Geotechnical Evaluation and Infiltration Study
Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
East of Agua Mansa Road and North of Wilson Street
Jurupa Valley, Riverside County, California

Prepared for

Burrtec Waste Industries, Inc.
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Fontana, California 92355

Prepared by

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Project No. 2484-CR **October 9, 2020**

GEOTEK

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Project No. 2484-CR

Burrtec Waste Industries, Inc.
9890 Cherry Avenue
Fontana, California 92355

Attention: Mr. Gary Koontz

Subject: Geotechnical Evaluation and Infiltration Study
Proposed Industrial Hauling Yard
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Jurupa Valley, Riverside County, California

Dear Mr. Koontz:

We are pleased to provide the results of our geotechnical evaluation and infiltration study for the subject site located in the city of Jurupa Valley, Riverside County, California. This report presents a discussion of our evaluation and provides preliminary geotechnical recommendations for earthwork and construction. In our opinion, the planned improvements appear feasible from a geotechnical viewpoint provided that the recommendations included in this report are incorporated into the design and construction phases of site development.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

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1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to complete an geotechnical evaluation and infiltration study for the currently proposed improvements at the project site. Services provided for this study included the following:

- Research and review of available geologic and geotechnical data, and general information pertinent to the site,
- Site reconnaissance,
- Site exploration consisting of the excavation and logging of six exploratory test pits and two infiltration test borings,
- Infiltration testing of the on-site materials,
- Review and evaluation of site seismicity and seismic settlement potential, and
- Compilation of this geotechnical report which presents our recommendations for site development.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The approximately 9.6-acre project site is located east of Agua Mansa Road and north of Wilson Street in the city of Jurupa Valley, Riverside County, California (see Figure 1). At the time of our site reconnaissance and field investigation, the site is currently vacant with no structural developments. There are several roll-off storage containers on the central and eastern portions of the site that are stored over a layer of crushed aggregate base. Additionally, there appears to be a stormwater detention basin near the northern property boundary. The site can be considered as having relatively flat terrain with site elevations ranging from approximately 895 feet above mean sea level (msl) in the southeast to 885 feet above msl in the northwest.

The property is bounded by railroad tracks, followed by a recycling center beyond to the north; Agua Mansa Road, followed by industrial developments beyond to the west; Wilson Street, followed by vacant land and industrial developments beyond to the south; and industrial developments to the east.

2.2 PROPOSED DEVELOPMENT

Based on email correspondence with a representative of Burrtec Waste Industries, Inc., the proposed construction will consist of a new hauling yard and water quality basin (assuming surface retention for a 25-year, 24-hour storm). The location of the anticipated water quality basin was not known at the time of our field investigation. Structural improvements may be associated with this development in the future. Although structural information has not been provided, we have assumed that the buildings will be supported by conventional shallow spread footings and will most likely include conventional slab-on-grade floor systems.

The proposed improvements are anticipated to exert relatively light foundation loads on the underlying soils. Proposed grades for the improvements are anticipated to be near existing grades. Due to the relatively flat topography of the site, retaining walls are not planned for development.

If site development differs from these assumptions, the recommendations included in this report should be subject to further review and evaluation. Site development plans should be reviewed by GeoTek when they become available. Additional geotechnical field exploration, analyses and recommendations may be necessary upon review of site development plans.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

Our field exploration was conducted on September 9, 2020. GeoTek observed and logged the excavations of six exploratory borings throughout the site to depths ranging from approximately 6.5 feet to 51.5 feet below existing ground surface (bgs). Additionally, two infiltration test borings were excavated within the anticipated stormwater infiltration area with a truck-mounted hollow-stem auger drill rig, to a maximum depth of approximately five feet bgs. A registered geologist from GeoTek logged the explorations. The two test borings were subsequently prepared and utilized for infiltration testing. The approximate locations of the field explorations are shown on the Exploration Location Map (Figure 2). Logs of the excavations are included in Appendix A.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The subject 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 south of the Transverse Ranges geomorphic province to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. 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.

More specific to the property, this is an area geologically mapped to be underlain by alluvium (Dibblee, T.W. and Minch, J.A., 2003). The nearest zoned fault is the San Jacinto Fault, located approximately five miles to the northeast. No faults are presently shown in the immediate site vicinity on the maps reviewed for the area.

4.2 GENERAL SOIL/GEOLOGIC CONDITIONS

A brief description of the earth materials encountered below the site and within the area of anticipated construction is presented in the following section. Based on our field explorations, the area of anticipated improvements is underlain by relatively minor amounts of organic material and undocumented artificial fill underlain by alluvium.

4.2.1 Undocumented Fill and Crushed Aggregate Base

A layer of crushed aggregate base (CAB) was observed to be present overlying alluvium within three of our borings (B-3, B-4 and B-6), ranging in thickness from three inches to six inches. Although undocumented fill materials were not encountered in the borings excavated, localized areas of undocumented fill and/or CAB may be present in areas of the site not explored.

4.2.2 Alluvium

Alluvial material was encountered in all of the exploratory borings excavated on the site. In general, these materials typically consist of medium dense to very dense sand with varying amounts of silt, and stiff to hard silt with varying amounts of sand and the occasional trace of caliche stringers. The alluvial materials were observed to be slightly oxidized. Within the exploratory boring B-4, a mostly cohesive silty clay material was encountered between depths of approximately 29.5 feet and 44.5 feet.

4.3 SURFACE AND GROUNDWATER

4.3.1 Surface Water

Surface water was not observed on the site during our subsurface investigation nor the site reconnaissance. If encountered during the earthwork construction, surface water on this site is the result of precipitation or surface run-off from surrounding sites. Overall area drainage in the area is most generally directed to the west. Provisions for surface drainage should be accounted for by the project civil engineer.

4.3.2 Groundwater

Groundwater was not encountered in any of our borings explored. Based on data collected from a well located approximately 0.3-mile south of the site, groundwater was reported to be encountered at a depth of approximately 75 feet below ground surface in 2005 (http://www.geotracker.waterboards.ca.gov/).

It is possible that seasonal variations (temperature, rainfall, etc.) will cause fluctuations in the groundwater level. The groundwater levels presented in this report are the levels that were measured at the time of our field activities. It is recommended that the contractor determine the actual groundwater levels at the site at the time of the construction activities to determine the impact, if any, on the construction procedures.

4.4 INFILTRATION TESTING

As part of our field investigation and within the anticipated stormwater infiltration area at the northwestern corner of the site, two infiltration tests were conducted in test borings I-1 and I-2 at depths of five feet bgs. The exploratory borings excavated and logged throughout the site, B-1 through B-6, verify that at least five feet of permeable materials are present below the bottom of the future infiltration system and that there is at least 10 feet between the bottom of the system and a seasonal high groundwater level.

Subsequent to pre-soaking the test holes in general conformance with the referenced document (County of Riverside, 2011), percolation testing was performed in the bottom 20 inches of the percolation test boring by a registered geologist from our firm. The percolation testing was conducted in general conformance with the referenced document from the County of Riverside. The percolation rates were converted to infiltration rates utilizing the Porchet Method.

The infiltration rates are presented in the following table, after the water levels had stabilized.

Exploration No.	Infiltration Rate (inches per hour)	Depth of Test (feet)
Boring I-1	8.0	5
Boring I-2	10.6	5

Copies of the percolation data sheets and infiltration conversion sheets (Porchet Method) are included in Appendix C. The reported infiltration rates are the measured rates without any factors of safety applied. Over the lifetime of the infiltration areas, the infiltration rates may be affected by silt build up and biological activities, as well as local variations in near surface soil conditions. A suitable factor of safety should be applied to the field rate in designing the infiltration system.

It should be noted that the infiltration rates provided above were performed in relatively undisturbed on-site soils. Infiltration rates will vary and are mostly dependent on the underlying consistency of the site soils and relative density. Infiltration rates may be impacted by weight of equipment travelling over the soils, placement of engineered fill and other various factors. GeoTek assumes no responsibility or liability for the ultimate design or performance of the storm water facility.

4.5 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is located in a seismically active region. 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. The site has not been mapped by the State of California for potential seismic hazards such as liquefaction or landslides. The County of Riverside indicates that the site is "not in a fault zone," "not in a fault line," has a "low" liquefaction potential and is "susceptible" to subsidence.

4.5.1 Seismic Design Parameters

The site is located at approximately 34.0204° Latitude and -117.3834° Longitude. Site spectral accelerations (S_S and S_1), for 0.2 and 1.0 second periods for a Class "D" site, was determined from the SEAOC/OSHPD web interface that utilizes the USGS web services and retrieves the seismic design data and presents that information in a report format. As noted using the ASCE 7-16 option on the SEAOC/OSHPD website, the values for S_{M1} and S_{D1} are 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 S_1 exceeds 0.2. The value S_1 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 S_1 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 $T > T_L$.

Assuming that the C_S 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, S_s	1.5g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.6g
Site Coefficient for Site Class "D," F_a	1.0
Site Coefficient for Site Class "D," F_v	1.7
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.5g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	1.02g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	1.0g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.658g

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.

4.5.2 Surface Fault Rupture

The site is in a seismically active region; however, 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 (Bryant and Hart, 2007). The nearest known active fault is located approximately five mils to the northeast. The potential for surface rupture at the site is considered to be nil.

4.5.3 Seismic Settlement Analysis

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless and some low-plastic soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding and 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.

The factors known to influence liquefaction potential include soil type and grain size, relative density, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are most susceptible to liquefaction are loose, saturated granular soils and some low plasticity silts and clays under low confining pressures. The site is mapped by Riverside County as possessing a low potential for liquefaction. However, the depth to groundwater at the site is estimated to be greater than 50 feet below grade.

GeoTek utilized a methodology to evaluate liquefaction as presented by Idriss and Boulanger, 2008. The USGS website (https://earthquake.usgs.gov/hazards/interactive/) was used to deaggregate the seismic hazards (faults) contributing to the site's seismic ground motion potential. Considering an exceedance probability of 2 percent in 50 years (i.e. 2,475-year return period), a magnitude weighted (Mw) earthquake of Mw=6.98 was determined for use in the liquefaction analysis.

GeoTek evaluated the liquefaction potential at the site using the computer program LiquefyPro Version 5.8n and the results of Boring B-4 to determine seismic settlement potential. An earthquake magnitude of M6.98 and an acceleration of 0.658g were used in the analyses. Since the historical high regional groundwater level is in excess of 50 feet below the ground surface, liquefaction is not a consideration in the design of the buildings. Since groundwater is relatively deep, a dry seismic settlement analysis was conducted. As recommended by the State of California Special Publication 117, our seismic settlement analysis has incorporated a safety factor of 1.3.

Using the information presented in Table 3 of Page 73 of the referenced publication by Idriss and Boulanger, an analysis was conducted to determine the sampler correction factor C_S. The SPT sampler is machined to fit liners, therefore a correction factor of 1.0 may not be appropriate. Throughout the test borings, a calculation was performed at each 12-inch interval to determine the value of C_S based on the $(N_1)_{60}$ values between or equal to 10 and 30. A C_S value of 1.3 was used where $(N_1)_{60}$ was greater than or equal to 30. Using an average of all the $(N_1)_{60}$ values throughout the depth of the borings, a C_S value of 1.3 was utilized in our LiquefyPro calculation.

Based on the interior diameter of the flight-auger of 4.3 inches, the value for C_B that was used in our analysis was 1.0.

Our analyses revealed seismic-induced settlement potential of approximately 0.5-inch in Boring B-4. The results of this evaluation are shown in Appendix D.

The total settlement will occur over a large area and will not affect local buried utilities. We would estimate the differential dynamic settlement to be approximately 0.25-inch over a distance of 40 feet. A maximum angular distortion of 1/1,846 is calculated, which is within tolerable limits. It is our opinion that neither liquefaction nor dynamic settlement should be a consideration in the design of the structure.

4.6 OTHER SEISMIC HAZARDS

Evidence of ancient landslides or slope instabilities at this site was not observed during our investigation. The subject property does not lie within an earthquake induced landslide zone.

The potential for secondary seismic hazards such as a seiche or tsunami is considered negligible due to site elevation and distance to an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The anticipated site development appears feasible from a geotechnical viewpoint provided that the following recommendations, and those provided by this firm at a later date are properly incorporated into the design of the project. Final site development and grading plans should be reviewed by GeoTek when they become available.

5.2 EARTHWORK CONSIDERATIONS

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

5.2.1 Site Clearing

In areas of planned grading or improvements, the site should be cleared of vegetation, roots, existing flatwork, trash and debris, and properly disposed of offsite. Voids resulting from removing any materials should be replaced with engineered fill materials with expansion characteristics similar to the on-site materials.

5.2.2 Removals and Overexcavations

Any undocumented fill and CAB should be removed below all areas to receive improvements, including any footings, pavement, and hardscape areas. The soils below proposed improvements should be observed by a representative of this firm. Areas anticipated to be subject to structural loading should be overexcavated a minimum of one foot below the deepest foundation element, whichever is deeper.

All undocumented fill should also be removed beneath flatwork improvement areas. A minimum of 12 inches of engineered fill should be provided below asphaltic concrete pavement and Portland cement concrete hardscape areas. The horizontal extent of removals should extend at least two feet beyond the edge of hardscape.

The overexcavation should extend a minimum of five feet outside of the foundation perimeter or extend down and away from foundation elements at a 1:1 (horizontal to vertical) projection to the recommended removal depth, whichever is greater.

A representative of this firm should observe the bottom of all excavations. In areas where loose soil is present in the bottom of the excavations, the removals should continue until competent natural materials are encountered. Competent materials are defined as relatively uniform and not visibly porous natural soils with an in-place relative compaction of at least 85 percent.

Development plans should be reviewed by this firm when available. Depending on actual field conditions encountered during grading, locally deeper areas of removal may be recommended.

5.2.4 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 inches, moistened to at least above the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D 1557). If no additional fill placement is necessary subsequent to the completion of removals, or if additional cut is required to achieve design grades, the final pavement subgrade should be processed to a minimum depth of eight inches in-place, moisture conditioned to at least above the optimum moisture content and compacted to a minimum compaction of at least 90 percent (ASTM D 1557).

5.2.5 Engineered Fill

The on-site soils are generally considered suitable for reuse as engineered fill provided that they are free from vegetation, debris, roots, and other deleterious material. Rock fragments greater than six inches in maximum dimension should not be incorporated in engineered fill. Engineered fill should be placed in loose lifts with a thickness of eight 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).

5.2.6 Excavation Characteristics

Processing/excavations into the on-site soil materials is expected to be feasible using heavy-duty grading equipment in good operating conditions.

5.2.7 Trench Excavations and Backfill

Temporary trench excavations within the on-site materials should be stable at 1:1 inclinations for short durations during construction and where cuts do not exceed 10 feet in height. We anticipate that temporary cuts to a maximum height of four feet can be excavated vertically.

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should be compacted to at least 90 percent relative compaction (as determined per ASTM D 1557). Under-slab trenches should also be compacted to project specifications. Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for road pavements should be compacted to at least 95 percent relative compaction. On-site materials may not be suitable for use as bedding material but should be suitable as backfill provided particles larger than six inches are removed.

Compaction should be achieved with a mechanical compaction device. Ponding or jetting of trench backfill is not recommended. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.2.8 Shrinkage and Subsidence

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities, as well as the accuracy of topography.

Shrinkage is primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, a shrinkage factor of up to 15 percent may be considered for the materials requiring removal and/or recompaction. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of earthwork construction. Subsidence on the order of up to 0.10 foot may be anticipated for areas to receive fill.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

Foundation design criteria for a conventional foundation system, in general conformance with the 2019 CBC, are presented below. Based on laboratory test results of the soils during our field investigation, the expansion potential of the on-site soils near subgrade may be classified as "very low" (EI≤20) per ASTM D 4829.

Additional expansion index and soluble sulfate testing of the soils should be performed during construction to evaluate the as-graded conditions. Final recommendations should be based upon the as-graded soils conditions.

A summary of our foundation design recommendations is presented in the following table:

MINIMUM FOUNDATION DESIGN RECOMMENDATIONS

Design Parameter	"Very Low" Expansion Potential
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	12
Minimum Foundation Width (Inches)*	12
Minimum Slab Thickness (actual)	4 – Actual
Minimum Slab Reinforcing	6" x 6" – W1.4/W1.4 welded wire fabric placed in middle of slab, or No. 3 reinforcing bars spaced 24 inches on-center, each way, in the middle of the slab
Minimum Footing Reinforcement	Two No. 4 reinforcing bars, one placed near the top and one near the bottom
Presaturation of Subgrade Soil (Percent of Optimum)	Minimum of 100% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete

* Code minimums per Table 1809.7 of the 2019 CBC.

