LGC Geotechnical, Inc.

July 26, 2019 Project No. 18184-01

Mr. Donald Lamm
Diamond Star Associates
4100 MacArthur Blvd., Suite 330
Newport Beach, California 92660

Subject: ***Preliminary Geotechnical Report for Proposed Development of Tentative Tract Map 19035, Mission Viejo, California***

In accordance with your request and authorization, LGC Geotechnical, Inc. has prepared a preliminary geotechnical report for proposed development of the Tentative Tract Map 19035, located adjacent to El Toro Road within the City of Mission Viejo, California. The purpose of our study was to evaluate the existing onsite geotechnical conditions and to confirm that the site can be developed from a geotechnical perspective.

Should you have any questions regarding this report, please do not hesitate to contact our office. We appreciate this opportunity to be of service.

Respectfully Submitted,

LGC Geotechnical, Inc.

REGISTERED PROFESSIONAL ENGINEER
DENNIS BORATYNEC
No. 2770
GEOTECHNICAL
STATE OF CALIFORNIA

Dennis Boratynec, GE 2770
Vice President

Katie Maes, CEG 2216
Project Geologist

PROFESSIONAL GEOLOGIST
KATHERIN M. MAES
No. 2216
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

BTZ/DJB/KTM/amm

Distribution: (4) Addressee (3 wet-signed copies & electronic copy)

131 Calle Iglesia, Suite 200, San Clemente, CA 92672 (949) 369-6141 www.lgcgeotechnical.com

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1.0 INTRODUCTION

1.1 Purpose and Scope of Services

This report presents the results of our preliminary geotechnical evaluation for the proposed residential development located southwest of the intersection of El Toro Road and the 241 Eastern Transportation Corridor located in the City of Mission Viejo, California. The preliminary grading plan as reviewed in this report was prepared by Hunsaker and Associates, Inc. (Hunsaker, 2019).

The purpose of our study was to evaluate the existing onsite geotechnical conditions and to confirm that the site can be developed from a geotechnical perspective. As part of this report, we have: 1) reviewed available geotechnical reports, geologic maps, and air photos pertinent to the site (Appendix A); 2) performed a subsurface geotechnical evaluation of the site; 3) prepared a geotechnical map of the site incorporating available geotechnical information; 4) prepared geotechnical cross-sections depicting the interpreted subsurface conditions of the site relative to the proposed design; 5) performed slope stability analysis in support of the proposed design; and 6) prepared this summary report presenting our preliminary findings and conclusions for the proposed development.

The findings and conclusions presented herein should be considered preliminary and will need to be confirmed as part of a grading plan review report to be provided at a later date. It should be noted that LGC Geotechnical does not provide environmental consulting services.

1.2 Existing Conditions

The subject site consists of an approximately 12.5-acre hillside area at the location depicted on the Site Location Map, Figure 1 (Page 5). The moderately vegetated site is currently vacant land with several utility easements including a 200-feet wide Edison powerline easement at the eastern side of the area, and communication utility easements across the site and along the southern-most ridgetop that bounds the site at the south.

An Edison tower and set of power poles is located at the top of the hill at the southeast corner of the site, and the powerlines span the site within the easement, to another Edison tower and poles located offsite to the north. A cell tower "tree" and associated access road are located at the top of the ridgeline at the southern boundary of the site, and a residential development is located over the ridgeline at the base of the descending hill to the south. The existing tract is generally at lower elevations than the east-west trending ridgetop that forms the southern boundary of the site, and that development is separated from the site by a descending manufactured fill slope.

A large design cut slope for the Foothill Transportation Corridor (FTC) Highway 241, was constructed just east of the property boundary, with a significant excavation including removal of the original "top-of-hill" for the area. The FTC Highway 241 alignment passes at the northeast corner of the site as it transitions to an overpass bridge for El Toro Road. The northern boundary of the site consists of El Toro Road and a storage facility across the road that extends down to Aliso Creek. Two roadcut slopes to El Toro Road are provided with v-ditches that flow to a drainage underpass from the small canyon at the north-central portion of the site. The western boundary of the site consists of a low-angle, cut-over fill slope with v-ditches, and a native slope with a small basin at the base, both adjacent to the existing parking lot for the office building located at 20532 El Toro Road.

Overall the site has moderate to significant relief, the lowest in the northwest at an approximate elevation of 845 feet, the highest at the southeastern corner up to an approximate elevation of 1020 feet.

*1.3 **Project Description***

The proposed project consists of construction of an approximately 3.3-acre area of developable pad, set within hillside terrain constructed with 2:1 (Horizontal to Vertical) slopes and a Mechanically Stabilized Earth (MSE) retaining wall. The plan by Hunsaker and Associates, Inc., (Hunsaker, 2019) is presented as the base for the Geotechnical Map (Sheet 1) and has been the basis of this evaluation. Access to the proposed development would be provided from an entrance road, "A" Drive, off El Toro Road at the northeast corner of the site. A water quality basin is proposed to be located just east of the entrance road. It is our understanding that a multi-family residential development is currently proposed for the site.

The maximum proposed design cut and fill slopes are approximately 85 and 65 feet, respectively. The grading plan depicts planned cuts and fills (not including required remedial grading) up to approximately 45 and 50 feet, respectively. An MSE retaining wall approximately 12 feet in height is proposed within the development at middle of the design fill slope adjacent to El Toro Road.

*1.4 **Background***

The geotechnical background of the site is based on review of available regional geologic data, geotechnical reports and portions of reports for the surrounding areas, and historic aerial photographs and stereoscopic pairs of photographs (Continental, 2019). Information from previous geotechnical investigations and grading reports for surrounding developments from the 1980's and 1990's has been reviewed, and pertinent data added to the current evaluation.

A preliminary geotechnical evaluation for the areas west and north of the site was performed in 1991 by Leighton and Associates, Inc. (Leighton, 1991), as part of a grading plan review for the proposed Lots 2 & 3, of Tentative Tract 14602 to the west, and Lot 4 of Tentative Tract 14496 to the north. A supplemental grading plan review including revisions to the plan for the same areas, was provided in the referenced report (Leighton, 1992; Incomplete Copy). Information obtained from the Leighton reports included large-diameter boring information by others from various stages of investigation for the adjacent developments such as the Foothill Transportation Corridor (FTC), and the residential development to the south. Selected borings and an exploratory trench by others have been included in the current evaluation.

Lots 2, 3, & 4 were rough graded during 1992 through 1993 under observation and testing by Leighton, as reported in the referenced as-graded report (Leighton, 1993). Selected information including the approximate dimensions of the off-site buttress keyway for Lot 4 (currently developed as a storage facility across El Toro Road) and keyway details for Lot 3 (existing parking lot), were reviewed and incorporated into the current evaluation. Notably, the keyway constructed for Lot 3 at the existing west-facing manufactured cut over fill slope, was the result of a backcut failure that occurred during excavation for a steeper slope that was subsequently revised to the lower-angle slope that was eventually graded to today's topography (Leighton, 1992).

In 1999, a geotechnical evaluation was performed for the adjacent mass-graded building pad (Lots 2 & 3 of Tentative Tract 14602) located west of the site. The referenced geotechnical update and finish grade report by Anthony-Taylor Consultants (1999) provided limited additional surficial geotechnical information. Rough grading of the pad was performed under observation and testing by MTG_L, as detailed in their referenced report (MTG_L, 2001). At that time, the building pad was over-excavated, and retaining walls, parking areas, and associated improvements were constructed.

1.5 <u>Subsurface Geotechnical Evaluation</u>

LGC Geotechnical performed a subsurface geotechnical evaluation of the site consisting of the excavation of three large-diameter bucket auger borings to evaluate onsite geotechnical conditions downhole-logged by an engineering geologist, and excavation of three exploratory trenches. The bucket auger borings (BA-1 through BA-3) were drilled by Al-Roy Drilling under subcontract to LGC Geotechnical. The maximum depth of the borings was approximately 62 feet below existing grade. Boring BA-1 was terminated at a depth of approximately 44 feet below existing grade due to auger refusal. The bucket auger borings were excavated to evaluate the geologic structure of the bedrock materials and to obtain samples for laboratory testing. The large-diameter boreholes were surface logged during excavation and downhole logged by an engineering geologist in order to obtain structural geologic information. Borings were subsequently backfilled with cuttings and tamped.

Three exploratory trenches were excavated by backhoe and the trenches logged by a geologist. One trench was used as an infiltration test location in order to pre-soak and perform a subsequent preliminary test of potential for subsurface infiltration at the site in accordance with the referenced guidelines (County of Orange, 2017).

The approximate locations of borings are shown on the Geotechnical Map (Sheet 1). Boring logs are presented in Appendix B.

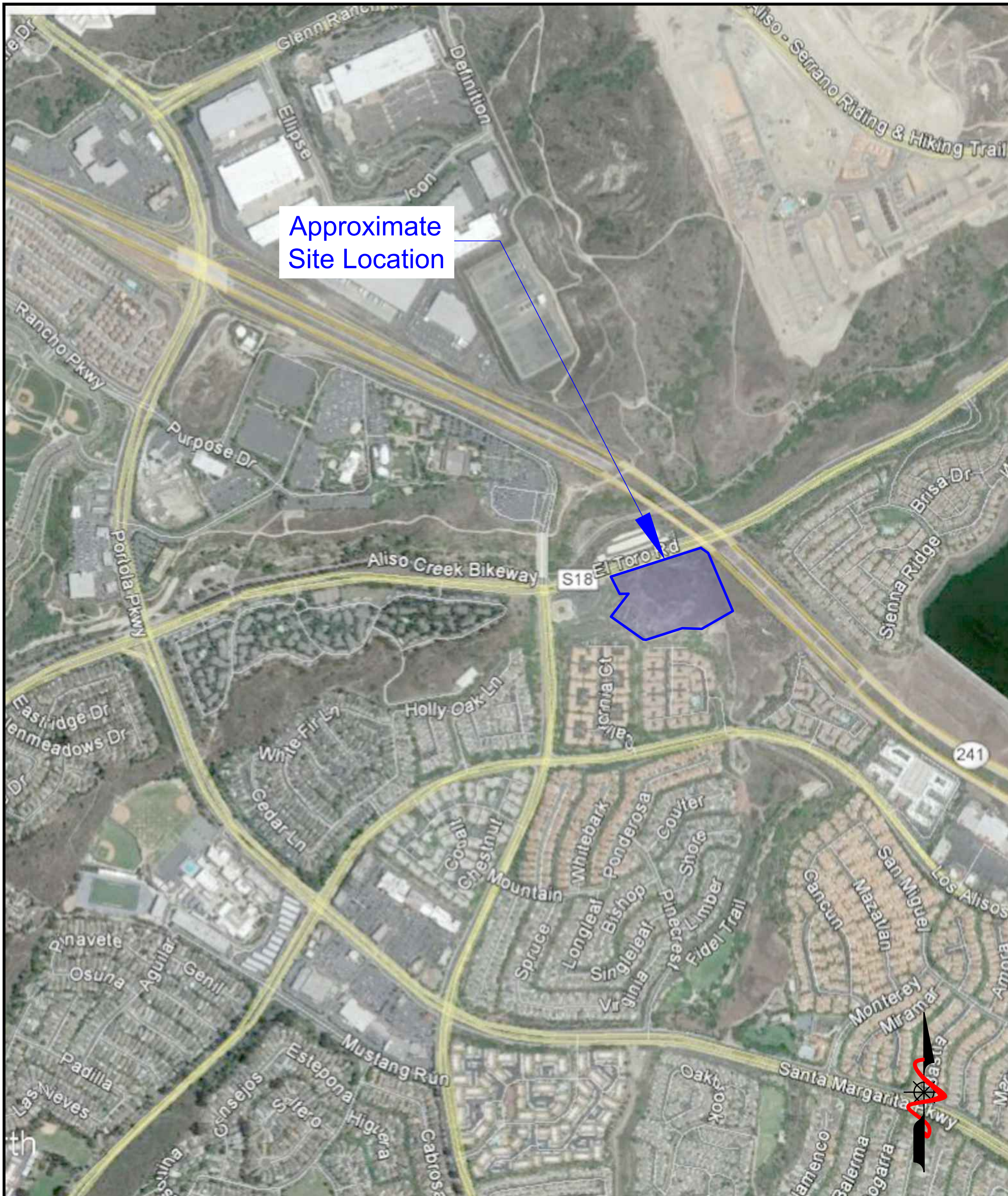
1.6 <u>Laboratory Testing</u>

Representative bulk and driven samples were retained for laboratory testing during our field evaluation. Laboratory testing included in-situ moisture content and in-situ dry density, Atterberg Limits, direct shear, fully softened torsional ring shear, expansion index, laboratory compaction and corrosion (sulfate, chloride, pH and minimum resistivity).

The following is a summary of the laboratory test results.

- Dry density of the samples collected ranged from approximately 82 pounds per cubic foot (pcf) to 115 pcf, with an average of 98 pcf. Field moisture contents ranged from approximately 15 percent to 37 percent, with an average of 23 percent.
- Two Atterberg Limit (liquid limit and plastic limit) tests were performed. Results indicated Plasticity Index values of 41 and 46.
- Direct shear tests were performed on select driven samples. The plots are provided in Appendix C.
- A fully softened torsional ring shear test was performed on a grab sample of site clay materials. The plot is provided in Appendix C.
- Two Expansion Index (EI) tests were performed. Results indicate EI value of 97 and 92, corresponding to "High" expansion potential.
- Laboratory compaction testing of two bulk samples indicated maximum dry density values of 105.5 and 97.0 pounds per cubic foot (pcf) and optimum moisture contents of 8.5 and 23.5 percent, respectively.
- Corrosion testing indicated soluble sulfate contents of approximately 0.042 and 0.03 percent, chloride contents of 380 and 780 parts per million (ppm), pH values of 7.4 and 6.8, and minimum resistivity values of 365 and 279 ohm-cm.

A summary of the results is presented in Appendix C. The moisture and dry density test results are presented on the boring logs in Appendix B.



LGC Geotechnical, Inc.	**FIGURE 1** **Site Location Map**	PROJECT NAME	El Toro 5
		PROJECT NO.	18184-01
		ENG. / GEOL.	DJB/KTM
		SCALE	Not to Scale
		DATE	July 2019

2.0 GEOTECHNICAL CONDITIONS

2.1 Regional Geology

The subject site is located within the foothills of the Santa Ana Mountains, part of the Peninsular Ranges Geomorphic Province of California. The Santa Ana Mountains are bounded by the major regional northwest-trending faults including the Newport- Inglewood Offshore fault to the south and the Elsinore Fault System to the north. Tertiary Puente Formation underlies the site; the regional sedimentary deposit consists of gently west-dipping marine siltstone and sandstone with few claystone beds (Morton, 2004). The nearby Aliso Creek drainage that flows to the southwest dissects the foothills within a moderately broad alluvial channel.

2.2 Site-Specific Geology

The subject site is located within the uplifted bedrock that forms the low hills of surrounding foothills of the Santa Ana mountains. Tertiary Puente Formation underlies the site; the regional sedimentary deposit consists of gently west-dipping marine siltstone and sandstone with few claystone beds (Morton, 2004). Two existing landslides derived from this material have been identified within the limits of the site. Also, an alluvial deposit, colluvium (thick topsoil), and older artificial fills mantle portions of the site. A brief description of these geologic units is presented in the following sections (from youngest to oldest) and their approximate lateral extents are depicted on the site Geotechnical Map (Sheet 1).

2.2.1 Artificial Fill – Older (Map Symbol - Afo)

Older artificial fill soils encountered at the west boundary of the site are documented structural fill, reportedly having been placed in relatively thin lifts, at near optimum moisture content, and compacted with heavy construction equipment to achieve a minimum relative compaction of at least 90 percent (Leighton, 1993). The material reportedly consists of variable layers of sandy silt, clayey silt, some sand with scattered gravel, generally moist, stiff to very stiff/dense.

2.2.3 Quaternary Alluvium and Colluvium (Map Symbol – Qal)

Quaternary alluvium was observed in the small north-central canyon; the material is an accumulation of eroded materials from the surrounding slopes. The thick accumulation of topsoil/colluvium on the ascending slopes (unit not mapped) likely interfingers with the alluvium. The alluvium generally consists of dark to moderate brown, sandy silt and sandy clays with minor amounts of gravel, dry to moist, stiff.

2.2.4 Quaternary Landslide Deposit (Map Symbol – Qls)

Quaternary landslide deposits were encountered at the site as observed during the recent subsurface investigation and as previously noted by others during development of surrounding areas. The materials were observed to be similar to Puente Formation materials but fractured and sheared as described in the section below and on boring logs (Appendix B). Based on carbon dating performed by others during stabilization of the lower offsite portion of landslides, the ages of the landslides on site range from 11,000 years old to 24,700 years old (Leighton, 1991).

2.2.5 Tertiary Puente Formation (Map Symbol – Tp)

The sedimentary bedrock unit that underlies the site is the Tertiary-age Puente Formation. The Puente Formation was derived from a shallow marine depositional environment. The formation is regionally broken into four members that vary in dominant material type, undifferentiated with this evaluation. Previous evaluations and the regional geologic map generally agree that the site includes the Puente Formation, Soquel Member (Morton, 2004) and the Puente Formation, La Vida Member (Leighton, 1991). The members have similarities but the main descriptive difference between the units is that the Soquel Member has more sandstone that the underlying La Vida Member. The La Vida Member is more likely to be the dominant bedrock formation member at the site based on the materials observed during down-hole logging of borings. The material generally consists of thinly interbedded siltstone and clayey siltstone, and few sandstone beds including rare, very thin beds of vitric tuff (volcanic ash deposit). The material as observed was typically light gray, well-bedded, locally shaley, with abundant foraminifera, very stiff to hard, and moist.

2.3 Geologic Structure

The gently-inclined north and west-facing hillside that encompasses the site generally consists of a homocline that forms a gently variable dip-slope condition that has been altered by landslides and grading activities that have occurred around the perimeter of the site. A broad, north-plunging syncline was mapped by others during previous grading activities to the west of the site (Leighton, 1993), within the current parking lot area. Bedding angles were observed to range between 8 and 11 degrees to the northwest overall, within the majority of the hillside site; with exception of a flattening of average dip at the crest of the ridgeline to the south of the site, and a steepening of the dip in the northern portion of the site adjacent to El Toro Road (Leighton, 1991).

Bedding ranges from very thin to moderately thick, interbedded siltstone, sandstone and few scattered very thin clay beds with variable levels of cementation. Scattered joints lined with gypsum were observed in the upper weathered zone of the hillside. Minor tectonic shearing along-bedding has been observed in the bedrock material, within beds of relatively weak bedding. The hillside around the central canyon is mantled with a thick layer of topsoil/colluvium that is the result of in-place weathering, slope creep and slopewash.

Two site landslides have been drilled and identified during downhole logging, and supporting data evaluated for interpretation of landslide limits. The west landslide as observed in bucket auger boring BA-1, was 28 feet deep at the boring, and extends under El Toro Road. The landslide does not extent up the hillside to the south within the site based on the information from boring BA-2 and the geomorphic expression of the slope. The east landslide as observed in boring BA-3 was part of a larger landslide that also extends below El Toro Road, and was partially beheaded when the design cut slope for the FTC was excavated along the east boundary of the site. Although the slide is relatively thin at the location explored at 18.5 feet below ground, the bedding appears to flatten slightly to the southeast under the former ridgeline (since cut down), making the slide slightly thicker to the southeast. Several older borings and one trench by others within the limits of the east landslide have constrained its limits, as presented on the Geotechnical Map and Cross Sections (Sheets 1 & 2). During development of the existing commercial lots and self-storage buildings across El Toro Road (to the north) both landslides were provided with a buttress keyway and subdrain system.

2.4 Groundwater

During our subsurface evaluation, groundwater was not encountered to the maximum explored depth of approximately 62 feet below existing grade.

Seasonal fluctuations of groundwater elevations should be expected over time. In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be present within the near-surface deposits due to local seepage or during rainy seasons. Local perched groundwater conditions or surface seepage may develop once site development is completed and landscape irrigation commences.

2.5 Faulting and Seismic Hazards

The subject site is not located within a State of California Earthquake Fault Zone (i.e., Alquist-Priolo Earthquake Fault Act Zone) and no active faults were identified on the site during our site evaluation (CGS, 2018). A fault is considered “Holocene-active” if evidence of surface rupture in Holocene time (the last approximately 11,000 years) is present. The possibility of damage due to ground rupture is considered low since no active faults are known to cross the site.

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the Southern California region, which may affect the site, include ground lurching, soil liquefaction, dynamic settlement and earthquake induced landslides. These secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependent on the distance between the site and causative fault and the onsite geology. Faults that may produce significant shaking include but are not limited to the Whittier-Elsinore, the Newport-Inglewood, San Andreas and San Jacinto Fault Zones. A discussion of these secondary effects and proposed mitigation in accordance with the provisions of the Seismic Hazards Mapping Act is provided in the following sections.

2.5.1 Liquefaction and Dynamic Settlement

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similar to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions coexist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that saturated, loose, near surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. In general, cohesive soils are not considered susceptible to liquefaction (Bray & Sancio, 2006). Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity failures below structures. Dynamic settlement of dry loose sands can occur as the sand particles tend to settle and densify as a result of a seismic event.

The site is not located in a State of California liquefaction hazard zone (CDMG, 2001). Based on the proposed plans and remedial grading, the site will consist of compacted fill over dense/hard native materials. The potential for post construction liquefaction and liquefaction-induced dynamic settlement is considered negligible.

2.5.2 Lateral Spreading

Lateral spreading is a type of liquefaction-induced ground failure associated with the lateral displacement of surficial blocks of sediment resulting from liquefaction in a subsurface layer. Once liquefaction transforms the subsurface layer into a fluid mass, gravity plus the earthquake inertial forces may cause the mass to move downslope towards a free face (such as a river channel or an embankment). Lateral spreading may cause large horizontal displacements and such movement typically damages pipelines, utilities, bridges, and structures.

Due to the negligible potential for liquefaction, the potential for lateral spreading is also considered negligible.

2.5.3 Earthquake Induced Landslide

A small portion of the site is located within a State of California Seismic Hazard Zone (CDMG, 2001) for earthquake-induced landslide, at the northeast-most corner of the property. Construction of the Foothill Transportation Corridor (FTC) altered the topography in that location; the hazard zone depicted on the seismic hazard potential map was originally delineated on the pre-existing topography of the region and is no longer applicable. Once the site has been rough graded in general accordance with the recommendations presented here and in future applicable reports, potential for earthquake-induced landslide at the site is considered very low.

2.6 Seismic Design Criteria

The site seismic characteristics were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2016 CBC. Representative site coordinates of latitude 33.6616 degrees north and longitude -117.6375 degrees west were utilized in our analyses. Please note that these coordinates are considered representative of the site for preliminary planning purposes, however their applicability must be verified with respect to a desired specific location within the site. The maximum considered earthquake (MCE) spectral response accelerations (S_{MS} and S_{M1}) and adjusted design spectral response acceleration parameters (S_{DS} and S_{D1}) for Site Class D are provided in Table 1 on the following page.

TABLE 1

Seismic Design Parameters

Selected Parameters from 2016 CBC, Section 1613 - Earthquake Loads	**Seismic Design Values**
Site Class per Chapter 20 of ASCE 7	D
Risk-Targeted Spectral Acceleration for Short Periods (S_S)*	1.450g
Risk-Targeted Spectral Accelerations for 1-Second Periods (S_1)*	0.539g
Site Coefficient F_a per Table 1613.3.3(1)	1.0
Site Coefficient F_v per Table 1613.3.3(2)	1.5
Site Modified Spectral Acceleration for Short Periods (S_{MS}) for Site Class D [Note: $S_{MS} = F_aS_S$]	1.450g
Site Modified Spectral Acceleration for 1-Second Periods (S_{M1}) for Site Class D [Note: $S_{M1} = F_vS_1$]	0.809g
Design Spectral Acceleration for Short Periods (S_{DS}) for Site Class D [Note: $S_{DS} = (^2/_3)S_{MS}$]	0.966g
Design Spectral Acceleration for 1-Second Periods (S_{D1}) for Site Class D [Note: $S_{D1} = (^2/_3)S_{M1}$]	0.539g
Mapped Risk Coefficient at 0.2 sec Spectral Response Period, C_{RS} (per ASCE 7)	1.028
Mapped Risk Coefficient at 1 sec Spectral Response Period, C_{R1} (per ASCE 7)	1.058
PGA_M (Section 11.8.3 of ASCE 7)	0.526g

* From SEAOC, 2019

A deaggregation of the PGA based on a 2,475-year average return period indicates that an earthquake magnitude of 6.7 at a distance of approximately 17.4 km from the site would contribute the most to this ground motion. A deaggregation of the PGA based on a 475-year average return period indicates that an earthquake magnitude of 6.7 at a distance of approximately 23.5 km from the site would contribute the most to this ground motion (USGS, 2008).

2.7 Soil Shear Strength Parameters

The soil shear strength parameters utilized in our slope stability analysis are based on laboratory testing of the onsite materials, previous site shear strength parameters and published shear strength data (CDMG, 2000). The soil shear strength for along clay bedding is based on the results of a fully-softened residual torsional ring shear test from clay materials obtained during downhole logging from our recent field evaluation. Where applicable, soil shear strength parameters were increased (less than composite peak strength values) for seismic loading conditions. Laboratory test results are provided in Appendix C.

