APPENDIX E

GEOTECHNICAL EXPLORATION STUDY

UPDATE GEOTECHNICAL EXPLORATION
MULTI-FAMILY RESIDENTIAL DEVELOPMENT
MURRIETA HOT SPRINGS ROAD & JEFFERSON AVENUE, MURRIETA, CALIFORNIA

Prepared For

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Project Number 13343.004

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Leighton and Associates, Inc.
A Leighton Group Company

April 8, 2022

Project No. 13343-004

Lennar Multifamily Communities, LLC
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Attention: Mr. Alec Chaseman Development Manager

Subject: Update Geotechnical Exploration
Multi-Family Residential Development: APN 910-410-011
Murrieta Hot Springs Road & Jefferson Avenue
City of Murrieta, California

In accordance with your request and authorization, we are pleased to provide herein the results of our update geotechnical exploration for the subject site. The purpose of our investigation was to evaluate the onsite subsurface conditions and provide preliminary geotechnical recommendations for site development in view of the proposed grading plan. Based on the results of our exploration, it is our opinion that the subject site is generally suitable for the intended use provided the recommendations included in this report are implemented during design and construction. As discussed further in this report, the major geotechnical concern on this site is the presence of shallow groundwater and compressible soil layers that underlie the majority of the site.

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

Respectfully submitted,

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1.0 EXECUTIVE SUMMARY

Based on the results of this update geotechnical exploration, the proposed development of the subject property appears feasible from a geotechnical viewpoint provided the preliminary recommendations included in this report are incorporated into the design and construction phases of development. The main geotechnical/geologic concern associated with this parcel is the presence of compressible and/or liquefiable layers which can induce excessive differential settlement if subjected to additional loads or seismic shaking. The following is a summary of the geotechnical concerns and/or opportunities that exist on this site:

- The site is underlain by alluvial deposits and weathered Pauba Formation to the maximum depth explored. Groundwater has been encountered at a depth of 4.5 feet to 6.5 feet below existing ground surface within the low lying portions of the site.
- Remedial grading (over-excavation) will be required to reduce the anticipated excessive differential settlement. However, due to the presence of shallow groundwater and in view of the proposed site development, the depth of over-excavation should be limited to 4 feet below existing ground surface or 3 feet below bottom of footings, whichever is deeper.
- The western portion of the site (~350 to 400 feet) lies within a designated Alquist-Priolo (AP) and Riverside County Fault Hazard Zone. However, according to a site-specific fault investigation performed within this zone (Leighton, 1980), no evidence for faults were found to exist within the site or fault zone area. No fault related structural setbacks are recommended.
- Based on the proposed site grading and anticipated building loads, consolidation induced settlement of up to 2.8 inches is estimated to occur over a period of 16 month. Approximately 50 percent of this settlement will occur within 4 months of applied load.
- Liquefaction-induced settlement is estimated to range up to 3.3 inches. However, due to the depth of the liquefiable layers and presence of cohesive/clay layers at shallow depth, settlement is estimated to be relatively global. Differential settlement is not expected to exceed 1-inch in a 30-foot horizontal distance.
- Typical 2- to 3-story multi-family residential and/or retail commercial structures may be founded on conventional shallow spread or continuous wall footings based on a net allowable bearing capacity of 2,500 pounds-per-square-foot.
- The site, like much of the Murrieta area, could be subjected to relatively strong shaking due to earthquakes on active faults in the region. Thus, the potential for relatively high seismic forces should be considered in the design of the proposed buildings.

2.0 INTRODUCTION

2.1 Purpose and Scope of Work

The purpose of this update geotechnical exploration is to further evaluate the overall geotechnical/geologic conditions and the potential for settlement on this site in view of the new proposed site plan. In addition, this report provides preliminary geotechnical recommendations for foundation design and remedial grading. As such, this report is a stand-alone document and supersedes the previous reports referenced herein. Our scope of services for this update geotechnical evaluation included the following:

- Review of published geologic hazard maps for this area including site-specific geotechnical reports as listed in the references at the end of this report;
- Site reconnaissance to observe and document the current surface conditions; During this task, we marked the proposed exploration locations and notified DigAlert for utility clearance,
- Drilled six (6) hollow-stem auger soil borings at select locations across the site. The borings were drilled to target depths ranging from 21 to 31 feet below ground surface (bgs) and were logged by a geologist from our office. Representative bulk and relatively undisturbed soil samples were collected at specified intervals of approximately 2½ to 5 feet to the proposed target depth. Samples were then transported to our laboratory for testing. Upon completion of drilling, the borings were backfilled with soil cuttings to the ground surface,
- Laboratory testing of selected soil samples to determine in-situ moisture and density, soil classification, maximum dry density and optimum moisture content, Atterberg limits, consolidation, and R-value;
- Engineering evaluation and analysis including: general subsurface soil characterization (thickness of various subsurface soil strata and their classification), settlement, time rate of consolidation, liquefaction, slope stability analysis, geotechnical seismic design parameters; and
- Preparation of this report summarizing our findings, conclusions, and preliminary recommendations regarding the development of this site as described herein.

2.2 Site Location and Description

The vacant 18-acre parcel (APN 910-410-011) is located at the southeast corner of Murrieta Hot Springs Road and Jefferson Avenue, City of Murrieta, California,see Figure 1, *Site Location Map*. The site is relatively flat and appears to have been partially graded during previous site work or grading activities associated with the construction of adjacent roads. At the time of our field exploration, the site was covered with native grasses/weeds and

brush. The adjacent Murrieta Hot Springs Road and Jefferson Avenue appear to be improved to their maximum width with existing curbs along the frontage of the parcel. The existing drainage dissecting the parcel in a southerly direction appears to be concrete lined near Jefferson Avenue, just outside the southern boundary of the site.

2.3 Proposed Development

Review of the preliminary grading plans (Option 2) provided by Kimley-Horn (December 6, 2021), indicate nineteen (19) buildings consisting of two- to three-story residential apartment buildings, rental offices, and associated facilities. The preliminary grading plans depict conventional cut and fill grading with a net import of approximately 13,200 cubic yards to construct the design building pad elevations. The Option 2 grading plan also depicts 10 to 15 feet high retaining walls bordering the western edges along Murrieta Hot Springs Road and Jefferson Avenue. Site plan reflects minor cut and fill grading (±2 feet) for proposed building pads. Structural loads for the proposed wood-frame buildings are expected to be typical and not exceed 125 kips for column loads and 7.5 kips/ft for continuous wall footings. If site development significantly differs from the above assumptions and the plans referenced herein, the recommendations included in this report should be subject to further review and evaluation.

2.4 Previous Investigations

Based on our in-house data, four site-specific geologic/geotechnical investigations were reviewed for this site.

- The first investigation was a geologic study performed for Riverside County Parcel 15420 by Leighton, in 1980 to evaluate whether or not the Wildomar fault underlies the site. As shown on Figure 2, *Geotechnical Map/Boring Location Plan*, the exploratory trench (T-1) extended 350 into the subject parcel and slightly beyond the limits of the designated AP fault zone. The results of this investigation indicate that the mapped Wildomar fault does not exist within the limits of this property and no building restrictions or setbacks are necessary for site development.
- The second site-specific geotechnical investigation (LGC, 2004) was performed to explore the subsurface soils conditions and included four (4) geotechnical borings (B-1 through B-4). The results of LGC's study indicated the presence of compressible and liquefiable layers underlying the site and thus the recommendations required the removal of the upper 7 to 10 feet of surficial soils. Groundwater was encountered during drilling at a depth a depth of 7.5 to 10 feet below existing ground surface.
- A third investigation of this property consisted of an Updated Geotechnical Exploration performed by Leighton in 2011 and consisted of advancing five (5) geotechnical borings (LB-1 through LB-5) to verify and amend the previous findings as applicable. Results of this update study confirmed the presence of groundwater at shallower

depths than encountered in 2004 by LGC and potentially liquefiable soils. However, recommended remedial grading was limited to 3 feet below existing ground surface in view of the proposed placement of 5 to 8 feet of import fill across the site at that time. A consolidation settlement in the underlying compressible silt and clay layers on the order of 2 to 4 inches was estimated. This settlement was expected to occur over a period of 6 to 18 months. Settlement monitoring during grading is recommended to confirm the estimates of time rate consolidation.

- In December of 2021 Leighton provided Due-Diligence level (desktop) review of the site for Lennar Multifamily Communities wherein Leighton reviewed the previous reports and provided recommendations for an additional investigation based on current land improvement plans.

Boring and fault trench logs from the previous studies are included in Appendix A, *Exploration Data.* Laboratory tests data is included in Appendix B, *Geotechnical Laboratory Test Results.*

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 Field Exploration

On March 8th, 2022, we conducted a subsurface field exploration of the subject site using a CME 75, truck-mounted hollow-stem auger drill rig. Site exploration consisted of the excavation, sampling and logging of six (6) exploratory borings. The borings were advanced to depths ranging from a depth of 21.5 to 31.5 feet below existing ground surface. Approximate locations of the borings are depicted on the Boring Location Plan (Figure 2). The borings were loosely backfilled after drilling with the excavated cuttings.

The exploratory borings were sampled utilizing a 140-pound automatic safety hammer dropping 30-inches. During the drilling operation, bulk and relatively undisturbed samples were obtained from the borings for laboratory testing and evaluation. The relatively undisturbed samples were obtained utilizing a modified California drive sampler (2⅜-inch inside diameter and 3-inch outside diameter) driven 18-inches (where possible), in general accordance with ASTM Test Method D3550. Sampling and logging of the exploratory borings were performed by a Geologist from our office. Soil materials were visually classified according to the Unified Soil Classification System and further characterized in the laboratory.

3.2 Laboratory Testing

Laboratory tests were performed on representative bulk samples to provide a basis for development of remedial earthwork and geotechnical design parameters. Selected samples were tested to determine the following parameters: in-situ moisture content, Atterberg limits, maximum dry density and optimum moisture, expansion index, R-value, soluble sulfate content, and consolidation test. The results of our laboratory testing are presented in Appendix B.

4.0 GEOLOGIC AND SOILS CONDITIONS

4.1 Regional Geology

The subject property is located within a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. This northwest-trending geomorphic region is characterized, by steep, elongated mountain ranges and intervening valleys. The most common rock types found in the Peninsular Ranges consist of early Cretaceous age (140 to 105 million-year old) formations including the metasedimentary Bedford Canyon Formation and Santiago Peak Volcanics. These formations were intruded by granodiorite, quartz monzonite and other granitics of the Southern California Batholith during the Cretaceous period (Kennedy, 1977).

More specifically, the subject property is located along the eastern edge of the fault controlled, down dropped graben of Temecula Valley where it forms the southern end of the Elsinore Trough (Mann, 1955; Kennedy, 1977). The active Wildomar segment of the Elsinore Fault Zone forms a part of the eastern margin of the graben in this area and the Willard segment of the fault zone extends along the western margin of the trough to the west of the site. The Elsinore Fault Zone extends from the San Gabriel River Valley southeasterly towards, and then beyond the United States-Mexico border.

The Santa Ana Mountains lie along the western side of the Elsinore Fault Zone and the Perris Block is located along the northeastern side of the fault zone. The mountain ranges nearest to the site are comprised predominantly of pre-Cretaceous metasedimentary and metavolcanic rocks and Cretaceous plutonic rocks of the Southern California batholith. Tertiary aged sediments, different volcanic rock types and Quaternary aged sediments and sedimentary rocks flank the igneous, or other crystalline basement rocks within these mountain ranges. The Tertiary and Quaternary rocks are generally comprised of non-marine sediments consisting of sandstones, mudstones, conglomerates, and localized volcanic units. Alluvial deposits (recent and older Pleistocene-aged) and Pleistocene age Pauba Formation sedimentary materials fill in the lower valley and drainage areas.

4.2 Site Geologic Units

Based on the results of this and previous studies, the site is underlain by alluvial deposits and weathered Pauba formation to the depth explored. Although not encountered in our borings, some portions of the site along the existing roads may be covered with a thin layer of artificial fill due to past grading activities associated with the existing street improvements.

Our field exploration and laboratory testing results indicate that the alluvial deposits and/or weathered Pauba formation beneath portions of this site include layers of relatively loose and compressible soils. These soils can undergo significant settlement if subjected to higher loading conditions or seismic shaking. Based on the field and laboratory testing performed during this and previous studies, the pertinent engineering properties for the underlying loose/soft silt and clay deposits can be summarized as follows:

- A coefficient of compressibility (Cc) ranging from 0.06 to 0.12 was estimated based on applied loads of less than 2.5 ksf. A higher Cc should be considered for higher loads.
- A coefficient of consolidation (Cv) ranging from 0.08 to 0.16 square-ft/day was measured for the encountered sandy silt, clayey silt and silty clay layers.
- Expansion Index (EI) is expected to vary from very low (EI<21) for sandy soils to low (EI<51) for the surficial silt and clay layers.

4.3 Surface and Groundwater

Surface water was not encountered within the site boundaries during our field exploration, except for the existing creek channel that had storm water ponding in some areas. Groundwater was encountered at a depths of 5.7 to 8.8 feet in our current phase of exploration borings. However, previous borings drilled on this site document groundwater as shallow as 4.5 feet below ground surface (Leighton, 2011). Thus, groundwater is anticipated to be a construction challenge (saturated subgrade instability) during site development if proposed site grading or site utilities extend below groundwater levels.

4.4 Infiltration

Due to shallow groundwater (4 to 8 feet bgs) and high silt/clay content in near surface soils, onsite infiltration of storm water is not considered feasible. Current County design guidelines, groundwater should be deeper than 10 feet below bottom of drainage facility (Riverside County, 2011).

4.5 Faulting

Murrieta, like the rest of Southern California, is located within a seismically active region located near the active margin between the North American and Pacific tectonic plates. The principal source of seismic activity is movement along the northwest-trending regional faults such as the San Andreas, San Jacinto and Elsinore fault zones. These fault systems produce approximately 55 millimeters per year of slip between the plates. The Elsinore fault zone comprised of the Willard Fault and the Wildomar Fault, are estimated to accommodate 10 to 15 percent of the plate boundary slip (WGCEP, 1995).

The location of the site in relationship to postulated faults in the subject area is depicted on Figure 3, *Fault Map*. Per published geologic hazards maps, the State Alquist-Priolo (AP) and Riverside County Fault Zones extend into the property for approximately 350 feet (see Figure 2). As previously discussed in this report, fault trench T-1 (Leighton, 1980) extended 350 into the subject parcel or slightly beyond the limits of the designated AP/County Fault Zones. Based on our review, the postulated mapped Wildomar fault as previously inferred (Kennedy, 1977) does not exist within the limits of this property. Furthermore, trenching conducted during fault hazard investigations for the surrounding and adjacent properties (GeoSoils, 1989; Leighton, 1989; & Soil Tech, 1987) concluded that the previously inferred fault trace as mapped by Kennedy (1977) adjacent to the site does not exist. Based on these findings, the potential for surface rupture is considered very low and building restrictions or setbacks are not necessary for site development

4.6 Ground Shaking and Seismic Coefficients

Strong ground shaking can be expected at the site during moderate to severe earthquakes in this general region. This is common to virtually all of Southern California. Intensity of ground shaking at a given location depends primarily upon earthquake magnitude, site distance from the source, and site response (soil type) characteristics. Based on the previous explorations, the site is underlain by shallow soft alluvial materials and highly weathered Pauba formation at depth. As such, the site is classified as a Class D site, and in accordance with ASCE 7-16 as the Design Code Reference Document, the 2019 CBC seismic coefficients are listed in table below. These seismic coefficients are generated based on interactive tools/programs currently available on USGS website and/or OSHPD seismic maps.

Table 1. 2019 CBC Seismic Coefficients per USGS General Procedure

CBC Categorization/Coefficient	Value[1]
Site Longitude (decimal degrees)	-117.1971°
Site Latitude (decimal degrees)	33.5503°
Site Class Definition	**D**
Mapped Spectral Response Acceleration at 0.2s Period, S_s	**1.63 g**
Mapped Spectral Response Acceleration at 1s Period, S_1	**0.61 g**
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS}	**1.63 g**
Adjusted Spectral Response Acceleration at 1s Period, S_{M1}	**1.04g**
Design Spectral Response Acceleration at 0.2s Period, S_{DS}	**1.09 g**
Design Spectral Response Acceleration at 1s Period, S_{D1}	**0.69g**
Site-Specific Modified Peak Ground Acceleration, PGA_m	**0.80 g**
Note: The seismic coefficients for Site Class D follows Exception (2) in Section 11.4.8 of ASCE 7-16 that assumes a fundamental period of vibration less than 0.5s for the proposed structures. The project structural engineer should confirm such assumption or else a site–specific ground motion analysis will be required	

g = Gravity acceleration

4.7 Secondary Seismic Hazards

Secondary seismic hazards generally associated with severe ground shaking during an earthquake include shallow ground rupture, liquefaction, seismically-induced settlement, and flooding. These hazards are discussed in the following sections.

4.7.1 *Liquefaction*

Liquefaction of cohesionless soils can be caused by strong vibratory motion due to earthquakes. Research and historical data indicate that loose granular soils below a near-surface groundwater table are most susceptible to liquefaction, while the stability of most clayey material is not adversely affected by vibratory motion. When loose to medium dense, saturated granular deposits are subjected to strong seismic shaking of significant duration without substantial dissipation of excess pore water pressure, then soil deposits may liquefy (i.e., behave like a liquid) and lose bearing strength.

Based on our analysis of the subsurface exploration data and laboratory test results, there is a potential for liquefaction in relatively loose silt and sand layers at depth greater than 10 BGS. The total seismically induced settlement in the upper 50 feet is estimated to range up to 3.3 inches where shallow groundwater exists. However, due to the depth of the liquefiable layers and presence of cohesive/clay layers at shallow depth (upper 10 feet), differential settlement is estimated to be relatively global and on the order of 1 inch or less over a horizontal distance of 30 feet.

4.7.2 *Lateral Spreading Potential*

Lateral spreading is a phenomenon in which large blocks of intact, non-liquefied soil move down slope on a liquefied soil layer. Lateral spreading is often a regional event. For lateral spreading to occur, the liquefiable soil zone must be laterally continuous, unconstrained laterally, and free to move along sloping ground. Due to relatively flat terrain, fine and cohesive nature of the shallow layers (upper 10 to 15 feet), it is our opinion that the potential for lateral spreading is low.

4.7.3 *Ground Rupture*

Ground rupture is generally considered most likely to occur along pre-existing active faults. Based on the results of the previous Leighton fault trench investigation, the potential for ground rupture within this site is considered low.

4.7.4 *Flooding*

Risk of flooding on this site is not within the scope of this study. However, a moderate drainage course traverses the eastern margin of the property from the north. The design civil engineer should consider potential impacts of this drainage or flooding on the site development.

5.0 PRELIMINARY RECOMMENDATIONS

5.1 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 the site's development. The main geotechnical concern associated with site development is the presence of potentially shallow groundwater and compressible alluvium in upper 5 to 10 feet below ground surface (bgs). If subjected to additional loads from proposed building, the underlying alluvium may settle up 2.8 inches that is estimated to occur over a period of 16 month.

5.2 Earthwork Considerations

Earthwork should be performed in accordance with the General Earthwork and Grading Specifications in Appendix D as well as the following recommendations. The recommendations contained in Appendix D 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 D.

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 and the specifications in Appendix D, notwithstanding the testing and observation of the geotechnical consultant.

5.2.1 *Site Preparation and Removal*

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 and organic material. Heavy vegetation, roots, and debris should be disposed of offsite. Voids created by removal of buried material should be backfilled with properly compacted soil in general accordance with the recommendations of this report.

To reduce the potential for adverse differential settlement, we recommend that onsite soils be over-excavated and recompacted to a depth of 4 feet below existing grades or 3 feet below bottom of footings, whichever is deeper. Local conditions may require deeper over-excavation. Such areas should be evaluated by Leighton during grading and depth of removal should not encroach to within 2 feet of groundwater that is expected to be as shallow as 5.7 feet below existing ground surface in some areas. Grading contractor should confirm the depth to

groundwater with local test pit explorations at the time of earthwork cost estimating and grading.

After completion of the recommended removal/over-excavation and prior to placing additional fill, the approved surface should be scarified a minimum of 8 inches, moisture conditioned or dried out and compacted to a minimum 90 percent of the maximum dry density in accordance with ASTM D1557. The limits of subgrade instability will be determined during site grading based on field observations by the engineering geologist or field technician. The means-and-method of subgrade stabilization may vary and it is the contractor's responsibility to achieve a non-yielding subgrade prior to fill placement. In areas where subgrade instability occurs, subgrade stabilization by mechanical modification may be necessary if scarification, aeration and recompaction is not feasible. Mechanical methods consist of placement of coarse crushed aggregate, perhaps in conjunction with a geogrid or geotextile fabric as further described below.

***Rock Stabilization**:* Subgrade stabilization in this method consists of placing 2- to 3-inch (nominal diameter) crushed rock in lifts and compacting each lift of the aggregate into the subgrade to improve stability. Rock should be mechanically compacted under the weight of the equipment to push the rock into the underlying soils. Vibratory equipment **should not be used** to work in the rock blanket as the vibrations may aggravate locally soft saturated clays causing pumping conditions to expand laterally and destabilize the subgrade further.

Depending upon the degree of subgrade instability, the initial lift may completely penetrate the subgrade, and additional lifts will be necessary. The quantity of material may be reduced if a geogrid or geotextile fabric is used to provide additional reinforcement effect after the placement of the initial lift. Geogrid or geotextile reinforcement should be placed with a minimum 3 feet of overlap between adjacent panels extending a distance of at least 5 feet beyond the footprint on all sides.

5.2.2 Structural Fills

The onsite soils are generally suitable for re-use as compacted fill, provided they are free of debris and organic matter. Fills placed within 10 vertical feet of finish pad grades or slope faces should contain no rocks over 12 inches in maximum dimension.

Placement and compaction of fill should be performed in accordance with local grading ordinances under the observation and testing of Leighton. 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 soils should be placed at a minimum of 90 percent relative compaction (based on ASTM D1557) and at near or above optimum moisture content.

5.2.3Import Soils

Import soils and borrow sites (if needed) should be evaluated by Leighton prior to importation. Import soils should be granular in nature, free of organic material, and have a low expansion potential, a minimum R-value of 35, and a low corrosion impact to the proposed improvements.

5.2.4Trench Excavations and Backfill

The onsite soils may generally be suitable as trench backfill provided they are free of rocks over 3 inches in diameter (or per governing agency requirements) and free of organic matter. Trench backfill should be compacted in uniform lifts (not exceeding 8 inches in compacted thickness) by mechanical means to at least 90 percent relative compaction (ASTM Test Method D1557).

Excavation of utility trenches should be performed in accordance with the project plans, specifications, and all applicable OSHA requirements. The contractor should be responsible for providing the "competent person" required by OSHA standards. Contractors should be advised that sandy soils could make excavations particularly unsafe, even and necessary safety precautions should be taken. Groundwater and/or saturated soils may be encountered during excavations and construction of underground utilities, if to be installed a depth greater than 5 feet BGS.

5.2.5Shrinkage 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 and the laboratory data, we anticipate shrinkage of approximately 5 to 15 percent in the onsite surficial soils. A subsidence value of 0.3 should be used to account for potential settlement in underlying materials.

5.3 Foundation Recommendations

5.3.1 *General*

Our recommendations below are provided as minimum and do not supersede local or State ordinances or Codes, the requirements of the project structural engineer or the 2019 CBC. Grading and foundation plans should be reviewed to confirm foundation design parameters as provided below.

5.3.2 *Foundation Design Criteria*

Based on our preliminary analysis, the proposed structures may be founded on a conventional foundation system in accordance with the design criteria provided below. The proposed foundations and slabs should be designed in accordance with the structural consultants' design, the geotechnical recommendations presented herein, and the 2019 CBC. In utilizing the minimum geotechnical foundation recommendations, the structural consultant should design the foundation system to the acceptable deflection criteria as determined by the structural engineer and/or architect.

Foundation footings for the proposed buildings may be designed in accordance with the following parameters:

- A net allowable bearing capacity of 2,400 pounds per square foot (psf), or a modulus of subgrade reaction of 150 pci may be used for design of footings founded entirely into compacted fill. The footings should extend a minimum of 12 inches below lowest adjacent grade. A minimum base width of 18 inches for continuous footings and a minimum bearing area of 3 square feet (1.75 ft by 1.75 ft) for pad foundations should be used. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind).

- The passive earth pressure may be computed as an equivalent fluid having a density of 300 psf per foot of depth, to a maximum earth pressure of 3000 pounds per square foot. A coefficient of friction between soil and concrete of 0.35 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third

It should be noted that the above recommendation is based on soil support characteristics only. The footing width, depth, reinforcement, slab reinforcement, and the slab-on-grade thickness should be designed by the structural consultant based on recommendations and soil characteristics indicated herein and the most recently adopted edition of the CBC.

A moisture retarder should be installed underneath all slabs where moisture condensation is undesirable. The vapor retarder should be properly installed in accordance with the recommendations of the architect, concrete subcontractor, and the manufacturer's recommendations. Moisture vapor retarders may retard but not eliminate moisture vapor movement from the underlying soils up through the slabs. Moisture vapor transmission may be additionally reduced by use of concrete additives. A slipsheet or equivalent should be utilized above the concrete slab if crack-sensitive floor coverings (such as ceramic tiles, etc.) are to be placed directly on the concrete slab.

5.4 Settlement Considerations

The project civil engineer, structural engineer, and architect should consider the potential effects of both static settlement and dynamic settlement presented below.

5.4.1 *Static Settlement*

Due to presence of potentially compressible alluvium at shallow depth (~5' to 15' BGS), long-term consolidation settlement will occur and expected to generally take place within 16 months of applied loads. This consolidation settlement is estimated to be on the order of 2.8 inches in some areas. Fifty percent of this consolidation settlement will generally occur within four month period of applied load. As such, differential static settlement of 1 inch over a 30-foot span should be considered for design purposes.

5.4.2 *Dynamic Settlement*

Based on our analysis we estimate that total dynamic settlement may be on the order of 3.3 inches. However, due to the depth of the liquefiable layers and presence of cohesive/clay layers at shallow depth and proposed compacted fill cap, this settlement is estimated to be relatively global and on the order of 1-inch over a horizontal distance of 30 feet. This post mass-grading total/ differential settlement is expected to decrease if the underlying materials are allowed to consolidate under the proposed loading. The project civil, structural engineer and architect should consider the potential combined effects of both static and dynamic settlement as presented in this report. If the above settlements are considered excessive for building design, other methods of ground improvements should be considered such as deeper removal or surcharging.

5.5 Footing Setback

We recommend a minimum horizontal setback distance from the face of slopes for all structural footings (retaining and decorative walls, building footings, etc.). This distance is measured from the outside bottom edge of the footing horizontally to the slope face (or to the face of a retaining wall) and should be a minimum of H/2 (or as required by the CBC), where H is the slope height (in feet). The setback should not be less than 7 feet and need not be greater than 15 feet.

The soils within the structural setback area may possess poor lateral stability and improvements (such as retaining walls, sidewalks, fences, pavements, etc.) constructed within this setback area may 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 as described above.

5.6 Sulfate Attack

The results of the laboratory testing on representative soils samples indicate negligible exposure to concrete per ACI 318. Further testing should be performed at the completion of site grading to confirm soluble-sulfate content of finish subgrade soils.

5.7 Concrete Flatwork

Sidewalk/Flatwork should conform to City of Murrieta 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. Homeowners (HOA) should be advised of their maintenance responsibilities as well as geotechnical issues that could affect performance of site improvements.

5.8 Site Drainage and Erosion Control

Surface drainage should be controlled at all times. Positive surface drainage should be provided to direct surface water away from structures toward the street or suitable drainage facilities. Positive drainage may be accomplished by providing a minimum 2 percent gradient away from the structures for a distance of at least 5 feet. Below grade planters should not be situated adjacent to structures or pavements unless provisions for drainage such as catch basins and drains are made. In general, ponding of water should be avoided adjacent to the structures or pavements. Over-watering of the site should be avoided. Protective measures to mitigate excessive site erosion during construction should also be implemented in accordance with the latest Riverside County grading ordinances.

5.9 Slope Stability

The existing 2:1 or flatter descending slopes along the exiting channel and cut slopes in the western portion of the site (Cross-Sections AA’ and BB’ - see Figure 2) were evaluated

for long-term stability. As presented in Appendix C, the results of our analyses indicate that both slopes are considered stable under static and pseudo-static conditions.

Slope faces are inherently subject to erosion, particularly if exposed to rainfall and storm drainage water. It is recommended that proper erosion control measures be provided that may include breakwater berms and rip-rap in accordance with recommendations of the project Civil Engineer or erosion control specialist.