It should be noted that the criteria provided are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions.

The following criteria for design of foundations are preliminary and should be re-evaluated based on the results of additional laboratory testing of samples obtained near finish pad grade.

An allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design of continuous and perimeter footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep. This value may be increased by 200 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 3,000 psf. An increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads).

Structural foundations may be designed in accordance with the 2019 CBC, and to withstand a total settlement of one 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 3,000 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.30 may be used with dead load forces. The upper one foot of soil below the adjacent grade should not be used in calculating passive pressure. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these are provided in the 2019 California Green Building Standards Code (CALGreen) Section 4.505.2, the 2019 CBC Section 1907.1 and ACI 360R-10. The vapor retarder design and construction should also meet the requirements of ASTM E 1643. A portion of the vapor retarder design should be the implementation of a moisture vapor retardant membrane.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as a result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the vapor retarder placed on the underlying aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. Although the CBC specifies a 6-mil vapor retarder membrane, a minimum 10 mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. The membrane should consist of Stego wrap or the equivalent.

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 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 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 a flooring contractor, structural engineer, architect, and/or other experts specializing in moisture control within the buildings be consulted to evaluate the general and specific moisture and vapor transmission paths and associated potential impact on the proposed construction. That person 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 our services in general are not intended to address mold prevention, since we, 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.

We recommend that control joints be placed in two directions spaced approximately 24 to 36 times the thickness of the slab in inches. These joints are a widely accepted means to control cracks and should be reviewed by the project structural engineer.

5.3.2 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.

5.3.3 Foundation Set Backs

Minimum setbacks for all foundations should comply with the 2019 CBC or City of Jurupa Valley/County of Riverside 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 top 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 five 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 Soil Corrosivity

Based on the chemical test results presented in Appendix B, the corrosivity test results indicate that the on-site soils are "highly corrosive" to buried ferrous metal. This corrosion classification is obtained from "Corrosion Basics: An Introduction," by Pierre R. Roberge, 2nd Edition, 2005. Recommendations for protection of buried ferrous metal should be provided by a corrosion engineer.

5.3.5 Soil Sulfate Content

Based on the chemical test results of a sample collected during our field investigation, the sulfate test results on samples obtained from the project site indicate soluble sulfate contents of less than 0.1 percent by weight should be expected. Soluble sulfate contents of this level would be in the range of "not applicable" (i.e. negligible) per Table 4.2.1 of ACI 318. Based on the test results and Table 4.3.1 of ACI 318, no special concrete mix design would be necessary to resist sulfate attack.

5.3.6 Import Soils

Import soils should have a "very low" expansion potential. GeoTek, Inc. also recommends that the proposed import soils be tested for expansion and corrosivity potential. GeoTek, Inc. should be notified a minimum of 72 hours prior to importing so that appropriate sampling and laboratory testing can be performed.

5.3.7 Asphalt Concrete Pavement Design

GeoTek utilized a bulk sample obtained from the field investigation for R-Value testing. The testing (by others) indicated an R-Value of 54. The R-Value test results are included in Appendix B.

Traffic Indices (TI) of 5.5 and 7.0 were assumed for preliminary pavement design. The traffic indices selected to determine the pavement section should be reviewed by a design engineer when truck traffic loading is known. The table below provides the roadway area, TI, and the recommended minimum structural pavement sections.

MINIMUM RECOMMENDED ASPHALT CONCRETE PAVEMENT SECTIONS

Traffic Area	Assumed Traffic Index	Design R-Value	Asphaltic Concrete (inches)	Aggregate Base (inches)
Light Duty (including parking stalls and drive aisles not subject to heavy truck traffic	5.5	54	3.0	3.0
Heavy Duty (including fire lanes, trash dumpster pads and approaches)	7.0	54	4.0	4.0

The pavement sections recommended are subject to review by the City of Jurupa Valley and/or the County of Riverside. Performance of the pavement sections will ultimately be based largely on construction methods, traffic loading and subgrade performance.

Additional laboratory testing should be completed during earthwork construction when pavement subgrade elevations are reached to confirm the sections presented above.

5.3.8 Portland Cement Concrete Pavement Design

It is anticipated that areas of the project site may be paved with Portland Cement Concrete (PCC) pavement. Heavy truck traffic is expected to exert loads on the concrete pavement.

The table below provides the street area/usage, associated TI, and the recommended minimum concrete pavement section for the subject project. An R-Value of 54 was correlated to a modulus of subgrade reaction, k-Value, of approximately 240 for design purposes.

MINIMUM RECOMMENDED CONCRETE PAVEMENT SECTIONS

Traffic Area	Assumed Traffic Category*	Design k-Value	PCC (inches)	Aggregate Base (inches)
Heavy Duty (including dock aprons, fire lanes, trash dumpster pads and approaches)	D	240	7.0	4.0

*Reference: *Guide for the Design and Construction of Concrete Parking Lots*, Reported by ACI Committee 330, ACI 330R-08, 2008.

The PCC pavement sections should incorporate appropriate steel reinforcement as designed by the project structural engineer. Crack control joints should be provided in the transverse direction spaced at horizontal intervals with a maximum spacing of 15 feet. The actual design should also be in accordance with design criteria specified by the governing jurisdiction.

The concrete should have a minimum modulus of rupture of 500 pounds per square inch (psi), and a minimum 28-day compressive strength of 2,500 psi. Concrete should incorporate one-inch maximum size aggregate and should be proportioned to achieve a maximum slump of four inches. Instead of increasing the water content, a plasticizing admixture may be utilized to increase the workability of the concrete. The concrete should be properly cured after placement. Concrete should not be placed during hot and windy weather.

The concrete pavement section is subject to the review and approval by the City of Jurupa Valley/County of Riverside. Performance of the pavement sections will ultimately be based largely on construction methods, traffic loading and subgrade performance.

5.3.9 Pavement Construction

All pavement installation, including preparation and compaction of subgrade, compaction of base material, placement of concrete and rolling of asphaltic concrete, should be done in accordance with the City of Jurupa Valley/County of Riverside specifications and under the observation and testing of GeoTek and a City inspector where required.

The aggregate base should consist of crushed rock with an R-Value and gradation in accordance with Crushed Aggregate Base (Section 200-2 of the “Greenbook”). Asphaltic concrete materials and construction should conform to Section 203 of the Greenbook. Minimum compaction requirements should be 95 percent for subgrade and 95 percent for aggregate base, as per ASTM D 1557. The upper 12 inches of subgrade should be moisture conditioned to at least two percent above optimum. Jurisdictional minimum compaction requirements in excess of the aforementioned minimums may govern.

5.3.10 Concrete Flatwork

5.3.10.1 Exterior Concrete Slabs and Sidewalks

Any exterior concrete slabs and sidewalks that are not subject to heavy truck traffic should be designed using a minimum thickness of four inches. No specific reinforcement is required due to the non-structural nature. However, the use of some reinforcement should be considered. Recommendations can be provided upon request. Some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices commonly utilized in residential 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. at the subject site should be pre-saturated to a minimum of 100 percent of 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 Jurupa Valley/County of Riverside specifications, and under the observation and testing of GeoTek and a City/County inspector, if necessary.

5.3.10.2 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are essentially unnoticeable 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 can also undergo 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 also 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 suggests that control joints be placed in two directions and located a distance apart roughly equal to 24 to 36 times the slab thickness.

Exterior concrete flatwork (walkways, driveways, etc.) is often some of the most visible aspects of site development. They are typically given the least level of quality control, being considered "non-structural" components. We suggest that the same standards of care be applied to these features as to the structure itself.

5.4 POST CONSTRUCTION CONSIDERATIONS

5.4.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, which can be significantly reduced by overly wet conditions. 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. Care should be taken when adding soil amendments to avoid excessive watering. Leaching as a method of soil preparation prior to planting is not recommended. An abatement program to control ground-burrowing rodents should be implemented and maintained. This is critical as burrowing rodents can decreased 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 screen wall foundations. This type of landscaping should be avoided. If used, then extreme care should be exercised with regard to the irrigation and drainage in these areas.

5.4.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. 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. Pad drainage should be directed toward approved areas and not be blocked by other improvements.

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

5.5 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that site grading plans and relevant project specifications be reviewed by this office prior to construction to check for conformance with the recommendations of this report. We also recommend that GeoTek representatives be present during site grading to check for proper implementation of the geotechnical recommendations. The owner/developer should verify that GeoTek 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 trenches.
- Perform field density testing of the fill materials.

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

6. INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our evaluation is limited to the boundaries of the subject parking lot. This review does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope is based on our understanding of the project and the client's needs, our fee estimate (P-0800220-CR) dated August 5, 2020 and geotechnical engineering standards normally used on similar projects in this region.

7. LIMITATIONS

The materials observed on the project site appear to be representative of the area; however, soil and bedrock materials 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 our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusion 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

California Code of Regulations, Title 24, 2019 "California Building Code," 3 volumes.

California Geological Survey (CGS, formerly referred to as the Division of Mines and Geology), 1949, "Geologic Map of California."

Dibblee, T.W., and Minch, J.A., 2003, "Geologic Map of the Riverside East/South ½ of San Bernardino South Quadrangles, San Bernardino and Riverside County, California," Dibblee Geological Foundation Map DF-109, scale 1:24,000.

GeoTek, Inc., In-house proprietary information.

OSHPD Seismic Design Maps (https://seismicmaps.org/), accessed on October 8, 2020.

Riverside County Flood Control and Water Conservation District, 2011, "Design Handbook for Low Impact Development Best Management Practices, Appendix A – Infiltration Testing Guidelines," effective September 2011.

Riverside County Parcel Report for APNs 175-180-012 and 175-180-016, accessed on August 3, 2020.

Burrtec Waste Industries, Inc.
Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California

Project No. 2484-CR

GEOTEK

Figure 1

Site Location Map

Legend
(Locations are approximate)

B-6 Exploratory Boring

I-2 Infiltration Test

Site Limits

Burrtec Waste Industries, Inc.
Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California

Project No. 2484-CR

GEOTEK

Figure 2

Exploration Location Map

APPENDIX A

LOGS OF EXPLORATORY AND INFILTRATION TEST BORINGS

Proposed Industrial Hauling Yard

APNs 175-180-012 and -016

Jurupa Valley, Riverside County, California

Project No. 2484-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

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

B – BORING/TRENCH 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 boring

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

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: B- 1

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
	Large Bulk			ML	**Alluvium** Sandy SILT, tan, light brown, slightly moist, stiff			RV
5	Ring	13 17 20	R1	SP	F SAND, tan to light brown, slightly moist, medium dense, friable	3.3	112.2	
10	Ring	10 18 29	R2	ML	Sandy SILT, grayish brown, slightly moist, very stiff, trace caliche and oxidation staining	6.5	105.6	
15	Ring	22 50/6	R3		Becoming moist, hard and slightly mottled at 15'	18.2	99.9	
20	Ring	15 34 41	R4	SM	Silty f SAND, olive, slightly moist, dense	7.3	115.4	
					BORING TERMINATED AT 21.5 FEET No groundwater encountered Boring 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	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

GEOTEK

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: B- 2

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
				ML	**Alluvium** Sandy SILT, brown, slightly moist, very stiff, trace pinhole pores and caliche			
	Ring	10 19 28	R1			3.7	116.0	
5								
	Ring	13 17 17	R2		Becoming slightly moist with oxidation staining at 7'	6.6	97.5	
10	Ring	14 22 29	R3	SM-ML	Silty f SAND to Sandy SILT, grayish brown, dry, dense to hard, trace pinhole pores	6.1	109.5	
15	Ring	10 20 29	R4	SP	F SAND with some interbedded f-m SAND, tan, light grayish brown, slightly moist, medium dense, slightly friable	3.8	104.0	
					BORING TERMINATED AT 16.5 FEET No groundwater encountered Boring 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; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

GEOTEK

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

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
					3" Crushed Aggregate Base			
				SM-ML	**Alluvium** Silty f SAND to Sandy SILT, brown, slightly moist, medium dense to very stiff, trace caliche stringers and pinhole pores			
5	Ring	14 15 20	R1			7.3	115.3	
10	Ring	19 25 40	R2	ML	Sandy SILT, olive brown, moist, hard, caliche stringers	11.2	117.0	
15	Ring	13 26 32	R3	SP	F-m SAND, tan, slightly moist, dense, friable	1.0	105.2	
	Ring	12 18 29	R4	SM	Silty f SAND, tan, slightly moist, medium dense	3.1	105.0	
20	Ring	14 22 30	R5	SM-ML	Silty f SAND to Sandy SILT, olive brown, slightly moist, dense to hard, caliche stringers	9.7	108.4	
					BORING TERMINATED AT 21.5 FEET No groundwater encountered Boring 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; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: B- 4 Sheet 1 of 2

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
					4" Crushed Aggregate Base			
	Large Bulk			SP	**Alluvium** F SAND, tan, light brown, slightly moist, medium dense, slightly friable			MD, EI, SH, SR
5	Ring	9 12 15	R1			3.6	106.5	
10	Ring	10 21 29	R2	SM-ML	Silty f SAND to Sandy SILT, light brown, slightly moist, dense to hard, trace caliche stringers	5.9	109.5	
15	Ring	17 24 26	R3	SP	F SAND, grayish brown, slightly moist, dense	3.9	107.4	
20	Ring	13 27 33	R4	ML	SILT, brown, moist, hard, caliche stringers	14.1	120.5	
25	Ring	9 18 46	R5			17.5	112.8	
30	SPT	12 18 20	S1	CL	Silty CLAY, olive, moist to wet, hard, mottled and oxidized, trace carbon, minor seepage			

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; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: B-4 Sheet 2 of 2

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
35	SPT	15 9 13	S2	CL	Becoming moist and very stiff, abundant caliche, mottled at 35'			LL = 46, PI = 20
40	SPT	6 10 12	S3		Laminated bedding observed at 40'			
45	SPT	10 15 25	S4	SP	F SAND, tan, light brown, slightly moist, dense, friable			
50	SPT	13 18 37	S5		Becoming moist and very dense at 50'			

BORING TERMINATED AT 51.5 FEET

No groundwater encountered
Boring backfilled with soil cuttings

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 | HC= Consolidation | MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

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
					Alluvium			
				SM-ML	Silty f SAND to Sandy SILT, orangish brown, slightly moist, medium dense to very stiff, caliche stringers			
	Ring	8 12 14	R1			6.8	117.2	
5								
	Ring	7 16 19	R2			5.4	117.9	
10	Ring	10 19 23	R3	SM	Silty f SAND, orangish brown, moist, medium dense	10.8	101.4	
15	Ring	8 23	R4					
		26		ML	Sandy SILT, olive, moist to wet, very stiff, slightly mottled, caliche	23.7	101.0	
20	Ring	14 27 36	R5		Becoming moist, hard and micaceous at 20'	11.2	113.5	
					BORING TERMINATED AT 21.5 FEET			
					No groundwater encountered Boring 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 HC= Consolidation MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

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
					3" Crushed Aggregate Base			
	Large Bulk			ML	**Alluvium** Sandy SILT, tan, light brown, dry to slightly moist, stiff			
5	Ring	11 19 27	R1	SM	Silty f SAND, orangish brown, slightly moist, medium dense, caliche stringers	2.1	117.1	
10	Ring	10 19 27	R2	ML	Sandy SILT, olive, slightly moist, very stiff, caliche stringers	9.0	119.7	
15	Ring	17 20 33	R3		Becoming hard with pinhole pores locally observed at 15'	5.1	102.8	
20	Ring	10 21 29	R4	SM-ML	Silty f SAND to Sandy SILT, olive, slightly moist, dense to hard	5.0	106.4	
					BORING TERMINATED AT 21.5 FEET No groundwater encountered Boring 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	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: I-1

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
					Alluvium			
				SM	Silty f SAND, light brown, dry, loose to medium dense			
					Becoming slighty moist at 2'			
				SP	F SAND, tan, slightly moist, medium dense			
5					**BORING TERMINATED AT 5 FEET**			
					No groundwater encountered			
					Boring subsequently prepared for infiltration testing (pvc pipe, filter sock, gravel)			
10								
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	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: I-2

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
					Alluvium			
				SM	Silty f SAND, light brown, dry, loose to medium dense			
					Becoming slighty moist at 2'			
				SP	F SAND, tan, dry to slightly moist, medium dense			
5					**BORING TERMINATED AT 5 FEET**			
					No groundwater encountered			
					Boring subsequently prepared for infiltration testing (pvc pipe, filter sock, gravel)			
10								
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; HC= Consolidation; MD = Maximum Density

APPENDIX B

LABORATORY TEST RESULTS

Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California
Project No. 2484-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

Classification
Soils were classified visually in general accordance with the Unified Soil Classification System (ASTM Test Method D 2487). The soil classifications are shown on the logs of exploratory borings in Appendix A.

