GEOTEK

PRELIMINARY GEOTECHNICAL EVALUATION REPORT
PROPOSED PACIFICA ELEMENTARY RE-DEVELOPMENT
ASSESSOR PARCEL NUMBERS:
122-190-22-00
122-190-19-00
157-070-42-00
OCEANSIDE, CALIFORNIA

PREPARED FOR

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PROJECT NO. 3743-SD **JANUARY 19, 2022**

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January 19, 2022
Project No. 3743-SD

MLC Holdings, Inc.
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Attention: Ms. Johanna Crooker

Subject: **Preliminary Geotechnical Evaluation Report**
Proposed Pacifica Elementary Re-Development
APN: 122-190-22-00, 122-190-19-00, and 157-070-42-00
Oceanside, California

Dear Ms. Crooker:

GeoTek, Inc. (GeoTek) is pleased to present the results of this preliminary geotechnical evaluation for the subject project located in the City of Oceanside, California. This report presents a discussion of GeoTek's field evaluation, analyses, and suitability of the site soils to support the proposed improvements. Based upon review, site development appears feasible from a geotechnical viewpoint provided that recommendations presented in this report are incorporated into the design and construction phases of the project.

We appreciate the opportunity to be of service on this project. Please contact the undersigned if you have any questions.

Respectfully submitted,
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1. PURPOSE AND SCOPE OF SERVICES

The purpose of this geotechnical evaluation is to provide recommendations for site development in consideration of the proposed site plans. Services provided included the following:

- Research and review of available geologic information pertinent to the property.
- Drilled, sampled, and logged thirteen (13) exploratory borings. Representative bulk samples and relatively undisturbed samples were obtained for laboratory testing. One cone penetration test (CPT) sounding was also performed.
- Drilled two (2) borings for percolation testing and infiltration analysis via the Porchet method.
- Geotechnical analyses and evaluation of site seismicity.
- Liquefaction and static settlement analyses.
- Preliminary recommendations for site development.

The intent of this report is to aid in the evaluation of the site for future development from a geotechnical engineering perspective. The professional opinions and geotechnical information contained in this report may need to be updated based on future review of final site development plans. These should be provided to GeoTek for review when available.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION AND HISTORY

The subject site is located west of 4991 Macario Drive in the city of Oceanside, California (see Figure-1, Site Location Map). The site is an irregular shaped property approximately 14.2 acres and encompasses County of San Diego assessor parcel numbers (APN) 122-190-22-00, 122-190-19-00, and 157-070-42-00. The site is bounded by an approximate 30-foot-high ascending slopes and residential properties to the north and south; a sewer lift station, Macario Drive, and single-family dwellings to the east; and an approximate 25-foot descending slope followed by vacant land and Libby Lake to the west. Overall topography of the site has been graded as a building pad has a gentle fall across the pad of about 3 to 5 feet to the west-southwest. Surface drainage is to the west-southwest, with some local variations.

The site previously was developed and operated as Pacifica elementary school. The eastern and central portions of the site were previously occupied by various buildings which have been demolished, however foundations still appear to be present. The property also contains paved areas, and existing landscape.

Review of site topographic maps indicates that the site previously resided within an alluvial canyon. An earthen dam was constructed within the site to facilitate a water reservoir until the site was infilled to construct a relatively flat earthen pad for the construction of Pacifica elementary school. The following is a general timeline of pertinent historic geotechnical events regarding the site.

1938: The site appeared to be in a natural state as a broad canyon drainage. Some agricultural fields can be seen to the south.
1946: A large reservoir retained by an earthen dam covered a majority of the site.
1953: The reservoir remains, however has reduced significantly in storage volume.
1964: The reservoir remains, however has reduced further in storage volume.
1967: The reservoir appears to have been drained and a braided alluvial fan can be observed.
1978: The graded pad is completed and the initial building has been constructed.
1980 to Present: the grades generally remain the same.

The site is located in an area geologically mapped by others to be underlain by young to older alluvial deposits and bedrock of the Santiago Formation (Kennedy, M.P. et. Al., 2007).

2.2 PROPOSED DEVELOPMENT

Based upon discussions with the design team, it is our understanding that the project will consist of the construction of twenty five, two-story, multi-family townhomes arranged as 3, 5, and 6-plexes. The structures are anticipated to be composed of wood-framed construction and utilize post-tensioned slabs. Planned development includes 130 residential units, 325 parking spaces, 6’ front patios for each home unit, multiple open spaces for specific amenities such as tennis courts and tot lots, retaining walls, an EVA/Secondary access road, and interior street and utility improvements. Average cuts and fills averaging 3 to 4 feet are estimated to be required to reach design grades. The majority of taller cuts are localized and up to twelve feet tall. There are also localized taller fills for a proposed extension of Malaga Drive into the site as an emergency pathway.

3. FIELD EXPLORATION

3.1 FIELD EXPLORATION

Exploratory borings were advanced with a dual purposed, rubber-tire truck mounted CME-75 hollow-stem auger, equipped with optional CPT equipment, drill rig. On October 5, 2021, five (5) borings and one (1) CPT sounding were performed on the site. On November 4th, 2021 an additional eight (8) exploratory borings were performed. The explorations were advanced to depths ranging between 5 and 46.5 feet below the existing ground surface. The approximate locations of these explorations are shown on the Geotechnical Map, Figure 2a and Figure 2b. A geologist from GeoTek observed and logged the explorations, as well as obtained loose and relatively undisturbed samples that were transported to GeoTek's offices. Geotechnical logs of the explorations are included in Appendix A.

Standard penetration tests (SPT) were performed with a 2.0-inch outside diameter split-barrel sampler with a length of 18 inches. The inside diameter of the sampler shoe was 1.4 inches. The SPT sampler was unlined and conformed to the requirements of ASTM D 1586. The SPT sampler is machined to fit liners. The standard penetration test data are presented on the boring logs.

Relatively undisturbed soil samples were recovered at various depths/intervals in the geotechnical borings with a California sampler. The California sampler is a 3-inch outside diameter, 2.4-inch inside diameter, split barrel sampler lined with brass rings. The sampler was 18 inches long. The sampler conformed to the requirements of ASTM D 3550.

Additionally, large bulk samples were taken from the exploratory boring cuttings. Representative samples obtained during the field exploration, were returned to the laboratory for testing and evaluation.

The CPT sounding was advanced to a depth of approximately 67.5 feet below existing grades. The approximate locations of the explorations are shown on Figure 2a and Figure 2b. CPT soundings measure the tip and frictional resistance at near continuous intervals as an instrumented probe is advanced through the soil profile with a cone area ratio of 0.84.

3.2 PERCOLATION TESTING AND INFILTRATION ANALYSIS

Two percolation test borings and infiltration analyses were performed on site in two (2) locations (P-1 and P-2). The testing was conducted at an approximate boring depth of 60 inches at each location. The percolation test rate was converted to an infiltration rate via the Porchet method.

Results of our infiltration analyses are presented below. Copies of the infiltration conversion sheets and Table D.1-1 are included in Appendix B.

Boring	Depth (inches)	Infiltration Rate (inches per hour)*
P-1	60	0.24
P-2	60	0.06

* Rate was converted to an infiltration rate via the Porchet method
Factors of Safety have not been applied.

3.3 LABORATORY ANALYSES

Laboratory testing was performed on soil samples collected during the field exploration. The purpose of the laboratory testing was to evaluate the physical and chemical soil properties for use in engineering design and analysis. Results of the laboratory testing program, along with a brief description and relevant information regarding testing procedures, are included in Appendix C.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL GEOLOGIC SETTING

The property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. It extends approximately 975 miles from the north and northeasterly adjacent to the Transverse Range geomorphic province to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the north by the Transverse Ranges, west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

4.2 GENERAL SOIL CONDITIONS

A brief description of the earth materials encountered during the subsurface explorations are presented in the following section. Based on review of the explorations, available geologic maps and technical literature and our site specific evaluation, the site is underlain by artificial fill, quaternary-age alluvium, and tertiary-age Santiago Formation sedimentary bedrock.

4.2.1 Artificial Fill (Af)

Artificial fill soils were encountered in each of GeoTek's test borings. These soils were found to consist of silty fine to coarse sands with occasional clayey sands (SM/SC soil type based upon the Unified Soil Classification System), ranging from yellow brown to dark brown in color with various other heterogeneous inclusions, dry to moist, and loose to medium dense. Artificial fill was encountered to depths ranging between 2 to 25.5 feet below existing grade with the average depth across all the borings being roughly 10 to 15 feet deep. A request for all geotechnically related documents regarding the site history was performed on be-half of GeoTek to the School District. The request did not return any information.

4.2.2 Quaternary Alluvium (Qal)

Alluvial soils were encountered in six (6) of GeoTek's test borings (B-1, B-3, B-6, B-7, B-12, and B-13) to depths ranging between 11 to 46.5 feet below existing grades with the average depth being roughly 13 to 21.5 feet deep. These soils consisted of various concentrations of silty sands, and clayey sands and were found to be various grey-blacks and browns in color, slightly moist to saturated, silty fine to coarse grained sands. The soil behavior type of the CPT sounding is interpreted to be variations of clays and silts. Moisture was noted to increase with depth and became saturated near a groundwater table located approximately 45 feet below existing grades in Boring B-1. Some of the alluvium contained roots that brought an organic odor with them.

4.2.3 Tertiary Santiago Formation (Tsa)

Tertiary-age Santiago Formation (sedimentary bedrock) was encountered in eight (8) of GeoTek's test borings (B-2, B-3, B-4, B-5, B-8, B-9, B-10, and B-11) Santiago Formation was encountered at depths between 2 to 26.5 feet below existing grades. The sedimentary bedrock has also been mapped to underlie the subject property on a regional geologic map reviewed for the area (Kennedy and Tan, 2007). The TSantiago Formation is regionally described to consist of medium to coarse grained, moderately well indurated, massive and broadly cross bedded sandstone. The sedimentary formation as encountered at the site was a yellow to light brown, fine to coarse sandstone with orange oxidation. The weathered bedrock varied in moisture (dry to very moist) depending on the boring location and was found to be dense to very dense.

4.3 SURFACE WATER AND GROUNDWATER

4.3.1 Surface Water

Surface water was not observed during the recent exploration. If encountered during earthwork operations, surface water on this site is the likely result of precipitation, irrigation, or possibly some minor surface run-off from immediately surrounding properties. Overall, the site drainage is directed toward the west to southwest with localized variations.

4.3.2 Groundwater

Groundwater was encountered in one of GeoTek's explorations, B-1, at a depth of 45 feet below existing grades. Due to the absence of groundwater in the rest of the borings and the apparent depth of the encountered groundwater, groundwater is not anticipated to be a factor in the proposed construction.

4.4 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The site is in a seismically active region. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province. No active or potentially active fault is known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone or a Special Studies Zone (Bryant and Hart, 2007; CGS, 1980). The nearest known active fault to the project site is the Rose Canyon-Newport-Inglewood fault (offshore), which is located approximately 9 miles to the southwest of the property. A potential earthquake with a magnitude (MCE) of up to 6.9 may result from this fault. These faults identified on geologic maps are readily available and reviewed by this firm for the immediate study area.

4.4.1 Seismic Design Parameters

The site is located at approximately 33.2562 Latitude and -117.3040 Longitude. Site spectral accelerations (Ss and S1), for 0.2 and 1.0 second periods for a risk targeted two (2) percent probability of exceedance in 50 years (MCER) were determined using the web interface provided by SEAOC/OSHPD (https://seismicmaps.org) to access the USGS Seismic Design Parameters. Using the ASCE 7-16 option on the SEAOC/OSHPD website results in the values for SM1 and SD1 reported as "null-See Section 11.4.8" (of ASCE 7-16). As noted in ASCE 7-16, Section 11.4.8, a site-specific ground motion procedure is recommended for Site Class D when the value S1 exceeds 0.2. The value S1 for the subject site exceeds 0.2.

For a site Class D, an exception to performing a site-specific ground motion analysis is allowed in ASCE 7-16 where S1 exceeds 0.2 provided the value of the seismic response coefficient, Cs, is conservatively calculated by Eq 12.8-2 of ASCE 7-16 for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $T_L \geq T > 1.5T_s$ or Eq. 12.8-4 for $T > T_L$. Based on the explorations performed at this site, the reviewed geologic map, and planned grading activities, the site structural improvements will be underlain by engineered fill, alluvium, and bedrock. For these soil conditions, a Site Class D is considered appropriate.

Assuming that the Cs value calculated by and used by the structural engineer allows for the exclusion per ASCE 7-16, noted above, then a site-specific ground motion analysis is not required. For this assumption and condition, the following seismic design parameters, based on the 2015 National Earthquake Hazards Reduction Program (NEHRP), are presented on the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, Ss	0.923g
Mapped 1.0 sec Period Spectral Acceleration, S1	0.342g
Site Coefficient for Site Class "D," Fa	1.131
Site Coefficient for Site Class "D," Fv	1.958
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, SMS	1.044g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, SM1	0.67g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, SDS	0.696g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, SD1	0.446g
PGA_M	0.479g
Seismic Design Category	D

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon the local practices and ordinances, expected building response and desired level of conservatism. Should it be determined that the exclusion as outlined in ASCE 7-16 is not appropriate for this site, then a site-specific ground motion analysis will be necessary.

4.4.2 Liquefaction/Seismic Settlement

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates.

Utilizing the results of the CPT-1 sounding, GeoTek evaluated the liquefaction potential of the on-site soils using the computer program *Cliq Version 3.3.1.14*. For this analysis, the computer software program utilized an estimated high-water depth of 40 feet, a ground acceleration of 0.48g (PGA_M) and a mean earthquake event of 6.57. The ground acceleration and earthquake magnitude were obtained from the USGS websites. The results of this analysis indicated that the soils below the estimated high-water depth of 40 feet are not potentially susceptible to liquefaction during a seismic event. The following table summarizes the amount of total settlement (liquefaction settlement plus settlement of dry sands) estimated at the referenced location:

ESTIMATED SEISMICALLY INDUCED TOTAL SETTLEMENT	
CPT Sounding	Total Settlement (inches)
CPT-1	0.00

*Sounding terminated at about 67.5 feet

As noted above, no seismically induced settlement is estimated for the subject property. The results of the liquefaction and seismic settlement analyses are presented within Appendix E.

4.5 STATIC SETTLEMENT ANALYSES

Static settlement of the alluvial soils below proposed improvements may occur as a result of the loads imposed by changes in pad grade and building loads. Due to the relatively high moisture content of the soil and fine-grained consistency, hydro consolidation due to the introduction of water into the fills and alluvial deposits is not considered likely.

Settlement estimates were calculated using the CPT data and the computer program CPeT-IT version 3.0.2.1 by Geologismiki. More specifically, CPT data was used to calculate the constrained modulus for each depth increment in the tested soil column. Constrained modulus is then used in combination with the anticipated stress increase due to planned improvements to quantify a settlement quantity for each depth increment. Settlements are summed over the entire data range to provide an estimated settlement at the existing surface. For CPT-1, the calculation was conducted assuming a large post-tensioned foundation with an embedment of 1 foot into existing soils (modeled as a 0.75 tsf foundation load), consistent with the proposed improvements. The results are tabulated below and are presented in Appendix D:

CPT NUMBER	POTENTIAL STATIC SETTLEMENT (in.)
CPT-1	≈ 1

Based on the above estimates, static total settlement for the proposed structures should be considered to be one inch with a differential settlement of one-half inch over 40 feet. The actual magnitude of settlement is dependent upon actual subsurface conditions, planned grade changes, foundation loads, and may vary from that anticipated.

4.6 GLOBAL SLOPE STABILITY ANALYSES

Direct shear test results, experience, and judgement were used in selecting shear strengths. GeoTek performed laboratory direct shear testing on one remolded soil sample collected during our field exploration. The result of the test is presented in Appendix B. The existing ascending fill slopes were observed to be consistent with the fill soils observed during test borings and laboratory testing. In addition, the ascending slopes exposing Santiago formation was observed to be visually consistent and in some areas exposed silty medium to coarse grained sandstones with occasional small rounded gravels. Remolded shear strength testing results of bedrock materials have lower strength than undisturbed parent material that does not exhibit adverse geologic structure or joint/fractures. Therefore, utilizing the remolded shear strength of the fill, is considered a conservative approach. Observation of the slopes exposing Santiago formation was performed by a certified engineering geologist and found to be absent of geologic structure. As such, evaluating the Santiago Formation as isotropic is considered in our analyses.

Three slope stability sections were performed to analyze the existing and proposed improvements. The sections were selected to represent three different geotechnical conditions:

- Section AA: Represents the existing fill slope, located in the western end of the site.
- Section BB: Represents the offsite ascending fill slope along the north of the site retained by a proposed ten foot tall wall.
- Section CC: Represents the offsite ascending fill slope along the north of the site retained by a proposed ten foot tall wall.

In general, the results of the stability analyses indicated factors of safety for a static condition to be 1.5 or greater and for a pseudo-static condition to be 1.1 or greater. Sections BB and CC were performed to be preliminary proofs of concept for the design of retaining walls. Where a factor of safety of less than acceptable resulted (1.5 for static and 1.1 for psuedo-static), a wedge of high strength backfill was applied to the active zone behind the retaining wall. A summary of slope stability is presented in Appendix E. After retaining wall designs have been prepared, our office should be contacted to re-evaluate the global slope stability.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

Considering the history of the site, borings were planned to advance in the anticipated location of the earthen reservoir damn, behind the damn, fill placed for the building pad, and in the alluvial soils. These areas were explored with the intent of evaluating their consistency.

The location of a remnant earthen reservoir could not be identified based on our geotechnical borings. It is our opinion that the earthen dam was constructed with effort, based on the purpose of the design. If the earthen dam remains in place, further evaluation during remedial grading will determine the need for additional recommendations.

Our exploration program also was performed to provide coverage across the site to evaluate the existing fills and alluvial soils. Consolidation data and moisture density data was obtained throughout the fills. The moisture-density data of the fill was compared to the alluvial data. Based on the blow count data obtained during drilling, the consistency of the fills deeper than 10 feet was relatively consistent with the alluvial soils. Considering the alluvial soils have been surcharged with eleven to twenty feet of fills over a period of 46 to 53 years, the primary settlement has been considered to be complete with negligible secondary settlements anticipated to remain. This also serves as a basis for concluding that the building pad fills deeper than ten feet are generally consistent with the alluvial soils based on blow counts.

The anticipated site development appears feasible from a geotechnical viewpoint provided that the following recommendations, and any subsequent recommendations provided by this firm at a later date, are incorporated into the design and construction phases of development.

5.2 EARTHWORK CONSIDERATIONS

5.2.1 General

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the City of Oceanside, the 2019 California Building Code (CBC), and recommendations contained in this report. The Grading Guidelines included in Appendix F outline general procedures and do not anticipate all site-specific situations. In the event of conflict, the recommendations presented in the text of this report supersede those contained in Appendix F.

5.2.2 Site Clearing and Preparation

In areas of planned grading and improvements, the site should be cleared of existing structures and foundations, vegetation and other deleterious materials and properly disposed off-site. Concrete may be incorporated into fills provided the concrete is processed to remove the reinforcement bar (if present) and incorporated as general fill provided placement of oversized material is in accordance to the general guidelines presented in Appendix F. The concrete should be placed in designated areas, preferably outside building pads. Similarly, existing asphalt and aggregate base may be incorporated into the subbase of proposed interior streets, provided the asphalt is processed into ¾-inch maximum aggregate. Voids resulting from site clearing should be replaced with engineered fill after remedial removals/over-excavations have occurred. Existing underground improvements and utilities not to remain is service should also be removed as part of site development operations. It should be noted that an existing 8 inch vitrified clay pipe (VCP) and 24 inch storm drain underground utility underlies the site. If the utility extends offsite, the utility should be sealed water tight. Alternatively, the utility may be infilled with a low controlled strength material, such as sand-cement slurry consisting of two 94lb bags of cement for each yard of sand slurry.

5.2.3 Remedial Grading (Removals)

Based on the consolidation and moisture-density test results in the upper 10 feet, it is recommended that the upper 10 feet of existing fills should be removed below all areas to receive improvements and engineered fill. The depth of removals should be below existing grades or rough grades, whichever is deeper. Where sedimentary bedrock is encountered, the removal may be reduced to meet overexcavation recommendations. Removal bottoms exposing fills tested to at least 90% relative to ASTM D1557 test procedures is an acceptable bottom to receive engineered fills.

5.2.4 Horizontal Extent of Removals

The horizontal limits of removals should extend to the property line or ascending slope. Where existing fills daylight into ascending slopes, a temporary slope may be projected into the site at a maximum inclination of 1:1 (horizontal:vertical). Where removals are performed for proposed retaining walls supporting existing ascending slopes, the extent of the lateral removal can be terminated at the proposed wall foundation, provided the wall foundation is bearing into competent Santiago Formation or fills.

5.2.5 Preparation of Excavation Bottoms

A representative of this firm should observe the bottom of all excavations. Upon approval, the exposed soils and all soils in areas to receive engineered fill should be scarified to a depth of approximately eight (8) inches, moistened to at least the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D 1557).

5.2.6 Engineered Fill

The on-site soils are generally considered suitable for reuse as engineered fill provided they are free from vegetation, debris, other deleterious material, and rock no larger than six inches. Engineered fill should be placed in loose lifts with a thickness of eight (8) inches or less, moisture conditioned to at least two percent above the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D-1557).

5.2.7 Cut/Fill Building Pad Overexcavation

Site grading may result in portions of a building pad exposing Santiago Formation and engineered fills across the building pad. This condition creates a cut/fill transition. Whenever a cut/fill transition occurs, the cut portion of the pad should be over-excavated a minimum of three feet and replaced with engineered fill.

In pavement areas, removals should extend at least two feet below finish grade, or one foot below finished subgrade, whichever is lower.

5.2.8 Excavation Characteristics

Excavations in the fills and Santiago Formation should be accomplished with medium to heavy-duty earthmoving or excavating equipment in good operating condition.

5.2.9 Shrinkage and Bulking

Several factors will impact earthwork balancing on the site, including artificial fills to be remedially graded and bedrock bulking, trench spoils from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage and bulking are largely dependent upon the degree of compactive effort achieved during construction relative to the pre-construction relative compaction. For planning purposes, a shrinkage factor ranging from 0 to 7 percent may be considered for undocumented fill materials requiring removal and re-compaction. A shrinkage factor of 5 percent may be considered for fill materials requiring removal and re-compaction. For bedrock material, a bulking factor should consider 10 percent.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Stormwater Infiltration

Many factors control infiltration of surface waters into the subsurface, such as consistency of native soils and bedrock, geologic structure, fill consistency, material density differences, and existing groundwater conditions. Due to the location of the proposed stormwater BMP basin in close proximity to existing descending slope, collection of surface waters in this area should be designed with as a filtration basin constructed with an impermeable liner along the sidewalls and bottom.

5.3.2 Foundation Recommendations

Foundation design criteria for a post-tensioned foundation system, in general conformance with the 2019 CBC, are presented below. Following site grading, the site soils are anticipated as having a "low" ($21 \leq EI \leq 50$) to "medium" ($51 \leq EI \leq 90$) expansion potential in accordance with ASTM D 4829. These are minimal recommendations and are not intended to supersede the design by the project structural engineer.

The post-tensioned slabs for the proposed structures should bear entirely in engineered fill soils.

Presented below are post-tension foundation design parameters for the proposed residential structures derived in general conformance with *Design of Post-Tension Slabs-on-Ground, Third Edition* (PTI, 2004) and *Addendum No. 1 to the 3rd Edition of the Design of Post-Tension Slabs-on-Ground* (PTI, 2007). Post-tensioned slabs should be designed in accordance with the 2019 CBC and PTI design methodology.

DESIGN PARAMETERS FOR POST-TENSIONED SLABS		
Foundation Design Parameter	Design Value	
	"Low" Expansive Soils 21≤EI≤50	"Medium" Expansive Soils 51≤EI≤90
Edge Moisture Variation Distance, e_m - Edge Lift (swelling) - Center Lift (shrinkage)	 5.2 ft 9.0 ft	 5.1 ft 9.0 ft
Soil Differential Movement, y_m - Edge Lift (swelling) - Center Lift (shrinkage)	 ≈0.45 in ≈0.20 in	 ≈0.51 in ≈0.22 in
Ext. Perimeter Beam Embedment	12 inches*	18 inches*
Presaturation of Subgrade Soil (Percent of Optimum)	Minimum 110% to a depth of 12 inches	Minimum 120% to a depth of 12 inches

* Required depth of perimeter beam/stiffening rib per structural calculations may govern.
The following assumptions were used to generate e_m and y_m values: Thornthwaite Moisture Index = -20; constant suction value = 3.9pF; post-equilibrium case assumed with wet (swelling) cycle going from 3.9pF to 3.0pF and drying (shrinking) cycle going from 3.9pF to 4.5pF.

We recommend that an allowable soil bearing pressure of 1,500 psf for the design of the post-tensioned systems. This recommended allowable soil bearing pressure maybe increased by one-third for temporary seismic or wind loading.

Based on experience in the area, structural foundations may be designed in accordance with the 2019 CBC to withstand a total settlement of about 1 inch and maximum differential settlement of one-half of the total settlement over a horizontal distance of 40 feet.

The passive earth pressure may be computed as an equivalent fluid having a density of 250 psf per foot of depth, to a maximum earth pressure of 2,500 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.35 may be used with dead load forces. passive pressure and frictional resistance can be combined without reduction.

A grade beam, should be utilized across large entrances. The base of the grade beam should be at the same elevation as the bottom of the adjoining footings.

5.3.3 Foundation Setbacks

Minimum setbacks for all foundations should comply with the 2019 CBC or City of Oceanside requirements, whichever is more stringent. Improvements not conforming to these setbacks are subject to the increased likelihood of excessive lateral movement and/or differential settlement. If large enough, these movements can compromise the integrity of the improvements.

- The outside bottom edge of all footings should be set back a minimum of H/3 (where H is the slope height) from the face of any descending slope. The setback should be at least seven feet and need not exceed 40 feet.

- The bottom of any proposed foundations should be deepened so as to extend below a 1:1 upward projection from the bottom edge of the nearest excavation and the bottom edge of the closest footing.

5.3.4 Miscellaneous Foundation Recommendations

To minimize moisture penetration beneath the slab-on-grade areas, utility trenches should be backfilled with engineered fill, lean concrete or concrete slurry where they intercept the perimeter footing or thickened slab edge.

Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.

5.3.5 Moisture and Vapor Retarding System

A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. As a minimum, the capillary break and moisture retarder should be in conformance with the 2019 CBC Section 1910.1 or, if adopted by the local agency, the current California Green Building Standards Code (CALGreen) Section 4.505.2.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as the result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more puncture resistant than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. It is GeoTek's opinion that a minimum 10 mil thick membrane with joints properly overlapped and sealed should be used. Although, thinner specifically design retarder may be acceptable.

Moisture and vapor retarding systems constructed in compliance with Code minimums provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used. Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e. thickness, composition, strength, and permeance) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation. Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and environmental conditions. Ultimately, the vapor retarding system should be comprised of suitable elements to limited migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e. thickness, composition, strength, and permeability) to achieve the desired performance level.

Moisture retarders can reduce, but not eliminate, moisture vapor rise from the underlying soils up through the slab. Moisture retarder systems should be designed and constructed in accordance with applicable American Concrete Institute, Portland Cement Association, Post-Tensioning Concrete Institute, ASTM and California Building Code requirements and guidelines.

GeoTek recommends that a qualified person, such as the flooring contractor, structural engineer, architect, and/or other experts specializing in moisture control within the building be consulted to evaluate the general and specific moisture and vapor transmission paths and associated potential impact on the proposed construction. That person (or persons) should provide recommendations relative to the slab moisture and vapor retarder systems and for migration of potential adverse impact of moisture vapor transmission on various components of the structures, as deemed appropriate.

In addition, the recommendations in this report and GeoTek's services in general are not intended to address mold prevention; since GeoTek, along with geotechnical consultants in general, do not practice in the area of mold prevention. If specific recommendations addressing potential mold issues are desired, then a professional mold prevention consultant should be contacted.

5.3.6 Soil Corrosivity and Sulfate Content

A full corrosion series was performed by GeoTek's subconsultant Project X Corrosion Engineering on two representative soil samples obtained from the borings. The results indicate a soil water-soluble sulfate content of less than 0.1 percent by weight, which is considered "negligible" per Table 4.2.1 of ACI 318. Based on the test results and ACI 318, no special recommendations for concrete on this project are required for this project due to soil sulfate exposure. Also, the results of saturated resistivity tests suggest that the on-site materials are "highly corrosive" to buried metals (Roberge, P.R., 2005). The laboratory results are presented in Appendix C.

5.4 RETAINING WALL DESIGN AND CONSTRUCTION

5.4.1 General Design Criteria

Recommendations presented herein may apply to typical masonry or concrete vertical retaining walls to a maximum height of up to 15 feet. Additional review and recommendations should be requested for higher walls.

Retaining wall foundations at least 12 inches wide embedded a minimum of 18 inches into engineered fill deposits should be designed using an allowable bearing capacity of 2,500 psf. This value may be increased by 300 pounds per square foot for each additional 12 inches in depth and 100 pounds per square foot for each additional 12 inches in width to a maximum value of 4,500 psf. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g., seismic and wind loads).

The passive earth pressure may be computed as an equivalent fluid having a density of 250 psf per foot of depth, to a maximum earth pressure of 2,500 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.35 may be used with dead load forces. Passive pressure and frictional resistance can be combined without reduction.

Retaining walls, including basement walls, should consider the use of a waterproofing to reduce moisture transmission through the wall facing elements and resulting efflorescence.

5.4.2 Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to 15 feet high. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions such as traffic, structures, seismic events, or adverse geologic conditions.

ACTIVE EARTH PRESSURES		
Surface Slope of Retained Materials (h:v)	Equivalent Fluid Pressure(pcf) Native Soils*	Equivalent Fluid Pressure(pcf) Imported Granular Materials**
Level	45	37
2:1	75	53

* The design pressures assume the native backfill material has an expansion index less than or equal to 50 and a friction angle of at least 29 degrees. Backfill zone includes area between the back of the wall and footing to a plane (1:1 h:v) up from the bottom of the wall foundation to the ground surface.

**The design pressures assume the imported granular backfill material has an expansion index less than or equal to 20 and a friction angle of at least 34 degrees. Backfill zone includes area between the back of the wall and footing to a plane (1:1 h:v) up from the bottom of the wall foundation to the ground surface.

It should be noted that the 2019 CBC requires the inclusion of an additional earthquake-induced lateral force to be considered on retaining walls retaining more than 6 feet of soil. An incremental seismic (dynamic) lateral earth pressure of 15 pcf is recommended for cantilever (unrestrained) walls with level backfill. The point of application of the dynamic load increment is at 1/3H, where H is the retained height. Additional surcharge loads from adjacent structures, pavements, retaining walls, etc. should be incorporated by the structural engineer into the retaining wall design as necessary.

5.4.3 Retaining Wall Backfill and Drainage

Retaining and/or basement wall backfill should have the properties indicated in Section 5.4.2 and should be free of deleterious and/or oversized materials. The wall backfill should also include a minimum one-foot wide section of ¾- to 1-inch clean crushed rock (or approved equivalent). The rock should be placed immediately adjacent to the back of wall and extend up from the back drain to within approximately 12 inches of finish grade. The upper 12 inches should consist of compacted onsite materials. Presence of other materials might necessitate revision to the parameters provided and modification of wall designs. The backfill materials should be placed in lifts no greater than 8-inches in thickness and compacted to a minimum of 90 percent of the soil's maximum dry density as determined by ASTM D 1557 test procedures. Proper surface drainage needs to be provided and maintained. Bracing of the walls during backfilling and compaction may also be necessary.

All earth retention structures should be provided with an adequate pipe and gravel back drain system to reduce the potential for hydrostatic pressure build up. As a minimum, backdrains should consist of a four-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one cubic foot per lineal foot of ¾- to 1-inch clean crushed rock or equivalent, wrapped in filter fabric (Mirafi 140N or approved equivalent). The drain system should be connected to a suitable outlet, as determined by the civil engineer. Drain outlets should be maintained over the life of the project and should not be obstructed or plugged by adjacent improvements. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

As an alternative to the drain, rock and fabric, a pre-manufactured wall drainage product (example: Mira Drain 6000 or approved equivalent) may be used behind the retaining wall. The wall drainage product should extend from the base of the wall to within two (2) feet of the ground surface. The subdrain should be placed in direct contact with the wall drainage product.

Proper surface drainage needs to be provided and maintained. Water should not be allowed to pond behind retaining walls. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

5.4.4 Restrained Retaining Walls

Any retaining walls that will be restrained (e.g. basement walls) prior to placing and compacting backfill material or that have reentrant or male corners, should be designed for an at-rest equivalent fluid pressure of 65 pcf for level native backfill, plus any applicable surcharge loading. For imported granular backfill, an equivalent fluid pressure of 57 pcf should be utilized. For areas of male or reentrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner.

5.4.5 Soil Nail Walls

Soil nail walls may be desired in select areas. One of the primary design constraints with soil nail walls is the availability of property to embed soil nails behind the wall face. In general, it appears soil nail walls may be considered as an option. Our office should be contact if soil nail walls are preferred and soil design parameters are needed.

5.4.6 Mechanically Stabilized Earthen (MSE) Walls

Mechanically stabilized earthen walls may be considered to be a design option in proposed areas where walls are being considered to retain new fill slopes. Based on laboratory analyses, the existing site soils appear to be favorable for MSE wall design. However, selective grading during construction and verified by additional laboratory conformation testing or additional sampling and testing prior to construction is recommended. Preliminarily, the following MSE design parameters may be considered.

