GEOTECHNICAL DUE DILIGENCE EVALUATION
PROPOSED HIGHLAND GROVE III
LAKE MATHEWS AREA
RIVERSIDE COUNTY, CALIFORNIA

Prepared For

PULTE HOME CORPORATION
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Prepared By

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Project Number 13979.001

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Pulte Home Corporation
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Attention: Mr. Patrick Lynam

Subject: Geotechnical Due Diligence Evaluation
Proposed Highland Grove III Residential Development, Tract 38605
Lake Mathews Area, Riverside County, California

In accordance with your request, this report is presenting our findings, conclusions and recommendations pertaining to the geotechnical aspects of the proposed development. It is our opinion that the overall site appears suitable for the intended use provided our recommendations included herein are properly incorporated during the design and construction phases of development. Please note that pertinent information from previous geotechnical/geologic studies performed for this site (see references) are incorporated/included in this report. As such, this report is a stand-alone document and supersedes previous reports. The main geotechnical/geologic findings that impact the cost for the proposed developing is the presence of potentially unrippable rock in the northern portion of the site and collapsible potential in the site alluvium/colluvium.

If you have any questions regarding this report, please do not hesitate to contact the undersigned. We appreciate this opportunity to be of service on this project.

Respectfully submitted,

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1.0 INTRODUCTION

1.1 Purpose and Scope

This geotechnical evaluation report is for Proposed Highland Grove III Residential Development, Tract 38605, located generally northeast of the intersection of McAllister Street and El Sobrante Road in Riverside County, California (see Figure 1). Our scope of services for this geotechnical evaluation included the following:

- Review of available geologic information and relevant publications listed in the references at the end of this report.
- A site geologic reconnaissance, mapping and visual observations of surface conditions.
- Excavation of twelve (12) excavator test pits to explore the subsurface soil conditions and general rock rippability within the site. Approximate locations of these explorations are depicted on the Geotechnical Map (Plate 1).
- Laboratory testing was performed on representative samples and results (including previous test results) are included in Appendix B.
- Geotechnical engineering review and analyses performed or as directed by a California registered Geotechnical Engineer (GE). A California Certified Engineering Geologist (CEG) performed engineering geology review of site geologic hazards.
- Preparation of this report, which presents the results of our geotechnical review, update of seismic design coefficients in accordance with the 2022 California Building Code (CBC).

This report is not intended to be used as an environmental assessment (Phase I or other), and foundation and/or a rough grading plan review.

1.2 Site Location and Description

The site covers approximately 96 acres located in Riverside County, California (see Figure 1, Site Location Map). The site is bounded on the west by open land and Pulte's Highland Grove residential development, on the south by agricultural facilities and El Sobrante Road, on the east by undeveloped land, and on the north by vacant land and a residential development. The area of proposed development slopes away from a high southern-central portion of the site, at an elevation of approximately 1,405 feet above mean sea level (msl) located along the north-western portion of the site to lower elevations along the northern and western boundaries of the site and a low of approximately 1,205 feet (msl) in the northeastern portion of the property. A deeply incised, heavily vegetated drainage traverses the northern and southern edges of the site in a northwestern direction. The site is currently undeveloped with minor previous grading likely associated with agricultural activities that consisted of minor cuts and fills for drainage and access purposes. A northwest Western Municipal Water District water supply pipeline easement traverses the central portion of the site. Vegetation consists of seasonal grass and weeds to previous orchard stumps and associated dead trees/vegetation.

1.3 Proposed Development

Based on the Tentative Tract Map (Adkan, 2023), we understand that the project will consist of 163 residential lots with associated site improvements including roadways, retaining walls, retention basins and open space areas. It is our understanding; the residential lots will host typical one- or two-story single-family homes consisting of wood-frame structure with slab-on-grade foundations. Grading will generally require maximum cuts and fills on the order of ±20 feet and ±25 feet, respectively. Slopes are proposed at 2:1 inclination (horizontal to vertical) and flatter (basins) with maximum heights on the order of 45 feet.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Previous Studies

Albus-Keefe, 2004: A "Summary of Key Geotechnical and Environmental Issues" for this and surrounding tracts was prepared by AKA and was based on background review and a seismic refraction survey. Key issues included difficult excavating conditions, generation of oversized materials, and low permeability of bedrock materials resulting in perched groundwater conditions.

Leighton, 2005: Leighton prepared a "Preliminary Geotechnical Investigation" for the overall Victoria Grove residential development, which partially encompassed the subject site. Field exploration for this study included 65 backhoe test pits, and 6 hollow stem auger borings. Additionally, rotary air percussion borings and seismic refraction surveys performed by AKA were reviewed in preparation of this report. Logs of subsurface exploration and laboratory testing from this study that were performed in the vicinity of the subject site.

AGS, 2018: AGS prepared a "Preliminary Geotechnical Investigation" for the previously proposed greater Victoria Heights residential development, which encompasses the proposed footprint of the subject site. As a part of the AGS report, previous studies were reviewed, and additional field exploration was conducted. Field exploration for this study included 32 backhoe test pits and 19 excavator test pits as well as a subcontracted seismic refraction survey performed by Southwest Geophysics. Predominant geotechnical constraints and opportunities presented by AGS remain consistent with other reports prepared for the site.

All previous exploration logs and seismic lines are included in Appendix A and their approximate locations are depicted on Plate 1 (Geotechnical Map).

2.2 Field Exploration – This Study

Our field exploration for this report consisted of the excavation of twelve (12) excavator test pits located throughout the site to supplement previous investigations and provide basis for site grading and foundation design. During exploration, disturbed/bulk samples were collected for further laboratory testing and evaluation. Approximate locations of these and previous field explorations are depicted on the Geotechnical Map (see Plate 1). Sampling was conducted by a geologist from our firm. After logging and sampling, the excavations were loosely backfilled with spoils generated during excavation. The exploration logs from this and previous explorations are provided in Appendix A.

2.3 Laboratory Testing

Previous and current laboratory testing on representative soils samples are presented in Appendix B. Soils were visually classified in the field according to the Unified Soil Classification System (U.S.C.S.). Laboratory tests were performed in general accordance with the American Society of Testing and Materials (ASTM) procedures and/or applicable California Test Methods (CTM).

3.0 GEOTECHNICAL AND GEOLOGIC FINDINGS

3.1 Regional Geology

The site is located within the Peninsular Ranges, a prominent physiographic province forming much of southwestern California. This region is characterized by relatively steep, elongated northwest trending mountain ranges and valleys. More specifically, the site is situated within the Perris Block, an eroded mass of Cretaceous and older crystalline bedrock.

The Perris Block, approximately 20 miles by 50 miles in extent, is bounded by the San Jacinto Fault Zone to the northeast, the Elsinore Fault Zone to the southwest, the Cucamonga Fault Zone to the northwest, and the Temecula Basin to the southeast. The southeast boundary of the Perris block is poorly defined. The Perris Block has had a complex tectonic history, apparently experiencing relative vertical land movements of several thousand feet in response to movement along the Elsinore and San Jacinto Fault Zones. Sedimentary and volcanic deposits locally mantle the crystalline bedrock. Alluvial and colluvial deposits fill the valley areas.

Geologic deposits underlying the property include Quaternary alluvium within the low lying drainage areas of the site and Cretaceous-age granitic bedrock exposed on the hillsides and underlying the alluvium.

3.2 Site Specific Geology

The geologic units encountered are discussed in the following sections in order of increasing age and further described on the logs of geotechnical borings in Appendix A.

3.2.1 Artificial Fill (map Symbols and Afu)

Artificial fill was observed as existing fill embankments supporting the unpaved access roads that traverse the site, as well as the berms associated with the water storage pond. Some minor undocumented fill exists associated with some end dump piles and previous grading associated with past agricultural activities and a home site.

3.2.2 Topsoil/Colluvium (not a mapped unit)

Topsoil/ soil was observed in the majority of the explorations overlying the bedrock and appear to be derived from in-place weathering of the bedrock below. As encountered in the explorations on-site, the alluvial deposits are generally comprised of silty sand, and clayey sand with varying amounts of gravel. The topsoil/colluvium is anticipated possess very low to low expansive potential (EI<51) and have a slight collapse potential.

3.2.3 Alluvium (mapped as Qal)

Shallow alluvial soils should be expected in natural drainages crossing the site. As encountered in the explorations on-site, the alluvial deposits are generally comprised of silty to clayey sand and sandy silt with varying amounts of gravel. The alluvial soils are anticipated possess very low to low expansive potential (EI<51) and have a slight collapse potential.

3.2.4 Granitic Bedrock (mapped as Kcgb)

Granitic bedrock is observed at ground surface (outcrops) along the elevated portions of the site and was encountered in all of our test pits. The bedrock consists of highly to moderately weathered gabbro and granodiorite within the depth explored.

Due to the foliated and relatively dense crystalline nature of the near-surface granitic bedrock, very heavy ripping or localized blasting may be required in areas of deep excavation and/or areas underlain by shallow rock. Further information is provided as to rippability in Section 3.3 below. The approximate limits and general distribution of granitic bedrock within the site is depicted on the *Geotechnical Map (Plate 1)*. Special placement of oversized material (greater than 12 inches) will be required as described later in Section 5.2 of this report.

Fill generated for granitic rock excavation is expected to have a “Very Low” expansion potential (EI<21). Highly weathered portions of the bedrock may have a “low” expansion potential (EI<51).

3.3 Rippability

Based on previous studies (AGS, 2018), our review of our geotechnical exploration and the seismic refraction survey conducted previously for the site (Southwest, 2018), we anticipate the bedrock in most of the planned excavations deeper than about 10 to 20 feet will be considered marginally to non-rippable as further described in the table below. The remaining areas of excavations are considered rippable to the proposed design grades with conventional heavy earth moving equipment in good operating conditions (Caterpillar D9L or D10 with single shank ripper and rock teeth). Additional details and discussion on rippability and contractors review considerations are presented in appendix A-2.

In general, deep cuts on the site (particularly near existing rock outcrops) may be difficult to excavate and will generate a significant number of boulders or core stones. Other areas may also encounter buried core stones or non-rippable rock within the design excavation depths or during excavation for the underground utility trenches. In addition, due to differential weathering of the bedrock materials, very heavy ripping and/or other specialized excavation techniques may be required to maintain desired excavation rates. For proposed building pads and utility trenches in marginally rippable to non-rippable rock areas, it may be desirable to over-excavate at least 2 feet below the bottom of proposed utility trenches or 5 feet below pad grade to facilitate future trenching operations.

The California Building Code and County of Riverside require that no oversize rock (>12-inches) be placed within 10 feet of the surface of a structural fill and/or building pad. The grading plan should be carefully reviewed during grading to verify that oversized rocks are buried below a 10-foot fill cap. Generally, oversize rock will require windrowing, individual burial, or other special placement methods as further described in Appendix D. In addition, an adequate supply of granular fill material will be needed for placement around the rocks. A grading contractor with experience in the handling and placement of oversize rock should be selected for this project.

3.4 Groundwater and Surface Water

Groundwater was not encountered in any of the exploratory borings or test pits during this or previous studies. Depth to ground water at the site is anticipated to be greater than 100 feet and not a design concern.

Although not anticipated, groundwater may be locally encountered during grading or future development. It should be noted that local perched water conditions may occur and may fluctuate seasonally, depending on rainfall conditions. Any seepage conditions should be evaluated on a case-by-case basis to provide the mitigation recommendations, if needed. No standing or surface water was observed on the site at the time of our field subsurface explorations.

3.5 Faulting

No evidence of active or potentially active faults are known nor observed on-site or trending to the project site. The closest active fault is the Temecula Segment of the Elsinore Fault Zone. The subject site is not included within an Earthquake Fault Zone as created by the Alquist-Priolo Earthquake Fault Zoning Act (CGS, 2018, Bryant, 2007). The nearest zoned active faults are the Glen Ivy Segment of the Elsinore Fault Zone, located approximately 8.3 miles (13.3 km) southwest of the site and the Chino-Central Avenue Segment of the Elsinore Fault Zone, located approximately 9.0 miles (14.5 km) northwest of the site (Blake, 2000c). This site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone or County of Riverside Fault Zone.

3.6 Seismicity

As is common for virtually all of Southern California, strong ground shaking can be expected at the site during moderate to severe earthquakes in this general region. Intensity of ground shaking at a given location depends primarily upon earthquake magnitude, site distance from the source, and site response (soil type) characteristics. The seismic coefficients were calculated utilizing an interactive program on current United States Geological Survey (USGS) website using ASCE 7-16 procedures, as well as USGS Unified Hazard Maps. Based on our explorations and review, the site will be underlain by relatively shallow dense fill and granitic bedrock. As such, the site is classified as a Class C site, and the site-specific seismic coefficients following this USGS general procedure are as listed in the following table:

Table 1. 2019 CBC Seismic Coefficients per USGS General Procedure

Site Seismic Coefficients / Coordinates		Value
Latitude		**33.8656**
Longitude		**-117.4242**
Mapped Spectra (OSHPD)	Spectral Response – Class C (short), S_S	1.50
	Spectral Response – Class C (1 sec), S_1	0.60
	Site Modified Peak Ground Acceleration, PGA_M	0.66
	Max. Considered Earthquake Spectral Response Acceleration (short), S_{MS}	1.80
	Max. Considered Earthquake Spectral Response Acceleration – (1 sec), S_{M1}	0.83
	5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.20
	5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.56
	Site-Specific Peak Ground Acceleration, PGA	0.55

g = Gravity acceleration

3.7 Dynamic Settlement (Liquefaction and Dry Settlement)

Assuming that loose, near-surface soils will be removed and recompacted in accordance with the recommendations of Section 5.0 of this report in the areas of development, the potential for liquefaction or dynamic settlement due to the design earthquake event to affect structures at this site is considered very low. Following completion of the recommended remedial grading, we estimate that the total settlement to be less than ½ inch and differential settlement to be ¼ inch in 40 feet horizontal distance.

3.8 Expansive Soils

Limited laboratory testing indicates that near surface soils generally possess very low to low expansion potential (0≤EI≤51). Any silty to clay-rich expansive soil may be encountered locally within the alluvial or highly weathered bedrock portions of the project site and should be addressed during the grading process and final design.

3.9 Corrosion

Limited laboratory tests were conducted for corrosion potential (soluble sulfate, chloride, pH, and minimum resistivity) of on-site soils (see Appendix B). Excessive sulfate or chloride in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. Laboratory tests indicate a negligible concentration of soluble sulfate and chloride in onsite soils for representative samples (Appendix B). Based on our test results, Type II cement or equivalent may be used.

Electrical resistivity testing indicates onsite soils may have a severe corrosion potential for buried metal. A qualified corrosion engineer may be consulted regarding the corrosion effects of the onsite soils on underground metal utilities.

3.10 Slope Stability

The provided Tentative Tract Map (Adkan, 2023) indicates that fill slopes up to 45-feet and cut slopes up to 20-feet in height at 2:1 (horizontal to vertical) are anticipated. Based on field observations and geologic maps, the proposed 2:1 inclination (horizontal to vertical) cut slopes will be predominantly within the granitic bedrock. Slope instability is not considered an issue at this site. All cut slopes should be mapped by project geologist to confirm joint configuration do not create a local slope stability concern.

Cut and fill slopes should be provided with appropriate surface drainage features and landscaped (with drought tolerant vegetation) as soon as possible after grading to minimize the potential for erosion. Brow ditches should be constructed at the top of cut slopes. Drainage should be directed such that surface runoff on the slope face is minimized.

3.11 Landslide/Debris Flow and Rock Fall Hazard

No evidence of onsite landslides/debris flow was observed during our field investigation or in review of California Geologic Survey landslide inventory maps (CGS, 2012). However, the potential for rockfall due to either erosion or seismic ground shaking is considered possible in areas where boulder outcrops are present. Based on our review of the tentative tract map (MDS), we anticipate that exposed boulders will remain on the natural slope above the planned slope and may require mitigation.

Ways to mitigate the potential rock fall hazard are to remove the rocks, partially bury or break the rocks, construct a barrier (a berm, a fence, or a ditch), or create a combination of barriers that remove the kinetic energy of the boulders prior to their causing damage to a residence. If additional loose rocks are exposed during grading, removal, repositioning, embedment or stabilization may be needed to prevent rockfall. Methods to further mitigate the rockfall hazard should be based on further rock stability evaluation and review of rough grading plans.

4.0 PRELIMINARY RECOMMENDATIONS

4.1 General

The proposed development of the site appears feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into the design and construction phases of development. The main geotechnical/geologic findings that may impact the construction cost for this project is the presence of potentially unrippable rock, especially in deeper excavations within the site. As such, blasting may be necessary in deep cuts.

4.2 Earthwork

Earthwork should be performed in accordance with the following recommendations and the *Earthwork and Grading Specifications* Appendix C. The recommendations contained in Appendix C, are general grading specifications provided for typical grading projects and some of the recommendations may not be strictly applicable to this project. The specific recommendations contained in the text of this report supersede the general recommendations in Appendix C. The contract between the developer and earthwork contractor should be worded such that it is the responsibility of the contractor to place the fill properly in accordance with the recommendations of this report, the specifications in Appendix C, applicable County Grading Ordinances, notwithstanding the testing and observation of the geotechnical consultant.

4.2.1 Site Preparation and Remedial Grading

Prior to grading, the proposed structural improvement areas (i.e. all structural fill areas, pavement areas, buildings, etc.) of the site should be cleared of surface and subsurface obstructions, heavy vegetation, root balls and boulders. Roots and debris should be disposed of offsite. Septic tanks or seepage pits, water wells, if encountered, should be abandoned in accordance with the County of Riverside Department of Health Services guidelines.

Undocumented fill, surficial topsoil, alluvial deposits, and highly weathered bedrock are potentially compressible in their present state and may settle under the surcharge of fills or foundation loading. In areas supporting additional fill soils or structural improvements, these soils should be removed down to competent bedrock material. In general, competent material is considered to be dense granitic bedrock. Acceptability of all removal bottoms should be reviewed by a representative of Leighton. The removal bottom elevations should be documented in the as-graded geotechnical report.

The removal depths are generally expected to range from approximately 3 to 5 feet below existing ground over much of the site. However, deeper removal will be required in the alluvial channels and may extend from 5 feet to as much as 15 feet. However, this removal depth may be limited to upper 5 to 7 feet BGS if further compressibility evaluation of alluvium left in place confirms that post-construction settlement is acceptable or tolerable by the proposed structures. Estimated removal depths are depicted on Plate 1. The exploration logs in Appendix A should be carefully reviewed for depth of granitic bedrock. The removal limit should be established by a 1:1 projection from the edge of fill soils supporting settlement-sensitive structures downward and outward to competent material identified by the geotechnical consultant. Removals will also include benching into competent material as the fills rise. Areas adjacent to existing roadways may require special monitoring. Temporary slopes in these areas should be no steeper than 1:1 gradient. Friable materials, if encountered, may require additional layback.

4.2.2 Cut Lots and Streets

Remedial grading/overexcavation of cut pads in weathered bedrock should extend to a minimum depth of 3 feet below pad grade or one-half of the maximum fill thickness beneath the proposed structure, whichever is deeper. Overexcavation should encompass the entire lot. If alluvial soils extend into cut pads, a complete removal of alluvium is recommended. Overexcavation bottoms should be sloped as needed to prevent the accumulation of subsurface water. After overexcavation, the lots should then capped with compacted fill. We also recommend that streets in granitic rock be overexcavated to a depth of 1 foot below the deepest utility and then brought back up to design grades with compacted fill.

4.2.3 Suitability of Site Soils for Fills

The onsite soils are generally suitable for re-use as compacted fill, provided they are free of debris, organic matter, and oversize rock. Fills placed within 10 feet of finish pad grades or slope faces should contain no rocks over 12 inches in maximum dimension. In addition, expansive clayey soils (EI>51) should be placed at depth greater than 3 feet below finished grades where feasible. All structural fill should be compacted throughout to 90 percent of the ASTM D 1557 laboratory maximum density, at or slightly above optimum moisture.

Areas to receive structural fill and/or other surface improvements should be approved by the geotechnical consultant then scarified to a minimum depth of 8 inches, conditioned to at least optimum moisture content, and recompacted. Fill soils should be placed at a minimum of 90 percent relative compaction (based on ASTM D1557) and near or above optimum moisture content. Placement and compaction of fill should be performed in accordance with local grading ordinances under the observation and testing of the geotechnical consultant. The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in thickness.

Fill slope keyways will be necessary at the toe of all fill slopes and at fill-over-cut contacts. Keyway schematics, including dimensions and subdrain recommendations, are provided in Appendix C. All keyways should be excavated into dense bedrock or dense alluvium as determined by the geotechnical engineer. The cut portions of all slope and keyway excavations should be geologically mapped and approved by a geologist prior to fill placement.

Fills placed on slopes steeper than 5:1 (horizontal:vertical) should be benched into dense soils (see Appendix C for benching detail). Benching should be of sufficient depth to remove all loose material. A minimum bench height of 2 feet into approved material should be maintained at all times. A grading contractor with experience in the handling and placement of oversize rock should be selected for this project.

4.2.4 Oversize Rock

We anticipate that grading will produce a significant amount of oversized rock (greater than 12 inches in maximum dimension). No rock in excess of 12 inches in maximum dimension may be placed in any fill within 10 feet of finish grade. Oversized rock may be placed in fills more than 10 feet below finish grade, if placed in accordance with the following guidelines and the specifications contained in Appendix C.

Within the upper 5 feet of finish grade, fill soils should not contain rock greater than 6 inches in maximum dimension in order to facilitate foundation and utility trench excavation. For fill soils between 5 and 10 feet below finish grade, the fill may contain rock up to 12 inches in maximum dimension and should be mixed with sufficient soil to eliminate voids. Below a depth of 10 feet, rocks up to a maximum dimension of 36 inches may be incorporated into the fill provided adequate fines to fill all voids are present. Rocks greater than 36 inches in diameter may be placed on a case-by-case basis.

4.2.5 Shrinkage and Bulking

The volume-change of excavated onsite materials upon recompaction is expected to vary with materials, density, insitu moisture content, location, and compaction effort. The in-place and compacted densities of soil materials vary and accurate overall determination of shrinkage and bulking cannot be made. Therefore, we recommend site grading include, if possible, a balance area or ability to adjust import quantities to accommodate some variation. Based on our experience with similar materials, the following values are provided as guidelines:

Table 2. Earthwork Shrinkage and Bulking Estimates

Geologic Unit	Estimated Shrinkage/Bulking
Undocumented Fill/Surficial Soils (upper 3 feet)	10 to 15 percent shrinkage
Alluvium	5 to 15 percent shrinkage
Granitic Bedrock	0 to 10 percent bulking

4.2.6 Import Soils

Import soils and/or borrow sites, if needed, should be evaluated by us prior to import. Import soils should be uncontaminated, granular in nature, free of organic material (loss on ignition less-than 2 percent), rocks smaller than 12-inches (6 inches to cap pads), have low expansion potential (with an Expansion Index less than 21) and have a low corrosion impact to the proposed improvements.

4.2.7 Utility Trenches

Utility trenches should be backfilled with compacted fill in accordance with the *Standard Specifications for Public Works Construction,* (“Greenbook”), 2021 Edition. Fill material above the pipe zone should be placed in lifts not exceeding 8 inches in uncompacted thickness and should be compacted to at least 90 percent relative compaction (ASTM D 1557) by mechanical means only. Site soils may generally be suitable as trench backfill provided these soils are screened of rocks over 1½ inches in diameter and organic matter. The upper 6 inches of backfill in all pavement areas should be compacted to at least 95 percent relative compaction.

Excavation of utility trenches should be performed in accordance with the project plans, specifications and the *“Greenbook”*. The contractor should be responsible for providing a "competent person" as defined in Article 6 of the *California Construction Safety Orders*. Contractors should be advised that sandy soils (such as fills generated from the onsite alluvium) could make excavations particularly unsafe if all safety precautions are not properly implemented. In addition, excavations at or near the toe of slopes and/or parallel to slopes may be highly unstable due to the increased driving force and load on the trench wall. Spoil piles from the excavation(s) and construction equipment should be kept away from the sides of the trenches. Leighton does not consult in the area of safety engineering.

4.2.8 Drainage

All drainage should be directed away from structures a minimum of 1% by means of approved permanent/temporary drainage devices. Adequate surface drainage of any building pad should be provided to avoid wetting of foundation soils. Irrigation adjacent to buildings should be avoided when possible. As an option, sealed-bottom planter boxes and/or drought resistant vegetation should be used within 5-feet of buildings. As shown on Plate 1, a permanent subdrain system is recommended in the deeper fills beneath lots 233 and 239 through 244. This subdrain system can be outletted into Retention Basin “A”. Further evaluation and recommendations should be provided based on actual conditions encountered during grading.

4.2.9 Slope Construction

Compacted fill or granitic bedrock cut slopes at 2:1 (horizontal:vertical) are considered grossly stable for static and pseudostatic conditions. Cut slopes exposing Older Fan Deposits should be replaced as compacted fill. Higher or steeper slopes should be subject to further review and evaluation. Any new 2:1 slopes using the onsite soils compacted to minimum 90 percent should also be stable under short and long-term conditions. The outer portion of new fill slopes should be either overbuilt by 2 feet (minimum) and trimmed back to the finished slope configuration or compacted in vertical increments of 5 feet (maximum) by a weighted sheepsfoot roller as the fill is placed. The slope face should then be track-walked by dozers of appropriate weight to achieve the final slope configuration and compaction to the slope face.

New fill or replacement fill slopes should be provided a toe of slope keyways as depicted in Appendix C. If fill is placed against existing cut slope (exposing older alluvium), the minimum fill width should be 15 feet per Appendix C. All cut slopes exposing Old Fan Deposits should be replaced by compacted fill as depicted in Appendix C. All cut slopes in granitic bedrock should be observed and mapped by a Leighton geologist to confirm the exposed conditions are stable.

Slope faces are inherently subject to erosion, particularly if exposed to rainfall and irrigation. Landscaping and slope maintenance should be conducted as soon as possible in order to increase long-term surficial stability. Berms should be provided at the top of fill slopes. Drainage should be directed such that surface runoff on the slope face is minimized.

4.3 Preliminary Foundation Design

4.3.1 Bearing and Lateral Pressures

Based on our analysis, proposed single-family residential structures may be founded on conventional slab-on-grade system based on prevailing finish pad soils conditions after grading. The compacted fill is anticipated to be very low expansion potential. As such, we recommend that the structural consultant and/or foundation engineer presents foundation design categories (i.e. conventional or stiffened slab-on-grade design) based on actual expansion potential of subgrade soils of each pad at completion of grading. Foundation footings may be designed with the following geotechnical design parameters:

Allowable Bearing Capacity:	2,000 psf at a minimum depth of embedment of 12 inches (minimum width of 12 inches). This bearing capacity may be increased by ⅓ for short-term loading conditions (e.g., wind, seismic).
Sliding Coefficient:	0.35
Total Settlement:	1 inch
Differential Settlement:	0.5 inch in 40 feet

The conventional slabs should be designed in accordance with the 2019 CBC.

4.3.2 Stiffened Slab Design (21<EI≤91)

Per the California Building Code, slab-on-grade design for expansive soils (EI>21) should be designed in accordance with WRI/CRSI Design of Slab-On-Ground Foundations or PTI DC 10.5 or any other approved method taking into consideration the anticipated differential movement.

If these slabs are to be designed per PTI DC 10.5, the table below provides two sets of PTI design parameters based on Expansion Index (EI) or Plasticity Index (PI) of prevailing subgrade conditions. The following parameters were derived using VOLFLO 1.5 computer program developed by Geostructural Tool Kit, Inc. and the laboratory test results included in Appendix B.