In-Situ Moisture and Density
The natural water content was determined in accordance with ASTM D 2216 on samples of the materials recovered from the subsurface exploration. In addition, in-place dry density determinations (ASTM D 2937) were performed on relatively undisturbed samples to measure the unit weight of the subsurface soils. Results of these tests are shown on the boring logs at the appropriate sample depths in Appendix A.

Moisture-Density Relationship
Laboratory testing was performed on a sample collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil type was determined in general accordance with test method ASTM D 1557. The results are presented in the table below.

Boring No.	Depth (ft.)	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture (%)
B-4	0-5	Fine sand	126.5	9.5

Direct Shear
Direct shear testing was performed on remolded samples of the surficial soils according to ASTM D 3080. The results of these tests are presented in Appendix B.

Expansion Index
The expansion potential of the soils was determined by performing expansion index testing on a sample in general accordance with ASTM D 4829. The result of the testing is provided below.

Boring No.	Depth (ft.)	Soil Type	Expansion Index	Classification
B-4	0-5	Fine sand	3	Very Low

Atterberg Limits
Laboratory testing to determine the liquid and plastic limits of a select sample was performed in general accordance with ASTM D4318. The results of the testing are included on the boring logs in Appendix A.

Sulfate Content, Resistivity and Chloride Content

Testing to determine the water-soluble sulfate content was performed by others on a sample collected during the subsurface exploration. The results are presented in the table below.

Boring No.	Depth (ft.)	pH ASTM D 4972	Chloride ASTM D 4327 (ppm)	Sulfate ASTM D 4327 (% by weight)	Resistivity ASTM G187 (ohm-cm)
B-4	0-5	8.74	14.5	0.0053	2,479

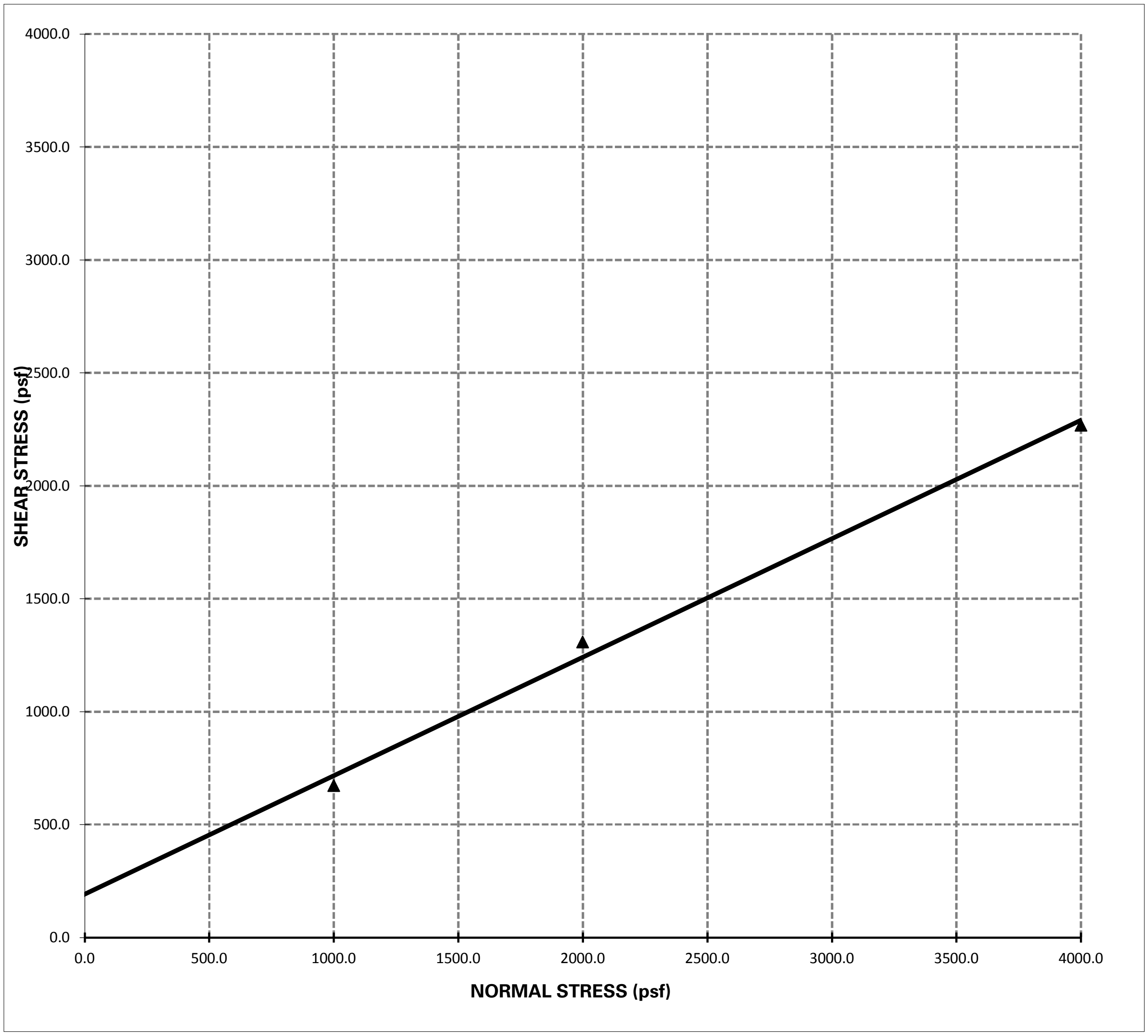
R-Value

Testing to determine the resistance value for pavement design was performed by others in accordance with California Test Method 301, on a sample collected during the subsurface exploration. The results are presented in Appendix B.

GEOTEK

DIRECT SHEAR TEST

Project Name:	Wilson St Hauling Yard	***Sample Location:***	B-4 @ 0 - 5
Project Number:	2484-CR	***Date Tested:***	9/28/2020



Shear Strength: $\Phi =$ **27.7 °** , **C = 192.00 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 0.035 in/min.

• ANALYSIS
• DESIGN

LaBelle • Marvin

PROFESSIONAL PAVEMENT ENGINEERING

A CALIFORNIA CORPORATION

• SOILS, ASPHALT TECHNOLOGY

September 22, 2020

Ms. Anna Scott
GeoTek Inc.
1548 North Maple Street
Corona, California 92880

Project No. 46447

Attention: Ms. Scott

Laboratory testing of the bulk soil sample delivered to our laboratory on 9/18/2020 has been completed.

Reference:	W.O. # 2484-CR
Project:	Burrtec Hauling Yard, Jurupa Valley
Sample:	B-1 @ 0'-5'

Data sheets 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

Steven R. Marvin
RCE 30659

SRM:mm
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. 46447

DATE: 9/22/2020

BORING NO. B-1 @ 0'-5'

Burrtec Hauling Yard, Jurupa Valley

W.O.# 2484-CR

SAMPLE DESCRIPTION: Brown Silty Sand

R-VALUE TESTING DATA | CA TEST 301			
	SPECIMEN ID		
	a	b	c
Mold ID Number	1	2	3
Water added, grams	85	65	56
Initial Test Water, %	12.2	10.3	9.5
Compact Gage Pressure,psi	65	255	350
Exudation Pressure, psi	194	554	732
Height Sample, Inches	2.65	2.57	2.55
Gross Weight Mold, grams	3114	3097	3100
Tare Weight Mold, grams	1954	1946	1958
Sample Wet Weight, grams	1160	1151	1142
Expansion, Inches x 10exp-4	0	16	41
Stability 2,000 lbs (160psi)	37 / 69	19 / 38	18 / 37
Turns Displacement	5.78	4.49	4.35
R-Value Uncorrected	36	64	66
R-Value Corrected	40	66	66
Dry Density, pcf	118.2	123.0	124.0

DESIGN CALCULATION DATA

Traffic Index Assumed:	4.0	4.0	4.0
G.E. by Stability	0.61	0.35	0.35
G. E. by Expansion	0.00	0.53	1.37

Equilibrium R-Value	54 by EXUDATION	Examined & Checked: 9 /22/ 20
REMARKS:	Gf = 1.25 0.2% Retained on the 3/4" Sieve.	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.

R-VALUE GRAPHICAL PRESENTATION

LaBelle Marvin

PROJECT NO. 46447

DATE: 9 /22/ 2020

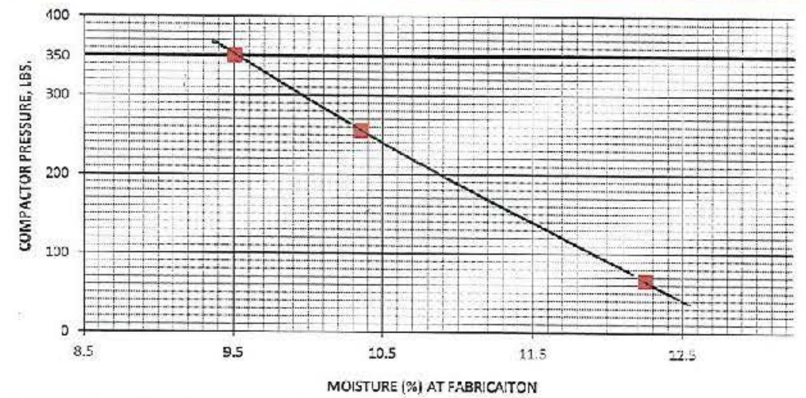
REMARKS:

BORING NO. B-1 @ 0'-5'

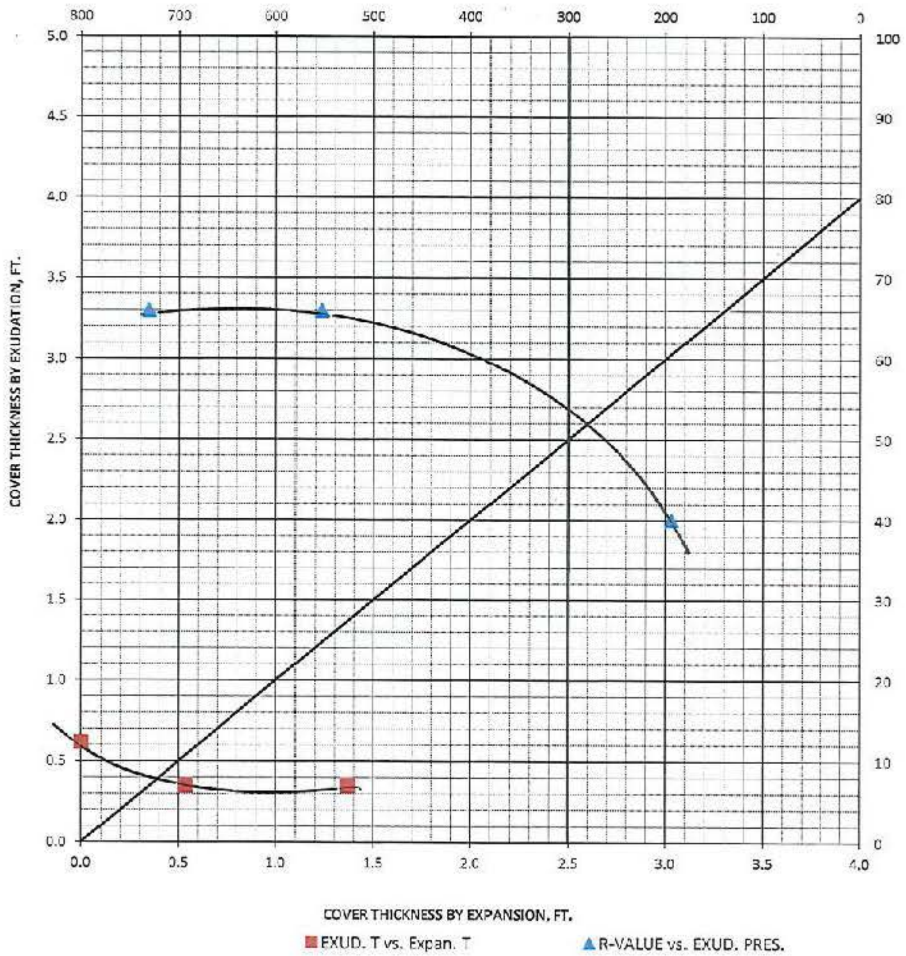
Burrtec Hauling Yard, Jurupa Valley

W.O.# 2484-CR

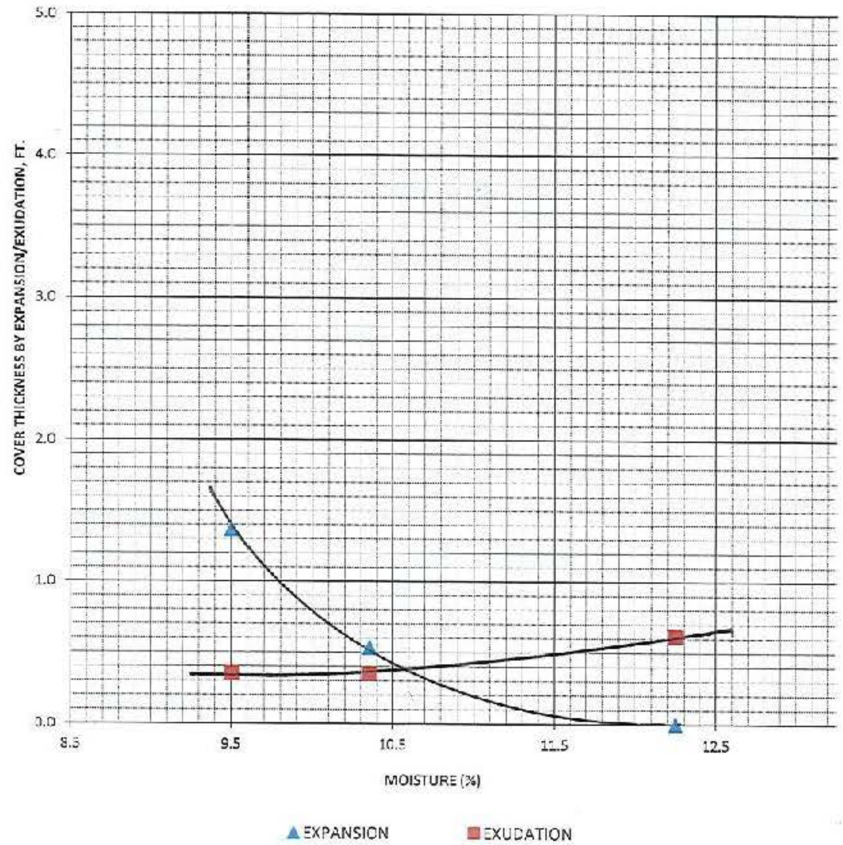
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



APPENDIX C

INFILTRATION TEST RESULTS AND CALCULATIONS

Proposed Industrial Hauling Yard

APNs 175-180-012 and -016

Jurupa Valley, Riverside County, California

Project No. 2484-CR

GEOTEK

Percolation Test Data Sheet

Project: Burgstee - Agua Mansa & Wilson St. Job No.: 2484-CR

Test Hole No.: I-1 Date Excavated: 9/9/20

Depth of Test Hole (ft): 5 Soil Description: SM

Percolation Test By: KRM Date: 9/10/20 Presoak: Yes

Percolation Test Data

Time	Time Interval (min)	Total Elapsed Time (min)	Water Depth, from top Initial (inch)	Water Depth, from top Final (inch)	Water Depth, from top Λ (inch)	Percolation Rate (min/inch)
8:30 8:55	25	25	20	0	>20	
8:56 9:21	25	51	20	0	>20	
9:22 9:32	10	62	20	10	10	
9:34 9:40	10	74	20	9½	10½	
9:46 9:56	10	86	20	10½	9½	
9:58 10:08	10	98	20	10¾	9¼	
10:10 10:20	10	110	20	11	9	
10:22 10:32	10	122	20	11	9	
10:34 10:44	10	134	20	11	9	1.11

END TEST

Design Percolation Rate: **min/inch**

Percolation Test Data Sheet

Project: Borrego - [illegible] & Wilson St. Job No.: 2484-CR
Test Hole No.: I-2 Date Excavated: 9/9/20
Depth of Test Hole (ft): 5 Soil Description: SM
Percolation Test By: KRM Date: 9/10/20 Presoak: Yes

Percolation Test Data

Time	Time Interval (min)	Total Elapsed Time (min)	Water Depth, from top: Initial (inch)	Final (inch)	Δ (inch)	Percolation Rate (min/inch)
8:31 8:56	25	25	20	6	14	
8:57 9:22	25	51	20	6 1/4	13 3/4	
9:23 9:33	10	62	20	13	7	
9:35 9:45	10	74	20	14	6	
9:47 9:57	10	86	20	13 1/2	6 1/2	
9:59 10:09	10	98	20	13 1/4	6 3/4	
10:11 10:21	10	110	20	13 1/2	6 1/2	
10:23 10:33	10	122	20	13 1/2	6 1/2	
10:35 10:45	10	134	20	13 1/2	6 1/2	1.54

END TEST

Design Percolation Rate: min/inch

GeoTek, Inc.