Preliminary MSE Wall Design Parameters				
Purpose	Material	Unit Weight	Angle of Internal Friction (degrees)	Apparent Cohesion (psf)
MSE Walls	Select Fill	125	29	0

5.5 PRELIMINARY PAVEMENT DESIGN AND CONSTRUCTION

5.5.1 Asphalt Concrete Pavement Design

Based on laboratory testing, preliminary pavement sections have been designed using a R-value of 25. Traffic Indices (TIs) of 5.0 and 6.0 were utilized, and depending on final guidance from a traffic engineer, may require revision of the following recommendations:
Traffic Index of 5.0:

3-inches asphalt concrete (AC) over
7-inches of aggregate base (AB) over
12-inches of subgrade compacted to 95% of maximum dry density

Traffic Index of 6.0:

4-inches asphalt-concrete (AC) over
8-inches of aggregate base (AB) over
12-inches of subgrade compacted to 95% of maximum dry density

The provided pavement sections are intended as a minimum guideline and final selection of pavement cross section parameters should be made by the project civil engineer, based upon the local laws and ordinates, expected subgrade and pavement response, and desired level of conservatism. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving may result in premature pavement failure. Final pavement design should be checked by testing of soils exposed at subgrade (the upper 12 inches) after final grading has been completed.

Asphalt concrete and aggregate base should conform to current Caltrans Standard Specifications Section 39 and 26-1.02, respectively. As an alternative, asphalt concrete can conform to Section 203-6 of the current Standard Specifications for Public Work (Green Book). Crushed aggregate base or crushed miscellaneous base can conform to Section 200-2.2 and 200-2.4 of the Green

Book, respectively. Pavement base should be compacted to at least 95 percent of the ASTM D 1557 laboratory maximum dry density (modified proctor).

All pavement installation, including preparation and compaction of subgrade, compaction of base material, placement and rolling of asphaltic concrete, should be done in accordance with the City of Oceanside specifications, and under the observation and testing of GeoTek and a City inspector, if necessary. Jurisdictional minimum compaction requirements in excess of the aforementioned minimums may govern.

5.6 CONCRETE FLATWORK

5.6.1 Exterior Concrete Slabs, Sidewalks and Driveways

Exterior concrete slabs, sidewalks and driveways should be designed using a four-inch minimum thickness. Some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices typically utilized in construction.

Sidewalks and driveways may be under the jurisdiction of the governing agency. If so, jurisdictional design and construction criteria would apply, if more restrictive than the recommendations presented in this report.

Subgrade soils should be pre-moistened prior to placing concrete. The subgrade soils below exterior slabs, sidewalks, driveways, etc. should be pre-saturated to a minimum of 110 percent (for "low" expansivity) of the optimum moisture content to a depth of 12 inches.

All concrete installation, including preparation and compaction of subgrade, should be done in accordance with the City of Oceanside specifications, and under the observation and testing of GeoTek, Inc. and a City inspector, if necessary.

5.6.2 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are "hairline" to more than 1/8 inch in width. Most cracks in concrete, while unsightly, do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete undergoes chemical processes that are dependent on a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek, Inc. suggests that control joints be placed in two directions and located a distance apart approximately equal to 24 to 36 times the slab thickness.

6. POST CONSTRUCTION CONSIDERATIONS

6.1 LANDSCAPE MAINTENANCE AND PLANTING

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. Soils should be maintained in solid to semi-solid state as indicated by the material's Atterberg limits. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. An abatement program to control ground-burrowing rodents should be implemented and maintained. Burrowing rodents can decrease the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundations. This type of landscaping should be avoided.

6.2 DRAINAGE

Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground adjacent to the footings. Paved areas should be sloped at two percent away from the structure. Downspouts should discharge onto paved surfaces sloping away from the structure or into a closed pipe system which outfalls to a street gutter or directly to a storm drain system. Pad drainage should be directed toward approved areas and not be blocked by other improvements. Additional recommendations can be found in Section 1804A of the California Building Code.

It is the owner's responsibility to maintain and clean drainage devices. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

6.3 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

It is recommended that specifications and foundation plans be reviewed by GeoTek prior to construction to check for conformance with the recommendations of this report. It is also recommended that GeoTek, Inc. representatives be present during site grading and foundation construction to observe and document proper implementation of the geotechnical recommendations. The owner/developer should verify that GeoTek, Inc. representatives perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of on-site and import materials for fill placement and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement, including utility trench backfill. Also, perform field density testing of the fill materials.
- Observe and probe foundation excavations to confirm suitability of bearing materials with respect to density.

If requested, a construction observation and compaction report can be provided by GeoTek, Inc. which can comply with the requirements of the governmental agencies having jurisdiction over the project. GeoTek recommends that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

7. LIMITATIONS

The scope of GeoTek's evaluation is limited to the area explored that is shown on Figure 2a and Figure 2b. This evaluation does not and should in no way be construed to encompass any areas beyond the specific area of proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope of services for this evaluation is based on GeoTek's understanding of the project and the client's needs, GeoTek's proposal (Proposal No. P-0901621-SD) dated September 23, 2021 and geotechnical engineering standards normally used on similar projects in this region.

The earth materials observed on the project site appear to be representative of the area; however, soil and bedrock may vary in character between excavations and natural outcrops or conditions exposed during site construction. Site conditions may vary due to seasonal changes or other factors. GeoTek, Inc. assumes no responsibility or liability for work, testing or recommendations performed or provided by others.

Since GeoTek's recommendations are based on a limited subsurface evaluation and the site conditions observed and encountered, GeoTek's conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty is expressed or implied. Standards of practice are subject to change with time.

8. SELECTED REFERENCES

American Society of Civil Engineers (ASCE), 2016, "Minimum Design Loads for Buildings and Other Structures," ASCE/SEI 7-16.

California Code of Regulations, Title 24, 2019 "California Building Code," 2 volumes.

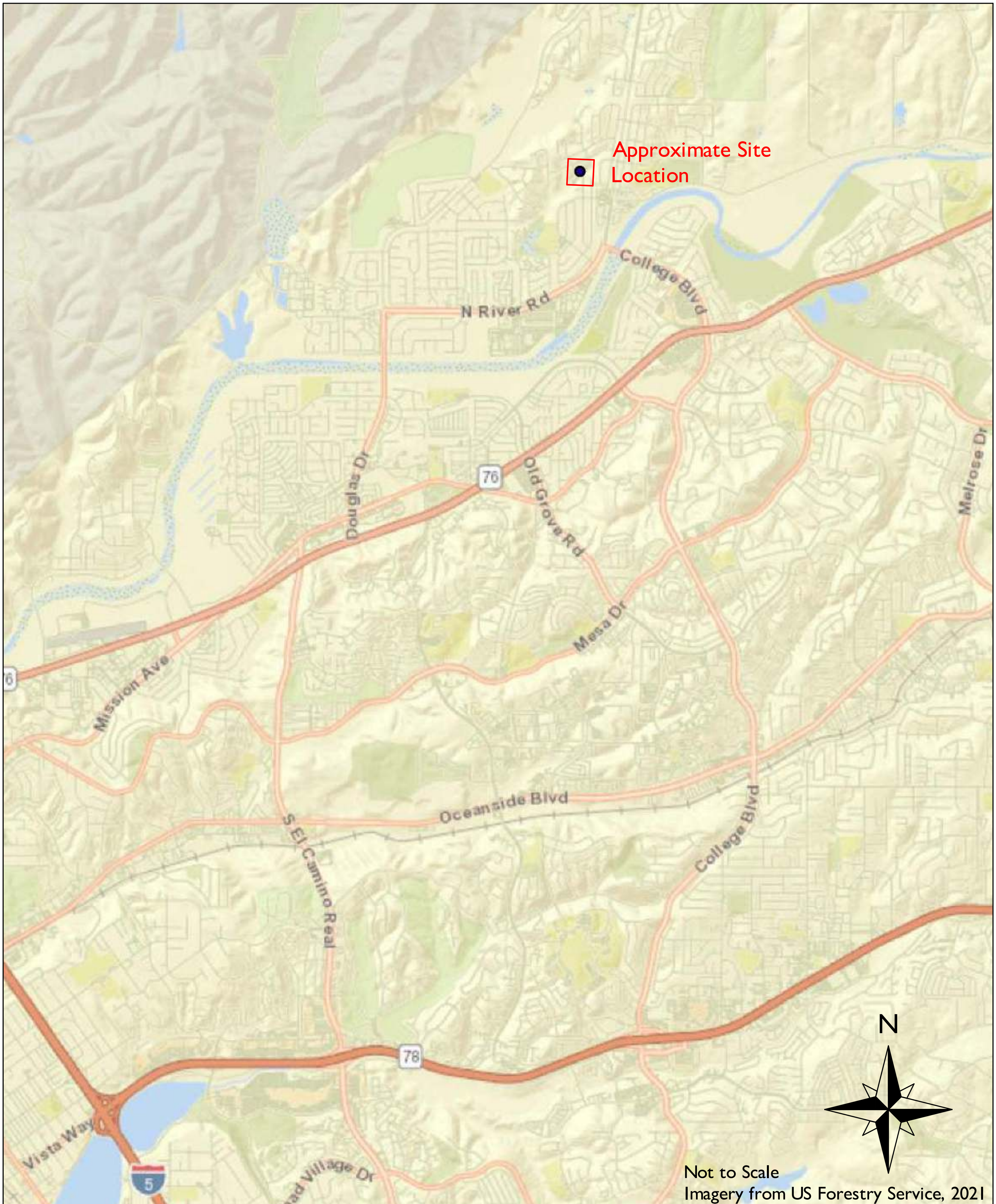
California Geological Survey, 2008, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," Special Publication 117A.

GeoTek, Inc., In-house proprietary information.

Kennedy, M.P., and Tan, S.S., 2007, "Geologic Map of the Oceanside 30x60-minute Quadrangle, California," California Geological Survey, Regional Geologic Map No. 2, map scale 1:100,000.

MLC Holdings, Inc., 2021, "Pacifica Elementary, Oceanside, California", Meritage Homes, dated July 14, 2021.

Structural Engineers Association of California/California Office of Statewide Health Planning and Development (SEOC/OSHPD), 2020, Seismic Design Maps web interface, at https://seismicmaps.org



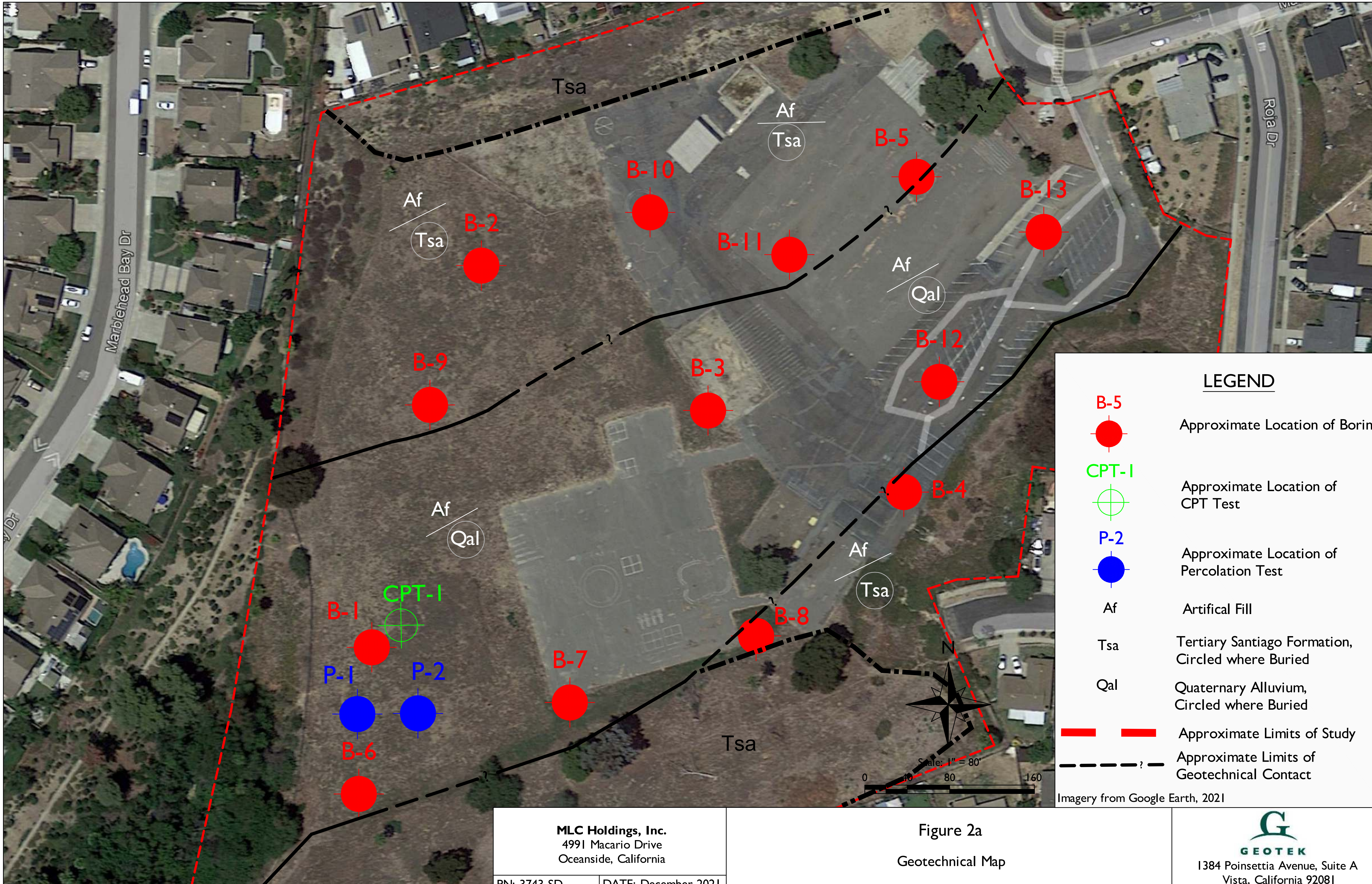
MLC Holdings, Inc.
4991 Macario Drive
Oceanside, California

PN: 3743-SD | DATE: November 2021

Figure 1

Site Location Map

GEOTEK
1384 Poinsettia Avenue, Suite A
Vista, California 92081



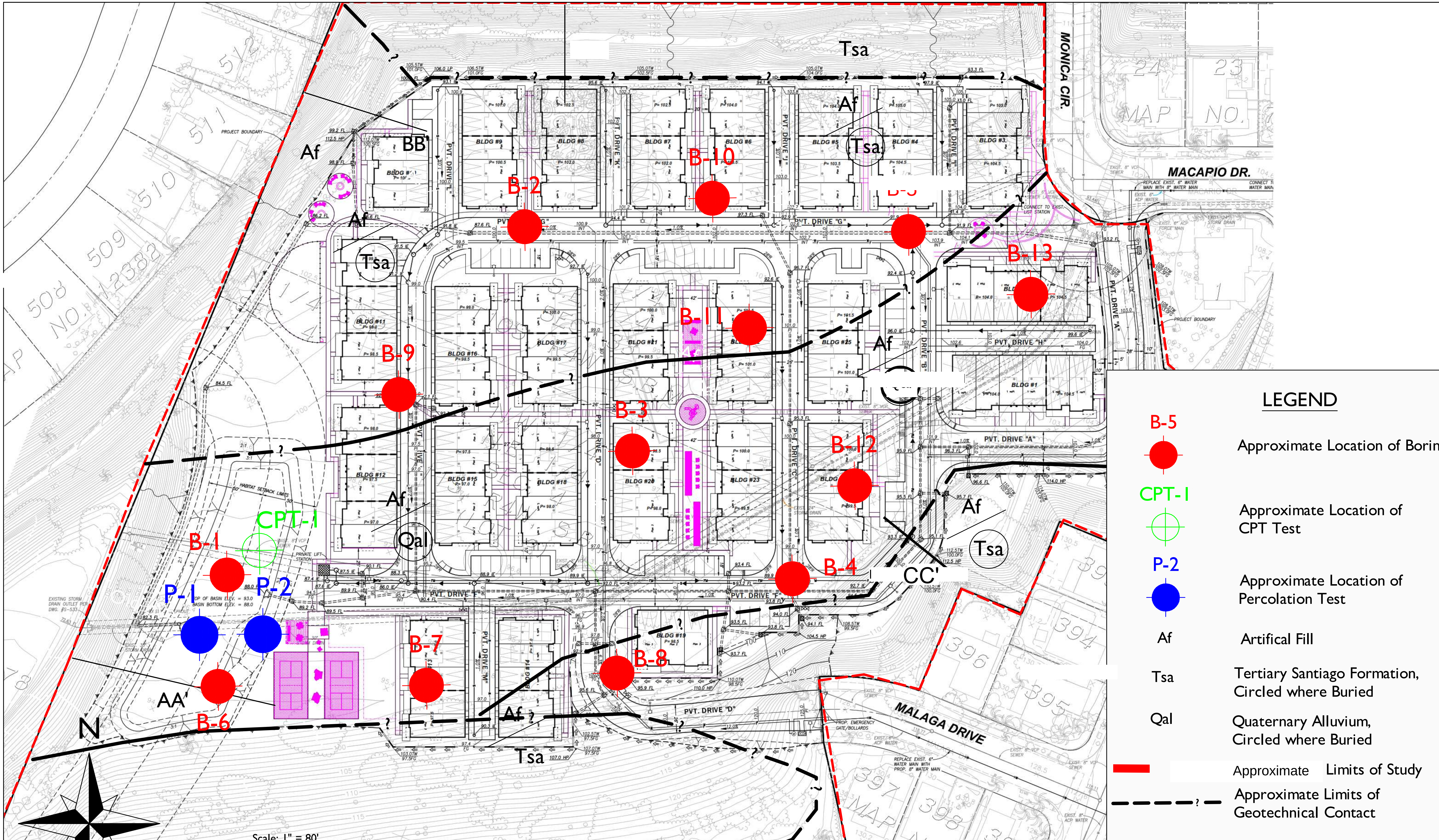
MLC Holdings, Inc.
4991 Macario Drive
Oceanside, California

PN: 3743-SD | DATE: December 2021

Figure 2a

Geotechnical Map

GEOTEK
1384 Poinsettia Avenue, Suite A
Vista, California 92081



MLC Holdings, Inc.
4991 Macario Drive
Oceanside, California

PN: 3743-SD | DATE: December 2021

Figure 2b

Geotechnical Map

GEOTEK
1384 Poinsettia Avenue, Suite A
Vista, California 92081

APPENDIX A

EXPLORATORY LOGS

A - FIELD TESTING AND SAMPLING PROCEDURES

Bulk Samples (Large)
These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

Bulk Samples (Small)
These are plastic bag samples which are normally airtight and contain less than 5 pounds in weight of earth materials collected from the field by means of hand digging or exploratory cuttings. These samples are primarily used for determining natural moisture content and classification indices.

B – EXPLORATORY LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the logs of borings:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
………..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
━━━	Thick solid line denotes end of the boring

(Additional denotations and symbols are provided on the log of Explorations)

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Miguel & Brian
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Yeti M10
LOCATION:	See Geotechnical Map	**ELEVATION:**	94 feet	**DATE:**	10/5/2021

BORING NO.: B-1

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
					Artifical Fill (Af) Silty fine to medium SAND, yellow brown			
	Ring	10 19 25	R-1 BB-1	SM	Silty fine to medium SAND, yellow brown with brown/white/brown-gray inclusions, dry, medium dense			
5	Ring	8 17 23	R-2	SM SM/SC	Silty fine to medium SAND, yellow brown with brown/white/brown-gray intermixed, dry, medium dense Silty fine to coarse SAND with clay, red brown with brown/white/yellow-gray, damp, medium dense, ~5% clay, medium plasticity	11.4	114.8	CO
	Ring	10 10 14	R-3	SC	Clayey fine to medium SAND, dark brown with red/white/yellow intermixed, slightly moist, medium dense, ~10% clay	7.9	109.7	
10	Ring	7 8 13	R-4	SC SM	Clayey fine to medium SAND, dark brown with red/white/yellow intermixed, slightly moist, medium dense, ~10% clay Bottom 6" of sampler-Silty fine to medium SAND, yellow brown with white/gray, brown moist, medium dense	9.5	113.2	
	Ring	4 6 10	R-5	SC	Clayey fine to medium SAND, red brown to brown with mixed colors, moist, loose, ~20-25% clay	15.2	113.5	CO
15	Ring	6 13 21	R-6	SC SC	Clayey fine to medium SAND, red brown to brown with mixed colors, moist, medium dense, ~20-25% clay Bottom 4" of sampler- Clayey fine to coarse SAND, gray, moist, medium dense, ~20-25% clay	12.4	119.7	
	Ring	6 11 12	R-7	SC	Clayey fine to coarse SAND, gray with reddish-white, brown, yellow intermixed, moist, medium dense, ~20-30% clay	13.2	108	CO
20	Ring	6 9 12	R-8	SC	Clayey fine to coarse SAND, gray with reddish-white, brown, yellow intermixed, moist, medium dense, ~20-30% clay	13.4	113.8	
				SP	**Quaternary Alluvium (Qal)** Bottom 4" of sampler- Fine to coarse SAND with few clay, gray-black to light gray, moist, medium dense			
25	Ring	5 5 13	R-9	SP	Fine to coarse SAND with few clay, dark gray to light gray, moist, loose to medium dense, root mottling at top of sampler, tap roots throughout	15.1	103.9	
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Miguel & Brian
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Yeti M10
LOCATION:	See Geotechnical Map	**ELEVATION:**	94 feet	**DATE:**	10/5/2021

BORING NO.: B-1

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
	Ring	7 11 19	R-10	SP/SC	Clayey sand to fine to coarse SAND, dark gray, very moist to wet, some visible water at top of sampler, medium dense, many organics, ~10-15% clay	15.3	117.9	
35	Ring	9 13 19	R-11	SP/SC	Clayey sand to fine to coarse SAND, dark gray, very moist to wet, some visible water at top of sampler, medium dense, many organics, ~10-15% clay	16.5	115.8	
40	SPT	6 7 9	S-1	SC	Clayey fine to coarse SAND, red brown to light brown, moist, medium dense, low recovery			
45	SPT	- - 14	S-2	Water Table SC	Clayey fine to medium SAND to sandy clay, light brown, saturated, loose, ~40% clay, highly plastic			
					HOLE TERMINIATED AT 46.5 FEET Groundwater encountered at 45 feet Backfilled with soil cuttings			
50								
55								
60								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Miguel & Brian
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Yeti M10
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	10/5/2021

BORING NO.: B-2

Depth (ft)	Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Others
	Large Bulk		BB-1		**Artifical Fill (Af)** Cuttings silty fine to medium SAND, yellow brown with green, brown, white inclusions			
					Tertiary Santiago Formation (Tsa)			
5	Ring	26 50/5	R-1		Fine to coarse SANDSTONE, white with orange oxidation, dry, dense to very dense, jointed, some silt, ~10%			
10	SPT	13 22 30	S-1		Fine to coarse SANDSTONE, white with orange oxidation, dry, dense to very dense, jointed, some silt, ~10%			
					HOLE TERMINATED AT 11.5 FEET No groundwater encountered Backfilled with soil cuttings			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits | EI = Expansion Index | SA = Sieve Analysis | RV = R-Value Test
SR = Sulfate/Resisitivity Test | SH = Shear Test | CO = Consolidation test | MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Miguel & Brian
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Yeti M10
LOCATION:	See Geotechnical Map	**ELEVATION:**	95 feet	**DATE:**	10/5/2021

BORING NO.: B-3

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
	Large Bulk		BB-1		**Artifical Fill (Af)**			
5	Ring	12 20 26	R-1	SM	Silty medium to coarse SAND, few gravels, red brown with yellow, dark brown, gray gravels, dry, medium dense to dense Bottom 6" of sampler- Silty fine to medium SAND with clay, yellow brown with white, brown, grey inclusions, slightly moist, medium dense	5.2	112.3	
10	Ring	9 11 10	R-2	SC	Clayey medium to coarse SAND, yellow brown with white, brown, gray inclusions, moist, loose	16.6	105.5	CO
					Quaternary Alluvium (Qal) Cuttings become gray clayey SAND			
15	Ring	6 24 29	R-3	SM	Silty fine to medium SAND with few clay, dark gray to light brownish gray, very moist to moist, medium dense to dense, ~10% clay top sampler, no clay bottom sampler	12.9	105.3	CO
20	Ring	28	R-4	SM	Silty fine to medium SAND with clay, dark to light gray, moist, medium dense			
		50/4			**Tertiary Santiago Formation (Tsa)** Bottom sampler - Fine to medium SANDSTONE, white with yellow laminations, slightly moist, very dense			
	SPT	15 25 32	S-1		Fine to medium SANDSTONE, white with some yellow laminations, very moist, dense			
25					**HOLE TERMINATED AT 24.5 FEET** No groundwater encountered Backfilled with soil cuttings			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Miguel & Brian
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Yeti M10
LOCATION:	See Geotechnical Map	**ELEVATION:**	95 feet	**DATE:**	10/5/2021

BORING NO.: B-4

Depth (ft)	Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Others
					2" Asphalt over 3" Base			
					Artificial Fill (Af)			
5		6 15 25	R-1	SC	Clayey SAND with gravel, blackish-gray with yellow, white, brown, reddish inclusions, slightly moist, medium dense, coarse gravels in top sampler, "manure odor"	11.4	114.8	
10		5 13 16	R-2	SM	Silty fine to medium SAND, white with yellowish gray mottling, slightly moist, medium dense	17	101.7	CO
15		6 10 13	R-3	SM/SC	Silty fine to medium SAND with gravel, white with yellowish gray mottling, slighly moist, medium dense, interlaminated black clayey lenses, ~10% clay	15.8	107.2	CO
20		9 12 16	R-4	SC	Clayey fine to medium SAND, yellowish brown mottled with black and gray lenses, moist, loose to medium dense, ~10% clay	16.3	106.9	
25		12	R-5	SC	Clayey fine to medium SAND, yellowish brown, moist, medium dense			
		22 32			**Tertiary Santiago Formation (Tsa)** Weathered SANDSTONE, white with yellowish orange, moist, dense			
					HOLE TERMINATED AT 26.5 FEET			
					No groundwater encountered Backfilled with soil cuttings			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Miguel & Brian
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Yeti M10
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	10/5/2021

BORING NO.: B-5

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
	Large Bulk		BB-1	SM	**A/C**- Asphalt 3" / Subgrade **Artificial Fill (Af)** Cuttings yellow silty SAND			
5	Ring	5 8 13	R-1	SC	Clayey SAND with gravel, black to brown with some yellow mottling, moist, loose to medium dense, ~35% clay	18.9	106.2	
		14		SC	Clayey SAND with gravel, black to brown with some yellow mottling, moist, loose to medium dense, ~35% clay			
10	Ring	50/4	R-2		**Tertiary Santiago Formation (Tsa)** Bottom half of sampler- Fine to medium weathered SANDSTONE, yellow brown to reddish white, moist, dense to very dense	10.9	106.9	
	SPT	21 34 45	S-1		Fine to medium weathered SANDSTONE, yellow brown to reddish white, moist, dense to very dense			
15					**HOLE TERMINATED AT 14 FEET** No groundwater encountered Backfilled with soil cuttings			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:				
	AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
	SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Brian and Carlos
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Sabercat MTXD
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	11/4/2021

BORING NO.: B-6

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Artificial Fill (Af)			
				SM	silty fine to medium SAND, yellow to light brown, dry			
5	Ring / Large Bulk	4 10 11	R-1	SM	Silty fine to medium SAND, yellow brown with brown, white, and gray inclusions, dry to damp, medium dense, poorly graded	10.5	97	
			BB-1					
	SPT	4 5 4	S-1	SM	Silty fine to medium SAND, yellow brown with brown, white, and gray inclusions, dry to damp, loose, poorly graded			
10	Ring	6 13	R-2	SM	Top of sampler - Silty fine to medium SAND, yellow brown with brown, white, and gray inclusions, dry to damp, medium dense, poorly graded	10.8	117.2	
		21		SP	**Quaternary Alluvium (Qal)** Bottom of sampler - medium to coarse SAND with clay, some white caliche, red brown with few white, moist, medium dense			
	SPT	3 4 5	S-2	SC	Clayey fine to medium SAND, many charcoal, black-gray to red brown, damp to slightly moist, loose, burnt, some organics			
15					**HOLE TERMINATED AT 14 FEET** No groundwater encountered Backfilled with soil cuttings			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Brian and Carlos
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Sabercat MTXD
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	11/4/2021

BORING NO.: B-7

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Artificial Fill (Af)			
5	Ring	3 9 10	R-1	SC	Clayey SAND with silt, dark brown with yellowish gray inclusions, very damp, loose	11.7	114.9	
	Ring	5 6 5	R-2	SC	Clayey SAND with silt, dark brown to light brown with red mottling, some black lenses, slightly moist, loose	16	102.7	
10	Ring	5 5 8	R-3	SM	Silty SAND with clay, light yellow brown with blak clay sand lenses, some reddish mottling, moist, loose	15.6	111.2	
					Quaternary Alluvium (Qal)			
15	Ring	4 11 16	R-4	SM/SP	Silty fine-medium SAND, black-gray, moist, loose to medium dense, roots, very poorly graded	10.7	112.3	
20	Ring	3 5 7	R-5	SM/SP	Silty fine-medium SAND, black-gray, moist, loose to medium dense, roots, very poorly graded	12.6	106.2	
					HOLE TERMINATED AT 20 FEET No groundwater encountered Backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Brian and Carlos
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Sabercat MTXD
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	11/4/2021

BORING NO.: B-8

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Artificial Fill (Af)			
				SM	Cuttings silty SAND with clay, yellow brown to red brown			
5	Ring	6 8 11	R-1	SM	Silty fine to medium SAND, yellow brown with reddish brown, white, and gray inclusions, slightly moist, medium desne	17.2	96.2	
10	Ring	3 4 5	R-2	SM	Silty fine to medium SAND, yellow brown with white and gray inclusions, slightly moist, loose, poorly graded	15.4	97	
15	Ring	4 11 18	R-3	SC	Clayey fine SAND, dark brown to gray, some white to reddish inclusions, moist, loose to medium dense, poorly graded	19.9	106.6	
					cuttings turn black clayey sand, moist			
20	Ring	5 8 12	R-4	SC	Clayey fine to medium SAND with silt, yellow brown with white to red inclusions, damp, loose to medium dense, poorly graded	14.4	115	
25	Ring	19 43 50/4	R-5		**Tertiary Santiago Formation (Tsa)** Fine to medium SANDSTONE, yellow brown, moist, medium dense to dense	13.8	107.8	
					HOLE TERMINATED AT 26.5 FEET			
					No groundwater encountered Backfilled with soil cuttings			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits | EI = Expansion Index | SA = Sieve Analysis | RV = R-Value Test
SR = Sulfate/Resisitivity Test | SH = Shear Test | CO = Consolidation test | MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Brian and Carlos
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Sabercat MTXD
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	11/4/2021

BORING NO.: B-9

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Artificial Fill (Af)			
5	Ring	8 13 12	R-1	SM	Silty fine to medium SAND, yellow brown with brown, gray, and white inclusions, damp, medium dense	6	105.3	
10	Ring	5 6 15	R-2	SM	Silty fine to medium SAND, yellow brown with brown, gray, and white inclusions, moist, medium dense to loose	10.8	108.7	
	Ring	19 40 50/5	R-3		**Tertiary Santiago Formation (Tsa)** Fine to medium SANDSTONE, yellow brown to light brown, moist, dense	10.9	109.3	
15					**HOLE TERMINATED AT 14 FEET** No groundwater encountered Backfilled with soil cuttings			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Brian and Carlos
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Sabercat MTXD
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	11/4/2021

BORING NO.: B-10

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
					2" asphalt over 3" base			
					Artificial Fill (Af)			
5	Ring	4 11 23	R-1	SM	Silty fine to medium SAND, yellow-brown with white to gray inclusions, damp to slightly moist, medium dense	16.6	106.1	
	Large Bulk		BB-1					
					Tertiary Santiago Formation (Tsa)			
10	Ring	12 37 50/4	R-2		Fine to medium SANDSTONE, yellow with red-brown mottling, moist, dense	16.1	115.3	
					HOLE TERMINATED AT 11.5 FEET			
					No groundwater encountered Backfilled with soil cuttings			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Brian and Carlos
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Sabercat MTXD
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	11/4/2021

BORING NO.: B-11

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
					2" asphalt over 2" base **Artificial Fill (Af)**			
5	Ring / Large Bulk	6 8 10	R-1	SM	Silty fine to medium SAND with clay, yellow brown with red, white, and green inclusions, damp to slightly moist, loose	15.3	105.4	
				BB-1				
10	Ring	6 16	R-2A	SC	Top of sampler - clayey SAND with silt, brown with yellow, red, and gray inclusions, moist, loose to medium dense	16.5	108.2	
		45	R-2B/ S-1		**Tertiary Santiago Formation (Tsa)** Bottom of sampler - fine SANDSTONE, white to light brown, moist, dense	11.9	104.7	
					HOLE TERMINATED AT 11.5 FEET No groundwater encountered Backfilled with soil cuttings			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test
SR = Sulfate/Resisitivity Test SH = Shear Test CO = Consolidation test MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Brian and Carlos
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Sabercat MTXD
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	11/4/2021

BORING NO.: B-12

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					2" asphalt over 3" base **Artificial Fill (Af)**			
5	Ring	6 10 15	R-1	SM	Silty fine to medium SAND with clay, dark brown with red-white inclusions, moist, loose to medium dense	14.4	113.5	
	Large Bulk		BB-1					
10	Ring	6 8 13	R-2	SM	Silty fine to medium SAND, yellow brown with white, dark brown, red, and gray inclusions, moist to very moist, loose to medium dense	19.6	104.6	
15	Ring	5 8 12	R-3	SM	Top of smpler - Silty fine to medium SAND, yellow brown with white, dark brown, red, and gray inclusions, moist to very moist, loose to medium dense	17.2	105.1	
				SP/SC	**Quaternary Alluvium (Qal)** Bottom of sampler - clayey fine SAND, grayish black, moist, loose to medium dense, many roots, organic odor			
20	Ring	4 7 15	R-4	SP/SC	Clayey fine SAND, gray-black, moist, loose to medium dense, many roots, organic odor	13.4	115.9	
25					**HOLE TERMINATED AT 21.5 FEET** No groundwater encountered Backfilled with soil cuttings			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits | EI = Expansion Index | SA = Sieve Analysis | RV = R-Value Test
SR = Sulfate/Resisitivity Test | SH = Shear Test | CO = Consolidation test | MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	MLC Holdings	**DRILLER:**	Pacific Drilling	**LOGGED BY:**	MSB
PROJECT NAME:	4991 Macario Drive	**DRILL METHOD:**	8" HSA 3.75" ID	**OPERATOR:**	Brian and Carlos
PROJECT NO.:	3743-SD	**HAMMER:**	140lbs/30in	**RIG TYPE:**	Sabercat MTXD
LOCATION:	See Geotechnical Map	**ELEVATION:**	99 feet	**DATE:**	11/4/2021