Table 3. PTI Method Design Parameters (3rd Edition)

Design Parameters	Category I PI≤15 or EI≤51	Category II 15<PI≤25 or 51≤EI≤90
Thornthwaite Moisture Index	-20	-20
Depth to Constant Soil Suction	9.0 feet	9.0 feet
Constant Soil Suction	3.9 feet	3.9 feet
Edge Moisture Variation Distance, e_m -Edge Lift -Center Lift	 5.5 feet 9.0 feet	 4.7 feet 9.0 feet
Soil Differential Movement, y_m -Edge Lift - Swell -Center Lift - Shrink	 0.75 inch 0.35 inch	 1.1 inch 0.55 inch

The allowable pressures provided in Section 4.3.1 above may be used for slab-on-grade design using the PTI method. Moisture content for the upper 12 inches of subgrade should be near optimum moisture content (±2%) prior to placing concrete.

Based on past experience with similar compacted fills and application of elastic settlement due to weight of additional fill, settlement is expected to be less than 1-inch. As such, a differential settlement of 0.5-inch across a lateral distance of 40 feet should be considered for design in addition to the shrink/swell settlement given in table above.

4.3.3 Vapor Retarder

It has been a standard of care to install a moisture-vapor retarder underneath all slabs where moisture condensation is undesirable. Moisture vapor retarders may retard but not totally eliminate moisture vapor movement from the underlying soils up through the slabs. Moisture vapor transmission may be additionally reduced by use of concrete additives. Leighton and Associates, Inc. does not practice in the field of moisture vapor transmission evaluation/mitigation. Therefore, we recommend that a qualified person/firm be engaged/consulted with to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person/firm should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

However, based on our experience, the standard of practice in Southern California has evolved over the last 15 to 20 years into a construction of a vapor retarder system that generally consisted of a membrane (such as 10-mil thick or greater), underlain by a capillary break consisting of 4 inches of clean ½-inch-minimum gravel or 2-inch sand layer (SE>30). The structural engineer/architect or concrete contractor often require a sand layer be placed over the membrane (typically 2-inch thick layer) to help in curing and reduction of curling of concrete. If such sand layer is placed on top of the membrane, the contractor should not allow the sand to become wet prior to concrete placement (e.g., sand should not be placed if rain is expected).

In conclusion, the construction of the vapor barrier/retarder system is dependent on several variables which cannot be all geotechnically evaluated and/or tested. As such, the design of this system should be a design team/owner decision taking into consideration finish flooring materials and manufacture's installation requirements of proposed membrane. Moreover, we recommend that the design team also follow ACI Committee 302 publication for "Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials" (ACI 302.2R-06) which includes a flow chart that assists in determining if a vapor barrier /retarder is required and where it is to be placed.

4.4 Retaining Walls

Retaining wall earth pressures are a function of the amount of wall yielding horizontally under load. If the wall can yield enough to mobilize full shear strength of backfill soils, then the wall can be designed for "active" pressure. If the wall cannot yield under the applied load, the shear strength of the soil cannot be mobilized and the earth pressure will be higher. Such walls should be designed for "at rest" conditions. If a structure moves toward the soils, the resulting resistance developed by the soil is the "passive" resistance. Retaining walls backfilled with non-expansive soils should be designed using the following equivalent fluid pressures:

Table 4. Retaining Wall Design Earth Pressures (Static, Drained)

Loading Conditions	Equivalent Fluid Density (pcf)	
	Level Backfill	2:1 Backfill
Active	33	52
At-Rest	55	75
Passive*	300	150 (2:1, sloping down)

* This assumes level condition in front of the wall will remain for the duration of the project, not to exceed 3,000 psf at depth. If sloping down (2:1) grades exist in front of walls, then they should be designed using passive values reduced to ½ of level backfill passive resistance values.

Unrestrained (yielding) cantilever walls should be designed for the active equivalent-fluid weight value provided above for very low expansive soils that are free draining. In the design of walls restrained from movement at the top (non-yielding) such as basement or elevator pit/utility vaults, the at-rest equivalent fluid weight value should be used. Total depth of retained earth for design of cantilever walls should be measured as the vertical distance below the ground surface measured at the wall face for stem design or measured at the heel of the footing for overturning and sliding calculations. Should a sloping backfill other than a 2:1 (horizontal:vertical) be constructed above the wall (or a backfill is loaded by an adjacent surcharge load), the equivalent fluid weight values provided above should be re-evaluated on an individual case basis by us. Non-standard wall designs should also be reviewed by us prior to construction to check that the proper soil parameters have been incorporated into the wall design.

All retaining walls should be provided with appropriate drainage. The outlet pipe should be sloped to drain to a suitable outlet. Typical wall drainage design is illustrated in Appendix C, *Retaining Wall Backfill and Subdrain Detail*. Wall backfill should be non-expansive (EI $\leq$ 21) sands compacted by mechanical methods to a minimum of 90 percent relative compaction (ASTM D 1557). Clayey site soils should not be used as wall backfill. Walls should not be backfilled until wall concrete attains the 28-day compressive strength and/or as determined by the Structural Engineer that the wall is structurally capable of supporting backfill. Lightweight compaction equipment should be used, unless otherwise approved by the Structural Engineer.

4.5 Foundation Setback from Slopes

We recommend a minimum horizontal setback distance from the face of slopes for all structural footings (retaining and decorative walls, flatwork, building footings, pools, etc.). This distance is measured from the outside bottom edge of the footing horizontally to the slope face (or the face of a retaining wall) and should be a minimum of H/2, where H is the slope height (in feet).

Table 5. Footing Setbacks

Slope Height	Recommended Footing Setback
<5 feet	5 feet minimum
5 to 15 feet	7 feet minimum
>15 feet	H/2, where H is the slope height, not to exceed 10 feet to 2:1 slope face

The soils within the structural setback area generally possess poor lateral stability and improvements (such as retaining walls, pools, sidewalks, fences, pavements, decorative flatwork, etc.) constructed within this setback area will be subject to lateral movement and/or differential settlement. Potential distress to such improvements may be mitigated by providing a deepened footing or a pier and grade-beam foundation system to support the improvement. The deepened footing should meet the setback described above. Modifications of slope inclinations near foundations may increase the setback and should be reviewed by the design team prior to completion of design or implementation.

4.6 Sulfate Attack

The results of limited laboratory testing indicated negligible exposure to concrete per ACI 318. Further testing should be performed during site grading to confirm soluble-sulfate content of near finish subgrade soils. Additional testing for general corrosion potential to ferrous materials should also be performed during grading.

4.7 Concrete Flatwork

Sidewalk/Flatwork should conform to applicable County standards. A representative of Leighton should verify subgrade soil expansion, moisture conditions and compaction prior to formwork and reinforcement placement. If subgrade soils possess expansion index greater than 21, we recommend a minimum 8-inch deepened edge be constructed for all flatwork to reduce moisture variation in subgrade soils along concrete edges adjacent to open (unfinished) or irrigated landscape areas.

Concrete flatwork should be constructed of uniformly cured, low-slump concrete and should contain sufficient control/contraction joints. Additional provisions such as ascending/descending slope conditions, perched (irrigation) water, special surcharge loading conditions, potential expansive soil pressure and differential settlement/heave should be incorporated into the design of exterior improvements. Additional exterior slab details are suggested in the American Concrete Institute (ACI) guidelines.

4.8 Preliminary Pavement Design

The preliminary pavement design provided below is based on the locally accepted Caltrans Highway Design Manual and a laboratory-determined R-value of 65 for subgrade and traffic indices of 5, 6 and 7 were used for the design. The following range of pavement sections is to be used for preliminary planning purposes only.

Table 6. Asphalt Pavement Sections

General Traffic Condition*	Traffic Index (TI)**	Asphalt Concrete (inches)	Aggregate Base* (inches)
Private Street	5.0	3.0	4.0
General Local Street	6.0	4.0	4.0
Collector/Enhanced Local	7.0	4.0	6.0

*Per county minimum or as calculated

Tests of the exposed subgrade soils during rough grading should be performed to confirm the appropriate pavement section. Appropriate TI data should be selected by the project civil engineer or traffic-engineering consultant for finalization of the pavement section and should be in general accordance with County of Riverside and industry standards. The pavement sections should meet or exceed County of Riverside standards.

The subgrade soils in the upper 6 inches should be properly compacted to at least 95 percent relative compaction and should be moisture-conditioned to near optimum and kept in this condition until the pavement section is constructed. Proof-rolling subgrade to identify localized areas of yielding subgrade (if any) should be performed prior to placement of aggregate base and under the observation of the geotechnical consultant.

Minimum relative, compaction requirements for aggregate base should be 95 percent of the maximum laboratory density as determined by ASTM D1557. Base rock should conform to the “Standard Specifications for Public Works Construction” (green book) current edition or Caltrans Class 2 aggregate base having a minimum R-value of 78.

The preliminary pavement sections provided in this section are meant as minimum, if thinner or highly variable pavement sections are constructed, increased maintenance and repair may be needed.

5.0 GEOTECHNICAL CONSTRUCTION SERVICES

Geotechnical review is of paramount importance in engineering practice. Poor performances of many foundation and earthwork projects have been attributed to inadequate construction review. We recommend that Leighton be provided the opportunity to review the grading plan and foundation plan(s) prior to bid.

Reasonably continuous construction observation and review during site grading and foundation installation allows for evaluation of the actual soil conditions and the ability to provide appropriate revisions where required during construction. Geotechnical conclusions and preliminary recommendations should be reviewed and verified by Leighton during construction and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Geotechnical observation and testing should be provided:

- After completion of site clearing,
- During preparation and overexcavation of surface soils as described herein,
- During rock placement and compaction of all fill materials,
- Testing of slab subgrade moisture content, prior to placement of vapor retarder,
- After excavation of all footings, and prior to placement of concrete,
- During utility trench backfilling and compaction, and
- When any unusual conditions are encountered.

Additional geotechnical exploration and analysis may be required based on final development plans, for reasons such as significant changes in proposed structure locations/footprints. We should review grading (civil) and foundation (structural) plans, and comment further on geotechnical aspects of this project.

6.0 LIMITATIONS

This report was necessarily based in part upon data obtained from a limited number of observances, site visits, soil samples, tests, analyses, histories of occurrences, spaced subsurface explorations and limited information on historical events and observations. Such information is necessarily incomplete. The nature of many sites is such that differing characteristics can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can and do occur over time. This investigation was performed with the understanding that the subject site is proposed for residential and commercial development. The client is referred to Appendix D regarding important information provided by the GBA (Geoprofessional Business Association) on geotechnical engineering studies and reports and their applicability.

This report was prepared for Pulte Home Corporation based on Pulte Home Corporation's needs, directions, and requirements at the time of our investigation. This report is not authorized for use by and is not to be relied upon by any party except Pulte Home Corporation, and its successors and assigns as owner of the property, with whom Leighton and Associates, Inc. has contracted for the work. Use of or reliance on this report by any other party is at that party's risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton and Associates, Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Leighton and Associates, Inc.

REFERENCES

ASCE, 2016, ASCE Standard 7-16, Minimum Design Loads for Buildings and Other Structures by Structural Engineering Institute.

Adkan Engineers, 2022, Tentative Tract Map 38605, County of Riverside, California, 3 sheets, dated December 2022.

Advanced Geotechnical Solutions, Inc. (AGS) 2017, Preliminary Geotechnical Investigation of 100-Scale Tentative Map, Greentree Ranch Project, Tentative Tract No. 37217, County of Riverside, California, (Report No. 1507-05-B-7) dated January 20, 2017.

Advanced Geotechnical Solutions, Inc. (AGS) 2016, Preliminary Infiltration Investigation, Greentree Ranch Project, Formerly Victoria Meadows Project, Tentative Tract Map No. 26826, County of Riverside, California, (Report No. 1507-B-5) dated November 6, 2016.

Albus-Keefe and Associates, Inc., 2005 Geotechnical Due-Diligence Summary Report, Victoria Grove (Phase VI), Lake Mathews Area, County of Riverside, California, J.N. 1387.00, dated April 11, 2005.

Bedrossian, T.L., and Roffers, P. D., Geologic Compilation of Quaternary Surficial Deposits in Southern California, Santa Ana 30' X 30' Quadrangle, CGS Special Report 217, December 2012.

Blake, T. F., 2000a, EQSEARCH, Version 4.00, A Computer Program for the Estimation of Peak Horizontal Acceleration from Southern California Historical Earthquake Catalogs, Users Manual, 94pp., with update data, 2015.

Bryant, W.A., and Hart, E.W., 2007, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Zones Maps, Department of Conservation, California Geological Survey, Special Publication 42. 2007 Interim Revision.

California Geologic Survey (CGS), 2018, Earthquake Fault Zones, A guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California, Fault-Rupture Hazard Zones in California, Department of Conservation, Division of Mines and Geology, Special Publication 42, Revised 2018.

California Building Code, (CBC) 2022, California Code of Regulations Title 24, Part 2, Volume 2 of 2.

California Department of Water Resources (CDWR) 2023, Water Data Library, http://www.water.ca.gov/waterdatalibrary/index.cfm, Data viewed November 30, 2020.

Leighton and Associates, 2005, Preliminary Geotechnical Investigation, Victoria Grove, Phase 6, McAllister Street, Riverside, California, dated May 13, 2005.

Morton, D.M., and Cox, B.F., 1994, Geologic map of the Riverside West Quadrangle, Riverside County, California: U.S. Geological Survey, Open-File Report OF-88-753.

OSHPD, 2023, Seismic Design Maps, an interactive computer program on OSHPD website to calculate Seismic Response and Design Parameters based on ASCE 7-16 seismic procedures, https://seismicmaps.org/

Public Works Standard, Inc., 2021, Greenbook, *Standard Specifications for Public Works Construction*: BNI Building News, Anaheim, California.

Riverside County Information Technology, 2023, Map My County (website), http://mmc.rivcoit.org/MMC_Public/Viewer.html?Viewer=MMC_Public.

University California at Berkeley, Pacific Earthquake Engineering Research Center, The 5 NGA-West2 horizontal ground motion prediction equations, Updated on April 14, 2015, https://peer.berkeley.edu/research/data-sciences/databases

USGS, 2023, Web-Service Wrapper Around the nshmp-haz Probabilistic Seismic Hazard Analysis (PSHA) Platform, https://earthquake.usgs.gov/hazards/interactive/

Project: 13979.001	Eng/Geol: SIS/BAA
Scale: 1 " = 4,000 '	Date: August 2023
Base Map: ESRI ArcGIS Online 2023	

SITE LOCATION MAP

Highland Grove III
Tract No. 38605
Riverside County, California

FIGURE 1

Leighton

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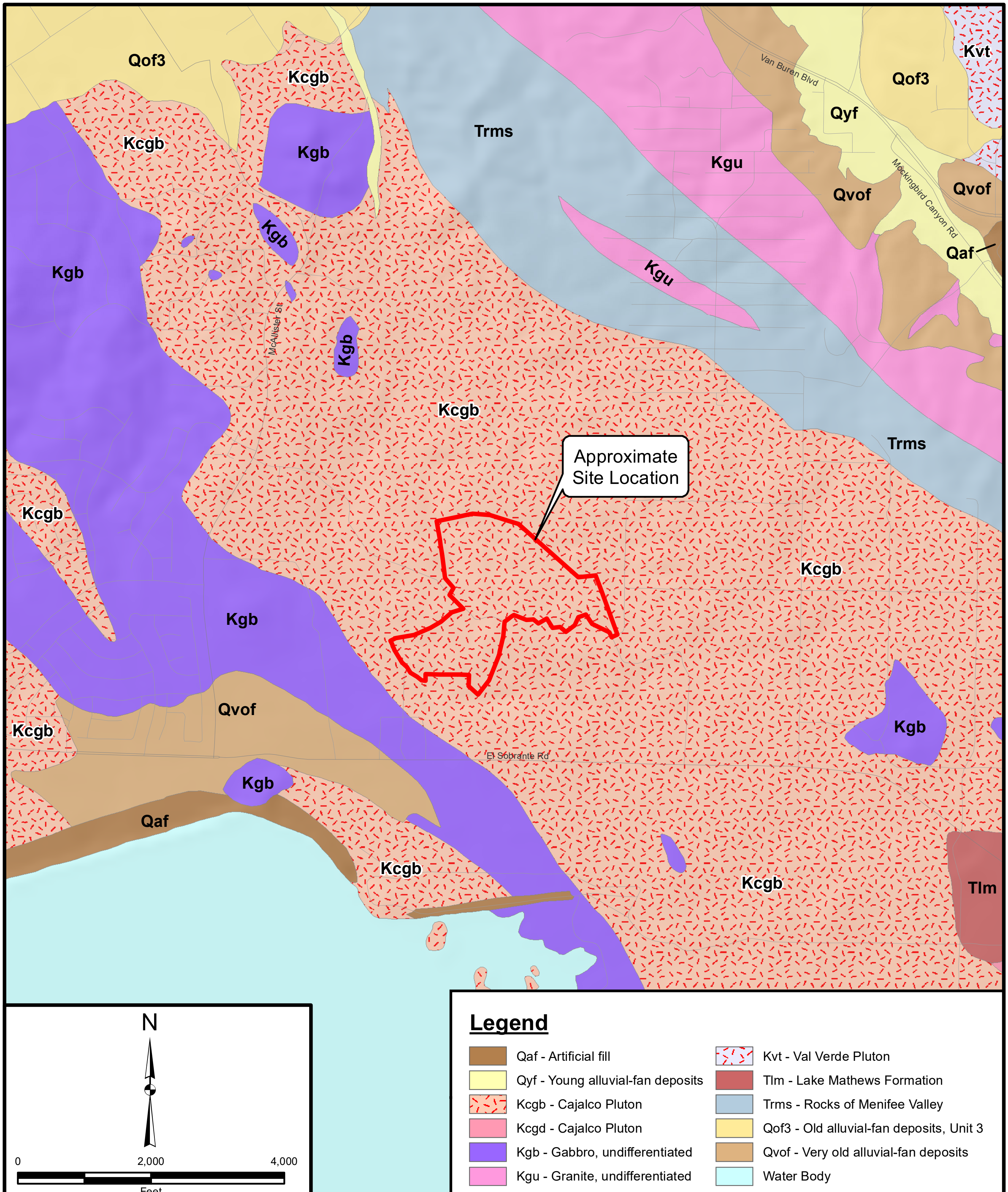


Legend

Qaf - Artificial fill	Kvt - Val Verde Pluton
Qyf - Young alluvial-fan deposits	Tlm - Lake Mathews Formation
Kcgb - Cajalco Pluton	Trms - Rocks of Menifee Valley
Kcgd - Cajalco Pluton	Qof3 - Old alluvial-fan deposits, Unit 3
Kgb - Gabbro, undifferentiated	Qvof - Very old alluvial-fan deposits
Kgu - Granite, undifferentiated	Water Body

Project: 13979.001	Eng/Geol: SIS/BAA
Scale: 1 " = 2,000 '	Date: August 2023

Reference: USGS, 2006 Geologic map of the San Bernardino and Santa Ana 30'x60 quadrangle, California Version 1,0 Open File Report 2006-1217.

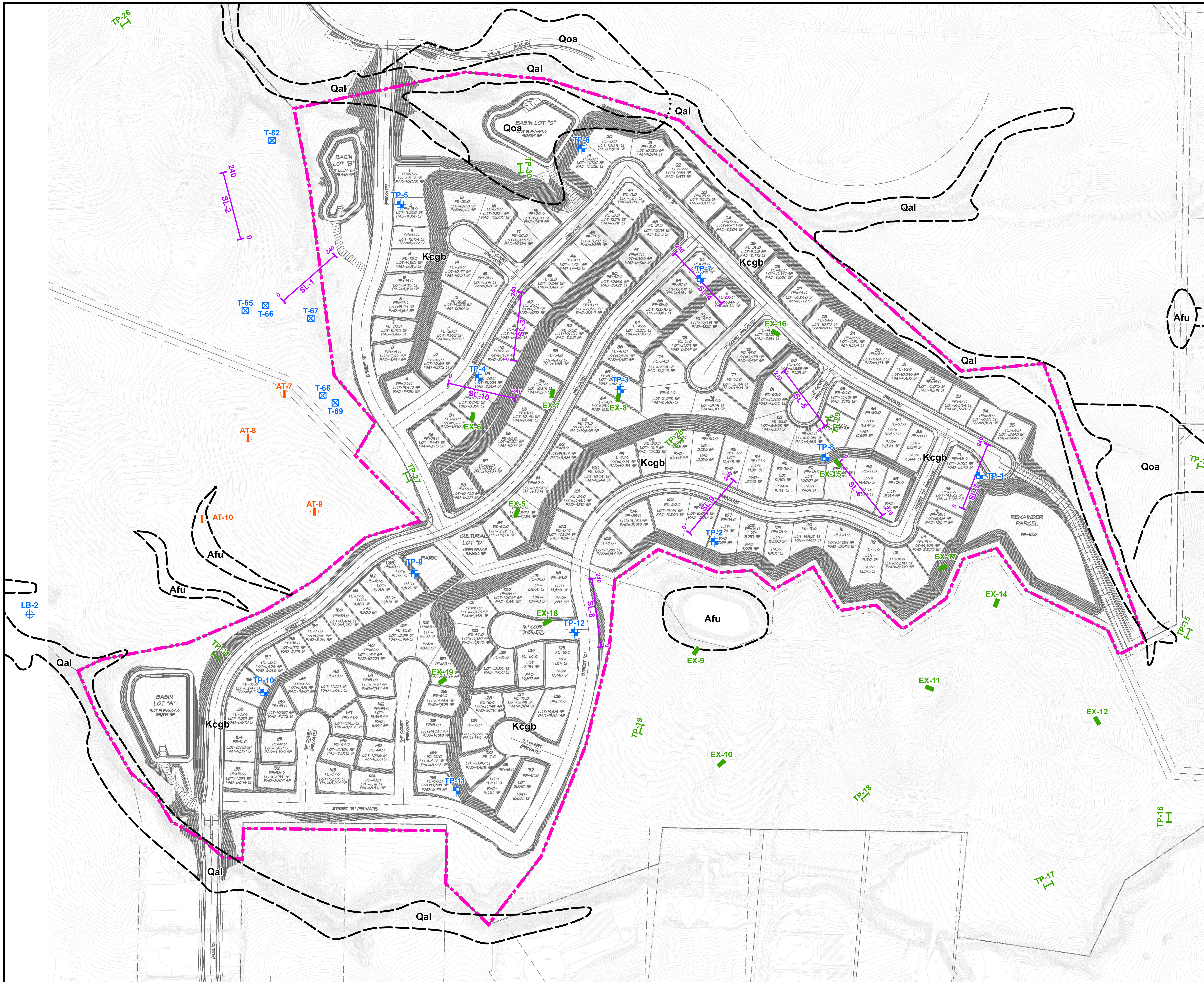
REGIONAL GEOLOGY MAP

Highland Grove III
Tract No. 38605
Riverside County, California

FIGURE 2

Leighton

Map Saved as V:\Drafting\13979\001\Maps\13979-001_F02_RGM_2023-08-22.mxd on 8/22/2023 2:01:05 PM Author: Leighton Geomatics (mmurphy)



Legend

TP-12	Approximate Location of Test Pit (Leighton, This Study)
LB-3	Approximate Location of Hollow Stem Boring (Leighton, 2006)
T-83	Approximate Location of Backhoe Test Pit (Leighton, 2005)
AT-12	Approximate Location of Air Track Boring (Albus Keefe)
EX-17	Approximate Location of Excavator Test Pit (AGS, 2015)
TP-31	Approximate Location of Backhoe Test Pit (AGS, 2015)
SL-10 (0–240)	Approximate Location of Seismic Line (Southwest Geophysics, Inc., April 2018)
	Approximate Geologic Contact (dotted where buried)
	Approximate Site Boundary

Geologic Units

Afu	Artificial Fill (Undocumented)
Qal	Alluvium
Qoa	Older Alluvium
Qvof	Alluvial Fan Deposits
Kcgb	Granodiorite and Gabbro - Undifferentiated

GEOTECHNICAL MAP

Highland Grove III
Tract No. 38605
Riverside County, California

Leighton

PLATE 1

Scale: 1 " = 150 feet

Date: September 2023

Proj: 13979.001

Eng/Geol: SIS/BAA

Base Map: Adkan, 2023.

APPENDIX A-1

FIELD EXPLORATION LOGS (THIS STUDY)

LOG OF TRENCH PITS

PROJECT NO.: 13979.001 **LOGGED BY: BAA**
PROJECT NAME: Highland Grove 3 **DATE: 7/31/2023**

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-1		SM	**Residual / Topsoil:** 0' - 2' – Silty SAND, light reddish brown, dry to slightly moist, trace clay, weathered in place **Gabbro Bedrock:** 2 - 6' – soft, gray, moist completely to moderately weathered, heavily fractured, recovers as: silty SAND, becomes fresher with depth Terminated at 6' on marginally to non-rippable rock, no groundwater, backfilled with spoils.

LOG OF TRENCH PITS

PROJECT NO.: 13979.001
PROJECT NAME: Highland Grove 3

LOGGED BY: DH
DATE: 7/31/2023

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-2		SM	**Topsoil:** 0’ 2’ – Silty SAND, light reddish-brown, slightly moist, trace clay **Gabbro Bedrock:** 2’-5’ – soft, gray to white, moist, completely to moderately weathered, heavily fractured, recovered as silty SAND, fresher in depth Total Depth 5’, no groundwater, backfilled with spoils.

LOG OF TRENCH PITS

PROJECT NO.: 13979.001 **LOGGED BY: DH**
PROJECT NAME: Highland Grove 3 **DATE: 7/31/2023**

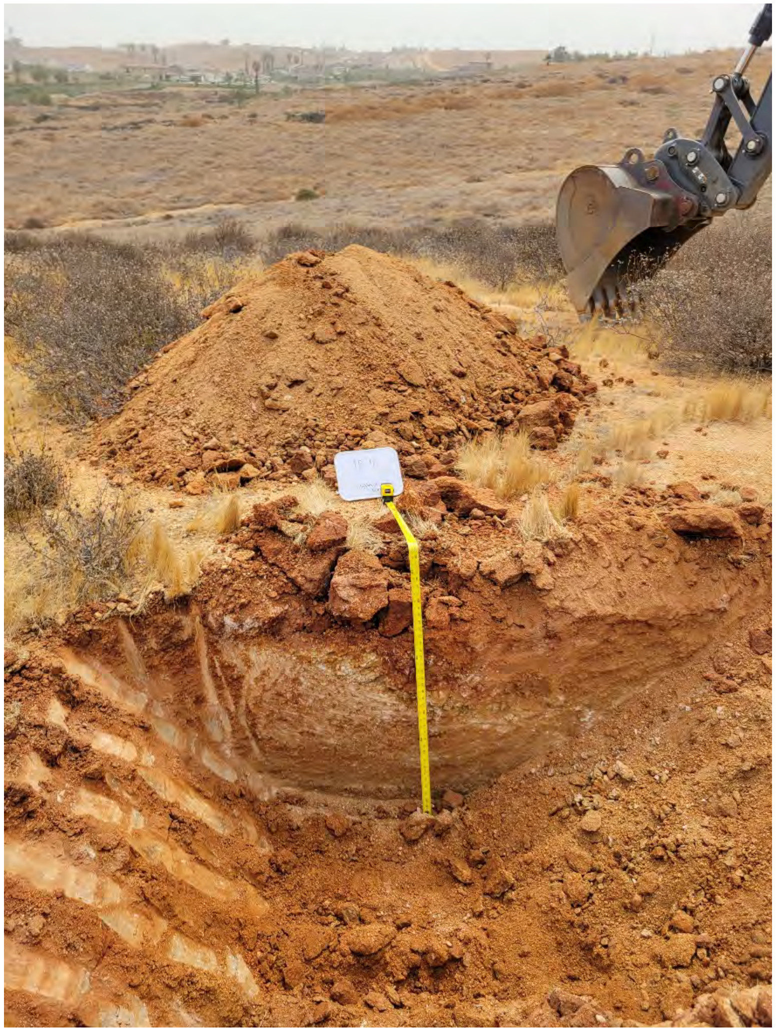
TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-3		SM	**Topsoil:** 0’ 1’ – Silty SAND, light red to red, slightly moist, few to little clay **Gabbro Bedrock:** 1’- 4’ – soft, gray to orange, moist, completely to moderately weathered, heavily fractured, recovered as silty SAND 4’ 13’ – gray, fresher, iron oxide staining Total Depth 13’, no groundwater, backfilled with spoils.