5.10 Preliminary Pavement Design

Our preliminary pavement design is based on an R-value of 18 for onsite soils (clayey sand). For planning and estimating purposes, the pavement sections are calculated based on a range of Traffic Indexes (TI) as indicated in Table below and the Caltrans Highway Design Manual:

Table 2. Preliminary Asphalt Pavement Sections

General Traffic Condition	Design Traffic Index (TI)	Asphalt Concrete (inches)	Aggregate Base* (inches)
Automobile Parking Lanes	4.5	3.0	6.0
	5.0	3.0	7.50
Truck Access & Driveways	6.0	3.5	8.0
	6.5	3.5	12.0

Appropriate Traffic Index (TI) data should be selected or verified by the project civil engineer or traffic engineering consultant and appropriate R-value of the subgrade soils will need to be verified after completion of site grading to finalize the pavement design. Final pavement sections should be constructed in general accordance with local, county and industry standards. The Caltrans pavement section design calculations were based on a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. A minimum of 6 inches of Portland Cement Concrete (PCC) pavement over 6-inch of AB may be used, rather than asphalt, in high impact load areas such as loading docks, trash truck bin loading areas, etc. The PCC pavement may be placed directly on a compacted subgrade with an R-Value of 40 or higher. The PCC pavement should be adequately reinforced to prevent shrinkage cracking and have a minimum of 28-day flexural strength of 550 psi. Other requirements of Caltrans Standard Specifications regarding mixing and placing of concrete should be followed.

The upper 12 inches of the subgrade soils should be moisture-conditioned to near optimum moisture content, compacted to at least 95 percent relative compaction (ASTM D1557) and kept in this condition until the pavement section is constructed. Minimum

relative compaction requirements for aggregate base should be 95 percent of the maximum laboratory density as determined by ASTM D1557. Aggregate base 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.

If pavement areas are adjacent to heavily watered landscape areas, some deterioration of the subgrade load bearing capacity may result. Moisture control measures such as deepened curbs or other moisture barrier materials may be used to prevent the subgrade soils from becoming saturated. The use of concrete cutoff or edge barriers should be considered when pavement is planned adjacent to either open (unfinished) or irrigated landscaped areas.

5.11 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 can be designed using the following equivalent fluid pressures:

Table 3. Retaining Wall Design Earth Pressures (Static, Drained)

Loading Conditions	Equivalent Fluid Density (pcf)	
	Level Backfill	2:1 Backfill
Active	33	55
At-Rest	52	85
Passive*	350	125 (2:1, sloping down)

* This assumes level condition in front of the wall will remain for the duration of the project, not to exceed 2,000 psf at depth.

For walls retaining more than 6 feet of soils, we recommend for non-restrained walls with level backfill, a uniform pressure distribution of 14H psf with resultant force applied at mid-height of wall, where H is the retaining wall stem height in feet. For walls with 2:1 sloping backfill, a uniform pressure distribution of 28H psf with resultant force applied at mid-height. These seismic pressures should be added to static pressures above or any applicable surcharge loads.

Unrestrained (yielding) cantilever walls should be designed for the active equivalent-fluid weight value provided above for very low to 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. 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.

6.0 GEOTECHNICAL REVIEW

Geotechnical review is of paramount importance in engineering practice. The 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 all geotechnical aspects of the project including the following.

6.1 Plan Review

Leighton should review the rough-grading plans prior to release for bidding and construction. Such review is necessary to evaluate whether the geotechnical recommendations have been effectively incorporated into the plans. Leighton should also review the proposed commercial building layout, retaining wall plans, and foundation plans to determine whether the preliminary recommendations provided in this report are adequate or whether additional recommendations are required.

6.2 Construction Observation and Testing

Observation and testing should be performed by Leighton during grading and onsite construction. It should be anticipated that the substrata exposed during grading may vary from that encountered in the previously excavated borings. Reasonably continuous geotechnical observation and testing during site grading allows for evaluation of the actual soil conditions and the ability to provide appropriate revisions during grading, if required.

Site preparation, removal of unsuitable soils, approval of imported earth materials, fill placement and other site geotechnically-related operations should be observed and tested by Leighton. Additional tests of subsurface materials to confirm compacted density and moisture content, corrosive potential, expansion potential, and resistance value (R-value) should be performed during or prior to grading.

7.0 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 development as described in Section 2.3 of this report.

This report was prepared for Lennar Multifamily Communities, LLC based on Lennar Multifamily Communities, LLC'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 Lennar Multifamily Communities, LLC, and its successors and assigns as owner of the property, with whom Leighton Consulting, 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 Consulting, 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 Consulting, Inc.

The client is referred to Appendix E regarding important information provided by the Geoprofessional Business Association (GBA).on geotechnical engineering studies and report and their applicability.

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Project: 13343.004	Eng/Geol: SIS/MSB
Scale: 1 " = 2,000 '	Date: March 2022

Basemap Reference: © 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS © 2022 TomTom

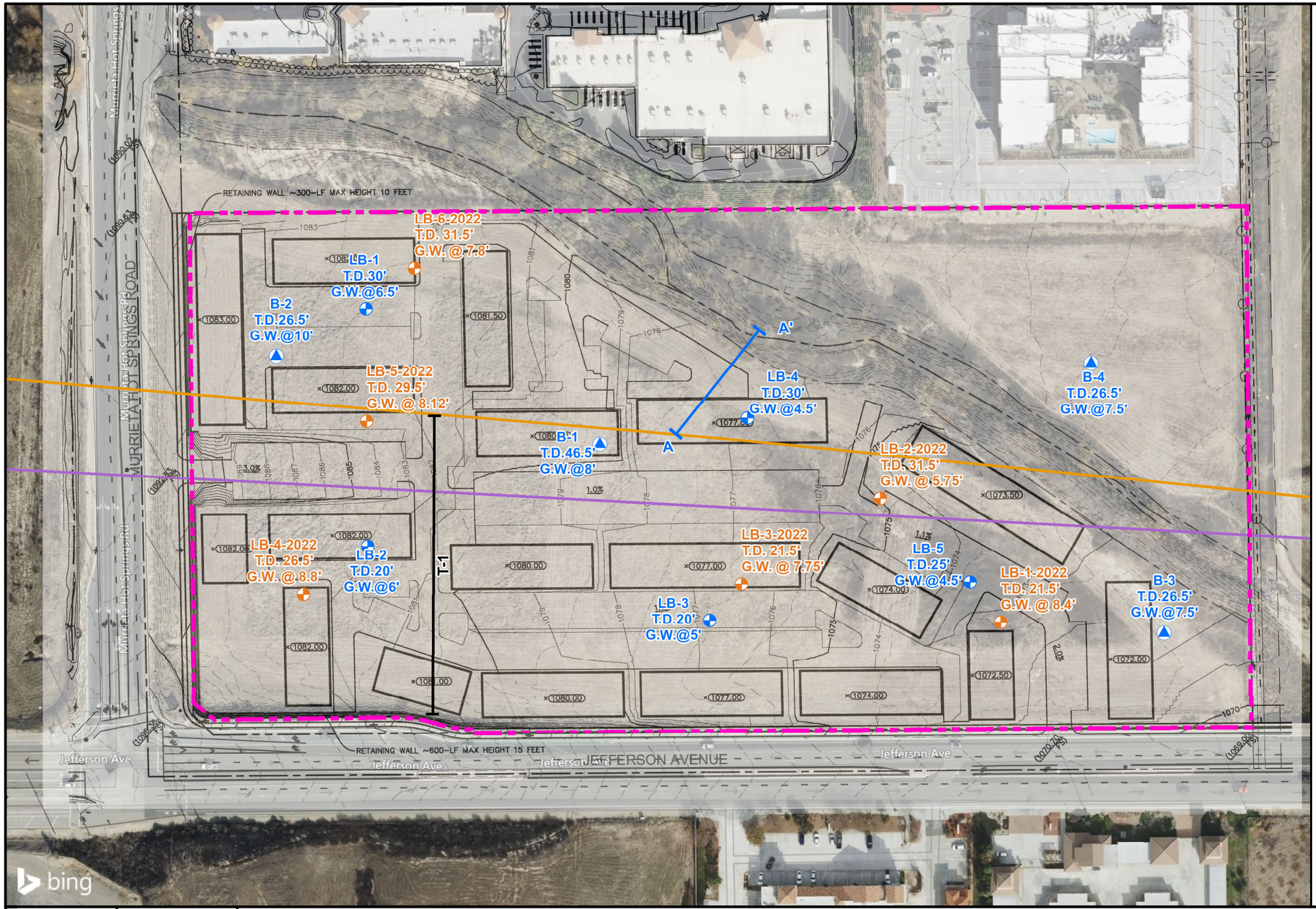
SITE LOCATION MAP

Proposed Multifamily Residential Development
APN: 910-410-011
Murrieta, California

FIGURE 1

Leighton

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LEGEND

LB-6-2022 T.D. 31.5' G.W. @ 7.8' — Approximate Location of Boring shown with Total Depth (T.D.) and Groundwater (G.W.) Depth at Time of Exploration in Feet Below Ground (Leighton 2022)

LB-5 T.D 25' G.W.@4.5' — Approximate Location of shown with Total Depth (T.D.) and Groundwater (G.W.) Depth at Time of Exploration in Feet Below Ground (Leighton, 2011)

B-4 T.D. 26.5' G.W.@7.5' — Approximate Location of Boring shown with Total Depth (T.D.) and Groundwater (G.W.) Depth at Time of Exploration in Feet Below Ground (LGC, 2004)

A — A' Slope Stability Cross-section

T-1 Approximate Locatoin of Fault Trench (Leighton, 1980)

Eastern Limits of Alquist-Priolo Fault Zone

Eastern Limits of Riverside County Fault Zone

Approximate Site Boundary

N

0 120 240
Feet

Project: 13343.004	Eng/Geol: SIS/MSB
Scale: 1 " = 120 '	Date: April 2022

Basemap Reference: © 2022 Microsoft Corporation
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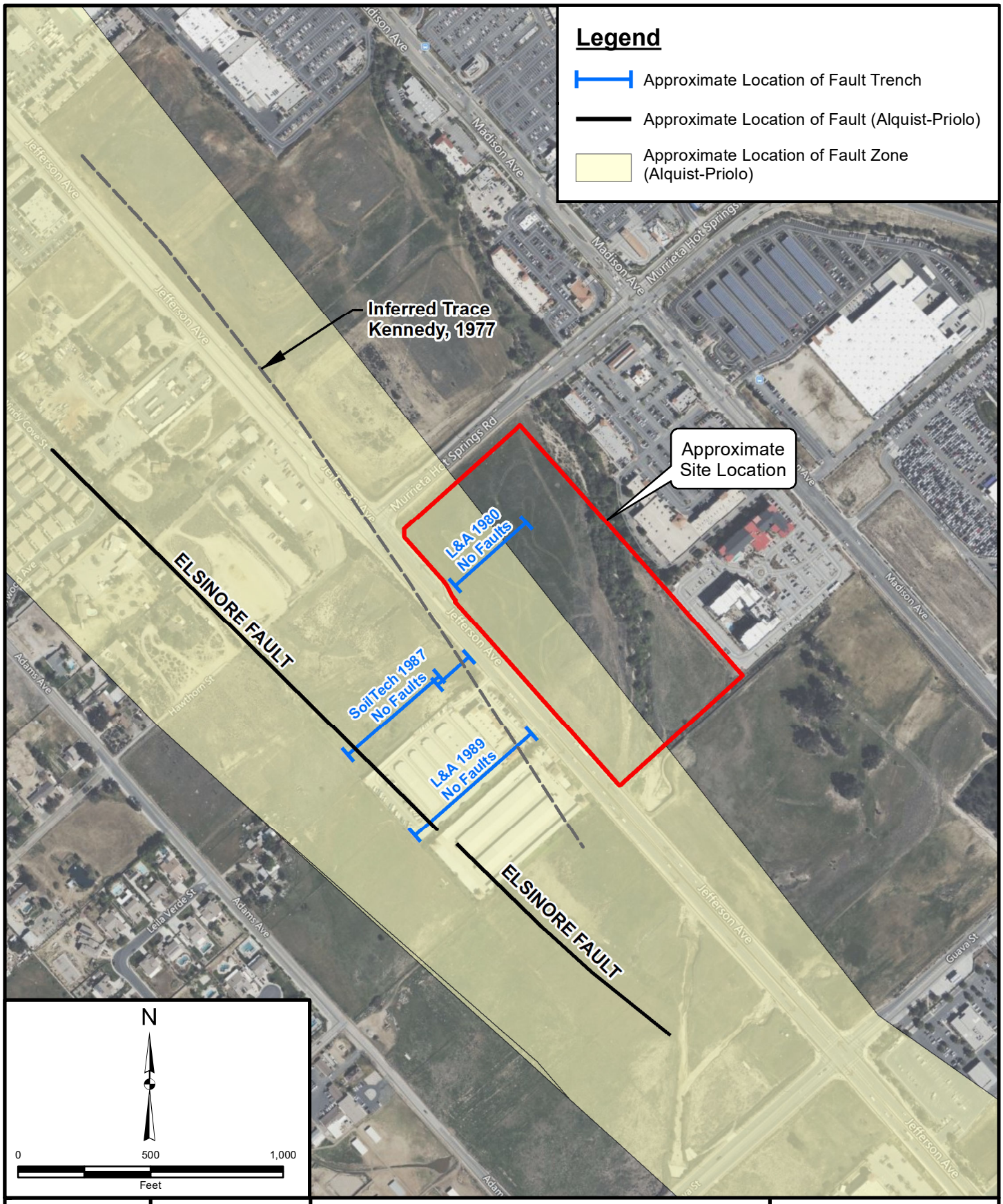
GEOTECHNICAL MAP/BORING LOCATION PLAN

Proposed Multifamily Residential Development
APN: 910-410-011
Murrieta, California

FIGURE 2

Leighton

Map Saved as J:\Drafting\13343\004\Maps\13343-004_F02_BLP_2022-04-05.mxd on 4/6/2022 12:28:59 PM Author: (kmanchikanti)



Project: 13343.004	Eng/Geol: SIS/MSB
Scale: 1 " = 500 '	Date: September 2022

Base Map: ESRI ArcGIS Online 2022
Reference: Riverside County Mapping Portal, 9/9/2019.

Author: (mmurphy)

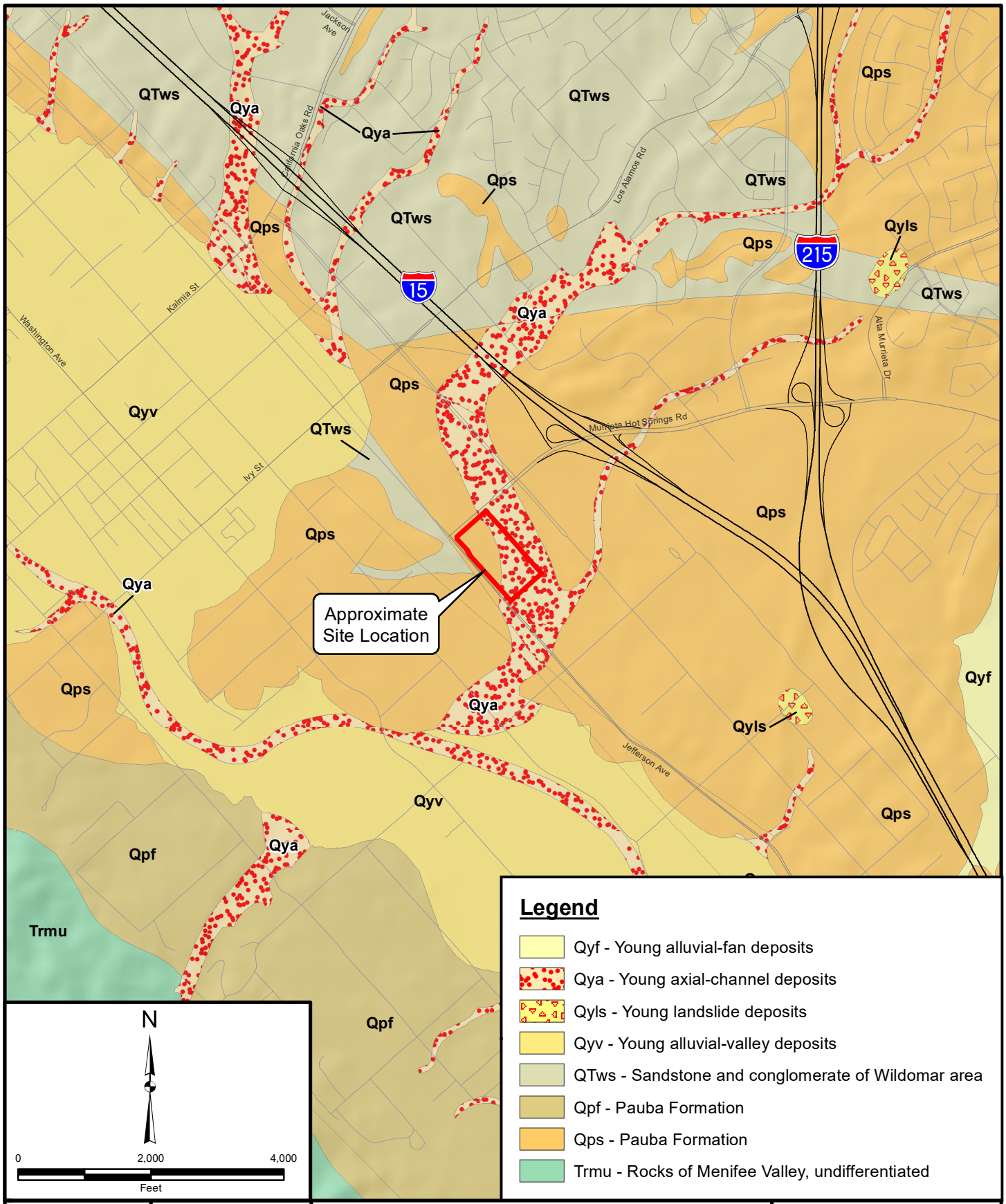
FAULT MAP

Proposed Multifamily Residential Development
APN: 910-410-011
Murrieta, California

FIGURE 3

Leighton

Map Saved as J:\Drafting\13343\004\Maps\13343-004_F03_RFM_2022-09-16.mxd on 9/16/2022 3:16:03 PM



Project: 13343.004	Eng/Geol: SIS/MSB
Scale: 1 " = 2,000 '	Date: March 2022

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

REGIONAL GEOLOGY MAP

Proposed Multifamily Residential Development
APN: 910-410-011
Murrieta, California

FIGURE 4

Leighton

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APPENDIX A

Field Boring Logs (This and Previous Studies)

The exploration logs included within Appendix A and related information depicts subsurface conditions only at the locations indicated and at the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these borings locations. The passage of time may result in altered subsurface conditions. In addition, any stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual

GEOTECHNICAL BORING LOG LB-1-22

Project No.	13343.004	**Date Drilled**	3-8-22
Project	LMC - Murrieta Hot Springs	**Logged By**	JWJ
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Figure 2 - *Boring Location Map*	**Sampled By**	JWJ

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			BB-1				CL-SM	**QUATERNARY ALLUVIUM (Qal)** CLAYEY, SILTY SAND, loose, yellow to brown, dry, fine sand, sparse vegetation	
								SM	SANDY SILT with clay, black to brown, moist, fine sand, low plasticity	
	5			R-1	4 6 8	109	21	CL	SANDY LEAN CLAY, stiff, black to brown, moist, fine sand, carbonate stringers prevalent	PP=1.5 tsf
▽	10			R-2	2 2 4	96	29		SANDY LEAN CLAY, reddish brown, very moist, fine sand, low plasticity, mottled with light gray, carbonate stringers prevalent	
	15			R-3	5 13 15	116	19	SM	**PAUBA FORMATION (Qps)** SILTY SAND, medium dense, gray, very moist, very fine sand	
	20			R-4	4 5 13				SILTY SAND, gray, moist, very fine sand, micaceous	
									Total Depth 21.5' GW measured @ 8.35' Backfilled upon completion of drilling	
	25									
	30									
	35									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LB-2-22

Project No.	13343.004	**Date Drilled**	3-8-22
Project	LMC - Murrieta Hot Springs	**Logged By**	JWJ
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Figure 2 - *Boring Location Map*	**Sampled By**	JWJ

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			BB-1				SC	**QUATERNARY ALLUVIUM (Qal)** CLAYEY SAND, loose, brown, vegetation, trace subangular granitc gravel	
				R-1	7 5 8	117 113	3 15	SP CL	Poorly graded SAND with silt, gray to light yellowish brown, moist, fine to medium sand Sandy Lean CLAY, black to brown, moist, fine sand, low plasticity, transition in sample	PP=3.5 tsf
	5			R-2	5 8 11	112	17	CL-CH	Lean CLAY to high porosity Fat CLAY, very stiff, black to brown, moist, medium to high plasticity, carbonate stringers prevalent	
				R-3	3 4 6	106	21	ML/CL	SANDY SILT with few clay, gray to olive brown, moist, fine sand, low plasticity	PP=1.0
	10			R-4	2 4 4	94	27		SILT with clay, light gray to gray, wet, low plasticity, little fine grained sand	PP=0.5
	15			S-1	2 2 4				SILT with clay, medium stiff to stiff, olive gray, wet, low plasticity, few fine grained sand	
								SP	transition in sample, medium to coarse sand ~ 1/8" in diameter over	
								CH	high plasticity fat clay, olive gray to olive brown, moist	
	20			R-5	3 6 10	108	22	SM-SW	**PAUBA FORMATION (Qps)** SILTY SAND, medium dense, gray to olive brown, moist, primarily fine grained sand with few medium grained sand	
	25			S-2	7 12 15				Well graded SAND, wet, medium sand, well-rounded grains, trace fine gravel	
	30			R-6	11 21 28	124	14	SW	Same as above, dense, gray, medium to coarse sand, fine gravels	
	35								Total Depth 31.5' GW measured @ 5.75' Backfilled upon completion of drilling	

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

Leighton

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LB-3-22

Project No.	13343.004	**Date Drilled**	3-8-22
Project	LMC - Murrieta Hot Springs	**Logged By**	JWJ
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Figure 2 - *Boring Location Map*	**Sampled By**	JWJ

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			BB-1				SC	**QUATERNARY ALLUVIUM (Qal)** CLAYEY SAND, yellowish brown, slightly moist, fine sand, vegetation (EI=19, RV=18)	EI, RV
				R-1	11 11 14	111	8	CL/ML	SANDY SILT, loose, dark brown, slightly moist, fine sand	
	5			R-2	6 9 11	118	16	CL	SANDY LEAN CLAY, very stiff, dark brown, moist, fine sand	PP=2.75
				R-3	4 5 8	109	20		SANDY LEAN CLAY, gray to dark brown, wet, low plasticity, few to little fine grained sand	
	10			R-4	3 5 10	116	18	CL/ML	SANDY SILT with few clay, brown, wet, little fine grained sand	
	15			R-5	4 5 6	93	23	SM	**PAUBA FORMATION (Qps)** SILTY SAND, gray, wet, fine sand, trace to few medium grained sand	
	20			S-1	1 1 2			SW	Well graded SAND, white to yellowish brown, wet, medium to coarse sand, with few subrounded gravels, well rounded sand grains	
								ML\CL	SANDY SILT with clay, very stiff, gray, very moist, fine sand, medium plasticity	PP=2.75
	25								Total Depth 21.5' GW measured @ 7.75' Backfilled upon completion of drilling	
	30									
	35									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

Leighton

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GEOTECHNICAL BORING LOG LB-4-22

Project No.	13343.004	**Date Drilled**	3-8-22
Project	LMC - Murrieta Hot Springs	**Logged By**	JWJ
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Figure 2 - *Boring Location Map*	**Sampled By**	JWJ

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			BB-1				SC-SM	**QUATERNARY ALLUVIUM (Qal)** CLAYEY SILTY SAND, yellowish brown, slightly moist, vegetated	
				R-1	6 10 12	120	14	SC	CLAYEY SAND, hard, black to brown, moist, micaceous	PP>4.0
	5			R-2	11 9 11	118	14	CL	SANDY LEAN CLAY, hard, black to brown, moist, low plasticity, few to little fine grained sand	
				R-3	2 2 2	104	22	CL-ML	SILTY CLAY, olive gray, wet, fine to medium sand	
	10			R-4	3 5 5	102	23	ML	CLAYEY SILT, medium stiff to stiff, gray, moist, very fine sand, trace coarse grained sand	PP=1.0
	15			S-1	3 5 9				SANDY SILT with clay, very stiff, gray, low to medium plasticity	PP=2.0
	20			R-5	10 22 37	114	19	SM	SILTY SAND, dense, moist, fine sand, few to little medium grained sand	
									PAUBA FORMATION (Qps)	
	25			S-2	4 8 18			CH	FAT CLAY, very stiff, gray to dark gray, moist, high plasticity	PP=3.25
								SC	CLAYEY SAND with gravel, medium dense to dense, gray, moist, fine to medium sand, with fine subangular granitic gravels	
	30								Total Depth 26.5' GW measured @ 8.80' Backfilled upon completion of drilling	
	35									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

Leighton

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GEOTECHNICAL BORING LOG LB-5-22

Project No.	13343.004	**Date Drilled**	3-8-22
Project	LMC - Murrieta Hot Springs	**Logged By**	JWJ
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Figure 2 - *Boring Location Map*	**Sampled By**	JWJ

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			BB-1				SC	**QUATERNARY ALLUVIUM (Qal)** CLAYEY SAND, loose, yellowish brown, moist, vegetation	
				R-1	5 8 12	125	10	SC	SANDY LEAN CLAY, hard, dark brown, moist, fine sand, low plasticity, trace coarse grained sand	PP=>4
	5			R-2	11 15 18	131	10	SM/SC	SILTY CLAYEY SAND, medium dense, light reddish brown, very moist, fine to coarse sand	
				R-3	6 6 10	120	14		SILTY CLAYEY SAND, medium dense, light reddish brown, moist, fine to coarse sand, few fine gravels, subangular to subrounded, trace subangular black slate gravel, flatted	
	10			R-4	7 6 11	120	13		SILTY CLAYEY SAND with gravels, light reddish brown, wet, fine to coarse sand, subangular fine granitic gravels	
	15			S-1	2 3 5			SW	Poorly graded SAND with SILT, loose to medium dense, light olive gray, wet, fine to coarse sand, trace fine subangular gravel	
	20			R-5	6 7 8	110	22	SM	SILTY SAND with few clay, gray to dark gray, wet, fine sand, few to little medium to coarse grained sand	
								SW	transition to Well graded SAND, light gray to gray, wet, fine to coarse sand, few fine subangular granitic gravels	
								SW	**PAUBA FORMATION (Qps)**	
	25			S-2	3 4 4			CL	Well graded SAND with Silt, gray, wet, fine sand, few to little medium coarse grains, few fine granitic gravel, subangular SILTY CLAY, medium stiff to very stiff, dark gray to yellowish red, moist, low plasticity, laminated	PP=2.0
				R-6	12 37 50/6"	107	22	ML SW	SANDY SILT with few clay, gray to yellowish brown, very moist, micaceous Poorly graded SAND with Silt, very dense, gray, moist, fine sand, few to little medium grains	
	30								Total Depth 29.5' GW measured @ 8.12' Backfilled upon completion of drilling	
	35									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

Leighton

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GEOTECHNICAL BORING LOG LB-6-22

Project No.	13343.004	**Date Drilled**	3-8-22
Project	LMC - Murrieta Hot Springs	**Logged By**	JWJ
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Figure 2 - *Boring Location Map*	**Sampled By**	JWJ

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			BB-1				SC	**QUATERNARY ALLUVIUM (Qal)** CLAYEY SAND with slit, yellowish brown, slightly moist, fine sand, trace fine granitic gravel, (MD= 131.0 @ 10.0, EI=31)	AL, MD, EI, CR
				R-1	8 11 13	125	11	SC	SANDY LEAN CLAY, vey stiff, black to brown, moist, medium plasticity, few to little fine gravel	PP=3.75
	5			R-2	5 8 11	121	14	SC	CLAYEY SAND, medium dense, light reddish brown, moist, fine sand, trace coarse grains	
				R-3	3 3 4	113	17		CLAYEY SAND with silt, loose, reddish brown, wet, fine sand, trace to few medium to coarse grains	
	10			R-4	4 6 7	111	20	SC-SM	SILTY SAND, medium dense, olive gray to brown, wet, fine sand, few coarse grains, trace clay	
	15			R-5	5 8 11	109	20	SM/ML	SILTY SAND to SANDY SILT, olive brown, moist, very fine sand, grades silter, trace clay	
	20			S-1	2 2 4			ML	SANDY SILT with few clay, stiff to very stiff, olive gray to brown, fine sand, low to medium plasticity	PP=2.0
	25			R-6	2 5 14				SANDY SILT with clay, medium stiff, olive gray to red, mottled with reddish yellow brown	PP=1.5
									PAUBA FORMATION (Qps)	
	30			S-2	7 14 17			SW	Well-graded SAND with silt, dense, gray, wet, fine to coarse sand, primarly medium grained, well rounded grains, few to little silt	
	35								Total Depth 31.5' GW measured @ 7.80' Backfilled upon completion of drilling	

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

Leighton

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GEOTECHNICAL BORING LOG LB-1

