fine Sandy Silt, trace Iron Oxide staining, medium dense-damp							
					@ 13½ feet, very moist							
	X	26				89	31					
15												
					Boring Terminated at 15'							

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-8

JOB NO.: 23G117-1
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/20/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Brown Silty fine to medium Sand, trace coarse Sand, very dense-damp							
	X	62					5					
					ALLUVIUM: Light Brown fine Sandy Silt, trace medium Sand, medium dense-damp							
	X	12					6					
5												
					Light Brown to Light Gray Silty fine Sand, trace to little medium to coarse Sand, medium dense-damp to moist							
	X	11					3					
	X	22					3					
10												
	X	22					7					
15												
	X	36			@ 18½ feet, no medium to coarse Sand, dense-dry		2					
20												
					Red Brown Gravelly fine to coarse Sand, trace Silt, very dense-dry							
	X	78/11"					2					
25												
					Boring Terminated at 25'							

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

BORING NO. B-9

JOB NO.: 23G117-1	DRILLING DATE: 3/27/23	WATER DEPTH: Dry
PROJECT: Proposed Industrial Development	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 15 feet
LOCATION: Fontana, California	LOGGED BY: Ryan Bremer	READING TAKEN: At Completion

FIELD RESULTS / LABORATORY RESULTS

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Light Brown Silty fine Sand to fine Sandy Silt, trace to little medium to coarse Sand, medium dense-damp							
	X	11					7					
					ALLUVIUM: Light Brown fine Sandy Silt, trace medium to coarse Sand, trace fine Gravel, trace Iron Oxide staining, loose-moist							
	X	7					9					
5												
					Light Brown Silty fine Sand to fine Sandy Silt, medium dense-damp to moist							
	X	11					13					
	X	10			@ 8½ feet, little Iron Oxide staining		8					
10												
	X	11			@ 13½ Gray, trace medium to coarse Sand, very moist		28					
15												
					Gray Silty fine Sand, trace Iron Oxide veining, medium dense-damp to moist							
	X	22					6					
20												
	X	26					8					
					Boring Terminated at 22'							

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-10

JOB NO.: 23G117-1
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/27/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: 11 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
		33			FILL: Brown Silty fine to medium Sand, trace coarse Sand, medium dense-damp	114	4					
		11			ALLUVIUM: Brown Silty fine Sand, trace medium Sand, loose-damp	104	5					
5		14			Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, loose-damp	94	6					
		23			Gray Brown Silty fine to medium Sand, medium dense-damp	110	5					
10		30			Gray fine Sandy Silt, trace medium to coarse Sand, little Iron Oxide staining, medium dense-moist	95	12					
		13			Brown Silty fine to medium Sand, little Iron Oxide veining, medium dense-damp		6					
15					Boring Terminated at 15'							

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-11

JOB NO.: 23G117-1
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/20/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

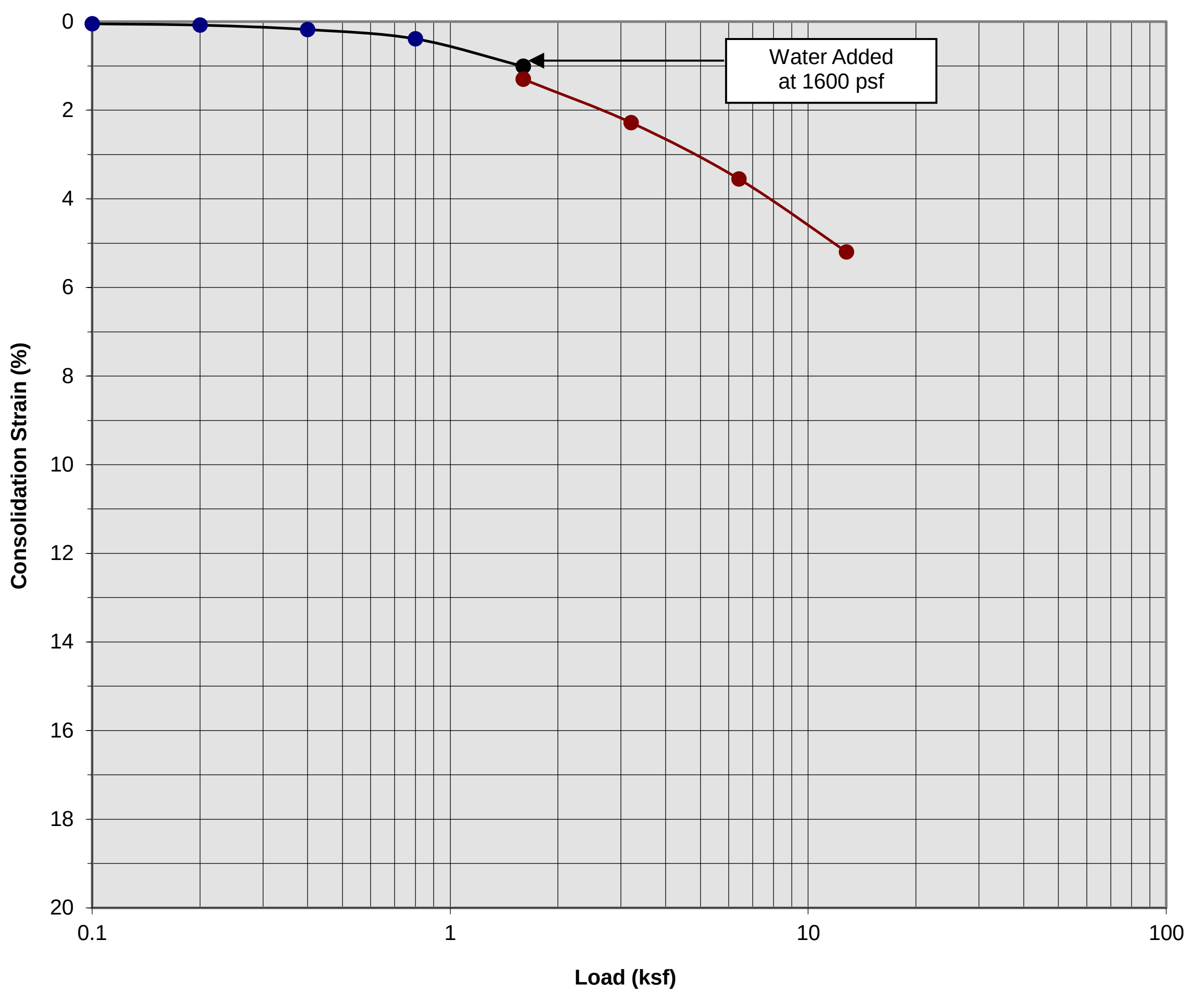
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Brown Silty fine Sand to fine Sandy Silt, trace to little medium to coarse Sand, trace fine to coarse Gravel, mottled, medium dense-damp to moist							
		24				116	8					
					ALLUVIUM: Gray Brown Silty fine to medium Sand, trace Iron Oxide staining, medium dense-damp to moist							
		20				113	7					
5		33			@ 5 feet, trace coarse Sand, little fine to coarse Gravel	113	4					
					Gray fine Sand, trace Silt, little Iron Oxide staining, medium dense-dry							
		24				101	2					
					Gray fine Sandy Silt, little Iron Oxide veining, very dense-very moist							
		80				100	24					
10												
					Brown Silty fine Sand, little Iron Oxide staining, medium dense-moist							
		16					10					
15												

Boring Terminated at 15'

TBL 23G117-1.GPJ SOCALGEO.GDT 4/6/23

APPENDIX C

Consolidation/Collapse Test Results

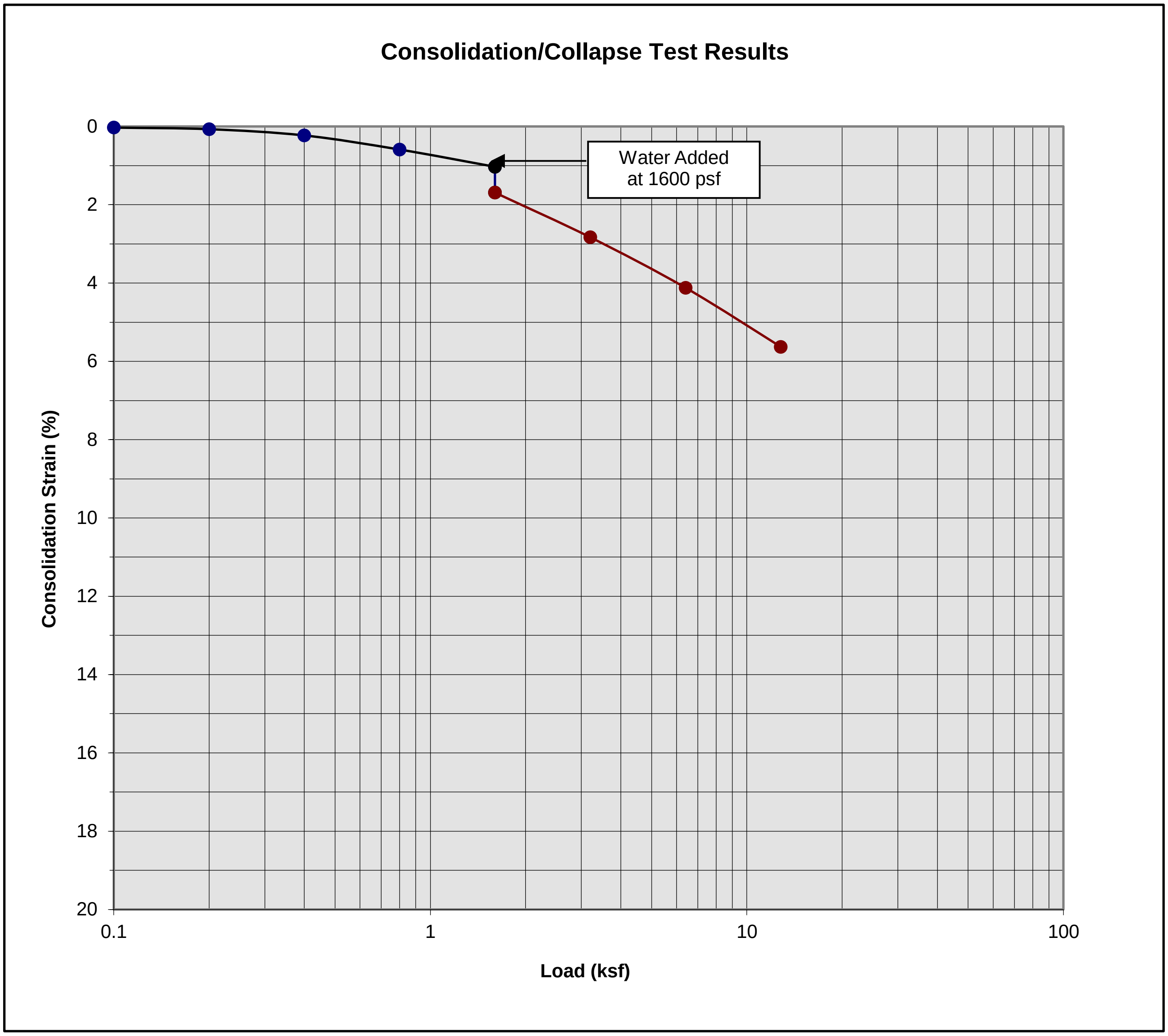


Classification: Light Brown Silty fine Sand to fine Sandy Silt, trace medium to coarse Sand

Boring Number:	B-7	Initial Moisture Content (%)	11
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	3 to 4	Initial Dry Density (pcf)	118.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	124.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.29

Proposed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

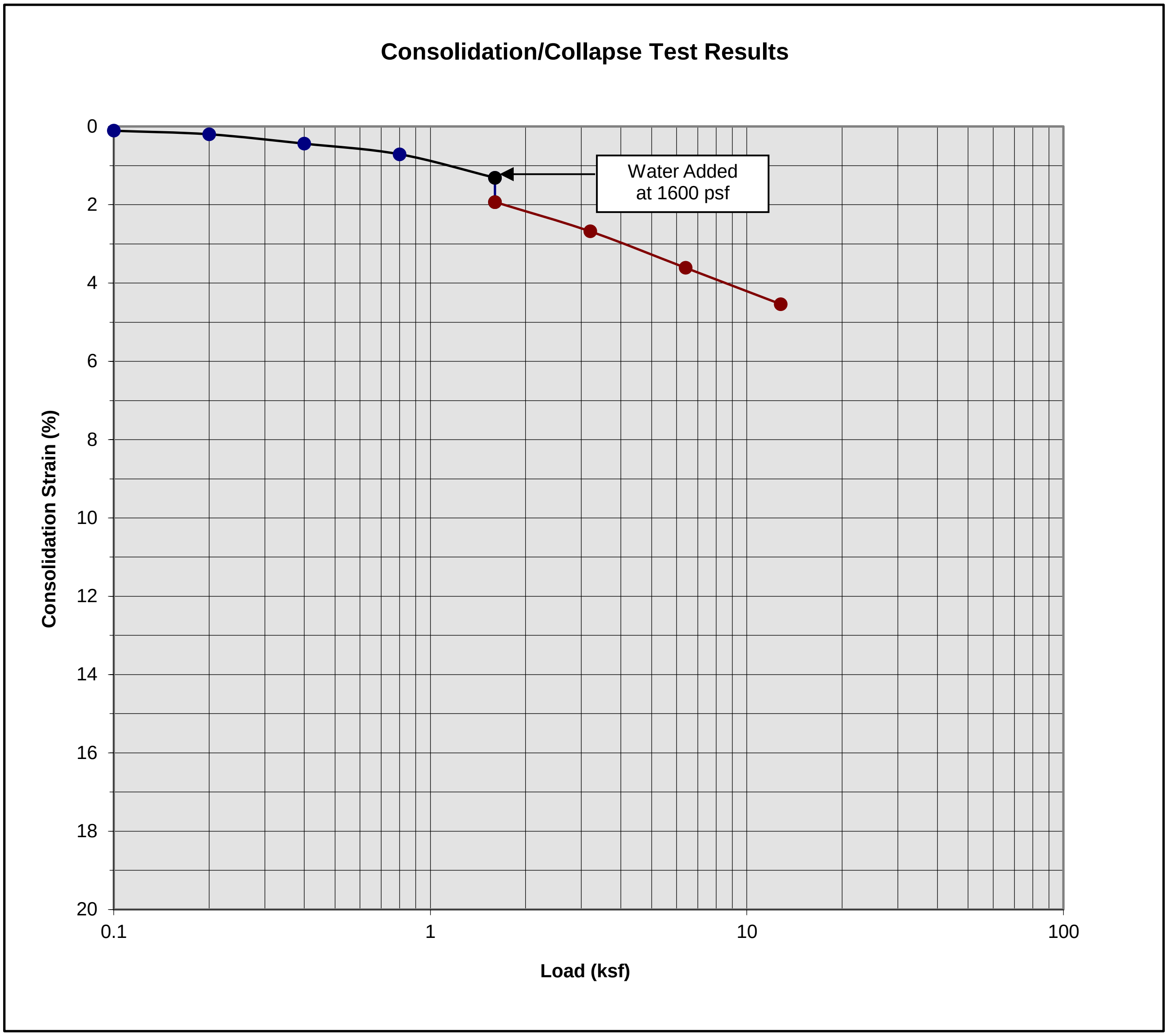


Classification: Brown Silty fine to medium Sand, little fine to coarse Gravel

Boring Number:	B-7	Initial Moisture Content (%)	7
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	5 to 6	Initial Dry Density (pcf)	112.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.66

Proposed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 2

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



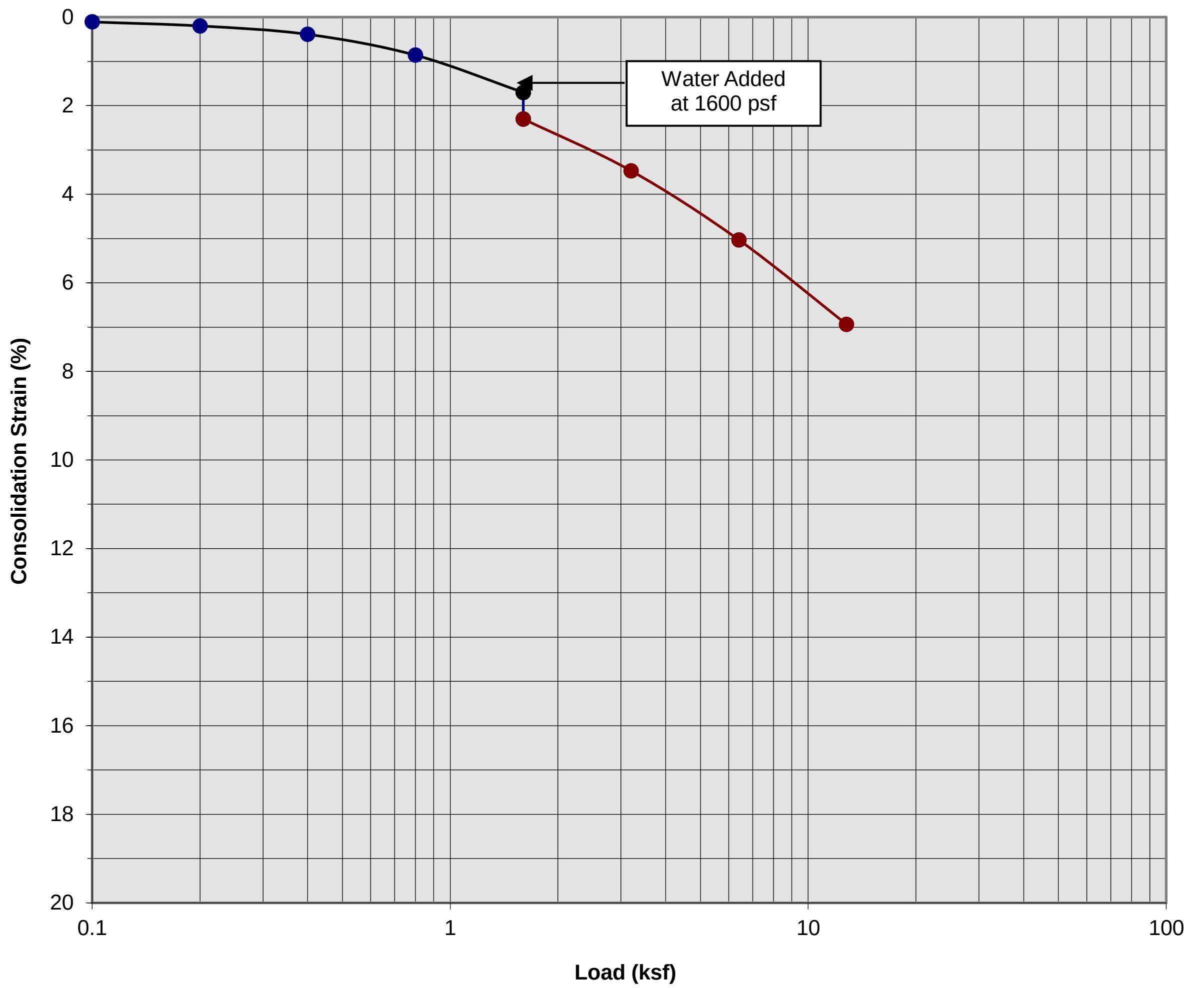
Classification: Brown Silty fine to medium Sand, little fine to coarse Gravel

Boring Number:	B-7	Initial Moisture Content (%)	3
Sample Number:	---	Final Moisture Content (%)	22
Depth (ft)	7 to 8	Initial Dry Density (pcf)	100.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	104.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.62