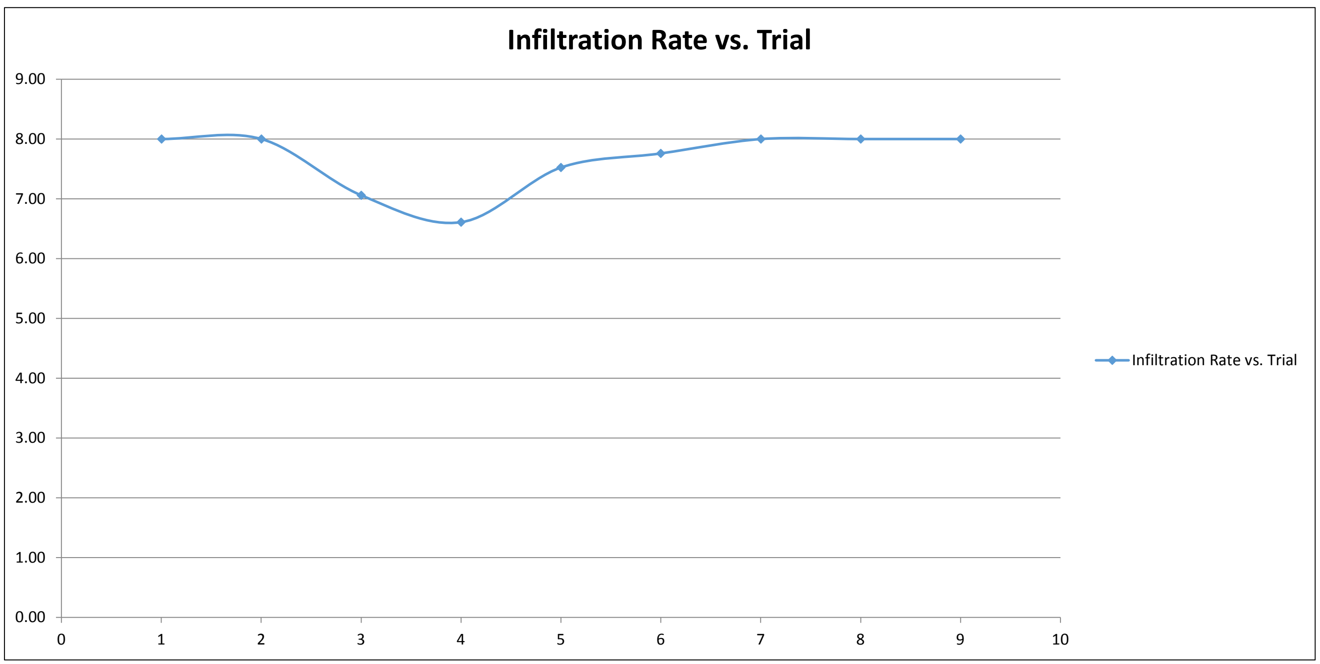
PERCOLATION TESTING

Shallow Percolation Test (<10 ft) | **Test No. I-1**
2484-CR

Depth of Hole (D_T) in.	60
Boring Radius, in.	4

Trial No.	Time Interval (ΔT) Min.	Initial Depth (D_0) in.	Final Depth (D_f) in.	Change In Level (ΔD) in.	Perc Rate (min/in)	Infiltration Rate (in/hr)
Sandy Soil	25	40.00	60.00	20.00	0.80	8.00
Sandy Soil	25	40.00	60.00	20.00	0.80	8.00
1	10	40.00	50.00	10.00	1.00	7.06
2	10	40.00	49.50	9.50	0.95	6.61
3	10	40.00	50.50	10.50	1.05	7.52
4	10	40.00	50.75	10.75	1.08	7.76
5	10	40.00	51.00	11.00	1.10	8.00
6	10	40.00	51.00	11.00	1.10	8.00
7	10	40.00	51.00	11.00	1.10	8.00

Initial Height (H_0)	Final Height (H_f)	Height Change (ΔH)	Height Average (H_{avg})
20	0	20	10
20	0	20	10
20	10	10	15
20	10.5	9.5	15.25
20	9.5	10.5	14.75
20	9.25	10.75	14.625
20	9	11	14.5
20	9	11	14.5
20	9	11	14.5



GeoTek, Inc.
PERCOLATION TESTING

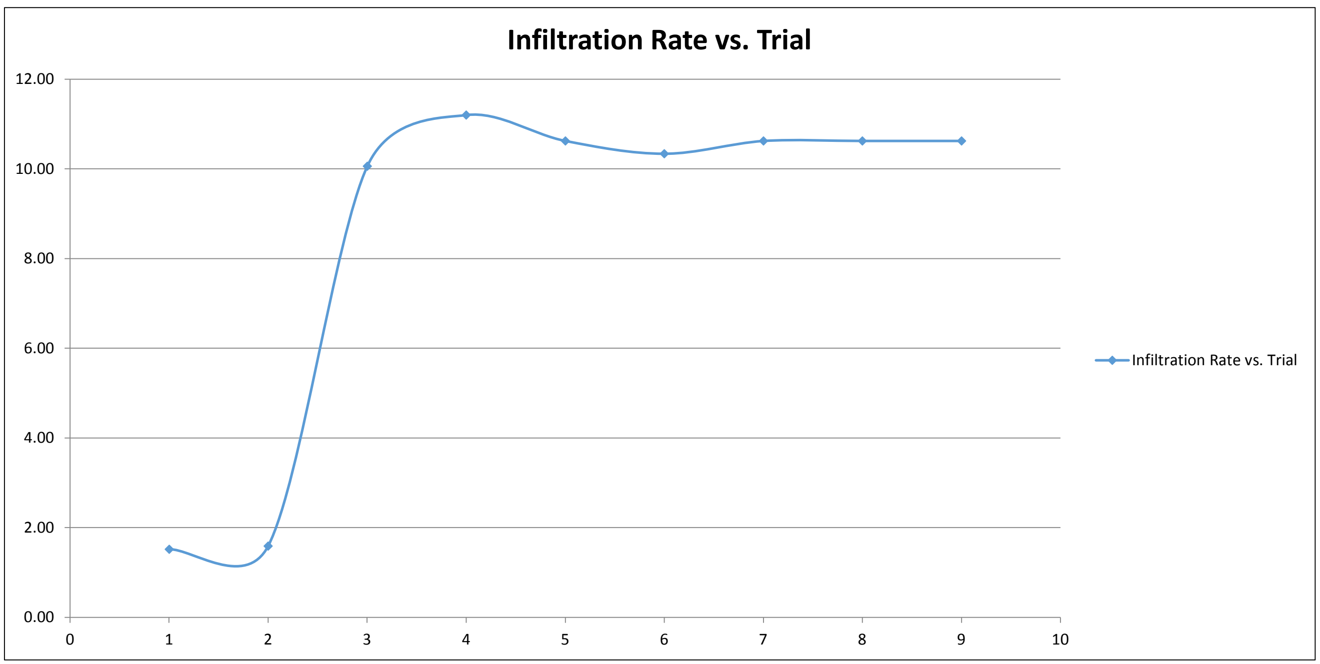
Shallow Percolation Test (<10 ft) **Test No. I-2**

2484-CR

Depth of Hole (D_T) in.	60
Boring Radius, in.	4

Trial No.	Time Interval (ΔT) Min.	Initial Depth (D_0) in.	Final Depth (D_f) in.	Change In Level (ΔD) in.	Perc Rate (min/in)	Infiltration Rate (in/hr)
Sandy Soil	25	40.00	46.00	6.00	0.24	1.52
Sandy Soil	25	40.00	46.25	6.25	0.25	1.59
1	10	40.00	53.00	13.00	1.30	10.06
2	10	40.00	54.00	14.00	1.40	11.20
3	10	40.00	53.50	13.50	1.35	10.62
4	10	40.00	53.25	13.25	1.33	10.34
5	10	40.00	53.50	13.50	1.35	10.62
6	10	40.00	53.50	13.50	1.35	10.62
7	10	40.00	53.50	13.50	1.35	10.62

Initial Height (H_0)	Final Height (H_f)	Height Change (ΔH)	Height Average (H_{avg})
20	14	6	17
20	13.75	6.25	16.875
20	7	13	13.5
20	6	14	13
20	6.5	13.5	13.25
20	6.75	13.25	13.375
20	6.5	13.5	13.25
20	6.5	13.5	13.25
20	6.5	13.5	13.25



APPENDIX D

SEISMIC SETTLEMENT ANALYSIS

Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California
Project No. 2484-CR

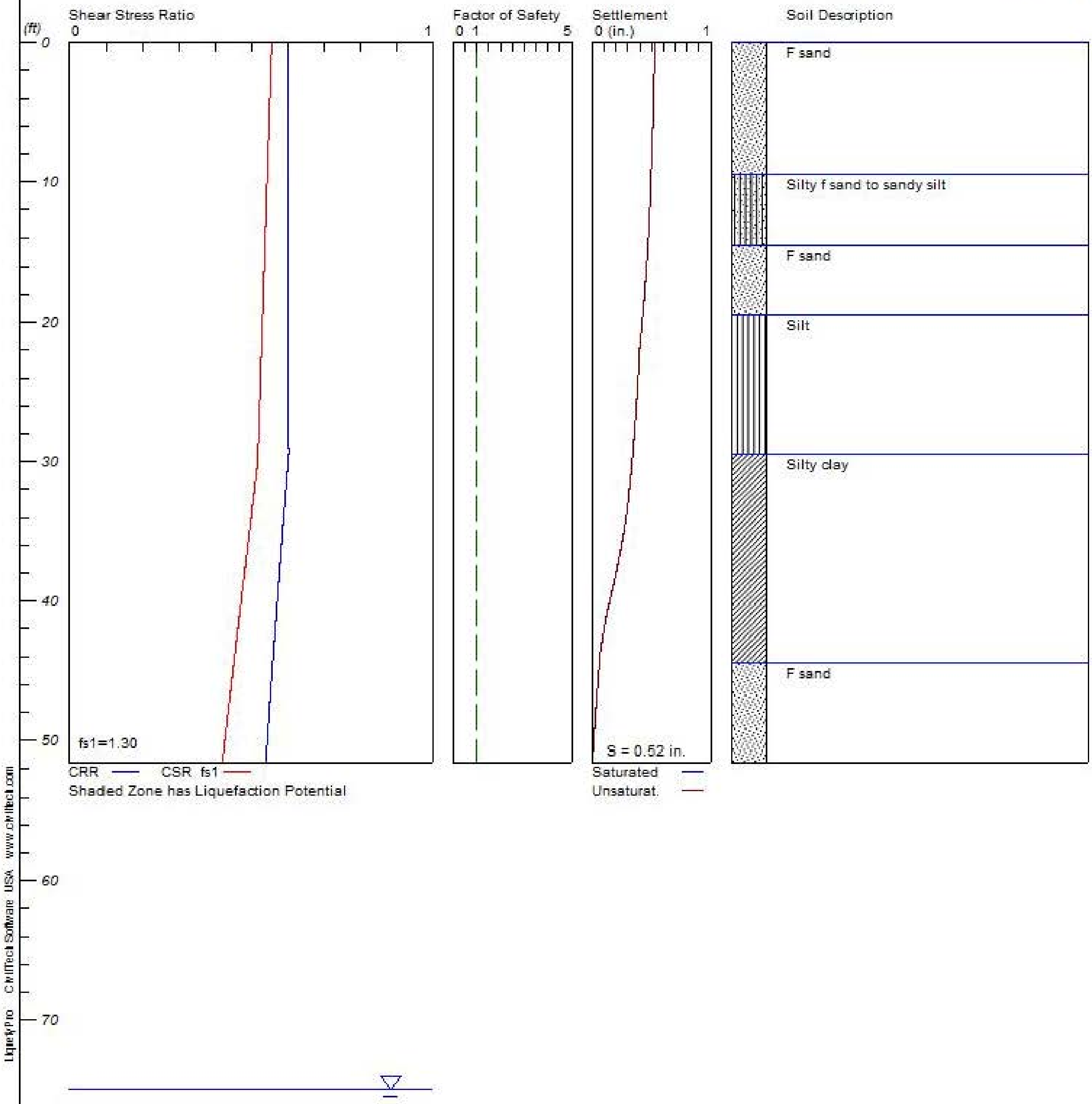
GEOTEK

LIQUEFACTION ANALYSIS

2484-CR Burrtec Hauling Yard

Hole No.=B-4 Water Depth=75 ft

Magnitude=6.98
Acceleration=0.658g



GeoTek, Inc. **Agua Mansa/Wilson, Jurupa Valley, California**

****

LIQUEFACTION ANALYSIS CALCULATION DETAILS

****

Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 10/8/2020 8:15:14 PM

Input File Name: G:\Projects\2451 to 2500\2484CR Burrtec Waste Industries, Inc. Hauling Yard Development Jurupa Valley\Geo\Liquefaction\2484CR B-4.liq
Title: 2484-CR Burrtec Hauling Yard
Subtitle: Agua Mansa/Wilson, Jurupa Valley, California

Input Data:
Surface Elev.=
Hole No.=B-4
Depth of Hole=51.50 ft
Water Table during Earthquake= 75.00 ft
Water Table during In-Situ Testing= 75.00 ft
Max. Acceleration=0.66 g
Earthquake Magnitude=6.98
No-Liquefiable Soils: Based on Analysis
1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.4
7. Borehole Diameter, Cb= 1.0
8. Sampling Method, Cs= 1.3
9. User request factor of safety (apply to CSR) , User= 1.3
Plot one CSR curve (fs1=User)
10. Average two input data between two Depths: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	Gamma pcf	Fines %
0.00	18.00	113.00	20.00
5.50	18.00	113.00	20.00
10.50	33.00	115.00	45.00
15.50	33.00	113.00	20.00

20.50	39.00	110.00	90.00
25.50	42.00	110.00	90.00
30.50	38.00	110.00	90.00
35.50	22.00	110.00	90.00
40.50	22.00	110.00	90.00
45.50	40.00	113.00	20.00
50.50	55.00	113.00	20.00

Output Results:
Calculation segment, dz=0.050 ft
User defined Print Interval, dp=1.00 ft

Peak Ground Acceleration (PGA), a_max = 0.66g

CSR Calculation:

Depth ft	gamma pcf	sigma atm	gamma' pcf	sigma' atm	rd	mZ g	a(z) g	CSR	x	fs1 =CSRfs
0.00	113.00	0.000	113.00	0.000	1.00	0.000	0.658	0.43	1.30	0.56
1.00	113.00	0.053	113.00	0.053	1.00	0.000	0.658	0.43	1.30	0.55
2.00	113.00	0.107	113.00	0.107	1.00	0.000	0.658	0.43	1.30	0.55
3.00	113.00	0.160	113.00	0.160	0.99	0.000	0.658	0.42	1.30	0.55
4.00	113.00	0.214	113.00	0.214	0.99	0.000	0.658	0.42	1.30	0.55
5.00	113.00	0.267	113.00	0.267	0.99	0.000	0.658	0.42	1.30	0.55
6.00	113.20	0.320	113.20	0.320	0.99	0.000	0.658	0.42	1.30	0.55
7.00	113.60	0.374	113.60	0.374	0.98	0.000	0.658	0.42	1.30	0.55
8.00	114.00	0.428	114.00	0.428	0.98	0.000	0.658	0.42	1.30	0.55
9.00	114.40	0.482	114.40	0.482	0.98	0.000	0.658	0.42	1.30	0.54
10.00	114.80	0.536	114.80	0.536	0.98	0.000	0.658	0.42	1.30	0.54
11.00	114.80	0.590	114.80	0.590	0.97	0.000	0.658	0.42	1.30	0.54
12.00	114.40	0.644	114.40	0.644	0.97	0.000	0.658	0.42	1.30	