TABLE 2

Soil Shear Strength Parameters for Static Slope Stability Analysis

Soil Type	ϕ (Degrees)	Cohesion (psf)
Tps – Cross Bedding	30	300
Tps - Along Clay Beds	15	0
Compacted Fill	30	300
Landslide Material	26	300
Landslide Rupture Surface	12	100
Landslide Backscarp	18	150
Alluvium	27	100

2.8 Slope Stability Analyses

Slope stability analyses were performed on cross-sections positioned throughout the site based on the proposed design profile. Slope stability analysis was performed using the computer program GSTABL7 with STEDwin version 2.005.3 (Gregory Geotechnical Software, 2013). Potential rotational and block surfaces were analyzed using Bishop's Modified Method and Janbu's Simplified Method, respectively. A minimum factor of safety of 1.5 is typically required for static loading conditions. Seismic slope stability analysis was performed in accordance with the City of Mission Viejo Grading Manual (2010). Where applicable, the Grading Manual requires a horizontal seismic coefficient (Kh) of 0.15 with a minimum resulting factor of safety of 1.1. Since the landslide rupture plane is less than 12 degrees from the horizontal, pseudostatic (seismic) slope stability was not performed for the onsite landslides in accordance with City of Mission Viejo Grading Manual.

Based on the proposed grading plan, slope stability analysis indicates a global factor of safety greater than 1.5 and 1.1 for static and pseudo-static (seismic) loading conditions, respectively. Slope stability analysis is provided in Appendix D.

Additional slope stability analysis may need to be performed once the 40-scale rough grading plans have been prepared and more specific details are available regarding finalized slopes and MSE wall configurations, etc. This additional analysis may include additional cross-sections for confirmation of localized stabilization recommendations.

2.9 Temporary Stability

Temporary stability of proposed backcut slopes during remedial grading will require additional analysis, monitoring and potential grading sequence recommendations to ensure protection of existing improvements along the southern portion of the site. Monitoring is recommended to include regular inclinometer readings and field mapping/observations of slopes by the geologist. Proposed inclinometer locations are depicted on the Geotechnical Map

(Sheet 1). Grading sequence recommendations include the “sliding keyway” method of construction where a maximum keyway length (section) is determined and excavation is sequenced to maintain temporary stability. Appropriate maximum section sizes for keyways should be determined as part of a future grading plan review for site development.

2.10 ***Rippability and Oversize Material***

Based on observations during our subsurface investigation and experience at nearby sites in similar materials, we anticipate the native soils will be rippable with conventional earth-moving equipment in good condition. However, it should be noted that locally cemented beds or concretion nodules may be encountered that do not break down and must be handled as “oversize” material during fill placement.

2.11 ***Expansion Potential***

Based on the results of laboratory testing, site soils have a “High” expansion potential. Final expansion potential of site soils should be determined at the completion of grading. Results of expansion testing at finish grades will be utilized to confirm final foundation design.

2.12 ***Soil Corrosivity***

Preliminary corrosion testing indicated soluble sulfate contents of approximately 0.042 and 0.03 percent, chloride contents of 380 and 780 parts per million (ppm), pH values of 7.4 and 6.8, and minimum resistivity values of 365 and 279 ohm-cm. Based on Caltrans Corrosion Guidelines, soils are considered corrosive to structural elements if the pH is 5.5 or less, or the chloride concentration is 500 ppm or greater, or the sulfate concentration is 2,000 ppm (0.2 percent) or greater (Caltrans, 2015).

Based on preliminary laboratory sulfate test results, the near surface soils are designated to a class “S0” per ACI 318, Table 19.3.1.1 with respect to sulfates. Concrete in direct contact with the onsite soils can be designed according to ACI 318, Table 19.3.2.1 using the “S0” sulfate classification.

2.13 ***Settlement Monitoring***

Fill soils are subject to post-grading settlement. This even occurs to properly compacted fill soils with proper remedial grading. In general, total fill depths greater than approximately 40 feet require surface settlement monitoring be performed after grading is completed to ensure long-term fill settlement is within tolerable limits. Based on the current design, it appears that selected areas will exceed 40 feet in thickness of artificial fill and therefore should be monitored for settlement prior to releasing the area for construction of settlement sensitive improvements.

2.14 ***Infiltration Potential***

Based on our site evaluation and subsurface investigation, the majority of site soils (i.e., bedrock, fill and alluvium) are predominately fine-grained silts and clays that are known to have a very low hydraulic conductivity and therefore have very low infiltration rates. Based on one infiltration test, the on-site alluvium has a very low infiltration rate (Refer to Appendix B for infiltration data summary); however, that alluvium will be removed with remedial grading and the remaining soils are not feasible for infiltration as summarized below.

At the completion of grading, in general the proposed development will consist of compacted fill over bedrock. Engineered fill is considered unacceptable for infiltration in accordance with the Orange County Technical Guidance Document (County of Orange, 2017; "Section 4.2.2.4 Geotechnical Criteria"). By definition, on-site bedrock materials do not readily transmit water, and landslide materials tend to only transmit limited water via fracture permeability due to their density and fine-grained composition.

Purposeful infiltration of water to the subsurface at the subject site is neither possible nor acceptable from a geotechnical standpoint given the onsite materials and the hillside nature of the site.

3.0 <u>CONCLUSIONS</u>

Based on the results of our subsurface evaluation and geotechnical review of the proposed plan, it is our opinion that the proposed improvements are feasible from a geotechnical standpoint, provided that the recommendations provided here and in future reports (40 scale grading plan review, etc.) are incorporated during site grading and development. A summary of our geotechnical conclusions are as follows:

- The bedrock geologic unit mapped on the site is the Tertiary Puente Formation. Two landslides derived from site bedrock materials were identified in the central and northern portions of the site. Artificial fill was placed on the west-facing slope at the southwest portion of the site, during previous rough grading on the site.
- Anticipated earthwork at the site will consist of rough grading including design cuts and fills, excavation of buttress keyways for design slopes, remedial grading of potentially compressible soils and landslide materials, installation of subdrains for keyways and slope backcuts, and construction of Mechanically Stabilized Earth (MSE) Walls.
- Groundwater was not encountered the maximum explored depth of approximately 62 below existing grade.
- Construction sequencing of earthwork operations will be required during rough grading, in order to reduce the risk of temporary instability. Methods including construction of a "sliding keyway" should be analyzed to determine a maximum length of keyway (section size) that may be constructed.
- Monitoring of inclinometers at selected locations is recommended during future rough grading activities to ensure protection of existing improvements such as offsite slopes, the Edison tower and power poles, and communication utilities.
- Based on our review of the State of California Seismic Hazard Zones, a small portion of the site is located within a zone having a potential for earthquake induced landslide. This potential will be mitigated with design cut and fill grading and remedial grading measures presented herein.
- Based on our review of the State of California Seismic Hazard Zones, the site is not located within a zone having a potential for liquefaction. Based on the proposed plans and remedial grading, the site will consist of compacted fill over dense/hard native materials Therefore, the potential for post construction liquefaction and liquefaction-induced dynamic settlement is considered negligible.
- Active or potentially active faults are not known to exist on or in the immediate vicinity of the site. The subject site will likely experience strong seismic ground shaking during its design life.
- Based on the results of our evaluation, it is anticipated that the onsite materials may be excavated with conventional heavy-duty construction equipment in good working condition.
- From a geotechnical perspective, the existing onsite soils (including older fill, alluvium and landslide) are suitable material for use as general fill, provided that they are relatively free from rocks (larger than 8 inches in maximum dimension), construction debris, and significant organic material.
- Existing onsite soils contain clayey materials with high fines content and expansion potential that are <u>not</u> suitable for use in Mechanically Stabilized Earth (MSE) retaining wall backfill, or conventional retaining wall backfill. Therefore, import of sandy soils meeting project recommendations will be required for retaining wall backfill.
- Global slope stability analysis indicates that two large buttress keyways are necessary in order to provide a static factor of safety of 1.5. Design slopes are anticipated to be grossly stable as designed,

as long as they are constructed in accordance with these recommendations and future applicable geotechnical recommendations, California Building Code, and City of Mission Viejo requirements, and are properly landscaped and maintained. Design cut slopes should be provided with buttress/stability fills to reduce the potential for block and surficial failures and to facilitate planting.

- Fill slopes are anticipated to be both grossly and surficially stable, as long as they are constructed in accordance with these recommendations and future, applicable, geotechnical recommendations, and they are properly landscaped and maintained.
- Existing native slopes surrounding the development are anticipated to perform as they have in the past, therefore minor surficial failures may occur.
- Based on preliminary laboratory test results, the onsite soils are anticipated to generally have “High” expansion potential. Final design expansion potential must be determined at the completion of grading. Mitigation measures are required for planned foundations and site improvements such as concrete flatwork to minimize the impacts of expansive soils. In addition, improvements located adjacent to tops of slopes will be impacted by slope creep.
- Based on laboratory test results (chlorides), site soils are considered “corrosive” according to Caltrans guidelines (Caltrans, 2015).
- Based on preliminary sulfate test results, the near-surface soils are designated as class “S0” with respect to sulfates.
- The main seismic hazard that may affect the site is from ground shaking from one of the active regional faults. The subject site will likely experience strong seismic ground shaking during its design life.
- Based on the results of our evaluation and analysis provided herein, and provided our recommendations and future geotechnical recommendations are properly implemented during construction, the proposed development of the site is not anticipated to significantly impact adjacent perimeter properties.
- Design fill slopes are anticipated to be both grossly and surficially stable, as long as they are constructed in accordance with our geotechnical recommendations and are properly landscaped and maintained throughout their design life.
- Existing native slopes surrounding the development are anticipated to be grossly stable; however, minor surficial failures may occur.
- From a geotechnical perspective, the existing onsite soils including existing fill are considered suitable material for use as general fill (with the exception of MSE wall backfill and conventional retaining wall backfill), provided that they are relatively free from rocks (larger than 8 inches in maximum dimension) and significant organic material. Moisture conditioning will be required to obtain the required compaction. Import of soils suitable for backfill of MSE and conventional retaining walls will also likely be required.
- Site soils (i.e., bedrock, fill and alluvium) are predominately fine-grained silts and clays which have very low permeability and therefore have very low infiltration rates. At the completion of grading, the proposed development will consist of compacted fill over bedrock and therefore purposeful infiltration of water is not possible nor recommended from a geotechnical standpoint.

4.0 PRELIMINARY RECOMMENDATIONS

A grading plan review report based on the 40-scale rough grading plans should be prepared in order to provide updated geotechnical recommendations (as necessary) for the proposed development. Additional field work and laboratory testing may be required. Additional and/or modified geotechnical recommendations may also be required.

Based on our preliminary study, the following is a summary of our preliminary geotechnical recommendations.

- Remedial grading is recommended to include removal and recompactions of unsuitable soils including landslide materials, alluvium/colluvium, and highly weathered native soils, from areas within influence of the proposed development.
- Based on our analysis, buttress keyways are required to provide adequate global factor of safety. Locations of recommended buttress keyways are shown on the Geotechnical Map, Sheet 1. Construction sequencing of earthwork operations will be required during rough grading, in order to reduce the risk of temporary instability. Methods including construction of a "sliding keyway" should be analyzed to determine the length of keyway sections that may be constructed, particularly along the rear perimeter slope.
- Temporary backcuts during grading should be constructed at a maximum slope ratio of 1.5:1 (horizontal: vertical). Temporary keyway sidecuts may be excavated at a ratio of 1:1.
- Temporary backcuts should be mapped by a geologist and monitored for stability during excavation of keyways, using frequent visual observation and monitoring of slope inclinometers.
- Design cut lots, or lots with less than 5 feet of design fill that are not undercut by remedial grading, should be overexcavated a minimum of 5 feet below respective pad grades.
- MSE walls and conventional retaining walls should be backfilled with relatively sandy soils. Onsite soils are too fine-grained and therefore are not suitable for MSE and conventional retaining wall backfill. Therefore, we anticipate that import of sandy soils meeting project recommendations will be required. Sandy soils should comprise the geogrid zone required for local stability as determined by the MSE wall designer. For conventional retaining walls, the sandy import zone should be a minimum of one-half the height of the retaining wall.
- Allowance in the earthwork volumes budget should be made for an estimated 5 to 10 percent reduction in volume of existing soils. It should be stressed that these values are only estimates and that an actual shrinkage factor would be extremely difficult to predetermine. Subsidence due to earthwork activities is expected to be on the order of 0.1 feet. This value is an estimate only and excludes losses due to removal of vegetation or debris. The effective shrinkage of onsite soils will depend primarily on the type of compaction equipment and method of compaction used onsite by the contractor, and the accuracy of the topographic survey.
- Due to onsite expansive soils, mitigation measures such as stiffened and/or post-tensioned slab foundations are recommended. Pre-soaking of the subgrade soils will be required to reduce the potential impact of expansive soils. Recommendations for foundation design should be provided at the 40-scale plan review design level.
- At completion of grading, additional testing will be required to confirm the characteristics of the fill materials including expansion potential and corrosivity characteristics. While LGC Geotechnical

does not provide recommendations for corrosion, based on our experience typical mitigation measures include increased compressive strength for structural concrete, decreased water-to-cement ratio for structural concrete and/or encapsulation of post-tensioned cables. A corrosion consultant should provide recommendations for mitigation of corrosivity based on laboratory testing results of near-surface soils at completion of grading.

- Due to site soils being predominately compacted fill and bedrock consisting of fine-grained soil interbeds (silts and clays), and the hillside nature of the site, the intentional infiltration of storm water is not recommended.
- After completion of site rough grading, graded slopes, existing perimeter landscaped slopes, subdrain outlets, etc., will require regular maintenance in accordance with this and future geotechnical grading plan review reports.

5.0 LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

This report is based on data obtained from limited observations of the site, which have been extrapolated to characterize the site. While the scope of services performed is considered suitable to adequately characterize the site geotechnical conditions relative to the proposed development, no practical evaluation can completely eliminate uncertainty regarding the anticipated geotechnical conditions in connection with a subject site. Variations may exist and conditions not observed or described in this report may be encountered during grading and construction.

The findings of this report are valid as of the present date. However, changes in the conditions of a site can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. The findings and conclusions presented in this report can be relied upon only if LGC Geotechnical has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site. This report is intended exclusively for use by the client, any use of or reliance on this report by a third party shall be at such party's sole risk.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification.

Appendix A
References

APPENDIX A

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Appendix B
Logs of Exploratory Borings

Geotechnical Boring Log BA-1

Date : 3/26/2019	Page 1 of 2	**Drilling Company :**	Alroy Drilling
Project Name :	El Toro 5	**Type of Rig :**	Earthdrill Bucket Auger
Project Number :	18184-01	**Drop :** 12"	**Hole Diameter :** 26"
Elevation of Top of Hole :	~ 898 ' MSL	**Drive Weight :**	0' to 24' - 2400lbs, 25' to 44'- 1550lbs, 45' to 62' - 850lbs
Hole Location :	See Geotechnical Map		

Logged by ARN/KTM

Sampled by ARN/KTM

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0								**0' to 28' - <u>Quaternary Landslide Deposits (Qls):</u>** Variable, disturbed; internal shears and jumbled bedding. @0' - Sandy CLAY and SILT: dark brown, moist, stiff; topsoil rootlets.	EI CR MD
				B-1		105.5	8.5	CL		
815										
	5								@5' - Base of surficial debris flow defined by internal shearing above contact with lanslide block. Clayey to Silty SANDSTONE and SILTSTONE: light gray to light yellowish brown, slightly moist to moist; offset beds in a clayey, sheared matrix.	
810										
	10			R-1	5 6	87.3	30.9	ML	@10' - Silty SANDSTONE and Sandy SILTSTONE interbeds: light gray to light brown, slightly moist, very stiff; rootlets to 10'.	
			GB: N40E, 30SE						@13' - General bedding attitude on buff SANDSTONE interbed; ~4 inches thick; cemented; fractured and slightly offset. @14' - Grades to well-bedded silty CLAY and Sandy SILTSTONE: moist, very stiff; highly fractured; gypsum stringers.	
805										
	15		B:N60W, 23SW						@15' - Bedding attitude on Silty SAND interbed.	
800										
	20		GB: N75E, 25SE	R-2	3 4	86.1	25.5	ML	@20' - General bedding attitude on 2-inch thick volcanic Ash Bed; very fine SAND: light orange to off white, dry, stiff; slightly offset.	
795										
	25									
			RS: N25E, 8NW Striations N50W	GB-1					@28' - Attitude on rupture surface: ~$\frac{1}{8}$-inch thick; greenish gray; basal striations; variable ~2-inch zone. **28' to T.D. - <u>Tertiary Puente Formation (Tp):</u>** @28' - Interbedded SILTSTONE and SANDSTONE: light brown to light gray, slightly moist, hard; consistent bedding; iron oxide stained beds; some jarosite and gypsum filled joints.	
790										AL

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:
- B BULK SAMPLE
- R RING SAMPLE
- G GRAB SAMPLE

TEST TYPES:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- SA SIEVE ANALYSIS
- S&H SIEVE AND HYDROMETER
- EI EXPANSION INDEX
- CN CONSOLIDATION
- CR CORROSION
- AL ATTERBERG LIMITS
- CO COLLAPSE/SWELL
- RV R-VALUE

Geotechnical Boring Log BA-1

Date : 3/26/2019	Page 2 of 2	**Drilling Company :**	Alroy Drilling
Project Name :	El Toro 5	**Type of Rig :**	Earthdrill Bucket Auger
Project Number :	18184-01	**Drop :** 12"	**Hole Diameter :** 26"
Elevation of Top of Hole :	~ 898 ' MSL	**Drive Weight :**	0' to 24' - 2400lbs, 25' to 44'- 1550lbs, 45' to 62' - 850lbs
Hole Location :	See Geotechnical Map		

Logged by ARN/KTM

Sampled by ARN/KTM

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	30		B: N18E, 7NW	R-3	4 25	100	23.3	ML	@30' - Attitude on Sandy SILTSTONE: light to medium gray, slightly moist, hard.	
			B: N20W 7SW						@31' - Cemented SANDSTONE; gypsum and iron oxide along bedding; ~4 inches thick.	
									@32' - Attitude on contact of SANDSTONE and unoxidized SILTSTONE.	
785										
	35									
			CB: N-S, 7W						@36.5' - Attitude on razor thin CLAY Bed: black; slightly polished base with gypsum and iron oxide staining; fresh unoxidized siltstone below.	
780										
	40			R-4	20 10/2"	98.3	20.1	CL-ML	@40' - Sandy SILTSTONE: medium to dark gray, dry, hard; abundant foraminifera; micaceous; shallow dipping beds.	DS
									@41.5' - Clayey SILTSTONE: three blue-black interbedded CLAY beds; ~1/8-inch each. End of visual log.	
									@44' Refusal on concretion.	
775										
	45								**Total Depth = 44'** **No Ground Water Encountered** **Backfilled with Cuttings on 3/26/2019**	
770										
	50									
765										
	55									
760										

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Geotechnical Boring Log BA-2

Date : 3/27/2019 Page 1 of 3	**Drilling Company :** Alroy Drilling
Project Name : El Toro 5	**Type of Rig :** Earthdrill Bucket Auger
Project Number : 18184-01	**Drop :** 12" **Hole Diameter :** 26"
Elevation of Top of Hole : ~ 966 ' MSL	**Drive Weight :** 0' to 24' - 2400lbs, 25' to 44'- 1550lbs, 45' to 62' - 850lbs
Hole Location : See Geotechnical Map	

Logged by ARN/KTM

Sampled by ARN/KTM

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0								**0' to T.D. - <u>Tertiary Puente Formation (Tp):</u>** @0' - Colluvium, Sandy CLAY and SILT: dark brown, moist, stiff; clasts of topsoil; abundant rootlets.	
865										
	5								@5' - SILTSTONE and SANDSTONE: light brown to light gray, slightly moist, hard; consistent bedding; iron oxide and jarosite stained beds; gypsum filled clay seams and joints.	
860									@7' - Increased hardness.	
			GB: N20W, 5W						@9' - General bedding attitude, slightly offset violet Ash Bed, 2 inches thick.	
	10			R-1	3 7	86	22.7	ML	@10' - Sandy SILTSTONE to Sandy SILTSTONE: light yellowish brown, slightly moist, dense; moderately cemented; fine sand.	
			B: N37W, 10SW						@11' - Attitude on SANDSTONE Bed.	
855			CB: N60W, 12SW						@12' - CLAY Bed attitude; very thin clay truncates fractures; increased competence below.	
	15									
850			GB: N25W, 12SW						@17.5' - General bedding attitude on SANDSTONE; jarosite and iron oxide staining. Decreased soft-sediment deformation below.	
	20			R-2	10/8"	82	37.1	ML	@20' - SILTSTONE and SANDSTONE interbeds: light gray and light brown, slightly moist, very dense; subhorizontal bedding; fissile.	
			GB: N38W, 12SW						@21' - General bedding attitude on concretion; ~6 inches thick.	
845			CB: N24W, 10SW	GB-1					@22.5' - Attitude on CLAY Bed; bluish gray; lacks internal shear; ~1/4-inch thick.	
	25									
840										
			B: N36W, 11SW						@28' - Bedding attitude, SILT lens with gypsum.	
	30		B: N50E, 10NW						@30' - Bedding attitude on Ash Bed; Sandy SILT: off white, dry, stiff; continuous and undisrupted around boring; ~2 inches thick.	

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SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

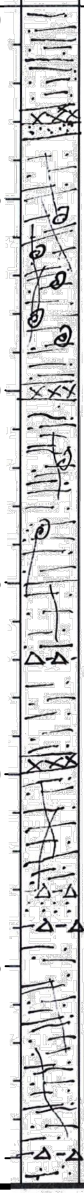
DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Geotechnical Boring Log BA-2

Date : 3/27/2019	Page 2 of 3	**Drilling Company :**	Alroy Drilling
Project Name :	El Toro 5	**Type of Rig :**	Earthdrill Bucket Auger
Project Number :	18184-01	**Drop :** 12"	**Hole Diameter :** 26"
Elevation of Top of Hole :	~ 966 ' MSL	**Drive Weight :**	0' to 24' - 2400lbs, 25' to 44'- 1550lbs, 45' to 62' - 850lbs
Hole Location :	See Geotechnical Map		

Logged by ARN/KTM

Sampled by ARN/KTM



Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	30			R-3	19/12"	91.9	27.2	CL-ML	@30' - Sandy SILT: light gray and light brown, moist, very stiff; well-bedded; few joints.	DS
835										
									@33' - Partially concreted silty SANDSTONE over 3-inch sand bed.	
									@34' - SILTSTONE concretion; off-white.	
	35								@35' - SILTSTONE with abundant foraminifera; scattered sand lenses.	
830										
	40			R-4	30/10"	97.5	26.2	CL-ML	@40' - Clayey SILTSTONE: brown and dark gray, moist, hard; unoxidized. Concretion 4 inches thick; continuous.	DS
825										
									@43' - SILTSTONE: dark gray; gypsum.	
	45									
820			CB: N12W, 5SW						@47' - Attitude on CLAY Bed: dark green, moist; very thin; fresh bedrock below.	
									@49' - SILTSTONE concretion; ~4 inches thick, continuous.	
	50			R-5	50/8"	99.9	21.3	ML	@50' - SILTSTONE: dark gray, moist, very hard.	
815										
									@53' - CLAY Bed: dark gray; $\sim\frac{1}{16}$-inch thick.	
			CB: N29W, 5-9 SW						@53.5' - SAND Bed: light purplish brown; fine-grained; ~6 inches thick; Possible Ash Bed.	
	55								@54' - Attitude on CLAY Bed: dark gray; $\sim\frac{1}{2}$-inch thick; faint s-shears within bed. Below is massive clayey siltstone.	
810										
			B: N42W, 9SW CB: N41W, 8SW	GB-2					@60' - Attitude on SILTSTONE: blue gray, moist, soft to slightly stiff; Attitude on $\sim\frac{1}{2}$-inch thick clay bed just below. Approximately 8-inch zone of interbedded sandstone, siltstone and clay beds, abundant soft sediment deformation. Possible flexural slip shearing. End of visual log.	AL TS

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SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
TS	TORSIONAL SHEAR

Geotechnical Boring Log BA-2

Date : 3/27/2019		**Drilling Company :** Alroy Drilling
Project Name : El Toro 5		**Type of Rig :** Earthdrill Bucket Auger
Project Number : 18184-01		**Drop :** 12" **Hole Diameter :** 26"
Elevation of Top of Hole : ~ 966 ' MSL		**Drive Weight :** 0' to 24' - 2400lbs, 25' to 44'- 1550lbs, 45' to 62' - 850lbs
Hole Location : See Geotechnical Map		

Logged by ARN/KTM

Sampled by ARN/KTM

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	60			R-6 GB-3	50/8"	108.2	14.6	ML	@61' - SILTSTONE: dark gray, moist, very hard; abundant foraminifera; massive; fresh; unoxidized.	
805									**Total Depth = 62'** **No Ground Water Encountered** **Backfilled with Cuttings on 3/27/2019**	
	65									
800										
	70									
795										
	75									
790										
	80									
785										
	85									
780										

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Geotechnical Boring Log BA-3

Date : 3/28/2019		**Drilling Company :**	Alroy Drilling
Project Name :	El Toro 5	**Type of Rig :**	Earthdrill Bucket Auger
Project Number :	18184-01	**Drop :** 12"	**Hole Diameter :** 26"
Elevation of Top of Hole :	~ 952 ' MSL	**Drive Weight :**	0' to 24' - 2400lbs, 25' to 44'- 1550lbs, 45' to 62' - 850lbs
Hole Location :	See Geotechnical Map		

Logged by ARN/KTM

Sampled by ARN

Elevation (ft)	Depth (ft)	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0							**0' to 18.5' - <u>Quaternary Landslide Deposits (Qls):</u>** Clayey to Silty SANDSTONE and SILTSTONE: light gray to light brown, slightly moist to moist, hard. Contains signs of internal shear and blocky, rotated beds with some voids. @0' - Sandy SILT: blackish brown, moist, medium stiff; thin scattered rootlets.	
850	5							@3.5' - Transition to light brown material; sandier than above; some gray and yellow mottle.	
			B-1		97	23.5	SC		EI CR MD
		GB: N70E, 20SE						@8' - General bedding attitude on Ash Bed; Silty SAND: white, dry, medium dense; ~2 inches thick.	
845	10	B: N85W, 27NE	R-1	4 5	92.5	20.3	CL-ML	@10' - Attitude on Sandy SILTSTONE: white, slightly moist to dry, hard; iron oxide staining; slightly friable.	DS
840	15	B: N56E, 47NW						@15' - Attitude on SILTSTONE; thin laminated beds interupted with abundant fractures and voids.	
		RS: N11W, 12SW						@18.5' - Rupture surface attitude; very thin clay overlying concretion. **18.5' to T.D. - <u>Tertiary Puente Formation - (Tp)</u>** @18.5' - Interbedded SILTSTONE and SANDSTONE: light brown to light gray, slightly moist, hard; consistent bedding; iron oxide and jarosite stained beds.	
835	20	CB: N25W, 18SW	R-2	6 5/3"	106.9	17.7	SM	@18.5' - Concretion Bed; ~6 inches thick. @20' - Silty SANDSTONE and Sandy SILTSTONE: tan to light brown, dense, dry; iron oxide staining; gypsum filled joints. @20.5' - Concretion layer. @21' - Attitude on CLAY Bed; greenish gray; gypsum lined; ~1/4-inch thick.	
830	25								
								@29' - Heavy bioturbation.	