Proposed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



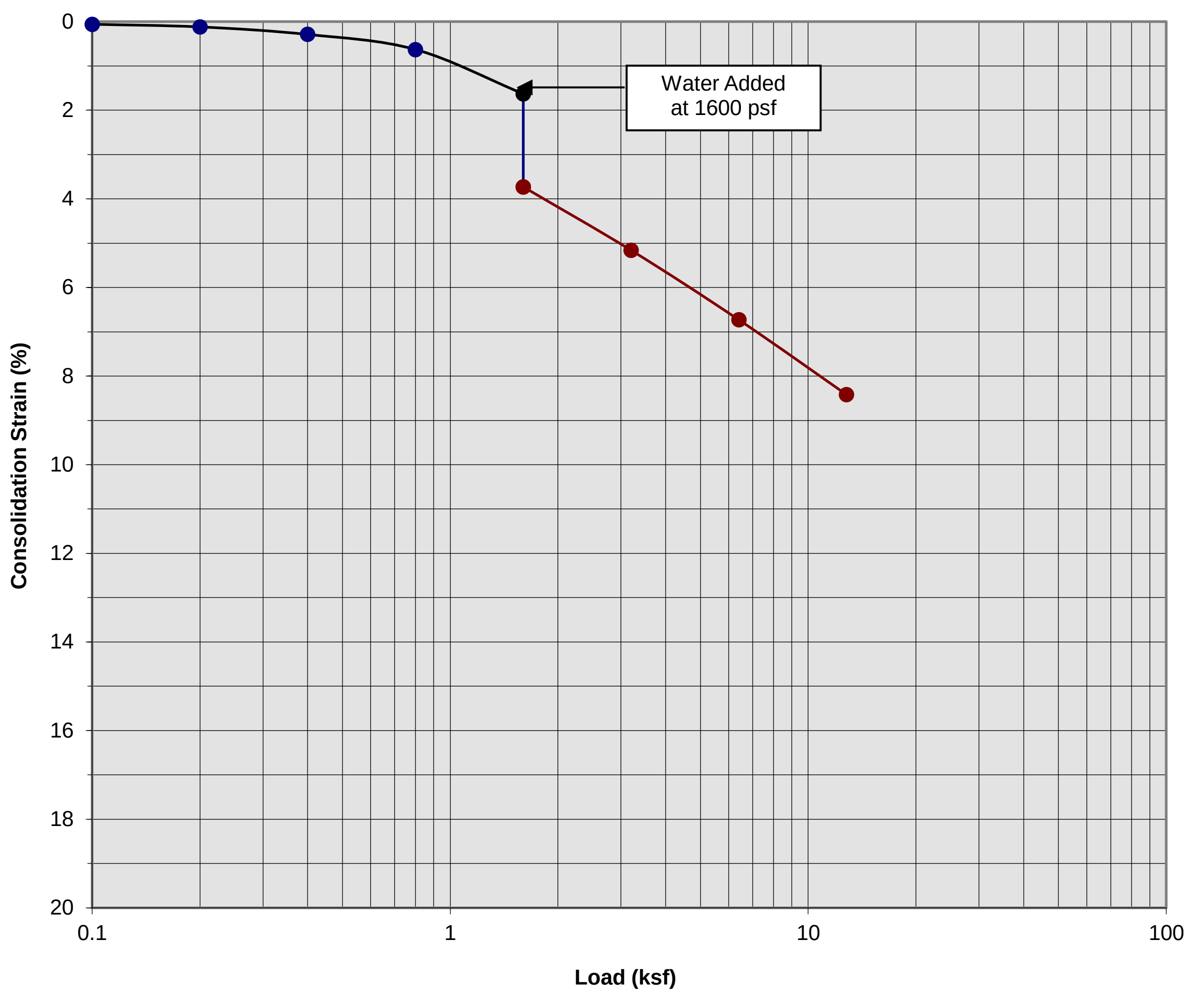
Classification: Light Gray fine Sandy Silt

Boring Number:	B-7	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	21
Depth (ft)	9 to 10	Initial Dry Density (pcf)	104.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	112.0
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.60

Proposed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 4

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



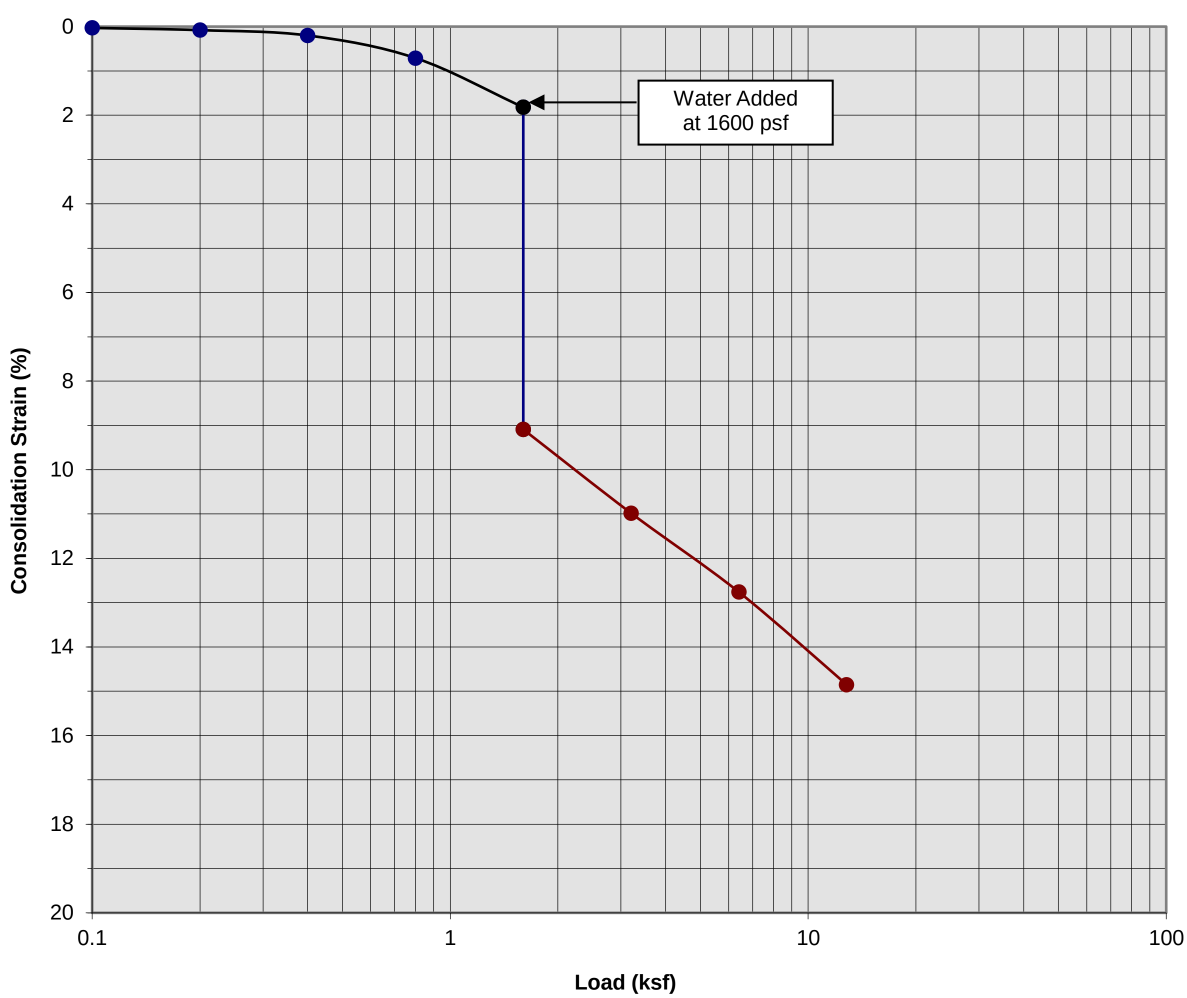
Classification: Brown Silty fine Sand, trace medium Sand

Boring Number:	B-10	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	18
Depth (ft)	3 to 4	Initial Dry Density (pcf)	104.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	113.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.10

Proposed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 5

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



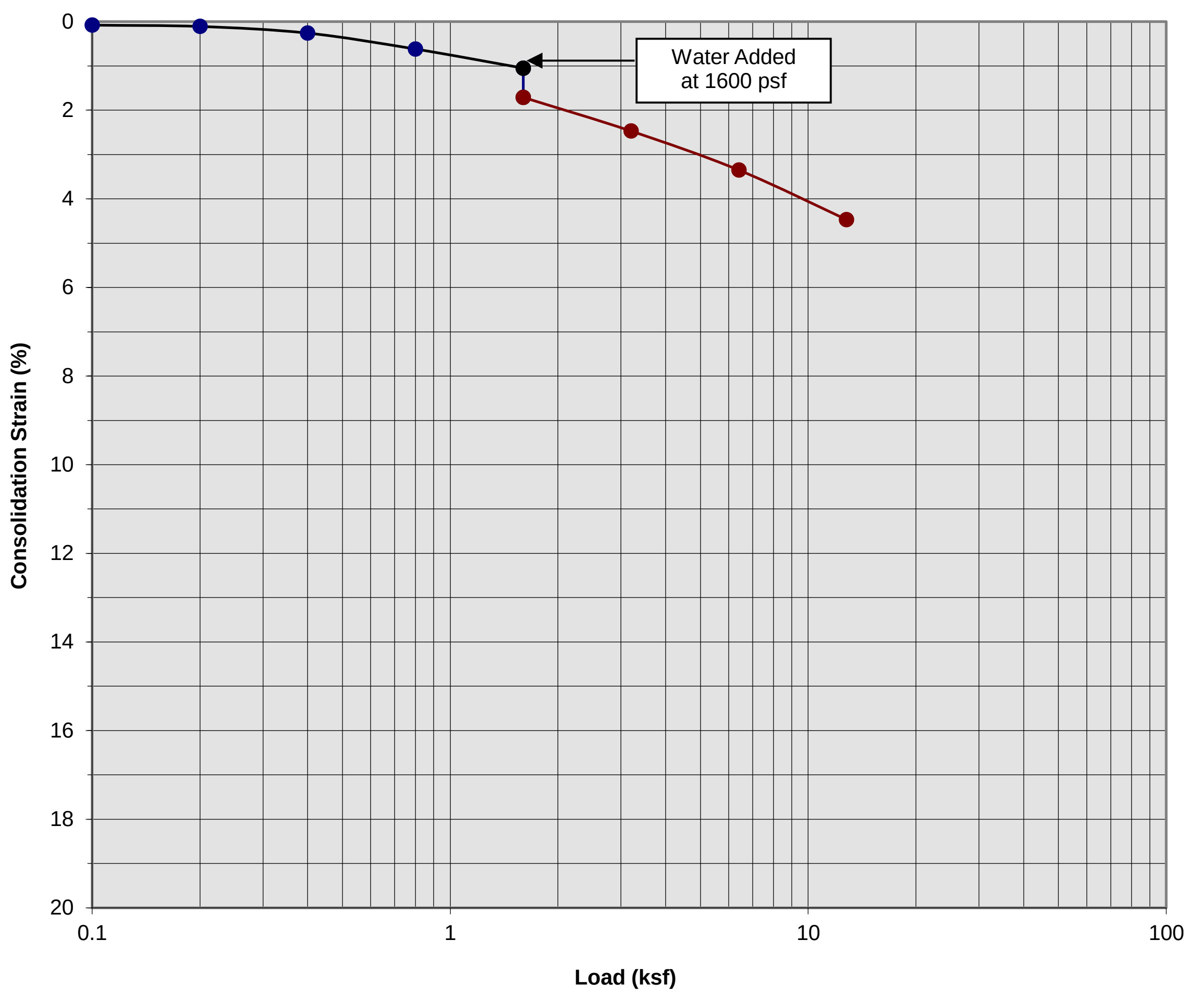
Classification: Brown Silty fine Sand to fine Sandy Silt

Boring Number:	B-10	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	22
Depth (ft)	5 to 6	Initial Dry Density (pcf)	93.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	109.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	7.27

Proposed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 6

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

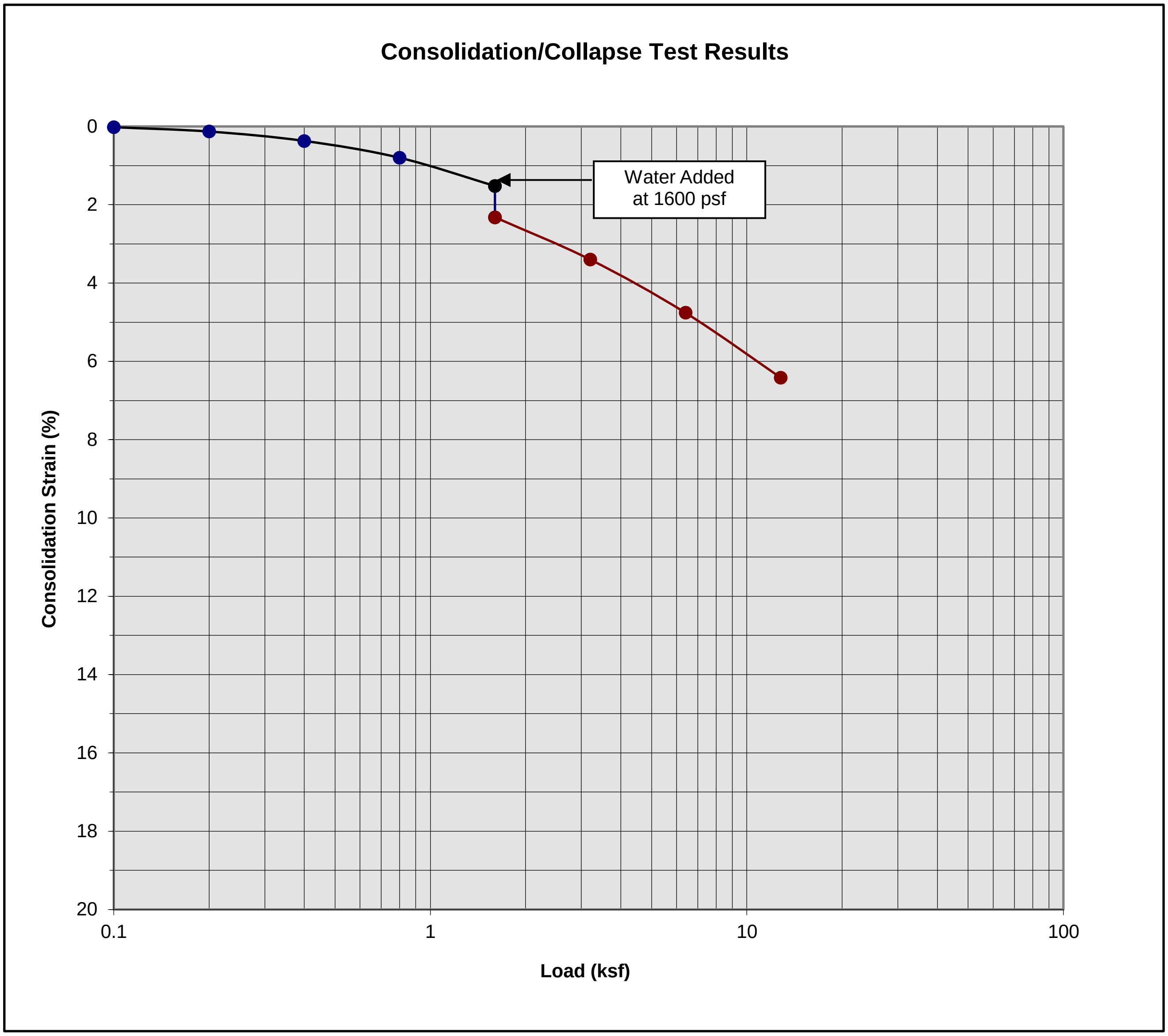


Classification: Gray Brown Silty fine to medium Sand

Boring Number:	B-10	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	18
Depth (ft)	7 to 8	Initial Dry Density (pcf)	110.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	114.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.66

Proposed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 7

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

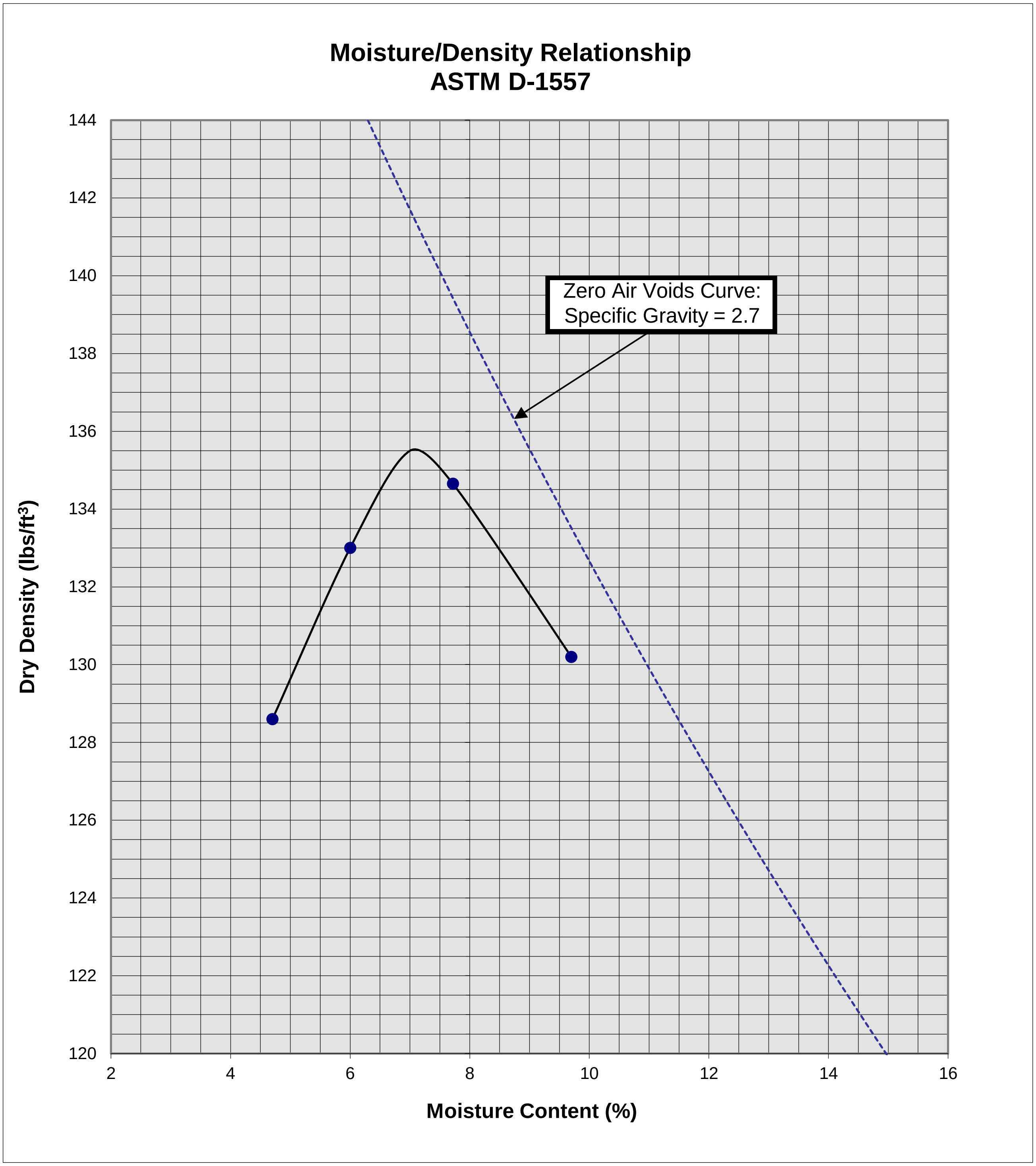


Classification: Gray fine Sandy Silt, trace medium to coarse Sand

Boring Number:	B-10	Initial Moisture Content (%)	13
Sample Number:	---	Final Moisture Content (%)	28
Depth (ft)	9 to 10	Initial Dry Density (pcf)	94.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	102.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.80

Proposed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 8

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Soil ID Number	B-7 @ 1-5'
Optimum Moisture (%)	7
Maximum Dry Density (pcf)	135.5
Soil Classification	Brown Silty fine to medium Sand, trace coarse Sand, little fine to coarse Gravel