0.54
13.00 114.00 0.698 114.00 0.698 0.97 0.000 0.658 0.41 1.30
0.54
14.00 113.60 0.752 113.60 0.752 0.97 0.000 0.658 0.41 1.30
0.54
15.00 113.20 0.806 113.20 0.806 0.97 0.000 0.658 0.41 1.30
0.54
16.00 112.70 0.859 112.70 0.859 0.96 0.000 0.658 0.41 1.30
0.54
17.00 112.10 0.912 112.10 0.912 0.96 0.000 0.658 0.41 1.30
0.53
18.00 111.50 0.965 111.50 0.965 0.96 0.000 0.658 0.41 1.30
0.53
19.00 110.90 1.018 110.90 1.018 0.96 0.000 0.658 0.41 1.30
0.53
20.00 110.30 1.070 110.30 1.070 0.95 0.000 0.658 0.41 1.30
0.53
21.00 110.00 1.122 110.00 1.122 0.95 0.000 0.658 0.41 1.30
0.53
22.00 110.00 1.174 110.00 1.174 0.95 0.000 0.658 0.41 1.30
0.53
23.00 110.00 1.226 110.00 1.226 0.95 0.000 0.658 0.40 1.30
0.53
24.00 110.00 1.278 110.00 1.278 0.94 0.000 0.658 0.40 1.30
0.52
25.00 110.00 1.330 110.00 1.330 0.94 0.000 0.658 0.40 1.30
0.52
26.00 110.00 1.382 110.00 1.382 0.94 0.000 0.658 0.40 1.30
0.52
27.00 110.00 1.434 110.00 1.434 0.94 0.000 0.658 0.40 1.30
0.52
28.00 110.00 1.486 110.00 1.486 0.93 0.000 0.658 0.40 1.30
0.52
29.00 110.00 1.538 110.00 1.538 0.93 0.000 0.658 0.40 1.30
0.52
30.00 110.00 1.590 110.00 1.590 0.93 0.000 0.658 0.40 1.30
0.52
31.00 110.00 1.642 110.00 1.642 0.92 0.000 0.658 0.39 1.30
0.51
32.00 110.00 1.694 110.00 1.694 0.91 0.000 0.658 0.39 1.30
0.51
33.00 110.00 1.746 110.00 1.746 0.91 0.000 0.658 0.39 1.30
0.50
34.00 110.00 1.798 110.00 1.798 0.90 0.000 0.658 0.38 1.30
0.50
35.00 110.00 1.850 110.00 1.850 0.89 0.000 0.658 0.38 1.30
0.49
36.00 110.00 1.902 110.00 1.902 0.88 0.000 0.658 0.38 1.30

0.49
37.00 110.00 1.954 110.00 1.954 0.87 0.000 0.658 0.37 1.30
0.49
38.00 110.00 2.006 110.00 2.006 0.86 0.000 0.658 0.37 1.30
0.48
39.00 110.00 2.058 110.00 2.058 0.86 0.000 0.658 0.37 1.30
0.48
40.00 110.00 2.109 110.00 2.109 0.85 0.000 0.658 0.36 1.30
0.47
41.00 110.30 2.162 110.30 2.162 0.84 0.000 0.658 0.36 1.30
0.47
42.00 110.90 2.214 110.90 2.214 0.83 0.000 0.658 0.36 1.30
0.46
43.00 111.50 2.266 111.50 2.266 0.82 0.000 0.658 0.35 1.30
0.46
44.00 112.10 2.319 112.10 2.319 0.82 0.000 0.658 0.35 1.30
0.45
45.00 112.70 2.372 112.70 2.372 0.81 0.000 0.658 0.35 1.30
0.45
46.00 113.00 2.426 113.00 2.426 0.80 0.000 0.658 0.34 1.30
0.44
47.00 113.00 2.479 113.00 2.479 0.79 0.000 0.658 0.34 1.30
0.44
48.00 113.00 2.532 113.00 2.532 0.78 0.000 0.658 0.34 1.30
0.44
49.00 113.00 2.586 113.00 2.586 0.78 0.000 0.658 0.33 1.30
0.43
50.00 113.00 2.639 113.00 2.639 0.77 0.000 0.658 0.33 1.30
0.43
51.00 113.00 2.693 113.00 2.693 0.76 0.000 0.658 0.32 1.30
0.42

_

CSR is based on water table at 75.00 during earthquake

CRR Calculation from SPT or BPT data:
Depth SPT Cebs Cr sigma' Cn (N1)60 Fines d(N1)60
(N1)60f CRR7.5
ft atm %

_
0.00 18.00 1.82 0.75 0.000 1.70 41.77 20.00 6.93
48.70 0.50
1.00 18.00 1.82 0.75 0.053 1.70 41.77 20.00 6.93
48.70 0.50
2.00 18.00 1.82 0.75 0.107 1.70 41.77 20.00 6.93

48.70	0.50								
	3.00	18.00	1.82	0.75	0.160	1.70	41.77	20.00	6.93
48.70	0.50								
	4.00	18.00	1.82	0.75	0.214	1.70	41.77	20.00	6.93
48.70	0.50								
	5.00	18.00	1.82	0.75	0.267	1.70	41.77	20.00	6.93
48.70	0.50								
	6.00	19.50	1.82	0.75	0.320	1.70	45.25	22.50	8.37
53.62	0.50								
	7.00	22.50	1.82	0.75	0.374	1.64	50.22	27.50	11.26
61.48	0.50								
	8.00	25.50	1.82	0.75	0.428	1.53	53.22	32.50	14.18
67.40	0.50								
	9.00	28.50	1.82	0.85	0.482	1.44	63.52	37.50	17.70
81.23	0.50								
	10.00	31.50	1.82	0.85	0.536	1.37	66.57	42.50	18.31
84.88	0.50								
	11.00	33.00	1.82	0.85	0.590	1.30	66.45	42.50	18.29
84.74	0.50								
	12.00	33.00	1.82	0.85	0.644	1.25	63.60	37.50	17.72
81.32	0.50								
	13.00	33.00	1.82	0.85	0.698	1.20	61.09	32.50	15.56
76.66	0.50								
	14.00	33.00	1.82	0.85	0.752	1.15	58.87	27.50	12.42
71.29	0.50								
	15.00	33.00	1.82	0.95	0.806	1.11	63.57	22.50	10.14
73.71	0.50								
	16.00	33.60	1.82	0.95	0.859	1.08	62.68	27.00	12.65
75.32	0.50								
	17.00	34.80	1.82	0.95	0.912	1.05	63.00	41.00	17.60
80.60	0.50								
	18.00	36.00	1.82	0.95	0.965	1.02	63.36	55.00	17.67
81.03	0.50								
	19.00	37.20	1.82	0.95	1.018	0.99	63.76	69.00	17.75
81.51	0.50								
	20.00	38.40	1.82	0.95	1.070	0.97	64.19	83.00	17.84
82.03	0.50								
	21.00	39.30	1.82	0.95	1.122	0.94	64.15	90.00	17.83
81.98	0.50								
	22.00	39.90	1.82	0.95	1.174	0.92	63.67	90.00	17.73
81.41	0.50								
	23.00	40.50	1.82	0.95	1.226	0.90	63.25	90.00	17.65
80.90	0.50								
	24.00	41.10	1.82	0.95	1.278	0.88	62.86	90.00	17.57
80.44	0.50								
	25.00	41.70	1.82	0.95	1.330	0.87	62.52	90.00	17.50
80.03	0.50								
	26.00	41.60	1.82	0.95	1.382	0.85	61.19	90.00	17.24

78.43	0.50								
	27.00	40.80	1.82	0.95	1.434	0.84	58.91	90.00	16.78
75.70	0.50								
	28.00	40.00	1.82	1.00	1.486	0.82	59.73	90.00	16.95
76.67	0.50								
	29.00	39.20	1.82	1.00	1.538	0.81	57.53	90.00	16.51
74.04	0.50								
	30.00	38.40	1.82	1.00	1.590	0.79	55.43	90.00	16.09
71.52	0.50								
	31.00	36.40	1.82	1.00	1.642	0.78	51.71	90.00	15.34
67.05	0.50								
	32.00	33.20	1.82	1.00	1.694	0.77	46.43	90.00	14.29
60.72	0.50								
	33.00	30.00	1.82	1.00	1.746	0.76	41.33	90.00	13.27
54.59	0.50								
	34.00	26.80	1.82	1.00	1.798	0.75	36.38	90.00	12.28
48.66	0.50								
	35.00	23.60	1.82	1.00	1.850	0.74	31.58	90.00	11.32
42.90	0.50								
	36.00	22.00	1.82	1.00	1.902	0.73	29.04	90.00	10.81
39.84	0.50								
	37.00	22.00	1.82	1.00	1.954	0.72	28.65	90.00	10.73
39.38	0.50								
	38.00	22.00	1.82	1.00	2.006	0.71	28.27	90.00	10.65
38.93	0.50								
	39.00	22.00	1.82	1.00	2.058	0.70	27.91	90.00	10.58
38.50	0.50								
	40.00	22.00	1.82	1.00	2.109	0.69	27.57	90.00	10.51
38.08	0.50								
	41.00	23.80	1.82	1.00	2.162	0.68	29.46	83.00	10.89
40.35	0.50								
	42.00	27.40	1.82	1.00	2.214	0.67	33.51	69.00	11.70
45.22	0.50								
	43.00	31.00	1.82	1.00	2.266	0.66	37.48	55.01	12.50
49.97	0.50								
	44.00	34.60	1.82	1.00	2.319	0.66	41.35	41.01	13.27
54.62	0.50								
	45.00	38.20	1.82	1.00	2.372	0.65	45.14	27.01	10.36
55.50	0.50								
	46.00	41.50	1.82	1.00	2.426	0.64	48.50	20.00	7.47
55.96	0.50								
	47.00	44.50	1.82	1.00	2.479	0.64	51.44	20.00	7.70
59.14	0.50								
	48.00	47.50	1.82	1.00	2.532	0.63	54.32	20.00	7.93
62.25	0.50								
	49.00	50.50	1.82	1.00	2.586	0.62	57.16	20.00	8.16
65.31	0.50								
	50.00	53.50	1.82	1.00	2.639	0.62	59.93	20.00	8.38

68.31	0.50								
	51.00	55.00	1.82	1.00	2.693	0.61	61.00	20.00	8.46
69.46	0.50								

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CRR is based on water table at 75.00 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 6.98:

Depth ft	sigC' atm	CRR7.5	x Ksig	=CRRv	x MSF	=CRRm	CSRfs	F.S.=CRRm/CSRfs
0.00	0.00	0.50	1.00	0.50	1.20	0.60	0.56	5.00
1.00	0.03	0.50	1.00	0.50	1.20	0.60	0.55	5.00
2.00	0.07	0.50	1.00	0.50	1.20	0.60	0.55	5.00
3.00	0.10	0.50	1.00	0.50	1.20	0.60	0.55	5.00
4.00	0.14	0.50	1.00	0.50	1.20	0.60	0.55	5.00
5.00	0.17	0.50	1.00	0.50	1.20	0.60	0.55	5.00
6.00	0.21	0.50	1.00	0.50	1.20	0.60	0.55	5.00
7.00	0.24	0.50	1.00	0.50	1.20	0.60	0.55	5.00
8.00	0.28	0.50	1.00	0.50	1.20	0.60	0.55	5.00
9.00	0.31	0.50	1.00	0.50	1.20	0.60	0.54	5.00
10.00	0.35	0.50	1.00	0.50	1.20	0.60	0.54	5.00
11.00	0.38	0.50	1.00	0.50	1.20	0.60	0.54	5.00
12.00	0.42	0.50	1.00	0.50	1.20	0.60	0.54	5.00
13.00	0.45	0.50	1.00	0.50	1.20	0.60	0.54	5.00
14.00	0.49	0.50	1.00	0.50	1.20	0.60	0.54	5.00
15.00	0.52	0.50	1.00	0.50	1.20	0.60	0.54	5.00
16.00	0.56	0.50	1.00	0.50	1.20	0.60	0.54	5.00
17.00	0.59	0.50	1.00	0.50	1.20	0.60	0.53	5.00
18.00	0.63	0.50	1.00	0.50	1.20	0.60	0.53	5.00
19.00	0.66	0.50	1.00	0.50	1.20	0.60	0.53	5.00
20.00	0.70	0.50	1.00	0.50	1.20	0.60	0.53	5.00
21.00	0.73	0.50	1.00	0.50	1.20	0.60	0.53	5.00
22.00	0.76	0.50	1.00	0.50	1.20	0.60	0.53	5.00
23.00	0.80	0.50	1.00	0.50	1.20	0.60	0.53	5.00
24.00	0.83	0.50	1.00	0.50	1.20	0.60	0.52	5.00
25.00	0.86	0.50	1.00	0.50	1.20	0.60	0.52	5.00
26.00	0.90	0.50	1.00	0.50	1.20	0.60	0.52	5.00
27.00	0.93	0.50	1.00	0.50	1.20	0.60	0.52	5.00
28.00	0.97	0.50	1.00	0.50	1.20	0.60	0.52	5.00
29.00	1.00	0.50	1.00	0.50	1.20	0.60	0.52	5.00
30.00	1.03	0.50	1.00	0.50	1.20	0.60	0.52	5.00
31.00	1.07	0.50	1.00	0.50	1.20	0.60	0.51	5.00
32.00	1.10	0.50	0.99	0.50	1.20	0.59	0.51	5.00
33.00	1.13	0.50	0.99	0.49	1.20	0.59	0.50	5.00
34.00	1.17	0.50	0.98	0.49	1.20	0.59	0.50	5.00

35.00	1.20	0.50	0.97	0.49	1.20	0.59	0.49	5.00
36.00	1.24	0.50	0.97	0.48	1.20	0.58	0.49	5.00
37.00	1.27	0.50	0.96	0.48	1.20	0.58	0.49	5.00
38.00	1.30	0.50	0.96	0.48	1.20	0.58	0.48	5.00
39.00	1.34	0.50	0.96	0.48	1.20	0.57	0.48	5.00
40.00	1.37	0.50	0.95	0.48	1.20	0.57	0.47	5.00
41.00	1.40	0.50	0.95	0.47	1.20	0.57	0.47	5.00
42.00	1.44	0.50	0.94	0.47	1.20	0.57	0.46	5.00
43.00	1.47	0.50	0.94	0.47	1.20	0.56	0.46	5.00
44.00	1.51	0.50	0.93	0.47	1.20	0.56	0.45	5.00
45.00	1.54	0.50	0.93	0.46	1.20	0.56	0.45	5.00
46.00	1.58	0.50	0.92	0.46	1.20	0.55	0.44	5.00
47.00	1.61	0.50	0.92	0.46	1.20	0.55	0.44	5.00
48.00	1.65	0.50	0.91	0.46	1.20	0.55	0.44	5.00
49.00	1.68	0.50	0.91	0.45	1.20	0.55	0.43	5.00
50.00	1.72	0.50	0.91	0.45	1.20	0.54	0.43	5.00
51.00	1.75	0.50	0.90	0.45	1.20	0.54	0.42	5.00

