NMG Geotechnical, Inc.

August 24, 2018

Project No. 18014-01

To: Sunjoint Development, LLC
280 Machin Ct.
City of Industry, California 91789

Attention: Mr. Michael Xu

Subject: Geotechnical Investigation and Review of Tentative Tract Map No. 78210, The Terraces, City of Walnut, California

In accordance with your request, NMG Geotechnical, Inc. (NMG) has performed a geotechnical review of Tentative Tract Map (TTM) No. 78210, "The Terraces," in the City of Walnut, County of Los Angeles, California (see Figure 1, Site Location Map). The plan reviewed for this report was the 80-scale TTM No. 78210, prepared by Michael Baker International (MBI) and received on August 22, 2018. The purpose of this study was to review the mixed-use planned development (residential and commercial) and proposed grading in light of the geotechnical conditions at the site to evaluate project feasibility and to provide preliminary recommendations for grading and construction.

NMG recently performed a geotechnical investigation that included 16 bucket-auger borings and 17 exploratory trenches. During this study, we also collected and compiled previous geotechnical data pertinent to the site. This report includes the data from the prior onsite geotechnical report (GeoTek, 2015), and geologic mapping from the adjacent Snow Creek development (Leighton, 1981, 1986 and 1987).

The main geotechnical constraints for this project include:

- Highly faulted and folded bedrock that varies in orientation across the project. Design cut slopes may require buttress fills for stabilization.
- Numerous tiered mechanically stabilized earth (MSE) walls surround the project. Wall construction will require a key-like excavation and select grading for approximately 400,000 yards of structural backfill that meet specific geotechnical requirements.
- Settlement potential in deep design fills up to 85 feet thick.
- Locally porous colluvium that is not well consolidated and will require remedial removals generally varying between 10 and 25 feet deep.
- Soils ranging from very low to very high expansion index and corrosivity to ferrous metal and concrete ranging from negligible to severe.

Section 2.0 of this report includes a description of the geotechnical conditions and findings for the site. The geotechnical conditions are shown geographically on the Geotechnical Map, Plate 1. The

planned site grading and existing topography from the TTM was used as the base map to depict the geotechnical data, prepared at 80-scale for this report.

References and prior geotechnical reports pertinent to the site are included in Appendix A. The boring and trench logs by NMG and others are included in Appendix B. The laboratory test results by NMG and others are presented in Appendix C. The seismic design parameters are presented in Appendix D. NMG's general earthwork and grading specifications are presented in Appendix E.

This report presents our preliminary findings, conclusions and recommendations for proposed grading and preliminary design recommendations for the mixed-use (residential and commercial) development. Based on our study, the proposed grading and planned development is considered geotechnically feasible provided the recommendations in this report are implemented during design, grading and construction. Final design measures will be provided in an upcoming grading plan review report that will be submitted to the City and used by the contractor during future grading at the site.

Environmental evaluation of onsite soil or imported soil is not a part of this report and is the purview of others.

If you have any questions regarding this report, please contact our office. We appreciate the opportunity to provide our services.

Respectfully submitted,

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1.0 INTRODUCTION

1.1 Introduction and Purpose

NMG Geotechnical, Inc. (NMG) has conducted a review of TTM No. 78210 for "The Terraces" mixed-use development (residential and commercial) in the City of Walnut, California. The purpose of this study was to evaluate the proposed grading and development in light of the geotechnical conditions at the site in order to provide preliminary recommendations for grading, design, and construction. The 80-scale TTM, prepared by MBI and received by NMG on August 22, 2018, was reviewed for this study and was used as the base map for the Geotechnical Map (Plate 1).

1.2 Scope of Work

The scope of work for this study included the following tasks:

- **Background Research:** City of Walnut archive search and review of available geotechnical reports and maps. Review of historic stereoscopic aerial photographs dating back to the 1950s. Referenced reports and aerial photos reviewed are listed in Appendix A.
- **Site Reconnaissance:** Field visits on several occasions to review the existing site conditions and update our findings accordingly.
- **Compilation and Review of Existing Data:** Review of boring/trench logs and associated laboratory testing from prior investigation efforts (GeoTek, 2015) for inclusion in this report. Laboratory testing included in-situ moisture and density, maximum density and optimum moisture content, Atterberg limits, direct shear, consolidation, expansion potential and corrosivity testing. Boring and trench logs are included in Appendix B and the laboratory test results are included in Appendix C.
  Additional geotechnical data and geologic mapping from the adjacent residential development was also reviewed (Leighton 1986 and 1987). Pertinent mapping from these reports is included on the Geotechnical Map (Plate 1).
- **Field Investigation:** Excavation of 17 trenches (T-1 through T-17) and 16 bucket-auger borings (B-1 through B-16). This investigation is discussed further in Section 1.6, the logs are included in Appendix B, and the boring/trench locations are shown on the Geotechnical Map (Plate 1).
- **Laboratory Testing:** Laboratory testing, including in-situ moisture and density, maximum density and optimum moisture content, grain size distribution (sieve and hydrometer), Atterberg limits, direct shear, and consolidation. Results of these tests are included in Appendix C. In-situ moisture contents and dry densities are presented on the geotechnical boring logs (Appendix B).
- **Plan Review:** Geotechnical review of the grading plan with respect to planned cuts and fills, perimeter conditions, cut and fill slopes, and retaining walls.
- **Geotechnical Analysis:** Presentation of data and preparation of the Geotechnical Map (Plate 1). Preliminary review of slope stability for the proposed graded and natural slopes, and

settlement evaluation was performed. Remedial measures (including slope stabilization, remedial removals, subdrain systems, etc.) were evaluated and are discussed in Section 3 of this report. Earthwork shrinkage and bulking were also estimated. Preliminary recommendations are also included for future grading and development.

- **Report Preparation:** Preparation of this geotechnical report with the accompanying illustrations and appendices. This report summarizes our findings, conclusions, and recommendations for the planned grading and provides preliminary design information for the future site development.

1.3 Site Location and Existing Conditions

The approximately 49-acre site is located within the southeast San Jose Hills, north of the Puente Hills and San Jose Creek, within the City of Walnut, County of Los Angeles, California (see Figure 1). The subject property is currently vacant land in near natural conditions with access roads/trails, and natural and invasive vegetation ranging from sparse to dense. The site terrain consists of steeply to gently sloping hillside slopes that range from 10H:1V to locally as steep as 1H:1V. The total topographic relief within the project site is nearly 245 feet, ranging from a high elevation of 860 feet above mean sea level (msl) to a low elevation of 616 feet above msl. There is one storm drain system (concrete v-ditch and laterals) along the east and southeast property line, adjacent to East Valley Boulevard, in order to control surface runoff from the project. Numerous manhole and debris covers are present along the v-ditch where they drain into laterals, outletting into a storm drain along East Valley Boulevard.

The project includes "off-site" grading on a portion of Lots 17 and 18 of Tract 32158 (Plate 1), along the northern property line. A natural canyon/swale is present along the property line that separates the two tracts. The "off-site" portion of the project is currently the respective homeowner's rear yard/lot that is used for storage, horse stables, and trails.

1.4 Site History and Previous Geotechnical Investigations

Stereoscopic pairs of aerial photographs dating back to the early 1950s have been reviewed. Between 1953 and 1983, the site was essentially in its natural condition except for evidence of dirt access roads and minor grading at the top of the hill. Between 1971 and 1975, improvements and widening of East Valley Boulevard occurred, resulting in the existing steepened (approximately 1:1) cut slope along the eastern perimeter of the site. By 1983, portions of the subject site appear to have been recently cleared/grubbed and graded for agricultural purposes. These activities continued through 1995. Since 1995, the site has remained relatively unchanged, with periodic clearing/grubbing of portions of the site.

The adjacent housing development (Snow Creek) was partially graded by 1983, with the remainder of the development graded by 1986. Construction of the homes occurred between 1986 and 1990.

Based on our background review, the following pertinent geotechnical investigations and grading operations were performed at the subject site and for adjacent properties:

- Leighton and Associates, Inc. (1980) performed a geotechnical investigation during design stages for the adjacent Tract 32185 (Snow Creek). Leighton also performed geotechnical

observation and testing during numerous phases of grading and construction (1981, 1986, and 1987). The pertinent data collected during our review has been included on Plate 1.

- Geotechnical studies by GeoTek were performed for a feasibility evaluation in 2008 and later for additional geotechnical evaluation in 2015. NMG only received and reviewed the latter report; data collected during the 2008 feasibility evaluation was included in the 2015 report. The exploration and laboratory data are included in Appendix B and C, respectively. The locations of the exploratory borings/trenches are shown on the Geotechnical Map (Plate 1).

1.5 Tentative Tract Map Plan and Future Development

TTM No. 78210, prepared by MBI and reviewed during this study, shows the proposed grading and mechanically stabilized earth (MSE) walls at 80-scale. The TTM also contains legal descriptions, general information, lot information and summary, and typical sections. The proposed grading and existing topography were used as the base map for our Geotechnical Map (Plate 1).

The overall site is approximately 49 acres, of which 23 acres will be developed for residential use. Approximately three acres of the site will be developed for commercial use. The balance of the site will be used for public and private streets, landscape, water quality basins, park, and open space. The proposed development is anticipated to yield 214 residential pads and one 3-acre commercial pad.

The proposed grading includes design fills and cuts of up to approximately 85 and 100 feet thick, respectively. The proposed graded slopes within the development area are designed at 2H:1V or flatter. The highest design fill slope is 95 feet and the highest design cut slope is 96 feet.

Approximately 16 single and tiered MSE walls are planned, ranging in height from 4 to 25 feet, and up to 2,600 feet long. A number of the walls have 2H:1V slopes ascending above, up to 40 feet high. Additionally, two 4-foot-high retaining walls are planned between lots. The proposed wall locations are shown on Plate 1.

1.6 Field Exploration

Field exploration conducted by NMG included excavation, surface logging and soil sampling of 16 large-diameter, bucket-auger borings and excavation and logging of 17 trenches/test pits to evaluate the near-surface soil conditions and evaluate bedrock structure. The boring and test pit logs are provided in Appendix B and the locations are depicted on the Geotechnical Map (Plate 1).

Sixteen bucket-auger borings (B-1 through B-16) were excavated throughout the site. The borings ranged from 40 to 100 feet deep below ground surface (bgs). The borings were sampled, geotechnically surface logged and downhole logged by an engineering geologist to evaluate bedrock stratigraphy and structure. Soil samples were taken at selected intervals, with a 2.5-inch-inside-diameter California split-barrel sampler, and were also used to obtain a measure of resistance of the soil to penetration (recorded as blows-per-foot on our geotechnical boring logs). Drive weights for the bucket-auger vary with the telescoping Kelly bar and depth of sample, as noted on the boring logs. Bulk samples of onsite soils were collected from the cuttings and used

for additional soil identification purposes and laboratory testing. Soil samples were visually classified in accordance with the Unified Soil Classification System (USCS). Upon completion of downhole logging, the borings were backfilled with native soils and tamped.

The trench/test pit exploration consisted of 17 trenches (T-1 to T-17) excavated with a rubber-tired backhoe to depths of 2 to 9.5 feet bgs. The excavations were geotechnically logged by an engineering geologist, and samples were taken at selected intervals. Representative bulk samples of onsite soil were collected from the trenches and backhoe cuttings and used for additional soil identification purposes and laboratory testing.

The approximate location of the borings and trenches are shown on the Geotechnical Map, (Plate 1) and the logs are included in Appendix B.

1.7 Laboratory Testing

NMG performed laboratory testing on selected soil and bedrock samples in order to characterize and confirm engineering properties with respect to the future site development. The laboratory testing included:

- Moisture content and dry density;
- Consolidation;
- Direct shear;
- Maximum density and optimum moisture content;
- Atterberg limits;
- Grain size distribution; and
- Hydrometer analysis.

Laboratory tests were conducted in general conformance with applicable ASTM International test standards. Laboratory test results by NMG and others are presented in Appendix C. In-situ moisture content and dry density data are included on the geotechnical boring logs (Appendix B).

2.0 GEOTECHNICAL FINDINGS

2.1 Regional Geologic Setting

The project site is located within the Peninsular Range geomorphic province, in the southeasterly San Jose Hills. The site is north of the Puente Hills and northwest of San Jose Creek. Tertiary-age marine claystone, siltstone, and sandstone bedrock units are exposed throughout the site with Quaternary-age colluvium in-filling the swales and low-lying areas of the site.

2.2 Earth Units

The subject site is underlain by Late Miocene-age bedrock of the Puente Formation, Yorba Member. Overlying the bedrock are surficial units, including colluvium, and uncertified artificial fill.5

Puente Formation, Yorba Member (Map Symbol – Tpy): This formation was deposited in a deep marine basin during the middle- to late-Miocene. This bedrock unit underlies the majority of the site and was encountered in all of the borings and trenches performed onsite (Plate 1). This bedrock generally consists of thinly interbedded to laminated sandstone, siltstone, and claystone. In general, the northwestern portion of the site is dominated by the presence of diatomaceous siltstones and claystone, and minor sandstones, while the southwestern portion of the site consists of sandstone and siltstone with minor claystone. The bedrock material is generally moist to very moist, stiff to very stiff/medium dense to very dense with minor amounts of cemented beds. Two borings encountered seepage and perched water along sandstone beds.

Locally, faulted and sheared bedrock was observed in the borings. The faults are predominantly iron-stained and gypsum-lined and the shears generally consist of polished, soft, and plastic clays typically less than one inch thick. Folding was observed in several of our borings within the bedrock. Generally, the folding ranged from local, small-scale folds, to larger, more regional folds. In general, a synclinal fold near the northern boundary of the site is present, with some associated overturned bedding.

Colluvium (Map Symbol – Col): Colluvium is mapped along hillsides in areas of active soil creep. It typically forms as a gravity-type deposit from erosion of the hillside and movement down slope. Generally, this material is on the order of 5 to 20 feet thick. It consists of dark brown and grayish-brown fine sandy silt and clay. The material is damp to moist, soft to medium stiff, and porous.

Artificial Fill (Map symbol – Afo$_{1,2}$/Afu): Areas underlain by artificial fill occur across the site; both compacted fill associated with the adjacent residential development (**Afo$_1$ and Afo$_2$)** and undocumented fill (**Afu**) associated with drainage berms and fill associated with the northerly offsite area. The fills are generally derived from onsite soils and bedrock materials.

Leighton (1987) reported that an organic stripping material stockpile was placed on the offsite Lots 17 and 18 of the adjacent Tract 32185. The mapped organic material was not encountered in our borings or trenches, and is not anticipated to be encountered during grading.

The undocumented fills are considered unsuitable for support of improvements and should be removed and recompacted. The documented fills may be weathered near-surface and will require some minimal removals to expose competent fill material. These compacted fills were placed against native soils along the perimeter of the mapped unit and will require some removal to overlap/tie-in to the prior remedial removals.

2.3 Geologic Structure and Faulting

The geologic structure across the majority of the site consists of a homoclinal sequence that generally strikes east-west, and dips 38 to 63 degrees to the north. The structure changes abruptly near the north-northeast perimeter of the site, where a syncline trends to the east-northeast. Vertical and overturned bedding associated with the syncline was encountered in our borings and trenches, and is shown on our Geotechnical Map (Plate 1).

Faults encountered in our borings generally showed minor offset and were typically clay-lined or lined with gypsum and/or calcium carbonate. No evidence of faulting at the surface was found during mapping and/or investigations at the site by NMG or others.

2.4 Regional Faulting and Seismicity

The site is not located within a fault-rupture hazard zone as defined by the Alquist-Priolo Special Studies Zones Act (Hart and Bryant, 2007) and no evidence of active faulting was observed during this investigation, or by prior work at the site. Also, based on mapping by the State (Jennings, 2010), there are no active faults at the site. Therefore, the potential for primary ground rupture is considered slight to nil.

Using the USGS deaggregation computer program and the site coordinates of 34.032 degrees north latitude and 117.930 degrees west longitude, the closest major active faults to the site is the San Jose Fault located 4.1 mi (6.6 km) south of the site. The moment magnitude (Mw) of this fault is 6.6.

The primary seismic hazard at the subject site is ground shaking due to a future earthquake on one a major regional active faults. Based on mapping by the State (CDMG, 1999), portions the southwesterly flat-lying areas are mapped as potentially liquefiable (Figure 2). The potential for liquefaction is discussed further in Section 2.9. Secondary seismic hazards, such as tsunami or seiche hazard, need not be considered as the site is located away from the ocean or bodies of water.

2.5 Groundwater

Groundwater and/or seepage was only encountered in two bucket-auger borings (B-4 and B-15), as shown on the Geotechnical Map (Plate 1) and as indicated on the geotechnical boring logs (Appendix B). In the hillside areas underlain by the Yorba Member bedrock, light to moderate seepage was encountered at a depth 76 feet, with standing groundwater at 88 feet. In the northerly canyon, light seepage was observed at a depth of 36.5 feet, with no standing groundwater observed at the completion of drilling. Groundwater was not encountered during the site exploration by others (GeoTek, 2015).

2.6 Mass Movements

Based on the seismic hazard mapping by the State (CDMG, 1999), one area of potential seismically-induced landsliding is mapped within the subject site (Figure 2). This area will be graded by cutting the hilltop and/or replacement with a MSE wall, therefore, removing the potential hazard.

Shallow slumps and surficial sloughing are located within the topographically steep areas within the subject site. These shallow features generally consist of colluvium and weathered bedrock that is loose to medium dense and porous and will also be mitigated during grading.

2.7 Soil Engineering Properties

The following includes a summary of the soil engineering properties based on the laboratory test results presented in Appendix C, which includes a compilation of laboratory data by NMG and data by others (GeoTek, 2015).

Soil Properties: Grain-size distribution tests were conducted on nine bulk samples collected from various depths during drilling. The bedrock material had fines content (passing No. 200 sieve) in the range of 33 to 80 percent. Atterberg limits testing was performed on five of these fine-grained samples. The samples had liquid limits in the range of 46 to 63 percent and plasticity indices in the range of 20 to 29. In general, the sandy portion of the bedrock formation encountered during this investigation was classified as silty and clayey sand (USCS Classification of SM and SC). The fine-grained bedrock materials consisted of low and high plasticity silts and clays (USCS Classification of ML, MH, and CL).

In-situ Moisture and Density: The in-situ moisture content and dry densities were determined on the relatively undisturbed samples collected from the borings in accordance with ASTM Test Methods D2216 and D2937. The in-situ dry density and moisture content test results are included in our boring logs (Appendix B).

Direct Shear: Direct shear tests were performed to evaluate the in-situ and remolded soil strength in accordance with ASTM D3080. Tests were conducted on undisturbed samples collected from the borings that consisted of siltstone and claystone within the bedrock. In addition, remolded samples were tested to estimate compacted fill strengths to assist with MSE wall design. The direct shear test results showing the interpreted peak, ultimate and residual strength envelopes are included in Appendix C.

Maximum Density and Optimum Moisture: Maximum density tests were performed on selected soil samples from the sandstone, siltstone, and claystone materials. Maximum density curves are included in Appendix C.

Consolidation: Consolidation testing was performed during this and the prior investigation on two selected soil samples of the onsite colluvium to determine the compressibility of the soil material. The samples were collected at depths of 5 and 12.5 feet. The result of the testing indicates that the colluvium (Col) materials have moderate compressibility. Two additional consolidation tests were

performed on bedrock samples. The results indicate that the bedrock (Tpy) materials have very low compressibility.

Expansion Index: Expansion index testing was performed on a number of samples during this and prior investigations. Test results indicate that the onsite bedrock and colluvial materials range from very low to very high expansion potential.

Corrosivity: Soil corrosivity testing with respect to metals and concrete in contact with earth was determined from two bulk samples in the upper 3 feet during the prior investigation. The soil was tested for chloride, pH, electrical resistivity, and soluble sulfate content. The electrical resistivity test indicates that onsite soils are severely corrosive to ferrous metals. The soluble sulfate content test results range from negligible ("S0") to severe ("S2") exposure levels. The laboratory test results are presented in Appendix C.

2.8 Preliminary Slope Stability

Site conditions are generally favorable for overall stability of the planned slopes and MSE walls. Soil strength parameters will be developed during a future 40-scale grading plan review. Cross-sections and slope stability analysis will also be provided at that time. The proposed natural, cut, and fill slopes have been qualitatively reviewed based on the known geotechnical conditions. The preliminary slope stabilization recommendations are further discussed in Section 3.4. The following includes a summary by slope type.

Natural Hillsides: At the completion of grading, no natural hillsides will remain within the subject site. One natural slope will remain along the northern boundary of the "off-site" grading area, within Lots 17 and 18 of Tract 32158. Based on our review of the as-graded reports, and review of aerial photography, the hillside is roughly in its natural state. Minor grading and construction for a barn and stables was completed after the home construction. Review of the existing data indicates that bedding is highly variable but generally favorable, dipping neutral or into slope. The hillsides generally descend down at 2H:1V or flatter. One nearby trench indicates that a small portion of the hillside dips out of slope where the hillside descends down at 3H:1V or flatter. The proposed "off-site" grading will fill over the toe of existing natural slopes, which is generally favorable.

Proposed Cut Slopes: Due to the substantial use of MSE walls throughout the project, a very limited amount of 2H:1V cut slopes are proposed. These cut slopes will expose Yorba Member sandstone, siltstone, or claystone. The bedrock formation is generally well-bedded and contains clay seams and claystone bedrock throughout, and may be susceptible to instability where unfavorable bedding conditions will be exposed.

Additionally, MSE wall construction will require excavation of a backcut and keyway in bedrock for construction and placement of grid in the reinforced soil zone behind the wall face. Based on the proposed wall heights, we anticipate keyway widths to range from 10 to 60 feet wide, resulting in temporary backcuts up to 90 feet high. These temporary backcuts will be supported by geogrid reinforced compacted fill when the MSE walls are constructed.

Proposed Fill Slopes: The planned fill slopes along the perimeter of the site, adjacent to East Valley Boulevard, are anticipated to be up to 95 feet high (including a tiered MSE wall 50 feet high). Interior fill slopes are anticipated to be 15 to 90 feet high (including tiered MSE walls). The fill slopes will toe out over bedrock or compacted fill over bedrock. In general, grading for the fill keys should start near the Limit of Remedial Grading Line (to be established at a later date) and extend down to competent bedrock.

Surficial stability depends upon the steepness of the slopes, compaction, and strength of near-surface soils. The onsite soils are anticipated to consist of generally silty material with varying amounts of sand and clay. At the completion of grading, slopes may be composed of relatively cohesive earth materials.

2.9 Liquefaction Potential

Liquefaction is a phenomenon in which earthquake-induced cyclic stresses generate excess pore water pressure in low density (loose), saturated sandy soils and soft silts below the water table. This causes a loss of shear strength and, in many cases, ground settlement. For liquefaction to occur, all of the following conditions must be present:

- There must be severe ground shaking, such as occurs during a strong earthquake.
- The soil material must be saturated or nearly saturated (generally below the water table).
- The corrected normalized standard penetration test (SPT) blow counts (N_1) or the CPT tip resistance (Q) must be relatively low.
- The soil material must be granular (usually sands or silts) with, at most, only low plasticity. Clayey soils and silts of relatively high plasticity are generally not subject to liquefaction.

Based on seismic hazard mapping by CDMG (1999), the flat-lying western portions of the site are located within mapped areas of potential liquefaction (Figure 3). Site-specific investigation within this area indicates that the colluvial soils are generally 5 to 20 feet thick, overlying bedrock. Due to the shallow thickness, absence of groundwater, relatively clayey nature of the soils, and anticipated remedial grading (Section 3.2), the potential for liquefaction at the subject site is considered very low.

2.10 Settlement

Based upon our subsurface exploration, laboratory testing and analysis, and review of prior data, the near-surface soil at the site generally consists of low density and porous materials, undocumented fill materials, or weathered bedrock. This unsuitable soil and weathered bedrock is prone to significant collapse and/or consolidation and has poor bearing properties. The thickness of this unsuitable material varies from approximately 5 to 25 feet across the site.

The unsuitable soil is underlain by bedrock that has higher density and is not porous. Subsurface data (blow counts, in-situ dry densities) and laboratory testing (consolidation testing) indicates relatively low consolidation potential in competent bedrock.

The amount of potential settlement can vary significantly over the site due to variations in subsurface conditions and depths of planned cuts and fills. In conducting our preliminary settlement evaluation, we have assumed that remedial removals will be implemented to remove the undocumented fill materials, topsoil, colluvium, and weathered bedrock; that fill loading will be a maximum of 85 feet over existing ground (on the order of 100 feet after removals); and structures will be of low-rise wood-framed construction (one to two stories).

We anticipate monitoring the settlement of deep fills after the completion of grading, until the total remaining consolidation settlement is on the order of 1.0 to 2.0 inches. The differential settlement is then expected to be on the order of 1 inch over a 30-foot span or less.

2.11 Earthwork Bulking/Shrinkage and Subsidence

The loss or gain of volume (shrinkage or bulking, respectively) of excavated natural materials and recompaction as fill varies according to earth material type and location. This volume change is represented as percent shrinkage (volume loss) and as percent bulking (volume gain) after recompaction of a unit volume of cut in this same material in its natural state. The onsite materials will have varying shrinkage or bulking characteristics. The following table presents the projected range of values for each type of material:

Earth Unit	***Approximate Percent Shrinkage/Bulking***
Undocumented Fill and Topsoil	5 to 15 percent shrinkage
Colluvium	5 to 10 percent shrinkage
Puente Formation, Yorba Member	0 to 3 percent bulking

Ground subsidence at the site is estimated to be on the order of 0.1 foot based upon the historic land use.

2.12 Existing Utilities

Storm drain systems (v-ditch and laterals) are present along the east and southeastern property line, adjacent to East Valley Boulevard. Additionally, we anticipate that utilities may be present within the limits of the "off-site" grading associated with the residential rear yard improvements. We are not aware of any other existing utilities onsite.

2.13 Rippability and Generation of Oversize Material

The rippability characteristics of bedrock depend upon the rock type, hardness, the depth of weathering, degree of fracturing, and the structure. Our borings were drilled into bedrock with little difficulty to maximum depths of 100 feet. Sandstone and siltstone of the Yorba Member vary from medium dense/stiff to very dense/hard with very little cemented beds and should be excavatable with little difficulty.

Rippability depends upon the depth of design cut into the rock. The deepest cuts within the site are up to 100 feet deep (including remedial grading). We anticipate that the denser bedrock will be

rippable with D-9/D-10 bulldozers. Sandstone beds may require heavy ripping locally, and oversize rock material may be generated.

Oversize rock (defined as rock exceeding 12 inches in the maximum diameter) may be generated during grading. Our exploration indicates that the quantities of oversize rock will not require crushing or export. The oversize rock may be disposed of in the deeper fills (greater than 10 feet below finish grade) provided it is placed in accordance with the recommendations provided in Section 3.12, the City of Walnut Grading Code, and the General Earthwork and Grading Specifications included in Appendix E.

2.14 Perimeter Conditions

The roughly triangular-shaped site is bounded on three sides by improved areas. Specific geotechnical issues related to the perimeter conditions are discussed below. Impacts to existing structures or improvements will need to be evaluated at the 40-scale grading plan review level.

East Valley Boulevard: East Valley Boulevard defines the east and southeast property line. Within the east corner of the site, borings and trenches indicate unsuitable, moderately compressible colluvium up to 20+ feet thick. The portion of the site adjacent to East Valley Boulevard is proposed to receive a two-tiered 25-foot-high MSE wall (50 feet total height) with 2H:1V slope above up to 45 feet high. Design fills up to 85 feet are planned within this vicinity.

City of Walnut Maintenance Department and Recreation Services: An existing City of Walnut maintenance facility is located at the topographically-low end of the site, at the southwest corner. It is unknown if the facility is underlain by compacted fill or colluvium at this time. Colluvium mapped near the property line is on the order of 10+ feet thick and is moderately compressible. An existing freestanding wall (to remain) is located along the property line. A 25-foot-high MSE wall is planned adjacent to this property line, with a 10 to 15-foot-high 2H:1V slope above the wall.

Snow Creek Residential Development: The Snow Creek residential development defines the west, north, and northeast property line of the project. Based on our review of the as-graded geotechnical reports, this perimeter is underlain by compacted fill, colluvium, or Puente Formation bedrock. Many of the adjacent lots have slopes ascending up to the project site, on the order of 5 to 17 feet high. The proposed grading along this boundary consists of a mixture of MSE walls (up to 25 feet high), design cut and fill slopes, and daylight cut pads.

3.0 CONCLUSION AND PRELIMINARY RECOMMENDATIONS

3.1 General Conclusion and Recommendation

Based on our findings, the proposed development is considered geotechnically feasible provided the recommendations of this report are implemented during grading and future design and construction.

This report presents the preliminary geotechnical recommendations for grading of the site. Additional evaluation and analysis will be performed and remedial grading measures will be refined and presented in a forthcoming 40-scale grading plan review.

Our recommendations are considered minimum and may be superseded by more stringent requirements of others. The grading and construction should be performed in accordance with the City of Walnut Grading Code and the General Earthwork and Grading Specifications provided in Appendix E, except as superseded below.

3.2 Remedial Removals

Unsuitable earth materials should be removed prior to placement of proposed fill. Unsuitable materials at the site include undocumented fills, topsoil, colluvium, and weathered bedrock. Estimated removal depths across the site are anticipated to vary on the order of 5 to 25 feet.

The removal bottom should expose competent bedrock material and should be evaluated, mapped and accepted by the geotechnical consultant prior to scarification/recompaction and placement of compacted fill.

3.3 General Earthwork and Grading

Prior to commencement of grading operations, deleterious material (including highly organic material, vegetation, trash, unsuitable debris) should be cleared from the site and disposed of offsite. Grading and excavations should be performed in accordance with the City of Walnut Grading Code and the General Earthwork and Grading Specifications in Appendix E. Prior to placement of fill, removal bottoms should be scarified a minimum of 6 inches, moisture-conditioned as needed, and compacted to a minimum 90 percent relative compaction. Where fills are greater than 40 feet thick (including remedial grading and behind MSE walls) fill materials are to be compacted to a minimum of 93 percent relative compaction. Relative compaction should be based upon ASTM Test Method D1557. Moisture content of fill soil should be over optimum moisture content. Consideration should be given to placing fill at higher moisture contents to facilitate the subgrade presoaking process under slabs-on-grade.

Native materials that are relatively free of deleterious material should be suitable for use as compacted fill. Fill material should be placed in loose lifts no greater than 8 inches in thickness and compacted prior to placement of the next lift. Ground sloping greater than 5H:1V should be prepared by benching into firm, competent material as fill is placed.

3.4 Slope Stabilization

General Slope Stability: During grading, backcut and keyway excavations should be mapped and evaluated by the geotechnical consultant to verify the anticipated conditions. If the conditions are different than anticipated, cross-sections should be updated to perform slope stability analysis, and the remedial grading measures should be modified as necessary. The excavations should be evaluated and accepted by the geotechnical consultant prior to placement of the subdrain and/or backfill.

As discussed previously, the majority of design cut slopes are planned to be converted to MSE walls for both interior and perimeter slopes. Currently, a limited number of design 2H:1V cut slopes are planned. For surficial stability purposes, stabilization fills are recommended where bedrock is exposed. Where unfavorable conditions are anticipated, cross- sections will need to be prepared and slope stability analysis performed to design the necessary buttresses for slope stabilization.

MSE wall construction will require excavation of a backcut and keyway within bedrock (in design cut areas) for construction and placement of grid in the reinforced soil zone. Preparation of cross-sections depicting the bedrock structure and global slope stability analysis will need to be performed to verify the adequacy of the geogrid type, embedment depth, spacing, and wall design.

The reworked onsite soils are anticipated to provide adequate strength for the gross and surficial stability of the proposed fill slopes at 2H:1V inclinations or flatter. A base fill key should be provided for the majority of these slopes. The depth of the key should be a minimum of 2 feet into competent earth material, at least 15 feet wide, and have a one-foot tilt back into the slope. Fill slopes are anticipated to be stable as designed provided they are constructed in accordance with the details in our General Grading and Earthwork Specifications (Appendix E). Slopes may be subject to erosion, and should be planted as soon as practical.

Temporary Slope Stability: Temporary slopes will be created as a result of the backcuts for MSE wall construction, recommended stabilization fill keys (if any), as well as for remedial removals adjacent to natural slopes, adjacent property, or existing improvements. The actual stability of the backcuts will depend on many factors, including the geologic bedding, jointing, seepage (if any), and the amount of time the excavation remains exposed. Extra care and attention should be provided while grading next to adjacent properties. Measures to mitigate potential backcut failure may include the following:

- Excavations should not be left open for long periods of time and should be backfilled as soon as practical (i.e., backfilled prior to the weekend or holiday, if possible).
- The backcut and frontcut should be carefully excavated at the recommended slope angles and "on grade" to reduce oversteepened areas. Cutting areas at steeper angles may result in slope failure.
- The backcut and frontcut should be "slope-boarded" on a routine basis so that the geotechnical consultant can map the slope carefully during excavation and help to notify the project team of critically unstable areas. This will also allow those working below the excavation to observe any potential failures.

- If necessary, slope excavations may need to be constructed in sections (on the order of 100 to 200 feet long); smaller sections may be necessary if backcut failures occur.

3.5 MSE Walls

We understand that MSE walls ("Verdura") will be designed by Soil Retention, based on soil shear strength and site seismic design parameters provided by NMG. As noted in Section 3.4, cross-sections will need to be prepared and global slope stability analysis will need to be performed to confirm that the overall slopes with walls meet the required minimum factors of safety.

Based on our review of the site soil engineering characteristics, MSE walls are geotechnically feasible for this project. Our exploration and soil testing indicates that there are sufficient quantities of earth materials at the site which will meet the minimum soil property requirements for the MSE walls. The granular material meeting the MSE wall criteria is located in the southern half of the site. Select grading may be required to generate this backfill material. The walls should be constructed in accordance with the plans and specifications on the approved plans. The manufacturer's representative (Soil Retention) should be present during construction to verify the proper installation of the blocks and geogrid. Representatives of the geotechnical consultant should also be present to observe and test compacted fill and drainage systems.

3.6 Foundation Setbacks

The footings of structures located above descending slopes should be set back from the slope face in accordance with the minimum requirements of the City of Walnut and CBC criteria, whichever is greater. The setback distance is measured from the outside edge of the footing bottom along a horizontal line to the face of the slope.

We understand that an alternative (reduced) foundation setback criteria was previously requested (GeoTek, 2018) and conceptually accepted by the City of Walnut. The reduced foundation setback will allow for the slope height (H) to be taken as the height of the slope above the top of the planned MSE walls. NMG generally concurs with the alternative setback criteria; however, additional geotechnical analysis should be anticipated to further evaluate the condition at 40-scale and for final City approval. Additionally, the geotechnical consultant should review planned top of slope improvements, foundation loads, and provide additional recommendations for deepened foundations, if required.

The tables below summarize the minimum setback criteria for structures above descending slopes:

Structural Setback Requirements

Case A – Building and Retaining Wall Footings Above Descending Slopes	
Slope Height [H] (feet)	*Minimum Setback from Slope face (feet)*
Less than 10	5
10 to 20	½ * H
20 to 30	10
More than 30	⅓ * H (maximum of 40')

Case B – Freestanding Wall Footings Above Descending Slopes	
Slope Height [H] (feet)	*Minimum Setback from Slope face (feet)*
Less than 10	5
10 to 20	½ * H
More than 20	Maximum of 10

For freestanding walls and other structures that are sensitive to lateral movement (e.g., smooth stucco finish, glass screens, etc.), NMG recommends that the structural setback requirements in accordance with Case A above be followed or that additional design measures be used to help control the potential for cracking and displacements. Otherwise, typical freestanding walls may have a setback in accordance with Case B.

3.7 Groundwater

Groundwater and/or seepage lies relatively deep below the site and varies based on location within the site. We do not anticipate that groundwater will be encountered during grading and construction. However, if the site is graded after a significant rainy period/winter, perched groundwater could be encountered during grading. Also, nuisance seepage may be encountered locally within structural elements, such as faults and folds, which act as groundwater traps.

3.8 Liquefaction and Seismic Settlement

Potentially liquefiable layers may be present in the colluvium deposits at the site. Based on available information, the potential for liquefaction is low, as noted in Section 2.9. Additionally, the preliminarily designed remedial grading will remove all existing colluvium and be replaced with compacted fill over bedrock.

3.9 Seismic Design Guidelines

The following table summarizes the seismic design criteria for the subject site. The seismic design parameters are developed in accordance with ASCE 7-10 and 2016 California Building Code (CBC). The data is included in Appendix D.

Selected Seismic Design Parameters from 2016 CBC/ASCE 7-10	***Seismic Design Values***	***Reference***
Latitude	34.0323 North	
Longitude	117.8292 West	
Nearest Seismic Source	San Jose Fault	USGS, 2017a
Distance to Nearest Seismic Source	4.1 Miles	USGS, 2017a
Site Class per Table 20.3-1 of ASCE 7-10	D	USGS, 2017b
Spectral Acceleration for Short Periods (Ss)	2.19 g	USGS, 2017b
Spectral Accelerations for 1-Second Periods (S1)	0.78 g	USGS, 2017b
Site Coefficient F_a, Table 11.4-1 of ASCE 7-10	1.0	USGS, 2017b
Site Coefficient F_v, Table 11.4-2 of ASCE 7-10	1.5	USGS, 2017b
Design Spectral Response Acceleration at Short Periods (S_{DS}) from Equation 11.4-3 of ASCE 7-10	1.46 g	USGS, 2017b
Design Spectral Response Acceleration at 1-Second Period (S_{D1}) from Equation 11.4-4 of ASCE 7-10	0.78 g	USGS, 2017b
Peak Ground Acceleration (MCE_R) Corrected for Site Class Effects from Equation 11.8-1 of ASCE 7-10	0.78 g	USGS, 2017b
Seismic Design Category, Section 11.6 of ASCE 7-10	E	USGS, 2017b

3.10 Settlement Conditions and Monitoring

The proposed design fill, above the existing ground at the site, is up to 85 feet thick (100 feet, including remedial removals). Following completion of remedial removals at the site, we anticipate competent bedrock to be exposed at the removal bottoms prior to placement of fill materials. The anticipated settlement of the fill soils under its own weight can be on the order of several inches. A large portion of the settlement will likely occur during grading operations. We recommend monitoring of settlement upon completion of grading in locations where there is greater than 60 feet of total fill (including remedial grading).

Settlement monuments should be installed at finish grade, based on the conditions observed during grading and the anticipated construction sequence for the future development. The monuments should be surveyed every two weeks for three months and monthly thereafter to initialize and monitor settlement trends. We do not expect the settlement monitoring to require more than 3 to 6 months. Survey data for settlement monuments should be forwarded to the geotechnical consultant after each reading. The settlement devices will need to be protected in-place to ensure integrity of the data collection.

The settlement estimates and monitoring duration may be subject to revision based upon the collected monitoring data within settlement-prone areas. In general, long-term settlement should

not exceed 1 to 2 inches once an area is released from a geotechnical standpoint. Also, differential settlement should not exceed 1 inch over a 30-foot span.

3.11 Rippability and Placement of Oversize Material

The bedrock at the site includes dense sandstone and siltstone beds that may be locally difficult to rip in the deeper cuts. We anticipate that the rock will be rippable using D-9/D-10 bulldozers in the planned excavations (up to 100 feet deep).

Locally, the planned cuts may produce oversize rock (greater than 12 inches in size) that may be placed in the deeper fills. The rock may be placed in fills deeper than 10 feet below design lot/pad grade and deeper than any planned utilities within streets. However, oversize rock shall not be placed within the geogrid reinforced fill associated with the planned MSE walls. The Grading and Earthwork Specifications in Appendix E includes the details of the placement of oversize rock.

3.12 Lot Capping/Overexcavation

The proposed grading is anticipated to expose cut and fill transitions at finish grade within some lots. The cut portions of pads and streets exposing bedrock should be overexcavated to a minimum depth of 5 feet and replaced with compacted fill to provide a uniform fill cap over each lot.

In areas where hard rock is exposed at grade and cannot be easily excavated with equipment or backhoes, overexcavation should be considered to facilitate future construction and utility installation.

Additional lot overexcavation/capping may also be recommended during grading in areas were earth materials are very different within an individual lot, such as in areas where highly expansive claystone beds are encountered adjacent to sandstone.

3.13 Subdrainage

Canyon-type subdrains (9 cubic feet of gravel per linear foot, with 6-inch, Schedule 40, perforated pipe wrapped in filter fabric) should be placed on the removal bottom or sides of the canyons/swales and provided with outlets into the future storm drain systems.

Backdrains (3 cubic feet of gravel per linear foot, with 4-inch, Schedule 40, perforated pipe wrapped in filter fabric) should also be provided for stabilization fills at 30-foot-vertical intervals with outlets every 100 feet through the slope face.

During grading, additional subdrains may be necessary for areas where seepage is encountered.

3.14 Expansion Potential and Sulfate Exposure

The expansion potential of the onsite soils ranges from "very low" to "very high," as classified by ASTM D4829. Grading and lot capping are likely to blend the soils so that at the completion of grading most of the residential lots should fall within the "medium" range. During and at the completion of grading operations, soil samples should be collected and tested for expansion

potential to confirm anticipated conditions. Additional soil testing and analysis will also be required for structural design recommendations.

Based on laboratory testing, soluble sulfate exposure in the onsite soils range in classification from "S0" to "S2" per Table 19.3.1.1 of ACI-318-14. At the completion of grading we anticipate that the sulfate classification will vary across the site. Soil samples should be collected at finish grade and tested for soluble sulfate content at the completion of rough grading.

3.15 Surface Drainage

Surface drainage should be carefully taken into consideration during all grading, landscaping, and building construction. Positive surface drainage should be provided to direct surface water away from structures and slopes and toward the street or suitable drainage devices. Ponding of water adjacent to the structures should not be allowed. Paved areas should be provided with adequate drainage devices, gradients, and curbing to reduce run-off flowing from paved areas onto adjacent unpaved areas.

The performance of foundations is also dependent upon maintaining adequate surface drainage away from structures. The minimum gradient within 5 feet of the structures will depend upon surface landscaping. In general, we recommend that unpaved lawn and landscape areas have a minimum gradient of 2 percent away from structures immediately adjacent to structures, and a minimum gradient of 1 percent for devices, such as swales, to collect this runoff and direct it toward the street or other appropriate collection points.

3.16 Maintenance of Graded Slopes

To reduce the erosion and slumping potential of the graded slopes, all permanent manufactured slopes should be protected from erosion by planting with appropriate vegetation, or suitable erosion protection should be applied as soon as is practical. Proper drainage should be designed and maintained to collect surface waters and direct them away from slopes. A rodent-control program should be established and maintained as well, to reduce the potential for damage related to burrowing. In addition, the design and construction of improvements and landscaping should also provide appropriate drainage measures.

3.17 Protection of Existing Improvements

Existing utilities and improvements should be located and marked during grading operations. Grading and construction activities near existing structures, streets, pipelines, etc. should be performed with care and under the direction of the improvement or utility company. Stockpiling of soils over utility lines should not be allowed without prior acceptance by the utility company. Excavations adjacent to existing improvements or utilities should be performed with care, so as not to undermine or destabilize the adjacent ground. Where significant fill loading is planned, geotechnical analysis will need to be performed to evaluate settlement impacts to adjacent properties.

3.18 Geotechnical Review of Future Plans

Future grading plans and any revisions/changes in the current plan for the site should be reviewed and accepted by the geotechnical consultant prior to grading. A geotechnical report with recommendations specific to the grading plan and construction is anticipated at the 40-scale plan stage for submittal to the City and to be used as a basis for grading.

The geotechnical consultant should also review future precise grading and foundation plans. A geotechnical report with recommendations for design and construction will be necessary.

3.19 Geotechnical Observation and Testing during Grading

The findings, conclusions and recommendations in this report are based upon interpretation of data and data points having limited spatial extent. Verification and refinement of actual geotechnical conditions during grading is essential, especially where slope stabilization is involved. At minimum, geotechnical observation and testing should be conducted during grading operations at the following stages:

- During and following clearing and grubbing, prior to site processing;
- During and following remedial removals to evaluate and accept the removal bottom;
- During and following cutting of slopes and excavation of slope stabilization measures;
- During installation of subdrains;
- During placement of compacted fill;
- During abandonment of groundwater and/or oil wells;
- During construction of utility lines (if applicable);
- During and upon completion of excavations for storm drain structures and during trench backfill;
- During pavement subgrade and aggregate base preparation for street pavements; and
- When any unusual or unexpected geotechnical conditions are encountered during grading and construction.

4.0 LIMITATIONS

This report has been prepared for the exclusive use of our client, Sunjoint Development, LLC within the specific scope of services requested by our client for "The Terraces" project in the City of Walnut. This report or its contents should not be used or relied upon for other projects or purposes or by other parties without the written consent of NMG or the involvement of a geotechnical professional. Our methodology for this study is based on local geotechnical standards of practice, care, and requirements of governing agencies for a given time. No warranty or guarantee, express or implied is given.