Project No.	603181-001	**Date Drilled**	5-16-11
Project	Regent Murrieta 18	**Logged By**	BSS
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140 - Automatic - 30" Drop	**Ground Elevation**	1082'
Location	See Borings Location Plan	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								Surface covered with grass and weeds	
1080				R-1	14 19 14	126	8	SC	CLAYEY SAND, medium dense, dark brown, moist, fine to medium sand, trace fine roots	
	5			R-2	3 4 5	109	20	ML	SILT with SAND, medium stiff, dark brown, moist to wet, fine to coarse sand, some clay (PP = 0.5 TSF)	PP
1075										
	10			R-3	4 6 9	112	19	SM	SILTY SAND, loose, brown, wet, fine sand, (34% fines)	CN, -200
1070										
	15			R-4	8 16 11	112	17		SILTY SAND, medium dense, brown, wet, fine to coarse sand	
1065										
	20			R-5	8 13 17	100	23	ML	SANDY SILT, stiff, dark grayish brown, wet, fine to medium sand	
1060										
	25			R-6	4 9 13	110	21	SM	SILTY SAND, medium dense, grayish brown, moist to wet, fine to medium sand, some oxidation	
1055										
	30			R-7	4 7 19			SW-SM	Well-graded SAND, medium dense, grayish brown, wet, fine to coarse sand, trace silt	
1050									Drilled to 30' Sampled to 31.5' Groundwater at 6.5' Backfilled with soil cuttings (5/16/2011)	
	35									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH



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GEOTECHNICAL BORING LOG LB-2

Project No.	603181-001	**Date Drilled**	5-16-11
Project	Regent Murrieta 18	**Logged By**	BSS
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140 - Automatic - 30" Drop	**Ground Elevation**	1081'
Location	See Borings Location Plan	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								Surface covered with weeds	
1080				B-1				SC	CLAYEY SAND, loose, dark brown, moist, fine to medium sand, (EI = 33)	EI
				R-1	5 7 9	123	14		dark brown, moist, fine sand, to sandy silt	
	5			R-2	6 9 10	123	13		medium dense, brown, moist to wet, fine to coarse sand, (PP = 4 TSF)	PP
1075 ▼										
				R-3	2 3 10	119	15	SW-SM	Well-graded SAND with SILT, medium dense, brown, wet, fine to coarse sand	
	10			R-4	6 10 12	120	14		medium dense, grayish brown, wet, fine to coarse sand, trace silt	
1070										
	15			R-5	7 10 10	119	15		with silt, medium dense, light brownish gray, wet, medium to coarse sand, (7% fines)	-200
1065										
	20			R-6	4 5 8	112	26	CL	SILTY SAND, medium stiff, grayish brown, wet, trace fine to medium sand	
1060									Drilled to 20' Sampled to 21.5' Groundwater at 6' Backfilled with soil cuttings (5/16/2011)	
	25									
1055										
	30									
1050										
	35									

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SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		



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GEOTECHNICAL BORING LOG LB-3

Project No.	603181-001	**Date Drilled**	5-16-11
Project	Regent Murrieta 18	**Logged By**	BSS
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140 - Automatic - 30" Drop	**Ground Elevation**	1076'
Location	See Borings Location Plan	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	0								Surface covered with weeds	
1075								SC	CLAYEY SAND, loose, brown, dry to moist, fine to medium sand	
				R-1	4 6 10	119	15	CL	SANDY Lean CLAY, medium stiff, dark brown, moist, fine sand, (PP = 2.5 - 3.5 TSF)	PP
	5			R-2	6 8 8	117	16		SANDY Lean CLAY, medium stiff, dark grayish brown, moist to wet, fine sand, (PP = 2.5 TSF)	PP
1070										
	10			R-3	9 10 12	118	18	SW-SM	Well-graded SAND with SILT, medium dense, brown, wet, fine to coarse sand, trace gravel	
1065										
	15			R-4	6 7 10			SW	Well-graded SAND, medium dense, light brownish gray, wet, fine to coarse sand	
1060						109	20	ML	SILT with SAND, stiff, brown, moist to wet, fine sand, some clay	
	20			R-5	5 6 7	98	26	CL-ML	SILTY CLAY with SAND, loose, light brown, wet, fine sand, more sand in the top of sample	
1055									Drilled to 20' Sampled to 21.5' Groundwater at 5' Backfilled with soil cuttings (5/16/2011)	
	25									
1050										
	30									
1045										
	35									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		



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GEOTECHNICAL BORING LOG LB-4

Project No.	603181-001	**Date Drilled**	5-16-11
Project	Regent Murrieta 18	**Logged By**	BSS
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140 - Automatic - 30" Drop	**Ground Elevation**	1078'
Location	See Borings Location Plan	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SC	Surface covered with weeds CLAYEY SAND, loose, dark brown, dry to moist, fine to coarse sand, some rootlets	
1075				R-1	4 8 10	120	15		medium dense, dark grayish brown, moist, fine to medium sand, (PP = 2 - 4 TSF)	PP
	5			R-2	4 5 7	109	19	CL	SILTY CLAY with sand, medium stiff, dark gray, moist to wet, fine sand, (PP = 0.5 - 0.75 TSF)	PP
1070				B-2 R-3	3 3 4				soft, dark grayish brown, wet, fine sand, mottled (EI = 60) (PP = 0.25 - 0.5 TSF)	EI PP
	10			R-4	2 7 10	105	20	ML	SANDY SILT, stiff, brown, wet, fine sand, some clay in the top	
1065										
	15			R-5	5 9 12	105	21		stiff, grayish brown, wet, fine to coarse gravel, trace clay, mottled (LL = 26, PL = 24, PI = 2) (PP = .05 TSF)	AL, PP
1060										
	20			R-6	5 8 13	105	21		stiff, brown, wet, fine to medium sand	
1055										
	25			R-7	4 8 10	115	19	SW	Well-graded SAND, medium dense, light brownish gray, wet, fine to coarse sand with fine gravel, trace silt	
1050										
	30			R-8	5 6 7	112	19		Well-graded SAND, loose, light brownish gray, wet, fine to coarse sand with fine gravel, trace silt	
1045									Drilled to 30' Sampled to 31.5' Groundwater at 4.5' Backfilled with soil cuttings (5/16/2011)	
	35									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH



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GEOTECHNICAL BORING LOG LB-5

Project No.	603181-001	**Date Drilled**	5-16-11
Project	Regent Murrieta 18	**Logged By**	BSS
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140 - Automatic - 30" Drop	**Ground Elevation**	1080'
Location	See Borings Location Plan	**Sampled By**	BSS

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
1080	0							SC	Surface coved with weeds CLAYEY SAND, loose, dark brown, moist, fine sand	
				R-1	2 4 7	107	19	CL	Lean CLAY with SAND, medium stiff, dark grayish brown, moist, fine sand, more clay (PP=1.5 TSF)	PP
1075	5			R-2	4 7 11	111	19		Lean CLAY with SAND, medium stiff, dark grayish brown, moist, fine sand, mottled (PP=2.0 - 2.5 TSF)	PP
				R-3	3 3 7				grayish brown, moist to wet, fine sand, (PP=0.5 TSF)	PP
1070	10			R-4	3 4 8	113	19	ML	SANDY SILT, medium stiff, brown, wet, fine to coarse sand, trace clay, mottled (PP=1.25 TSF)	PP
1065	15			R-5	3 7 9	103	24		light brown, wet, fine sand, more coarse sand in the top of the sample	
1060	20			R-6	4 5 7	108	21	SW-SM	Well-graded SAND with SILT, medium dense, light brown, wet, fine to coarse sand, more silt toward the bottom	
1055	25			R-7	8 13 20	116	17	SW	Well-graded SAND, medium dense, grayish brown, wet, fine to coarse sand with fine gravel, trace silt	
									Drilled to 25' Sampled to 26.5' Groundwater at 4.5' Backfilled with soil cuttings (5/16/2011)	
1050	30									
1045	35									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH



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Geotechnical Boring Log B-1

Date: April 28, 2004	Project Name: Murrieta Hot Springs Road / Jefferson Road	Page 1 of 2
Project Number: 042423	Logged By: AW	
Drilling Company: 2R Drilling	Type of Rig: CME-55	
Drive Weight (lbs): 140	Drop (in): 30 Hole Dia (in): 8	
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
0	8 17 20	Bag R-1	0-4 115.3	7.1	SM	***Alluvium:*** Silty SAND; dark yellowish brown, dry, medium dense, fine to coarse SAND.	Max, EI
5	7 9 12	R-2	114.9	16.6	CL	Sandy CLAY; dark yellowish brown, slightly moist, medium dense, fine to coarse sand.	-200
					¥	***Groundwater @ 8 Feet 4 Inches.***	
10	3 6 12	R-3	112.2	18.6	SM	Silty SAND; dary yellowish brown, moist, medium dense, fine to coarse sand.	-200
15	1 4 4	SPT-1		18.0	ML	Sandy SILT; dark yellowish brown, wet, loose, fine sand.	-200
20	2 6 8	SPT-2		24.5		Sandy SILT; reddish brown, wet, medium dense, fine to medium sand.	-200
					SP	SAND; dark yellowish brown, wet, dense, fine to coarse sand fine to medium gravel, trace of silt interlayed with	
25	7 22 34	R-4	127.3	8.7	SM	Silty SAND; dark yellowish brown, wet, medium dense, fine to medium sand trace coarse sand.	
30							

LGC INLAND

Geotechnical Boring Log B-1

Date: April 28, 2004	Project Name: Murrieta Hot Springs Road / Jefferson Road	Page 2 of 2
Project Number: 042423	Logged By: AW	
Drilling Company: 2R Drilling	Type of Rig: CME-55	
Drive Weight (lbs): 140	Drop (in): 30 Hole Dia (in): 8	
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
30	4 15 24	SPT-3		15.4	SP	SAND; yellowish brown, wet, medium dense, fine to coarse sand, fine to medium gravel.	-200
						SAND interlayed with	
35	6 10 15	R-5	104.7	22.6	ML	Sandy SILT; dark olive brown, wet, medium dense, fine sand.	
40	3 6 10	SPT-4		28.7			
45	15 42 50/ 3½	R-6	119.6	14.9		Sandy SILT; dark olive brown, moist, very stiff, fine to medium sand, trace coarse sand.	
						Total Depth - 46½ Feet	
50						***Groundwater @ 8 Feet 4 Inches***	
						Backfilled with Cuttings.	
55							
60							

LGC INLAND

Geotechnical Boring Log B-2

Date: April 28, 2004	Project Name: Murrieta Hot Springs Road / Jefferson Road — Page 1 of 1
Project Number: 042423	Logged By: AW
Drilling Company: 2R Drilling	Type of Rig: CME-55
Drive Weight (lbs): 140	Drop (in): 30 — Hole Dia (in): 8
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
0	11 20 18	Bag R-1	0-5 124.0	6.4	SM	***Alluvium:*** Silty SAND; dark yellowish brown, slightly moist, medium dense, fine to coarse sand, porosity.	R-value SS, Chem.
5	4 4 7	R-2	115.3	14.5	ML	Sandy SILT; dark yellowish brown, moist, medium dense.	
10	3 7	R-3	112.2	18.5	¥	***Goundwater @ 10 Feet.***	
	10				SM	Silty SAND, dark yellowish brown, moist, medium dense.	
15	4 13 14	R-4	107.9	20.3	ML	Sandy SILT; dark yellowish brown, moist, medium stiff, fine sand interlayed with	
					SP	Poorly graded SAND with SILT; yellowish brown, saturated, fine to coarse sand, trace of silt.	
20	2 4 9	SPT-1		19.5	SM SC	Silty SAND with CLAY; dark yellowish brown, moist, loose, fine to coarse sand, trace of clay.	
25	12 30 39	R-5	112.1	17.9	SP	SAND; yellowish brown with lens of dark red, wet, very dense, fine to coarse sand, trace of silt.	
30						***Total Depth- 26½ Feet*** ***Groundwater @ 10 Feet*** ***Backfilled with Cuttings.***	

LGC INLAND

Geotechnical Boring Log B-3

Date: April 28, 2004	Project Name: Murrieta Hot Springs Road / Jefferson Road	Page 1 of 1
Project Number: 042423	Logged By: AW	
Drilling Company: 2R Drilling	Type of Rig: CME-55	
Drive Weight (lbs): 140	Drop (in): 30 Hole Dia (in): 8	
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
0						***Alluvium:***	
	5 9 10	Bag R-1	0-5 101.0	8.6	SM	Silty SAND; dark yellowish brown, slightly moist, medium dense, fine to coarse sand, porosity.	
5	3 4 7	R-2	103.5	22.3	CL	Sandy CLAY; black, moist, stiff, fine to coarse sand.	
					¥	***Groundwater @ 7½ Feet.***	
10	2 2 4	R-3	102.8	24.5	ML	Clayey SILT; dark yellowish brown, moist, soft, trace of sand.	
15	2 4 7	R-4	92.9	31.1	SM	Silty SAND; dark yellowish brown, moist, medium dense, fine to medium sand, trace coarse sand.	
20	4 5 5	SPT-5		17.4			
25	4 15 13	R-6	111.3	19.9	CL	Silty CLAY; dark yellowish brown, wet, very stiff, fine to medium sand, trace of sand.	
						Total Depth - 26½ Feet ***Groundwater @ 7½ Feet*** ***Backfilled with Cuttings.***	
30							

LGC INLAND

Geotechnical Boring Log B-4

Date: April 28, 2004	Project Name: Murrieta Hot Springs Road / Jefferson Road		Page 1 of 2
Project Number: 042423	Logged By: AW		
Drilling Company: 2R Drilling	Type of Rig: CME-55		
Drive Weight (lbs): 140	Drop (in): 30	Hole Dia (in): 8	
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map		

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / ASTM Symbol	DESCRIPTION	Type of Test
0	7 10 13	Bag R-1	0-5 109.9	5.1	SM	***Alluvium:*** Silty SAND; dark yellowish brown, slightly moist, medium dense, fine to corse sand.	
5	7 8 12	R-2	114.5	16.2	SC ¥	Clayey SAND; dark yellowish brown, slightly moist, medium dense, fine to coarse sand. ***Groundwater @ 7½ Feet.***	
10	4 11 12	R-3	107.0	18.5	SM	Silty SAND; yellowish brown, saturated, medium dense, fine to corse sand.	
15	13 22 28	R-4	119.5	14.2	SP	SAND; yellowish brown, saturated, dense, fine to corse sand (7% silty).	
20	2 4 6	SPT-1		21.9	CL	Clayey SILT; olive brown, wet, firm, fine sand.	
					SP	SAND; yellowish brown, saturated, dense, fine to coarse sand interlayed with	
25	10 15 40	R-6	117.1	16.5	CL	Sandy SILT; olive brown, wet, very stiff, fine to medium sand.	
30						***Total Depth - 26½ Feet*** ***Groundwater @ 7½ Feet*** ***Backfilled with Cuttings.***	

LGC INLAND

501-A - (3/77)

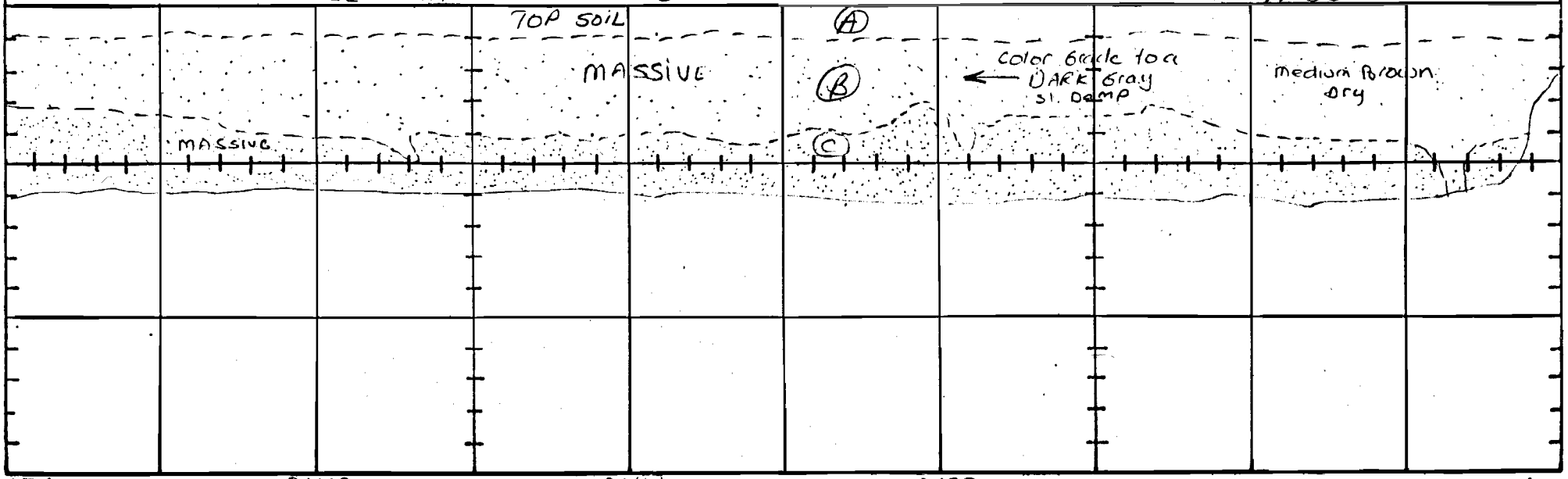
Project Name: Ralph Pacific Engineering & Logged By: DS

Project Number: 680073-01 Elevation: 1084± TRENCH NO. T-1

Equipment: JD 500 Backhoe Location: SHEET 1 of 7

GEOLOGIC ATTITUDES	DATE: 7/21/80 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	(A) 0-1' Sandy SILT: LT Brown, Dry, Dense, roots in upper 6" (TOP SOIL)	Qal				
	(B) 1'-4½' Sandstone: Med Brown - DARK Gray, MASSIVE w/coarse angular rock Fragments Very dense. Dry - slightly damp non cohesive. OCCASIONAL roots. some silt present with OCCASIONAL 1-3" cobbles - <1%.	Qps				
	(C) 4½-6' Sandstone: Med Brown, Fine Grained, MASSIVE micaceous, moderately dense, cohesive slightly damp. OCCASIONAL roots. Angular grains					

GRAPHIC REPRESENTATION SE WALL SCALE: 1" = 5' SURFACE SLOPE: 0 TREND: N 50 E ←



LOG OF TRENCH NO: T-1

Leighton & Associates

501-A - (3/77)

Project Name: Rancho Pacific Engineering Corp. Logged By: DS

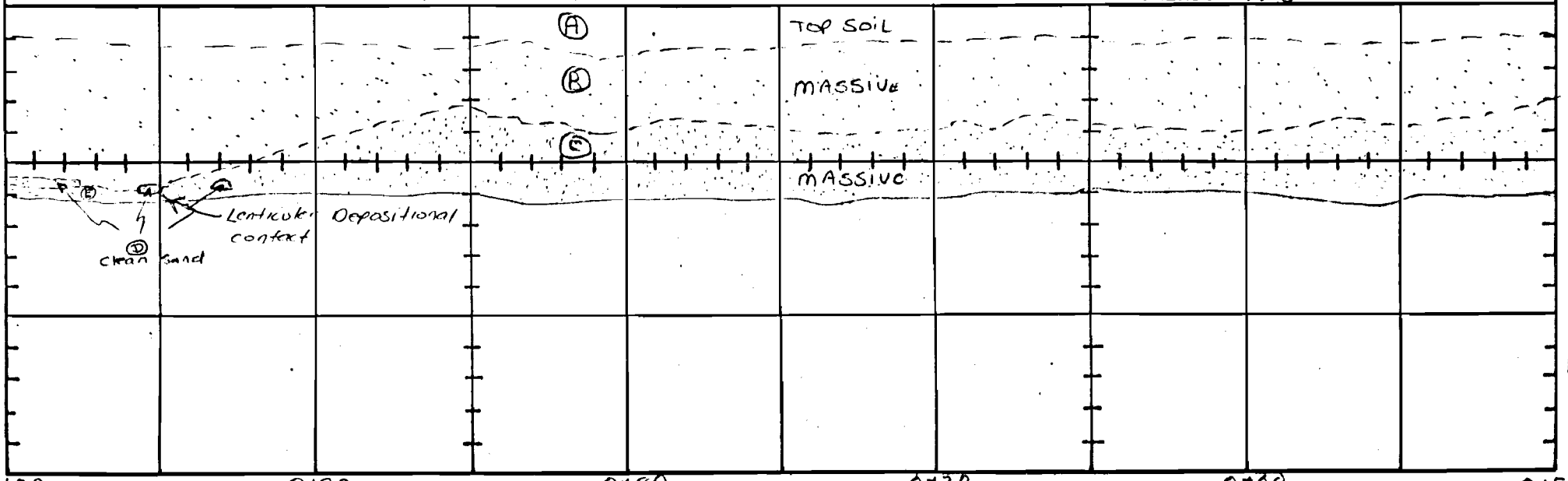
Project Number: 680073-01 Elevation: 1084 ± TRENCH NO. T-1

Equipment: JD 500 Backhoe Location: SHEET 2 of 7

ENGINEERING PROPERTIES

GEOLOGIC ATTITUDES	DATE: 7/21/80 DESCRIPTION:	GEOLOGIC UNIT	U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	(A) (B) (C) } SEE SHEET 1	Qal Qps				
	(D) Clean Sand: medium brown poorly sorted, very coarse w/ angular grains					
	(E) 5½-6' Siltstone: medium brown, micaceous, moderately dense, slightly damp, cohesive					

GRAPHIC REPRESENTATION SE WALL SCALE: 1" = 5' SURFACE SLOPE: 0 TREND: N50E ←



LOG OF TRENCH NO: T-1

Leighton & Associates

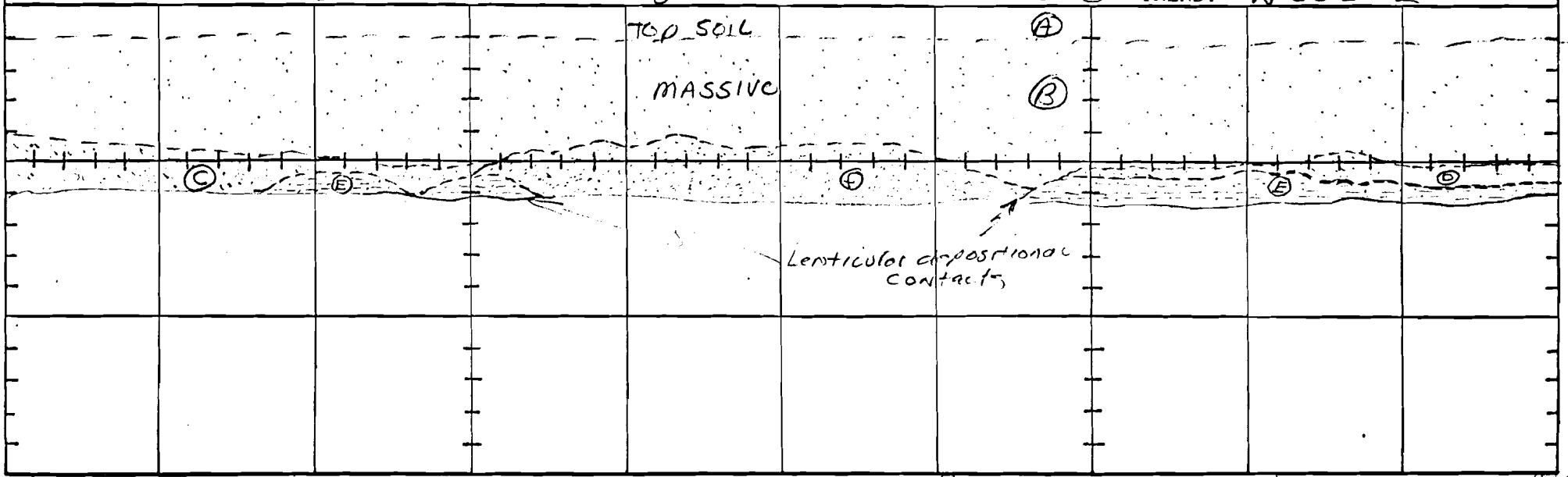
Project Name: Rancho Pacific Engineering Corp. Logged By: DS

Project Number: 680073-01 Elevation: 1083± TRENCH NO. T-1

Equipment: JD 500 Backhoe Location: SHEET 3 of 7

GEOLOGIC ATTITUDES	DATE: 7/21/80 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	Ⓐ-Ⓔ SEE SHEETS 1 & 2	Qal / QPs				
	Ⓕ 4'-6' Sandstone: massive, fine grained, medium brown, mod dense, non cohesive, loose angular coarse grains. Slightly damp					

GRAPHIC REPRESENTATION SE wall SCALE: 1" = 5' SURFACE SLOPE: 0 TREND: N 50 E



LOG OF TRENCH NO: T-1

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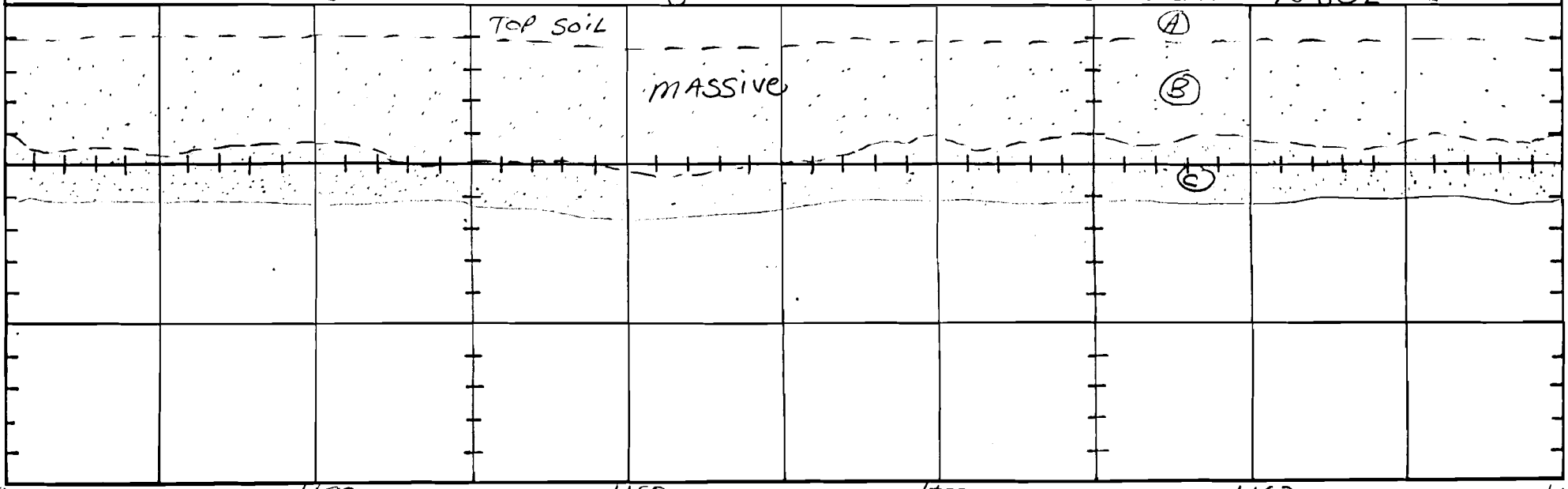
Project Name: Rancho Pacific Engineering Corp Logged By: DS

Project Number: 680073-01 Elevation: 1082± TRENCH NO. T-1

Equipment: JD 500 Backhoe Location: SHEET 4 of 7

GEOLOGIC ATTITUDES	DATE: 7/21/80 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	(A) (B) (C) SEE SHEET 1	Qal Qps ↓				

GRAPHIC REPRESENTATION SE WALL SCALE: 1" = 5' SURFACE SLOPE: 0 TREND: N 60 E ←



LOG OF TRENCH NO: T-1

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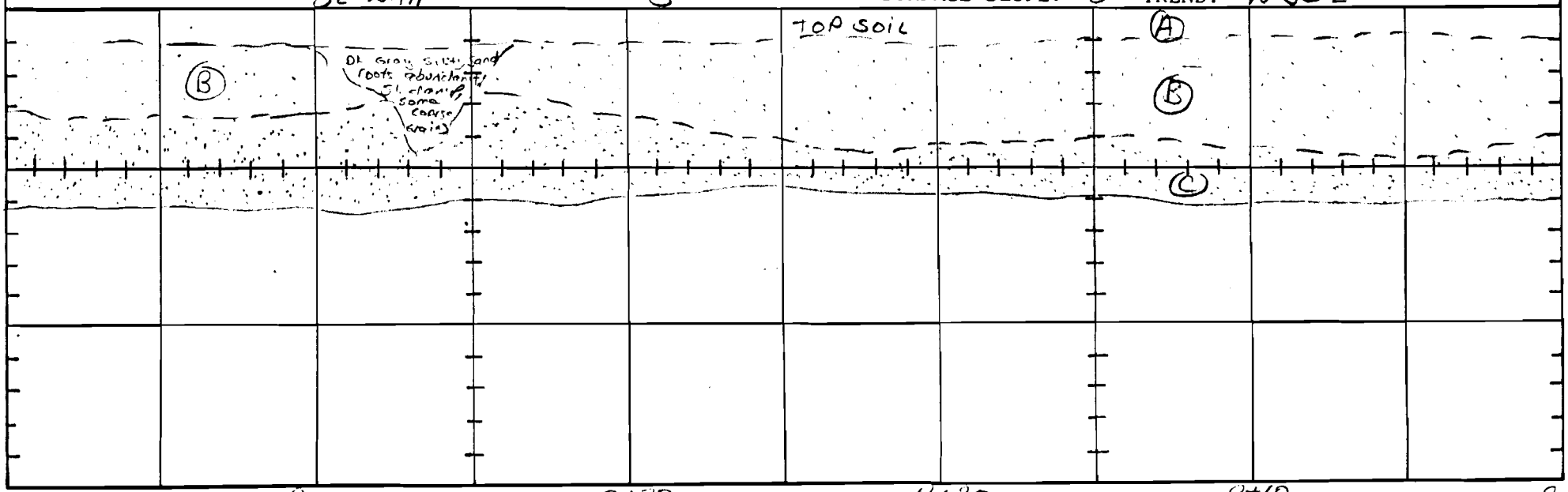
Project Name: Rancho Pacific Engineering Corp Logged By: DS