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Geotechnical Boring Log BA-3

Date : 3/28/2019		**Drilling Company :**	Alroy Drilling
Project Name :	El Toro 5	**Type of Rig :**	Earthdrill Bucket Auger
Project Number :	18184-01	**Drop :** 12"	**Hole Diameter :** 26"
Elevation of Top of Hole :	~ 952 ' MSL	**Drive Weight :**	0' to 24' - 2400lbs, 25' to 44'- 1550lbs, 45' to 62' - 850lbs
Hole Location :	See Geotechnical Map		

Logged by ARN/KTM

Sampled by ARN

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	30			R-3	18 13/3"	113.7	17	ML	@30' - Silty SANDSTONE to Sandy SILTSTONE: medium to dark gray, slightly moist, dense/hard. Gradual change to unoxidized with depth.	
			GB: N15W, 16SW						@32.5' - General Bedding on Volcanic Ash Bed; fine SAND: dry, dense; ~2-3 inches thick.	
825	35									
									@38' - SANDSTONE: light gray, slightly moist, dense; some manganeese nodules; iron oxide and gypsum lined lower contact with unoxidized siltstone.	
820	40		CB: N25W, 13SW	R-4 GB-1	10/1"	115.4	15	ML	@40 - Sandy SILTSTONE: light gray grading to dark gray, slightly moist, hard. Attitude on CLAY Bed, ~$\frac{1}{16}$-inch thick, at base of sandstone.	
815	45								@45' - Silty CLAY: blue-ish gray; ~2 inch thick zone with polished clay at base, $\frac{1}{16}$-inch thick.	
			CB: N15W, 15SW						@48' - Attitude on Clay Bed, ~1/8-inch thick, blue-ish gray, some gypsum, another thin Clay Bed, 6 inches below.	
810	50			R-5	50/4"	103.5	14.6	CL-ML	@50' - Sandy SILTSTONE: dark gray, slightly moist, very hard; abundant foraminifera; massive to poorly bedded; slightly friable.	DS
									@52.5' - CLAY Bed; gypsum lined; ~1/8 inch thick. @54' - Clayey parting. @55' - Light gray SAND Bed; 3 inches thick.	
805	55									
									@59' - End visual log.	

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Geotechnical Boring Log BA-3

Date : 3/28/2019	Page 3 of 3	**Drilling Company :**	Alroy Drilling
Project Name :	El Toro 5	**Type of Rig :**	Earthdrill Bucket Auger
Project Number :	18184-01	**Drop :** 12"	**Hole Diameter :** 26"
Elevation of Top of Hole :	~ 952 ' MSL	**Drive Weight :**	0' to 24' - 2400lbs, 25' to 44'- 1550lbs, 45' to 62' - 850lbs
Hole Location :	See Geotechnical Map		

Logged by ARN/KTM

Sampled by ARN/KTM

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	60			R-6	50/6"	108.2	14.6	ML	@60' - Sandy SILTSTONE and Silty SANDSTONE: dark gray, slightly moist, very hard; some gypsum lined joints	
									Total Depth = 62' **No Ground Water Encountered** **Backfilled with Cuttings on 3/28/2019**	
800	65									
795	70									
790	75									
785	80									
780	85									

Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

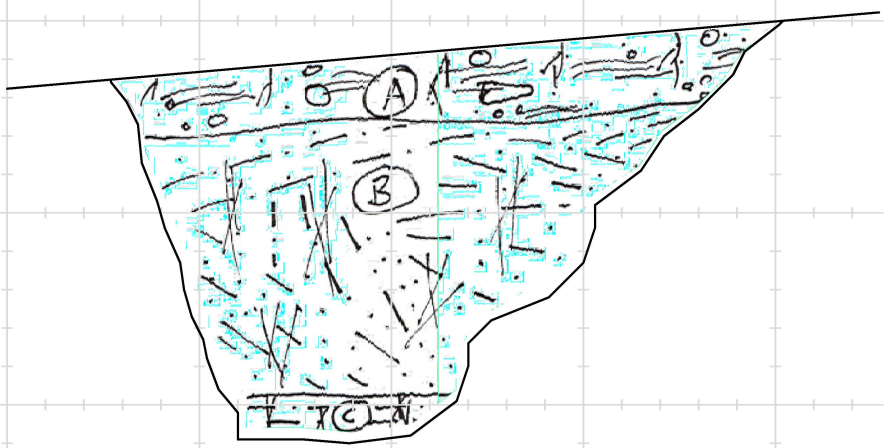
DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Project Name: El Toro 5	Logged By: ARN	Trench No: TP-1
Project Number : 18184-01	Date : 3/26/2019	Engineering Properties:
Equipment: Cat 420F excavator	Location: See Geotechnical Map	

LGC Geotechnical, Inc.

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	a	***Quaternary Colluvium (Qcol)*** @0' to 2' Sandy CLAY: dark brown, moist, medium stiff; some vegetation; roots; bedrock derived, gravel-sized clasts	Qcol	CL			
	b	***Quaternary Landslide Deposits (Qls)*** @2' to 10' Silty SAND to Sandy SILT: brown and yellow brown, moist, stiff/medium dense; generally poorly cemented clasts in a deformed silty sand and sandy silt matrix	Qls	SM-ML			
	c	***Tertiary Puente Formation (Tp)*** @10' to T.D. Sandy SILTSTONE: light gray, slightly moist, hard; faint bedding; iron oxide staining	Tp	ML			

GRAPHICAL REPRESENTATION BELOW: **Elevation : 890' MSL** **Surface Slope: 5 deg.** **Trend: N55W**



Total Depth: 11'
Groundwater: None
Backfilled: 3/26/2019

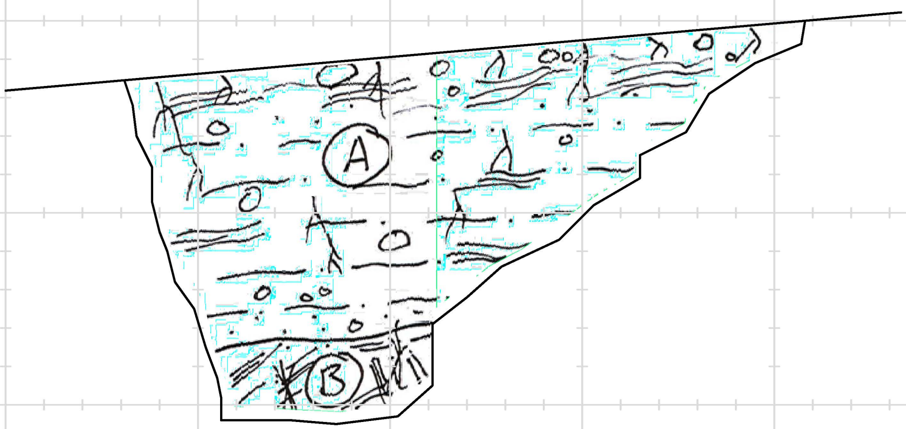
scale : 1 in = 5 ft

Last Edited: 6/5/2019

Project Name: El Toro 5	Logged By: ARN	Trench No: TP-2	LGC Geotechnical, Inc.
Project Number : 18184-01	Date : 3/26/2019	Engineering Properties:	
Equipment: Cat 420F excavator	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	a	***Quaternary Colluvium and Alluvium (Qcol/Qal)*** **@0 to 8' Sandy CLAY and SILT: brownish black and light brown mottled, moist, stiff; scattered platy bedrock derived clasts; minor iron oxide staining**	Qcol/Qal	CL-ML			
	b	***Quaternary Landslide Deposits (Qls)*** **@ 8' to T.D. Sandy CLAY to CLAYSTONE: medium brown, moist, stiff; pervasive white mineralization; extremely weathered** **@10' harder material**	Qls	CL			

GRAPHICAL REPRESENTATION BELOW: **Elevation : 877' MSL** **Surface Slope: 5 deg.** **Trend: N50W**



Total Depth: 10.5'
Groundwater: None
Backfilled: 3/26/2019

scale : 1 in = 5 ft

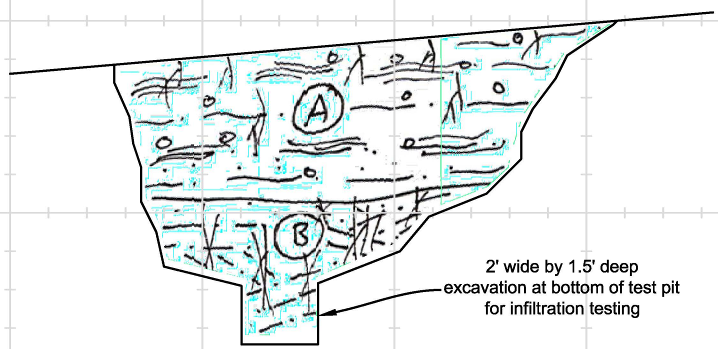
Last Edited: 6/5/2019

Project Name: El Toro 5	Logged By: ARN	Trench No: TP-3
Project Number : 18184-01	Date : 3/26/2019	Engineering Properties:
Equipment: Cat 420F excavator	Location: See Geotechnical Map	

LGC Geotechnical, Inc.

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	a	***Quaternary Colluvium and Alluvium (Qcol/Qal)*** @0 to 4' Sandy CLAY to Sandy SILT: brownish black and brown, moist, stiff; scattered rootlets; some gravel	Qcol/Qal	CL-ML			
	b	**Quaternary Landslide Deposits (Qls)** @4' to T.D. Sandy SILTSTONE and Silty SANDSTONE: medium brown, slightly moist, dense/hard; distinct and consistent bedding; heavily weathered bedrock; some voids	Qls	ML-SM			

GRAPHICAL REPRESENTATION BELOW: **Elevation : 869' MSL** **Surface Slope: 5 deg.** **Trend: N45E**



Total Depth: 8.5'
Groundwater: None
Backfilled: 3/26/2019

scale : 1 in = 5 ft

Last Edited: 6/5/2019

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite 200, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: El Toro 5
Project Number: 18184-01
Date: 3/27/2019
Boring Number: I-1, Test 1

Test hole dimensions (if circular)

Boring Depth (feet)*:	1.5
Boring Diameter (inches):	24

*measured at time of test

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Measured Infiltration Rate (in/hr)
1	8:46	8:56	10.0	1.042	1.167	0.125	5.0
2	8:56	9:06	10.0	0.99	1.04	0.052	1.9
3	9:06	9:16	10.0	0.92	0.99	0.073	2.5
4	9:16	9:26	10.0	0.87	0.92	0.047	1.5
5	9:26	9:36	10.0	0.797	0.87	0.073	2.3
6	9:36	9:46	10.0	0.682	0.797	0.115	3.3
7	9:46	9:56	10.0	0.646	0.682	0.036	1.0
8							
9							
10							
11							
12							

Measured Infiltration Rate (No factor of safety)	**1.0**
Feasibility Factor of Safety	**2.0**
Measured Infiltration Rate (With Factor of Safety for Feasibility Only)	**0.5**

Sketch:

Notes:

Refer to text discussion

Spreadsheet Revised on: 7/25/2019

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite 200, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: El Toro 5
Project Number: 18184-01
Date: 3/27/2019
Boring Number: I-1, Test 2

Test hole dimensions (if circular)

Boring Depth (feet)*:	1.5
Boring Diameter (inches):	24

*measured at time of test

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Measured Infiltration Rate (in/hr)
1	9:56	10:06	10.0	1.068	1.172	0.104	4.3
2	10:07	10:17	10.0	1	1.07	0.068	2.5
3	10:18	10:28	10.0	0.93	1	0.073	2.5
4	10:29	10:39	10.0	0.87	0.93	0.057	1.9
5	10:40	10:50	10.0	0.823	0.87	0.047	1.5
6	10:51	11:01	10.0	0.781	0.823	0.042	1.3
7	11:02	11:12	10.0	0.74	0.781	0.041	1.2
8	11:13	11:23	10.0	0.677	0.708	0.031	0.9
9							
10							
11							
12							

Measured Infiltration Rate (No factor of safety)	**0.9**
Feasibility Factor of Safety	**2.0**
Measured Infiltration Rate (With Factor of Safety for Feasibility Only)	**0.4**

Sketch:

Notes:

Refer to text discussion

Spreadsheet Revised on: 7/25/2019

Infiltration Test Data Sheet

LGC Geotechnical, Inc

131 Calle Iglesia Suite 200, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: El Toro 5
Project Number: 18184-01
Date: 3/27/2019
Boring Number: I-1, Test 3

Test hole dimensions (if circular)

Boring Depth (feet)*:	1.5
Boring Diameter (inches):	24

*measured at time of test

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Measured Infiltration Rate (in/hr)
1	11:23	11:33	10.0	1.036	1.125	0.089	3.5
2	11:33	11:43	10.0	0.984	1.04	0.052	1.9
3	11:43	11:53	10.0	0.94	0.984	0.046	1.6
4	11:53	12:03	10.0	0.891	0.94	0.047	1.6
5	12:03	12:13	10.0	0.844	0.891	0.047	1.5
6	12:13	12:23	10.0	0.813	0.844	0.031	1.0
7	12:23	12:33	10.0	0.776	0.813	0.037	1.1
8	12:33	14:03	90.0	0.599	0.776	0.177	0.5
9							
10							
11							
12							

Measured Infiltration Rate (No factor of safety)	**0.5**
Feasibility Factor of Safety	**2.0**
Measured Infiltration Rate (With Factor of Safety for Feasibility Only)	**0.3**

Sketch:

Notes:

Refer to text discussion

Spreadsheet Revised on: 7/25/2019

GEOTECHNICAL BORING LOG

DATE 10/6/92 DRILL HOLE No. IGB-5 SHEET 1 OF 4

PROJECT PA-40 PROJECT No. 1901591-07

DRILLING CO. Contractors Drilling Service TYPE OF RIG Bucket Auger

HOLE DIAMETER 24" DRIVE WEIGHT — DROP — IN.

ELEVATION TOP OF HOLE 884±' REF. OR DATUM See Geotechnical Map

DEPTH FEET	GRAPHIC LOG	ATTITUDES	TUBE SAMPLE No.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION LOGGED BY SW/WG SAMPLED BY —
0		@0.5' B:N15W,11W						Puente Formation, Sycamore(?) Member
								@0' Med grey with FeOx mottling fine sandy siltstone
								@0.5' 2 to 3" thick white sandstone bed; abundant black mafic minerals; basal contact is FeOx stained
								@0.7' Med. brown-grey siltstone; moist, stiff
		@3.0' B:N15W,8SW						@1.0' ¼ to ½" thick olive-green clay, sheared
								@1.5' ¼ to ½" thick med. grey clay, sheared, ⅛" thick sandstone laminae below
								@1.8' discontinuous sandstone lenses, up to 0.3' thick
5								@2.4' Clay seam; polished surface
								@2.9' Sandstone beds within the siltstone to 3.1'
								@4.0' White sandstone, 2" thick
								@4.6' 0.6' thick siliceous layer, hard
		@7.0' J:N85E,vert J:N80W,vert						@6.6' 0.7' thick siliceous layer, hard; gypsum crystals at top
								@7.1' ⅛ to ½" thick clay seam
		@8.4' B:N20E,4W						@8.1' 2" thick sandstone bed with yellowish iron staining
								@9.0' Polished surface; no clay
								@9.5' Unoxidized patches
10								@10.4' Discontinuous sandstone layer; siltstone below this sandstone is bioturbated
								@11.2' Dark grey unoxidized siltstone, moist, very stiff, micaceous, massive
								@14.2' ¼ to 1½" thick lt grey fine sandstone; bottom contact is scoured; some biotite within laminations; siltstone below is mottled red-brown and black, red-brown staining along joints
15								@15.0' Joint, gypsum filled
		@16.5' J:N40E,88SE J:N75W,80W						@17.0' 1 to 1½" thick lt. grey vitric tuff
		@17.0' B:N10E,7W						@17.2' sheared siltstone, locally clayey rich; black unoxidized siltstone, massive
								@17.5' Siliceous siltstone
20								
								@21.7' ¼" thick sheared grey siltstone
								@22.7' ¼" thick sheared grey siltstone
								@23.0' ½" thick white sandstone
								@23.5' ¼" thick sheared grey siltstone
		@23.5' J:N10E,82E J:N50W,vert						@23.6' Sheared siltstone
		@24.6' CS:N55E,10W						@24.6' ¼" clay seam, sheared
25								@25.2' Thin clay seam
								@25.5' Thin clay seam
								@26.0 Siliceous layer
								@27.0' Frequent clay seams to 29.0', thin
30								

505A(11/77)

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GEOTECHNICAL BORING LOG

DATE 10/6/91　　DRILL HOLE NO. IGB-5　　SHEET 2 OF 4

PROJECT PA-40　　PROJECT NO. 1901591-07

DRILLING CO. Contractors Drilling Service　　TYPE OF RIG Bucket Auger

HOLE DIAMETER 24"　　DRIVE WEIGHT -　　DROP - IN.

ELEVATION TOP OF HOLE 884.5'　　REF. OR DATUM See Geotechnical Map

DEPTH FEET	GRAPHIC LOG	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION LOGGED BY SW/WG SAMPLED BY -
30								
		@32.4' 11N2W,11W						@32.4' ½" thick white sandstone, biotite - flazer structure
								@34.2' Clay seam
35								@34.9' 0.15' thick white vitric tuff, sl. altered; uniform thickness
		@35.9' CC1A2E,10W						@35.9' ¼" thick clay seam
								@38.0' Siliceous layer
								@38.2' 0.2' thick white sandstone bed
								@38.8' 0.2' thick discontinuous sandstone bed
40								
								@41.3' Grey siltstone, sheared
		@41.9' SS1N4W,9SI						@41.9' ¼ to ½" thick clay seam
								@42.5' grey clay seam
								@45.0' siltstone below contains frequent clay seams @ about a 1½" spacing, nonsheared
45								
50								
		@51.4' SS:N8E,10W						@51.4' ¼" thick clay seam; soft, plastic, sheared
								@52.0' Clay seam
								@52.5' sheared siltstone; siltstone below contains frequent clay seams @ ½ to 1" spacing
55								@55.4' Sheared silt
		@57.4'						@57.4' f.i. to med grained sand bed; water seepage
		@57.7' SS.N4,NW						@57.7' ¾" thick sheared clayey siltstone, v. soft, not highly plastic, basal shear surface @ 57.8', siltstone below contains series of nonplastic clays
								@59.5' Thin clay seam; sheared
60								

GEOTECHNICAL BORING LOG

DATE 10/6/91 DRILL HOLE No IGB-5 SHEET 3 OF 4
PROJECT PA-40 PROJECT No. 4901591-07
DRILLING CO. Contractors Drilling Service TYPE OF RIG Bucket Auger
HOLE DIAMETER 24" DRIVE WEIGHT – DROP – IN.
ELEVATION TOP OF HOLE 2945' REF. OR DATUM See Geotechnical Map

LOGGED BY SW/WG
SAMPLED BY –

DEPTH FEET	GRAPHIC LOG	ATTITUDES	TUBE SAMPLE NO.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
60								
								@64.7' 1" thick grey clay; highly plastic, sheared
65		@65.0' CS: N6E, 8W						@65.0' 1/16 to 1/8" thick clay; sheared; some nonplastic clays below
								@66.4' Clay seam
		@66.5' ?						@66.5' Seepage
70								@70.7' 0.3' thick zone with 1/4" nonplastic clay seams
		@71.0' C: N13E, 12W						@71.0' 1/16 to 1/8" thick clay seam; plastic
								@72.0' Clay seam, sheared
								@73.9' 1/8" thick clay seam; nonplastic, polished surface @ base
75								
		@78.8' CS: N37E, 11W						@78.8' 1/8" thick clay seam, nonplastic, polished basal surface
		@79.2' CS: N7E, 10W						@79.2' 1/4" thick clay seam, plastic, sheared
								@79.6' 1/8 to 1/16" thick clay seam, nonplastic
80								@80.0' Siltstone below contains frequent nonplastic clay seams @ about a 1 1/2" spacing
		@84.0' R N13E, 11W						@84.0' 2" thick bed of grey fine sandstone
								@84.5' 1/8" thick clay seam, plastic, sheared
		@84.9' CS: N9E, 12W						@84.9' 1/2" thick clay seam; plastic, sheared
85								@85.7' 1/8" thick clay seam, plastic
								@86.1' 1/8" thick clay seam, thin discontinuous greyish white fine sandstone above
								@87.9' 8" thick greyish white fine to med. sandstone with siltstone rip-up clasts; sheared and contorted
		@88' ?						
								@89.3 1/16" (south wall) to 1" thick (north side) clay seam, highly plastic, large gypsum crystals on northern side
90								

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GEOTECHNICAL BORING LOG

DATE 10/6/92 DRILL HOLE No. IGB-5 SHEET 4 OF 4
PROJECT PA-40 PROJECT No. 190159-07
DRILLING Co. Contractors Drilling Service TYPE OF RIG Bucket Auger
HOLE DIAMETER 24" DRIVE WEIGHT – DROP – IN.
ELEVATION TOP OF HOLE 884± REF. OR DATUM See Geotechnical Map

DEPTH FEET	GRAPHIC LOG	ATTITUDES	TUBE SAMPLE No.	BLOWS PER FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOIL CLASS. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION LOGGED BY SW/WG SAMPLED BY –
90		@91.2' B: N2W, 11W						@90.5' 1' thick layer containing irregular/rectangular shaped lenses of lt grey siltstone @91.2' lt grey siltstone lenses; as above; continuous around hole; 1 to 2" spacing between lenses
95		@96' ▽						
100								Notes: TD 99' concretionary layer @ 93' Down Hole logged to 93' Standing water @ 96' No caving
105								
110								
115								
120								

DATE DRILLED	ENG: Millazzo / GEO: Dickey, Robertson	LOCATION	ELEVATION & DATUM	BASEMAP	BORING NUMBER
May 10, 1985	ENG: Millazzo GEO: Dickey Robertson	N 46,088 E 77,610	959	80 Scale Topo	JGR-17 (1 of [illegible]

DRILL RIG	BORING DIAMETER	
Al-Roy Bucket Auger	24"	This log is a representation of subsurface conditions at the time & place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.

GRAPHIC LOG	ATTITUDES	GEOLOGIC DESCRIPTION (REMARKS)	DEPTH (FEET)	SAMPLE	SAMPLE NUMBER AND TYPE	BLOWS PER FOOT	SYMBOL	ENGINEERING CLASSIFICATION DESCRIPTION (REMARKS)	MOISTURE (% OF DRY WEIGHT)	DRY UNIT WEIGHT (PCF)	LAB
		Colluvium				2150 lbs.		Sandy SILT (ML), brown, trace of CLAY, damp, fine SAND			
	N60W 7°NE	At 2½', Interbedded silty SAND and SILTSTONE, Puente Formation - Soquel Member						Silty SAND (SM), white			
		At 4', Zone of very weak SILTSTONE, 1' thick.						Becoming grey brown with grey clayey SILTSTONE.			
		At 5', Dark grey dense SILTSTONE with thin rusty grey CLAY interbeds every 4".	954 - 5		D-1			Clayey SILTSTONE (ML), grey brown, stiff, saturated, caliche streaks, iron stains.	25.9	99.4	
					B-1						
	N48E 19°NW	At 6', Bedding plane									
		At 8', Horizontal Bed Grey SILTSTONE									
			949 - 10		D-2	6		Silty SAND (SM), grey brown, interbedded with clayey SILT (ML), grey, fine SAND, iron stains.	33.3	89.4	
		At 11', Contact. White to tan fine-grained micaceous SANDSTONE.						CLAY (CH), highly plastic slickensided.			
		At 12' Silty fine SAND						SANDSTONE, cemented, hard drilling.			
	N73E 8NW	At 13' SILT bed, 2" thick.									
		At 14' Massive, white, fine-grained, silty SAND with concretions.						Silty SAND (SM), red grey			
			944 - 15		D-3	6		SAND (SP), white, dry, medium dense, fine, trace of SILT, micaceous, iron stains	3.9	113.6	
					B-2						
		SAND becomes rust-stained	939 - 20								
	N15E 8NW	At 20½', Contact. Dark grey SILTSTONE, partly bedded			D-4	7		Silty SAND (SM), grey brown, wet, iron streaks, fine SAND, interbedded with Clayey SILTSTONE (ML), grey moist, fine SAND, iron stains	19.7	107.9	
		At 22' Becomes massive to poorly bedded.									
		At 23½', Silty SAND interbedded with SILT									
	N65E 45E	At 25' Plastic CLAY bed, below which is massive, dark grey SILTSTONE	934 - 25		D-5	4		SILTSTONE interbeds becoming more sandy, fine to coarse, saturated. Becoming more silty at 26½ feet.	18.4	111.5	
		At 27' SAND interbeds									
		At 27½' Grey SILTSTONE			B-3						
		At 29', Siliceous SILTSTONE layer 2" thick nearly horizontal CLAY bed.						Cemented SANDSTONE, hard drilling at 28½ feet.			
	N20W 17SW	At 29½', Rusty, cemented SAND [illegible]									

Jack G. Raub Company
Engineering & Planning
[illegible] • Mission Viejo • California [illegible]

PLANNING AREA 16 N
MISSION VIEJO

geotechnical boring log

DATE DRILLED	ENG.	LOCATION	ELEVATION & DATUM	BASEMAP	BORING NUMBER
May 10, 1985	ENG. Milazzo GEO. Dickey Robertson	N 46,083 E 77,610	959	80 Scale Topo	JGR-17 (2 of 2)

DRILL RIG	BORING DIAMETER	
Al-Roy Bucket Auger	24"	This log is a representation of subsurface conditions at the time & place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.

