UPDATED GEOTECHNICAL EVALUATION

PROPOSED SINGLE-FAMILY RESIDENTIAL DEVELOPMENT

APNs 245-300-001 AND -004
NORTHWEST OF IRIS AVENUE AND CHICAGO AVENUE
WOODCREST AREA OF RIVERSIDE COUNTY, CALIFORNIA

PREPARED FOR

TTLC MANAGEMENT, INC., AN ARIZONA CORPORATION
2942 CENTURY PLACE, SUITE 121
COSTA MESA, CALIFORNIA 92626

PREPARED BY

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PROJECT NO. 2855-CR **SEPTEMBER 21, 2021**

GEOTEK

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September 21, 2021
Project No. 2855-CR

TTLC Management, Inc., an Arizona Corporation
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Attention: Mr. Michael Torres

Subject: Updated Geotechnical Evaluation
Proposed Single-Family Residential Development
APN 245-300-001 and -004
Northwest of Iris Avenue and Chicago Avenue
Woodcrest Area of Riverside County, California

Dear Mr. Torres:

GeoTek, Inc. (GeoTek) is pleased to provide the results of this updated geotechnical evaluation for the subject project located north of Iris Avenue and west of Chicago Avenue, in the Woodcrest area of Riverside County, California. This report presents the results of GeoTek's evaluation and discussion of findings.

Based upon review, it is GeoTek's opinion that site development appears feasible from a geotechnical viewpoint. Final site development and grading plans should be reviewed by this firm as they become available, as it will be necessary to provide appropriate recommendations for intended specific site development as those plans become refined.

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

Respectfully submitted,
GeoTek, Inc.

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TABLE OF CONTENTS

TABLE OF CONTENTS

1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the general geotechnical conditions on the site and provide updated geotechnical recommendations as deemed appropriate. Services for this study included the following:

- Research and review of available geologic and geotechnical data, and past reports pertinent to the site,
- Perform a reconnaissance of the site,
- Excavation of eleven (11) exploratory trenches to assess the general subsurface soil and bedrock conditions and rock hardness at the property,
- A seismic refraction survey, performed by a subconsultant, to further evaluate rock excavatability,
- Collection of bulk samples of the onsite materials for laboratory testing,
- Laboratory testing,
- Review and evaluation of site seismicity, and
- Compilation of this updated geotechnical evaluation report which presents GeoTek's findings, conclusions, and recommendations for the site development.

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

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The project site consists of two parcels of land identified as Riverside County Assessor's Parcel Numbers (APNs) 245-300-001 (119.0-acres) and 245-300-001 (19.99-acres) (See Figure 1). The site is located at the northwest corner of Iris Avenue and Chicago Avenue, in the Woodcrest area of Riverside County, California. The majority of the property is currently gently-rolling vacant land that was previously utilized as an agricultural orchard. The orchard trees, including visible tree stumps, appeared to have been removed at the time of the field exploration. In addition, there currently is a single-family residence and three outbuildings in the east-central portion of the site. The northwest portion of the subject site is hillside terrain that is currently vacant and does not appear to have been utilized as an agricultural orchard.

There is an existing incised drainage course trending southeast to northwest that meanders through the central portion of the site. Furthermore, several granitic bedrock outcrops were visible throughout the central and northwest portions of the property.

The subject site is bounded by residential development and vacant land to the north; Chicago Avenue, followed by residential development to the east; Iris Avenue, followed by residential development to the south; and vacant land to the west.

2.2 PROPOSED DEVELOPMENT

The *Master Plan*, prepared by Urban Arena and dated August 10, 2021 ("Chicago 139"), indicates that the site development will consist of the construction of 276 single-family residences, a neighborhood park, open spaces, interior streets, and underground utilities. In addition, a pedestrian bridge over the drainage course and multi-purposes trails are proposed. The existing drainage channel will remain undeveloped and will act as a natural drainage course (see Figure 2).

It is anticipated that the residential structures will be one and/or two stories in height utilizing conventional shallow footings with slab-on-grade. Sewage disposal is to be by a public sewer system.

The inclusion and/or location of water quality basins are not known at this time. As such, infiltration testing was not included in this evaluation.

If site development differs from the assumptions made herein, the recommendations included in this report should be subject to further review and evaluation. Final 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. REPORT REVIEW

On April 27, 2015, Earth-Strata, Inc. (Earth-Strata) issued a *Revised Preliminary Geotechnical Interpretive Report* (Earth-Strata, 2015a) for a portion of the subject site. Earth-Strata's report pertained exclusively to APN 245-300-001 (See Figure 1). Earth-Strata's subsurface investigation consisted of the excavation of eight (8) hollow-stem auger borings to a maximum depth of 10 feet. Additionally, a backhoe was utilized to excavate 18 test pits to a maximum depth of 6 feet throughout the development areas. Earth-Strata indicated that their explorations encountered "surficial" deposits (topsoil), quaternary-age alluvium and Cretaceous-age Tonalite bedrock of the Val Verde Formation within the proposed site development area. The alluvium was encountered to the maximum depth explored and generally consisted of silty sand (SM soil type based upon the Unified Soil Classification System). The tonalite bedrock was generally found to be moderately hard to very hard and typically weathered in the upper 1 to 4 feet.

Earth-Strata concluded that there are no known faults that project through the site and the site is not located within an Alquist-Priolo Earthquake Fault Zone. No landslides were identified on the site by Earth-Strata.

Earth-Strata concluded that the subject property is considered suitable for the proposed development and offered numerous earthwork recommendations. The consultant stated that the near surface earth materials except in areas of rock outcrops will be readily excavated with conventional earth moving equipment. However, the consultant noted that sewer lines may be in excess of 25 feet deep on the west portion of the site and should be further investigated with seismic refraction lines.

Groundwater was not encountered by Earth-Strata during their subsurface exploration. However, water was noted within the drainage channel that trends through the middle of the project site.

Earth-Strata recommended the removal of topsoil, alluvial materials and artificial fill down to competent bedrock. Removals were anticipated to be about 2 to 4 feet deep across much of the site, with localized areas up to 6 to 8 feet within the orchard areas. Properly constructed fill slopes and cut slopes up to 20 feet high with inclinations of 2:1 (horizontal:vertical) are considered to be grossly stable.

The evaluation estimated a shrinkage factor of 5 to 10 percent for the artificial fill and 0 to 5 percent for the bedrock. No shrinkage values were given for the alluvial materials. Earth-Strata stated the subsidence is estimated to be negligible to 0.01 feet.
The Earth Strata report estimated that the on-site materials have a "very low" to "low" expansion index and recommended confirmation after grading. Soils were encountered to have "negligible" soluble sulfate contents and to be "corrosive" to "very corrosive" to common metallic components. Earth-Strata recommended that additional corrosion testing be conducted at the completion of the site grading.

Earth-Strata provided geotechnical parameters for design of both conventionally reinforced shallow foundations and post-tensioned slab systems for soils having "very low" to "low" expansion index potential.

Copies of the excavation logs, seismic refraction lines, and laboratory test results by Earth-Strata are included in Appendix A. The locations of Earth-Strata's excavations are shown on Figure 2.

On June 8, 2015, Earth-Strata issued a *Seismic Refraction Survey* (Earth-Strata, 2015b) for a portion of the subject site. Earth-Strata's report pertained exclusively to APN 245-300-001 (See Figure 1). Earth-Strata completed a total of four (4) seismic refraction survey lines each totaling 150 feet in length. The seismic line locations are shown on Figure 2.

Earth-Strata concluded that minor excavation difficulties are to be expected in the uppermost 2 feet to 10 feet. However, areas of surficial bedrock outcropping may require more significant excavation techniques. Within the areas of seismic line 1, areas as shallow as 2 feet to 5 feet and as deep as 40 feet are expected to be excavated with moderately difficult conditions utilizing appropriately sized good working equipment.

Earth-Strata concluded that locally areas referred to as "floaters" and/or "corestones" should be expected and will likely cause difficult excavation conditions. Placement of infrastructure within these areas may require some breaking and/or light blasting to obtain desired grades. Additionally, Earth-Strata concluded that areas with seismic velocities less than 6,800 feet per second (fps) are generally noted to be within the threshold for conventional ripping.

Copies of the seismic refraction survey data by Earth-Strata are included in Appendix A.

4. FIELD EXPLORATION AND LABORATORY TESTING

4.1 FIELD EXPLORATION

To supplement the existing subsurface exploration by Earth-Strata and to assess previously unexplored areas of the proposed development, GeoTek excavated nine (9) exploratory trenches on August 30, 2021. The trenches extended to depths ranging from about 5 to 14 feet below existing grades and were excavated to log the subsurface materials and examine the rippability and/or hardness of localized areas throughout the site. The trenches were excavated by a backhoe.

A seismic refraction survey was conducted on August 12, 2021 by a subconsultant (Subsurface Surveys & Associates, Inc.). The seismic refraction survey involved the recording and measuring of man-made energy waves from seven (7) seismic refraction and tomography lines placed in site areas where deep excavations are proposed, as discussed with the project civil engineer. The seismic survey summary report is included in Appendix D of this report.

The approximate locations of GeoTek's site explorations are shown on the Exploration Location Map, Figure 2. Logs of the explorations by Earth Strata, in addition to the trenches and seismic refraction lines by GeoTek, are provided in Appendices A and B, respectively.

4.2 LABORATORY TESTING

Laboratory testing was performed on selected bulk and relatively undisturbed soil and bedrock samples collected during the field exploration. The purpose of the laboratory testing was to confirm the field classification of the subsurface materials encountered and to evaluate the soil/bedrock physical properties for use in the engineering design and analysis. GeoTek's test results along with a brief description and relevant information regarding testing procedures are included in Appendix C.

5. GEOLOGIC AND SOILS CONDITIONS

5.1 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 from the point of contact with the Transverse Ranges geomorphic province, southerly 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 mostly found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province, and the San Jacinto fault borders the province adjacent the Colorado Desert province.

More specific to the subject property, the site is located within a large structural mass known as the Perris Block of the Peninsula Ranges providence. The Perris Block is a relatively stable mass of granitic bedrock that in places is overlain by alluvium and thin sedimentary and volcanic units. After formation of granitic rocks, the Perris Block experienced vertical movements that produced nearly flat erosional surfaces. Sediments emanating from the elevated portions of the Perris Block filled low lying areas of the region. The project area is in an area geologically mapped by others to be underlain by granitic bedrock (tonalite, Dibblee, T.W. and Minch, J.A., 2004).

No active faults are shown in the immediate site vicinity on the maps reviewed for the area. The site is not located within an Earthquake Fault Zone (Alquist-Priolo) as designated by the State of California. The Riverside County website (https://gis.countyofriverside.us/) has designated the site as "not in a fault zone", "not in a fault line", "not in a liquefaction area", and "not in a subsidence area".

5.2 EARTH MATERIALS

A brief description of the earth materials reported to be on the site by Earth-Strata (2015) and encountered in GeoTek's explorations is presented in the following sections.

5.2.1 Disturbed Soil/Undocumented Fill/Topsoils

Earth-Strata and GeoTek observations noted the presence of topsoil and disturbed soil/undocumented fill ("surficial") soils throughout the site. The surficial soils generally consist of silty and clayey sands and sandy silts (SM, SC, and ML soil types based upon the Unified Soil Classification System) which are predominately brown in color and loose/very soft to medium dense/stiff in consistency. The thickness of the surficial soils ranged from about 1 to 3 feet. However, the composition and thickness of the on-site surficial soils could be highly variable.

5.2.2 Quaternary Alluvium

Quaternary-aged alluvium was encountered in most of the Earth-Strata and GeoTek explorations. These alluvial deposits consist predominately of brown, fine to coarse-grained sands, silty sands, clayey sands and sandy silts (SP, SM, SC and ML soil types). These deposits were found to be in a loose/soft to medium dense/stiff state. The thickness of the alluvium ranged up to approximately 7 feet near the toes of slopes and 8 feet in the drainage courses.

5.2.3 Cretaceous Val Verde Tonalite

The Val Verde Tonalite was mapped within the site and underlies the surficial and alluvial deposits. Tonalite has a similar chemical composition to gabbro but includes a higher percentage of quartz. The Val Verde Tonalite was generally noted to be light gray to yellowish tan and was found to be in a moderately hard to very hard state. The bedrock was generally massive and lacks significant structural planes. Typically, the upper approximate three to four feet of the bedrock was found to be moderately to severely weathered and not as hard. The weathered granitic material consisted of massive, slightly friable fine to very coarse-grained sand when excavated ("Decomposed Granite" (DG)). The bedrock becomes less weathered with depth. Most of GeoTek's trench excavations were terminated due to refusal in the tonalite.

As part of GeoTek's services for this report, a seismic refraction survey was performed by Subsurface Surveys & Associates, Inc. on the site. As part of this survey, seven (7) seismic lines were recorded at various site locations. The results of the seismic refraction survey are presented in Appendix D.

GeoTek's seismic refraction survey performed within planned deep cut areas or areas with deep utilities proposed, as shown on Figure 2, identified three layers of subsurface materials. The uppermost zone comprises alluvial soil (colluvium) and is estimated to extend up to 10 feet below grade. The middle layer was noted to correspond to weathered bedrock with velocities ranging from 3,027 to 4,408 feet per second (fps). The bottom layer was noted to comprise slightly weathered to unweathered bedrock. Results of the seismic refraction survey are provided in Appendix C.

Earth-Strata's seismic refraction survey was performed within APN 245-300-001, as shown on Figure 2, identified three major layers of subsurface materials. The uppermost zone comprises alluvial and colluvium and/or completely weathered bedrock and was estimated to extend up to 10 feet below grade. This layer was estimated to be excavatable with only minor difficulties. However, localized boulders should be anticipated based on surficial exposures which may require more significant excavation techniques.

The middle layer, which starts as shallow as 2 to 5 feet and extended in excess of 40 feet below existing grade, consists of slightly to highly weathered bedrock. This layer is expected to be excavated with moderate conditions, assuming appropriately sized good working equipment. Isolated floaters (i.e., boulders, corestones, etc.) should be expected to be present within this second layer which could produce somewhat difficult conditions locally. Placement of infrastructure within this layer may require some breaking and/or light blasting to obtain desired grades.

The third layer starts at depths of 2 to 30 feet below existing grade, consists of moderately to unweathered bedrock. Placement of infrastructure within this layer may require some localized blasting to obtain desired grades. Results of Earth-Strata's seismic refraction survey are provided in Appendix A.

Based on the results of laboratory testing by Earth-Strata and GeoTek, the surficial soils are considered to have a "very low" (0-20) to "low" (21-50) expansion potential (ASTM D 4829). Based on the laboratory test results, the near surface soils have a soluble sulfate content of less than 0.1 percent (ASTM D 4327). The test results are provided in Appendix A (Earth-Strata) and Appendix C (GeoTek).

Detailed logs of the subsurface conditions of the site are presented in Appendix A (Earth-Strata) and Appendix B (GeoTek).

5.3 SURFACE WATER AND GROUNDWATER

5.3.1 Surface Water

Surface water was not noted during GeoTek's field investigation. However, water was observed within the drainages during Earth Strata's field exploration. If encountered during earthwork construction, surface water on this site is the result of precipitation or possibly some minor surface run-off from immediately surrounding properties. Overall site area drainage is generally to the north/northwest, as directed by site topography. As previously discussed, a "blue-line" drainage trends northwest through the central portion of the site. Provisions for surface drainage will need to be accounted for by the project civil engineer.

5.3.2 Groundwater

Groundwater was encountered at a depth of approximately 6.5 feet below the existing ground surface in Trench T-5 at the time of exploration. This groundwater appears to be the result of a perched condition. Groundwater was not encountered in any other trenches excavated by GeoTek for this project. Groundwater was not encountered by Earth Strata (2015a) to an explored depth of 10 feet. The California Department of Water Resources, Water Data Library indicates that the presence of various groundwater wells within a one-mile radius from the site. Records for these wells show depths to groundwater in excess of 100 feet. Based on the above, groundwater is not anticipated to be a factor during the site grading. However, seasonal perched groundwater may be encountered during grading within portions of the site.

5.4 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 in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within a State of California designated *"Alquist-Priolo"* Earthquake Fault Zone (Bryant and Hart, 2007; CGS, 1986).

The County of Riverside has designated the site as "not in a fault zone" and "not in a fault line." The nearest known active faults are the Elsinore fault zone and the San Jacinto fault zone located approximately 11.4 and 11.2 miles to the southwest and northeast of the site, respectively.

5.4.1 Seismic Design Parameters

The site is located at approximately 33.8902 North Latitude and -117.3516 West Longitude. A Site Class "C" is considered appropriate due to the presence of shallow bedrock across the site. Site spectral accelerations (S_a and S_1), for 0.2 and 1.0 second periods for a Class "C" site, were 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. The results are presented in 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	0.562g
Site Coefficient for Site Class "C", F_a	1.2
Site Coefficient for Site Class "C", F_v	1.438
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.8g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.809g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	1.2g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.539g
Site Modified Peak Ground Acceleration, PGA_M	0.6g

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.

5.4.2 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). No faults are identified on geologic maps readily available and reviewed by this firm for the immediate study area. The nearest known active faults are the Elsinore fault zone and the San Jacinto fault zone located approximately 11.4 and 11.2 miles to the southwest and northeast of the site, respectively.

5.4.3 Liquefaction and Seismically Induced Settlement

The County of Riverside has designated the site as being "not in a liquefaction area" and "not in a subsidence area".

Liquefaction is not considered to be a hazard at the subject site due the lack of a true groundwater level within the site, presence of shallow bedrock, and proposed remedial grading. Also, the potential for seismically induced settlement at the property is considered to be nil to very low due to the presence of shallow bedrock and proposed remedial grading.

5.4.4 Other Seismic Hazards

Evidence of ancient landslides or slope instabilities at this site was not observed during the field investigation. Thus, the potential for landslides is considered negligible.

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.

As previously discussed, bedrock (tonalite) outcrops are present on portions of the site. As previously noted, the tonalite is generally massive and lacks significant structural planes. In addition, the site topography is relatively gentle with a moderate slope to the north/northwest. Based upon this condition, the rock fall hazard at the site is not a design consideration for this project.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL

Development of the site appears feasible from a geotechnical viewpoint. The following recommendations should be incorporated into the design and construction phases of development.

6.2 EARTHWORK CONSIDERATIONS

6.2.1 General

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the County of Riverside, the 2019 California Building Code (CBC), and recommendations contained in this report. The General 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 text of this report should supersede those contained in Appendix E.

Final site grading plans should be reviewed by this office when they become available. Additional recommendations will likely be offered subsequent to review of these plans.

6.2.2 Site Clearing

Site preparation should start with removal of any existing improvements, deleterious materials, and vegetation within the planned development areas of the site. These materials should be properly disposed of off-site.

6.2.3 Remedial Grading

The trenches excavated during this evaluation and likely the previous trenches performed by Earth Strata were backfilled without compaction effort. All trench backfill should be entirely removed and replaced with engineered compacted fill.

All topsoil, disturbed soil/undocumented fill ("surficial") soils, loose alluvium, and highly weathered bedrock should be removed to expose competent native materials. Competent native materials are defined as either relatively dense alluvium, which is relatively uniform, not visibly porous, and having an in-place compaction of at least 85 percent of the soil's maximum dry density (per ASTM D 1557 test procedures) or firm, unyielding bedrock. Estimated removal depths are anticipated to range from 2 to 4 feet within "bedrock" areas and 6 to 8 feet within "alluvial" areas.

Actual depths of removals should be determined in the field based on observation and in-place density testing. A representative of this firm should observe and approve the bottom of all excavations. As a minimum, removals should extend down and away from foundation elements at a 1:1 (horizontal:vertical) projection to the recommended removal depth, or a minimum of five feet laterally, whichever is greater. The bottom of the removals should be graded to drain toward the front of the lot at a gradient of at least two percent.

Project rough grading will create fill, cut/fill transition and cut building pads. All pads in fill should be overexcavated such that the pads are underlain by at least five feet of engineered fill and over-excavation bottoms should slope to drain to the adjacent street of suitable direction so ponding of water is not likely. In addition, the minimum fill thickness should be at least one-half of the maximum fill thickness under the pad, up to a maximum of 15 feet. The lateral extent of this recommendation should include an area of at least 5 feet beyond the building limits.

The cut portions of transition (i.e., cut/fill) pads should be overexcavated a minimum of five feet below proposed grades or to a depth of one-half the maximum fill thickness.

All building pads in cut areas exposing tonalite bedrock should be overexcavated to a minimum depth of three feet below proposed grade and replaced with engineered fill.

The base of all project footings should be underlain by at least 24 inches of engineered compacted fill.

In order to facilitate footing excavation and installation of house services, consideration should be given to over-excavating cut lots to a minimum depth of five feet below proposed finished grades. It is recommended that the entire lot be over-excavated. It is also recommended that utility alignments be over-excavated to at least one foot below the depth of the lowest underground utility.

To prevent potential differential settlement, the cut portions of transition (i.e., cut/fill) lots should be over-excavated a minimum of five feet below proposed grades or to a depth of one-half of the maximum fill thickness on the lot, whichever is greater. The horizontal extent of over-excavation could comprise the entire lot or extend at least five feet outside the structural area, or a distance equal to the depth of over-excavation below the bottom of the structural elements, whichever is greater. Over-excavation bottoms should be graded to drain toward the front of the lot (two percent minimum).

The approved removal/over-excavation bottom exposed should then be scarified to a depth of about six inches, be moisture conditioned to slightly above the soil's optimum moisture content and then be compacted to at least 90 percent of the soil's maximum dry density as determined by ASTM D 1557 test procedures. Compaction should be confirmed by testing.

6.2.4 Excavation Characteristics

As previously discussed, excavation up to approximately 25 feet or less will be needed for localized areas of infrastructure (sewer line) construction. Based upon results of GeoTek's and Earth Strata's exploration, backhoe and drill rigs met shallow refusal in bedrock. In addition, bedrock outcrops were present on portions of the site.

As part of GeoTek's services for this report, a seismic refraction survey was performed by Subsurface Surveys & Associates, Inc. on the site. As part of this survey, seven (7) seismic lines were recorded at various site locations. The results of the seismic refraction survey are presented in Appendix D. Earth-Strata's seismic refraction survey was performed within APN 245-300-001, as shown on Figure 2. The results of Earth Strata's seismic refraction survey are presented in Appendix A.

A brief discussion of the results of the seismic refraction surveys performed by Earth Strata and GeoTek was provided in Section 5.2.3. of this report. Much of the rock at the site is extremely hard and relatively unfractured, with bedrock outcrops present on the site. Some blasting or special excavation techniques will likely be required to complete the proposed project grading and infrastructure construction.

The above evaluation of rock hardness is based on review of previous studies performed for the site and the recently performed seismic refraction survey. It should be realized that the ability of any particular contractor to excavate the materials encountered will vary based on factors that may or may not be considered in the evaluation. All methods available to evaluate rock hardness and associated rippability are interpretive to some extent. As such, experience and judgment are primary factors in such evaluations.

Utility excavation is expected to be challenging due to the presence of hard rock. Extensive blasting or special excavation techniques should be anticipated to perform the utility infrastructure of this project. It is recommended that utility corridors within streets be over-excavated to at least 1 foot below the deepest utility and backfilling with compacted soil. Oversized rocks (>6 inches) should be anticipated on this site and hard floaters/corestones may be encountered at varying depths during grading and/or blasting operations. A caving or loosening of bedrock often known as "overbreak" of utility trench excavations is expected in excavations into the tonalite bedrock.

Overexcavation of street areas underlain by bedrock during rough grading should be considered to prevent significant trenching difficulties associated with utility installations. The overexcavation should extend to a depth of at least one foot below the deepest planned utility and then be backfilled with properly compacted fill.

Excavation of alluvial deposits to the design elevations is expected to be feasible with heavy-duty grading equipment in good operating condition. All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with local and Cal-OSHA guidelines. Temporary excavations within the on-site materials should be stable at 1:1 (horizontal:vertical) inclinations for cuts less than ten feet in height.

Based on the soils encountered in the various site explorations, site earth materials can be categorized as OSHA Soil Type C. It is recommended that temporary slopes greater than four feet in height not be constructed at inclinations steeper than 1:1 (horizontal:vertical). Flatter inclinations may be needed depending on the field conditions. Temporary construction slopes should be periodically examined by a competent person, per OSHA requirements, to look of evidence of instability.

6.2.5 Canyon Subdrains

Subdrains are recommended within the bottom of the existing major drainage swales/canyons in areas where the depth of fill will exceed 10 feet in thickness. The subdrains should consist of 6-inch diameter (subdrain length less than 500 feet) or 8-inch diameter (lengths greater than

500 feet) Schedule 40 perforated PVC pipe encapsulated within 9 cubic feet of suitable drainage material (¾ inch open graded rock, or equivalent) surrounded by a filter fabric, such as Mirafi 140N, or equivalent. Where possible, the subdrains should be installed within the bottom of the canyon cleanouts. The subdrains should be installed with a minimum 1 percent gradient sloping to an approved outlet. The final 10 feet of pipe, where connecting to an outlet, should consist of solid PVC pipe. A subdrain detail is shown on Plate E-1 in Appendix E.

6.2.6 Slope Construction

Cut slopes constructed in bedrock at maximum gradients of 2:1 (horizontal:vertical), in accordance with industry standards, are anticipated to be both grossly and surficially stable. Cut slopes constructed at maximum gradients of 2:1 (horizontal:vertical) in suitable alluvial soils, in accordance with industry standards, are anticipated to be both grossly and surficially stable. An engineering geologist should observe all cut slopes. Cut slopes should expose competent bedrock (defined as tonalite) or suitable alluvium. If adverse structure or incompetent materials are exposed and identified in the cut slopes, stabilization fills may be recommended. Where alluvial soils are present over bedrock in the cut slope, the alluvial portion of the slope should be reconstructed as a surficial stability fill.

Swales should be constructed at the top of all cut slopes to collect and divert drainage away from the slope face. Drainage should be directed to an approved drainage discharge location. Swales should be constructed with concrete, shotcrete or approved non-erosive material. Swales should be cleaned of loose soil and debris on an on-going basis.

Fill slopes constructed at maximum gradients of 2:1 (horizontal:vertical), in accordance with industry standards, are anticipated to be both grossly and surficially stable. Where fill is to be placed against sloping terrain with gradients of 5:1 (horizontal:vertical) or steeper, the sloping ground surface should be benched to remove loose and disturbed surface soil to assure that the new fill is placed in direct contact with competent bedrock and to provide horizontal surfaces for fill placement. A 10- to 15-foot-wide keyway should be constructed at the toe of the fill slope areas extending at least 2 to 3 feet vertically into competent natural material.

The base of the keyways and benches should be sloped back into the hillside at a gradient of at least two percent. The base of the benches should be evaluated by a representative of GeoTek prior to processing. Upon approval, the exposed materials should be moistened to at least the optimum moisture content and densified to a relative compaction of at least 90 percent of maximum dry density as determined by ASTM D 1557 test procedures.

Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction and then roll the final slope to provide a dense, erosion resistant surface.

Berms should be constructed and maintained at the top of all slopes to divert drainage away from the slope faces. An abatement program to control ground-burrowing rodents should be implemented and maintained. Burrowing rodents can decrease the long-term performance of slopes.