Project Number: 680073-01 Elevation: 1082 ± TRENCH NO. T-1

Equipment: JD 500 Backhoe Location: SHEET 5 of 7

GEOLOGIC ATTITUDES	DATE: 7/21/80 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	(A) (B) (C) SEE SHEET 1	Qol Qps ↓				

GRAPHIC REPRESENTATION SE WALL SCALE: 1" = 5' SURFACE SLOPE: 0 TREND: N 50 E ←



LOG OF TRENCH NO: _____

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501-A - (3/77)

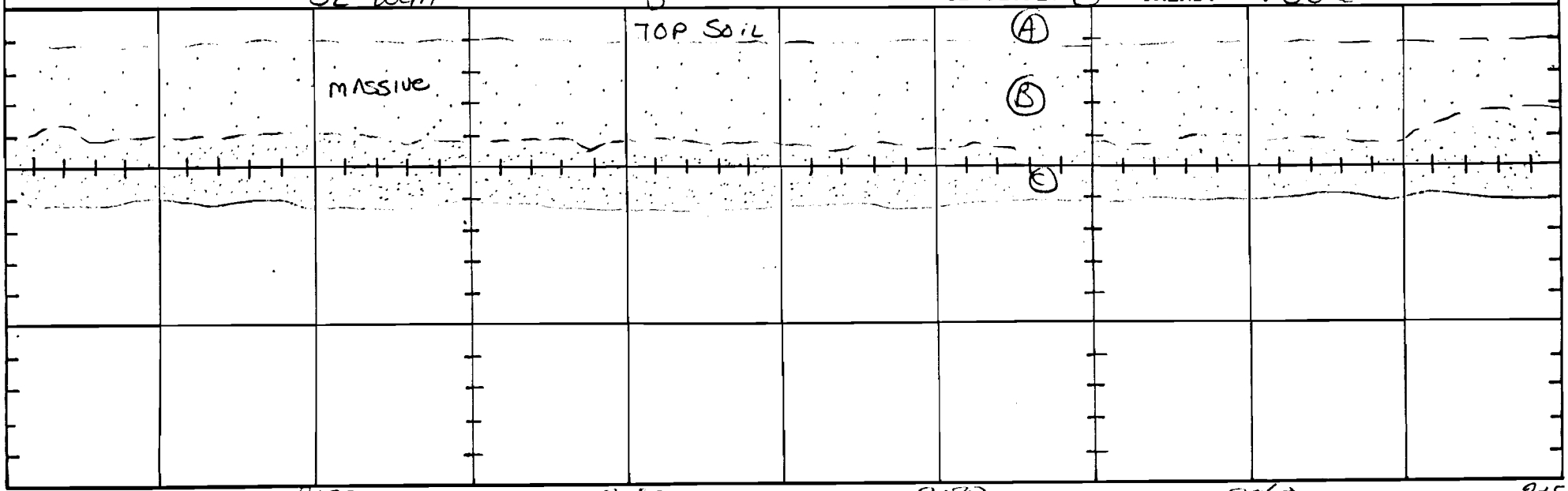
Project Name: Rancho Pacific Engineering Corp Logged By: DS

Project Number: 680073-01 Elevation: 1082 ± TRENCH NO. T-1

Equipment: JD 500 Backhoe Location: SHEET 6 of 7

GEOLOGIC ATTITUDES	DATE: 7/21/80 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	(A) (B) (C) SEE SHEET 1	Qal Qps ↓				

GRAPHIC REPRESENTATION SE Wall SCALE: 1" = 5' SURFACE SLOPE: 0 TREND: N 50 E ←



LOG OF TRENCH NO: T-1

Leighton & Associates

Project Name: Rancho Pacific Engineering Corp. Logged By: DS

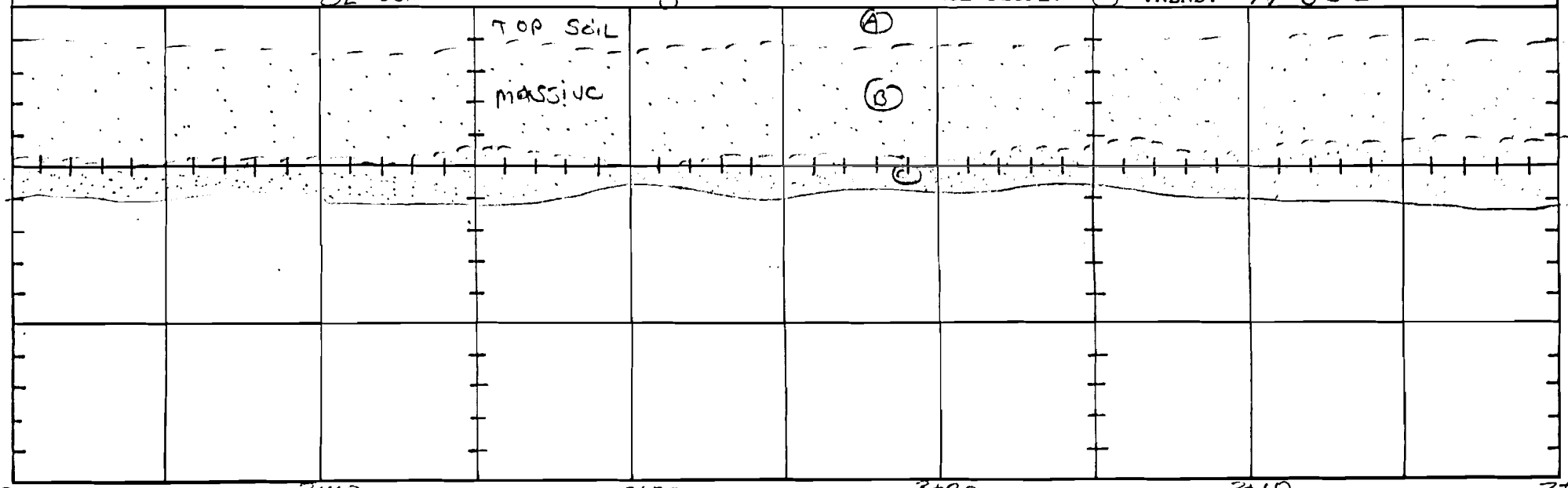
Project Number: 680023-01 Elevation: 1082± TRENCH NO. T-1

Equipment: JD 500 Backhoe Location: SHEET 7 of 7

ENGINEERING PROPERTIES

GEOLOGIC ATTITUDES	DATE: 7/21/80 DESCRIPTION:	GEOLOGIC UNIT	U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	(A) (B) (C) SEE SHEET 1	Qal / Qps				

GRAPHIC REPRESENTATION SE WALL SCALE: 1" = 5' SURFACE SLOPE: 0 TREND: N 50 E



LOG OF TRENCH NO: T-1

Leighton & Associates

501-A - (3/77)

APPENDIX B

Laboratory Test Results (This and Previous Studies)

R-VALUE TEST RESULTS

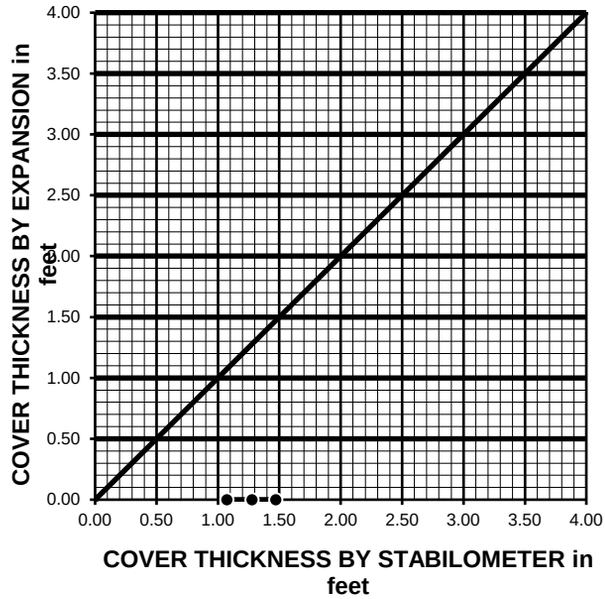
ASTM D 2844

Project Name:	LMC/Murrieta Hot Springs/Geo	Date:	3/11/22
Project Number:	13343.004	Technician:	F. Mina
Boring Number:	LB-3	Depth (ft.):	0 - 5.0
Sample Number:	B-1	Sample Location:	N/A
Sample Description:	Lean Clay with Sand (CL)s, Dark Brown.		

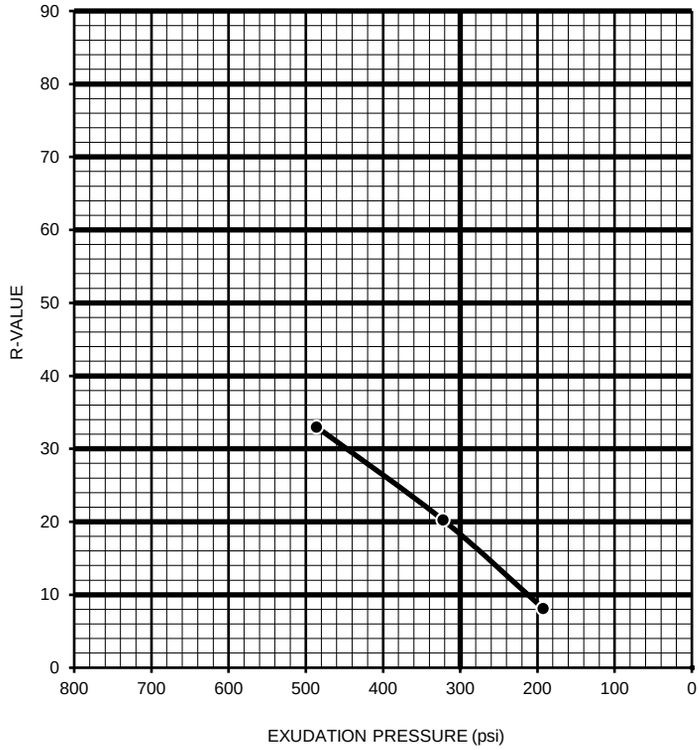
TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	12.7	13.8	15.5
HEIGHT OF SAMPLE, Inches	2.58	2.48	2.55
DRY DENSITY, pcf	113.2	111.6	114.2
COMPACTOR AIR PRESSURE, psi	125	100	50
EXUDATION PRESSURE, psi	486	322	193
EXPANSION, Inches x 10exp-4	0	0	0
STABILITY Ph 2,000 lbs (160 psi)	90	111	137
TURNS DISPLACEMENT	4.28	4.35	4.75
R-VALUE UNCORRECTED	31	20	8
R-VALUE CORRECTED	33	20	8

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.	1.07	1.28	1.47
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:	18
EQUILIBRIUM R-VALUE:	18

TESTS for SULFATE CONTENT

Project Name: LMC/Murrieta Hot Springs/Geo Tested By : M. Vinet Date: 03/14/22

Project No. : 13343.004 Data Input By: M. Vinet Date: 03/14/22

Boring No.	LB-6			
Sample No.	B-1			
Sample Depth (ft)	0 - 5.0			
Soil Identification:	Clayey Sand (SC)			
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)	25.0362			
Wt. of Crucible (g)	25.0319			
Wt. of Residue (g) (A)	0.0043			
PPM of Sulfate (A) x 41150	176.95			
PPM of Sulfate, Dry Weight Basis	**177**			

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	LMC/Murrieta Hot Springs/Geo	Tested By:	M. Vinet	Date:	3/11/22
Project No. :	13343.004	Checked By:	M. Vinet	Date:	3/14/22
Boring No.:	LB-3	Depth:	0 - 5.0		
Sample No. :	B-1	Location:	N/A		
Sample Description:	Lean Clay with Sand (CL)s, Dark Brown.				

Dry Wt. of Soil + Cont. (gm.)	2012.3
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2012.3
Weight Soil Retained on #4 Sieve	2.5
Percent Passing # 4	99.9

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0186
Wt. Comp. Soil + Mold (gm.)	604.5	633.4
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.)	629.1	633.4
Dry Wt. of Soil + Cont. (gm.)	601.8	367.7
Wt. of Container (gm.)	329.1	200.0
Moisture Content (%)	10.0	17.9
Wet Density (pcf)	122.0	128.3
Dry Density (pcf)	110.9	108.9
Void Ratio	0.520	0.548
Total Porosity	0.342	0.354
Pore Volume (cc)	70.8	74.6
Degree of Saturation (%) [S meas]	**51.9**	**88.0**

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.)
3/11/22	11:15	1.0	0	0.5000
3/11/22	11:25	1.0	10	0.5000
	Add Distilled Water to the Specimen			
3/12/22	8:00	1.0	1235	0.5186
3/12/22	9:00	1.0	1295	0.5186

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	18.6
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**19**

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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	LMC/Murrieta Hot Springs/Geo	Tested By:	M. Vinet	Date:	3/11/22
Project No. :	13343.004	Checked By:	M. Vinet	Date:	3/14/22
Boring No.:	LB-6	Depth:	0 - 5.0		
Sample No. :	B-1	Location:	N/A		
Sample Description:	Clayey Sand (SC), Dark Brown.				

Dry Wt. of Soil + Cont. (gm.)	10123.2
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	10123.2
Weight Soil Retained on #4 Sieve	0.0
Percent Passing # 4	100.0

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0307
Wt. Comp. Soil + Mold (gm.)	579.4	613.8
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.)	633.0	613.8
Dry Wt. of Soil + Cont. (gm.)	605.7	364.9
Wt. of Container (gm.)	333.0	178.0
Moisture Content (%)	10.0	19.4
Wet Density (pcf)	121.1	127.5
Dry Density (pcf)	110.1	106.8
Void Ratio	0.532	0.579
Total Porosity	0.347	0.367
Pore Volume (cc)	71.8	78.2
Degree of Saturation (%) [S meas]	**50.8**	**90.7**

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.)
3/11/22	10:55	1.0	0	0.5000
3/11/22	11:05	1.0	10	0.5000
	Add Distilled Water to the Specimen			
3/12/22	8:00	1.0	1255	0.5307
3/12/22	9:00	1.0	1315	0.5307

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	30.7
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**31**

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MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	LMC/Murrieta Hot Springs/Geo	Tested By:	M. Vinet	Date:	03/11/22
Project No.:	13343.004	Input By:	M. Vinet	Date:	03/14/22
Boring No.:	LB-6	Depth (ft.):	0 - 5.0		
Sample No.:	B-1				
Soil Identification:	Clayey Sand (SC), Dark Brown.				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03340 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5585	5719	5693			
Weight of Mold (g)	3540	3540	3540			
Net Weight of Soil (g)	2045	2179	2153			
Wet Weight of Soil + Cont. (g)	1132.2	1023.2	896.7			
Dry Weight of Soil + Cont. (g)	1069.8	956.0	836.7			
Weight of Container (g)	280.1	277.4	333.0			
Moisture Content (%)	7.9	9.9	11.9			
Wet Density (pcf)	135.0	143.8	142.1			
Dry Density (pcf)	125.1	130.9	127.0			

Maximum Dry Density (pcf) 131.0 **Optimum Moisture Content (%)** 10.0

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

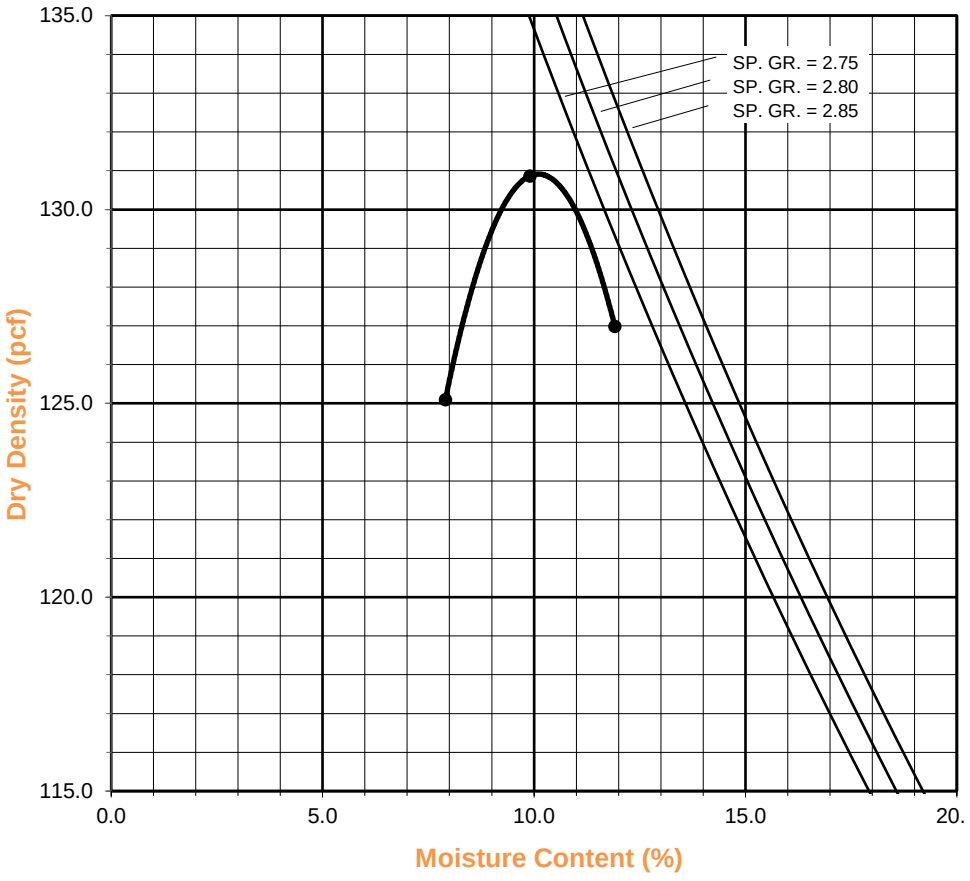
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



ATTERBERG LIMITS

ASTM D 4318

Project Name:	LMC/Murrieta Hot Springs/Geo	Tested By:	M. Vinet	Date:	03/14/22
Project No. :	13343.004	Input By:	M. Vinet	Date:	03/14/22
Boring No.:	LB-6	Checked By:	M. Vinet		
Sample No.:	B-1	Depth (ft.)	0 - 5.0		
Soil Identification:	Clayey Sand (SC), Dark Brown.				

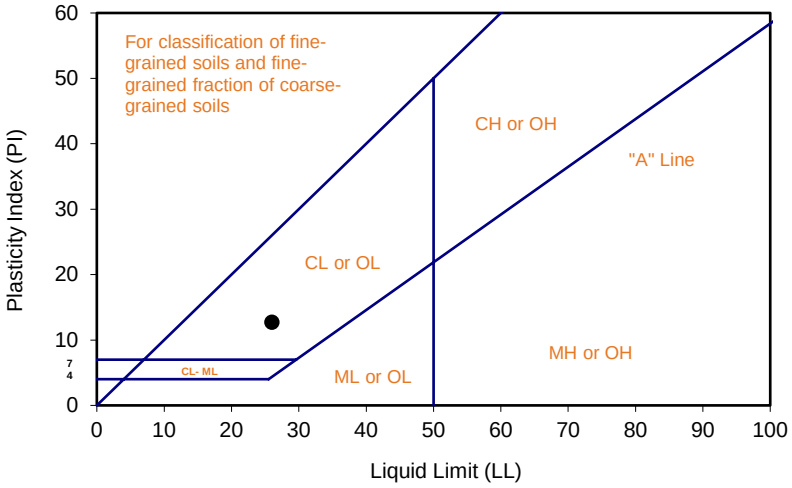
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			17	25	34	
Wet Wt. of Soil + Cont. (g)	21.26	20.81	24.13	23.82	22.76	
Dry Wt. of Soil + Cont. (g)	20.37	20.00	21.90	21.74	20.95	
Wt. of Container (g)	13.79	13.78	13.66	13.67	13.67	
Moisture Content (%) [Wn]	13.53	13.02	27.06	25.77	24.86	

Liquid Limit	**26**
Plastic Limit	**13**
Plasticity Index	**13**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 4.38

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



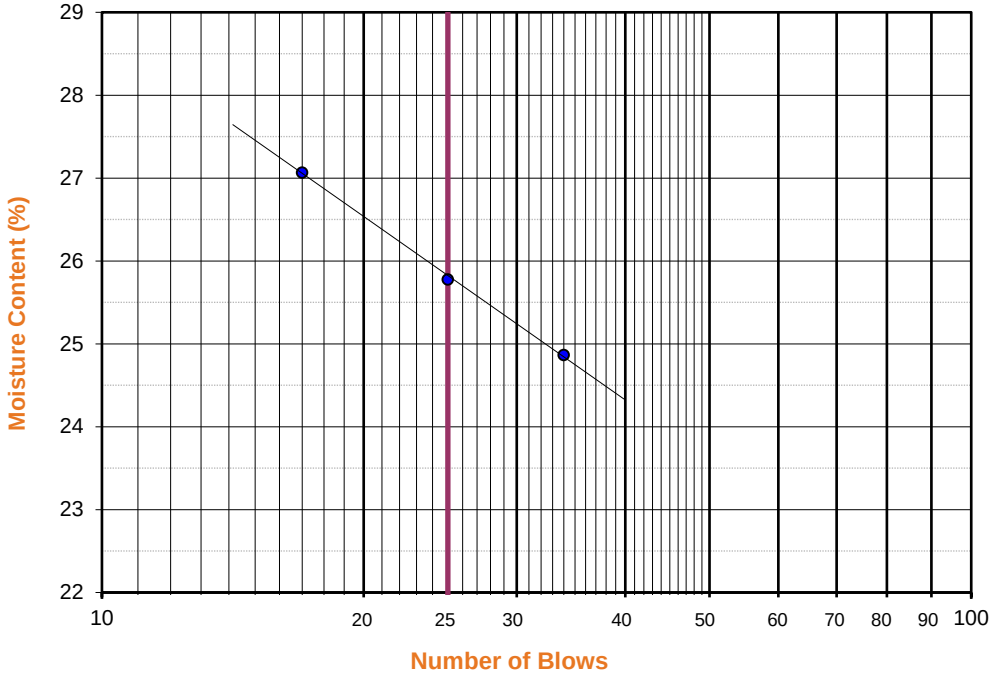
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	MURRIETA 18	Tested By:	JMB	Date:	5/26/11
Project No. :	603181-001	Input By:	JMB	Date:	5/26/11
Boring No.:	**LB-4**	Checked By:	JMB	Date:	5/26/11
Sample No.:	**R-5**	Depth (ft.)	15.0		

Sample Description: SILT WITH SAND (ML)s, dark grayish brown.

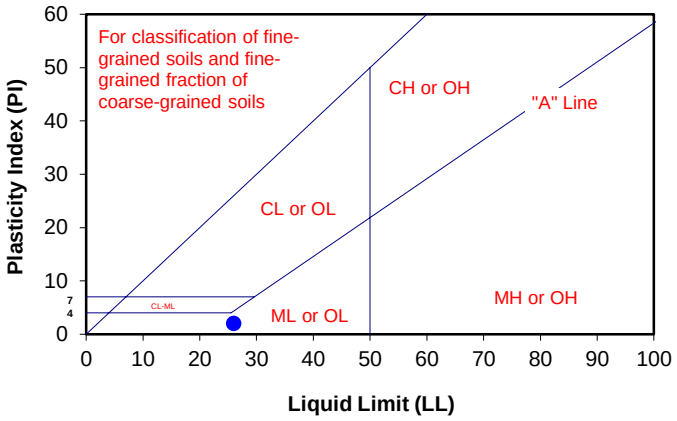
	PLASTIC LIMIT		LIQUID LIMIT			**IN-SITU
TEST NO.	1	2	1	2	3	MOISTURE
Number of Blows [N]			29	22	17	
Wet Wt. of Soil + Cont. (gm)	23.888	23.936	29.086	27.895	25.156	974.0
Dry Wt. of Soil + Cont. (gm)	21.906	21.924	25.952	24.830	22.549	841.5
Wt. of Container (gm)	13.646	13.556	13.626	13.623	13.575	214.2
Moisture Content (%) [Wn]	24.0	24.0	25.4	27.3	29.1	21.1

Liquid Limit	**26**
Plastic Limit	**24**
Plasticity Index	**2**
Classification	**(ML)s**

PI at "A" - Line = 0.73(LL-20) = 4.38

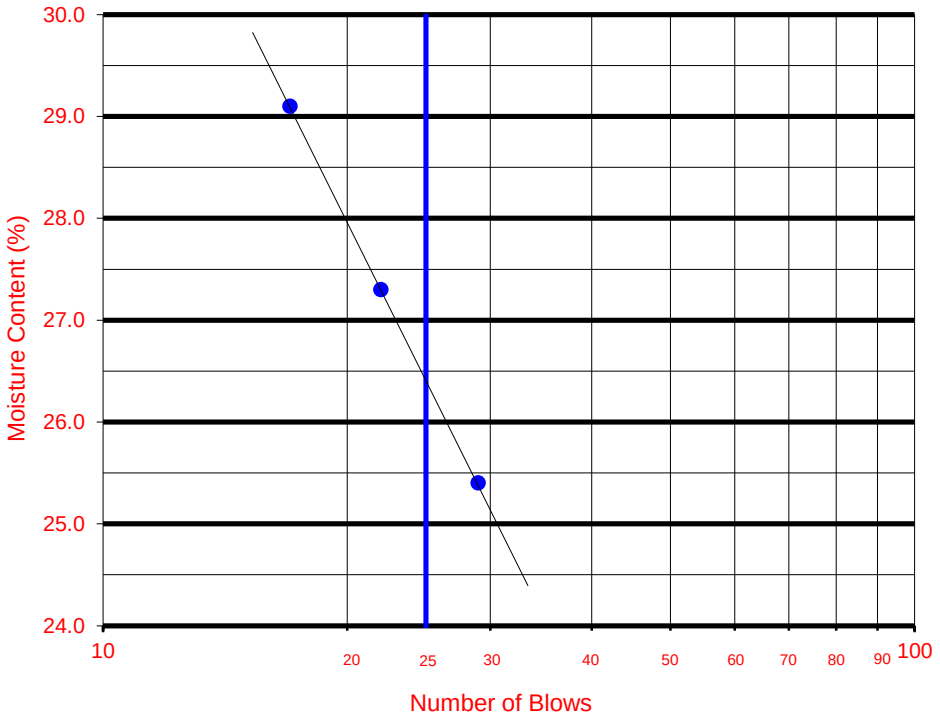
One - Point Liquid Limit Calculation

LL =Wn(N/25) $^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	MURRIETA 18	Tested By:	JAP	Date:	5/25/11
Project No. :	603181-001	Checked By:	JMB	Date:	5/26/11
Boring No:	**LB-2**	Depth (ft.)	0-5.0		
Sample No. :	**B-1**	Location:	**		
Sample Description:	SILT WITH SAND AND TRACE GRAVEL (ML)s, dark brown.				

Dry Wt. of Soil + Cont. (gm.)	3089.6
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	3089.6
Weight Soil Retained on #4 Sieve	35.3
Percent Passing # 4	98.9

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0329
Wt. Comp. Soil + Mold (gm.)	607.1	640.5
Wt. of Mold (gm.)	189.8	189.8
Specific Gravity (Assumed)	2.70	2.70
Container No.	5	5
Wet Wt. of Soil + Cont. (gm.)	418.4	640.5
Dry Wt. of Soil + Cont. (gm.)	396.2	386.4
Wt. of Container (gm.)	118.4	189.8
Moisture Content (%)	8.0	16.6
Wet Density (pcf)	125.9	135.8
Dry Density (pcf)	116.6	116.4
Void Ratio	0.446	0.494
Total Porosity	0.309	0.331
Pore Volume (cc)	63.9	70.7
Degree of Saturation (%) [S meas]	**48.4**	**91.0**

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.)
5/25/11	10:45	1.0	0	0.5000
5/25/11	10:55	1.0	10	0.5000
	Add Distilled Water to the Specimen			
5/26/11	5:25	1.0	1110	0.5329
5/26/11	6:25	1.0	1170	0.5329

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	32.9
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Height	**33**

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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	MURRIETA 18	Tested By:	JAP	Date:	5/25/11
Project No. :	603181-001	Checked By:	JMB	Date:	5/26/11
Boring No:	**LB-4**	Depth (ft.)	5-7.0		
Sample No. :	**B-2**	Location:	**		
Sample Description:	LEAN CLAY WITH SAND AND TRACE GRAVEL (CL)s, brown.				