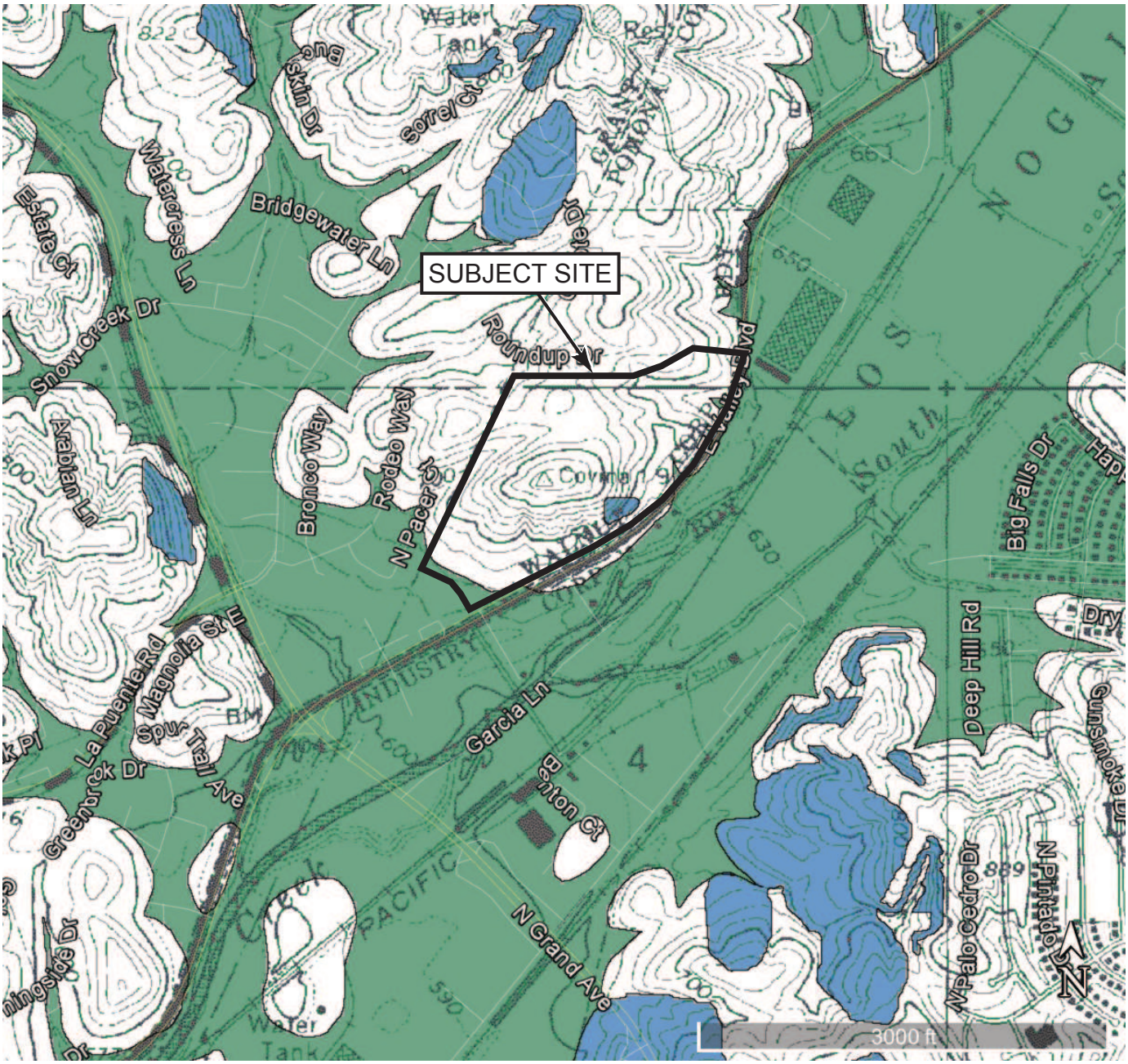
The findings, conclusions, and recommendations are professional opinions based on interpretations and inferences made from geologic and engineering data from specific locations and depths, observed or collected at a given time. By nature, geologic conditions can be very different in between data points, and can also change over time. Our conclusions and recommendations are subject to verification and/or modification with more exploration and/or during grading and construction when more subsurface conditions are exposed.

This report may not necessarily "stand alone." Persons using this report must determine if prior reports, or additions, modifications, and/or clarifications to this report are applicable.

NMG's expertise and scope of services did not include assessment of potential subsurface environmental contaminants or environmental health hazards.

SITE LOCATION MAP

THE TERRACES TENTATIVE TRACT 78210 CITY OF WALNUT, CALIFORNIA	Project Number: 18014-01 Project Name: Sunjoint / The Terraces Date: 8/24/18 Figure 1	NMG Geotechnical, Inc.



Liquefaction

Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslides

Areas where previous occurance of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

SEISMIC HAZARDS MAP

BASE: DIVISION OF MINES AND GEOLOGY SEISMIC HAZARDS MAP,
SAN DIMAS QUADRANGLE
Dated: March 25, 1999

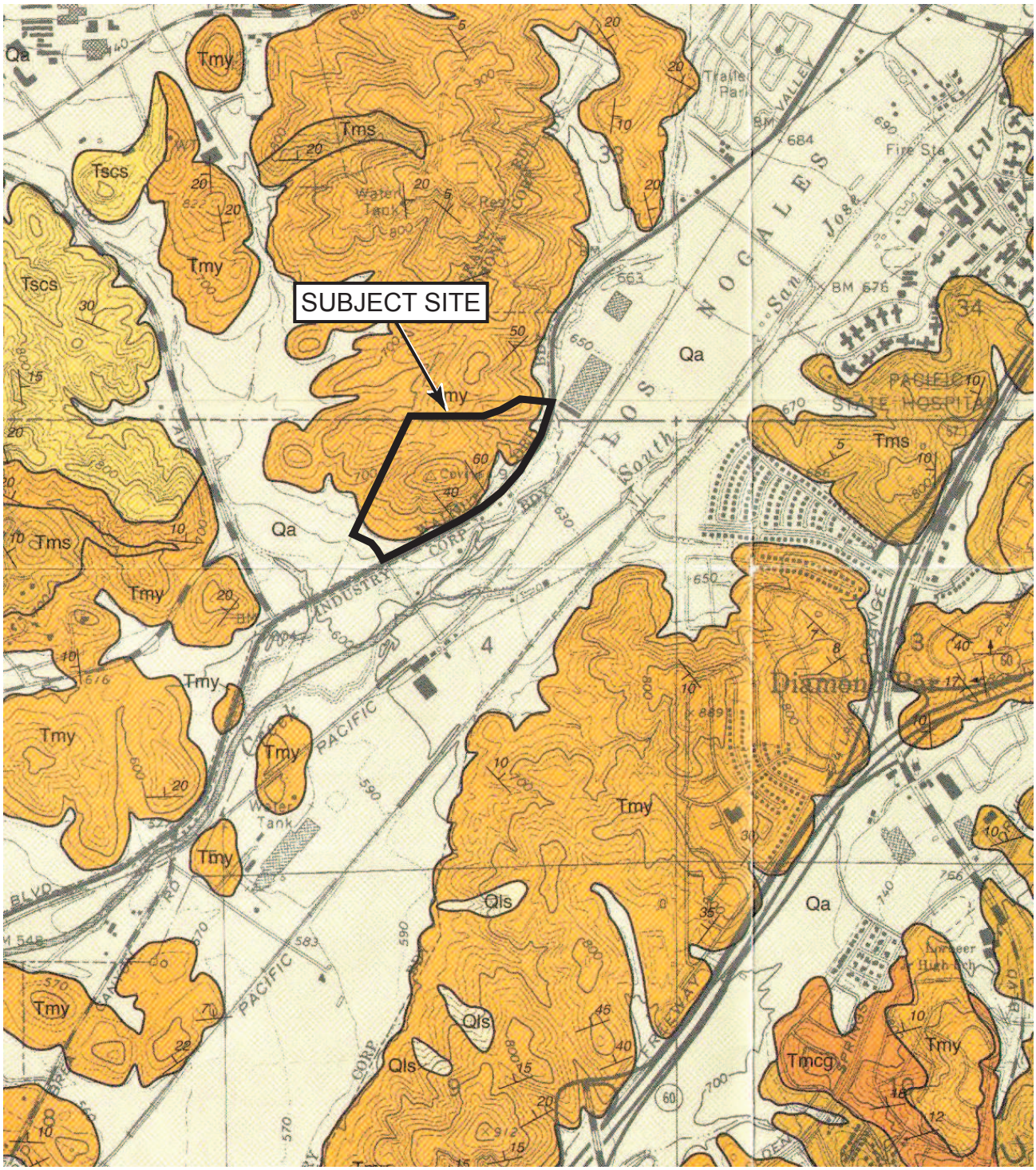
THE TERRACES
TENTATIVE TRACT 78210
CITY OF WALNUT, CALIFORNIA

Project Number: 18014-01

Project Name: Sunjoint / The Terraces

Date: 8/24/18 Figure 2

NMG Geotechnical, Inc.



GEOLOGIC MAP

BASE: DIBBLEE GEOLOGICAL FOUNDATION MAP,
SAN DIMAS AND ONTARIO QUADRANGLES
Dated: 2002

THE TERRACES TENTATIVE TRACT 78210 CITY OF WALNUT, CALIFORNIA	Project Number: 18014-01 Project Name: Sunjoint / The Terraces Date: 8/24/18 Figure 3	NMG Geotechnical, Inc.

APPENDIX A

APPENDIX A

REFERENCES

California Division of Mines and Geology, 1997, Guidelines for Evaluation and Mitigating Seismic Hazards in California, Special Publication 117.

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Jennings, Charles W., 2010, Fault Activity Map of California and Adjacent Areas, Department of Conservation, Division of Mines and Geology, Geologic Data Map No. 6.

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Leighton and Associates, Inc., 1981, Geotechnical Inspection and Testing of Fill Placement, Disposal Area for Parent Tract 32158, City of Walnut, California, Project No. 2770113-10, dated September 3, 1981.

Leighton and Associates, Inc., 1986, Geotechnical Report of Rough Grading, Tracts 32158, 41683, 41684, Lots 46 through 89 of Tract 41685, Snow Creek Development, City of Walnut, California, Project No. 2770113-44, dated October 27, 1986.

APPENDIX A (Cont'd.)

REFERENCES

Leighton and Associates, Inc., 1987, Geotechnical Report of Mitigation of Organic Strippings on Lots 17 and 18, Tract 32158 and Disposal of Strippings on Lots 10 through 13, Tract 32158, Snow Creek Development, City of Walnut, California, Project No. 2770113-46, dated December 14, 1987.

U.S. Geological Survey, 2017a, 2008 Interactive Deaggregations Program; web site address: https://geohazards.usgs.gov/deaggint/2008/.

U.S. Geological Survey, 2017b, U.S. Seismic Design Maps, web site address: http://geohazards.usgs.gov/designmaps/us/application.php.

AERIAL PHOTOGRAPHS REVIEWED

Date	*Flight*	*Photo No.*	*Scale (1"=)*	*Source*
1/2/1953	9K	104, 105	-	Continental
3/29/1960	65	10, 11	-	Continental
1/30/1970	60-3	81, 82	-	Continental
3/3/1971	71000	57, 58	-	Continental
1/13/1975	157-8	1, 2	-	Continental
10/24/1975	75000	93, 94	-	Continental
11/7/1976	76162	106, 107	-	Continental
1/24/1977	181-8	4, 5	-	Continental
12/10/1978	203-8	1, 2	2,000'	Continental
5/12/1979	FCLA	6, 7, 8	-	Continental
1/2/1983	83001	96, 97	-	Continental
12/30/1986	F	62, 63	-	Continental
7/7/1988		19117	2,167'	Continental
6/12/1990	C83-11	22, 23	-	Continental
5/13/1993	C90-20	59, 60	2,000'	Continental
7/11/1995	C115-29	209, 210	2,000'	Continental
2/2/1999	C131-29	36, 37	2,000'	Continental

APPENDIX B

Boring No. B- 1

DATE STARTED: 3/5/18 DATE ENDED: 3/5/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 822 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
							Puente Formation, Yorba Member (Tpy)			
			@ 0.5' B: N81W, 43NE				@ 0': Greenish gray SILTSTONE to pale yellow silty fine SANDSTONE, dry to damp, stiff/dense, interbedded, siltstone beds are up to 1" thick, sandstone beds are up to 6" thick.			
820			@ 1.7' B: N72W, 43NE							
							@ 2.6': Diatomaceous blebs along bedding.			
	5		@ 5' B: N61W, 40NE							
			@ 6' B: N71W, 43NE	SB-1			@ 6': Clayey SILTSTONE, 4" thick, clayey shear surfaces.			SB-1 @ 6'
							@ 8': FeO stained SANDSTONE, 8" thick. FeO staining and calcium carbonate lined along bedding.			
	10		@ 10.4' B: N67W, 34NE	D-1 B-1	2	SM-ML	@ 10' SAMPLE: Gray to moderate yellow brown silty very fine SANDSTONE/SILTSTONE with trace CLAYSTONE, moist, very dense/hard, FeO stained, thinly interbedded.	92.1	21.0	
810							@ 12.8' - 13.5': Slightly cemented, FeO stained and CaCO3 lined surfaces.			
	15		@ 14.7' B: N72W, 36NE							B-1 @ 0'-20'
							@ 16.1': Dark gray clay bed, paper-thin, very moist, low plasticity.			
	20			D-2	2	SM-ML	@ 19.9'-21.7': CaCO3-lined bedding. @ 20' SAMPLE: Gray to moderate yellow brown silty very fine SANDSTONE/SILTSTONE with trace CLAYSTONE, moist, very dense/hard, FeO stained, thinly interbedded, sheared paper thin clay beds in upper rings.	90.0	27.6	
800			@ 22.3' B: N70W, 37NE							
			@ 23.5' B: N84W, 33NE							
	25									
			@ 26.9' B: N77W, 46NE				@ 26.9': Sheared SANDSTONE/SILTSTONE contact, slickenlines along bedding surface, FeO staining and cementation on the up-dip side.			
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 1

DATE STARTED: 3/5/18 DATE ENDED: 3/5/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 822 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
790				D-3 B-2	4	SM-CL	@ 30' SAMPLE: Moderate yellow brown to gray silty fine SANDSTONE/sandy silty CLAYSTONE, moist, very dense/hard, CaCO3, thinly interbedded.	95.9	20.7	
	35		@ 34' GB: N68W, 48-53NE				@ 34': Undulatory bedding, polished SILTSTONE surface along bedding.			B-2 @ 20'-40' GS, AL, DS, MD
			@ 36.9' B: N77W, 49NE				@ 36.5': Sheared SILTSTONE, discontinuous, slightly polished surface along bedding, paper thin clayey surfaces.			
	40			D-4	5	SM-ML	@ 40' SAMPLE: Moderate yellow brown to gray silty fine SANDSTONE/sandy SILTSTONE, moist, very dense/hard, trace CaCO3, thinly interbedded.	97.8	17.7	
780			@ 40.9' B: N81W, 41NE				@ 40.9': FeO stained cemented blebs.			
			@ 43' B/SH: N81W, 55NE				@ 42.5': Cemented zone, 4" thick along bedding. @ 43': Dark gray sheared SILTSTONE, shear surface is clayey, paper thin, along bedding, very moist, continuous around hole. Similar surface at 43.8'.			
	45						@ 45': Light gray SANDSTONE.			
	50		@ 49.5' J: N15W, 58SW				@ 49.5' FeO stained joint.			
770			@ 51.3' B: N78W, 42NE	D-5 B-3	5	SM-ML	@ 50' SAMPLE: Moderate yellow brown to gray silty fine SANDSTONE/sandy silty SILTSTONE, moist, very dense/hard, trace CaCO3, thinly interbedded.	89.7	27.6	
							@ 53': FeO stained concretion zone, 2-3" thick.			
	55		@ 55' B: N81W, 45NE				@ 55': Clay bed, 1/4" thick, sheared zone in SILTSTONE plastic, some striations, continuous.			B-3 @ 40'-60' GS, DS, MD
							@ 56.7'-59': Massive SANDSTONE.			
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 1

DATE STARTED: 3/5/18 DATE ENDED: 3/5/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 822 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
				D-6	9	SM-ML	@ 60' SAMPLE: Moderate yellow brown to gray silty fine SANDSTONE/ sandy SILTSTONE, moist, very dense/hard, trace paper thin sheared claystone, FeO stained, thinly interbedded.	92.4	22.1	
760			@ 61.9' B: N77W, 41NE				@ 61.9': Dark gray SILTSTONE, interbedded/laminated with white to light gray diatomaceous SILTSTONE, 3" thick. Cemented below at 62.1'.			
	65									
			@ 67.7' B: N84W, 51NE				@ 67.7': 3" thick cemented zone along bedding.			
	70			D-7 B-4	10	SM-ML	@ 70' SAMPLE: Moderate yellow brown to gray silty fine SANDSTONE/ sandy SILTSTONE, moist, very dense/hard, FeO stained, some jointing, thinly interbedded.	90.6	26.7	
750			@ 72.2' B: N73W, 47NE							
			@ 73.8' B: N83W, 49NE							
	75									B-4 @ 60'-80' GS, DS, MD
							@ 77.3': 3" thick cemented zone along bedding.			
	80			D-8	10	SM	@ 80' SAMPLE: Dark yellowish brown to moderate yellowish brown silty fine SANDSTONE, moist, very dense, some siltstone.	99.4	14.8	
740			@ 82' B: N65W, 30NE	SB-2			@ 82': Sheared CLAYSTONE/SILTSTONE bed.			SB-2 @ 82'
	85									
			@ 86' B: N78W, 41NE				@ 85': Dark gray SILTSTONE laminated with white diatomaceous SILTSTONE beds, 5" thick.			
			@ 88.2' CB: N76W, 38NE	SB-3			@ 88.2': Dark gray CLAY bed, 1/2" thick highly plastic, pinches and swells.			SB-3 @ 88.2'
	90									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

Boring No. B- 1

DATE STARTED: 3/5/18 DATE ENDED: 3/5/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 822 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
730	95	N S	@ 90.3' B: N74W, 45NE @ 94.5' B: N80W, 59NE	D-9	15	SM-ML	@ 90' SAMPLE: Moderate yellowish brown to gray silty very fine SANDSTONE/sandy SILTSTONE, moist, very dense/hard, FeO stained, thinly interbedded.	88.2	28.7	
720	100			D-10	21	SM-ML	@ 100' SAMPLE: Moderate yellowish brown to gray silty very fine SANDSTONE/sandy SILTSTONE, moist, very dense/hard, FeO stained, thinly interbedded.	100.4	15.6	
710	105						Notes: Total Depth: 100 Feet. Downhole Logged to 98 Feet. No Groundwater encountered. Backfilled and Tamped with Cuttings.			
	110									
	115									
	120									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

Boring No. B- 2

DATE STARTED: 3/6/18 DATE ENDED: 3/6/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 850 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
							Puente Formation, Yorba Member (Tpy) @ 0'-4': SILTSTONE, heavily weathered, CaCO3 lined bedding, FeO stained.			
			@ 2.9' B: N49W, 47NE							
	5						@ 4': Interbedded gray SILTSTONE and orangish yellow SANDSTONE, damp, less weathered.			
			@ 5.9' B: N52W, 47NE							
840	10		@ 10.1' B: N44W, 43NE	D-1 B-1	3	ML-SM	@ 10' SAMPLE: Greenish gray SILTSTONE/moderate yellowish brown silty very fine SANDSTONE, moist, very dense/hard, interbedded, beds are ~1/2" thick, well bedded, some diatomaceous beds. @ 10.1': SILTSTONE beds with interbedded diatomaceous lenses. @ 11.7': FeO staining.	91.8	23.9	
	15		@ 14.4' B: N45W, 42NE				@ 14.4': SILTSTONE with clayey bedding surfaces, paper thin.			B-1 @ 0'-20'
830	20		@ 19.5' CB: N51W, 42NE	D-2	2	ML-SM	@ 19.5': Dark gray sandy CLAY, 1/4" thick, continuous around boring, low plasticity. Similar bed at 19.9'. @ 20' SAMPLE: Gray SILTSTONE/moderate yellowish brown silty very fine SANDSTONE, moist, very dense/hard, interbedded, beds are ~1/2" thick, well bedded, some polished paper thin clays along bedding in upper rings.	90.8	23.4	
			@ 21.4' F: N52W, 22-45NE	SB-1			@ 21.4': Fault along bedding, greenish clay lining, 1/4"-1/2" thick, brittle, low plasticity.			SB-1 @ 22'
			@ 22.7' B: N48W, 45NE				@ 21.9': Sheared SILTSTONE/CLAYSTONE, with ductile deformation.			
	25						@ 26.6': Sheared SILTSTONE beds with clay lining.			
820	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 2

DATE STARTED: 3/6/18 DATE ENDED: 3/6/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 850 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
				D-3 B-2	4	ML-SM	@ 30': SAMPLE: Greenish gray SILTSTONE/moderate yellowish brown silty very fine SANDSTONE, moist, very dense/hard, interbedded, beds are ~1/2" thick, well bedded.	90.5	25.4	
			@ 31.6' B: N50W, 42NE				@ 31.6': 2" CLAYSTONE, sheared, wet, waxy texture, low plasticity.			
	35		@ 35' B: N45W, 48NE				@ 35.3': Cemented bed, 4" thick. @ 35.9': Sheared CLAY, 1" thick, continuous around boring.			B-2 @ 20'-40' GS, DS, MD
810	40			D-4	4	ML-SM	@ 40' SAMPLE: Gray clayey SILTSTONE/moderate yellowish brown silty very fine SANDSTONE, moist, very dense/hard, interbedded, beds are ~1/2" thick, well bedded, some diatomaceous beds.	98.8	12.6	
							@ 41.8': Fault dips similar to bedding. Midway through the hole, at 45', fault is near vertical, clay-lined, but truncates bedding. Fault exits hole at 46'.			
			@ 43.9' B: N41W, 54NE							
	45		@ 44.5' B: N63W, 69NE				@ 44.9': Discontinuous shear zone, slightly polished surface along bedding. Similar zones at 47.7' and 50.2'.			
			@ 47.7' S: N47W, 39NE							
800	50			D-5 B-3	6	ML-SM	@ 50' SAMPLE: Gray clayey SILTSTONE/silty very fine SANDSTONE, moist, very dense/hard, interbedded, paper thin clays within siltstone, sandstone is friable.	89.2	28.8	
			@ 54' B: N58W, 41NE							
	55						@ 55': Cemented bed, 6" thick, fractured.			B-3 @ 40'-60' GS, AL, DS, MD
			@ 56.8' B: N50W, 54NE				@ 56.8': Minor/tight fold in bedding.			
			@ 57.9' B/S: N63W, 57NE	SB-2			@ 57.9': Sheared CLAY bed, plastic.			SB-2 @ 58'
790	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 2

DATE STARTED: 3/6/18 DATE ENDED: 3/6/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 850 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S		D-6	7	ML-SM	@ 60' SAMPLE: Gray SILTSTONE/silty very fine SANDSTONE, moist, very dense/hard, interbedded.	95.1	19.2	
			@ 63' B: N48W, 48NE							
	65						@ 65.7': Sheared CLAY bed, $CaCO_3$, polished bedding surface. Similar bed at 66.5'.			
			@ 66.5' B: N30W, 36NE				@ 67': High plasticity CLAY, sheared, polished. @67': Fault, local folding along fault. Exits boring at 71.2'.			
							@ 69': Folding.			
780	70			D-7 B-4	10	ML-SM	@ 70' SAMPLE: Gray SILTSTONE/silty very fine SANDSTONE, moist, very dense/hard, interbedded.	91.4	26.0	
			@ 71.2' F: N75W, 67NE @ 71.5' B: N76W, 82NE							
	75									B-4 @ 60'-80'
770	80		@ 80.2' B: N69W, 58NE	D-8	11	ML-SM	@ 80' SAMPLE: Gray SILTSTONE/silty very fine SANDSTONE, moist, very dense/hard, interbedded. @ 80.2': Hard sheared SILTSTONE.	95.4	21.7	
							@ 82.1': SILTSTONE with polished surface and striations. Similar surface at 83.8'.			
	85						@ 86.4': FeO stained SANDSTONE, with cemented blebs.			
			@ 87.9' B: N54W, 50NE							
760	90		@ 89' B: N55W, 42NE				@ 89': Cemented bed, harder below, sheared SILTSTONE above.			

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 2

DATE STARTED: 3/6/18 DATE ENDED: 3/6/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 850 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
	95		@ 93.4' B: N58W, 39NE	D-9 B-5	20	ML-SM	@ 90' SAMPLE: Gray SILTSTONE/silty very fine SANDSTONE, moist, very dense/hard, interbedded, beds in upper rings are cemented. @ 90.5': FeO stained SANDSTONE bed.	97.5	14.7	B-5 @ 80'-100'
750	100			D-10	13	ML/SM	@ 100' SAMPLE: Upper: Dark gray clayey SILTSTONE, moist, very hard. Lower: Yellowish brown silty fine SANDSTONE, moist, very dense.	92.1	26.9	
	105						Notes: Total Depth: 100 Feet. Downhole Logged to 96 Feet. No Groundwater Encountered. Backfilled and Tamped with Cuttings.			
740	110									
	115									
730	120									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 3

DATE STARTED: 3/7/18 DATE ENDED: 3/7/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 841 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/TW
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
840							**Topsoil** @ 0': Grayish brown silty SAND, dry to damp, medium dense, caliche, roots throughout.			
							Puente Formation, Yorba Member (Tpy) @ 2.5': Gray to pale yellow SILTSTONE, dry to damp, stiff, diatomaceous, well bedded, 1.5" thick beds, fractured. Dark gray CLAY, 1/4" thick, low plasticity, brittle, not sheared, interbedded with SILTSTONE.			
	5		@ 3.5' B: N59W, 55NE @ 4.9' CB: N60W, 47NE				@ 7.4': CLAYSTONE bed, 1/4" thick, CaCO3 lined, not sheared, brittle.			
	10		@ 9.8' CB: N76W, 48NE	B-1 D-1	1	CL-MH	@ 9.8': CLAY bed, 1/2" thick, moderately plastic, moist, basal surface, several subvertical joints.	83.7	34.0	
830			@ 11.9' F: N75W, 27SE @ 13.5' B: N75W, 44NE				@ 10' SAMPLE: Dark olive gray to gray silty CLAYSTONE/clayey SILTSTONE, moist, stiff, thinly bedded, CaCO3 lined bedding, FeO staining. @ 11.9': Discontinuous fault on east wall, truncates 3" thick CLAYSTONE. Locally folded bedding near fault. @ 12.2': Root hairs along CLAYSTONE bed, some gypsum lined bedding. @ 13.5': Polished surface along bedding.			
	15						@ 14.4': Gypsum lined beds begin, and several 1/8" thick gypsum lined joints.			B-1 @ 0'-20' GS, AL, DS, MD
			@ 17.9' S/CB: N72W, 46NE	SB-1			@ 17.9': Dark gray plastic CLAY bed, moist, soft to medium stiff, 1.5" thick, polished, tectonically sheared. Interbedded gypsum lined CLAYSTONE.			SB-1 @ 17.9'
	20			D-2	3	CL-MH	@ 20' SAMPLE: Dark olive gray to gray silty CLAYSTONE/clayey SILTSTONE, moist, stiff, 1/8" to 1/4" thick beds, gypsum lined bedding, foraminifera bearing.	96.5	20.3	
820			@ 21.7' B/S: N72W, 50NE				@ 21.7': Top of tectonically sheared zone, crumbly CLAY, 2-3" thick.			
							@ 23.8': Slightly harder bedrock.			
	25		@ 24.9' B: N80W, 38NE				@ 24.9': Yellowish orange silty SANDSTONE/sandy SILTSTONE bedding, fish scales, dense/very stiff.			
							@ 26.1': SILTSTONE, thinly bedded.			
							@ 27': Sheared zone, folding in SILTSTONE along joint.			
	30						@ 29': SANDSTONE, 1.5' thick, moderately cemented, MnO staining along joints. Below, olive gray SILTSTONE and CLAYSTONE, less fractured than above, but has gypsum lined beds.			

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 3

DATE STARTED: 3/7/18 DATE ENDED: 3/7/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 841 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/TW
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
810			@ 30.5' B: N69W, 38NE	D-3 B-2	3	ML	@ 30' SAMPLE: Light olive gray clayey SILTSTONE, moist, very stiff, thinly bedded with some CLAYSTONE.	81.5	39.2	
	35						@ 34.6': Pale yellow SANDSTONE beds, 1" thick interbedded SILTSTONE and CLAYSTONE.			B-2 @ 20'-40'
			@ 36' B: N35W, 22NE							
	40									
800			@ 39.9' B: N71W, 43NE	D-4	3	CL-MH	@ 39.9': CLAYSTONE, polished surfaces, striations in down dip direction. Below, is predominantly SILTSTONE/CLAYSTONE with some thin SANDSTONE beds, with gypsum lined joints. @ 40' SAMPLE: Olive gray CLAYSTONE/SILTSTONE, moist, very stiff, gypsum lined joints. @ 42.2': FeO staining in CLAYSTONE bed. @ 43': Yellowish brown silty SANDSTONE, fractured, cemented, 1.5' to 1.8' thick.	83.7	35.2	
	45		@ 44.9' B: N71W, 46NE				@ 45.5': SANDSTONE bed, 6" thick.			
	50		@ 48.9' B: N55W, 50NE				@ 48.9': Clayey shear zone, brittle, continuous around boring. @ 49.3': Cemented gray SANDSTONE bed, 1.7' thick, gypsum lined. @ 50': Too hard to sample.			
790				B-3 D-5	3	CL-MH	@ 51' SAMPLE: Olive gray CLAYSTONE/SILTSTONE, moist, very stiff, gypsum lined joints, trace fish scales.	82.2	37.6	
							@ 53.5' SANDSTONE bed, slightly cemented.			
	55		@ 55' B/S: N67W, 53NE				@ 55': Clayey SILTSTONE shear zone, sheared along bedding, abundant gypsum. Cemented SANDSTONE below.			B-3 @ 40'-60' GS, AL
	60						@ 59.5'-61.9': SANDSTONE bed, cemented.			

Boring No. B- 3

DATE STARTED: 3/7/18 DATE ENDED: 3/7/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 841 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/TW
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
780				D-6	10	SM-ML	@ 60' SAMPLE: Greenish gray to moderate yellowish brown silty SANDSTONE/sandy SILTSTONE, moist, very dense/hard, fish scales, gypsum lined joints.	89.8	31.4	
	65		@ 66' B: N69W, 55NE				@ 66': SILTSTONE bed, FeO stained at 67', foraminifera-rich.			
	70									
770				D-7	7	ML-CL	@ 70' SAMPLE: Olive gray SILTSTONE/CLAYSTONE, moist, hard, foraminifera bearing, 1/2" to 3/4" thick gypsum filled joints, FeO stained.	86.0	32.2	
			@ 72' B: N69W, 55NE				@ 72': Belled out area, 6" thick SILTSTONE, broken, numerous gypsum filled joints, polished shear surfaces along bedding.			
	75									
			@ 76.4' J/B: N73W, 73NE				@ 76.4': Joint set. @ 76.6': Wavy, parallel bedding.			
	80									
760				D-8	4	ML-CL	@ 80' SAMPLE: Dark yellowish brown SILTSTONE/CLAYSTONE, wet, stiff, diatomaceous, foraminifera bearing, FeO stained, 1/4" thick gypsum filled joints, thinly bedded.	72.9	45.0	DS
			@ 81.3' B: N69W, 64NE				@ 82.5': Gypsum filled joints, less than 1" thick, continuous around boring, steepens at 85', exits boring at 90'.			
	85									
			@ 86' B: N67W, 64NE							
			@ 89.5' B: N74W, 82SW				@ 88': Near vertical bedding.			
	90						@ 89.5': Overturned bedding, fractured, but very stiff.			

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

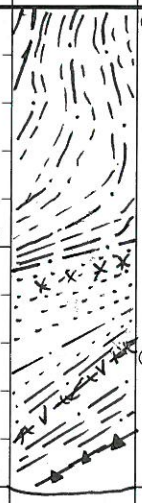
NMG

Boring No. B- 3

DATE STARTED: 3/7/18 DATE ENDED: 3/7/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 841 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/TW
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
750			@ 90' B: N71W, 67NE	D-9	13	ML-CL	@ 90' SAMPLE: Dark yellowish brown SILTSTONE/CLAYSTONE, very moist, stiff, diatomaceous, foraminifera bearing, FeO stained, 1/4" thick gypsum filled joints, thinly bedded.	78.2	38.9	
							@ 91.7': Wavy, overturned bedding at 92.4', NE dipping by 93'.			
	95		@ 95' B/C: N77W, 16NE				@ 95': Sandy CLAYSTONE above cemented SANDSTONE.			
			@ 97' B: N63W, 23NE	SB-2			@ 97.3': White to pale yellow 1" to 1.5" thick TUFF bed, locally sheared, bottom of tuff is very polished.			SB-2 @ 97.3'
			@ 97.3' S: N67W, 42NE							
			@ 99' S/CB: N50W, 40NE				@ 99': Dark gray to black sheared CLAY bed, polished.			
	100									
740				D-10	16	ML-CL	@ 100' SAMPLE: Dark yellowish brown SILTSTONE/CLAYSTONE, moist, hard, diatomaceous.	76.0	42.4	
							Notes: Total Depth: 100 Feet. Downhole Logged to 99 Feet. Groundwater Not Encountered. Backfilled and Tamped with Cuttings.			
	105									
	110									
730										
	115									
	120									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 4

DATE STARTED: 3/13/18 DATE ENDED: 3/13/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 713 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/WG
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
							Topsoil @ 0': Gray silty SAND, abundant roots, undulatory contact with bedrock below.			
710							**Puente Formation, Yorba Member (Tpy)** @ 2': Pale to dark gray and pale yellow SILTSTONE/CLAYSTONE, damp, stiff, diatomaceous, interbedded, FeO stained laminations, foraminifera bearing. Some thin SANDSTONE beds, 1/8" thick.			
	5		@ 3.7' B: N23E, 30NW				@ 5' Mostly CLAYSTONE, paper thin polished surfaces, increase in moisture at 4.9'. Foraminifera bearing at 6'.			
			@ 6' B: N21E, 36NW				@ 6.9': Cemented dark gray SILTSTONE. Well bedded, but slightly fractured.			
			@ 8.8' B: N30E, 25NW				@ 8.8': CLAYSTONE/SILTSTONE beds are 1/4" to 1/8" thick.			
	10			D-1 B-1	1	ML	@ 10' SAMPLE: Yellowish gray SILTSTONE, moist, stiff, diatomaceous, foraminifera bearing, clayey zones. @ 11': Light gray SILTSTONE interbedded with dark gray CLAYSTONES, and FeO stained silty fine SANDSTONE.	79.5	35.5	DS
700			@ 13' B: N26E, 24NW							
	15									B-1 @ 0'-20'
							@ 17.5': Fractured, vertical joint is open.			
	20		@ 20.3' B: N33E, 24NW	D-2	1	MH-CL	@ 20' SAMPLE: Yellowish gray SILTSTONE/CLAYSTONE, moist, stiff, paper thin clayey polished surfaces, joints/fractures.	80.6	35.9	DS
690							@ 22.3': Pale yellow SANDSTONE bed, cemented.			
	25		@ 25.1' B: N27E, 24NW							
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 4

DATE STARTED: 3/13/18 DATE ENDED: 3/13/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 713 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/WG
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S		D-3 B-2	2	MH-CL	@ 30' SAMPLE: Yellowish gray SILTSTONE/CLAYSTONE, moist, stiff.	82.0	39.7	
680							@ 32.8': FeO stained bedding, white silty very fine SANDSTONE beds.			
	35		@ 34.6' B: N40E, 22NW				@ 35': Increase in hardness.			B-2 @ 20'-40' GS, AL
			@ 38.9' B: N37E, 19NW				@ 38.9': 4" cemented bed.			
	40		@ 40.1' B: N38E, 20NW	D-4	3	MH-CL	@ 40' SAMPLE: Dark gray to pale yellowish orange SILTSTONE/CLAYSTONE, moist, stiff to very stiff, diatomaceous, foraminifera bearing, FeO stained beds, abundant fish scales. @ 40': Medium gray CLAYSTONE bed, 1/2" thick, continuous.	75.3	37.8	
670										
	45		@ 45.5' B: N32E, 18NW							
	50			D-5	3	MH-CL	@ 50' SAMPLE: Dark gray to pale yellowish orange SILTSTONE/CLAYSTONE, moist, very stiff, trace sandy SILTSTONE in upper rings, abundant fish scales, diatomaceous.	78.8	42.4	DS
660			@ 53.2' CB: N28E, 23NW				@ 53': Orange cemented silty fine SANDSTONE, moist, hard. @ 53.2' CLAY bed, 1/2" to paper thin, sheared, plastic. @ 53.7': Massive SILTSTONE, irregular FeO staining.			
	55									
	60		@ 59.3' B: N61E, 24NW							

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

Boring No. B- 4

DATE STARTED: 3/13/18 DATE ENDED: 3/13/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 713 ft
DATUM: msl
LOCATION:
COORD/STATION:

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S					Logged By: ZKH/WG Sampled By: ZKH			
650				D-6	4	ML-CL	@ 60' SAMPLE: Dark yellowish brown to light olive gray SILTSTONE/CLAYSTONE, moist to very moist, stiff, trace polished surfaces, foraminifera bearing, FeO stained bedding.	95.9	22.3	
	65		@ 65.1' B: N38E, 23NW				@ 65.2': SANDSTONE bed, cemented, 1' thick.			
			@ 67.3' J: N45E, 89NW				@ 67': Phosphate nodule, bedding draped around it.			
	70		@ 70.7' B: N50E, 23NW	D-7	7	ML-CL	@ 70' SAMPLE: Gray to dark yellowish brown SILTSTONE/CLAYSTONE, moist, very stiff, FeO stained, diatomaceous. @ 70.5': Medium gray CLAYSTONE, 1" thick, very stiff, FeO stained, polished surface on bottom of bed. Massive CLAYSTONE below.	85.6	33.6	
640										
	75						@ 74': Thinly bedded to laminated CLAYSTONE/SILTSTONE.			
							@ 76.1': Moderate seepage from joint, MnO stained.			
			@ 76.9' J: N27E, 68SE							
	80						@ 79': Mottled brownish gray silty fine SANDSTONE bed, friable, 3" thick. Moderate seepage from bed.			
				D-8	4	SM-CL	@ 80' SAMPLE: Gray to dark yellowish brown silty very fine SANDSTONE/CLAYSTONE, wet, moist, very dense/very stiff, diatomaceous, laminated.	84.0	35.9	
			@ 81' B: N39E, 19NW							
630										
			@ 83' B: N30E, 20NW				@ 83': CLAYSTONE bed, 1" thick, continuous.			
	85									
			▼				@ 88': Gray SILTSTONE, wet, hard, micaceous. Standing groundwater.			
	90									

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 4

DATE STARTED: 3/13/18 DATE ENDED: 3/13/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 713 ft
DATUM: msl
LOCATION:
COORD/STATION:

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
				D-9	13	SM/CL	Logged By: ZKH/WG Sampled By: ZKH @ 90' SAMPLE: Gray to dark yellowish brown silty very fine SANDSTONE/CLAYSTONE, very moist, very dense/very stiff, interbedded, diatomaceous. Notes: Total Depth: 90 Feet. Downhole Logged to 84 Feet. Seepage Encountered at 76.1'. Standing Groundwater at 88 Feet. Backfilled with Cuttings and Tamped.	87.1	33.7	
620	95									
	100									
610	105									
	110									
600	115									
	120									

Boring No. B- 5

DATE STARTED: 3/14/18 DATE ENDED: 3/14/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 733 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
730	0		@ 2.1' B: N88E, 57N				**Puente Formation, Yorba Member (Tpy)** @ 0': Pale yellow to yellowish brown silty fine SANDSTONE interbedded with dark olive gray SILTSTONE/CLAYSTONE, damp, dense/stiff, jointed/fractured near surface, FeO stained bedding. Alternating sequences of SANDSTONE/SILTSTONE/CLAYSTONE, generally 3/4" to 7" thick. SILTSTONE/CLAYSTONE is thinly laminated.			
							@ 3.2': FeO stained concretions.			
	5		@ 3.8' B: N86W, 53N @ 5.1' CB: N86W, 50N				@ 4.6': Contact with gray SILTSTONE/CLAYSTONE, clayey polished surfaces, brittle. At 5.9', sharp contact with SANDSTONE below, 1.3' thick.			
	10			D-1 B-1	6/8"	SM	@ 10' SAMPLE: Pale yellow to orange brown silty fine SANDSTONE, damp, very dense, friable, trace SILTSTONE interbeds are 1/2" thick, FeO stained bedding.	113.2	5.0	
720			@ 12.1' B: N78W, 34NE				@ 12.1': CLAYSTONE with shearing, CaCO3 lined bedding, CLAYSTONE is 1/4" thick, low plasticity, brittle. Similar beds at 12.5' and 14.7'. @ 13': CLAYSTONE/SANDSTONE thinly interbedded.			
	15		@ 14.6' B: N80W, 47NE							B-1 @ 0'-20'
							@ 17.5': FeO stained concretions.			
	20			D-2	6	SM	@ 20' SAMPLE: Pale yellowish gray to gray silty fine SANDSTONE, moist, very dense, FeO staining, trace gray CLAYSTONE in upper rings, interbedded, FeO stained, friable.	104.5	12.9	
710			@ 21.7' B: N84W, 48N							
							@ 23.4': SANDSTONE bed, cemented, 5" thick.			
	25						@ 24.4': Silty fine to medium SANDSTONE.			
			@ 27.9' B: N82W, 51N @ 29.2' B: N81W, 50N				@ 27.2': Soft sediment deformation.			
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

Boring No. B- 5

DATE STARTED: 3/14/18 DATE ENDED: 3/14/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 733 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S	@ 30.1' SH: N89W, 63N @ 30.1' B: N84W, 45N	D-3 B-2	7	SM	@ 30' SAMPLE: Pale yellowish gray to gray silty fine SANDSTONE, moist, very dense, FeO staining, friable. @ 30.1': Sheared CLAYSTONE, 2" thick, brittle, CaCO3 lined bedding. @ 30.7': CLAY on top of contact with SANDSTONE/CLAYSTONE package, paper thin, brittle, striations.	105.1	13.2	
700										
	35						@ 33': CLAYSTONE, hard/cemented, plastic, paper thin, not sheared.			B-2 @ 20'-40'
			@ 38.9' B: N86W, 49N				@ 38.9': CLAYSTONE, sheared, brittle, waxy texture.			
	40			D-4	5	SM-SC	@ 40' SAMPLE: Gray silty/clayey SANDSTONE, moist, very dense, trace sandy CLAYSTONE, FeO stained bedding. @ 40.9': Cemented SANDSTONE, 4" thick, FeO stained.	93.4	25.1	
690										
	45		@ 44.2' B/SH: N86W, 39-53N				@ 44.2'-44.6': Polished clayey shear surfaces, undulatory, striated down dip.			
	50		@ 49.8' B: N87W, 49N	D-5 B-3	6	SM-CL	@ 50' SAMPLE: Gray to pale yellowish gray silty fine SANDSTONE/CLAYSTONE, moist, very dense/hard, thinly interbedded, FeO stained, friable, CLAYSTONE is slightly cemented.	95.4	25.6	DS
680										
	55						@ 55.7': Sheared clay zone, 1.5" thick, brittle, polished, hard.			B-3 @ 40'-60' GS, DS, MD
	60		@ 59' B: N89E, 48N				@ 59': Sheared clay zone, 1.5" thick, brittle, polished, hard.			

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 5

DATE STARTED: 3/14/18 DATE ENDED: 3/14/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 733 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH/AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
				D-6	11/11"	SM-CL	@ 60' SAMPLE: Gray to pale yellowish gray silty fine SANDSTONE/CLAYSTONE, moist, very dense/hard, thinly interbedded, FeO/MnO stained, friable.	93.2	23.5	DS
670							@ 62.7' to 63.9': Cemented zone.			
	65									
			@ 67.1' B: N83W, 50N							
	70		@ 69.7' CB: N80W, 46NE	D-7 B-4	14	SM-CL	@ 69.7': Dark gray CLAY bed within CLAYSTONE, 1.5" thick, highly plastic, polished, sheared. Overall CLAYSTONE is 8" thick. @ 70' SAMPLE: Gray to pale yellowish gray silty fine SANDSTONE/CLAYSTONE, moist, very dense/hard, thinly interbedded, FeO/MnO stained, friable.	100.9	14.6	SB-1 @ 69.7'
660							@ 72.5': Interbedded with cemented bed. SILTSTONE packages are laminated internally.			
	75									B-4 @ 60'-90'
			@ 76.1' CB: N82W, 46N				@ 76': Very light gray SILTSTONE. @ 76.1': Dark gray CLAY surface, sheared, polished, paper thin to 1/8" thick, brittle, plastic only near upper contact.			
	80			D-8	13	SC-CL	@ 80' SAMPLE: Gray clayey fine SANDSTONE/CLAYSTONE, moist, very dense/hard, polished hard surfaces, thinly interbedded, MnO stained, slightly cemented.	100.8	21.9	
650										
	85		@ 84.9' CB: N88W, 52N				@ 84.9': Gray CLAY bed, 1/2" thick, highly plastic, pinches and swells, polished, sheared, paper thin on down dip side. @ 86': Sheared CLAYSTONE, paper thin surface.			
	90									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 5

DATE STARTED: 3/14/18 DATE ENDED: 3/14/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EZ Bore
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-30': 4800 lbs.; 30'-59': 3350 lbs.; 59'-87': 2045 lbs; 87'-115': 1200 lbs

GROUND SURFACE ELEVATION: 733 ft
DATUM: msl
LOCATION:
COORD/STATION:

Elevation (ft.)	Depth (ft.)	Graphic Log (N S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
				D-9	25/6"	SM	@ 90' SAMPLE: Yellowish brown silty SANDSTONE, moist, very dense, friable, FeO stained.	92.8	19.8	
640	95						Notes: Total Depth: 90 Feet. Downhole Logged to 88 Feet. No Groundwater Encountered. Backfilled and Tamped with Cuttings.			
	100									
630	105									
	110									
620	115									
	120									

Logged By: ZKH/AZ
Sampled By: ZKH

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

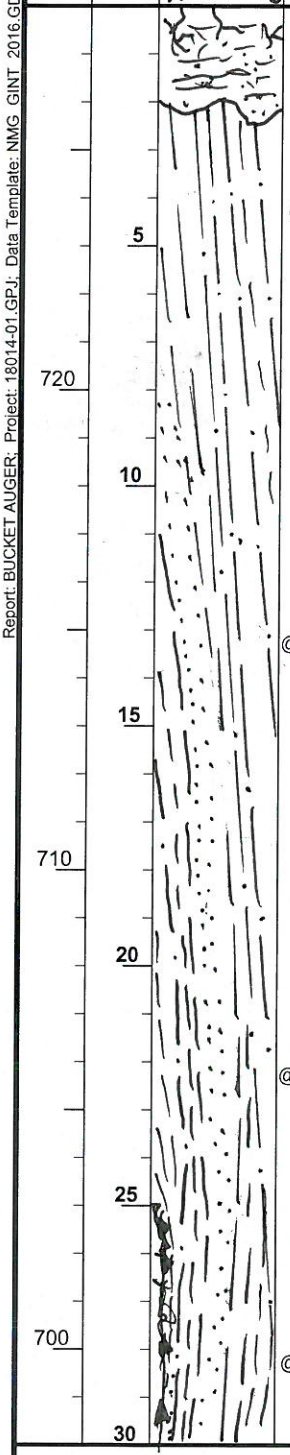
NMG

Boring No. B- 6

DATE STARTED: 3/19/18 DATE ENDED: 3/19/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EarthDrill
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-24': 2400 lbs.; 24'-43': 1550 lbs.; 43'-62': 850 lbs.