6.2.7 Engineered Fill

The onsite materials are considered suitable for reuse as engineered fill provided the materials are free from vegetation, roots, and rock/hard lumps greater than six inches in maximum dimension.

Prior to placing fill, the approved exposed subgrade should then be scarified to a depth of about 12 inches, be moisture conditioned to slightly above the soil's optimum moisture content and then be compacted to at least 90 percent of maximum dry density as determined by ASTM D 1557 test procedures.

The undercut areas should be brought to final subgrade elevations with fill materials that are placed and compacted in general accordance with minimum project standards. Engineered fill should be placed in six- to eight-inch loose lifts, moisture conditioned to slightly above optimum moisture content, and compacted to a minimum relative compaction of 90 percent as determined by ASTM D 1557 test procedures. If engineered fill depths exceed 50 feet, the engineered fill below a depth of 50 feet from finish grade should be compacted to a minimum relative compaction of 95 percent as determined by ASTM D 1557. Fills deeper than 30 feet from finish grade should be compacted to a minimum relative compaction of 93 percent. Placement of engineered fill should be observed and tested on a full-time basis by a GeoTek representative during grading activities.

The site excavations noted that the bedrock generally breaks down to sand and gravel with trace of boulders and cobbles up to 2 feet in maximum dimension. Occasional cobbles and boulders were also encountered in the deeper portions of the alluvium. Oversized materials (greater than six inches) should be placed scattered (windrows) on site as detailed in Appendix E and Figure E-4. Alternatively, oversized rock could be disposed of offsite or stockpiled on site and crushed for future use.

6.2.8 Trench Excavations and Backfill

Temporary trench excavations within the on-site materials should be stable at 1:1 (h:v) inclinations for short durations during construction and where cuts do not exceed ten feet in height. It is anticipated 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 test procedures). 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.

6.2.9 Shrinkage and Bulking

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities and footing excavations, 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 5 to 10 percent may be considered for the alluvium. Bedrock materials may bulk up to 10 percent or possibly more. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of site earthwork construction.

Due to the presence of relatively shallow bedrock across the site, subsidence is expected to be negligible.

6.3 DESIGN RECOMMENDATIONS

6.3.1 Foundation Design Criteria

Foundation design criteria for a conventional foundation system, in general conformance with the 2019 CBC, are presented herein. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Based on the results of laboratory testing (GeoTek and Earth Strata, 2015a), the on-site materials are classified as having "very low" (0≤EI≤20) to "low" (21≤EI≤50) expansion potential per ASTM D 4829. Additional laboratory testing should be performed at the completion of site grading to verify the expansion potential of the near-surface soils.

The foundation elements for the proposed structures should bear entirely in engineered fill soils as recommended in this report. Foundations should be designed in accordance with the *2019 California Building Code* (CBC). A summary of the foundation design recommendations is presented in the following table:

MINIMUM DESIGN REQUIREMENTS FOR CONVENTIONALLY REINFORCED FOUNDATIONS		
Design Parameter	"Very Low" Expansion Potential (0≤EI≤20)	"Low" Expansion Potential (21≤EI≤50)
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	One- and two-story – 12	One- and two-story - 12
Minimum Foundation Width (Inches)*	One-and two-story – 12	One- and two-story – 15
Minimum Slab Thickness (Inches)	4 - Actual	4 - Actual
Minimum Slab Reinforcing	6" x 6" – W1.4/W1.4 welded wire fabric placed in middle of slab	6" x 6" – W2.9/W2.9 welded wire fabric or No. 3 reinforcing bars placed at 18 o.c. each way placed in middle of slab
Minimum Reinforcement for Continuous Footings, Grade Beams, and Retailing Wall Footings	Two No. 4 reinforcing bars, one placed near the top and one near the bottom	Two No. 4 reinforcing bars, one placed near the top and one near the bottom
Effective Plasticity Index**	0 – design value	35 – design value
Presaturation of Subgrade Soil (Percent of Optimum/Depth in Inches)	Minimum 100% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete	Minimum of 110% 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 2016 CBC
**Effective plasticity index should be verified at the completion of remedial grading

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.

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 300 psf for each additional 12 inches in depth and by 300 psf for each additional 12 inches in width to a maximum value of 3,500 psf. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g., seismic and wind loads).

The recommended allowable bearing capacity is based on an estimated maximum post-construction settlement of 1-inch. Differential settlement of about one-half of the total settlement over a horizontal distance of 40 feet could result. Seismically induced settlement is expected to be negligible. The project structural engineer, foundation engineer, and earth retention structure designer should incorporate these settlement estimates into the design, as appropriate.

The passive earth pressure may be computed as an equivalent fluid having a density of 300 psf per foot of depth, to a maximum earth pressure of 3,500 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.35 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

A grade beam, a minimum of 12 inches wide and 12 inches deep, should be utilized across large entrances. The base of the grade beam should be at the same elevation as the bottom of the adjoining footings.

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 the result of construction related punctures (e.g., stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. It is GeoTek's opinion that a minimum ten mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. 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 atmospheric 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 permeance) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation.

It is recommended 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.

6.3.2 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.

6.3.3 Foundation Setbacks

Where applicable, the following setbacks should apply to all foundations. Any improvements not conforming to these setbacks may be subject to lateral movements and/or differential settlements:

- The outside bottom edge of all footings should be set back a minimum of H/3 (where H is the slope height) from the face of any descending slope. The setback should be at least 5 feet and need not exceed 40 feet.

- The outside bottom edge of all footings should be set back a minimum of H/2 (where H is the slope height) from the face of any ascending slope. The setback should be at least 7 feet and need not to exceed 15 feet. Where a retaining wall is constructed at the toe of the slope, the height of the slope should be measured from top of the wall to the top of the slope.
- The bottom of all footings for structures near retaining walls should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom inside edge of the wall footing.
- The bottom of any proposed foundations for structures should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom of the nearest excavation.

6.4 RETAINING WALL DESIGN AND SITE CONSTRUCTION

6.4.1 General Design Criteria

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

Retaining wall foundations embedded a minimum of 12 inches below the lowest adjacent grade and should rest on at least 24 inches of compacted fill. Wall footings should be designed using an allowable bearing capacity of 2,000 psf. An increase of one-third may be applied when considering short-term live loads (e.g., seismic and wind loads). The passive earth pressure may be computed as an equivalent fluid having a density of 300 psf per foot of depth, to a maximum earth pressure of 3,500 psf. A coefficient of friction between soil and concrete of 0.35 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

An equivalent fluid pressure approach may be used to compute the horizontal active pressure against the wall. The appropriate fluid unit weights are given in the table below for specific slope gradients of retained materials.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (H:V)	Equivalent Fluid Pressure (PCF) Native Materials*
Level	42
2:1	65

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

The above equivalent fluid weights do not include superimposed loading conditions such as expansive soils, vehicular traffic, structures, seismic conditions or adverse geologic conditions.

For walls with more than 6 feet of compacted backfill, a seismic force must also be included into the wall design. For proposed earth retention structures an earthquake-induced equivalent fluid pressure of 15 pcf should be included into the wall design. This earthquake pressure was determined using the Seed and Whitman method. This seismic pressure can be assumed to be a conventional triangular distribution.

6.4.2 Restrained Retaining Walls

Any retaining wall that will be restrained prior to placing backfill or walls that have male or reentrant corners should be designed for at-rest soil conditions using an equivalent fluid pressure of 65 pcf, plus any applicable surcharge loading. For areas having male or reentrant corners, the restrained wall design should extend a minimum distance equal to twice the height of the wall laterally from the corner, or as otherwise determined by the structural engineer.

6.4.3 Wall Backfill and Drainage

Retaining wall backfill should be free of deleterious and/or oversized materials and should have and expansion index of less than 20. Retaining walls should be provided with an adequate pipe and gravel back drain system to help prevent buildup of hydrostatic pressures. Backdrains should consist of a four-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one-cubic foot per linear foot of ¾ to 1-inch clean crushed rock or an approved equivalent, wrapped in filter fabric (Mirafi 140N or an approved equivalent). The drain system should be connected to a suitable outlet. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

Retaining wall backfill should be placed in lifts no greater than eight inches in thickness and compacted to a minimum of 90 percent relative compaction as determined by ASTM D 1557 test procedures. The wall backfill should also include a minimum one-foot wide section of ¾- to 1-inch clean crushed rock (or an approved equivalent). The rock should be placed immediately adjacent to the back of the wall and extend up from a back drain to within approximately 24 inches of the finish grade. The rock should be separated from the earth with filter fabric. The upper 24 inches should consist of compacted on-site soil.

As an alternative to the drain rock and fabric, Miradrain 2000, or approved equivalent, may be used behind the retaining wall. The Miradrain 2000 should extend from the base of the wall to within two feet of the ground surface. The subdrain should be placed at the base of the wall in direct contact with the Miradrain 2000.

The presence of other materials might necessitate revision to the parameters provided and modification of the wall designs. Proper surface drainage needs to be provided and maintained. Walls from two to four feet in height may be drained using localized gravel packs behind weep holes at eight feet maximum spacing (e.g., approximately 1.5 cubic feet of gravel in a woven plastic bag). Weep holes should be provided or the head joints omitted in the first course of block extended above the ground surface. However, nuisance water may still collect in front of the wall.

Drain outlets should be maintained over the life of the project and should not be obstructed or plugged by adjacent improvements.

6.4.3.1 Other Design Considerations

- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.
- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved by the project geotechnical engineer or their authorized representative.
- Positive separations should be provided in garden walls at horizontal distances not exceeding 20 feet.

6.4.4 Pavement Design Considerations

No on-site earth material has been tested to determine a preliminary R-Value for pavement design. A R-Value of 40 is assumed for the determination of preliminary pavement sections for this report. The final design should be based on R-Value testing of the soil subgrade following completion of rough grading operations. Project streets should be designed in accordance with County of Riverside requirements when final Traffic Indices and R-Value test results of the subgrade soil are completed.

Pavement design for proposed on-site and off-site street improvements was conducted per Caltrans *Highway Design Manual* guidelines for flexible pavements. Based on traffic indices (TIs) generally associated with this type of project and using a design R-value of 40, the following preliminary sections were calculated:

PRELIMINARY PAVEMENT SECTIONS			
TI	R-Value	Thickness of Asphalt Concrete (inches)	Thickness of Aggregate Base (inches)
5.5 (Access Road and Local Street)	40	3*	6
6.5 (Enhanced Local Street at School or Park)		4*	6*
7.0 (Collector)		4*	8
8.5 (Secondary Highway)		5*	9
9.0 (Major Highway)		5*	10

*Minimum pavement structural section per County of Riverside Standards

The TIs used in the above pavement analysis and design were designated by Riverside County for the indicated street types and should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving may result in premature pavement failure. Traffic parameters used for design were selected based upon engineering judgment and not upon information furnished to us such as an equivalent wheel load analysis or a traffic study.

The recommended pavement sections provided are intended as a minimum guideline and final selection of pavement cross section parameters should be made by the project civil engineer, based upon the local laws and ordinates, expected subgrade and pavement response, and desired level of conservatism. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. Final pavement design should be checked by testing of soils exposed at subgrade (the upper 12 inches) after final grading has been completed.

Asphalt concrete and aggregate base should conform to current Caltrans Standard Specifications Section 39 and 26-1.02, respectively. As an alternative, asphalt concrete can conform to Section 203-6 of the current Standard Specifications for Public Work (Green Book). Crushed aggregate base or crushed miscellaneous base can conform to Section 200-2.2 and 200-2.4 of the Green Book, respectively. Pavement base should be compacted to at least 95 percent of the ASTM D1557 laboratory maximum dry density (modified proctor).

All pavement installation, including preparation and compaction of subgrade, compaction of base material, placement and rolling of asphaltic concrete, should be done in accordance with County of Riverside specifications, and under the observation and testing of GeoTek and a County Inspector where required. Jurisdictional minimum compaction requirements in excess of the aforementioned minimums may govern.

Deleterious material, excessive wet or dry pockets, oversized rock fragments, and other unsuitable yielding materials encountered during grading should be removed. Once existing compacted fill are brought to the proposed pavement subgrade elevations, the subgrade should be proof rolled in order to check for a uniform and unyielding surface. The upper 12 inches of pavement subgrade soils should be scarified, moisture conditioned at or near optimum moisture content, and recompacted to at least 95 percent of the laboratory maximum dry density as determined by ASTM D1557 test procedures. If loose or yielding materials are encountered during construction, additional evaluation of these areas should be carried out by GeoTek. All pavement section changes should be properly transitioned.

6.4.5 Soil Corrosivity

The soil resistivity at this site was tested in the laboratory on two samples collected during the field investigation. The results of the testing indicate that the on-site soils are considered "extremely corrosive" (804 ohm-cm) (Roberge, 2000) to buried ferrous metal in accordance with current standards used by corrosion engineers. It is recommended that a corrosion engineer be consulted to provide recommendations for the protection of buried ferrous metal at this site.

6.4.6 Soil Sulfate Content

The sulfate content was determined in the laboratory on two samples collected during the field investigation. The results indicate that the water-soluble sulfate results are less than 0.1 percent by weight, which is considered "negligible" as per ACI 318. Based on the test results and Table 4.3.1 of ACI 318, no special recommendations for concrete are required for this project due to soil sulfate exposure.

Additional soil sampling, laboratory testing and analysis regarding soil corrosion and soil sulfate content should be conducted following completion of the project rough grading operation.

6.4.7 Import Soils

Import soils should have expansion characteristics similar to the on-site soils. GeoTek also recommends that the proposed import soils be tested for expansion and sulfate potential. GeoTek should be notified a minimum of 72 hours prior to importing so that appropriate sampling and laboratory testing can be performed.

6.4.8 Concrete Flatwork

6.4.8.1 Exterior Concrete Slabs, Sidewalks, and Driveways

Exterior concrete slabs, sidewalks and driveways should be designed using a four-inch minimum thickness. No specific reinforcement is required from a geotechnical perspective. However, some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices commonly utilized in industrial 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 flatwork with "very low" expansive soils should be pre-saturated to a minimum of 100 percent of optimum moisture content or 110 percent of optimum moisture for "low" expansive soils to a depth of at least 12 inches.

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

6.4.8.2 Concrete Performance

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

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

6.5 POST CONSTRUCTION CONSIDERATIONS

6.5.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. 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 the foundations. This type of landscaping should be avoided. Due to the presence of high expansive soils, irrigation should be minimized adjacent to the buildings. Planters within 30 feet of the buildings should be above ground and underlain by a concrete slab. Waterproofing of the foundation and/or subdrains may be warranted and advisable. We could discuss these issues, if desired, when plans are made available.

6.5.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times, as directed by the project civil engineer. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground adjacent to the footings and floor-slabs. Pad drainage should be directed toward approved areas and not be blocked by other improvements.

Roof gutters should be installed that will direct the collected water at least 20 feet from the buildings.

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.

6.6 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

It is recommended that site grading, specifications, retaining wall/shoring plans and foundation plans be reviewed by this office prior to construction to check for conformance with the recommendations contained in this report. Additional recommendations may be necessary based on these reviews. It is also recommended that GeoTek representatives be present during site grading and foundation construction to check for proper implementation of the geotechnical recommendations. The owner/developer should have GeoTek's representative 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 when necessary.
- Observe the fill for uniformity during placement including utility trenches.

- Test the fill for field density and relative compaction.
- Test the near-surface soils to verify proper moisture content.
- Observe and probe foundation excavations to confirm suitability of bearing 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. It is recommended that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

7. LIMITATIONS

This evaluation does not and should in no way be construed to encompass any areas beyond the specific area of proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope of this report is based on GeoTek's understanding of the project and the client's needs, GeoTek's proposal (Proposal No. P-0705721-CR) dated July 21, 2021 and geotechnical engineering standards normally used on similar projects in this region.

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

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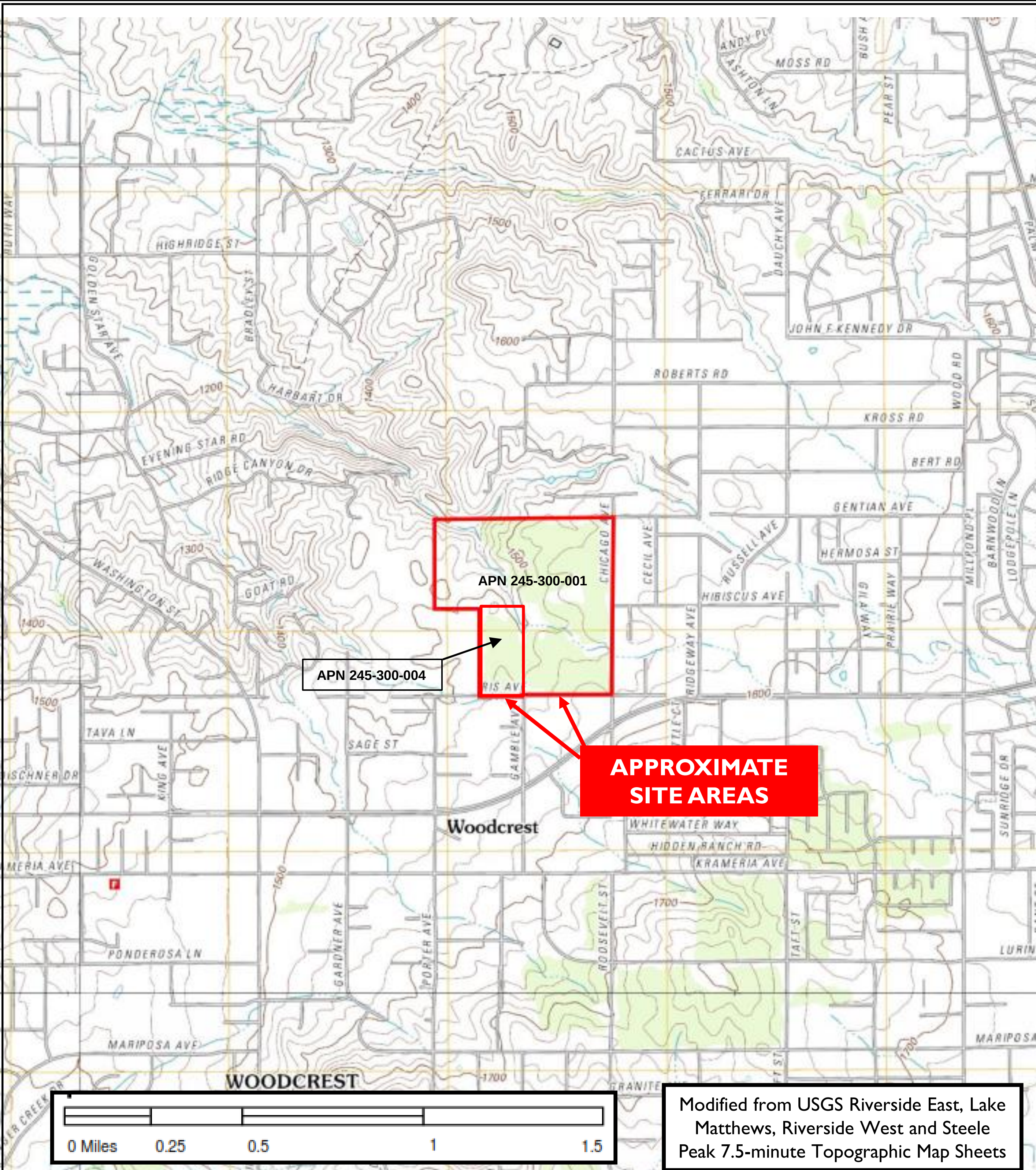

Modified from USGS Riverside East, Lake Matthews, Riverside West and Steele Peak 7.5-minute Topographic Map Sheets

TTLC Management an Arizona Corp.
Assessor's Parcel Numbers 245-300-001
and -004
Woodcrest Area of Riverside County, California

Project No. 2855-CR

NORTH

Figure 1

Site Location Map

GEOTEK

TTLC Management an Arizona Corp.
Proposed Single-Family Residential Development
NW of Iris Avenue and Chicago Avenue
Woodcrest Area of Riverside County, California

GeoTek Project No. 2855-CR

NORTH

200 ft.
SCALE

Figure 2

Exploration Location Map

GEOTEK

APPENDIX A

EXPLORATION LOGS, LABORATORY TEST RESULTS AND SEISMIC REFRACTION SURVEY DATA BY EARTH-STRATA (2015a)

Updated Geotechnical Evaluation

Proposed Single-Family Residential Development

Woodcrest, Riverside County, California

Project No. 2855-CR

GEOTEK

Geotechnical Boring Log B-1

Date: March 25, 2015	**Project Name: P& F Prpoerty** — **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** — **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; light orange brown, dry to slightly moist, medium dense
	70	1	105.1	10.3		**Cretaceous Val Verde Tonalite (Kvt)**
					SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5	50/4"	2	81.4	19.6	SC	Clayey SAND; light grey, moist, grainitic bedrock
						Dark grey, moist, coarse, very hard
10						End of Boring at 10 feet
						No Groundwater
15						
20						
25						
30						

Geotechnical Boring Log B-2

Date: March 25, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SC	Clayey SAND; reddish brown, dry
						Cretaceous Val Verde Tonalite (Kvt)
	68	1	118.6	8.9	SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5	50/8"	2	91.6	4.6		
10						End of Boring at 10 feet
						No Groundwater
15						
20						
25						
30						

Geotechnical Boring Log B-3

Date: March 31, 2015	Project Name: P& F Prpoerty — Page: 1 of 1
Project Number: 15735-10A	Logged By: GWG
Drilling Company: Drilling It	Type of Rig: CME 45B
Drive Weight (lbs): 140	Drop (in): 30 — Hole Diameter (in): 8
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					ML	Sandy SILT; light brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
5					SC	Clayey Sandstone; light tan brown, moist, hard to very hard
						End of Boring at 5.5 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log B-4

Date: March 31, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
						Sandy SILT; light brown, dense
	88/10"	1				**Cretaceous Val Verde Tonalite (Kvt)**
					SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5						
10						End of Boring at 10 feet
						No Groundwater
15						
20						
25						
30						

Geotechnical Boring Log B-5

Date: March 31, 2015	**Project Name: P& F Prpoerty** — **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** — **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
						Sandy SILT; light brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
	96/8"	1			SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5						
						End of Boring at 7.5
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log B-6

Date: March 31, 2015	**Project Name: P& F Prpoerty** — **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** — **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					ML	Sandy SILT; light brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
	110/3"	1			SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5	50/1"	2				
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log B-7

Date: March 31, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
						Sandy SILT; light brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
	50/4"	1			SM	Silty SAND (weathered bedrock);
5						
10						End of Boring at 10 feet
						No Groundwater
15						
20						
25						
30						

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Geotechnical Boring Log B-8

Date: March 31, 2015	**Project Name: P& F Prpoerty**	**Page: 1 of 1**
Project Number: 15735-10A	**Logged By: DV**	
Drilling Company: Drilling It	**Type of Rig: CME 45B**	
Drive Weight (lbs): 140	**Drop (in): 30**	**Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**	

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
						Sandy SILT; reddish brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
	50/2"	1			SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5						
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-1

Date: March 27, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, slightly moist, with weathered rock
						Tonalite (Kvt):
5					SP	Sand with SILT and weathered rock, gravel size; grey and light brown
						End of Boring at 6 feet
						No Groundwater
						`
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-2

Date: March 28, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, medium dense
						Tonalite (Kvt):
					SP	SAND with fine GRAVEL (weathered rock); light grey
5						End of Boring at 4.9 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-3

Date: March 28, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil**
					SM	Silty SAND; reddish brown, dry, medium dense
						Tonalite (Kvt):
					SP	Sand with fine GRAVEL; light grey, dry, weatherd bedrock
						End of Boring at 4 feet
5						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-4

Date: March 28, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, medium dense
						Tonalite (Kvt):
5						
					SP	SAND with SILT; reddish brown, dry, medium dense
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-5

Date: March 27, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose to medium dense
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey with black spots, very dense
5						End of Boring at 4.7 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-6

Date: March 27, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey, dry, very dense
5						End of Boring 5 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-7

Date: March 27, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; brown, dry, medium dense
						Tonalite (Kvt):
					SP	SAND (weathered bedrock) with gravel; light grey, very dense
						End of Boring at 2.5 feet
5						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-8

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; Reddish brown, dry, loose
5						**Tonalite (Kvt):**
					SP	SAND (weathered bedrock); light grey, dry, very dense
						End of Boring at 5.1 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-9

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
5						
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-10

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
5					SP	SAND (wethered bedrock); light grey, hard, dry, very dense
						End of Boring at 5 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-11

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (wethered bedrock); light grey, hard, dry, very dense
						End of Boring at 2.1 feet
5						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-12

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, loose, moist
						Tonalite (Kvt):
5					SP	SAND (weathered bedrock); light grey, moist, very dense
						End of Boring at 5 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-13

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey, moist, very dense
						End of Boring at 3.8 feet
5						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-14A

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; brown, dry, hard, medium-dense
					SP	**Tonalite (Kvt):**
						SAND (weathered bedrock); brown, dry, very dense
5						End of Boring at 3 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-14

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
5					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-15

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
5						End of Boring at 5 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-16

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
5						End of Boring at 3.2 feet
						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-17

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
5					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
						End of Boring at 5.2 feet
						No Groundwater
10						
15						
20						
25						
30						

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APPENDIX C

LABORATORY PROCEDURES AND TEST RESULTS

APPENDIX C

Laboratory Procedures and Test Results

Laboratory testing provided quantitative and qualitative data involving the relevant engineering properties of the representative earth materials selected for testing. The representative samples were tested in general accordance with American Society for Testing and Materials (ASTM) procedures and/or California Test Methods (CTM).

Soil Classification: Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions were reconciled to reflect laboratory test results with regard to ASTM D 2487.

Moisture and Density Tests: For select samples moisture content was determined using the guidelines of ASTM D 2216 and dry density determinations were made using the guidelines of ASTM D 2937. These tests were performed on relatively undisturbed samples and the test results are presented on the exploratory logs.