Propossed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 9

SOUTHERN CALIFORNIA GEOTECHNICAL
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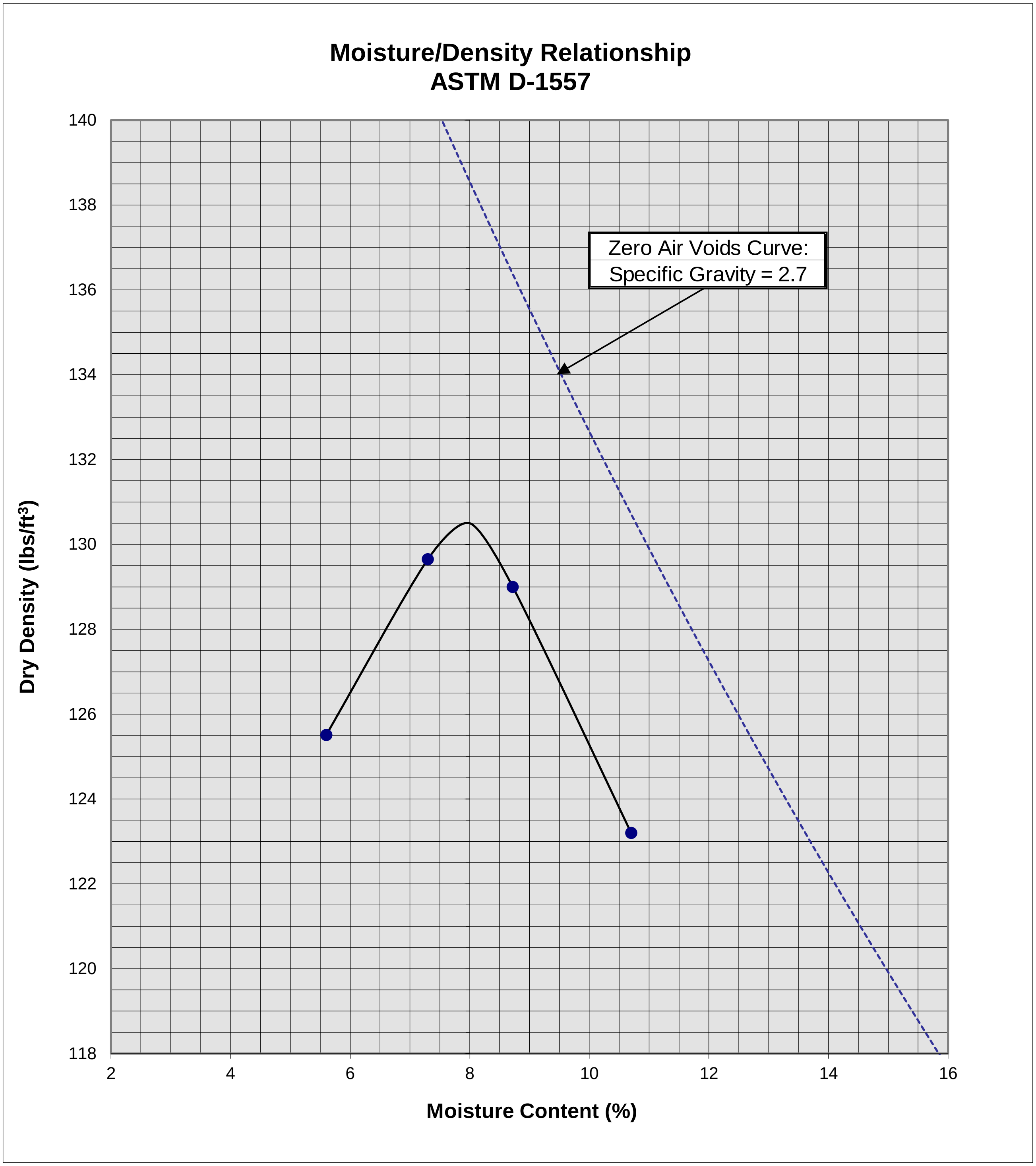

Soil ID Number		B-10 @ 1-5'
Optimum Moisture (%)		8
Maximum Dry Density (pcf)		130.5
Soil Classification	Brown Silty fine Sand, trace medium to coarse Sand	

Propossed Industrial Development
Fontana, California
Project No. 23G117-1
PLATE C- 10

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.

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.

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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.

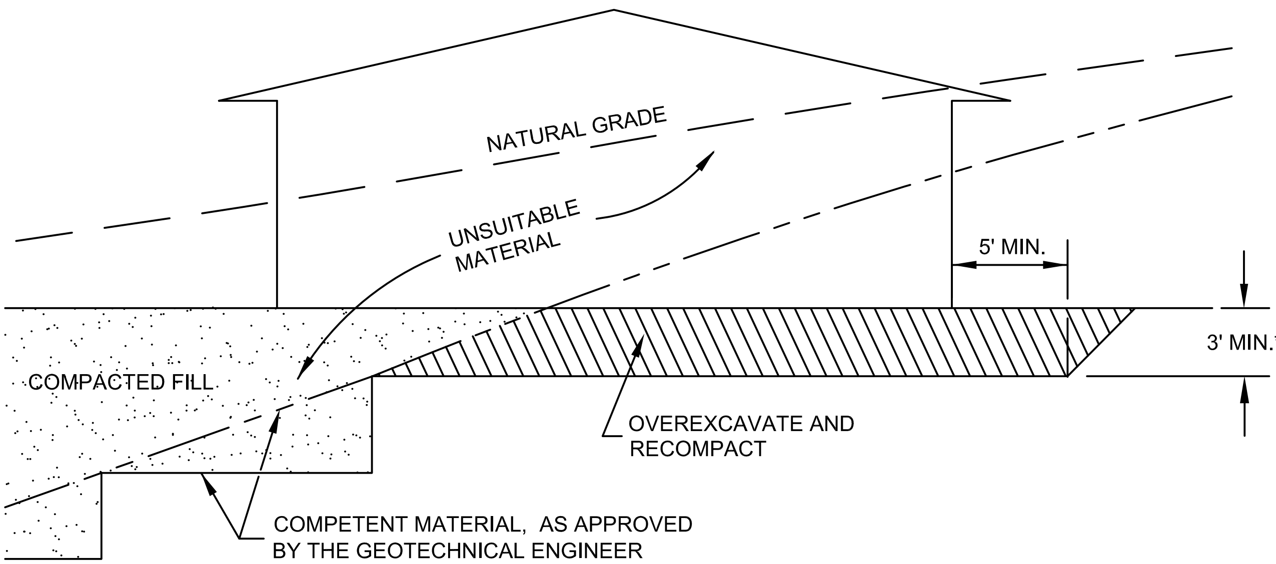
Subdrains

- 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.

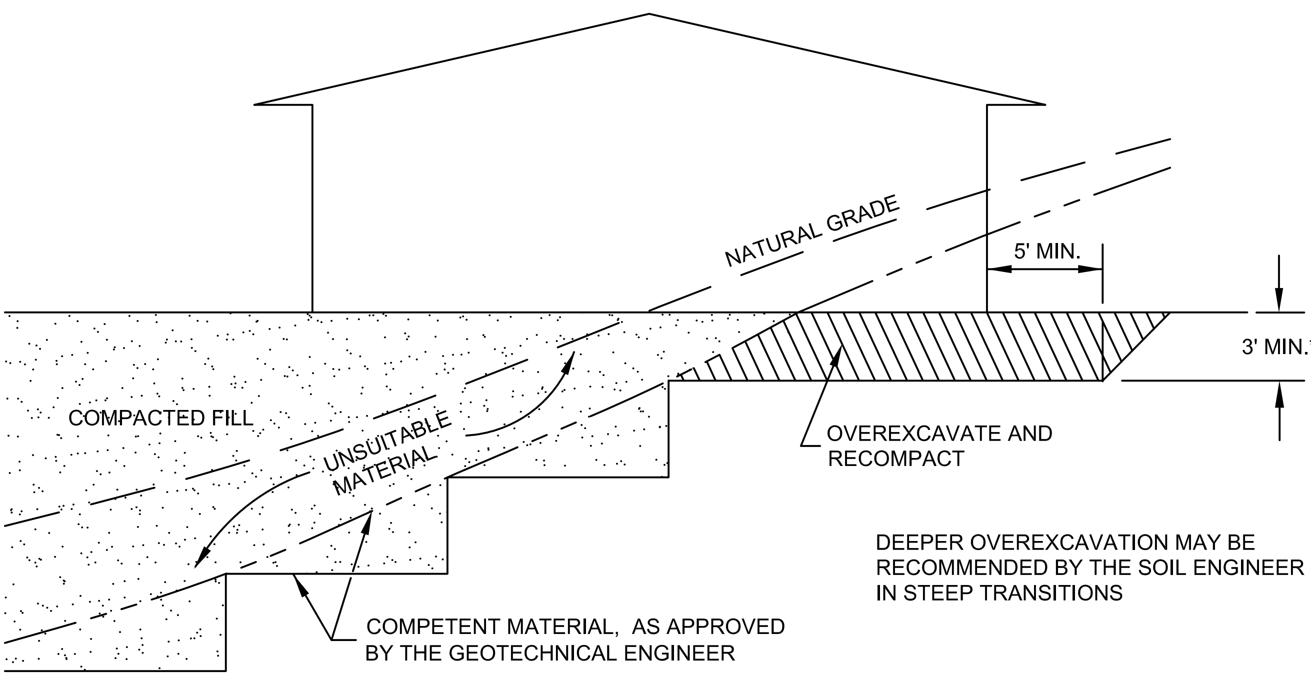
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- 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

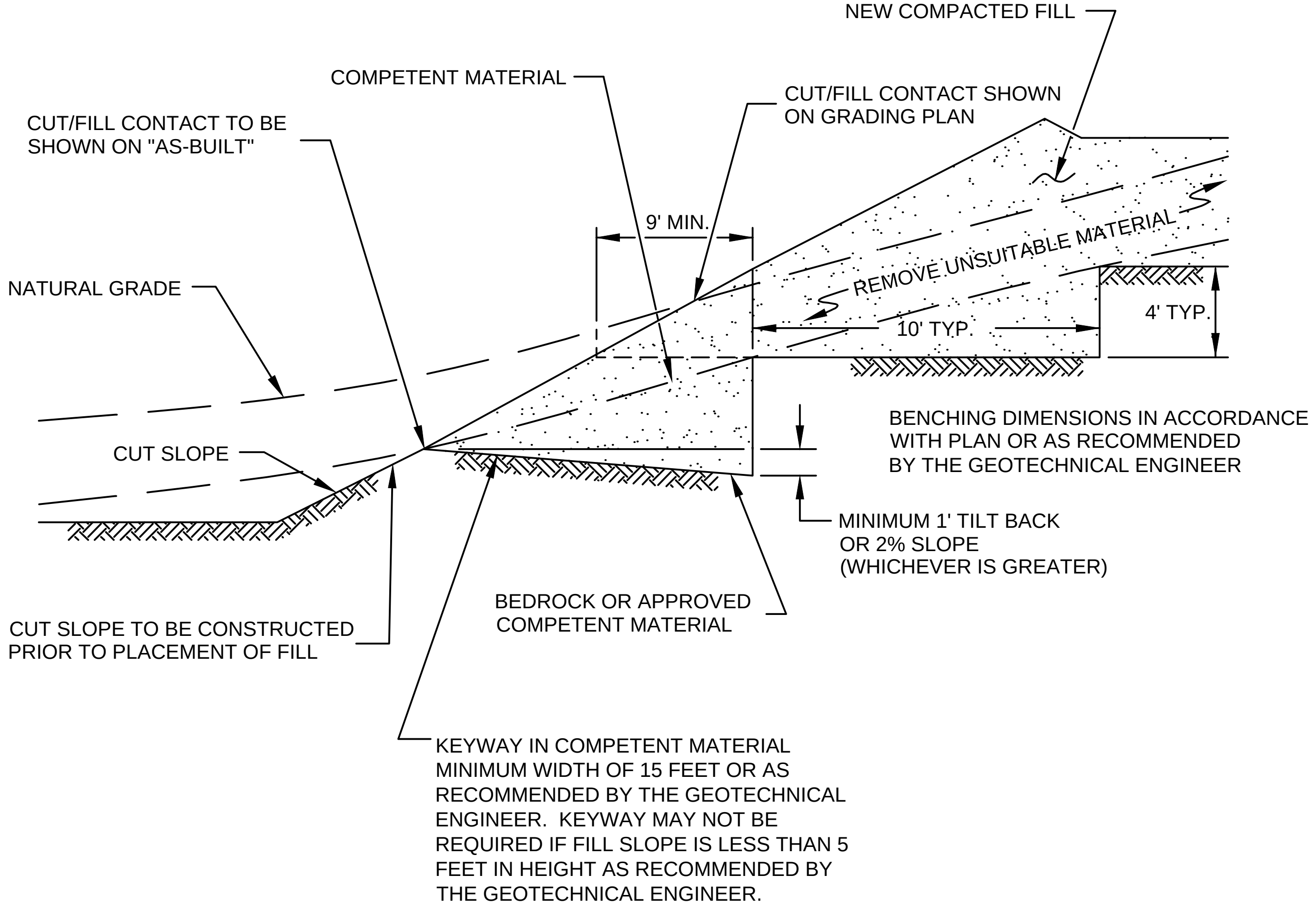
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

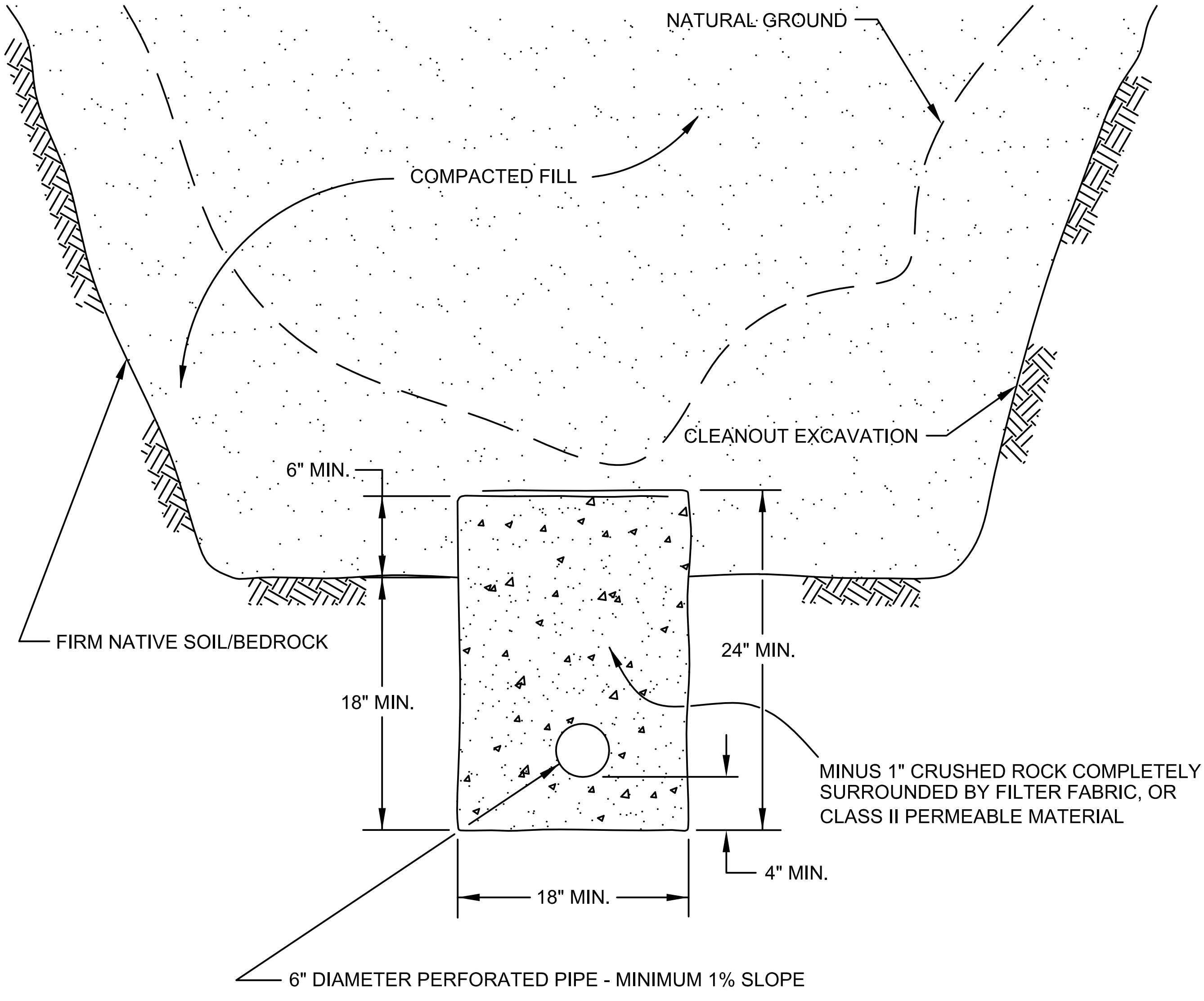
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

SoCalGeo
SOUTHERN
CALIFORNIA
GEOTECHNICAL



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

SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL

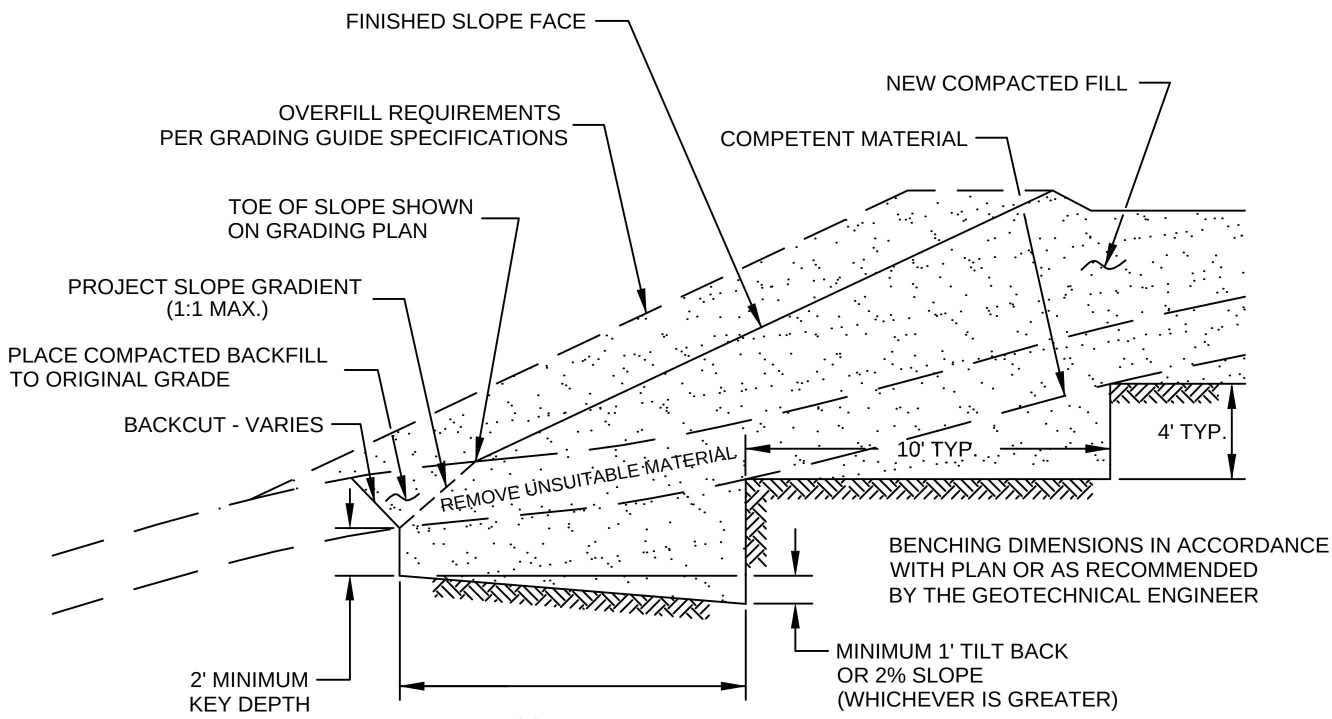
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