BORING NO.: B-13

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
					Artificial Fill (Af)			
5	Ring	5 10 13	R-1	SM	Silty fine to medium SAND, light brown to yellow brown with gray, and orange inclusions, damp, medium dense	14.2	103.4	
	Large Bulk		BB-1					
10	Ring	6 8 11	R-2	SM	Silty fine to medium SAND, yellow brown to light brown with red, white, gray inclusions, moist, medium dense	16.3	108.2	
15	Ring	3 5 11	R-3	SM/SC	Top of sampler - Silty fine to medium SAND, yellow brown to light brown with red, white, and gray inclusions, moist, loose. Gray clay SAND near mid sampler	12.8	110	
					Quaternary Alluvium (Qal)			
				SM/SP	Bottom of sampler - silty SAND, grayish black, moist, loose, roots, organic odor			
					HOLE TERMINATED AT 16.5 FEET No groundwater encountered Backfilled with soil cuttings			
20								
25								
30								

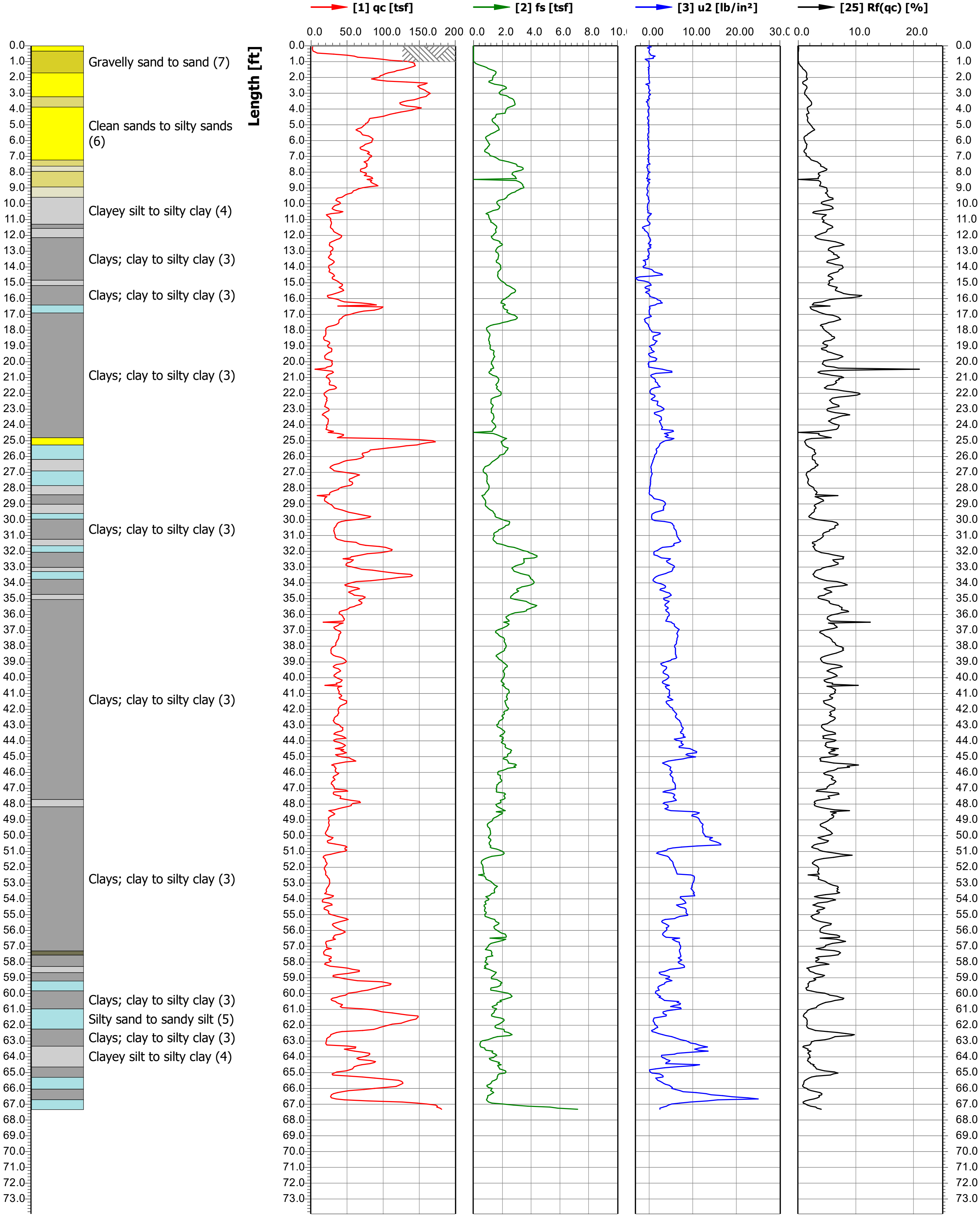
LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	CO = Consolidation test	MD = Maximum Density

Cone no: 5238	Location:	Position: X: 0.00 ft Y: 0.00 ft	Ground level: 0.00	Test no: CPT #1
Tip/sleeve area [cm²]: 10 / 150	Project ID:	Client: Geotek	Date: 10/5/2021	Standard / class: /
Area factor a/b: 0.838 / 0.000	Project: 4991 Macario, Oceanside		Page: 1/1	Scale: 1:100
Pore pressure: U2			Coordinate system:	



APPENDIX B

PERCOLATION TESTS AND ANALYSIS

GEOTEK

PERCOLATION DATA SHEET

Project: 4991 Macario Drive **Job No.:** 3743-SD.

Test Hole No.: P-1 **Tested By:** MSB, **Date:** 10/6/21.

Depth of Hole As Drilled: 60" **Before Test:** 60" **After Test:** 60"

Reading No.	Time	Time Interval (Min)	Total Depth of Hole (Inches)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ In Water Level (Inches)		Comments
1	9:40	30	60	15	19.5	4.5		
2	10:15	30	60	12	16.25	4.25		
3	10:50	30	60	12	16	4		
4	11:25	30	60	12	15.75	3.75		
5	12:00	30	60	12	15	3		
6	12:35	60	60	12	17.75	5.75		
7	12:35	60	60	12	18	6		
8	14:40	60	60	12	17.75	5.75		
9	15:45	60	60	12	17.5	5.5		

Client:	**MLC Holdings, Inc.**
Project:	**4991 Macario Drive Residential Project**
Project No:	**3743-SD**
Date:	**10/6/2021**

Boring No. **P-1**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	30
Final Depth to Water, D_F =	17.50
Test Hole Radius, r =	2.00
Initial Depth to Water, D_O =	12
Total Test Hole Depth, D_T =	60

Equation -

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

$H_O = D_T - D_O$ =	48.00
$H_F = D_T - D_F$ =	42.50
$\Delta H = \Delta D = H_O - H_F$ =	5.50
Havg = $(H_O+H_F)/2$ =	45.25

I_t = 0.24 **Inches per Hour**

GEOTEK

PERCOLATION DATA SHEET

Project: 4991 Macario Drive **Job No.:** 3743-SD.

Test Hole No.: P-2 **Tested By:** MSB, **Date:** 10/6/21.

Depth of Hole As Drilled: 60" **Before Test:** 60" **After Test:** 60".

Reading No.	Time	Time Interval (Min)	Total Depth of Hole (Inches)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ In Water Level (Inches)		Comments
1	9:41	30	60	12.75	15	0		
2	10:16	30	60	12	13.25	1.25		
3	10:51	30	60	12	13.25	1.25		
4	11:26	30	60	12	13.5	1.5		
5	11:26	30	60	12	13.5	1.5		
6	12:31	60	60	12	14.75	2.75		
7	13:36	60	60	12	13.5	1.5		
8	14:41	60	60	12	13.75	1.75		
9	15:46	60	60	12	13.5	1.5		

Client:	**MLC Holdings, Inc.**
Project:	**4991 Macario Drive Residential Project**
Project No:	**3743-SD**
Date:	**10/6/2021**

Boring No. **P-2**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	30
Final Depth to Water, D_F =	13.50
Test Hole Radius, r =	2.00
Initial Depth to Water, D_O =	12
Total Test Hole Depth, D_T =	60

Equation - $I_t = \dfrac{\Delta H\,(60r)}{\Delta t\,(r+2H_{avg})}$

$H_O = D_T - D_O$ =	48.00
$H_F = D_T - D_F$ =	46.50
$\Delta H = \Delta D = H_O - H_F$ =	1.50
Havg = $(H_O+H_F)/2$ =	47.25

I_t = 0.06 **Inches per Hour**

GEOTEK

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Categorization of Infiltration Feasibility Condition		**Worksheet C.4-1**	
Part 1 - Full Infiltration Feasibility Screening Criteria **Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?**			
Criteria	Screening Question	**Yes**	**No**
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X
Provide basis: Based on in-situ field percolation testing and infiltration analysis, the site underlying soils infiltrate at a rate less than 0.5 inches per hour. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X
Provide basis: Not applicable. Answer to question number 1 expresses rates are below 0.5 inches per hour. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Worksheet C.4-1 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, stormwater pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: Not applicable. Answer to question number 1 expresses rates are below 0.5 inches per hour. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: Not applicable. Answer to question number 1 expresses rates are below 0.5 inches per hour. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result*	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		No

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Worksheet C.4-1 Page 3 of 4			
Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria **Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?**			
Criteria	Screening Question	**Yes**	**No**
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	
Provide basis: Based on in-situ field percolation testing and infiltration analysis, the site underlying soils infiltrate rate was measured at 0.06 and 0.24 inches per hour. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X
Provide basis: The proposed plan consists of a stormwater quality basin in the western portion of the site at the top of an approximate 20 foot tall descending fill slope. It is our understanding, based on conversations with the project's civil engineer, the basin is proposed at a fixed location. Based on the proposed location of the stormwater quality basin, designed infiltration of surface water increases adverse geotechnical slope stability hazards. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 4 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>7</td><td>Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, stormwater pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

Not applicable. Answer to question number 6 is no.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>8</td><td>Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

Not applicable. Answer to question number 6 is no.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration.

If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.</td><td>No
Infiltration</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

APPENDIX C

LABORATORY TEST RESULTS

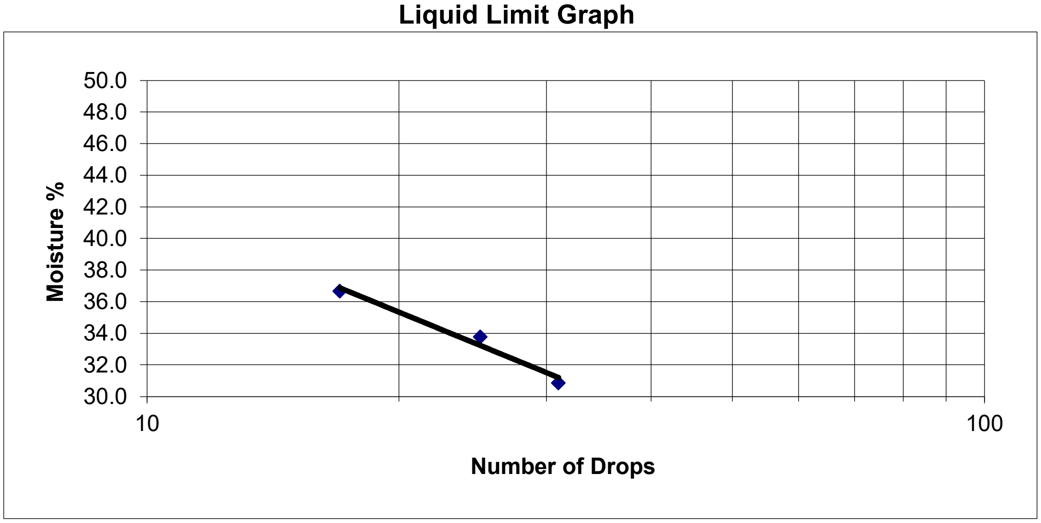
GEOTEK

ATTERBERG LIMITS DATA

Field Classification		Job No.	3743-SD
Sample Number		Client	MLC Holdings
Sample Type		Project	4991 Macario Drive
Location	B-1 @ 2.5-15 feet		
Tested by:	RL		

	Plastic Limit			Liquid Limit		
Number of Blows				31	25	17
Wt. of Dish + Wet Soil	36.74	36.42		16.12	16.16	17.33
Wt. of Dish + Dry Soil	35.90	35.57		13.76	13.63	14.33
Wt. of Moisture	0.84	0.85		2.36	2.53	3.00
Wt. of Dish	30.71	30.37		6.11	6.14	6.15
Wt. of Dry Soil	5.19	5.20		7.65	7.49	8.18
Moisture Content %	16.2	16.3		30.8	33.8	36.7

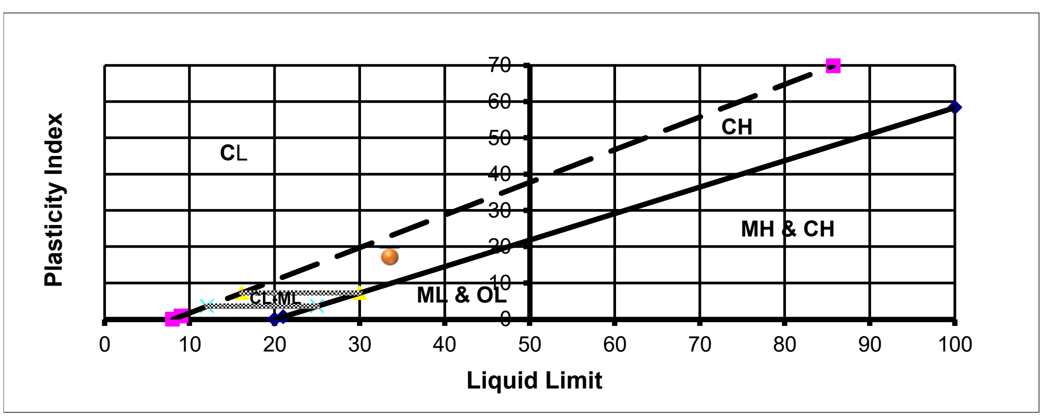
Liquid Limit Graph



Liquid Limit
33

Plastic Limit
16

Plasticity Index
17



GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	MLC Holdings	***Tested/ Checked By:***	ADLC Lab No Corona
Project Number:	3743-SD	***Date Tested:***	10/27/2021
Project Location:	4991 Macario Drive	***Sample Source:***	B-1 @ 2.5 - 15 feet
		Sample Description:	

Ring #:______ Ring Dia. : 4.01" Ring Ht.:1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	758.4
B	Weight of ring (gm)	362.0
C	Net weight of sample (gm)	**396.4**
D	Wet Density, lb / ft3 (C*0.3016)	**119.6**
E	Dry Density, lb / ft3 (D/1.F)	**109.0**

SATURATION DETERMINATION

F	Moisture Content, %	9.7
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20 °C, (pcf)	**62.4**
I	% Saturation	**48.0**

READINGS

DATE	TIME	READING	
10/27/2021		0.1220	Initial
10/27/2021		0.1222	10 min/Dry
10/28/2021		0.1810	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
800.2	**20.2**

EXPANSION INDEX = 59

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	MLC Holdings	***Tested/ Checked By:***	ADLC Lab No Corona
Project Number:	3743-SD	***Date Tested:***	10/27/2021
Project Location:	4991 Macario Drive	***Sample Source:***	B-5 @ 0-10 feet
		Sample Description:	

Ring #:______ Ring Dia. : 4.01" Ring Ht.:1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	771.4
B	Weight of ring (gm)	363.0
C	Net weight of sample (gm)	**408.4**
D	Wet Density, lb / ft3 (C*0.3016)	**123.2**
E	Dry Density, lb / ft3 (D/1.F)	**112.4**

SATURATION DETERMINATION

F	Moisture Content, %	9.6
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20 °C, (pcf)	**62.4**
I	% Saturation	**51.9**

READINGS

DATE	TIME	READING	
10/27/2021		0.3490	Initial
10/27/2021		0.3500	10 min/Dry
10/28/2021		0.3930	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
800.4	**16.7**

EXPANSION INDEX = 43

GEOTEK

-200 WASH

Date:
W.O.: 3743-SD sample ID B-1
Client: MLC Holdings depth 2.5 - 15 feet
Project: 4991 Macario Drive

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	169.3	109.2	39.2%	

Dry Weight 278.5

Soak Time 1440 Minutes

GEOTEK

-200 WASH

Date:
W.O.: 3743-SD   sample ID B-5
Client: MLC Holdings   depth 0-10 feet
Project: 4991 Macario Drive

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	207.6	68.6	24.8%	

Dry Weight 276.2

Soak Time 1440 Minutes

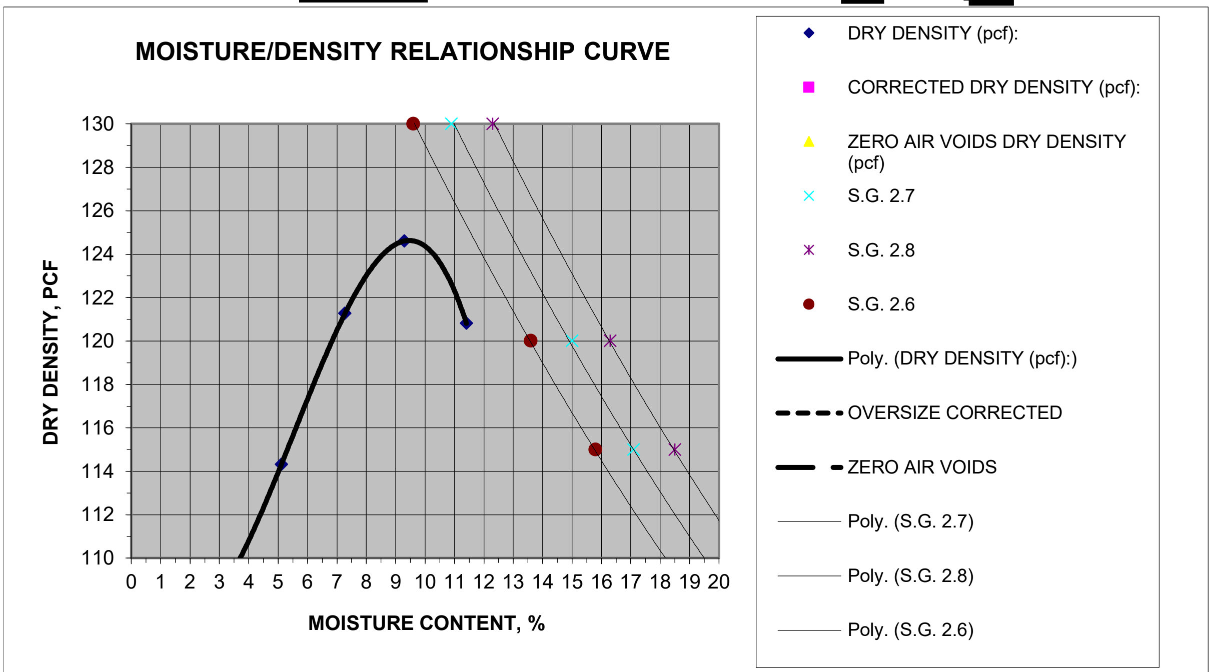
GEOTEK

MOISTURE/DENSITY RELATIONSHIP

Client:	MLC Holdings	**Job No.:**	3743-SD
Project:	4991 Macario Drive	**Lab No.:**	Corona
Location:	-		
Material Type:	Gray-brown silty sand with some clay		
Material Supplier:	-		
Material Source:	-		
Sample Location:	B-1 @ 2.5-15 feet		
	-		
Sampled By:	MSB	**Date Sampled:**	10/6/2021
Received By:	ADLC	**Date Received:**	10/6/2021
Tested By:	ADLC	**Date Tested:**	10/26/2021
Reviewed By:	DA	**Date Reviewed:**	11/8/2021

Test Procedure: ASTM D1557 **Method:** A

Oversized Material (%): 0.1 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	124.6	**@ Optimum Moisture, %**	9.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

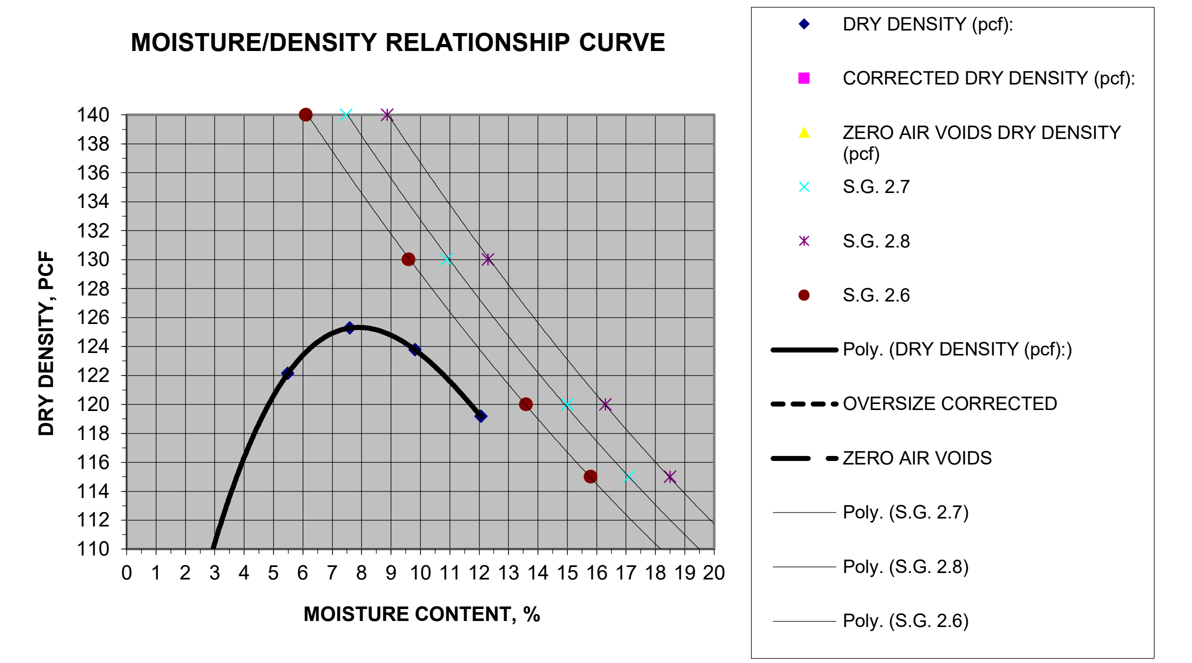
Unified Soils Classification: ____

AASHTO Soils Classification: ____

MOISTURE/DENSITY RELATIONSHIP

Client:	MLC Holdings	**Job No.:**	3743-SD
Project:	4991 Macario Drive	**Lab No.:**	Corona
Location:	-		
Material Type:	Gray-brown silty sand with some clay		
Material Supplier:	-		
Material Source:	-		
Sample Location:	B-3 @ 0-15 feet		
	-		
Sampled By:	MSB	**Date Sampled:**	10/6/2021
Received By:	ADLC	**Date Received:**	10/6/2021
Tested By:	ADLC	**Date Tested:**	10/26/2021
Reviewed By:	DA	**Date Reviewed:**	11/8/2021

Test Procedure: ASTM D1557 **Method:** A
Oversized Material (%): 0.1 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	125.5	**@ Optimum Moisture, %**	8.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

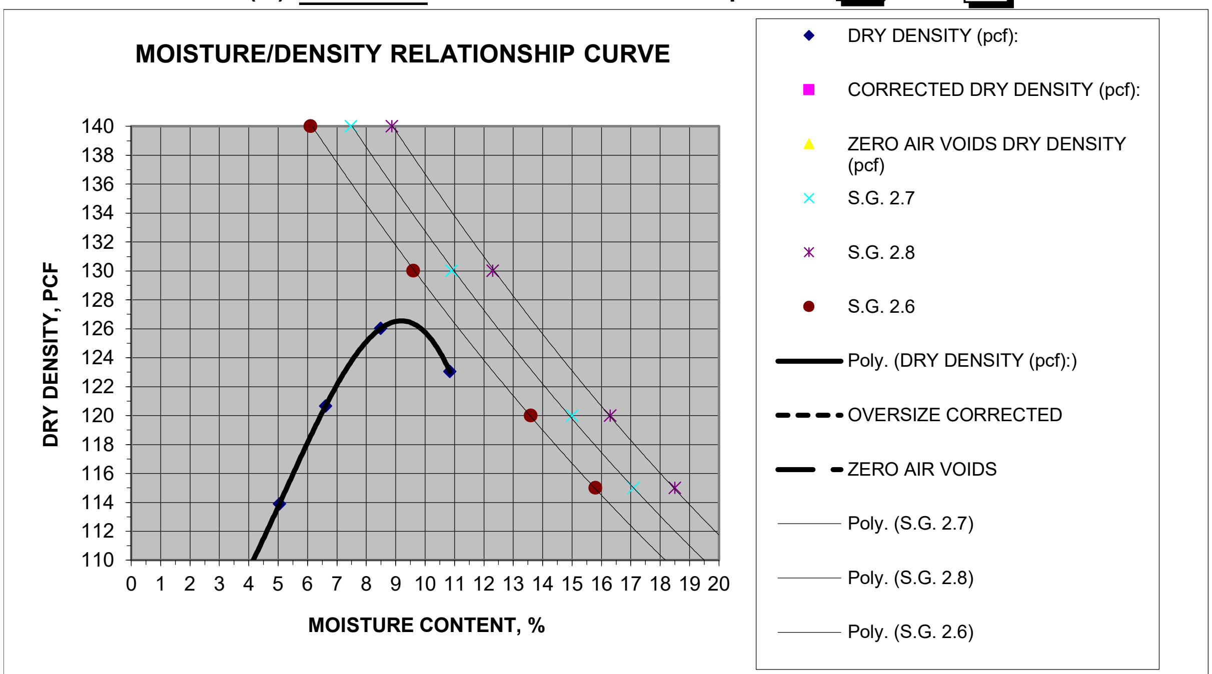
Unified Soils Classification: __________

AASHTO Soils Classification: __________

MOISTURE/DENSITY RELATIONSHIP

Client: MLC Holdings
Job No.: 3743-SD
Project: 4991 Macario Drive
Lab No.: Corona
Location: -
Material Type: Gray-brown silty sand with some clay
Material Supplier: -
Material Source: -
Sample Location: B-4 @ 1-10 feet
-
Sampled By: MSB
Date Sampled: 10/6/2021
Received By: ADLC
Date Received: 10/6/2021
Tested By: ADLC
Date Tested: 10/26/2021
Reviewed By: DA
Date Reviewed: 11/8/2021

Test Procedure: ASTM D1557
Method: A
Oversized Material (%): 0.5
Correction Required: yes x no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	126.5	**@ Optimum Moisture, %**	9.2
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification:
AASHTO Soils Classification:

GEOTEK

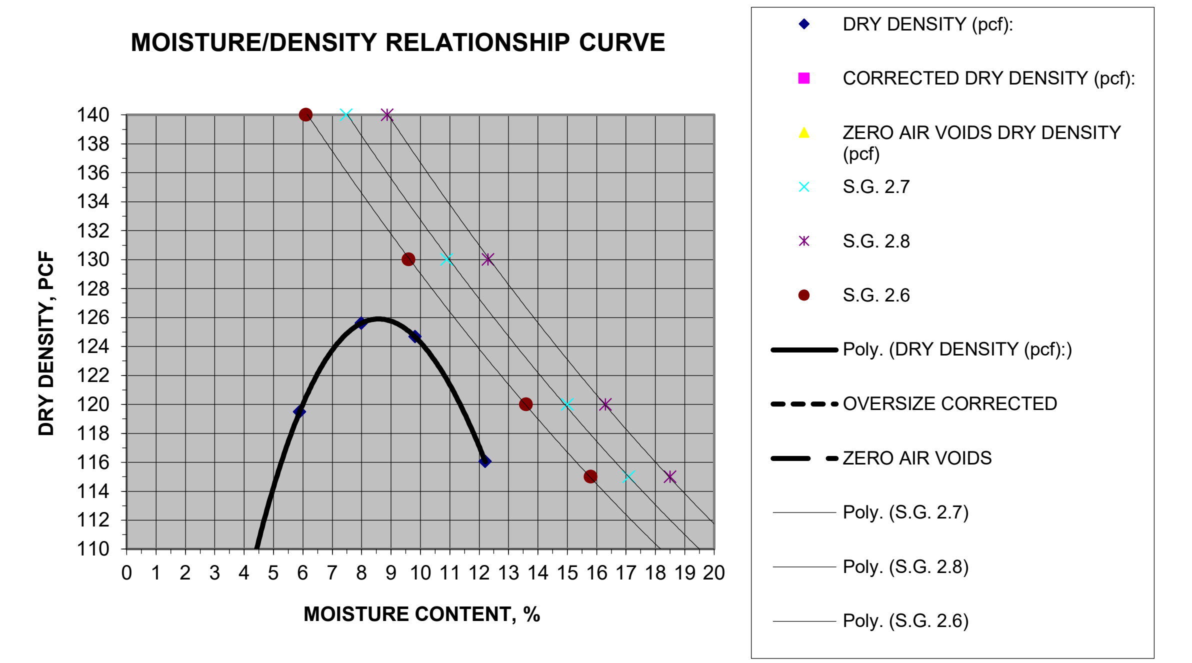
MOISTURE/DENSITY RELATIONSHIP

Client: MLC Holdings
Project: 4991 Macario Drive
Location: -
Material Type: Gray-brown silty sand with some clay
Material Supplier: -
Material Source: -
Sample Location: B-5 @ 0-10 feet
-
Sampled By: MSB
Received By: ADLC
Tested By: ADLC
Reviewed By: DA

Job No.: 3743-SD
Lab No.: Corona

Date Sampled: 10/6/2021
Date Received: 10/6/2021
Date Tested: 10/26/2021
Date Reviewed: 11/8/2021

Test Procedure: ASTM D1557 **Method:** A
Oversized Material (%): 1.3 **Correction Required:** ☐ yes ☒ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	126.0	**@ Optimum Moisture, %**	8.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification: ________

AASHTO Soils Classification: ________

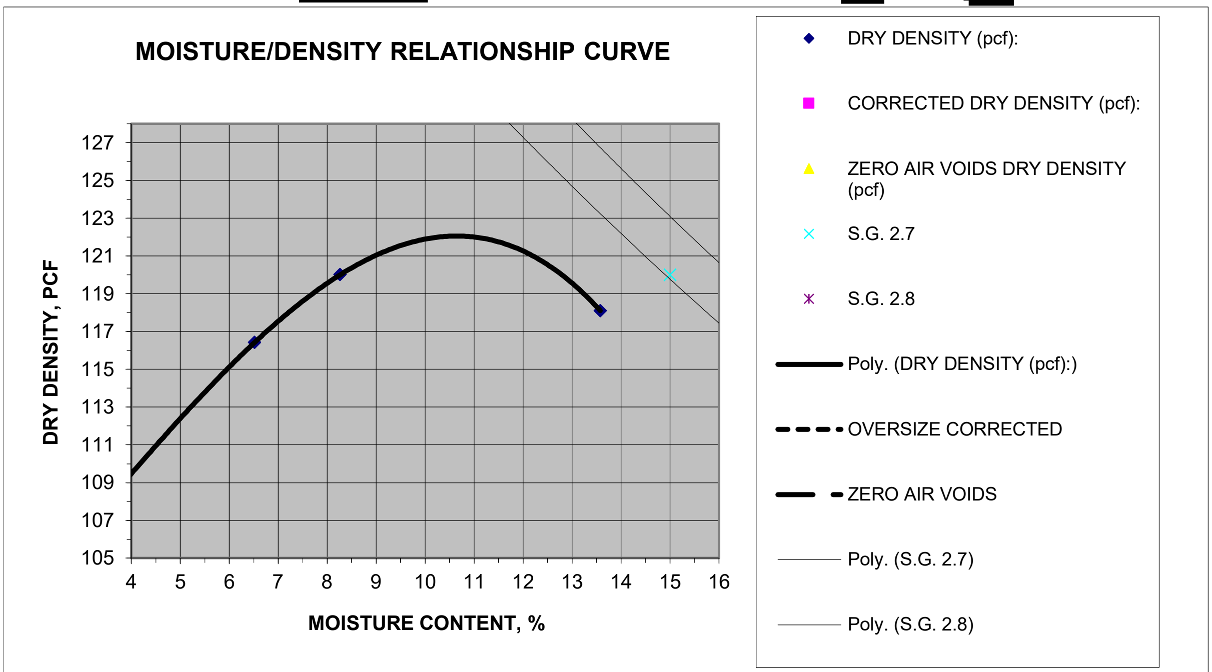
GEOTEK

MOISTURE/DENSITY RELATIONSHIP

Client:	MLC Holding, Inc.	**Job No.:**	3743-SD
Project:	4991 Macario Drive	**Lab No.:**	3643
Location:	Oceanside, California		
Material Type:	Yellow-Brown Clayey F-M Sand		
Material Supplier:	-		
Material Source:	-		
Sample Location:	B-6		
	-		
Sampled By:	MSB	**Date Sampled:**	11/4/2021
Received By:	MRB	**Date Received:**	11/4/2021
Tested By:	MRB	**Date Tested:**	11/23/2021
Reviewed By:	CDL	**Date Reviewed:**	-

Test Procedure: ASTM D1557 **Method:** A

Oversized Material (%): 0.0 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	122.0	**@ Optimum Moisture, %**	10.7
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification: ______