Maximum Density Tests: The maximum dry density and optimum moisture content of representative samples were determined using the guidelines of ASTM D 1557. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	133.0	7.5
B-2 @ 0 to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	127.0	8.0
TP-1 @ 0 to 3 feet	Dark Brown Silty SAND	125.0	11.5
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	108.5	10.0

Expansion Index: The expansion potential of representative samples was evaluated using the guidelines of ASTM D 4829. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	EXPANSION INDEX	EXPANSION POTENTIAL
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	0	Very Low
B-2 @ 0to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	7	Very Low
TP-1 @ 0 to 3 feet	Dark Brown Silty SAND	29	Low
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	7	Very Low

Minimum Resistivity and pH Tests: Minimum resistivity and pH Tests of select samples were performed using the guidelines of CTM 643. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	pH	MINIMUM RESISTIVITY (ohm-cm)
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	7.3	1,000
B-2 @ 0 to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	7.1	440
TP-1 @ 0 to 3 feet	Dark Brown Silty SAND	7.2	400
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	7.8	1,100

Soluble Sulfate: The soluble sulfate content of select samples was determined using the guidelines of CTM 417. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	SULFATE CONTENT (% by weight)	SULFATE EXPOSURE
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	0.002	Negigible
B-2 @ 0 to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	0.029	Negigible
TP-1 @ 0 to 3	Dark Brown Silty SAND	0.002	Negigible
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	0.002	Negigible

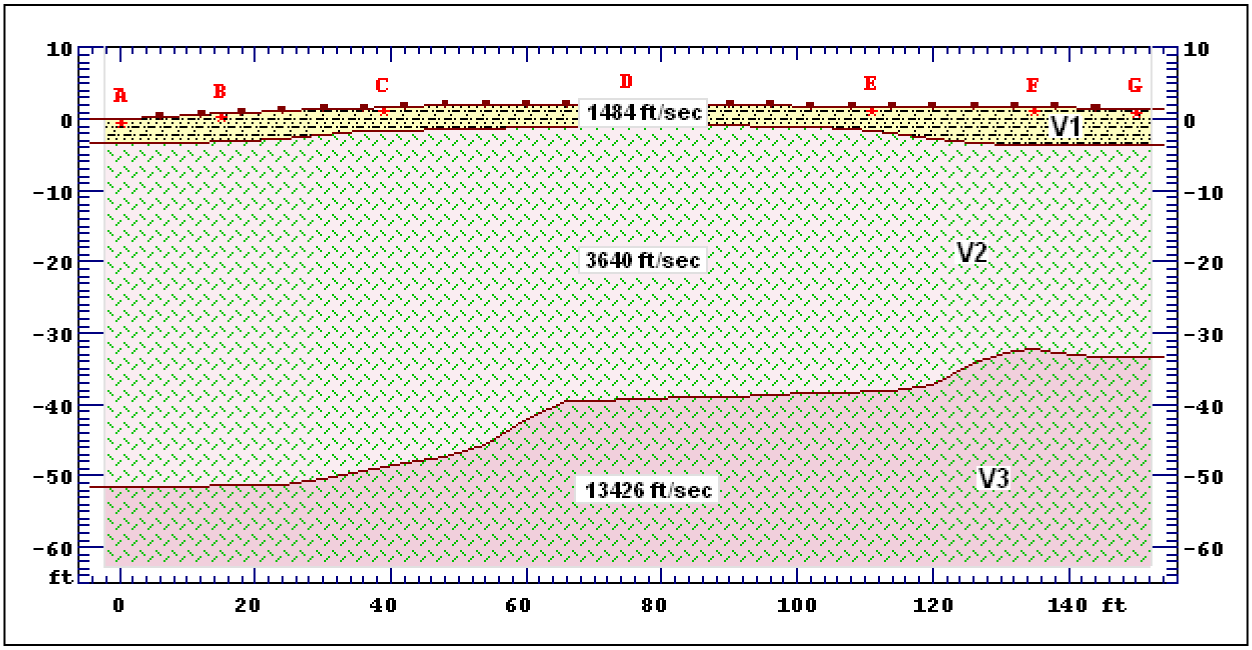
Chloride Content: Chloride content of select samples was determined using the guidelines of CTM 422. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	CHLORIDE CONTENT (ppm)
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	50
B-2 @ 0 to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	70
TP-1 @ 0 to 3 feet	Dark Brown Silty SAND	60
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	20

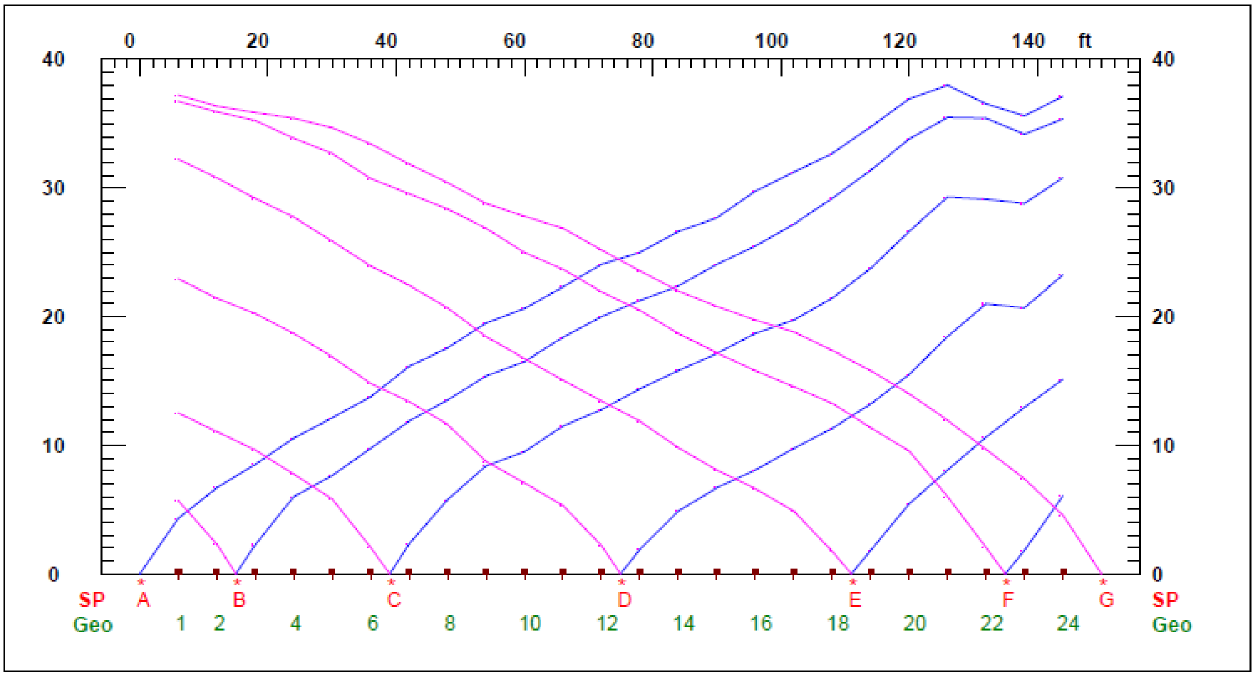
SEISMIC LINE S-1

< South - North >

LAYER VELOCITY MODEL



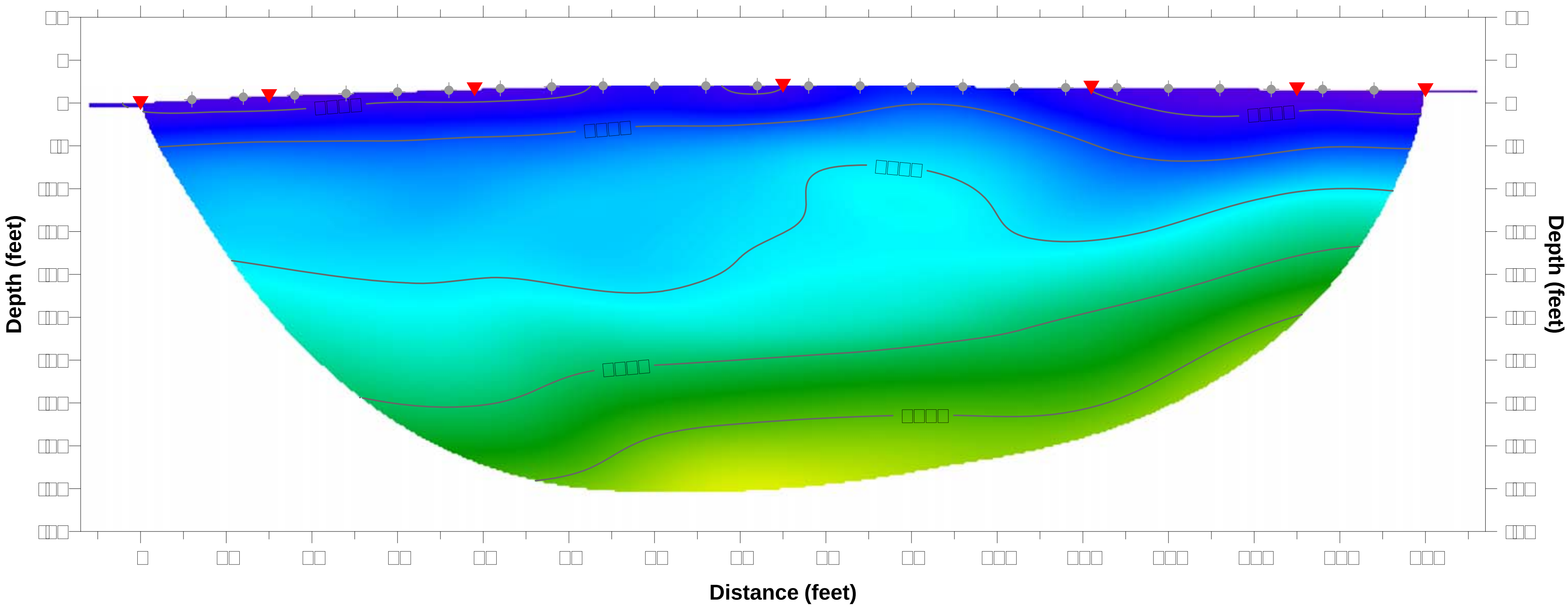
TIME-DISTANCE PLOT

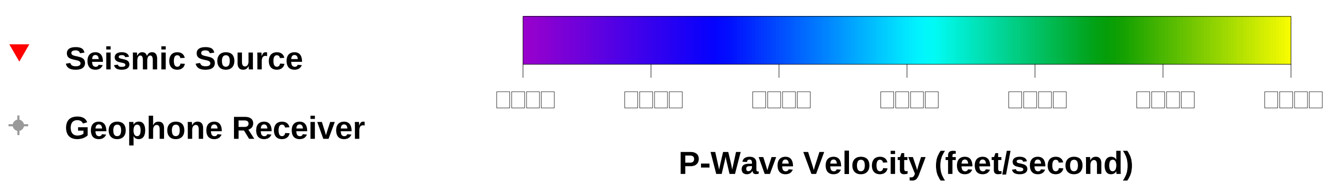


SEISMIC LINE S-1

← South - North →

REFRACTION TOMOGRAPHIC MODEL





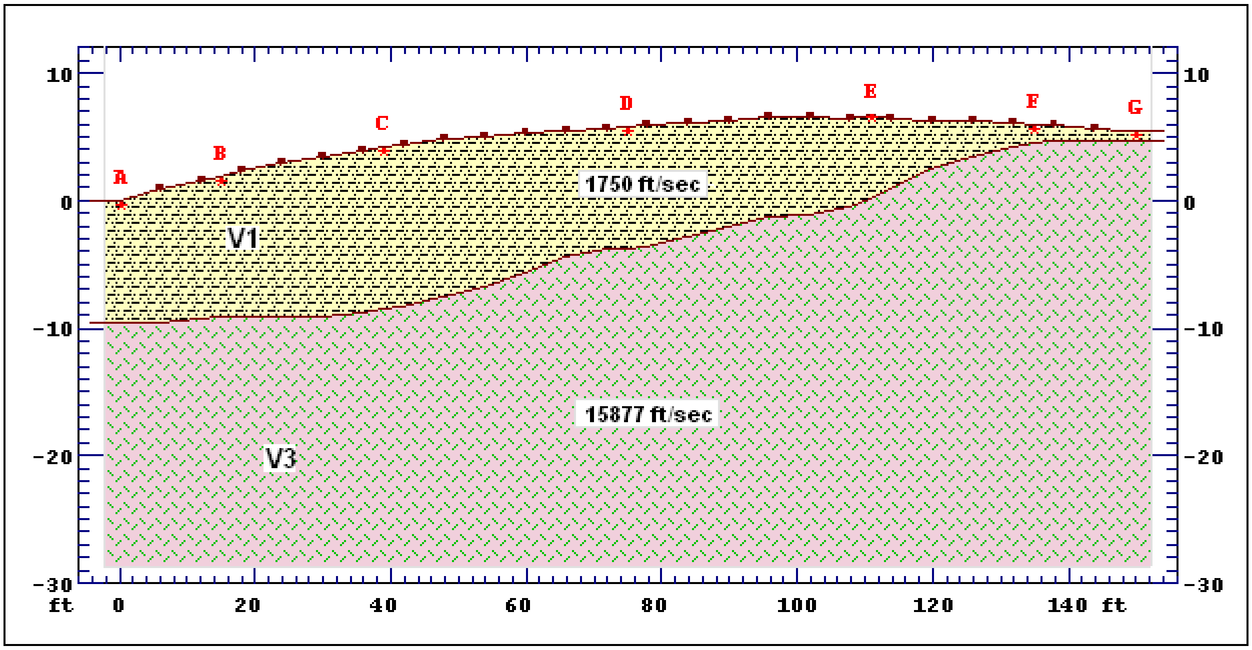
SCALE: 1" = 18' (Horizontal & Vertical)

RMS error 1.4 %, Rayfract Version 3.33

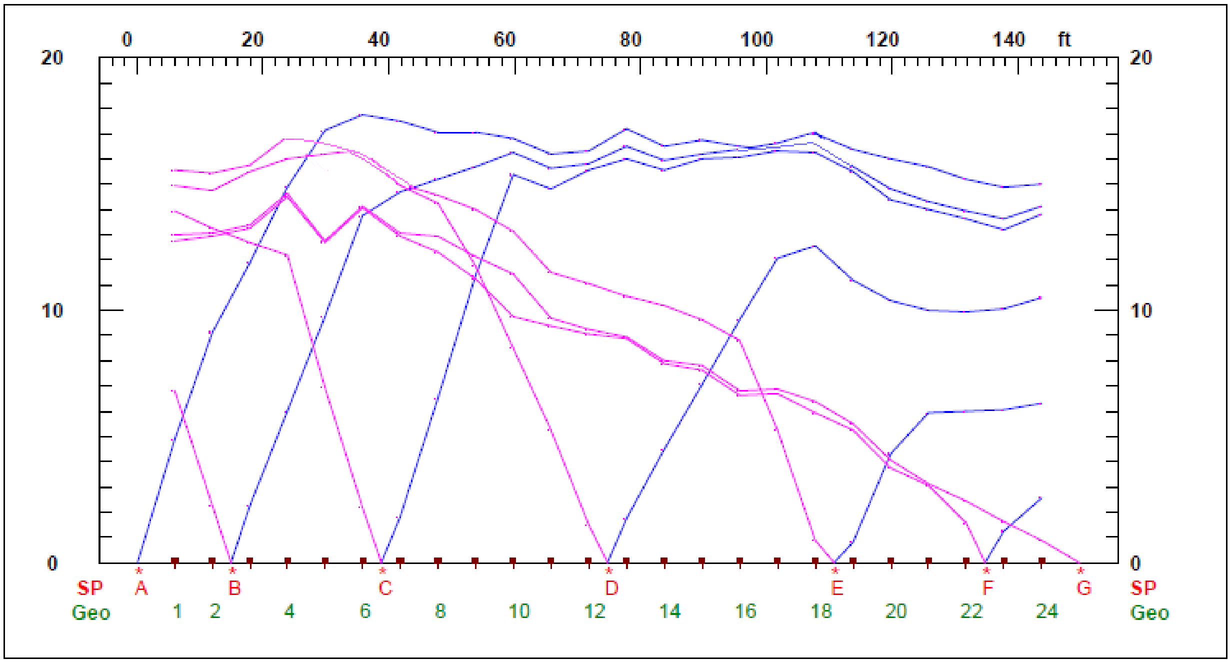
SEISMIC LINE S-2

< South - North >

LAYER VELOCITY MODEL



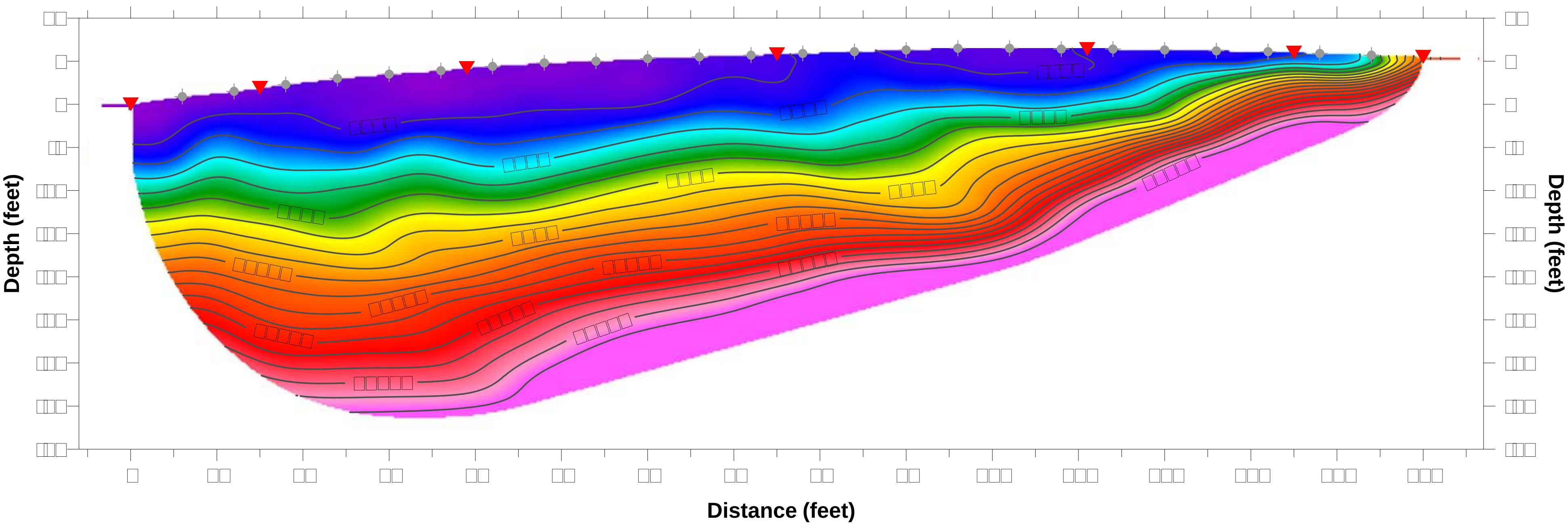
TIME-DISTANCE PLOT

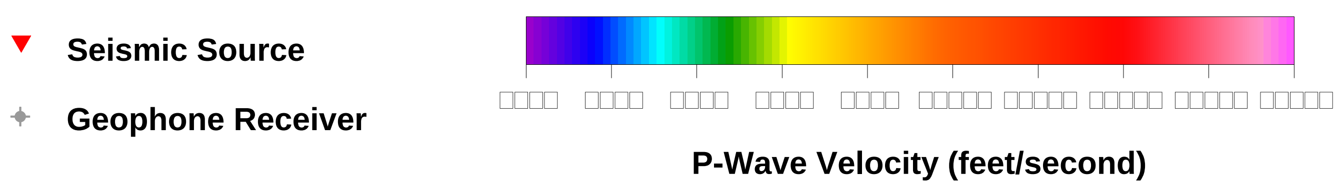


SEISMIC LINE S-2

← South - North →

REFRACTION TOMOGRAPHIC MODEL





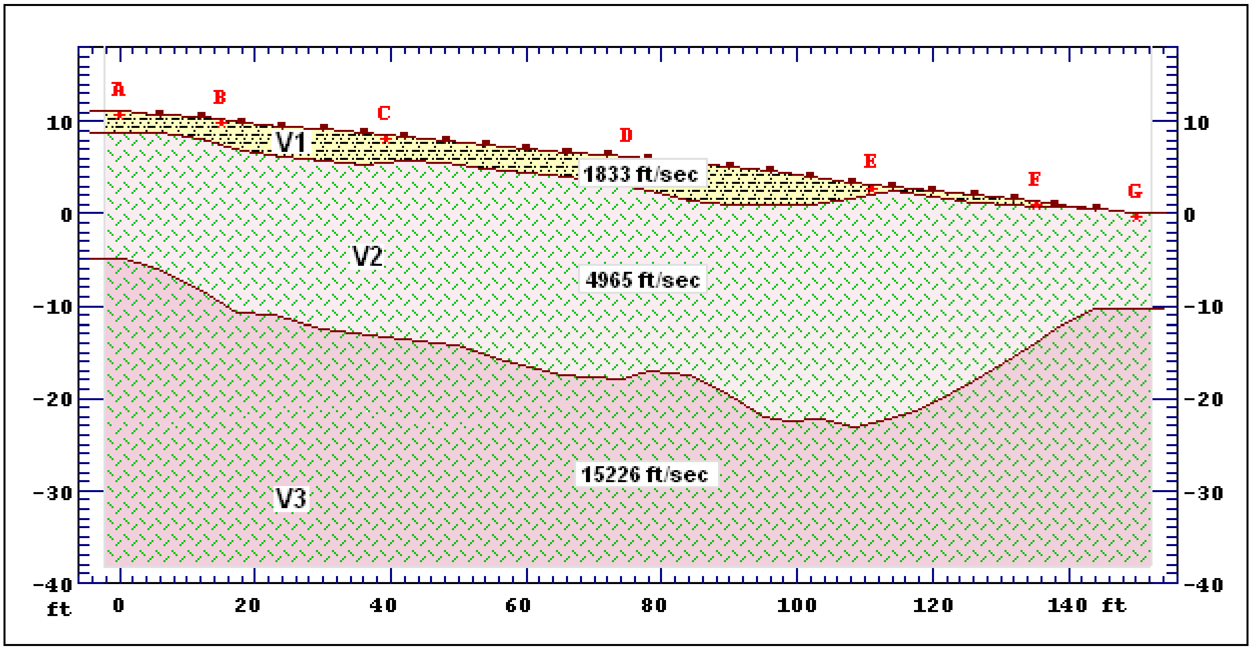
SCALE: 1" = 18' (Horizontal & Vertical)

RMS error 2.9 %, Rayfract Version 3.33

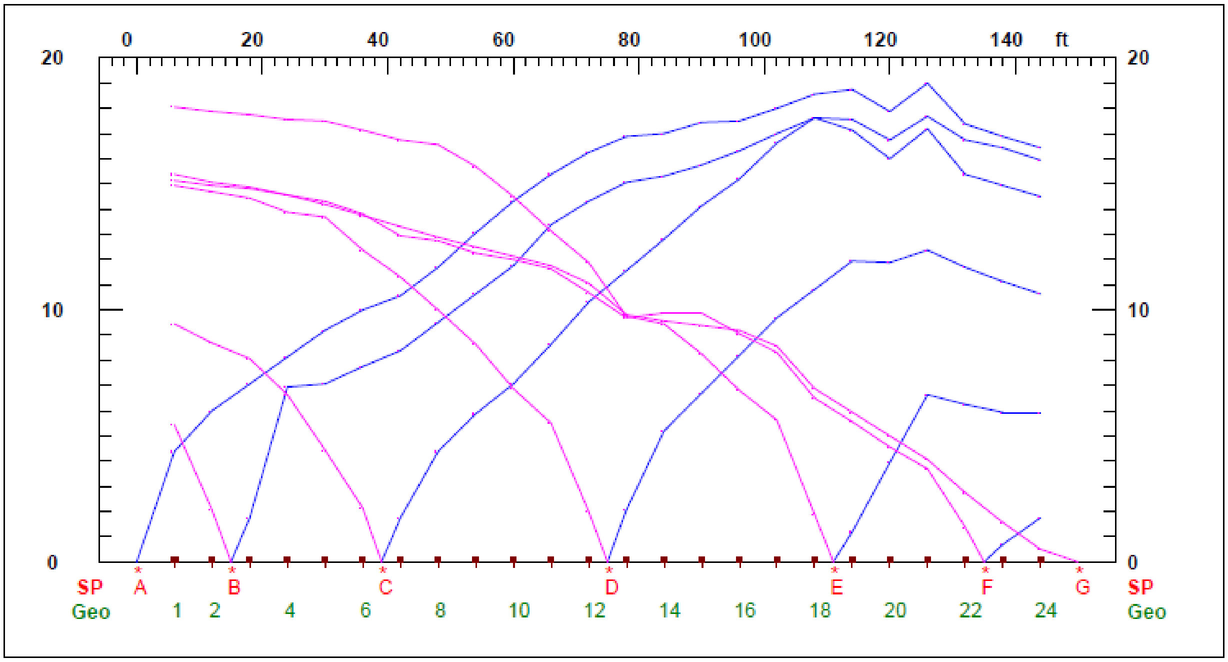
SEISMIC LINE S-3

< South - North >

LAYER VELOCITY MODEL



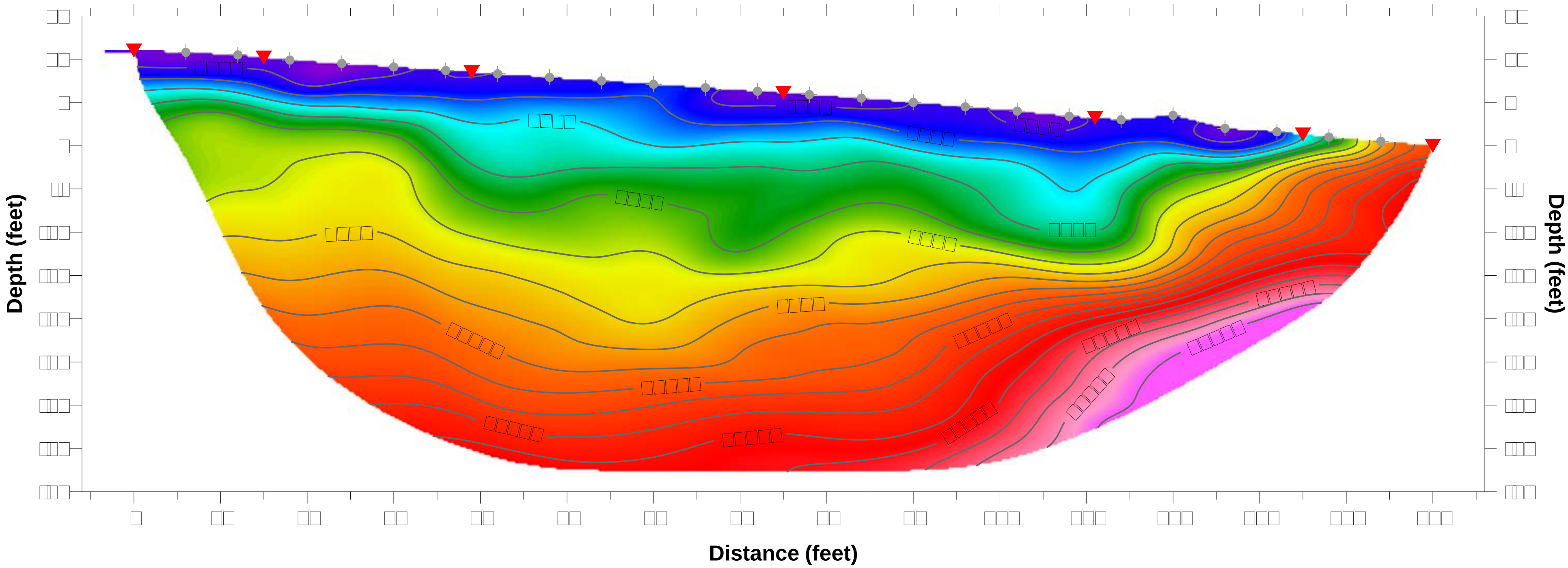
TIME-DISTANCE PLOT



SEISMIC LINE S-3

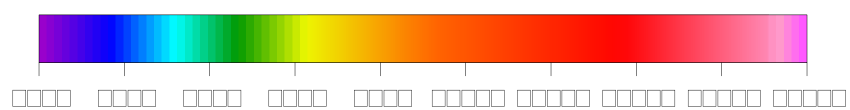
← South - North →

REFRACTION TOMOGRAPHIC MODEL



▼ Seismic Source

✦ Geophone Receiver



P-Wave Velocity (feet/second)