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

FILL ABOVE NATURAL SLOPE DETAIL

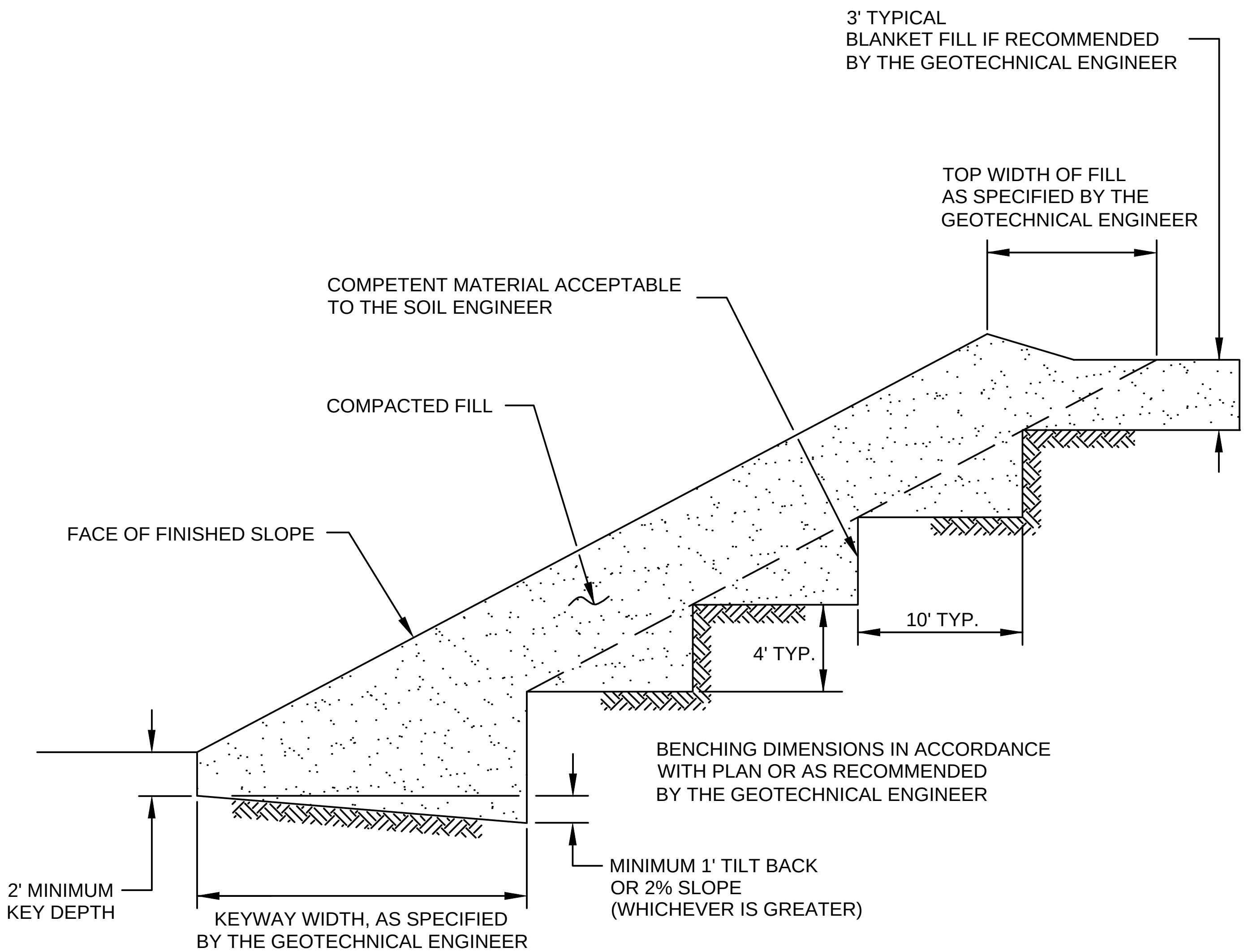
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

GRADING GUIDE SPECIFICATIONS

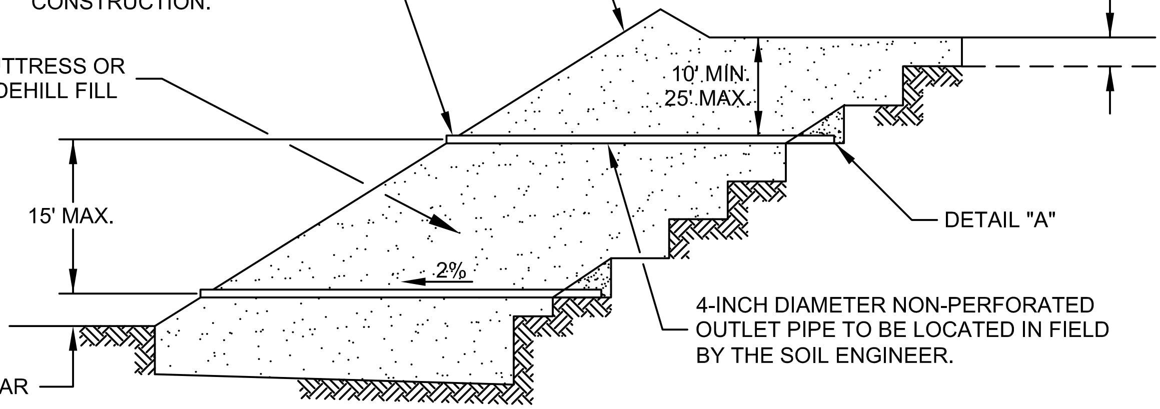
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



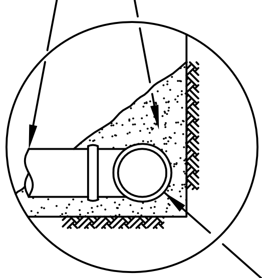
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

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

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

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

SAND EQUIVALENT = MINIMUM OF 50



DETAIL "A"

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

SLOPE FILL SUBDRAINS

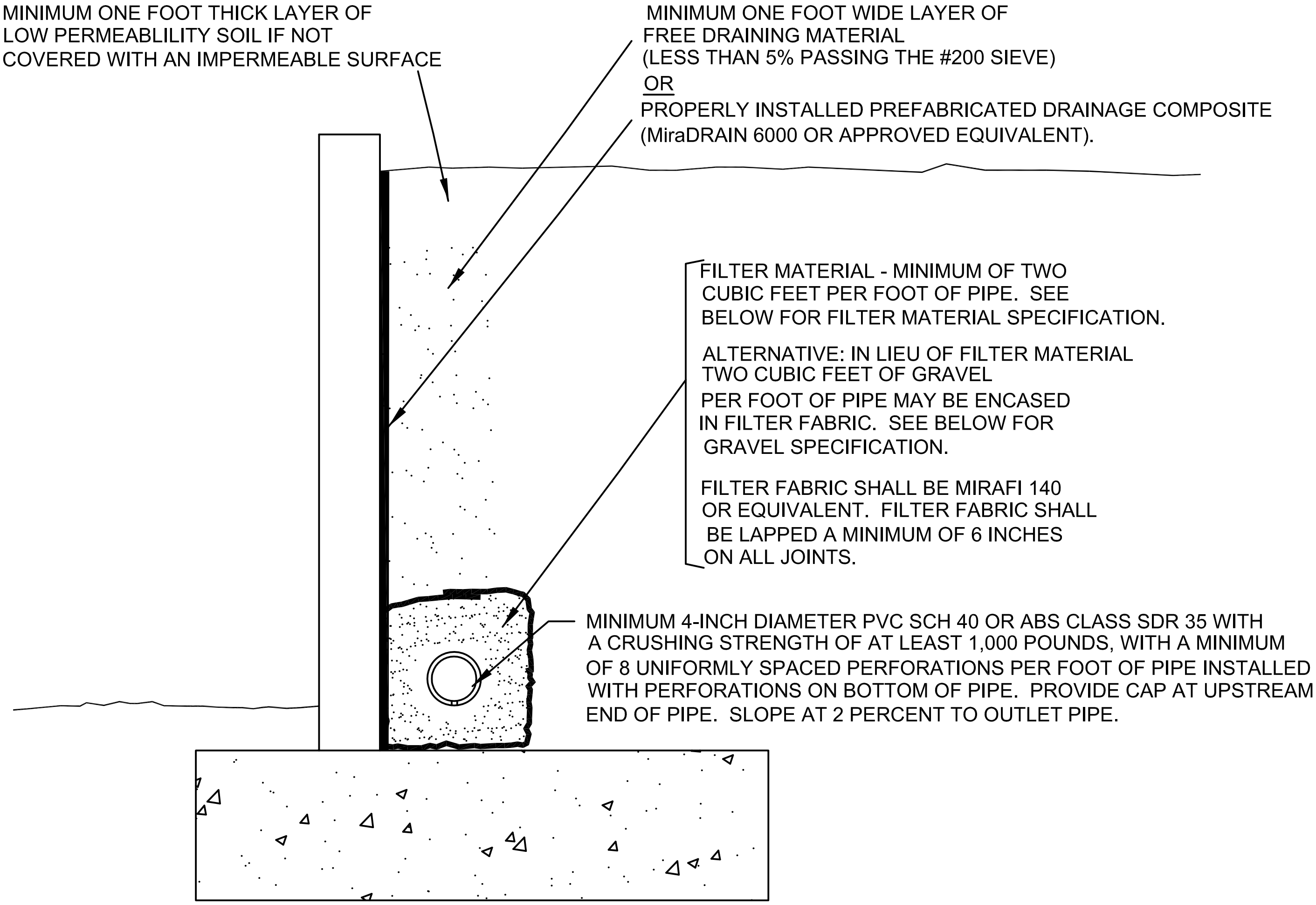
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL



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

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

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

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

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

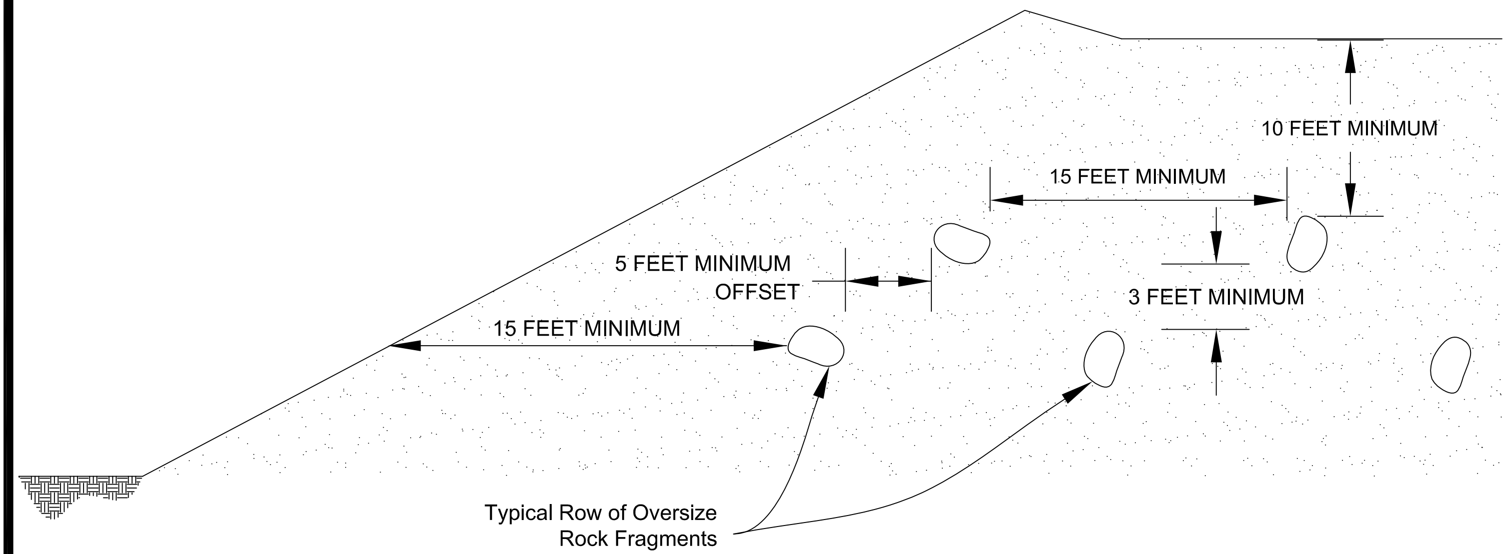
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

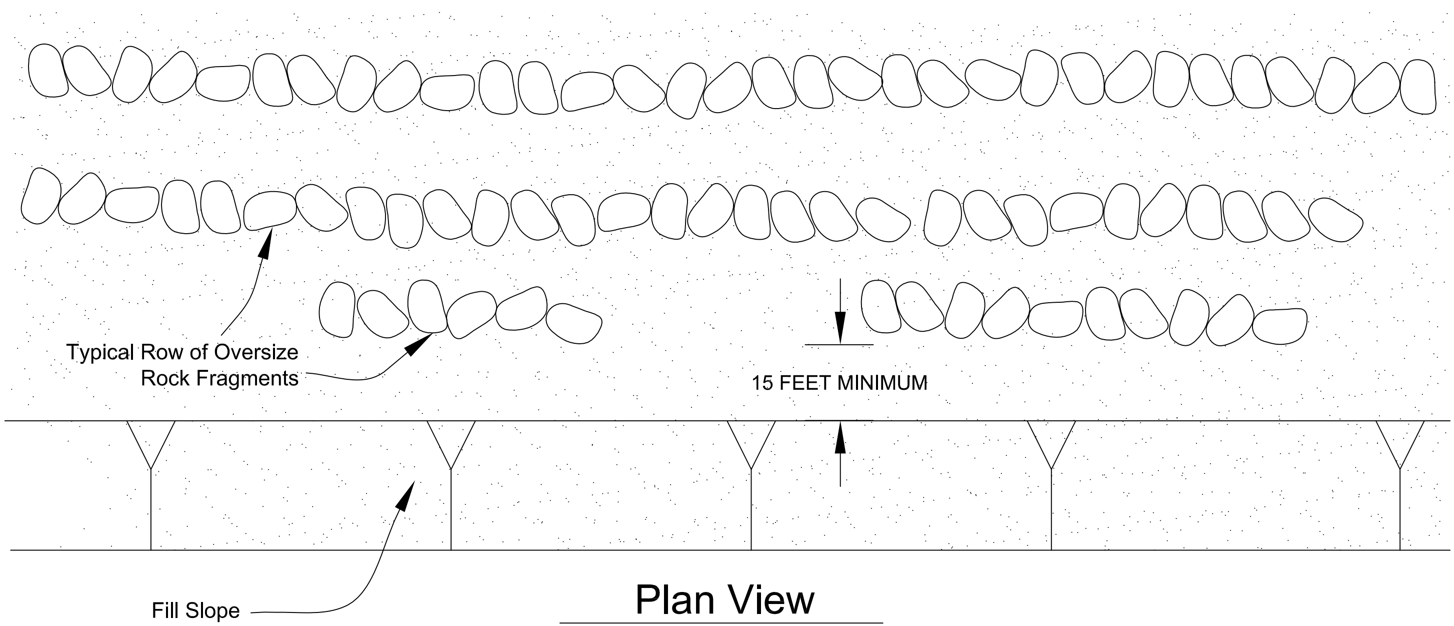
DRAWN: JAS
CHKD: GKM

PLATE D-7

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

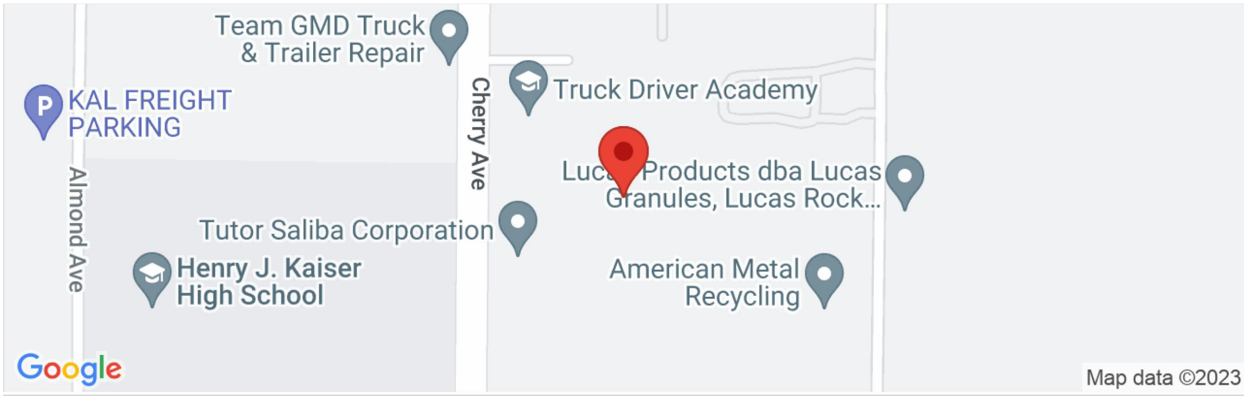
PLATE D-8

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

OSHPD

Latitude, Longitude: 34.051626, -117.487310



Date	3/20/2023, 2:47:01 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.721	MCE_R ground motion. (for 0.2 second period)
S_1	0.638	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.721	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.147	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.73	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.803	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.721	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.835	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.056	Factored deterministic acceleration value. (0.2 second)
S1RT	0.638	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.699	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.683	Factored deterministic acceleration value. (1.0 second)
PGAd	0.842	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.73	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.937	Mapped value of the risk coefficient at short periods
C_{R1}	0.913	Mapped value of the risk coefficient at a period of 1 s
C_V	1.444	Vertical coefficient

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

SEISMIC DESIGN PARAMETERS - 2022 CBC

PROPOSED INDUSTRIAL DEVELOPMENT

FONTANA, CALIFORNIA

DRAWN: JLL
CHKD: RGT

SCG PROJECT
23G117-1

PLATE E-1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

April 12, 2023

Hillwood
36 Discovery, Suite 130
Irvine, California 92618

Attention: Ms. Kathy Hoffer
Vice President, Development

Project No.: **23G117-2**

Subject: **Results of Infiltration Testing**
Proposed Industrial Development
11171 Cherry Avenue
Fontana, California

Reference: Geotechnical Investigation, Proposed Industrial Development, 11171 Cherry Avenue, Fontana, California, prepared by Southern California Geotechnical, Inc. (SCG) for Hillwood, SCG Project No. 23G117-1, dated April 7, 2023.

Ms. Hoffer:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 23P177, dated March 6, 2023. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, prepared for the Riverside County Department of Environmental Health (RCDEH), dated December, 2013. The San Bernardino County standards defer to the guidelines published by the RCDEH.

Site and Project Description

The subject site is located at the northeast corner of Cherry Avenue and Jurupa Avenue in Fontana, California. The site is also referenced by the street address 11171 Cherry Avenue. The site is bound to the north by existing commercial/industrial developments, to the west by Cherry Avenue, to the south by Jurupa Avenue, and to the east by Redwood Avenue and an existing commercial/industrial development. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The subject site is an L-shaped property and consists of two (2) rectangular-shaped parcels which total 29.6± acres in size. The northern parcel is developed with two (2) industrial buildings, 16,500 ft² and 20,000± ft² in size, and is mainly used for equipment and trailer storage. The buildings are single-story structures of metal frame and metal siding construction, and are presumed to be supported on conventional shallow foundations with concrete slab-on-grade floors. Ground surface cover immediately surrounding the existing structures consist of Portland cement concrete (PCC) and asphaltic concrete (AC) pavements. The existing pavements are in poor condition with severe cracking throughout. Ground surface cover for the remainder of the northern parcel consists of open-graded gravel areas, and exposed soil. The southern parcel is developed with a few steel-framed canopies with ground surface cover consisting of open-graded gravel areas, and exposed soil. This parcel is mainly used for equipment and material storage. A tree line is present in most areas between the two parcels.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the overall site topography slopes downward to the south at a gradient of 2± percent.