GROUND SURFACE ELEVATION: 728 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ
Sampled By: ZKH



Elevation (ft.)	Depth (ft.)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
						Topsoil @ 0'-2': Grayish brown to brown sandy SILT/CLAY, damp, medium stiff.			
						Puente Formation, Yorba Member (Tpy) @ 2': Weathered white to pale yellow SILTSTONE, damp, very stiff, diatomaceous, krotovina at 3', weathering masks bedding.			
	5	@ 4' B: N88W, 85S				@ 4': Olive clayey SILTSTONE, interbeds. Bedding is overturned.			
720		@ 7.3' B: N86W, 77S				@ 8'-9': FeO stained SANDSTONE beds, thinly bedded.			
	10		D-1 B-1	6	ML-CL	@ 10' SAMPLE: Pale yellow to greenish gray SILTSTONE/CLAYSTONE, moist, stiff, diatomaceous, $CaCO_3$ lined bedding, well bedded, trace fine sand in SILTSTONE, FeO stained.	88.7	27.3	
		@ 13' B: N85W, 81S							
	15					@ 15': FeO stained SANDSTONE beds, slightly darker, more clayey SILTSTONE.			B-1 @ 0'-20'
710									
	20		D-2	4	ML-CL	@ 20' SAMPLE: Pale yellow to greenish gray SILTSTONE/CLAYSTONE, moist, stiff, diatomaceous, abundant foraminifera, well bedded, trace fine sand in SILTSTONE, FeO stained.	84.3	33.8	CN
		@ 22' B: N85W, 82S				@ 21.5': Joint, strikes perpendicular to bedding, sub vertical to 24'.			
	25	@ 25' CB: N86W, 89S				@ 25': CLAY bed, paper thin, moist to wet, slightly sheared, brittle, slightly plastic.			
700		@ 28' B: N82E, 87N				@ 27': Bedding dips back to upright orientation.			
	30								

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 6

DATE STARTED: 3/19/18 DATE ENDED: 3/19/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EarthDrill
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-24': 2400 lbs.; 24'-43': 1550 lbs.; 43'-62': 850 lbs.

GROUND SURFACE ELEVATION: 728 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
690	35	N S	@ 31.5' B: N79E, 84NW @ 36' B: N78E, 78NW	D-3 B-2	7	ML-CL	@ 30' SAMPLE: Pale yellow to greenish gray SILTSTONE/CLAYSTONE, moist, stiff, diatomaceous, abundant foraminifera, well bedded, trace fine sand in SILTSTONE, FeO stained.	84.2	35.4	CN B-2 @ 20'-40'
	40			D-4	8	ML-CL	@ 40' SAMPLE: Pale yellow to greenish gray SILTSTONE/CLAYSTONE, moist, stiff, diatomaceous, abundant foraminifera, well bedded, some brittle paper thin clay beds, FeO stained.	86.1	33.3	
680	45						Notes: Total Depth: 40 Feet. Downhole Logged to 38 Feet. No Groundwater Encountered. Backfilled and Tamped with Cuttings.			
	50									
670	55									
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-7

DATE STARTED: 3/19/18 DATE ENDED: 3/19/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EarthDrill
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-24': 2400 lbs.; 24'-43': 1550 lbs.; 43'-62': 850 lbs.

GROUND SURFACE ELEVATION: 698 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		Afu					**Artificial Fill (Afu)** @ 0'-1': Dark brown SILT/CLAY graded pad for drill rig.			
		Col		B-1			**Colluvium (Col)** @ 1': Dark brown SILT/CLAY, moist, medium stiff to stiff, porous, roots to 3', abundant caliche stringers.			B-1 @ 0'-5'
	5			D-1	7	CL	@ 5' SAMPLE: Brown CLAY, moist, medium stiff, caliche stringers, pinhole pores. @ 6'-7': Grayish brown SILT/CLAY, stiff.	93.7	19.6	CN
690										
	10			D-2	5	SM-ML	**Puente Formation, Yorba Member (Tpy)** @ 9': Weathered bedrock, contact is gradational. @ 9.5': White to yellow and olive SILTSTONE, heavily fractured/weathered, diatomaceous. @ 10' SAMPLE: Greenish gray to yellow orange silty fine SANDSTONE/SILTSTONE, moist, dense/very stiff, diatomaceous, slightly friable, CaCO3. @ 11': Less weathered, bedding is visible, FeO stained SANDSTONE, olive gray SILTSTONE, interbedded.	87.2	25.3	
			@ 11.5' B: N54E, 26NW							
			@ 13.6' B: N43E, 26NW							
	15			B-2						B-2 @ 10'-20'
680							@ 17': Much less weathered, hard.			
	20			D-3	7	ML	@ 20' SAMPLE: Greenish gray SILTSTONE, moist, very stiff, not as weathered, diatomaceous. @ 20.8': 1/2" cemented bed.	84.6	31.6	
			@ 20.8' B: N79E, 29NW							
							@ 22': SILTSTONE, 1/2" thick, with clayey shear surfaces, striated on bottom, low plasticity, brittle.			
			@ 23' B: N57E, 33NW							
	25						@ 25': Shearing, ductile deformation.			
							@ 26'-29.5': Subvertical joint. @ 26.5': Cemented bed, 1.5' thick, broken.			
670										
			@ 28.3' CB: N58E, 39NW				@ 28.3': Paper thin CLAY bed.			
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 7

DATE STARTED: 3/19/18 DATE ENDED: 3/19/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EarthDrill
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-24': 2400 lbs.; 24'-43': 1550 lbs.; 43'-62': 850 lbs.

GROUND SURFACE ELEVATION: 698 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S		D-4	8	SM-CL	@ 30' SAMPLE: Orangish yellow and greenish gray silty fine SANDSTONE/CLAYSTONE, moist, very dense/very stiff.	93.0	21.0	DS
			@ 31.2' B: N73E, 53NW				@ 31.8': Sheared SILTSTONE, 4" thick, sheared clayey surfaces within bed, striated at base. Similar 2" thick bed at 34.5'.			
	35		@ 34.8' B: N64E, 52NW				@ 36': Cemented zone, 1" thick.			
660							@ 38': Interbedded SILTSTONE/SANDSTONE, FeO stained.			
	40			D-5	10	SM-CL	@ 40' SAMPLE: Orangish yellow and greenish gray silty fine SANDSTONE/CLAYSTONE, moist, very dense/very stiff.	91.7	26.6	
							Notes: Total Depth: 40 Feet. Downhole Logged to 38 Feet. No Groundwater Encountered. Backfilled and Tamped with Cuttings.			
	45									
650										
	50									
	55									
640										
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 8

DATE STARTED: 3/19/18 DATE ENDED: 3/19/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EarthDrill
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-24': 2400 lbs.; 24'-43': 1550 lbs.; 43'-62': 850 lbs.

GROUND SURFACE ELEVATION: 774 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
							Topsoil @ 0'-3': Brown sandy SILT/CLAY, moist, medium stiff, caliche stringers.			
770	5						**Puente Formation, Yorba Member (Tpy)** @ 3': White to pale yellow SILTSTONE, damp to moist, weathered, diatomaceous.			
							@ 7'-10': Jointed, 8-12" spacing.			
			@ 8.6' B: N71E, 56SE				@ 8.5': Bedding is masked by weathering above 8.5'.			
	10		@ 10' J: N4W, 73W	D-1 B-1	5	SM-CL	@ 10'-15': Joints, CaCO3 filled. @ 10' SAMPLE: Light greenish gray to white silty fine SANDSTONE/CLAYSTONE, moist, very dense/very stiff, interbedded, diatomaceous, weathered, jointed.	88.0	27.5	
760	15		@ 14.3' B: N66E, 48SE							B-1 @ 3'-20'
			@ 18.1' B: N72E, 44SE				@ 18': SILTSTONE with green paper thin clay surface along bedding. @ 18.8': Sheared SILTSTONE, 2" thick, slightly broken.			
	20			D-2	6	SM-CL	@ 20' SAMPLE: Light greenish gray to white silty fine SANDSTONE/CLAYSTONE, moist, very dense/very stiff, diatomaceous, jointed. @ 21': SANDSTONE beds are a maximum of 2" thick.	95.1	20.6	
750			@ 23.5' B: N79E, 56SE							
	25						@ 24'-30': Highly folded zone, SILTSTONE, broken/fractured.			
			@ 29' B: N67W, 56SW				@ 29': SILTSTONE has clayey shear surfaces and is broken.			
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 8

DATE STARTED: 3/19/18 DATE ENDED: 3/19/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EarthDrill
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-24': 2400 lbs.; 24'-43': 1550 lbs.; 43'-62': 850 lbs.

GROUND SURFACE ELEVATION: 774 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S	@ 29.4' B: N85E, 64SE	D-3 B-2	7	SM-CL	@ 30' SAMPLE: Light greenish gray to white silty fine SANDSTONE/CLAYSTONE, moist, very dense/very stiff, CLAYSTONE is sheared, jointed.	102.0	16.4	
			@ 32' B: N46E, 33SE				@ 31.4': Cemented bed, minor faulting.			
740							@ 32': Less folded.			
	35		@ 35' B: N59E, 32SE							B-2 @ 20'-40'
			@ 38' B: N83W, 54SW				@ 38': Folded zones, interbedded SANDSTONE/SILTSTONE.			
	40			D-4	9	SM-CL	@ 40' SAMPLE: Orangish yellow to pale yellow and dark gray SANDSTONE/CLAYSTONE, moist, very dense/very stiff, highly sheared CLAYSTONE.	88.9	29.7	
730							Notes: Total Depth: 40 Feet. Downhole Logged to 38 Feet. No Groundwater Encountered. Backfilled and Tamped with Cuttings.			
	45									
	50									
720										
	55									
	60									

Boring No. B- 9

DATE STARTED: 3/19/18 DATE ENDED: 3/19/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EarthDrill
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-24': 2400 lbs.; 24'-43': 1550 lbs.; 43'-62': 850 lbs.

GROUND SURFACE ELEVATION: 666 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
							Topsoil @ 0'-3.3': Grayish brown to brown sandy SILT/CLAY, dry, bedrock contact below is undulatory.			
							Puente Formation, Yorba Member (Tpy) @ 3.3': Pale yellowish to white sandy SILTSTONE, damp, medium stiff to stiff, heavilty weathered, diatomaceous, some root hairs, trace sheared CLAYSTONE surfaces.			B-1 @ 5'-20'
660	5		@ 6.2' B: N65W, 63NE				@ 8.6: 1/4" CLAYSTONE, beds interbedded with SILTSTONE, slightly polished.			
	10			D-1 B-1	4	ML-CL	@ 10' SAMPLE: Pale yellow SILTSTONE/CLAYSTONE, moist, stiff, diatomaceous.	83.1	35.3	
			@ 12' CB: N68W, 58NE				@ 12': Olive Gray CLAY bed, 1/4" to 1/2" thick, striations down dip, slightly plastic, CaCO3 lined bedding, bed is continuous around boring, exits hole at 15.8'			
650	15						@ 14.9': Interbedded SILTSTONE/CLAYSTONE, slightly broken/fractured.			
	20		@ 19.9' CB: N71W, 55NE	SB-1 D-2	11	ML-CL	@ 19.9': CLAYSTONE, 1" to 1.5" thick, tectonically sheared along bedding, upper 1/4" is moderately plastic, pinches and swells, exits hole at 23.4'. @ 20' SAMPLE: Pale yellowish brown SILTSTONE/CLAYSTONE, moist, very stiff, slightly sheared.	107.2	19.6	SB-1 @ 19.9'
640	25						@ 27': Sheared CLAYSTONE, polished, waxy.			
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B- 9

DATE STARTED: 3/19/18 DATE ENDED: 3/19/18
DRILLING COMPANY: Alroy Drilling Services
EQUIPMENT USED: EarthDrill
HOLE DIAMETER (in.) 28"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0'-24': 2400 lbs.; 24'-43': 1550 lbs.; 43'-62': 850 lbs.

GROUND SURFACE ELEVATION: 666 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S		D-3 B-2	6	CL	@ 30' SAMPLE: Olive brown CLAYSTONE, moist to wet, medium stiff, highly sheared clayey surfaces, broken, diatomaceous.	80.2	39.3	
			@ 32.2' B: N72W, 54NE							
	35						@ 34.6': CLAYSTONE, broken, little to no plasticity, tectonically sheared, brittle.			B-2 @ 20'-40'
630			@ 36' B: N66W, 60NE							
							@ 38'-39': Yellow SANDSTONE, cemented.			
	40						@ 40': Too hard to sample, cemented SANDSTONE.			
							Notes: Total Depth: 40 Feet. Downhole Logged to 38'. No Groundwater Encountered. Backfilled and Tamped with Cuttings.			
	45									
620										
	50									
	55									
610										
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-10

DATE STARTED: 5/7/18 DATE ENDED: 5/7/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 686 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
							Artificial Fill (Afu) @ 0': Dark brown clayey fine SAND, dry, loose.			
							Topsoil @ 1.5': Dark brown clayey fine SAND, damp, loose.			
							Puente Formation, Yorba Member (Tpy) @ 2.6': Pale olive yellow to dark gray to yellowish red SILTSTONE/silty fine SANDSTONE, damp, very dense/very stiff, very thinly and well bedded, $CaCO_3$ lined bedding and fractures, less weathered and broken by 4.5'.			
680	5			D-1 B-1	4	ML	@ 4.1': Massive gray and FeO stained SILTSTONE to 6.5'. @ 5' SAMPLE: Gray SILTSTONE, moist, stiff, diatomaceous, weathered, foraminifera bearing.	86.9	27.1	
			@ 7' B: N48E, 8NW @ 7.8' F: N58E, 57NW				@ 7.8': Fault, $CaCO_3$ lined, offsets laminated bedding, continuous around 3/4 of boring, steepens mid-hole and splits into many small faults. @ 8': Small scale folding, bedding is undulatory.			B-1 @ 2'-10'
	10			D-2	3	ML	@ 10' SAMPLE: Gray SILTSTONE, moist, very stiff, diatomaceous, root hairs along fracture in sample.	85.0	21.4	
	15		@ 14.2' B: N31E, 9NW				@ 14': Gray to dark gray to yellowish red SILTSTONE/silty fine SANDSTONE.			
670				D-3	3	SM-ML	@ 15' SAMPLE: Reddish yellow to gray silty fine SANDSTONE/SILTSTONE, moist, very stiff, interbedded, diatomaceous.	87.6	21.2	
			@ 18' J: N70E, 80SE				@ 18': Prominent joint enters hole at 16.5', dies out around 19.5' midway through hole. Tight, no open voids or lining.			
	20		@ 20' B: N8E, 8NW	D-4	4	SM-ML	@ 20' SAMPLE: Reddish yellow to gray silty fine SANDSTONE/SILTSTONE, moist, very stiff, interbedded, diatomaceous.	90.6	23.3	
							@ 22': 3/4" clean fine SANDSTONE bed, FeO stained, continuous around hole. @ 23': CLAYSTONE.			
	25									
660			@ 25' B: N4E, 22NW				@ 25': Cemented zone, broken, slightly belled out on up dip side of boring, 1' thick.			
			@ 27.2' B: N22E, 10NW							
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

NMG Geotechnical, Inc.

Boring No. B-10

DATE STARTED: 5/7/18 DATE ENDED: 5/7/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 686 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
				D-5	3	SM-CL	@ 30' SAMPLE: Reddish yellow to gray silty fine SANDSTONE/CLAYSTONE, moist, very stiff, diatomaceous.	88.5	22.1	
	35		@ 35' B: N36E, 20NW							
650										
							@ 38': Soft sediment deformation, undulatory bedding. @ 38.4': Dark gray silty CLAY, pinches and swells, paper thin to 1/4" thick, continuous, low plasticity. @ 38.6': Cemented zone, 1.2' thick, very dense, not broken.			
	40		@ 40' B: N45E, 9NW	D-6	3	SM-CL	@ 40' SAMPLE: Olive gray to reddish yellow silty fine SANDSTONE/CLAYSTONE, moist, very dense/hard, diatomaceous.	81.5	29.9	
	45						Notes: Total Depth: 44 Feet. Downhole Logged to 43 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
640										
	50									
	55									
630										
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-11

DATE STARTED: 5/8/18 DATE ENDED: 5/8/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 693 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
							Artificial Fill (Afu) @ 0-2': Dark brown silty CLAY, dry, loose.			
690							**Puente Formation, Yorba Member (Tpy)** @ 2': Gray SILTSTONE, damp, very dense, massive, random FeO staining.			
	5			D-1	3	ML	@ 5' SAMPLE: Yellowish gray clayey SILTSTONE, moist, very stiff, CaCO3 lined bedding and fractures. @ 6': Bedding becomes more clearly defined, slightly undulatory.	90.6	24.6	
			@ 7.2' B: N12E, 9NW				@ 7.5': CaCO3 lined bedding. @ 8.5': Some roots.			
	10			D-2	3	ML	@ 10' SAMPLE: Yellowish gray to reddish yellow SILTSTONE, moist, very stiff, trace sandstone.	91.9	22.5	
680										
	15			D-3	3	ML	@ 15' SAMPLE: Yellowish gray to reddish yellow SILTSTONE, moist, very stiff, diatomaceous, trace sandstone.	87.3	25.4	
			@ 17' B: N21E, 6NW				@ 17': Gray claye-y SILTSTONE, interbedded with thin FeO stained sandstone beds, root hairs along bedding. @ 18.9'-22.5': Gray to yellowish gray SILTSTONE, massive.			
	20			D-4	5	ML	@ 20' SAMPLE: Yellowish gray SILTSTONE, moist, very stiff, FeO stained.	86.4	29.4	
670			@ 22.5' B: N11E, 10NW				@ 22.5': 1/4" FeO stained SANDSTONE bed, continuous, below is well-bedded. @ 23.9' and 25.1':1/4" thick SANDSTONE beds.			
	25		@ 25.5' B: N20E, 13NW				@ 25.5': 1" thick SANDSTONE bed. @ 26.1': 2" thick weakly cemented zone.			
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-11

DATE STARTED: 5/8/18 DATE ENDED: 5/8/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 693 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
660	35		@ 32.1' B: N5E, 10NW	D-5	5	SM-ML	@ 30' SAMPLE: Reddish yellow and yellowish gray to gray silty fine SANDSTONE/SILTSTONE, moist, very dense/very stiff, FeO stained. @ 30': Frequency of SANDSTONE bed increases, but mostly SILTSTONE overall. @ 32.1': SANDSTONE bed, friable, FeO stained on upper and lower contact, pinches and swells to 1/2" to 2" thick. @ 34.2': Gray SILTSTONE, massive, with random FeO staining. @ 36.2': Well-bedded dark gray SILTSTONE and FeO stained silty fine SANDSTONE.	95.1	19.8	
	40		@ 37.8' B: N24E, 9NW	D-6	4	CL	@ 40' SAMPLE: Olive gray silty CLAYSTONE, moist, very stiff, diatomaceous, fish scales, phosphate nodules. @ 41.5': Interbedded SILTSTONE/CLAYSTONE.	85.3	34.3	
650	45		@ 42' B: N41E, 8NW	B-1						B-1 @ 42'-44'
640	50						Notes: Total Depth: 46 Feet. Downhole Logged to 44 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
	55									
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-12

DATE STARTED: 5/7/18 DATE ENDED: 5/7/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 676 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
							Artificial Fill (Afu) @ 0': Yellowish brown silty fine SAND/sandy SILT, moist, medium dense/stiff, slightly porous.			
	5		@ 4' B: N34W, 10SW	D-1	4	SM-ML	**Puente Formation, Yorba Member (Tpy)** @ 3.8': Light olive gray SILTSTONE with interbedded reddish yellow silty fine SANDSTONE, moist, hard/very dense, CaCO3 lined bedding and joints. @ 5' SAMPLE: Gray to yellowish red silty fine SANDSTONE/SILTSTONE, moist, very dense/hard, diatomaceous, thinly interbedded. @ 6.5': Below, trace FeO stained SANDSTONE beds.	92.6	21.9	
670			@ 7.5' B: N48-64W, 3SW							
	10		@ 11.9' B: N51W, 1-3SW	D-2 B-1	5	SM-ML	@ 8.8': Weakly cemented zone, on north and northwest wall, 4" thick. @ 9.9', cemented zone with reddish yellow silty fine SANDSTONE, 5" thick. @ 10' SAMPLE: Gray to pale yellow silty fine SANDSTONE/SILTSTONE, moist, very dense/hard. @ 12'-14': Gray to dark gray SANDSTONE/SILTSTONE, some rootlets along bedding.		14.5	B-1 @ 10'-12'
	15		@ 15.5' B: N18W, 3SW	D-3	5	SM-CL	@ 15' SAMPLE: Gray to reddish yellow SANDSTONE/silty CLAYSTONE, moist, very dense/hard, interbedded. @ 17.5' and 18': Pale yellow fine SANDSTONE, 1/4" to 1" thick, FeO stained on top and bottom, pinches and swells, friable.	98.1	15.4	
660			@ 18' B: N21W, 6SW							
	20		@ 23': B: N34W, 12SW	D-4	5	SM-CL	@ 20' SAMPLE: Gray to reddish yellow SANDSTONE/CLAYSTONE, moist, very dense/hard. @ 23' to 24.5': Weakly cemented zone, yellow to yellowish red, continuous around boring.	92.0	24.7	
	25		@ 24.9' CB: N12W, 7SW	SB-1			@ 24.9': Dark gray clayey SILTSTONE, moist, low plasticity, 1/4" to 1" thick. @ 27.1': CLAY bed, paper thin to 1/2" thick, very moist, continuous, sheared internally, low to medium plasticity. @ 28': Mostly SILTSTONE, easier drilling.			SB-1 @ 24.9'
650										
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/24/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-12

DATE STARTED: 5/7/18 DATE ENDED: 5/7/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 676 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
				D-5	3	ML-CL	@ 30' SAMPLE: Gray to dark gray SILTSTONE/CLAYSTONE, very moist, stiff, diatomaceous, gypsum lined joint within sample. @ 30.5': CaCO3 lined bedding. @ 31.2': FeO stained SANDSTONE, below is wet gray diatomaceous CLAYSTONE.	84.3	32.4	
							@ 33.2'-34.7': Massive gray SILTSTONE.			
640	35		@ 35' B: N24W, 11SW				@ 34.7' and 35': Up to 3/4" SANDSTONE beds, below is massive SILTSTONE. @ 36': 3/4" thick SANDSTONE bed.			
	40		@ 40.2' B: N31W, 11SW	D-6	2	ML-CL	@ 40' SAMPLE: Gray to dark gray SILTSTONE/CLAYSTONE, very moist, very stiff, thinly bedded, diatomaceous. @ 40': Paper thin to 1/4" CLAY bed, within CLAYSTONE, not well defined. @ 40.2': SILTSTONE bed has clayey surfaces, more diatomaceous below.	74.8	46.0	
630	45		@ 45' B: N28W, 13SW				@ 48': Dark bluish gray SILTSTONE.			
	50			D-7	10	ML	@ 50' SAMPLE: Dark gray SILTSTONE, very moist, hard, diatomaceous.	82.4	35.9	
620	55						Notes: Total Depth: 50 Feet. Downhole Logged to 47 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/24/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-13

DATE STARTED: 5/8/18 DATE ENDED: 5/8/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 704 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
							Artificial Fill, Undocumented (Afu) @ 0'-4': Dark brown sandy CLAY, damp, stiff.			
700	5						**Colluvium (Col)** @ 4': Dark brown sandy CLAY, moist, stiff.			
				D-1	1	CL	@ 5' SAMPLE: Brown silty sandy CLAY, moist, medium stiff, abundant pinhole pores, roots.	81.4	18.5	
				B-1			@ 6': Caliche stringers, more silty by 7'. @ 7'-8': Yellowish brown to brown clayey SILT/silty CLAY, moist, stiff, roots.			B-1 @ 2.5'-12'
	10			D-2	2	CL	@ 10' SAMPLE: Brown silty sandy CLAY, moist, stiff, abundant pinhole pores, caliche stringers, roots.	81.4	20.2	
690										
	15		@ 16' B: N74W, 24NE	D-3	6	ML	**Puente Formation, Yorba Member (Tpy)** @ 14.3': Gradational contact to highly weathered pale yellow to light gray sandy SILTSTONE, massive. @ 15' SAMPLE: White to gray SILTSTONE, moist, very stiff, pinhole pores, diatomaceous, weathered. @ 16': Bedrock is weathered, but bedding becomes more apparent with interbedded SANDSTONE.	89.9	19.0	
	20		@ 21' B: N82W, 26NE	D-4	4	SM	@ 20' SAMPLE: Reddish yellow silty fine SANDSTONE, moist, very dense, claystone interbeds, $CaCO_3$ lined bedding. @ 20.2' and 21': Light gray 1" thick SANDSTONE beds, FeO stained on top and bottom of bed, friable.	91.6	19.9	
680			@ 23.6' B: N61E, 19NW							
	25						@ 24' and 26.8': $CaCO_3$ lined bedding and phosphate nodules.			
			@ 29.5' B: N87W, 24N				@ 28.3': Cemented bed, 2" to 5" thick, continuous around boring.			
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG GINT 2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-13

DATE STARTED: 5/8/18 DATE ENDED: 5/8/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 704 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S		D-5	4	SM/CL	@ 30' SAMPLE: Upper: Reddish yellow silty fine SANDSTONE, moist, very dense. Lower (In Sample): Olive gray CLAYSTONE, moist, hard, diatomaceous. @ 30.5': SANDSTONE bed, 3/4" thick, friable.	91.3	22.2	
670	35						@ 33': More CLAYSTONE, minor sheared surfaces, very tight. @ 34': Deformation in SANDSTONE beds, non-parallel wavy bedding, soft-sediment deformation.			
			@ 36.7' GB: E-W, 18N @ 37.3' CB: N70W, 17NW				@ 36.7': 1/4" to 1/2" thick SANDSTONE bed. @ 37.3' and 37.7': Silty CLAY bed, dark gray, 1/2" thick, undulatory/truncated by small fault, bedding dips are variable, low to medium plasticity. @ 38'-42': Dark gray SILTSTONE becomes massive, with random FeO staining.			
	40			D-6	4	SM-CL	@ 40' SAMPLE: Gray silty fine SANDSTONE/CLAYSTONE, moist, very dense/hard, foraminifera-bearing, diatomaceous.	87.3	28.2	
660			@ 42.3' B: N84E, 6NW @ 42.5' B: N79E, 6NW							
	45									
							Notes: Total Depth 45.5 Feet. Downhole Logged to 44 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
	50									
650										
	55									
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-14

DATE STARTED: 5/9/18 DATE ENDED: 5/9/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 773 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S					**Topsoil** @ 0'-2.6': Grayish brown sandy silty CLAY, damp, soft/medium stiff, porous, root hairs, bedrock fragments in soil, contact with bedrock is undulatory.			
770							**Puente Formation, Yorba Member(Tpy)** @ 2.6'-3.6': Pale yellow to light gray SILTSTONE, with 1/4" dark CLAYSTONE interbeds, weathered, undulatory bedding, krotovina.			
	5		@ 3.8' B: N81W, 64SW	D-1	3	ML	@ 5' SAMPLE: Pale yellow to grayish white SILTSTONE, moist, very stiff, highly diatomaceous.	72.4	36.3	
			@ 5.6' B: N77W, 47SW				@ 5.5': Krotovina, CaCO3 lined bedding.			
			@ 8' B: N74W, 64SW				@ 8'-9': Bedding truncated by fault.			
	10			D-2	3	ML-CL	@ 9.6': Clayey zone, polished surfaces, fractured/broken, diatomaceous. @ 10' SAMPLE: Greenish gray SILTSTONE/CLAYSTONE, moist, very stiff, foraminifera, bedding is poorly defined, FeO stained.	91.0	26.8	
760										
			@ 13' B: N79W, 49SW				@ 12.5'-13': SILTSTONE is broken/fractured.			
	15			D-3	2	ML-CL	@ 15' SAMPLE: Greenish gray SILTSTONE/CLAYSTONE, moist, very stiff, thinly bedded.	92.2	23.9	
			@ 16.9' B: N85E, 54S				@ 16': Fault truncates and folds adjacent bedding.			
	20			D-4	2	ML-CL	@ 20' SAMPLE: Greenish gray SILTSTONE/CLAYSTONE, moist, very stiff, diatomaceous.	88.1	30.5	
			@ 21.5' B: N87E, 69S				@ 21.5': Bedding steepens, slightly broken, polished surfaces on CLAYSTONE, CaCO3 lined bedding.			
750										
	25						@ 24'-25.5': Gray SILTSTONE, massive, random FeO staining, strike is rotated compared to above.			
			@ 25.9' B: N61E, 66SE							
	30						@ 28.7': Clayey zone with striations, slightly sheared.			

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-14

DATE STARTED: 5/9/18 DATE ENDED: 5/9/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 773 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
		N S								
740			@ 30.5' B: N42E, 61SE	D-5	2	ML-CL	@ 30' SAMPLE: Greenish gray SILTSTONE/CLAYSTONE, moist, very stiff, diatomaceous. @ 30.5': FeO stained SILTSTONE bedding, undulatory, phosphate nodules.	84.0	33.5	
	35		@ 33.5' B: N64E, 65SE				@ 33.8'-35.6': Cemented zone along bedding, yellowish red SANDSTONE with white CaCO3 cemented nodules.			
							@ 35.6': 1/2" thick dark gray CLAY bed, moist, medium stiff, low plasticity.			
			@ 36.5' CB: N85W, 48S				@ 37': Bedding steepens, locally folded/overturned.			
			@ 39' B: N84W, 72SW				@ 39': 1/4" thick FeO stained SANDSTONE bed. SILTSTONE below, sheared, clayey surfaces, broken to 40.2'.			
	40			D-6	3	ML-CL	@ 40' SAMPLE: Greenish gray SILTSTONE/CLAYSTONE, moist, very stiff, FeO staining along bedding, diatomaceous.	88.2	31.0	
730										
	45						Notes: Total Depth: 44 Feet. Downhole Logged to 43 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
	50									
720										
	55									
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-15

DATE STARTED: 5/8/18 DATE ENDED: 5/8/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 673 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
670	0	N S		B-1			**Artificial Fill (Afu)** @ 0'-3': Brown to dark brown sandy CLAY, damp, medium stiff.			B-1 @ 0'-5'
							Colluvium (Col) @ 3'-7': Dark brown sandy CLAY, moist, stiff, caliche stringers.			
	5			D-1	2	ML-CL	@ 5' SAMPLE: Olive gray SILT/CLAY, moist, stiff, pinhole pores, abundant fine bedrock fragments. @ 5.5': Yellowish brown sandy CLAY.	76.8	19.7	
			@ 7.5' B: N52W, 62SW				**Puente Formation, Yorba Member (Tpy)** @ 7': Gray to yellowish red silty fine SANDSTONE/SILTSTONE, moist, medium dense/stiff, highly weathered along contact.			
	10			D-2	3	SM-CL	@ 9.5': CaCO3 lined bedding. @ 10' SAMPLE: Yellow to greenish gray silty fine SANDSTONE/CLAYSTONE, moist, very dense/hard, thinly well-bedded. @ 10.7'-13.8': Small-scale folding.	82.6	26.4	
660			@ 11.5' B: N58W, 63SW @ 12.5' B: N49W, 81SW @ 13.5' B: N57W, 67SW				@ 12': Olive SILTSTONE, interbedded with reddish yellow silty fine SANDSTONE.			
	15			D-3	3	SM-ML	@ 15' SAMPLE: Yellow to pale grayish yellow silty fine SANDSTONE/SILTSTONE, moist, very dense/hard, thinly interbedded.	86.0	18.1	
			@ 16' B: N65W, 66SW @ 16.2' CB: N60W, 63SW				@ 16.2': Pale gray CLAY bed, paper thin to 1/4" thick, not sheared or striated.			
	20			D-4	3	SM-ML	@ 19': 4" thick zone of CaCO3 lined bedding, clay lined contact, paper thin between SANDSTONE and SILTSTONE, root hairs. @ 20' SAMPLE: Yellow to pale grayish yellow silty fine SANDSTONE/SILTSTONE, moist, very dense/hard, thinly interbedded.	92.0	24.1	
			@ 21' B: N68W, 53SW				@ 21.1': Similar clay lined contact, paper thin.			
650							@ 22.4': Clay lined contact, paper thin to 1/4" thick, low to medium plasticity, slightly broken, not sheared.			
	25						@ 25': Clayey surfaces in SILTSTONE.			
			@ 27' B: N56W, 36SW				@ 27': Gray SILTSTONE, massive, very stiff to hard, very few SANDSTONE beds. @ 27.1': SANDSTONE bed, 1.5" thick.			
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-15

DATE STARTED: 5/8/18 DATE ENDED: 5/8/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 673 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N / S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
640	35		@ 30.5' B: N56W, 36SW @ 34' B: N61W, 38SW @ 37' B: N62W, 41SW @ 39' B: N58W, 36SW	D-5	3	SM-ML	@ 30' SAMPLE: Gray to dark gray SILTSTONE/CLAYSTONE, moist, hard, FeO stained, foraminifera-bearing, diatomaceous. @ 30.5': SANDSTONE bed, 1/4" thick, clayey surfaces on SANDSTONE/SILTSTONE contacts, well bedded below. @ 31': Moisture content increases. @ 33.5'-34': Clayey surfaces/lamina. @ 36.5': Light seepage on down dip side on SANDSTONE bed, 1.5" thick. @ 38': Silty SANDSTONE/clayey SILTSTONE, well bedded.	81.7	35.6	
	40			D-6	2	CL	@ 40' SAMPLE: Dark gray CLAYSTONE, wet, hard, interbedded with sandstone, FeO stained, diatomaceous.	83.5	35.2	
630	45						Notes: Total Depth: 42 Feet. Downhole Logged to 40 Feet. Seepage Encountered at 36.5 Feet. Standing Groundwater Not Encountered. Backfilled with Cuttings and Tamped.			
620	50									
	55									
	60									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-16

DATE STARTED: 5/9/18 DATE ENDED: 5/9/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 701 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log (N S)	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
700							**Artificial Fill (Afu)** @ 0'-1': Graded drill rig pad.			
							Topsoil @ 1': Grayish brown sandy/clayey SILT, damp, medium stiff.			
	5		@ 6' CB: N66W, 12SW	D-1	3	ML	**Puente Formation, Yorba Member (Tpy)** @ 3.5': Whitish gray SILTSTONE, damp, very stiff, $CaCO_3$ filled fracture, diatomaceous, weathered. @ 5' SAMPLE: Light gray to gray SILTSTONE, moist, very stiff/hard, diatomaceous. @ 6': Dark gray CLAY bed, 1/4" thick, moist, brittle, diatomaceous, low plasticity.	88.4	28.6	
							@ 8'-9': Increase in density, less weathered.			
	10			D-2	4	CL	@ 10' SAMPLE: Dark gray to greenish gray CLAYSTONE, moist, very stiff to hard, diatomaceous, trace clayey shear surfaces, FeO stained.	89.0	34.2	
690			@ 12.5' B: N56W, 11SW				@ 12.5' and 13': Clayey surfaces on SILTSTONE contacts.			
	15		@ 14.5' B: N77W, 8SW	D-3	2	CL	@ 14.5'-20.3': Up to 2" thick pale brownish gray CLAYSTONE beds, very moist to wet, very stiff. @ 15' SAMPLE: Gray to dark gray CLAYSTONE, moist, hard, clayey surfaces, diatomaceous, foraminifera-bearing.	82.0	34.6	
	20			D-4	2	CL	@ 20' SAMPLE: Gray to dark gray CLAYSTONE, moist, hard, clayey surfaces, diatomaceous, foraminifera-bearing.	84.4	31.7	
680							@ 21.2': Cemented zone, 2" to 5" thick, exposed on eastern half of boring.			
							@ 23.3': Weakly cemented SILTSTONE, 1.5" thick.			
	25		@ 23.8' B: N74W, 8SW				@ 25.5'-29.0': Gray SILTSTONE, massive, random FeO staining.			
	30									

Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

GEOTECHNICAL LOG OF BORING

18014-01

Sunjoint/The Terraces

NMG

Boring No. B-16

DATE STARTED: 5/9/18 DATE ENDED: 5/9/18
DRILLING COMPANY: Big Johnny
EQUIPMENT USED: 200B Bucket Auger
HOLE DIAMETER (in.) 26"
DRIVE DROP (in.) 12"
DRIVE WEIGHT (lbs.) 0-25': 3300lbs, 25-50': 2200lbs, 50-75': 1100lbs, 80': 1850lbs

GROUND SURFACE ELEVATION: 701 ft
DATUM: msl
LOCATION:
COORD/STATION:

Logged By: AZ/ZKH
Sampled By: ZKH

Elevation (ft.)	Depth (ft.)	Graphic Log	Attitudes	Sample Method and Number	Blows Per Foot	Soil Class. (U.S.C.S.)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Remarks
670		N S	@ 30' B: N73W, 14SW	D-5	3	CL	@ 30' SAMPLE: Gray to dark gray CLAYSTONE, moist, hard, clayey surfaces, diatomaceous. @ 30.1': Brownish gray CLAYSTONE, 1.5" thick.	86.1	32.8	
			@ 32.5' B: N72W, 14SW				@ 32.5': Cemented zone, 2.5" thick.			
	35		@ 33.8' B: N48W, 8SW				@ 33.3': Dark gray silty CLAYSTONE, 8" thick. Clay beds within CLAYSTONE are paper thin and not sheared. @ 33.6': SILTSTONE bed, thinly bedded, cemented. Below is 10" thick CLAYSTONE. @ 35.8': Reddish yellow silty fine SANDSTONE.			
			@ 38.5' B: N57W, 7SW				@ 38.5': SANDSTONE bed, 1/4" thick.			
	40			D-6	6	CL	@ 40' SAMPLE: Dark gray to greenish gray CLAYSTONE, moist, very stiff to hard, FeO stained, trace clayey surfaces, diatomaceous.	86.5	36.3	
660										
	45						Notes: Total Depth: 43 Feet. Downhole Logged to 40 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
	50									
650										
	55									
	60									

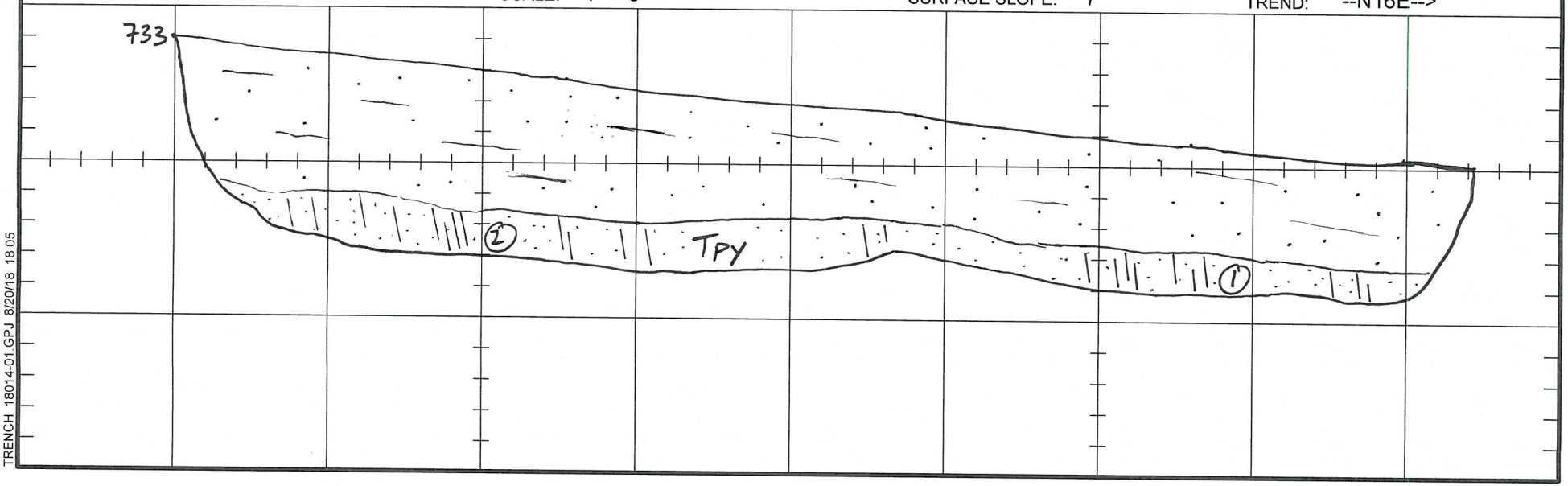
Report: BUCKET AUGER; Project: 18014-01.GPJ; Data Template: NMG_GINT_2016.GDT; Printed: 8/23/18

NMG

Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 733
Location:
TRENCH NO.: T-1

GEOLOGIC ATTITUDES	DESCRIPTION: (DATE: 4/30/18)	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-2': Dark brown sandy SILT/CLAY, damp, medium stiff, abundant caliche, pinhole pores, roots.		ML-CL			
	@ 2-4': Grayish brown to yellowish brown CLAY, moist, abundant pinhole pores, caliche, root hairs.		CL			
1) B: N87E, 83N 2) B: N89W, 79N	**Puente Formation, Yorba Member (Tpy)** @ 4-6': Pale yellow sandy and clayey SILTSTONE, damp, very stiff, weathered, thinly bedded.	Tpy	ML			
	Notes: Total Depth: 6 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: NW Wall SCALE: 1" = 5' SURFACE SLOPE: 7° TREND: --N16E-->



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-1

TRENCH 18014-01.GPJ 8/20/18 18:05

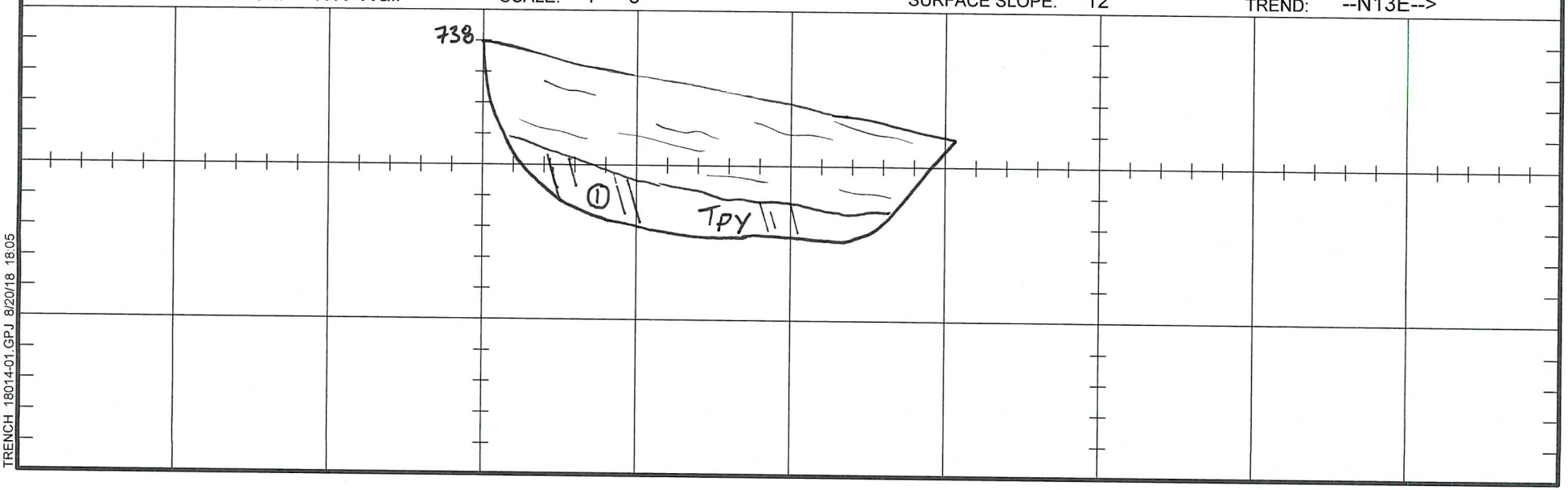
Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 738
Location:

TRENCH NO.: **T- 2**

DATE: 4/30/18

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-4': Brown SILT/CLAY, damp, medium stiff, dessicated.		ML-CL			
1) B: N75W, 74NE	**Puente Formation, Yorba Member (Tpy)** @ 4-6': Pale yellow SILTSTONE, damp, very stiff, weathered, thinly bedded.	Tpy	ML			
	Notes: Total Depth: 6 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: NW Wall SCALE: 1" = 5' SURFACE SLOPE: 12° TREND: --N13E-->



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-2

TRENCH 18014-01.GPJ 8/20/18 18.05

NMG

Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214

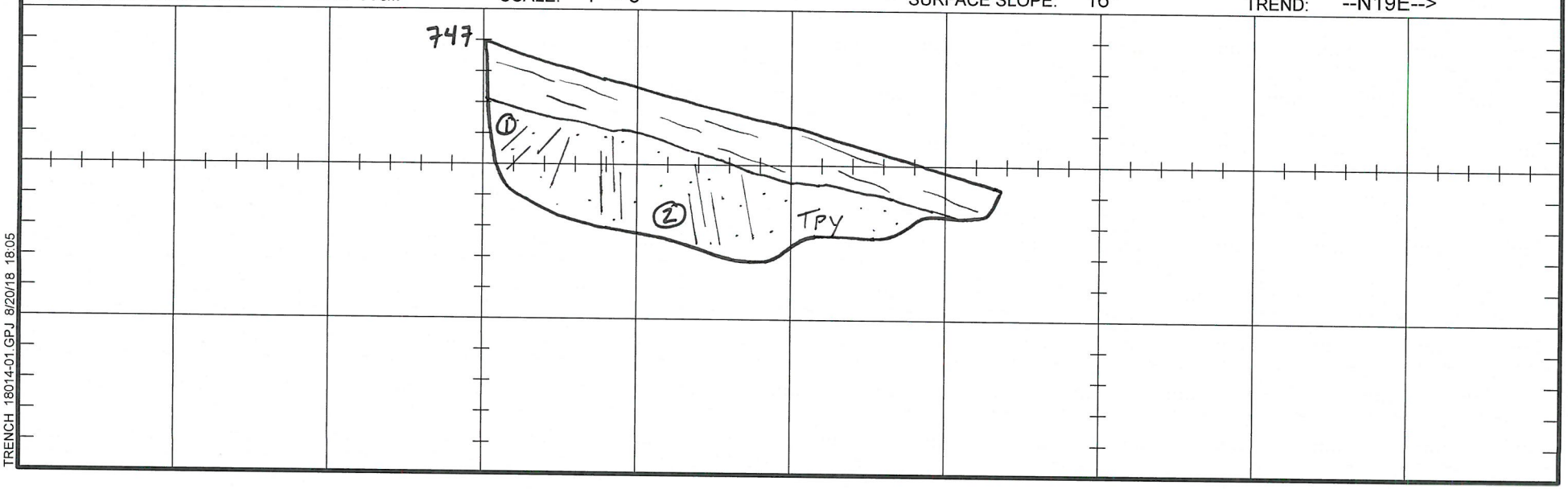
Logged By: ZKH
Elevation: 747
Location:

TRENCH NO.: **T- 3**

DATE: 4/30/18

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-2': Dark brown SILT/CLAY, damp, medium stiff, dessicated, roots, pinhole pores.		ML-CL			
1) B: N61W, 45SW (overturned) 2) B: N85W, 80NE	**Puente Formation, Yorba Member (Tpy)** @ 2-6': Pale yellow to greenish gray SILTSTONE/CLAYSTONE, damp, very stiff, thinly bedded, well-bedded.	Tpy	ML-CL			
	Notes: Total Depth: 6 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: NW Wall SCALE: 1" = 5' SURFACE SLOPE: 16° TREND: --N19E-->



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-3

TRENCH 18014-01.GPJ 8/20/18 18:05

NMG

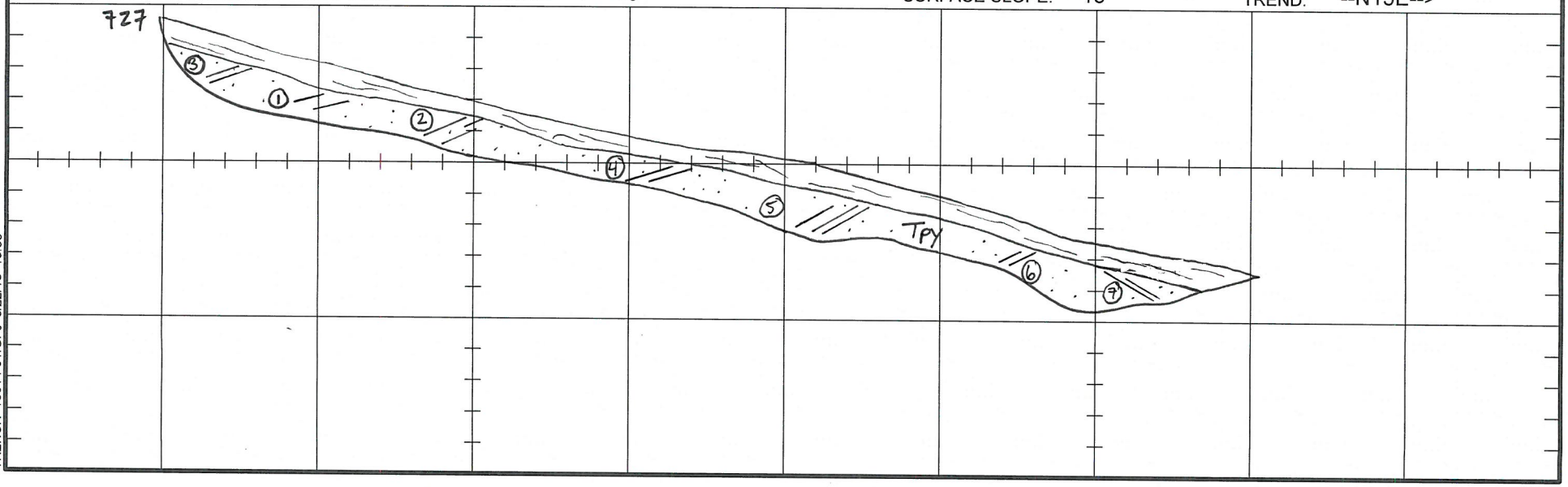
Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 727
Location:

TRENCH NO.: **T- 4**

DATE: 4/30/18

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-2': Dark brown sandy CLAY/SILT, damp, medium stiff, dessicated, roots, pinhole pores.		ML-CL			
1) B: N64W, 21SW 2) B: N60W, 37SW 3) B: N75W, 20SW 4) B: N53W, 20SW 5) B: N87W, 32S 6) B: N76E, 30SE 7) B: N49E, 38NW	**Puente Formation, Yorba Member (Tpy)** @ 2-4': Pale yellow to greenish gray SILTSTONE/CLAYSTONE, damp, very stiff, thinly bedded, well bedded.	Tpy	ML-CL			
	Notes: Total Depth: 4 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: NW Wall SCALE: 1" = 10' SURFACE SLOPE: 15° TREND: --N15E-->



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-4

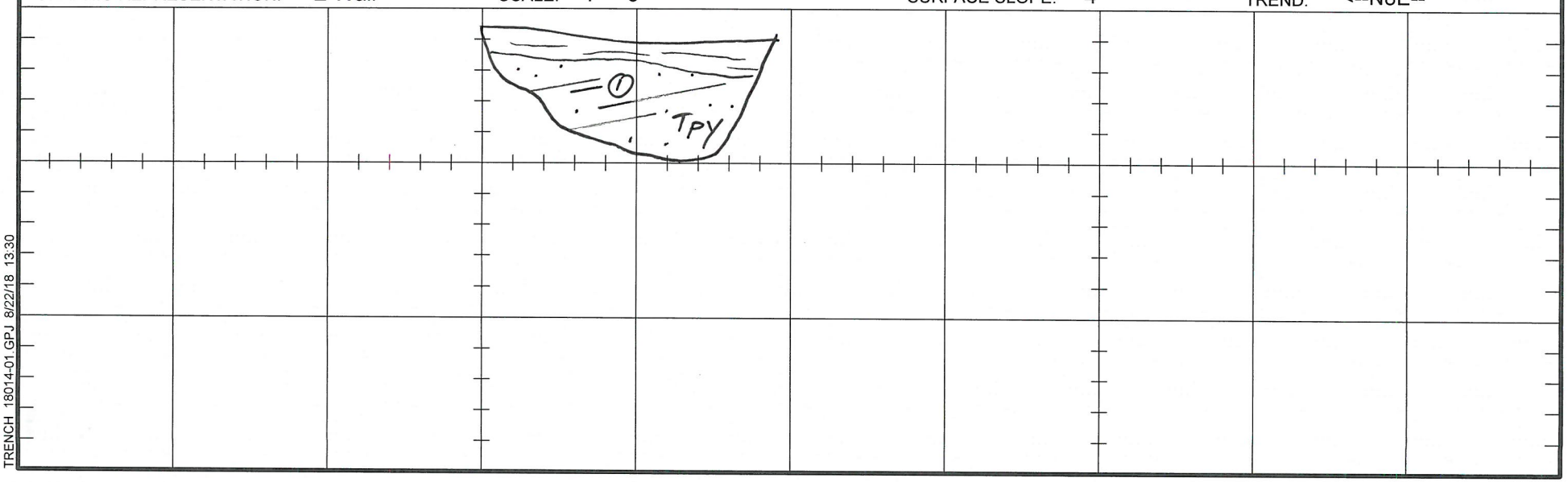
TRENCH 18014-01.GPJ 8/22/18 13:30

Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 716
Location:

TRENCH NO.: **T- 5**

GEOLOGIC ATTITUDES	DESCRIPTION: DATE: 4/30/18	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-1': Dark brown sandy CLAY, damp, medium stiff, porous, dessicated, root hairs.		CL			
1) B: N27E, 49NW	**Puente Formation, Yorba Member (Tpy)** @ 1-4': Pale yellow to greenish gray sandy SILTSTONE/CLAYSTONE, damp, very stiff, weathered, thinly bedded.	Tpy	ML-CL			
	Notes: Total Depth: 4 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: E Wall SCALE: 1" = 5' SURFACE SLOPE: 4° TREND: <--N8E--



NMG Geotechnical, Inc.

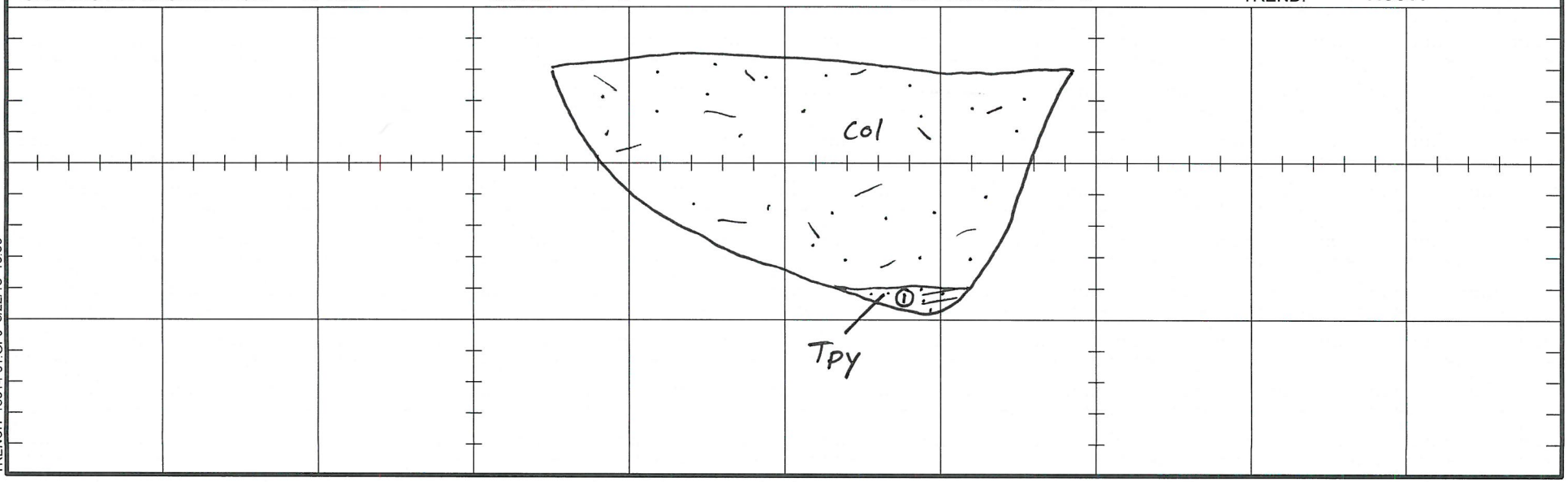
LOG OF TRENCH NO: T-5

TRENCH 18014-01.GPJ 8/22/18 13:30

Project Name: Sunjoint/The Terraces	Logged By: ZKH	TRENCH NO.:	ENGINEERING PROPERTIES
Project Number: 18014-01	Elevation: 703	T- 6	
Equipment: JCB 214	Location:		

GEOLOGIC ATTITUDES	DESCRIPTION: DATE: 4/30/18	GEOLOGIC UNIT	U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Colluvium (Col) @ 0-7': Dark brown sandy CLAY, damp, medium stiff, root hairs, pinhole pores.	Col	CL			
1) B: N21W, 19SW	**Puente Formation, Yorba Member (Tpy)** @ 7-8': Pale yellow sandy SILTSTONE/CLAYSTONE, damp, very stiff, well-bedded, weathered.	Tpy	ML-CL			
	Notes: Total Depth: 8 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: N Wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: <--N83W--



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-6

TRENCH 18014-01.GPJ 8/22/18 13:30

NMG Geotechnical, Inc.

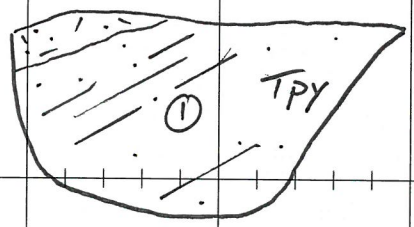
Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 773
Location:

TRENCH NO.: **T- 7**

DATE: 5/1/18

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-1': Dark brown sandy CLAY, damp, medium stiff, root hairs.		CL			
1) B: N55W, 36NE	**Puente Formation, Yorba Member (Tpy)** @ 1-5': Pale yellow to greenish gray sandy SILTSTONE/CLAYSTONE, damp, very stiff, thinly bedded.	Tpy	ML-CL			
	Notes: Total Depth: 5 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: S Wall SCALE: 1" = 5' SURFACE SLOPE: 5° TREND: E-W



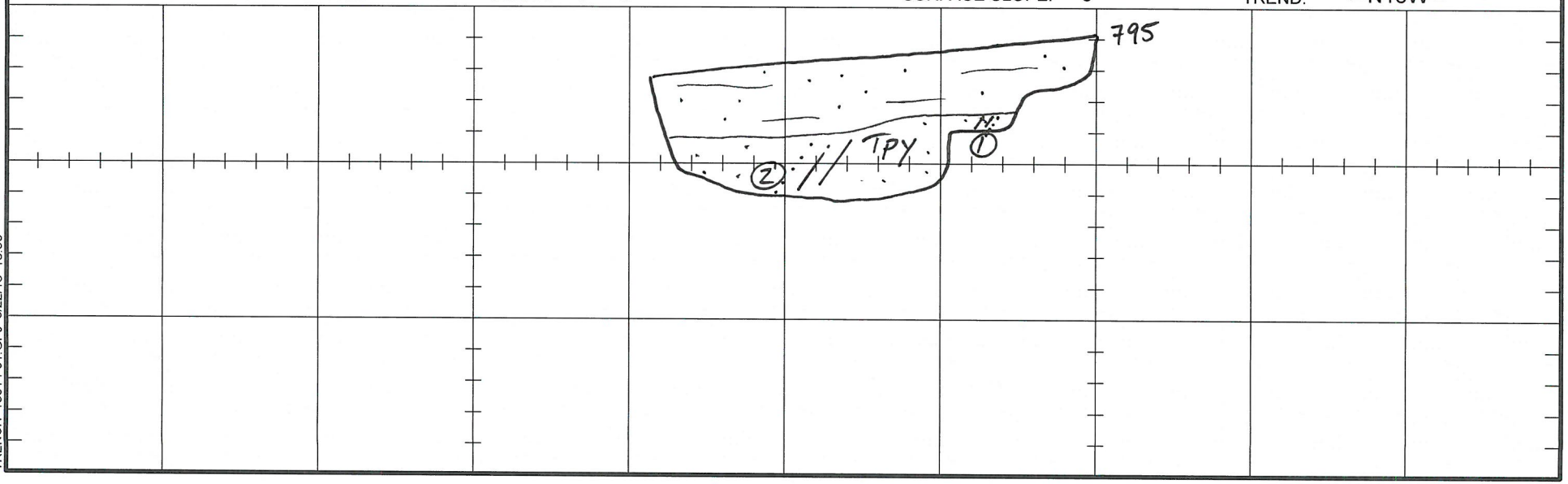
LOG OF TRENCH NO: T-7

TRENCH 18014-01.GPJ 8/22/18 13:30

Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 795
Location:
TRENCH NO.: T- 8

GEOLOGIC ATTITUDES	DESCRIPTION: DATE: 5/1/18	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-2.5': Dark brown sandy CLAY, damp, medium stiff, root hairs, porous.		CL			
1) B: N89W, 57N 2) B: N79W, 61N	**Puente Formation, Yorba Member (Tpy)** @ 2.5-5': Pale yellow to orange SANDSTONE/SILTSTONE, damp, very dense/stiff, well bedded.	Tpy	ML-CL			
	Notes: Total Depth: 5 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: E Wall SCALE: 1" = 5' SURFACE SLOPE: 5° TREND: <--N18W--



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-8

TRENCH 18014-01.GPJ 8/22/18 13:30

NMG Geotechnical, Inc.

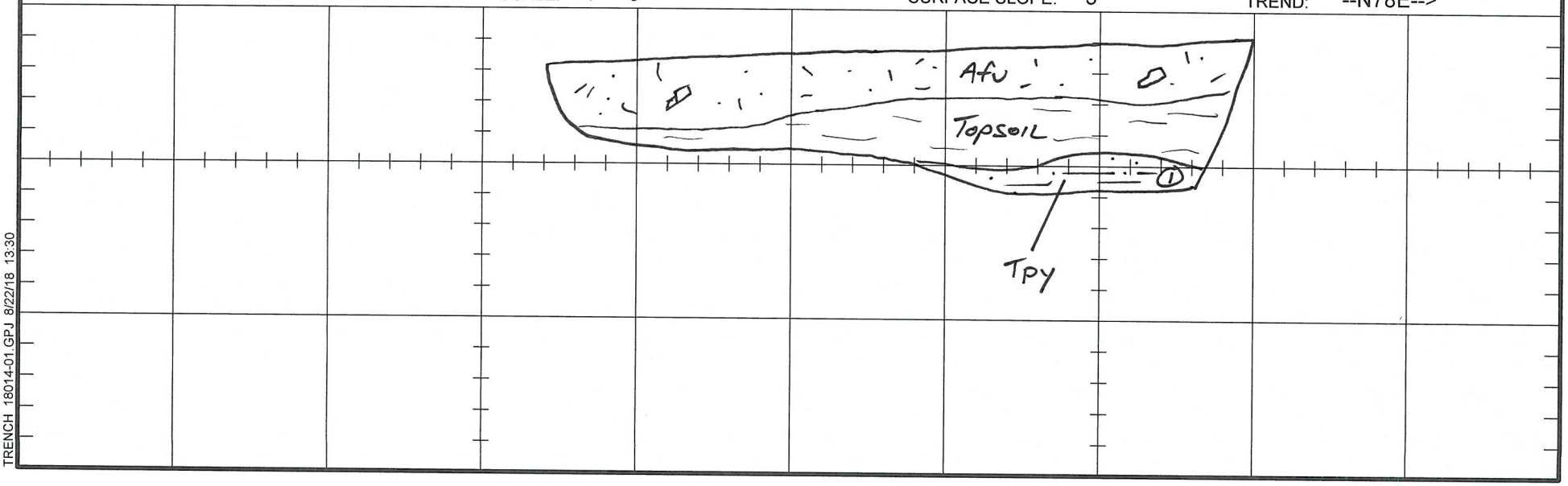
Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 717
Location:

TRENCH NO.: **T- 9**

DATE: 5/1/18

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Undocumented Artificial Fill (Afu) @ 0-2': Dark brown clayey SILT, dry, soft, abundant roots, trace concrete and brick.		ML			
	Topsoil @ 2-4.5': Light grayish brown SILT, dry to damp, medium stiff, abundant caliche, pencil-tip pores, trace bedrock fragments.		ML			
1) B: N79W, 6S	**Puente Formation, Yorba Member (Tpy)** @ 4.5-5': Pale yellow SILTSTONE, damp, very stiff, well-bedded, diatomaceous.	Tpy	ML			
	Notes: Total Depth: 5 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: N Wall SCALE: 1" = 5' SURFACE SLOPE: 3° TREND: --N78E-->



LOG OF TRENCH NO. T-9

TRENCH 18014-01.GPJ 8/22/18 13:30

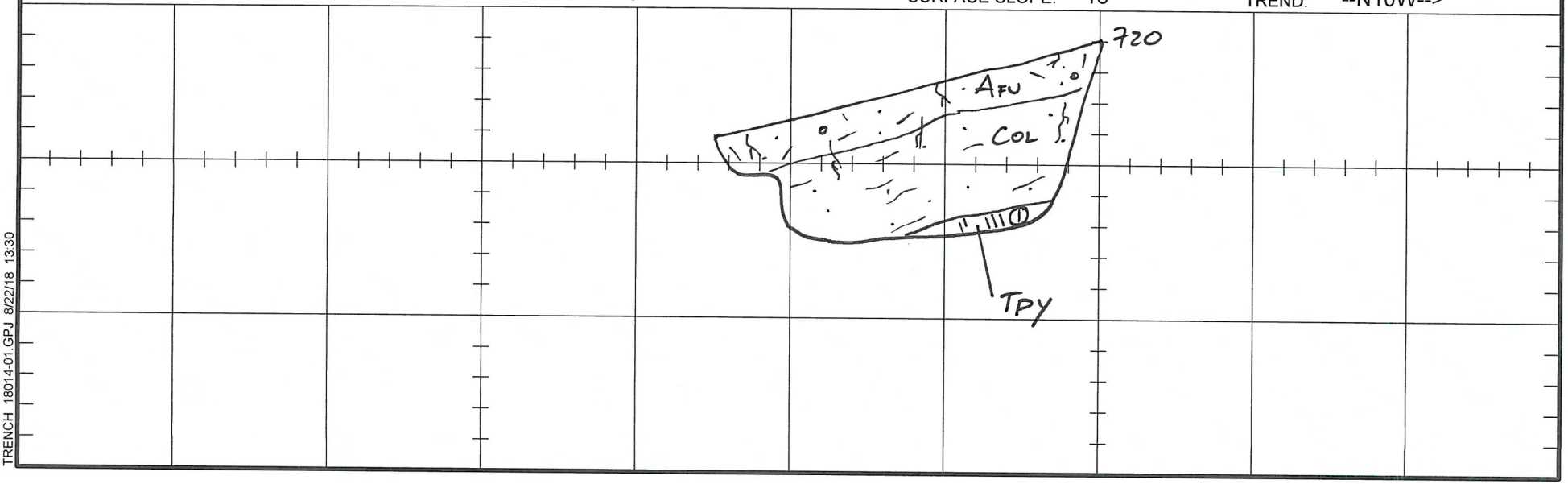
NMG

Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 720
Location:

TRENCH NO.: **T-10**

GEOLOGIC ATTITUDES	DESCRIPTION: DATE: 5/1/18	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Undocumented Artificial Fill (Afu) @ 0-1.8': Dark brown SILT/CLAY, damp, soft, abundant roots, animal burrows.	Afu	ML-CL			
	Colluvium (Col) @ 1.8'-5.5': Grayish brown sandy SILT, damp, soft, abundant pinhole/pencil pores, roots, caliche.	Col	ML			
1) B: N80E, 70N	**Puente Formation, Yorba Member (Tpy)** @ 5.5-6.5': White to pale yellow SILTSTONE, damp, very stiff, thinly bedded.	Tpy	ML			
	Notes: Total Depth: 6.5 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: W Wall SCALE: 1" = 5' SURFACE SLOPE: 16° TREND: --N10W-->



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-10

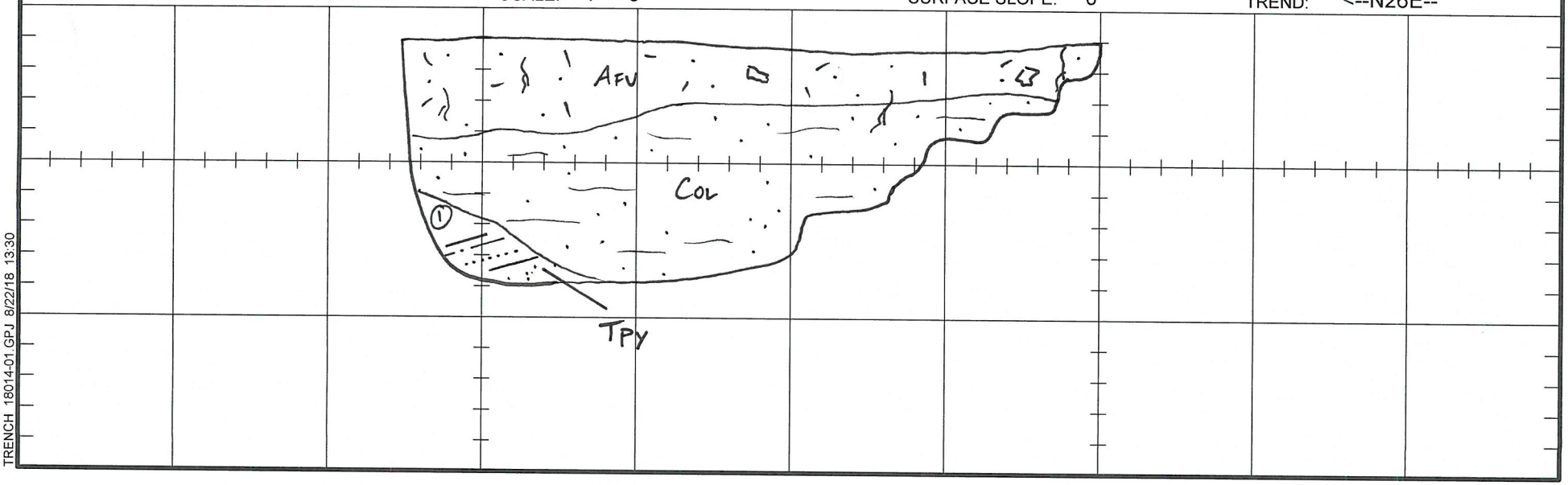
TRENCH 18014-01.GPJ 8/22/18 13:30

NMG

Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 703
Location:
TRENCH NO.: **T-11**

GEOLOGIC ATTITUDES	DESCRIPTION: DATE: 5/1/18	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Undocumented Artificial Fill (Afu) @ 0-3.5': Dark brown CLAY/SILT, dry, soft, abundant roots, concrete debris.	Afu	ML-CL			
	Colluvium (Col) @ 3.5-5': Grayish brown sandy SILT, damp, medium stiff, caliche, pencil tip pores, roots.	Col	ML			
1) B: N58E, 29NW	**Puente Formation, Yorba Member (Tpy)** @ 5-8': White to orange SANDSTONE/SILTSTONE, damp, very dense/hard, well-bedded.	Tpy	SM-ML			
	Notes: Total Depth: 8 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: NE Wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: <--N26E--



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-11

TRENCH 18014-01.GPJ 8/22/18 13:30

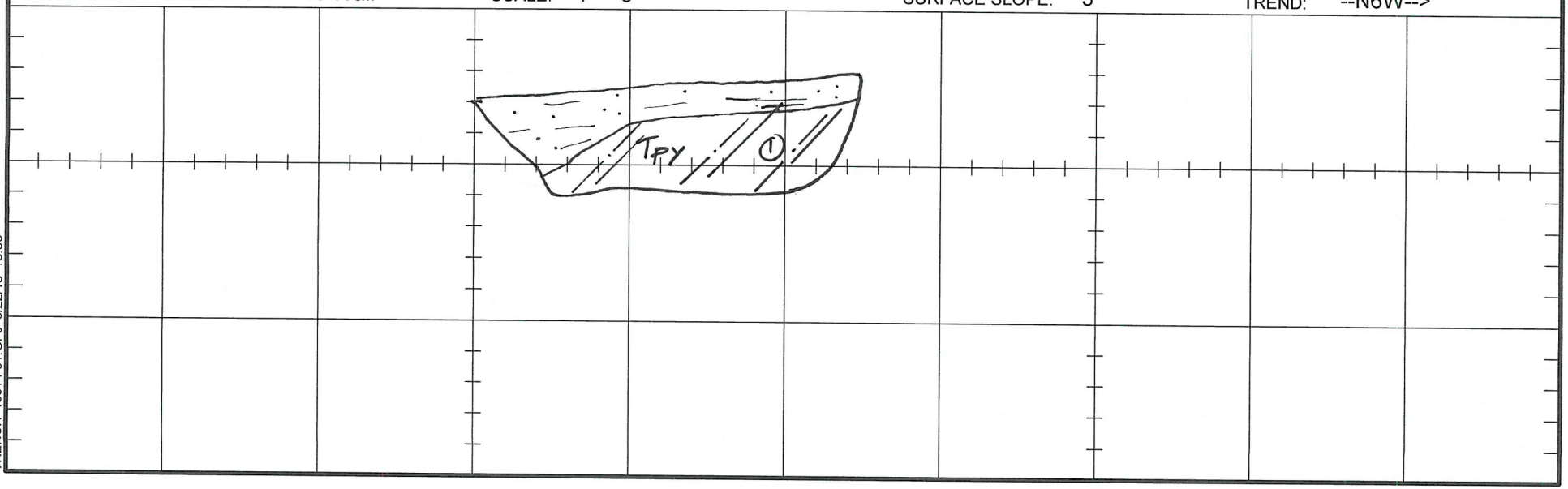
NMG Geotechnical, Inc.

Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 740
Location:

TRENCH NO.: **T-12**

GEOLOGIC ATTITUDES	DESCRIPTION: DATE: 5/1/18	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-3': Brown sandy SILT, dry, soft, roots.		ML			
1) B: N78E, 49NW	**Puente Formation, Yorba Member (Tpy)** @ 3-5': White to pale yellow SILTSTONE, damp, hard, diatomaceous, well-bedded.	Tpy	ML			
	Notes: Total Depth: 3.5 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: W Wall SCALE: 1" = 5' SURFACE SLOPE: 3° TREND: --N6W-->



LOG OF TRENCH NO: T-12

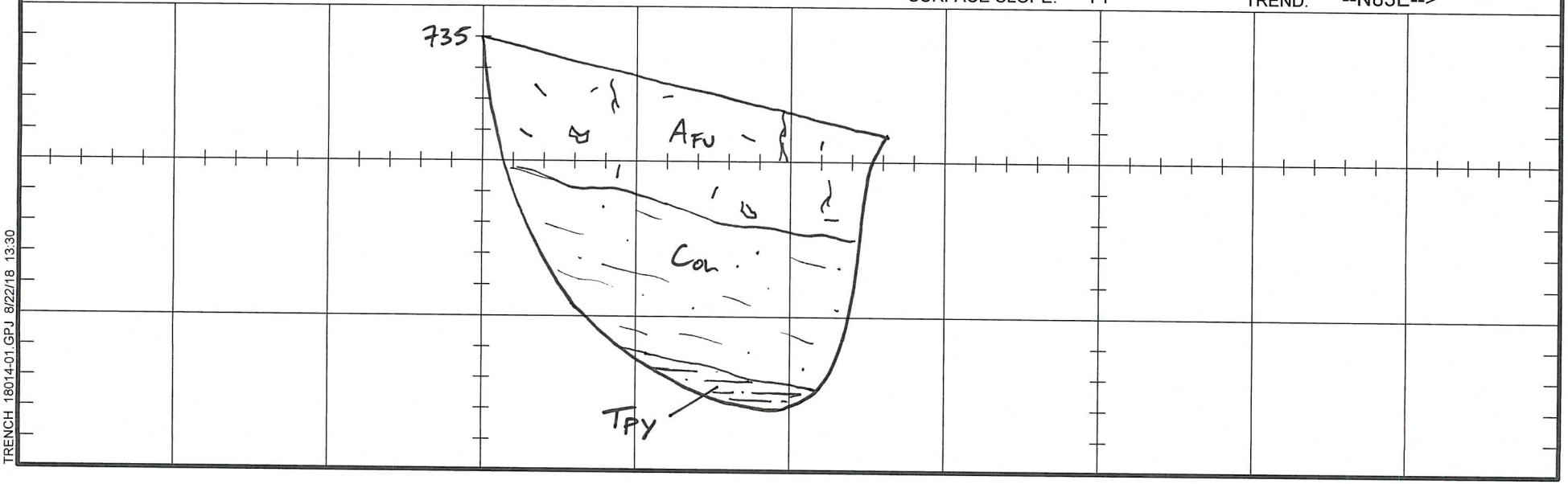
TRENCH 18014-01.GPJ 8/22/18 13:30

Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 735
Location:

TRENCH NO.: **T-13**

GEOLOGIC ATTITUDES	DESCRIPTION: (DATE: 5/1/18)	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Undocumented Artificial Fill (Afu) @ 0-4.5': Dark brown to gray SILT, damp, soft, mottled, roots, bedrock fragments.	Afu	ML			
	Colluvium (Col) @ 4.5'-9': Grayish brown to dark brown clayey SILT/CLAY, damp, pencil tip pores, caliche.	Col	ML-CL			
	Puente Formation, Yorba Member (Tpy) @ 9-9.5': White to pale yellow SILTSTONE, damp, hard.	Tpy	ML			
	Notes: Total Depth: 9.5 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: N Wall SCALE: 1" = 5' SURFACE SLOPE: 14° TREND: --N83E-->



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-13

TRENCH 18014-01.GPJ 8/22/18 13:30

NMG Geotechnical, Inc.

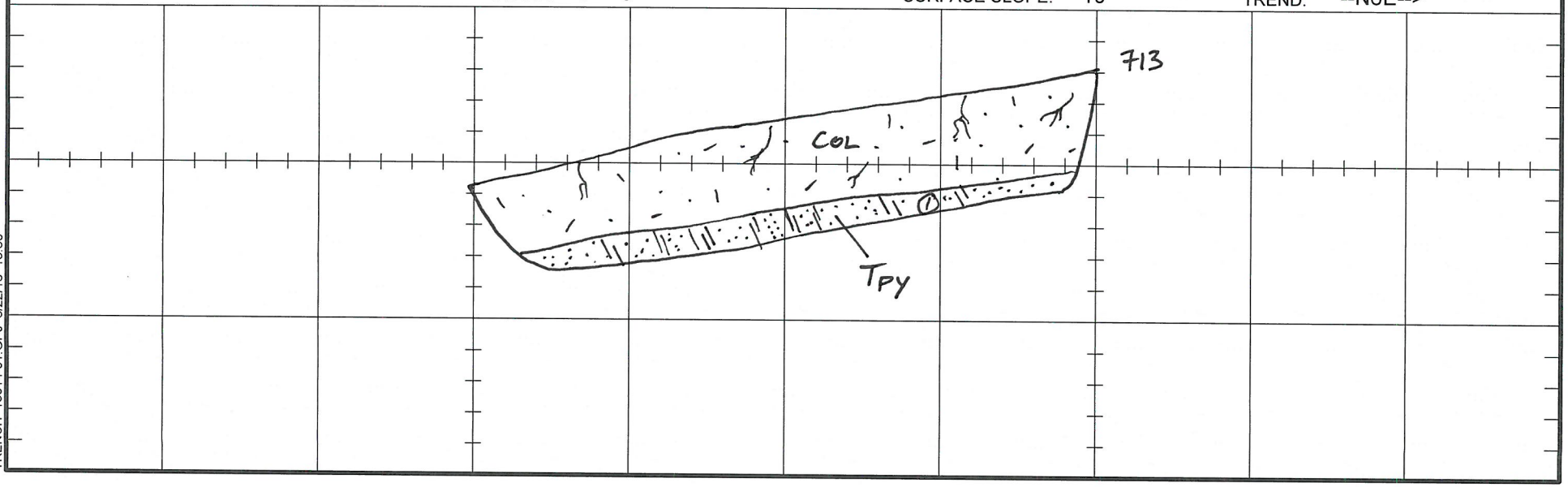
Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 713
Location:

TRENCH NO.: **T-14**

DATE: 5/1/18

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Colluvium (Col) @ 0-3': Dark brown to grayish brown sandy and clayey SILT, damp, soft, abundant roots.	Col	ML			
1) B: N84E, 62N	**Puente Formation, Yorba Member (Tpy)** @ 3-4': White to pale yellow SANDSTONE/SILTSTONE, damp, very dense/hard, thinly bedded, diatomaceous.	Tpy	SM-ML			
	Notes: Total Depth: 4 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: W Wall SCALE: 1" = 5' SURFACE SLOPE: 10° TREND: --N6E-->



LOG OF TRENCH NO: T-14

TRENCH 18014-01.GPJ 8/22/18 13:30

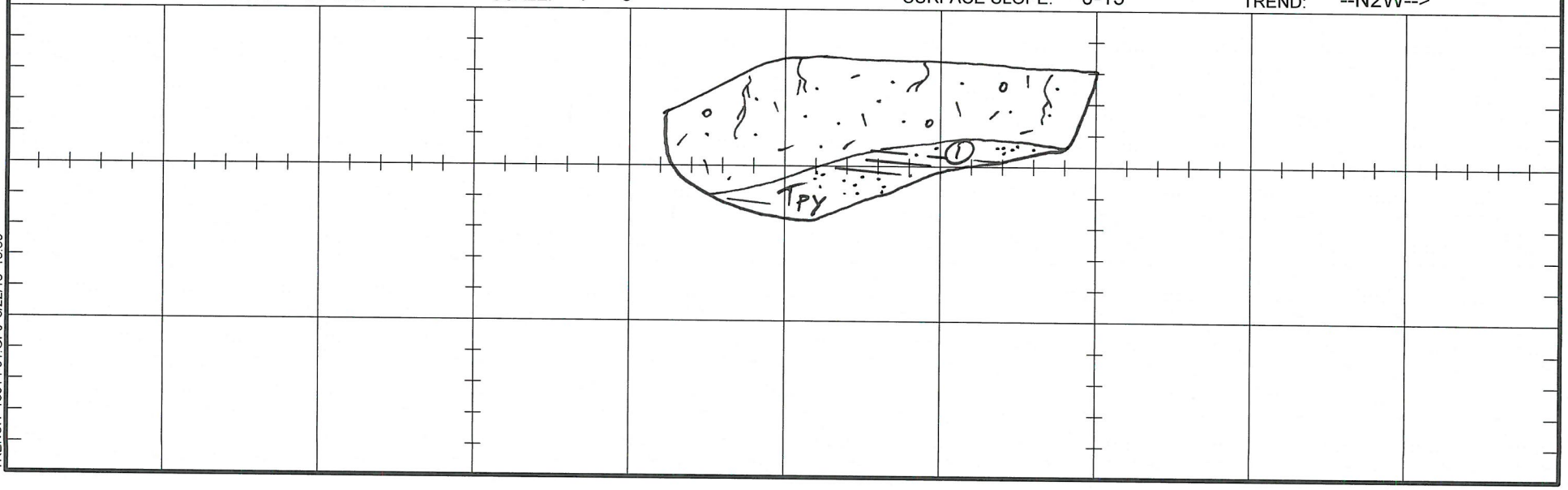
Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 708
Location:

TRENCH NO.: **T-15**

DATE: 5/1/18

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-4': Grayish brown sandy SILT, damp, soft, abundant roots, pencil-tip pores, animal burrows.		ML			
1) B: N15E, 15W	**Puente Formation, Yorba Member (Tpy)** @ 4-5': Pale yellowish brown to white SANDSTONE/SILTSTONE, damp, very dense/hard, thinly bedded.	Tpy	SM-ML			
	Notes: Total Depth: 5 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: W Wall SCALE: 1" = 5' SURFACE SLOPE: 0-15° TREND: --N2W-->



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-15

TRENCH 18014-01.GPJ 8/22/18 13:30

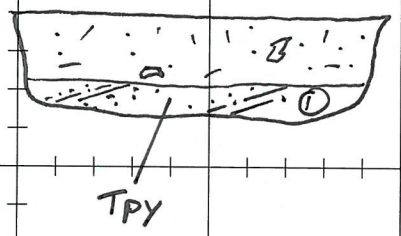
Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 687
Location:

TRENCH NO.: **T-16**

DATE: 5/1/18

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Topsoil @ 0-2': Grayish brown sandy SILT, damp, soft, caliche, pinhole pores, bedrock fragments.		ML			
1) B: N58E, 22NW	**Puente Formation, Yorba Member (Tpy)** @ 2-2.5': White to pale yellow SANDSTONE/SILTSTONE, damp, very dense/hard, well bedded.	Tpy	SM-ML			
	Notes: Total Depth: 2.5 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: N Wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: E-W



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-16

TRENCH 18014-01.GPJ 8/22/18 13:30

NMG

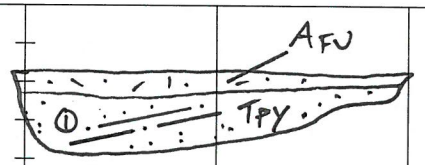
Project Name: Sunjoint/The Terraces
Project Number: 18014-01
Equipment: JCB 214
Logged By: ZKH
Elevation: 680
Location:

TRENCH NO.: **T-17**

DATE: 5/1/18

GEOLOGIC ATTITUDES	DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	SAMPLE NO.	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
	Undocumented Artificial Fill (Afu) @ 0-0.5': Dark brown to grayish brown sandy and clayey SILT, damp, soft.		ML			
1) B: N22E, 18NW	**Puente Formation, Yorba Member (Tpy)** @ 0.5-2': White to yellowish brown SANDSTONE/SILTSTONE, damp, very dense/hard, diatomaceous, weathered, thinly bedded.	Tpy	SM-ML			
	Notes: Total Depth: 2 Feet. Groundwater Not Encountered. Backfilled with Cuttings.					

GRAPHIC REPRESENTATION: NW Wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: --N66E-->



NMG Geotechnical, Inc.