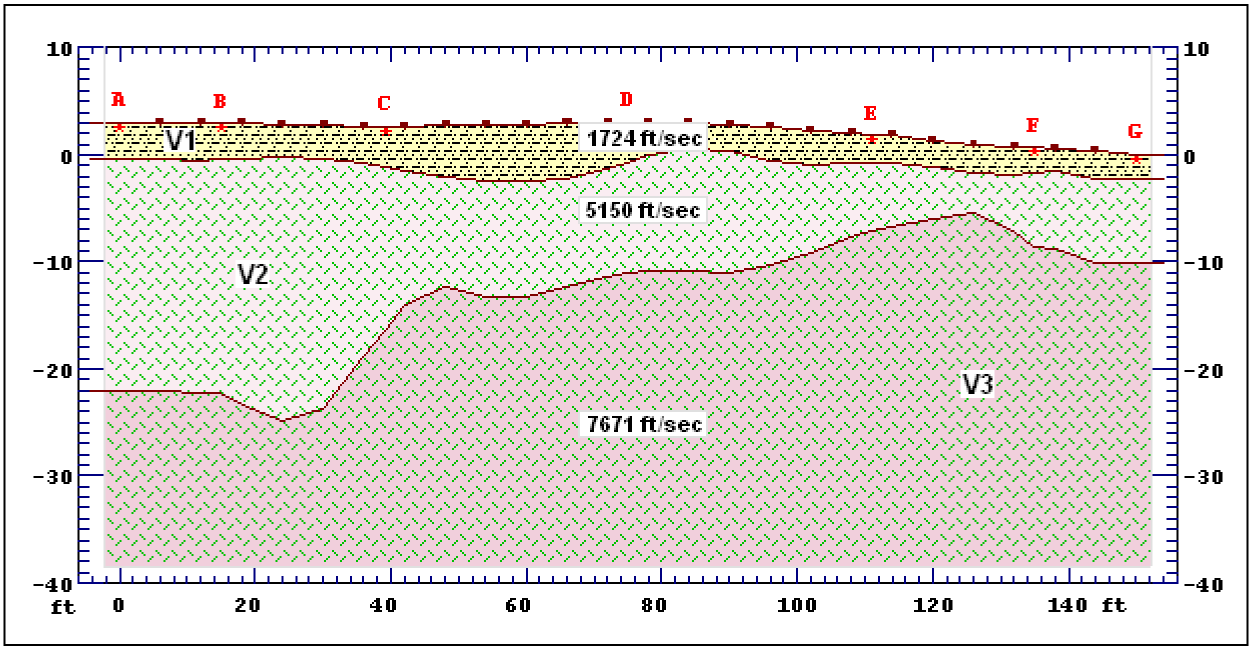
SCALE: 1" = 18' (Horizontal & Vertical)

RMS error 2.4 %, Rayfract Version 3.33

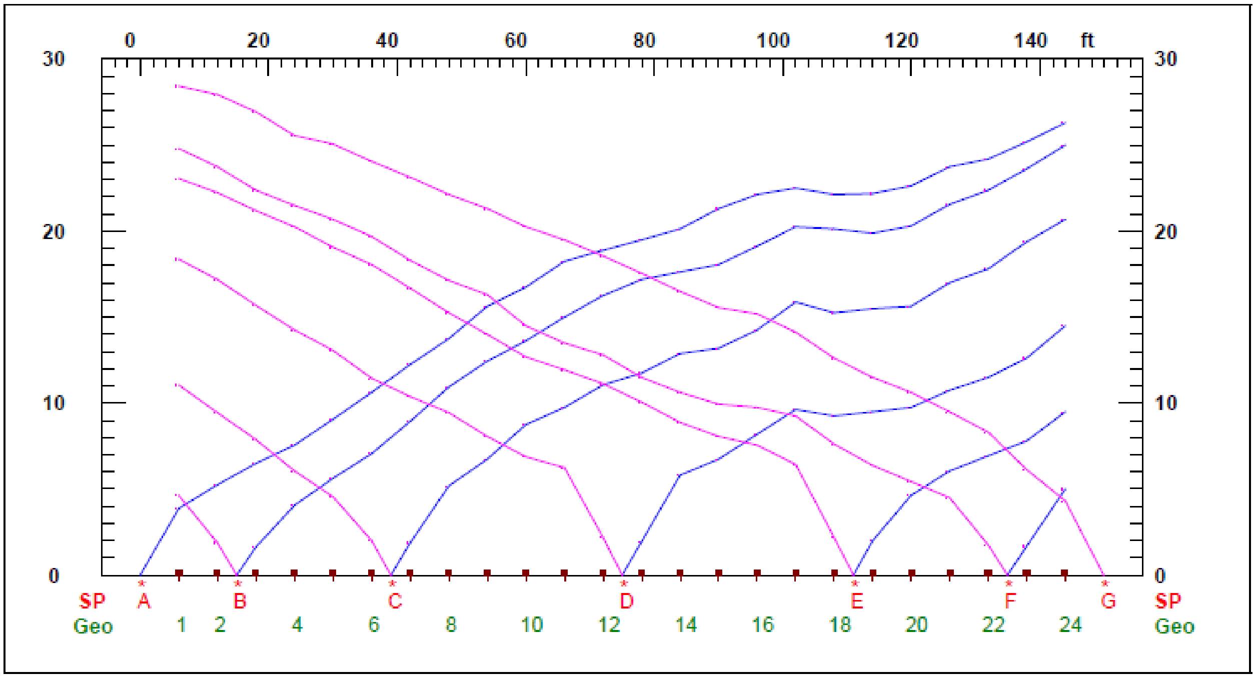
SEISMIC LINE S-4

< West - East >

LAYER VELOCITY MODEL



TIME-DISTANCE PLOT



Additionally, as presented below on Figure 1, the Caterpillar D9R Ripper Performance Chart (Caterpillar, 2012) has been provided for reference.

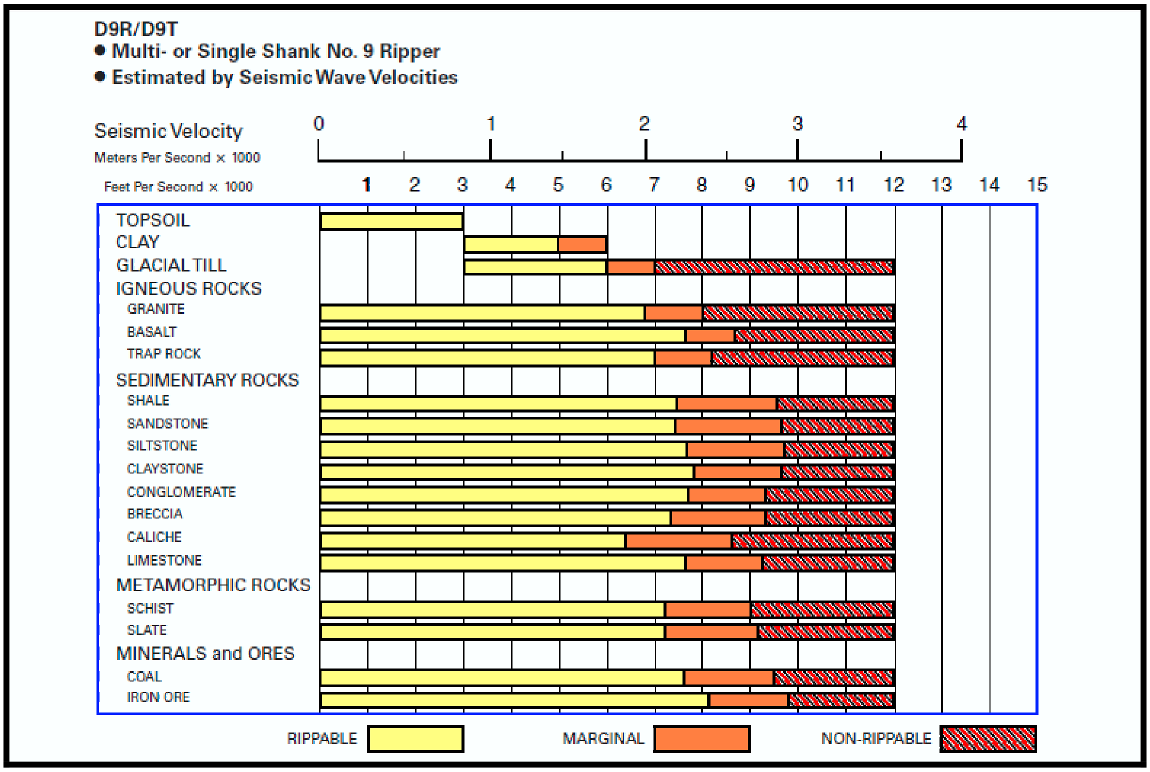
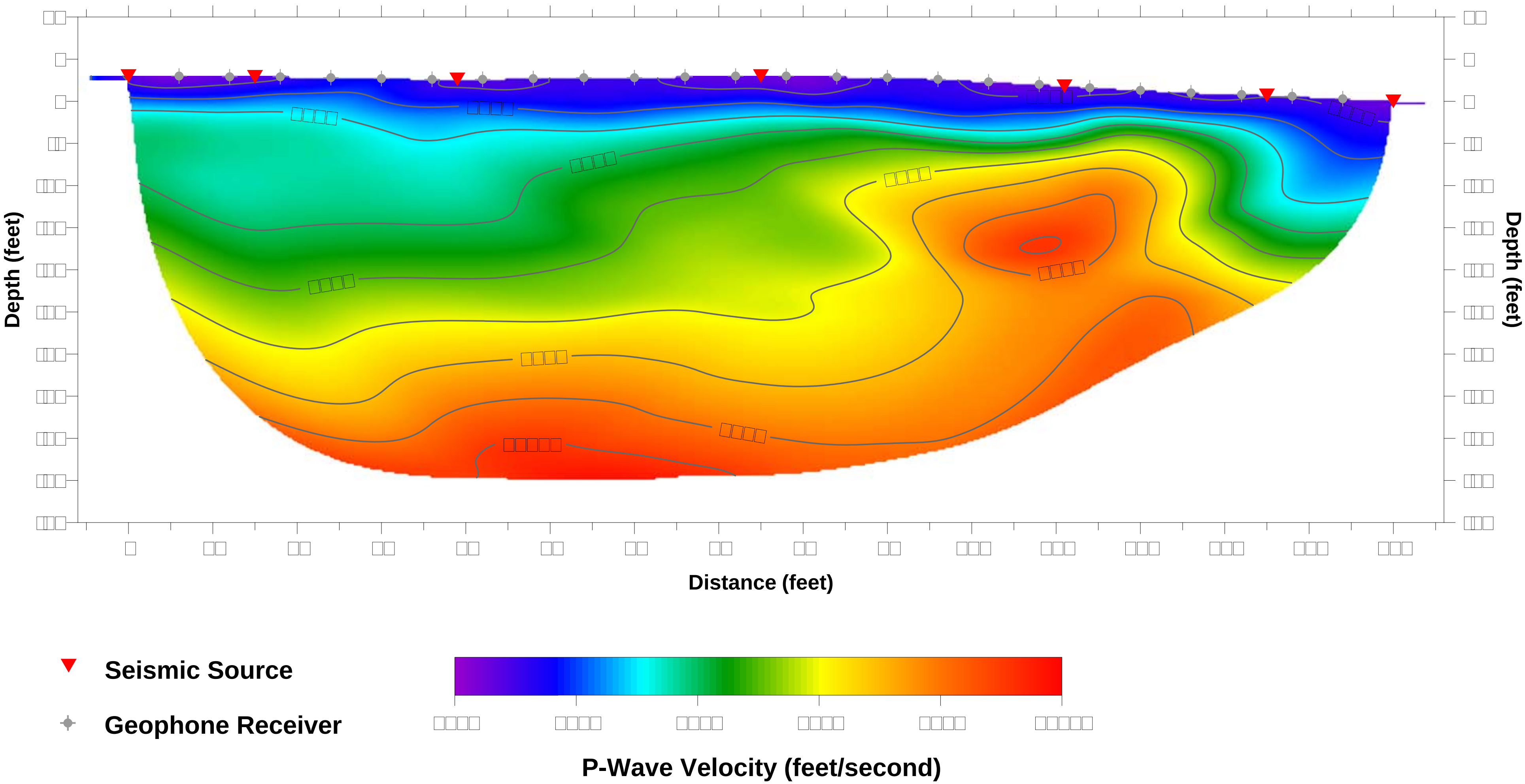


FIGURE 1- Caterpillar D9R Ripper Performance Chart

SEISMIC LINE S-4

← East - West →

REFRACTION TOMOGRAPHIC MODEL



SCALE: 1" = 18' (Horizontal & Vertical)

RMS error 1.5 %, Rayfract Version 3.33

APPENDIX B

Generalized Rippability Characteristic of Bedrock

GENERALIZED RIPPABILITY CHARACTERISTICS OF BEDROCK

A summary of the generalized rippability characteristics of bedrock based on a compilation of rippability performance charts prepared by Caterpillar, Inc. (2004), Caltrans (Stephens, 1978), and Santi (2006), has been provided to aid in evaluating potential excavation difficulties with respect to the seismic velocities obtained along the local areas surveyed. These seismic velocity ranges and rippability potentials have been tabulated below for reference.

TABLE 1- CATERPILLAR RIPPABILITY CHART (D9 Ripper)

Granitic Rock Velocity	Rippability
< 6,800	Rippable
6,800 – 8,000	Moderately Rippable
> 8,000	Non-Rippable

Additionally, we have provided the Caltrans Rippability Chart as presented below within Table 2 for comparison. These values are from published Caltrans studies (Stephens, 1978) that are based on their experience which are more conservative than Caterpillar's rippability charts. It should be noted that the type of bedrock was not indicated.

TABLE 2- STANDARD CALTRANS RIPPABILITY CHART

Velocity (feet/sec ±)	Rippability
< 3,500	Easily Ripped
3,500 – 5,000	Moderately Difficult
5,000 – 6,600	Difficult Ripping / Light Blasting
> 6,600	Blasting Required

Table 3 is partially modified from the "Engineering Behavior from Weathering Grade" as presented by Santi (2006), which also provides velocity ranges with respect to rippability potentials, along with other rock engineering properties that may be pertinent.

TABLE 3- SUMMARY OF ROCK ENGINEERING PROPERTIES

ENGINEERING PROPERTY:	Slightly Weathered	Moderately Weathered	Highly Weathered	Completely Weathered
Excavatability	Blasting necessary	Blasting to rippable	Generally rippable	Rippable
Slope Stability	½ :1 to 1:1 (H:V)	1:1 (H:V)	1:1 to 1.5:1 (H:V)	1.5:1 to 2:1 (H:V)
Schmidt Hammer Value	51 – 56	37 – 48	12 – 21	5 – 20
Seismic Velocity (fps)	8,200 – 13,125	5,000 – 10,000	3,300 – 6,600	1,650 – 3,300

APPENDIX B

LOGS OF EXPLORATORY TRENCHES BY GEOTEK

Updated Geotechnical Evaluation

Proposed Single-Family Residential Development

Woodcrest, Riverside County, California

Project No. 2855-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

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

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

B – TRENCH LOG LEGEND

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

SOILS

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

GEOLOGIC

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

(Additional denotations and symbols are provided on the logs of trenches)

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

TRENCH NO.: T-1

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty m-c SAND with some clay, light brown, slightly moist				
				Alluvium				
			SC	Clayey m-c SAND, red-brown, very moist				
				Granitic Bedrock				
5				Tonalite, red-yellow, slightly moist, relatively easy to excavate				
				- Becomes hard to excavate, 2-3 scratches for 1/4 bucket				
10				**TRENCH TERMINATED AT 10 FEET DUE TO REFUSAL**				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing:
ND = Nuclear Density Test
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 TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

TRENCH NO.: T-2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty m-c SAND with some clay, light brown, slightly moist, some pvc pipe				
				Alluvium				
			SM	Silty m-c SAND with some clay, light brown, moist, some granite fragments				
				Granitic Bedrock				
				Tonalite, excavates as m-c SAND, moist, yellowish tan, relatively easy to excavate				
5				-Becomes gray @ 5.0 feet				
10								
				TRENCH TERMINATED AT 13 FEET				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing:

ND = Nuclear Density Test	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 TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	**TRENCH NO.: T-3** **MATERIAL DESCRIPTION AND COMMENTS**	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, slightly moist, loose, some rootlets				
	Large Bulk			**Alluvium**				Expansion Index = 17
			ML	Sandy SILT with some clay, red-brown, moist to very moist				Corrosion Testing
								Remolded Shear Test
								Maximum Density Test
				Granitic Bedrock				
				Tonalite, excavates as m-c sand, yellowish tan, relatively easy to excavate				
5								
				- Becomes medium hard to excavate, 2-3 scratches for 1/2 bucket				
10								
				TRENCH TERMINATED AT 10.5 FEET				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing:

ND = Nuclear Density Test	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 TRENCH

CLIENT: TTLC Management Inc., An Arizona Corp.
PROJECT NAME: Proposed Single-Family Residential Development
PROJECT NO.: 2855-CR
LOCATION: Woodcrest, CA
LOGGED BY: DA
EQUIPMENT: Backhoe
DATE: 8/30/2021

TRENCH NO.: T-4

Depth (ft)	Sample Type	DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Rel. Comp. (%)	Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, dry to slightly moist, loose, some rootlets				
				Alluvium				
			SM	Silty f SAND, brown, moist, some rootlets				
				Granitic Bedrock				
				Tonalite, excavates as m-c sand, orange black, easy to medium hard to excavate				
5								
10								
				TRENCH TERMINATED AT 14.0 FEET				
15				No groundwater encountered Trench backfilled with soil cuttings				

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing:
- ND = Nuclear Density Test
- 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 TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	**TRENCH NO.: T-5** / **MATERIAL DESCRIPTION AND COMMENTS**	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, dry to slightly moist, loose, some rootlets				
				Alluvium				
			SM	Silty f SAND, brown, moist, some rootlets				
			SP	F-m SAND with some silt and clay, moderate brown, very moist				
				Granitic Bedrock				
				Tonalite, excavates as m-c sand, black-gray, Relatively easy to excavate				
5								
		∇						
				TRENCH TERMINATED AT 8.0 FEET				
				Groundwater encountered at 6.5 feet				
				Trench backfilled with soil cuttings				
10								
15								

LEGEND

Sample type: ---Ring ---Large Bulk ∇ ---Water Table

Lab testing:

ND = Nuclear Density Test; 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 TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

TRENCH NO.: T-6

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f-m SAND with some clay, light brown, slightly moist, some rootlets				
				Alluvium				
			SM	Silty f-m SAND with some clay, brown, moist, some rootlets				
			SC	Clayey m-c SAND with some granitic fragments, red-brown, moist				
5				**Granitic Bedrock**				
				Tonalite, red-brown, moist, very hard to excavate				
				TRENCH TERMINATED AT 5 FEET DUE TO REFUSAL				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
10								
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing:
ND = Nuclear Density Test
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 TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

TRENCH NO.: T-7

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Rel. Comp. (%)	Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f-m SAND with some clay, light brown, slightly moist, some rootlets				
				Alluvium				
			SM	Silty f-m SAND with some clay and granite fragments, brown, moist, some rootlets and cobbles				
	Large Bulk		SC	Clayey m-c SAND, red-brown, very moist				Expansion Index = 0 Corrosion Testing Remolded Shear Test Maximum Density Test
				-Becomes yellowish red-brown				
5				**Granitic Bedrock**				
				Tonalite, yellow-tan, moist, easy to excavate				
				- Becomes hard to excavate, 3 scratches for 1/4 bucket				
10								
				TRENCH TERMINATED AT 10.5 FEET				
				No groundwater encountered Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing:

ND = Nuclear Density Test	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 TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

TRENCH NO.: T-8

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, dry to slightly moist, loose, some rootlets				
				Alluvium				
			SC	Clayey f-m SAND with some silt, red-brown, moist				
				Granitic Bedrock				
				Tonalite, excavates as m-c sand, yellowish tan, easy to excavate				
5								
				- Becomes hard to excavate, 2-3 scratches for 1/4 bucket				
				TRENCH TERMINATED AT 7.0 FEET DUE TO REFUSAL				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
10								
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing:

ND = Nuclear Density Test	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 TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

TRENCH NO.: T-9

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, dry to slightly moist, loose, some rootlets				
				Alluvium				
			SM-SC	Silty f SAND with clay, red-brown, moist				
				Granitic Bedrock				
				Tonalite, excavates as m-c sand, black-orange, easy to excavate				
5								
10				**TRENCH TERMINATED AT 10.0 FEET**				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing:

ND = Nuclear Density Test	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	HC= Consolidation	MD = Maximum Density

APPENDIX C

LABORATORY TEST RESULTS BY GEOTEK

Updated Geotechnical Evaluation
Proposed Single-Family Residential Development
Woodcrest, Riverside County, California
Project No. 2855-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

Direct Shear

Shear testing was performed in a direct shear machine of the strain-control type in general accordance with ASTM D 3080 test procedures. The rate of deformation was approximately 0.035 inch per minute. The sample was sheared under varying confining loads in order to determine the coulomb shear strength parameters, angle of internal friction and cohesion. The tests were performed on soil samples remolded to approximately 90 percent of maximum dry density as determined by ASTM D 1557 test procedures. The shear test results are presented in Appendix C.

Expansion Index

Expansion Index testing was performed on two soil samples. Testing was performed in general accordance with ASTM Test Method D 4829. The results of the testing are provided below and in Appendix C.

Trench No.	Depth (ft.)	Description	Expansion Index	Classification
T-3	1-2	Sandy Silt with Clay	17	Very Low
T-7	2-3	Silty Sand with Clay	0	Very Low

Moisture-Density Relationship

Laboratory testing was performed on two samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil type was determined in general accordance with ASTM Test D 1557 test procedures. The results of the testing are provided in Appendix C.

Sulfate Content, Resistivity and Chloride Content

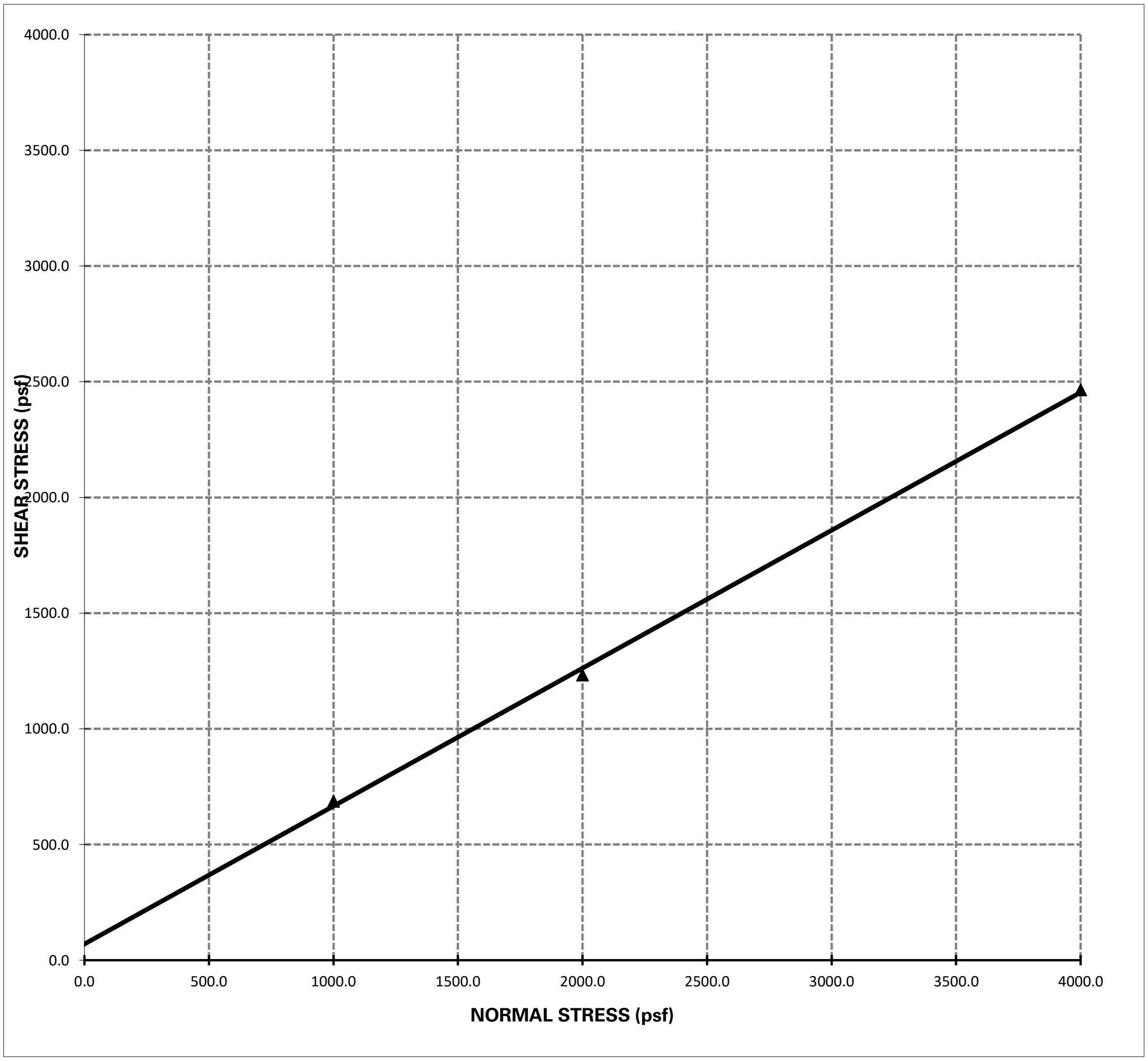
Testing to determine the water-soluble sulfate content was performed by others in general accordance with ASTM D4327 test procedures. Resistivity testing was completed by others in general accordance with ASTM G187 test procedures. Testing to determine the chloride content was performed by others in general accordance with ASTM D4327 test procedures. The results of the testing are provided below and in Appendix B.

Trench No.	Depth (ft.)	pH ASTM D4972	Chloride ASTM D4327 (mg/kg)	Sulfate ASTM D4327 (% by weight)	Resistivity ASTM G187 (ohm-cm)
T-3	1-2	7.7	135.9	0.0278	804
T-7	2-3	8.3	15.5	0.0047	3,685

DIRECT SHEAR TEST

Project Name:	The True Life Comapanies	***Sample Location:***	T3 @ 1-2'
Project Number:	2855-CR	***Date Tested:***	9/15/2021

PEAK VALUE



Shear Strength: **Φ = 31 °** **C = 70 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.