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)
^ No-liquefiable Soils or above Water Table.
(F.S. is limited to 5, CRR is limited to 2,   CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 atm	(N1)60	Fines %	d(N1)60	(N1)60s
0.00	-	-	-	48.70	20.00	0.00	48.70
1.00	-	-	-	48.70	20.00	0.00	48.70
2.00	-	-	-	48.70	20.00	0.00	48.70
3.00	-	-	-	48.70	20.00	0.00	48.70
4.00	-	-	-	48.70	20.00	0.00	48.70
5.00	-	-	-	48.70	20.00	0.00	48.70
6.00	-	-	-	53.62	22.50	0.00	53.62
7.00	-	-	-	61.48	27.50	0.00	61.48
8.00	-	-	-	67.40	32.50	0.00	67.40
9.00	-	-	-	81.23	37.50	0.00	81.23
10.00	-	-	-	84.88	42.50	0.00	84.88
11.00	-	-	-	84.74	42.50	0.00	84.74
12.00	-	-	-	81.32	37.50	0.00	81.32
13.00	-	-	-	76.66	32.50	0.00	76.66
14.00	-	-	-	71.29	27.50	0.00	71.29
15.00	-	-	-	73.71	22.50	0.00	73.71
16.00	-	-	-	75.32	27.00	0.00	75.32
17.00	-	-	-	80.60	41.00	0.00	80.60
18.00	-	-	-	81.03	55.00	0.00	81.03
19.00	-	-	-	81.51	69.00	0.00	81.51

20.00	-	-	-	82.03	83.00	0.00	82.03
21.00	-	-	-	81.98	90.00	0.00	81.98
22.00	-	-	-	81.41	90.00	0.00	81.41
23.00	-	-	-	80.90	90.00	0.00	80.90
24.00	-	-	-	80.44	90.00	0.00	80.44
25.00	-	-	-	80.03	90.00	0.00	80.03
26.00	-	-	-	78.43	90.00	0.00	78.43
27.00	-	-	-	75.70	90.00	0.00	75.70
28.00	-	-	-	76.67	90.00	0.00	76.67
29.00	-	-	-	74.04	90.00	0.00	74.04
30.00	-	-	-	71.52	90.00	0.00	71.52
31.00	-	-	-	67.05	90.00	0.00	67.05
32.00	-	-	-	60.72	90.00	0.00	60.72
33.00	-	-	-	54.59	90.00	0.00	54.59
34.00	-	-	-	48.66	90.00	0.00	48.66
35.00	-	-	-	42.90	90.00	0.00	42.90
36.00	-	-	-	39.84	90.00	0.00	39.84
37.00	-	-	-	39.38	90.00	0.00	39.38
38.00	-	-	-	38.93	90.00	0.00	38.93
39.00	-	-	-	38.50	90.00	0.00	38.50
40.00	-	-	-	38.08	90.00	0.00	38.08
41.00	-	-	-	40.35	83.00	0.00	40.35
42.00	-	-	-	45.22	69.00	0.00	45.22
43.00	-	-	-	49.97	55.01	0.00	49.97
44.00	-	-	-	54.62	41.01	0.00	54.62
45.00	-	-	-	55.50	27.01	0.00	55.50
46.00	-	-	-	55.96	20.00	0.00	55.96
47.00	-	-	-	59.14	20.00	0.00	59.14
48.00	-	-	-	62.25	20.00	0.00	62.25
49.00	-	-	-	65.31	20.00	0.00	65.31
50.00	-	-	-	68.31	20.00	0.00	68.31
51.00	-	-	-	69.46	20.00	0.00	69.46

(N1)60s has been fines corrected in liquefaction analysis, therefore d(N1)60=0.

Fines=NoLiq means the soils are not liquefiable.

Settlement of Saturated Sands:

Settlement Analysis Method: Ishihara / Yoshimine

Depth	CSRsf	/ MSF*	=CSRm	F.S.	Fines	(N1)60s	Dr	ec	dsz	dsp	S
ft					%		%	%	in.	in.	in.

No Settlement of Saturated Sands

Settlement of Saturated Sands=0.000 in.
qc1 and (N1)60 is after fines correction in liquefaction analysis
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=1.00 ft
S is cumulated settlement at this depth

Settlement of Unsaturated Sands:

Depth ft	sigma' atm	sigC' atm	(N1)60s	CSRsf	Gmax atm	g*Ge/Gm	g_eff	ec7.5 %	Cec	ec %	dsz in.	dsp in.	S in.
51.45	2.72	1.77	69.17	0.42	2436.02	4.7E-4	0.1101	0.0348	0.92	0.0321	3.86E-4	0.000	0.000
51.00	2.69	1.75	69.46	0.42	2428.63	4.7E-4	0.1099	0.0347	0.92	0.0321	3.85E-4	0.003	0.004
50.00	2.64	1.72	68.31	0.43	2391.06	4.7E-4	0.1115	0.0352	0.92	0.0325	3.90E-4	0.008	0.012
49.00	2.59	1.68	65.31	0.43	2331.61	4.8E-4	0.1155	0.0365	0.92	0.0337	4.04E-4	0.008	0.020
48.00	2.53	1.65	62.25	0.44	2270.88	4.9E-4	0.1199	0.0379	0.92	0.0350	4.20E-4	0.008	0.028
47.00	2.48	1.61	59.14	0.44	2208.73	4.9E-4	0.1247	0.0394	0.92	0.0364	4.37E-4	0.009	0.036
46.00	2.43	1.58	55.96	0.44	2145.01	5.0E-4	0.1301	0.0412	0.92	0.0380	4.56E-4	0.009	0.045
45.00	2.37	1.54	55.50	0.45	2115.44	5.0E-4	0.1307	0.0413	0.92	0.0381	4.58E-4	0.009	0.055
44.00	2.32	1.51	54.62	0.45	2080.51	5.1E-4	0.1320	0.0417	0.92	0.0385	4.62E-4	0.009	0.064
43.00	2.27	1.47	49.97	0.46	1996.66	5.2E-4	0.2522	0.0798	0.92	0.0736	8.83E-4	0.015	0.079
42.00	2.21	1.44	45.22	0.46	1908.77	5.4E-4	0.2835	0.0897	0.92	0.0828	9.93E-4	0.019	0.098
41.00	2.16	1.40	40.35	0.47	1815.96	5.6E-4	0.3262	0.1032	0.92	0.0952	1.14E-3	0.021	0.119
40.00	2.11	1.37	38.08	0.47	1759.70	5.7E-4	0.3495	0.1259	0.92	0.1163	1.40E-3	0.027	0.146
39.00	2.06	1.34	38.50	0.48	1744.17	5.6E-4	0.3401	0.1192	0.92	0.1100	1.32E-3	0.027	0.173
38.00	2.01	1.30	38.93	0.48	1728.40	5.6E-4	0.3305	0.1125	0.92	0.1038	1.25E-3	0.026	0.199
37.00	1.95	1.27	39.38	0.49	1712.37	5.5E-4	0.3205	0.1057	0.92				

0.0976	1.17E-3	0.024	0.223							
	36.00	1.90	1.24	39.84	0.49	1696.08	5.5E-4	0.3103	0.0989	0.92
0.0913	1.10E-3	0.023	0.246							
	35.00	1.85	1.20	42.90	0.49	1714.42	5.3E-4	0.2770	0.0876	0.92
0.0808	9.70E-4	0.021	0.267							
	34.00	1.80	1.17	48.66	0.50	1762.54	5.1E-4	0.2332	0.0738	0.92
0.0681	8.17E-4	0.018	0.284							
	33.00	1.75	1.13	54.59	0.50	1804.72	4.9E-4	0.2007	0.0635	0.92
0.0586	7.03E-4	0.015	0.299							
	32.00	1.69	1.10	60.72	0.51	1841.73	4.7E-4	0.1755	0.0555	0.92
0.0512	6.15E-4	0.013	0.312							
	31.00	1.64	1.07	67.05	0.51	1874.12	4.5E-4	0.1554	0.0491	0.92
0.0454	5.44E-4	0.012	0.324							
	30.00	1.59	1.03	71.52	0.52	1884.28	4.4E-4	0.1429	0.0452	0.92
0.0417	5.00E-4	0.010	0.334							
	29.00	1.54	1.00	74.04	0.52	1874.74	4.3E-4	0.1328	0.0420	0.92
0.0388	4.65E-4	0.010	0.344							
	28.00	1.49	0.97	76.67	0.52	1864.33	4.1E-4	0.1235	0.0391	0.92
0.0360	4.33E-4	0.009	0.353							
	27.00	1.43	0.93	75.70	0.52	1823.65	4.1E-4	0.1199	0.0379	0.92
0.0350	4.20E-4	0.009	0.362							
	26.00	1.38	0.90	78.43	0.52	1811.53	4.0E-4	0.1114	0.0352	0.92
0.0325	3.90E-4	0.008	0.370							
	25.00	1.33	0.86	80.03	0.52	1789.13	3.9E-4	0.1048	0.0331	0.92
0.0306	3.67E-4	0.008	0.377							
	24.00	1.28	0.83	80.44	0.52	1756.80	3.8E-4	0.0999	0.0316	0.92
0.0291	3.50E-4	0.007	0.384							
	23.00	1.23	0.80	80.90	0.53	1723.95	3.7E-4	0.0950	0.0300	0.92
0.0277	3.33E-4	0.007	0.391							
	22.00	1.17	0.76	81.41	0.53	1690.56	3.7E-4	0.0902	0.0285	0.92
0.0263	3.16E-4	0.006	0.398							
	21.00	1.12	0.73	81.98	0.53	1656.58	3.6E-4	0.1694	0.0536	0.92
0.0494	5.93E-4	0.010	0.408							
	20.00	1.07	0.70	82.03	0.53	1618.01	3.5E-4	0.1549	0.0490	0.92
0.0452	5.42E-4	0.011	0.419							
	19.00	1.02	0.66	81.51	0.53	1574.69	3.4E-4	0.1426	0.0451	0.92
0.0416	4.99E-4	0.010	0.429							
	18.00	0.97	0.63	81.03	0.53	1530.48	3.4E-4	0.1308	0.0414	0.92
0.0382	4.58E-4	0.010	0.439							
	17.00	0.91	0.59	80.60	0.53	1485.32	3.3E-4	0.1195	0.0378	0.92
0.0349	4.19E-4	0.009	0.448							
	16.00	0.86	0.56	75.32	0.54	1409.31	3.3E-4	0.1173	0.0371	0.92
0.0342	4.11E-4	0.008	0.456							
	15.00	0.81	0.52	73.71	0.54	1354.99	3.2E-4	0.1081	0.0342	0.92
0.0316	3.79E-4	0.008	0.464							
	14.00	0.75	0.49	71.29	0.54	1294.67	3.1E-4	0.1005	0.0318	0.92
0.0293	3.52E-4	0.008	0.472							
	13.00	0.70	0.45	76.66	0.54	1278.04	2.9E-4	0.0828	0.0262	0.92

0.0242	2.90E-4	0.006	0.478						
	12.00	0.64	0.42	81.32	0.54	1252.05	2.8E-4	0.0697	0.0220	0.92
0.0203	2.44E-4	0.005	0.483						
	11.00	0.59	0.38	84.74	0.54	1214.85	2.6E-4	0.0598	0.0189	0.92
0.0175	2.10E-4	0.005	0.488						
	10.00	0.54	0.35	84.88	0.54	1158.25	2.5E-4	0.0771	0.0244	0.92
0.0225	2.70E-4	0.004	0.492						
	9.00	0.48	0.31	81.23	0.54	1082.20	2.4E-4	0.0646	0.0204	0.92
0.0189	2.26E-4	0.005	0.497						
	8.00	0.43	0.28	67.40	0.55	958.36	2.4E-4	0.0661	0.0209	0.92
0.0193	2.31E-4	0.004	0.501						
	7.00	0.37	0.24	61.48	0.55	869.08	2.4E-4	0.0574	0.0181	0.92
0.0167	2.01E-4	0.004	0.505						
	6.00	0.32	0.21	53.62	0.55	768.59	2.3E-4	0.0518	0.0164	0.92
0.0151	1.82E-4	0.004	0.509						
	5.00	0.27	0.17	48.70	0.55	679.48	2.2E-4	0.0445	0.0141	0.92
0.0130	1.56E-4	0.003	0.513						
	4.00	0.21	0.14	48.70	0.55	607.75	1.9E-4	0.0515	0.0163	0.92
0.0150	1.80E-4	0.004	0.516						
	3.00	0.16	0.10	48.70	0.55	526.33	1.7E-4	0.0364	0.0115	0.92
0.0106	1.28E-4	0.003	0.519						
	2.00	0.11	0.07	48.70	0.55	429.75	1.4E-4	0.0257	0.0081	0.92
0.0075	9.02E-5	0.002	0.521						
	1.00	0.05	0.03	48.70	0.55	303.90	9.7E-5	0.0192	0.0061	0.92
0.0056	6.71E-5	0.002	0.523						
	0.00	0.00	0.00	48.70	0.56	4.16	1.3E-6	0.0010	0.0003	0.92
0.0003	3.56E-6	0.001	0.524						

Settlement of Unsaturated Sands=0.524 in.
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=1.00 ft
S is cumulated settlement at this depth

Total Settlement of Saturated and Unsaturated Sands=0.524 in.
Differential Settlement=0.262 to 0.346 in.

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

---

1 atm (atmosphere) = 1.0581 tsf(1 tsf = 1 ton/ft2 = 2 kip/ft2)
1 atm (atmosphere) = 101.325 kPa(1 kPa = 1 kN/m2 = 0.001 Mpa)
SPT Field data from Standard Penetration Test (SPT)
BPT Field data from Becker Penetration Test (BPT)
qc Field data from Cone Penetration Test (CPT) [atm (tsf)]

```
        fs              Friction from CPT testing [atm (tsf)]
        Rf              Ratio of fs/qc (%)
        gamma           Total unit weight of soil
        gamma'          Effective unit weight of soil
        Fines           Fines content [%]
        D50             Mean grain size
        Dr              Relative Density
        sigma           Total vertical stress [atm]
        sigma'          Effective vertical stress [atm]
        sigC'           Effective confining pressure [atm]
        rd              Acceleration reduction coefficient by Seed
        a_max.          Peak Ground Acceleration (PGA) in ground surface
        mZ              Linear acceleration reduction coefficient X depth
        a_min.          Minimum acceleration under linear reduction, mZ
        CRRv            CRR after overburden stress correction, CRRv=CRR7.5 * Ksig
          CRR7.5                Cyclic resistance ratio (M=7.5)
          Ksig          Overburden stress correction factor for CRR7.5
        CRRm            After magnitude scaling correction CRRm=CRRv * MSF
          MSF           Magnitude scaling factor from M=7.5 to user input M
        CSR             Cyclic stress ratio induced by earthquake
        CSRfs           CSRfs=CSR*fs1 (Default fs1=1)
          fs1           First CSR curve in graphic defined in #9 of Advanced page
          fs2           2nd CSR curve in graphic defined in #9 of Advanced page
        F.S.            Calculated factor of safety against liquefaction
F.S.=CRRm/CSRsf
        Cebs            Energy Ratio, Borehole Dia., and Sampling Method Corrections
        Cr              Rod Length Corrections
        Cn              Overburden Pressure Correction
        (N1)60          SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
        d(N1)60         Fines correction of SPT
        (N1)60f         (N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
        Cq              Overburden stress correction factor
        qc1             CPT after Overburden stress correction
        dqc1            Fines correction of CPT
        qc1f            CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
        qc1n            CPT after normalization in Robertson's method
        Kc              Fine correction factor in Robertson's Method
        qc1f            CPT after Fines correction in Robertson's Method
        Ic              Soil type index in Suzuki's and Robertson's Methods
        (N1)60s         (N1)60 after settlement fines corrections
        CSRm            After magnitude scaling correction for Settlement
calculation  CSRm=CSRsf / MSF*
          CSRfs                 Cyclic stress ratio induced by earthquake with user
inputed fs
          MSF*                  Scaling factor from CSR, MSF*=1, based on Item 2 of
Page C.
        ec              Volumetric strain for saturated sands
        dz              Calculation segment, dz=0.050 ft
```

dsz	Settlement in each segment, dz
dp	User defined print interval
dsp	Settlement in each print interval, dp
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for unsaturated sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

1. NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.
SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.
2. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING AND SEISMIC SITE RESPONSE EVALUATION, Paper No. SPL-2, PROCEEDINGS: Fourth International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, San Diego, CA, March 2001.
3. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING: A UNIFIED AND CONSISTENT FRAMEWORK, Earthquake Engineering Research Center, Report No. EERC 2003-06 by R.B Seed and etc. April 2003.

Note: Print Interval you selected does not show complete results. To get complete results, you should select 'Segment' in Print Interval (Item 12, Page C).

APPENDIX E

GENERAL GRADING GUIDELINES

Proposed Industrial Hauling Yard

APNs 175-180-012 and -016

Jurupa Valley, Riverside County, California

Project No. 2484-CR

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, Chapters 18 and 33 of the California Building Code, CBC (2016) 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.

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 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.