LOG OF TRENCH NO: T-17

TRENCH 18014-01.GPJ 8/22/18 13:30

BORING AND TRENCH LOGS
BY:

GEOTEK (2015)

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Sunjoint Development, LLC	**DRILLER:**	2R Drilling	**LOGGED BY:**	JMP
PROJECT NAME:	Walnut 49-Acre Site	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	1280-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75 (Track Rig)
LOCATION:	See Geotechnical Map			**DATE:**	2/27/2015

BORING NO.: B-1

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			B1 @ 0-5'		**Alluvium**			AL
		21 28 29	R1	CL/ML	@ 2.5': Silty CLAY to clayey SILT, dark brown, moist to very moist, hard, minor CaCO3 deposits.	18.7	102.5	
5		4 7 10	S1	CL	@ 5': Silty CLAY, brown, very moist, very stiff, increase in CaCO3 deposits.			
		9 16 22	R2	CL	@ 7.5': Silty CLAY, brown to olive brown, very moist, very stiff, CaCO3 deposits.	28.6	93.1	
10		4 5 5	S2		**Puente Formation Bedrock, Yorba Member** @ 10': SILTSTONE, olive gray with orange brown oxidation, moist, medium stiff, moderately weathered.			
		18 34 46	R3		@ 12.5': same as above, hard, thinnly bedded, bedding inclined aproximately 45-50 degrees.	26.5	115.2	
15		7 11 14	S3		@ 15': same as above, stiff to very stiff.			
20					**Notes:** Total depth of boring: 16.5' No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring; ---SPT; ---Small Bulk; ---Large Bulk; ---No Recovery; ---Water Table

Lab testing:

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

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Sunjoint Development, LLC	**DRILLER:**	2R Drilling	**LOGGED BY:**	JMP
PROJECT NAME:	Walnut 49-Acre Site	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	1280-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75 (Track Rig)
LOCATION:	See Geotechnical Map			**DATE:**	2/27/2015

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B-2 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Alluvium			
		8 10 11	S1	CL/ML	@ 1': Silty CLAY to clayey SILT, dark brown, dry to slightly moist, stiff.			
		15 35 37	R1	CL/ML	@ 3.5': same as above, moist.	10.4	115.2	
5		6 11 19	S2	CL	@ 6': Silty CLAY, olive brown, moist, very stiff, abundant CaCO3 deposits.			
		14 28 38	R2	CL/ML	@ 8.5': Silty CLAY to clayey SILT, brown to olive brown, very moist, hard, transitioning to intensely weathered bedrock.	25.8	97.4	
10					**Puente Formation Bedrock, Yorba Member**			
		8 12 18	S3		@ 11': SILTSTONE, olive gray with orange brown oxidation, slightly moist, very stiff.	21.4	100.2	
		30 50/4"	R3		@ 13.5': SILTSTONE to fine SANDSTONE, interbedded, olive gray to orange brown with oxidation, slightly moist, hard.			
15								
					Notes: Total depth of boring: 14.3' No groundwater encountered Boring backfilled with soil cuttings			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Sunjoint Development, LLC	**DRILLER:**	2R Drilling	**LOGGED BY:**	JMP
PROJECT NAME:	Walnut 49-Acre Site	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	1280-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75 (Track Rig)
LOCATION:	See Geotechnical Map			**DATE:**	2/27/2015

BORING NO.: B-3

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			B1 @ 0-5'		**Alluvium**			MD,SH,EI,AL,SR
		8 9 11	S1	CL/ML	@ 2.5': Silty CLAY to clayey SILT, dark brown, slightly moist, stiff.			
5		18 26 33	R1	CL	@ 5': Silty CLAY, dark brown, moist to very moist, hard.	16.4	113.7	
		5 11 18	S2		**Puente Formation Bedrock, Yorba Member** @ 7.5': SILTSTONE, olive gray to orange brown with oxidation, slightly moist, very stiff.			
10		40 50/3"	R2		@ 10': SILTSTONE to fine SANDSTONE, interbedded, olive gray to orange brown with oxidation, slightly moist, hard.	26.1	90.1	
15								
20					**Notes:** Total depth of boring: 10.8' No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Sunjoint Development, LLC	**DRILLER:**	2R Drilling	**LOGGED BY:**	JMP
PROJECT NAME:	Walnut 49-Acre Site	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	1280-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75 (Track Rig)
LOCATION:	See Geotechnical Map			**DATE:**	2/27/2015

BORING NO.: B-4

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			B1 @ 0-5'		**Alluvium**			MD,SH,EI,AL,SR
		15 22 22	R1	CL/ML	@ 2.5': Silty CLAY to clayey SILT, dark brown, moist to very moist, hard, minor CaCO3 deposits.			
5		6 7 7	S1	CL/ML	@ 5': same as above, siff.			
		12 28 39	R2	CL/ML	@ 7.5': same as above, very moist, hard.	22.9	102.1	
10		5 6 10	S2	CL/ML	@ 10': same as above, very stiff, abundant CaCO3 deposits.			
		8 11 14	R3	CL	@ 12.5': CLAY, medium brown, very moist, stiff to very stiff, minor CaCO3 deposits.	30.4	91.7	HC
15		3 5 8	S3	CL	@ 15': same as above, stiff.			
		6 12 19	R4	CL	@ 17.5': Silty CLAY, light yellow brown to white, moist, very stiff, very abundant CaCO3.	23.0	101.3	
20		5 7 7	S4		**Puente Formation Bedrock, Yorba Member** @ 20': SILTSTONE, light orange brown to light yellow brown, slightly moist, medium stiff to stiff, intensely weathered.			
		10 20 27	R5		@ 22.5': SILTSTONE with interbedded fine SANDSTONE, olive gray to orange brown with oxidation, moist, very stiff, CaCO3 deposits.	25.7	94.8	
25		5 8 10	S5		@ 25': same as above.			
30					**Notes:** Total depth of boring: 26.5' No groundwater encountered Boring backfilled with soil cuttings			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Sunjoint Development, LLC	**DRILLER:**	2R Drilling	**LOGGED BY:**	JMP
PROJECT NAME:	Walnut 49-Acre Site	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	1280-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75 (Track Rig)
LOCATION:	See Geotechnical Map			**DATE:**	2/27/2015

BORING NO.: B-5

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Alluvium			
		8 9 9	S1	CL	@ 1': Silty CLAY, dark brown, slightly moist to moist, very stiff.			
		22 39 50	R1	CL	@ 3.5': same as above, very moist, hard.	20.9	103.3	
5		7 8 9	S2	CL	@ 6': same as above, very moist, very stiff.			
		18 30 39	R2	CL	@ 8.5': same as above, very moist, hard.	23.4	101.7	
10		5 9 12	S3	CL	@ 11': Silty CLAY, brown, very moist, stiff, some CaCO3 deposits.			
		14 20 25	R3	CL	@ 13.5': same as above, very stiff.	25.1	100.6	
15		4 7 10	S4		**Puente Formation Bedrock, Yorba Member** @ 16': SILTSTONE, olive gray to orange brown with oxidation, moist, very stiff, CaCO3 deposits.			
		17 26 36	R4		@ 18.5': SILTSTONE with fine SANDSTONE, interbedded, olive gray to orange brown with oxidation, moist, hard.	28.0	92.8	
20					**Notes:** Total depth of boring: 20' No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Sunjoint Development, LLC	**DRILLER:**	2R Drilling	**LOGGED BY:**	JMP
PROJECT NAME:	Walnut 49-Acre Site	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	1280-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75 (Track Rig)
LOCATION:	See Geotechnical Map			**DATE:**	2/27/2015

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: B-6** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Alluvium			
		9 14 17	R1	CL	@ 1': Silty CLAY, dark brown, very moist, very stiff.	31.6	78.7	
		3 5 5	S1	CL/ML	@ 3.5': Silty CLAY to clayey SILT, dark brown, moist, stiff.			
5		26 40 50/5"	R2	CL/ML	@ 6': Silty CLAY to clayey SILT, medium brown, very moist, hard.	20.3	100.9	
		10 10 12	S2	CL/ML	@ 8.5': Silty CLAY to clayey SILT, gray brown to olive brown, moist, stiff, transitioning to weathered bedrock.			
10					**Puente Formation Bedrock, Yorba Member**			
		20 25 27	R3		@ 11': SILTSTONE yto CLAYSTONE, olive gray to orange brown with oxidation, very moist, hard, CaCO3 deposits.	32.0	83.3	
15					**Notes:** Total depth of boring: 12.5' No groundwater encountered Boring backfilled with soil cuttings			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-1*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
	X		CL/ML	**Colluvium (Qcol):** Silty Clay (CL) to clayey Silt (ML), dark gray brown, damp to slightly moist, soft to medium stiff, dessicated to at least three feet, locally porous with rootlets, locally heavily stained with calcium carbonate - more at three to five feet, seems slightly coarser grained with depth, rootlets down to five to seven feet			MD, EI
5			ML	Becomes mostly clayey Silt (ML), medium to dark gray brown, slightly moist to moist, soft to medium stiff, more ped structure, locally porous			
			CL/ML	Silty Clay (CL) to clayey Silt (ML), medium yellow brown, slightly moist, medium stiff			
10				**Bedrock - Puente Formation (Tp):** Clayey Siltstone, dark gray and brown, thinly bedded			
				TRENCH TERMINATED AT 11 FEET No Groundwater Encountered Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: ▭ --- Ring Sample ⊠ --- Large Bulk Sample ▽ ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-2*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			CL/ML	**Colluvium (Qcol):** Silty Clay (CL) to clayey Silt (ML), dark gray, damp to slightly moist, soft to medium stiff, dessicated to at least three feet, locally porous with rootlets, locally heavily stained with calcium carbonate - more at three to five feet, seems slightly coarser grained with depth, rootlets down to five to seven feet @3', becomes dark gray brown			
5				@7', more calcium carbonate along ped faces			
			ML	Becomes clayey Silt (ML), yellow brown, slightly moist, stiff			
10				**Bedrock - Puente Formation (Tp):** Clayey Siltstone, dark gray and brown, thinly bedded			
				TRENCH TERMINATED AT 11.5 FEET No Groundwater Encountered Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-3*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			CL	**Colluvium (Qcol):** Silty Clay (CL), dark gray brown, damp, soft, dessicated, some rootlets			
			ML	Becomes clayey Silt (ML), dark yellow gray brown, slightly moist, soft to medium stiff			
5				**Bedrock - Puente Formation (Tp):** Clayey Siltstone, dark gray and brown, thinly bedded			
				TRENCH TERMINATED AT 8 FEET			
10				No Groundwater Encountered Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-4*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				Colluvium (Qcol):			
			CL	Silty Clay (CL), dark gray brown, damp, soft, dessicated, some rootlets			
			ML	Becomes clayey Silt (ML), dark yellow brown, slightly moist to moist, soft to medium stiff			
5				**Bedrock - Puente Formation (Tp):** Clayey Siltstone, olive gray, thinly bedded			
				TRENCH TERMINATED AT 7 FEET			
				No Groundwater Encountered			
				Trench Backfilled with Soil Cuttings			
10							
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-5*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			CL	**Colluvium (Qcol):** Silty Clay (CL), dark gray brown, damp, loose/soft, dessicated, becomes slightly moist at one foot			
			ML	Becomes clayey Silt (ML), dark yellow gray mottled, soft to medium stiff Becomes medium yellow brown, slightly moist to moist, firm/stiff			
5				**Bedrock - Puente Formation (Tp):** Interbedded Clayey Siltstone and fine Sandstone, medium brown yellow, slightly moist			
				TRENCH TERMINATED AT 8 FEET			
10				No Groundwater Encountered Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-6*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			ML	**Colluvium (Qcol):** Clayey fine sandy Silt (ML), light to medium gray, damp, soft to firm, porous, rootlets			
5				**Bedrock - Puente Formation (Tp):** Interbedded clayey Siltstone and fine Sandstone, medium brown yellow, slightly moist			
10				TRENCH TERMINATED AT 8 FEET No Groundwater Encountered Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	**TRENCH NO.:** *T-7* / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			ML	**Colluvium (Qcol):** Clayey fine sandy Silt (ML), light to medium gray, damp, soft to firm, porous, rootlets			
				Bedrock - Puente Formation (Tp): Thinly bedded silty fine Sandstone, light gray with calcium carbonate along bedding planes and fractures, damp			
5				TRENCH TERMINATED AT 4 FEET No Groundwater Encountered Trench Backfilled with Soil Cuttings			
10							
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-8*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				Bedrock - Puente Formation (Tp):			
				Thinly bedded Siltstone, light olive gray with calcium carbonate along fractures and bedding planes, rootlets down to two to three feet			
				@3', B: N88W, 50NE			
5				TRENCH TERMINATED AT 5 FEET			
				No Groundwater Encountered			
				Trench Backfilled with Soil Cuttings			
10							
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	**TRENCH NO.:** *T-9* — MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
	X		CL	**Colluvium (Qcol):** Silty Clay (CL), dark gray brown, slightly moist, soft, dessicated, rootlets, locally porous			MD, EI
			ML	Becomes clayey Silt (ML), dark olive gray brown, slightly moist to moist, soft, some calcium carbonate, ped structure			
5							
			ML/CL	Clayey Silt (ML) to silty Clay (CL), dark yellow olive brown, moist, firm/stiff			
10							
				Bedrock - Puente Formation (Tp): Thinly bedded Clayey Siltstone, olive brown			
				TRENCH TERMINATED AT 13 FEET No Groundwater Encountered Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-10*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			CL	**Colluvium (Qcol):** Silty Clay (CL), dark gray brown, slightly moist, soft, dessicated, rootlets, locally porous			
				@3', some calcium carbonate			
5							
				Bedrock - Puente Formation (Tp): Fine Sandstone, thinly bedded with some Siltstone, light gray			
				TRENCH TERMINATED AT 8 FEET			
10				No Groundwater Encountered Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-11*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			CL	**Colluvium (Qcol):** Silty Clay (CL), dark gray, damp, soft, dessicated, porous, rootlets			
				Bedrock - Puente Formation (Tp): Thinly bedded clayey Siltstone and silty Sandstone, light yellow to olive gray B: N8E, 31SE B: N20E, 31SE			
5							
				TRENCH TERMINATED AT 6 FEET No Groundwater Encountered Trench Backfilled with Soil Cuttings			
10							
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-12*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			CL	**Colluvium (Qcol):** Silty Clay (CL), dark gray, damp, soft, dessicated, porous, rootlets			
5				**Bedrock - Puente Formation (Tp):** Clayey Siltstone, weathered & highly fractured with calcium carbonate along bedding and fracture planes			
10				TRENCH TERMINATED AT 6 FEET No Groundwater Encountered Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-13*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				Colluvium (Qcol):			
			CL	Silty Clay (CL), dark gray, damp, soft, dessicated, porous, rootlets			
				Bedrock - Puente Formation (Tp):			
				Silty Sandstone to fine sandy Siltstone, light yellow, thinly bedded, excavates easily			
5				@5', B: N55W, 50NE			
10				TRENCH TERMINATED AT 10 FEET			
				No Groundwater Encountered			
				Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-14*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				Colluvium (Qcol):			
			CL	Silty Clay (CL), dark gray, damp, soft, dessicated, porous, rootlets			
				Bedrock - Puente Formation (Tp):			
				Silty Sandstone, light yellow, thinly bedded, indurated, fractured			
				B: N70W, 50 NE			
				TRENCH TERMINATED AT 3 FEET			
				No Groundwater Encountered			
				Trench Backfilled with Soil Cuttings			
5							
10							
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

TRENCH NO.: *T-15*

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				Colluvium (Qcol):			
			CL	Silty Clay (CL), dark gray, damp, soft, dessicated, porous, rootlets			
				@4', some calcium carbonate			
5							
			ML	Becomes clayey Silt (ML), dark brown, slightly moist, medium stiff			
				Bedrock - Puente Formation (Tp):			
				Siltstone, thinly bedded			
				TRENCH TERMINATED AT 9 FEET			
10				No Groundwater Encountered			
				Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	**TRENCH NO.:** *T-16* — MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			CL	**Colluvium (Qcol):** Silty Clay (CL), dark gray, damp, soft, dessicated, porous, rootlets			
5			ML	Becomes clayey Silt (ML), gray brown, with calcium carbonate, soft to medium stiff			
				Bedrock: Clayey Siltstone, thinly bedded			
10				TRENCH TERMINATED AT 7 FEET No Groundwater Encountered Trench Backfilled with Soil Cuttings			
15							

LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

PROJECT NO.:	0468-CR3	**LOGGED BY:**	EHL
PROJECT NAME:	APN's 8709-023-273, -274 & -275	**EQUIPMENT:**	Backhoe
CLIENT:	Mr. Tom Lee	**DATE:**	7/7/2008
LOCATION:	See Trench Location Map		

Depth (ft)	SAMPLES: Sample Type*	SAMPLES: Sample Number	USCS Symbol	**TRENCH NO.:** *T-17* / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			CL	**Colluvium (Qcol):** Silty Clay (CL), dark gray, damp, soft, dessicated, porous, rootlets			
				Bedrock - Puente Formation (Tp): Clayey Siltstone, thinly bedded @3', B: N75E, 33 NW			
5				TRENCH TERMINATED AT 5 FEET No Groundwater Encountered Trench Backfilled with Soil Cuttings			
10							
15							

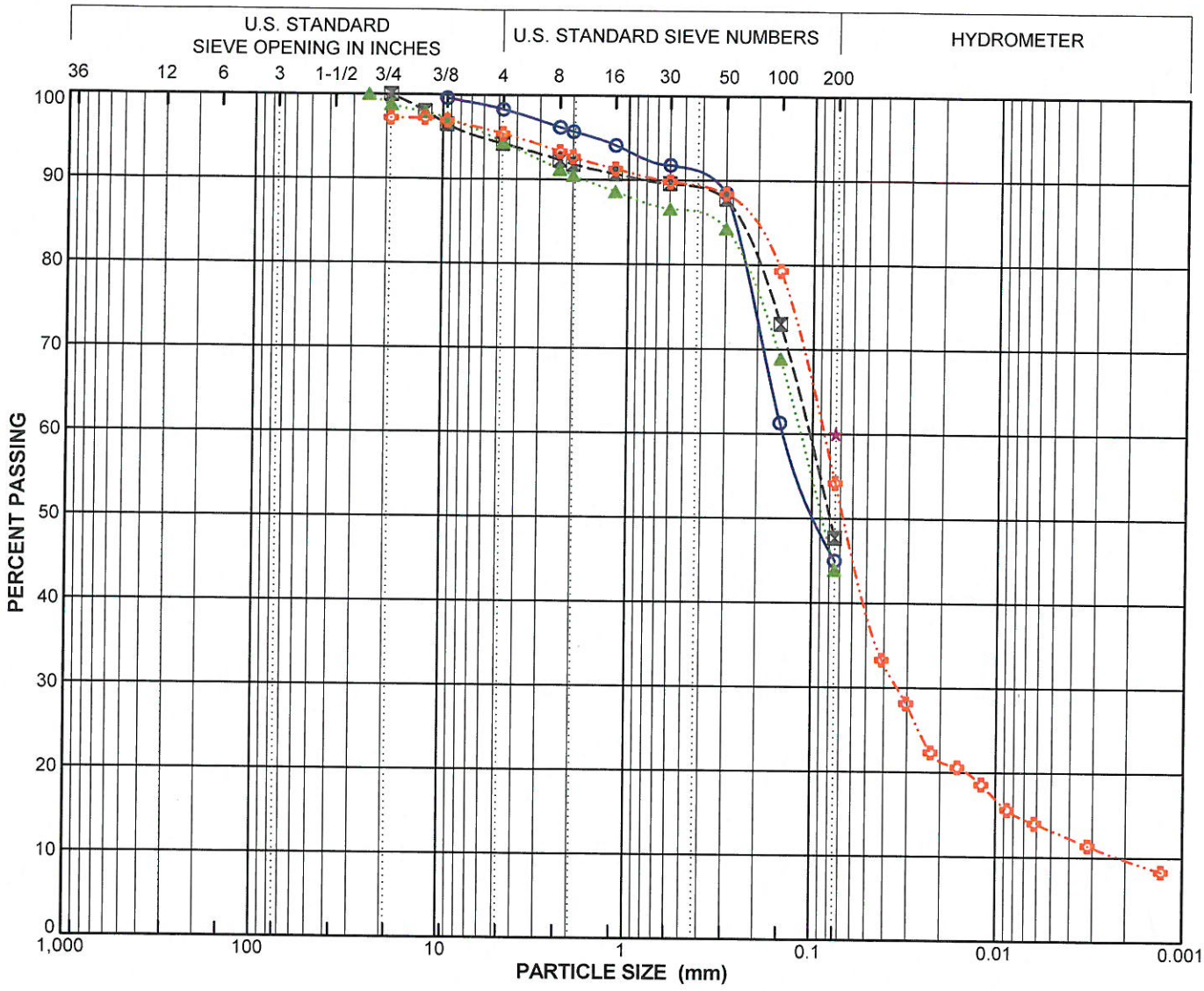
LEGEND

Sample Type: --- Ring Sample; --- Large Bulk Sample; ---Water Table

Laboratory Testing: AL = Atterberg Limits; EI = Expansion Index; MD = Maximum Density; SA = Sieve Analysis; SR = Sulfate/Resistivity Test; SH = Shear Testing; RV = R-Value Test; CO = Consolidation

APPENDIX C

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	



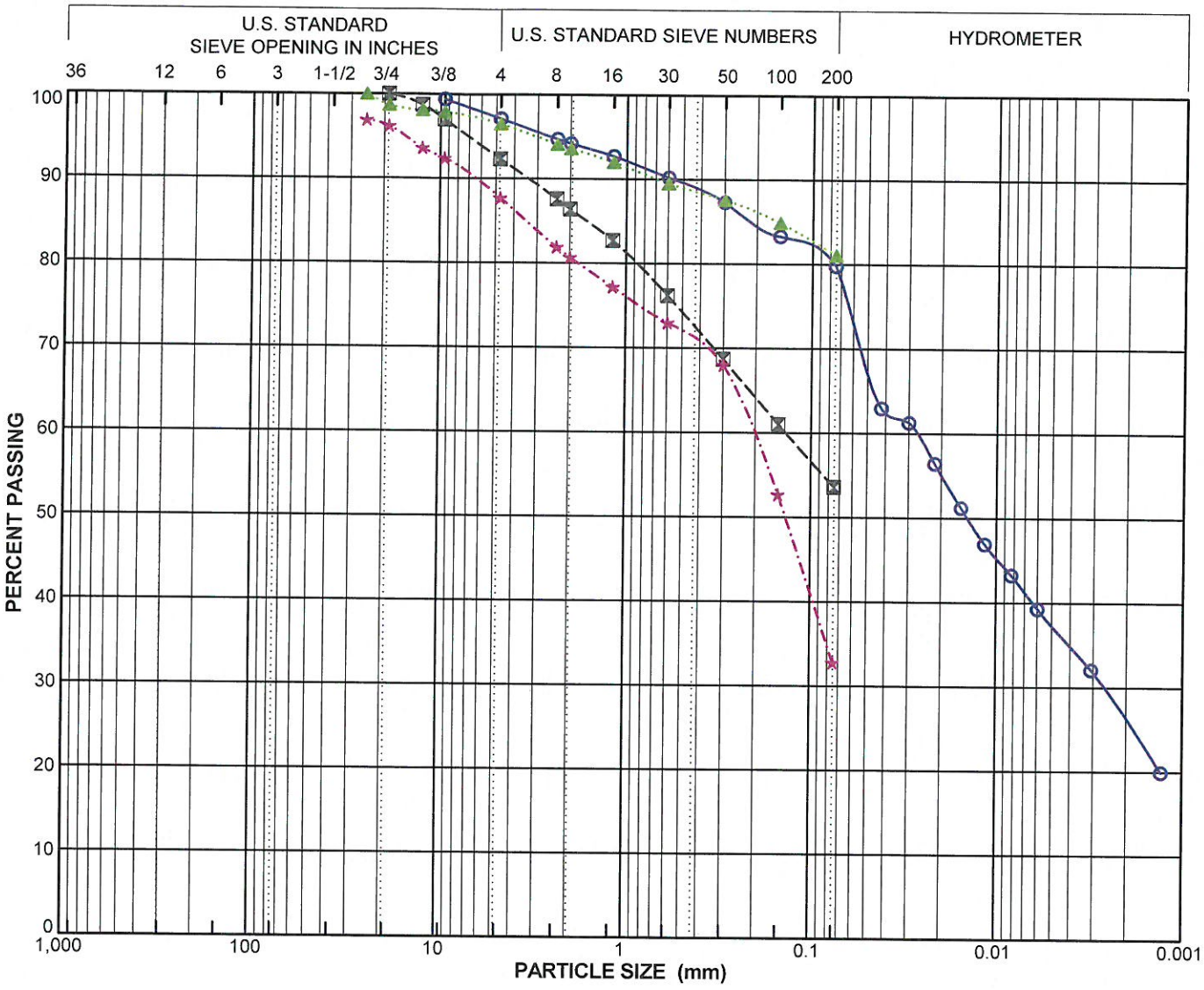
Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
○	B- 1	B-2	30.0	33	47	21				45		SC
⊠	B- 1	B-3	50.0	32						48		SM
▲	B- 1	B-4	70.0	30						44		SM
★	B- 2	B-2	30.0	34						60		ML
✿	B- 2	B-3	50.0	33	46	20	2.00			54	10	CL

PARTICLE SIZE DISTRIBUTION

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

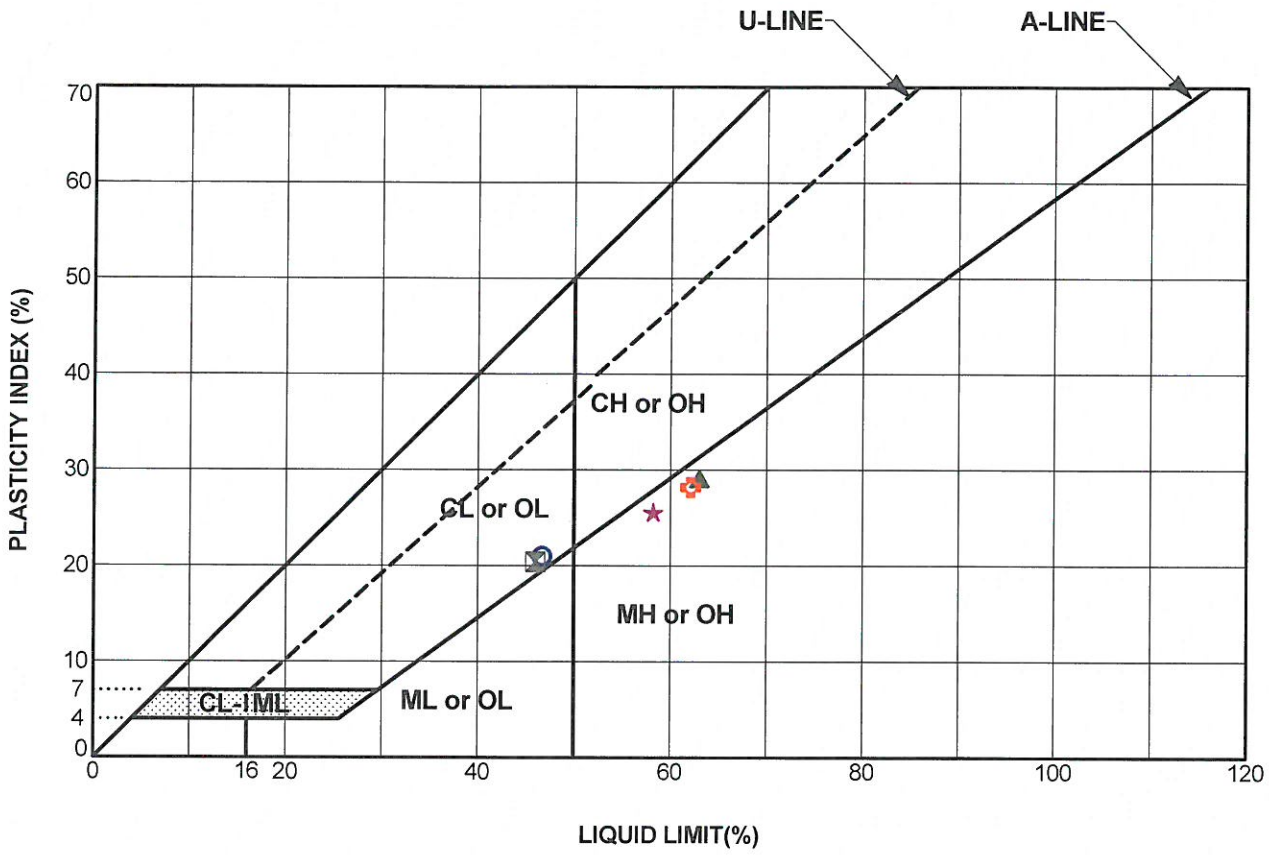


Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
○	B- 3	B-1	10.0	40	63	29	1.12			80	26	MH
⊠	B- 3	B-3	50.0		58	25				54		MH
▲	B- 4	B-2	30.0		62	28				81		MH
★	B- 5	B-3	50.0	33						33		SM

PARTICLE SIZE DISTRIBUTION

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



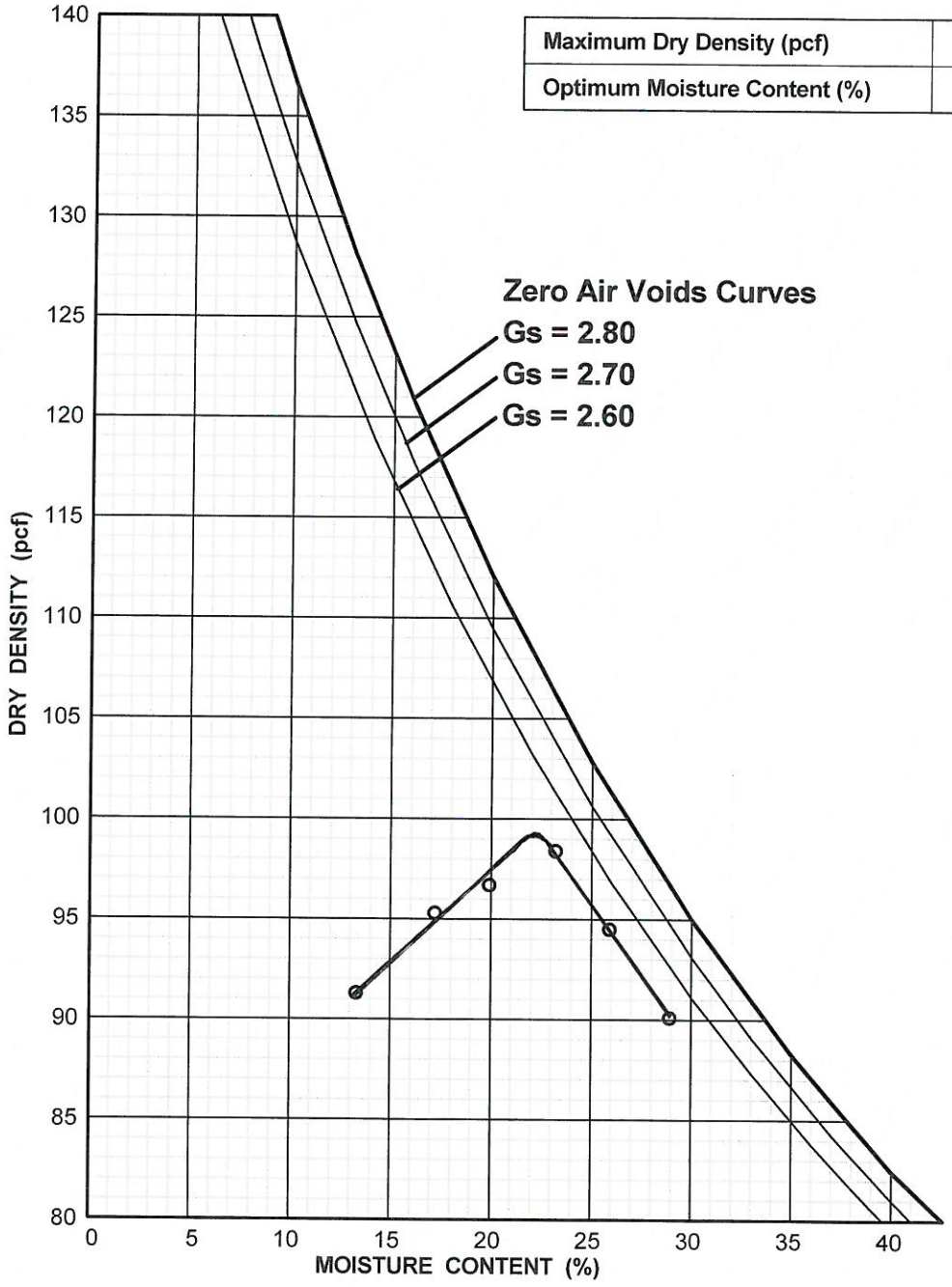
Symbol	Boring Number	Sample Number	Depth (feet)	Passing No. 200 Sieve (%)	LL	PI	USCS	Description
○	B- 1	B-2	30.0	45	47	21	SC	(Tpy) Light olive brown silty clayey SAND
⊠	B- 2	B-3	50.0	54	46	20	CL	(Tpy) Light olive brown sandy silty CLAY
▲	B- 3	B-1	10.0	80	63	29	MH	(Tpy) Olive brown clayey elastic SILT
★	B- 3	B-3	50.0	54	58	25	MH	(Tpy) Olive gray sandy elastic SILT
✿	B- 4	B-2	30.0	81	62	28	MH	(Tpy) Olive clayey elastic SILT

PLASTICITY CHART

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	99.5
Optimum Moisture Content (%)	22.5



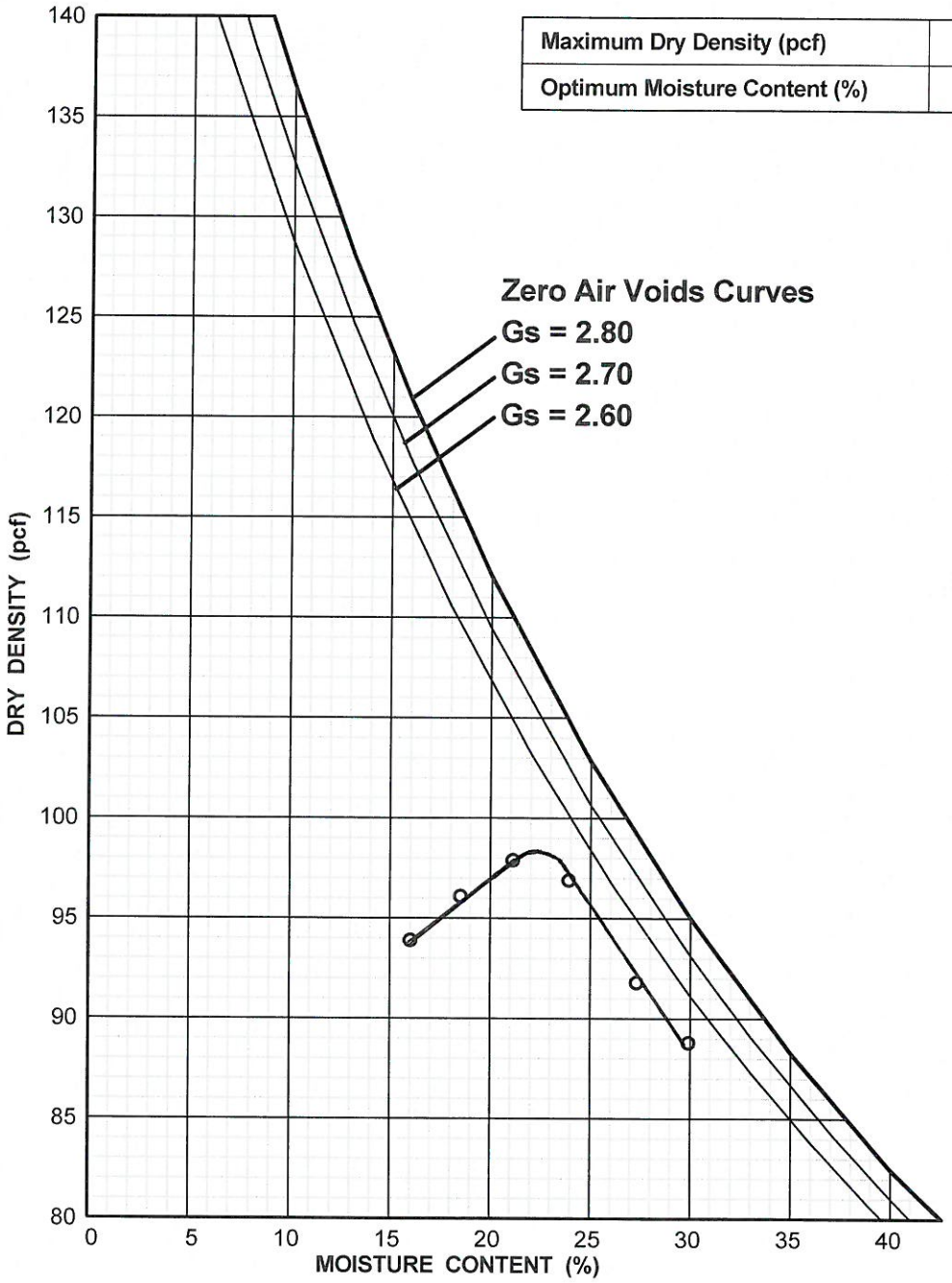
Boring No. B- 1	**Sample No. B-2**	**Depth: 30.0 ft**
Sample Description: (Tpy) Light olive brown silty clayey SAND		**USCS:** SC
Liquid Limit: 47	**Plasticity Index:** 21	**Percent Passing No. 200 Sieve:** 45
Comments: 1557A		

COMPACTION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	98.5
Optimum Moisture Content (%)	22.5



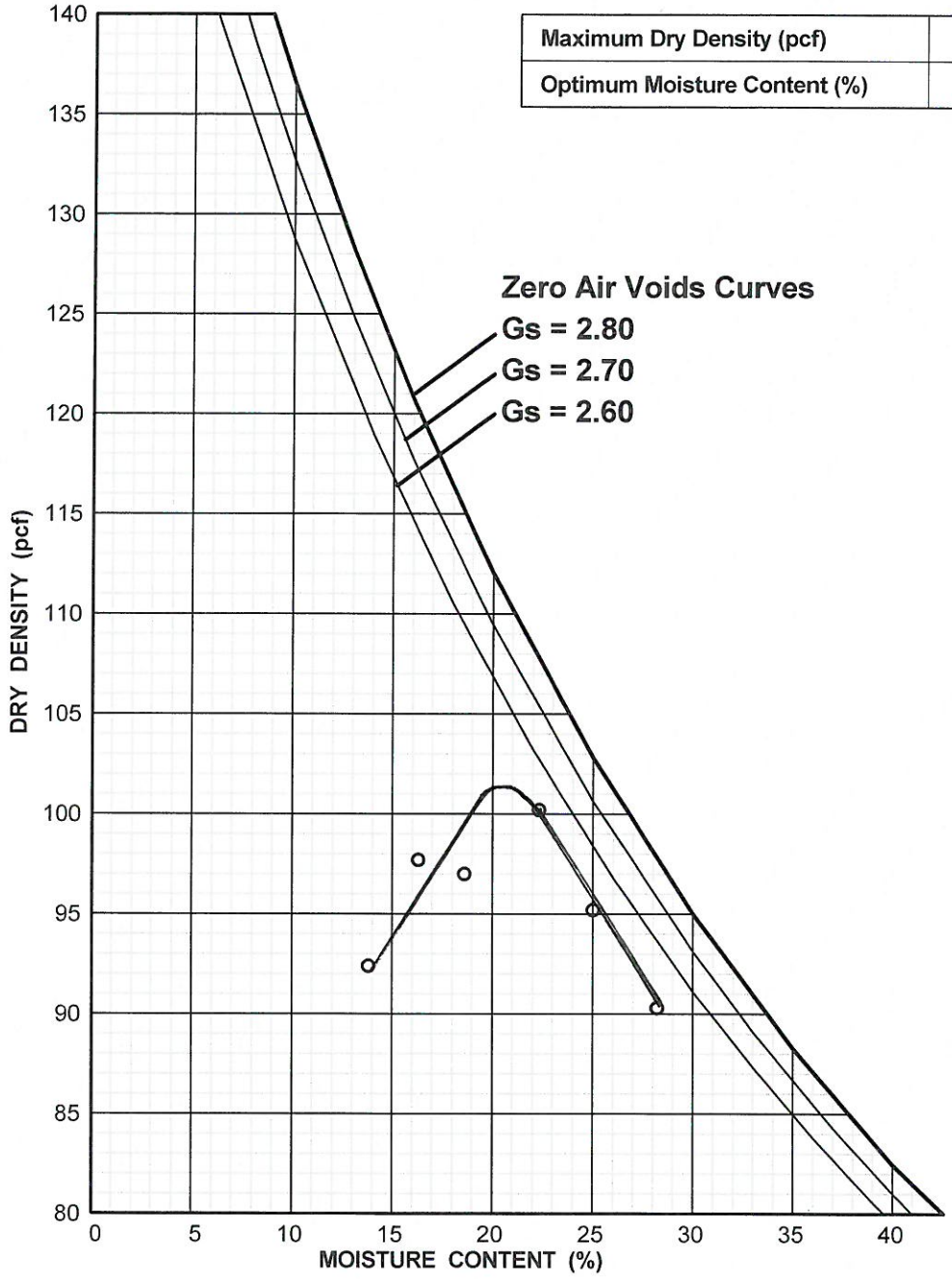
Boring No. B- 1	**Sample No. B-3**	**Depth: 50.0 ft**
Sample Description: (Tpy) Light olive gray silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 48
Comments: 1557A		

COMPACTION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	101.5
Optimum Moisture Content (%)	20.5



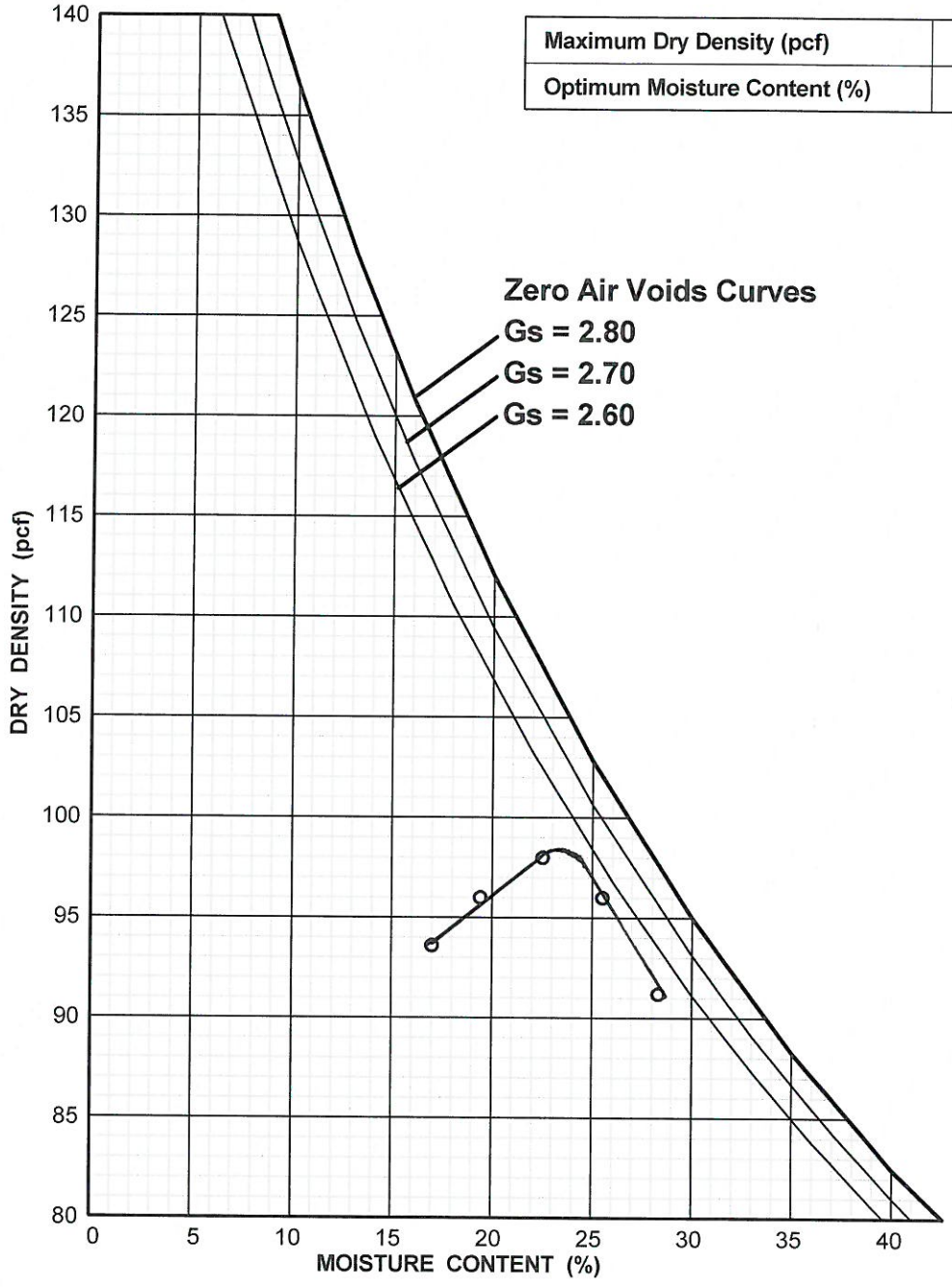
Boring No. B- 1	**Sample No. B-4**	**Depth: 70.0 ft**
Sample Description: (Tpy) Light olive gray silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 44
Comments: 1557A		

COMPACTION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	98.5
Optimum Moisture Content (%)	23.5



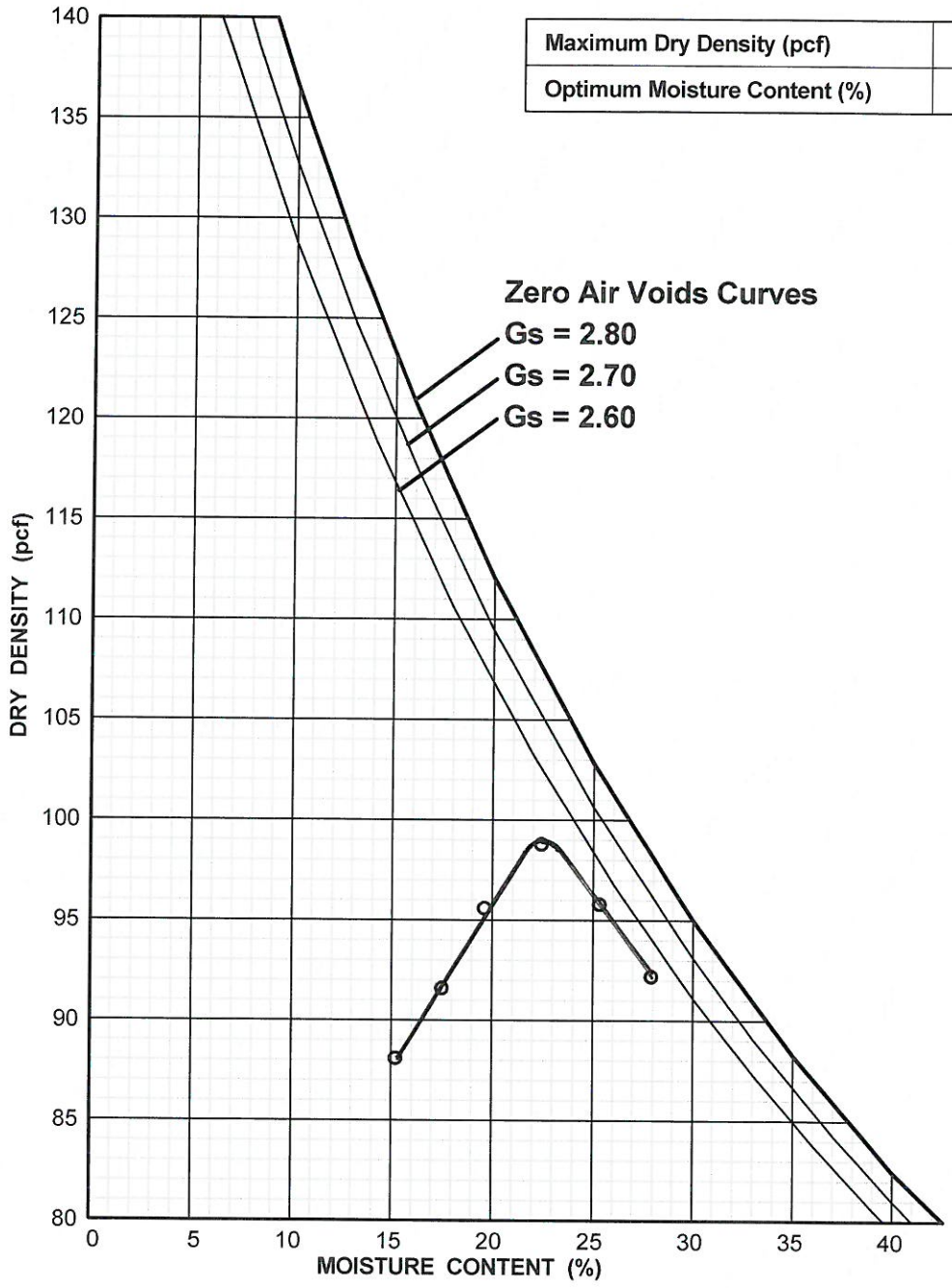
Boring No. B- 2	**Sample No. B-2**	**Depth: 30.0 ft**
Sample Description: (Tpy) Yellowish brown sandy SILT		**USCS:** ML
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 60
Comments: 1557A		

COMPACTION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	99.0
Optimum Moisture Content (%)	22.5



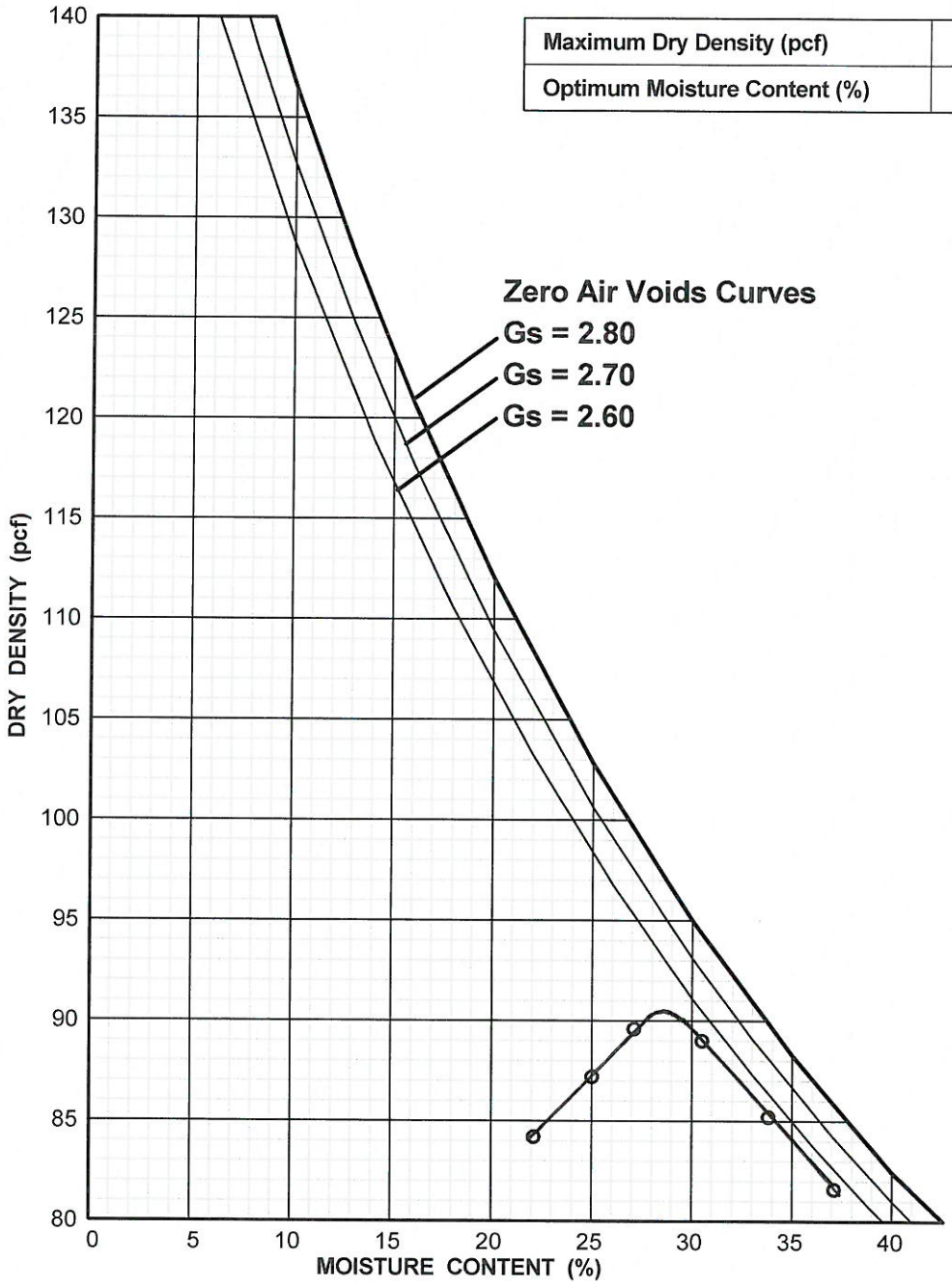
Boring No. B- 2	**Sample No. B-3**	**Depth: 50.0 ft**
Sample Description: (Tpy) Light olive brown sandy silty CLAY		**USCS:** CL
Liquid Limit: 46	**Plasticity Index:** 20	**Percent Passing No. 200 Sieve:** 54
Comments: 1557A		