GRAPHIC LOG	ATTITUDES	GEOLOGIC DESCRIPTION (REMARKS)	DEPTH (FEET)	SAMPLE	SAMPLE NUMBER AND TYPE	BLOWS PER FOOT	SYMBOL	ENGINEERING CLASSIFICATION DESCRIPTION (REMARKS)	MOISTURE (% OF DRY WEIGHT)	DRY UNIT WEIGHT (PCF)	LAB TESTS
		At 30' Massive SILTSTONE 929	30		D-6	1350 lbs 12		Silty SAND (SM), red to grey, medium dense, very moist, heavy iron stains, with cemented lenses of Silty SANDSTONE, grey.	15.5	113.3	
		At 32', SAND and SILT, mixed.									
		924	35					End of boring at 35 feet. No groundwater. No caving. Hole backfilled.			
		919	40								

Jack G. Raub Company
Engineering & Planning
3441 Ovrevero Drive, Mission Viejo, California 92691

PLANNING AREA 16 N
MISSION VIEJO

geotechnical boring log

DATE OBSERVED: [illegible] METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RG GROUND ELEVATION: 877± LOCATION: See Plot Plan

BORING NO. 1

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0							LANDSLIDE DEBRIS: Light gray sandy siltstone, mottled, fractured, roots	
5				X				
10		2	X	X	30.2	80	@10.5' rupture surface, irregular contact, slight seepage, R.S.: N3E/9NW (general) COLLUVIUM: Dark brown silty CLAY, wet, soft, roots, porous, caliche deposits	MECHANICAL ANALYSIS HYDROMETER ANALYSIS ATTERBERG LIMITS MAXIMUM DENSITY DIRECT SHEAR ATTERBERG LIMITS
15		3	X		23.9	102	@16' sandy SILTSTONE lense, discontinuous around hole, located on north side of hole, 1 foot thick	
20							BEDROCK: PUENTE FORMATION Gray to buff silty SANDSTONE, weathered, mottled, poorly bedded @22' seepage - from upslope Clay seam, no slicks present, [illegible] Gray SILTSTONE interlayered with thin SANDSTONE well bedded, dense @24' Bedding: N76E/11NW @25' Bedding: N [illegible]	DIRECT SHEAR MECHANICAL ANALYSIS ATTERBERG LIMITS HYDROMETER ANALYSIS
25								
30			X	X				
							TOTAL DEPTH 31' [illegible] Seepage @ 10.5' and 22'	
35								
40								

JOB NO.: 382-00 LOG OF BORING FIGURE: 2

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 4/6/83 METHOD OF DRILLING: [illegible]" Bucket Auger

LOGGED BY: RG GROUND ELEVATION: [illegible] LOCATION: See Plot Plan

BORING NO. [illegible]

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0							LANDSLIDE DEBRIS: Interlayerd gray and brown platy SILTSTONE, fractured well bedded, caliche streaks @2' bedding: N10E/15NW @3' CLAY layer, 1" thick, parallel to bedding with thin layers of oxidized sand @5' moisture and fracturing increase @6' bedding: N15E/15NW @9' 1" CLAY seam	
5								ATTERBERG LIMITS
10		8	X	X	20.[illegible]	[illegible]	@12' thin layers of cemented SILTSTONE, brittle, 1" thick zone	
15							@15.[illegible]' Basal Rupture Surface, 1" CLAY seam, soft and very moist R.S. [illegible]/11[illegible], N1[illegible]E/15NW	
							BEDROCK: PUENTE FORMATION Dark brown and gray SILTSTONE interlayered with oxidized SANDSTONE, dense @16.[illegible]' shear: [illegible]60W/73SW @17.[illegible]' orange SANDSTONE bed, bedding: [illegible]W/15[illegible] @[illegible]' concretion bed, 1 foot thick [illegible], gypsum deposits @20' green SILTSTONE bed, sheared, @2[illegible]' orange SANDSTONE bed, oxidized, friable, mottled @[illegible] thin CLAY layer, [illegible]	
20								
25								DIRECT SHEAR MECHANICAL ANALYSIS HYDROMETER ANALYSIS ATTERBERG LIMITS DIRECT SHEAR
							@2[illegible]' dark brown SILTSTONE, unoxidized, very dense, massive, numerous shears @[illegible]' seepage above cemented [illegible] bed, 3/4" thick [illegible]	
30							[illegible] dark gray SILTSTONE, [illegible]aceous, very dense, massive [illegible] dense @3[illegible]' shear parallel to bedding, minor [illegible] @3[illegible].[illegible]' shear, thin CLAY layer @3[illegible]' 1" CLAY layer, soft [illegible]/12[illegible]	
35		[illegible]	X	X	[illegible]	10[illegible]		
40								

JOB NO: [illegible]32-00 LOG OF BORING FIGURE: 3

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 6/6/83 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RG GROUND ELEVATION: 369± LOCATION: See Plot Plan

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	BORING NO. 2 (CONTINUED) DESCRIPTION	SOIL TEST
40							@36' 3" SANDSTONE layer @39' sheared CLAY layer interlayered with SANDSTONE @40' sheared CLAY layer, slicks, S: N10E/12NW @42' sheared CLAY layer 1/8" thick S: N62E/13NW @42.5' sheared CLAY layer @44' silty SANDSTONE layer, 1" thick, Bedding: N60E/12NW	
45								
50							TOTAL DEPTH 49' No Caving @30' Seepage	
55								
60								
65								
70								
75								
80								

JOB NO.: 383-40 LOG OF BORING FIGURE: 4

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 4/6/83 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: [illegible] GROUND ELEVATION: 962± LOCATION: See Plot Plan

BORING NO. [illegible]

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0							COLLUVIUM: Dark brown silty CLAY, very moist, soft porous @3' caliche streaks	
5							LANDSLIDE DEBRIS: Mottled interbedded SILTSTONE and SANDSTONE, dry, well bedded Bedding: N36W/66NE	
10			X	X	21.[illegible]	95	@10' sandy SILTSTONE, highly fractured and contorted, loose, bedding as above	ATTERBERG LIMITS
15								
20							@18' Concretionary SILTSTONE 8" thick, fractured, Bedding: N25W/51NE @20' silty SANDSTONE, light gray to buff, iron stained streaks, soft, 6" thick @22' dark gray SILTSTONE, fractured soft	
25							@23' [illegible]" CLAY seam, soft, wet, continuous around hole, sheared, with slicks at N34E/20NW @25' gray poorly bedded, fractured SANDSTONE, loose @28' [illegible] CLAY seam [illegible] to [illegible]" thick [illegible] N52E/[illegible]	
30							BEDROCK: PUENTE FORMATION Reddish-brown SILTSTONE, massive, shears with gypsum deposits [illegible] thick, interlayered with thin layers of SILTSTONE @31' sheared CLAY layer, at [illegible] [illegible]	Slide Debris 28' BEDROCK
35							[illegible] very hard	
40							@3[illegible]' [illegible] SANDSTONE, massive [illegible] thick	ATTERBERG LIMITS

JOB NO.: [illegible] LOG OF BORING FIGURE: 5

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: ?/6/83 METHOD OF DRILLING: 24" Bucket Auger

LOGGED BY: RG GROUND ELEVATION: 962± LOCATION: See Plot Plan

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	BORING NO. 3 (CONTINUED) DESCRIPTION	SOIL TEST
40							Dark gray sandy SILTSTONE, unoxidized iron-stained streaks, massive. @41.5' reddish-brown SILTSTONE bed, massive, 1 inch thick	
45							@45' buff SANDSTONE bed, friable, massive	
		40/6"	X	X	13.8	95		
50							TOTAL DEPTH 49' No Water No Caving	
55								
60								
65								
70								
75								
80								

JOB NO.: ?282-00 LOG OF BORING FIGURE: ?

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 3/1/84 METHOD OF DRILLING: Bo-Jac 24" Bucket

1st-4525lbs 2nd-1500 lbs 3rd-750 lbs

LOGGED BY: RJR GROUND ELEVATION: 915± LOCATION: See Plot Plan

BORING NO. 3

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
0							LANDSLIDE DEBRIS Silty CLAYSTONE, with sandstone, in-beds, moderately brown to light olive brown, soft to moderately hard, moderate red staining along fractures, some bedding planes, foraminifera, intensely to very fractured, thinly laminated 2.3-3" Sandstone and shale interbeds from 3' moderately hard with dark yellowish orange and moderately red staining	
5 1st		8	X		23.9	92		
10		9	X		26.7	108	13' Bedding: N17W 16SW 19' 1" Sandstone Interbed 18' Bedding: N15W 31SW 12.5 Very hard cemented shale to 14' 10.5 Joint: N63E 78SE Open Joints @ 15'	
15		10	X		24.5	98	16.5-18.5 Joint: N63E 84SE 18.8 Bedding: N32W 19SW 19.0 Shear: N32E 16NW Multiple Sheared Clays	
20		9	X		20.2	104	23.4 Bedding/Shear: N15W 09SW 23.9 1" Sheared Clay, soft [illegible] 1" Sheared Clay	
25 2nd		16	X		33.5	85	27.2 Sheared Clay with gypsum, soft, [illegible] below [illegible], dark olive green	ATTERBERG LIMITS HYDROMETER
30		[illegible]	X		[illegible]	[illegible]	[illegible] dark yellow orange sandstone [illegible] thick, faintly bedded to semi-massive CLAYSTONE, dark olive brown, slightly [illegible]aceous [illegible] sandstone interbed	
35			X		16.4	1[illegible]	[illegible]	
40								

JOB NO.: 2382-01 LOG OF BORING FIGURE: B-5

IRVINE SOILS ENGINEERING, INC.

DATE OBSERVED: 3/1/84 METHOD OF DRILLING: ~~Bo Jac 24" Auger~~
3rd 750 lbs 12" Drop

LOGGED BY: RJR GROUND ELEVATION: LOCATION: ~~See Plot Plan~~

BORING NO. 3 (CONTINUED)

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT (%)	IN PLACE DRY DENSITY (PCF)	DESCRIPTION	SOIL TEST
40 3rd		30	X		15.3	115	LANDSLIDE DEBRIS Silty CLAYSTONE, hard, well cemented	
				X			SANDSTONE, 1" ash bed above sheared clay, very soft, slicks @45.3 Rupture Surface: N20W 12SW	
45		50	X		14.4	99	BEDROCK SHALE, intensely fractured, medium gray, massive, dark brown to black 48.5 - 49.5 SANDSTONE	
50		39	X		15.3	109	Sheared clay layer, soft, below sandstone @50.0 Bedding:Shear: N12E 14NW	
55		60	X					
60							Total Depth 56' Seepage Encountered @ 45.8' No Caving	
65								
70								
75								
80								

JOB NO: 2382-01 LOG OF BORING FIGURE: B-8

IRVINE SOILS ENGINEERING, INC.

CDMG Contract No. F89-16

GEOTECHNICAL BORING LOG

PROJECT NAME	FOOTHILL TRANSPORTATION CORRIDOR				
PROJECT NO	101452-02			BORING DESIG	B-616
DATE STARTED	3/28/90	DATE FINISHED	3/30/90	STATION	[illegible]
DRILLER	Larive	LOGGED BY	BDB.SAB.	OFFSET (FT)	243 LT
GROUND WATER ELEV		GW DEPTH (FT)		GSE	939.4
TYPE OF DRILL RIG	30" dia bucket	DRIVE WT (LBS)	See sheet 4	DROP	12

DEPTH FEET	ELEVATION	SAMPLE	BLOWS/FT	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONTENT	DRY DENSITY PCF	SHEAR STRENGTH KSF / OTHER
0					**COLLUVIUM (Qcol):**			
					@0.0': SILTY CLAY (CH), very stiff, high plasticity, very dark brown, moist, scattered sand-size pieces of white and light brown claystone			
					@2.0': Change in consistency to hard			
					@2.5': Abundant sand and scattered gravel-size pieces of light brown siltstone to approx. 1/2" diameter			
	935				**ANCIENT LANDSLIDE (Qls):**			
5					@4.3': SILTY CLAY (CH), very stiff, high plasticity, gray-brown, mo[illegible] scattered pockets of very dark brown sil[illegible] to approx. 5" diameter, scattered sil[illegible] sand, gravel and cobbles-size pieces of [illegible] to approx. 5" diameter			
					@6.5': FINE SANDY SILTSTONE (ML), hard, low plasticity, [illegible], light gray-brown, damp, abundant iron oxide staining			
					@6.6': Pocket of light gray and light brown silty fine sand approx. 14"x36"			
	930							
10		B	2	B N20W 54W				
					@11.0': Scattered pockets of silty fine sand to approx. 6" diameter	11.0	113.0	C=0.70 φ=47°
					@11.2': Chaotic mixture of randomly oriented blocks of fine sandy siltstone			
					@12.5': Fractures infilled with silty fine sand			
	925							
15					@17.5': Continuous remolded clayey silt seam approx. 1/4" to 1" thick, firm, moderate plasticity, medium gray, moist			
					SOQUEL MEMBER, PUENTE FORMATION (Tpsq):			
				S N15W 17W	@17.6': CLAYEY SILTSTONE, hard, gray-brown, damp, thinly bedded, abundant iron oxide staining along joint and bedding surfaces, competent			
					@20.1': SILTY FINE GRAINED SANDSTONE/FINE SANDY SILTSTONE, soft, light red-brown, massive, scattered randomly oriented stringers of gypsum to approx. 1/4" wide			
	920				@21.6': Layer of light brown silty fine grained sandstone approx. 1" thick			
20		D	0	B N10E 20W		19.2	108.6	
					@24.5': Layer of light gray and red brown silty fine grained sandstone approx. 4" thick, layer of medium gray soft moderately plastic silty claystone approx. 1/4" thick at base of sandstone			
	915			B N13W 20W	@24.8': Interbedded medium brown to very dark brown to black damp soft SILTY CLAYSTONE and light brown damp soft SILTY FINE GRAINED SANDSTONE and gray-brown damp soft CLAYEY SILTSTONE, beds approx. 2" to 18" thick			
25					@29.7': Layer of light gray and red brown silty fine grained sandstone approx. 2" thick, iron oxide staining			
	910			B N10W 18W	@29.9': SILTY FINE GRAINED SANDSTONE, soft, light yellow brown, abundant iron oxide staining, abundant stringers of gypsum to approx. 1/4" thick oriented parallel to bedding			
30								

DRAFT

SAMPLE TYPES:

C	ROCK CORE	B	BULK SAMPLE		SEEPAGE
S	SPLIT SPOON	T	TUBE SAMPLE		GW WHILE DRILLING
	DRIVE SAMPLE				GW 24 HRS
					BEDDING PLANE
J	JOINT				
C	CONTACT				
F	FAULT				
S	SHEAR				

Ninyo & Moore

CDMG Contract No. F88-16

GEOTECHNICAL BORING LOG

PROJECT NAME	FOOTHILL TRANSPORTATION CORRIDOR				
PROJECT NO	101452-02			BORING DESIG	B-616
DATE STARTED	3/28/90	DATE FINISHED	3/30/90	STATION	2347+20
DRILLER	Larive	LOGGED BY	BDB SAB	OFFSET (FT)	343 Lt
GROUND WATER ELEV		GW DEPTH (FT)		GSE	939.4
TYPE OF DRILL RIG	30" dia bucket	DRIVE WT (LBS)	See sheet 4	DROP	12

DEPTH FEET	ELEVATION	SAMPLE TYPE	SAMPLE	BLOWS/FT	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONTENT %	DRY DENSITY PCF	SHEAR STRENGTH KSF	OTHER TESTS
		B D	5 6	13/4"			10.9	121.4		MD
	905					@34.8': Layer of very light gray damp soft fine to medium-grained sandstone approx. 17" thick, scattered iron oxide staining				
					B: N20W 10W	@36.2': Layer of gypsum approx. 1/4" thick				
	900									
40		B	7	13/8"		LA VIDA MEMBER (Oxidized), PUENTE FORMATION (Tplv): @41.6': SILTY CLAYSTONE/CLAYEY SILTSTONE, soft, very dark brown, damp, massive, abundant forams	15.4	106.5		
	895					@44.5': Shear zone consisting of highly sheared silty claystone/clayey siltstone				
45		D	8		S: N26W 16W	@44.9': Continuous remolded silty clay seam approx. 1/2" thick, dark gray, stiff, moderately plastic, very moist, change in color to dark gray brown, some fine sand				
	890				B: N10W 10W	@48.8': Layer of dark gray very silty fine grained sandstone approx. 1/2" thick @49.3': Layer of dark gray very silty fine grained sandstone approx. 1 1/2" thick				
50		B D	10 11	16/6"		@51.0': Layer of dark gray very silty fine grained sandstone approx. 2" thick @51.6': Layer of light gray silty fine grained sandstone approx. 6" thick				
	885									
55					B: N23W 20W	@55.4': Layer of light gray silty fine grained sandstone approx. 3" to 5" thick, bioturbated @55.8': SILTY FINE GRAINED SANDSTONE, soft, gray-brown, damp, poorly cemented, massive				
						@57.2': Cemented layer of sandstone approx. 5" thick @57.8': Layer of light gray silty fine grained sandstone, friable, scattered pockets of hard cemented sandstone				
	880					@58.9': Layer of cemented sandstone approx. 2" thick				
60										

DRAFT

SAMPLE TYPES:

C ROCK CORE
S SPLIT SPOON
D DRIVE SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

SEEPAGE
GW WHILE DRILLING
GW 24 HRS
BEDDING PLANE

J JOINT
C CONTACT
F FAULT
S SHEAR

Ninyo & Moore

CDMG Contract No. F89-18

GEOTECHNICAL BORING LOG

PROJECT NAME	FOOTHILL TRANSPORTATION CORRIDOR		
PROJECT NO	101452-02	BORING DESIG	B-618
DATE STARTED	3/28/90	DATE FINISHED	3/30/90
STATION	2347+20	DRILLER	Larive
LOGGED BY	BOB SAB	OFFSET (FT)	343 LT
GROUND WATER ELEV		GW DEPTH (FT)	
GSE	939.4	TYPE OF DRILL RIG	30" dia bucket
DRIVE WT (LBS)	See sheet 4	DROP	12

DEPTH FEET	ELEVATION	SAMPLE TYPE	SAMPLE	BLOWS/FT	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONTENT %	DRY DENSITY PCF	SHEAR STRENGTH KSF
		D	12	30/5"		@61.9': Layer of very dark brown to black very hard clayey siltstone approx 14" thick, scattered rounded gravel to approx. 1/2" diameter			
						@63.5': CLAYEY SILTSTONE, hard, gray-brown, damp, massive			
	645								
65									
						@66.1': Abundant inclusions of clayey siltstone			
						@66.7': Continuous shear zone (possible fault zone) consisting of moderately sheared silty claystone approx. 1" thick, scattered rounded hard gravel to approx. 1" diameter, abundant randomly oriented polished surfaces, inclusions of clayey siltstone down to 67.7'			
		B	13		C: N66W 12E C: N65W 10E				
						@67.6': Continuous remolded silty clay seam approx. 1/2" thick, very dark brown to black, stiff, high plasticity, moist			
						@67.7': SILTY FINE GRAINED SANDSTONE, soft, medium gray, damp, poorly cemented			
	640				C: N30E 7W				
70		B D	14 15	25/3"	C: N5E 7W	@69.2': Layer of clayey siltstone conglomerate, rounded gravel to approx. 1" diameter			
						@71.2': Scattered subangular to subrounded gravel to approx. 1/2" diameter			
						@72.7': Layer of clayey siltstone conglomerate approx. 9" thick			
						@73.0': SILTY CLAYSTONE, soft, very dark brown to black, damp			
	635								
75					S: N30W 20W	@75.0': Shear zone approx. 14" thick consisting of moderately sheared claystone and scattered discontinuous randomly oriented highly polished surfaces			
						@76.2': Layer of very dark brown silty claystone approx. 1/2" thick, lense of light gray silty fine grained sandstone approx. 4" thick below claystone			
						@76.3': SILTY FINE GRAINED SANDSTONE, soft, gray-brown, damp			
	630				B: N15W 1?	@79.6': Layer of light gray silty fine grained sandstone approx. 14" thick, scattered pockets of hard rounded gravel to approx. 1 1/2" diameter within layer			
80		B D	16 17	35/3"		@80.8': SILTY SANDSTONE, hard, gray-brown, damp			
					B: N25W 14W	@81.9': Cemented conglomerate layer approx. 3" thick			
						@83.0': Cemented conglomerate layer approx. 2" thick			
					B: N10W 13W	@83.7': Cemented conglomerate layer approx. 4" thick			
	625								
85						@85.5': Cemented conglomerate layer approx. 14" thick			
	620					@89.0': SILTY CLAYSTONE, hard, very dark brown to black, damp			
90									

SAMPLE TYPES:

C ROCK CORE
S SPLIT SPOON
D DRIVE SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

SEEPAGE
GW WHILE DRILLING
GW 24 HRS
BEDDING PLANE

J JOINT
C CONTACT
F FAULT
S SHEAR

Ninyo & Moore

PROJECT NAME: OCLIM - El Toro Road TRENCH NO.: 6

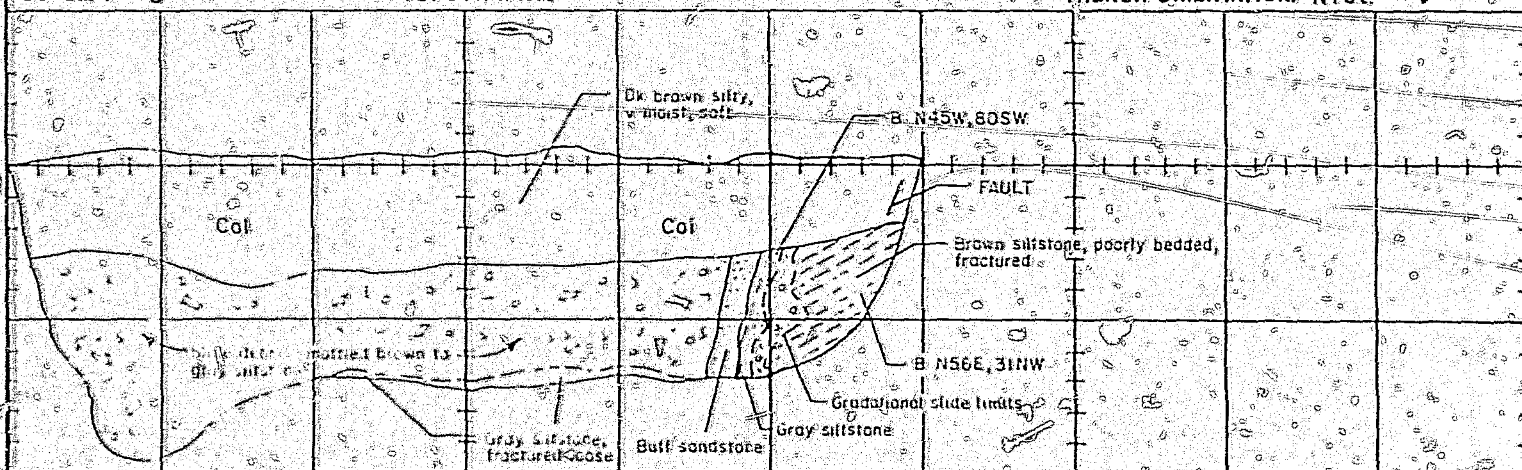
JOB NO.: [illegible]-00 DATE: April 12, 1983

EQUIPMENT: [illegible] ELEVATION:

LOGGED BY: dl LOCATION: See Map

DESCRIPTION	ENGINEERING PROPERTIES				
	CLASSIFICATION U.S.C.S.	BULK SAMPLE	UNDISTURBED SAMPLE	MOISTURE (%)	DENSITY (PCF)

SCALE: 1" = 5' TOPOGRAPHY: TRENCH ORIENTATION: N75E



TRENCH LOG IRVINE SOILS ENGINEERING, INC.

Figure 13

Appendix C
Laboratory Test Results

APPENDIX C

Laboratory 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.

Moisture and Density Determination Tests: Moisture content (ASTM D2216) and dry density determinations (ASTM D2937) were performed on driven samples obtained from the test borings. The results of these tests are presented in the boring logs.

Atterberg Limits: The liquid and plastic limits ("Atterberg Limits") were determined per ASTM D4318 for engineering classification of fine-grained material and presented in the table below. The USCS soil classification indicated in the table below is based on the portion of sample passing the No. 40 sieve and may not necessarily be representative of the entire sample. The plots are provided in this Appendix.

Sample Location	**Liquid Limit (%)**	**Plastic Limit (%)**	**Plasticity Index (%)**	**USCS Soil Classification**
BA-1 @ 28 ft	69	28	41	CH
BA-2 @ 59.5 ft	78	32	46	CH

Direct Shear: Direct shear tests were performed on selected driven samples, which were soaked for a minimum of 24 hours prior to testing. The samples were tested under various normal loads using a motor-driven, strain-controlled, direct-shear testing apparatus (ASTM D3080). The plots are provided in this Appendix.

Torsional Ring Shear for Residual Shear Strength: A drained, residual torsional ring shear test was performed on site clay grab sample (BA-1 @ 28 ft). The sample was tested under various normal loads (2, 4 and 8 ksf) using a torsional ring-shear testing apparatus (ASTM D6467). The plot is presented in this Appendix.