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. 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.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors 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 contractors 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 contractors 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.

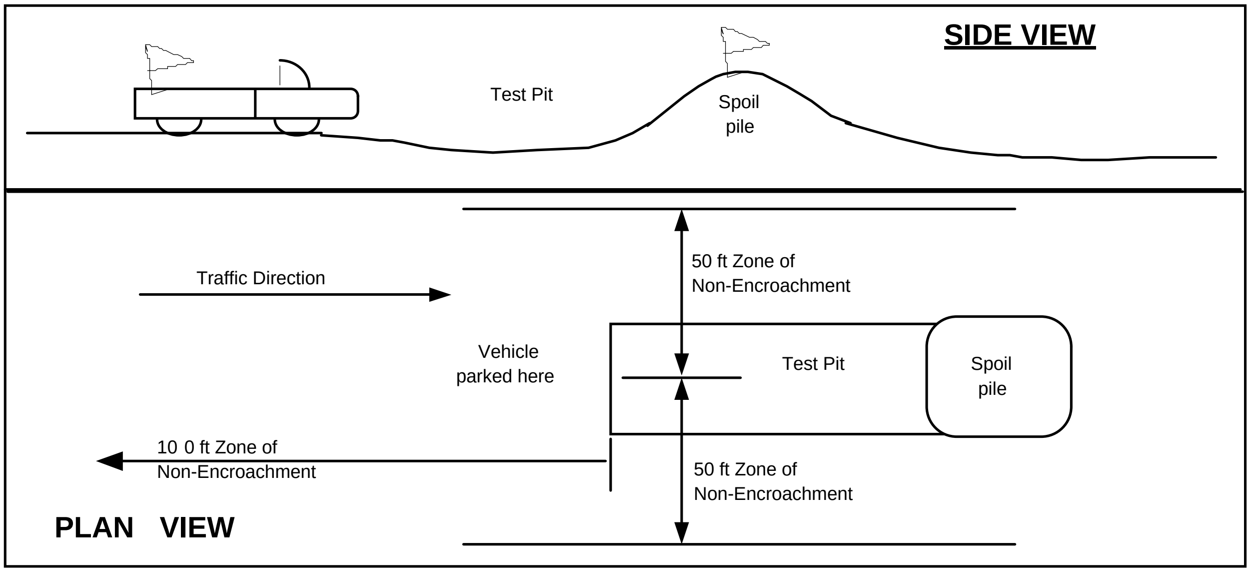
Test Pits Location, Orientation and Clearance

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 contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

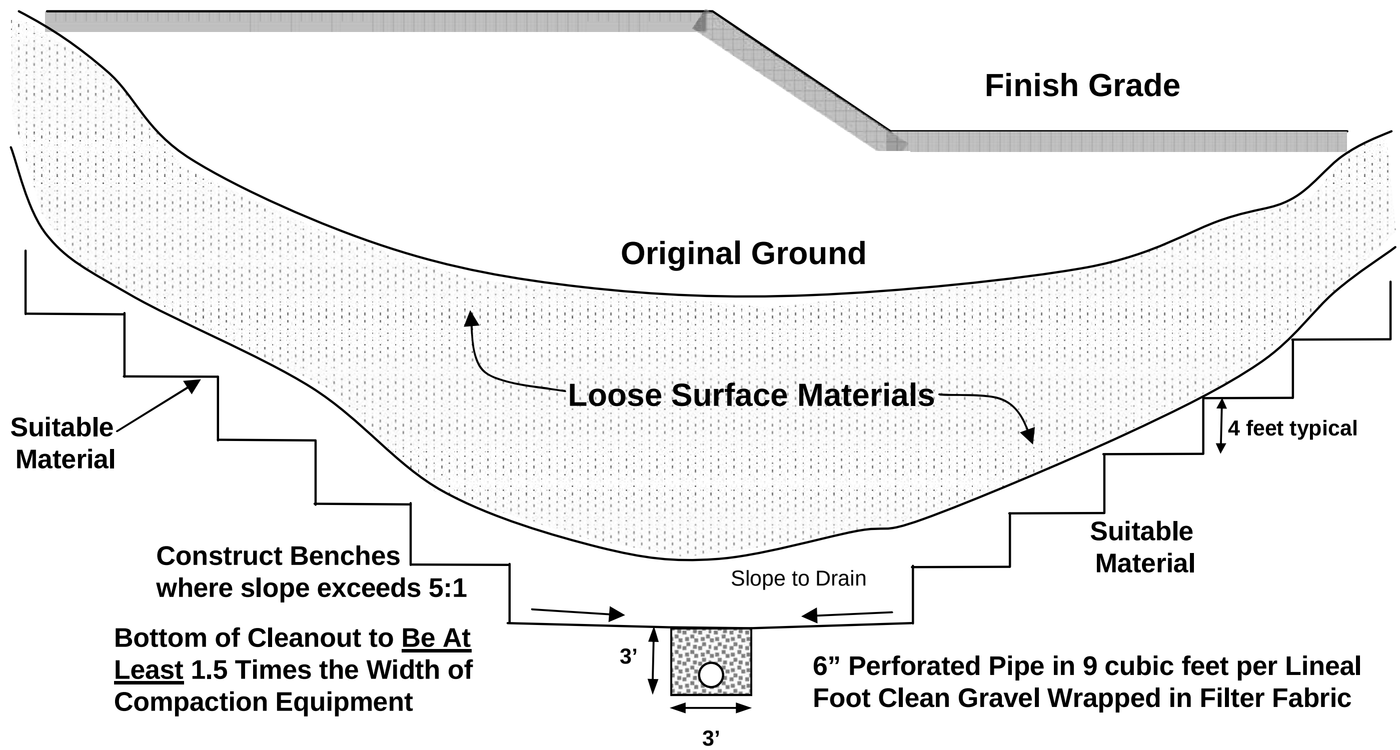
In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect 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.

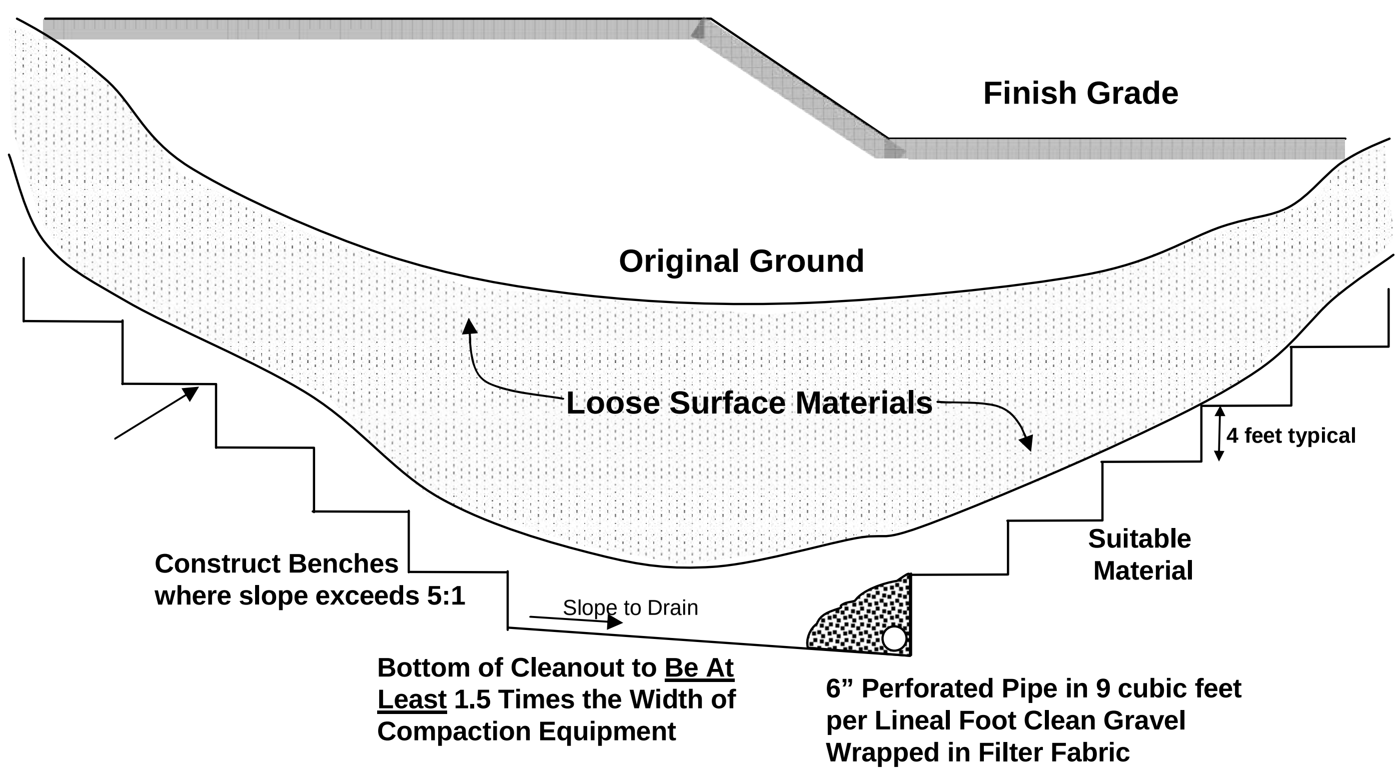
In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and 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.

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.

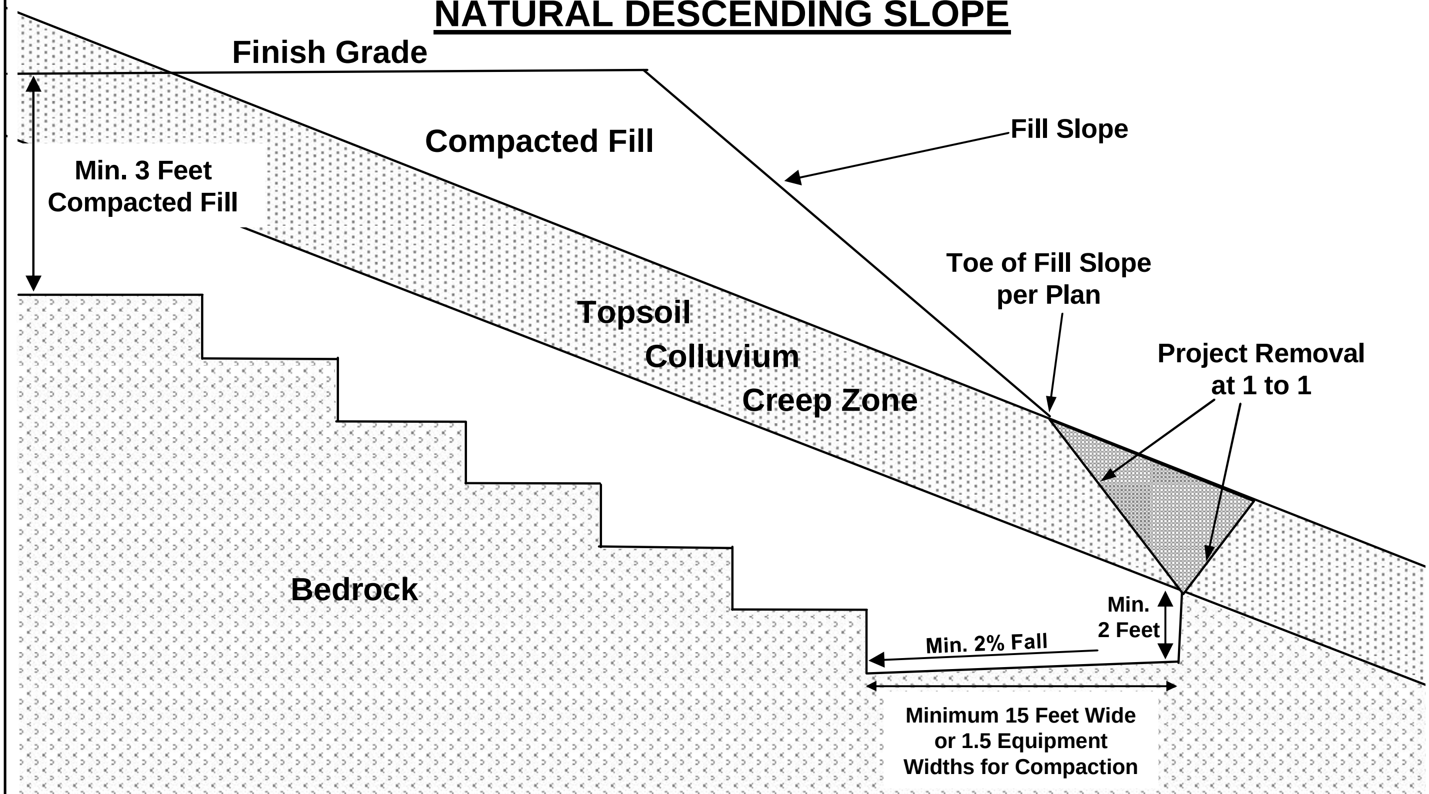
ALTERNATES



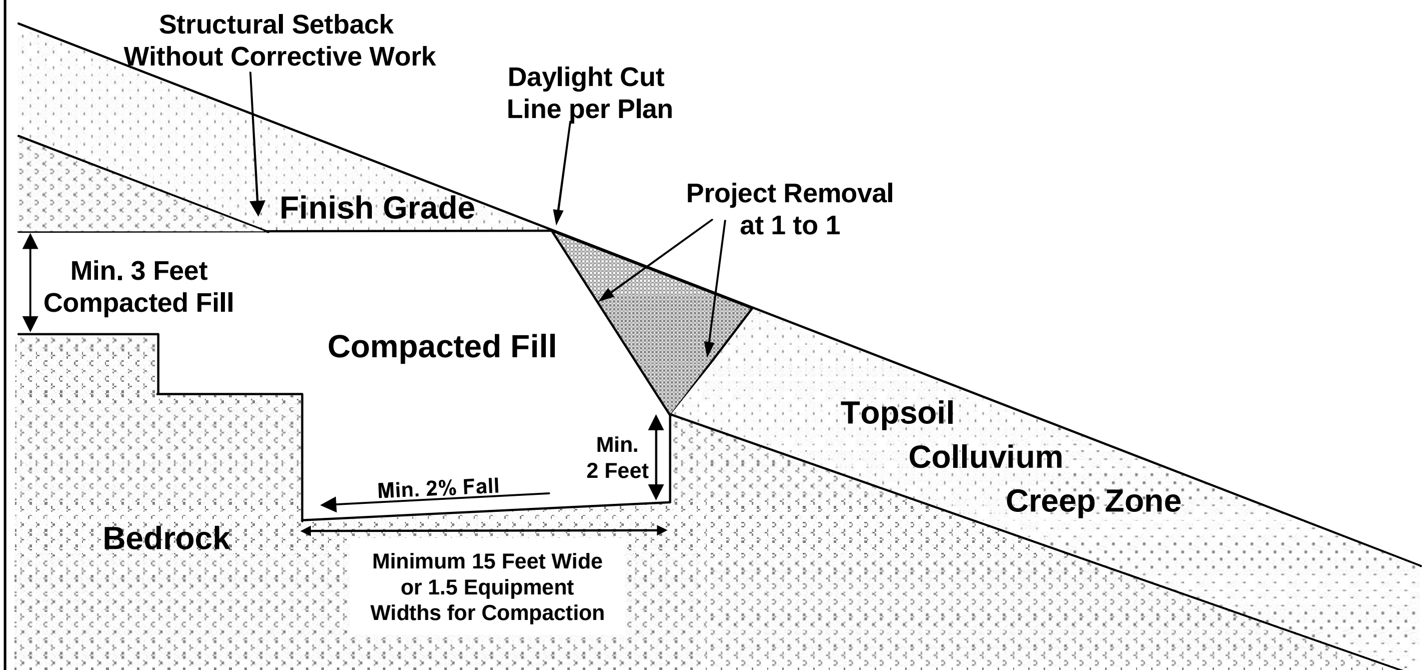


GEOTEK	1548 North Maple Street Corona, California 92880	TYPICAL CANYON CLEANOUT	STANDARD GRADING GUIDELINES PLATE G-1