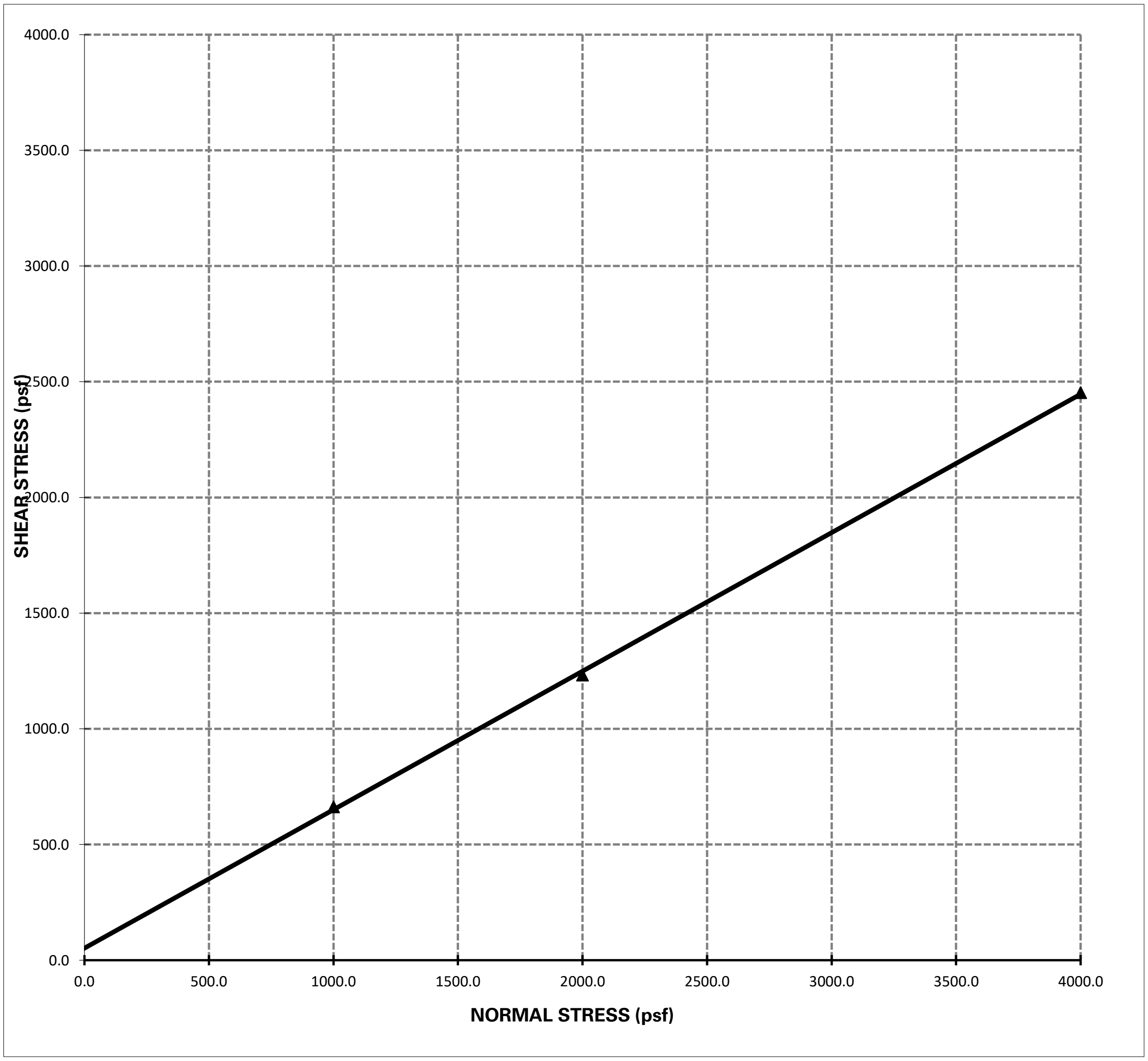
2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

DIRECT SHEAR TEST

GEOTEK

Project Name:	The True Life Comapanies	***Sample Location:***	T3 @ 1-2'
Project Number:	2855-CR	***Date Tested:***	9/15/2021



Shear Strength: Φ = **31 °** **C = 52 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.

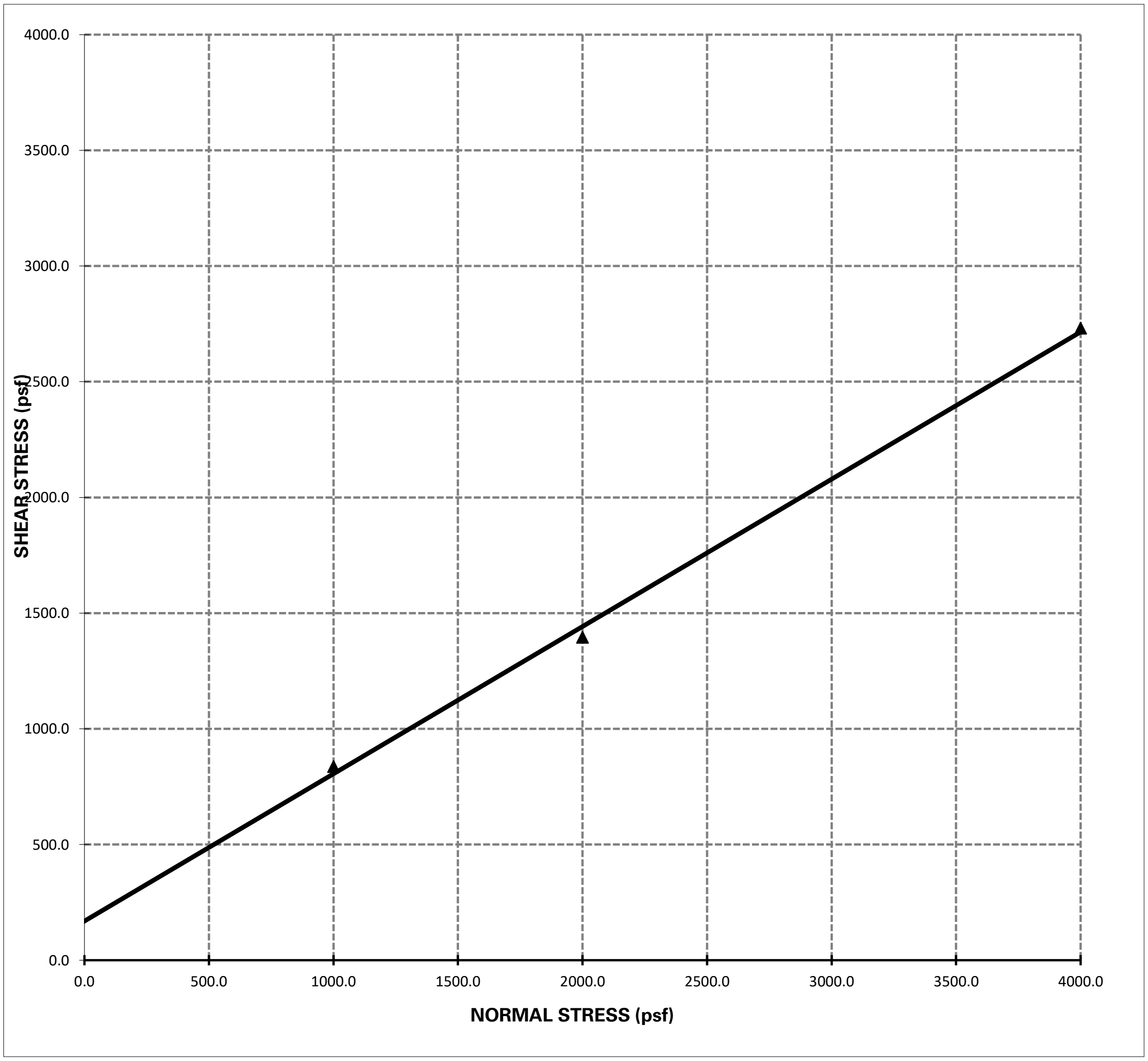
3 - The tests were run at a shear rate of 0.035 in/min.

DIRECT SHEAR TEST

GEOTEK

Project Name:	The True Life Comapanies	***Sample Location:***	T7 @ 2-3'
Project Number:	2855-CR	***Date Tested:***	9/15/2021

PEAK VALUE



Shear Strength: **Φ = 32 °** **C = 169 psf**

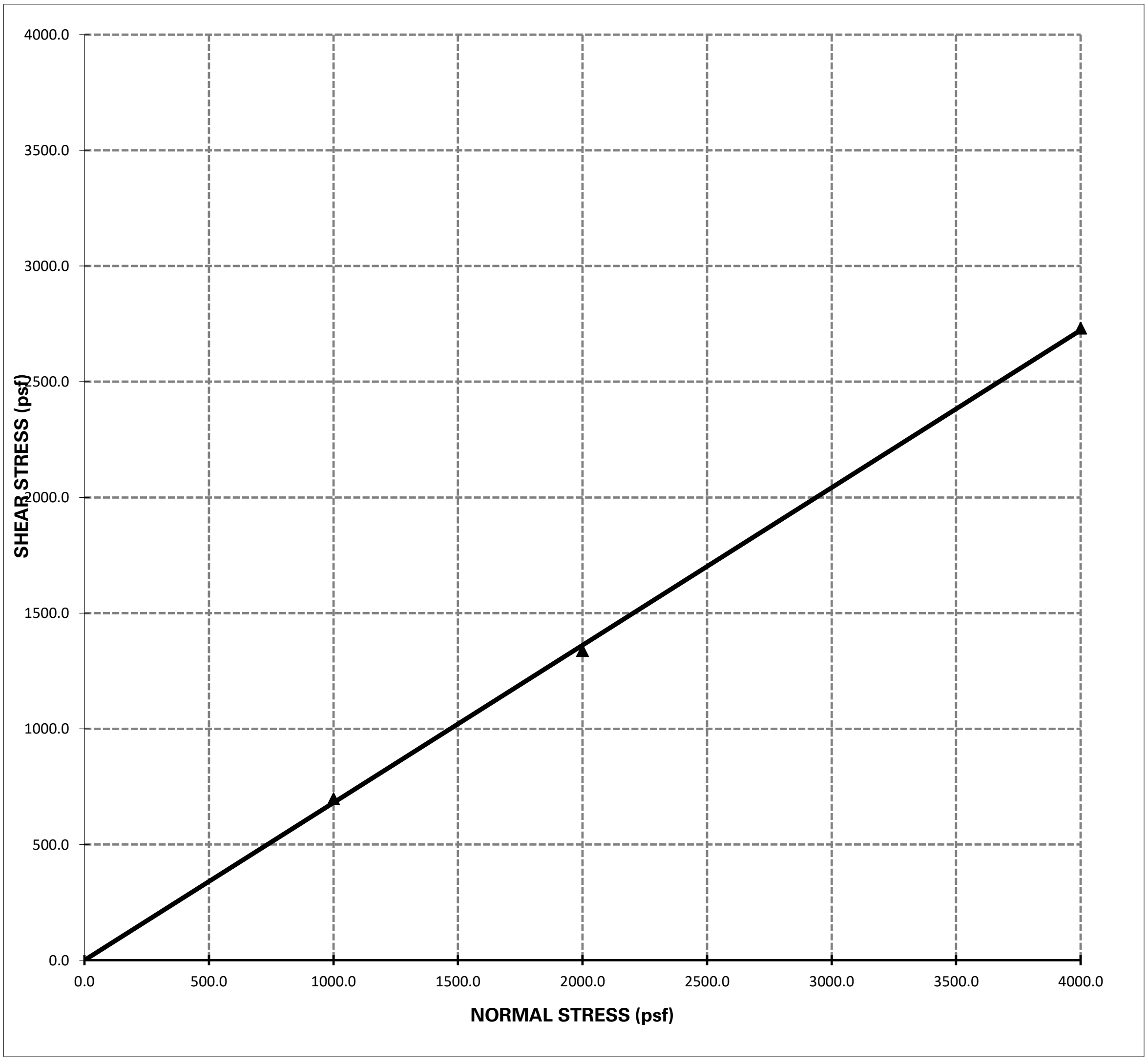
Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

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

3 - The tests were run at a shear rate of 0.035 in/min.

DIRECT SHEAR TEST

Project Name:	The True Life Comapanies	***Sample Location:***	T7 @ 2-3'
Project Number:	2855-CR	***Date Tested:***	9/15/2021



Shear Strength: $\Phi =$ **34°** **C = 0 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.

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	[illegible]	***Tested/ Checked By:***	[illegible]
Project Number:	[illegible]	***Date Tested:***	[illegible]
Project Location:	[illegible]	***Sample Source:***	[illegible]
		Sample Description:	

[illegible]

DENSITY DETERMINATION

A	[illegible]	[illegible]
B	[illegible]	[illegible]
C	[illegible]	**409.9**
D	[illegible]	**123.6**
E	[illegible]	**113.5**

SATURATION DETERMINATION

F	[illegible]	[illegible]
G	[illegible]	**2.70**
H	[illegible] °C, (pcf)	**62.4**
I	[illegible]	**49.6**

READINGS

DATE	TIME	READING	
[illegible]		[illegible]	[illegible]
[illegible]		[illegible]	[illegible]
[illegible]		[illegible]	[illegible]

FINAL MOISTURE

[illegible]	[illegible]
[illegible]	**16.3**

EXPANSION INDEX = 17

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	[illegible]
Project Number:	[illegible]
Project Location:	[illegible]
Tested/ Checked By:	[illegible]
Date Tested:	[illegible]
Sample Source:	[illegible]
Sample Description:	

[illegible]

DENSITY DETERMINATION

A	[illegible]	[illegible]
B	[illegible]	[illegible]
C	[illegible]	**407.9**
D	[illegible]	**123.0**
E	[illegible]	**112.9**

SATURATION DETERMINATION

F	[illegible]	[illegible]
G	[illegible]	**2.70**
H	[illegible] °C, (pcf)	**62.4**
I	[illegible]	**49.3**

READINGS			
DATE	TIME	READING	
[illegible]		[illegible]	Initial
[illegible]		[illegible]	[illegible]
[illegible]		[illegible]	[illegible]

FINAL MOISTURE	
[illegible]	[illegible]
[illegible]	**10.3**

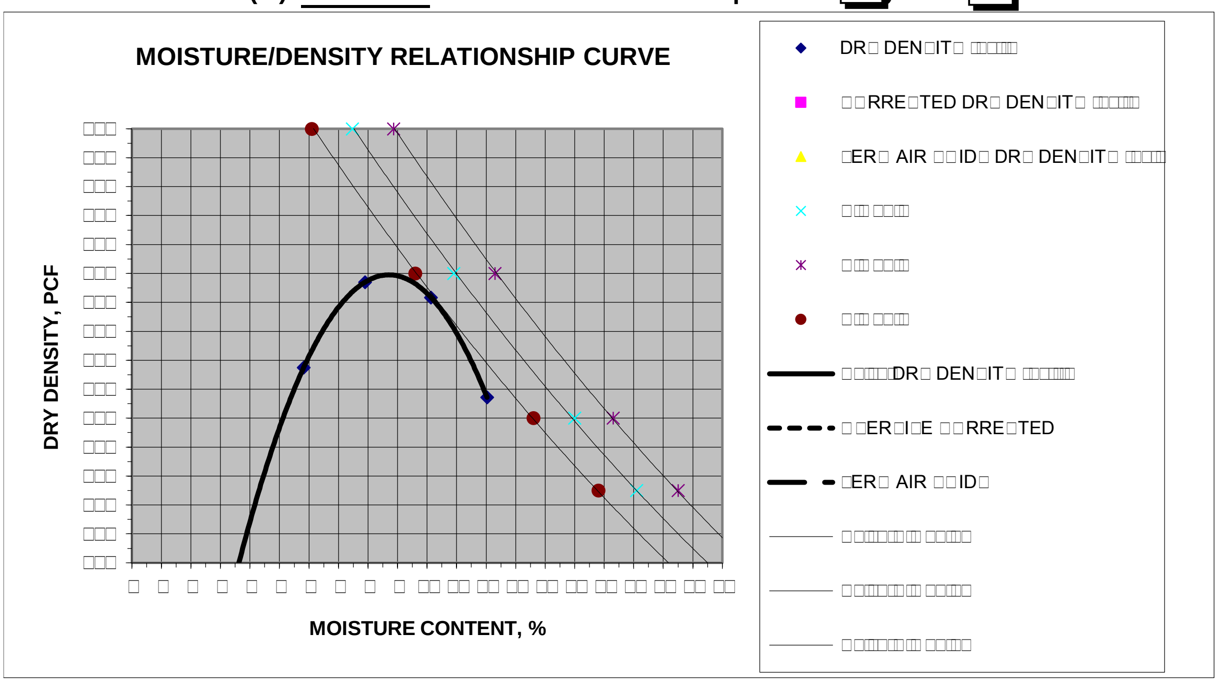
EXPANSION INDEX = 0

MOISTURE/DENSITY RELATIONSHIP

Client:	T□□ Tr□□ □i□□ □□□ □□ni□□	**Job No.:**	□□□□□□R
Project:	N□ Iri□A□□□□ □□i□□□□ A□□□	**Lab No.:**	□□r□n□
Location:	□ □□d□r□□□		
Material Type:	R□ddi□□ □r□□n □i□□ □□nd		
Material Supplier:	□		
Material Source:	□		
Sample Location:	T□ □ □□□□		
	□		
Sampled By:	DA	**Date Sampled:**	□□□□□□□□□
Received By:	R□	**Date Received:**	□□□□□□□□□
Tested By:	AD	**Date Tested:**	□□□□□□□□□
Reviewed By:	R□	**Date Reviewed:**	□□□□□□□□□

Test Procedure: A□TM D□□□□ **Method:** A

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



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	□□□□	**@ Optimum Moisture, %**	□□□
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	□ □r□□□□r□□in□d □n N□□□□
	□ □□nd □□□□in□ N□□□□R□□in□d □n N□□□□□□
	□ □i□□nd □□□□ □□□□in□ N□□□□□□

Atterberg Limits:

	□i□□id □i□i□□
	□□□□i□ □i□i□□
	□□□□i□i□ Ind□□□

Classification:

□ni□i□d □□i□ □□□□□i□□□i□n□

AA□□T□ □□i□ □□□□□i□□□i□n□

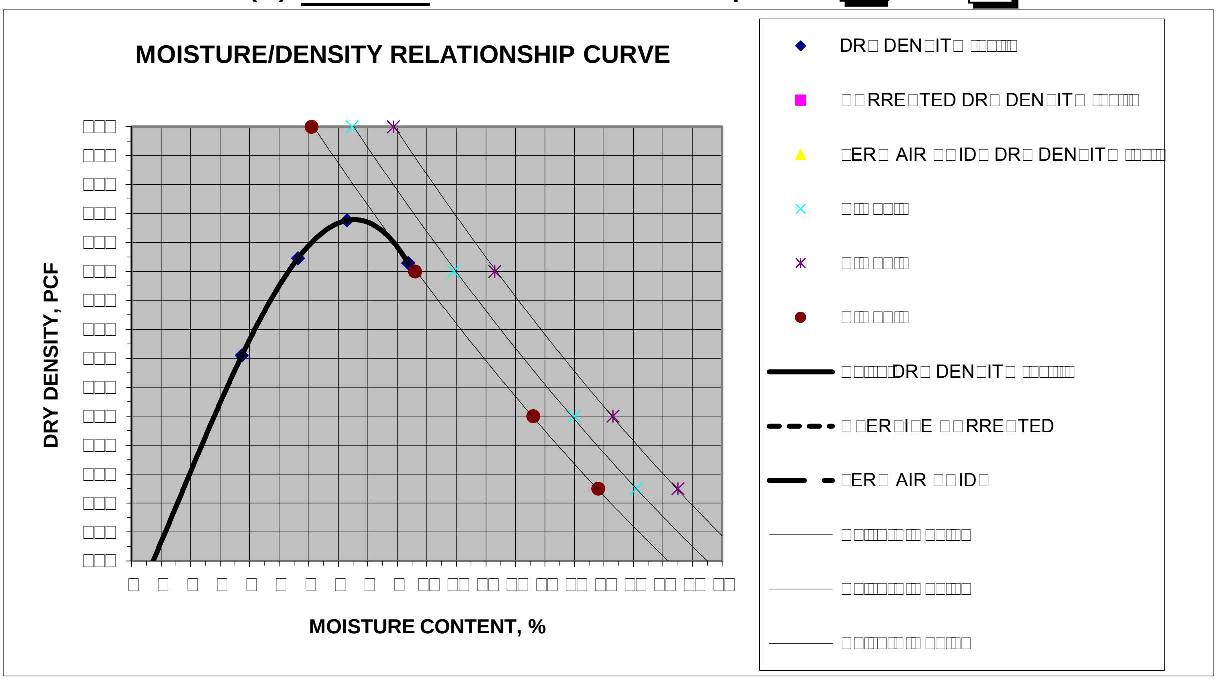
GEOTEK

MOISTURE/DENSITY RELATIONSHIP

Client:	T□□ Tr□□ □i□□ □□□ □□ni□□	**Job No.:**	□□□□□□R
Project:	N□ Iri□A□□□□ □□i□□□□A□□□	**Lab No.:**	□□r□n□
Location:	□ □□d□r□□□		
Material Type:	R□ddi□□ □r□□n □i□□ □□nd		
Material Supplier:	□		
Material Source:	□		
Sample Location:	T□ □ □□□□		
	□		
Sampled By:	DA	**Date Sampled:**	□□□□□□□□□
Received By:	R□	**Date Received:**	□□□□□□□□□
Tested By:	AD	**Date Tested:**	□□□□□□□□□
Reviewed By:	R□	**Date Reviewed:**	□□□□□□□□□

Test Procedure: A□TM D□□□□ **Method:** A

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



MOISTURE DENSITY RELATIONSHIP VALUES			
Maximum Dry Density, pcf	□□□□	**@ Optimum Moisture, %**	□□□
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	□ □r□□□□r□□in□d □n N□□□□
	□ □□nd □□□□in□ N□□□□R□□in□d □n N□□□□□□
	□ □i□□nd □□□□ □□□□in□ N□□□□□□

Atterberg Limits:

	□i□□id □i□ i□□□
	□□□□i□ □i□ i□□□
	□□□□i□i□ Ind□□□□

Classification:

□ni□i□d □□i□ □□□□□i□□i□□n□

AA□□T□ □□i□ □□□□□i□□i□□n□

Results Only Soil Testing for NW of Iris Ave Chicago Ave, Woodcrest

September 9, 2021

Prepared for:
Kyle McHargue
GeoTek, Inc.
1548 North Maple Street
Corona, CA 92280
kmchargue@geotekusa.com

Project X Job#: S210908G
Client Job or PO#: 2855-CR The True Life Companies

Respectfully Submitted,

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

REGISTERED PROFESSIONAL ENGINEER
EDUARDO HERNANDEZ
No. M37102
MECHANICAL
STATE OF CALIFORNIA

Soil Analysis Lab Results

Client: GeoTek, Inc.
Job Name: NW of Iris Ave Chicago Ave, Woodcrest
Client Job Number: 2855-CR The True Life Companies
Project X Job Number: S210908G
September 9, 2021

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM D4972	ASTM G200	ASTM D4658	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd	Minimum	**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^-	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
2855-CR T3	1-2	277.8	0.0278	135.9	0.0136	4,221	804	7.7	164	<0.01	404.9	9.1	0.07	229.0	1.2	40.7	148.7	4.8	2.9
2855-CR T7	2-3	46.7	0.0047	15.5	0.0015	9,380	3,685	8.3	116	0.01	35.0	2.6	ND	66.6	1.5	25.2	53.4	2.3	14.9

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

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

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

Project X Job Number: S210908G Geotek 2855-CR NW of Iris Ave 2 Full

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

Company Name:	Geotek USA	**Contact Name:**	Kyle McHargue — **Phone No:** 951-206-5443
Mailing Address:	1548 N. Maple St. Corona,CA 92880	**Contact Email:**	KmcHargue@geotekusa.com
Accounting Contact:		**Invoice Email:**	
Client Project No:	The True Life Companies	**Project Name:**	NW of Iris Ave Chicago Ave, Woodcrest
P.O. #:			

(Business Days) Turn Around Time:	3-5 Day Standard	3 Day Guarantee 50% mark-up	24 Hr RUSH 100% mark-up
	X		

Results By: ☐ Phone ☐ Fax ☒ Email

Date & Received by: [signature] 09/08/21

Special Instructions:

ANALYSIS REQUESTED (Please circle)

Methods: Caltrans CTM643, Caltrans CTM643, Caltrans CTM417, Caltrans CTM422; AASHTO T288, AASHTO T289, AASHTO T290, AASHTO T291, SM 2580B, SM 4500-NH3, SM 4500-NO3; Default Method: ASTM G187, ASTM G51, ASTM D4327, ASTM D4327, ASTM G200, SM 4500-S2, ASTM D6919, ASTM D4327, ASTM D4327, ASTM D4327, ASTM D6919, ASTM D6919, ASTM D6919, ASTM D6919, ASTM D6919, SM 2320B, ASTM D2216, SM 2520B

Geo Quad: Soil Resistivity, pH, Sulfate, Chloride. Full Corrosion Series. Reports: *Req. Min. 3 Samples, site map, and groundwater info

	SAMPLE ID - BORE #	DESCRIPTION	DEPTH (ft)	DATE COLLECTED	Soil Resistivity	pH	Sulfate	Chloride	Redox Potential	Sulfide	Ammonia	Nitrate	Flouride	Phosphate	Lithium	Sodium	Potassium	Magnesium	Calcium	BiCarbonate	Full Corrosion Series	Soil Corrosivity Evaluation Report	Water Corrosivity Mini Report	Moisture Content	Total Alkalinity	Thermal Resistivity	Metallurgical Analysis	Langelier Index	Puckorius Index	XRF Elemental Analysis	Water Hardness
59 1	2855-CR	T3	1-2	BULK																	\										
60 2	2855-CR	T7	2-3	BULK																	\										
3																															
4																															
5																															
6																															
7																															
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APPENDIX D

SEISMIC REFRACTION SURVEY RESULTS BY GEOTEK

Updated Geotechnical Evaluation

Proposed Single-Family Residential Development

Woodcrest, Riverside County, California

Project No. 2855-CR

GEOTEK

Subsurface Surveys & Associates, Inc.
2075 Corte Del Nogal, Suite W   Carlsbad, CA 92011
Phone: (760) 476-0492   Fax: (760) 476-0493

GeoTek. Inc.
1548 North Maple Street
Corona, CA 92880

August 23, 2021

Attn: Kyle McHargue

Re: Seismic Survey Summary Report
Woodcrest Project, Riverside County

This report covers the results of a seismic refraction survey performed at the Woodcrest Project Site, located northwest of the intersection of Iris Ave and Chicago Ave, in Riverside County, California. The purpose of the survey was to measure the compressional wave velocity of bedrock for rippability assessment and to provide cross sections showing thickness of the weathered zone and depth to the unweathered interface. This should be useful for planning cuts, grading, and other earthwork.

The field work was conducted on August 12, 2021. Seven seismic lines were recorded at locations selected by GeoTek. A survey location map is provided on Figure 1 that shows the position and orientation of the traverses.

GEOLOGIC SETTING

A review of the "Geologic Map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California ", (USGS Open File Report 2006-1217, 2006) indicates the survey area is underlain by Val Verde tonalite (Kvt) of Cretaceous age. This rock unit is described as relatively homogeneous and massive to well foliated.