COMPACTION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	90.5
Optimum Moisture Content (%)	28.5



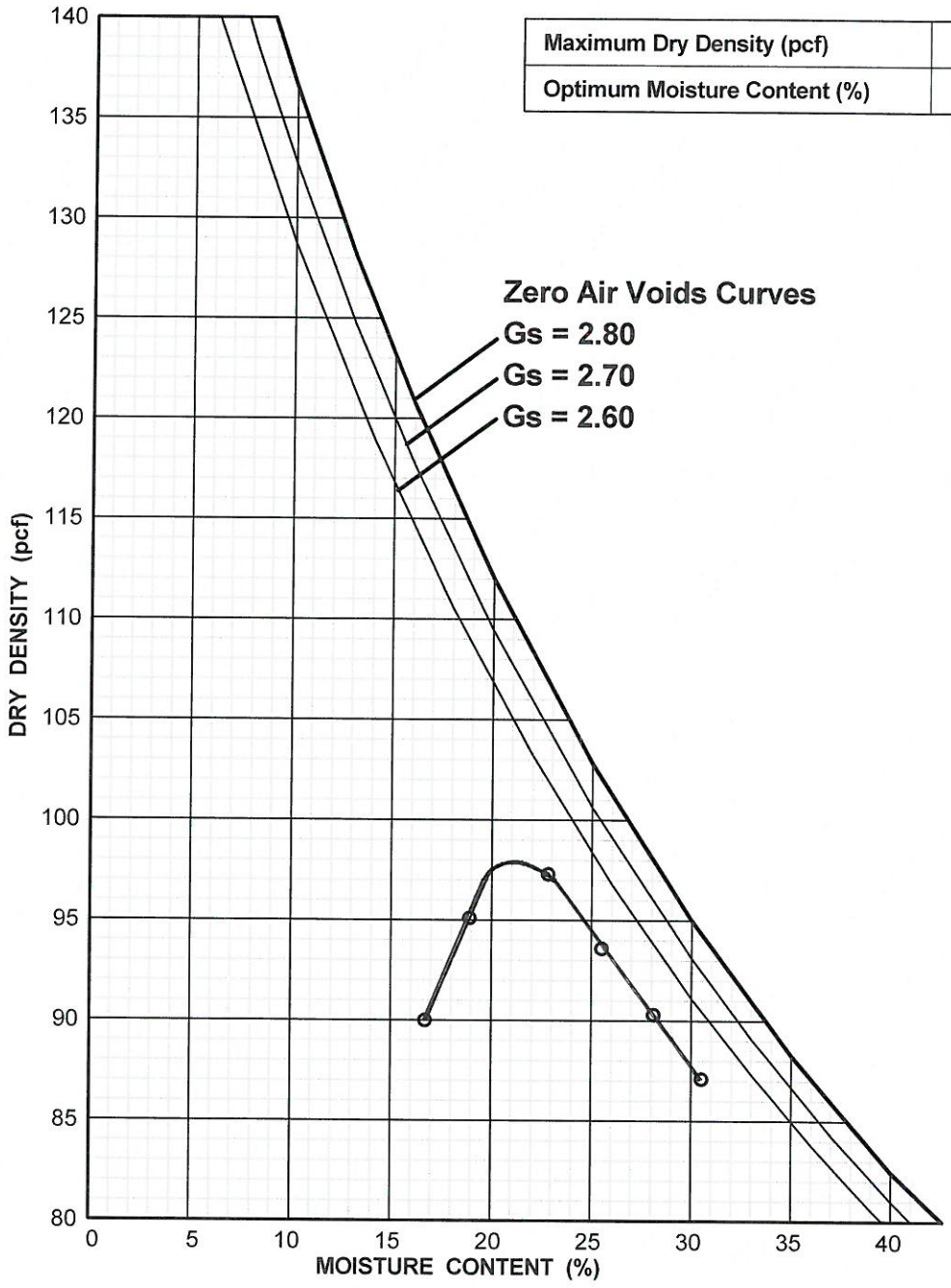
Boring No. B- 3	**Sample No. B-1**	**Depth: 10.0 ft**
Sample Description: (Tpy) Olive brown clayey elastic SILT		**USCS:** MH
Liquid Limit: 63	**Plasticity Index:** 29	**Percent Passing No. 200 Sieve:** 80
Comments: 1557A		

COMPACTION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	98.0
Optimum Moisture Content (%)	21.5

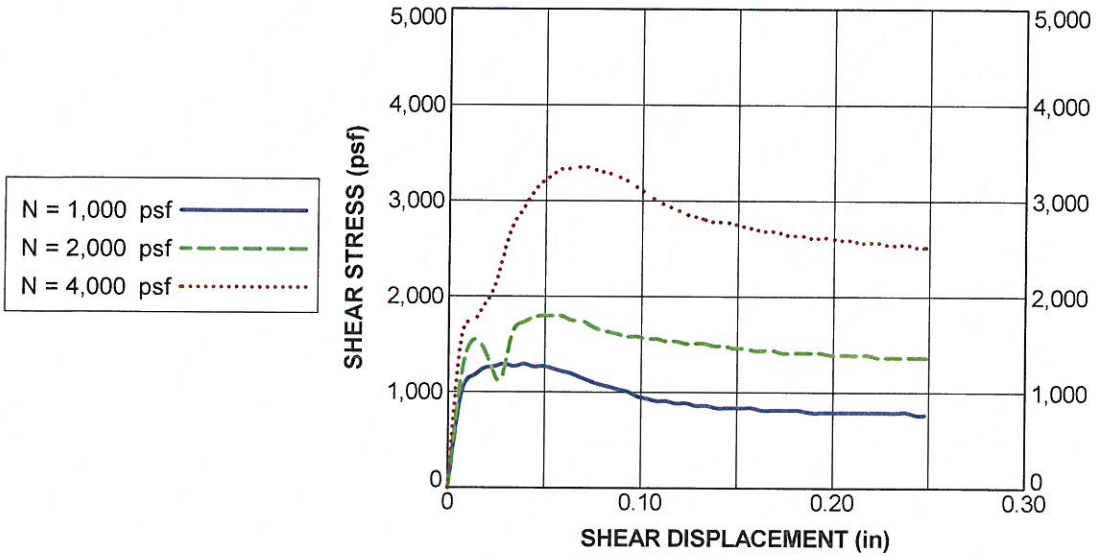


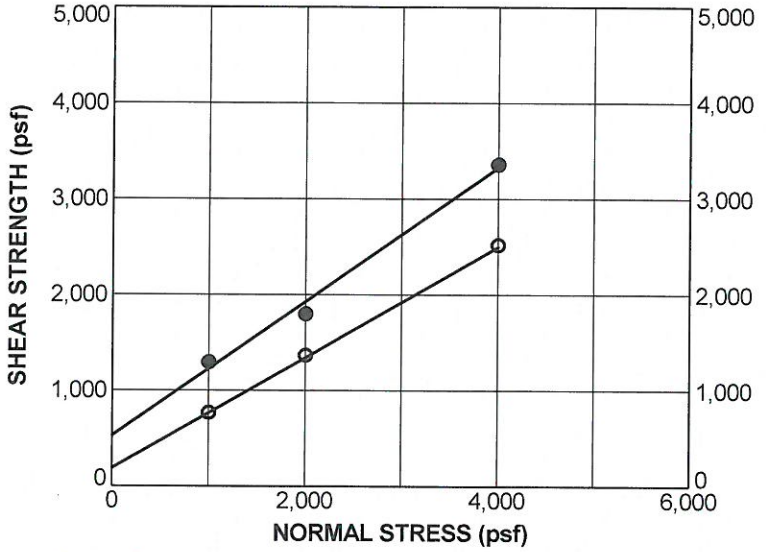
Boring No. B- 5	**Sample No. B-3**	**Depth: 50.0 ft**
Sample Description: (Tpy) Light brown silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 33
Comments: 1557A		

COMPACTION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.





Boring No. B- 1	Sample No. B-2	Depth: 30.0 ft
Sample Description: (Tpy) Light olive brown silty clayey SAND		**USCS:** SC
Liquid Limit: 47	**Plasticity Index:** 21	**Percent Passing No. 200 Sieve:** 45
Moisture Content (%): 33.3	**Dry Density (pcf):** 92.5	**Degree of Saturation (%):** 100
Sample Type: Remolded to 93%	**Rate of Shear (in./min.):** 0.05	

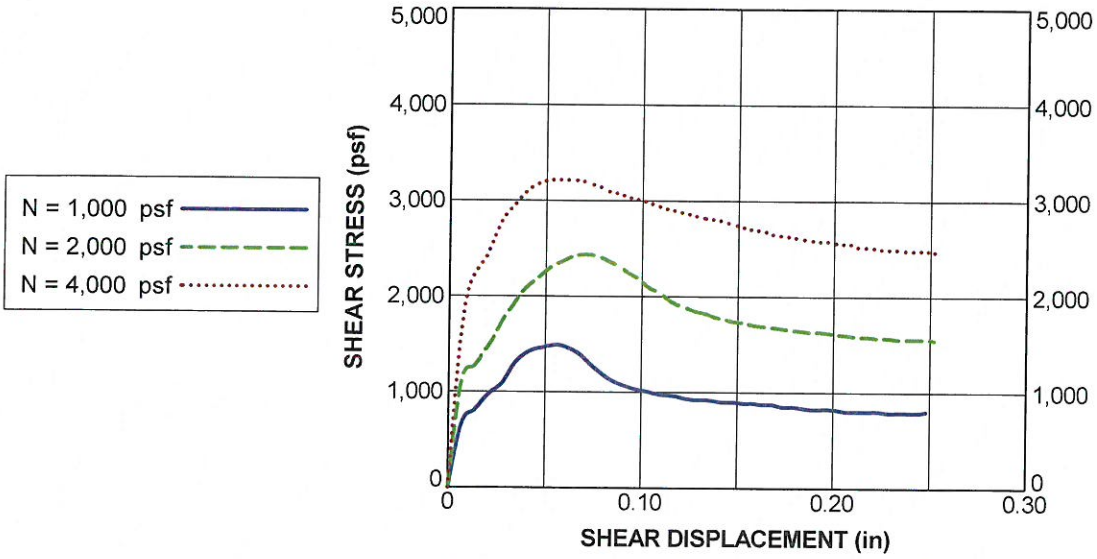
SHEAR STRENGTH PARAMETERS

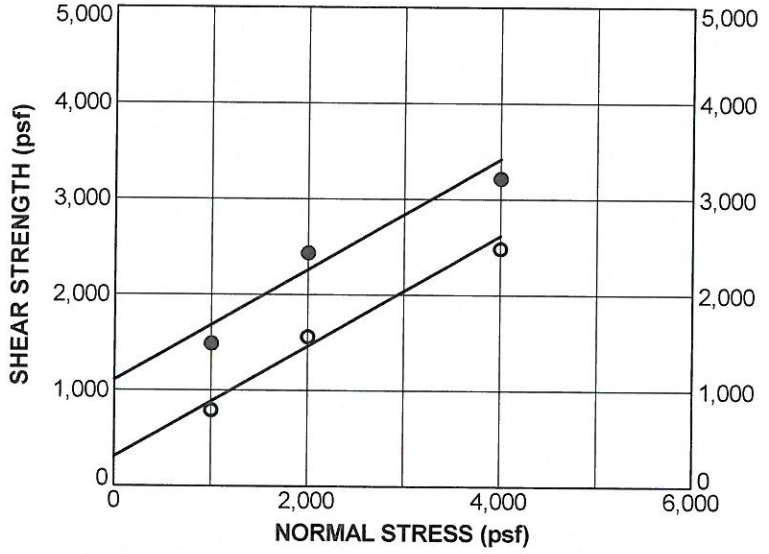
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	530	190
Friction Angle (degrees)	35.0	30.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.





Boring No. B- 1	Sample No. B-3	Depth: 50.0 ft
Sample Description: (Tpy) Light olive gray silty SAND		USCS: SM
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve: 48
Moisture Content (%): 31.7	Dry Density (pcf): 91.5	Degree of Saturation (%): 100
Sample Type: Remolded to 93%	Rate of Shear (in./min.): 0.05	

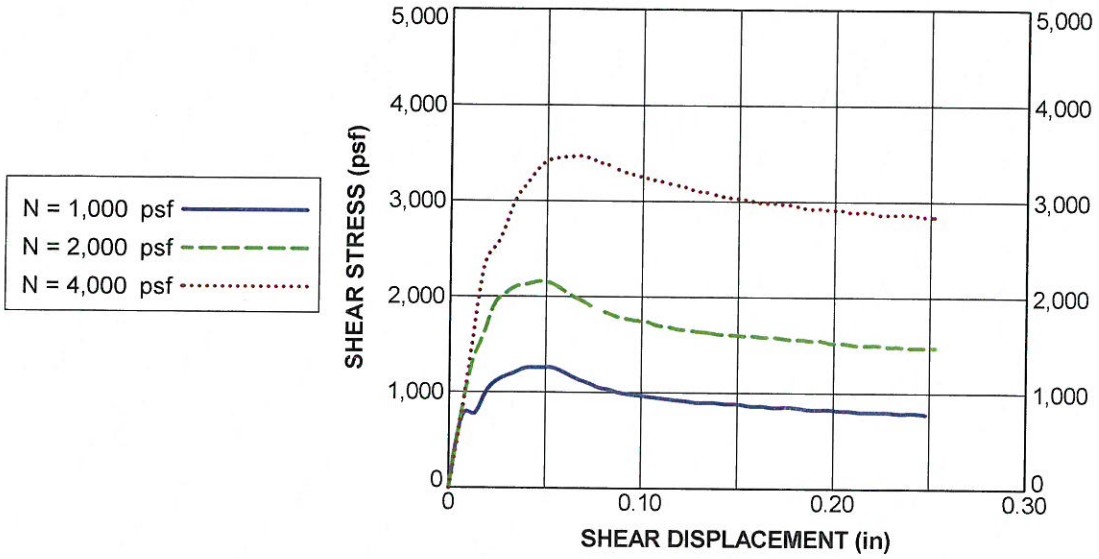
SHEAR STRENGTH PARAMETERS

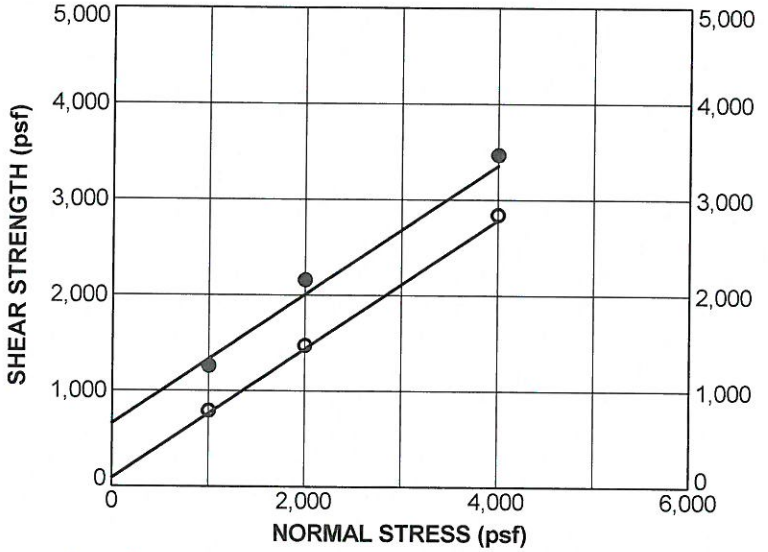
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	1110	310
Friction Angle (degrees)	30.0	30.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.





Boring No. B- 1	Sample No. B-4	Depth: 70.0 ft
Sample Description: (Tpy) Light olive gray silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 44
Moisture Content (%): 30.4	**Dry Density (pcf):** 94.4	**Degree of Saturation (%):** 100
Sample Type: Remolded to 93%	**Rate of Shear (in./min.):** 0.05	

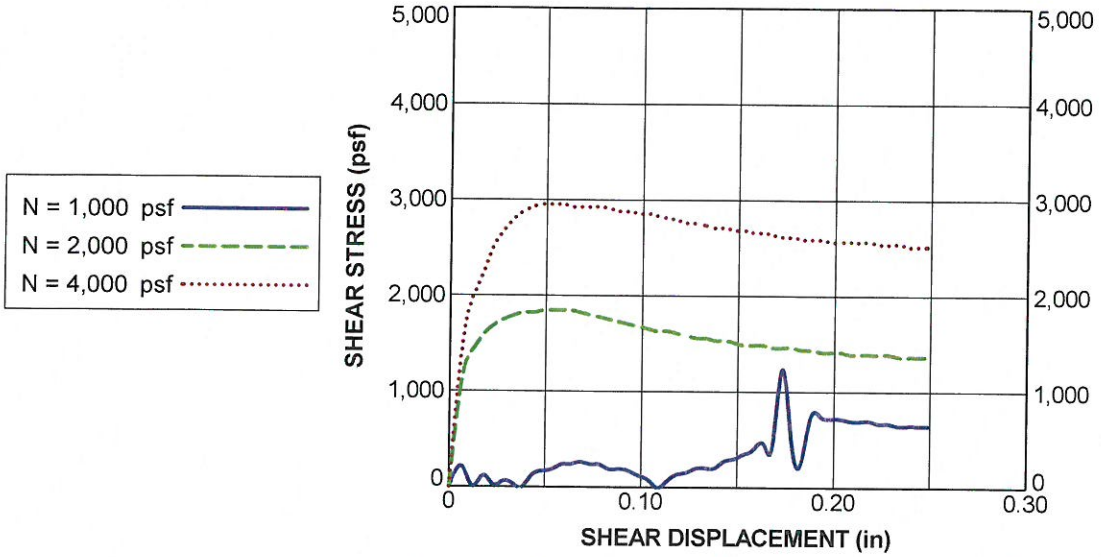
SHEAR STRENGTH PARAMETERS

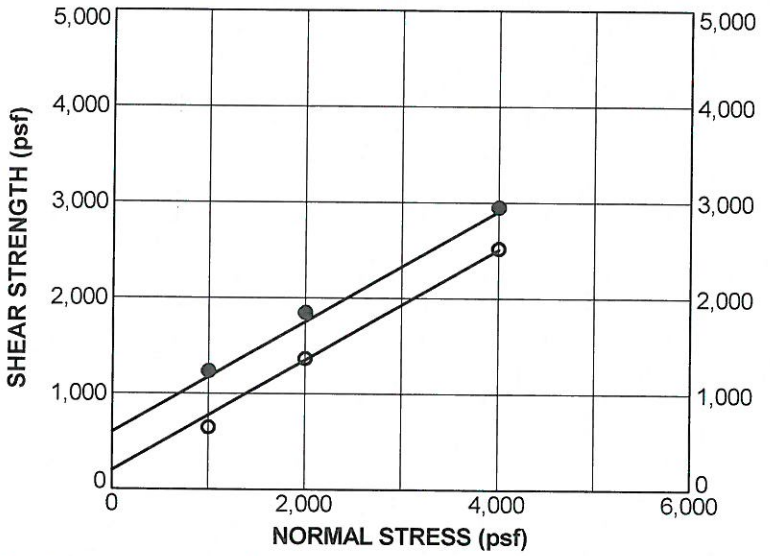
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	660	90
Friction Angle (degrees)	34.0	34.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.





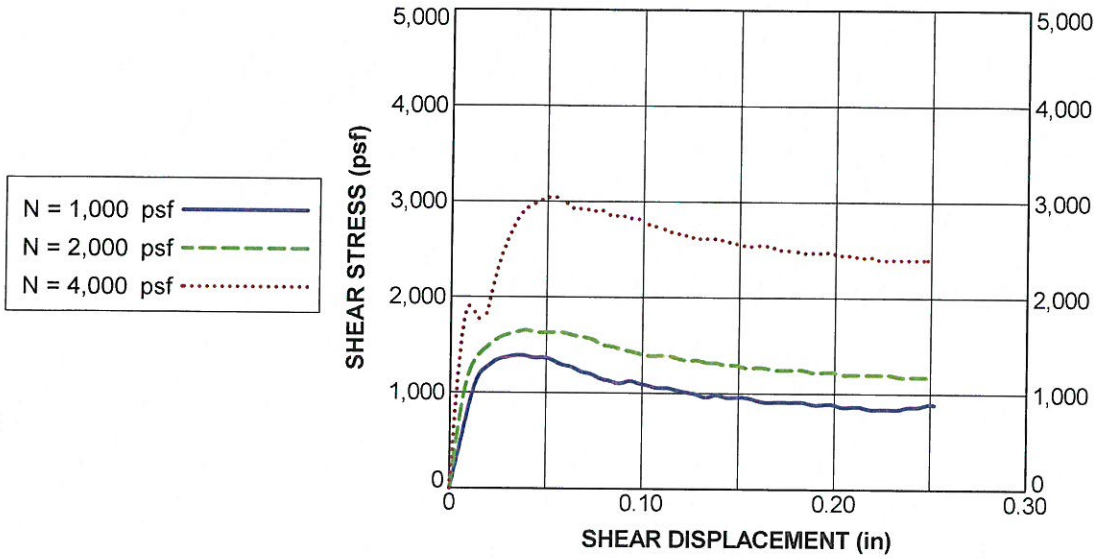
Boring No. B- 2	Sample No. B-2	Depth: 30.0 ft
Sample Description: (Tpy) Yellowish brown sandy SILT		USCS: ML
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve: 60
Moisture Content (%): 33.8	Dry Density (pcf): 91.6	Degree of Saturation (%): 100
Sample Type: Remolded to 93%	Rate of Shear (in./min.): 0.05	

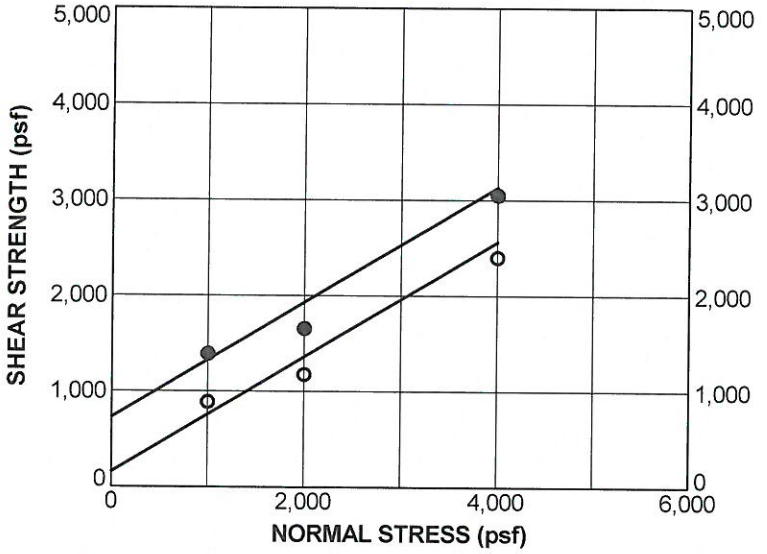
SHEAR STRENGTH PARAMETERS		
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	600	200
Friction Angle (degrees)	30.0	30.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.





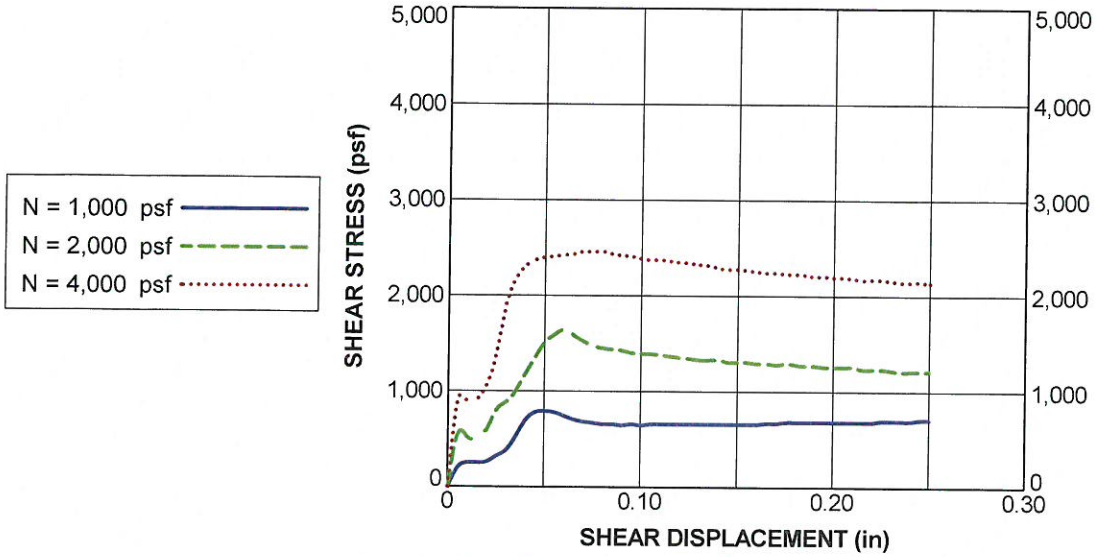
Boring No. B- 2	Sample No. B-3	Depth: 50.0 ft
Sample Description: (Tpy) Light olive brown sandy silty CLAY		**USCS:** CL
Liquid Limit: 46	**Plasticity Index:** 20	**Percent Passing No. 200 Sieve:** 54
Moisture Content (%): 33.4	**Dry Density (pcf):** 92.1	**Degree of Saturation (%):** 100
Sample Type: Remolded to 93%	**Rate of Shear (in./min.):** 0.05	

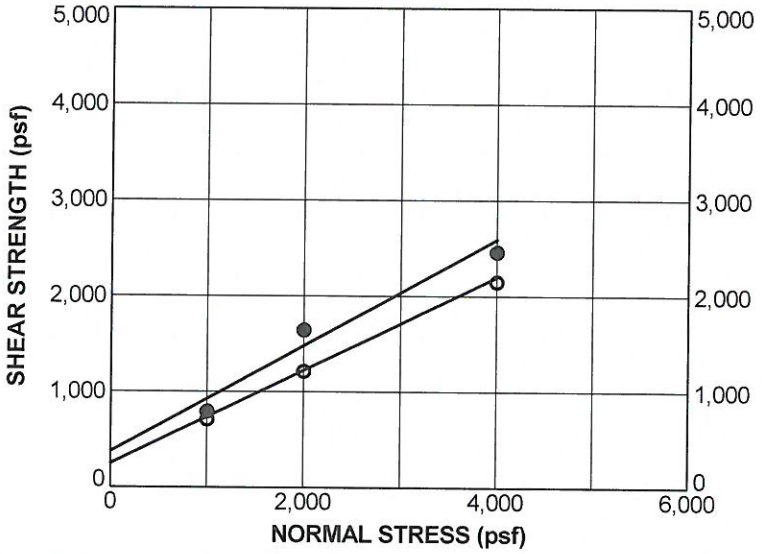
SHEAR STRENGTH PARAMETERS		
Parameter	**Peak ●**	**Ultimate ○**
Cohesion (psf)	730	160
Friction Angle (degrees)	31.0	31.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.





Boring No. B- 3	Sample No. B-1	Depth: 10.0 ft
Sample Description: (Tpy) Olive brown clayey elastic SILT		**USCS:** MH
Liquid Limit: 63	**Plasticity Index:** 29	**Percent Passing No. 200 Sieve:** 80
Moisture Content (%): 39.5	**Dry Density (pcf):** 84.2	**Degree of Saturation (%):** 100
Sample Type: Remolded to 93% RC	**Rate of Shear (in./min.):** 0.005	

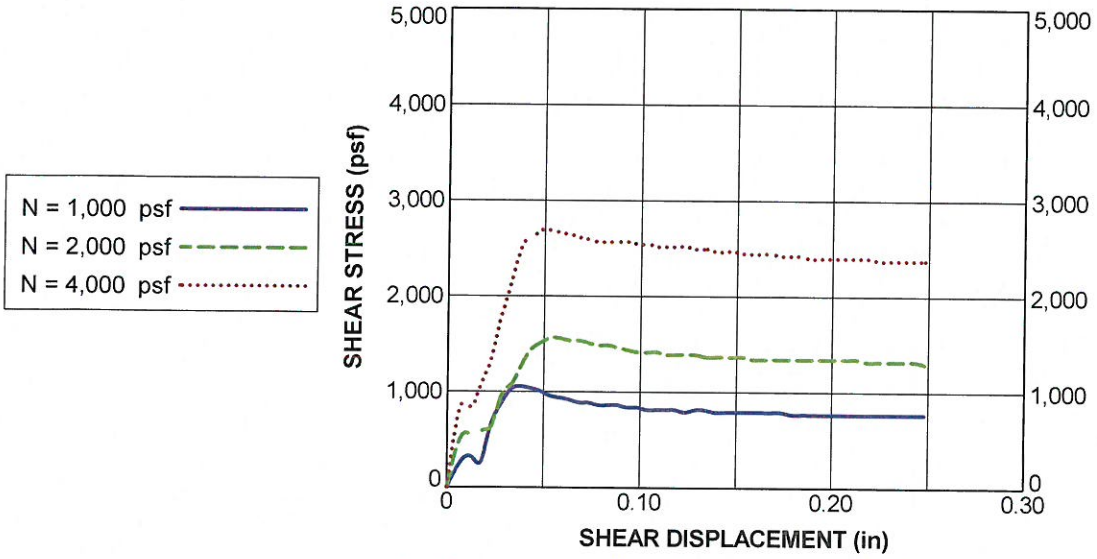
SHEAR STRENGTH PARAMETERS

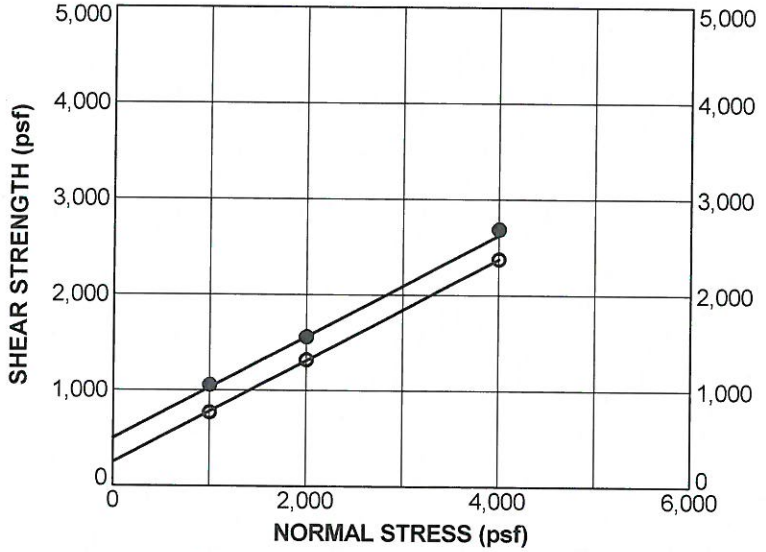
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	375	250
Friction Angle (degrees)	29.0	26.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.





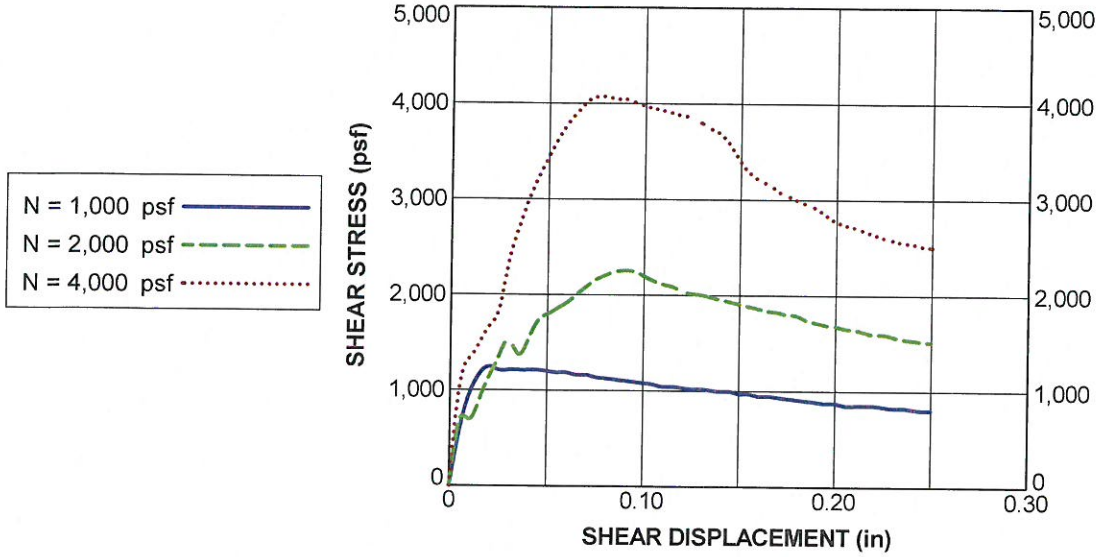
Boring No. B- 5	Sample No. B-3	Depth: 50.0 ft
Sample Description: (Tpy) Light brown silty SAND		USCS: SM
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve: 33
Moisture Content (%): 32.5	Dry Density (pcf): 91.1	Degree of Saturation (%): 100
Sample Type: Remolded to 93% RC	Rate of Shear (in./min.): 0.05	

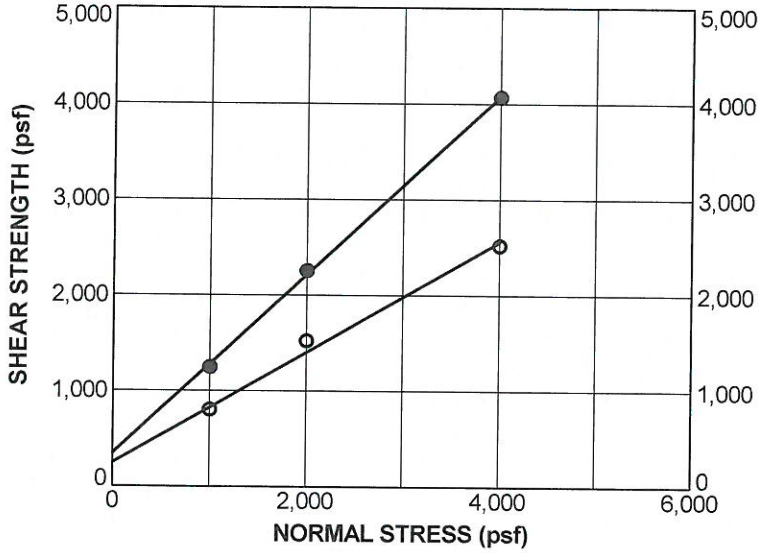
SHEAR STRENGTH PARAMETERS		
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	500	250
Friction Angle (degrees)	28.0	28.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.





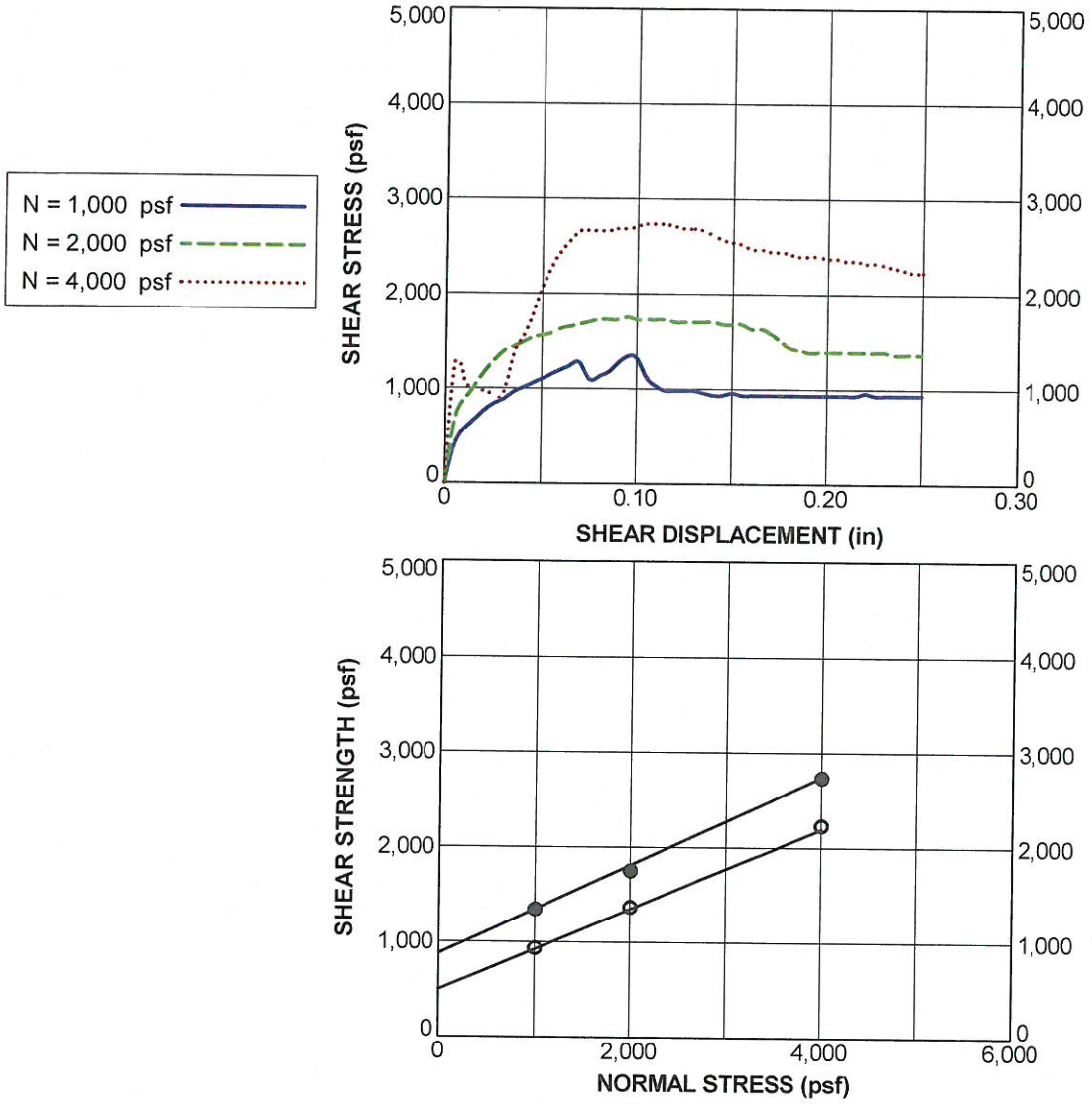
Boring No. B- 3	**Sample No. D-8**	**Depth: 80.0 ft**	
Sample Description: (Tpy) Brown silty CLAY		**USCS:** CL	
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**	
Moisture Content (%): 51.6	**Dry Density (pcf):** 70.3	**Degree of Saturation (%):** 100	
Sample Type: Undisturbed	**Rate of Shear (in./min.):** 0.005		

SHEAR STRENGTH PARAMETERS		
Parameter	**Peak ●**	**Ultimate ○**
Cohesion (psf)	350	250
Friction Angle (degrees)	43.0	30.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



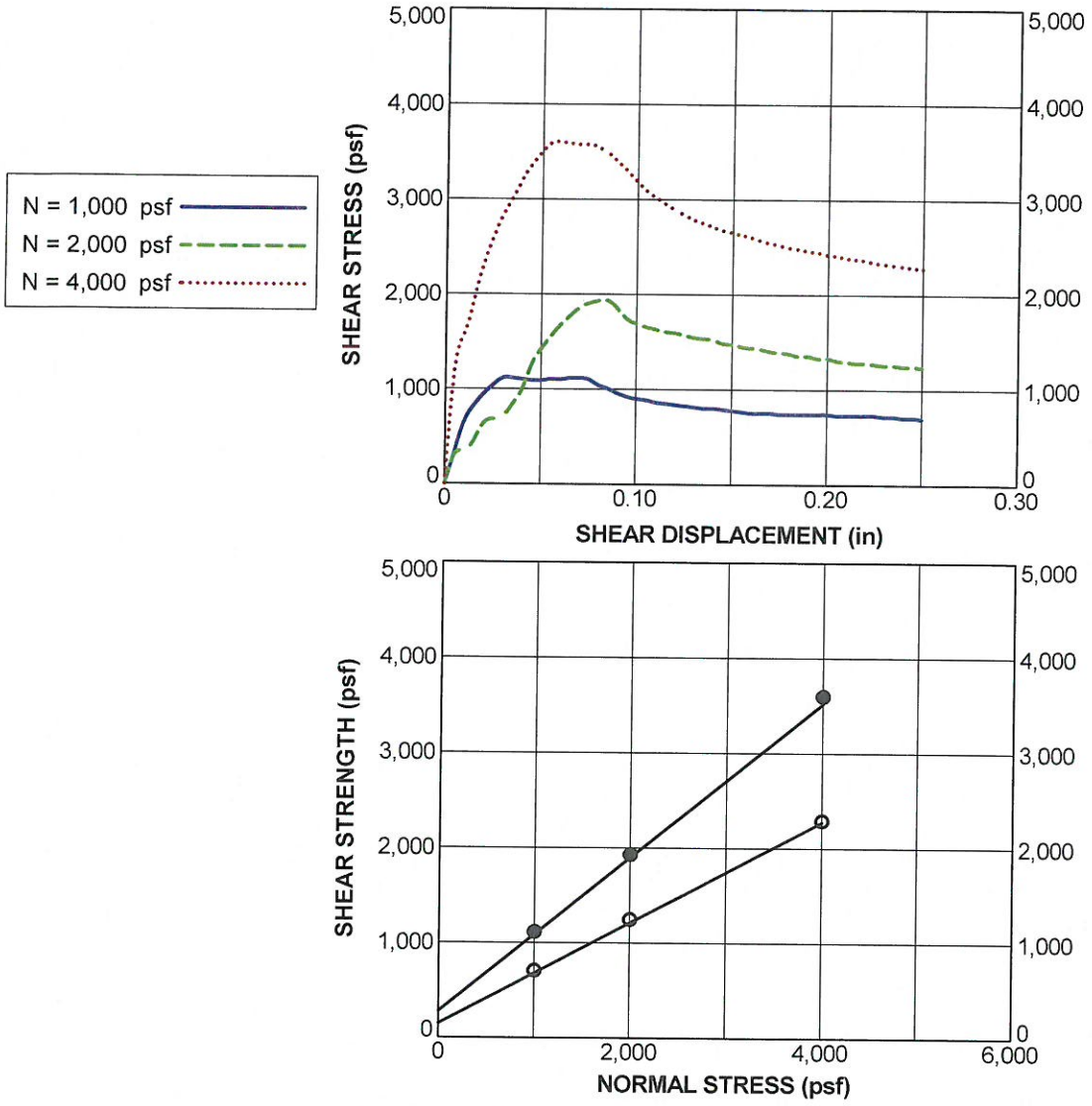
Boring No. B- 4	Sample No. D-1	Depth: 10.0 ft
Sample Description: (Tpy) Light gray clayey SILTSTONE		USCS: ML
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:
Moisture Content (%): 47.3	Dry Density (pcf): 77.9	Degree of Saturation (%): 100
Sample Type: Undisturbed	Rate of Shear (in./min.): 0.005	

SHEAR STRENGTH PARAMETERS		
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	880	500
Friction Angle (degrees)	25.0	23.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



Boring No. B- 4	**Sample No. D-2**	**Depth: 20.0 ft**	
Sample Description: (Tpy) Gray clayey SILTSTONE		**USCS:** ML	
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**	
Moisture Content (%): 42.8	**Dry Density (pcf):** 78.1	**Degree of Saturation (%):** 100	
Sample Type: Undisturbed	**Rate of Shear (in./min.):** 0.005		