TYPICAL FILL SLOPE OVER NATURAL DESCENDING SLOPE



DAYLIGHT CUT AREA OVER NATURAL DESCENDING SLOPE



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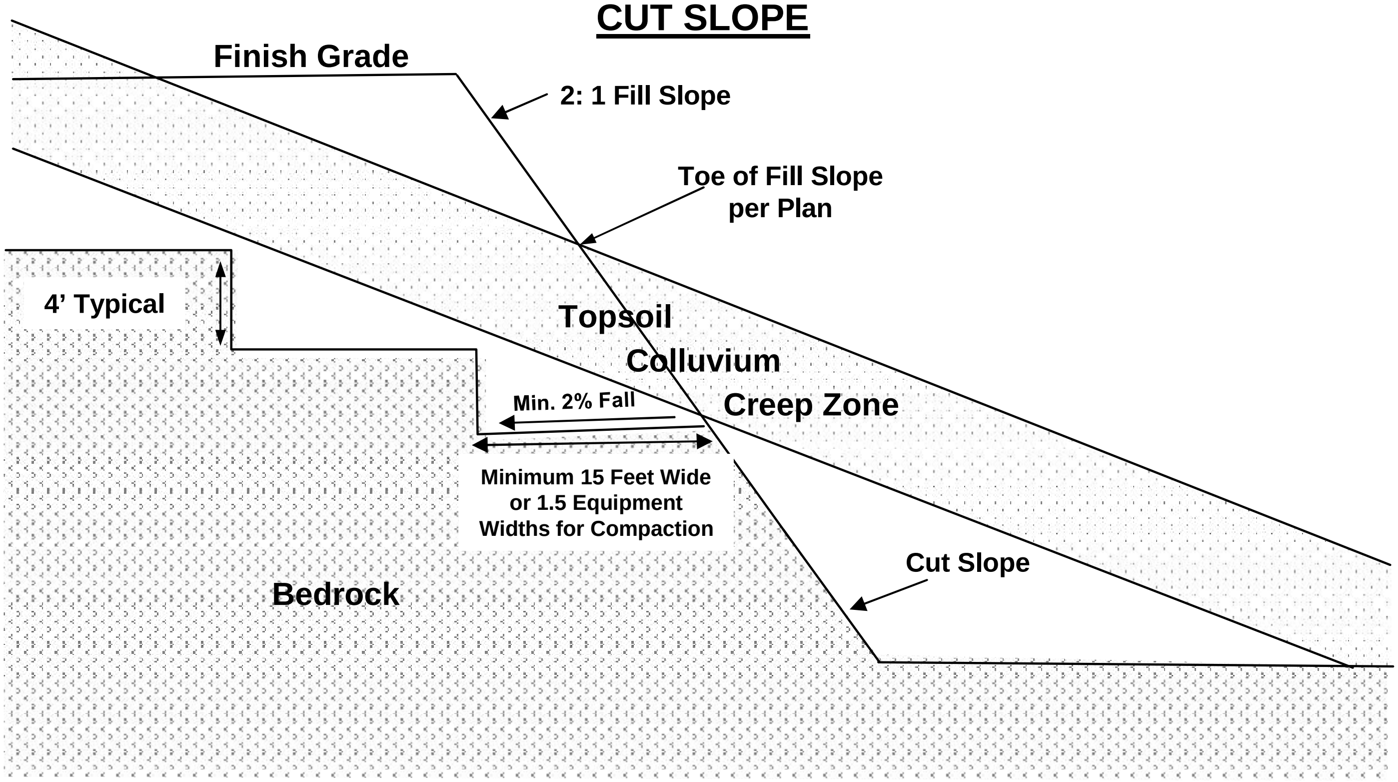
TREATMENT ABOVE
NATURAL SLOPES

STANDARD GRADING
GUIDELINES

PLATE G-2

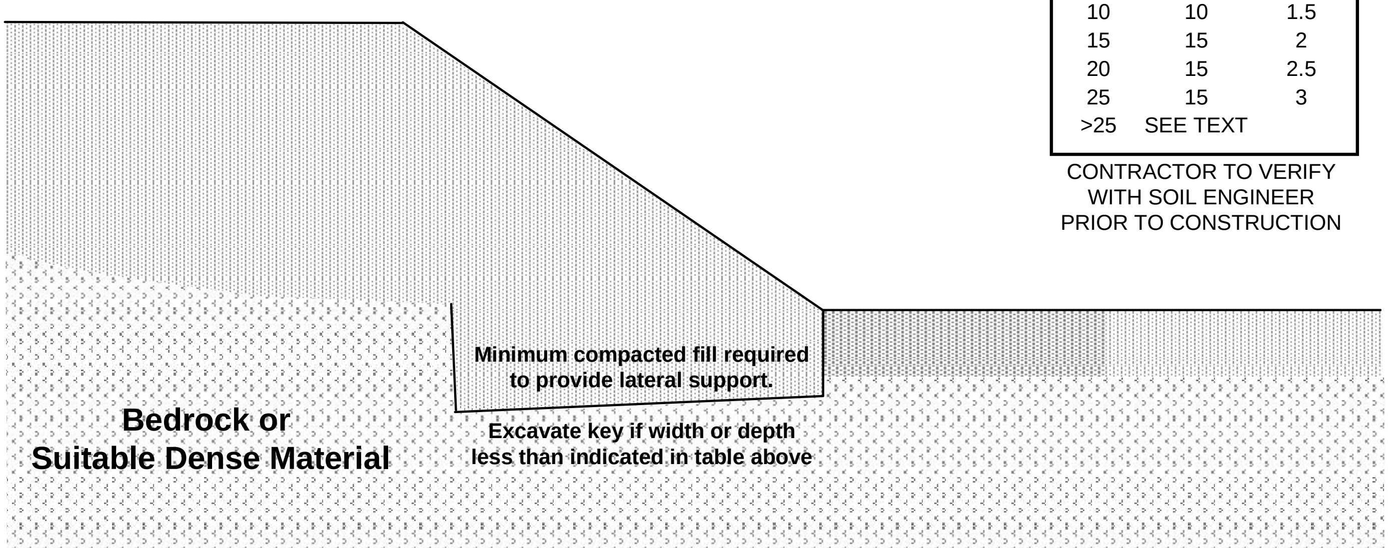
TYPICAL FILL SLOPE OVER CUT SLOPE



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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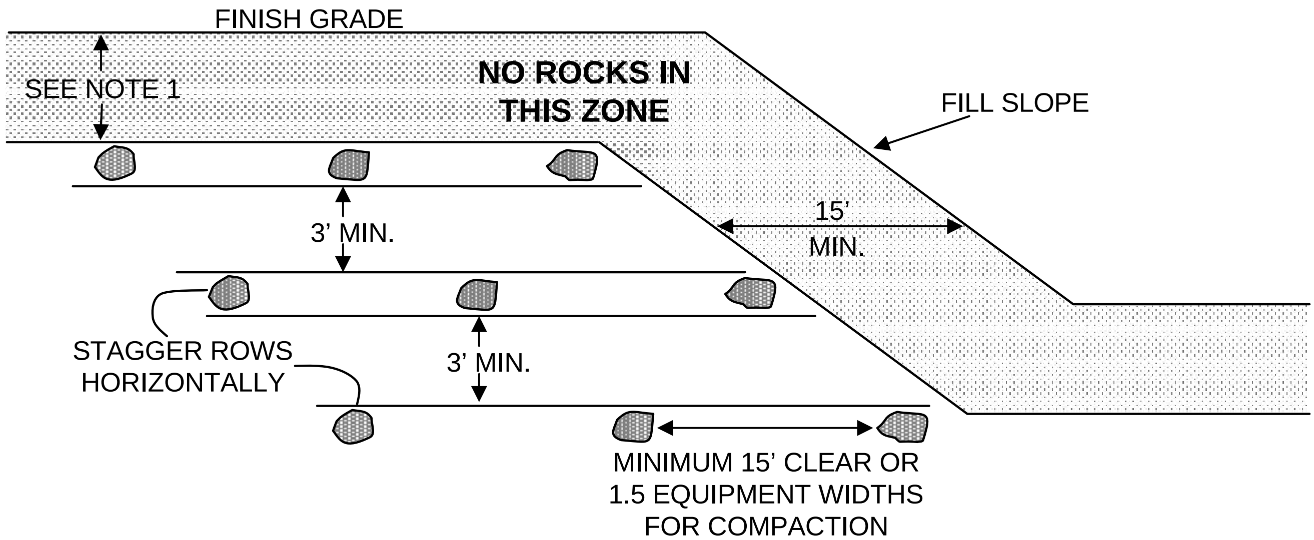
COMMON FILL SLOPE KEYS

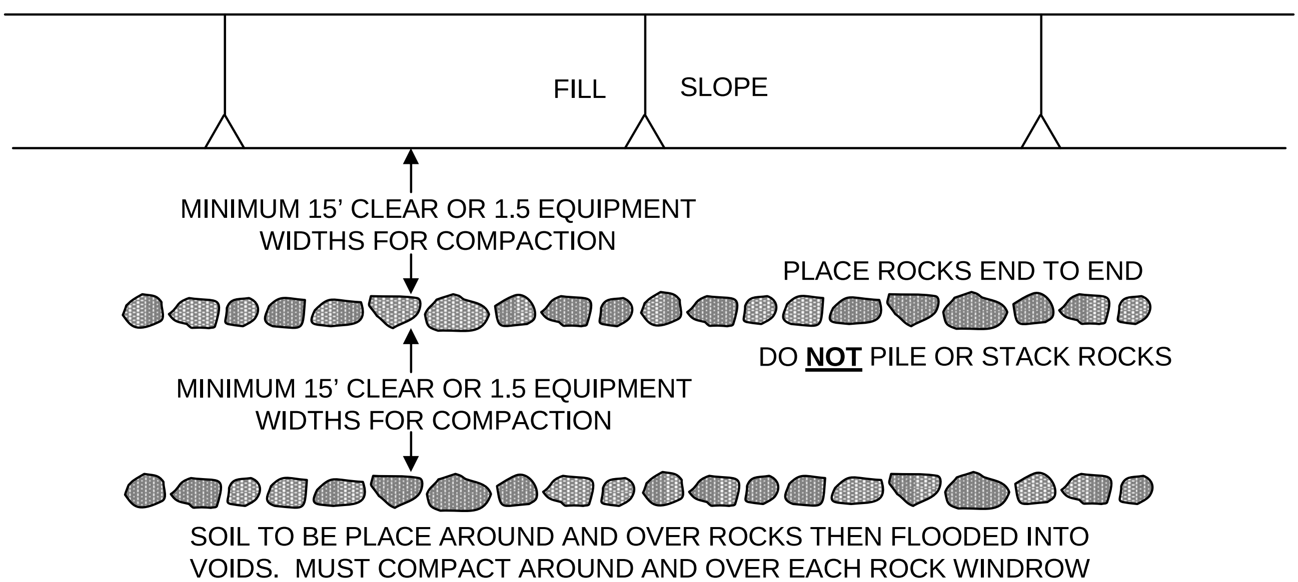
STANDARD GRADING GUIDELINES

PLATE G-3

CROSS SECTIONAL VIEW



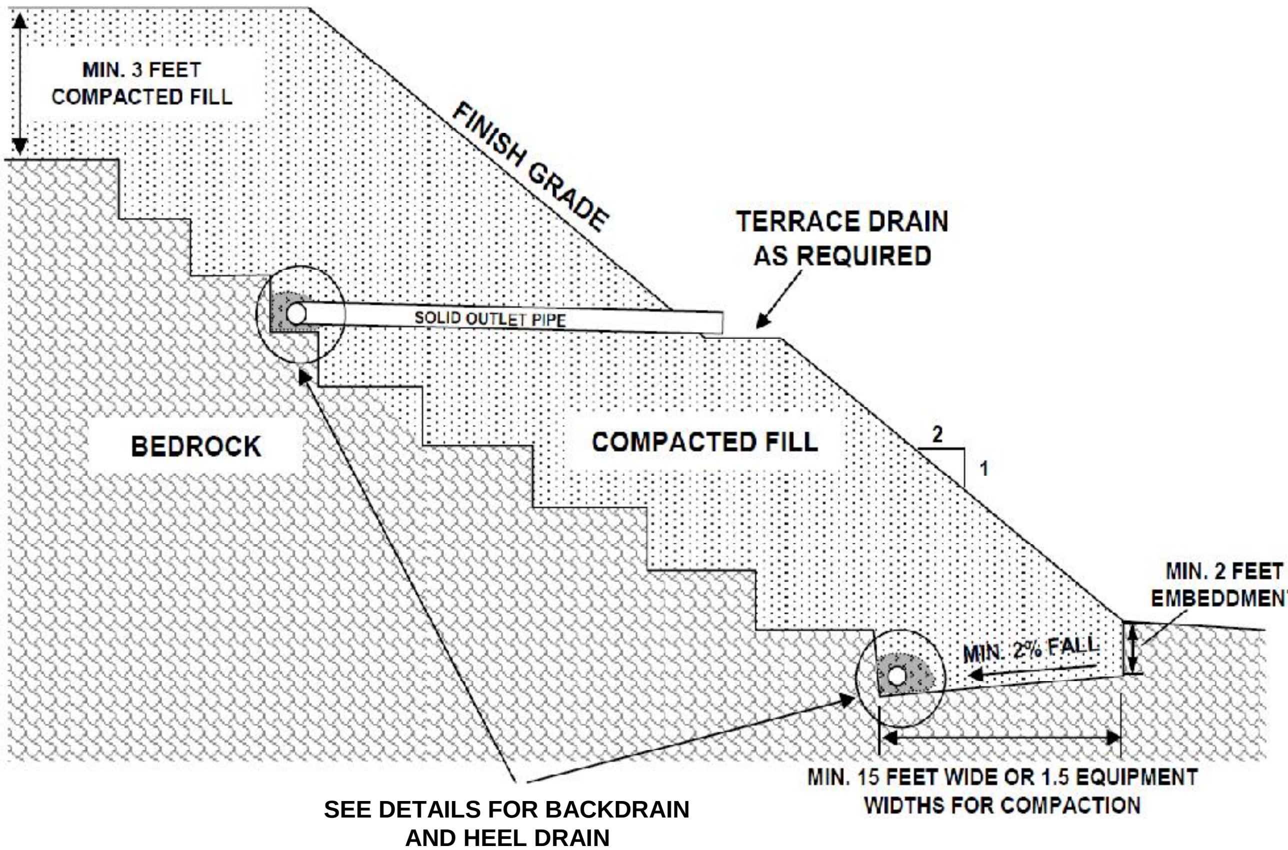
PLAN VIEW

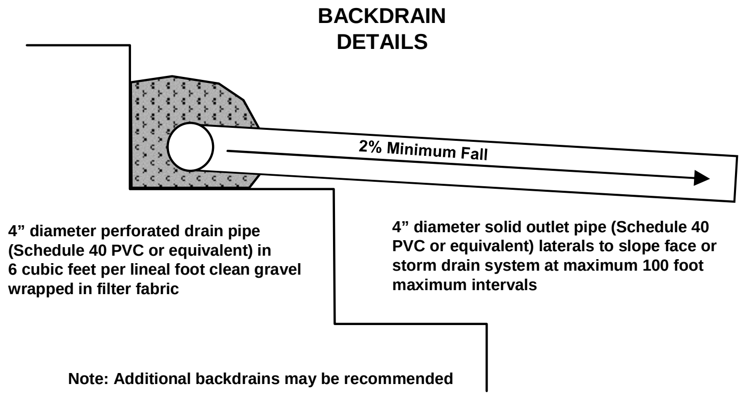


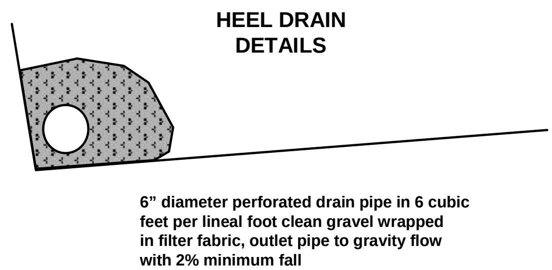
NOTES:

1) SOIL FILL OVER WINDROW SHOULD BE 7 FEET OR PER JURISDUICTIONAL STANDARDS AND SUFFICIENT FOR FUTURE EXCAVATIONS TO AVOID ROCKS
2) MAXIMUM ROCK SIZE IN WINDROWS IS 4 FEET IN 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.

GEOTEK	1548 North Maple Street Corona, California 92880	ROCK BURIAL DETAILS	STANDARD GRADING GUIDELINES PLATE G-4







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TYPICAL BUTTRESS AND STABILIZATION FILL

STANDARD GRADING GUIDELINES

PLATE G-5