DATA ACQUISITION AND FIELD METHODS

Seismic refraction data were recorded with a Bison 9024 signal enhancement seismograph and 28 Hz geophones. The standard spread layout used 24 geophones with a 7-foot spacing which provided a line length of 168 feet. Each spread used five shotpoints, one off each end (5-foot offset) and three within the interior of the spread. Depth of investigation was approximately 40-45 feet.

Compressional wave energy was created by sledge hammer impacts on a metal plate. The signal enhancement feature of the seismograph allowed returns from repeated hits to be stacked, thus improving the signal. Each record was stored digitally on an internal hard disk and printed copies of each seismogram were made in the field on thermal paper. Example field records are shown on Figure 2.

Relative elevations of all shotpoints and geophones were determined by differential leveling with a hand level. Geophone 1 (distance = 0 ft.) at the beginning of each line was assigned a elevation value of 0.0 feet. This datum point served as the reference elevation for all other measurements.

Labeled wooden stakes were placed at the beginning and end of each spread and a Garmin handheld GPS receiver was used to record the latitude and longitude coordinates of the stakes. The coordinates were used to make the location map shown on Figure 1.

SEISMIC REFRACTION METHOD

The refraction method involves measuring the total time for compressional waves to travel from a shotpoint through the subsurface to a set of geophones placed linearly along the ground. Based on Snell's Law, when two or more layers are present with increasingly higher acoustic velocity, waves become critically refracted across the layer boundaries and begin traveling at the speed of the underlying layer. The advancing waves then generate new wavefronts back to the ground surface. The first surge of energy hitting the geophone is termed the "first arrival" and is depicted on the seismogram as a high angle deflection along each trace.

Recognition of direct wave arrivals (non-refracted) verses refracted waves is a key element of refraction interpretation. To assist this process, the first arrival times measured from the seismic records are plotted on graphs of time verses distance called Time-Distance graphs. An example T-D graph from Line 1 is shown on Figure 3. Based on changes in slope on the graphs, a preliminary layer number (i.e. 1, 2, 3) is assigned to each segment of the graph. The layer assignments together with time, distance and elevation data are input to a computer for additional processing.

DATA REDUCTION AND VELOCITY DETERMINATION

Processing and interpretation of this data set was accomplished with “SIPT2", an interactive inversion modeling program developed by James Scott for the U.S. Bureau of Mines. The inversion algorithm uses the delay time method to construct a first pass depth model. The model is then adjusted by an iterative ray tracing process that attempts to minimize the discrepancies between the total travel times calculated along ray paths and the observed travel times measured in the field.

This program calculates refractor velocity in two ways. First, apparent velocities from each shot are determined by the inverse slope of a best fit (least squares) line through datum-corrected travel times. True velocity is estimated from the apparent velocities by using the following equation:

$$Vt = 2(Vu \times Vd)/(Vu + Vd)$$

where Vt = true velocity
Vu = apparent up dip velocity
Vd = apparent down dip velocity

The second method uses a more sophisticated set of equations (the Hobson-Overton formula) developed by the Canadian Geological Survey. The final velocity assigned to the refractor is a weighted average of the results of the two methods. The weighting is based on the number of arrival times used in the computations.

SUMMARY OF RESULTS

Results from refraction analysis show a three layer solution beneath all lines (see Figures 5-11). Velocities posted on the cross sections represent averages as described in the previous section. Therefore, minor localized changes in velocity may occur along any profile. A description of the layers is provided below and a cross section summary is shown in Table 1.

Layer 1 - is mostly colluvium with rock fragments and alluvium in low lying areas. Thickness is generally less than 10 feet.

Layer 2 - is interpreted to be weathered bedrock. The velocity range is 3027-4408 ft/sec. Based on the Cat rippability chart shown on Figure 4, this range is considered easily rippable with a D-9 Cat.

Layer 3 - represents slightly weathered to unweathered bedrock.

Table 1. Cross Section Summary Velocity in (ft/sec), Depth in (feet)

Line	Velocity Layer 1	Velocity Layer 2	Velocity Layer 3	Depth Range Layer 2/3 Interface
1	1370	3199	8634	20 - 29
2	1490	4408	12494	5 - 26
3	1699	4345	14636	5 - 13
4	1334	3027	8423	29 - 40
5	1345	3273	10696	13 - 22
6	1471	4018	7011	26 - 37
7	1424	4265	8568	20 - 28

Weathering tends to be gradational for most granitic rock types and usually produces a gradual increase in velocity with depth. Consequently, variation of ± 10% from the posted averages may occur between the top and bottom of Layer 2.

Figure 4 presents a rippability chart (courtesy of Caterpillar Tractor Co.) for a D9R Ripper. Bar graphs show the relationship between seismic compressional wave velocity and ripper performance for various rock types in three categories: rippable, marginal, and non-rippable. Granitic rocks are listed as marginally rippable at approximately 6800 ft/sec and are considered non-rippable above 8000 ft/sec. This chart is provided only as a guide and should not be considered absolute. Other geologic factors that may influence bedrock rippability at this site include changes in composition of the bedrock and the presence of fractures and joints.

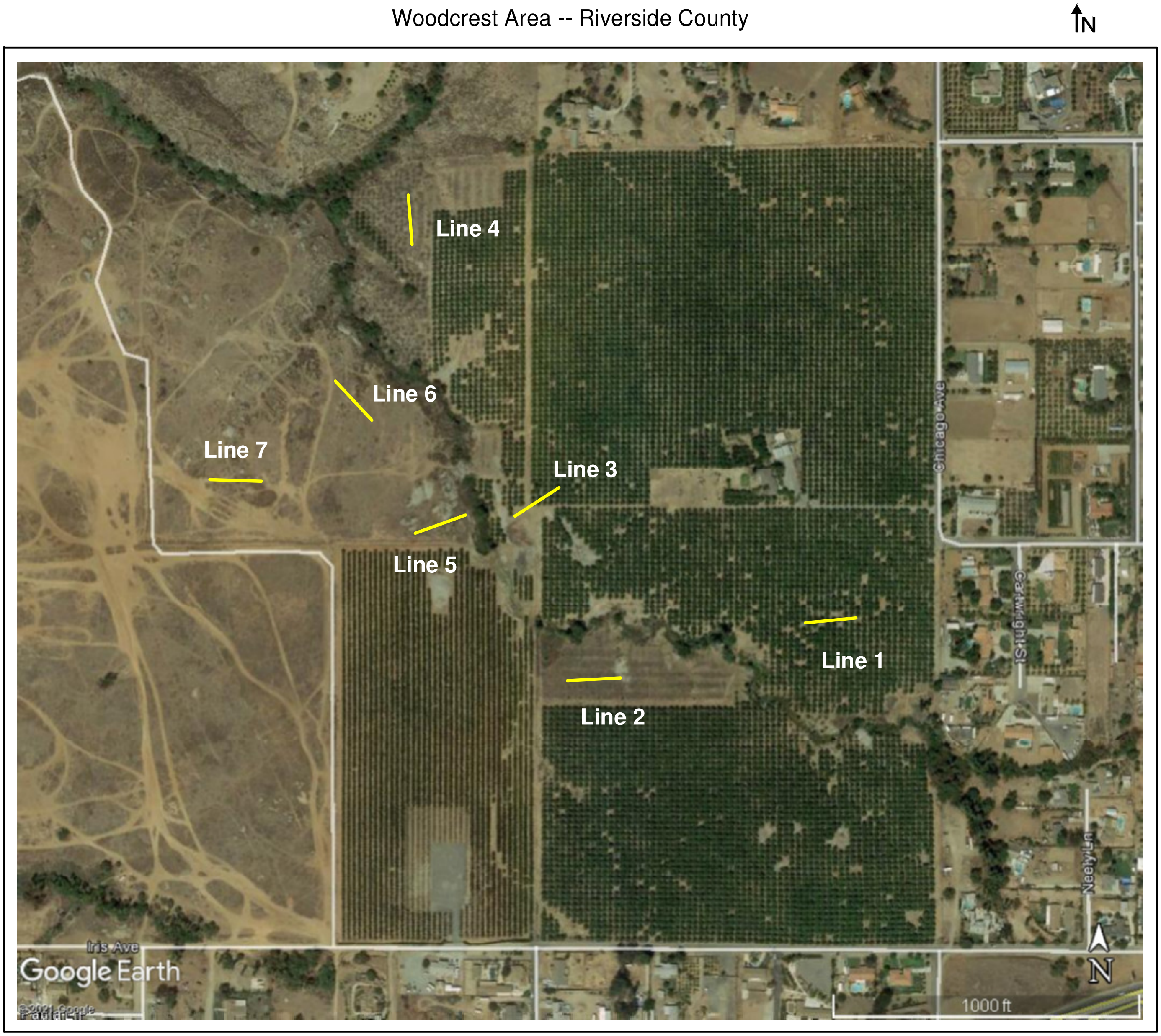
All data acquired during this survey is considered confidential and is available for review by your staff at any time. We appreciate the opportunity to participate in this project.

Please call if there are any questions.

Phillip A. Walen
Senior Geophysicist
CA Registration No. GP917

Seismic Survey Location Map

Woodcrest Area -- Riverside County



All seismic lines are
168 feet in length.

Figure 1

Example Seismic Field Records

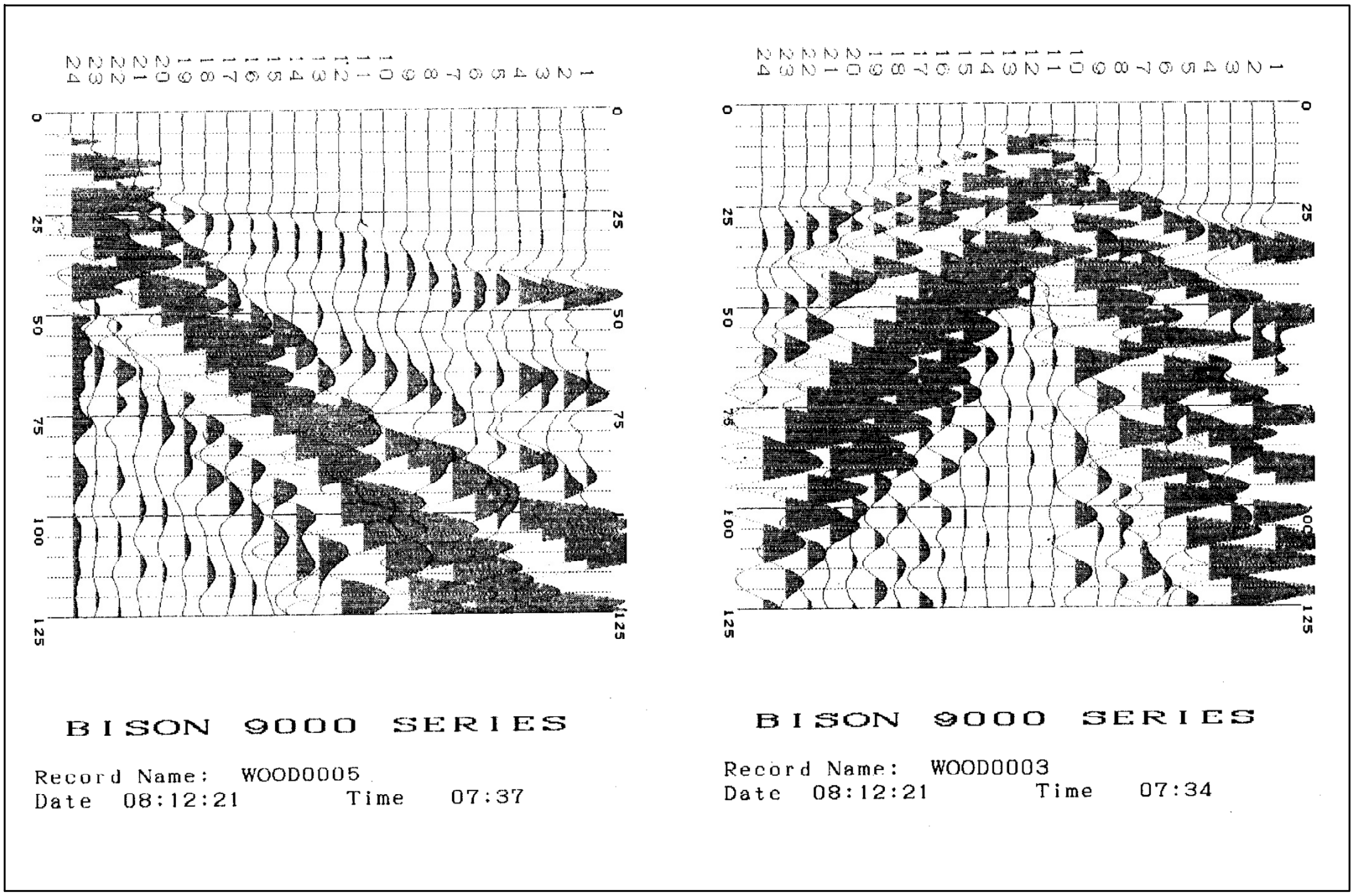
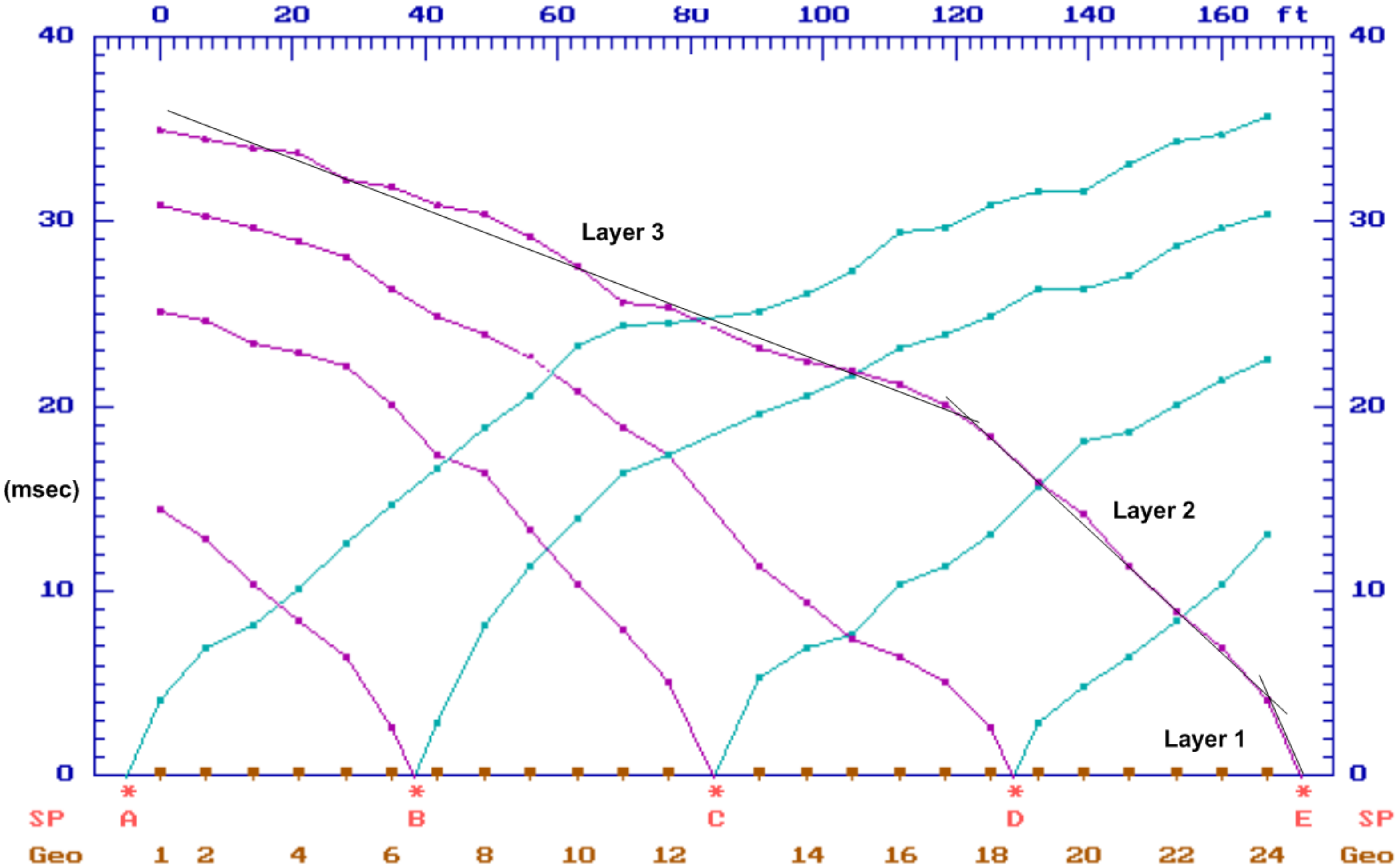


Figure 2

Example Time-Distance Graph -- Line 1



Seismic Refraction Survey 08/12/2021	Woodcrest Project Site
For Geotek Inc, Project No. 2855-CR	Riverside County, California **Figure 3**

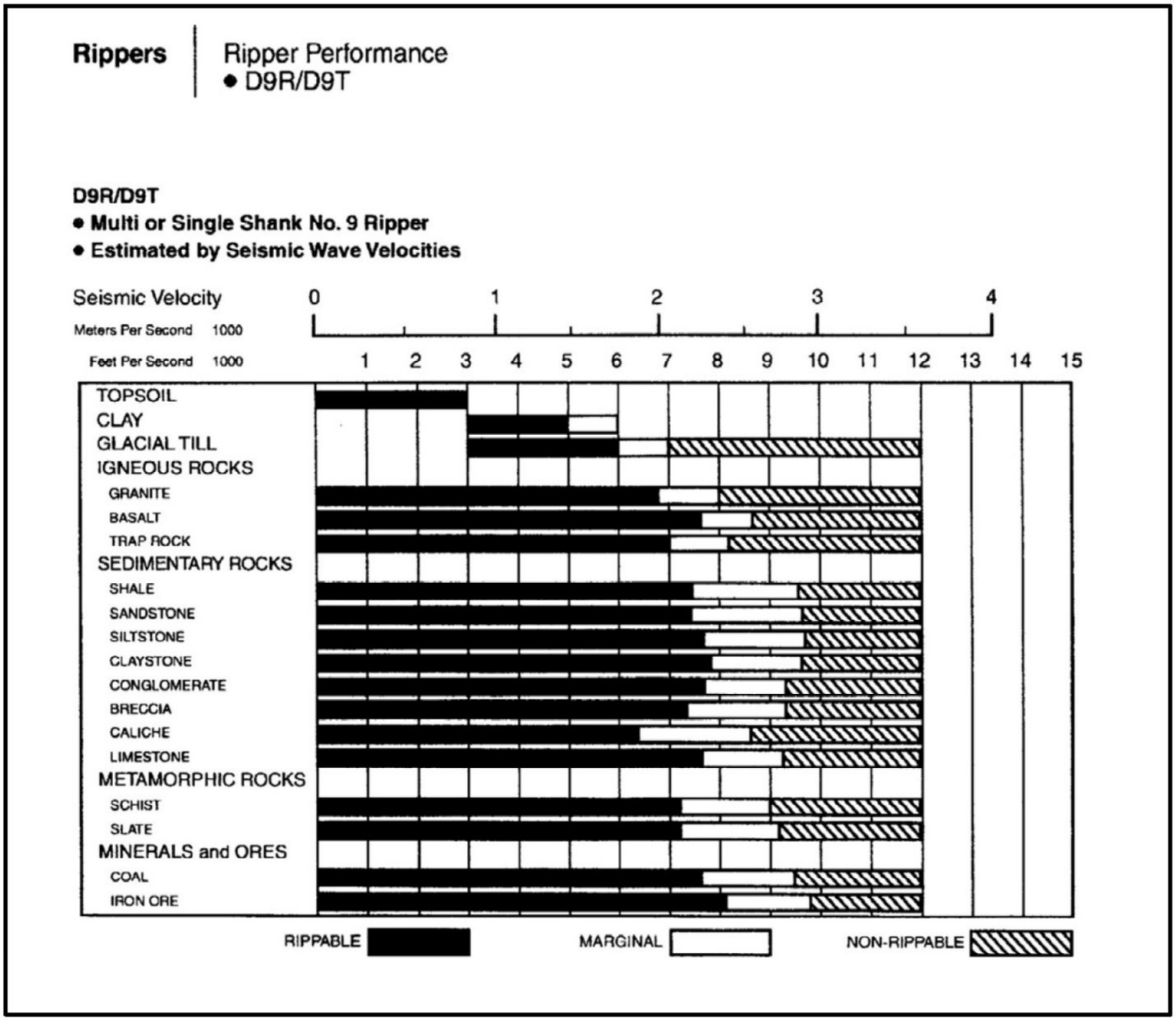
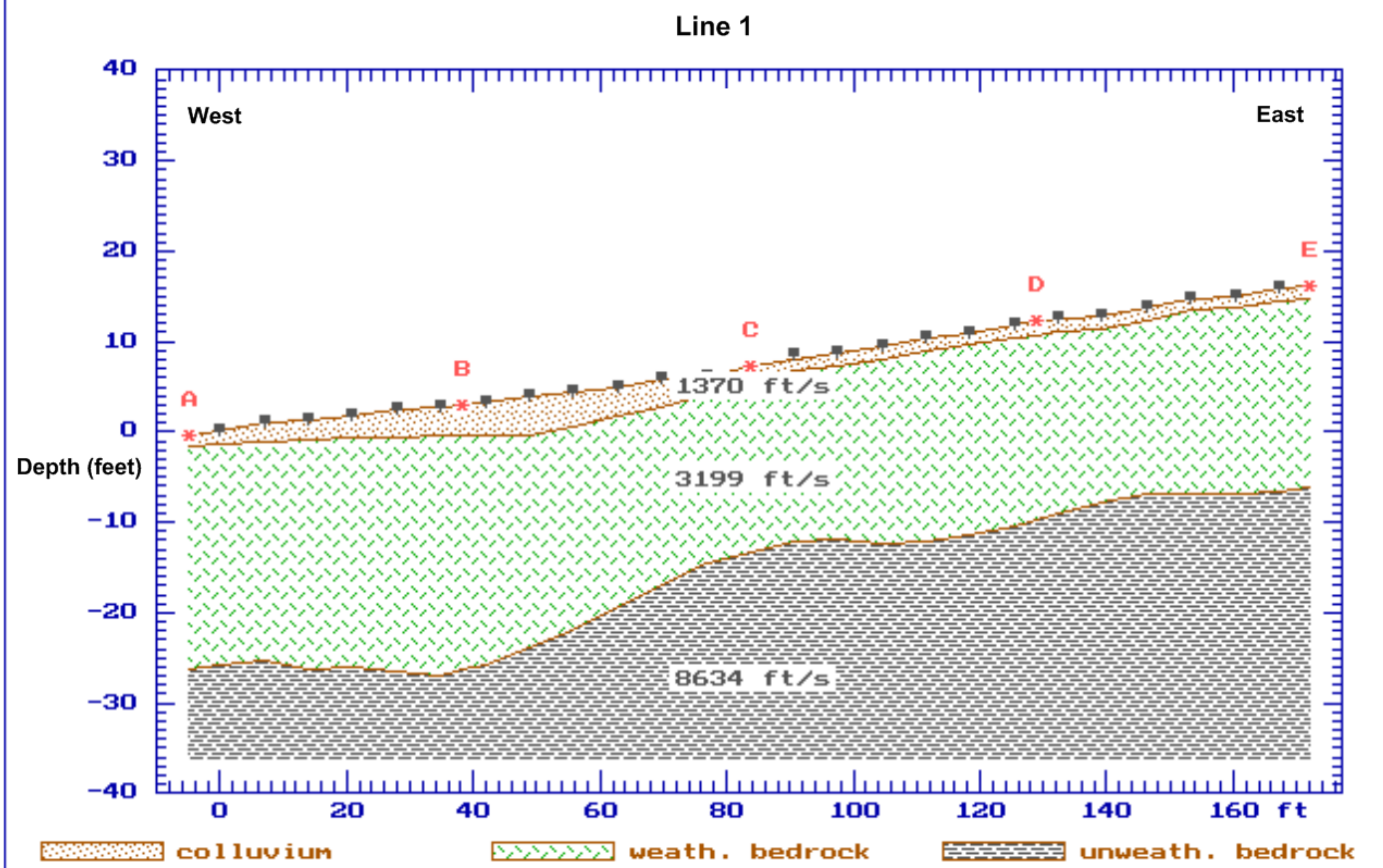
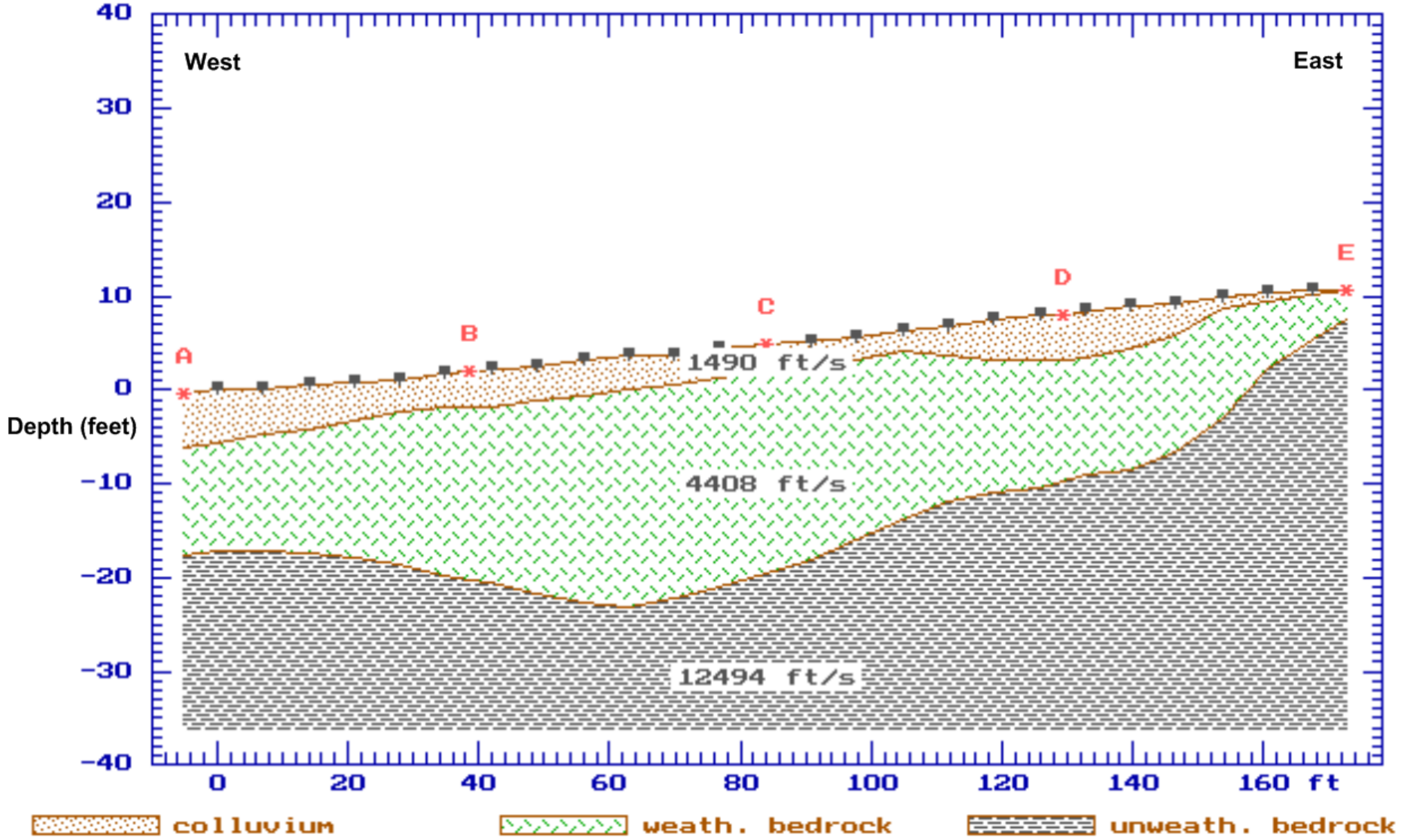