3.2 Proposed Development

A conceptual site plan (Scheme 1), prepared by HPA, Inc., has been provided to our office by the client. Based on this plan, the subject site will be developed with two new buildings:

Building No.	Warehouse (ft^2)	Office (ft^2)	Location on site
1	473,980	3,500	West
2	229,000	3,500	East

Dock-high doors will be constructed along portions of at least one building wall for both buildings. The proposed buildings are expected to be surrounded by AC pavements in the parking and drive areas, PCC pavements in the loading dock areas, and concrete flatwork and landscaped planters throughout the site.

Detailed structural information has not been provided. We assume that the new buildings will be single-story structures of tilt-up concrete construction, typically supported on conventional shallow foundations with concrete slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

Based on discussions with representatives of Huitt-Zollars, Inc. (HZI), the project civil engineer, the site will utilize on-site stormwater disposal. Prior to infiltration testing, HZI provided an infiltration location plan. Based on this plan, the infiltration system will consist of the following:

Infiltration System	Infiltration Location	Depth to Bottom of System (feet)
"A"	East of Building 1	12
"B"	South of Building 1	12
"C"	West of Building 2	12

However, we understand that Infiltration System "B" will not be used in the design of the on-site stormwater disposal. SCG has included the infiltration test results and design recommendations for Infiltration System "B" should this system be used in the design of the stormwater disposal system in the future.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, referenced above. As a part of this study, eleven (11) borings (identified as Boring Nos. B-1 through B-11) were advanced to depths of 15 to 25± feet below the existing site grades. Each boring was logged during drilling by a member of our staff.

Artificial fill soils were encountered at the ground surface at all of the boring locations, extending to depths of 1½ to 5½± feet below the existing site grades. The fill soils generally consist of medium dense to very dense silty sands and sandy silts with varying fine to coarse gravel content. Boring Nos. B-1 encountered a stratum consisting of dense sandy silts with little fine gravel content at depths of 4½ to 5½± feet. The fill soils possess a disturbed and mottled appearance, with a sample possessing debris such as brick fragments, resulting in their classification as artificial fill. Native alluvial soils were encountered beneath the fill soils at all of the boring locations, extending to at least the maximum depth explored of 25± feet below the existing site grades. The near-surface alluvium generally consists of loose to dense gravelly sands, sandy silts, and silty sands, extending to depths of 4½ to 8± feet. At greater depths, the alluvium becomes denser with occasional medium dense sands.

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 table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of six (6) infiltration test borings, advanced to a depth of 12± feet below the existing site grades. The infiltration borings were advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow-stem augers and were logged during drilling by a member of our staff. The approximate locations of the infiltration test borings (identified as I-1 through I-6) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, the bottom of each test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Native alluvial soils were encountered beneath the ground surface at all infiltration test locations, extending to at least the maximum depth explored of 12± feet. The alluvium generally consists of loose to medium dense fine to medium sandy silts, silty fine to medium sands, and fine to medium sands extending to the maximum explored depth of 12± feet. The Boring Logs, which illustrate the conditions encountered at the boring locations, are included with this report.

Free water was not encountered during the drilling of any of the geotechnical or infiltration borings. Based on the lack of any water within the geotechnical and infiltration borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet 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. Recent water level data was obtained from the California Department of Water Resources, Water Data Library Station Map, website, https://wdl.water.ca.gov/waterdatalibrary/. One monitoring well on record (identified as Local Well: CHINO-1207068) is located as close as 700± feet west of the site. Water level readings within this monitoring well indicate a high groundwater level of 225± feet below the ground surface in January 2000.

Infiltration Testing

The infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, which apply to San Bernardino County.

Pre-soaking

In accordance with the county infiltration standards for sandy soils, the infiltration test borings were pre-soaked 2 hours prior to the infiltration testing or until all of the water had percolated through the test holes. The pre-soaking process consisted of filling test borings by inverting a full 5-gallon bottle of clear water supported over each hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of each hole. Pre-soaking was completed after all of the water had percolated through the test holes.

Infiltration Testing

Following the pre-soaking process of the infiltration test borings, SCG performed the infiltration testing. Each test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the test holes. In accordance with the San Bernardino County guidelines, since "sandy soils" (where 6 inches of water infiltrated into the surrounding soils in less than 25 minutes for two consecutive readings) were encountered at the bottom of the infiltration test borings, readings were taken at 10-minute intervals for a total of 1 hour, except for I-3 in which readings were taken at 30-minute intervals for a total of 3 hours. After each reading, water was added to the borings so that the depth of the water was at least 5 times the radius of the hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates from the tests are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used as the design infiltration rate. The rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Measured Infiltration Rate (inches/hour)
I-1	12	Brown Silty fine to medium Sand, trace coarse Sand	6.0
I-2	12	Gray fine Sandy Silt, trace medium Sand	1.3
I-3	12	Brown Silty fine to medium Sand, trace coarse Sand, trace fine Gravel	0.8
I-4	12	Brown Silty fine Sand to fine Sandy Silt, little medium Sand	0.7
I-5	12	Gray fine to medium Sandy Silt	2.7
I-6	12	Brown Silty fine Sand, trace medium Sand	2.1

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were 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.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 through C-6 of this report.

Design Recommendations

Six (6) infiltration tests were performed at the subject site. As noted above, the infiltration rates at these locations vary from 0.7 to 6.0 inches per hour. The major factor affecting the difference in infiltration rates at the infiltration test locations is the presence of silt in the soils at the tested depths.

Based on the results of the infiltration testing, we recommend the following infiltration rates for the proposed infiltration systems:

Infiltration System	Location	Bottom of Infiltration System (feet)	Design Infiltration Rate (Inches per Hour)
"A"	East of Building 1	12	3.7*
"B"	South of Building 1	12	0.8*
"C"	West of Building 2	12	2.4*

*Please note that an average infiltration rate was used for the recommended design infiltration rates.

The design of the storm water infiltration systems should be performed by the project civil engineer, in accordance with the County of San Bernardino guidelines. It is recommended that the systems be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above are based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rate.** It should be noted that the recommended infiltration rates are based on infiltration testing at six (6) discrete locations and that the overall infiltration rates of the proposed infiltration systems could vary considerably.

Infiltration Rate Considerations

The infiltration rates presented herein were determined in accordance with the San Bernardino County guidelines and is considered valid only for the time and place of the actual test. Varying subsurface conditions will exist in other areas of the site, which could alter the recommended infiltration rate presented above. The infiltration rate will decline over time between maintenance cycles as silt or clay particles accumulate on the BMP surface. The infiltration rate is highly dependent upon a number of factors, including density, silt and clay content, grainsize distribution throughout the range of particle sizes, and particle shape. Small changes in these factors can cause large changes in the infiltration rate.

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. Changes in soil moisture content will affect the infiltration rate. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and tested depths. Infiltration rates can be significantly reduced if the soils are exposed to excessive disturbance or compaction during construction. Compaction of the soils at the bottom of the infiltration system can significantly reduce the infiltration ability of the basins. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration system to identify the soil classification at the base of the system. It should be confirmed that the soils at the base of the proposed infiltration systems correspond with those presented in this report to ensure that the performance of the systems will be consistent with the rate reported herein.

We recommend that scrapers and other rubber-tired heavy equipment not be operated on the basin bottom, or at levels lower than 2 feet above the bottom of the system, particularly within basins. As such, the bottom 24 inches of the infiltration system should be excavated with non-rubber-tired equipment, such as excavators.

Chamber Maintenance

The proposed project will include infiltration chambers. Water flowing into these chambers will carry some level of sediment. This layer has the potential to significantly reduce the infiltration rate of the chamber subgrade soils. Therefore, a formal chamber maintenance program should be established to ensure that these silt and clay deposits are removed from the chamber on a regular basis.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration system for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building(s), it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration system may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

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, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. 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 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 testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

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,

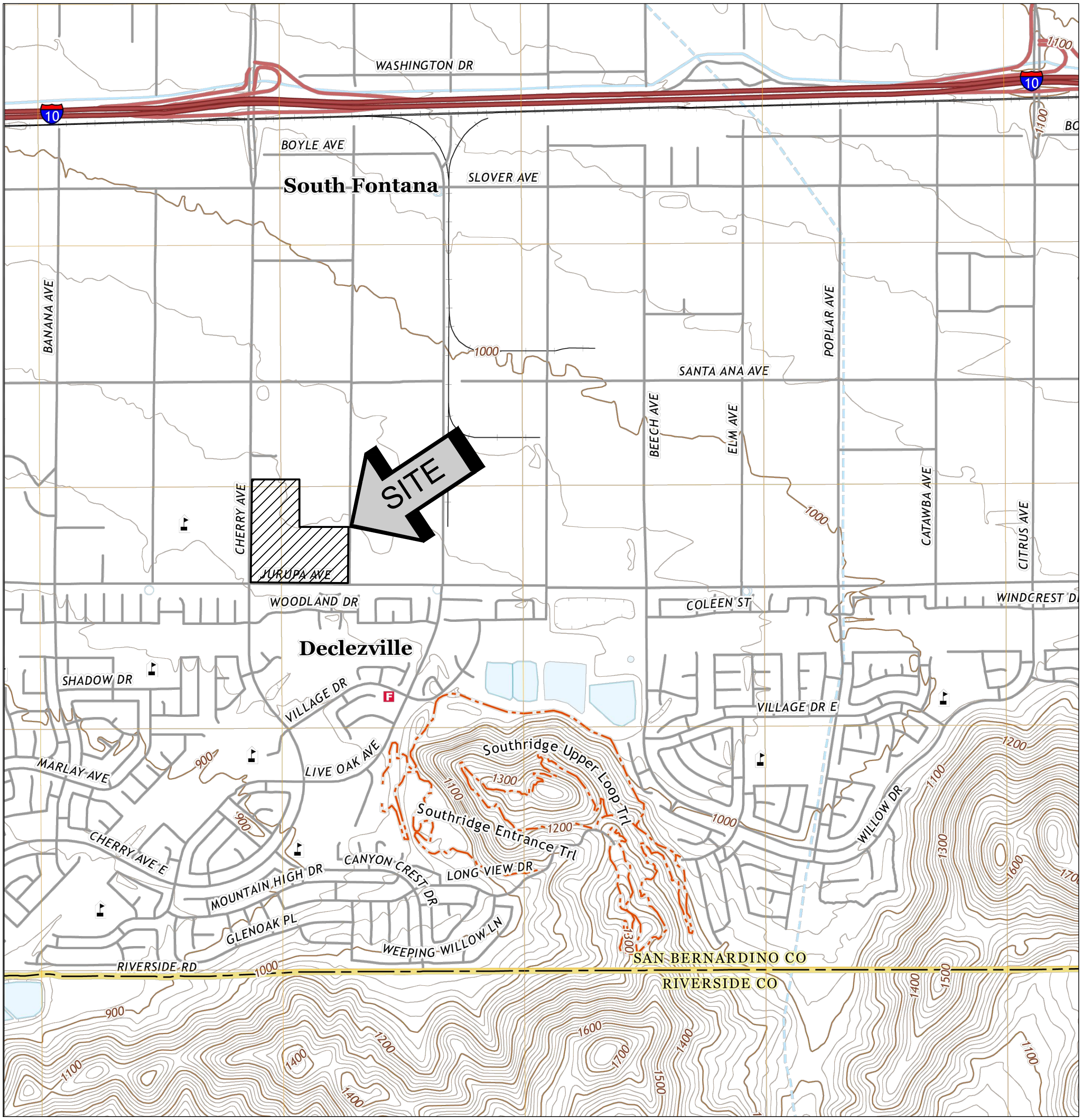
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Michelle Krizek
Staff Geologist

Robert G. Trazo, GE 2364
Principal Engineer

Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (8 pages)
Infiltration Test Results Spreadsheets (6 pages)
Grain Size Distribution Graphs (6 pages)



SOURCE: USGS TOPOGRAPHIC MAP OF THE FONTANA QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, 2021.

SITE LOCATION MAP

PROPOSED INDUSTRIAL DEVELOPMENT

FONTANA, CALIFORNIA

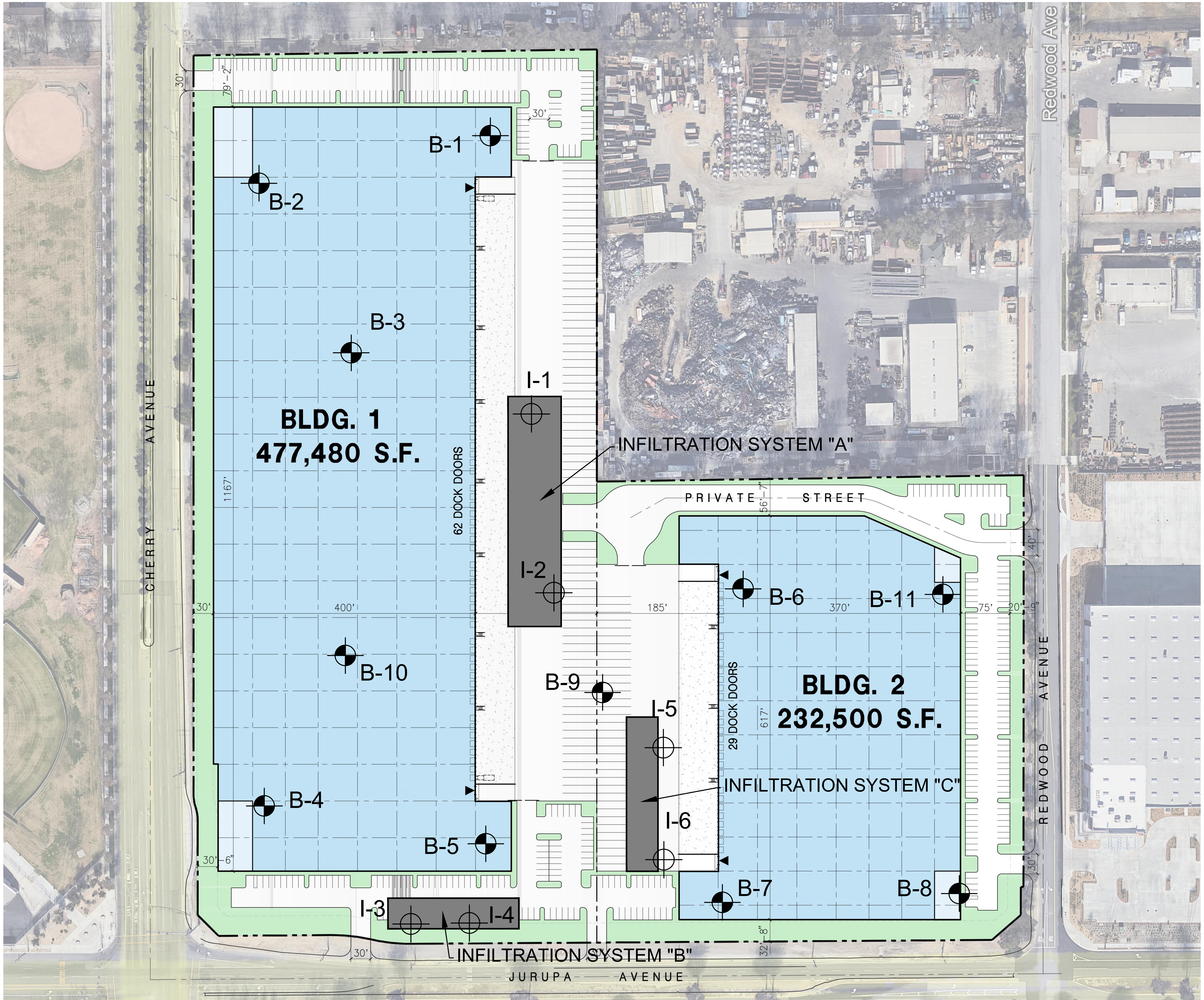
SCALE: 1" = 2000'

DRAWN: JLL
CHKD: RGT

SCG PROJECT
23G117-2

PLATE 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



NORTH
SoCalGeo

GEOTECHNICAL LEGEND

APPROXIMATE INFILTRATION LOCATION

APPROXIMATE BORING LOCATION
(SCG PROJECT NO. 23G117-1)

PROPOSED INFILTRATION CHAMBERS

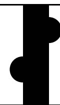
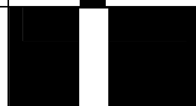
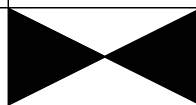
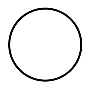
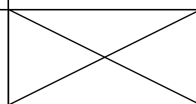
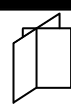
NOTE: CONCEPTUAL SITE PLAN PROVIDED BY HPA, INC.
AERIAL PHOTO OBTAINED FROM GOOGLE EARTH.

INFILTRATION TEST LOCATION PLAN
PROPOSED INDUSTRIAL DEVELOPMENT
FONTANA, CALIFORNIA

SCALE: 1" = 150'
DRAWN: JLL
CHKD: RGT
SCG PROJECT
23G117-2
PLATE 2

SoCalGeo
SOUTHERN
CALIFORNIA
GEOTECHNICAL

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. I-1

JOB NO.: 23G117-2
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/27/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown fine Sandy Silt, trace medium Sand, medium dense-damp							
5	X	15					3					
					Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, medium dense-damp							
10	X	16					3					
	X	14			Brown Silty fine to medium Sand, trace coarse Sand, medium dense-dry		2			30		
					Boring Terminated at 12'							

TBL 23G117-2.GPJ SOCALGEO.GDT 4/12/23

TEST BORING LOG

JOB NO.: 23G117-2
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/27/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
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: Brown Silty fine Sand to fine Sandy Silt, loose-damp to moist							
	X	6					9					
5												
					Gray fine Sandy Silt, trace medium Sand, little Calcareous veining, medium dense to dense-dampt to moist							
	X	38					12					
10												
	X	11					9			57		

Boring Terminated at 12'

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-3

JOB NO.: 23G117-2
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/27/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

SURFACE ELEVATION: --- MSL

FIELD RESULTS: DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS: DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, medium dense-damp							
	X	10					9					
5												
					Brown fine Sandy Silt, trace medium Sand, trace Iron Oxide veining, some Calcareous deposits, medium dense-very moist							
	X	18					28					
10												
	X	9			Brown Silty fine to medium Sand, trace coarse Sand, trace fine Gravel, trace Calcareous veining, loose-damp to moist		11			43		

Boring Terminated at 12'

TBL 23G117-2.GPJ SOCALGEO.GDT 4/12/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-4

JOB NO.: 23G117-2
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/27/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine Sand, trace medium to coarse Sand, loose-damp							
	X	7					5					
5												
					Brown Silty fine Sand to fine Sandy Silt, little medium Sand, trace Iron Oxide staining, medium dense-moist							
	X	16					14					
10												
	X	16					12			49		
					Boring Terminated at 12'							

TBL 23G117-2.GPJ SOCALGEO.GDT 4/12/23

BORING NO. I-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 23G117-2
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/27/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown fine to medium Sand, trace Silt, medium dense-damp							
	X	13					3					
5												
					Gray Brown Silty fine Sand, trace medium Sand, trace Iron Oxide staining, medium dense-damp							
	X	22					4					
10												
	X	29			Gray fine to medium Sandy Silt, little Iron Oxide veining, some Calcareous deposits, medium dense-very moist		26			82		

Boring Terminated at 12'

TBL 23G117-2.GPJ SOCALGEO.GDT 4/12/23

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-6

JOB NO.: 23G117-2
PROJECT: Proposed Industrial Development
LOCATION: Fontana, California

DRILLING DATE: 3/27/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
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: Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, loose-damp							
	X	7					10					
5												
					Brown Silty fine Sand, trace medium Sand, medium dense-damp to moist							
	X	17					14					
10												
	X	15					9			43		
					Boring Terminated at 12'							