Dry Wt. of Soil + Cont. (gm.)	3640.2
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	3640.2
Weight Soil Retained on #4 Sieve	2.8
Percent Passing # 4	99.9

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0600
Wt. Comp. Soil + Mold (gm.)	597.7	641.4
Wt. of Mold (gm.)	191.0	191.0
Specific Gravity (Assumed)	2.70	2.70
Container No.	4	4
Wet Wt. of Soil + Cont. (gm.)	444.1	641.4
Dry Wt. of Soil + Cont. (gm.)	419.8	373.8
Wt. of Container (gm.)	144.1	191.0
Moisture Content (%)	8.8	20.5
Wet Density (pcf)	122.7	135.7
Dry Density (pcf)	112.8	112.6
Void Ratio	0.495	0.585
Total Porosity	0.331	0.369
Pore Volume (cc)	68.5	81.0
Degree of Saturation (%) [S meas]	**48.0**	**94.6**

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.)
5/25/11	9:23	1.0	0	0.5000
5/25/11	9:33	1.0	10	0.4999
	Add Distilled Water to the Specimen			
5/26/11	5:25	1.0	1192	0.5600
5/26/11	6:25	1.0	1252	0.5600

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	60.1
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Height	**60**

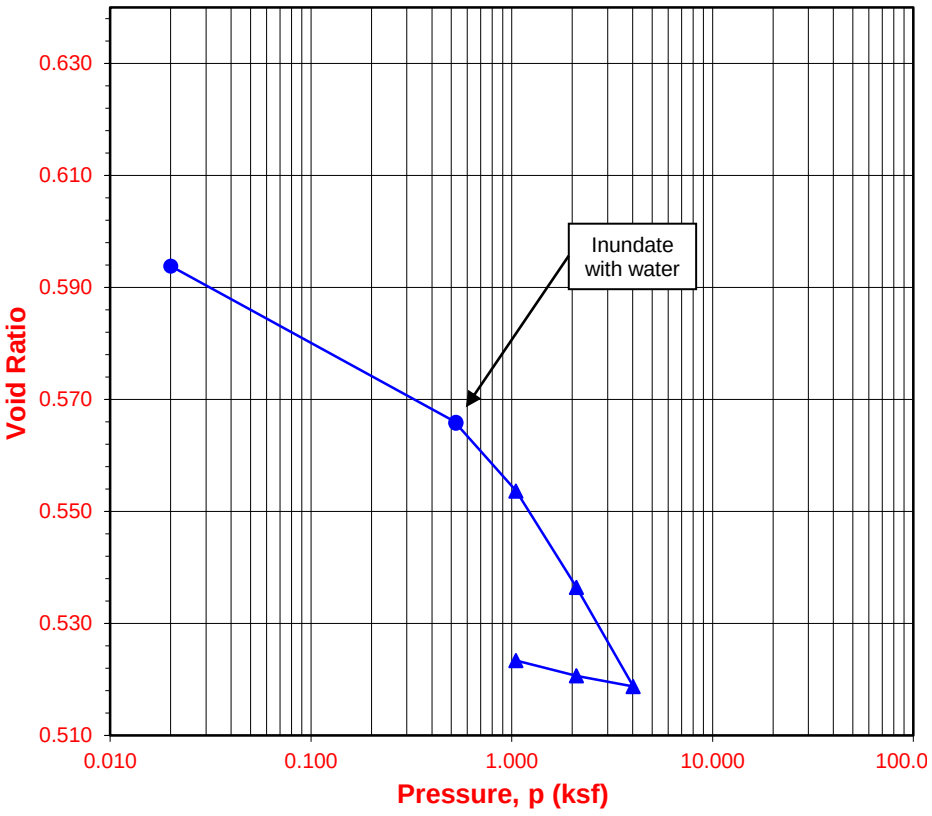
Leighton

CONSOLIDATION TEST RESULTS

(ASTM D 2435)

Project Name:	MURRIETA 18		Tested By:	JAP	Date: 5/20/11
Project No.:	603181-001		Checked By:	JMB	Date: 5/31/11
Boring No.:	**LB-1**		Depth (ft.):	10.0	
Sample No.:	**R-3**				
Sample Description:	SILTY SAND (SM), brown.				

Sample Diameter (in.):	2.421
Sample Thickness (in.):	0.997
Weight of Sample + ring (g):	198.8
Weight of Ring (g):	44.2
Height after consol. (in.):	0.9557
Before Test	
Wt. of Wet Sample+Cont. (g):	198.8
Wt. of Dry Sample+Cont. (g):	172.0
Weight of Container (g):	44.2
Initial Moisture Content (%)	21.0
Initial Dry Density (pcf)	106.1
Initial Saturation (%):	96
Initial Vertical Reading (in.)	0.2500
After Test	
Wt. of Wet Sample+Cont. (g):	198.2
Wt. of Dry Sample+Cont. (g):	172.0
Weight of Container (g):	44.2
Final Moisture Content (%)	20.5
Final Dry Density (pcf):	110.7
Final Saturation (%):	100
Final Vertical Reading (in.)	0.2942
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43



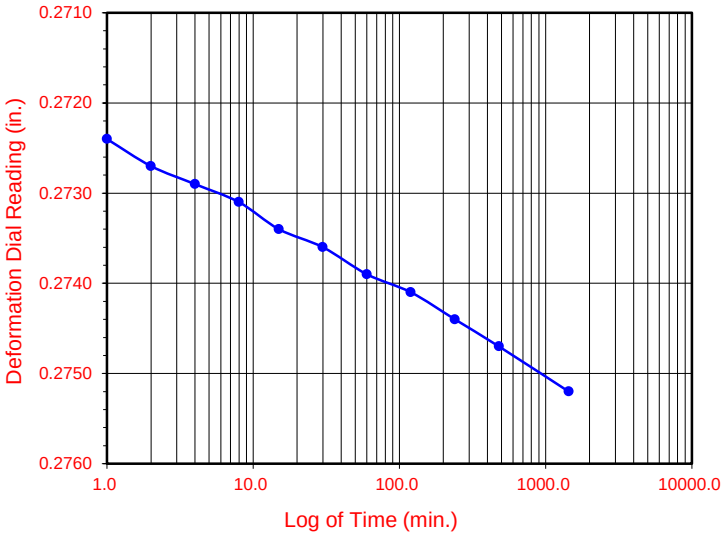
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.020	0.2500	1.0000	0.00	-0.30	0.594	-0.30
0.526	0.2675	0.9825	0.00	1.45	0.566	1.45
0.526	0.2676	0.9824	0.00	1.46	0.566	1.46
1.051	0.2752	0.9748	0.00	2.23	0.554	2.23
2.101	0.2860	0.9640	0.00	3.31	0.536	3.31
4.026	0.2971	0.9529	0.00	4.42	0.519	4.42
2.101	0.2959	0.9541	0.00	4.30	0.521	4.30
1.051	0.2942	0.9558	0.00	4.13	0.523	4.13

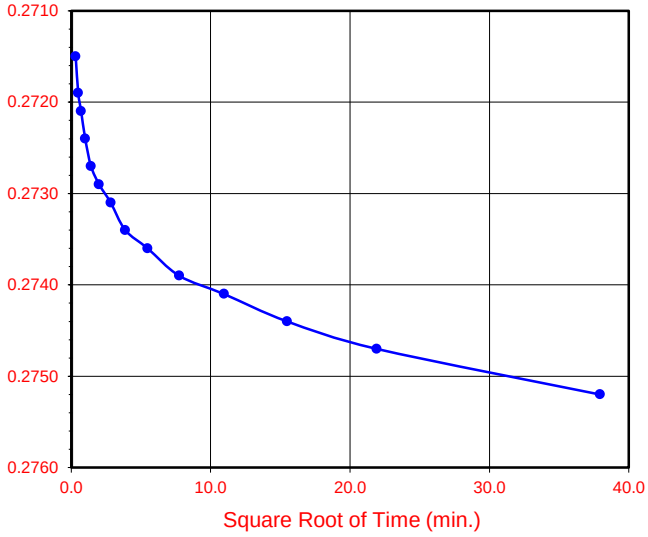
Time Readings @ 1.051 ksf

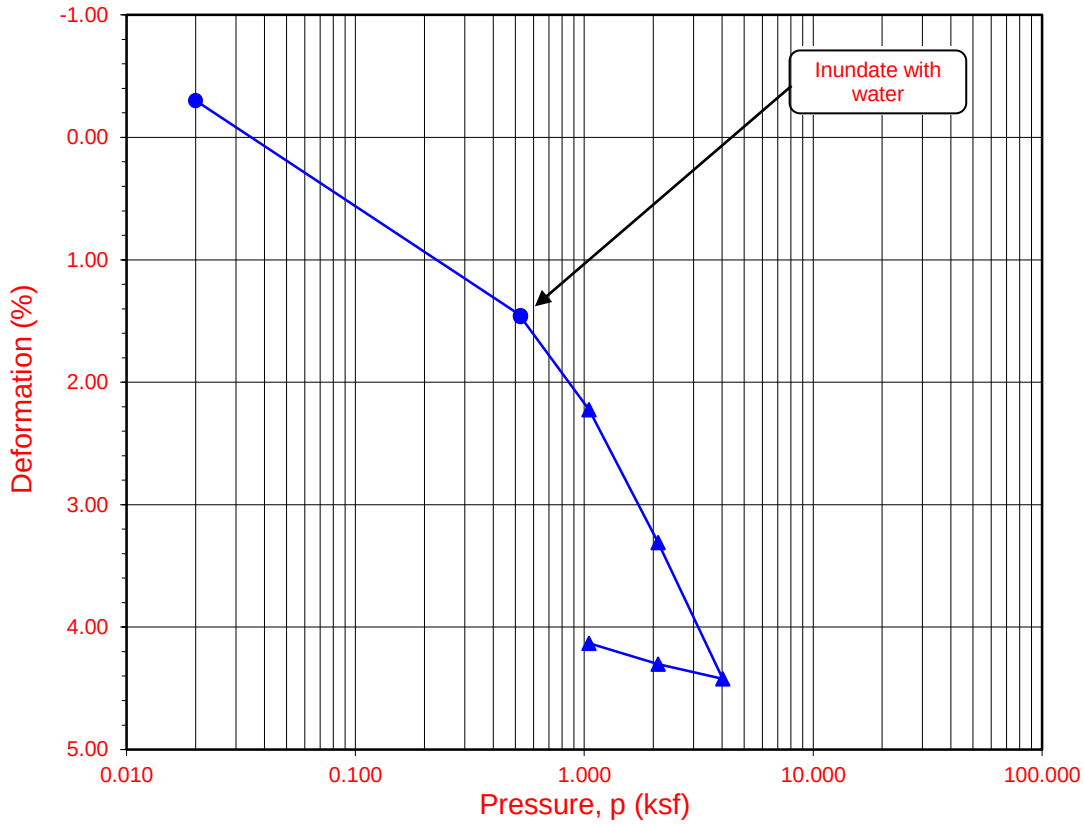
Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
5/24/11	5:30:00	0.0	0.0	0.2676
5/24/11	5:30:06	0.1	0.3	0.2715
5/24/11	5:30:15	0.2	0.5	0.2719
5/24/11	5:30:30	0.5	0.7	0.2721
5/24/11	5:31:00	1.0	1.0	0.2724
5/24/11	5:32:00	2.0	1.4	0.2727
5/24/11	5:34:00	4.0	2.0	0.2729
5/24/11	5:38:00	8.0	2.8	0.2731
5/24/11	5:45:00	15.0	3.9	0.2734
5/24/11	6:00:00	30.0	5.5	0.2736
5/24/11	6:30:00	60.0	7.7	0.2739
5/24/11	7:30:00	120.0	11.0	0.2741
5/24/11	9:30:00	240.0	15.5	0.2744
5/24/11	13:30:00	480.0	21.9	0.2747
5/25/11	5:30:00	1440.0	37.9	0.2752

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Time Readings @ 1.051 ksf







Boring No.	Sample No.:	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-1	**R-3**	**10.0**	**21.0**	**20.5**	**106.1**	**110.7**	**0.589**	**0.523**	**96**	**100**

Sample Description:

SILTY SAND (SM), brown.

Leighton

Project No.:	603181-001
Project Name:	MURRIETA 18

ONE - DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

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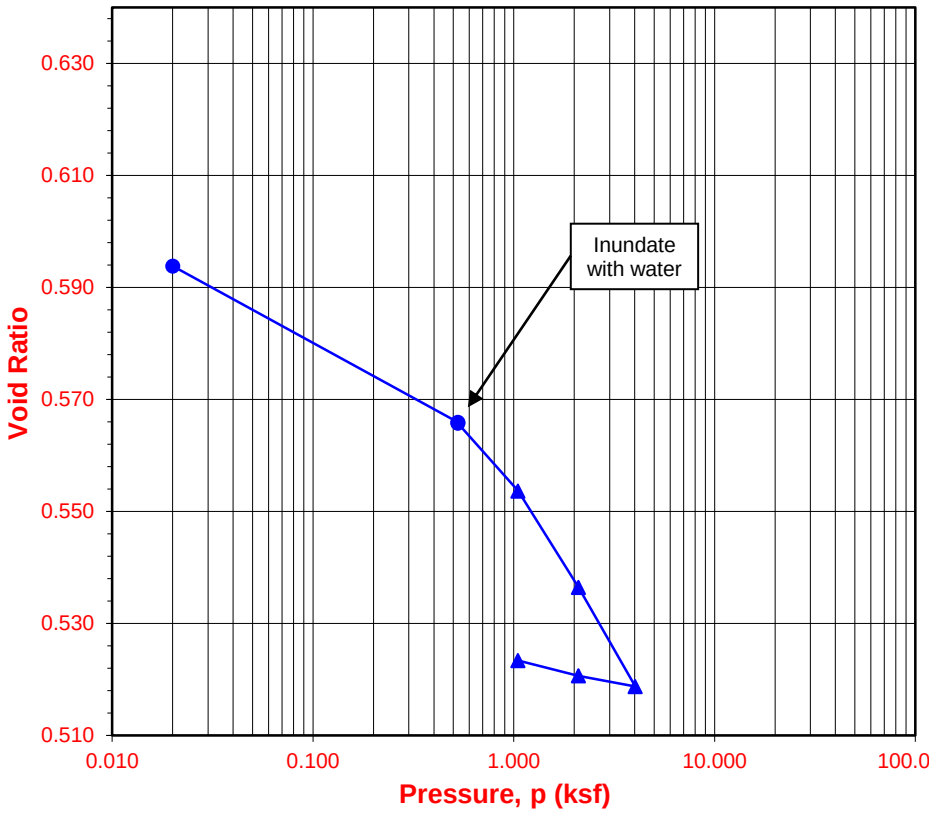
Leighton

CONSOLIDATION TEST RESULTS

(ASTM D 2435)

Project Name:	MURRIETA 18		Tested By:	JAP	Date: 5/20/11
Project No.:	603181-001		Checked By:	JMB	Date: 5/31/11
Boring No.:	**LB-1**		Depth (ft.):	10.0	
Sample No.:	**R-3**				
Sample Description:	SILTY SAND (SM), brown.				

Sample Diameter (in.):	2.421
Sample Thickness (in.):	0.997
Weight of Sample + ring (g):	198.8
Weight of Ring (g):	44.2
Height after consol. (in.):	0.9557
Before Test	
Wt. of Wet Sample+Cont. (g):	198.8
Wt. of Dry Sample+Cont. (g):	172.0
Weight of Container (g):	44.2
Initial Moisture Content (%)	21.0
Initial Dry Density (pcf)	106.1
Initial Saturation (%):	96
Initial Vertical Reading (in.)	0.2500
After Test	
Wt. of Wet Sample+Cont. (g):	198.2
Wt. of Dry Sample+Cont. (g):	172.0
Weight of Container (g):	44.2
Final Moisture Content (%)	20.5
Final Dry Density (pcf):	110.7
Final Saturation (%):	100
Final Vertical Reading (in.)	0.2942
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43



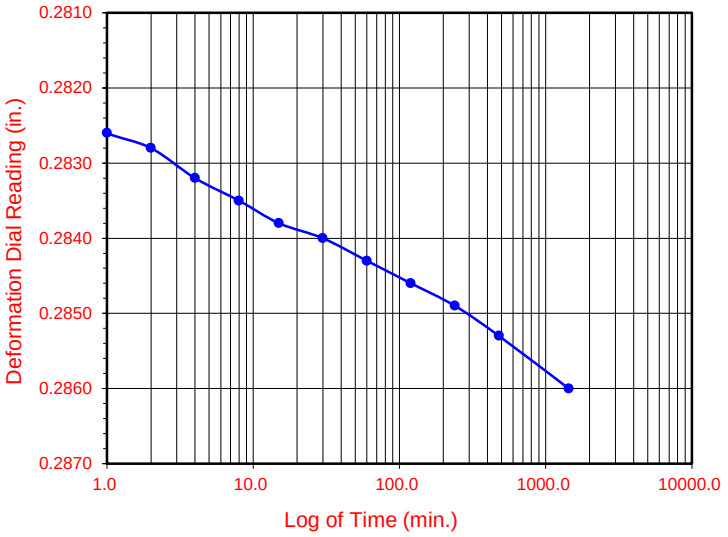
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.020	0.2500	1.0000	0.00	-0.30	0.594	-0.30
0.526	0.2675	0.9825	0.00	1.45	0.566	1.45
0.526	0.2676	0.9824	0.00	1.46	0.566	1.46
1.051	0.2752	0.9748	0.00	2.23	0.554	2.23
2.101	0.2860	0.9640	0.00	3.31	0.536	3.31
4.026	0.2971	0.9529	0.00	4.42	0.519	4.42
2.101	0.2959	0.9541	0.00	4.30	0.521	4.30
1.051	0.2942	0.9558	0.00	4.13	0.523	4.13

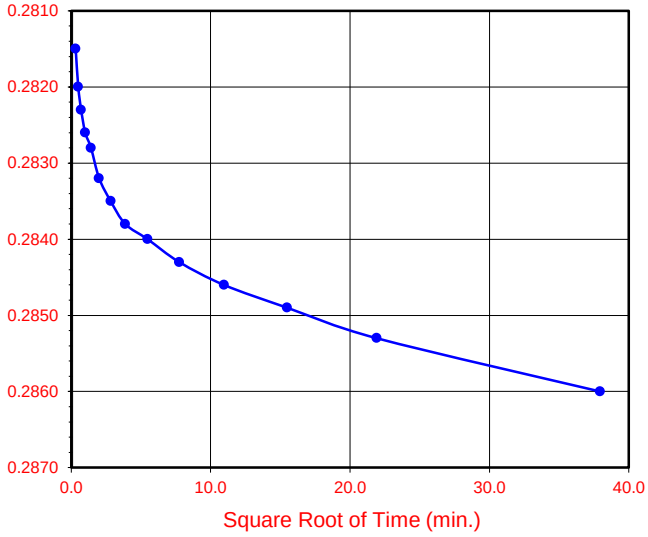
Time Readings @ 2.101 ksf

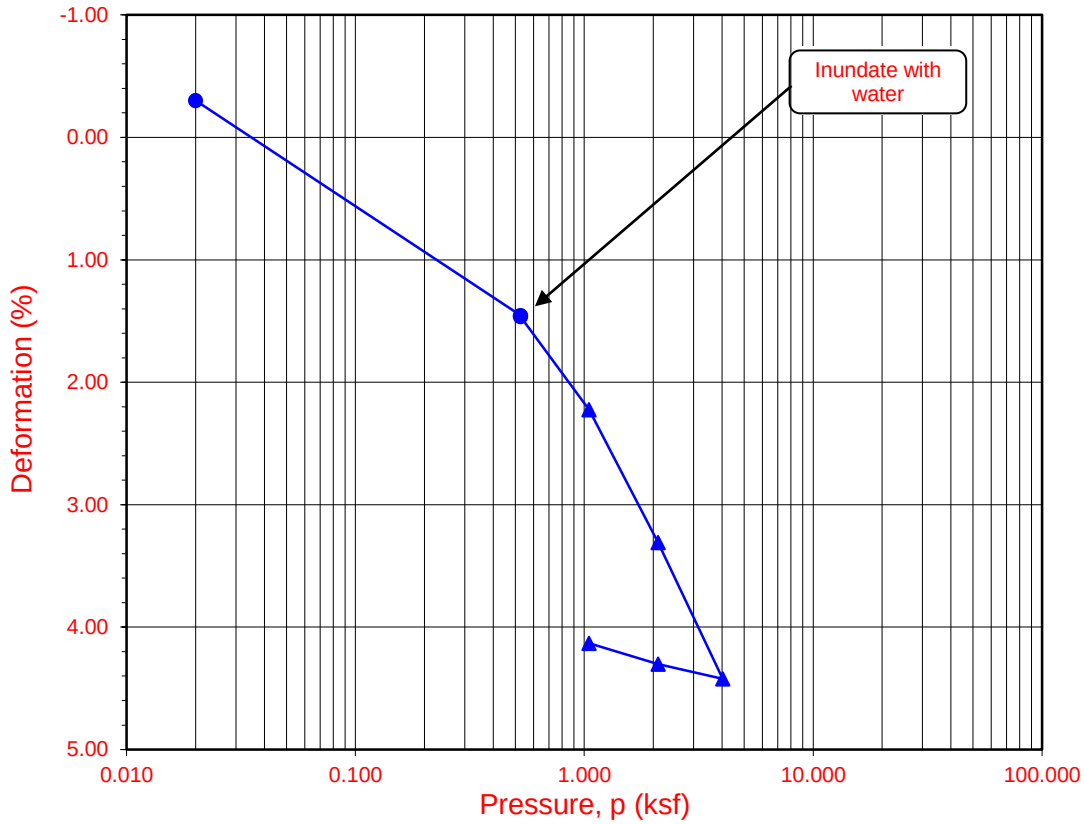
Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
5/25/11	5:30:00	0.0	0.0	0.2752
5/25/11	5:30:06	0.1	0.3	0.2815
5/25/11	5:30:15	0.2	0.5	0.2820
5/25/11	5:30:30	0.5	0.7	0.2823
5/25/11	5:31:00	1.0	1.0	0.2826
5/25/11	5:32:00	2.0	1.4	0.2828
5/25/11	5:34:00	4.0	2.0	0.2832
5/25/11	5:38:00	8.0	2.8	0.2835
5/25/11	5:45:00	15.0	3.9	0.2838
5/25/11	6:00:00	30.0	5.5	0.2840
5/25/11	6:30:00	60.0	7.7	0.2843
5/25/11	7:30:00	120.0	11.0	0.2846
5/25/11	9:30:00	240.0	15.5	0.2849
5/25/11	13:30:00	480.0	21.9	0.2853
5/26/11	5:30:00	1440.0	37.9	0.2860

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Time Readings @ 2.101 ksf







Boring No.	Sample No.:	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-1	**R-3**	**10.0**	**21.0**	**20.5**	**106.1**	**110.7**	**0.589**	**0.523**	**96**	**100**

Sample Description:

SILTY SAND (SM), brown.

Leighton

Project No.: 603181-001

Project Name: MURRIETA 18

ONE - DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
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Leighton

CONSOLIDATION TEST RESULTS

(ASTM D 2435)

Project Name: MURRIETA 18 | Tested By: JAP | Date: 5/20/11

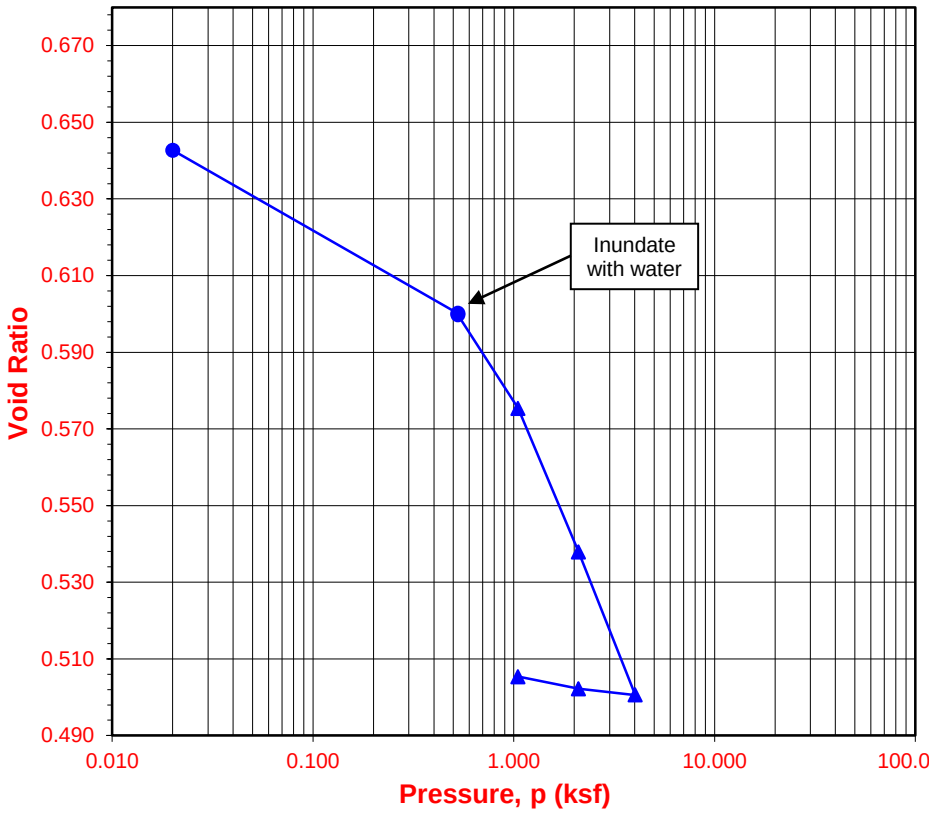
Project No.: 603181-001 | Checked By: JMB | Date: 5/31/11

Boring No.: **LB-4** | Depth (ft.): 7.5

Sample No.: **R-3**

Sample Description: LEAN CLAY (CL), brown.