Torsional Ring Shear for Fully Softened Shear Strength: A drained, fully softened torsional ring shear test was performed on site clay grab samples (BA-2 @ 59.5 ft). The sample was tested under various normal loads (3, 6 and 12 ksf) using a torsional ring-shear testing apparatus (ASTM D7608). The plot is presented in this Appendix.

Laboratory Test Results

Expansion Index: The expansion potential of selected representative samples was evaluated by the Expansion Index Test per ASTM D4829.

Sample Location	Expansion Index	Expansion Potential*
BA-1 @ 0-5 ft	97	High
BA-1 @ 5-7 ft	92	High

* Per ASTM D4829

Laboratory Compaction: 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 (%)
BA-1 @ 0-5 ft	Dark Brown Clay	105.5	8.5
BA-1 @ 5-7 ft	Light Brown Sandy Clay	97.0	23.5

Soluble Sulfates: The soluble sulfate contents of selected samples were determined by standard geochemical methods (CTM 417). The test results are presented in the table below.

Sample Location	Sulfate Content
BA-1 @ 0-5 ft	~0.03%
BA-1 @ 5-7 ft	~ 0.042%

Chloride Content: Chloride content was tested per CTM 422. The results are presented below.

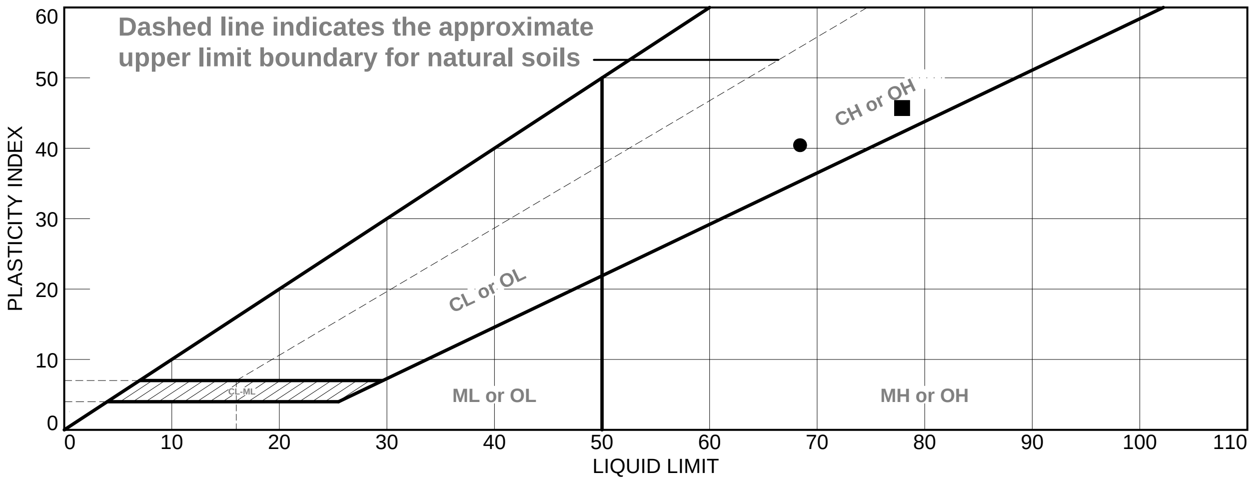
Sample Location	Chloride Content, ppm
BA-1 @ 0-5 ft	380
BA-1 @ 5-7 ft	780

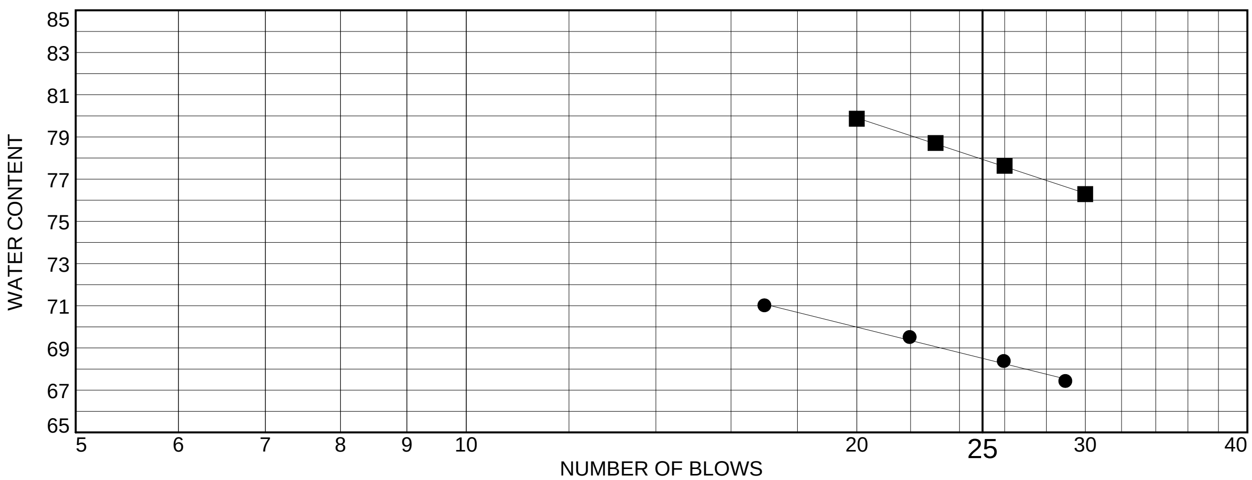
Laboratory Test Results

Minimum Resistivity and pH Tests: Minimum resistivity and pH tests were performed in general accordance with CTM 643 and standard geochemical methods. The results are presented in the table below.

Sample Location	pH	Minimum Resistivity (ohms-cm)
BA-1 @ 0-5 ft	7.4	365
BA-1 @ 5-7 ft	6.8	279

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Fat CLAY w/ Sand	68.5	28.2	40.3			
■	Dark Greenish Gray Fat CLAY	77.9	32.2	45.7			

Project No. 040-020 **Client:** LGC Geotechnical

Project: El Toro - 18184-01

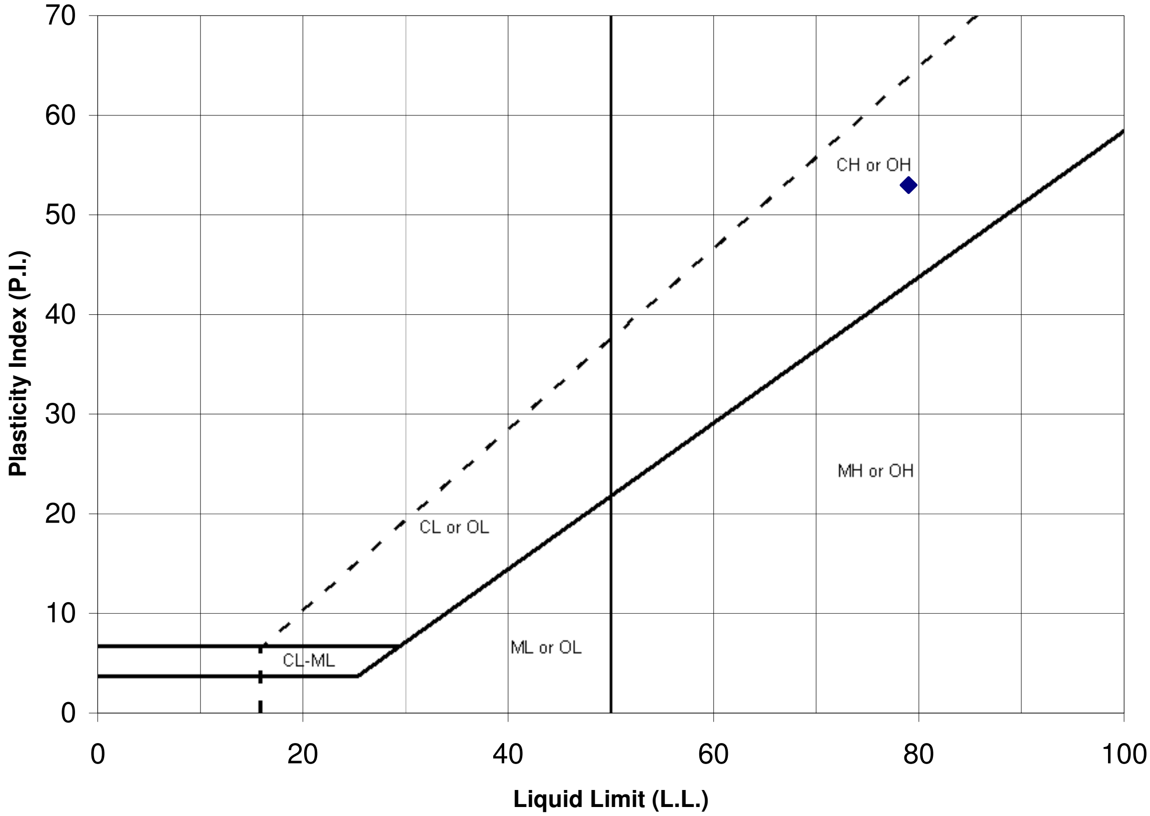
●**Source of Sample:** BA-1 **Depth:** 28 **Sample Number:** GB-1
■**Source of Sample:** BA-2 **Depth:** 59.5 **Sample Number:** GB-2

Remarks:

Benchmark Geolabs, LLC

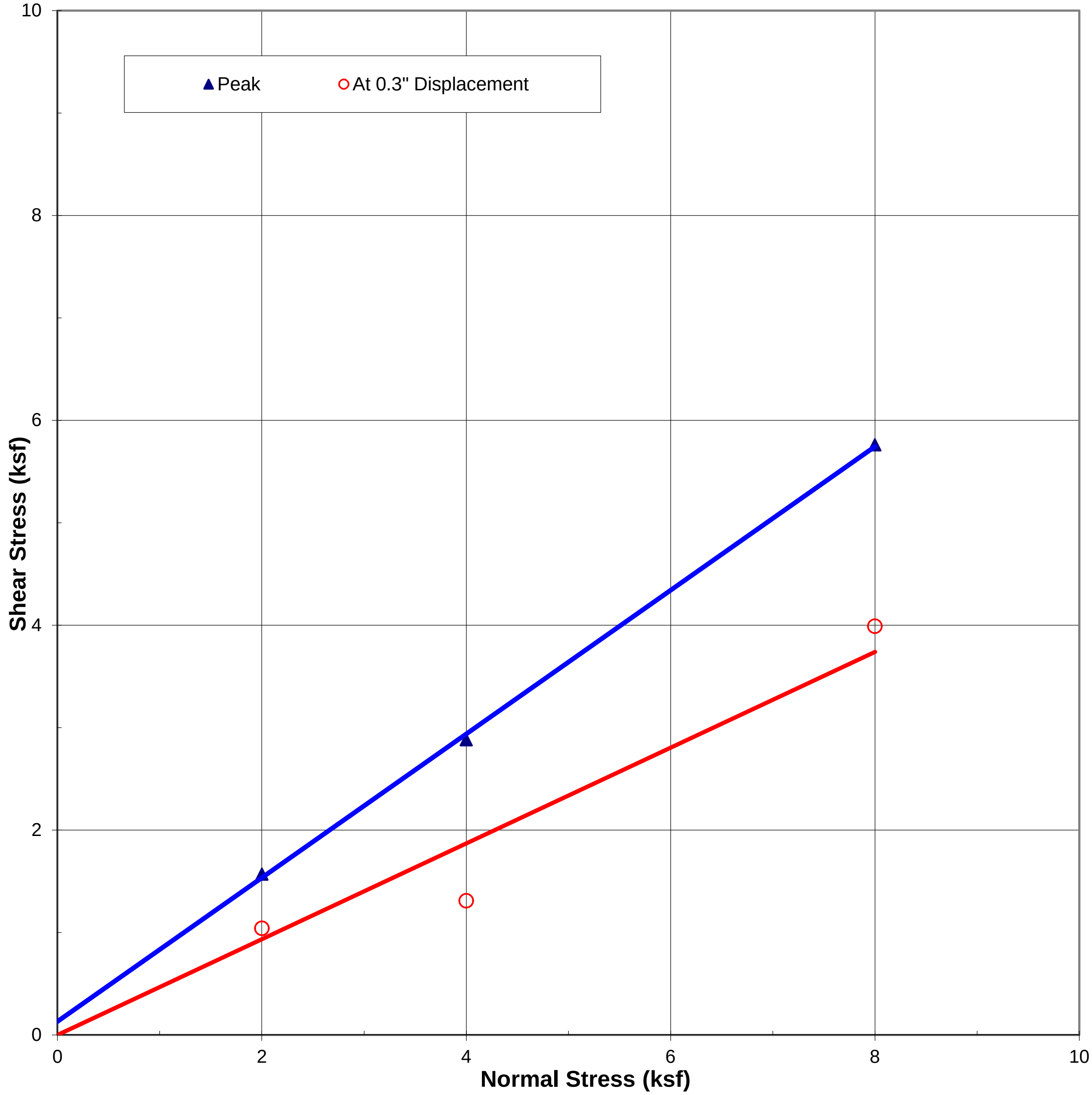
Figure

PLASTICITY CHART - CLASSIFICATION OF FINE-GRAINED SOILS



Symbol	Location.:	Sample No.:	Depth (ft)	Passing No. 200 Sieve (%)	Liquid Limit (%) LL	Plastic Limit (%) PL	Plasticity Index (%) PI	USCS
◆	BA-2	GB-3	59.5'	-	79	26	53	CH

LGC Geotechnical, Inc.	**ATTERBERG LIMITS** (ASTM D 4318)	**Project Number:** 18184-01 **Date:** Mar-19 **El Toro**



Tested Sample:
BA-1 at 40 ft

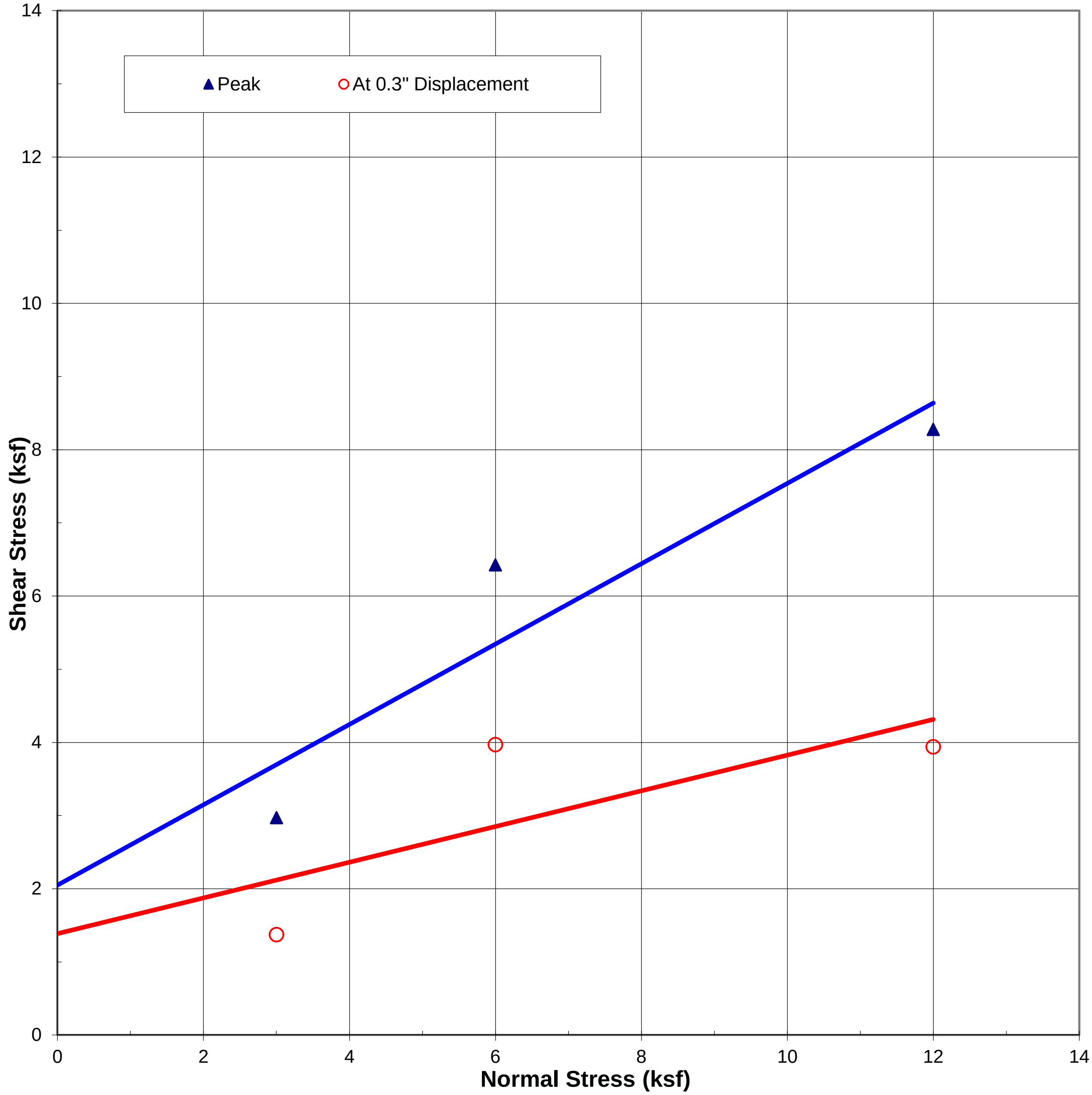
	Peak:		At 0.30" Displacement:	
	35.0	Degrees	25.1	Degrees
	0.13	ksf	0.0	ksf

LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 18184-01
Date: Jun-19

El Toro



Tested Sample:
BA-2 at 30 ft

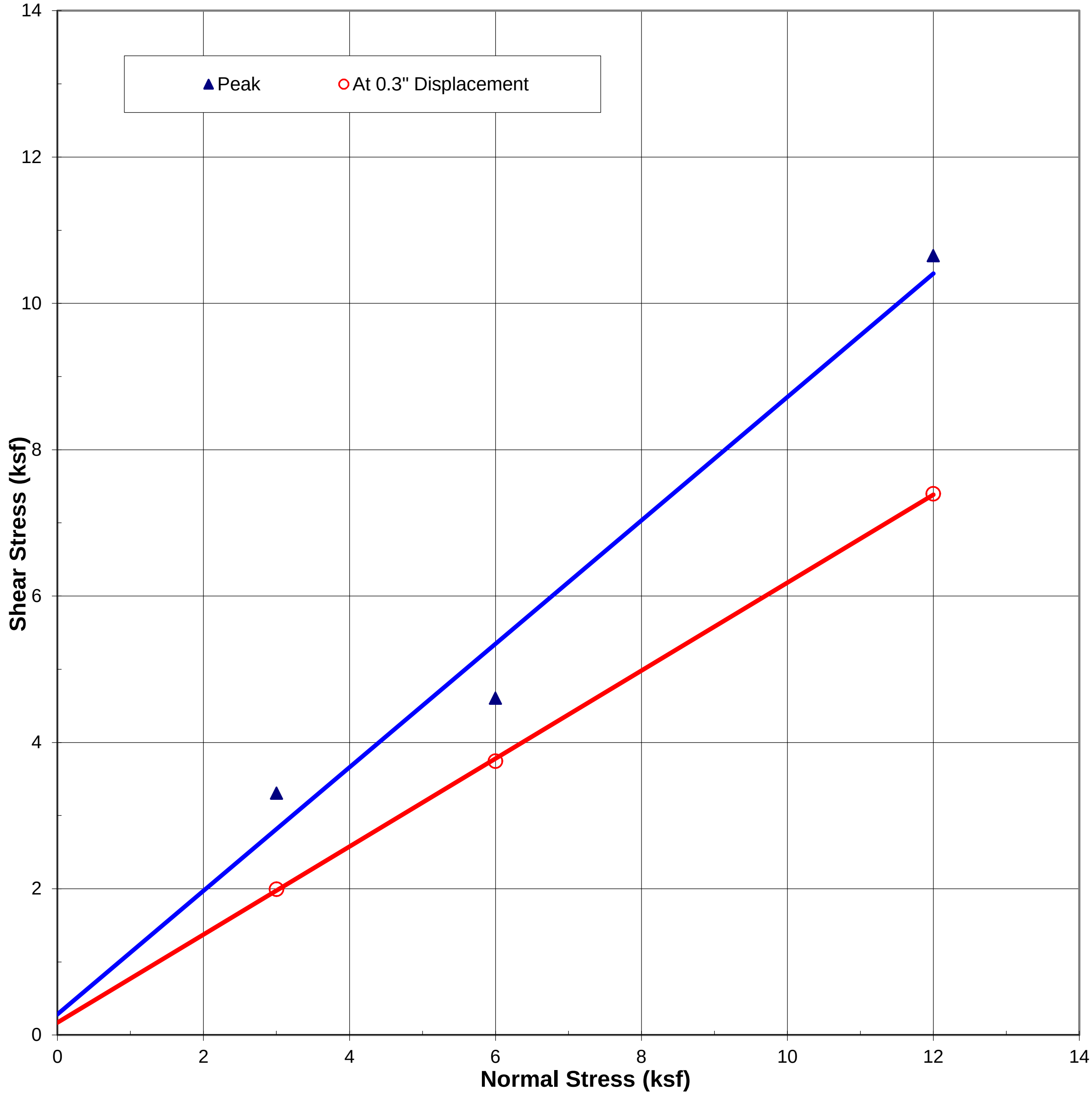
	Peak:	At 0.30" Displacement:
	28.8 Degrees	13.7 Degrees
	2.05 ksf	1.39 ksf

LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 18184-01
Date: Jun-19

El Toro



Tested Sample:
BA-2 at 40 ft

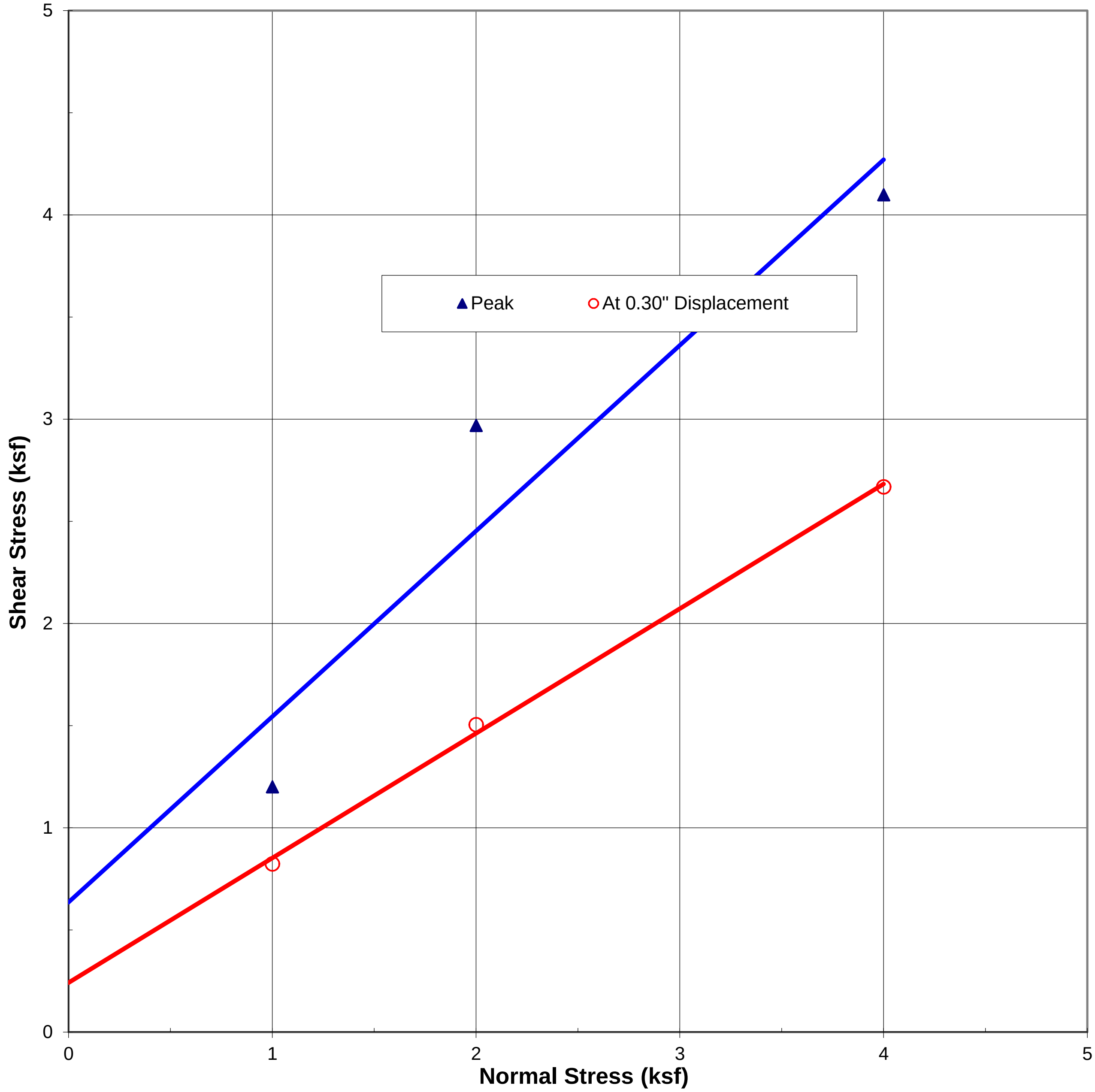
	Peak:	At 0.30" Displacement:
	40.2 Degrees	31.0 Degrees
	0.28 ksf	0.17 ksf

LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 18184-01
Date: Jun-19

El Toro



Tested Sample:
BA-3 at 10 ft

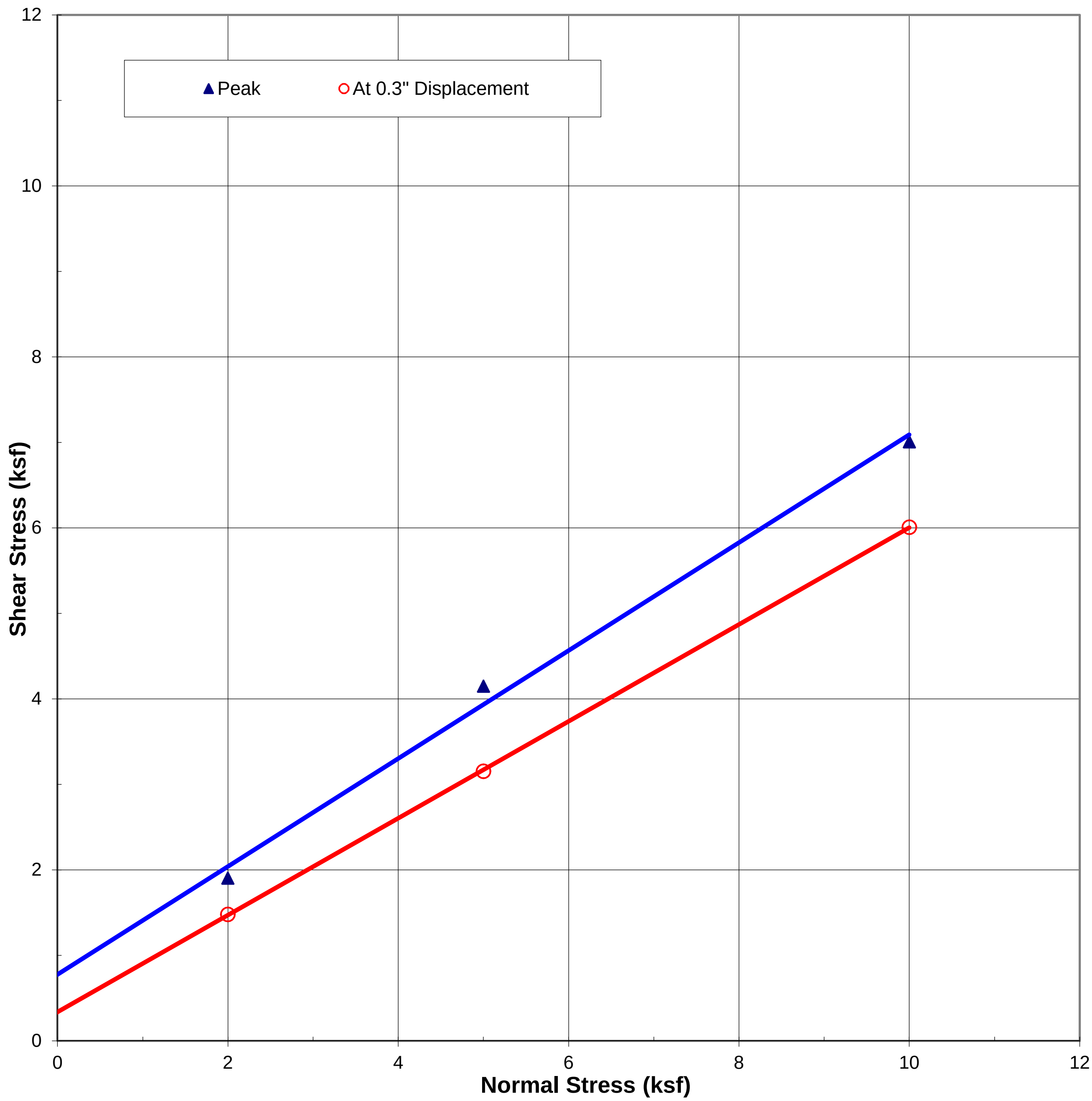
	Peak:	At 0.30" Displacement:
	42.3 Degrees	31.4 Degrees
	0.64 ksf	0.24 ksf

LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 18184-01
Date: Jun-19

El Toro



Tested Sample:
BA-3 at 50 ft

	Peak:	At 0.30" Displacement:
	32.3 Degrees	29.5 Degrees
	0.78 ksf	0.34 ksf

LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 18184-01
Date: Jun-19

El Toro

Drained Residual Torsional Shear Strength (ASTM D6467)

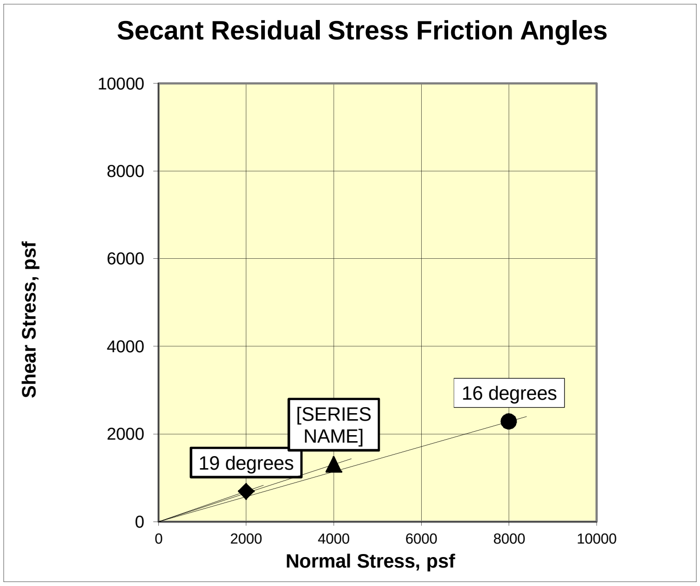
BENCHMARK GEOLABS

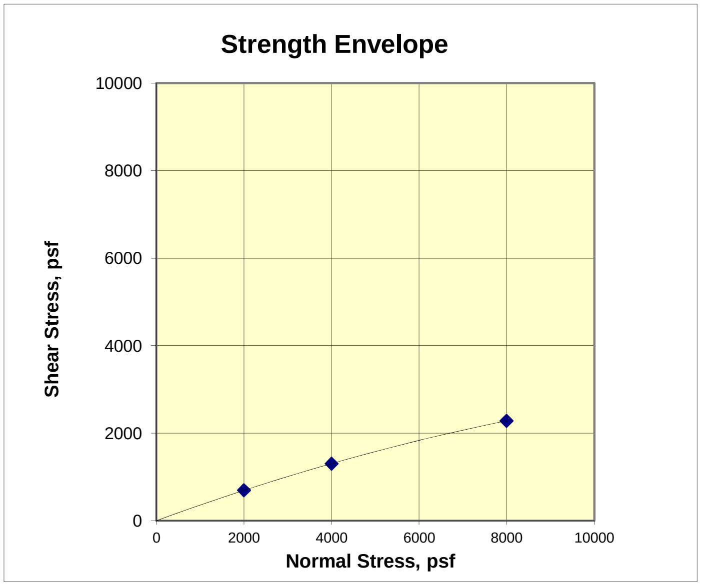
BGL Job No.:	040-002	**Boring:**	BA-1	**Date:**	5/28/2019	**Clay, %:**	
Client:	LGC Geotechnical	**Sample:**	GB-1	**By:**	PJ	**LL:**	68.5
Project Name:	El Toro	**Depth (ft):**	28	**Checked:**	PJ	**PL:**	28.2
Project Number:	18184-01	**Test Type:**	Reconstituted Residual			**Sample Preparation:**	<#40

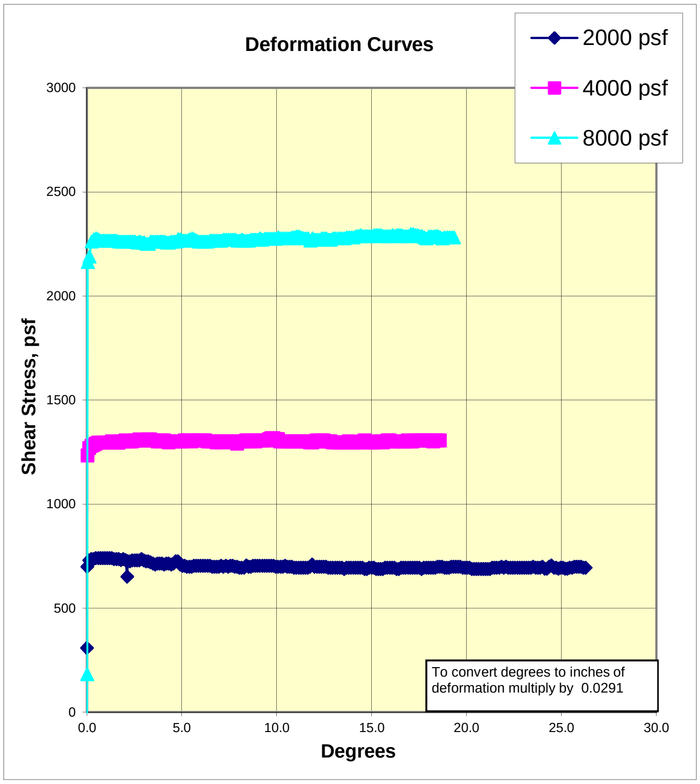
Soil Type: Gray Fat CLAY w/ Sand

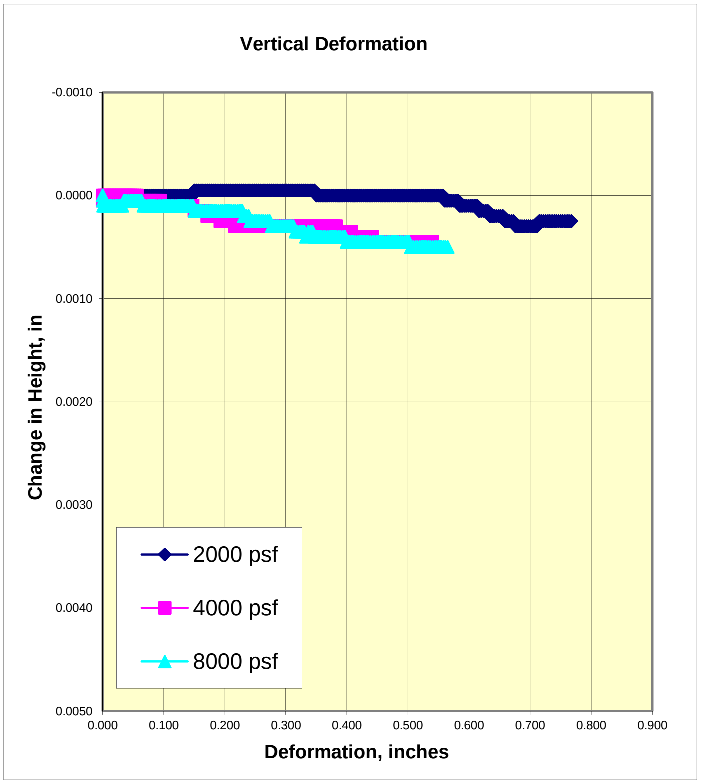
Normal Stress, psf	2000	4000	8000
Secant Phi, deg.:	19	18	16

Remarks: A small friction correction was applied to each point.







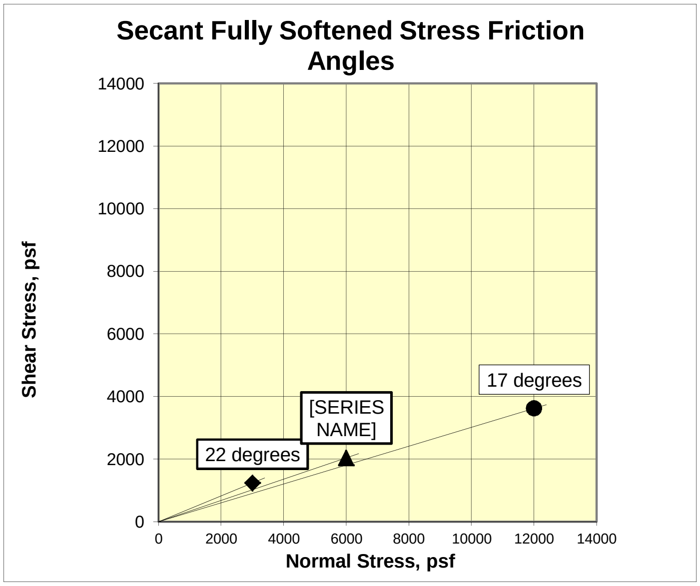


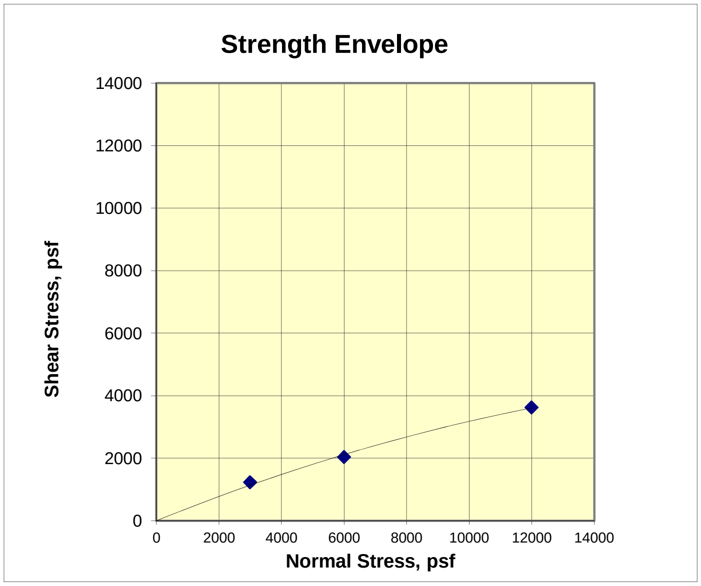
BENCHMARK GEOLABS

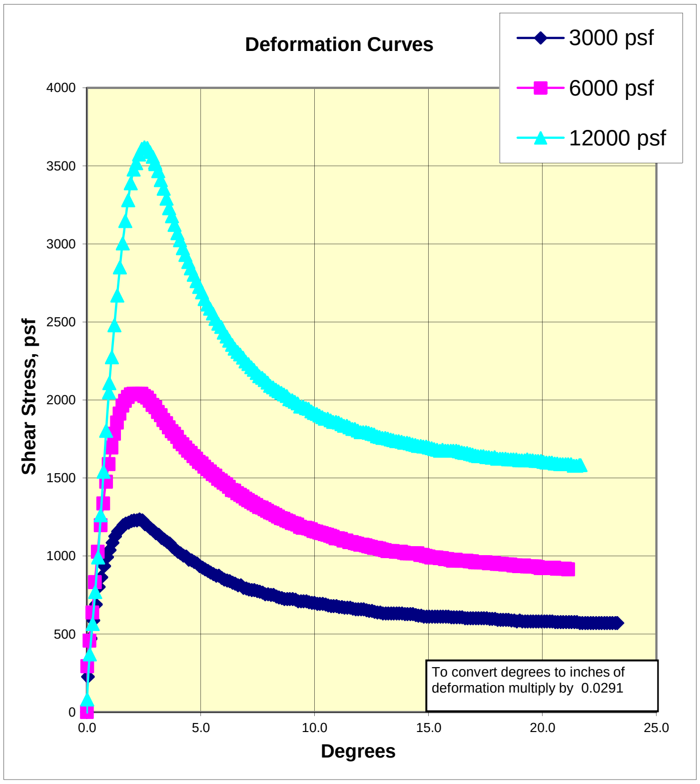
Drained Fully Softened Torsional Shear Strength (ASTM D7608)

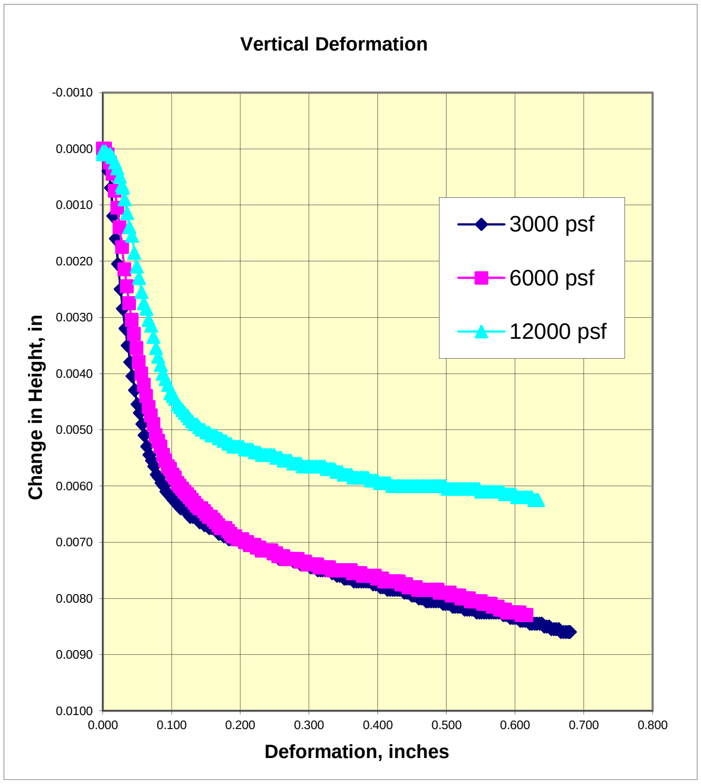
BGL Job No.:	040-002	**Boring:**	BA-2	**Date:**	5/28/2019	**Clay, %:**	
Client:	LGC Geotechnical	**Sample:**	GB-2	**By:**	PJ	**LL:**	77.9
Project Name:	El Toro	**Depth (ft):**	59.5	**Checked:**	PJ	**PL:**	32.2
Project Number:	18184-01	**Test Type:**	Reconstituted Fully Softened	**Sample Preparation:**			<#40
Soil Type:	Dark Greenish Gray Fat CLAY		**Remarks:**				

Normal Stress, psf	3000	6000	12000
Secant Phi, deg.:	22	19	17









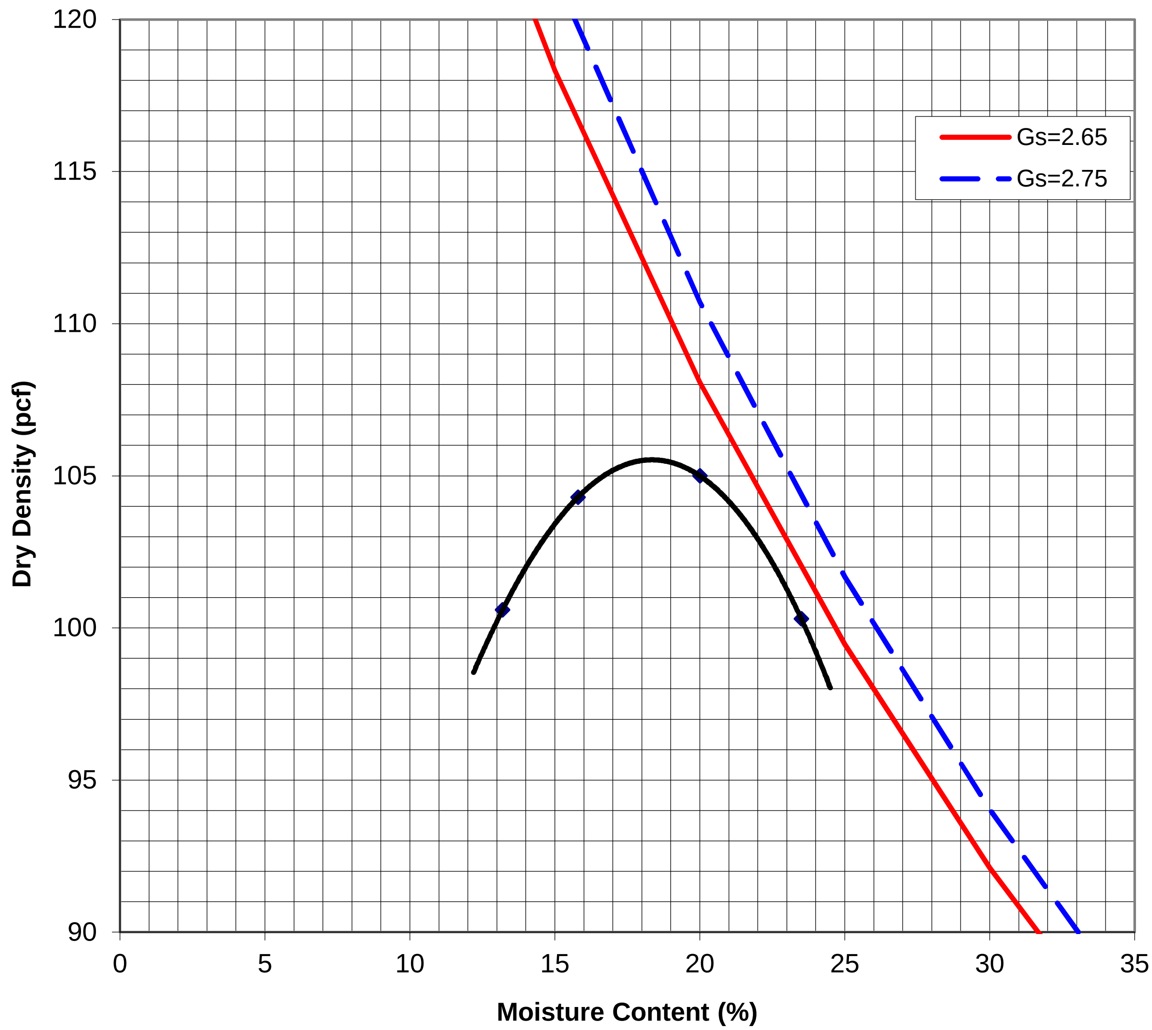
Location	Sample No.	Depth (ft)	Molding Moisture Content (%)	Initial Dry Density (pcf)	Final Moisture Content (%)	Expansion Index	Expansion Classification[1]
BA-1	B-1	0-5'	10.5	110.0	35.0	97	High
BA-3	B-1	5-7'	19.0	86.8	43.0	92	High

LGC Geotechnical, Inc.

EXPANSION INDEX
(ASTM D 4829)

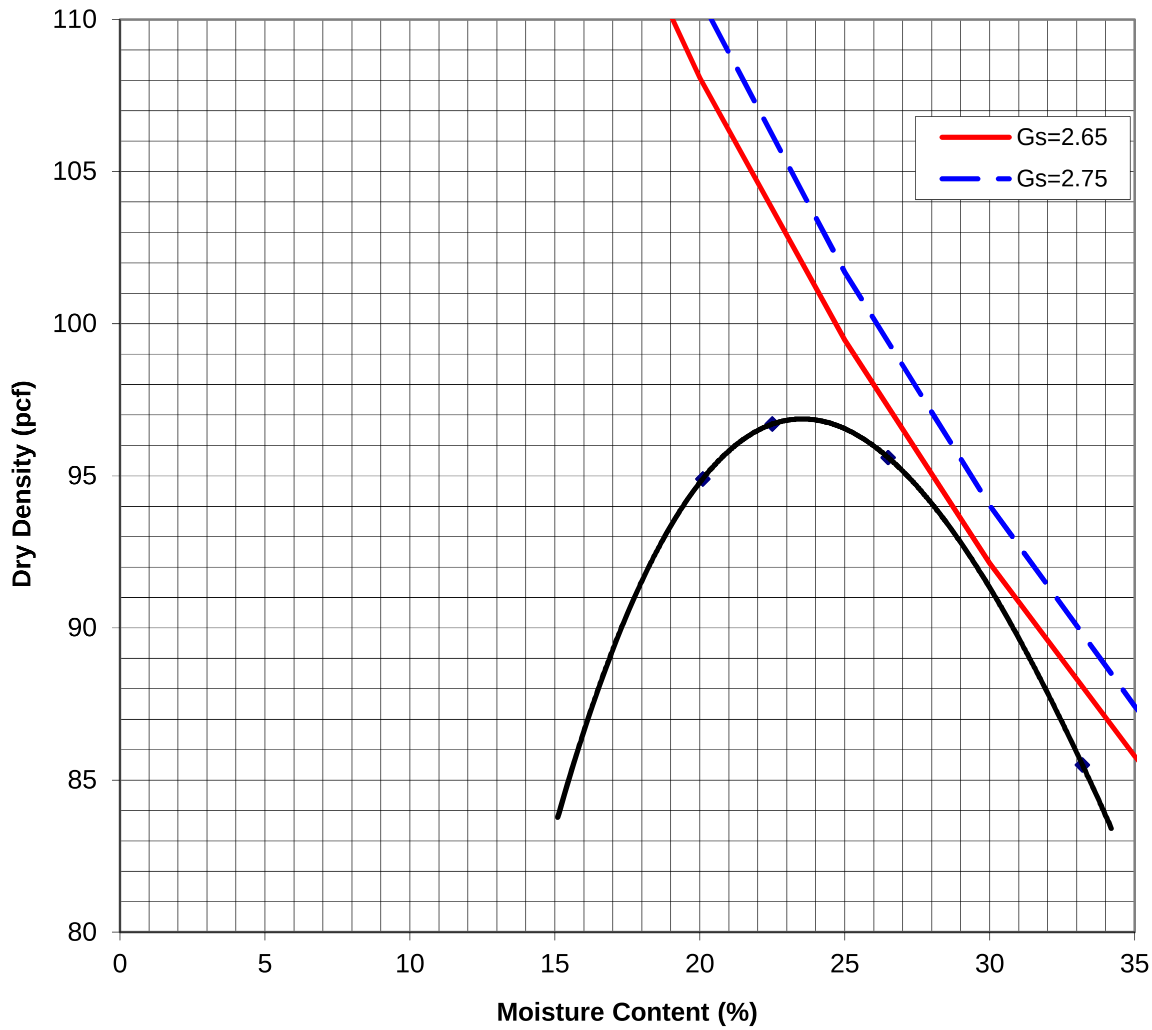
Project Number: 18184-01
Date: Jun-19

El Toro



Location:	Sample No.:	Depth (ft)	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
BA-1	**B-1**	**0-5'**	**Dark Brown Clay**	**105.5**	**8.5**

LGC Geotechnical, Inc.	**LABORATORY COMPACTION** (ASTM D 1557)	**Project Number:** 18184-01 **Date:** Jun-19	**El Toro**



Location:	Sample No.:	Depth (ft)	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
BA-3	**B-1**	**5-7'**	**Light Brown Sandy Clay**	**97.0**	**23.5**

LGC Geotechnical, Inc.