LOG OF TRENCH PITS

PROJECT NO.: 13979.001
PROJECT NAME: Highland Grove 3

LOGGED BY: DH
DATE: 7/31/2023

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-4		SM	**Topsoil:** 0' - 1' – Silty SAND, red to light reddish-brown, slightly moist, few to little clay **Gabbro Bedrock:** 1'- 3' – soft, white to gray, moist, completely to moderately weathered, heavily fractured, recovered as silty SAND Total Depth 3', no groundwater, backfilled with spoils.



LOG OF TRENCH PITS

PROJECT NO.: 13979.001
PROJECT NAME: Highland Grove 3

LOGGED BY: DH
DATE: 7/31/2023

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-5		SM	**Topsoil:** 0' - 2' – Silty SAND, brown to light brown, slightly moist, little trace clay **Gabbro Bedrock:** 2'- 4' – soft, gray to dark gray, moist, moderately weathered, heavily fractured, recovered as silty SAND Total Depth 4', no groundwater, backfilled with spoils.

LOG OF TRENCH PITS

PROJECT NO.: 13979.001
PROJECT NAME: Highland Grove 3

LOGGED BY: DH
DATE: 7/31/2023

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-6		SM	**Topsoil:** 0' - 1' – Silty SAND, light brown to light reddish-brown, slightly moist, little trace clay **Gabbro Bedrock:** 1'- 4' – soft, light gray to orange, moist, completely to moderately weathered, heavily fractured, recovered as silty SAND Total Depth 4', no groundwater, backfilled with spoils.

LOG OF TRENCH PITS

PROJECT NO.: 13979.001 | **LOGGED BY: DH**
PROJECT NAME: Highland Grove 3 | **DATE: 7/31/2023**

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-7		SM	**Topsoil:** 0' - 1' – Silty SAND, light brown to brown, slightly moist, little trace clay **Gabbro Bedrock:** 1'- 4' – soft, light gray to white, moist, completely to moderately weathered, heavily eroded, recovered as silty SAND Total Depth 4', no groundwater, backfilled with spoils.

LOG OF TRENCH PITS

PROJECT NO.: 13979.001
PROJECT NAME: Highland Grove 3

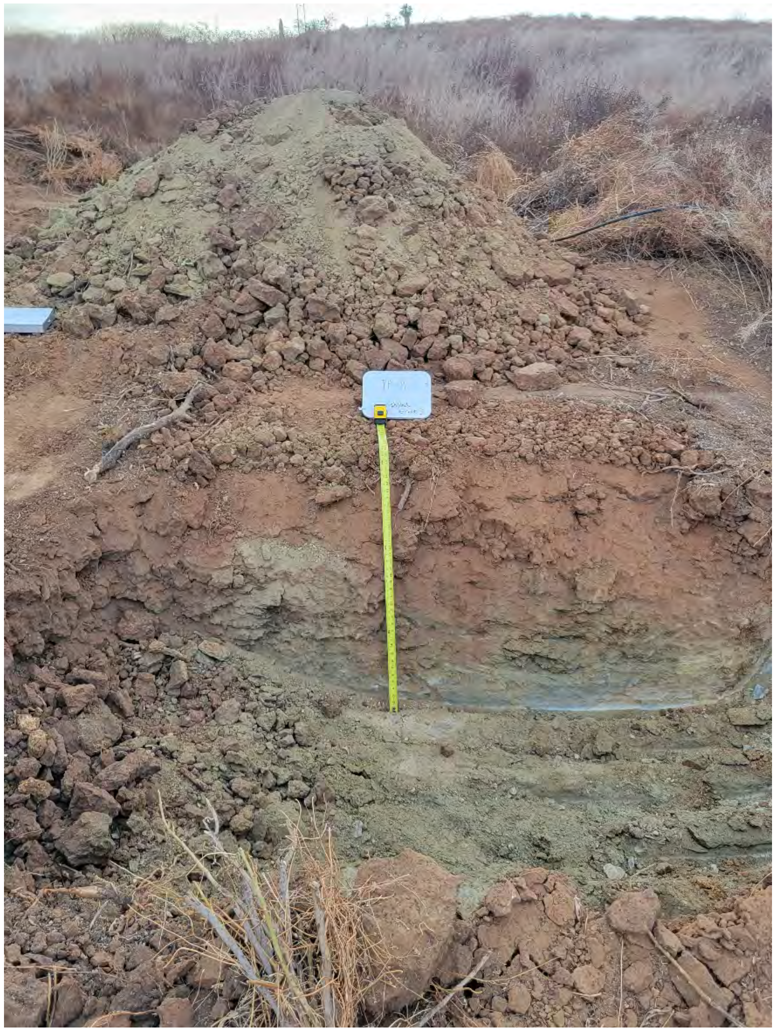
LOGGED BY: DH
DATE: 7/31/2023

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-8		SM	**Topsoil:** 0' - 1' – Silty SAND, light brown, slightly moist, few to little clay **Gabbro Bedrock:** 1'- 4' – soft, gray to light gray, moist, moderately weathered, heavily fractured, recovered as silty SAND Total Depth 4', no groundwater, backfilled with spoils.

LOG OF TRENCH PITS

PROJECT NO.: 13979.001 | **LOGGED BY: DH**
PROJECT NAME: Highland Grove 3 | **DATE: 8/1/2023**

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-9		SM	**Topsoil:** 0' - 1' – Silty SAND, dark red to light brown, slightly moist, few to little clay **Gabbro Bedrock:** 1'- 3' – soft, dark green to gray, moist, completely to moderately weathered, heavily fractured, recovered as silty SAND Total Depth 3', no groundwater, backfilled with spoils.



LOG OF TRENCH PITS

PROJECT NO.: 13979.001
PROJECT NAME: Highland Grove 3

LOGGED BY: DH
DATE: 8/1/2023

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-10		SM	**Topsoil:** 0' - 2' – Silty SAND, light brown to gray, slightly moist, little trace clay **Gabbro Bedrock:** 2'- 4' – soft, light gray, moderately weathered, moderate to heavily fractured, recovered as silty SAND 4' – 7': color changes to gray, fresh Total Depth 7', no groundwater, backfilled with spoils.

LOG OF TRENCH PITS

PROJECT NO.: 13979.001 **LOGGED BY: DH**
PROJECT NAME: Highland Grove 3 **DATE: 8/1/2023**

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-11		SC	**Topsoil:** 0' - 3' – Clayey SAND, light brown, slightly moist **Gabbro Bedrock:** 3'- 4' – soft, gray, slightly weathered, slightly fractured, recovered as silty SAND 4' – 8': Color change to dark gray, fresh Total Depth 8', no groundwater, backfilled with spoils.

LOG OF TRENCH PITS

PROJECT NO.: 13979.001
PROJECT NAME: Highland Grove 3

LOGGED BY: DH
DATE: 8/1/2023

TEST PIT#	LAB TEST	USCS	DESCRIPTION
TP-12		SM	**Topsoil:** 0' - 1' – Silty SAND, light brown, slightly moist **Gabbro Bedrock:** 1'- 3' – soft, light gray to dark gray, moist, completely to moderately weathered, recovered as silty SAND Total Depth 3', no groundwater, backfilled with spoils.

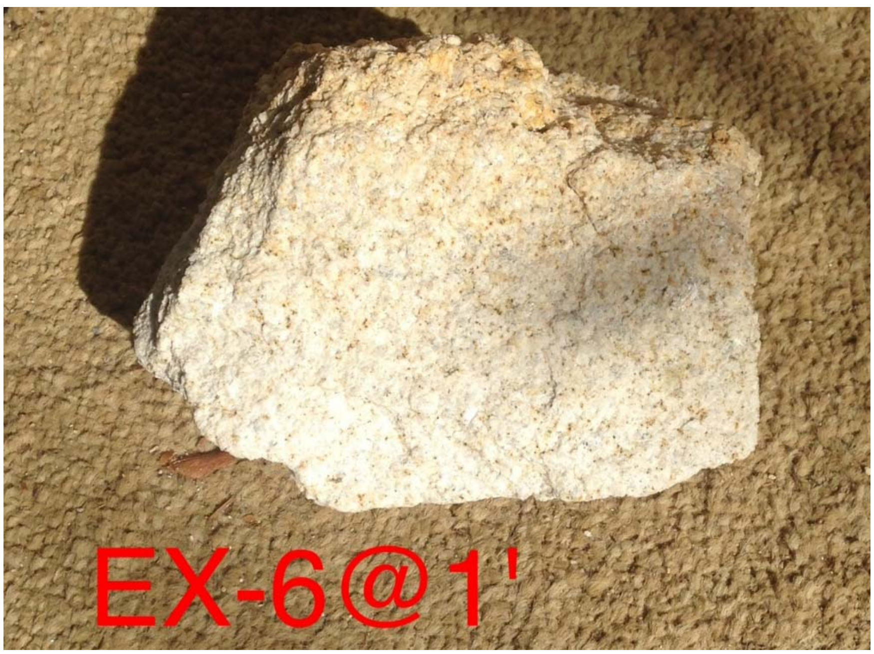
APPENDIX A-2

LOGS OF EXPLORATORY BORINGS/TEST PITS
(PREVIOUS STUDIES)

Leighton

Test Pit No.	Depth (ft.)	USCS	Description
EX-4	0.0 – 1.0	SC	**Topsoil:** CLAYEY SAND; reddish brown, dry, loose, fine to medium grained.
	1.0 – 16.5		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Yellowish red, dry, soft, fine to medium grained, highly weathered, abundant secondary clays. @ 3 ft. light olive with horizontal iron oxide staining along fine fractures, moderately soft, breaks into sand with some silt and clay. @ 15 ft. light olive, hard
			TOTAL DEPTH 16.5 FT./PRACTICAL REFUSAL NO WATER, NO CAVING
EX-5	0.0 – 0.5	SM	**Topsoil:** SILTY SAND, grayish brown, dry, loose, fine to medium grained.
	0.5 – 4.0		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Yellowish brown and reddish brown, dry, moderately hard, fine to medium grained, moderately weathered. @ 2.5 ft. light gray to gray, fine grained, hard. @ 3.0 ft. very hard @ 3.0 ft. N 45 E, 85 SE – Joint @ 3.0 ft. N 35 E, 70 NE – Joint
			TOTAL DEPTH 4 FT./REFUSAL NO WATER, NO CAVING

Test Pit No.	Depth (ft.)	USCS	Description
EX-6	0.0 – 1.0	SC	**Topsoil:** CLAYEY SAND; reddish brown, slightly moist, loose, fine to medium grained.
	1.0 – 2.5		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Quartz Latite; yellowish brown, slightly moist, moderately hard, moderately weathered, fine grained, soft. @1.5 ft. white, dry, very hard, slightly weathered.
			TOTAL DEPTH 2.5 FT./REFUSAL NO WATER, NO CAVING




EX-6

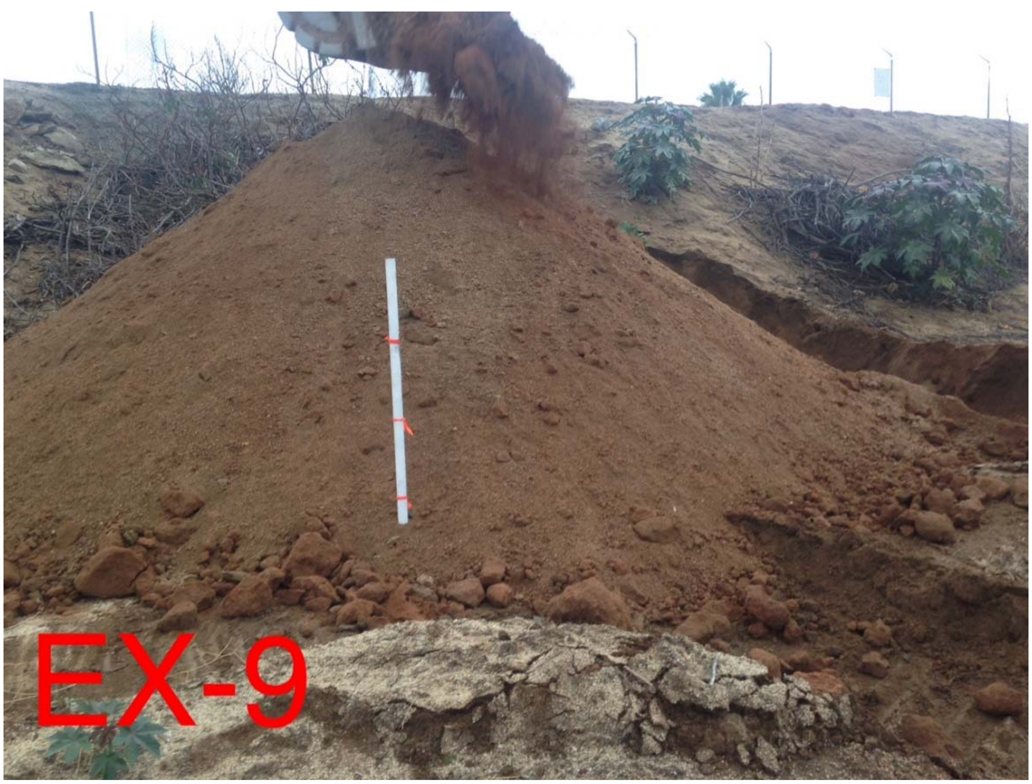

EX-6

Test Pit No.	Depth (ft.)	USCS	Description
EX-7	0.0 – 7.0	SC	**Artificial Fill - undocumented:** CLAYEY SAND; yellowish brown and grayish brown, moist, loose, fine to medium grained. @ 6 ft. 4-inch clay pipe.
	7.0 – 8.0		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Light olive, slightly moist, moderately hard, coarse grained/large crystal size.
			TOTAL DEPTH 8 FT. / REFUSAL NO WATER, NO CAVING

Test Pit No.	Depth (ft.)	USCS	Description
EX-8	0.0 – 18.5		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Brownish red, dry, soft, fine to medium grained, highly weathered, abundant secondary clays. @ 2 ft. yellowish brown, moderately soft, breaks into sand with some silt and clay. @ 6 ft. moderately hard, slow digging. @ 16 ft. light gray, hard, still rippable. TOTAL DEPTH 18.5 FT./PRACTICAL REFUSAL NO WATER, NO CAVING

Date Excavated 8/28/2015

Test Pit No.	Depth (ft.)	USCS	Description
EX-9	0.0 – 2.0	SM	**Artificial Fill - undocumented:** SILTY SAND; brown, moist, loose, fine to coarse grained.
	2.0 – 20.0		**Granodiorite/Gabbro undifferentiated (Kcgb):** Red, dry, soft, fine to medium grained, highly weathered to clayey sand, abundant secondary clays. @ 4 ft. brownish gray, moderately soft, breaks into clayey sand. @ 6 ft. breaks into fine to coarse grained sand, some silt and clay. @ 7 ft. Some ½ inch thick pegmatite dikes. @ 11 ft. gray, large crystal size/coarse grained. @ 15 ft. moderately hard. @ 16 ft. light gray, breaks into fine to coarse grained sand, (SE 30+) @ 20 ft. still rippable.
			TOTAL DEPTH 20 FT. NO WATER, NO CAVING



Test Pit No.	Depth (ft.)	USCS	Description
EX-10	0.0 – 2.0	SM	**Artificial Fill - undocumented:** SILTY SAND; reddish brown and brown, slightly moist, loose, fine to coarse grained.
	2.0 – 20.5		**Granodiorite/Gabbro undifferentiated (Kcgb):** Yellowish brown and gray, dry, moderately hard, coarse grained, moderately weathered, breaks into fine to coarse grained sand with some silt and clay. Steeply dipping clay-lined joints, approximately 8-inch spacing. @ 7 ft. N32E, 82SE - Joint @ 7 ft. N33W, 85N - Joint @ 10 ft. moderately hard. @ 16 ft. gray with trace of iron oxide, moderately hard to hard. @ 19 ft. bluish gray, hard, very slow digging. @ 20.5 ft. still rippable. TOTAL DEPTH 20.5 FT. NO WATER, NO CAVING

Test Pit No.	Depth (ft.)	USCS	Description
EX-11	0.0 – 1.0	SM	**Topsoil:** SILTY SAND; reddish brown, dry, loose, fine to coarse grained, some angular granitic gravel.
	1.0 – 20.0		**Granodiorite/Gabbro undifferentiated (Kcgb):** Red, dry, soft, fine to medium grained, highly weathered, densely fractured, abundant secondary clays. @ 2.5 ft. gray to dark gray (Gabbro), hard, some flat-lying to shallowly dipping fine fractures with iron oxide. @ 5 ft. N20W, 55NE – parallel joints. @ 18 ft. very slow digging. @ 20 ft. still rippable. TOTAL DEPTH 20 FT. NO WATER, NO CAVING

Test Pit No.	Depth (ft.)	USCS	Description
EX-12	0.0 – 6.5		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Brownish red, slightly moist, moderately soft, fine to medium grained, highly weathered, abundant secondary clays. @ 3 ft. yellowish brown, moderately soft, breaks into sand with some silt and clay. @4 ft. some dark gray mafic inclusions up to 6-inch thick and elongated within the Granodiorite. @ 5 ft. gray, hard, slow digging. @ 6 ft. very hard. TOTAL DEPTH 6.5 FT./Refusal NO WATER, NO CAVING

Test Pit No.	Depth (ft.)	USCS	Description
EX-14	0.0 – 16.5		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Brownish red, slightly moist, moderately soft, fine to coarse grained, highly to moderately weathered. @4 ft. light yellowish brown, moderately hard, breaks-up to fine to coarse grained sand. @ 5 ft. gray, hard, slow digging. @ 6 ft. N60E, Vertical - Joint @ 6 ft. N40W, 80NE - Joint @ 12 ft. gray, very slow digging. @ 16.5 ft. Practical Refusal. TOTAL DEPTH 16.5 FT NO WATER, NO CAVING


EX-14@15'

Test Pit No.	Depth (ft.)	USCS	Description
EX-15	0.0 – 3.5		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Reddish brown, slightly moist, moderately soft, fine to medium grained, moderately weathered, densely fractured. @ 2.5 ft. gray to light gray (Gabbro), breaks into sand with angular clasts to 8-inch diameter. @ 2.5 ft. N30W, 60NE TOTAL DEPTH 3.5 FT./REFUSAL NO WATER, NO CAVING

Test Pit No.	Depth (ft.)	USCS	Description
EX-16	0.0 – 1.0	SM	**Artificial Fill - undocumented:** SILTY SAND; reddish brown, slightly moist, loose, fine to coarse grained.
	1.0 – 3.5		**Granodiorite/Gabbro undifferentiated (Kcgb):** Yellowish brown and gray, dry, moderately hard, very fine grained, moderately weathered, thinly foliated along mica minerals (Phyllite). @ 3 ft. gray, hard
			TOTAL DEPTH 3.5 FT./REFUSAL NO WATER, NO CAVING

Test Pit No.	Depth (ft.)	USCS	Description
EX-17	0.0 – 0.5	SC	**Topsoil:** CLAYEY SAND; reddish brown, dry, loose, fine grained.
	0.5 – 19.0		**Granodiorite/Gabbro undifferentiated (Kcgb):** Reddish brown, dry, soft, fine to medium grained, highly weathered, abundant secondary clays. @ 2.5 ft. yellowish brown, slightly moist, fine to coarse grained. @ 16 ft. olive with iron oxide staining, slow digging. @ 18 ft. very hard. TOTAL DEPTH 19 FT./PRACTICAL REFUSAL NO WATER, NO CAVING

Test Pit No.	Depth (ft.)	USCS	Description
EX-18	0.0 – 1.5	SC	**Older Alluvium (Qoa):** CLAYEY SAND, yellowish brown, dry, medium dense, fine to medium grained, highly weathered, some clay, some visible porosity. Sharp contact with underlying Kcgb.
	1.5 – 17.5		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Gray with iron oxide along fine fractures, dry, moderately soft, fine grained, moderately weathered. @ 7.0 ft. moderately hard, moderately weathered. @ 11 ft. hard, some clay lined steeply dipping joints. @ 11 ft. N5E, 70SW – Joint
			TOTAL DEPTH 17.5 FT./ PRACTICAL REFUSAL NO WATER, NO CAVING

Test Pit No.	Depth (ft.)	USCS	Description
EX-19	0.0 –2.0	SC	**Artificial Fill-undocumented:** CLAYEY SAND, grayish brown and gray, dry, loose, fine to medium grained.
	2.0 – 16.0		**Granodiorite/Gabbro - undifferentiated (Kcgb):** Red, dry, soft, coarse grained, large Biotite crystals, highly weathered. @ 4.0 ft. light gray and yellowish brown, moderately hard, moderately weathered. @ 12.0 ft. hard, slow digging. @ 15.0 ft. Blueish gray, very hard, very slow digging. TOTAL DEPTH 16.0 FT./PRACTICAL REFUSAL NO WATER, NO CAVING

LOG OF TEST PITS

Project No. 111446-001 **LOGGED BY:** PC
CLIENT: Victoria Grove **DATE:** 12/27/04

TEST PIT#	DEPTH (FT)	SAMPLE TYPE C, B & DEPTH	DRY DENSITY (PCF)	MOIST (%)	USCS	DESCRIPTION
T-46	0-5				SM	**Quaternary Colluvium (Qcol) –** Red-brown, moist, medium dense, silty, fine SAND and GRAVEL; scattered pebbles <3 mm in diameter, rootlets, porous
	5-6				SM	Red-brown, damp, medium dense to dense, silty, fine SAND; scattered pebbles <3 mm in diameter, micaceous
	6-7					**Cretaceous-Aged Granitic Bedrock (Kgr) –** Red-brown, damp, dense to very dense, weathered BEDROCK; friable, breaks to medium to coarse sand
						Total Depth 7', No Groundwater, No Caving, Backfilled 12/22/04
T-65	0-2				SM	**Topsoil-** Red-brown, damp to moist, loose, silty, fine SAND; scattered pebbles <3mm in diameter, dense root system throughout, pinhole pores very common
	2-6				SM	**Quaternary Colluvium (Qcol) –** Red-brown, damp to moist, medium dense, silty, fine SAND and GRAVEL; subrounded pebbles between 2mm and 20 mm in diameter, rootlets throughout, pinhole pores very common
	6-7					**Cretaceous-Aged Granitic Bedrock (Kgr) –** Red-brown, damp, dense, weathered BEDROCK; friable, breaks into medium to coarse sand
						Total Depth 7', No Groundwater, No Caving, Backfilled 12/27/04
T-66	0-4				SM	**Quaternary Colluvium (Qcol) –** Red-brown, damp to moist, loose to medium dense, silty, fine SAND; scattered pebbles <3mm in diameter, rootlets
	4-7.5				SM	Red-brown, damp to moist, medium dense, silty, fine SAND and GRAVEL; subrounded pebbles between 2mm and 20 mm in diameter, rootlets throughout, pinhole pores very common
	7.5-8					**Cretaceous-Aged Granitic Bedrock (Kgr) –** Red-brown, damp, dense, weathered BEDROCK; friable, breaks into medium to coarse sand
						Total Depth 8', No Groundwater, No Caving, Backfilled 12/27/04

LOG OF TEST PITS

Project No. 111446-001 **LOGGED BY:** PC
CLIENT: Victoria Grove **DATE:** 12/27/04

TEST PIT#	DEPTH (FT)	SAMPLE TYPE C, B & DEPTH	DRY DENSITY (PCF)	MOIST (%)	USCS	DESCRIPTION
T-67	0-1				SM	**Quaternary Colluvium (Qcol) –** Red-brown, damp to moist, loose to medium dense, silty, fine SAND; scattered pebbles <3mm in diameter, rootlets throughout
	1-2.5					**Cretaceous-Aged Granitic Bedrock (Kgr) –** Red-brown, damp to moist, dense, weathered BEDROCK; friable, breaks into medium to coarse sand, mafic 80%, felsic 20%
						Total Depth 2.5', No Groundwater, No Caving, Backfilled 12/27/04
T-68	0-3				SM	**Undocumented Artificial Fill (Afu) –** Red-brown, damp to moist, loose to medium dense, silty, fine SAND; scattered rootlets, few large roots
	2-3				SM	**Quaternary Colluvium (Qcol) –** Red-brown, damp to moist, medium dense, silty, fine SAND and GRAVEL; subrounded pebbles between 2mm and 20 mm in diameter, rootlets throughout, pinhole pores very common
	3-3.5					**Cretaceous-Aged Granitic Bedrock (Kgr) –** Red-brown, damp, dense to very dense, weathered BEDROCK; friable, breaks into medium to coarse sand
						Total Depth 3.5', No Groundwater, No Caving, Backfilled 12/27/04
T-69	0-5				SM	**Undocumented Artificial Fill (Afu) –** Yellow-red-brown, damp to moist, loose to medium dense, silty, fine to coarse SAND and GRAVEL; scattered pebbles <3mm in diameter
	5-6.5				SM	**Quaternary Colluvium (Qcol) –** Dark red-brown, damp to slightly moist, medium dense to dense, silty, fine SAND and GRAVEL; subrounded to subangular pebbles between <20 mm in diameter
	6.5-7.5					**Cretaceous-Aged Granitic Bedrock (Kgr) –** Dark red-brown, damp, very dense, weathered BEDROCK; friable, breaks into medium to coarse sand
						Total Depth 7.5', No Groundwater, No Caving, Backfilled 12/27/04

LOG OF TEST PITS

Project No. 111446-001
CLIENT: Victoria Grove

LOGGED BY: PC
DATE: 12/27/04

TEST PIT#	DEPTH (FT)	SAMPLE TYPE C, B & DEPTH	DRY DENSITY (PCF)	MOIST (%)	USCS	DESCRIPTION
T-79	0-10				SM	**Quaternary Colluvium (Qcol) –** Light brown, damp, medium dense, silty, fine SAND; scattered pebbles <3mm in diameter, rootlets throughout, pinhole pores very common, calcium carbonate stringers common, sand fines upwards Total Depth 10', No Groundwater, No Caving, Backfilled 12/27/04
T-80	0-4.5				SM	**Quaternary Colluvium (Qcol) –** Red-brown, damp to moist, medium dense, silty, fine to coarse SAND; scattered pebbles <4mm in diameter, very porous, rootlets throughout
	4.5-6					**Cretaceous-Aged Granitic Bedrock (Kgr) –** Blue-brown, damp, very dense, weathered BEDROCK; slightly friable, breaks into medium to coarse sand and gravel Total Depth 6', No Groundwater, No Caving, Backfilled 12/27/04
T-81	0-3				SM	**Topsoil –** Red-brown, moist, loose, silty, fine SAND; scattered pebbles, porous, rootlets common
	3-8				SM	**Quaternary Alluvium Older (Qalo) –** Dark red-brown, damp, dense, silty, fine SAND; scattered pebbles, porous, calcium carbonate stringers common Total Depth 8', No Groundwater, No Caving, Backfilled 12/27/04
T-82	0-3.5				SM	**Topsoil –** Red-brown, damp to moist, medium dense, silty, fine SAND; scattered pebbles <3mm in diameter, porous, rootlets common
	3.5-4					**Cretaceous-Aged Granitic Bedrock (Kgr) –** Red-brown, damp, very dense, weathered BEDROCK; friable, breaks into medium to coarse sand Total Depth 4', No Groundwater, No Caving, Backfilled 12/27/04