Sample Diameter (in.):	2.422
Sample Thickness (in.):	0.993
Weight of Sample + ring (g):	196.8
Weight of Ring (g):	43.4
Height after consol. (in.):	0.9159
Before Test	
Wt. of Wet Sample+Cont. (g):	196.8
Wt. of Dry Sample+Cont. (g):	167.5
Weight of Container (g):	43.4
Initial Moisture Content (%)	23.6
Initial Dry Density (pcf)	103.3
Initial Saturation (%):	100
Initial Vertical Reading (in.)	0.2500
After Test	
Wt. of Wet Sample+Cont. (g):	192.8
Wt. of Dry Sample+Cont. (g):	167.5
Weight of Container (g):	43.4
Final Moisture Content (%)	20.4
Final Dry Density (pcf):	112.0
Final Saturation (%):	100
Final Vertical Reading (in.)	0.3336
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43



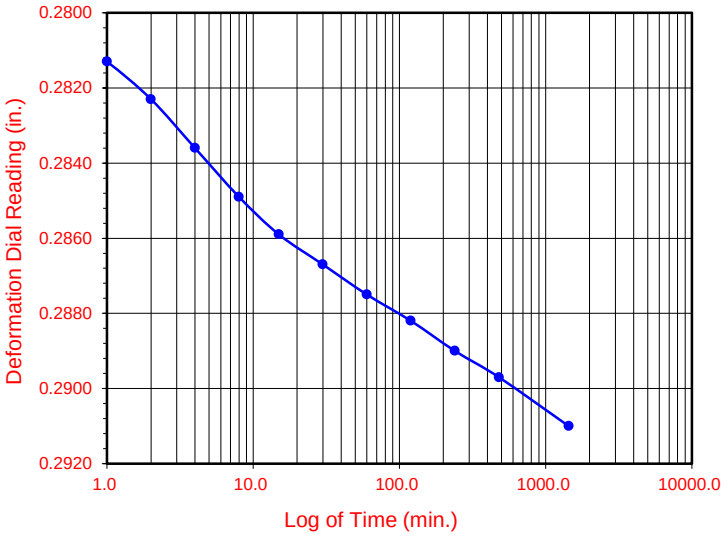
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.020	0.2500	1.0000	0.00	-0.70	0.643	-0.70
0.526	0.2759	0.9741	0.00	1.90	0.600	1.90
0.526	0.2761	0.9739	0.00	1.92	0.600	1.92
1.051	0.2910	0.9590	0.00	3.42	0.575	3.42
2.101	0.3138	0.9362	0.00	5.72	0.538	5.72
4.029	0.3365	0.9135	0.00	8.01	0.501	8.01
2.101	0.3355	0.9145	0.00	7.91	0.502	7.91
1.051	0.3336	0.9164	0.00	7.71	0.505	7.71

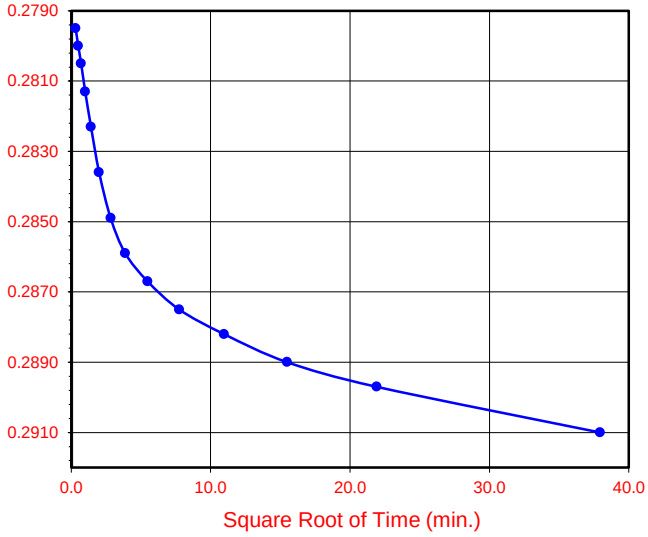
Time Readings @ 1.051 ksf

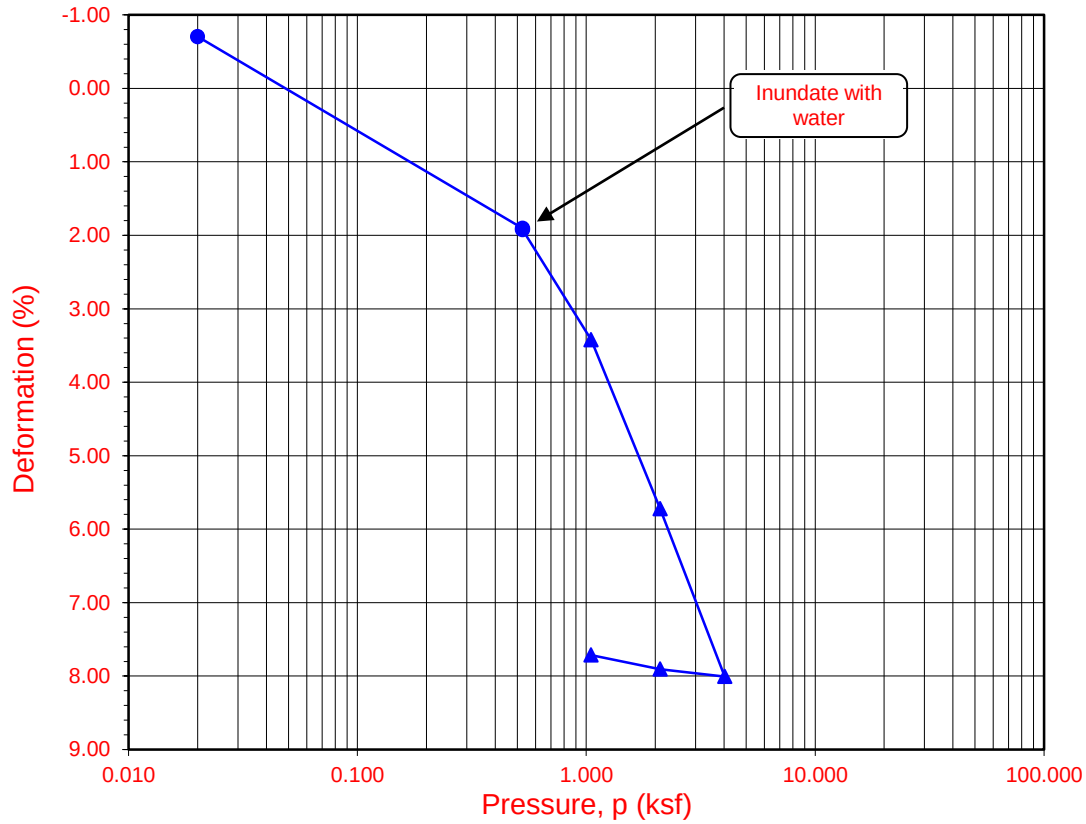
Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
5/24/11	5:35:00	0.0	0.0	0.2761
5/24/11	5:35:06	0.1	0.3	0.2795
5/24/11	5:35:15	0.2	0.5	0.2800
5/24/11	5:35:30	0.5	0.7	0.2805
5/24/11	5:36:00	1.0	1.0	0.2813
5/24/11	5:37:00	2.0	1.4	0.2823
5/24/11	5:39:00	4.0	2.0	0.2836
5/24/11	5:43:00	8.0	2.8	0.2849
5/24/11	5:50:00	15.0	3.9	0.2859
5/24/11	6:05:00	30.0	5.5	0.2867
5/24/11	6:35:00	60.0	7.7	0.2875
5/24/11	7:35:00	120.0	11.0	0.2882
5/24/11	9:35:00	240.0	15.5	0.2890
5/24/11	13:35:00	480.0	21.9	0.2897
5/25/11	5:35:00	1440.0	37.9	0.2910

Rev. 08-04

Time Readings @ 1.051 ksf







Boring No.	Sample No.:	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-4	**R-3**	**7.5**	**23.6**	**20.4**	**103.3**	**112.0**	**0.631**	**0.505**	**100**	**100**

Sample Description:

LEAN CLAY (CL), brown.

Project No.: 603181-001

Project Name: MURRIETA 18

ONE - DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Leighton

Rev. 08-04

Leighton

CONSOLIDATION TEST RESULTS

(ASTM D 2435)

Project Name: MURRIETA 18 | Tested By: JAP | Date: 5/20/11

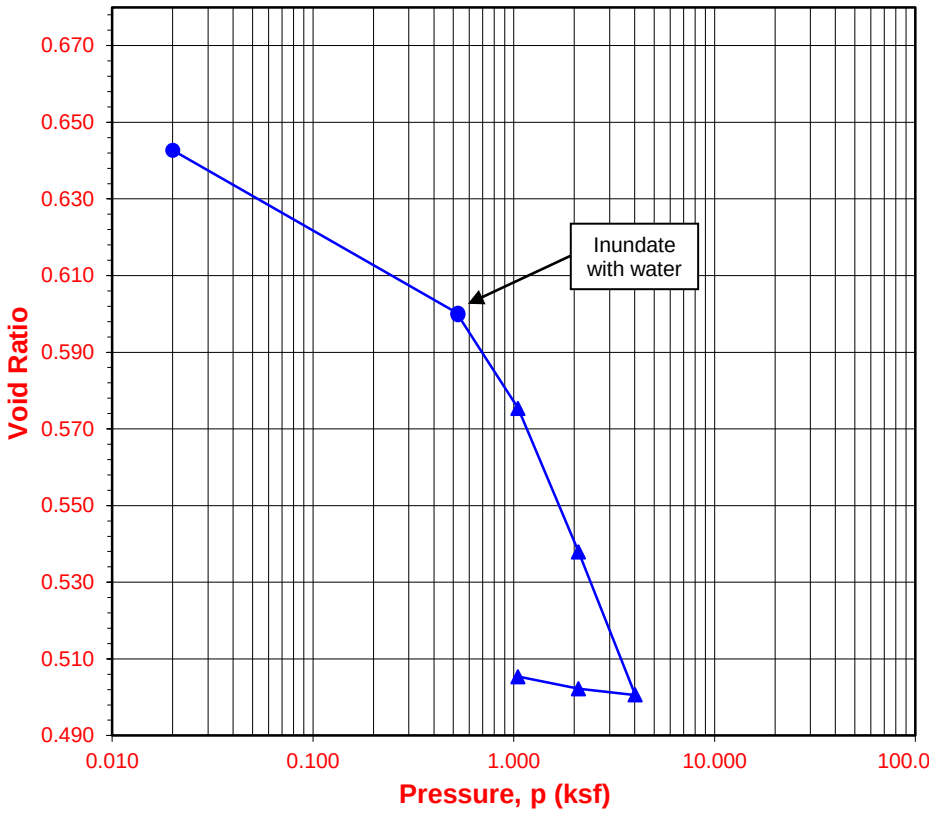
Project No.: 603181-001 | Checked By: JMB | Date: 5/31/11

Boring No.: **LB-4** | Depth (ft.): 7.5

Sample No.: **R-3**

Sample Description: LEAN CLAY (CL), brown.

Sample Diameter (in.):	2.422
Sample Thickness (in.):	0.993
Weight of Sample + ring (g):	196.8
Weight of Ring (g):	43.4
Height after consol. (in.):	0.9159
Before Test	
Wt. of Wet Sample+Cont. (g):	196.8
Wt. of Dry Sample+Cont. (g):	167.5
Weight of Container (g):	43.4
Initial Moisture Content (%)	23.6
Initial Dry Density (pcf)	103.3
Initial Saturation (%):	100
Initial Vertical Reading (in.)	0.2500
After Test	
Wt. of Wet Sample+Cont. (g):	192.8
Wt. of Dry Sample+Cont. (g):	167.5
Weight of Container (g):	43.4
Final Moisture Content (%)	20.4
Final Dry Density (pcf):	112.0
Final Saturation (%):	100
Final Vertical Reading (in.)	0.3336
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43



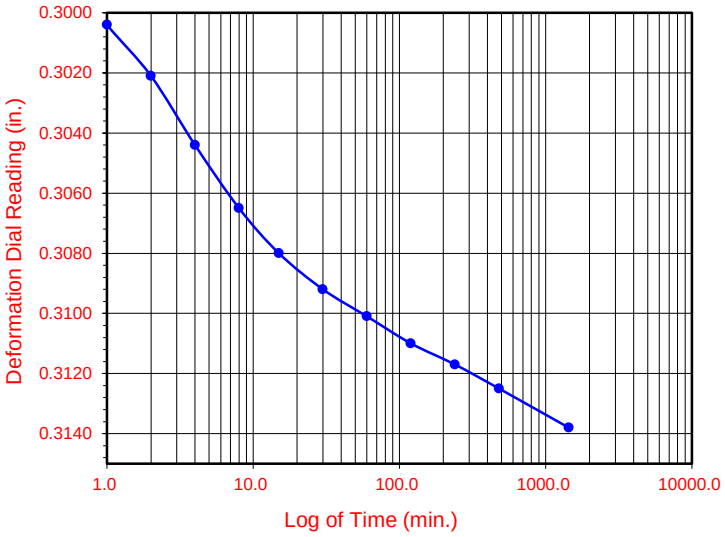
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.020	0.2500	1.0000	0.00	-0.70	0.643	-0.70
0.526	0.2759	0.9741	0.00	1.90	0.600	1.90
0.526	0.2761	0.9739	0.00	1.92	0.600	1.92
1.051	0.2910	0.9590	0.00	3.42	0.575	3.42
2.101	0.3138	0.9362	0.00	5.72	0.538	5.72
4.029	0.3365	0.9135	0.00	8.01	0.501	8.01
2.101	0.3355	0.9145	0.00	7.91	0.502	7.91
1.051	0.3336	0.9164	0.00	7.71	0.505	7.71

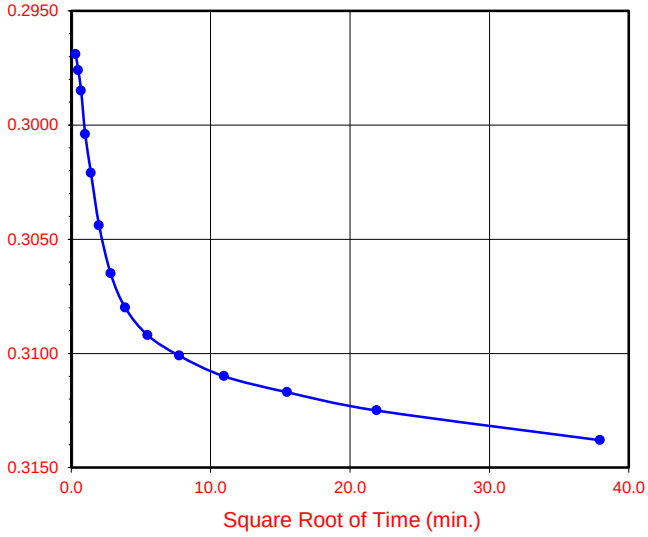
Time Readings @ 2.101 ksf

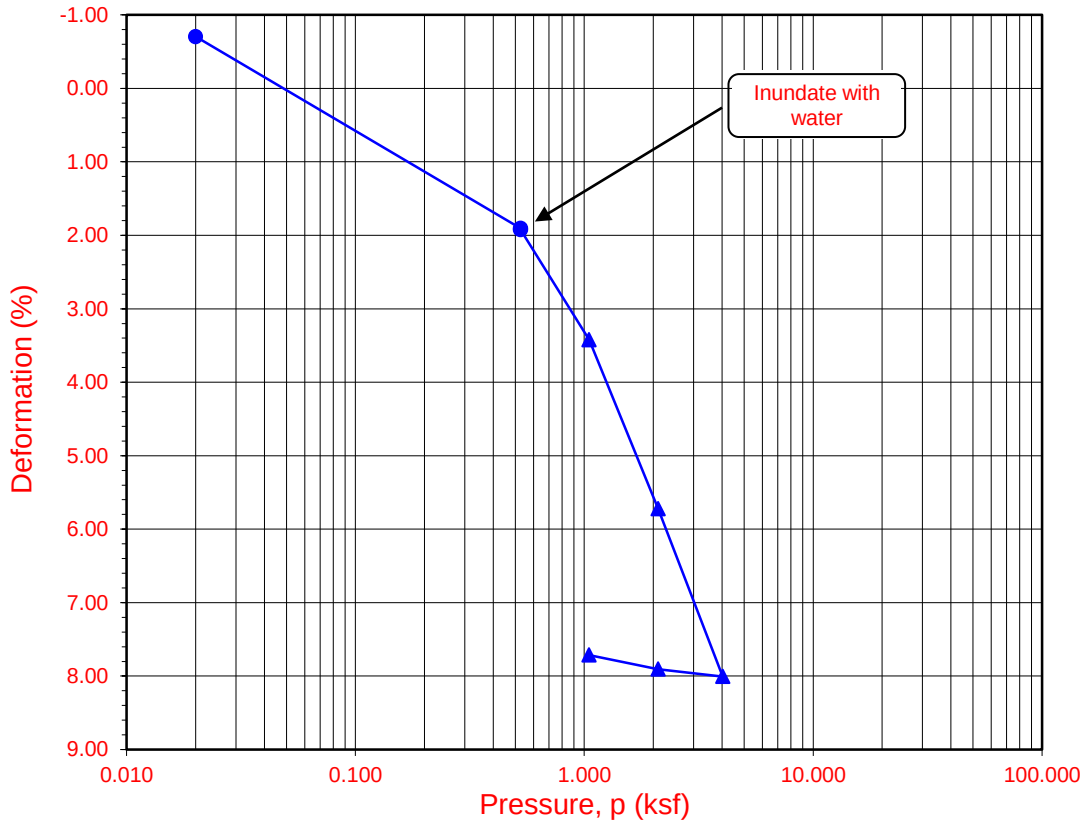
Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
5/25/11	5:35:00	0.0	0.0	0.2910
5/25/11	5:35:06	0.1	0.3	0.2969
5/25/11	5:35:15	0.2	0.5	0.2976
5/25/11	5:35:30	0.5	0.7	0.2985
5/25/11	5:36:00	1.0	1.0	0.3004
5/25/11	5:37:00	2.0	1.4	0.3021
5/25/11	5:39:00	4.0	2.0	0.3044
5/25/11	5:43:00	8.0	2.8	0.3065
5/25/11	5:50:00	15.0	3.9	0.3080
5/25/11	6:05:00	30.0	5.5	0.3092
5/25/11	6:35:00	60.0	7.7	0.3101
5/25/11	7:35:00	120.0	11.0	0.3110
5/25/11	9:35:00	240.0	15.5	0.3117
5/25/11	13:35:00	480.0	21.9	0.3125
5/26/11	5:35:00	1440.0	37.9	0.3138

Rev. 08-04

Time Readings @ 2.101 ksf







Boring No.	Sample No.:	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-4	**R-3**	**7.5**	**23.6**	**20.4**	**103.3**	**112.0**	**0.631**	**0.505**	**100**	**100**

Sample Description:

LEAN CLAY (CL), brown.

Project No.: 603181-001

Project Name: MURRIETA 18

ONE - DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Leighton

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Boring No.	**LB-1**							
Sample No.	**R-3**							
Depth (ft.)	10.0							
Sample Type	RING							
Visual Soil Classification	SM							
Moisture Correction								
Wet Weight of Soil + Container (gm.)	328.9							
Dry Weight of Soil + Container (gm.)	327.0							
Weight of Container (gm)	199.9							
Moisture Content (%)	1.5							
Container No.:	RH							
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	328.9							
Weight of Container (gm.)	199.9							
Weight of Dry Sample (gm.)	127.1							
Container No.:	RH							
After Wash								
Dry Weight of Sample + Container (gm)	283.4							
Weight of Container (gm)	199.9							
Dry Weight of Sample (gm)	83.5							
% Passing No. 200 Sieve	**34**							
% Retained No. 200 Sieve	66							

PERCENT PASSING No. 200 SIEVE
ASTM D 1140

Leighton

Project Name: MURRIETA 18

Project No.: 603181-001

Client Name: **

Tested By: JMB Date: 6/3/11

Rev. 08-04

Boring No.	**LB-2**							
Sample No.	**R-5**							
Depth (ft.)	15.0							
Sample Type	RING							
Visual Soil Classification	(SW-SM)							
Moisture Correction								
Wet Weight of Soil + Container (gm.)	717.5							
Dry Weight of Soil + Container (gm.)	644.2							
Weight of Container (gm)	158.9							
Moisture Content (%)	15.1							
Container No.:	KR							
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	717.5							
Weight of Container (gm.)	158.9							
Weight of Dry Sample (gm.)	485.3							
Container No.:	KR							
After Wash								
Dry Weight of Sample + Container (gm)	612.5							
Weight of Container (gm)	158.9							
Dry Weight of Sample (gm)	453.6							
% Passing No. 200 Sieve	**7**							
% Retained No. 200 Sieve	93							

PERCENT PASSING No. 200 SIEVE
ASTM D 1140

Leighton

Project Name: MURRIETA 18

Project No.: 603181-001

Client Name: **

Tested By: JAP Date: 5/23/11

Rev. 08-04

APPENDIX C

Laboratory Testing Procedures and Test Results

The laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Expansion Index: The expansion potential of selected samples were evaluated by the Expansion Index Test ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the table below:

SAMPLE LOCATION	*EXPANSION INDEX*	*EXPANSION POTENTIAL**
B-1 @ 0-4 feet	60	Medium

* Per Table 18-1-B of 1997 UBC.

Maximum Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557. The results of these tests are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*MAXIMUM DRY DENSITY (pcf)*	*OPTIMUM MOISTURE CONTENT (%)*
B-1 @ 0-4 feet	Silty Sand	130.5	9.0

Soluble Sulfates: The soluble sulfate contents of selected sample(s) were determined by standard geochemical methods (CTM 417). The soluble sulfate content is used to determine the appropriate cement type and maximum water-cement ratios. The test results are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*SULFATE CONTENT (ppm)**	*SULFATE EXPOSURE**
B-2 @ 0-5 feet	Silty Sand	ND	Negligible

* Based on the 1997 edition of the Uniform Building Code (UBC), Table No. 19-A-4, prepared by the International Conference of Building Officials (ICBO, 1997).

Minimum Resistivity and pH Tests: Minimum resistivity and pH tests were performed in general accordance with CTM 643 and standard geochemical methods. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. As a results of soil's resistivity decreases corrosivity increases. The results are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*pH*	*MINIMUM RESISTIVITY (OHMS-CM)*
B-2 @ 0-5 feet	Silty Sand	6.8	1,900

Chloride Content: Chloride content was tested in accordance with Caltrans Test Method (CTM) 422. The results are presented below:

SAMPLE LOCATION	*CHLORIDE CONTENT, PPM*
B-2 @ 0-5 feet	38

R-Value: The resistance R-value was determined by the ASTM D2844 soils. The sample was prepared and exudation pressure and R-value were determined. This result was used for asphaltic concrete pavement design purposes.

SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*R-VALUE*
B-2 @ 0-5 feet	Sandy Silt	17

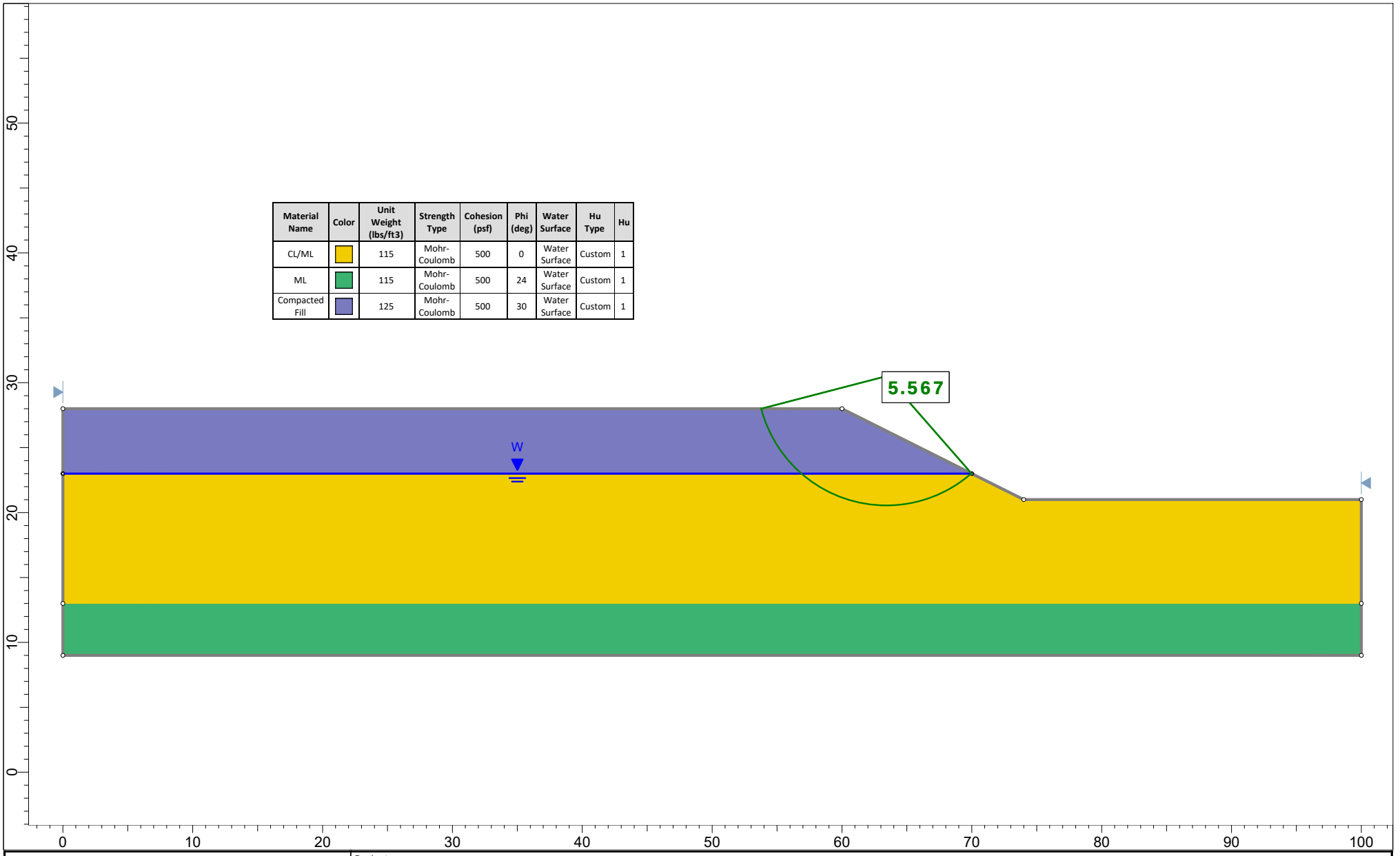
Grain Size Distribution: Representative samples were dried, weighed, and soaked in water until individual soil particles were separated (per ASTM D421) and then washed on a No. 200 sieve. The portion retained on the No. 200 sieve was dried and then sieved on a U.S. Standard brass sieve set in accordance with ASTM D422 (CTM 202). Where an appreciable amount of fines were encountered (greater than 20 percent passing the No. 200 sieve) a hydrometer analysis was done to determine the distribution of soil particles passing the No. 200 sieve.