TBL 23G117-2.GPJ SOCALGEO.GDT 4/12/23

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Fontana, California
Project Number	23G117-2
Engineer	Michelle Krizek

Test Hole Radius	4	(in)
Test Depth	12.05	(ft)

Infiltration Test Hole	I-1

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	11:01 AM	25.00	10.00	23.28	YES	SANDY SOILS
	Final	11:26 AM		11.94			
2	Initial	11:33 AM	25.00	10.00	23.16	YES	SANDY SOILS
	Final	11:58 AM		11.93			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	12:05 PM	10.00	10.00	1.54	1.28	12.77
	Final	12:15 PM		11.54			
2	Initial	12:17 PM	10.00	10.00	1.32	1.39	10.18
	Final	12:27 PM		11.32			
3	Initial	12:30 PM	10.00	10.00	1.19	1.46	8.81
	Final	12:40 PM		11.19			
4	Initial	12:41 PM	10.00	10.00	1.05	1.53	7.45
	Final	12:51 PM		11.05			
5	Initial	12:54 PM	10.00	10.00	0.90	1.60	6.11
	Final	1:04 PM		10.90			
6	Initial	1:06 PM	10.00	10.00	0.89	1.61	6.03
	Final	1:16 PM		10.89			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)

ΔH = Change in Height (Water Level) over the time interval

r = Test Hole (Borehole) Radius

Δt = Time Interval

H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Fontana, California
Project Number	23G117-2
Engineer	Michelle Krizek

Test Hole Radius	4	(in)
Test Depth	11.90	(ft)

Infiltration Test Hole	I-2

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	10:51 AM	25.00	9.50	12.60	YES	SANDY SOILS
	Final	11:16 AM		10.55			
2	Initial	11:21 AM	25.00	9.50	10.08	YES	SANDY SOILS
	Final	11:46 AM		10.34			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	11:48 AM	10.00	9.50	0.71	2.05	3.85
	Final	11:58 AM		10.21			
2	Initial	12:01 PM	10.00	9.50	0.48	2.16	2.48
	Final	12:11 PM		9.98			
3	Initial	12:13 PM	10.00	9.50	0.41	2.20	2.08
	Final	12:23 PM		9.91			
4	Initial	12:26 PM	10.00	9.50	0.37	2.22	1.86
	Final	12:36 PM		9.87			
5	Initial	12:37 PM	10.00	9.50	0.28	2.26	1.38
	Final	12:47 PM		9.78			
6	Initial	12:49 PM	10.00	9.50	0.27	2.27	1.33
	Final	12:59 PM		9.77			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)

ΔH = Change in Height (Water Level) over the time interval

r = Test Hole (Borehole) Radius

Δt = Time Interval

H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Fontana, California
Project Number	23G117-2
Engineer	Michelle Krizek

Test Hole Radius	4	(in)
Test Depth	12.92	(ft)

Infiltration Test Hole	I-3

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	10:19 AM	25.00	11.00	9.60	YES	SANDY SOILS
	Final	10:44 AM		11.80			
2	Initial	10:51 AM	25.00	11.00	5.16	NO	NON-SANDY SOILS
	Final	11:16 AM		11.43			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	11:24 AM	30.00	11.00	0.42	1.71	0.90
	Final	11:54 AM		11.42			
2	Initial	11:56 AM	30.00	11.00	0.41	1.72	0.87
	Final	12:26 PM		11.41			
3	Initial	12:30 PM	30.00	11.00	0.40	1.72	0.85
	Final	1:00 PM		11.40			
4	Initial	1:02 PM	30.00	11.00	0.39	1.73	0.82
	Final	1:32 PM		11.39			
5	Initial	1:35 PM	30.00	11.00	0.38	1.73	0.80
	Final	2:05 PM		11.38			
6	Initial	2:08 PM	30.00	11.00	0.38	1.73	0.80
	Final	2:38 PM		11.38			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Fontana, California
Project Number	23G117-2
Engineer	Michelle Krizek

Test Hole Radius	4	(in)
Test Depth	12.86	(ft)

Infiltration Test Hole	I-4

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	10:31 AM	25.00	10.85	9.60	YES	SANDY SOILS
	Final	10:56 AM		11.65			
2	Initial	11:03 AM	25.00	10.85	8.40	YES	SANDY SOILS
	Final	11:28 AM		11.55			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	11:31 AM	10.00	10.85	0.26	1.88	1.52
	Final	11:41 AM		11.11			
2	Initial	11:42 AM	10.00	10.85	0.21	1.91	1.22
	Final	11:52 AM		11.06			
3	Initial	11:53 AM	10.00	10.85	0.17	1.93	0.98
	Final	12:03 PM		11.02			
4	Initial	12:04 PM	10.00	10.85	0.15	1.94	0.86
	Final	12:14 PM		11.00			
5	Initial	12:15 PM	10.00	10.85	0.15	1.94	0.86
	Final	12:25 PM		11.00			
6	Initial	12:27 PM	10.00	10.85	0.13	1.95	0.74
	Final	12:37 PM		10.98			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Fontana, California
Project Number	23G117-2
Engineer	Michelle Krizek

Test Hole Radius	4	(in)
Test Depth	11.65	(ft)

Infiltration Test Hole	I-5

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	9:51 AM	25.00	9.65	18.72	YES	SANDY SOILS
	Final	10:16 AM		11.21			
2	Initial	10:22 AM	25.00	9.65	14.28	YES	SANDY SOILS
	Final	10:47 AM		10.84			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	10:50 AM	10.00	9.65	1.00	1.50	7.20
	Final	11:00 AM		10.65			
2	Initial	11:02 AM	10.00	9.65	0.64	1.68	4.16
	Final	11:12 AM		10.29			
3	Initial	11:13 AM	10.00	9.65	0.56	1.72	3.56
	Final	11:23 AM		10.21			
4	Initial	11:25 AM	10.00	9.65	0.49	1.76	3.06
	Final	11:35 AM		10.14			
5	Initial	11:38 AM	10.00	9.65	0.44	1.78	2.71
	Final	11:48 AM		10.09			
6	Initial	11:52 AM	10.00	9.65	0.44	1.78	2.71
	Final	12:02 PM		10.09			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)

ΔH = Change in Height (Water Level) over the time interval

r = Test Hole (Borehole) Radius

Δt = Time Interval

H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Fontana, California
Project Number	23G117-2
Engineer	Michelle Krizek

Test Hole Radius	4	(in)
Test Depth	11.48	(ft)

Infiltration Test Hole	I-6

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	8:34 AM	25.00	9.00	28.32	YES	SANDY SOILS
	Final	8:59 AM		11.36			
2	Initial	9:06 AM	25.00	9.00	16.20	YES	SANDY SOILS
	Final	9:31 AM		10.35			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	9:33 AM	10.00	9.00	1.17	1.90	6.81
	Final	9:43 AM		10.17			
2	Initial	9:46 AM	10.00	9.00	0.74	2.11	3.90
	Final	9:56 AM		9.74			
3	Initial	9:58 AM	10.00	9.00	0.53	2.22	2.67
	Final	10:08 AM		9.53			
4	Initial	10:10 AM	10.00	9.00	0.49	2.24	2.45
	Final	10:20 AM		9.49			
5	Initial	10:24 AM	10.00	9.00	0.43	2.27	2.12
	Final	10:34 AM		9.43			
6	Initial	10:35 AM	10.00	9.00	0.43	2.27	2.12
	Final	10:45 AM		9.43			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)

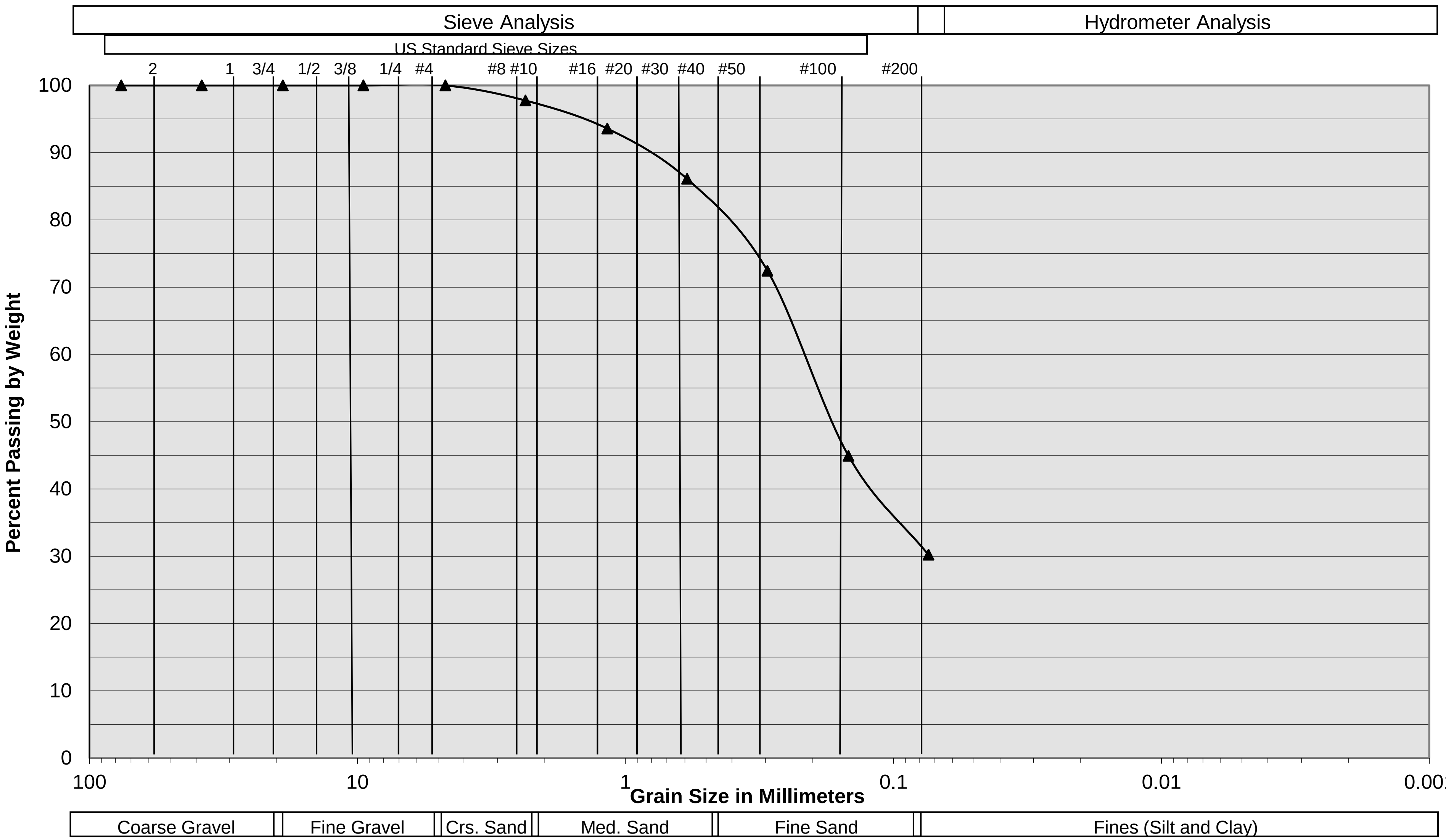
ΔH = Change in Height (Water Level) over the time interval

r = Test Hole (Borehole) Radius

Δt = Time Interval

H_{avg} = Average Head Height over the time interval

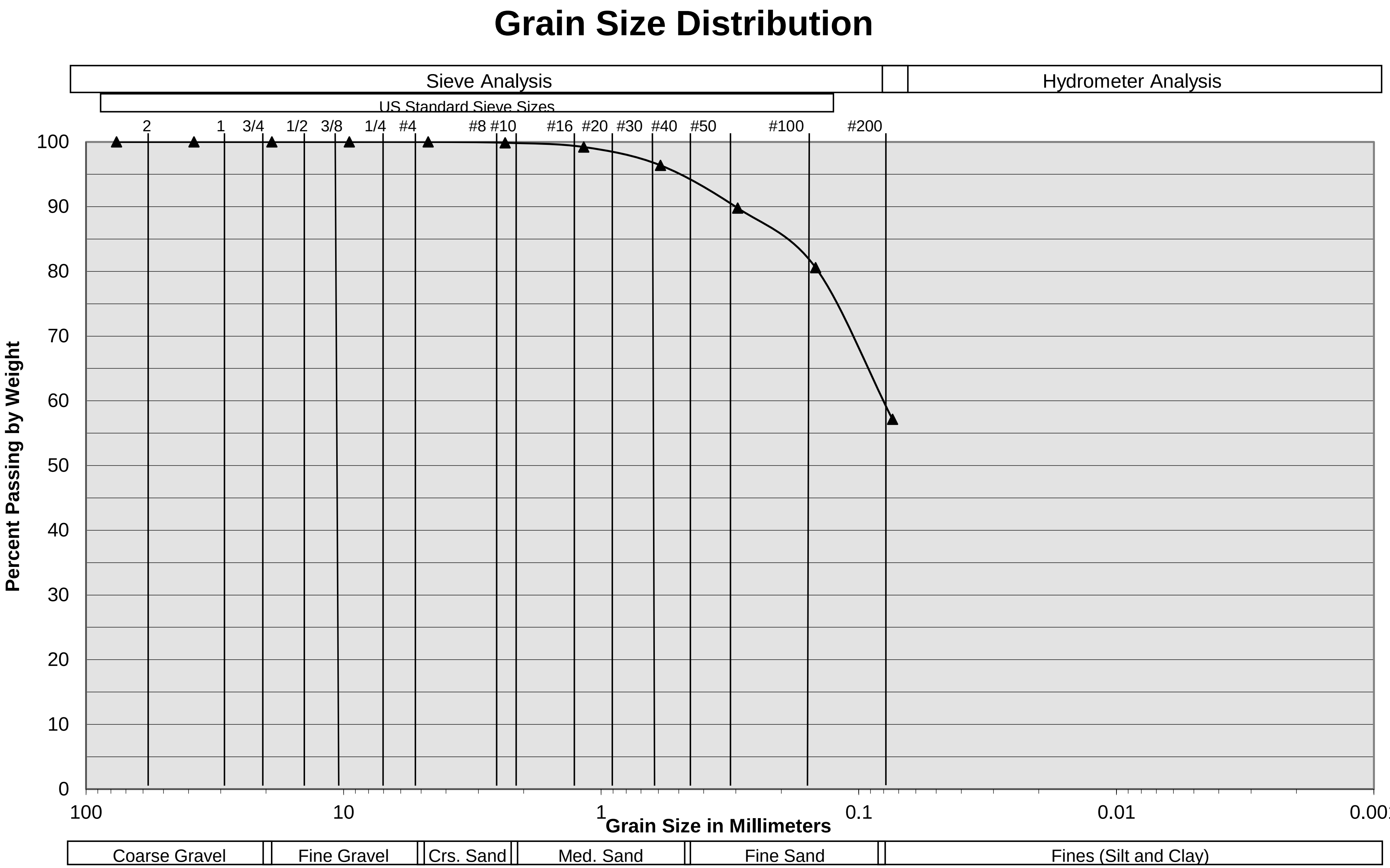
Grain Size Distribution



Sample Description	I-1 @ 10½ to 12 feet
Soil Classification	Brown Silty fine to medium Sand, trace coarse Sand

Proposed Industrial Development
Fontana, California
Project No. 23G117-2
PLATE C- 1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL A California Corporation

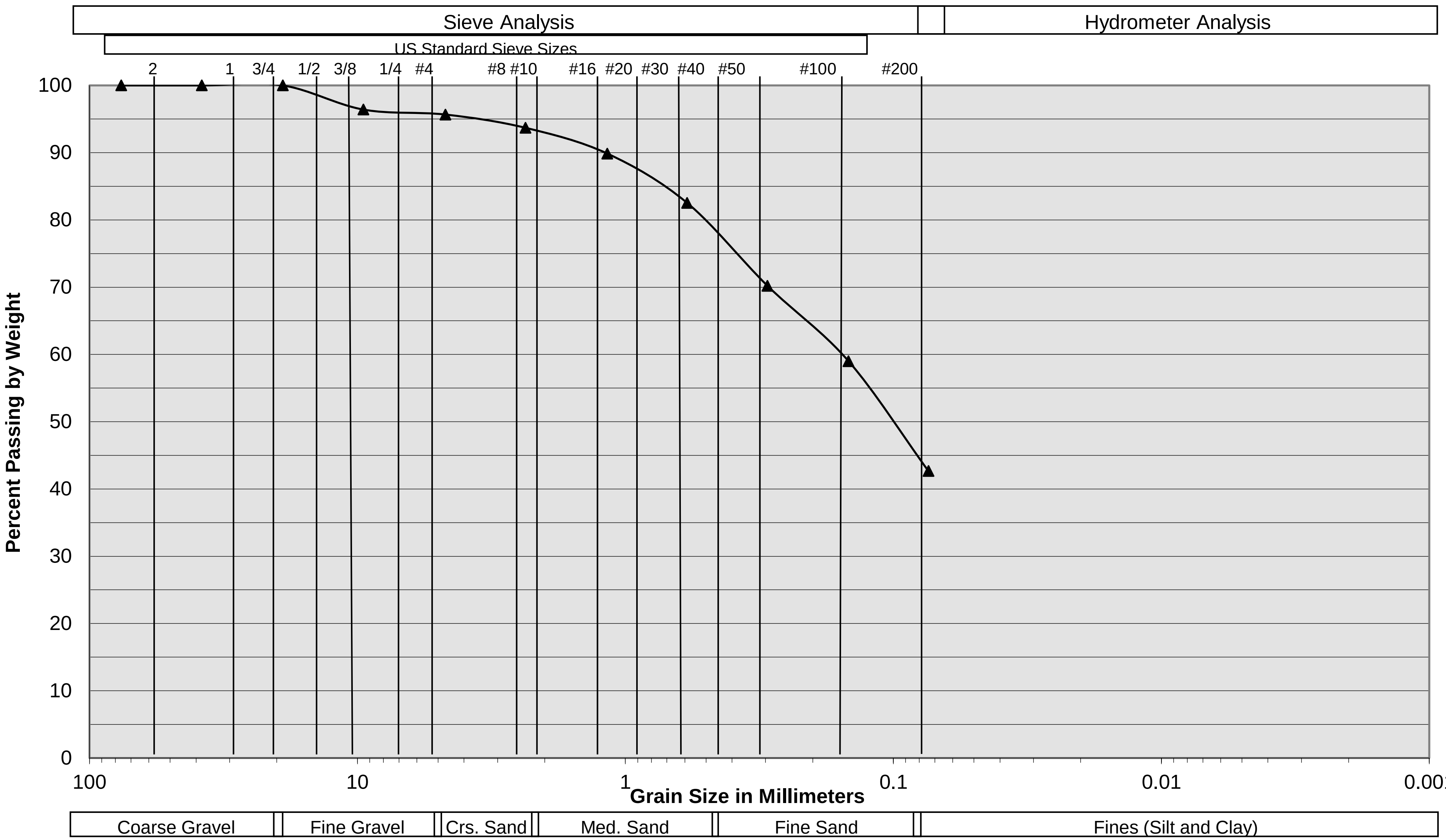


Sample Description	I-2 @ 10½ to 12 feet
Soil Classification	Gray fine Sandy Silt, trace medium Sand

Proposed Industrial Development
Fontana, California
Project No. 23G117-2
PLATE C- 2