GEOTECHNICAL BORING LOG LB-2

Date 1-24-05 **Sheet** 1 **of** 1
Project Victoria Grove East **Project No.** 111446-001
Drilling Co. Layne Christiansen **Type of Rig**
Hole Diameter 8" **Drive Weight** 140 lbs **Drop** 30"
Elevation Top of Hole +/- 1290' **Location** See Map

Logged By PC
Sampled By PC

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1290	0								TOPSOIL QUATERNARY ALLUVIUM OLDER (Qalo)	
				R1	73	111.2	14.9	ML	@ 2.5': Light to medium brown, moist, very stiff, sandy SILT; pinhole pores, rootlets common, blocky texture	RDS
1285	5			R2	46	111.4	4.4		@ 5': Medium brown, damp to moist, very stiff, sandy SILT; pinhole pores common, calcium carbonate stringers common, blocky texture	HCO, -200, EI
				R3	34			SM	@ 7.5': Light to medium brown, damp to moist, medium dense, silty, fine SAND; pinhole to 2mm diameter hole pores common, calcium carbonate stringers common, blocky texture	
1280	10			R4	63	117.1	8.0		@ 10': Medium to red-brown, damp to moist, dense, silty, fine SAND; pinhole pores common, calcium carbonate stringers very common, blocky texture	HCO, EI
				R5	81	132.9	7.8		@ 12.5': Dark red-brown, moist, dense, silty, fine to medium SAND; few rock fragments, micaceous	HCO, -200, EI
1275	15			R6	19				@ 15': Dark red-brown, moist, medium dense, silty, fine to medium SAND; few rock fragments, micaceous	
				R7	24	112.9	17.2		@ 17.5': Red-brown, damp to moist, medium dense, silty, fine to medium SAND; calcium carbonate stringers very common, micaceous	-200
1270	20			R8	20				@ 20': Red-brown, damp to moist, medium dense, silty, fine to medium SAND; pebbles common, very micaceous	
				R9	63	123.8	2.5		CRETACEOUS AGED GRANITIC BEDROCK (Kgr) @ 22.5': Red-brown, damp to moist, dense, weathered BEDROCK; friable, breaks into coarse sand and gravel, very micaceous	
1265	25			S10	50/5"				@ 25': Gray-brown, damp, very dense, weathered BEDROCK; friable, breaks into coarse sand and gravel	
									Total Depth 25.9' No Groundwater Encountered Backfilled with Spoils 1/24/05	
1260	30									

SAMPLE TYPES:
S SPT
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
C CORE SAMPLE

TYPE OF TESTS:
SU SULFATE
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDROCOLLAPSE
HD HYDROMETER
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE
CS CORROSION SUITE
MC MOISTURE CONTENT
SE SAND EQUIVALENT
-200 200 WASH
RDS Remolded DS

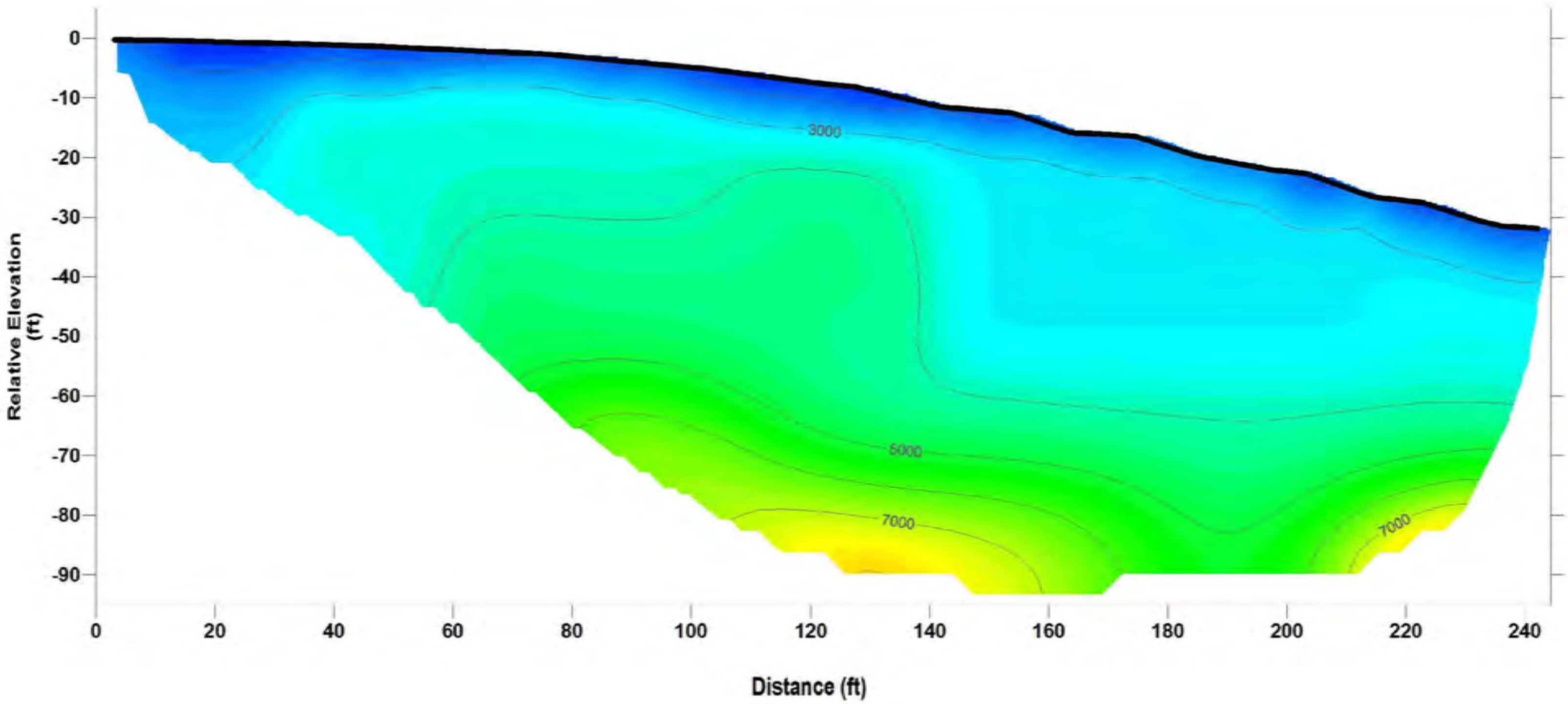
LEIGHTON

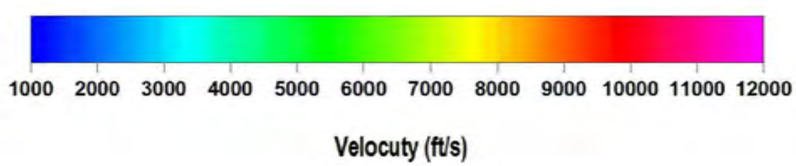
APPENDIX A-3

SEISMIC REFRACTION SURVEY (PREVIOUS STUDY)

Leighton

TOMOGRAPHY MODEL

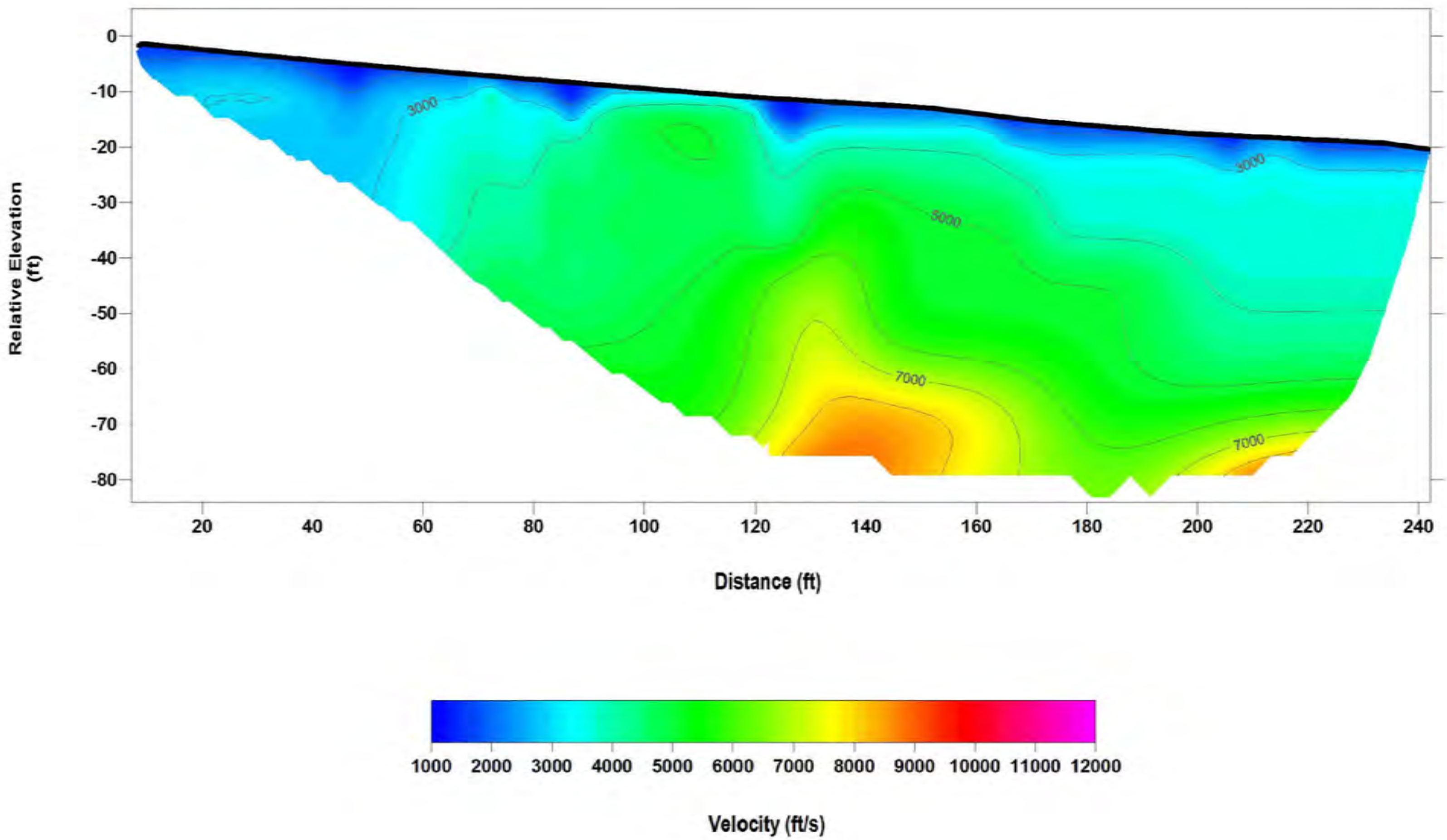




P-WAVE PROFILE SL-1	Green Tree Ranch Riverside, California Project No.: 118142 Date: 04/18	SOUTHWEST GEOPHYSICS INC. Figure 4a

Note: Contour Interval = 1,000 feet per second

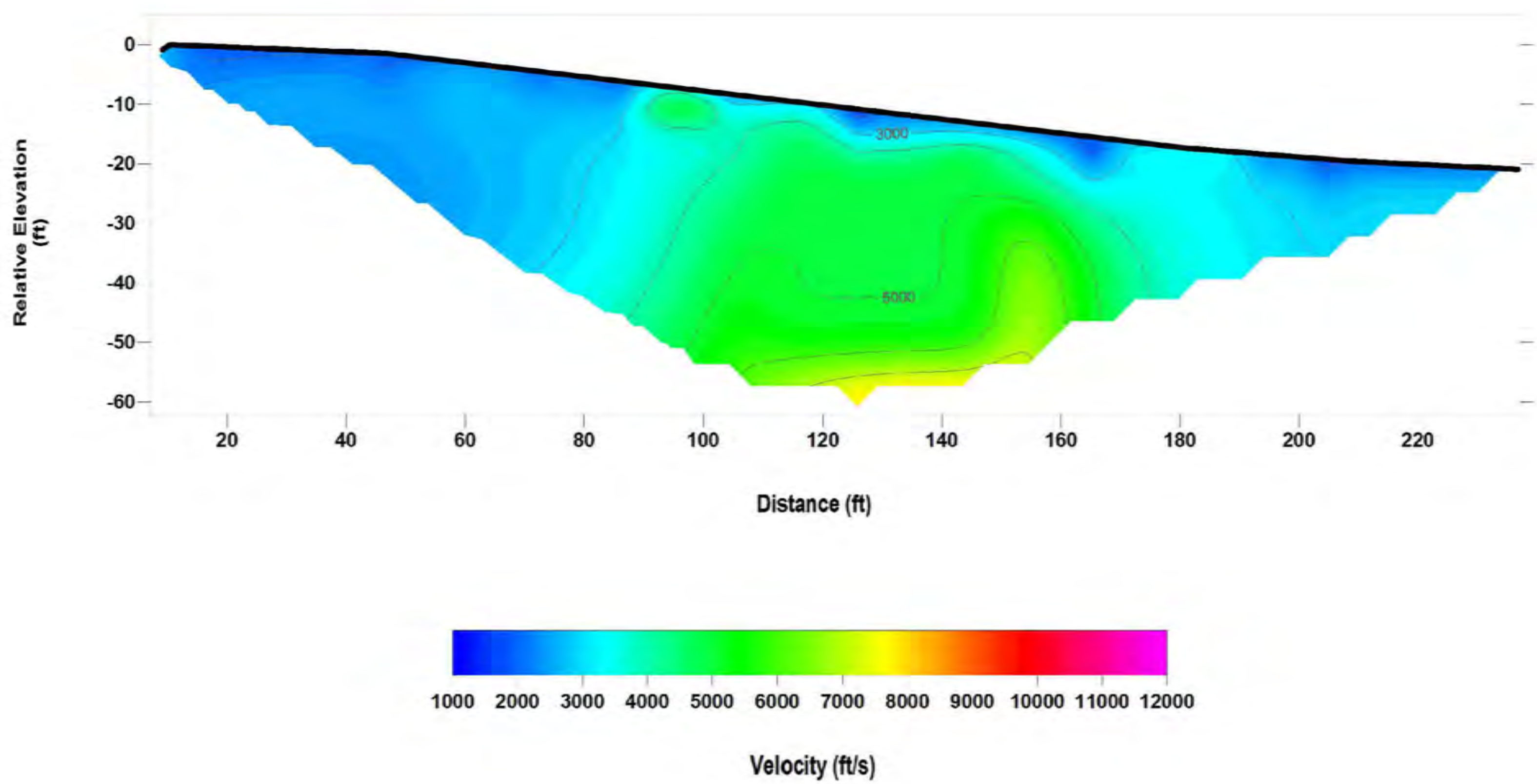
TOMOGRAPHY MODEL



P-WAVE PROFILE SL-2	Green Tree Ranch Riverside, California	SOUTHWEST GEOPHYSICS INC. Figure 4b
	Project No.: 118142 / Date: 04/18	

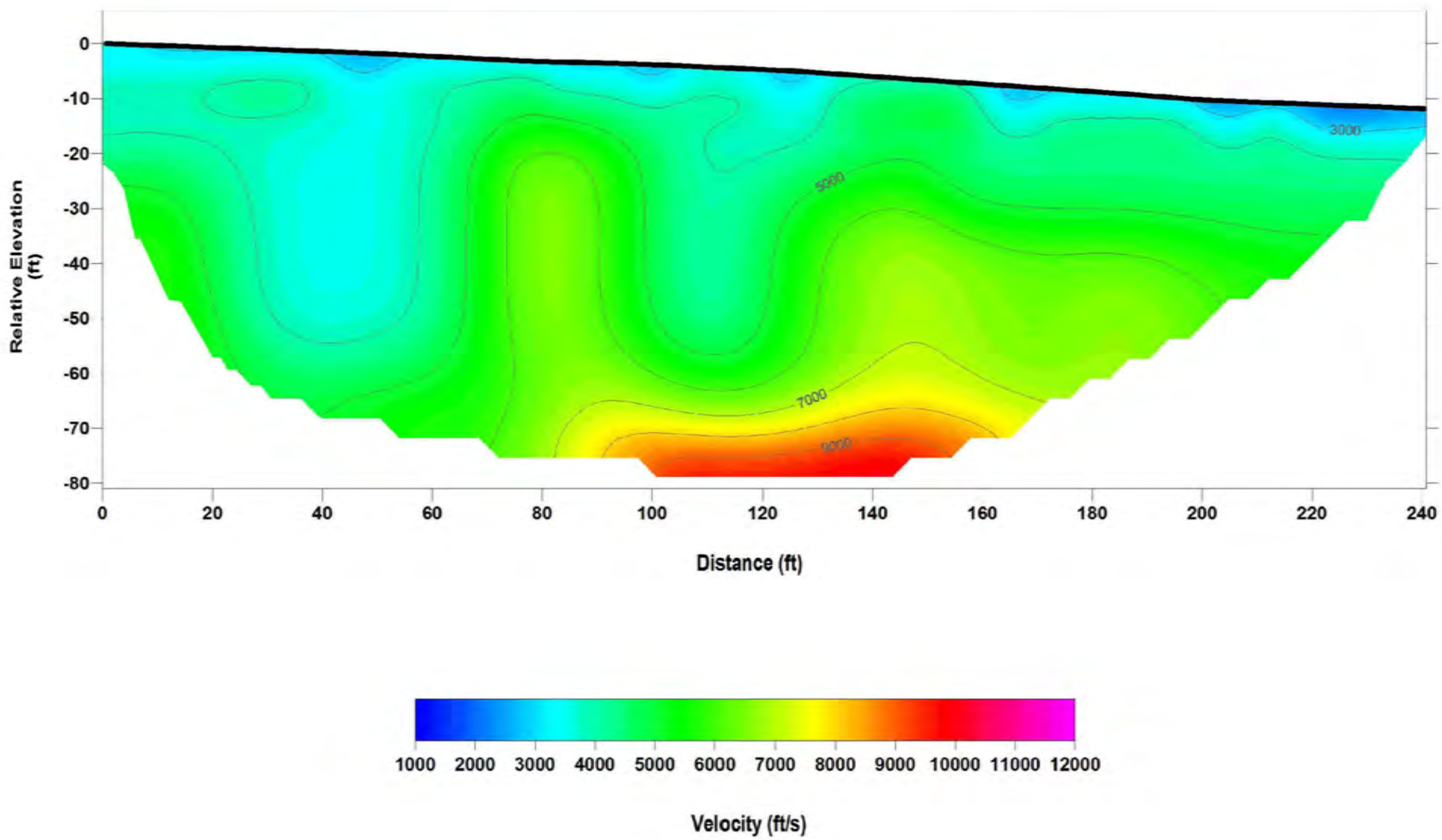
Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL



P-WAVE PROFILE **SL-3**	Green Tree Ranch Riverside, California Project No.: 118142 Date: 04/18	SOUTHWEST GEOPHYSICS INC. Figure 4c	**Note: Contour Interval = 1,000 feet per second**

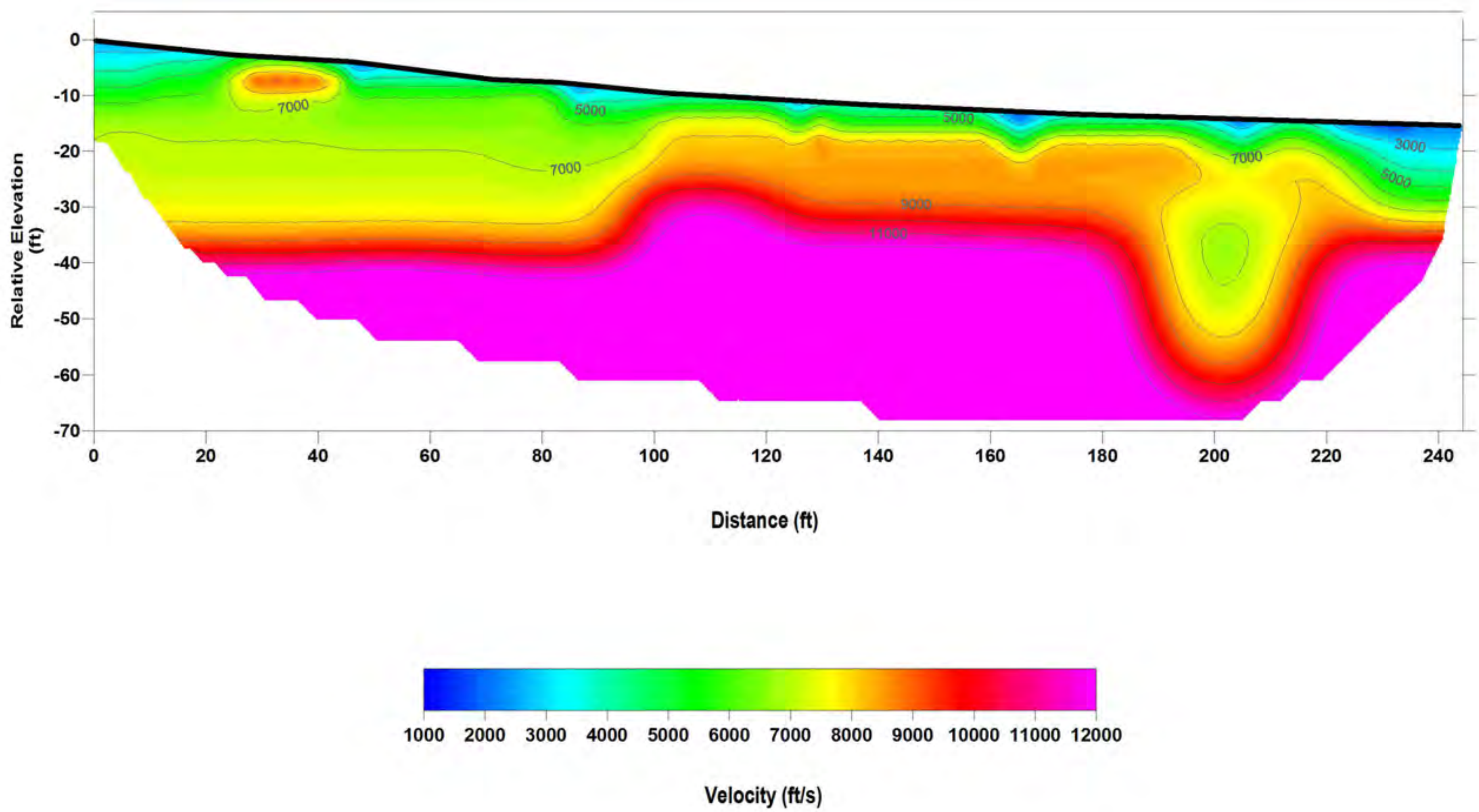
TOMOGRAPHY MODEL



P-WAVE PROFILE SL-4	Green Tree Ranch Riverside, California	SOUTHWEST GEOPHYSICS INC. Figure 4d
	Project No.: 118142 — Date: 04/18	

Note: Contour Interval = 1,000 feet per second

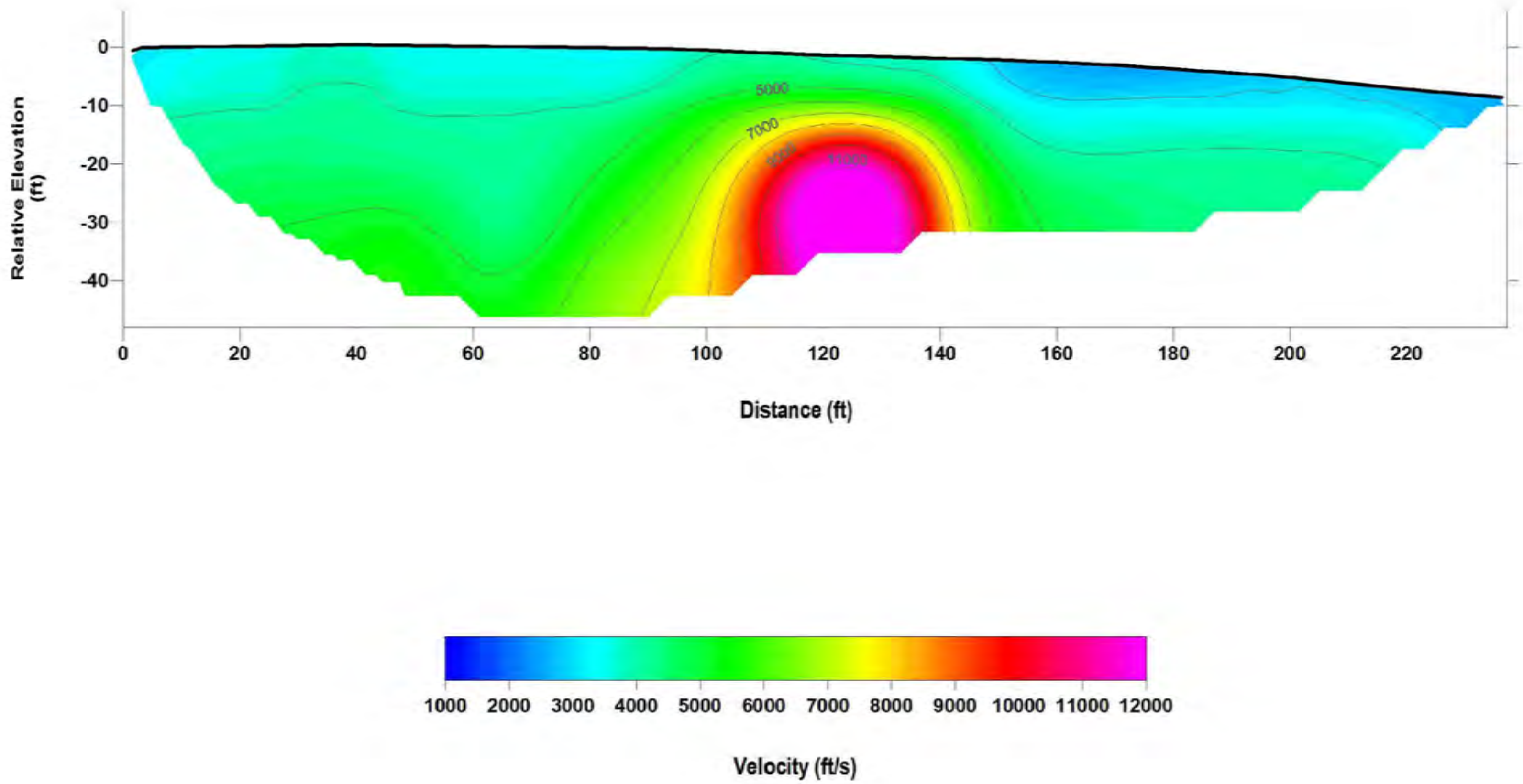
TOMOGRAPHY MODEL



P-WAVE PROFILE SL-5	Green Tree Ranch Riverside, California	SOUTHWEST GEOPHYSICS INC. Figure 4e
	Project No.: 118142 — Date: 04/18	