SAMPLE LOCATION	*DESCRIPTION*	*% PASSING # 200 SIEVE*
B-1 @ 5 feet	Sandy Clay	62
B-1 @ 10 feet	Silty Sand	39
B-1 @ 15 feet	Sandy Silt	65
B-1 @ 20 feet	Sandy Silt	54
B-1 @ 35 feet	Sandy Silt	52

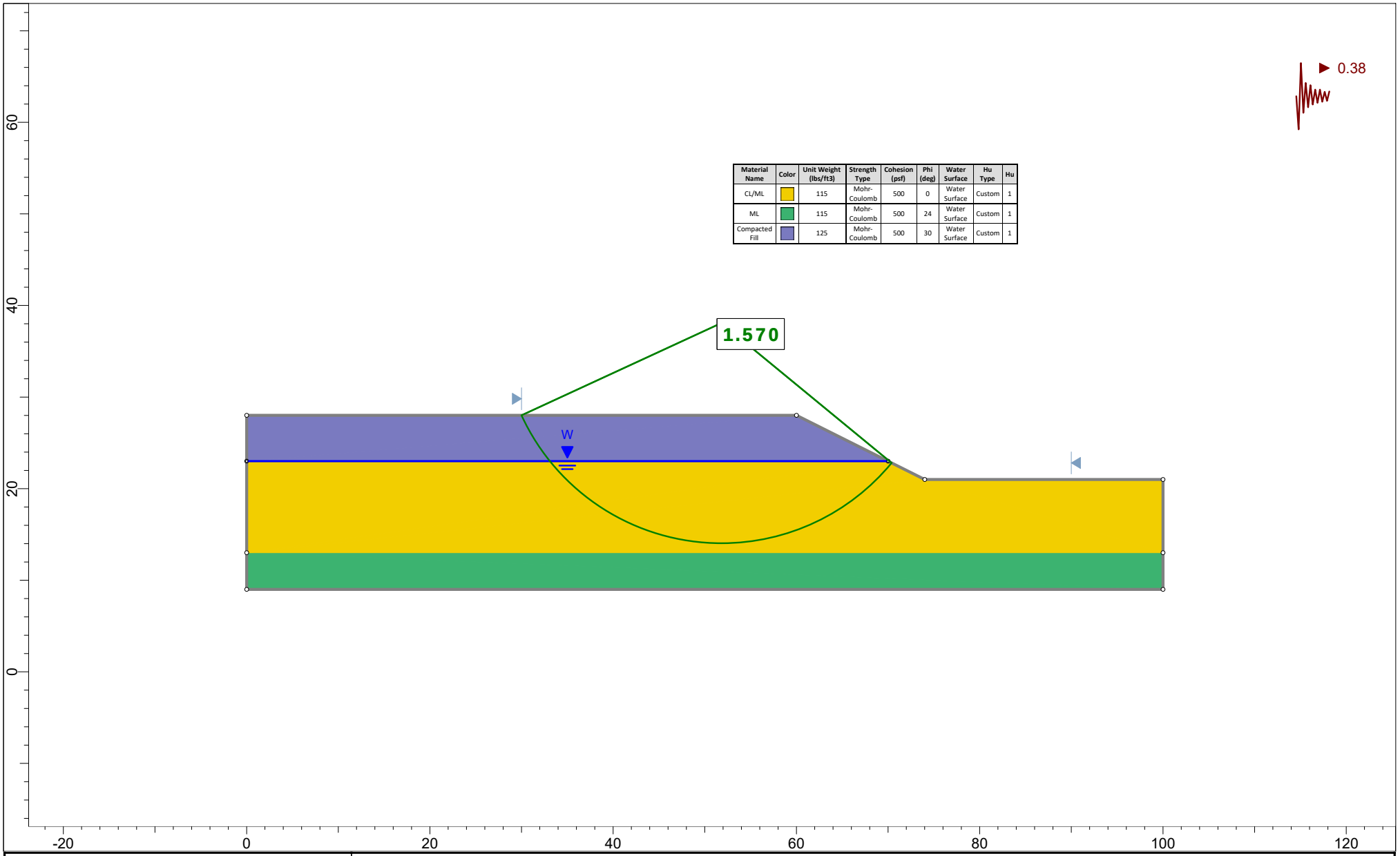
APPENDIX C

Slope Stability and Settlement Analyses

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
CL/ML		115	Mohr-Coulomb	500	0	Water Surface	Custom	1
ML		115	Mohr-Coulomb	500	24	Water Surface	Custom	1
Compacted Fill		125	Mohr-Coulomb	500	30	Water Surface	Custom	1



	Project	LMC Murrieta	
	Project Number	13343.001	*Scenario* Static
	Drawn By	BSS	*Company* Leighton and Associates
SLIDEINTERPRET 9.020	*Date*	4/6/2022, 1:54:05 PM	*File Name* Drainage Slope.slmd



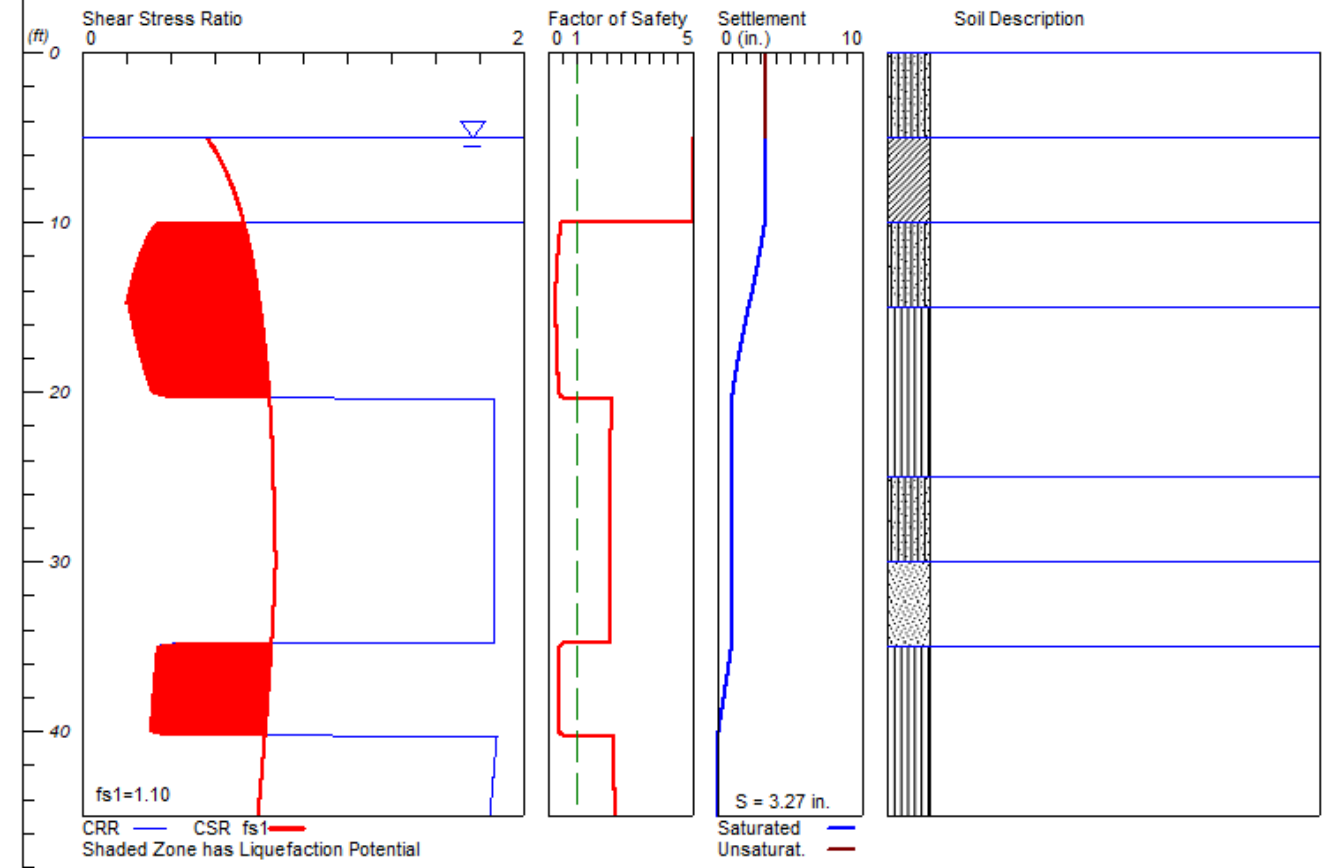
	Project	LMC Murrieta	
	Project Number	13343.001	*Scenario* Seismic
	Drawn By	BSS	*Company* Leighton and Associates
SLIDEINTERPRET 9.020	*Date*	4/6/2022, 1:54:05 PM	*File Name* Drainage Slope.slmd

LIQUEFACTION ANALYSIS

LMC Murrieta

Hole No.=B-1 (LGC) Water Depth=5 ft Surface Elev.=1078

Magnitude=7.7
Acceleration=0.8g



LiquefyPro CivilTech Software USA www.civiltech.com

****
LIQUEFACTION ANALYSIS SUMMARY

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****
Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 4/6/2022 3:59:52 PM

Input File Name: P:\Leighton - Infocus\13000 - 13999\13343 LMC Murrieta Hot Springs\004 LMC Murrieta - Investigation\Analyses\Liquefaction\B-1 LGC Liq.liq
Title: LMC Murrieta
Subtitle: 13343.004

Surface Elev.=1078
Hole No.=B-1 (LGC)
Depth of Hole= 45.00 ft
Water Table during Earthquake= 5.00 ft
Water Table during In-Situ Testing= 8.00 ft
Max. Acceleration= 0.8 g
Earthquake Magnitude= 7.70

Input Data:
Surface Elev.=1078
Hole No.=B-1 (LGC)
Depth of Hole=45.00 ft
Water Table during Earthquake= 5.00 ft
Water Table during In-Situ Testing= 8.00 ft
Max. Acceleration=0.8 g
Earthquake Magnitude=7.70
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.1
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	24.00	123.50	NoLiq
5.00	14.00	134.00	NoLiq
10.00	12.00	133.10	39.00
15.00	8.00	130.00	65.00
20.00	13.00	130.00	54.00
25.00	36.00	138.40	15.00
30.00	39.00	126.90	10.00
35.00	16.00	128.40	52.00
40.00	16.00	135.10	52.00
45.00	60.00	137.40	52.00

Output Results:

Settlement of Saturated Sands=3.27 in.
Settlement of Unsaturated Sands=0.00 in.
Total Settlement of Saturated and Unsaturated Sands=3.27 in.
Differential Settlement=1.637 to 2.160 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.57	5.00	3.27	0.00	3.27
5.00	2.00	0.57	5.00	3.27	0.00	3.27
10.00	0.33	0.73	0.46*	3.27	0.00	3.27
15.00	0.21	0.81	0.26*	2.14	0.00	2.14
20.00	0.31	0.85	0.37*	1.04	0.00	1.04
25.00	1.87	0.87	2.15	0.98	0.00	0.98
30.00	1.87	0.88	2.13	0.98	0.00	0.98
35.00	0.34	0.86	0.39*	0.95	0.00	0.95
40.00	0.30	0.83	0.37*	0.04	0.00	0.04
45.00	1.85	0.80	2.32	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

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

---

1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands

S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Latitude, Longitude: 33.5499, -117.1963



Date	4/6/2022, 1:16:52 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.628	MCE_R ground motion. (for 0.2 second period)
S_1	0.611	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.628	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.085	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.726	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.798	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.628	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.809	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.465	Factored deterministic acceleration value. (0.2 second)
S1RT	0.611	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.676	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.982	Factored deterministic acceleration value. (1.0 second)
PGAd	1.038	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.9	Mapped value of the risk coefficient at short periods
C_{R1}	0.903	Mapped value of the risk coefficient at a period of 1 s

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (update…

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.5499

Time Horizon

Return period in years

2475

Longitude

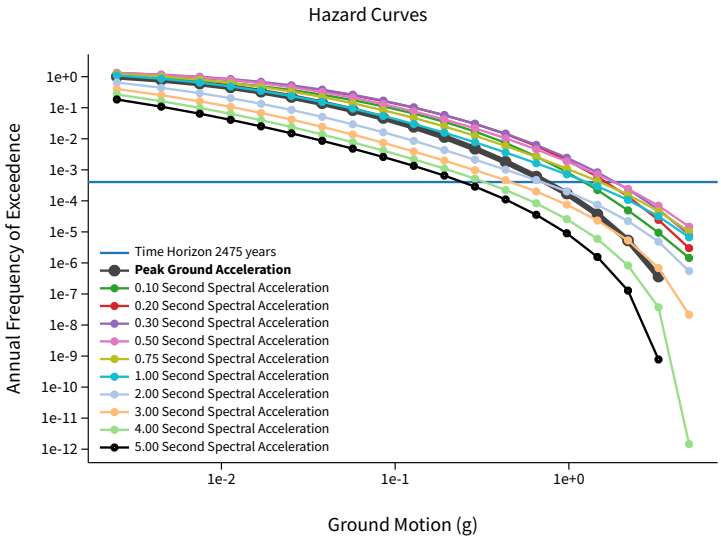
Decimal degrees, negative values for western longitudes

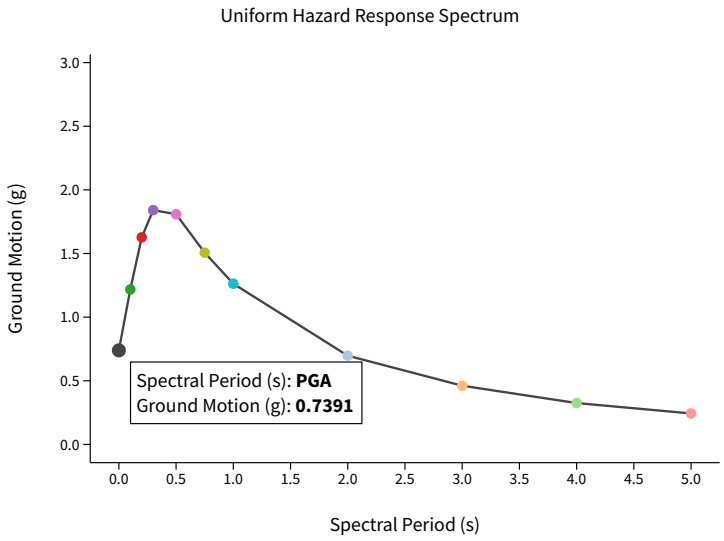
-117.1963

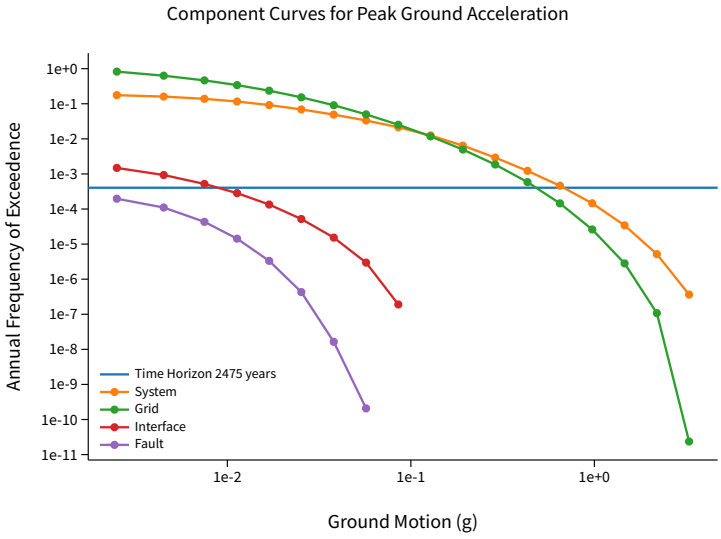
Site Class

259 m/s (Site class D)

Hazard Curve





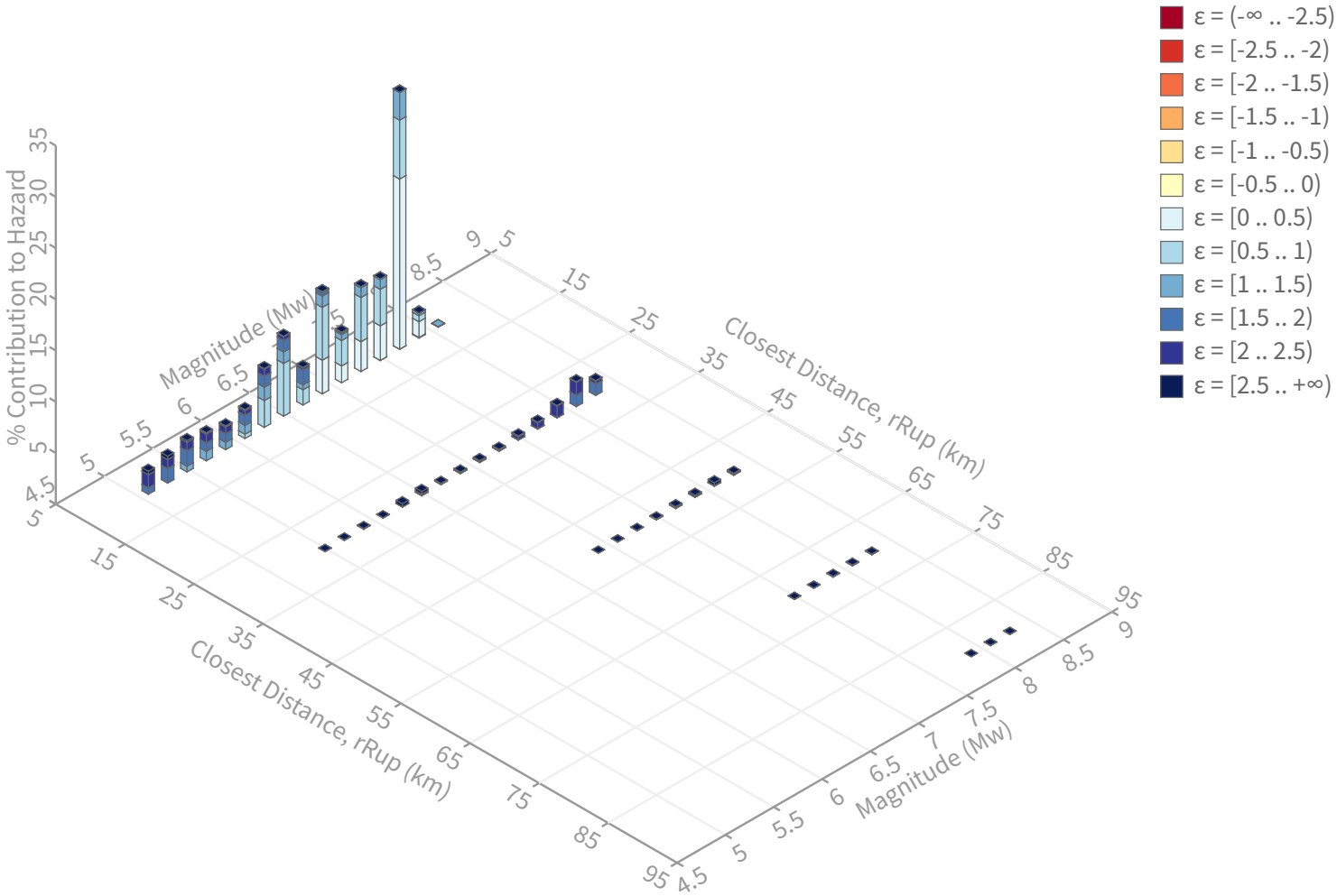


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.73908283 g

Recovered targets

Return period: 2796.0398 yrs
Exceedance rate: 0.0003576487 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.07 %

Mean (over all sources)

m: 7.02
r: 6.21 km
ε_0: 1.04 σ

Mode (largest m-r bin)

m: 7.71
r: 1.43 km
ε_0: 0.54 σ
Contribution: 25.07 %

Mode (largest m-r-ε_0 bin)

m: 7.71
r: 1.42 km
ε_0: 0.37 σ
Contribution: 16.61 %

Discretization

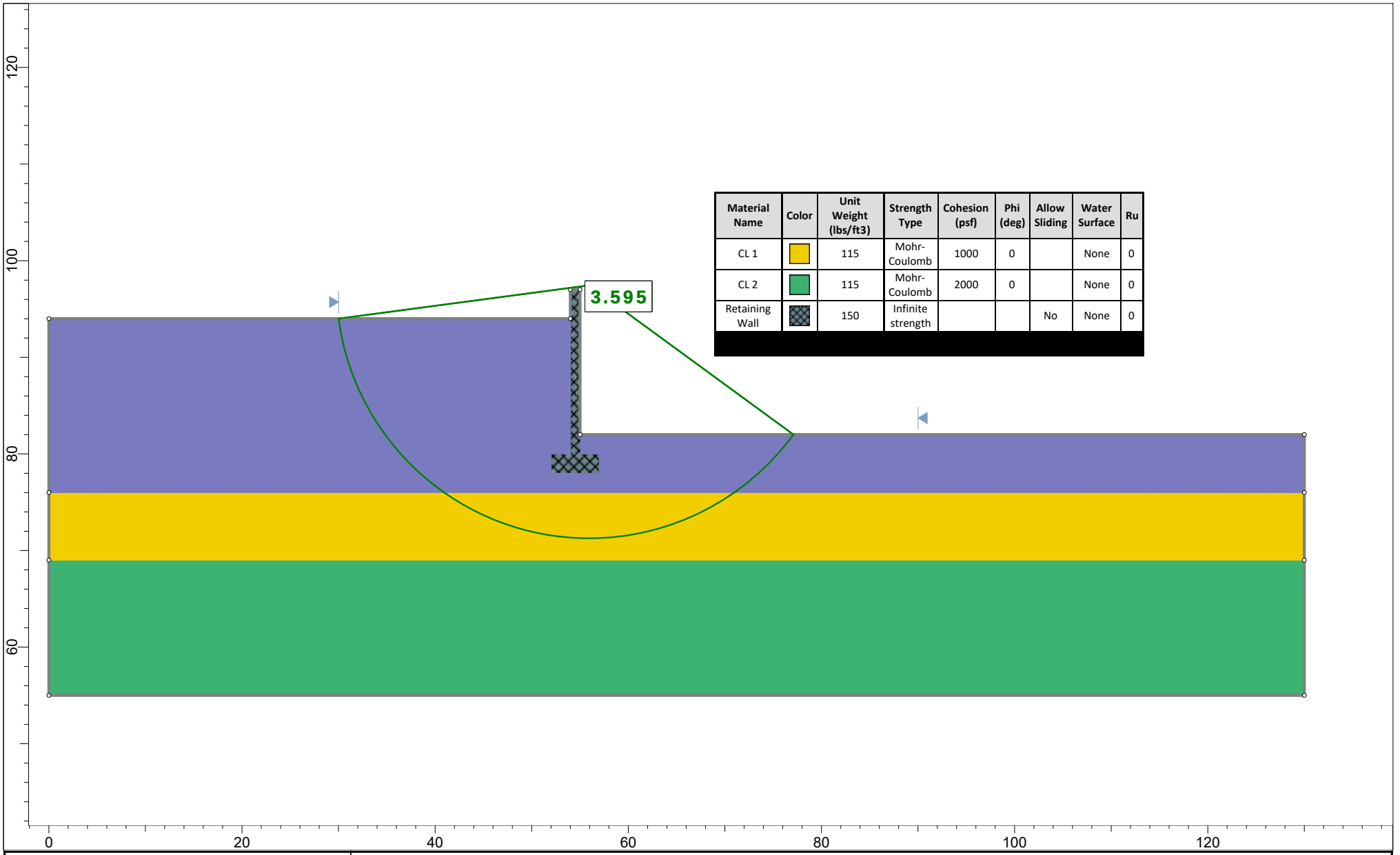
r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

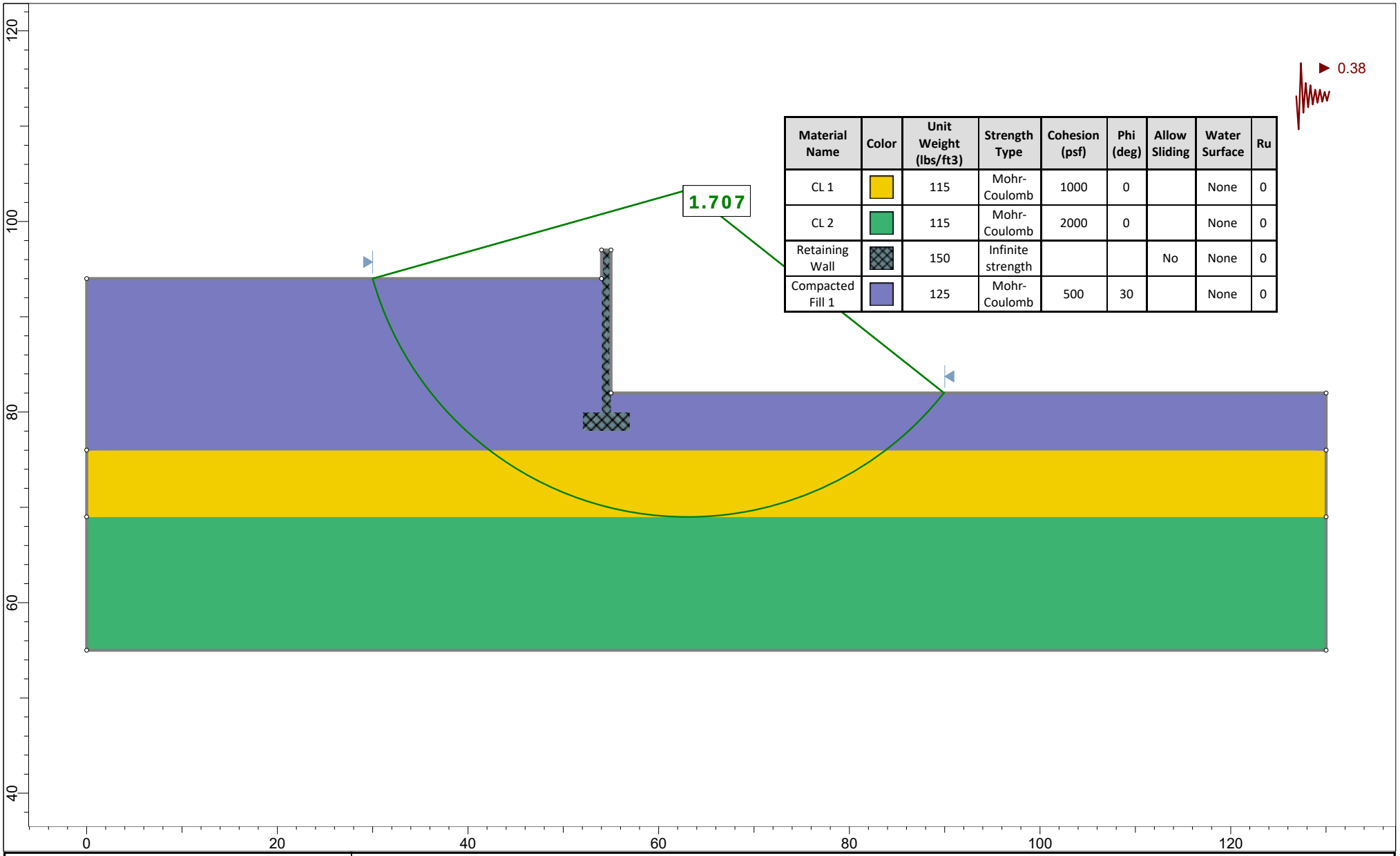
Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31	System							40.94
Elsinore (Temecula) rev [1]		1.42	7.30	0.61	117.195°W	33.550°N	63.08	33.19
San Jacinto (Stepovers Combined) [3]		33.32	8.04	2.08	116.927°W	33.748°N	48.42	2.94
Elsinore (Temecula) rev [2]		3.22	6.49	1.01	117.175°W	33.531°N	135.90	1.90
UC33brAvg_FM32	System							39.70
Elsinore (Temecula) rev [1]		1.42	7.35	0.60	117.195°W	33.550°N	63.08	32.25
San Jacinto (Stepovers Combined) [3]		33.32	8.03	2.09	116.927°W	33.748°N	48.42	2.91
Elsinore (Temecula) rev [2]		3.22	6.52	1.00	117.175°W	33.531°N	135.90	1.67
UC33brAvg_FM31 (opt)	Grid							9.68
PointSourceFinite: -117.196, 33.599		7.53	5.59	1.69	117.196°W	33.599°N	0.00	2.68
PointSourceFinite: -117.196, 33.599		7.53	5.59	1.69	117.196°W	33.599°N	0.00	2.68
UC33brAvg_FM32 (opt)	Grid							9.68
PointSourceFinite: -117.196, 33.599		7.53	5.59	1.69	117.196°W	33.599°N	0.00	2.68
PointSourceFinite: -117.196, 33.599		7.53	5.59	1.69	117.196°W	33.599°N	0.00	2.68



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Ru
CL 1		115	Mohr-Coulomb	1000	0		None	0
CL 2		115	Mohr-Coulomb	2000	0		None	0
Retaining Wall		150	Infinite strength			No	None	0

	Project	13343.004	
	Project Number	13343.001	*Scenario* Static
	Drawn By	BSS	*Company* Leighton and Associates
SLIDEINTERPRET 9.020	*Date*	4/8/2022, 12:49:42 PM	*File Name* Street Slope.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Ru
CL 1		115	Mohr-Coulomb	1000	0		None	0
CL 2		115	Mohr-Coulomb	2000	0		None	0
Retaining Wall		150	Infinite strength			No	None	0
Compacted Fill 1		125	Mohr-Coulomb	500	30		None	0

	Project	13343.004	
	Project Number	13343.001	*Scenario* Seismic
	Drawn By	BSS	*Company* Leighton and Associates
SLIDEINTERPRET 9.020	*Date*	4/8/2022, 12:49:42 PM	*File Name* Street Slope.slmd

APPENDIX D

General Earthwork and Grading Specifications

Leighton

LEIGHTON AND ASSOCIATES, INC.

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

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B - Oversize Rock Disposal	Rear of Text
C - Canyon Subdrains	Rear of Text
D - Buttress or Replacement Fill Subdrains	Rear of Text
E - Transition Lot Fills and Side Hill Fills	Rear of Text
Retaining Wall	Rear of Text

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.

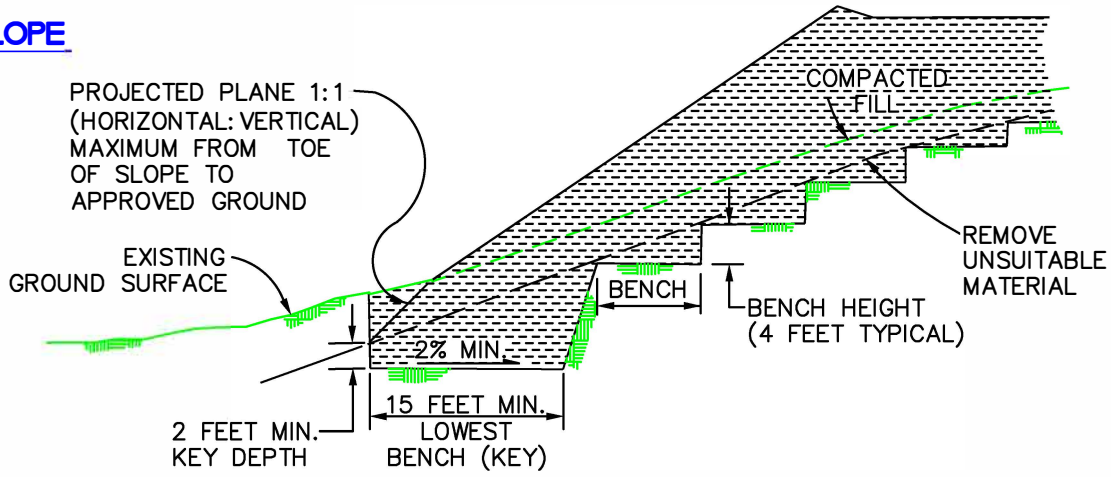
7.3 Lift Thickness

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.