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

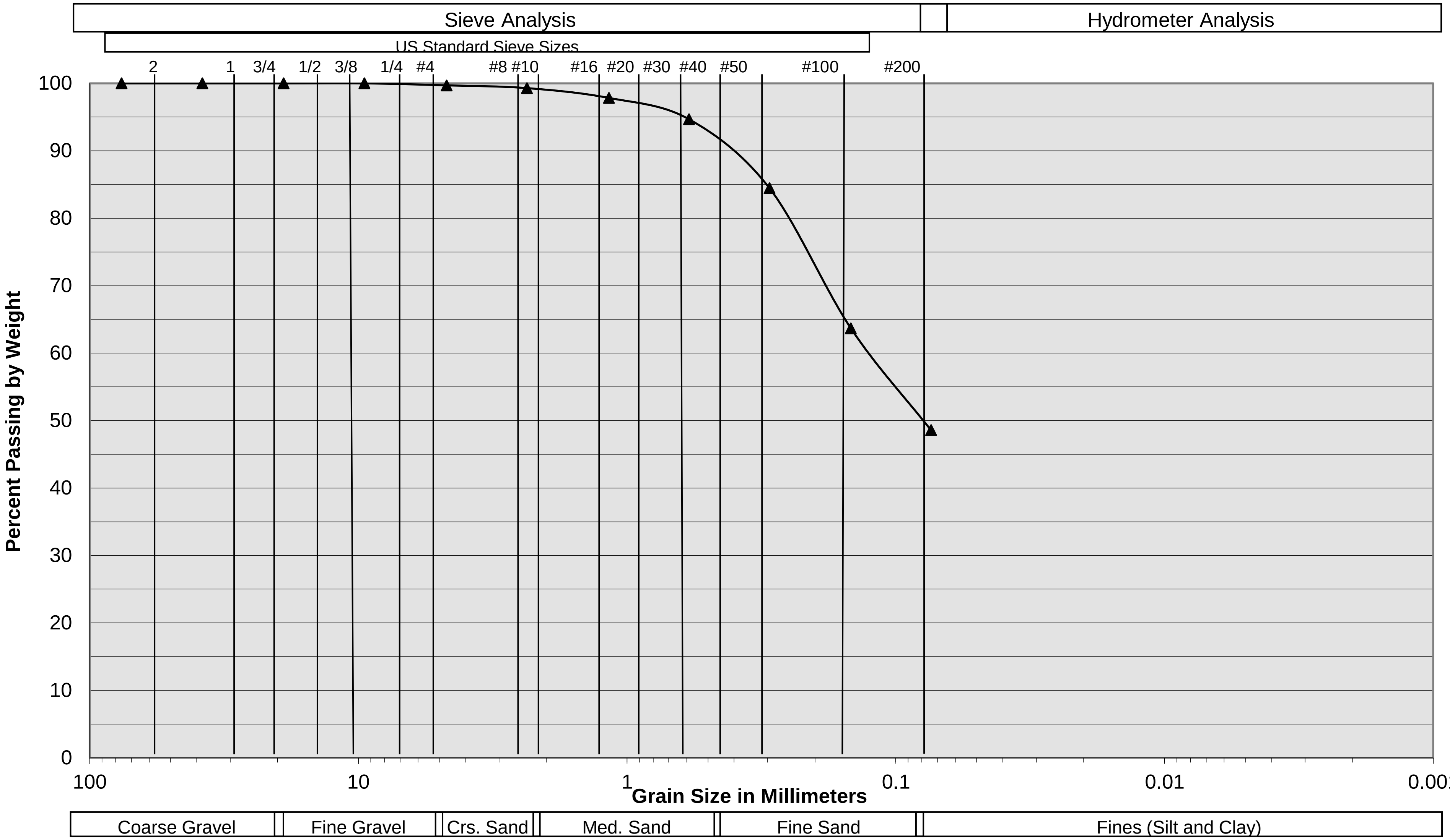


Sample Description	I-3 @ 10½ to 12 feet
Soil Classification	Brown Silty fine to medium Sand, trace coarse Sand, trace fine Gravel

Proposed Industrial Development
Fontana, California
Project No. 23G117-2
PLATE C- 3

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

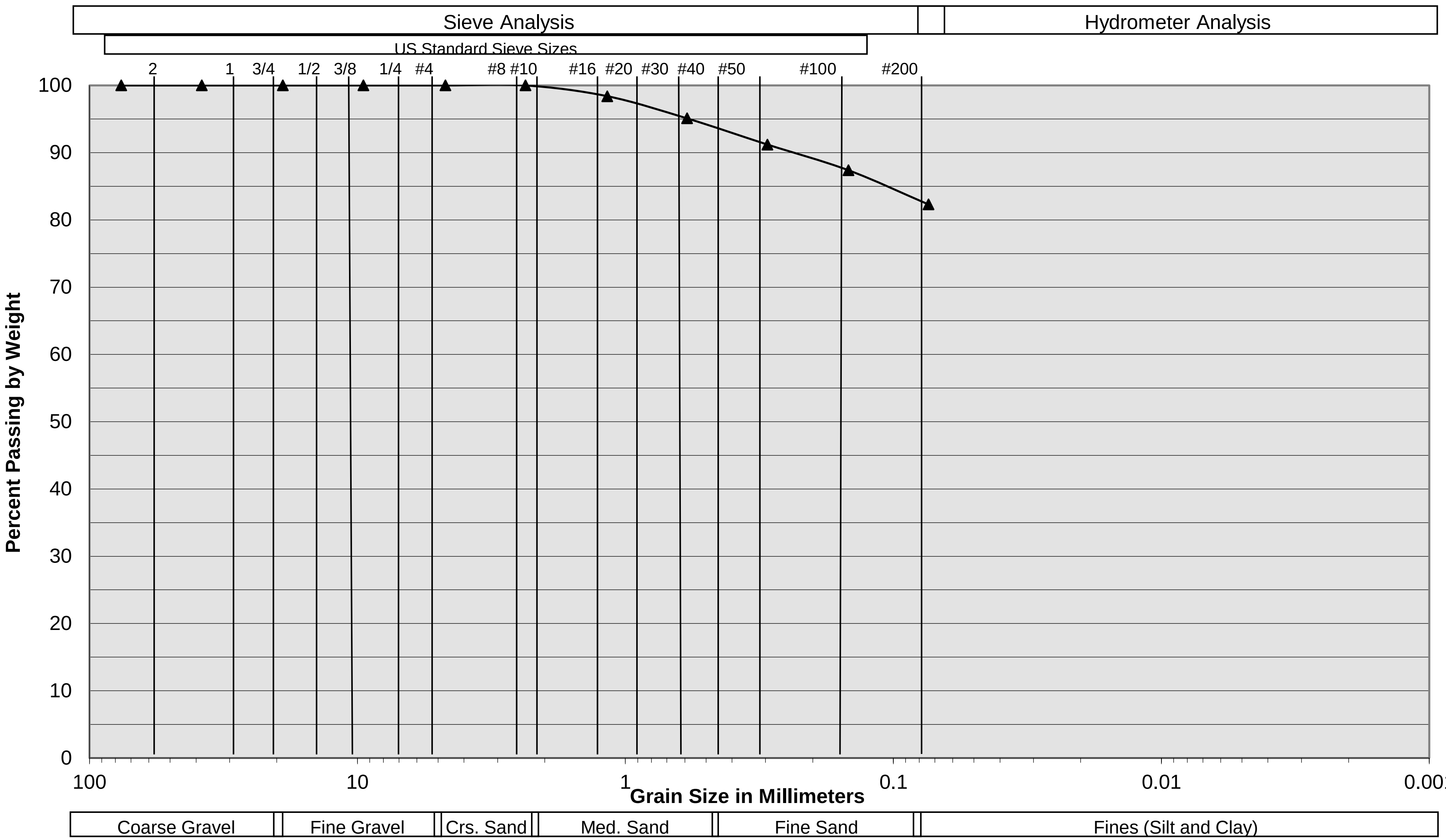


Sample Description	I-4 @ 10½ to 12 feet
Soil Classification	Brown Silty fine Sand to fine Sandy Silt, little medium Sand

Proposed Industrial Development
Fontana, California
Project No. 23G117-2
PLATE C- 4

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL A California Corporation

Grain Size Distribution

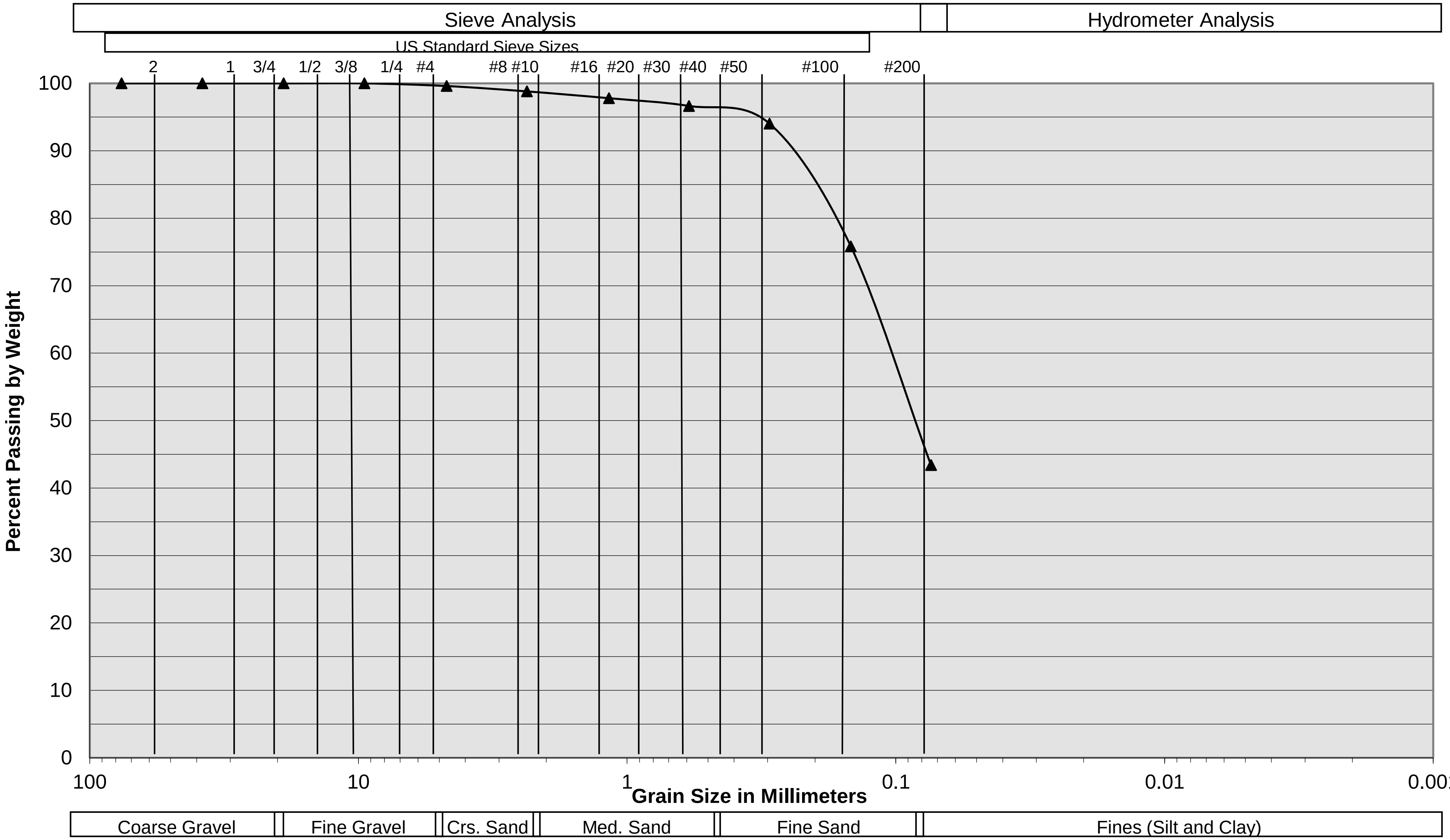


Sample Description	I-5 @ 10½ to 12 feet
Soil Classification	Gray fine to medium Sandy Silt

Proposed Industrial Development
Fontana, California
Project No. 23G117-2
PLATE C- 5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-6 @ 10½ to 12 feet
Soil Classification	Brown Silty fine Sand, trace medium Sand

Proposed Industrial Development
Fontana, California
Project No. 23G117-2
PLATE C- 6

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL *A California Corporation*

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April 28, 2023

Candyce Burnett
Project Manager
Kimley-Horn
3880 Lemon Street, Suite 420
Riverside, California 92501
Transmitted via email to Candyce.Burnett@kimley-horn.com

RE: Paleontological Resource Assessment for the Hillwood Cherry Avenue Project, City of Fontana, San Bernardino County, California

Dear Sabrina Wallace,

At the request of Kimley-Horn, PaleoWest, LLC (PaleoWest) conducted a paleontological resource assessment for the Hillwood Cherry Avenue Project (Project) in the city of Fontana, San Bernardino County, California. The goal of the assessment is to identify the geologic units that may be impacted by the development of the Project, determine the paleontological sensitivity of geologic units within the Project area, assess potential for impacts to paleontological resources from development of the Project, and recommend mitigation measures to avoid or mitigate impacts to scientifically significant paleontological resources, as necessary.

This paleontological resource assessment included a fossil locality records search conducted by the San Bernardino County Museum (SBCM) in Redlands, California. The records search was supplemented by a review of existing geologic maps and primary literature regarding fossiliferous geologic units within the proposed Project vicinity and region. This technical memorandum, which was written in accordance with the guidelines set forth by the Society of Vertebrate Paleontology (SVP, 2010), has been prepared to support environmental review under the California Environmental Quality Act (CEQA). The City of Fontana (City) is the Lead Agency for CEQA compliance.

PROJECT LOCATION AND DESCRIPTION

The proposed Project area is at the northeast corner of the intersection of Jurupa Avenue and Cherry Avenue in the southern extent of the city of Fontana (Figure 1). The Project area encompasses 29.6 acres of land on two contiguous parcels (Assessor's Parcel Numbers [APN] 023-619-114 and 023-619-125). The Project area is in Section 26, Township 1 South, Range 6 West, San Bernardino Baseline and Meridian (SBBM), as depicted on the Fontana, CA 7.5-minute U.S. Geological Survey (USGS) topographic quadrangle (Figure 2). The elevation of the Project area ranges from 940–960 feet (ft) above mean sea level (amsl). The Project area is currently in use as an equipment storage facility for the Tutor Perini Corporation, a building contractor (Terracon Consultants, Inc., 2022) (Figure 3).

Figure 1. Project vicinity map.

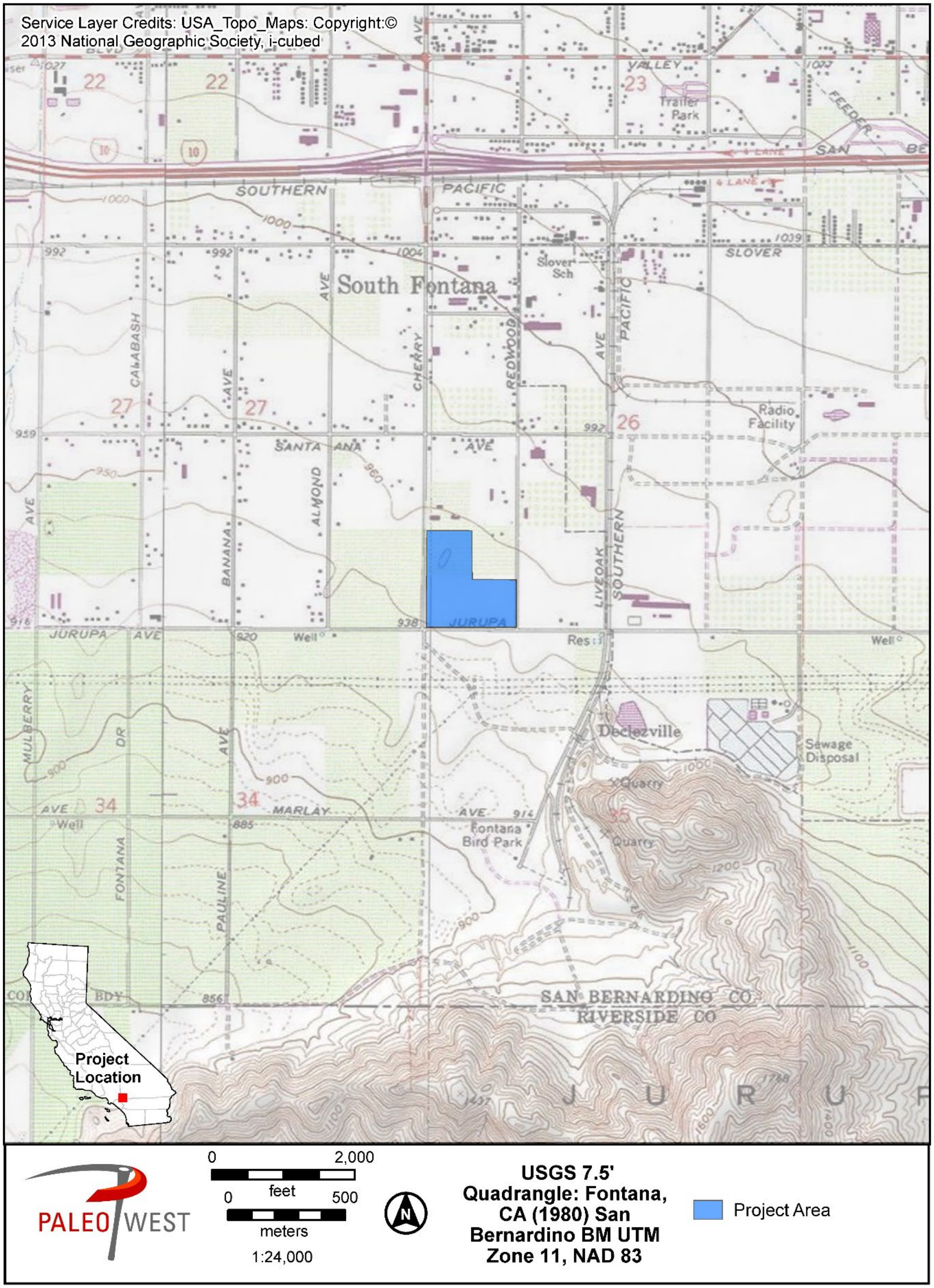

Figure 2. Project location map.

The proposed Project involves the construction of two warehouse buildings that total 709,980 ft^2. Other elements of the Project include auto and trailer parking and landscaping around the property's perimeter. One commercial building currently occupies the property; this building would be demolished as part of the Project.

REGULATORY CONTEXT

Paleontological resources (i.e., fossils) are considered nonrenewable scientific resources because once destroyed, they cannot be replaced. As such, paleontological resources are afforded protection under various federal, state, and local laws and regulations. Laws pertinent to this Project are discussed below.

STATE LAWS AND REGULATIONS

California Environmental Quality Act

CEQA requires that public agencies and private interests identify the potential environmental consequences of their Projects on any object or site of significance to the scientific annals of California (Division I, California Public Resources Code [PRC] Section 5020.1 [b]). Appendix G in Section 15023 provides an Environmental Checklist of questions (PRC 15023, Appendix G, Section VII, Part f) that includes the following: "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geological feature?"

CEQA does not define "a unique paleontological resource or site." However, the SVP has provided guidance specifically designed to support state and federal environmental review. The SVP broadly defines significant paleontological resources as follows:

> Fossils and fossiliferous deposits consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be older than recorded human history and/or older than middle Holocene (i.e., older than about 5,000 radiocarbon years). (SVP, 2010, page 11)

Significant paleontological resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, diagnostically important, or are common but have the potential to provide valuable scientific information for evaluating evolutionary patterns and processes, or that could improve our understanding of paleochronology, paleoecology, paleophylogeography, or depositional histories. New or unique specimens can provide new insights into evolutionary history; however, additional specimens of even well represented lineages can be equally important for studying evolutionary pattern and process, evolutionary rates, and paleophylogeography. Even unidentifiable material can provide useful data for dating geologic units if radiometric dating is possible. As such, common fossils (especially vertebrates) may be scientifically important, and therefore considered significant.

California Public Resources Code

Section 5097.5 of the PRC states:

> No person shall knowingly and willfully excavate upon, or remove, destroy, injure or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands. Violation of this section is a misdemeanor.