AASHTO Soils Classification: ______

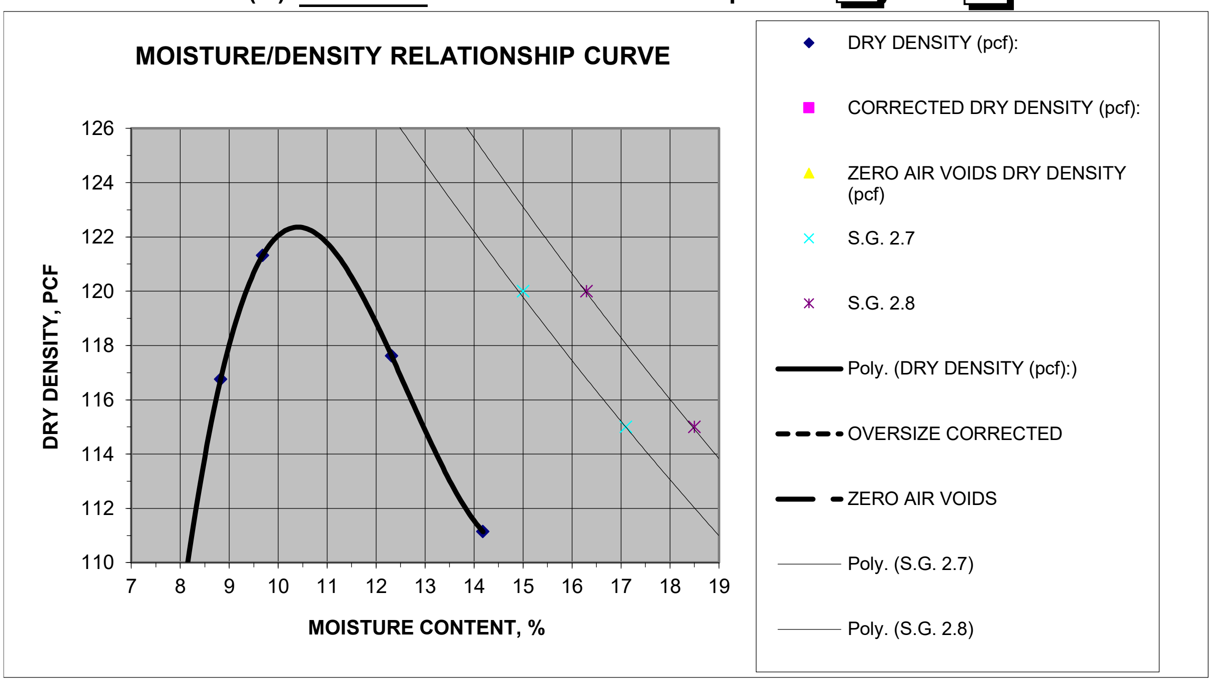
GEOTEK

MOISTURE/DENSITY RELATIONSHIP

Client:	MLC Holding, Inc.	**Job No.:**	3743-SD
Project:	4991 Macario Drive	**Lab No.:**	3653
Location:	Oceanside, California		
Material Type:	Yellow-Brown Clayey F-M Sand		
Material Supplier:	-		
Material Source:	-		
Sample Location:	B-10		
	-		
Sampled By:	MSB	**Date Sampled:**	11/4/2021
Received By:	MRB	**Date Received:**	11/4/2021
Tested By:	MRB	**Date Tested:**	11/23/2021
Reviewed By:	CDL	**Date Reviewed:**	-

Test Procedure: ASTM D1557 **Method:** A

Oversized Material (%): 0.0 **Correction Required:** ☐ yes ☒ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	122.3	**@ Optimum Moisture, %**	10.2
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification:

AASHTO Soils Classification:

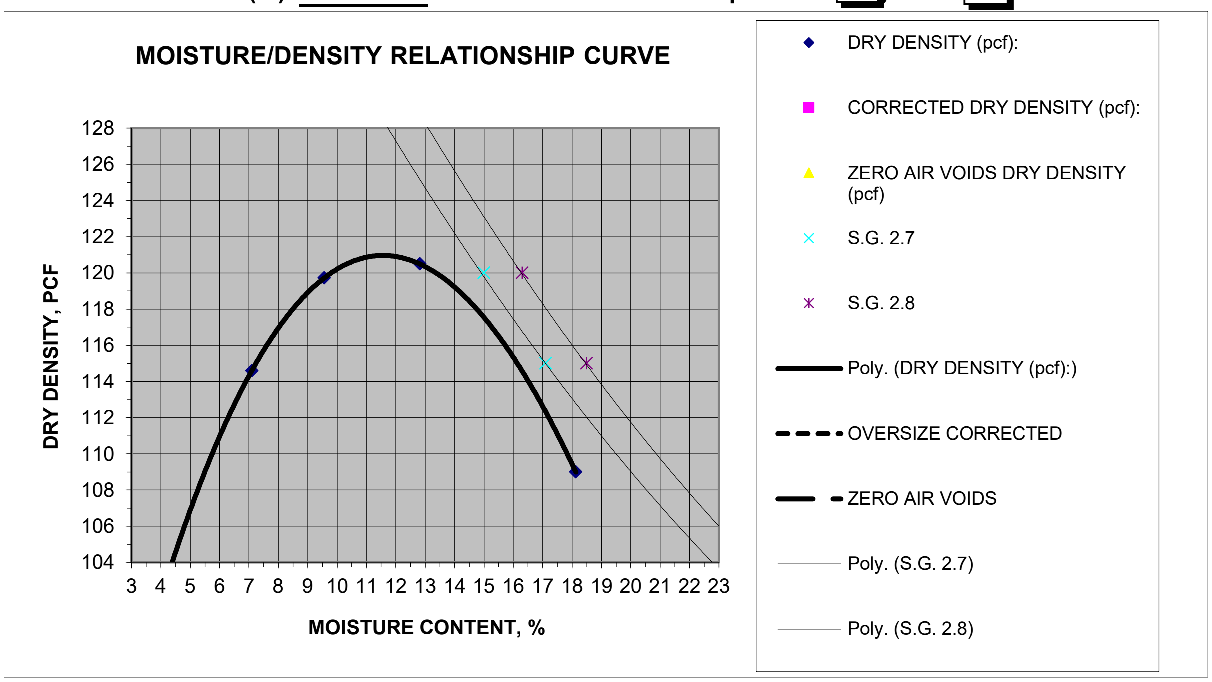
GEOTEK

MOISTURE/DENSITY RELATIONSHIP

Client:	MLC Holding, Inc.	**Job No.:**	3743-SD
Project:	4991 Macario Drive	**Lab No.:**	3631
Location:	Oceanside, California		
Material Type:	Yellow-Brown Clayey F-M Sand w/Asphalt		
Material Supplier:	-		
Material Source:	-		
Sample Location:	B-11		
	-		
Sampled By:	MSB	**Date Sampled:**	11/4/2021
Received By:	MRB	**Date Received:**	11/4/2021
Tested By:	MRB	**Date Tested:**	11/19/2021
Reviewed By:	CDL	**Date Reviewed:**	-

Test Procedure: ASTM D1557 **Method:** A

Oversized Material (%): 3.5 **Correction Required:** ☐ yes ☒ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	121.0	**@ Optimum Moisture, %**	11.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification: ____________

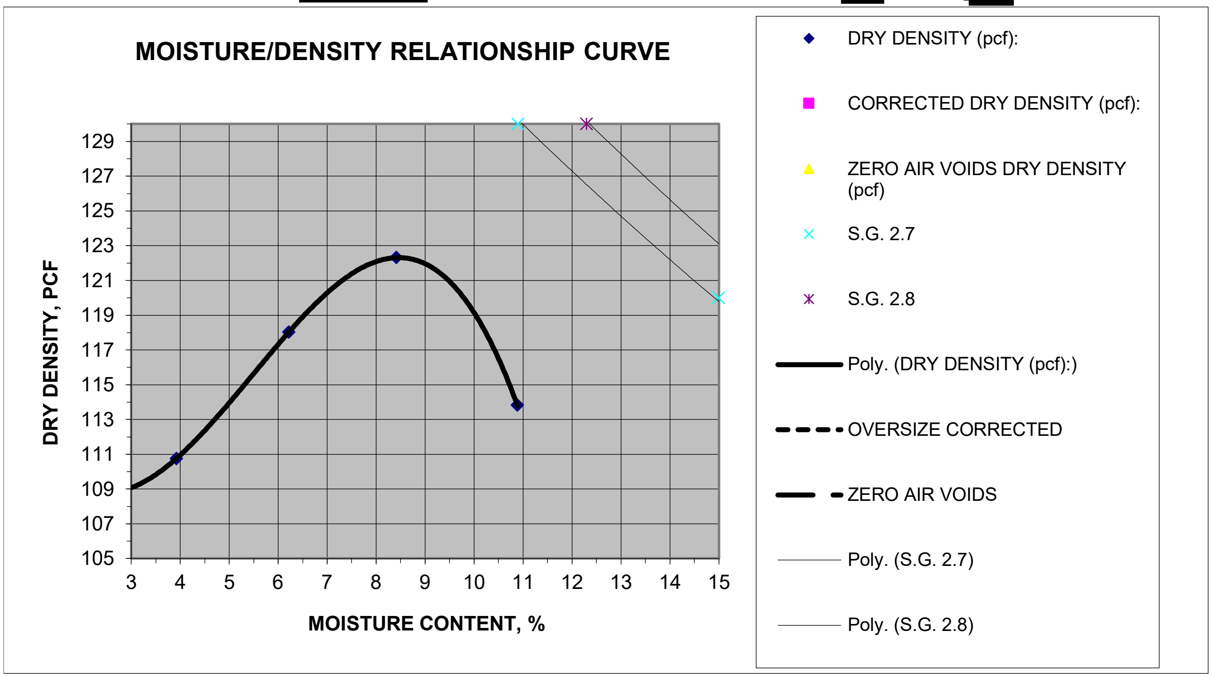
AASHTO Soils Classification: ____________

MOISTURE/DENSITY RELATIONSHIP

Client: MLC Holding, Inc.
Project: 4991 Macario Drive
Location: Oceanside, California
Material Type: Yellow-Brown Clayey F-M Sand
Material Supplier: -
Material Source: -
Sample Location: B-12
-
Sampled By: MSB
Received By: MRB
Tested By: MRB
Reviewed By: CDL

Job No.: 3743-SD
Lab No.: 3632
Date Sampled: 11/4/2021
Date Received: 11/4/2021
Date Tested: 11/19/2021
Date Reviewed: -

Test Procedure: ASTM D1557 **Method:** A
Oversized Material (%): 0.0 **Correction Required:** ☐ yes ☒ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	122.5	**@ Optimum Moisture, %**	8.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification: ______

AASHTO Soils Classification: ______

GEOTEK

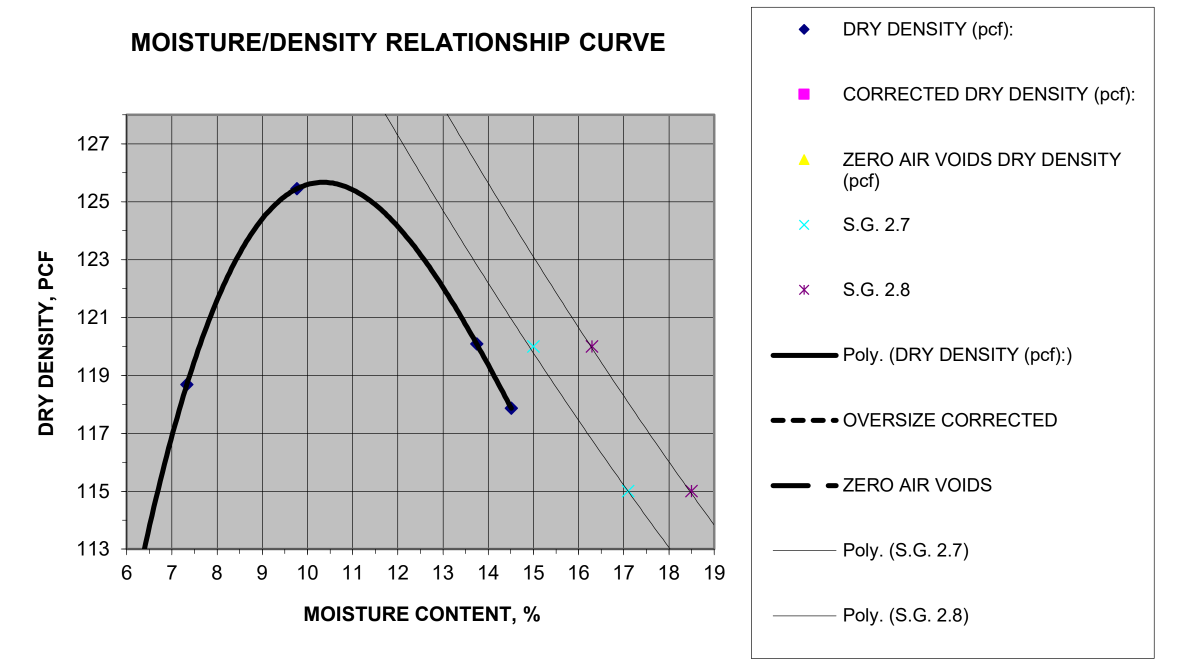
MOISTURE/DENSITY RELATIONSHIP

Client: MLC Holding, Inc.
Project: 4991 Macario Drive
Location: Oceanside, California
Material Type: Yellow-Brown Clayey F-M Sand
Material Supplier: -
Material Source: -
Sample Location: B-13
-
Sampled By: MSB
Received By: MRB
Tested By: MRB
Reviewed By: CDL

Job No.: 3743-SD
Lab No.: 3632

Date Sampled: 11/4/2021
Date Received: 11/4/2021
Date Tested: 11/19/2021
Date Reviewed: -

Test Procedure: ASTM D1557 **Method:** A
Oversized Material (%): 0.0 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	125.5	**@ Optimum Moisture, %**	10.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

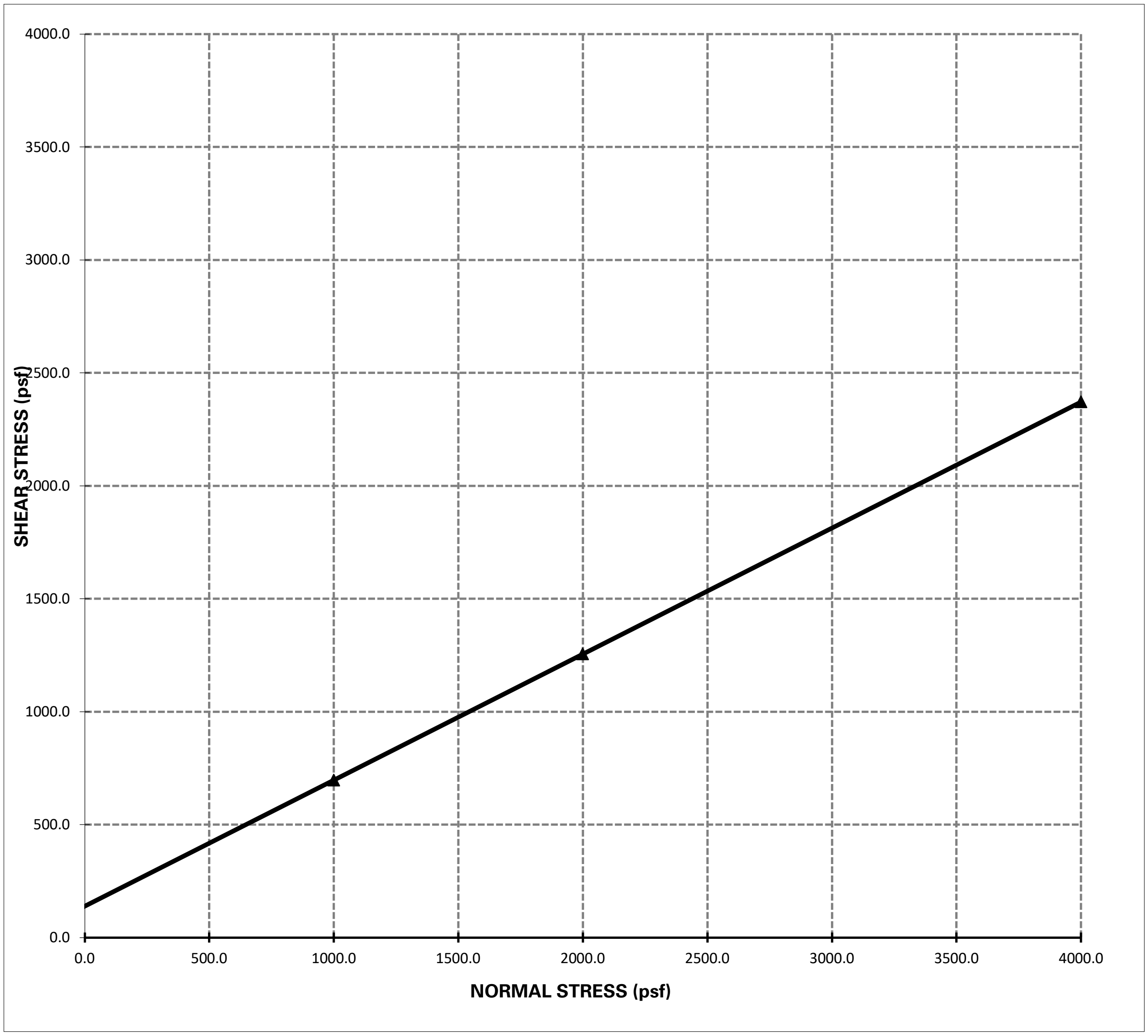
	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification:
AASHTO Soils Classification:

DIRECT SHEAR TEST

Project Name: 4991 Macario Drive
Project Number: 3743-SD
Sample Location: B-3 @ 0-15 feet
Date Tested: 11/3/2021



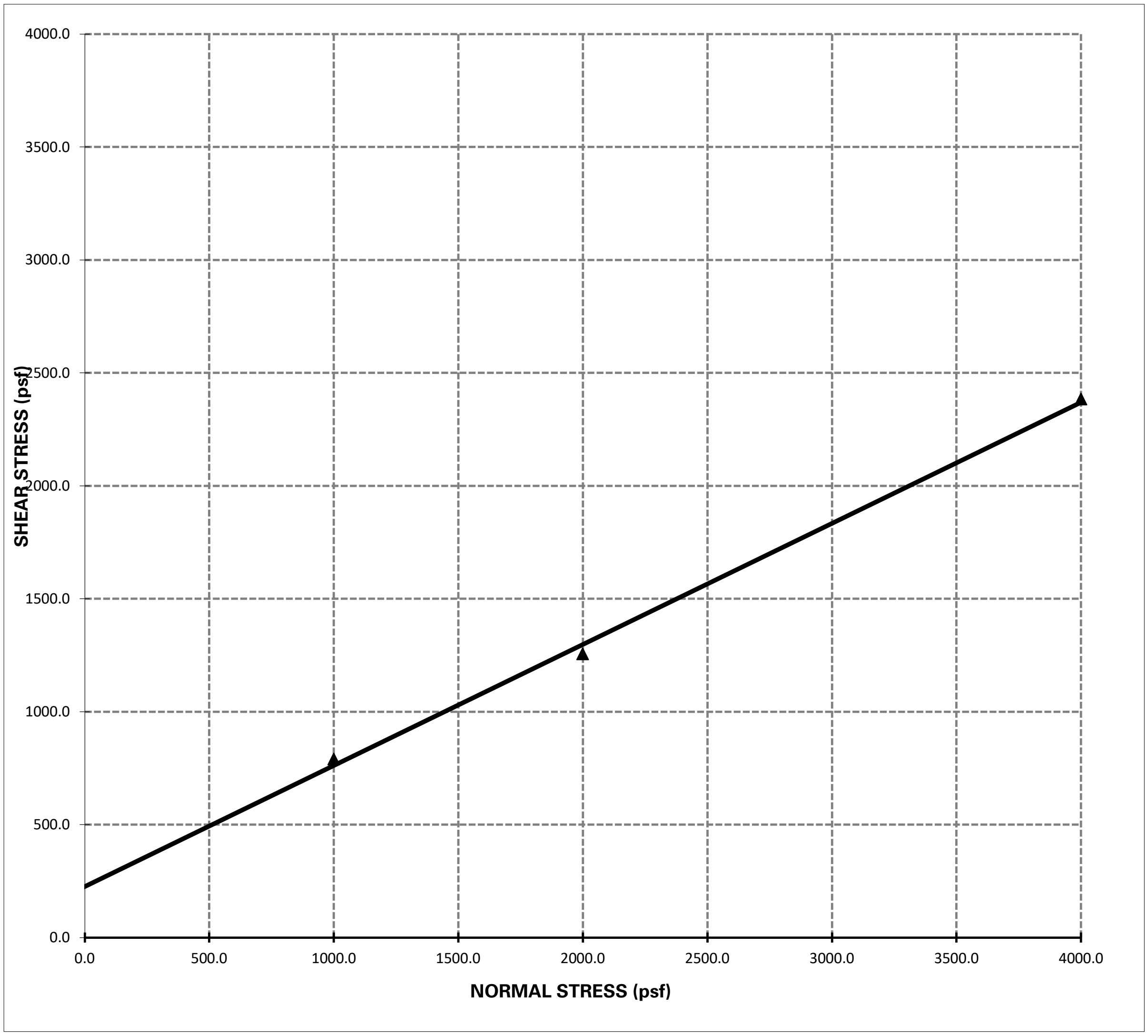
Shear Strength: Φ = 29 ° , C = 139 psf

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.
2 - The above reflect direct shear strength at saturated conditions.
3 - The tests were run at a shear rate of 0.01 in/min.

DIRECT SHEAR TEST

Project Name:	4991 Macario Drive	***Sample Location:***	B-3 @ 0-15 feet
Project Number:	3743-SD	***Date Tested:***	11/3/2021

PEAK VALUE

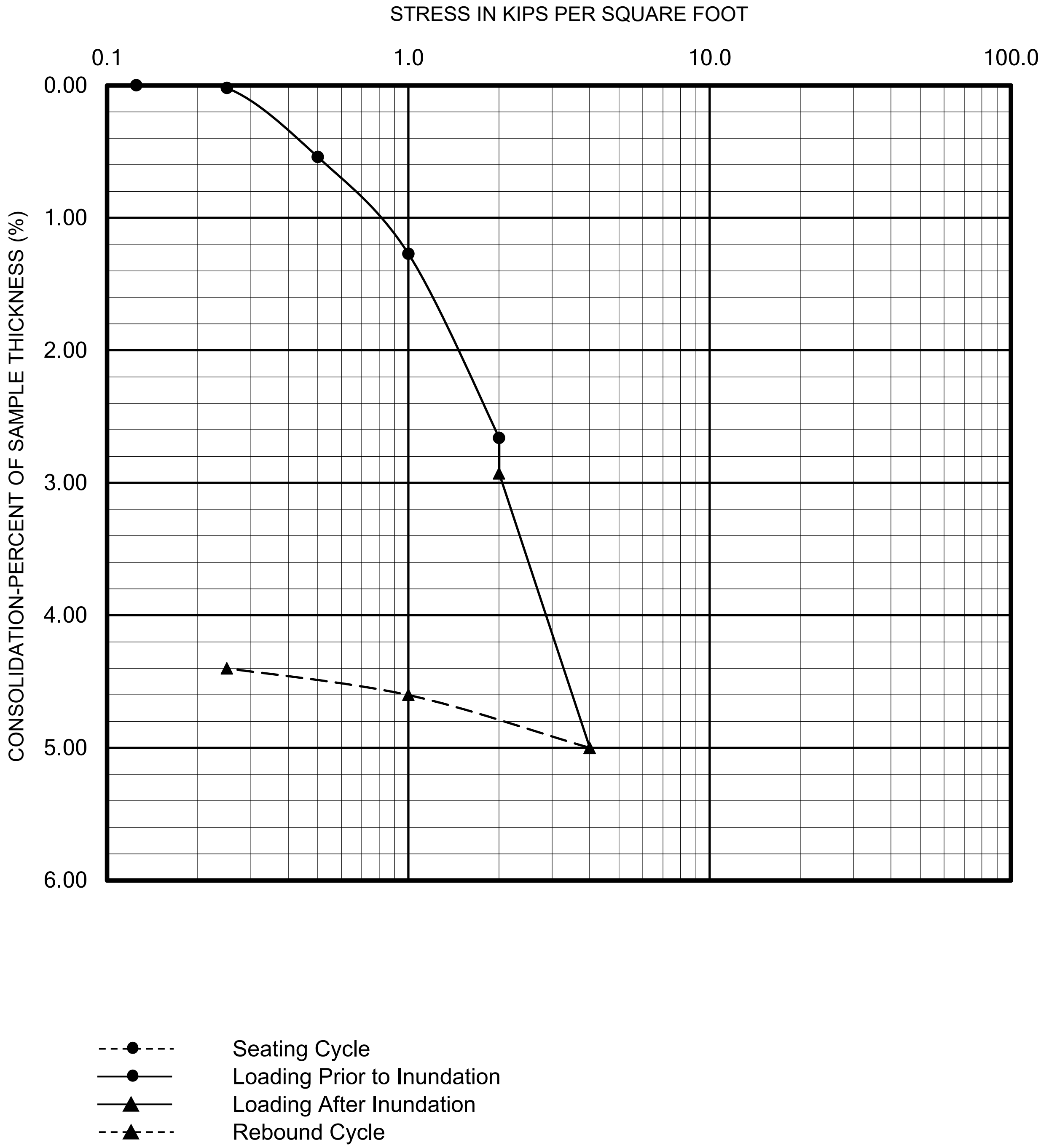


Shear Strength: Φ = **29°**, **C = 139 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.01 in/min.



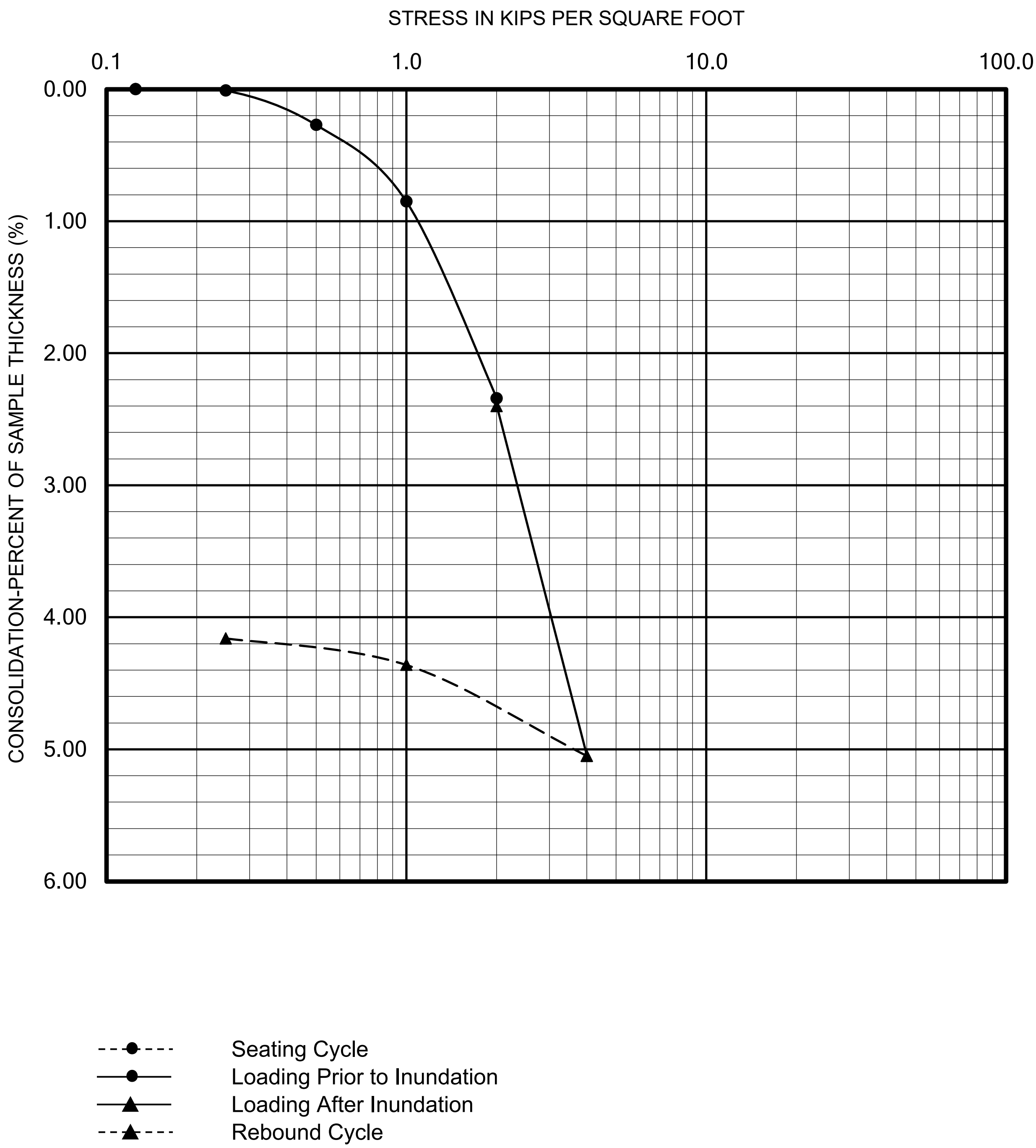
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

Sample: B-1 @ 5 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 3743-SD	Date: 11/8/2021



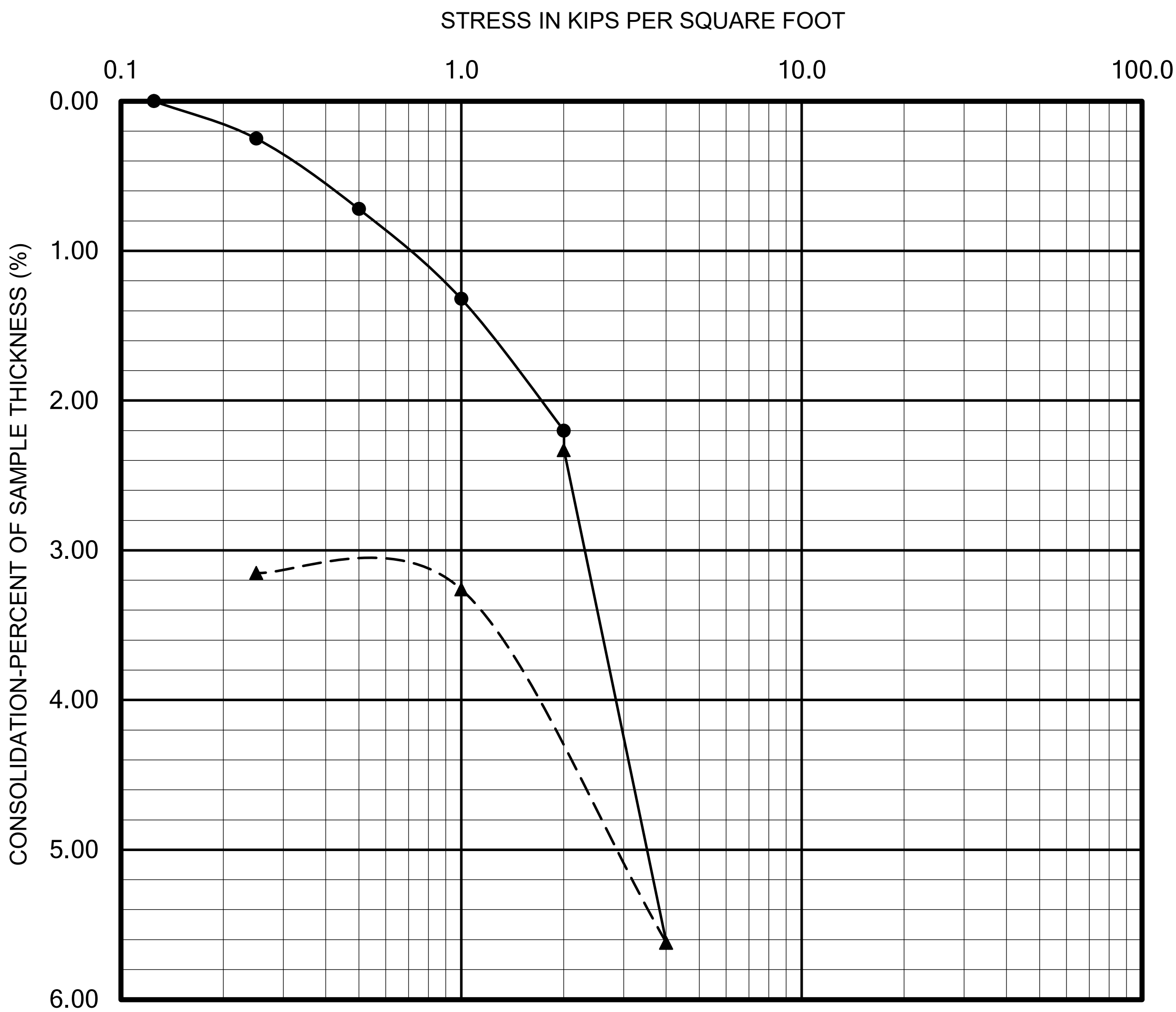
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

Sample: B-1 @ 12.5 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 3743-SD	Date: 11/8/2021