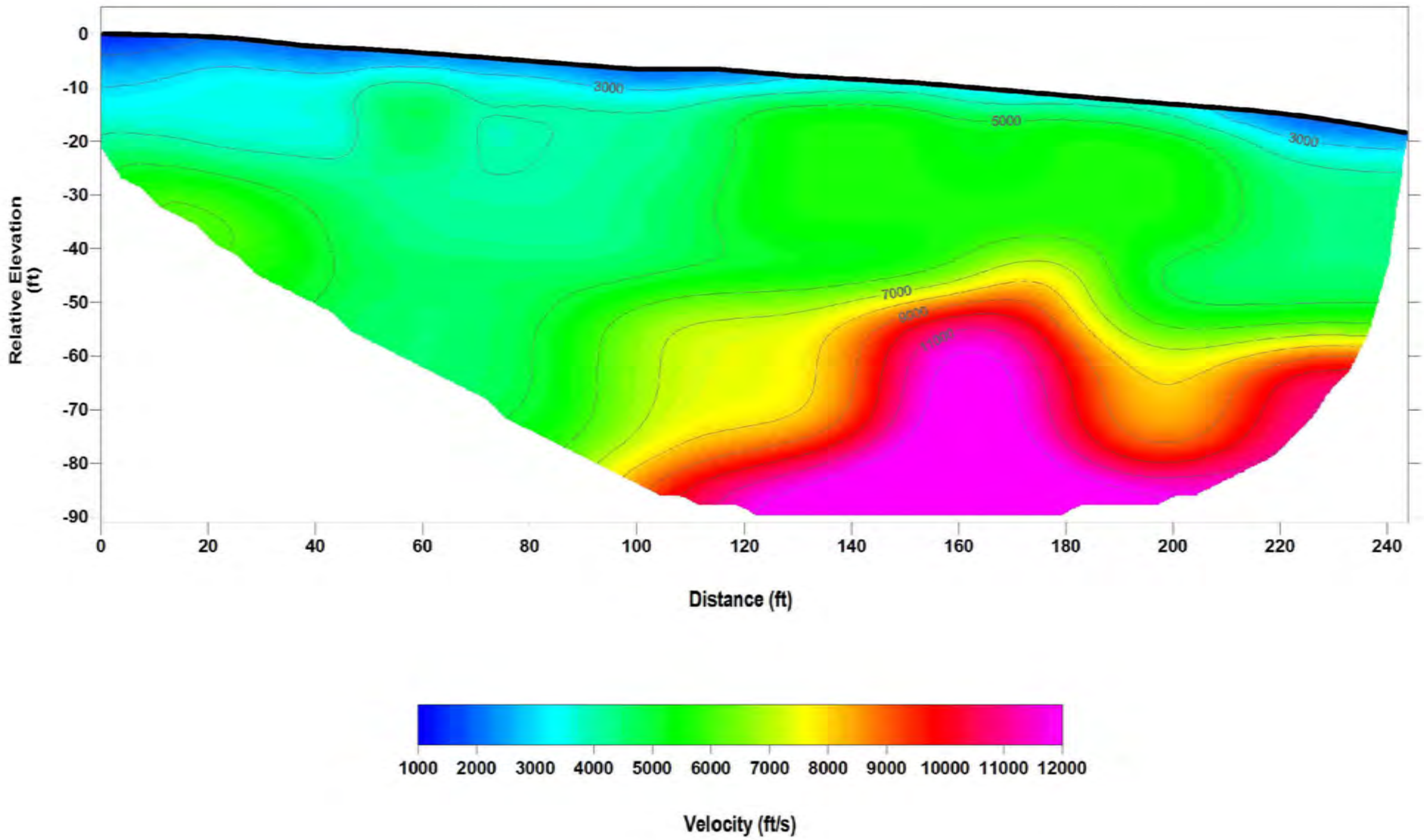
Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL



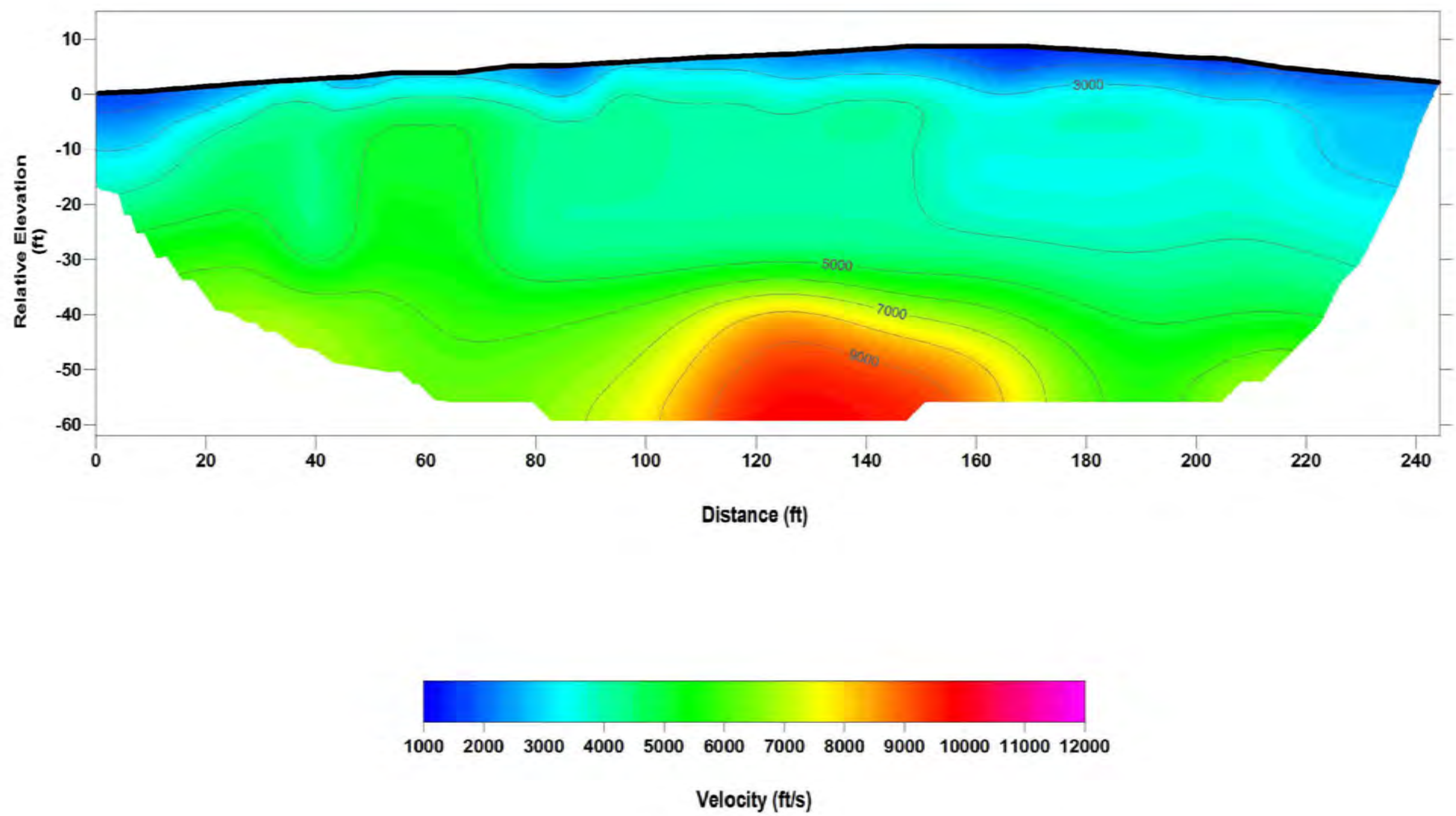
P-WAVE PROFILE SL-6	Green Tree Ranch Riverside, California Project No.: 118142 — Date: 04/18	SOUTHWEST GEOPHYSICS INC. Figure 4f	**Note: Contour Interval = 1,000 feet per second**

TOMOGRAPHY MODEL



P-WAVE PROFILE SL-7	Green Tree Ranch Riverside, California	SOUTHWEST GEOPHYSICS INC.	Note: Contour Interval = 1,000 feet per second
	Project No.: 118142 Date: 04/18	Figure 4g	

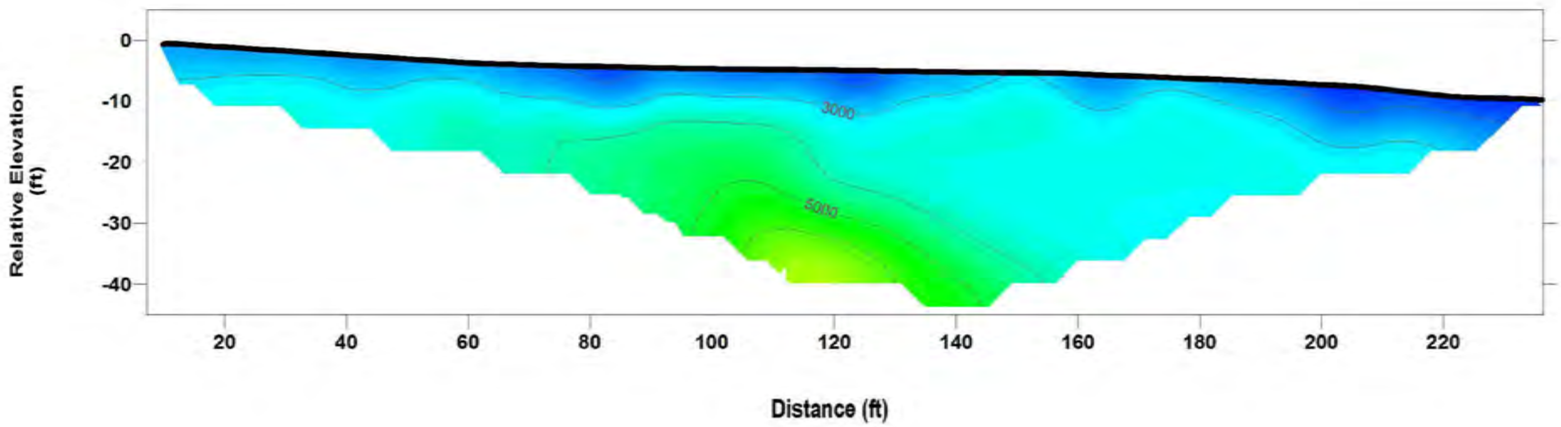
TOMOGRAPHY MODEL

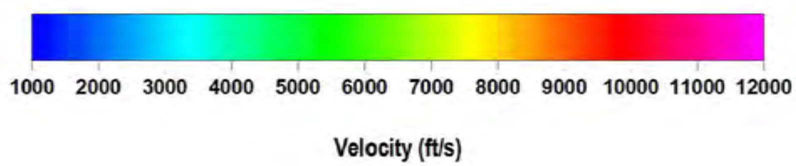


P-WAVE PROFILE SL-8	Green Tree Ranch Riverside, California Project No.: 118142 Date: 04/18	SOUTHWEST GEOPHYSICS INC. Figure 4h

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

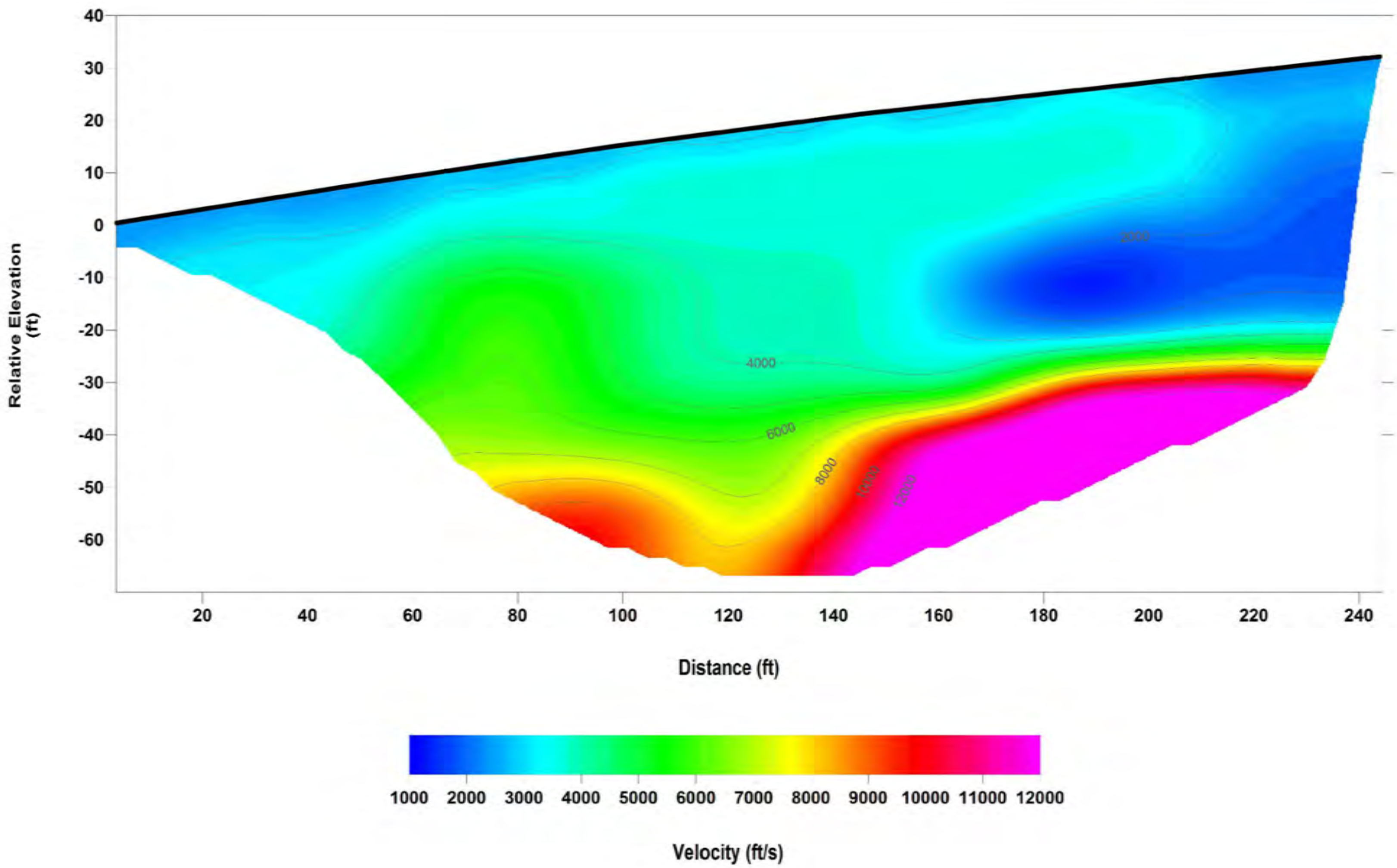




P-WAVE PROFILE SL-9	Green Tree Ranch Riverside, California Project No.: 118142 Date: 04/18	SOUTHWEST GEOPHYSICS INC. Figure 4i

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL



P-WAVE PROFILE SL-10	Green Tree Ranch Riverside, California Project No.: 118142 Date: 04/18	SOUTHWEST GEOPHYSICS INC. Figure 4j

Note: Contour Interval = 1,000 feet per second

APPENDIX A-4

AIRTRACK LOGS (PREVIOUS STUDY)

Leighton

Drilling Report

E.C.M.

EarthConstructionMining

Rotary Percussion Test Drilling Penetration Rates

Job Name	**VICTORIA HEIGHTS PHASE 1**
Location	
Job Number	**1387.00**
For	**ALBUS- KEEFE**

Drill Date(s)		15-Jan-05
	3½":	4":
Field Tech(s)		
Drill Model	**841- ECM 370**	

Disclaimer:

The following Data contains estimated Rippable/Marginal and Marginal/Blasting Horizons are based upon experience in Massive Homogeneous Granite Rock Types. Deviations due to changes in geologic formations, bedding planes, joints sets faulting or hydrological conditions as well as ripper equipment types and conditions can result in wide variances in either direction in the actual rippability limits encountered.

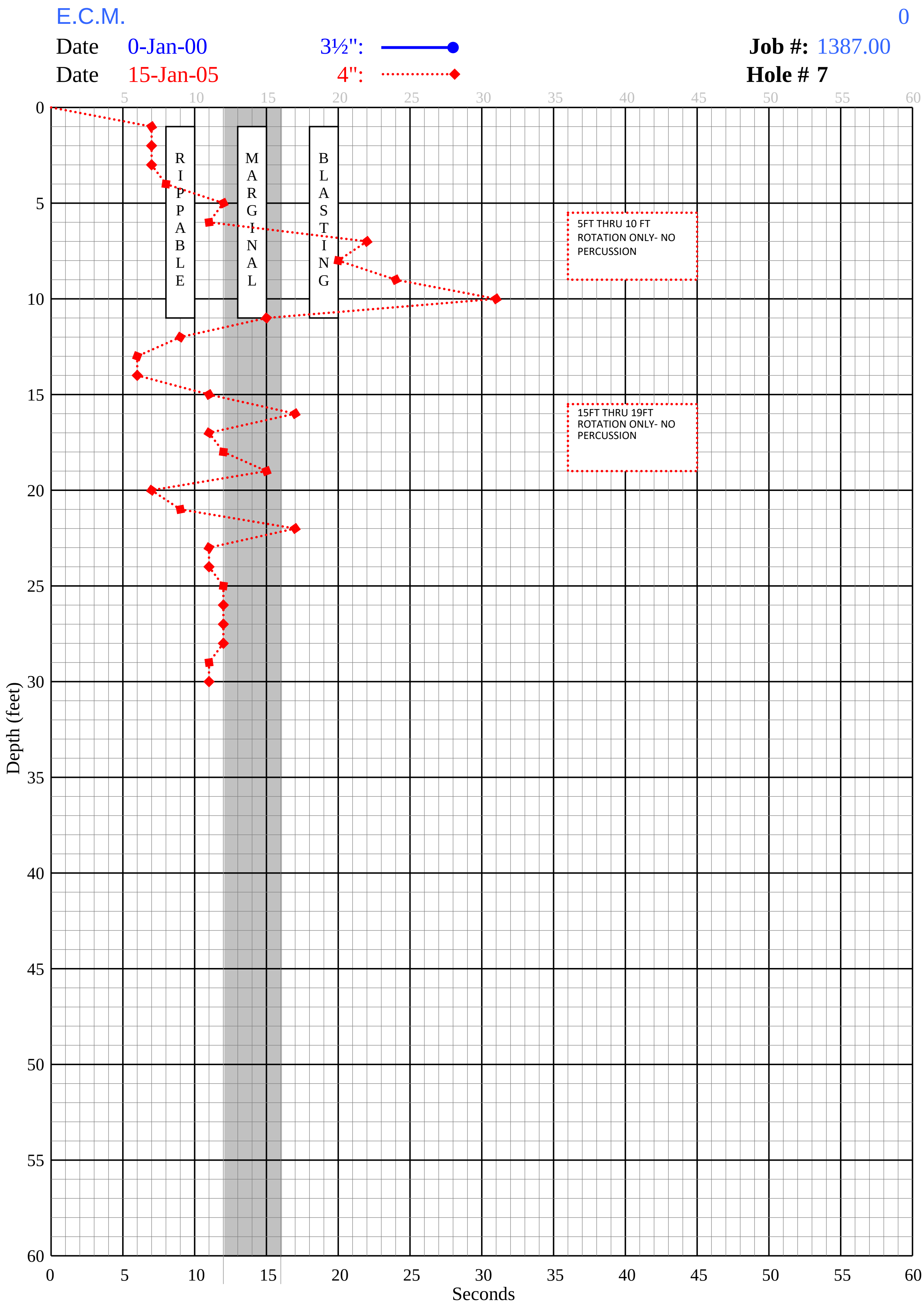
EarthConstructionMining

1387.00 VICTORIA HEIGHTS PHASE 1

0

Test Drilling Graphs

Graphs	Hole Number	Number of Feet with 3½" Bit	Number of Feet with 4" Bit	**Total Feet**
1	1		**31**	**31**
2	2		**42**	**42**
3	3		**27**	**27**
4	4		**40**	**40**
5	5		**30**	**30**
6	6		**30**	**30**
7	7		**30**	**30**
8	8		**49**	**49**
9	9		**45**	**45**
10	10		**40**	**40**
11	11		**40**	**40**
12	12		**30**	**30**
13	13		**43**	**43**
14	14		**33**	**33**
15				**0**
16				**0**
17				**0**
18				**0**
19				**0**
20				**0**
21				**0**
22				**0**
23				**0**
24				**0**
25				**0**
26				**0**
27				**0**
28				**0**
29				**0**
30				**0**
31				**0**
32				**0**
33				**0**
34				**0**
35				**0**
36				**0**
37				**0**
38				**0**
39				**0**
40				**0**
41				**0**
42				**0**
43				**0**
44				**0**
45				**0**
			TOTAL FEET	**510**
			TOTAL HOURS	



E.C.M.
0
Date 0-Jan-00
Date 15-Jan-05
3½":
4":
Job #: 1387.00
Hole # 7
RIPPABLE
MARGINAL
BLASTING
5FT THRU 10 FT ROTATION ONLY- NO PERCUSSION
15FT THRU 19FT ROTATION ONLY- NO PERCUSSION
Depth (feet)
Seconds

E.C.M.

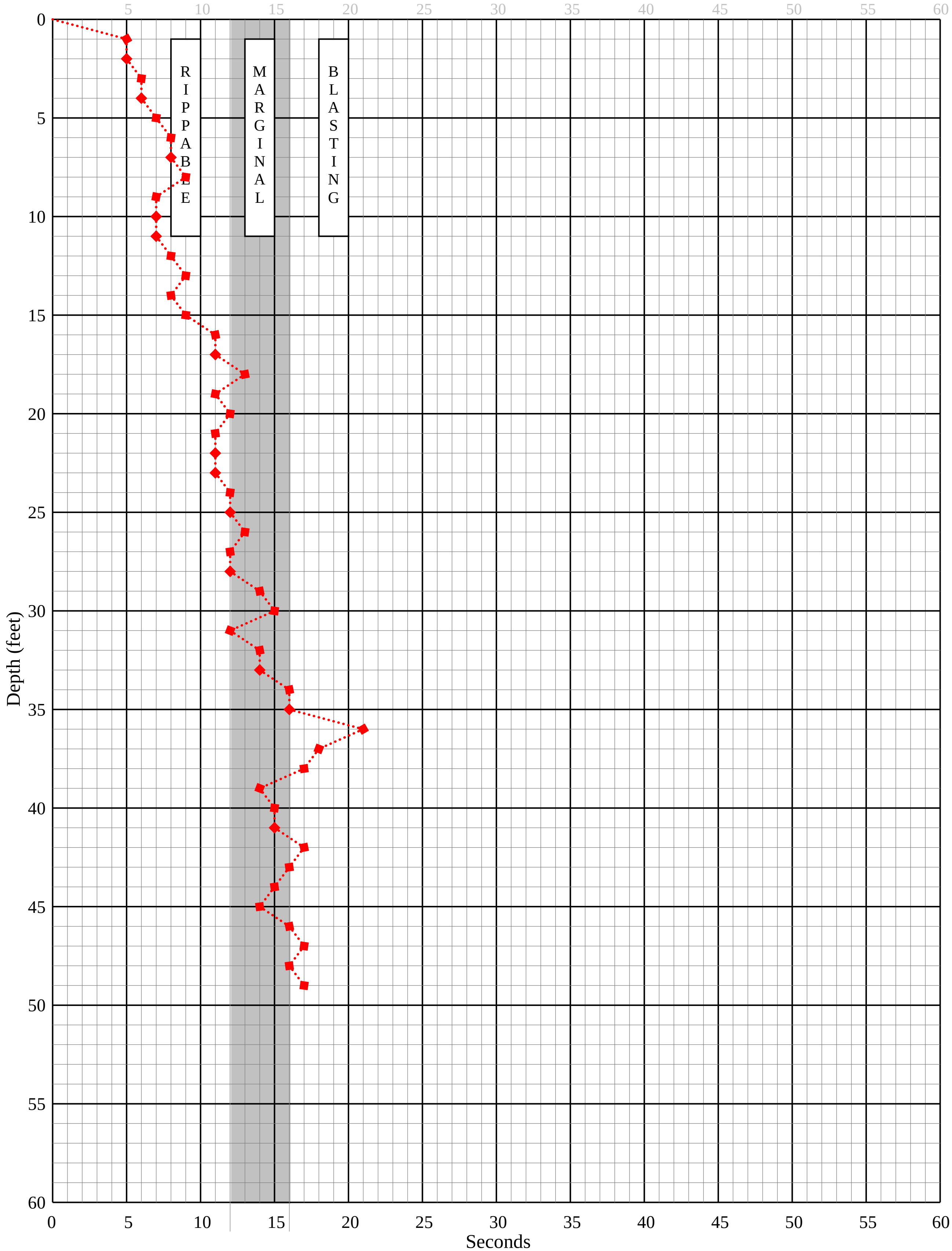
0

Date 0-Jan-00 3½":

Date 15-Jan-05 4":

Job #: 1387.00

Hole # 8



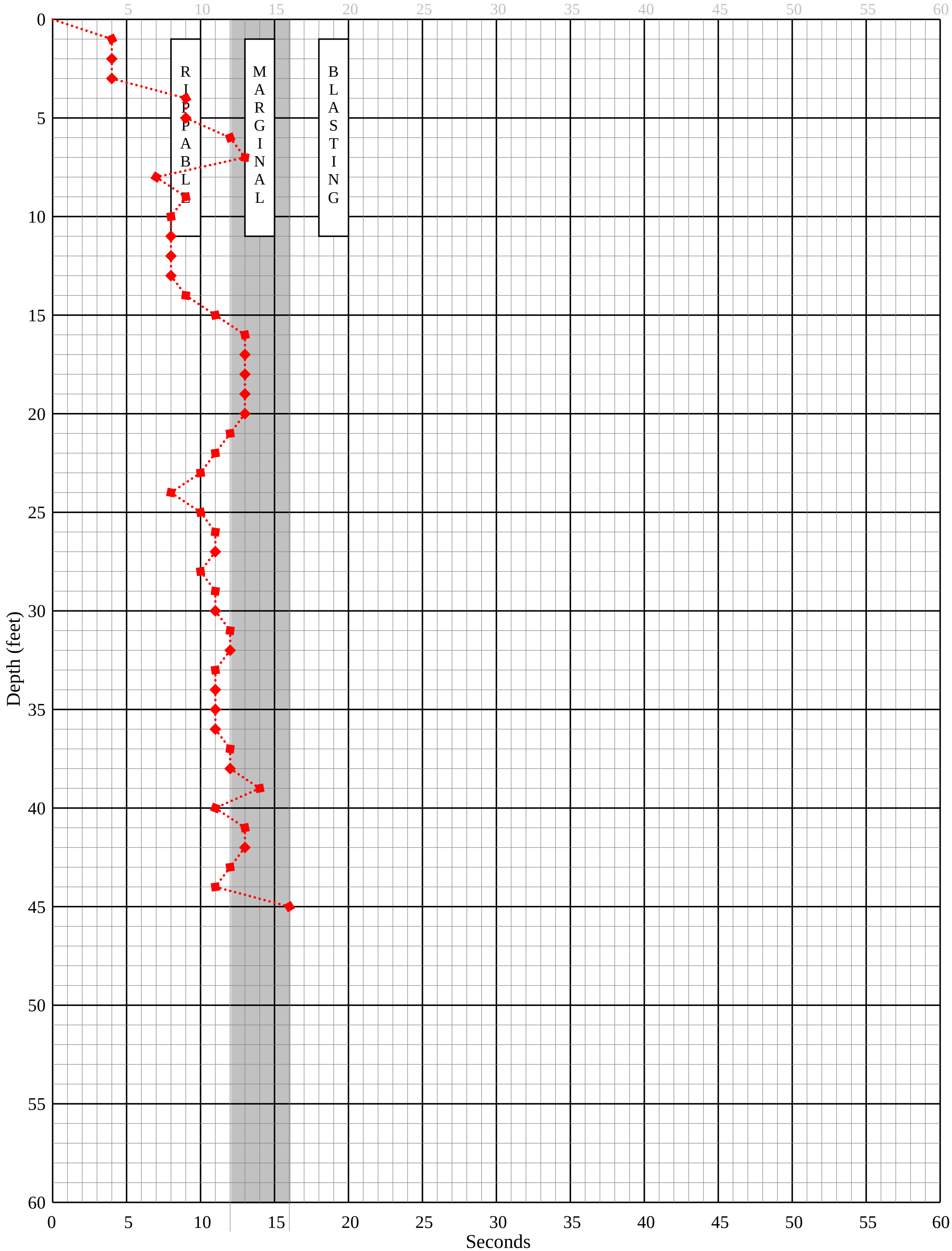
E.C.M. 0

Date 0-Jan-00 3½":

Date 15-Jan-05 4":

Job #: 1387.00

Hole # 9



APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS (THIS AND PREVIOUS STUDIES)

Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS
ASTM D 6913

Leighton

Project Name:	Pulte/Highland Grove 3/Geo DD	Tested By:	MRV	Date:	08/31/23
Project No.:	13979.001	Checked By:	MRV	Date:	09/01/23
Boring No.:	TP-4	Depth (feet):	0 - 4.0		
Sample No.:	B-1				
Soil Identification:	Well-Graded Sand with Silt (SW-SM), Reddish Brown.				