LABORATORY COMPACTION
(ASTM D 1557)

Project Number:	18184-01
Date:	Jun-19

El Toro

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: El Toro | Tested By : OHF/ACS | Date: 05/16/19

Project No. : 18184-01 | Input By: J. Ward | Date: 05/24/19

Boring No.	BA-1	BA-3		
Sample No.	B-1	B-1		
Sample Depth (ft)	0-5	5-7		
Soil Identification:	Dark grayish brown (CL-ML)s	Olive brown CL-ML		
Wet Weight of Soil + Container (g)	0.00	0.00		
Dry Weight of Soil + Container (g)	0.00	0.00		
Weight of Container (g)	1.00	1.00		
Moisture Content (%)	0.00	0.00		
Weight of Soaked Soil (g)	100.39	100.23		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	304	152		
Crucible No.	12	14		
Furnace Temperature (°C)	860	860		
Time In / Time Out	8:45/9:30	8:45/9:30		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	20.7436	19.6927		
Wt. of Crucible (g)	20.7365	19.6826		
Wt. of Residue (g) (A)	0.0071	0.0101		
PPM of Sulfate (A) x 41150	292.17	415.61		
PPM of Sulfate, Dry Weight Basis	**292**	**416**		

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	15	5		
ml of AgNO3 Soln. Used in Titration (C)	2.1	1.5		
PPM of Chloride (C -0.2) * 100 * 30 / B	380	780		
PPM of Chloride, Dry Wt. Basis	**380**	**780**		

pH TEST, DOT California Test 643

pH Value	**7.40**	**6.80**		
Temperature °C	22.3	22.4		

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	El Toro	Tested By :	O. Figueroa Date: 05/20/19
Project No. :	18184-01	Input By:	J. Ward Date: 05/24/19
Boring No.:	BA-1	Depth (ft.) :	0-5
Sample No. :	B-1		

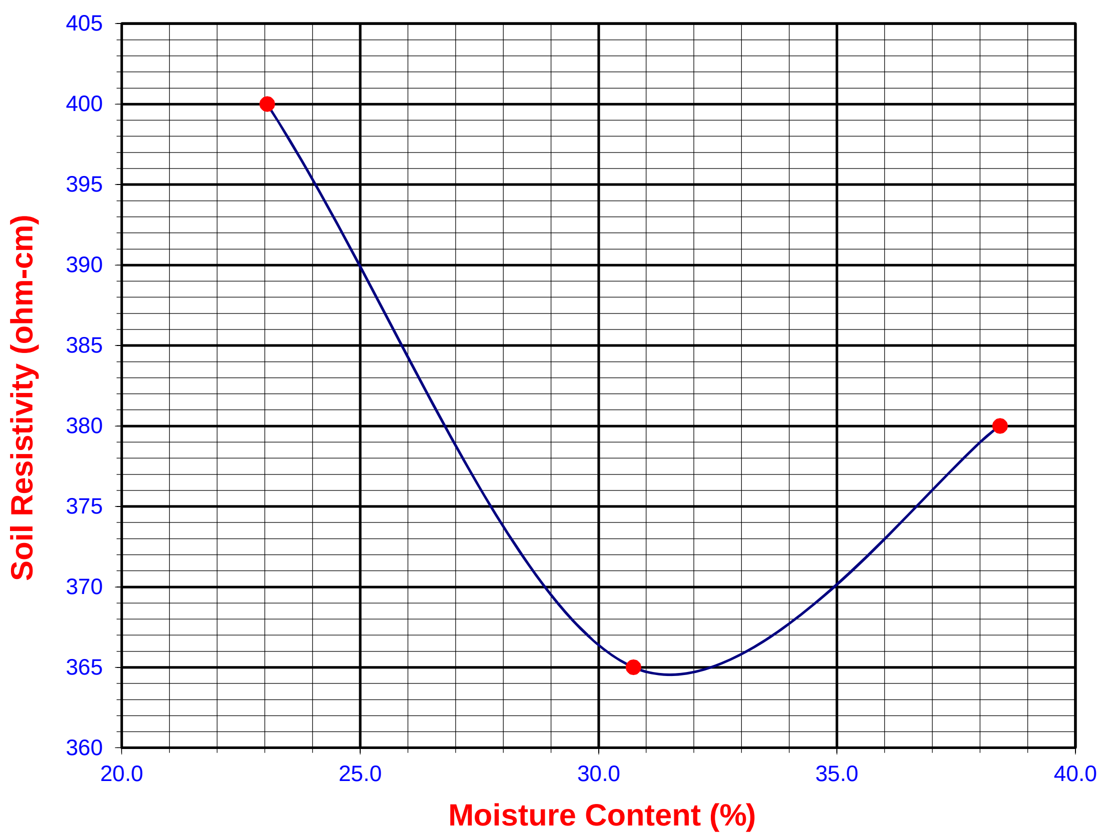
Soil Identification:* Dark grayish brown (CL-ML)s

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

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	30	23.05	400	400
2	40	30.73	365	365
3	50	38.42	380	380
4				
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	0.00
Dry Wt. of Soil + Cont. (g)	0.00
Wt. of Container (g)	1.00
Container No.	
Initial Soil Wt. (g) (Wt)	130.15
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
365	**31.5**	**292**	**380**	**7.40**	**22.3**



SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	El Toro	Tested By :	O. Figueroa Date: 05/20/19
Project No. :	18184-01	Input By:	J. Ward Date: 05/24/19
Boring No.:	BA-3	Depth (ft.) :	5-7
Sample No. :	B-1		

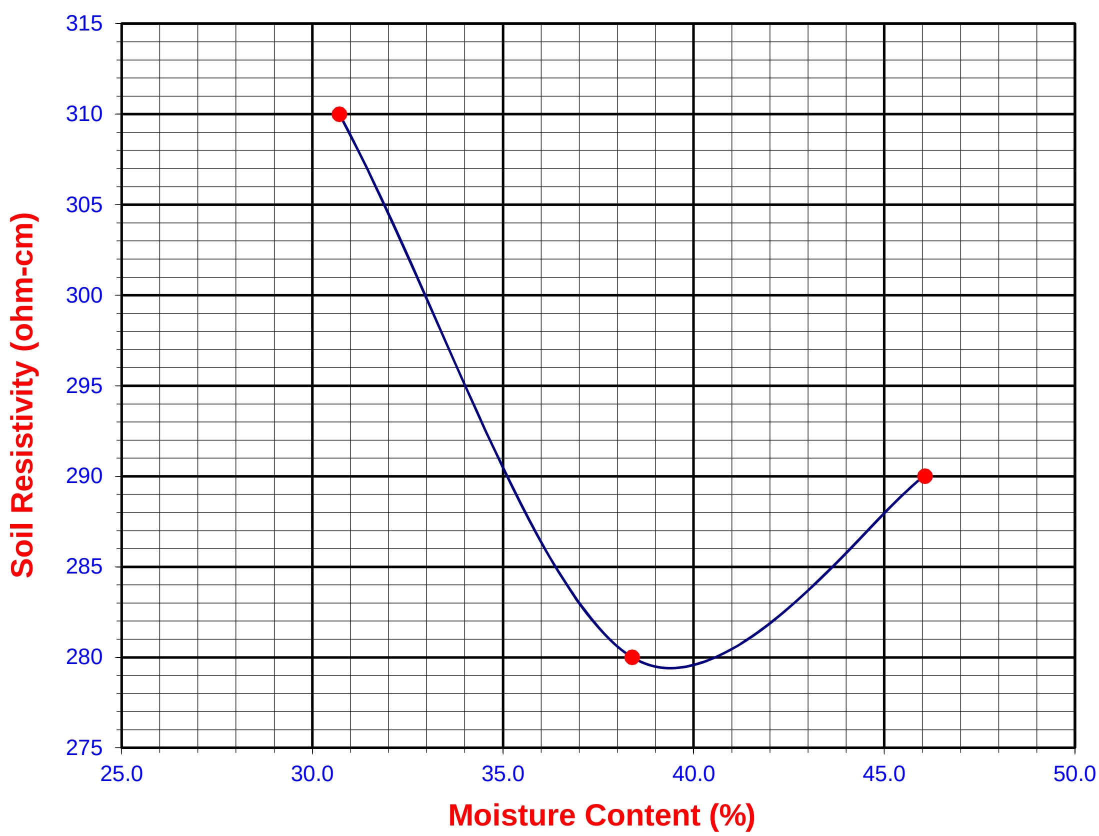
Soil Identification:* Olive brown CL-ML

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

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	40	30.71	310	310
2	50	38.39	280	280
3	60	46.07	290	290
4				
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	0.00
Dry Wt. of Soil + Cont. (g)	0.00
Wt. of Container (g)	1.00
Container No.	
Initial Soil Wt. (g) (Wt)	130.25
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH: pH	Soil pH: Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
279	**39.4**	**416**	**780**	**6.80**	**22.4**



Appendix D
Slope Stability Analyses

Summary of Slope Stability Analysis

Cross-Section	File Name	Factor of Safety	Description
A-A'	xad	2.14	Lower Slope
	xadf	2.14	Lower Slope – Entire Length
	xadkb	2.22	Lower Slope – Behind Keyway
	xadku	2.08	Lower Slope – Below Keyway
	xadr	1.58	Lower Slope – Rotational Static
	xadre	1.19	Lower Slope – Rotational Seismic
	xaku2	1.52	Upper Slope – Below Keyway
	xaku3	1.57	Upper Slope – Behind Keyway
	xku4	1.70	Upper Slope – Upper Clay Search
	xaku5	1.95	Upper Slope – Upper Clay Search 2
	xakur	1.85	Upper Slope – Rotational Static
	xakure	1.31	Upper Slope – Rotational Seismic
B-B'	xbd	2.19	Lower Slope
	xbdf	1.76	Lower Slope – Entire Length
	xbdkb	1.71	Lower Slope – Behind Keyway
	xbdku	2.01	Lower Slope – Below Keyway
	xbdukb	1.63	Upper Slope – Behind Keyway
	xbduklcb	1.50	Upper Slope – Lower Clay Bed
	xbdukucb	1.52	Upper Slope – Upper Clay Bed
	xbduku	1.60	Upper Slope – Below Keyway
C-C'	xck	1.52	Lower Slope – Below Keyway
	xck2	2.42	Lower Slope – Behind Keyway
	xck3	1.77	Lower Slope – Below Keyway
	xck4	1.52	Lower Slope – Below Keyway
	xcuk	1.56	Upper Slope – Below Keyway
	xcuk3	1.63	Upper Slope – Behind Keyway
	xcuk3b	1.61	Upper Slope – Behind Keyway
	xcuk3c	1.64	Upper Slope – Behind Keyway
	xcuk4	1.73	Upper Slope – Upper Clay Search
	xcukb	1.60	Upper Slope – Below Keyway
D-D'	xddvb2	1.54	Design Section – Search
	xddvb2kb	1.61	Design Section – Behind Keyway
	xddvb2ku	1.62	Design Section – Below Keyway
Generic	-	2.11	Surficial Slope Stability Analysis

18184-01 / A-A' / Design /

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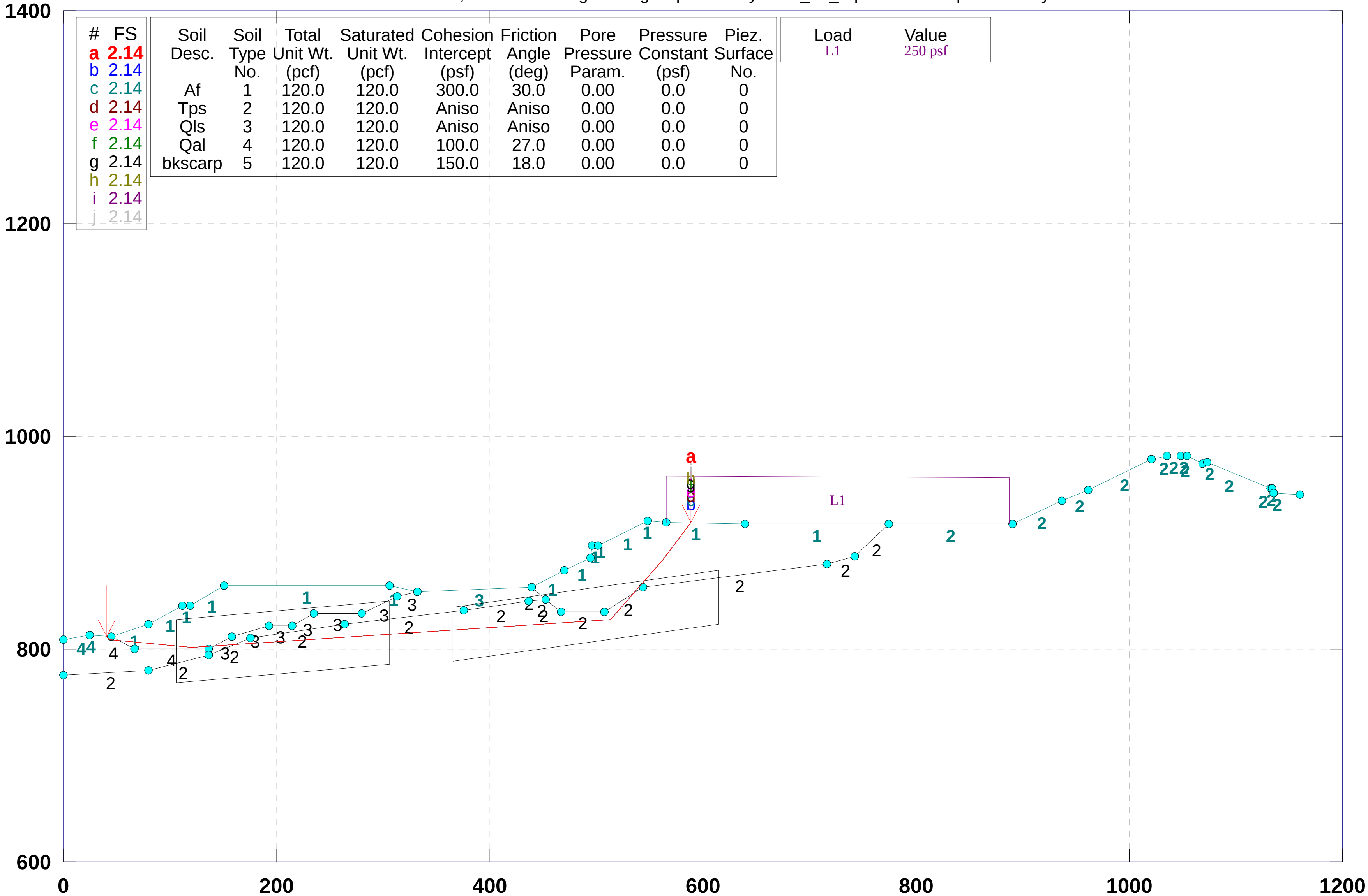


#	FS
a	2.14
b	2.14
c	2.14
d	2.14
e	2.14
f	2.14
g	2.14
h	2.14
i	2.14
j	2.14

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Af	1	120.0	120.0	300.0	30.0	0.00	0.0	0
Tps	2	120.0	120.0	Aniso	Aniso	0.00	0.0	0
Qls	3	120.0	120.0	Aniso	Aniso	0.00	0.0	0
Qal	4	120.0	120.0	100.0	27.0	0.00	0.0	0
bkscarp	5	120.0	120.0	150.0	18.0	0.00	0.0	0

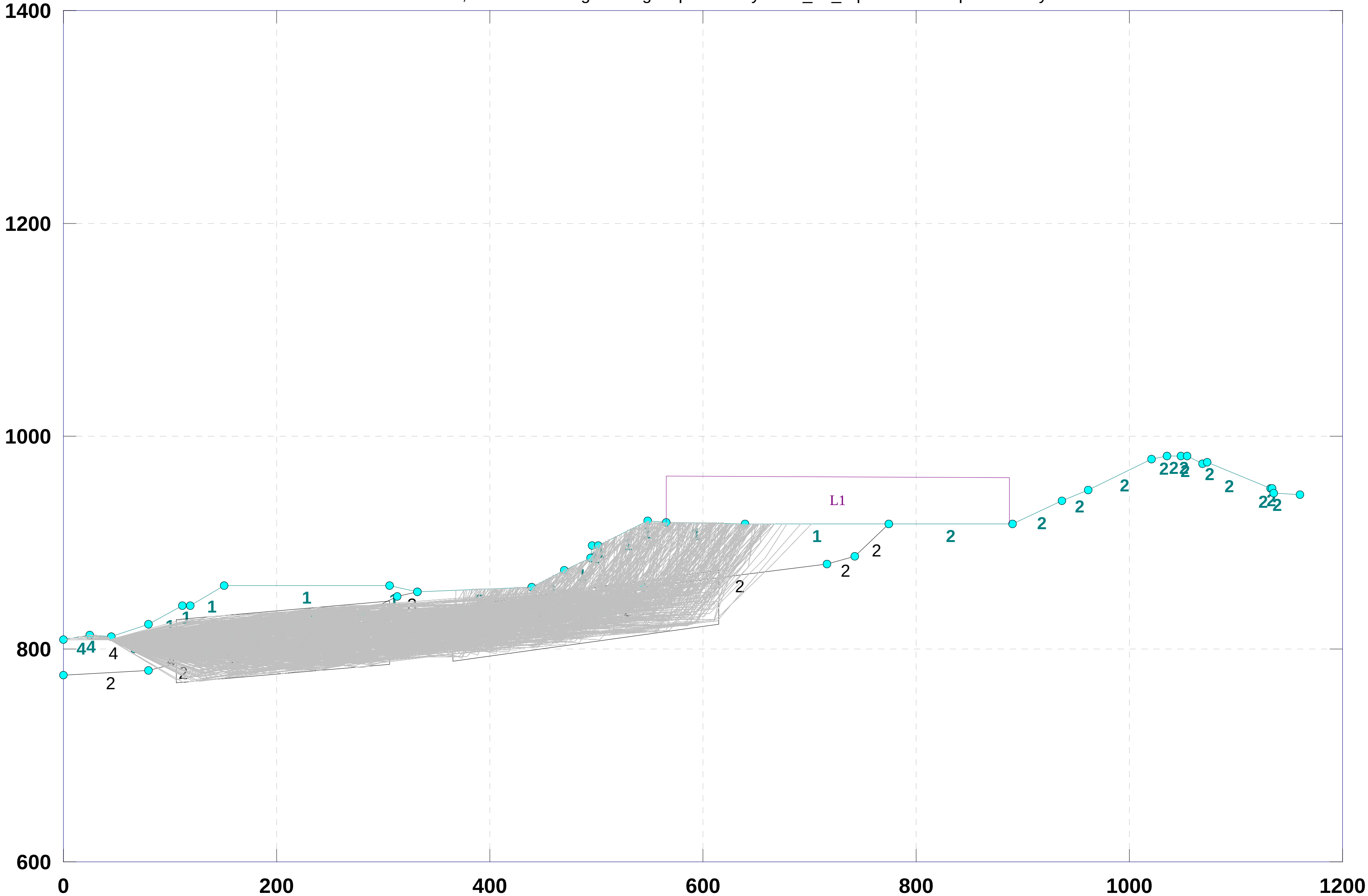
Load	Value
L1	250 psf

GSTABL7 v.2 FSmin=2.14

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

18184-01 / A-A' / Design /

z:\2018\18184-01 diamond star associates, inc.- el toro\engineering\slope stability\2019_07_report files\xad.plt   Run By: KMS   7/26/2019   07:21AM



*** GSTABL7 ***

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **

** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **

****
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Run Date: 7/26/2019
Time of Run: 07:21AM
Run By:
KMS

Input Data Filename: C:\Users\kstyler\Desktop\Personal\Scripts\autoHotKey\gstabl reports\files\xad.in

Output Filename: C:\Users\kstyler\Desktop\Personal\Scripts\autoHotKey\gstabl reports\files\xad.OUT

Unit System: English

Plotted Output Filename: C:\Users\kstyler\Desktop\Personal\Scripts\autoHotKey\gstabl reports\files\xad.PLT

PROBLEM DESCRIPTION: 18184-01 / A-A' / Design /

BOUNDARY COORDINATES

30 Top Boundaries
53 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	809.00	25.00	813.00	4
2	25.00	813.00	45.00	811.00	4
3	45.00	811.00	80.00	824.00	1
4	80.00	824.00	111.00	840.00	1
5	111.00	840.00	119.00	841.00	1
6	119.00	841.00	151.00	859.00	1
7	151.00	859.00	306.00	860.00	1

8	306.00	860.00	332.00	854.00	1
9	332.00	854.00	439.00	858.00	3
10	439.00	858.00	470.00	874.00	1
11	470.00	874.00	494.00	885.00	1
12	494.00	885.00	496.00	897.00	1
13	496.00	897.00	501.00	897.00	1
14	501.00	897.00	548.00	920.00	1
15	548.00	920.00	565.00	919.00	1
16	565.00	919.00	640.00	918.00	1
17	640.00	918.00	774.00	918.00	1
18	774.00	918.00	890.00	918.00	2
19	890.00	918.00	936.00	940.00	2
20	936.00	940.00	962.00	950.00	2
21	962.00	950.00	1021.00	979.00	2
22	1021.00	979.00	1035.00	981.00	2
23	1035.00	981.00	1048.00	982.00	2
24	1048.00	982.00	1054.00	981.00	2
25	1054.00	981.00	1068.00	974.00	2
26	1068.00	974.00	1073.00	975.00	2
27	1073.00	975.00	1132.00	951.00	2
28	1132.00	951.00	1134.00	951.00	2
29	1134.00	951.00	1136.00	946.00	2
30	1136.00	946.00	1160.00	945.00	2
31	45.00	811.00	66.00	800.00	4
32	66.00	800.00	137.00	800.00	4
33	137.00	800.00	158.00	812.00	3
34	158.00	812.00	193.00	822.00	3
35	193.00	822.00	215.00	822.00	3
36	215.00	822.00	235.00	834.00	3
37	235.00	834.00	280.00	834.00	3
38	280.00	834.00	313.00	849.00	3
39	313.00	849.00	332.00	854.00	3
40	0.00	775.00	80.00	780.00	2
41	80.00	780.00	137.00	795.00	2
42	137.00	795.00	175.00	810.00	2
43	175.00	810.00	264.00	823.00	2
44	264.00	823.00	375.00	837.00	2
45	375.00	837.00	436.00	845.00	2
46	439.00	858.00	452.00	847.00	2
47	436.00	845.00	452.00	847.00	2
48	452.00	847.00	467.00	835.00	2
49	467.00	835.00	507.00	835.00	2
50	507.00	835.00	544.00	858.00	2
51	544.00	858.00	716.00	880.00	2
52	716.00	880.00	742.00	887.00	2
53	742.00	887.00	774.00	918.00	2

User Specified Y-Origin = 600.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	120.0	120.0	300.0	30.0	0.00	0.0	0

2	120.0	120.0	300.0	30.0	0.00	0.0	0
3	120.0	120.0	300.0	26.0	0.00	0.0	0
4	120.0	120.0	100.0	27.0	0.00	0.0	0
5	120.0	120.0	150.0	18.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	2.0	300.00	30.00
2	9.0	0.00	15.00
3	90.0	300.00	30.00

Soil Type 3 Is Anisotropic

Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	2.0	300.00	26.00
2	9.0	100.00	12.00
3	90.0	300.00	26.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.

(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.

(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

1

BOUNDARY LOAD(S)

1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	565.00	888.00	250.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

Janbus Empirical Coef is being used for the case of c & phi both > 0

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.