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

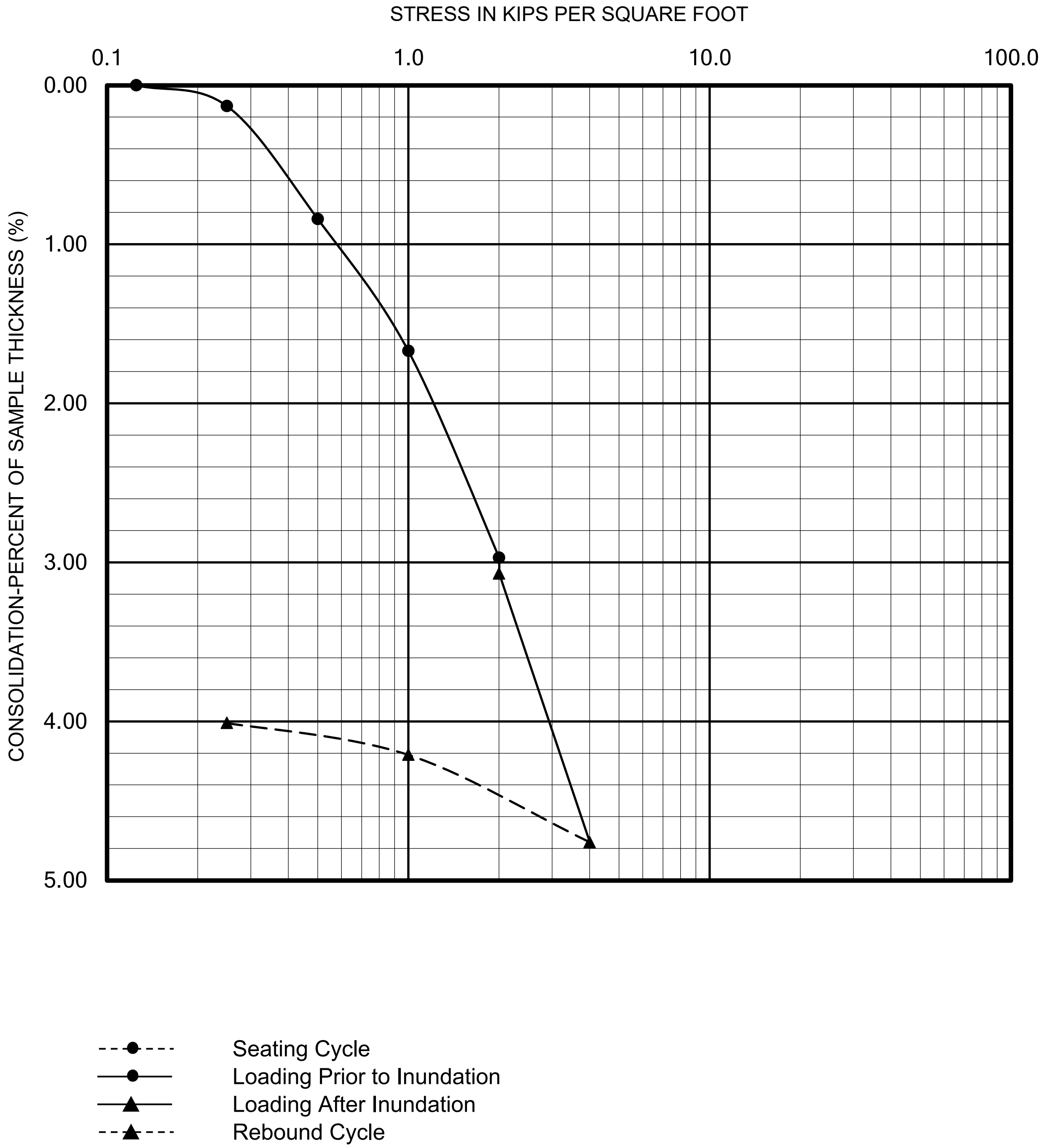
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

Sample: B-1 @ 17.5 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 3743-SD	Date: 11/8/2021



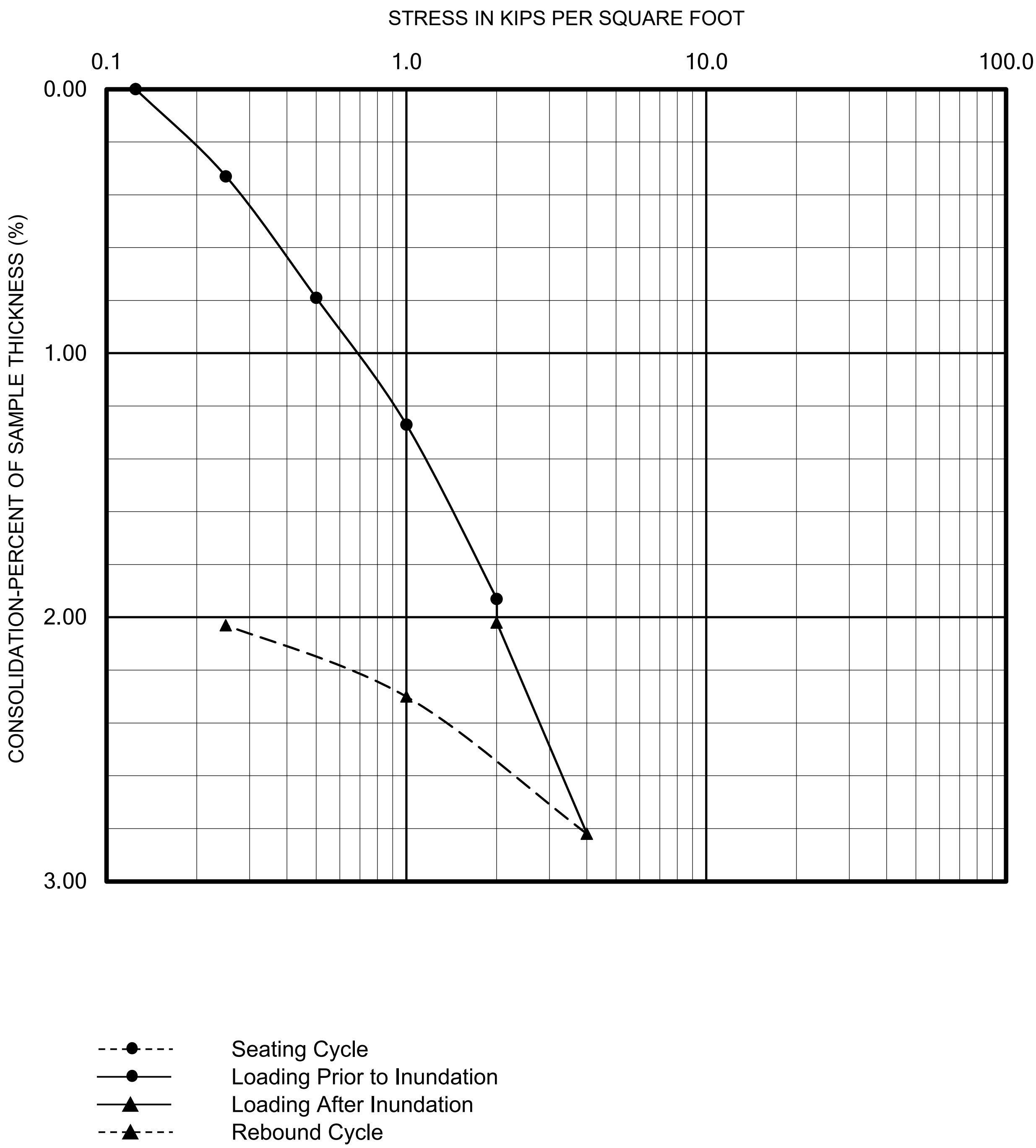
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

Sample: B-3 @ 10 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 3743-SD	Date: 11/8/2021



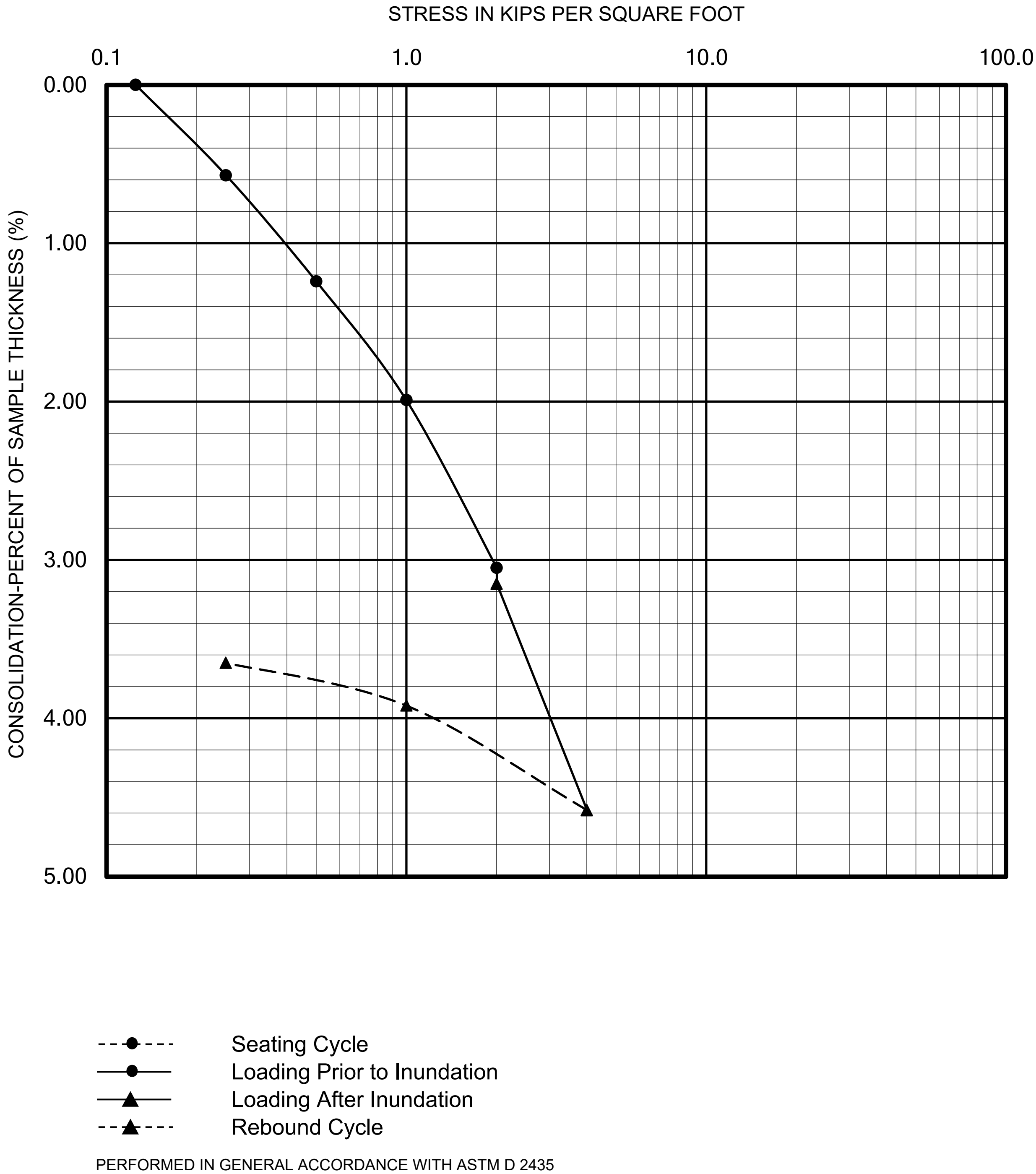
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

Sample: B-3 @ 15 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 3743-SD	Date: 11/8/2021



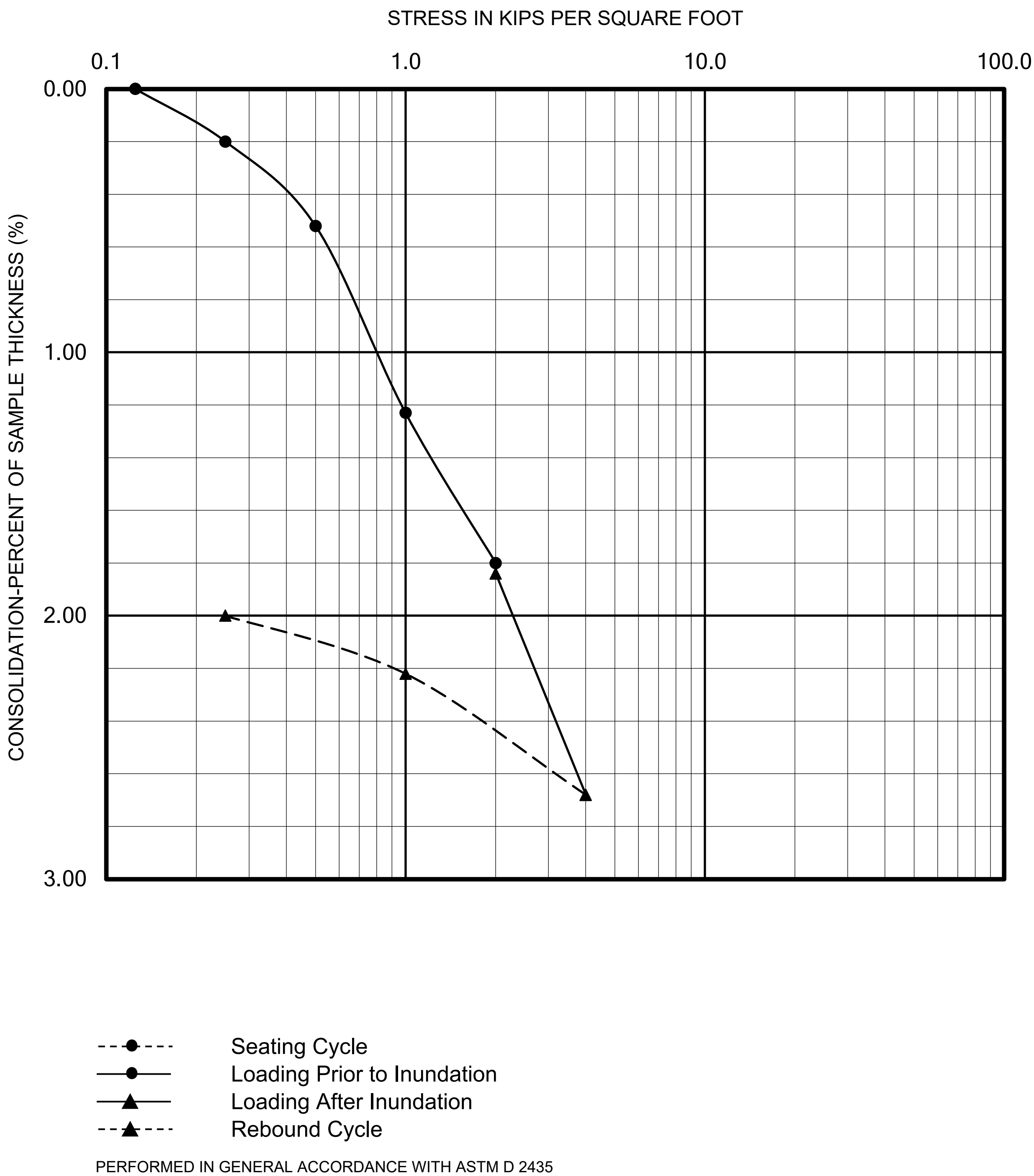
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

Sample: B-4 @ 10 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 3743-SD	Date: 11/8/2021



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

Sample: B-4 @ 15 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 3743-SD	Date: 11/8/2021

• ANALYSIS
• DESIGN

LaBelle • Marvin

PROFESSIONAL PAVEMENT ENGINEERING
A CALIFORNIA CORPORATION

• SOILS, ASPHALT TECHNOLOGY

October 25, 2021

Mr. Chris Livesey
GeoTek Inc.
1384 Poinsettia Avenue Suite A
Vista, CA 92081-8505

Project No. 47713

Dear Mr. Livesey:

Laboratory testing of the bulk soil sample delivered to our laboratory on 10/21/2021 has been completed.

Reference:	W.O. # 3743-SD
Project:	MLC Holdings, 4991 Macarijo Drive
Sample:	B-3 @ 0'-15'

Data sheets and graphical presentations are transmitted herewith for your use and information. Any untested portion of the samples will be retained for a period of sixty (60) days prior to disposal. The opportunity to be of service is appreciated, and should you have any questions, kindly call.

Very truly yours,

REGISTERED PROFESSIONAL ENGINEER
STEVEN R. MARVIN
NO. 30659
CIVIL
STATE OF CALIFORNIA

DocuSigned by:
D9A356504F9B448...

Steven R. Marvin
RCE 30659

SRM:tw
Enclosures

2700 S. GRAND AVENUE • SANTA ANA, CA 92705-5404 • (714) 546-3468 • FAX (714) 546-5841
INFO@LABELLEMARVIN.COM

LaBelle Marvin

R - VALUE DATA SHEET

PROJECT No.: 47713
DATE: 10/25/2021

BORING NO.: B-3 @ 0'-15'
MLC Holdings, 4991 Macarijo Drive
W.O.# 3743-SD

SAMPLE DESCRIPTION: Brown Sandy Clay

R-VALUE TESTING DATA | CA TEST 301

	SPECIMEN ID		
	a	b	c
Mold ID Number	13	14	15
Water added, grams	110	79	64
Initial Test Water, %	16.0	12.9	11.4
Compact Gage Pressure,psi	40	85	170
Exudation Pressure, psi	249	427	624
Height Sample, Inches	2.65	2.49	2.41
Gross Weight Mold, grams	3105	3040	3025
Tare Weight Mold, grams	1966	1937	1941
Sample Wet Weight, grams	1139	1103	1084
Expansion, Inches x 10exp-4	7	39	87
Stability 2,000 lbs (160psi)	64 / 135	34 / 77	25 / 57
Turns Displacement	4.40	3.90	3.65
R-Value Uncorrected	10	41	55
R-Value Corrected	11	41	53
Dry Density, pcf	112.2	118.9	122.3

DESIGN CALCULATION DATA

Traffic Index Assumed:	4.0	4.0	4.0
G.E. by Stability	0.91	0.60	0.48
G. E. by Expansion	0.23	1.30	2.90

Equilibrium R-Value	**25** by EXUDATION
REMARKS:	Gf = 1.25 0.0% Retained on the 3/4" Sieve.

Examined & Checked: 10 /25/ 21

REGISTERED PROFESSIONAL ENGINEER STEVEN R. MARVIN No. 30659 CIVIL STATE OF CALIFORNIA

DocuSigned by:
D9A356504F9B448...

Steven R. Marvin, RCE 30659

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301.

LaBelle Marvin

R-VALUE GRAPHICAL PRESENTATION

PROJECT NO. 47713

DATE: 10 /25/ 2021

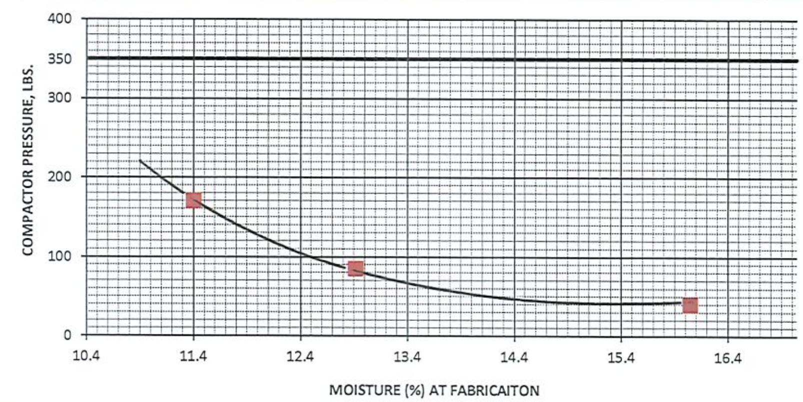
REMARKS:

BORING NO. B-3 @ 0'-15'

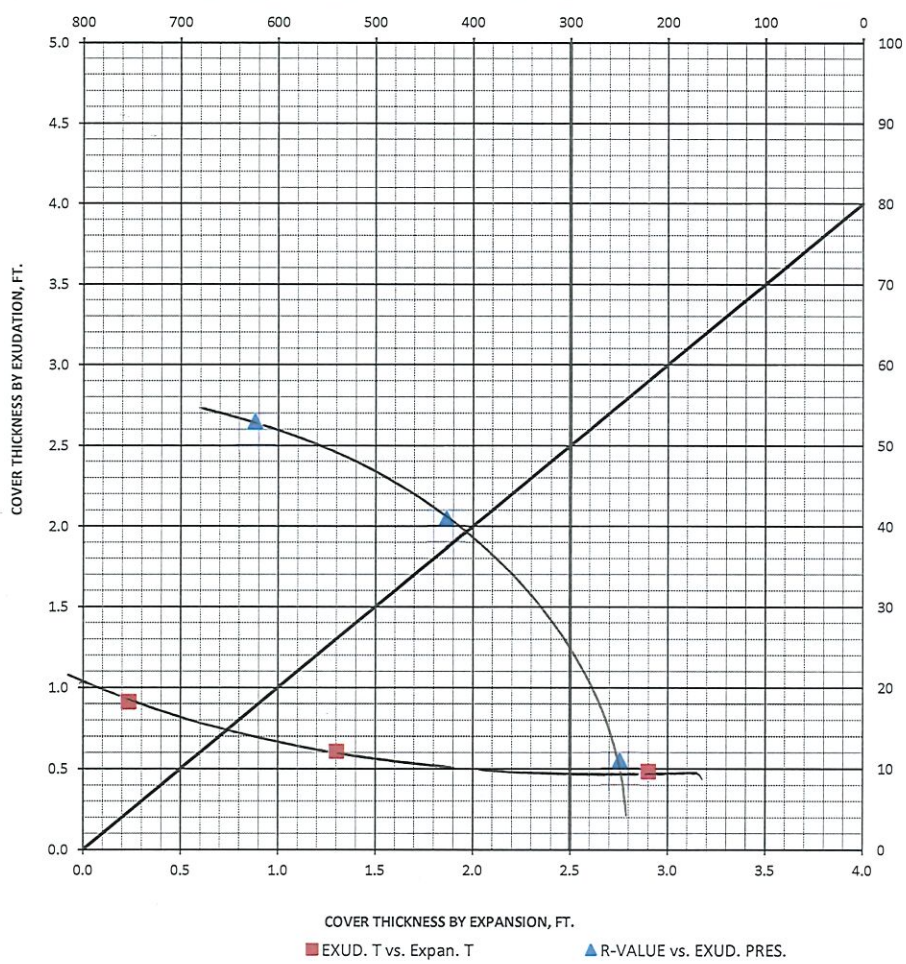
MLC Holdings, 4991 Macarijo Drive

W.O.# 3743-SD

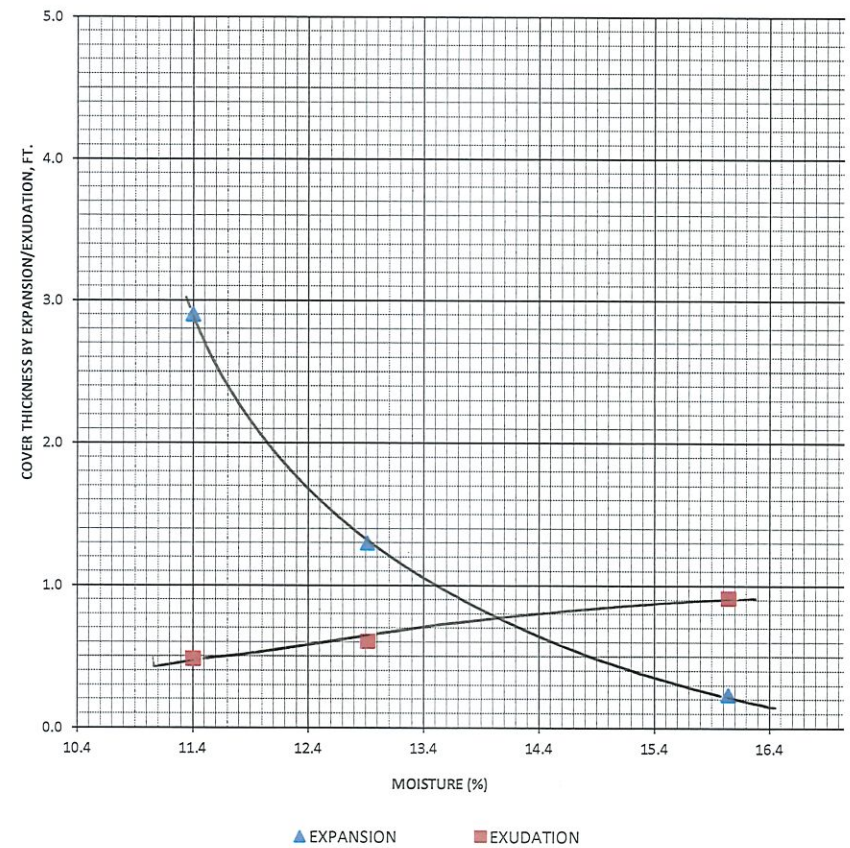
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



Results Only Soil Testing for 4991 Macario Drive

October 25, 2021

Prepared for:

Bruce Hick
GeoTek, Inc.
1548 North Maple Street
Corona, CA 92280
bhick@geotekusa.com

Project X Job#: S211022G
Client Job or PO#: 3743-SD

Respectfully Submitted,

Eduardo Hernandez, M.Sc., P.E.
Sr. Corrosion Consultant
NACE Corrosion Technologist #16592
Professional Engineer
California No. M37102
ehernandez@projectxcorrosion.com

Soil Analysis Lab Results

Client: GeoTek, Inc.
Job Name: 4991 Macario Drive
Client Job Number: 3743-SD
Project X Job Number: S211022G
October 25, 2021

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM D4972	ASTM G200	ASTM D4658	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd	Minimum	**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^{--}	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
3743-SD B1 BB-1	2.5-15	191.2	0.0191	58.9	0.0059	11,390	1,273	8.6	79	0.30	6.6	13.2	ND	180.1	0.7	37.2	19.4	8.3	4.2
3743-SD B5 BB-1	0-10	93.0	0.0093	20.6	0.0021	6,901	2,412	9.1	57	0.56	19.1	3.0	ND	128.4	3.6	63.8	27.6	5.8	7.1

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract
PPM = mg/kg (soil) = mg/L (Liquid)

Project X
Corrosion Engineering
Corrosion Control - Soil, Water, and Metallurgy Lab

Lab Request Sheet Chain of Custody
Phone: (213) 928-7213 · Fax (951) 226-1720 · www.projectxcorrosion.com
Ship Samples To: 29990 Technology Dr, Suite 13, Murrieta, CA 92563

Project X Job Number	S211022G Geotek 3743-SD 4991-Macario 2 Full

IMPORTANT: Please complete Project and Sample Identification Data as you would like it to appear in report & include this form with samples.

Company Name:	Geotek USA	Contact Name:	Bruce Hick	Phone No:	661-233-5229
Mailing Address:	1548 N. Maple Ave. Corona, CA	Contact Email:	bhick@geotekusa.com		
Accounting Contact:		Invoice Email:	bhick@geotekusa.com		
Client Project No:	MLC Holdings, Inc	Project Name:	4991 Macario Drive		
P.O. #:					

(Business Days) Turn Around Time:	3-5 Day Standard	3 Day Guarantee 50% mark-up	2 Day RUSH 100% mark-up
	✓		

Results By: ☐ Phone ☐ Fax ☒ Email

Date & Received by : 10/22/21 [signature]

Special Instructions:

ANALYSIS REQUESTED (Please circle)

		Default Method
Geo Quad	Soil Resistivity	Caltrans CTM643 / AASHTO T288 / ASTM G187
Geo Quad	pH	Caltrans CTM643 / AASHTO T289 / ASTM G51
Geo Quad	Sulfate	Caltrans CTM417 / AASHTO T290 / ASTM D4327
Geo Quad	Chloride	Caltrans CTM422 / AASHTO T291 / ASTM D4327
Full Corrosion Series	Redox Potential	SM 2580B / ASTM G200
Full Corrosion Series	Sulfide	SM 4500-S2
Full Corrosion Series	Ammonia	SM 4500-NH3 / ASTM D4327
Full Corrosion Series	Nitrate	SM 4500-NO3 / ASTM D4327
Full Corrosion Series	Flouride	SM 2320B
Full Corrosion Series	Phosphate	ASTM D4327
Full Corrosion Series	Lithium	ASTM D4327
Full Corrosion Series	Sodium	ASTM D4327
Full Corrosion Series	Potassium	ASTM D4327
Full Corrosion Series	Magnesium	ASTM D4327
Full Corrosion Series	Calcium	ASTM D4327
Full Corrosion Series	BiCarbonate	SM 2320B
	Full Corrosion Series	
Reports	Soil Corrosivity Evaluation Report	*Req: Min. 3 Samples, site map, and groundwater info
Reports	Water Corrosivity Mini Report	
	Moisture Content	ASTM D2216
	Total Alkalinity	SM 2520B
	Thermal Resistivity	IEEE 442 / ASTM D5334
	(ANC) Alk Neutr Cap	
	(SRB) Sulfate Reducing	HACH BART
	Puckorius Index	
	XRF Elemental Analysis	ASTM E1621 / ASTM E322 / ASTM A751
	Water Hardness	

	#	SAMPLE ID - BORE #	DEPTH (ft)	DATE COLLECTED	Full Corrosion Series
234	1	3743-SD B1 BB-1	2.5-15'		✓
235	2	3743-SD B5 BB-1	0-10'		✓
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				

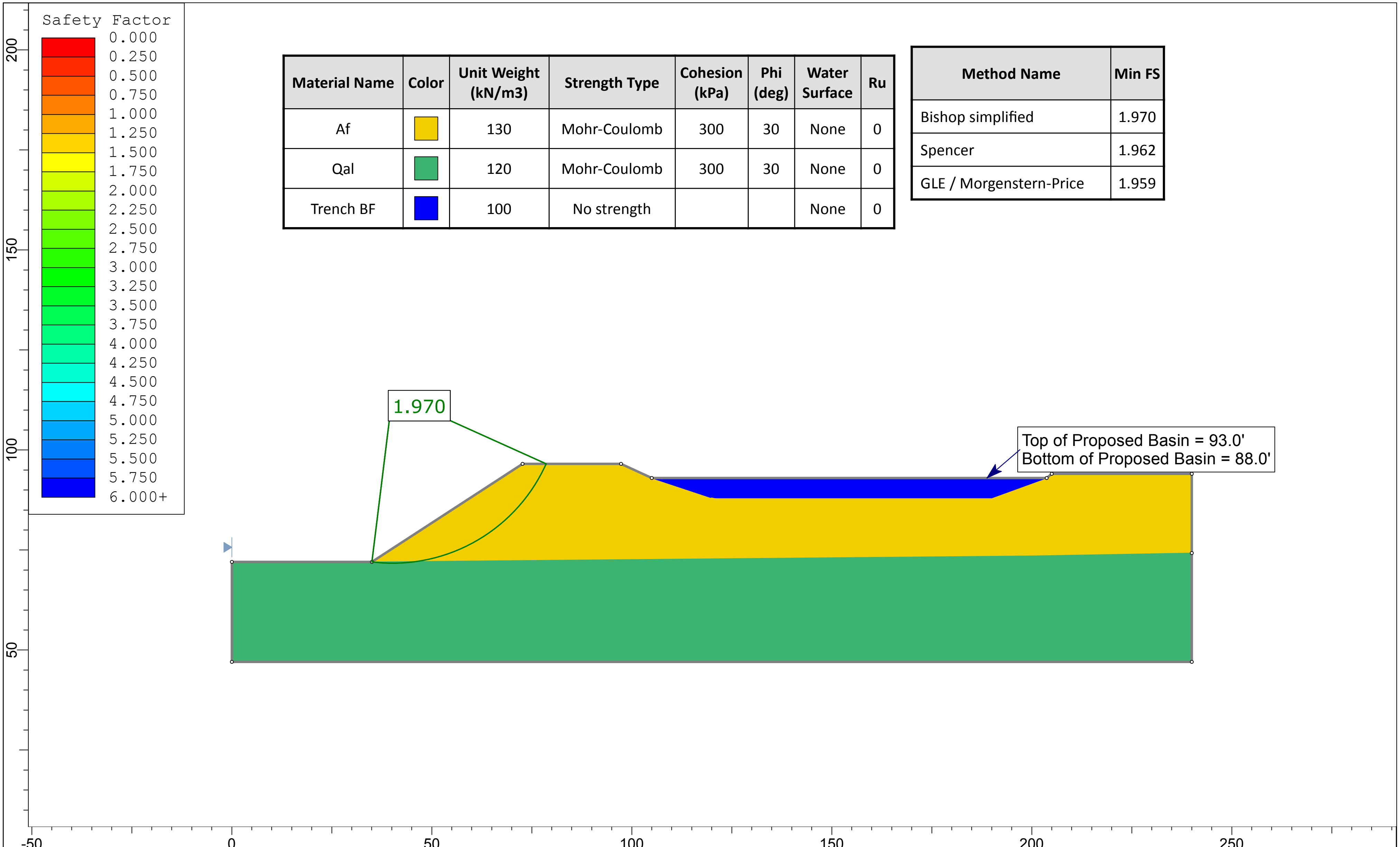
APPENDIX D

SLOPE STABILITY ANALYSES

GEOTEK

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Af		130	Mohr-Coulomb	300	30	None	0
Qal		120	Mohr-Coulomb	300	30	None	0
Trench BF		100	No strength			None	0