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	P	P	Wt. of Air-Dry Soil + Cont.(g)	1622.6	624.7
Wt. Air-Dried Soil + Cont.(g)	1622.6	624.7	Wt. of Dry Soil + Cont. (g)	1573.6	624.7
Wt. of Container (g)	278.8	279.3	Wt. of Container No._____(g)	278.8	279.3
Dry Wt. of Soil (g)	1294.6	345.4	Moisture Content (%)	3.8	0.0

Passing #4 Material After Wet Sieve		
	Container No.	A
	Wt. of Dry Soil + Container (g)	607.8
	Wt. of Container (g)	279.3
	Dry Wt. of Soil Retained on # 200 Sieve (g)	328.5

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
1 1/2"	37.500			100.0
1"	25.000			100.0
3/4"	19.000	0.0		100.0
1/2"	12.500	15.2		98.8
3/8"	9.500	24.6		98.1
#4	4.750	139.2		89.2
#8	2.360		85.6	67.1
#16	1.180		183.0	41.9
#30	0.600		250.0	24.6
#50	0.300		291.4	13.9
#100	0.150		312.4	8.5
#200	0.075		324.2	5.5
PAN				

GRAVEL: **11 %**

SAND: **83 %**

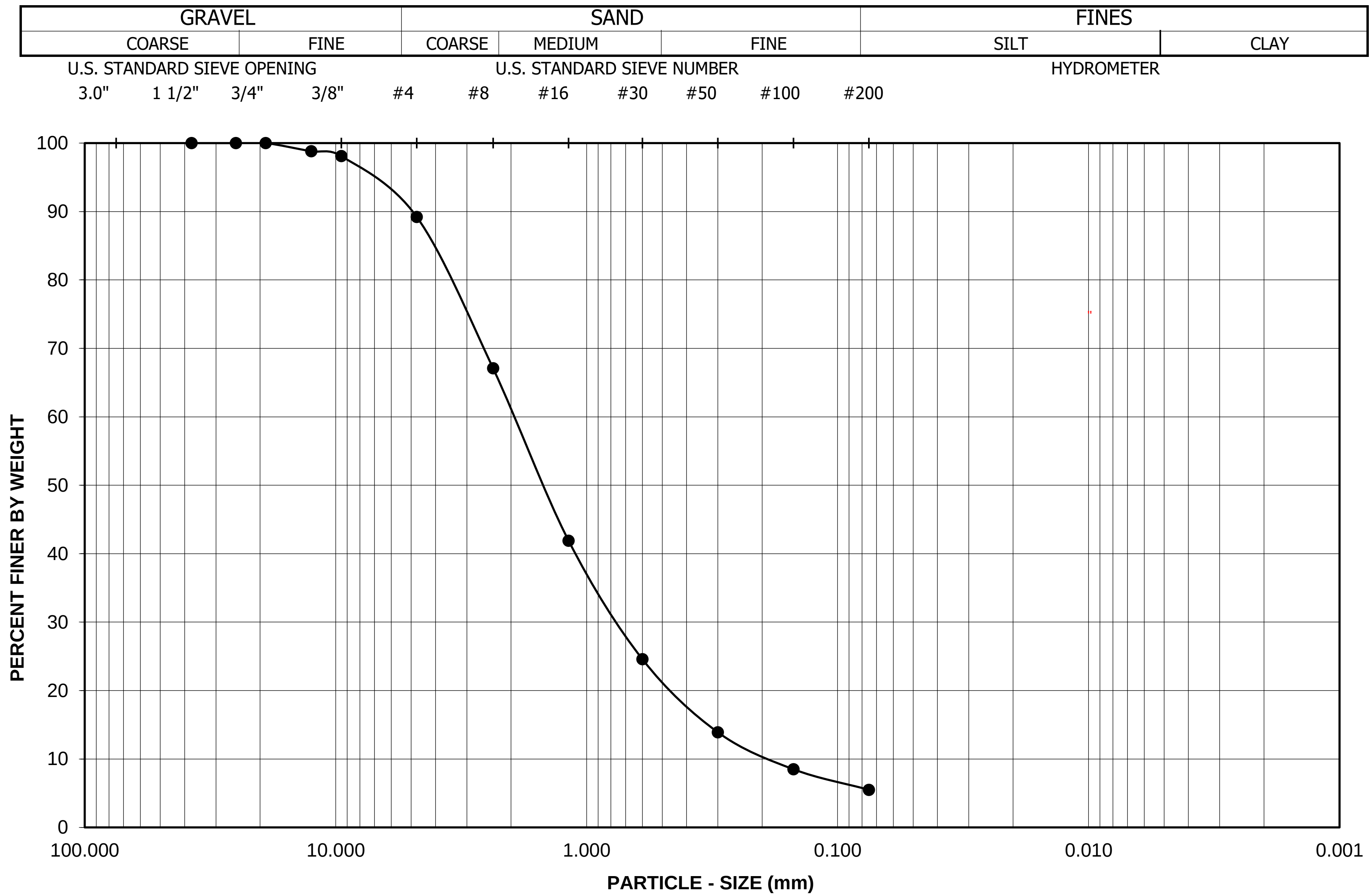
FINES: **6 %**

GROUP SYMBOL: **SW-SM**

$Cu = D60/D10 =$ 10.00

$Cc = (D30)^2/(D60*D10) =$ 1.60

Remarks:



Project Name: Pulte/Highland Grove 3/Geo DD

Project No.: 13979.001

Boring No.: TP-4 Sample No.: B-1

Depth (feet): 0 - 4.0 Soil Type : SW-SM

Soil Identification: Well-Graded Sand with Silt (SW-SM), Reddish Brown.

GR:SA:FI : (%) 11 : 83 : 6

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Sep-23

Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name: Pulte/Highland Grove 3/Geo DD

Tested By: MRV Date: 08/31/23

Project No.: 13979.001

Checked By: MRV Date: 09/01/23

Boring No.: TP-8

Depth (feet): 0 - 4.0

Sample No.: B-1

Soil Identification: Silty Sand (SM), Grayish Brown.

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	B	M	Wt. of Air-Dry Soil + Cont.(g)	1893.7	619.7
Wt. Air-Dried Soil + Cont.(g)	1893.7	619.7	Wt. of Dry Soil + Cont. (g)	1859.1	619.7
Wt. of Container (g)	278.1	277.5	Wt. of Container No._____(g)	278.1	277.5
Dry Wt. of Soil (g)	1580.8	342.2	Moisture Content (%)	2.2	0.0

Passing #4 Material After Wet Sieve		
	Container No.	M
	Wt. of Dry Soil + Container (g)	547.5
	Wt. of Container (g)	277.5
	Dry Wt. of Soil Retained on # 200 Sieve (g)	270.0

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
1 1/2"	37.500			100.0
1"	25.000			100.0
3/4"	19.000	0.0		100.0
1/2"	12.500	23.8		98.5
3/8"	9.500	33.2		97.9
#4	4.750	54.0		96.6
#8	2.360		18.2	91.5
#16	1.180		67.6	77.5
#30	0.600		117.4	63.5
#50	0.300		161.8	50.9
#100	0.150		209.2	37.5
#200	0.075		257.7	23.9
PAN				

GRAVEL: **3 %**

SAND: **73 %**

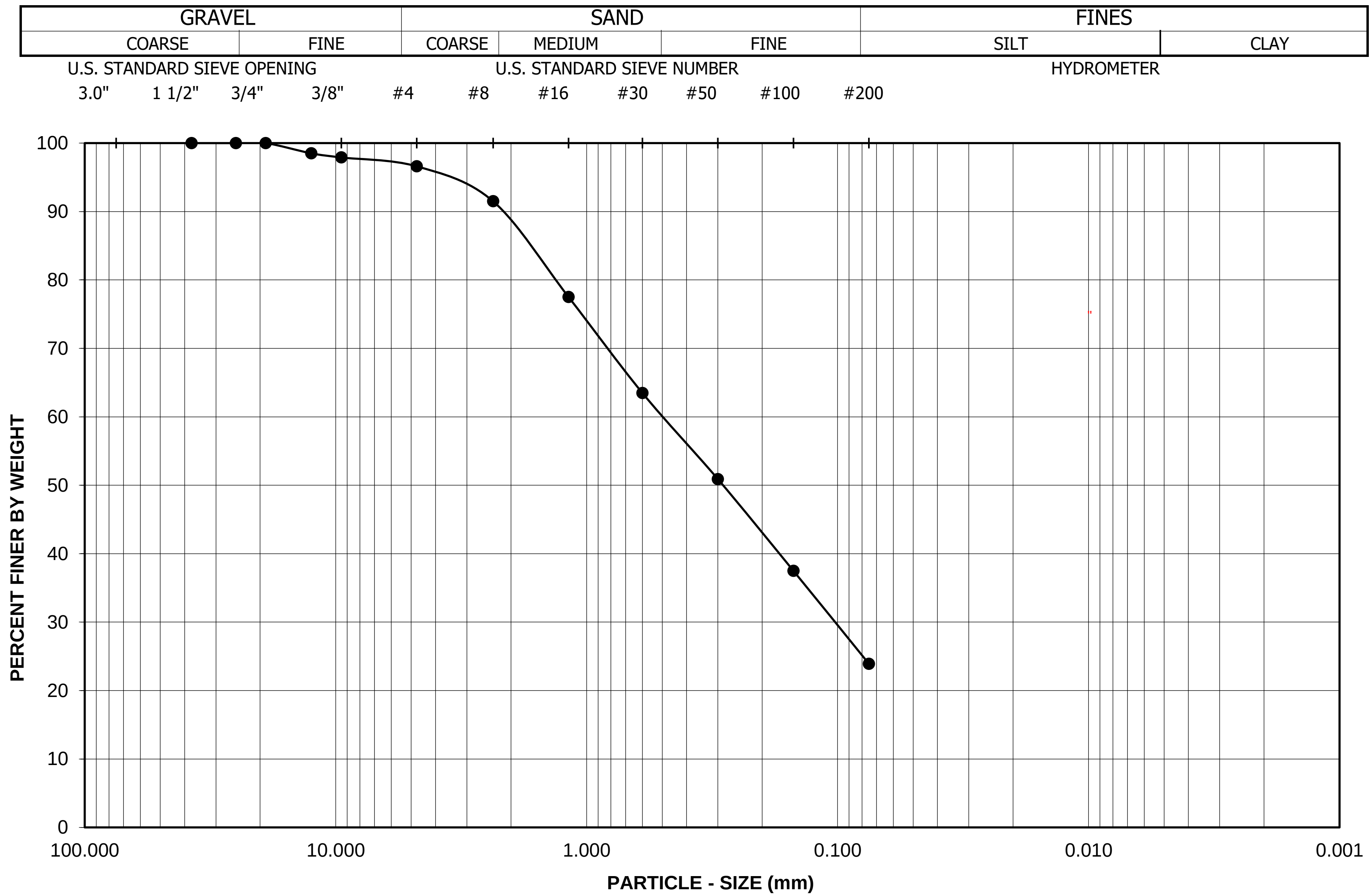
FINES: **24 %**

GROUP SYMBOL: **SM**

$Cu = D60/D10 =$ N/A

$Cc = (D30)^2/(D60*D10) =$ N/A

Remarks:



Project Name: Pulte/Highland Grove 3/Geo DD

Project No.: 13979.001

Boring No.: TP-8 Sample No.: B-1

Depth (feet): 0 - 4.0 Soil Type : SM

Soil Identification: Silty Sand (SM), Grayish Brown.

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PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 3 : 73 : 24

Sep-23

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	Pulte/Highland Grove 3/Geo DD	Tested By:	M. Vinet	Date:	8/31/23
Project No. :	13979.001	Checked By:	M. Vinet	Date:	9/1/23
Boring No.:	TP-3	Depth:	0 - 4.0		
Sample No. :	B-1	Location:	N/A		
Sample Description:	Well-Graded Sand with Silt (SW-SM), Reddish Brown.				

Dry Wt. of Soil + Cont. (gm.)	2632.2
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2632.2
Weight Soil Retained on #4 Sieve	25.2
Percent Passing # 4	99.0

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	0.9945
Wt. Comp. Soil + Mold (gm.)	585.0	609.2
Wt. of Mold (gm.)	178.0	178.0
Specific Gravity (Assumed)	2.70	2.70
Container No.	7	7
Wet Wt. of Soil + Cont. (gm.)	337.3	609.2
Dry Wt. of Soil + Cont. (gm.)	312.5	373.4
Wt. of Container (gm.)	37.3	178.0
Moisture Content (%)	9.0	15.5
Wet Density (pcf)	122.8	130.8
Dry Density (pcf)	112.6	113.3
Void Ratio	0.497	0.489
Total Porosity	0.332	0.328
Pore Volume (cc)	68.7	67.6
Degree of Saturation (%) [S meas]	**48.9**	**85.6**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
8/31/23	12:00	1.0	0	0.5000
8/31/23	12:10	1.0	10	0.5000
	Add Distilled Water to the Specimen			
9/1/23	8:00	1.0	1190	0.4945
9/1/23	9:00	1.0	1250	0.4945

Expansion Index (EI meas) =	((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	-5.5
Expansion Index (Report) =	Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**0**

Rev. 03-08

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	Pulte/Highland Grove 3/Geo DD	Tested By:	M. Vinet	Date:	8/31/23
Project No. :	13979.001	Checked By:	M. Vinet	Date:	9/1/23
Boring No.:	TP-7	Depth:	0 - 4.0		
Sample No. :	B-1	Location:	N/A		
Sample Description:	Well-Graded Sand with Silt (SW-SM), Yellowish Brown.				

Dry Wt. of Soil + Cont. (gm.)	2688.2
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2688.2
Weight Soil Retained on #4 Sieve	61.2
Percent Passing # 4	97.7

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	0.9963
Wt. Comp. Soil + Mold (gm.)	605.2	621.5
Wt. of Mold (gm.)	200.0	200.0
Specific Gravity (Assumed)	2.70	2.70
Container No.	8	8
Wet Wt. of Soil + Cont. (gm.)	337.1	621.5
Dry Wt. of Soil + Cont. (gm.)	311.1	370.0
Wt. of Container (gm.)	37.1	200.0
Moisture Content (%)	9.5	13.9
Wet Density (pcf)	122.2	127.6
Dry Density (pcf)	111.6	112.0
Void Ratio	0.510	0.505
Total Porosity	0.338	0.335
Pore Volume (cc)	69.9	69.2
Degree of Saturation (%) [S meas]	**50.3**	**74.4**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
8/31/23	12:15	1.0	0	0.5000
8/31/23	12:25	1.0	10	0.5000
	Add Distilled Water to the Specimen			
9/1/23	8:00	1.0	1175	0.4963
9/1/23	9:00	1.0	1235	0.4963

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	-3.7
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**0**

Rev. 03-08

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	Pulte/Highland Grove 3/Geo DD	Tested By: M. Vinet	Date: 8/31/23
Project No. :	13979.001	Checked By: M. Vinet	Date: 9/1/23
Boring No.:	TP-9	Depth: 0 - 4.0	
Sample No. :	B-1	Location: N/A	
Sample Description:	Silty Sand (SM), Dark Brown.		

Dry Wt. of Soil + Cont. (gm.)	2412.3
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2412.3
Weight Soil Retained on #4 Sieve	12.2
Percent Passing # 4	99.5

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	0.9985
Wt. Comp. Soil + Mold (gm.)	601.1	619.2
Wt. of Mold (gm.)	199.1	199.1
Specific Gravity (Assumed)	2.70	2.70
Container No.	9	9
Wet Wt. of Soil + Cont. (gm.)	349.8	619.2
Dry Wt. of Soil + Cont. (gm.)	323.8	367.1
Wt. of Container (gm.)	49.8	199.1
Moisture Content (%)	9.5	14.4
Wet Density (pcf)	121.3	126.9
Dry Density (pcf)	110.7	110.9
Void Ratio	0.522	0.520
Total Porosity	0.343	0.342
Pore Volume (cc)	71.0	70.7
Degree of Saturation (%) [S meas]	**49.1**	**74.9**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
8/31/23	12:45	1.0	0	0.5000
8/31/23	12:55	1.0	10	0.5000
	Add Distilled Water to the Specimen			
9/1/23	8:00	1.0	1145	0.4985
9/1/23	9:00	1.0	1205	0.4985

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	-1.5
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**0**

Rev. 03-08

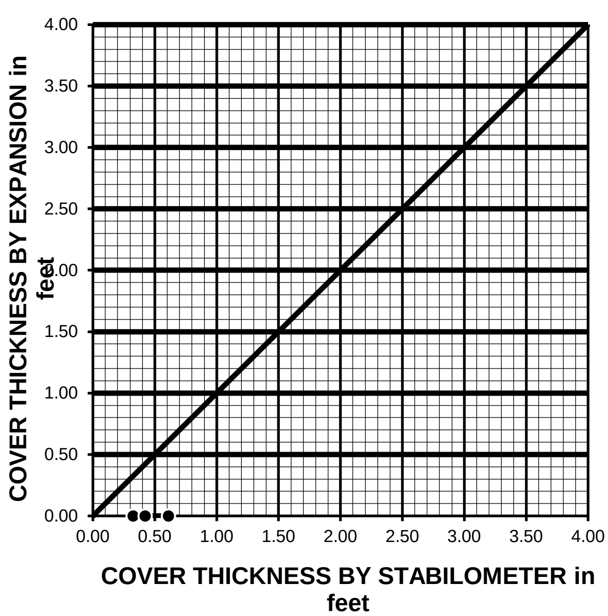
R-VALUE TEST RESULTS
ASTM D 2844

Project Name:	Pulte/Highland Grove 3/Geo DD	Date:	8/31/23
Project Number:	13979.001	Technician:	M. Vinet
Boring Number:	TP-4	Depth (ft.):	0 - 4.0
Sample Number:	B-1		
Sample Description:	Well-Graded Sand with Silt (SW-SM), Reddish	Sample Location:	N/A

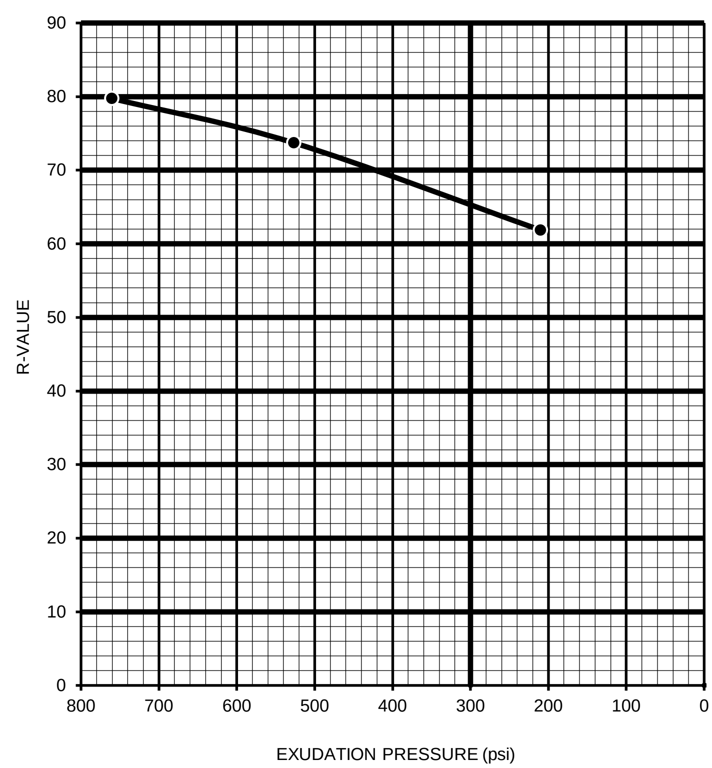
TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	8.8	9.4	10.4
HEIGHT OF SAMPLE, Inches	2.52	2.54	2.51
DRY DENSITY, pcf	116.6	117.8	117.0
COMPACTOR AIR PRESSURE, psi	350	350	275
EXUDATION PRESSURE, psi	761	527	210
EXPANSION, Inches x 10exp-4	0	0	0
STABILITY Ph 2,000 lbs (160 psi)	19	24	36
TURNS DISPLACEMENT	4.71	5.05	5.31
R-VALUE UNCORRECTED	80	74	62
R-VALUE CORRECTED	80	74	62

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.32	0.42	0.61
EXPANSION PRESSURE THICKNESS, ft.	0.00	0.00	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	N/A
R-VALUE BY EXUDATION:	65
EQUILIBRIUM R-VALUE:	65

TESTS for SULFATE CONTENT CHLORIDE CONTENT and pH of SOILS

Project Name: Pulte/Highland Grove 3/Geo DD — Tested By : M. Vinet — Date: 09/01/23

Project No. : 13979.001 — Data Input By: M. Vinet — Date: 09/01/23

Boring No.	TP-8			
Sample No.	B-1			
Sample Depth (ft)	0 - 5.0			
Soil Identification:	Silty Sand (SM)			
Wet Weight of Soil + Container (g)	100.00			
Dry Weight of Soil + Container (g)	100.00			
Weight of Container (g)	0.00			
Moisture Content (%)	0.00			
Weight of Soaked Soil (g)	100.00			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	1			
Crucible No.	1			
Furnace Temperature (°C)	850			
Time In / Time Out	Timer			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	25.0407			
Wt. of Crucible (g)	25.0362			
Wt. of Residue (g) (A)	0.0045			
PPM of Sulfate (A) x 41150	185.18			
PPM of Sulfate, Dry Weight Basis	**185**			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	30			
ml of AgNO3 Soln. Used in Titration (C)	0.8			
PPM of Chloride (C -0.2) * 100 * 30 / B	60			
PPM of Chloride, Dry Wt. Basis	**60**			

pH TEST, DOT California Test 643

pH Value	**7.30**			
Temperature °C	21.0			

SOIL RESISTIVITY TEST
DOT CA TEST 643

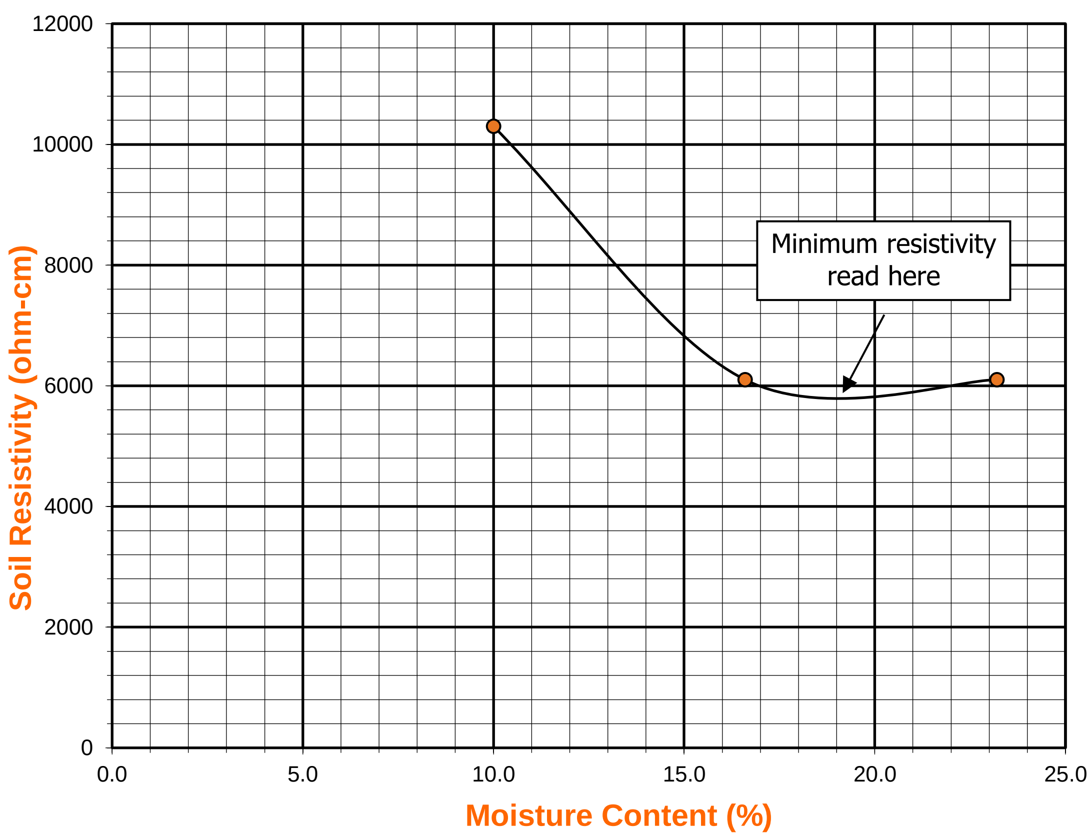
Project Name:	Pulte/Highland Grove 3/Geo DD	Tested By :	M. Vinet Date: 09/01/23
Project No. :	13979.001	Data Input By:	M. Vinet Date: 09/01/23
Boring No.:	TP-8	Depth (ft.) :	0 - 5.0
Sample No. :	B-1		
Soil Identification:*	Silty Sand (SM)		

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	50	10.00	10300	10300
2	83	16.60	6100	6100
3	116	23.20	6100	6100
4				
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	100.00
Dry Wt. of Soil + Cont. (g)	100.00
Wt. of Container (g)	0.00
Container No.	A
Initial Soil Wt. (g) (Wt)	500.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH: pH	Soil pH: Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
5800	**19.0**	**185**	**60**	**7.30**	**21.0**



Boring No.	LB-2	LB-2	LB-2					
Sample No.	R-2	R-5	R-7					
Depth (ft.)	5	12.5	17.5					
Sample Type	RING	RING	RING					
Visual Soil Classification	ML	SM	SM					
Moisture Correction								
Wet Weight of Soil + Container (gm.)	401.6	401.4	402.5					
Dry Weight of Soil + Container (gm.)	392.5	385.8	381.9					
Weight of Container (gm)	216.5	220.1	219.2					
Moisture Content (%)	5.2	9.4	12.7					
Container No.:	QR	IJ	ST					
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	401.6	401.4	402.5					
Weight of Container (gm.)	216.5	220.1	219.2					
Weight of Dry Sample (gm.)	176.0	165.7	162.7					
Container No.:	QR	IJ	ST					
After Wash								
Dry Weight of Sample + Container (gm)	258.3	318.0	320.3					
Weight of Container (gm)	216.5	220.1	219.2					
Dry Weight of Sample (gm)	41.8	97.9	101.1					
% Passing No. 200 Sieve	**76**	**41**	**38**					
% Retained No. 200 Sieve	24	59	62					

PERCENT PASSING No. 200 SIEVE
ASTM D 1140

Leighton and Associates, Inc.