As used in this PRC section, "public lands" means lands owned by, or under the jurisdiction of, the state or any city, county, district, authority, or public corporation, or any agency thereof. Consequently, public agencies are required to comply with PRC 5097.5 for their own activities, including construction and maintenance, as well as for permit actions (e.g., encroachment permits) undertaken by others.

LOCAL

The *Final Environmental Impact Report for the City's General Plan Update 2015–2035* (City of Fontana, 2017, 2-9) identifies two mitigation measures related to paleontological resources to be implemented by the City. These include:

MM-CUL-4 A qualified paleontologist shall conduct a pre-construction field survey of any project site within the Specific Plan Update area that is underlain by older alluvium.

- The paleontologist shall submit a report of findings that provides specific recommendations regarding further mitigation measures (i.e., paleontological monitoring) that may be appropriate.

MM-CUL-5 Should mitigation monitoring of paleontological resources be recommended for a specific project within the project site, the program shall include, but not be limited to, the following measures:

- Assign a paleontological monitor, trained and equipped to allow the rapid removal of fossils with minimal construction delay, to the site full-time during the interval of earth-disturbing activities.
- Should fossils be found within an area being cleared or graded, earth-disturbing activities shall be diverted elsewhere until the monitor has completed salvage. If construction personnel make the discovery, the grading contractor shalt immediately divert construction and notify the monitor of the find.
- All recovered fossils shall be prepared, identified, and curated for documentation in the summary report and transferred to an appropriate depository (i.e., San Bernardino County Museum).
- A summary report shall be submitted to City of Fontana. Collected specimens shall be transferred with copy of report to San Bernardino County Museum.

PALEONTOLOGICAL RESOURCE POTENTIAL

Absent specific agency guidelines, most professional paleontologists in California adhere to the guidelines set forth by the SVP (2010) to determine the course of paleontological mitigation for a given project. These guidelines establish protocols for the assessment of the paleontological resource potential of underlying geologic units and outline measures to mitigate adverse impacts that could result from project development. Using baseline information gathered during a paleontological resource assessment, the paleontological resource potential of the geologic unit(s) (or members thereof) underlying a Project area can be assigned to one of four categories defined by SVP (2010). Although these standards were written specifically to protect vertebrate paleontological resources, all fields of paleontology have adopted the following guidelines.

HIGH POTENTIAL (SENSITIVITY)

Rock units from which significant vertebrate or significant invertebrate fossils or significant suites of plant fossils have been recovered have a high potential for containing significant non-renewable fossiliferous resources. These units include but are not limited to, sedimentary formations and some volcanic formations which contain significant nonrenewable.

LOW POTENTIAL (SENSITIVITY)

Sedimentary rock units that are potentially fossiliferous but have not yielded fossils in the past or contain common and/or widespread invertebrate fossils of well documented and understood taphonomic, phylogenetic species and habitat ecology. Reports in the paleontological literature or field surveys by a qualified vertebrate paleontologist may allow determination that some areas or units have low potentials for yielding significant fossils prior to the start of construction. Generally, these units will be poorly represented by specimens in institutional collections and will not require protection or salvage operations. However, as excavation for construction gets underway it is possible that significant and unanticipated paleontological resources might be encountered and require a change of classification from Low to High Potential and, thus, require monitoring and mitigation if the resources are found to be significant.

UNDETERMINED POTENTIAL (SENSITIVITY)

Specific areas underlain by sedimentary rock units for which little information is available have undetermined fossiliferous potentials. Field surveys by a qualified vertebrate paleontologist to specifically determine the potentials of the rock units are required before programs of impact mitigation for such areas may be developed.

NO POTENTIAL

Rock units of metamorphic or igneous origin are commonly classified as having no potential for containing significant paleontological resources.

METHODS

To assess whether or not a particular area has the potential to contain significant fossil resources at the subsurface, it is necessary to review published geologic mapping to determine the geology and stratigraphy of the area. Geologic units are considered "sensitive" for paleontological resources if they are known to contain significant fossils anywhere in their extent. Therefore, a search of pertinent local and regional museum repositories for paleontological localities within and nearby the Project area is necessary to determine whether or not fossil localities have been previously discovered within a particular rock unit. For this Project, a formal museum records search was conducted at the SBCM, and informal records searches were conducted of the online University of California Museum of Paleontology Collections (UCMP) and other published and unpublished geological and paleontological literature of the area.

RESOURCE CONTEXT

GEOLOGIC SETTING

The Project area is south of the foothills of the San Gabriel Mountains, which are part of the Transverse Ranges geomorphic province of Southern California. The San Gabriel Mountains extend approximately 60 miles (mi) west to the Verdugo Hills, San Fernando Valley, and Soledad Basin. Active uplift and erosion in the San Gabriel Mountains have produced steep canyons, rugged topography, numerous landslides, and extensive alluvial sedimentation (Morton and Miller, 2006). Late Cenozoic uplift of the San Gabriel Mountains is largely due to compression along the Sierra Madre Fault Zone just south of the Project area. The highest peak in the San Gabriel Mountains is Mount San Antonio (Old Baldy) at 10,080 ft, and much of the range displays large relief with deep narrow canyons and peaks above 7,000 ft (Norris and Webb, 1976). The San Gabriel Mountains are predominantly crystalline and consist of Proterozoic to Mesozoic intrusive igneous (plutonic) and metamorphic rocks as well as Cenozoic volcanic, marine, and terrestrial sedimentary deposits, including extensive alluvial fan and terrace deposits (Morton et al., 2003). The Project area is underlain by Quaternary alluvial fan deposits eroded from the San Gabriel Mountains to the north (Figure 3).

SITE SPECIFIC GEOLOGY AND PALEONTOLOGY

According to geologic mapping by Morton (2003), the Project area is underlain Young alluvial-fan deposits (Qyfl) from the early Holocene and late Pleistocene, and Old alluvial-fan deposits (Qof_3) from the middle to late Pleistocene (Figure 3). These geologic units are described below.

Quaternary young alluvial fan deposits of Lytle Creek (Qyfl)

The early Holocene to late Pleistocene young alluvial fan deposits consist of unconsolidated, gray, cobbly and boulder alluvium (Morton, 2003). Locally, these fans are sourced from the Lytle Creek alluvial fan and are typically composed of sand, pebbles, and cobbles, coarsening northward to cobbles and boulders (Morton, 2003). Holocene deposits are generally too young to have accumulated or preserved significant biological material and are assigned low paleontological sensitivity as a result. However, Pleistocene deposits may be present at shallow depths (5 ft bgs) and can contain significant paleontological resources (Reynolds and Reynolds, 1991).

Quaternary old alluvial-fan deposits (Qof_3)

The late to middle Pleistocene Old alluvial fan deposits are composed of unconsolidated, tan, cobble and boulder alluvium derived from the Lytle Creek fan (Morton, 2003). This unit is mapped at ground surface at the very southeastern portion of the Project area and may be buried below younger Qyfl at approximately 5 ft bgs. Pleistocene deposits have yielded scientifically significant vertebrate fossils throughout San Bernardino County. Fossiliferous Pleistocene sedimentary deposits have produced localities of deer, mammoth, camel, horse, bison, badger, mole, rabbit, gray fox, and coyote (Jefferson, 1991a, 1991b; Miller, 1971).

RECORDS SEARCH RESULTS

The SBCM records search did not produce any fossil localities from within the Project area but did produce nine localities in Pleistocene sediment within two miles. Searches of online databases and other literature produced no additional fossil localities within five miles of the Project area (UCMP, 2023) (Table 1).

Table 1. Pleistocene fossil Localities in Project Vicinity

Fossil Locality	Formation	Fossils Present	Depth (ft bgs)	Distance from Project
SBCM 5.1.11	Old alluvial-fan deposits	*Smilodon* sp. (Sabertooth)	5	.95 mi, E-SE
SBCM 5.1.14 – 5.1.21	Old alluvial-fan deposits	*Mammut pacificus* (mastodon); *Bison* sp. (bison); *Camelops hesternus* (extinct Western Camel); *Equus* sp. (horse); *Sylvilagus* sp. (Cottontail rabbit); *Thomomys* sp. (pocket gopher); *Neotoma* sp. (wood rat); *Microtus californicus* (California vole)	0-21	1-1.5 mi, W

Note: ft bgs= feet below ground surface.

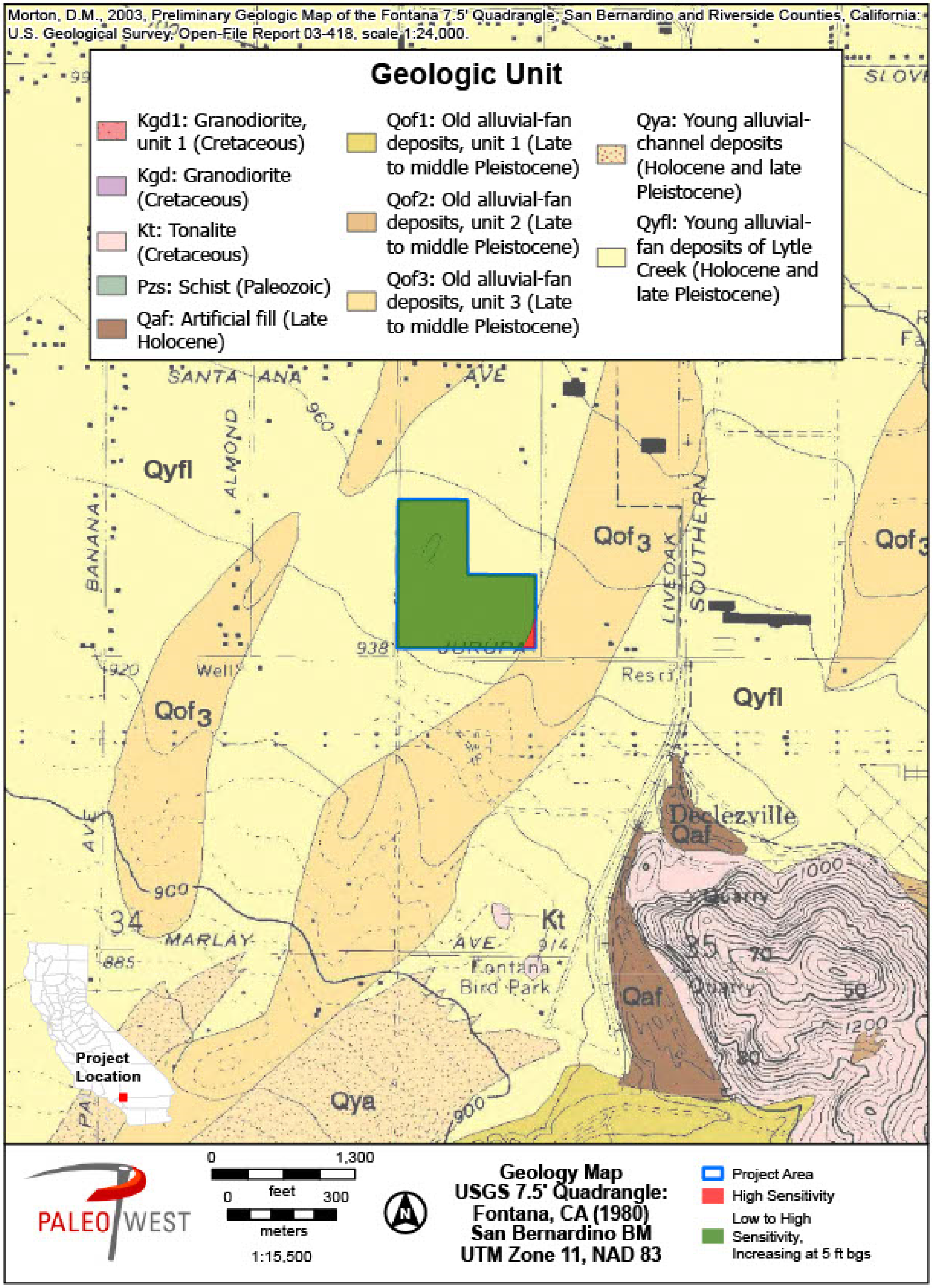

Figure 3. Geologic map.

FINDINGS

This memorandum uses the SVP (2010) classification system to assess paleontological sensitivity and the level of effort required to manage potential impacts to significant fossil resources. Using this system, the sensitivity of geologic units was determined based on the relative abundance and risk of adverse impacts to vertebrate fossils and significant invertebrates and plants.

Pleistocene alluvial deposits (Qof_3) deposits are mapped at ground surface in the very southeastern portion of the Project area. According to the SVP (2010), these Pleistocene deposits have a high paleontological sensitivity due to the presence of Pleistocene fossil localities in the vicinity. Most of the Project area is immediately underlain by Quaternary young alluvial fan deposits of Lytle Creek (Qyfl). These Holocene deposits have low paleontological sensitivity at the surface, but may overlie older more sensitive Pleistocene deposits at approximately 5 ft bgs. Therefore, further paleontological resource management is recommended during Project development.

Table 2. Geologic Units in the Project Area and their Paleontological Sensitivity

Geologic Unit[1]	Age	Fossils Present[2]	Paleontological Sensitivity	Recommended Monitoring
Young alluvial-fan deposits of Lytle Creek (Qyfl)	Late Pleistocene-Early Holocene	None	Low to High	Full-time below 5 ft bgs
Old alluvial-fan deposits (Qof_3)	Middle-Late Pleistocene	Vertebrates; large mammals, rodents	High	Full-time at surface and at depth

[1] Morton, 2003.
[2] SBCM Records Search Results (Kottkamp, 2023)

RECOMMENDATIONS

In general, the potential for a given project to result in negative impacts to paleontological resources is directly proportional to the amount of ground disturbance associated with the project; thus, the higher the amount of ground disturbances within geological deposits with a known paleontological sensitivity, the greater the potential for negative impacts to paleontological resources. Since this Project entails excavation for a warehouse complex, new ground disturbances are anticipated. The presence of Pleistocene deposits at the surface, and likely at depth in the Project area, suggests that ground disturbance may result in significant impacts under CEQA to paleontological resources, such as destruction, damage, or loss of scientifically important paleontological resources. A qualified paleontologist should be retained to develop and implement the measures recommended below. These measures have been developed in accordance with SVP guidelines; if implemented, these measures will satisfy the requirements of CEQA.

WORKER'S ENVIRONMENTAL AWARENESS PROGRAM (WEAP)

Prior to the start of the proposed Project activities, all field personnel will receive a worker's environmental awareness training on paleontological resources. The training will provide a description of the laws and ordinances protecting fossil resources, the types of fossil resources that may be encountered in the Project area, the role of the paleontological monitor, outline steps to follow if a fossil discovery is made and provide contact information for the Project Paleontologist. The training will be developed by the Project Paleontologist and can be delivered concurrently with other training, including cultural, biological, safety, et cetera.

PALEONTOLOGICAL MITIGATION MONITORING

Prior to the commencement of ground disturbing activities, a professional paleontologist will be retained to prepare and implement a paleontological mitigation plan for the Project. The plan will describe the monitoring required during ground disturbing activities. Monitoring will entail the visual inspection of excavated or graded areas and trench sidewalls. If the Project Paleontologist determines full-time monitoring is no longer warranted based on the geologic conditions at depth, they may recommend that monitoring be reduced or cease entirely.

FOSSIL DISCOVERIES

If a paleontological resource is discovered, the monitor will have the authority to temporarily divert the construction equipment around the find until it is assessed for scientific significance and, if appropriate, collected. If the resource is determined to be of scientific significance, the Project Paleontologist shall complete the following:

1. **Salvage of Fossils.** If fossils are discovered, all work in the immediate vicinity should be halted to allow the paleontological monitor and/or Project Paleontologist to evaluate the discovery and determine if the fossil may be considered significant. If the fossils are determined to be potentially significant, the Project Paleontologist (or paleontological monitor) should recover them following standard field procedures for collecting paleontological resources as outlined in the mitigation plan prepared for the Project. Typically, fossils can be safely salvaged quickly by a single paleontologist and not disrupt construction activity. In some cases, larger fossils (such as complete skeletons or large mammal fossils) require more extensive excavation and longer salvage periods. In this case, the paleontologist should have the authority to temporarily direct, divert or halt construction activity to ensure that the fossil(s) can be removed in a safe and timely manner.
2. **Fossil Preparation and Curation.** The paleontological mitigation plan will identify the museum that has agreed to accept fossils that may be discovered during Project related excavations. Upon completion of fieldwork, all significant fossils collected will be prepared in a properly equipped laboratory to a point ready for curation. Preparation may include the removal of excess matrix from fossil materials and stabilizing or repairing specimens. During preparation and inventory, the fossils specimens will be identified to the lowest taxonomic level practical prior to curation at an accredited museum. The fossil specimens must be delivered to the accredited

museum or repository after all fieldwork is completed. The cost of curation will be assessed by the repository and will be the responsibility of the client.

FINAL PALEONTOLOGICAL MITIGATION REPORT

Upon completion of ground disturbing activity (and curation of fossils, if necessary), the Project Paleontologist should prepare a final mitigation and monitoring report outlining the results of the mitigation and monitoring program. The report should include a discussion of the location, duration, and methods of the monitoring, stratigraphic sections, any recovered fossils, and the scientific significance of those fossils, and where fossils were curated.

Thank you for contacting PaleoWest for this Project. If you have any questions, please do not hesitate to contact us.

Sincerely,

PALEOWEST

Sincerely,

Michaela Adler
Associate Paleontologist

Heather Clifford
Senior Paleontologist

REFERENCES

City of Fontana, 2017, Final Environmental Impact Report for the City's General Plan Update 2015-2035: https://www.fontana.org/DocumentCenter/View/28271/Complete-Document---Approved-General-Plan-Documents-11-13-2018 (accessed August 18, 2022).

Jefferson, G.T., 1991a, A catalogue of Late Quaternary vertebrates from California: part one, Non-marine lower vertebrate and avian taxa: Natural History Museum of Los Angeles County Technical Reports, no. 5.

——— 1991b, A catalogue of Late Quaternary vertebrates from California: part two, Mammals: Natural History Museum of Los Angeles County Technical Reports, no. 7.

Kottkamp, S., 2023, Unpublished museum records search of the SBCM.

Miller, W.E., 1971, Pleistocene Vertebrates of the Los Angeles Basin and Vicinity (exclusive of Rancho La Brea), Bulletin of the Natural History Museum of Los Angeles County, Science, no. 10, 121 pp.

Morton, D.M., 2003, Preliminary geologic map of the Fontana 7.5' quadrangle, Riverside and San Bernardino Counties, California, U.S. Geological Survey, Open-File Report OF-2003-418, 1:24,000.

Morton, D.M., and Miller, F.K., 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California: U.S. Geological Survey, Open-File Report OF-2006-1217, scale 1:100,000.

Morton, D.M., Miller, F.K., Cossette, P.M., and Bovard, K.R., 2003, Preliminary geologic map of the San Bernardino 30' X 60' quadrangle, California: U.S. Geological Survey, Open-File Report OF-2003-293, scale 1:100,000.

Norris, R.M., and R.W. Webb, 1976, *Geology of California*. John Wiley & Sons, New York.

Reynolds, R. E., and Reynolds, R. L., 1991, The Pleistocene Beneath our Feet: Near-surface Pleistocene Fossils from Inland Southern California Basins, San Bernardino County Museum Association Quarterly, no. 38(3 & 4), pp 41-43.

Society of Vertebrate Paleontology (SVP), 2010, Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources Society of Vertebrate Paleontology, Impact Mitigation Guidelines Revision Committee, Bethesda, MD.

Terracon Consultants, Inc., 2022, Phase I Environmental Site Assessment, Proposed Industrial Buildings, 11171 Cherry Avenue, Fontana, San Bernardino County, California. Report prepared for Industrial VI Enterprises, LLC. By Terracon Consultant, Inc., Carson, California.

University of California Museum of Paleontology (UCMP), 2023, University of California Museum of Paleontology Specimen Search. Retrieved from ucmpdb.berkeley.edu.