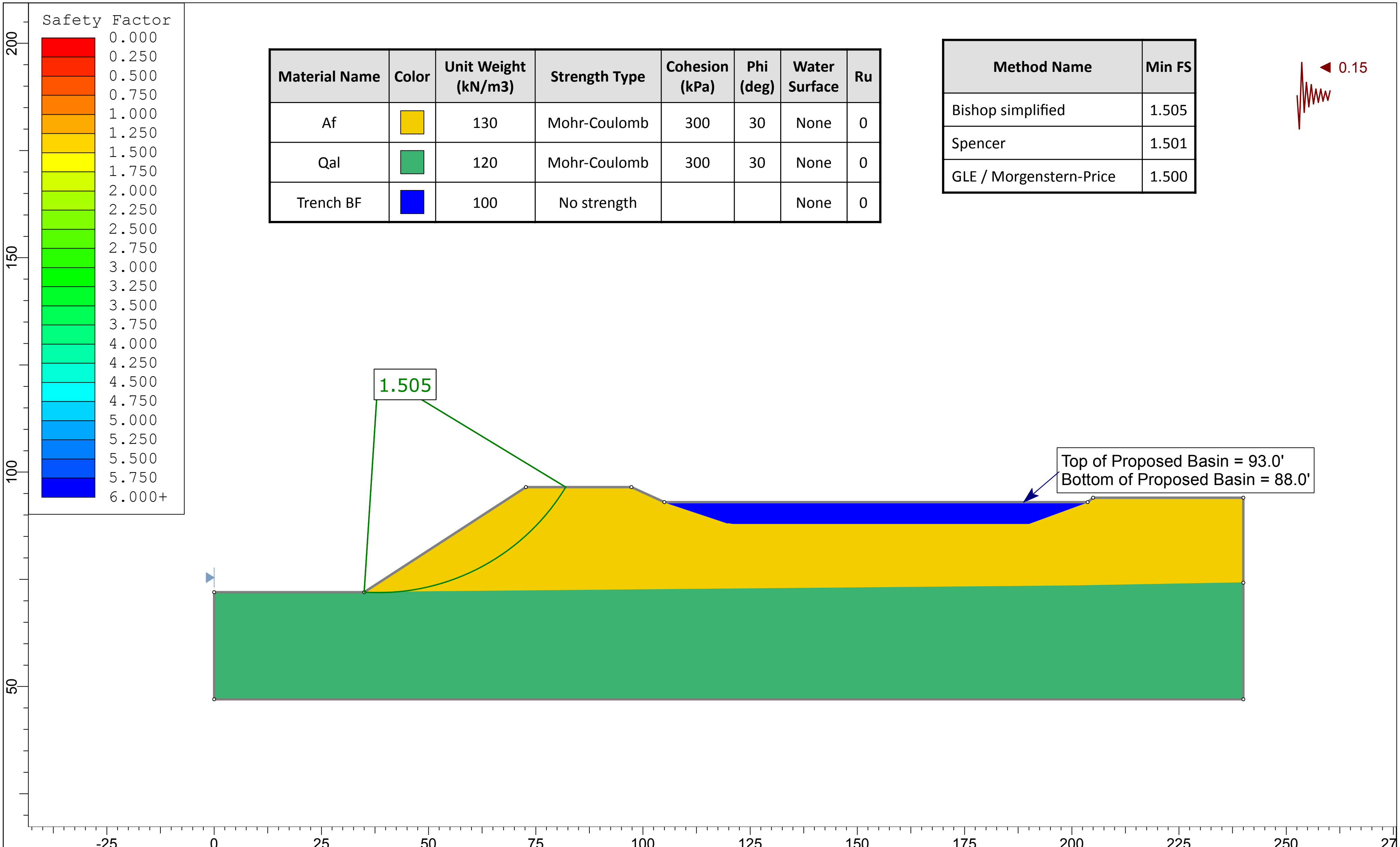
Method Name	Min FS
Bishop simplified	1.970
Spencer	1.962
GLE / Morgenstern-Price	1.959



rocscience

SLIDEINTERPRET 7.038

Project	4991 Macario Drive
Analysis Description	Cross Section A-A' Circular Analysis - Static
Drawn By	CH
Scale	1:1306
Company	GeoTek
Date	1/13/2022, 4:43:40 PM
File Name	Cross Section A-A' Static.slim



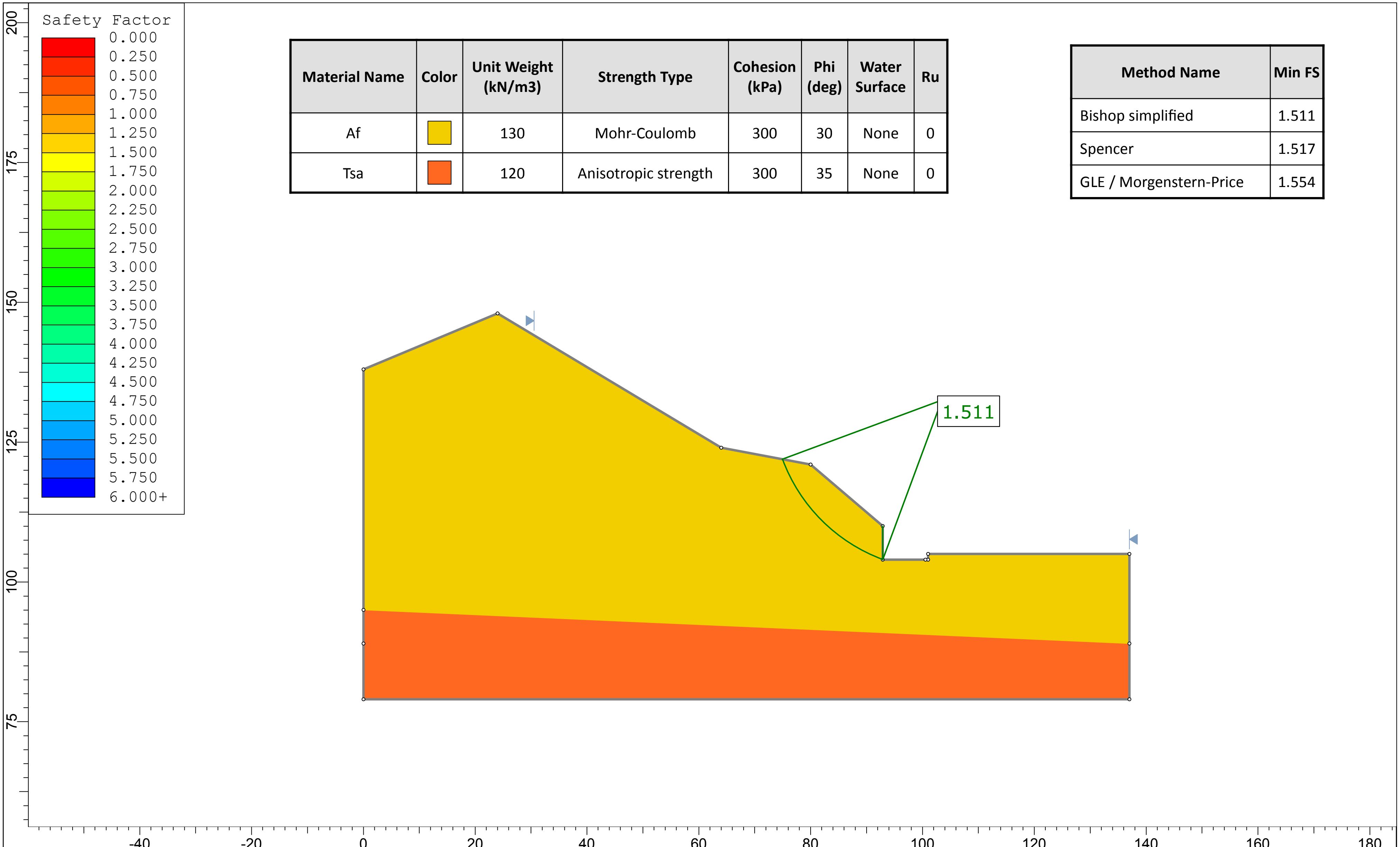
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Af		130	Mohr-Coulomb	300	30	None	0
Qal		120	Mohr-Coulomb	300	30	None	0
Trench BF		100	No strength			None	0

Method Name	Min FS
Bishop simplified	1.505
Spencer	1.501
GLE / Morgenstern-Price	1.500

rocscience

SLIDEINTERPRET 7.038

Project	4991 Macario Drive		
Analysis Description	Cross Section A-A' Circular Analysis - PseudoStatic		
Drawn By CH	*Scale* 1:1219	*Company*	GeoTek
Date	1/19/2022, 4:43:40 PM	*File Name*	Cross Section A-A' Static.slim



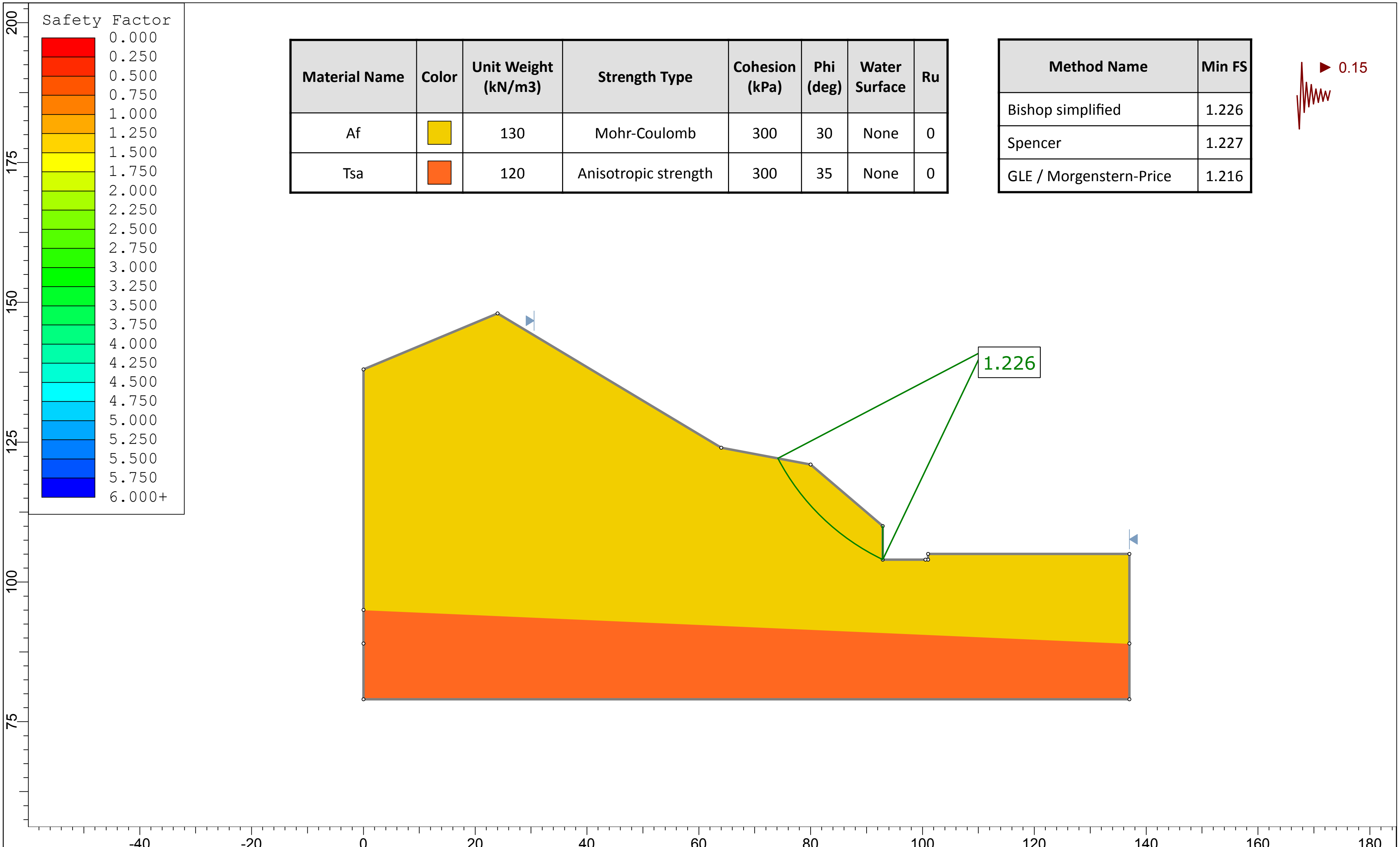
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Af		130	Mohr-Coulomb	300	30	None	0
Tsa		120	Anisotropic strength	300	35	None	0

Method Name	Min FS
Bishop simplified	1.511
Spencer	1.517
GLE / Morgenstern-Price	1.554

rocscience

SLIDEINTERPRET 7.038

Project	Cross Section B-B' - Circular Analysis - Static		
Analysis Description	4991 Macario Drive		
Drawn By CH	*Scale* 1:935	*Company*	GeoTek, Inc.
Date	1/19/2022, 4:38:27 PM	*File Name*	Cross Section B-B' Static.slim



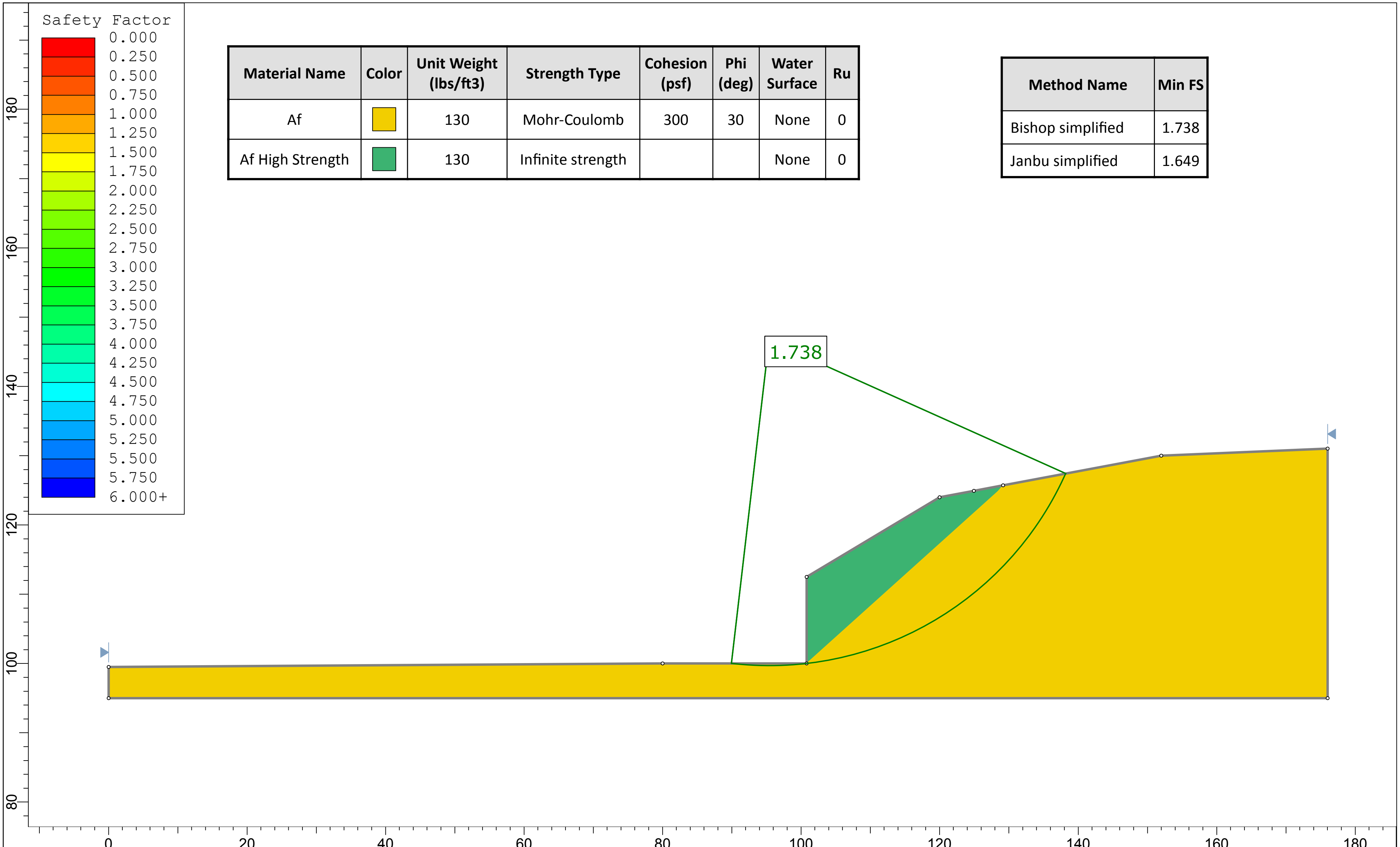
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Af		130	Mohr-Coulomb	300	30	None	0
Tsa		120	Anisotropic strength	300	35	None	0

Method Name	Min FS
Bishop simplified	1.226
Spencer	1.227
GLE / Morgenstern-Price	1.216

rocscience

SLIDEINTERPRET 7.038

Project	Cross Section B-B' - Circular Analysis - PseudoStatic
Analysis Description	4991 Macario Drive
Drawn By	CH
Scale	1:935
Company	GeoTek, Inc.
Date	1/19/2022, 4:38:27 PM
File Name	Cross Section B-B' Static.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Af		130	Mohr-Coulomb	300	30	None	0
Af High Strength		130	Infinite strength			None	0

Method Name	Min FS
Bishop simplified	1.738
Janbu simplified	1.649

rocscience

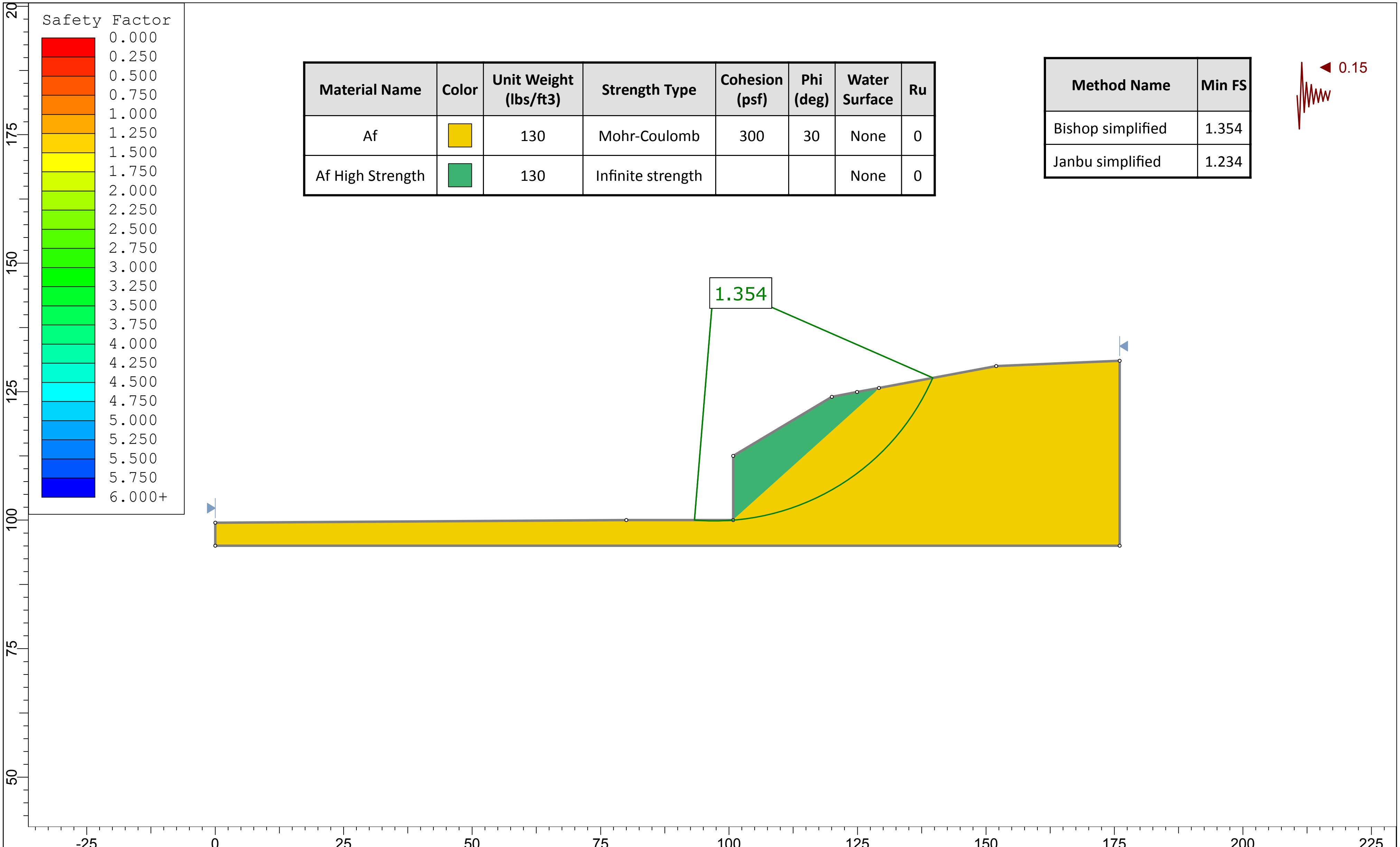
SLIDEINTERPRET 7.038

Project Cross Section C-C' Circular Analysis - Static

Analysis Description 4991 Macario Drive- 3743-SD

Drawn By CH *Scale* 1:230 *Company* GeoTek, Inc.

Date 1/19/2022, 6:19:54 PM *File Name* Cross Section C-C' Static High Strength Active Zone.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Af		130	Mohr-Coulomb	300	30	None	0
Af High Strength		130	Infinite strength			None	0

Method Name	Min FS
Bishop simplified	1.354
Janbu simplified	1.234

rocscience

SLIDEINTERPRET 7.038

Project	Cross Section C-C' Circular Analysis - PseudoStatic		
Analysis Description	4991 Macario Drive- 3743-SD		
Drawn By	CH	*Scale* 1:310	*Company* GeoTek, Inc.
Date	1/19/2022, 6:19:54 PM	*File Name*	Cross Section C-C' Static High Strength Active Zone.slim

APPENDIX E

LIQUEFACTION SETTLEMENT ANALYSES

GEOTEK

GeoTek, Inc.
1548 N. Maple Street
Corona, CA 92878
951-710-1160, www.geotekusa.com

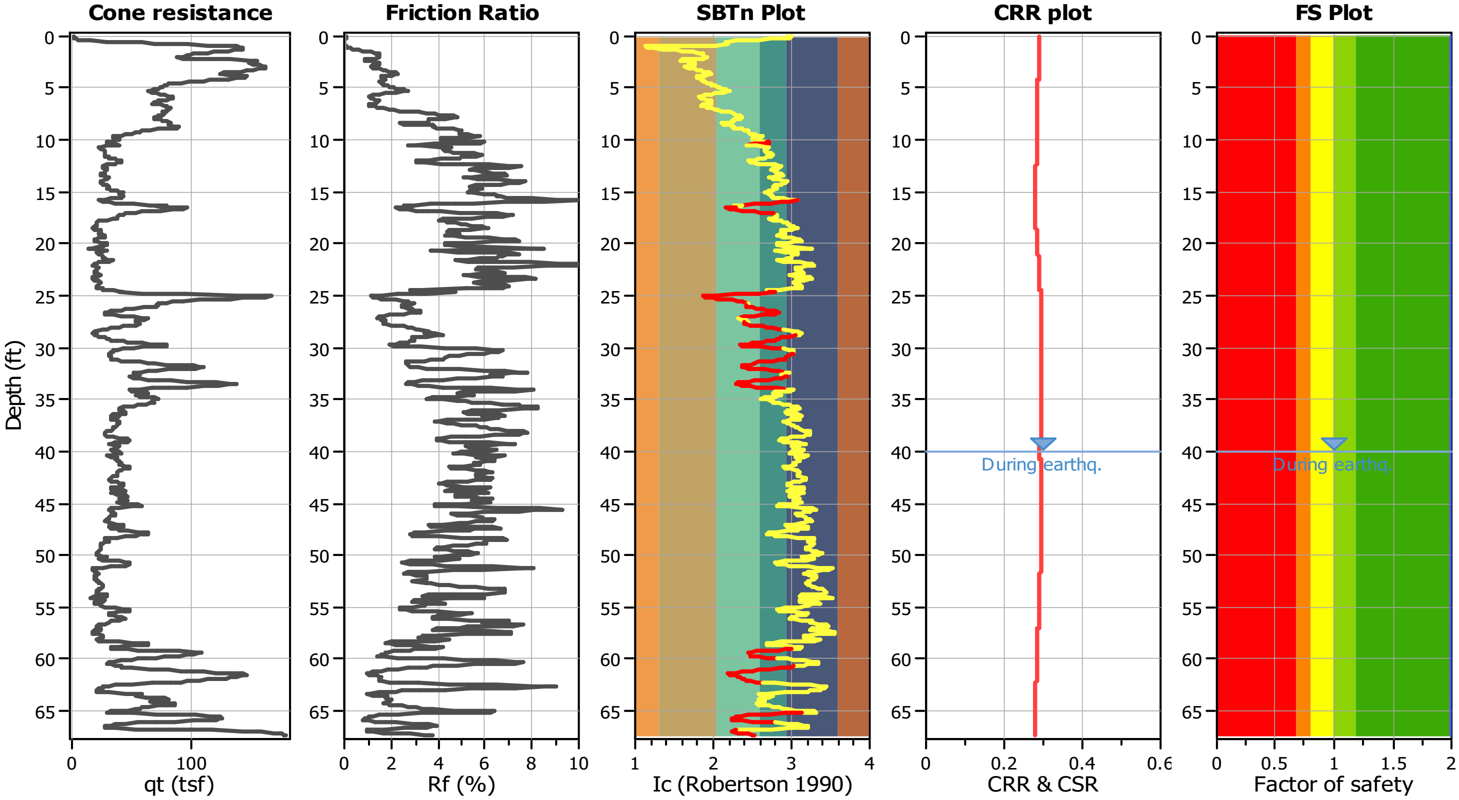
LIQUEFACTION ANALYSIS REPORT

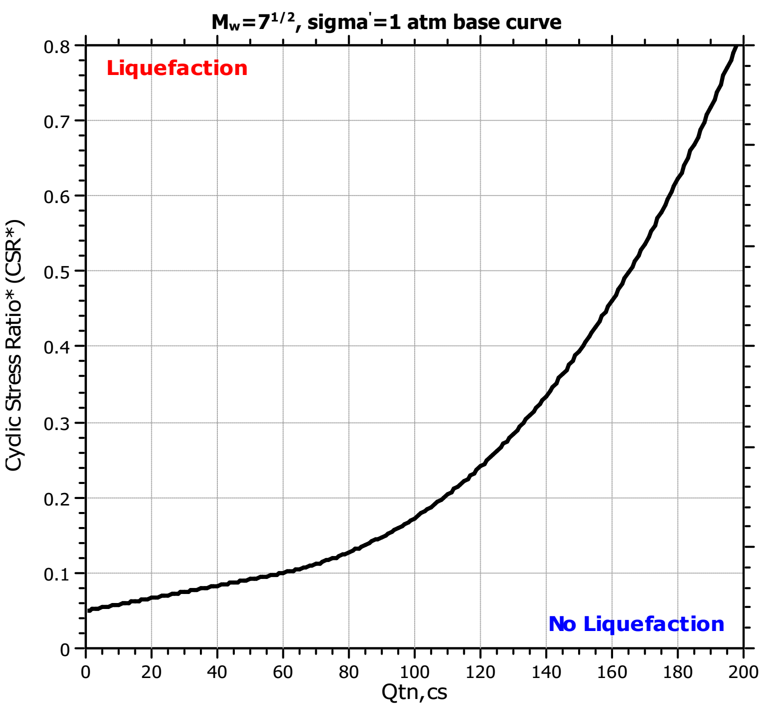
Project title : 4991 Macario Dr **Location : Oceanside, CA**

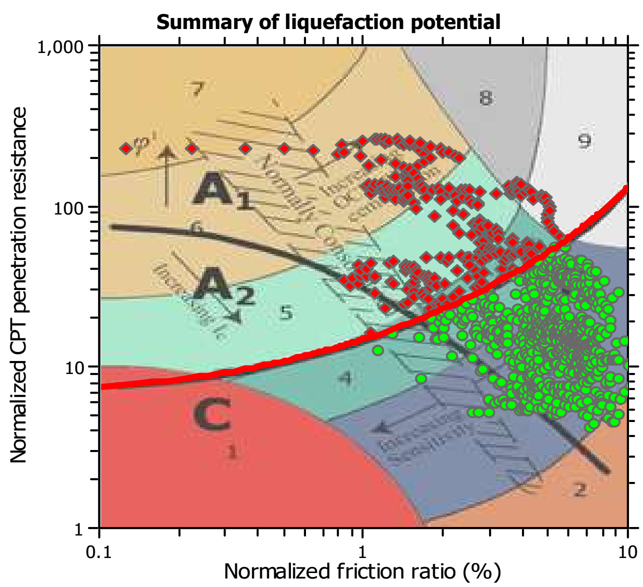
CPT file : Sheet 1 - Geotek 4991 Macario O

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	45.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	40.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.57	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.48	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

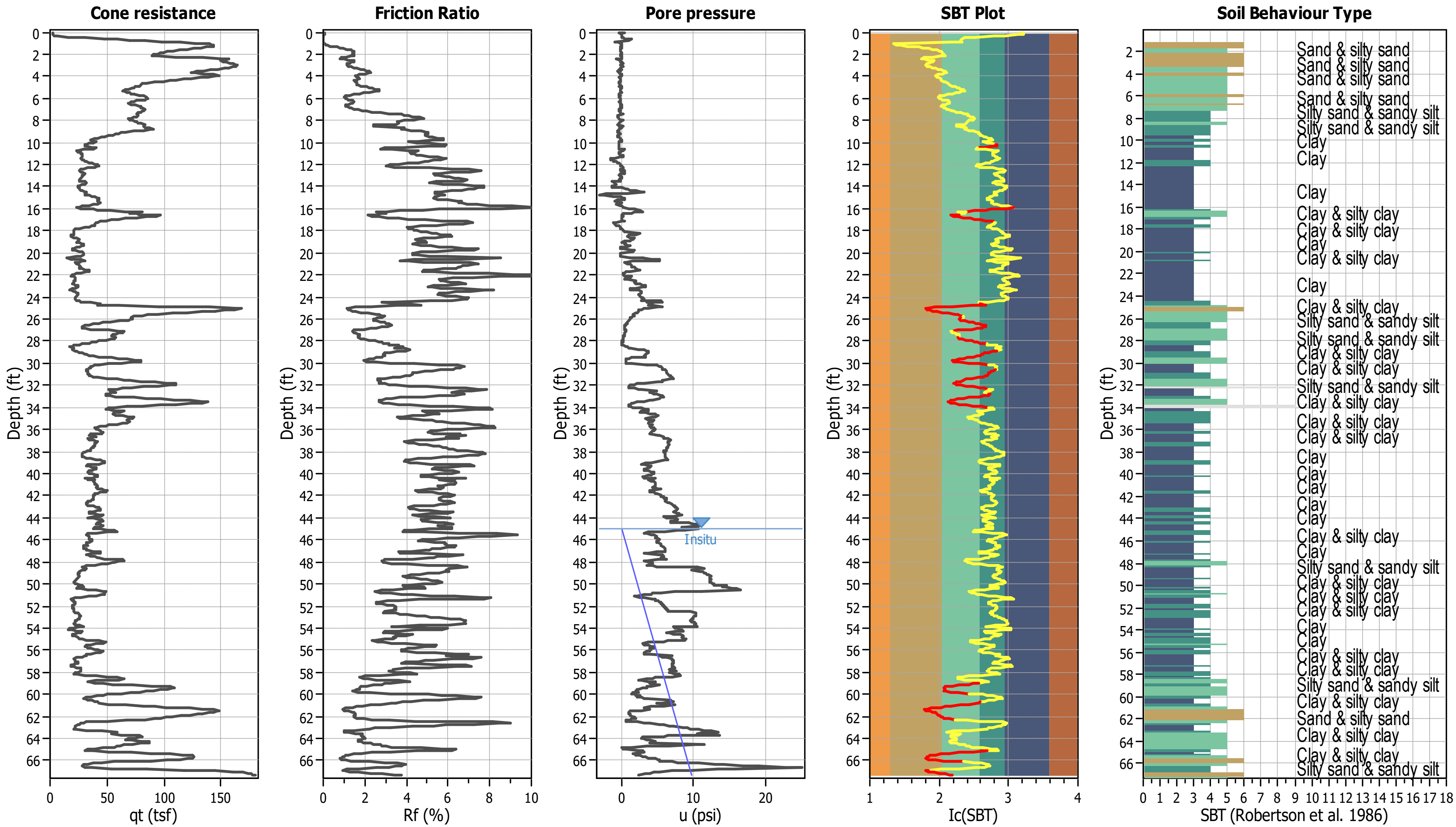






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



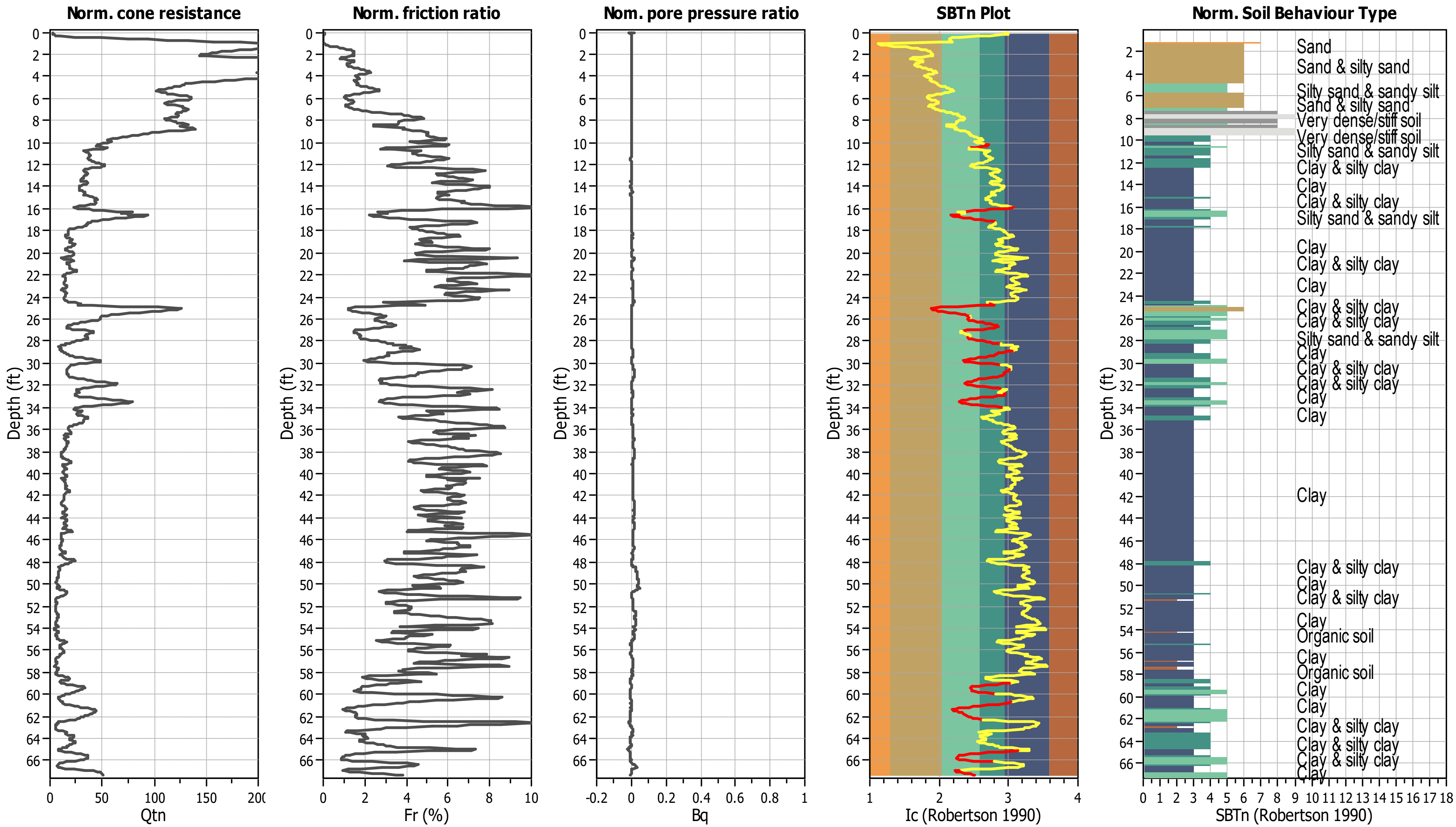
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.57	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