Project Name: VICTORIA GROVE
Project No.: 111446-001
Client Name:
Tested By: JMD Date: 2/7/05

Rev. 08-04

x200 Wash

Leighton and Associates, Inc.

One-Dimensional Swell or Settlement Potential of Cohesive Soils
(ASTM D 4546)

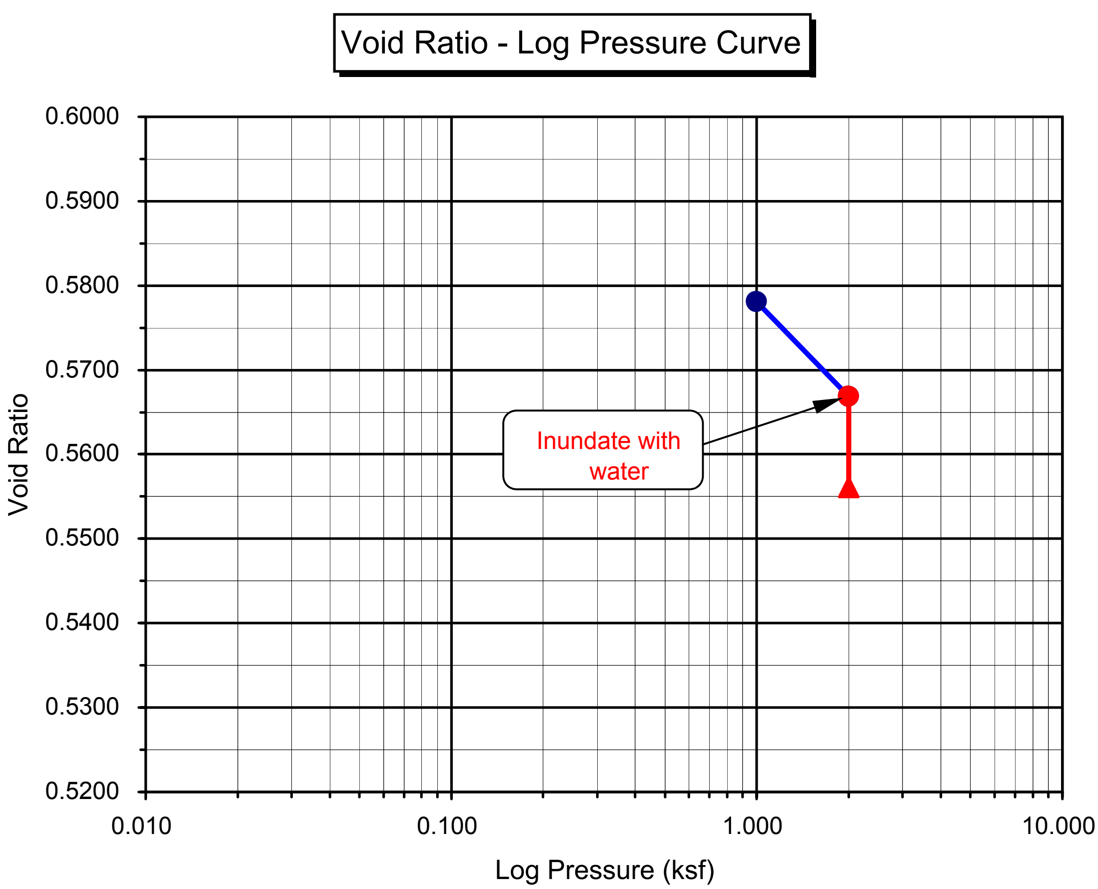
Project Name:	VICTORIA GROVE	Tested By:	JMD	Date:	2/3/05
Project No.:	111446-001	Checked By:	PRC	Date:	2/7/05
Boring No.:	LB-2	Sample Type:	IN SITU		
Sample No.:	R-2	Depth (ft.)	5		
Sample Description:	ML, BROWN SANDY SILT				

Initial Dry Density (pcf):	106.5
Initial Moisture (%):	5.6
Initial Length (in.):	1.0000
Initial Dial Reading:	0.0500
Diameter(in):	2.416

Final Dry Density (pcf):	108.3
Final Moisture (%) :	19.8
Initial Void ratio:	0.5835
Specific Gravity(assumed):	2.70
Initial Saturation (%)	26.0

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.000	0.0534	0.9966	0.00	-0.34	0.5781	-0.34
2.000	0.0605	0.9895	0.00	-1.05	0.5668	-1.05
H2O	0.0673	0.9827	0.00	-1.73	0.5561	-1.73

Percent Swell / Settlement After Inundation = -0.69



Rev. 08-04

Leighton and Associates, Inc.

One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546)

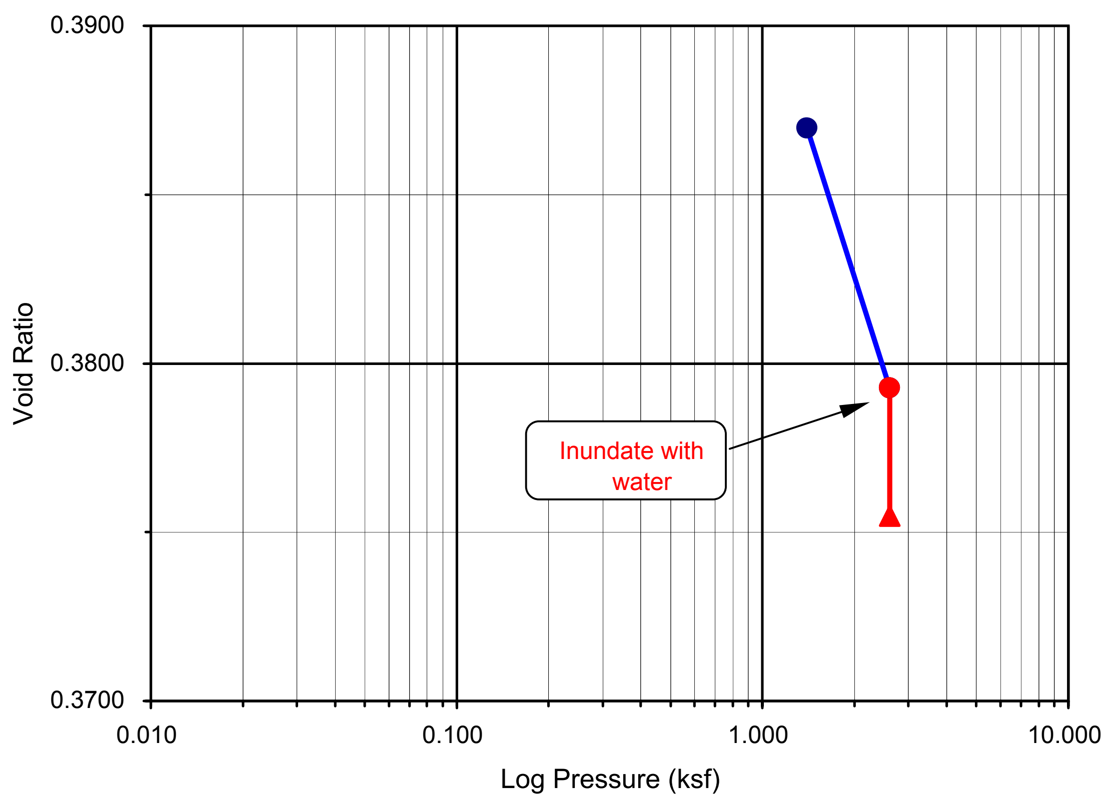
Project Name:	VICTORIA GROVE	Tested By:	JMD	Date:	2/3/05
Project No.:	111446-001	Checked By:	PRC	Date:	2/7/05
Boring No.:	LB-2	Sample Type:	IN SITU		
Sample No.:	R-4	Depth (ft.)	10		
Sample Description:	SM, BROWN SILTY SAND				

Initial Dry Density (pcf):	120.3	Final Dry Density (pcf):	122.5
Initial Moisture (%):	10.5	Final Moisture (%) :	14.6
Initial Length (in.):	1.0000	Initial Void ratio:	0.4008
Initial Dial Reading:	0.0500	Specific Gravity(assumed):	2.70
Diameter(in):	2.416	Initial Saturation (%)	70.7

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.400	0.0599	0.9901	0.00	-0.99	0.3870	-0.99
2.600	0.0654	0.9846	0.00	-1.54	0.3793	-1.54
H2O	0.0681	0.9819	0.00	-1.81	0.3755	-1.81

Percent Swell / Settlement After Inundation = -0.27

Void Ratio - Log Pressure Curve



Rev. 08-04

xCollapse-Swell LB-2,R-4

Leighton and Associates, Inc.

One-Dimensional Swell or Settlement Potential of Cohesive Soils
(ASTM D 4546)

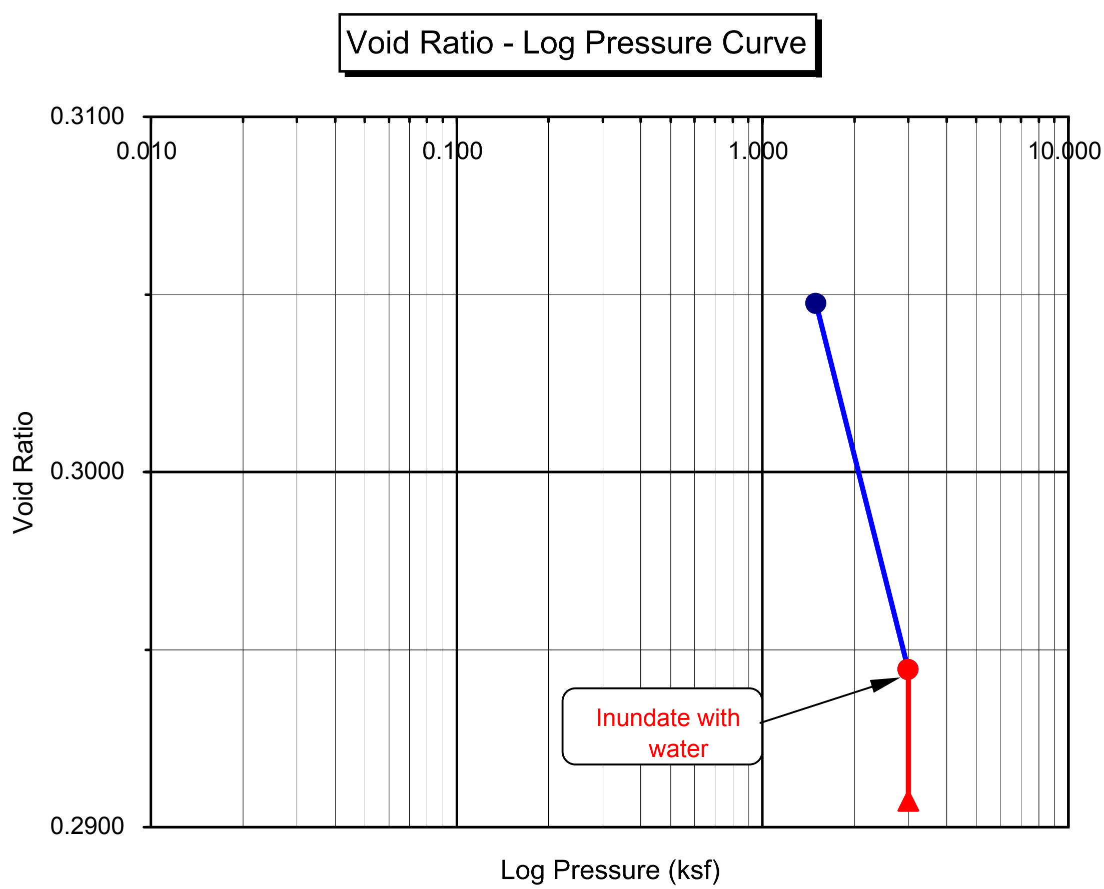
Project Name:	VICTORIA GROVE	Tested By:	JMD	Date:	2/3/05
Project No.:	111446-001	Checked By:	PRC	Date:	2/7/05
Boring No.:	LB-2	Sample Type:	IN SITU		
Sample No.:	R-5	Depth (ft.)	12.5		
Sample Description:	SM, BROWN SILTY SAND				

Initial Dry Density (pcf):	127.6
Initial Moisture (%):	10.7
Initial Length (in.):	1.0000
Initial Dial Reading:	0.0500
Diameter(in):	2.416

Final Dry Density (pcf):	130.6
Final Moisture (%) :	13.2
Initial Void ratio:	0.3206
Specific Gravity(assumed):	2.70
Initial Saturation (%)	89.9

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.500	0.0620	0.9880	0.00	-1.20	0.3047	-1.20
3.000	0.0698	0.9802	0.00	-1.98	0.2944	-1.98
H2O	0.0726	0.9774	0.00	-2.26	0.2907	-2.26

Percent Swell / Settlement After Inundation = -0.29



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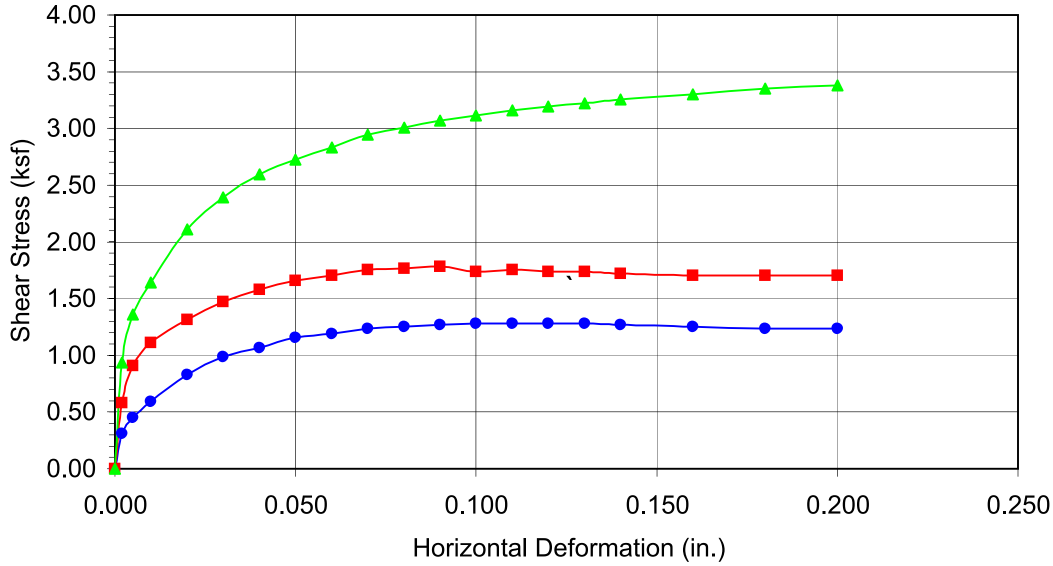
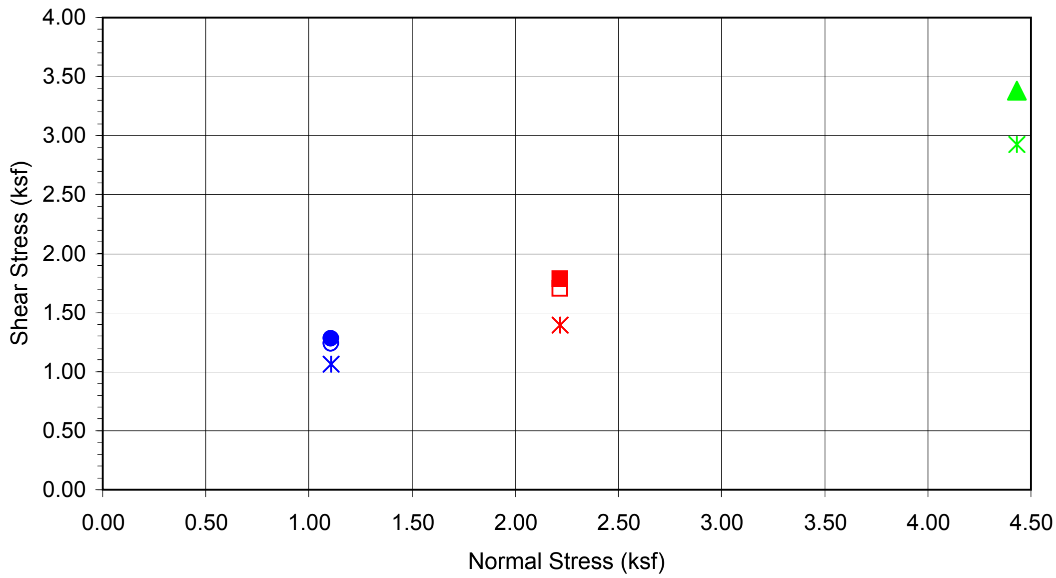




Normal Stress (kip/ft²)	1.108	2.216	4.432
Peak Shear Stress (kip/ft²)	● 1.283	■ 1.784	▲ 3.380
Shear Stress @ End of Test (ksf)	○ 1.236	□ 1.706	△ 3.380
Relaxed Value (ksf)	X 1.064	X 1.393	X 2.927
Deformation Rate (in./min.)	0.010	0.010	0.010
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.416	2.416	2.416
Initial Moisture Content (%)	9.0	9.0	9.0
Dry Density (pcf)	119.1	119.1	119.1
Saturation (%)	58.5	58.5	58.5
Soil Height Before Shearing (in.)	N/A	N/A	N/A
Final Moisture Content (%)	21.6	19.7	20.8

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Sample Remolded to 92% Relative Compaction

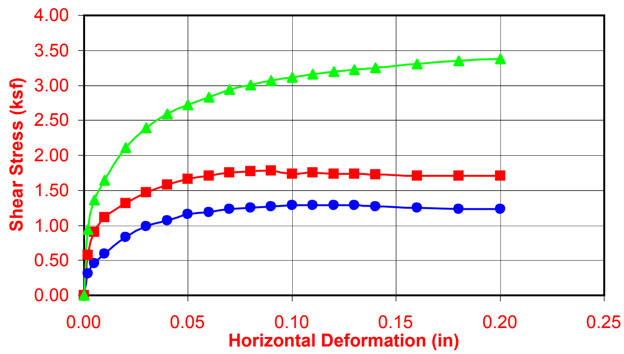
Leighton and Associates, Inc.

Boring No.:	LB-2
Sample No.:	R-1
Depth (ft)	2.5
Soil Description:	ML, BROWN SANDY SILT

Project No.: 111446-001

VICTORIA GROVE

Rev. 08-04



	Load 1	Load 2	Load 3
Normal Stress (kg)	16	32	64
Normal Stress (psf)	1108	2216	4432
Load Factor:	15.65	15.65	15.65
Max. Stress (ksf)	1.28	1.78	3.38
Stress @ end of Test	1.24	1.71	3.38
Shear Rate (in/min)	0.01	0.01	0.01

Load 1				Load 2			Load 3	
Horiz. Displaceme nt (in.)	Proving Ring Dial Rdg.	Proving Ring Dial Rdg. (ksf)		Proving Ring Dial Rdg.	Proving Ring Dial Rdg. (ksf)		Proving Ring Dial Rdg.	Proving Ring Dial Rdg. (ksf)
0.000	0	0.00		0	0.00		0	0.00
0.002	20	0.31		37	0.58		60	0.94
0.005	29	0.45		58	0.91		87	1.36
0.010	38	0.59		71	1.11		105	1.64
0.020	53	0.83		84	1.31		135	2.11
0.030	63	0.99		94	1.47		153	2.39
0.040	68	1.06		101	1.58		166	2.60
0.050	74	1.16		106	1.66		174	2.72
0.060	76	1.19		109	1.71		181	2.83
0.070	79	1.24		112	1.75		188	2.94
0.080	80	1.25		113	1.77		192	3.00
0.090	81	1.27		114	1.78		196	3.07
0.100	**82**	1.28		111	1.74		199	3.11
0.110	82	1.28		**112**	1.75		202	3.16
0.120	82	1.28		111	1.74		204	3.19
0.130	82	1.28		111	1.74		206	3.22
0.140	81	1.27		110	1.72		208	3.26
0.160	80	1.25		109	1.71		211	3.30
0.180	79	1.24		109	1.71		214	3.35
0.200	79	1.24		109	1.71		**216**	3.38
0.200	68	1.06	RELAXED	89	1.39	RELAXED	187	2.93

Rev. 08-04

DIRECT SHEAR TEST

ASTM D 3080

Project Name:	VICTORIA GROVE	Tested By:	RGO	Date:	2/3/05
Project No.:	111446-001	Checked By:	PRC	Date:	2/7/05
Boring No.:	LB-2	Sample Type:	REMOLDED		
Sample No.:	R-1	Depth (ft.):	2.5		

Sample Description: ML, BROWN SANDY SILT

Sample Diameter(in):	2.416	2.416	2.416
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	201.7	199.9	203.0
Weight of Ring(gm):	45.5	43.7	46.8
Before Shearing			
Weight of Wet Sample+Cont.(gm):	201.7	199.9	203.0
Weight of Dry Sample+Cont.(gm):	188.8	187.0	190.1
Weight of Container(gm):	45.5	43.7	46.8
Vertical Rdg.(in): Initial	No measurements of height change is being done during consolidation of sample		
Vertical Rdg.(in): Final			
After Shearing			
Weight of Wet Sample+Cont.(gm):	219.8	215.2	219.9
Weight of Dry Sample+Cont.(gm):	188.8	187.0	190.1
Weight of Container(gm):	45.5	43.7	46.8
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43

Rev. 08-04

REMOLD DATA

MAX DENS.	OPTIMUM %	% REM.	RING WTS.	CAN MOIST.
129.5	9.0	92	45.5	13.0
	=	119.14	43.7	
			46.8	

CONV. FACTOR	DRY SOIL	ADD TO 500 g	GRAMS PER RING
1.203	143.3	-17.7	156.2

APPENDIX C

EARTHWORK AND GRADING SPECIFICATIONS

LEIGHTON AND ASSOCIATES, INC.
GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

TABLE OF CONTENTS

Standard Details

1.0 General

1.1 Intent

These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record

Prior to commencement of work, the owner shall employ the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation

In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing

Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations.

7.2 Bedding and Backfill

All bedding and backfill of utility trenches shall be performed in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of relative compaction from 1 foot above the top of the conduit to the surface.

The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

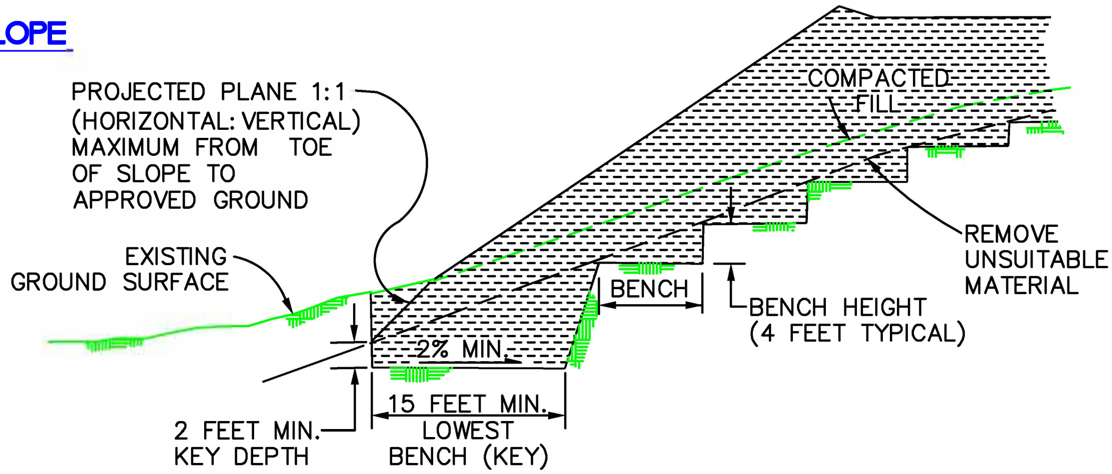
7.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