Rippers
Ripper Performance
• D9R/D9T
D9R/D9T
• Multi or Single Shank No. 9 Ripper
• Estimated by Seismic Wave Velocities
Seismic Velocity
Meters Per Second 1000
0 1 2 3 4
Feet Per Second 1000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TOPSOIL
CLAY
GLACIAL TILL
IGNEOUS ROCKS
GRANITE
BASALT
TRAP ROCK
SEDIMENTARY ROCKS
SHALE
SANDSTONE
SILTSTONE
CLAYSTONE
CONGLOMERATE
BRECCIA
CALICHE
LIMESTONE
METAMORPHIC ROCKS
SCHIST
SLATE
MINERALS and ORES
COAL
IRON ORE
RIPPABLE
MARGINAL
NON-RIPPABLE

Figure 4



Seismic Refraction Survey 08/12/2021	Woodcrest Project Site
For Geotek Inc, Project No. 2855-CR	Riverside County, California **Figure 5**

Line 2



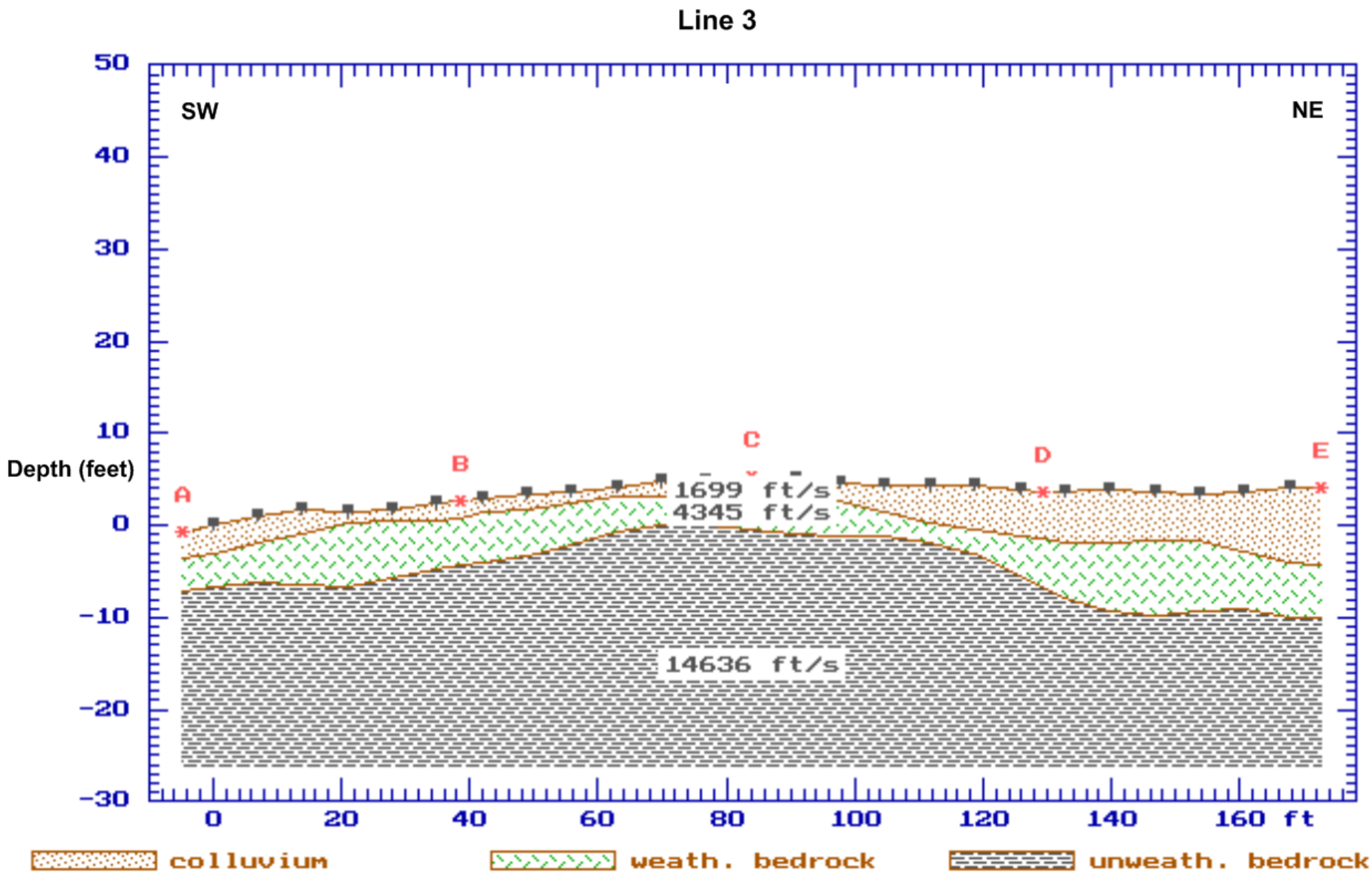
Seismic Refraction Survey 08/12/2021

For Geotek Inc, Project No. 2855-CR

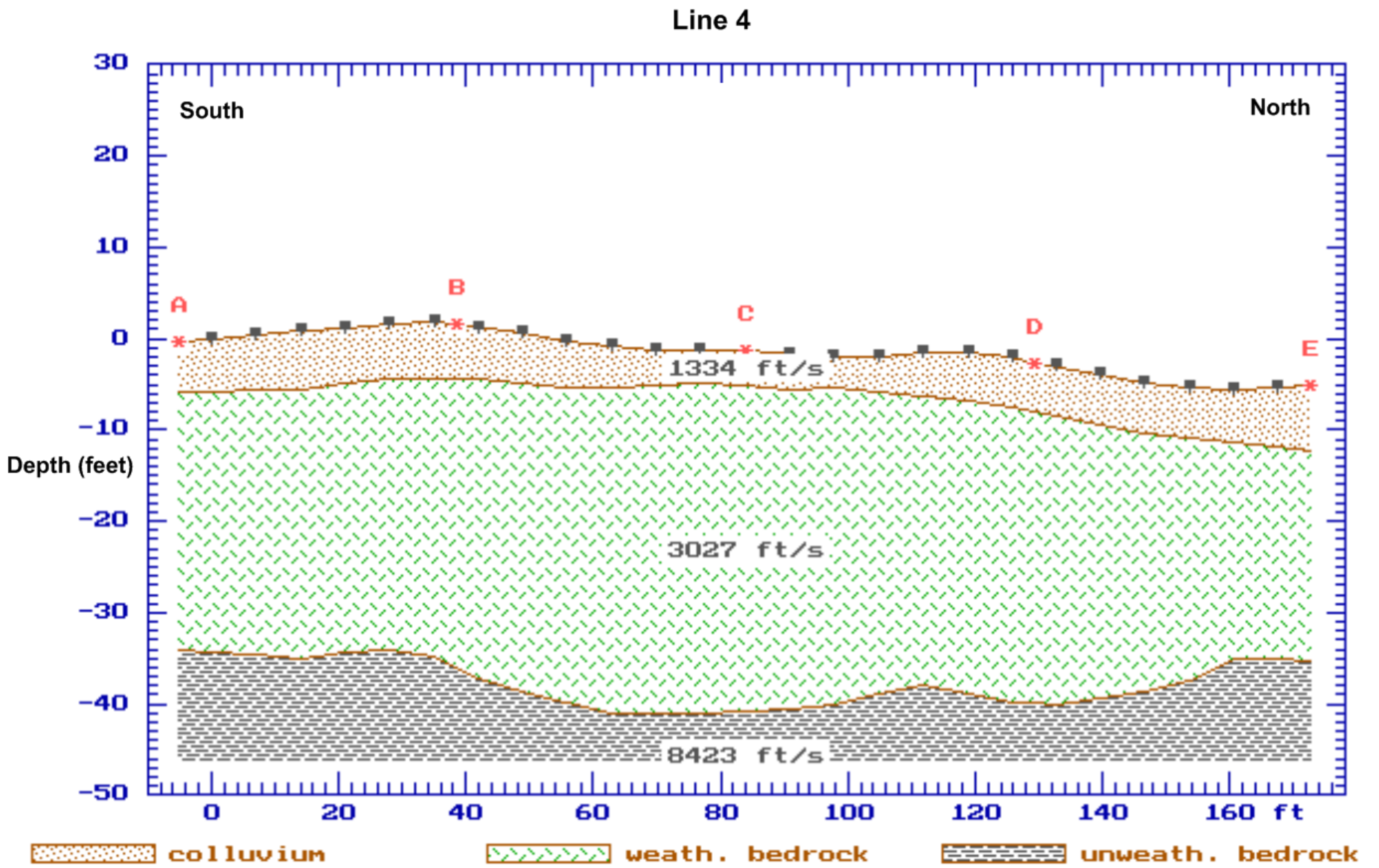
Woodcrest Project Site

Riverside County, California

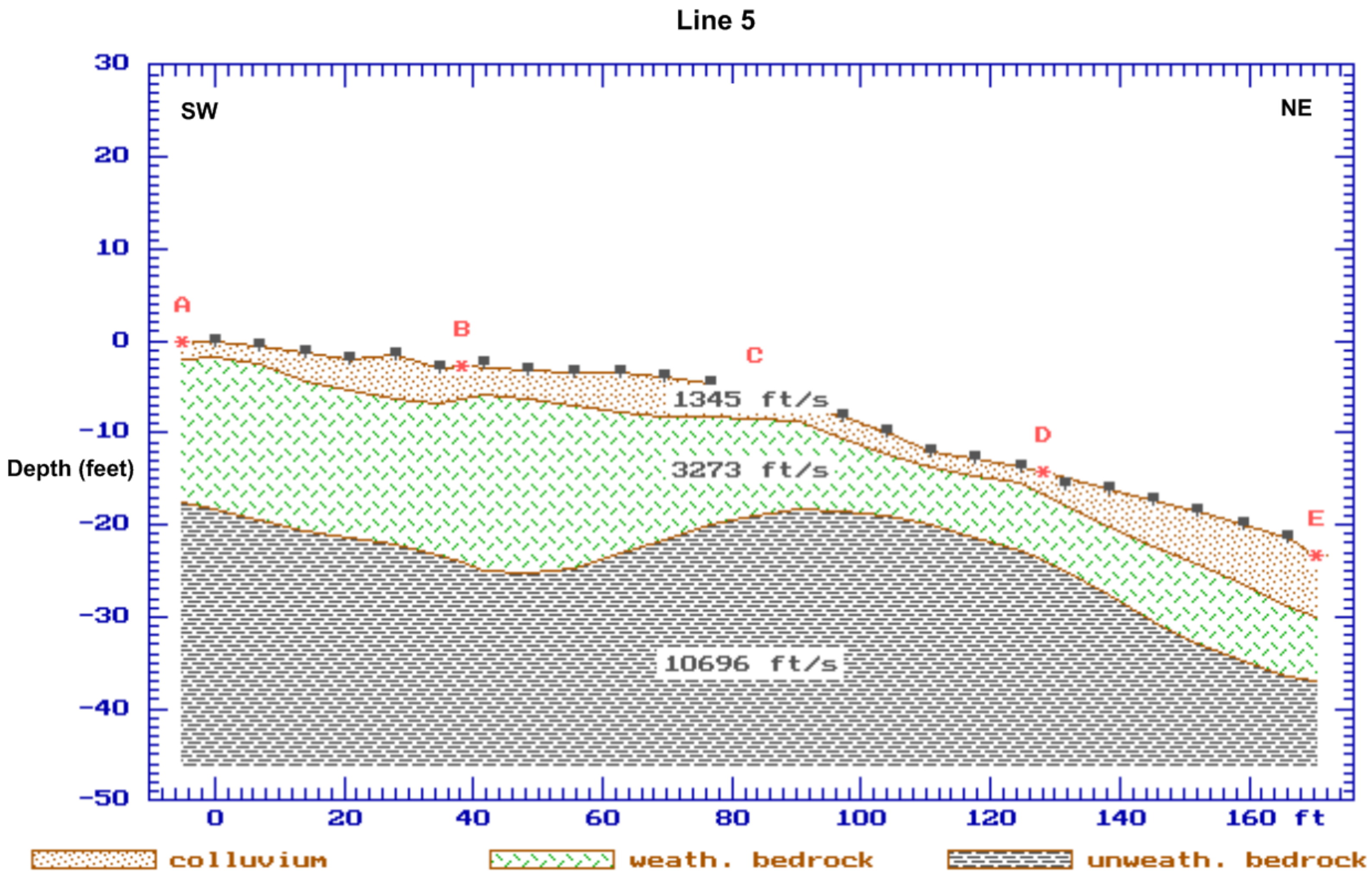
Figure 6



Seismic Refraction Survey 08/12/2021	Woodcrest Project Site
For Geotek Inc, Project No. 2855-CR	Riverside County, California Figure 7

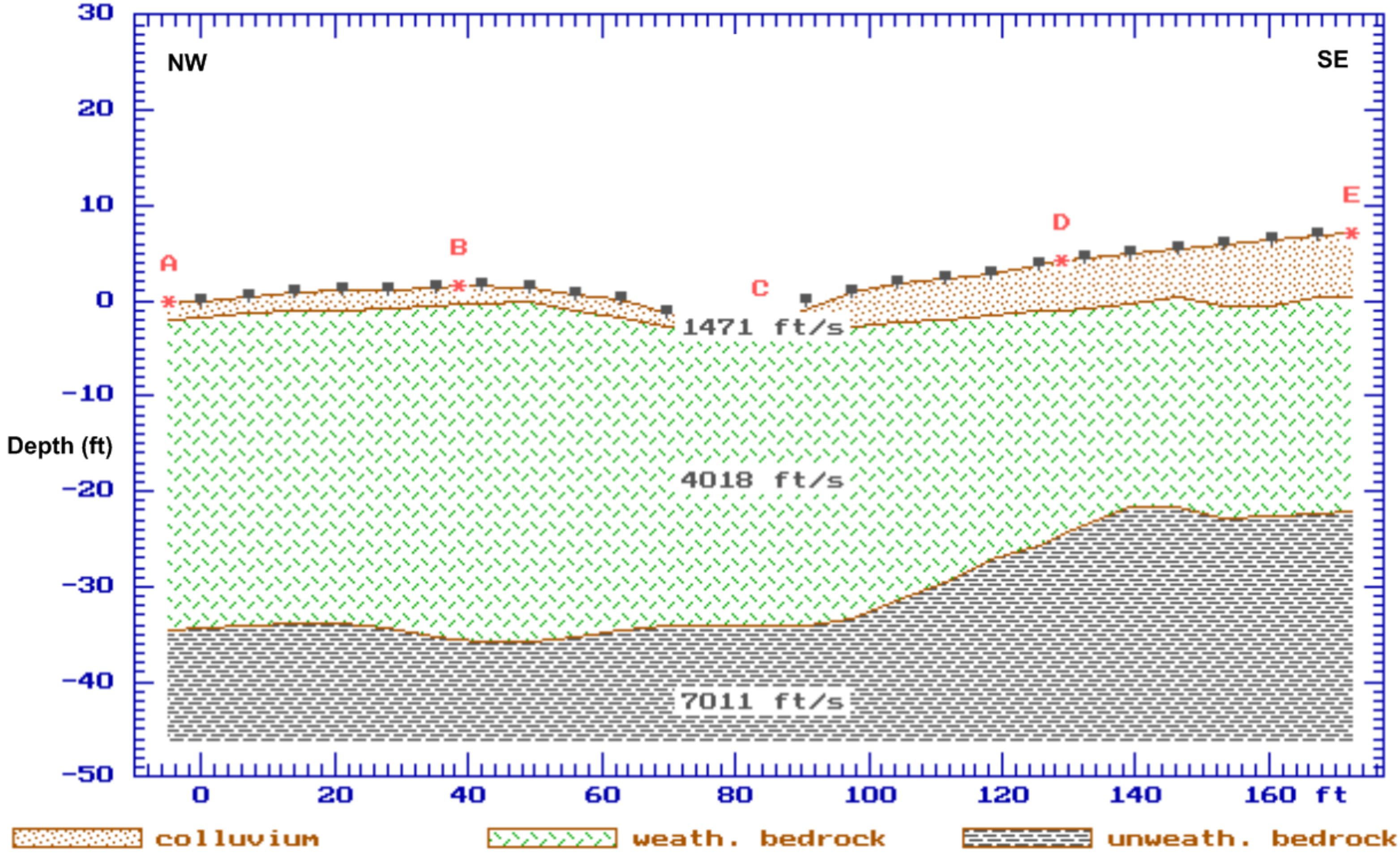


Seismic Refraction Survey 08/12/2021	Woodcrest Project Site
For Geotek Inc, Project No. 2855-CR	Riverside County, California **Figure 8**



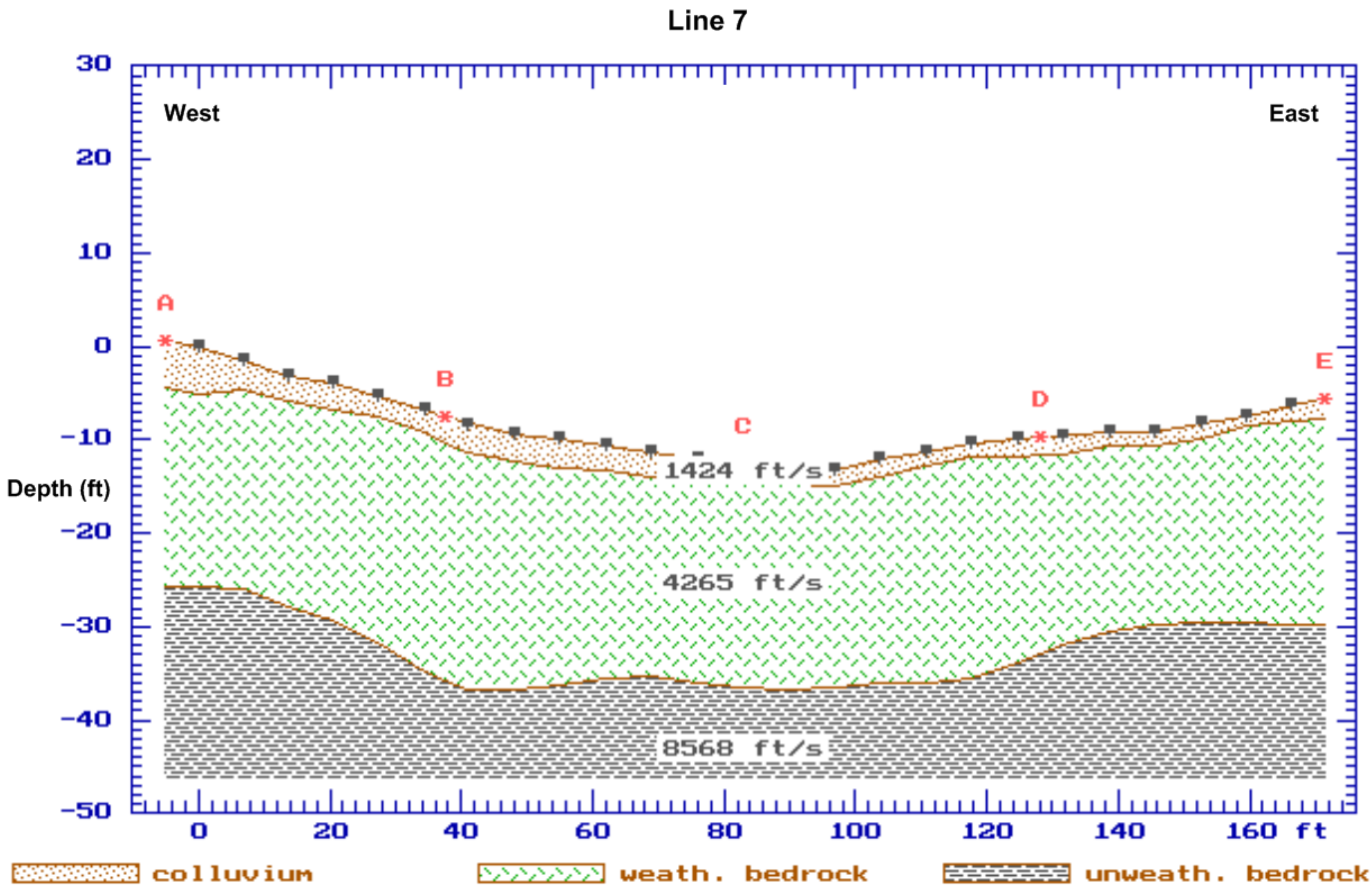
Seismic Refraction Survey 08/12/2021	Woodcrest Project Site
For Geotek Inc, Project No. 2855-CR	Riverside County, California **Figure 9**

Line 6



Seismic Refraction Survey 08/12/2021	Woodcrest Project Site
For Geotek Inc, Project No. 2855-CR	Riverside County, California

Figure 10



Seismic Refraction Survey 08/12/2021	Woodcrest Project Site
For Geotek Inc, Project No. 2855-CR	Riverside County, California Figure 11

APPENDIX E

GENERAL GRADING GUIDELINES

Updated Geotechnical Evaluation
Proposed Single-Family Residential Development
Woodcrest, Riverside County, California
Project No. 2855-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 (2019) and the guidelines presented below.

Preconstruction Meeting

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

Grading Observation and Testing

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

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

Site Clearing

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

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of topsoil, 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.

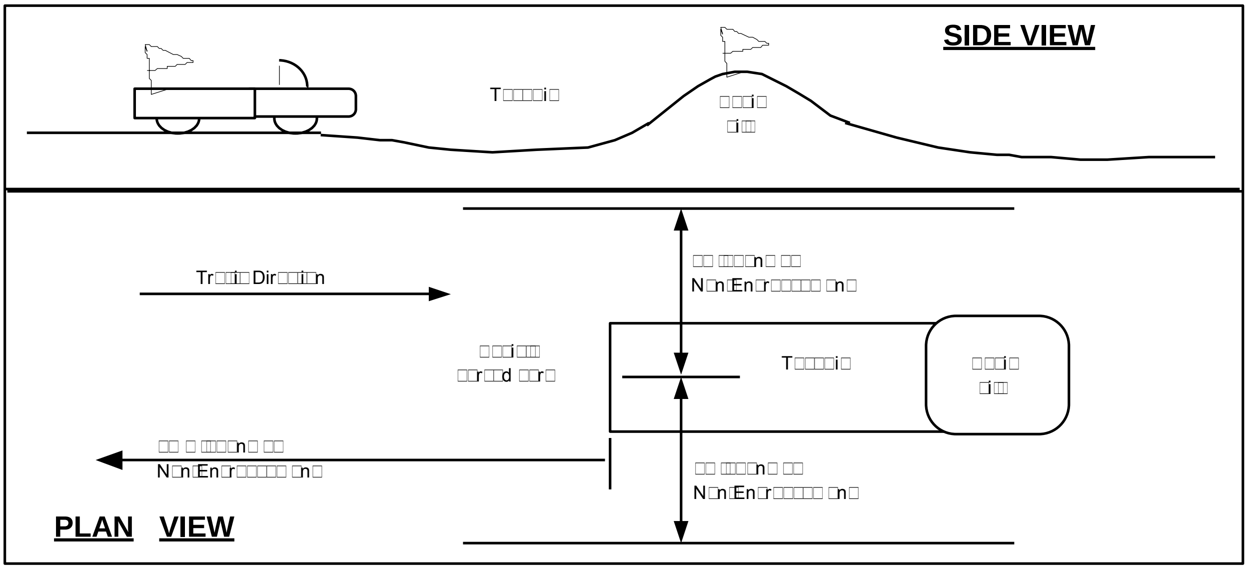
Test Pits Location, Orientation and Clearance

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

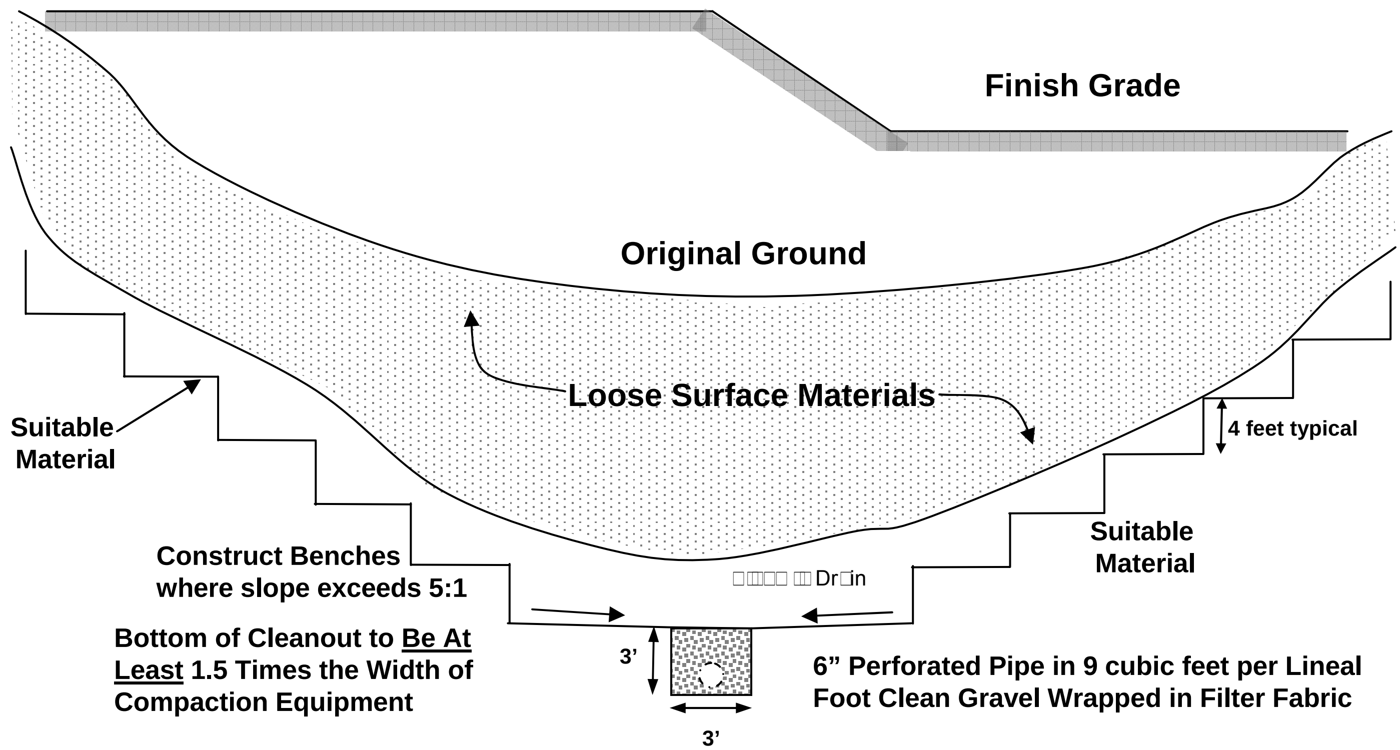
In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by 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.