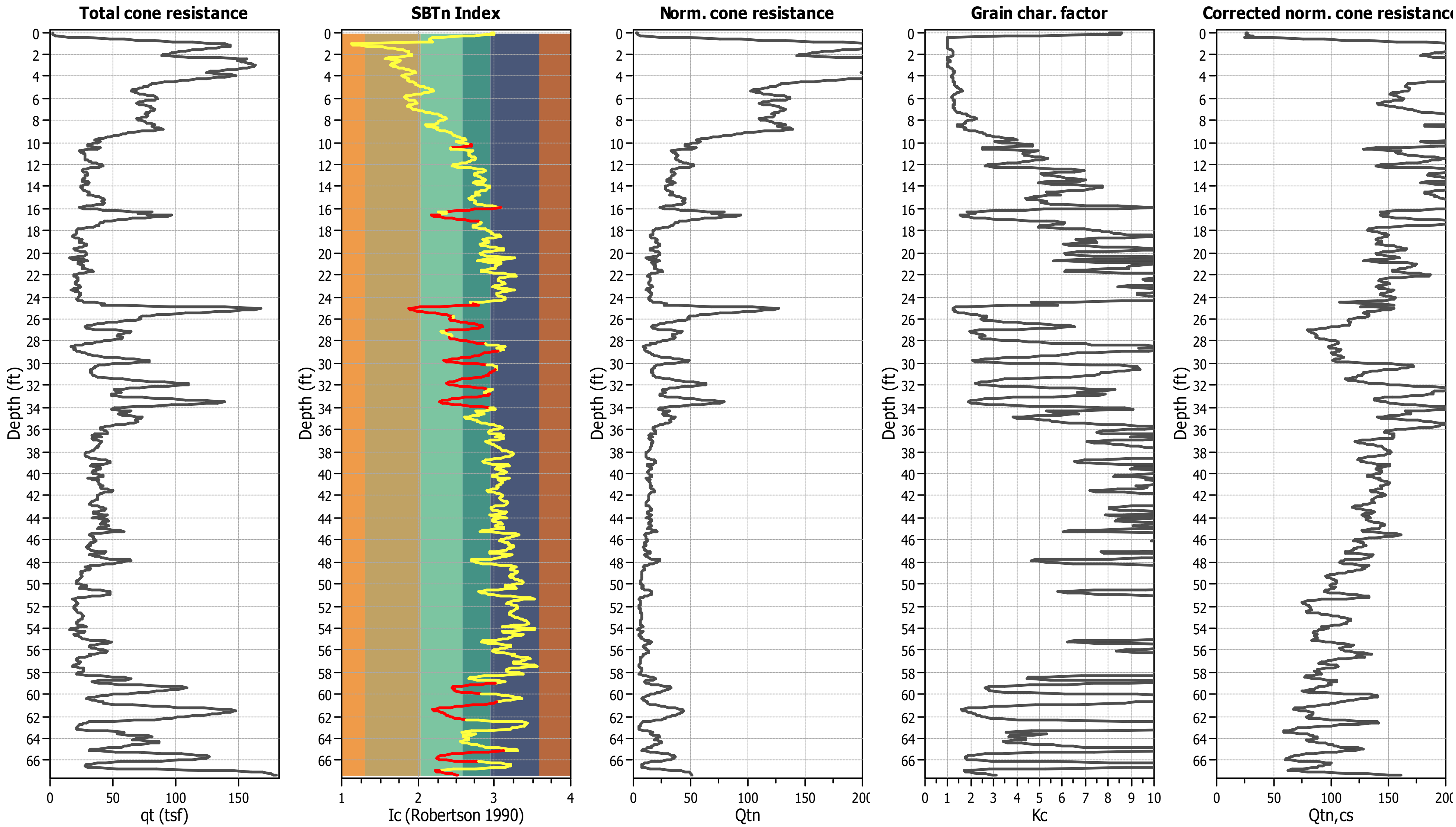
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.57	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

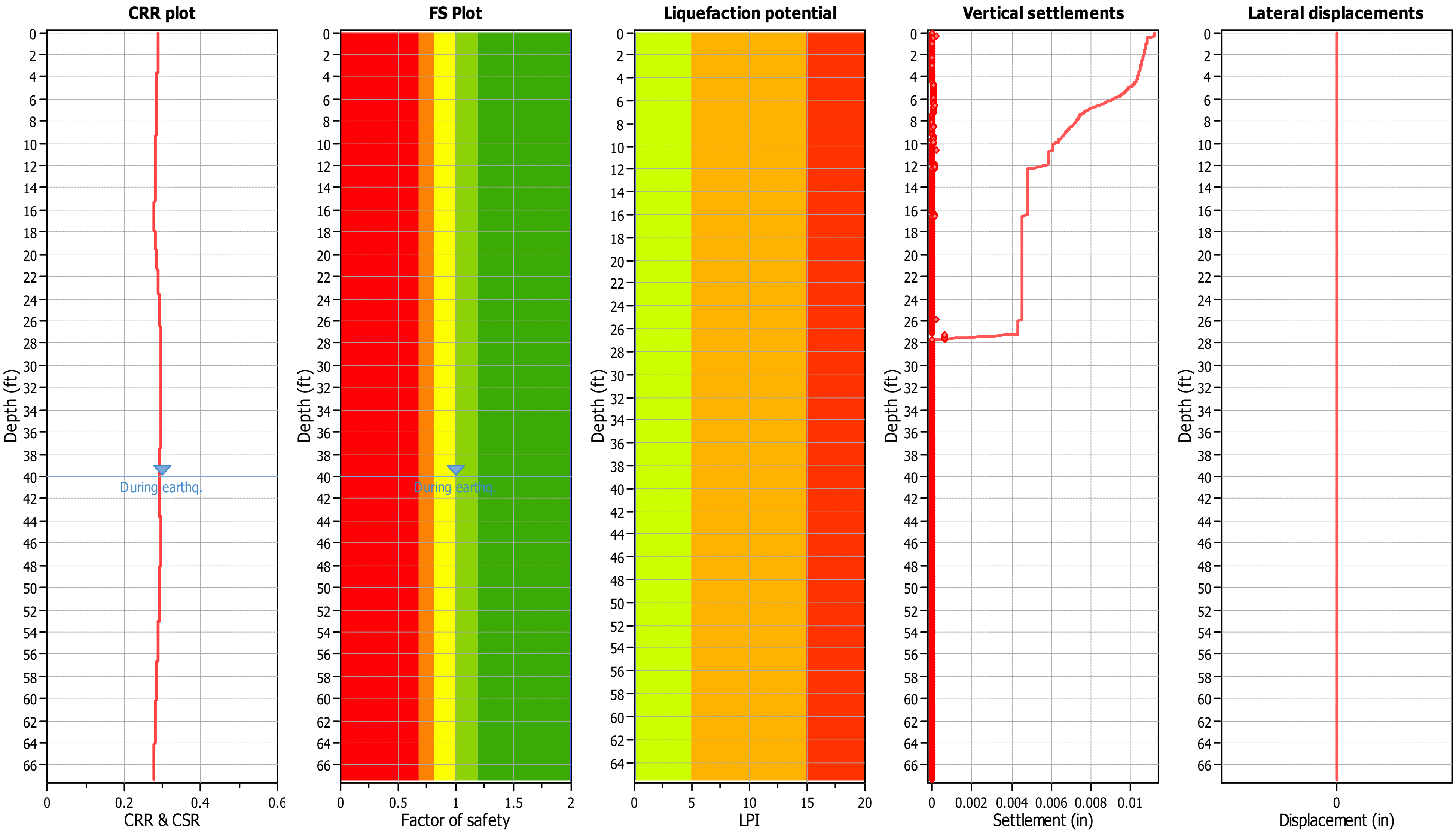
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	6.57	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.57	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

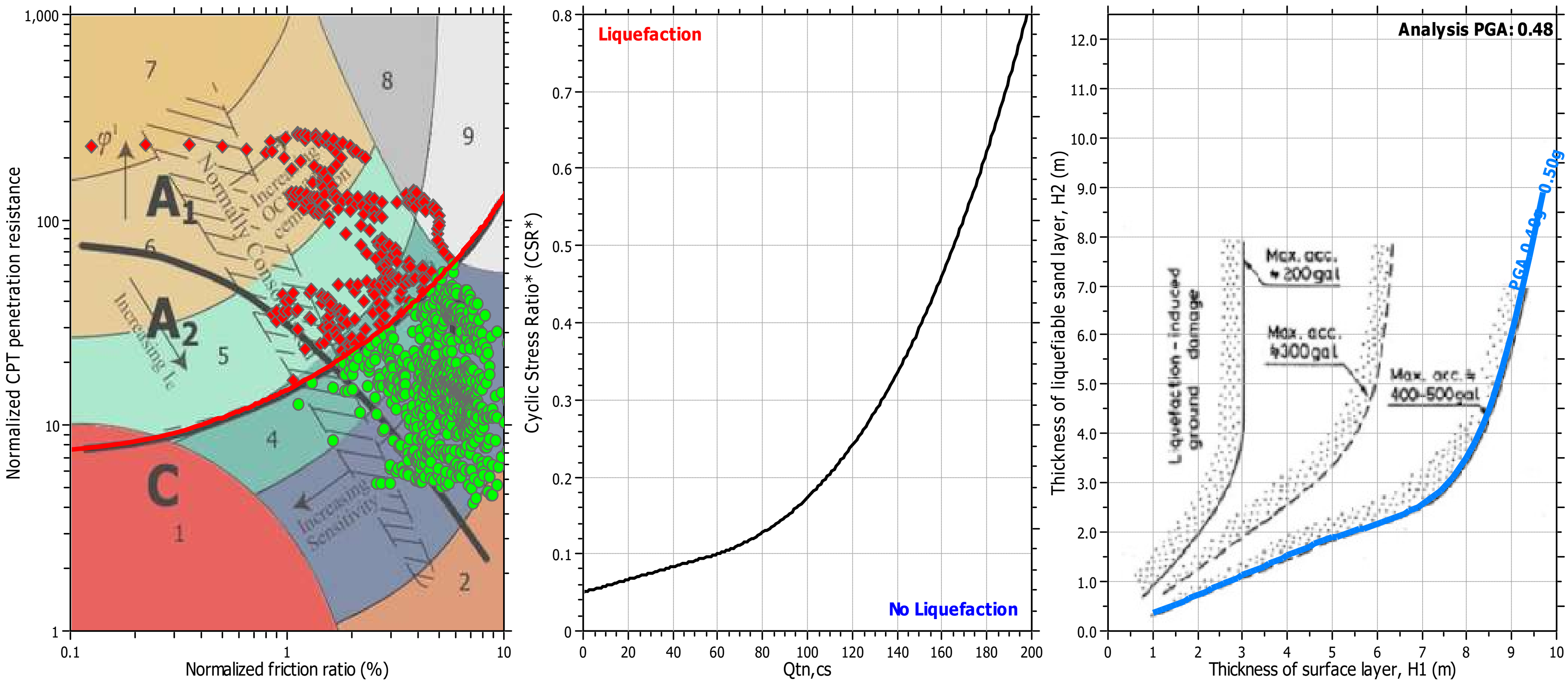
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

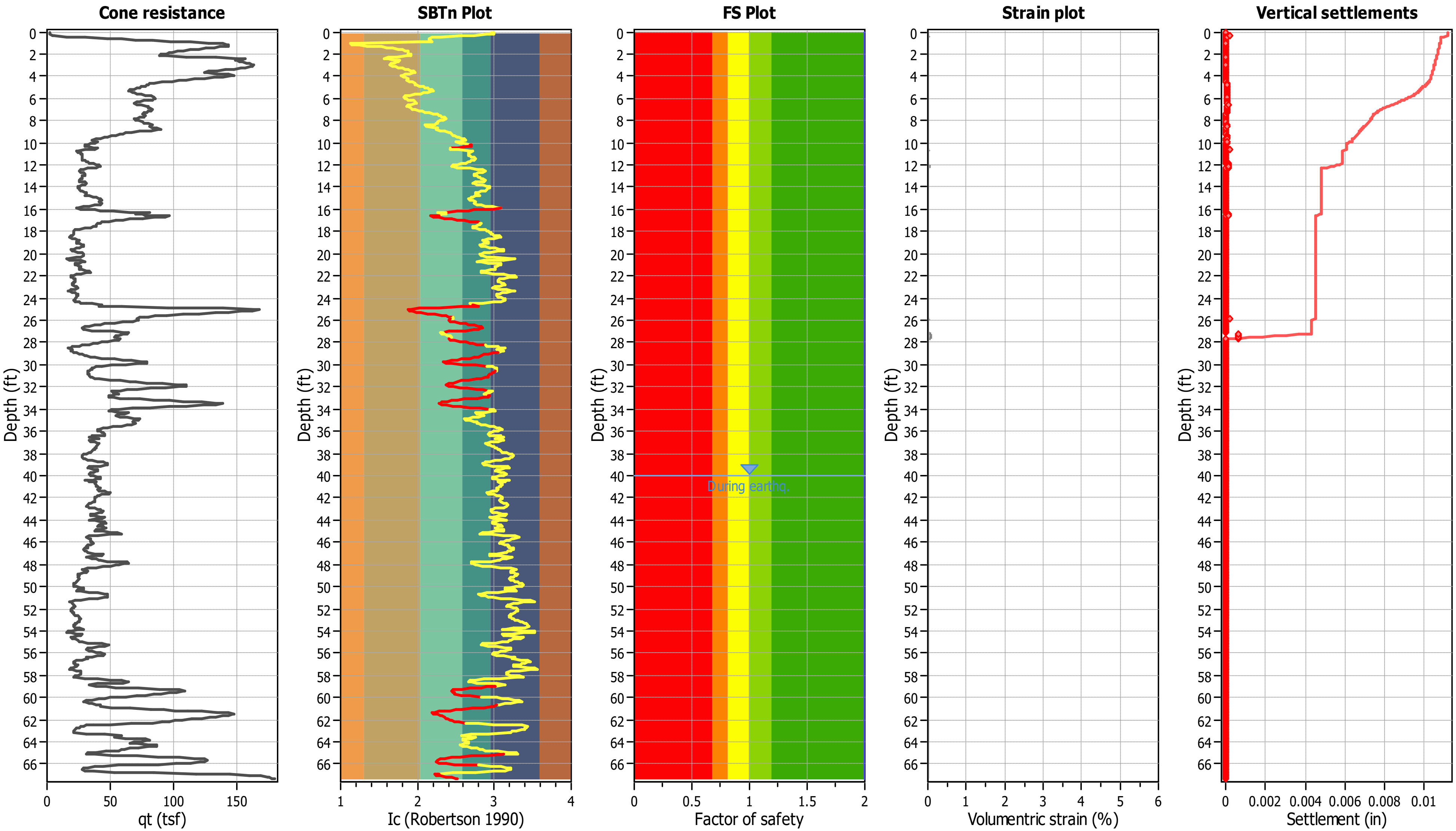
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	40.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	6.57	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
FS: Calculated Factor of Safety against liquefaction
Volumentric strain: Post-liquefaction volumentric strain

APPENDIX E

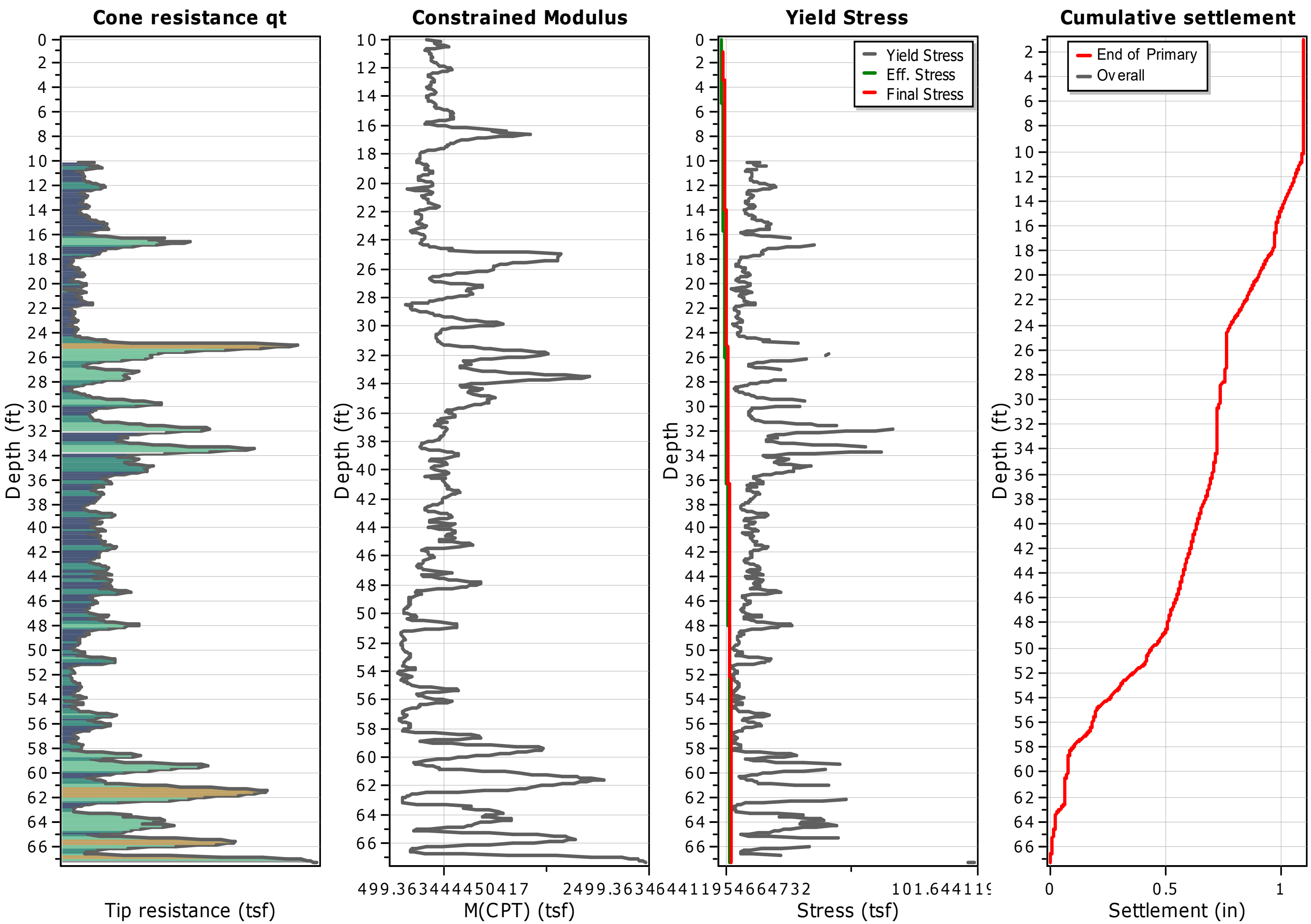
STATIC SETTLEMENT ANALYSES

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

CPT: CPT-1
Total depth: 67.32 ft, Date: 10/26/2021
Surface Elevation: 0.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **4991 Macario Drive**
Location: **Oceanside, CA**

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (ft)
L/B: 1.0
Footing pressure: 0.75 (tsf)
Embedment depth: 1.00 (ft)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

APPENDIX F

GENERAL GRADING GUIDELINES

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, the California Building Code, CBC (2019) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.
5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.

6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative. Typical procedures are similar to those indicated on Plate G-4.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed (see Plates G-1, G-2 and G-3) unless otherwise specifically indicated in the text of this report.
2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Subdrainage

1. Subdrainage systems should be provided in canyon bottoms prior to placing fill, and behind buttress and stabilization fills and in other areas indicated in the report. Subdrains should conform to schematic diagrams G-1 and G-5, and be acceptable to our representative.
2. For canyon subdrains, runs less than 500 feet may use six-inch pipe. Typically, runs in excess of 500 feet should have the lower end as eight-inch minimum.
3. Filter material should be clean, 1/2 to 1-inch gravel wrapped in a suitable filter fabric. Class 2 permeable filter material per California Department of Transportation Standards tested by this office to verify its suitability, may be used without filter fabric. A sample of the material should be provided to the Soils Engineer by the contractor at least two working days before it is delivered to the site. The filter should be clean with a wide range of sizes.
4. Approximate delineation of anticipated subdrain locations may be offered at 40-scale plan review stage. During grading, this office would evaluate the necessity of placing additional drains.
5. All subdrainage systems should be observed by our representative during construction and prior to covering with compacted fill.
6. Subdrains should outlet into storm drains where possible. Outlets should be located and protected. The need for backflow preventers should be assessed during construction.
7. Consideration should be given to having subdrains located by the project surveyors.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).
2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
   a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
   b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
   a) They are not placed in concentrated pockets;
   b) There is a sufficient percentage of fine-grained material to surround the rocks;
   c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal (see Plate G-4). On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If

significant oversize materials are encountered during construction, these guidelines should be requested.

6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

Keyways, Buttress and Stabilization Fills

Keyways are needed to provide support for fill slope and various corrective procedures.

1. Side-hill fills should have an equipment-width key at their toe excavated through all surficial soil and into competent material and tilted back into the hill (Plates G-2, G-3). As the fill is elevated, it should be benched through surficial soil and slopewash, and into competent bedrock or other material deemed suitable by our representatives (See Plates G-1, G-2, and G-3).
2. Fill over cut slopes should be constructed in the following manner:
   a) All surficial soils and weathered rock materials should be removed at the cut-fill interface.
   b) A key at least one and one-half (1.5) equipment width wide (or as needed for compaction), and tipped at least one (1) foot into slope, should be excavated into competent materials and observed by our representative.
   c) The cut portion of the slope should be excavated prior to fill placement to evaluate if stabilization is necessary. The contractor should be responsible for any additional earthwork created by placing fill prior to cut excavation. (see Plate G-3 for schematic details.)
3. Daylight cut lots above descending natural slopes may require removal and replacement of the outer portion of the lot. A schematic diagram for this condition is presented on Plate G-2.

4. A basal key is needed for fill slopes extending over natural slopes. A schematic diagram for this condition is presented on Plate G-2.
5. All fill slopes should be provided with a key unless within the body of a larger overall fill mass. Please refer to Plate G-3 for specific guidelines.

Anticipated buttress and stabilization fills are discussed in the text of the report. The need to stabilize other proposed cut slopes will be evaluated during construction. Plate G-5 shows a schematic of buttress construction.

1. All backcuts should be excavated at gradients of 1:1 or flatter. The backcut configuration should be determined based on the design, exposed conditions, and need to maintain a minimum fill width and provide working room for the equipment.
2. On longer slopes, backcuts and keyways should be excavated in maximum 250 feet long segments. The specific configurations will be determined during construction.
3. All keys should be a minimum of two (2) feet deep at the toe and slope toward the heel at least one foot or two (2%) percent, whichever is greater.
4. Subdrains are to be placed for all stabilization slopes exceeding 10 feet in height. Lower slopes are subject to review. Drains may be required. Guidelines for subdrains are presented on Plate G-5.
5. Benching of backcuts during fill placement is required.

Lot Capping

1. When practical, the upper three (3) feet of material placed below finish grade should be comprised of the least expansive material available. Preferably, highly and very highly expansive materials should not be used. We will attempt to offer advice based on visual evaluations of the materials during grading, but it must be realized that laboratory testing is needed to evaluate the expansive potential of soil. Minimally, this testing takes two (2) to four (4) days to complete.
2. Transition lots (cut and fill) both per plan and those created by remedial grading (e.g. lots above stabilization fills, along daylight lines, above natural slopes, etc.) should be capped with a minimum three foot thick compacted fill blanket.
3. Cut pads should be observed by our representative(s) to evaluate the need for overexcavation and replacement with fill. This may be necessary to reduce water infiltration into highly fractured bedrock or other permeable zones, and/or due to differing expansive potential of materials beneath a structure. The overexcavation should be at least three feet. Deeper overexcavation may be recommended in some cases.

ROCK PLACEMENT AND ROCK FILL GUIDELINES

If large quantities of oversize material would be generated during grading, it's likely that such materials may require special handling for burial. Although alternatives may be developed in the field, the following methods of rock disposal are recommended on a preliminary basis.

Limited Larger Rock

When materials encountered are principally soil with limited quantities of larger rock fragments or boulders, placement in windrows is recommended. The following procedures should be applied:

1. Oversize rock (greater than 8 inches) should be placed in windrows.
   a) Windrows are rows of single file rocks placed to avoid nesting or clusters of rock.

b) Each adjacent rock should be approximately the same size (within ~one foot in diameter).

c) The maximum rock size allowed in windrows is four feet

2. A minimum vertical distance of three feet between lifts should be maintained. Also, the windrows should be offset from lift to lift. Rock windrows should not be closer than 15 feet to the face of fill slopes and sufficient space must be maintained for proper slope construction (see Plate G-4).
3. Rocks greater than eight inches in diameter should not be placed within seven feet of the finished subgrade for a roadway or pads and should be held below the depth of the lowest utility. This will allow easier trenching for utility lines.
4. Rocks greater than four feet in diameter should be broken down, if possible, or they may be placed in a dozer trench. Each trench should be excavated into the compacted fill a minimum of one foot deeper than the largest diameter of rock.

a) The rock should be placed in the trench and granular fill materials (SE>30) should be flooded into the trench to fill voids around the rock.

b) The over size rock trenches should be no closer together than 15 feet from any slope face.

c) Trenches at higher elevation should be staggered and there should be a minimum of four feet of compacted fill between the top of the one trench and the bottom of the next higher trench.

d) It would be necessary to verify 90 percent relative compaction in these pits. A 24 to 72 hour delay to allow for water dissipation should be anticipated prior to additional fill placement.

Structural Rock Fills

If the materials generated for placement in structural fills contains a significant percentage of material more than six (6) inches in one dimension, then placement using conventional soil fill methods with isolated windrows would not be feasible. In such cases the following could be considered:

1. Mixes of large rock or boulders may be placed as rock fill. They should be below the depth of all utilities both on pads and in roadways and below any proposed swimming pools or other excavations. If these fills are placed within seven (7) feet of finished grade, they may affect foundation design.
2. Rock fills are required to be placed in horizontal layers that should **not exceed two feet in thickness, or the maximum rock size present, which ever is less**. All rocks exceeding two feet should be broken down to a smaller size, windrowed (see above), or disposed of in non-structural fill areas. Localized larger rock up to 3 feet in largest dimension may be placed in rock fill as follows:

a) individual rocks are placed in a given lift so as to be roughly 50% exposed above the typical surface of the fill ,

b) loaded rock trucks or alternate compactors are worked around the rock on all sides to the satisfaction of the soil engineer,

c) the portion of the rock above grade is covered with a second lift.

3. Material placed in each lift should be well graded. No unfilled spaces (voids) should be permitted in the rock fill.

Compaction Procedures

Compaction of rock fills is largely procedural. The following procedures have been found to generally produce satisfactory compaction.

1. Provisions for routing of construction traffic over the fill should be implemented.
   a) Placement should be by rock trucks crossing the lift being placed and dumping at its edge.
   b) The trucks should be routed so that each pass across the fill is via a different path and that all areas are uniformly traversed.
   c) The dumped piles should be knocked down and spread by a large dozer (D-8 or larger suggested). (Water should be applied before and during spreading.)
2. Rock fill should be generously watered (sluiced)
   a) Water should be applied by water trucks to the:
      i) dump piles,
      ii) front face of the lift being placed and,
      iii) surface of the fill prior to compaction.
   b) No material should be placed without adequate water.
   c) The number of water trucks and water supply should be sufficient to provide constant water.
   d) Rock fill placement should be suspended when water trucks are unavailable:
      i) for more than 5 minutes straight, or,
      ii) for more than 10 minutes/hour.
3. In addition to the truck pattern and at the discretion of the soil engineer, large, rubber tired compactors may be required.
   a) The need for this equipment will depend largely on the ability of the operators to provide complete and uniform coverage by wheel rolling with the trucks.
   b) Other large compactors will also be considered by the soil engineer provided that required compaction is achieved.
4. Placement and compaction of the rock fill is largely procedural. Observation by trenching should be made to check:
   a) the general segregation of rock size,
   b) for any unfilled spaces between the large blocks, and
   c) the matrix compaction and moisture content.
5. Test fills may be required to evaluate relative compaction of finer grained zones or as deemed appropriate by the soil engineer.
   a) A lift should be constructed by the methods proposed, as proposed
6. Frequency of the test trenching is to be at the discretion of the soil engineer. Control areas may be used to evaluate the contractor's procedures.
7. A minimum horizontal distance of 15 feet should be maintained from the face of the rock fill and any finish slope face. At least the outer 15 feet should be built of conventional fill materials.

Piping Potential and Filter Blankets

Where conventional fill is placed over rock fill, the potential for piping (migration) of the fine grained material from the conventional fill into rock fills will need to be addressed.
The potential for particle migration is related to the grain size comparisons of the materials present and in contact with each other. Provided that 15 percent of the finer soil is larger than the effective

pore size of the coarse soil, then particle migration is substantially mitigated. This can be accomplished with a well-graded matrix material for the rock fill and a zone of fill similar to the matrix above it. The specific gradation of the fill materials placed during grading must be known to evaluate the need for any type of filter that may be necessary to cap the rock fills. This, unfortunately, can only be accurately determined during construction.

In the event that poorly graded matrix is used in the rock fills, properly graded filter blankets 2 to 3 feet thick separating rock fills and conventional fill may be needed. As an alternative, use of two layers of filter fabric (Mirafi 700 x or equivalent) could be employed on top of the rock fill. In order to mitigate excess puncturing, the surface of the rock fill should be well broken down and smoothed prior to placing the filter fabric. The first layer of the fabric may then be placed and covered with relatively permeable fill material (with respect to overlying material) 1 to 2 feet thick. The relative permeable material should be compacted to fill standards. The second layer of fabric should be placed and conventional fill placement continued.

Subdrainage

Rock fill areas should be tied to a subdrainage system. If conventional fill is placed that separates the rock from the main canyon subdrain, then a secondary system should be installed. A system consisting of an adequately graded base (3 to 4 percent to the lower side) with a collector system and outlets may suffice.

Additionally, at approximately every 25 foot vertical interval, a collector system with outlets should be placed at the interface of the rock fill and the conventional fill blanketing a fill slope.

Monitoring

Depending upon the depth of the rock fill and other factors, monitoring for settlement of the fill areas may be needed following completion of grading. Typically, if rock fill depths exceed 40 feet, monitoring would be recommend prior to construction of any settlement sensitive improvements. Delays of 3 to 6 months or longer can be expected prior to the start of construction.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractor's responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.