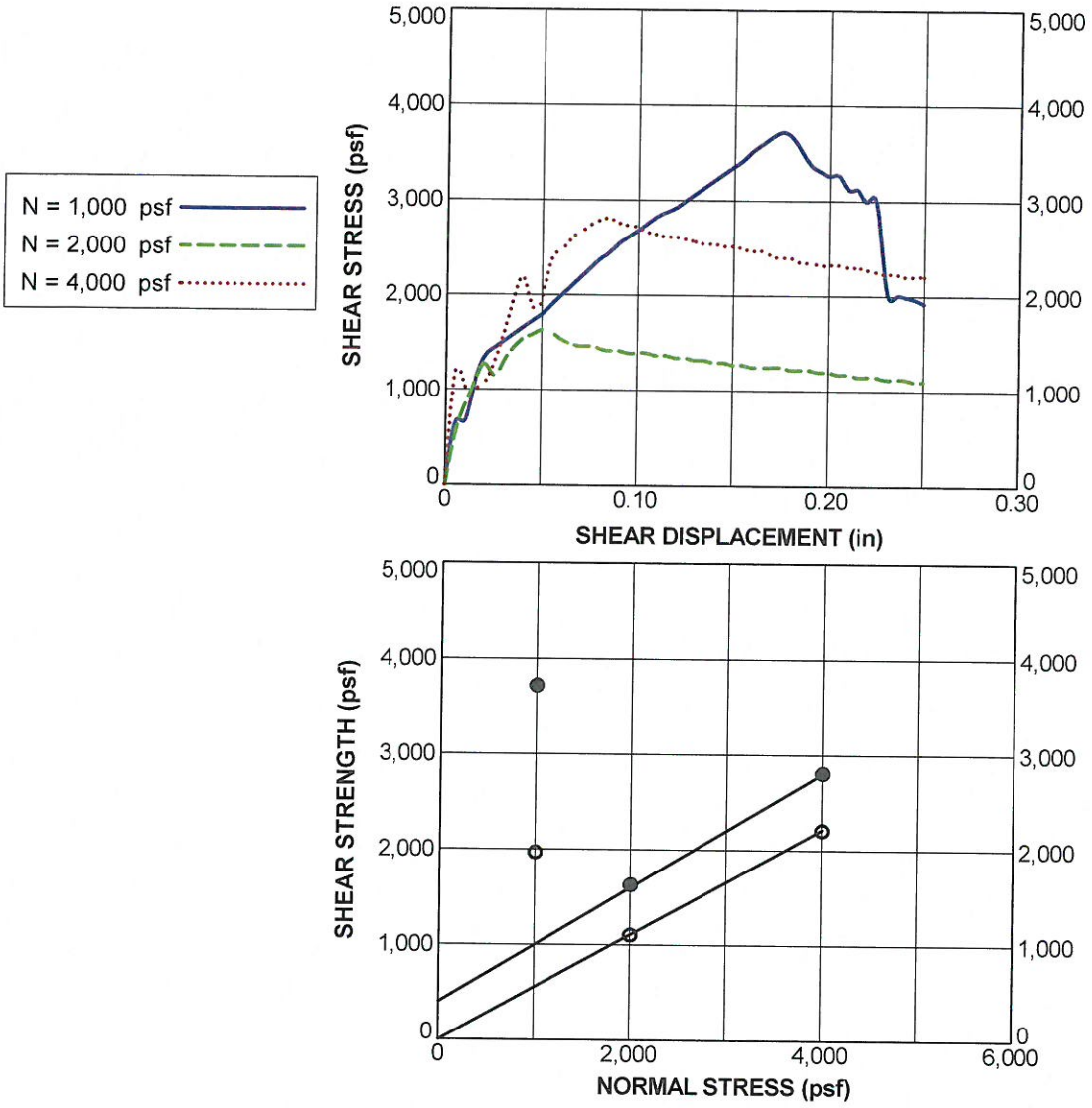
SHEAR STRENGTH PARAMETERS

Parameter	Peak ●	Ultimate ○
Cohesion (psf)	280	150
Friction Angle (degrees)	39.0	28.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



Boring No. B- 4	**Sample No. D-5**	**Depth: 50.0 ft**	
Sample Description: (Tpy) Gray clayey SILTSTONE		**USCS:** ML	
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**	
Moisture Content (%): 45.4	**Dry Density (pcf):** 79.7	**Degree of Saturation (%):** 100	
Sample Type: Undisturbed	**Rate of Shear (in./min.):** 0.005		

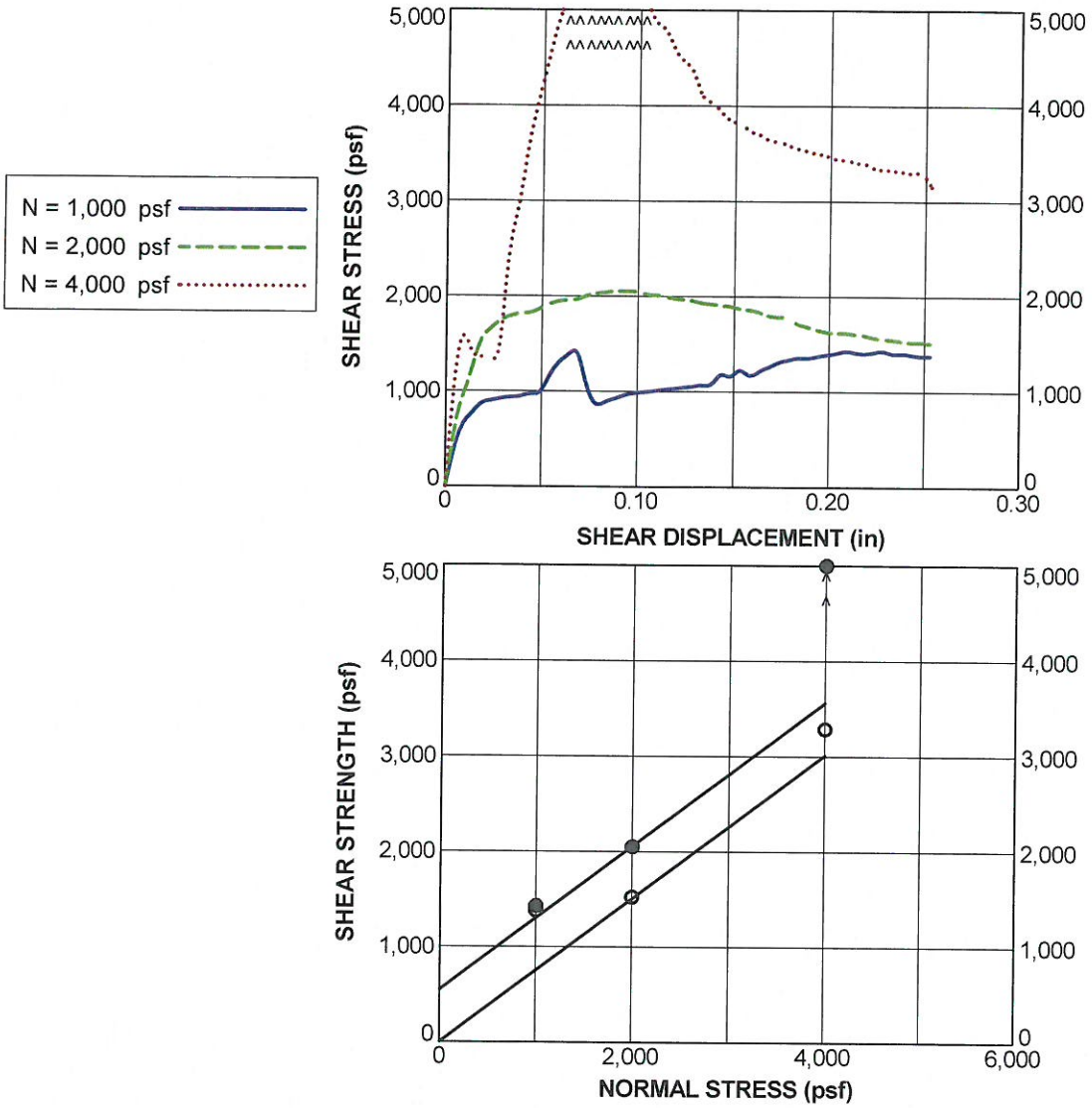
SHEAR STRENGTH PARAMETERS

Parameter	Peak ●	Ultimate ○
Cohesion (psf)	400	0
Friction Angle (degrees)	31.0	29.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



Boring No. B- 5	**Sample No. D-5**	**Depth: 50.0 ft**	
Sample Description: (Tpy) Grayish yellow silty SANDSTONE		**USCS:** SM	
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**	
Moisture Content (%): 32.0	**Dry Density (pcf):** 91.4	**Degree of Saturation (%):** 100	
Sample Type: Undisturbed	**Rate of Shear (in./min.):** 0.05		

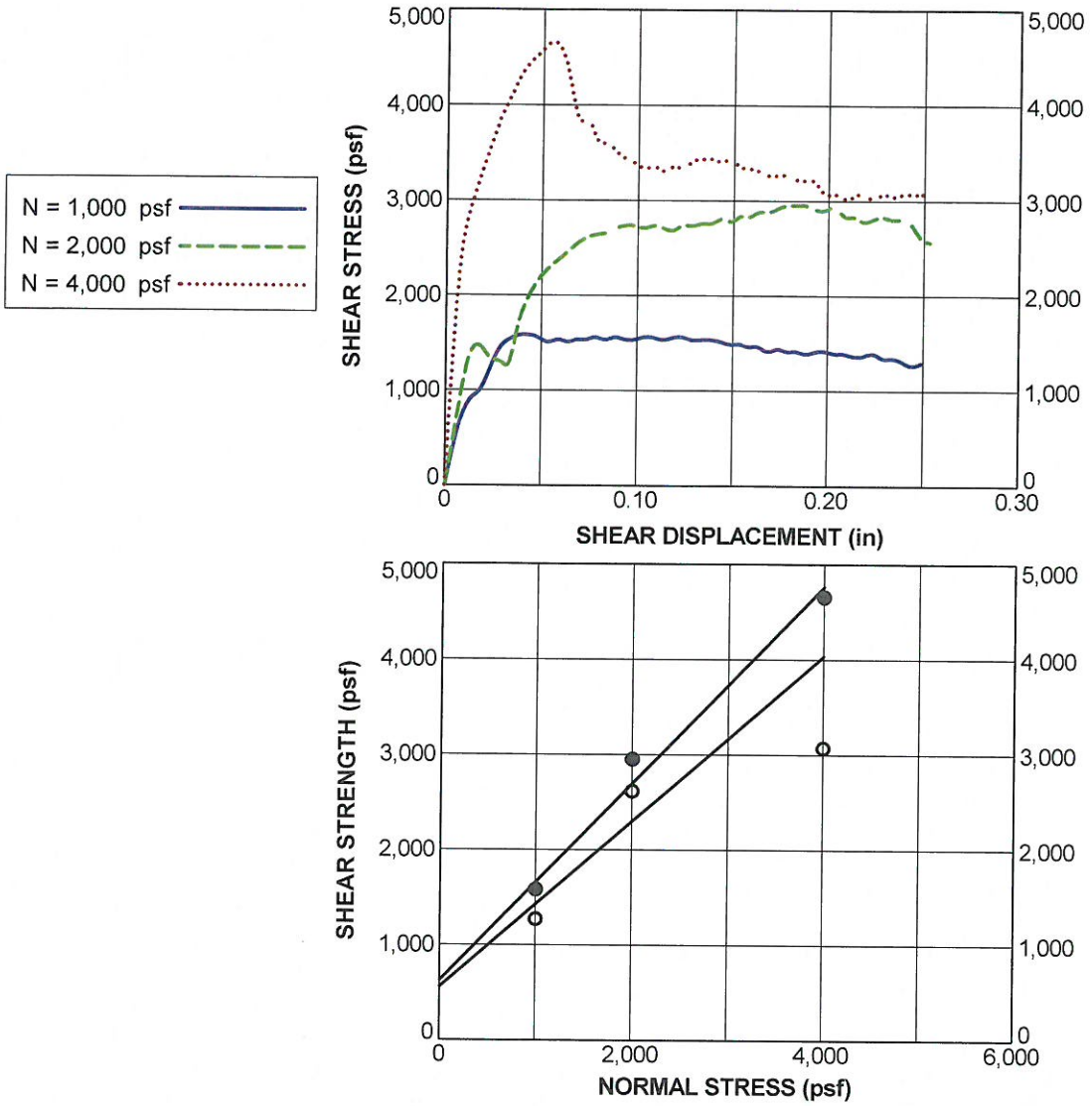
SHEAR STRENGTH PARAMETERS

Parameter	Peak ●	Ultimate ○
Cohesion (psf)	550	0
Friction Angle (degrees)	37.0	37.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



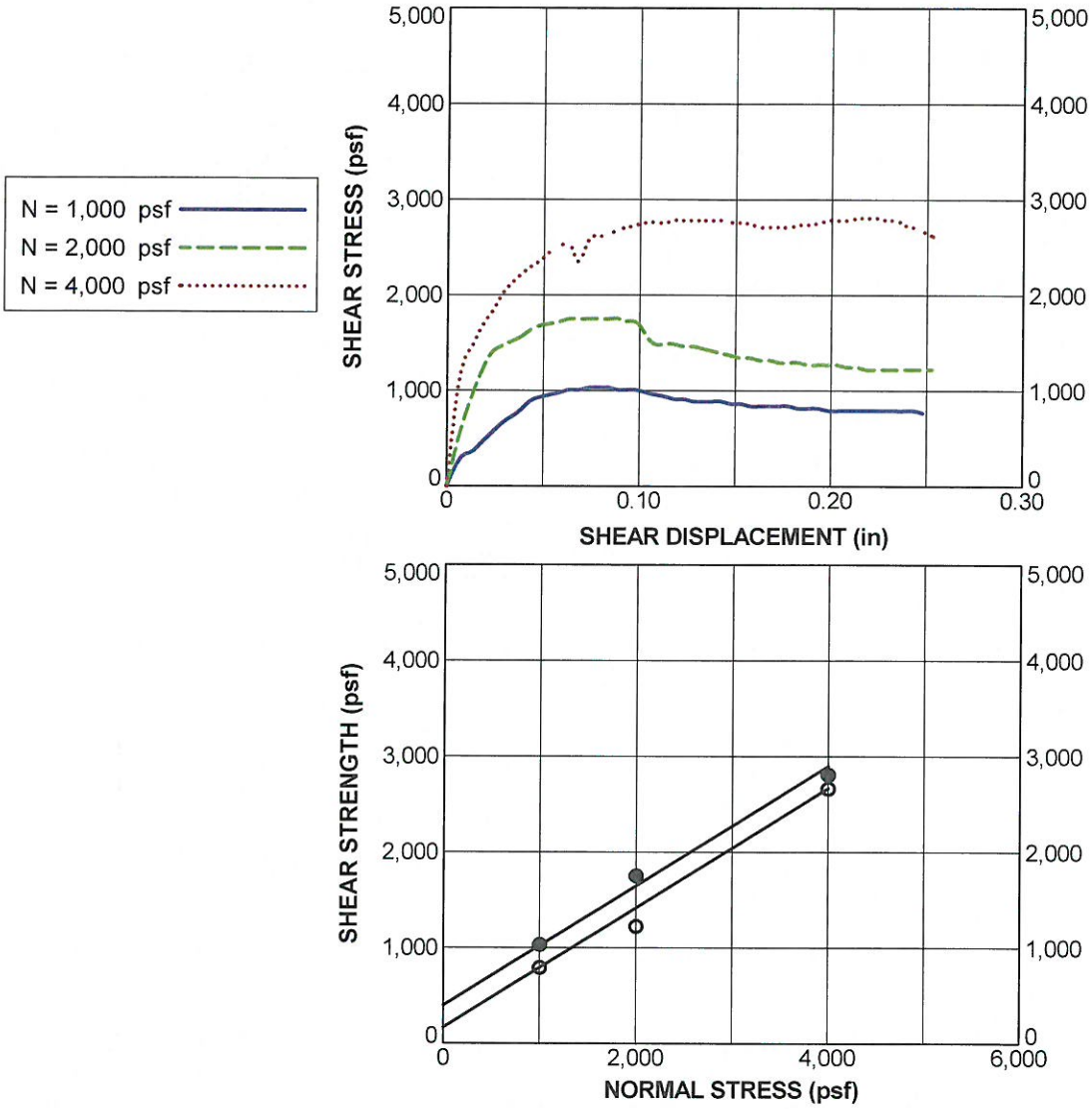
Boring No. B- 5	**Sample No. D-6**	**Depth: 60.0 ft**	
Sample Description: (Tpy) Olive yellow clayey SANDSTONE		**USCS:** SC	
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**	
Moisture Content (%): 35.3	**Dry Density (pcf):** 91.4	**Degree of Saturation (%):** 100	
Sample Type: Undisturbed	**Rate of Shear (in./min.):** 0.05		

SHEAR STRENGTH PARAMETERS		
Parameter	**Peak ●**	**Ultimate ○**
Cohesion (psf)	625	560
Friction Angle (degrees)	46.0	41.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



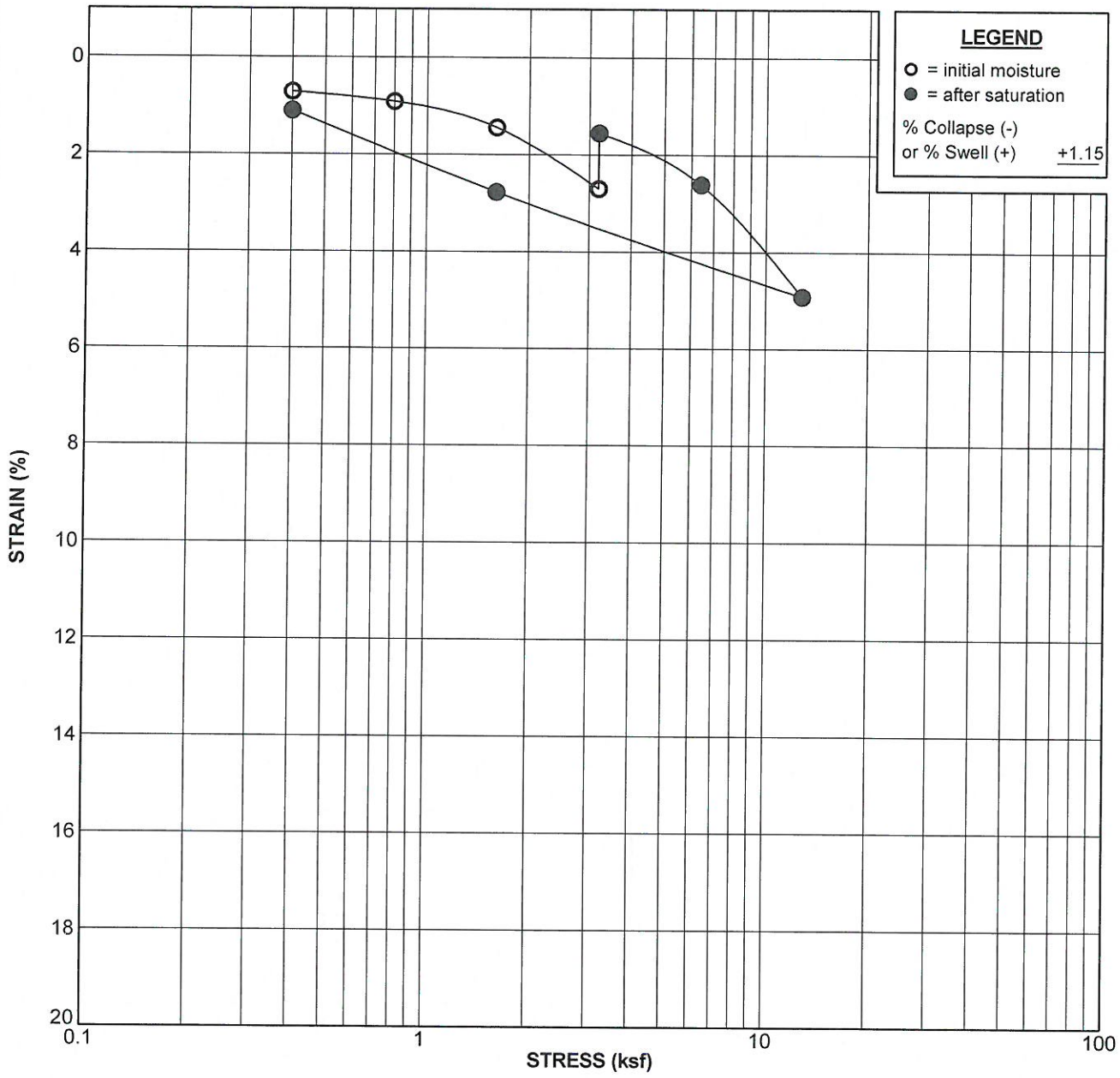
Boring No. B- 7	Sample No. D-4	Depth: 30.0 ft
Sample Description: (Tpy) Light gray yellow silty SANDSTONE		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**
Moisture Content (%): 36.9	**Dry Density (pcf):** 88.5	**Degree of Saturation (%):** 100
Sample Type: Undisturbed	**Rate of Shear (in./min.):** 0.05	

SHEAR STRENGTH PARAMETERS		
Parameter	**Peak ●**	**Ultimate ○**
Cohesion (psf)	400	170
Friction Angle (degrees)	32.0	32.0

DIRECT SHEAR TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



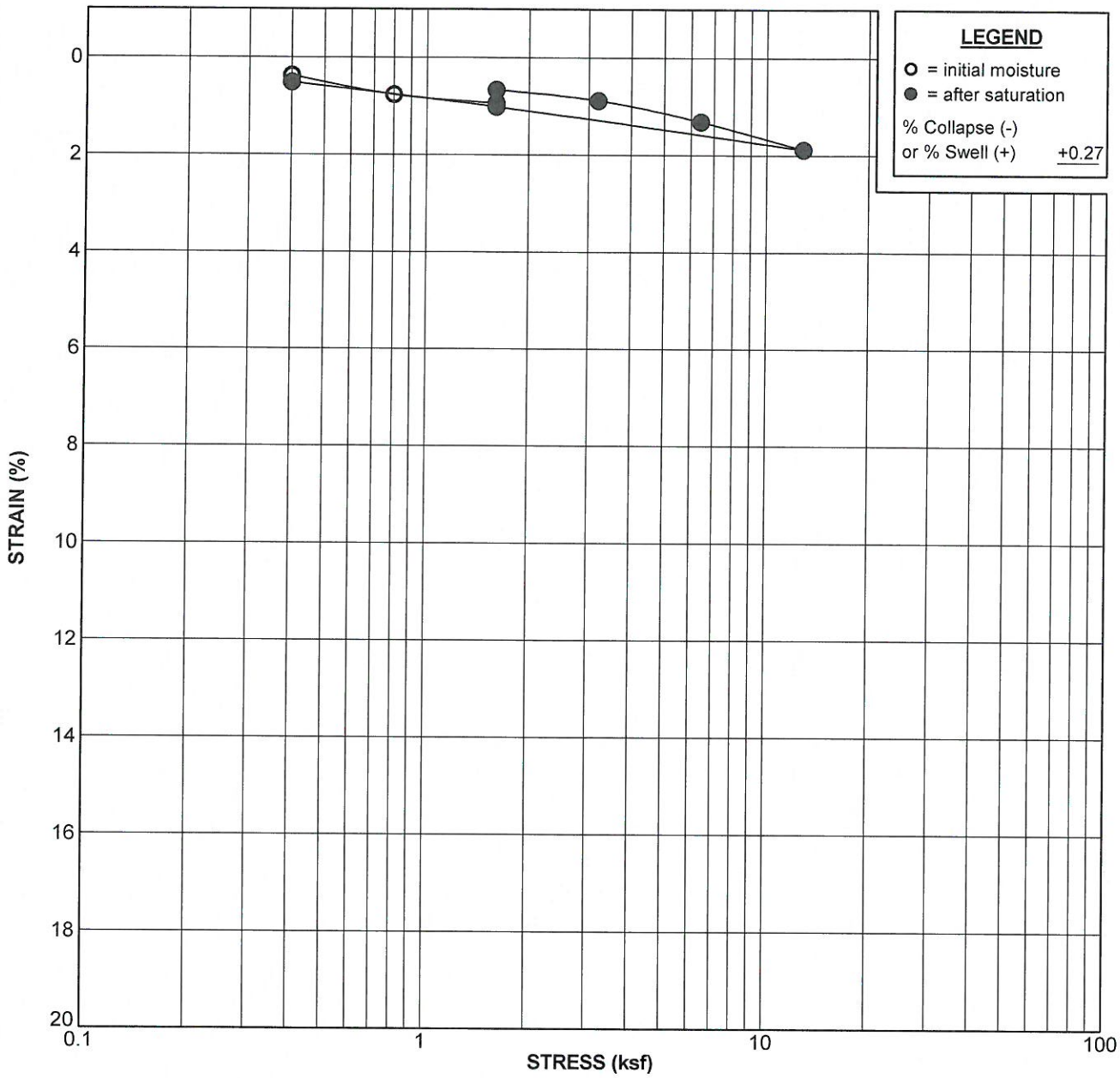
Boring No. B- 7	Sample No. D-1	Depth: 5.0 ft
Sample Description: (Col) Dark brown silty CLAY		USCS: CL
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	20.8	92.1	67.7	0.829
Final	27.8	93.1	92.7	0.810

CONSOLIDATION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



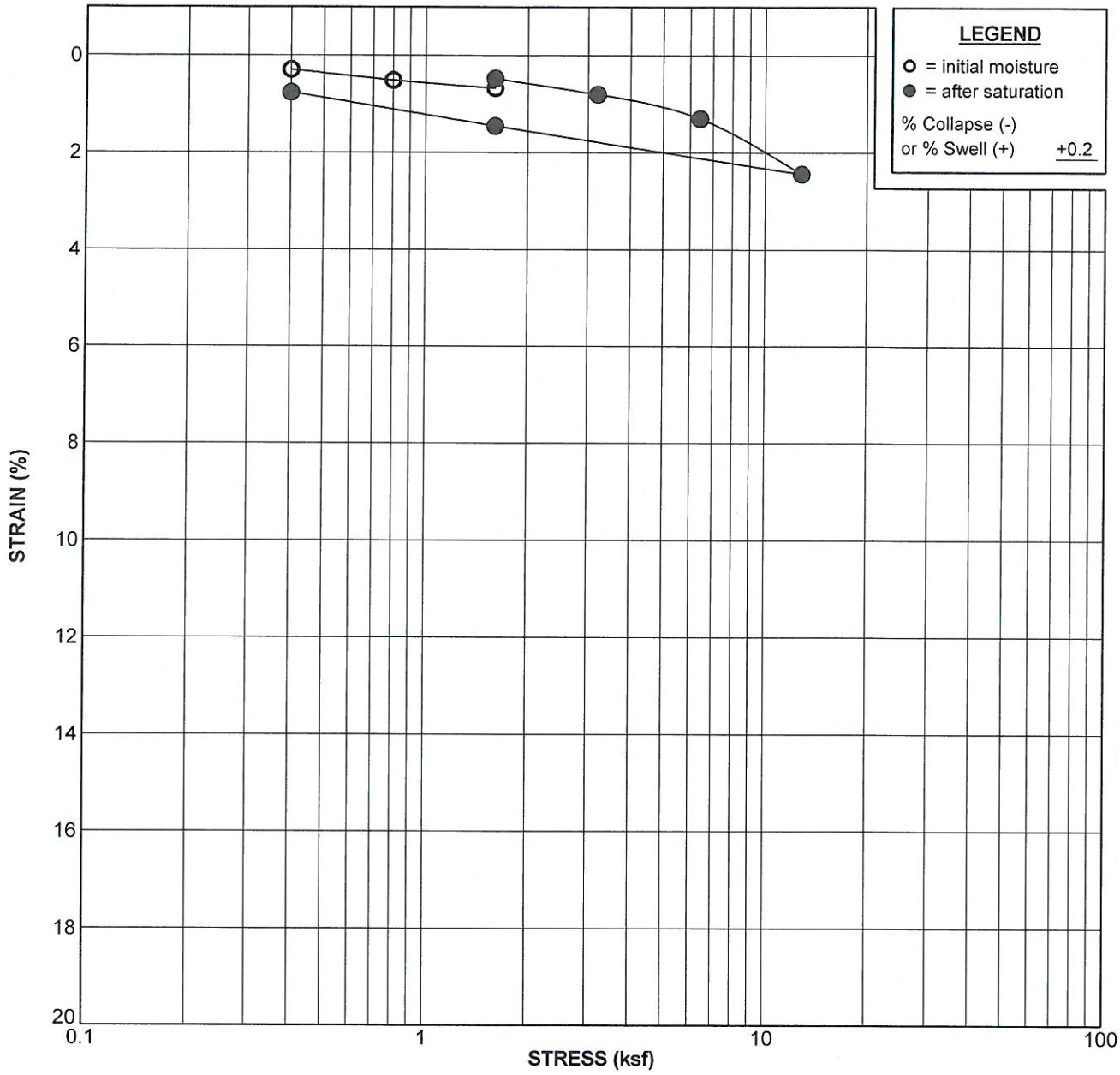
Boring No. B- 6	Sample No. D-3	Depth: 30.0 ft
Sample Description: (Tpy) Olive gray clayey SILTSTONE		USCS: ML
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	35.9	83.9	94.8	1.038
Final	37.5	84.3	99.9	1.028

CONSOLIDATION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.



Boring No. B- 6	Sample No. D-2	Depth: 20.0 ft
Sample Description: (Tpy) Light olive brown clayey SILTSTONE		USCS: ML
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	33.7	81.3	84.9	1.072
Final	39.0	81.9	99.6	1.057

CONSOLIDATION TEST RESULTS

Sunjoint/The Terraces
Walnut, California
PROJECT NO. 18014-01

NMG Geotechnical, Inc.

Sample	Compacted Moisture (%)	Compacted Dry Density (pcf)	Final Moisture (%)	Volumetric Swell (%)	Expansion Index[1] Value	Expansion Index[1] Method	Expansive Classification[2]	Soluble Sulfate (%)	Sulfate Exposure[3]
Boring B-1 B-2 20-40'	19.0	84.5	30.8	0.35	4	A	Very Low	--	--
Boring B-2 B-3 40-60'	18.5	86.0	31.6	0.71	7	A	Very Low	--	--
Boring B-3 B-1 0-20'	22.0	75.7	45.6	5.48	55	A	Medium	0.45	S2
B-4 B-2 20-40'	21.0	79.3	45.0	8.5	85	A	Medium	--	--
B-3 B-3 40-60'	19.0	81.5	39.7	5.3	53	A	Medium	0.36	S2
B-5 B-3 40-60'	18.5	85.7	30.6	1.42	14	A	Very Low	0.05	S0

Test Method:
ASTM D4829

HACH SF-1 (Turbidimetric)

Notes:
1. Expansion Index (EI) method of determination:
   [A] E.I. determined by adjusting water content to achieve a 50 ±1% degree of saturation
   [B] E.I. calculated based on measured saturation within the range of 40% and 60%
2. ASTM D4829 *(Classification of Expansive Soil)*
3. ACI-318-14 Table 19.3.1.1 *(Requirement for Concrete Exposed to Sulfate-Containing Solutions)*

Expansion Index and Soluble Sulfate Test Results
(FRM001 Rev.5)

Project No. 18014-01

Project Name: Sunjoint / The Terraces

NMG

LABORATORY TEST RESULTS
BY:

GEOTEK (2015)

SUMMARY OF LABORATORY TESTING

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

In Situ Moisture Content and Unit Weight
The field moisture content was measured in the laboratory on selected samples collected during the field investigation. The field moisture content is determined as a percentage of the dry unit weight. The dry density was measured in the laboratory on selected ring samples. The results are shown on the logs of exploratory borings in Appendix A.

Moisture-Density Relationship
Laboratory testing was performed on a representative site sample collected during the recent subsurface exploration. The laboratory maximum dry density and optimum moisture content for the sample tested was determined in general accordance with test method ASTM Test Procedure D 1557. The results are included herein.

Expansion Index
Expansion Index testing was performed on a site soil sample. Testing was performed in general accordance with ASTM Test Method D 4829. The lab results are included herein.

Direct Shear Test
Shear testing was performed by others on a remolded sample of the site soil materials in general accordance with ASTM Test Method D 3080. The test results are included herein.

Atterberg Limits
Liquid limit and plastic limit testing was completed in general accordance with ASTM Test Method D 4318 on a soil sample collected from the site. Results are included herein.

Consolidation
Consolidation testing was performed on a selected sample of the site soils in general accordance with ASTM Test Method D 2435. The results of this testing are presented herein.

Sulfate Content, Resistivity and Chloride Content
Testing to determine the water-soluble sulfate content was performed by others in general accordance with California Test No. 417. Resistivity testing was completed by others in general accordance with California Test 643. Testing to determine the chloride content was performed by others in general accordance with California Test No. 422. The results of the testing are included herein.

GEOTEK

MOISTURE/DENSITY RELATIONSHIP

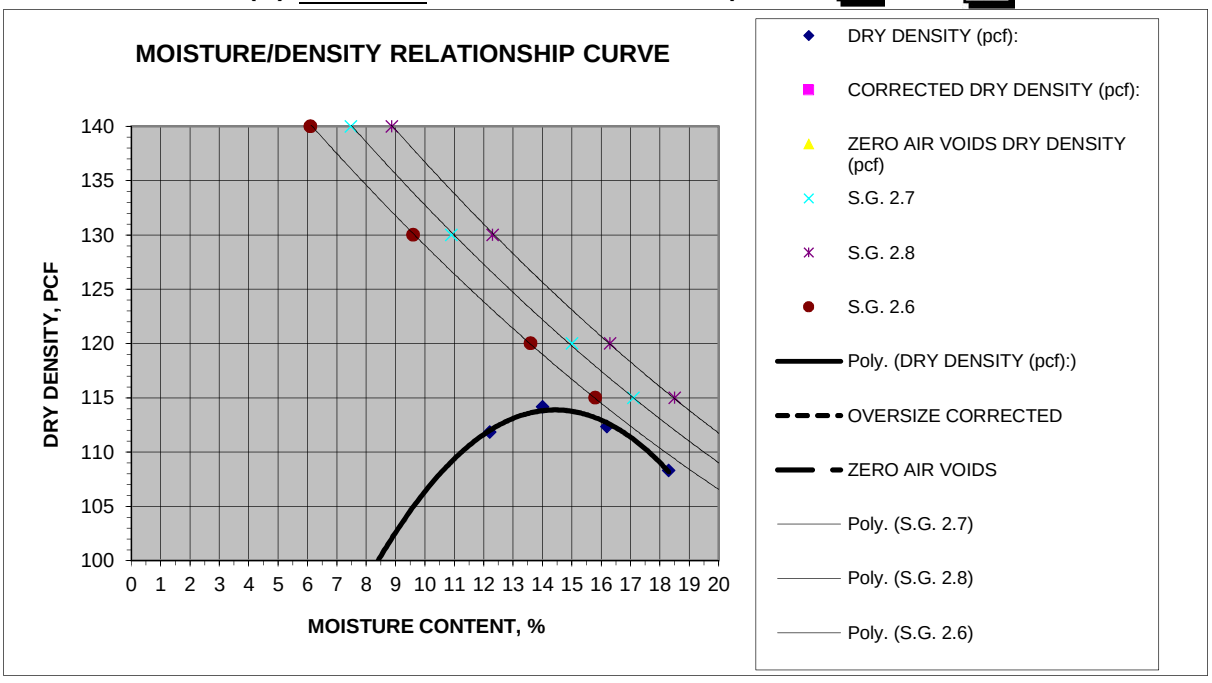
Client: Sunjoint Development
Project: Walunt
Location:
Material Type: Dark Brown Silty Clay to Clayey Silt
Material Supplier:
Material Source:
Sample Location: B-3 @ 0 - 5

Job No.: 1280-CR
Lab No.: Corona

Sampled By: JMP
Received By: DLI
Tested By: DLI
Reviewed By:

Date Sampled: 27-Feb-15
Date Received: 27-Feb-15
Date Tested: 9-Mar-15
Date Reviewed:

Test Procedure: ASTM 1557 **Method:** A
Oversized Material (%): 4.2 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	114.5	**@ Optimum Moisture, %**	14.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification:
AASHTO Soils Classification:

GEOTEK

MOISTURE/DENSITY RELATIONSHIP

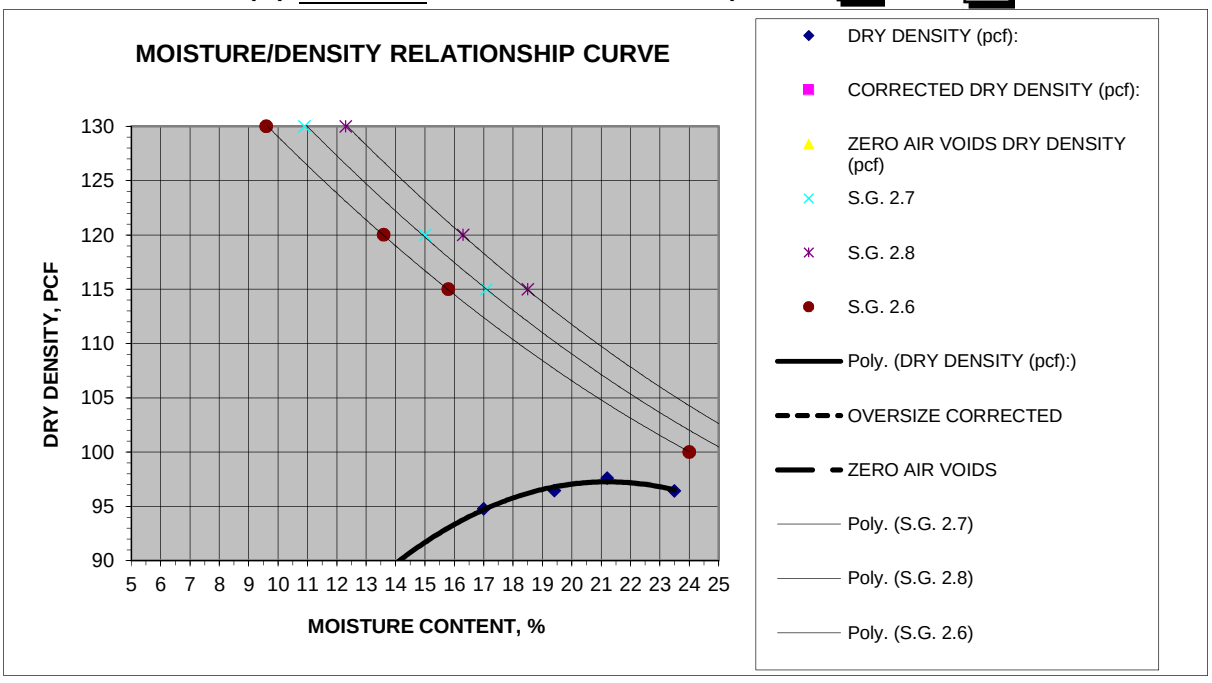
Client: Sunjoint Development
Project: Walnut
Location:
Material Type: Dark Brown Silty Clay to Clayey Silt
Material Supplier:
Material Source:
Sample Location: B-4 @ 0 - 5

Job No.: 1280-CR
Lab No.: Corona

Sampled By: JMP
Received By: DLI
Tested By: DLI
Reviewed By:

Date Sampled: 27-Feb-15
Date Received: 27-Feb-15
Date Tested: 9-Mar-15
Date Reviewed:

Test Procedure: ASTM 1557 **Method:** A
Oversized Material (%): 3.8 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	97.5	**@ Optimum Moisture, %**	21.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

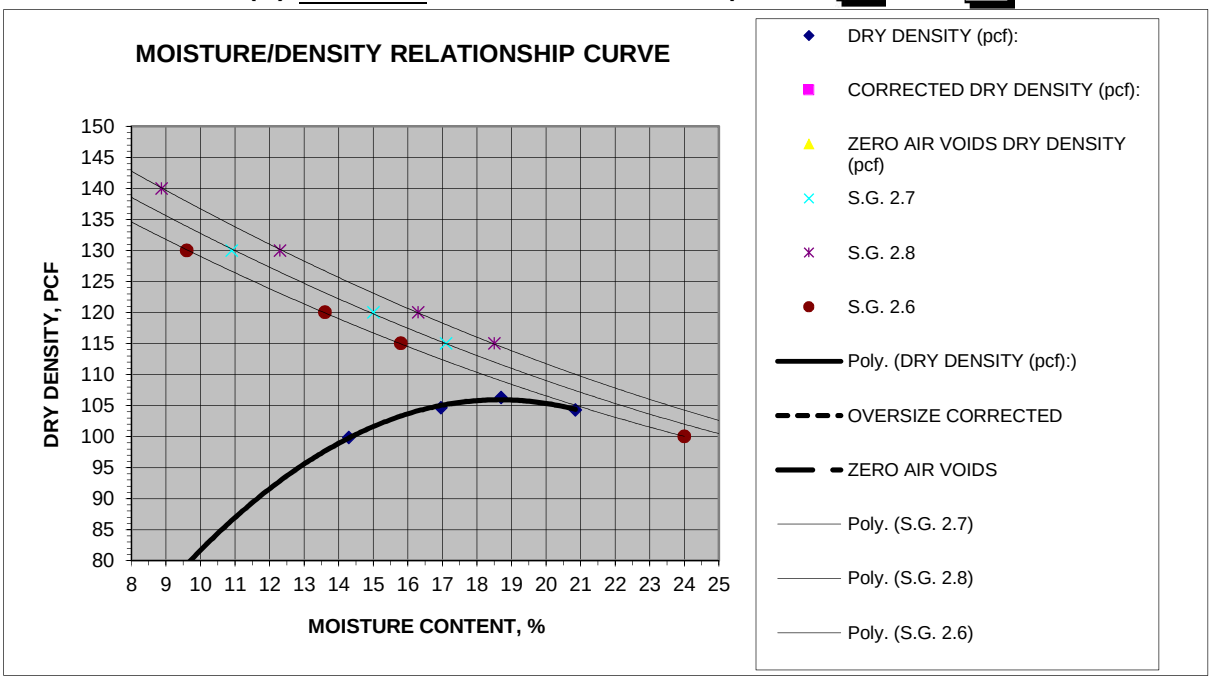
Unified Soils Classification:
AASHTO Soils Classification:

GEOTEK
4130 Flat Rock Drive, Suite 140, Riverside, CA, 92505-5864
951-710-1160 Office 951-710-1167 Fax

MOISTURE/DENSITY RELATIONSHIP

Client:	Mr. Tom Lee	**Job No.:**	0468-CR3
Project:	APN's 8709-230-273, -274 & -275	**Lab No.:**	Riv
Location:	Walnut		
Material Type:	0		
Material Supplier:	N/A		
Material Source:	0		
Sample Location:	T - 1 @ 0 - 3'		
	0		
Sampled By:	EHL	**Date Sampled:**	3-Jul-08
Received By:	N/A	**Date Received:**	3-Jul-08
Tested By:	FH	**Date Tested:**	9-Jul-08
Reviewed By:	N/A	**Date Reviewed:**	15-Jul-08

Test Procedure: ASTM 1557 **Method:** 0
Oversized Material (%): 0.0 **Correction Required:** ☐ Yes ☐ No



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	107.0	**@ Optimum Moisture, %**	18.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:
Unified Soils Classification: _____
AASHTO Soils Classification: _____

Plate MD-1

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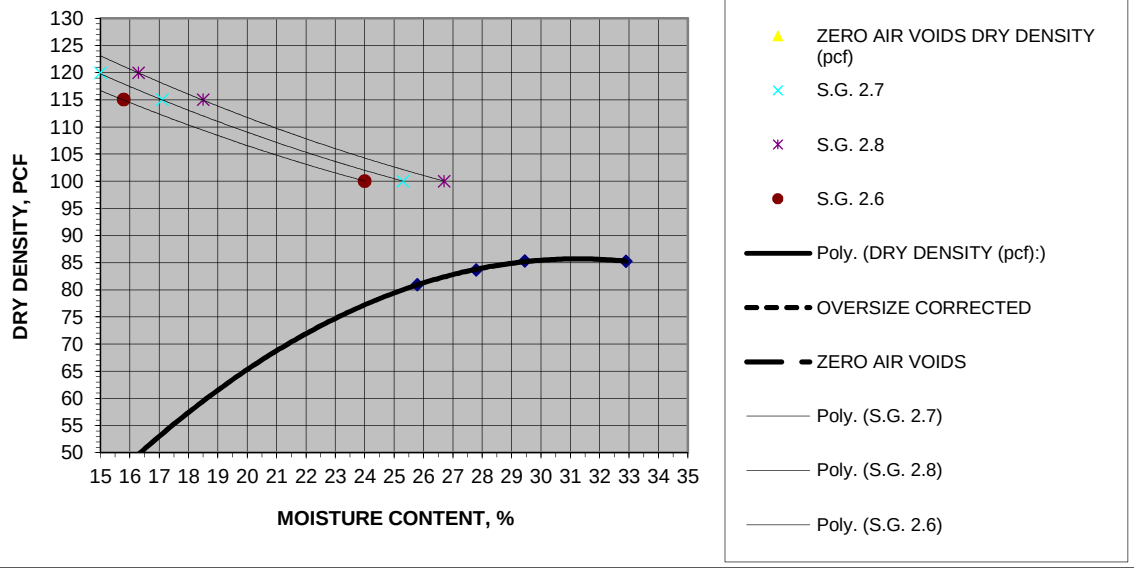
4130 Flat Rock Drive, Suite 140, Riverside, CA, 92505-5864
951-710-1160 Office 951-710-1167 Fax

MOISTURE/DENSITY RELATIONSHIP

Client:	Mr. Tom Lee	**Job No.:**	0468-CR3
Project:	APN's 8709-230-273, -274 & -275	**Lab No.:**	Riv
Location:	Walnut		
Material Type:	0		
Material Supplier:	N/A		
Material Source:	0		
Sample Location:	T - 9 @ 0 - 3'		
	0		
Sampled By:	EHL	**Date Sampled:**	3-Jul-08
Received By:	N/A	**Date Received:**	3-Jul-08
Tested By:	FH	**Date Tested:**	10-Jul-08
Reviewed By:	N/A	**Date Reviewed:**	15-Jul-08

Test Procedure: ASTM 1557 **Method:** 0
Oversized Material (%): 0.0 **Correction Required:** ☐ Yes ☐ No

MOISTURE/DENSITY RELATIONSHIP CURVE



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	86.5	**@ Optimum Moisture, %**	31.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