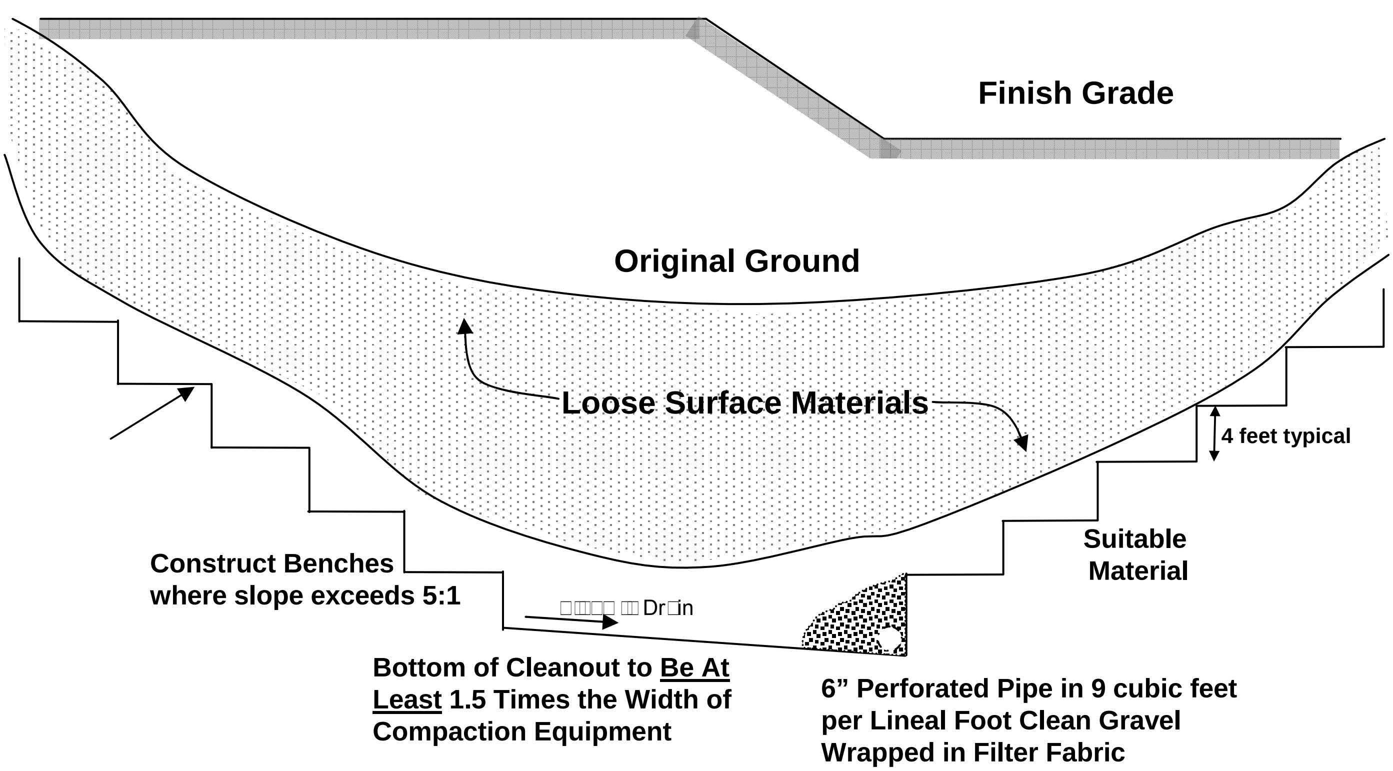
In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and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

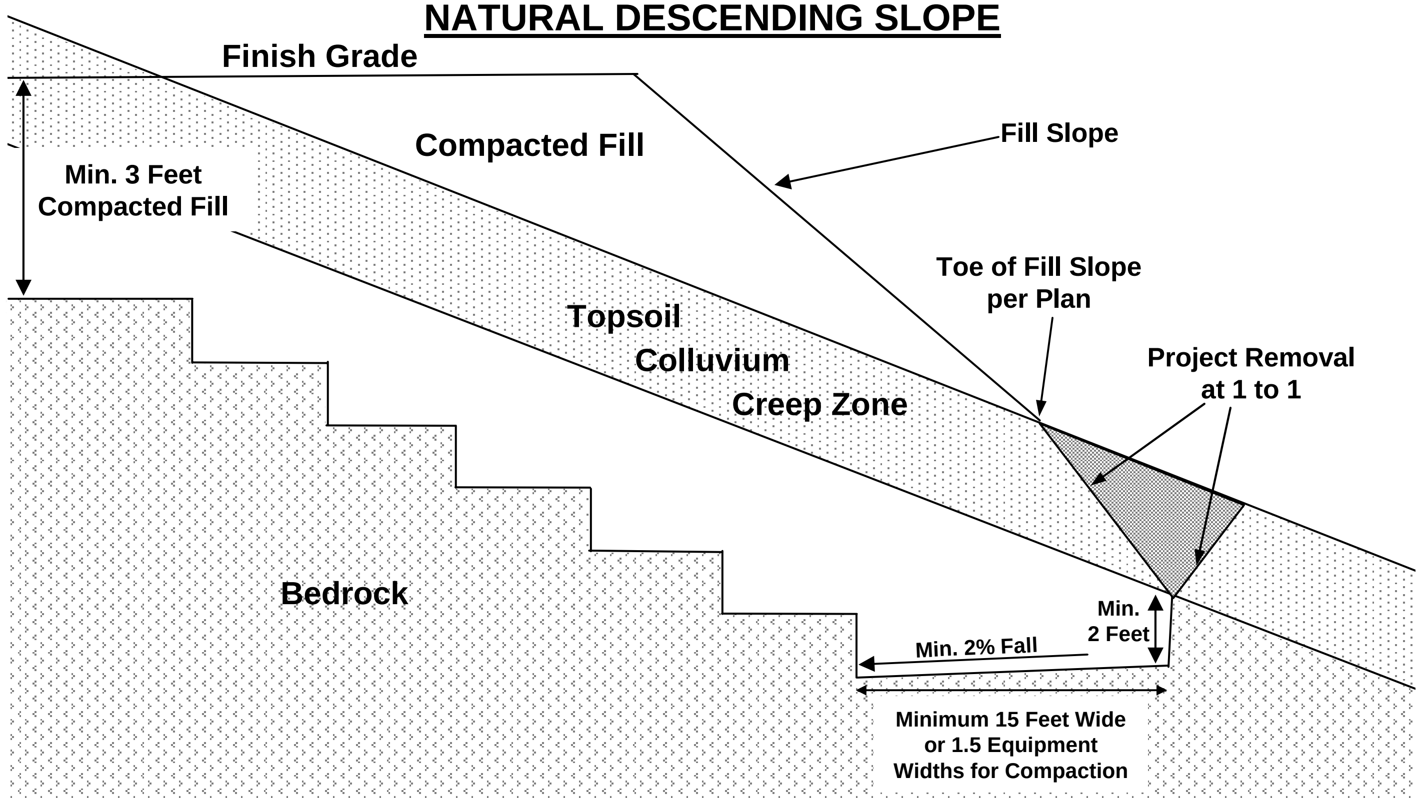
ALTERNATES



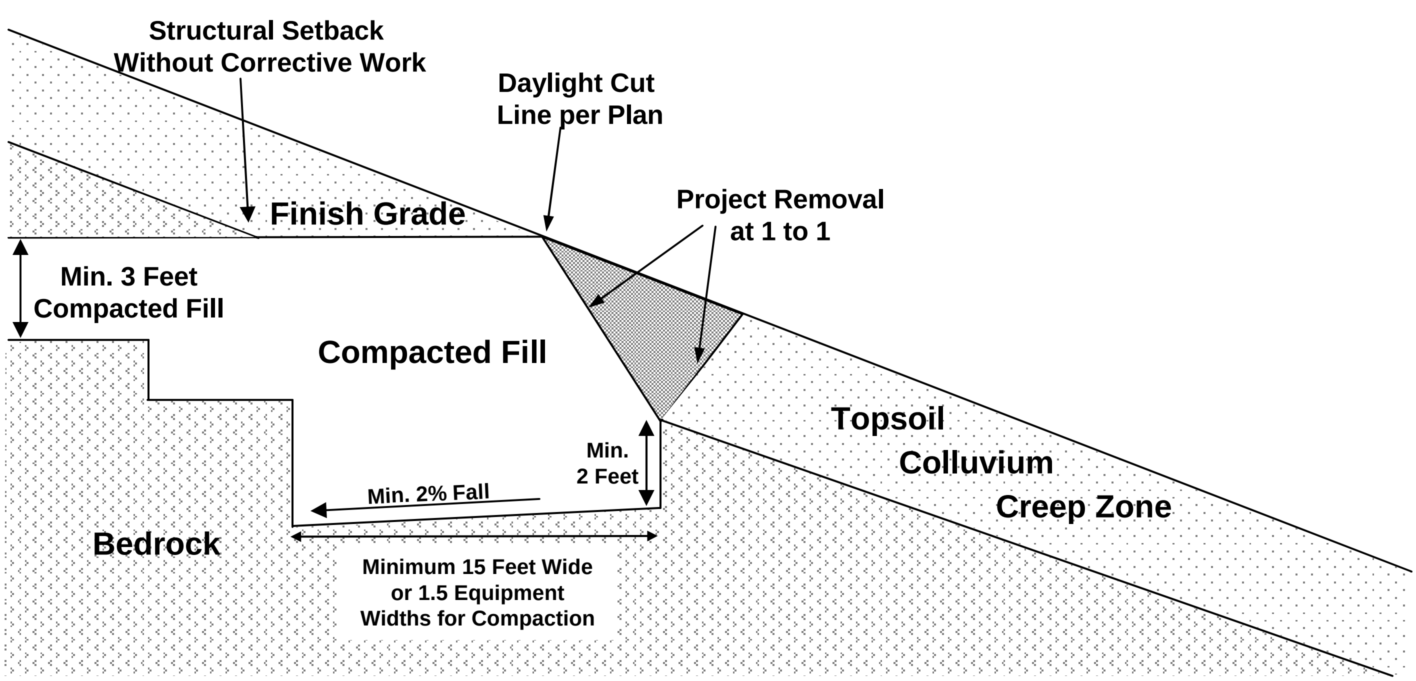


GEOTEK	1548 North Maple Street Corona, California 92880	TYPICAL CANYON CLEANOUT	STANDARD GRADING GUIDELINES PLATE G-1

TYPICAL FILL SLOPE OVER NATURAL DESCENDING SLOPE



DAYLIGHT CUT AREA OVER NATURAL DESCENDING SLOPE



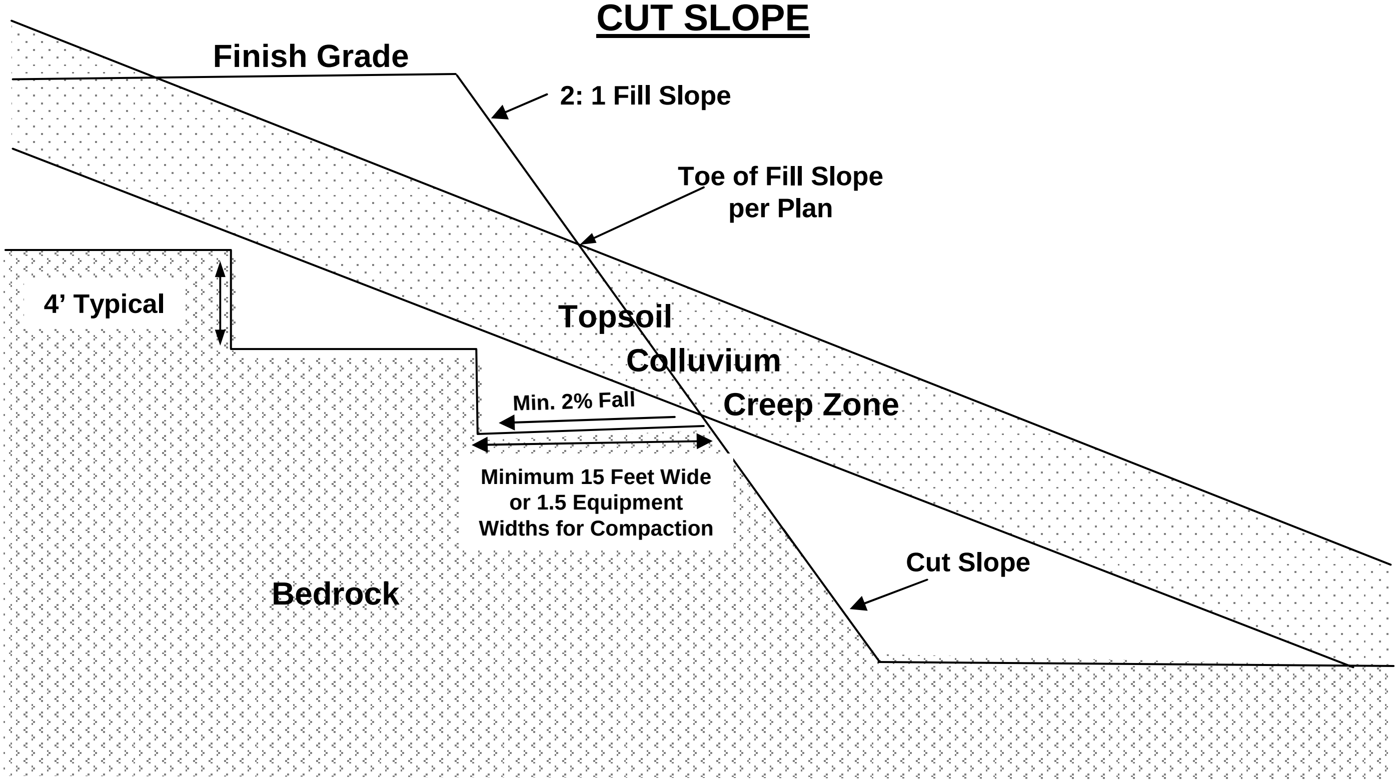
GEOTEK
1548 North Maple Street
Corona, California 92880

TREATMENT ABOVE NATURAL SLOPES

STANDARD GRADING GUIDELINES

PLATE G-2

TYPICAL FILL SLOPE OVER CUT SLOPE



TYPICAL FILL SLOPE

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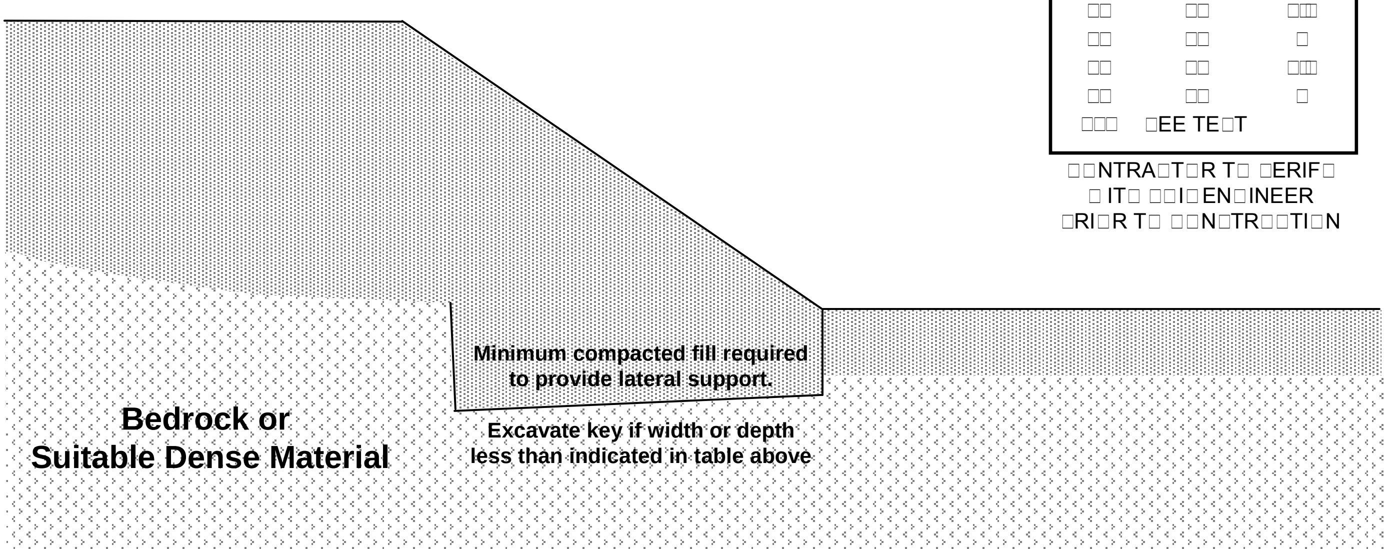
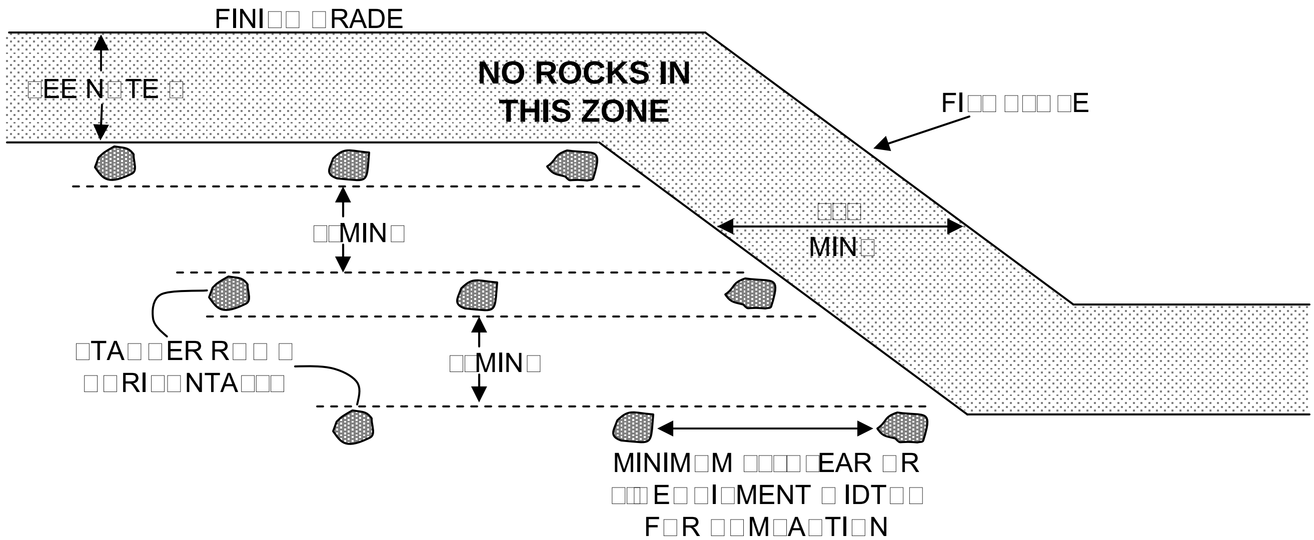
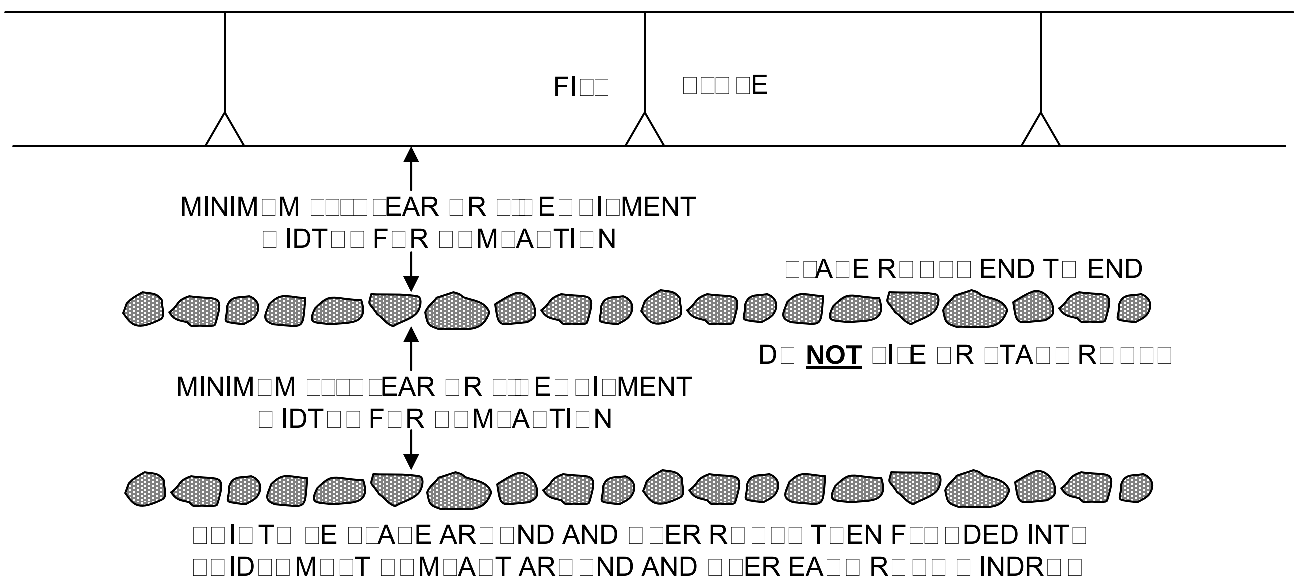


CROSS SECTIONAL VIEW



PLAN VIEW



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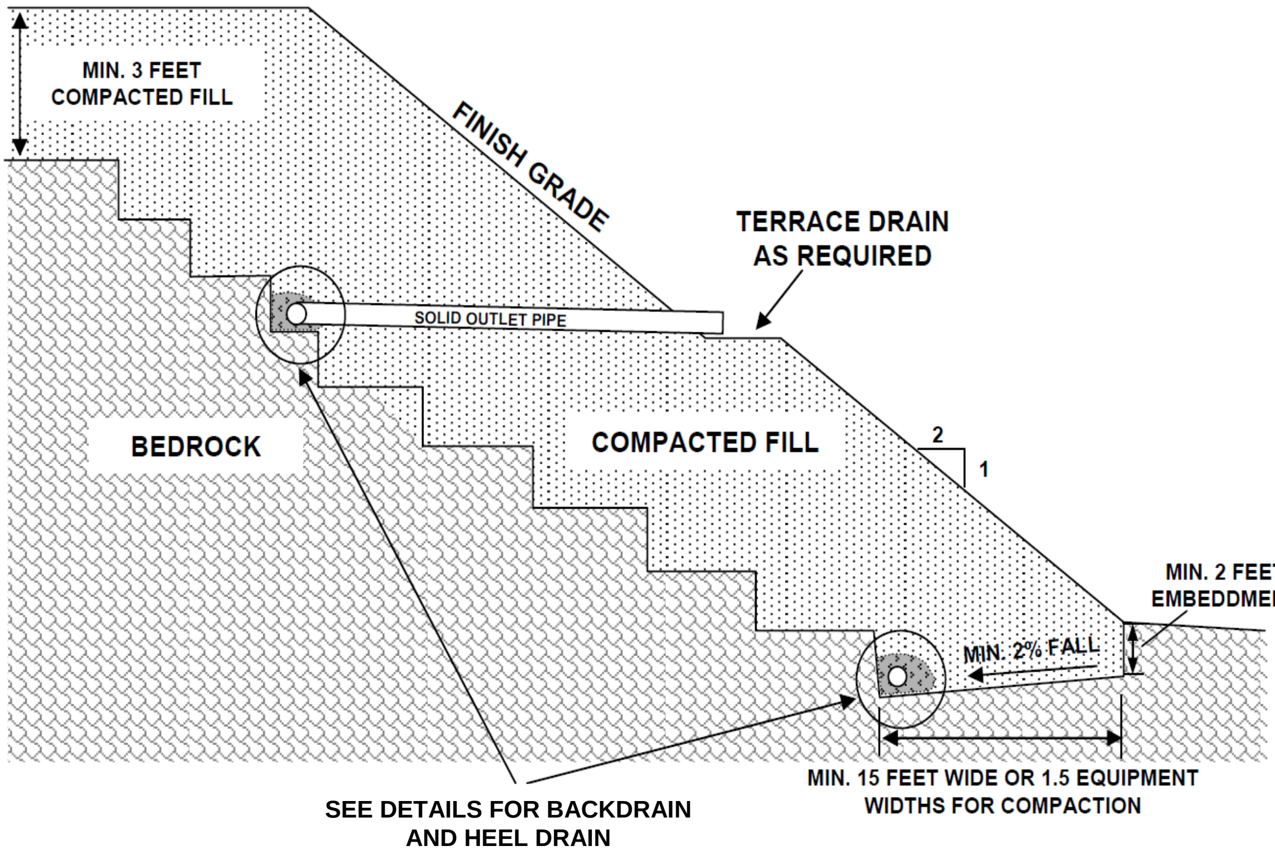
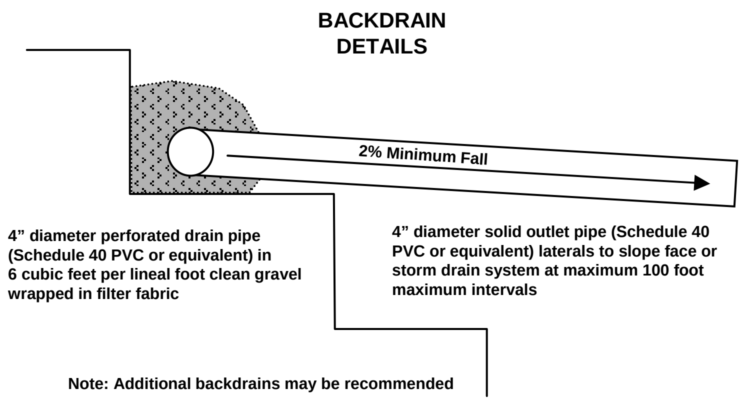
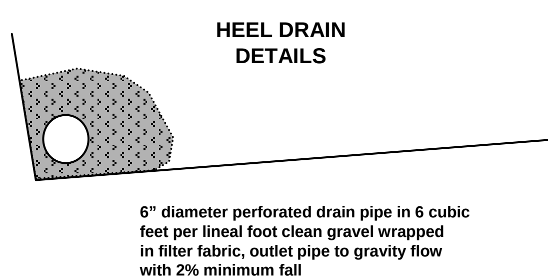
GEOTEK 1548 North Maple Street Corona, California 92880	ROCK BURIAL DETAILS	STANDARD GRADING GUIDELINES PLATE G-4







GEOTEK	1548 North Maple Street Corona, California 92880	TYPICAL BUTTRESS AND STABILIZATION FILL	STANDARD GRADING GUIDELINES PLATE G-5