2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractor's procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractor's attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

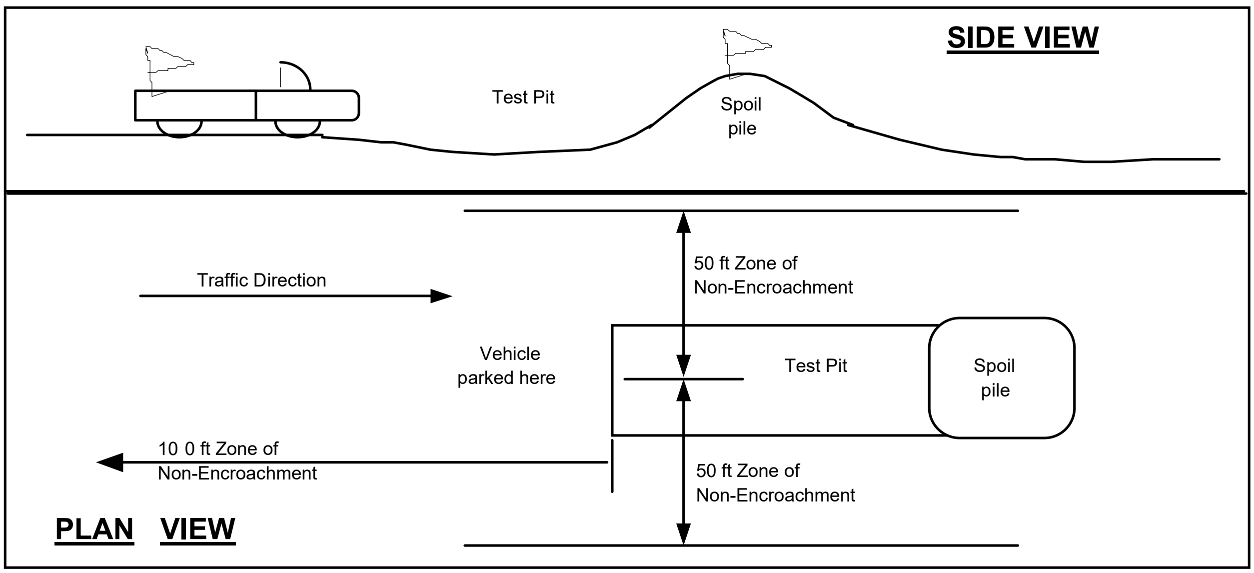
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractor's representative will then be contacted in an effort to affect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to affect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technician's attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

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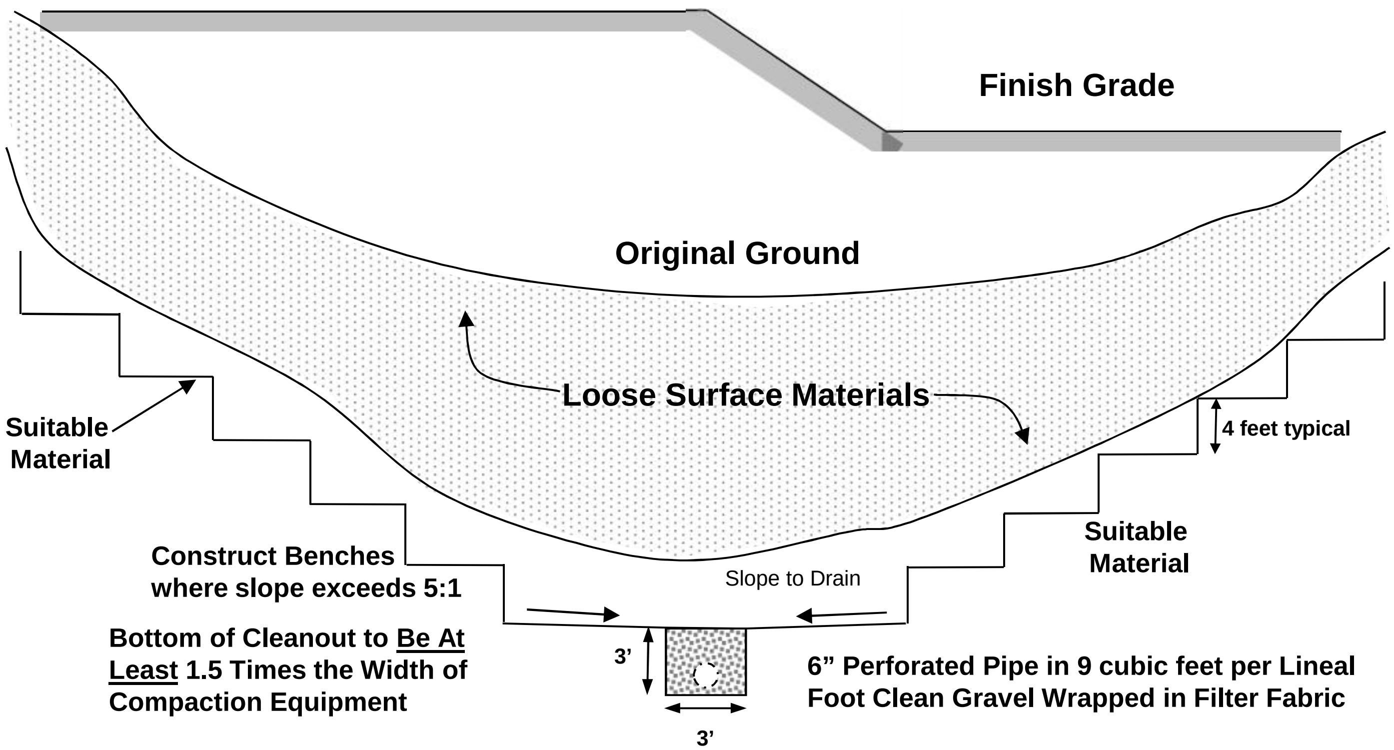
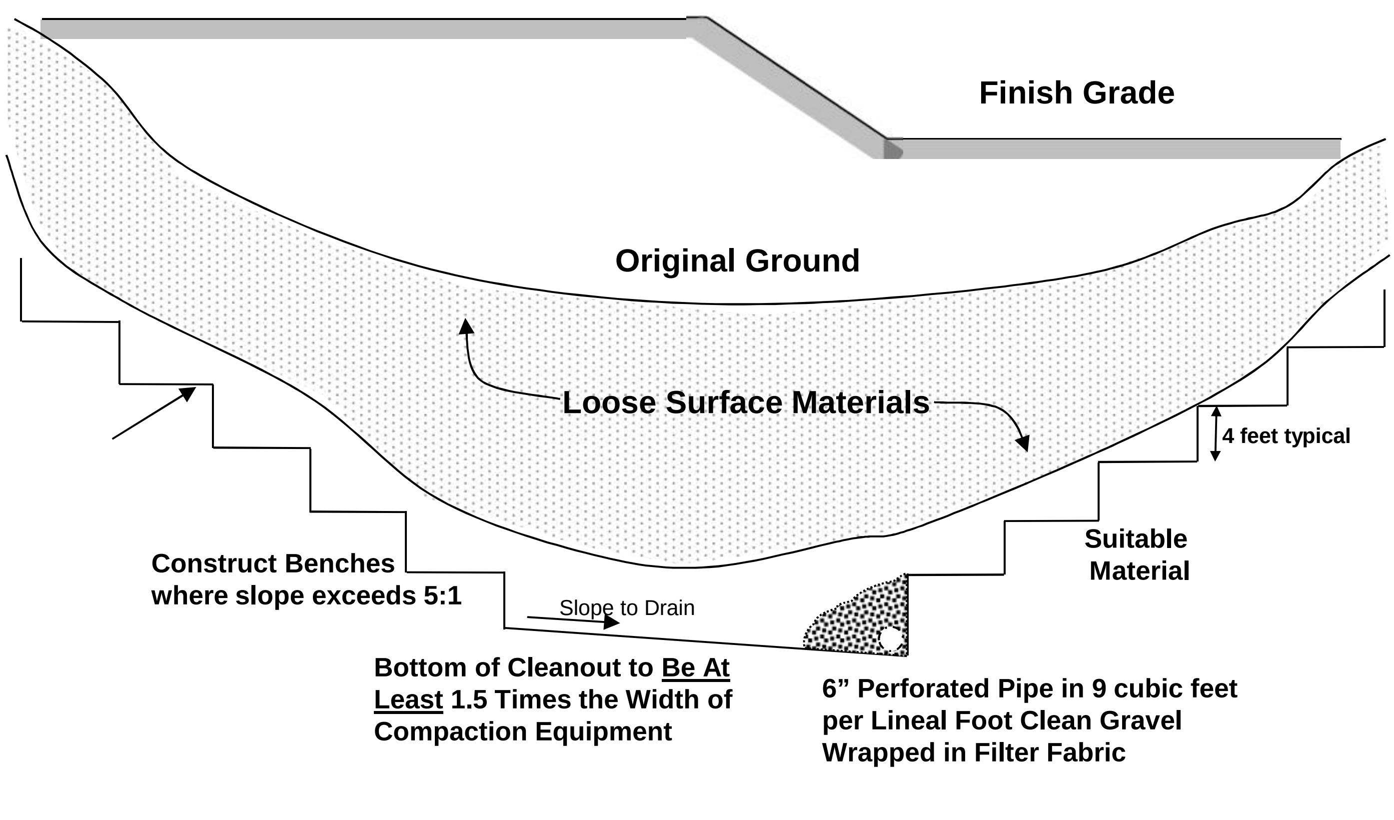
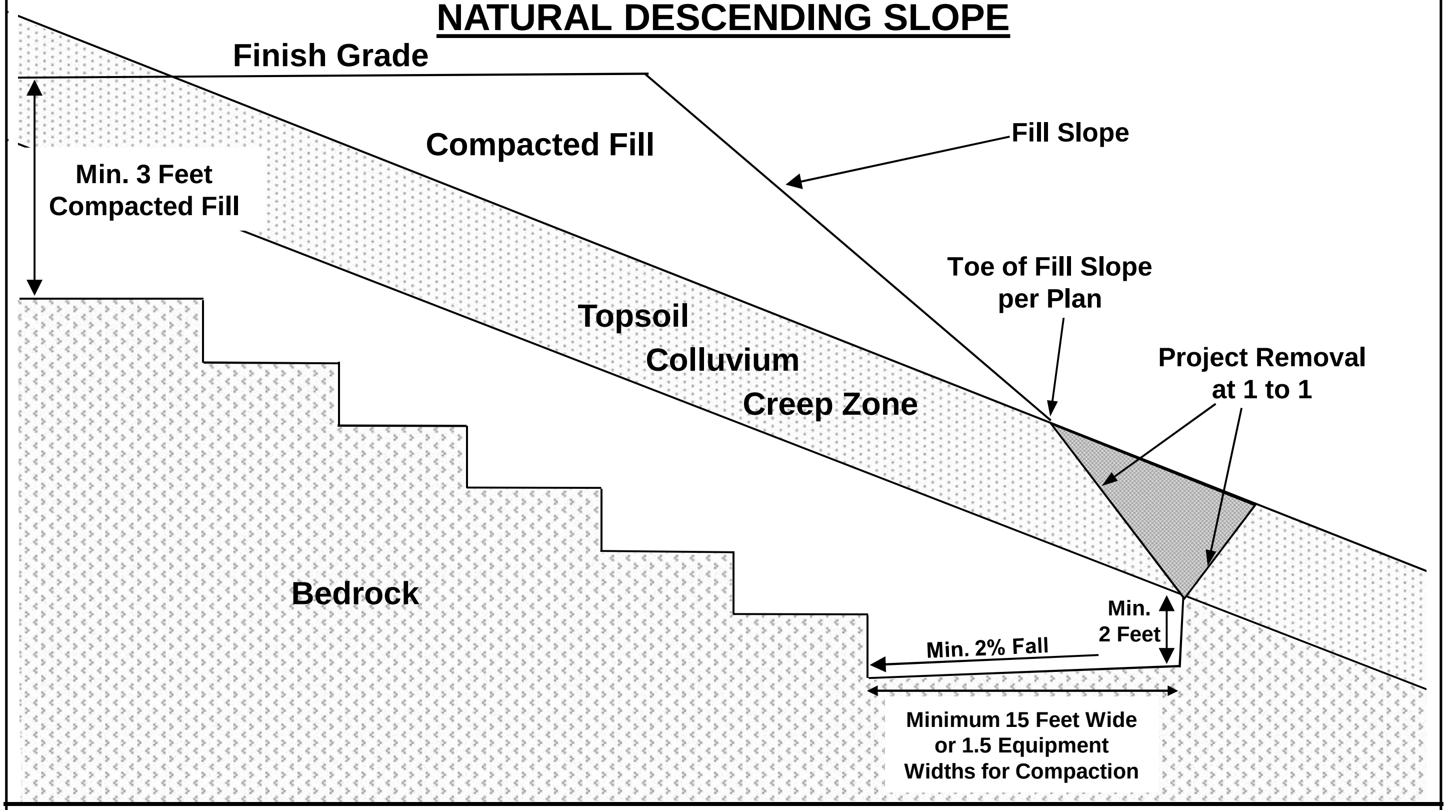
ALTERNATES



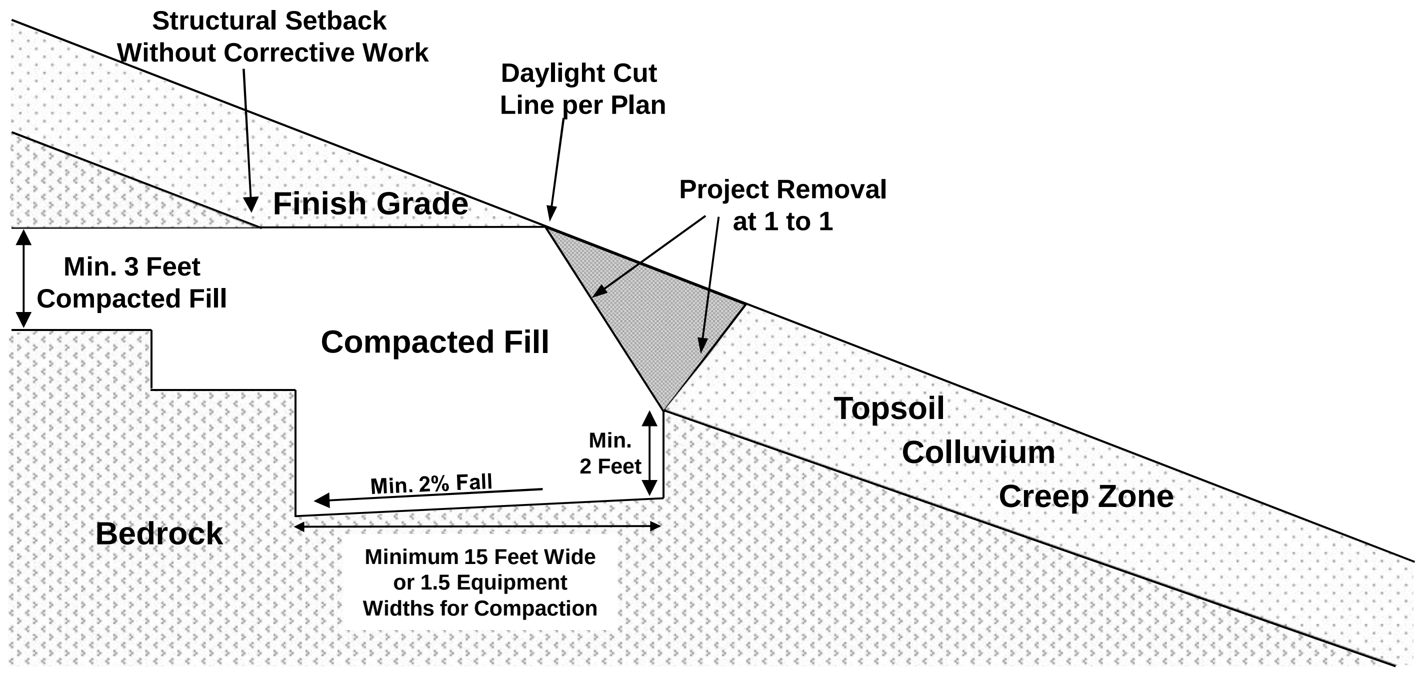


GEOTEK	1384 Poinsettia Avenue, Suite A Vista, California 92083	TYPICAL CANYON CLEANOUT	STANDARD GRADING GUIDELINES PLATE G-1

TYPICAL FILL SLOPE OVER NATURAL DESCENDING SLOPE



DAYLIGHT CUT AREA OVER NATURAL DESCENDING SLOPE



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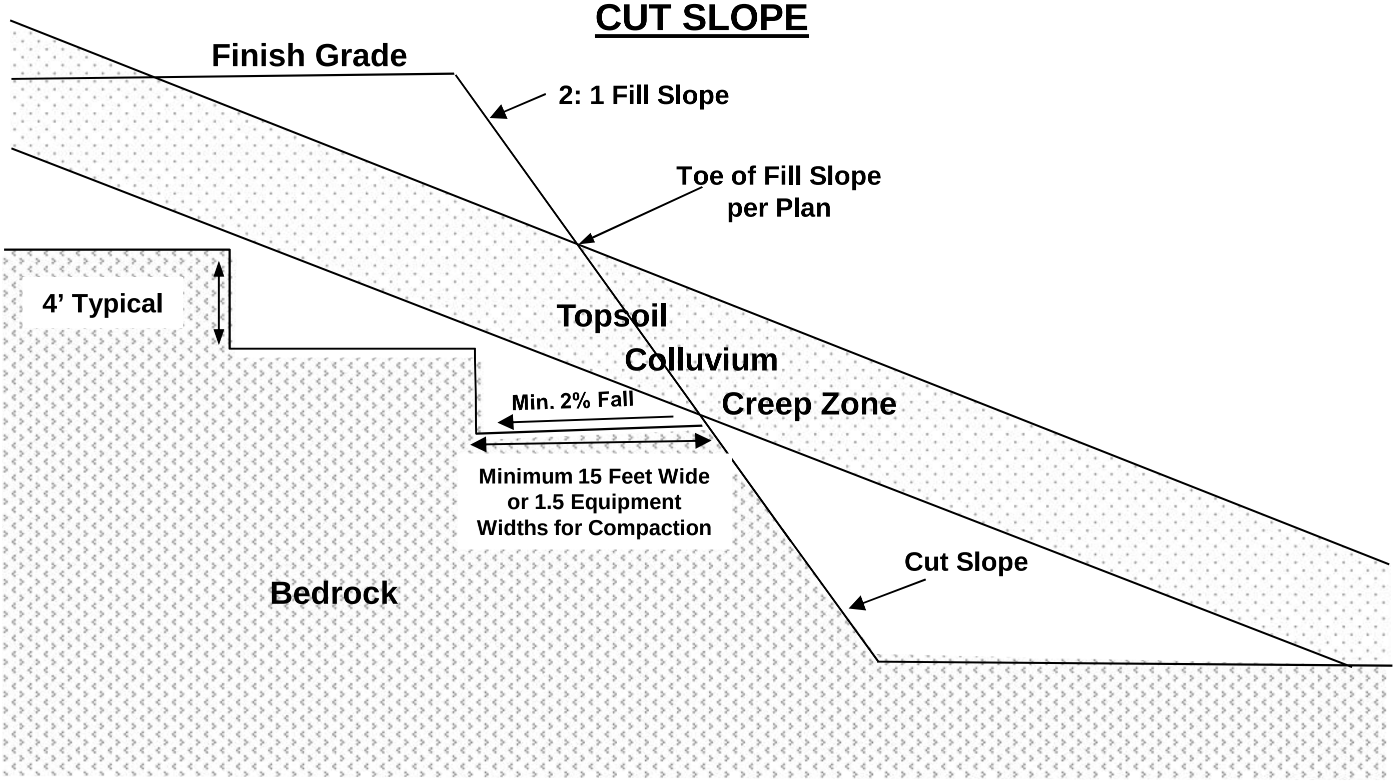
TREATMENT ABOVE NATURAL SLOPES

STANDARD GRADING GUIDELINES

PLATE G-2

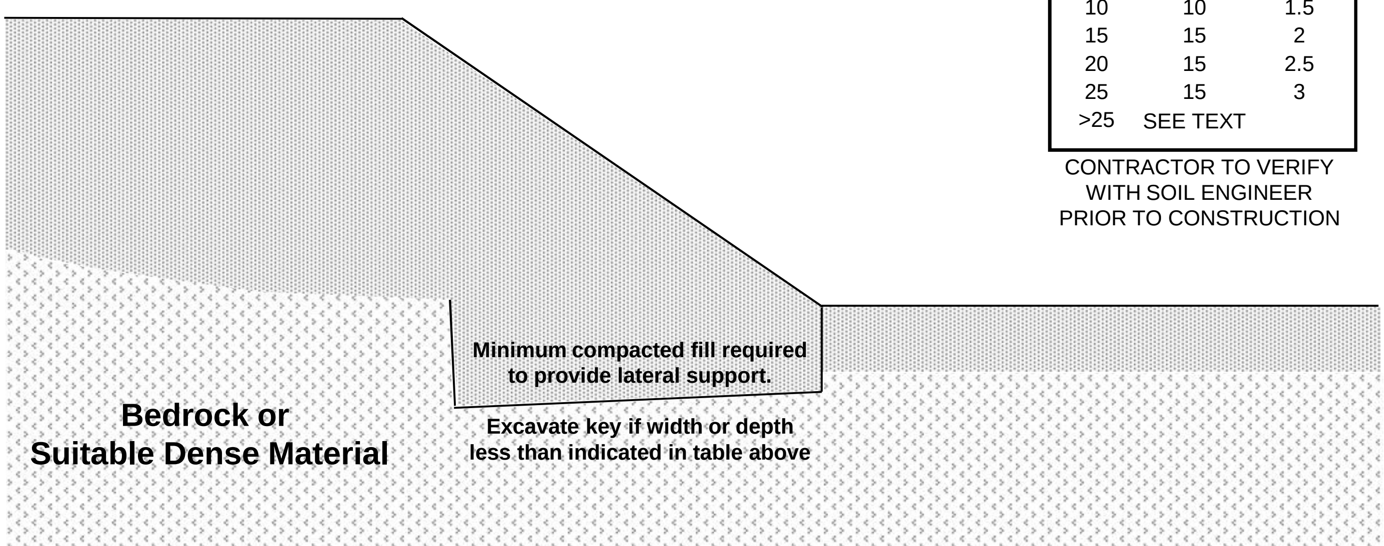
TYPICAL FILL SLOPE OVER CUT SLOPE



TYPICAL FILL SLOPE

SLOPE HEIGHT	MIN. KEY WIDTH	MIN. KEY DEPTH
5	7	1
10	10	1.5
15	15	2
20	15	2.5
25	15	3
>25	SEE TEXT	

CONTRACTOR TO VERIFY WITH SOIL ENGINEER PRIOR TO CONSTRUCTION



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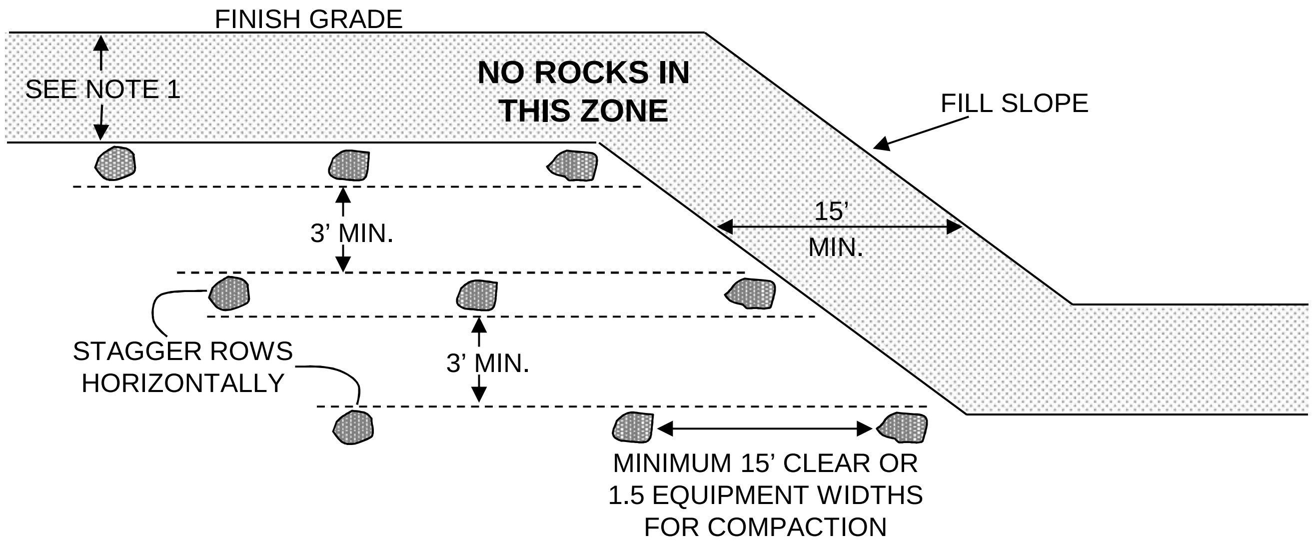
COMMON FILL SLOPE KEYS

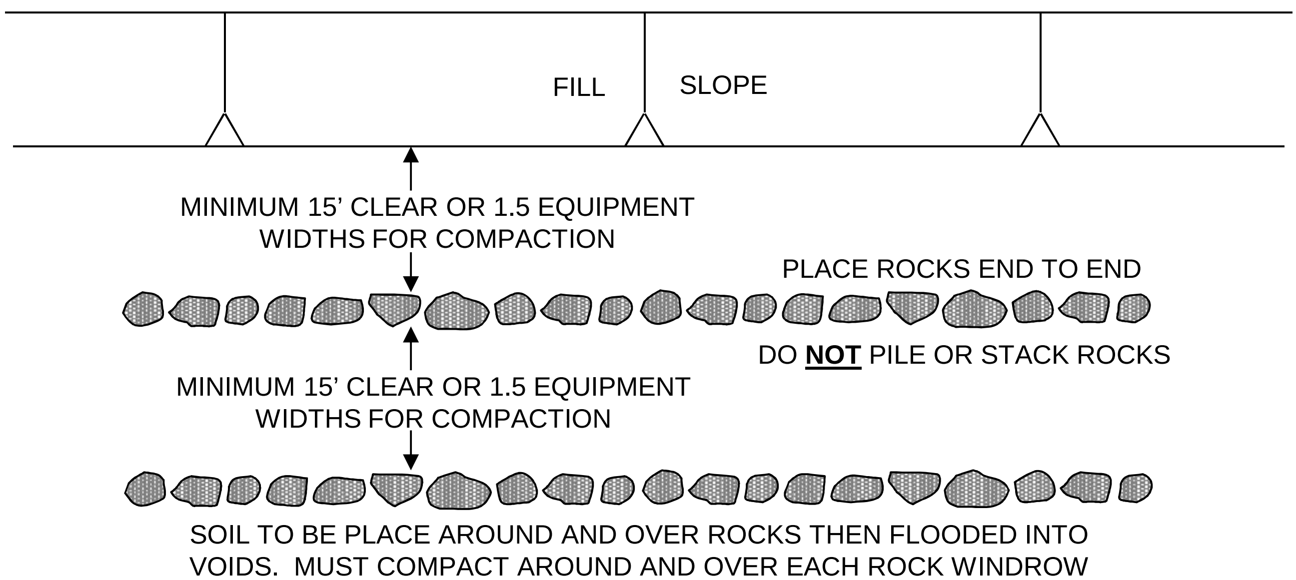
STANDARD GRADING GUIDELINES

PLATE G-3

CROSS SECTIONAL VIEW



PLAN VIEW



NOTES:

1) SOIL FILL OVER WINDROW SHOULE BE 7 FEET OR PER JURISDUICTIONAL STANDARDS AND SUFFICIENT FOR FUTURE EXCAVATIONS TO AVOID ROCKS
2) MAXIMUM ROCK SIZE IN WINDROWS IS 4 FEET MINIMUM DIAMETER
3) SOIL AROUND WINDROWS TO BE SANDY MATERIAL SUBJECT TO SOIL ENGINEER ACCEPTANCE
4) SPACING AND CLEARANCES MUST BE SUFFICIENT TO ALLOW FOR PROPER COMPACTION
5) INDIVDUAL LARGE ROCKS MAY BE BURIED IN PITS.

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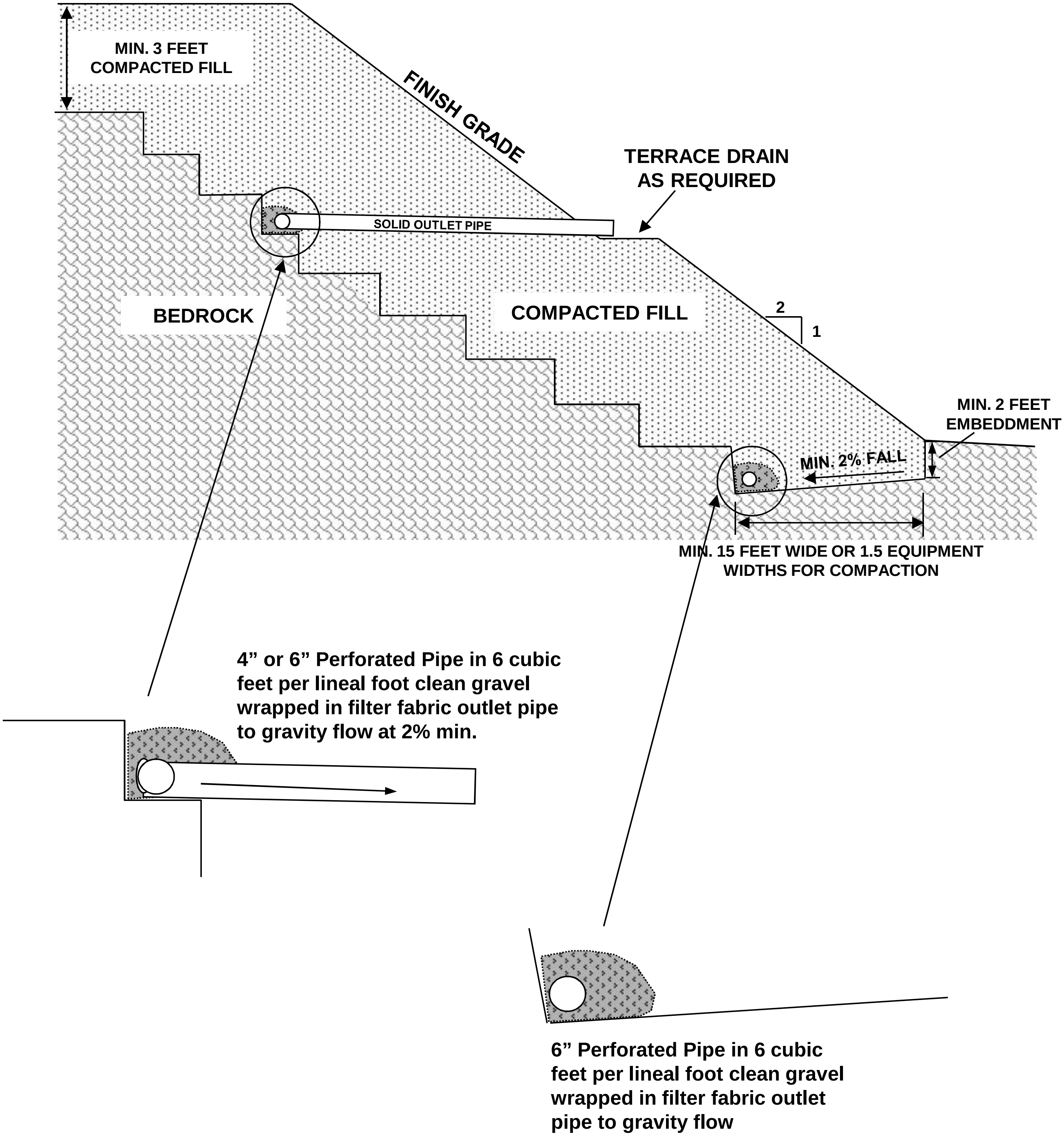
ROCK BURIAL DETAILS

STANDARD GRADING GUIDELINES

PLATE G-4



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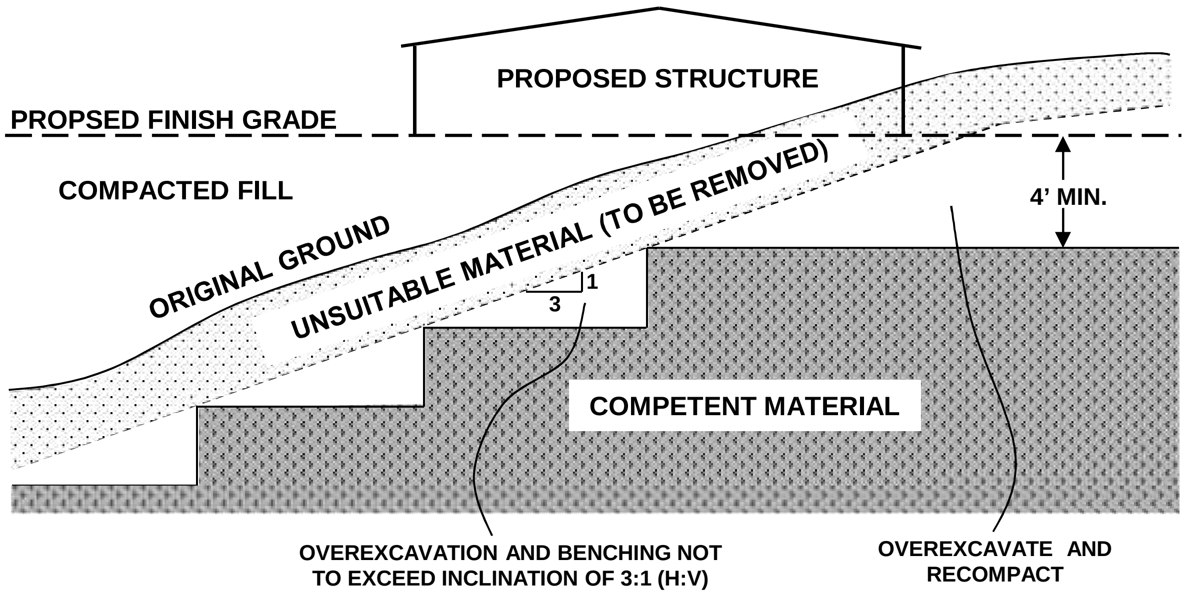
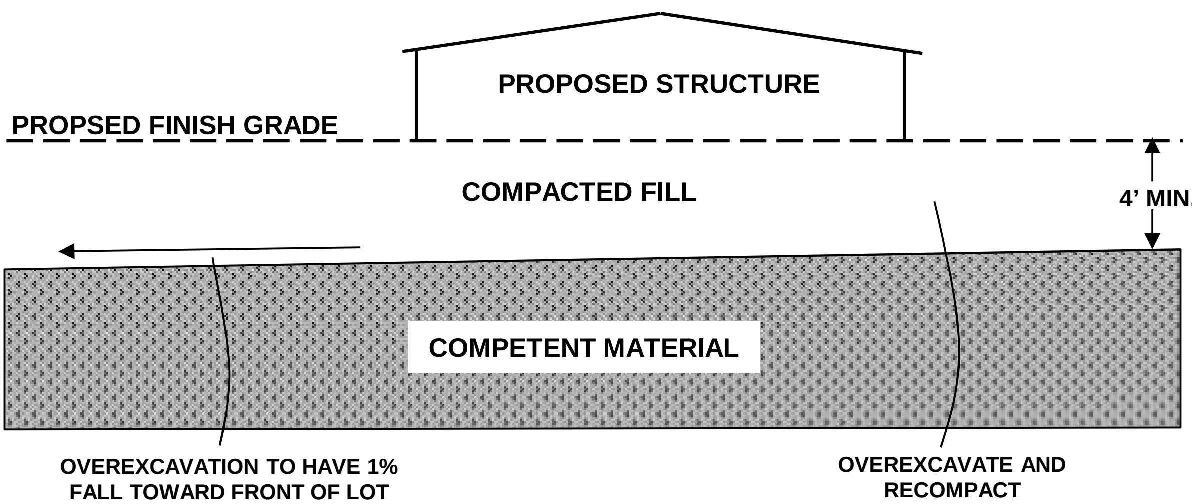
Typical Buttress and Stabilization Fill

PLATE G-5

TRANSITION LOT



UNDERCUT LOT



Notes:
1. Removed/overexcavated soils should be recompacted in accordance with recommendations included in the text of the report.
2. Location of cut/fill transition should verified in the field during site grading.

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TRANSITION & UNDERCUT LOTS

STANDARD GRADING GUIDELINES

PLATE G-6