4999 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 75.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	44.00	809.00	44.00	809.00	0.00
2	106.00	798.00	306.00	815.00	60.00
3	365.00	814.00	615.00	849.00	50.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 4999

Number of Trial Surfaces With Valid FS = 4999

Statistical Data On All Valid FS Values:
FS Max = 37.120 FS Min = 2.143 FS Ave = 5.046
Standard Deviation = 2.994 Coefficient of Variation = 59.34 %

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	41.066	811.393
2	44.000	809.000
3	120.148	801.762
4	512.934	827.835
5	563.156	883.537
6	587.991	918.693

Factor of Safety
*** 2.143 ***

Individual data on the 36 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.9	369.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.0	251.7	0.0	0.0	0.	0.	0.0	0.0	0.0
3	4.9	1896.7	0.0	0.0	0.	0.	0.0	0.0	0.0
4	30.1	41188.6	0.0	0.0	0.	0.	0.0	0.0	0.0
5	31.0	103769.0	0.0	0.0	0.	0.	0.0	0.0	0.0
6	8.0	36718.4	0.0	0.0	0.	0.	0.0	0.0	0.0
7	1.1	5442.1	0.0	0.0	0.	0.	0.0	0.0	0.0
8	22.6	123100.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	8.3	52891.2	0.0	0.0	0.	0.	0.0	0.0	0.0
10	7.0	46183.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	3.0	19693.4	0.0	0.0	0.	0.	0.0	0.0	0.0
12	14.0	90998.7	0.0	0.0	0.	0.	0.0	0.0	0.0
13	18.0	114938.0	0.0	0.0	0.	0.	0.0	0.0	0.0
14	22.0	137315.6	0.0	0.0	0.	0.	0.0	0.0	0.0
15	20.0	121812.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	29.0	171518.3	0.0	0.0	0.	0.	0.0	0.0	0.0
17	16.0	92041.9	0.0	0.0	0.	0.	0.0	0.0	0.0
18	26.0	145641.6	0.0	0.0	0.	0.	0.0	0.0	0.0
19	7.0	37683.2	0.0	0.0	0.	0.	0.0	0.0	0.0
20	19.0	93475.4	0.0	0.0	0.	0.	0.0	0.0	0.0
21	43.0	193766.4	0.0	0.0	0.	0.	0.0	0.0	0.0
22	61.0	263841.2	0.0	0.0	0.	0.	0.0	0.0	0.0
23	3.0	12641.8	0.0	0.0	0.	0.	0.0	0.0	0.0
24	13.0	59273.6	0.0	0.0	0.	0.	0.0	0.0	0.0
25	15.0	79726.2	0.0	0.0	0.	0.	0.0	0.0	0.0
26	3.0	17402.5	0.0	0.0	0.	0.	0.0	0.0	0.0
27	24.0	154708.4	0.0	0.0	0.	0.	0.0	0.0	0.0
28	2.0	15445.3	0.0	0.0	0.	0.	0.0	0.0	0.0
29	5.0	42073.8	0.0	0.0	0.	0.	0.0	0.0	0.0
30	6.0	51282.7	0.0	0.0	0.	0.	0.0	0.0	0.0
31	5.9	52515.5	0.0	0.0	0.	0.	0.0	0.0	0.0
32	22.3	181959.1	0.0	0.0	0.	0.	0.0	0.0	0.0
33	12.8	87932.3	0.0	0.0	0.	0.	0.0	0.0	0.0
34	15.2	80792.9	0.0	0.0	0.	0.	0.0	0.0	0.0
35	1.8	7569.2	0.0	0.0	0.	0.	0.0	0.0	0.0
36	23.0	45320.1	0.0	0.0	0.	0.	0.0	0.0	5747.8

Failure Surface Specified By 6 Coordinate Points

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2	44.000	809.000
3	120.148	801.762
4	512.934	827.835
5	563.156	883.537
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Factor of Safety
*** 2.143 ***

1

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Factor of Safety
*** 2.143 ***

**** END OF GSTABL7 OUTPUT ****

18184-01 / A-A' / Design / Search Entire Length

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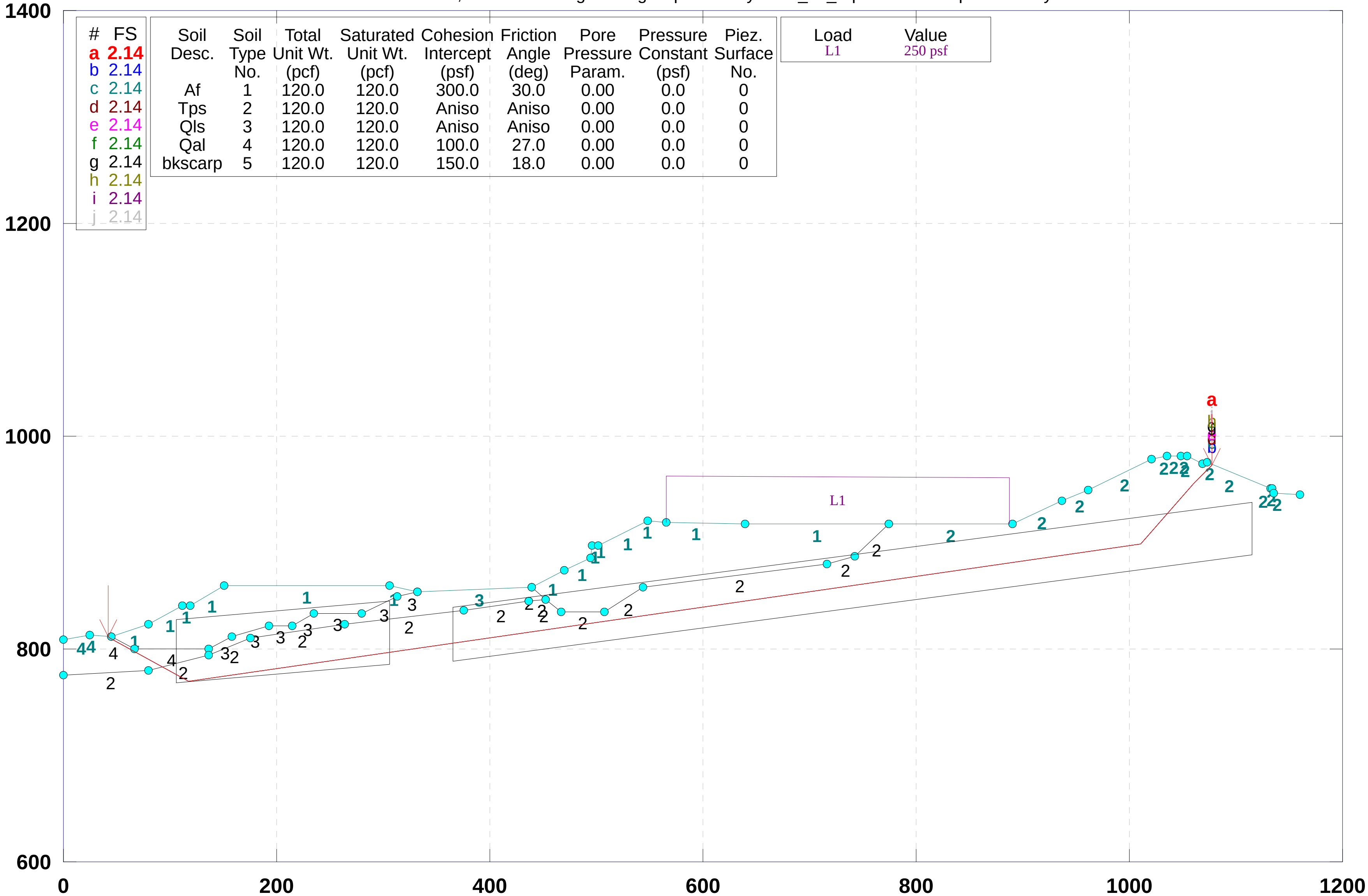

GSTABL7 v.2 FSmin=2.14

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

18184-01 / A-A' / Design / Search Entire Length

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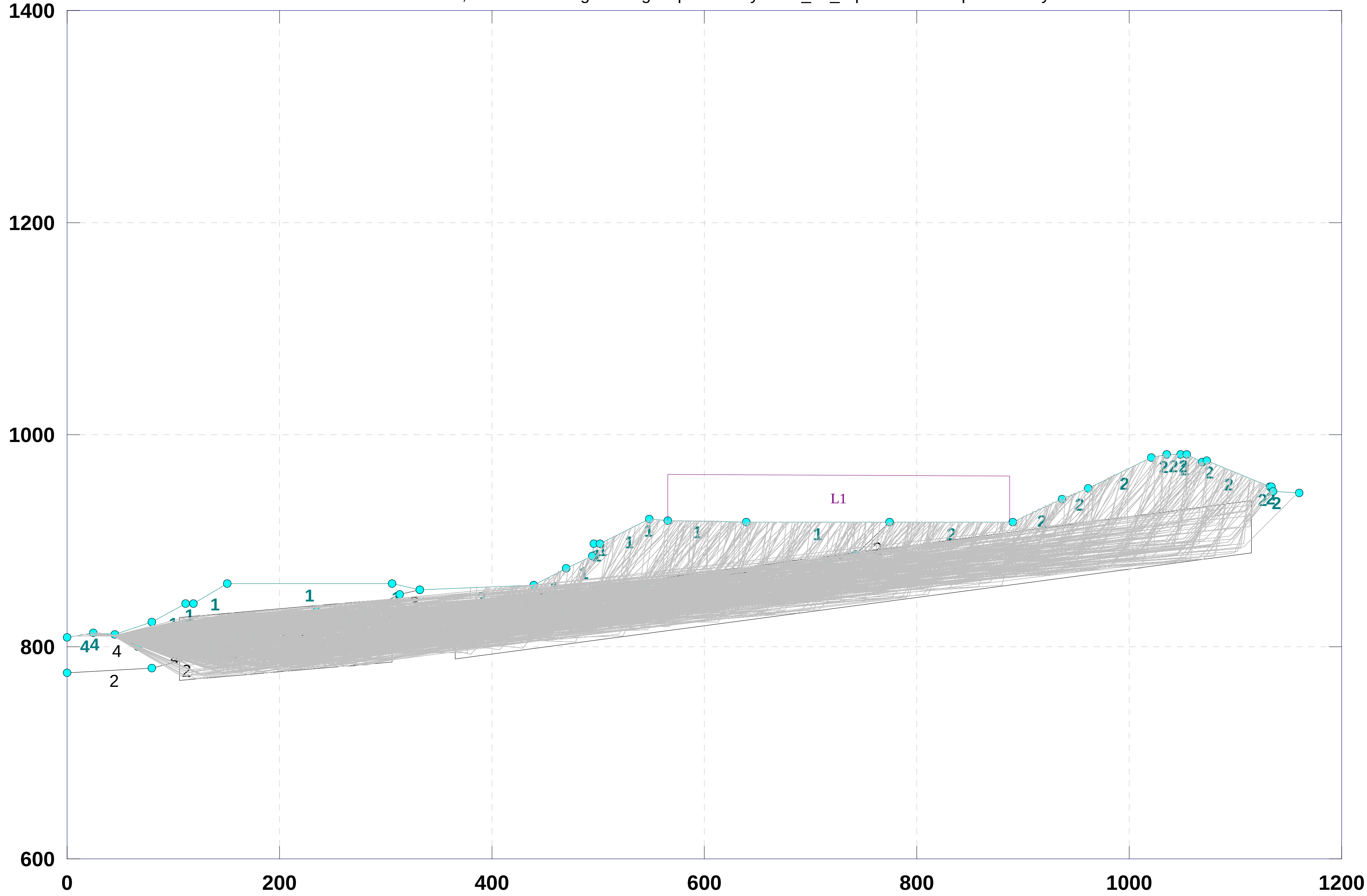

*** GSTABL7 ***

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **

** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **

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SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Run Date: 7/26/2019
Time of Run: 07:27AM
Run By:
KMS

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Output Filename: C:\Users\kstyler\Desktop\Personal\Scripts\autoHotKey\gstabl reports\files\xadf.OUT

Unit System: English

Plotted Output Filename: C:\Users\kstyler\Desktop\Personal\Scripts\autoHotKey\gstabl reports\files\xadf.PLT

PROBLEM DESCRIPTION: 18184-01 / A-A' / Design /
Search Entire Length

BOUNDARY COORDINATES

30 Top Boundaries
53 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
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6	119.00	841.00	151.00	859.00	1
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26	1068.00	974.00	1073.00	975.00	2
27	1073.00	975.00	1132.00	951.00	2
28	1132.00	951.00	1134.00	951.00	2
29	1134.00	951.00	1136.00	946.00	2
30	1136.00	946.00	1160.00	945.00	2
31	45.00	811.00	66.00	800.00	4
32	66.00	800.00	137.00	800.00	4
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35	193.00	822.00	215.00	822.00	3
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38	280.00	834.00	313.00	849.00	3
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45	375.00	837.00	436.00	845.00	2
46	439.00	858.00	452.00	847.00	2
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User Specified Y-Origin = 600.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	120.0	120.0	300.0	30.0	0.00	0.0	0

2	120.0	120.0	300.0	30.0	0.00	0.0	0
3	120.0	120.0	300.0	26.0	0.00	0.0	0
4	120.0	120.0	100.0	27.0	0.00	0.0	0
5	120.0	120.0	150.0	18.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	2.0	300.00	30.00
2	9.0	0.00	15.00
3	90.0	300.00	30.00

Soil Type 3 Is Anisotropic

Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	2.0	300.00	26.00
2	9.0	100.00	12.00
3	90.0	300.00	26.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
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1

BOUNDARY LOAD(S)

1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	565.00	888.00	250.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

Janbus Empirical Coef is being used for the case of c & phi both > 0

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.

4999 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 75.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	44.00	810.00	44.00	810.00	0.00
2	106.00	798.00	306.00	815.00	60.00
3	365.00	814.00	1115.00	913.00	50.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 4999

Number of Trial Surfaces With Valid FS = 4999

Statistical Data On All Valid FS Values:
FS Max = 22.283 FS Min = 2.141 FS Ave = 3.969
Standard Deviation = 2.075 Coefficient of Variation = 52.29 %

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	42.722	811.228
2	44.000	810.000
3	117.804	769.923
4	1010.950	898.835
5	1060.324	955.291
6	1077.954	972.985

Factor of Safety
*** 2.141 ***

Individual data on the 50 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.3	84.3	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.0	158.6	0.0	0.0	0.	0.	0.0	0.0	0.0
3	21.0	28084.8	0.0	0.0	0.	0.	0.0	0.0	0.0
4	14.0	45608.1	0.0	0.0	0.	0.	0.0	0.0	0.0
5	13.0	62870.2	0.0	0.0	0.	0.	0.0	0.0	0.0
6	18.0	123002.2	0.0	0.0	0.	0.	0.0	0.0	0.0
7	6.8	56057.4	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.2	10176.2	0.0	0.0	0.	0.	0.0	0.0	0.0
9	18.0	161283.6	0.0	0.0	0.	0.	0.0	0.0	0.0
10	14.0	136683.0	0.0	0.0	0.	0.	0.0	0.0	0.0
11	7.0	70395.0	0.0	0.0	0.	0.	0.0	0.0	0.0
12	17.0	167583.8	0.0	0.0	0.	0.	0.0	0.0	0.0
13	18.0	172229.7	0.0	0.0	0.	0.	0.0	0.0	0.0
14	22.0	203222.6	0.0	0.0	0.	0.	0.0	0.0	0.0
15	20.0	177798.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	29.0	246052.0	0.0	0.0	0.	0.	0.0	0.0	0.0
17	16.0	129796.2	0.0	0.0	0.	0.	0.0	0.0	0.0
18	26.0	201884.8	0.0	0.0	0.	0.	0.0	0.0	0.0
19	7.0	51745.1	0.0	0.0	0.	0.	0.0	0.0	0.0
20	19.0	129332.8	0.0	0.0	0.	0.	0.0	0.0	0.0
21	43.0	262447.6	0.0	0.0	0.	0.	0.0	0.0	0.0
22	61.0	331599.5	0.0	0.0	0.	0.	0.0	0.0	0.0
23	3.0	15076.1	0.0	0.0	0.	0.	0.0	0.0	0.0
24	13.0	68849.4	0.0	0.0	0.	0.	0.0	0.0	0.0
25	15.0	88810.7	0.0	0.0	0.	0.	0.0	0.0	0.0
26	3.0	18966.8	0.0	0.0	0.	0.	0.0	0.0	0.0
27	24.0	164192.0	0.0	0.0	0.	0.	0.0	0.0	0.0
28	2.0	15992.3	0.0	0.0	0.	0.	0.0	0.0	0.0
29	5.0	43277.7	0.0	0.0	0.	0.	0.0	0.0	0.0
30	6.0	52418.8	0.0	0.0	0.	0.	0.0	0.0	0.0
31	37.0	356185.3	0.0	0.0	0.	0.	0.0	0.0	0.0
32	4.0	41901.6	0.0	0.0	0.	0.	0.0	0.0	0.0
33	17.0	175966.6	0.0	0.0	0.	0.	0.0	0.0	0.0
34	75.0	707568.4	0.0	0.0	0.	0.	0.0	0.0	18750.0
35	76.0	613058.9	0.0	0.0	0.	0.	0.0	0.0	19000.0
36	26.0	186764.1	0.0	0.0	0.	0.	0.0	0.0	6500.0
37	32.0	213790.3	0.0	0.0	0.	0.	0.0	0.0	8000.0
38	114.0	617488.7	0.0	0.0	0.	0.	0.0	0.0	28500.0
39	2.0	8824.0	0.0	0.0	0.	0.	0.0	0.0	0.0
40	46.0	244550.1	0.0	0.0	0.	0.	0.0	0.0	0.0
41	26.0	171932.3	0.0	0.0	0.	0.	0.0	0.0	0.0
42	49.0	391960.8	0.0	0.0	0.	0.	0.0	0.0	0.0
43	10.0	86768.2	0.0	0.0	0.	0.	0.0	0.0	0.0
44	14.0	103604.8	0.0	0.0	0.	0.	0.0	0.0	0.0
45	13.0	74463.5	0.0	0.0	0.	0.	0.0	0.0	0.0
46	6.0	26546.7	0.0	0.0	0.	0.	0.0	0.0	0.0
47	6.3	21053.6	0.0	0.0	0.	0.	0.0	0.0	0.0
48	7.7	15453.3	0.0	0.0	0.	0.	0.0	0.0	0.0
49	5.0	5397.8	0.0	0.0	0.	0.	0.0	0.0	0.0
50	5.0	2077.0	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 6 Coordinate Points

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Factor of Safety
*** 2.141 ***

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**** END OF GSTABL7 OUTPUT ****

18184-01 / A-A' / Design / Search Behind Keyway

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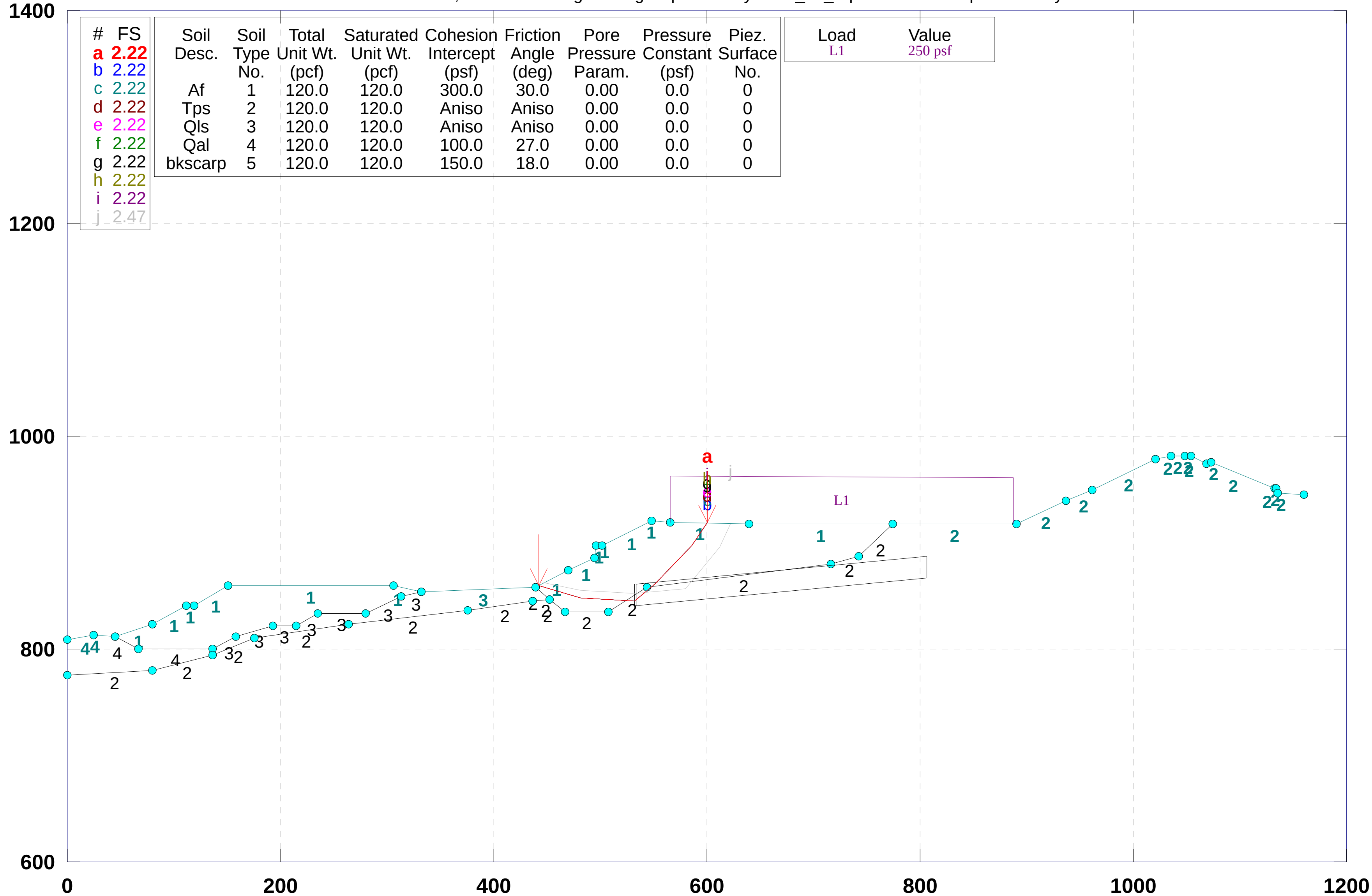


#	FS
a	2.22
b	2.22
c	2.22
d	2.22
e	2.22
f	2.22
g	2.22
h	2.22
i	2.22
j	2.47

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Af	1	120.0	120.0	300.0	30.0	0.00	0.0	0
Tps	2	120.0	120.0	Aniso	Aniso	0.00	0.0	0
Qls	3	120.0	120.0	Aniso	Aniso	0.00	0.0	0
Qal	4	120.0	120.0	100.0	27.0	0.00	0.0	0
bkscarp	5	120.0	120.0	150.0	18.0	0.00	0.0	0

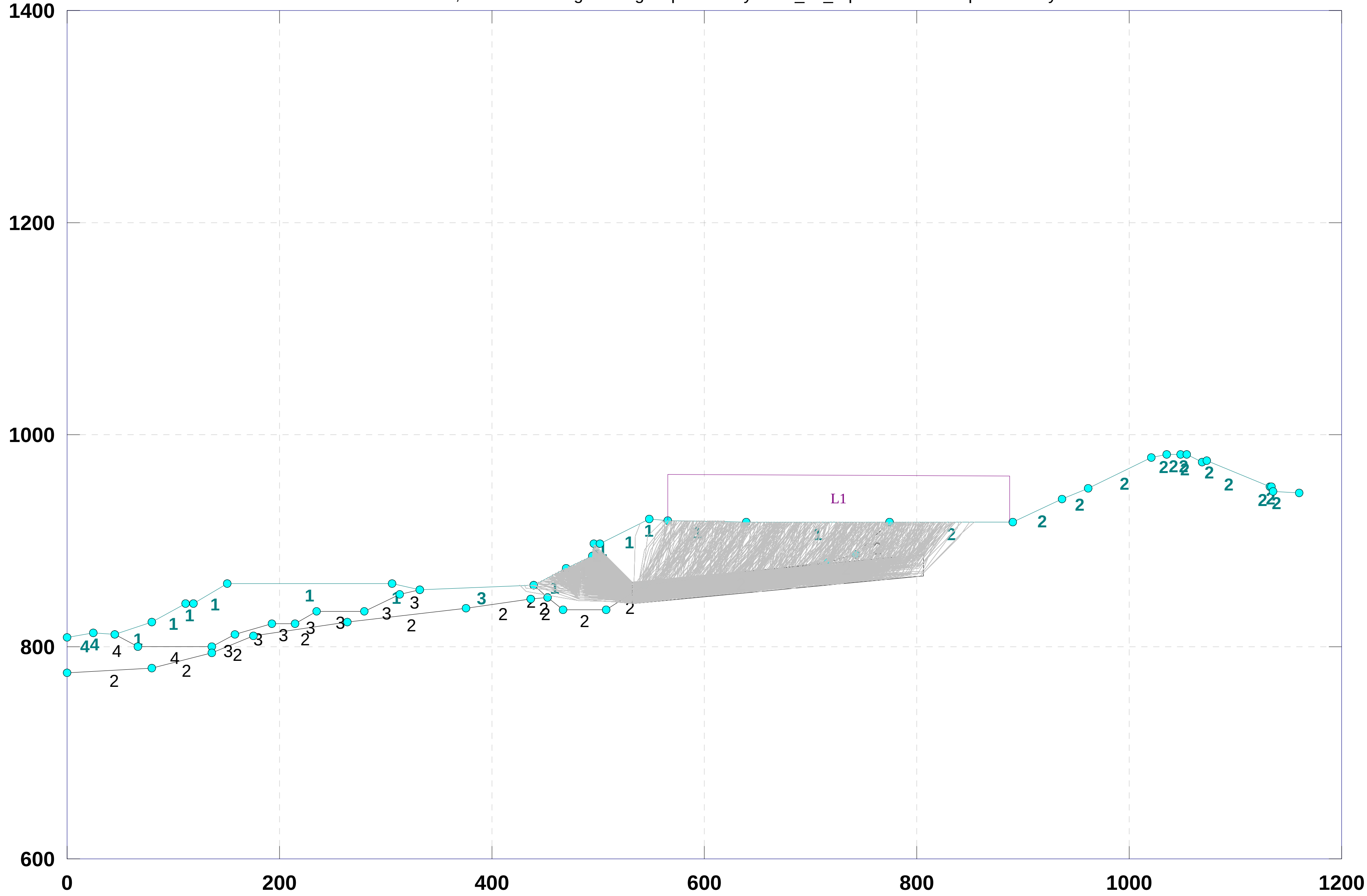
Load	Value
L1	250 psf

GSTABL7 v.2 FSmin=2.22

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

18184-01 / A-A' / Design / Search Behind Keyway

z:\2018\18184-01 diamond star associates, inc.- el toro\engineering\slope stability\2019_07_report files\xadkb.plt   Run By: KMS   7/25/2019   03:00PM



*** GSTABL7 ***

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **

** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **

****
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Run Date: 7/25/2019
Time of Run: 03:00PM
Run By:
KMS

Input Data Filename: Z:\2018\18184-01 Diamond Star Associates, Inc.- El Toro\Engineering\Slope Stability\Sec A\2019_07_xa\xadkb.in

Output Filename: Z:\2018\18184-01 Diamond Star Associates, Inc.- El Toro\Engineering\Slope Stability\Sec A\2019_07_xa\xadkb.OUT

Unit System: English

Plotted Output Filename: Z:\2018\18184-01 Diamond Star Associates, Inc.- El Toro\Engineering\Slope Stability\Sec A\2019_07_xa\xadkb.PLT

PROBLEM DESCRIPTION: 18184-01 / A-A' / Design / Search
Behind Keyway

BOUNDARY COORDINATES

30 Top Boundaries
53 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	809.00	25.00	813.00	4
2	25.00	813.00	45.00	811.00	4
3	45.00	811.00	80.00	824.00	1
4	80.00	824.00	111.00	840.00	1
5	111.00	840.00	119.00	841.00	1
6	119.00	841.00	151.00	859.00	1
7	151.00	859.00	306.00	860.00	1