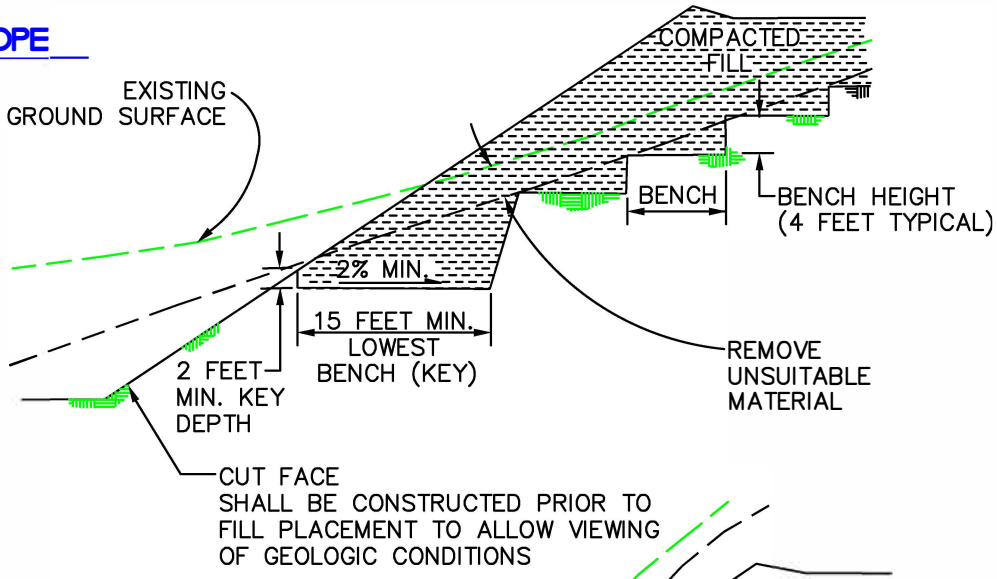
7.4 Observation and Testing

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

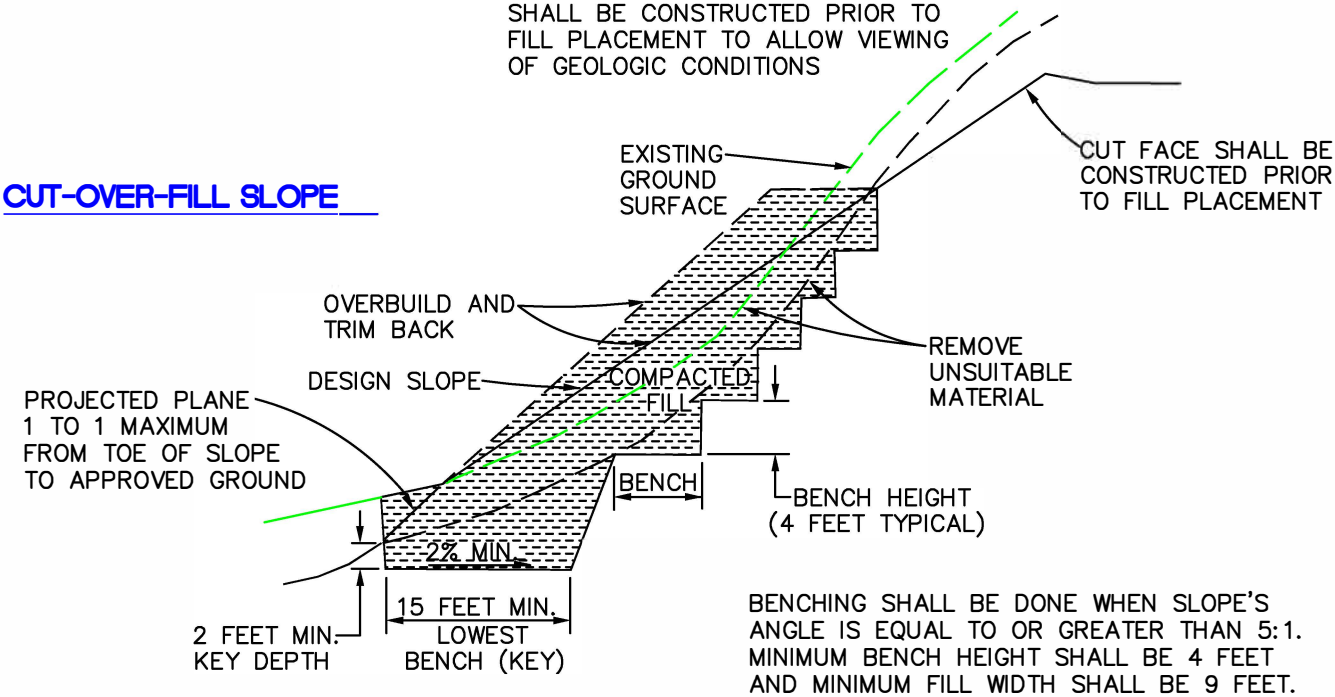
FILL SLOPE



FILL-OVER-CUT SLOPE

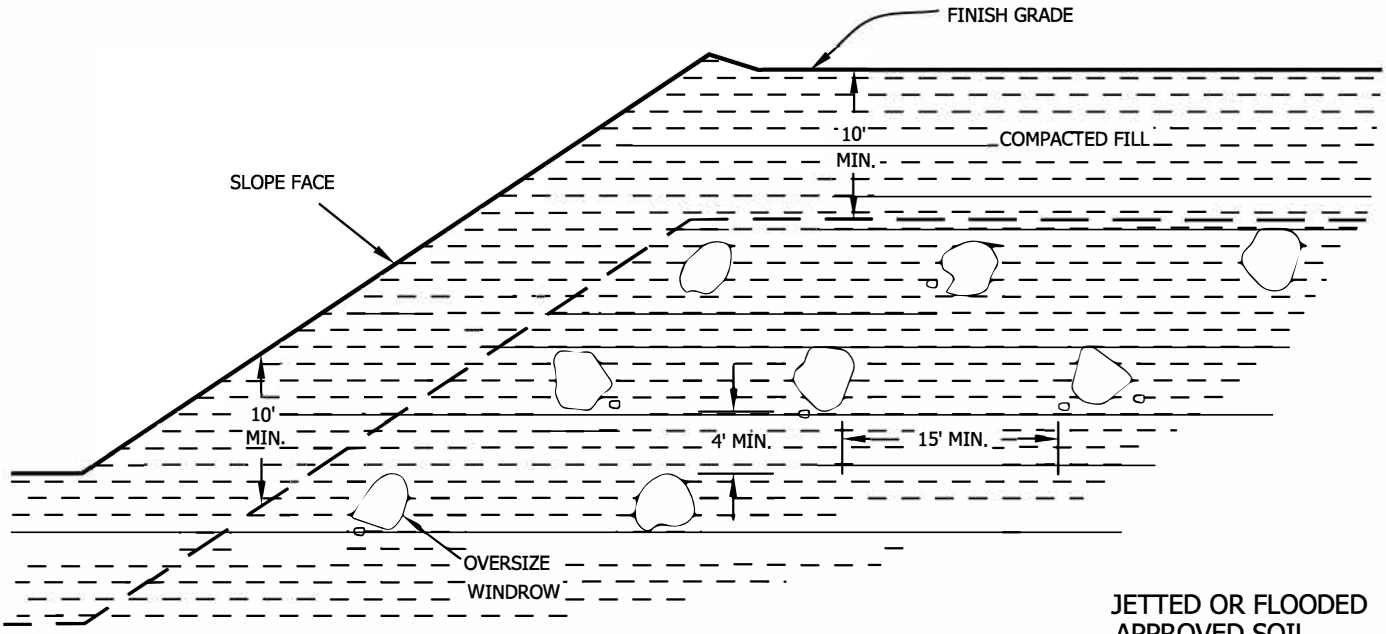


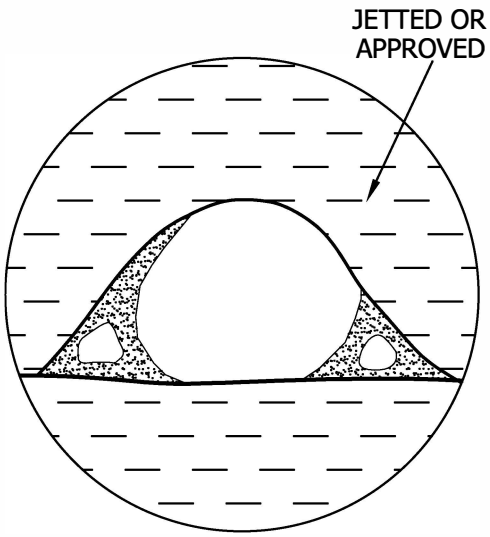
CUT-OVER-FILL SLOPE



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

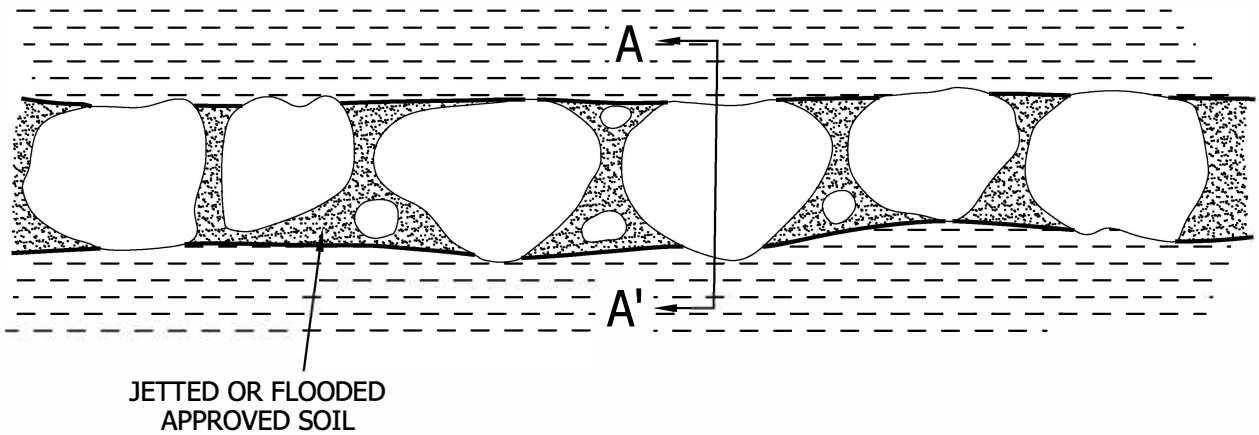




SECTION A-A'

- 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.

PROFILE ALONG WINDROW

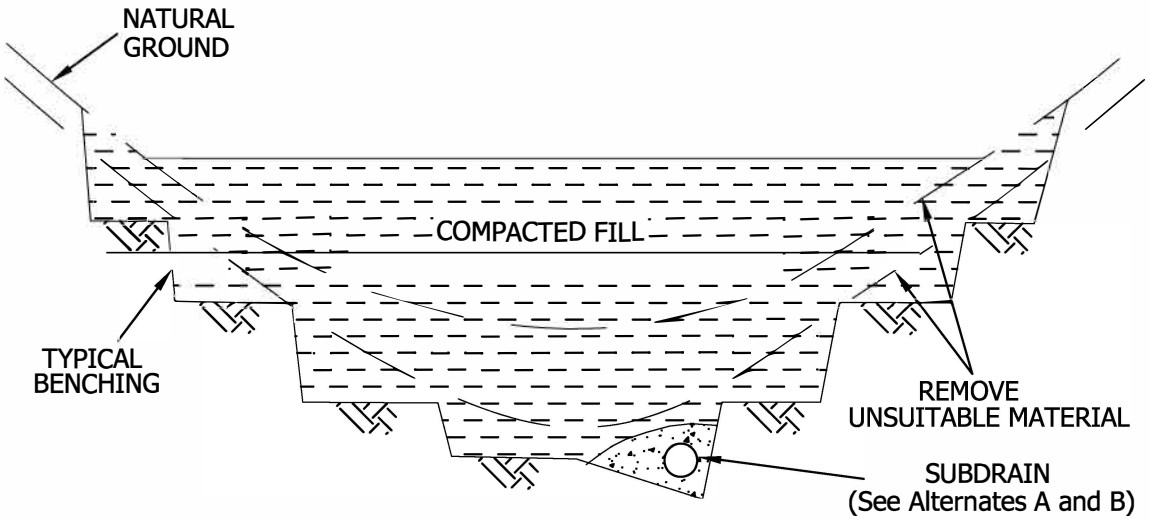


OVERSIZE ROCK DISPOSAL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
STANDARD DETAILS B

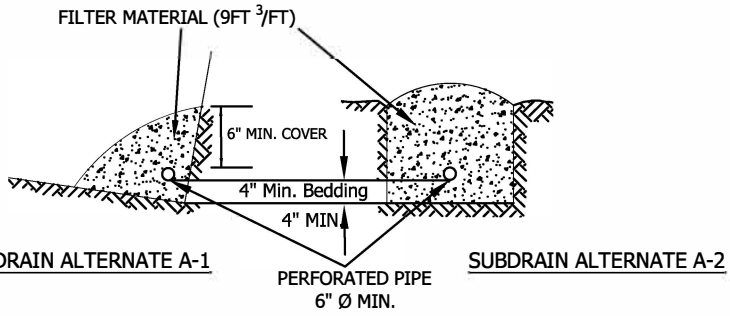
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SUBDRAIN ALTERNATE A

PERFORATED PIPE SURROUNDED WITH FILTER MATERIAL

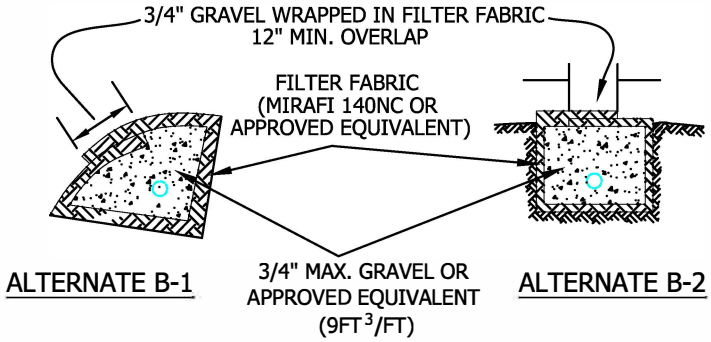


FILTER MATERIAL

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

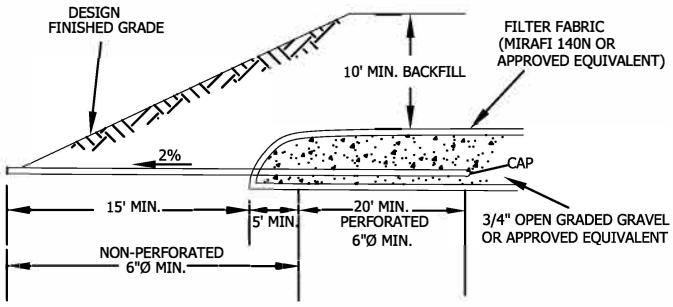
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

SUBDRAIN ALTERNATE B



○ PERFORATED PIPE IS OPTIONAL PER GOVERNING AGENCY'S REQUIREMENTS

DETAIL OF CANYON SUBDRAIN TERMINAL

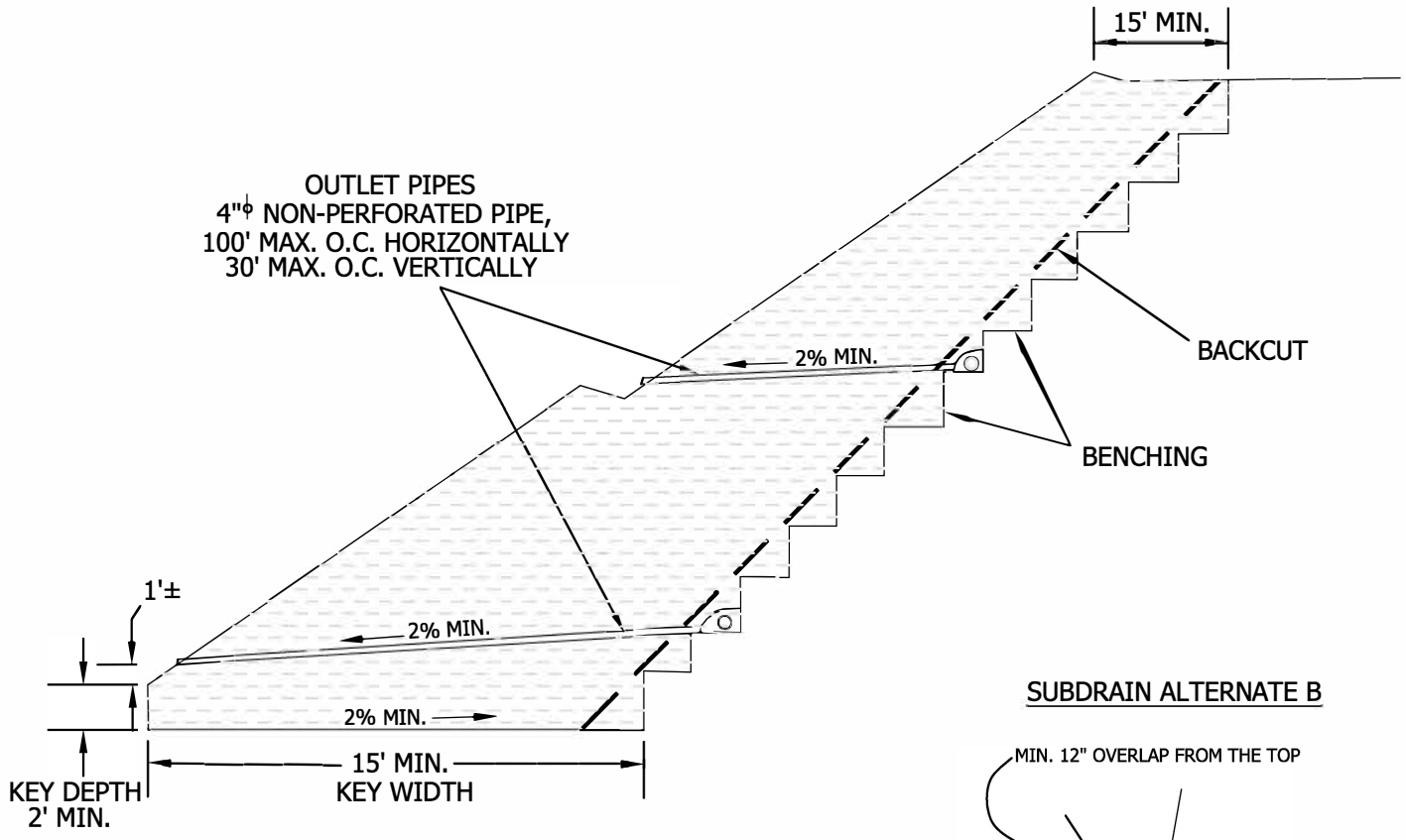


CANYON SUBDRAIN

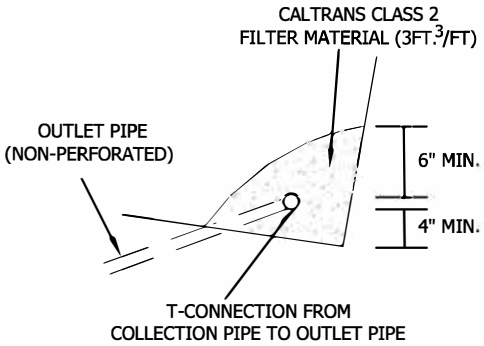
GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS C

Leighton

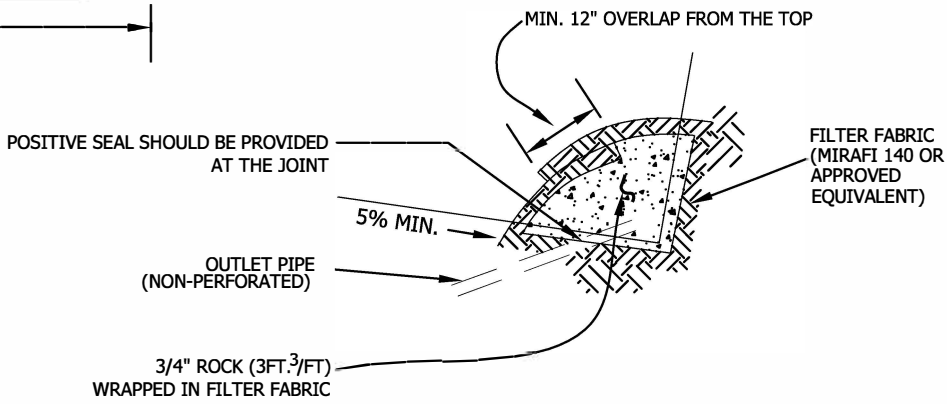
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SUBDRAIN ALTERNATE A



SUBDRAIN ALTERNATE B

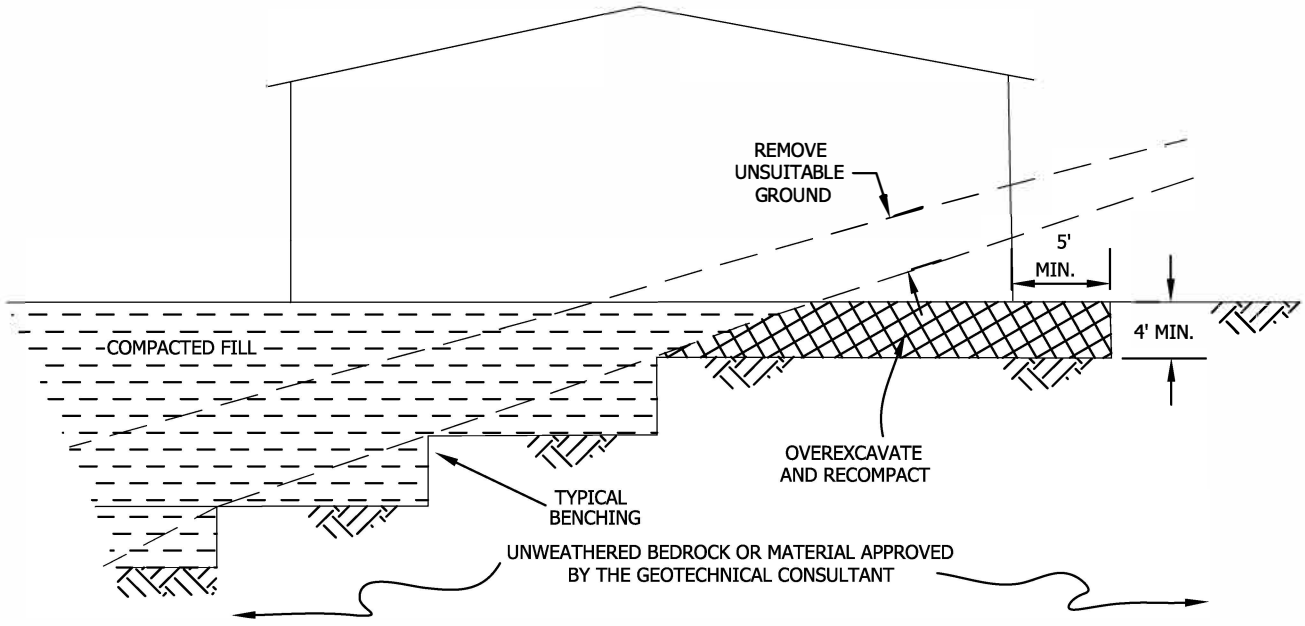


- SUBDRAIN INSTALLATION - Subdrain collector pipe shall be installed with perforations down or, unless otherwise designated by the geotechnical consultant. Outlet pipes shall be non-perforated pipe. The subdrain pipe shall have at least 8 perforations uniformly spaced per foot. Perforation shall be 1/4" 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.

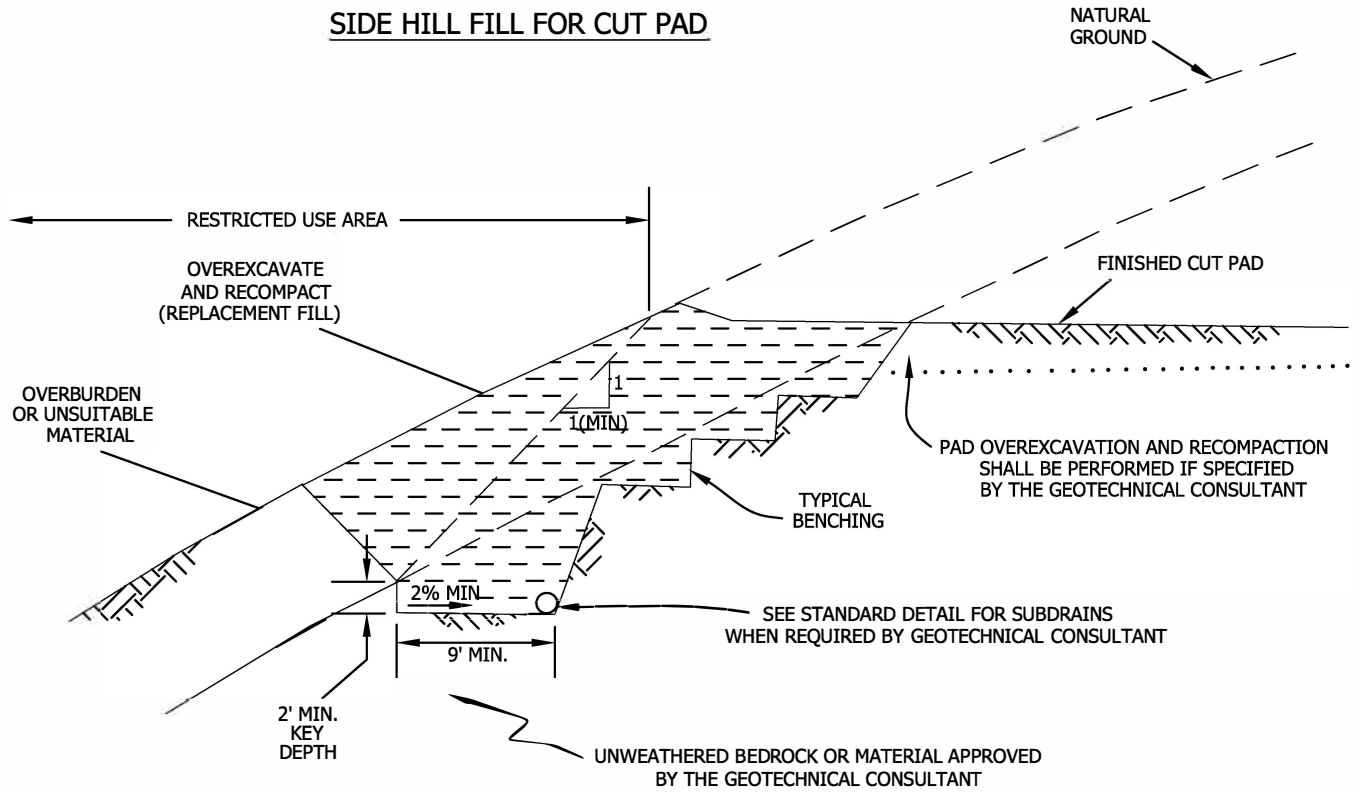
BUTTRESS OR REPLACEMENT FILL SUBDRAINS	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS D	Leighton

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CUT-FILL TRANSITION LOT OVEREXCAVATION



SIDE HILL FILL FOR CUT PAD



TRANSITION LOT FILLS AND SIDE HILL FILLS

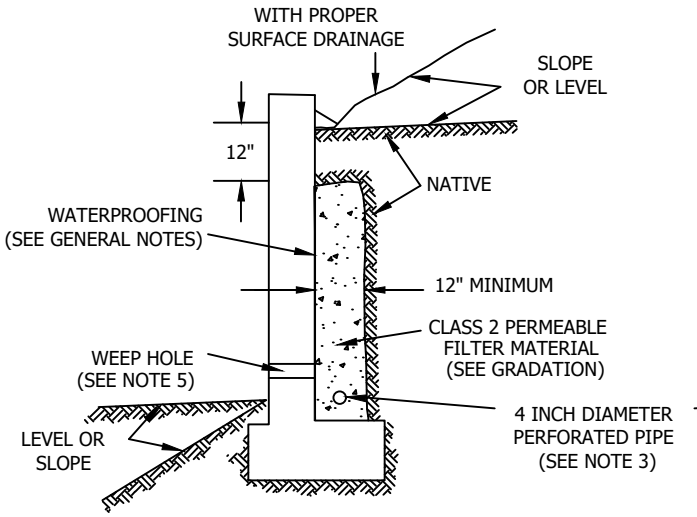
GENERAL EARTHWORK AND GRADING SPECIFICATIONS
STANDARD DETAILS E

Leighton

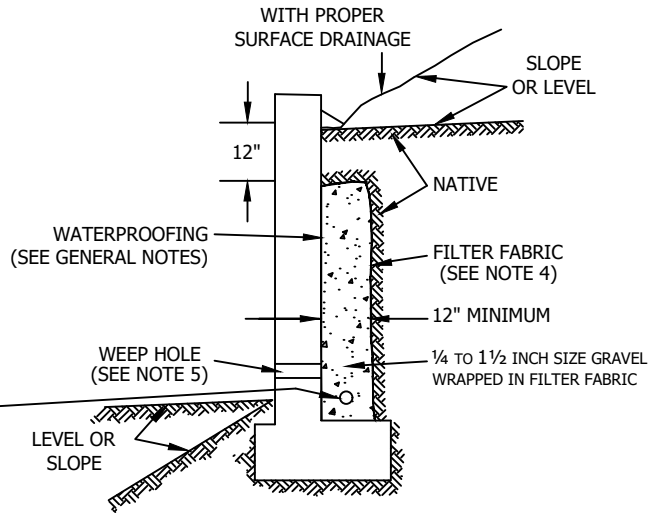
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SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

OPTION 1: PIPE SURROUNDED WITH CLASS 2 PERMEABLE MATERIAL



OPTION 2: GRAVEL WRAPPED IN FILTER FABRIC



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

V:\DRAFTING\TEMPLATES\STANDARD-FIGURES\WALL-STANDARD-FIGURES.DWG (09-02-21 9:07:35AM) Plotted by bbain

APPENDIX E

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 not 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 not be adequate to develop geotechnical design recommendations for the project.

Do not 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 not rely on an executive summary. Do not 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 not 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 Not 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 not 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 not building-envelope or mold specialists.***

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