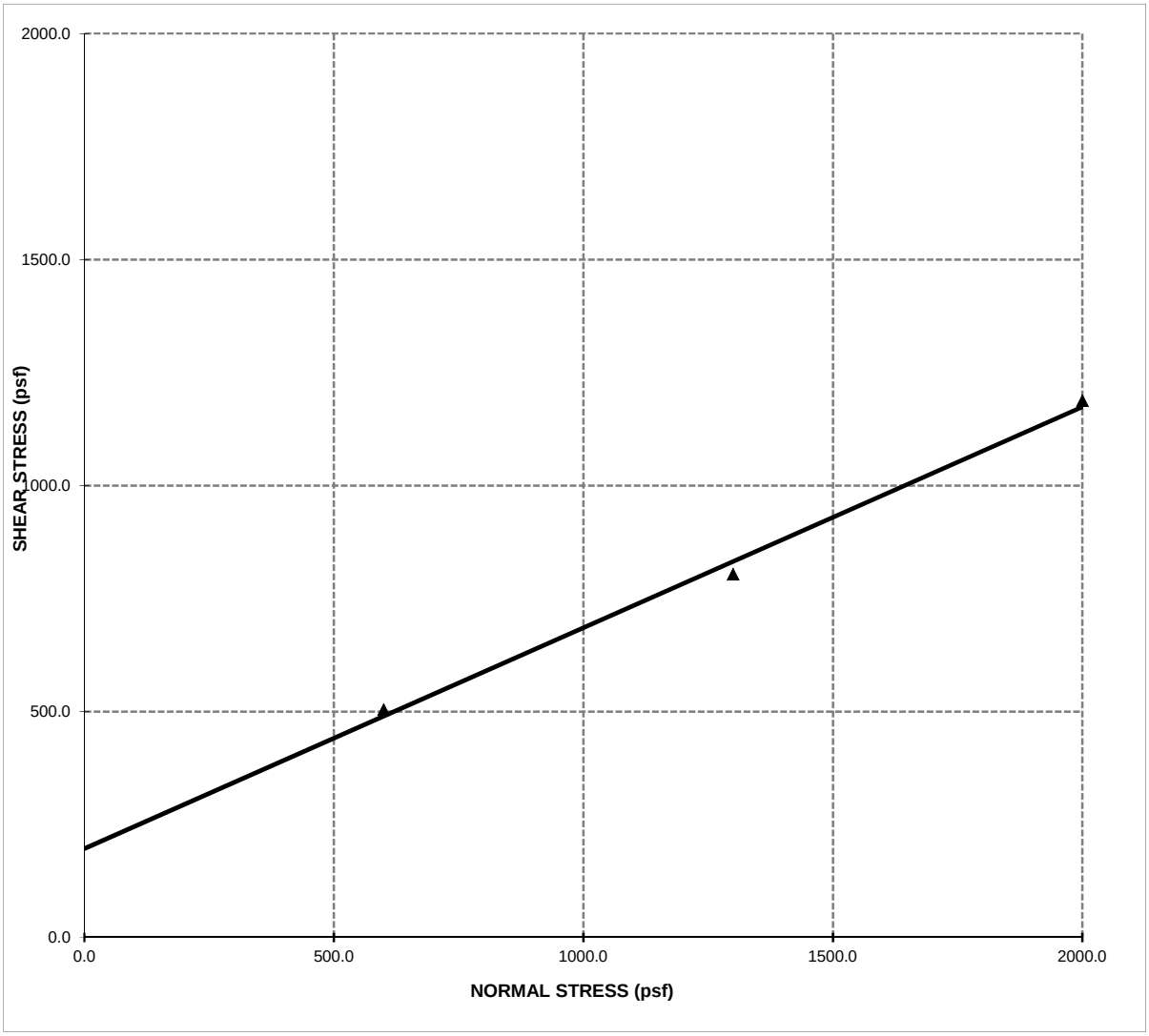
	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:
Unified Soils Classification: _____
AASHTO Soils Classification: _____

Plate MD-2

DIRECT SHEAR TEST

Project Name:	Walnut	***Sample Location:***	B-3 @ 0 - 5
Project Number:	1280-CR	***Date Tested:***	3/18/2015



Shear Strength: F = **26.0** ° , **C = 196.86 psf**

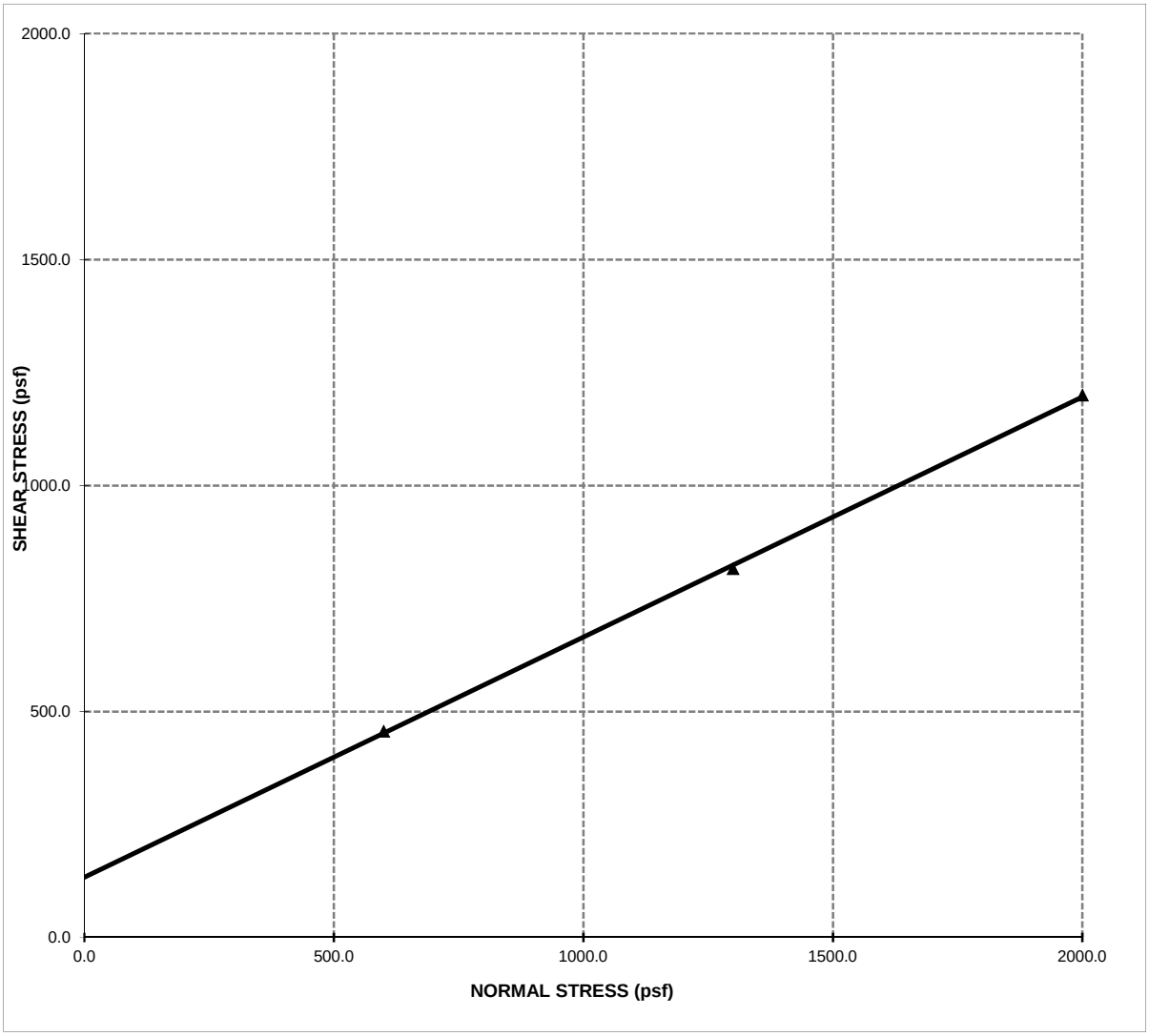
Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

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

3 - The tests were run at a shear rate of 0.010 in/min.

DIRECT SHEAR TEST

Project Name:	Walnut	***Sample Location:***	B-4 @ 0 - 5
Project Number:	1280-CR	***Date Tested:***	3/18/2015



Shear Strength: F = **28.0** ° , **C = 133.14 psf**

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

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

3 - The tests were run at a shear rate of 0.010 in/min.

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	Sunjoint Development	***Tested/ Checked By:***	DI Lab No Corona
Project Number:	1280-CR	***Date Tested:***	3/11/2015
Project Location:	Walnut	***Sample Source:***	B-3 @ 0 - 5
		Sample Description:	

Ring #: _____ Ring Dia. : 4.01" Ring Ht.1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	730.3
B	Weight of ring (gm)	365.4
C	Net weight of sample (gm)	**364.9**
D	Wet Density, lb / ft3 (C*0.3016)	**110.1**
E	Dry Density, lb / ft3 (D/1.F)	**96.7**

SATURATION DETERMINATION

F	Moisture Content, %	13.8
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20°C, (pcf)	**62.3**
I	% Saturation	**50.4**

READINGS

DATE	TIME	READING	
3/11/2015	6:38	0.3590	Initial
	6:48	0.3590	10 min/Dry
	7:40	0.4480	
	12:40	0.4580	
3/12/2015	3:05	0.4630	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
785.3	**28.9**

EXPANSION INDEX = 104

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	Sunjoint Development	***Tested/ Checked By:***	DI Lab No Corona
Project Number:	1280-CR	***Date Tested:***	3/11/2015
Project Location:	Walnut	***Sample Source:***	B-4 @ 0 - 5
		Sample Description:	

Ring #: _____ Ring Dia. : 4.01" Ring Ht.1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	690.6
B	Weight of ring (gm)	365.1
C	Net weight of sample (gm)	**325.5**
D	Wet Density, lb / ft3 (C*0.3016)	**98.2**
E	Dry Density, lb / ft3 (D/1.F)	**81.5**

SATURATION DETERMINATION

F	Moisture Content, %	20.4
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20°C, (pcf)	**62.3**
I	% Saturation	**51.8**

READINGS

DATE	TIME	READING	
3/11/2015	6:20	0.2090	Initial
	6:30	0.2090	10 min/Dry
	7:40	0.3230	
	12:40	0.3360	
3/12/2015	3:05	0.3400	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
754.3	**40.0**

EXPANSION INDEX = 131

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Project Name:	Mr. Tom Lee	***Tested/ Checked By:***	EV Lab No Riv
Project Number:	0468-CR3	***Date Tested:***	7/19/2008
Project Location:	Walnut	***Sample Source:***	T-1 @ 0-3'
		Sample Description:	Dark Brown Silty Clay

Ring Id 12 Ring Dia. " 4" Ring l 1"

Loading weight: 5516. grams

DENSITY DETERMINATION

A	Weight of compacted sample & ring	710.0
B	Weight of ring	363.5
C	Net weight of sample	346.5
D	Wet Density, lb / ft3 (C*0.3017)	104.5
E	Dry Density, lb / ft3 (D/1.F)	**89.3**

SATURATION DETERMINATION

F	Moisture Content, %	17.0
G	(E*F)	1518.9
H	(E/167.48)	0.53
I	(1.-H)	0.47
J	(62.4*I)	29.1
K	(G/J)= **L** % Saturation	**52.2**

READINGS

DATE	TIME	READING	
7/19/2008	1:05	0.000	Initial
7/19/2008	1:15	0.000	10 min/Dry
7/19/2008	1:16	0.050	1 min/Wet
7/19/2008	1:21	0.150	5 min/Wet
7/19/2008	3:00	0.150	Random
7/20/2008	1:05	51.000	Final

FINAL MOISTURE

Weight of wet sample & tare	Weight of dry sample & tare	Tare	% Moisture

EXPANSION INDEX = 51

(@50% SATURATION)

Plate EI-1

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Project Name:	Mr. Tom Lee	***Tested/ Checked By:***	EV Lab No Riv
Project Number:	0468-CR3	***Date Tested:***	7/19/2008
Project Location:	Walnut	***Sample Source:***	T-9 @ 0-3'
		Sample Description:	Light Brown Silty Sand

Ring Id 12 Ring Dia. " 4" Ring l 1"

Loading weight: 5516. grams

DENSITY DETERMINATION

A	Weight of compacted sample & ring	709.0
B	Weight of ring	369.4
C	Net weight of sample	339.6
D	Wet Density, lb / ft3 (C*0.3017)	102.5
E	Dry Density, lb / ft3 (D/1.F)	**77.4**

SATURATION DETERMINATION

F	Moisture Content, %	32.4
G	(E*F)	2507.3
H	(E/167.48)	0.46
I	(1.-H)	0.54
J	(62.4*I)	33.6
K	(G/J)= **L** % Saturation	**74.7**

READINGS

DATE	TIME	READING	
7/19/2008	1:05	0.000	Initial
7/19/2008	1:15	0.000	10 min/Dry
7/19/2008	1:16	0.050	1 min/Wet
7/19/2008	1:21	0.150	5 min/Wet
7/19/2008	3:00	0.150	Random
7/20/2008	1:05	27.000	Final

FINAL MOISTURE

Weight of wet sample & tare	Weight of dry sample & tare	Tare	% Moisture

EXPANSION INDEX = 27

(@50% SATURATION)

Plate EI-2

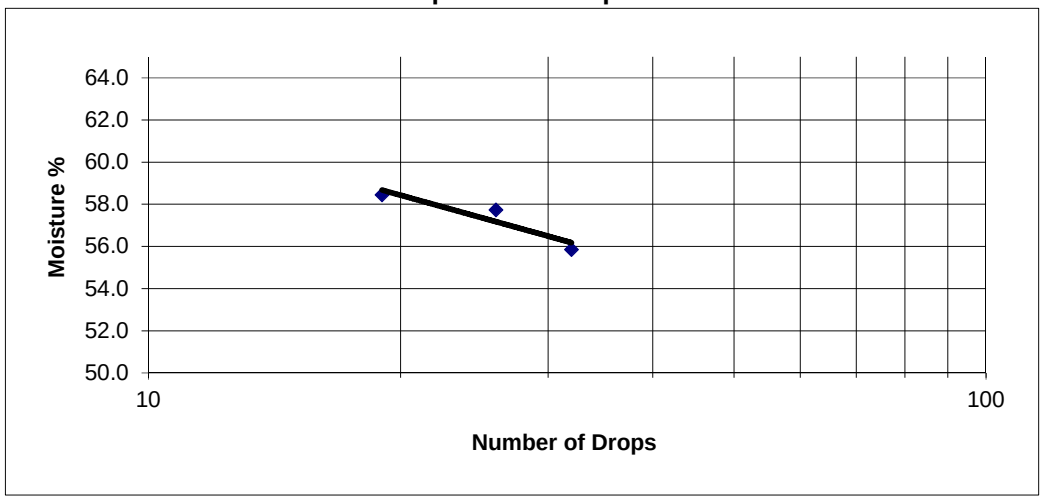
GEOTEK

ATTERBERG LIMITS DATA

Field Classification		Job No.	1280-CR
Sample Number		Client	Sunjoint Development
Sample Type	Bulk	Project	Walnut
Location	B-1 @ 0 - 5		
Tested by:	DI		

	Plastic Limit			Liquid Limit		
Number of Blows				32	26	19
Determination	1	2	3	4	5	6
Dish						
Wt. of Dish + Wet Soil	13.60	13.54		20.44	20.29	20.25
Wt. of Dish + Dry Soil	12.34	12.31		15.28	15.10	15.03
Wt. of Moisture	1.26	1.23		5.16	5.19	5.22
Wt. of Dish	6.04	6.06		6.04	6.11	6.10
Wt. of Dry Soil	6.30	6.25		9.24	8.99	8.93
Moisture Content %	20.0	19.7		55.8	57.7	58.5

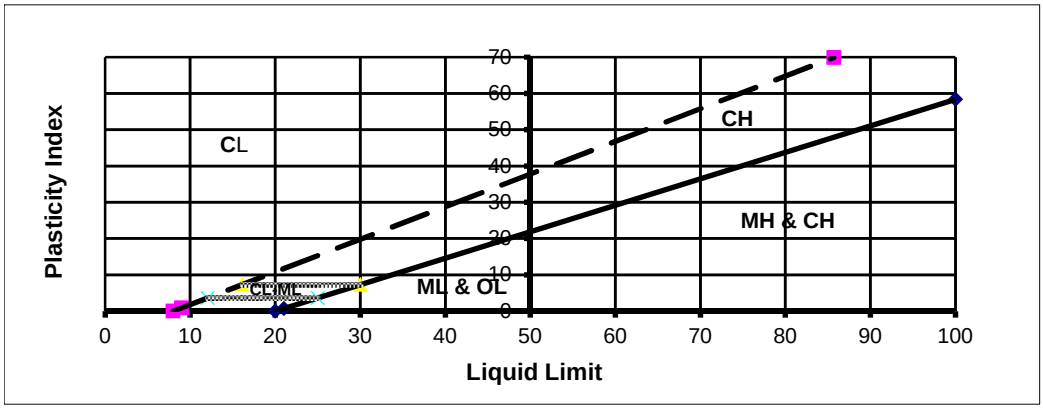
Liquid Limit Graph



Liquid Limit
57

Plastic Limit
20

Plasticity Index
37



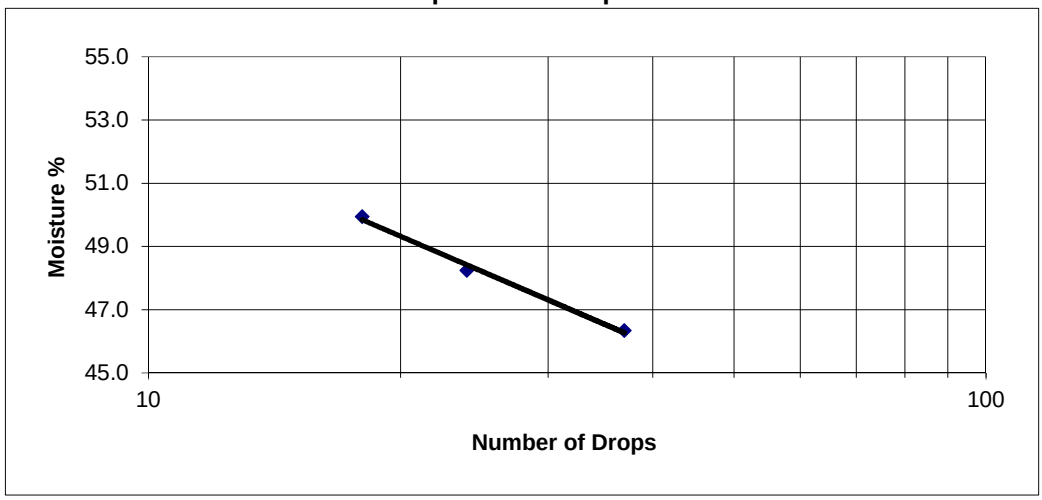
GEOTEK

ATTERBERG LIMITS DATA

Field Classification		Job No.	1280-CR
Sample Number		Client	Sunjoint Development
Sample Type	Bulk	Project	Walnut
Location	B-3 @ 0 - 5		
Tested by:	DI		

	Plastic Limit			Liquid Limit		
Number of Blows				37	24	18
Determination	1	2	3	4	5	6
Dish						
Wt. of Dish + Wet Soil	13.56	13.55		20.32	20.43	20.39
Wt. of Dish + Dry Soil	12.32	12.30		15.83	15.76	15.63
Wt. of Moisture	1.24	1.25		4.49	4.67	4.76
Wt. of Dish	6.05	6.10		6.14	6.08	6.10
Wt. of Dry Soil	6.27	6.20		9.69	9.68	9.53
Moisture Content %	19.8	20.2		46.3	48.2	49.9

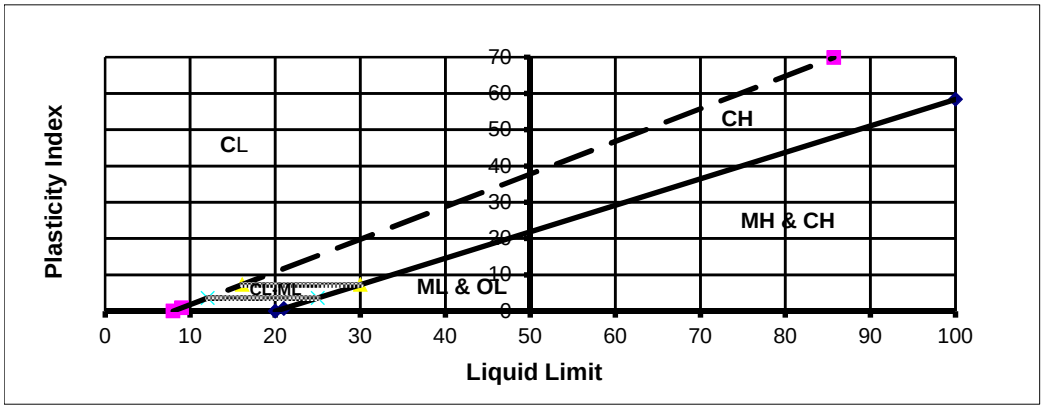
Liquid Limit Graph



Liquid Limit
48

Plastic Limit
20

Plasticity Index
28



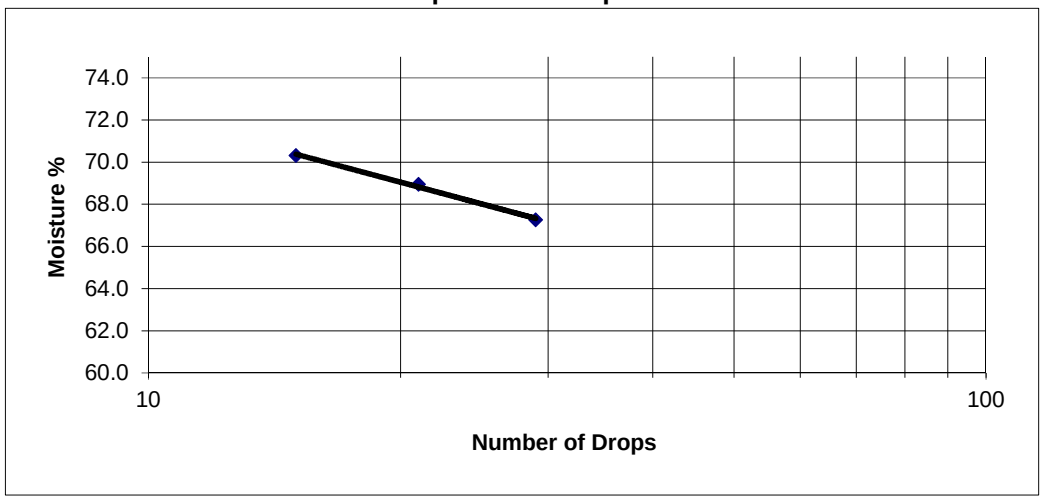
GEOTEK

ATTERBERG LIMITS DATA

Field Classification		Job No.	1280-CR
Sample Number		Client	Sunjoint Development
Sample Type	Bulk	Project	Walnut
Location	B-4 @ 0 - 5		
Tested by:	DI		

	Plastic Limit			Liquid Limit		
Number of Blows				29	21	15
Determination	1	2	3	4	5	6
Dish						
Wt. of Dish + Wet Soil	13.51	13.47		20.03	20.14	20.11
Wt. of Dish + Dry Soil	11.80	11.79		14.42	14.39	14.33
Wt. of Moisture	1.71	1.68		5.61	5.75	5.78
Wt. of Dish	6.09	6.12		6.08	6.05	6.11
Wt. of Dry Soil	5.71	5.67		8.34	8.34	8.22
Moisture Content %	29.9	29.6		67.3	68.9	70.3

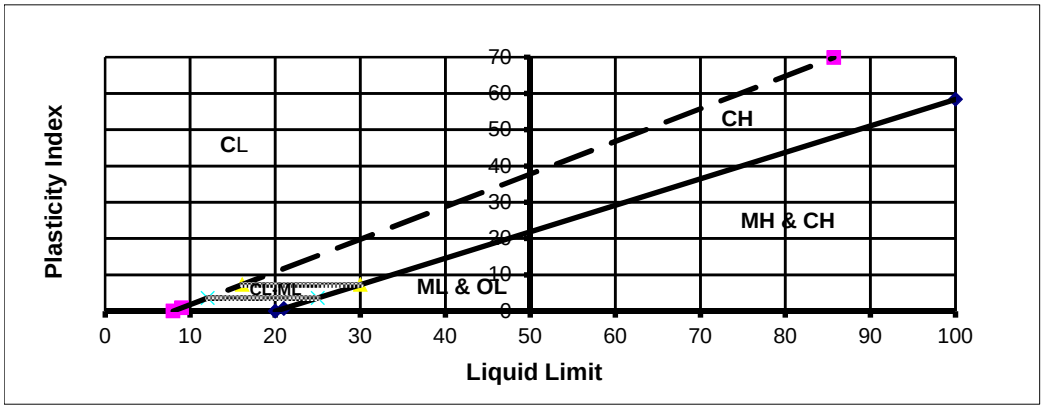
Liquid Limit Graph

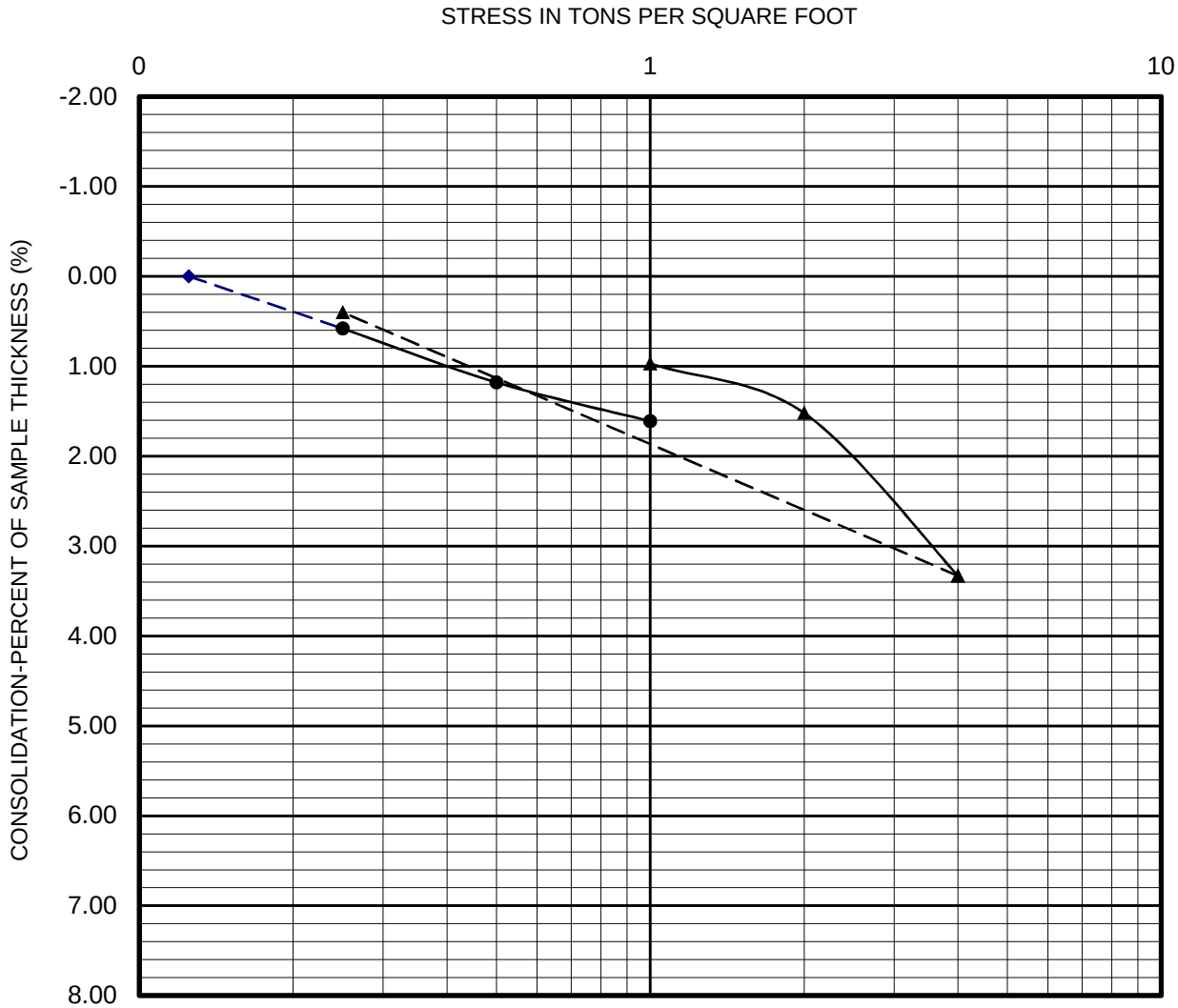


Liquid Limit
68

Plastic Limit
30

Plasticity Index
38





Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CHECKED BY: GF	Lab: DI
PROJECT NO.: 1280-CR	Date: 03/15

CONSOLIDATION REPORT

Sample: B-4 @ 12.5'

East Valley Blvd. Property
City of Walnut, California

Plate C-1

Cal Land Engineering, Inc.
dba Quartech Consultants
Geotechnical, Environmental, and Civil Engineering

GeoTek, Inc.
710 East Parkridge Avenue, Suite 105
Corona, California 92879

Client: Sunjoint Development
W.O.: 1280-CR3
Project: Walnut

Date: March 26, 2015
QCI Project No.: 15-167-003p
Summarized by: KA

Corrosivity Test Results

Sample ID	Sample Depth (Feet)	pH CT-532 (643)	Chloride CT-422 (ppm)	Sulfate CT-417 (% By Weight)	Resistivity CT-532 (643) (ohm-cm)
B-3	0-5’	6.82	185	0.0010	1000
B-4’	0-5’	N/A	N/A	0.0015	N/A

APPENDIX D

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

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

Input

Edition

Dynamic: Conterminous U.S. 2008 (v3.3.

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

34.0323

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

-117.8292

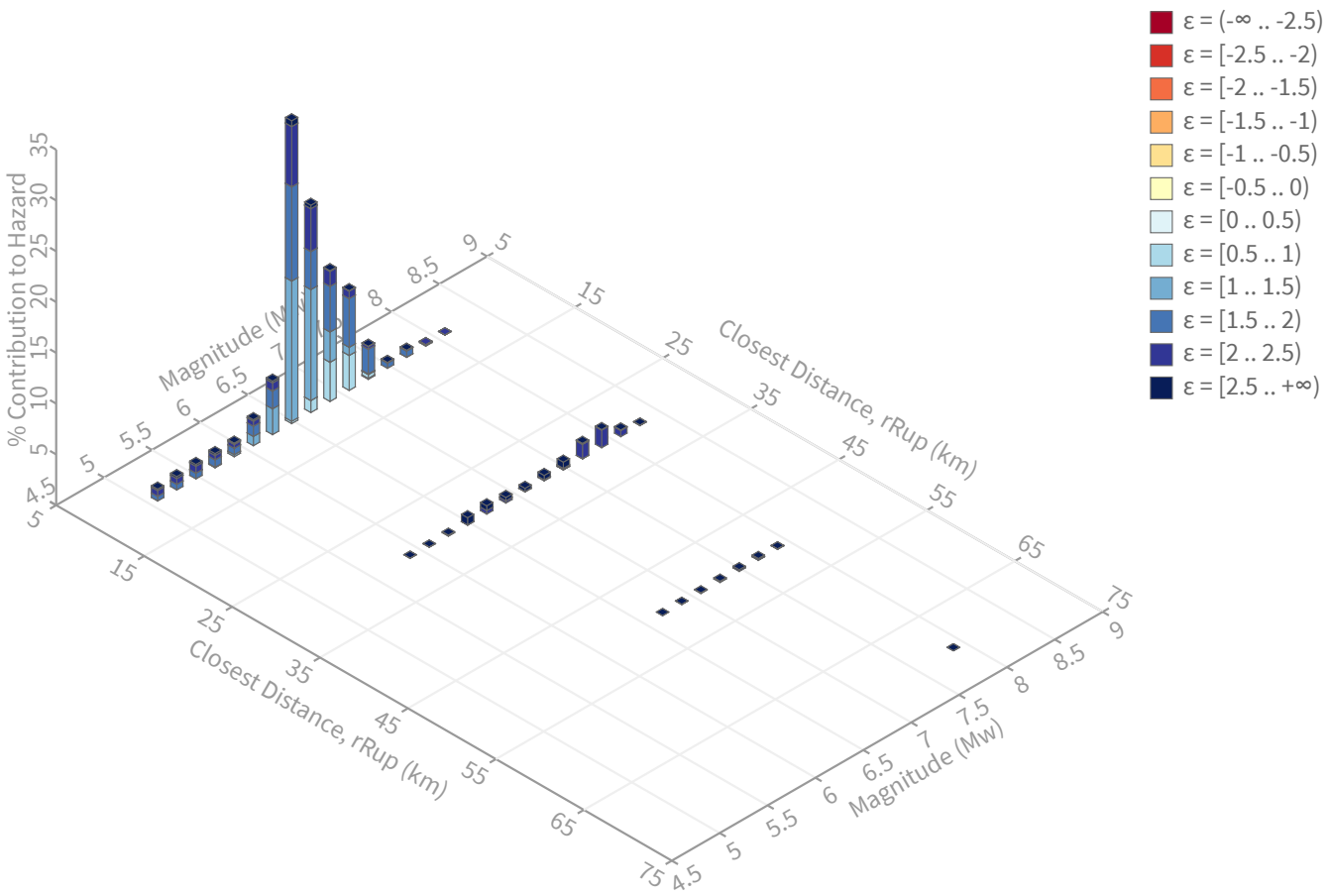
Site Class

259 m/s (Site class D)

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.74720331 g

Recovered targets

Return period: 2931.5324 yrs
Exceedance rate: 0.00034111853 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.05 %

Mean (for all sources)

r: 11.07 km
m: 6.68
ε_0: 1.66 σ

Mode (largest r-m bin)

r: 7.89 km
m: 6.51
ε_0: 1.62 σ
Contribution: 29.8 %

Mode (largest ε_0 bin)

r: 5.63 km
m: 6.5
ε_0: 1.27 σ
Contribution: 13.81 %

Discretization

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

Epsilon keys

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

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
bFault.ch	Fault							45.61
San Jose		3.11	6.58	1.27	117.838°W	34.060°N	344.66	8.91
Puente Hills		9.73	7.05	0.78	117.867°W	33.927°N	196.68	6.69
Chino - alt 1		6.60	6.51	1.47	117.745°W	34.031°N	90.72	6.54
Cucamonga		13.87	6.61	2.30	117.729°W	34.125°N	41.76	6.36
Puente Hills (Coyote Hills)		9.87	6.70	1.22	117.867°W	33.898°N	193.23	5.85
Chino - alt 2		7.24	6.68	1.49	117.745°W	34.033°N	89.23	5.51
Sierra Madre Connected		11.12	7.26	1.79	117.807°W	34.130°N	10.60	2.33
Sierra Madre		11.12	7.16	1.84	117.807°W	34.130°N	10.60	2.22
bFault.gr	Fault							24.98
San Jose		3.54	6.54	1.30	117.838°W	34.060°N	344.66	5.16
Chino - alt 1		6.61	6.48	1.48	117.745°W	34.031°N	90.72	3.87
Cucamonga		14.59	6.55	2.36	117.729°W	34.125°N	41.76	3.66
Puente Hills		11.07	6.81	1.14	117.867°W	33.927°N	196.68	3.37
Chino - alt 2		7.76	6.61	1.58	117.745°W	34.033°N	89.23	2.90
Puente Hills (Coyote Hills)		10.57	6.64	1.44	117.867°W	33.898°N	193.23	2.60
Sierra Madre		13.17	6.86	2.07	117.807°W	34.130°N	10.60	1.59
Sierra Madre Connected		13.76	6.94	2.07	117.807°W	34.130°N	10.60	1.25
aFault_MoBal	Fault							7.62
Elsinore : W		11.06	6.93	1.80	117.852°W	33.930°N	190.45	4.51
aFault_aPriori_D2.1	Fault							6.79
Elsinore : W		11.06	6.95	1.79	117.852°W	33.930°N	190.45	3.08
CAmap.24.ch.in (opt)	Grid							4.74
PointSourceFinite: -117.829, 34.073		6.74	5.79	1.66	117.829°W	34.073°N	0.00	1.74
PointSourceFinite: -117.829, 34.100		8.44	5.91	1.83	117.829°W	34.100°N	0.00	1.62
CAmap.21.ch.in (opt)	Grid							4.73
PointSourceFinite: -117.829, 34.073		6.77	5.77	1.67	117.829°W	34.073°N	0.00	1.71
PointSourceFinite: -117.829, 34.100		8.44	5.91	1.83	117.829°W	34.100°N	0.00	1.63
CAmap.24.gr.in (opt)	Grid							2.26
CAmap.21.gr.in (opt)	Grid							2.23
aFault_unseg	Fault							1.02

USGS Design Maps Detailed Report

ASCE 7-10 Standard (34.0323°N, 117.8292°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	S_S = 2.188 g
From Figure 22-2 [2]	S_1 = 0.776 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\overline{v}_s$	$\overline{N}$ or $\overline{N}_{ch}$	$\overline{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index *PI* > 20, • Moisture content *w* ≥ 40%, and • Undrained shear strength $\overline{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_S = 2.188 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.776 g, F_v = 1.500

Equation (11.4–1): $S_{MS} = F_a S_S = 1.000 \times 2.188 = 2.188$ g

Equation (11.4–2): $S_{M1} = F_v S_1 = 1.500 \times 0.776 = 1.165$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

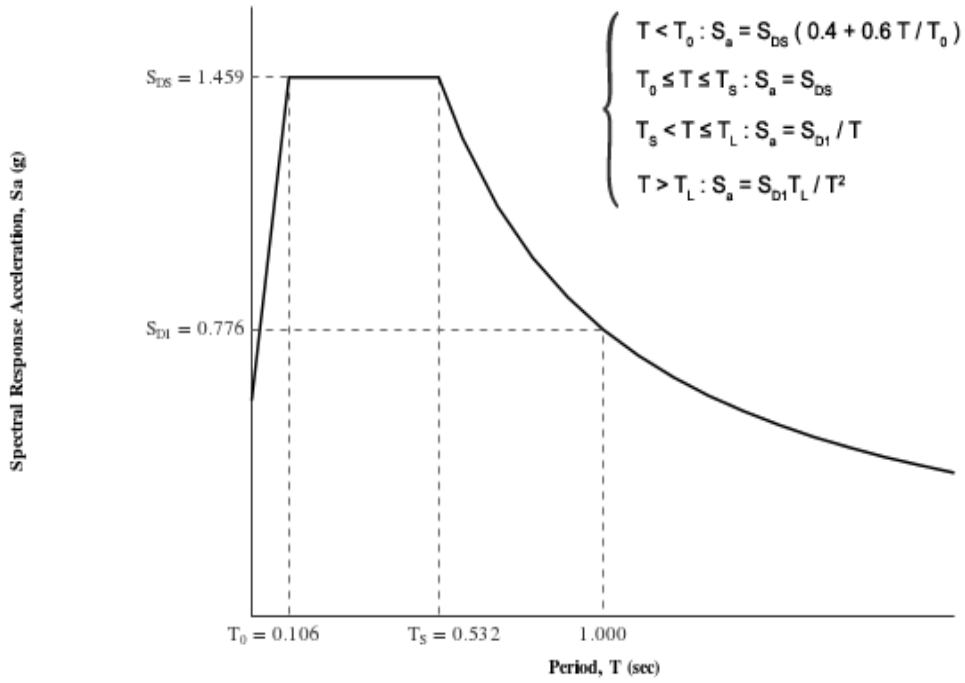
Equation (11.4–3): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 2.188 = 1.459$ g

Equation (11.4–4): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 1.165 = 0.776$ g

Section 11.4.5 — Design Response Spectrum

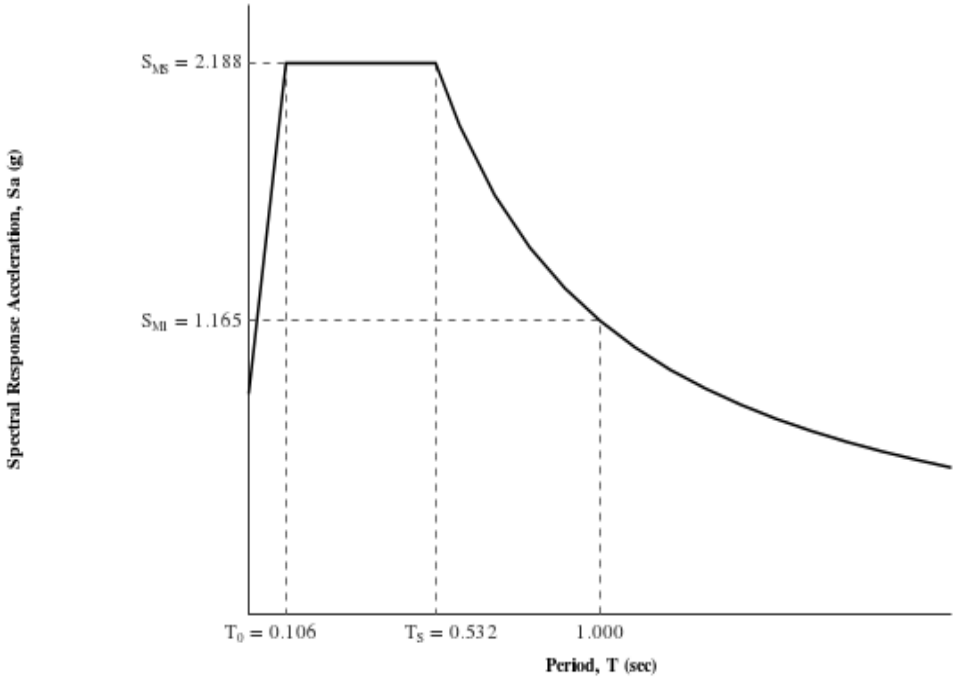
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.780

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.780 = 0.78$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.780 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 1.007

From Figure 22-18 [6] C_{R1} = 1.021

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.459 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.776 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = E

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

APPENDIX E

APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1.0 General

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

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

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

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

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

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

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

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

2.0 Preparation of Areas to be Filled

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

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

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed

immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

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

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

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

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

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

3.0 Fill Material

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

3.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

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

4.0 Fill Placement and Compaction

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

4.2 Fill Moisture Conditioning: Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

4.3 Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

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

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

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

5.0 Subdrain Installation

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

6.0 Excavation

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

7.0 Trench Backfills

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

7.2 Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum 90 percent of maximum from 1 foot above the top of the conduit to the surface, except in traveled ways (see Section 7.6 below).

7.3 Jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

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

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

7.6 Trench backfill in the upper foot measured from finish grade within existing or future traveled way, shoulder, and other paved areas (or areas to receive pavement) should be placed to a minimum 95 percent relative compaction.

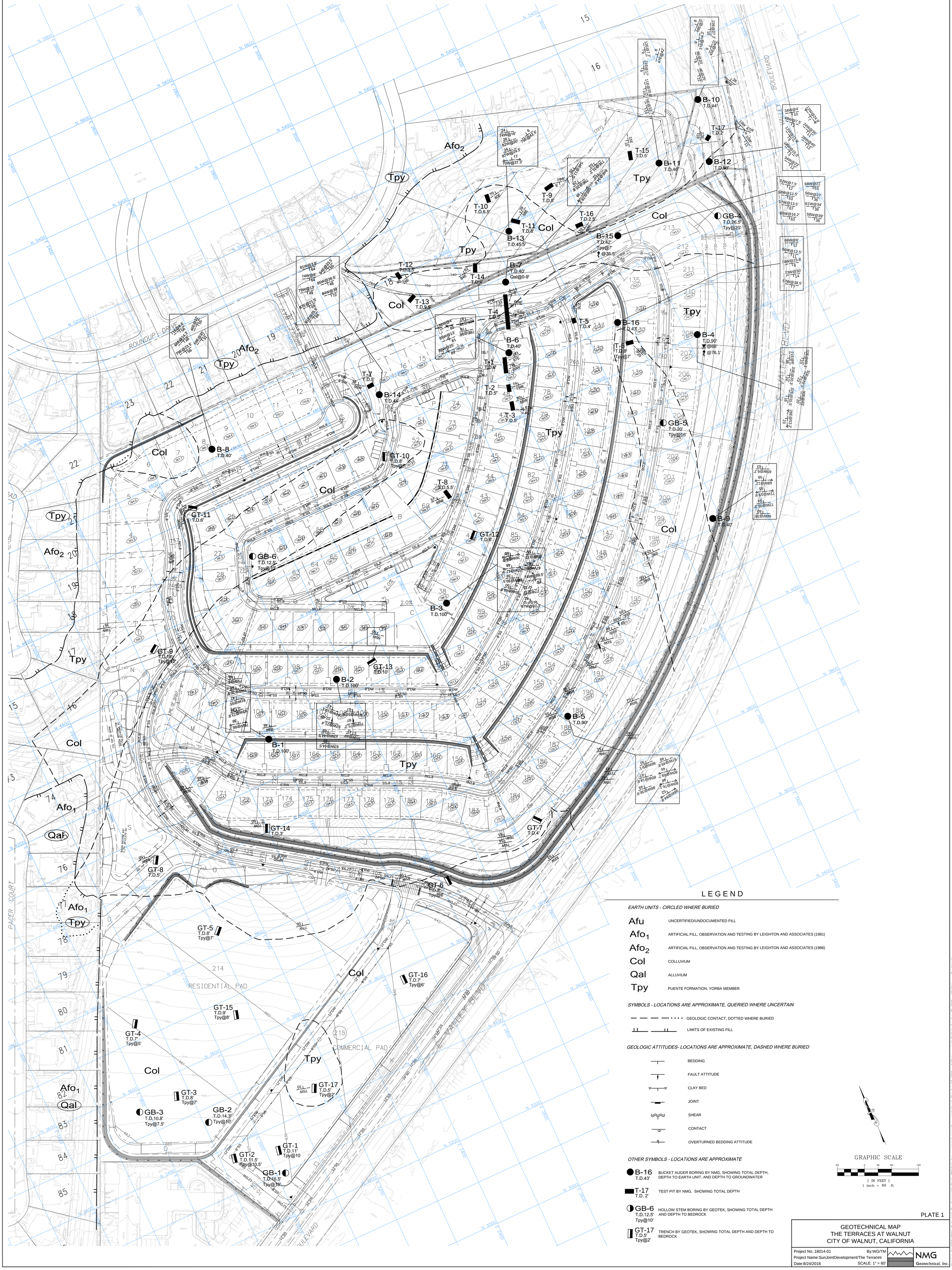


PLATE 1

GEOTECHNICAL MAP
THE TERRACES AT WALNUT
CITY OF WALNUT, CALIFORNIA

Project No.:18014-01 By:WG/TM
Project Name:SunJointDevelopment/The Terraces
Date:8/24/2018 SCALE: 1" = 60'

NMG Geotechnical, Inc.