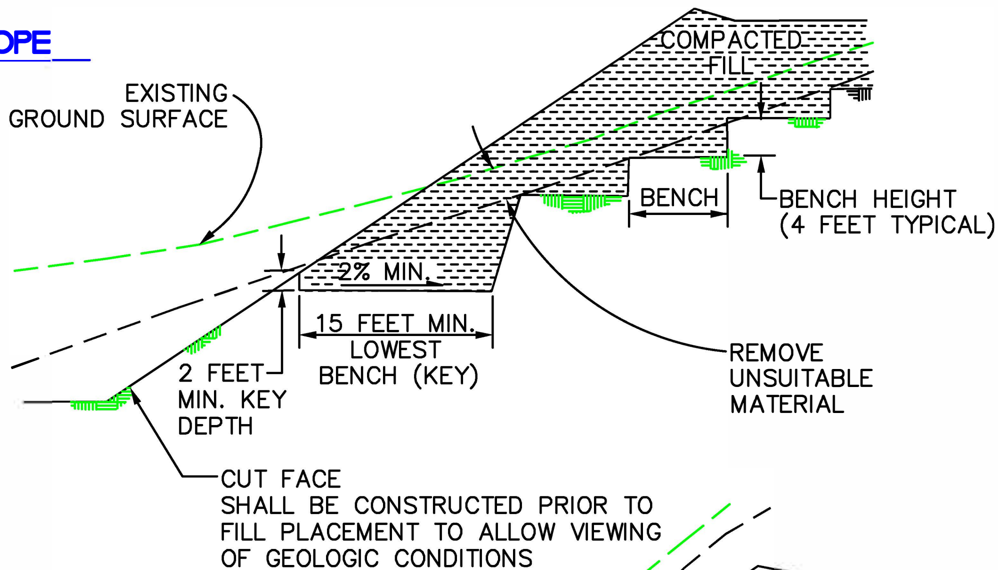
7.4 Observation and Testing

The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

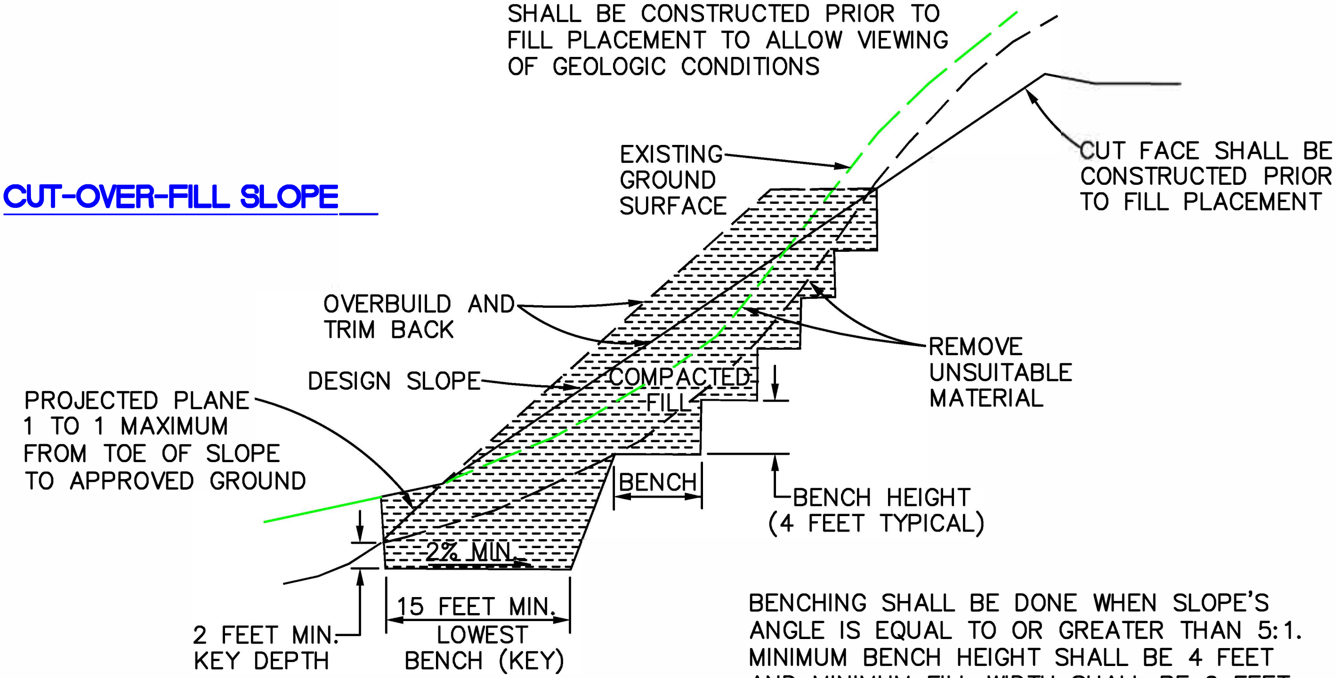
FILL SLOPE



FILL-OVER-CUT SLOPE

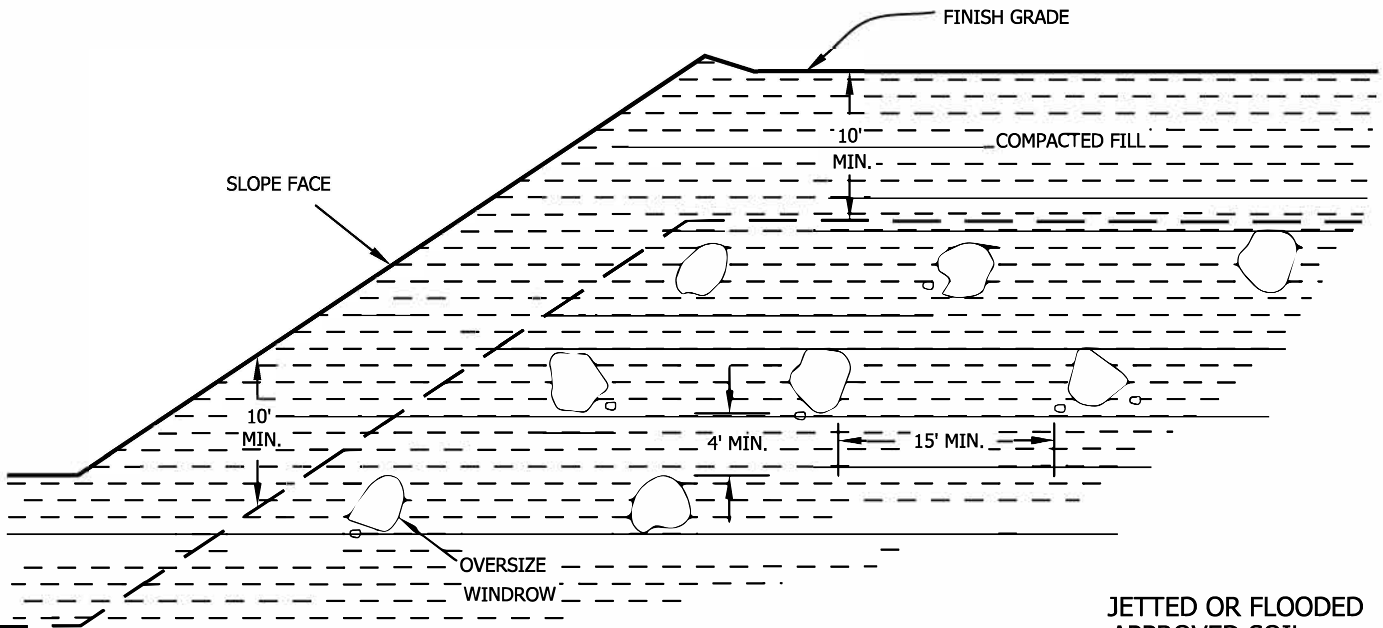


CUT-OVER-FILL SLOPE

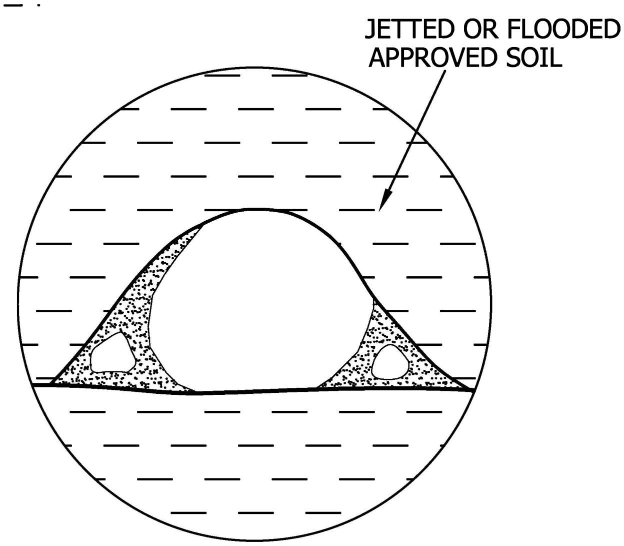


BENCHING SHALL BE DONE WHEN SLOPE'S ANGLE IS EQUAL TO OR GREATER THAN 5:1. MINIMUM BENCH HEIGHT SHALL BE 4 FEET AND MINIMUM FILL WIDTH SHALL BE 9 FEET.

KEYING AND BENCHING	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS A	Leighton

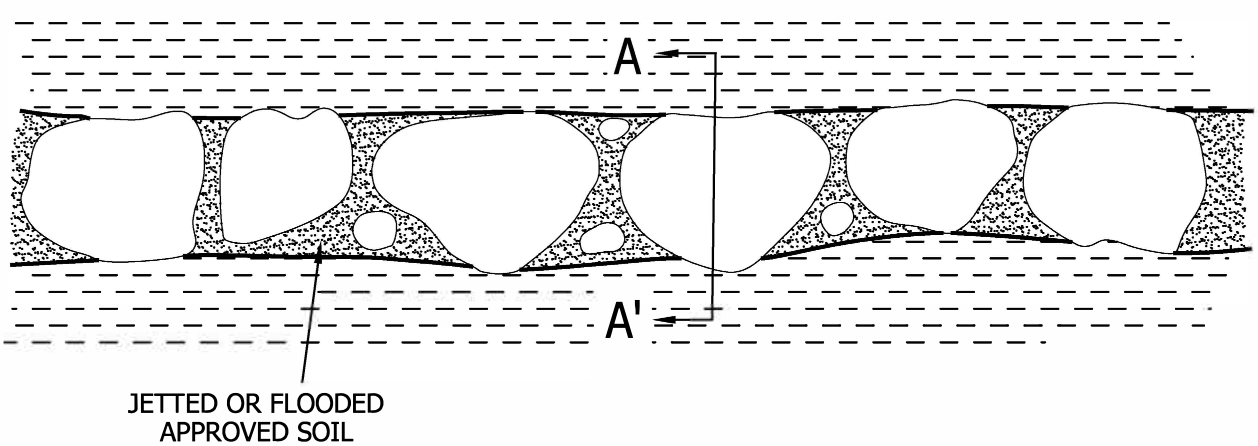


- Oversize rock is larger than 8 inches in largest dimension.
- Backfill with approved soil jetted or flooded in place to fill all the voids.
- Do not bury rock within 10 feet of finish grade.
- Windrow of buried rock shall be parallel to the finished slope face.



SECTION A-A'

PROFILE ALONG WINDROW



OVERSIZE ROCK DISPOSAL	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS B	Leighton

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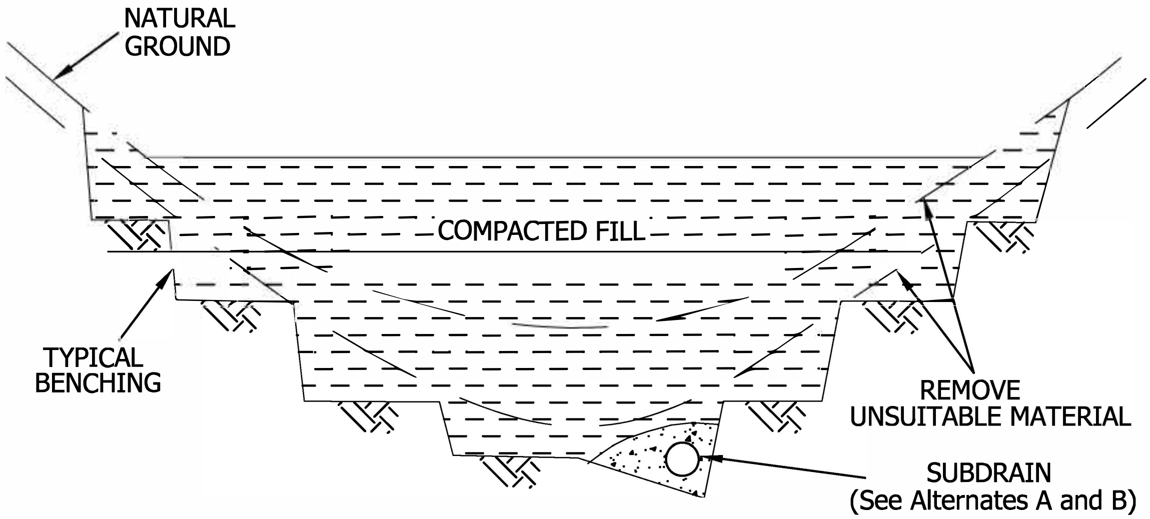
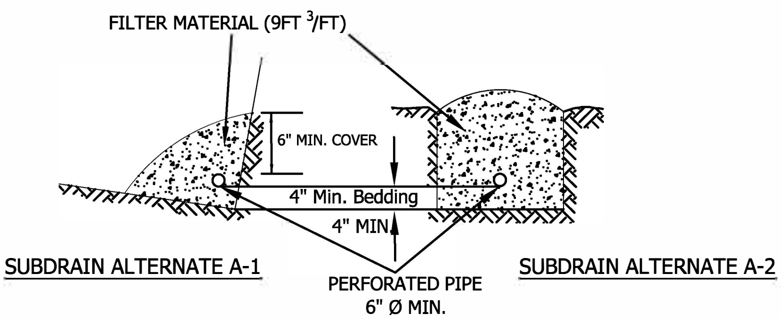


SUBDRAIN ALTERNATE A

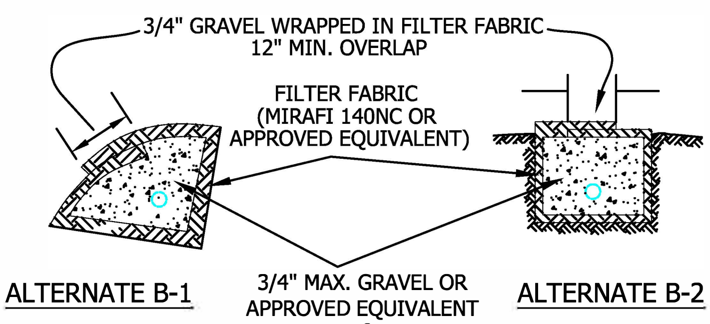


FILTER MATERIAL

FILTER MATERIAL SHALL BE CLASS 2 PERMEABLE MATERIAL PER STATE OF CALIFORNIA STANDARD SPECIFICATION, OR APPROVED ALTERNATE. CLASS 2 GRADING AS FOLLOWS:

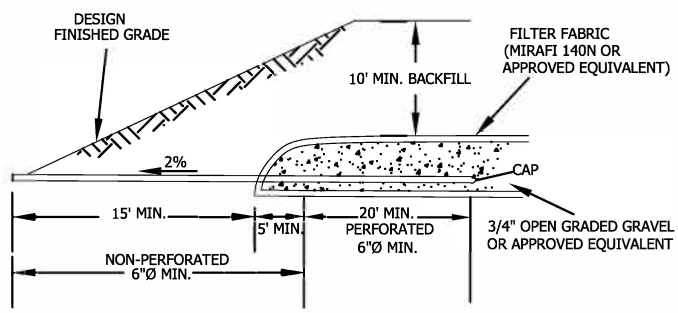
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

SUBDRAIN ALTERNATE B



PERFORATED PIPE IS OPTIONAL PER GOVERNING AGENCY'S REQUIREMENTS

DETAIL OF CANYON SUBDRAIN TERMINAL



CANYON SUBDRAIN

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

STANDARD DETAILS C

Leighton

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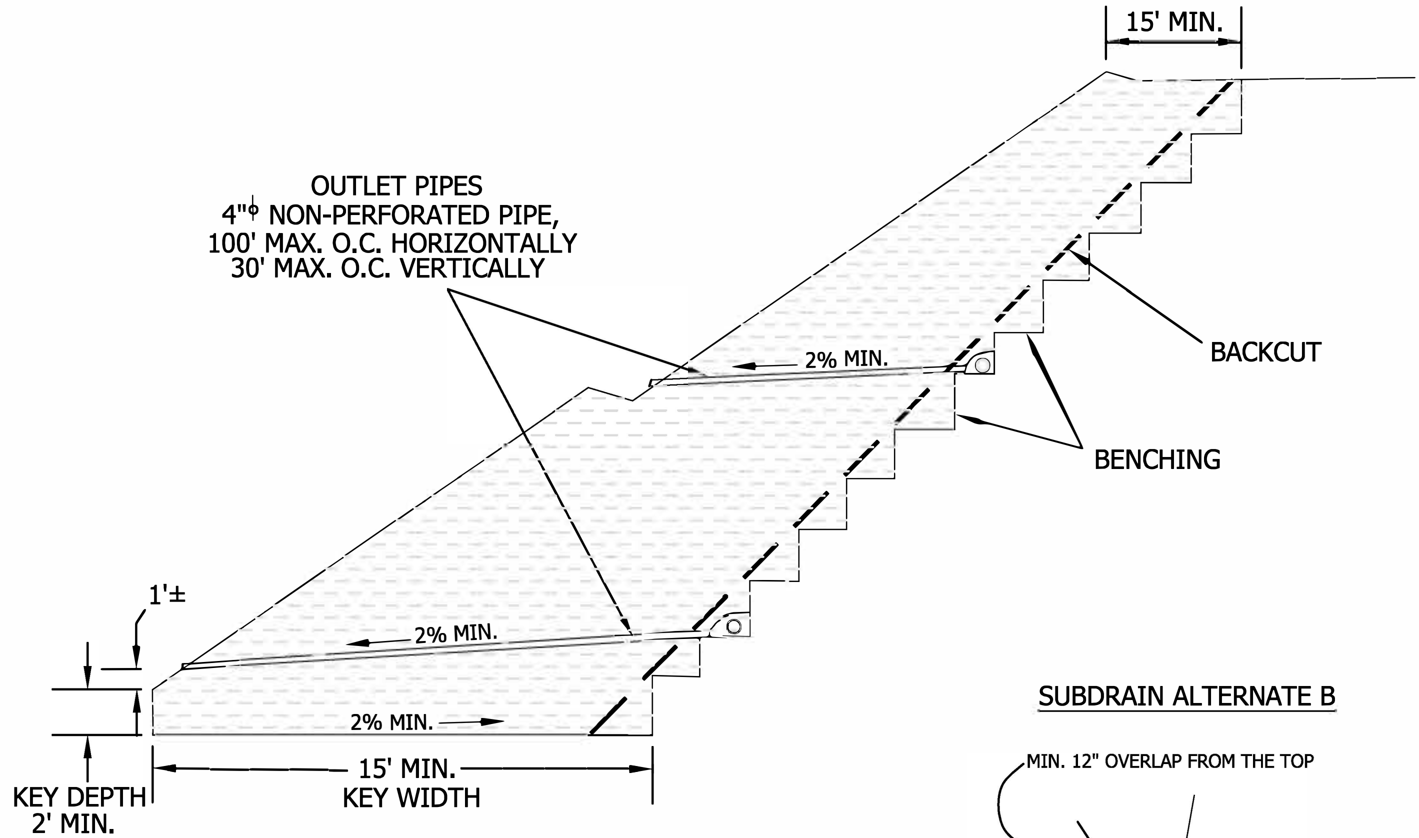
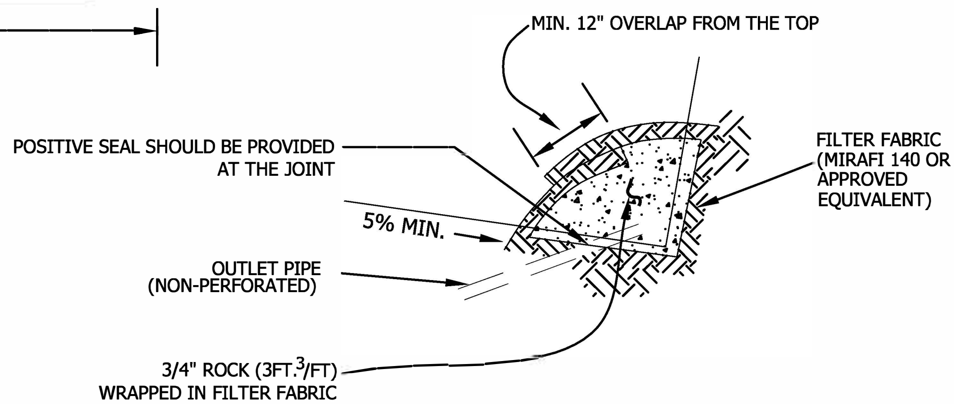
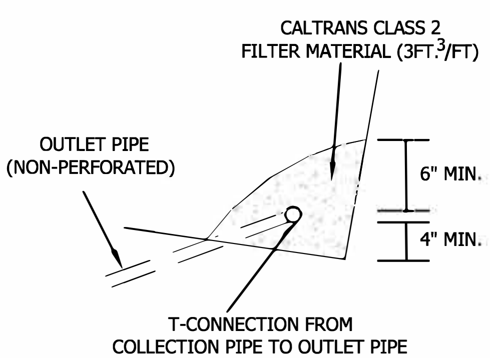


SUBDRAIN ALTERNATE B



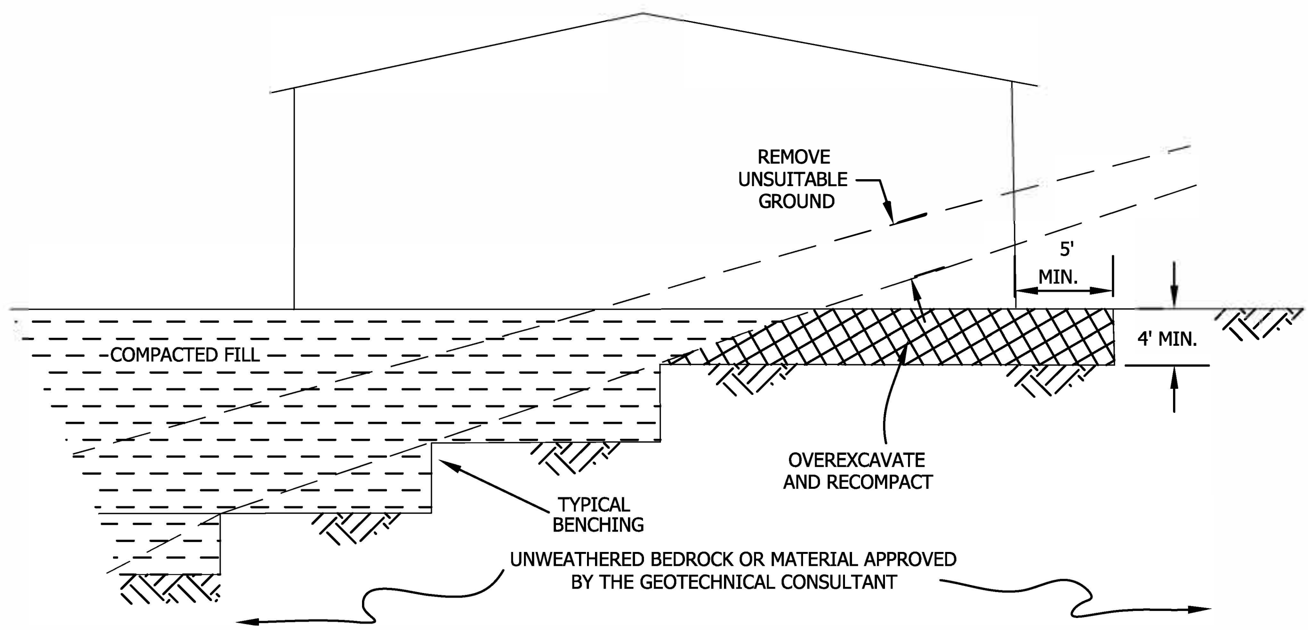
SUBDRAIN ALTERNATE A



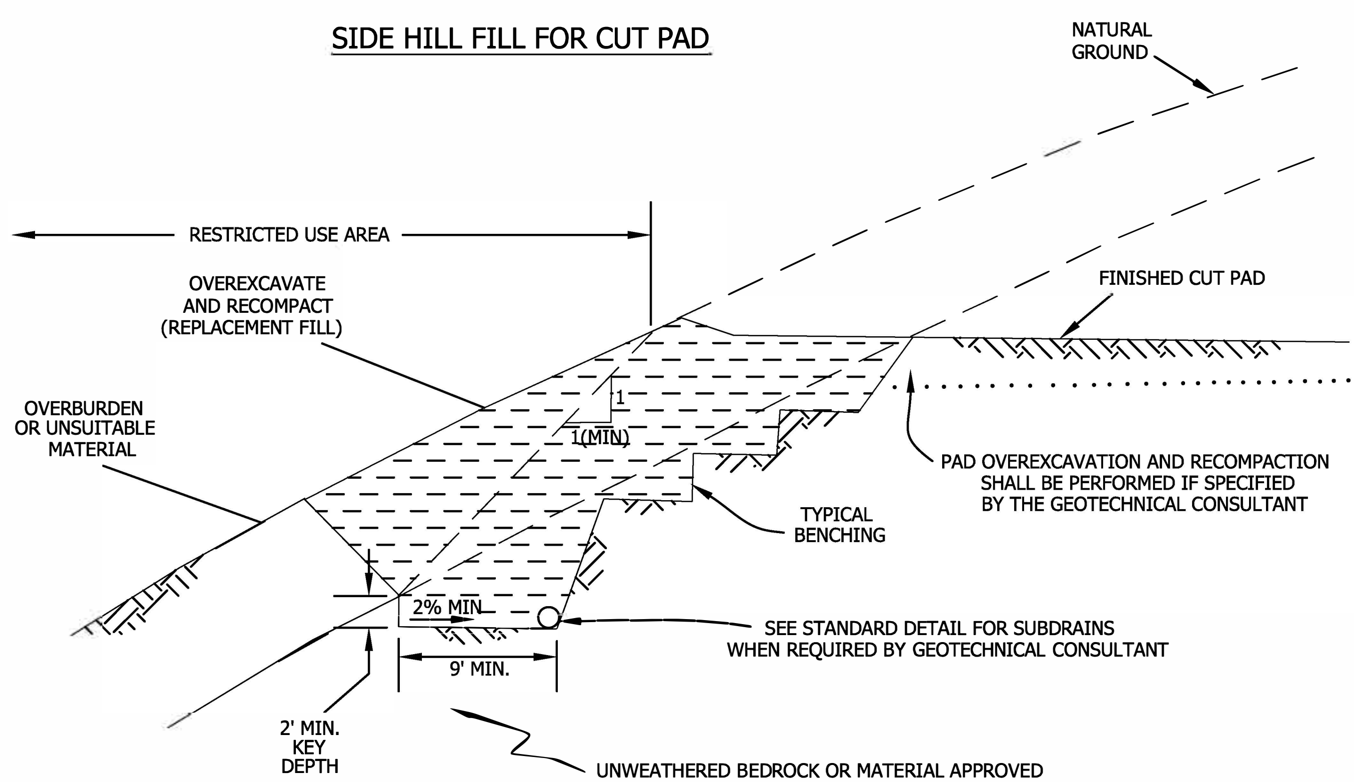
- SUBDRAIN INSTALLATION - Subdrain collector pipe shall be installed with perforations down or, unless otherwise designated by the geotechnical consultant. Outlet pipes shall be non-perforated pipe. The subdrain pipe shall have at least 8 perforations uniformly spaced per foot. Perforation shall be 1/4" to 1/2" if drilled holes are used. All subdrain pipes shall have a gradient at least 2% towards the outlet.
- SUBDRAIN PIPE - Subdrain pipe shall be ASTM D2751, ASTM D1527 (Schedule 40) or SDR 23.5 ABS pipe or ASTM D3034 (Schedule 40) or SDR 23.5 PVC pipe.
- All outlet pipe shall be placed in a trench and, after fill is placed above it, rodded to verify integrity.

BUTTRESS OR REPLACEMENT FILL SUBDRAINS	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS D	Leighton

CUT-FILL TRANSITION LOT OVEREXCAVATION



SIDE HILL FILL FOR CUT PAD



TRANSITION LOT FILLS AND SIDE HILL FILLS	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS E	Leighton

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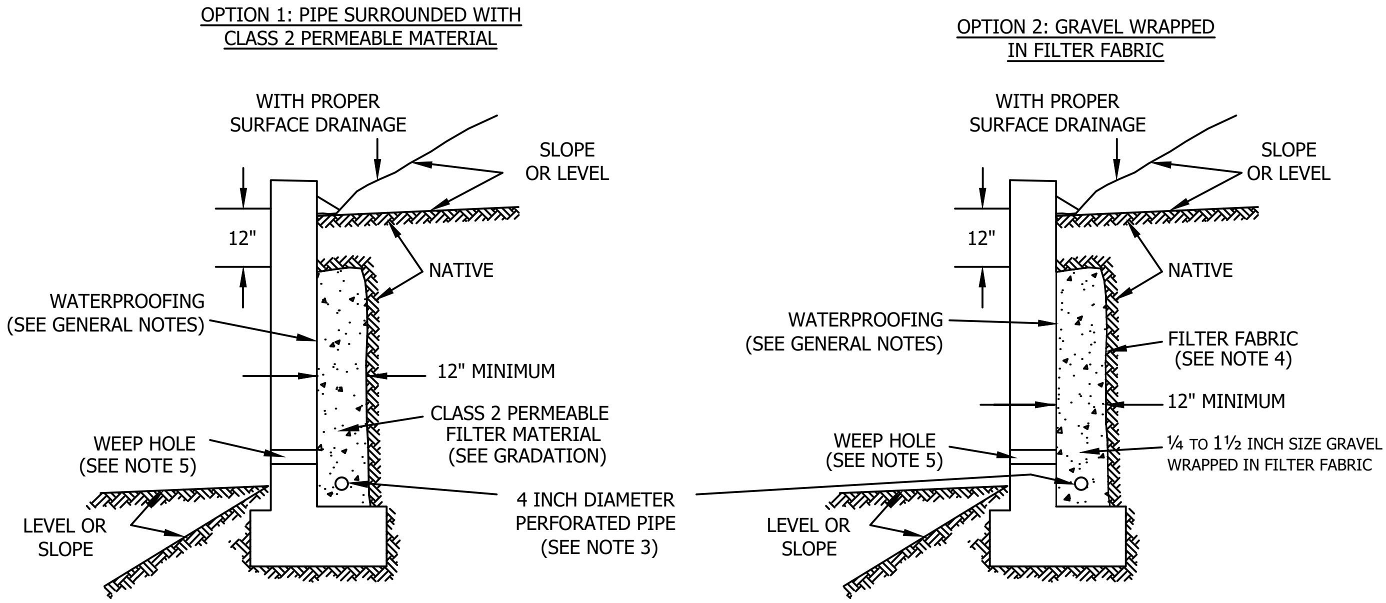
SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

Leighton

APPENDIX D

GBA IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will <u>not</u> likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will <u>not</u> be adequate to develop geotechnical design recommendations for the project.

Do <u>not</u> rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do <u>not</u> rely on an executive summary. Do <u>not</u> read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

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